

Aculab E1/T1 cPCI card

Installation guide

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1 Introduction

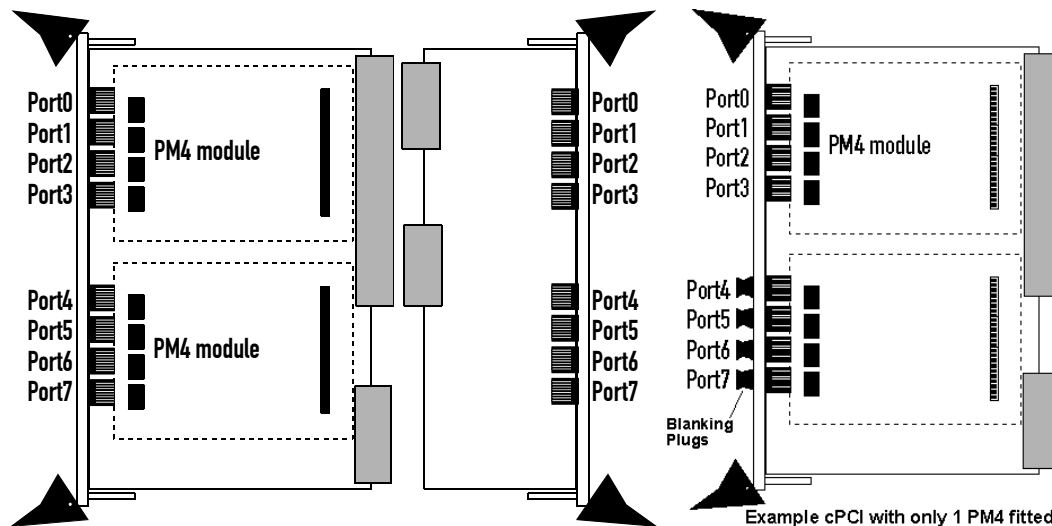
1.1 General

This installation guide is for the Aculab E1/T1 Compact PCI (cPCI) card. The Aculab E1/T1 cPCI card is a digital network access card with up to eight E1/T1 ports. The network ports are provided by Aculab primary rate modules (PMs) with four E1/T1 ports (Rev 2 PM4 modules).

This product is referred to as the 'E1/T1 cPCI card' in this document unless the context requires a more specific term.

The design of the Aculab E1/T1 cPCI card allows primary rate ISDN network connections to be made via RJ45 connectors on the front face of the card. Connection can also be made via an optional 'transition module' card with RJ45 connectors at the rear of the CompactPCI® chassis. The advantage of the transition module approach is that the E1/T1 cPCI card can be removed and replaced without disturbing the network connections.

CAUTION When the transition module is used for network connection, do not attempt to simultaneously connect to the network using the front panel RJ45 connectors. Only one connector may be used for each network port. Misuse will invalidate telecommunications approvals.



The Aculab E1/T1 cPCI card and transition module

Example cPCI with only 1 PM4 fitted

Note If the card is supplied with only one PM4 module fitted, ports 4-7 on both the endplate and the transition module are inactive. Blanking plugs are normally fitted to the inactive ports. To avoid problems when replacing or swapping cards, care must be taken to ensure that the replacement card has the same functionality as the card it replaces.

The **serial number** of the E1/T1 cPCI card is used to uniquely identify an E1/T1 cPCI card in the system. The serial number is hard coded into the card firmware by Aculab, and a label detailing the number is placed on the reverse of the card (no components) on the leading edge. It has the format P/N ACXXXX S/N XXXX WONXXX, S/N denotes the serial number.

Note As required, make a note of the card serial number before fitting the card to the chassis.

The **Card installation** section, details the installation of the E1/T1 cPCI card into a host chassis, and subsequent connection to the network.

The **Approval information** section, in conjunction with the country-specific appendices, gives the conditions of the approval for connection to the telephone network, requirements for installation and safety, and other regulatory matters. This section and the appropriate country-specific appendices contain statements regarding your use of the E1/T1 cPCI card that are **legal** requirements for connection to the public network. Failure to use the E1/T1 cPCI card in accordance with any of these instructions for use may invalidate the approval for connection.

Note These instructions for use assume that these various elements are being assembled and integrated by someone competent in such matters.

1.2 Uses of the E1/T1 cPCI card

The E1/T1 cPCI card is a plug-in card suitable for use in many different types of CompactPCI® compatible chassis. Up to eight E1/T1 ports, on two Aculab plug-in PM4 modules, provide a means of connection to a digital telephone network. The E1/T1 cPCI card provides an interface between the telephone network and the H.110 CTBus. The H.110 expansion port enables connectivity with various types of CompactPCI® based speech and data products from different vendors using an H.110 compliant interface. With the CompactPCI® specification, the H.110 connections between cards are integrated into the CompactPCI® backplane.

The E1/T1 cPCI card contains a digital switch matrix that allows arbitrarily switched interconnection between 240 channels on the E1-network or up to 192 channels on the T1-network and the 4096 speechpaths (timeslots or channels) on the H.110 CTBus. These speech paths can be switched through the signalling DSPs and to the telephone network via up to eight E1/T1 ports.

Control of the E1/T1 cPCI card is via a low-level interface ported to the CompactPCI® bus. The card is essentially operating system independent, and may be used in a UNIX, Windows NT, or indeed any other operating system environment, using a suitable device driver. Call control and digital switch control functions are provided via device drivers that are described in separate publications specific to those topics. Please contact Aculab Plc for information on device driver availability. Drivers and additional documentation are available for download from the Aculab web site. <http://www.aculab.com>

Note The E1/T1 cPCI card is not a complete product, and only has usable functionality when associated with a host chassis and an application program.

1.3 Telephone network attachment

Each port on an Aculab E1/T1 cPCI card, fitted with revision 2 E1/T1 PM 4 line interface modules, attaches to either an E1 (2Mbit) or T1 (1.544Mbit) digital system. It is available with 4 or 8 primary rate ports and subject to each port configuration may make or receive between 92 and 240 separate calls at a time. Each individual ports driver is software configurable for either T1 or E1 (75 or 120 Ohms).

An E1 port attaches to the 2Mbit digital system or Primary Rate (2.048 Mbit/s) Integrated Services Digital Network (ISDN). Network attachment is via a service provision often used to connect digital PBXs to the telephone network (NT1). Each E1 primary rate ISDN ports may make or receive 30 separate calls at a time.

