

Aculab Passive Monitor cards

Installation & call monitoring API guide

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RECORD OF REVISION

Revision	Description	Date
1.00	Instructions for use	7/4/98
1.01	Addition of Australian approvals	16/2/99
1.02	Addition of connection diagram	14/5/99
1.03	Addition of NZ Approvals	22/10/99
1.04	Addition of 'T' piece information	July 2000
1.05	Addition of DOC	Jan 2001
1.06	Updates include: Call Control Driver API Guide updates, Combined ISA & PCI card versions, Notes on passive monitor tester, Missing error codes to Appendix, Monitor.exe information.	07/03/01
1.07	Minor API amendments, addition of Glossary of abbreviations	23.11.01
2.0	Introduced revision 2 PM – pass through mode	June 2003
2.1	Removal of information relating to ISA cards	July 2003
2.2	Addition of information on LED states	Dec 2003
2.2.1	Addition of reference to other card resources such as signalling DSPs	Mar 2004
2.3.0	Updated for V6 call control drivers	Aug 2004
2.3.1	Clarification on Timeslots added	Nov 2004
2.3.2	Update to USA/AUS and Rev 2 PM details	Aug 2005

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1 Passive Monitor cards - connection to the network

The Aculab Passive Monitor module is different from the primary rate module in that it provides no active call control facilities. The Aculab Passive Monitor module is used to listen to call control signalling on an E1 or T1 line and feed that information through the base card to the application via a device driver. This may includes, for example, the following types of signalling systems:

- T1 - AT&T, INS1500, NI-2, NI-1, Hong Kong ISDN(HKTA)
- E1 - DASS, DPNSS, EuroISDN(ETS300), QSIG
- Q.931-based signaling systems

The Aculab PCI and cPCI cards, with special high impedance passive monitor modules fitted, may be connected to either E1 or T1 lines without adversely affecting the lines being monitored. The cards can be either Aculab E1/T1 or Prosody (if speech recording functionality is required), PCI/cPCI format cards. Refer to the relevant manual for details of other card resources such as signalling DSPs.

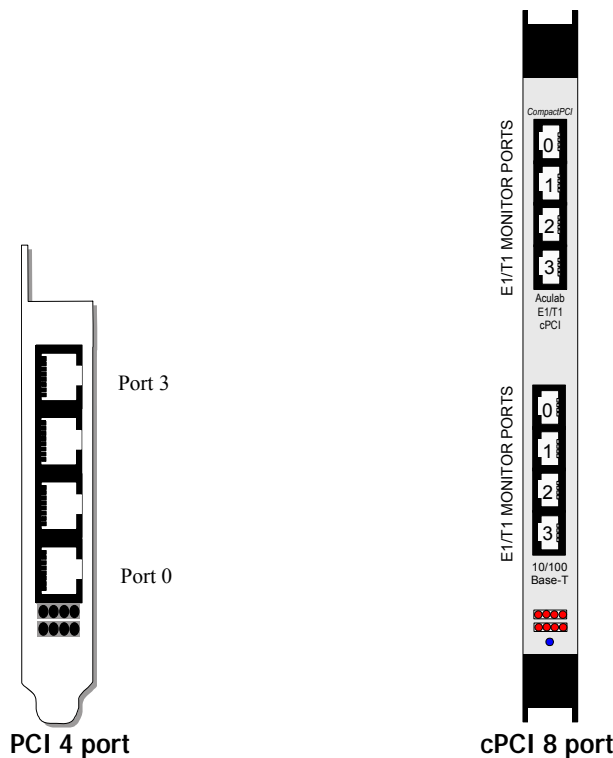
The Aculab Passive Monitor PCI card is available with either a two port or four port module fitted. The cards with two ports allow monitoring of a single connection, while cards with four ports can monitor two connections.

The Aculab Passive Monitor cPCI card is available with either one or two four-port modules fitted. The cards with a single module allow monitoring of two connections, while cards with two modules fitted can monitor four connections.

On each passive monitor module, port 0 is used to listen to the receiving signal while port 1 is used to listen to the transmit signal of the first line. Port 2 is used to listen to the receiving signal while port 3 is used to listen to the transmit signal of the second line.

Revision 2 and later passive monitor modules have a pass through connection option.

Methods of connection are described in the following sections of this manual.



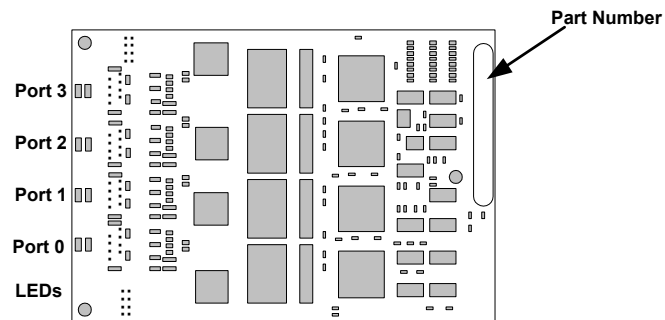
1.1 E1/T1 Passive Monitor card identification

In order to correctly distinguish between a passive monitor card and an ordinary Rev 2 PM, you need to check the PM Part Number as follows:

For revision 2 passive monitor modules

AC5660	E1/T1 Dual Passive Monitor for PCI card
AC5670	E1/T1 Single Passive Monitor for PCI card
AC6460	E1/T1 Dual Passive Monitor for cPCI card

This number is located on the serial number label usually located on the back edge of the PM module, as shown in the following diagrams:



1.2 PM module LED usage

There are up to 12 surface mount LEDs mounted on the PM module. These are difficult to see after the card has been installed. The LEDs are arranged in 4 rows, one for each port.

```

LED A, LED B, LED C, PORT 3
LED A, LED B, LED C, PORT 2
LED A, LED B, LED C, PORT 1
LED A, LED B, LED C, PORT 0
    
```

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

While a microprocessor is in the reset state the LED A is on. It will go out once firmware is downloaded to the port. LED B turns on briefly during firmware download. LED C flashes when layer 1 receives a frame.

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

2 Country specific use of accessories

The accessories supplied vary depending on the country that the card was ordered for, the number of ports, and the card's line type (E1 or T1).

