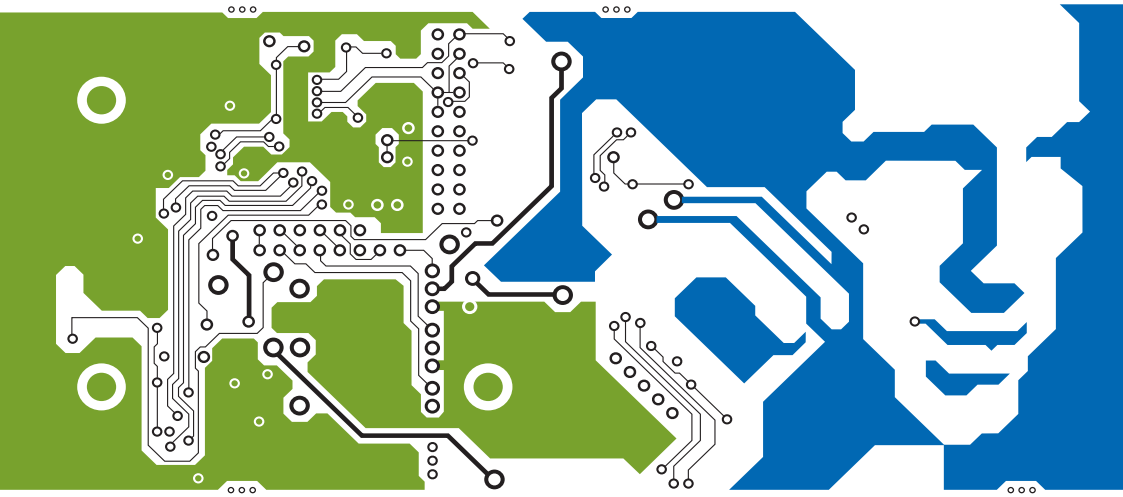
CODAN

Digital Microwave Radio

8800 series

MICROWAVE LINKS



REFERENCE MANUAL

Codan part number 15-44025-EN Issue 2, April 2006

The English version takes precedence over any translated versions.

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1 About this manual

This manual is for installation technicians and operators of the Codan Digital Microwave Radio 8800 series.

This manual contains the following sections:

Section 1 About this manual—explains the terms, abbreviations and standards used in this manual

Section 2 Compliance—provides compliance information and safety notices

Section 3 Overview—provides a general overview of a DMR system

Section 4 System description—provides a detailed description of the DMR system, including the IDU and DIUs and how to use the front panel, the ODU, and how the system is managed

Section 5 Installation—explains how to install the hardware

Section 6 Basic terminal setup—explains how to set up terminals using the **QUICK CONFIG** menu

Section 7 Aligning the antenna—explains how to align the antennas in a link, then how to perform a functional test on each terminal

Section 8 Advanced terminal setup—describes how to set up advanced features in the DMR, and how to reset the DMR

Section 9 Managing a 1+0 system—provides examples of how to layout and plan IP addressing for systems using out-of-band and in-band management

Section 10 Commissioning the system—explains how to commission the system

Section 11 Fault diagnosis—provides information on fault diagnosis

Appendix A Factory-default settings—provides the factory-default settings for the DIUs and DMR

Appendix B Pin connections—provides the pinouts for the connectors on the IDU

There is an index at the end of this manual.

Standards and icons

The following standards and icons are used in this manual:

This typeface...	Means...
Bold	the name of a menu, button, knob, and LED
`Courier`	a segment of text from the display
Bold Times	text that is typed in as a command, or the name of a key on a computer keyboard
Italics	a cross-reference or text requiring emphasis

This icon...	Means...
WARNING	it is possible that you will seriously damage yourself or the equipment
CAUTION	proceed with caution as your actions may lead to loss of data, privacy or signal quality
NOTE	the text provided next to this icon may be of interest to you
❑	a step within a task

Definitions

Acronyms and abbreviations

Acronym...	Means...
AC	alternating current
AGC	automatic gain control
AIS	alarm indication signal
async	asynchronous
BER	bit error rate
C	common
CTS	clear to send
DC	direct current
DIU	data interface unit
DMR	digital microwave radio
DSR	data set ready
DTR	data terminal ready
EIA	Electronics Industry Alliance
EMC	electromagnetic compatibility
EOW	engineering orderwire
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission
GUI	graphical user interface
HPA	high power amplifier

Acronym...	Means...
I/O	input/output
IDU	indoor unit
IF	intermediate frequency
ISP	internet service provider
ITU	International Telecommunications Union
LAN	local area network
LEC	local exchange carrier
LED	light-emitting diode
LOS	loss-of-signal
MIB	management information base
MINet	microwave intelligent network
Mux	multiplexer
N/A	not applicable
NC	normally closed
NMS	network management system
NO	normally open
ODU	outdoor unit
PCN	personal communication network
PCS	personal communication system
PDH	plesiochronous digital hierarchy
ppm	parts per million
RAM	random-access memory
RF	radio frequency
RIP	routing information protocol

Acronym...	Means...
RMA	return materials authorisation
RSL	received signal level
RTS	request to send
RU	rack unit
Rx	receive
RxD	receive data
SCSI	small computer system interface
SLIP	serial line internet protocol
SNMP	simple network management protocol
TCP/IP	transport control protocol/internet protocol
TDM	time division multiplex
TFTP	trivial file transfer protocol
Tx	transmit
TxD	transmit data
UPS	uninterruptible power supply

Glossary

This term...	Means...
agent	A software module that carries out an SNMP management function.
balanced system	The method used to transmit data on a twisted pair of wires.
cascaded system	A serial chain of data connections.
Ethernet	A standard for connecting computers into a LAN. A common form of Ethernet is called 10 BaseT, which denotes a peak data rate of 10 Mbps using twisted-pair copper cable.
host	A device connected to an Ethernet network.
hub	A device that is used to connect Ethernet signals to several hosts.
in-band management	A method of managing an Ethernet network by utilising a small portion of the available customer data transmission capacity for supervisory communications.
indoor unit (IDU)	The portion of a DMR that is mounted indoors.
IP address	A unique string of numbers that identifies a computer on a network. These numbers are usually shown in groups separated by periods, for example, 123.123.023.002. All resources on a network have an IP address.
link	Two DMR terminals that communicate with each other.
local terminal	The terminal that is at the same site as the operator.
management station	A computer used to monitor an entire network.

This term...	Means...
outdoor unit (ODU)	The portion of a DMR that is mounted outdoors.
out-of-band management	A method of managing a data transmission network by utilising a purpose-provided data channel for supervisory communications.
IP management	The methodology used to allocate and manage IP addresses that are used in an Ethernet network.
data interface unit (DIU)	A plug-in module that provides a physical data connection to a DMR terminal.
site	The location of a complete terminal. Typically, a site contains a terminal from one link that is (are) connected to a terminal from another link.
remote terminal	The terminal at the far end of the link with reference to the operator.
routing statement	An operator-defined command at a data transmission device telling it where to send data.
SNMP trap	A message sent by an SNMP agent when a pre-defined performance or alarm condition is met or exceeded.
switch	The equipment used to switch data between hosts on an Ethernet network.
terminal	The IDU, ODU, antenna and connecting cables at each end of a link.
unbalanced system	The method used to transmit data on a coaxial cable.

Units

Measurement	Unit	Abbreviation
Attenuation	decibel	dB
Current	ampere	A
Data rate	bits per second	bps
Frequency	hertz	Hz
Impedance	ohm	
Length	metre (feet/inches)	m (ft/in)
Power	decibels relative to 1 mW	dBm
Temperature	degrees Celsius	°C
Voltage	volts	V

Unit multipliers

Unit	Name	Multiplier
m	milli	0.001
c	centi	0.01
d	deci	0.1
k	kilo	1000
M	mega	1000000
G	giga	1000000000

About this issue

This is the second issue of the Digital Microwave Radio 8800 series Reference Manual.

Associated documents

The associated documents are:

- Digital Microwave Radio 8800 series Installation Handbook (Codan part number 15-44024-EN)
- Digital Microwave Radio 8800 series Redundancy Systems Reference Manual (Codan part number 15-44029-EN)
- MINet Management Software User Guide (Codan part number 15-44026-EN)
- Declaration of Conformity for the 8800 series Digital Microwave Radio, 7–38 GHz (Codan part number 19-40200)
- Declaration of Conformity for the 8800 series Digital Microwave Radio, 7–8 GHz (Codan part number 19-40201)
- Declaration of Conformity for the 8800 series Digital Microwave Radio, 10.5 GHz (Codan part number 19-40202)
- Declaration of Conformity for the 8800 series Digital Microwave Radio, 13 GHz (Codan part number 19-40203)
- Declaration of Conformity for the 8800 series Digital Microwave Radio, 15 GHz (Codan part number 19-40204)
- Declaration of Conformity for the 8800 series Digital Microwave Radio, 18 GHz (Codan part number 19-40205)
- Declaration of Conformity for the 8800 series Digital Microwave Radio, 23 GHz (Codan part number 19-40206)

- Declaration of Conformity for the 8800 series Digital Microwave Radio, 26 GHz (Codan part number 19-40207)
- Declaration of Conformity for the 8800 series Digital Microwave Radio, 38 GHz (Codan part number 19-40208)
- Reference Note: Continuous phase, four-state, frequency shift keying (Codan part number 17-60101-EN)
- Reference Note: Adjacent channel interference in the Codan 8800 series Digital Microwave Radio (Codan part number 17-60102-EN)
- Reference Note: Using external relay inputs and outputs with the 8800 series Digital Microwave Radio (Codan part number 17-60103-EN)
- Reference Note: Automatic transmitter power control (Codan part number 17-60104-EN)
- Reference Note: Forward error correction (Codan part number 17-60105-EN)
- Reference Note: Network management principles (Codan part number 17-60106-EN)
- Referene Note: TCP/IP principles (Codan part number 17-60107-EN)
- Reference Note: Terms used in microwave communication (Codan part number 17-60108-EN)

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2 Compliance

This section contains the following topics:

Introduction

This section describes how to ensure the Digital Microwave Radio 8800 series complies with the European Electromagnetic Compatibility Directive 89/336/EEC and the European Low Voltage Directive 73/23/EEC as called up in the European Radio and Telecommunications Terminal Equipment Directive 1999/5/EC.

The CE Declarations of Conformity and Expert Letters of Opinion for the product range are listed on page 10, *Associated documents*. These documents can be made available upon request to Codan or a Codan-authorised supplier.

This section also contains the requirements for FCC and A-tick compliance.

European Radio and Telecommunications Terminal Equipment Directive

The Digital Microwave Radio 8800 series has been tested and complies with the following standards and requirements (articles of the R&TTE Directive):

- Article 3.2: EN301216 V1.2.1 (2000)
- Article 3.2: EN301128 V1.2.1 (2000)
- Article 3.2: EN300198 V1.2.2 (1998)
- Article 3.2: EN300431 V1.2.1 (2000)
- Article 3.2: EN300197 V1.4.1 (2001)
- Article 3.2: EN301751 V1.1.1 (2000)
- Article 3.2: EN301390 V1.1.1 (2000)
- Article 3.2: EN301126-1 V1.1.2 (1999)
- Article 3.1b: EN300385 V1.2.1 (1999)
- Article 3.1b: EN301489-1 V1.4.1 (2002)
- Article 3.1b: EN301489-4 V1.3.1 (2002)
- Article 3.1a: EN60950-1:2001
- Article 3.1a: Council Rec. 1999/519/EC
- Article 3.1a: ICNIRP Guidelines
- Article 3.1a: EN50392:2004

Product marking and labelling

Any equipment supplied by Codan that satisfies these requirements is identified by the CE0682 ! marking on the model label of the product.

Declarations of Conformity and Expert Letters of Opinion

The CE Declarations of Conformity and Expert Letters of Opinion for this product range are listed on page 10, *Associated documents*. These documents can be made available upon request to Codan or a Codan-authorised supplier.

Protection of the radio spectrum

CAUTION

Most countries restrict the use of microwave communications equipment to certain frequency bands and/or require such equipment to be licensed. It is the user's responsibility to check the specific requirements with the appropriate communications authorities. If necessary, contact Codan for more information.

Electromagnetic compatibility and safety notices

Radiation safety

To ensure optimal DMR performance and to avoid exposure to excessive electromagnetic fields, the antenna system must be installed according to the instructions provided.

WARNING Do not operate the link unless all personnel are beyond the safe working distance of 3 m (10 ft) from the front of the antenna.

WARNING Remove operating power from the link before removing the antenna.

NOTE There are no limitations on safe working distance at the back of the antenna.

Electromagnetic compatibility

To ensure compliance with the EMC Directive is maintained, you must:

- ❑ Use standard shielded cables supplied from Codan (where applicable).
- ❑ Ensure the covers for the equipment are fitted correctly.

Electrical safety

To ensure compliance with the European Low Voltage Directive is maintained, you must install and use the Digital Microwave Radio 8800 series in accordance with the instructions in this manual.

The 8800 series DMR is DC operated.

When using an AC mains power supply, these precautions must be followed and checked before applying AC power to the unit:

- ❑ Use the standard AC mains cable supplied.
- ❑ Ensure the covers for the equipment are fitted correctly.

CAUTION — If it is necessary for a qualified electronics technician to remove the covers during servicing, they must be refitted correctly before using the equipment.

WARNING — A protective earth connection must be attached to each protective earth terminal provided on the 8800 series DMR (see page 19, *Earth symbol*).

- ❑ Connect the protective earth on the IDU to the protective earth on the rack-mounting unit.
- ❑ Connect the protective earth on the ODU to the protective earth system of the structure.

Earth symbol

A protective earth connection point is provided on both the IDU and ODU of the Digital Microwave Radio 8800 series. These must always be connected to the protective earth. The symbol shown in Table 1 is used to identify the earths on the equipment.

Table 1: Earth symbol

Symbol	Meaning
	Protective earth

FCC compliance

FCC Part 2, 15 and 101 verification

The Digital Microwave Radio 8800 series (18, 23 and 38 GHz systems) has been tested and verified to comply with FCC Parts 2, 15 and 101.

FCC Part 15 compliance

Any modification made to a Digital Microwave Radio 8800 series that is not approved by the party responsible for compliance may void your equipment's compliance under Part 15 of the FCC rules.

The Digital Microwave Radio 8800 series has been tested and found to comply with the limits for a Class B device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by switching the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- reorient or relocate the receiving antenna
- increase the separation between the equipment and receiver
- connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- consult the dealer or an experienced radio/TV technician for help

A-tick compliance

The Digital Microwave Radio 8800 series meets the requirements of the Australian Communications Authority:

- AS/NZS 60950:2000
- AS/NZS CISPR 22
- AS/ACIF S016:2001

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3 Overview

This section contains the following topics:

Introduction to the Codan Digital Microwave Radio 8800 series

The Codan Digital Microwave Radio 8800 series is a line-of-sight DMR operating in microwave frequency bands between 7 and 38 GHz. The system supports a wide range of data rates from 3 Mbps to 52 Mbps. The Digital Microwave Radio 8800 series has interfaces to North American FCC digital signalling at 2 DS1 to 16 DS1 and DS3, or ETSI standard signalling at 2 E1 to 16 E1 and E3. The Codan Digital Microwave Radio 8800 series also provides a wireless connection of Ethernet 10/100 BaseT.

The Codan Digital Microwave Radio 8800 series product range serves the following communication markets:

- PCS/PCN and cellular networks for high-speed links between base stations
- wireless local loop networks with fixed wireless systems of LECs
- private networks with wireless bridged LANs
- ISPs

The Codan Digital Microwave Radio 8800 series may be managed by a Windows 98/NT/2000/XP-compatible SNMP element management application called MINet.

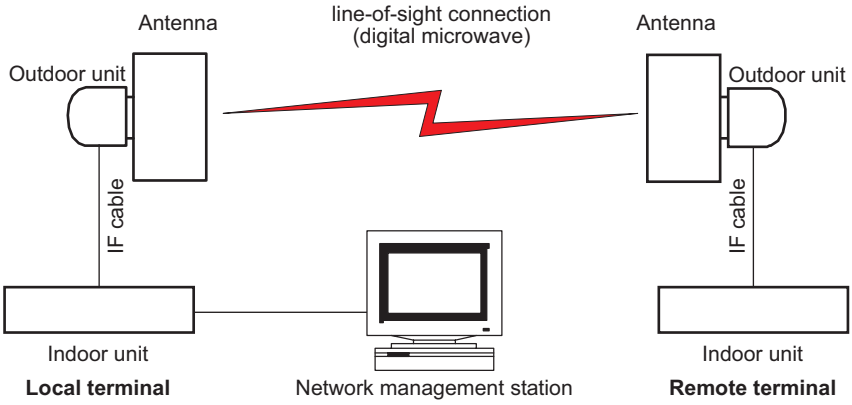
The Codan Digital Microwave Radio 8800 series has a standard MIB interface that may be managed by HP OpenView and other similar management platforms. 8800 series DMR network management communications are an open system that uses the TCP/IP protocol to manage all units of the link.

General description

In order to establish a DMR connection, an 8800 series DMR is installed at each end of a link. These sites are designated as the local and remote sites, as shown in Figure 1. There must be a clear line of sight between the sites. The achievable maximum range is determined by the availability requirements, operating frequency, and antenna size.

DMR systems are sensitive to atmospheric conditions such as rain, hail, fog, and clouds.

Figure 1: Typical radio link



Each 8800 series terminal is normally mounted on an appropriate microwave parabolic dish antenna (direct mount), which provides the mounting and alignment devices.

Each terminal consists of an IDU, an ODU, an antenna, and appropriate connecting cables as shown in Figure 1. In a typical installation, the IDU is mounted inside a standard 19" rack enclosure, and the ODU and the antenna are mounted on a tower or rooftop.

A single coaxial cable connects the IDU to the ODU; the ODU is normally mounted directly on the antenna.

NOTE

The terms local and remote are relative, depending on the location of the operator. The local terminal is at the same location as the operator. The remote terminal is located at the other site.

NOTE

The ODU may also be mounted separately from the antenna using an indirect-mounting kit or an indoor-mounting kit. Contact your Codan representative for more information.

