

# Contents

---

<b>1</b>	<b>Introduction</b>	<b>2</b>
<b>2</b>	<b>Installation</b>	<b>4</b>
2.1	Signal I/O and control pinout	5
2.2	Crosspoint control	7
<b>3</b>	<b>Configuration</b>	<b>10</b>
3.1	Input set-up	12
3.2	Configuring an 8x1 switcher	13
3.3	Source expansion	14
3.4	Level expansion	17
3.5	Building a 64 input switcher	19
3.6	Using the 4408 with the 4405 re-framer	23
<b>4</b>	<b>Trouble shooting</b>	<b>24</b>
<b>5</b>	<b>COSMOS status monitoring</b>	<b>26</b>
<b>6</b>	<b>Specification</b>	<b>28</b>
<b>7</b>	<b>Ordering Information</b>	<b>30</b>

# 1 Introduction

---

The 4408 is an eight input, one output AES/EBU digital audio switcher with a choice of rear connector to support balanced or unbalanced I/O. It is designed to fit in the 1050 3U and 1051 1U Pro-Bel ICON modular product rackframes.

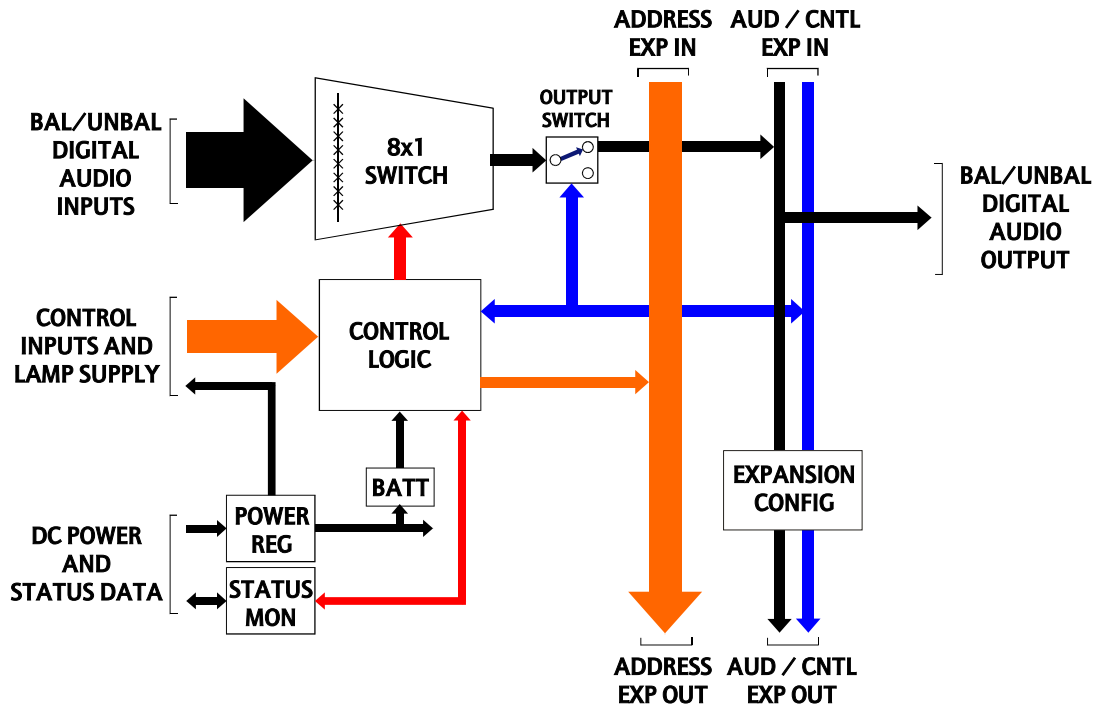
The switcher provides a solution for small ancillary or monitoring matrices with the benefit of simple button per crosspoint control.

The architecture of the modules allow crosspoint outputs to be bussed together to allow switchers above eight inputs to be built. In addition the AES/EBU digital audio switcher may be configured with other modules in the Pro-Bel range to form married multi-level matrices.

An onboard rechargeable battery provides retention of crosspoint settings after power loss.

Characteristics of the 4408 module are:

- I/O selectable for balanced or unbalanced operation
- easy expansion up to 64 inputs
- flexible control, with button per crosspoint or binary addressing
- synchronised switching using an external video field pulse
- can be used with the 4405 re-framer for glitch-free switching
- standalone and master slave configuration
- crosspoint memory via battery backup
- card edge yellow LED crosspoint tally display
- compatible with Pro-Bel COSMOS status monitoring

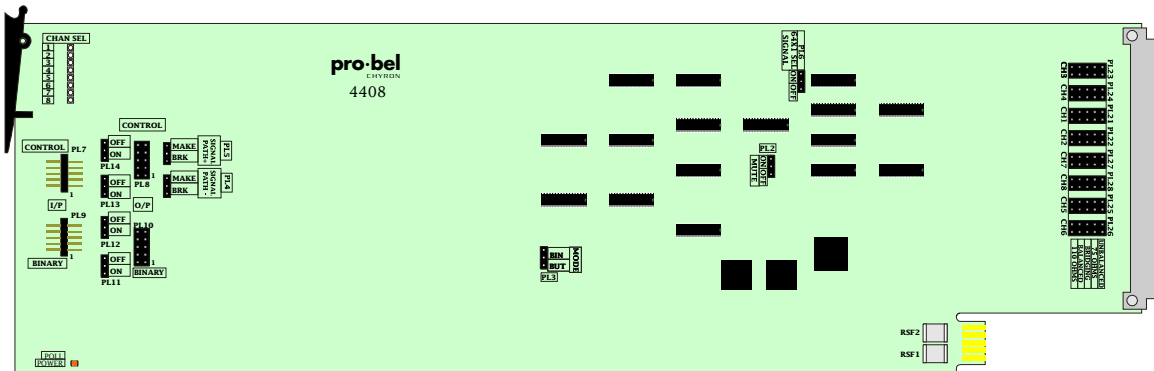


The 4408 audio switch

## 2 Installation

---

The 8x1 digital audio switch consists of an 4408 ICON module which fits in either a 1U 1051 or a 3U 1050 ICON Pro-Bel modular rackframe. It is available with two rear connectors, the 20mm K4408.2B for balanced signals and the 30mm K4408.3U for unbalanced signals.

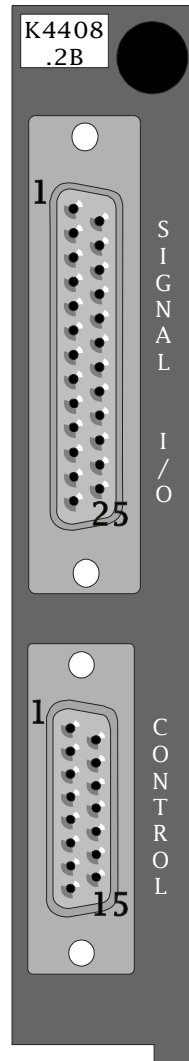


The 4408 digital audio 8x1 switch

For module and rear connector installation please refer to the appropriate ICON rackframe section of the manual.

