MDU 2048

User Guide

AM768A

22 OCT 1999

AM2048A

AM2048A OPTO

- March 1999.

Contents

1. Introduction

This manual applies to the High Speed DSL Systems, designed and manufactured by Ascom Telecommunications Ltd in the U.K..

There are three variations of user interface, each with a different physical data interface circuit. There are two varieties of transmission interface, copper and optical.
The Ascom Telecommunications Ltd. part numbers are as follows for:

1. Optical Transmission		
AM2048A OPTO	G703 (75/120) :	1/187/501/100
AM2048A OPTO	X.21 :	1/187/502/100
AM2048A OPTO	V.35:	1/187/503/100
2. Three pair Copper Transmission		
AM2048A	G703 (75/120):	1/187/511/100
AM2048A	X.21 :	1/187/512/100
AM2048A	V.35:	1/187/513/100
3. Single Pair Copper Transmission		
AM768A	G703 (75/120) :	1/187/521/100
AM768A	X.21 :	1/187/522/100
AM768A	V.35:	1/187/523/100

The AM768A is a reduced cost unit, available with a single transmission module. This has most of the functionality of the AM2048 but reduced payload bandwidth due to using one transmission line instead of three.

Throughout the handbook, all types of unit are referred to as DSLU (Digital Subscriber Line Unit)

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 modems can provide synchronous communications at user data rates between 64kbps and 2048kbps over up to three twisted pair cables or a single mono mode optical fibre.

The DSLU can easily be configured via a dumb terminal. It is recommended to use a VT100 terminal emulation program running on a notebook or palmtop PC. Using the menu system with on-line help should reduce the need to refer to the handbook.

Once configured, the operation of the DSLU 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.

The VT100 Management User Guide gives a full description of the menu system..

1.1 International Models

Modifications to line cords and power supply leads are available for country specific requirements. In such cases, line cord pinout may be different. The basic model is the same, line cords and power cords are separate plug in items.

2. Constructional Details

The desktop unit is housed in a black plastic case. The membrane front panel contains 4 LED indicators.

1. Urgent Alarm
2. Non Urgent Alarm
3. Test
4. Power

On the rear panel there are the following connectors:

–48V DC supply inlet socket	3-pin mini-fit
line interface	8 way RJ45 (Copper) FC/SPC (Optical)
Management port interface	9 way female D-type
Alarm interface	13 way circular DIN
Data Ports (depending on module fitted)	
G703 120Ω	8 way RJ45
G703 75Ω	BNC
X21	15 way D-type female
V35	34 way MRAC female

The data interface connector type will be from one of the three user specified interfaces available. They are detailed in section 5. 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.

Also included is a 3 metre screened, stranded, Category 5 line cord terminated in 8-way RJ45 plugs at both ends.

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).

3. System Overview

The DSLU uses the digital transmission systems designed and developed by Ascom Telecommunications Ltd. in Cardiff, U.K.

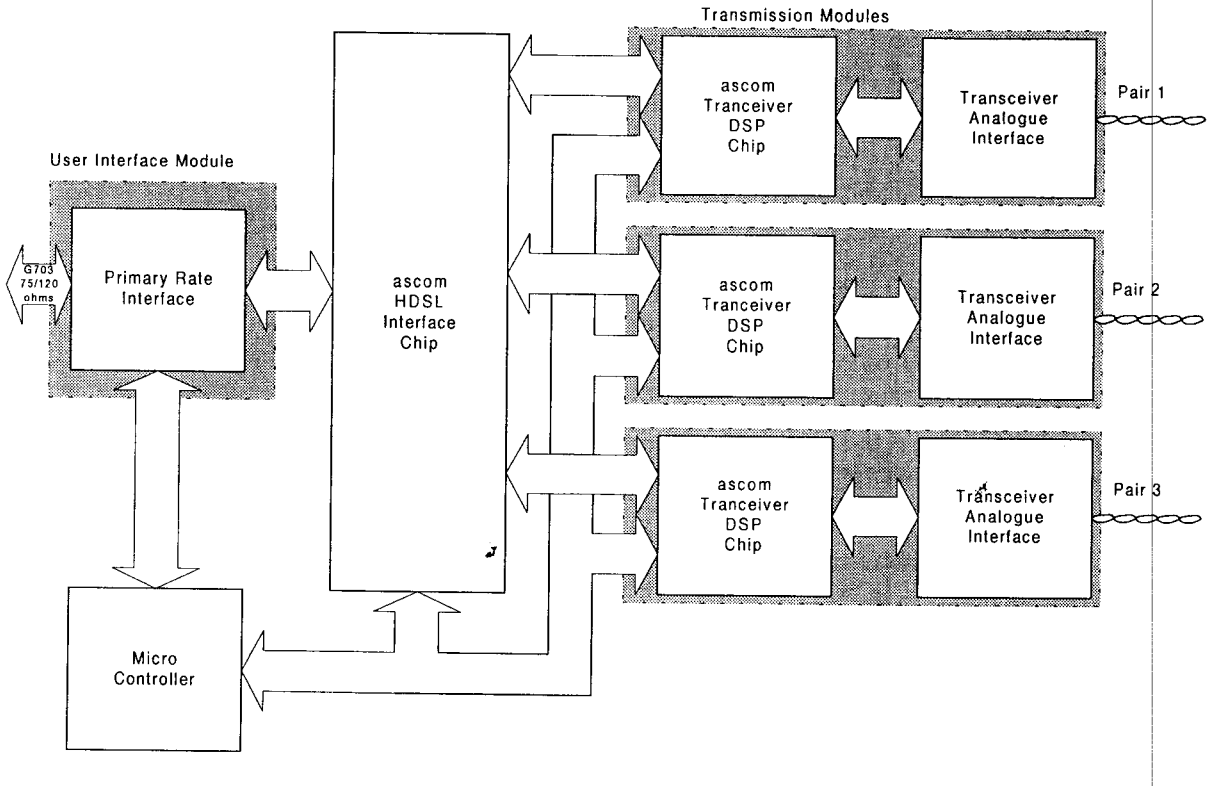


Figure 1 Copper System Block Diagram

3.1 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 DSLU requires between one and three 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 baseband circuit, a continuous loop at DC is not required. The system line signal code is 3B1O. The system can transmit data at 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 echo canceller can eliminate echoes of up to 16 bit periods duration. To counteract the signal distortion inherent in long lines the system employs, adaptive decision feedback equalisation to eliminate trailing intersymbol interference; this also has a span of 16 bit periods.

A fixed linear equaliser is incorporated to control the received pulse waveform and to reduce the effect of long tails of both echo and transmission responses. Digital signal processing is used throughout to achieve high performance reproducibly. A block diagram of the units is shown in figure 1

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.

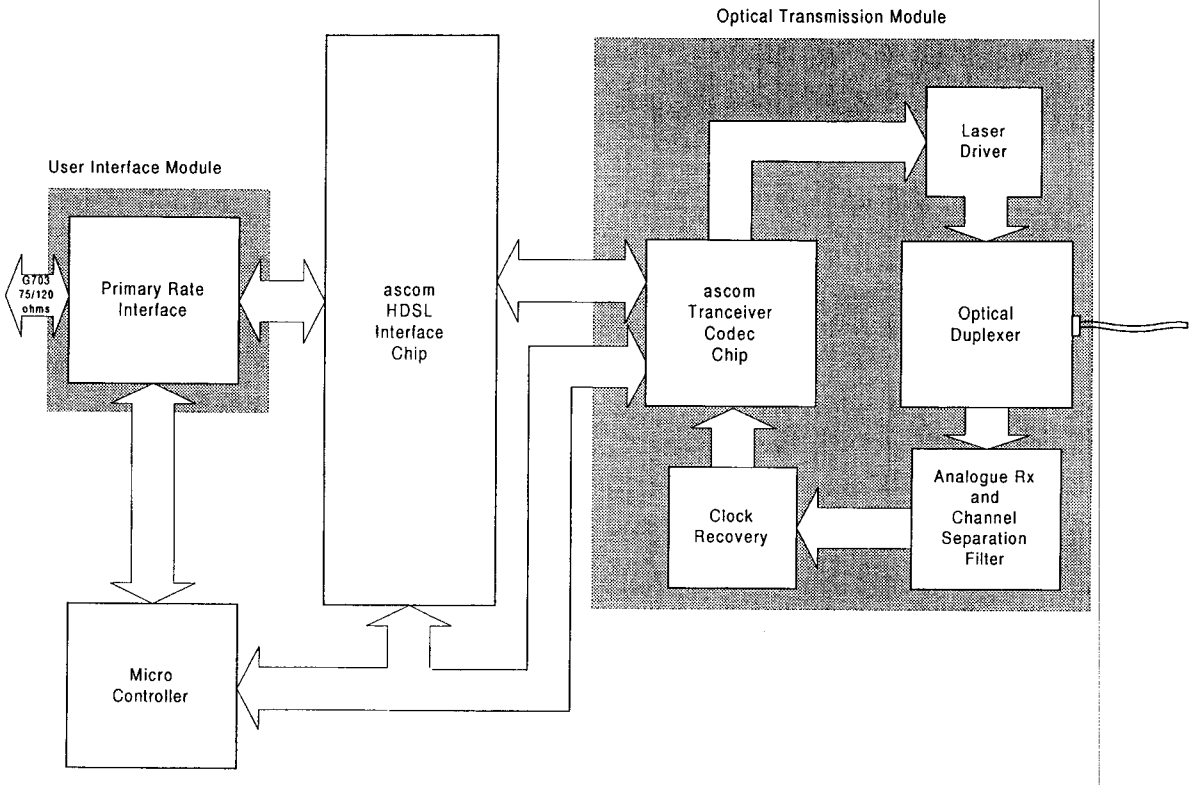


Figure 2 Optical System Block Diagram

3.2 Optical Transmission

The optical transmission interface module fits into the same envelope as three copper modules and 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.

