



# Sentinel

Signal Monitoring  
& Detection

## User Guide

Issue 0.6

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This document is still in preparation and subject to revision.

DOCUMENT

Sentinel User Guide

ISSUE 0.6

Issue	Date	Reason for Change	Approved
0.1	12 Aug. 00	First Issue for Internal Review	
0.2	25 August 2000	Format only	
0.3	15 January 2001	COSMOS & 600-03-00 added	
0.4	18 January 2001	Format – US dealer conf issue.	
0.5	22 January 2001	Corrected & proof read	
0.51	15 February 2001	Default settings added	
0.6	19 March 2001	600-04-00 added (first issue)	
0.61	30 March 2001	600-03 update, 600-04 x-refs	
0.62	18 May 2001	Text corrections, NT4 driver start	
0.63	27 May 2001	Troubleshooting	
0.64	05 June 2001	Analog audio thresholds	

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## 1. INTRODUCTION

The 600 series **Sentinel** range builds on the Trilogy 200 Series of analogue monitoring products and offers a complete solution for both digital and analogue signals including the monitoring of audio embedded into a Serial Digital Video data stream.

As well as offering basic signal detection functions the cards have facilities to monitor transport errors in the data streams and to look for content errors. Problems such as frozen video, stuck bits, missing or incorrect level audio can all be detected.

All **Sentinel** cards have on board GP outputs, which can be used to trigger remote alarms. In addition, the modules have an on-board changeover facility allowing automatic or manual switching of signals. This enables a fully automatic monitoring and switching system to be built very cost effectively.

For larger systems or applications where more comprehensive control and fault logging are required then **COSMOS**, a Windows based software package can be used to remotely configure, control and monitor the system. A range of Fault Display options will be available and multiple rack systems can be linked together and networked, using CAT5 UTP cable and RJ45 connectors, to a central, controlling PC.



## **2. RACK FRAME**

### **2.1 Introduction**

The Trilogy 600-50-00 rackframe is a 19 inch wide 3U high unit. Each module has a 30mm wide rear connector, allowing a maximum of 12 modules to be fitted into a 3U frame.

The main features are:

- Accommodates up to 12 modules with 30mm rear connectors.
- Hot-swappable dual power supplies
- Alarm outputs for power supply and fan failure
- Compatible with Pro-Bel **COSMOS** configuration and status monitoring system
- Removable door
- Robust construction
- Fan assisted cross flow cooling
- Cards from the Pro-Bel Modular Product Range are compatible with the 600-50-00 frame. Contact Trilogy Sales Department for more details.

### **2.2 Installation**

#### **2.2.1 Installing the rackframe**

Since the 600-50-00 3U rackframe is designed for transverse air flow, it is not necessary to leave vertical space between multiple frames. However, the rear and side vents must not be obstructed.

#### **2.2.2 Door fitting and removal**

The frame door is held closed by sprung ball latches at either side. To open the door, pull outwards using the finger pull recesses at the top.

The door can be removed from the frame by opening it approximately 30° and lifting upwards. It will not disconnect from the hinge at a greater angle. To re-fit the door, ensure that it is located centrally on the hinge.

#### **2.2.3 Module Installation**

##### **Step 1. Fit the rear connector:**

- Ensure plastic latch is fully retracted
- Slot the rear connector 'locating guide' into the appropriate locating holes then push the latch fully home

##### **Step 2. Fit the module:**

Slide the module along the guide rail of the required slot, gently pushing it fully home until it marries up with both the rear connector and power and status monitoring bus connectors.

##### **Step 3. Fit the module locator**

On the 600-50-00 3U frame, the card guides and rear connector fitting holes use 10mm spacing. However the Trilogy **Sentinel** range of modules are based on a 30mm pitch.

To ease the fitting and removal of modules, module locators may be fitted. The locators snap-in to 10mm spaced holes at the front of the rack frame.

**WARNING:** Always fit the rear connector before inserting the module. Fitting the rear connector after the module is inserted may damage the connector.

**Note:** Cover unused rear panel space with the blank rear panels supplied.

#### **2.2.4 Module removal**

To remove the card proceed as follows:

Lift up the card ejector and gently pull the card out

**WARNING:** Do not remove the rear connector with the module in place, as connector pins may be bent or damaged.

**WARNING:** Please observe normal static handling precautions when handling electronic equipment or sub assemblies.

#### **2.2.5 Inserting and removing power supplies**

The 600-50-00 3U frame accepts both main and redundant 600-51-00 universal power supplies which autosense input voltage between 90 and 253 volts and 50-60 Hz. The 600-50-00 rackframe includes a single 600-51-00 PSU.

The power supply integral fan provides cooling for itself and all modules. There is an 80mm deep space between the front of the modules and the door to allow the cross flow cooling air to reach each module. However, the front door must be kept closed for this cooling to function.

The adjustments on this power supply unit are set at the factory and should not require re-adjustment.

Power supply insertion for the 600-50-00 3U frame involves the following steps:-

- Slide the 600-51-00 power supply into one of the available slots at the left of the 600-50-00 frame using the top and bottom PSU guides
- Tighten the captive screw at the rear of the frame
- Insert mains cable
- Repeat for the second power supply
- Ensure front door is closed
- If only one PSU is fitted, use the left hand slot to encourage good air-flow

**WARNING:** When dual power supplies are used, two mains cables are required. To remove risk of shock, remove both cables before servicing.

Power supply removal is as follows:

- Remove mains cable
- Loosen the retaining screw at the rear of the unit
- Slide out the power supply from the front

Repeat as necessary

Note: It may be necessary to remove a blanking plate covering the inner mains connector opening. To do this remove any adjacent rear connector panel, loosen the PSU retaining thumb screw and withdraw the blanking plate through the connector panel space.

### **2.2.6 Power supply monitoring**

The status socket at the rear of the 3U frame allows the status of the 600-51-00 PSU to be monitored remotely. Relay contacts indicate errors in DC output voltage, fan operation or over temperature for each power supply. Relay 1 is fitted on PSU 1 and relay 2 is fitted on PSU 2.

Pin	Function
1	Chassis
2	Relay 1 common }
3	Relay 1, closed for fault } PSU 1
4	Relay 1, open for fault }
5	Relay 2, common }
6	Relay 2, closed for fault } PSU 2
7	Relay 2, open for fault }
8	N/C
9	N/C

### **2.2.7 Inserting and removing 600-52-00 COSMOS controllers**

For configuration and status monitoring up to two controllers may be slotted into dedicated positions at the rear of the rack frame.

Insertion involves the following steps:

- Remove mains input power from the rack frame.
- Remove any blanking panels by loosening the two captive screws
- Carefully align the 600-52-00 **COSMOS** controller with the internal guides and gently push it fully home
- Tighten the two captive screws

Removal is the reverse of insertion

A single controller may be fitted in either slot. If two cards are fitted, they will provide a dual redundancy role. Both controllers may be connected on a single CANbus network or each may be connected to completely independent networks.

Two loop-through RJ45 connectors are provided on each 600-52-00 controller and maybe wired using CAT5 UTP cable.

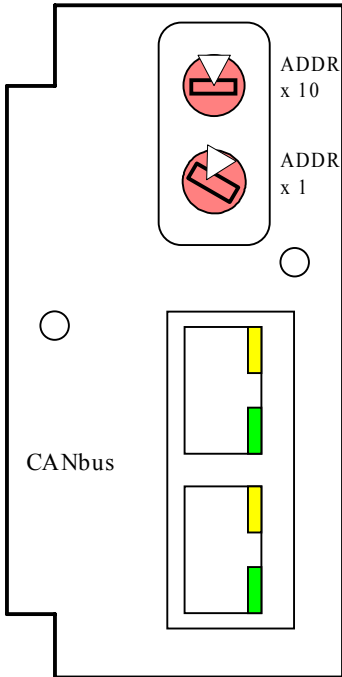
The connections are as follows:

CANbus RJ45 connections	
Pin	Function
1	CAN+
2	CAN
3-8	N/C

If shielded cable is preferred, the RJ45 connectors on the 600-52-00 are of a screened type and a ground contact can be made to the mating connector screen.

### 2.2.8 Setting the frame address

The 600-52-00 CANbus controller module has two rotary switches, which are used to set the unique frame address. See the diagram below.



This example shows the 600-52-00 controller set to address 01.

- The x 10 selector is set to 0 (zero)
- The x 1 selector is set to 1 (one)

Every frame **MUST** have a unique address, which must not conflict with the PC based CANbus interface card. The COSMOS software is pre-configured at installation to assign address 0 to the PC interface card. Do not set any 600-52 controllers to address 0. See section 0 for more details.

## **2.3 Operation**

### **2.3.1 Checking the power supply**

Power supply indicators are off:

- Check that the mains is connected
- Check that the fuses are intact

Note that the 600-51-00 power LEDs are visible through apertures in the door. In normal operation, they should illuminate green.

### **2.3.2 Power supply indicators change from green to red**

If the 600-51-00 dual colour LED changes to red then a fault condition exists and a replacement unit should be obtained. A red LED indicates that one of the following conditions is present:

- Voltage rails under or over voltage
- Fan defective
- Unit is over heating

In the event of a failure of one power supply the second unit will continue to supply the modules in the rack. In addition, the working unit will power the fan of the defective unit to prevent air flow obstruction. A replacement unit should still be obtained as soon as possible.

Power supply operation is also monitored via the status monitoring system, please refer to section 7 for details.

**WARNING: For continued protection against fire, always replace fuse with a 250V 3.15A (T) 20mm fuse as specified.**

## **2.4 Specification**

### **2.4.1 General**

Frame size	3U x 19 inch x 480mm (depth behind rack)
Frame weight	14kg (typical, fully equipped)
Capacity	12 modules with 30mm rear connectors:

### **2.4.2 PSU type 600-51-00 (main and redundant)**

Mains Input	Single AC input autosensing 90 to 253 volts, 50-60 Hz
Fuse	3.15A, 250V, anti-surge 20mm
Indicators	PSU OK indicator on each unit
Alarms	9 pin 'D' socket on frame for PSU failure alarms

### **2.4.3 600-52-00 COSMOS controller (main and redundant):**

Controller	The frame has space at the rear for dual status monitoring controllers type 600-52-00 compatible with the Pro-Bel <b>COSMOS</b> system
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### **3. 600-00-00 AES/EBU SIGNAL MONITOR & CHANGEOVER CARD**

#### **3.1 Introduction**

**The information contained in this Section refers to Revision 2 hardware, fitted with Revision d firmware.**

The **Sentinel** series, 600-00-00 AES/EBU Signal Monitor & Changeover card provides detection for 4 AES/EBU streams, with configurable detection parameters, presented as GPIO and LED errors, as well as to the **COSMOS** status and control software.

The card may be set up and configured via local jumper links and switches.

#### **3.1.1 Terminology**

AES/EBU is confusing to discuss, since each feed carries two audio channels. These are sometimes referred to as Channels 1 and 2, or as left and right. This document uses the following terminology: -

AES/EBU A, B, C and D refer to 4 individual AES/EBU audio feeds, each carrying two audio channels.

These two audio channels are identified as channels 1 and 2.

Therefore the module can monitor 8 channels of audio – A1/A2; B1/B2; C1/C2; D1/D2.

#### **3.1.2 Specification Summary**

- Provides detection for 4 AES-3 feeds, A through D.
- Detector configurations are for pairs of detector channels - A/B and C/D.
- Detector outputs are per channel – A, B, C and D.
- Provides switching capability to switch feed A or B to an output, and/or C or D to an output.
- The card has 6, open collector, voltage free, Darlington outputs, made available on the module RCU. See section 3.5.1.
- Card parameters are configured manually using jumper links and DIP switches.
- Individual detector outputs also available to **COSMOS** monitoring software.
- 12 Cards (48 AES/EBU Feeds) per **Sentinel** 3U Rack Frame.

## **3.2 Function**

### **3.2.1 Introduction**

The board has four AES inputs, termed A, B, C and D. Each AES input is individually monitored for errors and all errors are reported back to the **COSMOS** control software. Each signal is monitored for a variety of errors, including:

- 1) Signal presence
- 2) Signal level
- 3) Audio level
- 4) Incorrect sample frequency
- 5) CRC error
- 6) Validity bit

The board has one output termed AB, whose source can be changed between the A input signal and the B input signal. The changeover between A and B can be caused either by:

- Switch at the front edge of the card
- GPI input
- Automatic: The output will changeover to B automatically if an error is detected on the A input. Individual errors may be ignored using on board DIL switches. In addition, the switch is only effected after a programmable delay allowing short duration errors to be ignored.
- COSMOS. Changeover control is also provided from an on-screen button in the (optional) COSMOS monitoring software.

The mode of changeover is determined by on board DIL switches. See section 3.4.2.

The board has a second output termed CD, whose source can be changed between the C and D input signals. An independent set of logic and controls, identical to the A/B controls, are present to control the selection of this output.

The module rear connector unit (RCU) also provides six GP output signals. These are described in section 3.5.2.

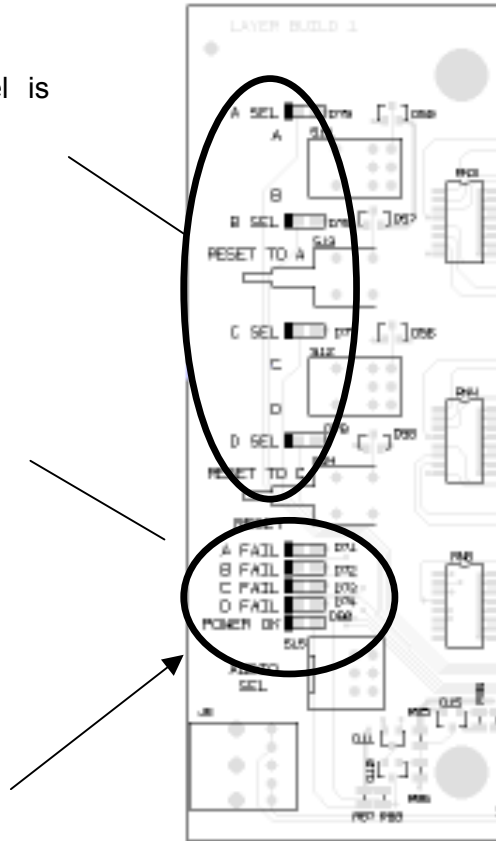
### 3.3 LED Indications

There are a number of card edge LED indicators, detailed below.

These LEDs light to show which channel is routed to the module outputs

Each of these will light (red) if the corresponding channel has an error. The Error Selection switches S5 and S6 may be adjusted to mask the errors.

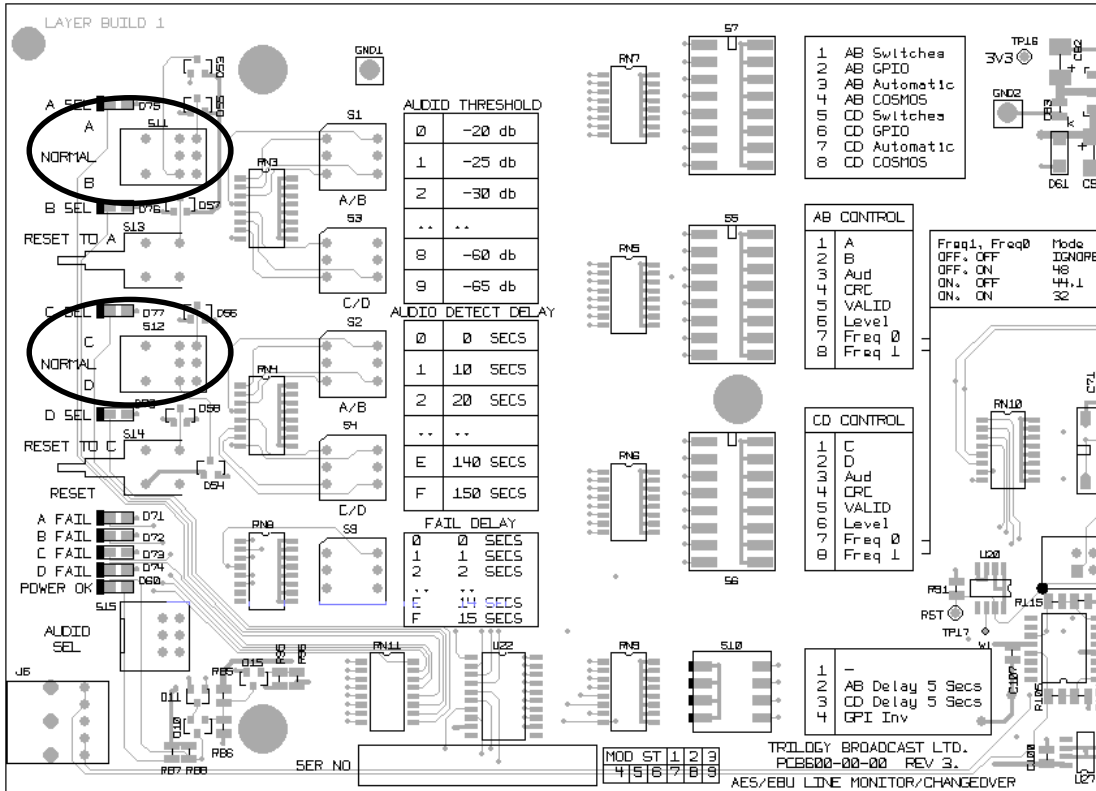
Power OK. This will be lit if the power to the board is correct. If it is not lit, either the board or the Sentinel frame is faulty.



### 3.4 Switch functions

#### 3.4.1 S11 and S12 : On board A/B and C/D switches

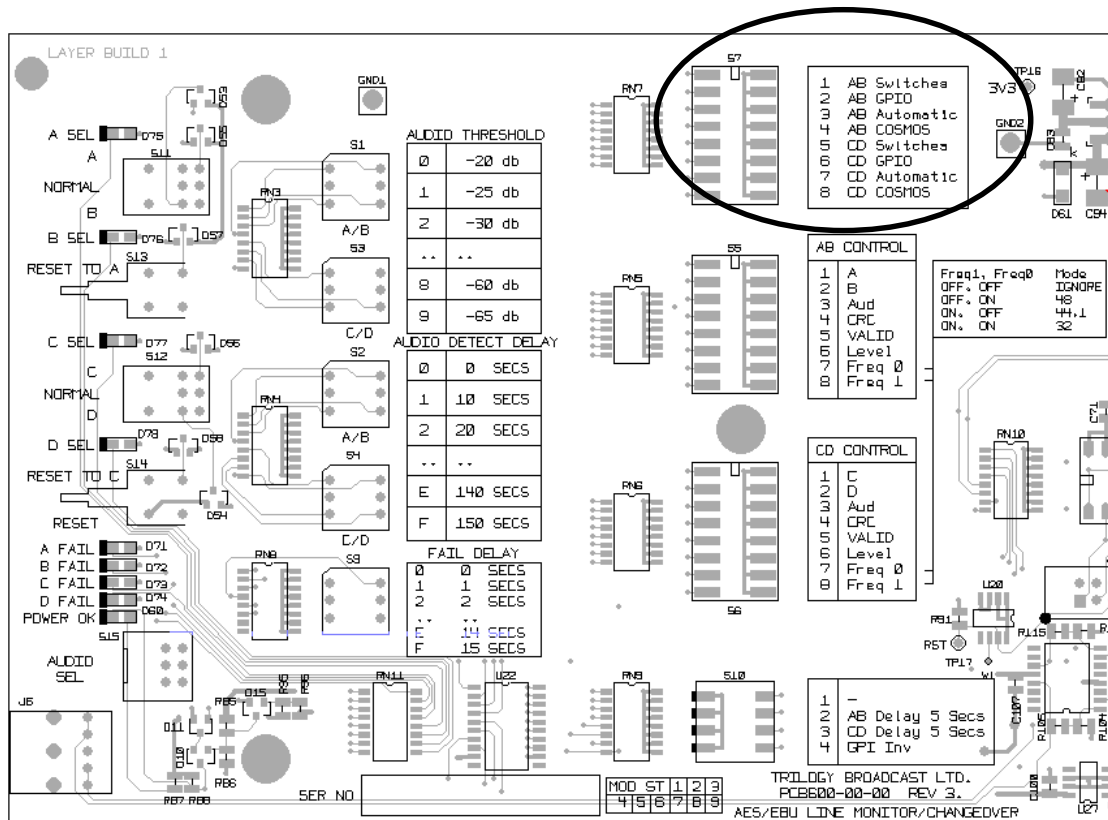
Suggested default settings are given in **bold italic text**.



S11 is a three position switch which determines how the changeover between A and B is made. When the switch is in position A (up), the A signal is routed to the AB output. When the switch is in position B (down), the B signal is routed to the AB output. When the switch is in position NORMAL, the operation depends on the setting of S7 (see 3.4.2).

S12 is a three-position switch, which determines how the changeover between C and D is made, in a similar manner to that of S11. When the switch is in position C (up), the C signal is routed to the CD output. When the switch is in position D (down), the D signal is routed to the CD output. When the switch is in position NORMAL, the operation depends on the setting of S7 (see 3.4.2).

### 3.4.2 S7 : Changeover Mode switch



This is an on board switch which determines how the changeover from A to B (or C to D) is controlled.

Each switch of S7 is OFF in the left position and ON in the right position.

Switch.	Name	Function	Default
1	AB switches	Reserved – please leave in the OFF position	OFF
2	AB GPIO	When ON, the GPI input determines the changeover state of the AB output.	OFF
3	AB Automatic	When ON, the AB output will changeover to the B signal when an error is detected on A. Note that this can be overridden by GPIO or COSMOS inputs if either of these switches are enabled	ON
4	AB COSMOS	When ON, the COSMOS control determines the changeover state of the AB output	ON
5	CD switches	Reserved – please leave in the OFF position	OFF
6	CD GPIO	When ON, the GPI input determines the changeover state of the CD output.	OFF
7	CD Automatic	When ON, the CD output will changeover to the D signal when an error is detected on C. Note that this can be overridden by GPIO or COSMOS inputs if either of these switches are enabled	ON
8	CD COSMOS	When ON, the COSMOS control determines the changeover state of the AB output	ON

The function of S7 is described below (only AB changeover discussed for clarity):

With the Automatic switch in the OFF position, setting the GPIO or COSMOS switches ON will enable control of the changeover by GPIO or COSMOS respectively. If both switches are ON, only COSMOS will control the changeover.

If the Automatic switch is ON and the GPIO and COSMOS switches are OFF, then the unit will switch the B signal in the event that A has failed and that B is OK. Note that the conditions for which A / B is deemed to have failed is set by S5. The changeover will not revert back to A even if A subsequently becomes OK. However the unit can be forced back to A if the Reset switch, S13, is pressed.

If the Automatic switch is ON and either the GPIO or COSMOS switches are ON, then the changeover occurs as described above. The GPIO or COSMOS control can disable the Automatic mode by switching back to A. Once this has occurred, the Automatic mode is disabled and the GPIO or COSMOS switches between A and B just as if the automatic switch was OFF. The automatic mode can be re-enabled by pressing the Reset switch, S13. If both GPIO and COSMOS switches are ON, only COSMOS will have effect.

Note that when the Automatic and GPIO modes are enabled, the GPIO must be grounded (as if selecting the B input) in order for the Automatic mode to operate – i.e. the GPIO cannot be left floating as this will select the A channel and always override the Automatic mode.

The various settings of the three switches are summarised below (only AB changeover discussed for clarity):

Auto switch	COSMOS switch	GPIO switch	Function
OFF	OFF	OFF	COSMOS and GPIO have no effect – changeover can only occur using the front edge switch, S11
OFF	OFF	ON	If GPIO B input is grounded, the unit will switch to B
OFF	ON	OFF	If B is selected using the COSMOS control, the unit will switch to B
OFF	ON	ON	If B is selected using the COSMOS control, the unit will switch to B (GPIO ignored)
ON	OFF	OFF	Will switch to B if A is faulty whilst B is good. Will stay on B until the Reset switch, S13, is pressed.
ON	OFF	ON	Will switch to B if A is faulty whilst B is good. Will stay on B until the Reset switch, S13, is pressed. However if GPIO input selects A, A will be selected and thereafter unit will be under GPIO control, unless the Reset switch is pressed in which case the unit will revert to Automatic mode.
ON	ON	OFF	Will switch to B if A is faulty whilst B is good. Will stay on B until the Reset switch, S13, is pressed. However if COSMOS selects A, A will be selected and thereafter unit will be under COSMOS control, unless the Reset switch is pressed in which case the unit will revert to Automatic mode.
ON	ON	ON	Will switch to B if A is faulty whilst B is good. Will stay on B until the Reset switch, S13, is pressed. However if COSMOS selects A, A will be selected and thereafter unit will be under COSMOS control, unless the Reset switch is pressed in which case the unit will revert to Automatic mode. GPIO is ignored.

### 3.4.3 S1, S2, S3, S4 Audio Threshold and Delay Switches

S1 / S3 position	Threshold
<b>0</b>	<b>-20dB</b>
1	-25dB
2	-30dB
3	-35dB
4	-40dB
5	-45dB
6	-50dB
7	-55dB
8	-60dB
9	-65dB

S1 determines the audio threshold (with respect to peak digital level) which when below, will be flagged as an error for the A or B signal.

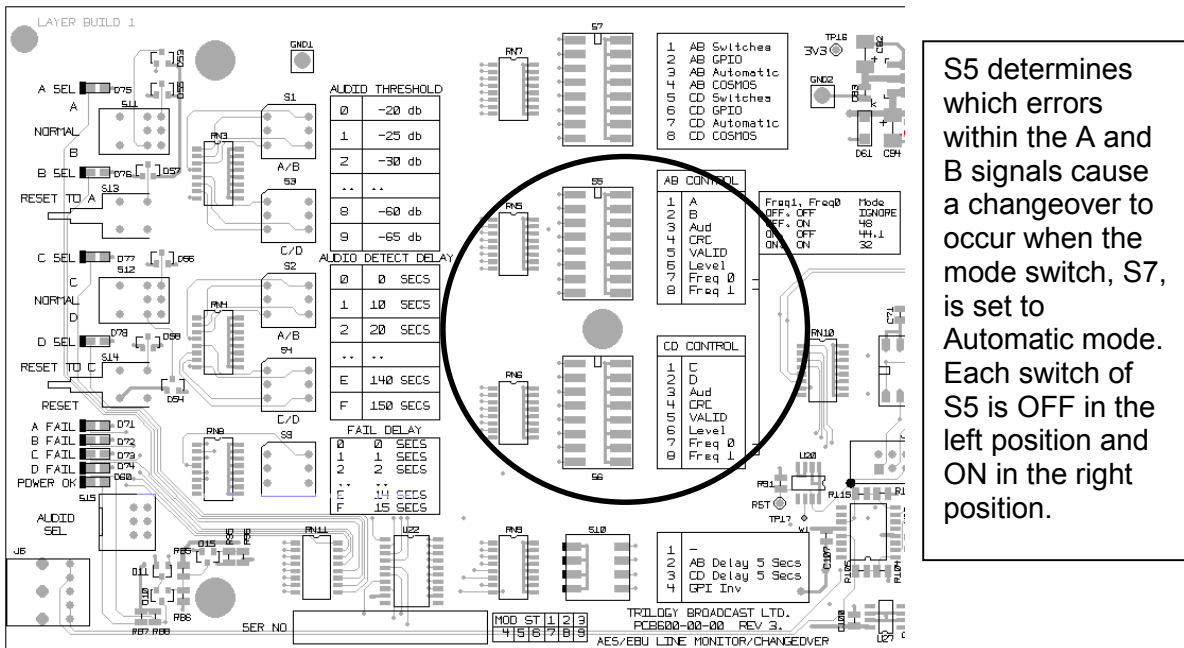
S3 determines the audio threshold (with respect to peak digital level) which when below, will be flagged as an error for the C or D signal.

