



BLACK BOX[®]
NETWORK SERVICES

Sept 96 / Version 1.1

4-Port X.21 Composite Sprint 2 TDM:
MXU9010

MXF9504-V11 (France Only)

8-Port X.21 Composite Sprint 2 TDM:
MXU9011

4-Port RS232/V.24 Composite Sprint 2 TDM:
MXU9012

8-Port RS232/V.24 Composite Sprint 2 TDM:
MXU9013

4-Port V.35 Composite Sprint 2 TDM:
MXU9014

MXF9504-V35 (France Only)

8-Port V.35 Composite Sprint 2 TDM:
MXU9015

Sprint 2 Time-Division Multiplexer

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SPRINT 2
Voice & Data Multiplexer
User Manual



**WARNING - BEFORE
INSTALLATION,**
PLEASE REFER TO SAFETY INSTRUCTIONS IN
APPENDIX A, AND EMC INSTRUCTIONS IN APPENDIX
C

Certified Compliant in the EC, when fitted in accordance with the installation instructions,
against the following directives/standards:

Low Voltage Directive (73/23/EEC and amendment 93/68/EEC)

EN60950 : 1992 (Safety)

Electromagnetic Compatibility directive (89/336/EEC and subsequent
amendments to date):

EN55022 : 1994 (Emissions)

EN50082-1 : 1992 (Immunity)

Telecommunications Terminal Equipment directive (91/263/EEC and
amendment 93/68/EEC) where indicated in approvals requirements section.




!! IMPORTANT - Use in USA & Canada !!

References to Voice

Please note that within this manual, all references to Voice or the X21/V11 channel port refer to options which are **not available for use in the U.S. or Canada.**

Safety

Units bearing the mark and mark  are LISTED by Underwriters Laboratories Inc. to U.S. and Canadian Safety Standards.

Electromagnetic Emissions & Immunity

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

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution:

Changes or modifications not expressly approved by the manufacturer of this product could void the user's authority to operate this equipment.



Contents

Contents.....	6
Introduction.....	8
Sprint 2 Applications.....	8
V.24 Low Speed Data Only.....	9
High Speed X.21/V.11 & V.24 Data.....	9
Technical Features.....	11
Sprint 2 Throughput/Efficiency.....	11
Data Format.....	11
Synchronous Data.....	11
Asynchronous Data.....	11
Frame Length.....	12
Frame Structure.....	12
Composite Rates 32.8Kbps - 64Kbps.....	12
Composite Rates 4.8 - 32Kbps.....	13
Synchronisation.....	13
Composite Link Rates.....	13
Round Trip Polling Delay.....	13
Interface Signals/Sample Rate.....	13
Use And Configuration.....	14
Data Channel Connection.....	14
Default Channel Setup.....	14
Changing the Configuration.....	14
Supervisor Terminal Requirements.....	14
Supervisor Terminal Emulations.....	15
Configuration Display Layout.....	15
General Keyboard Conventions.....	16
Cursor Movement.....	16
Changing Parameters.....	17
Accepting Changes and Updating the Configuration.....	17
Abandoning Changes.....	17
Local or Remote Configuration.....	17
Screen Messages.....	17
Error Messages.....	18
Data Channel Configuration.....	18
Copying A Channel Setup.....	19
Integral X.21/V.11 Data Channel.....	24
Technical Overview.....	24
Configuration Procedure.....	24
Installation.....	25
Supply Voltage & Connection.....	25
Environmental Considerations.....	25
Mechanical Construction.....	25
Composite Interface Selection.....	26
Composite Network Connection.....	26
Composite Link Parameters.....	26
Troubleshooting.....	27
Front Panel LEDs.....	27
Diagnostics & Loopbacks.....	28



Self Test Procedure.....	28
Back-To-Back Testing.....	29
Appendix A - Safety Requirements.....	30
Appendix B - Approval Requirements.....	33
Appendix C - EMC Requirements.....	35
Limitation of Emissions:.....	35
Data Connections.....	35
Mains Connection.....	35
To Ensure Adequate Immunity is Achieved:.....	35
Appendix D - Rear Panel Layout.....	37
Appendix E - Supervisor Port Pinout.....	38
Appendix F - Composite Link DB15 Pinout.....	39
Appendix G - Composite Back To Back Test Cables.....	40
X.21/V.11 Test Cable.....	40
X.21bis/V.35, V.24 and V.36 Test Cables.....	40
G.703 Test Cable.....	41
Appendix H - Data Channel Pinout.....	42
Appendix I - Network Composite Cables.....	43
Appendix J - Technical Specification.....	47



Introduction

The Sprint 2 is a four or eight channel time division multiplexer offering users voice and data integration over digital links up to 64Kbps.

Both local and remote units may be easily configured from one end of the link, using a terminal or PC terminal emulation software.

The V.24 data channels will support synchronous and asynchronous data rates of up to 28.8Kbps. An X.21/V.11 data channel is optionally available to replace the eighth V.24 channel and will support rates up to 48Kbps.

This user manual covers installation and setup of user options for the multiplexer. Cable specifications are detailed in the appendices.

The composite link has a plug-in selectable interface (X.21/V.11, V.24, G.703 or V.35) which must be specified at the time of ordering the equipment.

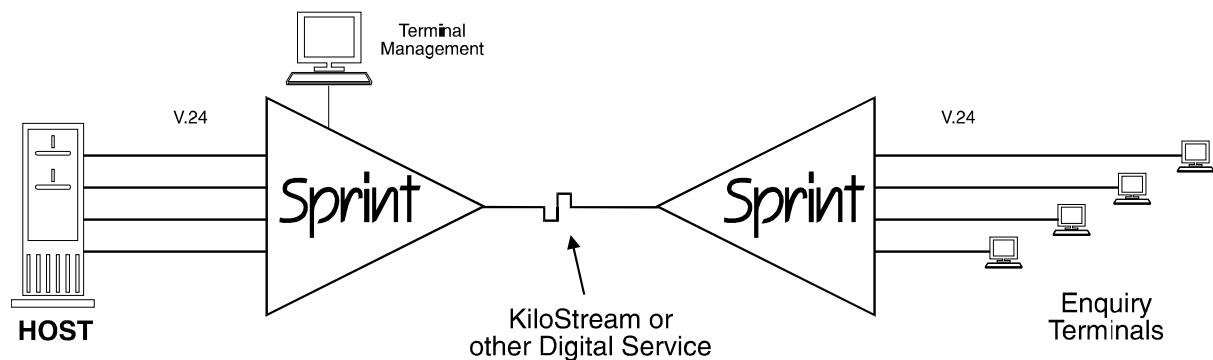
Sprint 2 Applications



The Sprint 2 can be used in many applications, from simple asynchronous V.24 data transfer through to a complicated mix of low speed V.24 and high speed V.11 data with up to two voice channels. The low price of the basic unit and options give users the opportunity to maximise the benefits of their networking budget.

