*Synapse*

# HEB05

HD/SD preset based audio embedder

**Installation and Operation manual**

SynLite

**HD**
High definition

**MASTER**
**Card**

COMPATIBLE WITH
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**AXON**®

# TECHNICAL MANUAL

## HEB05

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⚡ **WARNING:** TO REDUCE THE RISK OF FIRE OR ELECTRICAL SHOCK, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE

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● ALWAYS disconnect your entire system from the AC mains before cleaning any component. The product frame (SFR18 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.

**Warranty:** Axon warrants their products according to the warranty policy as described in the general terms. That means that Axon Digital Design BV can only warrant the products as long as the serial numbers are not removed.

This product complies with the requirements of the product family standards for audio, video, audio-visual entertainment lighting control apparatus for professional use as mentioned below.

| CE | EN60950          Safety<br>EN55103-1: 1996     Emission<br>EN55103-2: 1996     Immunity |
|---|---|

| | |
|---|---|
| Axon Digital Design<br>HEB05<br><br>**FC** Tested To Comply<br>With FCC Standards<br><br>FOR HOME OR OFFICE USE | This device complies with part 15 of the FCC Rules<br>Operation is subject to the following two conditions:<br>(1) This device may cause harmful interference, and<br>(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 the RRC/RRS manual.

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**!** **CHECK-OUT:** "AXON CORTEX" SOFTWARE WILL INCREASE SYSTEM FLEXIBILITY OF ONE OR MORE SYNAPSE FRAMES

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Although not required to use 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.

**Placing the card**

The Synapse card can be placed vertically in an SFR18 frame or horizontally in an SFR04 and SFR08 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 LED's will light for a few seconds, this is the time it takes to initialise the card.

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## 3  A Quick Start

**When Powering-up**

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

**Changing settings and parameters**

The front panel controls or the 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

```
[No Alarms]
```
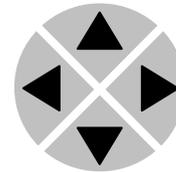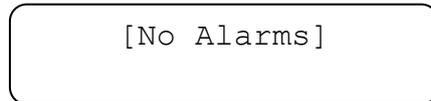
Settings are displayed and changed as follows;

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

Press ►    To g    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.

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

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**Example of changing parameters using front panel control**

With the display as shown below

```
RRC18 [Select Card]
>S01=SFS10
```
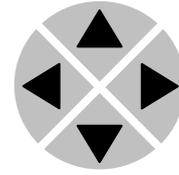
Pressing the ► selects the SFS10 in frame slot 01.

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

```
SFS10 [Select Menu]
>Settings
```
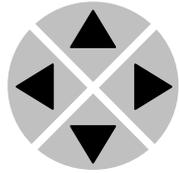
Pressing the ► selects the menu item shown, in this example Settings.