S2 / S4 position	Time, in seconds
0	0
1	10
2	20
<b>3</b>	<b>30</b>
4	40
5	50
6	60
7	70
8	80
9	90
A	100
B	110
C	120
D	130
E	140
F	150

S2 determines how long the A or B audio level has to be below the threshold before an error is flagged. If the audio level rises above the threshold during this time, an error will not be flagged and the time count will be 'reset'.

S4 determines how long the C or D audio level has to be below the threshold before an error is flagged. If the audio level rises above the threshold during this time, an error will not be flagged and the time count will be 'reset'.

**3.4.4 S5 and S6 : Error selection switches**



S5 determines which errors within the A and B signals cause a changeover to occur when the mode switch, S7, is set to Automatic mode. Each switch of S5 is OFF in the left position and ON in the right position.

Switch No.	Name	Function	Default
1	A	When OFF, the state of the A channel is ignored.	ON
2	B	When OFF, the state of the B channel is ignored.	ON
3	Aud	When ON, the level of the audio content will be checked against the threshold set by S1 and if consistently below this threshold for more than the number of seconds selected by S2, an error will be flagged.	ON
4	CRC	When ON, a AES block CRC error will be flagged as an error.	OFF
5	VALID	When ON, an AES stream with a high (non audio) validity bit will be flagged as an error.	OFF
6	Level	When ON, a level of the AES signal below 200mV will be flagged as an error. Note this is the level of the AES signal, not the audio data contained within.	ON
7	Freq 0	Together with Freq1, these flag a wrong sample frequency as an error. See table below.	ON
8	Freq 1		OFF

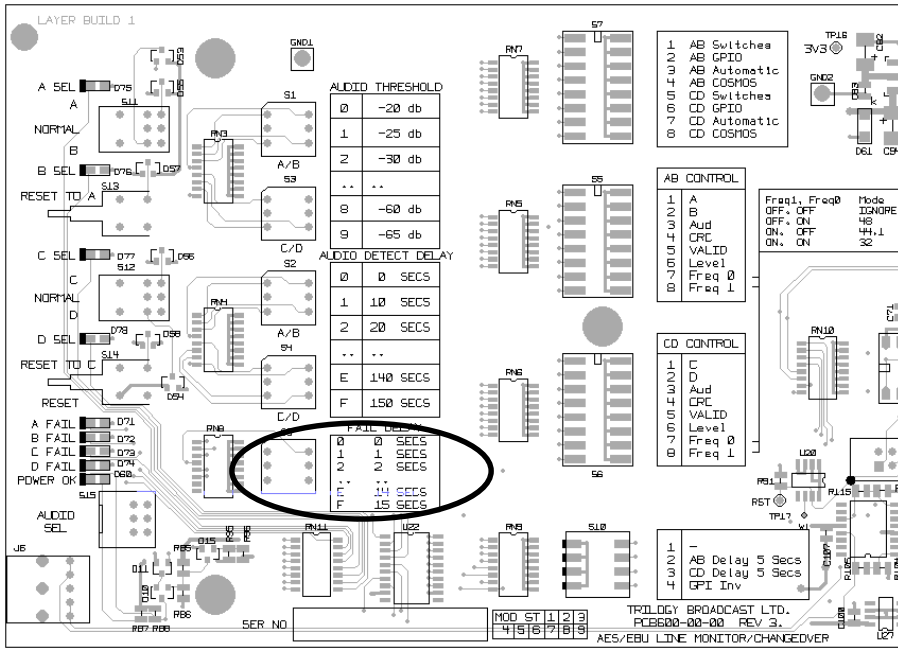
Note that with the exception of FREQ0 and FREQ1, these switches do not disable the **COSMOS** error reporting – all errors are reported to **COSMOS** regardless of switch settings.

Settings	Function
Freq0 = OFF Freq1 = OFF	The sample frequency will not be checked – it will never generate an error.
Freq0 = ON Freq1 = OFF	Any sample frequency other than 48KHz will be flagged as an error.
Freq0 = OFF Freq1 = ON	Any sample frequency other than 44.1KHz will be flagged as an error.
Freq0 = ON Freq1 = ON	Any sample frequency other than 32KHz will be flagged as an error.

S6 performs an identical function for channels C and D.



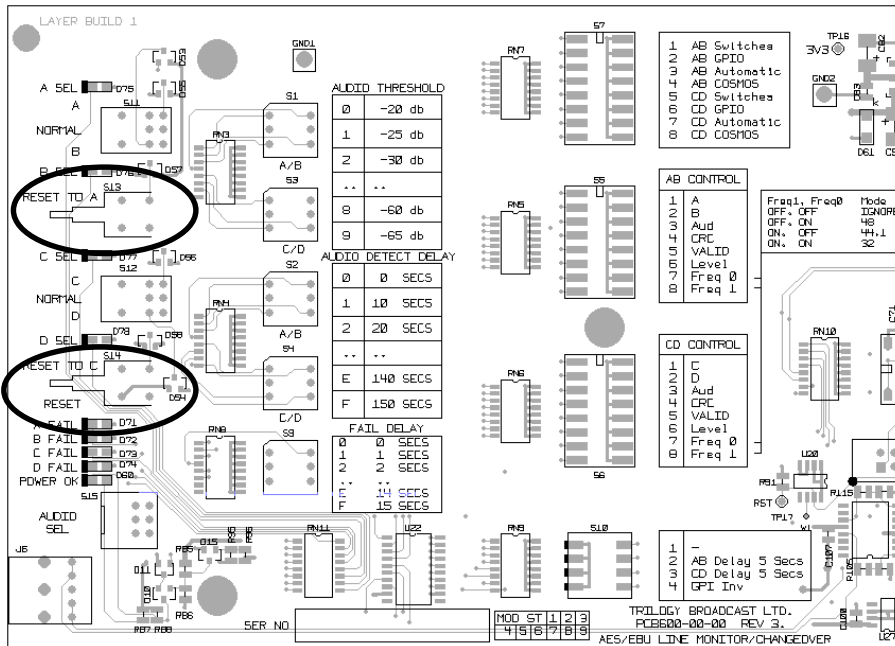
**3.4.5 S9 : Changoover delay**



When in automatic mode, S9 determines the time between the first error on the A (or C) channel occurring and the unit changing over to the B (or D) channel. If the error is cleared within the time interval then the error is ignored and the time count is 'reset'.

Position	Time, in seconds
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	10
B	11
C	12
D	13
E	14
F	15

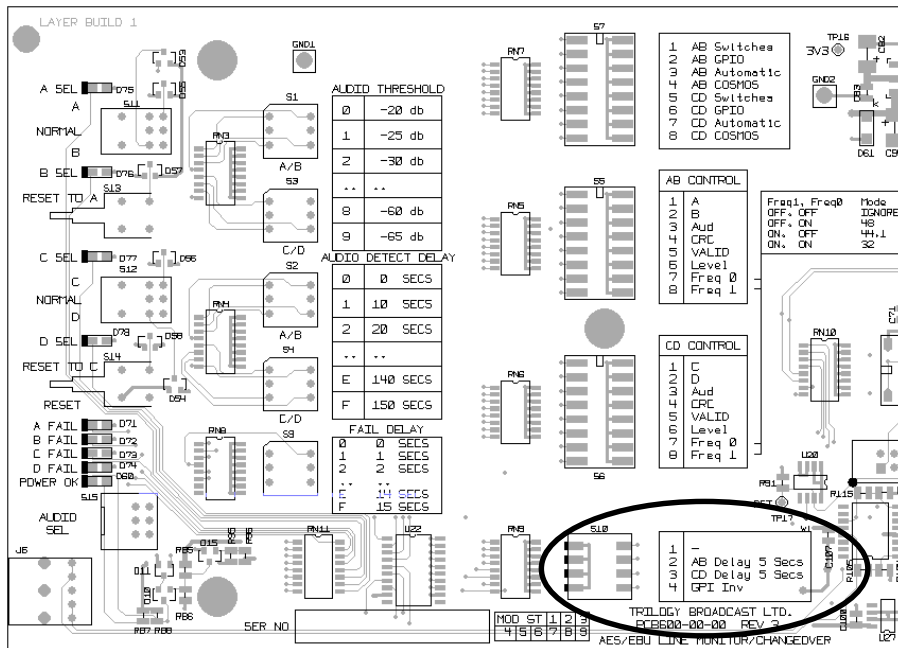
**3.4.6 S13 and S14 : Reset to A/C switches**



When in automatic mode and output AB has changed to B, due to an error on A, the unit will not revert to A when A becomes correct again. Instead the unit will remain on B and must be ‘reset’ back to A by pressing pushbutton S13. The switch can also be used to revert from **COSMOS** or GPIO override back to automatic mode.

Similarly, when in automatic mode and output CD has changed to D, due to an error on C, the unit will not revert to C when C becomes correct again. Instead the unit will remain on D and must be ‘reset’ back to C by pressing pushbutton S14. The switch can also be used to revert from **COSMOS** or GPIO override back to automatic mode.

**3.4.7 S10 : Miscellaneous**

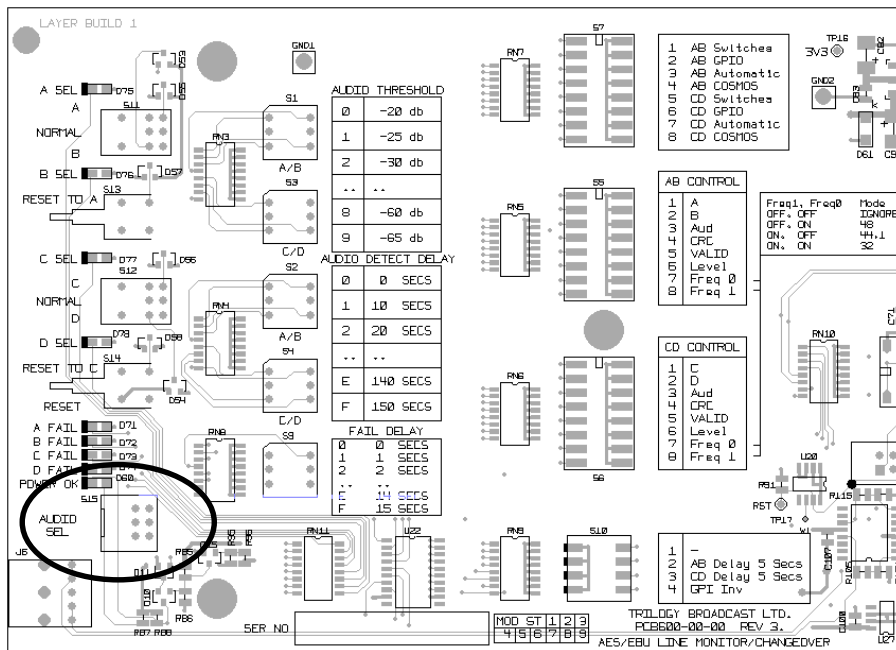


Each switch of S10 is OFF in the left position and ON in the right position.

S10 switches have the following functions:

Switch.	Name	Function	Default
1	--	Not used, set to OFF	<b>OFF</b>
2	AB Delay 5 secs	When ON, an additional 5 seconds will be added to the A/B audio delay time set by S2	<b>OFF</b>
3	CD Delay 5 secs	When ON, an additional 5 seconds will be added to the C/D audio delay time set by S4	<b>OFF</b>
4	GPI invert	When OFF, the GPI inputs will select the B (or D) signal when they are grounded. When ON, the GPI inputs will select the B (or D) signal when open circuit. This will only have any effect if the GPI control is enabled using the mode switch, S7	<b>OFF</b>

**3.4.8 S15 : Audio select switch**



You can listen to any of the AES audio channels by connecting to the jack socket J6. S15 determines which channel to be selected:

Position	Function
0	Listen to channel A
1	Listen to channel B
2	Listen to channel C
3	Listen to channel D

Note also that the volume of the signal can be adjusted using the pots RP1 and RP2, positioned within the mid-lower section of the board.

## 3.5 Card Format

### 3.5.1 GPIO

The card has six, open collector, voltage free, Darlington outputs, made available on the module RCU. The outputs may be set globally to be:

**Immediate** – i.e. asserted immediately any of the relevant error conditions occur – or:

**Asserted after a delay.** There is one configurable delay that applies to all outputs. The delay may be set for 0 to 15 seconds in 1 second increments. This delay is not applied in addition to the audio level delay (i.e. an audio level error will be immediately asserted on the appropriate fail output regardless of this delay setting). Setting the delay is described in Section 3.4.5. The connector pin-out provided on the rear connector is described in section 3.5.2.

### 3.5.2 600-00-80 RCU

The RCU is equipped with a 15 way D and a 25 way D socket, with the connections shown below. Note that the pin-out is chosen to be close to existing 200 series relay RCUs (in the case of the 25 way), and identical to the 330-06 (in the case of the 15 way). The GP Outputs are low impedance when the stated condition is true: high impedance when false.

#### GPIO Connections

Pin	D25 Fixed Socket
1	A OK +
14	A OK -
2	Not connected
15	B OK +
3	B OK -
16	Not connected
4	C OK +
17	C OK -
5	Not connected
18	D OK +
6	D OK -
19	Not connected
7	'B' Selected +
20	'B' Selected -
8	Not connected
21	'D' Selected +
9	'D' Selected -
22	Not connected
10	Not connected
23	Select A/B C/over to B (Gnd to Select B)
11	Not connected
24	Select C/D C/over to D (Gnd to Select D)
12	Not connected
25	Not connected
13	Ground

The output provides a low resistance 'ON' state for an OK indication, changing to a high impedance 'OFF' state for a FAIL indication, if one or more of the following detectors has an error:-

- Feed A not present
- Feed A, input signal level too low.
- Audio Level Detector Fail, Channel A
- Validity Bit Error Feed A
- CRC Error Feed A
- Sample Rate Error Feed A

This is repeated in the same style for Channel B, C, and D.

Note:

- The logical operation of pins 23 and 24 may be inverted by on-board link. See 3.4.7.

## Signal Connections

Pin	D15 Fixed Socket
1	Ground
9	AES/EBU A +
2	AES/EBU A -
10	AES/EBU B +
3	AES/EBU B -
11	Ground
4	A/B changeover Out +
12	A/B changeover Out -
5	AES/EBU C +
13	AES/EBU C -
6	AES/EBU D +
14	AES/EBU D -
7	Ground
15	C/D changeover Out +
8	C/D changeover Out -

### Note:

- Signal Input impedance is 110R for the currently un-selected signal: 10KR for the selected signal.
- For the GP outputs, the maximum output current must be limited to 160mA and the maximum external voltage must not exceed 40V. The maximum power dissipation must not exceed 160mW.

## **4. 600-02-00 SDI MONITOR & CHANGEOVER CARD**

### **4.1 Introduction**

**The information contained in this Section refers to Revision 4 hardware, fitted with Revision d firmware.**

The **Sentinel** series, 600-02-00, SDI Monitor & Changeover card provides 2 channels of SDI video detection, with configurable detection parameters, presented as GPI outputs and LED indicators, as well as data outputs to the **COSMOS** status and control software.

The card can be set up and configured via local jumper links and switches.

#### **4.1.1 Specification Summary**

- Provides detection for 2 SDI inputs, A and B.
- Provides A/B switching capability to switch input A or B to an output, with power fail relay bypass.
- Provides freeze frame and video black detection.
- Module provides a number of GPI outputs.
- Card can be configured manually using jumper links/DIP switches.
- Provides detection of embedded audio.
- Individual detector outputs are also available to **COSMOS**.
- Embedded Audio Monitoring Output.
- 12 Cards (24 Channels) per **Sentinel** 3U Rack Frame.

### **4.2 Specification Detail**

#### **4.2.1 Available Detectors**

Detectors are pre-grouped into detector types to provide the GP outputs: See categories below.

##### **4.2.1.1 Lock Detector**

- SDI present detection.

##### **4.2.1.2 Transport Errors**

- TRS error – the TRS words are missing or invalid.
- Data Rate Error – indicates that the incoming data rate is not as required.
- Video Standard error – indicates that the incoming data is not at the required video standard.

#### **4.2.1.3 Content Errors**

- Black Detector – asserted when the active picture area falls below a pre-determined level of luminance and chrominance content.
- Freeze Frame Detector – shows that a number of successive video frames appear to have identical content.
- Stuck Bit detector – shows that the video data has all binary 1's or 0's.

#### **4.2.1.4 Channel Comparison**

- Channel comparator – shows that both A and B inputs have grossly dissimilar APL: within 0.5, 1.0, 2.0 or 4.0% of each other.

#### **4.2.1.5 Audio Errors**

- Embedded audio detector – shows that one or more audio group headers exist in the ancillary data area.
- 4 Audio level detectors – detects that audio has fallen below a preset level on any of the four analogue audio channels of a selected group. Detectors are automatically disabled if valid data is not detected for specific audio channel pairs within the group.
- Audio Sample Rate error – indicates that audio data is not at the required audio sample rate

#### **4.2.1.6 EDH Errors**

- EDH detector – indicates the presence of EDH packets
- EDH error – indicates any error in the EDH packet.

#### **4.2.2 Audio Monitoring**

Each SDI stream carries four embedded AES groups. Each AES group contains two audio signal pairs (four signals). A single front of card 3.5mm jack socket (J17) is provided for audio monitoring.

- S12 (U) selects the SDI stream.
- S17 sets the embedded AES group in SDI stream A.
- S7 sets the embedded AES group in SDI stream B.
- S12 (L) sets the currently monitored signal pair (routed to the jack) and is common to SDI stream A & B.

#### **4.2.3 Changeover Functionality**

The card is equipped with a 2x1-changeover element to switch between feeds A and B. The changeover element has 4 modes of operation. A front edge, 3 position toggle switch may be set to manually force either A or B, or to the centre “normal” position where control is passed to the jumpers described below. See section 4.6.10.1 for jumper settings.

- Switch at the front edge of the card
- GPI input



- **Automatic:** The output will changeover to B automatically if an error is detected on the A input. Individual errors may be ignored using on board DIL switches. In addition, the switch is only effected after a programmable delay allowing short duration errors to be ignored.
- **COSMOS.** Changeover control is also provided from an on-screen button in the (optional) COSMOS monitoring software.

The changeover is implemented using active devices. To provide a fail-safe route in the event of a card or power failure an RF relay is provided to route the A input to the output.

This relay has an additional contact brought out to the RCU to provide an error output in the event that it fails.

See section 4.6.10.1 for card settings.

### **4.3 COSMOS Software**

#### **4.3.1 Status Reporting**

When connected to **COSMOS**, a number of status indications are made available, per SDI channel. See 7.3 for more details.

#### **4.3.2 COSMOS Configuration**

Currently, cards may not be configured via **COSMOS**. See section 4.6 for manual settings.

### **4.4 Embedded Audio Monitoring**

It is possible to select audio channels 1&2 or 3&4 from the chosen audio group, for monitoring. The audio is of monitoring quality only, and is presented on a 3.5mm jack on the board edge.

### 4.5 LED Indications

A number of LED indicators are provided at the front edge of the module. These refer to Channel A, Channel B and General Card Functionality.

#### LED Indicators for

- Channel A
- Channel B.

Green LED indicates OK.

#### Changeover Status

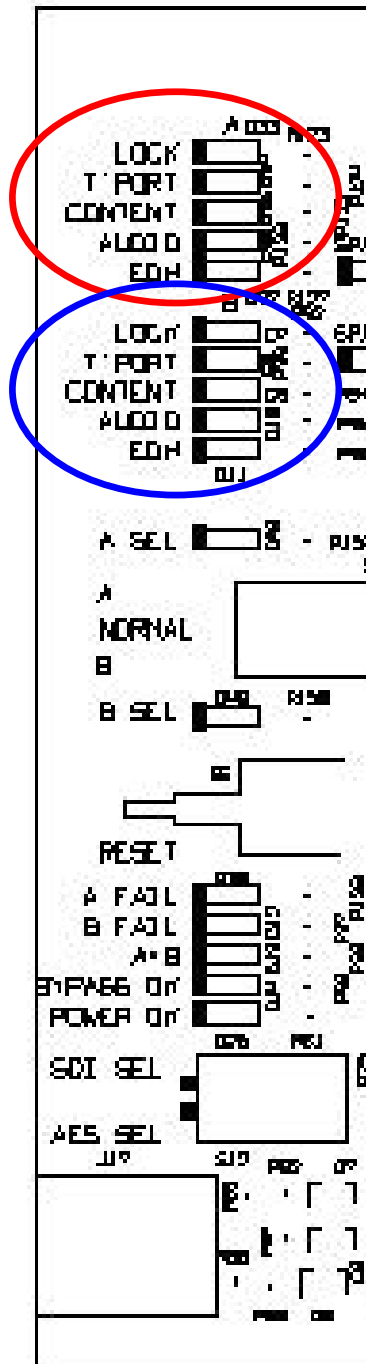
- A Selected (Green)
- B Selected (Yellow)

#### Channel Failure

- A Failure (Red)
- B Failure (Red)

Comparator A = B (Green)

Module Power OK (Green)

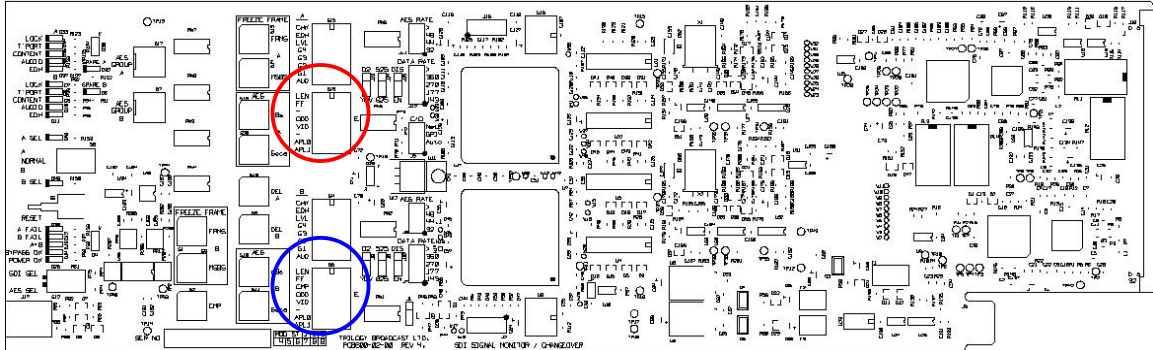


Other card edge LED indicators are not currently used.

## 4.6 Configuration Settings

### 4.6.1 General

Suggested default settings are given in **bold italic text**.



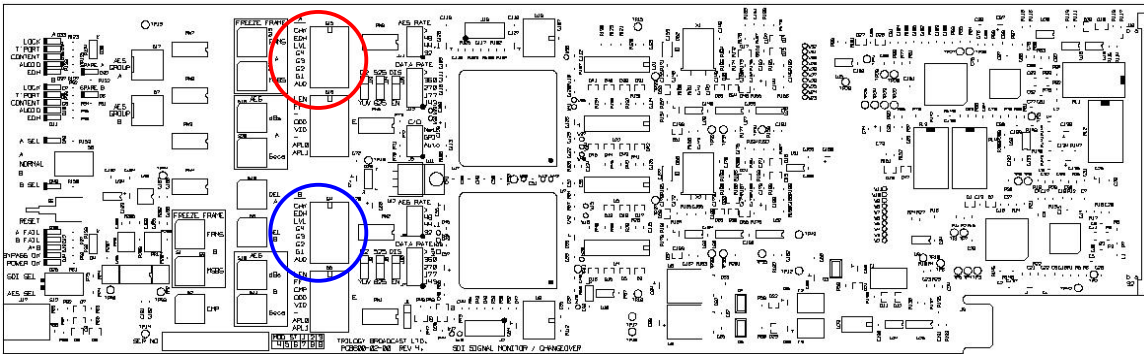
#### Switch S16 (Channel A)

#### Switch S5 (Channel B)

Each section of S16 and S5 is OFF in the left position and ON to the right, as viewed above.

Position	Feature	Default
1	Cable length detection enable (ON- enable,OFF-disable)	<b>OFF</b>
2	Frozen Frame detection enable (ON- enable,OFF-disable)	<b>ON</b>
3	<b>Reserved (S16): Enable Channel Comparison (S5)</b>	<b>OFF</b>
4	Field selection for Frozen Frame detection ODD / EVEN	<b>OFF</b>
5	Video black detection enable (ON- enable,OFF-disable)	<b>ON</b>
6	GPI Out Inversion option	<b>OFF</b>
7	APL bit 0 for video black detection (see below)	<b>ON</b>
8	APL bit 1 for video black detection (see below)	<b>ON</b>

Switch Position 7 (APL 0 bit)	Switch Position 8 (APL 1 bit)	Video black APL threshold
<b>ON</b>	<b>ON</b>	<b>&lt;= 0.5%</b>
OFF	ON	<=1.0%
ON	OFF	<=2.0%
OFF	OFF	<=4.0%



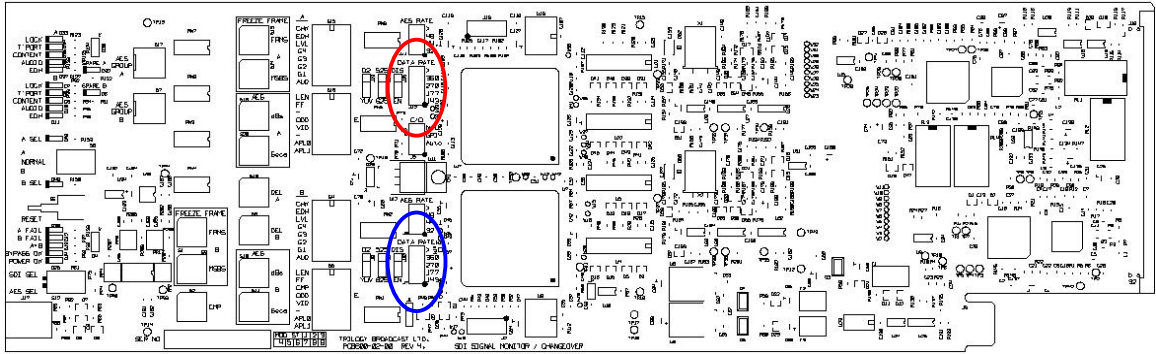
**Switch S15 (Channel A)**

**Switch S4 (Channel B)**

Each section of S15 and S4 is OFF in the left position and ON to the right, as viewed above.

