Jan 97 / Version 1.1

Echo Mux X.21/V.11:
MXU9070

Echo Mux V.35:
MXU9076

Echo 2 Mbps Multiplexer

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ECHO

E1 2 Megabit Multiplexer range
User Manual

CE

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.

Contents

Introduction

The Echo is an E1 time division multiplexer, operating at 2.048 Mbps, supporting up to 4 X.21/V.11 data channels, and an additional (optional) E1 drop and insert link.

The unit is easily configured from either end of the link, using a terminal or a PC running a terminal emulation package.

This user manual covers installation and setup of user options for the multiplexer. A full set of cable diagrams is available in the appendices.

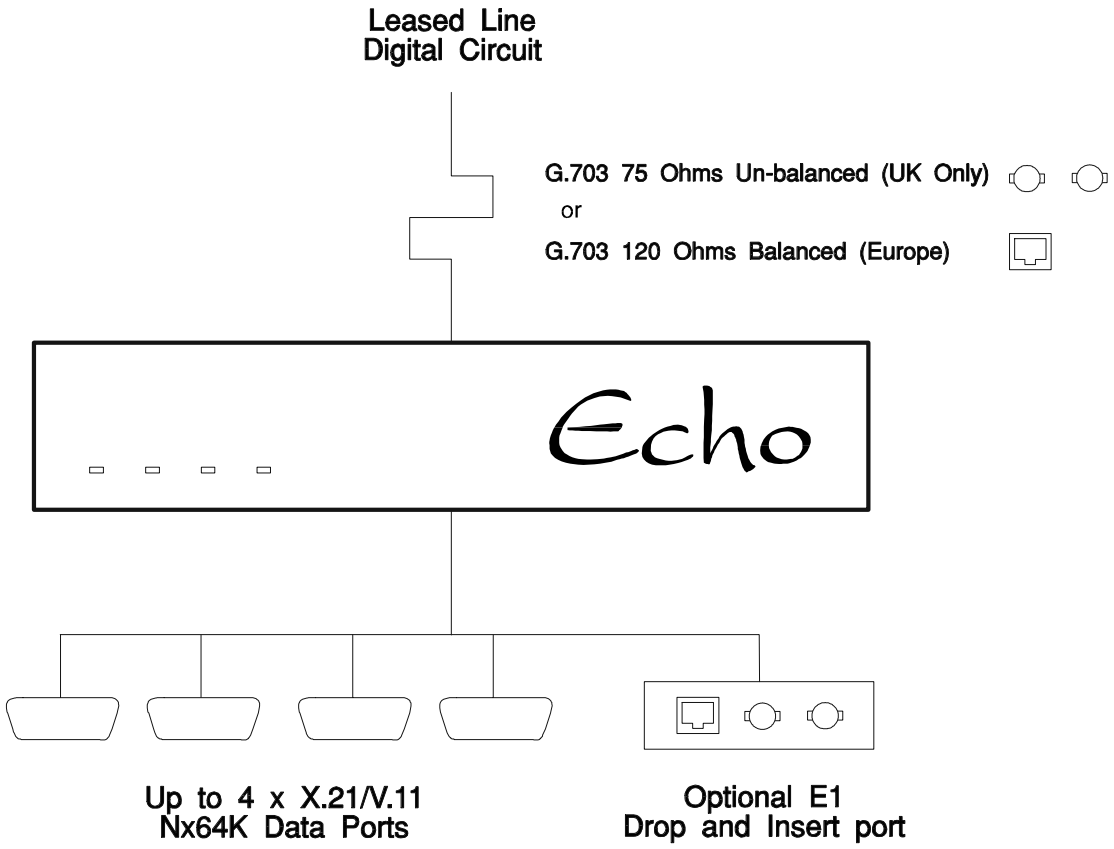
Functional overview

The ECHO E1 multiplexer is a time division multiplexer operating at 2.048 Mbps, compliant with both EUROPEAN and UK G.703 standards.

The composite link is interface selectable for either UK (75 Ohms un-balanced) or EUROPEAN (120 Ohms balanced).

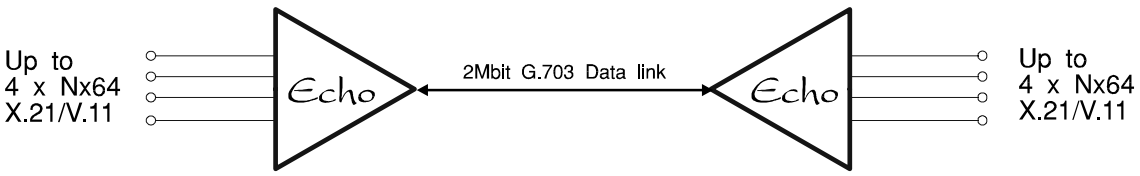
Up to 4 synchronous data ports are supported, operating at data rates of up to 1984Kbps, in 64Kbps steps. The channel data rates are set by time slot allocation (which need not be contiguous).

A **drop and insert** (D&I) option card allows an additional E1 link, for connection of a PABX. Time slots not used by the D&I channel made available for use on any of the data channels.



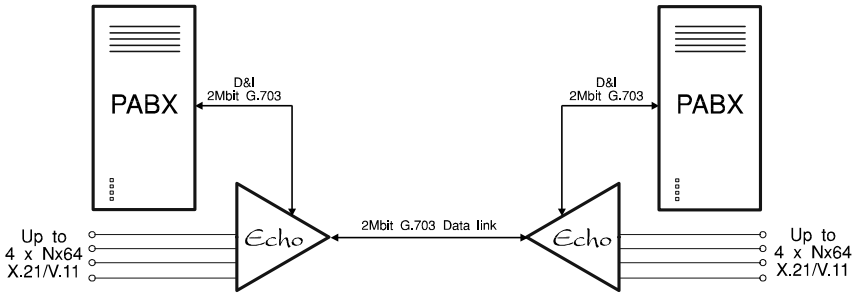
Typical Applications

The Echo may be used to provide up to 4 Nx64K X.21/V.11 channel connections (at any multiple of 64K) between two sites, using a G.703 2 Megabit/Second data link, as shown below:



It is also possible to connect two systems back to back directly in this manner, using an appropriate cable. This configuration is described on page 25.

Where the Echo is to be used to provide unused PABX (or bridge) bandwidth to Nx64 X.21/V.11 ports, the optional Drop and Insert card is used as follows:



The Echo is set so that the slots used by the PABX are passed through to the main G.703 link transparently. This is described on page 15. The remaining unused timeslots can now be assigned as required to the channel ports.

The connection between the D&I port and the PABX will need to be crossed over using the appropriate cable arrangement (same as the back to back Demo cable) shown on page 25.

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

Peripherals are connected to the X.21/V.11 15 way 'D'-type connectors configured DCE and numbered 1 to 4 at the rear of the multiplexer. The pin connections for these data channels are defined in Appendix H.