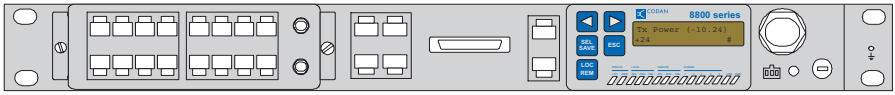
IDU

The IDU performs the following functions:

- multiplexes and demultiplexes the customer data channels with the service and supervisory channels
- modulates and demodulates the aggregate data stream onto an intermediate frequency
- terminates the coaxial cable from the ODU
- provides a control interface for the operator
- provides an interface for external alarms

The IDU is housed in a standard 19" rack and is powered by a DC supply voltage of ±(22 to 60) V DC.

Figure 2: IDU



All interfaces are located on the front panel.

ODU

The ODU performs the following functions:

- up converts the Tx IF frequency to the Tx RF frequency
- amplifies the transmit signal and sends it to the antenna
- receives an incoming signal
- down converts the Rx RF frequency to the Rx IF frequency
- amplifies the receive signal and sends it to the IDU
- monitors the performance of the transmitter and the receiver

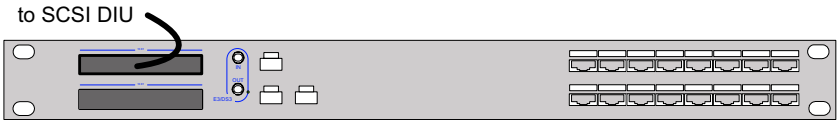
The ODU is a single unit and is designed to mount directly on the antenna.

Figure 3: ODU

Access panels

The access panels are used to interface customer traffic into the 8800 series DMR using standard G.703 interfaces. Control and timing lines are used in the access panels to ensure error-free data operation and switching.

Figure 4: Typical access panel



Signal flow of a DMR link

Digital data, service channels, radio overhead, and network management information at the local terminal are fed to the IDU. The IDU multiplexes them together onto an aggregate data stream.

The IDU digital modem modulates the aggregate signal to create an IF signal. The IF signal is superimposed with DC power and ODU telemetry, then sent to the ODU on a coaxial cable.

The ODU converts the IF signal to an RF signal, which is sent to the antenna at the remote terminal.

At the remote terminal ODU, the received signal is converted back to an IF signal. The IF signal is fed through the coaxial cable to the IDU, where it is demodulated and demultiplexed into digital data and the appropriate service channels.

The link is full duplex (bi-directional), fully symmetrical and transparent to the data stream.

In a 1+1 hot standby or 1+1 space diversity system, the on-line transmit path is selected by muting the off-line transmitter to less than –45 dBm. The main side is selected via the front panel of the IDU, or during the power-up sequence.

4 System description

This section contains the following topics:

IDU

The IDU is a standard 1 RU, 19" shelf unit intended for mounting in a standard rack. The IDU comprises the modem, tributary multiplexer, power supply, and monitor and control hardware. The front panel of the IDU contains the tributary interfaces, service channels, keys, LCD, LEDs, DC supply, and network management interfaces.

A DIU, located within the IDU, is used to interface various transmission systems with the IDU. The tributaries and service channels are multiplexed, modulated, converted to IF, then passed with the DC voltage and telemetry channel via a single cable to the ODU.

The IDU is a firmware-driven device that operates unattended. The link is configured, operated and monitored through a user interface. The operator can access the system locally through the keys on the front panel on the IDU, or from a computer running MINet. This computer may be connected directly to the IDU, remotely through an Ethernet LAN, or via a modem using a SLIP connection.

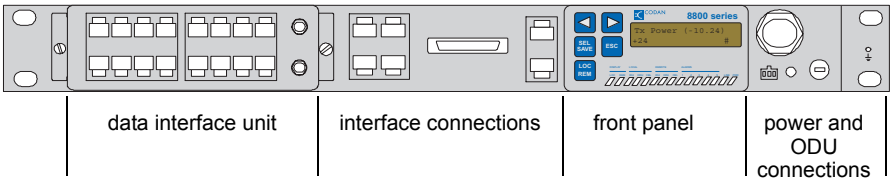
Alarm status and link-integrity status is displayed on the front panel. The remote terminal may also be monitored using the front panel on the local IDU.

IDU models are available for international data connections according to the ETSI and FCC standards.

The front panel of the IDU provides:

- an interconnection panel for interfacing to external equipment, inputs/outputs and power
- a user interface to the NMS through the front panel controls
- a user interface via a connected PC that has NMS software installed

Figure 5: Front panel of the IDU



DIUs

DIUs are briefly described in this section. Refer to the relevant technical specification sheets for details.

ETSI operation

Table 2: DIUs for ETSI operation

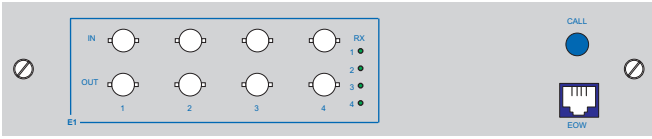
DIU	Description
4 E1 BNC + EOW	 This DIU can be used up to a maximum capacity of 4 E1. The E1 interface is unbalanced with an impedance of 75 ohms. Each E1 has a dedicated green LED to indicate that data is being received. This DIU features an RJ11 connector for a telephone handset and a push button to call the remote side. The RJ11 connector enables telephone communications between two units. The handset is a k-style handset.

Table 2: DIUs for ETSI operation (cont.)

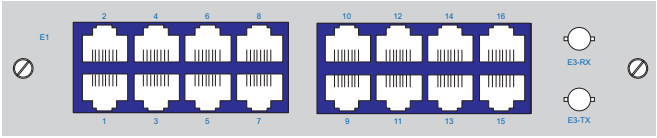
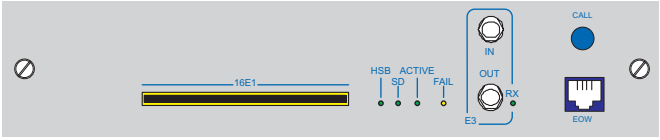
DIU	Description
E3 + 16 E1 (RJ45 version)	 This DIU can be used up to a maximum capacity of E3 + E1. It can be configured to 4 E1, 8 E1, 16 E1, E3, or E3 + E1 using software commands. NOTE 16 E1, E3, and E3 + E1 are not available with the 10.5 GHz band. Data connections are made via: • E1: shielded RJ45 connectors (×16), 120 ohms balanced • E3: Tx/Rx BNC connectors (×2), 75 ohms unbalanced
E3 + 16 E1 (SCSI version)	 This DIU supports redundant E1 and E3 operation but may be used for non-redundant operation. It can be used up to a maximum capacity of E3 + E1. It can be configured as 4 E1, 8 E1, 16 E1, E3, or E3 + E1 using software commands. NOTE 16 E1, E3, and E3 + E1 are not available with the 10.5 GHz band. This DIU features an RJ11 connector for a telephone handset and a push button to call the remote side. The RJ11 connector enables telephone communications between two units. The LEDs indicate the redundancy status. Data connections are made via: • E1: SCSI cable, 75/120 ohms, software-selectable • E3: Tx/Rx BNC connectors (×2), 75 ohms unbalanced • EOW: RJ11 connector

Table 2: DIUs for ETSI operation (cont.)

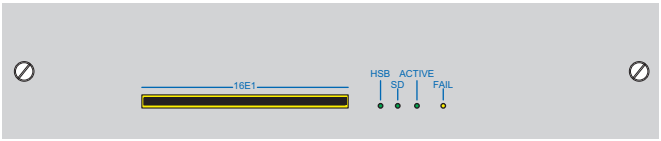
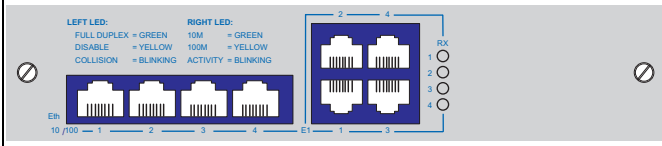
DIU	Description
16 E1 (SCSI version)	 This DIU supports redundant E1 operation but may be used for non-redundant operation. It can be configured as 4 E1, 8 E1, or 16 E1 using software commands. NOTE 16 E1 is not available with the 10.5 GHz band. The LEDs indicate the redundancy status. Data connections are made via: • E1: SCSI cable, 75/120 ohms, software-selectable

Table 2: DIUs for ETSI operation (cont.)

DIU	Description
4 Eth 10/100 BaseT + 4 E1	 This DIU has a digital capacity of 4 10/100 BaseT ports (including full duplex) + 4 E1 ports. It also has configurable capacities of 4 10/100 BaseT, or 4 10/100 BaseT with 1, 2 or 4 E1. The Eth 10/100 connection is equipped with on-line status indications. Two LEDs on each port perform the indication as follows: Left LED: • half duplex while the LED is off • full duplex while the LED is green • disabled while the LED is yellow • collisions while the LED is blinking green Right LED: • configured to 10 Mbps while the LED is green • throughput is 10 Mbps while the LED is blinking green • configured to 100 Mbps while the LED is yellow • throughput is 100 Mbps while the LED is blinking yellow Each E1 has a dedicated green LED to indicate that data is being received. Data connections are made via: • 10/100 BaseT: shielded RJ45 connectors (×4), 120 ohms balanced • E1: shielded RJ45 connectors (×4), 120 ohms balanced

FCC operation

Table 3: DIUs for FCC operation

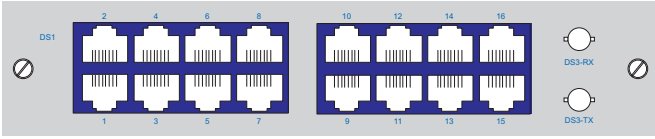
DIU	Description
DS3 + 16 DS1 (RJ45 version)	 This DIU can be used up to a maximum capacity of DS3 + 4 DS1. It can be configured to 4 DS1, 8 DS1, 16 DS1, DS3, or DS3 + 4 DS1 using software commands. NOTE 16 DS1, DS3, and DS3 + 4 DS1 are not available with the 10.5 GHz band. Data connections are made via: • DS1: shielded RJ45 connectors (×16), 100 ohms balanced • DS3: Tx/Rx BNC connectors (×2), 75 ohms unbalanced
DS3 + 16 DS1 (SCSI version)	 This DIU supports redundant DS1 and DS3 operation but may be used for non-redundant operation. It can be used up to a maximum capacity of DS3 + 4 DS1. It can be configured to 4 DS1, 8 DS1, 16 DS1, DS3, or DS3 + 4 DS1 using software commands. NOTE 16 DS1, DS3, and DS3 + 4 DS1 are not available with the 10.5 GHz band. Data connections are made via: • DS1: SCSI cable, 100 ohms balanced • DS3: Tx/Rx BNC connectors (×2), 75 ohms unbalanced

Table 3: DIUs for FCC operation (cont.)

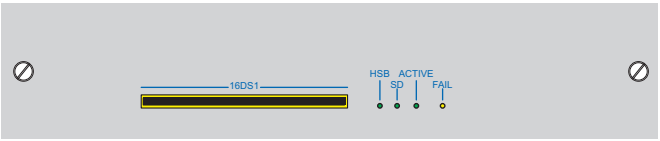
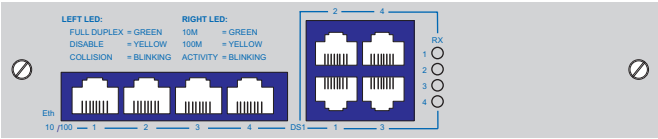
DIU	Description
16 DS1 (SCSI version)	 This DIU supports redundant DS1 operation but may be used for non-redundant operation. It can be configured to 4 DS1, 8 DS1, or 16 DS1 using software commands. NOTE 16 DS1 is not available with the 10.5 GHz band. The LEDs indicate the redundancy status. Data connections are made via: • DS1: SCSI cable, 100 ohms balanced

Table 3: DIUs for FCC operation (cont.)

DIU	Description
4 Eth 10/100 BaseT + 4 DS1	 This DIU has a digital capacity of 4 10/100 BaseT ports (including full duplex) + 4 DS1 ports. It also has configurable capacities for 4 10/100 BaseT, or 4 10/100 BaseT + 4 DS1 ports. The Eth 10/100 connection is equipped with on-line status indications. Two LEDs on each port perform the indication as follows: Left LED: • half duplex while the LED is off • full duplex while the LED is green • disabled while the LED is yellow • collisions while the LED is blinking green Right LED: • configured to 10 Mbps while the LED is green • throughput is 10 Mbps while the LED is blinking green • configured to 100 Mbps while the LED is yellow • throughput is 100 Mbps while the LED is blinking yellow Each DS1 has a dedicated green LED to indicate that data is being received. Data connections are made via: • DS1: shielded RJ45 connectors (×4), 100 ohms balanced • 10/100 BaseT: shielded RJ45 connectors (×4), 100 ohms balanced

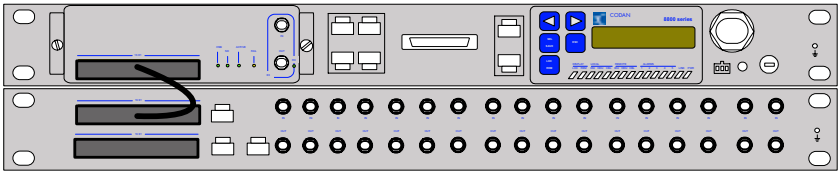
Access panels

Access panels are passive devices that may be used to interface between a SCSI DIU and external equipment. RS232 equipment may also be connected to the access panel. The internal DIP switches on an access panel must be up (off) for operation with only one IDU.

75 ohm BNC interface

The 75 ohm BNC interface access panel (Codan part number 08-06460-001) may be used to provide the Y-connections between the IDUs of the radio terminals. The access panel also provides auxiliary channel connectivity and 16 × 75 ohm E1 interfaces as shown in Figure 6. The 75 ohm impedance option can be selected via the keys on the front panel (see Figure 14a on page 51).

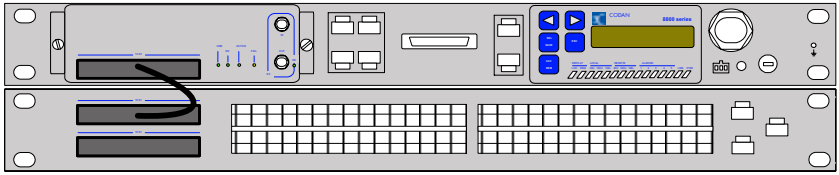
Figure 6: 75 ohm BNC interface



120 ohm Krone interface

The 120 ohm Krone interface access panel (Codan part number 08-06438-001) may be used to provide the Y-connections between the IDUs of the radio terminals. The access panel also provides auxiliary channel connectivity and 16 × 120 ohm E1 interfaces as shown in Figure 7.

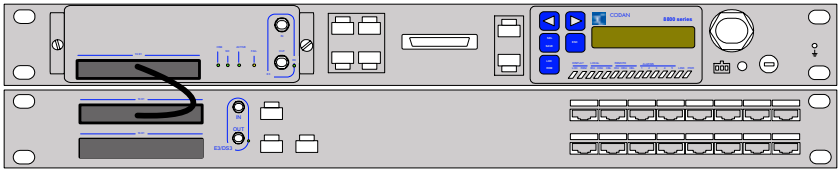
Figure 7: 120 ohm Krone interface



120 ohm RJ45 interface

The 120 ohm RJ45 interface access panel (Codan part number 08-06451-001) may be used to provide the Y-connections between the IDUs of the radio terminals. The access panel also provides auxiliary channel connectivity and 16 × 120 ohm E1 interfaces and a 75 ohm E3 interface as shown in Figure 8.

Figure 8: 120 ohm RJ45 interface



Interface connections

The interface connections for the IDU are shown in Figure 9.

Figure 9: IDU interface connections

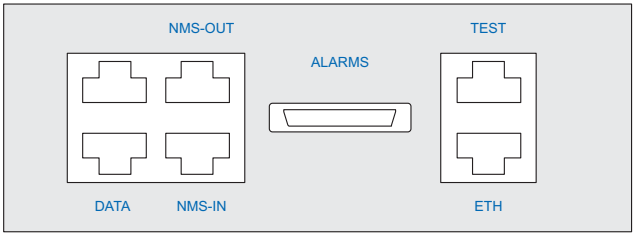


Table 4: IDU interface connections

Connector	Type	Function	To/From	Note
DATA	Shielded RJ45	General purpose data service channel	Async RS232	9.6 to 38.4 kbps, parity None/Even, stop bit 1/2, data bits 7/8, flow control None/Xon/Xoff.
NMS-OUT	Shielded RJ45	NMS output serial daisy-chaining	Cascading IDUs	Connect to next-stacked IDU for out-of-band management.
NMS-IN	Shielded RJ45	NMS input serial daisy-chaining	Cascading IDUs, a PC, or a dial-up modem	SLIP or direct to RS232 modem. Connect to **NMS-OUT** port on next-stacked IDU for out-of-band management.

Table 4: IDU interface connections (cont.)

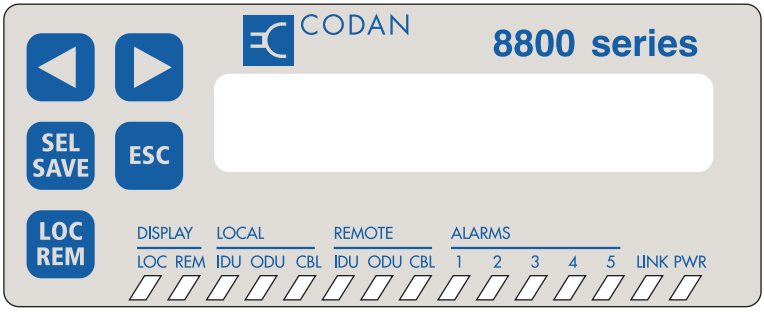
Connector	Type	Function	To/From	Note
ALARMS	25-way D-type female connector	5 operator-definable dry contact relay outputs	External alerting devices	Provides normally closed and normally open contacts. Most 8800 series DMR alarms can be mapped to any of the five alarm relays.
		4 external inputs	External devices	IDU can sense low-level/high-level/low-to-high transitions, and define the severity level as a warning, error, or fatal condition. All external inputs are protected by an opto-coupler and provide interfacing to signals between 2.4 and 9 V DC.
TEST	Shielded RJ45	Factory connection		For Codan personnel only.
ETH	Shielded RJ45	10 BaseT interface	Hub, switch or PC	SNMP management.

For connector pinout wiring see page 159, *Pin connections*.

Front panel

The front panel comprises the LCD, keys and LED indicators. It provides operator access to configure the local and remote terminals, and to control operations. It also displays the current/working parameters, system messages, status and alarms for the local and remote terminals, statistics, and test results.