Position	Feature	Default
1	EDH checksum error enable (ON- enable,OFF-disable)	OFF
2	No EDH detection enable (ON- enable,OFF-disable)	OFF
3	AES level enable (ON- enable,OFF-disable)	OFF
4	Audio Group 4 enable (ON- enable,OFF-disable)	OFF
5	Audio Group 3 enable (ON- enable,OFF-disable)	OFF
6	Audio Group 2 enable (ON- enable,OFF-disable)	OFF
7	Audio Group 1 enable (ON- enable,OFF-disable)	OFF
8	Audio features enable (ON- enable,OFF-disable)	OFF

### 4.6.2 User Data Rate Selection



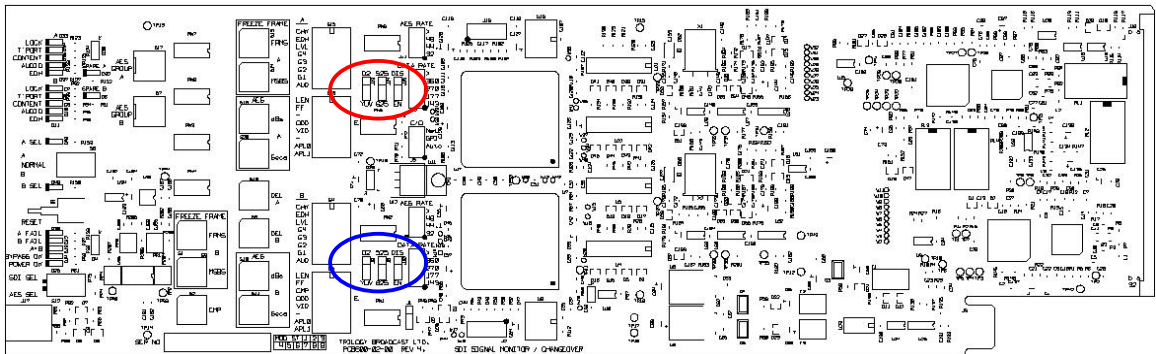
J12 Channel A

J7 Channel B

For each channel, fit a link to one of the five possible locations to select Data Rate.

Jumper Position	Setting
1	Don't care
2	360 MHz
3	270 MHz
4	177 MHz
5	143 MHz

### 4.6.3 Video Standard Selection

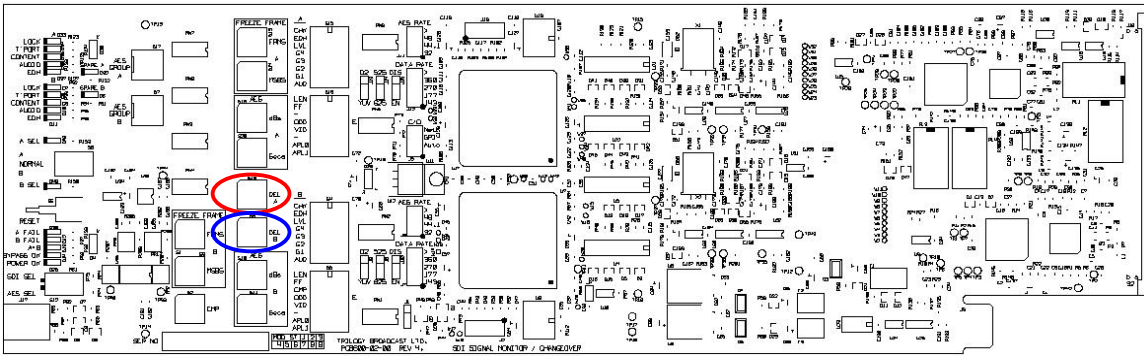


There are 3 sets of jumpers per channel to set the video standard.

Ch A	Ch B	Function		
J13	J8	YUV / D2	YUV	D2
J14	J9	625 / 525	625 †	525 †
J15	J10	Video Standard Detection	Enabled	Disabled

† Set as appropriate for region.

### 4.6.4 Global Alarm Timer delay

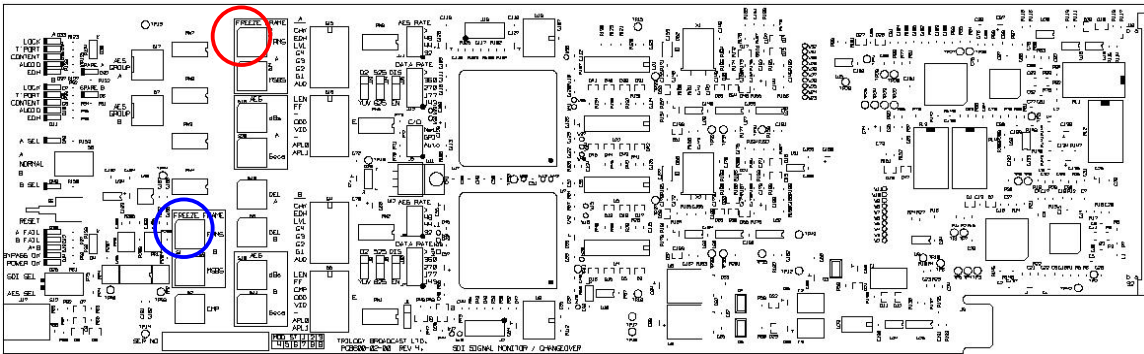


Switch S19 (Channel A)

Switch S9 (Channel B)

Position	Time Delay (seconds)	Position	Time Delay (seconds)
0	0	8	8
1	1	9	9
2	2	10	10
3	3	11	11
4	4	12	12
5	5	13	13
6	6	14	14
7	7	15	15

### 4.6.5 Frozen frame detection



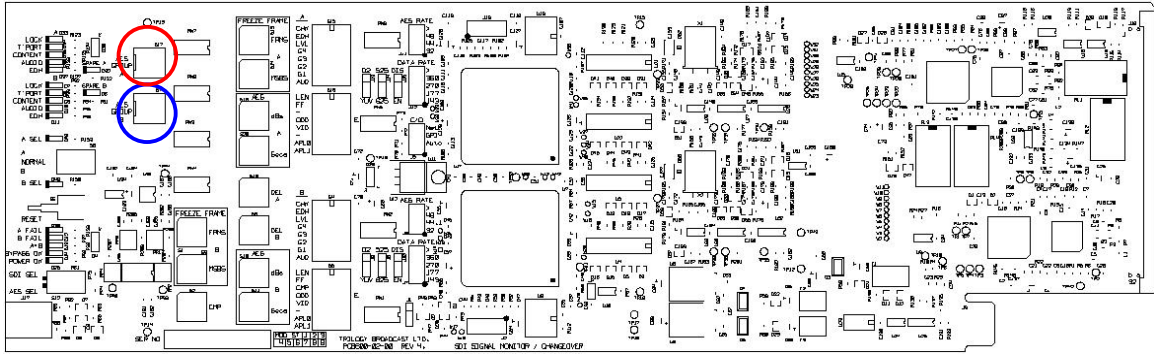
Number of consecutive frames to detect frozen signal.

Switch S13 (Channel A)

Switch S1 (Channel B)

Position	Frames (for frozen frame detection)	Frames (for video black detection)	Position	Frames (for frozen frame detection)	Frames (for video black detection)
0	Reserved	Reserved	8	96	24
1	Reserved	Reserved	9	128	32
2	Reserved	Reserved	10	192	48
3	16	Reserved	11	256	64
4	24	Reserved	12	384	96
5	32	Reserved	13	512	128
6	48	Reserved	14	768	192
7	64	16	15	1023	255

**4.6.6 AES group selection for monitoring.**

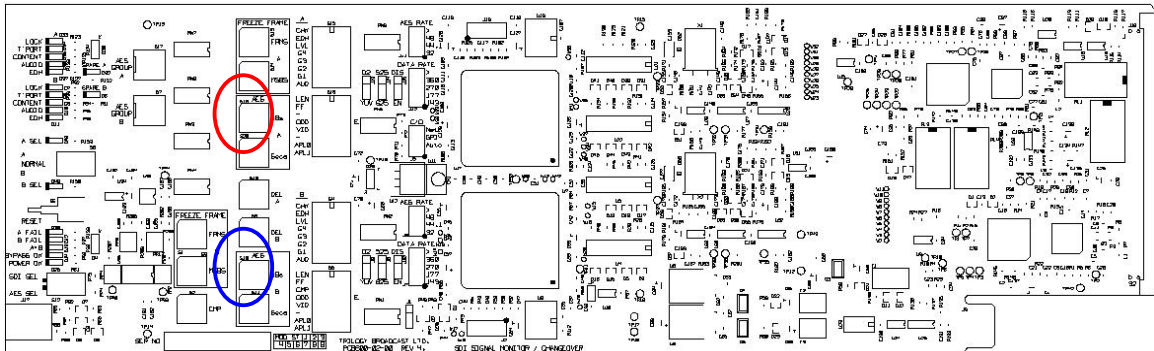


Switch S17 (Channel A)

Switch S7 (Channel B)

Position	Group selected
0	1
1	2
2	3
3	4

**4.6.7 AES Threshold selection for level detection.**

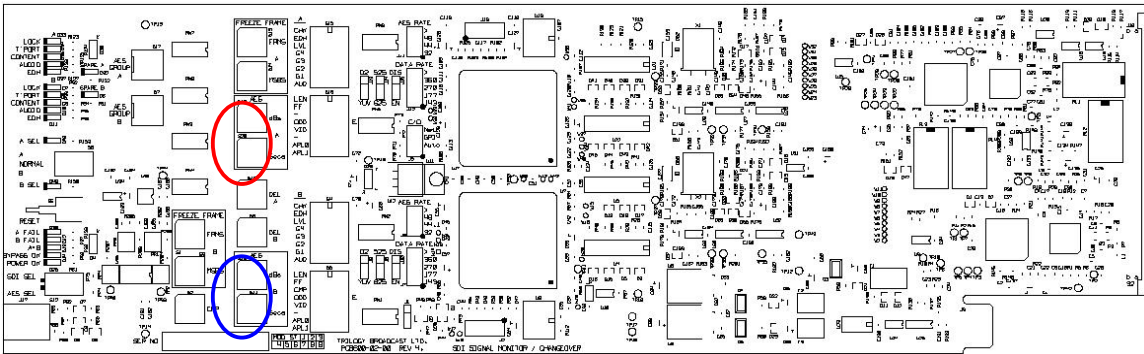


Switch S18 (Channel A)

Switch S10 (Channel B)

Position	Level	Position	Level
0	-20dB	8	-60dB
1	-25dB	9	-65dB
2	-30dB	10	-70dB
3	-35dB	11	-75dB
4	-40dB	12	-80dB
5	-45dB	13	-85dB
6	-50dB	14	-90dB
7	-55dB	15	-95dB

**4.6.8 AES timer selection for level detection.**

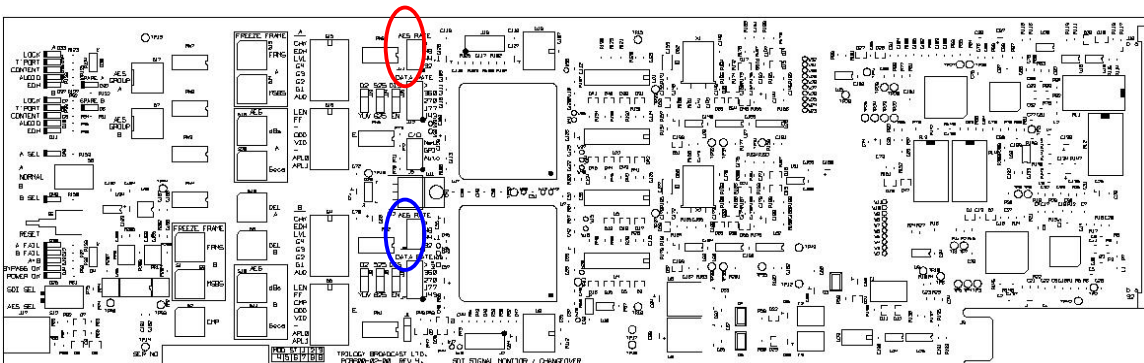


Switch S20 (Channel A)

Switch S11 (Channel B)

Position	Seconds	Position	Seconds
0	0	8	80
1	10	9	90
2	20	10	100
<b>3</b>	<b>30</b>	11	110
4	40	12	120
5	50	13	130
6	60	14	140
7	70	15	150

**4.6.9 AES Sample rate.**



Jumper J11 (Channel A)

Jumper J6 (Channel B)

Note: J11 and J6 are 4 position jumpers. Positions 3 and 4 are not currently used.

Jxx.1	Jxx.2	AES Sample Rate
ON	OFF	Don't care
<b>OFF</b>	<b>ON</b>	<b>48kHz</b>

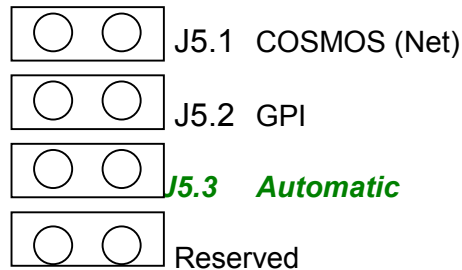


#### **4.6.10 Channel A / B Common Features**

For an explanation of the front of card toggle switch operation, see section 4.2.3.

##### **4.6.10.1 Changeover feature - Jumper J5**

Fit jumper link to one of the four positions shown below. These jumper positions are only read when the front edge toggle switch is in the centre (normal) position.



The reset switch is located at the card front edge.

With J5.3 (Automatic) not fitted, fitting J5.1 or J5.2 will enable control of the changeover by GPIO or COSMOS respectively. If both J5.1 and J5.2 are fitted, only COSMOS will control the changeover.

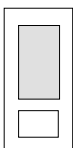
If J5.3 is fitted and neither J5.1 or J5.2 is fitted, then the unit will switch the B signal in the event that A has failed and that B is OK. Note that the conditions for which A /B is deemed to have failed is set by the general configuration switches described in section 4.6.1. The changeover will not revert back to A even if A subsequently becomes OK. However the unit can be forced back to A if the Reset switch is pressed.

If J5.3 is fitted and either J5.1 or J5.2 is also fitted, then the changeover occurs as described above. GPIO or COSMOS control will disable the Automatic mode if utilised to switch back to A. Once this has occurred, the Automatic mode is disabled and only GPIO or COSMOS controls the changeover function as if the automatic link was not fitted. The automatic mode can be re-enabled by pressing the Reset switch.. If both GPIO and COSMOS links (J5.1 and J5.2) are fitted, only COSMOS will have effect.

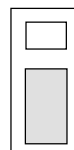
Note that when the Automatic and GPIO are fitted, the GPIO must be grounded (as if selecting the B input) in order for the Automatic mode to operate – i.e. the GPIO cannot be left floating as this will select the A channel and always override the Automatic mode. The various settings of the links are summarised below.

COSMOS J5.1	GPIO J5.2	Auto J5.3	Function
NO	NO	NO	COSMOS and GPIO have no effect – changeover can only occur using the front edge toggle switch.
NO	YES	NO	If GPIO B input is grounded, the unit will switch to B
YES	NO	NO	If B is selected using the COSMOS control, the unit will switch to B
YES	YES	NO	If B is selected using the COSMOS control, the unit will switch to B (GPIO ignored)
NO	NO	YES	Will switch to B if A is faulty whilst B is good. Will stay on B until the Reset switch, S3, is pressed.
NO	YES	YES	Will switch to B if A is faulty whilst B is good. Will stay on B until the Reset switch is pressed. However if GPIO input selects A, A will be selected and thereafter unit will be under GPIO control, unless the Reset switch is pressed in which case the unit will revert to Automatic mode.
YES	NO	YES	Will switch to B if A is faulty whilst B is good. Will stay on B until the Reset switch is pressed. However if COSMOS selects A, A will be selected and thereafter unit will be under COSMOS control, unless the Reset switch is pressed in which case the unit will revert to Automatic mode.
YES	YES	YES	Will switch to B if A is faulty whilst B is good. Will stay on B until the Reset switch is pressed. However if COSMOS selects A, A will be selected and thereafter unit will be under COSMOS control, unless the Reset switch is pressed in which case the unit will revert to Automatic mode. GPIO is ignored.

#### 4.6.10.2 GPI inversion Jumper J1



*Normal*



Inverted

#### 4.6.10.3 Comparison Setting on switch S2

Switch Position	Percentage
<b>0</b>	<b><math>\leq 0.5\%</math></b>
1	$\leq 1\%$
2	$\leq 2\%$
3	$\leq 4\%$

#### **4.6.11 Other jumpers and switches**

The following jumpers and switches are not currently used and should be set as described below.

Switch	Label	Setting
S14	MSB	0
S3	MSB	0
S16 Position 1	LEN	OFF
S5 Position 1	LEN	OFF
S16 Position 3		OFF

## **4.7 Card Format**

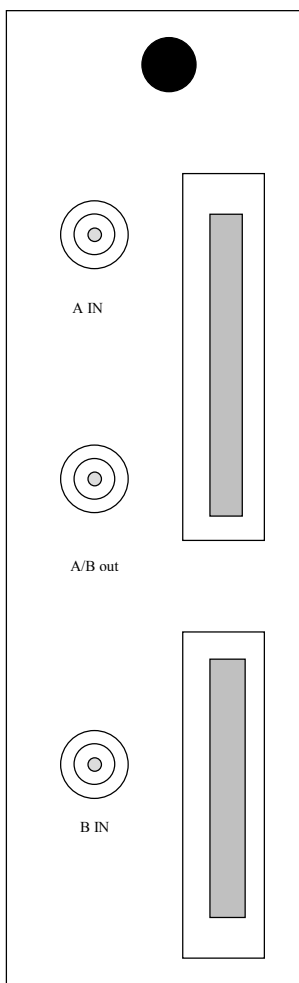
### **4.7.1 GPIO**

The card has 15, open collector, voltage free, Darlington outputs, made available on the module RCU. Of these, 12 are provided on the D25 connector: 6 relate to Channel A and 6 to Channel B. The outputs may be set globally to be:

- **Immediate** – i.e. asserted immediately any of the relevant error conditions occur – or:
- **Asserted after a delay.** There is one configurable delay that applies to both channels. The delay may be set for 0 to 15 seconds in 1-second increments. The connector pin-out provided on the rear connector is described in section 4.7.3.
- For the GP outputs, the maximum output current must be limited to 160mA and the maximum external voltage must not exceed 40V. The maximum power dissipation must not exceed 160mW.

### **4.7.2 Rear Connector 600-02-80**

Rear Connectors are equipped with a D25 fixed socket, a D15 fixed socket and 3 BNC signal connectors. Pin designations for the control connections are detailed in the next section.



A and B signal inputs are terminated in 75R at the rear connector. The selected output should be terminated in 75R at the next point along the signal path.

### 4.7.3 600-02-80 RCU Pin-Out

Pin	D25 Fixed Socket
1	Lock A+
14	Lock A-
2	Transport A+
15	Transport A-
3	Content A+
16	Content A-
4	Audio A+
17	Audio A-
5	EDH A+
18	EDH A-
6	Overall GOOD A+
19	Overall GOOD A-
7	Lock B+
20	Lock B-
8	Transport B+
21	Transport B-
9	Content B+
22	Content B-
10	Audio B+
23	Audio B-
11	EDH B+
24	EDH B-
12	Overall GOOD B+
25	Overall GOOD B-
13	Ground (Chassis)

**Signal OK**, changing to a FAIL state if the signal disappears

**Transport OK**, changing to a FAIL state if one or more of the following detectors shows a fail: -

- TRS error
- Data Rate Error
- Video Standard Error
- Cable Length Warning

**Content OK**, changing to a FAIL state if one or more of the following detectors shows a fail: -

- Active Video Content error
- Freeze Frame detected
- Stuck bit detected.

**Audio OK**, changing to a FAIL state if one or more of the following detectors shows a fail: -

- Embedded audio not present
- Audio level error
- Sample Rate error

**EDH OK**, changing to a FAIL state if one or more of the following detectors shows a fail: -

- EDH not present
- EDH Checksum error

**“Global” OK**, changing to a FAIL state if one or more the above detectors shows a fail.

Note:

- All of the GP outputs listed above for Channel A are repeated in the same format for Channel B.
- The GP outputs are low impedance when “good”: high impedance when “fail”.

Pin	D15 Fixed Socket
1	A=B Comparator +
9	A=B Comparator -
2	Ground
10	N/C
3	Changeover, Select 'B' I/P (Gnd)
11	Ground
4	'B' Selected +
12	'B' Selected -
5	Bypass Relay Fail+
13	Bypass Relay Fail-
6	N/C
14	N/C
7	N/C
15	N/C
8	N/C

Three further GPI outputs are provided on the D15 socket:

- Channel Comparison A = B
- B input routed to output (changeover tally)
- Bypass Relay Failure



## **5. 600-03-00 ANALOGUE VIDEO DETECTOR CARD**

### **5.1 Introduction**

**The information contained in this Section refers to Revision 3 hardware, fitted with Revision d firmware.**

The **Sentinel** series, 600-03-00 Analogue Video Detector Card provides detection for 4 analogue video signals, with configurable detection parameters, presented as GP output and LED errors, as well as to the **COSMOS** status and control software.

The card parameters may be set up and configured via local jumper links and switches.

#### **5.1.1 Specification Summary**

- Provides detection for 4 Analogue Video feeds, A through D.
- Auto format Detection PAL, NTSC.
- Detector configurations are for pairs of detector channels - A/B and C/D.
- Detector outputs are per channel – A, B, C and D.
- Provides A/B switching capability to switch feed A or B to an output, and/or C or D to an output.
- Module provides eight GP outputs.
- The card parameters may be set up and configured via local jumper links and switches.
- Individual detector outputs also available to Cosmos.
- 3U card format.
- 12 cards (48 channels) per Sentinel 3U rack frame.

### **5.2 Function**

The 600-03-00 provides detection for 4 Analogue Video feeds, A through D.

#### **5.2.1 Available Detectors**

Detectors are grouped into detector “types” to provide the GP outputs and LED indications. See below for detector categories.

##### **5.2.1.1 Signal Present/Conformance Errors**

- Input sync level analysers to check that the voltage level of the input video sync is greater than the preset threshold (adjustable to –3dB, -6dB or –9dB). Provides a basic “signal present” detector. One detector per input, with thresholds set per pair (A/B and C/D)
- Burst level detector with adjustable thresholds of –3dB, -6dB, –9dB or “don’t care” by means of DIP switch disable. One detector per input, with thresholds set per pair (A&B and C&D)

- Line Standard detector (counter). The required Line standard may be set for each detector pair to 525, 625 or “either”. One detector per input, with standard set per pair (A/B and C/D).
- Subcarrier frequency detector. The required frequency standard may be set to 3.5MHz, 4.4MHz or “don’t care”. Frequency detectors give a rough indication that the burst frequency is within 400kHz of nominal. One detector per input, with thresholds set per pair (A&B and C&D)

### **5.2.1.2 Video Content Errors**

- Video Black detector. Thresholds are 0.5%, 1.0%, 2.0%, 4.0%, 8.0% then 12% to 28% in 4% steps. These thresholds should be increased by 7.5% when operating in NTSC mode, to take account of the NTSC setup pedestal. One detector per input, with thresholds set per pair (A&B and C&D)
- Freeze-frame (APL) detector. Shows that a number of consecutive video frames appear to have identical content. “Identical” in this context means that the APL has remained within a selectable percentage (1%, 2% or 4%), for a set number of fields up to 1024 (approx. 41 seconds in 625 mode: 34 seconds in 525 mode). One detector per input, with parameters set per pair (A&B and C&D)

### **5.2.1.3 Channel Comparison**

- Video content comparators. These show that the two feeds are grossly dissimilar. Comparison is made by checking that the APL of the two feeds is within 0.5%, 1.0%, 2.0% or 4.0% (user selectable). See section 5.5.7. One comparator per input pair (A/B and C/D).

## **5.3 Changeover Function**

The board has one output termed AB, whose source can be changed between the A input signal and the B input signal. The changeover between A and B can be caused either by:

- Switch at the front edge of the card
- GP input.
- Automatic: The output will changeover to B automatically if an error is detected on the A input. Individual errors may be ignored using on board DIL switches. In addition, the switch is only effected after a programmable delay allowing short duration errors to be ignored.
- COSMOS. Changeover control is also provided from an on-screen button in the (optional) COSMOS monitoring software.

The mode of changeover is determined by on board DIL switches.

The board has a second output termed CD, whose source can be changed between the C input signal and the D input signal. An independent set of logic and controls, identical to the A/B controls, are present to control the selection of this output.

The module rear connector unit (RCU) also provides six GPIO output signals. These are described in section 5.6.4.



**5.4 LED Indication**

**LED Indicators for**

- Channel A OK

Normally lit Green. Turned OFF if sync, burst or line standard errors detected.

- Channel A Video

Normally lit Green. Turned OFF if APL or Freeze Frame errors detected.

**Errors may be excluded by using S1 and S2. See section 5.5.1**

**LEDs are repeated for Channel B, C, and D.**

**Comparators**

- A = B (Green)
- C = D (Green)

**Changeover Status**

- A Selected (Green)
- B Selected (Yellow)
- C Selected (Green)
- D Selected (Yellow)

**Channel Failure**

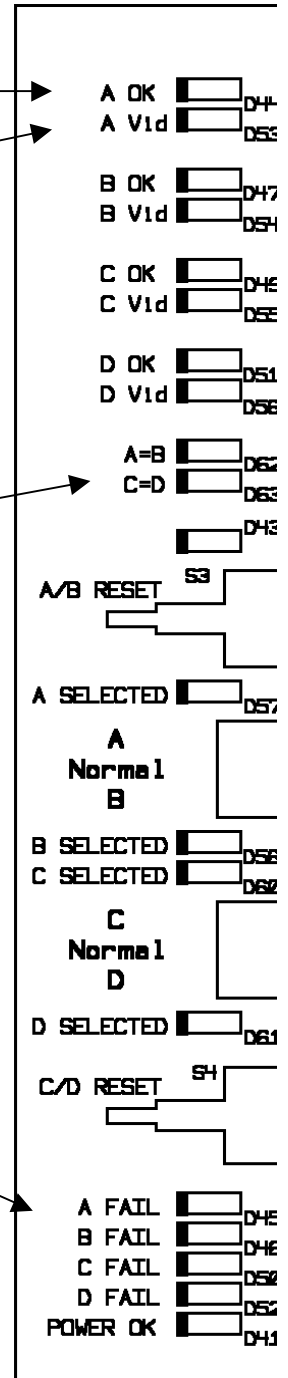
- A Failure (Red)

Lit RED if errors detected in any of APL, Freeze Frame, Sync, Burst, and Line Standard.

**Errors may be excluded by using S1 and S2. See section 5.5.1**

**LEDs are repeated for Channel B, C, and D.**

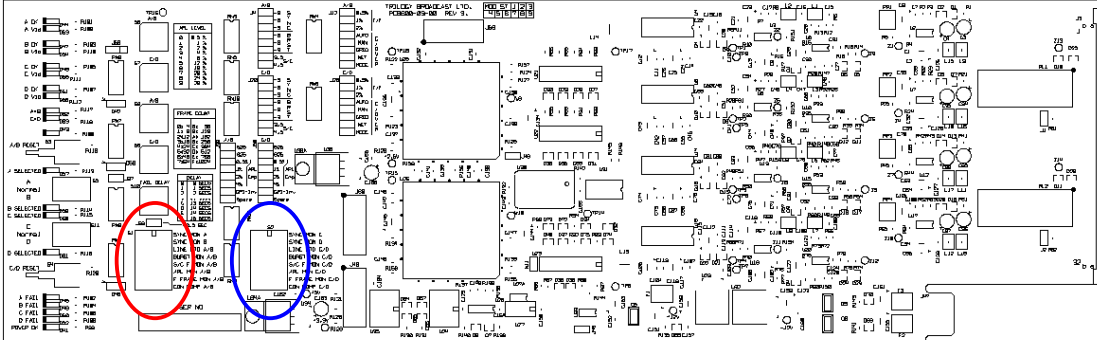
**Module Power OK (Green)**



## 5.5 Switch Functions

### 5.5.1 Monitor Enable Switch Settings

Default settings are shown in **bold italic type**.



