MX 9043

CONTENTS

ELAN Junior Networking Multiplexer

User Manual

1 INTRODUCTION

The ELAN JUNIOR is a total multiplexing solution, easily upgraded to meet all of your requirements. It is a modular networking time division multiplexer. The multiplexer may be used for either point to point or networking applications with an ELAN and offers voice and fax transmission over KiloStream™ or similar circuits.

The basic unit contains three **V.24 data channels** and a single selectable interface (V.11, V.24, V.35) **High Speed data Channel** (HSC) for LAN bridge connection. The cabinet has the capacity to house one **option module** increasing the functionality of the multiplexer with voice and fax transmission, ISDN connection or more TDM channels.

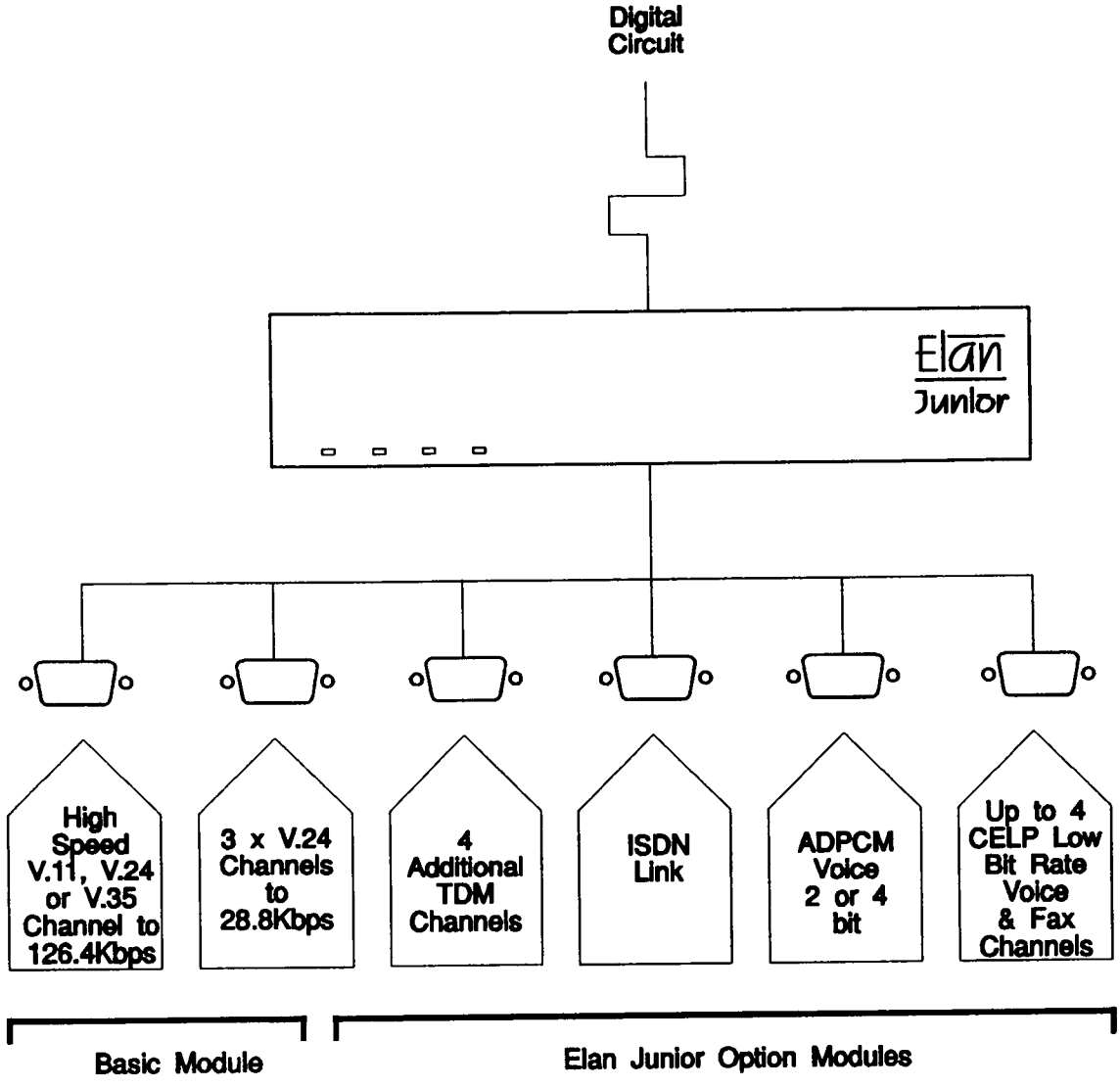
1.1 Elan Junior option modules

The modular construction of the Elan Junior allows installation of one **option module**. Many of these modules are available now or in the near future including:

CELP Low Bit Rate Voice
CELP Low Bit Rate Voice with FAX
Quad High Speed TDM
ADPCM voice
ISDN backup or permanent link connection.

1.1.1 CELP Low Bit Rate Voice Option

Each option module allows up to four low bit rate voice channels to be transmitted over the link. The CELP algorithm can be used to compress voice lines to near toll quality at 9.6Kbps, or to 6.4Kbs or 4.8Kbps where necessary. This is extremely useful where expensive international lines are in use.



1.2 Functional overview

The ELAN JUNIOR TDM multiplexes the three data ports, and any option card, over the composite link as shown in the above figure.

Three of the four data ports are V.24 synchronous or asynchronous channels

configured as DCE with data rates up to 28.8Kbps each. The 4th port has a selectable interface (V.11, V.24, or V.35), synchronous only, configured as a DCE, with a data rate up to 126.4Kbps.

The synchronous composite links have a selectable interface (X.21, V.24, V.35) with a data rate of up to 128Kbps in single link mode or 64Kbps per link in dual link mode for connection to digital services such as BT KiloStream™.

The multiplexer is easily configured from an asynchronous terminal (or PC with a terminal emulation program).

An alarm port is provided, which may be used to signal link failure or power failure at a central location. This is particularly useful in a central networking site. Connection is via a 25 pin D type connector.

2 USE AND CONFIGURATION

This section covers connection and set-up of the channel data ports. Composite ports and connection of the High Speed channel to a network is covered in Section 3, the **installation** section of this manual.

2.1 Data Channel Connection

Low speed peripherals are connected to the V.24/V.28 25-way 'D' type connectors configured DCE and numbered Ch1 to Ch3 at the rear of the multiplexer. The pin connections for these data channels are defined in Appendix F.

The High Speed Channel connection is also via a 25 way 'D' type Socket which may be configured to V.24, V.11 or V.35 (DCE) through the use of High Speed Channel Interface Selector Cards plugged into the base PCB as described in section 3.4.

2.2 Default Channel Setup

When delivered, the ELAN JUNIOR TDM is set to operate **'point to point'** with all channels set as follows:

Speed :	4800bps
Type :	SYNC
Clock :	INT

It is assumed that the composite link will be connected to a digital service such as BT KiloStream™ which provides external clock. Connection to **digital Networks** using the link ports (and optionally the HSC) is described in Section 3, **Installation.**

2.3 Changing the Configuration

The ELAN JUNIOR 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.

2.4 Supervisor Terminal requirements

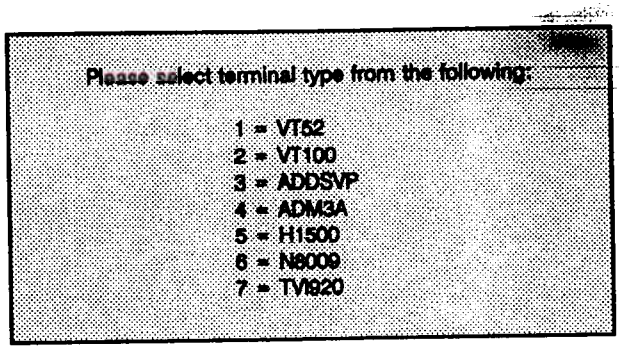
The terminal must be configured to:

8 bit character, no parity, one stop bit, speed 9.6Kbps

A suitable cable for connection of the Supervisor port is defined in Appendix D.