The AM2048A OPTO is a Class I product in accordance with EN60825-1 and therefore inherently safe.

3.3 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 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.

3.4 DSL Interface Chip

A 6ms reference pulse is derived from the incoming user clock. (This equates to 48 PCM frames or their equivalent when operating at nx64K). The transmit DSL frame is then locked to this reference waveform by the use of the stuff bits.

An internal lookup memory is used to store the destination of the incoming and outgoing user octets. e.g. TS0 and TS16 are broadcast on all pairs, whereas TS1 may be sent on Line1 TS1. This may also be programmed by the user.

Data entering at the user port is then directed into a transmit FIFO for a particular transmission line depending on the value in the lookup memory. Data is clocked out of the FIFO by the transmit DSL frame.

At the DSL receiver, one channel is automatically selected as the reference channel for timing recovery purposes. A 6ms reference pulse is generated from the reference channel's received DSL frame. A 6ms reference clock is also generated from the recovered user rate clock. A digital phase locked loop is used to keep the two reference signals in lock and so recover the user clock.

Data entering from the DSL line is directed to the receive FIFO. Data is clocked out of the received FIFO as instructed by the data stored in the lookup memory.

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 X21 or V35 interfaces, there is only a single clock at each user interface.)

Byte timing is maintained by the transmission system and is available if required.

The chip contains local loop and remote loop request pattern detectors for X.21 operation.

3.5 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 from the ELU to the remote NTU over the line.

3.6 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 easily be integrated into the alarm systems of other equipment.

3.7 User Interface Modules

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

- G.703, with software selectable 75ohm or 120ohm ports
- X21
- V35

The existing interface module can be changed out using a pluggable replacement unit. These can be ordered separately using the part numbers detailed below.

- G.703 -BNC/RJ45 Part number – 2/187/002/100.
- X.21 -15 way D-type socket Part number – 2/187/004/100.
- V.35 -34 way MRAC socket Part number – 2/187/005/100.

4. Installation

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

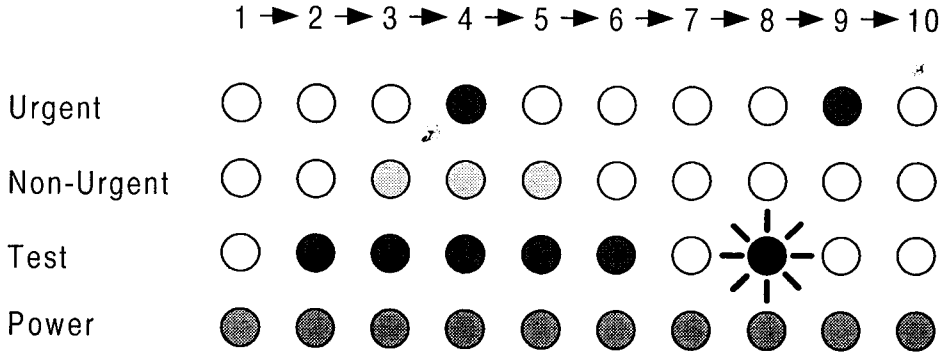
4.1 Connection of Protective Earth

If it is required to connect the G703 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 Section 8.1.6.

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 Section 8.2.2

4.2 Power On Sequence

With no DTE or line connected to the DSLU 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 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. The log on screen should appear automatically once the DSLU detects the terminal.
Type 'C' to select Configuration, then press 'Enter'
Type 'ascom' the default password setting, then press 'Enter'
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'.

4.4 Setting Master/Slave mode.

For all modes of operation, one unit must be set to *master mode*, while the other unit is set to *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.

The factory default is for the unit to be configured as a slave (NTU).

To change the setting, using the terminal go to the "Configuration>Master/Slave" screen and select the appropriate option. 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

At the slave end:
The factory default setting should allow the units to get into sync, otherwise:
Configuration>Master/Slave

4. select Slave.
5. select Point- to Point or Point to Multipoint, as appropriate.
6. enable the required number of lines

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.

4.5 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 X21 and V35, 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.

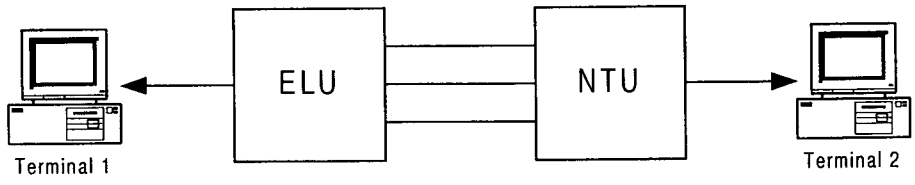
4.6 Selecting the Circuit Configuration

The term 'digital section' refers to the data link between the user ports of the connected DSLUs.
In a standalone section, the DSLUs provide the complete transmission system.
In a tandem section, the DSLUs are used to extend an existing circuit or network port. To achieve synchronous data transfer, the master DSLU must derive its timing from the circuit to which it is connected.
A Point to Point link requires two DSLUs, one master and one slave.
A Point to Multipoint link can have up to four DSLUs, one master and up to three slaves.

The DSLU 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 DSLU connected to the tandem section is configured as the master.
Please refer to the diagrams on the following pages.

4.7 Point to Point Link

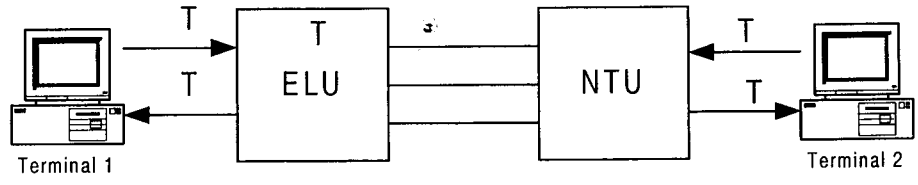
4.7.1 Standalone Section



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

4.7.1.1 G.703 to G703 Internal Timing

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

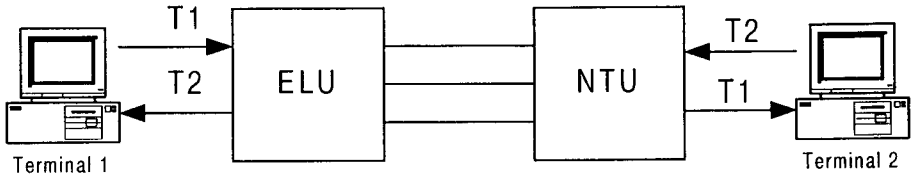


The internal clock T is generated at the ELU, both terminals lock to this clock and return the clock T to the DSL units. An elastic store in the DSLUs buffers the framed data.
Using the "Configuration > User Port" Menu:

1. At the ELU, select the 'Internal' timing option
2. Using F8, cycle to the NTU user port, select the 'Internal' timing option
3. Press 'Return' to enter the changes.

4.7.1.2 G.703 to G703 Transparent Timing

One of the connected terminals acts as a master, the other is a slave. However, both terminals could operate independently or pleisiochronously.

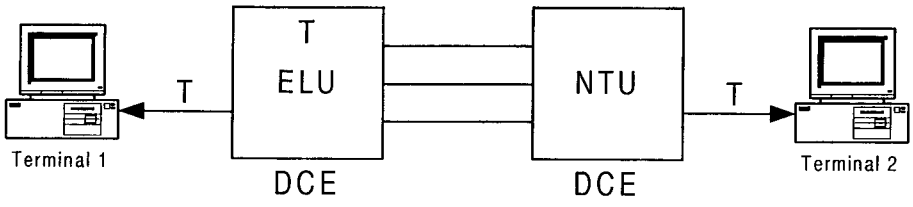


Clocks T1 and T2 are independent of one another and are transported independently through the DSL system.
Using the "Configuration > User Port" Menu:

4. At the ELU, select the 'Transparent' timing option
5. Using F8, cycle to the NTU user port, select the 'Transparent' timing option
6. Press 'Return' to enter the changes.