Figure 10: Keys, LEDs and LCD on the front panel



Passwords

Access to the system is limited by password. Any attempt to read or change parameters using the front panel will activate a screen requesting the appropriate password. These passwords are changed using MINet.

Table 5: Access levels and factory-default passwords

Access level	Purpose	Default password
User	Provides read-only access.	**ESC ESC ESC ESC ESC**
Administrator	Provides read/write access to configuration options. You cannot access options that may affect the integrity of the link.	**ESC ESC SEL/SAVE SEL/SAVE SEL/SAVE**
Supervisor	Provides full read/write access to all configuration options.	**ESC ESC ▶ ▶ ▶**

A stand-alone IDU may be configured, monitored, and controlled using the front panel. The LCD and LEDs display information on the status of the IDU. An NMS application, such as MINet, running on an NMS workstation is another means of communicating with the 8800 series DMR.

The keys

The parameters of the 8800 series DMR are hierarchically arranged in a menu structure (see Figure 14a on page 51 and Figure 14b on page 52). The keys on the front panel enable navigation up and down through the menu structure.

Table 6: Keys on the front panel

Key	Function
▶	Scrolls forward through menu options and command parameters at the same level, or increases a digit.
◀	Scrolls backward through menu options and command parameters at the same level, or decreases a digit.
SEL/**SAVE**	Enters a menu, selects or saves groups or individual parameters, and initiates an editing session. If the parameter value is one that you can edit, adjust the first digit using ◀ or ▶, then press **SEL**/**SAVE**. Adjust the next digit, and so on, until the parameter value is correct. Press **SEL**/**SAVE** to save the parameter value.
LOC/**REM**	Selects local or remote terminal from the default screen (**LOC**/**REM** LEDs indicate state, see Figure 11 on page 50).
ESC	Moves upward in the menu structure (see Figure 14a on page 51 and Figure 14b on page 52).

In the **ALARM LOG** menu, the keys on the front panel enable the operator to erase alarms from the queue.

Table 7: Key function in the ALARM LOG menu

Key	Function
▶	Moves to the next alarm.
◀	Moves to the previous alarm.
SEL/**SAVE**	Erases the selected alarm from the alarm log queue. `Alarm Log Empty` is displayed when all of the alarms have been erased.
ESC	Exits the **ALARM LOG** menu.

NOTE For information on setting up alarms see the *MINet Management Software User Guide*.

The LEDs

The LEDs on the front panel show general link status at a glance. The lower portion of the front panel contains 15 LEDs. Two LEDs (on the right side of the panel) show general link functionality, indicating if the terminal is powered on and is operational.

The LEDs on the left side of the panel show whether the display is receiving messages from the local (**LOC**) or remote (**REM**) terminal. The operator can select the local or remote terminal by toggling the **LOC**/**REM** key.

The **LOCAL** and **REMOTE** groups of LEDs show the status of the respective IDU, ODU and cable (**CBL**). Six LEDs show if alarms have been received for the respective terminal.

Table 8: LED indicators on the front panel

LED	Colour	Function
LOC	Green	Indicates that the local terminal is selected.
REM	Green	Indicates that the remote terminal is selected.
LOC IDU	Yellow	Indicates malfunction of the local IDU.
LOC ODU	Yellow	Indicates malfunction of the local ODU.
LOC CBL	Yellow	Indicates disconnection or failure of local terminal coaxial cable.
REM IDU	Yellow	Indicates malfunction of the remote IDU.
REM ODU	Yellow	Indicates malfunction of the remote ODU.
REM CBL	Yellow	Indicates disconnection or failure of remote terminal coaxial cable.
ALARM 1 **ALARM 2** **ALARM 3** **ALARM 4** **ALARM 5**	Yellow	Alerts the operator that the relay mapped to this LED is active.
LINK	Yellow	Indicates a fault.
PWR	Green	Indicates that the terminal has power connected.

The LCD

The 16-character, 2-row LCD displays the status of the link, system messages and configuration parameters.

The LCD may display the following types of messages:

Type of message	Description
Current operation	Status of the terminal is displayed on the default screen.
Alarm	Alarm status of the terminal is displayed (alarm messages take priority over all other screens). The message relates to the most recent alarm detected. To view stored alarms, the operator must enter the **ALARM LOG** menu.
Self-test	After a power-on, cold reset, or self-test activation, the `SELF-TEST` message is displayed. If a specific test has failed, the system displays `SELF-TEST failed` and waits for the operator's confirmation.
Configuration	During configuration of a parameter that applies to both terminals of the link, the operator is prompted to apply these modifications to the other terminal, for example, `Update Changes?` and `Update 2 sides?`
Communication	When communication problems with the remote terminal or the local ODU occur, certain parameters may be unavailable and a `Communication Timeout` message is displayed.

NOTE The screens displayed in Figure 11, Figure 12 and Figure 13 are examples only.

Figure 11: Layout of the default screen

```
BER  1.000 E-15
RSL  -031  PWR +20
```

Figure 12: Layout of a menu screen

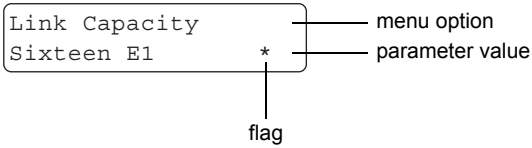


Figure 13: Layout of a message screen

```
TELEMETRY FAIL.
LOC 01:46:22
```

NOTE For all alarms, a time stamp (in minutes) is included on the second row of the display.

NOTE Each terminal reports the local and remote end alarms. These are viewed via the local terminal. Each alarm message contains a `LOC` or `REM` prefix.

There are two flags that indicate parameter conditions (see Figure 12).

This flag...	**Used for...**
*	Active values of parameters, that is, those that the terminal is currently using.
#	Parameters that have been saved in temporary memory, but are not yet activated as current.

Configuration parameters

The configuration parameters are grouped in a menu structure (see Figure 14a and Figure 14b).

Figure 14a: Menu structure

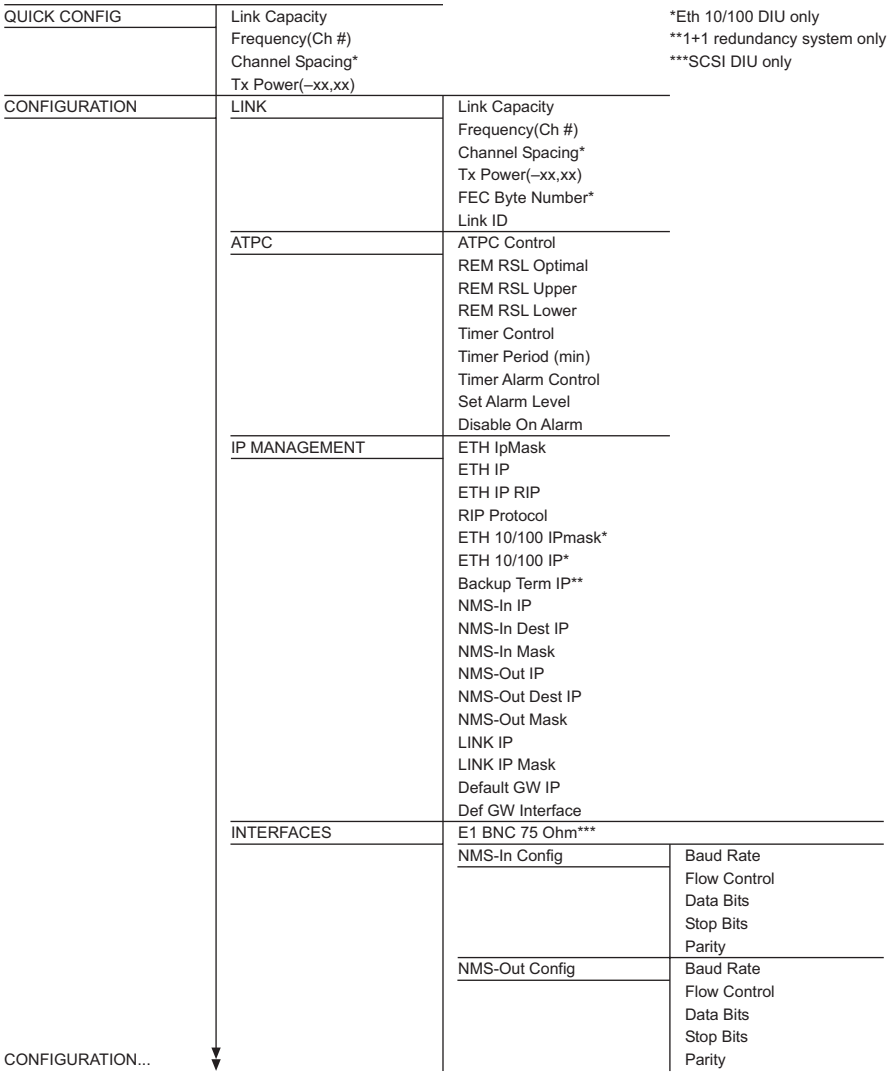
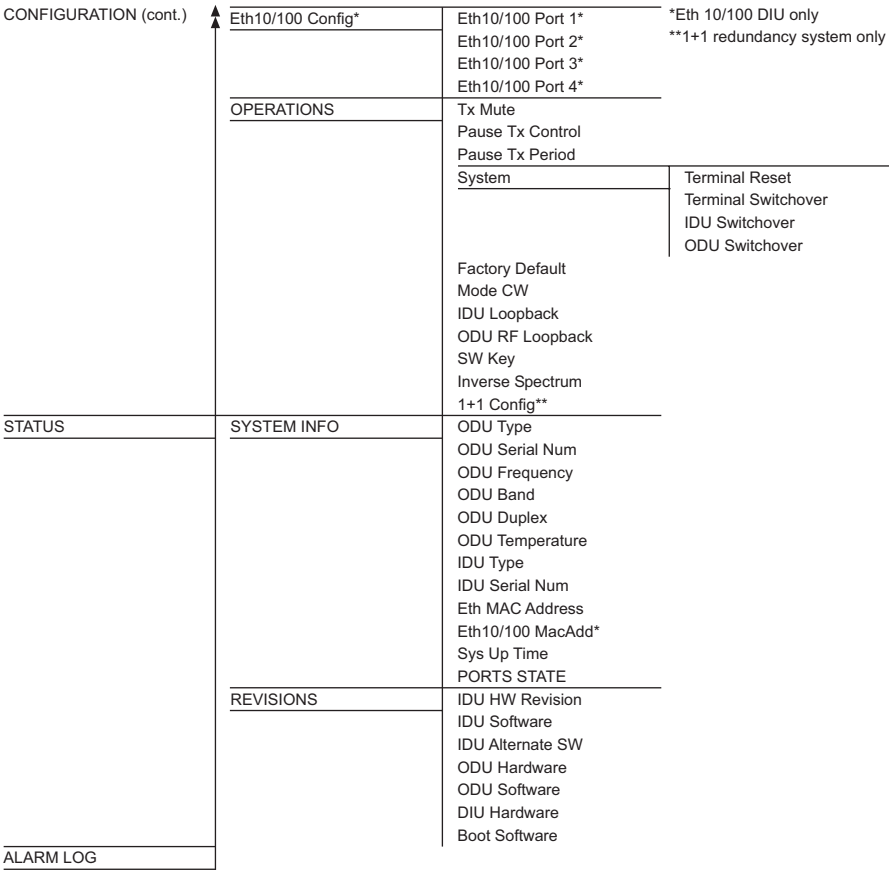


Figure 14b: Menu structure (cont.)



Some parameters are active and can be changed on the fly after modifying the individual parameter. Other parameters are static and only become active after the entire configuration (which may include several parameters) is updated.

When a parameter value is changed, a temporary save is performed by the system. Some parameters may cause messages or alarms to be generated, in which case verification by the operator will be necessary. Finally, an update of all the parameters is performed when **SEL**/**SAVE** is pressed.

Integer values are generally displayed in decimal format (some may be hexadecimal). Numbers may be positive or negative. The ± sign can also be modified when necessary (for example, Tx in dBm values). For a parameter that has digits that may be changed, the number is modified by editing each digit of the number.

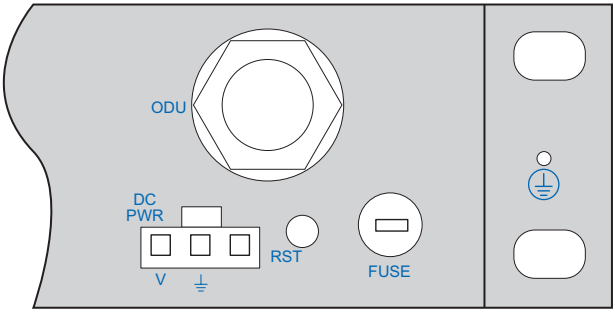
Power and ODU connections

The IDU can be powered by ±(22 to 60) V DC, according to on-site requirements, from batteries or a safety-approved power supply. Power switches and an external replaceable fuse protect the power input. The ODU is powered via the IDU through the coaxial cable.

The power and ODU connections are shown in Figure 15.

Refer to Table 9 on page 54 for a description of the power and ODU connections.

Figure 15: Front panel power and ODU connections



WARNING To avoid electrical shock, always unplug the power cord from the socket before checking the line fuse.

Table 9: Power and ODU connections

Connector	Type	Function
ODU	N-type female coaxial connector	Connects to ODU.
DC PWR	3-pin receptacle	Provides DC power in. ±(22 to 60) V DC, –48 V typical. The IDU power socket has three connecting points. The left connection point is marked with **V**. The centre point is earth and marked with an earth symbol, and the right connection point is not used. For correct connections during installation see page 75, *Connecting the DC power*.
RST	Push button	Resets the terminal (cold reset).
FUSE	Fuse	Provides DC protection. 3 A for 22 to 36 V DC. 1.6 A for 36 to 60 V DC.
Protective earth symbol (⏚)	Earthing lug	Provides earth.

Codan provides a bi-colour power cable (about 3 m long). For correct connections during installation see page 75, *Connecting the DC power*.

As the IDU supports 22 to 60 V DC, two types of fuses are provided with each IDU to cover the ranges of 22 to 36 V DC and 36 to 60 V DC. The 8800 series DMR is shipped with the 1.6 A fuse installed, supporting 36 to 60 V DC.

WARNING If your IDU is required to operate on 22 to 36 V DC, replace the 1.6 A fuse with the 3 A fuse provided.

ODU

The ODU contains the RF section of the link and generates all of the RF signals. RF status is indicated to the IDU.

The coaxial cable is used to transfer the uplink IF signal and DC power from the IDU to the ODU. It transfers the downlink IF signal back to the IDU with telemetry signals being passed in both directions.

ODU frequency band and labelling

Both ETSI and FCC radio standards define transmit and receive frequencies. The spacing between the transmit and receive frequencies is fixed, and varies depending on the frequency band in use and the applicable local standards.

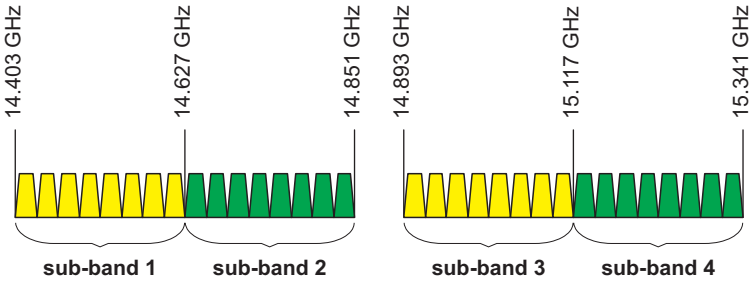
Codan divides most frequency bands into four sub-bands. An 8800 series DMR local terminal that transmits on sub-band 1 receives a signal transmitted in sub-band 3 from the remote terminal and vice versa. An 8800 series DMR that transmits in sub-band 2 receives a signal transmitted in sub-band 4 and vice versa.

Figure 16 shows an example of one of the 15 GHz bands available. A link will always include two ODUs as either:

- two ODUs marked as sub-band 1 and sub-band 3, or
- two ODUs marked as sub-band 2 and sub-band 4

A label on the ODU identifies its sub-band.

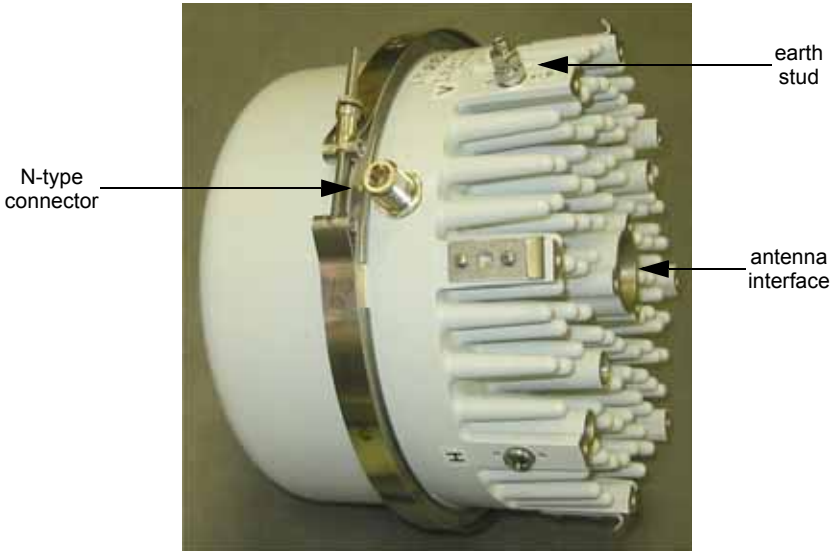
Figure 16: Frequency band example



ODU housing and connections

The ODU electronics are located in a hermetically-sealed enclosure, which is mounted directly on the antenna. The ODU can be disconnected from the antenna without affecting antenna alignment.

Figure 17: ODU connections



System network management

The 8800 series DMR can be managed using MINet, or other SNMP application, through two physical ports and one DIU (see Table 10).

Table 10: IDU management ports

Port	Application	Function
ETH (on IDU)	MINet, or other SNMP software	Out-of-band management using Ethernet connection
NMS-IN (on IDU)	MINet, or other SNMP software	Out-of-band management using SLIP connection
Eth 10/100 (on DIU)	MINet, or other SNMP software	In-band management

MINet element manager

MINet is an intuitive, proactive element management system with enhanced diagnostic and performance-monitoring tools. It provides open, reliable and user-friendly operation with a simple GUI, and uses SNMP for compatibility with standard platforms such as HP OpenView.

