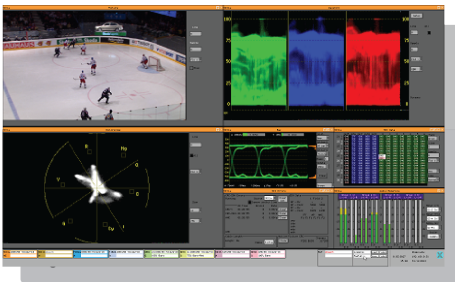# PHABRIX®

A Leader Company

Rx 500 / Rx 1000

User Manual

Software Release 9.09

Revision: 12

Preface

About this Manual

This User Manual is a guide to the functions provided by your Rx Series instrument.

For further information on PHABRIX products, please refer to the PHABRIX web page:

https://www.phabrix.com/products

Notice

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Revision

This guide is a revision controlled document. Any changes to any page content will be reflected in the overall revision status of the whole manual.

Release	Date	Software Version	Updates Include:
1	October 2013	0.08.0018	Release of Version 8
2	April 2014	0.09.0024	Dolby Decoder & High res Waveforms
3	July 2014	9.01.12565	Dolby Generator
4	October 2014	9.02.13137	
5	March 2015	9.02.13417	Frame Grab
6	July 2015	9.03.13798	AV Delay
7	June 2017	9.05	2K over HD-SDI, left-hand TFT Instrument View & Closed Caption Error Logging
8	July 2017	9.05	Loudness enhancements
9	February 2019	9.05	Vertical Ancillary Data display in Picture & Waveform using cursors
10	January 2020	9.07	GPIO Loudness Control; Increased Range of Rx Generators' Master Control.
11	March 2023	9.08	Vectorscope addition of x2 Gain for CbCr signals; 16:9 mode support for 525-line signals in Picture scaler; additional bug fixes.
12	October 2023	9.09	Added Gamut instrument with setup dialog and gamut logging. Ability to save custom gamut settings to preset using Custom mode. Removed existing Gamut checking from the Picture side menu; added a Mono (monochrome) checkbox.

Getting Started

Package Contents

The shipping box should include the following:

One black carrying bag containing:

- PHABRIX Rx 500 or Rx 1000 unit

- Power Supply Unit

- Mains lead

- Allen key

- User Manual and Firmware on USB key.

> **Note:** Both the latest versions of the user manual and firmware are available from the Software Downloads section of the PHABRIX website:

https://www.phabrix.com/support/product-software-downloads/

The title page of this manual displays the supported version of the Rx 500 1000 software.

General Safety

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Avoiding Personal Injury

> **Warning:** This instrument is designed for use by qualified personnel only.

No internal user-serviceable parts are provided. Units should be returned to your local PHABRIX agent for servicing.

The Operator must NOT remove the case from the unit as this will invalidate the warranty.

Do not spill any liquid onto the unit or its power adapter.

> **Warning:** Do not look directly into the fiber optic connections of cable as this may cause permanent damage to the eyes.

Power Supply

Make sure that the unit is connected to the correct power supply voltage. A power supply adapter is supplied with the unit which may be connected to any AC power supply between 100 and 240 V AC at 50-60 Hz. Only the supplied power adapter should be used with the unit. Do not use a damaged AC cable with the unit as it may cause a shock or fire hazard. Replacement AC cables are available from your local PHABRIX agent.

Installation Environment

⚠️

Operating Temperature

Warning: The unit should only be operated between 0 and 40°Celsius. If the unit is operated at a higher temperature, there is a possibility of a fire hazard. If the temperature is changed rapidly from a cold environment to a hot environment, moisture can be created internally which can cause malfunction or damage the unit. Allow the unit to sit for 30 minutes without power applied to reduce any possibility of condensation. If the temperature rises above 60°Celsius a warning dialog will be given. If the temperature rises above 65°Celsius the unit will be turned OFF. Under both conditions, an event will be added to the event log to show what happened.

Input/Output Terminals

Do not connect the input or output BNC connectors to external power as this can damage the internal circuitry and cause the unit to work incorrectly.

The BNC connectors fitted on this unit are 75 ohm type which are not compatible with 50 ohm plugs.

Warning: The use of 50 ohm plugs will permanently damage the connectors on the unit. The use of 50 ohm plugs is considered to be misuse of the equipment and will therefore invalidate the unit's warranty.

SFP Cage

Warning: When the SFP cage is fitted, either an SFP or a bung must be fitted in the SFP cage at all times to prevent the Sx TAG overheating.

When Not in Use

Disconnect the unit from the power supply and AC power source when not in use.

Maintenance

Wipe the case, and knobs gently with a soft cloth, lightly dampened with a neutral cleaning agent. A screen cleaning cloth may be used to clean the LCD. Do not apply force to the LCD when cleaning or it may be damaged.

Warning: Remove the power supply from the unit and turn OFF before cleaning. Do not allow any water or other liquid to enter the unit while cleaning.

RoHS 2 Compliance

PHABRIX products are designed and manufactured using only Restriction of Hazardous Substances (RoHS) compliant components and materials. Based on information provided by our suppliers, therefore, PHABRIX certifies that ALL products that it manufactures are RoHS-5 compliant and that they do not exceed the designated levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether flame retardants (PBDE) legislated under the provisions of the "*European Parliament and Council Directive*" on the "*Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (2011/65/EC)*" and associated regulations collectively known as the RoHS Regulations.

Disposal of Equipment

This product is subject to the European WEEE (Waste Electrical and Electronic Equipment) directive and should be disposed of according to the regulations of each country.

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- Dolby, Dolby E, Dolby Digital (Dolby AC-3), and Dolby Digital Plus (Dolby E-AC-3) are trademarks of Dolby Laboratories, Inc.

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- Intel and Intel Core are trademarks of Intel Corporation or its subsidiaries.

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Table of Contents

Description

Rx Platform

Overview

The **Rx platform** has been designed to serve the varied test and measurement needs of the broadcast industry. PHABRIX has developed a modular system from which specific broadcast client requirements can be satisfied.

The Rx platform allows a flexible approach to test and measurement on a new technological platform designed for longevity. The system has been created to allow broadcast engineers to specify features according to the complexity of the required test and measurement application by simply adding additional modules and software licenses to their chosen core chassis.

Adding modules is like adding independent new instruments, each module providing a dedicated set of instruments for the task required.

The Rx Platform is available in a choice of chassis types:

- **Rx 2000** – a unique audio video monitoring solution combining front panel instrumentation, using dual TFT LCD screens, and integrated full range stereo speakers. Unique 2U tapered *tilt-in-bay* engineering with four Rx module bays.

- **Rx 1000 Rasterizer** – a compact 1U 19 inch rack-mount chassis with OLED display interface with four Rx module bays.

- **Rx 500 Rasterizer** – a compact 1U half-rack width chassis with OLED display interface with two Rx module bays.

Rx 1000 Rasterizer

Description

The Rx 1000 is a 1U rack-mounted instrument that provides the following:

- OLED display to allow the monitoring inputs and the selection of Monitor display, Analyzer and Generator presets.

- Rasterized HDMI/SDI outputs to allow up to 16 individual instrument panels (windows) to be displayed on a single DVI 1920 x 1080 resolution monitor. Ideal for outside broadcast facilities and engineering bays where space is at a premium.

- Control via front panel controls, for in-bay use and remotely via a network connection using a web browser.

- Front panel audio monitoring, provided by high quality speakers and/or a headphone socket, to allow the monitoring of the selected Audio channel.

- Four Module slots allowing the installation of Analyzer and Generator modules.

Front Panel

The front panel provides access to the OLED display and menu system to allow the instrument to be configured and preset Monitor display, Analyzer and Generator settings to be recalled.

Rear Panel

The rear panel provides the Rx instrument's connections via the CPU module and the installed Analyzer or Generator modules. See the section *Rx Module Descriptions* for details of the different module types.

The power for the Rx instrument is provided by a separate PSU unit that connects to the 4-pin male XLR connector at the left of the instrument.

Specifications

See the Appendix *Specifications* for details.

Rx 500 Rasterizer

Description

The Rx 500 is a 1U, half-rack width instrument (available with optional rack mount kit) that provides the following:

- OLED display to allow the monitoring inputs and the selection of Monitor display, Analyzer and Generator presets.

- Rasterized HDMI/SDI outputs to allow up to 16 individual instrument panels (windows) to be displayed on a single DVI 1920 x 1080 resolution monitor. Ideal for outside broadcast facilities and engineering bays where space is at a premium.

- Control via front panel controls, for in-bay use and remotely via a network connection using a web browser.

- Front panel headphone socket to allow the monitoring of the selected Audio channel.

- Two Module slots allowing the installation of Analyzer and Generator modules.

Front Panel

The front panel provides access to the OLED Display and menu system to allowing you to configure the instrument and recall preset settings for the Monitor display, Analyzer and Generator.

Rear Panel
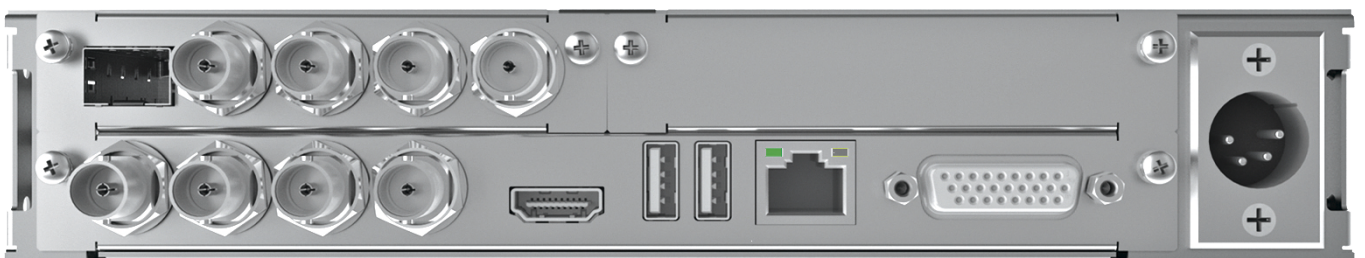
The rear panel provides the Rx instrument's connections via the CPU module and the installed Analyzer or Generator modules. See the section *Rx Module Descriptions* for details of the different module types.

The power for the Rx instrument is provided by a separate PSU unit that connects to the 4-pin male XLR connector at the left of the instrument.

Specifications

See Appendix *Specifications* for details.

Rx Modules

Overview

The Rx range can be configured with a range of plug-in modules (printed circuit boards with dedicated hardware for specific functions) that enable functionality in the software and allow various menus to be selected allowing different Instrument panels (windows) to be created on the Monitor output.

> **Note:** The **Monitor Output → System Status** menu can be used to inspect which Modules have been installed in the Rx instrument. See the chapter *HDMI Monitor Output* for details.

CPU Module

At the heart of every Rx product is the CPU module. Here signals from each installed instrument module are processed to provide a variety of instrument displays. Unhindered by stacked processing restraints, the CPU board creates an output display at an industry leading 1920 x 1080 pixels with perfect scaling through simultaneous HDMI and/or SDI outputs. In practice the Rx acts like a Test and Measurement multi-viewer providing scaled instruments from any selected video/audio input.
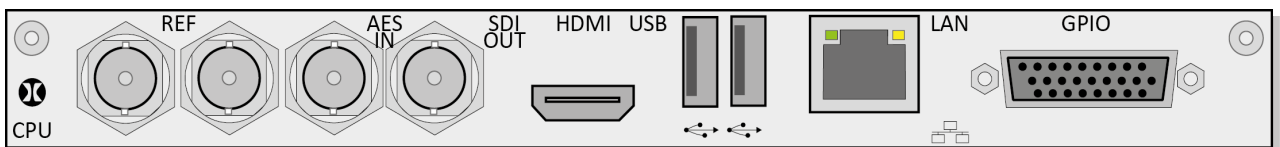
The CPU board also provides AES input, Bi- / Tri-level looping reference, eight channel GPI, LTC input and stereo analog audio output. Dual USB ports are provided for mouse and keyboard control. Ethernet provides remote access by way of a web browser and is also the method for updating firmware and software from the PHABRIX dedicated server.

REF:

Bi- / Tri-level looping reference that allows the Rx instrument to be locked to a studio reference.

AES IN:

An AES audio input

SDI OUT:

An SD-SDI or HD-SDI signal generator output that provides test signals generated by the on-board Generator module on the CPU board. This output can also be used to provide an SDI monitor output tied to the HDMI® monitor output.

HDMI:

A DVI 1920 x 1080 resolution monitor output that allows up to 16 individual instrument panels (or windows) to be displayed. Note that on some HDMI® monitors this output may appear too sharp causing ringing on the edges of text and menus. This can be resolved by reducing the monitor's image sharpness setting.

USB:

Are standard USB 2 connections provided for connection of a keyboard and mouse to control the HDMI® monitor output.

LAN:

10 / 100-base-T connection allowing the Rx instrument to be connected into a network and accessed over TCP/IP so that it can be controlled remotely.

GPIO:

> Provides a GPI (general purpose input), LTC control and analog audio connections.

Single Analyzer, Dual Input Module
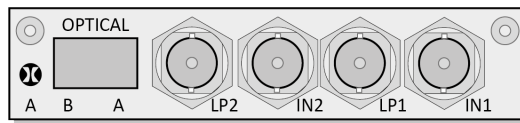
The **PHRXM-A** module allows two connected SDI or Optical video signals to be present continuously and switched for analysis or display by the single analyzer channel as required.

IN1 - LP1:

> SD-SDI or HD-SDI signal, high impedance loop through that allows the Rx instrument to analyze the connected input.

IN2 - LP2:

> A second SD-SDI or HD-SDI signal, high impedance loop through that allows the Rx instrument to analyze the connected input.

OPTICAL:

> Allows a Video Transceiver (SFP Optical) module to be installed.

> **Note:** Note that for Dual Link analysis the Link 1 signal must be connected to the **IN1** BNC connector and the Link 2 signal must be connected to the **IN2** BNC connector on the same Analyzer module. Likewise if Fiber is being used, Link 1 should connect to **OPTICAL A** and Link 2 should connect to **OPTICAL B**.

Single Analyzer, Dual Input, Physical Layer Measurement Module
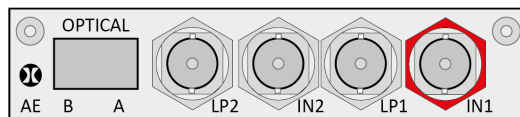
The **PHRXM-AE** module allows two connected SDI or Optical video signals to be present continuously and selected for analysis or display as required.

IN1 - LP1:

> Is an SD-SDI or HD-SDI signal, high impedance loop through that allows the Rx instrument to analyze the connected input. Connector **IN1** (red or black nut) provides physical layer measurements.

IN2 - LP2:

> Is a second SD-SDI or HD-SDI signal, high impedance loop through that allows the Rx instrument to analyze the connected input.

OPTICAL:

> Allows a Video Transceiver (SFP Optical) module to be installed.

> **Note:** For Dual Link analysis the Link 1 signal must be connected to **IN1** BNC connector and the Link 2 signal must be connected to **IN2** BNC connector on the same Analyzer module. Likewise if Fiber is being used Link 1 should connect to **OPTICAL A** and Link 2 should connect to **OPTICAL B** .

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Single Analyzer, Single Generator Module

The **PHRXM-AG** module allows a single connected SDI or Optical video signal to be monitored continuously and allows the generation of a single SDI or Optical video test signal.

SDI ANA IN:

> Is an SD-SDI or HD-SDI signal, high impedance loop through to **SDI ANA OUT** that allows the Rx instrument to analyze the input.

SDI GEN OUT:

> Are two identical SD-SDI or HD-SDI generator output that provide a test signal generated by the PHRXM-AG module.

OPTICAL:

> Allows a Video Transceiver (SFP Optical) module to be installed.

> **GEN:**

>> Provides a test signal generated by the PHRXM-AG module.

> **ANA:**

>> Allows the Rx instrument to analyze the connected input.

AES Digital Audio Input / Output Module
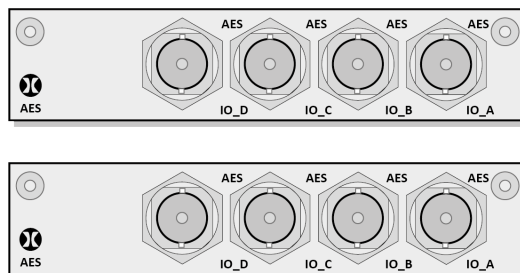
The **PHRXM-4AES** module allows four AES digital audio pairs to be routed to the Audio Meter and Loudness instruments. It also allows AES audio to be used by Generator modules and allows Embedded SDI audio channels to be output as AES audio.

- **AES IO_A:** An AES digital audio pair input/output.

- **AES IO_B:** An AES digital audio pair input/output.

- **AES IO_C:** An AES digital audio pair input/output.

- **AES IO_D:** An AES digital audio pair input/output.

Single Analyzer, Single Generator, Physical Layer Measurement Module
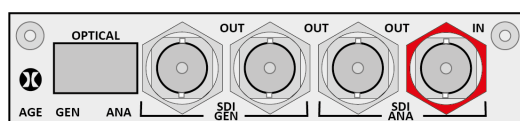
The **PHRXM-AGE** module allows a single connected SDI or Optical video signal to be monitored continuously and allows the generation of a single SDI or Optical video test signal.

SDI ANA IN:

> An SD-SDI or HD-SDI signal, high impedance loop through to **SDI ANA OUT** that allows the Rx instrument to analyze the input, and provides physical layer measurements (red nut).

SDI GEN OUT:

> Two identical SD-SDI or HD-SDI generator outputs that provide a test signal generated by the PHRXM-AG module.

OPTICAL:

> Allows a Video Transceiver (SFP Optical) module to be installed.

GEN:

> Provides a test signal generated by the PHRXM-AG module.

ANA:

> Allows the Rx instrument to analyze the connected input.

Dual Output Generator Module
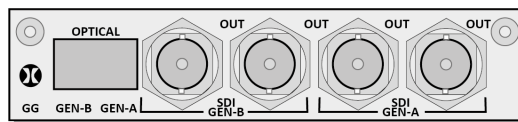
The **PHRXM-GDL** module allows the generation of a two independent SDI or Optical video test signals with the same video format, color-space and frame rate for Dual link use.

SDI GEN-A OUT:

> Ttwo identical SD-SDI or HD-SDI generator outputs that provide a test signal generated by the PHRXM-GDL module.

SDI GEN-B OUT:

> Two identical SD-SDI or HD-SDI generator outputs that provide a test signal generated by the PHRXM-GDL module.

OPTICAL:

> Allows a Video Transceiver (SFP Optical) module to be installed.

GEN-A:

> Provides a test signal generated by the PHRXM-GDL module.

GEN-B:

> Provides a test signal generated by the PHRXM-GDL module.

> **Note:** For Dual Link test pattern generation both Output 1 and Output 2 must be enabled on the Generator. The Link 1 signal is produced on the module's **GEN A** output and the Link 2 signal is produced on the module's **GEN B** output. Likewise if a Fiber connection is being used the Link 1 signal is produced on **OPTICAL GEN A** and the Link 2 signal is produced on **OPTICAL GEN B**.

Rx Software Options

Overview

The Rx range provides a number of software options to enhance the Rx functionality for specific applications.

3G-SDI and Advanced Formats Upgrade for Rx Chassis
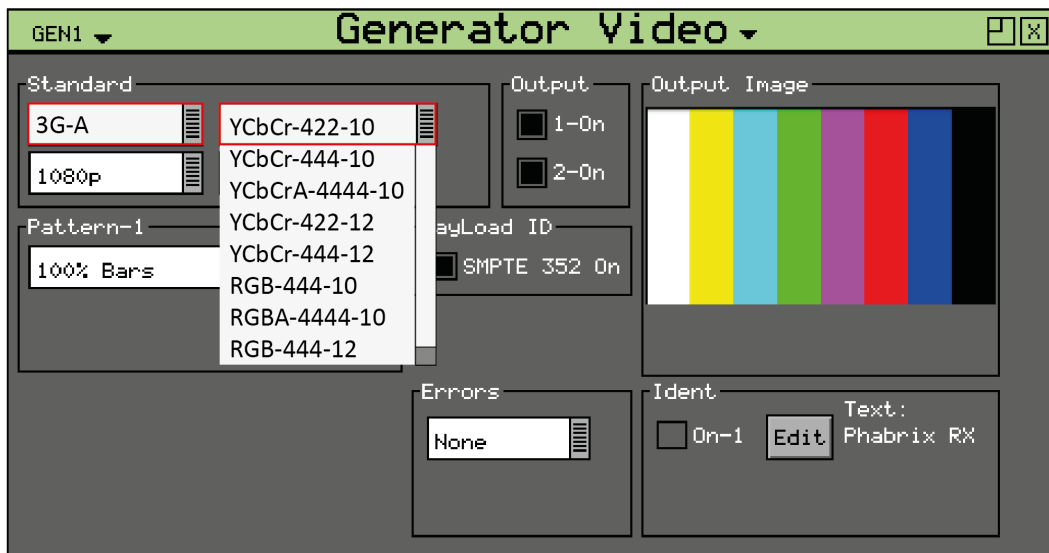
This option (**PHRXO-3G**) provides advanced formats include 4:2:2 YUV, 4:4:4 RGB and 4:4:4 YUV at 10/12 bit and 3G level A and B. For broadcast manufacturers this option allows rigorous testing of many more formats beyond the standard signals used in traditional broadcasting.

Among the support for 3G level B is the ability to analyze signals such as SMPTE 425-B carrying 1 x SMPTE 372M Dual-Link payload. Generation of these signals is activated if the generator is present.

HD/SD-SDI Data Analyzer and Ancillary Packet Analyzer
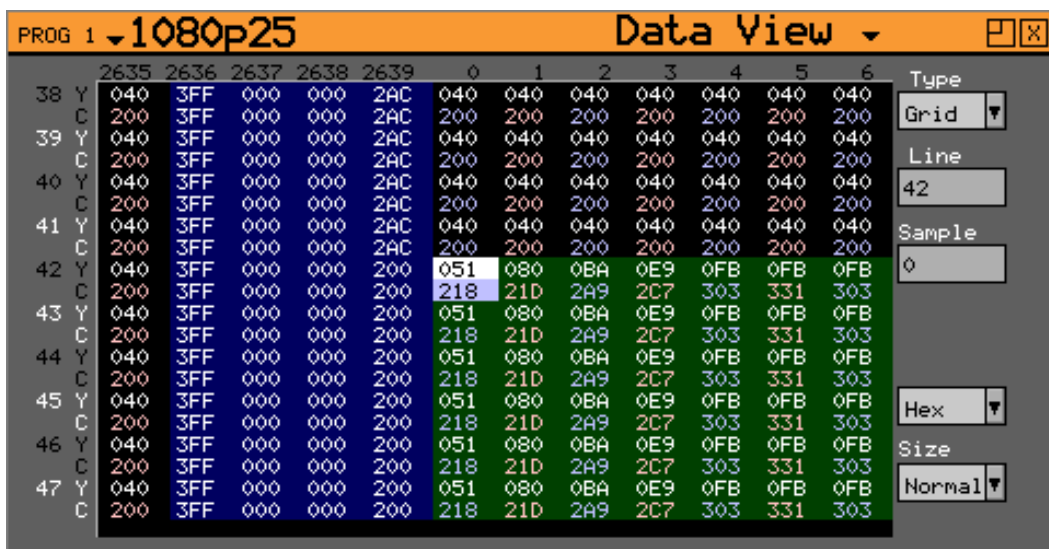
The SDI analysis option (**PHRXO-SD**) provides the engineer with a detailed view of the data words contained within the SDI stream. This allows the analysis of complex faults and is particularly useful when determining compatibility issues between equipment and when debugging new product developments particularly in a R&D environment.

Detail within the active SDI stream can be viewed with continuous update. The SDI Analysis option provides the following functional areas:

Grid:

Displays the SDI data in the form of an array.

Stream:

Allows the SDI continuous datastream to be viewed.

Component:

Allows the video components to be displayed in separate columns.

Split:

Allows the video components to be display individually.

Ancillary Data:

Allows the user to capture whole Ancillary data packets identified by their data id (DID).

Ancillary Status:

Allows additional user-defined selections with the appropriate DID or SDID code.

Access to the SDI analysis functionality is by way of the **Analyzer ➜ Signal Data** menu.

Advanced Physical Layer Analysis
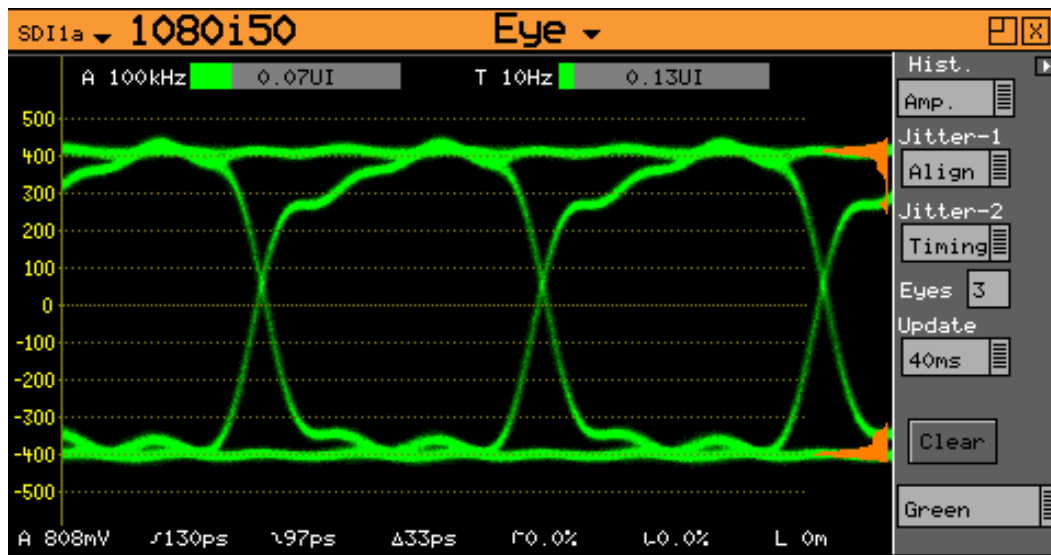
The analysis option (**PHRXO-EA**) for the Rx range adds an additional jitter screen, plus enhancements to the eye display. The extra features added to the eye and jitter module are focused on broadcast manufacturers who have a need for high-end analysis tools. Histograms, decade filters, multiple eye display, full screen jitter display and alignment and timing thermometers are all available with comprehensive logging.

The Advanced physical layer analysis option provides the following functional areas:

Multi Eye Display:

Enables analysis when serializer jitter is present: Products process video in either a 10 or 20 bit parallel data domain which is subsequently transmitted as a single bit serial datastream. By triggering every 10 or 20 eyes you can reveal repetitive parallel/serial clock domain jitter in equipment being analyzed.

Histograms:

Give statistical information which can be used to accurately measure rise time, fall time and amplitude. These automatic, accurate measurements can then be logged for extended

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periods of time. Measurements like rise time and fall time are notoriously difficult to make with SDI signals.

In addition to the standard timing and alignment jitter filters, decade filters are provided allowing an engineer to analyze the frequency content of any jitter present. The number of eyes displayed is adjustable from one eye up to one frame of eyes.

Decade Filters:

Provided to enable an engineer to analyze the frequency content of any jitter present. The number of eyes displayed is adjustable from one eye up to one frame of eyes.

Jitter Display:

Separate full-screen jitter analysis display incorporated into the advanced option to enable an engineer to analyze the nature of jitter present using a graph of jitter versus time. Again, the decade filters are present and the time base can be adjusted from one line through to one frame. By analyzing jitter in this detailed way an engineer can determine whether a signal is in or out of specification and also get a feel for where any problems lie.