1 or 2 x Aculab RJ45 T Piece (Supplied with E1 and T1 Monitor cards)

2 or 4 x Aculab RJ45 to BNC converters (Supplied with E1 Monitor cards only)

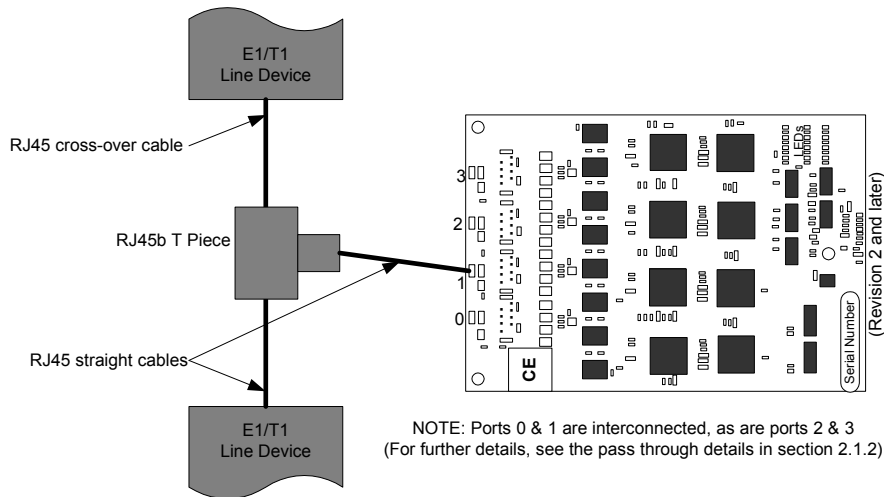
2.1 Examples of accessory usage

The following examples show how the supplied accessories can be used to monitor a line. Aculab does not supply the cables shown.

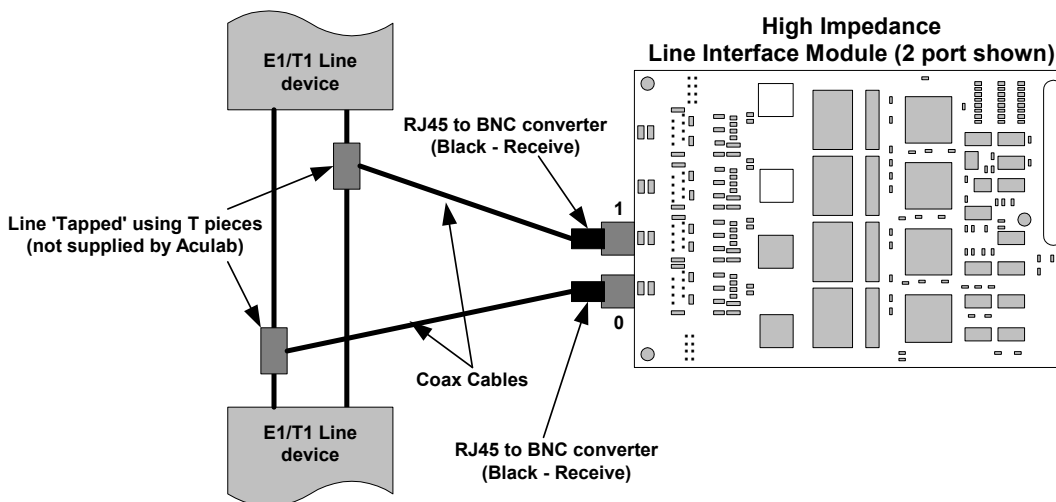
2.1.1 T-point installation

CAUTION To ensure no impact on the monitored line and high quality reception at the monitor port, the overall length of cable between the "Tapped" point and the monitor card needs to be kept as short as possible. It is recommended that this length be kept below 5m, with an absolute maximum of 10m.

Example 1: Using the Aculab RJ45 T piece when monitoring 100 or 120 Ohm RJ48/RJ45 connections



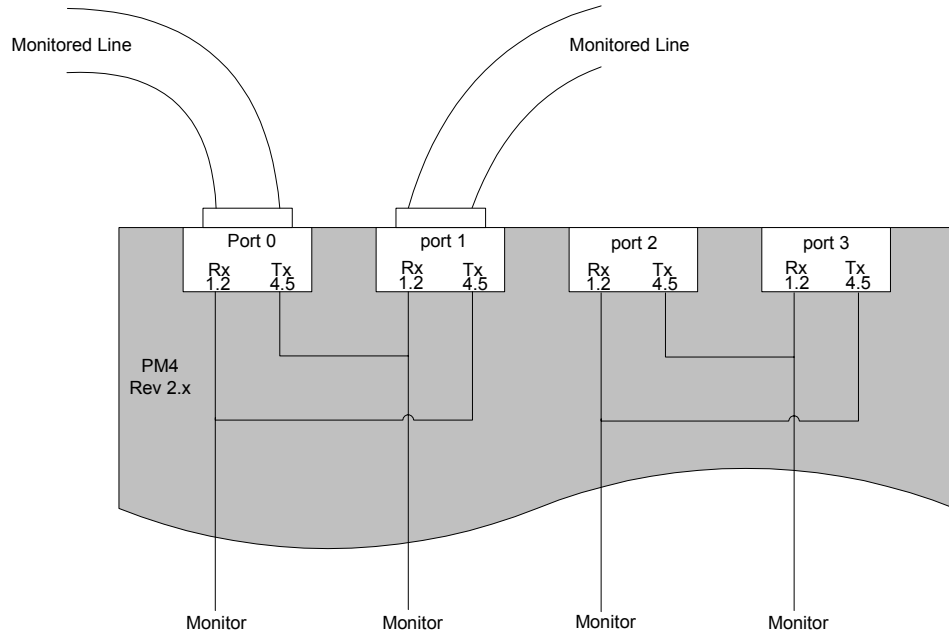
Example 2: Using Aculab RJ45 to BNC converters when monitoring a 75 Ohm BNC connection



