BLACK BOX®
NETWORK SERVICES

MDU248A User Guide

This publication has three parts:

1. MDU248A Modem User Guide
2. MDU248A / VT100 Management User Guide
3. ePIM Bridge/Router User Guide

TECHNICAL: 0870 90 10 750
SALES: 0870 90 10 750
FAX: (0118) 965 5001
ADDRESS: 464 Basingstoke Road, Reading, Berkshire RG2 0QN
WEB: www.blackbox.co.uk

Publication 1/298/100/613 issue 01

Jan. 2003

Netherlands:

Black Box Datacom BV
Tel: 03032417700
Fax: 0302414746
Web Site: www.blackbox.nl

Norway:

Black Box Norge as.
Tel: +47 55 300 700
Fax: +47 55 300 701
Web Site: www.blackboxnorge.no

U.S.A. :

Black Box Corporation
Tel: 724-746-5500
Fax: 724-746-0746
Web Site: www.blackbox.com

Brazil:

Black Box Do Brasil.
Tel: (011) 5515-4000
Fax: (011) 5515-4002
Web Site: www.blackbox.com.br

Belgium:

Black Box Communications S.A. N.V.
Tel: 02 725 85 50
Fax: 02 725 92 12
Web Site: www.blackbox.be

Finland:

Black Box Finland Oy.
Tel: +358 (0) 201 888 888
Fax: +358 (0) 201 888 808
Web Site: www.blackbox.fi

Chile:

Black Box Chile
Tel: 00 562 6680 141
Fax: 00 562 6680 140
Web Site: www.Blackbox.cl

Australia:

Black Box Network Services Australia P/L
Tel: 03-9879-7100
Fax: 03-9870-2955
Web Site: www.blackboxoz.com.au

MDU248A USER GUIDE (PART 1)

BLACK BOX part no:
1/298/100/613
Issue 01 - Jan. 2003

PIM - 15 WAY D-Type connection has a safety status of EARTHED SELV.
PIM - V35 connection has a safety status of EARTHED SELV.
PIM - ePIM 10/100Base T - 8 WAY RJ45 connection has a safety status of UNEARTHED SELV.
USB - 4 WAY Type B connection has a safety status of EARTHED SELV.

Safety Status Classification of non network PORTS.
Mains Input - IEC320 - 85Vrms - 250Vrms 50/60Hz connection has a safety status of PRIMARY CIRCUIT.
DC Input - 3 PIN MINIFIT -40Vdc -72Vdc connection has a safety status of TNV-2.
Management Port Interface - 9 WAY FEMALE D-Type connection has a safety status of EARTHED SELV.

Definitions:

Exposed Environment
A TELECOMMUNICATIONS NETWORK is considered to be an exposed environment if one or more conditions for an unexposed environment are not fulfiled.

Unexposed Environment
A TELECOMMUNICATIONS NETWORK is considered to be an unexposed environment if the following conditions apply to all parts of the network.

a) The possible effect of indirect lightning has been reduced by measures described in IEC 61312-1.

b) The possibility of having different earth potentials has been reduced by connecting all equipment within the network to the same equipotential bonding system (see HD 384).

c) The possibility of power cross/contact has been reduced (see HD 384).

d) The possibility of induced transients and voltages has been reduced.

Caution – Electrostatic sensitive device
Electro-static discharge (ESD) Warning:

Antistatic precautions should be observed at all times.
If the unit is power fed from the DSL line interface then a functional earth MUST be connected. (See Section 4 on Installation).

Manufacturers Declaration*
BLACK BOX Limited declares that this product is in conformity with the essential requirements of the 'R&TTE directive 1999/5/EC'.

* **A copy of the Declaration of Conformity is available upon request from BLACK BOX Limited.**

1

1 SCOPE

This User Guide applies to the High Speed DSL product family. It provides guidance for installation and commissioning of the products, as well as useful reference information.

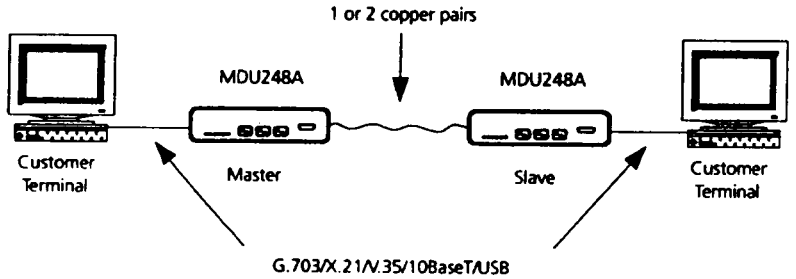
For guidance on the use of the VT100 management port refer to part 2 of this user guide.

For guidance on programming the e-PIM Bridge/Router module (where fitted) refer to part 3 of this user guide.

2.1 EXAMPLE APPLICATIONS

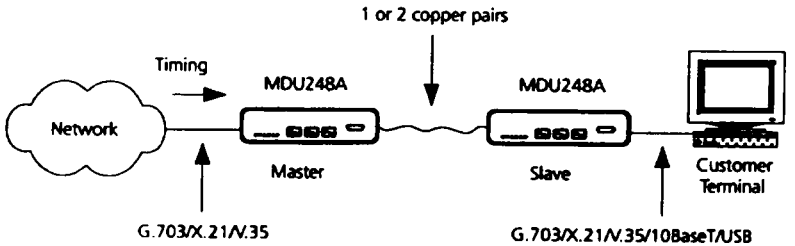
The diagrams below illustrate some basic applications:

2.1.1 Desktop modem to desktop modem, no external timing



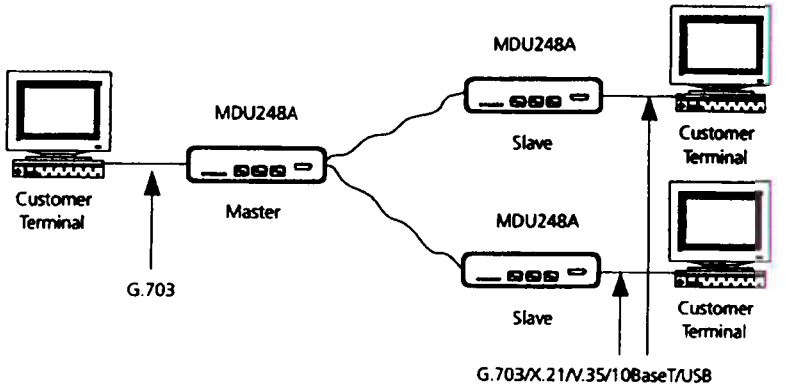
The circuit timing originates from the internal clock in the master, and is sent out to the customer terminal at both ends.

2.1.2 Desktop modem to desktop modem, with external timing



For synchronous interfaces, the timing can be taken from the network and passed to the customer's terminating unit.

2.1.3 Desktop modem to desktop modem with split site working



This is referred to as point-to-multipoint working. The G.703 interface at the master end must use the G.704 frame structure. It may be used for providing two Nx64k circuits from one 2Mbps pipe.

Note: When operating in Point to Multipoint, the master unit always has a G.703 user interface.

The slave units may be EITHER all G.703 OR all Datacom (any mixture of X.21, V.35 and ePIM).

On the rear panel there are the following connectors:

Power Input (depending on the model)

	85 - 250 Volt mains socket	IEC 320
	–48V DC supply inlet socket	3-pin mini-fit

Line Interface 8-way RJ45 (Copper)

Data Ports (depending on module fitted)

G.703 120 ohm	8-way RJ45
G.703 75 ohm	BNC
X.21	15 way D-type female
V35	34 way MRAC female
10BaseT/100BaseT	8-way RJ45
USB	USB type B (Slave)

The data interface connector type will be from one of the four user-specified interfaces available. They are detailed in section 7.5. The plastic housing contains the main PCB. The plastic case has an internal metallised layer for EMC screening purposes.

Also included is a 1.5m mains lead fitted with a country variant mains plug (mains models only) and a 3 metre screened, stranded, Category 5 line cord terminated in 8-way RJ45 plugs at both ends.

A VT100 Management connection cable is also available.

The overall dimensions of the unit are 274mm(L) x 251mm(W) x 55mm(H).

4 INSTALLATION

This chapter describes the basic steps that are required to set up a system using the DSL Modem.

It is recommended that a pair of units is set up back-to-back and working correctly in the desired operational mode before deployment.

4.1 CONNECTION OF PROTECTIVE EARTH

If it is required to connect the G.703 port to a circuit that is defined as TNV, then a protective earth must be connected to the earth bond stud on the rear panel. See the Safety Statements at the front of this User Guide.

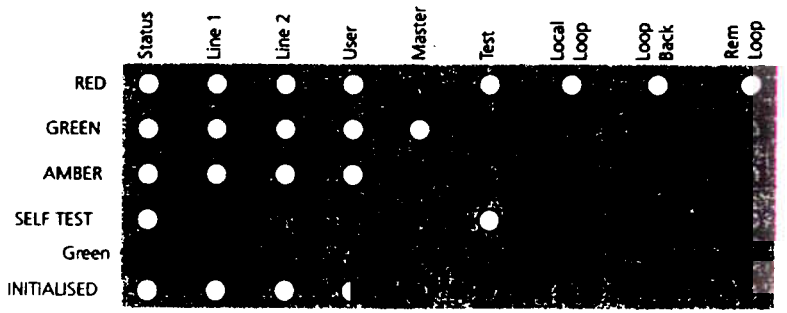
If the unit is power fed then a functional earth must be connected to the earth bond stud on the rear panel to provide a discharge path to ground for ESD protection. See the ESD warning at the front of this User Guide.

4.2 WARNING - DC POWERING DIRECT FROM EXCHANGE BATTERY

If the installation requires that the –48V is referenced to earth (as opposed to using a floating DC input) please ensure that the MDU248A is the special DC powered option.

4.3 POWER ON SEQUENCE

With no DTE or line connected to the MDU248A on power up, the LED colour test sequence is displayed (RED - GREEN - AMBER) followed by the self test indication as follows:



Prior to the sequence starting, a random pattern may appear momentarily.

During sequence the available colours of each LED are displayed in turn as a confidence check.

For X.21 and V.35, DTE/DCE selection is carried out by moving the link header on the user interface plug-in module. The software automatically senses the link setting and sets the unit up accordingly.

To check the user interface and any link settings, using the terminal, go to the "Information>System" screen, this will display which user interface has been plugged in, and which mode it is in.

Once a unit is configured as an ELU, the expected interface at the NTU may be set, or by default, the unit will auto-discover the NTU user port configuration after the line gets into synchronisation.

4.8 SETTING THE Nx64K USER DATA RATE

For X.21 and V.35 the user port data rate may be set in increments of 64kbps. The data rate is set by entering the desired value of N. The full range of N is from 1 to 32. The screen display gives the equivalent data rate in kbps for the value of N. The default value of N is 32, i.e. 2048kbps.

The MDU248A automatically restricts the maximum value of N to match the number of transmission lines enabled and the transmission line rate selected in the "Configuration>Master/Slave" screen.

The default value of N is 32.

Note: In a G.703 to X.21/V.35 configuration, if the G.703 interface is changed to structured working, the maximum value of N at the X.21/V.35 interface is N = 31.

To change the user port data rate:
At the master end:
1 Configuration>User Port.
2 Set the desired value of N.
Press Enter to activate the change.

4.9 SELECTING THE CIRCUIT CONFIGURATION

The term 'digital section' refers to the data link between the user ports of the connected MDU248A's.

In a standalone section, the MDU248A's provide the complete transmission system.

In a tandem section, the MDU248's are used to extend an existing circuit or network port. To achieve synchronous data transfer, the master MDU248A must derive its timing from the circuit to which it is connected.

A Point-to-Point link requires two MDU248A's, one master and one slave.

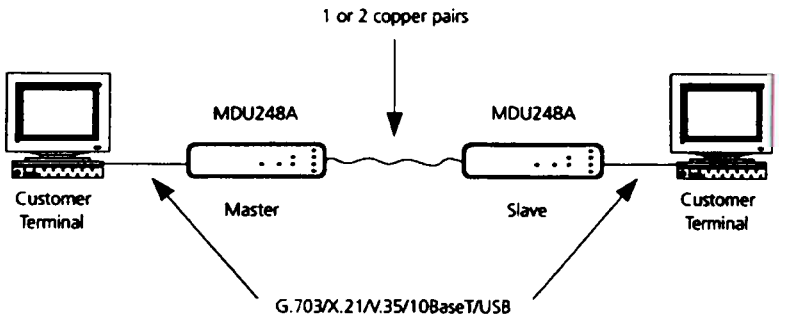
A Point to Multipoint link can have up to three MDU248A's, one master and two slaves.

The MDU248A at one end of the digital section is selected to be a Master (ELU), the remote end(s) are selected to be slave(s) (NTUs).

For a tandem section, the MDU248A connected to the tandem section is configured as the master.

Please refer to the diagrams on the following pages.

4.9.1 Standalone Section



The transmission channel can be a single optical fibre, one or two copper pairs.

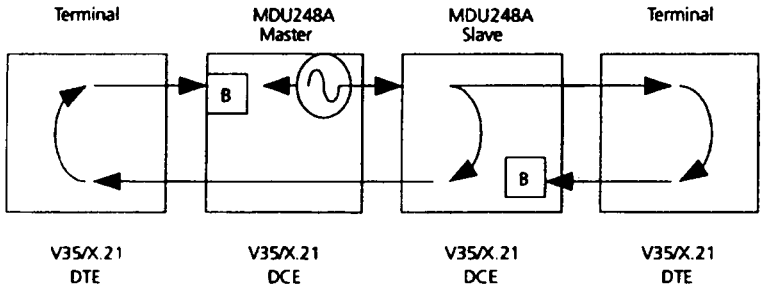
Key for following diagrams:

Clock Source

B Buffer (Elastic Store)

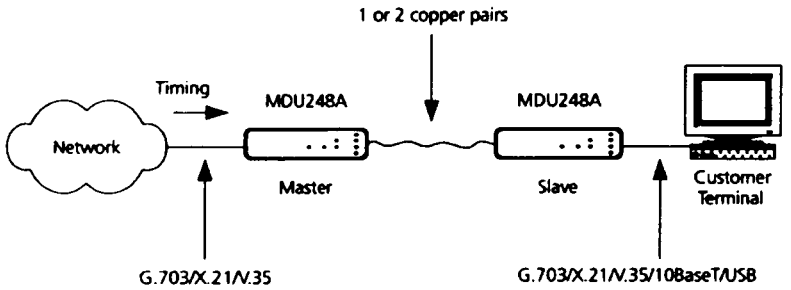
4.9.1.4 X.21/V.35 DCE to X.21/V.35 DCE

The terminals connected to the digital section at both ends are DTEs, a clock inside the ELU then becomes the reference clock for the entire system.



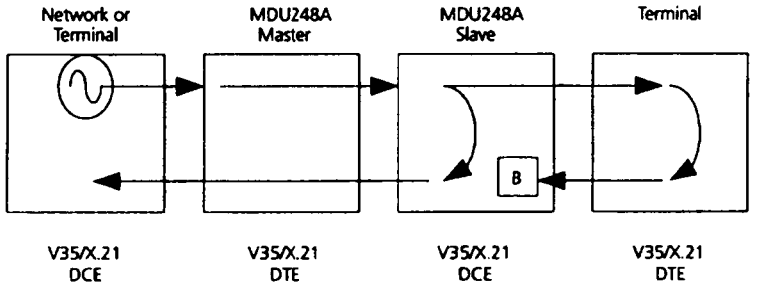
4.9.2 Tandem Section – External Timing

For the following configurations, the modems are connected in series with another transmission system or equipment that is the source of timing.

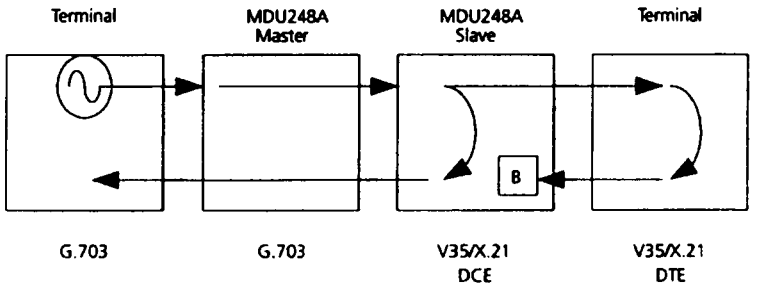


4.9.2.1 X.21/V.35 DTE-to X.21/V.35 DCE

In order to recover timing from the network, the plug in module at the master end of the digital section must be configured as a DTE by unplugging the User Port Module and moving the links as indicated on the PCB legend. See section 8.



