

Operating Manual

Precision Audio Monitoring



PAM2 MK2

SAFETY

Installation.

Unless otherwise stated TSL equipment may be installed at any angle or position within an operating temperature range of 5°C - 30°C.

All TSL equipment conforms to the EC Low Voltage Directive:

| |
|---|
| EC Low Voltage Directive (73/23/EEC)(OJ L76 26.3.73)(LVD). Amendment: (93/68/EEC) (OJ L220 30.8.93). |
|---|

In all cases the frame of the equipment must be earthed on installation.

Where appropriate, the earth pin on the IEC mains inlet connector is connected to the metal frame of the equipment, to 0 volts on the internal DC PSU and to signal ground unless otherwise stated. All metal panels are bonded together.

Check that the voltage selector setting (if fitted) and the fuse rating is correct for the local mains supply.

Due consideration for cooling requirements must be given when mounting the equipment. It is recommended that a 1RU of rack space, or a vent panel, should be left above and below the unit.

WARRANTY, MAINTENANCE AND REPAIR

- All TSL products have a one year warranty period starting from the date it leaves the factory.
- A repair warranty is to apply. That is, the product is to be returned for repair with no replacement and an exchange shipping policy is also to apply.
- TSL offers a seven day DOA policy together with an exchange shipping policy. That is, if a product has been declared 'dead on arrival' within a seven day period a warranty replacement will be shipped.
- A temporary replacement may be available where, for operational reasons, it is imperative that service is continued. The customer will be asked to enter into a 'loan agreement' for the duration of repair.
- All faulty equipment returned to TSL for repair will, where possible, be returned to the customer within seven working days.

TSL Returns Procedure

Please telephone +44 (0)1628 676221 (Fax: +44 (0)1682 676299) and ask for Customer Support, detailing the model and serial number of the equipment, who will provide a Returns Number. This will enable us to track the unit effectively and will provide some information prior to the unit arriving.

For each item, this unique Returns Number must be included with the Fault Report sent with the unit.

A contact name and telephone number are also required with the Fault Report sent with the unit.

Fault report details required.

- Company:
- Name:
- Address:
- Contact Name:
- Telephone number:
- Fax number:
- Email address:
- Returns Number:
- Symptoms of the fault (to include switch setting positions, input signals etc):

Packing

Please ensure that the unit is well packed as all mechanical damage is chargeable. TSL recommends that you insure your equipment for transit damage.

The original packaging, when available, should always be used when returning equipment.

If returned equipment is received in a damaged condition, the damage should be reported both to TSL and the carrier immediately.

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1.0 Introduction

The PAM2 is a 2RU x 320mm deep Audio Monitoring Unit (AMU) with two OLED displays for audio level measurement, video confidence and metadata status indication.

PAM2 has been designed in conjunction with some of the worlds leading broadcasters to produce arguably the most comprehensive, intuitive and feature packed product of its type.

As with any new product which relies on complex software, it is possible that you may find minor bugs or perhaps think of enhancements which would improve the operation of PAM2. In the event of either scenario, please feel free to contact TSL via your local reseller or directly on +44 1628-676221, asking for the PAM Product Manager.

TSL will be releasing upgrades and feature enhancements from time to time – as a purchaser of a PAM2 product you can receive these free of charge through your reseller or directly from TSL. Please refer to www.tslproducts.com for announcements.

PAM2 MK2 is available in Dolby decoding and non-Dolby versions.

The following features are standard:

- Dual auto-sensing, 1080p (60, 59, 94 and 50Hz), HD/SDI video inputs
- De-embedded audio monitoring from video (HD/SDI) with intuitive selection from up to sixteen channels (four groups)
- 8 AES (8 Pairs/16 Channel) Inputs– 110Ohm Balanced or 75Ohm unbalanced via optional CAB-D25-BNC cable
- SPDIF Optical Input
- 6 Analogue Stereo Inputs
- Ethernet for Network connectivity
- USB connector for system updates and preset save/recall
- SD card slot for system updates and preset save/recall
- ‘Scroll To Hear’ – top level bargraph navigation using rotary encoder
- Downmix of discrete multichannel audio to stereo for compatibility monitoring
- Multichannel audio outputs for external stereo or 5.1 loudspeaker system integration
- ITU BS1770/71 loudness measurement and Histogram
- User Programmable ‘Assign Matrix’
- Audio Output Delay
- Automatic mode switching – depending on signal type
- Energy Saver Screen Mode
- Dolby E, Dolby Digital and Dolby Digital Plus decoding from HD.SDI and AES signal sources
- Lt Rt and Lo Ro Downmixing of Dolby Signals
- SMPTE 2020 Metadata Monitoring and Auto-Downmix
- Hi Resolution Video confidence monitoring
- Re-clocked HD/SDI with down converted SDI or composite (PAL.NTSC) video outputs selected via rear panel Config. Switch.
- Dual high resolution OLED screens for 16 bargraphs, setup and metadata display.
- Choice of user selectable bargraph scales (BBC PPM, EBU PPM, EBU Digital, Nordic,VU and DIN)
- User programmable presets. 8 by hardware buttons, GPI and 24 internal, accessible by high level menu selection
- Factory preset recall – 5 presets selecting SDI1, SDI2, AES, Analogue and Optical Inputs
- Fixed or variable analogue multichannel outputs (8 mono)
- Fixed or variable AES multichannel outputs (8 pairs/16 Channels)
- Variable stereo analogue outputs
- High quality internal full range loudspeaker system
- Variable LED brightness control
- Dual 12V DC inputs
- Serial remote control
- Headphone output with LS muting
- Compact, lightweight (5.1Kg) 2RU case, 320mm deep

The PAM2 MK2 represents the natural evolution of the award winning PAM2 3G audio monitoring family. In purchasing the PAM2 MK2 you are investing in a solution which will evolve to meet your needs at no further cost to you the owner. As part of TSL company policy, software updates for the product will be free charge for the life of the unit (subject to conditions) and will unlock new features and improve existing ones.

From September 2014 PAM2 MK2 will be shipped with a Dolby CAT1100 decoder card. The Dolby CAT1100 represents a considerable advancement in functionality including the following key features which will become available as part of your CAT1100 equipped PAM2 MK2 as future software updates unlock them.

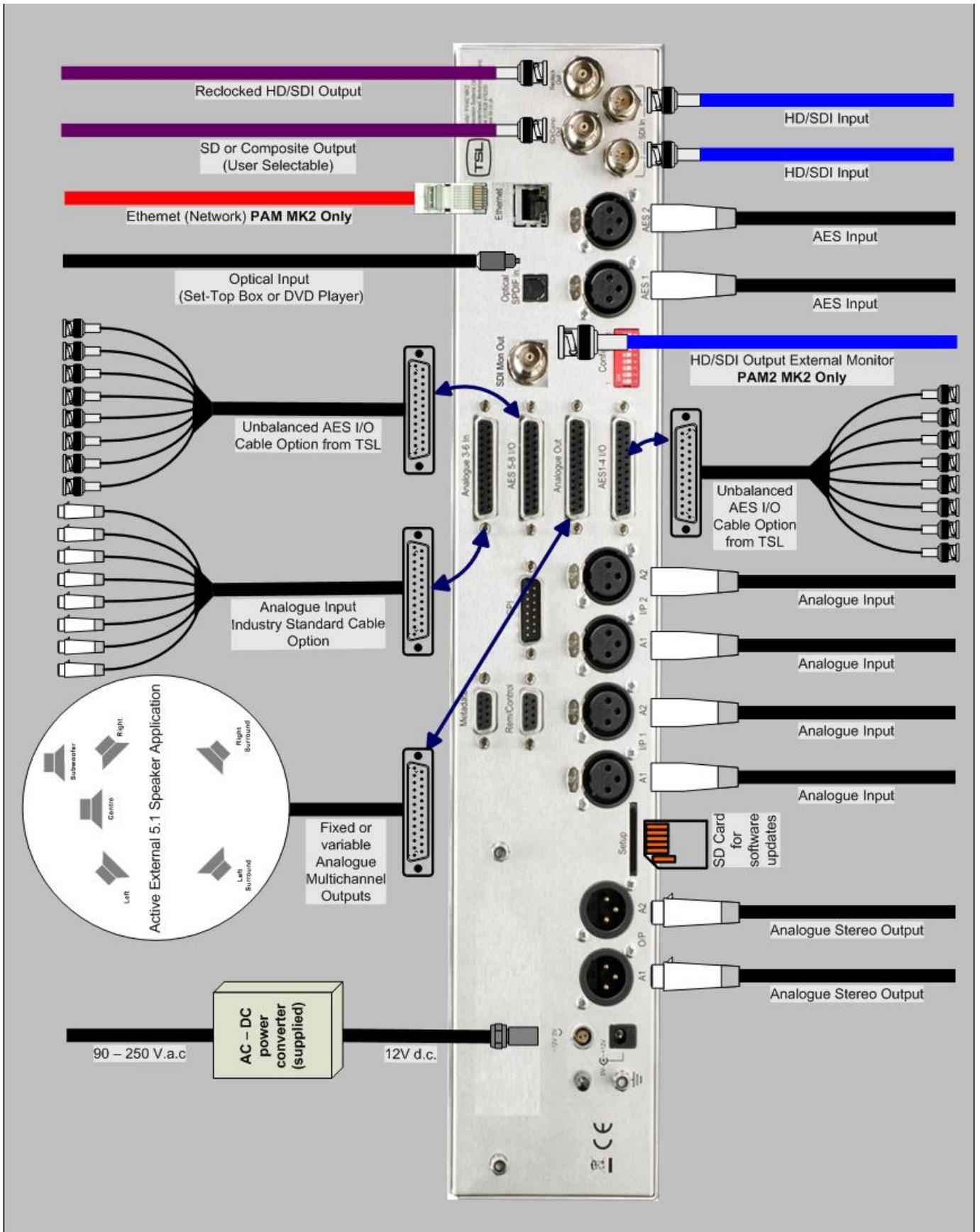
- Single stream Dolby E decoding (up to 7.1)
- Single stream Dolby Digital decoding (up to 5.1)
- Single stream Dolby Digital Plus Main audio decoding (up to 7.1) with Audio Description and stream mixing
- PCM bypass with latency matching and Metadata generation
- Selectable error concealment (On Air, Test and Measurement modes)
- Loudness measurement to ITU, EBU and Leq (A) standards/recommendations for each decoded audio stream.
- Dialogue intelligence Loudness measurement
- True Peak measurement
- Metadata and Metadata subset outputs

Note: When monitoring a Dolby source, the CAT1100 equipped PAM2 MK2 will use the extended type 3 metadata values, (known as LtRt Cmixlev, LtRt Surmixlev, LoRo Cmixlev and LoRo Surmixlev), to create the LtRt and LoRo downmixes at the correct level. However, for some legacy Dolby streams that don't contain this data, the card will cause the LtRt and LoRo downmixes to be created using a default set of levels.

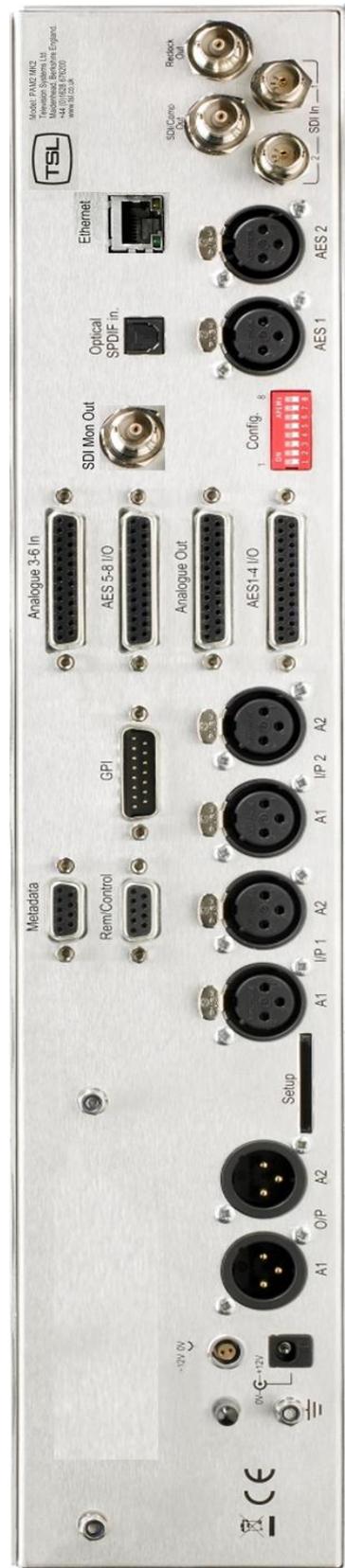
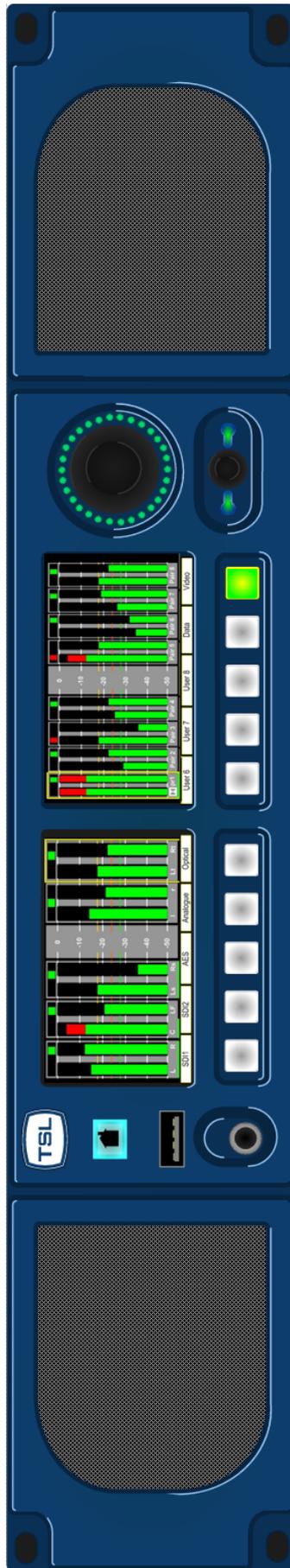
If there is no Extended bitstream information within the type 3 metadata section of the Dolby stream, the unit will use coefficient values of +3.0dB for both the Cmixlvl and Surmixlvl, rather than using the Cmixlev and Surmixlev levels from type 3 metadata (which are normally -3dB or -6dB). For example, if the required Cmixlev and Surmixlev values were both -3dB, the actual output would be roughly 4dB higher than expected.

This behaviour does not affect the loudness onboard calculations and does not alter the balance of a downmixed signal being monitored.

1.1 PAM2 MK2 Hookup Schematic



1.2 PAM2 MK2 Front and Rear Panel



2.0 Getting Started

The PAM2 is designed to be user friendly and intuitive to operate. The menus and functions will feel familiar to both users of TSL multichannel audio monitoring products and those buying a TSL solution for the first time.

The PAM2-MK2 comprises the complete operating system and features of the PAM2-3G16 however a number of additional features such as the External Monitor output, Home button and USB port are unique to PAM2 MK2 and their functionality is described within this document.

Important Note: PAM2 ships with a default 0dBu reference level set to -18 dBFS, the default operating scale is EBU Digital. A simple power up sequence may be used to alter the operating reference level to -20 dBFS with a default EBU Digital operating scale.

For -20 dBFS default operation – apply DC power to the rear power connector whilst simultaneously pressing buttons 6 and 8. The following message will appear on the right hand OLED signalling a successful operation.

“Default memories cleared Restored Factory - 0dBu = -20dBFS”

For -18 dBFS default operation – apply DC power to the rear power connector whilst simultaneously pressing buttons 6, 7 and 8. A message will appear on the right hand OLED signalling a successful operation.

“Default memories cleared Restored Factory - 0dBu = -18dBFS”

2.1 Front Panel Controls and Displays

PAM2 MK2 menus and features are navigated via a multi-function encoder, a bank of ten pushbuttons and the 'Home' button. No monitoring function is ever more than two clicks away from the front panel view.



- The left hand OLED screen displays bargraphs 1-8 in **Full-screen** mode and bargraphs 1-16 when Menu / Data or Video modes are activated.
- The left hand OLED also displays decoded Dolby bargraphs, Downmix components and Assign Matrix selections
- The right hand OLED screen displays bargraphs 9-16 in **Full-screen** mode and Menu / Data or Video screens when activated.
- The lower rotary encoder is used to activate the '**Scroll To Hear**' feature and to access **Menus** and **Presets**.
- The volume knob is used to adjust internal/external loudspeaker and headphone levels. The control also features a 'push' action which **Cut/Dim** loudspeaker audio.
- The 'Home' button is used to cycle through the **24 User Presets** and **Audio Monitor Shortcut Keys** accessed via buttons 1-8
- The USB port is used to save and load **User Presets** to a compatible memory storage device
- The 5 buttons located below the left hand OLED screen are used to recall presets 1-5, 9-13, 17-21 and various monitor functions (accessed by successive presses of the **Home** button).
- The Factory Default condition ships the following User Presets pre-programmed on buttons 1-5 respectively. These may be overwritten by customer programmed presets; defaults can be restored via the reset procedure described in Section 2.17 of this handbook.
 1. SDI 1 Input Pair 1
 2. SDI 2 Input Pair 1
 3. AES Input Pair 1
 4. Analogue Input Pair 1
 5. Optical Input (Digital Audio Pair 8)
- The first 3 buttons located below the right hand OLED screen are used to recall presets 6-8, 14-16, 22-24 and various monitor functions (accessed by successive presses of the **Home** button) They are also used to restore system default conditions during a power up sequence.
- Buttons 1-8 when pressed and held for 2 seconds activate the **Preset Save** menu enabling the user to save operational setups for instant recall.

- The 9th button which is located below the right hand OLED screen is used to toggle the **Meters, Data and Loudness Histogram Screens** when in **Full-screen mode** and to save **User Presets** when in **Menu mode**
- The 10th button located below the right hand OLED screen is used to toggle the **Video Screen** when in **Full-screen mode** and to navigate '**Back**' from **Menu modes**.

2.2 Rear Panel Connectivity

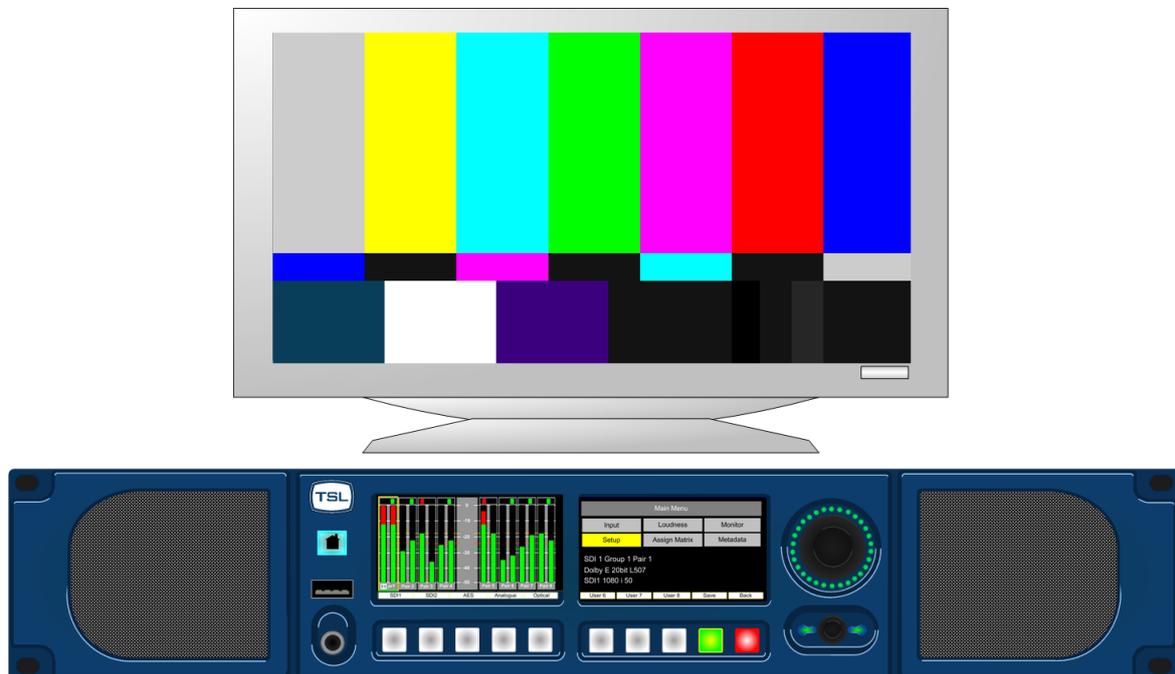
Unique to the PAM2 MK2, the rear panel features an External Monitor HD-SDI output BNC which can be connected to a compatible external display device directly via SDI or by use of a 3rd party convertor to HDMI or DVI equipped monitors.

The Ethernet port fitted to the rear of the unit is not active in the initial product release however it will be activated by a forthcoming software release and application software will follow in due course.

2.3 External Monitor Functionality

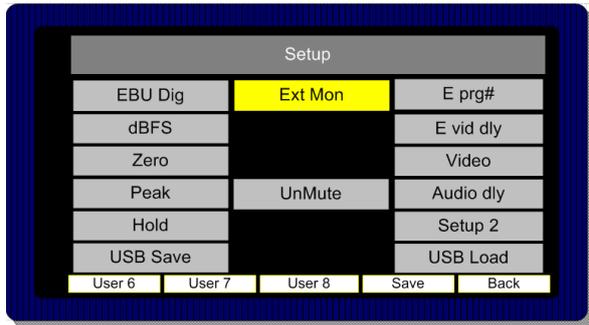
When an external monitor is first connected to PAM2 MK2 the screen will display a colour bar pattern signifying that the output is connected but not activated.

The External Monitor output is set to the format 1080i59.94 with a 16:9 aspect ratio.



2.4 Activating the External Monitor Output

The External Monitor output is activated via the Setup menu. The menu is accessed by pressing the encoder, selecting **Setup** and then selecting **Ext Mon**



The default view upon activation will appear as per the image below with bargraph displays in the upper quadrants of the image, **Loudness Histogram** in the lower left and **Data** or **Video** in the lower right section.

The **Video** image may be toggled between the **PAM2 MK2 OLED** and the **External Monitor** lower right quadrant by pressing **Button 10** when not in **Menu** modes.



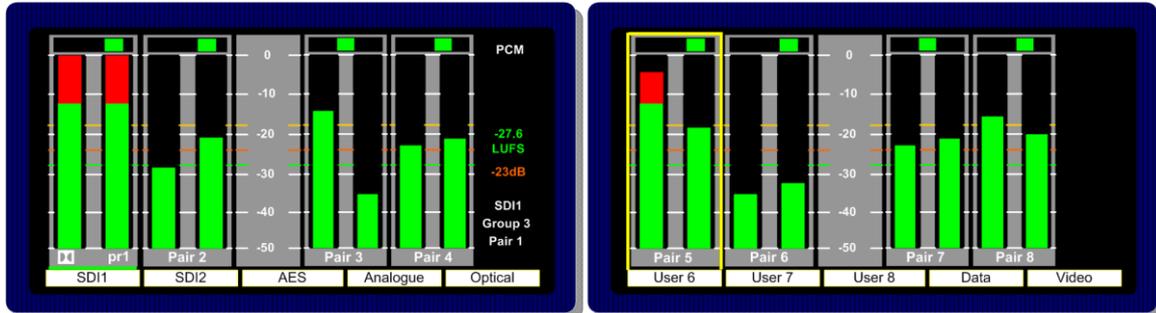
2.5 Home Button Selection

The 'Home' button has two primary functions. It can be used to 'toggle' the function of the 1-8 selection buttons and also as a means to return to the top level screen view from any place within the menu structure.