A T1 port attaches to the 1.544Mbit digital system via a Channel Service Unit (FCC, IC or UL Listed CSU). Each T1 ports may make or receive 23/24* separate calls at a time.

** T1 capacity is signalling system dependent.*

CAUTION When making a network connection, to reduce the risk of fire, only telecommunications line cord of 26 AWG or larger may be used.

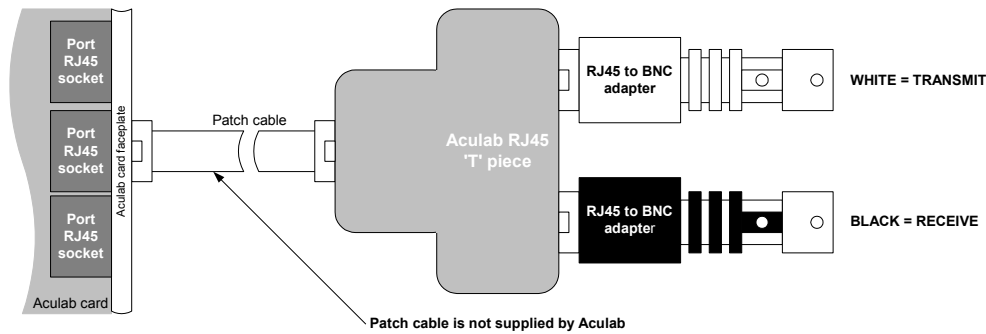
Please refer to the appendices for details of the specific international connections.

1.4 75 ohm network connection

- Different impedance can be supported on the same E1 variant module;
- The revision 2 module can simultaneously support both E1 and T1 ports.
- Besides E1 and T1 ports requiring different firmware, E1 firmware also needs to support both 75 and 120ohms.

The default impedance is 120 ohms, changing the impedance to 75ohms is achieved through changes to the firmware/firmware switches. For example, ETS300 firmware uses a switch `-s61,1` for 75ohms, but E1 DASS requires the firmware DASS75. Refer to the Call, Switch and Speech Driver Installation Guide for further details

To connect to 75ohm E1 networks, RJ45 to BNC adapters are needed. The correct configuration of these adapters is as follows:



Grounding option

Extending ground from the Aculab card to both BNC connectors is possible using a screened RJ45 to RJ45 patch cable and an Aculab screened RJ45 T piece.

The RJ45 T piece is only screened if specifically requested.

An Aculab screened RJ45 T piece has internal connections from the outer screening to both the transmit ring and receive ring pins.

CAUTION An Aculab screened RJ45 T piece must always be grounded through a screened patch cable connecting to the Aculab card; failure to do so could affect signal integrity on the trunk.

1.5 E1/T1 cPCI card – host interface

A device driver program, running on the host chassis, controls the operation of the E1/T1 cPCI card.

The driver accesses the card via a control space within an area of shared RAM. This shared area is a block of memory physically resident on the card that appears as a normal area of memory in the memory map of the host chassis.

For information on device driver installation and configuration, please refer to the Aculab publication 'Call, Switch and Speech Driver Installation Guide'. This guide can be downloaded from the Aculab company web site at www.aculab.com.

1.6 Call control

Processors on the PM4 module daughter-card (one processor per E1/T1 port) control all of the call signalling (set-up, acceptance, clearing, etc.) in response to commands from an application program running on the host chassis.

The call control interface to the PM4 module is at a low level (in signalling terms), and this provides maximum information and control over the various stages of call progress. This interface is accessed via a device driver that has been prepared for the operating system in use.

The PM4 module processor checks each outgoing message provided by the application program for syntax, validity of content and context. If errors are found, the call is automatically cleared. The software on the PM4 module, therefore, forms an effective barrier between the application program and the telephone network, and protects the network from incorrect call signalling.

Several elements of call signalling related information are available to the application program, although in some cases this depends upon provision by the Public Switched Telephone network (PSTN) of certain information along with each call. One such information element is the number used by the caller on calling into the card, (the DDI number); this is only available when the service obtained from the PSTN is of the appropriate type. Another such information element, which may be available according to the protocol and PSTN, is Calling Line Identity (CLI), which, on incoming calls, makes the telephone number of the calling party available to the application program.

Full details on the control of calls using the E1/T1 cPCI card are available in a separate publication 'Aculab Call Control API Guide'. This guide can be downloaded from the Aculab company web site at www.aculab.com.

1.7 Speech and data paths

Speech and data associated with telephone calls are not terminated on the card, but are always switched without modification to other cards, or on-board modules, for processing. The card maintains bit integrity within timeslots between ports on the card.

There are two categories of multi-channel path provided by the card. The figures in part 1 below are for one PM4 module. The fitting of a second E1 or T1 PM4 module will increase the call handling capacity accordingly.

1. E1 (G703) ports - 120 calls (2Mbit system or ISDN) per E1 PM4 or
T1 (G703) ports - 92/96 calls (1.554Mbit T1 system or T1 PRI) per T1 PM4
2. The H.110 CTBus – 512 bi-directional speech paths (out of a possible 4096)

Additionally, any one 'source' of speech or data may be distributed to a number of separate 'sinks', but note that it is not possible via switching on the card alone, for more than one source to feed a single sink.

Full details on the switching of calls using the E1/T1 cPCI card are available in a separate publication '**Aculab Switch Control API Guide**'. This guide can be downloaded from <http://www.aculab.com>.

1.8 H.110 CTBus loading

The E1/T1 cPCI card has a loading factor of 1 on the H.110 CTBus. The maximum loading allowed on the H.110 CTBus is 20. The total loading is calculated by adding the loading factor of all the devices on a single H.110 CTBus.

2 Card installation

The installation procedure for expansion cards will vary from one type of host chassis to another, and the exact details of the installation procedures for expansion cards must be sought in the user guide supplied by the host chassis manufacturer. However, in general:

- Do not connect the E1/T1 cPCI card to the 2.048/1.554 Mbit/s service or primary rate ISDN network termination port until this document, and in particular the sections marked 'Installation and Safety', have been read in full and understood.
- Proper ESD (electrostatic discharge) procedures should be maintained throughout.

CAUTION Care must be taken when inserting CompactPCI cards or transition modules into the host system. The contact pins in the host system can easily be bent if undue force is applied during card insertion, or if the locking tabs are engaged without the card being properly aligned. Aculab accepts no responsibility for damage to the host system connectors arising from miss-use of the E1/T1 cPCI card.

