USER GUIDE

AM2048A

ATL part no: 1/298/100/610
Issue 02 - Jan. 2003

Note: The information contained in this document is supplied without liability for errors or omissions.

ATL Telecom Limited reserves the right to make changes to this document at any time without notice.

COMPLIANCE NOTES AND SAFETY INSTRUCTIONS:

Caution – Hazardous voltage inside the equipment

Safety Instructions:

This apparatus must be installed and maintained by SERVICE PERSONNEL.

Disconnect Device Statement:

For the AM2048A AC versions the Mains Switch serves as the disconnect device, therefore a socket outlet should be installed near the equipment and be easily accessible.

Power Rating Information – DC Version:

Voltage Range	-40V to -72V
Maximum Current	170mA

Power Rating Information - AC Version:

Voltage Range	85Vrms to 250Vrms
Maximum Current	20mA
Frequency Range	50 - 60Hz

TTE – Network Safety Statements:

The AM2048A is a CLASS I product and USER SAFETY and the safety status of the Ports is dependent upon the earth connection. If the MAINS EARTH or the DC EARTH cannot be guaranteed to be a PROTECTIVE EARTH a PROTECTIVE EARTH conductor must be connected to the M3 STUD on the REAR PANEL.

The copper DSL line connection has a safety status of TNV-3.
This is a RFT-C type power feed circuit and must only be connected to another circuit of the same type.

PIM - G703 1/298/001 connected to an UNEXPOSED ENVIRONMENT;
- Tx 75 Ohm BNC connection has a safety status of EARTHED SELV.
- Rx 75 Ohm BNC connection has a safety status of UNEARTHED SELV.
- 120 Ohm 8 WAY RJ45 connection has a safety status of UNEARTHED SELV.

PIM - G703 1/298/001 connected to an EXPOSED ENVIRONMENT;
- Tx 75 Ohm BNC connection has a safety status of EARTHED TNV-1.
- Rx 75 Ohm BNC connection has a safety status of UNEARTHED TNV-1.
- 120 Ohm 8 WAY RJ45 connection has a safety status of UNEARTHED TNV-1.

PIM - X21 1/298/002 - 15 WAY D-Type connection has a safety status of EARTHED SELV.
PIM - V35 1/298/003 - V35 connection has a safety status of EARTHED SELV.
PIM - ePIM 1/298/004 -
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 - -75Vdc 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*
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 Limited.**

1 SCOPE

This User Guide applies to the High Speed DSL product family, designed and manufactured by ATL Telecom Limited 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 (part no. 1/187/009/610).

2 INTRODUCTION

The modems provide synchronous communications at user data rates between 64kbps and 2048kbps over one or two twisted pair cables. The equipment has modular transmission and 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 standard version of AM2048 uses G.SHDSL TC-PAM line code. In special circumstances, they may be suplied with 2B1Q or CAP line codes. The modem may be modified from one line code to the other by software download.

The customer interface is provided via interchangeable plug-in modules. Separate interface modules can be purchased in order to modify the units for operation with a different customer interface at a later date.

The standard version comes with two transmission pairs equipped and may be configured to operate using one or two pairs. A more economical single pair version is also available for applications where the flexibility of two pairs isn't necessary.

The AM2048 is available as a mains powered (85-250Vac) version , or a DC (-48Vdc) version that can also be line powered.

The AM2048 can be easily configured via a VT100 dumb terminal or via the front panel controls. For VT100 configuration, 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.

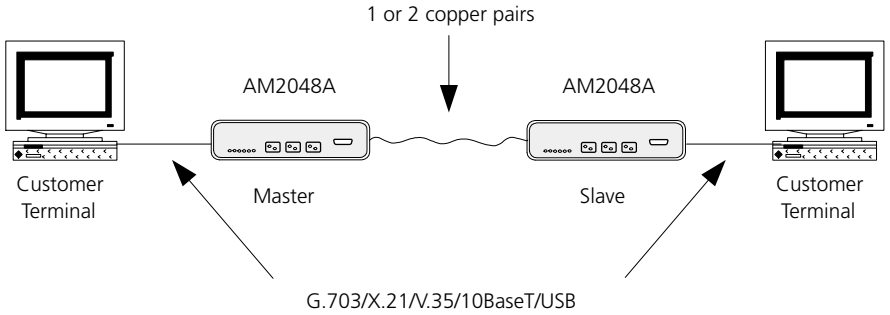
Chapter 4 (Installation) describes the basic set-up procedure and this should be read prior to setting up any link.

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

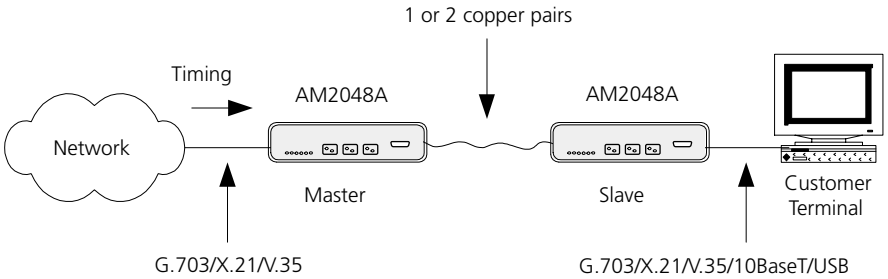
The diagrams below illustrate some basic applications:

2.1.1 Desktop modem to desktop modem, no external timing



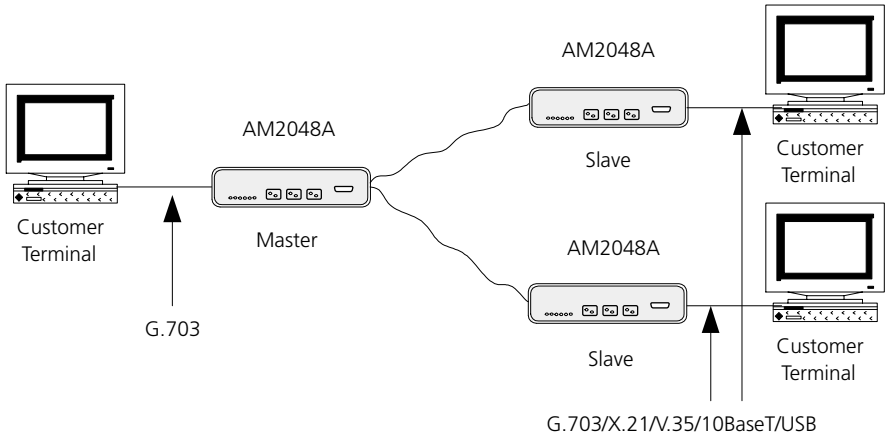
The circuit timing originates from the internal clock in the master, and is sent out to the customer terminal at both ends.

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 Desktop modem to desktop modem with split site working

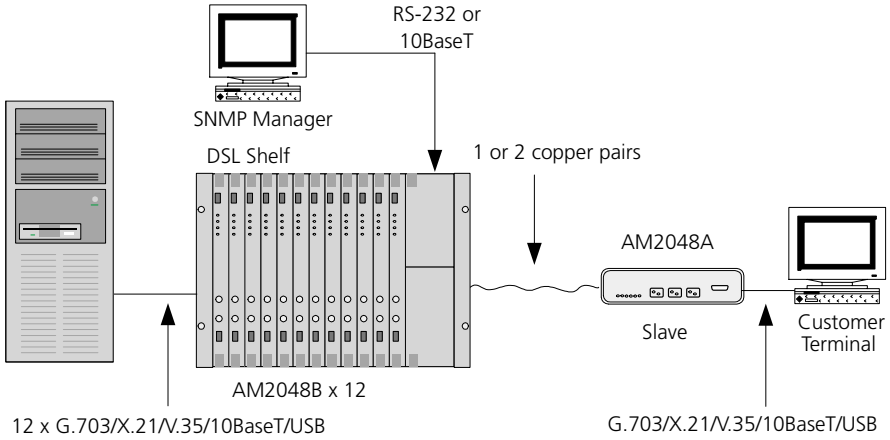


This is referred to as point-to-multipoint working. The G.703 interface at the master end must use the G.704 frame structure. It may be used for providing two Nx64k circuits from one 2Mbps pipe.