Dolby Metadata Generator
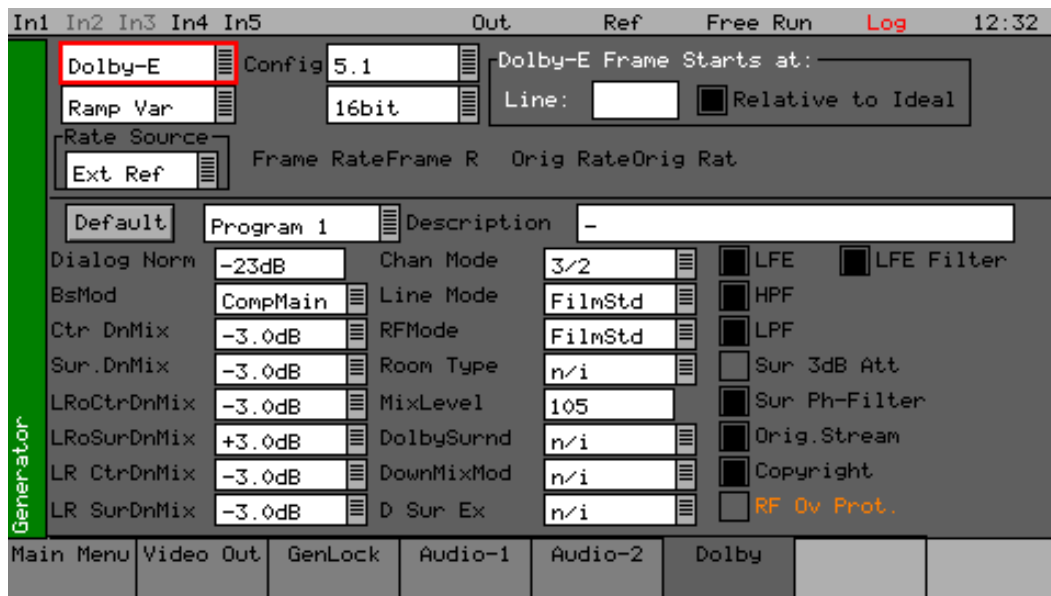
The Dolby Metadata Generator software option (**PHRXO-BDG**) allows generation of Dolby-E, Dolby Digital and Dolby Digital Plus pre-encoded test signals to check that they are transferred transparently through the broadcast chain unaffected by routers / switchers, satellite links, etc.

Dolby Analysis
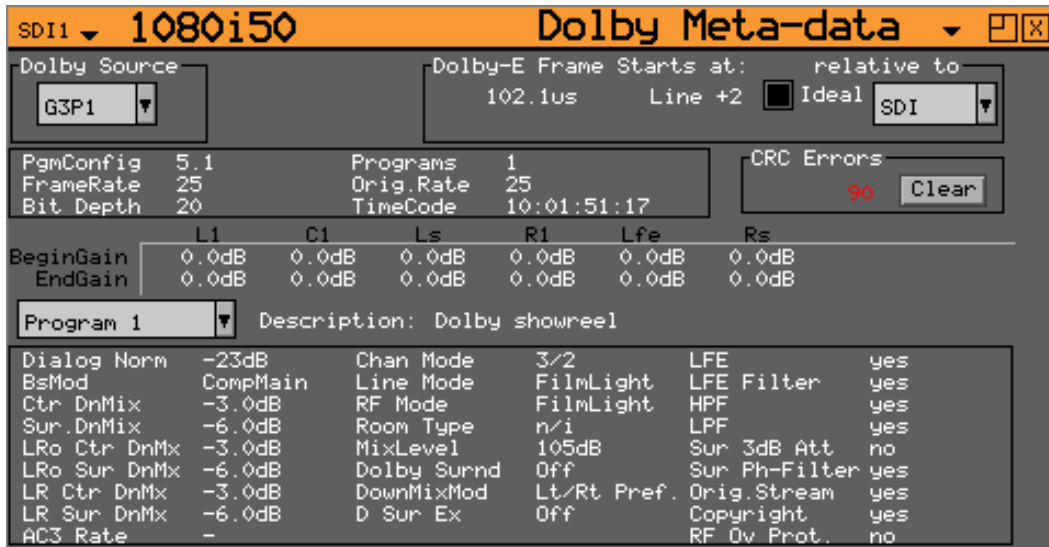
The Dolby-analysis option (**PHBRO-BDA**) displays Dolby E, Dolby Digital and Dolby Digital Plus metadata present in a selected audio stream and determines whether a Dolby-E packet is timed correctly on the SDI video stream. The Dolby audio may be monitored from any of the SDI input embedded audio channel pairs or AES input.

Peak metadata audio levels metering is also displayed for Dolby E.

Enhanced Remote Control (*Now Included as Standard*)
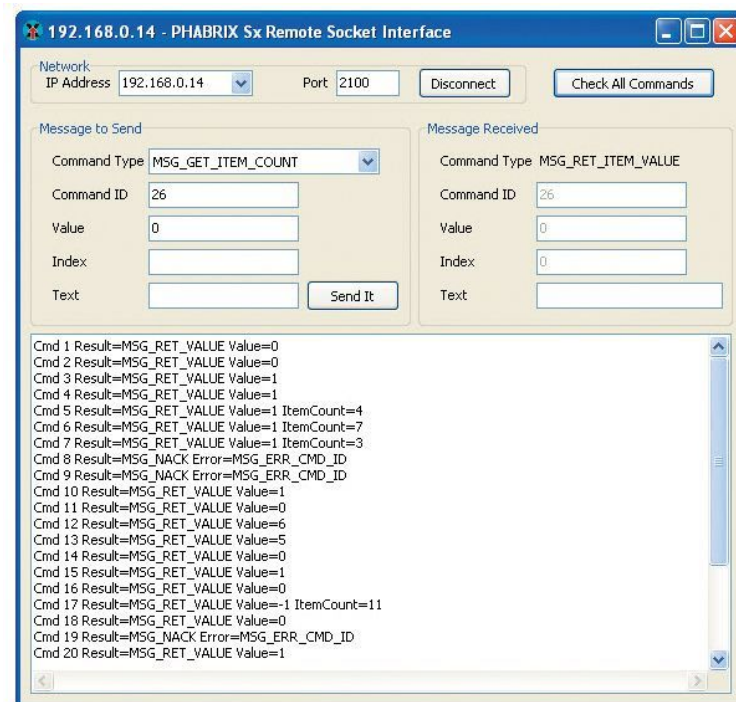
The Enhanced remote control option gives users full remote control of the unit via TCP/IP Sockets to allow any aspect of the unit to be modified or queried.

This allows complex applications to be created to perform test and measurement functions such as automated testing of routers or other broadcast equipment.

The Rx instrument can act as a server and listen on a port waiting for incoming requests from clients such as a PC. Using this method of communication, the Rx range can provide a variety of information

to the control device it is connected to and be controlled in specified areas of the product using the command details included. All visual controls on the product have an associated command.

Messages may be sent to *set* or *get* data from a command i.e., if you set a value the unit will be configured accordingly and a reply returned and if you *get* a value from the PHABRIX unit it will reply with that value. All messages are acknowledged to increase the security of the interface i.e., closed-loop communication.

The control structure can be selected as Passive or Active. Passive control allows simple remote control where the host PC is in control and sends commands when it wants to change data or get information. It is this method which is the most popular use for remote control.

Active control is when the Rx unit synchronizes with the host PC. Any changes on the Rx unit will result in a message being sent to the host PC. This method is useful for controlling a Rx unit from another unit or via the PC simulator software. It requires more complex software on the host to respond to the returned messages.

The option provides a programming guide including command information and examples, and can be downloaded from the PHABRIX website. A Windows™ application for testing the interface is also provided as part of this option.

See the *Remote Control Guide* for details.

Four Channel Loudness (*Now Included as Standard*)
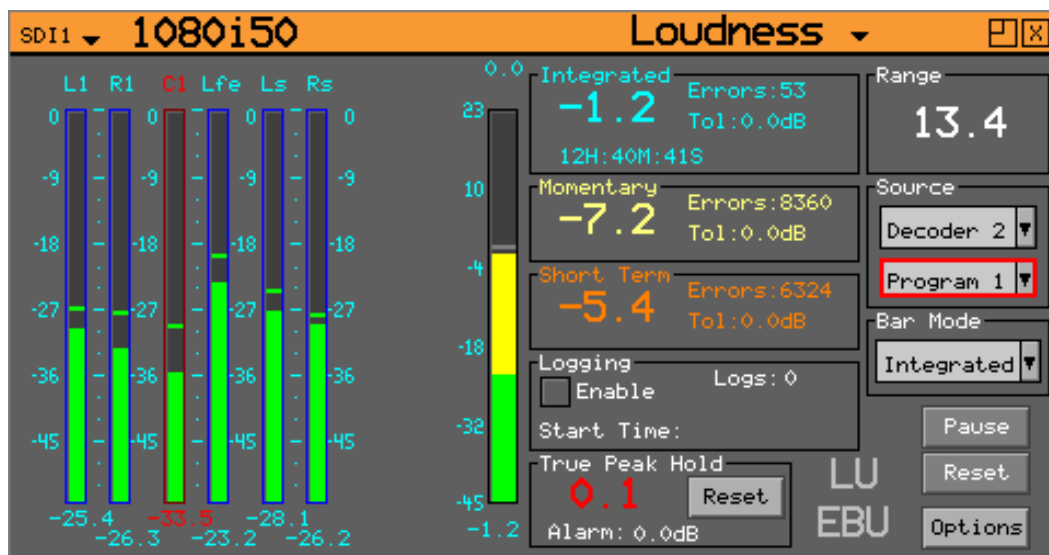
This option (**PHRXO-4LOU**) allows up to four channels of loudness metering and monitoring to be performed by the Rx unit (one loudness channel per analyzer module).

The tools provided in the Loudness window allow the loudness of the selected stereo audio pair or 5.1 surround audio group to be monitored and measured. The Rx system provides a single Loudness meter as standard and an additional three Loudness meters are available as an option. The Loudness meters are accessed via the Analyzer module menu on the HDMI® monitor output.

The Loudness Setup allows the meter scale (LU, LUFS or LKFS), measurement standard (EBU or ITU) and Meter Range as well as user-defined threshold values for Integrated, Momentary and Short Term loudness.

Four Channel Closed Caption (*Now Included as Standard*)

This option (**PHRXO-4CAP**) allows up to four channels of closed caption to be displayed. This is allocated as one channel per analyzer module.

This supports WTS/OP42/OP47, EIA 608 and EIA 708 closed caption / subtitle formats.

Rx Front Panel

<div style="text-align: right; font-size: 3em;">2</div>

Front Panel Controls

Switching On and Off the Instrument

To switch on your PHABRIX Rx 1000 or Rx 500 instrument, press the red button at the top right-hand corner of the front panel.

Once the system has started, pressing the button again will switch it off. If for some reason the instrument stops responding, press and hold the button for a few seconds to switch it off.

Navigation

The left and right cursor buttons can be used to move through the main menus. The currently selected menu being the one in the center of the display between the left and right arrow symbols.

The down cursor button can be used to edit numeric fields and the up cursor button can be used to save the changes made.

The six buttons below the OLED display control the selection of the options within the currently selected menu.

The **Input** button to the left of the screen selects the Inputs menu and the **Preset** button selects the Presets menu.

Preset Menu

The **Preset** menu can be selected either using the **Preset** button or by using the left and right cursor buttons to scroll through the menus.
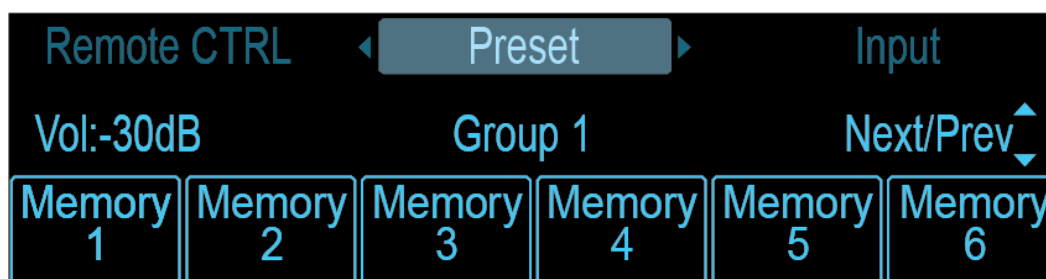
The Presets menu allows predefined system presets to be loaded. The buttons below the LED screen can be used to select the presets (for example **Memory 1**, **Memory 2**, etc.) currently stored on the Rx instrument.

See the section *Preset Memories* for information about creating presets.

Inputs Menu

The **Input** menu can be selected either using the **Preset** button or by using the left and right cursor buttons to scroll through the menus.

The Inputs menu allows the video signals connected to the Rx instrument to be selected for analysis. The buttons below the LED screen can be used to select the inputs such as **SDI1a**, **SDI1b**, **SDI2a**, **FIB2a**, etc. The options that are displayed here depend on the number and type of Rx modules that are installed.

DHCP Mode Menu

The **DHCP Mode** menu is used to switch on or off the unit's network Dynamic Host Configuration Protocol mode.
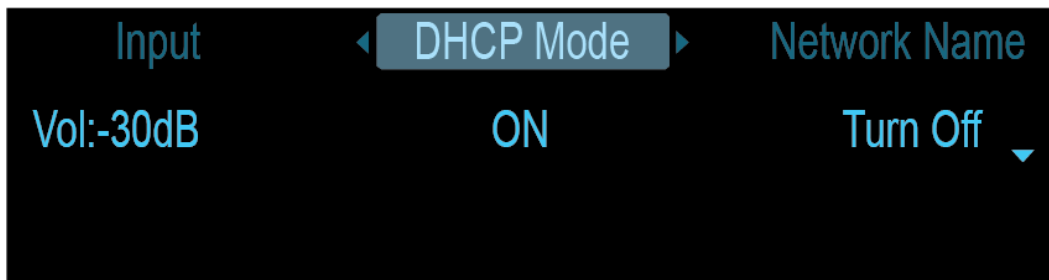
When DHCP is active, then the Rx instrument will automatically attempt to obtain an IP address for the instrument from your organization's DHCP server. In this mode it will not be possible to manually change the IP Address, Subnet mask, etc.

To switch off the DHCP mode use the down cursor button. With DHCP switched off the unit's IP address, subnet mask and gateway details will have to be entered manually.

Network Name

Network Name is a read-only menu that displays the hostname given to the Rx instrument, i.e., **PhabrixRx**. This Network name can be setup using the Network Setup menu of the HDMI® monitor output.

IP Address Menu

The **IP Address** menu allows the IP address for the Rx instrument to be viewed and setup. Note that if DHCP mode is active, then the address will be populated automatically and this will be read-only.
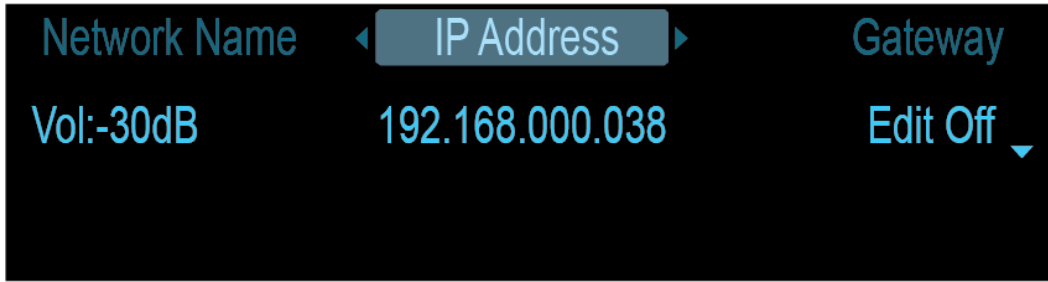
To enter or change the address press the down cursor button to enter edit mode :
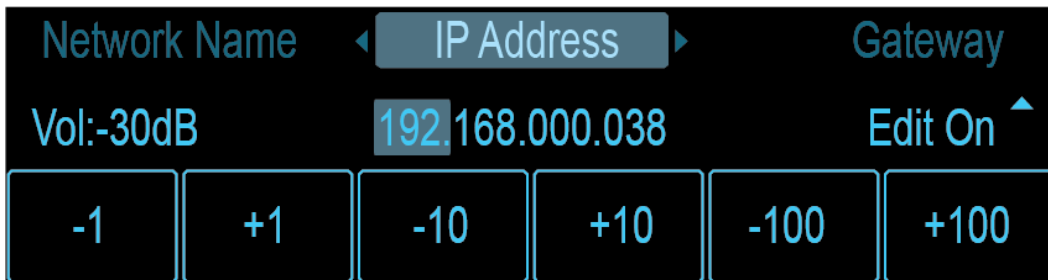
The first number bank will be selected automatically. Use the buttons below the screen to change the number or select any of the buttons below the LED screen (−1, +1, −10, +10, −100, +100) to increment the value accordingly.

Select the right-hand cursor button to move to the next number bank.

Repeat this process until the required address has been entered, then select the up cursor button to exit edit mode.

Gateway Menu

The **Gateway** menu allows the network gateway address to be setup. To enter or change the address:

1. Press the down cursor button to enter edit mode and to select the first number bank.

2. Use the buttons below the screen to change the number or select any of the buttons below the LED screen (−1, +1, −10, +10, −100, +100) to increment the value accordingly.

3. Select the right-hand cursor button to move to the next number bank

4. Repeat this process until the required address has been entered then select the up cursor button to exit edit mode.

Note: If DHCP mode is active, then the address will be populated automatically and will be read-only.

Sub Net Mask Menu

The **Sub Net Mask** menu allows the network Subnet mask address to be setup. To enter or change the address:

1. Press the down cursor button to enter edit mode and to select the first number bank.

2. Use the buttons below the screen to change the number or select any of the buttons below the LED screen (–1, +1, –10, +10, –100, +100) to increment the value accordingly.

3. Select the right-hand cursor button to move to the next number bank.

4. Repeat this process until the required address has been entered then select the up cursor button to exit edit mode.

Note: Note that if DHCP mode is active, then the address will be populated automatically and this will be read-only.

DNS Server Menu

The **DNS Server** menu allows the address of your organization's DNS (Domain Name Service) server to be entered. To enter or change the address:

1. Press the down cursor button to enter edit mode and to select the first number bank.

2. Use the buttons below the screen to change the number or select any of the buttons below the LED screen (–1, +1, –10, +10, –100, +100) to increment or decrement the value accordingly.

3. Select the right-hand cursor button to move to the next number bank

4. Repeat this process until the required address has been entered then select the up cursor button to exit edit mode.

Note: Note that if DHCP mode is turned on, then the address will be populated automatically and this will be read-only.

SDI GEN Type Menu

The **SDI GEN Type** menu allows the SD-SDI format for the CPU generator output to be selected. The buttons below the LED screen allow the SDI output to be turned on.
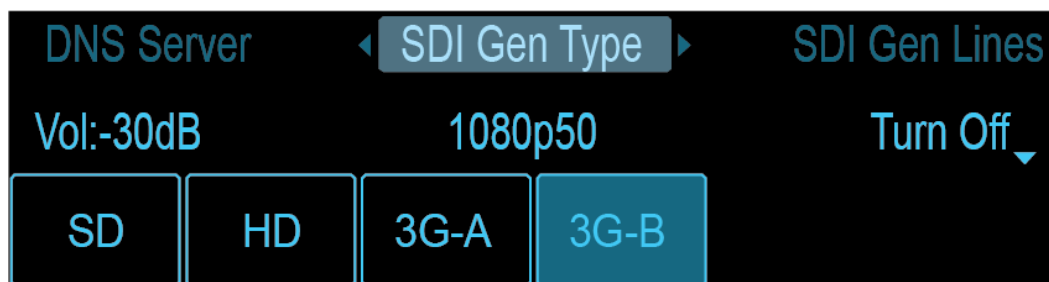
GEN Lines Menu

The **GEN Lines** menu allows the line standard of the test pattern to be selected. To select a line standard, press the button beneath the screen for the standard you require.

GEN Rate Menu

The **GEN Rate** menu allows the frame rate of the test pattern to be selected. To select a frame rate, press the button beneath the screen for the frame rate you require.

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SDI Pattern Menu

The **SDI Pattern** menu allows the test pattern on the CPU generator output to be selected. To select a pattern, press the button beneath the screen for the pattern you require.
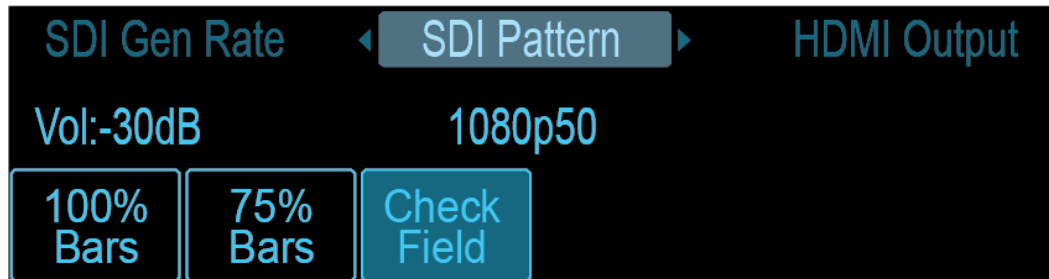
HDMI Output Menu

The **HDMI Output** menu allows the HDMI® monitor to be switched on and off. Use the up and down cursor buttons to switch on and off the HDMI® monitor output.

HDMI Rate Menu

The **HDMI Rate** menu allows the frame rate of the HDMI® monitor to be selected. To select a frame rate, press the button beneath the screen for the frame rate you require.

Brightness Menu

The **Brightness** menu allows the OLED screen brightness to be setup. The buttons below the screen can be used to increment or decrement the value.

Screensaver Menu

The **Screensaver** menu allows the OLED screen saver to be switchd on or off and allows the wait time to be setup. The buttons below the screen can be used to select the value.

Software Version Menu

The **Sw Version** menu displays the current version of software that is installed on the Rx instrument.

Remote Control Menu

The **Remote Control** menu allows the Rx remote control to be switched on or off. Use the up and down cursor buttons to turn on and off the remote control mode.

HDMI Monitor Output

<div style="text-align:right">

3

</div>

Overview

The Rx range of products provide a Monitor output in the form of an HDMI output that can display up to 16 instrument windows at 1920 x 1080 resolution. This Monitor output display can display the presets selected by the Preset Buttons and can be controlled by a USB mouse and keyboard connected to the Rx instrument.

> **Note:** On Rx 500 and Rx 1000 instruments, the Monitor Output is always enabled.

When an HDMI or SDI monitor is connected to the Rx instrument, it will display a Task Bar along the bottom of the screen that shows the currently installed Analyzer and Generator modules. These are color coded to match the instrument panels allocated to the selected input/output and module. All of the instruments that share the same Analyzer or Generator resource have the same color coding.

Clicking on the Input of an Analyzer module will allow different analyzer instrument windows to be selected for that input. Clicking on the Output of a Generator module will allow different generator windows to be displayed for that output. Clicking on the System, Logging and Presets menus will display the corresponding windows.

Display Area

The display area above the Task Bar can display any of the instrument panels that are available with the installed hardware modules and software options. The instrument panels that are displayed can be selected from preconfigured, already saved and/or new instrument panels (or windows) created by right-clicking the mouse.

Locking Reference VITC and LTC

Vertical Interval Timecode (VITC) and Longitudinal Timecode (LTC) present on the analog (625i/50 and 525i/59.94) locking reference signal connected to the **REF** connector on the rear of the Rx unit can be displayed on the Task Bar of the HDMI® monitor output.
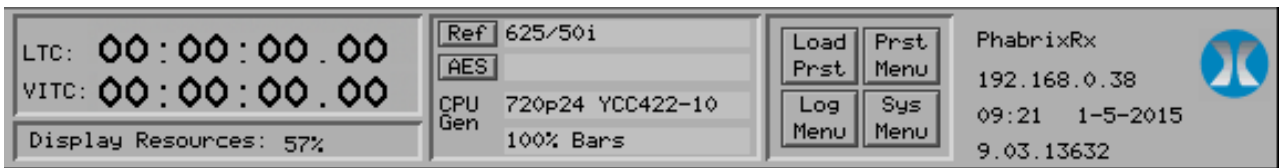
The locking reference can be selected by pressing the **Ref** button. This offers Free Run, External Reference (analog locking reference signal) and SDI inputs.

The **System ➜ Time Code Setup** menu allows the system's locking reference input LTC and VITC to be displayed on the HDMI® monitor output. The line number where the VITC is located on the analog locking reference signal can be selected using the **Line Number** field.

Managing the Monitor Output

Closing Open Panels (Windows)

Any open panels can be closed using the **X** button in the top-right corner of each panel. The currently selected panel (the one with the blue bar) can be closed by left-clicking the mouse on the System menu and selecting **Close Window**. The **Close ALL Windows** function will remove all of the instrument panels from the display area.

The functions within each Instrument panel on the Monitor Output display can be selected using the mouse rather than the Navigation Buttons used with the front panel Instrument Display.

Working with Multiple Analyzers

The analyzer channel that is used for the instrument panels is directly locked to the input of the Analyzer module itself. Clicking on the Input of an Analyzer module on the task bar will allow different analyzer instruments windows to be selected for that input. The input to be analyzed can also be selected from a dropdown list (**sDI1a**, **FIB1a**, **sDI1b**, **FIB1b**, **sDI2a**, etc.)
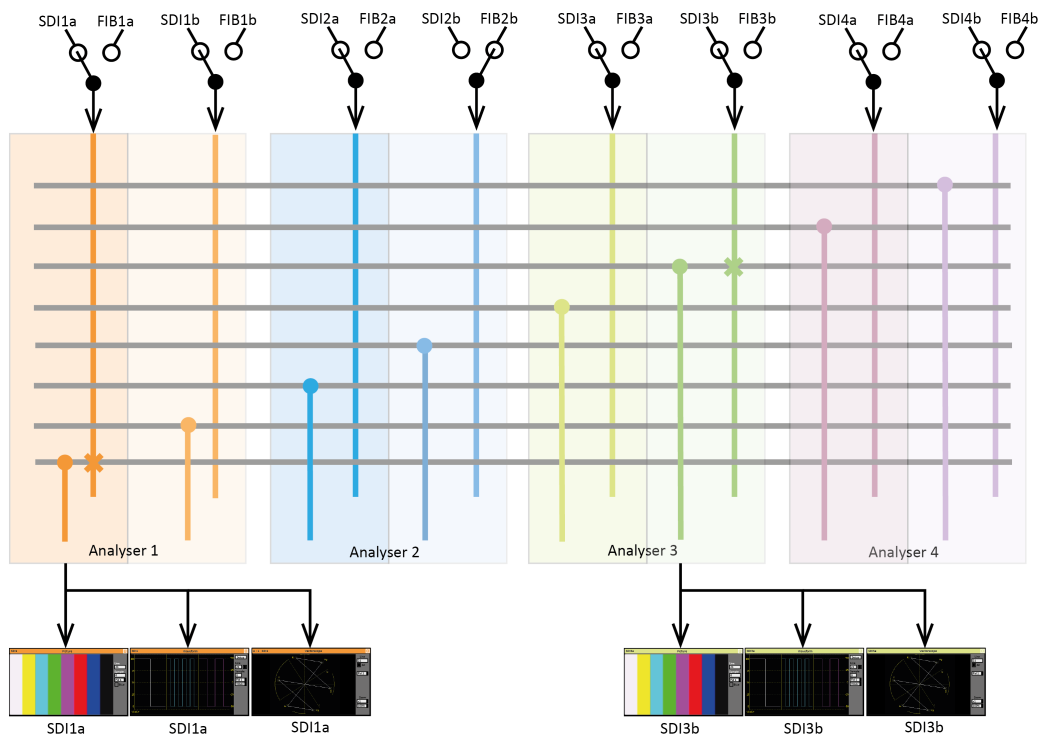
> **Note:** Analyzer 1 is used by the Front Panel on the Rx 2000 instrument so if the input to analyzer 1 is changed on the Front Panel it will also change the HDMI® monitor output.

Changing an input that has already been assigned to an analyzer will re-assign the input to all of the instrument panels that share the same analyzer. In addition, an input can only be monitored by one analyzer channel at a time.

For Dual Link analysis the Link 1 signal must be connected to **IN1** BNC connector and the Link 2 signal must be connected to **IN2** BNC connector on the same Analyzer module. Likewise, if using fiber, Link 1 should connect to **OPTICAL A** and Link 2 should connect to **OPTICAL B**.