(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 it 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]
SDI-Format>Auto
```
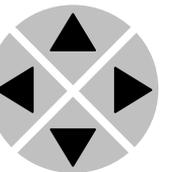
To edit the setting of the menu item press ▲ or ▼.

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

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**Axon Cortex
Software**

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 Cortex help files.

**Menu Structure
Example**

| Slot | Module | Item | Parameter | Setting |
|------|--------|------|-----------|---------|
| ▲ | | | | |
| ▲ | | | | |
| S02 | | Identity | | |
| ▲ | | ▲ | | |
| S01 | SFS10 ► | Set-tings | ► Standard_dig | ► Auto |
| ▼ | | ▼ | ▼ | ▼ |
| S00 | RRC18 | Status | Mode | 625 |
| | | ▼ | ▼ | ▼ |
| | | Events | Ref-Input | 525 |
| | | | ▼ | |
| | | | H-Delay | |
| | | | ▼ | |
| | | | ▼ | |

**NOTE:** Further information about Front Panel Control and Synapse Cortex can be obtained from the RRC and RRS operational manuals and the Cortex help files.

# 4 The HEB05 Card

**Introduction**

The HEB05 is an HD SDI and SD SDI digital audio embedder. It is capable of inserting or appending 4 free-running AES/EBU digital audio channels (8 channels). The core of the HEB05 consists of four embedder-blocks Emb_A, Emb_B and Emb_C and Emb_D. Each block is capable of embedding 4 audio channels into one group, which gives a total of 16 audio channels into four groups. In addition, four ADD-ON cards can be connected to create a routing matrix. One ADD-ON card is needed to get 16 embedded channels (DIO48). The architecture of Emb_A to Emb_D blocks is identical. The local inputs have the opportunity to do additional Phase and Gain corrections (on the fly). The HEB05 has two HD-SDI processed outputs and 4 local AES/EBU inputs

**Features**

- 4 AES/EBU inputs with sample rate converter (available with 110 Ohm and 75 Ohm inputs)
- 4 extra AES/EBU inputs through the Synapse bus
- 1 x reclocked HD SDI output
- 2 x HD SDI + embedded audio outputs
- 8 presets that configure all 16 input channels at once. One controlled by closing of BNC 5
- Audio level and phase control (local inputs only)
- Audio offset delay (local inputs only) up to 2600 ms
- 8 extra audio channels (2 groups) with ADD-ON card
- Peak detection 0, -6, -12 and -18dBFS
- Silence detection with threshold (-100 to -20dBFS) and time control (1 to 255 sec)
- Transparent for ATC time code RP188, RP196, RP215
- Locks to SDI input
- Full control and status monitoring through the front panel of the SFR04/SFR08/SFR18 frame and the Ethernet port (ACP)
- Optional 1 fiber input (replacing 1 SDI input) or 1 fiber output (replacing 1 SDI output) on I/O panel

**Applications**

- HD/SD audio embedding
- Preset based 8 channel audio embedding
- Preset based 16 channel audio embedding with DIO48 ADD-ON card

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# Block schematic

# 5 Settings Menu

**Introduction**

The settings menu displays the current state of each HEB05 setting and allows you to change or adjust it. Settings can be changed using the front panel of the Synapse frame (SFR18, SFR08 or SFR04) or with Cortex. Also the SCP08 control can be used. Please refer to chapter 3 for information on the Synapse front panel control and Cortex.

*Note:* All items preceded with a #-sign are part of the presets.

**SDI-Format**

The Input format setting allows you to set input format.

AUTO: the card is recognizing the input format automatically.

The selectable formats are:
- Auto
- 1080i-60 ,1080i-50
- 1080p-24 , 1080p-24, 1080p-24
- 1035i-60
