

# USER GUIDE

AM2048A OS/OM

ATL part no:

1/187/500/617

Issue 02 - October 2002

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**Compliance Notes and Safety Instructions:**



**Caution – Hazardous voltage inside the equipment**

**Safety Instructions:**

This apparatus must be installed and maintained by SERVICE PERSONNEL.

Disconnect the mains plug and the NTP line connection before attempting to change the user interface plug-in module.

The mains plug on the equipment serves as the disconnect device, therefore a socket outlet shall be installed near the equipment and shall be easily accessible.

**Power Rating Information – AC plug top adaptor:**

Voltage Range 240V – 10% +6%  
Current Range 25mA to 50mA  
Frequency Range 50/60Hz

**Power Rating Information – 240V AC in-line adaptor:**

Voltage Range 240V – 10% +6%  
Current Range 25mA to 50mA  
Frequency Range 50/60Hz

**Power Rating Information – 110V AC in-line adaptor:**

Voltage Range 110V – 10% +6%  
Current Range 50mA to 100mA  
Frequency Range 50/60Hz

**Power Rating Information – DC Source:**

Voltage Range 40.5V to 58V  
Current Range 70mA to 200mA

**TTE – Network Statement Safety Statements:**

The Plug Top DC Power connection has a safety status of TNV-2.  
The X.21 Digital Network Interface Port has a safety status of SELV.  
The V.35 Digital Network Interface Port has a safety status of SELV.

For the G.703 Port Connection to Unexposed Environments:  
The Alarm Port has a safety status of SELV.  
The G.703 Digital Network Interface Port has a safety status of SELV.

For the G.703 Port Connection to Exposed Environments:  
The Alarm Port has a safety status of earthed SELV.  
The G.703 Digital Network Interface Port has a safety status of TNV-1.  
The Protective Earth on the rear panel MUST be connected (see Section 4 on Installation).

**Definitions:**

**Exposed Environment**

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

**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 - Laser Product** The Optical Interface is classified as a CLASS 1 LASER PRODUCT.



**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\***  
ATL Telecom 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 ATL Telecom Ltd.

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1 SCOPE

This User Guide applies to the High Speed DSL product family, designed and manufactured by ATL Telecom Ltd in the U.K. 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 the VT100 User Guide (part no. 1/187/500/611).

For guidance on programming the e-PIM Bridge/Router module (where fitted) refer to the e-PIM supplement to this manual.

## 2 INTRODUCTION

The modems provide synchronous communications at user data rates between 64kbps and 2048kbps over a single fibre. The equipment has modular user interfaces, which allows the equipment to be configured to meet many different installation requirements. Both rack and desktop versions of all units are available. Desktop units are AM2048A and rack mount units are AM2048B. This manual covers the desktop units.

The AM2048A OS provides full duplex transmission at 2.048Mbps over a single single-mode optical fibre.

The AM2048A OM provides full duplex transmission at 2.048Mbps over a single multi-mode optical fibre.

Separate interface modules can also be purchased in order to modify the units for operation with a different terminal interface at a later date.

The AM2048 can easily be configured via a VT100 dumb terminal. It is recommended to use a VT100 terminal emulation program running on a notebook or palmtop PC (see FAQs for details about obtaining a VT100 emulator program). Using the menu system with on-line help should reduce the need to refer to the handbook. The VT100 Management User Guide gives a full description of the menu system.

Once configured, the operation of the AM2048 is totally automatic. In the event of line disturbances or power failure, the data link is restored without operator intervention.

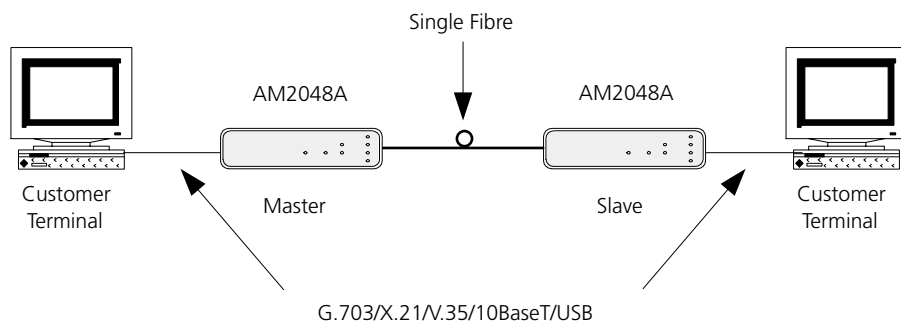
Chapter 4 (Installation) describes the basic set up procedure and this should be read prior to setting up any link.

Modifications to line cords and power supply leads are available for country specific requirements. In such cases, the line cord pin-out may be different.

## 2.1 EXAMPLE APPLICATIONS

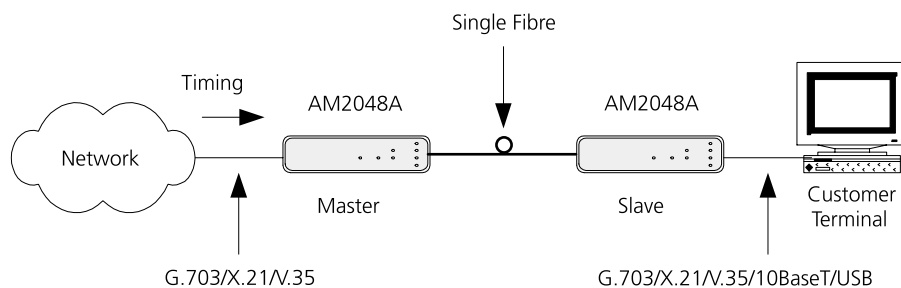
The diagrams below illustrate some basic applications:

### 2.1.1 Desktop modem to desktop modem, no external timing



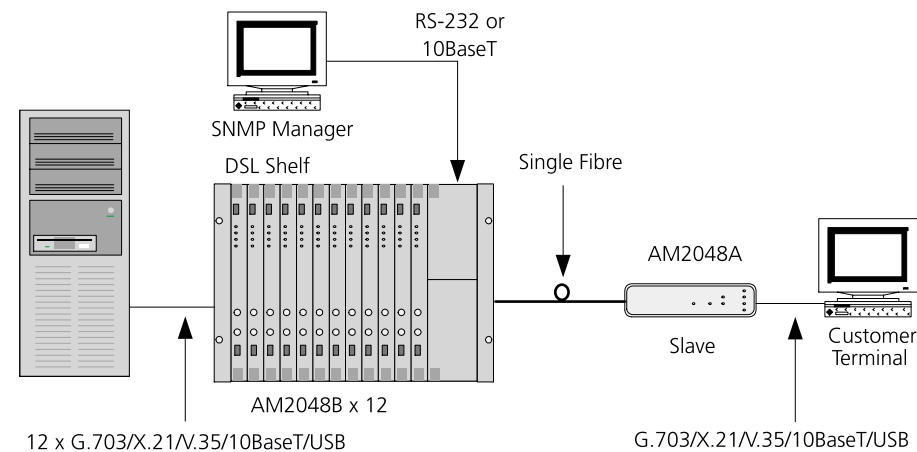
The circuit timing originates from the internal clock in the master, and is sent out to the customer terminal at both ends.

### 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 Rack mount modem to desktop modem



For customers with large installations at a central site, the DSL shelf is available to fit both 19" and ETSI shelves, to help save space. The shelf holds 12 AM2048B rack mount cards. All of the user interfaces available on the desktop unit are also available on the rack mount unit.

Network management is available by both SNMP over Ethernet (10BaseT) and the standard VT100 system using a local terminal.

### 3 CONSTRUCTION



FIGURE 3.1 DESKTOP UNIT

The desktop unit is housed in a grey non-flammable plastic case (UL94 rating V0). The membrane front panel contains 5 LED indicators and 3 push button switches with LEDs to indicate their activation.

#### LEDs

- Urgent Alarm
- Non-Urgent Alarm
- Test
- Power
- Master

#### Buttons

- Local Loop
- Loop Back
- Rem Loop

Refer to section 7.7 for an explanation of the front panel controls.



On the rear panel there are the following connectors:

-48V DC supply inlet socket	3-pin mini-fit
Fibre interface	PC/SPC or ST or SC
Management port interface	9 way female D-type
Alarm interface	13 way circular DIN

**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	8-way RJ45
10/100BaseT	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 7.6. The plastic housing contains the main PCB.

The plastic case has an internal metallised layer for EMC screening purposes. The membrane front panel is attached to the main PCB with a flexible circuit connector.

Optional plug-top and in-line mains adapters are available with a 1.8 metre long DC lead, terminating in a 3-pin mini-fit plug. Also available is a VT100 Management connection cable.

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.