Default Channel Setup

When delivered or factory reset, the Echo Time Division Multiplexer is set to operate with all channels set as follows:

Rate	:	Off
Mode	:	NORMAL
TX Clock	:	INT
RX Clock	:	INT
Indicate	:	ON

Changing the Configuration

The Echo may be configured using an asynchronous terminal. A laptop PC running an asynchronous terminal emulation program such as PCAnywhere™, CrossTalk™ or Windows Terminal™ 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

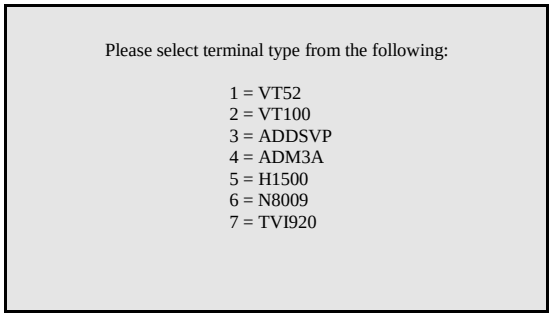
The terminal must be configured to:

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

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

Supervisor Terminal Emulations

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

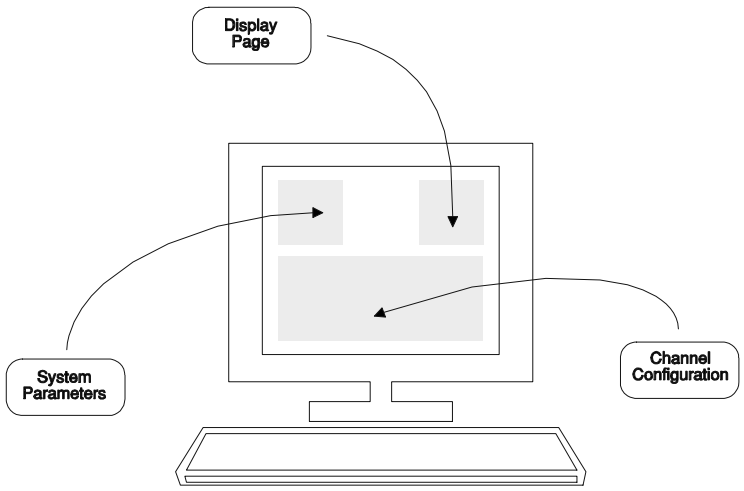


The terminal type or emulation in use should be selected by pressing the relevant number key on the PC or terminal. The monitor will now show the basic configuration screen for the multiplexer setup. This is formatted as below:

```
                              2 MEGABIT E1 MULTIPLEXER                    V1.00
================================ 15:35 16/09/96 ================================

Main Link (EUR   :                    SYNCHRONISED
    Mode         :          NORMAL          * Nx64 Channels  :   4
   Framing       :          CRC4            D&I Channels     :   NOT FITTED
Idle Bandwidth   :          1344K           System Alarms    :   None
Clock Reference  :          INTERNAL        Statistics       :   Error Counts
Configuration    :           >LOCAL         Events           :   Log

Nx64 Channel     :        1        2        3        4
  Rate           :      384K     256K      OFF      OFF
  Mode           :    NORMAL   NORMAL   NORMAL   NORMAL
  TX Clock       :       INT      EXT      INT      INT
  RX Clock       :       INT      EXT      INT      INT
  Indicate       :        ON       ON       ON       ON
  Control        :        ON       ON       ON       ON

    ---------------------- TIMESLOT MAP --------------------------
    0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 3 3 3
    0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
    ------------------------------------------------------------
    R 2 2 1 1 2 2 1 1 1 1 ----------------------
        Cursor Keys to move, CTRL-U to save, ESC to abandon
================================================================================
Use <SPACEBAR>/<+>/<-> to select
```

General Set-Up Display Layout

There are three main areas on the supervisor set-up screen used to change parameters for the Echo:



Upper left -
System parameters (Mode, Clock Ref, Carrier, Idle Bandwidth, and Configure etc.).

Upper right -
Other **display pages** which may be selected, (Statistics etc.).

Bottom -
Channel configuration.

The initial display is that for the Nx64 channels.

General Keyboard Conventions

Only a few keys are required to configure the Echo 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.

Cursor Movement

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

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.

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.)

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.

Local or Remote Configuration.

Most settings are independent at each end of the multiplexer link e.g. **Clock Reference**.

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

Changing the configuration page

The **Configuration Page** required, e.g. 'Channels', or 'Events' etc., is selected by moving the cursor to the **upper right area** and pressing Enter when alongside the required page.

Nx64 channel Configuration

To change the Nx64 channel configuration, select the configuration screen (shown on page 10) by moving the cursor to the top line on the right hand area of the screen, next to '**Nx64 Channels:**' and pressing **ENTER** or **RETURN**.

The display shows parameters for up to four data channels CH1 to CH4.

Each data channel has parameters selectable as detailed in the table on the following page.

Timeslot Assignment

Timeslots are assigned by moving the cursor down to the **Timeslot map** section of the Nx64 Channels screen.

Timeslots may be assigned directly by pressing the appropriate key on the Supervisor port terminal keyboard eg:

Pressing:	**1**	Assigns the slot to Nx64 Channel 1
	2	Assigns the slot to Nx64 Channel 2
	3	Assigns the slot to Nx64 Channel 3
	4	Assigns the slot to Nx64 Channel 4
	D	Assigns the slot to the D&I Channel (if fitted)
	-	Un-assigns the timeslot

Timeslots assigned to each channel will each contribute 64K of bandwidth. The **Rate** field for the channel will automatically be updated to show the rate which the channel will be running.

Note that if the D&I channel is connected to a PABX which is using timeslot 16 for signalling or CCS signalling, timeslot 16 **must** be assigned to the D&I channel.

It is of course, very important to **plan** which timeslots are to be used by the connected PABX and which are to be used for data channels. This will almost certainly require some setting up of the PABX as well as the multiplexer.

Echo Channel Set-up Options		
PARAMETER	CHOICES	NOTES
Rate	Off, 64K ... 1984K in 64K steps.	Channel data rate (**calculated** from time slot allocation set by user).
Mode	NORMAL	Normal RUN mode.
	LOOP	Set this to enable bi-lateral channel loopback.
TX Clock	INT	Clock is supplied by MUX to device connected to channel using S(A) and S(B) pins for TX data.
	EXT	Clock is supplied by device connected to channel port, using X(A) and X(B) pins for TX data. See note below.
RX Clock	INT	Clock is supplied by MUX to device connected to channel using S(A) and S(B) pins for RX data.
	EXT	Clock is supplied by device connected to channel port, using X(A) and X(B) pins for RX data. See note below.
Indicate	ON	Indicated pin permanently asserted.
	OFF	Indicated pin permanently not asserted.
	TRANS	Transparent mode. *Indicate* pin asserted when remote *Control* pin is asserted (updated at approximately 10 times per second)
	CARRIER	Indicate pin asserted whenever carrier is present.

Note: If an external clock option is selected, unless the external device is **synchronised** to the main link clock, clock slips will inevitably occur, leading to data loss.

