BLACK BOX®
NETWORK SERVICES

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PCM/ADPCM Compression
Option: MXU9081C

Echo & Echo LANLink PCM/ADPCM Compression Option

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Echo

ADPCM Module

User Manual Supplement

-

WARNING - BEFORE INSTALLATION, PLEASE REFER TO SAFETY INSTRUCTIONS IN APPENDIX A

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

00000000Introduction

This User Manual Supplement describes the Installation, Operation and Use of the ECHO ADPCM module, and must be read in conjunction with the ECHO Multiplexer User Manual.

The ECHO ADPCM module allows the ECHO multiplexer to take 30 channels of PCM (G.711) voice, presented on the Drop & Insert (D&I) interface, and compress them down to 15 timeslots, each containing two four bit samples of 32k ADPCM (G.721).

For normal voice conversations, ADPCM (Adaptive Differential Pulse-Code Modulation) provides voice quality that comparable to PCM digitised voice conversation.

Typical use of the ADPCM module is to interconnect two PABX systems. Even if the full 30 channels of PCM are selected, it still leaves 960Kbps of spare bandwidth free for data traffic.

Installation details for the ADPCM module are covered on page 15.

Functional Overview

The ADPCM module is a plug-in replacement for the Drop and Insert (D&I) card. It contains 30 bi-directional ADPCM compression units operating at 64K to 32K G.721 compression.

Each timeslot allocated to the ADPCM module maps to two compressed PCM timeslots, determined by which mapping mode is selected. Two mapping modes, **Alternate** (see Example a) and **Sequential** (see Example b), have been implemented to allow some flexibility when assigning timeslots.

Timeslots may still be assigned to transparent Drop and Insert (D&I) as described in the ECHO MULTIPLEXER User Manual as the ADPCM module incorporates all the functions of the D&I card.

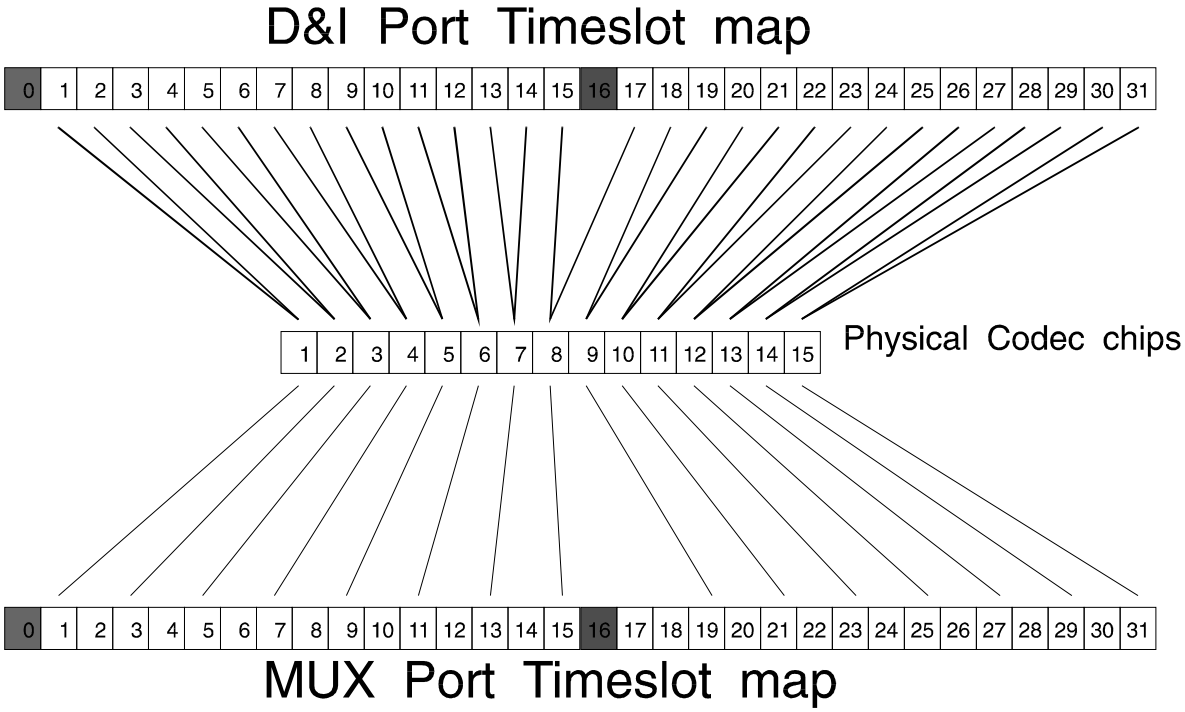
Both A-Law and u-Law PCM coding is available via soft configuration.