## 2.1 Signal I/O and control pinout

The K4408.2B rear connector has one 25 way 'D' female socket for balanced signal I/O and one 15 way 'D' type socket for control.



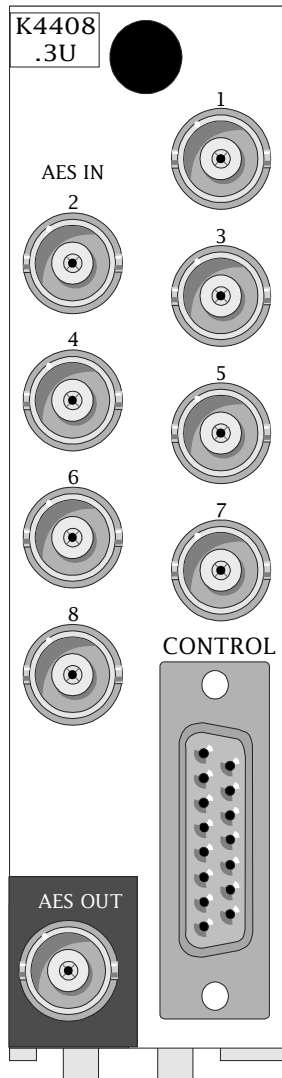
### Signal I/O (K4408.2B)

Pin	Function	Pin	Function
1	IP3-	14	IP7-
2	IP3+	15	IP7+
3	GND	16	GND
4	IP4-	17	IP8-
5	IP4+	18	IP8+
6	OP-	19	N/C
7	OP+	20	N/C
8	GND	21	IP5-
9	IP1-	22	IP5+
10	IP1+	23	GND
11	GND	24	IP6-
12	IP2-	25	IP6+
13	IP2+		

### Control Pin outs

Pin	Function	Pin	Function
1	$\overline{\text{SEL 1}}$	9	A0EXT
2	$\overline{\text{SEL 2}}$	10	A1EXT
3	$\overline{\text{SEL 3}}$	11	A2EXT
4	$\overline{\text{SEL 4}}$	12	A3EXT/64x1
5	$\overline{\text{SEL 5}}$	13	LAMP SUP
6	$\overline{\text{SEL 6}}$	14	OV
7	$\overline{\text{SEL 7}}$	15	SCREEN
8	$\overline{\text{SEL 8}}$		

The K4408.3U uses the same 15 way 'D' connector for control but BNC connectors are used for the unbalanced signal I/O. Where possible, the ICON colour scheme reserves a grey background for outputs and a white background for inputs.



Control Pin outs			
Pin	Function	Pin	Function
1	SEL 1	9	A0EXT
2	SEL 2	10	A1EXT
3	SEL 3	11	A2EXT
4	SEL 4	12	A3EXT/64x1
5	SEL 5	13	LAMP SUP
6	SEL 6	14	OV
7	SEL 7	15	SCREEN
8	SEL 8		

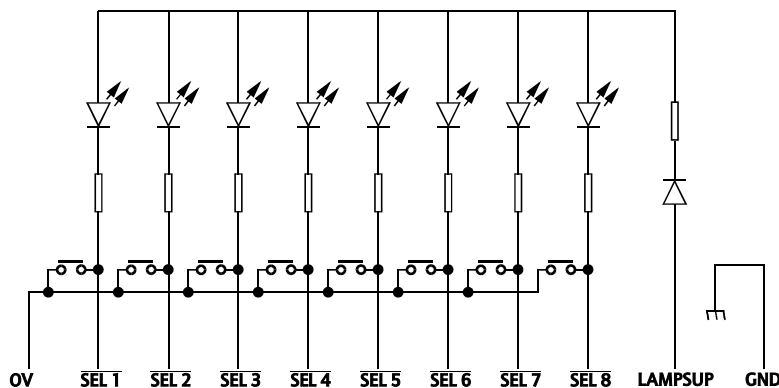
## 2.2 Crosspoint control

### Connecting button panels

Crosspoints may be selected by connecting a button panel (eg. Pro-Bel's 8 button 6200 or 16 button 6202) to the control socket on the rear panel and setting PL3 to 'BUTTON'.

The analogue audio switcher card has priority switching built in. If two keys are pressed simultaneously, the higher numbered one will be selected. This feature allows signal 'line up' to be performed quickly. To achieve this, one key must be held down and a higher numbered key pushed and released. Each time the higher numbered key is pushed and released that source will be selected, as long as the button is held down. Once the button is released, the previous source is selected again.

Two 8x1 modules may be independently controlled from a 16 button panel, such as the Pro-Bel 6202. This particular panel has two separate connectors to plug into the control socket on each module, simplifying the installation. If the internal expansion cables are fitted (see Source expansion), priority switching can be performed across several modules. The highest priority module will always be the left most, viewed from the front of the cards.



Example 8 way button panel wiring

### Using binary control

To use binary control instead of a button panel, PL3 must be set to 'BIN'. Crosspoints may be then selected by binary addressing using 12V CMOS levels.

<b>Binary addressing</b>				
<b>I/P</b>	<b>A2EXT</b>	<b>A1EXT</b>	<b>A0EXT</b>	<b>A3EXT</b>
<b>1</b>	0	0	0	0
<b>2</b>	0	0	1	0
<b>3</b>	0	1	0	0
<b>4</b>	0	1	1	0
<b>5</b>	1	0	0	0
<b>6</b>	1	0	1	0
<b>7</b>	1	1	0	0
<b>8</b>	1	1	1	0
<b>*</b>	X	X	X	1

\* Crosspoint output is tri-stated - used for system expansion.

LOGIC 1 = +12V, LOGIC 0 = 0V

For externally supplied binary signals wiring must be made to the rear panel. To select an input the correct binary address is needed and A3EXT must be logic 0. For source expansion, all other modules whose inputs are not selected, A3EXT must be at logic 1.

Binary control signals can be generated by one 8x1 module and fed to another, to create a master slave configuration. To achieve this, the lower expansion cable on the front of the cards must be fitted, and all slave modules set to binary mode. The master module can be set to button mode and conveniently driven from a button panel.