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).

2.1.4 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

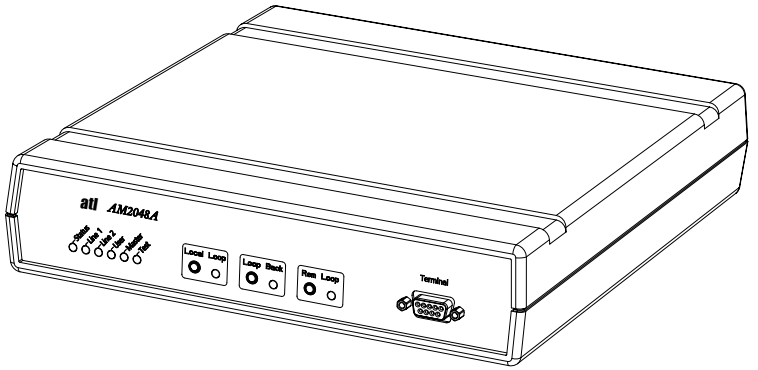


FIGURE 3.1 DESKTOP UNIT

The desktop unit is housed in a grey non-flammable plastic case (UL94 rating V0).
The front panel contains 6 LED indicators, 3 push button switches with LEDs to indicate their activation, and a management port interface.

LEDs
- Status
- Line 1
- Line 2
- User
- Master
- Test

Buttons (with associated LEDs)
- Local Loop
- Loop Back
- Rem Loop

Refer to section 7.6 for an explanation of the front panel controls.

Connectors
- Management port interface 9 way female D-type

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.

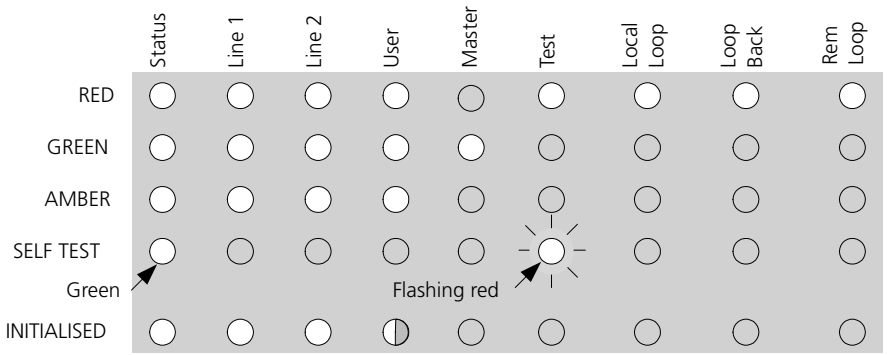
4.2 WARNING - DC POWERING DIRECT FROM EXCHANGE BATTERY

If the installation requires that the –48V is referenced to earth (as opposed to using a floating DC input) please ensure that the AM2048 is the special DC powered option.

Please refer to the order codes in Appendix B.

4.3 POWER ON SEQUENCE

With no DTE or line connected to the AM2048 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.

When the LED confidence check is complete, 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 and raise the appropriate alarms by illuminating the Line 1 LED in red (and Line 2 LED if the modem is configured for two lines). The User LED may also be illuminated depending upon the type of user interface fitted.

When the system has been installed and is working correctly the Status, Line 1, Line 2 (if configured for 2 lines), User and Master (if configured as master modem) LEDs will be illuminated in green and all other LEDs will be extinguished.

4.4 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.

The default number of transmission lines is two pairs.

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.

4.5 LOGGING ON

Connect a VT100 terminal (or PC running a VT100 emulation program) to the 9-way serial port on the front 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, then press 'Enter' (note: the password is case sensitive). The default password is carraige return.

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'.

4.6 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 space bar to change the setting). The basic setup for all modes is as follows:

At the master end:
Configuration>Master/Slave
1 select Master
2 select Point-to-Point or Point-to-Multipoint, as appropriate
3 enable the required number of lines
4 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 select Point-to-Point or Point-to-Multipoint, as appropriate
3 enable the required number of lines
4 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.

4.7 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.

4.8 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 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.

4.9 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.

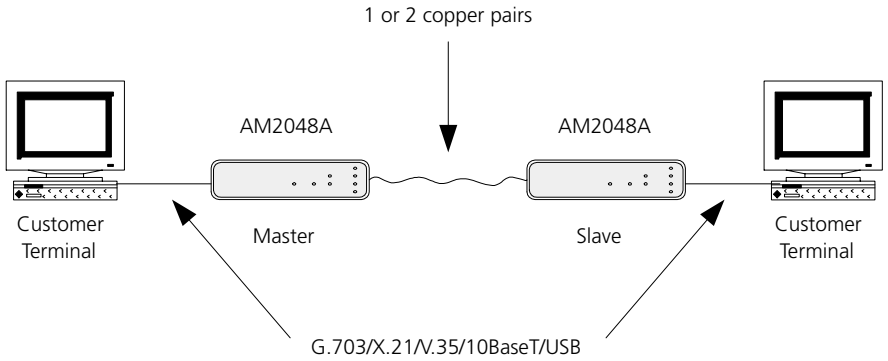
A Point to Multipoint link can have up to three AM2048s, one master and two slaves.

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.

4.9.1 Standalone Section



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

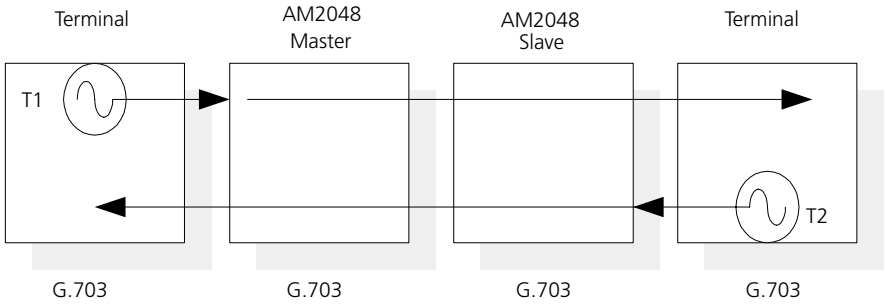
Key for following diagrams:

Clock Source

B Buffer (Elastic Store)

4.9.1.1 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:

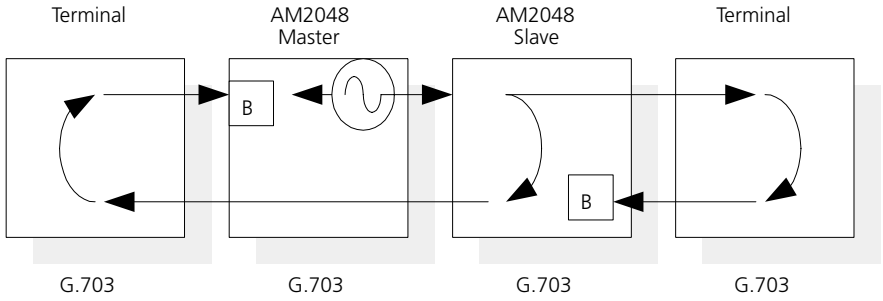
1 At the ELU, select the 'Transparent' timing option.
2 Using F8, cycle to the NTU user port, select the 'Transparent' timing option.