- 720p-60, 720p-50, 720p-30, 720p-25, 720p-24
- 525i
- 625i

The default setting is AUTO. Please note that the functionality of the card will be affected, if the correct input format is not selected.

**Field Freq**

1:1, 1:1.001 or AUTO  are the values that can be selected

1:1 is the right field frequency for 1080i-50. Because the actual field frequency of 1080i-60 is 59.97 and not 60 is it necessary when 1080i-60 is selected as input format to adjust the field frequency to 1:1.001

There is also an AUTO mode, the HEB05 will detect the format and switch then to the according field-frequency. Default is AUTO.

**Emb-Mode**

Emb-Mode enables additional audio channels to be added to the existing audio-groups in the ancillary data space of the HD stream Emb-Mode has three settings, Off, Append, and Overwrite. The default setting is Overwrite.

In Off mode the card will reclock the input. In Overwrite mode all existing audio groups will be overwritten and the processes group is inserted. In Append mode additional audio channels will be added. In order to blank the ancillary data space of the HD-SDI stream, set Emb-Mode to Overwrite  and set Emb-Sel  to Off.

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| | |
|---|---|
| **Emb-A-Sel ~ Emb_D-Sel** | These settings determine which of the four groups of audio, available on the Synapse ADD-ON bus, will be embedded by embedders A till D into the HD SDI stream. The possible settings are Off (switching the corresponding embedder entirely), group_1, group_2, group_3 or group_4. |
| **Preset-Contr** | This item sets the card to be controlled either manually (Manual), thru GPIs (GPI) or by both (Manual+GPI). By default, this is set to Manual. |
| **Preset** | It is possible to define the number of presets with this setting. The possible presets range from 1 to 8. Each setting with the # symbol is part of the preset.<br><br>The Default setting is set to #1. |
| **GPI-Off** | With Preset-Contr set to GPI or Manual+GPI, you can change presets with a GPI trigger. The HEB05 can react differently to both GPI open en GPI close events.<br><br>With the GPI-Off setting you can select a preset number which should be triggered when a GPI contact is opened again after being closed. You can also turn this option off (meaning a preset will only be triggered when a GPI is closed, without anything changing when it opened again). Can also be set to Previous, in which the last active preset will be activated when the GPI is opened after being closed. The Default is off. |
| **GPI-On** | With Preset-Contr set to GPI or Manual+GPI, you can change presets with a GPI trigger. The HEB05 can react differently to both GPI open en GPI close events.<br><br>With the GPI-on setting you can select a preset number which should be triggered when a GPI contact is closed after being open. You can also turn this option off (meaning a preset will only be triggered when a GPI is opened, without anything changing when it is closed again). Can also be set to Previous, in which the last active preset will be activated when the GPI is closed after being open. Default is off. |
| **#Emb-A1/2 ~ #Emb-A3/4** | Emb-A1/2 and Emb-A3/4 determine which audio channels are embedded by channels 1/2 and 3/4 of embedder A. The available settings are, AES1/2, AES3/4, AES5/6, AES7/8, AddOnA1/2, AddOnA3/4, AddOnB1/2, AddOnB3/4, AddOnC1/2, AddOnC3/4, AddOnD1/2 and AddOnD3/4 |

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| | |
|---|---|