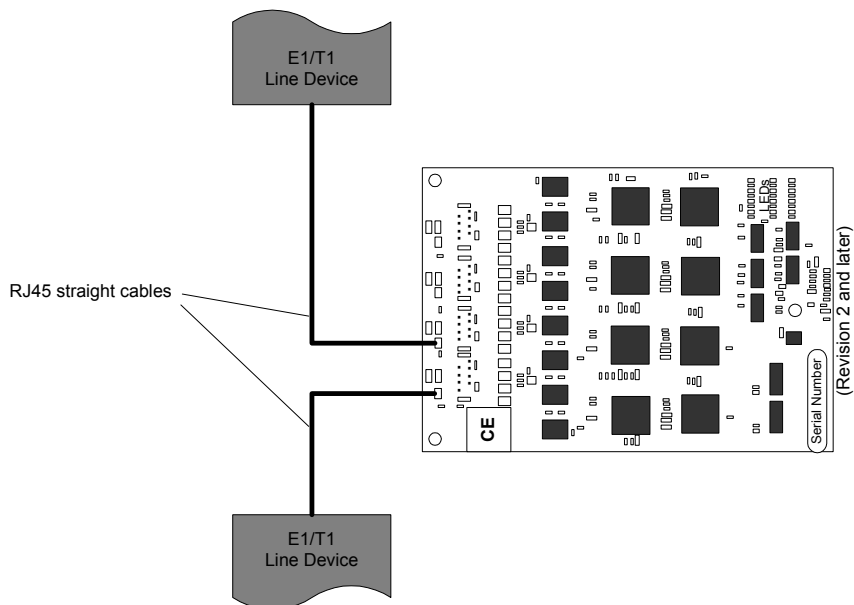
2.1.2 Pass through installation

On revision 2 PMs and later, the passive monitor variant of the primary rate module has a pass through capability from the RJ45/48 ports 0 to 1 and 2 to 3.

This simplifies the connection to a monitored line. The connection between the two ports provides a cross over between the transmit pair on one side and the receive pair on the other, as illustrated below:



Example 3: Using pass through when monitoring 100 or 120 Ohm RJ48/RJ45 connections



Appendix A: Country specific information

This appendix supplies the country-specific information to supplement the Installation Guide for the Aculab cards. These appendices should always be read in conjunction with the other sections of the '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 versions of the Line Interface Modules.

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:AAAEO##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 the equipment 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 the equipment, 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.)

There are no user serviceable components on the cards.

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

The PCI and cPCI cards have been assessed against UL1950 and are listed accessory components under UL file number E178354. The Passive Monitor **PCI or cPCI** card should be installed in an appropriate UL listed **PCI or 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.

These devices comply with part 15 of the FCC Rules. Operation is subject to the following conditions:

- The devices may not cause harmful interference.
- The devices must accept any interference received, including interference that may cause undesired operation.

No changes or modification to the PCI cards is allowed without explicit written permission from Aculab, as these could void the end user's authority to operate the device.

The cards are only intended for use in commercial applications and should not be operated in a domestic environment. They 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 (FCC, IC or UL Listed CSU) to ensure continued compliance to EMC regulations.

Canadian EMC requirements

These Class A digital apparatus meet all requirements of the Canadian interference-causing equipment regulations.

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

Usage and type

The Passive Monitor cards are 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.

The files to be loaded into RAM for signalling software to connect to the network are:

T1MON.UPM for PCI revision 2 cards

Functionality

The monitoring of:

- 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 these cards 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 μ -law PCM.

Many of the speech and FAX resource cards that may be used with these cards 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 in themselves 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 UL1950/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.

Network cable pinout

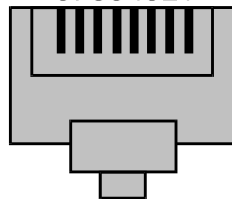
The 8-contact RJ48 (RJ45) Telephone Modular Plugs on the cables between the card and the network must be wired as detailed in this section. Refer to the section 2.1 example 1 for further clarification on cable configurations.

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)

87654321



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 (FCC, IC or UL Listed CSU) provided.

A 'straight' cable is required to connect from the Aculab RJ45 T piece to the first T1 port (port 0 or 2), on the card. A straight cable should be wired as follows:

RJ45 T piece end		Card End
1	to	1
2	to	2

A 'cross-over' cable is required to connect from the Aculab RJ45 T piece to the second T1 port, (port 1 or 3). The cross over cable should be wired as follows:

RJ45 T piece end		Card End
4	to	1
5	to	2

Connection between the Aculab RJ45 T piece and the network tapping point (not provided by Aculab), can be by a straight or cross over cable as appropriate.

A straight cable should be wired as follows:

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

A cross over 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 & UK



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 PCI High Impedance Monitor Card
With Rev2 PM4 or PM2 module

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

Signed: 
Location: Milton Keynes
Date: 7th October 2002

Position: Managing Director



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 Prosody PCI High Impedance Monitor Card
With Rev2 PM2 or PM4 module

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

Signed:



Location: Milton Keynes

Date: 7th October 2002

Position: Managing Director

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.

Service centre **Aculab plc (Service Dept.)**
 Unit 4, Bramley Road
 Mount Farm, Milton Keynes
 MK1 1PT, England, UK

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

EN55022 declaration

These are class B products. The products have been tested in a chassis that is itself EN55022 compliant and the combination of Aculab Passive Monitor cards with that chassis is EN55022 compliant. The combination of these products and another chassis that is EN55022 compliant does not guarantee that the combination will be EN55022 compliant. In a domestic environment, these products may cause radio interference. In the case of interference being produced, the user may be required to take adequate measures.

No changes or modification to the cards is allowed without explicit written permission from Aculab, as these could void the end user's authority to operate the device.

Safety warnings

The apparatus is approved by NSAI for connection to telecommunications systems specified in this appendix subject to the conditions set out in this document.

The Passive Monitor cards have been assessed against relevant parts of the Primary Rate Specification CTR4/ETS300 etc, for passive monitoring of a primary rate ISDN network. There are specific instructions and warnings, which must be adhered to when these products are being used. See usage section below.

The connections via the edge-connector to the PC and the MVIP and SC-Bus/PEB ports (the 'labelled ports') do not themselves provide isolation sufficient to satisfy the requirements of EN60950: 1992/A3: 1996.

The Passive Monitor cards are not suitable for connection to cabling requiring Over Voltage Protection as defined in BS6701. (Most digital connections do not require over-voltage protection).