4.9.2.2 G.703-to X.21/V.35 DCE



Using the "Configuration > User Port" Menu:

1 At the Master, select the 'Transparent' timing option.
2 At the Slave there is nothing to select.

Press 'Return' to enter the changes.

4.10.3.2 Structured Operation

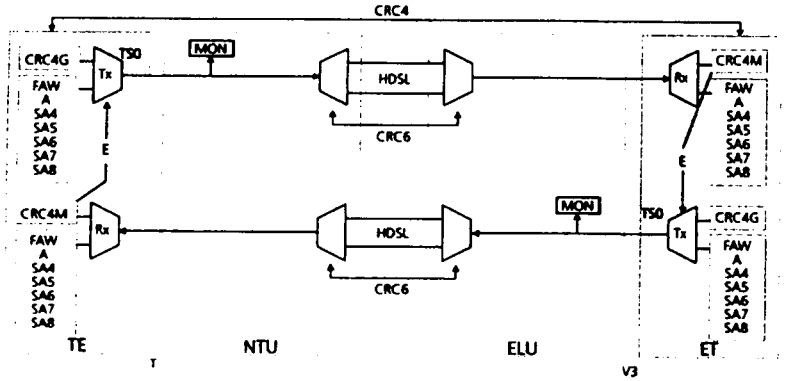


FIGURE 4.10.2: STRUCTURED WORKING, END-TO-END TRANSPARENT CRCS

To set up to monitor structured G.703 data, go to the "Configuration > User Port" Menu and select

Rx Unframed	( )
Rx Framed	(*)
Rx CRC4	[ ]
Tx TSO Transparent	(*)
Tx TSO Generate	( )
Tx CRC4	[ ]

The incoming structured data may be set to monitor CRC4 errors by enabling the Rx CRC4 checkbox.. However, no E bits are returned at the user interface from the transmission equipment.

For fractional working where the aggregate line rate is less than 2048kbps, Rx Framed is selected automatically. When working fractionally, not all of the timeslots are transported from one end of the link to the other; the G.704 frame is padded out with the programmable 'Idle' pattern. This can be set in the "Configuration>User Port" Screen.

4.10.3.3 Structured Working, CRCs Enabled

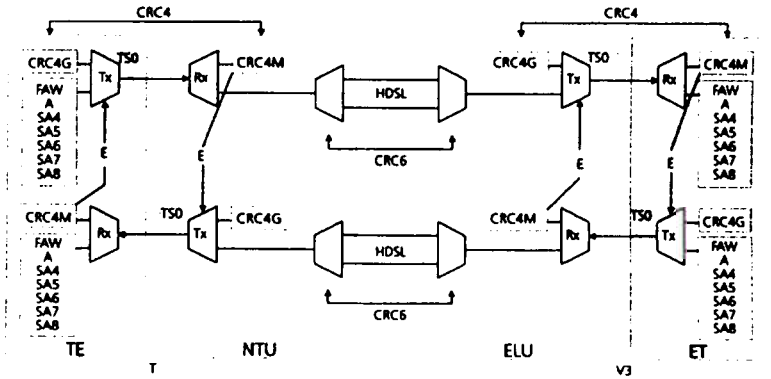


FIGURE 4.10.3: STRUCTURED WORKING, CRCS ENABLED

In this case, the CRCs are checked and errored blocks are indicated back across the user interface by use of the E bits.

This is the least ambiguous mode of operation from a performance monitoring point of view because each transmission section is covered by its own independent CRC check.

To set up this configuration, go to the "Configuration > User Port" Menu and select

Rx Unframed	( )
Rx Framed	(*)
Rx CRC4	[X]
Tx TSO Transparent	( )
Tx TSO Generate	(*)
Tx CRC4	[X]

In this mode of operation, the test loop activation messages defined in ETS 300 233 are passed to and from the LT over the V3 interface.

5 COMMISSIONING

Once the equipment is correctly installed, it may be necessary to monitor the quality of service before putting live traffic on the circuit, depending on the installation rules of the network.

The MDU248A has various features that help the user to do this with a high degree of confidence without the use of extra test equipment. A terminal plugged into the ELU gives access to the following information:

In the "Performance > M.2100" History screen, the display records errored seconds, severely errored seconds and unavailable seconds for the aggregate line system. The recording interval and the pass-fail criterion of the datalog record are programmable by the user to match the tables found in ITU Recommendation M.2100.

In the "Performance > Transmission Line" screen, the display records G.826 statistics for both ends of each transmission line. In a multi pair system, if errors are recorded in the M.2100 screen, this screen will help to locate the erroring line and direction of errors.

Once the circuit is working, the "Alarm > History" screen should be checked and cleared. The alarm history should be checked after a suitable interval to ensure that no alarms are occurring.

6.3.3 1-Pair With Noise Range on 04mm Wire

The MDU248A has been extensively tested for performance over a wide range of "with noise" models with excellent results. The following are examples of these measurements to provide general guidance to the performance quality.

These "with noise" measurements have been carried out with reference to, ETSI TS 101 524 V1.1.2 (2001-08), page 73, Table 12-3, Noise model C /ITU G.991.2 Annex B noise model C. The physical lengths (L2) were used, to the nearest 50m, and the noise was increased until the BER was in the order of 10-8. The results are as follows:

SPEED	LENGTH (L2) of 0.4mm	BER	NOISE MARGIN
2048kbps	2.15km	$6.4x10^{-8}$	5.4dB
1536kbps	2.45km	$3.4x10^{-8}$	5.2dB
1024kbps	3.05km	$2.3x10^{-8}$	5.0dB
768kbps	3.4km	$2.6x10^{-8}$	5.9dB
512kbps	4.2km	$5.5x10^{-9}$	3.8dB

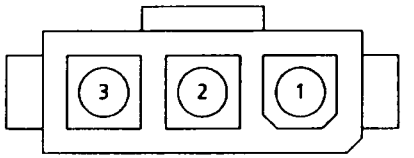
7 INTERFACES

7.1 AC POWER INLET

AC power is fed via a standard 3 pin IEC socket. A power cord fitted with a country variant mains plug is supplied with the unit. This should be plugged into a suitable power supply with earth protection to provide ESD protection of the unit.

7.2 DC POWER INLET

DC power is fed in via the three-pin socket on the rear panel.



1	-48V
2	0V
3	CGND

A connection from CGND to earth is required for ESD protection of the unit.

If the unit is line powered, the ground connection must be made to the earth bonding point on the rear panel. (M3 stud).

Mating connector

Molex Minifit Junior Receptacle — Molex Part Number: 39-01-4031
Molex female contact — Molex Part Number: 39-00-0039

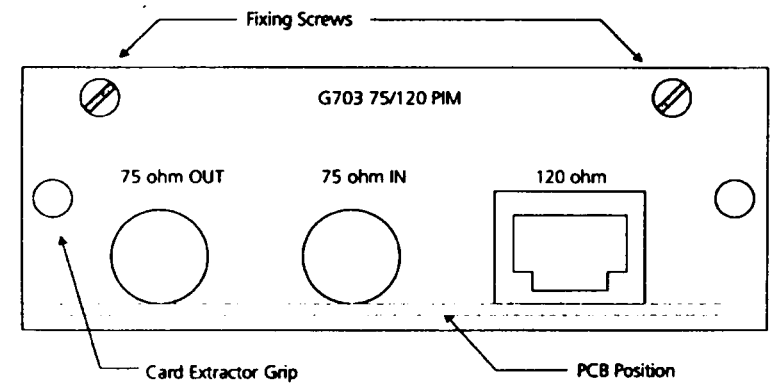
7.5 INTERFACE MODULES

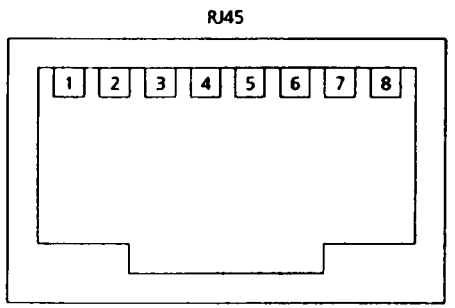
7.5.1 G.703

The 75 ohm interface connectors are BNC.

The 120 ohm interface connector is RJ45.

Selection of the interface is carried out in the "Configuration > User Port" menu.





1	TxA
2	TxB
3	screen
4	RxA
5	RxB
6	screen
7	n.c.
8	n.c.

7.5.2 X.21

ITU Recommendation V.11 refers to ISO 4903 for the connector pin-out.

Circuit	Interchange Circuit Name	Pins A	Pins B	Definition
G	Signal ground or Common Return	8		
T	Transmit	2	9	From DTE to DCE
R	Receive	4	11	From DCE to DTE
C	Control	3	10	From DTE to DCE ON during Data OFF during Control
I	Indication	5	12	From DCE to DTE ON during Data OFF during Control
S	Signal Element Timing	6	13	From DCE to DTE T and R change at OFF to ON of S
B	Byte Timing	7	14	From DCE to DTE OFF for the ON period of S During the last bit of the octet
X	DTE Signal Element Timing	7	14	MK I, not used MK II, From DTE to DCE

The clock rate is set up using the "Configuration > User Port" Menu.

Select the required value of N for Nx64K circuits.

DTE – DCE mode, and X-B mode are selected using the hardware links on the X.21 interface module.

7.6 FRONT PANEL

7.6.1 Controls

The front panel controls have a dual purpose. For normal operation, the LED indicators display status information as described in section 7.6.2 and the push buttons are used for applying test loops as described in section 7.6.1.4. These controls can however, also be used to configure the modems without the need to plug in a VT100 terminal or PC. To do this, the front panel controls must be enabled for "Full Control" (default setting) and the modem set to Programming Mode.

7.6.1.1 Disabling the Front Panel Controls

The modems are delivered with the front panel controls fully enabled as the default configuration. This means that both test loop activation and modem programming are possible from the front panel. They can however be disabled to prevent unauthorised persons from using them to interfere with the settings of the modem. The VT100 management system (which is password protected) is used to enable or disable the front panel controls via the Configuration > Front Panel menu (see the VT100 Management User Guide for details). The options available are "Full Control" (default), "Loops Only" and "Input Disabled".

7.6.1.2 Programming Mode

To enter the programming mode, press the Local Loop and Loop Back buttons together and then release them. Upon releasing the buttons, the Status indicator starts to flash. This indicates that the modem is in programming mode and will continue to flash for approximately 30 seconds after the last programming action. Programming is carried out using the Local Loop and Loop Back buttons with the LED indicators showing the parameter numbers and their values, and the Remote Loop button is used to store the new parameter values causing the modem to reboot. If the values aren't stored within the 30 second timeout period, the modem will exit programming mode (Status Indicator stops flashing) and the new parameter values will be discarded.

Refer to Appendix B for a full explanation on entering parameters using the front panel controls.

7.6.1.3 Resetting to Factory Default Configuration

Press the Local Loop and Loop Back buttons together, and then with the buttons still pressed, press the Remote Loop button as well. The unit will automatically restart with all of its configuration data cleared.

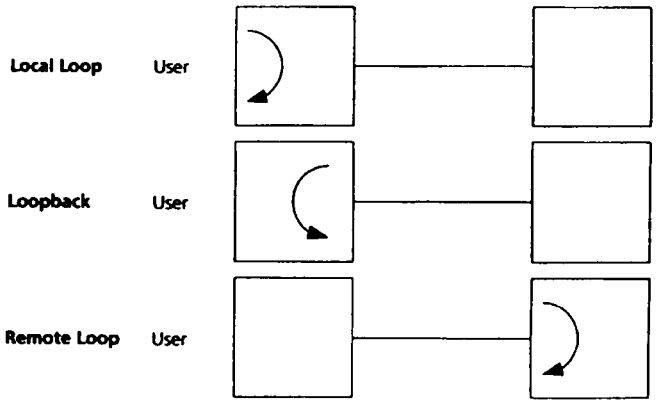
Note: When the units reboots it will be configured as a "Slave".

7.6.1.4 Setting Loops

The following test loops may be set using the front panel buttons.

- Local Loop
- Loop back
- Remote Loop

N.B. These buttons may be disabled from the 'Test > User Port' menu.

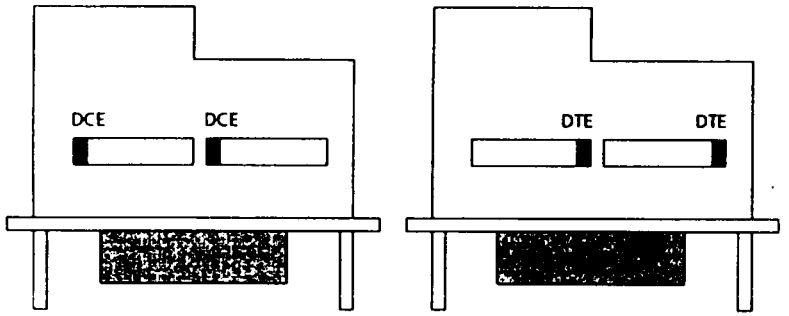


In DCE mode, the module may be configured to generate Byte Timing (B) or receive the DTE clock (X).

In DTE mode, the module may be configured to receive Byte Timing (B) or generate a DTE clock (X).

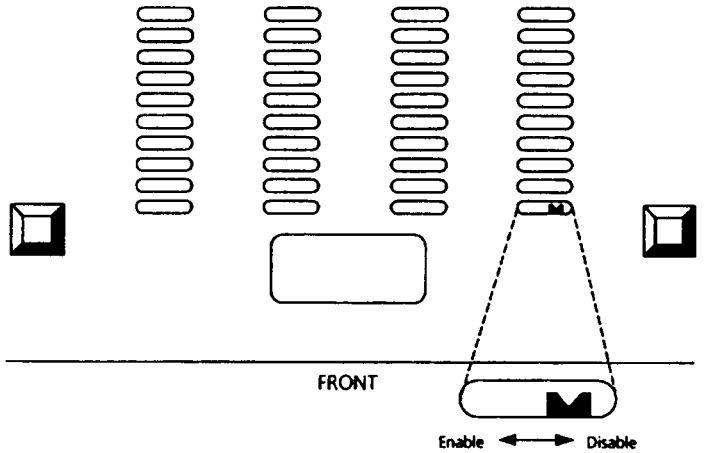
8.3 V.35 PLUG IN MODULE

The V.35 module may be configured as a DCE or DTE. Both links must be in the correct position. If the links are incorrectly set, the unit will detect the illegal setting.



8.4 MOTHERBOARD

The motherboard is fitted with a 'bootblock download enable' switch that is accessible from the underneath of the plastic housing. This makes it unnecessary to open the case to enable the downloading of new bootblock software.



ACCESS TO BOOTBLOCK SWITCH

It may occasionally be required to to update the bootblock software to a later build as part of an upgrade to the modem. The switch must be placed in the enable position for the modem to accept a new version of bootblock software.

Using the F8 function key check to see if the performance statistics are roughly the same for each line and for each end (ELU and NTU) of the line.

If there is a difference it could be that one end of the link is near a source of interference, either in the cable bundle or externally, such as a source of RF power.

Check the line connections to see if they are all OK.

If the equipment is connected to a very long line near to the limit of operation, it is possible that one or more of the circuit ends can work error free whereas another end might have a high bit error rate.

There are no alarms but data transfer is not happening

For all interface types

1 Check that no test loops are active. (The front panel TEST LED should be off on all units).

2 Go to the "Configuration>Timeslot Map" screen. Check to see that the Network Timeslots (nTS) and the Customer Timeslots (cTS) are suitable for your application. Pressing F5 will restore the timeslot map to its default setting.

For X.21/V.35

1 Check that the interface is in the correct mode, i.e. DTE or DCE. The user interface module has hardware links that may be used to change the setting. The factory default setting is DCE. When connecting the MDU248A to terminal equipment, either the MDU248A must be set to be a DCE and the terminal equipment to a DTE or vice versa. The setting of the links may be checked without opening the box by going to the "Information>System"screen.