To install the card to the host with the power off:

1. Locate a vacant CompactPCI® slot and remove the host chassis CompactPCI® slot cover.
2. Inspect the back-plane connector for any bent pins.
3. Slide the card in to the CompactPCI® slot making sure the alignment pins at the top and bottom of the end plate engage in their sockets. Using light finger pressure only, ensure the card is correctly aligned and pressed into the connector. When you are satisfied that the card is positioned correctly, engage the upper and lower levers simultaneously. The levers will click to indicate they are locked.
4. Locating screws may be fitted to secure the top and bottom of the card.
5. Optional: If the Aculab cPCI transition module is being used, repeat steps 1, 2 & 3 at the rear of the chassis with the matching rear slot cover and the Aculab cPCI transition module. Particular care must be taken to avoid connector pin damage, as the transition module is more difficult to align than the E1/T1 cPCI card.
6. If necessary, install the driver and application firmware as detailed in 'Call, Switch and Speech Driver Installation Guide'.
7. If necessary, install the application software as detailed in the appropriate documentation.

This completes the installation of the E1/T1 cPCI card into a non-running system.

To 'hot swap' the card in a running host system:

1. Make sure you have a replacement E1/T1 cPCI with the same functionality as the card being removed.
2. Identify the card that needs to be changed. This identification process may involve examination of the card LEDs and/or information from the application using the card.
3. When you are satisfied that you have identified the card to 'hot swap', remove the locating screws (at the top and bottom of the card, if fitted). Press the red release button to unlock the lower lever, but **do not operate the lever to remove the card**.
4. There is a single blue LED on the end plate of the E1/T1 cPCI card. Only when this LED is lit is the card then ready to be fully removed. Press the red release button to unlock the upper lever, then simultaneously operate both levers and slide out the card to fully remove it.
5. Inspect the backplane connector for any bent pins.
6. Slide the replacement card in to the CompactPCI® slot making sure the alignment pins at the top and bottom of the end plate engage in their sockets. Using light finger pressure only, ensure the card is correctly aligned and pressed into the connector.
7. There is a single, blue LED on the end plate of the E1/T1 cPCI card. Only when this LED is lit and you are satisfied that the card is positioned correctly, engage the upper and lower levers simultaneously. The levers will click to indicate they are locked.
8. Locating screws may now be fitted to secure the top and bottom of the card.

This completes the 'hot swap' of the card in a running host system.

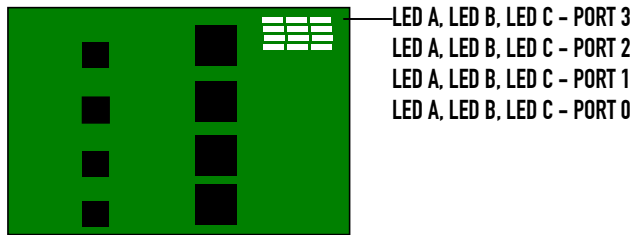
2.1 E1/T1 cPCI card LED usage

The Aculab E1/T1 cPCI card has a block of eight LEDs visible on the endplate of the card. These LEDs are labelled, and each one corresponds to a port on the card. If the card is fitted with one PM4 module, then the LEDs for those four ports will operate and the LEDs for the unused ports will be off. A solid, red LED indicates the port in RESET. A green LED indicates activity on that port.

The single, blue LED is used during the ‘hot swapping’ of cards to indicate that a card can be removed or replaced safely.

2.2 PM4 module LED usage

There are 12 surface mounted LEDs on PM4 modules. The LEDs are arranged in four rows, one for each port.



Current production is LED A red, LEDs B & C green.

While a port microprocessor is in the reset state, the LED A is on. It will go out when firmware is downloaded to the port. LED B turns on briefly during firmware download.

ISDN protocols

LED B flashes when layer 1 transmits a frame. LED C flashes when layer 1 receives a frame. The state of LEDs B & C indicates the state of layer 1. When LEDs are off, layer 1 is inactive, and the LEDs will flash on to indicate frames.

When both LEDs are on, layer 1 is active (F1 or F2 state), and the LEDs will flash off to indicate frames.

CAS protocols

The state of LEDs B & C indicate line state. When both LEDs are off, there is a line problem (for example, no signal or loss of sync). When both LEDs are on, the line is active and LED B (LED C) will flash off when a digit is transmitted or received.

Note If the power supply voltage goes outside of tolerance, the board will go into the reset state. This is indicated by all four of the A (Red) LEDs being on.

3 Approval information

This section provides information on the Approval of the E1/T1 cPCI card, and information that may affect the Approval status of the card in use. Failure to use the E1/T1 cPCI card in accordance with any of these instructions may invalidate the Approval for connection.

3.1 Safety warnings

Seek advice from a competent telecommunication engineer before installation and connection to the network is made.

The network ports on the E1/T1 cPCI cards are only suitable for connection to TNV (Telecom Network Voltage) circuits operating as SELV (Safety Extra Low Voltage) TNV class 1.

The interconnection ports on the card other than the network ports have the following safety status:

Type of circuit	Port description
SELV	Host bus interface (CompactPCI®)
SELV	H.110 Telecommunications bus
SELV (TNV class1)	RJ45 network interface ports

CAUTION When making a network connection, to reduce the risk of fire, only telecommunications line cord of 26 AWG or larger may be used.

See the appendices following the **General Approvals Information** for additional safety related information.

3.2 EMC compliance

The card has been tested for compliance with EMC regulations in the USA, Canada, the UK, Europe and Australia in conjunction with a host system that was compliant. This does not guarantee that every EMC compliant host system will remain compliant when used with the card. In extreme cases, high frequency energy within the host system may be conducted out of the host system and re-radiated via the network cables. In this case the network cables may require additional treatment (such as clamp-on ferrite rings), and system-grounding provisions may require revision.

Good quality shielded cables must be used for the network connections in all cases.

If there is doubt regarding the overall EMC performance of a particular system, the user is advised to obtain competent advice, and local systems testing for EMC. Should local testing identify that additional EMC protection is required in the form of E1/T1 trunk cable clamping, you can refer to Appendix F: for guidance on the retrofit of Aculab Ferrite Clamps.

3.3 Approval details

The Approval Number and Approval Holder details are included in the appendices.

3.4 Usage and type

The usage and type of connections supported by the E1/T1 cPCI cards are detailed in the appendices.