2.5 Supervisor Terminal Emulations

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

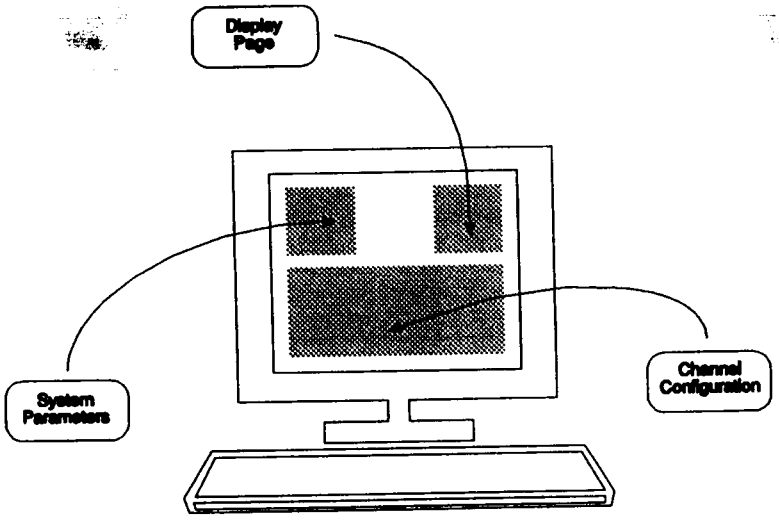


The terminal type or emulation in use should be selected by pressing the relevant number key on the PC or terminal. The monitor will now show the basic configuration screen for the multiplexer setup. This is formatted as below:

```
                              TIME DIVISION MULTIPLEXER                                  Vx.xx
========================================= 15.53  14/02/93 ==============================================

Mode            :    Normal                                  Baseboard      :    TDM 4 Channel
Link Clock      :    EXT 64000                               Option Card    :    CELP 4 Channel
V.11 Carrier    :    Present
Residual        :    12800
Configure       :    LOCAL                                   System         :    Management


Channel         :    1         2         3         4
Interface       :    V24       V24       V24       V11
Rate            :    >9600     9600      0         30400
Type            :    SYNC      ASYNC     SYNC      SYNC
Rx Clk          :    INT                 INT
Tx Clk          :    INT                 INT       INT
Parity          :              EVEN
Data Bits       :              8
RTS-CTS Dly     :    0ms       0ms       0ms       0ms
Signals         :    BOTH+     BOTH+     BOTH+     BOTH+
Mode            :    RUN       RUN       RUN       RUN

                        Cursor Keys to move, CTRL-U to save, ESC to quit
=============================================================================================================

                                  Use <SPACEBAR>/<+>/<-> to select
```

2.6 General Set-Up Display Layout

There are three main areas on the supervisor set-up screen used to change parameters for the Elan and the installed modules:



Upper left -
System parameters (Mode, Link Clock, Carrier, Residual, and Configure).

Upper right -
Other **display pages** which may be selected (Baseboard, Option Card, System).

Bottom -
Channel configuration.

The initial display is that for the TDM channels. The configuration displays for other option cards are different for each type of option card installed and are described fully in the appropriate option card manual.

2.7 General Keyboard Conventions

Only a few keys are required to configure the ELAN multiplexer and 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.
+ (Plus) or <SPACEBAR>	Toggles the parameter value **up** to the next available setting.
- (Minus)	Toggles the parameter value **down** to the next available setting.
<ENTER> or <RETURN>	Accepts the current display page (else same as ↓).
<CTRL> and U	Accepts all changes and causes multiplexer re-configuration.
<ESC>	Abandons all changes since last <CTRL> and U.

2.7.1 Cursor Movement

The cursor symbol ">" is moved around the screen to the required field using the **arrow keys**. An example is shown on the TDM configuration screen (page 8) as a grey shaded area (>9600).

2.7.2 Parameter changing

If it is possible to modify the field over which the cursor is placed, the message "Use <SPACEBAR>, <+>, <->" is shown at the bottom of the screen. No message will appear if the field is calculated, un-modifiable or hardware set.

Pressing the **Space** bar, the "+" key or the "-" key will cycle through the choices available for a parameter.

Changes to "**Rate**" (port speed) parameters will directly modify the "Residual" value (upper left of screen, fourth line), i.e. the amount of bandwidth remaining on the composite link.

The message "**!!ERRORS!!**" appears on the top line if the bandwidth is exceeded and port speeds must be adjusted accordingly to total the composite rate or less before a configuration can be used.

2.7.3 Accepting all changes and Updating the configuration

If "Control" and **"U"** are pressed at the same time 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.)

There is a delay after **"Control"** and **"U"** are pressed before the update is effective, during this time, the **"!!ERRORS!!"** message may appear, but should then vanish.

2.7.4 Abandoning Changes

Pressing **ESC** at any point before a configuration is updated will cause the message **Abandon Changes? (y/n)** to appear at the bottom of the screen. If **n** is selected the message will disappear and editing may continue. If **y** is pressed, all modifications will be abandoned and last updated configuration will be re-painted to the screen.

2.7.5 Local or Remote Configuration.

Some settings are independent at each end of the multiplexer link e.g. **RTS-CTS Dly** and **Signals** (Interface Signal Affirmation).

The **"Configure"** parameter in the upper left of the selected screen shows whether the LOCAL or REMOTE multiplexer is being configured.

2.7.6 Changing the configuration page

The **Configuration Page** required, e.g. Baseboard, System (statistics) or Option, is selected by moving the cursor to the **upper right area** and pressing Enter when alongside the required page.

2.8 TDM channel Configuration

To change the TDM channel configuration, select the TDM configuration screen (shown on page 8) by moving the cursor to the top line on the right hand area of the screen, next to **'Baseboard:'** and pressing **ENTER** or **RETURN.**

The display shows parameters for the four data channels CH1 to CH4/HSC:

> The **first three** channels V.24 only SYNC/ASYNC channels, with speeds selectable to a maximum of 28.8Kbps.
>
> The **High Speed Channel** is SYNC only and can be set to higher speeds in increments of 800bps and has a selectable interface (V.11, V.24, V.35 etc) which is automatically determined from the interface card installed. Any speed may be set to utilise all residual data bandwidth if necessary. (Single link rate less any other channels & overheads).

Only port parameters appropriate to a channel when set as SYNC or ASYNC will be accessible by the cursor.

Each data channel has the following parameters selectable at the **Setup Page**:

TDM Channel Set-up Options

PARAMETER	CHOICES	NOTES
Channel	1 to 4	
Interface	V.24 for channels 1 to 3 V.11, V.24, V.35 for Ch4 by option card selection.	Interface card selected.
Rate	Channel 1 to 3: 1200, 2400, 4800, 7200, 9600, 14400, 19200, 28800. Channel 4: 0 to 126.4Kbps, 800bps steps.	Data channel bit rate. Channel 4 increments in 800bps steps
Type	SYNC ASYNC	Data channel type
RX Clk	INT EXT	SYNC channel receive clock source. Blank if ASYNC
TX Clk	INT EXT	SYNC channel transmit clock source. Blank if ASYNC
Parity	EVEN ODD NONE	ASYNC data parity. Blank if SYNC
Data bits	7 or 8	Blank if SYNC
RTS-CTS Dly	0ms 50ms	Data channel RTS/CTS delay
Signals	BOTH+ TRANS DSR+ DCD+	DSR/DCD affirmed at local multiplexer. Remote RTS to local DCD Remote DTR to local DSR DSR affirmed at local mux DCD affirmed at local mux
Mode	RUN LOOP	Channel RUN (normal) or local channel LOOP

2.9 Copying another channel's set-up

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

The message '**Enter number or use <+>/<-> to copy channel**' appears.

