

Synapse

DI088

Universal triple mode, 16 channel audio I/O card
for quad speed ADD-ON applications.

Installation and Operation manual

Quad speed
ADD-ON

Committed.

[®]**AXON**

Synapse

TECHNICAL MANUAL

DIO88

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- ALWAYS disconnect your entire system from the AC mains before cleaning any component. The product frame (SFR18, SFR08 or SFR04) must be terminated with three-conductor AC mains power cord that includes an earth ground connection. To prevent shock hazard, all three connections must always be used.
- NEVER use flammable or combustible chemicals for cleaning components.
- NEVER operate this product if any cover is removed.
- NEVER wet the inside of this product with any liquid.
- NEVER pour or spill liquids directly onto this unit.
- NEVER block airflow through ventilation slots.
- NEVER bypass any fuse.
- NEVER replace any fuse with a value or type other than those specified.
- NEVER attempt to repair this product. If a problem occurs, contact your local Axon distributor.
- NEVER expose this product to extremely high or low temperatures.
- NEVER operate this product in an explosive atmosphere.

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EN60950	Safety
EN55103-1: 1996	Emission
EN55103-2: 1996	Immunity

Axon Digital Design DIO88



FOR HOME OR OFFICE USE

This device complies with part 15 of the FCC Rules Operation is subject to the following two conditions:
 (1) This device may cause harmful interference, and
 (2) This device must accept any interference received, including interference that may cause undesired operation.

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1 Introduction to Synapse

An Introduction to Synapse

Synapse is a modular system designed for the broadcast industry. High density, intuitive operation and high quality processing are key features of this system. Synapse offers a full range of converters and processing modules. Please visit the AXON Digital Design Website at www.axon.tv to obtain the latest information on our new products and updates.

Local Control Panel

The local control panel gives access to all adjustable parameters and provides status information for any of the cards in the Synapse frame, including the Synapse rack controller. The local control panel is also used to back-up and restore card settings. Please refer to the RRC18, RRC10, RRC04, RRS18 and RRS04 manuals for a detailed description of the local control panel, the way to set-up remote control over IP and for frame related settings and status information.

Remote Control Capabilities

The remote control options are explained in the rack controller (RRC18/RRC10/RRC04/RRS18/RRS04) manual. The method of connection to a computer using Ethernet is described in those manuals as well.



CHECK-OUT: “AXON CORTEX” SOFTWARE WILL INCREASE SYSTEM FLEXIBILITY OF ONE OR MORE SYNAPSE FRAMES

Although not required to use Axon Cortex with a Synapse frame, you are strongly advised to use a remote personal computer or laptop PC with Axon Cortex installed as this increases the ease of use and understanding of the modules.

2 Unpacking and Placement

Unpacking

The Axon Synapse card must be unpacked in an anti-static environment. Care must be taken NOT to touch components on the card – always handle the card carefully by the edges. The card must be stored and shipped in anti-static packaging. Ensuring that these precautions are followed will prevent premature failure from components mounted on the board.

Locating the card

The Synapse card can be placed vertically in an SFR18 frame or horizontally in an SFR08 or SFR04 frame. Locate the two guide slots to be used, slide in the mounted circuit board, and push it firmly to locate the connectors.

Correct insertion of card is essential as a card that is not located properly may show valid indicators, but does not function correctly.

Note: On power up all LEDs will light for a few seconds, this is the time it takes to initialise the card.

3 A Quick Start

When Powering-up

On powering up the Synapse frame, the card set will use basic data and default initialization settings. All LEDs will light during this process. After initialization, several LEDs will remain lit – the exact number and configuration is dependant upon the number of inputs connected and the status of the inputs.

Default settings

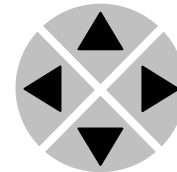
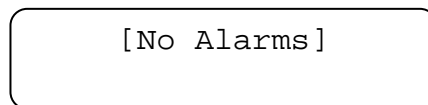
In the default condition, the DIO88 acts as a Dolby Digital Plus encoder locked to AES input 1, encoding AES 1/2 till AES 7/8 into a 5.1+2 Dolby digital plus output, using external incoming meta data program streams.

Changing settings and parameters

The front panel controls or Axon Cortex can be used to change settings. An overview of the settings can be found in chapter 5, 6 and 7 of this manual.

Front Panel Control

Front Panel Display and Cursor



Settings are displayed and changed as follows;

Use the cursor ‘arrows’ on the front panel to select the menu and parameter to be displayed and/or changed.

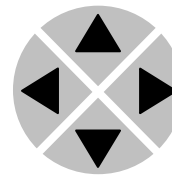
- Press ► To go forward through the menu structure.
- Press ◀ To go back through the menu structure.
- Press ▲ To move up within a menu or increase the value of a parameter.
- Press ▼ To move down through a menu or decrease the value of a parameter.

REMARK: Whilst editing a setting, pressing ► twice will reset the value to its default.

Example of changing parameters using front panel control

With the display as shown below

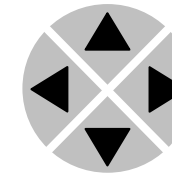
```
RRC18 [Select Card]
>S01=SFS10
```



Pressing the ► selects the SFS10 in frame slot 01.

The display changes to indicate that the SFS10 has been selected. In this example the Settings menu item is indicated.

```
SFS10 [Select Menu]
>Settings
```

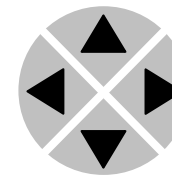


Pressing the ► selects the menu item shown, in this example Settings.

(Pressing ▲ or ▼ will change to a different menu eg Status, Events).