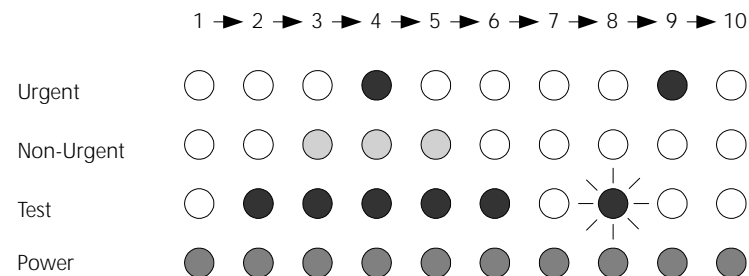
### 4.1 CONNECTION OF PROTECTIVE EARTH

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 POWER ON SEQUENCE

With no DTE or line connected to the AM2048 on power up, the following LED sequence will be displayed:



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

During sequence 1 to 7 the LEDs are illuminated in turn as an LED confidence test.

During stage 8 the test LED flashes as the internal self-test sequence is completed. The flashing will normally last for about 4 seconds, however, if a new application has been loaded this time will be extended by about 10 seconds while a backup copy of the application is made.

With no external connections the unit will sense the loss of external signals, raise the urgent alarm and stop at stage 9. When the system has been installed and is working correctly, the unit should move to stage 10.

### 4.3 DEFAULT SETTINGS

The factory default is for the unit to be configured as a slave (NTU). For all modes of operation, one unit must be set to master mode, while the other unit must be set to slave mode. The front panel 'Master' LED indicates the mode of the unit.

The factory defaults have been chosen to allow the minimum configuration for most users.

It is possible to set-up the following without changing configuration.

Master	Slave	Comment
G.703	G.703	Unframed, transparent timing.
G.703	X.21/V.35 DCE	
G.703	e-PIM	
X.21/V.35 DCE	X.21/V.35 DCE	
X.21/V.35 DCE	e-PIM	
e-PIM	e-PIM	

For all configurations, the default user rate is 2048kbps.

### 4.4 LOGGING ON

Connect a VT100 terminal (or PC running a VT100 emulation program) to the 9-way serial port on the rear of the unit. Configure the serial port settings of the VT100 terminal to 19,200 baud, 8 bits, no parity, Xon/Xoff. The log on screen should appear automatically once the AM2048 detects the terminal.

Type 'C' to select Configuration, then press 'Enter'.

Type the password and Press 'Enter' (note: the default password is 'ascom', however later versions of software will allow simply the 'Enter' key to be pressed).

The top-level menu system displays the sub-menus available.

For a full description of the menu system, refer to the 'VT100 Management User Guide'.

### 4.5 SETTING MASTER/SLAVE MODE

The master unit is referred to as the ELU or Exchange Line Unit and the slave unit is referred to as the NTU or Network Terminating Unit.

The ELU is a 'master' in several senses. The master end provides the source of the bit rate timing for the transmission line(s). The ELU is also the 'master' from a network management point of view. It contains the database of configuration information for itself and all connected NTUs. The alarm and performance monitoring history is saved at the ELU. When the management terminal is connected to the ELU it can read all of the information from the remote NTU, whereas when the management terminal is connected to the NTU, only the local information is obtainable.

It is possible to set Master/Slave by using the front panel buttons if a terminal is unavailable, see section 7.7.1.

To change the setting using the terminal go to the "Configuration>Master/Slave" screen and select the appropriate option. (Use the arrow keys or tab key to navigate and the spacebar to change the setting). The basic setup for all modes is as follows:

#### At the master end:

Configuration>Master/Slave

- 1 select Master
- 2 enable the required number of lines
- 3 select the required line rate

#### At the slave end:

The factory default setting should allow the units to get into sync, otherwise:

Configuration>Master/Slave

- 1 select Slave
- 2 enable the required number of lines
- 3 select the required line rate

The unit will automatically reboot with the new settings once the "return" key is pressed to accept the changes. You will then be invited to log back on to the system.

### 4.6 SETTING THE USER INTERFACE

The unit automatically detects what kind of user interface is plugged in and displays the appropriate screen in the "Configuration>User Port" screen.

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.

### 4.7 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 AM2048 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.

**4.8 SELECTING THE CIRCUIT CONFIGURATION**

The term 'digital section' refers to the data link between the user ports of the connected AM2048s.

In a standalone section, the AM2048s provide the complete transmission system.

In a tandem section, the AM2048s are used to extend an existing circuit or network port. To achieve synchronous data transfer, the master AM2048 must derive its timing from the circuit to which it is connected.

A Point-to-Point link requires two AM2048s, one master and one slave.

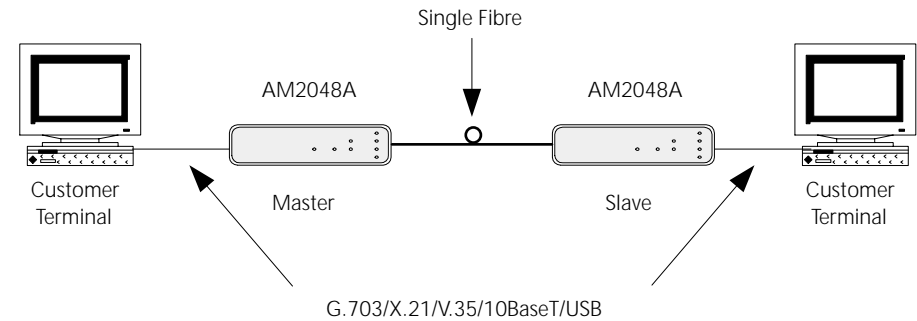
A Point to Multipoint link can have up to three AM2048s, one master and two slaves.

The AM2048 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 AM2048 connected to the tandem section is configured as the master.



Please refer to the diagrams on the following pages.

**4.8.1 Standalone Section**



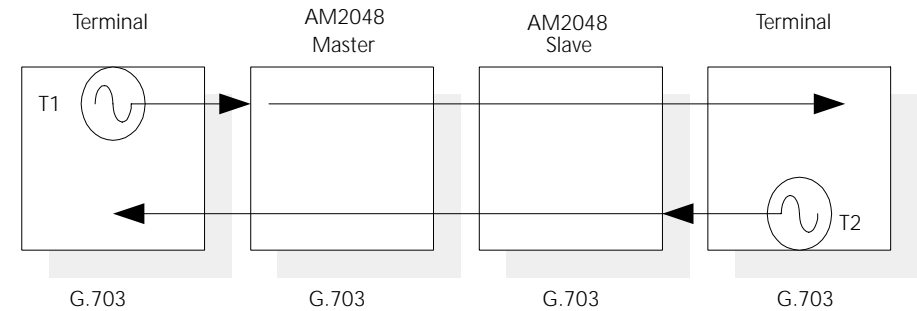
The transmission channel can be a single optical fibre, single or multimode.

Key for following diagrams:

-  Clock Source
-  Buffer - Elastic Store

**4.8.1.1 G.703 to G.703 Transparent Timing**

In this configuration, the terminals are the source of timing. One of the connected terminals may act as a master, the other as a slave. However, both terminals could operate independently or pleisiochronously.



Clocks T1 and T2 are independent of one another and are transported independently through the DSL system.

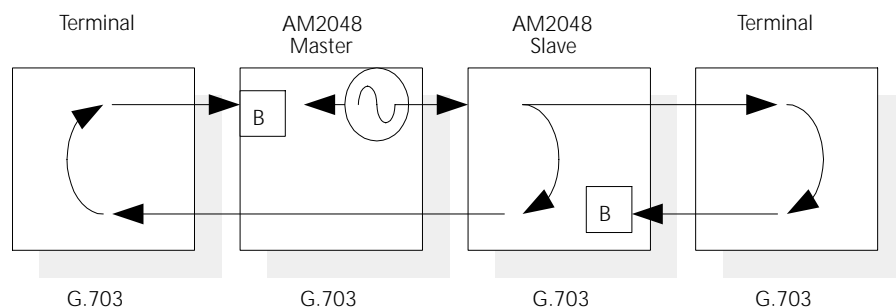
**Using the “Configuration > User Port” Menu:**

- 1 At the ELU, select the ‘Transparent’ timing option.
- 2 Using F8, cycle to the NTU user port, select the ‘Transparent’ timing option. Press ‘Return’ to enter the changes.

**Note:** This is the default timing option for G.703.

**4.8.1.2 G.703 to G.703 Internal Timing**

Slave terminals are connected to the digital section at both ends, the clock source inside the Master then becomes the reference clock for the entire system.



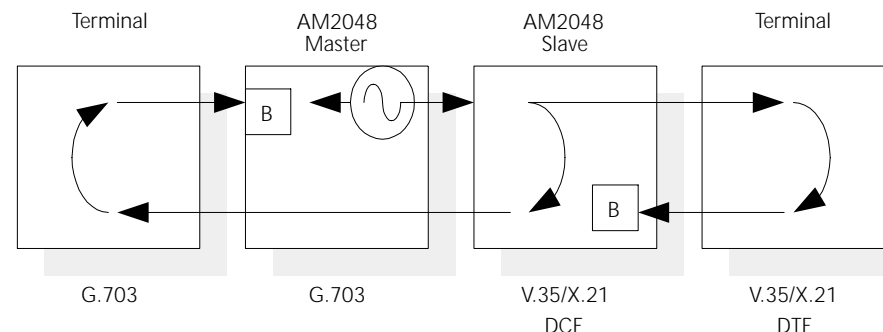
The internal clock is generated at the Master, both terminals lock to this clock and return the clock to the AM2048s. An elastic store in the AM2048 buffers the data.