MINet provides the means of proactively managing all the links from a single operator console. MINet runs on Microsoft Windows 98/Me/NT/2000/XP workstations, and is a stand-alone software package that is included with each link.

Monitoring a radio link may be either in-band or out-of-band. In-band management is only available with an Eth 10/100 DIU.

For comprehensive configuration information see the *MINet Management Software User Guide*.

MINet provides the following advantages:

- user-friendly management program
- easy remote terminal handling
- performance statistics, alarms, and self-tests
- on-line polling, with real-time status and colour-coded mapping assisting with fault diagnosis
- licensed version may be run under HP OpenView Node Manager for Windows NT/2000/XP

5 Installation

This section contains the following topics:

Overview

This section outlines the complete installation and configuration procedure for the 8800 series DMR. You must follow the flowchart provided in Figure 18 on page 61 to ensure correct operation of your system.

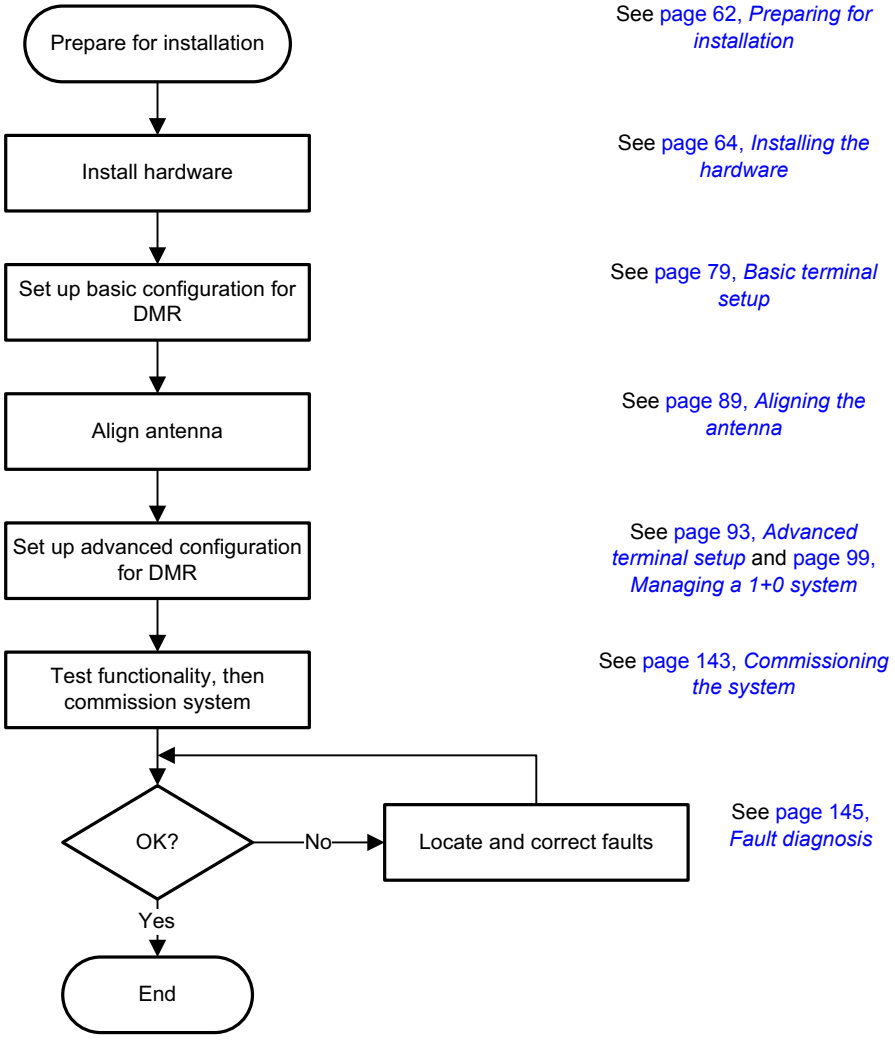
The 8800 series DMR must be installed and maintained by qualified and experienced personnel.

NOTE Before installing the 8800 series DMR system, read this section in its entirety. Installation personnel should be familiar with the system's components.

The 8800 series DMR electronics and components have been designed to be as rugged as possible. However, because of continued exposure to weather, it is recommended that qualified personnel inspect antenna systems once a year to verify proper installation, maintenance, and condition of the equipment.

CAUTION Codan disclaims any liability or responsibility for the results of improper or unsafe installation practices.

Figure 18: Installation flow chart



Preparing for installation

Unpacking the equipment

Ensure that the packing boxes are upright as indicated by the printing on the boxes. Open each box and check for signs of damage to the equipment. If you notice any damage, contact Codan immediately to obtain an RMA. Failure to contact Codan before returning the unit may result in any warranty being void.

NOTE

Retain at least one of each type of packing carton with all its packing materials. In the event that it is necessary to transport a unit, you will have the required packing material for safe shipment.

Check the contents of each box against the supplied packing list.

Each 8800 series DMR terminal is shipped in one box. There are two boxes within. One box contains the IDU and the second box contains the ODU. The MINet software and all documentation are provided on a single CD with one of the terminals.

The main equipment (IDU, ODU and antenna) depends on the specifics of your order and the required standards for data transmission (ETSI or FCC). Verify that you have received the correct equipment and that the ODUs are paired correctly. A sub-band 1 terminal must be paired with a sub-band 3 terminal. Similarly, a sub-band 2 terminal must be paired with a sub-band 4 terminal.

Equipment and materials required for installation

You should have the following equipment and materials on hand before attempting to install the 8800 series DMR system:

- hand-held voltmeter, including an adaptor for a BNC connector for fine tuning the antenna alignment
- optical aid or compass (optional) for coarse antenna alignment
- flat-head screwdriver to tighten DB25 connector
- crimping tool (Molex P/N 11-01-0197 in USA, or Molex P/N 69008-0724 in Europe) for terminating the provided DC power connector kit
- equipment required by the antenna manufacturer's installation documents
- coaxial cable up to 300 m (1000 ft) with –48 V DC supply only, nominal impedance 50 ohm
- two standard N-type connectors (sealed)
- tie wraps (or similar) for fastening cables
- surge protectors (optional, but recommended) (FCC-250B-140-N (Fischer Custom Communications), 800 V/200 ms or equivalent)
- earthing kit suitable for coaxial cable (optional, but recommended)
- self-amalgamating tape for sealing connectors

NOTE Contact your Codan representative for information on other supply voltages and ODU-to-IDU connection distances.

Installing the hardware

This procedure assumes that the site power, earthing, and the antenna mounting pole have been installed prior to undertaking 8800 series DMR installation activities.

Hardware installation involves:

- Installing the antenna on page 64
- Installing the ODU-to-IDU coaxial cable
- Installing the ODU—direct mount on page 65
- Installing the ODU—indirect mount on page 67
- Installing the IDU
- Earthing the installation on page 74
- Connecting the DC power on page 75
- Connecting the communication, and monitor and control cables on page 76

Installing the antenna

Antenna installation requirements vary significantly depending upon the manufacturer. Please refer to the manufacturer's documentation.

Installing the ODU-to-IDU coaxial cable

To install the coaxial cable:

❑ Attach an N-type male connector to one end of the coaxial cable.

NOTE

Use a standard installation kit and follow the connector manufacturer's instructions.

The maximum allowable cable length is 300 m (1000 ft) for a –48 V DC supply.

- ❑ Position the coaxial cable, connector end up, on the mounting pole, leaving a minimum of 45 cm (18 in) for a service loop at the point where the cable will connect to the ODU.
- ❑ Fasten the coaxial cable to the structure every 2 m (6 ft).

CAUTION Avoid tight bending and over tightening the cable during fastening.

Installing the ODU—direct mount

NOTE If the antenna has a diameter greater than 1.8 m (6 ft), the ODU must be mounted indirectly (see page 67, *Installing the ODU—indirect mount*).

The ODU is an electronic unit that installs flush on the back of the antenna assembly.

WARNING Failure to follow the ODU installation procedure may damage the antenna mount assembly, and may render the DMR unusable.

To install the ODU directly:

- ❑ Mount the ODU onto the antenna, observing the **H** or **V** polarisation marks on the body of the ODU (see Figure 19 on page 66).

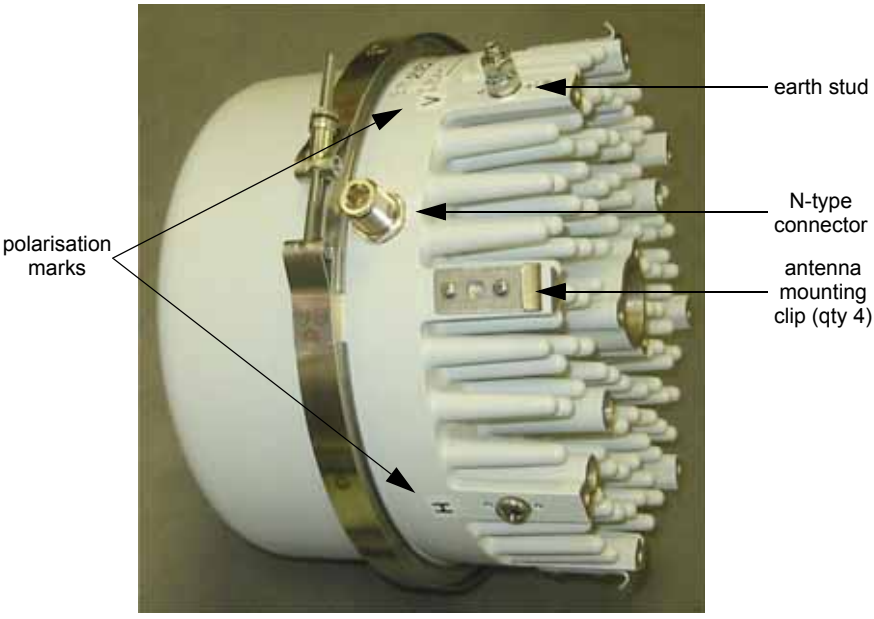
  The **H** label must point either straight up or straight down for horizontal polarisation.

  The **V** label must point either straight up or straight down for vertical polarisation.

  CAUTION Both ends of the link *must* be identically polarised.

  NOTE To discourage birds from perching on the ODU-to-IDU coaxial cable, orient the N-type connector on the ODU downwards.

Figure 19: ODU identification



- ❑ Secure the ODU in place using the four clips on the antenna.
- ❑ Connect surge protection to the ODU-to-IDU coaxial cable, if required.

NOTE In-line surge protection is recommended to minimise damage from lightning strikes.

- ❑ Connect the ODU-to-IDU coaxial cable to the N-type connector on the ODU.
- ❑ Seal the connection, and the surge protection if used, with self-amalgamating tape (PIB (Rotunda 2501) or EPR (3M Scotch™ 23)).
- ❑ Cover the self-amalgamating tape with an overlay of high-quality electrical tape (3M Scotch™ 33+, or similar) to minimise aging of the self-amalgamating tape.

- ❑ Connect the earth stud of the ODU directly to the tower using the earth cable supplied.

NOTE The position of the earth stud on the body of the ODU may be altered to suit installation requirements.

NOTE The earth cable should be as short as possible and follow the most direct route in order to minimise damage from lightning strikes.

Installing the ODU—indirect mount

NOTE If the antenna has a diameter greater than 1.8 m (6 ft), the ODU must be mounted indirectly.

To install the ODU indirectly:

- ❑ Attach the indirect-mount bracket to the heatsink of the ODU using three ¼-20 UNC × 1.0" long pan-head screws, each with a ¼" flat and lock washer (lock washer next to screw head).

Figure 20: Indirect-mount bracket on ODU

- ❑ Attach the indirect-mount bracket to the pole using two M12 × 140 mm long threaded rods, four M12 lock washers (on both sides of the bracket), and two M12 hex nuts.

Figure 21: Indirect-mount bracket on pole

- ❑ Attach the waveguide adaptor to the ODU using the following fasteners:

Adaptor	Fasteners	See...
7 and 8 GHz (CBR84/ PDR84/ WR112)	Two ¼-20 UNC × 1.5" long pan-head screws, each with ¼" flat and lock washer (lock washer next to screw head)	Figure 22 on page 70
10.5 GHz (PDR100/ PBR100/ WR90)	Three ¼-20 UNC × 0.5" long pan-head screws, each with ¼" lock washer	Figure 23 on page 70
13 and 15 GHz (PBR140/ WR62)	Two ¼-20 UNC × 1.5" long pan-head screws, each with ¼" flat and lock washer (lock washer next to screw head) Four ¼-20 UNC × 0.5" long CSK screws	Figure 24 on page 71
18 GHz (PBR220/ WR42)	Three ¼-20 UNC × 0.5" long pan-head screws, each with ¼" lock washer	Figure 25 on page 71

Figure 22: 7 and 8 GHz adaptor

Figure 23: 10.5 GHz adaptor

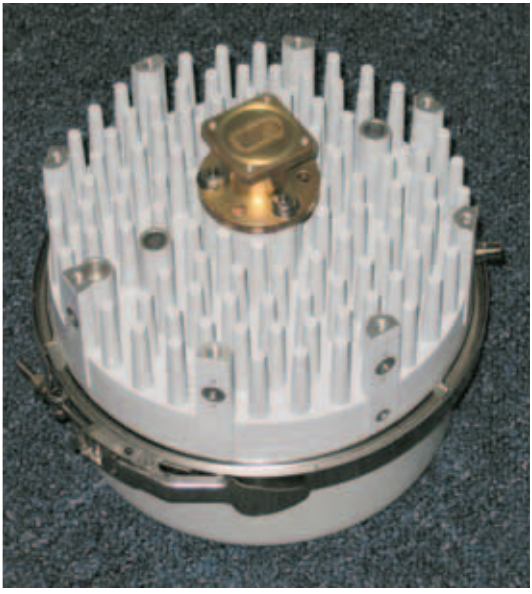


Figure 24: 13 and 15 GHz adaptor

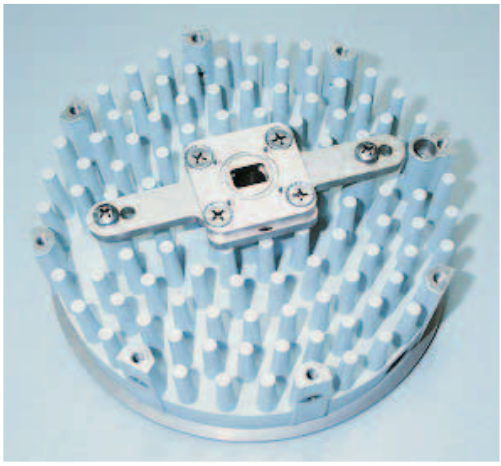


Figure 25: 18 GHz adaptor

- ❑ Connect the ODU to the antenna using flexible waveguide.
- ❑ Support or tie down the flexible waveguide to prevent vibration in high wind or other environmental conditions.
- ❑ Connect surge protection to the ODU-to-IDU coaxial cable, if required.

NOTE In-line surge protection is recommended to minimise damage from lightning strikes.

- ❑ Connect the ODU-to-IDU coaxial cable to the N-type connector on the ODU.
- ❑ Seal the connection, and the surge protection if used, with self-amalgamating tape (PIB (Rotunda 2501) or EPR (3M Scotch™ 23)).
- ❑ Cover the self-amalgamating tape with an overlay of high-quality electrical tape (3M Scotch™ 33+, or similar) to minimise aging of the self-amalgamating tape.
- ❑ Connect the earth stud of the ODU directly to the tower with the earth cable supplied.

NOTE The position of the earth stud on the body of the ODU may be altered to suit installation requirements.

NOTE The earth cable should be as short as possible and follow the most direct route in order to minimise damage from lightning strikes.

Installing the IDU

To mount the IDU:

- ❑ Mount the IDU in the rack in its pre-determined position using the supplied mounting screws.

  The IDU requires one standard 19" rack space (EIA 4.5 cm (1.75 in)).

- ❑ Pull the coaxial cable installed on page 64, *Installing the ODU-to-IDU coaxial cable* into the rack, then cut to length leaving a 45 cm (18 in) service loop.

- ❑ Attach an N-type male connector to the end of the coaxial cable.

  NOTE Use a standard installation kit and follow the connector manufacturer's instructions.

- ❑ Connect the N-type elbow connector to the **ODU** connector on the IDU (see Figure 15 on page 53).

- ❑ Connect surge protection to the ODU-to-IDU coaxial cable, if required.

  NOTE In-line surge protection is recommended to minimise damage from lightning strikes.

- ❑ Connect the coaxial cable to the female portion of the N-type elbow.

- ❑ If an access panel is used, mount this below the IDU using the fasteners provided.

  The DIP switches are located on the main PCB of the access panel and can be accessed by removing the lid. All switches must be set to off (up) for 1+0 operation.

- ❑ If an access panel is used, connect a SCSI cable between the SCSI port on the DIU and a SCSI port on the access panel (see page 40, *Access panels*).

  WARNING The SCSI cable is damaged easily.

- ❑ Tighten the retaining screws on the SCSI connector, as required.

Earthing the installation

To earth the installation:

- ❑ Connect the ring terminal of the supplied earth cable to the earth stud on the IDU.
- ❑ Cut the earth cable to an appropriate length to allow for connection to the rack earth.

  NOTE The earth cable should follow the most direct route possible.

- ❑ Attach the supplied ring terminal to the other end of the IDU earth cable.
- ❑ Connect the ring terminal to the rack earth.

Connecting the DC power

NOTE — The IDU supports 22 to 60 V DC. The 1.6 A fuse (installed in the factory) supports 36 to 60 V DC.

WARNING — If your IDU is required to operate on 22 to 36 V DC, replace the 1.6 A fuse with the 3 A fuse provided.

To connect the DC power:

- ❑ Measure the DC voltage to confirm its magnitude and polarity.

  WARNING — Use of an improper voltage or a faulty earth connection may cause serious injury or equipment damage.

- ❑ Use the DC connection kit provided to connect the switched DC power supply to the 3-pin receptacle on the IDU.

  WARNING — The rack earth of the DC power supply must be connected to the centre pin (⏚) of the **DC PWR** connector.

  When the terminal is rack-mounted, or two terminals are connected to the same power source, the **V** pin can be connected to the positive or negative pole of the power supply.

  WARNING — If two or more IDUs are connected to the same power source, the polarity of all terminals must be kept the same.