3.5 Environmental

The E1/T1 cPCI card is specified to operate within the following operating conditions:

- Temperature 0-50 deg. Celsius
- Relative Humidity 10-95% RH non-condensing
- Altitude 0 to 2,500 metres
- Weight 500g card, 80g PM4 & 115g transition module

3.6 Network timing

The E1/T1 cPCI card has been tested for compliance with the pulse and jitter requirements of CCITT G703, I431, and ETS300-011 and in some cases additional national or international service requirements.

The E1/T1 cPCI card usually derives the timing for all its network output ports from one of the network receive ports.

Alternatively, the E1/T1 cPCI card may be configured to derive the timing for network output ports from the H.110 CTBus clock. **The jitter performance required to maintain the card's approval status is only guaranteed if the external clock is derived from another Aculab E1/T1 cPCI digital network access card that is connected to the system.** Other clock configurations may require further testing to ensure compliance.

3.7 Power supply

The E1/T1 cPCI card takes its power from the host chassis expansion bus and has the following power requirements:

25W +/- 5% maximum

It is the user's responsibility to ensure that the host chassis will be able to safely supply the power required by the card in addition to any other auxiliary apparatus drawing power from it.

The card is specified to operate correctly with a tolerance (plus or minus) of 5% on the nominal 5V DC power supply voltage.

3.8 Approved functionality

Details of the approved functionality are included in the country specific appendices.

3.9 Regulatory Warnings.

The CE Marking has been applied to the Aculab GroomerII to demonstrate compliance with the following European standards.

EN55022 and EN55024 for electromagnetic compatibility.
EN60950 for electrical safety.

3.10 Approval label

Users are reminded that when the card has been installed in a host chassis, it is still only the card that is approved. The Approval label must not be attached to the host.

3.11 Documentation release

To ensure operation of the E1/T1 cPCI card is consistent with the terms of approval, it is essential to ensure that the card is accompanied by the correct release of the instructions for use, and is used in conjunction with appropriate device drivers.

If an application developer, by virtue of an application program, reduces the functionality of the E1/T1 cPCI card before delivery, then the instructions for use may be rewritten so that only the functionality implemented is described, provided that all of the sections regarding approval, installation and connection are retained.

3.12 Software release

To ensure correct operation of the cPCI card, it is necessary that application programs be built using the correct release of software files for the particular revision of the E1/T1 cPCI card. To aid this process it is recommended that the application program read the major revision level from the device driver, and compares it with the major revision value for which their application was built and tested. The minor revision level is essentially a documentary indicator, but the major revision level value indicates a change that may impact the Host application.

The control software supplied to run on the card (downloaded to on-card RAM) has been tested for compliance with the requirements of the approval authority referred to in the appendices for connection to the digital network. With a RAM-based card, the approval label on the card is only valid and applicable if the card is used with the Aculab supplied signalling software appropriate for the approval label.

Use of any other control software on a port connected to the PSTN is not covered by the approval and reference must be made to the approvals authority before any connection to the network is made.

3.13 User responsibilities

There may be configurations of the E1/T1 cPCI card along with other equipment that may require additional approval testing by an accredited test laboratory.

In particular, in producing the approval certificate for the card, the approval authority did not place any specific restriction on the use of the card apart from any restrictions listed in the appendices on **Country Specific Information**.

It is the responsibility of the user to ensure that all of the legal requirements for attachment are met. The user is advised to seek competent advice regarding any particular equipment configuration or use.

3.14 Speech calls

If the E1/T1 cPCI card is used in an application that makes or answers calls with a service code that indicates a speech or telephony call, or any call that may use a partly analogue route, the approval authority may place requirements on the audio signals transmitted. Please refer to the appendices on **Country Specific Information** for more details.

Many of the speech and fax resource cards that may be used with the E1/T1 cPCI card may comply with approval authority requirements, but it is the responsibility of the user to ensure that approval requirements are complied with by confirmation via the manufacturer of the card, or by any other suitable means such as independent testing.

Signal sources that do not guarantee compliance with approval requirements must be conditioned by appropriate circuitry before transmission.

Appendix A: Country Specific Information

This appendix supplies the country-specific information to supplement the Installation Guide for the E1/T1 cPCI card. These appendices should always be read in conjunction with the other sections of 'Instructions for Use'.

The appendices are arranged in separate sections detailing regulatory requirements for the following countries:

Appendix B - USA & Canada

Appendix C - European Union Countries

Appendix D - Australia

Appendix B: USA/Canada approval details

This section applies only to the 100 ohm T1 version of the PM4 module.

FCC connection requirements

This equipment complies with Part 68 of the FCC rules and the requirements adopted by the ACTA. On the exterior of the cabinet of this equipment is a label that contains, among other information, a product identifier in the format **US:AAAEQ##TXXXX**. If requested, this number must be provided to the telephone company.

ACTA Registration Number:	US: 5TC XD NA N PM4MODT1
Ringer Equivalence Number (REN):	NAN
Facility Interface Code (FIC):	04DU9.1SN
Service Order Code (SOC):	6.0N
USOC Jack Type:	NA

A FCC compliant telephone cord and modular plug is provided with this equipment. This equipment is designed for connection to the telephone network or premises wiring using a compatible modular jack that is Part 68 compliant. See Installation Instructions for details.

The REN is used to determine the quantity of devices that may be connected to the telephone line. Excessive RENs on the telephone line may result in the devices not ringing in response to an incoming call. Typically, the sum of RENs should not exceed five (5.0). To be certain of the number of devices that may be connected to a line (as determined by the total RENs) contact the local telephone company.

If this equipment E1/T1 cPCI causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes to its facilities, equipment, operations or procedures that could affect the operation of the equipment. If this happens the telephone company will provide advance notice so you can make the necessary modifications to maintain uninterrupted service.

If trouble is experienced with this equipment E1/T1 cPCI, for repair or warranty information, please contact Aculab INC, Customer Service, 197 First Avenue, Suite 130, Needham, MA 02494 +1 781 433 6000, (There are no user serviceable components on the card). If the equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.

Connection to party line service is subject to state tariffs. (Contact the state public utility commission, public service commission or corporation commission for information.)

This equipment is hearing aid compatible.

Customer Owned Coin/Credit Card Phones

To comply with state tariffs, the telephone company must be given notification prior to connection. In some states, the state public utility commission, public service commission or corporation commission must give prior approval of connection.

Data Equipment

The table below shows which jacks are associated with which modes of operation:

Mode of Operation	USOC Jack
Programmable	RJ45

Systems

Facility Interface Codes (FIC), Service Order Codes (SOC), USOC Jack Codes and Ringer Equivalence Numbers (REN) are shown in the table below.