**Using the “Configuration > User Port” Menu:**

- 1 At the Master, select the ‘Internal’ timing option.
- 2 Using F8, cycle to the NTU user port, select the ‘Internal’ timing option. Press ‘Return’ to enter the changes.

**4.8.1.3 G.703 to X.21/V.35 Internal Timing**

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



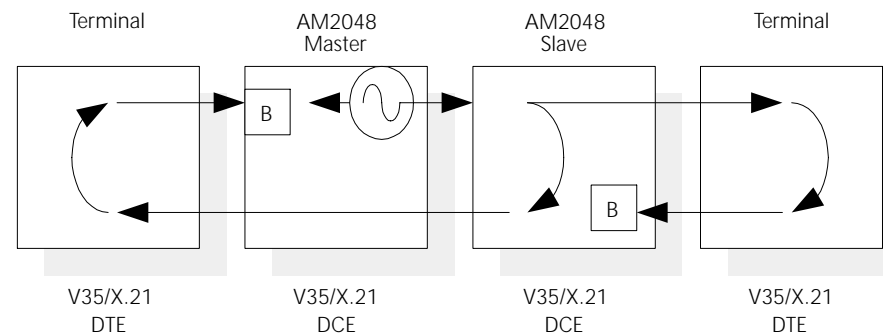
The internal clock is generated at the ELU, both terminals lock to this clock and return the clock to the AM2048s. An elastic store in the AM2048 buffers the data.

**Using the “Configuration > User Port” Menu:**

At the Master, select the ‘Internal’ timing option (There is nothing to set at the Slave). Press ‘Return’ to enter the changes.

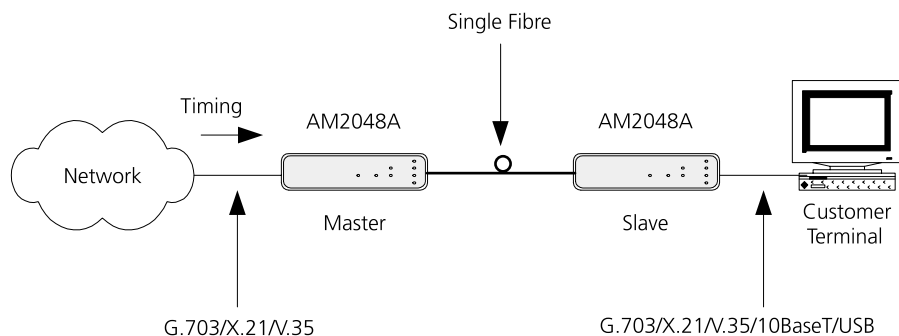
**4.8.1.4 X.21/V.35 DCE to X.21/V.35 DCE**

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.



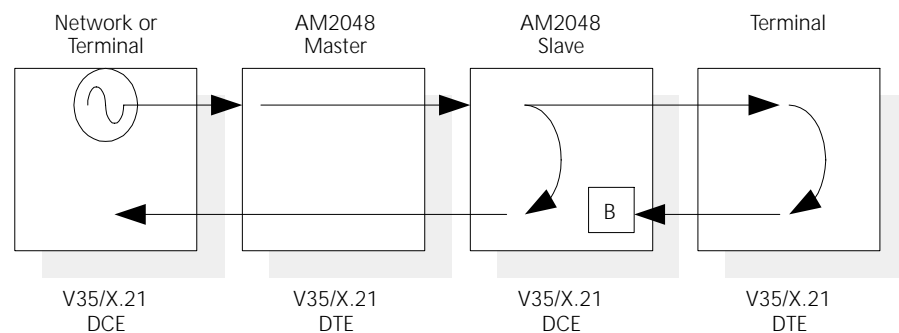
### 4.8.2 Tandem Section – External Timing

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

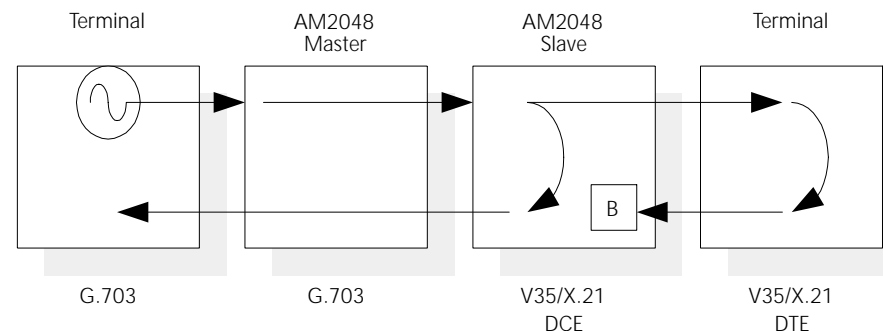


#### 4.8.2.1 X.21/V.35 DTE-to X.21/V.35 DCE

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.



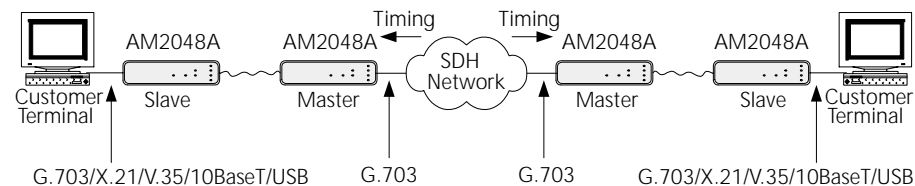
#### 4.8.2.2 G.703-to X.21/V.35 DCE



#### 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.

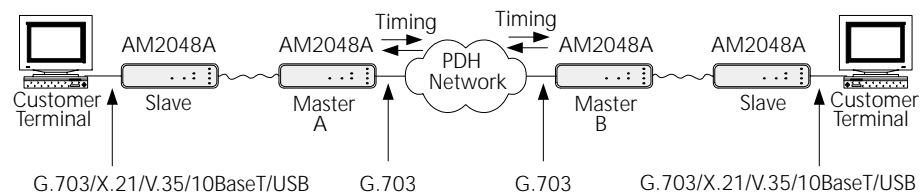
### 4.8.3 Crossing an SDH Network



Both AM2048 sections take their timing from the network and both are configured the same. Use the configuration shown in section 4.9.2.2.

**Note:** The SDH network might be configured to provide a PDH path, in which case see section 4.9.4.

#### 4.8.4 Crossing a PDH Network



In this example, a PDH network is shown where timing is passed transparently from end to end in both directions. From a timing point of view, this is equivalent to connecting Master A directly to Master B. To provide a Master clock to the system, side A should be set as in section 4.9.1.3, otherwise, without a master clock somewhere in the path, the timing will be unstable.

### 4.9 G.703 OPTIONS

#### 4.9.1 Impedance

120Ω Ohm and 75 Ohm<sub>Z</sub> may be selected under software control and set differently at each end of the link. E.g. CO (Master) set to 120Ω Ohm and the CPE set to 75 Ohm<sub>Z</sub>. The factory default is for the AM2048 to auto-detect which interface is being used. Once a signal has been detected on an interface, the impedance parameter is then set so that after a power OFF-ON event the impedance is selected immediately. The AM2048 may be set back to auto-detect at any time.

Connect the VT100 terminal emulator to the Master AM2048.  
Go to the "Configuration>User Port" Screen to view/change the settings for the Master.  
Use F8 to view/change the settings for the slave.

#### 4.9.2 Timing

For a full treatment of the timing options, see section 4.8.

### 4.9.3 Framing

#### 4.9.3.1 Unstructured Operation

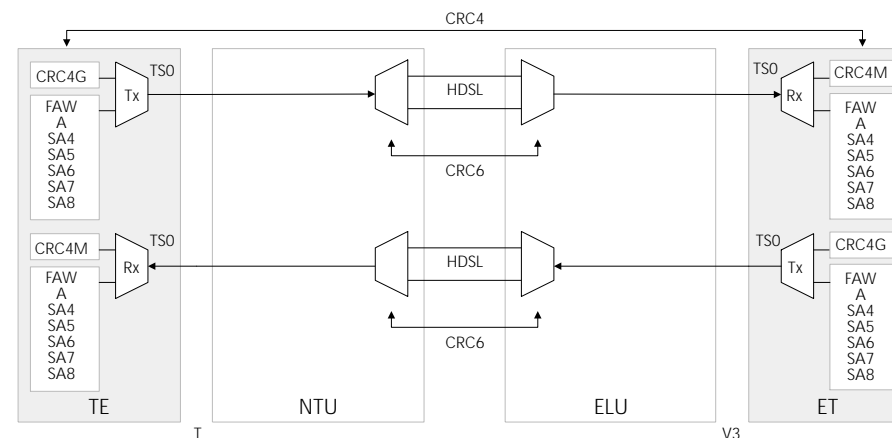


FIGURE 4.9.1: UNSTRUCTURED OPERATION

For unstructured working, Loss of Frame Alignment and AIS alarms are suppressed. The user data passes transparently through the system. An arbitrary frame position is assumed for mapping the user data in to the line pairs. The user data may or may not have TSO, and may or may not be using CRC4.