Note **Before installation and connection to the network is made, please refer to a competent telecommunication engineer.**

Installation and safety

The table below summarises some of the safety requirements of EN60950: 1992/A3: 1996 with regard to proximity of parts of the Passive Monitor cards to voltages present within the host PC.

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
For a host or other expansion card fitted in the host, using or generating voltages greater than 300V (rms. or dc), advice from a competent telecommunications safety engineer must be obtained before installation of the relevant equipment.		Above 300Vrms 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 parentheses apply where the local environment within the PC is subject to conductive pollution, or dry non-conductive pollution that could become conductive due to condensation.

These creepage and clearance distances must be maintained between the conductors on the Passive Monitor cards, and any parts of the host or other expansion cards carrying the voltages indicated. The exception being at the edge connector which plugs into the PC's expansion slot, and at the SC Bus/PEB, H100 and MVIP bus ports.

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

Failure to install the Passive Monitor cards in accordance with these instructions will invalidate the Approval.

Network connections

75 Ohm network connection

The connection of the network input (receive) port on the E1 PM module to the network tapping point must be via coaxial cables. Connection to the RJ45 port on the card is made using an RJ45 to BNC adapter, (Black receive type).

RJ45 Pin		BNC
1	to	Inner
2	to	Outer (screen)

Refer to section 2.1 example 2 for further clarification on cable configurations.

Approved functionality

The filenames for the software to be loaded into RAM for signalling software to connect to the network are:

E1MON.UPR for PCI revision 2 cards

Usage and type

Under the 1996 revision of the Telecommunications Service License (TSL) and the Self Provision License (SPL), a new condition of privacy was introduced requiring all parties to a call to be informed if these calls were being monitored, recorded or if there are any intrusive facilities in operation. This has normally taken the form of 'Warn Tones' to either or both of the parties being recorded.

Note Legal requirements for the use of Telecommunication Recording Equipment within the European Economic Area.

'The National Administration for the country of use may require a warning tone to be generated by the recording equipment to advise either, one or both, of the parties that the conversation is being recorded.'

With the Aculab Passive Monitoring Card, the injection of warn tones is not available as the card has no transmit capabilities. In this situation, it is a requirement that 'Warn Tones' are replaced by 'Written Notices' within all product and user documentation and any sales and promotional material. If a National Administration for any particular country requires warning tones, additional terminal equipment, available from Aculab, will need to be installed by the operator or installer to provide this function.

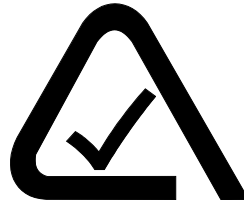
Under this new 1996 revision, it becomes the responsibility of the 'Operator or Installer' of the equipment and not the 'Approval Holder' to inform and ensure that all parties are aware of the use of passive monitoring operations on their calls. This is conducted via written notices and literature as detailed above.

Appendix D: Australia & NZ approvals & conditions of use

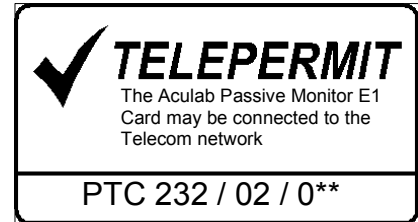
Approval type



C-Tick Mark
(EMC Australia)



A-Tick Mark
(Telecom Australia)



Telepermit
(Telecom New Zealand)

Supplier Identification

N1324 PTC220/02/0** (See table below)

Approval Holder

Aculab Australia
Aculab NZ Representative - via Aculab Australia

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 approvals:

E1/T1 PCI	- PTC220/02/029
E1/T1 cPCI	- PTC220/02/030
Prosody cPCI	- PTC220/02/031
Prosody PCI	- PTC220/02/022
IP Telephony PCI	- PTC220/02/010

Usage and type

The Passive Monitor cards are principally designed for use connected to a 2048 Kbps integrated services digital network (primary rate ISDN) with TS014 or TS038 signalling.

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

The filename for the software to be loaded into RAM for monitor software to connect to the network is:

E1MON.P4R	for PCI revision 1.5 cards
E1MON.UPM	for PCI revision 2 cards

Card installation & connection

Safety warnings

The Primary Rate E1 ISDN Interface is a TNV interface as detailed in section 6 of AS3260. In order to meet the safety requirements of AS 3260 and TS001.

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, after making connections between equipment's.

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.

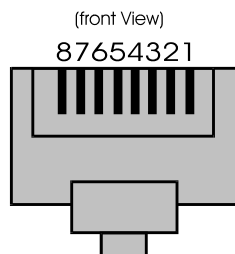
All host equipment incorporating an E1 ISDN Interface *must* be earthed.

Network connections

Network connection cable pinout

The 8-contact RJ48 (RJ45) Telephone Modular Plugs on the cables between the card and the network must be wired as detailed in this section. Refer to section 2.1 example1 for further clarification on cable configurations.

RJ48 (RJ45) connector



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 (FCC, IC or UL Listed CSU) provided.

A 'straight' cable is required to connect from the Aculab RJ45 T piece to the first E1 port, (port 0 or 2). A straight cable should be wired as follows:

RJ45 T piece end		Card End
1	to	1
2	to	2

A 'cross-over' cable is required to connect from the Aculab RJ45 T piece to the second E1 port, (port 1 or 3). The cross over cable should be wired as follows:

RJ45 T piece end		Card End
4	to	1
5	to	2

Connection between the Aculab RJ45 T piece and the network tapping point (not provided by Aculab), can be by a straight or cross over cable as appropriate.

A straight cable should be wired as follows:

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

A cross over cable should 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

High Impedance Passive Monitor PM 4, or PM2 module— 8 way RJ45/RJ48 balanced

Line interface (receive only)

E1 2Mbit to G703/G704/I431
 Doubleframe, CRC4 multiframe and CAS multiframe 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.100 compliant interface supporting connection to any of the 4096 timeslots

Note If Legacy Adapters are fitted, PCI Passive monitor cards cannot be installed in adjacent PCI slots due to the limited space between PCI slots.