Before connecting the card to the public network, you must inform the local telephone company of this information:

Service Type	SOC	FIC	USOC	REN
T1	6.0N	04DU9-1SN	NA	NAN
ISDN (PRI)	6.0N	04DU9-1SN	NA	NAN

UL requirements

This card has been assessed against UL60950-1 and is a listed accessory component under UL file number E178354. The **E1/T1 cPCI** card should be installed in a UL listed **cPCI bus**, based computer system.

Industry Canada warnings

The Industry Canada label identifies certified equipment. This certification means that the equipment meets telecommunications network protective, operational and safety requirements as prescribed in the appropriate terminal equipment technical requirements document(s). The Department does not guarantee the equipment will operate to the users satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions might not prevent degradation of service in some situations.

A representative designated by the supplier should co-ordinate repairs to certified equipment. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

Service requirements

In case of equipment malfunction, all repairs should be carried out by Aculab Plc. It is the responsibility of users requiring service to report the need for service to our company.

Contact details for the USA and Canada offices, (Aculab USA Inc) are available from the Aculab company web site at www.aculab.com.

Approval number USA

Approval type	FCC part 68 XD component registration
Approval number	US: 5TC XD NA N PM4MODT1
Approval holder	Aculab Plc, Lakeside, Bramley Road, Mount Farm, Milton Keynes MK1 1PT, UK

FCC approves the apparatus for connection to public T1 services as specified in the approval certificate, this appendix, and the 'Installation guide' subject to the conditions set out in these documents.

Approval number Canada

Approval Type	Industry Canada CS-03 issue 8
Approval Number	2789A – 12217 (rev 2)

FCC EMC requirements

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This device complies with part 15 of the FCC Rules. Operation is subject to the following conditions:

- this device may not cause harmful interference, and
- this device must accept any interference received, including interference that may cause undesired operation.

No changes or modification to the E1/T1 cPCI card is allowed without explicit written permission from Aculab Plc, as these could void the end user's authority to operate the device.

The card is only intended for use in commercial applications, and should not be operated in a domestic environment. It must only be installed by a professional engineer and good quality shielded cables must be used between the network ports and the Channel Service Unit (CSU) to ensure continued compliance to EMC regulations.

Canadian EMC requirements

This Class A digital apparatus meets all requirements of the Canadian interference-causing equipment regulations.

Cet appareil numérique de la Classe B respecte toutes les exigences du règlement sur le matériel brouilleur du Canada.

Usage and type

The E1/T1 cPCI card is principally designed for use connected to a 1544 Kbps T1 service configured for primary rate ISDN (PRI) with National ISDN 2 signalling. Other types of private circuit use are also appropriate, and other signalling systems are available or planned.

Examples of the files to be loaded into RAM for signalling software to connect with the network are:

<code>ni2_net.upr</code>	(for NI-2 T1 PRI – network to user)
<code>ni2_usr.upr</code>	(for NI-2 T1 PRI – user to network)
<code>att_tnet.upr</code>	(for AT&T, TR41459, T1 PRI – network to user)
<code>att_tusr.upr</code>	(for AT&T, TR41459, T1 PRI – user to network)

Functionality

- Call initiation
- Call clearing
- Call answering
- B-channel switching
- Host independent installation
- Application program generated by the user
- Independent operation of the network ports (one or more ports attached to the public network)
- Operational code running from RAM

Speech calls

If the T1 card is used in an application that makes or answers calls with a service code that indicates a speech or telephony call, or any call that may use a partly analogue route, there is a requirement that the audio signals transmitted are encoded using CCITT μ -law PCM. Many of the speech and fax resource cards that may be used with the T1 card comply with this requirement. It is the responsibility of the user to ensure that this requirement is complied with, by confirmation via the manufacturer of the card, or by any other suitable means such as independent testing.

Signal sources that do not guarantee compliance with this requirement must be conditioned by appropriate circuitry before transmission.

Card installation & connection

Safety Warnings

Interconnection circuits should be such that the equipment continues to comply with the requirements of UL60950-1/CSA C22 for SELV circuits, after making connections between circuits using any of the internal ports.

Refer to a competent telecommunications engineer before installation and connection to the network is made.

L'avertissements concernant la sécurité

Quel que soit le matériel qui est raccordé aux port le système doit respecter les exigence de la norme CSA C22 au sujet des circuits SELV.

Il conviendra de rechercher l'avis d'un technicien de télécommunications avant l'installation de la carte et sa connexion au réseau.

Line interface

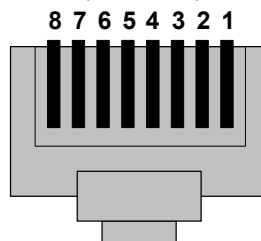
Each network port on the card carries one service connection via a screened twisted pair cable of 100 ohm characteristic impedance. There is one transmit pair and one receive pair. A T1 service will normally carry 24 channels and a T1-PRI service will carry 23 channels. The card is designed to connect to an FCC or IC registered Channel Service Unit (CSU), which is not supplied by Aculab. The default line build out setting is suitable for cables up to 133 feet between the card and the CSU.

Network cable pinout

The 8-contact RJ48 (RJ45) Telephone Modular Plug on the cable between the card and the network must be wired as follows:

Pin	Signal	Function	Direction
4	LTT	Transmit (tip)	output
5	LTR	Transmit (ring)	output
1	LRT	Receive (tip)	input
2	LRR	Receive (ring)	input

RJ48 (RJ45) connector
(Front view)



The cable and plug must be shielded to ensure EMC compliance.

If a cable is to be produced to wire into a network trunk connection, the connector on the network end of the cable must be wired as appropriate for the network terminating unit or Channel Service Unit (CSU) provided.

A 'cross-over' cable is required to connect two T1 ports 'back-to-back', for example, when one port is to run an exchange end emulation and the other port a user end application. The cable should be wired as follows.

User end		Exchange end
4	to	1
5	to	2
1	to	4
2	to	5

Appendix C: Approval details for European Union countries

This section applies only to the 120 ohm E1 version of the PM4 module.