2.5.1 Toggle Function

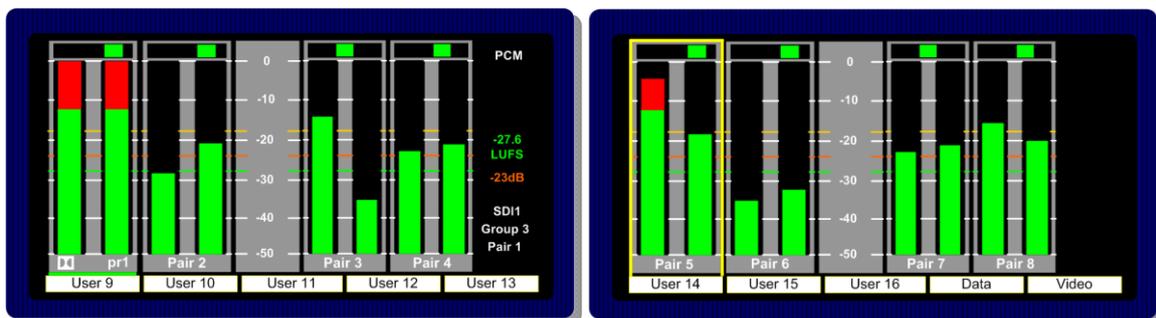
The images below depict the sequence in which the functions of buttons 1-8 are altered as the 'Home' button is pressed.

- **Default Condition**



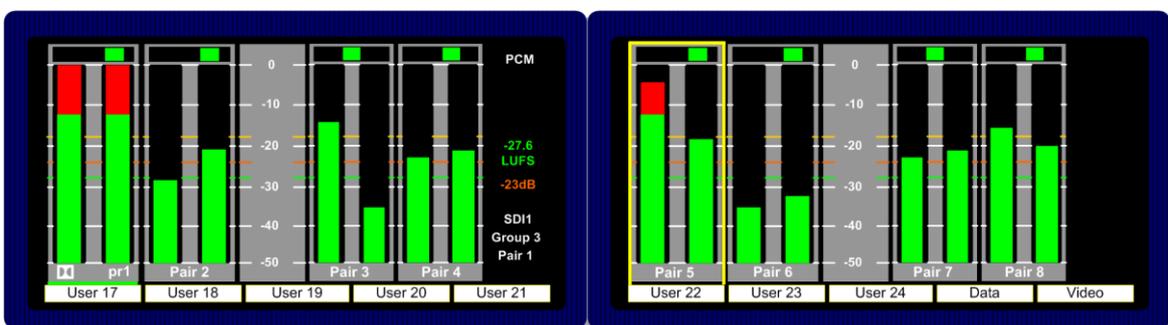
User can select presets 1-8 using buttons 1-8

- **Press 'Home' once**



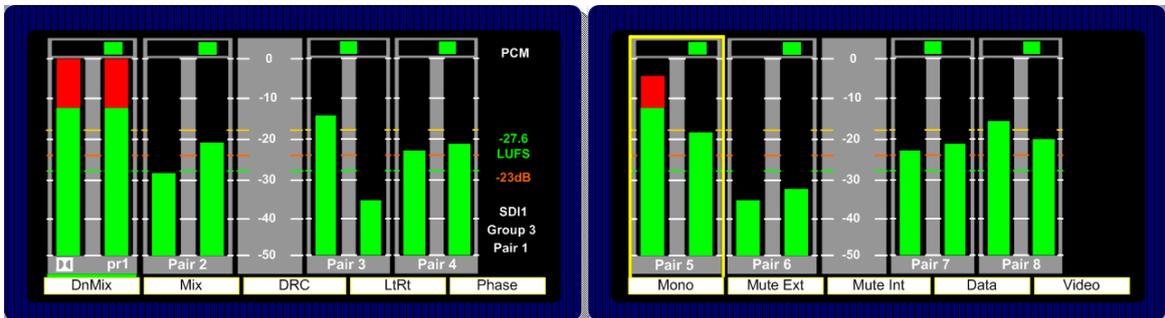
User can select presets 9-16 using buttons 1-8

- **Press 'Home' a second time**



User can select presets 17-24 using buttons 1-8

- Press 'Home' a third time



The Monitor Menu functions can be accessed using buttons 1-8

Mix – Selecting the Mix button enables the user to select multiple mono or stereo bargraphs using the encoder and 'Scroll to Hear' box.

DnMix – Pressing DnMix repeatedly will activate a Downmix replicating the method described in section 2.10.5 of this handbook.

ALL – Pressing ALL will route a 5.1 audio 'programme' to the external speaker system replicating the method described in section 2.13 of this handbook.

DRC – The DRC button activates the Dynamic Range Control emulation in conjunction with the default mode selected by the user within the Monitor Menu. **This feature is only active when a Dolby signal is decoded.**

LtRt or LoRo – This button activates an LtRt or LoRo Downmix. **This feature is only active when a Dolby signal is decoded.**

Phase – Phase button reverse the phase of the left audio signal with respect to the right.

Mono – Mono adds the left signal to the right.

Mute Ext – This button mutes the external speaker (variable AES or analogue) output connections

Mute Int – This button mutes the internal loudspeakers

2.5.2 Menu Exit Function



Pressing 'Home' the button when PAM2 MK2 is in any menu mode quickly switches the right hand screen to the top level view.

If the **External Monitor** mode is active, this will be either the 'Main Menu' or Video Screen depending on which view was previously selected.

2.6 Home Button Selection

The example below shows PAM2 in dual screen **Metering Mode** listening to **Group 1 Pair 1** of an embedded SDI video signal.

2.6.1 Scroll to Hear

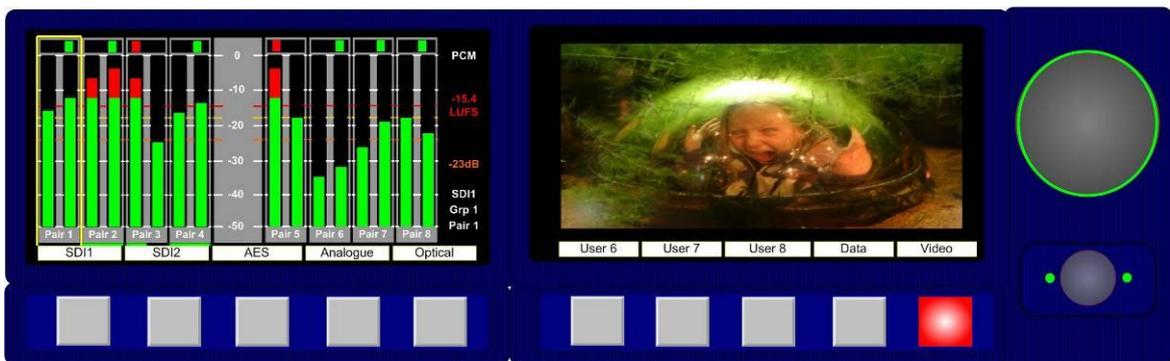
Push, hold and **rotate** the Encoder to move the yellow 'Scroll To Hear' box to listen to any of the 16 embedded audio channels. This is the simplest means to navigate **PAM2** and can be used whenever the unit is not in **Menu mode**.



2.6.2 Video Confidence Display

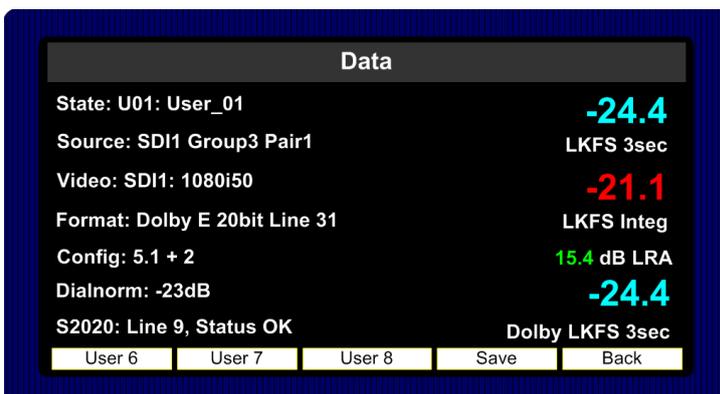
Press the **Video** button to toggle the right hand OLED display and view the input video signal. The bargraph display is compressed onto the left hand OLED screen.

The aspect ratio of the video display is selected via the **Setup Menu**.



2.6.3 Data Screen Mode

Press the **Data** button (button 9) to toggle the right hand OLED display and view the input signal data screen. The following image shows the **Data** screen in operation with a Dolby E signal encoded on SDI1 Pair1



2.6.4 Dim Cut Control

The rotary volume control of **PAM2** also features a push switch cut/dim function. Push the volume control once to cut the volume to internal speakers, headphones and variable audio outputs. Pushing the volume control a second time will dim the output level by 12 dB. A final push will return the output volume to full level – this is indicated by a single LED dot cursor in cut and dim conditions.

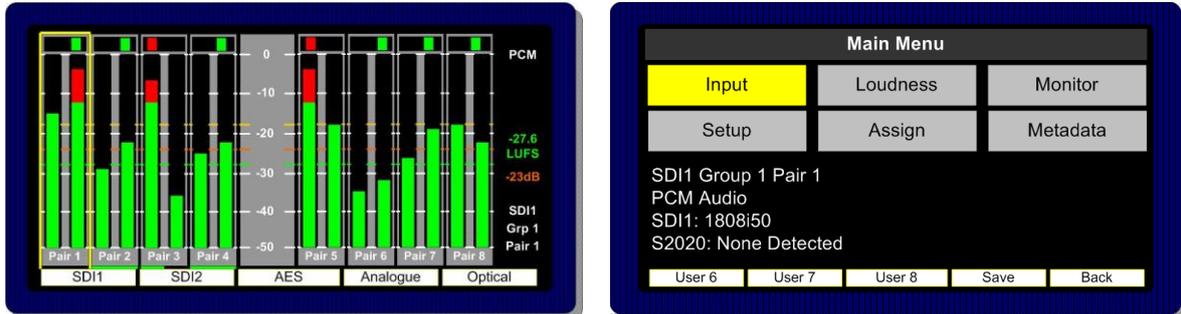


2.6.5 LED Brightness Settings

The **Setup 2 Menu** contains a button to select the operational brightness of the switch and encoder LEDs. By selecting and rotating the encoder the overall brightness of the LEDs may be changed from low to high level across 5 graduations. 1 is low, 5 is high.

2.7 Main Menu

Press the **Encoder** to access **Main Menu**. The encoder is then rotated and pressed to highlight and select from the displayed **Menu** options. From any **Menu**, pressing **Back** (illuminated red) or the **HOME** button (**PAM2 MK2 only**) will exit the current menu page or return to the top level screen.

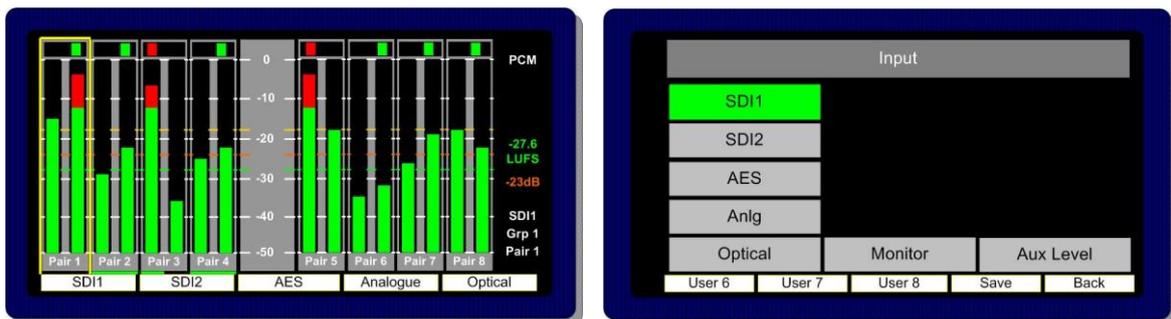


2.8 Input Selection

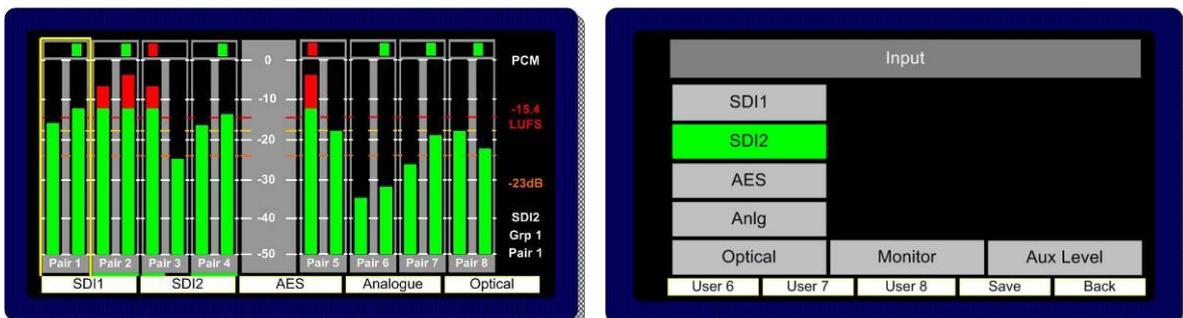
PAM2 ships with **User Presets 1-5** pre-programmed to instantly access SDI1, SDI2, AES, Analogue and Optical TOSLINK inputs. Selecting these presets will directly route either input signal to the bargraph display. These **User Presets** may be overwritten however and customised as required. From the **Main Menu** screen, **Input Menu mode** may be selected.

By highlighting and selecting the **Input** option, **SDI, AES and Analogue** inputs can be accessed. A **shortcut** button enables the user to 'jump' to the **Monitor Menu** once the desired input is selected.

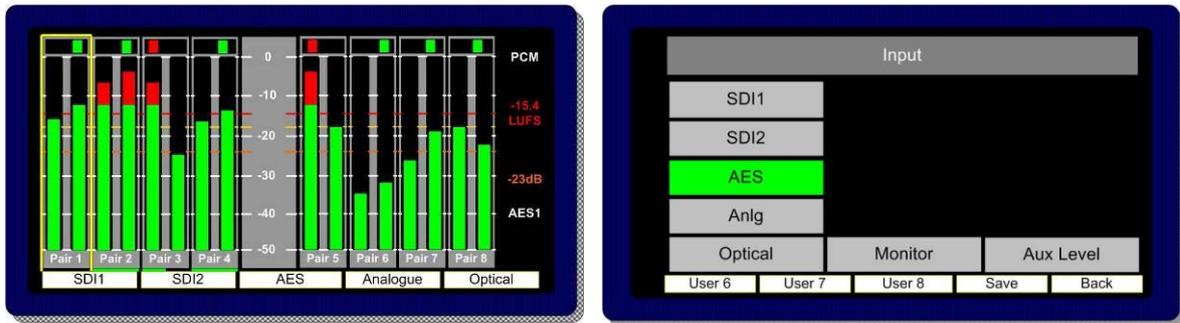
2.8.1 SDI 1 Input



2.8.2 SDI 2 Input



2.8.3 AES Input



2.8.4 Optical Input

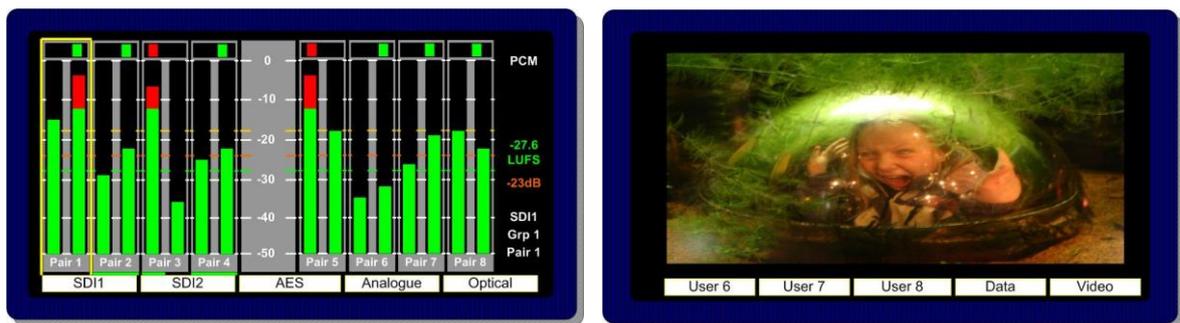
PAM2 is unique amongst rack mount audio monitoring products in that it features a TOSLINK Optical Input. The **Optical** Input is selected via Factory Preset 5 or from the AES input menu. When **Optical** is selected, **AES channel 8** is replaced by the signal received via the **Optical** connector. This input may be used to connect directly to a Set Top Box, DVD or CD player and can decode **Dolby Digital** or **Dolby Digital Plus** encoded signals.

2.8.5 Analogue Input

PAM2 features 6 stereo analogue audio inputs. These may be selected simultaneously by selecting **Analogue** from either the monitoring menu or preset buttons. Bargraph pairs 1-6 will display the respective input audio; pairs 7 and 8 are not active in this mode.

2.9 SDI Input and Video Confidence Display

The **Video Display** may be activated using button 10 when not in **Menu mode**. The input video signal of the **SDI Input** selected last will be routed to the screen when the audio input selected is either **AES** or **Analogue**.



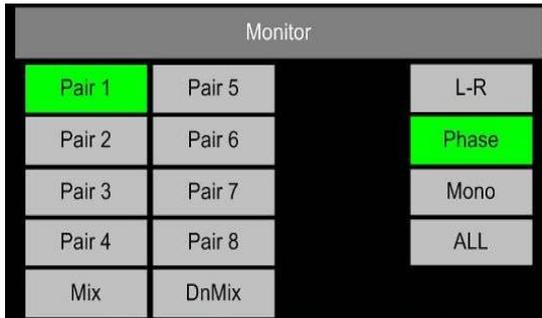
2.10 Monitor Menu – PCM (non-Dolby) signals

The **Monitor Menu** is generally used to activate listening modes not readily accessible via ‘**Scroll To Hear**’ selection or the **Shortcut Menu**. As PAM products have evolved over time since their introduction in 2008, more and more improvements to the operating system has meant that operators use the **Monitoring Menu** much more infrequently. Where alternative means to select **Monitoring** functions are available, they are described.

2.10.1 Phase Reverse

The **Monitor Menu** features a ‘**Phase Reverse**’ button which enables the user to reverse the phase of the right signal of a selected audio pair with respect to the left.

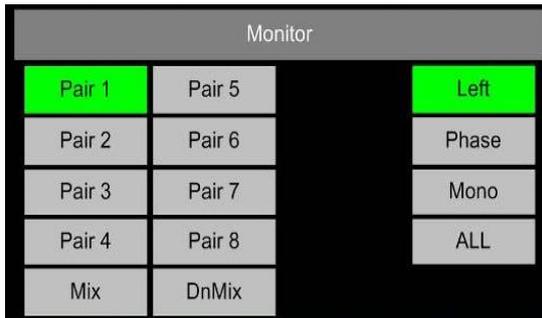
Note: This function can also be accessed directly via the **Shortcut Menu**



2.10.2 Left/Right/Swap

Pushing to select **L – R** enables individual selection of either **Left** or **Right** components of the highlighted stereo pair (or pairs).

The **L – R** function also enables **Left** and **Right** audio components to be **swapped**.



2.10.3 Mono

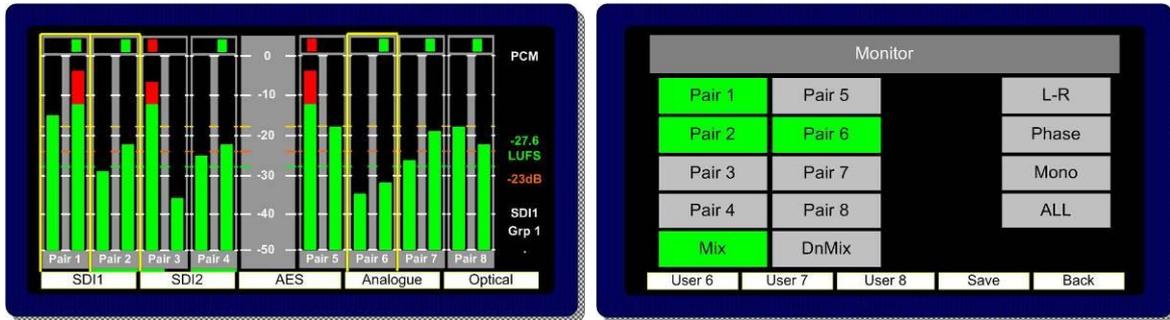
The **Mono** mode button sums the left and right components of the selected audio channels.

Note: This function can also be accessed directly via the **Shortcut Menu**



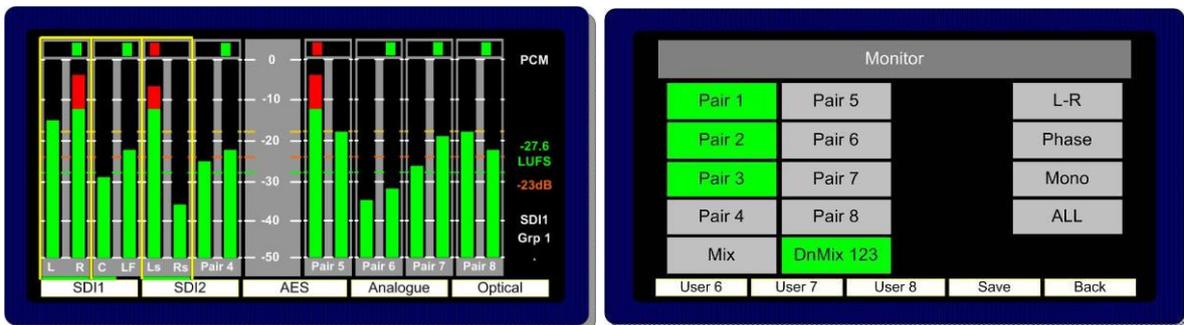
2.10.4 Mix

When **Mix Mode** is activated, multiple bargraph pairs may be selected and monitored as a mixed stereo pair. Up to four pairs may be mixed together simultaneously.



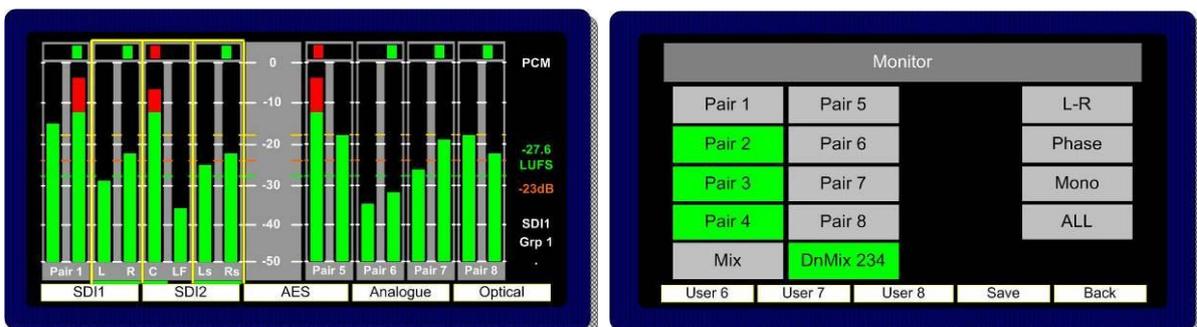
2.10.5 Downmix

Downmix Mode allows the operator to select an adjacent group of 3 audio pairs (6 audio channels) and create a stereo **Downmix**.



By repeatedly selecting the **DnMix** button, the group of selected audio pairs move from left to right across the bargraph display enabling the user to **Downmix** discrete 5.1 or 5.0 audio from any location within the 16 channels displayed. Pressing and rotating the **Downmix** button also enables the user to scroll through the pair's selection in the sequence **123, 234, 345, 456, 567** and **678**, **downmixing** the appropriate surround sound audio signals as desired.

The **Downmix Mode** assumes that audio channels are presented in the correct **SMPTE** order (L, R, C, Lfe, Ls, and Rs). The **Downmix Mode** uses the ITU-R BS.775 algorithm standard.



Once the 5.1 audio components are selected and **Downmixed**, the selection can be stored as a **User Preset** to a **Hotkey** (see **Storing User Presets**) and recalled at the press of a button.

2.10.6 All

ALL Mode allows the operator to select an adjacent group of 3 audio pairs (6 audio channels) and route them to a set of external 5.1 loudspeakers.