Switch S1. Set ON to enable; OFF to disable feature for Channel A / B.

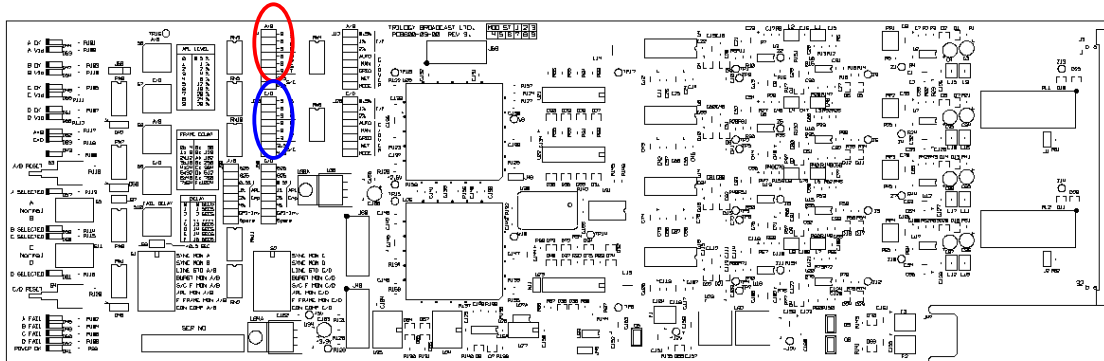
Position	Switch S1 (Channel A/B)	Comment	Default
1	Channel A Sync Level monitor	See J4, J5, J6	<b><i>ON</i></b>
2	Channel B Sync Level monitor	See J4, J5, J6	<b><i>ON</i></b>
3	Channel A/B Line Standard monitor	See J38, J39	<b><i>ON</i></b>
4	Channel A/B Burst Level monitor	See J7, J8, J9	<b><i>ON</i></b>
5	Channel A/B Burst Frequency monitor	See J10, J11	<b><i>ON</i></b>
6	Channel A/B Video Black monitor		<b><i>ON</i></b>
7	Channel A/B Freeze Frame monitor	See S8, J12, J13, J14	<b><i>ON</i></b>
8	Channel A/B Content (APL) Comparator	See J40 – J43	<b><i>OFF</i></b>

Switch S2. Set ON to enable; OFF to disable feature for Channel C / D.

Position	Switch S2 (Channel C/D)	Comment	Default
1	Channel C Sync Level monitor	See J20, J21, J22	<b><i>ON</i></b>
2	Channel D Sync Level monitor	See J20, J21, J22	<b><i>ON</i></b>
3	Channel C/D Line Standard monitor	See J50, J51	<b><i>ON</i></b>
4	Channel C/D Burst Level monitor	See J23, J24, J25	<b><i>ON</i></b>
5	Channel C/D Burst Frequency monitor	See J26, J27	<b><i>ON</i></b>
6	Channel C/D Video Black monitor		<b><i>ON</i></b>
7	Channel C/D Freeze Frame monitor	See S9, J28, J29, J30	<b><i>ON</i></b>
8	Channel C/D Content (APL) Comparator	See J52 – J55	<b><i>OFF</i></b>

### 5.5.2 Sync & Burst Threshold selection

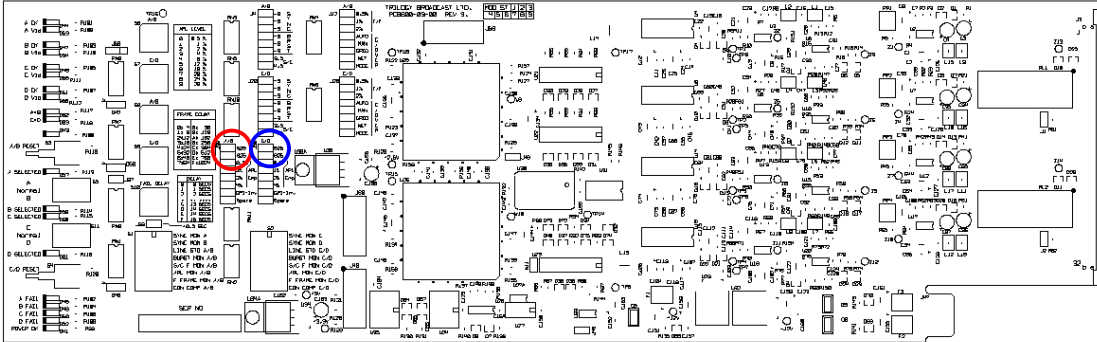
Note: Jumper links are grouped in 8-way blocks. On the PCB, only the first link in each block is labelled. These channel settings are enabled individually on S1 and S2. See 5.5.1.



Position	Jx Channel A/B	Jx Channel C/D	Threshold
1	J4	J20	-9dB Sync
2	J5	J21	-6dB Sync
3	J6	J22	-3dB Sync
4	J7	J23	-9dB Burst
5	J8	J24	-6dB Burst
6	J9	J25	-3dB Burst

### 5.5.3 Video Standard Selection

This feature is enabled / disabled by settings on S1 and S2. See 5.5.1.



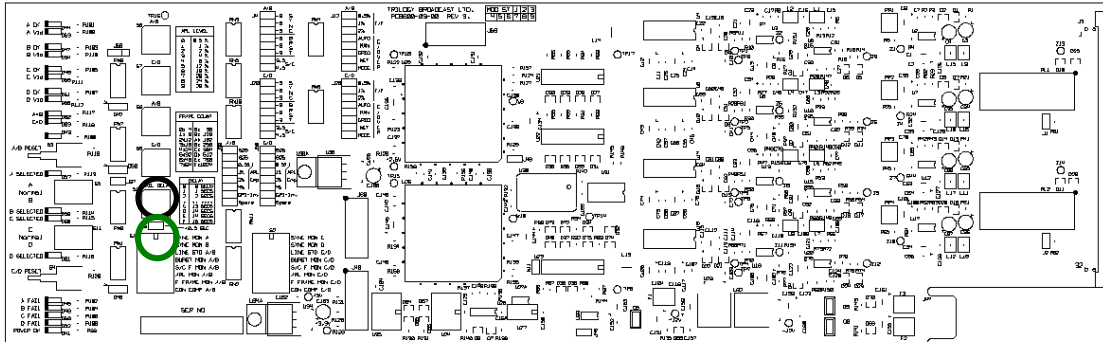
To select the video standard to 525 or 625, **fit** links as shown in the table below.

Standard	Channel A / B	Channel C / D
525 only	J38	J50
625 only	J39	J51
525 & 625	J38 & J39	J50 & J51

If **neither** link of a pair is fitted, the card defaults to detecting **both** 525 & 625 standards.

### 5.5.4 Global Alarm Timer Delay

This setting determines how long an error is present, before being notified via the LEDs or GP Outputs. If the error is corrected before the preset time has elapsed, then the LED or GP output state will not alter and the time count is reset.



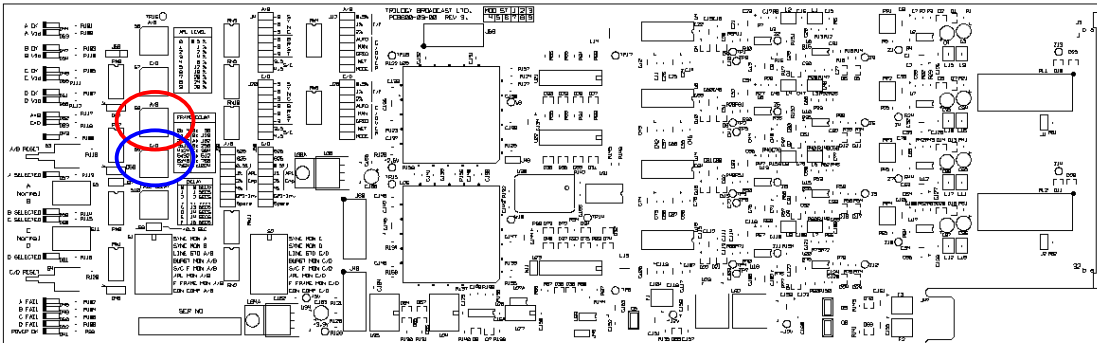
Set switch S10 for coarse delay in seconds.

Fit jumper link J36 to add 0.5 seconds.

Position of S10	Time delay (seconds)
0	0
1	1
2	2
3	3
4	4
<b>5</b>	<b>5</b>
6	6
7	7
8	8
9	9
A	10
B	11
C	12
D	13
E	14
F	15

### 5.5.5 Frozen frame detection

Set the number of consecutive frames to detect frozen. This feature is enabled / disabled by settings on S1 and S2. See 5.5.1.



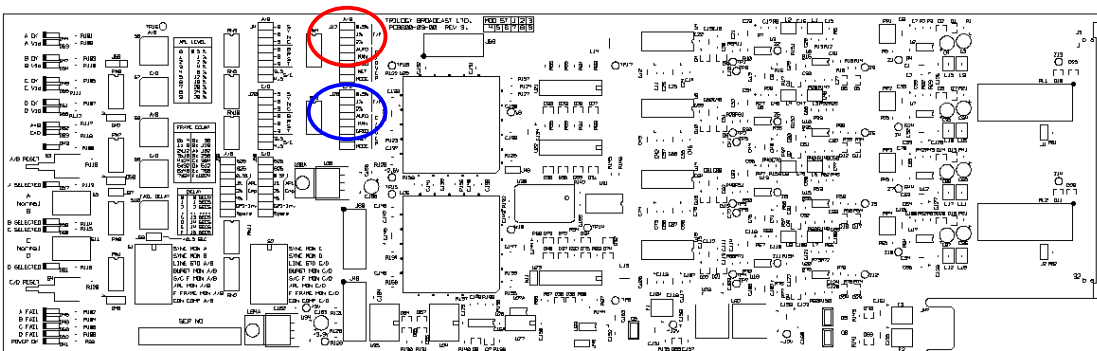
Switch S8 (Channel A / B)

Switch S9 (Channel C / D)

Position	Frames	Position	Frames
0	4	8	96
1	8	9	128
2	12	10	192
3	16	11	256
4	24	12	384
5	32	13	512
6	48	14	768
7	64	15	1024

### 5.5.6 Frozen frame Detection Accuracy.

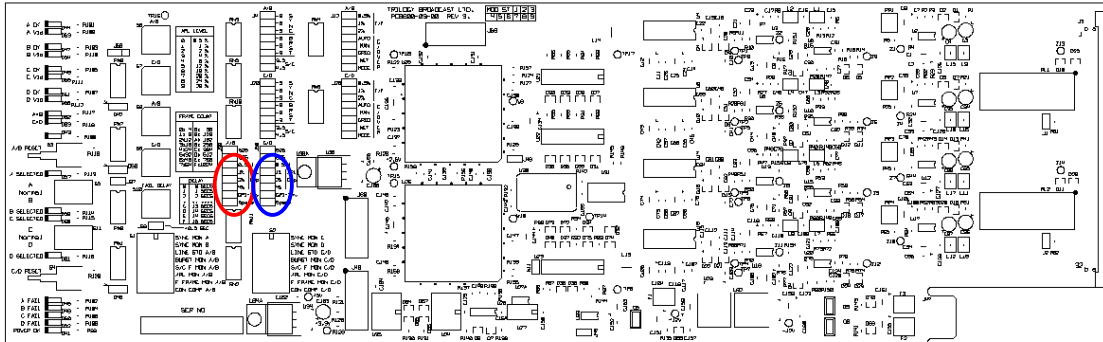
This feature operates by checking the similarity of consecutive frames. Fit one link only, for each Channel pair.



Consecutive frames match within __	Channel A & B	Channel C & D
0.5%	J12	J28
1.0%	J13	J29
2.0%	J14	J30

### 5.5.7 Channel Comparison APL Accuracy

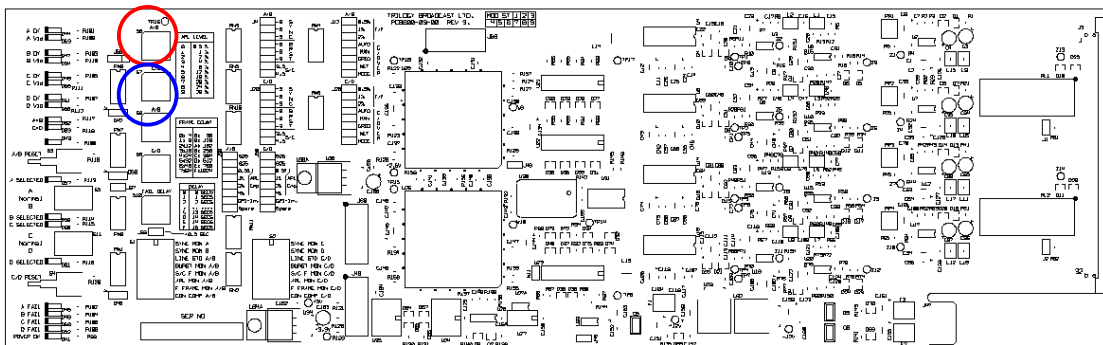
This feature checks the APL of paired channels. An error is indicated if the APLs differ by more than the preset level. Fit one link only, for each Channel pair.



Accuracy	Channel A & B	Channel C & D
0.5%	J40	J52
1.0%	J41	J53
2.0%	J42	J54
4.0%	J43	J55

### 5.5.8 Video Black Detection APL Threshold

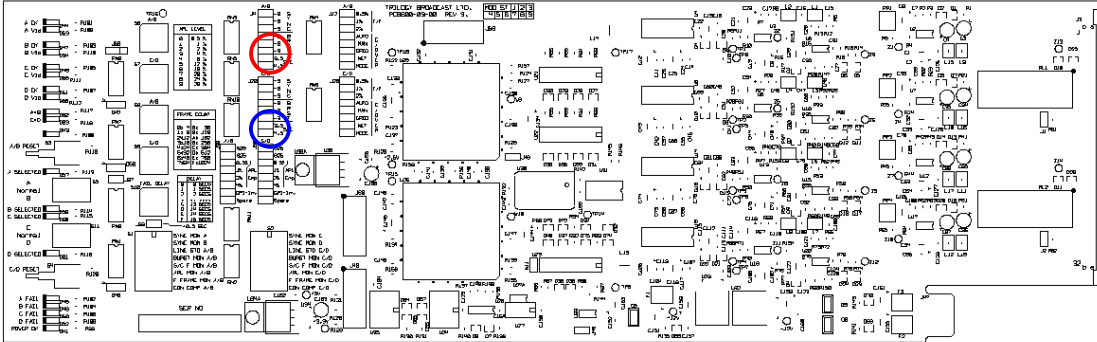
This feature checks for a level of active picture above the preset APL threshold. Channels are set in pairs. The feature is enabled / disabled by settings S1.6 and S2.6. See 5.5.1.



APL Threshold (%)	S6 position (Channel A & B)	S7 position (Channel C & D)
0.5	0	0
1.0	1	1
2.0	2	2
4.0	3	3
8.0	4	4
12.0	5	5
16.0	6	6
20.0	7	7
24.0	8	8
28.0	9	9

### 5.5.9 Burst Frequency Detection

Burst carrier frequency is checked to within 400KHz of a nominal setting. The feature is enabled / disabled by settings S1.5 and S2.5. See 5.5.1. Channels are set in pairs.



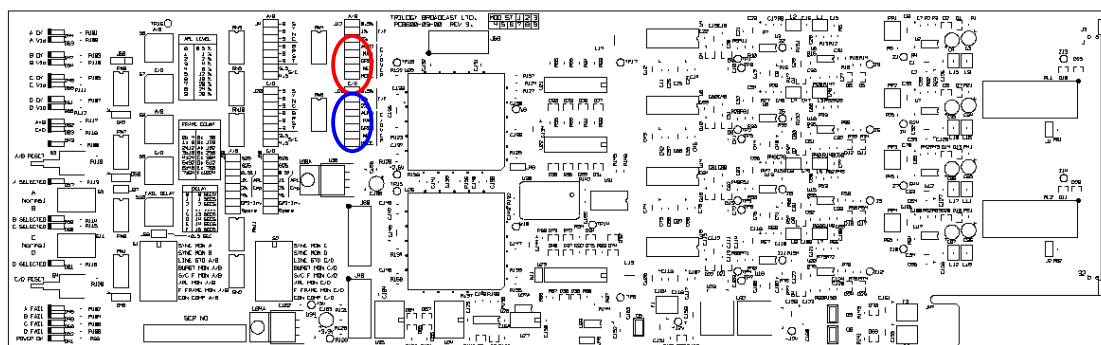
Fit either / both jumper link to each channel pair.

Nominal Burst Frequency (MHz)	Channel A & B	Channel C & D
3.5	J10	J26
4.5	J11	J27



## 5.5.10 Changeover control

### 5.5.10.1 Changeover operation



Fit jumper links as shown below. These jumper positions are only read when the front edge toggle switches are in the centre (normal) position. See also section 5.3.

Function	Ch A / B	Ch C / D	Note
<b>Auto</b>	<b>J15</b>	<b>J31</b>	Fit one link per channel pair.
Manual	J16	J32	
GPI	J17	J33	Fit one link per channel pair.
<b>COSMOS</b>	<b>J18</b>	<b>J34</b>	
Revert	J19 (Mode)	J35 (Mode)	Fit link to enable “revert to original”, if valid signal returns after changeover.

Reset switches are located at the card front edge: S3 for Channel A / B, S4 for C / D.

The function of J15-J18 is described below (only AB changeover discussed for clarity):

With J15 not fitted, fitting J17 or J18 will enable control of the changeover by GPIO or COSMOS respectively. If both links are fitted, only COSMOS will control the changeover.

If J15 is fitted and neither J17 or J18 is fitted, then the unit will switch the B signal in the event that A has failed and that B is OK. Note that the conditions for which A / B is deemed to have failed is set by S1. The changeover will not revert back to A even if A subsequently becomes OK (unless J19 is fitted). However the unit can be forced back to A if the Reset switch, S3 is pressed.

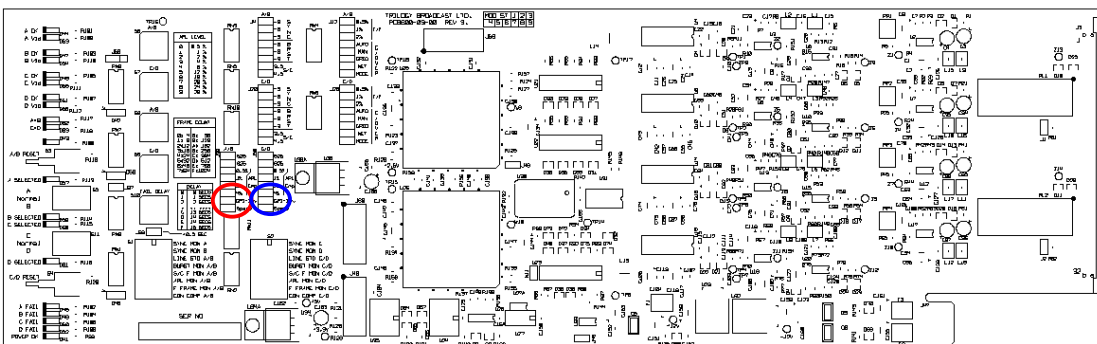
If J15 is fitted and either J17 or J18 is fitted, then the changeover occurs as described above. GPIO or COSMOS control will disable the Automatic mode if utilised to switch back to A. Once this has occurred, the Automatic mode is disabled and only GPIO or COSMOS controls the changeover function as if the automatic link was not fitted. The automatic mode can be re-enabled by pressing the Reset switch, S3. If both GPIO and COSMOS links are fitted, COSMOS will have priority.

Note that when the Automatic and GPIO are enabled, the GPI must be grounded (as if selecting the B input) in order for the Automatic mode to operate – i.e. the GPI cannot be left floating as this will select the A channel and always override the Automatic mode. The various settings of the links are summarised below (only AB changeover discussed for clarity):

Auto J15	GPIO J17	COSMOS J18	Function
NO	NO	NO	COSMOS and GPIO have no effect – changeover can only occur using the front edge toggle switch.
NO	YES	NO	If GPIO B input is grounded, the unit will switch to B
NO	NO	YES	If B is selected using the COSMOS control, the unit will switch to B
NO	YES	YES	If B is selected using the COSMOS control, the unit will switch to B. COSMOS control has priority.
YES	NO	NO	Will switch to B if A is faulty whilst B is good. Will stay on B until the Reset switch, S3, is pressed.
YES	YES	NO	Will switch to B if A is faulty whilst B is good. Will stay on B until the Reset switch, S3, is pressed. However if GPIO input selects A, A will be selected and thereafter unit will be under GPIO control, unless the Reset switch is pressed in which case the unit will revert to Automatic mode.
YES	NO	YES	Will switch to B if A is faulty whilst B is good. Will stay on B until the Reset switch, S3, is pressed. However if COSMOS selects A, A will be selected and thereafter unit will be under COSMOS control, unless the Reset switch is pressed in which case the unit will revert to Automatic mode.
YES	YES	YES	Will switch to B if A is faulty whilst B is good. Will stay on B until the Reset switch, S3, is pressed. However if COSMOS selects A, A will be selected and thereafter unit will be under COSMOS control, unless the Reset switch is pressed in which case the unit will revert to Automatic mode. COSMOS control has priority.

**5.5.10.2 Inversion of GPI changeover control input**

Fit a link (per channel pair) to invert the logical operation of this facility. If the link is fitted, then applying ground to the control pin will select A (J44) or C (J56).



Channel	Fit
A / B	J44
C / D	J56

**5.5.11 Other links**

Link	Function
J1	75R termination of unused input. Remove for loop through RCU. (Ch A / B)
J2	75R termination of unused input. Remove for loop through RCU. (Ch C / D)
J37	Test function only
J45	Fit to disable gross over-amplitude error indication (Channel A/B)
J46	Spare – DO NOT USE.
J48	Spare – DO NOT USE.
J49	Reset - Test function only
J57	Fit to disable gross over-amplitude error indication (Channel C/D)
J58	Test function only
J59	Spare – DO NOT USE.
J60	Spare – DO NOT USE.

J45 and / or J57 may be fitted to disable erroneous or irregular indication of signals which exceed a total excursion of 1280mV.

## 5.6 Card Format

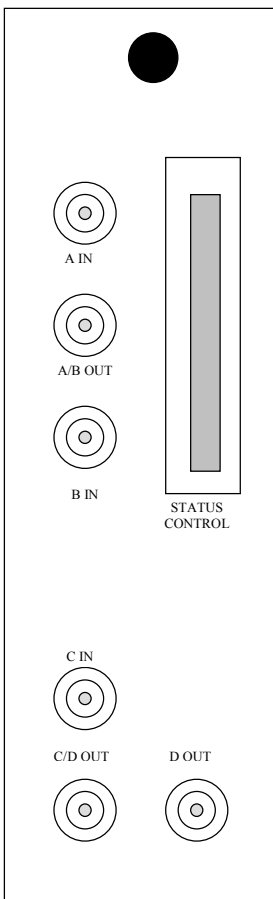
### 5.6.1 GPIO

The card has 8, open collector, voltage free, Darlington outputs, made available on the module RCU. The outputs may be set globally to be:

- **Immediate** – i.e. asserted immediately any of the relevant error conditions occur – or:
- **Asserted after a delay**. There is one configurable delay that applies to both channels. The delay may be set for 0 to 15 seconds in 1-second increments. The connector pin-out provided on the rear connector is described in section 5.6.4.
- For the GP outputs, the maximum output current must be limited to 160mA and the maximum external voltage must not exceed 40V. The maximum power dissipation must not exceed 160mW.

### 5.6.2 Rear Connector 600-03-80 - Changeover

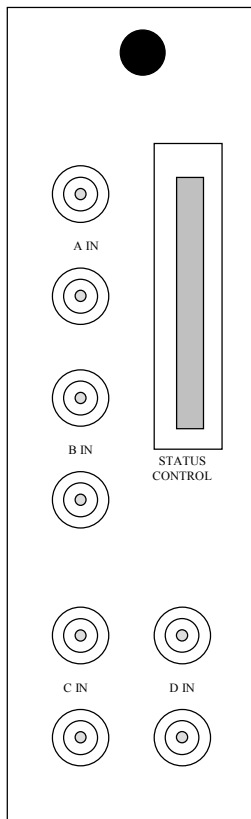
Rear Connectors are equipped with a D25 fixed socket, and 6 BNC signal connectors.



The selected route is high impedance and should be terminated in 75R at the next point along the signal path. The non-selected signal will be terminated in 75R provided jumper links J1 and J2 are fitted. See 5.5.11 for details.

### **5.6.3 Rear Connector 600-03-81 – Signal loop through**

Rear Connectors are equipped with a D25 fixed socket, and 8 BNC signal connectors.

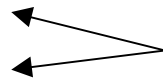


All signals are loop-through and the card is used solely for monitoring. Jumper links J1 and J2 should be removed. See 5.5.11.

#### 5.6.4 600-03-80 / 81 RCU Pin-Out

The RCU is equipped with a D25 fixed socket with the connections below.

Pin	D25 fixed socket
1	A OK +
14	A OK -
2	N/C
15	B OK +
3	B OK -
16	N/C
4	C OK +
17	C OK -
5	N/C
18	D OK +
6	D OK -
19	N/C
7	'B' Selected +
20	'B' Selected -
8	N/C
21	'D' Selected +
9	'D' Selected -
22	C=D Comparator +
10	C=D Comparator -
23	Select 'B' input
11	N/C
24	Select 'D' input
12	A=B Comparator +
25	A=B Comparator -
13	Ground (Chassis)



Connect to 0V to select.  
Logical sense may be inverted (see 5.5.10.2).

**Note:**

- The GP outputs are low impedance when “good”: high impedance when “fail”.

## **6. 600-04-00 AUDIO SIGNAL MONITOR & CHANGEOVER CARD**

### **6.1 Introduction**

The **Sentinel** series, 600-00-04 Audio Signal Monitor & Changeover card provides detection for 4 Audio inputs, with configurable detection parameters, presented as GPIO and LED errors, as well as to the **COSMOS** status and control software.

The card may be set up and configured via local jumper links and switches.

#### **6.1.1 Terminology**

The four channels are designated A, B, C and D. The 'Main' inputs are A & B (default in the event of a power failure) and the Reserve inputs, C & D. The stereo pairs are A & B and C & D.

#### **6.1.2 Specification Summary**

- Provides detection for 4 Audio feeds, channels A, B, C and D. For stereo operation channels are paired as A/B and C/D.
- Jumper link “gangs” channels A/B and C/D to provide stereo operation.
- Detector configurations are for channel pairs – one set for channels A and B, and one for channels C and D.
- The card has 6, open collector, voltage free, Darlington outputs, made available on the module RCU. See section xxx.
- Provides switching capability to switch inputs A or C to output 1 and/or inputs B and D to output 2.
- Module provides a number of GPIO outputs.
- Card is configured manually using jumper links/DIP switches.
- Individual detector outputs available to Cosmos.
- 12 Cards (48 Audio Feeds) per Sentinel 3U Rack Frame.