2 Does the connected V.35 DTE implement RTS? If not, go to the "Configuration>User Port" screen and use the circuit clamps to ensure that the MDU248A will accept data.

Note: For V.35
Circuit 105 = RTS Request to send.
Circuit 106 = CTS Clear to send.
Circuit 107 = DTR Data terminal ready.
Circuit 109 = CD Carrier detected.

3 Check that the interface has been set to the correct speed. Go to the "Configuration>User Port" screen and check the value of N (x64) and the given data rate, matches the rate expected by the connected data terminal. If there is a doubt, go to the Configuration> User Port Screen and press 'Enter'.

4 When the MDU248A is configured as a DCE and if the connected DTE provides a TX clock, go to the "Configuration>User Port" screen and select the "DTE clock enable" option. For data terminals that do not provide a clock, try using the "Invert Receive Clock'. This will change the position at which the receive data is sampled and may help if cable clock skew is a problem.

For G.703:

1 Check that the G.703 port configuration matches that of the connected equipment.

2 Check the "Performance>User Port" screen

a) If Bipolar violations are occurring there could be problems with the receive data path, i.e. the link is too long or there is interference in the cable.

b) If clock slips are occurring the timing mode may not be set correctly. The likely cause is that in the "Configuration>User Port" screen the timing is set to 'internal' whereas the timing should be set to 'transparent' to lock to the incoming clock.

3 If CRCs are enabled and only one copper pair is being used for transmission, ensure that the idle pattern is set correctly in the "Configuration>User Port" Screen.

The front panel loops appear not to work

With the management terminal connected at the ELU, go to the "Test > User Port" screen if using version 4 software (go to "Configuration > Front panel" for version 5)

See that the Front Panel Enable is checked.

Use F8 to view the NTU configuration, again, see that the Front Panel Enable is checked.

Check that no conflicting tests are already activated.

What does the 'Quality Factor' mean in the Performance > Transmission Line Screen?

The quality factor is a rough measure of the signal to noise ratio of the received signal.
Apply the following formula:
Received S/N (dB) = 58.4 – 10log10 (QF)

Different types of noise will have different QF levels that give a 1xE-7 BER. For some types of coloured noise the SQ will be lower. For non-linear distortion and impulse noise, the QF will be higher. Because of its qualitative nature it is best used as an indicator of long term variations. For example, introduction of additional interferers into a cable, flooded cable ducting, etc.

The quality factor may be different between the ELU and the NTU because:

a Different tolerances between components.
b Different noise sources at either end.

For a two pair link, one would expect the quality factor at each end to be similar for each line. Results in the lab show the ELU to have a higher QF than the NTU. Also, the QF may vary from one line synchronisation to the next.

10.2 DSL TRANSMISSION FRAME

Both of the above transmission systems operate in a bit pump mode. The DSL frame is sent over this 'data pipe'. The DSL frame contains the following:

- Sync word
- Stuff bits
- Stuff control bits
- EOC channel
- Customer data

The nominal DSL frame is always 6ms long, regardless of the transmission rate of the individual channels.

The DSL frame length is adjusted slightly by the use of stuff bits. There may be 4 stuff bits or 2 stuff bits per frame. The stuff bits are used to adjust the effective payload bandwidth of the DSL frame.

If the user rate clock is slightly quicker than the line rate clock then less stuff bits are sent. Alternatively, if the user rate clock is slightly slower than the line rate clock then more stuff bits are sent. This mechanism allows the line rate bandwidth to be adjusted to match the user rate bandwidth.

At the receive end, the rate at which the stuff bits arrive is used to recover the user clock.

The transmit and receive paths may be operated independently from one another so that when a G.703 user interface is present, the transmit and receive clocks are allowed to vary independently by ±50ppm. (**Note**: When operating with X.21 or V.35 interfaces, there is only a single clock at each user interface.)

The Embedded Operation Channel (EOC) is carried in spare overhead bits in the transmission frame. Packetised SNMP SET and GET messages are passed over the link from the ELU to the NTU, which answers with the appropriate SNMP response.

10.3 CONTROL CIRCUIT

The control circuit is based on a micro-controller and determines the operational status of the unit according to the state of the transmission system, the data interface and the configuration information received from the terminal.

Configuration data and two copies of the application are stored internally in FLASH memory. On power-up the application program is copied from FLASH to RAM from where it is executed. The main application program is backed up so that if a corruption occurs it can be corrected. This also enables the programming of a new application while the equipment is operating normally. Control is transferred to the new application after an automatic restart at the end of the download. This minimises the interruption of payload traffic. Also, if programming is interrupted, the previous version of software will remain intact. A new application program may also be downloaded via the ELU to the remote NTU over the line.

10.4 USER INTERFACE MODULES

The user interface is provided by a plug-in module of which there are five types:

- G.703, with software selectable 75Ω or 120Ω ports
- G.703 MK II (with 1 + 1 protection switch)
- X.21
- V.35
- e-PIM 100BaseT/USB

12 GLOSSARY

A	Alarm bit in G.704 frame, timeslot 0
AC	Alternating Current
AIS	Alarm Indication Signal
BT	British Telecom
CAP	Carrierless Amplitude and Phase Modulation
CCITT	International Telegraph and Telephone Consultative Committee
CRC4	Cyclic Redundancy Check 4 (bits)
CRC6	Cyclic Redundancy Check 6 (bits)
CRC6G	CRC6 Generator
CRC6M	CRC6 Monitor
DC	Direct Current
DCE	Data Circuit Terminating Equipment
DS	Digital Section (Line section including ELU and NTU)
DSP	Digital Signal Processing
DSL	Digital Subscriber Line
DTE	Data Terminating Equipment
E bit	Bits in the G.704 frame used to indicate that a CRC has been received in error
ELU	Exchange Line Unit
EMC	Electromagnetic Compatibility
EN 41003	Particular Safety Requirements for Equipment to be connected to Telecommunications Networks
EN 60950	1992. Up to A11 (1997) Safety of Information Technology Equipment
EOC	Embedded Operations Channel
ESD	Electro Static Discharge
ET	Exchange Termination
ETR152	ETSI Technical Report 152 (1996). Transmission and multiplexing; DSL transmission system on local lines;

APPENDIX A - X.21/V.35 CLOCK OPTIONS

There is an inherent limitation with X.21 and V.35 standards when timing information is only transmitted in one direction.

The timing is usually sent from the DCE to the DTE. Data originating from the DCE and travelling to the DTE arrives at the DTE with the same clock skew with which it originated at the DCE. However, data originating at the DTE arrives back at the DCE skewed relative to the DCE clock. This skew is equal to (2 x cable delay) + Driver delays at both ends.

Receive data is normally sampled at the half bit period position. So when the total clock skew approaches half a bit period the DCE will be sampling the incoming data at the transition between bits, this will cause the link to error.

When in DCE mode the MDU248A provides two extra clocking options to work around this problem. These options are accessed from the "Configuration>User Port" screen.

INVERT RECEIVE CLOCK – Causes the MDU248A to sample the incoming data on the rising edge of the TX clock instead of the falling edge. See Figure A1 for more information. This is available for both V35, and X21.

DTE CLOCK ENABLE – Causes the MDU248A to use the clock returned from the DTE to sample receive data instead of the TX clock. See Figure A2 for more information. This is available for V35 (return clock on cct. 113), and X21 when in X mode (return clock on S Ext).

For this option to work the DTE must be providing a return clock.

In X21 mode this option cannot be used at the same time as byte timing.

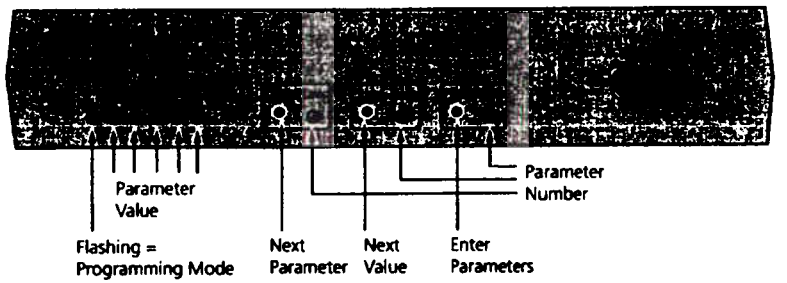
APPENDIX B - PROGRAMMING FRONT PANEL

INTRODUCTION

For users that don't have access to a PC or prefer to configure the MDU248A without the need for a PC, the operating parameters can be configured using the front panel controls. Parameter values in the slave modem (NTU) can be set from the front panel of the master modem (ELU) in a similar manner to the VT100 management system. Front panel programming is carried out by placing the modem into Programming Mode by pressing the "Local Loop" and Loop Back" buttons simultaneously and then releasing them. Programming mode will be indicated by the Status LED flashing. The remaining LED indicators will display the first parameter number and it's value.

Note: If the front panel controls have been previously set to "Loops only" or "Input disabled" from the VT100 screen, it will not be possible to enter Programming Mode.

The front panel buttons and indicators are used as follows:



OPERATION

The "Local Loop" and "Loop Back" buttons are used to programme the parameters. Once programming is complete, the "Remote Loop" is pressed to store the new parameter values (this must be done within 30 second of the last programming action or the modem will automatically leave programming mode and discard the new values). When "Remote Loop" is pressed, the modem reboots into its new configuration, if a configuration change warrants.

All of the configurable parameters have a "Parameter Number" displayed as a 3-bit binary number on the loop active indicators (Local Loop = MSB), and a "Value" displayed as a 5-bit binary number on the status indicators (Line 1 = MSB).

Parameter Number	LL	LB	RL	Value	Meaning
1	0	0	1	00000	Slave - 1 Line
				00001	Slave - 2 Lines (Default Value)
				00010	Master - 1 Line
				00011	Master - 2 Lines
2	0	1	0	00000	Adaptive Line Rate - Default Value
				00001	Line Rate 256kbps
				00010	Line Rate 320kbps
				00011	Line Rate 384kbps
				00100	Line Rate 448kbps
				00101	Line Rate 512kbps
				00110	Line Rate 576kbps
				00111	Line Rate 640kbps
				01000	Line Rate 704kbps
				01001	Line Rate 768kbps
				01010	Line Rate 832kbps
				01011	Line Rate 896kbps
				01100	Line Rate 960kbps
				...	...
				11101	Line Rate 2048kbps
3	0	1	1	00000	User Rate 64kbps
				00001	User Rate 128kbps
				...	...
				11110	User Rate 1984kbps
				11111	Auto Data Rate - 2048kbps (Default Value)

TABLE C2.1 - G.SHDSL

G.703 Interface	LL	LB	RL	Value	Timing	Structured	CRC	Impedance
4a (ELU)	1	0	0	00000	Transparent	No	Off	75 Ohm
				00001	Transparent	No	Off	120 Ohm
				00010	Transparent	No	Off	75 Ohm
				00011	Transparent	No	Off	120 Ohm
				00100	Transparent	Yes	Off	75 Ohm
				00101	Transparent	Yes	Off	120 Ohm
				00110	Transparent	Yes	On	75 Ohm
				00111	Transparent	Yes	On	120 Ohm
				01000	Internal	No	Off	75 Ohm
				01001	Internal	No	Off	120 Ohm
				01010	Internal	No	Off	75 Ohm
				01011	Internal	No	Off	120 Ohm
				01100	Internal	Yes	Off	75 Ohm
				01101	Internal	Yes	Off	120 Ohm
				01110	Internal	Yes	On	75 Ohm
				01111	Internal	Yes	On	120 Ohm
5a (NTU)	1	0	1	00000		No	Off	75 Ohm
				00001		No	Off	120 Ohm
				00010		No	Off	75 Ohm
				00011		No	Off	120 Ohm
				00100		Yes	Off	75 Ohm
				00101		Yes	Off	120 Ohm
				00110		Yes	On	75 Ohm
				00111		Yes	On	120 Ohm

TABLE C2.2 - G.SHDSL AND NON G.SHDSL

MDU248A / VT100 Management
User Guide (part 2)

BLACK BOX part no:
1/298/100/613
Issue 01
Jan. 2003

2 INTRODUCTION

This document describes the functionality contained in the menu system of the MDU248A family of products. The menus are accessed via a serial interface to a VT100 compatible terminal.

A VT100 terminal may, for example, be emulated by a programme running on a notebook PC running under Windows. A screen of 80 characters wide by 24 lines high and a fully compatible VT100 keyboard is required.

The menu system provides access to configuration data, alarm information, performance monitoring and diagnostic functions.

There is also a monitoring mode for fault reporting to a dumb terminal or printer.

The Management menu is based on the OSI model for network management. The VTMS Screens are functionally cohesive, i.e. System Configuration, User Port Configuration are grouped together (accessed through the same menu).

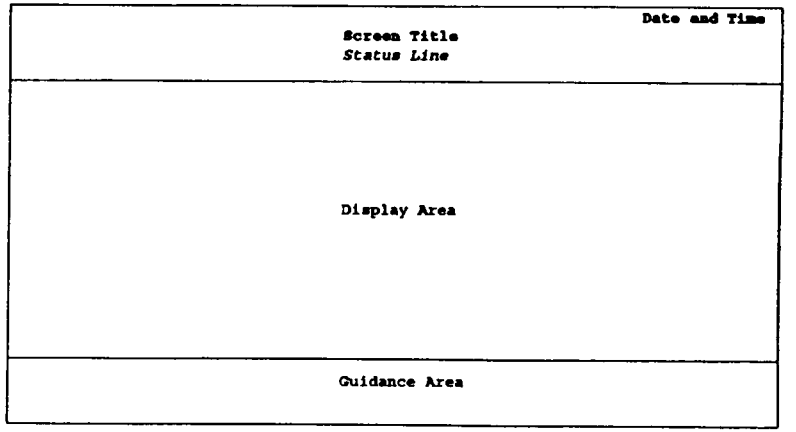
4 GENERAL DESCRIPTION

4.1 DEFINITIONS

Text attributes used within the screen are represented within this document as follows:

- normal - normal
- bold - **bold**
- flash - *italic*
- bold & flash - ***italic & bold***
- underline - not used
- Reverse - dotted underline

4.2 SCREEN LAYOUT



The screen has the following dimensions:

Width = 80 characters
Height = 24 Lines

The screen title area can hold 3 lines (of 78 characters).
The status line is 78 characters wide.
The display area holds 14 lines (of 78 characters)
The Guidance area holds 3 lines (of 78 characters).

Typical function keys are:

F7 - Previous Page
F8 - Next Page

Every screen will have an **F1** key. This will display screen specific online help information in the bottom field of the screen. Pressing **ESCAPE** will return to the normal display.

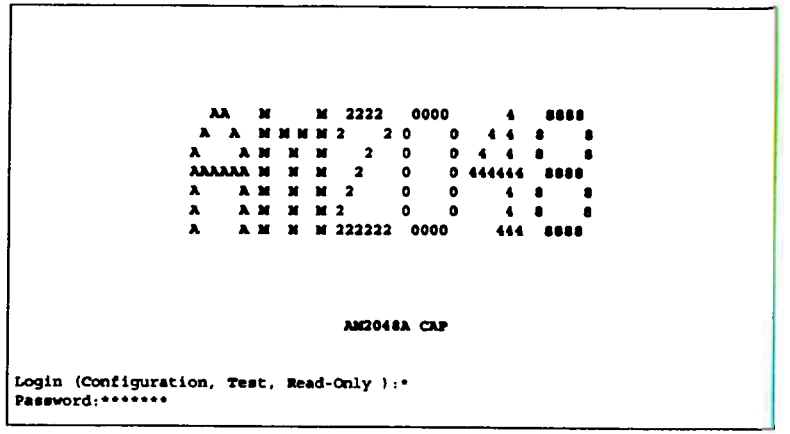
The total range of function keys available is **F1** to **F10**

Should the VT100 terminal emulation not provide these function keys then the same functionality can be achieved as follows:

F1 'Control F' followed by '1'
F2 'Control F' followed by '2'
F3 'Control F' followed by '3'
F4 'Control F' followed by '4'
F5 'Control F' followed by '5'
F6 'Control F' followed by '6'
F7 'Control F' followed by '7'
F8 'Control F' followed by '8'
F9 'Control F' followed by '9'
F10 'Control F' followed by '0'

5 ACCESS

5.1 LOGIN SEQUENCE



On connection of a VT100 TERMINAL to the Access Line System and the reception of characters (spaces) from the VT100 terminal, a welcome screen with the words "Press space-bar to continue" will be displayed. On the space-bar being pressed, the above screen with login prompt will be displayed.