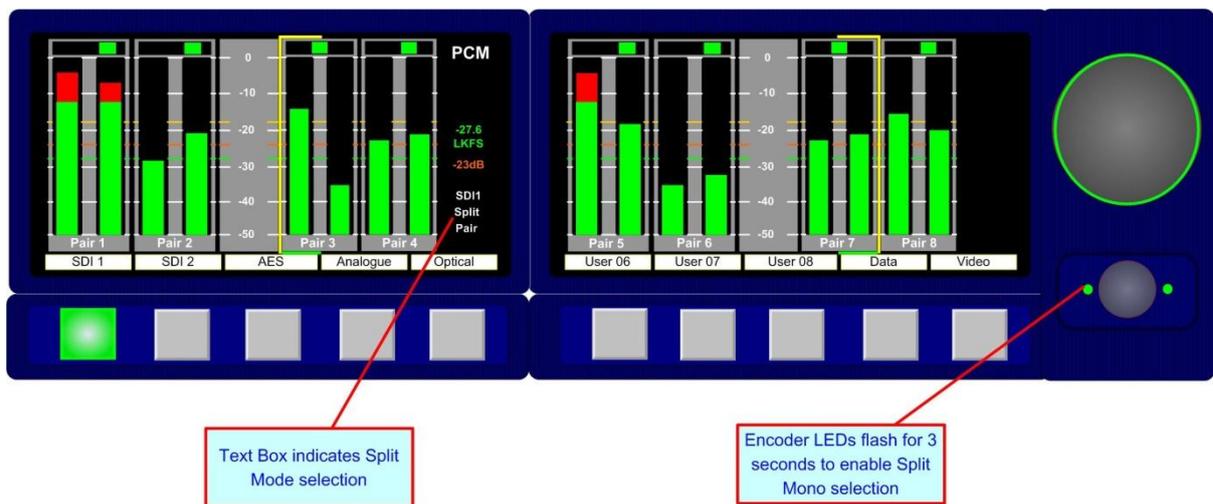
ALL Mode is described fully within the **Monitoring Using External Speakers** section of this document

2.10.7 Split Mono Input Selection

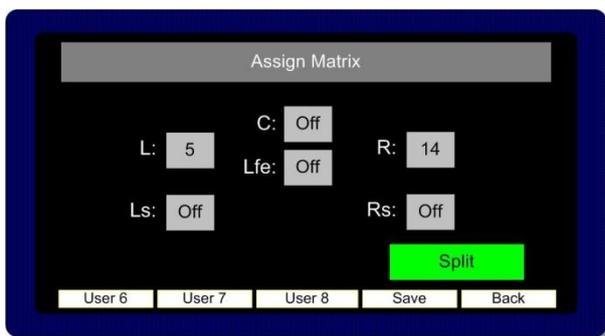
The **Scroll to Hear** function of the **PAM2** features a special operational mode which enables the operator to select to listen to two non adjacent mono audio channels.

By scrolling the yellow **Hear Box** to the first of the desired mono channels the LEDs on either side of the rotary encoder will flash for a period of 3 seconds. During that time the user is permitted to turn the encoder (without pressing) to select a second non adjacent mono audio signal. Once the selection is made the LEDs will stop flashing and the resultant selection is heard through the loudspeaker or headphone outputs.

Note; A **Split Mono** selection is indicated on the front left hand screen in the lower right text window. The selection may be saved as a **User Preset** for instant recall (see **Saving User Presets**).



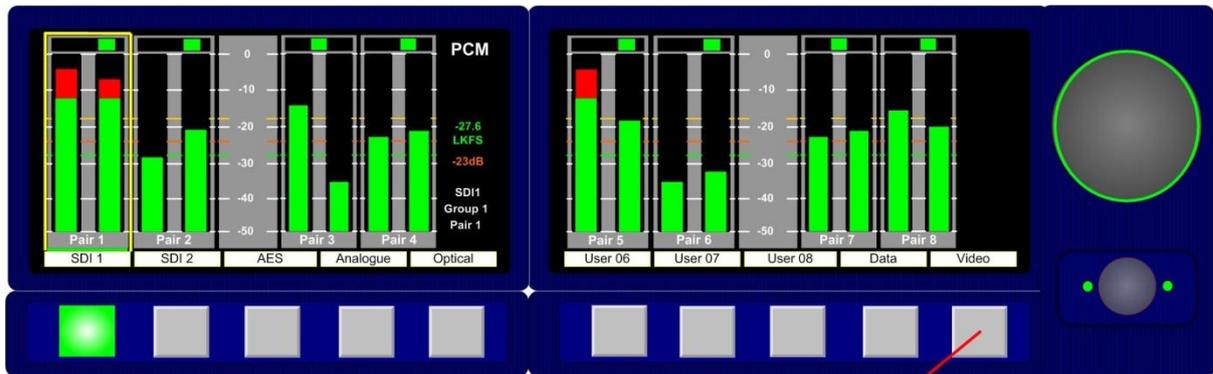
Note; **Split Mono** selection uses the **Assign Matrix** section of the **PAM2** in order to create a pair of non consequential audio channels. When a **Split Mono** pair is defined, the Assign Matrix represents the resultant signal selection as illustrated below.



2.11 Front Switch Monitor Select Mode

In order to further enhance hands on operation of **PAM2**, an operational mode exists which enables the user to toggle between the standard front panel operation of 8 user preset recall switches below the OLED displays and direct access to up to 6 monitoring mode selector buttons. This mode of operation is particularly useful when operating a **PAM2-3G16** however the use of the **HOME** button on a **PAM2 MK2** provides an alternative means of achieving the same functionality.

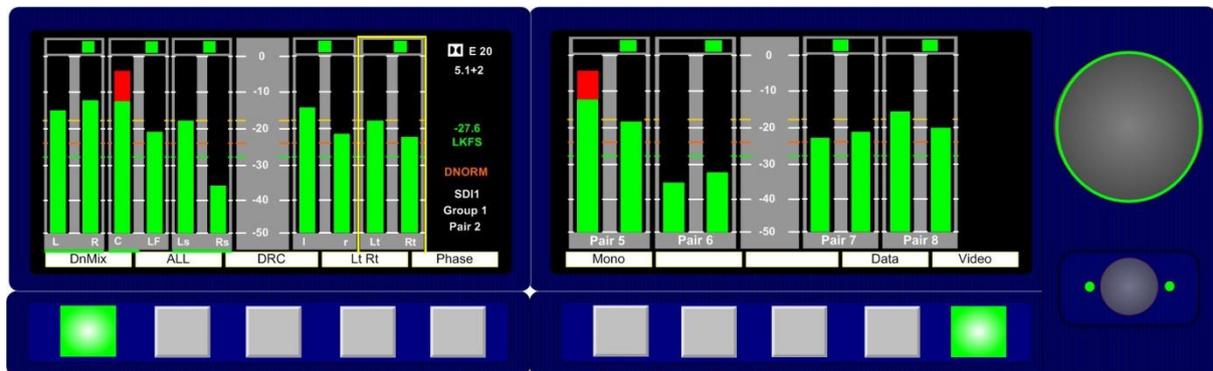
By simply holding button 10 (**Video Button**) for a period of more than one second, the display of buttons 1-8 switches from the standard operating view of User Preset recall selection to one giving direct and instantaneous access to a number of **Monitoring Menu** features.

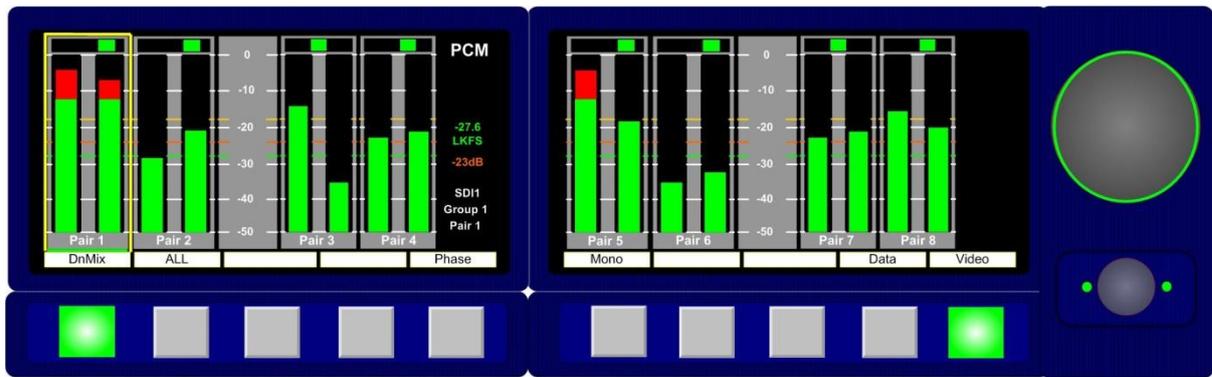


Push and Hold Button 10 for 1 second to switch modes

The display changes depending on the whether the signals currently monitored are **Dolby E, D, DD+** or **PCM** audio. The images below represents the front panel view for Dolby encoded signals and **PCM** audio respectively.

Dolby





PCM

DnMix

Downmix Mode allows the operator to select an adjacent group of 3 audio pairs (6 audio channels) and create a stereo **Downmix**.

By repeatedly selecting the **DnMix** button, the group of selected audio pairs move from left to right across the bargraph display enabling the user to **Downmix** discrete 5.1 or 5.0 audio from any location within the 16 channels displayed. Repeatedly pressing **Downmix** button also enables the user to scroll through the pair's selection in the sequence **123, 234, 345, 456, 567** and **678**, **downmixing** the appropriate surround sound audio signals as desired.

The **Downmix Mode** assumes that audio channels are presented in the correct **SMPTE** order (L, R, C, Lfe, Ls, and Rs). The **Downmix Mode** uses the ITU-R BS.775 algorithm standard

ALL (Non Dolby)

By selecting **ALL**, the operator can select the group of 6 audios from 2 groups which corresponds to the 5.1 audio signal. Once a 5.1 group has been defined, the 5.1 audio stems are routed to the external speaker outputs in the correct **SMPTE** order (L, R, C, Lfe, Ls, and Rs).

By repeatedly selecting the **ALL** button, the group of selected audio pairs move from left to right across the bargraph display enabling the user to route discrete 5.1 or 5.0 audio from any location within the 16 channels displayed to the external variable audio connectors in order to feed external active 5.1 speaker systems. Pressing and rotating the **ALL** button also enables the user to scroll through the pair's selection in the sequence **123, 234, 345, 456, 567** and **678**

ALL and DRC (Dolby Only)

The Dolby monitoring menu includes options called **ALL** and **DRC**. When used with a 5.1 loudspeaker monitoring system **ALL** routes the decoded 5.1 audio to the multichannel outputs. In **DRC** mode, the Dolby decoded 5.1 output is affected by Dolby DRC metadata and adjusted accordingly. If the monitoring mode is switched away from **ALL** or **DRC** then the **Centre, Lfe, Ls** and **Rs** speaker channels are muted and only the **Left** and **Right** channels are active. The **5.1** monitoring selections enable a user to 'solo' individual surround sound signals to check the integrity of their audio.

The **DRC** listening mode can be used in conjunction with either **ALL** or **Lt Rt (Lo Ro)** modes and switches **Dynamic Range Compression** into the monitoring output signal path providing **DRC** is activated with the **Dolby Metadata** component of the encoded signal. **DRC** monitoring mode can be selected via the **DRC** button in the enabling the user to hear the effect of dynamic range compression on the decoded signal and hence check the integrity of the audio heard by the consumer.

Lt Rt (Dolby Only)

By pressing the **LtRt** button when **PAM2-3G16** is decoding a Dolby E, D or DD+ signal, a stereo **Downmix** will be selected. This is the default listening/monitoring condition for a Dolby signal and is derived using the originally authored Dolby metadata thus enabling the user to hear the effect of stereo downmixing as heard by the consumer.

Phase

The **Monitor Menu** features a '**Phase Swap**' button which enables the user to reverse the phase of the right signal of a selected audio pair with respect to the right.

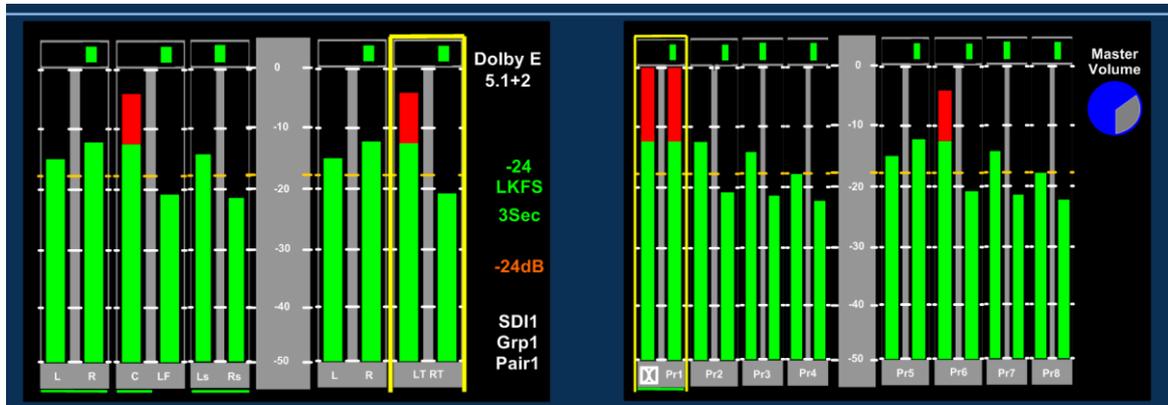
Mono

The **Mono** mode button mono's the selected bargraph pair.

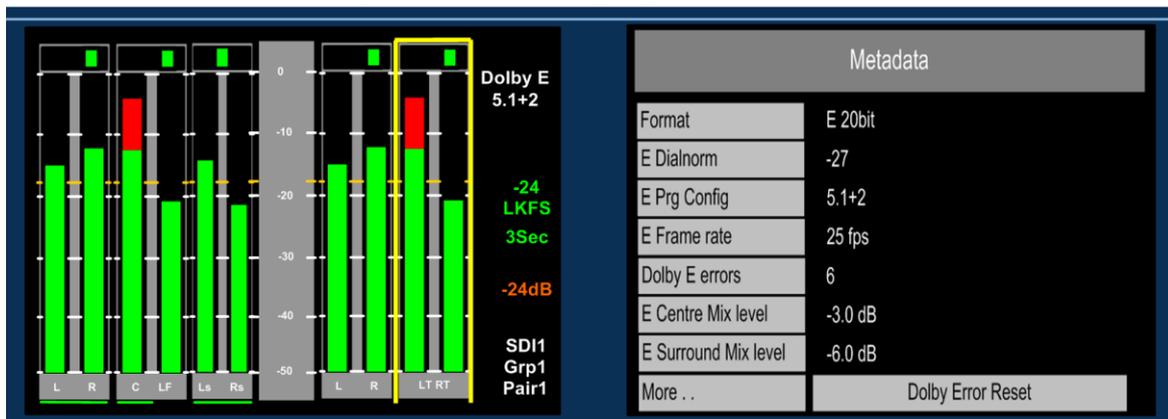
2.12 Dolby E, Dolby Digital and Dolby Digital Plus Monitoring

PAM2 MK2 with Dolby Option Fitted

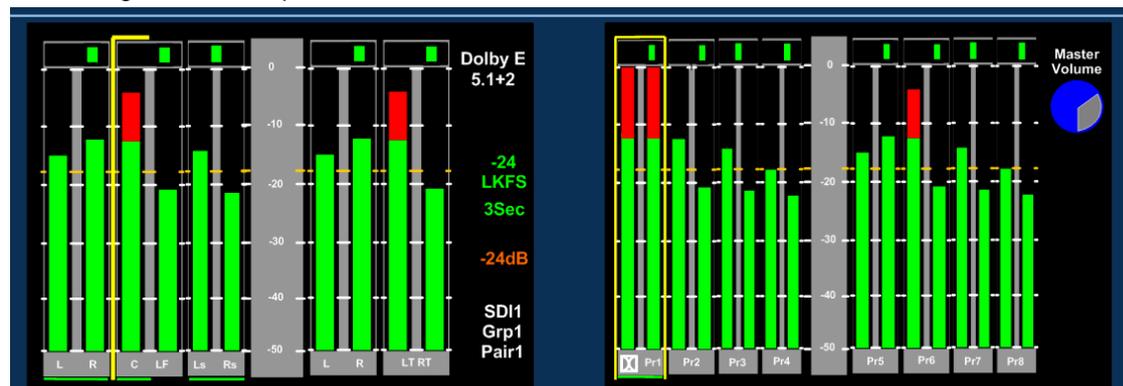
When a **Dolby E, Dolby Digital or Dolby Digital Plus** encoded audio pair is selected, **PAM2** will automatically decode the signal into its component parts and name the stems according to the Channel Coding information carried within the **Metadata**. The decoded audio component bargraph is displayed on the left **OLED** display and an Lt/Rt or Lo/Ro (user selectable) **Downmix** bargraph pair is created from the **Metadata** and shown as a 5th pair on the left screen (as shown below). In **Top Level Mode** the input bargraph display is shown on the right **OLED** display with a **Dolby** logo now superimposed below the decoded bargraph pair (as shown).



The right hand display can be altered using the **Shortcut Menu** to show **data, video, loudness or metadata information** as required when a **Dolby** signal is decoded.



Scroll to Hear Mode is used as normal when monitoring **Dolby E, Dolby Digital or Dolby Digital Plus** encoded signals. By pushing and turning the encoder the **'Hear Box'** can be moved across the decoded audio channels in the usual way, selecting to listen to **Dolby** components as desired. In the example below, the **Centre** channel has been 'soloed' and would be heard equally from the left and right stereo output channels.



To exit **Dolby Decoding Mode**, push and hold the encoder for several seconds and the **PAM2** will revert to the **Top Level Mode**. The encoder can be rotated to move the 'Hear Box' and select another signal from the **top level screen**.

2.12.1 Dolby E Timing and Rate Information

The **Data Screen** of the **PAM2** displays extended information about any decoded **Dolby E** and **Dolby Digital** sources. This shows the frame rate of the Dolby encoded signal and its timing relative to a video source where available.

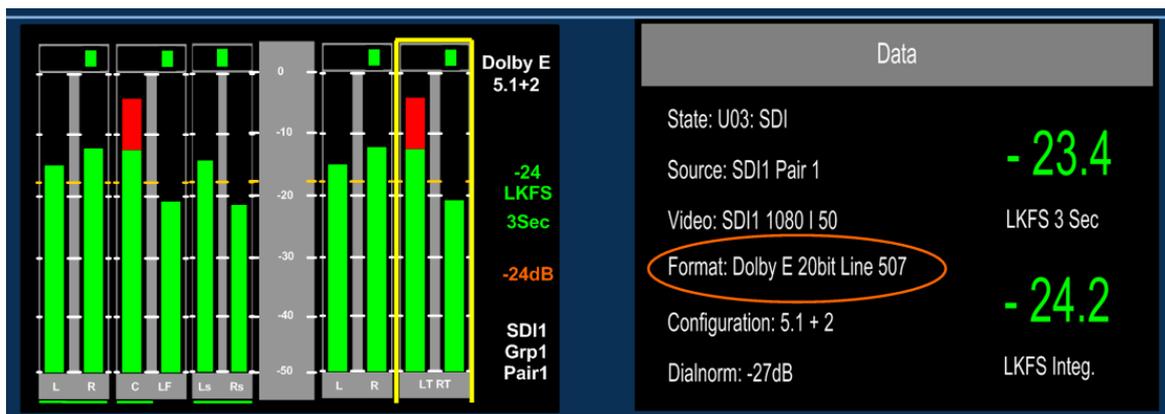
For AES inputs, the frame rate information is displayed as a minimum:

Dolby E 20bit 29.97 - or - **Dolby E 16bit 25Hz**

For embedded Dolby E sources, the start line position is displayed in the format:

Dolby E 16bit L11

The image below shows an example of a 20 bit **Dolby E** signal embedded at line 507



This functionality is also extended to mixed sources. If an AES source is selected for monitoring, whilst a video source is selected with the same frame rate, then the display will give the approximate line position of the AES **Dolby E** start relative to the video. This allows the timing of an AES signal to be checked either before embedding or after extraction (note the embedder / extractor delays need to be accounted for in a system). For sources of different frame rates, the display reverts to the **Dolby E** frame rate. The video frame rate is already displayed on the top level menu.

Dolby Digital and Digital Plus sources are also identified, although no further information is provided without a decoder.

All of the above functions are available both with and without on-board **Dolby** decoding, providing the source has a correctly formatted **SMPTE 337M** header

2.12.2 Dolby Metadata

Primarily for use with **Dolby E**, **Dolby Digital** and **Dolby Digital Plus** encoded audio signals: the **Metadata Menu** accesses a user selectable 3 pages each containing a group of 7 Dolby Metadata parameters. By highlighting and selecting any of the 7 options, the user can use the encoder to scroll through a list of all Metadata settings read by the CAT552 card for **Dolby E**, **Dolby Digital** and **Dolby Digital Plus** audio and create their own Metadata monitoring view.

Metadata - Page 1

| Metadata | |
|----------------------|-------------------|
| Format | E 20bit |
| E Dialnorm | -27 |
| E Prg Config | 5.1+2 |
| E Frame rate | 25 fps |
| Dolby E errors | 6 |
| E Centre Mix level | -3.0 dB |
| E Surround Mix level | -6.0 dB |
| More . . | Dolby Error Reset |

Metadata – Page 2

Page 2 Metadata fields include -

- Video rate
- Dolby E Programme Description
- Dolby E Stream mode
- Dolby E Surround mode
- Dolby E LFE On/Off
- Dolby E Mix Level
- Dolby E Room type

Metadata – Page 3

Page 3 Metadata fields include -

- Format
- Dolby D Errors
- Dolby D Coding
- Dolby D Centre mix
- Dolby D Surround mix
- Dolby D Data rate
- Dolby D Dialnorm

2.12.3 Dolby E programme number selection

The **Setup Menu** allows the user to select which programme the Metadata is read from. The screen below shows the **E prg#** selection on the Setup window. By selecting **E prg#** the user may scroll through **Dolby E** programme numbers 1 to 8 and select the appropriate programme number. This setting may be saved as part of a user preset.

| Setup | | |
|----------|---------|---------------|
| EBU Dig | Ext Mon | E prg# |
| dBFS | | E vid dly |
| Zero | | Video |
| Peak | UnMute | Audio dly |
| Hold | | Setup 2 |
| USB Save | | USB Load |

2.13 Monitoring using external loudspeakers

The **PAM2** features an intelligent monitoring matrix designed to optimise the use of both internal and external loudspeaker systems. Connection of either Stereo or 5.1 loudspeaker systems is accommodated and monitoring modes automatically configured to ensure that only the audio components selected are those that are heard using the appropriate output channels.

For example: when listening to a stereo **Downmix** through a 5.1 surround sound loudspeaker system, only the left and right speakers are active whilst the centre, LFE and surround speakers are muted. Dedicated multichannel monitoring modes **ALL** and **DRC** route surround audio components to 5.1 loudspeakers in the correct channel order without the need for complex routing configuration.

The table shown in **Section 2.12** explains the default monitoring modes based on the various menus and DIP switch selections detailed in the following descriptions.

De-embedded or decoded multichannel audio (Dolby or discrete PCM) is automatically routed to the AES and analogue outputs connectors. The rear panel located **DIP Switch** includes a selection to mute internal loudspeakers and to set AES and analogue outputs to variable level (adjusted by the front panel volume control).