The display changes to indicate that the SFS10 Settings menu item SDI-Format has been selected and shows that its current setting is Auto.

```
SFS10 [Settings]
>SDI-Format=Auto
```

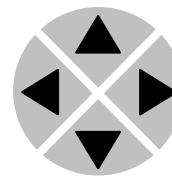


Pressing the ► selects the settings item shown, in this example SDI-Format.

(Pressing ▲ or ▼ will change to a different setting, eg Mode, H-Delay).

The display changes to indicate that the SFS10 Edit Setting menu item SDI-Format has been selected.

```
SFS10 [Edit Setting]
```



To edit the setting of the menu item press ▲ or ▼.

All menu items can be monitored and/or changed in this way. Changing a setting has an immediate effect.

Axon Cortex

Axon Cortex can be used to change the settings of Synapse modules from a PC, either locally or remotely. The software enables communication based on TCP/IP between the Setup PC and Synapse frames/modules.

Each Synapse frame is addressed through its rack controller's unique IP address, giving access to each module, its menus and adjustment items. Axon Cortex has access to data contained within the Synapse module and displays it on a GUI. The software has an intuitive structure following that of the module that it is controlling.

For operation of Axon Cortex, please refer to the Axon Cortex help files (press F1 in any window).

Menu Structure Example

Slot	Module	Item	Parameter	Setting
▲				
▲				
S02		Identity		
▲		▲		
S01	SFS10	Settings	SDI-Format	Auto
▼		▼	▼	▼
S00	RRC18	Status	Mode	625
		▼	▼	▼
		Events	Ref-Input	525
			▼	
			H-Delay	
			▼	
			▼	

REMARK: Further information about Front Panel Control and Axon Cortex can be obtained from the rack controller manual and Axon Cortex help files.

4 The DIO88 Card

Introduction

The Synapse quad speed audio bus enables up to 32 channels being transported from Master Card to ADD-ON card and simultaneously 32 channels from ADD-ON card(s) to Master Card.

The DIO88 can be used in 3 modes. The card *only* works as an **ADD-ON card** and can therefore *not* be used without a Master card. Mode 1 makes the card a universal 4 AES/EBU in and 4 AES/EBU output card. This gives the user a function to insert and extract up to 8 mono channels from any Quad Speed compatible Master card.

Mode 2 turns the DIO88 into an 8 AES/EBU insert card, providing the insertion of up to 16 mono channels into any Quad Speed compatible Master card.

Mode 3 is used to extract 8 AES/EBU (16 mono audio) channels from a Quad Speed compatible Master Card.

- Triple mode quad speed audio ADD-ON card (Cortex controllable, no reboot required)
 - Mode 1: 4x AES/EBU in and 4x AESEBU out.
 - Mode 2: 8x AES/EBU in.
 - Mode 3: 8x AESEBU out.
- Full audio swapping of all input channels allow for a selection of any AES/EBU input or any of the 32 channel bus input to be selected
- 16 channels of audio gain
- 16 channels of audio phase reversal
- 8x 2channel audio delay up to 1300ms
- 8 stereo>mono switches
- 16x 2 channel audio insertion into 32 channel Quad speed audio bus (allows for duplicates)
- Full control and status monitoring through the front panel of the SFR04/SFR08/SFR18 frame and the Ethernet port (ACP)