The ADPCM module is soft configured using the same configuration methods used for the ECHO MULTIPLEXER. This is outlined in the ECHO MULTIPLEXER manual and in the ADPCM Module Configuration section.

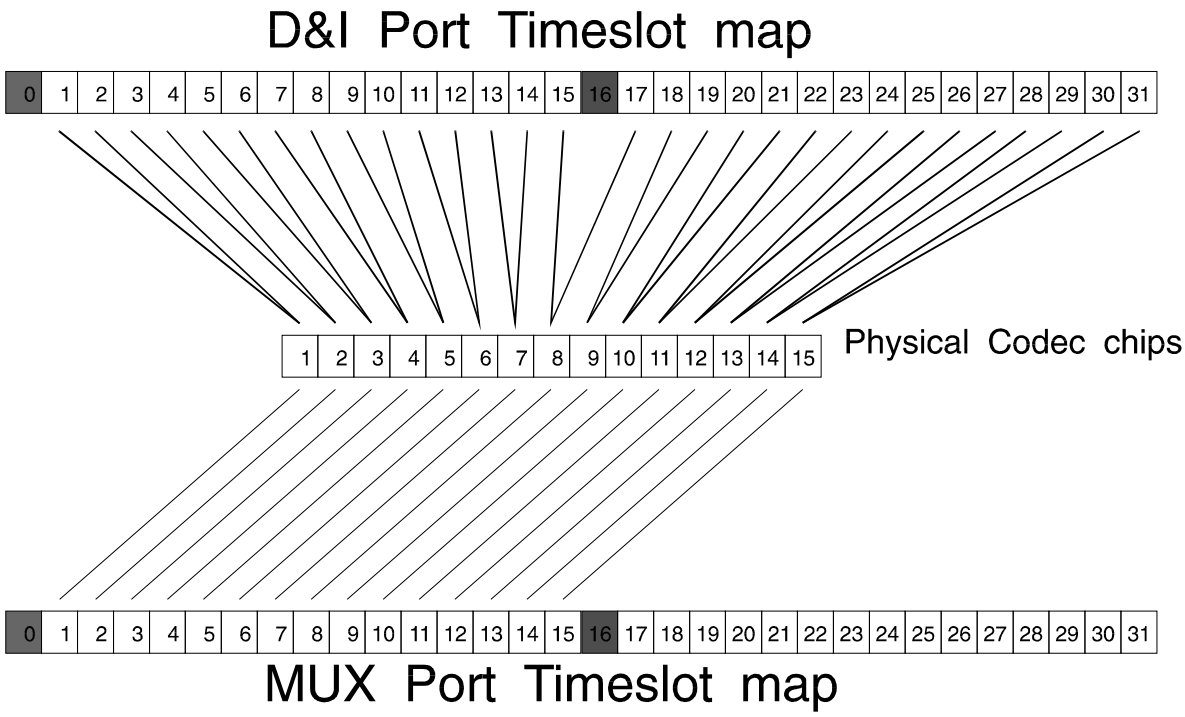
Mechanical Construction

The ADPCM module is built onto a single printed circuit board, which must be installed inside the ECHO MULTIPLEXER enclosure.

Fixed Timeslot Assignment example (a)



Fixed Timeslot Assignment example (b)



Use And Configuration

This section only describes configuration of the ECHO ADPCM module. Configuration of data channels is described in the USE AND CONFIGURATION section of the ECHO MULTIPLEXER User Manual.