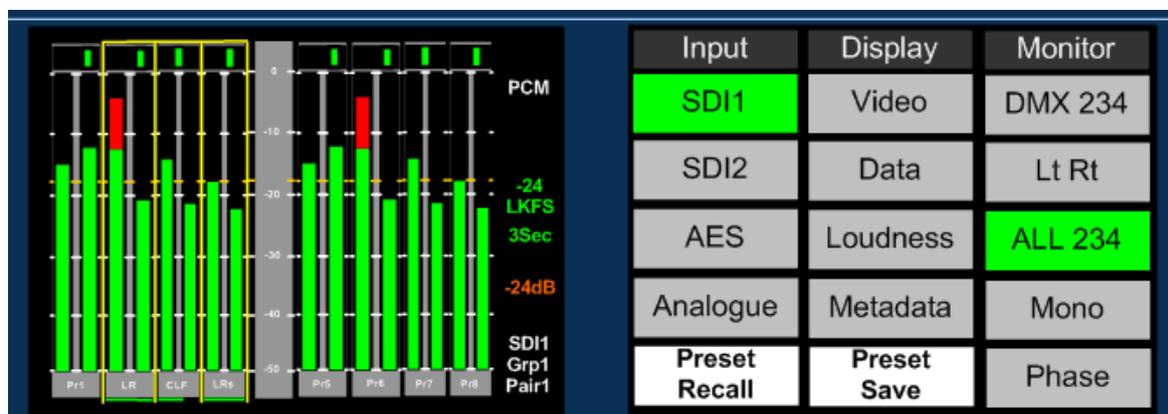
Stereo or 5.1 external loudspeakers can be connected (see the application diagram in front of this Handbook).

2.13.1 Discrete PCM 5.1 – Using ALL Mode

The **Shortcut** and **Monitoring** menus include an **ALL** option. By selecting **ALL** the operator can select any group of 6 audios channels from the bargraph display corresponding to the 5.1 audio signals. Once a 5.1 group has been defined, the 5.1 audio stems are routed to the external speaker outputs in the correct **SMPTE** order (L, R, C, LFE, Ls, and Rs).

By repeatedly selecting the **ALL** button, the group of selected audio pairs move from left to right across the bargraph display enabling the user to route discrete 5.1 or 5.0 audio from any location within the 16 channels displayed to the external variable audio connectors in order to feed external active 5.1 speaker systems. Pressing and rotating the **ALL** button also enables the user to scroll through the pair's selection in the sequence **123, 234, 345, 456, 567** and **678**.

The image below shows the **ALL** button selected from within the **Shortcut Menu** and the selection of audio pairs 2, 3 and 4 defined as an embedded 5.1 audio programme.



This function ensures that an embedded discrete **5.1** signal can be monitored regardless of the location of the 5.1 stems. The user can store different settings for monitoring discrete 5.1 audio using the **Hotkey** or **User Presets**.



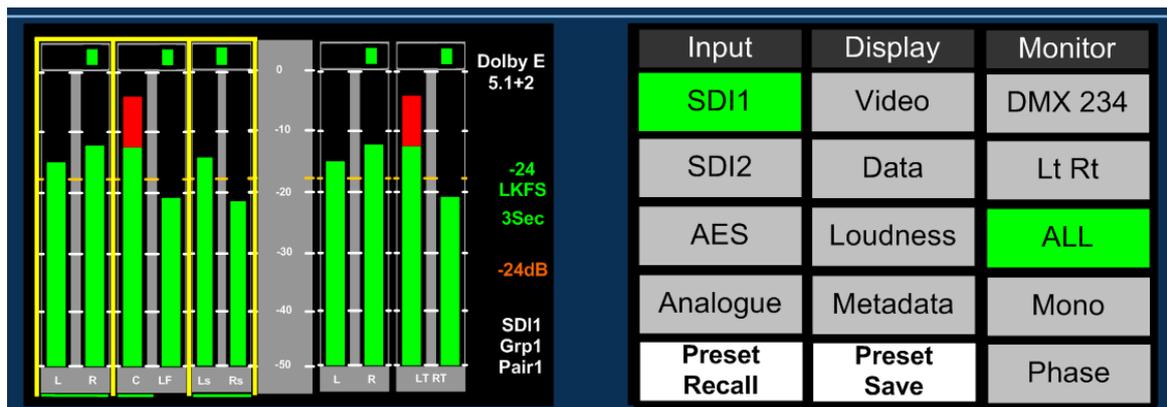
The **ALL** listening mode automatically **mutes** the internal loudspeakers and routes the selected audio to 5.1 external loudspeakers via the variable multichannel analogue and AES connectors. Selection can be saved as presets for instant recall.

2.13.2 Dolby E, Dolby Digital and Dolby Digital Plus

Using ALL and DRC Modes

The Dolby monitoring menu includes options called **ALL** and **DRC**. When used with a 5.1 loudspeaker monitoring system **ALL** routes the decoded 5.1 audio to the multichannel outputs. In **DRC** mode, the Dolby decoded 5.1 outputs is affected by Dolby DRC metadata and adjusted accordingly replicating the consumer/viewer listening experience. If the monitoring mode is switched away from **ALL** or **DRC** then the **Centre, LFE, Ls** and **Rs** speaker channels are muted and only the **Left** and **Right** channels are active. The **5.1** monitoring selections enable a user to 'solo' individual surround sound signals to check the integrity of their audio.

The image below shows how a Dolby decoded signal can be routed to external 5.1 speakers using the **Shortcut Menu**



The **DRC** listening mode can be used in conjunction with either **ALL** or **Lt Rt (Lo Ro)** modes and switches **Dynamic Range Compression** into the monitoring output signal path providing **DRC** is activated with the **Dolby Metadata** component of the encoded signal. **Line** and **RF DRC** monitoring modes can be selected via the **DRC** button enabling the user to hear the effect of either form of compression on the decoded signal and hence check the integrity of the audio heard by the consumer.

DRC mode can only be activated via the **Monitoring Menu** and is only available if a Dolby signal is being decoded. The images below show the selection of **ALL** and **DRC** modes using the monitoring menu.

| Monitor | | | |
|---------|--------|-------|-------|
| Pair 1 | Pair 5 | L R | L-R |
| Pair 2 | Pair 6 | C LF | Phase |
| Pair 3 | Pair 7 | Ls Rs | Mono |
| Pair 4 | Pair 8 | 7 8 | ALL |
| Mix | DnMix | Lt Rt | DRC |

| Monitor | | | |
|---------|--------|-------|-------|
| Pair 1 | Pair 5 | L R | L-R |
| Pair 2 | Pair 6 | C LF | Phase |
| Pair 3 | Pair 7 | Ls Rs | Mono |
| Pair 4 | Pair 8 | 7 8 | ALL |
| Mix | DnMix | Lt Rt | Line |

2.14 SMPTE 2020 (S2020) Metadata Monitoring and Downmix

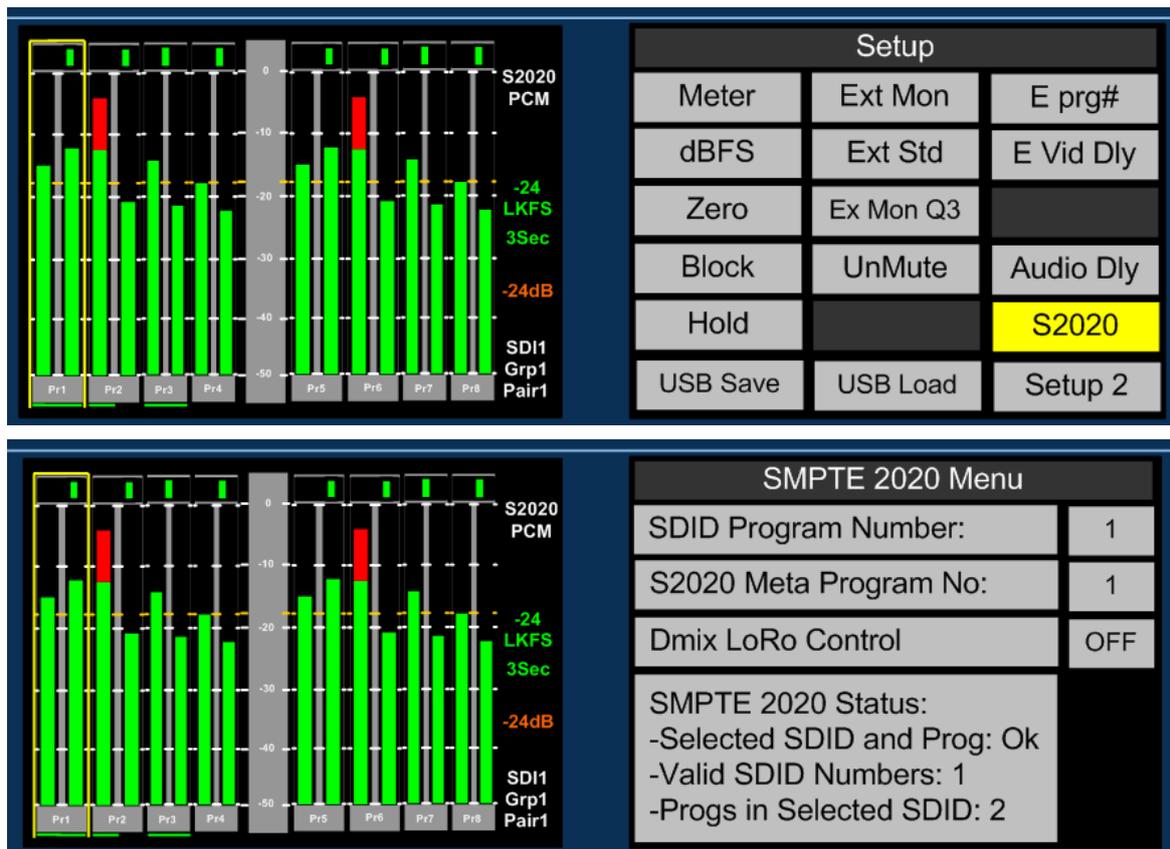
As of September 2014 the PAM 2 MK2 possesses the ability to extract ancillary SMPTE 2020 metadata from the VANC space of an SDI signal. The status of any embedded S2020 data is reported, metadata displayed and an automatic downmix capability can be activated to monitor the effect of the associated data values.

S2020 is a SMPTE defined standard method used to transport Dolby Digital metadata within an SDI based broadcast infrastructure removing the need for Dolby E encoding in favour of discrete PCM audio.

This manual assumes that the reader is familiar with the structure and terminology of S2020 data, if further information is required then please contact TSL Products Support Team or download a copy of the S2020 specification from www.smpte.org/standards

2.14.1 S2020 Menu

The S2020 menu is accessed via Main Menu/Setup/S2020



SDID Program Number: The SMPTE 2020 status indicator tells the user if any valid SDID are present and also the number (or numbers) from 1 to 9 where 1 is the default and 2 thru 9 represents audio pairs 1 to 8 respectively.

The user must set the SDID program number field to the appropriate value in order to extract the data which will be displayed within the metadata menus – described elsewhere in this handbook

S2020 Metadata Program Number: The SMPTE status indicator reports the number of programs within the selected SDID. In the configuration shown above there are 2 audio programs which might typically be 5.1 + 2 and as with Dolby E, there will be 2 sets of metadata for both the 5.1 and stereo program elements.

The user selects the program from which he/she wishes the metadata to be displayed.

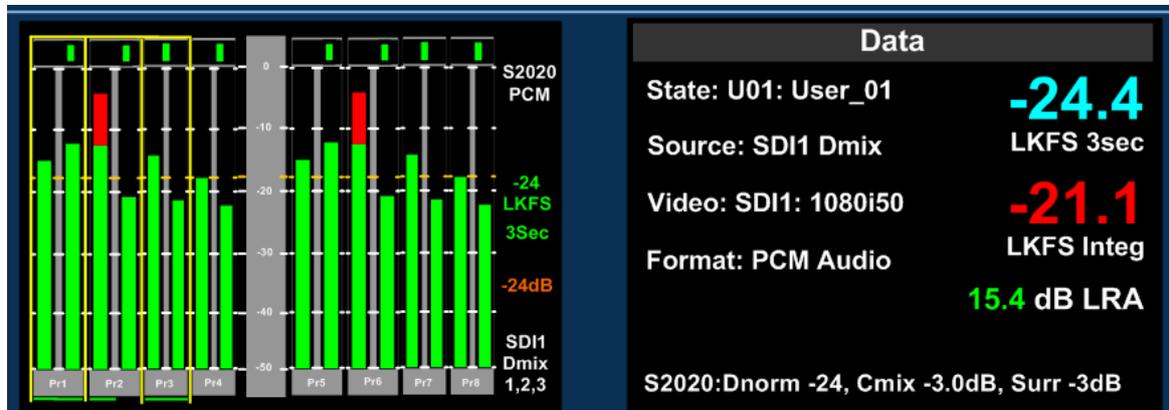
2.14.2 S2020 Downmix Lo Ro Control

PAM2 MK2 can use the LoRo downmix parameters held within the S2020 metadata to auto-downmix a 5.1 signal to stereo for compliance checking.

In the example below the operator has switched on the Dmix LoRo control for an S2020 program SDID number 2 (equating to discrete 5.1 audio channel pairs 1, 2 and 3 in an SDI signal).

| SMPTE 2020 Menu | |
|---|----|
| SDID Program Number: | 2 |
| S2020 Meta Program No: | 1 |
| Dmix LoRo Control | ON |
| SMPTE 2020 Status: -Selected SDID and Prog: Ok -Valid SDID Numbers: 2 -Progs in Selected SDID: 1 | |

The operator must then activate the PAM downmix feature via the shortcut menu as described elsewhere. With the data page active on PAM2 MK2 the operator will see the following images across the two LED displays.



In this example the downmix parameters associated with the S2020 metadata are displayed at the bottom of the data screen alongside the dialnorm value. PAM2 MK2 is using these values to create a stereo LoRo downmix in order for the operator to check the compatibility of the stereo image that will be heard by the viewer at home.

2.14.3 **S2020 Metadata**

There are five pages of Metadata information available to the PAM2 MK2 user accessed via Main Menu/Metadata or through the Shortcut button. S2020 Metadata is displayed on pages 4 and 5, accessed by repeatedly pressing the **'More..'** button at the bottom of the screen.

The two pages of S2020 Metadata report the following information. Unlike the Dolby Metadata pages, the parameters are not user selectable.

| SMPTE 2020 Metadata 1 | | SMPTE 2020 Metadata 2 | |
|-----------------------|-------------------|-----------------------|-------------------|
| Selected S2020 | SDID3, PGM1, OK | SDI Vid. Rate | SDI1: 1080i50 |
| Dialnorm | -24 | PGM Descr. | Pgrm 1 |
| Pgm Config. | 5.1 + 2 | Bitstream Mode | Complete Main |
| Frame Rate | 25Hz | Surround Mode | Not Indicated |
| Error Count | 0 | LFE On/Off | LFE off |
| Centre Mix Lvl | -3.0 dB | Mix Level | 80 dB SPL |
| Surr Mix Lvl | -3.0 dB | Room Type | Large Rm, XCurve |
| More .. | S2020 Error Reset | More .. | S2020 Error Reset |

2.15 Internal and External Monitoring Modes

The table below indicates the various monitoring modes available to PAM2 users and the audio signals presented to internal loudspeakers and external connectors when each mode is selected.

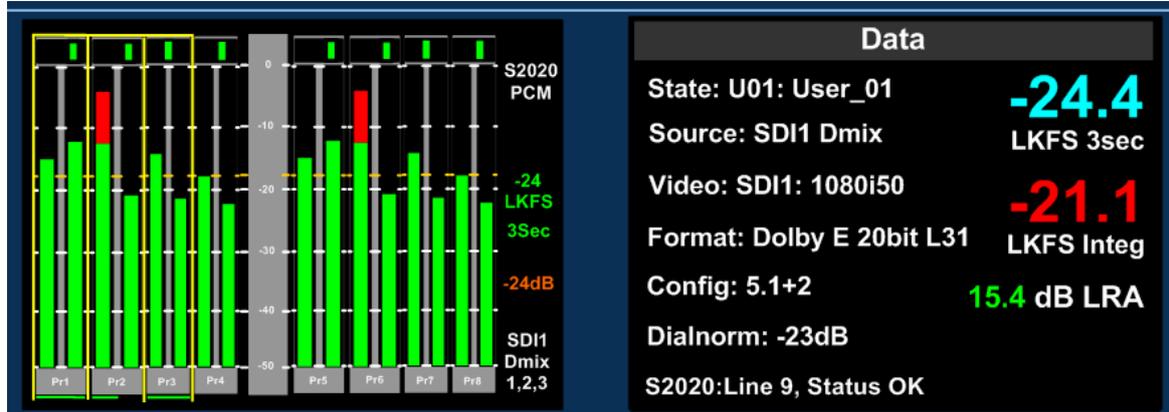
Ext Fixed/Variable D25 refers to both analogue and AES multichannel 1-8 output connectors whose modes can be altered between fixed and variable via the rear panel DIP switches.

AES outputs 9-16 are fixed level at all times and carry a direct feed of inputs 9-16 of the selected source whenever the **AES** outputs are in fixed mode. When **AES** outputs are set to variable mode, this connector carries a fixed level copy of the signal routed to the variable output connector.

| Monitoring Mode | Dolby Encoded Audio | | | | Discrete Audio | | | |
|---|------------------------------------|------------------------------|------------------------------|--|-------------------------------------|------------------------------|------------------------------|-------------------------------------|
| | Internal LS | Ext Fixed - D25 (Int LS On) | Ext Fixed - D25 (Int LS Off) | External Variable | Internal LS | Ext Fixed - D25 (Int LS On) | Ext Fixed - D25 (Int LS Off) | External Variable |
| All | Muted | De-embedded AES and Analogue | De-embedded AES and Analogue | 5.1Audio from decoded source | Muted | De-embedded AES and Analogue | De-embedded AES and Analogue | 5.1Audio from selected channels |
| DRC + ALL (Line or RF) | Muted | De-embedded AES and Analogue | De-embedded AES and Analogue | 5.1Audio from decoded source | N/A | N/A | N/A | N/A |
| Lt Rt | Lt Rt only | De-embedded AES and Analogue | De-embedded AES and Analogue | Lt Rt only | N/A | N/A | N/A | N/A |
| Lo Ro | Lo Ro only | De-embedded AES and Analogue | De-embedded AES and Analogue | Lo Ro only | N/A | N/A | N/A | N/A |
| DM ix | Stereo Downmix of pairs 1,2,3 | De-embedded AES and Analogue | De-embedded AES and Analogue | Stereo Downmix of decoded pairs 1,2,3 | Stereo Downmix of selected channels | De-embedded AES and Analogue | De-embedded AES and Analogue | Stereo Downmix of selected channels |
| * Individual | Stereo output of selected channels | De-embedded AES and Analogue | De-embedded AES and Analogue | Stereo output of selected decoded channels | Stereo output of selected channels | De-embedded AES and Analogue | De-embedded AES and Analogue | Stereo output of selected channels |
| * Individual refers to single, paired or multiple audio channels selected from the monitoring menu. | | | | | | | | |

2.16 Data Screen.

The **Data Screen** view is activated from the **Shortcut Menu** and provides up to 7 fields of feedback regarding the signal being monitored and the operational status of **PAM2**. It also displays several key Loudness measurement parameters including Shortterm, Integrated and Loudness Range values when Loudness measurement is activated



State: The current User Preset name and number

Source: The selected input signal and channel

Video: The format of the selected video input signal or that of the most recently selected signal should an audio only source be routed to the bargraph display

Format: Data pertaining to the audio component of the selected signal (ie PCM or Dolby encoded). The Dolby line position is also displayed where appropriate: however, this is replaced with the Dolby signal frame rate when the encoding rate is incompatible with that of the host video signal.

Configuration: Channel configuration of a Dolby encoded signal

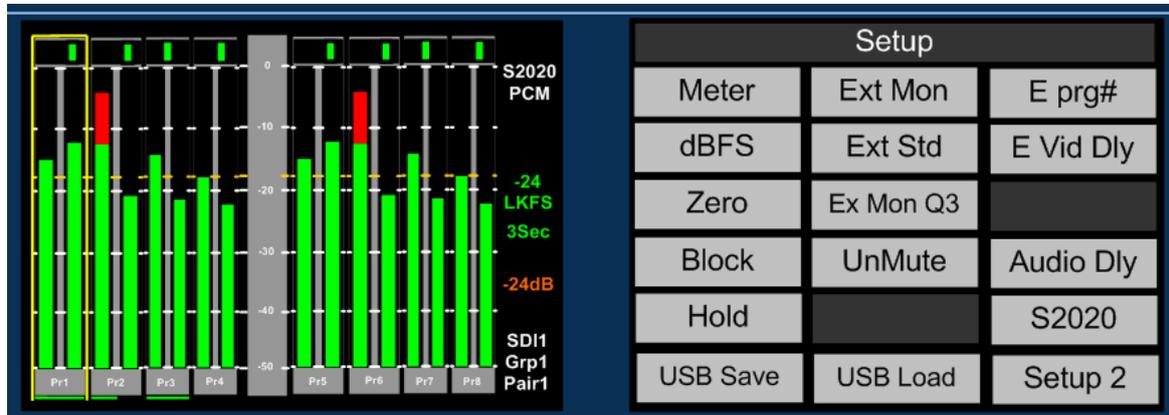
Dialnorm: Dialnorm value of a Dolby encoded signal

S2020: The line position and current status of any inserted SMPTE 2020 metadata. **This function was added to the software release in September 2014**

2.17 Setup and Setup 2 menus

Setup Menu 1 includes options for different **Scales, Reference Levels, Peak Hold, Dolby E programme, Dolby E Video compensation delay, Video Window** and **Audio delay**. By highlighting and selecting a parameter, the user can scroll through the available options and tailor **PAM2** to suit their needs.

From September 2014 onwards, the Setup menu has included a button used to access the **SMPTE 2020** menu. Not all screen images in this handbook reflect that change however all functionality described is unaffected by the minor adjustment to the Setup menu



2.17.1 Bargraph Settings and non-system default conditions

The standard operating conditions of **PAM2** are described during the Introduction to this **Handbook** in section **2.0**. Non system operating defaults for level and scale options may be set as follows:

From initial power up, go into the **SETUP** menu and choose the desired values for Meter type and alignment levels. These will be echoed on the left display as you choose them. Having chosen your defaults, move the yellow highlight box to "**SETUP2**", but do not go into the lower menu.

Then press and hold the encoder without turning it for 15 seconds (the screens will refresh after 1 second, which is the Dolby scroll exit timer finishing - ignore this)

After 15 seconds, you should get a message saying "Default Setup stored Back to proceed".

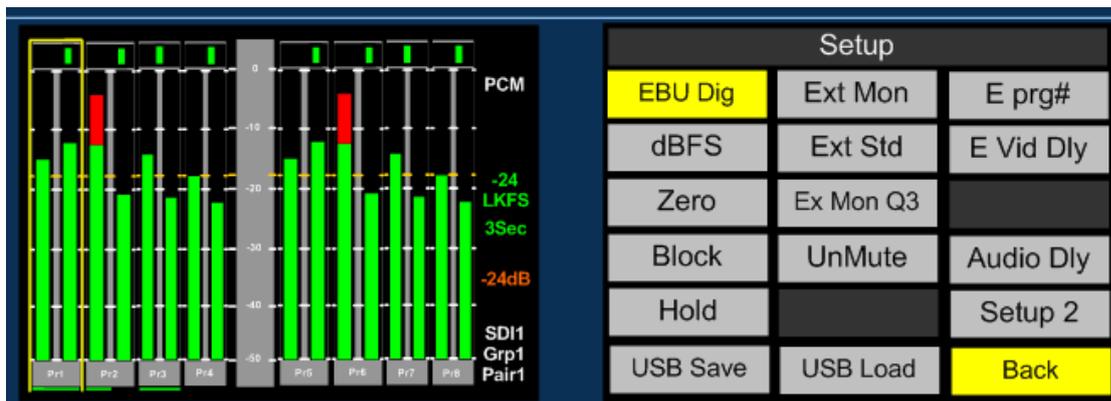
You should now find all memories, factory or user, have the chosen defaults

The factory memories can only be changed by repeating this process (or by a factory reset), but the user memories can be configured as desired (so you can have different metering types on different presets).

NOTE, however, that if you repeat this procedure to change the factory memories, then **ALL** user memories will have their metering defaults over-written.

2.17.2 Meter Scale Selection

The highlighted option at the top left of the Setup Menu is used to choose the bargraph scale type displayed by the current preset.