Press 'Return' to enter the changes.

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

4.9.1.2 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.

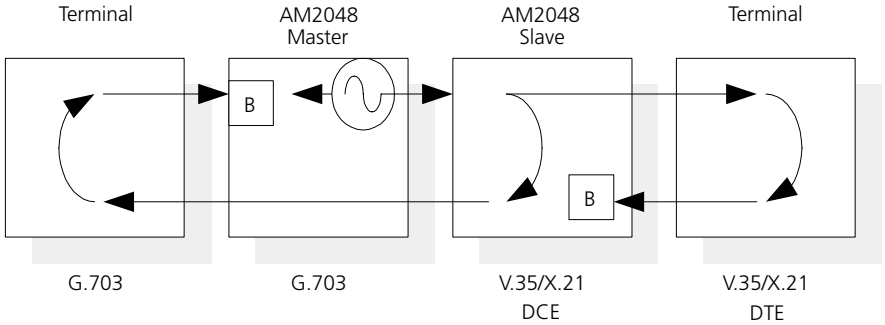
Using the "Configuration > User Port" Menu:

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.

4.9.1.3 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.

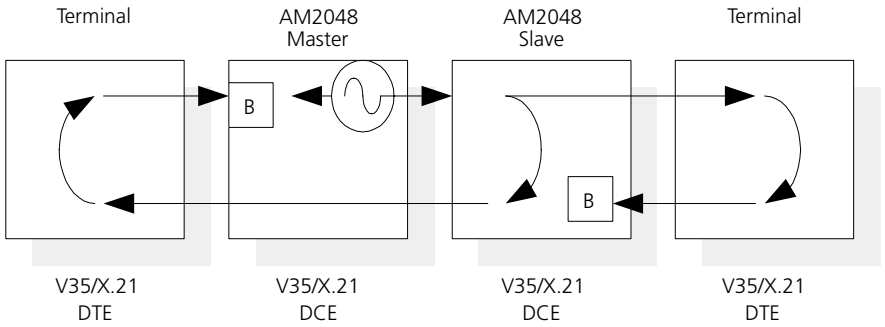
Using the "Configuration > User Port" Menu:

At the Master, select the 'Internal' timing option (There is nothing to set at the Slave).

Press 'Return' to enter the changes.

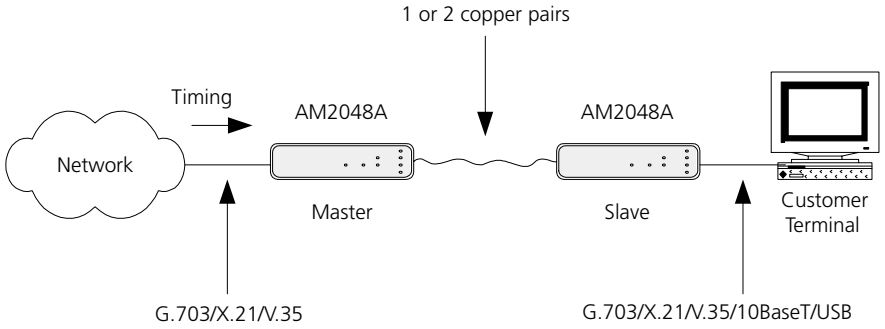
4.9.1.4 X.21/V.35 DCE to X.21/V.35 DCE

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.



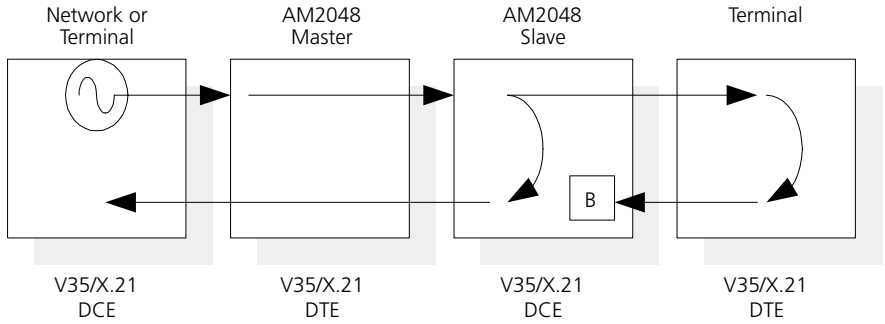
4.9.2 Tandem Section – External Timing

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

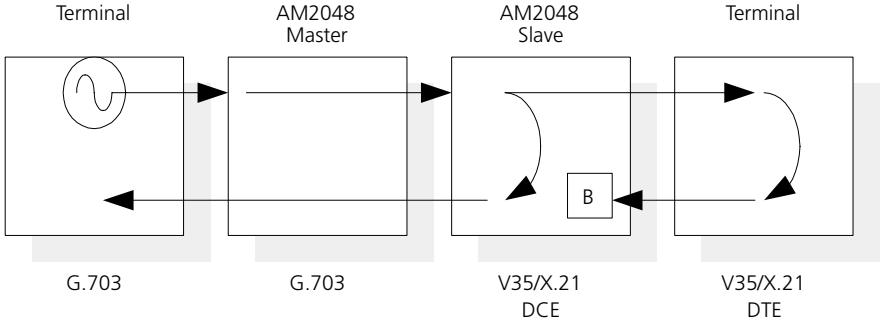


4.9.2.1 X.21/V.35 DTE-to X.21/V.35 DCE

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



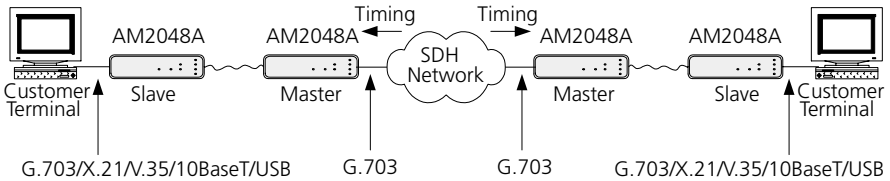
Using the "Configuration > User Port" Menu:

1 At the Master, select the 'Transparent' timing option.

2 At the Slave there is nothing to select.

Press 'Return' to enter the changes.

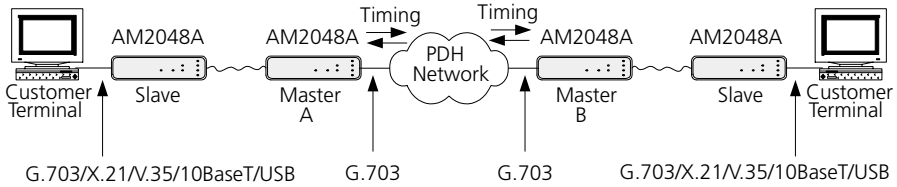
4.9.3 Crossing an SDH Network



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.

4.9.4 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.

4.10 G.703 OPTIONS

4.10.1 Impedance

120Ω and 75Ω may be selected under software control and set differently at each end of the link. E.g. CO (Master) set to 120Ω and the CPE set to 75Ω. 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.

4.10.2 Timing

For a full treatment of the timing options, see section 4.9.