## **6.2 Function**

### **6.2.1 Introduction**

The board has four Audio inputs, termed A, B, C and D. Each Audio input is individually monitored for errors and all errors are reported back to the **COSMOS** control software.

### **6.2.2 Available Detectors**

Detectors are grouped into detector “types” to provide the GP outputs and/or LED indications.

See below for detector categories.

### **6.2.3 Signal Present/Conformance Errors**

The Signal Present LED indicators give a dynamic indication of the input level. The GP outputs indications are only changed after the preset delay.

- Input level analysers to check that the voltage level of the input signal is greater than the preset threshold (adjustable from 0dB down to –50dB in 1dB steps). Provides a basic “signal present” detector. One detector per input, with the thresholds set per pair (A/B and C/D).
- Input level analysers to check that the voltage level of the input signal is less than the preset threshold (adjustable from 0dB up to +18dB in 2dB steps). One detector per input, with the thresholds set per pair (A/B and C/D).

### **6.2.4 Audio Content Errors**

The Tone Present LED & GP outputs give an indication of the presence of line-up tone on the input. The indications are only changed after the fixed 8-second delay. The Tone detector is disabled when the input signal falls below  $-30\text{dB}$ .

### **6.2.5 Phase Reversal Errors**

In stereo mode, the Phase Reversal LED & GP output give an indication that the input signal is phase reversed. The indications are only changed after the nominal 8-second delay. Phase reversal detection is frozen when the input signal falls below  $-15\text{dB}$ .

## **6.3 Changeover Function**

The board has one output termed AC, whose source can be changed between the A input signal and the C input signal. The changeover between A and C can be caused either by:

- Switch at the front edge of the card
- GP input.
- Automatic: The output will changeover to B automatically if an error is detected on input A. Individual errors may be ignored using on board DIL switches. In addition, the switch is only effected after a programmable delay allowing short duration errors to be ignored.
- COSMOS. Changeover control is also provided from an on-screen button in the (optional) COSMOS monitoring software.

The mode of changeover is determined by on board DIL switches and links.

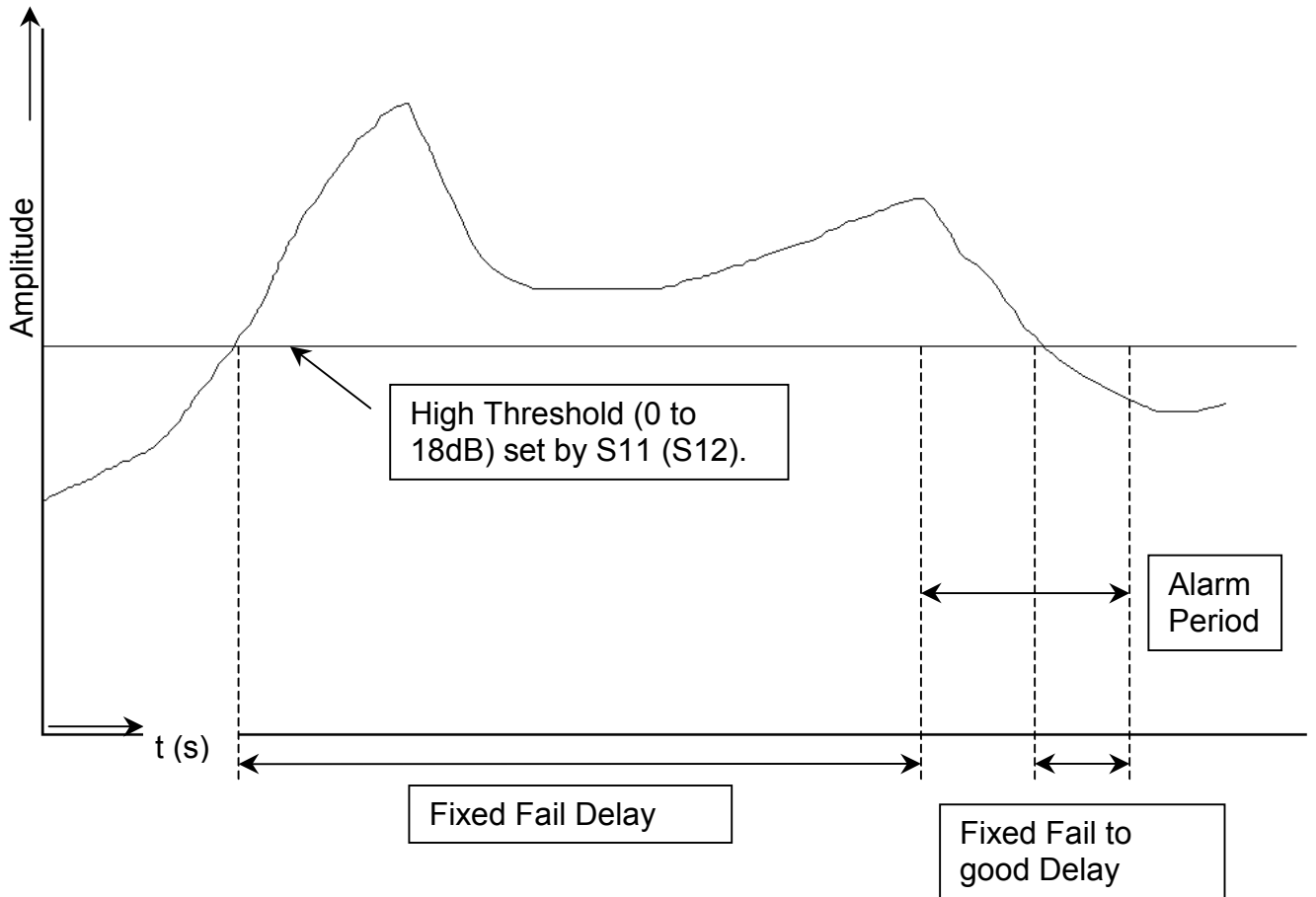
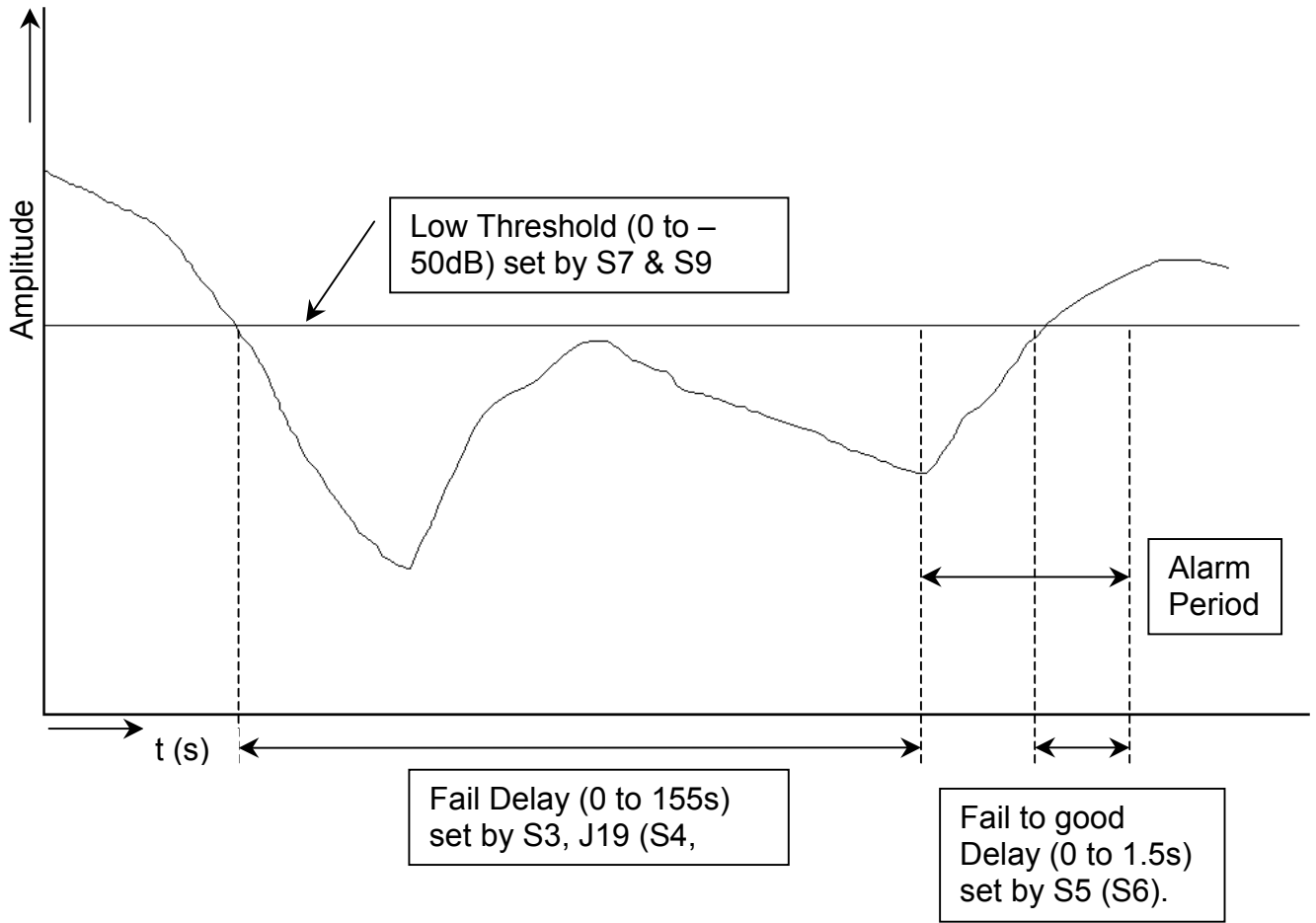
The board has a second output termed BD, whose source can be changed between the B input signal and the D input signal. An independent set of logic and controls, identical to those for A/C, are present to control the selection of this output.

The module rear connector unit (RCU) also provides six GPIO output signals. These are described in section 6.7.

## **6.4 Amplitude settings**

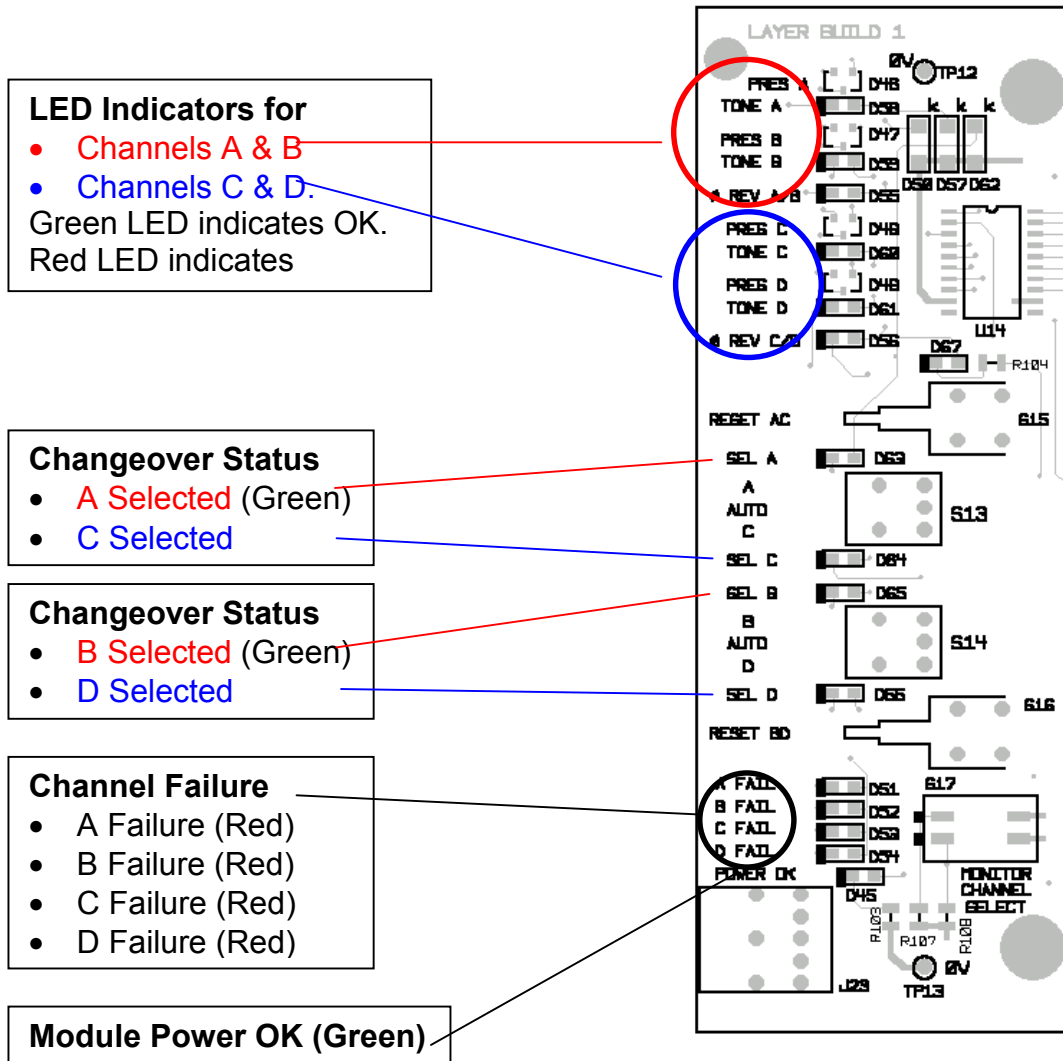
The following diagrams show the effect and related settings for both low and high amplitude thresholds.





### 6.5 LED Indications

A number of LED indicators are provided at the front edge of the module. These refer to Channel A, Channel B and General Card Functionality.



Other card edge LED indicators are not currently used.

#### 6.5.1 Audio Present LED

A tricolour LED for each channel shows the input status as follows:

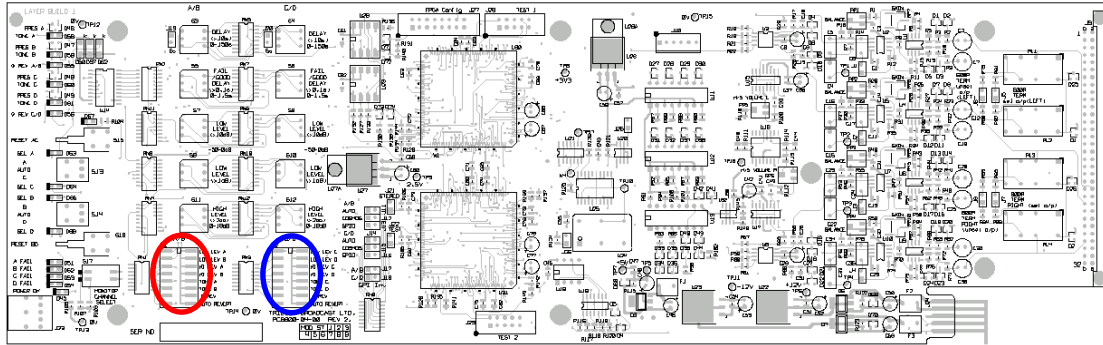
LED Status	Input Status
Off	Level is too low
Green	Level is OK
Red	Level is too high

#### 6.5.2 Other LEDs

All the other LEDs are single colour, with green signifying OK, yellow for warning and red for error conditions.

## 6.6 Switch Functions

### 6.6.1 Monitor Enable Switch Settings



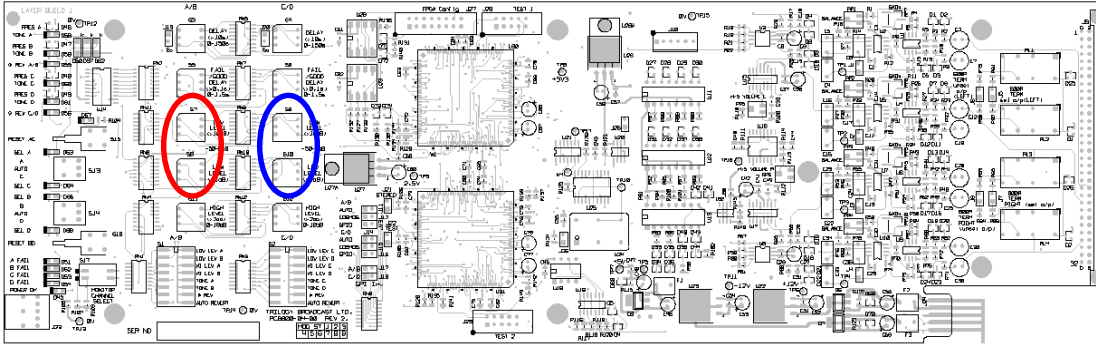
Switch S1. Set ON to enable; OFF to disable feature for Channel A / B.

Position	Switch S1 (Ch A/B)	Function	Default
1	Ch A Low Level monitor	When ON, the Low level alarm is enabled. See also S7 & S9.	ON
2	Ch B Low Level monitor	When ON, the Low level alarm is enabled. See also S7 & S9.	ON
3	Ch A High Level monitor	When ON, the High level alarm is enabled. See also S11.	ON
4	Ch B High Level monitor	When ON, the High level alarm is enabled. See also S11.	ON
5	Ch A Tone monitor	When ON, the Tone detector alarm is enabled.	ON
6	Ch B Tone monitor	When ON, the Tone detector alarm is enabled.	ON
7	Ch A & B Phase Reversal	When ON, the Phase Reversal detector alarm is enabled. See also J21.	ON
8	Ch A & C Auto Revert	When ON, the changeover state of the AC output will revert to A, if A returns after failure.	OFF

Switch S2. Set ON to enable; OFF to disable feature for Channel C / D.

Position	Switch S2 (Ch C/D)	Function	Default
1	Ch C Low Level monitor	When ON, the Low level alarm is enabled. See also S8 & S10.	ON
2	Ch D Low Level monitor	When ON, the Low level alarm is enabled. See also S8 & S10.	ON
3	Ch C High Level monitor	When ON, the High level alarm is enabled. See also S12.	ON
4	Ch D High Level monitor	When ON, the High level alarm is enabled. See also S12.	ON
5	Ch C Tone monitor	When ON, the Tone detector alarm is enabled.	ON
6	Ch D Tone monitor	When ON, the Tone detector alarm is enabled.	ON
7	Ch C & D Phase Reversal	When ON, the Phase Reversal detector alarm is enabled. See also J21.	ON
8	Ch B & D Auto Revert	When ON, the changeover state of the BD output will revert to B, if B returns after a failure.	OFF

### 6.6.2 Low Level Monitor Switch Settings



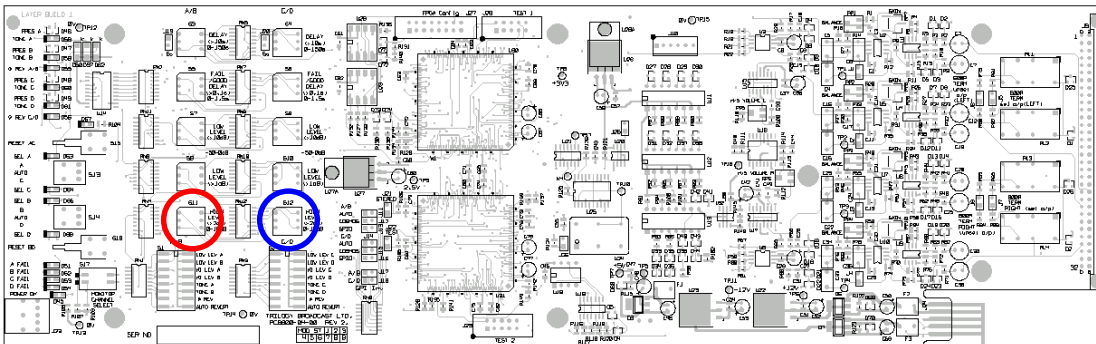
Switches S7 & S9. Set to select low threshold for Channel A / B.

Switches S8 & S10. Set to select low threshold for Channel C / D.

S7 / S8 Position	S9 / S10 Position	Low Level Threshold
0 – 4	0 – 9	0dB down to –49dB
5	0	–50dB
5	1 – 9	DO NOT USE (not Defined)
6 – 9	0 – 9	DO NOT USE (not Defined)

Note: Default setting is –25dB.

### 6.6.3 High Level Monitor Switch Settings

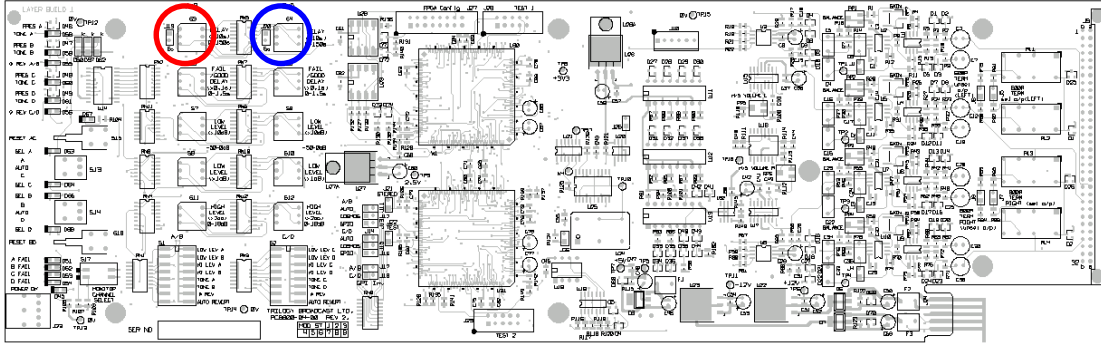


Switch S11. Set to select high threshold for Channel A / B.

Switch S12. Set to select high threshold for Channel C / D.

S11 / S12 Position	High Level Threshold	S11 / S12 Position	High Level Threshold
0	0dB	5	+10dB
1	+2dB	6	+12dB
2	+4dB	7	+14dB
3	+6dB	8	+16dB
<b>4</b>	<b>+8dB</b>	9	+18dB

### 6.6.4 Delay Switch Settings



Switch S3, Link J19. Set to select Good-to-Fail Delay for Channel A / B.

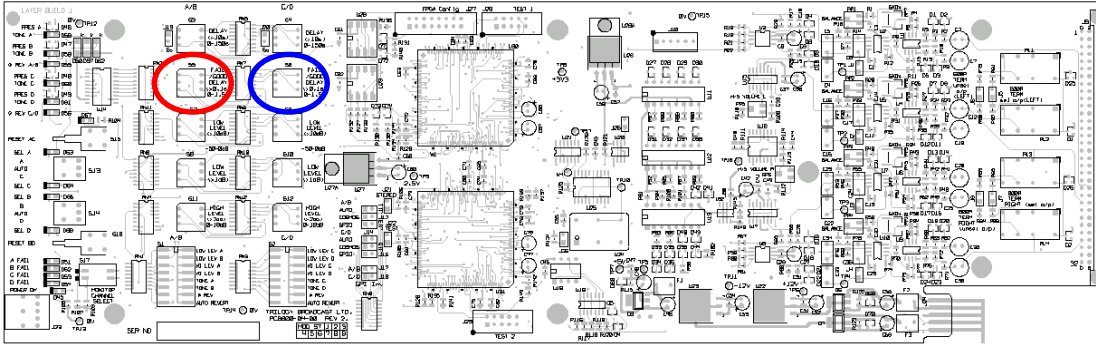
Switch S4, Link J20. Set to select Good-to-Fail Delay for Channel C / D.

S3 / S4 Position	Delay	S3 / S4 Position	Delay
0	0 seconds	8	80 seconds
1	10 seconds	9	90 seconds
2	20 seconds	A	100 seconds
3	30 seconds	B	110 seconds
4	40 seconds	C	120 seconds
5	50 seconds	D	130 seconds
6	60 seconds	E	140 seconds
7	70 seconds	F	150 seconds

J19 / J20 Position	Delay
NO	Add 0 seconds
YES	Add 5 seconds

This delay determines the time for which a low level failure must exist before the alarm is given. Other alarms have fixed 8-second “Good to Fail” delays.

### 6.6.5 Fail-to-Good Delay Switch Settings



Switch S5. Set to select Fail-to-Good Delay for Channel A / B.

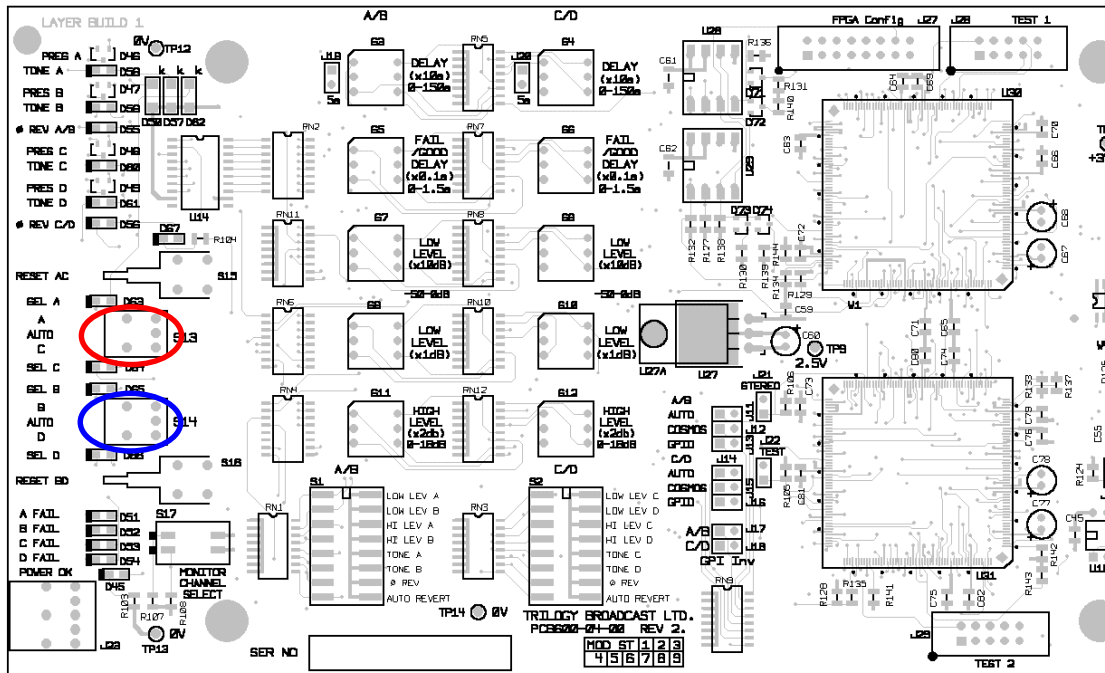
Switch S6. Set to select Fail-to-Good Delay for Channel C / D.

S5 / S6 Position	Delay	S5 / S6 Position	Delay
0	0.0 seconds	8	0.8 seconds
1	0.1 seconds	9	0.9 seconds
2	0.2 seconds	A	1.0 seconds
3	0.3 seconds	B	1.1 seconds
4	0.4 seconds	C	1.2 seconds
<b>5</b>	<b>0.5 seconds</b>	D	1.3 seconds
6	0.6 seconds	E	1.4 seconds
7	0.7 seconds	F	1.5 seconds

This delay determines the time for which no low level failure must exist before the alarm is cleared. Other alarms have fixed 0.5 second “Fail to Good” delays.