Switching

256 channel switching between the local resources and the H.100 bus
 High Impedance Passive Monitor PM4 module- Quad trunk 60/48 or 46 channels between network and TDM interface (E1, T1 or T1 PRI)
 High Impedance Passive Monitor PM2 module- Dual trunk 30/24 or 23 channels between network and TDM interface (E1, T1 or T1 PRI)
 Local switching of 120 channels to optional signalling DSP modules

Clocking

CT bus slave
 CT bus master supporting clock fallback

Embedded processors

AM188 @ 20MHz - One per network port
 Signalling DSP modules (DSP32):

- MF/DTMF tone signalling support. Conferencing, A-law/mu-law conversion, Attenuation, Fax and Bit Error rate testing

1 (Prosody) or 2 (E1/T1 Trunk) DSP32 modules providing up to 2 DSPs per network port.

Power supply (+5V DC +/- 5%)

Prosody PCI card	2.2A max
E1/T1 Trunk card	1.0A max
PM 2 or 4 module	1.4A max
DSP32 modules	0.8A max per module

Physical

All Aculab PCI products conform to PCI local bus specification revision 2.1
 Overall dimensions (excluding face plate):

Height 106.68mm +/- 0.127mm
 Depth (including retainer) 340.74mm +/- 1.57mm
 Depth (excluding retainer) 312mm +/- 0.127mm
 Each PCI card fits into a single card slot without impinging any adjacent slots

For further details on PCI standards, please contact the PCI Special Interest Group at <http://www.pcisig.com/home>.

3 Passive monitor call monitoring API guide

The processors on the E1/T1 Passive Monitor card (one per E1/T1 Port) do not put control call signalling on the line but monitor it, extracting information being passed between Telecommunication Entities.

Communication with this low layer software is via a device driver for the operating system on the host machine. The level of information being supplied to the application, on the host machine via the device driver, is dependent upon the level of signalling being supplied on the line monitored. For example, if Calling Line Information (CLI) is being passed on the E1/T1 D-Channel then this information will be made available to the host application via the device driver.

3.1 Introduction to device driver API

This functional specification covers the interface of a device driver capable of providing the requirements of a 'Layer 3' interface to the monitoring code resident on the Aculab E1/T1 monitor card.

The specification does not presume any particular environment and is intended for use under various operating systems. To this end the functions are defined as library calls where isolation from the operating system is desired.

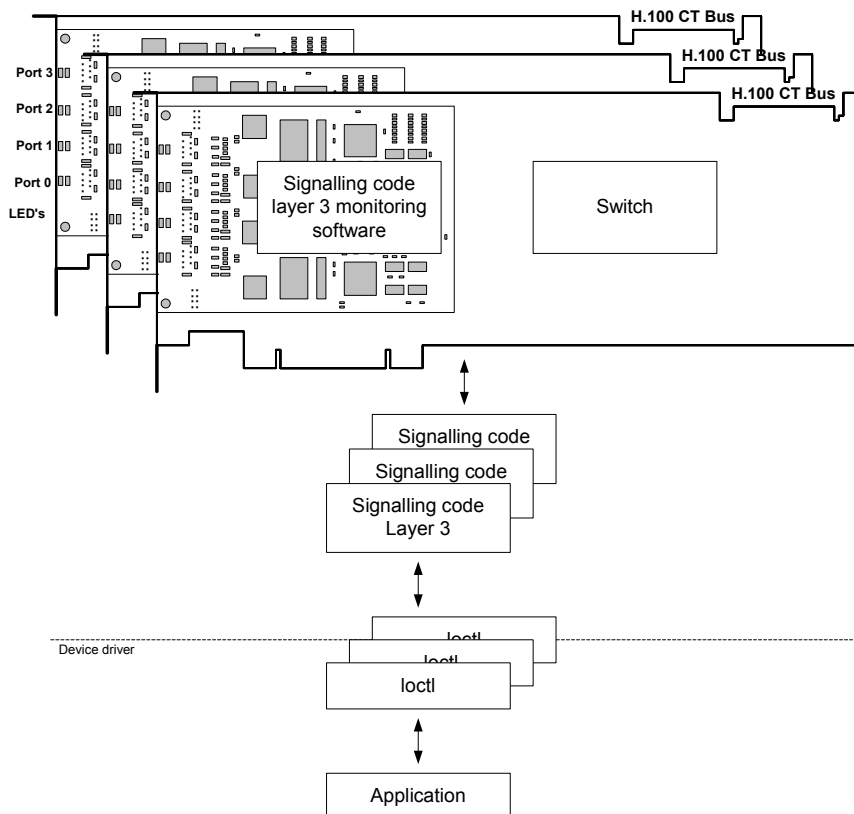
3.2 Scope

This functional specification is intended to be of use in the development of a device driver or of an application making use of the various function calls.

The specification covers the monitoring of outgoing calls and incoming calls. The control and switching of timeslots and streams is the subject of another specification.

3.3 System architecture

The system architecture is such that one device driver is responsible for the monitoring system on one card. Prior to V6 driver software, if multiple E1/T1 cards are used in a system then multiple device drivers will be required to support the multiple cards. V6 only uses a single driver.



3.3.1 Installing the device drivers

Installation of the Call Monitor Drivers is detailed in the Aculab Call, Switch and Speech Driver Installation Guide. The most up to date version can be found on the Aculab company web site at www.aculab.com

4 Call functions

The following describes the interface for the library functions and the device driver. Each function is described in terms of its calling parameters and the values that the function will return. No particular operating system or signalling system is assumed and function definitions may apply equally to either.

The specification is divided in to sections for ease of reference and covers the topics of basic call monitoring, firmware downloading and conversion functions that may be useful to an application writer.

The call monitoring library functions are the same as those used for call control on other Aculab digital access cards, but some of the parameters are different. Also the usage of them could be different. It must also be pointed out that some of the functions used for call control are not relevant to call monitoring. This document only describes the functions relevant to call monitoring. For descriptions of the other functions see the Call Control API Guide.

As with any of the API functions described in the V6 Call Control Driver API Guide, the `INIT_ACU_STRUCT` macro should be used to initialise data structures before using with the API.

This section of the specification covers the library functions available for call monitoring.

4.1 System configuration

These functions provide information about the system.

4.1.1 `call_type()` – get signalling system type

This function may be used to return a system wide signalling system reference value for a given network port number. This function will be useful for applications that support multiple signalling systems.