Note: The default serial port setting is
19200 baud, 8 bits, no parity, 1 stop bit, Xon/Xoff handshake.

At this point the operator will enter upper or lowercase **C**, **T** or **R** followed by a carriage return. See Login Modes for a full description.

The Password prompt appears next and the operator must then enter the password, each character being echoed to the terminal as an asterisk, backspace will operate normally. The password must be terminated with a carriage return.

Failure to enter the correct password will result in the message:
"Password failed"

This is followed by a repeat of the login message. 3 failed attempts will cause the system to disconnect, i.e. drop CTS/DTR.

Should the password not be forthcoming within 20 seconds, the following message will appear:
"Password time-out (Mon 01 Nov 2002 09:00:00)"

This is followed by the login message.

Configuration	The setting of attributes that determine how the system will operate.
Information	Displays system information that is read only.
Logout	Selection of this option performs the logout sequence.
Performance	The retrieval of information relating to how well the system is performing.
Security	Restriction of access to the system to only those authorities with clearance.

For functionality not directly falling into the above bands the following management category has been introduced.

Test	The configuration and performance of a number of system tests. The options available under these areas of management are described in the subsections that follow.

Note: The access rights of the operator determine the accessibility of the management areas.

7 ALARMS

This OSI category of management is described as Alarms (or Faults) within the local access network arena.

This section details the alarms and other events occurring within the ELU and its associated NTUs.

7.1 ALARM MENU

```
AM2048A CAP                                    Tue 18 Sep 2001 08:09:58
                                    Alarm Menu
Urgent Alarm:On     Non-Urgent Alarm:Off


                          S Status
                          H History
                          L Severity Level Settings

                               Type selection:L


F1 Help  F3 Previous Menu  F4 Main Menu
```

This menu provides access to the screens that deal with alarms occurring within the system, these screens are detailed in the following sections.

Explanation	
Menu Options	Each option displays a relevant screen.

Explanation	
Display Acknowledged Alarms	This checkbox controls the display of alarms that have been acknowledged in the Alarm Screen. An 'A' in the 'A' column indicates acknowledged alarms.
Subsystem	This checkbox enables the display of only those events on the same subsystem as the currently highlighted alarm entry.
F2 – Show ID/Name	This function key controls the toggling between the Subsystem ID and its name as assigned in the Configuration>Subsystem Names menu.
F5 - Clear History	This function clears the contents of the logbook.
F9 - Dump	This function dumps the entire contents of the logbook to the screen. If a terminal emulator running on a PC is being used, the data may then be cut and pasted to a document.
F10 - Update	This function updates the screen view of the logbook.

7.4 ALARM SEVERITY LEVEL SETTINGS SCREEN

```
AM2048A CAP                                          Tue 18 Sep 2001 12:10:25
                      Alarm > Severity Level Settings
Urgent Alarm:On     Non-Urgent Alarm:Off

 Id|                          Fault Description                          | Level
001|Cold Boot                                                            <1>
002|Warm Boot                                                            <1>
003|Failed to program (Fault:%n)                                         <1>
004|Power Fail                                                           <5>
005|Line %n - Power Feed Fail                                           <5>
006|Line %n - Wetting Current Fail                                      <3>
007|Line %n - BER worse than 1 in 10E4                                  <0>
008|Line %n - BER worse than 1 in 10E5                                  <0>
009|Line %n - BER worse than 1 in 10E6                                  <1>
010|Line %n - Sync Loss                                                 <5>

                  Press Return to Accept or Escape to Cancel

F1 Help  F3 Previous Menu  F4 Main Menu  F5 Default  F7 Previous Page
F8 Next Page
```

Each alarm in the system has a 'Fault Severity' Attribute. This attribute is used by a higher-level network manager to sort faults into their relative level of urgency.

If an alarm of Fault Severity 4 or 5 occurs, the urgent alarm LED is lit, and the urgent alarm relay is activated.

If an alarm of Fault Severity 2 or 3 occurs, the non-urgent alarm LED is lit, and the non-urgent alarm relay is activated.

If an alarm of Fault Severity 1 occurs, this is regarded as being informative only and raises no alarms.

If the Fault Severity is set to 0, the alarm is effectively disabled.

This screen allows the operator to change the default severity level settings. This may be used to demote or completely disable intermittent alarms. The default severity level of fault messages is detailed in Appendix A: Faults.

Explanation	
F5 Default	This function restores the default severity level to the selected fault.
Level	These edit boxes allow the operator to change the severity level given to a particular fault type. This will affect the way in which the fault is reported. Valid values are between 0 and 5 (setting to 0 disables reporting). **Note:** It is recommended that these values are only altered after a full evaluation of the alarm reporting requirements of the system, and where it is considered necessary to comply with a specific alarm scheme.

8.2 MASTER/SLAVE CONFIGURATION SCREEN

The Master/Slave configuration is the first item that must be programmed. This screen will vary depending on the hardware variant and the software version supplied. See below for the different screens.

The Master/Slave option is common to all variants.

Point to Point/Point to Multipoint option is common to all variants that have more than one transmission line.

Explanation	
Master/Slave	This option selects the basic mode of operation of the equipment. The unit is a 'Master' from both a timing and a management point of view. Since the exchange (or central office) site is usually the point of connection of the higher level management and the source of timing for the network, selecting Master mode sets the unit to operate as the ELU (Exchange Line Unit, sometimes known as the LT). The remote unit is a slave from both a timing and a management perspective, selecting Slave mode sets the unit to operate as the NTU (Network Terminating Unit, sometimes known as the NT). The standalone desktop unit is generally expected to be configured as a Slave (NTU) and the rack-mount equipment as the Master (ELU). However, there will be installations that require desktop-to-desktop operation and for large customers with many links rack to rack operation. For this reason, both equipment versions are able to work as Master or Slave.
Point to Point/ Point to Multipoint	Point to Point: One ELU is connected to one NTU over one or two copper pairs or one optical fibre. Point to Multipoint: One ELU is connected to two remote NTUs, one copper pair to each NTU.

8.2.1 Optical

```
AM2048A O                                          Tue 18 Sep 2001 17:01:05
                        Configuration > Master/Slave
Urgent Alarm:On    Non-Urgent Alarm:Off

                          Master - ELU ( )
                          Slave  - NTU (*)

                        Point To Point (*)


                        Line 1 Enable [X]




                  Press Return to Accept or Escape to Cancel

F1 Help  F3 Previous Menu  F4 Main Menu
```

Explanation	
Line 1 Enable	As the optical version uses only one transmission line, there is only one line checkbox. This is always enabled and is read-only to the operator.

8.3 USER PORT CONFIGURATION SCREEN

This screen is used to configure the operation of the user ports within the system (ELU and corresponding NTUs).

A number of user port configuration screens are detailed in this section. The screen display will depend on the user port hardware fitted to a selected subsystem.

8.3.1 G.703 Screen

```
AM2048A 0                                          Wed 19 Sep 2001 11:51:42
                          Configuration > User Port
Urgent Alarm:On    Non-Urgent Alarm:Off

Subsystem: ELU          Port Type: G703


              Framing                                        Timing
      RX Unframed          (*)                              Internal ( )
      RX Framed            ( )                            Transparent (*)
      RX CRC4              [ ]
      TX Transparent TS0   (*)                              Impedance
      TX Generate TS0      ( )                               75 Ohm ( )
      TX CRC4              [ ]                               120 Ohm ( )
      TX Idle Pattern      <10101011>                     Auto-Detect (*)


                              Press Escape to Exit

F1 Help  F2 Change Port Type  F3 Previous Menu  F4 Main Menu
F7 Previous Subsystem  F8 Next Subsystem
```

The Framing options depend on the system configuration. For all modes except G.703 point to point, the Rx Unframed and Tx Transparent TS0 options are not available. The system automatically works this out once the Configuration >Master and Configuration > User Ports screens have been set up.

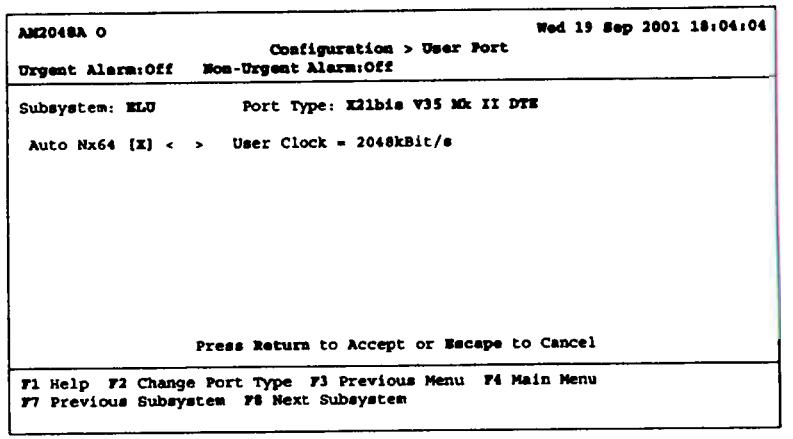
Explanation	
Rx Unframed **Rx Framed**	Selecting RX Unframed disables the receive framer. Timeslot mapping starts from an arbitrary position in the frame. Selecting RX Framed enables receive framing.
Rx CRC4	This option is enabled if the Rx Framed radio button has been selected. Correct reception of the CRC4 multiframe is required before declaring frame synchronisation. CRC4 error counting is enabled in the Performance > User Port screen.

Tx Transparent **Tx Generate TS0**	Selecting Tx Transparent causes TS0 to be passed through the system without being overwritten. Selecting Tx Generate TSO causes TS0 to be generated at the output port.
Tx CRC4	This option is only available when Tx Generate TS0 has been enabled. Selection of this option instigates CRC4 encoding and reporting of E bits when receive CRC4 bits are in error. **Note**: Timeslot 0 is no longer transparent.
Idle Pattern Edit Field	This field only accepts 1s or 0s. When the system is operating in a fractional mode, the idle pattern is used to fill timeslots that have not been transported across transmission lines.
Timing Options	For details of setting these options see the user guide.
Impedance Options	These options provide a choice of 75Ω or 120Ω connection, or enable the auto-detection mechanism. If the Auto-Detect radio button is selected, the modem will monitor both 120Ω and 75Ω user ports for a G.703 signal, toggling between them every 10 seconds. Upon recognition of a valid G.703 signal on one of the ports, the modem will automatically select that port. This enables the user to install the modem without the need to configure the user port in the software. Once a user port has been automatically configured, it will be shown on the display as if the user had selected it (i.e. the Auto-Detect radio button will be de-selected and the appropriate impedance option will be selected). If the modem subsequently looses the G.703 signal, it will continue to search for a signal on that port only. If the G.703 port connections are changed, then either the corresponding port impedance option must be selected manually, or the modem must be reset to enable the Auto-Detect sequence to re-commence.
F2 Change Port Type	This function key is only available when an NTU is selected. It cycles through the available port types for the selected NTU. This allows the ELU to be configured with the setting of the NTU user port, before it is connected to the remote NTU(s).
F7, F8 Previous/ Next Subsystem	These function keys allow the user to cycle through the user ports of the connected subsystems. (Only available at the ELU)

Explanation	
Invert Receive Clock (MK II PIM only)	Checking this option may cure the following problems: **Operating as DCE** If there is no DTE clock available there may be transmission problems across the user interface for high values of user clock and certain cable lengths. If this is the cause of the problem, inverting the receive clock moves the sample position of the receive data by half a bit period and this should provide a cure. **Operating as DTE** This may be of use if the DCE clock is the wrong sense.
DTE Clock Enable (MK II PIM only)	This option is only available when configured as a DCE. The X/B link on the plug in module must also be set to X, to physically connect the DTE clock to the X circuit. The setting of the hardware link may be checked by viewing the Information > System Screen. Only select this option if the DTE is providing a clock back to the DCE. **Note**: Not all DTEs provide a transmit clock. Selecting this option will cause the data from the DTE to be sampled relative to the clock coming from the DTE. The clock returned from the DTE must be the same frequency as the clock originating from the DCE. In the event that the DTE loses lock, the receive buffer will either overflow or under run and this will cause the slip counter in the Performance > User Port screen to increment. If the DTE clock is not present a system alarm will be raised. N.B. Enabling this option with the X-B link set incorrectly will also give rise to the 'User Port – Input Clock Loss' alarm.

8.3.4 X.21bis (V.35) DTE Screen

This screen will be available if an X.21bis (V.35) plug in module is fitted and the DCE/DTE link is set to DTE.



Explanation	
Auto Nx64	This provides automatic calculation of the value of N (the bandwidth offered to the customer). If the Auto Nx64 check box is selected, then it is unnecessary to type a value for N. The value for N will be automatically set to its maximum value calculated from the number of lines, the line speed and the application. (The maximum possible value for N is 32 unless the modem at the far end of the link is connected to a structured G.703 system, in which case it will be limited to 31). Where it's necessary to limit the bandwidth to the customer, the Auto Nx64 should not be selected and the required value for N inserted in the value box (see below).
Nx64 Value	The value of N is used to set the data rate of the user clock in 64kbps increments. The maximum value of N is limited by the number of lines enabled and the number of timeslots carried per line. The software automatically restricts the range of N accordingly.
F2 Change Port Type	This function key cycles through the available port types for the selected subsystem. This allows the ELU to be configured with the setting of the NTU user port, before it is connected to the remote NTU(s).

Managed Bridge (Layer 2)	Select this radio button if it is necessary to manage the bridge from a remote location. A suitable IP address will then need to be assigned.
Router (Layer 3)	Select this radio button if you need the ePIM to function in routing mode. You will need to assign suitable addresses to the Line and user ports for the router to function. Once the ePIM has been assigned an IP address and is connected to the network, further configuration parameters can be set via a remote Telnet session using the ePIMs command line interface.
Advanced Setup	When the MDU248A is rebooted or powered up, it automatically rewrites the IP addresses to the ePIM and resets certain ePIM settings to a default value such as enabling RIP. In the majority of applications this will ensure that the ePIM functions correctly. However, for users that require advanced ePIM set-ups such as RIP disabled, these settings (which would have been set via a Telnet session) would be destroyed during a reboot or temporary power loss. Use of the Advanced Setup option will prevent such an occurrence causing the loss of **saved** advanced settings. To do this, the operator must first choose the Router or Managed Bridge options and provide the Management IP address so that a Telnet session can be set up to the ePIM. The operator can then use a Telnet session to the ePIM to configure it as required and then **save** the configuration. Finally, the operator must return to the MDU248A VTMS and choose the Advanced Setup option on the ePIM screen. This will then protect the saved configuration.
Management/Line IP Address	Insert the required IP address for the line interface. This address is used for Telnet access.
Management/Line Subnet Mask	Insert the subnet mask corresponding to the line IP address.
Ethernet IP Address	Insert the required IP address for the Ethernet user port.
Ethernet Subnet Mask	Insert the subnet mask corresponding to the Ethernet user port IP address.
USB IP Address	Insert the required IP address for the USB user port.
USB Subnet Mask	Insert the subnet mask corresponding to the USB user port IP address.
Forward Traps	Enabling this option will cause the MDU248A to generate SNMP traps via the ePIM Ethernet port to enable alarms and events to be reported to an SNMP based management system such as ANMP. This option is not available when Unmanaged Bridge mode is selected.

Please refer to the ePIM User Guide for more detailed information on these parameters.

8.3.6.1 Managed at NTU Option

When configuring an ePIM fitted to an NTU from the ELU, an additional option field is provided:

Managed at NTU [ ]

This option allows the ePIM to be managed from the NTU management port.