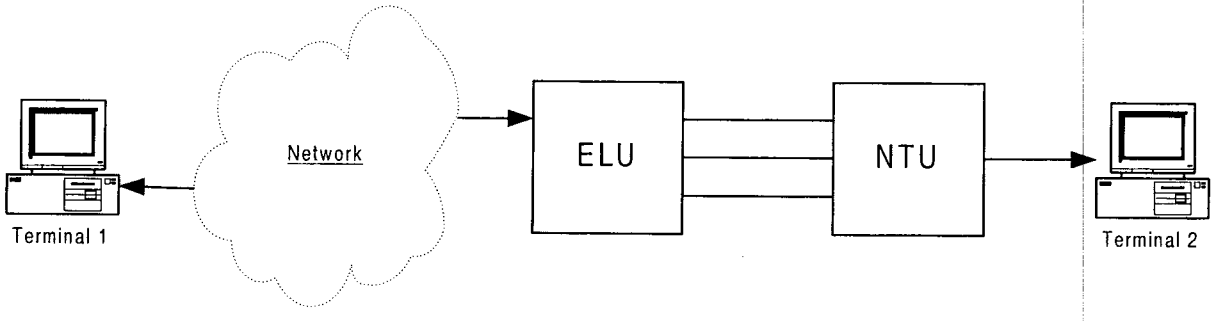
4.7.1.3 X21/V35 DCE to X21/V35 DCE

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.



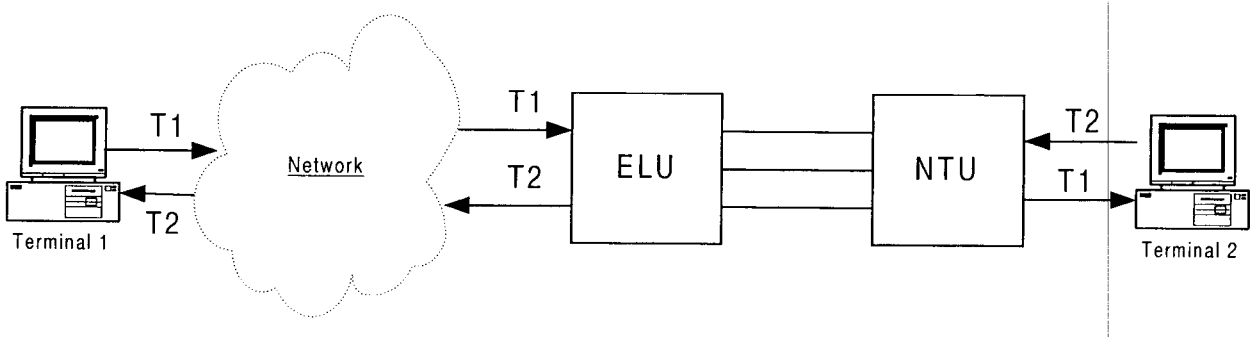
4.7.2 Tandem Section

For the following configurations, the DSLUs are connected in series with another transmission system or equipment



4.7.2.1 G.703 to G703 Transparent Timing

The timing for each terminal is carried independently across the digital section.

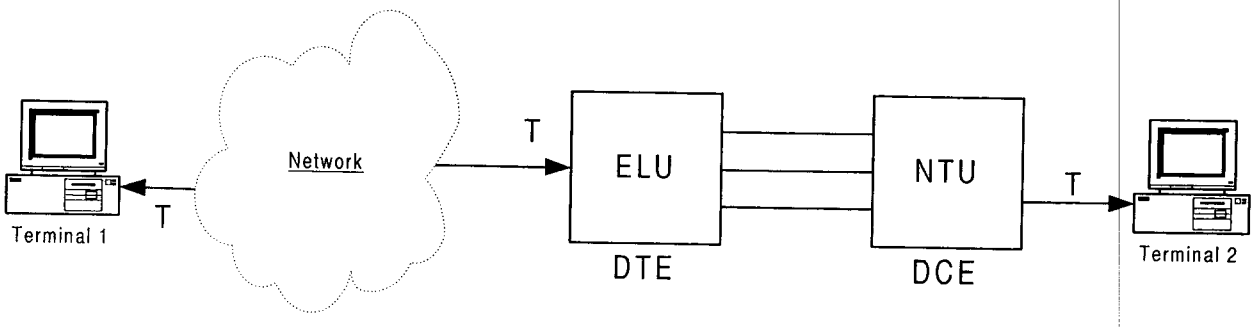


Using the "Configuration > User Port" Menu:

7. At the ELU, select the 'Transparent' timing option
8. Using F8, cycle to the NTU user port, select the 'Transparent' timing option
9. Press 'Return' to enter the changes.

4.7.2.2 X21/V35 DTE-to X21/V35 DCE

The plug in module at the master end of the digital section must be configured as a DTE. This allows timing to be recovered from the timing output from the tandem system.

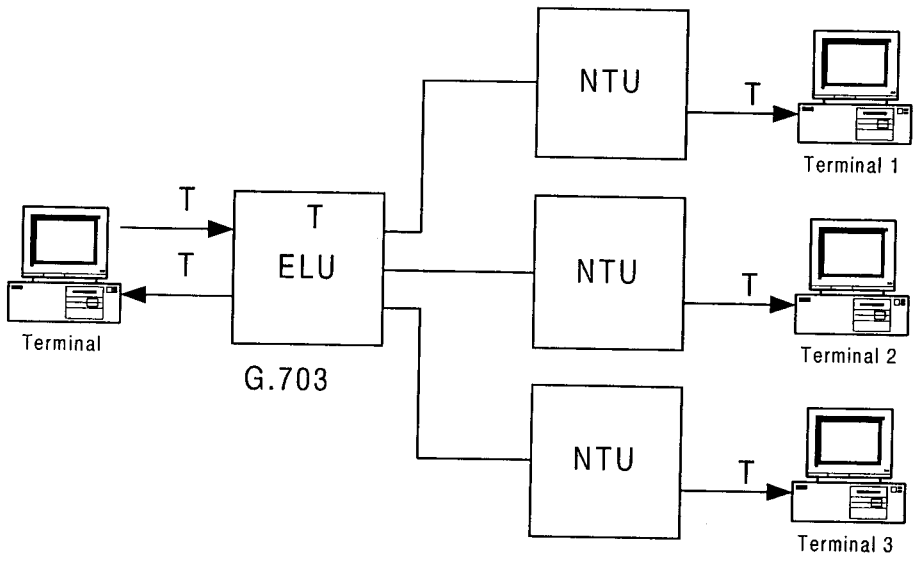


4.8 Point to Multipoint Link

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 X21 and V35).

4.8.1 Standalone Section



4.8.1.1 G.703 to G.703

A clock 'T' inside the master DSL unit provides the reference clock for the entire system.
Using the "Configuration > User Port" Menu:

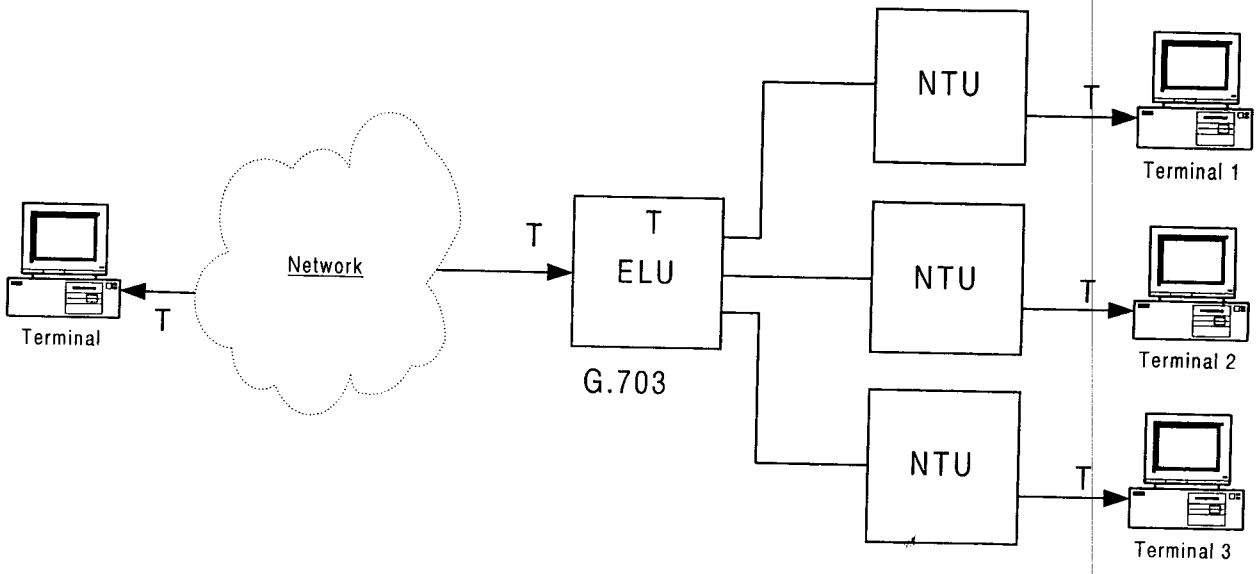
10. At the ELU, select the 'Internal' timing option
11. Using F8, cycle through the remote user ports, selecting the 'Internal' timing option
12. Press 'Return' to enter the changes.

4.8.1.2 G703 to X21/V35

A clock inside the master DSL unit provides the reference clock for the entire system.
Using the "Configuration > User Port" Menu:

1. At the ELU, select the 'Internal' timing option
2. Press 'Return' to enter the changes.

4.8.2 Tandem Section



4.8.2.1 G.703 to G.703

The master DSL unit locks on to the incoming clock 'T', this clock is passed to the remote terminals 1, 2 and 3.
Using the "Configuration > User Port" Menu:

1. At the ELU, select the 'transparent' timing option
2. Using F8, cycle through the remote user ports, selecting the 'Internal' timing option
3. Press 'Return' to enter the changes.