V.24 Low Speed Data Only

The simplest use of the Sprint 2 is the interconnection of data devices such as below;



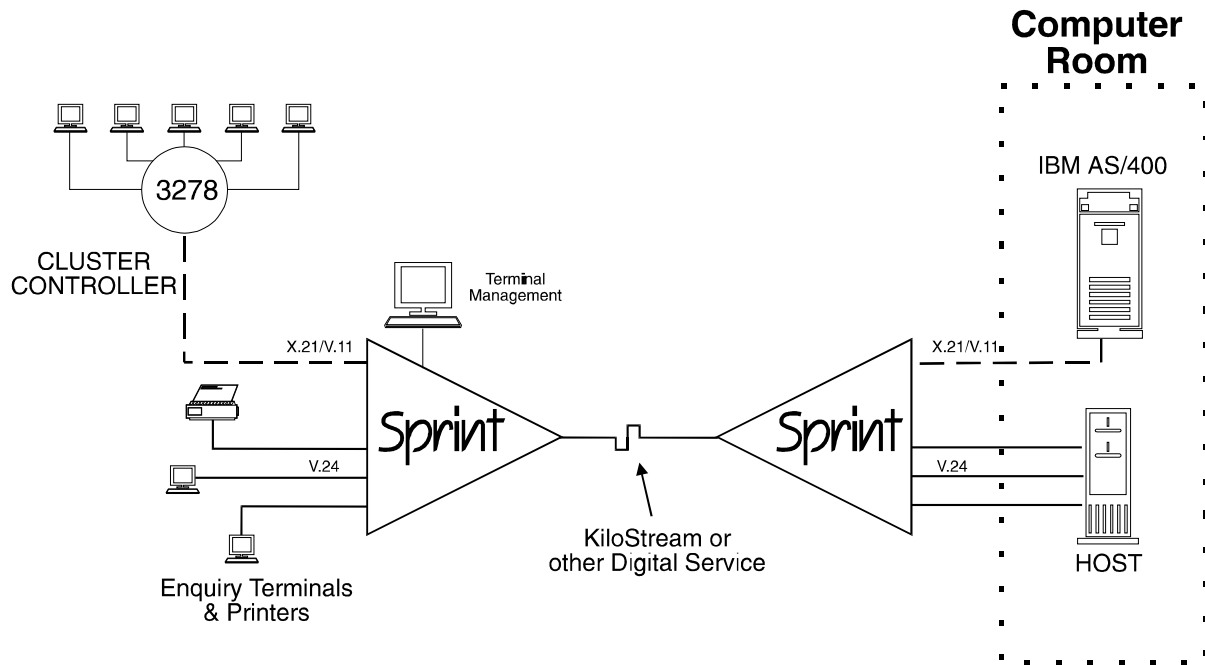
Up to eight synchronous or asynchronous devices can be connected to a central computer in this fashion when bandwidth allows. Bit stripping gives the Sprint 2 the ability to transmit eight asynchronous 9.6Kbps data channels through a 64Kbps link.

High Speed X.21/V.11 & V.24 Data

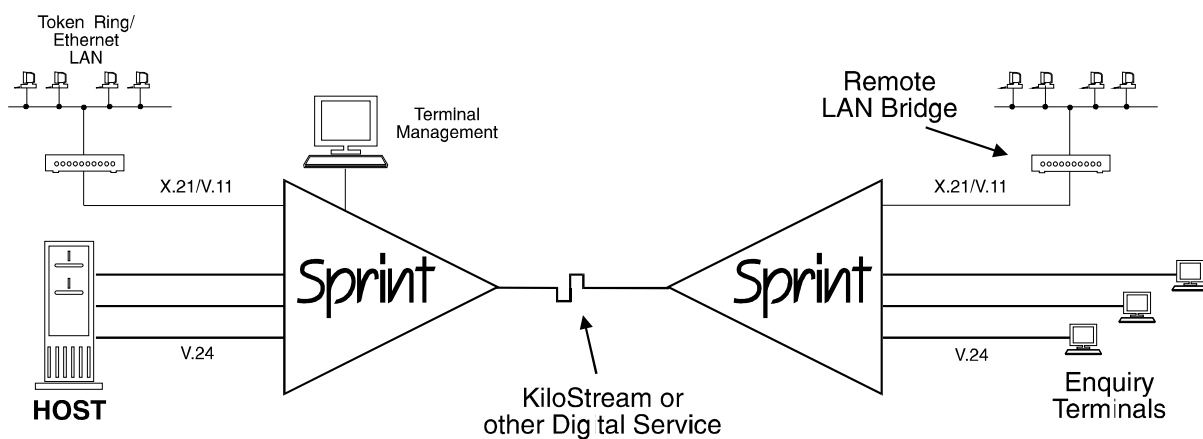
Many applications will require a combination of data types. The Sprint 2 LANLink will support a synchronous X.21/V.11 data channel in addition to seven V.24 ports. This can be used to connect a cluster controller alongside several asynchronous terminals as shown in the next diagram.



Sprint 2 Time-Division Multiplexer



This high speed X.21/V.11 port could also be used to split bandwidth between some low speed peripherals and a Remote LAN Bridge such as is shown in this diagram below.



Technical Features

Sprint 2 Throughput/Efficiency

Data throughput may be easily calculated. The overhead for composite rates above 32.8Kbps is 1600bps. For rates below 32.8Kbps, the overhead is halved. For example, a composite rate of 28.8Kbps will yield a throughput of 28Kbps.

Link Rate (Kbps)	Efficiency (%)	Throughput (Kbps)
64	97.5	62.4
19.2	95.83	18.4

Data Format

Synchronous Data

The internally generated data channel clocks are derived from the composite link clock rate.

Each data channel has a flexible input buffer (size depends on bit rate) to allow external clock (plesiochronous) operation.

Asynchronous Data

Asynchronous data is transmitted across the composite link as synchronous data with each character occupying eight bits in the aggregate frame irrespective of structure. Data parity is regenerated at the remote end. When the data channel is in idle or break condition the aggregate is padded with one of two non-ASCII codes (0BAh and 0BBh). If these codes are received by the data channel they are coded and appended with an escape character (0BCh) to allow them to pass across the aggregate link.

By stripping start, stop and parity bits from data, the Sprint 2 reduces the number of data bits transferred across the composite link. An asynchronous channel with a word structure of 81N will discard two bits and transfer eight useful characters, thus requiring 80% of the nominal bandwidth, or 7680bps for a 9600bps channel.

In practice the composite link is allocated in 800bps slots, so this channel actually uses 8000bps. When applied across all eight channels the following combinations are possible.

Composite Rates 4.8 - 32Kbps

2 x 24 Bytes at 19.2Kbps

S₁ DDDDDDDDDDDDDDDDDDDDDDDDDDDDD
C₁ DDDDDDDDDDDDDDDDDDDDDDDDDDDDD

S₁ Synchronising byte
C₁ Configuration byte
D Data Byte

Synchronisation

Synchronisation will occur after receipt of a superframe, i.e. 80ms, irrespective of the composite data rate. A super-frame comprises four composite frames, each of which has a different sync character.

Composite Link Rates

The composite data rate can be selected in increments of 800bps from 4.8Kbps to 64Kbps. This allows most efficient use of data bandwidth if multiplexers are daisy chained.

Round Trip Polling Delay

Round trip delay is defined as the time interval which elapses when a "poll" from a computer is transmitted from one of the low speed data ports of the multiplexer, through the composite link, and then looped at the remote multiplexer to return to the computer. This is generally referenced when the computer data is transmitted through a 9.6Kbps channel. The Sprint 2 has a delay of only 12ms at all link rates.