  WARNING — The polarity of the centre pin (earth) of the terminal must be the same as the earth point of the power supply.

Connecting the communication, and monitor and control cables

To connect the cables:

- ❑ Connect the tributary cables to the DIU on the IDU.

NOTE — If BNC connectors are used, connect the Tx/Rx port of the IDU to the respective Rx/Tx port of the external equipment.

NOTE — If Krone connectors are used see Table 32 on page 164 for the correct pinouts.

NOTE — If RJ45 connectors are used see Table 33 on page 165 for the correct pinouts.

- ❑ Connect the alarm I/O cables as required.

  For correct pinouts see Table 27 on page 160.

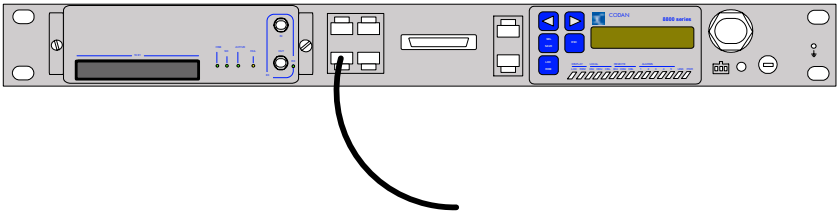
NOTE — The voltage allowed for each of the alarm inputs is 2.4 to 9 V DC. The polarity of the voltage is not relevant.

WARNING — Use of an improper voltage or a faulty earth connection may cause serious injury or equipment damage.

- ❑ Connect the data cables as required (see page 164, *Data channel connectors*).

  Serial RS232 asynchronous equipment may be connected at either end of the link. The **DATA** port supports Xon/Xoff flow control only (see Table 4 on page 42).

Figure 26: Connecting RS232 input



NOTE

Do not connect the **NMS-IN**/**NMS-OUT** and **ETH** ports at this time. These ports should be connected only after performing configuration as described on page 79, *Basic terminal setup*.

For comprehensive configuration information see the *MINet Management Software User Guide* that discusses the SNMP management system.

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6 Basic terminal setup

This section contains the following topics:

NOTE

After completing basic setup and antenna alignment, you may want to set up management for a complex network of Codan 8800 series DMRs. For more information see page 99, *Managing a 1+0 system*.

Configuring the terminals

The 8800 series DMRs are now ready for configuration. Configuration must be carried out before antenna alignment is attempted.

Use the keys on the front panel of each IDU to set up the parameters of the terminal via the **QUICK CONFIG** menu.

Any parameter values that exist within the **QUICK CONFIG** menu in a new link are the factory-default values, and may differ from those shown in the screens below. You must modify the data and adapt the parameters to your system.

NOTE Press **ESC** at any time in the following process to return to a known starting point.

NOTE For more information on accessing the menu structure see Table 6 on page 46.

Powering up the DMR

NOTE — The IDU supports 22 to 60 V DC. The 1.6 A fuse (installed in the factory) supports 36 to 60 V DC.

WARNING — If your IDU is required to operate on 22 to 36 V DC, replace the 1.6 A fuse with the 3 A fuse provided.

To power up the DMR:

- ❑ Switch on the power supply to the DMR.

  NOTE — When the IDU is connected to power, the unit is automatically powered up.

  The following tests are noted on the display:

  `RAM TEST`

  `LOADING BANK 1`

  `INITIALISING`

  `SELF-TEST` (all LEDs should flash)

  `HARDWARE INIT OK`

  `STARTING UP`

  `SELF TEST PASSED SUCCESSFULLY`

  On completion of all the startup tests, `LINK DOWN` is displayed unless the antenna is coincidentally aligned to allow system lockup with a low receiver power. If this is the case, you will be prompted with a `Save to Remote` message at each step of the configuration process.

- ❑ Check that the **PWR** LED on the front panel is on.
- ❑ Check that the **LOC** LED on the front panel is on.

  If the **REM** LED is on, press **LOC**/**REM**.

  The DMR is now ready to configure for use.

Entering the QUICK CONFIG menu

To enter the **QUICK CONFIG** menu:

- ❑ Press **SEL**/**SAVE** to enter the menu options.

```
Please Wait . . . .
. . . . . .
```

NOTE — The running dots indicate that this terminal is the local (master) terminal, and from this side you can configure both sides of the link.

- ❑ Scroll through the menu options using ◀ or ▶ until `QUICK CONFIG` is displayed.

```
QUICK CONFIG
```

- ❑ Press **SEL**/**SAVE** to enter the **QUICK CONFIG** menu.

  A password prompt is displayed.

```
ENTER PASSWORD
```

- ❑ Enter the default supervisor password:

  ESC ESC ▶▶▶.

```
ENTER PASSWORD
*****
```

Entering the link capacity

To enter the link capacity:

- ❑ Use ◀ or ▶ to move through the **QUICK CONFIG** menu until `Link Capacity` is displayed.

```
Link Capacity
Sixteen E1        *
```

- ❑ Press **SEL**/**SAVE** to enter the **Link Capacity** menu, then use ◀ or ▶ to scroll to the required capacity.
- ❑ Press **SEL**/**SAVE** to select the capacity.

NOTE

A # mark appears on the lower right of the display to indicate that any changes made have not been saved into the working configuration of the DMR (see page 86, *Saving the changes to the working configuration*).

- ❑ Press **ESC** to exit the **Link Capacity** menu.

Entering the frequency

To enter the frequency:

- ❑ Use ◀ or ▶ to move through the **QUICK CONFIG** menu until `Frequency` is displayed.

```
Frequency(Ch #)
38854.25 (1017)*
```

- ❑ Press **SEL**/**SAVE** to enter the **Frequency** menu.
- ❑ Press **SEL**/**SAVE** to move across the frequency digits and ◀ or ▶ to increase or decrease each digit until the correct transmit frequency is displayed.

NOTE

The frequency selected is the transmit frequency in MHz.

Frequency bands below 10 GHz will begin with a 0 as the first digit.

An error message is displayed if an invalid frequency is entered.

- ❑ Press **SEL**/**SAVE** to save the frequency.
- ❑ Press **ESC** to exit the **Frequency** menu.

Entering the channel spacing

NOTE Channel Spacing is only available if an Eth 10/100 DIU is installed.

To enter the channel spacing:

- ❑ Use ◀ or ▶ to move through the **QUICK CONFIG** menu until `Channel Spacing` is displayed.

```
Channel Spacing
28 MHz            *
```

- ❑ Press **SEL**/**SAVE** to enter the **Channel Spacing** menu, then use ◀ or ▶ to scroll to the desired channel spacing.
- ❑ Press **SEL/SAVE** to save the channel spacing.
- ❑ Press **ESC** to exit the **Channel Spacing** menu.

Entering the transmit power

To enter the transmit power:

- ❑ Use ◀ or ▶ to move through the **QUICK CONFIG** menu until `Tx Power` is displayed.

```
Tx Power(-10,24)
+24               #
```

- ❑ Press **SEL**/**SAVE** to enter the **Tx Power** menu.
- ❑ Use **SEL**/**SAVE** to move across the power digits and ◀ or ▶ to increase or decrease the individual digits.

  Adjust the power level for maximum transmit power (located in the top right corner of the display).
- ❑ Press **SEL**/**SAVE** to save the transmit power level.
- ❑ Press **ESC** to exit the **Tx Power** menu.

Setting up the IP address of the terminal

To set the IP address of each terminal:

- ❑ Use ◀ or ▶ to move through the **CONFIGURATION** menu until `IP MANAGEMENT` is displayed.
- ❑ Press **SEL**/**SAVE** to enter the **IP MANAGEMENT** menu, then use ◀ or ▶ to move through the menu until `ETH IP` is displayed.

```
ETH IP
192 . 168 . 3 . 1  *
```

- ❑ Use **SEL**/**SAVE** to move across the IP address digits and ◀ or ▶ to increase or decrease the individual digits.
- ❑ Press **SEL**/**SAVE** to save the IP address.
- ❑ Press **ESC** twice to exit the **IP MANAGEMENT** and **CONFIGURATION** menus.

Saving the changes to the working configuration

NOTE All changes made are stored in volatile RAM and are not implemented until they are saved into the working configuration.

To save the changes to the working configuration:

- ❑ Press **ESC** twice to exit the **QUICK CONFIG** menu.
- ❑ Press **SEL**/**SAVE** to move the changes to the current working configuration of the DMR, then press **ESC** *twice* to update the working configuration.

Checking the configuration

Initial configuration is completed when this process has been performed at both terminals in the link.

Fine tuning may be performed by viewing the parameters in the **CONFIGURATION** > **LINK** menu, then setting as required. All parameters that have been set using the **QUICK CONFIG** menu may be accessed and set through the **CONFIGURATION** > **LINK** menu.

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7 Aligning the antenna

In the previous sections, the 8800 series DMRs were installed, and initial parameters set. Communication may have been established between the terminals, depending on the rough alignment of the antennas. This section describes the procedure for aligning an antenna for maximum transmission and reception capability.

WARNING

Failure to follow this antenna alignment procedure may damage your equipment and may render the DMR unusable. Read through the entire procedure before attempting adjustment. Contact your Codan representative with any questions regarding this topic.

This procedure must be performed on both antennas in the link.

Aligning the antenna

To align the antenna:

- ❑ Locate the drain groove on the radome panel.

  The groove should be facing downwards to ensure good drainage.

- ❑ If the radome panel needs to be rotated:

  - loosen the locking nuts on the band clamp
  - rotate the radome until the drain groove is facing downward
  - slide the band clamp until the locking nut assembly is facing downward
  - tighten the locking nuts

- ❑ Attach a hand-held voltmeter and BNC test lead to the BNC connector on each ODU.

- ❑ At the local terminal, adjust the azimuth until the voltmeter displays the highest possible voltage for the expected RSL (see Table 11 on page 90).

Table 11: DC voltage for expected RSL

RSL (dBm)	–10	–20	–30	–40	–50	–60	–70	–80	–85
DC voltage (V)	4.9	4.3	3.8	3.2	2.7	2.1	1.6	1.1	0.8

- ❑ Use the fine-adjust bolt for the azimuth of the antenna until the voltage reaches a maximum.
- ❑ Adjust and fine tune the azimuth at the remote terminal in the same way until the maximum voltage is displayed on the voltmeter.
- ❑ At the local terminal, adjust the elevation until the voltmeter displays the highest possible voltage for the expected RSL (see Table 11).
- ❑ Use the fine-adjust bolt for the elevation of the antenna until the voltage reaches a maximum.
- ❑ Adjust and fine tune the elevation at the remote terminal in the same way until the maximum voltage is displayed on the voltmeter.

Performing a functional test

A functional test of the system should be performed after each antenna in the system has been aligned to the maximum achievable receiver power level.

To perform a functional test:

- ❑ Check the actual receiver power levels against the theoretical power levels.

  Power levels should be reciprocated (±5 dB tolerance).

- ❑ Check that appropriate fade margins are achieved (typically 30 to 40 dB).

- ❑ If receive levels are not achieved, check the alignment of the antenna, transmit power settings, and obstructions in the path.

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8 Advanced terminal setup

This section contains the following topics:

NOTE For guidance on setting up a complex network of Codan 8800 series DMRs see page 99, *Managing a 1+0 system*.

ATPC

NOTE For information on setting up the ATPC parameters see the *MINet Management Software User Guide*.

Each terminal of a link controls the transmit level of the other terminal to ensure the receive signal stays within its own preset limits. ATPC controls the transmit power so that the terminal is efficient relative to the specific site conditions. The concept is based on obtaining the measured transmit power and RSL values of both terminals, then calculating the differences between the measured powers of each. The algorithm then determines whether to increase or decrease the transmit power of the transmitting terminal to bring it within the preset RSL range of the receiving terminal.

The parameters that configure ATPC are:

- ATPC Control
- REM RSL Optimal
- REM RSL Upper
- REM RSL Lower
- Timer Control
- Timer Period
- Timer Alarm Control
- Set Alarm Level
- Disable On Alarm

It is recommended that you configure at least 5 dB difference between the upper, optimal and lower RSL parameters (see Figure 14a on page 51).

Tx Mute

Tx Mute is used for link diagnostics and testing.

The parameters that configure Tx Mute are:

- Tx Mute
- Pause Tx Control
- Pause Tx Period

The Pause Tx mechanism activates the Tx Mute for a pre-defined time, which is set using the Pause Tx Period parameter (up to 36000 s with a default time of 600 s).

SNMP traps

NOTE For information on setting up SNMP traps see the *MINet Management Software User Guide*.

SNMP traps are messages sent by the managing SNMP agent to a number of IP addresses. The messages include information about alarms, system status, and information in general. The 8800 series DMR firmware includes a number of defined trap parameters in the MIB, such as the IP, alarm selection, condition for activation, and content. The firmware does not include a default destination IP address configuration. Alarms can be mapped to external relays or selected to send SNMP traps to the managing agent.

NOTE Traps are asynchronous generated alarms. Alarms may be polled using the NMS.

Alarms and mapping

NOTE For information on setting up and mapping alarms see the *MINet Management Software User Guide*.

Any alarm (including status and threshold alarms) from the Codan 8800 series DMR may be mapped through to one or more relay outputs. These relay outputs are available through the DB25 connector on the front panel. The relay outputs may be software-configured as a normally open or closed hardware output, a LED indication on the front panel, or an SNMP trap, which is sent to a management PC.

External relays

NOTE For information on setting up external relays see the *MINet Management Software User Guide*.

External relays are used to control additional equipment connected to the 8800 series DMR system. This equipment is generally not related directly to communications. Such equipment could be a UPS, buzzer, lights etc. Relays enable the IDU to respond to defined internal conditions within the system.

Resetting the DMR

The 8800 series DMR may be reset in two ways:

- cold reset
- loading factory defaults

Cold reset

A cold reset is equivalent to powering down the DMR. To cold reset the DMR, push the **RST** button on the front panel of the IDU (see Figure 15 on page 53). You may also cold reset the DMR using MINet.

Loading factory defaults

Loading the factory defaults resets all parameters to those supplied at manufacture. This feature is useful during re-installation of a terminal, and commissioning and fault diagnosis from a known starting configuration (see page 155, *Factory-default settings*).

CAUTION

If you reset a terminal, you must re-enter the correct operating frequency before attempting to set up any other parameters. Follow the directions on page 79, *Basic terminal setup*.

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9 Managing a 1+0 system

This section contains the following topics:

Overview

An NMS consists of a centrally-located management PC that is used to monitor and control equipment located at remote sites, which may be difficult to access. Codan 8800 series DMRs use SNMP, enabling the use of a single software package to monitor and control the entire DMR network from a convenient location within the network.

SNMP systems comprise three main parts:

- a management PC
- a management agent
- a MIB

The management PC is used by a network administrator to manage the communication network system. Each device that needs to be managed via the management PC has a management agent loaded. The agent enables the device to send alerts (or traps) to the management PC when a pre-determined event occurs. The events include alarms or operator-defined thresholds being passed, and are determined either by the device itself or are configurable by the operator. Agents also compile information about the local managed device, then store this information in a local MIB. The MIB is a database file that the administrator uses with the agent to locate, retrieve and control data relating to the managed device.

Managing an 8800 series DMR network

Communication between sites in an 8800 series DMR network is set up using IP addresses. The architecture of the communication network should be planned carefully by a person experienced in IP addressing and networking, prior to rolling out the system.

Hardware requirements may change significantly depending on the customer requirements and network topology. This section covers some basic building blocks that may be used to form complete networks.

There are two types of management available:

- out-of-band management, which is mandatory for PDH-only DIUs, and may optionally be used for Eth 10/100 DIUs
- in-band management, which may be used with Eth 10/100 DIUs

When out-of-band management is used, the management traffic is passed over the link using the peer channel of the DMR. When in-band management is used, the management traffic is carried inside the customer's bandwidth, making the transmission of management traffic faster.

Managing an 8800 series DMR standard system using out-of-band management

Out-of-band management follows the rules of standard IP addressing.

Further guidance on conventions of IP addressing and networking is provided below:

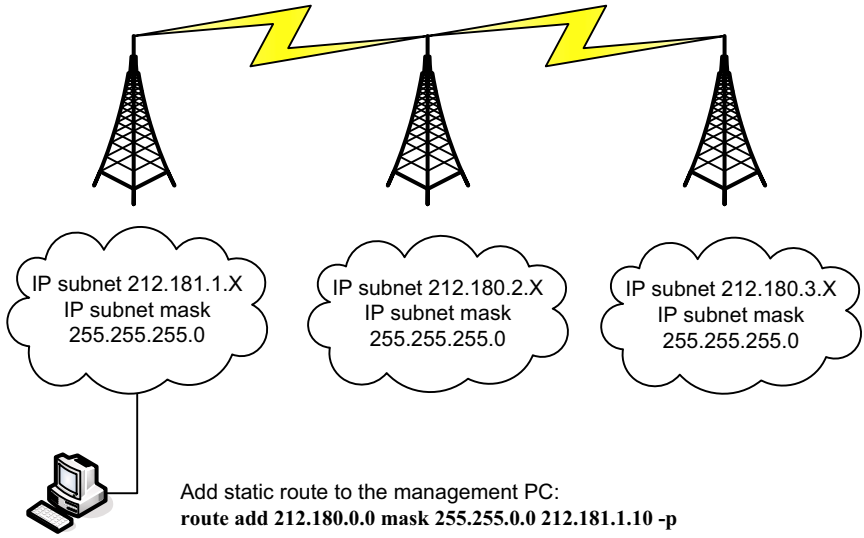
- Each IP address must be unique.
- There should be no active IP loops in the network.
- Every terminal must have an IP address and subnet mask assigned to the **ETH** port.
- Each site must be on a different ETH IP subnet.
- All equipment at the same site must be on the same subnet.
- A static route is required on the management PC for network connectivity and management of a number of terminals.
- If there are multiple IDUs at one site, there must be a connection between their management ports. This can be provided by *one* of the following:
  - daisy-chaining the **NMS-OUT** port of one IDU to the **NMS-IN** port of the next IDU using a straight (non-crossover) CAT5 cable

    NOTE — The **NMS-OUT** port of the last IDU in the chain should not be looped back to the **NMS-IN** port of the first IDU.

  - connecting the **ETH** ports to the same network using a crossover CAT5 cable (two IDUs only) or an Ethernet switch
- RIP protocol must be enabled.
- ETH RIP may be disabled on the **ETH** ports to prevent IP addresses being passed outside the 8800 series DMR network.