The ADPCM module options can be modified using the simple terminal configuration process, described in the next section, similar to that for the ECHO MULTIPLEXER (If you are not familiar with general configuration of the ECHO MULTIPLEXER, please refer to the **USE AND CONFIGURATION** section of the ECHO MULTIPLEXER User Manual before reading the following sections or attempting to configure the ADPCM module).

PABX Connection

The PABX may be connected to the ADPCM module using a European 120 Ohms RJ45 or UK 75 Ohms 2 x BNC. The interface type **must be selected using the internal jumper link** on the ADPCM module, before connecting the equipment.

ADPCM Configuration Display

If the ADPCM module has been fitted correctly the ECHO configuration screen will display **D&I Channels: 1 + ADPCM** in the upper right area of the screen. The D&I/ADPCM configuration display shown below is reached from any other page by locating the cursor alongside this option, and then pressing return.

The same page for setting up the D&I card is also used for setting up the ADPCM module.

The current interface type (UK or EUR) is reported next to **D&I Channel**. Alongside this the current status (SYNCHRONISED or NO CARRIER) of the D&I carrier signal is displayed.

The bandwidth allocated to the ADPCM module is displayed next to **Drop Bandwidth**. This is updated as timeslots are added/removed from the main timeslot map.

```
                    2 MEGABIT E1 MULTIPLEXER              V1.04
============================ 12:04 16/09/97 ========================
Main Link (EUR)  : SYNCHRONISED
   Mode          : NORMAL                    Nx64 Channels : 2
   Framing       : CRC4                    * D&I Channels  : 1 + ADPCM
Idle Bandwidth   : 1984K                     Alarms        : None
Clock Reference  : LOOP                      Statistics    : Main Link
Configuration    :>LOCAL                     Events        : Log

D&I Channel (EUR): SYNCHRONISED              Drop Bandwidth:  OFF
   Mode          : NORMAL
   Framing       : CRC4
   ADPCM Mapping : Alternate
   ADPCM Law     : A-Law
      ----------------------PCM TIMESLOT MAP-------------------------
      S - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
      -----------------------TIMESLOT MAP----------------------------
      0 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 2 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
      ----------------------------------------------------------------
      S - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
              Cursor keys to move, CTRL-U to save, ESC to abandon
====================================================================
 Use <SPACEBAR>/<+>/<-> to select
```

D&I /ADPCM Configuration Page

ADPCM Timeslot Assignment

Timeslots are assigned by moving the cursor down to the **TIMESLOT MAP** section of the D&I Channels screen.

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

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 (if fitted)
	4	assigns the slot to Nx64 Channel 4 (if fitted)
	D	assigns the slot to the D&I Channel
	A	assigns the slot to the ADPCM module
	-	un-assigns the timeslot

Unlike the other assignments, the ADPCM module may only be assigned to certain timeslots, determined by the **ADPCM Mapping**. An attempt to allocate an invalid slot will be ignored.

Timeslots assigned to the ADPCM module will also highlight which PCM timeslots are being assigned in the **PCM TIMESLOT MAP** above the main timeslot map, each PCM channel being represented by a '**P**'. Note that each ADPCM assignment will map to **two** PCM channels since it carries two compressed PCM samples.

Timeslots may also be assigned to transparent using the Drop and Insert (D&I) function as described in the ECHO MULTIPLEXER User Manual. A '**D**' in the PCM timeslot map indicates that a channel is being transparently passed to the remote (i.e. no compression).

Timeslot 16 Assignment

For correct operation of the PABX signalling information, timeslot 16 must be passed transparently to the remote PABX i.e. timeslot 16 must be assigned to 'D', drop and insert**.** This is not done automatically, and must be set manually by the user if any voice channels are to be used.

ADPCM Parameters

Locating the cursor alongside the entry in exactly the same manner as used on the ECHO MULTIPLEXER accesses parameters for the ADPCM module.

To view the valid choices for the parameter, press the **spacebar**, **+** or **-** keys.