Explanation	
Managed at NTU	Select this check box at the ELU to transfer the management of the NTU ePIM parameters to the NTU. This will make the parameters read-only at the ELU while enabling read-write access at the NTU. (The screen is normally read-only when accessed via the NTU management port). **Note:** Once this check box has been selected at the ELU, the read-only values in the IP Address and Subnet Mask fields at the ELU will be frozen at the last value set from the ELU. Subsequent changes to these values made by the customer at the NTU will not be reflected on this screen. **Application** Where network providers want to administer all aspects of the network (both transmission and internet working) then the NTU settings should be controlled from the ELU (the default setting). The separate administration of the two aspects may be required. For example, network providers that offer transparent WAN connections to customers will usually connect each segment to the backbone network via a G.703 connection at the ELU, and provide a Bridge/Router at the customer's premises. In such cases the network provider will want to retain the administration of the transmission links while allowing the customer to configure the IP parameters to their specific requirements.

8.4.2 Example 2, 2-Pair Point-to-Point G703 to Nx64 System

```
AM2048A CAP                                          Thu 20 Sep 2001 12:29:16
                        Configuration > Timeslot Map
Urgent Alarm:On     Non-Urgent Alarm:Off

  nTS cTS  NTU Pri  nTS cTS  NTU Pri  nTS cTS  NTU Pri  nTS cTS  NTU Pri
   00 <  > <X> <0>   08 <7 > <1> <0>   16 <15> <1> <0>   24 <23> <1> <0>
   01 <0 > <1> <0>   09 <8 > <1> <0>   17 <16> <1> <0>   25 <24> <1> <0>
   02 <1 > <1> <0>   10 <9 > <1> <0>   18 <17> <1> <0>   26 <25> <1> <0>
   03 <2 > <1> <0>   11 <10> <1> <0>   19 <18> <1> <0>   27 <26> <1> <0>
   04 <3 > <1> <0>   12 <11> <1> <0>   20 <19> <1> <0>   28 <27> <1> <0>
   05 <4 > <1> <0>   13 <12> <1> <0>   21 <20> <1> <0>   29 <28> <1> <0>
   06 <5 > <1> <0>   14 <13> <1> <0>   22 <21> <1> <0>   30 <29> <1> <0>
   07 <6 > <1> <0>   15 <14> <1> <0>   23 <22> <1> <0>   31 <30> <1> <0>

Priority: 0-Off, 1-High, 3-Low, Timeslots: 0-31, X - Don't Care

                Press Return to Accept or Escape to Cancel

F1 Help  F2 System Information  F3 Previous Menu  F4 Main Menu  F5 Default
```

Where the user interface fitted to the ELU is G.703 and the user interface fitted to the NTU is a Nx64 data port, the 64kbps components of the data bandwidth in the customer timeslots (cTS) are mapped to the framed G.703 data in the network timeslots (nTS) starting from nTS 01. This is because nTS 00 is reserved for frame synchronisation over the user port and is therefore not available to carry data. This leaves an available bandwidth of 31 x 64kbps.

As the Nx64kbps bandwidth needs to be carried over a contiguous range of timeslots, timeslot priority settings are not relevant to nx64 data.

The timeslot mapping for a 2048kbps point-to-point G703 to Nx64 system over a single line is the same as that described above.

8.4.3 Example 3, Point-to-Point Fractional G.703 Over a Single Pair

```
AM2048A CAP                                          Thu 20 Sep 2001 12:02:56
                        Configuration > Timeslot Map
Urgent Alarm:On     Non-Urgent Alarm:Off

  nTS cTS  NTU Pri  nTS cTS  NTU Pri  nTS cTS  NTU Pri  nTS cTS  NTU Pri
   00 <0 > <1>       08 <8 > <1>       16 <  > <X>       24 <  > <X>
   01 <1 > <1>       09 <9 > <1>       17 <  > <X>       25 <  > <X>
   02 <2 > <1>       10 <10> <1>       18 <  > <X>       26 <  > <X>
   03 <3 > <1>       11 <11> <1>       19 <  > <X>       27 <  > <X>
   04 <4 > <1>       12 <12> <1>       20 <  > <X>       28 <  > <X>
   05 <5 > <1>       13 <13> <1>       21 <  > <X>       29 <  > <X>
   06 <6 > <1>       14 <14> <1>       22 <  > <X>       30 <  > <X>
   07 <7 > <1>       15 <15> <1>       23 <  > <X>       31 <  > <X>

Priority: 0-Off, 1-High, 3-Low, Timeslots: 0-31, X - Don't Care

                Press Return to Accept or Escape to Cancel

F1 Help  F2 System Information  F3 Previous Menu  F4 Main Menu  F5 Default
```

Where only one pair is available and only some of timeslots in the G.703 frame are used, the line rate can be set to 1024kbps thereby reducing the bandwidth. Here the network timeslots are mapped one to one to the customer timeslots through to timeslot 15. The rest of the timeslots are unallocated due to the limited available bandwidth on the transmission line.

It is possible to re-assign the customer timeslots to different network timeslots to satisfy the requirements of a multiplexer at the network end, for example.

Explanation	
Screen Navigation	The screen is viewed as 4 columns of data. The TAB key can be used to navigate the table starting from the top left, across the first three items in column 1, and then down to the next 3 items in column 1. Continue like this down to the bottom of the first column and then up to the top of the next column etc. When the end of the table is reached the highlight bar returns to the top left of the table again. Consistency checking is performed when the operator presses <RETURN> to accept the screen.
F5 Default	This function generates a default timeslot map based upon the number of transmission lines, the line rates and the specified user ports. This function allows an operator to revert back to valid timeslot map should the need arise.

8.5 SUBSYSTEM NAMES CONFIGURATION SCREEN

```
AM2048A                                          Mon 24 Sep 2001 09:00:00
                        Configuration > Subsystem Names
Urgent Alarm: Off Non-Urgent Alarm: Off

Subsystem No: 1

                        Name          <ELU          >

                        Description   <Main Trunk Carrier  >

                        Location      <HQ:Room 101         >




                  Press Return to Accept or Escape to Cancel

F1 Help  F3 Previous Menu  F4 Main Menu  F7 Previous Subsystem
F8 Next Subsystem
```

This screen allows subsystem names to be added for the ELU and NTUs.

Explanation	
Name	This attribute allows a meaningful label to be attributed to the subsystem.
Description	This addition information field maybe useful in identifying the exact role of the subsystem.
Location	This field can help identify the physical position of the device within the network.
F7 & F8	Selecting these function keys causes the information for the next logical or previous logical subsystem to be displayed. Only available at the ELU.

Initiating Software Download	Once the operator has selected which units are to be downloaded, pressing 'Enter' will start the process. The unit will respond with the message: **Send file now!** At this point the operator should use the "send file.." option from the Teraterm menu. Once the download begins the message: **Wait %n done** will be displayed with a trailing rotating '|'. The percentage is displayed in increments of 1 %. If the download fails the following message will be displayed: **Stop Loading!** The operator should then press spacebar to continue within the Software Download Screen.

8.8 MONITORING CONFIGURATION SCREEN

```
AM2048A CAP                                          Tue 25 Sep 2001 04:12:42
                          Configuration > Monitoring
Urgent Alarm:On     Non-Urgent Alarm:Off


                  Monitoring Mode

                              Report Faults [X]

                            With Warning Bell [X]




                  Press Return to Accept or Escape to Cancel

F1 Help  F3 Previous Menu  F4 Main Menu
```

This screen is concerned with the monitoring mode of the ELU or NE. This facility causes system faults to be reported to a dumb terminal or printer whilst the operator is logged out.

Explanation	
Report Faults	This option enables the transmission of fault reports to an attached dumb terminal.
Warning Bell	This option is only available when the Report Faults option is switched on. Selecting this allows warning messages to be accompanied by an audible bell sound. The Status Line options behave similarly.

9 INFORMATION

9.1 INFORMATION MENU

```
AM2048A CAP                                        Tue 25 Sep 2001 04:35:44
                                Information Menu
Urgent Alarm:On     Non-Urgent Alarm:Off


                          S System
                          T Transmission Line Mapping

                              Type selection:




F1 Help  F3 Previous Menu  F4 Main Menu
```

This menu provides access to screens that display read only system information; these screens are detailed in the following sections.

Explanation	
Menu Options	Each option displays a relevant screen.

9.3 SYSTEM INFORMATION SCREEN - V 5 SOFTWARE

```
AM2048A G.SHDSL                                    Thu 01 Jan 2002 00:04:37
                          Information > System
Urgent Alarm:Off    Non-Urgent Alarm:Off

Subsystem: ELU          Base Unit Type:  DC Desktop (Copper)

Hardware:
Transmission System          User Port          Link Setting:
  Transmission Lines: 2      Type: X21-V11-II   Wetting Current Return
                             Mode/MAC: DCE X-Mode


Software: Application Version                  Bootstrap Version
          5.3a 2002 10 02 AM2048 MK2 SDSL      3.01 2002 08 06 Bootstrap MKII


                          Press Escape to Exit

F1 Help  F3 Previous Menu  F4 Main Menu  F7 Previous Subsystem
F8 Next Subsystem
```

Explanation

Hardware

Base Unit Type

- Power type: AC or DC (desktop units only).
- Unit construction: Desktop or Rackmount.
- Line type: copper or optical.

Transmission Lines

1 = Optical

2 = CAP, G.SHDSL (number available, not number configured for use)

Link Setting

This is for power feed / wetting current selection. Options will be different for desktop and rackmount variants.

- Line Power Feeding.
- Wetting Current Feeding.
- Wetting Current Return.
- N.A.(Wetting Current Return).
- Line Powering Enabled.

9.4 TRANSMISSION LINE MAP SCREEN

```
AM2048A CAP                                    Wed 26 Sep 2002 00:52:44
                    Information > Transmission Line Mapping
Urgent Alarm:Off    Non-Urgent Alarm:Off

                  Local Pair    Subsytem    Remote Pair    Priority
                       1          NTU            2             2
                       2          NTU            1             1


                          Press Escape to Exit

F1 Help  F3 Previous Menu  F4 Main Menu
```

This screen indicates the status of the transmission lines and how they have been physically connected. In point-to-point operation, if the pairs are connected out of sequence, the timeslot maps are automatically adjusted accordingly.

If a line is not synchronised, an asterisk (*) is displayed in the Remote Pair column.

The number of entries in this table is based upon the number of transmission modules within the ELU.

Explanation

Priority Priority is attributed to a line based upon the order of start-up of the lines. If line 2 starts before line 1, then line 2's priority will be 1, and line 1's priority will be 2. If line 2 then suffers a sync loss, or is physically disconnected, then line 1's priority will change to 1 and line 2's priority becomes 0. When line 2 achieves sync again the priority of line 2 will be 2.

Remote Pair In the example above, pairs 1 and 2 have been crossed over, this is automatically compensated for by the MDU248A.

10.2 TRANSMISSION LINE PERFORMANCE SCREEN

```
AM2048A CAP                                    Wed 26 Sep 2001 01:16:25
                    Performance > Transmission Line
Urgent Alarm:Off    Non-Urgent Alarm:Off

    Transmission Line: 1 At: ELU

          Quality Factor: 0.0              Line Quality
            Block Errors: 1                 BE Ratio: 0.00 10E-0
  Background Block Errors: 1
          Errored Seconds: 1                ES Ratio: 0.0000
 Severely Errored Seconds: 0               SES Ratio: 0.0000
     Unavailable Seconds: 0
       Available Seconds: 3720          Defects/Anomalies
      Error Free Seconds: 3719                FAW: 0
                                              LFA: 0
            Elapsed Time: 0000d 01h 02m 00s

                        Press Escape to Exit

F1 Help  F3 Previous Menu  F4 Main Menu  F5 Stop/Start Trips
F7 Previous Line  F8 Next Line
```

This screen informs the operator of line conditions, this is particularly helpful during installation.
The terms are defined in ITU recommendation G.826 (Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate).

Explanation	
Quality Factor	This gives a relative measurement of the receive signal quality on the transmission line. For CAP/2B1Q the value is displayed as a whole number, the range is from 0 (good) to 9999 (bad). This value may be used to give a relative measure of performance, for example, in long term monitoring to indicate degradation due to increased attenuation or noise. Refer to the FAQs section of the main MDU248A User Guide for more information. This field is not available for optical systems.
Block Error (BE)	A block is one DSL frame and there are 166 blocks per second. The number of bits per block depends on the line rate. A Block Error is an errored DSL frame.
Background Block Error (BBE)	An errored block that occurs outside a severely errored second.
Errored Second (ES)	A second containing a block error or a defect/anomaly.

Severely Errored Second (SES)	A second in which >30% of blocks are in error, or a defect or anomaly has occurred.
Unavailable Second	Unavailable time starts when 10 consecutive seconds are severely errored. Unavailable seconds count from the first severely errored second.
Available Second	Available Time starts when 10 consecutive seconds are not severely errored. Available seconds count from the first second that is not severely errored.
Error Free Second	A second in which no errors, defects or anomalies are detected.
BE Ratio	Ratio of Block errors to the total number of blocks received.
ES Ratio	Ratio of the Errored seconds to the Elapsed seconds.
SES Ratio	Ratio of SES to the Elapsed seconds.
Defect/Anomaly	A severe event, other than an errored block.
FAW	DSL Frame Alignment Word in error.
LFA	DSL Loss of Frame Alignment event.
F5 Start/Stop	Pressing the F2 will cause all trip counters to reset to zero and the Trip Reset Time to show 00:00:00. Pressing F2 again will freeze the Elapsed Time and the trip counter values.
F7, F8 End Selection	These function keys allow the selection of a different transmission line end, at the ELU or NTU.
Error Display Fields	These fields hold 10 digit numbers representing the errors counted.
Trip Counters	These counters can be reset using the Start/Stop key. They display the number of errors to have occurred since the Start/Stop key was pressed. These counters and the Elapsed Time continue to operate even after the screen has been exited.

10.4 USER PORT PERFORMANCE SCREEN

This screen provides access to the performance information relating to the user ports within the selected system. There will always be at least two user ports (one at the ELU and one at the NTU), but there could be up to two NTUs connected.

The performance information for the NTU customer interface is selected using **F7** and **F8**.

10.4.1 G.703

```
AM2048A CAP                                        Wed 26 Sep 2001 01:57:47
                          Performance > User Port
Urgent Alarm:On    Non-Urgent Alarm:Off

Subsystem: ELU            Port Type: G703

                 Bipolar Violations: 5757

                       CRC 4 Errors: 0

                        Clock Slips: 0

                       Elapsed Time: 0000d 00h 02m 10s


                            Press Escape to Exit

F1 Help  F3 Previous Menu  F4 Main Menu  F5 Stop/Start
F7 Previous Subsystem  F8 Next Subsystem
```

Explanation	
Bipolar Violations	This displays the number of occurrences of bipolar violations since start up.
CRC 4 Errors	This field is only displayed if the receive CRC4 is enabled. It displays the number of occurrences since start up.
Clock Slips	This field displays the total number of clock slips that have occurred since start up. A clock slip value of 1 or more may indicate that the modem's timing is in internal master mode and the incoming signal is also providing timing. The modem will tolerate short-term frequency differences between the incoming clock and the internal clock, but will introduce clock slips if the frequency difference persists. Clock slips should not occur when in transparent timing mode.

F5 Start/Stop toggle	Pressing the F5 key will cause the counters to stop and the display to be frozen. Pressing the F5 key again resets and enables the trip counters and the Elapsed Time timer.
F7 & F8	These function keys allow the selection of subsystems upon which each user port is located.