Interface Signals/Sample Rate

The Sprint 2 units sample and transmit the RTS and DTR signals from all 4 or 8 channels approximately every 230ms via the configuration bytes. If the full data bandwidth is not allocated, the residual is used to pass the interface signals, reducing delay to less than 15ms (800bps residual) or 10ms (>2400bps residual) respectively.

Therefore if the requirement is for onward linked, half duplex communication it is essential to leave some bandwidth unused to speed up the interchange of control signals. If the IBM Bisync protocol is being transmitted it is recommended that 2.4Kbps of data bandwidth is unused.

Use And Configuration

This section covers connection and set-up of the channel data ports. The composite port is covered in the **Installation** section of this manual.

Data Channel Connection

Low speed peripherals are connected to the V.24/V.28 (and X.21/V.11 where the High Speed Data option is fitted) DB25 connectors configured DCE and numbered 1 to 8 at the rear of the multiplexer. The pin connections for these data channels are defined in the Appendix.

Default Channel Setup

On delivery all V.24 channels are configured as follows;

Rate	:	4800bps
Type	:	Synchronous
Clocks	:	Internal
Signals	:	Both+
RTS/CTS Delay	:	0ms

Changing the Configuration

The Sprint 2 may be configured using an asynchronous terminal. A laptop PC running an asynchronous terminal emulation program such as PCAnywhere™, CrossTalk™ or Blast™ is ideal for the field engineer. The terminal should be connected via its serial port to the SUPERVISOR port on the rear of the multiplexer.

Supervisor Terminal Requirements

The 9.6Kbps terminal must be configured for soft flow control with an 8 bit word, one stop bit, and no parity (81N.)

The Supervisor Port pinout is defined in Appendix E.

Supervisor Terminal Emulations

Several terminal emulations are supported by the Sprint 2. When connection is made between the terminal or PC and the rear panel port labelled **SUPERVISOR**, the following screen will appear:

```

1 = VT52/HP2600
2 = ANSI/VT100/VT200
3 = ADDS
4 = ADM-3A
5 = HAZELTINE 1500
6 = NEWBURY 8009
7 = TELEVIDEO 912/920

```

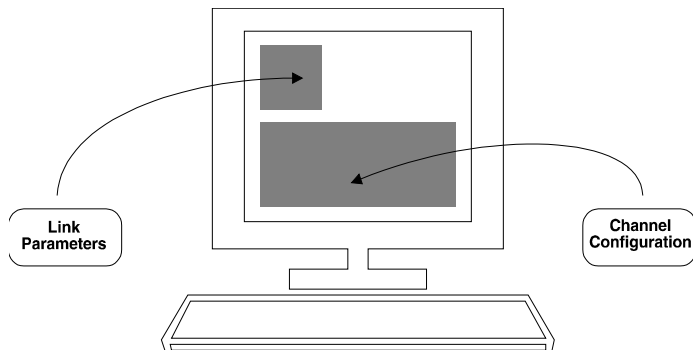
The terminal type or emulation in use should be selected by pressing the relevant number key on the PC or terminal. The monitor will now show the basic configuration screen for the multiplexer setup. On the Sprint 2 LANLink this is formatted as below. This display for the Sprint 2 shows standard V.24 data channels only.

SPRINT 2 TDM								xxxxAE/x.xx	
Mode	:	RUN							
Data Monitor	:	RXD							
Link Clock	:	AUTO 64000							
X.21 Carrier	:	PRESENT							
Residual	:	+24000							
Option Cards	:	NONE							
Configure	:	<u>>ACCEPT</u>							
Display Page	:	LOCAL							
COPY CHANNEL	:	1	2	3	4	5	6	7	X.21
RATE	:	4800	4800	4800	4800	4800	4800	4800	4800
TYPE	:	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC
RX CLOCK	:	INT	INT	INT	INT	INT	INT	INT	INT
TX CLOCK	:	INT	INT	INT	INT	INT	INT	INT	INT
BITS/CHAR	:								
PARITY :									
RTS/CTS DLY	:	0ms	0ms	0ms	0ms	0ms	0ms	0ms	0ms
SIGNALS	:	BOTH+	BOTH+	BOTH+	BOTH+	BOTH+	BOTH+	BOTH+	BOTH+
CHANNEL MODE	:	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN

Use cursor keys to select parameter, SPACE/- to toggle

Configuration Display Layout

There are two main areas on the supervisor set-up screen used to change parameters for the Sprint 2.



Clock, Carrier, Residual, and Configure).

Upper left -
System parameters (Mode, Link

Bottom -
Channel configuration.

General Keyboard Conventions

Only a few keys are required to configure the Sprint 2 multiplexer. They are summarised as follows.

→ (Right arrow)	Moves the cursor to the next field to the right.
← (Left arrow)	Moves the cursor to the next field to the left.
↑ (Up arrow)	Moves the cursor to the next field upwards.
↓ (Down arrow)	Moves the cursor to the next field downwards.
<SPACEBAR>	Toggles the parameter value up to the next available setting.
<ENTER> OR <RETURN>	Moves the cursor back to the CONFIGURE line.
<CTRL> and C	Abandons all changes since last update.
<CTRL> and A	Enables access to composite links settings.

Cursor Movement

The cursor symbol ">" is moved around the screen to the required field using the **arrow keys**.

Changing Parameters

If it is possible to modify the field over which the cursor is placed pressing the <SPACEBAR> will toggle through the parameters available. Link parameters are only adjustable if <CTRL> and A are keyed in advance. No change is possible if the field is calculated, unchangeable or hardware set.

Pressing the <SPACEBAR> will toggle through the choices available for a parameter.

Accepting Changes and Updating the Configuration

If the **CONFIGURE** parameter is selected to **ACCEPT** after the configuration has been suitably adjusted, the configuration is updated at the local and remote end as necessary and held in Non-Volatile Memory (NVRAM.)

Abandoning Changes

Pressing <CTRL> and <C> together at any point before a configuration is updated will cause all modifications to be abandoned and the last updated configuration will be represented on the screen.

Alternatively if the cursor remains unmoved for thirty seconds when in ENTER mode, the cursor marker will automatically return to the **CONFIGURE** line and revert to **ACCEPT**. The original configuration is maintained and any parameter changes will be lost.

Local or Remote Configuration

Most settings are independent at each end of the multiplexer link e.g. Signals, Clocks, and Rates. The "**Display Page**" parameter in the upper left of the selected screen shows whether the LOCAL or REMOTE multiplexer is being configured.

Screen Messages

The bottom of the configuration screen displays status messages as appropriate. When the **CONFIGURE** line is set to **ACCEPT** the following line will normally appear:

Use cursor keys to select parameter, SPACE/- to toggle

Two additional lines appear when the **CONFIGURE** line is set to **ENTER**, as follows:

Type <CTRL>&A to enable access to link parameters
Use cursor keys to select parameter, SPACE/- to toggle
Select ACCEPT to apply changes, type <CTRL>&C to abort

If <CTRL> and A are keyed simultaneously then the top line changes to:

Type <CTRL>&A to enable access to link parameters

If the remote unit is put into a composite loopback mode the local unit can not be configured and the following message is displayed:

Looping data back to remote - Keyboard Disabled

Error Messages

Error messages take precedence over any existing message and always appear on the top of the three previously described lines. The possible error conditions are as follows:

<p>WARNING - MAXIMUM AGGREGATE SPEED EXCEEDED</p>

<p>WARNING - LOCAL AND REMOTE SET-UPS DO NOT MATCH</p>
--

Data Channel Configuration

The display shows parameters for eight data channels CH1 to CH8. Each data channel has parameters selectable as shown in the following table.

| Copying A Channel Setup

Channel data may be copied from another similar data channel, by placing the cursor over the **channel number** field (of the channel to be changed.)