Figure 27 shows an example of a network that follows the rules above.

Figure 27: Example of out-of-band management



To set up a system using out-of-band management:

- ❑ Determine IP subnets and addresses for all terminals in the communication network.

  NOTE The network plan should be completed by a person experienced in IP addressing and networking.

- ❑ Install all 8800 series DMRs according to standard installation practices.
- ❑ Ensure all systems are operational and running error-free.
- ❑ Set the correct ETH IP address and ETH IP mask via the front panel of each IDU, according to the network plan.

- ❑ Set the RIP protocol to Enabled.
- ❑ Set the ETH RIP as required.
- ❑ Set up the management PC, including adding any persistent static routes (see the *MINet Management Software User Guide* for details).
- ❑ Connect the management PC and DMRs into the network using Ethernet CAT5 cables (see Table 12).

Cables used for out-of-band management

Table 12 shows the cable types used in the following example network configurations.

Table 12: Cable details for out-of-band management

Label	Cable type	From	To	Comment
B	Ethernet cable, crossover, standard CAT5	**ETH** port on IDU	PC	Provided standard with the 8800 series DMR
C	Ethernet cable, straight, standard CAT5	**NMS-IN**	**NMS-OUT**	Provides connection for out-of-band management between 1+0 terminals

Examples of out-of-band management

For a detailed example of out-of-band management used in a...	See...
Simple network containing a single 1+0 link	Figure 28 on page 107 and Table 13 on page 109
Complex network containing multiple 1+0 links in a series configuration	Figure 29 on page 111 and Table 14 on page 113
Complex network containing multiple 1+0 links in a star configuration	Figure 30 on page 115 and Table 15 on page 117

All of the above examples may be used as building blocks in a complex network for out-of-band management.

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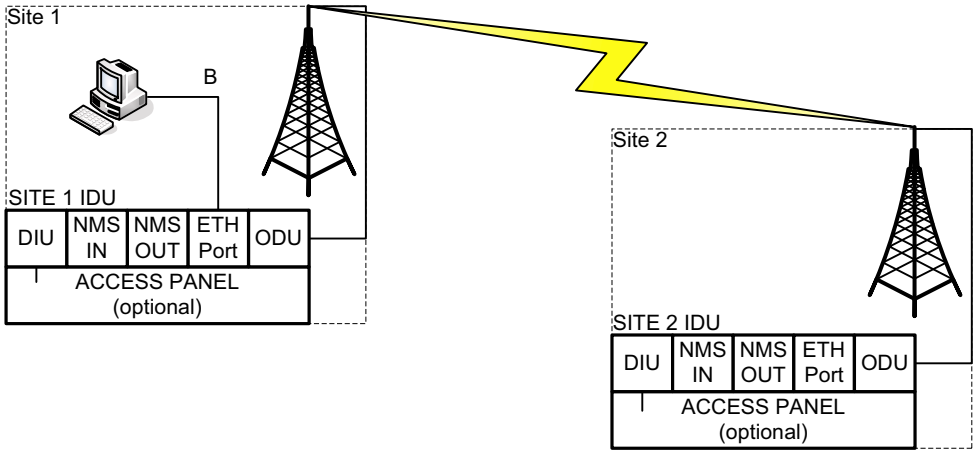
Figure 28: Single 1+0 link using out-of-band management



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In Figure 28 on page 107, the management PC requires the following static route to be added via a Command Prompt session:

route add 212.180.2.0 mask 255.255.255.0 212.180.1.10 -p

NOTE The static route may be set up automatically using MINet.

Table 13: IP addresses for a single 1+0 link using out-of-band management

IDU	ETH IP address	ETH Mask address	RIP protocol	ETH RIP
Site 1	212.180.1.10	255.255.255.0	Enabled	Disabled
Site 2	212.180.2.10	255.255.255.0	Enabled	Enabled

NOTE The management PC must be on the same subnet as the connected 8800 series DMR. In the above example, the IP address of the management PC could be 212.180.1.100 with a mask of 255.255.255.0.

NOTE For out-of-band management, all sites must be on different subnets.

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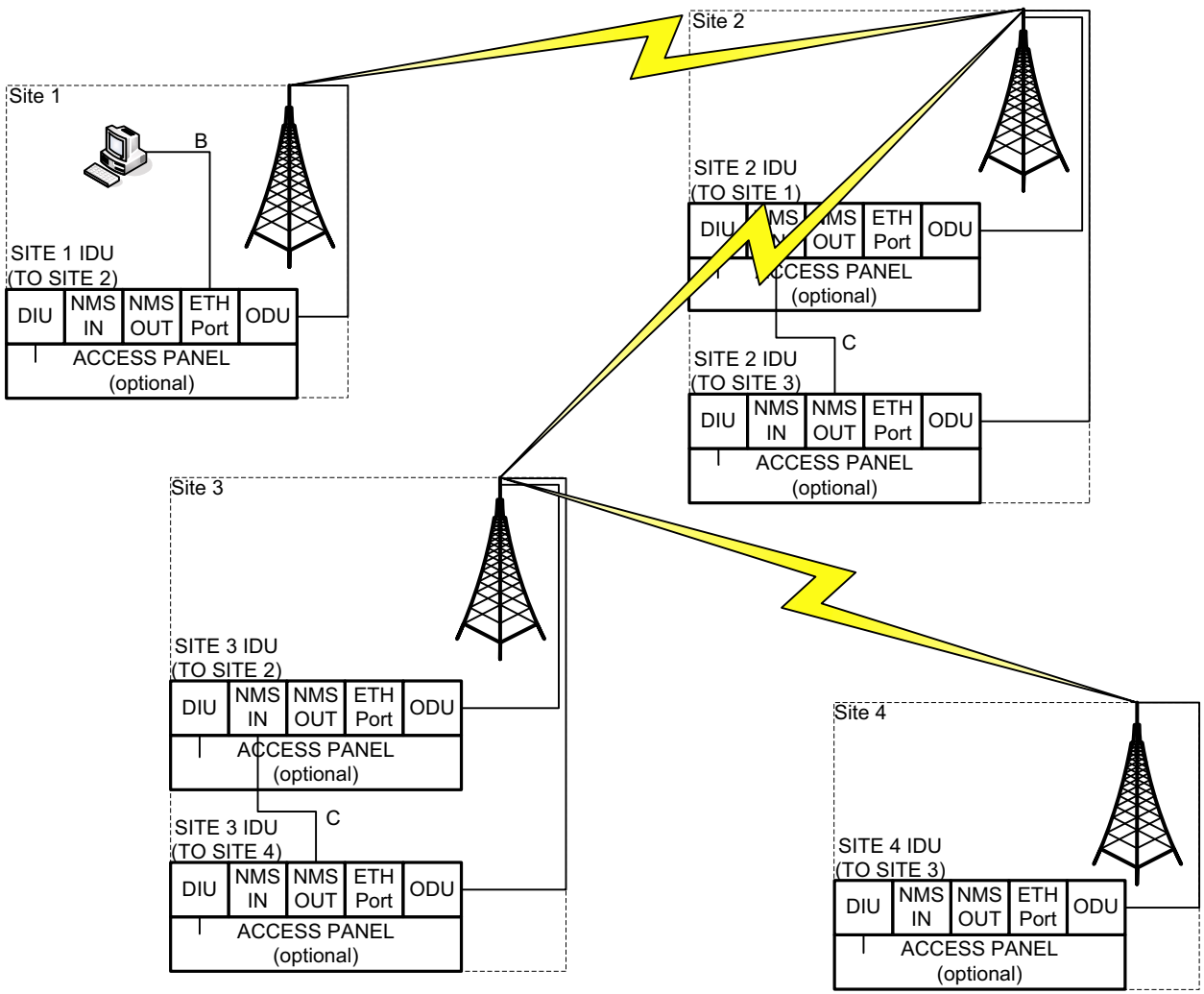
Figure 29: Series 1+0 link using out-of-band management



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In Figure 29 on page 111, the management PC requires the following static route to be added via a Command Prompt session:

route add 212.180.0.0 mask 255.255.0.0 212.181.1.10 -p

NOTE

A static route may also be set up for a single terminal using MINet. This must be repeated for each terminal. For more information see the section on setting up a static route for out-of-band management in the *MINet Management Software User Guide*.

Table 14: IP addresses for a series 1+0 link using out-of-band management

IDU	ETH IP address	ETH Mask address	RIP protocol	ETH RIP
Site 1 (to Site 2)	212.181.1.10	255.255.255.0	Enabled	Disabled
Site 2 (to Site 1)	212.180.2.10	255.255.255.0	Enabled	Enabled
Site 2 (to Site 3)	212.180.2.20	255.255.255.0	Enabled	Enabled
Site 3 (to Site 2)	212.180.3.10	255.255.255.0	Enabled	Enabled
Site 3 (to Site 4)	212.180.3.20	255.255.255.0	Enabled	Enabled
Site 4 (to Site 3)	212.180.4.10	255.255.255.0	Enabled	Enabled

NOTE

The management PC must be on the same subnet as the connected 8800 series DMR. In the above example, the IP address of the management PC could be 212.181.1.100 with a mask of 255.255.255.0.

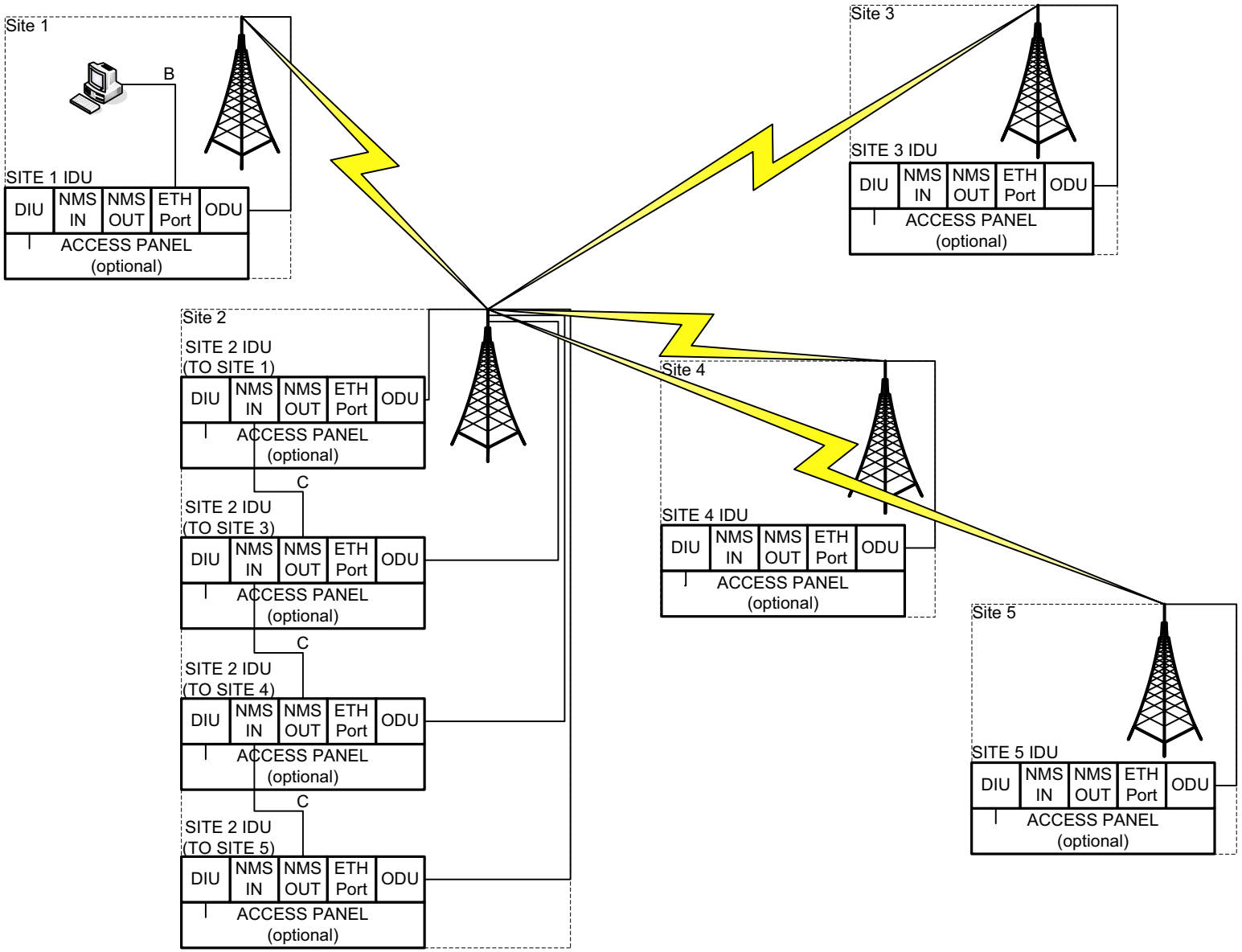
NOTE

During site maintenance, the maintenance PC should be connected to the **ETH** port on either IDU for that site. The PC must be on the same subnet as the site. Management is accomplished by accessing the **ETH** port of the IDU. Static routes are required for management of the far terminal.

NOTE

For out-of-band management, all sites must be on different subnets, and all DMRs at the same site must be on the same subnet.

Figure 30: Star 1+0 link using out-of-band management



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In Figure 30 on page 115, the management PC requires the following static route to be added via a Command Prompt session:

route add 212.180.0.0 mask 255.255.0.0 212.181.1.10 -p

NOTE

A static route may also be set up for a single terminal using MINet. This must be repeated for each terminal. For more information see the section on setting up a static route for out-of-band management in the *MINet Management Software User Guide*.

Table 15: IP addresses for a star 1+0 link using out-of-band management

IDU	ETH IP address	ETH Mask address	RIP protocol	ETH RIP
Site 1 (to Site 2)	212.181.1.10	255.255.255.0	Enabled	Disabled
Site 2 (to Site 1)	212.180.2.10	255.255.255.0	Enabled	Enabled
Site 2 (to Site 3)	212.180.2.20	255.255.255.0	Enabled	Enabled
Site 2 (to Site 4)	212.180.2.30	255.255.255.0	Enabled	Enabled
Site 2 (to Site 5)	212.180.2.40	255.255.255.0	Enabled	Enabled
Site 3 (to Site 2)	212.180.3.10	255.255.255.0	Enabled	Enabled
Site 4 (to Site 2)	212.180.4.10	255.255.255.0	Enabled	Enabled
Site 5 (to Site 2)	212.180.5.10	255.255.255.0	Enabled	Enabled

NOTE

The management PC must be on the same subnet as the connected 8800 series DMR. In the above example, the IP address of the management PC could be 212.181.1.100 with a mask of 255.255.255.0.

NOTE

During site maintenance, the maintenance PC should be connected to the **ETH** port on either IDU for that site. The PC must be on the same subnet as the site. Management is accomplished by accessing the **ETH** port of the IDU. Static routes are required for management of the far terminal.

NOTE

For out-of-band management, all sites must be on different subnets, and all DMRs at the same site must be on the same subnet.

Managing an 8800 series DMR standard system using in-band management

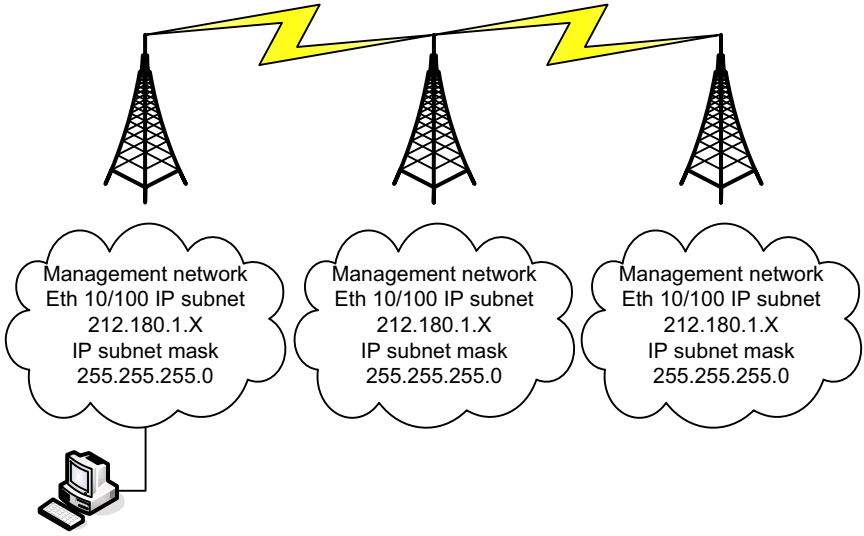
In-band management follows the rules of standard IP addressing. In-band management is available only when the Eth 10/100 DIU is used.

Further guidance on conventions of IP addressing and networking is provided below:

- Each IP address must be unique.
- There should be no active IP loops in the network, except across redundant links.
- Every terminal must have an IP address and mask assigned to the **ETH** port.
- Each site must be on a different ETH IP subnet.
- Every terminal must have an IP address and IP mask assigned to the **Eth 10/100** port on the DIU.
- All equipment across all sites must be on the same subnet for the **Eth 10/100** ports.
- RIP protocol must be enabled.

Figure 31 shows an example of a network that follows the rules above.

Figure 31: Example of in-band management



To set up a system using in-band management:

- ❑ Determine IP subnets and addresses for all terminals in the communication network.

  NOTE — The network plan should be completed by a person experienced in IP addressing and networking.

- ❑ Install all 8800 series DMRs according to standard installation practices.
- ❑ Ensure all systems are operational and running error-free.
- ❑ Set the correct Eth 10/100 IP address and Eth 10/100 IP mask of the Eth 10/100 DIU via the front panel of each IDU, according to the network plan.
- ❑ Set the RIP protocol to Enabled.
- ❑ Set the ETH RIP as required.

- ❑ Connect the management PC and DMRs into the network using Ethernet CAT5 cables (see Table 16).

NOTE In-band management uses the IP address of the **Eth 10/100** port on the DIU.

NOTE Ethernet switches may be used to provide network management.

Cables used for in-band management

Table 16 shows the cable types used in the following example network configurations.