Working with Multiple Generators

When the Rx instrument contains multiple Generator modules, the generator to be controlled can be selected from the dropdown list in the corner of the panel (GEN1, GEN2, etc). Note that the module

PHRXM-GDL has two outputs (GEN-A and GEN-B) but this is treated as a single Generator as the outputs are locked together.

Saving Monitor Display Layouts

Elements of the currently displayed Instrument Panels can be saved as presets using the **Prst Menu** button on the Task Bar.

The **System Presets** panel then allows you to select the checkbox **HDMI Layout** and provide a name for the preset before it is saved. You can then recall stored presets later using either the **Load Preset** menu or the front panel controls of the Rx instrument.

Context Menus
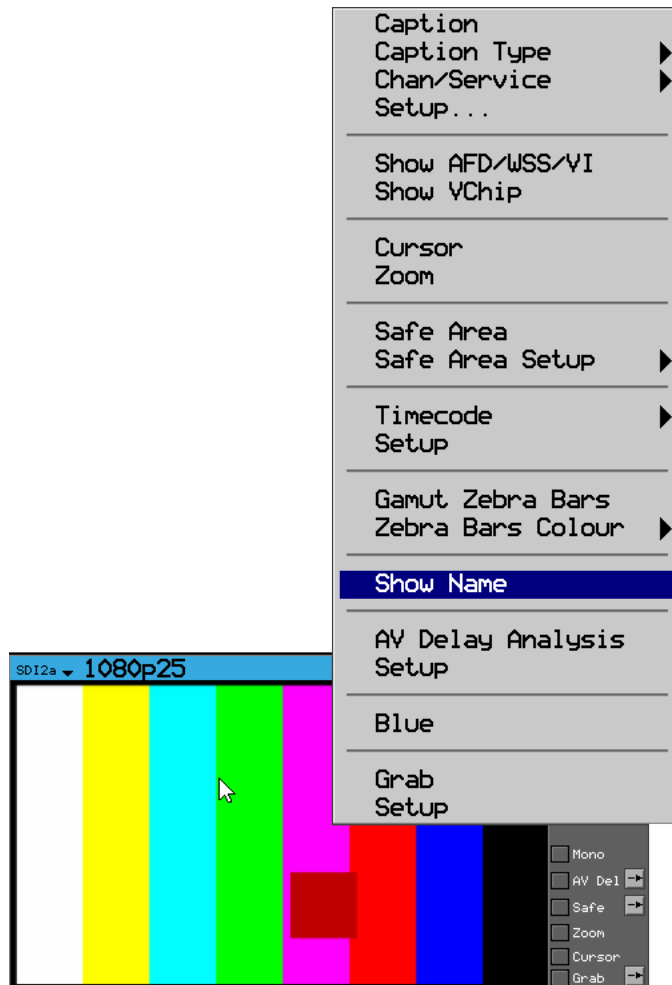
Right-clicking on the Picture, Waveform, Vectorscope, Lissajous, Eye and Jitter windows will display context sensitive menus that can be used to control the functions of these instruments.

Instrument Panel Resizing

Instrument panels are created and displayed at sixteenth screen size by default. Specific instruments such as Picture, Waveform, Vectorscope and Eye waveform can be displayed at quarter screen size. The Picture and Waveform instruments can also be displayed at 3/4 screen and at native resolution (with 1080i this will be full screen 1920 x 1080).

Instrument panels of different sizes can be assembled on screen in any combination and these can be saved as memory presets.

The icon buttons in the top right corner of the instrument panel control the size of the panel:

- 1/16th screen size panel:

- 1/4 screen size panel:

- Close panel:

> **Note:** The window panel size can also be changed by double-clicking in the instrument area using the left-hand mouse button.

To create 3/4 size Picture and Waveform, start with a 1/4 size window and drag the bottom right corner of the window until it is approximately 3/4 size then release.

Generator Panels

Overview

Clicking on the Output of a Generator module will allow different generator windows to be displayed for that output.
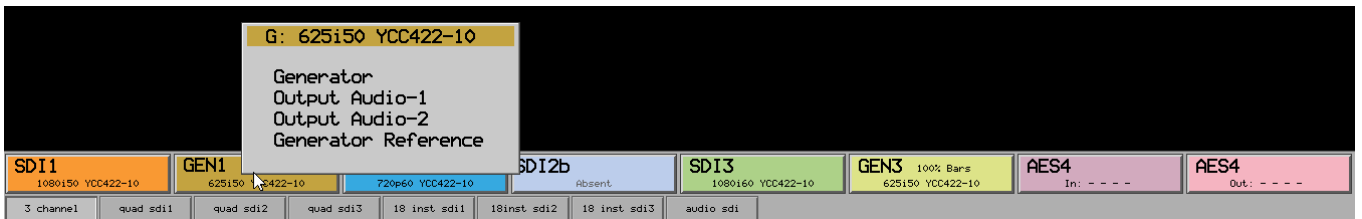
Clicking on instrument type title (Generator, Generator Audio 1-4, Generator Audio 5-8, Generator Reference) allows the generator type to be changed.
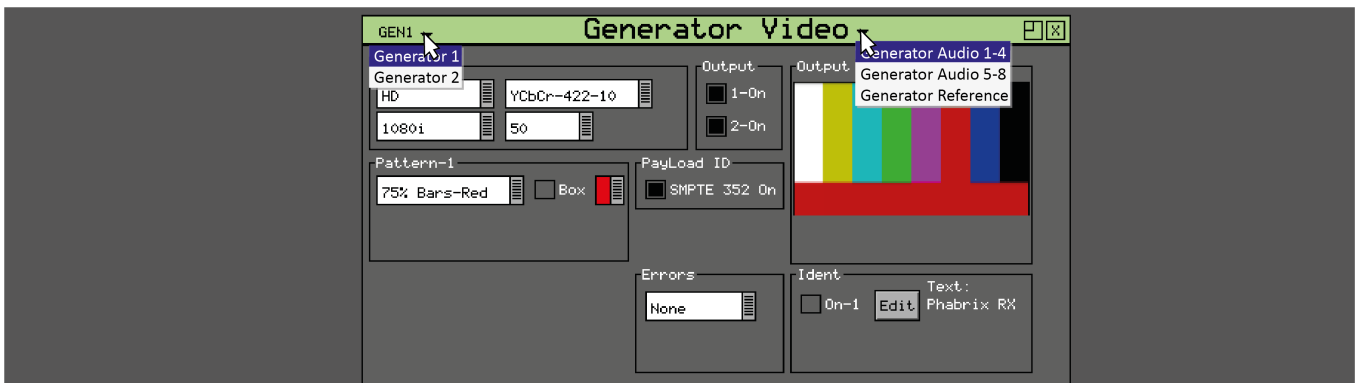
Generator Video

The Rx instrument with a Generator Module installed can create video test signals for all supported SD and HD SDI output standards including the 3GHz standards at 1080p/50/59/60. It will support Y,Cr,Cb formats as well as RGB formats.
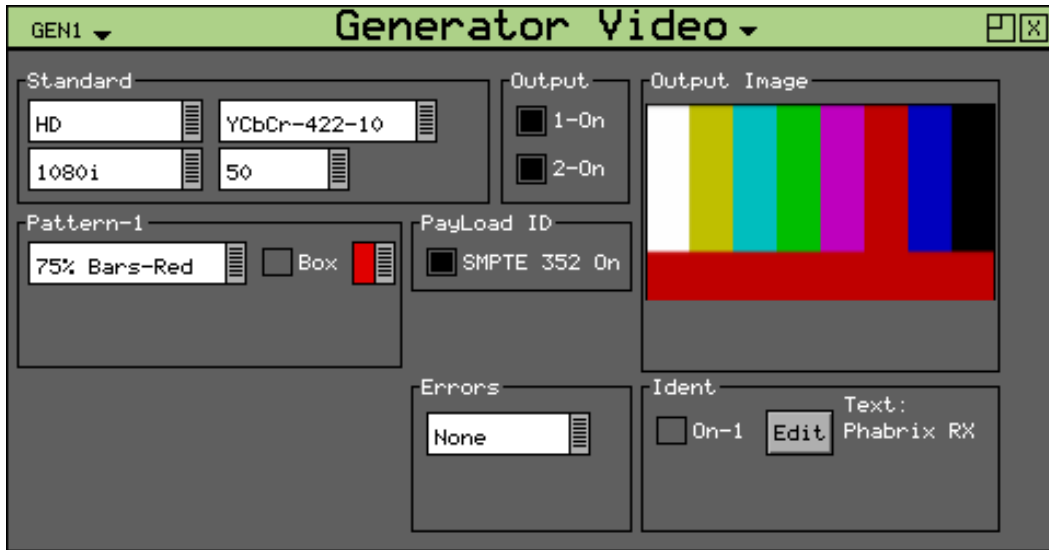
The Generator Video window is accessed by clicking on a Generator slot on the monitor output task bar and selecting **Generator**. This will create a new window panel for the selected output.

Output On

The Output On function activates the output circuitry. On Rx instruments that have dual generator modules, there is the option to switch on Output 1 (**1-On**) and Output 2 (**2-On**) which correspond to the two generator outputs.

Note that for Dual Link test pattern generation, both Output 1 and Output 2 must be enabled. The Link 1 signal is produced on the module's **GEN A** output and the Link 2 signal is produced on the module's **GEN B** output. Likewise, if a fiber connection is being used the Link 1 signal is produced on **OPTICAL GEN A** and the Link 2 signal is produced on **OPTICAL GEN B**.

Standard

The menus in the Standard section are used to select the desire video output format. The top-left box selects the basic mode of the Rx instrument and determines whether it is generating normal SD/HD vide or 3G level A or level B video. Dual streams refer to the ability of the Rx instrument to generate two separate pictures when transmitting 3G-level B in some formats. Which mode is selected determines which formats are available. Only valid frame rates for the output standard may be selected.

Color Format

Currently only YCbCr 4:2:2 10 bit picture formats are supported by the standard product but an Option may be purchased to enable other color formats. The following color modes may be selected dependent on line standard selected:

- YCbCr 422 10 bit
- YCbCr 444 12 bit
- YCbCr 444 10 bit

- YCbCrA 4444 10 bit

- YCbCr 422 12 bit

- RGB 444 10 bit

- RGBA 4444 10 bit

- RGB 444 12 bit

Pattern

This selects the video pattern that is output by the generator. Many standard patterns are provided by the Rx instrument. You may also upload your own test patterns to the Rx instrument into the **Patterns** directory and then select them using the **User File** option in this field. See the section *Rx File Structure* for supported file formats. If a **User File** has been selected, the **i** button, beside the file, can be selected to get information on the file properties. Unsupported file types will be displayed as a black image. If the video standard is changed while a user file is loaded and there is no file for the new standard present, a black image will be loaded and the User File blanked.

A bouncing Box may be overlaid on the current test pattern by selecting the **Box** checkbox.

Color Bars test patterns are used to check that the color gamut of the television system and to ensure the correct luminance and chrominance levels.

The **100% Color bars** test pattern is produced by using combinations of the Red, Green and Blue primary colors:

- White (100% R, 100% G, 100% B)

- Yellow (100% R, 100% G, 0% B)

- Cyan (0% R, 100% G, 100% B)

- Green (0% R, 100 G, 0% B)

- Magenta (100% R, 0% G, 100% B)

- Red (100% R, 0% G, 0% B)

- Blue (0% R, 0% G, 100% B)

- Black (0% R, 0% G, 0% B)

The **75% Color bars** and **75% Color bars + Red** test patterns are produced by using combinations of the Red, Green and Blue primary colors:

- White (100% R, 100% G, 100% B)

- Yellow (75% R, 75% G, 0% B)

- Cyan (0% R, 75% G, 75% B)

- Green (0% R, 75 G, 0% B)

- Magenta (75% R, 0% G, 100% B)

- Red (75% R, 0% G, 0% B)

- Blue (0% R, 0% G, 75% B)

- Black (0% R, 0% G, 0% B)

> **Note:** For consistency, 75% color bars should always be used when measuring or comparing jitter levels.
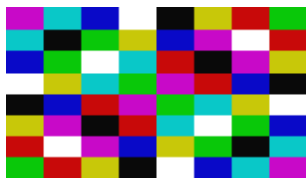
The **Tartan bars** test pattern is a chequerboard pattern of 75% color bar colors that produces every combination of color vector change.

The **SMPTE Color bars** test pattern was developed for the NTSC analog video standard and produced by using the combinations of the Red, Green and Blue primary colors as used in 75% color bars.

The **SMPTE ARIB STD-B28 Color bars** test pattern is an updated version of SMPTE color bars (developed by the Japanese Association of Radio Industry and Businesses) and standardized as SMPTE RP 219-2002 and is used to test both 4×3 standard definition and 16×9 high-definition video signals.
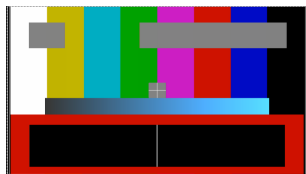
The **A/V Delay** test pattern and audio tone provided by the Generator module can be used to check any delay between the video and audio. This animated test pattern provides a constantly moving Clapper board and corresponding A/V Delay tone when the clapper board reaches the center of the test pattern. For more information, see the section *A/V Delay Analysis (Option: PHRXO-AVD)*.

The **Multi-burst** test pattern is used to check the frequency response of the video path and check that it has not been affected by digital processing such as resizing, standards conversion or color grading. The frequency of each burst will depend on the video format selected. For example:

For SD 720 pixels:

- 0.5 MHz, 1.75 MHz, 2.5 MHz, 3.5 MHz, 4.5 MHz, 5.5 MHz

For HD 1920 Pixels:

- 5 MHz, 7.25 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz
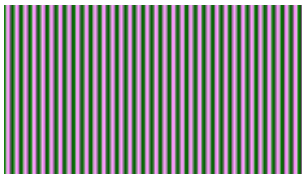
The **Bowtie** test pattern is used to check the alignment of the luminance and chrominance components through television equipment.

The **Ramps and Steps** test patterns are used to check the linearity of television equipment to ensure that there have been no digital bit level artifacts such as rounding errors introduced that may cause banding on the television pictures.

The **Luma Ramp** test pattern is used to check the linearity of the luminance component. This test pattern exercises all of the discrete digital video levels including illegal values below video black and above peak white.

The **Legal Ramp** test pattern is used to check the linearity of the luminance component. This test pattern exercises all of the discrete digital video levels from video black to video white, excluding illegal values.

The **Valid Ramp** test pattern is used to check the linearity of the Y (luminance), Cr (R-Y) and Cb (B-Y) components. This test pattern exercises all of the discrete digital video levels of these components, excluding illegal values.

The **Gray Bar - 5** test pattern is used to check for non-linear distortion in the luminance component. The bars range from 100% white to 0% black in 20% steps. Typically non-linearity will be seen as a loss of grayscale distinction.

The **Gray Bar - 11** test pattern is used to check for non-linear distortion in the luminance component. The bars range from 100% white to 0% black in 10% steps.

The **Gray Bar - 5 Vertical** test pattern is used to check for differential gain distortion in the luminance component line by line. The bars range from 100% white to 0% black in 20% steps. Typically, non-linearity will be seen as a loss of grayscale distinction.

The **Gray Bar - 11 - Vertical** test pattern is used to check for differential gain distortion in the luminance component line by line. The bars range from 100% white to 0% black in 10% steps.
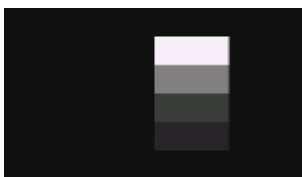
The **Pluge** (picture line-up generation equipment) test pattern is used to adjust the black level and contrast of a video monitor. The pattern consists of vertical luminance bars for white, mid-gray, black and super-black.

The **Color Field** test patterns are used to provide primary colors (such as 100% red, green, blue, cyan, magenta and yellow) and monochrome luminance levels to check for calibration and banding effects caused by encoding / decoding processes.

Full Field White	Full Field 75% Gray	Full Field 50% Gray	Full Field 75% Gray	Full Field Black

Full Field Red	Full Field Green	Full Field Blue	Full Field Cyan	Full Field Magenta

Full Field Yellow
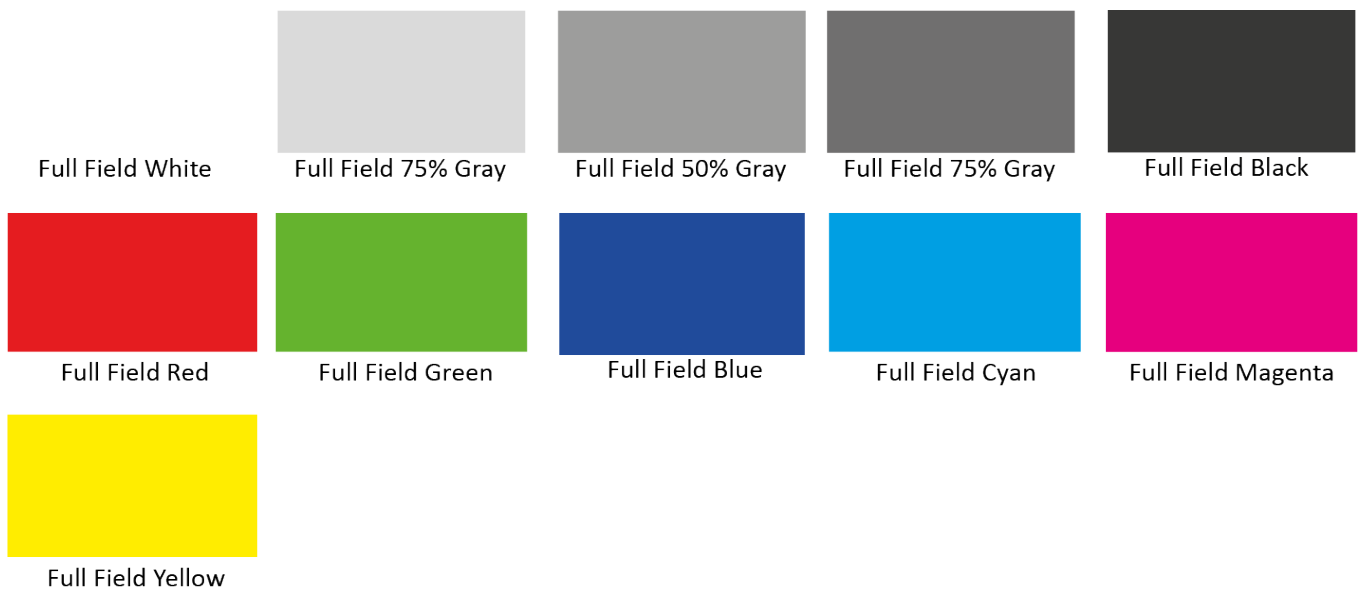
If **Color Field** is the selected test pattern, another control selects which color to generate. Three user definable custom colors may be defined using the **–>** button. Custom colors are edited using the Red-Green-Blue sliders. When setting the color using the RGB sliders, the YCbCr values will show the values for the current color space. When setting the color using the YCbCr sliders, the RGB values will show the values for the current color space.

The **Zone Plate** (below) is a two-dimensional linear frequency sweep test pattern used to check the effect of filtering, sub-Nyquist, sampling, processing standards conversion and display. Whenever an image is re-sized or re-sampled there is a strong probability that the resultant image will suffer from one or more of the artefacts such as aliasing / moire, softening (caused by reduced frequency response) and ringing / halos.
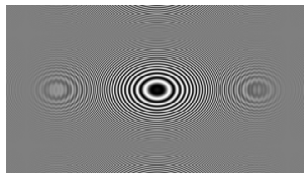
The **Zone Plate** test patterns are used to check that the horizontal and vertical frequency response of the video path is not affected by television equipment.

The zone plate selector will contain three user-customizable zone plates as well as several predetermined zone plates. The **–>** button displays a dialog which allows the parameters of the zone plate to be adjusted for the custom zone plates. Any of the preset zone plates may be copied to the custom zone plates to act as a starting point for a new zone plate. As the zone plate settings are stored in user memories several custom zone plates are available:

Moving Zone-2H:

> A moving zone plate centered on the screen.

Static Zone-2H:

> A static zone plate centered on the screen from DC to the Nyquist frequency at left/right edges.

Static Zone-2V:

> A static zone plate centered on the screen from DC to the Nyquist frequency at top/bottom edges.

Sweep-Horiz:

> A horizontal sweep from DC to Nyquist frequency horizontally.

Sweep-Vert:

A vertical sweep from DC vertically.

Grating-50kHz:

A 50 kHz frequency sine wave when using an HD output.

Grating-1MHz@HD:

A 1 MHz frequency sine wave when using an HD output.

Grating-5MHz@HD:

A 5 MHz frequency sine wave when using an HD output

Custom:

Allows editing of Custom zone plate settings. Three custom zone plates can be set-up and can also be copied from existing presets using the **Copy To** button.
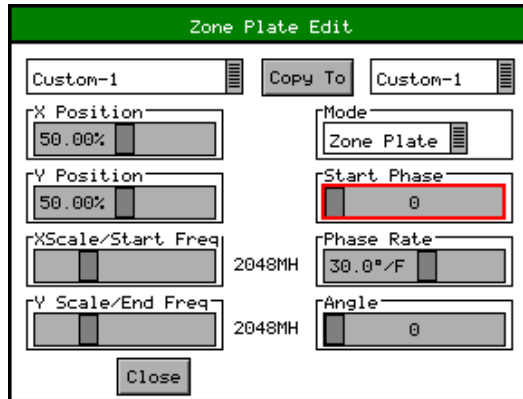
Mode:

Sets which type of Zone Plate is being produced. It may be Zone Plate (circular pattern) Grating (Linear horizontal or vertical grid) Sweep (Frequency sweeps from start to end Frequency)

Start Phase:

Sets the start phase of the sine wave generated by the zone plate generator and is set in degrees from 0 to 360 degrees

Phase Rate:

Used to set the rate of change of phase of the sine wave and thus changes the speed that the zone plate moves at. It is specified in degrees per frame.

Angle:

Changes the angle of the zone plate and thus can change a horizontal sweep into a vertical sweep or rotate an elliptical zone plate pattern.

XScale/Start Freq:

Sets the horizontal scale of grating patterns or the start value of the zone plate sweep frequency.

YScale/End Freq:

Sets the vertical scale of grating patterns or the end value of the zone plate sweep frequency.

The Pathological test patterns are used to check that the phase-locked loop circuitry used to decode SDI data can recover/regenerate the SDI sample clock under worst-case conditions.

EQ Test is a pathological signal that generates long run-lengths of 1s or 0s (for example 19 samples of 0 followed by a single 1) to test the accuracy of phase lock loop circuitry that recovers/the sample clock from the SDI data.

PLL Test is a pathological signal that generates a pattern of 2 consecutive 1s followed by 2 consecutive 0s repeated for the whole pattern. This is the worst-case to test phase lock loop circuitry that recovers/regenerates the sample clock from the SDI data.

Check Field is a pathological signal that generates long run-lengths of 1 s or 0 s to test the accuracy of phase lock loop circuitry that recovers/regenerates the sample clock from the SDI data. This is a combination of the EQ Test pattern and the PLL Test Pattern.

If **Check field/Pathological** is selected when a dual-stream format has also been selected, *both* outputs will be forced to check field due to internal hardware limitations. If another pattern is selected, the Check field pattern will be de-selected. The exceptions to this are when **Color Field** or Zone Plate are selected as test patterns.

The Check field/Pathological/PLL Check/EQ Check patterns will only look like the picture above when a YCbCr 422 10 bit color mode is selected. Other color modes will have different pictures but still create the SDI datastream required by SMPTE.

EDH (Error Detection and Handling):

If the output signal is SD (PAL-625 or NTSC-525) the insertion of EDH information may be switched on or off. **Note:** EDH is automatically active for HD.

Errors:

This field enables the insertion of CRC or EDH errors into the video signal. This allows checking of third party error detection circuitry. In SD there is one EDH ancillary packet per field. When errors are being inserted every EDH value gets deliberately corrupted. This creates one error count per field. (Actually one AP error and one FF error). In HD there is a CRC value calculated for each line. When errors are being inserted the CRC value on line number 1 gets deliberately corrupted. This creates one CRC error count per frame. There is also the option to generate CRC errors (not SD EDH errors) on only the switching line in field 1 which can be used to check that any downstream equipment ignores errors on switching lines.

SMPTE 352:

This checkbox allows the SMPTE 352 Payload ID field to be inserted into the video output stream. The state of this checkbox is stored separately for SD, HD and HD-3G line standards. Note that for HD-3G line standards the Payload ID should be turned ON.

Ident:

A picture or text *Ident* may be set to identify an SDI source. This Ident can be switched on or off from this page but changing the text, font, or bitmap is performed by selecting the Edit button to display the Ident dialog. An overview of the Ident is displayed beside the **Edit** button.

> **Note:** If the zone plate or color field are selected, text cannot be overlaid over them. A smaller version of the video output signal is displayed on this page with any overlaid ident.
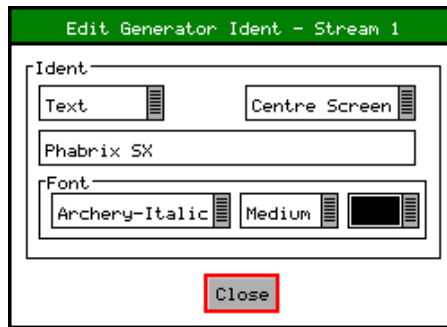
This dialog allows selection of either a user-defined bitmap picture which has been downloaded into the **Idents** directory of the Rx instrument or user defined text.

For both types, the position of the ident can be set to one of Top-Left, Top-Center, Top-Right, Left-Center, Center-Screen, Right Center, Bottom-Left, Bottom-Center, Bottom-Right. When text ident is used, the font, size and color can be specified. Several fonts are built in to the Rx instrument, other true-type (**.ttf**) fonts may be downloaded as required.
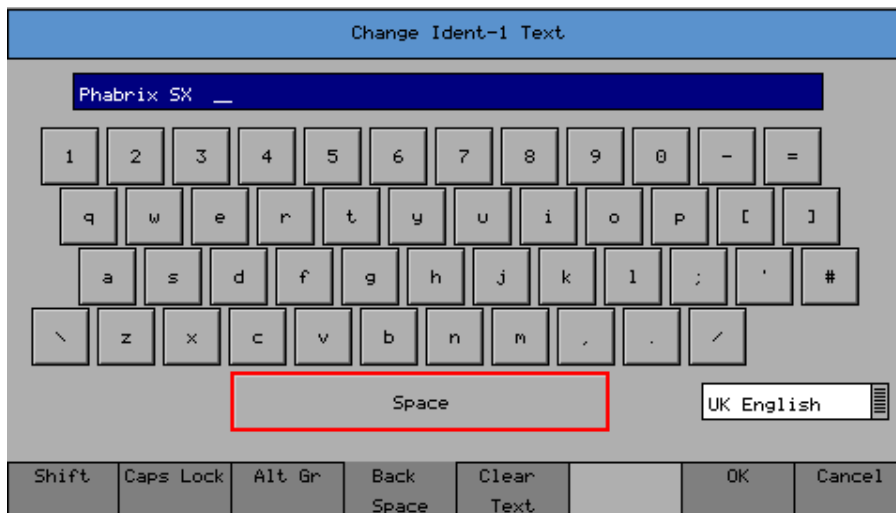
When editing text, the keyboard above is displayed to allow easy editing. Move the cursor to select the key to press and then press **Ok** to select. The **Shift** menu key causes the next keyboard to change to shift mode for the next key press.

The [**Caps Lock**] menu key locks the keyboard in all capitals mode. The [**Alt Gr**] key shows any language dependent alternate keys that may be pressed. Several country keyboard styles are provided. Note that not all fonts support all non-English characters.

A/V Delay Using the Generator (Option: PHRXO-AVD)

The A/V Delay option (**PHRXO-AVD**) provides an end-to-end solution to measure the differential delay between Audio and Video signals through a broadcast system.