4.10.3 Framing

4.10.3.1 Unstructured Operation

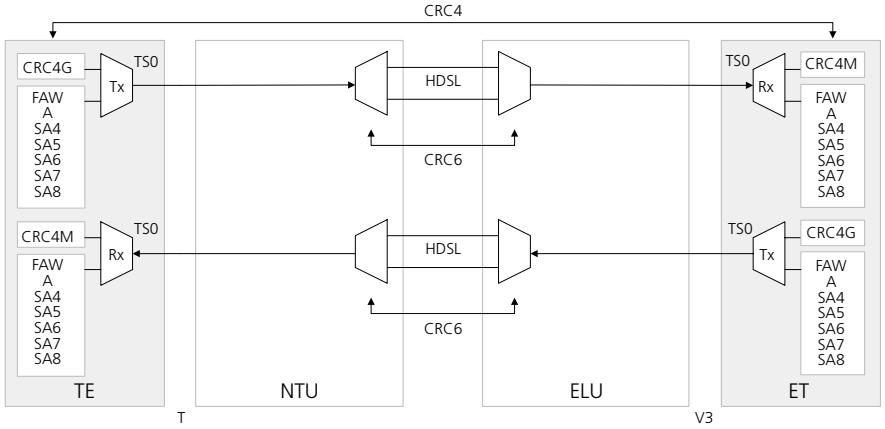


FIGURE 4.10.1: UNSTRUCTURED OPERATION

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 TS0, 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	[ ]

4.10.3.2 Structured Operation

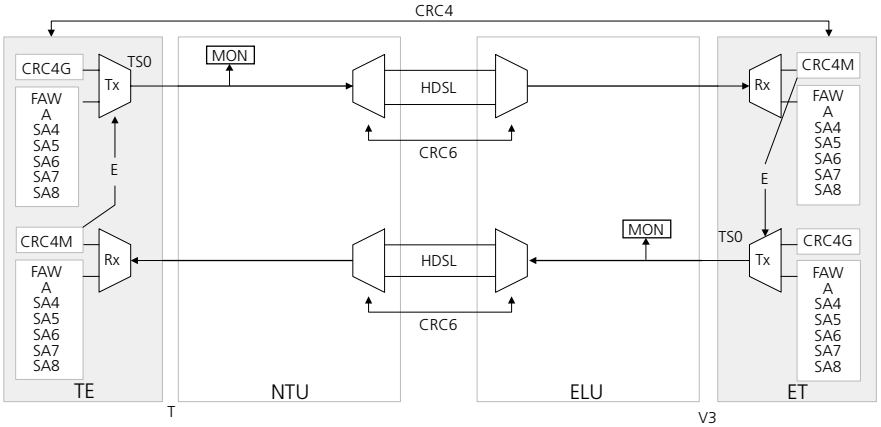


FIGURE 4.10.2: STRUCTURED WORKING, END-TO-END TRANSPARENT CRCS

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

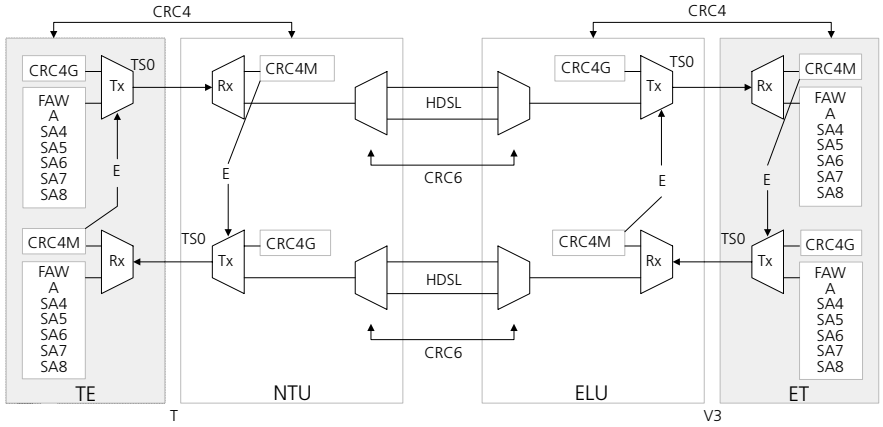


FIGURE 4.10.3: STRUCTURED WORKING, CRCS ENABLED

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.

4.10.4 ETS 300 233 Loopbacks

Loop 1 and Loop 2 may be activated by sending patterns using spare bits 5 and 6 in TS0.

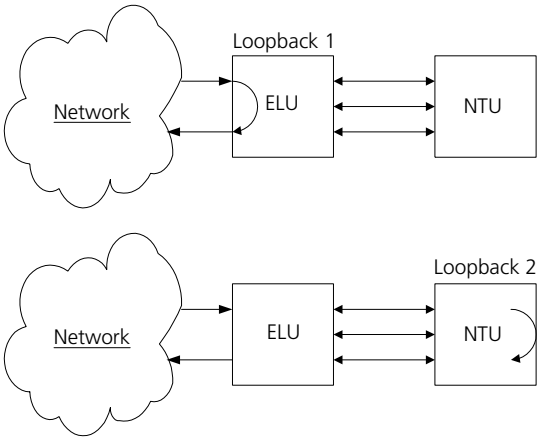


Table 1 CrC4 Multi-frame Structure

	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
Multi-frame	I	0	c1	0	0	1	1	0	1	1
		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. 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.

(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 TRANSMISSION RANGE

6.3.1 2-Pair Noise Free Range on 0.4mm Wire

SPEED	NOISE FREE RANGE	ATTENUATION
2048kbps	5.3km	56.4dB @ 150kHz

6.3.2 1-Pair Noise Free Range on 04mm Wire

SPEED	NOISE FREE RANGE	ATTENUATION
2048kbps	4.4km	46.8dB @150kHz
1536kbps	4.75km	50.5dB @150kHz
1024kbps	5.3km	55.3dB @150kHz
768kbps	5.6km	59.9dB @150kHz
512kbps	6.2km	66.2dB @150kHz

6.3.3 1-Pair With Noise Range on 04mm Wire

The AM2048 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

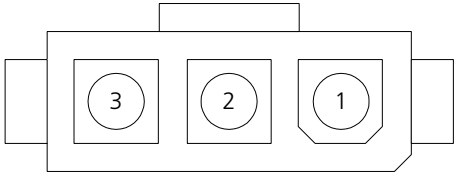
7 INTERFACES

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

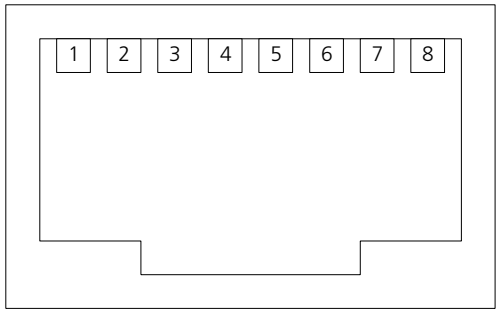
The DC Power Cable can be ordered from ATL, ATL Part Number (See Appendix B).

CABLE AM2048A DC POWER 6/910/000/423

7.3 COPPER TRANSMISSION LINE

The line interface connector on the unit is an 8-way RJ45 socket.

PANEL VIEW



1	Line 1 A
2	Line 1 B
3	n.c.
4	Line 2 A
5	Line 2 B
6	n.c.
7	n.c.
8	n.c.

The line cable supplied is a standard 3 metre screened Category 5 cable with an 8 way RJ45 plug on each end.

ATL part number 6/910/000/425 (See Appendix B).