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

- Rx Unframed (  )
- Rx Framed (  )
- Rx CRC4 (  )
- Tx TSO Transparent (  )
- Tx TSO Generate (  )
- Tx CRC4 (  )

4.9.3.2 Structured Operation

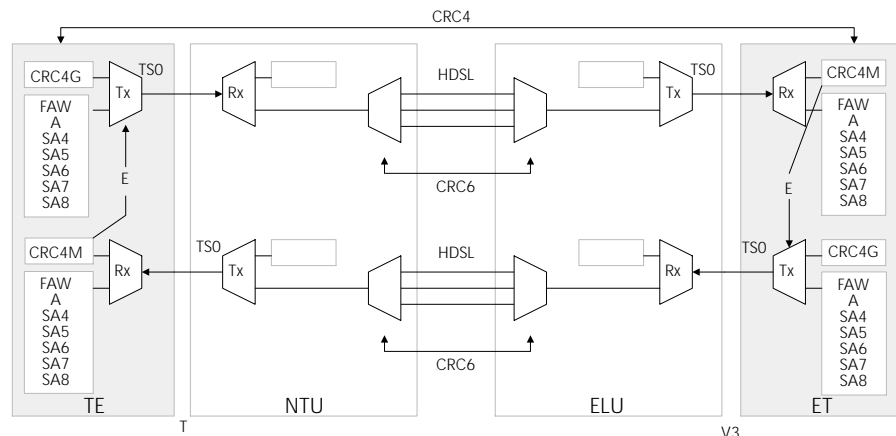


FIGURE 4.9.2: STRUCTURED WORKING, END-TO-END TRANSPARENT CRCs

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, however, no E bits are returned at the user interface from the transmission equipment. To do this, simply enable the Rx CRC4 checkbox.

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.

4.9.3.3 Structured Working, CRCs Enabled

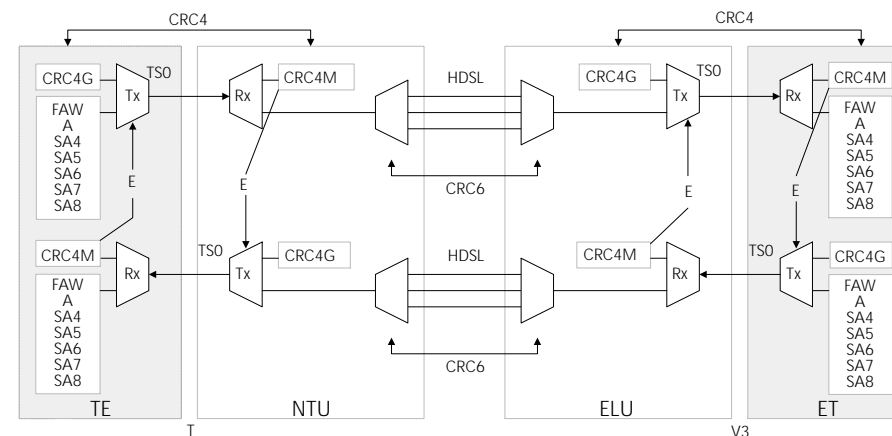


FIGURE 4.9.3: STRUCTURED WORKING, CRCs ENABLED

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.

4.9.4 ETS 300 233 Loopbacks

Loop 1 and Loop 2 may be activated by sending patterns using spare bits 5 and 6 in TSO.

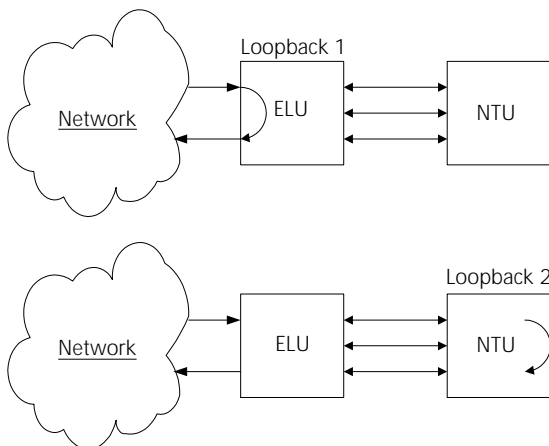


Table 1 CrC4 Multi-frame Structure

Multi-frame	Sub-Multi-frame	Frame number	Bits 1 to 8 of the PCM frame (i.e. time slot 0)							
			1	2	3	4	5	6	7	8
			I	0	c1	0	0	1	1	0
1	0	1		A	Sa4	Sa5	Sa61	Sa7	Sa8	
2	c2	0		0	1	1	0	1	1	
3	0	1		A	Sa4	Sa5	Sa62	Sa7	Sa8	
4	c3	0		0	1	1	0	1	1	
5	1	1		A	Sa4	Sa5	Sa63	Sa7	Sa8	
6	c4	0		0	1	1	0	1	1	
7	0	1		A	Sa4	Sa5	Sa64	Sa7	Sa8	
II	8	c1	0	0	1	1	0	1	1	
	9	1	1	A	Sa4	Sa5	Sa61	Sa7	Sa8	
	10	c2	0	0	1	1	0	1	1	
	11	1	1	A	Sa4	Sa5	Sa62	Sa7	Sa8	
	12	c3	0	0	1	1	0	1	1	
	13	E	1	A	Sa4	Sa5	Sa63	Sa7	Sa8	
	14	c4	0	0	1	1	0	1	1	
	15	E	1	A	Sa4	Sa5	Sa64	Sa7	Sa8	

Table 2 Loop-back code definitions

State	DS-ET	Sa5	Sa6
Loop-back 1 command	<--	0	1111
Loop-back 2 command	<--	0	1010
Loop-back acknowledge	-->	0	xxxx
Loop-back release command	<--	0	0000

These loop activation codes are only detected at the G.703 interface at the ELU when CRCs are enabled.

Loop 1 is the equivalent of a local loop at the ELU.

Loop 2 is the equivalent of a remote loop set from the ELU.

**Note:** The specification did not anticipate point to multipoint so in this mode loop 2 is not meaningful.



## 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 AM2048 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.

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.

(For more details of the menu system see the "VT100 Management User Guide for the AM2048.")

## 6 TRANSMISSION PERFORMANCE

### 6.1 END TO END DELAY

The transit delay from one end of the system to the other is < 700uS.

### 6.2 JITTER

For G.703 interfaces, the jitter meets the requirements of TBR12 and TBR13.

Measurement Filter Bandwidth		Output Jitter
Lower Cut Off (High Pass)	Upper Cut Off (Low Pass)	UI Peak to Peak (maximum)
40Hz	100kHz	0.11

These measurements are performed in the presence of the maximum tolerable input jitter.

### 6.3 OPTICAL TRANSMISSION

For single-mode fibre (9/125 @ 0~25dB.), with an attenuation of 0.35dB/km, this equates to a transmission distance up to 71km.

For multi-mode fibre (50/125 or 62.5/125 @ 0~20dB.), with an attenuation of 0.6dB/km, this equates to a transmission distance up to 33km.

**Attention!** Care must be taken to ensure that the fibre connectors are clean.

## 7 INTERFACES

### 7.1 MAINS POWER SUPPLY

If a 48V DC power supply is not available, mains to 48V converters are available.

#### 7.1.1 240V Plug Top PSU

This unit is a basic UK plug top with two core, screened cable terminated in a 3-way mini-fit connector.

Lead length 1.8m.

ATL part number 5/500/000/037.

#### 7.1.2 240V In Line PSU

On this unit, the mains connector is a standard 3 pin IEC 320 input.

Lead length 1.8m.

ATL part number 5/500/000/041.

#### 7.1.3 110V In-line PSU

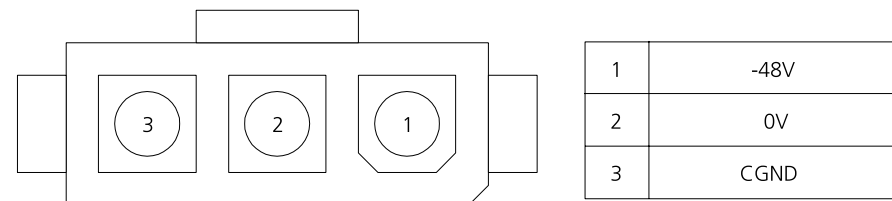
On this unit, the mains connector is a standard 3 pin IEC 320 input.

Lead length 1.8m.

ATL part number 5/500/000/038.

### 7.2 DC POWER INLET

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



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

**Mating connector**

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

The DC Power Cable can be ordered from ATL Telecom, ATL Part Number (See Appendix B).