Simply entering the **number** of the channel to be copied transfers all of that channels parameters to the current channel.

2.10 High Speed Channel

The High Speed Channel provides an additional synchronous only data channel. The signals available at the interface are one full duplex data (TXD/RXD,) one full duplex control (RTS/DCD,) one passive affirmed control (DSR,) and two clocks being internally or externally selectable (TXC/RXC.)

The interface standard can be selected from the range X.21/V.11, V.24, or V.35 as necessary using the optional interface modules. Fitting of these modules is described in Section 3.4

The terminal **Setup Page** for the Baseboard is used to alter the settings for this channel in the same manner as the other channels. The **TYPE** element is hardware selected and will show the type of interface card fitted.

The data rate may be selected in steps of 800bps.

2.11 System Event Log

This screen logs the most recent link failure and power-up for operator information. An example is shown below:

```
                          TIME DIVISION MULTIPLEXER                    Vx.xx
========================== 15.53  14/01/93 ==============================================

Mode                :     Normal                    Baseboard   :     TDM 4 Channel
Link Clock          :     EXT 64000                 Option Card :     CELP 4 Channel
V.11 Carrier        :     Present
Residual            :     12800
Configure           :     LOCAL

Set Clock           :     >12:58:00 01/08/93

                    -- SYSTEM STATUS --          -- EVENT LOG --

                    No errors                   12.58 14/01/93 Power up test passed
                                                13.00 14/01/93 Link A synchronised

                          Cursor Keys to move, CTRL-U to save, ESC to quit
================================================================================================
Enter time and date (hh-mm-ss dd/mm/yy)
```

2.12 Setting the System's Real-Time Clock

To change the system clock time, position the > cursor at the **"Set Clock"** field. The message '**Enter time and date (hh-mm-ss dd/mm/yy)**' will appear at the bottom of the screen. The time should be entered following the format shown. Time updates may be entered without a date, but to change the date both must be entered.
The standard Elan Junior will lose any time and date set whenever the unit is turned off or suffers a power failure.
An upgrade chip is available if required to prevent this happening.

3 ELAN JUNIOR Multiplexer Installation

BEFORE INSTALLATION, PLEASE REFER TO THE WARNINGS IN APPENDIX A.

3.1 Supply Voltage & Connection

A.C. 100 - 240V a.c. without adjustment.
D.C. 36 - 72V d.c. without adjustment. **(OPTIONAL TBA)**

The Elan Junior may be optionally DC or AC powered. The AC power supply is a switched mode unit. The optional DC power supply unit is a DC to DC convertor allowing considerable input voltage variation. Cooling is assisted by a fan located on the front panel.

3.2 Environmental Considerations

The ELAN Junior 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.

3.3 Mechanical Construction

The ELAN JUNIOR is housed in a 2U tall 19" rack mountable enclosure with fan assisted cooling. Four LEDs on the front panel indicate the current status of the multiplexer.

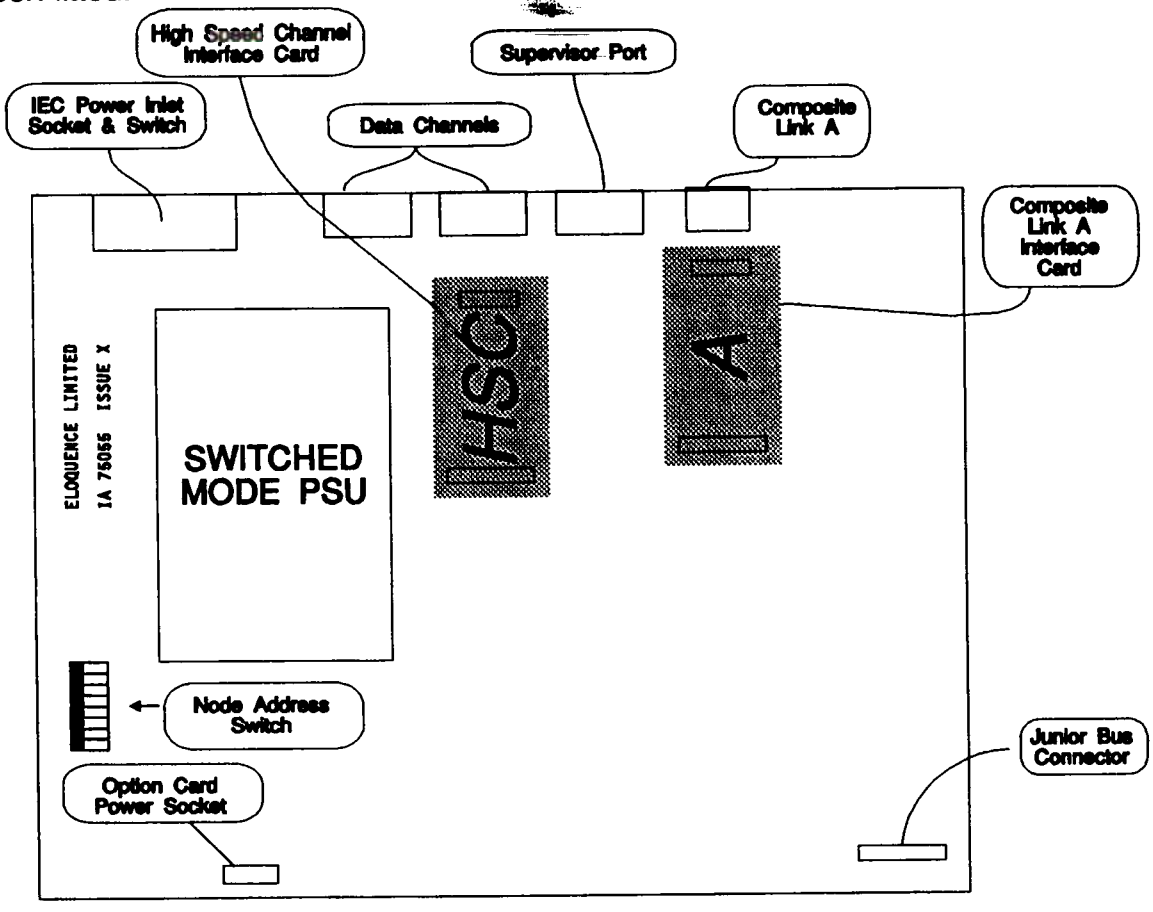
The multiplexer MUST be disconnected from the power supply before opening the unit or changing any network connections.

Screws on the left, right and top of the enclosure are removed using a Posidrive screwdriver to access the interior. This allows installation of option modules and interface cards.

The rear panel (illustrated on page 26) accommodates the link interface connectors, supervisor/alarm port and has apertures allowing access to the option card connectors. A Blanking panel is fitted in the absence of an option module.

3.4 Composite & High Speed Channel Interface Selection

Interface cards are used to determine the interface type (X21/V11, V24, V35 etc.) of **LINK A** and also on the high speed channel (Ch4/HSC). It will be necessary to use the corresponding external **cable** to make connection once the interface card has been fitted.



It will be necessary to set link positions on the interface cards as to whether the interface is to be a DTE or DCE interface. This affects internal clock generation. The link settings for each interface are defined as follows:

Interface	Link Number	DTE Setting (Network)	DCE Setting
V11 (IA75035B)	N/A	N/A	N/A
V24 (IA75038B)	LK1	CMP	HSC
V35 (IA75039B)	LK1, Nearest J1	EXT	INT
	LK2, Nearest J2	EXT	INT

The interface cards may be accessed through the front panel as described in section 3.3, 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.