The <SPACEBAR> allows you to toggle through each available channel so that the setup may be copied.

Configuration Display Definitions

Parameter	Display Options	Description
Mode	RUN	Composite link operation mode
	LOCAL LOOPBACK	
	REMOTE LOOPBACK	
Data Monitor	RXD	LEDs show RECEIVE data activity
	TXD	LEDs show TRANSMIT data activity
	RXD/TXD	LEDs show TRANSMIT and RECEIVE data activity
<i>With X.21 Composite Interface Selected</i>		
Link Clock	EXT xxxxx	Link clock external, manually set
	AUTO xxxxx	Link clock external, automatically calibrated
	INT xxxxx	Link clock internally generated
	xxxx 4800	Composite clock rate in 800bps steps
	xxxx 64000	
X.21 Carrier	PRESENT	The multiplexer is receiving clock (from the link if EXT/AUTO is set) and is also communicating with the remote multiplexer.
	LOST	There is no communication between the local and remote multiplexers.
<i>With V.24, V.35 or G.703 Composite Interface Selected</i>		
Link TXC	AUTO xxxxx	External link clock automatically calibrated
	RXC xxxxx	External link clock turn around mode
	EXT xxxxx	External link clock manually set
	INT xxxxx	Internally generated link clock
	xxxx 4800	Composite clock rate in 800bps steps
	xxxx 64000	

Configuration Display Definitions

Parameter	Display Options	Description
V.xx Carrier	PRESENT	The multiplexer is receiving clock (from the link if EXT/RXC/ AUTO clock V.35 Carrier is selected) and is also communicating with the remote multiplexer.
	LOST	There is no communication between the local and remote multiplexer.
Link TXC	RxC(xx xxxxx)	Transmitted data clocked from Receive Clock.
	INT(xx xxxxx)	Internally generated Transmit Clock.
	xxx(OCTET)	TxD with G.703 octet timing CCITT compliant.
	xxx(NO OCTET)	TxD without G.703 octet timing.
G.703 Carrier	PRESENT	The multiplexer is receiving clock from the link and data from the remote unit.
	LOST	There is no communication between the local and remote multiplexer.
Residual	+xxxxx	Surplus bandwidth available with current configuration.
	-xxxxx	Excess bandwidth situation - NVRAM will not ACCEPT configuration. A warning is displayed at the bottom of the screen and a bleep is heard. (WARNING - MAXIMUM AGGREGATE SPEED EXCEEDED)
Option Cards	NONE	No option card fitted
	VOICE	Single channel ADPCM voice option fitted
	DUAL VOICE	Dual channel ADPCM voice option fitted
Configure	ACCEPT	The displayed configuration is stored in NVRAM in both local and remote multiplexers.
	ENTER	The configuration may be changed.
Display Page	LOCAL	The screen shows the configuration of the local unit

	REMOTE		The screen shows the configuration of the remote unit
COPY CHANNEL	1-4, 1-8 or 1-7 & X.21		Provides facility to copy the set up parameters of any other data channel
RATE	V.24	X.21	Data channel bit rate
	0	0	
	1200	1200	
	2400	2400	
	4800	4800	
	7200	8000	
	9600	9600	
	14400	19200	
	19200	32000	
	28800	38400 48000	
TYPE	SYNC	SYNC	Data channel type
	ASYNC	-	
RX CLOCK	INT	INT	Synchronous data receive clock setting
	EXT	-	
TX CLOCK	INT	INT	Synchronous data transmit clock setting
	EXT	-	
BITS/CHAR	7	-	Asynchronous data channel word length
	8	-	
PARITY	ODD	-	Asynchronous data parity
	EVEN	-	
	NONE	-	

RTS/CTS DLY	0ms	Data channel RTS/CTS delay
	50ms	
SIGNALS	BOTH+	DSR and DCD are both affirmed at the local multiplexer.
	TRANS	Remote RTS transmitted to local DCD
	DSR+	DSR is affirmed at the local multiplexer
	DCD+	DCD is affirmed at the local multiplexer
CHANNEL MODE	RUN	Data channel in run mode
	LLOOP	Data channel in local loopback mode
	RLOOP	Data channel in remote loopback mode
	****	Remote page display cannot be set
N.B. All Parameters in BOLD may be selected differently at LOCAL & REMOTE ends.		

Integral X.21/V.11 Data Channel

Technical Overview

The Sprint 2 LANLink X.21/V.11 data channel provides a single synchronous data interface to complement the standard seven V.24 channels.

The data channel may be set to the following bit rates 1200bps, 2400bps, 4800bps, 8000bps, 9600bps, 19.2Kbps, 32Kbps, 38.4Kbps or 48Kbps.

Configuration Procedure

The internal X.21/V.11 channel is configured from the standard terminal display. Display options are listed below.

Configuration Display Definitions		
Parameter	Display Options	Description
COPY CHANNEL	X.21	Integral X.21/V.11 synchronous data channel selected
RATE	<XXXXX >	Synchronous data rates of 1.2Kbps, 2.4Kbps, 4.8Kbps, 8Kbps, 9.6Kbps, 19.2Kbps, 32Kbps, 38.4Kbps & 48Kbps
TYPE	SYNC	Synchronous data available
Rx CLOCK	INT	Data clock sourcing internal only
Tx CLOCK	INT	Data clock sourcing internal only
CHANNEL MODE	RUN	X.21 data channel in run mode
	LLOOP	X.21 data channel in local loopback mode
	RLOOP	X.21 data channel in remote loopback mode

Installation

BEFORE INSTALLATION, PLEASE REFER TO THE SAFETY WARNINGS, APPROVALS REQUIREMENTS, AND EMC REQUIREMENTS IN APPENDIX A,B AND C.

Supply Voltage & Connection

AC	100 - 240V AC without adjustment.
Optional DC	48V DC without adjustment.

The Sprint 2 may be optionally DC or AC powered. The AC power supply is a switched mode unit, whereas the optional DC power supply unit is a DC to DC convertor. Both allow considerable input voltage variation.

Environmental Considerations

The Sprint 2 Multiplexer must be operated under the following atmospheric conditions:

Temperature:	0 to 40 degrees centigrade.
Humidity:	0% to 90% non-condensing.
Air Pressure:	86 to 106 kPa.

Mechanical Construction

The Sprint 2 is housed in a 2U tall 19" enclosure. An optional rack mount kit is available on request. Eleven LEDs on the front panel indicate the current status of the multiplexer.

The multiplexer MUST be disconnected from the power supply before opening the unit or changing any network connections.

Screws on the left, right and top of the enclosure are removed using a Posidrive screwdriver to access the interior. This allows installation of interface and option cards. Please read the relevant option manual before attempting any retrofit operation.