7.4 SERIAL CONTROL

A VT100 compatible terminal can be plugged into the 9-way D-type c6nnecter on the front 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

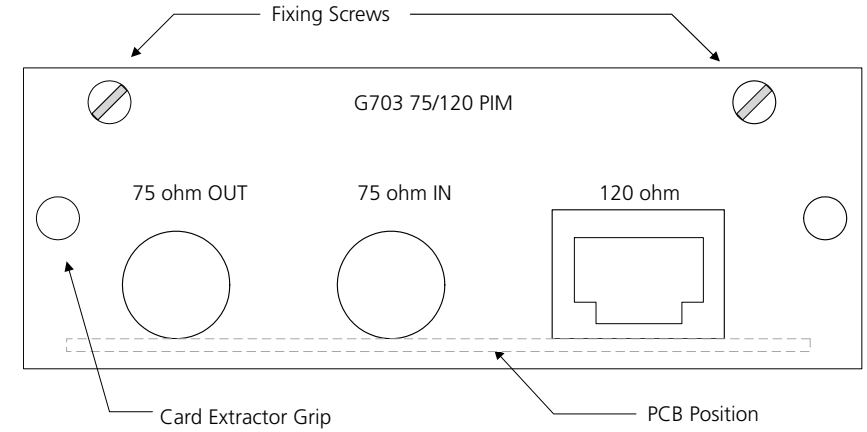
7.5 INTERFACE MODULES

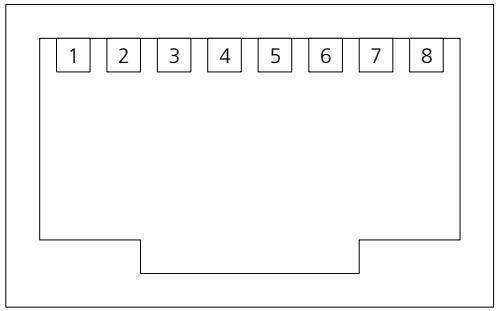
7.5.1 G.703

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.

7.5.3 V.35

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

Circuit	Interchange Circuit Name	Pins A	Pins B	Definition
102	Signal ground or Common Return	B		
103ϕ	Transmitted Data	P	S	From DTE to DCE
104ϕ	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
113ϕΔ	Terminal Signal Element Timing	U	W	103 changes at OFF to ON of 113
114ϕ	Transmitter Signal Element Timing	Y	AA	103 changes at OFF to ON of 114
115ϕ	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 ϕ are balanced V.35, unmarked circuits are to V.28.

Circuit marked Δ 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.

7.5.4 e-PIM

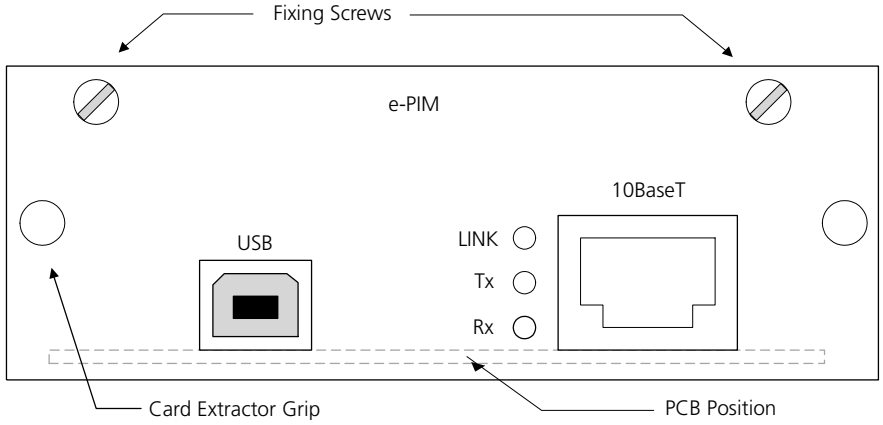
The Ethernet port is 10BaseT/100BaseT and the connector is RJ45, the pin-out is shown below.

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

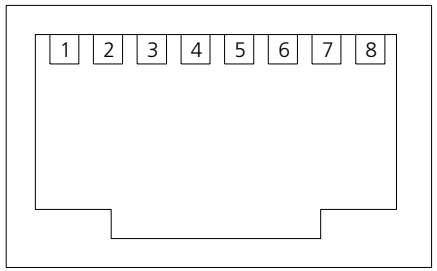
Ethernet Indicator LEDS

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 User Guide for further information.

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 C 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.

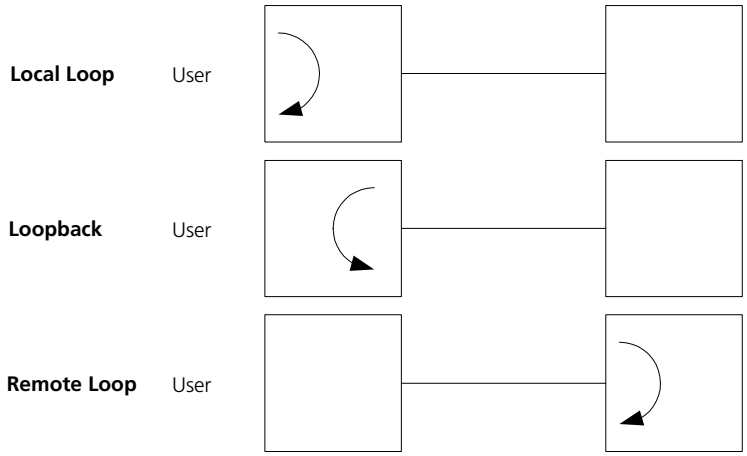
Note: When the units reboots it will be configured as a "Slave".

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.



7.6.2 Indicators

There are four tri-colour LEDs that provide status information. These are interpreted as follows:

LED	Red	Amber	Green	Off
Status	Urgent System Alarm(s) on	Non-Urgent System Alarm(s) on	OK	Power Off
Line 1	Loss Of Sync	High BER	OK	Not Applicable
Line 2	Loss Of Sync	High BER	OK	Not in use
Userport	Urgent Userport Alarm on	Non-Urgent Alarm on e.g. AIS	OK	Not Applicable

The single colour LED indicators are interpreted as follows:

Master (Green)

When lit, this LED indicates that 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 turned off.

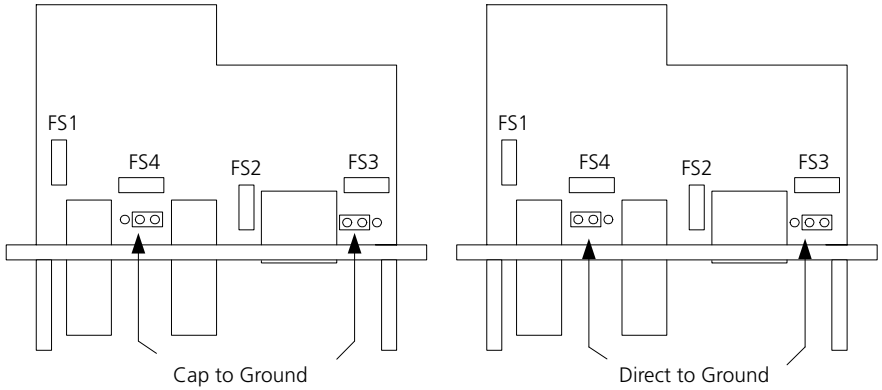
Test (Red)
This will be illuminated whenever:
the unit has a loop locally or remotely applied.
the unit is applying a remote loop.
the unit is running a data test.