If using the Rx as video source, open a **Generator Video** window , select an **HD** standard and then select **A/V Delay** from the Pattern dropdown menu to select the in-built EBU compatible pattern, available as an option on an AG or AGE Generator module. If desired, you can simulate a positive or negative delay by adjusting the number of frames in the **Audio Delay** field. An audio delay offset with respect to video of up to +/− 40 frames can be applied in increments of one frame. The AV Delay audio pulse can be inserted on up to 16 embedded SDI audio channels, which can be analyzed simultaneously.
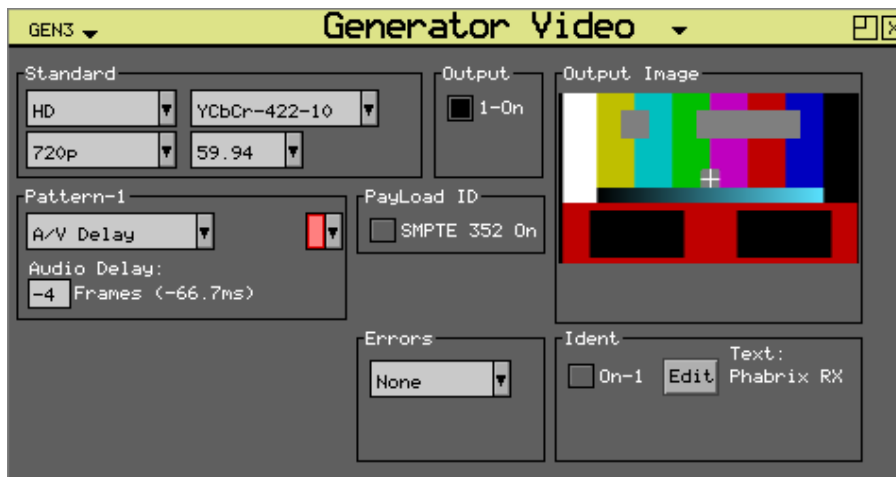
Next, set-up the audio signal in a generator **Output Audio** window. Select **A/V Delay** from the dropdown menu for one of the 16 available audio channels you would like to monitor, for example, group 1, pair 1, left Channel. You can choose to set the other channel of the pair to silent, fixed tone, etc., as required to listen to the A/V Delay tone.
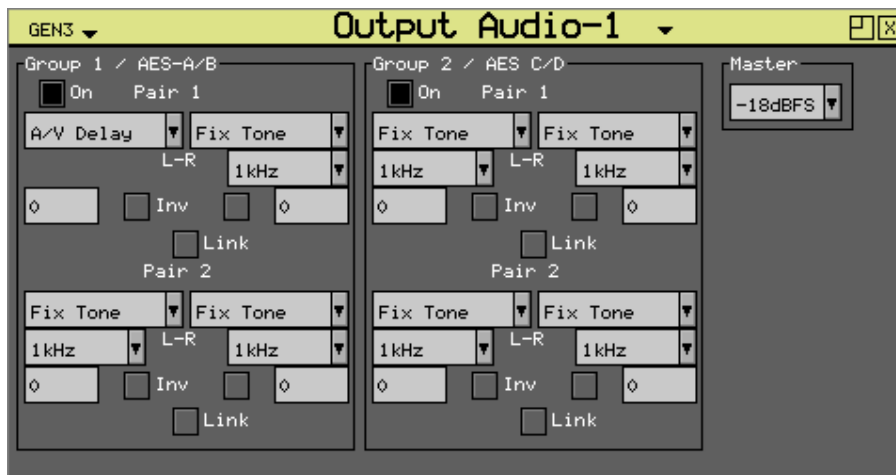
If you want to listen to the audio signal, you can open an **Audio Monitoring** window, set the Source dropdown to **Analyzer** and select the appropriate audio group pair for monitoring. Connect headphones to the unit to listen to the A/V Delay audio signal.
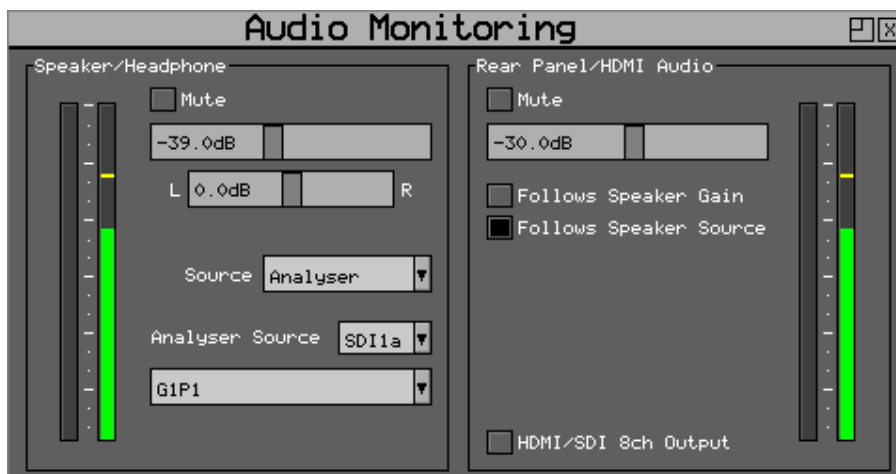
Frame Grab Playout

Each Generator module within the system can play-out a video clip captured and saved using the Picture Frame Grab function. This can be used to playout generated test clips as well as video clips

captured when an error condition occurred.

The Frame Grab playout mode can be enabled by selecting Frame Grab from the test patterns dropdown list.

Any video clip recorded using Frame Grab will appear in the dropdown list.

Once a video clip has been selected and loaded the transport controls can be used to play, stop, step forward and reverse.

- Step backward through the selected video clip frame by frame (**<**
- Stop playing the video clip (■)
- Step forward through the selected video clip frame by frame (**>**)
- Play the video clip repeatedly (►).

The displayed video clip will be output by way of the Generator video output connection along with its audio and SMPTE 352 payload.

> **Note:** The Generator video format and frame rate will automatically be set to that of the video clip being played.

> **Note:** The **Box** and **Ident** functions cannot be used when a video clip is selected for playout.

Generator Reference

The Rx instrument with a Generator Module installed can create video test signals that are either free-running or locked to a studio reference signal. The Genlock menu is used to select an external locking reference or set the instrument to free run.
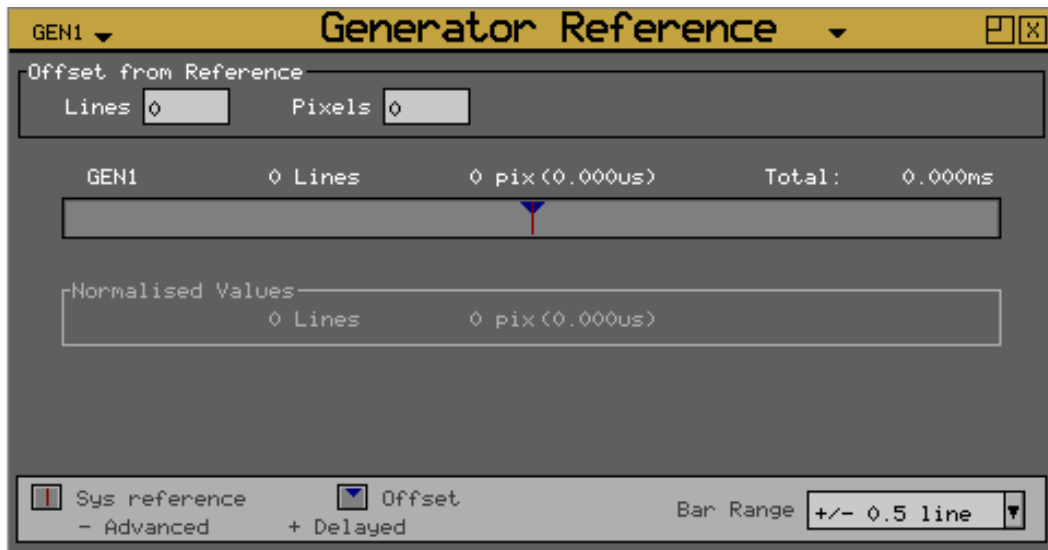
The Generator Reference window is accessed by clicking on a Generator slot on the monitor output task bar and selecting **Generator Reference**. This will create a new window panel for the selected output.

- When using an external locking reference signal, the Rx system will provide the best possible locking regardless of the locking reference frame rate and the generated frame rate.

- When the frame rate of the locking reference is exactly the same as the generated frame rate, there will be an exact lock vertical and horizontal between them.

- When the frame rate of the locking reference and the generated frame rate are divisible (for example 50/25, 60/30, 59.94/23.98) there will be an exact lock vertical and horizontal between them.

- When there is no relationship between the frame rate of the locking reference and that of the generated frame rate (for example a 625/50 locking reference and a 23.98 generated test pattern) then there will be a static lock between them but this will not be consistent.

Source

The generator may be locked to an input reference which may be either the reference input which is a Bi-Level / Tri-Level sync or may be locked to the video input. Alternatively, the generator may free run.

Delay

The test patterns generated by the Generator module can be delayed or advanced with respect to the locking reference input using the Lines and Pixel values.

Generator Output Audio Menu

The Rx instrument with a Generator Module installed can embed an audio signal on all 16 embedded audio outputs. The **Output Audio-1** and **-2** menus control which audio channels, pairs or groups have test tones applied and the type of tone.
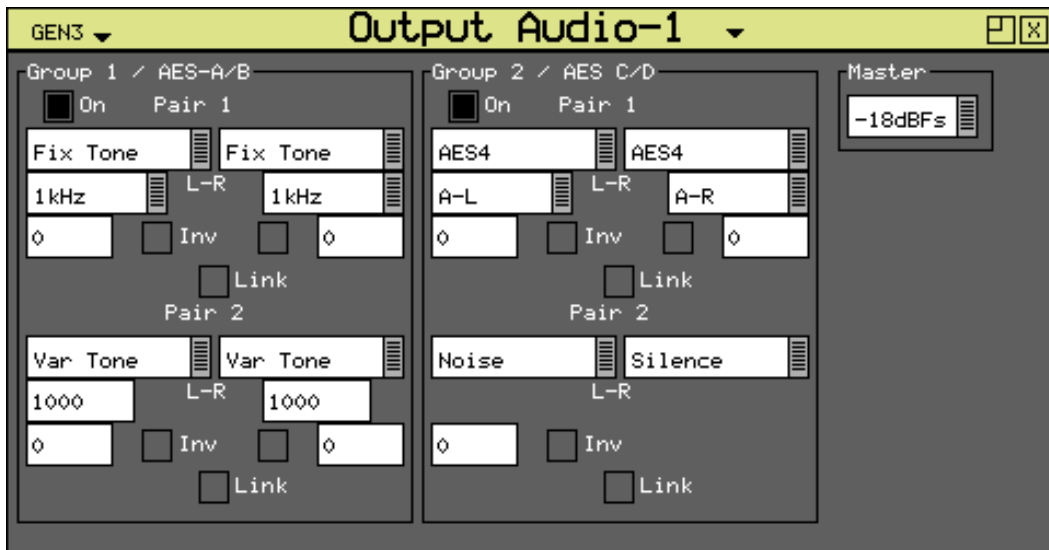
The **Output Audio-1** window is accessed by clicking on a Generator slot on the monitor output task bar and selecting **Output Audio 1**. This will create a new window panel for the selected output.

Group *n*

Each of the four groups may be separately enabled. When enabled, the source and level of each channel in a pair can be selected.

Source

The source for each channel may be set to any of the following:

Silence:

> Digital silence at −144 dB with 24-bit

Fixed Tone:

> A range of fixed frequencies from 100 Hz up to 20 kHz

Variable Tone:

> Where the frequency can be set in 1 Hz steps from 1 Hz to 23.99 kHz)

Noise:

> White noise

A/V Delay:

> Providing a 1 kHz pulse tone centered about the clapper board animation of the AV Delay Test pattern

AES In:

> Routing the audio from the CPU AES input if present.

DolbyGen:

> If the Dolby Generation option has been purchased, the source may be set to DolbyGen at which time the other channel in the audio pair is also set to DolbyGen and gain control disabled. The generated Dolby metadata is defined in the System - Dolby Generator menu.

DolbyDecode1:

If the Dolby Decoder module is installed, the decoded Dolby audio channels Dolby-1 to Dolby-8 from Decoder 1.

DolbyDecode2:

If the Dolby Decoder module is installed, the decoded Dolby audio channels Dolby-1 to Dolby-8 from Decoder 2.

AES:

If a 4AES module is installed along with a Generator module then the AES audio from the AES module can be routed to the Generator module SDI output. The specific 4AES module input channels can be selected from the source dropdown list in the form **A-L** where **A** indicates input AES Input A and **L** indicates the left channel.

Inv

This checkbox phase-inverts the audio signal to allow checking of third-party audio mixing.

Link

This links the left and right channels of a pair so that changing the level on the left-hand channel changes the level on the right-hand channel.

Master

The master level sets the 0dB level for all the embedded audio channels. Using the dropdown menu, the user can select an integer value between −18 and −24 dBFS. This feature allows all embedded outputs to be adjusted together as well as giving a simple method to change from −18 dB to −24 dB based standard levels. The Master level will not adjust the level of an AES input signal selected for embedding on SDI output.

4AES Module
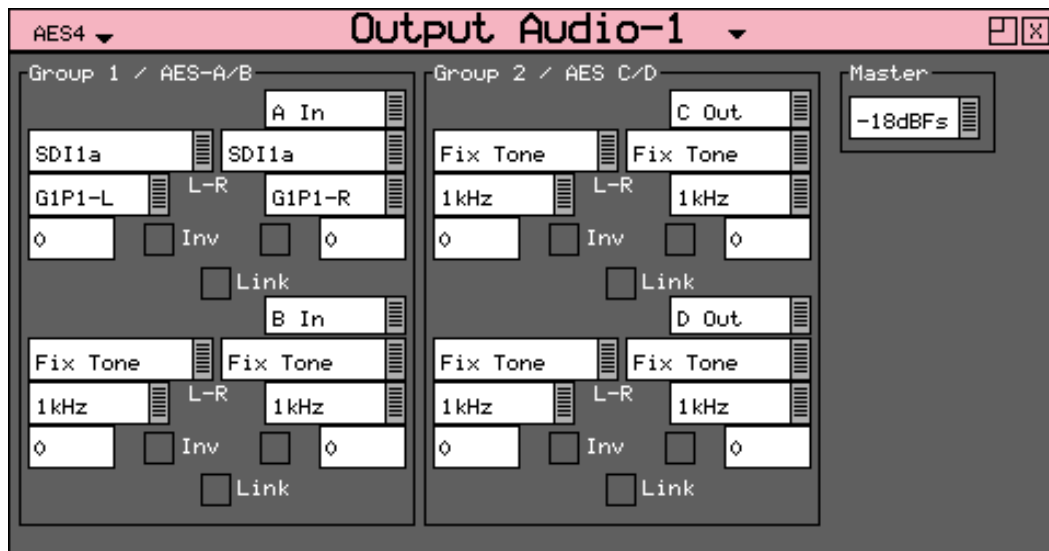
The Output Audio window is accessed by clicking on a 4AES Module Generator slot on the monitor output task bar and selecting **Output Audio 1**. This will create a new window panel for the selected output.

The **PHRXM-4AGE** module has four bi-directional AES digital audio pairs (**IO_A**, **IO_B**, **IO_C** and **IO_D**).

When configured as inputs this allows the audio pairs to be routed to the Audio Meter, Lissajous and Loudness instruments for the 4AES module.

When configured as outputs the audio pairs can be audio tones (including Fixed Tone, Variable Tone, Silence or Noise) or selected embedded audio channels from an Analyzer SDI video input or loop through copies from another AES input.

The mode of operation can be selected from the **Generator Audio Groups** menu the for each audio pair using the dropdown list (displaying **A Out**, **A In** or **B Loop**).

When **# Out** is selected the chosen AES pair will be configured as an output. The type of output is selectable from the dropdown list (displaying **Fixed Tone**, **Variable Tone**, **Noise**, etc.) The embedded audio from any Analyzer SDI video can be selected from the source dropdown list to allow it to be routed to the AES module output. Each audio channel that is output by the 4AES module can be selected from a specific SDI input, audio group and left/right channel.

When **# In** is selected the chosen AES pair will be configured as an input and therefore allow the audio from the AES connector to be viewed on the Audio Meter, Lissajous display or Loudness meter.

When **# Loop** is select the chosen AES pair will be configured as an output with a copy of the corresponding AES input.

> **Note:** If DolbyGen is selected as the Source for any AES output, the Dolby Generator in the System menu needs to be set to External reference otherwise the Dolby audio packet may not be embedded into the AES stream in the correct place.

Analyzer Panels

Overview

Clicking on the Analyzer module button on the task bar will allow different analyzer instruments windows to be selected for that input.

Clicking on instrument type title (Picture, Waveform, Vectorscope, etc.) allows the waveform type to be changed. Clicking on the input allows the input to the analyzer to be changed.
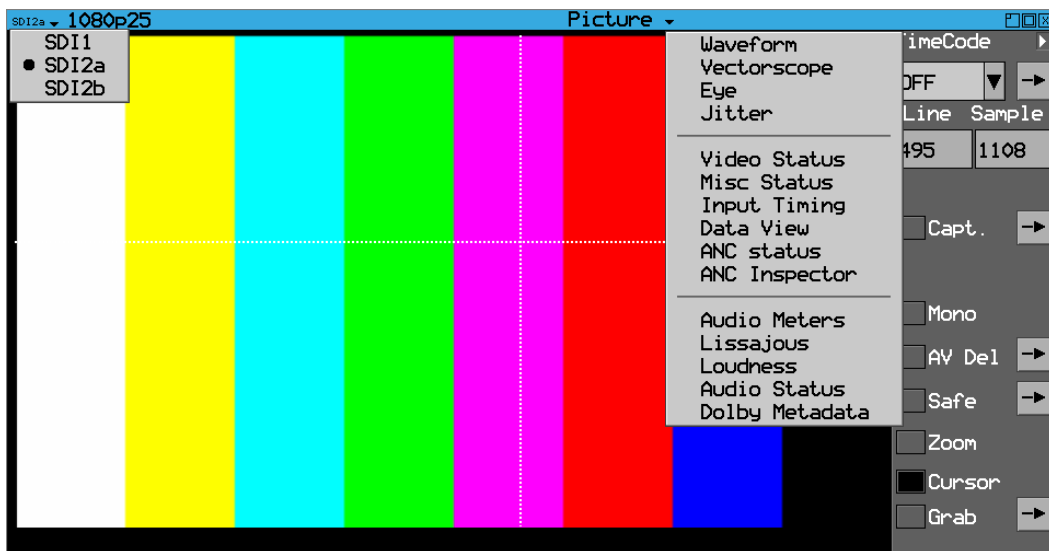
The AES4 module provides audio-only analysis tools and audio-only generation tools. Pressing the left-hand AES button (input) will display the analyzer functions that are available and pressing on the right-hand AES button (output) will display the Output audio configuration menu.
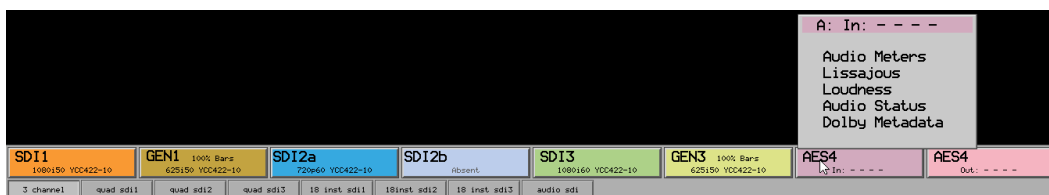
Picture

The Rx Instrument with an Analyzer Module installed can display the selected input in the form of a picture monitor.
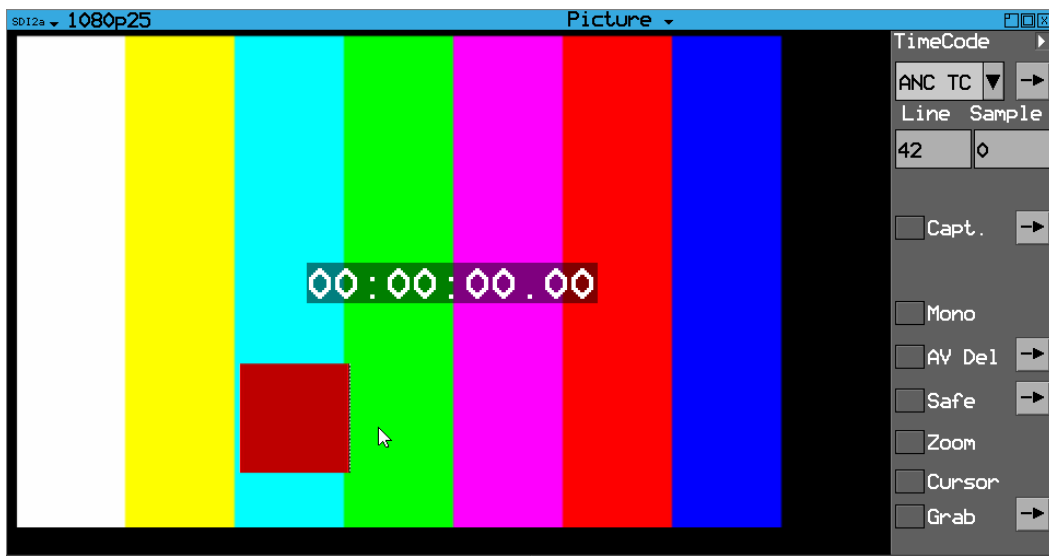
The Picture window is accessed by clicking on an **Analyzer** slot on the monitor output task bar and selecting **Picture**. This will create a new window panel for the selected input.

Selecting the white arrow in the top corner of the window will show or hide the menu controls. Right-clicking on the image will also allow menus to be selected.

The picture displayed is down-converted from the video source. The picture will automatically view the horizontal or vertical blanking areas if the line or sample values are in the blanking. Data carried in the vertical blanking area is visible in the picture instrument.
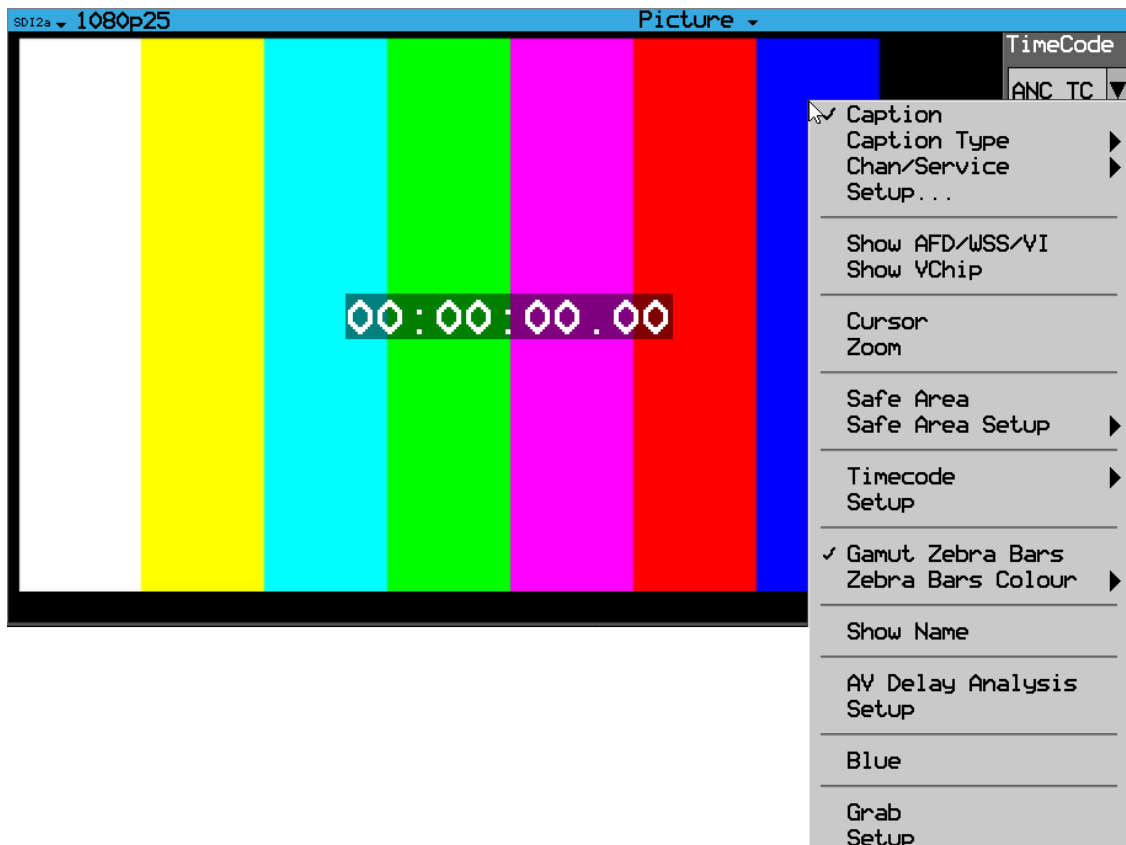
Right-clicking with the mouse in the image area will display contextual menus that can be used to select and setup the different functions on the Picture window.

Blue:

> Show only the Blue color component of the picture.

Aspect Ratio:

> The aspect ratio of PAL (625 lines) and NTSC (525 lines) may be set to either 4:3 or 16:9 as required for the source signal. HD signals are always set to an aspect ratio of 16:9.

Timecode Display

ANC time code can be displayed in the active picture area when turned on. Selecting the arrow to the right of the Time Code field allows this window to be displayed in three different positions and sizes.
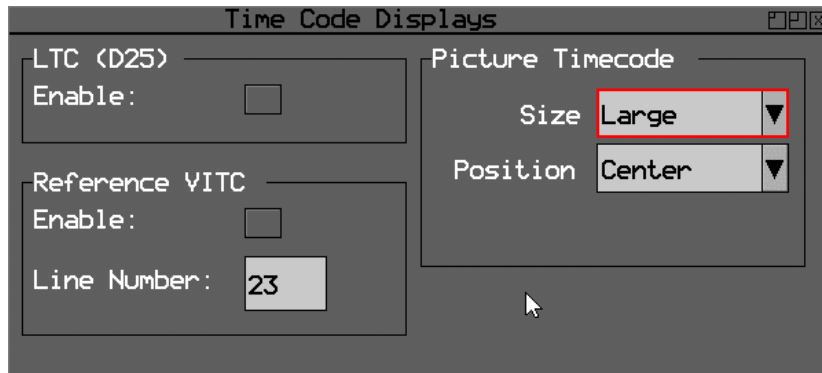
The **Time Code Displays** window also controls display of time code information on the HDMI® monitor output. Time code is available on the locking reference input and on each video input that is analyzed.

Safe Area Generator

The Picture instrument includes four independent safe area generators that can be selected for **Safe Action Area-1**, **Safe Title Area-1**, **Safe Action Area-2** and **Safe Title Area-2**. Selecting the arrow to the right of the **Safe Area** checkbox allows the required safe areas to be setup and selected.
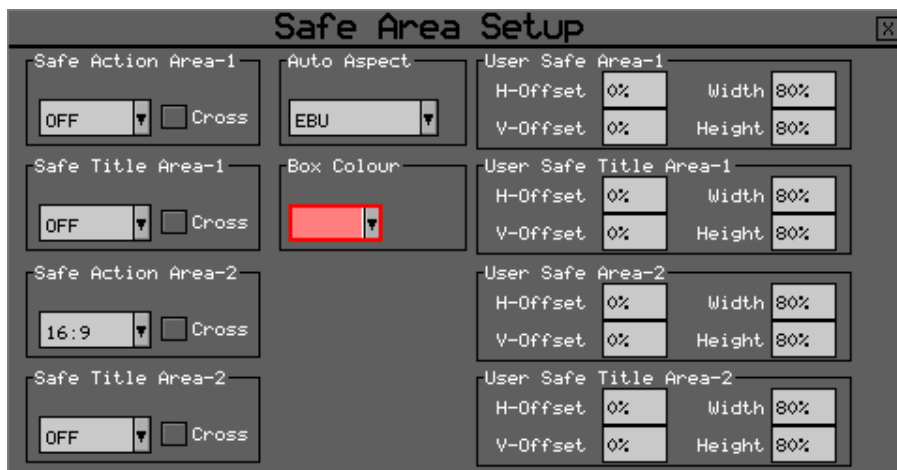
These can be selected from standard SMPTE, ARIB TR-B.4, EBU or ITU templates for 4:3, 14:9, 16:9 or aspect ratios or can be user-defined.