## 6.6.6 Changeover control

### 6.6.6.1 Manual Changeover operation



Switch S13. Set to select operational mode for Channel A / C in Mono Mode.

Switch S13. Set to select operational mode for Channel AB / CD in Stereo Mode.

Switch S14. Set to select operational mode for Channel B / D in Mono Mode.

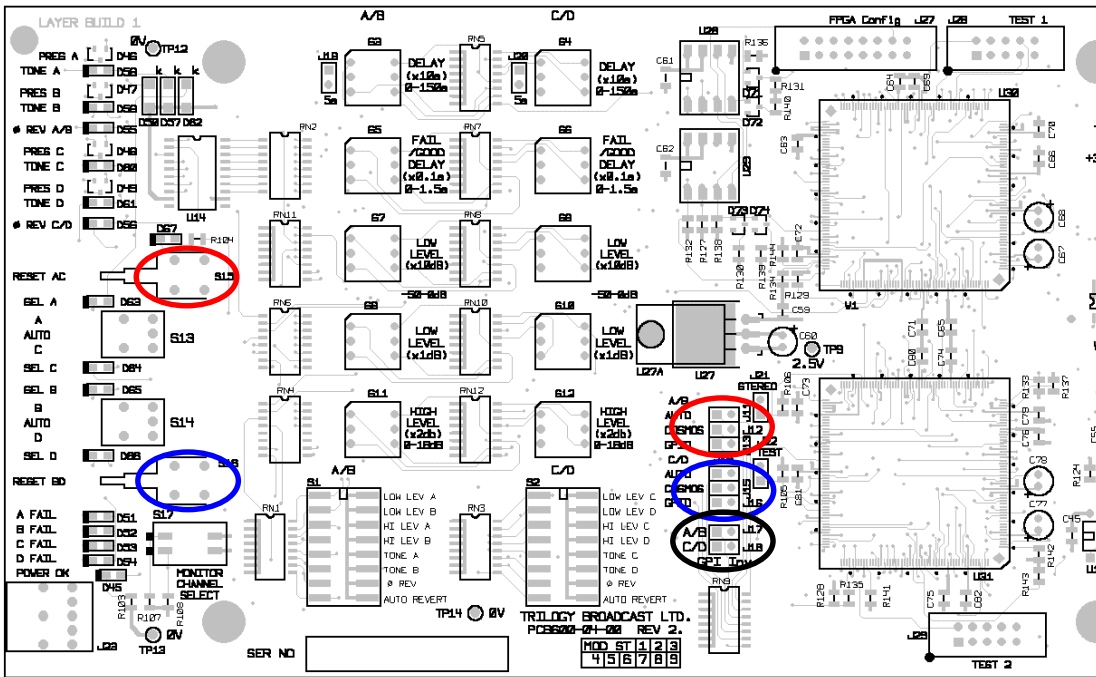
Switches S13 & S14 provide a manual override to force selection of the main channel (upper position) or the reserve channel (lower position). These switches are left in the central position for normal (automatic) operation.

If the Stereo link (J21) is fitted S13 selects the operation of all channels and S14 is ignored.

#### Default set-up:

- S13 Centre
- S14 Centre
- J21 fitted.

6.6.6.2 Changeover operation



Links J11 – J13. Set to select operation of Channels A / C.

Links J14 – J16. Set to select operation of Channels B / D.

Links J17, J18. Fit to invert sense of A / C and/or B / D GP Input.

Fit jumper links as shown below. These jumper positions are only read when the front edge toggle switches are in the centre (normal) position. See also section 5.3.

Function	Ch A / C	Ch B / D	Default
Auto	J11	J14	YES
COSMOS	J12	J15	YES
GPI	J13	J16	NO

Reset switches are located at the card front edge: Switch S15 (A / C channel), Switch S16 (B / D channels). Push to reselect Main input after a changeover. If the Stereo link (J21) is fitted S15 resets the operation of all channels and S16 is ignored.

The function of J11–J13 is described below (only AC changeover discussed for clarity):

With J11 not fitted, fitting J12 or J13 will enable control of the changeover by COSMOS or GPIO respectively. If both links are fitted, only COSMOS will control the changeover.

If J11 is fitted and neither J12 or J13 is fitted, then the unit will switch the C signal in the event that A has failed and that C is OK. Note that the conditions for which A / C is deemed to have failed is set by S1. The changeover will not revert back to A even if A subsequently becomes OK (unless 'Revert' S1 [8] is enabled). However the unit can be forced back to A if the Reset switch, S15 is pressed.

If J11 is fitted and either J12 or J13 is fitted, then the changeover occurs as described above. GPIO or COSMOS control will disable the Automatic mode if utilised to switch back to A. Once this has occurred, the Automatic mode is disabled and only GPIO or COSMOS controls the changeover function as if the automatic link was not fitted. The automatic mode can be re-enabled by pressing the Reset switch, S15. If both GPIO and COSMOS links are fitted, COSMOS will have priority.

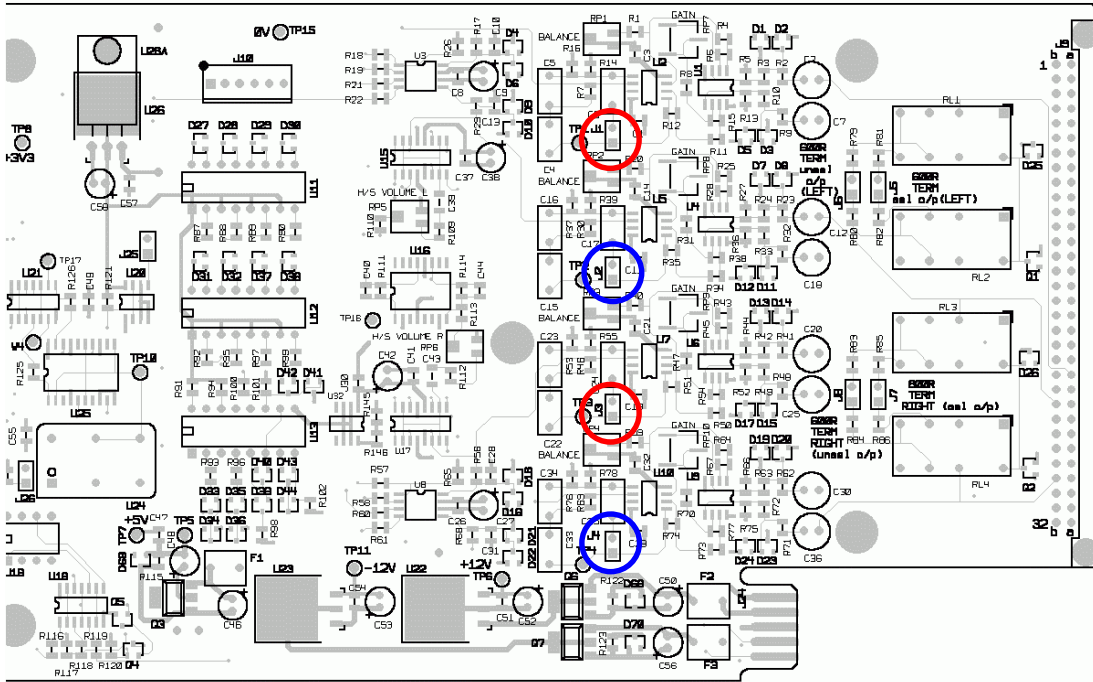
Note that when the Automatic and GPIO are enabled, the GPI must be grounded (as if selecting the C input) in order for the Automatic mode to operate – i.e. the GPI cannot be left



floating as this will select the A channel and always override the Automatic mode. The various settings of the links are summarised below (only AC changeover discussed for clarity):

Auto J11	COSMOS J12	GPIO J13	Function
NO	NO	NO	COSMOS and GPIO have no effect – changeover can only occur using the front edge toggle switch.
NO	NO	YES	If GPIO C input is grounded, the unit will switch to C.
NO	YES	NO	If C is selected using the COSMOS control, the unit will switch to C.
NO	YES	YES	If C is selected using the COSMOS control, the unit will switch to C. COSMOS control has priority.
YES	NO	NO	Will switch to C if A is faulty whilst C is good. Will stay on C until the Reset switch, S3, is pressed.
YES	NO	YES	Will switch to C if A is faulty whilst C is good. Will stay on C until the Reset switch, S3, is pressed. However if GPIO input selects A, A will be selected and thereafter unit will be under GPIO control, unless the Reset switch is pressed in which case the unit will revert to Automatic mode.
<b>YES</b>	<b>YES</b>	<b>NO</b>	Will switch to C if A is faulty whilst C is good. Will stay on C until the Reset switch, S3, is pressed. However if COSMOS selects A, A will be selected and thereafter unit will be under COSMOS control, unless the Reset switch is pressed in which case the unit will revert to Automatic mode.
YES	YES	YES	Will switch to C if A is faulty whilst C is good. Will stay on C until the Reset switch, S3, is pressed. However if COSMOS selects A, A will be selected and thereafter unit will be under COSMOS control, unless the Reset switch is pressed in which case the unit will revert to Automatic mode. COSMOS control has priority.

### 6.6.7 Low Frequency Roll-Off Control



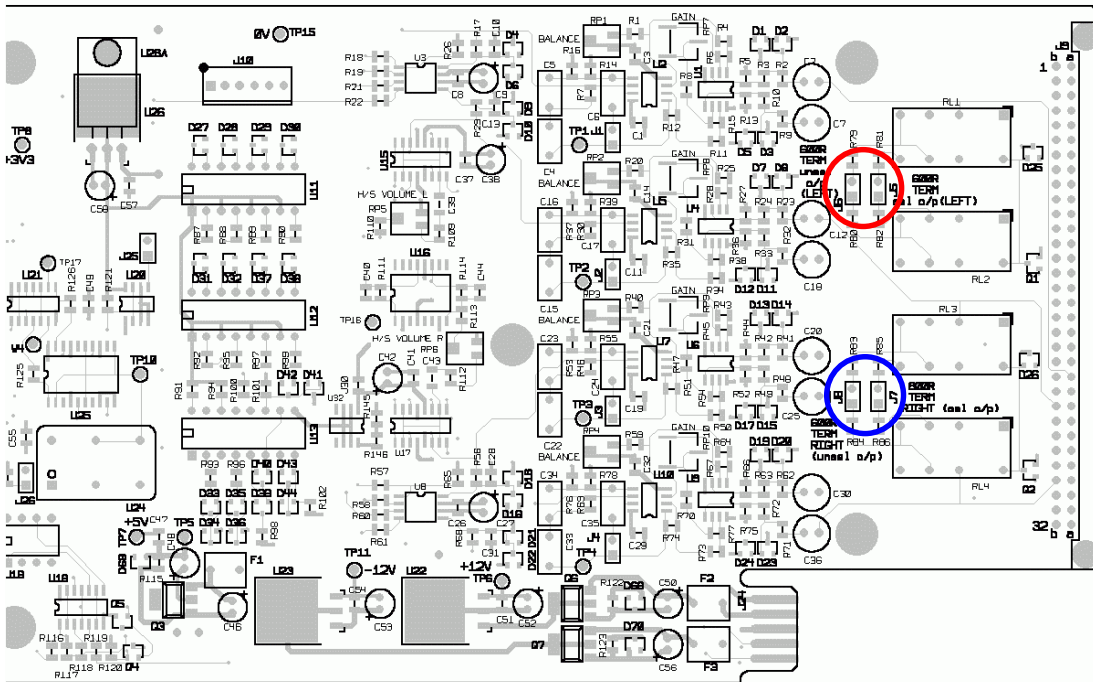
Links J1, J3. Fit to disable roll-off for Channels A / C.

Links J2, J4. Fit to disable roll-off for Channels B / D.

Fit links to disable or remove to enable low frequency roll-off at 12dB/octave below 200Hz.

**By default, these links are fitted.**

### 6.6.8 Input Termination

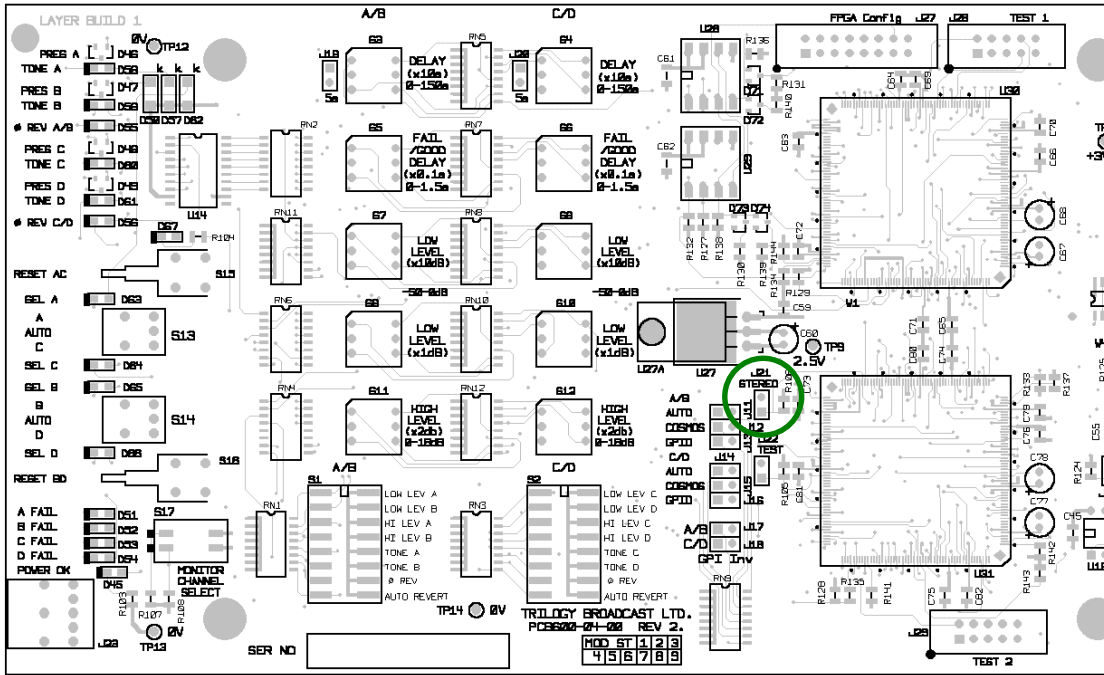


Fit J5 to terminate routed input (600R), J6 for unselected input for Channels A / C.

Fit J7 to terminate routed input (600R), J8 for unselected input for Channels B / D.

**By default, these links are not fitted.**

### 6.6.9 Stereo Enable



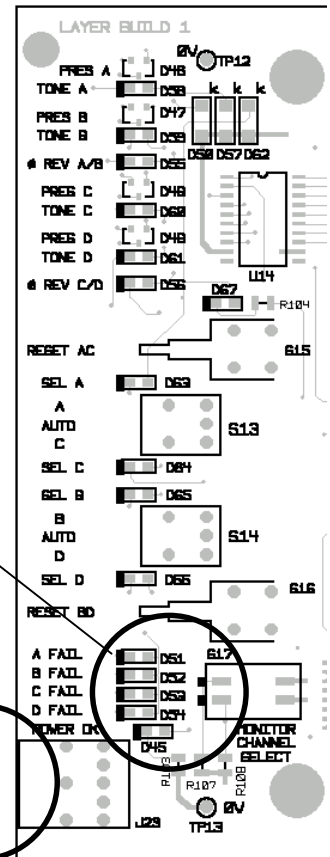
Fit link J21 to enable stereo mode or remove to enable mono mode. **By default, link fitted.**

### 6.6.10 Audio Monitor Jack

Use S17 to select Channel to monitor:

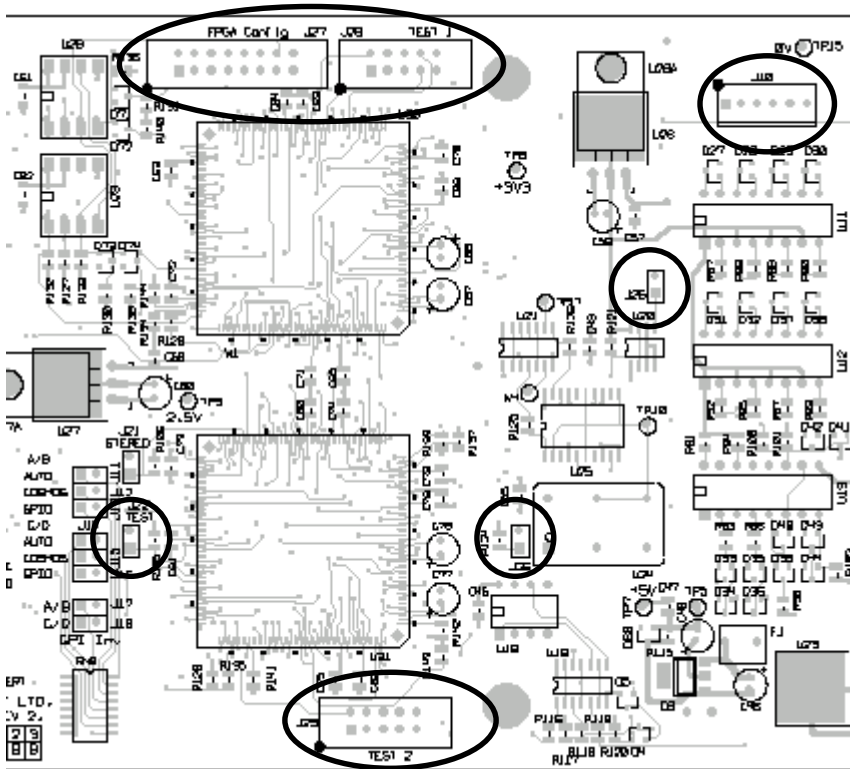
S17 2	S17 1	Mono L & R	Stereo L R
OFF	OFF	A	A B
OFF	ON	B	A B
ON	OFF	C	C D
ON	ON	D	C D

Stereo 3.5mm Jack allows monitoring of channel selected by DIP switches (S17).



**6.6.11 Test Headers & Links**

The following links are for factory use only and should not be used!



Part Reference	Type	Function
J10	6-pin Molex	Test Outputs
J22	2-pin Header	Test Mode Enable
J25	2-pin Header	Reset
J26	2-pin Header	Oscillator disable
J27	16-pin IDC	FPGA Configuration / JTAG
J28	10-pin IDC	Test Outputs – U30
J29	10-pin IDC	Test Outputs – U31

## 6.7 Card Format

### 6.7.1 GPIO

The card has six, open collector, voltage free, Darlington outputs, made available on the module RCU. The outputs may be set to be:

**Immediate** – i.e. asserted immediately any of the relevant error conditions occur – or:

**Asserted after a delay.** See Sections 6.6.4 and 6.6.5.

### 6.7.2 600-04-80 RCU

The RCU is equipped with a 15 way D and a 25 way D socket, with the connections shown below. The GP Outputs are low impedance when the stated condition is true: high impedance when false.

#### GPIO Connections

Pin	D25 Fixed Socket
1	A OK +
14	A OK -
2	Not connected
15	B OK +
3	B OK -
16	Not connected
4	C OK +
17	C OK -
5	Not connected
18	D OK +
6	D OK -
19	Not connected
7	'B' Selected +
20	'B' Selected -
8	Not connected
21	'D' Selected +
9	'D' Selected -
22	Not connected
10	Not connected
23	Select A/C C/over to C (Gnd to Select C)
11	Not connected
24	Select B/D C/over to D (Gnd to Select D)
12	Not connected
25	Not connected
13	Ground

The output provides a low resistance 'ON' state for an OK indication, changing to a high impedance 'OFF' state for a FAIL indication, if one or more of the following detectors has an error: -

- Feed A, input signal level too low.
- Feed A, input signal level too high
- Feed A Tone Error
- Feed A Phase Reversed with respect to B (detector only active if stereo mode enabled)

This is repeated in the same style for Channel B, C, and D.

Note:

- The logical operation of pins 23 and 24 may be inverted by on-board links J17 & J18.

## Signal Connections

Pin	D15 Fixed Socket
1	Ground
9	A +
2	A -
10	B +
3	B -
11	Ground
4	A/C changeover Out +
12	A/C changeover Out -
5	C +
13	C -
6	D +
14	D -
7	Ground
15	B/D changeover Out +
8	B/D changeover Out -

### Note:

- Signal Input impedance may be set to 600R or high-impedance (>50kR) for the currently selected or un-selected signal.
- For the GP outputs, the maximum output current must be limited to 160mA and the maximum external voltage must not exceed 40V. The maximum power dissipation must not exceed 160mW.

## 7. COSMOS SOFTWARE

### 7.1 Introduction

The **COSMOS** software portrays the **Sentinel** Signal Monitoring Racks and Cards in a “Windows Explorer” type format. In Multi-Rack systems a list of racks is shown in the window and double clicking on a rack icon lists the PSU’s and cards fitted into that rack.

All cards in the Sentinel range are auto detected and COSMOS will automatically recognise a card as it is plugged into a frame and update the inventory for the rack in question.

#### 7.1.1 Installing a CANBUS controller card

The CANBUS controller card is normally supplied with full versions of the **COSMOS** application software. It requires a half-length PCI slot, in a desktop PC running Microsoft Windows NT 4 Workstation. Microsoft NT4 Service Pack 4 (or later) must be installed.

- Shut down the PC
- Remove the cover and fit the PCI card
- Fit the cover and restart the PC
- Log on with Administrator privileges
- From the floppy disk supplied (or from the Trilogy CD) locate the setup program for the PCI331 CANBUS card.
- Run this software and re-start the PC as prompted.
- In Windows Control Panel, locate the Devices icon. Open this and from the list, select the device driver **c331**. The entry must read “**Started**” and “**Automatic**”. If either of these is incorrect, make changes as necessary. The c331 driver **must** be started before communication with the Sentinel frame can be established.

#### 7.1.2 Installing COSMOS software

The software will have been provided by Trilogy on a CD, a pair of Floppy disks or via the Trilogy Web site. In either case the install file is a single file named **setup.exe**. Further instructions are provided in a **readme.txt** file located in the root of the CD. Check this file for other information on the software supplied, including any patch updates.

Using Windows Explorer, locate this file and run it by double clicking. Accept all the defaults offered by the setup wizard, which will add all the necessary files and add shortcuts to your Windows Start Menu. There is no need to restart your PC.

Demonstration software includes a frame simulator, which is described in section 7.4. This may be installed on a Windows 9x platform, whereas the full version will only operate on a Windows NT4 platform.

#### 7.1.3 Running the Software

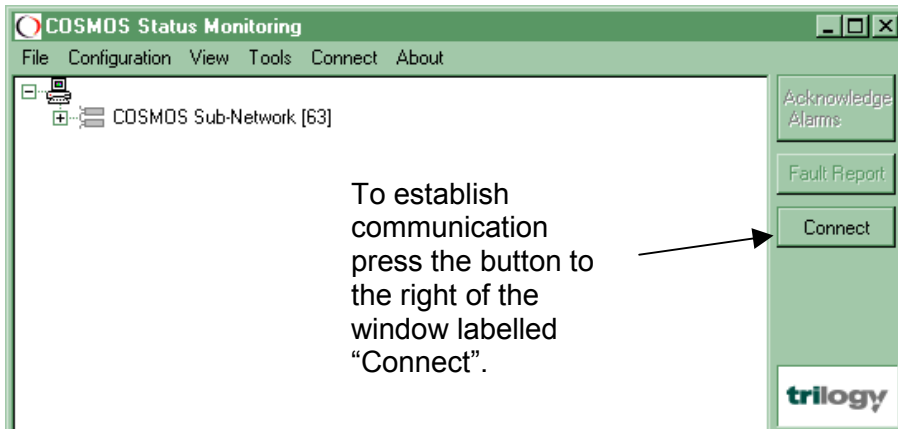
From the Start Menu locate the program folder “**Sentinel**” which contains the item “**COSMOS**”. Run the programme.

### 7.1.4 Configuring the CANBUS connection

The **COSMOS** software should be configured to communicate with the Canbus controller card. After starting the main programme as above, click the **Configuration** menu, then **Network Interface** and select **ESD Canbus** from the list displayed. On the same screen, set the **device address** to **0**. Click **Apply**, then **OK**. Press the **Configure** button and set **CAN Net = 0**. Click **Apply**, then **OK**. Close the **COSMOS** application and re-start.

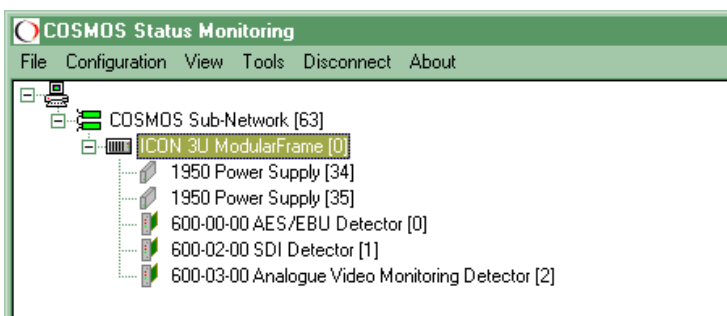
### 7.1.5 Enabling COSMOS Control

When the software is opened no frames will be shown in the window, as communication needs to be established with the Rack Controller Cards within each rack.



Three changes will occur:

- The button text will change to Disconnect.
- The **COSMOS** sub-network icon colour will change to green.
- The text on the status line at the bottom left of the screen changes from “Offline” to “Online”.



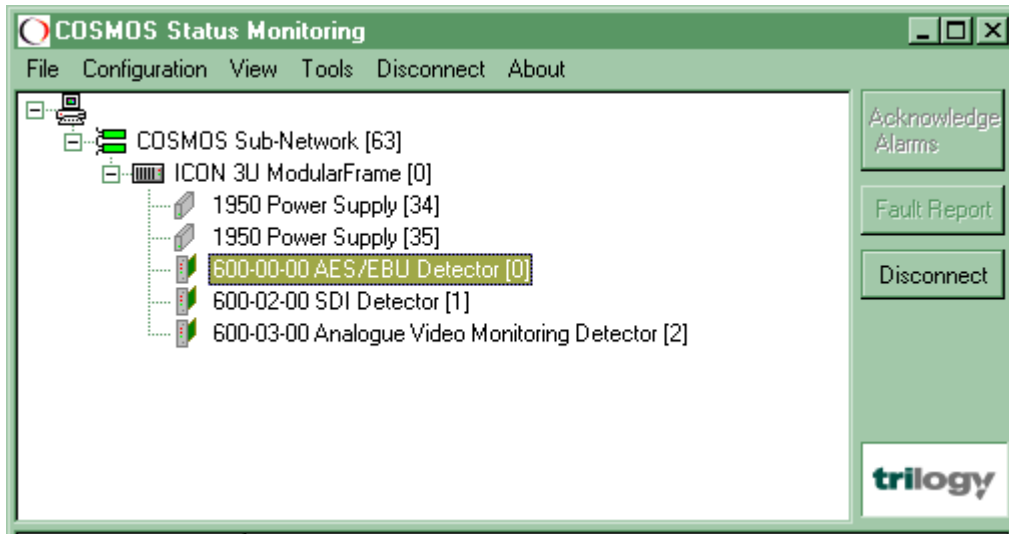
Click on the + sign to the left of the **COSMOS** sub-network icon to display the network tree. The tree view can now be expanded further to display individual modules.