CABLE AM2048A DC POWER 6/910/000/423

**7.3 OPTICAL TRANSMISSION LINE**

The rear panel optical connector is either FC/SPC, ST or SC. For ordering information see Appendix B. Connectors plugged into this port should be clean and should have a return loss better than -35dB. The dust cap should be fitted when the unit is not connected to the line. The optical output from this port is -5dBm (±2dB) at 1310nm.

**7.4 SERIAL CONTROL**

A VT100 compatible terminal can be plugged into the 9-way D-type connector on the rear panel.

The socket is wired to allow a straight connection to a PC serial port. The serial cable must have pins 2, 3, 4, 5 and 6 connected.

For a full description of the menu system, refer to the 'VT100 Management User Guide'.

The serial port setting is 19.2Kbaud, 8 bits, no parity, 1 stop bit, and Xon/Xoff flow control.

The RS232C interface complies with the CCITT V24/V28 standards. The maximum length of cable between communicating devices is limited to 15.2m (50ft).

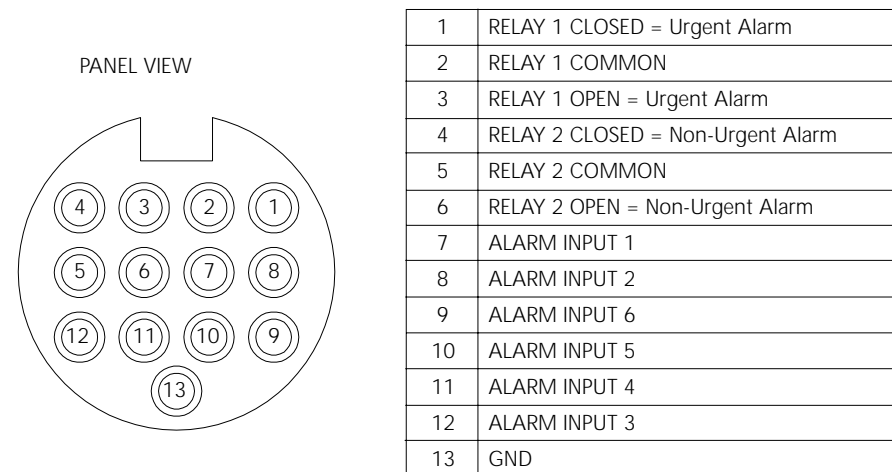
Pin #	Function
1	
2	Receive cct. 104
3	Transmit cct. 103
4	DTR
5	Ground cct. 102
6	DSR

The serial control cable can be ordered from ATL, (See Appendix B).

**Serial Cable Assembly- ATL Part Number**  
CABLE 9 WAY SERIAL 6/910/000/429

**7.5 ALARM INPUT/OUTPUT PORT**

The alarm port provides 6 logic level inputs, and the contacts of two changeover relays. The pin-out is shown below:



In the de-energised state, the urgent alarm relay closes the contact between pins 1 and 2 (pins 2 and 3 are open) and the non-urgent alarm relay closes the contact between pins 4 and 5 (pins 5 and 6 are open).

When power is applied and all alarms are off, the urgent alarm relay opens the contact between pins 1 and 2 (pins 2 and 3 are closed), the non-urgent alarm relay opens the contact between pins 4 and 5 (pins 5 and 6 are closed).

In the ELU, the alarms relay outputs may be used to integrate the AM2048 into the exchange alarm system.

To save power in the NTU the alarm relays are disabled.

The alarm inputs are available at both the ELU and the NTU and may be used for alarm collection from other equipment, e.g., door open alarm, battery low alarm, temperature alarms etc. The alarm inputs detect a short circuit between the alarm input pin and GND (pin 13).

**Mating connector - ATL Part Number**  
CONN. 13 WAY PLG 6/313/000/002

**Screened Cable Assembly- ATL Part Number**  
CABLE AM2048A ALARM 6/910/000/424

(See Appendix B).

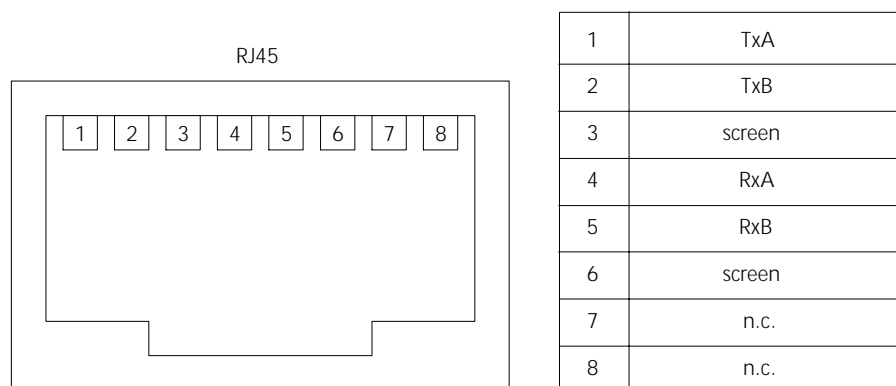
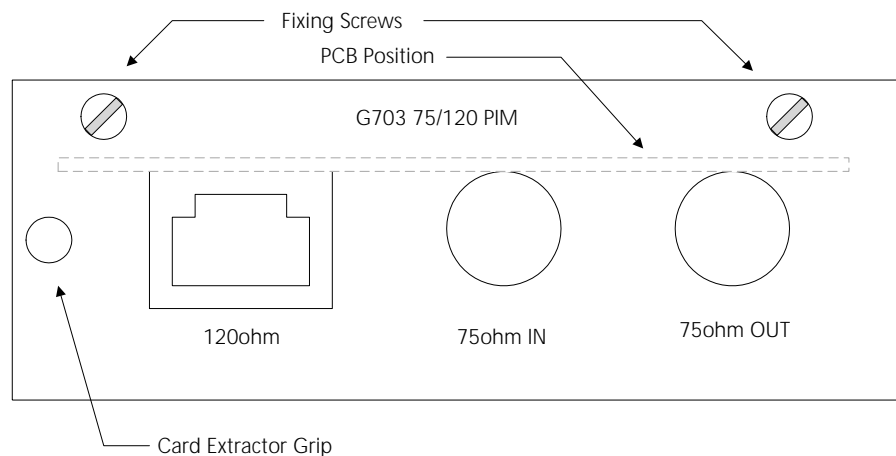
## 7.6 INTERFACE MODULES

### 7.6.1 G.703

The 75Ω Ohm interface connectors are BNC.

The 120Ω Ohm interface connector is RJ45.

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



### 7.6.2 X.21

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

Circuit	Interchange Circuit Name	Pins		Definition
		A	B	
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.

7.6.3 V.35

ITU recommendation V.35 refers to ISO 2593 for the connector pin out.

Circuit	Interchange Circuit Name	Pins		Definition
		A	B	
102	Signal ground or Common Return	B		
103 $\emptyset$	Transmitted Data	P	S	From DTE to DCE
104 $\emptyset$	Received Data	R	T	From DCE to DTE
105	Request To Send (RTS)	C		ON transmit Data OFF transmit binary 1
106	Ready For Sending (RFS)	D		ON DCE ready to accept data OFF DCE not ready
107	Data Set Ready (DSR)	E		ON DCE ready to operate OFF DCE not ready to operate
109	Received Signal Detector	F		ON line signal is good OFF line signal out of limits
113 $\emptyset\Delta$	Terminal Signal Element Timing	U	W	103 changes at OFF to ON of 113
114 $\emptyset$	Transmitter Signal Element Timing	Y	AA	103 changes at OFF to ON of 114
115 $\emptyset$	Receiver Signal Element Timing	V	X	Centre of bit on 104 ON to OFF on 115
140	Remote Loop-back	N		
141	Local Loop-back	L		
142	Test Indicator	NN		

Circuits marked  $\emptyset$  are balanced V.35, unmarked circuits are to V.28.

Circuit marked  $\Delta$  is only implemented in DTE mode.

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

Select the required value of N for Nx64K circuits.

DTE – DCE mode may be selected using Links 1 and 2.

7.6.4 e-PIM

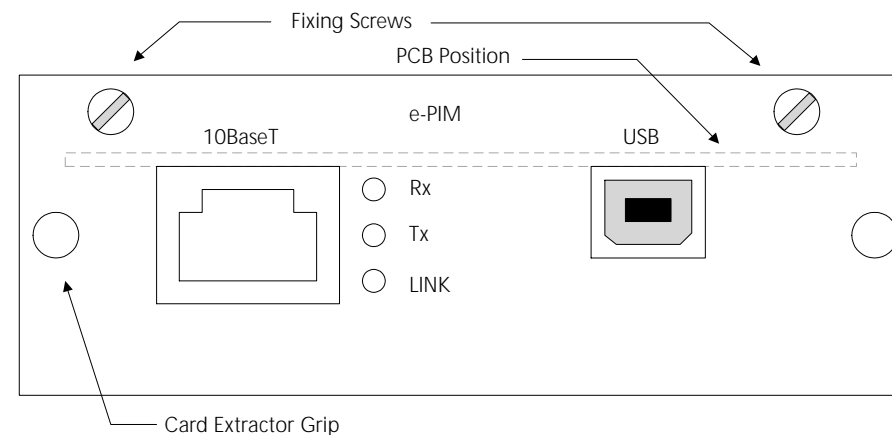
The Ethernet port is 10BaseT and the connector is RJ45, the pin-out is shown below.