3.5 Composite Network Connection

The Elan JUNIOR Multiplexer supports many different Network Interfaces including X21/V11, V35 and V24 on **LINK A** and the **Ch4/HSC** port, others being available now or in the near future (please contact your dealer for further details).

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

3.6 Onward Linking

Synchronous data may be onward linked from the multiplexer by an external synchronous modem or line driver, which provides a DCE interface.

The High Speed Channel (Ch4/HSC) appears on the back panel as a 25 way D-type connector, and may be used as a normal DCE port or configured as a DTE for Network connection (eg. onward linking) using a crossover cable as defined in Appendix K. TX CLOCK and/or RX CLOCK must be set EXT using the VDU set-up procedure.

If necessary, the modem can often be configured to take an external clock from the MUX. If this is required, the TX clock is selected **internal** and an appropriate cable modification must be made to connect the internal clock to the modem.

3.7 Composite Link Parameters

Parameters in the **System** area (upper left) and the choices available by pressing the **Space Bar** or + and - keys are:

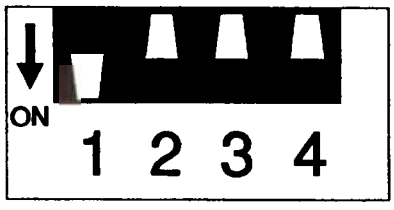
PARAMETER	CHOICES	NOTES
Mode	Normal L-loop Echo R-loop	The current operational mode of the composite link.
Link Clock	Ext 64000 Int 800 (to 128000) RXC	**Normal** Internal - steps of 800bps. For V.35 only.
V.11/V.24/ V.35 Carrier	Present Lost	Deduced from link status.
Residual	(Calculated)	Composite rate minus overhead, minus sum of port rates.
Configure	LOCAL REMOTE	"Modified" appears if change has been made.

3.8 Option Module Installation

With power turned **OFF**, the blanking panel should be removed before the option card is inserted. This is achieved by removing **four screws** (shown) on the back panel. The option module is fitted into position **above** the base card, using four screws on the rear panel and two screws on the support pillars.
Further instructions for installation and connection are included in the relevant user manual for each specific option card. Power must be connected to the option module (by its cable) to the power socket on the motherboard. Once the BUS ribbon cable on the right hand side has been fitted, only option switch setting remains (below).

3.9 Option Card Position Selector

The option module can occupy any physical position in the enclosure, but the software will recognise each card by the position selected on the switches at the front of the card. This switch can be located by referring to the relevant manual for that option.



The switches (shown **white**) are in the **on** position when pushed down, and should be set as follows:

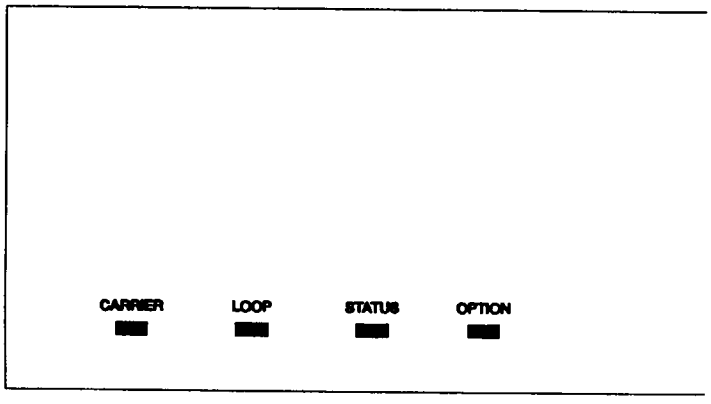
Option slot 1 (shown) = **ON** OFF OFF OFF

Any option card used in the Elan Junior **MUST** be set to slot 1

4 TROUBLESHOOTING

4.1 Front Panel LEDs

On the front panel only the **STATUS** and **CARRIER** lights should be illuminated, both constant green.



(this assumes that no option is fitted and the unit has been installed correctly). The front panel LEDs show general status of operation as shown here. These LEDs have two colours to identify various states. The normal operating condition is shown in **bold** in the table below, and coloured **Green** on the front panel. If the light is **red** a fault has been detected.

LED LABEL	CONDITION	NOTES
Status	**Green** Red	**OK** Problem - see System screen
Carrier	**Constant green** Blinking green	**Carrier OK** Carrier Lost
Loop	**Not illuminated** Green	**Normal un-looped mode** Channel/composite looped or Internal Clock
Option Card	**Green** **Red** **Not illuminated**	Green if option 1 installed. Red if an ERROR has occurred in option 1. Unlit if option slot vacant.

4.2 Diagnostics & Loopbacks

To assist in commissioning and fault-finding, various diagnostic modes are provided. They consist of :

i) Initial power-up self-test.

ii) Composite loopback mode selectable as either LOCAL or REMOTE.

iii) Individual channel loopbacks selectable as either LOCAL or REMOTE.

4.3 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 set-up 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 connectors using the appropriate cable selected from Appendix L.

An example is to use the X.21/V.11 crossover (see Appendix L) cable with the an X.21/V.11 Composite Interface Card present on the baseboard.

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 **EXT** (or RXC for V.35) thus accepting clock from the other.

When correctly interconnected the multiplexer pair will intercommunicate, **Carrier** indicated as **Present** and the **LINK A** LED on the front of the unit being illuminated constant green. Having achieved this situation all normal configuration procedures may be exercised.

After back-to-back testing it is **essential** to re-configure the composite clocking, from internal (INT) to external (EXT) on the unit which had been providing a system clock to allow the unit to accept clocking from the link. (For V.35, the other unit will also need to be returned from RXC to EXT mode).

4.4 Loopbacks

Three different **Composite loopback** modes are available:

L-Loop When L-Loop (LOCAL COMPOSITE LOOPBACK) is selected, the composite link of the **local multiplexer** is looped back, 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.

R-Loop When R-Loop (REMOTE COMPOSITE LOOPBACK) is selected the composite link is looped back **by the remote unit** which returns data to the local multiplexer, data inputs to the remote multiplexer are ignored. This tests the Network link.

Echo Causes the composite from the **remote** unit to be echoed to it. This is exactly the same as if a user at the remote site had selected R-Loop.

Channel loopbacks, which may be LOCAL or REMOTE, are not intrusive to other data channels. They are not bilateral and may only be set at one end of the link for one channel at any time.

During loopback operation, interface signals are also looped back to their corresponding outputs.

Only one channel may be put into loopback at a time. Loopback modes are not bilateral and it is not possible to apply a local AND a remote loopback on the same channel on different units.

5 TECHNICAL FEATURES

5.1 Data Throughput and Efficiency

At any link rate above 32Kbps the management overhead is 1600bps, for rates below this the overhead is halved to 800bps e.g. a composite rate of 28.8Kbps will yield a throughput of 28Kbps.

5.2 Frame Length

Frame length is 160 bytes at 64 or 128Kbps i.e. a byte has an equivalence of 400bps. The frame length is reduced at lower data rates to maintain a constant frame duration of 20ms, for example at 19.2Kbps the frame length falls to 48 bytes.

5.3 Synchronous Data

The internally generated data 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.

5.4 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. The 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.

5.5 Alarms

An isolated single pole changeover relay indicates the presence of DC power and carrier. Failure of either is signalled via contact closure. Carrier loss is also displayed as a statistic on the **System** display. See Appendix H for a connector pinout.