4.8.2.2 G703 to X21/V35

The master DSL unit locks on to the incoming clock 'T', this clock is passed to the remote terminals 1, 2 and 3.
Using the "Configuration > User Port" Menu:

1. At the ELU, select the 'transparent' timing option
2. Press 'Return' to enter the changes.

4.9 Bringing into Service

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 which 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 is programmable by the user to match the tables found in 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.")

4.10 Transmission Range

4.10.1 3B1O Copper System

The equipment is designed to meet the performance limits specified in ETR 152. This specification defines bit error rate performance for DSL systems in the presence of noise over a variety of cable loops. Most of the test loops are combinations of different gauge cable to simulate reflections caused by cable impedance mismatch at cable joints.

The table below gives the noise limited range for a continuous length of the same gauge cable.

Cable diameter (mm)	Noise Limited Range (km)
0.4	2.8
0.5	3.9
0.63	5.0
0.9	6.3

4.10.2 Optical System

The system operates from 0dB to 25dB of optical attenuation, which equates to a transmission distance up to 60km of single-mode (8/125) fibre. Over shorter distances, the system will also operate over multi-mode (50/125) or (62.5/125) fibre. The maximum transmission distance on multi-mode fibre depends on both the dispersion and numerical aperture of the fibre, but should be at least 15km.

5. G703 Interface Options

5.1 Unstructured Operation

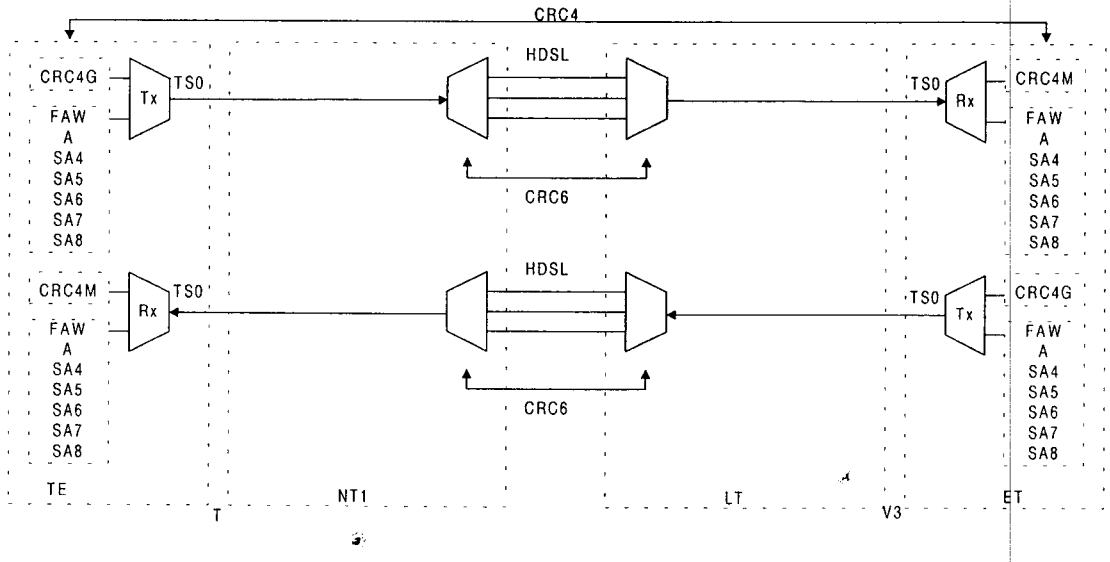


Figure 3 : Unstructured Operation

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, nothing is assumed about the user data.

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	[ ]

5.2 Structured Operation

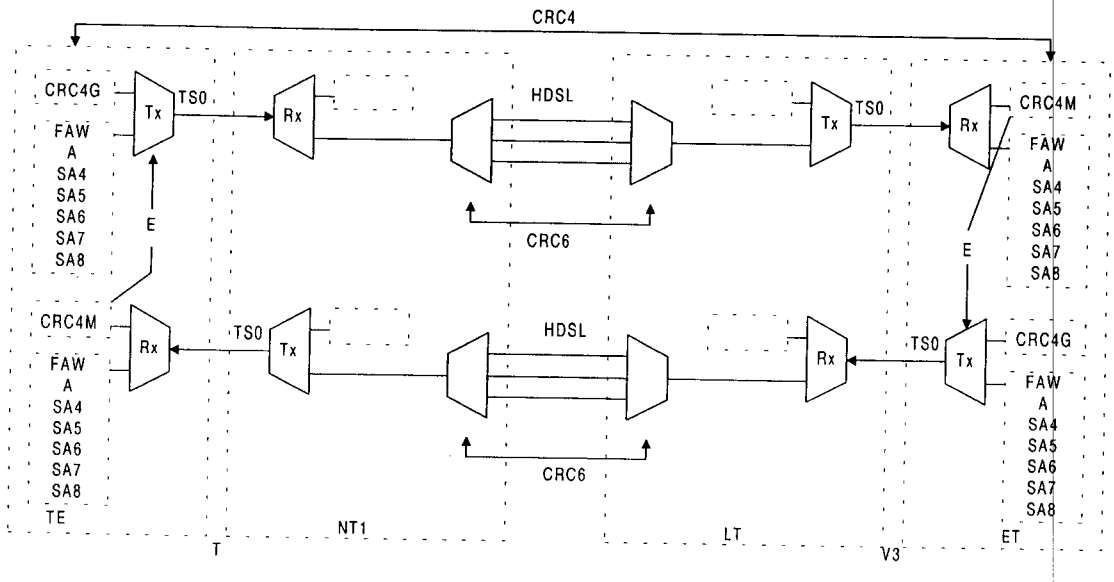


Figure 4 : Structured Working, End to End transparent CRCs

For fractional working where not all pairs are equipped, the G.704 frame is padded out with the programmable 'Idle' pattern.

To set up for structured working with transparent CRCs, 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 monitored for 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.

5.3 Structured Working, CRCs Enabled

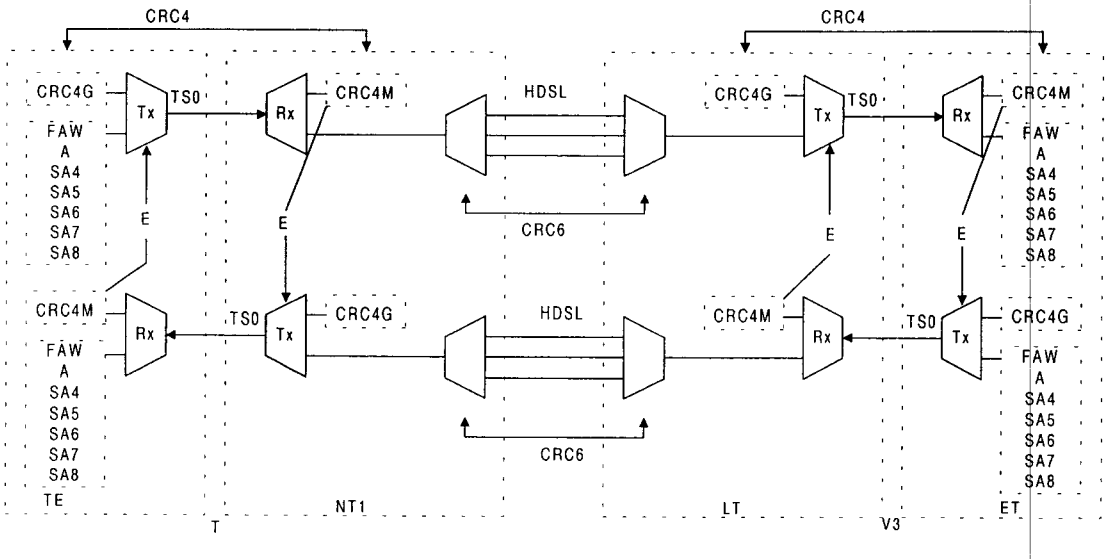


Figure 5 : Structured Working, CRCs Enabled

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

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

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

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

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

5.4 ETS 300 233 Loopbacks

Loop 1 and Loop2 may be activated by sending patterns using spare bits 5 and 6 in TS0.

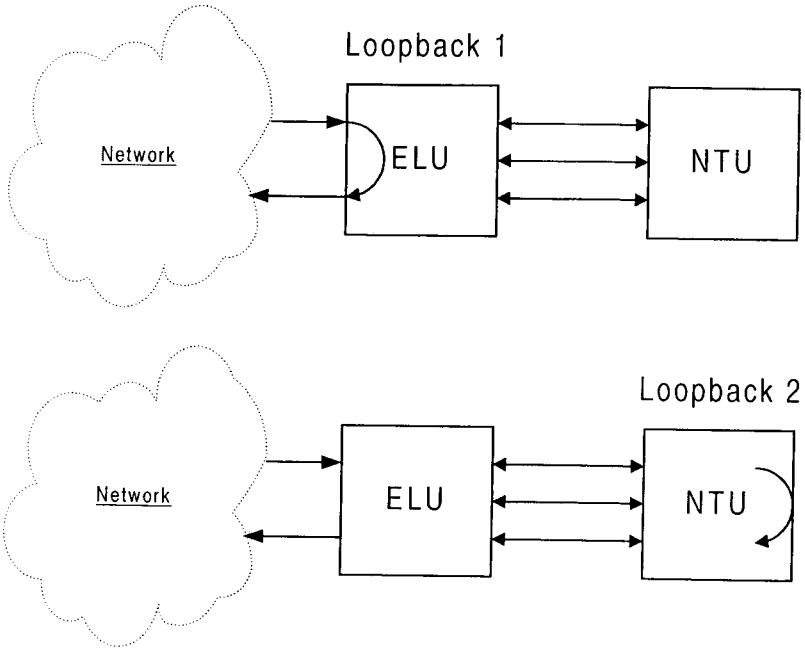


Table 1 CrC4 Multiframe Structure

	Sub-multiframe	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 Loopback code definitions

State	DS-ET	Sa5	Sa6
Loopback 1 command	<--	0	1111
Loopback 2 command	<--	0	1010
Loopback acknowledge	-->	0	XXXX
Loopback release command	<--	0	0000

These loop activation codes are only detected at the G703 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.