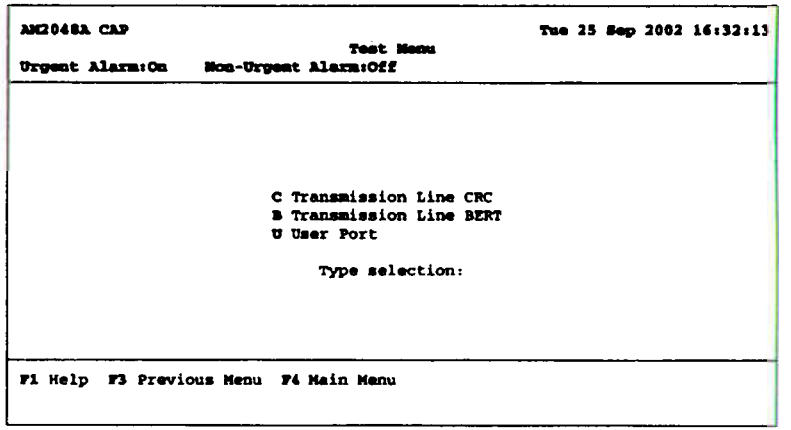
10.4.2 X.21 and V.35 MK II

```
AM2048A CAP                                        Tue 25 Sep 2001 16:02:22
                          Performance > User Port
Urgent Alarm:Off   Non-Urgent Alarm:Off

Subsystem: ELU            Port Type: X21bis-V35 Mk II




                        Clock Slips: 0

                       Elapsed Time: 0000d 00h 02m 21s


                            Press Escape to Exit

F1 Help  F3 Previous Menu  F4 Main Menu  F5 Stop/Start
F7 Previous Subsystem  F8 Next Subsystem
```

Explanation	
Clock Slips	This field is only displayed if the user port is X.21 or V.35 MK II. The new interfaces can make use of the DTE clock. A 'tail buffer' is used to take up the jitter and wander between the DTE clock and the DCE clock. If the DTE clock is not going at the same frequency as the DCE clock then the buffer will either over-run or under-run causing a clock slip to be detected. The display is active from power up.
F5 Start/Stop toggle	Pressing the F2 key will cause the counters to stop and the display to be frozen. Pressing the F2 key again resets and enables the trip counters and the Elapsed Time timer.
F7 & F8	These function keys allow the selection of subsystems upon which each user port is located.

12 TEST

12.1 TEST MENU



This menu provides access to screens that deal with testing the system, these screens are detailed in the following sections.

Explanation	
Menu Options	Each option displays a relevant screen. Please note that the User Port options will depend on the port type, e.g. G.703, X.21.

F5 Start/Stop	This function key causes the test to start and stop. Whilst in test mode the test pattern options are disabled.
F6 Inject Error	This function key causes an incorrect bit to be inserted in to the test pattern data stream.

12.4 USER PORT TEST SCREEN - V4 SOFTWARE

```
AM2048A CAP                                        Tue 25 Sep 2001 17:00:43
                              Test > User Port
Urgent Alarm:On    Non-Urgent Alarm:Off    Test Active

Subsystem: ELU



                                  Local Loop ( )
                                   Loop Back (*)
                                    Send AIS ( )
                                     Disable ( )

                             Front Panel Enabled [X]



                        Press Return to Accept or Escape to Cancel

F1 Help  F3 Previous Menu  F4 Main Menu  F7 Previous Subsystem
F8 Next Subsystem
```

When logged in at the ELU, this screen can be used to apply loop backs to the user ports at the ELU or NTU(s). When logged in at the NTU, only the NTU screen is available.

Explanation	
Loops	These options are mutually exclusive.
Send AIS	This causes the MDU248A to send an AIS bit pattern at the user interface. This applies to the G.703 user port type only.
Front Panel Enable	This provides a means of enabling/disabling front panel buttons on the MDU248A. This option is only presented for an ELU if buttons are detected.

12.5 USER PORT TEST SCREEN - V5 SOFTWARE

```
AM2048A  G.SHDSL                                   Tue 25 Sep 2002 17:00:43
                              Test > User Port
Urgent Alarm:On    Non-Urgent Alarm:Off    Test Active

Subsystem: ELU



                                  Local Loop ( )
                                   Loop Back (*)

                                     Disable ( )



                        Press Return to Accept or Escape to Cancel

F1 Help  F3 Previous Menu  F4 Main Menu  F7 Previous Subsystem
F8 Next Subsystem
```

14 GLOSSARY

AIS	Alarm Indication Signal
BBE	Background Block Error
BE	Block Error
BER	Bit Error Ratio
BER	Block Error Ratio
BERT	Bit Error Ratio Test
CAP	Carrierless Amplitude Phase Modulation
CRC4	Cyclic Redundancy Check 4
CRC6	Cyclic Redundancy Check 6
DCE	Data Circuit Equipment
DSL	Digital Subscriber Line
DTE	Data Circuit Terminating Equipment
ELU	Exchange Line Unit (Master)
EOC	Embedded Operations Channel
ePIM	Ethernet Plug-In Module
ES	Errored Seconds
FAW	Frame Alignment Word
G.703	CCITT Recommendation G.703 (1988): "Physical/electrical characteristics of hierarchical digital interfaces"
HDLC	High level Data Link Control
IP	Internet Protocol
LAN	Local Area Network
LED	Light Emitting Diode
LT	Line Termination (same as ELU)
MAC	Media Access Control
NE	Network Element

APPENDIX B FACTORY SETTINGS

To aid simple installation the following factory settings have been chosen as the most appropriate. All MDU248A units will be shipped with the following settings:

Subsystem

Master/Slave	Slave (NTU) (Desktop A Unit)
Master/Slave	Master (ELU) (Rackmount B Unit)
Connections	Point-to-Point
Name	NTU (Desktop A Unit)
Name	ELU (Rackmount B Unit)
Description	Undefined
Location	Undefined

G.703 UserPort

Rx Framed	OFF
Receive CRC4s	OFF
Tx Generate TS0	OFF
Transmit CRC4s	OFF
Idle Pattern	10101011
Transparent Timing	ON
Impedance	AUTO-DETECT

X.21/X.21bis UserPort

Auto Nx64	ON
Circuit Clamps	OFF
Byte Timing Clamp (DTE)	ON
Invert Receive Clock (DCE)	OFF
DTE Clock Enable (DCE)	OFF

BLACK BOX
NETWORK SERVICES

MDU248A

USER GUIDE (PART 3)

ePIM

Black Box Part No. 1/298/100/613 issue 01 Jan. 2003

2.2 Module Hardware

The ePIM module occupies the Customer Interface location at the rear of the Modem and is retained within the modem chassis with two screws. The module has two connectors and three LED's. Their functions are described below.

2.2.1 LAN Socket

This socket is for the connection to a 10 Mbit/sec twisted-pair (10baseT) Ethernet network. The connection details are provided in table 1.1.

Pin No.	LAN Socket		
1	Tx+	+ Transmitted signal	(Output)
2	Tx-	- Transmitted signal	(Output)
3	Rx+	+ Received signal	(Input)
4	NC	Unused	
5	NC	Unused	
6	Rx-	- Received signal	(Input)
7	NC	Unused	
8	NC	Unused	

Table 1.1

This interface must be connected using an externally cross-connected cable when connecting to any unit with similar pin-outs such as a PC.

Table 1.2 shows these connections. If the ePIM is to be connected to a switch or hub, it is likely that a straight connected cable is more appropriate. These cables are available from network equipment suppliers.

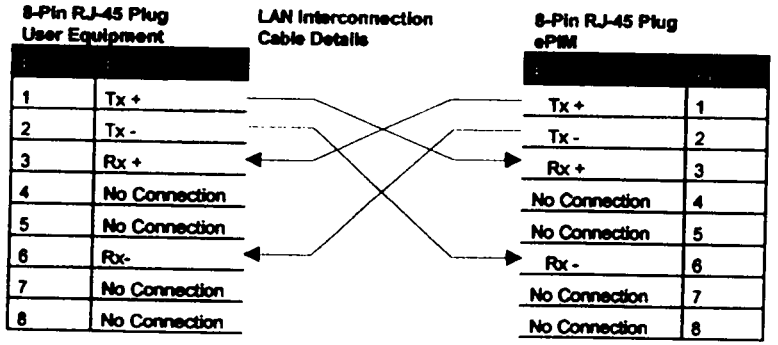


Table 1.2

2.2.2 USB Socket

This interface is intended for use with the USB Kit (sold separately) for connection to a USB port of a host or a hub.

2.2.3 LED Indicators

2.2.3.1 LINK Indicator

This LED displays the Link Integrity ensuring correct polarity connection between the ePIM and the user equipment (PC, Router, Hub, etc.). It is only lit when the associated transmitter is connected with a receiver pair.

2.2.3.2 TX Indicator

Indicates that the ePIM is transmitting data out to the user equipment. At high levels of data transfer the LED appears fully lit, and will appear to flicker at lower data transfer rates.

2.2.3.3 RX Indicator

Indicates that the ePIM is receiving data from the Ethernet. At high levels of data transfer the LED appears fully lit, and will appear to flicker at lower data transfer rates.

2.3 Operational Modes

The ePIM can be used either as an unmanaged bridge, a managed bridge, or as a router. The operational mode and associated IP addresses can be programmed from the MDU248A VT100 management port. For more advanced set-up options, the ePIM can be programmed directly via a Telnet session. The default setting for the ePIM is unmanaged bridge. The configuration procedure is described in detail in section 4.

2.3.1 Unmanaged Bridge

In unmanaged Bridge mode (default) the ePIM may simply be plugged into the network and will start to bridge traffic between the Ethernet side and the WAN side – effectively over the leased line link. Source address filtering is enabled and will learn the locations of devices on the network.

2.3.2 Managed Bridge

The ePIM may be given an IP address to allow telnet access to the unit for administrative control and configuration.

2.3.3 Router

The ePIM may be configured as a router and can simultaneously route traffic from the WAN port, the Ethernet port and the USB port.

2.3.4 Advanced Set-up

The ePIM supports many advanced features. These can be configured using a Telnet session. Where advanced set-up is required, the "Advanced Setup" option should be selected in the Configuration > User Port screen of the MDU248A VT100 management system.

4.2 VT100 ePIM Menu

Once communication has been established with the MDU248A and the MDU248A settings have been programmed, the ePIM User Port can then be configured by following the menu options to the Configuration > User Port screen:

```
AM2048A CAP                                        Thu 01 Jan 2003 02:41:15
                        Configuration > User Port
Urgent Alarm:Off    Non-Urgent Alarm:Off

Subsystem: NTU          Port Type: ePIM

                           Managed at NTU [ ]

 Unmanaged Bridge(Layer 2) (*)
  Managed Bridge (Layer 2) ( )   Management/Line Ip Address <               >
          Router (Layer 3) ( )  Management/Line Subnet Mask <               >
            Advanced Setup ( )          Ethernet Ip Address <               >
                                       Ethernet Subnet Mask <               >
                                             USB Ip Address <               >
                                            USB Subnet Mask <               >
                                              Forward Traps [ ]

                  Press Return to Accept or Escape to Cancel

F1 Help  F2 Change Port Type  F3 Previous Menu  F4 Main Menu
F7 Previous Subsystem  F8 Next Subsystem
```

This screen enables the user to program the basic parameters of the ePIM. The mode of operation is first selected on the left. The appropriate IP address and Subnet Mask fields are then enabled on the right. Suitable addresses can then be set in these fields.

Both ePIMs are usually configured from the "Master" MDU248A (ELU). In certain circumstances, it may be more appropriate for the IP addresses in the "Slave" unit (NTU) to be configured locally. In this case, the ELU must give control to the NTU by checking the "Managed at NTU" option in the Configuration>User Port screen for the NTU (this is reached by using the "F8 Next Subsystem" option.

The "Advanced Setup" mode is used to protect any configuration that has been set up via a Telnet session from being overwritten by the MDU248A during a reboot. See below.

4.3 Access via TELNET

Advanced features of the ePIM are configured by telnet access and using the command line configuration options. Telnet is only possible when the ePIM is in managed bridge or router mode, i.e. when it has been configured with an IP address.

4.3.1 Using Advanced Mode

The MDU248A uses the values set-up in the Configuration > User Port screen as a back up to the ePIM configuration. Together with default settings, these values are usually used to reprogram the ePIM after a reboot.

Where configuration commands are to be issued to the ePIM using the telnet session, the MDU248A needs to be configured so that it can't reprogram the ePIM with default values and potentially override these changes.

The advanced mode is available for such occasions. Set the IP addresses in the normal way with the MDU248A configuration via the VT100 interface. Once the IP addresses have been allocated to the master and the slave, telnet to both units and issue a "config save" (see below). Then in the VT100 screen set the units to advanced mode. Now, any configuration commands that are issued to the ePIM via the command line interface, such as disabling RIP, sending or setting/changing IP addresses and routes, can't be overridden by the MDU248A configuration. After issuing the commands, it is important to save the configuration by issuing a "config save" again, so that the configurations survive a reboot.

4.3.2 Saving Configuration Settings

After changes have been made to the configuration use the **"config save"** command to commit the changes to memory. This may be carried out at the top level prompt:

> config save

for all main settings. It may be necessary to enter the command from within a sub menu for some specific settings. Refer to section 7 for details of the use of this command.

Always wait for at least 30 seconds after a "config save" command has been executed before powering down the MDU248A. Failure to do this may cause loss of data and failure of the ePIM to boot up correctly.

4.3.3 Security

Telnet access is secured via a password that should be changed by the network administrator.

To do this, telnet to the ePIM and enter the existing password when prompted

The default password is "private".

The password is associated with the SNMP module of the ePIM and also controls the SNMP access to the ePIM.

From the top level prompt type the following:

> snmp access write password

where 'password' is the new password.

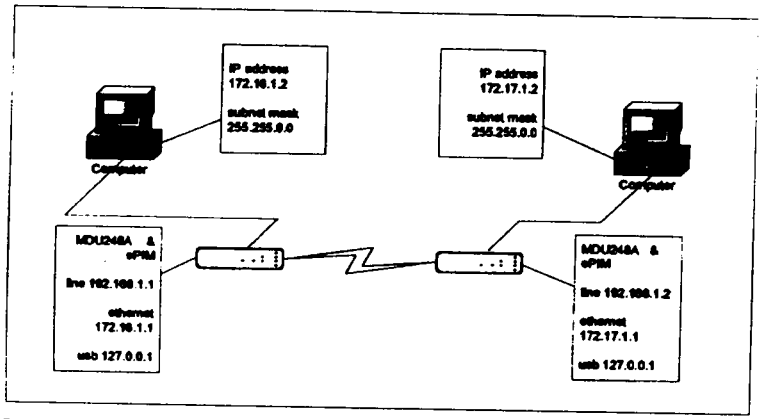
This adds the new password to the list of acceptable passwords but has not yet removed the previous entry. To do this type the following:

> snmp access delete oldpassword

where 'oldpassword' is the password that should no longer work.

4.6.3 Example Application

Figure 4.3.3 shows an example of a point-to-point application. This will be used to demonstrate the configuration of the ePIMs.



The following settings for ELU and NTU will give the desired configuration.

Configuration of the ELU

```
AM2048A CAP                                        Thu 01 Jan 2003 02:41:15
                                Configuration > User Port
Urgent Alarm:Off    Non-Urgent Alarm:Off

Subsystem: ELU          Port Type: ePIM


  Unmanaged Bridge(Layer 2) ( )
   Managed Bridge (Layer 2) ( )   Management/Line Ip Address <192.168.1.1    >
           Router (Layer 3) (*)  Management/Line Subnet Mask <255.255.255.252>
             Advanced Setup ( )          Ethernet Ip Address <172.16.1.1     >
                                       Ethernet Subnet Mask <255.255.0.0     >
                                            USB Ip Address <127.0.0.1        >
                                          USB Subnet Mask <255.255.255.255>
                                            Forward Traps [ ]

                    Press Return to Accept or Escape to Cancel

F1 Help  F2 Change Port Type  F3 Previous Menu  F4 Main Menu
F7 Previous Subsystem  F8 Next Subsystem
```


Configuration of the NTU

```
AM2048A CAP                                        Thu 01 Jan 2003 02:41:15
                                Configuration > User Port
Urgent Alarm:Off    Non-Urgent Alarm:Off

Subsystem: NTU          Port Type: ePIM

                              Managed at NTU [ ]

 Unmanaged Bridge(Layer 2) ( )
  Managed Bridge (Layer 2) ( )   Management/Line Ip Address <192.168.1.2    >
          Router (Layer 3) (*)  Management/Line Subnet Mask <255.255.255.252>
            Advanced Setup ( )          Ethernet Ip Address <172.17.1.1     >
                                      Ethernet Subnet Mask <255.255.0.0     >
                                           USB Ip Address <127.0.0.1        >
                                         USB Subnet Mask <255.255.255.255>
                                           Forward Traps [ ]

                    Press Return to Accept or Escape to Cancel

F1 Help  F2 Change Port Type  F3 Previous Menu  F4 Main Menu
F7 Previous Subsystem  F8 Next Subsystem
```

With these configurations, the ePIM will then learn the remote network addresses by exchanging routing information via RIP (Routing Information Protocol).