APPENDIX A

WARNING: **THIS EQUIPMENT MUST BE EARTHED**

This equipment relies on the EARTH 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/Alarm** Port
ii) **Link A**
iii) **Ch1** to **Ch4** (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.

Other Ports:

The Basic ELAN Multiplexer has **no other ports**. For Port connections on **Module cards** see the appropriate user manual section for the particular card.

APPENDIX B - APPROVAL REQUIREMENTS

The ELAN JUNIOR MULTIPLEXER carrying the BABT assessment symbol and approval number is approved for connection to the networks identified in this Appendix as follows:

X.21/V11

To NET1 at rates up to and including 128Kbps when the composie LINK A or High Speed Channel (Ch4/HSC) 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, page 32. This cable is available from your dealer using the specified part number.

X.21bis

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 in section 3.4 on page 16. Connection must be made using a suitable non-integral interface specific cable, details of which are provided in Appendix I, page 34. This cable is available from your dealer using the specified part number.

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 section 3.4 on page 16. Connection must be made using a suitable non-integral interface specific cable, details of which are provided in Appendix I, page 33. This cable is available from your dealer using the specified part number.

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.

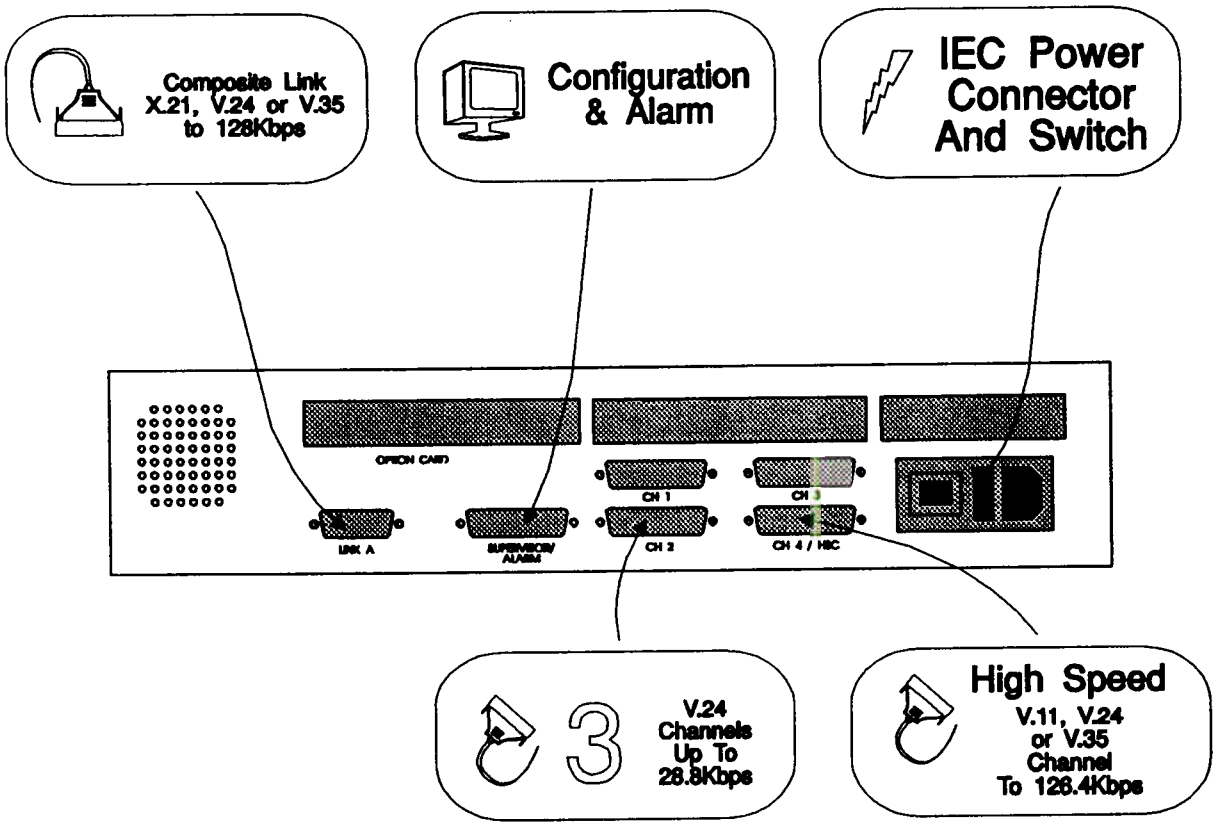
If any other apparatus, including cable or wiring, is to be connected between the apparatus and the point of connection to any particular digital circuit then that apparatus shall conform to the following:

(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

Rear Panel Layout

The layout of all ports on the rear panel of the Elan Junior multiplexer is shown in the diagram below:



APPENDIX D - Supervisor port pinout

V.24 Supervisor Port Pinout (25 Way D Type Configured DCE)

1	Ground
2	TxD
3	RxD
4	RTS
5	CTS
6	DSR
7	Common
8	DCD
20	DTR

9600bps Operation: The multiplexer requires connections to TxD, RxD and Common only. The output signals CTS, DSR and DCD are provided for the terminal if required.

APPENDIX E - LINK A 15 way pinout

15 D-Type Composite Interface Pin Connections (DTE)					
15 Way Mux Connector	**X.21/V11**	**V.35**	**V.24**	**G.703**	**Type at Connector** (Normal Use)
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]	RXCa[3]	RXC	-	Load
13	S(B)[2]	RXCb[3]	-	-	Load
7	-	TXCa[3]	TXC[4]	-	Load
14	-	TXCb[3]	TXCO[4]	-	See Note 1

Notes:

1. Pin 14 on Mux

V11	Not Connected
V35	Load
V24	Generator

2. V11 Clocks S(A), S(B) may be configured as generators for DCE or test purposes.
3. V35 Clocks TXC and RXC may be configured as generators for DCE or test purposes.
4. TXC should be derived from TXCO externally for V24 internal Clock and clock turnround mode.
5. G.703 Interface Transmit and Receive **screens** 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** is required.

APPENDIX F - V.24 Data Channel Pinout

V.24 Data Channels 1 - 3 Connector (25 Way D Type Configured DCE)

1	Ground
2	TxD
3	RxD
4	RTS
5	CTS
6	DSR
7	Common
8	DCD
15	TxC
17	RxC
20	DTR
24	Ext Ck

APPENDIX G

25 D-Type High Speed Channel (HSC) Interface Pin Connections (DCE)

25 Way Mux Connector	X.21/V11	V.35	V.24	Type at Connector (Normal Use)
1	PROTECTIVE GROUND			-
7	G	COMMON	COMMON	Common Return
2	T(A)	TXDa	TXD	Load
12	T(B)	TXDb	-	Load
4	C(A)	RTS	RTS	Load
20	C(B)	DTR	DTR	Load
3	R(A)	RXDa	RXD	Generator
11	R(B)	RXDb	-	Generator
8	I(A)	DCD	DCD	Generator
6	I(B)	DSR	DSR	Generator
10	S(A)[2]	RXCa[3]	-	Generator
9	S(B)[2]	RXCb[3]	-	Generator
5	-	-	CTS	Generator
15	-	-	TXC	Generator
17	-	TXCa[3]	RXC[4]	Generator
24	-	TXCb[3]	Ext Clk[4]	Load

Notes:

1 Pin 17 on Mux:

V11	Not Connected
V35	Load
V24	Generator

2 V11 Clocks S(A), S(B) may be configured as generators for DCE or test purposes, loads for DTE.

3 V35 Clocks TXC and RXC may be configured as generators for DCE or test purposes, loads for DTE.

4 Ext Clk should be derived from TXC externally for V24 **internal clock** and **clock turnround** mode.

APPENDIX H - Alarm Port Pinout 25 Way D Type

Carrier Present/Power On	11 and 12 open 11 and 13 closed
Carrier Loss/Power Fail	11 and 12 closed 11 and 13 open

APPENDIX I - NETWORK COMPOSITE CABLES

X.21/V.11 STRAIGHT 15 Way Multiplexer Composite DTE to Network DCE Cable (P/N BB15019B)			
MUX 15 Way Male Connector UNC 4/40 Screws	**V.11 15 Way Male Connector M3 Screws[3]**		**Type at Connector** (Normal Use)
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)[2]	Load
13	13	S(B)[2]	Load

Notes:

1. Pin 14 on Mux not Connected
2. V11 Clocks S(A), S(B) may be configured as generators, normally only for test purposes.
3. V11 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.
4. Dashed lines show wires to be twisted pairs.
5. Cable type: Belden 9506, 6 wire twisted pair overall screen (or equivalent). Maximum length 100 Metres.