8 INTERNAL LINKS AND FUSES

8.1 G.703 PLUG IN MODULE

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

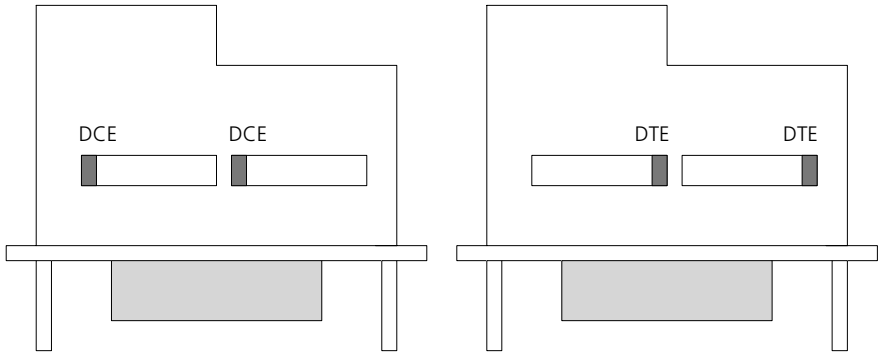
In all cases the factory default setting is shown on the left.



The 75ž G.703 receiver and the 120ž 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

The X.21 module may be configured as a DCE or DTE. The 120 termination is always in.

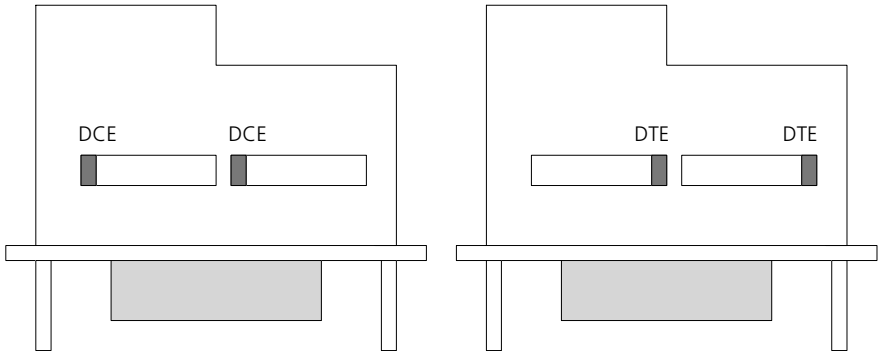


In DCE mode, the module may be configured to generate Byte Timing (B) or receive the DTE clock (X).

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

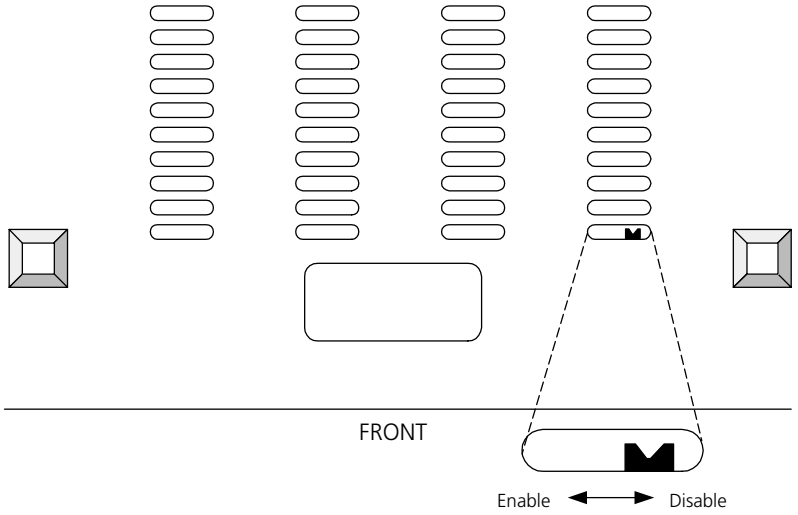
8.3 V.35 PLUG IN MODULE

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.



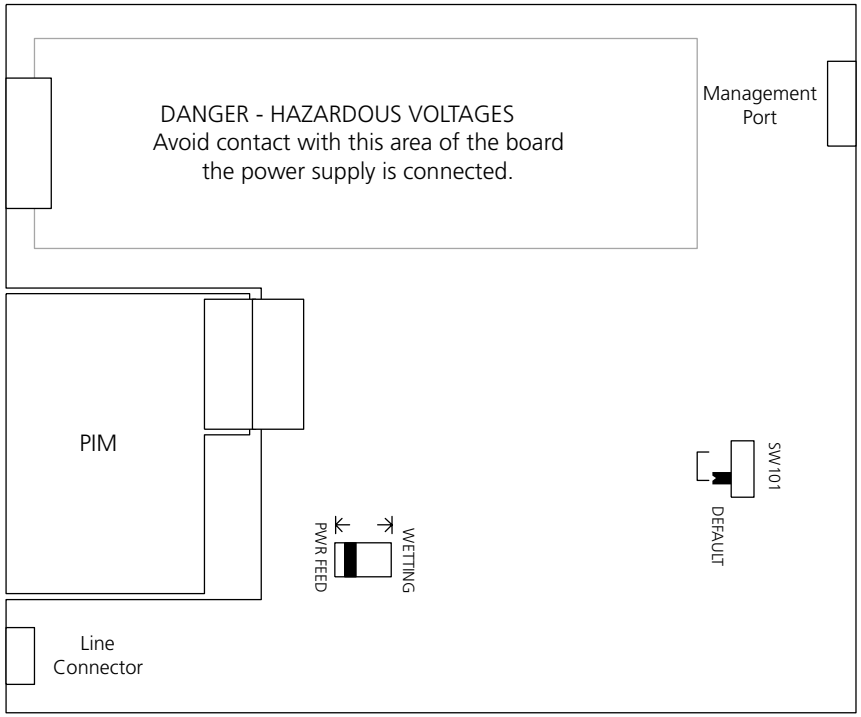
8.4 MOTHERBOARD

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.



MOTHERBOARD LINK SETTINGS

Link J1 is only fitted on the DC powered version and is factory fitted in the 'PWR Feed' position.

Power Feed - enables the unit to be line powered by an AM2048B card.

Wetting - configures the unit to return wetting current (line powering is not possible in this mode).

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

WARNING

Only authorised personnel are allowed to open the DSL System case to change the link settings. 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 unconditioned twisted pairs.

3 Check the correct pin connections are being used on the RJ45 line connector.

4 Check that the transmission distance is not beyond the range of the equipment. See section 6.

5 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 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 high error rate at one end of the link or there is a high error rate on one pair
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.

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 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 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.

Example results for 0.4mm gauge cable, white gaussian noise:

Line Length (km)	Noise Level	Error Rate	QF	S/N
2.75	OFF	0	280	33.9
2.75	0dBm	0	5200	21.2
2.75	+0.5dBm	1xE-7	5500	21.0
2.75	+0.9dBm	1xE-6	5600	20.9

Line Length (km)	Noise Level	Error Rate	QF	S/N
3.5	OFF	0	450	31.9
4.0	OFF	0	860	29.1
4.4	OFF	0	1800	25.8
4.5	OFF	1xE-7	2300	55.0

Line will not train, but I know the ELU and NTU are connected.
If an ELU running in two pair mode is connected to an NTU running in one pair mode, the transmission lines will never train.
Reprogram the ELU into one pair mode until synchronisation has been achieved and then set the system back to two pair mode. Both units will then be in two pair mode and there will be no problem. Warning: This will not work in the circumstance that the transmission line is too long to allow training at the higher single pair data rate.

My internal BERT test doesn't seem to work properly.
When running two AM2048 MKII's back to back in Structured G.703 mode using an internal timing source and transparently passing TS0, an internal BERT will not work.
Temporarily generate TS0 at the NTU. The internal BERT will then work correctly.