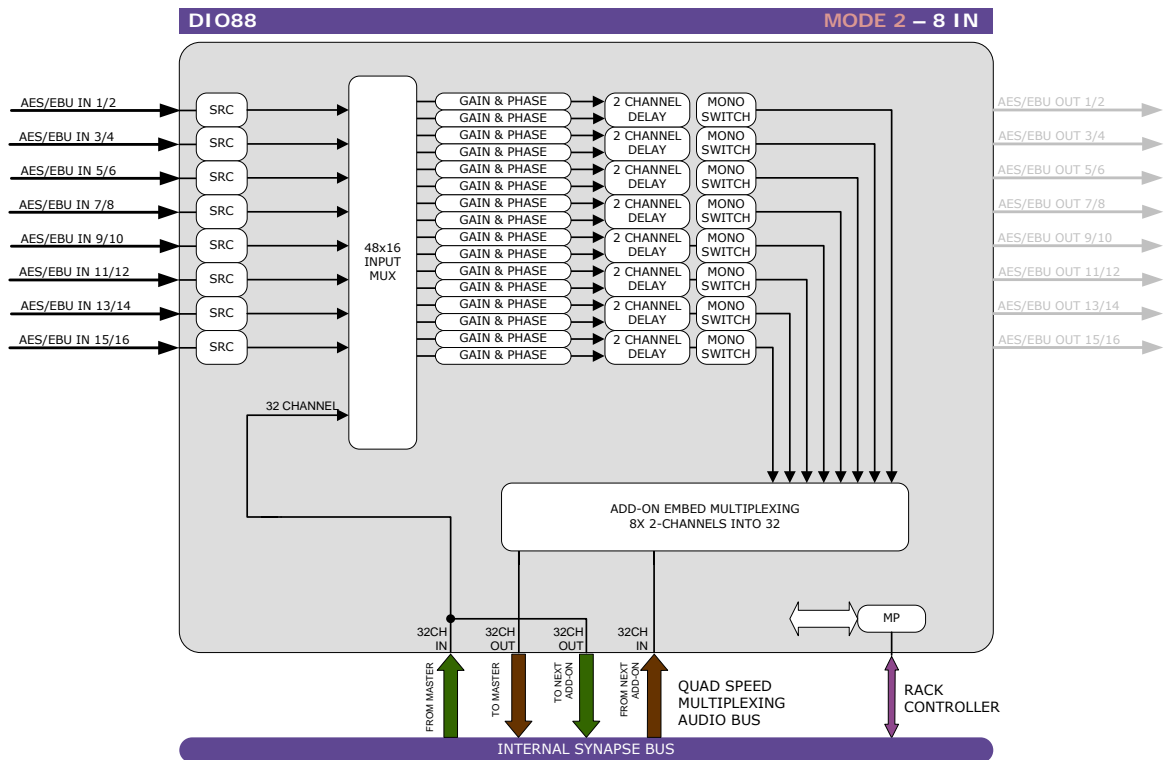
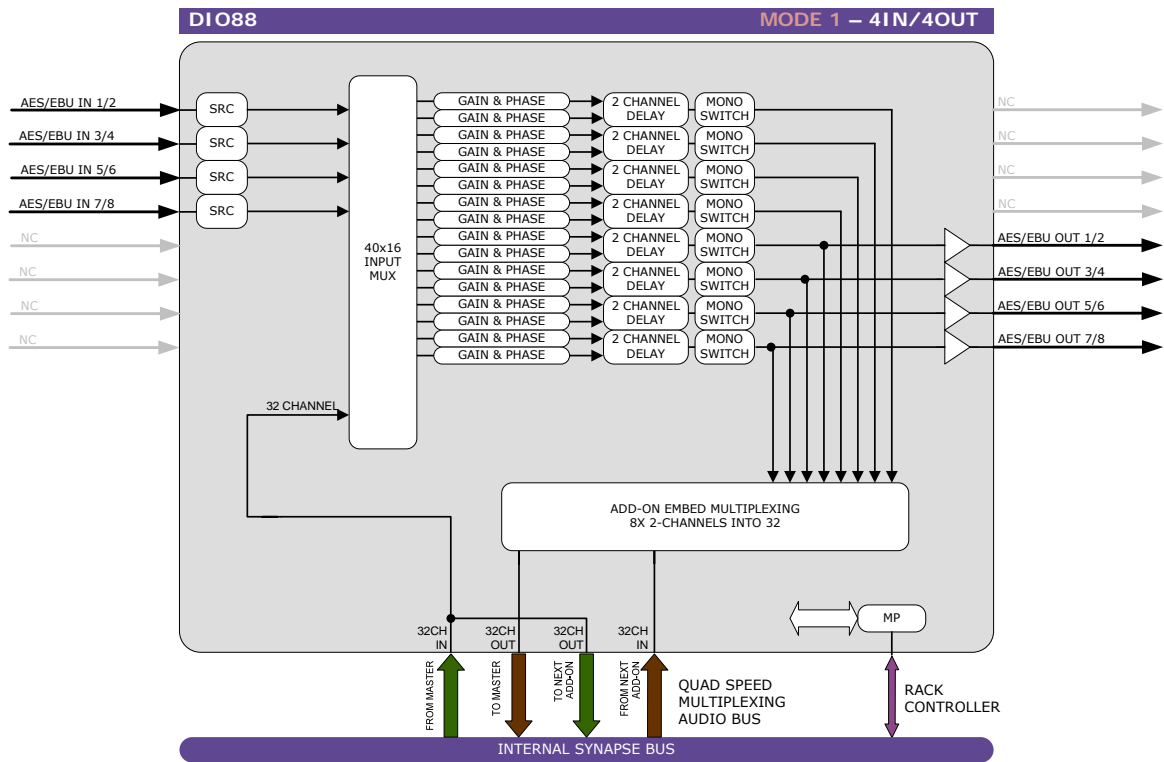
Applications

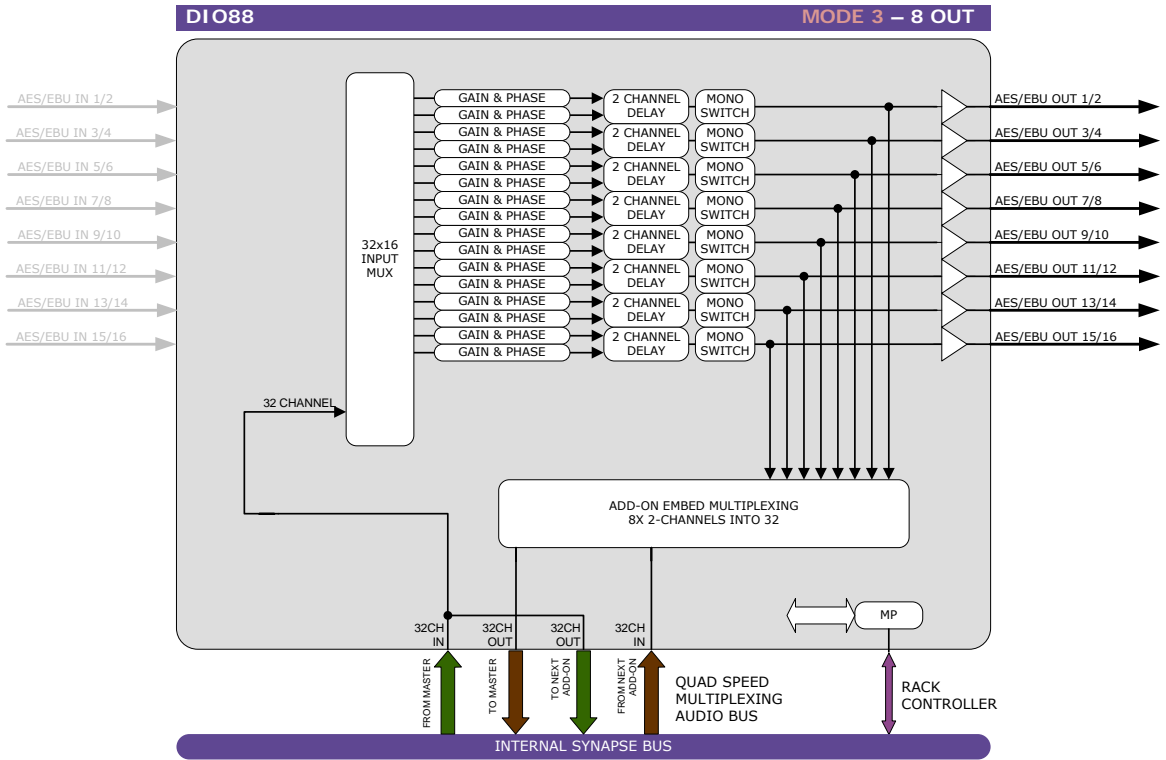
- 16 channel insertion to QUAD SPEED audio Master card
- 16 channel extraction from QUAD SPEED audio Master card