The reference value returned will be unknown or one of the set:

E1/T1 Passive Monitor

`S_MON` `S_MON_T1`

4.1.2 `call_line()` – get line type

This function may be used to return a reference value describing the type of trunk supported by the card. This function will be useful if support of multiple signalling systems is being considered for the application.

The reference value returned will be one of the set:

`L_E1` for the E1 card
`L_T1_ISDN` for a T1 ISDN card

4.1.3 `call_port_info()` – get information about a port

This function returns information about a port.

Return values

sig_sys

The driver will return a null terminated ASCII string containing the signalling system type that is supported by the device driver in the character array `sig_sys`. This string will contain one of the following:

Passive monitor

`MONE` (for E1) or `MONT` (for T1).

port_type

The `port_type` is a combination of values representing the capabilities of the port. For passive monitor ports it will be set to `ACU_PORT_CAP_E1_ISDN_MONITOR` for E1 or `ACU_PORT_CAP_T1_ISDN_MONITOR` for T1; or otherwise a combination of the two if both capabilities are supported.

lim_type

The *lim_type* field describes the actual type of LIM module that the port is on. For passive monitor high impedance LIM modules it will be set to one of :

PM4_TWO_PORT_E1_MONITOR
PM4_FOUR_PORT_E1_MONITOR
PM4_TWO_PORT_T1_MONITOR
PM4_FOUR_PORT_T1_MONITOR
UPM_TWO_PORT_E1T1_MONITOR
UPM_FOUR_PORT_E1T1_MONITOR

4.2 Call monitoring

4.2.1 call_open_port() – open a port

`call_open_port()` must be used to open a port before it can be used to monitor a call.

4.2.2 call_close_port() – close a port

`call_close_port()` must be used to open a port before the port can be used to monitor a call.

4.2.3 call_openin() - open for incoming call

As described in Section 1, the ports on a passive monitoring card are arranged in pairs with the first port from each pair on the card being used (from the software point of view) to receive any details of monitored calls on a single E1/T1 link. Hence calls to `call_openin()` should be made using ports 0, 2... etc. The second port operates as a “slave” port but will still need to have its firmware downloaded.

This function allows an application to initiate a wait for a call. The function registers the incoming call requirement with the device driver, which if satisfied with the calling parameters, will return a unique call identifier, the call *handle*. The call *handle* must be used in all successive call control related operations on the driver.

Input parameters

net – V6 drivers require a `port_id` value for a card that has been opened according to the procedure described in the *Resource Management API Guide*. It is up to the application to check that the port/card has passive monitoring capabilities.

ts/cnf - The recommended way to use `call_openin()` with passive monitor applications is to set the timeslot to ‘any’ (-1).

```
in_xparms.ts = -1
in_xparms.cnf = 0
```

The reason why this method is recommended is that for Q.931 calls the following points must be considered.

- If, in the monitored call, no specific or preferred timeslot has been requested in the initial setup message (*‘any timeslot’* requested) and if a specific timeslot is used (`in_xparms.ts = timeslot, in_xparms.cnf = 0`) then the call will not match any handles and the call will be lost (not monitored).
- If, in the monitored call, no specific or preferred timeslot has been requested in the initial setup message (*‘any timeslot’* requested) and if a preferred timeslot is specified (`in_xparms.ts = timeslot, in_xparms.cnf = CNF_TSPREFER`) then it must be remembered that the actual timeslot might be different from the one received. The call will be accepted and the effect will be the same as opening a call for any timeslot. This will be true even if all handles are opened for preferred timeslots.
- If an application opens a call handle with an exclusive timeslot (`in_xparms.ts = timeslot, in_xparms.cnf = 0`) the timeslot of a monitored call might initially match a handle allowing the call to be detected. Subsequently the call may be lost due to the timeslot changing during the progress of the call setup procedure (the timeslot no longer matches the one requested).

unique_xparms - not used for passive monitor.

4.2.4 `call_event()` – get A call event

This function is used to return an event that may have occurred on any call handle. An event is issued by the device driver when a change of state occurs. In the V6 driver, events are always queued.

Return values

`state`

The `state` field will only be valid when `handle` contains a valid handle (non-zero) and will contain the current state of the call.

The relevant events in a passive monitor system are:

`EV_WAIT_FOR_INCOMING`

Waiting for incoming call. The driver is waiting for an incoming call on this handle. Note in the context of the passive monitoring driver all calls are seen as incoming.

`EV_INCOMING_CALL_DET`

An incoming call has arrived. An incoming call has been detected on this call handle.

`EV_WAIT_FOR_ACCEPT`

This event will be returned in response to the ringing/alerting messages being passed.

`EV_DETAILS (EV_INCOMING_DETAILS)`

Incoming/outgoing call details. Additional incoming or outgoing call details are available in the driver. The application may use the `call_details()` function to retrieve the information. For monitored calls an `EV_DETAILS` event occurs whenever new information has arrived. This may be additional DDI or CLI digits available in the `destination_addr` or `originating_addr` fields of the `call_details()` function or a change of timeslot.

`EV_CALL_CONNECTED`

A call is connected. The monitoring firmware has detected a connect message on the link.

4.2.5 `call_details()` – get call details

This function is used to gather the details of the current call either incoming or outgoing, connected through the device driver.

The return value `stream` will contain the network stream number on which the call was received. For a full description of the Stream numbering on Aculab cards consult the Switch Driver API Guide.

The return value `ts` will contain the timeslot on which the call has been received or made. For passive monitor systems this will be set to `-1` until the timeslot for the call is known. It is also important to remember that the timeslot can change during the call setup procedure.

The return value `calltype` will indicate the direction of call in progress and will have the values `OUTGOING` for one call direction and `INCOMING` for the other call direction.

The `sending_complete` boolean is not supported by the passive monitor software.

The character buffers `originating_addr` and `destination_addr` will contain the *calling line identity* (cli) and *direct dial in* digits (ddi) respectively if known by the signalling system.

Additional digits will be returned in `destination_addr` as an when they occur on the network if overlap sending or receiving are used. The application may repeatedly call the `call_details()` function to pick up extra digits. All received digits will be shown if `call_details()` is called upon receiving an `EV_CALL_CONNECTED` event.