Sample, Line and Field Selection

Sample:

Specify the current sample for analysis. Picture cursor sample position.

Line:

Specify the current line for analysis. Picture cursor line position.

Field:

(Interlaced formats only.) This control selects the field for analysis. If the current line is in **Field 1**, changing the field will change to the same line in **Field 2**. The field number will change to show the correct field for the current line number.

Picture Cursors and Zoom
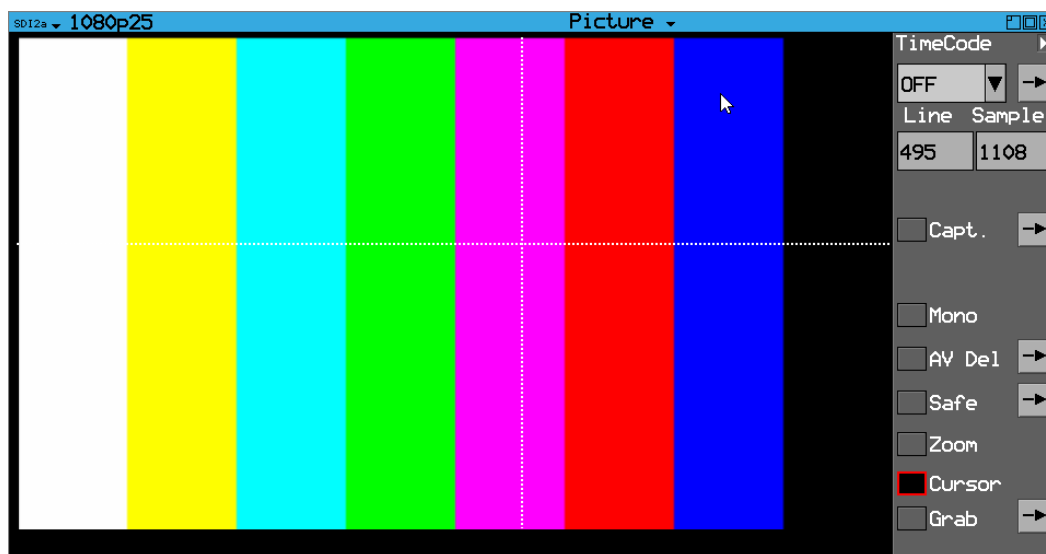
If the **Cursor** checkbox is selected, then clicking anywhere on the picture will place a crosshair cursor to identify a specific line and pixel.

When the cursor is moved to an area of interest on the picture, the selected line and pixel value will automatically be entered into the **Line** and **Sample** fields of the Waveform monitor, and the **Line** field of the Vectorscope. The same area of interest on the picture, will be visible on the SDI data option (if purchased); and on the Waveform monitor and Vectorscope, in single line mode. When the Waveform or Vectorscope **All** checkbox is switched off then the selected line will be displayed in these instruments.

The **All** checkboxes in Waveform and Vectorscope are linked – switching **All** on or off in one instrument does the same for the other.

Ancillary data present in the vertical blanking area can be displayed in the Picture instrument. Moving the cursor into the VANC region reveals any ancillary data present there in white – against the black background of the blanking area. The specific packet data words present can be inspected closely with the SDI data option toolset.

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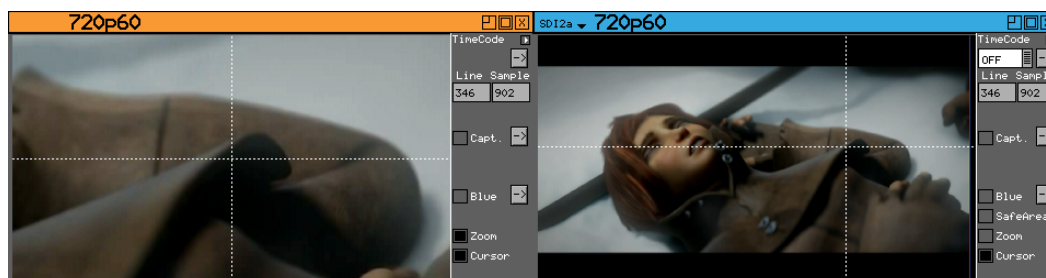
Selecting the Zoom function will expand the displayed image (within a 1/16 or 1/4 sized instrument window) to native resolution.

If the Cursor is used then the expanded image will be placed about the selected cursor position. Clicking and dragging on the image will move the zoomed image.

Closed Caption / Subtitle Display

If the closed caption option is installed, the **Caption Options** menu allows the selection of the following subtitle formats:

- WST
- OP42
- OP47
- EIA 608
- EIA 706

Closed caption text will be displayed in the image area as defined by the closed caption formatting information relevant to the closed caption type.

Closed caption is the name given to text-based, encoded and hidden information that is optionally displayed on screen by the user in America, Canada and Australia. In Europe this information is called subtitles. Europe and Australia use systems based on the standard WST (World System Teletext) format although they are named differently. The Closed Caption system used in America and Canada is technically a completely different system to WST.

The IEA 608 closed caption system (used in the USA and Canada for standard definition video) embeds a data packet on line 21/284 of the SDI 525i video framework and allows up to 32 characters per video frame and up to 4 different caption streams (called channels in this system).

The EIA 708 closed caption system (used in the USA and Canada for HD video) embeds information in the VANC area of the HD-SDI video framework and uses DID 61 for the Caption Distribution Packet (CDP). EIA 708 typically supports up to six different closed caption streams (called services in this system) although theoretically this system supports up to 63 services.

The WST subtitle system (used in Europe for HD-SDI) embeds information in the VANC area of the SDI video framework, typically on line 21/334. This system theoretically supports up to 2047 (0x7FF Hex pages) different closed caption pages. Typically, however, the number of pages is limited to those numbered 100 to 199, 200 to 299, etc up to 800 to 899. In Europe the common practice is to use pages 888, 889 and 890. In Australia however page 801 is used.

The OP42 closed caption system (used in Australia for analog 625i standard definition video) is a specific subset of the functionality of the WST system and embeds information on line 21/334. This system supports only a few different closed caption pages with page 801 is used as the first page.

The OP47 closed caption system (used in Australia for HD-SDI) is basically a wrapper around the WST system that allows it to be embedded in the VANC area of the SDI-HD video framework using DID 43. This system theoretically supports up to 2047 (0x7FF Hex pages) different closed caption pages. Typically, however, the number of pages is limited. In Australia page 801 is used as the first page.

When configuring an Rx instrument with the closed caption option, first establish which closed caption system is being used or is present on the video signal. The ANC Status display (available with the HD/SD-SDI Data Analyzer and Ancillary Packet Analyzer option) will show IEA 608, IEA 708 and OP47 data packets that appear in the vertical ancillary area of the SDI framework. The corresponding closed caption can then be selected from the **Captions** setup menu:
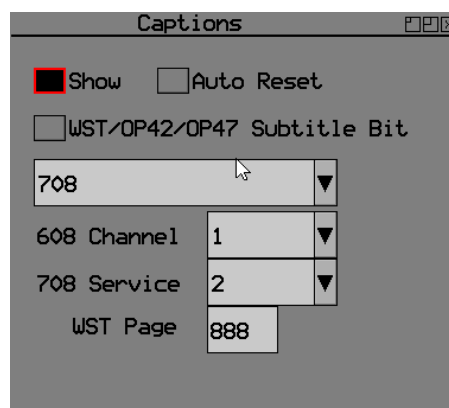
- The **Show** checkbox, when enabled, displays the chosen closed caption type on the image.

- The **Auto Reset** checkbox is for test purposes.

- The **608 Channel** numeric value allows the specific 608 closed caption channel to be selected.

- The **708 Service** numeric value allows the specific 708 service to be selected.

- The **WST Page** value allows the appropriate World Subtitle page to be selected.

A/V Delay Analysis (Option: PHRXO-AVD)

The A/V Delay Analysis option (**PHRXO-AVD**) provides an end-to-end solution to measure the differential delay between Audio and Video signals through a broadcast system, when used together with a suitable A/V Delay Generator. For more information on using the Rx Generator with A/V Delay, see the section *A/V Delay Using the Generator (Option: PHRXO-AVD)*.

The analyzer tool provides a real-time visual and audible (using headphones) indication of the differential delay between the video and the selected audio channel pair(s) and is compatible with EBU and Lawo V_line AV Sync measurement patterns. The Rx enables you to monitor up to 16 audio channels simultaneously. The Rx EBU-compatible test pattern displays a constantly moving clapper board and sounds an A/V delay tone when the clapper board reaches the center of the test pattern.

To analyze A/V delay, open a **Picture** window displaying a compatible pattern, which may be either an EBU Tech 3305 AV Sync clapperboard pattern or the Lavo V_Line AV Sync measurement pattern. In the Picture side menu, select the **AV Del** checkbox to display a screen overlay of the actual A/V Delay value(s) on the selected audio channel(s). To configure the audio channels for analysis or select the displayed pattern type, select the **AV Del** menu to open the **AV Delay Analysis Setup** dialog. Use the **Pattern Type** dropdown to select either **EBU** or **Lawo** options. In addition, you can also use this dialog to select which of the 16 possible audio channels you would like to analyze.
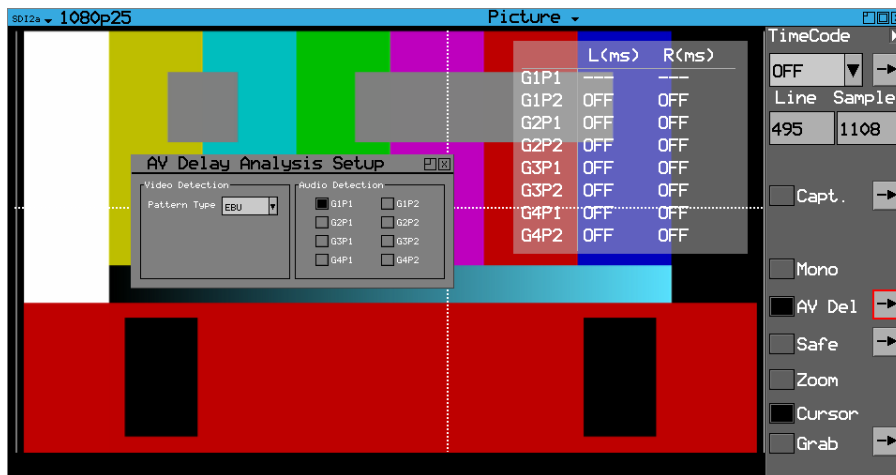
If an Audio Metering window is also open, you will see the periodic audio pulse on the meter for the selected audio channel.

You can use A/V Delay analysis with all supported video formats and frame rates on SDI interfaces.

Native Resolution Picture Display

The Picture instrument can now be displayed on the HDMI monitor at native resolution up to 1920 x 1080. A 1920 x 1080 image source will be displayed at full screen size. Smaller images formats such as SD (720 x 625 or 720 x 525) and HD image formats such as 1280 x 720 will be displayed at actual pixel size on the HDMI monitor.

The Picture can be displayed as full size by clicking on the image or by selecting the icon in the top right corner of the window. When expanded it will cover the underlying instruments and when it is reduced the underlying instruments will be displayed. The Picture can also be displayed at 3/4 screen size by dragging the bottom right corner of a 1/16 or 1/4 Picture.

AFD/WSS and V-Chip Monitoring

Both AFD/WSS and V-Chip monitoring is displayed in the top right corner of the image to allow quality control of program material to be performed prior and during transmission. These can be enabled by using the Picture contextual menu (right-click in the image area).

Frame Grab

Each Analyzer module allows a video clip to be captured for analysis and playback. The video clip contains the full SDI data frame including video data, metadata and audio data. The video clip can be recorded manually or can be triggered by different events such as EDH and CRC errors. When Frame Grab record mode is selected a rolling record buffer (holding approximately 70 SD frames or 13 HD frames) is started so that the full SDI data frames before and after the trigger point are available for analysis. When a trigger is received the record buffer is frozen to provide a video clip.

Once a video clip has been captured it can be played-back and navigated frame by frame using the transport controls within the image area of the Picture instrument. The Rx instruments can be used to analyze the SDI data frame-by-frame to display errors at the trigger point and the status of the SDI frames before and after the trigger point.

The captured video clip can be saved for future reference and previously saved clips can be restored.

To capture a video clip manually, select the record button to start the record buffer (RECORDING) and then press the T button to stop the record buffer (CAPTURED).

To capture a video clip from a trigger event, setup the event to be captured in the setup menu, press the record button to start the record buffer (RECORDING). As soon as the trigger event has occurred,

CAPTURED is displayed to indicate that event has been captured as a video clip. The play, step forward and step backward buttons can then be used to navigate through the SDI data frames.
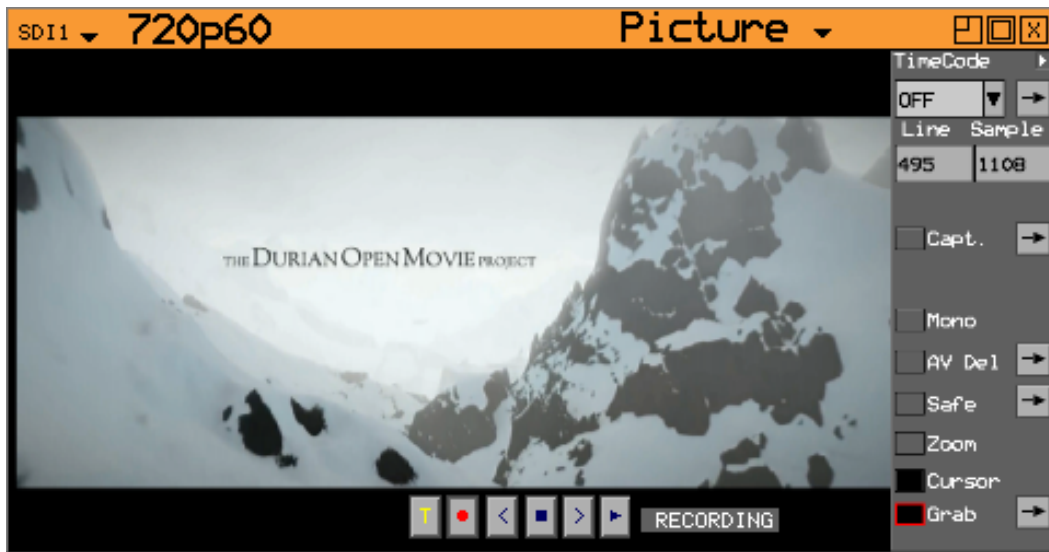
The Frame Grab controls are displayed by selecting the **Grab** checkbox in the Picture instrument menu.

The arrow box to the right of the **Grab** checkbox is used to setup triggers and save video clips using the following controls:

- Manual trigger for video clip capture (**T**)
- Start record buffer (●)
- Step backward through the captured video clip frame by frame (**<**)
- Stop playing the captured video clip (■)
- Step forward through the captured video clip frame by frame (**>**).
- Play the captured video clip repeatedly (►).

The text box to the right of the transport controls displays the current status of the record buffer:

- BUFFERING – indicates that the record buffer is filling up.
- RECORDING – indicates that the record buffer is actively recording the SDI datastream.
- CAPTURED –indicates that a video clip has been successfully captured.
- PLAYING – indicates that the current content is being played as a video clip.
- 13/13 (T:7) – indicates the current frame/total number of frames and the trigger frame number. This text will turn red when the currently displayed frame is the trigger frame.

Selecting the arrow box to the right of the **Grab** checkbox in the Picture menu will display the **Frame Grab** Setup menu.

Within the Setup menu, the **Frame Grab Triggers** section allows the events that trigger the video clip capture to be selected.
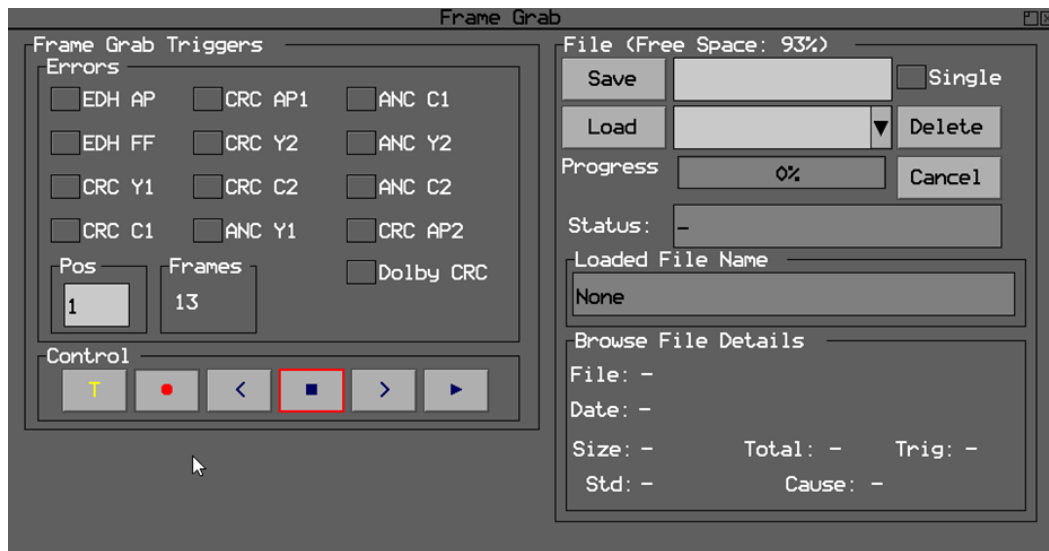
- EDH AP – will trigger when the SD-SDI Error Data Handling Active Picture flag status changes.

- EDH FF - will trigger when the SD-SDI Error Data Handling Full Field flag status changes.

- CRC Y1 – will trigger when the cyclic redundancy check for link 1 luminance data is set.

- CRC C1 – will trigger when the cyclic redundancy check for link 1 chrominance data is set.

- CRC Y2 – will trigger when the cyclic redundancy check for link 2 luminance data is set.

- CRC C2 – will trigger when the cyclic redundancy check for link 2 chrominance data is set.

- CRC AP1 – will trigger when the cyclic redundancy check for link 1 active picture changes.

- CRC AP2 – will trigger when the cyclic redundancy check for link 2 active picture changes.

- ANC Y1 – will trigger when the link 1 luminance ANC stream checksum error flag is set.

- ANC C1 – will trigger when the link 1 chrominance ANC stream checksum error flag is set.

- ANC Y2 – will trigger when the link 2 luminance ANC stream checksum error flag is set.

- ANC C2 – will trigger when the link 2 chroma ANC stream checksum error flag is set.

The **Pos** value is used to position the trigger point in the required position within the rolling record buffer to select the proportion of frames before and after the trigger point.

The **Control** section of the setup menu is a repeat of the transport controls available in the Picture instruments.

The **File** section of the setup menu allows the current video clip in the record buffer to be saved the Rx file system (**\FCAP** folder) and allows previously saved video clips to be restored into the record buffer.

Save:

Saves the current video clip in the record buffer in the **\FCAP** folder use the name entered in the text box to the right of the **Save** button. The **Single** checkbox, if enabled, will cause on the current frame of the video clip to be saved.

Load:

Allows a previously saved video clip to be restored to the record buffer. The dropdown list to the right of the **Load** buttons allows the required video clip to be selected. As video clips are selected in this list, their details will be displayed at the bottom of the menu.

Delete:

Allows the currently selected video clip in the dropdown list to be deleted.

The current progress of the Save or Load operation is displayed in the **Progress** thermometer.

Note: Video clips can be exported and imported using the USB copy menu.

Analyzer Gamut Monitor

The Rx Instrument, with an Analyzer Module installed, can monitor the selected input for the presence of gamut violations in the Picture monitor, when Gamut monitoring is enabled in the Gamut instrument. Areas of the picture, where the Gamut exceeds the configured threshold, can be highlighted on the Picture display using a selectable Zebra Bars overlay.
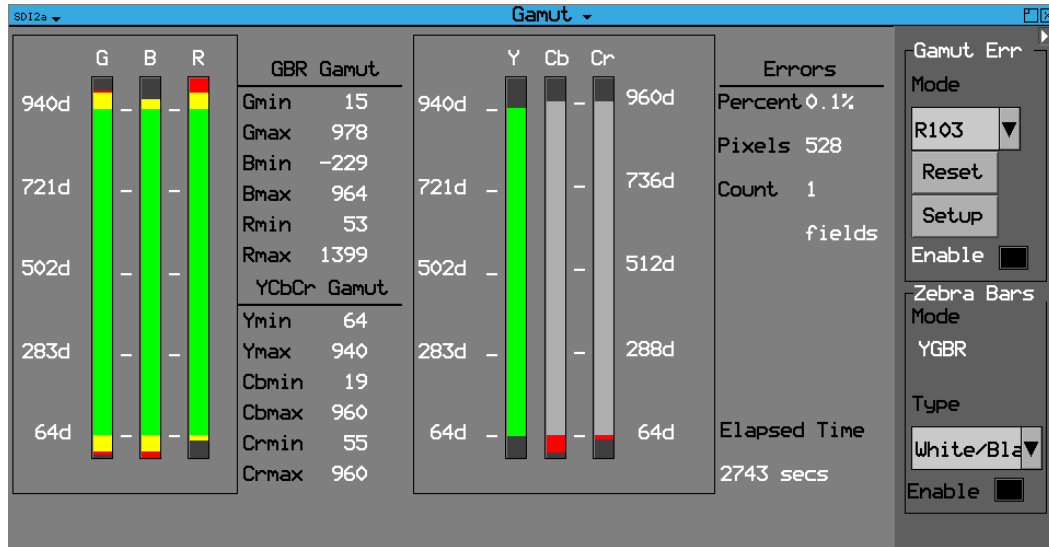
The Gamut window is accessed by clicking on an **Analyzer** slot on the monitor output task bar and selecting **Gamut**. This will create a new window panel displaying the Gamut meters, color component levels and any error counts.

> **Note:** Gamut monitoring can be enabled on the latest variants of the A/AE or AG/AGE interface cards. After upgrading to version **9.09**, if you notice that the Gamut features from an earlier version are unavailable and you have no access to the Gamut instrument described in this section, either revert to the previous version or contact PHABRIX Support for information on upgrading the Analyzer interface board.

The Gamut monitor provides gamut bars (or meters) for both the YCbCr and RGB color spaces, which operate on 444 sampled pixel data regardless of the video standard. The gamut bars are based on the analysis of unfiltered 444 RGB and YCbCr pixel data and indicate the maximum and minimum values detected in the active picture over the period of one frame or field.

A Gamut Error (Err) Mode can be selected from either the **EBU R103**, **Legal** or **Custom** modes. The Legal mode monitors the Gamut limits according to SMPTE Narrow Range definitions.

Gamut meter bars are colored as follows:

- Green: Gamut measurement lies within SMPTE narrow range levels (standard SDI range 64-940 (GBRY), 64-960 (CbCr))

- Yellow: Gamut measurements exceed SMPTE narrow range but lie within EBU R103 control range

- Red: Gamut measurements exceed the EBU R103, Legal and / or Custom control range and are in error.

The active green gamut meter bars have been selected (either by Gamut mode default (R103 or Legal) or in a Custom setup) to contribute to the gamut error counts displayed in the **Errors** section of the instrument. If a Gamut bar is deselected in the **Setup** dialog, then it is displayed in gray with the yellow and red areas still present and active. The red and yellow areas at the top or bottom of a

Gamut Bar informs the operator that gamut errors are occurring for that color component but are not being included in the error reports.

Zebra Bars can be enabled to overlay selectable cross-hatching patterns onto the Picture image to highlight areas in violation of the Gamut thresholds.

When gamut violations are detected, errors are displayed as a percentage of the picture in error (**Percent**), the number of pixels in error (**Pixels**) and a cumulative **Count** of detected frames or fields in error. A **Reset** button enables the reported errors and elapsed monitoring time to be cleared back to zero.

> **Note:** On starting the Gamut instrument, if the video signal is not immediately registered by the gamut bars, toggle the Gamut Err **Enable** checkbox to display the signal.

Gamut measurements are color-coded as follows:

- Gamut GBR and YCbCr minimum / maximum values: Always White
- Gamut error reports for Percent, Pixels and total Count:
    - Gamut in error (Percent, Pixels, Count): Red
    - Following reset: White

The following parameters are available in the sidebar menu to change the gamut monitoring configuration:

Gamut Error (Err) Mode

> **Note:** As a result of possible mathematical limitations in the conversion from YCbCr 422 to RGB 444 it is not recommended to use the RGB Gamut meters to monitor for exact values in a YCbCR 422 input.

Select one of the following Gamut error monitoring modes:

- R103
- Legal
- Custom

For **R103 Gamut Error Mode**, the processor provides picture gamut error detection using the default settings outlined in *EBU Technical Recommendation R103*. In this mode the video data for the RGB and Y components are monitored for levels less than −5% and greater than +105%. Each of the monitored channels (Y, R, G, B) may have a low-pass filter inserted with the filter coefficients: 1/16, 2/16, 3/16, 4/16, 3/16, 2/16, 1/16 per component as required by R103. The resultant filtered gamut error bits Y, R, G, B, are combined to create a single pixel error indicator.

> **Note:** EBU R103 recommended filtering is applied horizontally but not vertically.

For **Legal Gamut Error Mode**, the processor provides picture gamut error detection using the default settings within SMPTE narrow range. A low-pass filter is not available, by default, for this mode.

The **Custom Gamut Error Mode** becomes active when any of the default settings for either R103 or Legal modes are changed in the Gamut setup dialog. The Custom setup persists until another change is made. Custom modes can also be saved as Presets. For more information, see the section *Gamut Custom Mode*.

For all Gamut Error Modes, the ratio of the number of pixels in error compared to the total number of active pixels in the monitored video standard is computed per video frame or field and is displayed as a percentage in the GUI. Frames containing errors above the configured percentage threshold (**Pixels %** in the Setup dialog) are considered in error and are logged when Gamut Logging is enabled in the Setup dialog.

An error **Count** accumulates the number of frames (progressive) or fields (interlaced) in error since the last reset. The Count is displayed in red font if more than one frame or field is identified as containing gamut error .

If the percentage of pixels in error exceeds a threshold, then the video frame is considered to have a Video Frame Gamut Error. These errors can be logged in the Event Log when Gamut Logging is enabled in the Gamut Setup dialog.If the number of Video Frame Gamut is greater than one, then the Count is displayed in a red font. To summarize:

- A frame error is logged if the percentage of pixels in error exceeds the threshold default value, the EBU R103 alarm threshold at which 1% of the active image is in error.

The Gamut monitor runs continuously, once enabled, and can be reset.

See the section *Gamut Setup* for information on configuring the Gamut bars.

Zebra Bars Mode

A Zebra overlay generator provides a layer for all gamut modes, which can be superimposed on top of the picture window to highlight areas of gamut error. The overlay may be configured either to follow the R103 pixel error detector (YGBR) the Legal pixel error detector (YCbCrGBR) or any combination of the individual component pixel error processors in Custom mode. The Zebra Bars Mode indicator displays the current gamut component being monitored. For example, in R103 mode, it will display **YGBR**, or, if using the Custom mode, with Zebra bars active only on the R component, then Zebra Bars Mode will display **R**.

An additional monochrome setting for video is provided to enhance the visibility of the zebra overlay. **Monochrome** mode can be useful to spot a single pixel that might be in error, for example, there may be a faulty pixel on the camera sensor. The Zebra Red/Black overlay works well to highlight gamut errors when the image is set to monochrome display. Zebra visibility and monochrome settings are also part of the picture window configuration.

The Zebra Bars settings are as follows:

- Zebra Display: Enabled or disabled

- Zebra Type: White/Black, White/Dim, Red/Black, Red/Dim.