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

10 SYSTEM OVERVIEW

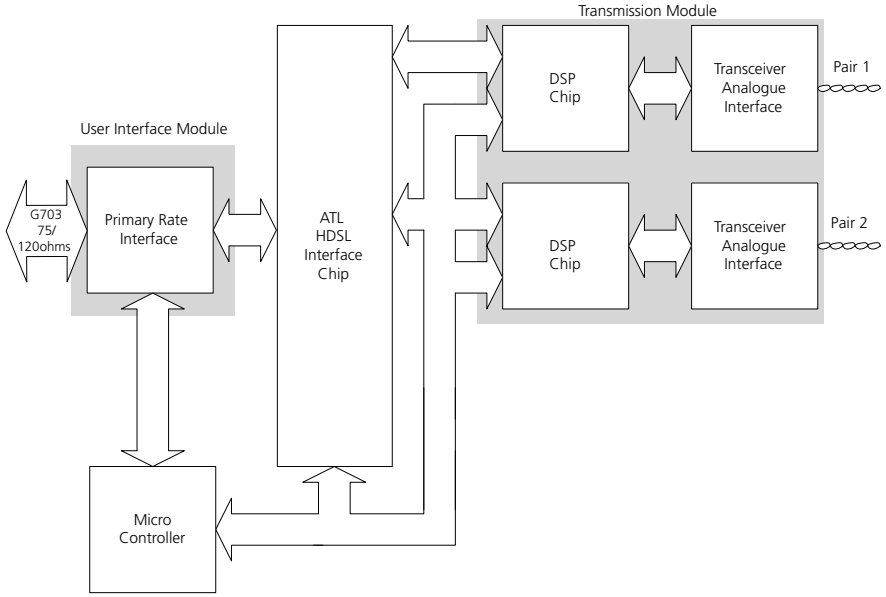


FIGURE 10.1 COPPER SYSTEM BLOCK DIAGRAM

10.1 COPPER TRANSMISSION

The copper system is intended for operation on 2-wire local telephone network circuits, such as those meeting BT EPS-9 (**Note**: The AM2048 requires either one or two such circuits). It will operate satisfactorily on unloaded lines having a wide range of characteristics; bridge taps can be tolerated, dependent upon their characteristics. Although, the system requires a base band circuit, a continuous loop at DC is not required. The system can transmit data at user port rates between 64k and 2048k.

For the copper system, echo cancellation is used to eliminate the unwanted reflections of the transmitted signal from the receiver input.

The line is connected to the transmission circuit via a line transformer, which acts as a balun and provides isolation; there is surge protection across the transformer line connections. The transmission circuit utilises a custom IC and a number of proprietary components to perform the signal processing described above.

When more than one transmission line is in operation, each transmission system operates with the same bit rate derived from an oscillator in the master unit.

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

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, 120Ω , unstructured
CTR13	G.703 2Mbps, 120Ω , structured

UK National Standards

NTR4	G.703, 75Ω
NTR14	Analogue Baseband

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;

ETS	European Telecommunications Standard
FAW	Frame Alignment Word
FIFO	First In First Out Buffer
FLASH	Non-volatile read/write memory
G.703	CCITT Recommendation G.703 (1988): "Physical/electrical characteristics of hierarchical digital interfaces"
G.704	CCITT Recommendation G.704 (1988): "Synchronous frame structures user at primary and secondary hierarchical levels"
G.706	CCITT Recommendation G.706 (1988): "Frame alignment and CRC procedures relating to basic frame structures defined in G.704"
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"
HD 384	Electrical Installation of Buildings (IEC 60364 series, modified)
IC	Integrated Circuit
IEC 61312-1	Protection against lightning electromagnetic impulse; Part 1 General Principals
ISO	International Standards Organisation
LED	Light Emitting Diode
LT	Line termination (Same as ELU)
LVD	Low Voltage Directive
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
RAM	Random Access Memory
SAn	G.704 Timeslot 0 spare bit n
SDH	Synchronous Digital Hierarchy
SELV	Safe Extra Low Voltage
SNMP	Simple Network Management Protocol
TC-PAM	Trellis Coded Pulse Amplitude Modulation
TE	Terminal Equipment
TSn	Timeslot n
TNV	Telecommunications Network Voltage
USB	Universal Serial Bus
VT100	Industry standard character based terminal
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
V.35	CCITT Recommendation V.24 List of definitions for interchange circuits between DTE and DCE
X.21	CCITT Recommendation X.21 Interface between DTE and DCE for synchronous operation public data networks
2B1Q	Line code where 2 binary bits are coded into 4 (quaternal) discrete levels

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.