The rear panel illustrated in Appendix D accommodates the link interface connectors and supervisor port.

Composite Interface Selection

Interface cards are used to determine the interface type (X.21/V.11, V.24, V.35 etc.) of the composite link. It is necessary to use the corresponding external **cable** to make connection once the interface card has been fitted.

It is necessary to set link positions on the composite interface cards as follows:

Interface	Link Number	DTE Setting (Network)
V.11 (IA75035)	N/A	N/A
V.24 (IA75038)	LK1, LK2	CMP
V.35 (IA75039)	LK1, Nearest J1 LK2, Nearest J2	EXT EXT

The interface cards may be accessed when the cover is removed, as described in the Mechanical Construction section on page 25, the position for each being shown in the above diagram. Anti-static precautions must be taken whilst fitting or changing the interface cards which simply plug into the motherboard at the positions shown.

Composite Network Connection

The Sprint 2 Multiplexer supports many different Network Interfaces including X.21/V.11, V.35, G.703 and V.24, others being available now or in the near future (please contact Black Box for further details).

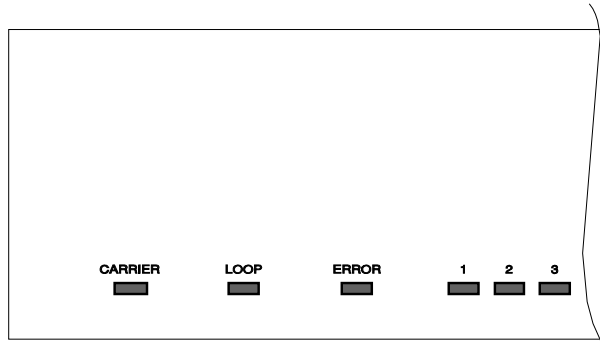
The composite port appears on the back panel as a 15 way D-type connector, the pin-out for each interface standard being shown in Appendix F. Correct cables for Network connection are shown in Appendix I.

Composite Link Parameters

Parameters may be toggled using the <SPACEBAR> as described previously. Access to the settings must be activated using <CTRL> and A.

Troubleshooting

Front Panel LEDs



During normal operation only the **CARRIER** front panel LED should be constantly illuminated. The **DATA** LEDs will flash as appropriate when data is transmitted.

LED LABEL	CONDITION	NOTES
CARRIER	Even Flash	No communication with remote unit - link or multiplexer fault.
	Uneven Flash	High error rate or intermittent communication on remote link.
ERROR	Steady Green	Link OK - framing signal present from remote unit.
	Not illuminated	Configuration OK.
LOOP	Red	Configuration not acceptable e.g. channel data rate aggregate exceeds available bandwidth.
	Not illuminated	No diagnostics running.
DATA	Green	Some Channels looped or in QBF test modes.
	Intermittent	Lit when channel passing data.

Diagnostics & Loopbacks

A number of diagnostic configuration options are available. It is possible to loop back the data channels and the composite link, both locally and remotely, to test for correct operation.

The configuration procedure is detailed in the Use and Configuration section starting on page 14.

LOCAL COMPOSITE LOOPBACK loops back the composite link of the local multiplexer, i.e. the unit to which a VDU being used to perform set-up is connected. Whilst the composite link on the local multiplexer is being looped back, incoming data from the remote multiplexer is ignored.

When REMOTE COMPOSITE LOOPBACK is selected the composite link is looped back at the remote unit which returns data to the local multiplexer, data inputs to the remote multiplexer are ignored.

CHANNEL LOOPBACKS, which may be LOCAL or REMOTE, are not intrusive to other data channels.

Loopbacks are not bilateral and may only be set at one end of the link for one channel at any time.

Self Test Procedure

The multiplexer automatically initiates a **Self Test** procedure when powered on. The progress of the self-test is indicated by the LEDs on the front panel and by a scrolling display (see below) if a terminal is connected for configuration.

```
***** SELF TEST *****  
  
ROM TEST PASSED  
  
RAM TEST PASSED  
  
LED TEST  
  
CTC READ/WRITE TEST PASSED  
  
SIO READ/WRITE TEST PASSED  
  
INTERRUPT DAISY-CHAIN TEST PASSED  
  
INTERNAL CLOCK/P.L.L. / TLOK / FLASH TEST PASSED  
  
CHANNEL CLOCK TEST PASSED  
*****
```

If any part of the self test fails, the display will stop and indicate "FAILED" after the appropriate test. The display does not proceed to the display of VDU emulations. The front panel LED display also stops. This indicates a fault that cannot be remedied. Please contact Black Box for assistance.

Back-To-Back Testing

It is possible to test a pair of multiplexers in a back-to-back mode. This is a useful way to gain familiarity with the configuration procedures, and to check for correct operation if malfunction is suspected.

To carry out a back to back test a multiplexer pair are interconnected via the composite connector using the appropriate cable selected from Appendix G.

Our normal procedure is to use the X.21/V.11 composite back-to-back cable with the interface selection also set to X.21/V.11.

When connected by the cable one multiplexer is selected to Internal Clock and the data rate set to an appropriate value (64Kbps.) The second multiplexer is selected to AUTO or EXT thus accepting clock from the other.

When correctly interconnected and appropriate clocking is accepted the multiplexer pair will intercommunicate as if a link was present; CARRIER is then indicated as PRESENT on the VDU, with the CARRIER LED being illuminated.

Having achieved this situation all configuration procedures may be exercised.

After back-to-back testing it is essential to reconfigure the composite clocking, from internal (INT) to external (EXT or AUTO,) on the unit originally providing a system clock.

Appendix A - Safety Requirements

WARNING: THIS EQUIPMENT MUST BE EARTHED / GROUNDED

This equipment relies on the EARTH / GROUND connection to ensure safe operation such that the user and TELECOM Network are adequately protected. It must not under any circumstances be operated without an earth connection, which could nullify its approval for connection to a network.

WARNING: INSTALLATION OF EQUIPMENT

Installation of this equipment must only be performed by suitably trained service personnel.

WARNING: CONNECTION OF OTHER EQUIPMENT

This equipment allows connection only of suitably approved equipment to its ports, the safety status of which are defined below.

SELV Ports:

- i) **Supervisor** port
- ii) **Composite** port
- iii) **1 to 8** (Channel ports)

The above named ports are classified as SELV (Safety Extra Low Voltage) in accordance with in Clause 2.3 of EN60950 (BS7002, IEC950 as applicable), and **must only** be connected to equipment which similarly complies with the SELV safety classification.

Warnung: **Dieses Gerät Muß an einem Anschluß mit Schutzleiter betrieben werden.**

Zum sicheren Betrieb ist der Anschluß des Gerätes an Spannungsversorgungen mit Schutzleiter notwendig. Nur so kann ein optimaler Schutz für Bedienpersonal und Übertragungseinrichtungen gewährleistet werden. Unter keinen Umständen darf dieses Gerät ohne Schutzleiter betrieben werden, da ansonsten die Zulassung für den Anschluß an Netzen erlischt.

Warnung: **Installation des Gerätes**

Die Installation des Gerätes darf nur von entsprechend ausgebildetem und autorisiertem Personal durchgeführt werden.