X21bis/V.35 STRAIGHT

15 Way Multiplexer Composite DTE
to Network DCE Cable
(P/N BB15030B)

MUX 15 Way Male Connector UNC 4/40 Screws	V.35 34 Way MRA Male Connector		Type at Connector (Normal Use)
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[1]	Load
13	X	RXCb[1]	Load
7	Y	TXCa[1]	Load
14	AA	TXCb[1]	Load

Notes:

1. V35 Clocks TXC and RXC may be configured as generators, normally only for test purposes.
2. Dashed lines show wires to be twisted pairs.
3. Cable type: Belden 9507, 7 twisted pair overall screen (or equivalent). Maximum length 100 Metres.

X.21bis/V.24 STRAIGHT

15 Way Multiplexer Composite DTE
to Network DCE Cable
(P/N BB15018B)

MUX 15 Way Male Connector UNC 4/40 Screws	V.24 25 Way Male Connector UNC 4/40 Screws		Type at Connector (Normal Use)
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
14	24	TXCO[2]	Generator

Notes:

1 Pin 14 on Mux is a Generator for V.24

2 Pin 14 of MUX 15 way to pin 24 of X.21bis **NOT INCLUDED** in this cable for BT Network connection. (Include for externally clocked Modem)

3 Cable type: Belden 9505, 5 twisted pair overall screen (or equivalent). Maximum length 10 Metres.

APPENDIX J - HSC STRAIGHT CABLES

X.21/V.11 HSC STRAIGHT 25 Way Multiplexer HSC DCE to DTE Cable			
MUX 25 Way Male Connector UNC 4/40 Screws	**V.11 15 Way Female Connector M3 Screws[2]**		**Type at Connector** (Normal Use)
1	1	SHIELD	-
7	8	G	Common Return
2	2	T(A)	Load
12	9	T(B)	Load
4	3	C(A)	Load
20	10	C(B)	Load
3	4	R(A)	Generator
11	11	R(B)	Generator
8	5	I(A)	Generator
6	12	I(B)	Generator
10	6	S(A)[1]	Generator
9	13	S(B)[1]	Generator

Notes:

1. V11 Clocks S(A), S(B) should be configured as generators, normally only for DEC or test purposes.
2. Dashed lines show wires to be twisted pairs.
3. Cable type: Belden 9506, 6 twisted pair overall screen (or equivalent). Maximum length 100 Metres.
4. RXC = Int, TXC = not relevant

X21bis/V.35 HSC STRAIGHT

25 Way Multiplexer HSC DCE
to DTE Cable

MUX 25 Way Male Connector UNC 4/40 Screws	V.35 34 Way MRA Female Connector		Type at Connector (Normal Use)
1	A	SHIELD	-
7	B	COMMON	Common Return
2	P	TXDa	Load
12	S	TXDb	Load
4	C	RTS	Load
20	H	DTR	Load
3	R	RXDa	Generator
11	T	RXDb	Generator
8	F	DCD	Generator
6	E	DSR	Generator
24	V	RXCa[1]	Generator
17	X	RXCb[1]	Generator
10	Y	TXCa[1]	Generator
9	AA	TXCb[1]	Generator

Notes:

1. V35 Clocks TXC and RXC may be configured as generators, normally only for DCE & test purposes.
2. Dashed lines show wires to be twisted pairs.
3. Cable type: Belden 9507, 7 twisted pair overall screen (or equivalent). Maximum length 100 Metres.
4. RXC = Int, TXC = Int

X.21bis/V.24 STRAIGHT

25 Way Multiplexer HSC DCE
to DTE Cable

MUX 25 Way Male Connector UNC 4/40 Screws	V.24 25 Way Female Connector UNC 4/40 Screws		Type at Connector (Normal Use)
1	1	SHIELD	-
7	7	COMMON	Common Return
2	2	TXD	Load
4	4	RTS	Load
20	20	DTR	Load
3	3	RXD	Generator
8	8	DCD	Generator
6	6	DSR	Generator
5	5	CTS	Generator
17	17	RXC	Generator
15	15	TXC	Generator
24	24	Ext Clk	Load

Notes:

1. Cable type: Belden 9505, 5 twisted pair overall screen (or equivalent). Maximum length 10 Metres.
2. RXC = Int, TXC = Int

APPENDIX K - HSC Network Crossover Cables

X.21/V.11 HSC CROSSOVER
25 Way Multiplexer HSC DCE
to Network DCE
ONWARD LINKING Crossover Cable
(P/N BB15031A)

MUX 25 Way Male Connector UNC 4/40 Screws	V.11 15 Way Male Connector M3 Screws[2]		Type at Connector (Normal Use)
1	1	SHIELD	-
7	8	G	Common Return
3	2	T(A)	Generator
11	9	T(B)	Generator
8	3	C(A)	Generator
6	10	C(B)	Generator
2	4	R(A)	Load
12	11	R(B)	Load
4	5	I(A)	Load
20	12	I(B)	Load
10	6	S(A)[1]	Load
9	13	S(B)[1]	Load

Notes:

1 V11 Clocks S(A), S(B) may be configured as generators, normally only for test purposes.

2 V11 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 twisted pair overall screen (or equivalent). Maximum length 100 Metres.

X21bis/V.35 HSC CROSSOVER

25 Way Multiplexer HSC DCE
to Network DCE
ONWARD LINKING Crossover Cable
(P/N BB15032A)

MUX 25 Way Male Connector UNC 4/40 Screws	V.35 34 Way MRA Male Connector		Type at Connector (Normal Use)
1	A	SHIELD	-
7	B	COMMON	Common Return
3	P	TXDa	Generator
11	S	TXDb	Generator
8	C	RTS	Generator
6	H	DTR	Generator
2	R	RXDa	Load
12	T	RXDb	Load
4	F	DCD	Load
20	E	DSR	Load
10	V	RXCa[1]	Load
9	X	RXCb[1]	Load
24	Y	TXCa[1]	Load
17	AA	TXCb[1]	Load

Notes:

1. V35 Clocks TXC and RXC may be configured as generators, normally only for test purposes.
2. Dashed lines show wires to be twisted pairs.
3. Cable type: Belden 9507, 7 twisted pair overall screen (or equivalent). Maximum length 100 Metres.