The character buffer `connected_addr` is used if a connected number is given in the Layer 3 connecting messages. This is often useful for monitoring ACD (automatic call distribution) queues.

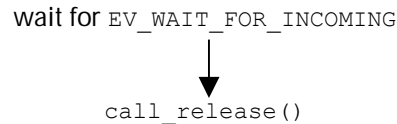
Note The remaining fields (including the unique structures) are part of the Aculab Generic API and are not used by the Monitor Driver.

4.2.6 `call_release()` - release call

This function is used to relinquish ownership of a call handle. If the `call_release()` function is successful, the call handle will be closed. The handle may no longer be used by the application.

If there is a call in progress when `call_release()` is invoked, the calling process will block in the driver until the call has finished. Control will then be returned to the application. This period is entirely dependent upon the call in progress and the network.

For single threaded applications this may be a problem. If there is a call in progress a better procedure would be to use the following method:



4.3 Diagnostic functions

4.3.1 `call_l1_stats()` - layer 1 statistics

This function may be used to obtain the current condition of Layer 1 of the signalling system and allows an application to inspect and clear line condition flags and counters.

4.3.2 `call_l2_stats()` - layer 2 state (unsupported)

Not supported by passive monitor software.

4.4 Firmware

The section of the specification describes the functions available in the library to allow the signalling/monitoring system firmware to be downloaded onto the Aculab E1/T1 monitor card via the device driver or which allow the signalling/monitoring system to be reset and restarted.

4.4.1 `call_download_fmw()` - download signalling system firmware

The function is used to download signalling system firmware to a port on the Aculab card.

The file presented for downloading will be read by the library, verified that it is a firmware file, transferred to the Aculab monitor card and executed by the on board monitor. The firmware will then be checked by the driver to ensure that it can be supported and finally registered by the device driver for use.

4.4.2 `call_restart_fmw()` - restart signalling system firmware

The function is used to restart the signalling system firmware on a port on the Aculab card without having to reboot the machine. The function will cause the selected port on the card to be reset and the firmware to be downloaded. The `call_restart_fmw()` function may be used to effect the initial firmware download so may replace the `call_download_fmw()` function.

4.5 Miscellaneous functions

The following functions are provided so that an application can relate a handle to a structure in an application relating to a call without having to do any searches through arrays or lists.

`call_handle_2_io()` Used to convert a given call reference value or handle to an indication of call direction.

`call_handle_2_port()` Used to convert a given handle to its equivalent port id number.

`call_handle_2_chan()` Used to convert a given handle to a logical channel number.

These functions are better described in the V6 Call Control Driver API Guide.

Another method is now supported for converting a handle returned by `call_event()` or `call_details()` to something useful for indexing the call control structure relating to a call. This uses the `ACU_ACT_app_context_token` field present in most of the call control API structures. This is a better method and should be used for any new applications for V6 (not ported from V5.x call control drivers) instead of `call_handle_2_chan()`.

4.5.1 `call_port_2_swdrvr()` – determine port's switch

This function may be used to obtain the switch id relating to a particular network port. This switch id may then be used to access a particular switch in a multiple switch driver environment. (See Switch Control API Guide).

Synopsis

```
int call_port_2_swdrvr(ACU_PORT_ID portnum);
```

Input parameters

The input parameter `portnum` identifies the network port number for which the switch driver number is required and will have a valid port id as returned from `call_open_port()`.

Return values

On successful completion the function will either return the switch id number relating to the port id provided or a negative value will be returned indicating the type of error (see Error Codes).

5 Function usage

The following section shows how the functions provided may be used to make and monitor calls and the requirements of an application using those functions.

5.1 Exception handling

As a rule whenever making calls using the Aculab API, the return codes should always be checked. Certain conditions can arise, through passing incorrect parameters, unavailable timeslots, network problems, operating systems issues, etc, that will be indicated by function return codes. A list of return codes is found in Appendix F. It is good practice to handle all possible exceptions; also it has proved useful to have some sort of logging or indication to the user during an exception condition.

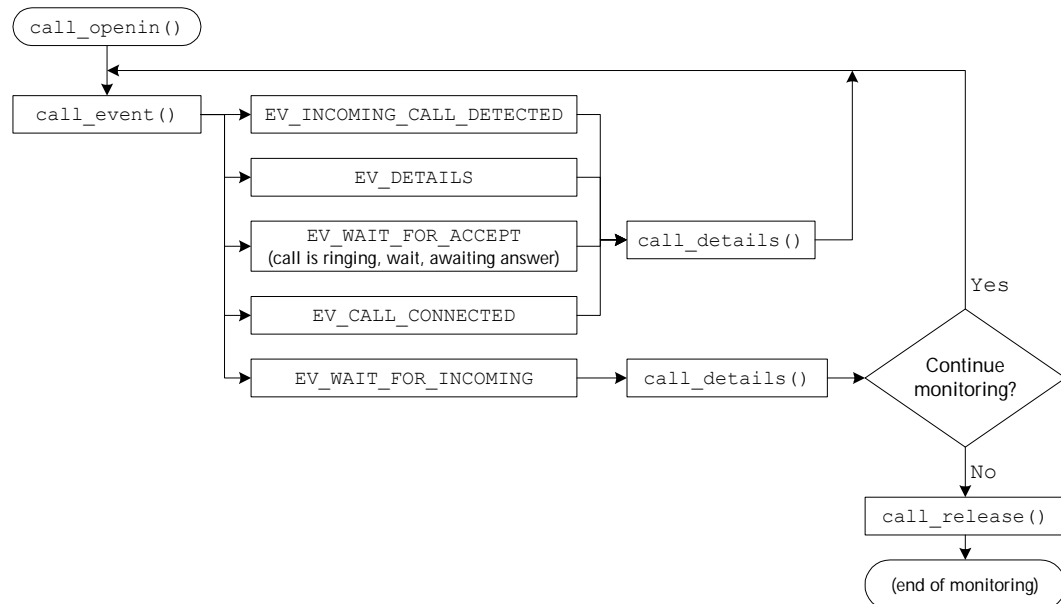
5.2 The event model of the call control driver

Event information can be provided on a per handle or per system basis. Per handle usage would be appropriate for an application having a single thread or process used to monitor one call. Per system usage would be appropriate for an application where one thread or process picks up event information for all calls in a system.