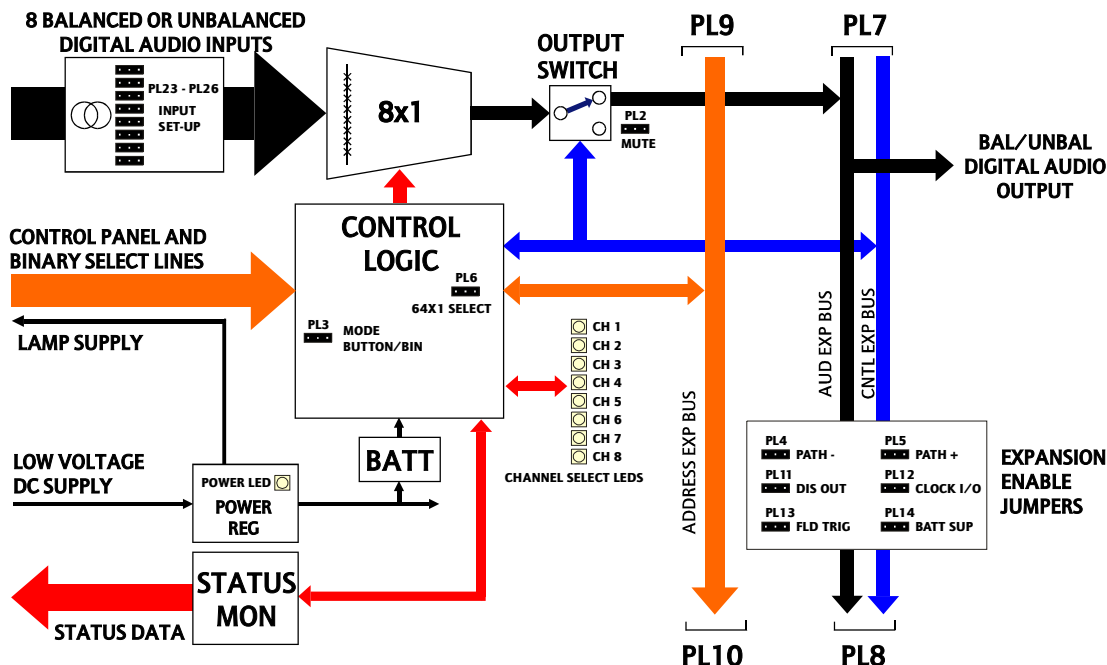
Note: The A3 EXT line (input) becomes the 64x1 select line (output) for systems expanded to 64x1 with PL6 in the ON position.





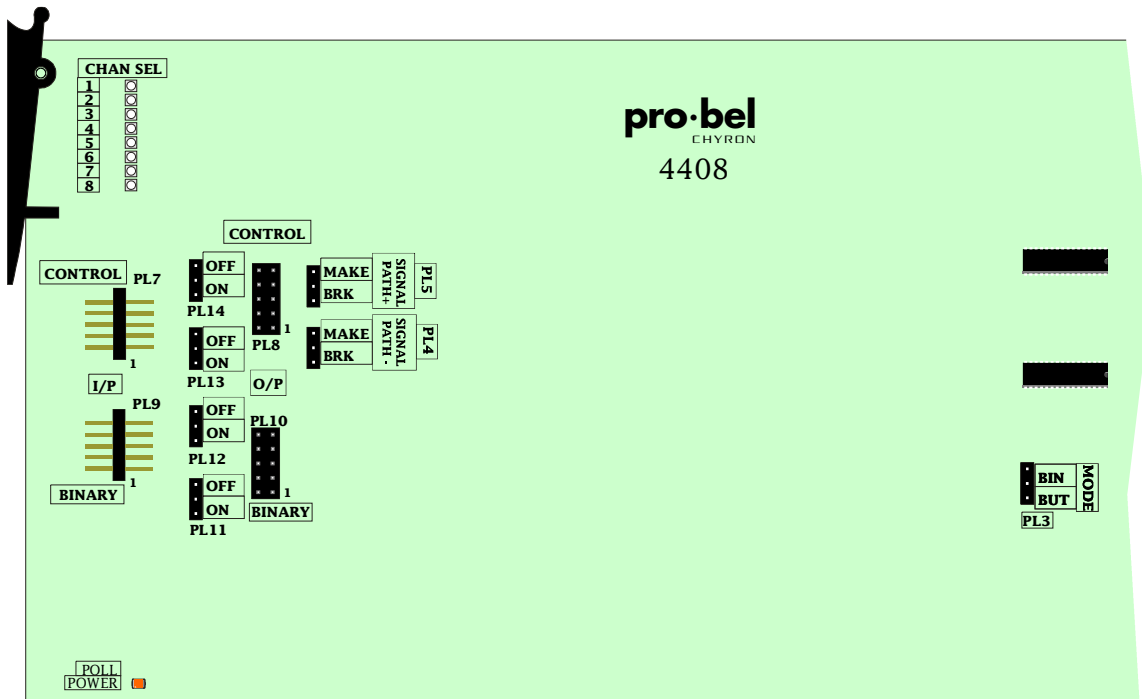
# 3 Configuration

The module is easy to configure and build into expanded systems using expansion cables and jumpers.

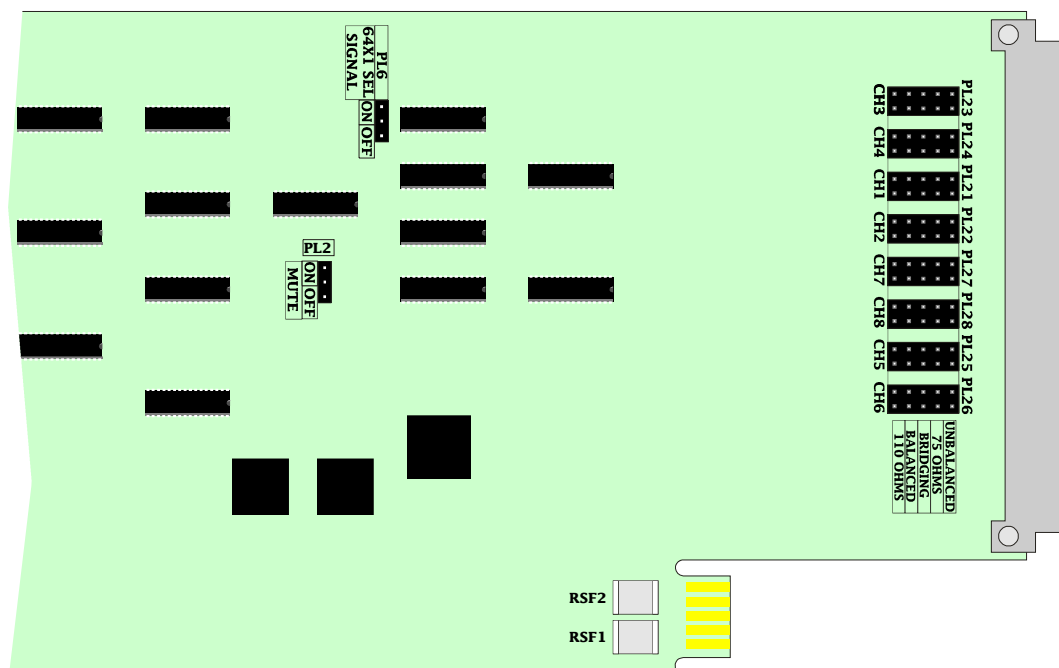


4408 8x1 switch schematic view

Configuration jumpers		
Jumper	Condition	Function
PL2	MUTE	Used with the 4405 re-framer
PL3	BUTTON BIN	Simple button per crosspoint control Binary control, used in expanded systems and computer control
PL4&PL5	OFF or ON	Audio expansion bus, used when expanding sources
PL6	OFF or ON	64x1 select, modifies binary addressing when expanding above 32x1
PL11	OFF or ON	DIS OUT, used to disable downstream cards when expanding sources
PL12	OFF or ON	CLOCK I/O, output clock for downstream cards when expanding sources
PL13	OFF or ON	FIELD TRIGGER, used to distribute to downstream cards for synchronous switching
PL14	OFF or ON	Battery supply, used to distribute 3.6V crosspoint retention power to other boards in a system
PL23-PL26	Five position	Used to select set-up for each input - see separate chart