Warnung: **Anschluß von anderen Geräten**

Angeschlossen werden dürfen nur Systeme mit entsprechenden zugelassenen und geeigneten Schnittstellen, siehe auch nachfolgende Tabelle:

SELV Ports

- i) Supervisor Port
- ii) Composite port
- iii) 1 to 8 (Channel Ports)

Die oben aufgeführten Ports sind klassifiziert als SELV (Safety Extra Low Voltage) in Übereinstimmung mit Absatz 2.3 der Verordnung EN60950 (BS7002, IEC950 soweit anwendbar), und dürfen nur zusammen mit Geräten verwendet werden, die dieser Bestimmung entsprechen.

Mise en garde: Cet équipement doit être relié a la terre

Cet équipement doit posséder une prise de terre de manière à ce que le réseau télécom et ses utilisateurs soient équitablement protégés. Tout manquement à cette obligation entraînerait l'annulation de l'autorisation de connexion a un réseau.

Mise en garde: Installation de l'équipement

L'installation doit être assurée uniquement par des personnels convenablement formés à ce type de matériel.

Mise en garde: Connexion d'autres équipements

Des équipement complémentaires pouvant être connectés aux ports de cet équipement à la seule condition que ceux-ci soient agréés. Les conditions optimales de sécurité pour toute connexion sont définies ci-dessous:

Ports SELV.

- 1) port **Supervisor**
- 2) port **Composite**
- 3) ports pour les canaux **1 à 8**

Les ports cités ci-dessous sont classés dans la catégorie SELV (Safety Extra Low Voltage) conformément à la classe 2.3 de EN60950 (BS7002, IEC950 applicable) et doivent être connectés à des équipements répondant à la norme de sécurité SELV.

Appendix B - Approval Requirements

The SPRINT 2 MULTIPLEXER carrying the BABT / CE168 assessment symbols and approval number, is approved for connection to the networks identified in this Appendix as follows:

X.21/V11

Throughout Europe (Pan European) to I-CTR2 based on NET2 at rates up to and including 64Kbps when the composite link is fitted with an X.21/V11 interface card. Connection must be made using a suitable non-integral interface specific cable, details of which are provided in Appendix I. This cable is available from Black Box.

X.21bis/ V.24/ V.35

In the UK only, when mains powered, subject to the following requirements:

Service category 1 at rates of 2400, 4800, 9600 and 19200 bps when composite link (LINK A) or High Speed Channel (HSC) is fitted with a V.24 interface card linked for DTE as shown on page 26. Connection must be made using a suitable non-integral interface specific cable, details of which are provided in Appendix I. This cable is available from Black Box.

Service category 2 at rates of 48000, 56000, and 64000 bps when composite link (LINK A) or High Speed Channel (HSC) is fitted with a V.35 interface card linked for DTE as shown in on page 26. Connection must be made using a suitable non-integral interface specific cable, details of which are provided in Appendix I. This cable is available from Black Box.

Approval for both service categories has been granted in accordance with BS6328 : part 7 : 1990 section 4.3, connection being only to a relevant branch system for particular digital circuits. The above defined interface specific cables constitute a relevant branch system for the particular digital circuit.

X.21bis - continued

If any other apparatus, including cable or wiring, is to be connected between the apparatus and the point of connection to any particular digital circuit then that apparatus shall conform to the following:

- (a) the overall transmission characteristics of all that other apparatus shall be such as to introduce no material effect upon the electrical conditions presented to one another by the apparatus and the particular digital circuit;
 - (b) all other apparatus shall comprise only:
 - (1) apparatus approved for the purpose of connection between the apparatus and a particular digital circuit; and
 - (2) cable and wiring complying with a code of practice for the installation of apparatus covered by BS6328 : Part 7 or such other requirements as may be applicable.
-

Appendix C - EMC Requirements

To ensure compliance with the EMC directive, some care must be taken to ensure that the units are installed properly, using suitable cables and connections. The following must be observed:

Limitation of Emissions:

Data Connections

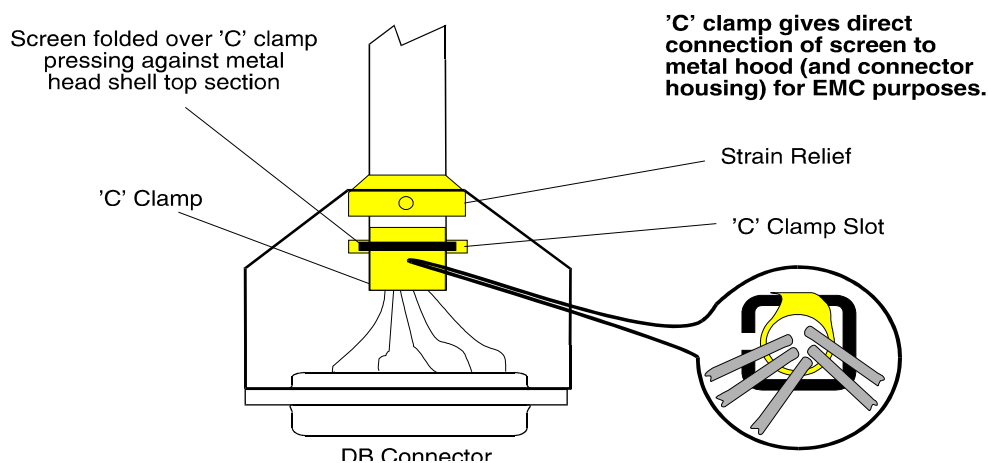
This product relies on the use of screened cables for connection to the 15 way and 25 way DB ports. The cables must have the foil or braid screen connected effectively to the metal headshell to ensure continued compliance. These headshells are available from Black Box under the following part numbers:

DB25 - FA031

DB15 - FA033

The diagram below illustrates an example of a suitable screen connection. N.B. the foil or braid screen is bent back over the 'C' clip to achieve a pressure contact of the screen against the shell.

It is important to keep the screen to shell connection as short as possible.