X.21bis/V.24 CROSSOVER

25 Way Multiplexer HSC DCE
to Network DCE
ONWARD LINKING Crossover Cable
(P/N BB15033A)

MUX 25 Way Male Connector UNC 4/40 Screws	V.24 25 Way Male Connector UNC 4/40 Screws		Type at Connector (Normal Use)
1	1	SHIELD	-
7	7	COMMON	Common Return
3	2	TXD	Generator
11	-	-	Generator
8	4	RTS	Generator
6	20	DTR	Generator
2	3	RXD	Load
12	-	-	Load
4	8	DCD	Load
20	6	DSR	Load
10	17	RXC	Load
9	-	-	Load
24	15	TXC	Load
17	24	TXCO[2]	Generator

Notes:

1 Pin 17 on Mux is a Generator for V.24

2 Pin 17 of MUX 25 way to pin 24 of X.21bis**NOT INCLUDED** in this cable for BT Network connection.

3 Cable type: Belden 9505, 5 twisted pair overall screen (or equivalent). Maximum length 10 Metres.

APPENDIX L

X.21/V.11/G.703 Composite Crossover Cable for Back to Back Test Operation

	Male 15 Way D Type (Mux A)	Male 15 Way D Type (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

N.B. Set 'Link Clock' to 'INT xxxxx' Unit A
Set 'Link Clock' to 'EXT' Unit B

X.21bis/V.35 and V.24 Composite Crossover Cable for Back to Back Test Operation

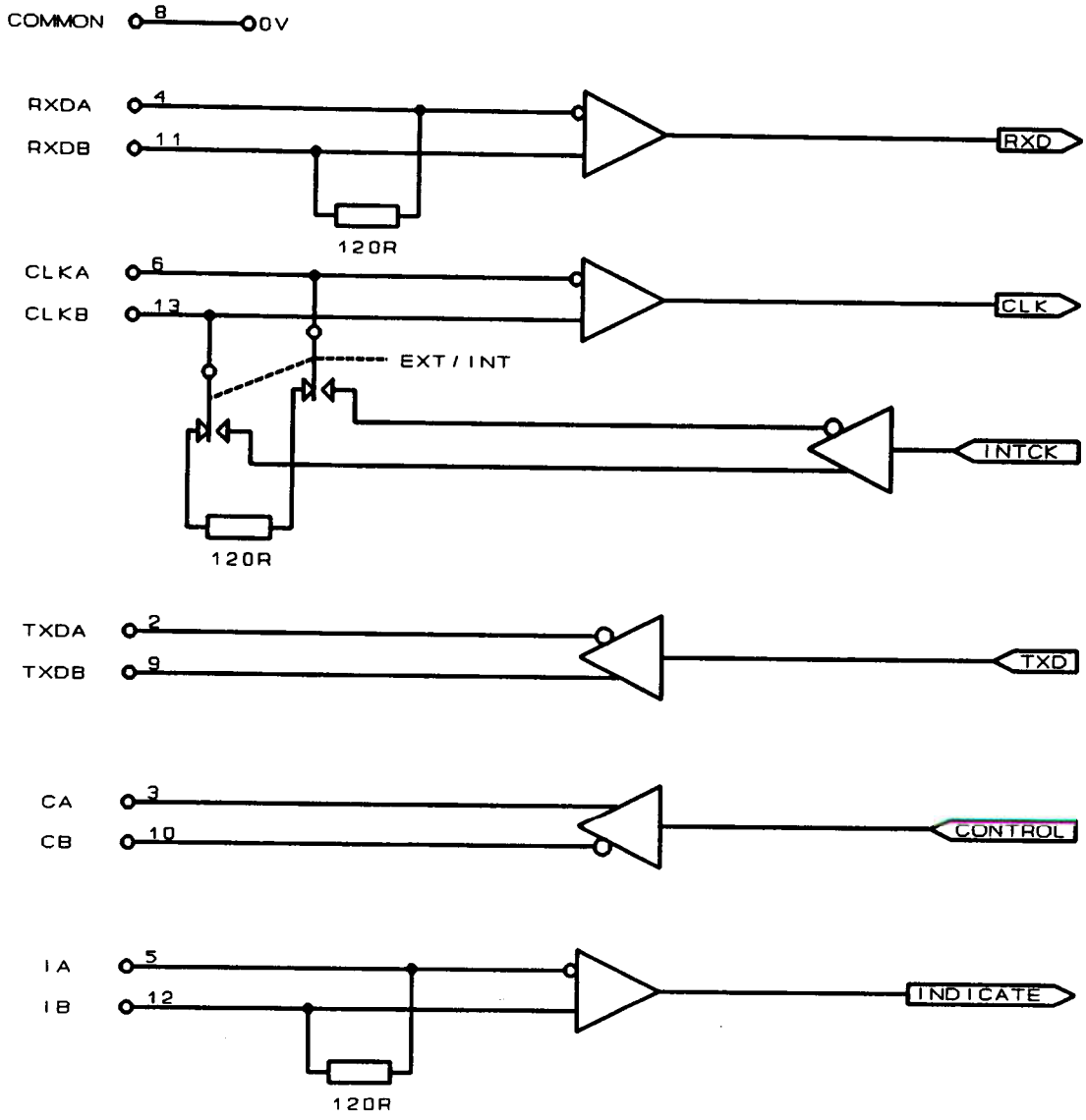
	Male 15 Way D Type (Mux A)	Male 15 Way D Type (Mux B)
Common	8	8
TxDa/RxDa	2	4
TxDb/RxDb	9	11
RxDa/TxDa	4	2
RxDb/TxDb	11	9
RxCa/TxCa	6	7
RxCb/TxCb	13	14
TxCa/RxCa	7	6
TxCb/RxCb	14	13

N.B. Set 'Link Clock' to 'INT xxxxx' Unit A
Set 'Link Clock' to 'RXC xxxxx' Unit B