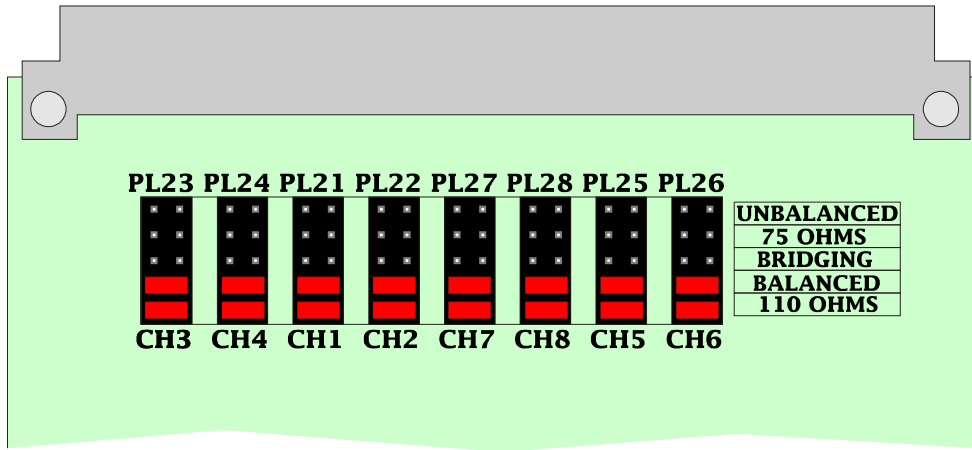
Jumper locations at front of card



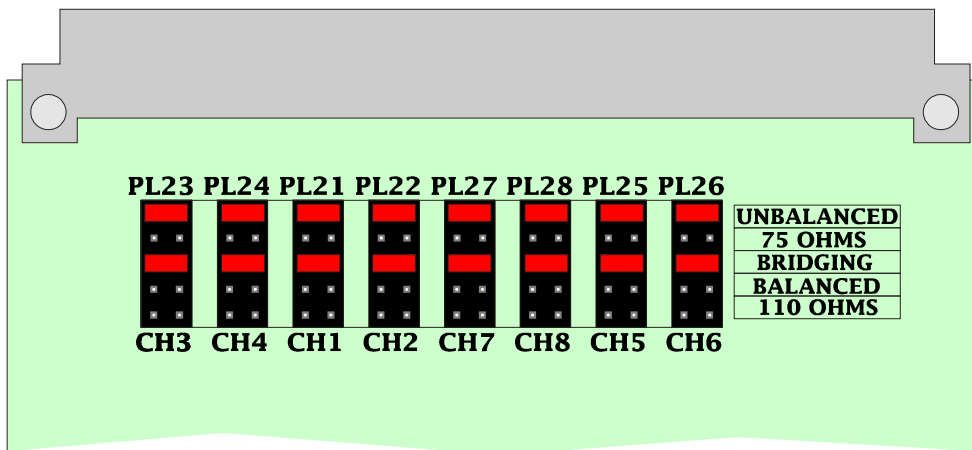
Jumper locations near edge connector

### 3.1 Input set-up

Jumpers are provided so that the eight inputs may be configured for different termination values and set for balanced or unbalanced operation.



Example: all inputs set to balanced, 110Ω




Example: all inputs set to Hi-Z, unbalanced

## 3.2 Configuring an 8x1 switcher

The simplest configuration is a single 8x1 module without expansion.

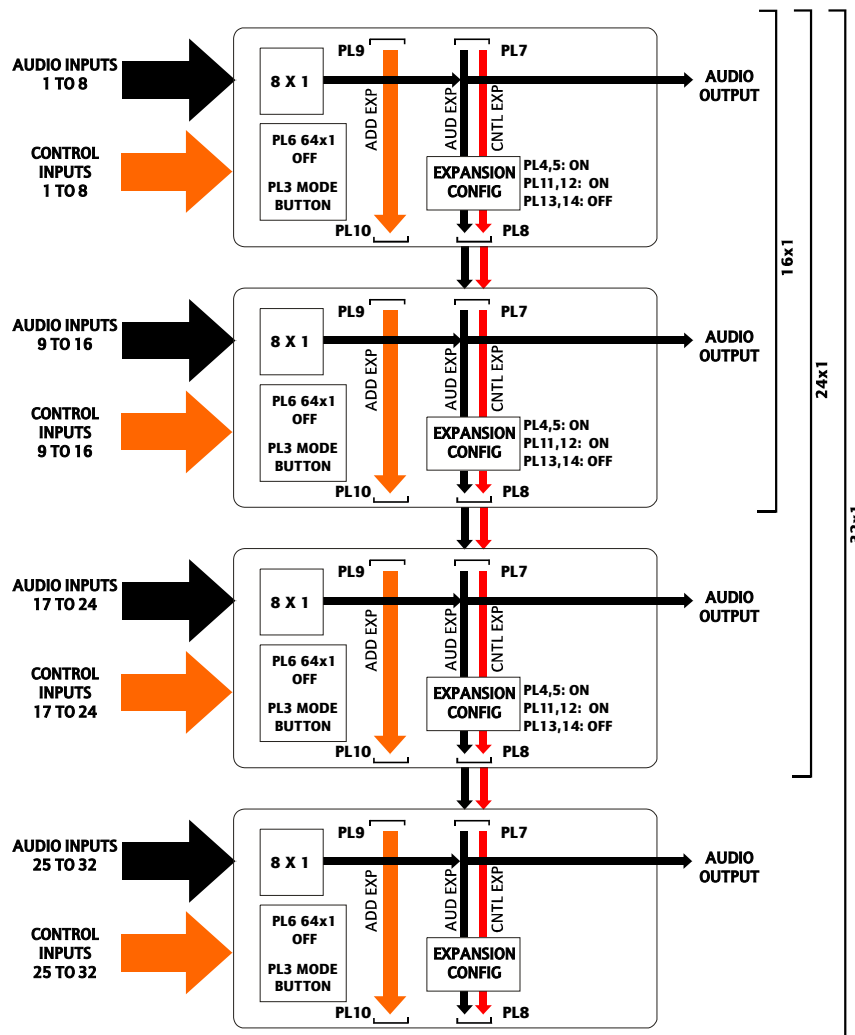
Control of the switcher may be from either a simple control panel or in binary form from a more complex control system such as a computer. PL3 is used to establish the method of crosspoint control. All other jumpers positions can be ignored since they only affect expansion.