Declaration of Conformity

We

Aculab PLC


of

**Lakeside
Bramley Road
Mount Farm
Milton Keynes MK1 1PT
United Kingdom.**

Declare under our sole responsibility that the product

**Aculab E1/T1 Compact PCI Card
With Rev2 PM4 Module**

To which this declaration relates, is in conformity with the Radio and Telecommunication Terminal Equipment (RTTE) Directive 1999/5/EC

Signed: 

Position: Managing Director

Location: Milton Keynes

Date: 7th October 2002

Usage and type

The 75 Ohm E1 card is designed;

- for use connected to the Public Switched Telephone Network (PSTN) via a 2048 Kbps digital service using Channel Associated Signaling (CAS).
- For use connected to a 2048 Kbps Integrated Services Digital Network (primary rate ISDN) with DASS-2 signaling.
- For use connected to a private circuit using the CCITT G.703 interface at 2048 Kbps in this case the signaling is not specified, and for example includes DPNSS signaling.

The 120 Ohm E1 card described here is principally designed for use connected to a 2048 kb/s integrated services digital network (primary rate ISDN) with ETS300-102 signalling, but other types of private circuit use are also appropriate, and other signalling systems are available or planned.

Approved functionality

The following files are examples of the signalling software that has to be loaded into RAM for connection to the various types of network:

Mercury CAS (PD1)	PD1 . UPR
DASS-2	DASS_USR . UPR
DPNSS	M1DPNSS . UPR

Please contact Aculab for details of other supported protocols.

CAS functionality

- Call initiation
- Call clearing
- Call answering
- Host independent installation
- Application program generated by the user
- Independent Operation of the network ports (one or both ports attached to the network)
- Operational code loaded to RAM
- Major Equipment Failure (MEF) watchdog circuitry
- Data and speech operation

DASS-2 (on the PSN) functionality

- Data and speech operation using any appropriate SIC (Service Indicator Code)
- Call initiation using DASS-2 signaling
- Call clearing using DASS-2 signaling
- Call answering using DASS-2 signaling
- Selection of Supplementary Services
- Host independent installation
- Application program generated by the user
- Independent Operation of the network ports (one or both ports attached to the network)
- Operational code loaded to RAM
- Major Equipment Failure (MEF) watchdog circuitry
- Host Watchdog security feature

Note The SIC determines the type of call being made, and the type of terminal equipment that may terminate the call.

ETS functionality

For 120 Ohm E1 cards with RAM, the filename for the software to be loaded into RAM for signalling software to connect to the network is:

```
ets_supn.upr      (ETS300 – network to user)
ets_supu.upr      (ETS300 – user to network)
```

- Call initiation using ETS300-102 signaling
- Call clearing using ETS300-102 signaling
- Call answering using ETS300-102 signaling
- Host independent installation
- Application program generated by the user
- Independent Operation of the network ports (one or both ports attached to the network)
- Operational code running from RAM

Speech calls

If the E1/T1 cPCI card is used in an application that makes or answers calls with a service code that indicates a speech or telephony call, or any call that may use a partly analogue route, there is a requirement that audio signals transmitted are encoded using CCITT A-law PCM, and do not exceed a 1 minute mean power level of -9dBm.

Many of the speech and FAX resource cards that may be used with the E1/T1 cPCI card comply with this requirement. It is the responsibility of the user to ensure that this requirement is complied with, by confirmation via the manufacturer of the card, or by any other suitable means such as independent testing.

Signal sources that do not guarantee compliance with this requirement must be conditioned by appropriate circuitry before transmission.

Card installation & connection

Safety warnings

Interconnection circuits should be such that the equipment continues to comply with the requirements of 2.3 of EN 60950 for SELV circuits, after making connections between circuits using any of the internal ports.

The host system into which the E1/T1 cPCI card is fitted is classed as an indirect attachment. The CompactPCI[®] bus connector provides an interconnection circuit between the host system and the E1/T1 cPCI card. Similarly, equipment connected to the E1/T1 cPCI card H.110 CTBus is also classed as indirect attachment.

Installation and safety

The card must be installed such that, with the exception of the CompactPCI[®], H.110 bus connections, clearance and creepage distances shown in the table below are maintained between the E1/T1 cPCI card and any parts of the host system or other expansion cards which use or generate a voltage, shown in the following table:

Clearance mm	Creepage mm	Voltage present on other parts of the host or on expansion cards.
2.0	2.4 (3.8)	Up to 50V rms or dc
2.6	3.0 (4.8)	Up to 125V rms or dc
4.0	5.0 (8.0)	Up to 250V rms or dc
4.0	6.4 (10.0)	Up to 300V rms or dc

Clearance mm	Creepage mm	Voltage present on other parts of the host or on expansion cards.
For a host or other expansion card fitted in the host, using or generating voltages <i>greater</i> than 300V (rms or dc), advice from a competent telecommunications safety engineer must be obtained before installation of the relevant equipment.		Above 300V rms or dc

Clearance distances refer to the shortest distance between parts, measured through air. Creepage distances refer to total distances measured across surfaces when installed in a normal office environment. The creepage distances in parenthesis apply where the local environment within the host system is subject to conductive pollution or dry non-conductive pollution that could become conductive due to condensation.

If in doubt, seek advice from a competent telecommunications safety engineer.

In order to maintain the host independent approval of the E1/T1 cPCI card, it is essential that when other expansion cards are introduced which use or generate a hazardous voltage, the minimum creepage and clearances specified above are also maintained. A hazardous voltage is one that exceeds 42.4V ac peak or 60V dc. If you have any doubt, seek advice from a competent engineer before installing other adapters into the host equipment.

Failure to install the E1/T1 cPCI card in accordance with these instructions will invalidate the approval.

75 ohm Line Interface

Each network port on the card carries one 30-channel digital service connection. For 75 ohm characteristic impedance coaxial cables connections, an RJ45 to BNC adapter is required. Each adapter contains a pair of BNC coaxial connections, one for the transmit cable that is colour coded white, and one for the receive cable that is colour coded black.

The coaxial adapter is fitted after the card is installed in the host PC. The adapters are only push fit so some form of strain relief is recommended.

75 Ohm Network Connection

The connection of the network input and output ports on the E1 card to the network termination port (NTP) must be via coaxial cables with a nominal impedance of 75 ohms terminated with a 75 ohm BNC plug.

Note There may be maximum cable lengths imposed by the PTO.

The correct identification of the input and output of the network termination ports is the responsibility of installation personnel.

120 Ohm Line Interface

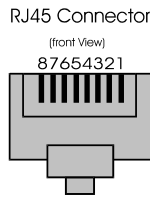
Each network port on the card carries one 30-channel digital service connection via a screened twisted pair cable of 120 ohm characteristic impedance. There is one transmit pair and one receive pair.