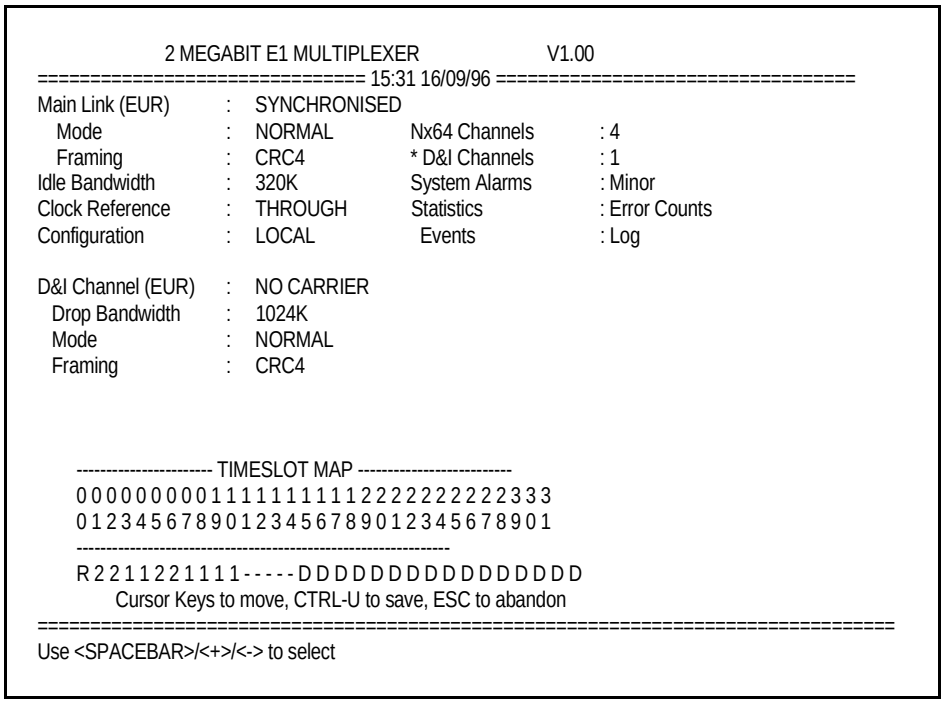
Drop and Insert (D&I) channel operation

The optional G.703 Drop and Insert channel allows connection of external G.703 equipment (eg. PABX) which uses only part of the 2 megabit timeslot map. This is sometimes referred to as 'Fractional E1'.

The timeslots are assigned as shown above for channels, using 'D' to select the D&I channel.

An additional menu page is available, allowing the Time Slot Map to be edited, whilst showing the D&I channel settings.

The way in which the D&I channel synchronises as well as mode settings, are also set on this page. For more details of these link settings see the main link parameter settings section (page 24).



When the D&I card is fitted, it is also possible to **slave** the clock reference to the D&I channel. This is achieved by selecting **THROUGH** as the Clock Reference as shown above.

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.

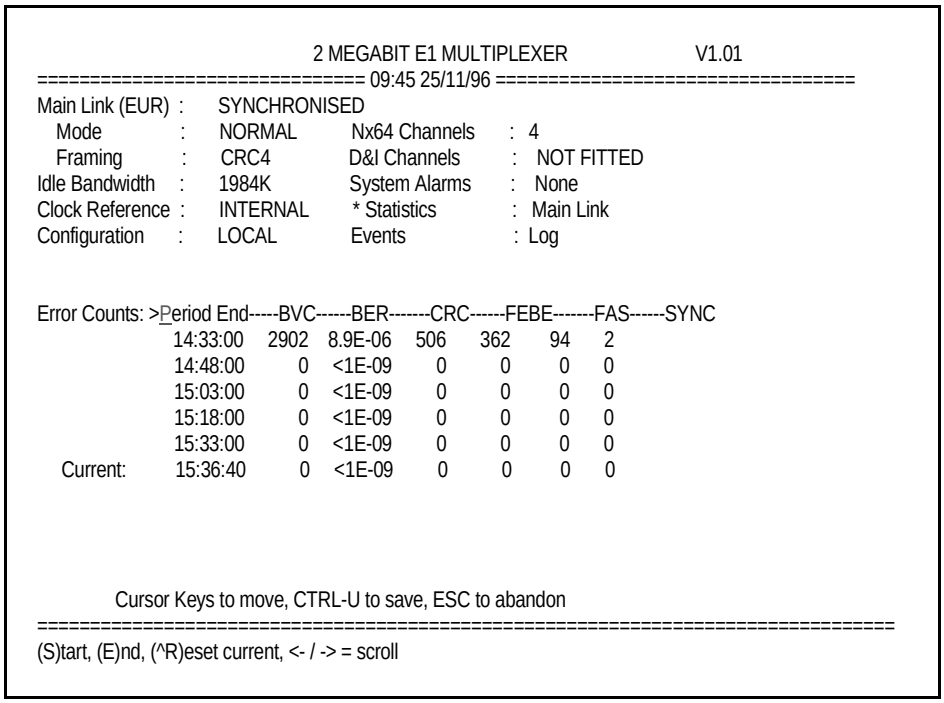
Viewing the Statistics pages

The Statistics pages give regularly updated information as to the performance of the E1 data link(s).

It is important to note that there are in fact **four** statistics pages available for viewing:

m) Local Main Link
n) Local D&I Link (if fitted)
o) Remote Main Link
p) Remote D&I Link (if fitted)

These pages are accessed by moving the cursor to the 'Statistics :' field, using the **spacebar** to select either the main link or the D&I link (if fitted). The local and remote pages are accessed in the normal manner (using the spacebar on the 'Configuration' field).



Each entry on a page represents a summary of link performance over 15 minutes of operation. The **Current** entry, is updated every 10 seconds with any errors identified in the preceding 10 seconds.

To view additional entries not shown (if any) on the current screen page, move the cursor to the **'Period end'** field, and use the **Left and Right arrow keys**. This will scroll the statistics information up or down by one page respectively.

For diagnostics purposes it is possible to **Clear** the **Current** line (ie start a fresh line), by moving the cursor to the **'Period end'** field, then typing <CTRL> and R. This is useful if the operator wishes to check that a condition which may have been causing errors has been removed.

On the screen display, the following abbreviations are used:

BVC	=	Bipolar Violation Count errors
BER	=	Approximate Bit Error Rate (based on BVC), which may be used to trigger an alarm. Note that BER is only calculated when the unit is in SYNC with the remote unit.
CRC	=	Cyclic Redundancy Check errors (in CRC4 mode only, otherwise shown as '----')
FEBE	=	Far End Block Errors (in CRC4 mode only otherwise shown as '----')
FAS	=	Frame Alignment Signal losses
SYNC	=	Synchronisation losses (reported each time sync goes from 'present' to 'lost')

These statistics provide a very useful summary of link performance over the last 24 Hour period.

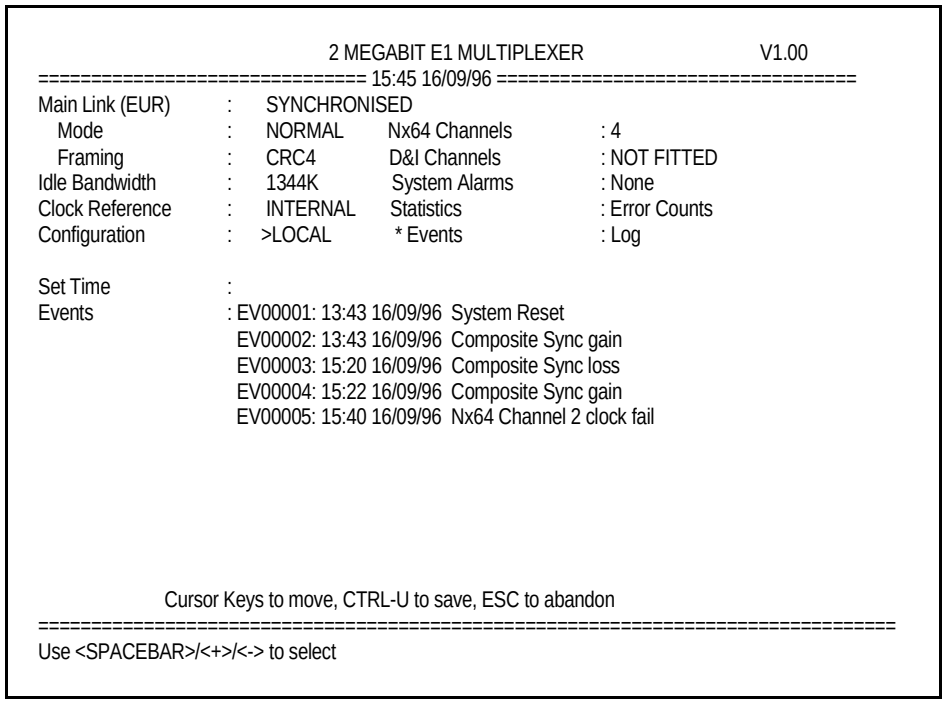
Note that, unlike the event log, the statistics are **not** retained in the event of a power failure.