The following image shows the use of different zebra mode overlays on a video input to the Picture window.

Zebra Mode: White/Black
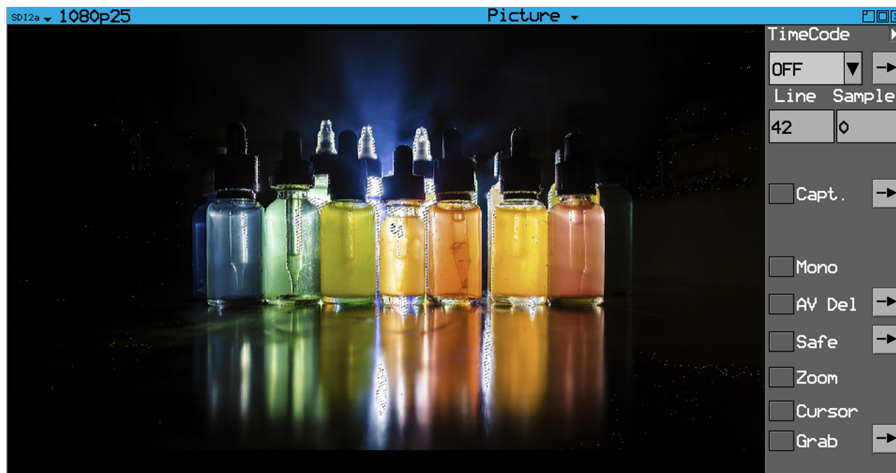
Zebra Mode: Red/Black

Monochrome and Zebra Mode: Red/Black

Gamut Errors Display

Gamut errors are displayed if the YCbCr or RGB levels exceed the following thresholds for the various selectable scales:

Gamut Monitoring Mode R103:

Scale:	Decimal		%IRE		Hex		mV	
R103	Min	Max	Min	Max	Min	Max	Min	Max
Y	20	984	−5	105	14	3D8	−35	735
Cb	64	960	−50	50	40	3C0	−350	350
Cr	64	960	−50	50	40	3C0	−350	350
G	20	984	−5	105	14	3D8	−35	735
B	20	984	−5	105	14	3D8	−35	735
R	20	984	−5	105	14	3D8	−35	735

Gamut Monitoring Mode Legal:

Scale:	Decimal		%IRE		Hex		mV	
Legal	Min	Max	Min	Max	Min	Max	Min	Max
Y	64	940	0	100	40	3AC	0	700
Cb	64	960	−50	50	40	3C0	−350	350
Cr	64	960	−50	50	40	3C0	−350	350
G	64	940	0	100	40	3AC	0	700
B	64	940	0	100	40	3AC	0	700
R	64	940	0	100	40	3AC	0	700

If the Picture cursor is used to select an out-of-gamut area, the corresponding line and pixel can be displayed on the Waveform monitor and Data View to measure the value.

The Gamut Error counters to the right of the Gamut meters show the cumulative Gamut errors detected since the last reset as follows:

- **Percent:** Shows the percentage of pixels in error
- **Pixels:** Shows the total number of pixels in error
- **Count:** Shows the total cumulative count of frames in error.

When Reset, all error counters and the elapsed time are set back to zero and restarted.

Gamut Setup

The Gamut Setup menu enables the following items to be configured:

- Include or exclude Gamut meter bars from the error count.

  When an Error checkbox is selected corresponding to a color component, the corresponding gamut meter bar will turn green and will contribute towards the error count. Where the corresponding Error checkbox is not selected, the gamut meter bar is displayed in gray and does not contribute towards the error count. Any gamut errors occurring when the component is not included in the error count are displayed at the top or bottom of the bar in red or yellow to alert the operator.

- Low pass filter (LPF) activated or disabled

- Metering scales (decimal, percent IRE, hexadecimal, mV)

- Custom setup

- Fine-tuning of error recording and zebra grid component selection

- Gamut logging.

Note: When entering a percentage, remember that the value entered is divided by ten to display the final percentage, so to enter 0.1% enter 10, or to enter 10%, enter 100, etc. It is also recommended to press **Clear ALL** to delete the previous entry before entering a new value.

The following figure shows the Gamut setup dialog and resulting configuration for the various gamut modes:

Gamut Setup
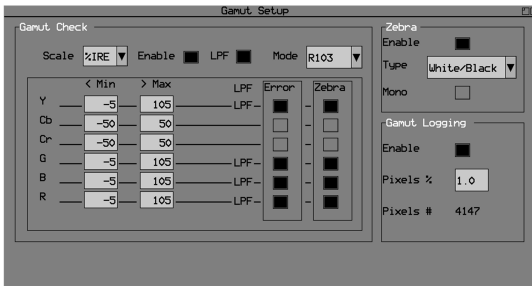
Resulting Configuration

Gamut Mode: R103
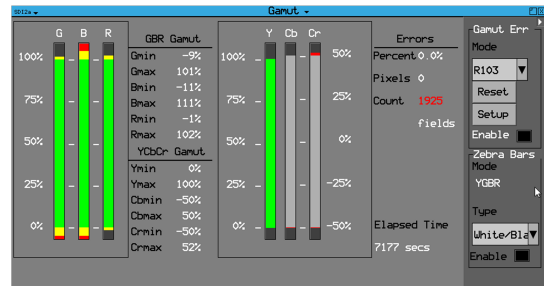
Gamut Mode: R103

Gamut Mode: Legal
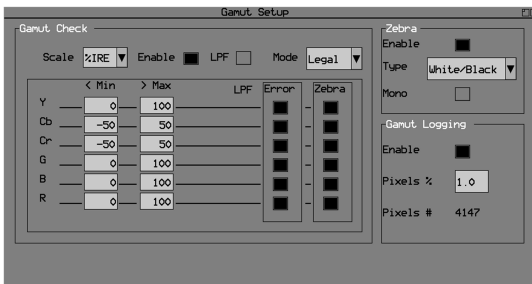
Gamut Mode: Legal
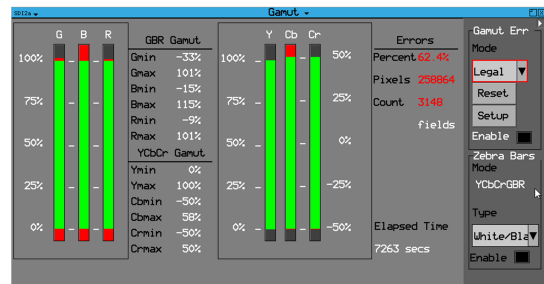
Gamut Mode: Custom
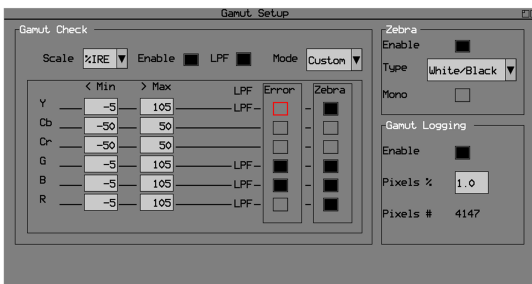
Gamut Mode: Custom
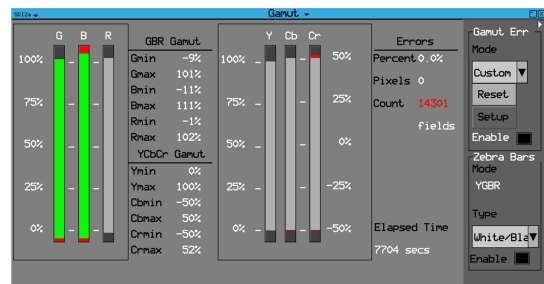
Gamut Check Configuration

Note: If you change any of the Gamut settings while in either R103 or Legal monitoring mode, the mode will switch immediately to Custom mode, which you can save as a preset.

Use the **Gamut Check** section of the **Setup** dialog to:

- Create a customized Gamut monitoring mode by changing the default monitoring ranges for R, G, B, Y, Cb and Cr.

- Change the default error recording from the various meters.

- Change the default signal to which the zebra overlay is applied.

- Select a different scale for the Gamut meters: decimal, %IRE, hex, or mV.

- Activate or deactivate a low pass filter (LPF).

When selecting or deselecting the **Error** or **Zebra** checkboxes, selecting an **Error** checkbox enables the counting of errors for the corresponding color component. Selecting a **Zebra** checkbox enables the display of Zebra Bars for the corresponding color component in the Picture instrument.

Gamut Custom Mode

If you change any of the default settings for either R103 or Legal Gamut monitoring modes, the unit automatically switches to **Custom** mode. It is possible to modify the monitored ranges, the LPF, type of errors recorded, and the color components to which zebra bar overlays are applied.

> **Note:** If the **LPF** checkbox is deselected, gamut monitoring may not report pixels in error, even when the gamut bars show that some pixels fall outside the range of expected values for the current frame.

When you select a custom setting, the Custom values that are selected will persist, enabling the operator to switch from Custom mode back to R103 and / or Legal mode and then return to Custom mode with the same settings. If, however, a Custom mode is defined and the operator switches to mode R103, for example, and makes a configuration change, this setting becomes the new Custom mode setting and the previous Custom mode is replaced, unless saved as a Preset.

Gamut Logging

Logging of Gamut errors is enabled by selecting the **Enable** checkbox in the **Setup** dialog.

All Gamut errors are reset to zero when the Reset button in the Gamut Monitoring window is clicked. When logging is active, this logs a Gamut Reset event in the logfile.

The percentage of pixels in error can be set in the **Pixels %** field so that Gamut errors are logged only when this threshold is exceeded.

When there is a change to the gamut setup but no gamut errors are recorded, an information entry is added to the gamut log:

i 14:39:12 03-10-2023 SDI1 Gamut OK: YGBR 1080p25 0.0%(0) (<= 0.1%)

When the Pixels % threshold is exceeded and logging is enabled, a Gamut Error is logged as follows:

In R103 Mode:

E 14:39:12 03-10-2023 SDI1 Gamut Error: YGBR 1080p25 2.7%(56954) (> 1.0%)

This error can be interpreted as follows:

- **i** - Information event
- **E** - Error event
- **14:39:12** - Time event occurred
- **03-10-2023** - Date event occurred
- **SDI1** - SDI input name
- **YGBR 1080p25** - Active color components and standard when the error occurred. For R103 Mode, the monitored color components are Y and GBR. For Legal mode all color components are monitored, so **YCbCrGBR** would be logged.
- **0.3%** - Percentage of total pixels in error.
- **(56954)** - Number of pixels in error when the event was logged.
- **(> 1.0%)** - Error logging initiated as the percentage of gamut errors has exceeded the configured gamut threshold for that gamut error mode.

A Gamut Reset information event is logged when the gamut **Reset** button is pressed.

Data View

The Rx Instrument with an Analyzer Module installed and SDI analysis option can display the selected input in the form of a data array.
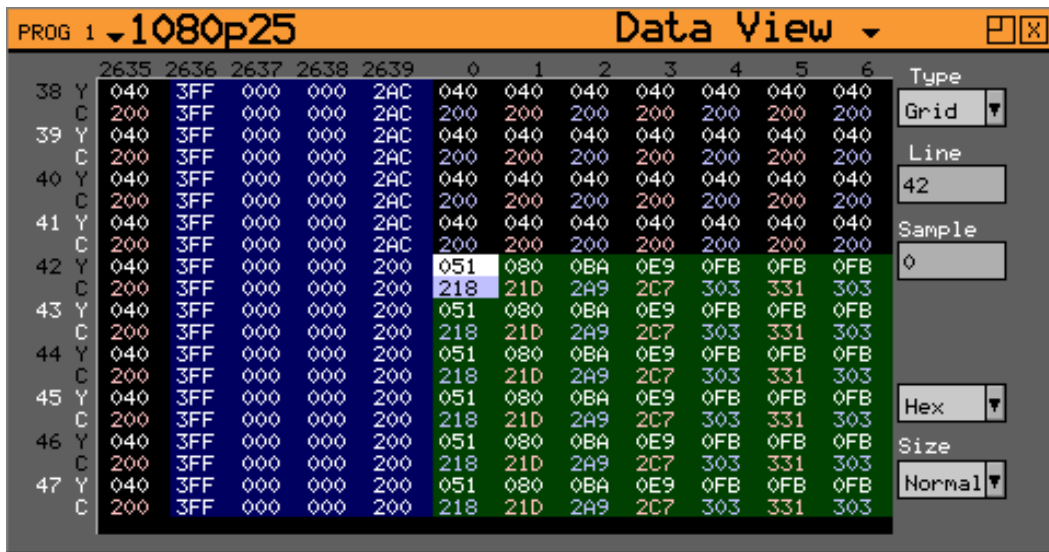
The SDI Data View window is accessed by clicking on an **Analyzer** slot on the monitor output task bar and selecting **Data View**. This will create a new window panel for the selected input.

This page shows the video signal as a datastream in several formats as described below. In each mode, the data may be displayed in hexadecimal, decimal or binary formats. In each mode, the data may be displayed in hexadecimal, decimal or binary formats. The binary format is not available in grid mode. The data may also be displayed as 10-bit or 8-bit format.

> **Note:** The line number of a line of video changes at the end of active video. This has the effect that the line number for pixels in horizontal blanking is the same as the line number for the active picture after that line.

Type

Grid:

In this mode the data is shown in an X-Y format with lines and samples at the same time, providing a representation of the picture in data format. If the cursor keys are used to select the grid window and **OK** pressed, the cursor keys will scroll around the window. The luma (Y) channel is shown in white whilst the Cr and Cb channels are shown with a red or blue tint respectively

Strm:

One of three modes for displaying the samples on the current line only. The cursor keys may be used to scroll the sample number when **OK** has been pressed. The **info** column shows the type of data being displayed.

- AP - Active picture
- VBL - Vertical blanking
- HBL - Horizontal blanking

Comp:

Similar to the **Strm** mode above but in a component mode with Cr and Cb in different columns. See **Strm** mode above for a description of the **info** column.

Split:

Shows the two streams split into four parts to show Y, Y', Cr and Cb in separate columns. See **Strm** mode above for a description of the **info** column.

Note: When in Color modes other than YCbCr 422 10 bit, the pixel RGB or YCbCr values are packed into 10 bit values across the different streams and thus will give unfamiliar values. When the **UnPack** checkbox is checked the values in the active picture are unpacked to RGB or YCbCr values.

Waveform Monitor

The Rx Instrument with an Analyzer Module installed can display the selected input in the form of a waveform monitor.
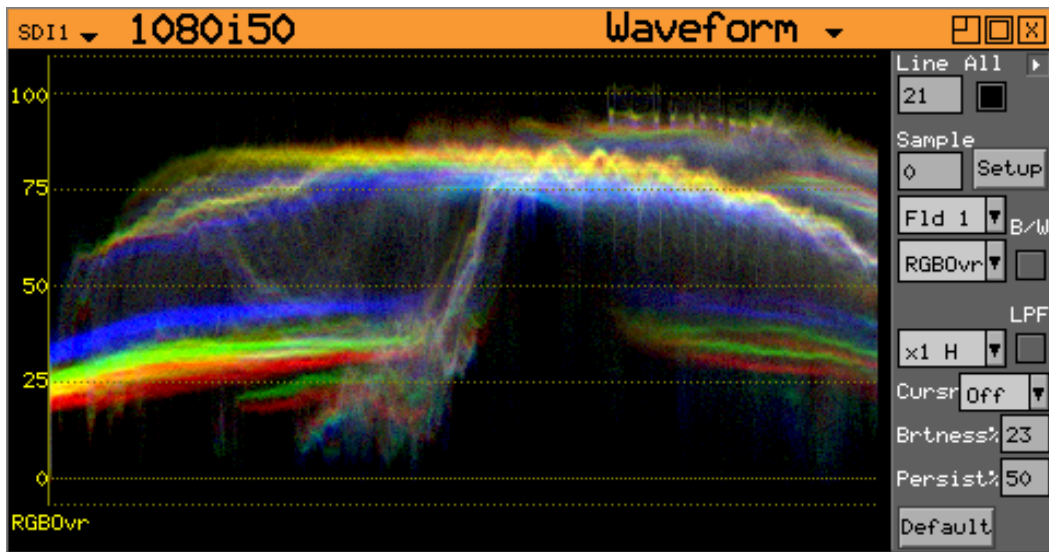
The Waveform window is accessed by clicking on an **Analyzer** slot on the monitor output task bar and selecting **Waveform**. This will create a new window panel for the selected input.

Selecting the white arrow in the top-right corner of the window will show or hide the menu controls.

Waveform Type

The waveform display format is set using the **Setup** button. The waveform monitor displays the selected signal in one of the following formats as set by the Mode control:

YCbCr:

The Y, Cr and Cb waveforms are shown as three separate waveforms in a Parade format.

Y:

Only the luminance channel is shown.

Cb:

Only the blue chroma channel is shown.

Cr:

Only the red chroma channel is shown.

GBR:

The Green, Blue and Red waveforms are shown as three separate waveforms in a Parade format.

Red:

Only the red channel is shown.

Green:

Only the green channel is shown.

Blue:

Only the blue channel is shown.

RGB:

The Red, Green and Blue waveforms are shown as three separate waveforms in a Parade format.

RGBOvr:

>The Red, Green and Blue waveforms are shown overlaid on the same waveform.

YCCOvr:

>The Luminance, Cr and Cb waveforms are shown overlaid on the same waveform.

Waveform Scale

The horizontal scale (x1 H) of the waveform (at 1/16 window size on the HDMI output) can be selected to view the left, right and center areas of the waveform display.

The vertical scale (x1 V) of the waveform (at 1/16 window size on the HDMI output) can be selected to view the high, middle and low areas of the waveform display.

Cursors

Various cursor modes are available on the Waveform monitor:

Pict:

>This makes the picture cursor visible. The picture cursor can be moved as required.

Ampl:

>The Amplitude cursor allows the level between 2 different levels (Cursor C and Cursor D) to be measured.

Time:

>The Time cursors allow the difference between to points (Cursor A and Cursor B) to be measured.

Both:

>This allows both the Amplitude and Time cursors to be selected at the same time.
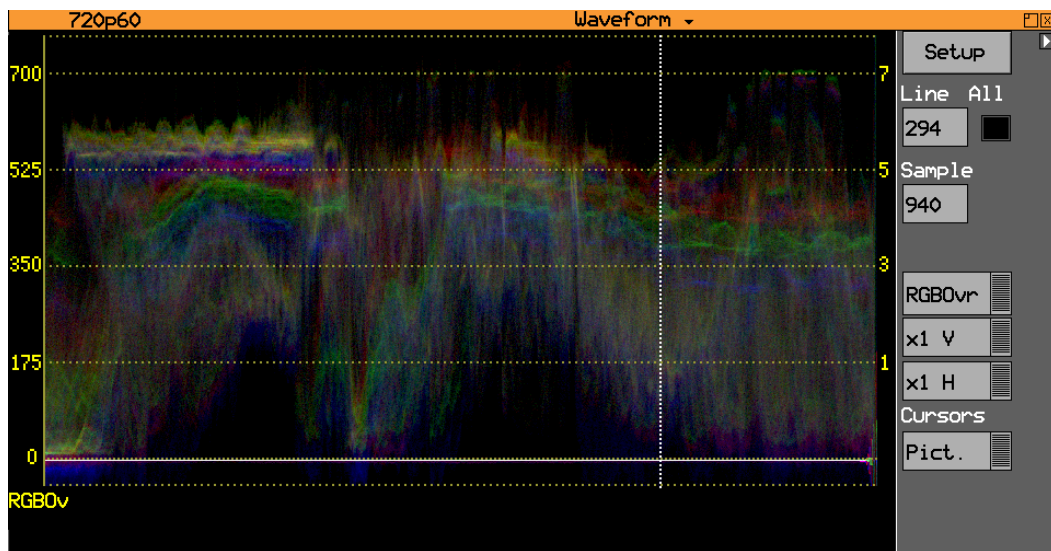
If the Waveform Pict (Picture) cursor is selected, then a vertical cursor will be also be displayed on the waveform at the corresponding pixel sample.

The Waveform monitor provides both amplitude cursors, to measure the amplitude of the waveform, and time cursors to measure the time between two selected points on the waveform.
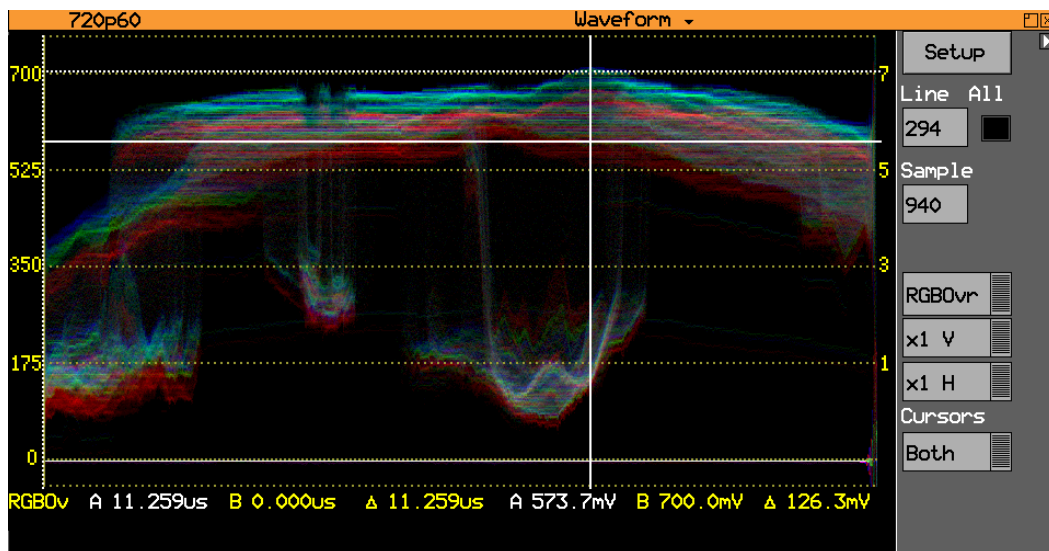
With the Time cursor selected, then clicking on the waveform will place a vertical cursor (Cursor A) on the waveform and the time (in pixels or microseconds) from the start of picture will displayed. Clicking a second time in a different place on the waveform will place a second cursor (Cursor B).

The difference between the Cursor A and Cursor B will be displayed in pixels or microseconds. Clicking on the vertical dotted cursor and then clicking a different horizontal position will move the cursor to that point.

With the Ampl (Amplitude) cursor selected, then clicking on the waveform will place a horizontal cursor (Cursor C) on the waveform and the amplitude at that point will be displayed at the bottom of the waveform prefixed by **C** either as a percentage or in millivolts. Clicking on the horizontal dotted cursor and then clicking a different vertical position will move the cursor there.

All, Line and Sample

The display may be restricted to a single line or all lines may be displayed at the same time. The display can be formatted as all streams (Luma and Chroma) or just a single stream.

The streams may be in YCbCr or GBR formats. The line, sample and field controls all track the related controls on other pages.

In active picture mode, the **All** checkbox is enabled, and waveform monitor displays the content of the active picture (all active picture lines, overlaid on each other).

In single line mode, the **All** checkbox is disabled, and the waveform monitor displays a single active picture line or VANC region line.

Waveform Setup Button Dialog
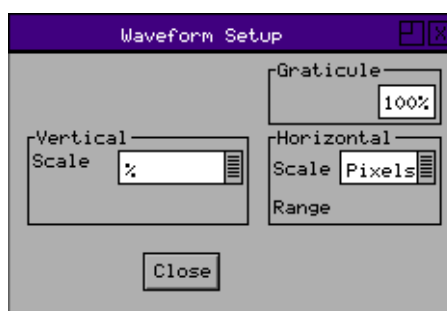
The **Waveform Setup** menu allows the vertical and horizontal scale of the waveform display to be setup.

Graticule:

> The brightness of the display graticule can be adjusted between 100% (full brightness) and 0% (not displayed)

Vertical Scale:

> The axes and measurements for the waveform monitor can be displayed either in percentages or in hex or decimal values as required.

Horizontal Scale:

> The timing measurements may be set in either pixels or micro-seconds (µs)

Vectorscope

The Rx Instrument with an Analyzer Module installed can display the selected input in the form of a vectorscope.
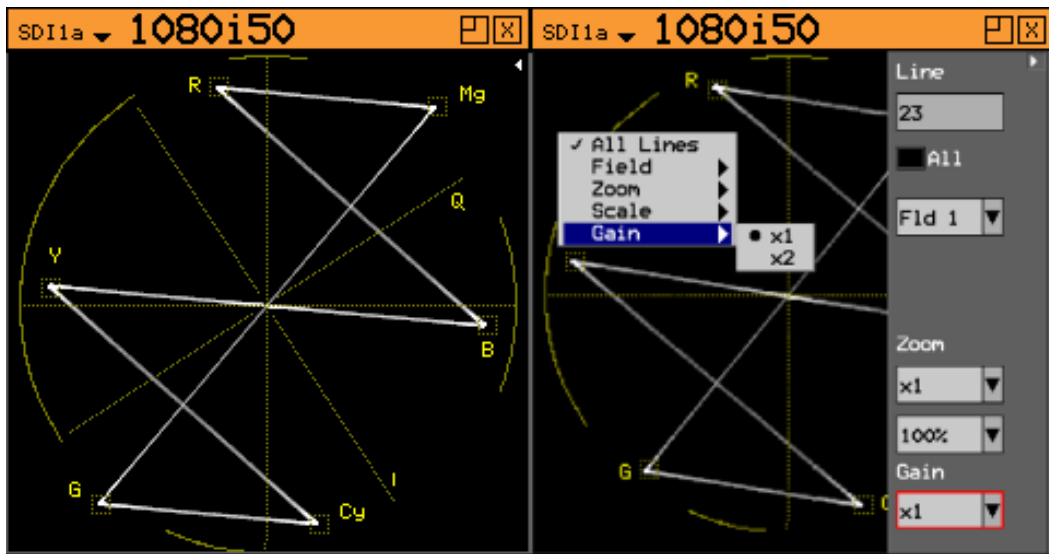
The Vectorscope window is accessed by clicking on an **Analyzer** slot on the monitor output task bar and selecting **Vectorscope**. This will create a new window panel for the selected input.

Selecting the white arrow in the top corner of the window will show or hide the menu controls.

The display graticule may be set to show either the 100% bar positions or 75% positions. The color bar position boxes will change according to the color space for the current input video standard.

Line:

> Allows a specific video line to be displayed. This is useful when test patterns are transmitted as part of a program on specific video lines.

All:

> The All checkbox forces the waveform monitor to display all lines, overlaid on each other. When unselected, the specified line is displayed.

Field:

> The **Fld 1** and **Fld 2** modes allow specific video fields to be displayed.

Zoom:

> Allows the vectorscope display to be zoomed-in to the Center, Cyan, Yellow, Green, Magenta, Red or Blue positions at x1, x2, x5 or x10 magnifications.

100% / 75%:

> Selects the graticule scale to match the color bars being analyzed.

Gain:

> When Zoom is set to x1, this function enables you to set the gain of the vectorscope display to x2. If Zoom is set to anything other than x1, the Gain control is grayed-out.