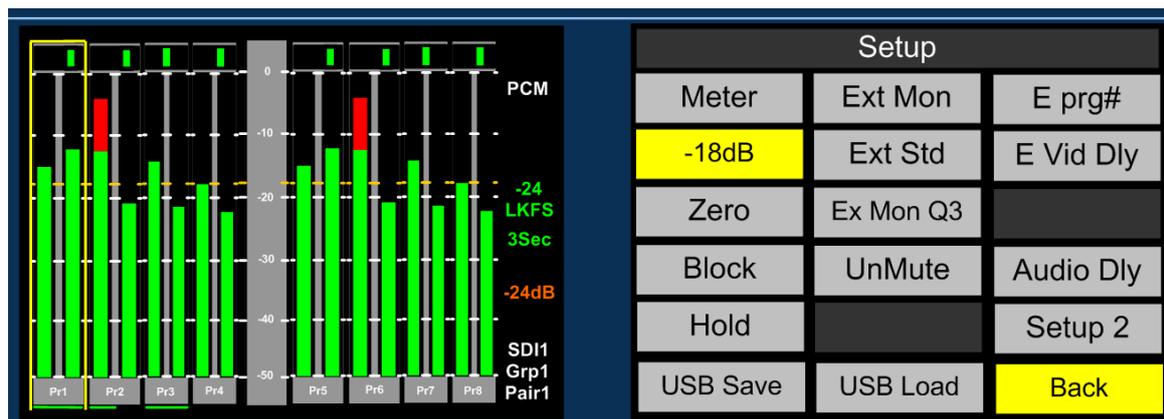


Seven International scales are supported by PAM2, they are as follows:

- EBU Digital (IEC 60268)
- BBC PPM (IEC IIa)
- EBU PPM (IEC IIb)
- Nordic (IEC I)
- DIN PPM
- Standard VU

2.17.3 Reference and Peak Level Selection

The dBFS parameter can be used to alter the 0dB reference level from between -12 and -24 dBFS. The Zero parameter selects the offset level between the Zero dBFS setting and the onset of Peak indication (the point where the bargraph changes colour to red).



2.17.4 Block Colour Mode Selection

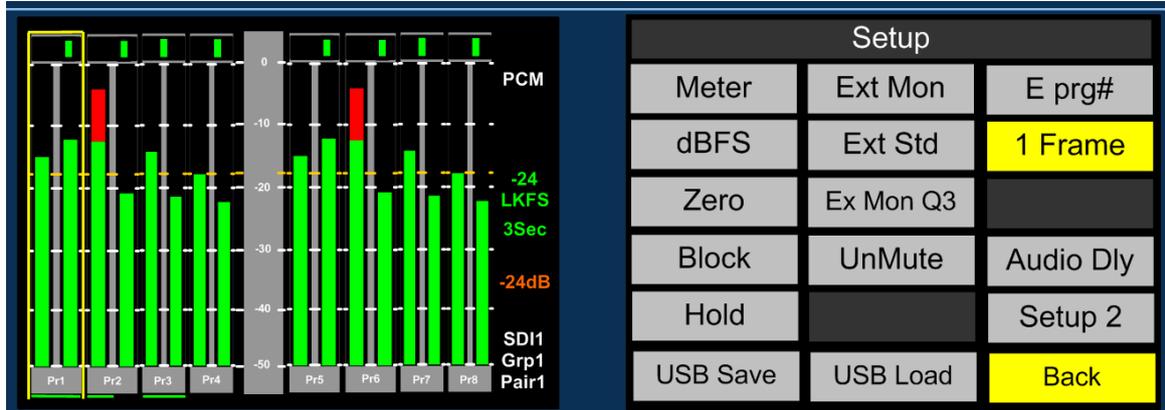
When set to Block mode, the Peak parameter enables the user to choose to illuminate the indication between zero dBFS and the peak level in yellow.

2.17.5 Hold

The Hold parameter activates a peak hold indication when switched on.

2.17.6 Dolby E Video Delay

The PAM2 features a 1 frame (40 ms) video delay setting which can be inserted into the Downconverted video display to compensate for the latency caused by decoding a Dolby E signal. If selected and activated, the delay will be switched into the video signal path automatically when a Dolby E input signal is detected and decoded. The Video Confidence window on PAM2 MK2 will be subject to a 1 frame delay when the video delay mode is active.

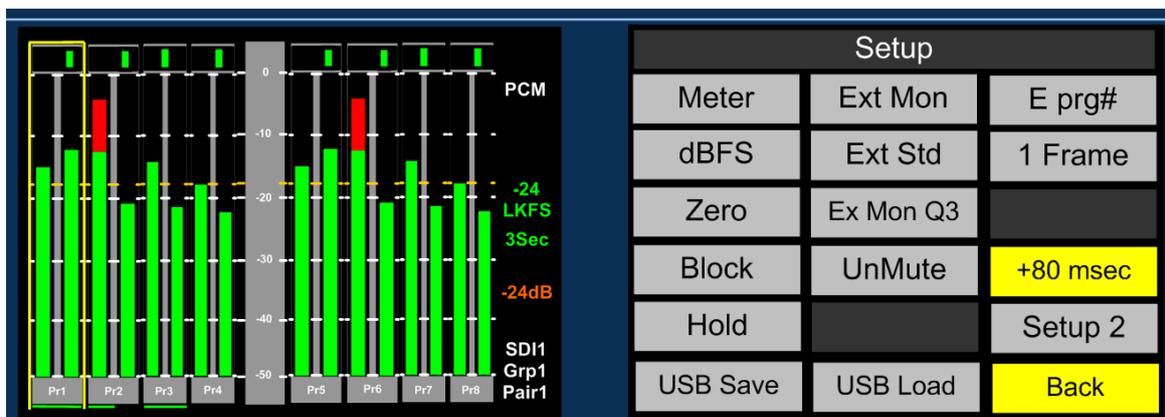


2.17.7 Audio Delay

The TSL PAM family of audio monitoring units is unique in that they feature the ability to insert up to 250ms of delay into the audio monitoring signal path (headphone, internal speaker or variable level outputs). This is designed for use in situations where the unit is being used in conjunction with a video system which introduces latency (for example: Multiviewer and OLED screen combinations) and so the audio monitoring system must be delayed to compensate.

By selecting 'Audio dly' from the **Setup Menu** whilst pushing and rotating the encoder, audio delay in 1ms steps up to a total value of 250ms may be selected. The selection must be stored as part of the associated **User Preset** and is not set as part of the system default. This allows the user to configure different settings for dissimilar signal types or for inputs and modes where audio delay is not required (such as analogue audio sources without associated video).

The delay feature auto-compensates for decoding latency introduced by Dolby D and E decoding. For example, if an audio monitoring delay setting has been configured for 80ms whenever the SDI1 input is selected and the embedded audio contains a Dolby E channel which is decoded, the audio delay algorithm will reduce the preset setting by 40ms so that the overall delay remains constant: 40ms (Dolby E decode latency) + 80ms (SDI 1 delay preset) – 40ms (auto compensation) = 80ms.



2.17.8 Signal Conditional UnMute

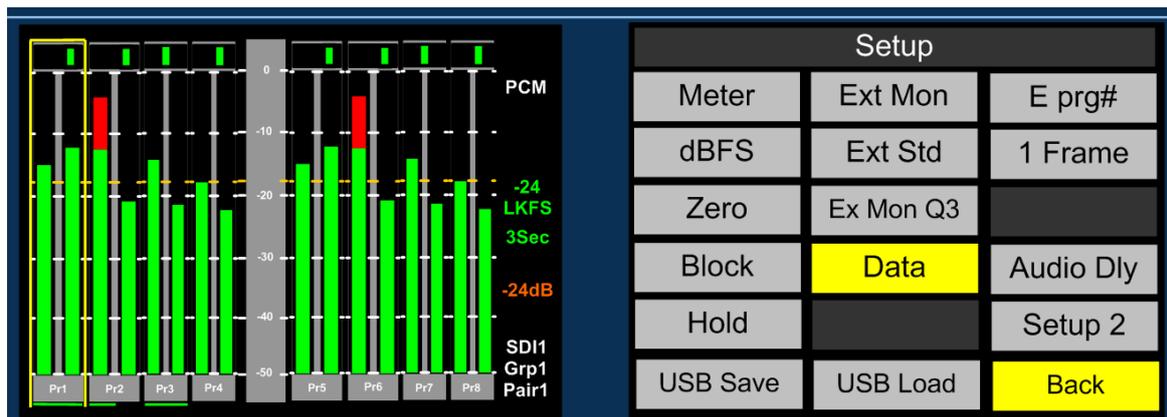
The **PAM2** is designed to protect the operator and his/her loudspeaker equipment against unexpected or hostile audio. It performs this task by monitoring the data contained within signal SMPTE headers and ancillary data which is compared to the audio signal.

Example: A PCM audio signal embedded within SDI may be accompanied by a SMPTE header declaring that it is data and not audio. Although the signal will be present on the **PAM2** bargraphs it will be reported within the data information fields as **Data** and the loudspeakers will be muted by default as a defence mechanism to protect against damage to hardware and hearing.

2.17.9 Un-Mute a PCM signal identified as 'Data'

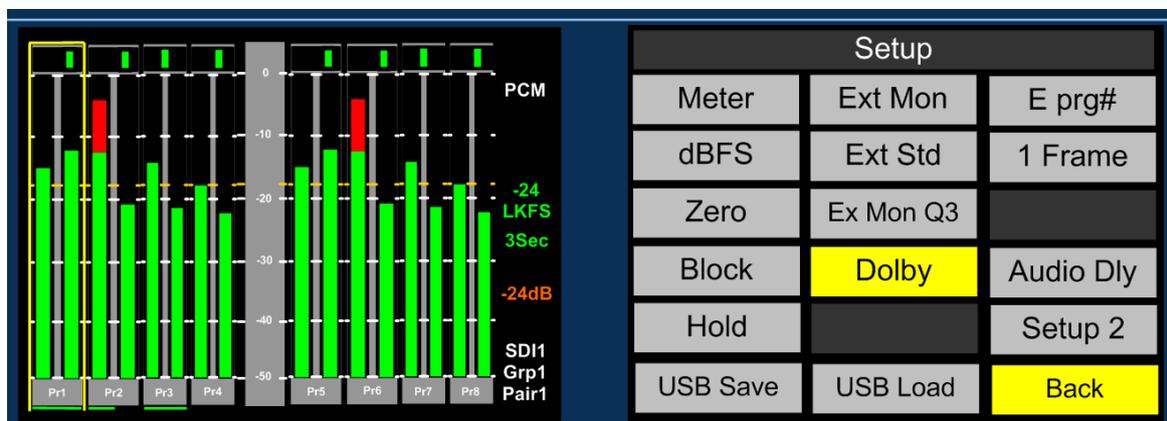
The button labelled **UnMute** provides a means to override the default speaker muting system designed to protect against hostile or unexpected audio signal conditions.

Use the encoder to select the **UnMute** button and push / turn to select **Data**. This will override the default speaker muting condition temporarily: the condition can be assigned to a user preset or **Hotkey** using the **User Preset Save** procedure described elsewhere in this handbook.



2.17.10 Un-Mute a Dolby signal identified as 'Data'

If a Dolby encoded signal is not identified as **Dolby** correctly or if there is unexpected header information then **PAM2** will mute by default. To override this condition please follow the procedure outlined previously and select **Dolby**. Save this condition as a preset or Hotkey.

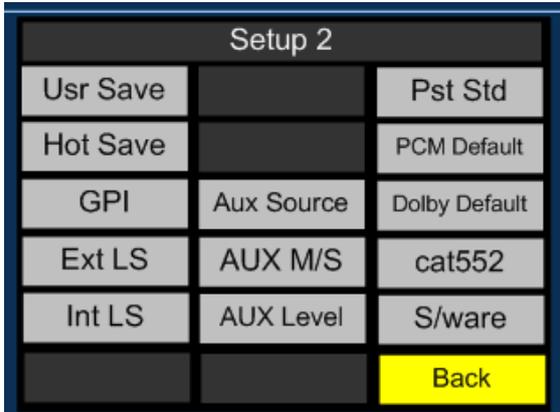


2.17.11 Override All conditional muting

Both Data and Dolby default mute conditions can be activated simultaneously by selecting **ALL** using the **UnMute** button. As previously described this selection must be saved to a preset or Hotkey for it to become a permanent state of operation.

2.17.12 Setup Menu 2

Setup Menu 2 is used to access the global system settings and software update processes (for information on software updating see **Section 2.20**). **Setup 2** is accessed from a button within the first level **Setup Menu**



2.17.13 Locking Presets (Usr Save)

Presets can be locked to prevent them from being accidentally overwritten. Select the **Usr save** button and push/turn to lock. The **Save** function will now become disabled and editing of the **User Preset** function de-activated.

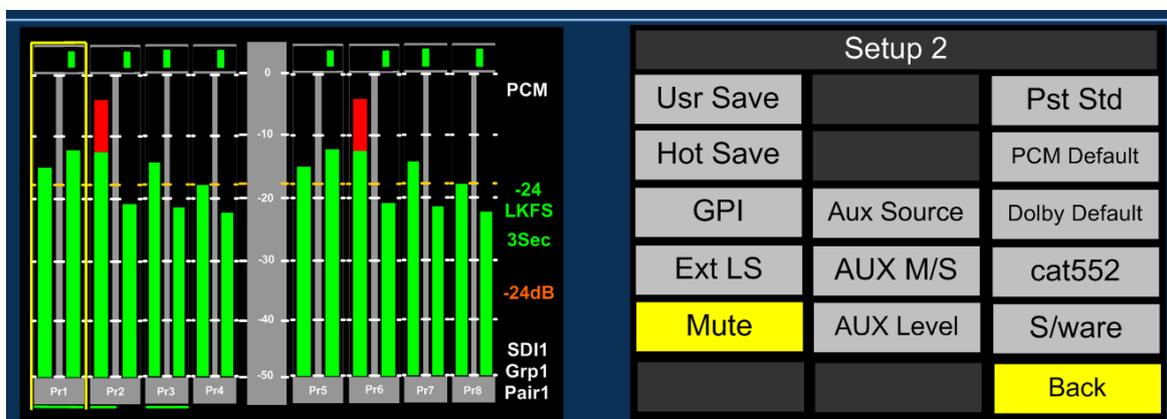
2.17.14 Locking Hotkeys (Hot Save)

Hotkeys can be locked to prevent them from being accidentally overwritten. Select the **Hot Save** button and push/turn to lock. The **Hotkey** function will now become disabled.

2.17.15 GPI

GPI functionality is described elsewhere within this handbook

2.17.16 Internal Speaker Mute (Int LS)

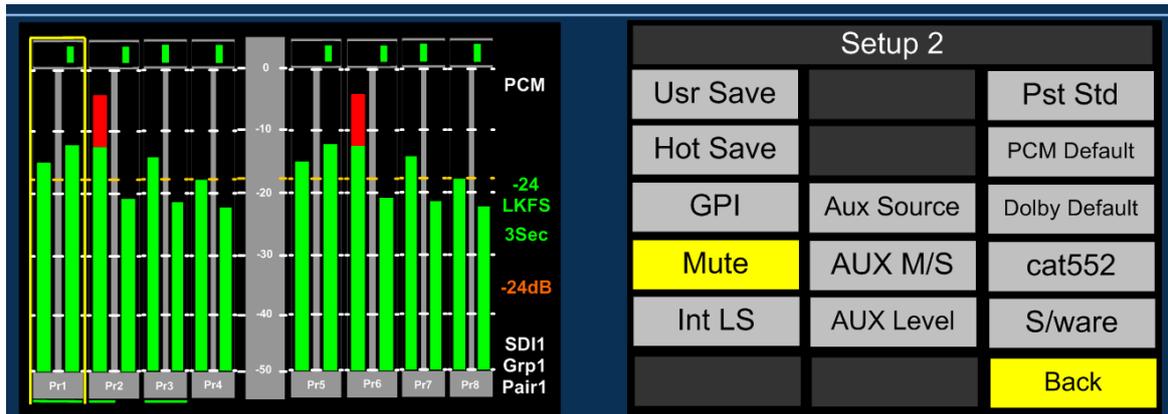


The **Internal loudspeakers** may be muted via either a rear panel DIP switch or by using the button located within **Setup 2** menu. If the DIP switch is set to 'off' then the function of the on screen button is defeated. **The action of the on screen Internal LS mute switch is preset dependant and not a system default.**

Coupled with the ability to mute the **External Speaker** outputs (see below) the **PAM2** can be used with both internal and external speaker systems switching between the two. This setup may suit applications such as **MCR** or **QC Suites** where specific programme content occasionally requires

the attention of full range or 5.1 listening or when two or more **PAM2** operators share a common external speaker system.

2.17.17 External Speaker Mute (Ext LS)



The **External loudspeaker (analogue and AES variable level outputs)** connections may be muted by using the button located within **Setup 2** menu. **The action of the on screen External LS mute switch is preset dependant and not a system default.**

2.17.18 Preset Standard Auto-Switching (Pst Std)

Preset Standard Auto-Switching functionality is described elsewhere within this handbook (see Section 2.17)

2.17.19 Aux Mixer (Aux Source, Aux M/S, Aux Level)

Aux Mixer functionality is described elsewhere within this handbook (see Section 2.19)

2.18 Assign Matrix

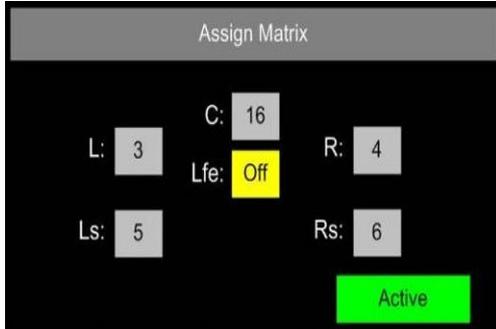
The **Assign Matrix** is intended for use in multichannel audio monitoring situations where discrete surround sound signals are being transported in non SMPTE or unconventional channel order.

The **Assign Matrix** takes the form of a **16 x 6** router where the inputs can be routed from **SDI1**, **SDI2**, **AES** or **Analogue** connections (exclusively). The outputs represent the 6 surround channels of a **5.1** programme and once the matrix is 'activated' are displayed as 6 bargraphs on the left **OLED**. Standard **PAM2** monitoring modes can be used to derive a **Downmix**, solo individual channels or route audio to external surround loudspeakers.

Access to the **Assign Matrix** is via the Main Menu.

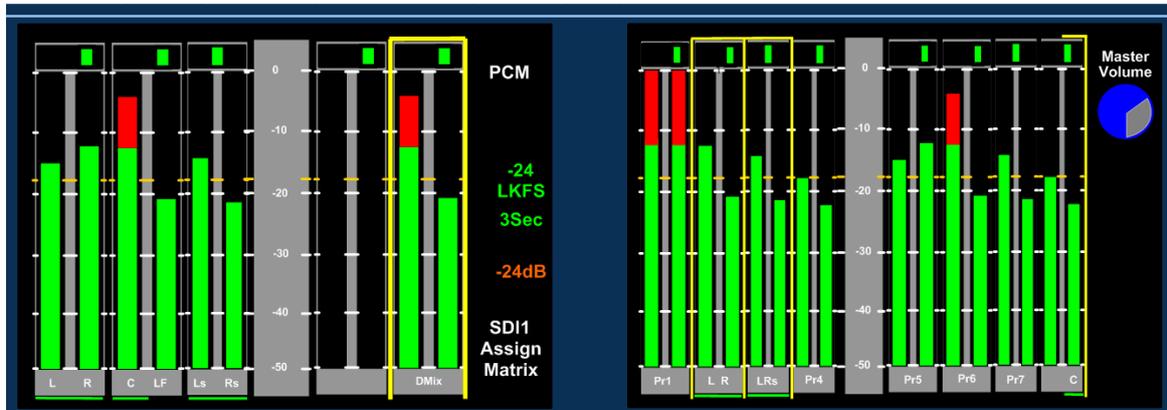


Application Example 1: a clean 4.0 surround mix of **Left, Right, Left** and **Right Surround** is embedded sequentially across channels 3 to 6 of an SDI signal while multiple language mono **Centre** channels are embedded elsewhere within the same signal. An operator it needs to be able to reconstruct each 5.0 surround sound mix for monitoring purposes – the **Assign Matrix** is designed to simplify the task and by using **User Preset** programming to enable instant recall of each monitoring setup. The images below show how this set up would be achieved using a Centre channel embedded on channel 16.



The icons within the **Assign Matrix** screen represent individual channels of a 5.1 programme – by selecting each individually via the encoder, any mono input audio signal can be routed to that output channel. Output channels can be muted if they are not required (as **LFE** in the example shown).

Once the **Assign Matrix** routing is completed and the matrix **activated** the following bargraph display is represented across the left and right OLED screens respectively.



The left hand screen shows a bargraph representation of the output channels with a default condition of a stereo **Downmix** whilst the right hand screen provides a reference to the status of the input channels as defined by the **Assign Matrix**. The sources of the surround sound components are denoted by yellow boxes and text identification below the bargraphs. The setup could then be stored directly to a **User Preset** button for instant recall.

The **Assign Matrix** may be used for non-surround applications and is ideal for creating customised stereo or mono mixes from multiple mono sources (by using **Downmix**) or for applications such as **'Solo in Place'** and **LCR** monitoring.

It is important to note that the **Assign Matrix** will remain active when associated with a **User Preset** state until the **Inactive** button is pressed.

2.19 Loudness Measurement

ITU-R BS1770 **Loudness Setup** menu is accessed from the **Main Menu**.

PAM2 aims to provide the user with a set of tools which comply with the recommendations of both the **ATSC (A85)** and **EBU (R128)** Loudness committees whilst giving the flexibility to tailor operation to suit local requirements.



The **Loudness Setup** menu may be used to define the parameters used to measure **Loudness** using the **ITU-R BS1770** algorithm, to select and set the specific audio channels under test and to start/stop measurement manually. The resultant **Loudness** measurement may be observed via either the **Bargraph Display** or from the **Loudness Histogram** which is accessed via the **Data** button.

The **Loudness** implementation does not require the operator to listen to the audio components being measured as the location of the **Hear Box** and **Loudness Cursor** may be independent of one another (**Fixed** and **Dolby** source modes).

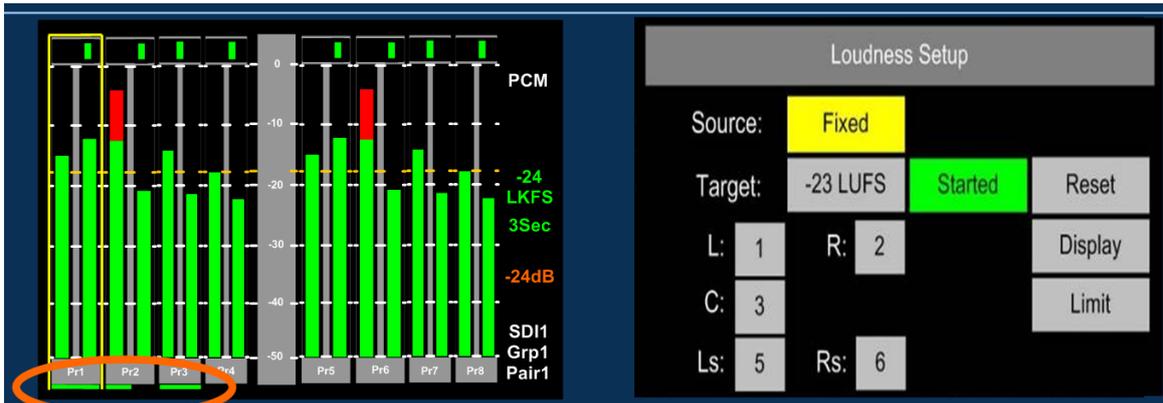


2.19.1 Source Selection.

The **PAM2** comprises 4 modes of operation for use when measuring Loudness from a User determined audio signal. In **Fixed mode** the user is able select whichever channels are subject to measurement, **Follow mode** takes a measurement of a 5.0 signal determined by the location of the yellow 'Hear' box and finally **Dolby mode** automatically selects the surround sound components of a decoded **Dolby E, Digital or Digital Plus** signal.