120 Ohm Network Connection

The 8-contact RJ45 Telephone Modular Plug on the cable between the card and the network must be wired as follows:

Pin	Signal	Function	Direction
4	LTT	Transmit (tip)	output
5	LTR	Transmit (ring)	output
1	LRT	Receive (tip)	input
2	LRR	Receive (ring)	input

The cable and plug must be shielded types to ensure EMC compliance.



If a cable is to be produced to wire into a network trunk connection, the connector on the network end of the cable must be wired as appropriate for the network-terminating unit provided.

A 'cross-over' cable is required to connect two E1 cards 'back-to-back', for example, when one card is to run an exchange end emulation and the other card a user end application. The cable should be wired as follows.

User End		Exchange End
4	to	1
5	to	2
1	to	4
2	to	5

Network connection via other apparatus

If other apparatus, including cable or wiring, is to be connected between the E1 card and the point of connection to the network, then all of that apparatus must comply with the following:

- The overall transmission characteristic of all the other apparatus, upon electrical conditions presented to one another by the apparatus and the network connection, shall be such as to introduce degradation no greater than the requirement for direct connection. The attenuation shall be assumed to follow the \sqrt{f} law, and the loss at a frequency of 1024KHz shall not exceed 6dB.
- All that other apparatus shall comprise only apparatus approved for the purpose of connection between the apparatus and the network. Cable, wire and wiring accessories shall comply with Approval No: NS/G/1235/M/100009 Section 22, Telecommunications Act 1984 Approval of cable, wire and wiring accessories for connection between certain digital telecommunication apparatus, published by OFTEL.

The installation should comply with the Wiring Code Part 2, published by OFTEL.

The MEF watchdog

Once running, the DASS-2 port processors enable an internal 'watchdog' timer that they must persistently and regularly update. Any error condition that causes processing to falter will cause the watchdog to generate a processor reset. This is the 'Major Equipment Failure' (MEF) condition, and will result in a 'no signal' being presented at the particular G703 output port, which is the required behaviour under these conditions.

Service requirements

In case of equipment malfunction, Aculab Plc should carry out all repairs. It is the responsibility of users requiring service to report the need for service to our company.

Service can be obtained at:

Aculab Plc
 Lakeside, Bramley Road
 Mount Farm, Milton Keynes
 MK1 1PT, England
 UK



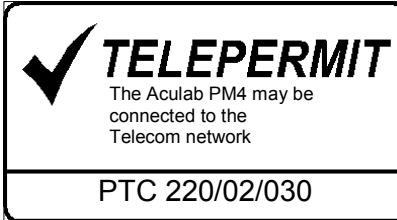
Phone : +44 1908 273800
 Fax : +44 1908 273801
 E-mail : repair@aculab.com

EN55022 declaration

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

No changes or modification to the E1/T1 cPCI card are allowed without explicit written permission from Aculab. Unauthorised changes could void the end user's authority to operate the device.

Appendix D: Approval details for Australia & New Zealand

Approval Types (TBA)		
		
C-Tick mark (EMC Australia)	A-Tick mark (Telecom Australia)	Telepermit (Telecom New Zealand)
Supplier Identification Approval Holder	N4292 Aculab Australia Aculab NZ Representative - via Aculab Australia	PTC 220 / 02 / 030

The current contact details for the Australia offices, are available from the Aculab company web site at www.aculab.com.

Approval by the ACA for connection to primary rate ISDN is held by the local subsidiary of Aculab Plc, as specified in this document and subject to the conditions set out in this appendix. The Telepermit approval is issued to the Aculab New Zealand representative who may be contacted through the Aculab Australian office. The rev 2 PM4 module has the NZ approval PTC220/02/030.

Usage and type

The E1/T1 cPCI card is principally designed for use connected to a 2048 Kbps integrated services digital network (primary rate ISDN) with TS038 signalling including the New Zealand primary rate ISDN network

Other types of private circuit use are also appropriate, and other signalling systems are available or planned.

The Australian and NZ approvals are only applicable when the E1/T1 cPCI card is used with Aculab supplied signalling software appropriate for use in the country covered by the Approval.

A typical example of the software filenames to be loaded into RAM for signalling software to connect to the network is:

`ets_supn.upr` (ETS300 – network to user), `ets_supu.upr` (ETS300 – user to network)

Approved functionality

- call initiation
- call clearing
- call answering
- application program generated by the user
- independent operation of the network ports (one or more ports attached to the network)
- operational code running from RAM

Speech calls

If the E1/T1 cPCI card is used in an application that makes or answers calls with a service code that indicates a speech or telephony call, or any call that may use a partly analogue route, there is a requirement that audio signals transmitted are encoded using CCITT A-law PCM, and do not exceed a 1 minute mean power level of -9dBm.

Many of the speech and fax resource cards that may be used with the E1/T1 cPCI card comply with this requirement. It is the responsibility of the user to ensure that this requirement is complied with, by confirmation via the manufacturer of the card, or by any other suitable means such as independent testing.

Signal sources that do not guarantee compliance with this requirement must be conditioned by appropriate circuitry before transmission.

Card installation & connection

Safety warnings

The primary rate E1 ISDN interface is a TNV interface as detailed in section 6 of AS/NZ 3260.

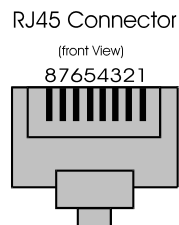
Where equipment is intended to be electrically connected to other equipment, interconnection circuits shall be selected to provide continued conformance with the requirements of section 2.3 for SELV circuits and with the requirements of clause 6 for TNV circuits.

Make sure that the integrity of the SELV system is maintained when connection is made through any other interface port within the system. If in any doubt, seek competent advice.

All host equipment incorporating the E1 ISDN interface must be earthed.

Network cable pinout

The 8-contact RJ45 telephone modular plug on the cable between the card and the network must be wired as follows:



Pin	Signal	Function	Direction
4	LTT	Transmit +ve (tip)	output
5	LTR	Transmit -ve (ring)	output
1	LRT	Receive +ve (tip)	input
2	LRR	Receive -ve (ring)	input

If a cable is to be produced to wire into a network trunk connection, the connector on the network end of the cable must be wired as appropriate for the network-terminating unit provided.