Viewing the Event Log

An event log is maintained which stores (in non-volatile memory) crucial events, such as power up, alarms, and configuration change, and carrier loss times.

It is also possible to enable channel related events, (such as loss of external channel clock) to be logged. These are enabled on the **System Alarms** page (see later).

The event log is very useful for diagnosing fault conditions.



The **kind of information** which is included in the event log may be chosen by the user, by selecting the Alarm **Actions** on the **Alarm page**, described in the section below.

Clearing the Event Log

The event log can be cleared by moving the cursor to the position on the screen where the first event is shown (after 'Events :') and pressing <CTRL> and 'R' together. This will **delete all events** from the list, and leave the message 'Event Log Cleared' as the only event. It may be useful to clear the **remote** event log at the same time, by accessing the REMOTE page, and repeating this process.

System Alarms & Alarm port

Two general purpose relay contact pairs are provided for use with the Echo. Separate changeover contacts are provided, for both MAJOR and Minor Alarms. The contacts may be connected to external low voltage (SELV) equipment to give an alarm / network management indication as required. These connections are shown in Appendix J.

The conditions which cause the alarm to operate may be selected from the **System Alarms** menu page (shown below). Each of the possible Alarm conditions may be set to any of the following actions:

a) NO ACTION The events will not cause the relay contacts to operate, or the event to be logged.

b) LOG ONLY The events will not cause the relay contacts to operate, but the event **will be logged**.

c) MINOR The event will be logged, and will cause the MINOR alarm LED to illuminate, and the MINOR alarm relay contacts to operate.

d) MAJOR The event will be logged, and will cause the MAJOR alarm LED to illuminate, and the MAJOR alarm relay contacts to operate.

```
                2 MEGABIT E1 MULTIPLEXER                V1.01
================================ 11:47 06/01/97 ==================================
Main Link (EUR)       :   SYNCHRONISED
   Mode               :   NORMAL          Nx64 Channels   : 4
   Framing            :   CRC4            D&I Channels    : 1
Idle Bandwidth        :   0K              * System Alarms : Minor
Clock Reference       :   INTERNAL        Statistics      : Main Link
Configuration         :   >LOCAL          Events          : Log

    Event             Action      Status
Link Carrier Loss :   MAJOR       OK
Timeslot Mismatch :   MAJOR       OK
D&I  Carrier Loss :   MINOR       FAULT
D&I  Remote Alarm :   MINOR       OK
Nx64 Control Off  :   NO ACTION   OK
Nx64 Clock Fail   :   LOG ONLY    OK
Remote Alarm      :   MAJOR       OK
Link BER High     :   MINOR       OK      BER Threshold  : 1E-8


          Cursor Keys to move, CTRL-U to save, ESC to abandon
================================================================================
Use <SPACEBAR>/<+>/<-> to select
```

Note that the screen display also indicates the highest active alarm status (None, Minor or MAJOR), to the right of the 'Alarm' page prompt on the top right of the screen.

The reasons for which an alarm may be reported as 'FAULT' are identified below:

Link Carrier Loss

The local Multiplexer cannot identify a valid synchronisation sequence (FAS, CRC4 etc) from the remote multiplexer.

Timeslot Mismatch

The configuration in the local unit **does not match** that in the remote unit. This would almost certainly lead to data errors on some channels.

D&I Carrier Loss

The Multiplexer cannot identify a valid synchronisation sequence (FAS, CRC4 etc) from the unit attached to the D&I port.

D&I Remote Alarm

The unit attached to the D&I port is generating an **alarm** in the framing information, that is, it is reporting that it has a problem.

Nx64 Control Off

One of the channel ports (which is in use) is not providing the multiplexer with a **true** CONTROL signal. This may mean that the signals have not been connected at all. Note that un-connected CONTROL inputs will produce a **random** ON or OFF indication. Control inputs from ports which are not allocated in the timeslot map are ignored.

Nx64 Clock Fail

One of the data channel cannot synchronise its clock to the global network clock. This may occur if a channel is set to **external** clock, and either no clock at all is connected, or the clock which is connected is the wrong rate.

Remote Alarm

Shows FAULT if a remote Alarm is being received from the remote multiplexer.

Remote alarms are generated by any condition set at the remote site to give a MAJOR alarm. If you want a particular alarm to be reported through the remote alarm bit, you must set its **Action** field to either MAJOR or MINOR.N Any alarm which is set to MAJOR or MINOR will cause a remote alarm to be sent through the link.

For example:

If 'D&I Remote alarms' are to be sent as **remote alarms** through the main multiplexer link, set:

D&I Remote alarms : MAJOR
at the remote site.

At the local site, setting:
Remote Alarm : MINOR

will result in a **MINOR** alarm being generated locally when **any** remote alarm is active.

In this way, D&I remote alarms may be carried on through the main link, so that connected peripheral equipment can cause alarms to be carried transparently through the main link.

Link BER High

Shows FAULT if the Bit Error Rate exceeds the threshold set. With an error free link, this fault will eventually clear when the BER becomes less than the threshold set.

Echo Multiplexer Installation

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

Supply Voltage & Connection

A.C. 100 - 240V a.c. without adjustment.
D.C. 48V d.c. without adjustment. **(OPTIONAL TBA)**

The Echo may be optionally DC or AC powered. The AC power supply is a switched mode unit, the optional DC power supply unit being a DC to DC converter. Both allow considerable input voltage variation.

Environmental Considerations

The Echo 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 Echo is housed in a 1.5U tall 19" enclosure. An optional rack mount kit is available on request. Four LEDs on the front panel indicate the current status of the multiplexer.