The choices by parameter are:

PARAMETER	CHOICES	NOTES
Mode	NORMAL	Normal run mode
	LOCAL LOOP	D&I Port Loopback, causes D&I to get carrier even when not connected to link
	REMOTE LOOP	Payload loopback, causes data at D&I port to be echoed back to the PABX
Framing	CRC4	16 Frame Synchronisation, using CRC4 pattern, Allows better link diagnostics
	Non-CRC4	2 Frame Synchronisation only.

ADPCM Mapping	Alternate	Allows odd timeslots 1-31 (excluding 17) to be allocated to the ADPCM module. See Examples
	Sequential	Allows timeslots 1-15 to be allocated to the ADPCM module. See Examples
ADPCM Law	A-Law	Affects the ADPCM algorithm. This must be set to the same as the PABX for the ADPCM to be encoded/decoded correctly.
	u-Law	

The LOCAL and REMOTE set-up pages are accessed as usual to configure either location.

Example Set-ups

The following example displays show how to set-up all 30 PCM channels to be compressed using both mapping modes. Note that timeslot 16 must be set to 'D' for the PABX signalling information. The free timeslots ('-') may be allocated to one or more data channels.

```
                    2 MEGABIT E1 MULTIPLEXER                        V1.04
================================ 12:04 16/09/97 ================================
    Main Link (EUR)  : SYNCHRONISED
    Mode          : NORMAL                    Nx64 Channels : 2
    Framing       : CRC4                    * D&I Channels  : 1 + ADPCM
    Idle Bandwidth   : 960K                     Alarms        : None
    Clock Reference  : LOOP                     Statistics    : Main Link
    Configuration    :>LOCAL                    Events        : Log

    D&I Channel (EUR): SYNCHRONISED             Drop Bandwidth:  1024K
       Mode          : NORMAL
       Framing       : CRC4
       ADPCM Mapping : Alternate
       ADPCM Law     : A-Law
          ----------------------PCM TIMESLOT MAP-------------------------
          S P P P P P P P P P P P P P P D P P P P P P P P P P P P P P P
          ----------------------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
          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
          ------------------------------------------------------------
          S A - A - A - A - A - A - A - A D - - A - A - A - A - A - A - A
                  Cursor keys to move, CTRL-U to save, ESC to abandon
    ================================================================================
     Use <SPACEBAR>/<+>/<-> to select
```

Set-up Example 1 – All 30 PCM channels selected for compression (Alternate ADPCM Mapping)

```
                          2 MEGABIT E1 MULTIPLEXER                        V1.04
================================ 12:04 16/09/97 ================================
Main Link (EUR)  : SYNCHRONISED
   Mode          : NORMAL                    Nx64 Channels : 2
   Framing       : CRC4                    * D&I Channels  : 1 + ADPCM
Idle Bandwidth   : 960K                      Alarms        : None
Clock Reference  : LOOP                      Statistics    : Main Link
Configuration    :>LOCAL                     Events        : Log

D&I Channel (EUR): SYNCHRONISED              Drop Bandwidth:  1024K
   Mode          : NORMAL
   Framing       : CRC4
   ADPCM Mapping : Sequential
   ADPCM Law     : A-Law
      ----------------------PCM TIMESLOT MAP-------------------------
      S P P P P P P P P P P P P P P D P P P P P P P P P P P P P P P
      ------------------------TIMESLOT MAP---------------------------
      0 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 2 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
      ------------------------------------------------------------
      S A A A A A A A A A A A A A A A D - - - - - - - - - - - - - -
              Cursor keys to move, CTRL-U to save, ESC to abandon
================================================================================
 Use <SPACEBAR>/<+>/<-> to select
```

Set-up Example 2 – All 30 PCM channels selected for compression (Sequential ADPCM Mapping)