Eye

Overview

The Rx Instrument with an Analyzer Eye Module installed can display the selected input in the form of an Eye Pattern. This allows the jitter of the selected input video signal to be monitored using an Eye Pattern display.
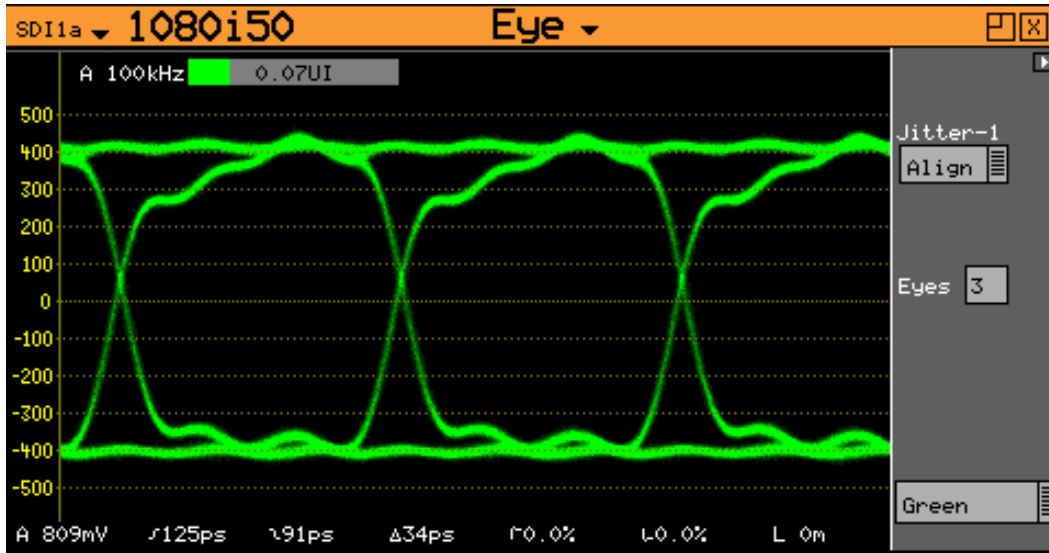
The Eye window is accessed by clicking on an **Analyzer Eye** slot on the monitor output task bar and selecting **Eye**. This will create a new window panel for the selected input.

Selecting the white arrow in the top corner of the window will show or hide the menu controls.

The term *Eye Pattern* is given to the measurement of SDI clock jitter display that forms the shape of an eye due to the two superimposed clock cycles. The *open eye* is displayed when monitoring a jitter free SDI signal and the eye closes increasingly with the severity of the jitter.

Open Eye
Ideal Eye Pattern

Closed Eye
Displaying Jitter

The Eye Pattern is formed by sampling the SDI signal at specific points in a progressive manner and displaying each sample taken on a persistent screen until the waveform is complete.

Causes of Jitter

Jitter can be caused by a number of different effects and the artifacts displayed in the Eye waveform are typically due to combinations of these at different frequencies and amplitudes:

- Transmission jitter caused by the equipment generating the video signal. This could include clock phase jitter, amplitude jitter and wander.

- Receiver phase lock loop errors in equipment decoding an SDI datastream. For example, when video sources are switched and the circuitry of the equipment needs time to establish phase lock or when the signal is distorted by long cable lengths.

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- Data dependent jitter due to the actual data content that, even after randomization, that contains sequences of zeros long enough for the clock regeneration to lose phase lock.

- Thermal and Shot Noise caused by the integrated circuits used within equipment. Integrated Circuits can contain many discrete transistors that can all cause random errors, increasing in number as the temperature of the equipment rises.

- Electromagnetic interference in long cable lengths that may be susceptible to interference from the power grid and from power switching.

- Distorted waveform shape, created by equipment, by long cable runs, by poorly terminated, un-equalized cables, poor cable frequency response of or poor return-loss.

Problems occur when these errors cause a level of jitter outside the specified acceptable parameters. The different types of jitter are classified as follows:

Timing Jitter:

> Refers to a short-term time interval error above a low frequency threshold of 10 Hz (as defined in the SMPTE standards for SDI signals).

Alignment Jitter:

> Refers to artifacts above the specified threshold frequencies of (1 kHz for SD-SDI signals and 100 kHz for HD-SDI signals). Typically, video equipment cannot tolerate Alignment Jitter which causes decoding errors from incorrect sampling of the datastream because the SDI Clock transition occurs on the edge of the data sample instead of at the center of the data sample.

Wander:

> Refers to a long-term time interval error, ie artefacts below 10 Hz. Typically, all video equipment has the tendency to cause wander over a long period, the display of these artefacts are not easily displayed in a meaningful way but are better logged as errors that exceed tolerances over a long period.

Random Jitter:

> Refers to artefacts caused by random events or processes such as thermal or shot noise that cause small amplitude variations in the clock edge position or could cause large signal amplitude variations, though these typically would be infrequent.

Note: If an Rx Generator module is being used as the test pattern generator then the System Reference should be set to **Free Run** to avoid the introduction of jitter caused by the Rx locking circuitry.

Eye Display

The **Eye and Jitter** display shows the Eye Pattern against a vertical graticule of +500 mV to −500 mV. Four horizontal cursor lines show the 100%, 80%, 20% and 0% measurement positions on the waveform. Along the bottom of the display are continuous automatic measurements for the following parameters:

- Amplitude – measured in mV

- Rise time – measured in picoseconds. The rise time measurement is specified as the time between the 20% and 80% points on the eye waveform.

- Fall time - measured in picoseconds. The fall time measurement is specified as the time between the 20% and 80% points on the eye waveform.

- Rise/fall difference - measured in picoseconds

- Rising edge overshoot – measured as a percentage of the overall signal amplitude.

- Falling edge overshoot – measured as a percentage of the overall signal amplitude.

- Cable length – measured in meters. The cable length display is only an approximate value with 10 m resolution, so a 5 m long cable will be shown as having a length of 0 m. The cable type affects the length displayed which has been calibrated for **Belden 1694A** cables.

Any measurements which exceed the specification of the SDI signal are indicated in red whilst valid parameters are displayed in white.

> **Note:** If jitter values are too large, the automated measurements cannot be made accurately and should not be relied on.

The eye display is only accurate when connected with a cable of length 1 m. If a longer cable is used the eye will begin to *close up* and measurements will become more difficult to perform. Note that the eye display is of the signal pre-equalizer, the equalizer in a system being used to compensate for long cable lengths. There is no method for the Rx instrument to view the signal post-equalizer.

Jitter Filters

The **Jitter 1** filter allows the specific type of jitter to be applied to the waveform and the thermometer displays. The options are:

Timing:

As determined by the SMPTE standard for the specific video standard (i.e., jitter above the 10 Hz threshold.)

Align:

As determined by the SMPTE standard for the specific video standard (i.e., jitter above 1 kHz threshold for SD-SDI signals and 100 kHz for HD-SDI signals.)

10Hz:

Jitter above a 10 Hz threshold.

100Hz:

Jitter above a 100 Hz threshold.

1kHz:

Jitter above a 1 kHz threshold.

10kHz:

Jitter above a 10 kHz threshold.

100kHz:

Jitter above a 100 kHz threshold.

Jitter filter selection affects both the jitter thermometer and eye pattern displays. Timing and Alignment jitter filters are defined in the relevant SMPTE publication. The thermometer automatically calibrates to the specification of the video standard and chosen filter. When the reading is within specification, the thermometer bar is green, when close to specification it is yellow, and when out of specification it is red.

	3G-SDI (2.97 Gbps)	HD-SDI (1.485 Gbps)	SD-SDI (270 Mbps)
Alignment Jitter	SD-SDI (270 Mbps)	100 kHz high pass	1 kHz high pass
Alignment Jitter	10 Hz high pass	10 Hz high pass	10 Hz high pass
Upper limit	−3 dB at 9.5 MHz low pass	−3 dB at 4.75 MHz low pass	−3 dB at 0.86 MHz low pass

On-screen horizontal cursors indicate the position on the eye that the rise time measurements are being made.

> **Note:** The Rx instrument takes a little time to stabilize when the SDI input standard changes.

Jitter Meter Ranges

	3G-SDI (2.97 Gbps)	HD-SDI (1.485 Gbps)	SD-SDI (270 Mbps)
Alignment Full-Scale	0.52 UI	0.34 UI	0.34 UI
Alignment (Red Threshold)	0.3 UI	0.2 UI	0.2 UI
Alignment (Yellow Threshold)	0.2 UI	0.14 UI	0.14 UI
Timing Full Scale	3.4 UI	1.7 UI	0.34 UI
Timing (Red Threshold)	2 UI	1 UI	0.2 UI
Timing (Yellow Threshold)	1.4 UI	0.7 UI	0.14 UI

Eye Color:

The eye color may be set to green or blue and may also be adjusted in gain to allow the eye display to show *hot spots* where most of the signal data is found.

Advanced Jitter Analysis
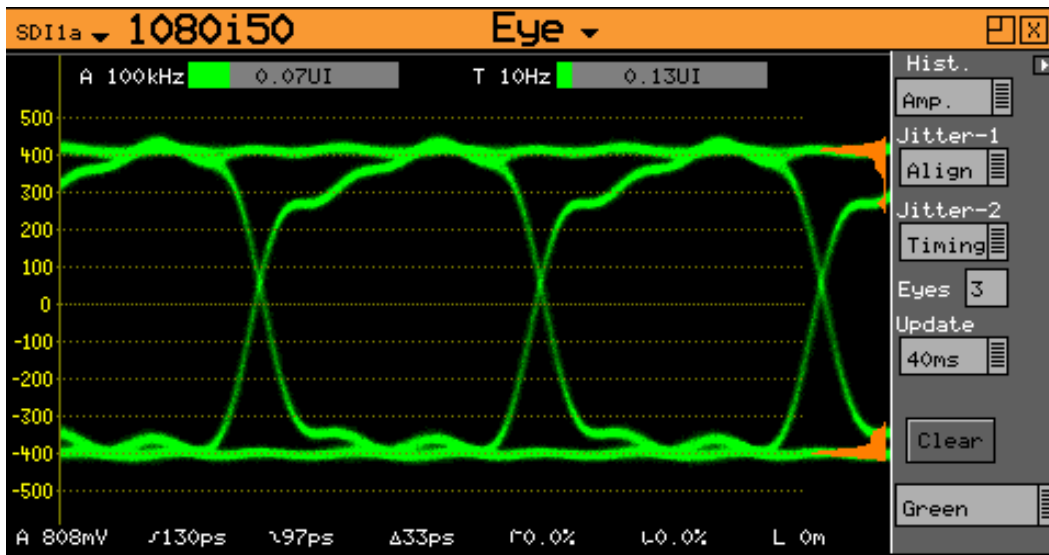
Advanced Jitter Analysis provides the user with additional tools on the Eye display to help determine the nature of jitter present in SDI signals.

Histogram:

Amp, Timing, or Both. Histograms enable the operator to observe the distribution of samples in both amplitude (**Amp**) and time (**Time**). The amplitude histogram shows the distribution of samples over the complete visible eye picture. The time histogram shows the distribution of samples at the zero point of the eye waveform for two thirds of the visible

time period. Note that he time histogram overlays some of the automatic measurement display. The measurements may still be read by Remote Control if purchased.

Jitter-1:

Timing, Align, 10Hz, 100 Hz, 1KHz, 10KHz or 100KHz. This filter operates on both the left-hand jitter thermometer and the eye waveform. The different filters enable the operator to understand more fully the nature of any jitter present. When in Timing or Alignment modes, the meter range is set to show appropriate ranges for the SMPTE specification at the current video input standard.

Jitter-2:

This is a second jitter measurement thermometer and may be set to Timing, Align, 10Hz, 100 Hz, 1KHz, 10KHz or 100KHz. This filter operates on just the right-hand jitter thermometer. When in Timing or Alignment modes, the meter range is set to show appropriate ranges for the SMPTE specification at the current video input standard. When in other filter modes, the meter ranges are expanded so that larger ranges may be viewed.

Update:

This allows selection of the update rate to allow longer display persistence. This may be set to **40 ms** (normal use) or **infinite**. When set to infinite, the **Run** and **Clear** buttons are enabled.

Run:

This checkbox stops the display from updating so that a waveform may be investigated in more detail. It is only enabled when the update mode is set to infinite update mode.

Clear:

This button clears the eye display. It is only enabled when the update mode is set to infinite update mode.

Eyes:

Adjusts the number of eyes visible on the eye display. The 10 and 20 modes are useful for observing serial-parallel conversion jitter.

Jitter

The Rx Instrument with an Analyzer Eye Module installed can display the selected input in the form of a Jitter waveform.
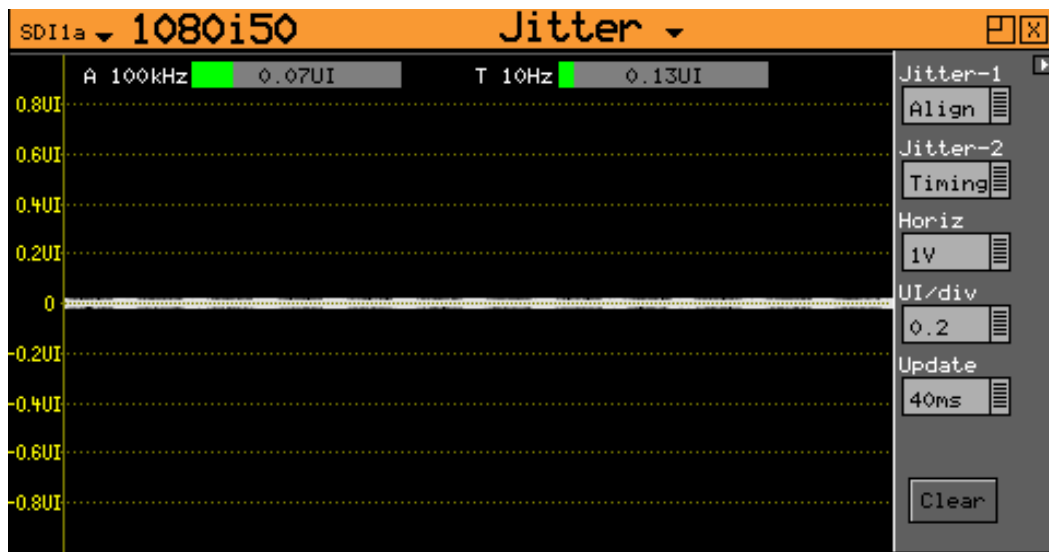
The Jitter window is accessed by clicking an **Analyzer Eye** slot on the monitor output task bar and selecting **Jitter**. This will create a new window panel for the selected input.

Selecting the white arrow in the top corner of the window will show or hide the menu controls.

This screen shows a trace of jitter amplitude versus time along with two jitter thermometers and has the following controls:

Jitter-1:

> Timing, Align, 10Hz, 100Hz, 1kHz, 10kHz, or 100kHz. This filter operates on both the left-hand jitter thermometer and the jitter trace.

Jitter-2:

> Timing, Align, 10Hz, 100Hz, 1kHz, 10kHz, or 100kHz. This filter operates on just the right-hand jitter thermometer.

Horiz:

> H, 2H, V or Frame – horizontal sweep control for jitter trace.

UI/div:

> 0.1, 0.2, 0.5, or 1.0 – vertical gain control for the sweep trace.

Update:

> This allows selection of the update rate to allow longer display persistence. This may be set to **40 ms** (normal use) or **infinite**. When set to infinite, the **Run** and **Clear** buttons are enabled.

Run:

> This checkbox stops the display from updating so that a waveform may be investigated in more detail. It is only enabled when the update mode is set to infinite update mode.

Clear:

> This button clears the eye display. It is only enabled when the update mode is set to **infinite** update mode.

Video Status

The Rx Instrument with an Analyzer Module installed can monitor the selected input and display any EDH (error detection and handling) or CRC (cyclic redundancy check) errors detected in the datastream.
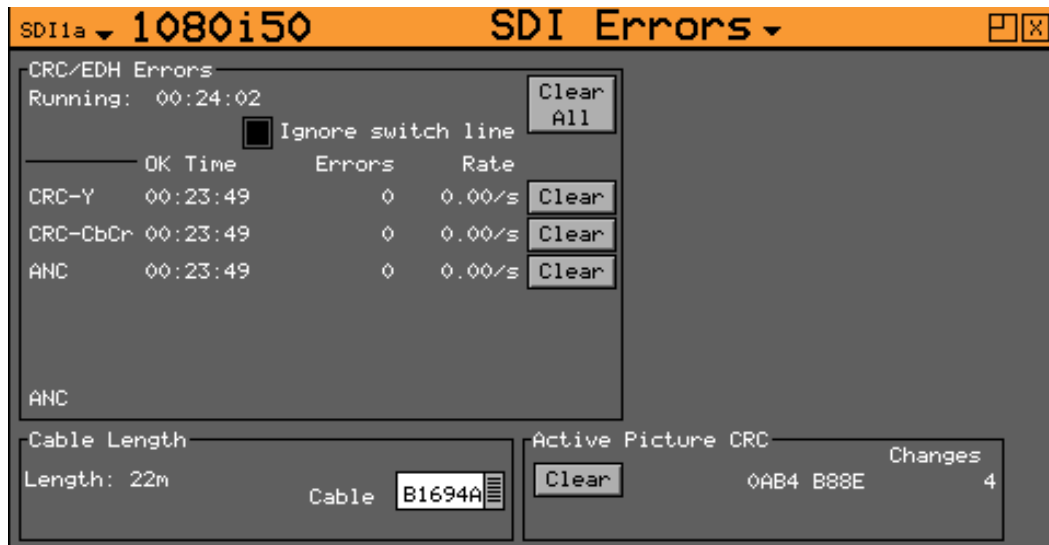
The Video Status window is accessed by clicking on an **Analyzer** slot on the monitor output task bar and selecting **SDI Errors**. This will create a new window panel for the selected input.

Selecting Video will display the EDH or CRC status of the analyzer input as appropriate for the video standard being monitored. The status of each EDH / CRC count is displayed as the number of seconds since an error occurred.

EDH/CRC Errors

This displays the EDH or CRC status of the analyzer input as appropriate for the video standard being monitored. The status of each EDH/ CRC count is displayed as the number of seconds since an error occurred. The individual CRC fields may be reset individually or together. The **Running** time field shows the time since the last error reset occurred. The error rate field shows the number of errors per second. The running time will also be affected by the input being lost or being intermittent. CRC errors are ignored on the switching line if the **Ignore switch line** checkbox is checked.

ANC checksum errors are also detected and counted and may be logged.

When analyzing a 3G-Level B signal, the CRC status is displayed for each link or stream present according to the input video format. On an RX instrument with a Dual-Link module with two video inputs, only one 3G-Level B may be analyzed for CRC status at a time.

EDH DATA

If the signal is SD (PAL-625 or NTSC-525) the EDH values for both active picture (AP) and full-field (FF) are displayed for each field. To enable engineers checking EDH integrity, the EDH values calculated for active picture and full-field are also displayed.

Under normal conditions, the EDH-AP values should be constant, the full-field values may change if audio or other ancillary data is embedded in the SDI signal.

The EDH flags for active picture, full-field and ancillary data are also displayed for diagnostic purposes.

Edh:

> Error Detected Here - This is set to 1 if a SDI error was detected. In the case of ancillary data, this means that one or more ANC data packets had an incorrect checksum.

Eda:

> Error Detected Already - This is set to 1 if a SDI error was detected in the signal received by the previous device.

Idh:

> Internal error Detected Here - This is set to 1 if a hardware error was detected in the previous device.

Ida:

> Internal error Detected Already - This is set to 1 if an idh flag was received by the previous device.

Ues:

> Unknown error status: This is set to 1 if the previous device received an SDI signal from a device not supporting EDH.

Note: Only a single EDH detector is connected to the input currently being analyzed. On an Rx instrument with multiple video inputs, only the current input being analyzed can check for EDH errors.

Cable Length

The Rx instrument measures the cable length connected to the SDI input BNC and the measurement is only an approximate value. The cable type may be set to one of the following:

- Belden: 8282, 1694A, 1505, 1855A.
- Canare L-5CFB
- Image 1000

The selected cable type will affect the cable length measurement.

Active Picture CRC

16-bit CCITT CRCs are calculated for the active picture data of the received signal. This can be used to give a known value for known static picture content and allows the user to determine if the active picture content is as expected.

CRCs are calculated independently upon each 10-bit stream (luminance and chrominance) of the interface.

For example, the generated 1920x1080, 100% bars in YCC422-10 should always produce a luminance CRC of 0x0AB4 and a chrominance CRC of 0xB88E, no matter what scanning mode (interlaced, segmented frame or progressive) or frame rate is used.

Note: When using 4:4:4, 4:4:4:4 or 12-bit video formats (in dual-link or 3Gbps) the CRCs are calculated for each of the packed 10-bit virtual interfaces and will therefore generate different values from those for YCC422-10.

Misc Status

The Rx Instrument with an Analyzer Module installed can monitor the selected input and display the content of any SMPTE 352 packets detected in the datastream.
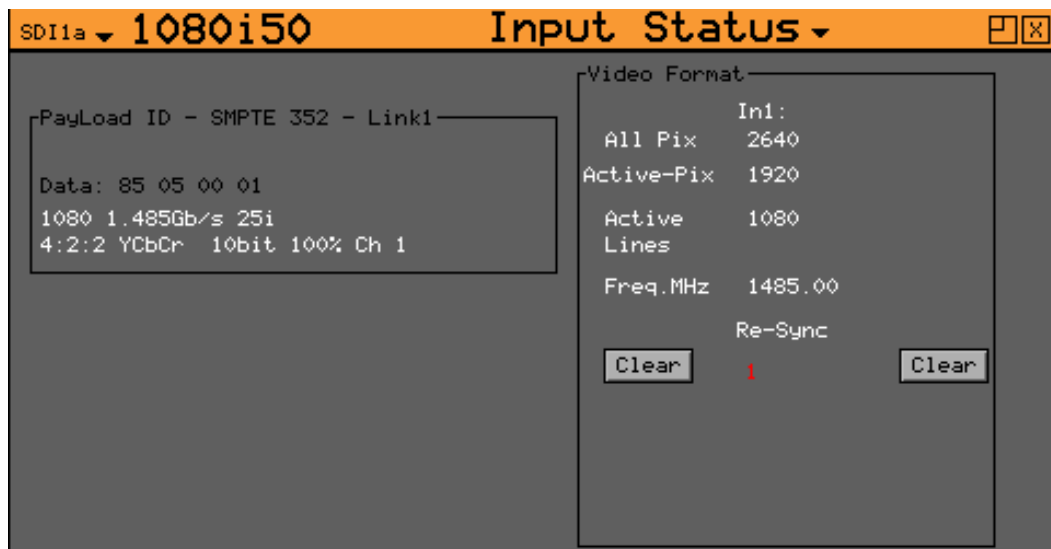
The Misc Status window is accessed by clicking on an **Analyzer** slot on the monitor output task bar and selecting **Input Status**. This will create a new window panel for the selected input.

Payload ID – SMPTE 352

If the Rx instrument has detected a SMPTE 352 ancillary packet, it will be displayed here in hex and decoded format.

The display shows the transport media, frame rate and frame mode (interlaced, progressive, or segmented) as well as color format, bit depth, dynamic range and channel number. See the SMPTE 352 specification for further details.

When analyzing a 3G-Level B signal, the SMPTE 352 status is displayed for each link or stream present according to the input video format. On an RX instrument with Dual-Link with two video inputs, only one 3G-Level B may be analyzed for SMPTE 352 status at a time.

Video Format

This displays the currently detected line length for both active video and full line including blanking as well as the number of active lines for the inputs present.

> **Note:** The video frequency displayed is only correct if the Rx instrument has been calibrated and free running or has been connected to an accurate reference input.

If the input signal is not a known signal (i.e., the line count or pixel count is not recognized) the input status on the top line will show **Invalid** but the values in this section will be updated every few seconds.

The **Re-sync** counter displays the number of times the SDI data has been re-synchronized and can help detect intermittent SDI signal problems.

Video Timing

The Rx Instrument with an Analyzer Module installed can monitor the selected input and display its timing relationship with the locking reference.
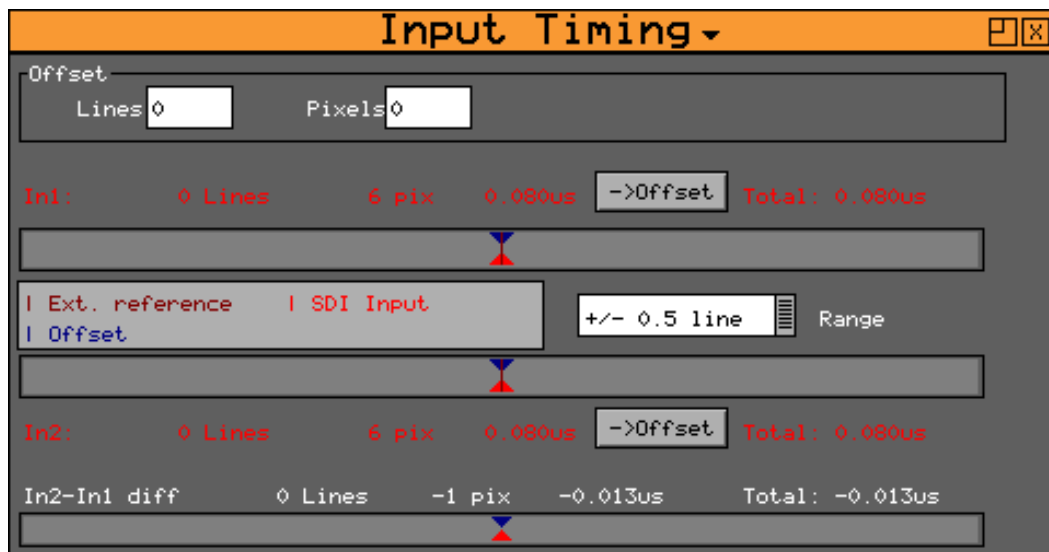
The Input Timing window is accessed by clicking on an **Analyzer** slot on the monitor output task bar and selecting **Input Timing**. This will create a new window panel for the selected input.

The timing of SDI input signals is displayed relative to the external reference. If no reference is present then an error message is displayed. If the signal is timed to within +/− 2 samples the values are displayed in black, in lines and samples (spl). If mistimed, then they will be displayed in red. A bar graph also displays the timing value which may either be line timing (+/− 0.1 lines or +/− 0.5 lines) or frame timing (+/− 0.5 frame). The total timing value is also displayed in microseconds.

The red arrow on the bar shows the SDI input timing and the blue arrow shows the current target timing point. The brown vertical line shows the timing of the reference signal.

To compare timings of different signals, connect the signal to be compared to the SDI input and select the **Offset** button to make this the current offset. All future timings will be relative to this offset value.

To clear the current offset, move the focus to the two offset fields, press **OK** to edit them and then press **Default**.

> **Note:** All timing measurements are relative to Line 1 on the SDI signal and Line 1 on the reference signal. This can lead to different values to other test and measurement instruments that include an SD (PAL/NTSC) offset in their calculations. By comparing Line 1 timings, the Rx instrument can be used to measure time delays accurately through up / down / cross converters.

ANC Status

The Rx Instrument with an Analyzer Module installed can monitor the selected input and display details of any Ancillary packets within the SDI datastream.
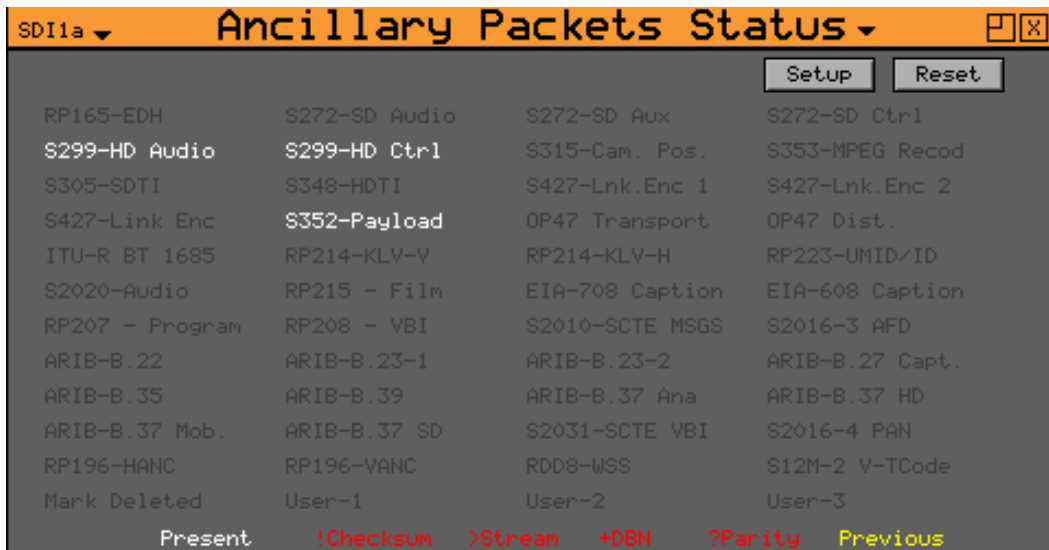
The Ancillary Packet Status window is accessed by clicking on an **Analyzer** slot on the monitor output task bar and selecting **ANC Status**. This will create a new window panel for the selected input.