Table 16: Cable details for in-band management

Label	Cable type	From	To	Comment
A	Ethernet cable, crossover or straight, standard CAT5	**Eth 10/100** port on DIU	PC or Ethernet LAN/switch	Ethernet switch requires auto crossover to be available for cable flexibility

Examples of in-band management

For a detailed example of in-band management used in a...	See...
Simple network containing a single 1+0 link	Figure 32 on page 123 and Table 17 on page 125
Complex network containing multiple 1+0 links in a series configuration	Figure 33 on page 127 and Table 18 on page 129
Complex network containing multiple 1+0 links in a star configuration	Figure 34 on page 131 and Table 19 on page 133

All of the above examples may be used as building blocks in a complex network for in-band management.

Figure 32: Single 1+0 link using in-band management

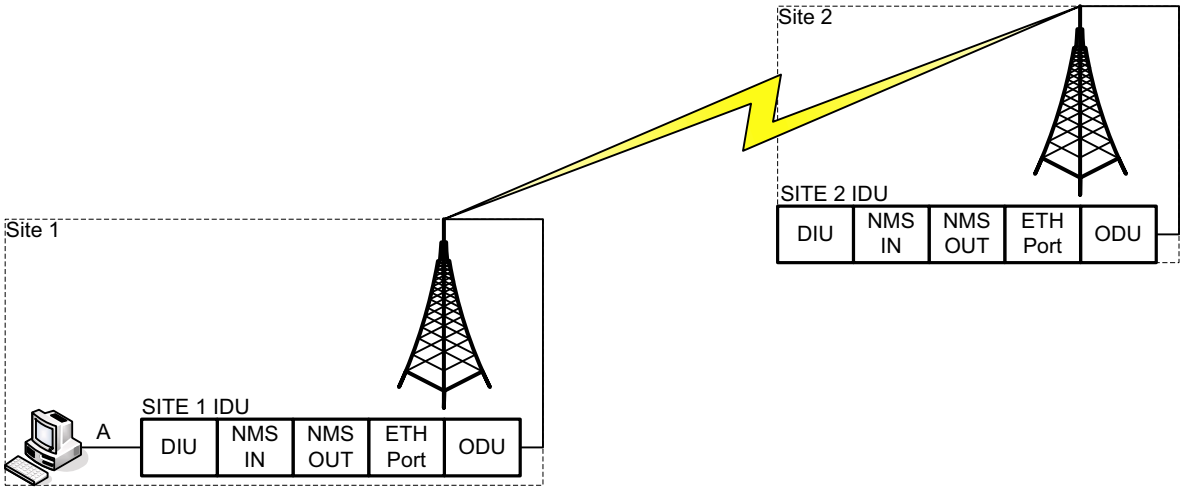


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Table 17: IP addresses for a single 1+0 link using in-band management

IDU	ETH IP/ETH IP Mask address	Eth 10/100 IP address	Eth 10/100 Mask address	RIP protocol	ETH RIP
Site 1	Default	212.180.1.10	255.255.255.0	Enabled	Disabled
Site 2	Default	212.180.1.20	255.255.255.0	Enabled	Enabled

NOTE The management PC must be on the same subnet as the connected 8800 series DMR. In the above example, the IP address of the management PC could be 212.180.1.100 with a mask of 255.255.255.0.

NOTE For in-band management, all sites must be on the same subnet.

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Figure 33: Series 1+0 link using in-band management

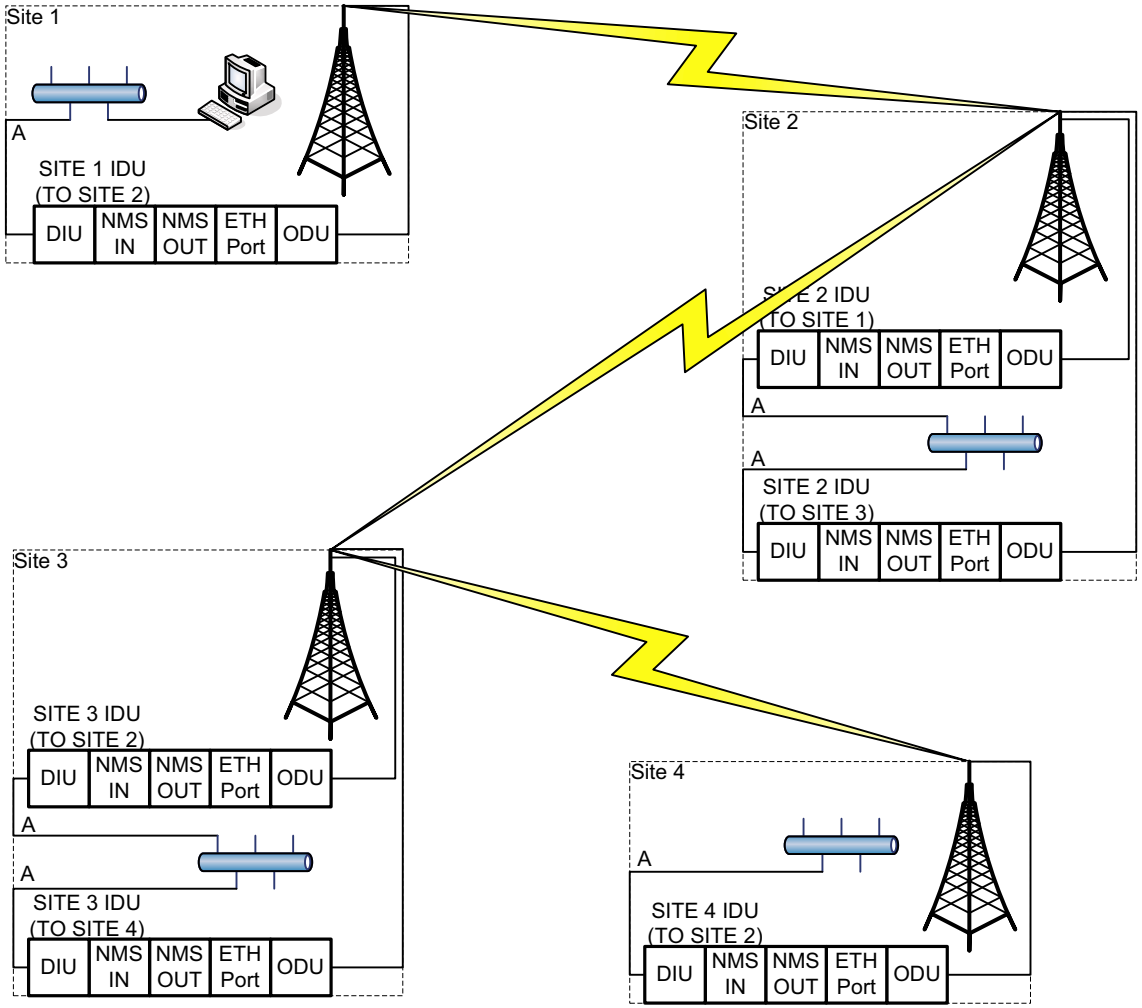

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Table 18: IP addresses for a series 1+0 link using in-band management

IDU	ETH IP/ETH IP Mask address	Eth 10/100 IP address	Eth 10/100 Mask address	RIP protocol	ETH RIP
Site 1 (to Site 2)	Default	212.180.1.10	255.255.255.0	Enabled	Disabled
Site 2 (to Site 1)	Default	212.180.1.20	255.255.255.0	Enabled	Enabled
Site 2 (to Site 3)	Default	212.180.1.30	255.255.255.0	Enabled	Enabled
Site 3 (to Site 2)	Default	212.180.1.40	255.255.255.0	Enabled	Enabled
Site 3 (to Site 4)	Default	212.180.1.50	255.255.255.0	Enabled	Enabled
Site 4 (to Site 3)	Default	212.180.1.60	255.255.255.0	Enabled	Enabled

NOTE

The management PC must be on the same subnet as the connected 8800 series DMR. In the above example, the IP address of the management PC could be 212.180.1.1 with a mask of 255.255.255.0.

NOTE

During site maintenance, the maintenance PC may be connected to either:

- the Ethernet switch on the Eth 10/100 DIU, using this IP address, or
- the **ETH** port (a static route is required for communication to the far end of the link)

NOTE

For in-band management, all sites must be on the same subnet.

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Figure 34: Star 1+0 link using in-band management

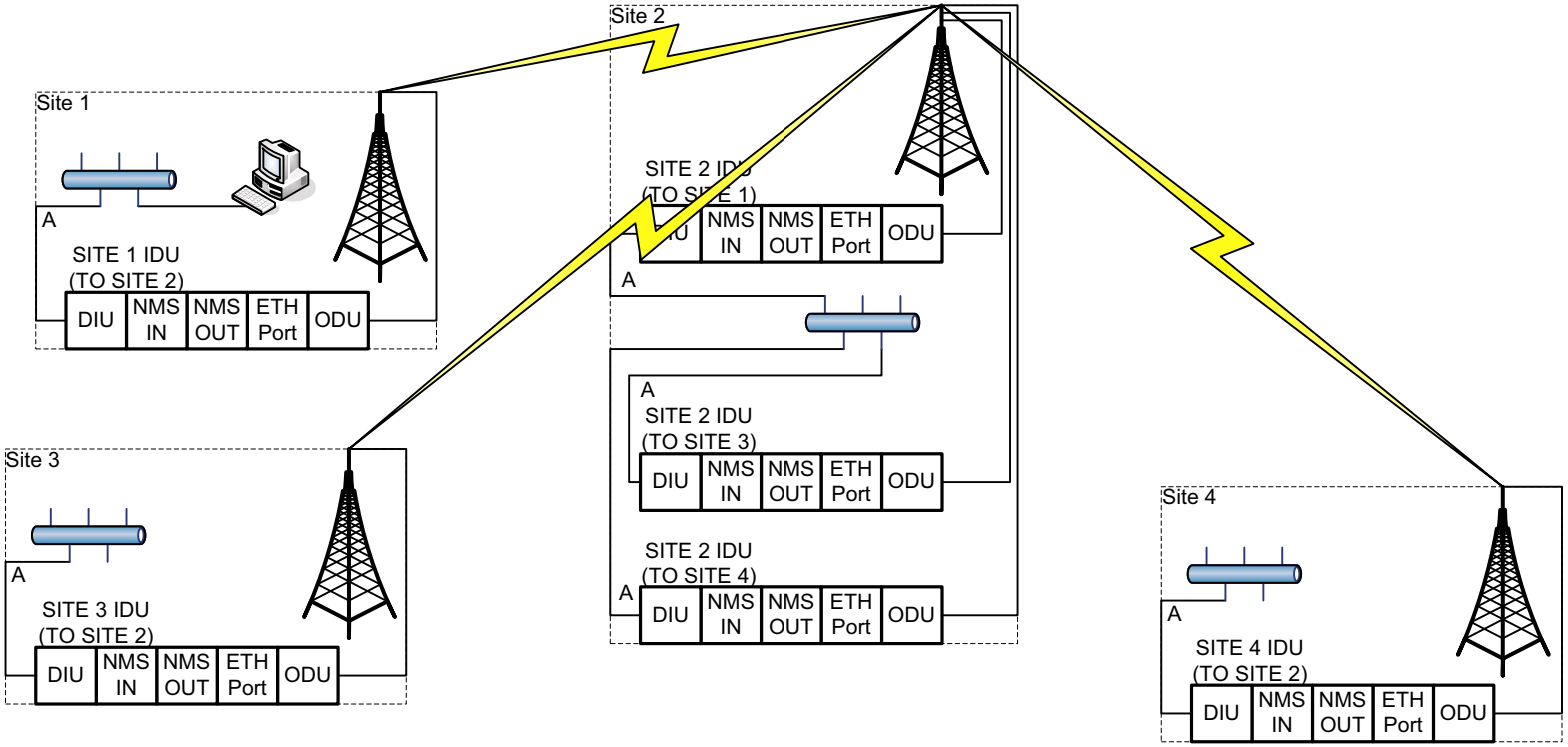

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Table 19: IP addresses for a star 1+0 link using in-band management

IDU	ETH IP/ETH IP Mask address	Eth 10/100 IP address	Eth 10/100 Mask address	RIP protocol	ETH RIP
Site 1 (to Site 2)	Default	212.180.1.10	255.255.255.0	Enabled	Disabled
Site 2 (to Site 1)	Default	212.180.1.20	255.255.255.0	Enabled	Enabled
Site 2 (to Site 3)	Default	212.180.1.30	255.255.255.0	Enabled	Enabled
Site 2 (to Site 4)	Default	212.180.1.40	255.255.255.0	Enabled	Enabled
Site 3 (to Site 2)	Default	212.180.1.50	255.255.255.0	Enabled	Enabled
Site 4 (to Site 2)	Default	212.180.1.60	255.255.255.0	Enabled	Enabled

NOTE

The management PC must be on the same subnet as the connected 8800 series DMR. In the above example, the IP address of the management PC could be 212.180.1.1 with a mask of 255.255.255.0.

NOTE

During site maintenance, the maintenance PC may be connected to either:

- the Ethernet switch on the Eth 10/100 DIU, using this IP address, or
- the **ETH** port (a static route is required for communication to the far end of the link)

NOTE

For in-band management, all sites must be on the same subnet.

Managing a mixed 8800 series DMR network

A mixed network may use both out-of-band and in-band management, and may comprise 1+0 terminals and 1+1 terminals. These networks can be built using the basic principles and IP addressing techniques described on page 101, *Managing an 8800 series DMR network*. For more information on 1+1 redundancy systems see the *Digital Microwave Radio 8800 series Redundancy Systems Reference Manual*.

CAUTION IP addresses should be allocated by a person experienced in IP addressing and networking, then programmed carefully into each IDU.

Other vendor equipment that is compatible with IEEE802.3, such as TDM multiplexers and Ethernet switches, may be managed via the same network. See the relevant equipment manuals to determine hardware and manager requirements.

Cables used in a mixed network

Table 20 shows the cable types used in the following example network configuration.

Table 20: Cable details for mixed networks

Label	Cable type	From	To	Comment
A	Ethernet cable, crossover or straight, standard CAT5	**ETH** port on IDU	Ethernet switch	Ethernet switch requires auto crossover to be available for cable flexibility
B	Ethernet cable, crossover, standard CAT5	**ETH** port on IDU	PC	Provided standard with the 8800 series DMR
C	Ethernet cable, straight, standard CAT5	**NMS-IN**	**NMS-OUT**	Provides connection for out-of-band management between 1+0 terminals

Example of a mixed network

Figure 35 on page 137 shows an example of a mixed network of 8800 series DMRs in 1+0 and 1+1 configurations using out-of-band management. If required, the manager may also be used to manage the Ethernet switches within the network.

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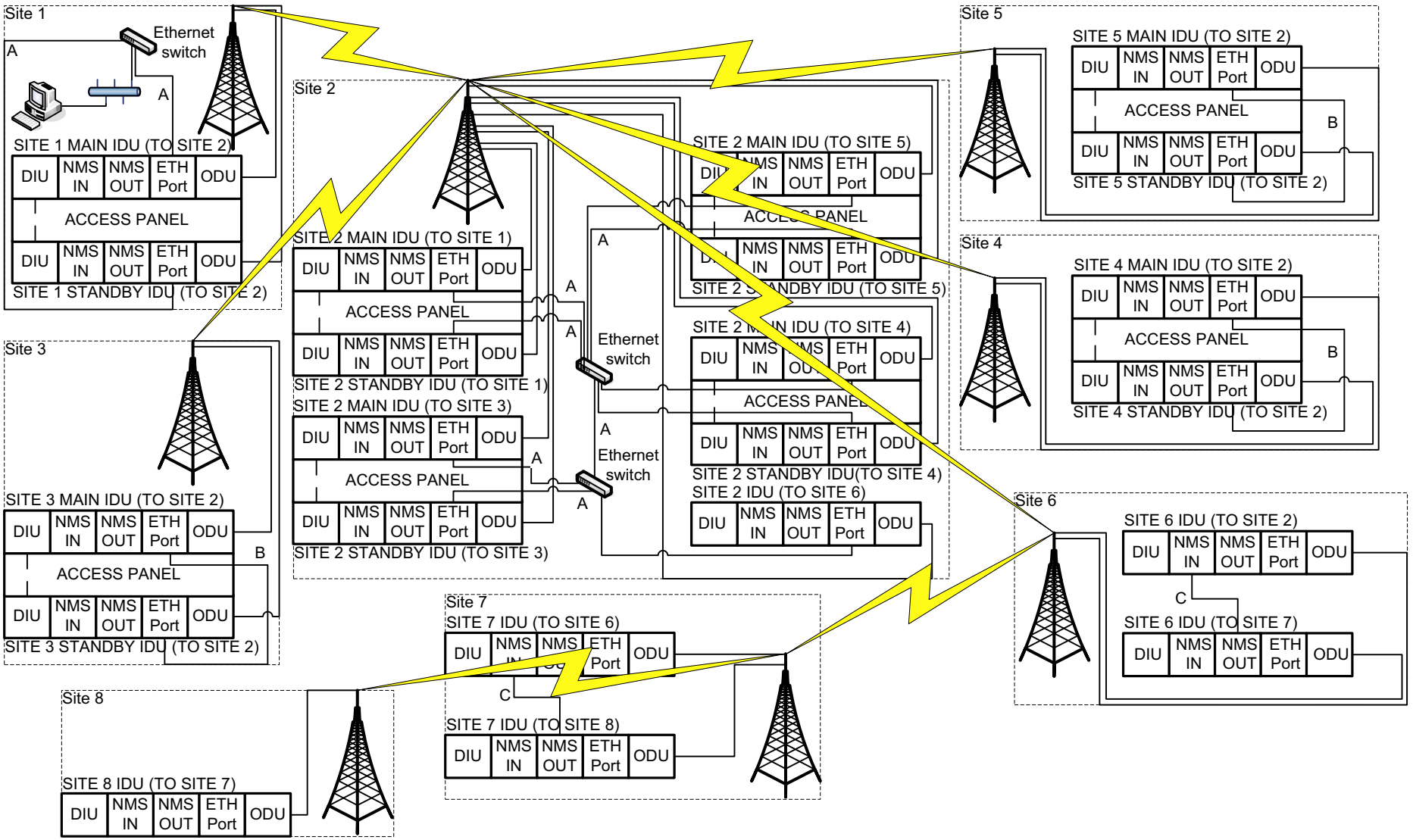
Figure 35: Mixed 1+0 and 1+1 network



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In Figure 35 on page 137, the management PC requires the following static route to be added via a Command Prompt session:

route add 212.180.1.0 mask 255.255.0.0 212.181.1.10 -p

NOTE The static route may be set up automatically using MINet.