5.2.1 Call monitoring using events

Wait For Incoming Call (Call Monitoring of calls in either direction)

This diagram shows how a call is monitored using the event model for a passive monitor call.



The application issues a `call_openin()` function to the device driver. The driver initiates the wait for incoming call and returns control to the application with the call handle. The application is now free to issue new commands to the device driver.

To ascertain the progress of a call the application should invoke the `call_event()` function. The device driver will return the state of the call and a call handle on which the event occurred.

The arrival of an incoming call is signalled by the event `EV_INCOMING_CALL_DET`, whereupon the application issues the `call_details()` function, which returns information about the incoming call.

Upon an Alerting message being monitored with respect to the call then the driver will generate an `EV_WAIT_FOR_ACCEPT` event. If a Connect message is monitored on the line then there will be a driver event `EV_CALL_CONNECTED` generated.

If the call is disconnected, then an `EV_WAIT_FOR_INCOMING` event will be generated to indicate the call has gone full circle. If additional call details are received by the driver, then the `EV_DETAILS` event will be generated. Additional details can include extra DDI digits or changing or confirmation of previous timeslot allocations.

5.3 Passive monitor timeslots

For a passive monitor call, the relevant timeslots for switching purposes will be on port n incoming timeslot, and for the other speech direction, port n+1 incoming timeslot. Where n is the even numbered port used to monitor the call and timeslot is the relevant timeslot as reported by `call_details()` for the call handle in question.

This differs from non-passive monitor calls due to the fact that with passive monitor, the relevant timeslots for a call are both incoming and are therefore on different ports.

6 Passive Monitor software

The Aculab call control driver should be used with a pre revision 2 E1 or T1 module, or a revision 2 E1/T1 module fitted to the Digital Access card. Either a two port or four port version in each instance. The signalling firmware file to be used with this driver for revision 2 modules is `mon.upr`, for a pre Revision 2 E1 modules use `e1mon.p4r`, and for a pre revision 2 T1 modules use `t1mon.p4r`.

The `-s96,1` configuration switch is used with Revision 2 E1/T1 modules to change from E1 to T1 monitoring.

There are currently no switches required for the firmware (-s switches) for the PCI signalling firmware's apart from the `-s96,1` switch although reference should be made to the latest firmware release notes.

6.1 FWDSPLDR usage

The PCI monitor cards can have two or four ports. cPCI monitor cards can have 4 ports (Prosody cPCI version) or 8 ports (E1/T1 cPCI version). Each port is controlled by its own processor. For a dual-port card, having two processors, the firmware must be downloaded to each processor.

The `fwdspldr` utility is provided to allow this to be download to be performed from the command line. The format of the command is:

```
fwdspldr <serial-number> <port-number> <filename> <config>
```

<serial> is the serial number of the card

<portnum> is the port number within the card

<filename> is the name of the firmware file

<config> is the optional configuration switch string for adding any extra parameters

Note All ports should have firmware downloaded even if they will not all be used.

6.1.1 An example

On a system with a four-port PCI card, the firmware will have to be downloaded to all four ports:

```
fwdspldr 137089 0 mon.upr
fwdspldr 137089 1 mon.upr
fwdspldr 137089 2 mon.upr
fwdspldr 137089 3 mon.upr
```

Appendix F: Error codes

The following lists the error codes returned by the call control system and will be added to requirements change. Some errors are internal to the driver occurring only during initialisation and will never be seen by an application.

F.1 Call control errors

Error	Description
ERR_HANDLE	The handle supplied is invalid or closed, or there are no more handles available
ERR_COMMAND	The command specified is invalid or was not expected.
ERR_NET	The network outlet number specified is invalid.
ERR_PARM	Inconsistency in the call parameters.
ERR_RESPONSE	Application Failed to respond within response time
ERR_NOCALLIP	Call_Details() was issued with no call in progress
ERR_CFAIL	Command Failed. Error detected during execution of command.
ERR_TSBAR	The specified timeslot is barred or illegal.
ERR_TSBUSY	The specified timeslot is in use or there are no free timeslots.
ERR_SERVICE	The specified service octet or associated additional information octet is unsupported or invalid.
ERR_BUFF_FAIL	The driver has run out of data buffer resources. This error should never be seen during normal operation.
ERR_LIB_INCOMPAT	Call driver doesn't support the version of library API call attempted.
ERR_DRV_INCOMPAT	API call attempted with an incompatible driver.
ERR_DRV_CALLINIT	Attempted to call call_init(), while other processes/threads are accessing the driver.

F.2 Errors occurring during download

Error	Description
ERR_DNLD_ZAP	The on-board monitor is running. This error will not be presented to an application and is for driver use only.
ERR_DNLD_NOCMD	The command you have attempted could not be executed as there is no signalling system firmware executing on the given network port.
ERR_DNLD_NODNLD	A firmware download was attempted but the signalling system firmware was already installed and running.
ERR_DNLD_GEN	A error occurred during the downloading of the signalling system firmware. This error should not be seen during normal operations.
ERR_DNLD_NOSIG	The signalling system firmware was downloaded successfully but failed to execute after a start command.
ERR_DNLD_NOEXEC	The signalling system firmware was downloaded successfully but failed to execute after a start command.
ERR_DNLD_NOCARD	No card is present in the system. This error will not be presented to an application and is for driver use only.
ERR_DNLD_SYSTAT	The signalling system firmware that was downloaded successfully detected an error after a start command. For CAS protocols, this may be due to a DSP not being fitted to the E1/T1 card.
ERR_DNLD_BADTLS	The device driver does not support the downloaded signalling system, possibly due to downloading User-end firmware to a driver expecting Network-side firmware or vice-versa.
ERR_DNLD_POST	The Aculab digital access card detected any error during initialisation. This error will not be presented to an application and is for driver use only.
ERR_DNLD_MEM	The call control library could not allocate enough memory from the operating system to start the download procedure.
ERR_DNLD_FILE	The file presented for firmware downloading could not be found by the operating system.
ERR_DNLD_TYPE	The file presented for firmware downloading is not considered suitable for downloading to the digital access card.