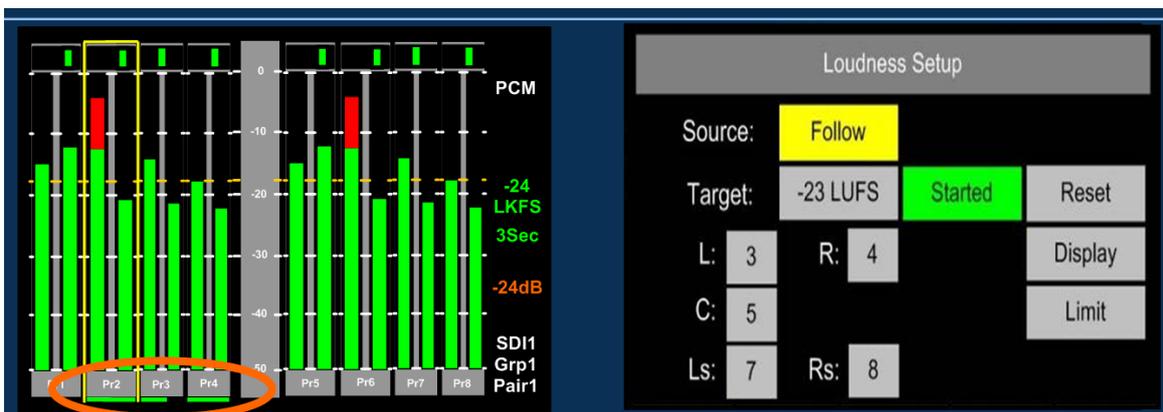
Off Mode: The **Loudness** menu **Source Selection** includes an **OFF** position for use when the **Loudness** measurement is not required. This switch position disables all onscreen representation of **Loudness** measurement including the **Target** value, **Measured** value, **Histogram** and **Menu** selection

Fixed Mode: Fixed Mode should be used when the audio signal under test should not change despite the position of the yellow 'Hear Box'. In the example shown below, channels 1, 2, 3, 5 and 6 are selected as the L, R, C, Ls and Rs components respectively.

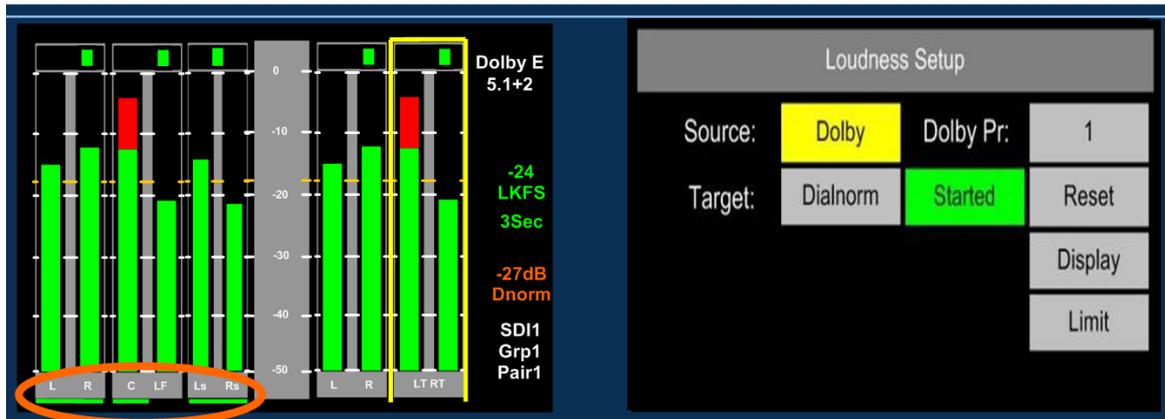


Their selection is denoted by the horizontal green cursor displayed below the 'pair' identification. Providing the user does not switch away from the selected signal input or **User Preset**, then the **PAM2** will continue to measure the Loudness of the highlighted audio components. In this mode of operation **PAM2** does not make the assumption that the audio signals are present in the correct **SMPTE** channel order for 5.1 sound – by selecting the channel components individually, non **SMPTE** order 5.1 audio can be chosen and measured. Unused channels can also be turned 'OFF' for **Stereo**, **4.0** or other custom applications. As per the **ITU-R** guidelines, the LF channel is not subject to measurement.

Follow Mode: Follow Mode should be used when the audio signal under test is determined by the position of the yellow **Hear Box**. In operation, as the user scrolls to hear audio components of the displayed audio signal, the green **Loudness** cursor will move accordingly and measure the 5 component signals to the right of the selected source. In this mode of operation **PAM2** makes the assumption that the audio signals are present in the correct **SMPTE** channel order for **5.1** audio. As per the **ITU-R** guidelines, the LF channel is not subject to measurement.

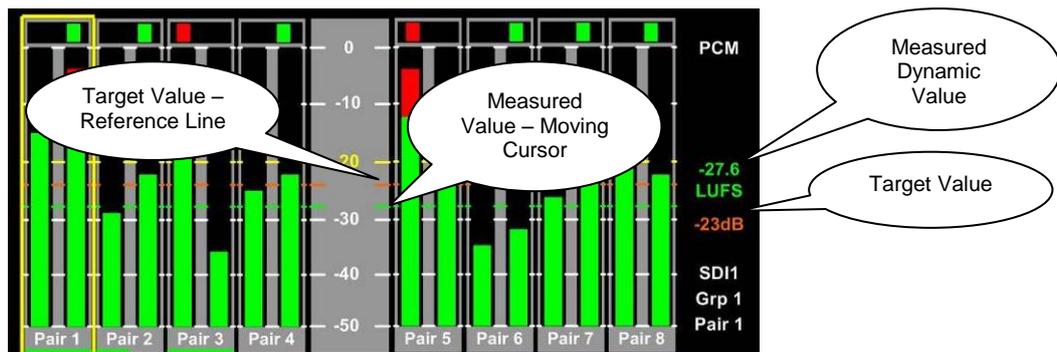


Dolby Mode: When decoding a Dolby signal, the **Loudness** measurement feature can be set to automatically select the appropriate audio components of the 5.1 programme. Since the **PAM2** identifies the channel configuration via the embedded **Dolby Metadata**, the Loudness feature uses this information to define the signal under test.



2.19.2 Target Level, Limit Threshold and Red Line Alarm

The purpose of Loudness measurement is to ensure that TV programme audio content is produced, distributed and ultimately transmitted at a level which does not inconvenience the listener and/or contravene any local or national regulations. **PAM2** helps the broadcaster to monitor the **Loudness** of programme audio content by comparing the measured level against a user defined **Target Level** (this might be figure determined by a regulator). A threshold **Limit** above or below the **Target** value determines the point at which the **Loudness** value displayed changes from green to red. The onscreen information is described below.



The **Target Level** can be set within a range of +13 to -30 or it can be defined by the **Dialnorm** of a decode **Dolby** signal. The value is displayed as an orange numerical value to the right of the left OLED screen. An orange reference cursor is also displayed across the bargraphs.

The derived **Loudness** figure is indicated as a dynamic red or green numerical value using either **LKFS** or **LUFS** units of measurement. A moving cursor follows the **LFS** value as it changes dynamically with both number and cursor changing colour from green to red as the **Target Value** plus **Limit** (if set) is exceeded.

The **Limit Value** at which a **Loudness** value 'red lines' can be set at up to +6 LU above the **Target Value**. At the point at which the '**Red Line**' limit is reached, **PAM2** triggers an output **GPI** via the D15 rear connector. This can be used for external **Alarm** notification and/or to control a third party **Loudness** control device.

2.19.3 Start, Stop and Reset Triggers

In order that **Loudness** measurement can be targeted towards specific programme content, **PAM2** is equipped with the ability to **Start** and **Stop** (pause) measurement cycles. These functions can either be triggered manually from the on screen button or from a **GPI** via the **D9** connector at the rear of the unit.

The action of restarting measurement after a 'stop' is executed recommences calculation of **Loudness** from the previous value or values. This methodology ensures that programme loudness measurement can be achieved outside of scheduled interruptions such as **commercial breaks** or **announcements**. A means to integrate this could be to use **studio** or **playout automation** to start/stop measurement via the **GPI**.

The **Reset** button discards any previously measured values enabling a new calculation to begin once the **Start** button is activated once more.

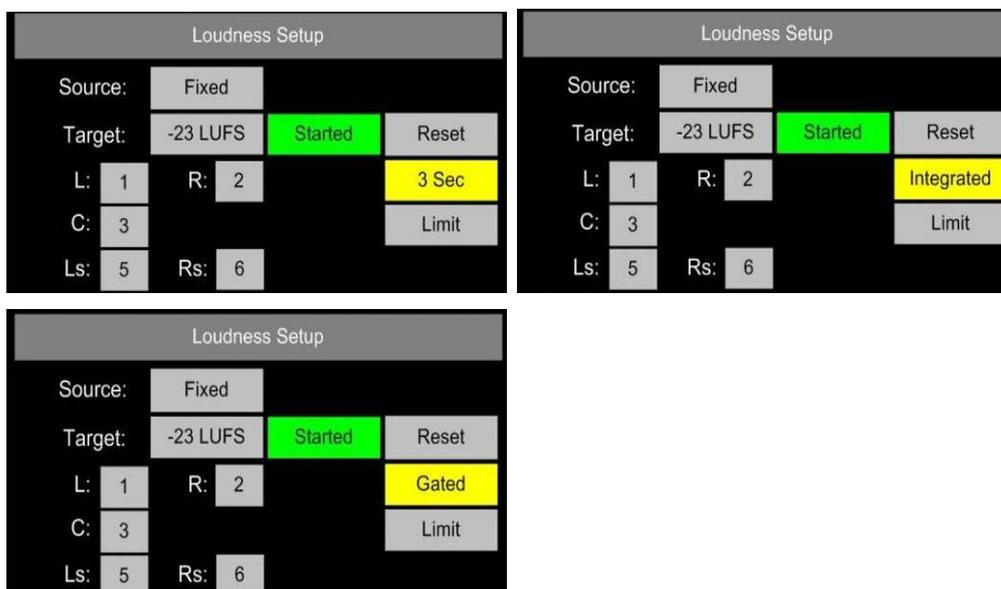


2.19.4 Histogram Display and Integration Settings

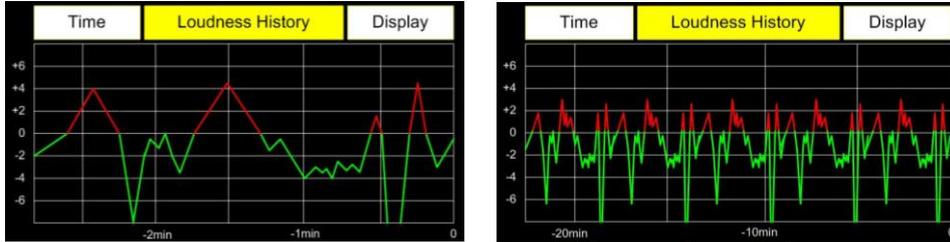
The **Display** button within the **Loudness Setup** menu provides access to three integration modes by which the resultant loudness level can be displayed as either a numerical value, moving line or via the **Histogram**.

The sample for all Loudness measurement is set internally at 400ms. The 3 modes of display are as follows:

- A **3 Second** sliding window.
- **Integrated Measurement** over the entire duration of any clip/programme. Control achieved via the Start/Stop/Reset buttons (soft or GPI)
- **Gated**: Similar to Integrated except that any sample lower than the -10dB gating level is discarded.



The **Loudness Histogram** is recalled via the 9th button at the **Top (Bargraph) Level** by toggling the **DATA** button between **Data/Loud/Meter** modes. The **Histogram** view can display loudness against time over a **2, 10, 20, 40** and **80 minute** period. The scale shows variation of +/- 6 LU either side of the user defined **Target Level**. There are direct access buttons at the top of the display which can be used to toggle between the two time period displays, three Integration modes and the **Loudness Setup** menu (via the **Loudness History** button).



Any measured values which exceed the **Target** level are shown in red. Over **Target** values which then exceed **Limit** are then clipped and do not extend to show peak. This gives the user a comprehensive and instantaneous reference to the behaviour of audio within the tested programme material.

The diagram below shows a programme **Histogram** displaying a **Target level** measurement with a **Limit** level set at +4 LU which is being exceeded at three points

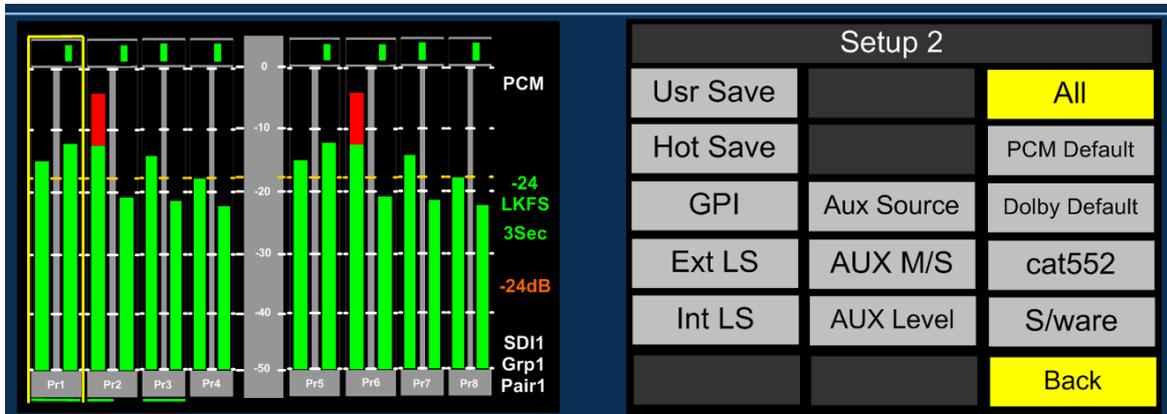


2.20 Preset Standard Rules

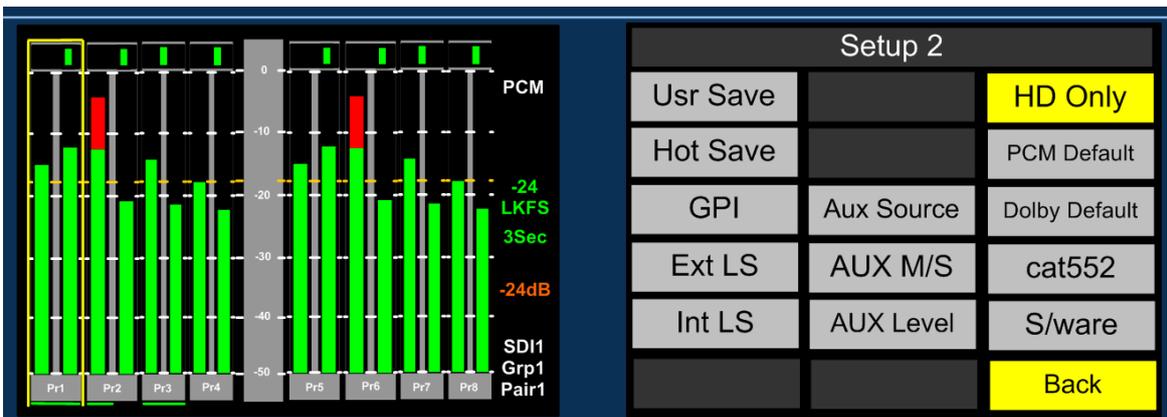
The **Preset Standard Rules** feature within the **Setup 2** menu enables **PAM2** to automatically switch between **Presets** depending on dynamic input signal format changes.

The **Preset Standard (Pst Std)** button has 3 user states.

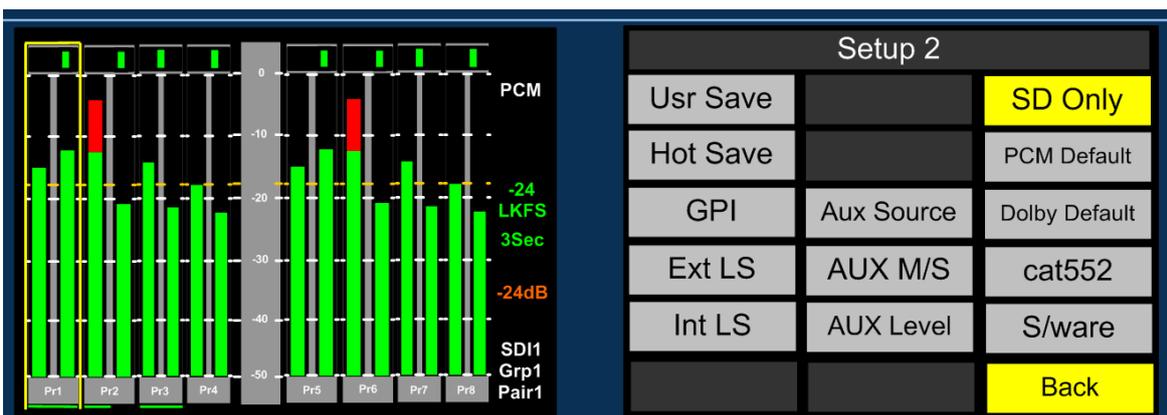
- **ALL** is the default condition and is used in normal operation. By definition, when **Preset Standard** is set to **ALL**, the **PAM2** operates as usual and is oblivious to changes to input signal types and functions as normal.



- **HD Only** should be selected as part of a **Preset** which is intended to be automatically activated whenever an **HD** signal is received.



- **SD Only** should be selected as part of a **Preset** which is intended to be automatically activated whenever an **SD** signal is received.

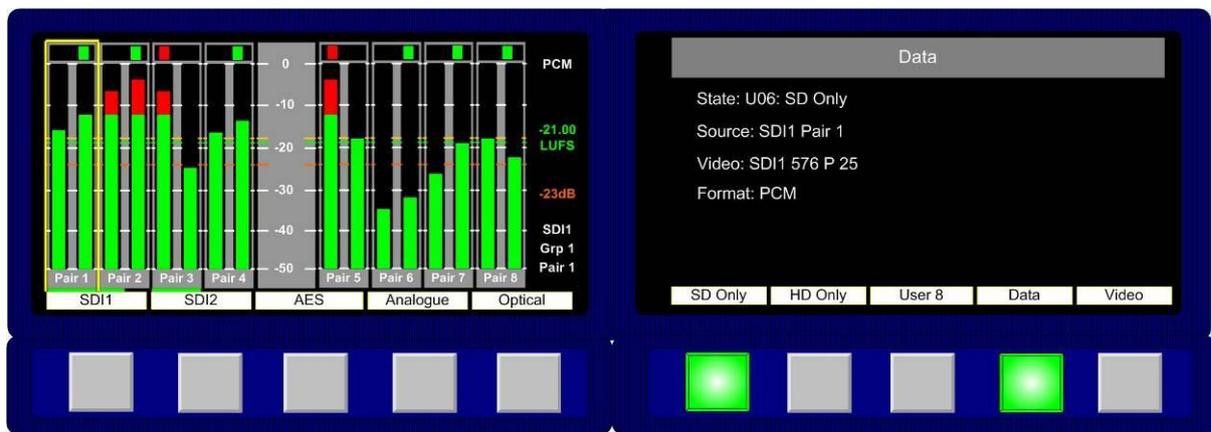


In use, when monitoring modes are being setup and saved as a **Preset** and will be subject to **Preset Standard** rules, the **Pst Std** selection must be made and saved as part of that preset or presets.

Important: For **Preset Standard** to work, the **SD** preset should be stored to the left and directly adjacent to the **HD preset** on a pair of front panel **User Preset** buttons. The **SD** button must first be pressed to recall said mode in order to activate automatic switching operation.

Application Example; SDI 1 input is cabled across a TV Station transmission which switches between **SD** and **HD** material. The **SD** signal always contains an embedded stereo audio programme on Group 1 Pair 1; the **HD** signal comprises a **Dolby E** signal on pair 2 with an encoded 5.1 programme. The operator wants to hear the stereo programme when an **SD** signal is present and the **Lt Rt Downmix** decoded from the **Dolby E** signal when **HD** is present without having to remember to switch between listening modes manually. **Preset Standard Rules** can be used to configure two independent **User Presets** between which the **PAM2** will automatically switch as the input signal standard changes.

The images below show how the application example would appear in operation with the **Data** button active and SD Only and HD Only **Preset Standard Rules** applied to **User Preset** buttons 6 and 7.



2.21 PCM and Dolby Default

The PCM and Dolby Default functions provide a sympathetic conditional switching function to the Preset Standard feature described previously. By assigning default conditions for PCM and Dolby signal types the PAM2 can automatically configure the audio monitoring characteristic appropriate to the operation on a preset by preset basis.

PCM Default can be set to 'OFF' or 'STEREO' where a detected incoming PCM signal will cause the PAM to either remain in its current monitoring state (OFF) or default to STEREO

Dolby Default can be set to 'OFF', 'Lx Rx' or 'ALL' where a detected incoming Dolby signal will cause the PAM to either remain in its current monitoring state (OFF), to automatically Downmix the signal (Lx Rx) or send the decoded 5.1 components to the external surround speaker output AES and analogue connections (ALL) providing they are set to 'Variable' mode.

Application Example: When the 'Hear Box' is set to monitor any given pair as part of a preset, the default monitoring condition for both internal and external speakers is to reproduce the audio in stereo. If the associated preset is set with a condition where the Dolby Default is set to ALL, the PAM2 will automatically select the surround 5.1 audio components of an incoming Dolby encoded signal and route them to the external speaker outputs. This kind of application may be used in an environment where PCM audio is always associated with stereo signals and Dolby encoding is used for 5.1 emission.

2.22 Auxiliary Input Mixer

The **Auxiliary Input Mixer (AIM)** is intended for use in environments where users of **PAM2** wear headphones during normal operation and need to listen to an additional audio input signal such as Intercom (Talkback) mixed into their monitoring feed.

The **Auxiliary Input Mixer** provides the ability to select exclusively from either an **Analogue** or **AES** audio input and to mix that audio signal into the **PAM2** monitoring output buss. The resultant signal can be heard through either headphone or the loudspeaker outputs. The selected auxiliary input signal can be defined as either mono or stereo in order that an associated input signal (such as a line level mono output from an **Intercom Panel** or **Matrix**) can be plugged into the left or right leg of the selected input and heard through the left, right or stereo outputs of the **PAM2**.

Auxiliary Input Mixer can be accessed via the **Setup 2** menu where 3 buttons allow the user to select the desired input, define whether it is mono or stereo and adjust an input level trim. In order that the input level can be quickly adjusted, the level trim control is duplicated on the **Input** menu screen.

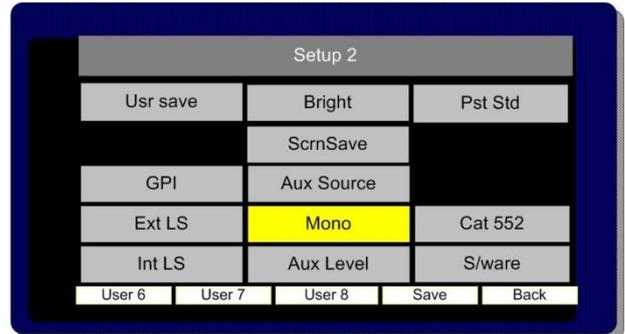
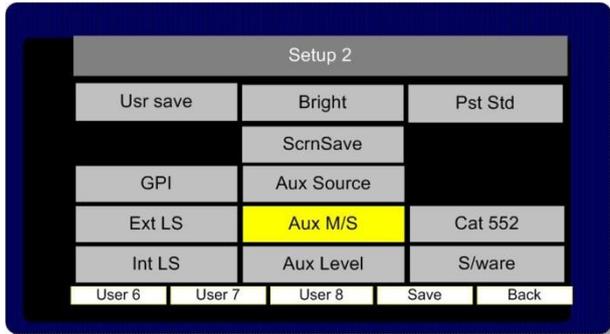
| Setup 2 | | |
|----------|------------|---------------|
| Usr Save | | Pst Std |
| Hot Save | | PCM Default |
| GPI | Aux Source | Dolby Default |
| Ext LS | AUX M/S | cat552 |
| Int LS | AUX Level | S/ware |
| | | Back |

| Setup 2 | | |
|----------|-----------|---------------|
| Usr Save | | Pst Std |
| Hot Save | | PCM Default |
| GPI | Anlg 1 | Dolby Default |
| Ext LS | AUX M/S | cat552 |
| Int LS | AUX Level | S/ware |
| | | Back |

Auxiliary Input Mixer is a global feature whose parameters and settings are not saved as part of a **User Preset**.