Program Procedure

This card can be updated with new firmware when new firmware versions are released by Axon. You can download the .spf file from our website when new releases are announced. To upgrade the DIO88 you can follow the instructions as described in the 'reprogramming cards quick-guide', downloadable via our website.

Block schematics





5 Settings Menu

Introduction

The settings menu displays the current state of each setting within the DIO88 and enables the item to be changed or adjusted.

Settings can be changed using the front panel of the Synapse frame (SFR18, SFR08 or SFR04) or Axon Cortex.

Please refer to chapter 3 for information on the Synapse front panel control and Axon Cortex.

SYSTEM CONTROL

SRC

The AES/EBU inputs are connected to a Sample Rate Converter. This enables the input to use audio sample rates that are non-synchronous to video of the master card (setting On). For Non PCM audio data (Dolby Digital, Dolby E, etc.) the SRC can be bypassed and the data is inserted in the card transparently (Trans).

The default setting is On.

In_Out

In_Out determines how the synapse bus inputs and outputs work. There's 3 modes:

- 4In-4Out: 4 AES/EBU input and 4 AES/EBU outputs
- 8In: 8 AES/EBU input and no outputs
- 8Out: no inputs and 8 AES/EBU outputs

Refer to the block schematics for more details on the difference modes.

INPUT CONTROL

Sel_Ch1 ~ Sel_Ch16

With these settings you select which audio source you want to use for process channel 1 till channel 16. You can choose either Local audio (using the card's own AES/EBU inputs) or audio coming from the Master card via de ADD-ON bus.

Note: when the card is set to 8Out mode (in the In_Out setting) the local inputs aren't used and therefore can't be selected here.

Ch_1 ~ Ch_16

With these settings you select the actual source channel in the above selected source.

Note: When Local is selected, you can choose channel 1 till channel 16. When Master is selected, you can choose channel 1 till channel 32.

PROCESS CONTROL

**Gain-CH_1 ~
Gain-CH_16**

These items allow you to gain the audio for each individual channel in a range from -60dB to 12 dB in steps of 0.25 dB. -999dB mutes this channel. Default is 0dB.

**Phase-CH_1 ~
Phase-CH_16**

These items allow you to gain the audio for each individual channel with 180 degrees. Default is 0 degree.

**Stereo-CH_1/2 ~
Stereo-CH_15/16**

With these settings you can configure the corresponding channels (channels 1/2, channels 3/4, channels 5/6, etc.) as being mono channels (In which case for instance channel 1 and 2 will both contain a mix of channel 1 + channel 2) or combined stereo channels.

**Delay_CH_1/2 ~
Delay_CH_15/16**

These settings allow you to delay the audio of each pair of channels in a range of 0 to 1300 ms. In steps of 0.01 ms. Default is 0ms.

OUTPUT CONTROL

Slot1/2 ~ Slot31/32

These menu items are to fill the Quad speed audio bus with the appropriate outputs. You can fill any of the 16 audio pairs (32 channels in total) with the audio that is set to Out1/2, Out3/4, etc till Out15/16. You can also switch the concerning pair to off, making the concerning audio pair empty.

6 Status Menu

Introduction	The status menu indicates the current status of each item listed below.
Addon-lock	This card must be locked to the ADD-ON bus. When this lock is OK, this item indicates OK. When there's no lock available, this item will indicate NA.
AES-In_1 ~ AES-In_8	If a valid signal is present on the corresponding input, AES-IN_1 till AES-In_8 indicate OK. NA indicates that no AES signal is present.
Ch_1_Inp ~ Ch_16_Inp	These status items indicate the status of the individual selected input channels. This can be both from the master card (via ADD-ON) or from the local inputs (depending on what source you selected with settings Sel_Ch1 till Sel_Ch16). If the signal is between -1 and 0dBFS, it is displayed as > -1dBFS. Can also be OK or NA (not available)

7 Events Menu

Introduction	An event is a special message that is generated on the card asynchronously. This means that it is not the response to a request to the card, but a spontaneous message.
What is the Goal of an event?	The goal of events is to inform the environment about a changing condition on the card. A message may be broadcast to mark the change in status. The message is volatile and cannot be retrieved from the system after it has been broadcast. There are several means by which the message can be filtered.
DIO88 Events	The events reported by the DIO88 are as follows;
Announcements	<code>Announcements</code> is not an event. This item is only used for switching the announcement of status changes on/off. 0=off, other =on
Audio-Data	<code>Error in Audio Data</code> can be selected between 0 .. 255. 0= no event, 1..255 are the priority setting. In case of a Dolby data ERROR an Event will be generated at the priority, or the audio carrier is falling away, or audio data is in the range of 0 dBFS and -1 dBFS, or the Encoder status is in error.
Reference	<code>Reference</code> can be selected between 0 .. 255. 0= no event, 1..255 are the priority setting. If the reference is lost an Event will be generated at the priority.
What information is available in an event?	The message consists of the following items; <ol style="list-style-type: none">1) A message string to show what has happened in text, for example: "INP_LOSS", "REF_LOSS", "INP_RETURN".2) A tag that also shows what happens, but with a predefined number: e.g. 1 (= loss of input), 2 (= loss of reference), 129(= 1+128 = return of input). For a list of these predefined tags see the table on the next page.3) A priority that marks the importance of an event. This value is defined by the user and can have any value between 1 and 255, or 0 when disabled.4) A slot number of the source of this event.
The Message String	The message string is defined in the card and is therefore fixed. It may be used in controlling software like Synapse Set-up to show the event.