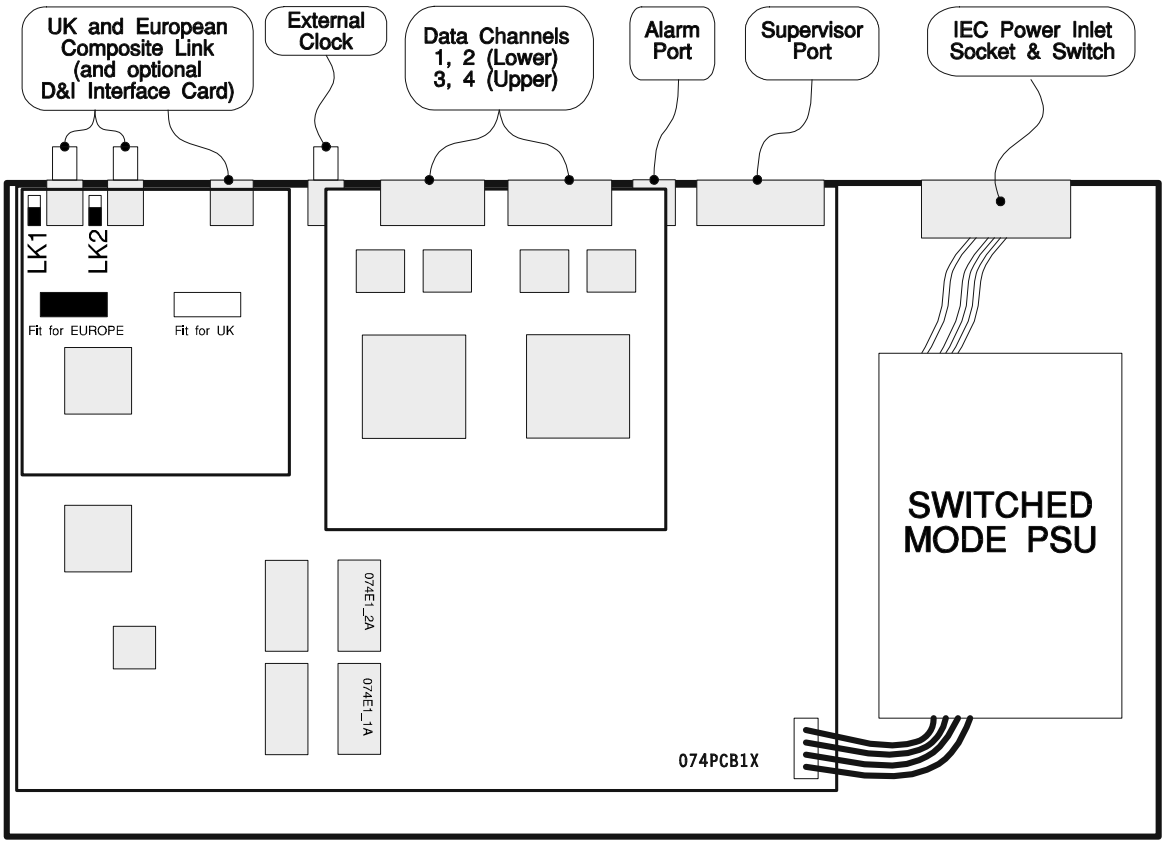
The multiplexer MUST be disconnected from the power supply before opening the unit or changing any network connections.

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 cards.

The rear panel (illustrated on page 36) accommodates the link interface connectors and supervisor port.

Composite Interface Selection

The required interface (European 120 Ohms RJ45 or UK 75 Ohms 2 x BNC), **must be selected using the internal jumper link** as described in the appendices, before connecting the equipment. The current interface type is reported on the main set-up screen as either UK or EUR as appropriate.



Composite Network Connection

The Echo Time Division Multiplexer supports both UK (75 Ohm) and European Network Interfaces.

The composite port appears on the back panel as an RJ45 socket (European 120 Ohms) and 2 x BNC connector (UK 75 Ohms), the pin-out for each interface standard being shown in Appendix F.

For UK connection, screened BNC cables should be used, with the screen connected to chassis at the TX connector only (LK1 = 1-2, LK2 = 2-3).

For EUROPEAN connection, un-screened RJ45 cables are suitable. The screen to chassis links must be fitted in the *isolated* position (LK1 = 1-2, LK2 = 1-2).

The positions of the links LK1, LK2 and the UK/EUR selector are shown (fitted for European 120 Ohms) on the diagram shown above.

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
Main Link	Present CRC4 Hunt Lost	Shows whether the link is successfully connected. No options selectable.
Mode	NORMAL	Normal run mode.
	LOCAL LOOP	Composite loopback, causes MUX to get carrier even when not connected to link.
	REMOTE LOOP	Payload loopback, causes data at E1 port to be echoed to the network.
Framing	CRC4	16 Frame synchronisation, using CRC4 pattern. Allows better link diagnostics.
	NON-CRC4	2 Frame Synchronisation only.
Clock Reference	INTERNAL	Clock sourced from Internal Crystal reference.
	LOOP	Clock sourced from MAIN E1 RX data.
	THROUGH	Clock sourced from D&I E1 RX data (only available if D&I port fitted.
	CHANNEL 1..4	Clock sourced from data channel external clock pin. Must be accurate to 50ppm or better.

	EXTERNAL	Clock sourced from external clock connector. Must be accurate to 50ppm or better. External clock rate **must** be set on screen to match the reference used.
Configuration	LOCAL REMOTE	"Modified" appears if change has been made.

Back to Back demonstration connection

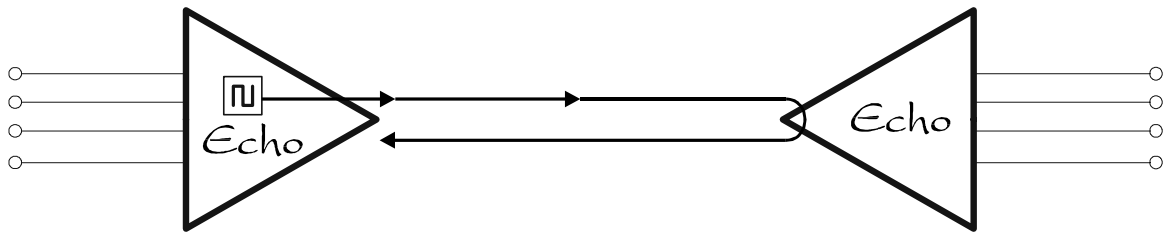
For a simple demonstration, or local network use, two Echo Multiplexers may be connected 'back to back', using a cross over cable arrangement, one unit being set to **internal clock** reference, the other to **loop clock**.

For **UK interfaces**, a pair of 75 Ohm BNC cables should be used, connecting TX on one unit to RX on the other and visa versa.

For **European interfaces** an RJ45 crossover cable should be used, as described in Appendix G, page 40.

The following diagrams show examples of the available clock options:

Internal Clock (other site in loop)



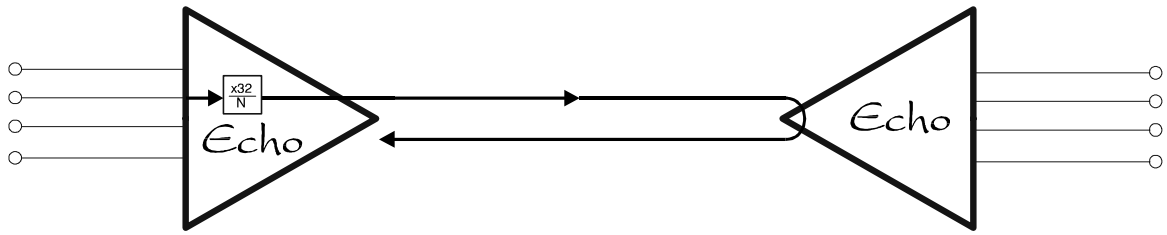
Clock Reference: Internal Clock Reference: Loop

Using an external Clock reference

A range of external clock reference options are available, and can be seen in the table above.