<b>PL3 Crosspoint control mode</b>		
<b>Position</b>	<b>Function</b>	<b>BUTTON BIN</b>
<b>BUTTON</b>	Crosspoint selection using a button panel	
<b>BIN</b>	Crosspoint selection using binary control	

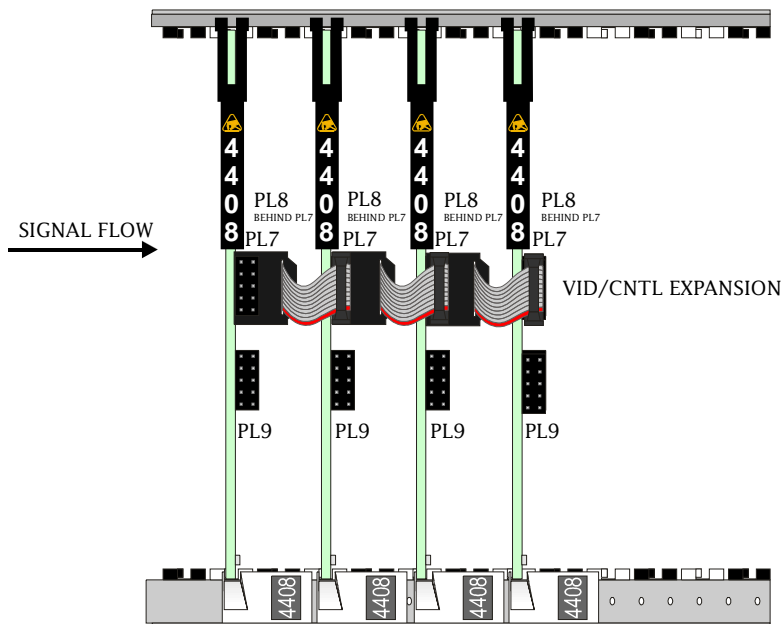
Configuration changes are accomplished by pulling the jumper (the shaded area above) from its current position on the header pins and moving it to the alternate position desired. The jumper must make electrical contact with at least two pins.

### 3.3 Source expansion

Several analogue audio switcher cards can be linked to make larger switchers up to 64x1. For switchers up to 32x1, only 4 modules are needed. Larger switchers need an extra 4408 as a combiner module. Expansion employs the front of card connectors together with the ribbon cables supplied with the card.



Expanding to 16, 24 and 32 x 1



Expansion cabling for an asynchronous 32x1 switcher

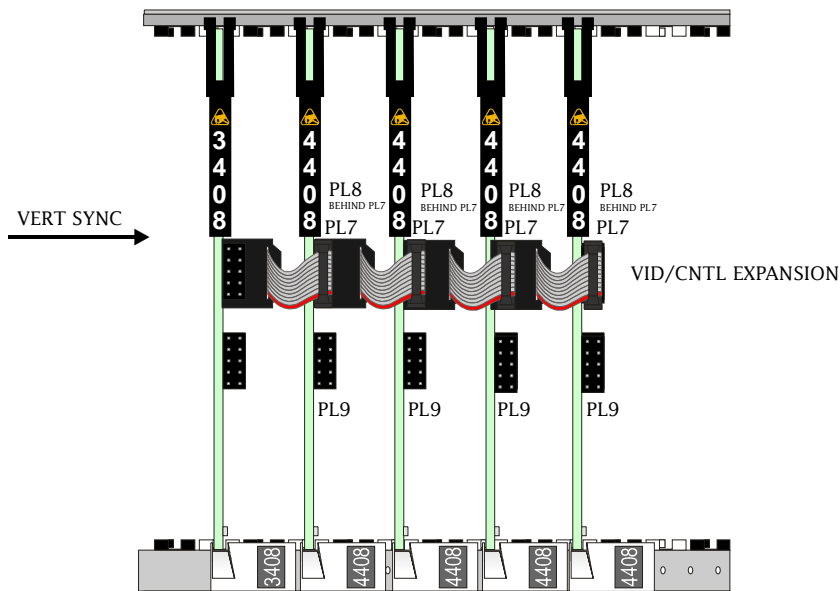
**Source expansion jumper settings with button control and asynchronous switching**

Jumper	Setting	Function
PL3	BUTTON	Control mode
PL4 & PL5	ON	Digital audio signal expansion O/P
PL6	OFF	64x1 select signal
PL11	ON	DIS OUT priority switching signal
PL12	ON	Output clock
PL13	OFF	Synchronous switching mode
PL14	OFF	Common battery supply line

**Synchronous switching**

If synchronous switching using a video vertical timing pulse is required, an extra module such as a 3408 digital video 8x1 switch or a 3438 analogue video 8x1 switch with a 2315 sync separator is required.

In addition, a ribbon cable from PL7 on the 3408/3438, should be connected to PL 7 on the upstream (left most) 4408 in a system. The 3408/3438 should be jumpered to only provide the vertical timing pulse on the control bus.



Expansion cabling for synchronous 32x1 switcher

### Source expansion jumper settings with button control and synchronous switching

Jumper	Setting	Function
PL3	BUTTON	Control mode
PL4 & PL5	ON	Digital audio signal expansion O/P
PL6	OFF	64x1 select signal
PL11	ON	DIS OUT priority switching signal
PL12	ON	Output clock
PL 13	ON	Synchronous switching mode
PL14	OFF	Common battery supply line

The following rules apply to source expansion from 16x1 to 32x1:

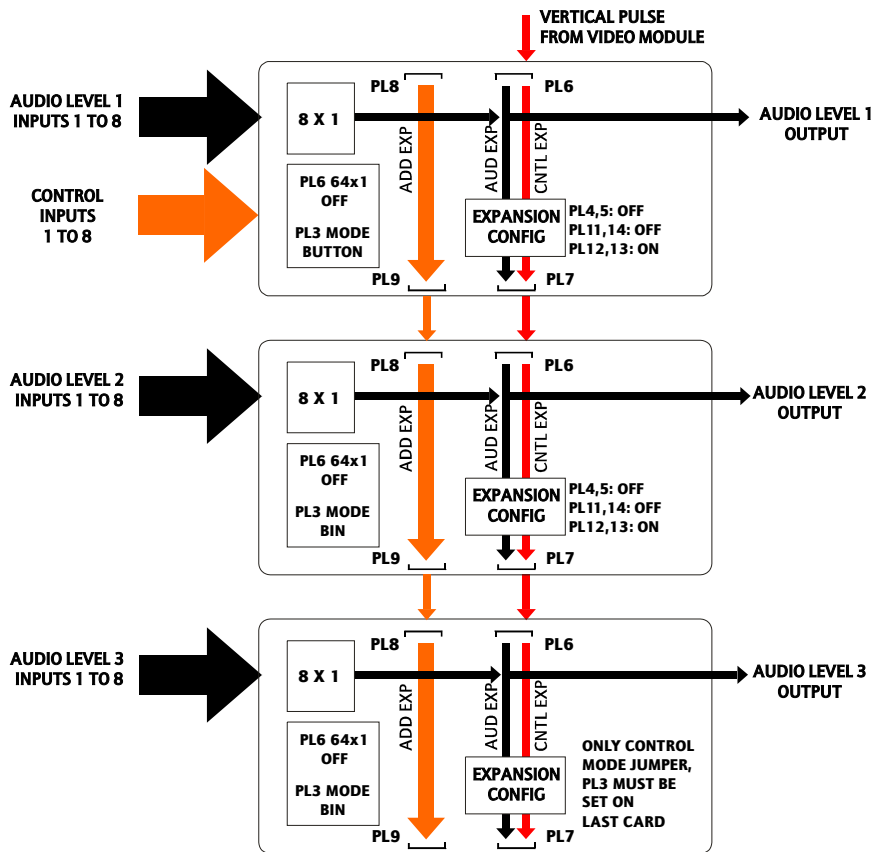
- only audio/control expansion bus used
- expansion jumpers not needed on last card in chain
- buffered outputs available from all cards
- Synchronous switching between audio sources is only possible if all sources are synchronised to one reference.