Aux Source: By using the encoder to select the **Aux Source** button, the user can scroll through the inputs and select the required source to route to the **Auxiliary Input Mixer**. Analogue Stereo Inputs 1 to 6 and AES pairs 1 to 8 are available for exclusive selection.

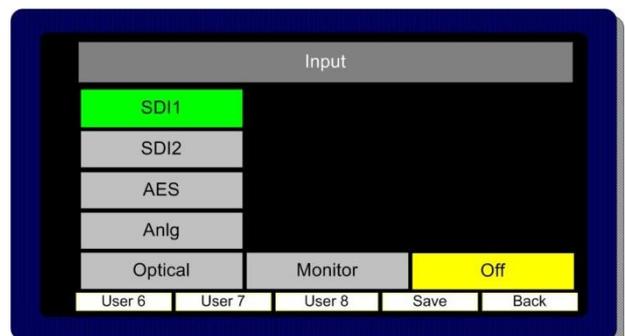
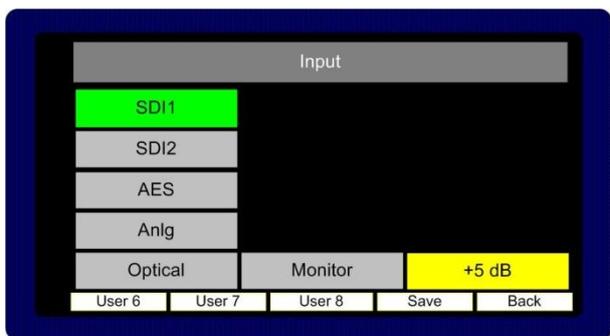
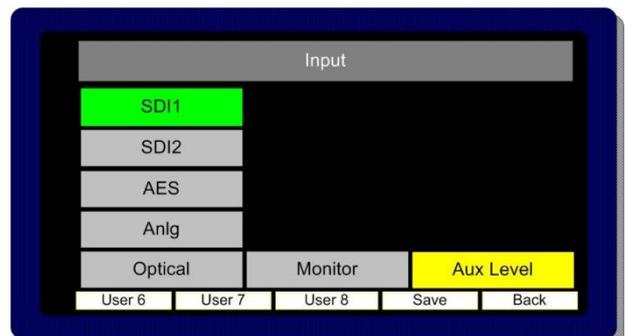
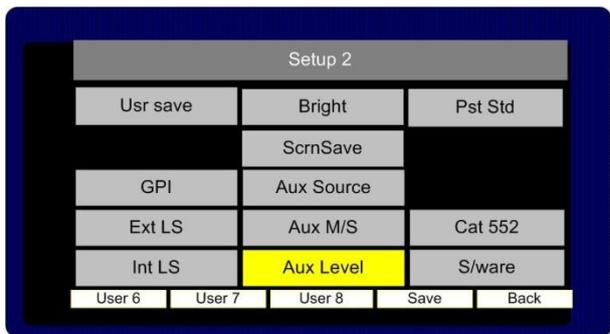
Aux M/S: By using the encoder to select the **Aux M/S** button, the user can define whether the selected input is to be mixed within **AIM** as a mono or stereo signal. For example: a mono line level input from a local **Intercom** panel might be connected to the left channel XLR connector of analogue input 1. In order that the operator can hear Intercom audio through both left and right headphone earpieces he would select the input to be mono so that the left and silent right inputs are summed together with equal signal sent to both left and right outputs.



Aux Level: The Aux Level control enables the user to trim the level of the selected Aux Input between 'Off' and +12dB of gain with respect to the signal monitored by the main **PAM2** monitoring function. The level adjustment is graduated in incremental steps as the user pushes and rotates the encoder control.

Note: As the encoder is pushed and turned, the change in trim level cannot be heard until the control is released.

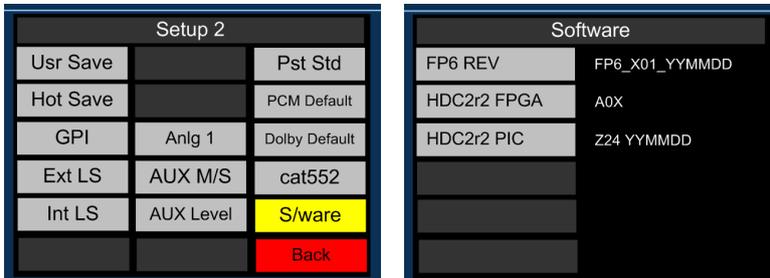
Aux Level control is duplicated within the **Input** menu screen in order to provide the user with rapid access to the trim control.



2.23 System Upgrade, Default Restore and CAT552 / CAT1100 Reset

PAM2 is designed to be field upgradeable. The user will need an SD memory card or USB thumb drive, a PC and a card reader (for SD only).

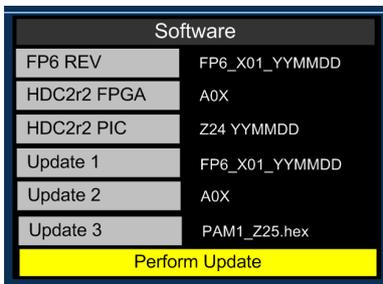
Format the memory card to FAT16 if used (or FAT as described in Windows XP). **PAM2** operating software and occasional **Dolby CAT552 / CAT1100** updates may be sent to you by TSL in the form of a ZIP file or can be downloaded from the **Product Support** area at www.tslproducts.com. These files **must** be extracted directly to the memory device in order to construct the correct file structure for upload.



Once the upgrade file is saved, select the **S/Ware** function from the **PAM2 Setup menu 2** and view the current **FP** (front panel) and **FPGA** software versions.

Press **Back** to exit the **S/Ware** mode and insert the memory device.

Then re-enter S/Ware mode, a new menu option should have appeared at the bottom of the screen. Highlight and select **Perform Update**.



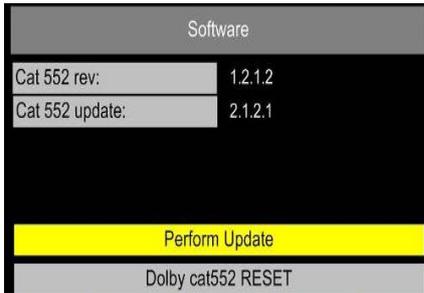
During an update, the left hand **OLED** screen displays the progress of each stage of the installation on a bargraph with a scale 0 to 100%. Front Panel (FP6), FPGA, PIC and Cat552 boards may all be updated via the SD card procedure. Depending on the file size of the update, the procedure may take up to 5 minutes to complete and may appear to have stopped – this is perfectly normal.

WARNING: Under no circumstances should power be interrupted during a software update. In the unfortunate event that this has occurred, PAM2 may have to be returned to TSL headquarters in the UK to have its operating system re-installed.

Once the update is complete, power PAM2 off and then re-apply power after 30 seconds to complete the procedure.

Note: Buttons 6, 7 and 8 should be pressed (6 and 8 to set -20 dBFS as operational default reference level) during a post update power cycle in order to clear the system memories and buffers. Please note that this will restore system default conditions and clear any customer programmed User Presets.

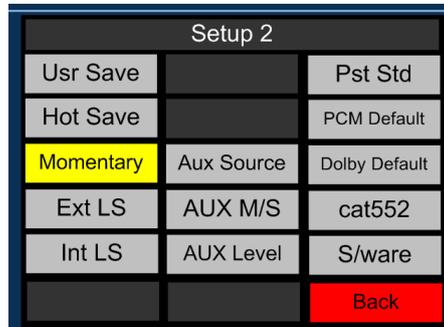
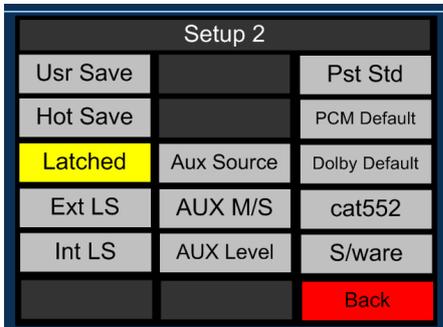
The optional **Dolby CAT552 / CAT1100** module can be updated using a similar procedure that described for the **PAM2** operating system. From **Setup 2** select **CAT552 / CAT1100** to review and update the Dolby card operating software. Features such as Dolby Digital Plus decoding may be added to the **CAT552 / CAT1100** module via the update procedure.



The **Dolby CAT552 / CAT1100** card may need to be reset in the event that it 'locks'. Select the **CAT552 / CAT1100** option from the **Setup 2** menu and then reset the card.

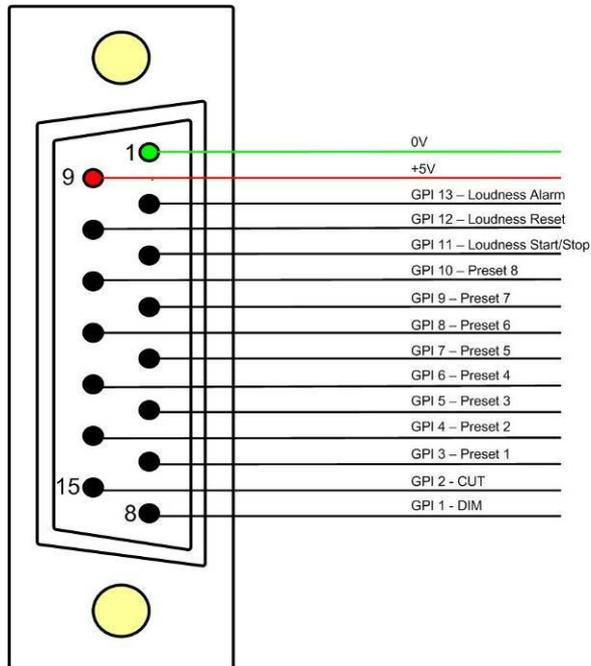
2.24 GPI Application

The rear panel GPI connector functionality can be used to **Dim/Cut** loudspeakers, to recall **User Presets** and to control **Loudness** measurement features. The Setup 2 menu page includes a button to access the GPI mode selector. The operator can choose to set the GPI connector to operate in either '**Latch**' or '**Momentary**' modes as described in the following section.



2.25 GPI Connectivity

The GPI operation is described pictorially by the pin out diagram shown below.



In **Momentary Mode**, **Dim** and **Cut** GPI's latch in a toggle manner, i.e. one closure to ground toggles the function ON: the next ground toggles it OFF. In an ON state: the GPI pin is driven low to allow an LED to be fed from the port. This LED drive is briefly pulsed high at about 100Hz to allow the port to be read whilst it is driving.

The preset recall GPI's in '**Latching**' mode are mutually exclusive.

! Note that the +5V power from this connector is intended to drive a "1-of-N" LED. If multiple LED's are to be used simultaneously, then a small external supply will be needed. An internal resistor within the PAM2 prevents the +5V rail from being shorted but limits the current available.

2.26 Hotkey and User Preset Memories

PAM2 features 8 Hotkey and 24 User Programmable Presets, for save and instant recall of default and favourite settings.

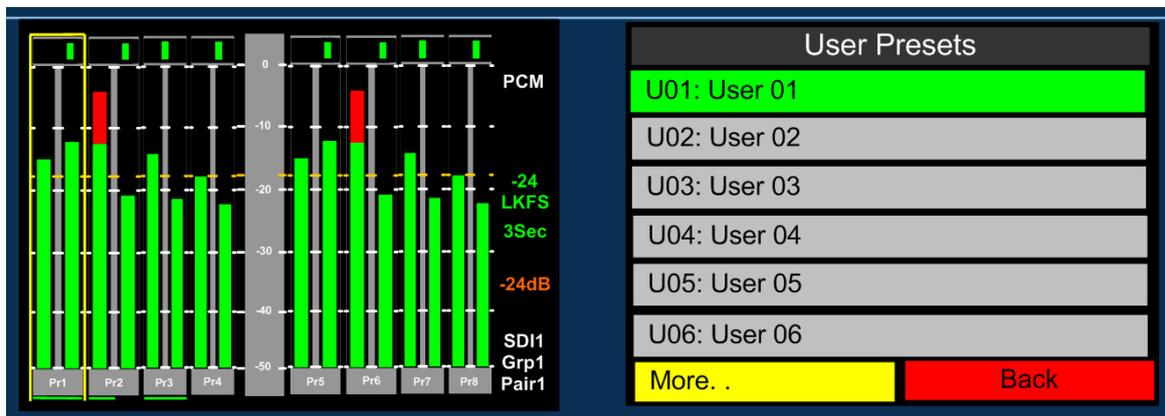
Hotkeys 1-8 are accessed directly from the front panel of PAM2 and User Presets 1-24 can be recalled and saved via the **Save** button

2.26.1 Recalling User Presets

Rotating the **Encoder** counter-clockwise activates the **Factory Preset** window in the right hand OLED screen. Highlight and select a preset, **PAM2** will revert to **Full Screen** mode displaying the selected audio from the preset list shown below.

Last User State returns the **PAM2** to the operational mode last used when the operator entered the **User** or **Factory Preset** condition.

Pressing Preset Recall brings up the 24 User Presets in four pages of 6 presets per page. Each preset is assigned the default user name in the form 'U01: User 01' to 'U24: User 24' however each preset can be allocated a unique user name.

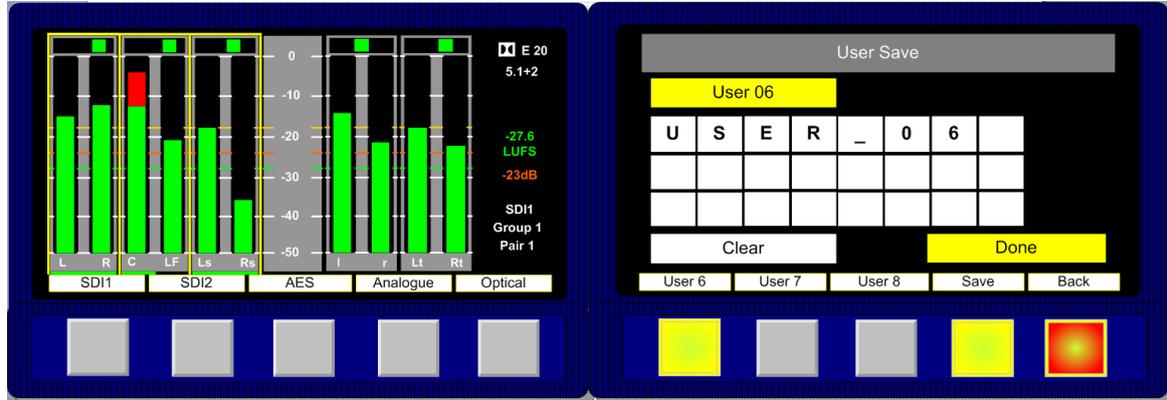


Recalling a preset instantly reconfigures the PAM2 to the settings previously stored.

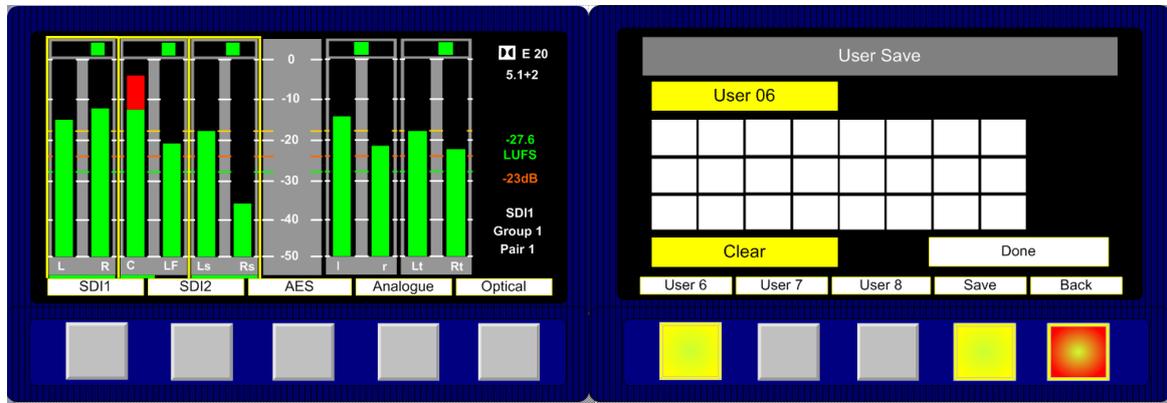
Note: All User Preset defaults are set to SDI1 Group1 Pair1

2.26.2 Managing User / Hotkey Presets

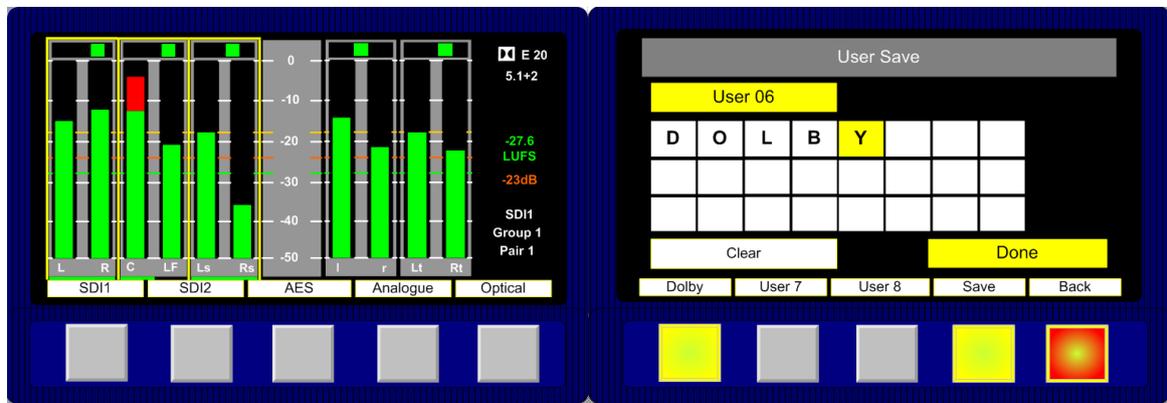
The **PAM2** enables the operator to save presets to 'Hotkey' buttons simply and quickly. In any operational mode (including menu screens) the user can save a preset by pushing and holding any of the physical buttons 1 to 8.



The User Save menu automatically appears on the right hand screen.



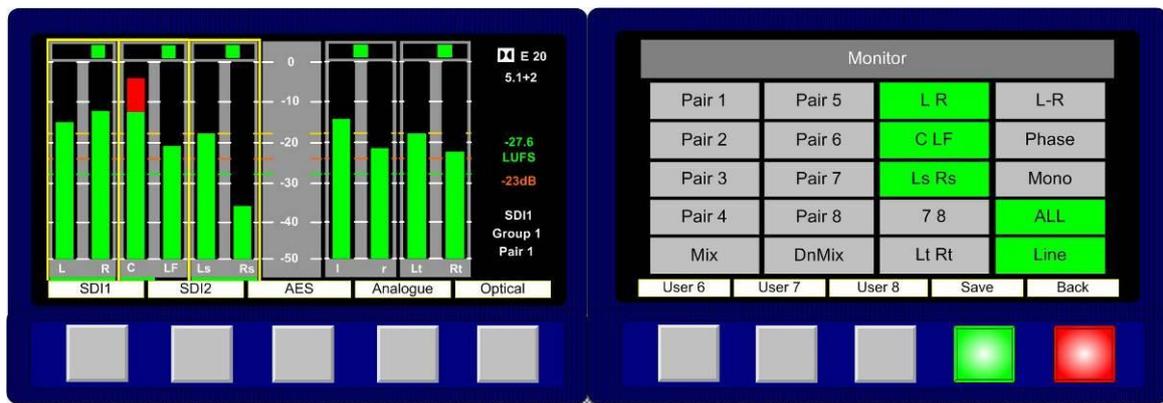
Select the **Clear** button to delete the default or existing text and use the text fields to create a preset or hotkey name to associate with the user setup.



Select the text fields and push / turn the encoder to select alphanumerics or symbols to create the intended name. Once complete simply select **Done** and the setup will be saved to the associated **Hotkey**

A secondary method can be used to save User Presets from any **Menu** mode.

When accessing a menu **Button 9** is illuminated **Green** and can be used to save the current monitoring condition to one of 24 **User Presets**. By pressing **Button 9** the **User Preset** list is



displayed in the right hand OLED screen. The image below show how a **User Preset** location may be selected from a **Main Menu** screen.

Once the **Green** save button (button 9) is pressed the **User Save** menu is activated. Select and highlight a **User Preset** location from the list **U1** to **U24**.

Note: **U1** to **U8** are automatically stored on **Preset Recall** buttons 1-8.

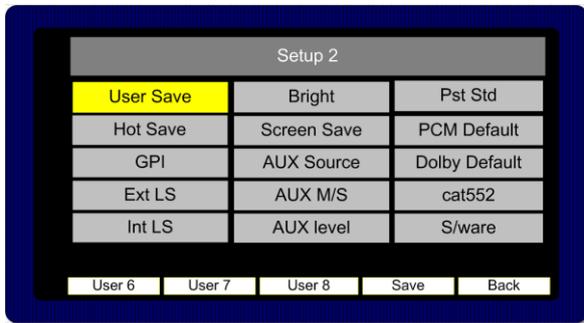
The text boxes in the **User Save** menu can be used to name a **User Preset**. Up to 18 letters or numbers are available. The example below shows a memory being named as **Dolby**. Selecting and pressing **Done** saves the memory to the chosen location.

Note; the text displayed above the **Preset Recall** button will display either the first word or 10 characters of text, whichever is shortest.

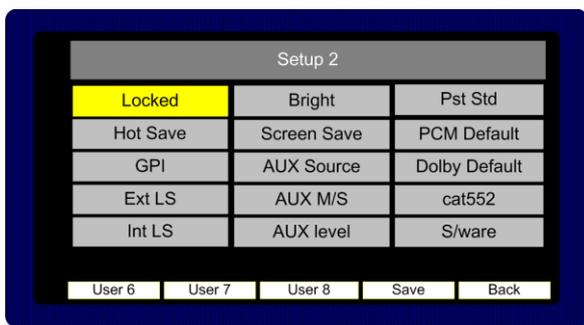
PAM2 Only - To recall a **User Preset** which isn't stored on **Preset Recall** buttons 1-8, rotate the **Encoder** clockwise to activate the **User Preset** window in the right hand OLED screen. Highlight and select to recall a **User Preset** from locations **U01** to **U24**.

2.26.3 Protecting User / Hotkeys Presets

Both User and Hotkey presets can be locked to avoid them being overwritten inadvertently. Navigate to the Setup 2 menu to access the User Save and Hotkey Save buttons.



Selecting either **User** or **Hot Save** buttons will enable the user to select to **Lock** either preset save function rendering it impossible for an operator to edit, erase or alter a preset.



2.26.4 Saving and Recalling Presets from External Devices

The **PAM2** configuration files can be backed up to an external memory device such as an SD card or USB drive. Both the front panel USB socket on PAM2 MK2 and rear panel SD card port (both models) can be used for backup and load procedures as well as a means to update new software releases.

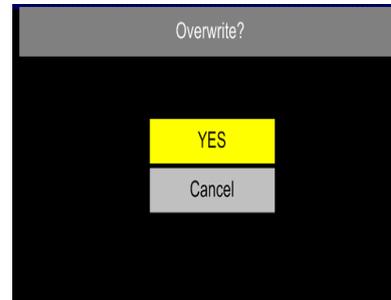
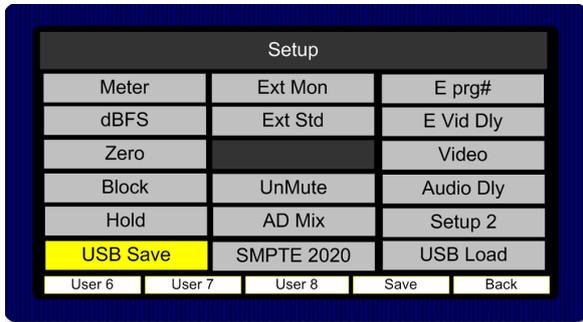
In order for a storage device to be recognised by PAM2 it must contain a folder named in a recognised format and called **PM2-3G16**.