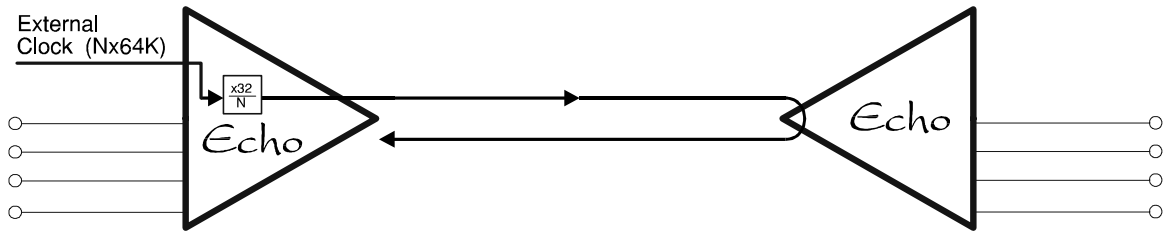
An external clock BNC connector is available for connection of a TTL square wave with a stability of 50ppm or better. Alternatively, the Echo may be clock slaved to one of the data channels. When this option is selected, the appropriate channel's clocks must, of course, be set to EXTernal. As with the other external clock options, it is important that the clock provided to the channel interface has a stability of 50ppm or better.

External Channel Clock



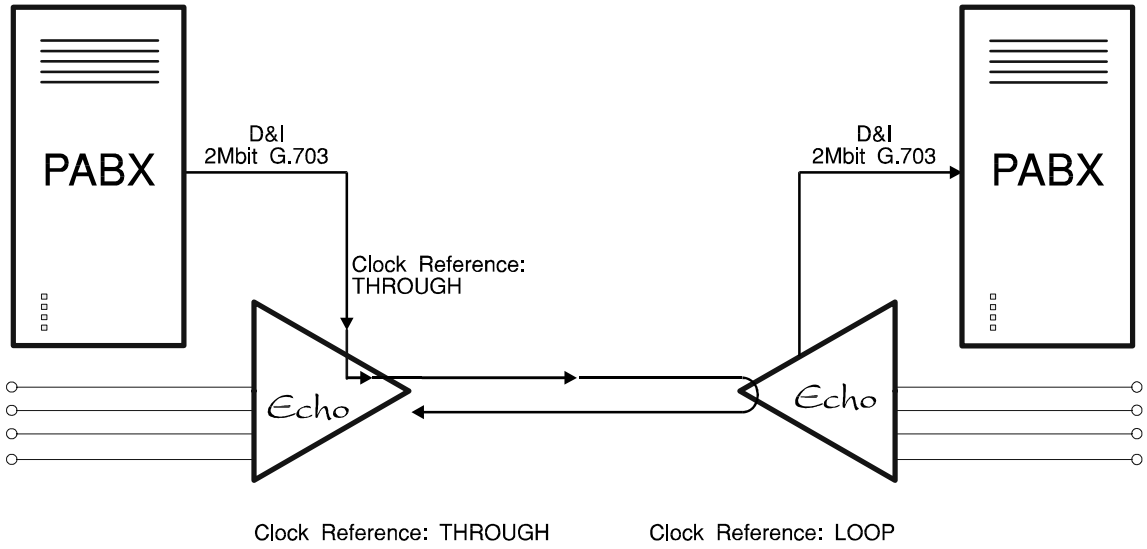
Clock Reference: Channel 2 Clock Reference: Loop

External Reference Clock



Clock Reference: External Clock Reference: Loop

Through Clock (Master from D&I link)

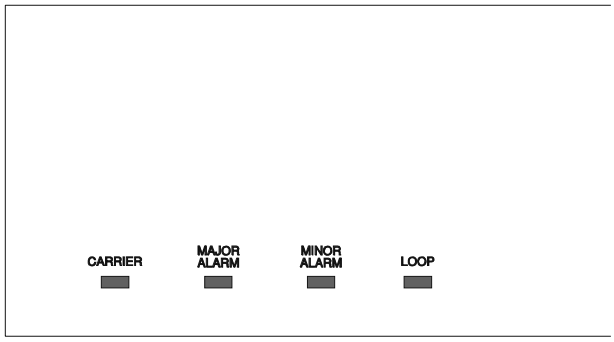


In this example, the master clock is derived from the PABX which is connected to the D&I channel.

Troubleshooting

Front Panel LEDs

On the front panel only the **CARRIER** LED should normally be lit.



When the multiplexer is un-connected or has lost carrier, the CARRIER LED will flash slowly. A faster flash shows that CRC4 sync hunt mode has been entered.

LED LABEL	CONDITION	NOTES
CARRIER	Slow Flash	No RX Carrier established
	Fast Flash	In CRC4 Mode, FAS present, searching for CRC4 synchronisation.
	Steady Green	CARRIER Synchronised
MAJOR Alarm	**Red**	Red if a MAJOR Alarm condition has occurred.
	Not illuminated	No MAJOR alarm condition.
Minor Alarm	**Red**	Red if a Minor Alarm condition has occurred.
	Not illuminated	No Minor alarm condition.
LOOP	**Not illuminated**	**Normal run mode**
	Green	If any Composite or data channel looped or in a test mode.

Diagnostics & Loopbacks

A number of debug options are available. They are described in the table on page 13. It is possible to loop back any channel bi-laterally (both locally and remotely), to allow data to be tested for proper operation.

Care should be taken when using **external** clocks, to either provide the master clock reference, or simply clock data.