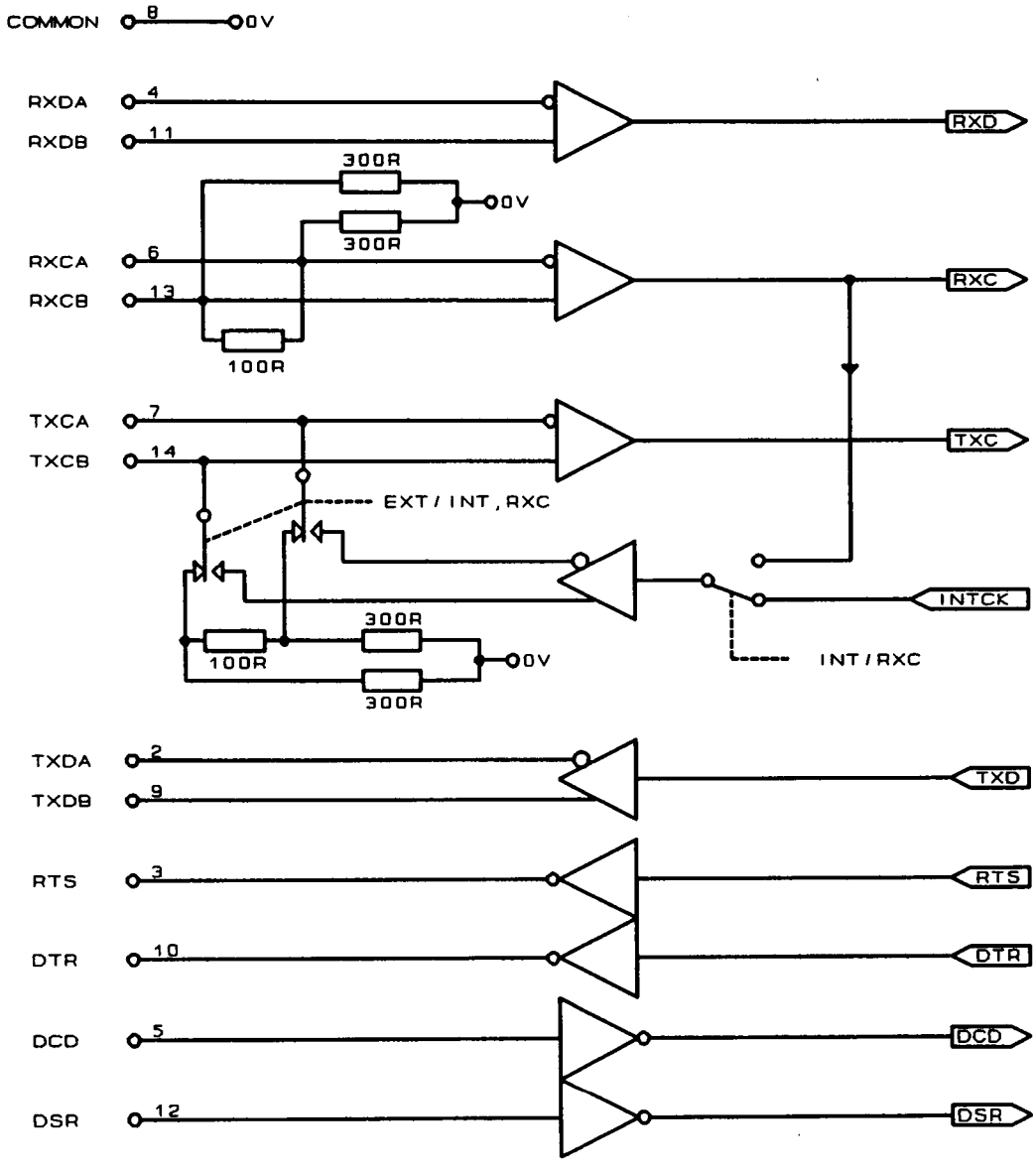
APPENDIX M

Composite Interface Implementation at 15 Way D Type Connector

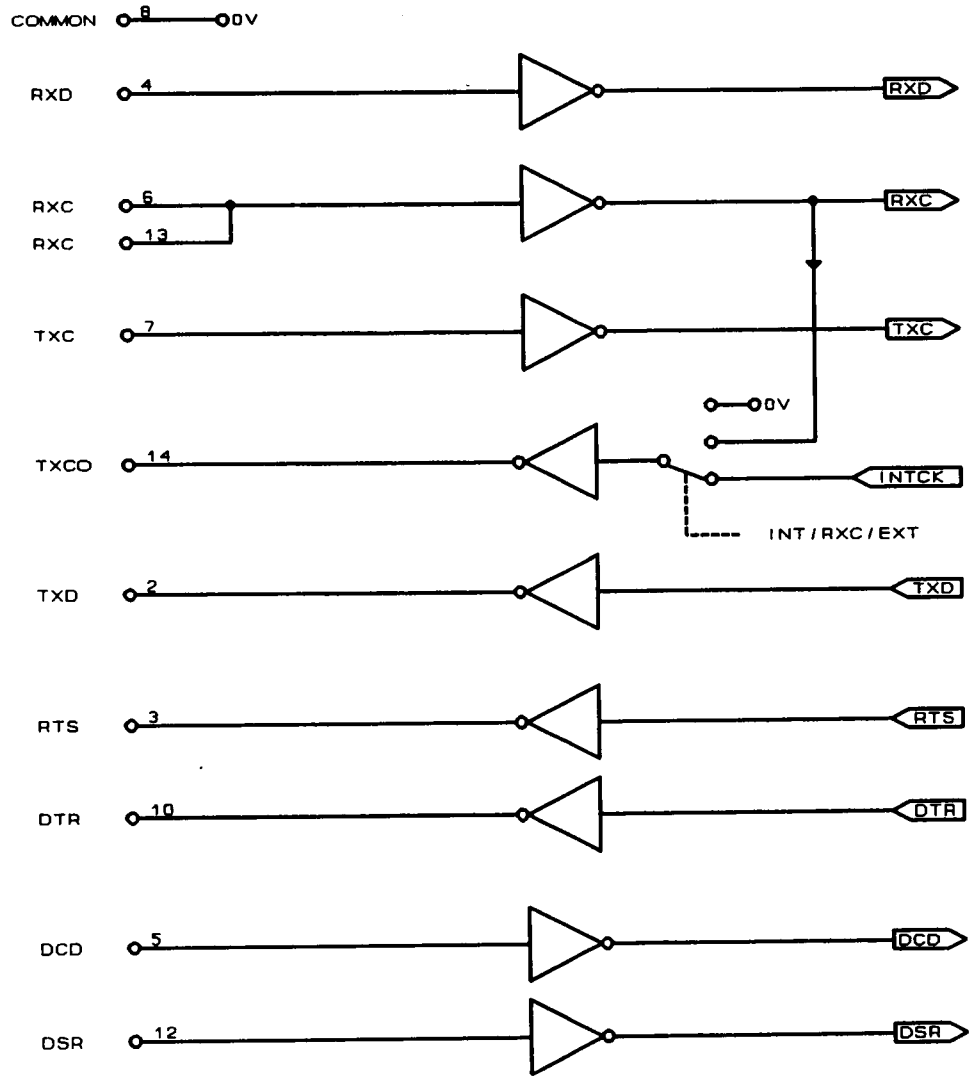
X.21 Composite Interface



V.35 Composite Interface



V.24 Composite Interface



APPENDIX N
ELAN JUNIOR TECHNICAL SPECIFICATION

* **COMPOSITE LINK**
LINK PROTOCOL:
Byte Interleaved fixed frame
RE-SYNCHRONISING TIME:
80ms
LINK EFFICIENCY:
97.5% at 64Kbps
DATA RATES:
4.8 - 128Kbps in 800bps steps
LINK INTERFACES:
X.21/V.11, V.35, V24,
G.703 64K Co-directional
LINK CONNECTION:
15 way D-type configured DTE
LINK CLOCK SOURCE:
Internal/External

* **V.24 CHANNELS (3)**
ROUND TRIP DELAY
12mS at 9.6Kbps channel rate
DATA RATES SYNC/ASYNC:
1.2,2.4,4.8,7.2,9.6,14.4,19.2 & 28.8Kbps
SYNC DATA CLOCK SOURCE:
Internal or External
CONNECTORS:
25 way D type socket configured as DCE
INTERFACE:
RS232C/V.24/V.28
GND(pin1), TXD(pin2),
RXD(pin3), RTS(pin4), CTS(pin5),
DSR(pin 6), SigGND(7), DCD(pin8)
TXC(pin15), RXC(pin17), DTR(pin20)
ExtTXC(pin24)

* **HIGH SPEED CHANNEL (1):**
DATA RATES (SYNCHRONOUS):
4.8-62.4Kbps dual link or
126.4Kbps single link
(In steps of 800bps)
INTERFACE:
X.21/V.11, V.35, V.24

* **GENERAL**
ALARMS: Power Fail/Carrier Loss by contact closure.
DIMENSIONS:
437mm X 360mm X 133mm
WEIGHT: (without options)
Approx 3.5Kg
ENVIRONMENT:
Operating temperature 0-40°C
0-90% Humidity non condensing
POWER SUPPLY:
100V-240V, 47-440Hz
POWER RATING:
Max 40W, Fused 2A Anti-Surge

* **OPTION MODULE:**
QUAD CELP VOICE MODULE:
DATA RATES:
4.8/6.4/9.6Kbps
SIGNALLING:
(E&M)-DC5 /DTMF/AC15
SPEECH CHANNEL INTERFACE:
2 or 4 wire, Complex & 600 ohm
ECHO CANCELLATION:
To CCITT G.165
EQUIVALENT QDU:
Analogue to Analogue, 6
Analogue to Digital, 3
BACK TO BACK DIGITISING DELAY:
120 mS
LINE ERROR TOLERANCE:
Bert = 1×10^{-3}
ATTENUATION:
Receive gain +6 to -15dB, 3dB steps
Transmit gain +6 to -15dB, 3dB steps