6. Physical Interfaces

6.1 Mains Power Supply

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

6.1.1 240V Plug Top PSU

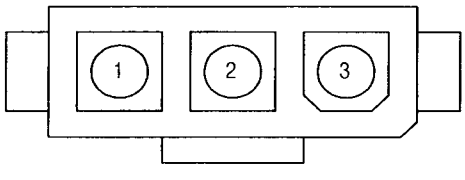
This unit is a basic UK plug top with two core screened cable terminated in a 3 way mini-fit connector.
Lead length 1.8m
Ascom part number 5/500/000/037

6.1.2 110V In-line PSU

On this unit, the mains connector is a standard 3 pin IEC 320 input.
Lead length 1.8m
Ascom part number 5/500/000/038

6.2 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 screw)

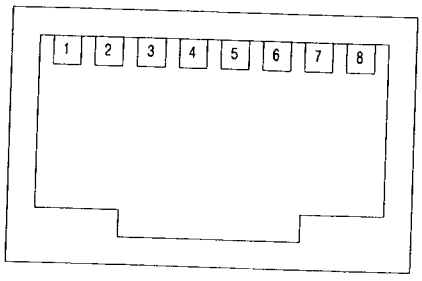
Mating connector
Molex Minifit Junior Receptacle Molex Part Number: 39-01-4031
Molex female contact Molex Part Number: 39-00-0039

The DC Power Cable can be ordered from Ascom, Ascom Part Number
CABLE AM2048A DC POWER 6/910/000/423

6.3 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	Line 3 A
8	Line 3 B

The line cable supplied is a standard 3 metre screened Category 5 cable with an 8 way RJ45 plug on each end.
Ascom part number 6/910/000/425

6.4 Optical Transmission Line

The rear panel optical connector is FC/SPC. 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 (±1dB) at 1310nm.

6.5 Serial Control

A VT100 compatible terminal can be plugged into the 9-way D-type on the rear panel.
The socket is wired to allow a straight connection to a PC serial port.
For a full description of the menu system, refer to the 'VT100 Management User Guide'.

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

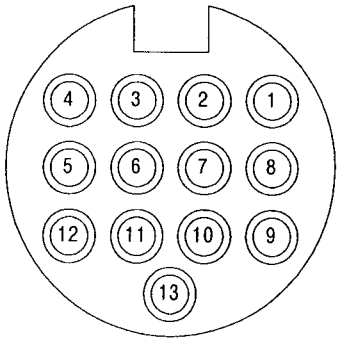
The serial control cable can be ordered from Ascom,

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

6.6 Alarm Input/Output Port

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

PANEL VIEW



1	RELAY 1 CLOSED = Urgent Alarm
2	RELAY 1 COMMON
3	RELAY 1 OPEN = Urgent Alarm
4	RELAY 2 CLOSED = Non-Urgent Alarm
5	RELAY 2 COMMON
6	RELAY 2 OPEN = Non-Urgent Alarm
7	ALARM INPUT 1
8	ALARM INPUT 2
9	ALARM INPUT 3
10	ALARM INPUT 4
11	ALARM INPUT 5
12	ALARM INPUT 6
13	GND

Figure 6 - Alarm Connector

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.

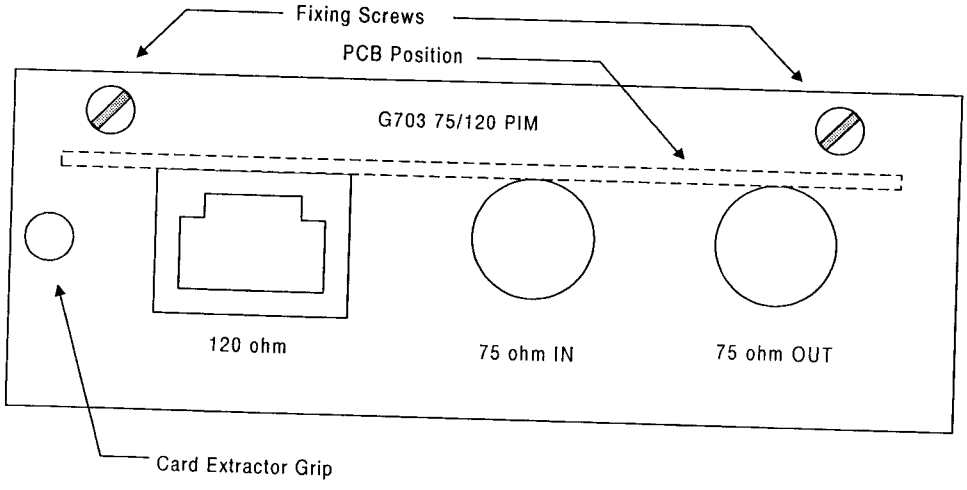
The alarm inputs are available at both the ELU and the NTU and may be used for alarm collection from other equipment, e.g, door open alarm, battery low alarm, temperature alarms etc. The alarm inputs detect a short circuit between the alarm input pin and GND (pin 13)

Mating connector -	Ascom Part Number
CONN 13 WAY PLG	6/313/000/002
Screened Cable Assembly-	Ascom Part Number
CABLE AM2048A ALARM	6/910/000/424

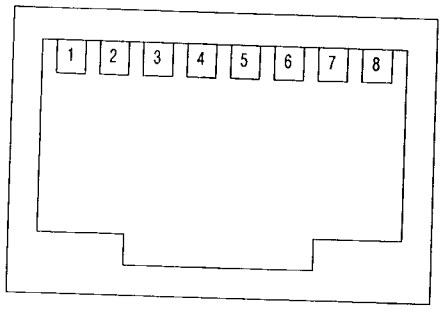
6.7 Interface Modules

6.7.1 G703

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.



RJ45



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

6.7.2 X21

V11 refers to ISO 4903 for the connector pin-out.

Circuit	Interchange Circuit Name	Pins A.....B		Definition
G	Signal ground or Common Return	2		
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
F	Frame Start Identification			Not used
X	DTE Signal Element Timing			Not used

The clock rate is set up using the "Configuration > User Port" Menu.
Select the required value of N for Nx64K circuits.
DTE – DCE mode is selected using Link 1
Terminated or Unterminated receive interchange circuits may be selected using Link 2

6.7.3 V35

V35 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	
103Ø	Transmitted Data	P	S	From DTE to DCE
104Ø	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
113ØX	Terminal Signal Element Timing	U	W	103 changes at OFF to ON of 113
114Ø	Transmitter Signal Element Timing	Y	AA	103 changes at OFF to ON of 114
115Ø	Receiver Signal Element Timing	V	X	Centre of bit on 104 ON to OFF on 115
140	Remote Loopback		N	
141	Local Loopback		L	
142	Test Indicator		NN	

Circuits marked Ø are balanced V35, unmarked circuits are to V.28
Circuit marked X 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.

6.8 Front Panel LEDs

The following indicators exist on the front panel:

(1) Power (Green)

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

(2) Test (Red)

This will be illuminated whenever the unit has a loop locally or remotely applied.
When the unit is applying a remote loop.
When the unit is running a data test.