| **#Emb-B1/2 ~ #Emb-B3/4** | Emb-B1/2 and Emb-B3/4 determine which audio channels are embedded by channels 1/2 and 3/4 of embedder B. The available settings are, AES1/2, AES3/4, AES5/6, AES7/8, AddOnA1/2, AddOnA3/4, AddOnB1/2, AddOnB3/4, AddOnC1/2, AddOnC3/4, AddOnD1/2 and AddOnD3/4 |
| **#Emb-C1/2 ~ #Emb-C3/4** | Emb-C1/2 and Emb-C3/4 determine which audio channels are embedded by channels 1/2 and 3/4 of embedder C. The available settings are, AES1/2, AES3/4, AES5/6, AES7/8, AddOnA1/2, AddOnA3/4, AddOnB1/2, AddOnB3/4, AddOnC1/2, AddOnC3/4, AddOnD1/2 and AddOnD3/4 |
| **#Emb-D1/2 ~ #Emb-D3/4** | Emb-D1/2 and Emb-D3/4 determine which audio channels are embedded by channels 1/2 and 3/4 of embedder D. The available settings are, AES1/2, AES3/4, AES5/6, AES7/8, AddOnA1/2, AddOnA3/4, AddOnB1/2, AddOnB3/4, AddOnC1/2, AddOnC3/4, AddOnD1/2 and AddOnD3/4 |
| **Delay-AES1 ~ Delay-AES8** | Every audio-process-output-channel can be delayed up to 2.6 seconds. The delay can be adjusted with `Delay-AES1` till `Delay-AES8`. The delay can be adjusted between `0`ms and `2600`ms in steps of 1ms. The default delay is `0`ms. |
| **Gain-AES1 ~ Gain-AES8** | The level of `Out_Ch1` till `Out_Ch8` is determined by the individual Gain control of each channel (`Gain-AES1` till `Gain-AES8`). The audio level can be adjusted between `+12`dB and `−60` dB in steps of 0.25dB. Below 60dB the audio is muted and the display shows `−999.00dB`. `Gain-AESx` adjusts the gain of the audio output of the card and does not change the outputs to the internal Synapse bus. The default setting is 0.00dB. |
| **Phase-AES1 ~ Phase-AES8** | The phase of the audio of `Out_Ch1` till `Out_Ch8` can be adjusted using `Phase-AES1` till `Phase-AES8`. The user can choose between `0` degrees and `180` degrees phase shift. `Phase-AESx` adjusts the phase of the audio output of the card and does not change the outputs to the internal Synapse bus. The default setting is `0` degrees. |
| **SRC_AES1/2 ~ SRC_AES7/8** | The AES/EBU inputs of the HEB05 are connected to a Sample Rate Converter. This enables the input to use audio sample rates that are non-synchronous to video. For Non PCM audio data the SRC can be bypassed and the data is inserted in the card transparently (`Transp`). The settings are `On` and `Transp`. The default setting is `On`. |

**Silence-Time** | This item allows you to set the amount of seconds before the card is to display a silence status. A variable of `1` up to `255sec` can be selected.

The default setting is `10 sec`.

**Silence-Level** | `Silence-level` determines what the level of silence is. A selectable range from `-100 dBFS` to `-20 dBFS` is available.

The default setting is `- 60dBFS`

**ATC-Transp** | With this setting you can select which ATC standard should be copied to the output. Can choose for standards `RP188`, `RP196` or `RP215`. You can also choose to copy all ATC standards present on the input with the `All (1pckt/ln)` setting. If you don't want to use ATC transparency, set this item to `off`.

# 6 Status Menu

**Introduction**   The status menu indicates the current status of each item listed below.

**HDSDI-Input**   This status item indicates the presence of a valid High Definition serial digital video signal is present at the input. HDSDI-Input indicates if an input signal is NA (not available), Present or the following formats;
- 1080i-60
- 1080i-50
- 1080p-30
- 1080p-25
- 1080p-24
- 1035i-60
- 720p-60
- 720p-50
- 720p-30
- 720p-25
- 720p-24

**GrpInUse**   GrpInUse indicates the audio groups that are already present in the incoming HD SDI signal. The indication of a group, or groups being present is as follows,

### Display