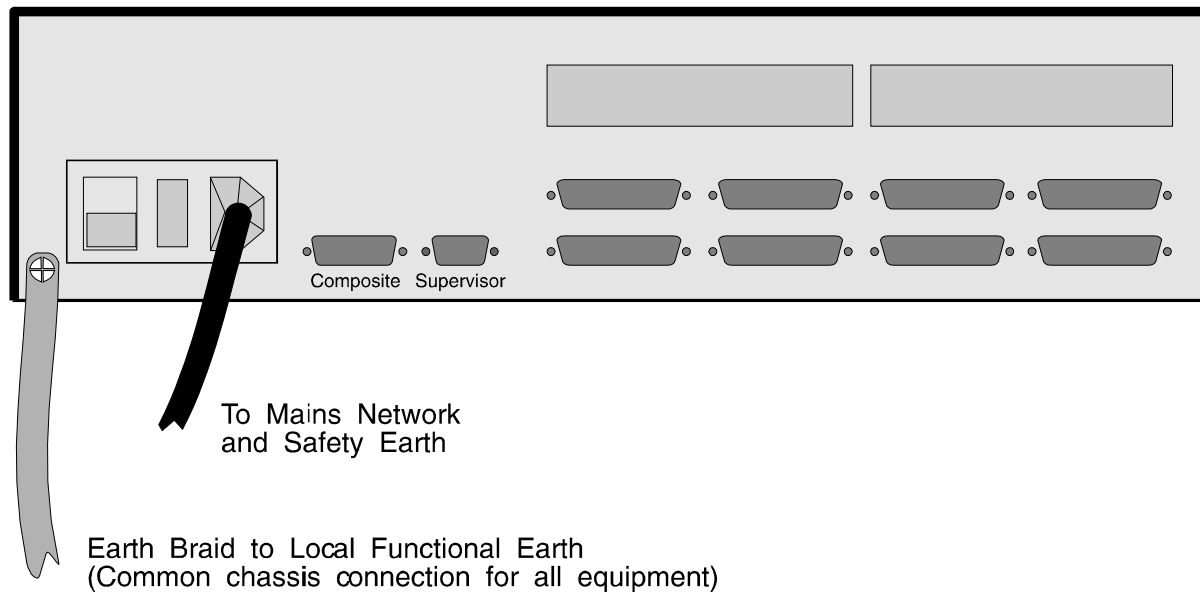
Mains Connection

The mains connection is internally filtered and requires no special consideration.

To Ensure Adequate Immunity is Achieved:

It is in the user's interest to ensure continued product immunity against mains born transients, and static discharge. To achieve this, it is important to ensure that equipment is effectively earthed.

Separate Chassis Earth Connection for Optimum Immunity



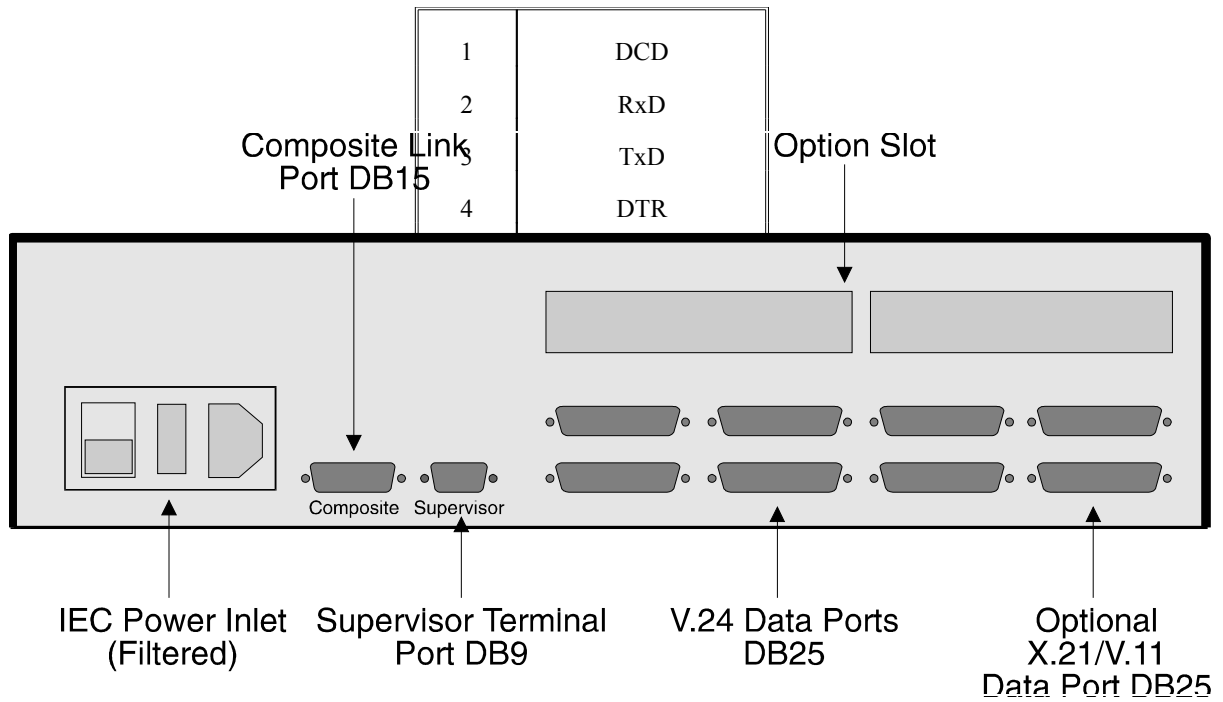
The mains IEC cable provides some protection, but to achieve optimal immunity, the chassis **EARTH screw connection** should be connected to a local **EARTH busbar** or cabinet frame wherever possible as shown above.

Appendix D - Rear Panel Layout

The layout of ports on the rear panel of the Sprint 2 multiplexer is shown in the diagram below.

Appendix E - Supervisor Port Pinout

V.24 Supervisor Port Pinout (DB9 Configured DCE)



The multiplexer requires connections to TxD, RxD and Common only. The output signals CTS, DSR and DCD are provided for the terminal if required.

Note: Connector shell and termination must be as specified in the EMC section (Appendix C.)

Appendix F - Composite Link DB15 Pinout

DB15 Composite Interface Pin Connections (DTE)					
DB15 Mux Connector	X.21/V11	V.35	V.24	G.703	Type at Connector <small>(Normal Use)</small>
1	PROTECTIVE GROUND				-
8	G	COMMON	COMMON	-	Common Return
2	T(A)	TXDa	TXD	T(A)	Generator
9	T(B)	TXDb	-	T(B)	Generator
3	C(A)	RTS	RTS	S(R) ⁵	Generator
10	C(B)	DTR	DTR	S(T) ⁵	Generator
4	R(A)	RXDa	RXD	R(A)	Load
11	R(B)	RXDb	-	R(B)	Load
5	I(A)	DCD	DCD	S(ext) ⁵	Load
12	I(B)	DSR	DSR	-	Load
6	S(A) ²	RXC _a ³	RXC	-	Load
13	S(B) ²	RXC _b ³	-	-	Load
7	-	TXC _a ³	TXC ⁴	-	Load
14	-	TXC _b ³	TXCO⁴	-	See Note 1

- Notes:
- 1 Pin 14 on Mux
 - V.11 Not Connected
 - V.35 Load
 - V.24 Generator
 - 2 V.11 Clocks S(A), S(B) may be configured as generators for DCE or test purposes.
 - 3 V.35 Clocks TXC and RXC may be configured as generators for DCE or test purposes.
 - 4 TXC should be derived from TXCO externally for V.24 Internal Clock and clock turnaround mode.
 - 5 G.703 interface Transmit and Receive **screen**s should be connected to S(T) and S(R) respectively. An on-board link connects these to signal ground (1-2) or S (Ext) External Ground (2-3.) External ground may be connected externally to Pin 1 if link grounding to **protective/chassis ground** if required.
 - 6 Connector shell and termination must be as specified in the EMC section (Appendix C.)