(3) Non-Urgent Alarm (Yellow)

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

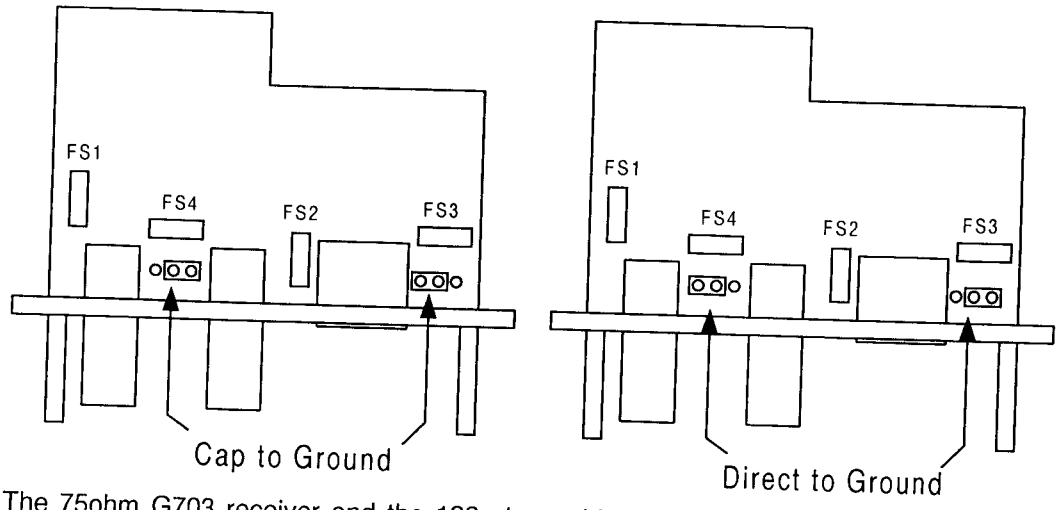
(4) Urgent Alarm (Red)

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

7. Internal Link Settings

7.1 G703 Plug In Module

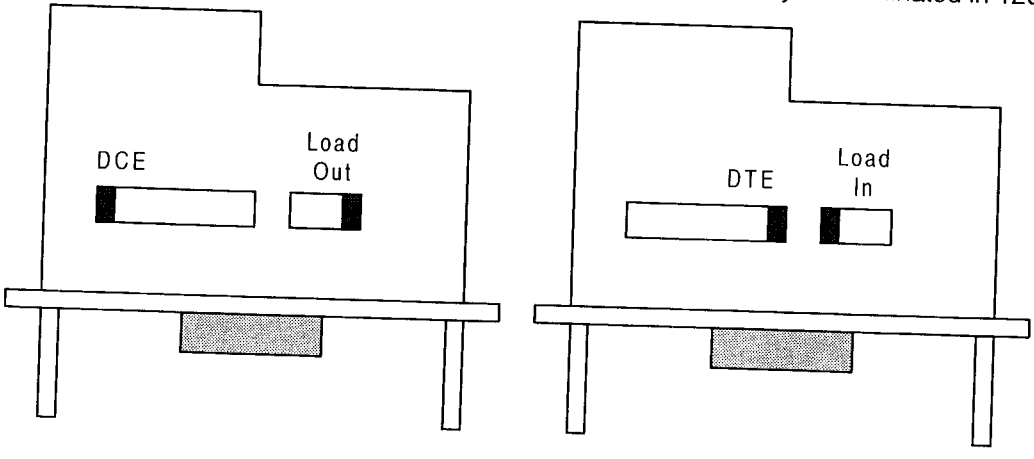
The following diagrams show the location of the internal hardware links.
In all cases the factory default setting is shown on the left.



The 75ohm G703 receiver and the 120 ohm 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.

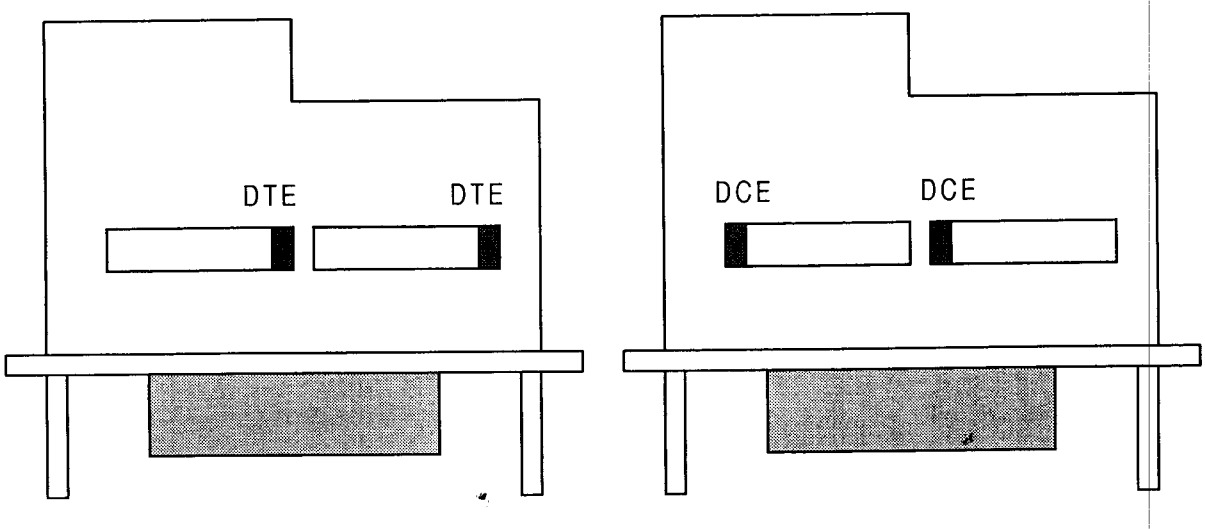
7.2 X21 Plug In Module

The X21 module may be configured as a DCE or DTE.
In both modes, the receive clock, data and byte timing circuits may be terminated in 120 ohms.



7.3 V35 Plug In module

The V35 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.

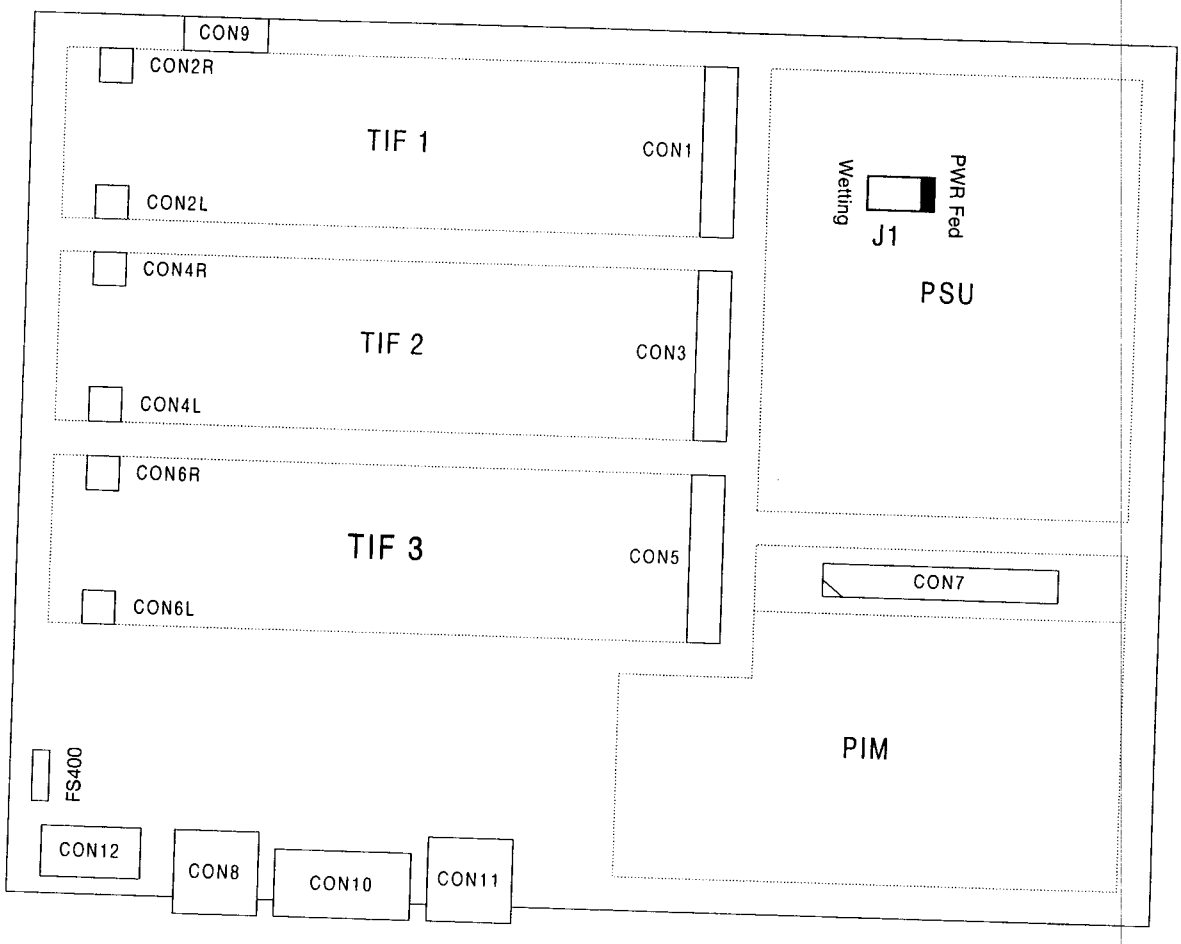


7.4 Motherboard

Link J1 is factory fitted in the 'PWR Fed' position.
This means that the unit can be powered directly from line (for copper transmission systems) or from the DC input.

The other position for the link is for future use.

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, CE and BABT approval.

8. Approvals

8.1 LVD Safety Statements

8.1.1 Power Rating Information – AC plug top adapter

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

8.1.2 Power Rating Information – AC in line adapter

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

8.1.3 Power Rating Information – DC Source

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

8.1.4 Safety Instructions

1. This apparatus must be installed and maintained by SERVICE PERSONNEL.
2. Disconnect the power inlet and the NTP line connector before attempting to change the user interface plug-in module.
3. The mains plug on the equipment serves as a disconnect device, therefore a socket-outlet shall be installed near the equipment and shall be made easily accessible

8.1.5 Definitions

Unexposed Environment

A TELECOMMUNICATIONS NETWORK is considered to be in an unexposed environment if the following conditions apply to all parts of that 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.