```
____
1___
_2__
12__
__3_
1_3_
_23_
123_
___4
1__4
_2_4
12_4
__34
1_34
_234
1234
```
When no groups are present,
GrpInUse indicates ____.

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|---|---|
| **Grp-Ins** | When the serial digital video signal already contains audio data and `Emb-Mode` is set to `Append` and the selection `Emb-Sel` is set to the same group number as the present audio, this status item will generate an `Error`. No embedding occurs for the selected group that creates the error. If `Emb-Mode` is set to `Overwrite` the present audio data will be lost, and replaced by the new audio data. If `Emb-Mode` is set to `Overwrite`, no `Grp-Ins` error can occur. If an error does not occur `Grp-Ins` will indicate `Ok`. |
| **AES1-In ~ AES8-In** | These items indicate the status of the audio-data of the corresponding AES input. |
| | When the channel does not contain audio, it will indicate `NA`. If audio is present and not clipped or silenced it will indicate `Ok`. |
| | Due to an adjustment of `Gain-AESx`, the audio signal can be raised above `0dBFS` and a distorted audio signal will be the result. In this situation this status indicates `Clipped` and the `DATA-ERROR`-led will light. |
| | When the signal meets the silence criteria, `Silence` is displayed and the `DATA-ERROR`-led lights. |
| **AddOnA1 ~ AddOnB4** | These status menu items indicate the status of audio data of ADD-On bus channels `AddOn-A1` till `AddOn-B4`. |
| | When these channels do not contain audio, it will indicate `NA`. If audio is present and not clipped or silenced it will indicate `Ok`. |
| **CRC-Stat** | CRC Stat gives the status of the incoming HD/SDI signal CRC `Error`. Can report `Luma_CRC` or `Chroma_CRC` |
| **FPGA-Stat** | `FPGA-Stat` displays the status of the internal processor of the HEB05. The status is indicated as `Ok` or `Error`. |
| **GPI-Stat** | This item displays the current GPI status. Can be either `Open` or `Closed`. |
| **Preset-Stat** | This status item shows which is the current active preset: #1 till #8. |

# 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.

**Events**

The events reported by the HEB05 are as follows;

**Announcements**

`Announcements` is not an event. This item is only used for switching the announcement of status changes on/off. 0=off, other =on

**Input**

Input can be selected between 0 .. 255. 0= no event, 1..255 is the priority setting.

**CRC-Status**

EDH status can be selected between 0 .. 255. 0= no event, 1..255 is the priority setting.

**Grp-Insert**

Grp-Insert status can be selected between 0 .. 255. 0= no event, 1..255 is the priority setting.