When connecting the 10BaseT port directly to a PC, a crossover cable is required.

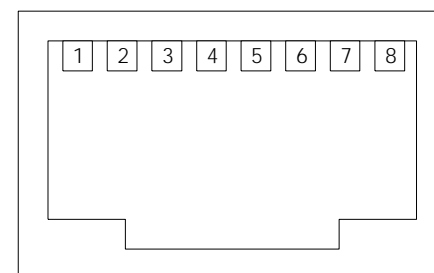
10BaseT Indicator LEDs

Rx Packet Received  
Tx Packet Transmitted  
LINK Link Active

The USB port is a slave and can be connected to a PC using a standard USB Peripheral Cable A - B.



PANEL VIEW



1	TX+
2	TX-
3	Rx+
4	n.c.
5	n.c.
6	Rx-
7	n.c.
8	n.c.

Please refer to the e-PIM Supplement for further information.

## 7.7 FRONT PANEL

### 7.7.1 Controls

#### 7.7.1.1 Disabling the Front Panel Controls

The modems are delivered with the front panel controls enabled as the default configuration. 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 Test>User Port menu (see the VT100 Management User Guide for details).

#### 7.7.1.2 Setting Master/Slave

- 1 Press the local loop and loop back buttons together and hold them until both the local loop and loop back indicators are lit. Upon releasing the buttons, the remote loop indicator starts to flash and you have 5 seconds to select and accept the required Master/Slave mode.
- 2 With the remote loop indicator flashing, press the remote loop button to toggle the state of the Master/Slave LED. Select Master/Slave as desired.
- 3 To accept the change, press local loop and loop back buttons together until the Remote Loop indicator goes off. The unit will then automatically restart in the selected mode. If this action is not completed within the 5-second period, the Remote Loop indicator will automatically stop flashing and the unit will leave the programming mode and return to normal operation with its mode unchanged.

To reject a change, simply allow the modem to time-out and return to normal operation.

#### 7.7.1.3 Resetting to Factory Default Configuration

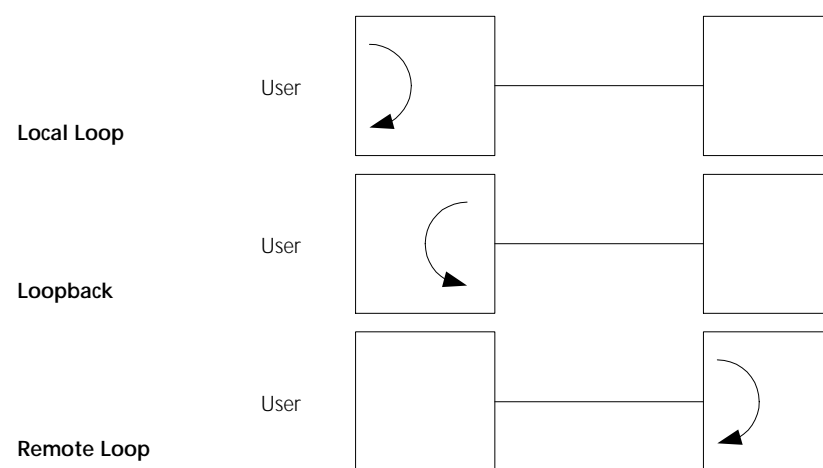
Press the Local Loop and Loop-back buttons together, and then with the buttons still pressed, press the remote loop button as well. The unit will automatically restart with all of its configuration data cleared. **Note:** When the units reboots it will be configured as a "Slave".

#### 7.7.1.4 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.



### 7.7.2 Indicators

#### Power (Green)

This will always be illuminated whenever the unit is powered up.

#### Test (Red)

This will be illuminated whenever:

- the unit has a loop locally or remotely applied.
- the unit is applying a remote loop.
- the unit is running a data test.

#### Non-Urgent Alarm (Yellow)

This LED will be illuminated if an alarm of fault severity 2 or 3 is present on the unit.

#### Urgent Alarm (Red)

This LED will be illuminated if an alarm of fault severity 4 or 5 is present on the unit.

#### Master (Green)

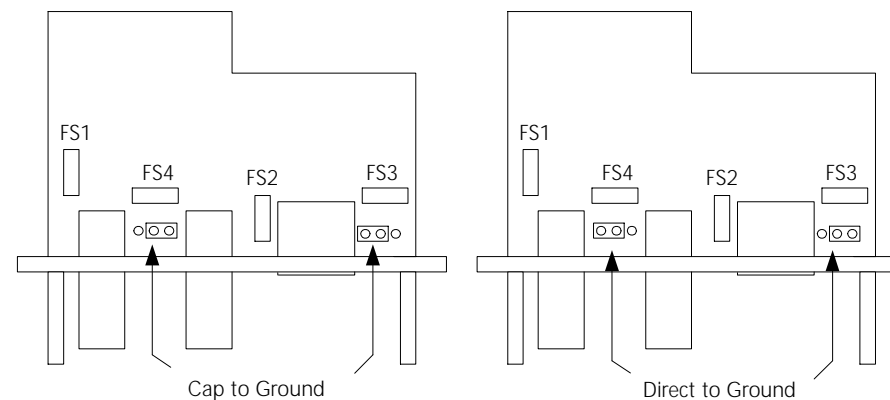
When lit, this LED indicates the unit has been configured to operate as a 'master'. The default setting is for the unit to be a 'slave' in which case the LED will be off.

8 INTERNAL LINKS AND FUSES

8.1 G.703 PLUG IN MODULE

The following diagrams show the location of the internal hardware links.

In all cases the factory default setting is shown on the left.

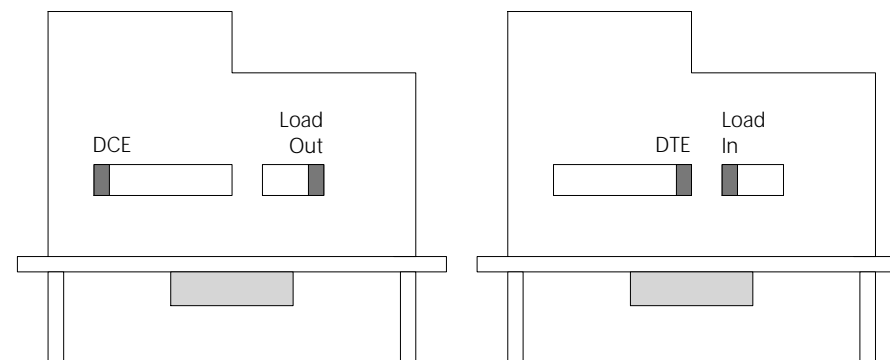


The 75Ω G.703 receiver and the 120Ω cable screen may be optionally connected directly to ground or to ground via a capacitor. The fuses FS1 to FS4 are used to protect the circuit against the transverse application of mains.

8.2 X.21 PLUG IN MODULE MK I

The X.21 module may be configured as a DCE or DTE.

In both modes, the receive clock, data and byte timing circuits may be terminated in 120Ω.

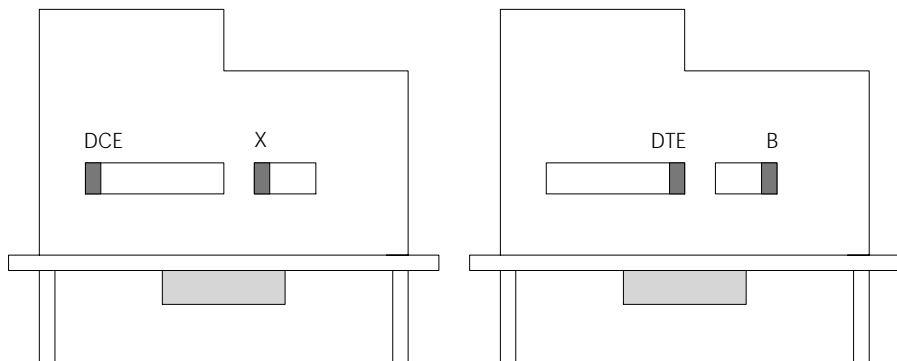




### 8.3 X.21 PLUG IN MODULE MK II

The X.21 module may be configured as a DCE or DTE.

The 120 termination is always in.

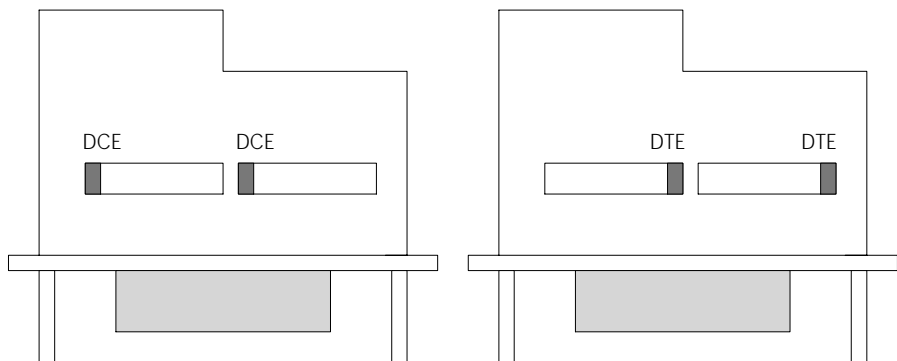


In DCE mode, the module may be configured to generate Byte Timing (B) or receive the DTE clock (X).