Exposed Environment

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

8.1.6 Safety Statements

The optical interface is classified as a **CLASS 1 LASER PRODUCT**
The copper DSL line connection has a safety status of TNV.
The Plug Top DC Power connection has a safety status of TNV.
The X21 Digital Network Interface Port has a safety status of SELV.
The V35 Digital Network Interface Port has a safety status of SELV.

For the G703 Port Connected to Unexposed Environments

The Alarm Port has a safety status of SELV.
The G703 Digital Network Interface Port has a safety status of SELV.

For the G703 Port Connected to Exposed Environments

The Alarm Port has a safety status of Earthed SELV.

The G703 Digital Network Interface Port has a safety status of TNV-1.
The Protective Earth on the rear panel must be connected. (See Section on Installation)

8.2 EMC – Statements

8.2.1 Radiated Emissions Warning

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

8.2.2 ESD Warning

If the unit is power fed from the DSL line interface then a functional earth must be connected. (See Section on Installation).

9. 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
DTE	Data Terminating Equipment
DS	Digital Section (Line section including ELU and NTU)
DSP	Digital Signal Processing
DSL	Digital Subscriber Line
DSLU	Digital Subscriber Line Unit. (AM768, AM2048, AM2048 OPTO)
EOC	Embedded Operations Channel
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.
ESD	Electro Static Discharge
E bit	Bits in the G.704 frame used to indicate that a CRC has been received in error.
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	Nonvolatile 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
NT	Network Termination
NTU	Network Terminating Unit
NTP	Network Termination Point
M.2100	CCITT recommendation M.2100 (1995) Performance limits for bringing into service and maintenance of international PDH paths, sections and transmission systems.
PC	Personal Computer

PCB	Printed Circuit Board
PCM	Pulse Code Modulation
RAM	Random Access Memory
SAn	G.704 Timeslot 0 spare bit n.
SELV	Safe Extra Low Voltage
SNMP	Simple Network Management Protocol
TE	Terminal Equipment
TSn	Timeslot n
TNV	Telecommunications Network Voltage
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
V35	CCITT Recommendation V.24 List of definitions for interchange circuits between DTE and DCE
X21	CCITT Recommendation X.21 Interface between DTE and DCE for synchronous operation public data networks.
3B1O	Line code where 3 binary bits are coded into 8 (octal) discrete levels.

10. Troubleshooting

Please check the following points if problems are experienced setting up a DSL link:

1. For the copper system, ensure the modem is being used on unconditioned twisted pairs.
2. For the copper system, check the correct pin connections are being used on the RJ45 line connector.
3. For the optical system, if problems are experienced with 'Loss of Sync' check that the optical connector is clean. On a single fibre system, the transmission may be sensitive to back reflections caused by dust in the connector.
4. Check that one DSLU is set to master and the other(s) to slave.
5. Check that no test loops are active. (The front panel TEST LED should be off on all units).
6. Using the Management Terminal,
   a) Check the "Information > System" screen for user port settings ie. DTE/DCE mode.
   b) Check the "Alarms > Status" screen for details of any faults.
   c) Check the "Configuration > Master/Slave" mode for general system settings.
   d) Check the "Configuration > User Port" for user clock rate settings.
7. For G703 interfaces. 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.
8. For nx64k check that the correct value of 'n' has been selected at BOTH ends of the link.
9. For nx64k, check the DCE-DTE cable length against the charts in Appendix A.

Appendix A - X21/V35 Cable lengths

There is an inherent design limitation with the X21 and V35 interfaces due to the fact that the 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 to guarantee correct operation, the data arriving at the DCE must avoid this half period delay.

NB. This calculation is only valid If the DTE samples receive data at the half bit position.

Example calculation:
Note: The driver delays for the DTE are only ESTIMATED values.

For N = 32
Bit period = 488ns
Half period = 244ns
Typical V11 driver delay = 30ns Total driver delay = driver delay x 4 = 120ns
Typical logic delay = 8ns
Typical cable delay per metre = 6ns

1st problem cable delay = (Half Bit Period – total driver delays – logic delay)/2
= (244 – 120 – 8 /2
= 58ns
1st problem cable length = 9.7m

2nd problem cable length = (one and a Half Bit Period – total driver delays – logic delay)/12
= (732 – 120 - 8)/12
= 50.3m

3rd problem cable length = (two and a Half Bit Period – total driver delays – logic delay)/12
= (1220 – 120 – 8)/12
= 91m

And so on...

So, further problem lengths occur at additional
(Bit Period)/(2 x Cable delay per metre) = 40.6m

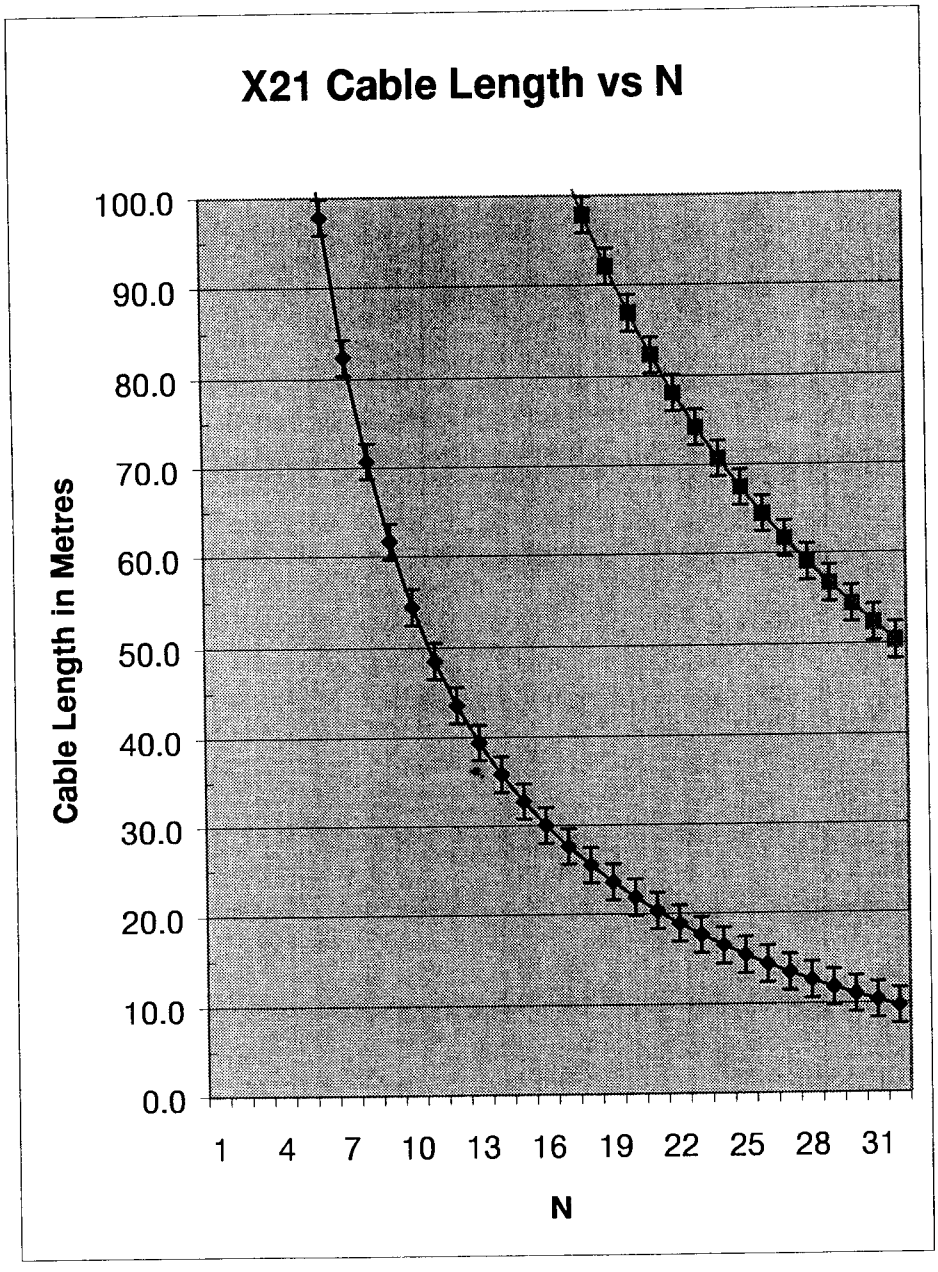
See the next pages for the potential problem cable lengths for all values of N.

If a problem is experienced, try adding two metres to the cable length.