**What information is available in an event?**

The message consists of the following items;

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.

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**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 card are:

| Event Menu Item | Tag | | Description |
|---|---|---|---|
| Announcements | 0 or NA | 0 or NA | Announcement of report and control values |
| Input | $01_{hex}$=INP_LOSS | $81_{hex}$=INP_RETURN | primary input lost or returned |
| GRP-Insert | $04_{hex}$=ANC_ERROR | $84_{hex}$=ANC_OK | Group insert error |

**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 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 LED**

The error LED indicates an error if the internal logic of the HEB05 card is not configured correctly or has a hardware failure.

**Input LED**

This LED indicated the presence of a valid SDI video signal on the input.

**ANC Data LED**

Indicates the presence of embedded audio within the SDI input signal.

**Data Error LED**

This LED indicate two different types of error:
- ANC (embedded audio) checksum error.
- EDH error

**Connection LED**

This LED illuminates after the card has initialised. The LED lights for 0.5 seconds every time a connection is made to the card.

# 9 Block Schematic
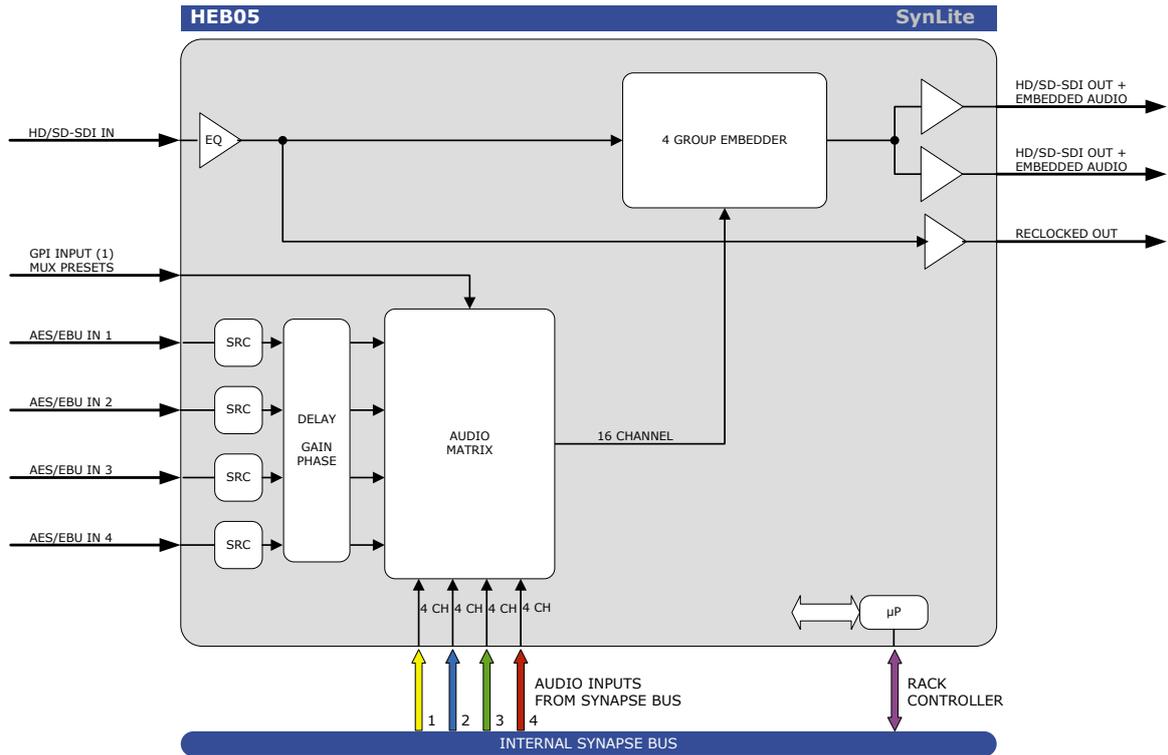
# 10  Connector Panels

The HEB05 can be used with the BPH01 and BPH02 or BPH02D. The following table displays the pinout of these backpanels.

| | BPH01 | BPH02 | BPH02D |
|---|---|---|---|
| HD/SD SDI INPUT (OPTIONAL FIBER INPUT) | | | |
| HD/SD SDI RECLOCKED OUTPUT | | | |
| HD/SD SDI PROCESSED OUTPUT 1 | | | |
| HD/SD SDI PROC. OUTPUT 2 (OPTIONAL FIBER OUTPUT) | | | |
| GPI (MUX presets) INPUT | | | |
| AES/EBU INPUT 1 | | | |
| AES/EBU INPUT 2 | | | |
| AES/EBU INPUT 3 | | | |
| AES/EBU INPUT 4 | | | |

**For fiber connectivity see www.axon.tv**

Unused inputs and outputs must be terminated with the correct impedance!

# BPH02D D-sub pinout:
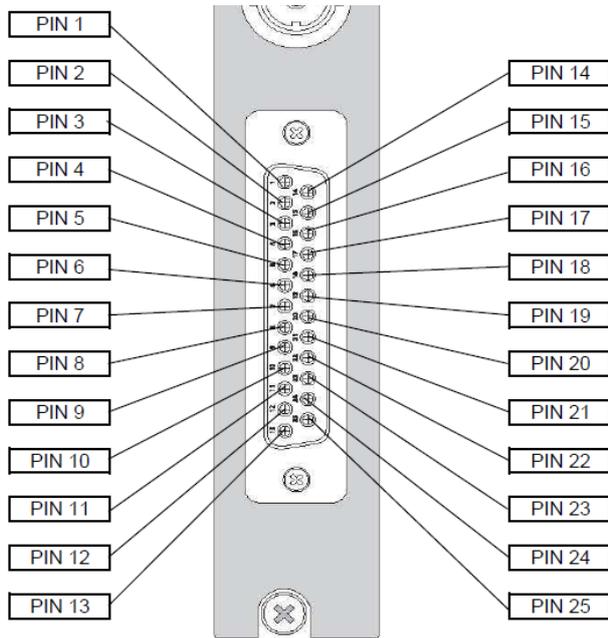


| Pin 1 | Not connected |
|---|---|
| Pin 2 | Not connected |
| Pin 3 | Ground |
| Pin 4 | Ground |
| Pin 5 | Ground |
| Pin 6 | Ground |
| Pin 7 | AES1- IN |
| Pin 8 | AES1+ IN |
| Pin 9 | Ground |
| Pin 10 | AES3- IN |
| Pin 11 | AES3+ IN |
| Pin 12 | Ground |
| Pin 13 | Ground |
| Pin 14 | Ground |
| Pin 15 | Not connected |
| Pin 16 | Not connected |
| Pin 17 | Ground |
| Pin 18 | Ground |
| Pin 19 | Ground |
| Pin 20 | Ground |
| Pin 21 | AES2- IN |
| Pin 22 | AES2+ IN |
| Pin 23 | Ground |
| Pin 24 | AES4- IN |
| Pin 25 | AES4+ IN |