The Tag

The tag is also defined in the card. The tag has a fixed meaning. When controlling or monitoring software should make decisions based on events, it is easier to use the tag instead of interpreting a string. The first implementation is the tag controlled switch in the GPI16.

In cases where the event marks a change to fault status (e.g. 1 for Loss of Input) the complement is marked by the tag increased by 128 (80_{hex}) (e.g. 129 (81_{hex}) for Return of Input).

Defining Tags

The tags defined for the DIO88 are:

Event Menu Item	Tag		Description
Announcements	0 or NA	0 or NA	Announcing of report and control values
Audio-Data	01 _{hex} =AUDIO_ERROR	81 _{hex} =AUDIO_OK	
Reference-Status	02 _{hex} =REF_LOSS	82 _{hex} =REF_RETURN	reference lost or returned

The Priority

The priority is a user-defined value. The higher the priority of the alarm, the higher this value. Setting the priority to Zero disables the announcement of this alarm. Alarms with priorities equal or higher than the Error Threshold setting of the RRC/RRS will cause the Error LED on the Synapse rack front panel to light.

The Address

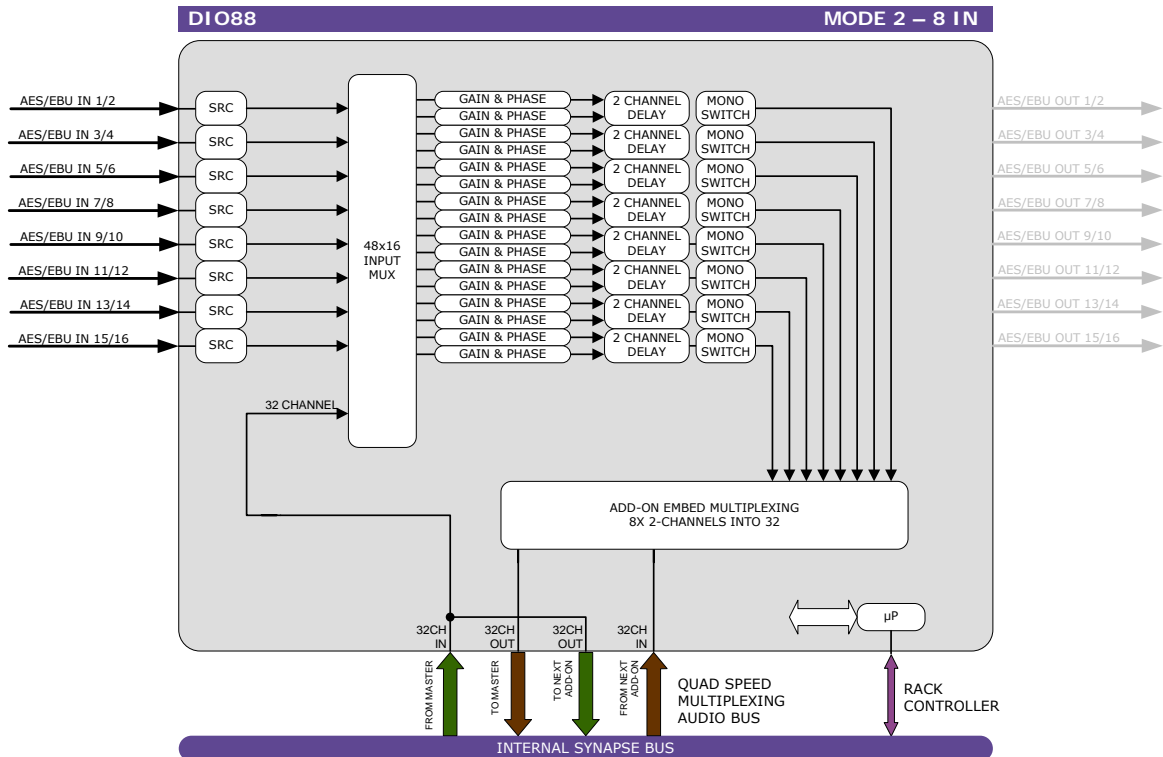
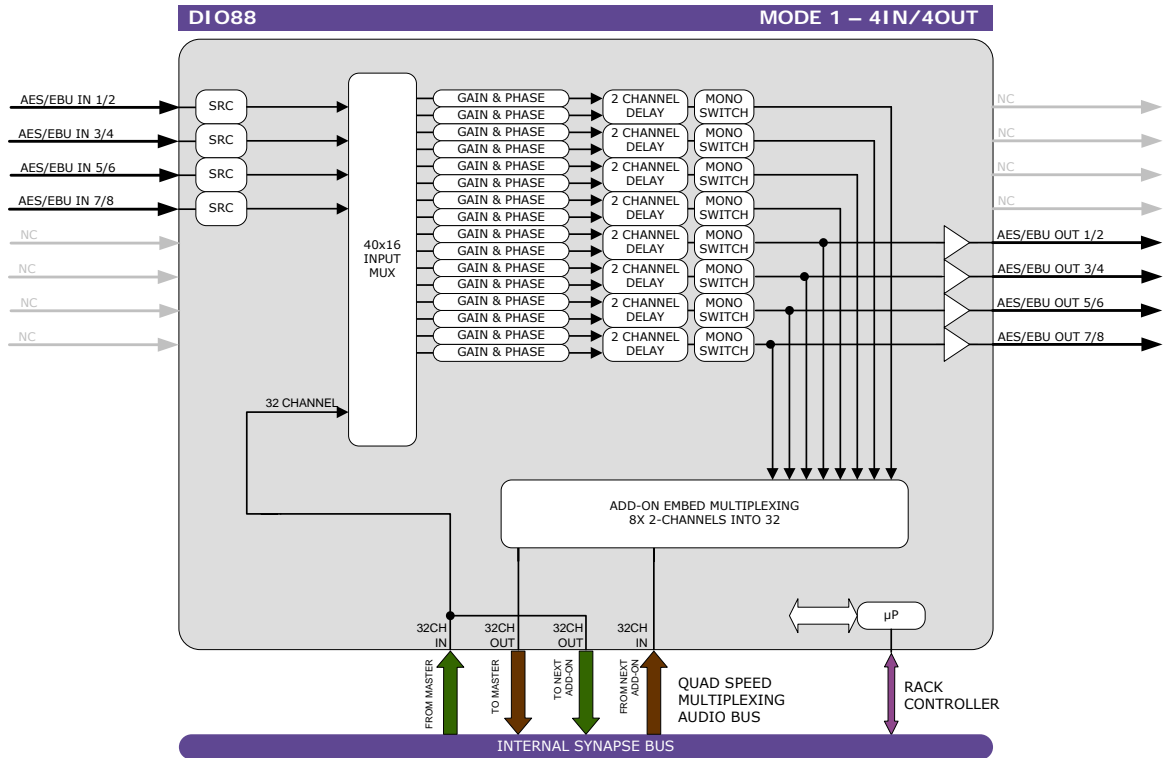
Together with the message string or the tag, the slot number or address of the card is relevant to be able to assign the event to a certain card.