The following example displays show how to set-up PCM channels 1, 2, 20 and 21 to be compressed using both mapping modes. Note that timeslot 16 must be set to 'D' for the PABX signalling information. The free timeslots ('-') may be allocated to one or more data channels.

```
                          2 MEGABIT E1 MULTIPLEXER                        V1.04
================================ 12:04 16/09/97 ================================
Main Link (EUR)  : SYNCHRONISED
   Mode          : NORMAL                    Nx64 Channels : 2
   Framing       : CRC4                    * D&I Channels  : 1 + ADPCM
Idle Bandwidth   : 960K                      Alarms        : None
Clock Reference  : LOOP                      Statistics    : Main Link
Configuration    :>LOCAL                     Events        : Log

D&I Channel (EUR): SYNCHRONISED              Drop Bandwidth:  1024K
   Mode          : NORMAL
   Framing       : CRC4
   ADPCM Mapping : Alternate
   ADPCM Law     : A-Law
      ----------------------PCM TIMESLOT MAP-------------------------
      S P P - - - - - - - - - - - - D - - - P P - - - - - - - - - - -
      ------------------------TIMESLOT MAP---------------------------
      0 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 2 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
      ------------------------------------------------------------
      S A - - - - - - - - - - - - - - D - - - - A - - - - - - - - - -
              Cursor keys to move, CTRL-U to save, ESC to abandon
================================================================================
 Use <SPACEBAR>/<+>/<-> to select
```

Set-up Example 3 – PCM channels 1, 2, 20 and 21 selected for compression (Alternate ADPCM Mapping)

```
                          2 MEGABIT E1 MULTIPLEXER                        V1.04
================================ 12:04 16/09/97 ================================
Main Link (EUR)  : SYNCHRONISED
   Mode          : NORMAL                    Nx64 Channels : 2
   Framing       : CRC4                    * D&I Channels  : 1 + ADPCM
Idle Bandwidth   : 960K                      Alarms        : None
Clock Reference  : LOOP                      Statistics    : Main Link
Configuration    :>LOCAL                     Events        : Log

D&I Channel (EUR): SYNCHRONISED              Drop Bandwidth:  1024K
   Mode          : NORMAL
   Framing       : CRC4
   ADPCM Mapping : Sequential
   ADPCM Law     : A-Law
      ----------------------PCM TIMESLOT MAP-------------------------
      S P P - - - - - - - - - - - - - - D - - - P P - - - - - - - - - -
      ------------------------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
      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
      ------------------------------------------------------------------
      S A - - - - - - - - - A - - - - - D - - - - - - - - - - - - - - -
              Cursor keys to move, CTRL-U to save, ESC to abandon
================================================================================
 Use <SPACEBAR>/<+>/<-> to select
```

Set-up Example 4 – PCM channels 1, 2, 20 and 21 selected for compression (Sequential ADPCM Mapping)

Installation

WARNING – Refer to Appendix A for Safety Instructions.

WARNING - The multiplexer must be disconnected from the power supply and all peripheral connections before opening.

ADPCM Module Installation

With power turned **OFF** and **DISCONNECTED**, the screws on the left, right and top of the multiplexer are removed using a No. 1 Pozidrive screwdriver to gain access to the interior of the multiplexer. Remove the **two screws** from either side of the **D&I port** on the rear panel of the unit. This will release the blanking plate or the D&I card (if fitted). The ADPCM module plugs into connector **J9** on the ECHO baseboard (replacing the D&I card if fitted). The two screws should then be used to retain the module once fitted.

ADPCM Interface Cabling & Connections

Suitable connection may be arranged using an RJ45 connector (for European installations) **or** BNC connectors (for UK installations) as described in the ECHO MULTIPLEXER User Manual.

Internal Jumper Link

The internal jumper link on the ADPCM module must be set to the required interface type. Fit to LK3 for European installations, LK4 for UK installations.

Testing

Replace the cover and screws before powering up the unit. Correct installation of the ADPCM module may be confirmed by **D&I Channels: 1 + ADPCM** being displayed in the upper right area of all ECHO configuration screens.

Appendix 00000000A - Warnings0

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** and **CH2** (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
ii) **MAIN** port
iii) **D&I** port
iv) **CH1** and **CH2** (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**
ii) port **MAIN**
iii) port **D&I**
iv) ports pour les canaux **CH1** à **CH2**
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 B0000000 - Approval Requirements

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.