RIP may be disabled in which case static routes must be used to provide the connectivity. See the IP Module commands section for details on adding static routes.

Configuration of the NTU

```
AM2048A CAP                                        Thu 01 Jan 2003 02:41:15
                        Configuration > User Port
Urgent Alarm:Off    Non-Urgent Alarm:Off

Subsystem: NTU          Port Type: ePIM

                           Managed at NTU [ ]

 Unmanaged Bridge(Layer 2) ( )
  Managed Bridge (Layer 2) (*)   Management/Line Ip Address <192.168.1.2    >
           Router (Layer 3) ( )  Management/Line Subnet Mask <255.255.255.0  >
             Advanced Setup ( )          Ethernet Ip Address <               >
                                       Ethernet Subnet Mask <               >
                                             USB Ip Address <               >
                                            USB Subnet Mask <               >
                                              Forward Traps [ ]

                  Press Return to Accept or Escape to Cancel

F1 Help  F2 Change Port Type  F3 Previous Menu  F4 Main Menu
F7 Previous Subsystem  F8 Next Subsystem
```

With this configuration, the NTU is on the same network as the ELU line interface. The NTU will also learn RIP routes that may be beneficial if configuration is required from other networks (Routes to these other networks will be learned). RIP may be disabled in which case static routes must be used to provide the connectivity. See section 7 for details on disabling RIP and adding static routes.

5.2 Managed Bridge

Bridging allows devices to be connected as if on a single LAN even when in a distributed environment. Management of the bridge is possible if required, details of which are available in section 7.2.2 Bridge Module Commands.

5.2.1 Information Required

Before starting the configuration, the following information must be either decided upon or obtained from the network administrator.

5.2.1.1 General Information

Both ePIMs are usually configured from the "Master" MDU248A (ELU). The slave ePIM would not require configuration unless, as in this case, it is to be set as a managed bridge. Here it is necessary to allocate an IP address.

5.2.1.2 IP Information Required

All ports require an IP address to be allocated. If a port is left with the default setting of 0.0.0.0 as the IP address and 0.0.0.0 as the subnet mask it will effectively be a route to anywhere – or the default route, and will prevent traffic leaving on the other ports without explicitly defining the routes.

If a port is not to be used then it should be configured with the loopback address 127.0.0.1 with a subnet mask of 255.255.255.255. It can be configured with any unused network address, but by using the loopback the possibility of someone plugging unauthorised equipment into that port is removed.

5.2.2 Configuration Set-up

To enable the configuration of the ePIM you must connect the "term" interface of the MDU248A to a PC running a terminal emulation package. Refer to section 4.1 of this User Guide for a full explanation of the set up of the configuration terminal.

Once the terminal emulator has been set up and connected to the MDU248A, press the "space bar" to display the menu system in the terminal emulator window. See the MDU248A VT100 Management user guide (part 2) for a full explanation of the menu options.

Log into the MDU248A with "c" for configuration and then the required password – the default is "carriage return".

From the Main Menu choose Configuration "c".

From the Configuration menu choose user port "u".

The ELU (Master) user port configuration will be displayed.

Press F8 to toggle to/from the configuration for the NTU (Slave) and ELU (Master).

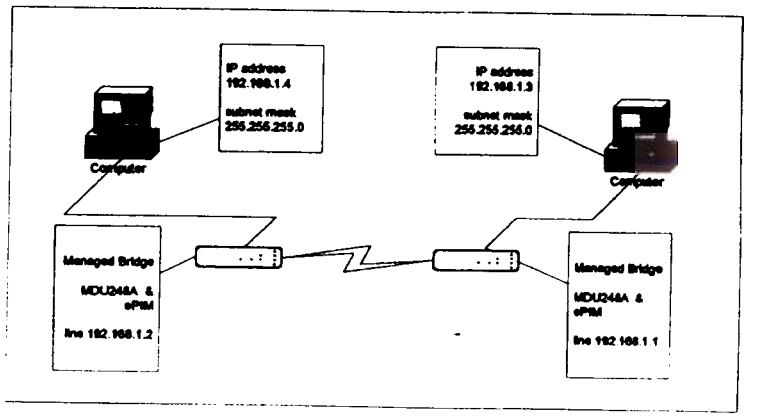
To move the cursor around the screens use the TAB or arrow keys.

To select check boxes and radio buttons use the "space bar".

When all required configuration is complete in both screens press "enter" to program the units.

5.2.3 Example Application

Figure 5.2.3 shows an example of a Bridged WAN application where the bridge has a management IP address applied. This will be used to demonstrate the configuration of the ePIMs.



The following settings for ELU and NTU will give the desired configuration.

```
AM2048A CAP                                    Thu 01 Jan 2003 02:41:15
                        Configuration > User Port
Urgent Alarm:Off    Non-Urgent Alarm:Off

Subsystem: NTU          Port Type: ePIM

                            Managed at NTU [ ]

 Unmanaged Bridge(Layer 2) ( )
  Managed Bridge (Layer 2) ( )   Management/Line Ip Address <              >
          Router (Layer 3) ( )  Management/Line Subnet Mask <              >
            Advanced Setup (*)          Ethernet Ip Address <              >
                                      Ethernet Subnet Mask <               >
                                              USB Ip Address <             >
                                          USB Subnet Mask <                >
                                            Forward Traps [ ]

                    Press Return to Accept or Escape to Cancel

F1 Help  F2 Change Port Type  F3 Previous Menu  F4 Main Menu
F7 Previous Subsystem  F8 Next Subsystem
```

5.3.5.2 IP Information Required

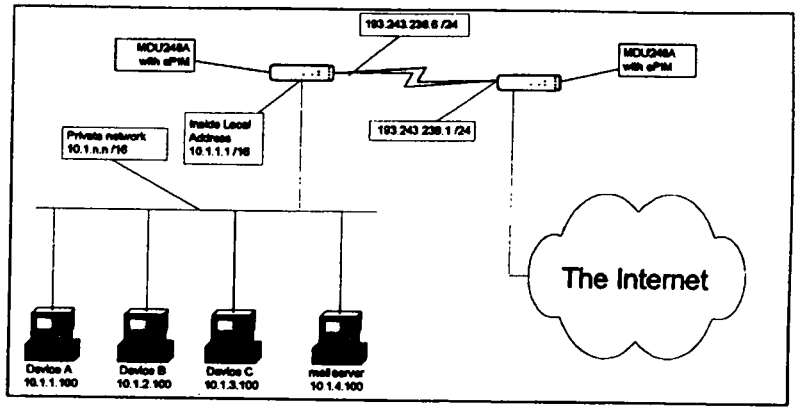
All ports require an IP address to be allocated. If a port is left with the default setting of 0.0.0.0 as the IP address and 0.0.0.0 as the subnet mask it will effectively be a route to anywhere – or the default route, and will prevent traffic leaving on the other ports without explicitly defining the routes.

If a port is not to be used then it should be configured with the loopback address 127.0.0.1 with a subnet mask of 255.255.255.255. It can be configured with any unused network address, but by using the loopback the possibility of someone plugging unauthorised equipment into that port is removed.

5.3.6 NAT Configuration Example

NAT is primarily used to access the Internet from a company network through a NAT enabled gateway router. This provides both a means of access when the number of valid addresses available is not sufficient for each node, as well as a limited amount of security by hiding the IP address of the client.

The diagram that follows shows this configuration.



The NAT Router appears on the local network as 10.1.1.1. The WAN interface is configured to be 193.243.238.6. This is the IP address allocated to the user by the ISP and may have been configured from the Master (ELU) or the slave (NTU) if the master end is set to allow this. See the 'Configuration' 'User port' menu for details. The Router to be connected to is numbered 193.243.238.1.

The WAN link configuration uses these two IP addresses and any additional security must be set up as required to connect to the ISP. For example, a firewall is recommended for any permanent connection to the Internet. Since these units are connecting to real world IP addresses then RIP should be disabled to prevent private network information "leaking" onto the Internet. A default route must be set up for the WAN link in the NAT Router to forward all unrecognised addresses to the ISP Router. This ensures that all frames get to the NAT Router WAN port where NAT is configured.

Consider a frame coming from Device A attempting to connect to an Internet Web site, for example – 193.243.242.3. The routing set up in the NAT router will forward the frame to the WAN port where the frame will arrive with source address 10.1.1.100 and destination address 193.243.242.3. The processing of the NAT will be done on the WAN port side since this address is the desired address to hide all internal addresses behind.

The command:

> ip nat add hdlc

is used to setup a rule to translate internal (Ethernet or LAN side) addresses to external (hdlc or WAN side) addresses.

This one rule should be enough to get all the devices to be able to access the Web. As each device establishes a new connection, the NAT software modifies the source address to be the one allocated by the ISP and adjusts the Port Number to a unique value to allow it to keep track of the connection. The record kept of the Addresses and Port numbers used allows the NAT software to make the reverse translation as frames arrive back from the Internet.

The record is kept for the life of the TCP connection, with a very long time-out to protect against connections that are not closed properly. This record is not cleared when the WAN link is reset allowing brief disconnections to be made for network configuration and maintenance.

In this instance NAT will reject incoming packets that are not in response to a previous outgoing packet, which will have defined a rule in the NAT lookup table.

If it is an acceptable configuration then use the **"flashfs update"** command to commit the changes to memory and then restart the unit – with the command **"restart"**.

If the configuration is not valid the **"dhcpserver config confirm"** command reports this and the configuration should be checked for invalid entries, note the use of ";" to end some, but not all lines.

6 DIAGNOSTICS AND PERFORMANCE MONITORING

6.1 Configuration Issues

Incorrect configuration is a likely cause of networking problems so attention should be given to ensuring the desired configuration has been input in terms of both IP addresses and network masks.

All ports require an IP address to be allocated. If a port is left with the default setting of 0.0.0.0 as the IP address and 0.0.0.0 as the subnet mask it will effectively be a route to anywhere – or the default route, and will prevent traffic leaving on the other ports without explicitly defining the routes.

If a port is not to be used then it should be configured with the loopback address 127.0.0.1 with a subnet mask of 255.255.255.255. It can be configured with any unused network address, but by using the loopback the possibility of someone plugging unauthorised equipment into that port is removed.

The ePIM is able to learn routing information via RIP from other devices on the network. Whilst this may be desirable in some cases it can also cause problems by advertising routing information inappropriately. If required RIP may be turned off via the console, with either, or both, of these commands:

> ip rip send all none

which stops the ePIM passing on RIP information, or with the command:

> ip rip accept all none

which stops the ePIM from learning any RIP information. The ePIM should be set to advanced mode and the configuration should be saved after issuing these commands.

6.2 Troubleshooting

The MDU248A provides comprehensive alarm status and history information that is accessed via the VT100 terminal interface. For the history of the alarms it may be useful to know the real time and date of the alarm occurrence. If the MDU248A is configured with the correct current time and date, it will calculate the correct time and date of the alarm occurrence. The current time and date can be configured through the Configuration > System screen.

Please refer to the Frequently Asked Questions section of the MDU248A User Guide (part 1) for information on common problems encountered when using modem links.

There are some standard confidence checks that can be carried out on the ePIM to eliminate the most obvious problems:

Check that the LINK indicator is illuminated. This indicates that the ePIM recognises the Ethernet connection. If it does not light when connected to another Ethernet port could indicate that the wrong type of cable is being used. Refer to section 2.2.1.

The RX indicator should flash to show activity on the local LAN. Pinging the ePIM address from a PC should cause some activity on the RX lamp if the PC is configured correctly.

The ePIM also has its own ping facility to verify network connections:

> ip ping 192.168.1.1

ip > device

```
ip > device [list]
ip > device add <interface> [mtu <size>] [<IP address>]
ip > device delete <interface>
ip > device flush
```

Adds, deletes and lists the interfaces that the IP module is configured to use. "Interface" is the name of the interface as defined by the user. "mtu" is maximum transmission unit. This refers to the maximum size of the datagram used in transmission. This can be configured if necessary but would normally be left as the default - 1500. The IP address defines the address for that interface and the mask is assumed to be 24 bits – ff:ff:ff:00. If this is not the case then it should be defined with the subnet command.

ip > disable

```
ip > disable <interface>
```

Disables either all interfaces or the interface specified. This will stop the ePIM working entirely if used without defining an interface.

ip > enable

```
ip > enable [<interface> [mtu <size>] [<IP address>]]
```

Enables all interfaces or the interface specified and with any parameters also defined. The parameters can also be defined when they require changing on an already enabled interface.

ip > nat

```
ip > nat add | delete <interface>
```

Adds or removes NAT functionality from the named interface. This interface should be connecting to the public network and not to the private network.

ip > norelay

```
ip > norelay [all | <interface> [forward]]
```

Turns off forwarding between interfaces.

ip > ping

```
ip > ping <IP address> [<ttl> <size>]
```

Sends an ICMP Echo message to the specified IP address. "ttl" is the Time To Live – default is 30. "size" is the data size of the message – default is 56 bytes.

ip > relay

```
ip > relay all | <interface> [<interface>] [forward]
```

Displays or sets the forwarding options between interfaces. By default forwarding between interfaces is enabled.

ip > rip accept

```
ip > rip accept [all | <interface>] [none | <version>]
```

By default both versions of RIP are accepted on all interfaces, but if required this can be modified.

ip > rip allowed

```
ip > rip allowed
```

Displays the RIP versions that will be accepted and sent on each interface.

ip > rip boot

```
ip > rip boot
```

Broadcasts a request for RIP information from other machines on the network. The request is made on boot anyway, and regular broadcasts should keep the information up to date, but this can be used to force a broadcast.

ip > rip help

```
ip > rip help [command | all]
```

Displays help on the RIP subcommands

ip > rip allowed

Displays the RIP versions that are accepted on each interface.

ip > rip boot

Forces a broadcast RIP request.

ip > rip hostroutes

```
ip > rip hostroutes [off]
```

Sets or clears the "hostroutes" flag. If the flag is on then RIP will recognize individual hosts. If the flag is off then RIP version 1 routes that appear to be to individual hosts will be treated as if they were to the network containing the host. RIP version 2 routes to individual hosts will be ignored.

ip > rip killrelay

```
ip > rip killrelay <relay>
```

Deletes the RIP relay.

Available commands:

bridge > filter

```
bridge > filter
```

Displays the contents of the bridge's filter table. The MAC entries for each device are displayed and the time that the device was last seen by the bridge. Creation failures are also displayed indicating the number of times that entries to the table were not permitted when the table was already full.

bridge > filterage

```
bridge > filterage [<age>]
```

Sets the filter table aging time after which MAC addresses are removed from the table. The current value will be displayed if no argument (age value) is supplied. The time is specified in seconds and may be an integer from 10 – 100,000 seconds. Changes will take immediate effect but needs to be saved in the configuration if it is to survive a reboot. The default ageing time is set to 300 seconds.

bridge > flush

```
bridge > flush [<device port  number>]
```

Removes the MAC entries for the specified port from the filter table. The port number for a device may be determined using the "device list" or "status" command. If no port is defined then all entries for all ports are removed from the filter table.

7.2.2.1 Spanning sub module commands

The spanning tree process is a sub module of the bridge process. It is a requirement of the spanning process that the bridge process is operational first. This may be checked with the bridge status command. Depending on the console module level it may be necessary to use the full command of bridge spanning <<option>>. if the console is already within the bridge module then it is only necessary to enter spanning and the relevant associated command. All following commands should be preceded by the spanning keyword.

bridge > spanning disable

```
bridge > spanning disable
```

Disables the spanning tree process and sets the bridge to transparent mode. By default spanning tree operation is enabled.

bridge > spanning enable

```
bridge > spanning enable
```

Enables the spanning tree process. When spanning tree operation is enabled, the spanning tree process controls the state of the bridge's ports. The status command reports the enabled state of the spanning tree process.