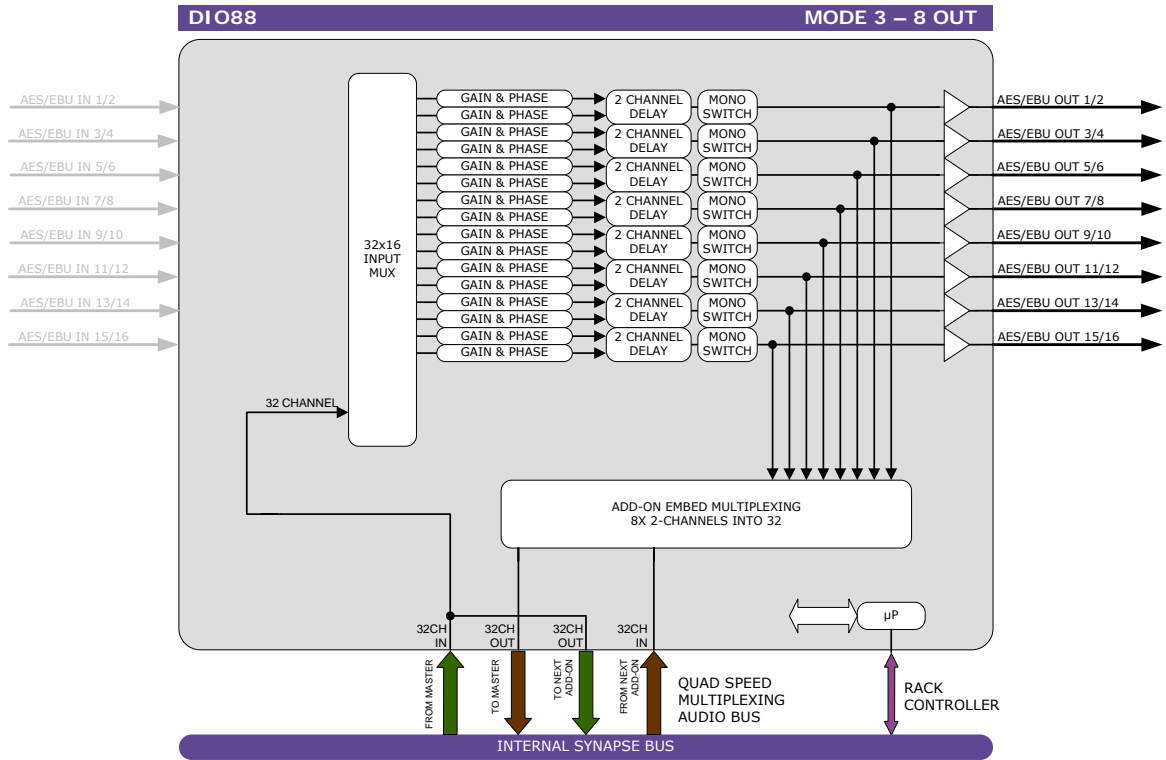
8 LED Indication

ERROR	The error LED indicates an error if the internal logic of the DIO88 card is not configured correctly or has a hardware failure.
INPUT 1 ~ INPUT 8	These LEDs indicated the presence of a valid AES/EBU signal on the inputs 1 till 5.
REFERENCE	This LED indicates the presence of a valid reference signal and that the DIO88 is locked to the master card.
DATA ERROR	This led indicates different types of errors if there is an error in the Dolby encoding, or the audio carrier is falling away, or audio data is in the range of 0 dBFS and -1 dBFS.
CONNECTION	This LED illuminates after the card has initialized. The LED lights for 0.5 seconds every time a connection is made to the card.

Note: When LEDS are blinking constantly, the card is still programming.