Table 21: IP addresses for a mixed 1+0 and 1+1 network

IDU	ETH IP address	ETH Mask address	Backup IP address	RIP protocol	ETH RIP
Site 1 Main (to Site 2)	212.181.1.10	255.255.255.0	212.181.1.20	Enabled	Disabled
Site 1 Standby (to Site 2)	212.181.1.20	255.255.255.0	212.181.1.10	Enabled	Disabled
Site 2 Main (to Site 1)	212.180.1.10	255.255.255.0	212.180.1.20	Enabled	Enabled
Site 2 Standby (to Site 1)	212.180.1.20	255.255.255.0	212.180.1.10	Enabled	Enabled
Site 2 Main (to Site 3)	212.180.1.30	255.255.255.0	212.180.1.40	Enabled	Enabled
Site 2 Standby (to Site 3)	212.180.1.40	255.255.255.0	212.180.1.30	Enabled	Enabled
Site 2 Main (to Site 4)	212.180.1.50	255.255.255.0	212.180.1.60	Enabled	Enabled
Site 2 Standby (to Site 4)	212.180.1.60	255.255.255.0	212.180.1.50	Enabled	Enabled
Site 2 Main (to Site 5)	212.180.1.70	255.255.255.0	212.180.1.80	Enabled	Enabled
Site 2 Standby (to Site 5)	212.180.1.80	255.255.255.0	212.180.1.70	Enabled	Enabled

Table 21: IP addresses for a mixed 1+0 and 1+1 network (cont.)

IDU	ETH IP address	ETH Mask address	Backup IP address	RIP protocol	ETH RIP
Site 2 (to Site 6)	212.180.1.90	255.255.255.0	N/A	Enabled	Enabled
Site 3 Main (to Site 2)	212.180.2.10	255.255.255.0	212.180.2.20	Enabled	Enabled
Site 3 Standby (to Site 2)	212.180.2.20	255.255.255.0	212.180.2.10	Enabled	Enabled
Site 4 Main (to Site 2)	212.180.3.10	255.255.255.0	212.180.3.20	Enabled	Enabled
Site 4 Standby (to Site 2)	212.180.3.20	255.255.255.0	212.180.3.10	Enabled	Enabled
Site 5 Main (to Site 2)	212.180.4.10	255.255.255.0	212.180.4.20	Enabled	Enabled
Site 5 Standby (to Site 2)	212.180.4.20	255.255.255.0	212.180.4.10	Enabled	Enabled
Site 6 (to Site 2)	212.180.5.10	255.255.255.0	N/A	Enabled	Enabled
Site 6 (to Site 7)	212.180.5.20	255.255.255.0	N/A	Enabled	Enabled
Site 7 (to Site 6)	212.180.6.10	255.255.255.0	N/A	Enabled	Enabled
Site 7 (to Site 8)	212.180.6.20	255.255.255.0	N/A	Enabled	Enabled
Site 8 (to Site 7)	212.180.7.10	255.255.255.0	N/A	Enabled	N/A

NOTE

The management PC must be on the same subnet as the connected 8800 series DMR. In the above example, the IP address of the management PC could be 212.180.1.1 with a mask of 255.255.255.0.

During site maintenance, the maintenance PC may be connected to:

- the Ethernet switch on the Eth 10/100 DIU, using this IP address

NOTE

- the **ETH** port (a static route is required for communication to the far end of the link)
- a spare Ethernet port on the Ethernet switch for that site, and be on the same subnet assigned for that site

NOTE

For out-of-band management, all sites must be on different subnets, and all DMRs at the same site must be on the same subnet.

For in-band management, all sites must be on the same subnet, and all DMRs at the same site must be on the same subnet.

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To commission the system:

- ❑ Launch MINet.
- ❑ Select the link that you want to commission.
- ❑ From the **Functions** menu, select **Status**, then **Performance...**
- ❑ Select the **Clear** tab.
- ❑ Click **Reset Performance**.
- ❑ From the **Functions** menu, select **Status**, then **Alarms...**
- ❑ Select the **Log** tab.
- ❑ Click **Clear All**.
- ❑ Repeat this procedure on all 8800 series DMRs that require commissioning.
- ❑ Monitor the link for a period of time.

NOTE — Codan recommends that a system is monitored for a minimum of 24 hours to ensure that the system is operational over the full temperature range of the local area.

- ❑ Complete the relevant commissioning sheet for each link in the system.

NOTE — A hard copy of the commissioning sheet for the link should be left at the terminal at each end of the link for later reference.

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11 Fault diagnosis

This section contains the following topics:

Basic fault diagnosis

Narrowing down, or identifying the possible sources of a problem is the most efficient way to fix a fault. Identifying a problem can be difficult and time consuming. Therefore, it is advised to proceed logically, and gradually narrow down all the possible sources until there is only one source left to examine.

Diagnosing the cause of a fault is often a process of elimination. You should perform tests and verify correct operation of components of the system to eliminate each one as a possible source of the fault.

Take notes during every phase of your testing, including the results. This prevents re-testing the same component.

You should record the following:

- What is the problem?
- When did the problem first appear?
- What was the system doing at the time when the problem appeared?
- Is the problem intermittent?
- Does the problem occur during startup, operation or shutdown?
- Is the problem repeatable, consistent or random?
- What was the system configuration and status at the time of the problem?
- What is the firmware version of the equipment?
- What corrective action has been taken?

Backups

If the source of the problem is a firmware fault, back up all critical data, including configuration files. If you have to upgrade to a newer version of firmware, make sure that the latest version is compatible with the system before performing the upgrade.

NOTE For more information see the *MINet Management Software User Guide*.

Safety

Avoid plugging and unplugging cables while the power to the unit is switched on, as the connectors may be damaged by power surges.

Avoid all short circuits on the coaxial cable between the ODU and the IDU.

Advanced fault diagnosis

If technical assistance is required...

If the fault diagnosis guidelines do not locate the faulty module or cable, or if further technical assistance is required for any other reason, please refer to the contact details supplied with the equipment. These details are also available on the internet at www.codan.com.au. In the Microwave Links section, click on Product Support.

Outside of normal office hours, Codan has Customer Service Engineers on call to provide emergency technical assistance. They will either answer your call immediately or return your call as soon as possible.

If you are connected to a voice mail system when you call, please follow the instructions carefully, that is, leave your name and contact phone number (including the country code), then a brief, clear description of your problem.

Fault diagnosis

The following table describes how to interpret messages, LED indicators, and severity levels in order to isolate a fault, and provides the steps needed to correct each fault. The indications are shown on the front panel, MINet, and included in the MIBs.

NOTE

You should be aware of any current mappings of external input/output relays to a particular **ALARM** LED on the front panel. For more information see the *MINet Management Software User Guide*.

Table 22: Fault diagnosis of events

Event	Indication	Severity	Possible cause	Corrective action
ODU-to-IDU communication failure	**LINK** LED plus SNMP message	Fatal	ODU-to-IDU connection fault Link down Remote terminal not accessible Low-level RSL	Check that ODU-to-IDU cable is properly connected and up to standard If surge protection is installed, disconnect it, and connect coaxial cable directly between IDU and ODU
Internal failure of IDU	**IDU** LED plus SNMP message	Fatal	IDU Rx or Tx synthesiser out of lock IDU power supply failure	Check DC power Load factory defaults Re-initialise system before setting all correct parameters
Internal failure of ODU	**ODU** LED plus SNMP message	Fatal	ODU Rx or Tx synthesiser out of lock ODU power supply failure	Switch ODU off, then on again Replace ODU

Table 22: Fault diagnosis of events (cont.)

Event	Indication	Severity	Possible cause	Corrective action
Link down	**IDU** LED plus SNMP message LCD displays a flashing X	Fatal	Mux or modem not synchronised Power failure Frequency interference	Check weather conditions such as snow, rain, fog etc Check for obstacles blocking line-of-sight Verify that remote terminal is operating correctly If possible, try another frequency Check ID of link Check that both terminals have the same parameters set
Remote terminal not accessible	Warning message	Warning	IP management problem Failure of remote link	Check that remote terminal is operating correctly Check IP connection
Security violation	SNMP message	Message	Invalid password entered	Re-enter password
Local ODU not accessible	Warning message No RSL indication	Fatal	Telemetry failure ODU faulty Cable disconnected	Check that IDU is connected to ODU Replace ODU

Table 22: Fault diagnosis of events (cont.)

Event	Indication	Severity	Possible cause	Corrective action
Local RSL out of range	Warning message Low RSL indication	Warning	RSL is below initial pre-defined threshold	Check weather conditions such as snow, rain, fog etc Check for obstacles blocking line-of-sight Increase remote Tx power to maximum permitted, or enable ATPC function Check alignment of antenna
Tributary port	SNMP message	Warning	AIS on specified line	Perform signal check using external signal source
DIU LOS detection (local)	SNMP message	Warning	LOS on the specified line Data transfer is blocked	Check line for proper connections Check another port
Local BER out of range	Warning message	Warning	BER is below initial pre-defined threshold Internal data transfer problem between Rx and Tx	Check weather conditions such as snow, rain, fog etc Check for obstacles blocking line-of-sight Check if RSL is low

Table 22: Fault diagnosis of events (cont.)

Event	Indication	Severity	Possible cause	Corrective action
External input doesn't function	No input signal SNMP message	Message	Incorrectly defined operator definition Faulty connection External connection signal is not at correct level	Check operator definitions Check connections Check specifications
TFTP failure	SNMP message	Message	TFTP failed: Connectivity: Physical indication or logical (TCP/IP connectivity between TFTP server and client) Operational: Incorrect TFTP process Hardware: Flash, checksum, or corrupt file	Check IP connection between terminal and TFTP server Check TFTP procedure
Local ODU temperature out of range	Warning message SNMP message	Warning	The local ODU temperature is outside acceptable temperature range	Check outside temperature is within ODU operational range as defined in technical specification

Table 22: Fault diagnosis of events (cont.)

Event	Indication	Severity	Possible cause	Corrective action
Mute transmitter	Warning message SNMP message	Warning	ODU transmitter is in mute mode Operator initiated IDU sends mute command	If an operator command is the cause, check ODU-to-IDU connectivity (physical, logical, or loopback)
Temporary communication break	Severely-errored seconds SNMP message LCD message	Error	Severely-error seconds are below initial pre-defined threshold	Check weather conditions such as snow, rain, fog etc Check if RSL is low

Returning the unit to service

After fixing a fault you should test that the system is fully functional.

You should test a range of functionality to ensure that:

- the entire problem has been solved
- no new problems have been introduced

Appendix A—Factory-default settings

Factory-default settings are provided to ensure communications in a link can be restored to a basic standard. These settings are especially useful when local adjustments are made that do not provide the desired communication result. The technician can always rely on the default settings for communications, and check them with local customised settings for debugging purposes.

Default settings are general and provide the basic parameters to ensure proper functionality. When a link is in the field and you need to reset factory-default settings, it is normally for one of the following reasons:

Status	Action
Link is not operating	Manually perform the factory default on both terminals (in any order).
Link is operating	Even though communications exist between two terminals, resetting to factory defaults may be required when a management mismatch situation occurs and you have to reset the IP addresses. You should reset the remote terminal first, followed by the local terminal.

CAUTION

If you reset a terminal, you must re-enter the correct operating frequency before attempting to set up any other parameters. Follow the directions on page 79, *Basic terminal setup*.

Table 23 and Table 24 list the factory-default settings for the DIUs and the 8800 series DMR.

Table 23: Factory-default settings of the DIUs

DIU	Default link capacity	Default channel spacing
DS3 + 16 DS1	DS3 + 4 DS1 (except 10.5 GHz, which is 8 DS1)	N/A
Eth 10/100 BaseT + 4 DS1	Eth 10/100 BaseT + 4 DS1	50 MHz (except 10.5 GHz, which is 25 MHz)
E3 + 16 E1	E3 + 1 E1 (except 10.5 GHz, which is 8 E1)	N/A
16 E1	16 E1 (except 10.5 GHz, which is 8 E1)	N/A
Eth 10/100 BaseT + 4 E1	Eth 10/100 BaseT + 4 E1	28 MHz (except 10.5 GHz, which is 14 MHz)
4 E1 BNC	4 E1	N/A

Table 24: Factory-default settings of the 8800 series DMR

Configuration parameter	Default parameter
ATPC Control	Disabled
Boot Software	Rev xx.xx
DIU Hardware	Rev x.xx
ETH 10/100 IP	0.0.0.0
ETH 10/100 IPmask	0.0.0.0
ETH IP	192.168.X.1
ETH IP RIP	Disabled
ETH IpMask	255.255.255.0
Eth MAC Address	IDU ETH MAC address
Frequency(Ch #)	Middle frequency (depends on type of ODU)

Table 24: Factory-default settings of the 8800 series DMR (cont.)

Configuration parameter	Default parameter
IDU Alternate SW	Rev xx.xx
IDU HW Revision	Rev x.x / x.x
IDU Serial Num	IDU serial number
IDU Software	Rev xx.xx
IDU Type	ETSI/FCC (depending on standard)
Link ID	1
LINK IP	NMS-Out IP + 1 (or NMS-In + 2)
Factory Default	Factory default
Mode CW	Off
NMS-In Config Baud Rate NMS-Out Config Baud Rate	19200 bps
NMS-In Config Data Bits NMS-Out Config Data Bits	8 bits
NMS-In Config Flow Control NMS-Out Config Flow Control	None
NMS-In Config Parity NMS-Out Config Parity	None
NMS-In Config Stop Bits NMS-Out Config Stop Bits	1 stop bit
NMS-In Dest IP	10.1.1.1
NMS-In IP	Determined by system
NMS-Out Dest IP	NMS-In Dest IP + 1

Table 24: Factory-default settings of the 8800 series DMR (cont.)

Configuration parameter	Default parameter
NMS-Out IP	NMS-In IP + 1
ODU Band	Bands from 1 to 4
ODU Duplex	According to frequency standard type
ODU Frequency	Operating frequency (GHz)
ODU Hardware	Rev xx.xx
ODU Serial Num	ODU serial number
ODU Software	Rev xx.xx
ODU Temperature	Internal ODU temperature (°C and °F)
ODU Type	ETSI/FCC (depending on standard)
Pause Tx Control	Disabled
Pause Tx Period	600 s
PORTS STATE	Active data ports
REM RSL Lower	–50 dBm
REM RSL Optimal	–45 dBm
REM RSL Upper	–40 dBm
RIP Protocol	Enabled
Sys Up Time	HH:MM:SS (operational system time)
System	None
Tx Mute	Off
Tx Power(–xx,xx)	Maximum power and transmit range (depends on maximum power of ODU)

Appendix B—Pin connections

Direct-access serial cable

Table 25: Pinouts of the RJ45 cable with DB9 (female) connector

Pin No. (DB9 female)	Pin No. (RJ45)	Function
3	6	Tx
5	4	Ground
2	5	Rx

Modem cable

Table 26: Pinouts of the RJ45 cable with DB25 (female) adaptor

Pin No. (DB9 female)	Pin No. (DB25 female)	Pin No. (RJ45)	Function
3	2	5	Tx
4	7	4	Ground
2	3	6	Rx
7–8 (shorted)	4–5 (shorted)	–	RTS-CTS
4–6 (shorted)	6–20 (shorted)	–	DTR-DSR

IDU alarm relay connector

Table 27: Pinouts of the IDU alarm relay connector

Pin No.	Function
1 (top right)	External input 1A
2	External input 1B
3	External input 2A
4	External input 2B
5	Relay 2 (NO)
6	Relay 2 (C)
7	Relay 1 (NC)
8	Relay 5 (C)
9	Relay 5 (NO)
10	Relay 4 (NC)
11	Relay 3 (NO)
12	Not used
13	Ground
14	External input 3A
15	External input 3B
16	External input 4A
17	External input 4B
18	Relay 2 (NC)
19	Relay 1 (NO)
20	Relay 1 (C)
21	Relay 5 (NC)

Table 27: Pinouts of the IDU alarm relay connector (cont.)

Pin No.	Function
22	Relay 4 (NO)
23	Relay 4 (C)
24	Relay 3 (NC)
25	Relay 3 (C)

Service channel connectors (RJ45)

Table 28: Pinouts of the DATA connector

Pin No.	Function
1 (top left)	Not used
2	Not used
3	Not used
4	Ground
5	RS232 TxD
6	RS232 RxD
7	Not used
8	Not used

Table 29: Pinouts of the NMS-IN connector

Pin No.	Function
1 (top left)	Not used
2	Not used
3	Not used
4	Ground
5	RS232 TxD
6	RS232 RxD
7	Not used
8	RS232 RTS

Table 30: Pinouts of the NMS-OUT connector

Pin No.	Function
1 (bottom right)	Not used
2	Not used
3	Not used
4	Ground
5	RS232 TxD
6	RS232 RxD
7	Not used
8	RS232 CTS

Table 31: Pinouts of the ETH connector

Pin No.	Function
1 (top left)	Tx+
2	Tx–
3	Rx+
6	Rx–

Data channel connectors

Table 32: Pinouts of the 120 ohm Krone interface (qty 2)

Position	Function	Position	Function
1 (top row, left to right)	Rx tip	1 (bottom row, left to right)	Tx tip 1
2	Rx ring 1	2	Tx ring 1
3	Ground	3	Ground
4	Rx tip 2	4	Tx tip 2
5	Rx ring 2	5	Tx ring 2
6	Rx tip 3	6	Tx tip 3
7	Rx ring 3	7	Tx ring 3
8	Ground	8	Ground
9	Rx tip 4	9	Tx tip 4
10	Rx ring 4	10	Tx ring 4
11	Rx tip 5	11	Tx tip 5
12	Rx ring 5	12	Tx ring 5
13	Ground	13	Ground
14	Rx tip 6	14	Tx tip 6
15	Rx ring 6	15	Tx ring 6
16	Rx tip 7	16	Tx tip 7
17	Rx ring 7	17	Tx ring 7
18	Ground	18	Ground
19	Rx tip 8	19	Tx tip 8
20	Rx ring 8	20	Tx ring 8

Table 33: Pinouts of the E1/DS1 connector and 120 ohm RJ45 interface (qty 16)

Pin No.	Function
1 (bottom right)	Rx ring
2	Rx tip
4	Tx ring
5	Tx tip

Eth 10/100 BaseT connector (Eth 10/100 DIU only)

Table 34: Pinouts of the Eth 10/100 BaseT connector

Pin No.	Function
1 (top left)	Rx+
2	Rx–
3	Tx+
6	Tx–

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