Configuration saving saves this information. By default, spanning tree operation is enabled.

bridge > spanning event

```
bridge > spanning event [<level>]
```

Sets the level of event reporting . "level" should be a value from 1 (least detailed event reporting) to 5 (most detailed event reporting). The default event level is 1.

bridge > spanning forwarddelay

```
bridge > spanning forwarddelay [<time>]
```

Reads or sets the time in seconds, in which the bridge remains in the listening or learning states, and is used when the bridge is or is attempting to become the root bridge. The forward delay time may be any value between 4 and 30, but it is also constrained by the maximum age and hello times. The forward delay time may also be changed by SNMP command. The "maxage", "hellotime" and "forwarddelay" times are constrained as follows:

2 × (forwarddelay - 1) = maxage

maxage = 2 × (hellotime + 1)

Configuration saving saves this information. By default the forward delay time is set to 15 seconds.

bridge > spanning hellotime

```
bridge > spanning hellotime [<time>]
```

Reads or sets the time in seconds, after which the spanning tree process sends notification of topology changes to the root bridge, and is used when the bridge is or is attempting to become the root bridge. The hello time may be any value between 1 and 10 and is also constrained by the "forwarddelay" and "maxage" times. The hello time may also by changed by SNMP command.

Configuration saving saves this information. By default the hello time is set to 2 seconds.

bridge > spanning info

```
bridge > spanning info
```

Displays the version number of the spanning tree implementation.

bridge > spanning maxage

```
bridge > spanning maxage [<time>]
```

Reads or sets the maximum age of received spanning tree protocol information before it is discarded, and is used when the bridge is or is attempting to become the root bridge. The "maxage" time may be any value between 6 and 40 and is also constrained by the "forwarddelay" and "hellotime" times. The "maxage" time may also by changed by SNMP command.

Configuration saving saves this information. By default the "maxage" time is set to 20 seconds.

bridge > spanning port <number>

The port commands, described in subsequent sections, control the configuration of the bridge's ports so far as the operation of the spanning tree protocol is concerned. Ports are numbered from 1. By typing "all" instead of a port number every port on the bridge may be specified.

To disable NAT at the ip> prompt type:

ip > nat delete <<interface name>>

7.2.4 DHCP-server console commands

The following section relates to commands accessible from within the DHCP-server module, itself reached with the following command:

> dhcpserver

Available commands:

dhcpserver > config

```
dhcpserver > config [add <text> | confirm | delete | flush]
```

This command displays or edits the current configuration of the DHCP server. The add option appends the line <text> to the end of the configuration file. The confirm option confirms the changes made if the file is re-parsed successfully. The delete option deletes the last line from the configuration file. The flush option removes the whole configuration. When the file is updated and confirmed it is necessary to restart the system before changes take effect.

dhcpserver > pool

```
dhcpserver > pool [verbose]
```

Displays a summary of the DHCP server memory usage. With the verbose option it displays the entire memory allocation.

dhcpserver > reset

```
dhcpserver > reset
```

The DHCP server performs a "warm" reset that is similar to a system reboot except that the lease database is preserved. It enables configuration changes to be made to the DHCP server and to take effect without a complete system reboot.

dhcpserver > status

```
dhcpserver > status
```

Provides a summary of all known leases on each interface, and the remaining available IP addresses.

dhcpserver > trace

```
dhcpserver > trace <trace option>
```

Sets the trace level, or if no options are specified then displays the current trace level. The options are:

lease – reports changes in the lease status for any device

bootp – report any bootp interoperation or emulation

error – report all fatal errors

warn – report all warnings

note – report note level events

all – all trace options

By default error level tracing is enabled.

dhcpserver > version

```
dhcpserver > version
```

Displays the current version of the DHCP software.

7.2.4.1 Configuring the DHCP server.

By using the **"config add"** command the configuration for the DHCP server is set. The configuration is held in the dhcpd.conf file. To disable the DHCP server completely the contents of the file should be deleted. The dhcpd.conf file is a free-form ASCII text file. Comments, Tabs and new lines may be inserted for formatting purposes. Comments begin with the # character and finish at the end of the line.

The file essentially consists of a list of statements. Statements fall into two broad categories - parameters and declarations.

Parameter statements indicate how to do something (e.g., how long a lease lasts), whether to do something (e.g., Allocate IP addresses to unknown clients or not), or what parameters to provide to the client (e.g., use gateway 10.1.1.1).

Declarations are used to describe the topology of the network, to describe clients on the network, to provide addresses that can be assigned to clients, or to apply a group of parameters to a group of declarations. In any group of parameters and declarations, all parameters must be specified before any declarations that depend on those parameters may be specified.

7.2.4.2 Network topology

Declarations about network topology include the shared-network and the subnet declarations. If clients on a subnet are to be assigned addresses dynamically, a range declaration must appear within the subnet declaration. For clients with statically assigned addresses, or for installations where only known clients will be served, each such client must have a host declaration. If parameters are to be applied to a group of declarations that are not related strictly on a per-subnet basis, the group declaration can be used.

For every subnet that will be served, and for every subnet to which the DHCP server is connected, there must be one subnet declaration, which informs DHCP of the addresses present on that subnet. A subnet declaration is required for each subnet even if no addresses will be dynamically allocated on that subnet.

unknown-clients

`allow unknown-clients; deny unknown-clients;`

The `"unknown-clients"` flag is used to tell the DHCP server whether or not to dynamically assign addresses to unknown clients. Dynamic address assignment to unknown clients is allowed by default.

bootp

`allow bootp;`

`deny bootp;`

The `"bootp"` flag is used to tell the DHCP server whether or not to respond to BOOTP queries. BOOTP queries are allowed by default.

booting

`allow booting; deny booting;`

The `"booting"` flag is used to inform the DHCP server whether or not to respond to queries from a particular client. This keyword only has meaning when it appears in a host declaration. By default, booting is allowed, but if it is disabled for a particular client, then that client will not be able to get an address from the DHCP server.

7.2.4.4 Parameters

default-lease-time

`default-lease-time` *`time`*`;`

`"time"` should be the length in seconds that will be assigned to a lease if the client requesting the Lease does not ask for a specific expiration time.

max-lease-time

`max-lease-time` *`time`*`;`

`"time"` should be the maximum length in seconds that will be assigned to a lease if the client requesting the lease asks for a specific expiration time.

hardware

`hardware` *`hardware-type hardware-address`*`;`

In order for a BOOTP client to be recognized, its network hardware address must be declared using a hardware clause in the host statement. *`"hardware-type"`* must be the name of a physical hardware interface type. Currently, only the Ethernet and Token-ring types are recognized. The *`"hardware-address"`* should be a set of hexadecimal octets (numbers from 0 through ff) separated by colons. The hardware statement may also be used for DHCP clients.

filename

`filename "`*`filename`*`";`

The **filename** statement can be used to specify the name of the initial boot file that is to be loaded by a client. The filename should be a filename recognisable to whatever file transfer protocol the client can be expected to use to load the file.

server-name

`server-name "`*`name`*`";`

The **server-name** statement can be used to inform the client of the name of the server from which it is booting. `name` should be the name that will be provided to the client.

next-server

`next-server` *`server-name`*`;`

The **next-server** statement is used to specify the host address of the server from which the initial boot file (specified in the **filename** statement) is to be loaded. Server-name should be a numeric IP address or a domain name. If no next-server parameter applies to a given client, the DHCP server's IP address is used.

fixed-address

`fixed-address` *`IP-address`* `[,` *`IP-address`* `... ];`

The **fixed-address** statement is used to assign one or more fixed IP addresses to a client. It should only appear in a host declaration. If more than one address is supplied, then when the client boots, it will be assigned the address that corresponds to the network on which it is booting. If none of the addresses in the **fixed-address** statement are on the network on which the client is booting, that client will not match the `host` declaration containing that **fixed-address** statement.

dynamic-bootp-lease-length

`dynamic-bootp-lease-length` *`length`*`;`

The **dynamic-bootp-lease-length** statement is used to set the length of leases dynamically assigned to BOOTP clients. At some sites, it may be possible to assume that a lease is no longer in use if its holder has not used BOOTP or DHCP to get its address within a certain time period. The period is specified in *`"length"`* as a number of seconds. If a client reboots using BOOTP during the timeout period, the lease duration is reset to *`"length"`*, so a BOOTP client that boots frequently enough will never lose its lease. Needless to say, this parameter should be adjusted with extreme caution.

`option host-name string;`

This option specifies the name of the client. The name may or may not be qualified with the local domain name (it is preferable to use the domain-name option to specify the domain name). See RFC 1035 for character set restrictions.

`option boot-size uint16;`

This option specifies the length in 512-octet blocks of the default boot image for the client.

`option merit-dump string;`

This option specifies the path-name of a file to which the client's core image should be dumped in the event the client crashes. The path is formatted as a character string consisting of characters from the NVT ASCII character set.

`option domain-name string;`

This option specifies the domain name that client should use when resolving hostnames via the Domain Name System.

`option swap-server ip-address;`

This specifies the IP address of the client's swap server.

`option root-path string;`

This option specifies the path-name that contains the client's root disk. The path is formatted as a character string consisting of characters from the NVT ASCII character set.

`option ip-forwarding flag;`

This option specifies whether the client should configure its IP layer for packet forwarding. A value of 0 means disable IP forwarding, and a value of 1 means enable IP forwarding.

`option non-local-source-routing flag;`

This option specifies whether the client should configure its IP layer to allow forwarding of datagrams with non-local source routes. A value of 0 means disallow forwarding of such datagrams, and a value of 1 means allow forwarding.

`option policy-filter ip-address ip-address [, ip-address ip address ... ];`

This option specifies policy filters for non-local source routing. The filters consist of a list of IP addresses and masks which specify destination/mask pairs with which to filter incoming source routes.

Any source routed datagram whose next-hop address does not match one of the filters should be discarded by the client.

`option max-dgram-reassembly uint16;`

This option specifies the maximum size datagram that the client should be prepared to reassemble. The minimum legal value is 576.

`option default-ip-ttl uint8;`

This option specifies the default time-to-live that the client should use on outgoing datagrams.

`option path-mtu-aging-timeout uint32;`

This option specifies the timeout (in seconds) to use when ageing Path MTU values discovered by the mechanism defined in RFC 1191.

`option path-mtu-plateau-table uint16 [, uint16 ... ];`

This option specifies a table of MTU sizes to use when performing Path MTU Discovery as defined in RFC 1191. The table is formatted as a list of 16-bit unsigned integers, ordered from smallest to largest. The minimum MTU value cannot be smaller than 68.

`option interface-mtu uint16;`

This option specifies the MTU to use on this interface. The minimum legal value is 68.

`option all-subnets-local flag;`

This option specifies whether or not the client may assume that all subnets of the IP network to which the client is connected use the same MTU as the subnet of that network to which the client is directly connected. A value of 1 indicates that all subnets share the same MTU. A value of 0 means that the client should assume that some subnets of the directly connected network may have smaller MTUs.

`option broadcast-address ip-address;`

This option specifies the broadcast address in use on the client's subnet.

`option perform-mask-discovery flag;`

This option specifies whether or not the client should perform subnet mask discovery using ICMP. A value of 0 indicates that the client should not perform mask discovery. A value of 1 means the client should perform mask discovery.

`option mask-supplier flag;`

This option specifies whether or not the client should respond to subnet mask requests using ICMP. A value of 0 indicates that the client should not respond. A value of 1 means the client should respond.

`option x-display-manager` *`ip-address [, ip-address ... ];`*

This option specifies a list of systems that are running the X Window System Display Manager and are available to the client. Addresses should be listed in order of preference.

`option dhcp-client-identifier` *`data-string;`*

This option can be used to specify a DHCP client identifier in a host declaration, so that DHCP can find the host record by matching against the client identifier. (Also used by the client in a `"send dhcp-client-identifier"` declaration to supply its identifier to the server).

8 SPECIFICATIONS AND APPROVALS

This section describes the technical specifications of the ePIM. For general compliance to International standards for the MDU248A, please refer to Modem User Guide (part 1).

8.1 Protocols and Features Supported

8.1.1 Ethernet

The following Frame types are handled over CSMA/CD.

- Ethernet II
- IEEE 802.2
- IEEE 802.3

8.1.2 IP Routing Protocols

- Address Resolution Protocol (ARP)
- Internet Protocol (IP - RFCs:760, 791, 815)
- Internet Control Message Protocol (ICMP)
- Routing Information Protocol (RIP)
- RIP II - Run in RIP 1 compatibility mode.
- Static Initialisation of Routing Entries

8.1.3 WAN Services

- User Datagram Protocol (UDP - RFC-.768)
- Transmission control Protocol (TCP - RFCs: 675, 761, 793)
- Using Telnet Protocol (TELNET - RFCs:854. 855)

8.1.4 Other.

- Network Address Translation (NAT) - based on ideas in RFCs 1631 and 1919
- Dynamic Host Configuration Protocol (DHCP)
- SNMP, including trap forwarding of events generated by the MDU248A

MAC address	The hardware address of a device connected to a shared network medium.
PAP	Password Authentication Protocol The most basic form of authentication, in which a user's name and password are transmitted over a network and compared to a table of name-password pairs.
PING	This is a facility used for testing. It involves sending a test message (using ICMP) and using the response, if any, to diagnose any possible problems. The PING command is available on the ADMIN menu.
PPP	Point to Point protocol This is a method of transmitting multi-protocol datagrams over point-to-point links.
RIP	Routing Information Protocol This is the name for two related, but different, protocols. One is used with IP and the other with IPX. Both are used to exchange routing information with other routers. The IP version of RIP is defined in RFC-1058.
RJ-11	One of the registered jack series of standard connectors. It can accommodate up to six wires, and the RJ11 plug can connect with an RJ-45 socket by connecting to the centremost six wires of the RJ-45 socket. It is the standard connector for telephone lines in several countries.
RJ-45	One of the registered jack series of standard connectors. It can accommodate up to ten wires, and the smaller RJ-11 plug can connect with an RJ-45 socket by connecting to the centremost six wires of the RJ-45 socket. It is the standard connector for Basic Rate ISDN, leased lines and twisted pair Ethernet.
SAP	Service Advertising Protocol This is a method of discovering services on an IPX network. A machine can broadcast a *Request* or a *Get Nearest Server Request* to find a server. To make this work, any routers on the local network must keep a table of non-local servers so that they can reply to such requests. This is done by listening for and sending SAP broadcasts. Every router broadcasts its SAP table every 60 seconds. By listening for broadcasts from other routers, a router can keep its SAP table updated with a complete list of all services. Servers act the same way except each always has its own services listed in its own SAP table. An entry in a SAP table is deleted if no broadcast that describes the service has been received for three minutes. This ensures that services are no longer considered to be available if a server becomes unreachable.
SNAP	Subnetwork Attachment Point Part of the IEEE LLC/SNAP header used to identify packet type.

SNMP	Simple Network Management Protocol This is used to configure equipment, to examine status and statistics, and to report problems. SNMP is defined in RFC-1157.
Spanning tree	A technique that detects loops in a network and logically blocks the redundant paths, ensuring that only one route exists between any two LANs; used in an IEEE 802.1d bridged network.
Static routes	These are routes that have been permanently entered into a routing table. Static routes are only affected by the relevant commands - they do not change automatically.
Subnet	This is a subdivision of an IP network. Subnetting is used to conserve the number of IP network numbers required and to simplify routing. Subnets simply use a more specific address mask than normal for the address class.
TCP	Transmission Control Protocol TCP provides transport level connections between hosts. It is designed to provide a reliable connection and handles error detection, lost packets and packets that arrive out of sequence. It is also called "TCP/IP" because it uses IP. The entire collection of IP protocols is also frequently referred to as "TCP/IP". TELNET uses TCP for its connections. TCP is defined in RFC-793.
TELNET	Telnet is the TCP/IP standard protocol for remote terminal connection service. Telnet allows a user at one site to interact with a remote host at another site as if the user's terminal was directly connected to the remote machine.
UDP	User Datagram Protocol UDP is a transport protocol designed to provide a connectionless mode service. It does not provide the error handling and automatic retransmission of TCP. UDP is defined in RFC-768.
USB	Universal Serial Bus
V.24 / RS-232	This is a standard method of connecting a low speed serial channel. While V.24 and RS-232 are actually separate standards, the terms are often used interchangeably to refer to the type of serial port that they describe.
VT100	Popular computer terminal standard for the display of on-screen information. The ABR presents its menu screens according to this standard. It is convenient to use a PC loaded with a suitable VT100 terminal emulator to communicate with this type of interface.
WAN	Wide Area Network A network that covers a large area, usually at relatively low speed.
X.21	CCITT specification for a serial interface between DTE and DCE for synchronous operation on public data networks.