Appendix G - Composite Back To Back Test Cables

X.21/V.11 Test Cable

	DB15M (Mux A)	DB15M (Mux B)
Common	8	8
TxDa/RxDa	2	4
TxDB/RxDB	9	11
RxDa/TxDa	4	2
RxDB/TxDB	11	9
Clocka	6	6
Clockb	13	13

Note: Set Link Clock to INT xxxxx Unit A. Set Link Clock to AUTO Unit B

X.21bis/V.35, V.24 and V.36 Test Cables

	DB15M (Mux A)	DB15M (Mux B)
Common	8	8
TxDa/RxDa	2	4
TxDB/RxDB	9	11
RxDa/TxDa	4	2
RxDB/TxDB	11	9
RxCa/TxCa	6	7
RxCb/TxCb	13	14
TxCa/RxCa	7	6
TxCb/RxCb	14	13

Note: Set Link Clock to INT xxxxx Unit A. Set Link Clock to RXC xxxxx Unit B

G.703 Test Cable

	DB15M (Mux A)	DB15M (Mux B)
TxDa/RxDa	2	4
TxDb/RxDb	9	11
TxDa/RxDa	4	2
RxDa/TxDa	11	9

Note: Set **Link TXC** to **INT (OCTET)** Unit A. Set **Link TXC** to **RXC OCTET** Unit B.

Note: Connector shell and termination must be as specified in the EMC section(Appendix C.)

Appendix H - Data Channel Pinout

V.24 and X.2/V.11 Data Channels Connectors 1 - 8 (DB25F Configured DCE)

V.24 and X.21/V.11 Data Connector (DB25F DCE)			
V.24 Pin	V.24 Signal	X.21/V.11 Pin	X.21/V.11 Signal
1	Ground	2	TxD _b
2	TxD	3	RxD _b
3	RxD	4	CLK _a
4	RTS	7	IND _b
5	CTS	7	0V
6	DSR	8	TxD _a
7	Common	15	CLK _b
8	DCD	20	RxD _a
15	TxC	24	IND _a
17	RxC	-	-
20	DTR	-	-
24	ExtClk	-	-

- Note:
- 1 IND_b should be connected to 0V to enable equipment connected to the multiplexer.
 - 2 Connector shell and termination must be as specified in the EMC section (Appendix C.)

Appendix I - Network Composite Cables

X.21/V.11 STRAIGHT DB15F Multiplexer Composite DTE to Network DCE Cable			
MUX DB15M Connector UNC 4/40 Screws	V.11 DB15M Connector M3 Screws²		Type at Connector <small>(Normal Use)</small>
1	1	SHIELD	-
8	8	G	Common Return
2	2	T(A)	Generator
9	9	T(B)	Generator
3	3	C(A)	Generator
10	10	C(B)	Generator
4	4	R(A)	Load
11	11	R(B)	Load
5	5	I(A)	Load
12	12	I(B)	Load
6	6	S(A)	Load
13	13	S(B)	Load

- Notes: 1 Pin 14 on Mux not Connected
- 2 V.11 Male for connection to NTU must have M3 Screws. Mux end has 4/40 screws unless National Regulations permit the use of UNC 4/40. Each cable end must be clearly identifiable.
- 3 Dashed lines show wires to be twisted pairs.
- 4 Cable type: Belden 9506, 6 wire twisted pair overall screen (or equivalent). Maximum length 100 Metres.
- 5 Connector shell and termination must be as specified in the EMC section (Appendix C.)

X.21bis/V.35 STRAIGHT
DB15F Multiplexer Composite DTE
to Network DCE Cable

MUX DB15M Connector UNC 4/40 Screws	V.35 34 Way MRA Male Connector		Type at Connector <small>(Normal Use)</small>
1	A	SHIELD	-
8	B	COMMON	Common Return
2	P	TXDa	Generator
9	S	TXDb	Generator
3	C	RTS	Generator
10	H	DTR	Generator
4	R	RXDa	Load
11	T	RXDb	Load
5	F	DCD	Load
12	E	DSR	Load
6	V	RXCa	Load
13	X	RXCb	Load
7	Y	TXCa	Load
14	AA	TXCb	Load

- Notes:
- 1 Dashed lines show wires to be twisted pairs.
 - 2 Cable type: Belden 9507, 7 twisted pair overall screen (or equivalent). Maximum length 100 Metres.
 - 3 Connector shell and termination must be as specified in the EMC section (Appendix C.)

X.21bis/V.24 STRAIGHT
DB15F Multiplexer Composite DTE
to Network DCE Cable

MUX DB15M Connector UNC 4/40 Screws	V.24 DB15M Connector UNC 4/40 Screws		Type at Connector <small>(Normal Use)</small>
1	1	SHIELD	-
8	7	COMMON	Common Return
2	2	TXD	Generator
9	-	-	Generator
3	4	RTS	Generator
10	20	DTR	Generator
4	3	RXD	Load
11	-	-	Load
5	8	DCD	Load
12	6	DSR	Load
6	17	RXC	Load
13	-	-	Load
7	15	TXC	Load

- Notes: 1 Cable type: Belden 9540, 10 conductors overall screen (or equivalent).
Maximum length 10 Metres.
- 2 Connector shell and termination must be as specified in the EMC section
(Appendix C.)

X.21bis/V.24 STRAIGHT
DB15F Multiplexer Composite DTE
to Network DCE Cable

MUX DB15M Connector UNC 4/40 Screws	V.24 DB15M Connector UNC 4/40 Screws		Type at Connector <small>(Normal Use)</small>
1	1	SHIELD	-
8	7	COMMON	Common Return
2	2	TXD	Generator
9	-	-	Generator
3	4	RTS	Generator
10	20	DTR	Generator
4	3	RXD	Load
11	-	-	Load
5	8	DCD	Load
12	6	DSR	Load
6	17	RXC	Load
13	-	-	Load
7	15	TXC	Load

- Notes: 1 Cable type: Belden 9540, 10 conductors overall screen (or equivalent).
Maximum length 10 Metres.
- 2 Connector shell and termination must be as specified in the EMC section
(Appendix C.)

Appendix J - Technical Specification

V.24 DATA CHANNELS

Interface:	V.24/V.28 DB25F (DCE)
Capacity:	4, 7 or 8
Data Rates:	0, 1200, 2400, 4800, 7200, 9600, 14400, 19200, 28800bps
Data Format:	Synchronous or Asynchronous (7/8 bit)
Diagnostics:	Local and Remote Loopbacks.

X.21 DATA CHANNEL

Interface:	X.21/V.11 DB25F (DCE)
Data Rates:	0, 1200, 2400, 4800, 8000, 9600, 19200, 32000, 38400 or 48000bps
Data Format:	Synchronous
Diagnostics:	Local and Remote Loopbacks.

COMPOSITE LINK

Interface:	X.21/V.11, V.35, V.24, G.703 DB15F (all DTE)
Data Rates:	4.8 to 64Kbps
Link Protocol:	Byte Interleaved Fixed Frame

SUPERVISOR PORT

Interface:	V.24/V.28 DB9F (DCE)
Data Rate:	9600bps asynchronous
Data Format:	8 bits, no parity, 1 stop bit, XON/XOFF Flow Control with DTR
Supported Terminals:	VT52/HP2600, ANSI/VT100/VT200, ADDS, ADM3A, Hazeltine 1500, Newbury 8009, Televideo 910/920

GENERAL

Front Panel Indicators:	Carrier, Loop, Error, Data (4/8)
Dimensions:	434mm x 274mm x 82mm
Weight:	3.0Kg without option fitted
Environment:	Operating 0-40°C, 0-90% humidity non-condensing
Power Requirements:	100 - 240V AC , 50 - 60Hz or 48V DC