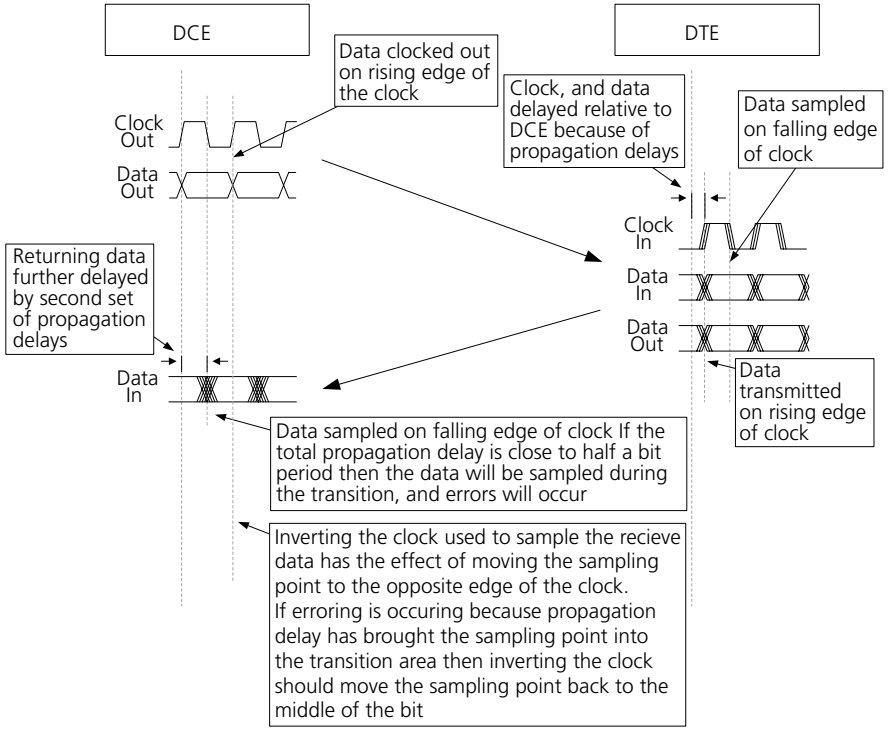


FIGURE A1 - RECEIVE CLOCK INVERSION

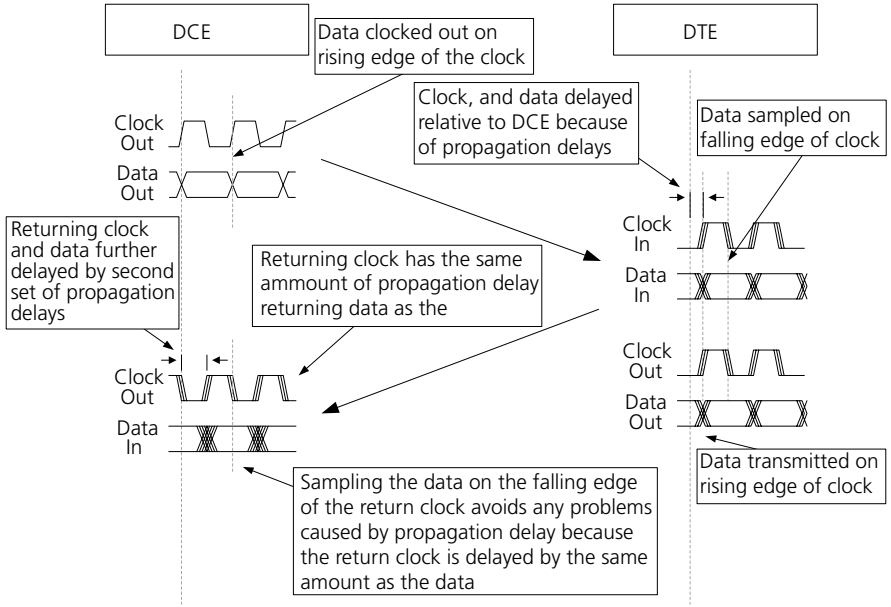


FIGURE A2 - DTE RETURN CLOCK OPERATION

APPENDIX B – ORDERING INFORMATION

KEY

User Interfaces

G.703	X = 1
X.21	X = 2
V.35	X = 3
e-PIM 10/100BaseT	X = 4

Desktop Units	**Order Code**
AM2048A G.SHDSL, Two Pair, Mains power	1/298/14X
AM2048A-1 G.SHDSL, Single Pair, Mains power	1/298/17X
AM2048A G.SHDSL, 2B1Q DC / line power	1/298/24X
AM2048A-1 G.SHDSL, Single Pair, DC / line power	1/298/27X

Example order code

1/298/173	AM2048A-1 Single Pair Mains Power TC-PAM Transmission User interface V.35

Spare User Interfaces	**ATL part number**	**Order Code**
G.703	2/298/001	1/298/001
X.21	2/298/002	1/298/002
V.35	2/298/003	1/298/003
e-PIM 10/100BaseT	2/298/004	1/298/004

Accessories	**ATL part number**	**Order Code**
AM2048 DC Cable	5/500/000/037	1/187/314
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 and optical transmission, please contact your ATL representative.

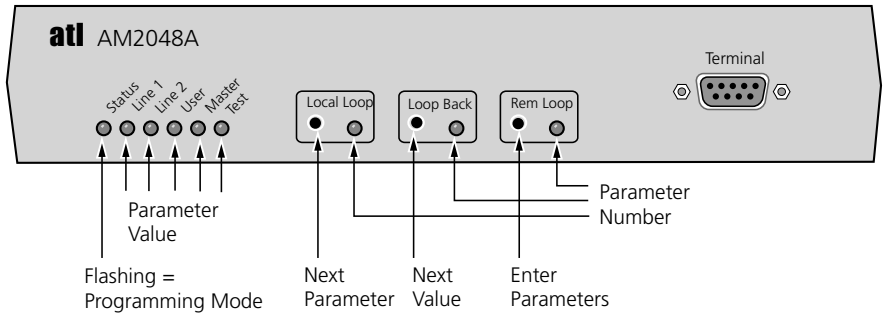
APPENDIX C – PROGRAMMING FRONT PANEL

INTRODUCTION

For users that don't have access to a PC or prefer to configure the AM2048A 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.

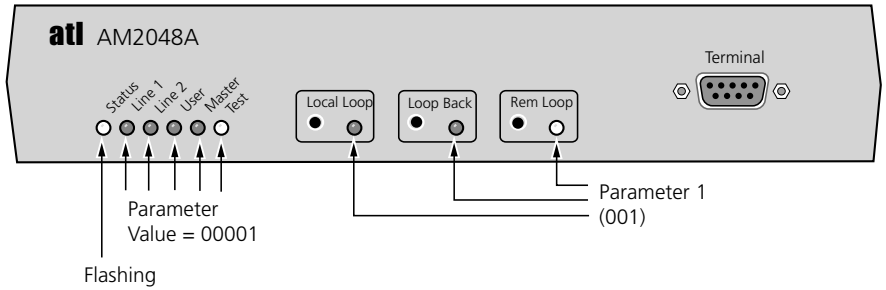
The front panel buttons and indicators are used as follows:



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).



In the above example, parameter 001 is displayed with a value of 00001. It can be seen from table C1 that parameter 001 is the master / slave and number of lines setting, and that value 00001 indicates that the modem is in Slave Mode with two transmission lines active.

Press "Loop Back" to step through the available values.

Press "Local Loop" to step to the next parameter.

Remember to press "Remote Loop" to store the parameter values and reboot the modem once all parameters have been set to the desired values.

Table C1 provides a full list of the parameters and their values available for programming using the front panel controls.

Note: You may not configure (via the front panel) an AM2048 MKII NTU's (Far end) User Port parameters until AFTER the ELU has determined what type of user port the far end has.

The ELU will determine the user port of the far end automatically, as soon as one transmission line has trained. I.e. Line 1 or Line 2 status LED is not red. All other configuration parameters may be changed as required to get to this state.

Note: The front panel controls can only be used for configuration of point to point working modes. Not all parameters that can be set via the VT100 screens can be set via the front panel controls (e.g. idle pattern on G.703 interface). Anything previously set by the VT100 screens that cannot be accesed from the front panel controls will remain unchanged. Values that are set via the front panel will override screen settings.

Note: Front Panel configuration should only be done (initially) after the unit has been cold booted. This is because some configuration options which are settable via VT100 are incompatible with the more limited range available on the front panel.

Note: The unit which is to be Master, should be set as such (via the front panel), and rebooted into master mode before any other configuration is undertaken. This is because certain configurations are not possible when in Slave mode. This matches the existing enforced functionality of the unit.

Parameter Number	LL	LB	RL	Value	Meaning
1	0	0	1	00000 00001 00010 00011	Slave - 1 Line Slave - 2 Lines (Default Value) Master - 1 Line Master - 2 Lines
2	0	1	0	00000 00001 00010 00011 00100	Line Rate 512kbps Line Rate 768kbps Line Rate 1024kbps (Default Value) Line Rate 1536kbps Line Rate 2048kbps
3	0	1	1	00000 00001 ... 11110 11111	User Rate 64kbps User Rate 128kbps ... User Rate 1984kbps User Rate 2048kbps (Default Value)

TABLE C1 - Non G.SHDSL

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

Parameter Number	LL	LB	RL	Value			
X21/V35 Interface					**Clamp**	**FIFO**	**Invert Rx Clock**
4b (ELU)	1	0	0	00000	Off	Disable	OFF
				00001	Off	Disable	ON
				00010	Off	Enable	OFF
				00011	Off	Enable	ON
				00100	On	Disable	OFF
				00101	On	Disable	ON
				00110	On	Enable	OFF
				00111	On	Enable	ON
5b (NTU)	1	0	1	00000	Off	Disable	OFF
				00001	Off	Disable	ON
				00010	Off	Enable	OFF
				00011	Off	Enable	ON
				00100	On	Disable	OFF
				00101	On	Disable	ON
				00110	On	Enable	OFF
				00111	On	Enable	ON

TABLE C3.1 - G.SHDSL and Non G.SHDSL

Notes:

1. Each bit in the parameter value controls a specific paramer (i.e. for the G.703 interface - bit 0 controls the connector impedance, bit 1 the CRC, bit 2 controls whether or not it is structured and bit 3 controls the timing). When bit 2 is set to unstructured, then the value of bit 1 (CRC) is ignored and is always interpreted as “Off”.
2. In 4b and 5b, “Clamp” refers to the C circuit for X21 interfaces, and circuit 105 for V35 interfaces.
3. In 5a and 5b, these options must be set at the ELU and will be downloaded to the NTU. They can’t be changed at the NTU.