### 3.4 Level expansion

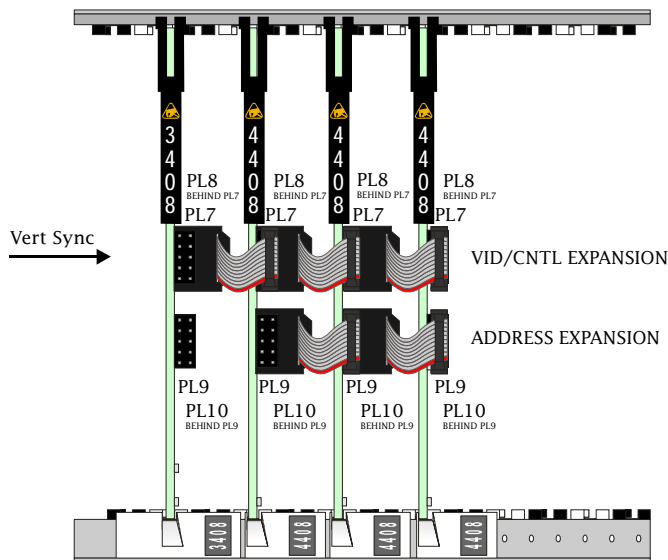
It may be useful in some applications for one card to control the input selection of other cards to create a multi-level switcher. This mode is called master/slave and utilises the binary control interconnections.

The master card can be driven from a button panel and all other cards by binary addressing using only the lower expansion connectors PL8-PL9 on the front of the card.



Example of level expansion:  
synchronous three level audio 8x1 switcher

In this example of a synchronous three level audio switcher, both address and control/audio expansion bus connectors are used. It may be desirable to distribute a vertical interval trigger signal from an external card to ensure switching during the correct line of a reference video field. This is why the aud/cntl ribbon is used. However, the AUD expansion jumpers PL4 and PL5 must be off on all cards.



Example of three level expansion wiring

Configuring level expansion with synchronous switching			
Jumper	Master card	Slave cards	Function
PL3	BUTTON	BIN	Control mode
PL4 & PL5	OFF	OFF	Analogue audio signal expansion O/P
PL6	OFF or ON	OFF or ON	64x1 select signal
PL11	OFF	OFF	DISOUT, priority switching signal
PL12	ON	ON	CLK I/O, output clock
PL13	ON	ON	Field trigger, crash/sync switching mode
PL14	OFF	OFF	Common battery supply

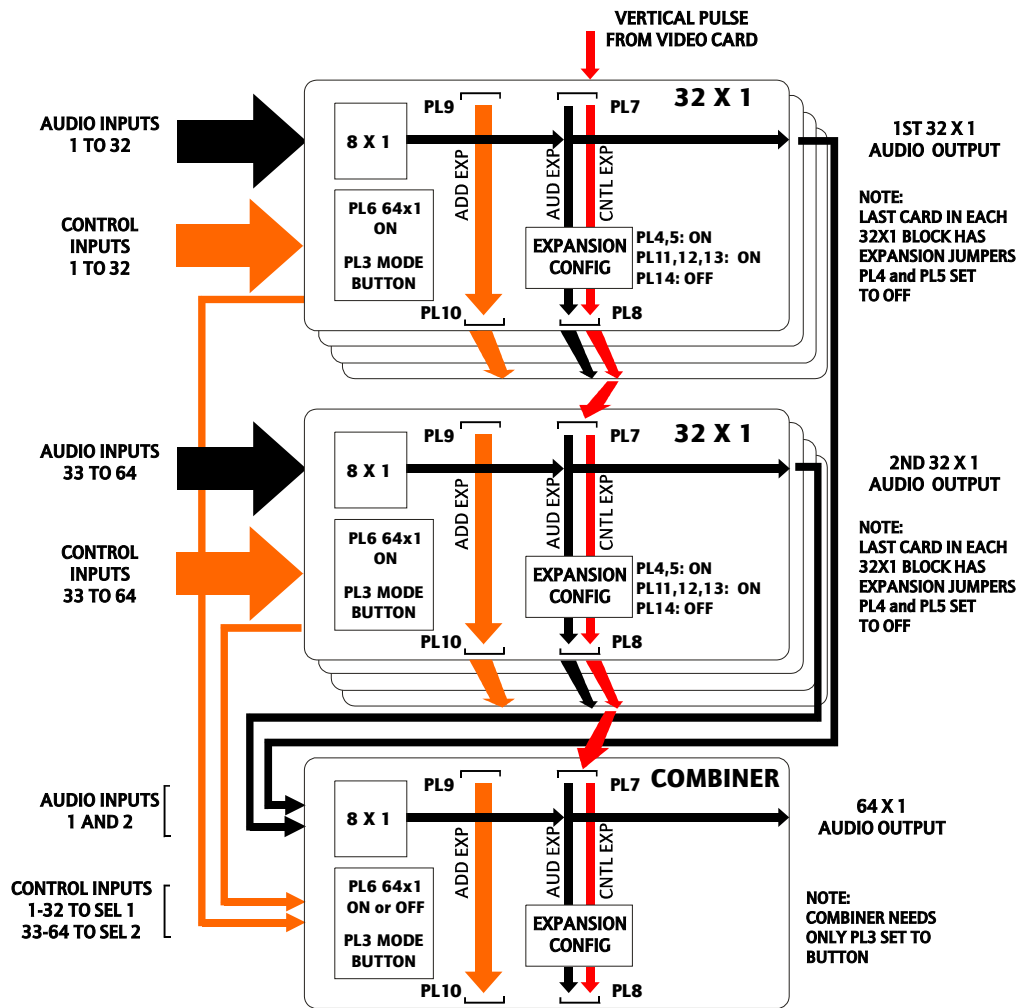
The following rules apply to synchronous level expansion

- Address and control expansion buses used
- Expansion jumpers not needed on last card in chain
- Synchronous switching between audio sources is only possible if all sources are already synchronised to one reference

**Note:** For asynchronous level expansion only the address expansion cabling is required and PL13 should be OFF on all cards.