A useful indication of a clock failure is provided by the message '**CLK??**' appearing to the right of the channel rate, as shown below. This indicates that the required external clock is either running too slow (or not at all) or too fast for the channel rate selected. If internal clock is selected, this message should not appear.

```
                              2 MEGABIT E1 MULTIPLEXER                V1.00
================================ 15:35 16/09/96 ================================
Main Link (EUR)      :   SYNCHRONISED
  Mode               :   NORMAL       * Nx64 Channels        : 4
  Framing            :   CRC4         D&I Channels           : 1
Idle Bandwidth       :   320K         System Alarms          : None
Clock Reference      :   INTERNAL     Statistics             : Error Counts
Configuration        :  >LOCAL        Events                 : Log

Nx64 Channel         :    1           2           3           4
  Rate               :   384K        256K CLK?   OFF         OFF
  Mode               :   NORMAL      NORMAL      NORMAL      NORMAL
  TX Clock           :    INT         EXT         INT         INT
  RX Clock           :    INT         EXT         INT         INT
  Indicate           :    ON          ON          ON          ON

    ---------- TIMESLOT MAP ----------
    0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 3 3 3
    0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
    ------------------------------------------------------------
    R 2 2 1 1 2 2 1 1 1 1 - - - - - D D D D D D D D D D D D D D D D
        Cursor Keys to move, CTRL-U to save, ESC to abandon

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

Appendix A - Warnings

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) **MAIN** port
iii) **D&I** port
iv) **CH1** to **CH4** (Channel ports)
v) **EXT CLOCK**
vi) **ALARM** port

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
iiii) **MAIN** port
ivi) **D&I** port
iv) **CH1** to **CH4** (Channel ports)
v) **EXT CLOCK**
vi) **ALARM** port

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'équipment

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

Ports SELV.

i) port **Supervisor**
vi) port **MAIN**
vii) port **D&I**
iv) ports pour les canaux **CH1** à **CH4**
v) port **EXT CLOCK**
vi) port **ALARM**

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 DO NOT change any of the wording in this section unless you are absolutely certain about what you are doing. The entries and particular format are an approval requirement and any change may invalidate product approval.

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

G.703

In the UK, to PD7024 (75 Ohm Un-balanced) via 2 x BNC connectors. The internal link must be set to the **UK** position, as detailed in the installation instructions.

Throughout Europe (Pan European) to CTR12 based on NET12 via RJ45 Connector (120 Ohms Balanced). The internal link must be set to the **EUR** position, as detailed in the installation instructions.

X.21/V11

Throughout Europe (Pan European) to I-CTR2 based on NET2 at rates up to and including 1984Kbps.

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:

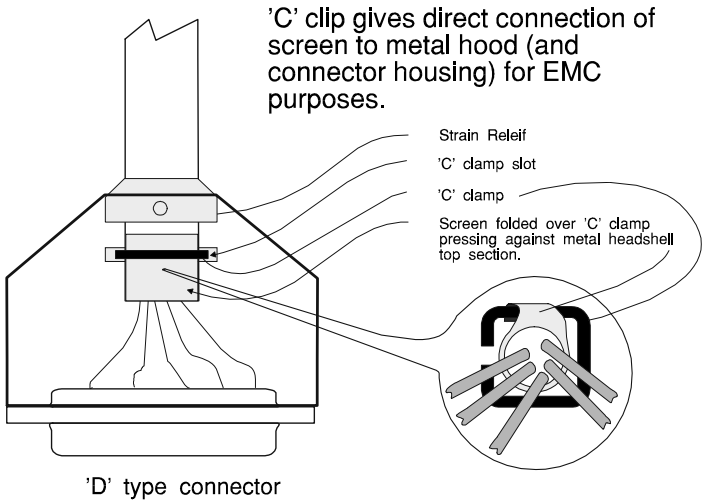
'D-Type' Connections

This product relies on the use of screened cables for connection to the 15 way 'D-Type' ports. The cables must have the foil or braid screen connected effectively to the metal headshell to ensure continued compliance. The following **headshells** provide suitable screen connection and are available from Black Box:

DB15 - FA033

DB25 - FA031

The diagram below illustrates an example of a suitable screen connection. Note how 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

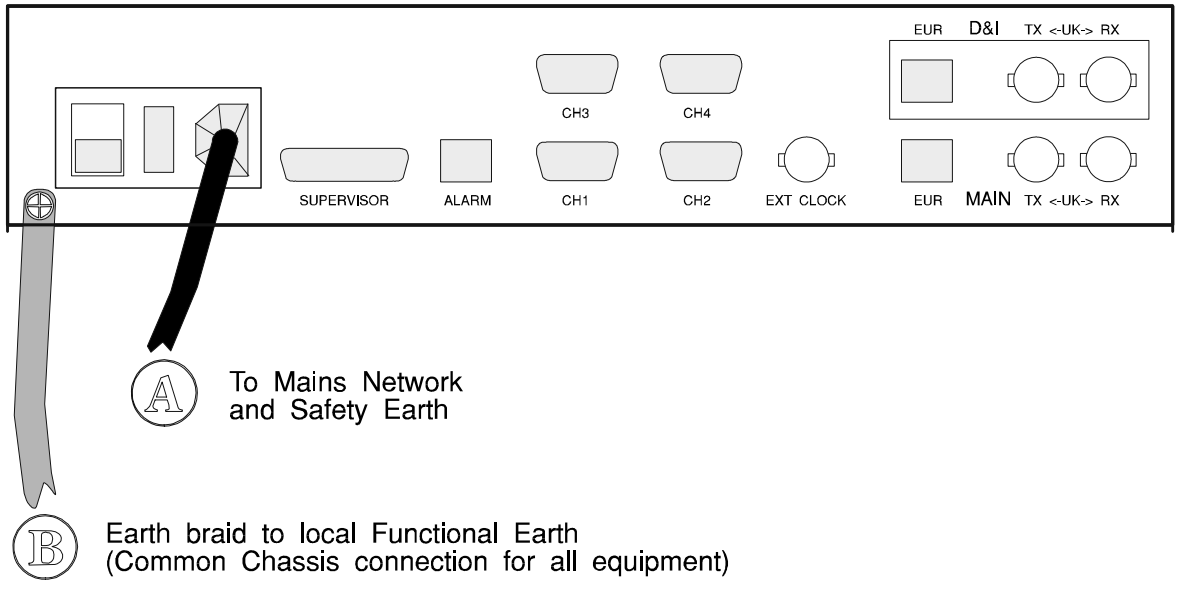
The mains connection is internally filtered and requires no special consideration.

To Ensure that 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.

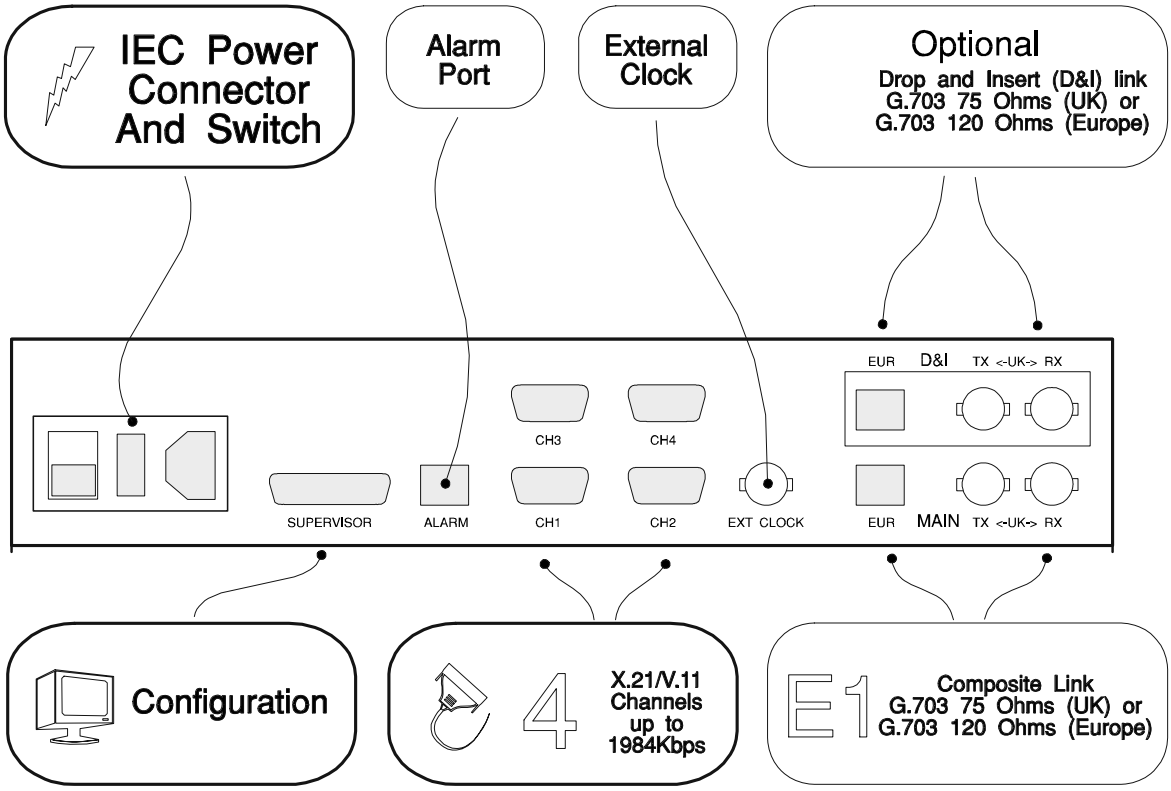
The mains IEC cable provides some protection, but to achieve optimal immunity, the chassis EARTH **screw connection** should be connected to a local EARTH busbar or cabinet frame wherever possible as shown below:

Separate Chassis Earth Connection for Optimum Immunity



Appendix D – Rear Panel Lay Out

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



Appendix E - 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

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.

Note: Connector shell and termination must be as specified in EMC section, Appendix C, on page 34 of this manual.

Appendix F - Composite Interface Pinouts

Composite Interface Connections (EUROPE) Using 120 Ohm Balanced RJ45			
Name	**Description**	**Type at Connector**	**DTE - RJ45 Female**
RxA	RX Pair	Input	1
RxB		Input	2
TxA	TX Pair	Output	4
TxB		Output	5
S1	Shield Reference	-	3
S2	Shield Reference	-	6

Notes: 1 5 way link strap must be fitted in EUR position (LK3) and not in UK position (LK4)