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

### 8.4 V.35 PLUG IN MODULE (MK I AND MK II)

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.



### 8.5 MOTHERBOARD

The fuse FS400 is a 1A slow blow fuse to protect the DC input.

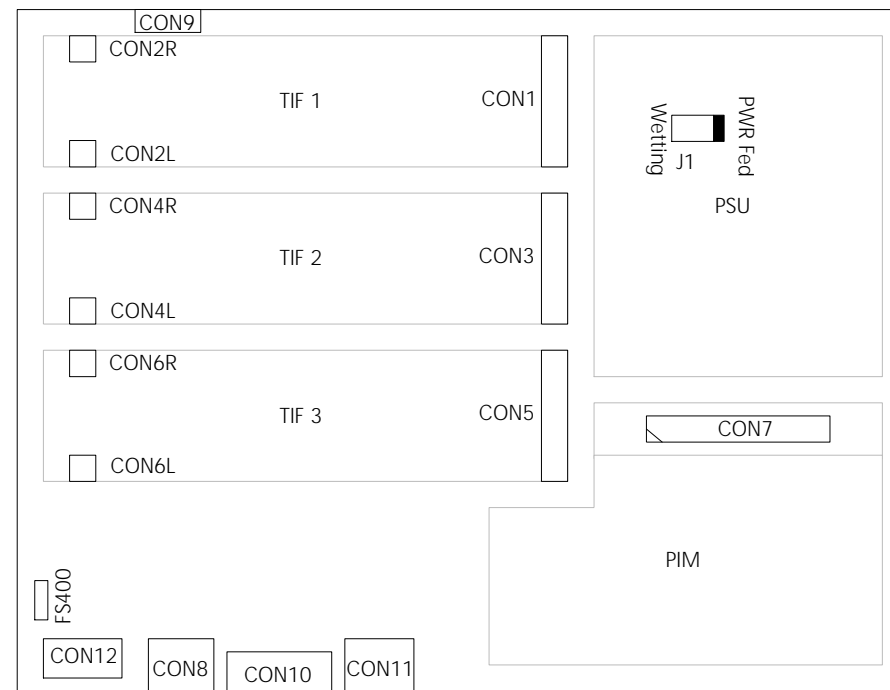


FIGURE 3 MOTHERBOARD FUSE LOCATION

#### WARNING

Only authorised personnel are allowed to open the DSL System case to change the fuse. Misuse or any modifications carried out to this unit other than in accordance with the instructions supplied, will invalidate the guarantee and CE approval.

## 9 FREQUENTLY ASKED QUESTIONS

Please check the following points if problems are experienced setting up a DSL link:  
It is recommended that a pair of units is set up back-to-back and working correctly in the desired operational mode before deployment.

### **The units will not get into sync**

- 1 Check that one AM2048 is set to master and the other(s) to slave.
- 2 Ensure the modem is being used on suitable single or multimode fibre.
- 3 Check that the transmission distance is not beyond the range of the equipment.  
See section 6.
- 4 If using an adaptor to connect to a BT EPS8/9 line, check that the colour is grey for the AM2048.

### **Where can I get a Terminal Emulator program?**

Most versions of Windows running on a PC come with a VT100 terminal emulator, such as HyperTerminal. TeraTerm is the recommended VT100 terminal emulator. This can be downloaded from the Atl telecom web site. <http://www.atltelecom.com/transmission/support>

### **When I plug in the Terminal Emulator I get strange characters on the screen**

The bit rate of the serial port is probably set to the wrong speed. The default bit rate for the AM2048 management serial port is 19.2kbps. Go to the terminal emulator serial port configuration menu and set the serial port to 19.2kbps, 8 bits, no parity, 1 stop bit, and Xon/Xoff flow control.

### **When using the management terminal, the function keys do not work**

Most PC based terminal emulators allow the programming of the function keys. If you follow the installation of TeraTerm the function keys will be set up for you. If the function keys cannot be programmed then you can type 'Control F' followed by the number of the function key.

E.g. for F8, type 'control F', release the keys, type '8'.

### **Loading new application software I get a 'Stop sending – failed to download' message**

Check that the VT100 terminal emulator that you are using supports binary file transfer and that the option is selected. TeraTerm is the recommended VT100 terminal emulator as it supports binary file transfer.

### **There is a problem with high error rates.**

Connect the VT100 terminal emulator and go to the 'Performance>User Port' screen.

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.

Check the fibre connections to see if they are all clean.

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 AM2048 to terminal equipment, either the AM2048 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 AM2048 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 AM2048 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 clips 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.

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.

### How do I get back to the factory settings?

Go to the "Configuration>Software" menu.

Select the 'Default Config.' option.

Use the TAB key or the arrow keys to place the cursor in the box.

Press spacebar to select the option.

Press 'Enter'.

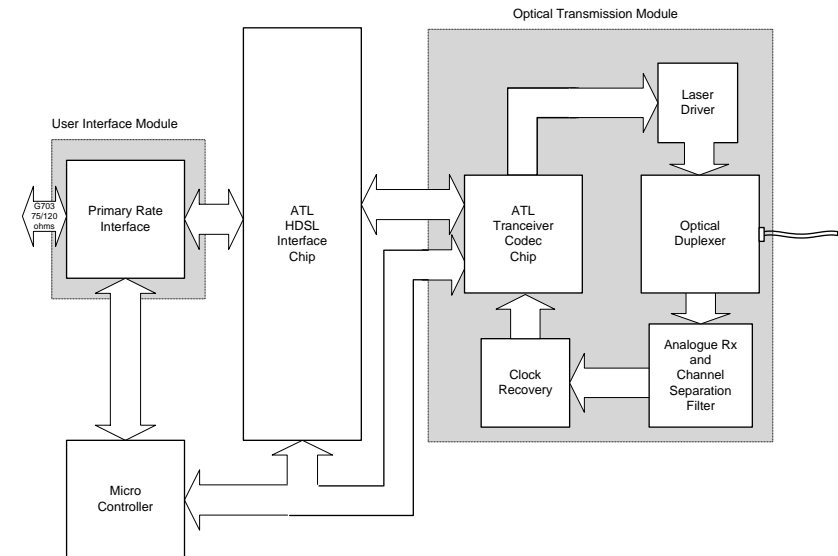
The unit will pause for a few seconds before re-booting.

The factory default for the desktop unit is an NTU.

For persistent problems please contact your local distributor for assistance.

Atl telecom Transmission technical support is available by fax on +44 29 20 500 850 in the first instance.

10 SYSTEM OVERVIEW



10.1 OPTICAL TRANSMISSION

The optical transmission interface module is designed to operate over a single optical fibre. This is accomplished using an optical duplexer, which integrates a laser and a photodiode in a single package. Both directions are transmitted at the 1310nm optical window, leaving the 1550nm window free. The interface module encodes the DSL framed data using a 5B6B block code for error monitoring and spectral shaping.

Sub-carrier modulation is used to increase the separation between the upstream and downstream directions. Baseband transmission is used from ELU to NTU, whereas the other direction is modulated onto a carrier.

For transmission over single-mode fibre, order the AM2048 OS.

For transmission over multi-mode fibre, order the AM2048 OM.

The AM2048A OS and AM2048 OM are Class I products in accordance with EN60825-1 and therefore inherently safe.

## 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  $\pm 50$ ppm. (**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 ALARM INTERFACE

A 13 pin circular DIN connector provides access to 6 alarm inputs that are used to detect metallic contact closure. For example, they can be used to sense a cabinet door open or temperature sensors. The priority of these auxiliary alarms may be programmed through the "Alarms>Severity Level Settings" screen.

There are also relay contact outputs to indicate urgent and non-urgent alarms. This allows the system to be easily integrated into the alarm systems of other equipment.

## 10.5 USER INTERFACE MODULES

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

- G.703, with software selectable 75 $\Omega$  or 120 $\Omega$  ports
- X.21 MK II (with tail buffer)
- V.35 MK II (with tail buffer)
- e-PIM 10BaseT/USB
- e-PIM2 10/100 BaseT/USB

The existing interface module can be changed out using a pluggable replacement unit. These can be ordered separately using the part numbers detailed below. For part numbers and order codes see Appendix B.

## 11 COMPLIANCE NOTES

TTE network statements and the declaration to conformity to EC directive 1999/5/EC are provided inside the front cover of this User Guide together with safety information.