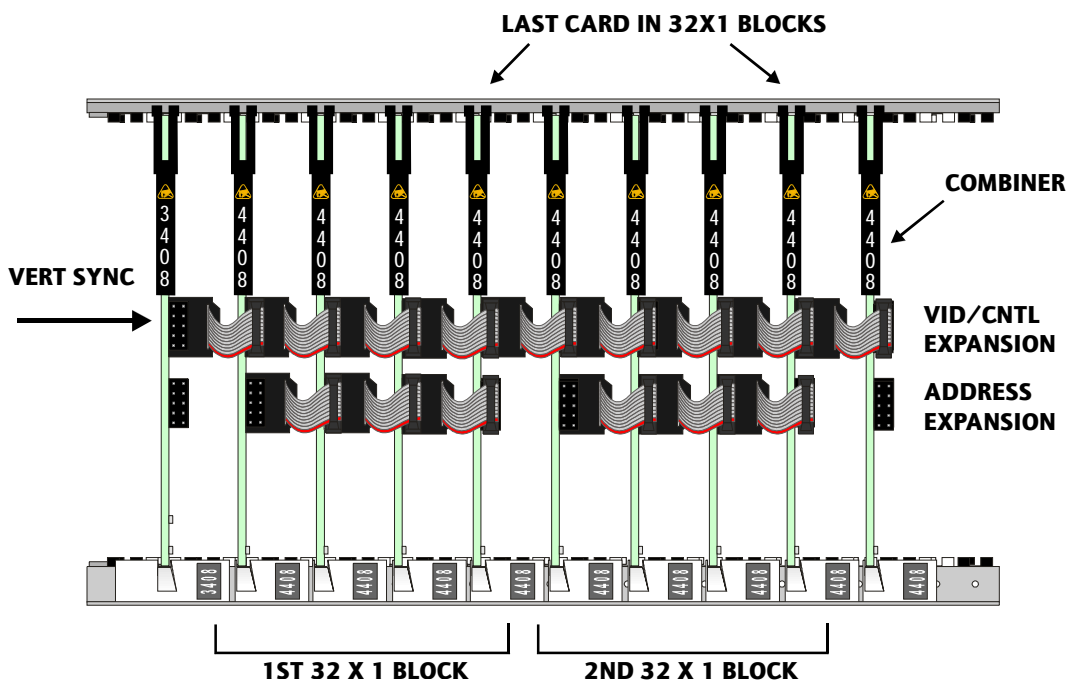
### 3.5 Building a 64 input switcher

To create a 64x1 an extra audio switcher card is needed to act as a combiner module.



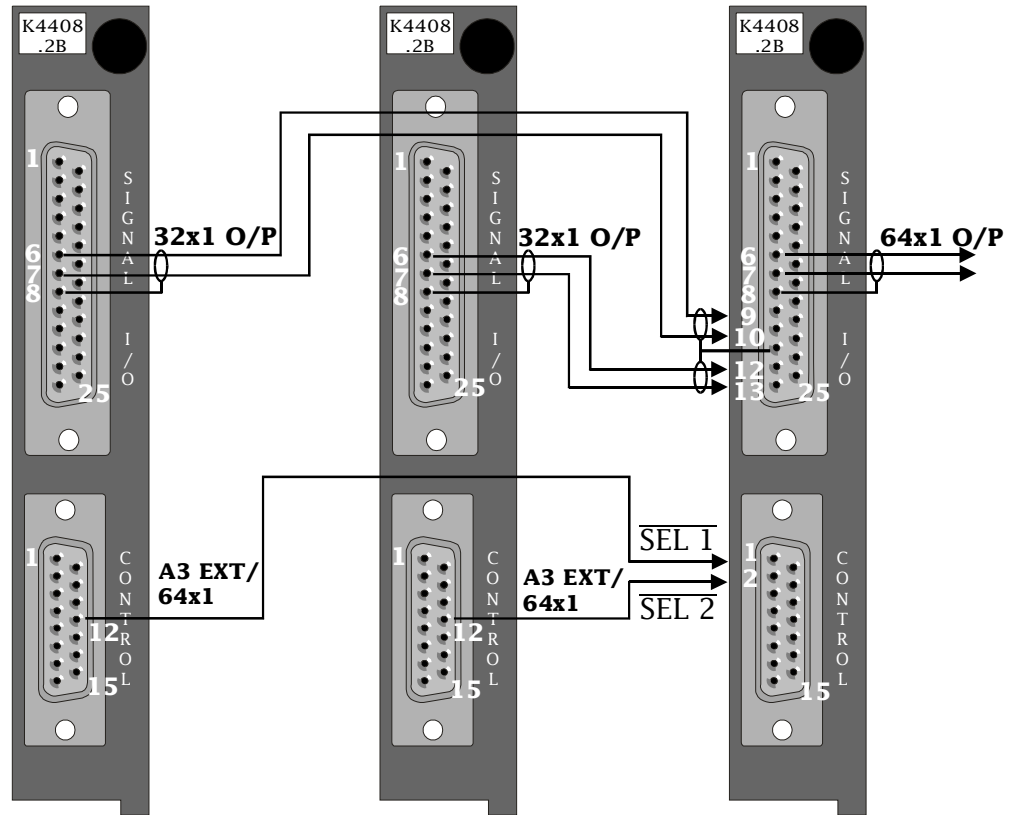
Building a synchronous 64x1 switch

Note: With PL6 set to ON, each card in each 32x1 block has the  $\overline{64x1 SEL}$  address lines bussed together using the address expansion connectors. The  $\overline{64x1 SEL}$  line is also brought to pin 12 of the control connector on each rear connector. This address line forms an active low select line for each 32x1 block, which then become the 2 channel select signals for combiner module by making external connections.



Source expansion with vertical sync reference

<b>Building a 64x1 synchronous switch</b>				
<b>Jumper</b>	<b>1st 3 cards in 32x1 block</b>	<b>Last card in 32x1 block</b>	<b>Combiner</b>	<b>Function</b>
<b>PL3</b>	BUTTON	BUTTON	BUTTON	Control mode
<b>PL4 &amp; PL5</b>	ON	OFF	OFF	Analogue signal expansion O/P
<b>PL6</b>	ON	ON	ON or OFF	64X1 select signal
<b>PL11</b>	ON	OFF	OFF	DISOUT, priority switching signal
<b>PL12</b>	ON	OFF	OFF	CLK I/O, output clock
<b>PL13</b>	ON	ON	ON	$\overline{\text{FTLOGIC}}$ , synchronous switching mode