2 LK1 and LK2 **must** both be fitted in position 1-2 (Isolated).

Composite Interface Connections (UK) Using 75 Ohm Un-balanced BNC			
Name	**Description**	**Type at Connector**	**DTE - BNC Female**
RxA	RX Pair	Input	Centre RX
RxB		Ground Reference	Outer RX[2]
TxA	TX Pair	Output	Centre TX
TxB		Ground Reference	Outer TX[3]

Notes: 1 5 way link strap must be fitted in UK position (LK4) and not in EUR position (LK3).

2 Fit LK1 position 1-2 to isolate RX ground from chassis. Fit LK1 position 2-3 to connect RX ground to chassis.

3 Fit LK2 position 1-2 to isolate TX ground from chassis. Fit LK2 position 2-3 to connect TX ground to chassis.

Appendix G - RJ45 E1 Crossover Cable.

RJ45 Crossover Cable (EUROPE) Using 120 Ohm Balanced RJ45			
Name	**Description**	**DTE2 - RJ45 Male**	**DTE1 - RJ45 Male**
TxRxA	TXRX Pair	4	1
TxRxB		5	2
RxTxA	RXTX Pair	1	4
RxTxB		2	5
S1	Shield Reference	6	3
S2	Shield Reference	3	6

Notes: 1 5 way link strap must be fitted in EUR position (LK3) and not in UK position (LK4)

2 LK1 and LK2 **must** be fitted in position 1-2 (Isolated).

3 For demonstration purposes, one unit should be set to **Internal clock** other unit should be set to **loop** clock.

Appendix H - X.21/V.11 Data Channel Pinout

X.21/V.11 Data Channels connectors 1 - 4
(15 Way DB25 Type Configured DCE)

DATA CHANNEL CONNECTIONS:			
Name	**Description**	**Type at Connector**	**DCE - DB15 Female**
Protective Ground		-	1
G	Signal Ground	-	8
T(A)	TxD a	Input	2
T(B)	TxD b	Input	9
R(A)	RxD a	Output	4
R(B)	RxD b	Output	11
S(A)	Clock a	Output	6
S(B)	Clock b	Output	13
I(A)	Indicate a	Output	5
I(B)	Indicate b	Output	12
C(A)	Control a	Input	3
C(B)	Control b	Input	10
X(A)	Ext Clock a	Input	7
X(B)	Ext Clock b	Input	14

Note: Connector shell and termination must be as specified in EMC section, Appendix C, on page 34 of this manual.

Appendix I - X.21/V.11 Network Crossover Cable

15 Way Multiplexer DCE
to DCE or Network DCE
ONWARD LINKING Crossover Cable

MUX 15 Way Male Connector UNC 4/40 Screws	**V.11 15 Way Male Connector M3 Screws**[2]		**Type at Network Connector** (Normal Use)
1	1	SHIELD	-
8	8	G	Common Return
4	2	T(A)	Generator
11	9	T(B)	Generator
2	4	R(A)	Load
9	11	R(B)	Load
5	3	C(A)	Generator
12	10	C(B)	Generator
3	5	I(A)	Load
10	12	I(B)	Load
7	6	S(A)	Load
14	13	S(B)	Load

Notes:

1 V11 Clocks X(A), X(B) from the Nx64 port are **generators**, and should not be connected. The channel port should be configured to use external clock for both external transmit and external receive clocks.

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.

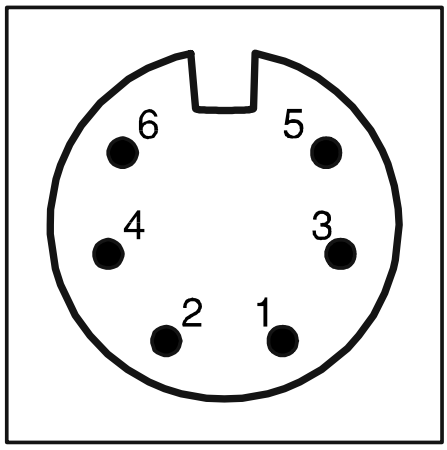
4 Cable type: Belden 9508, 8 twisted pair overall screen (or equivalent). Maximum length 100 Metres.

5 Connector shell and termination as specified in EMC section, Appendix C, on page 34 of this manual.

Appendix J - Alarms

The following pin connections may used when an external alarm indication is required. The 6 way DIN connector provides two sets of relay contacts for externally connected low voltage (SELV) equipment as follows:

MAJOR/Minor Alarm Port pin connections	
6 way Miniature DIN connector pin	**Function**
2	MAJOR NO - Closed on ALARM or power fail
1	MAJOR Common Contact
4	MAJOR NC - Closed on OK
3	Minor NO - Closed on ALARM or power fail
6	Minor Common Contact
5	Minor NC - Closed on OK



Major Com 1
Major NO 2
Major NC 4

Minor Com 6
Minor NO 3
Minor NC 5

Note that the contacts are **not** mechanical, and have an internal resistance of around 100 Ohms. This should be considered when making a connection to external equipment.

Appendix K - Echo Technical Specification

E1 COMPOSITE LINK and DROP & INSERT (D&I) PORTS

Link Ports:		Echo Mux: 1 E1 port, Echo T-Mux: 2 E1 ports
Compliance:		G.703, G.704, G.706, I.431, G.823, PD7024, CTR12, EN41003, EN60950, EN55022, EN50082-1, BABT, CE (EMC, LVD, TTE)
Interface:		G.703 75 Ohm un-balanced (UK), 2 x BNC connectors (to PD7024)
	or	G.703 120 Ohm balanced (Europe), 8 way RJ45 connector (to CTR12)
Data Rate:		2.048 Mbit/s +/- 50ppm, Ref: Internal, Loop, External, Channel 1..4
Transmission Modes:		AMI/HDB3
Statistics & Alarms:		24 Hour BERT / 15 minute intervals, 2 Major & Minor Alarm contacts.

Nx64K DATA CHANNELS

Interface:	X.21/V.11 (DCE)
Capacity:	Echo Mux & Echo T-Mux: 2..4 Channels
Data Rates:	Off, 64K, 128K, ... 1984K in 64K steps, Internal or External Clocks
Data Format:	Synchronous Transparent
Control Signals:	**Indicate** Permanant, Alarm controlled, or Transparent option.
Diagnostics:	Bilateral Loopbacks, Underflow & Overflow Alarms

SUPERVISOR PORT

Interface:	V.24/V.28 (DCE), 9600bps async, 8 bits, no parity, 1 stop bit
Supported Terminals:	VT52, VT100, ADDSVP, ADM3A, H1500, N8009, TVI920

GENERAL

Front Panel Indicators:	Carrier, MAJOR Alarm, Minor Alarm, Loop.
Dimensions:	434mm x 290mm x 61mm
Weight:	Min 2.4Kg (Access Lanlink) Max 2.6Kg (Access T-Mux)
Environment:	Operating 0-40°C, 0-90% humidity non-condensing
Power Supply Requirements:	100 - 240V AC , 50 - 60Hz, 40W (Internal switched mode PSU)