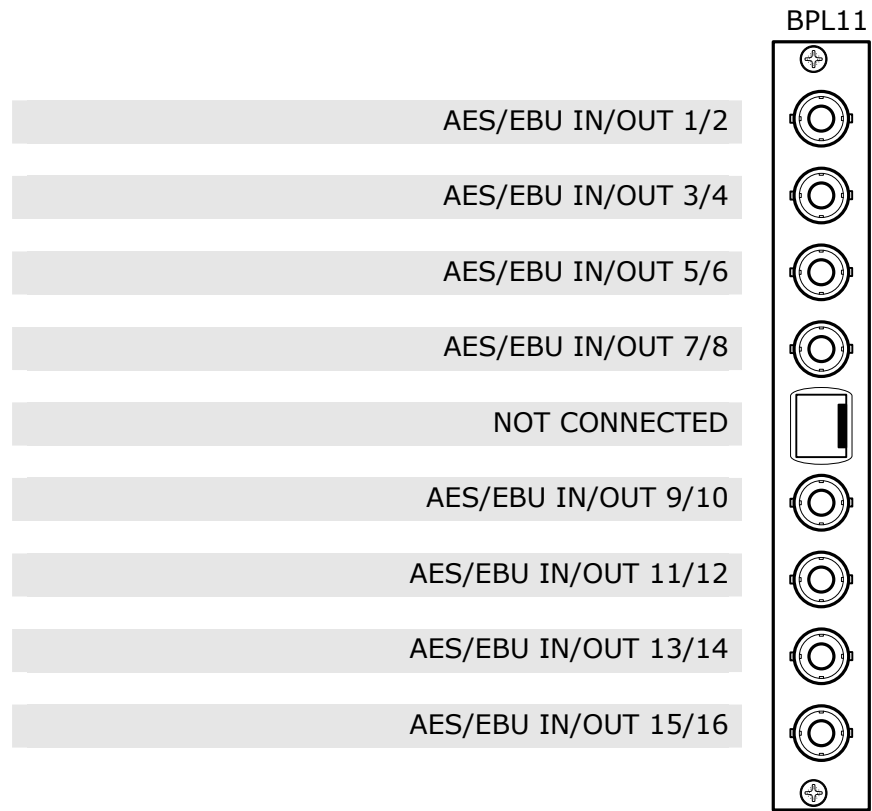
9 Block Schematics





10 Connector Panel

The DIO88 can be used with the BPL11 back plane only:



Appendix 1 Quad speed ADD-ON bus

Scope

The internal audio ADD-ON bus needs an upgrade. We want more channels (32 per video stream seems possible in the near future). And we want the bus to be bidirectional, so 32 channels in and 32 channels out at the same time.

The new interface needs to be compatible with all existing hardware (frames) and in the implementation of the master card it needs to be backward compatible with the original ADD-ON bus.

The master card will have two modes:

- ▶ Normal ADD-ON mode
- or
- ▶ Quad Speed audio ADD-ON mode

These modes are selectable on the Master Card. If a mode is selected all ADD-ON cards to that Master need to be in the same mode.

You can mix Master-Cards in one frame using the two different modes, but all cards to the right of the master must be in the same mode as the master. A new Master breaks the chain and the Master Card ADD-ON mode can be selected again.

Features

The following features and rules will apply:

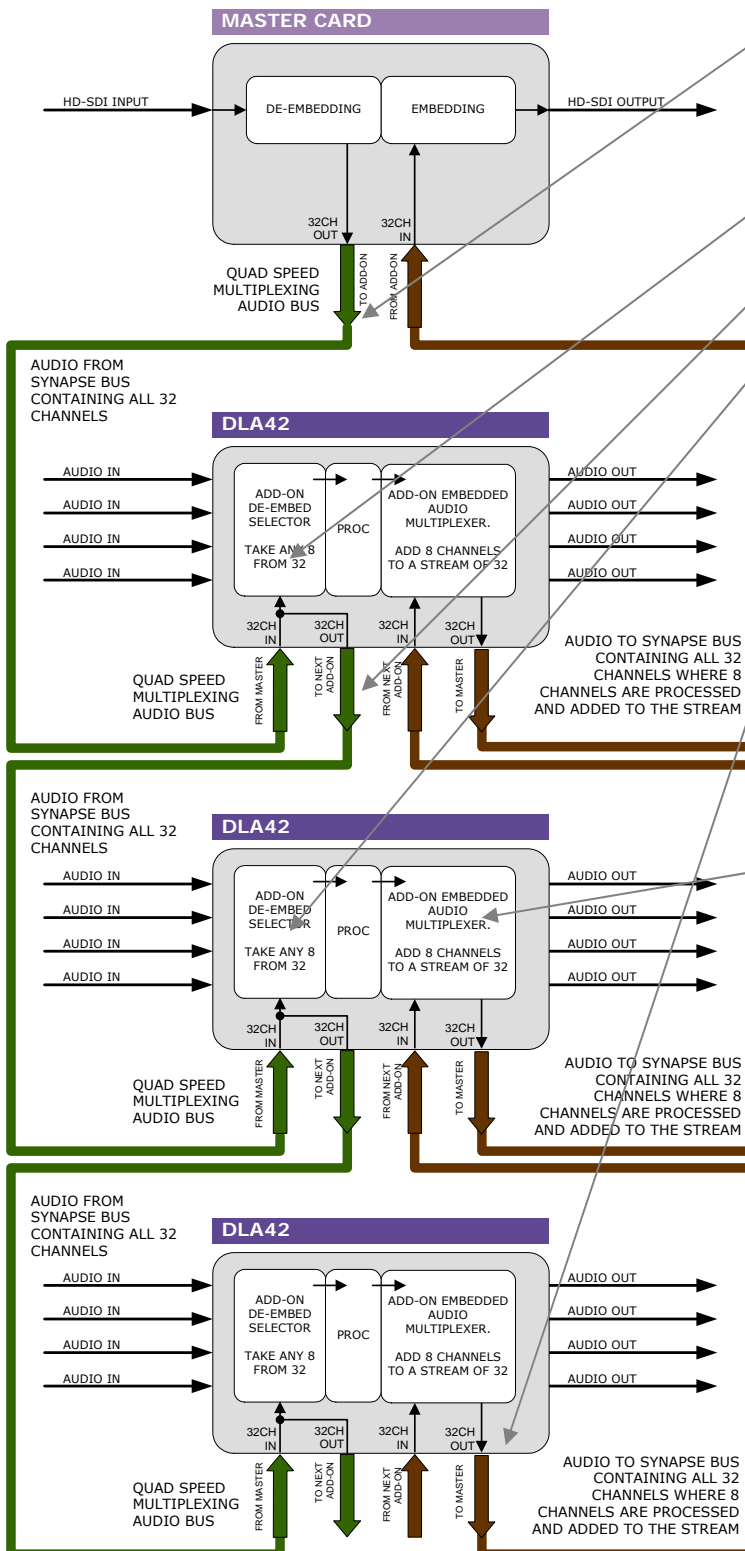
- Up to 32 channels output from the master card with looping to up to 3 ADD-ON cards
 - The ADD-ON card just picks the channels it wants to process
- Up to 32 channels input on the master card
 - If the master card can handle less than 32 channels, the lowest channel numbers will be used, as the ADD-ON card will always generate 32 channels (where some can be zero)
- Channel shuffling is done in the ADD-ON card
 - The Master Card has only one setting to enable the quad speed audio bus
- Every Quad-Speed ADD-ON card takes 32 channels from the 'right hand ADD-ON card' and adds (or overwrites) the local processed channels.
 - This can be done for any of the channels that are processed in the ADD-ON card
- Master Cards are switchable between normal and quad-speed bus
- Channel designations on the block schematics:
 - Channel 1-32 (or less) are injected into the dark green large arrow from Master Card to ADD-ON card and looped on to the next ADD-ON card via the dark green arrow
 - The ADD-ON card injects up to 32 channels into the brown large arrow
 - An ADD-ON card will also actively loop extra processed channels into the next ADD-ON card, and finally into the Master Card
- The cross looping of the original design is now a straight loop
- The quad speed bus can also work in one direction
 - You can use a Quad Speed audio bus to de-embed audio from the master and present on the ADD-ON card as AES/EBU, Bitstream (like Dolby) or analog audio
 - If applicable the ADD-ON card can also be used as an injection point of physical audio streams