Details of individual modules are given in section 7.3 (Card Status & Settings).



## **7.2 COSMOS Status Monitoring Menus**

In the Status Monitoring window a number of drop down menus are available. Sub-menus are described in subsequent sections.



### **7.2.1 File**

The File menu carries options to save the current system settings, load an alternate set of system settings or create a new system.

### **7.2.2 Configuration**

This menu has four options, described below.

#### **7.2.2.1 Access level**

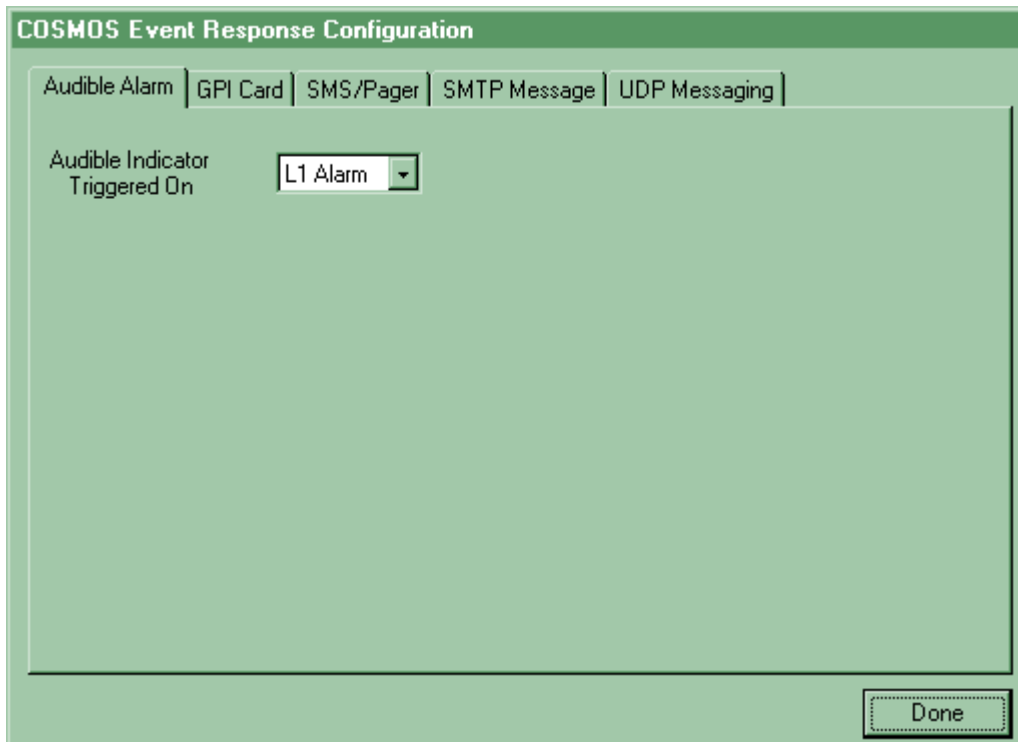
This allows three levels of access to the system via user passwords. The levels are defined as Monitor, Configure and Administer and can be allocated passwords according to the level required for different operators. The current Access level is displayed on the status line at the bottom of the main window.



### 7.2.2.2 Alarms

This is one of the most important menus and is used to determine what actions the software takes at the different Alarm Levels.

From the tabs available, select an action required and then set the alarm trigger level, for that action to occur.



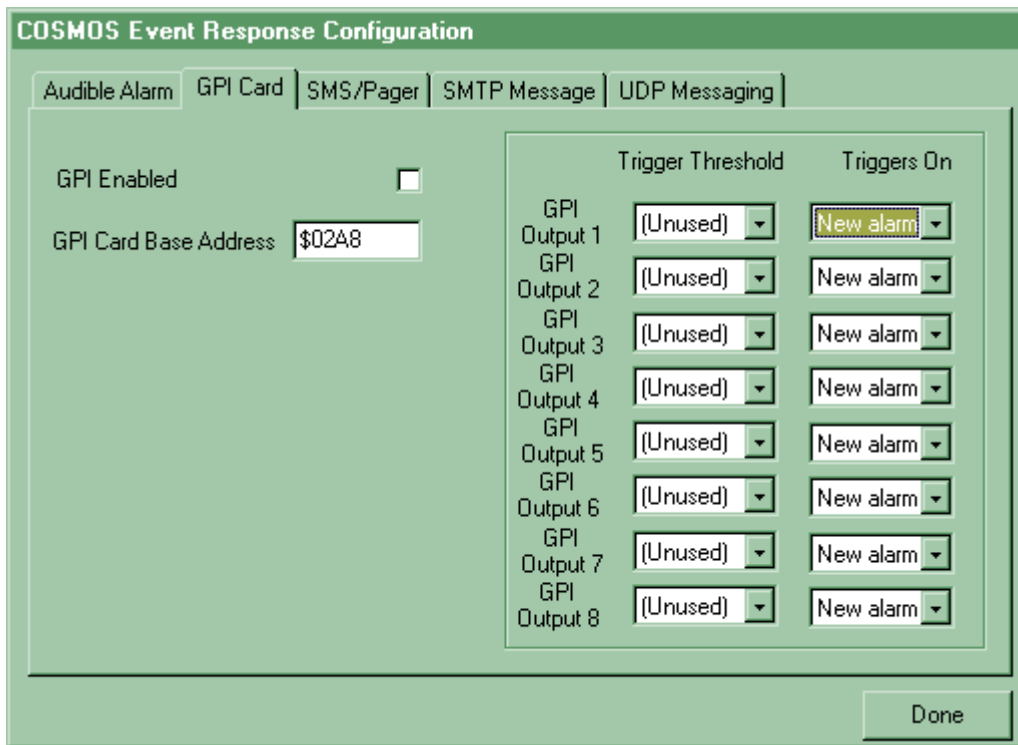
Complete the information in the boxes on each page selected and check the **enable** box. Click on the **Done** button when all the required pages have been completed. Note that to use the GPI's in this menu a GPI card has to be purchased from Trilogy Broadcast and inserted into the controlling PC. These settings are independent of the GPI settings on the individual cards.

#### 7.2.2.2.1 Audible Alarm

One of the 4 alarm levels may be set to trigger the standard Windows "default" sound. This Windows file with the suffix .wav file may be changed via the system control panel.

### 7.2.2.2.2 GPI Card

The optional PC based GPI card should be purchased from Trilogy Broadcast to allow this section to operate. The screenshot on the following page shows that the GPI card must be enabled with the checkbox and have the base address set correctly. This may be verified from Windows Control Panel. The eight GPI outputs provided on the card may be set to trigger on reaching any of the 4 alarm levels. A second option allows the GPI output to be asserted as all errors pass the threshold, or only on new errors.



### 7.2.2.2.3 SMS Pager

The screenshot shows the 'COSMOS Event Response Configuration' dialog box with the 'SMS/Pager' tab selected. The dialog has a title bar and a menu bar with options: Audible Alarm, GPI Card, SMS/Pager, SMTP Message, and UDP Messaging. The main area contains several configuration options:

- SMS/Pager Messaging Enabled:** A checkbox that is currently unchecked.
- SMS/Pager Triggered On:** A dropdown menu.
- Number to dial:** A text input field containing 'edtSMS\_PagerNumber'.
- Message Type:** Two radio buttons, 'Terse' and 'Verbose', both of which are unselected.
- Comms. Device:** A dropdown menu.
- Service Provider:** A dropdown menu.
- Message Precursor:** A text input field containing 'COSMOS Status monitoring platform reported event'.

Buttons for 'Config. Utility', 'Device Setup', 'Dial Parameter', 'New', 'Edit', and 'Done' are also visible.

The SMS / Pager alarm may be configured to notify an operator by

- The GSM network, using the SMS text message facility
- An alphanumeric message pager

In either case, a modem and telephone line must be attached directly to the COSMOS PC.

**7.2.2.2.4 SMTP Message**

The screenshot shows a configuration window titled "COSMOS Event Response Configuration" with a green header. It contains several tabs: "Audible Alarm", "GPI Card", "SMS/Pager", "SMTP Message" (which is selected), and "UDP Messaging". The "SMTP Message" tab is active and contains the following fields:

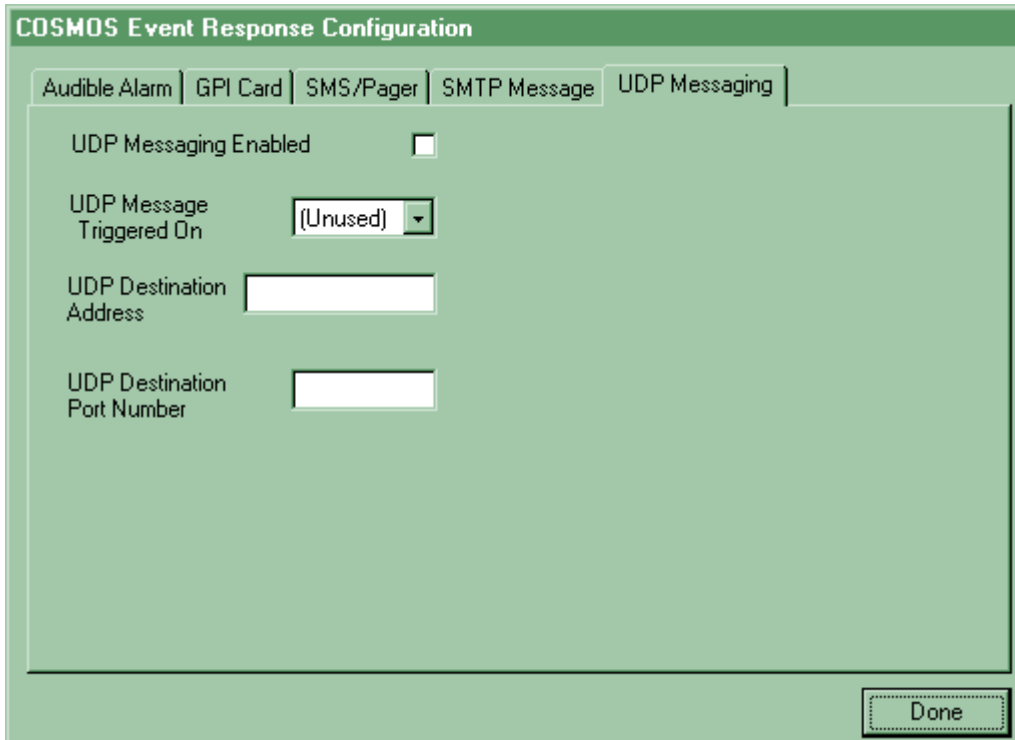
- "SMTP Messaging Enabled" with an unchecked checkbox.
- "SMTP Message Triggered On" with a dropdown menu showing "(Unused)".
- "SMTP Host" with an empty text input field.
- "Destination Addresses" with an empty text input field.
- "Message Precursor" with a text input field containing the text "COSMOS Status monitoring platform reported event".

A "Done" button is located at the bottom right of the dialog box.

The PC running **COSMOS** must have LAN access to an SMTP server, for example, Microsoft Exchange Server. Enable the SMTP option and set the event trigger threshold as before. The SMTP Host field is the computer name of the mail server. The Destination Address may be an internal or Internet address. Multiple addresses may be separated by a semicolon (;).

### 7.2.2.2.5 UDP Messaging

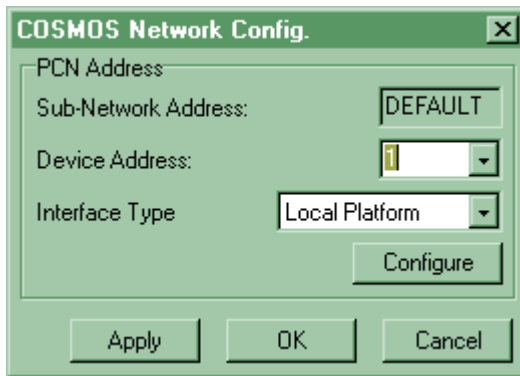
COSMOS includes the option to send alarm messages via UDP (User Datagram Protocol). This requires an application to receive and decode the message on the recipient PC. This type of application is not normally commercially available and would need to be custom written.



The screenshot shows the 'COSMOS Event Response Configuration' dialog box with the 'UDP Messaging' tab selected. The dialog has a green header and a light green background. At the top, there are five tabs: 'Audible Alarm', 'GPI Card', 'SMS/Pager', 'SMTP Message', and 'UDP Messaging'. The 'UDP Messaging' tab is active. Below the tabs, there are four configuration options: 'UDP Messaging Enabled' with an unchecked checkbox; 'UDP Message Triggered On' with a dropdown menu showing '(Unused)'; 'UDP Destination Address' with an empty text input field; and 'UDP Destination Port Number' with an empty text input field. A 'Done' button is located in the bottom right corner of the dialog.

UDP messaging may be configured to send a message within a local domain. The software does not currently allow UDP messaging to leave the domain.

### **7.2.2.2.6 Network Interface**



This form allows the PC based interface between **COSMOS** software and Sentinel hardware to be configured. Live connection is only possible when the interface type is set to ESD Canbus. This is preset in the full (NT4) package. The demonstration package is preset for “Local Platform” as shown in the screenshot (left). See section 7.1.4.

### **7.2.2.3 Printer**

Used to print a hard copy of the Error Log to an available Windows printer.

## **7.2.3 View**

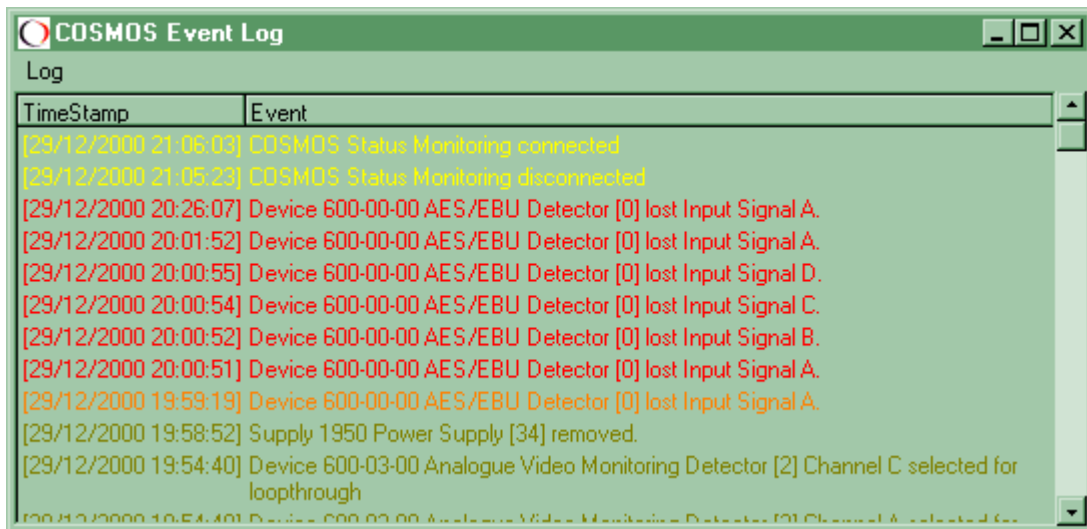
### **7.2.3.1 Network**

Gives a graphical “Windows Explorer” style display. This is the default setting.

### **7.2.3.2 Physical**

This option shows the physical connections to the system.

### **7.2.3.3 Event Log**



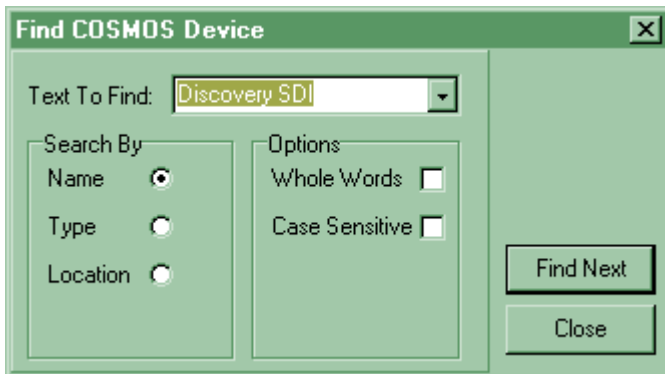
Displays the Error Log in list form and chronological order.

#### **7.2.3.3.1 Device Palette**

This menu option is only available when **COSMOS** is disconnected from **Sentinel** hardware. When selected, a pop-up window lists all the modules which this copy of **COSMOS** software is currently configured to recognise.

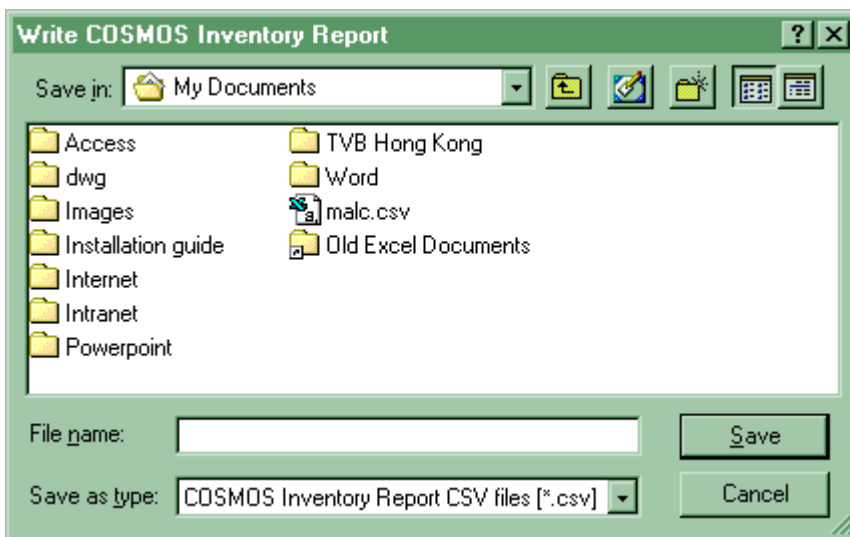
## 7.2.4 Tools

### 7.2.4.1 Find Device



This menu allows a specific device to be located within the system.

### 7.2.4.2 Inventory



This menu option automatically generates an inventory report of the current network. It is produced in csv (comma separated) format that allows easy manipulation in Microsoft Excel. The current modification status of all hardware is reported.

### 7.2.5 Disconnect

Clicking on this menu item disconnects **COSMOS** from the **Sentinel** system. Clicking the Disconnect button has the same effect (see 7.2.7). On disconnection, the labels change to Connect so that **COSMOS** may be re-connected.

### 7.2.6 About

This menu item carries important information about the **COSMOS** software, as currently installed. It provides details of the core software version, plus all the additional library files loaded during the installation phase.

If you contact Trilogy Broadcast with technical queries about the product, you may be asked to provide details from this section of the program.



### **7.2.7 COSMOS Main Window Control Buttons**

Three further on-screen buttons are provided on the right side of the main window. These are:



- Acknowledge Alarms. This button flashes alternately grey/red when a fault is detected. When the button is pressed, the colour changes to steady red. See section 7.2.2.2 for details of Alarm configuration.
- Fault Report prints a report to the current default Windows printer.
- Disconnect mirrors the action of the same item on the pull-down menu. See section 7.2.5.

### 7.3 Card Status & Settings

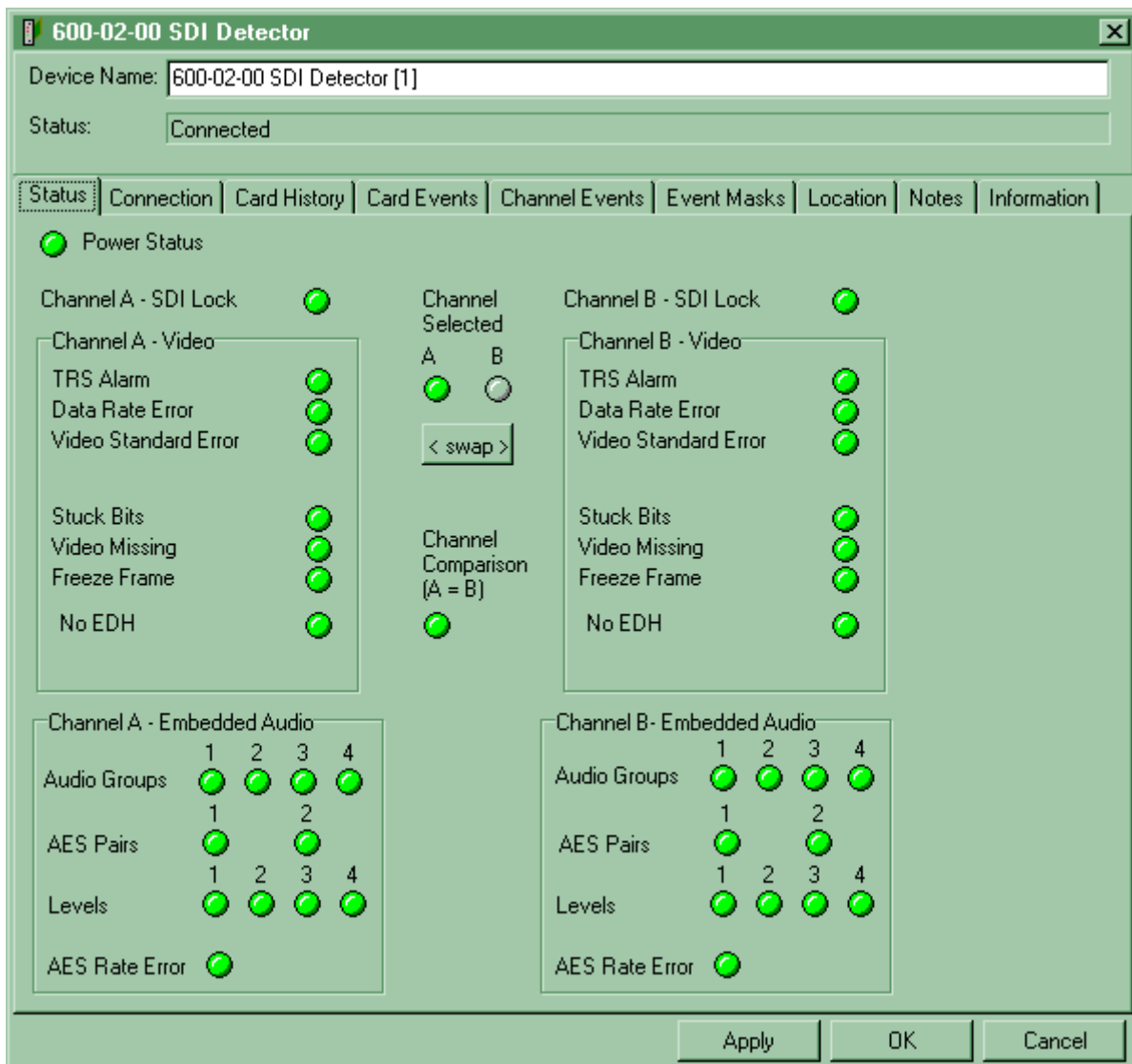
The status of individual cards within a **Sentinel** frame can be viewed using the controlling PC. On cards equipped with changeover circuitry, the changeover action may also be controlled.

To view an individual card, right-click the card icon and from the drop-down menu, select **“Show”**.

A window will appear according to the type of card selected and by selecting the appropriate tabs the following information and control options will be available. The following pages use the 600-02-00 SDI Detector as an example.

#### 7.3.1 Status

Selecting the **“Status”** tab shows the current status of the signals being monitored on the card and displays any errors that have been detected.



On this page, a green LED indicates signals being monitored, which are present and correct. A red LED indicates signal loss.

Data, or Errors not enabled, are shown by a grey indicator. At the centre of this window an indicator shows the status of the changeover switches where appropriate.

Each of the detector cards has four settings, selected by DIPswitches on the card, for control of the changeover function. These options are, Manual (from the card), Automatic (on loss of signal), GPI/O (using a GPI to the card) and **COSMOS**. If the changeover function on a card has been locally set to **COSMOS** control then the output from the changeover switch can be toggled with the button labelled <swap>.

If the card is set to Automatic then the status window shows the output status of the changeover dependent on signal integrity.

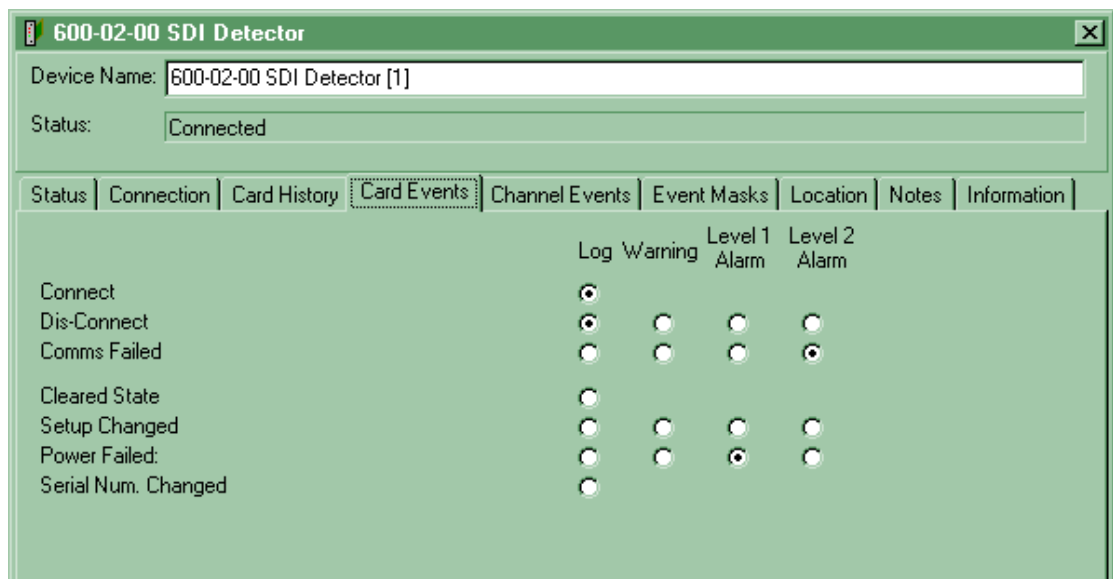
### 7.3.2 Connection

The second tab shows the Network, Device and Card address for the card being viewed.

### 7.3.3 Card History

The third tab shows the Serial Number and hardware version of the card and has the facility to show any change notes of relevance to the card.

### 7.3.4 Card Events



Along with the next tab (Channel Events) this is one of the most important pages and allows the classification of alarms raised into 4 categories of importance. These are labelled Log, Warning, Level 1 and Level 2. Level 2 is the highest importance. The events classified on this page are common to the whole of the card currently viewed.

We will see later that these ratings of alarm importance determine what actions are taken by **COSMOS** when a problem is detected.

An alarm rated as “Log” is simply logged in the error log file. A Warning, Level 1 or Level 2 Alarm will also be logged in the error log file but in the Configuration/Alarm/Event Response Configuration menu, a range of actions by **COSMOS** can be assigned to these alarm levels.