X21 Cables - Potential Problem Lengths

Cable Delay per metre (ns)	6
Driver Delay (ns)	30
Logic Delay (ns)	8

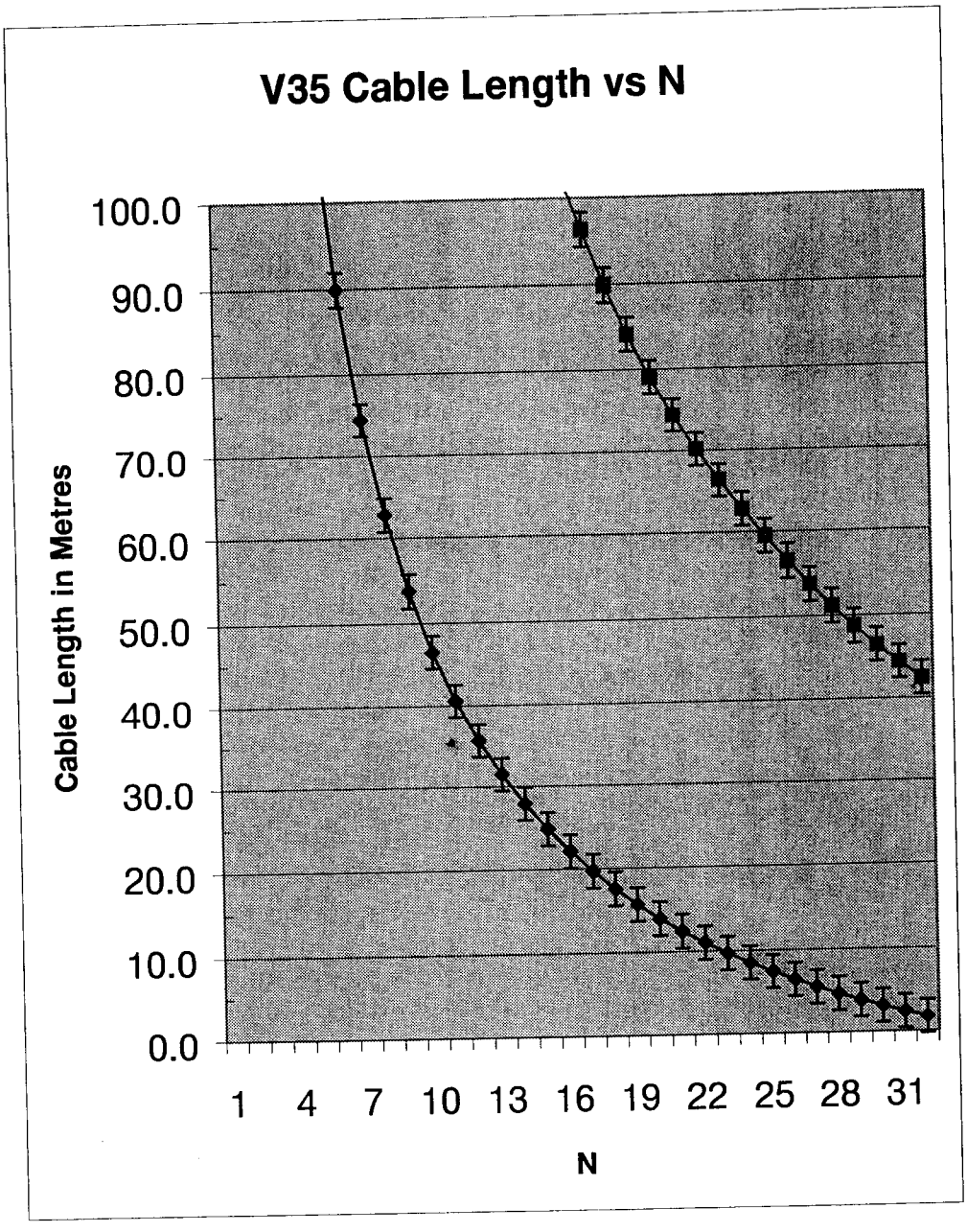
N	Data Rate	Bit Period	Max Delay	1st Length		2nd Length
	kbit/s	ns	ns	m		m
1	64	15625	3842	**640.4**	1302.1	**1942.5**
2	128	7813	1889	**314.9**	651.0	**965.9**
3	192	5208	1238	**206.3**	434.0	**640.4**
4	256	3906	913	**152.1**	325.5	**477.6**
5	320	3125	717	**119.5**	260.4	**380.0**
6	384	2604	587	**97.8**	217.0	**314.9**
7	448	2232	494	**82.3**	186.0	**268.4**
8	512	1953	424	**70.7**	162.8	**233.5**
9	576	1736	370	**61.7**	144.7	**206.3**
10	640	1563	327	**54.4**	130.2	**184.6**
11	704	1420	291	**48.5**	118.4	**166.9**
12	768	1302	262	**43.6**	108.5	**152.1**
13	832	1202	236	**39.4**	100.2	**139.6**
14	896	1116	215	**35.8**	93.0	**128.8**
15	960	1042	196	**32.7**	86.8	**119.5**
16	1024	977	180	**30.0**	81.4	**111.4**
17	1088	919	166	**27.6**	76.6	**104.2**
18	1152	868	153	**25.5**	72.3	**97.8**
19	1216	822	142	**23.6**	68.5	**92.1**
20	1280	781	131	**21.9**	65.1	**87.0**
21	1344	744	122	**20.3**	62.0	**82.3**
22	1408	710	114	**18.9**	59.2	**78.1**
23	1472	679	106	**17.6**	56.6	**74.3**
24	1536	651	99	**16.5**	54.3	**70.7**
25	1600	625	92	**15.4**	52.1	**67.5**
26	1664	601	86	**14.4**	50.1	**64.5**
27	1728	579	81	**13.4**	48.2	**61.7**
28	1792	558	76	**12.6**	46.5	**59.1**
29	1856	539	71	**11.8**	44.9	**56.7**
30	1920	521	66	**11.0**	43.4	**54.4**
31	1984	504	62	**10.3**	42.0	**52.3**
32	2048	488	58	**9.7**	40.7	**50.4**


X21 Cable Length vs N
Cable Length in Metres
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1
4
7
10
13
16
19
22
25
28
31
N

V35 Cables - Potential Problem Lengths

Cable Delay per metre (ns)	6
Driver Delay (ns)	50
Logic Delay (ns)	23

N	Data Rate	Bit Period	Max Delay	1st Length		2nd Length
	kbit/s	ns	ns	m		m
1	64	15625	3795	**632.5**	1302.1	**1934.5**
2	128	7813	1842	**306.9**	651.0	**958.0**
3	192	5208	1191	**198.4**	434.0	**632.5**
4	256	3906	865	**144.2**	325.5	**469.7**
5	320	3125	670	**111.6**	260.4	**372.0**
6	384	2604	540	**89.9**	217.0	**306.9**
7	448	2232	447	**74.4**	186.0	**260.4**
8	512	1953	377	**62.8**	162.8	**225.6**
9	576	1736	323	**53.8**	144.7	**198.4**
10	640	1563	279	**46.5**	130.2	**176.7**
11	704	1420	244	**40.6**	118.4	**159.0**
12	768	1302	214	**35.7**	108.5	**144.2**
13	832	1202	189	**31.5**	100.2	**131.7**
14	896	1116	168	**27.9**	93.0	**120.9**
15	960	1042	149	**24.8**	86.8	**111.6**
16	1024	977	133	**22.1**	81.4	**103.5**
17	1088	919	118	**19.7**	76.6	**96.3**
18	1152	868	106	**17.6**	72.3	**89.9**
19	1216	822	94	**15.7**	68.5	**84.2**
20	1280	781	84	**14.0**	65.1	**79.1**
21	1344	744	75	**12.4**	62.0	**74.4**
22	1408	710	66	**11.0**	59.2	**70.2**
23	1472	679	58	**9.7**	56.6	**66.3**
24	1536	651	51	**8.5**	54.3	**62.8**
25	1600	625	45	**7.5**	52.1	**59.5**
26	1664	601	39	**6.5**	50.1	**56.5**
27	1728	579	33	**5.5**	48.2	**53.8**
28	1792	558	28	**4.7**	46.5	**51.2**
29	1856	539	23	**3.9**	44.9	**48.8**
30	1920	521	19	**3.1**	43.4	**46.5**
31	1984	504	15	**2.4**	42.0	**44.4**
32	2048	488	11	**1.8**	40.7	**42.5**


V35 Cable Length vs N
Cable Length in Metres
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1 4 7 10 13 16 19 22 25 28 31
N

Errata Sheet

6.5 Serial Control Port

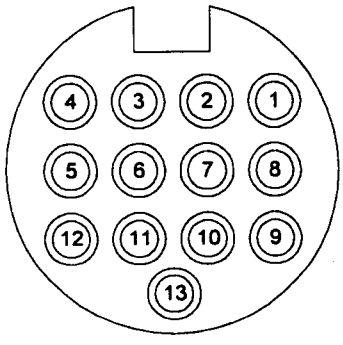
Add the following:

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

The serial cable must have pins 2, 3, 4, 5 and 6 connected.

6.6 Alarm Input/Output Port

The pin out of the alarm port connector pins 9 to 12 has been corrected.



1	RELAY 1 CLOSED = Urgent Alarm
2	RELAY 1 COMMON
3	RELAY 1 OPEN = Urgent Alarm
4	RELAY 2 CLOSED = Non-Urgent Alarm
5	RELAY 2 COMMON
6	RELAY 2 OPEN = Non-Urgent Alarm
7	ALARM INPUT 1
8	ALARM INPUT 2
12	ALARM INPUT 3
11	ALARM INPUT 4
10	ALARM INPUT 5
9	ALARM INPUT 6
13	GND

Figure 6 - Alarm Connector