Example

The big difference between the new and old bus structure is the fact that it carries 4 times as much audio channels.

It is also bi directional by design. So half of the original physical infrastructure moves audio from the master card to the ADD-ON cards, and the other half is used to put the audio back

The following graphic shows how a typical quad speed bus chain works



The audio coming from the master card (dark green arrow) contains up to 32 channels.

The first ADD-ON card can select any of the 32 channels for internal processing

These channels are looped on to the next ADD-ON card.

This next ADD-ON (sitting in the next n+1 slot) Card can also free select any 8 from 32 channels. *(The DIO88 can also take 3 channels from the ADD-ON bus and 5 channels from its physical input)*

This looping works up to 3 times.

The brown arrow is the return path and sends the (processed) audio back to the master card.

This path is 32 channels wide and is clocked from the master card.

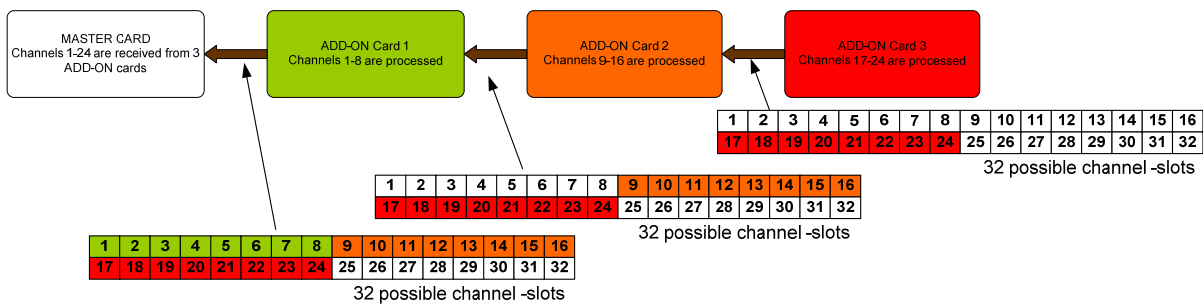
The ADD-ON card can overwrite for instance 8 channels of the 32. These 32 channels are then transported to the next ADD-ON card which overwrites another 8 channels.

Multiplexing

The injection of processed audio into the master card works differently then you were used to with the original audio ADD-ON bus. The brown large arrow will always carry 32 channels from ADD-ON to ADD-ON, or from ADD-ON to Master Card. If the actual channels are used or which channels are used is determined in the ADD-ON card.

In the example below you can see a 4 Card system. One Master Card, and 3 Quad speed ADD-ON cards (the maximum). The last (most right) ADD-ON card processes 8 channels. They are inserted (a menu selection) in slot 17-24 from 32 channel-slots. The second ADD-ON card also processes 8 channels, but they are inserted in slot 9-16 (of 32 slots). The first ADD-ON card inserts channels 1 to 8

This method allows for overwriting slots that come from the right hand Master Card. Channel-slot 25 to 32 are left empty in this example.



Note:

The top example shows a logical way of how the ADD-ON multiplexing could be performed. However; the insertion menu of for instance the DIO88 is much more flexible and allows putting every channel into any of the 32 channel-slots. The example below shows how the flexibility could be used.