### 11.1 TELECOMMUNICATION STANDARDS

The equipment is in conformity with the following Common Technical Regulations and National Standards:

#### Common Technical Regulations

CTR2	X.21, X.21bis (V.35)
CTR12	G.703 2Mbps, 120ž , unstructured
CTR13	G.703 2Mbps, 120ž , structured

#### UK National Standards

NTR4	G.703, 75ž
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## 12 GLOSSARY

A	Alarm bit in G.704 frame, timeslot 0
AC	Alternating Current
AIS	Alarm Indication Signal
BT	British Telecom
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;
ETS	European Telecommunications Standard

FAW	Frame Alignment Word	RAM	Random Access Memory
FC	The FC or Face Contact fibre connector features a threaded keyed design. This anti-rotation key prevents fiber endface damage. Suitable for both multimode and singlemode cable.	SAn	G.704 Timeslot 0 spare bit n
FIFO	First In First Out Buffer	SC	Square fibre connector. The SC connector features a push-pull type coupling mechanism which allows for dense packaging. It also has a spring loaded ferrule which resists shock, vibration, and temperature changes.
FLASH	Non-volatile read/write memory	SDH	Synchronous Digital Hierarchy
G.703	CCITT Recommendation G.703 (1988): "Physical/electrical characteristics of hierarchical digital interfaces"	SELV	Safe Extra Low Voltage
G.704	CCITT Recommendation G.704 (1988): "Synchronous frame structures user at primary and secondary hierarchical levels"	SNMP	Simple Network Management Protocol
G.706	CCITT Recommendation G.706 (1988): "Frame alignment and CRC procedures relating to basic frame structures defined in G.704"	ST	ST or straight tip. ST fibre connectors feature a bayonet style connector for secure connections and are suitable for either multimode or singlemode cable.
G.826	CCITT Recommendation G.826 (1996) "Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate"	TE	Terminal Equipment
HD 384	Electrical Installation of Buildings (IEC 60364 series, modified)	TSn	Timeslot n
IC	Integrated Circuit	TNV	Telecommunications Network Voltage
IEC 61312-1	Protection against lightning electromagnetic impulse; Part 1 General Principals	USB	Universal Serial Bus
ISO	International Standards Organisation	VT100	Industry standard character based terminal
LED	Light Emitting Diode	V11	CCITT Recommendation V.11 Electrical characteristics for balanced double-current interchange circuits for general use with integrated circuit equipment in the field of data communications
LT	Line termination (Same as ELU)	V.35	CCITT Recommendation V.24 List of definitions for interchange circuits between DTE and DCE
LVD	Low Voltage Directive	X.21	CCITT Recommendation X.21 Interface between DTE and DCE for synchronous operation public data networks
M.2100	CCITT recommendation M.2100 (1995) Performance limits for bringing into service and maintenance of international PDH paths, sections and transmission systems.		
NT	Network Termination		
NTU	Network Terminating Unit		
NTP	Network Termination Point		
PC	Personal Computer		
PCB	Printed Circuit Board		
PCM	Pulse Code Modulation		
PDH	Plesiochronous Digital Hierarchy		



## 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 AM2048 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 AM2048 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 AM2048 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.

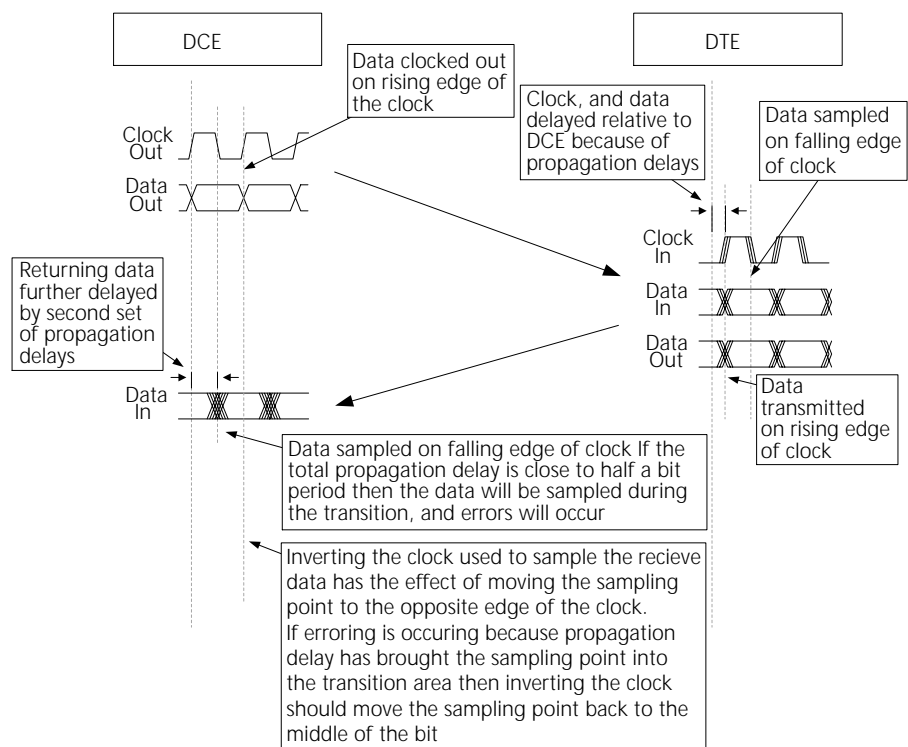


FIGURE A1 - RECEIVE CLOCK INVERSION

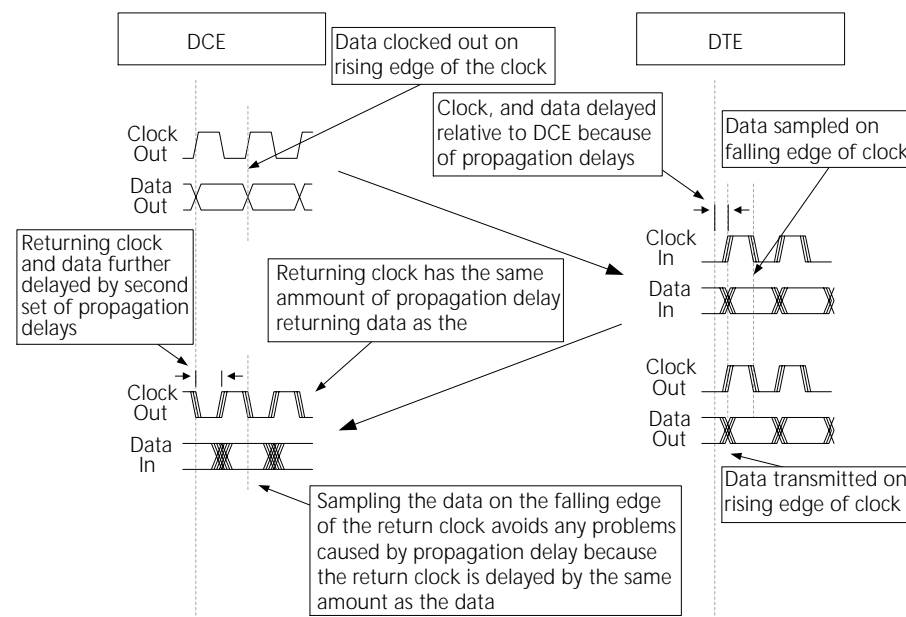


FIGURE A2 - DTE RETURN CLOCK OPERATION

## APPENDIX B – ORDERING INFORMATION

User Interfaces		Fibre Connectors	
G.703	X = 1	FC/SPC	Y = A
X.21 MK II	X = 5	ST	Y = B
V.35 MK II	X = 6	SC	Y = C
e-PIM	X = 7		
e-PIM2	X = 8		

Optical Transmission		Order Code
Single Mode Fibre	AM2048A OS	1/187/50X/9AY (X and Y, see key)
Multimode Fibre	AM2048A OM	1/187/53X/9AY

**Example order code**

1/187/536/9AB      AM2048A OM V.35 ST  
Optical Transmission  
Multimode fibre  
ST connector  
User interface V.35 MKII

Spare User Interfaces	ATL part number	Order Code
G.703	2/187/002	1/187/002
G.703 MK II	2/187/006	1/187/006
X.21 MK II	2/187/007	1/187/007
V.35 MK II	2/187/008	1/187/008
e-PIM	2/187/009	1/187/009
e-PIM2	2/187/010	1/187/010

Power Supplies	ATL part number	Order Code
240V UK Plug top	5/500/000/037	1/187/311
240V In Line IEC	5/500/000/041	1/187/312
110V In Line IEC	5/500/000/038	1/187/313

Accessories	ATL part number	Order Code
AM2048 DC Cable	6/910/000/423	1/187/314
AM2048 Alarm Connector	6/313/000/002	1/187/315
AM2048 Alarm Cable	6/910/000/424	1/187/316
AM2048 RJ45-RJ45 Cable	6/910/000/425	1/187/317
AM2048 RS232 Cable	6/910/000/429	1/187/320
Management Pack (Includes VTMS Handbook and RS232 cable)	n.a.	1/187/350

Please note, for details of rack mount versions, CAP, G.SHDSL and optical transmission, please contact your ATL representative.