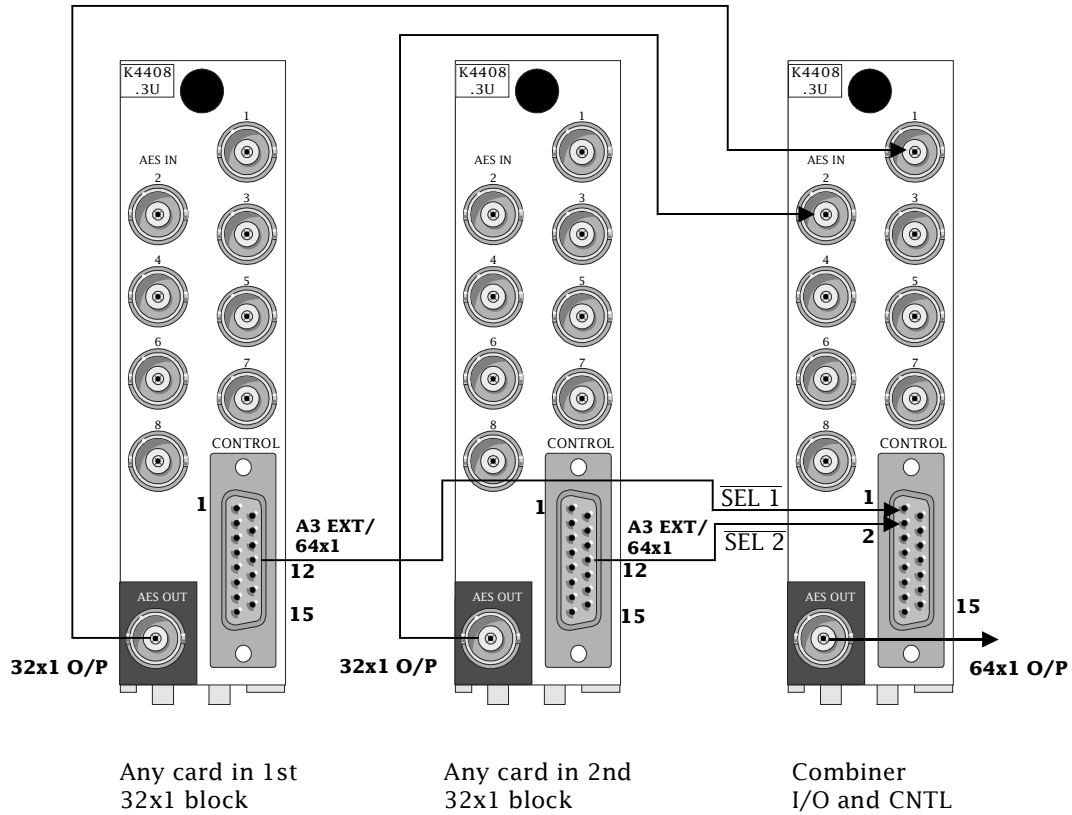


Any card in 1st  
32x1 block

Any card in 2nd  
32x1 block

Combiner  
I/O and CNTL

Combiner wiring for 64x1 expansion using balanced I/O



Combiner wiring for 64x1 expansion using unbalanced I/O

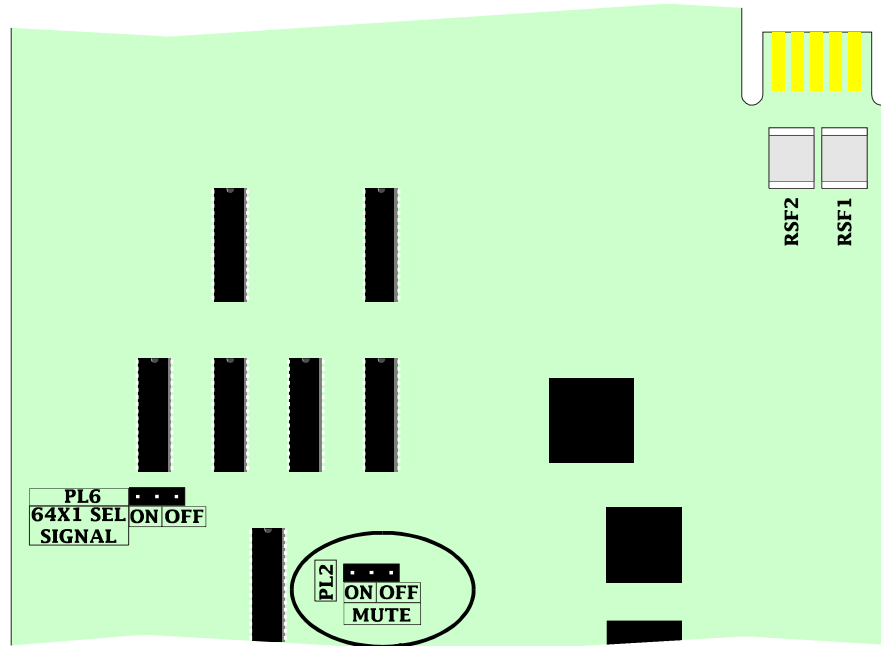
### 3.6 Using the 4408 with the 4405 re-framer

It is possible that bitstream corruption may occur when switching inputs. This may occur even if all signals are co-timed and referenced to video and when the 4408 uses a vertical switching reference derived from the same reference.

Bitstream corruption could cause downstream equipment to lose lock briefly, resulting in audible defects. The 4405 detects the corruption and inserts mute audio samples whilst maintaining a constant bitsream.

The 4408 can be configured to always produce a gap in the output bitsream, guaranteeing that the re-framer will see a disturbance and re-frame.

Please refer to the 4405 re-framer manual for further details.



PL2 Switch mute	
position	function
ON	Bitstream gap forced during input switch
OFF	Normal

## 4 Troubleshooting

---

### **The green card edge POWER LED is not lit**

- check the PSU indicator to confirm that there is power to the frame
- check the resettable fuses protecting the card - do this by removing the power to the card for about 30 seconds then restoring the power
- if necessary, refer to the power supply trouble shooting guide in the appropriate ICON rackframe manual section

### **There is no output signal**

- ensure that the green power LED on the front of the card is lit
- check that the inputs are connected to the rear panel and a valid signal is present
- verify that the correct channel is selected - the LED on the button panel should show the same channel number as the CHAN SEL LED on the front of the 4408 module
- check the output connection from the rear panel to the monitoring device and the output cable
- ensure that the cable wiring and jumper link settings are correct for the configuration used

### **The button panel will not select a different input**

- ensure that the jumper PL3 is correctly set to 'BUTTON' on all modules
- check that the expansion cables are correctly installed
- check that another, higher numbered, input is not permanently selected

### **The output signal is corrupted**

- check that jumpers PL4 and PL5 are set correctly for the configuration
- ensure all expansion cables are installed correctly

### **In a 64x1 configuration, only half of the inputs are being routed**

- check that the  $\overline{64x1\ SEL}$  line (PL6 ON) from pin 12 of CNTL on the rear panel from each 32x1 block is properly connected to the SEL 1 and SEL 2 pins of the combiner CNTL connector
- check that an audio output is connected from each 32x1 block to the first two combiner inputs





## 5 **COSMOS status monitoring**

---

If the frame is equipped with a COSMOS controller card the following parameters will be reported back to the COSMOS status monitoring system:

- module present
- power OK
- input selected

In addition, the module is programmed with the following information, which can be read by the status monitoring controller:

- module type
- module bar code
- module issue no

For further details of the Pro-Bel status monitoring system please refer to the COSMOS status monitoring manual.



## 6 Specification

---

### Inputs

Number and type:	8, balanced, transformer coupled to AES3-1992 or unbalanced to AES3-id
Termination:	High, 75Ω or 110Ω

### Outputs

Number and type:	1, transformer coupled, balanced to AES3-1992 or unbalanced to AES3-id
------------------	--

### Performance

Bitstream integrity:	Transparent to all AES/EBU parameters
Sample rate:	32 to 54kHz
Switch transition:	Normal or mute (jumper selectable)

### Control

Battery supply voltage: (BATTSUP)	If supplied by external DC source -3.5V to 12V
External field trigger: (FTLOGIC)	Allows switch transition to be synchronised to external source
BUTTON mode:	Max current sunk by select line 8mA for 24V external supply, 4mA for +12V on board supply. (LAMPSUP 12V @ 100mA maximum)
BINARY mode:	3 bit binary address, 12V CMOS positive logic convention

### Indications

Power:	Green LED
Input selected:	8 x yellow LEDs

### Temperature range

Operating:	0° to +40°C
Storage:	-10°C to +70°C



## 7 **Ordering Information**

---

ICO-4408-2B00

8x1 Digital Audio Switch with 20mm rear panel  
providing balanced AES3 interfaces

ICO-4408-3U00

8x1 Digital Audio Switch with 30mm rear panel  
providing unbalanced AES3 interfaces