This folder can be created manually using the ‘Make a new folder’ function within a Windows OS or via an equivalent command when using other programs or computer operating systems.

If a storage device is used to upgrade system software within **PAM2** the folder structure will automatically be created in the format described.

2.26.5 SD Card / USB Save

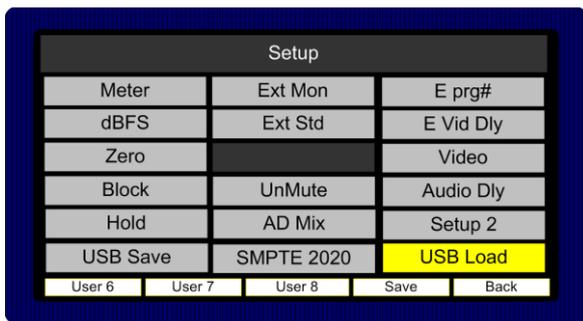
PAM2 will recognise a storage device containing a folder with the name **PAM2-3GM**. If the device is inserted into the USB or SD socket and the Setup Menu accessed then a button will be displayed labelled **SD or USB Save**. Selecting this button will cause the current status of **Hotkey** and **User Presets** 1 to 24 to be written to the device. If a preset backup already exists on the card then a request for confirmation prompt will be displayed before the save procedure commences.



2.26.6 SD Card / USB Load

Once a set of **Hotkey** and **User Presets** has been stored onto a USB storage device that device can be used to load the same presets onto other PAM2 units within the broadcast facility. Operators can also maintain copies of their own favourite settings and engineers can save and store backups of configurations to reload should a unit need to be reset during a software update or for operational reasons.

The SD / USB Load button is adjacent to the SD / USB Save key within the Setup Menu of PAM2. Selecting this function will automatically overwrite the User Presets on the device so please ensure these are backed up on another storage device if required.



3.0 Connectivity and pin-out details

PAM2 uses industry standard connectivity wherever possible. The D25 connectivity used for analogue and AES I/O adopts a pinning convention commonly used for Yamaha Commercial Audio equipment and breakout cables are readily available at low cost from companies such as www.cpc.farnell.com www.hosatech.com and many others.

For unbalanced AES I/O connectivity an optional BNC breakout cable, CAB-D25-BNC, is available from TSL or your local reseller. When used in conjunction with **PAM2**, DIP switch 2 (AES Impedance) must be switched to the 75 ohm position. For more information please refer to section 3.5 of this handbook.

3.1 Analogue XLR Connectors

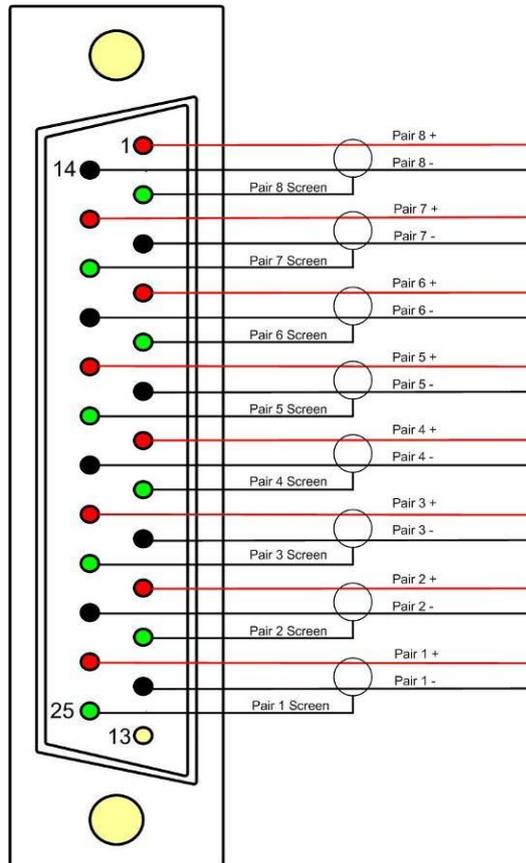
| CONN | PIN | FUNCTION |
|----------|-----|----------|
| ANALOG 1 | 1 | GND |
| ANALOG 1 | 2 | 1 IN+ |
| ANALOG 1 | 3 | 1 IN- |
| ANALOG 2 | 1 | GND |
| ANALOG 2 | 2 | 2 IN+ |
| ANALOG 2 | 3 | 2 IN- |

3.2 AES XLR Connectors

| CONN | PIN | FUNCTION |
|-------|-----|----------|
| AES1 | 1 | GND |
| AES 1 | 2 | 1 IN+ |
| AES 1 | 3 | 1 IN- |
| AES 2 | 1 | GND |
| AES 2 | 2 | 2 IN+ |
| AES 2 | 3 | 2 IN- |

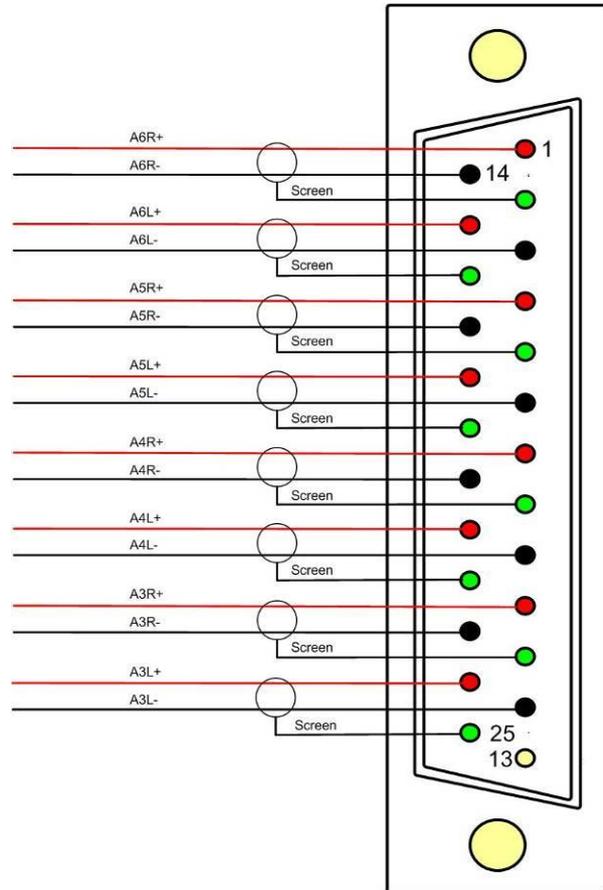
3.3 Analogue Output Connector – D25 Socket Pinout on unit, Plug (shown) on mating cable.

| D 25 SOCKET ON AMU | AUDIO OUT |
|--------------------|--------------|
| PIN NO | FUNCTION |
| 1 | A8+ (7.1) |
| 14 | A8- (7.1) |
| 2 | Ground |
| 15 | A7+ (7.1) |
| 3 | A7- (7.1) |
| 16 | Ground |
| 4 | A6+ (RS) |
| 17 | A6- (RS) |
| 5 | Ground |
| 18 | A5+ (LS) |
| 6 | A5- (LS) |
| 19 | Ground |
| 7 | A4+ (LFE) |
| 20 | A4- (LFE) |
| 8 | Ground |
| 21 | A3+ (Centre) |
| 9 | A3- (Centre) |
| 22 | Ground |
| 10 | A2+ (FR) |
| 23 | A2- (FR) |
| 11 | Ground |
| 24 | A1+ (FL) |
| 12 | A1- (FL) |
| 25 | Ground |
| 13 | N/C |



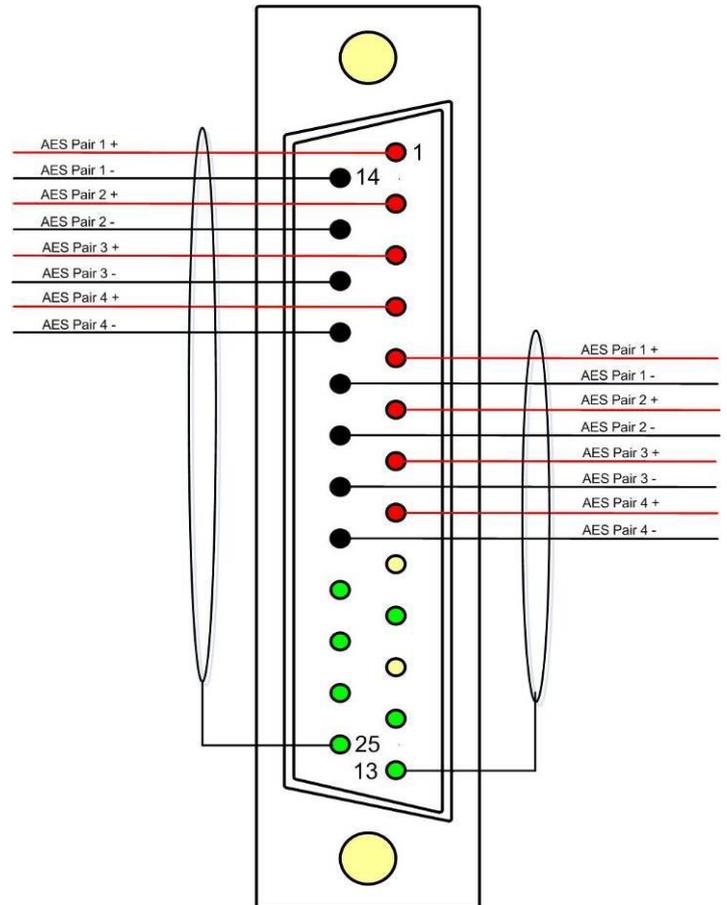
3.4 Analogue Input Connector – D25 Socket Pinout on unit, Plug on mating cable.

| D 25 SOCKET ON AMU | AUDIO IN |
|--------------------|----------|
| PIN NO | FUNCTION |
| 1 | A6R+ |
| 14 | A6R+ |
| 2 | Ground |
| 15 | A6L- |
| 3 | A6L- |
| 16 | Ground |
| 4 | A5R+ |
| 17 | A5R- |
| 5 | Ground |
| 18 | A5L+ |
| 6 | A5L- |
| 19 | Ground |
| 7 | A4R+ |
| 20 | A4R- |
| 8 | Ground |
| 21 | A4L+ |
| 9 | A4L- |
| 22 | Ground |
| 10 | A3R+ |
| 23 | A3R- |
| 11 | Ground |
| 24 | A3L+ |
| 12 | A3L- |
| 25 | Ground |
| 13 | N/C |



3.0 AES Input/Output Connectors 1-4 and 5-8 – D25 Socket Pinout, Plug (shown) on mating cable.

| D 25 SOCKET ON AMU | AES INPUTS/OUTPUTS |
|--------------------|--------------------|
| PIN NO | FUNCTION |
| 1 | Ch1&2 In 1+ |
| 14 | Ch1&2 In 1- |
| 2 | Ch3&4 In 2+ |
| 15 | Ch3&4 In 2- |
| 3 | Ch5&6 In 3+ |
| 16 | Ch5&6 In 3- |
| 4 | Ch7&8 In 4+ |
| 17 | Ch7&8 In 4- |
| 5 | Ch1&2 Out 1+ |
| 18 | Ch1&2 Out 1- |
| 6 | Ch3&4 Out 2+ |
| 19 | Ch3&4 Out 2- |
| 7 | Ch5&6 Out 3+ |
| 20 | Ch5&6 Out 3- |
| 8 | Ch7&8 Out 4+ |
| 21 | Ch7&8 Out 4- |
| 9 | N/C |
| 22 | Ground |
| 10 | Ground |
| 23 | Ground |
| 11 | N/C |
| 24 | Ground |
| 12 | Ground |
| 25 | Ground |
| 13 | Ground |



AES connectors may be wired using unbalanced terminations for SPDIF and 75R coaxial systems.

Optional AES breakout cable CAB-D25-BNC-2 is available from TSL Product Sales (+44 1628 676221) and provides BNC Socket to D25 connectivity.

Please note that when using PAM2 with unbalanced AES audio connections that the 75/110 ohm DIP Switch must be selected prior to use.

When using the D25 for unbalanced AES, AES XLR connectors 1 and 2 may not be used for balanced AES connectivity.

3.5 GPI Connector – D15 Plug Pinout, Socket on mating cable

| D 15 PLUG ON AMU | GPI |
|------------------|--------------------------|
| PIN NO | FUNCTION |
| 1 | 0V |
| 9 | +5V |
| 2 | GPI 13 – Loud Alarm |
| 10 | GPI 12 – Loud Reset |
| 3 | GPI 11 – Loud Start/Stop |
| 11 | GPI 10 – Preset 8 |
| 4 | GPI 9 – Preset 7 |
| 12 | GPI 8 – Preset 6 |
| 5 | GPI 7 – Preset 5 |
| 13 | GPI 6 – Preset 4 |
| 6 | GPI 5 – Preset 3 |
| 14 | GPI 4 – Preset 2 |
| 7 | GPI 3 – Preset 1 |
| 15 | GPI 2 – CUT |
| 8 | GPI 1 – DIM |

3.6 Remote Control Connector/ RS 422 - D9 Socket

This is wired for RS422 slave operation.

| D9 | CONTROL |
|----|---------|
| 1 | 0V |
| 6 | 0V |
| 2 | TX- |
| 7 | TX+ |
| 3 | RX+ |
| 8 | RX- |
| 4 | 0V |
| 9 | 0V |
| 5 | N/C |

3.7 Metadata - D9 Socket

This is wired for RS422 master operation.

| D9 | CONTROL |
|----|---------|
| 1 | 0V |
| 6 | 0V |
| 2 | RX- |
| 7 | RX+ |
| 3 | TX+ |
| 8 | TX- |
| 4 | 0V |
| 9 | 0V |
| 5 | N/C |

3.8 DIP switch configuration functions

| SWITCH | FUNCTION |
|---------------|-------------------------------------|
| 1 | Video aspect ratio (16:9 Up/4:3 Dn) |
| 2 | AES Impedance (75R Up/110R Dn) |
| 3 | Internal speaker mute - Up |
| 4 | Analogue variable – Up |
| 5 | AES variable - Up |
| 6 | XLR fixed Out (when set) |
| 7 | Not Used |
| 8 | Composite Up/SDI Dn |

4.0 Notes

There are no user adjustable assemblies/components within this unit.

This unit requires rear support when rack mounted.

In order to affect status changes of the unit using the rear DIP switch, the unit will require re powering before the changes take effect.

Output analogue levels are adjustable over the following range:

0dBm = 0.775V into 600Ω i.e. 1mW power dissipation.

0dBu = 0.775V RMS = PPM 4.

Shipping condition, -18 dB ref 0FS = 0dBu output.

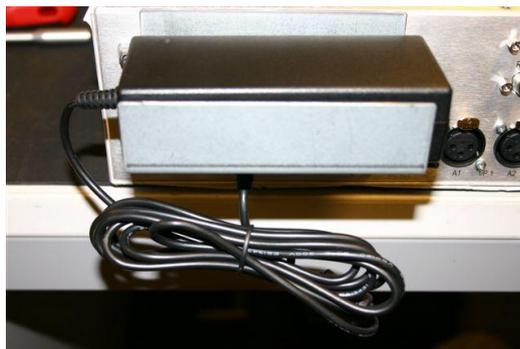
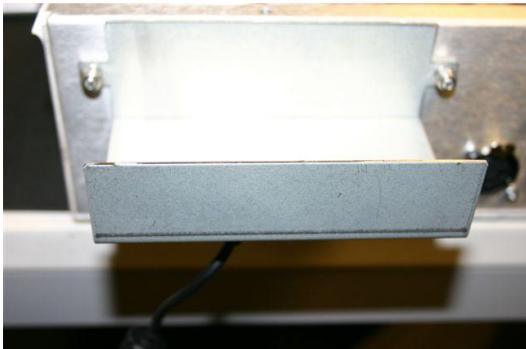
Typical European line up: -18 dBu

Typical American line: -20 dBu

4.0 Power Supply Mounting Bracket

PAM2 is powered via a supplied external 12 volt, DC supply. For your convenience a rear panel mounting bracket is also included with the product in order that the power supply can be held in place. Threaded studs are built onto the back panel of **PAM2** so that the bracket can be attached simply using a pair of 'nyloc' nuts.

Please see the photograph sequence below for details of how to mount the bracket and fit the power supply.



5.0 PAM2 - MK2 Technical Specifications

Power Supply

| | |
|-------------------|--------|
| Supply Voltage | 12V DC |
| Power Consumption | bc. |

Physical Dimensions

| | |
|--------|-------------|
| Height | 44mm (1RU) |
| Width | 483mm (19") |
| Depth | 280mm |
| Weight | 3100g |

Analogue Inputs 1 – 2 (Input 3-6 refer to section 3.4)

| | |
|--------------------|---|
| Connector Type | XLR Female 3 pin. Pin 1 Gnd, Pin 2 hot, Pin 3 cold. |
| Signal | Balanced line level audio. |
| Frequency Response | 30Hz to 25kHz |
| Impedance | >20k Ω |

Inputs AES 1&2

| | |
|----------------|---|
| Connector Type | XLR Female 3 pin. Pin 1 Gnd, Pin 2 hot, Pin 3 cold. |
| Standard | AES3 (1994) at 48kHz, 44.1kHz or 32kHz |
| Impedance | 110 ohm (balanced.) |

Inputs AES 1 to 8

AES I/O, 25 way D type (See elsewhere for details)

Input, HD/SDV 1 &2

| | |
|----------------|---|
| Connector Type | BNC. |
| Standard | 4:2:2 component with embedded 48Khz audio. (SMPTE 259M, 292M and 424M) |
| Impedance | 75ohm |

Line Output.

| | |
|----------------|---|
| Connector | XLR 3 pin Male |
| Impedance | 50 Ω |
| Output Levels | Through level control with 0dB gain. |
| Fixed Line O/P | Available on D25 (If selected on front panel) |

Headphone Output.

| | |
|---------------|--------------------------------------|
| Connector | Stereo Jack socket type A |
| Impedance | 50 Ω |
| Output Levels | Through level control with 0dB gain. |

De embedded output

| | |
|-----------|----------------------|
| Connector | 25 way D type |
| Impedance | 110 Ohm |
| Output | Groups 1, 2, 3 and 4 |

Video Output

| | |
|-----------|-------------------------------------|
| Connector | BNC |
| Impedance | 75 Ohm |
| Output | Composite video or SDI (selectable) |

Re-clocked Output

| | |
|-----------|---|
| Connector | BNC |
| Impedance | 75 Ohm |
| Output | Re-clocked serial output of the SELECTED input HD/SDV |

AES Output

| | |
|-----------|--|
| Connector | AES I/O, 25 way D type (See elsewhere for details) |
| Impedance | 110 Ohm |
| Output | Selected SDI Group. decoded Dolby signal or AES I/P 1- |

HD Standards Supported

| | | |
|------------------------|-------------|--------------|
| 1080i/50 | 1080p/23.98 | 1035i/30 |
| 1080i/59.94 | 1080p/24 | 1035i/29.94 |
| 1080i/60 | 1080p/25 | 1080sf/30 |
| 1080P/50 | 1080p/29.97 | 1080sf/29.97 |
| 1080P/59.94 | 1080p/30 | 1080sf/25 |
| 1080P/60 | 1080i/25 | 1080sf/24 |
| 720p/50 | 1080i/24.94 | 1080sf/23.98 |
| 720p/59.94 | 1080i/30 | |
| 720p/60 | | |
| 480i/30.00 (SD - NTSC) | | |
| 576i/25.00 (SD - PAL) | | |

Performance

| | |
|-----------------------|-----------------------------|
| Response | 70Hz to 20KHz |
| Electrical Distortion | Better than 0.1% |
| Hum and noise | Better than -80dB |
| SPL | >98dB at 0.6 m |
| Amplifier Output | 40 watts total power output |
| Digital Sample Rate | 32 to 48KHz auto select |

6.0 Installed HDC-2T Audio Monitor Module Specification Overview

This specification describes the HDC-2T Audio Monitor Module.

This module has been designed to monitor a combination of analogue audio, AES3 digital audio and AES or Dolby E digital audio embedded in SMPTE 259M or SMPTE 292M video data streams, together with the video content which is output as composite and/or SDI. HD formats are passed through a simple down-conversion process to the monitoring output.

Mechanical

PCB: 4 layer, 120mm x 376mm with integral BNC and XLR connectors
 Component Height: <30mm above pcb surface, <2mm below
 <65mm above pcb surface with Dolby E fitted

Power

The module assumes the supply of regulated power will be made available via the power input connector. Poorly regulated or noisy supply rails may affect the quality of the analogue outputs. The HDC-2T will accept two feeds of +12V to +24V DC power, approximately 60W typical when using loudspeaker outputs. This allows dual redundant or external battery operation.

Inputs

HD/SDI

Connector Type: BNC
 Receiver type: AC coupled, auto equalising with clock regeneration
 Impedance: 75 Ω , return loss \geq 15dB to 1.5GHz
 Standards: SMPTE 259M-C with embedded 48kHz audio per SMPTE 272M-A
 SMPTE 292M with embedded 48kHz audio per SMPTE 299M
 Performance: \geq 300m of high quality cable at 270Mbit (eg Belden 1694)
 \geq 100m of high quality cable at 1.5Gbit

AES 3 or AES 3id

Connector type: Inputs 1 & 2, XLR 3 pin. (can be built for unbalanced BNC input)
 Inputs 1, 2, 3 & 4. 25way D-type 4 stereo pairs, pin-out as per Yamaha
 Impedance: 75 Ω unbalanced or 110 Ω balanced. Impedance is switch selected via DIP
 Switch 2. To obtain an unbalanced connection one line of the input needs to be grounded at an electrically convenient point.
 Input Sensitivity: < 200mV p-p per AES3.
 Standards: AES3-1992 at 96 kHz, 48kHz, 44.1kHz or 32kHz

Analogue Inputs

Connector type: 4 x XLR 3 pin, (Two stereo pairs)
 Board header Further 4 stereo pairs (8 channels)

Remote control

Connector type: Header, 10way to connect to 9pin D-type (RS422)

Outputs

Video

Connector Type: BNC
 Output 1 Equalised active loop-through
 Impedance: 75 Ω
 Amplitude: 800mV p-p \pm 10%

Output 2 Composite SD (Down-converted when input is HD)
 Format: PAL or NTSC according to standard on SDI input
 Impedance: 75 Ω
 Amplitude: 1V p-p \pm 5%

Output 3 - Optional SDI version of image on composite output
Impedance: 75 Ω
Amplitude: 800mV p-p \pm 10%

AES

Eight AES (16 channels) may be output from analogue audio, embedded audio or from decoded Dolby E/D when the option is fitted

Connector type: 25way D-type 4 AES pairs (In and Out), pin-out as per Yamaha Standard
Impedance: 75 Ω unbalanced or 110 Ω balanced. Impedance is switch selected with on-board transformer balancing. To obtain an unbalanced connection one line of the output needs to be grounded at an electrically convenient point.
Amplitude: 1V into 75 Ω or >2V into 110 Ω

Analogue Audio

Eight analogue channels (4 stereo pairs) that may be output from AES, embedded audio or from decoded Dolby E/D when the option is fitted

Connector Type: XLR one pair fixed or variable
25 way D type 4 stereo pairs, pin-out as per Yamaha/Tascam
Format: Electronically balanced, centre ground.
D/A Conversion: 24 bit resolution.
THD+N: >80dB referred to 0dBFs

Loudspeakers

Connector Type: 0.156" board header
Format: Two active cross-over or 4 broad-band loudspeaker outputs
10 to 40W (4 Ω) per channel into depending on input power supply

GPI inputs

Connector type: Header to 9-way D-type plug

Control

Connector type: Header for current AMU-1 operator control board
Connector type: Header, serial bus for future operator control/display panels