If a 'cross-over' cable is to be produced to connect two E1/T1 cPCI cards 'back-to-back', for example, when one card is to run an exchange end emulation and the other card a user end application, the cable may be wired as follows.

User end		Exchange end
4	to	1
5	to	2
1	to	4
2	to	5

Appendix E: Technical specifications

Connectors

- 2 x PM 4 modules— 8 x RJ45/RJ48 balanced (75 ohm, 120 ohm 100 ohm)

Line interface

- E1 2Mbit to G703/G704/I431
- Double-frame, CRC4 multi-frame and CAS multi-frame supported
- HDB3 line encoding
- T1 1.544Mb to G703/G704/ANSI T1.403
- D4 and ESF support
- AMI or B8ZS line encoding

TDM interfaces

- H.110 compliant interface supporting connection to any of the 4096 timeslots

Switching

- Quad trunk 120/96/92 channels between network and TDM interface (E1/T1/T1 PRI) per PM4
- Local switching of 240 channels to signalling DSP

Clocking

- With PM4 module – CT bus master supporting clock fallback

Onboard signalling DSPs

MF and DTMF tone signalling support

Conferencing support

A-law – mu-law conversion

8 DSPs - One per PM4 module port

Power supply

- +5V DC +5%/-3%
- +3.3V DC +5%/-3%

Physical

- Universal 32 bit, 6U form factor CompactPCI® card
- Weight - 500g card, 80g PM4 & 115g transition module
- All Aculab Compact PCI (cPCI) products conform to PCI Industrial Computers Manufacturing group (PICMG) Compact PCI specification revision 3
- Overall dimensions (excluding face plate):

Height 233.35mm +0.0 / -0.3mm

Depth 160.0mm +0.0 / -0.3mm

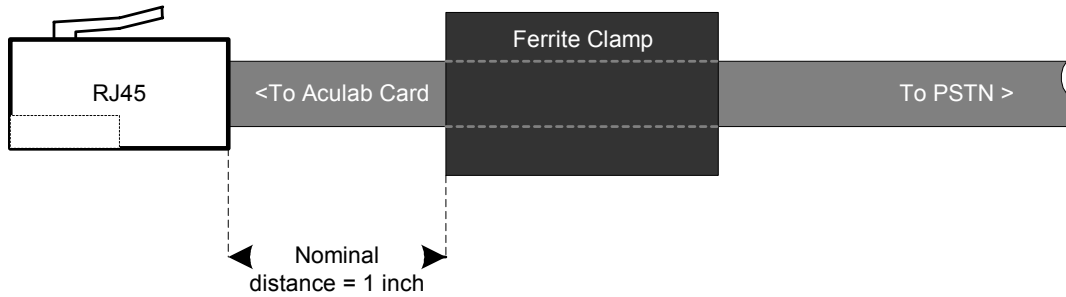
Transition module depth 76.50mm +/- 0.1mm

- Each cPCI card fits into a single card slot without impinging any adjacent slots
- For further details on cPCI standards, please contact the PICMG at <http://www.picmg.com>.

Appendix F: Ferrite clamp fitting instructions

The following diagram depicts the correct fitting of Aculab part number AC0440 Ferrite clamps. These may be fitted as required, for example, when local EMC testing of a system identifies the need for E1/T1 trunk cable clamping.

Europe & USA/Canada



The Ferrite clamp consists of two halves of a ferrite core encased in a hinged plastic holder that is closed and latched around a cable up to 6mm in diameter

Please contact Aculab should you require further clarification on obtaining and using Ferrite Clamps.

Glossary of abbreviations:

ACA	Australian Communications Authority
A-Law	The PCM coding and companding standard in Europe
BNC	Bayonet Neill Concelman (Locking bayonet co-axial connector)
CAS	Channel Associated Signalling
CCITT	Committee on International Telegraphy and Telephony
CCS	Common Channel Signalling
CLI	Calling Line Identifier
cPCI	Compact Peripheral Component Interconnect
CSA	Canadian Standards Authority
CSU	Channel Service Unit
CTBus	Computer Telephony Bus
DASS	Digital Access Signalling System
DC	Direct Current
DDI	Direct Dial In
DPNSS	Digital Private Network Signalling System
DSU	Digital Service Unit
DTMF	Dual Tone Multi Frequency (2 out of 5 or 8 tone signals representing single digits)
E1	Alternative title for the CEPT digital telephony format carrying data at a rate of 2.048 Mbps. E1 is the rate used by European CEPT carriers to transmit 32 64 Kb/s channel, 30 of them used for voice and data calls. A PCM system, E1 is used throughout the world with the exception of North America and Japan.

Also known as 120R.

The E1 link complies with the ITU-T recommendations G.703/G704. It is the interface between the ITS and the backhaul network (switch).

EC	Echo Cancellation
ECTF	Enterprise Computer Telephony Forum
EMC	ElectroMagnetic Compatability
EN	European Norme
ESD	ElectroStatic Discharge
ETS	European Telecommunications Standards
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission
G.703	ITU Standard for physical/electrical characteristics of hierarchical digital interfaces
H.110	Standard for Compact PCI bus operability
IC	Integrated Circuit
IEC	International Electrotechnical Commission
ISDN	Integrated Services Digital Network
ITU	International Telecommunications Union
J1	Japan variant of the American T1 (1.55Mbps/s) standard
JATE	Japan Approvals institute for Telecommunications Equipment
LED	Light Emitting Diode
LIM	Line Interface Module
LIU	Line Interface Unit
MEF	Major Equipment Failure
μ-Law	The PCM coding and companding standard in Japan and North America
MVIP	Multi-Vendor Integration Protocol
NSAI	National Standards Authority Ireland
NT (1)	Network Termination (type 1)
NT	New Technology
NTP	Network Termination Port
NTT	Nippon Telephone and Telegraph
PC	Personal Computer
PCM	Pulse Code Modulation
PM	Primary rate Module

POTS	Plain Old Telephone System
Pri	Primary Rate Interface (23B + 1D T1 or 30B + 1D E1)
PSTN	Public Switched Telephone Network
PTO	Public Telephone Operator
RAM	Random Access Memory
REN	Ringer Equivalence Number
RJ	Registered Jacks (RJ11=6 position, RJ45=8 position)
SELV	Safety Extra Low Voltage
SCBus	Dialogic specific version of MVIP bus
T1	American 1.55Mbits/s 24 channel standard
TDM	Time Division Multiplex
TE	Terminal Equipment
TNV	Telecom Network Voltage
UL	Underwriters Laboratories