For example, a Warning level could be set to trigger an audible warning at the controlling PC and a GPI to illuminate an “Alarm” lamp. A Level 1 alarm could be set to fire a number of GPI’s which sound buzzers in remote areas or signal to routers or automation control

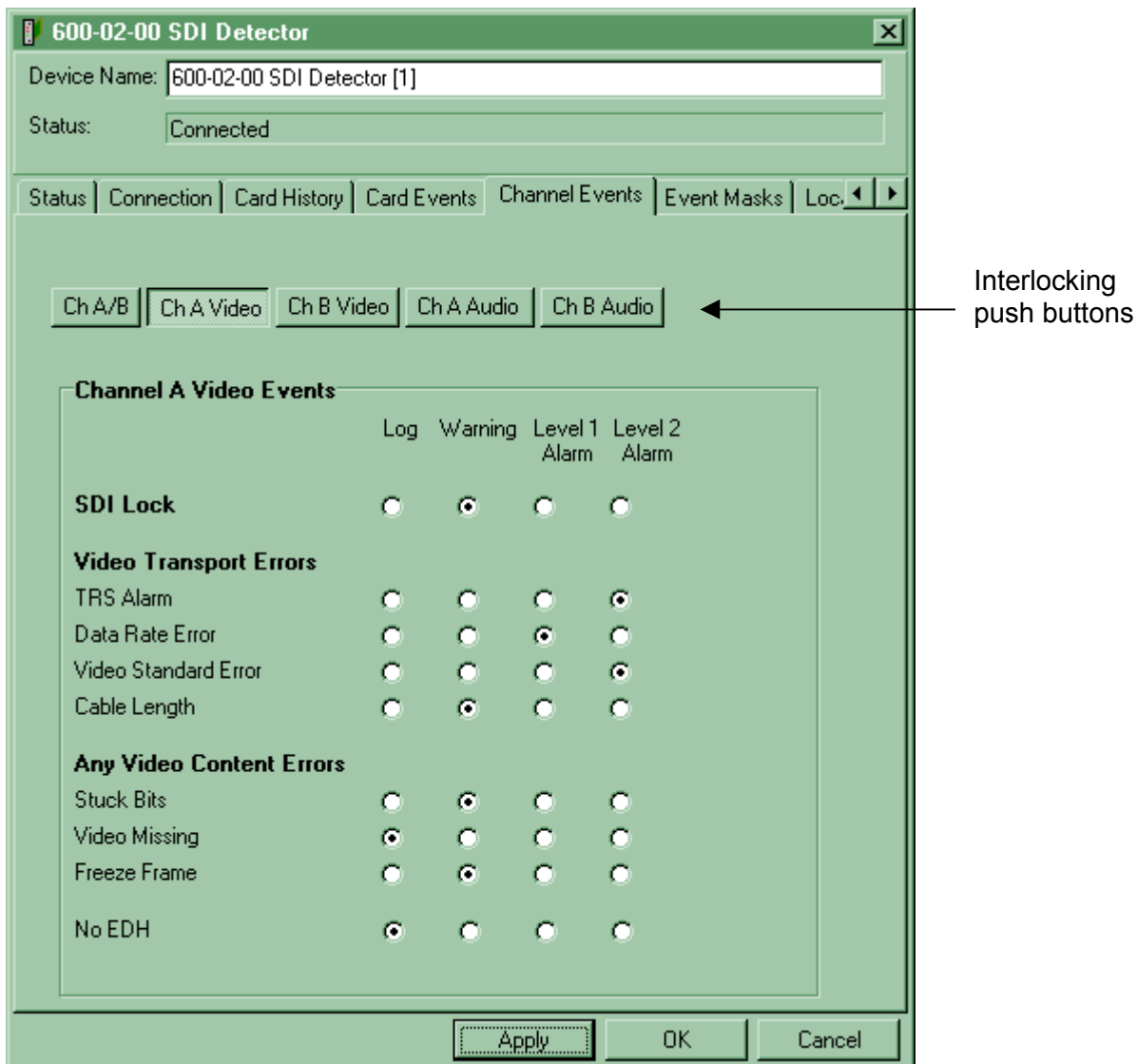
equipment. A Level 2 alarm could be set to fire further GPI's and to send text messages to mobile phones or pagers.

Set the buttons of the events that are to be monitored according to the level of alarms required.

After completing the page check the **“Apply”** and then the **“OK”** buttons.

### 7.3.5 Channel Events

Events related to the actual signal monitoring may now be mapped to the four alarm levels described in the previous section. Select the channel to be configured using the interlocked push buttons (see diagram below). The SDI card (600-02-00) shown carries 5 interlocked buttons relating to video and embedded audio for both A and B channels, plus a separate page of events related to the changeover function. Now assign an appropriate alarm level to each fault condition using the 4 radio buttons alongside each parameter.



Set the events as required, for all of the channels on each card. Events with no buttons set will be ignored by **COSMOS** and the appropriate LED on the status page will appear grey. After completing the page click the **“Apply”** and then the **“OK”** buttons.

### 7.3.6 Event masks

These masks apply on a card by card basis and can be used if maintenance is being carried out, or changes are being made. They can also be used to allow for times of day when certain signals may not be present or transmitted.

When a type of mask is checked, the buttons Always, One Off and Periodic become active. These allow the required masking times to be selected.

If One-Off is selected then a start date and time can be selected followed by a finish date and time.

If Periodic is selected then days and times can be selected from the pull down menu that appears.

To activate the Masks click **Apply** then **OK**.

**7.3.7 Location**

This page allows the user to insert location or geographical site information for easy physical location of the card.

**7.3.8 Notes**

Additional user notes may be entered here for each module.

**7.3.9 Information**

This page will give front panel control, together with rear view connection details, and provide access to the card user manual.

## 7.4 Sentinel Rack Frame Simulator

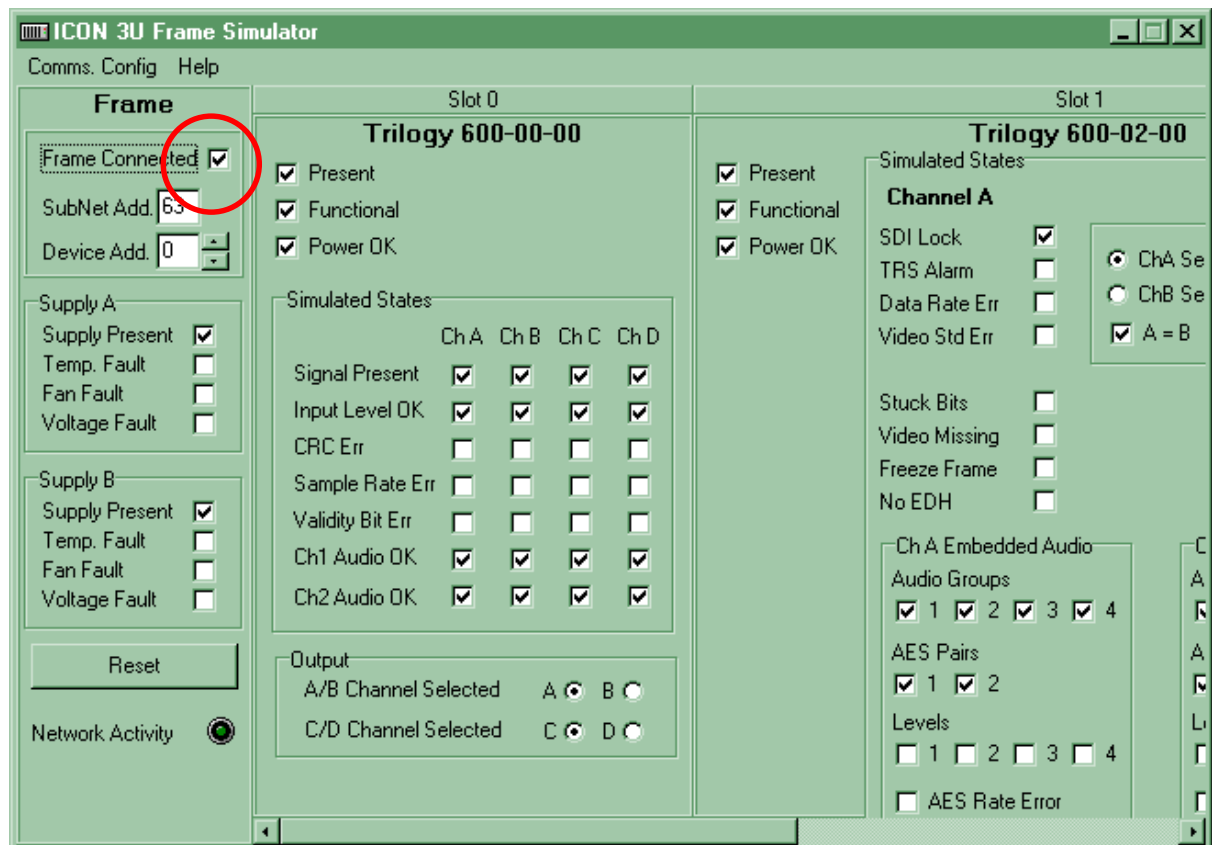
The simulator is a second programme, used for demonstration only. It mimics the action of a standard **Sentinel** card frame and displays on screen check boxes, which may be ticked or cleared to simulate real time signal errors.

The “**Sentinel** Frame Simulator” Programme should be run whenever the “**COSMOS** Demo” software is run and it is recommended that the frame Simulator programme is opened first.

### 7.4.1 Enabling the Rack Frame Simulator

After opening the programme, check the box labelled “Frame Connected” near the top left of the window.

The Frame Simulator window can now be moved to the side of the desktop so that just the left hand half is visible.



## 7.5 Demonstrating the Operation of alarms

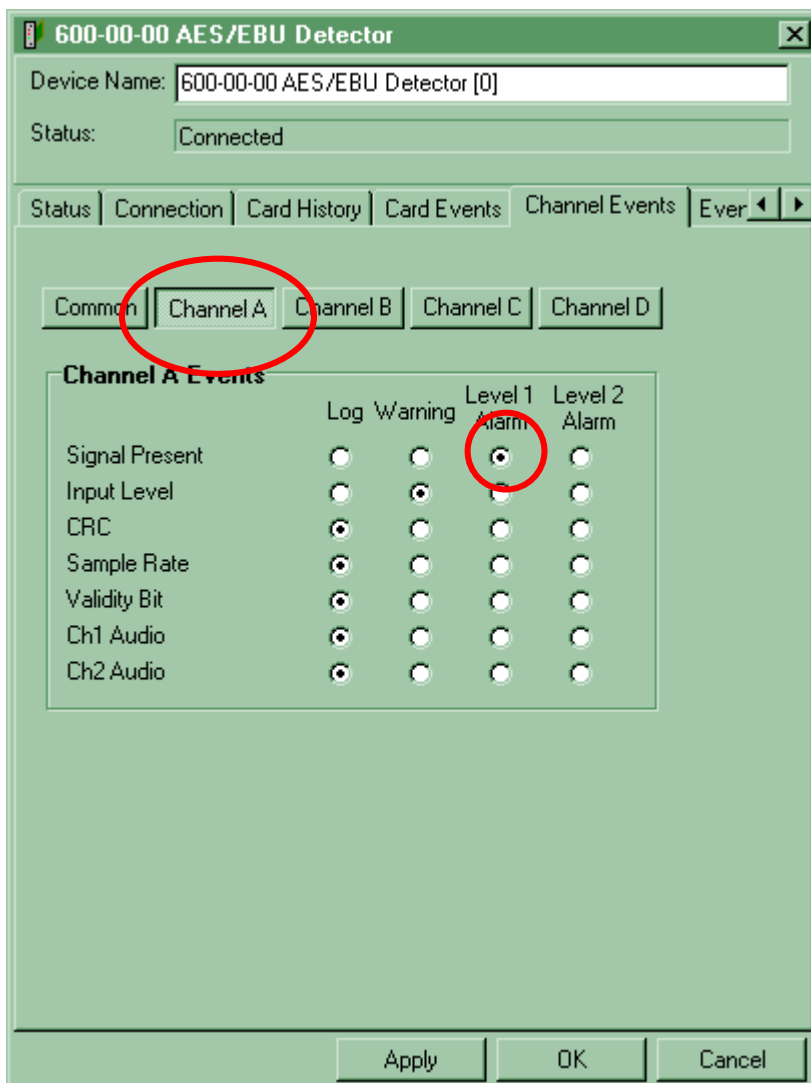
The operation of the alarms can be demonstrated after the card status and settings pages have been completed on the Frame Simulator.

A tick in the appropriate box on the Simulator denotes the presence of a signal. Checking the box to remove the tick simulates the loss of that signal.

Similarly, checking the appropriate box to insert a tick simulates a data error, or loss.

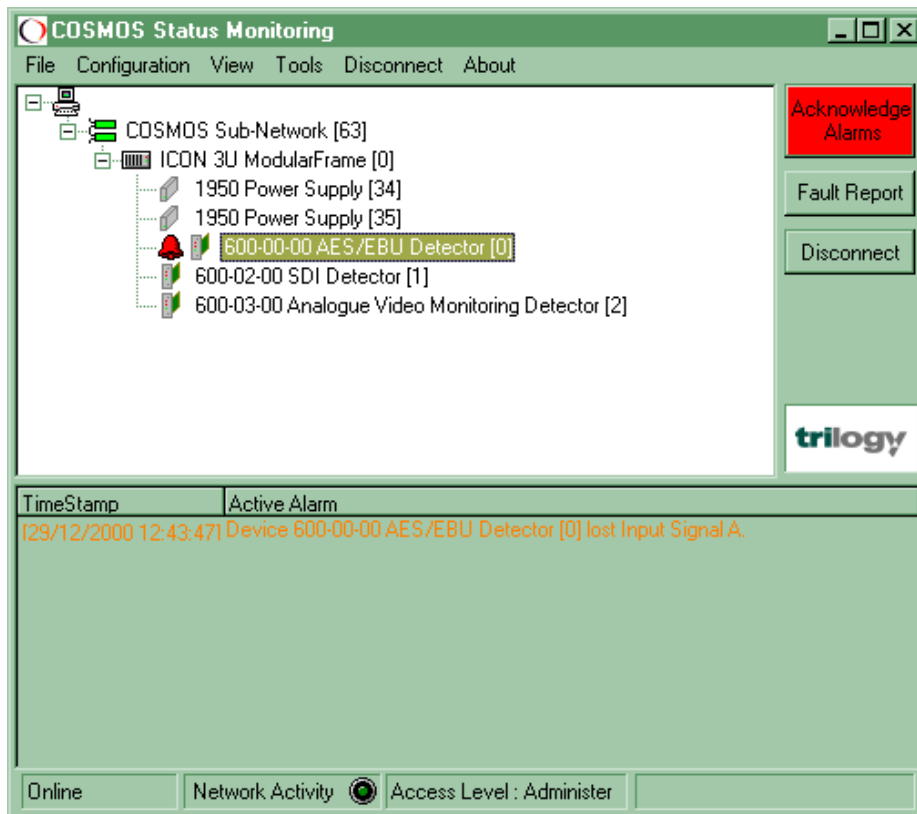
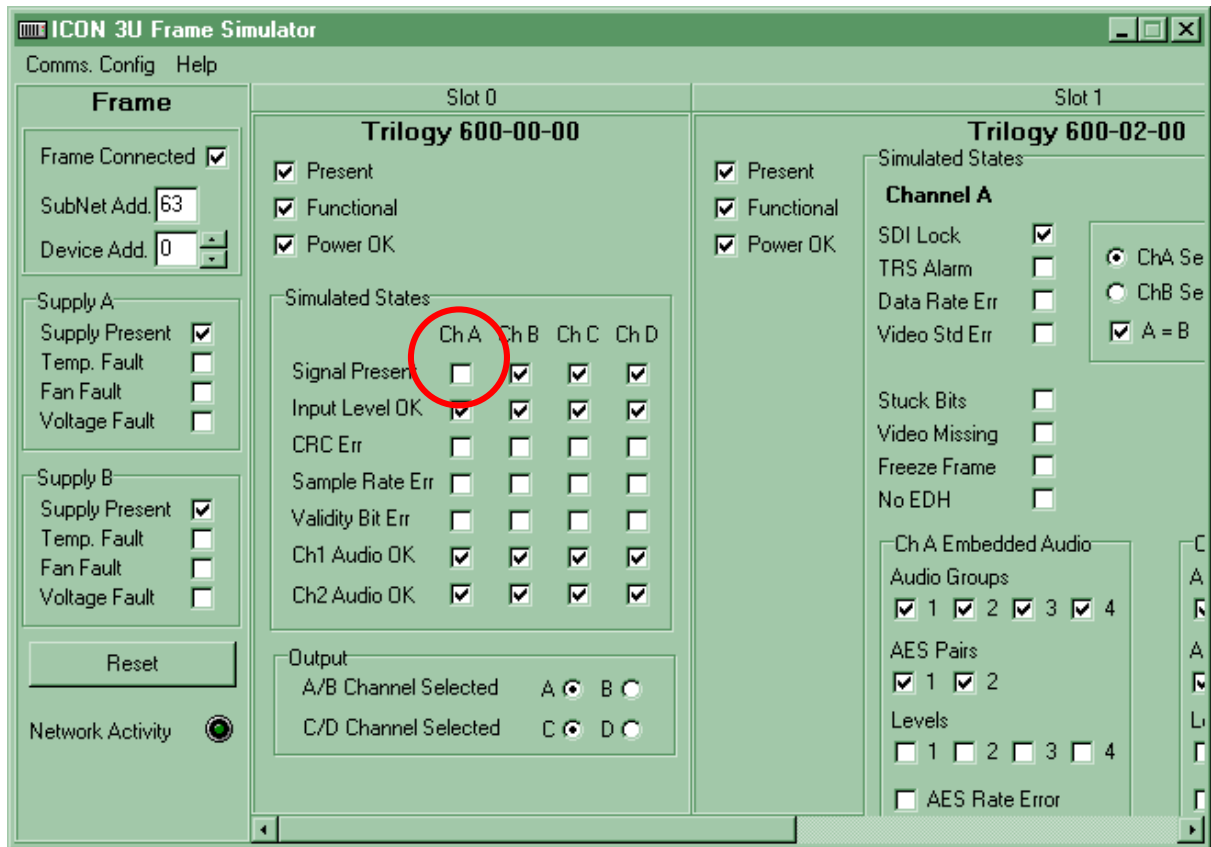
### 7.5.1 Demonstrating the Loss of an AES Stream

- Enable the Frame Simulator as described in section 7.4
- Enable **COSMOS** Control as described in section 7.4.1
- In the Status Monitoring window select the AES/EBU card by right clicking.
- Select Show.
- Select the **Channel Events** tab.
- Press the Channel A button
- Set the Signal Present option to Level 1 Alarm.
- Press Apply then OK to close this view.





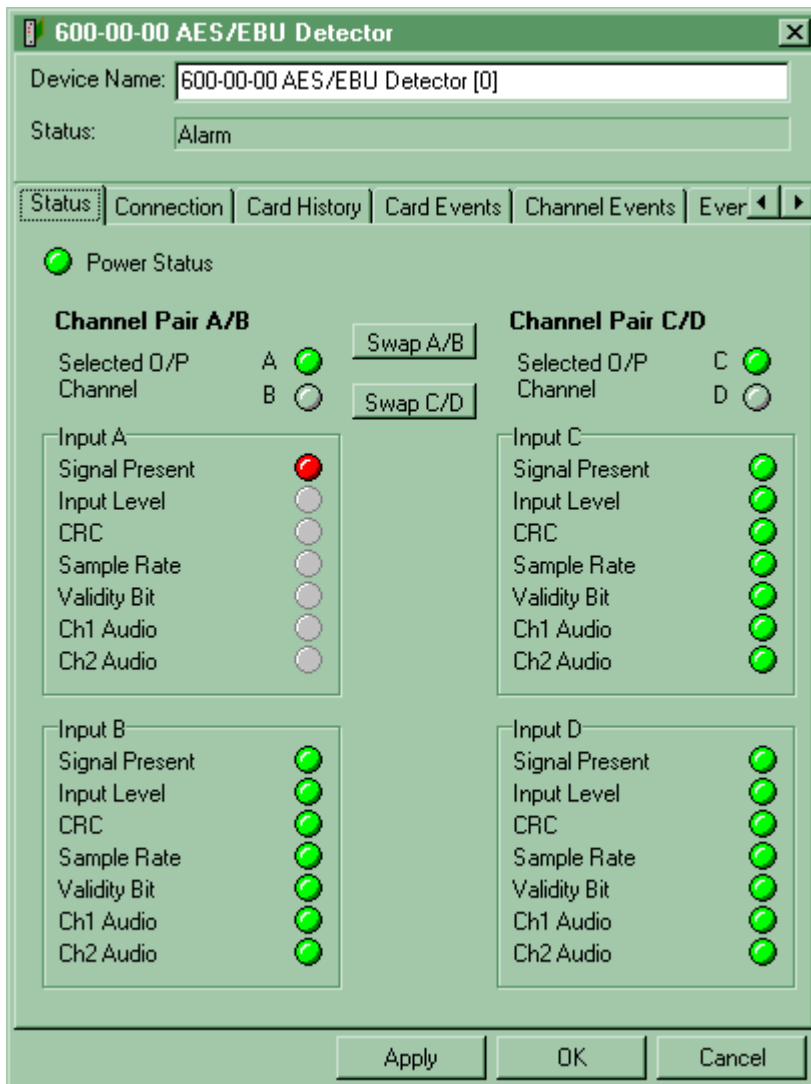
On the Frame Simulator window click on the **Ch A Signal Present** box to remove the tick.



On the **COSMOS** window you will now have **Acknowledge Alarms** flashing red and a flashing red alarm bell next to the AES/EBU card.

The lower section shows the Log entry and the fault detected

The AES/EBU Card can be selected by right clicking on the icon and then clicking on *Show* as described in section 7.3. The status tab is displayed by default and shows the exact fault detected.



Double click on the **3U Frame** icon to close the frame then the alarm bell moves to the frame to indicate that the fault is on a card within that frame.

If the **Acknowledge Alarms** button is now pressed then the button and the Bell change to a steady red. This indicates that the fault has been acknowledged but persists.

The signal can be restored by checking the **Input A Signal Present** box on the Frame Simulator. The **Acknowledge Alarms** box will return to grey and the bell will disappear.

The procedure can be repeated by removing the tick from the Audio Present boxes to simulate loss of Audio.

## **8. TROUBLESHOOTING COSMOS**

Initially, most problems are caused by failure to establish a connection between PC and Sentinel hardware. Check all of the following: -

### **8.1 Starting Out**

- Operating system is Microsoft Windows NT4 Workstation with Service Pack 4 or later (SP 6A preferred) **OR** Windows 2000 Professional
- If other Operating System components have been added, the Service Pack should be reapplied in line with Microsoft recommendations.
- To make any system changes (new hardware or software installation), you must always log on as Administrator, or with Administrator privileges.

### **8.2 Install The Canbus Card**

- Shut down and Power Off the PC
- Remove the cover and fit the CANBUS communication card into a vacant PCI slot
- Replace the cover, re-power the PC and log-on as Administrator
- From the supplied CD or disk, install the ESD CANbus PCI-331 drivers
- Follow all prompts and re-boot the PC if prompted
- In Windows Control Panel, find the Devices applet, run this, then locate the C331 driver from the list. Highlight.
- Set the C331 parameters to “started” and “Automatic”.
- if the driver is not currently running, press the “Start” button
- If the C331 driver will not start, either the CANbus card is not correctly fitted or a hardware conflict exists in your computer.

### **8.3 Check Windows Networking**

COSMOS utilises some standard Windows components, as follows: -

1. **TCP/IP Protocol.** This is the Windows NT/2000 default protocol and will be present if your PC has an Ethernet LAN card installed. If not, you must add the TCP/IP protocol from within Windows Control Panel. Network. Check here first. If the PC is not connected to a LAN and/or does not have an Ethernet card, install the TCP/IP protocol, selecting “Microsoft Loopback Adaptor” from the presented adaptor list. When required, set the IP address to xxx.xxx.xxx.xxx and the subnet mask to 255, 255, 255, 192.
2. **Windows Messaging.** The standard messaging component is used for email notification (SMTP). An email check or email account is not required, although if present will not cause any problems.
3. **Windows RAS.** The Remote Access Service is used in conjunction with a modern and analogue telephone line to activate the pager notification. Adding a modem, then following the “wizard” will add all necessary Windows component files.

**Note:** After any of 1, 2, 3 above, reapply NT Service Pack in line with Microsoft recommendations.

## 8.4 Configuration

- On starting COSMOS, select Network Interface from the Configuration menu
- Ensure that the device is set to “ESD CAN” with (usually) device address = 0. This is the installation default
- The CANBUS device address (set in software, as above) **MUST NOT** conflict with any frame address (set in hardware: see next).
- Set each Sentinel frame address(es) with the dual rotary switches on the rear of each frame. The dual controls set address tens and units. Each frame **MUST** be unique and **MUST NOT** conflict with the PC card address (see above).

## 8.5 Connection

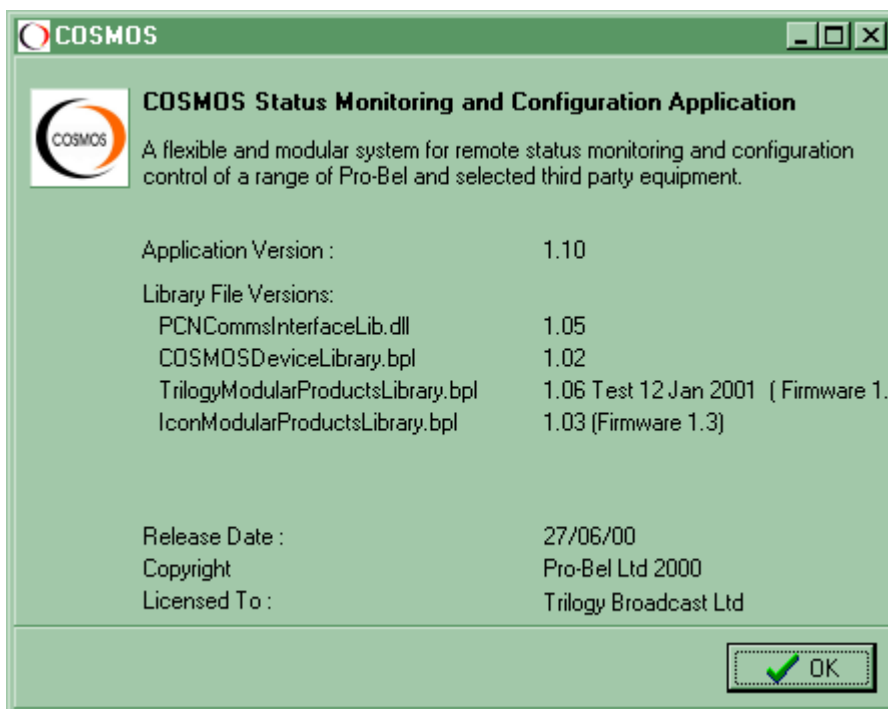
Ensure the cable is connected to the PC CANBUS connector (D9 on the PCI expansion card) and **not** to the computer serial post or ethernet connector.

Use **only** the supplied adaptor: those supplied as part of a Trilogy intercom system will not operate.

Connect to either upper or lower CANbus connector on the 1250 controller at the rear of the Sentinel frame.

## 8.6 Version Information

If you need further assistance after completing all of the above, please have the following information available: -



From within the COSMOS application, select the ABOUT menu. Take note of all the version information provided here.