The ANC status menu shows which ANC packets are present on the SDI input and whether they have any errors.

Each field is color-coded according to whether the ANC packet is present (White), missing (Gray), has errors (Red), or has previously had errors (yellow).

If the field has errors then a symbol beside the field shows which error type it is. The bottom of the page shows the symbol for each type of error. The Reset button resets the **Previous Errors** state.
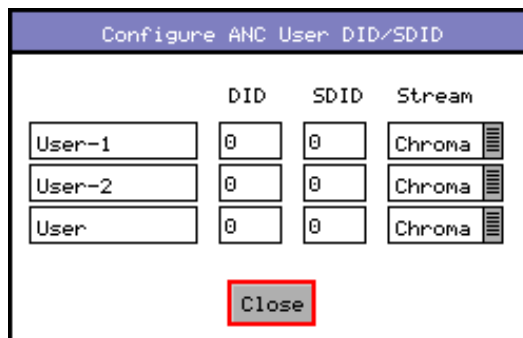
The Setup button and dialog allows user-defined ANC packets to be configured.

The packet name, data ID (DID) and SDID may be specified for up to three user-defined ancillary packets. The stream field specifies whether the packet should be on the chroma stream, the luminance stream or both. The data packets that can be trapped by the ANC Status are as follows:

RP165-EDH:

> The SMPTE RP165-EDH packet containing EDH (error data handling) and CRC (cyclic redundancy counts). This only appears on SD-SDI signals.

S272-SD Audio:

> The SMPTE 291M defined SD audio data in HANC space.

S272-SD Aux:

> The SMPTE 291M defined SD auxiliary data in HANC space.

S272-SD Ctrl:

>   The SMPTE 291M defined SD control data in HANC space.

S299-HD Audio:

>   The SMPTE 291M defined HD audio data in HANC space.

S299-HD Ctrl:

>   The SMPTE 291M defined HD control data in HANC space.

S315-Cam. Pos:

>   The SMPTE 291M defined camera position data in HANC and VANC space.

S353-MPEG Record:

>   The SMPTE 291M defined MPEG recoding data in HANC and VANC space.

S305-SDTI:

>   The SMPTE 291M defined SDTI transport data packet in active frame space.

S348-HDTI:

>   The SMPTE 291M defined HD-SDTI transport in active frame space.

S427-Lnk. Enc 1:

>   The SMPTE S427 defined link encryption data packet.

S427-Lnk. Enc 2:

>   The SMPTE S427 defined link encryption data packet.

S427-Link Enc:

>   The SMPTE S427 defined link encryption data packet.

S352-Payload:

>   The SMPTE 291M defined Payload Identification data packet in VANC space.

OP47 Transport:

>   The Free TV Operational Practice OP-47 defined transport of Closed Caption/Subtitling data in the VANC space.

OP47 Dist.:

>   The Free TV Operational Practice OP-47 defined distribution of Closed Caption/Subtitling data in the VANC space.

ITU-R BT 1685:

>   The ITU-R BT 1685 defined Structure of inter-station control data packets.

RP214-KLV-V:

>   The SMPTE defined KLV Metadata transport in VANC space.

RP214-KLV-H:

>   The SMPTE defined KLV Metadata transport in HANC space.

RP233-UMID/ID:

>   The SMPTE defined UMID (Unique Material Identifier) in VANC space.

S2020-Audio:

>   The SMPTE S2020 defined standardized data packet defining the encoding for a Dolby stereo or a multi-channel surround group of audio channels.

RP215 – Film:

>   The SMPTE defined recommended practice data packet for film codes in VANC space.

EIA-708 Caption:

>   The EIA standard defined closed caption data for HD-SDI in VANC space.

EIA-608 Caption:

>   The EIA standard defined closed caption data for SD SDI 525i (NTSC) in VANC space.

RP207 Program:

> The SMPTE RP207 defined program description data packet in VANC space.

RP208 – VBI:

> The SMPTE defined recommended practice VBI Data (vertical blanking interval data) in VANC space.

S2010-SCTE MSGS:

> The SMPTE S2010 defined standardized API message data in VANC space.

S2016-3 AFD:

> The SMPTE S2016 defined standardized AFD (active format description) and Bar data packet (defining active area of image).

ARIB-B.22:

> The ARIB-defined Sub information data packet in the VANC space.

ARIB-B.23-1:

> The ARIB-defined user data 1 packet in the VANC space.

ARIB-B.23-2:

> The ARIB-defined user data 2 packet in the VANC space.

ARIB-B.27 Capt.:

> The ARIB-defined caption data in the VANC space.

ARIB-B.35:

> The ARIB-defined trigger signal data packet for data broadcasting.

ARIB-B.39:

> The ARIB-defined inter-stationary control data packet in the VANC space.

ARIB-B.37:

> The ARIB-defined analog signal data in the VANC space.

ARIB-B.37 HD:

> The ARIB-defined HD data packet in the VANC space.

ARIB-B.37 Mob:

> The ARIB defined closed captioning information data packet.

ARIB-B.37 SD:

> The ARIB defined SD data packet in the VANC space.

S2031-SCTE VBI:

> The SCTE S2031 standard defined VBI (vertical blanking interval) data packet for closed captioning.

S2016-4 PAN:

> The SCTE S2016 standard defined pan and scan data packet.

RP196-HANC:

> The SMPTE defined recommended practice Time Code data packet in HANC space.

RP196-VANC:

> The SMPTE defined recommended practice Vertical Timecode data packet in VANC space.

RDD8-WSS:

> The SMPTE defined wide screen switching data packet in the VANC space.

S12M-2 V-Tcode:

> The SMPTE S12M defined standardized frame timecode data packet in VANC space.

Mark Deleted:

A user-defined data packet used to mark other data packets for deletion (ie to be ignored by down-stream processes.

User-1:

A user-defined data packet.

User-2:

A user-defined data packet.

User-3:

A user-defined data packet.

ANC Inspector (SDI Analysis Option)

The Rx Instrument with an Analyzer Module installed and SDI analysis option can monitor the selected input and display the contents of selected Ancillary packets within the SDI data.
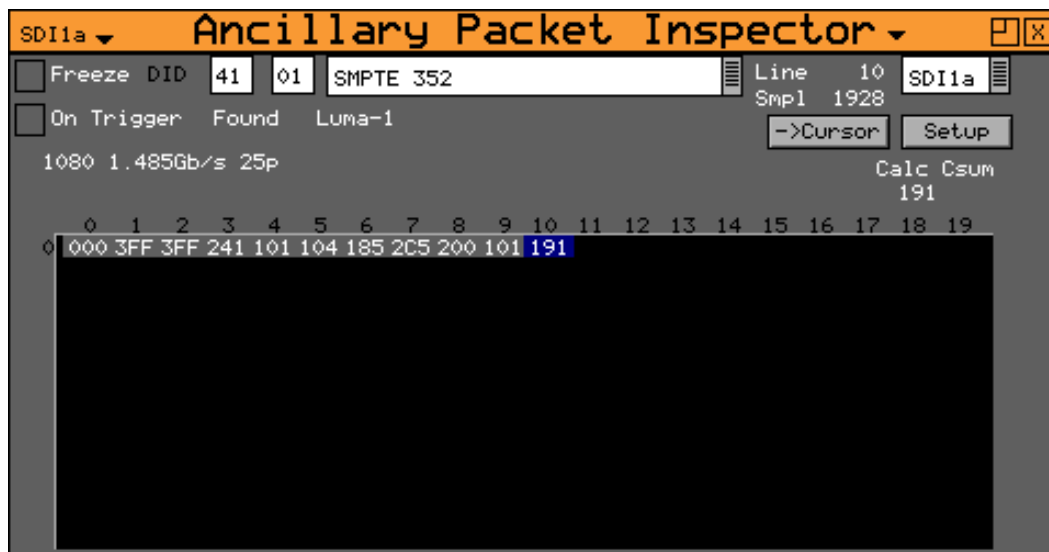
The Ancillary Inspector window is accessed by clicking on an **Analyzer** slot on the monitor output task bar and selecting **ANC Inspector**. This will create a new window panel for the selected input.

The packet type can be selected using either the dropdown list of known packets or the DID/SDID (Data Identifier/ Secondary Data Identifier) number fields (for example RP165 – EDH, S272 – SD Audio Group 1, S272 – SD Audio Group 2, etc.). If the DID/SDID values match a known type, then that type will be selected in the dropdown list. This may be further filtered using the checkboxes on the **Setup** dialog.

> **Note:** The settings of the **Setup** dialog affect the currently displayed data. For example, if any trigger parameters are set (such as DID or SubDID are set to specific values that do not appear in the data) this may prevent data being displayed.

When searching for specific data events it is advisable first to deselect the Trigger parameters such as **DID**, **subDID**, **Checksum**, **DBN** (Data Block Number), **Parity** and **ANC Gaps** to ensure that you are actually seeing data for the selected ANC packet. Only when the ANC Inspector is displaying streaming data, should you introduce the specific trigger parameters required to trap the data packet that you are looking for.

The Line and sample number of the detected packet is displayed to facilitate debugging of generation equipment. The complete data packet is displayed as a hexadecimal grid at the bottom of the page and may also be decoded into text above the grid.

If an error occurs in the packet, the header and checksum are displayed in red.

The display of data may be frozen by pressing the **Freeze** checkbox.

The **Found** description shows in which stream the ANC packet was detected, Chroma or Luma and what kind of trigger was detected. This may be:

- **C:** Checksum Error
- **D:** DBN (Data block number) Error
- **P:** Parity Error
- **G:** ANC Gap Error

Several of the above flags may be displayed at the same time.

The ANC packets detected may be filtered using the **Setup** dialog. This allows a great deal of freedom in setting when the display will be triggered.

If the **On Trigger** checkbox is checked the data packet will cause the display to be frozen and the **Freeze** checkbox will turn red when a trigger condition is met. See the section *ANC Inspector Setup* below. Un-checking the **Freeze** checkbox will restore normal operation.

The **->Cursor** button will copy the Line and Sample numbers to the SDI data view cursors to simplify navigation to the ANC packet under investigation.

ANC Inspector Setup
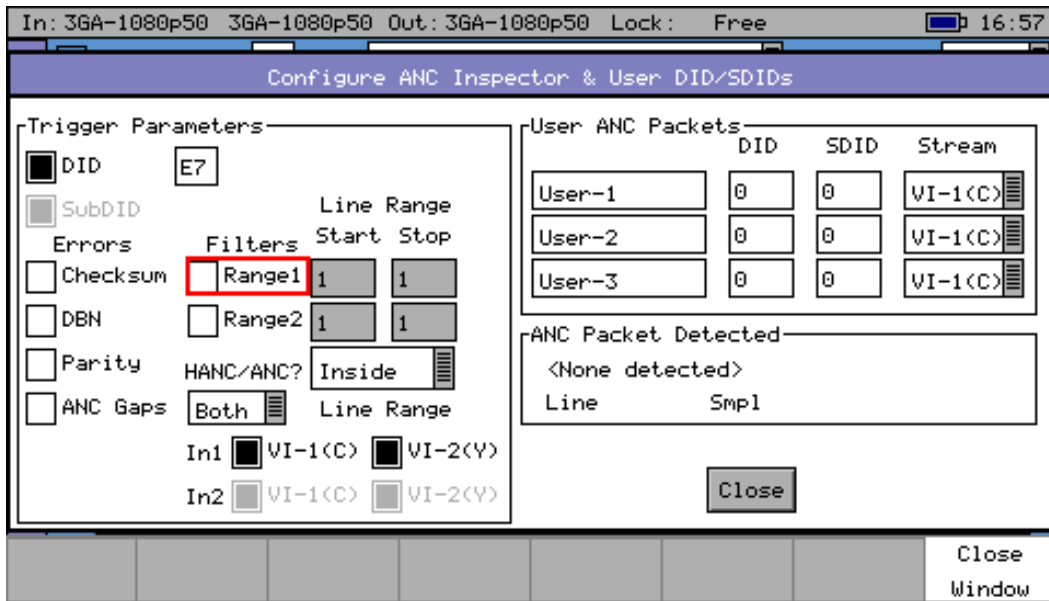
If the **Setup** button is pressed a dialog box is shown to allow the ANC packet trigger parameters to be set. The trigger parameters allow only selected lines to be checked or excluded when checking for the presence of packets.

Line Range Filter:

> If either of the Line Range Filter checkboxes are checked then the range of lines that the ANC inspector will check is limited to that range. If the **HANC/ANC** dropdown below the range is set to **Inside** then it will only check ANC packets inside the range (including the start and end lines). If it is set to **Outside** then it will only check ANC packets outside the specified range.

HANC/VANC Filter:

> A filter for simpler selection of where to search for packets. It may be selected to search the **HANC** (Horizontal Ancillary Data) area, the **VANC** (Vertical Ancillary Data) area or both areas.
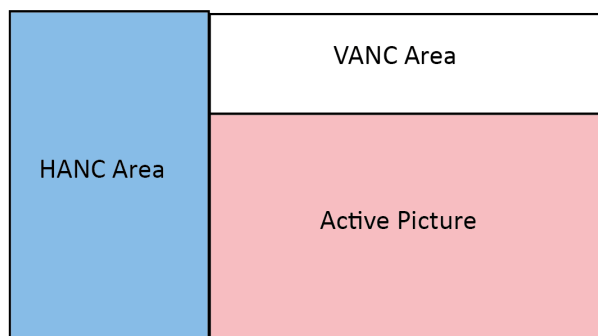
Error Triggers

If any of the **Errors** checkboxes are checked, then the ANC packet data will only be displayed if an error of that type occurs. The error states detected are:

Checksum:

A checksum error in a packet was detected. ie Sum of data between DID and final UDW (User Data Words).

DBN:

A Data Block number error was detected in an audio packet. The DBN field (in the same place as the SDID) of an audio packet should either be 0 and never change OR increment from 1...255 and then start at 1 again.

Parity:
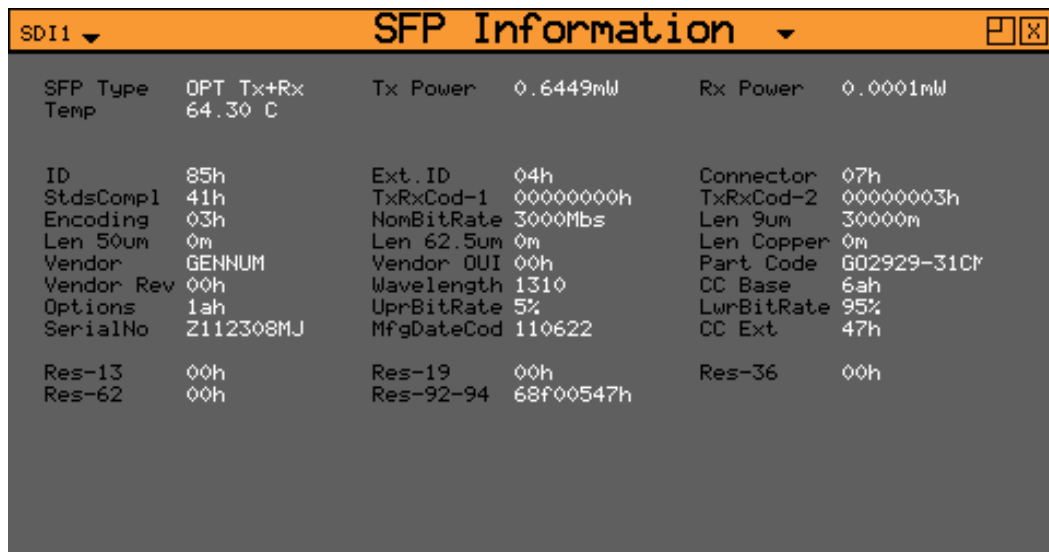
A parity error was detected for the DID, SDID and DataCount words in a packet. (Even Parity used and bit 9 is inverse of bit 8)

ANC Gaps:

The ANC packets were separated by a gap containing video blanking data. EDH (DID-D=0xf4) packets are ignored. Note that if an EDH packet is marked for deletion, this will result in an ANC GAP error.

The Setup dialog also shows when an ANC packet has been detected and where it was found. This makes changing a filter simpler as the effect of the filter can be determined without closing the dialog. This dialog also allows the user-defined ANC packets to be configured.

SFP Info


```
SDI1 ▾            SFP  Information    ▾              凹☒

  SFP Type   OPT Tx+Rx   Tx Power   0.6449mW    Rx Power   0.0001mW
  Temp       64.30 C


  ID          85h        Ext.ID     04h         Connector  07h
  StdsCompl   41h        TxRxCod-1  00000000h   TxRxCod-2  00000003h
  Encoding    03h        NomBitRate 3000Mbs     Len 9um    30000m
  Len 50um    0m         Len 62.5um 0m          Len Copper 0m
  Vendor      GENNUM     Vendor OUI 00h         Part Code  G02929-31CM
  Vendor Rev  00h        Wavelength 1310        CC Base    6ah
  Options     1ah        UprBitRate 5%          LwrBitRate 95%
  SerialNo    Z112308MJ  MfgDateCod 110622      CC Ext     47h


  Res-13      00h        Res-19     00h         Res-36     00h
  Res-62      00h        Res-92-94  68f00547h
```

The **SFP Info** menu displays details of the currently installed SFP module.

Along with the manufacturer's details of the SFP parameters, this displays the transmitted and received power which can indicate optical losses in the infrastructure (optical fiber type, distance and connection quality.)

Audio Metering

The Rx Instrument with an Analyzer Module installed can monitor the selected input audio and graphically display the audio level for each audio channel.
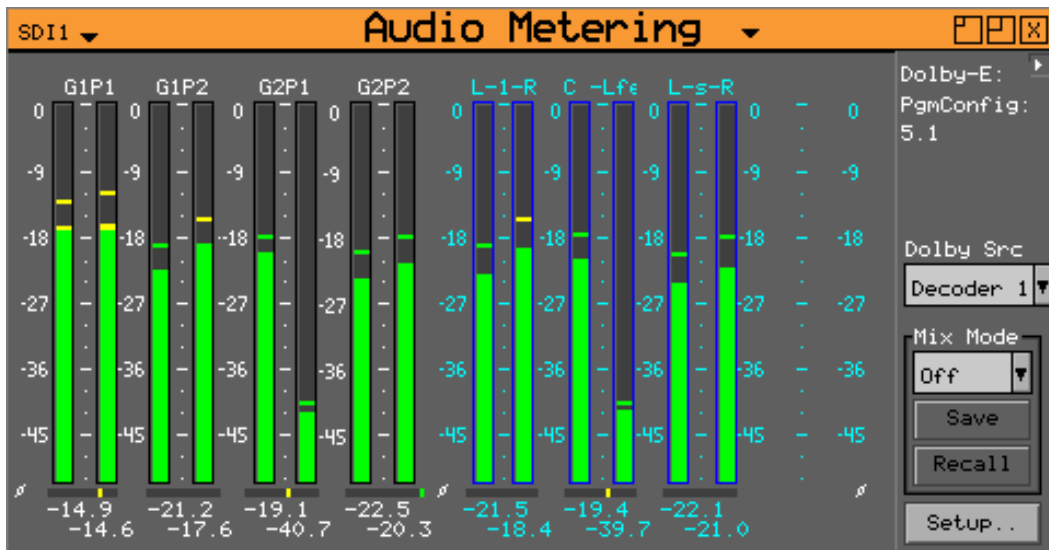
The Audio Metering window is accessed by clicking on an **Analyzer** slot on the monitor output task bar and selecting **Audio Meters**. This will create a new window panel for the selected input.

Note that where the Meters are displaying Dolby encoded audio data this will be labeled as such.

This window shows up to 16 audio channels. The source for each meter pair may be independently set to allow simultaneous metering of eight different meter pairs associated with the Analyzer or all 16 channels in an embedded SDI stream. This is selected using the **Setup** menu at the right of the window.
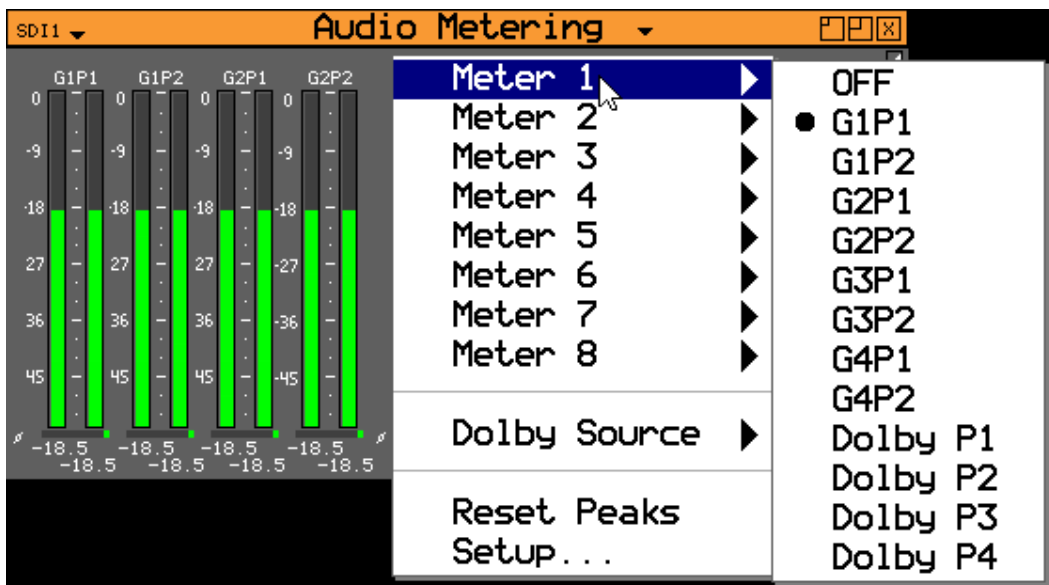
Right-clicking on the individual meters or on the window will display context-sensitive menus that can be used to control the functions of these instruments.

Audio Phase Meters

The signal amplitudes and the stereo pair phase meters are displayed at the bottom of each pair of audio PPMs.

If the phase indicator is green and aligned to the right then the stereo pair is fully in phase (i.e., the signal on both left and right are exactly the same which usually occurs only when a mono signal is on both channels.)

If the phase indicator is yellow and aligned in the center this indicates that the stereo pair is *in phase* (i.e., the normal position for a stereo pair.)

If the phase indicator is red and aligned to the left then the stereo pair is fully out-of-phase, (i.e., the signal on the left and right channels are 180 degrees out of phase.)

Metering Setup
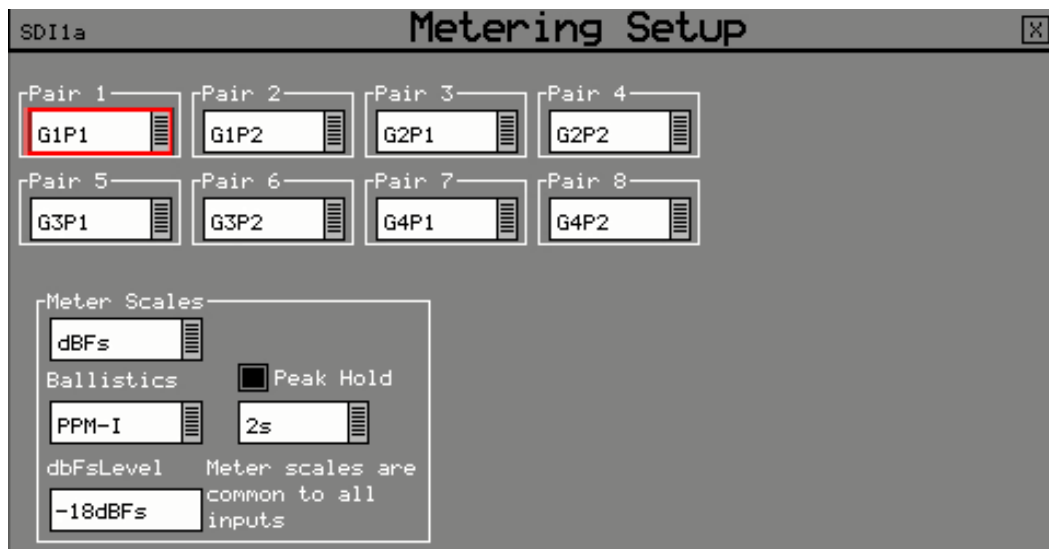
The source for each pair of audio meters can be selected from the dropdown lists for each pair. These choices can be SDI embedded audio channels, AES audio pairs or decoded Dolby audio channels.

The scale and peak program meter ballistics can also be selected from the dropdown menus.

The scale used by the meters may be set to −18dB, −20dB, BBC, BBCM, DIN45406 or NordicN9 according to the standard operating level used. The graticule and audio levels displayed will change to match the selected scale. The ballistics of the meter can be set to:

- **PPM I**: emulating the performance of IEC 60268-10 Type I PPM style audio meters typically used by German broadcasters.

- **PPM II**: emulating the performance of IEC 60268-10 Type II PPM style audio meters typically used by UK broadcasters.

- **Vu**: emulating the performance of IEC 60268-17 style audio meters typically used by American and Australian broadcasters.

- **Vu-Fr**: emulating the performance of ITU-R Rec. BS.645 style audio meters typically used by French broadcasters.

- **Fast**: displaying the meters without any ballistics applied. Primarily for automated measurement purposes where readings can be taken without waiting for levels to settle.

These settings affect the response of the meter display to dynamic changes in audio level.

The **Peak Hold** bars can be displayed if the checkbox is selected and the decay time can be setup using the dropdown list. The scale and peak program meter ballistics can also be selected from the dropdown menus.

Audio Mix Mode
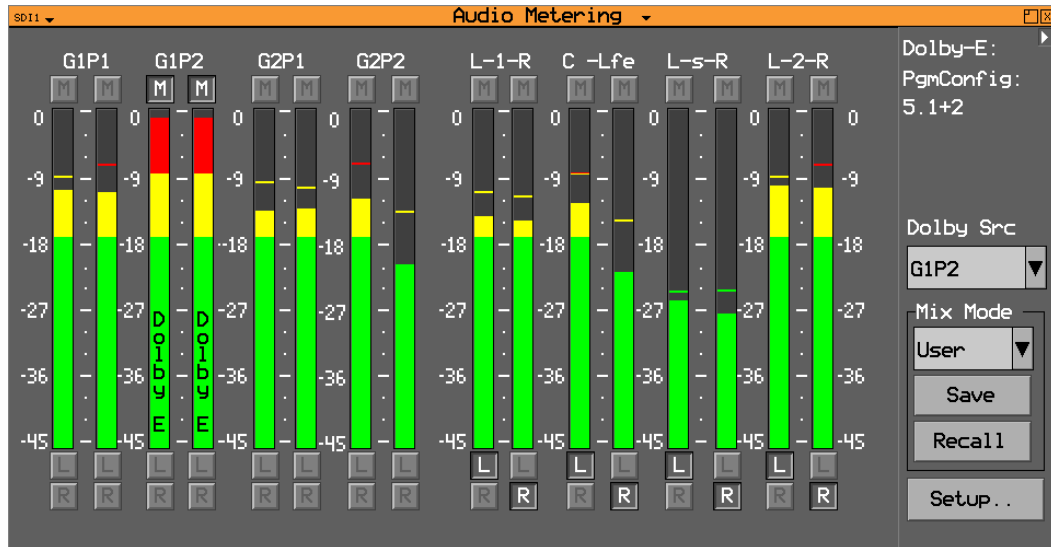
The Mix Mode function allows selected channels to be assigned to the left and right channels of the Audio Monitoring output when **Analyzer ➙ Downmix** is selected.

The dropdown menu allows **Mix Mode** to be set to **User defined**, **5.1A** or **5.1B** to use mappings defined in the **System - Surround Channel Setup**.

The Mix Mode channel mappings can be saved as an audio preset using the **Save** button and recalled using the front panel preset controls.

4AES Module

The Rx Instrument with an 4AES Module installed can monitor the selected AES input audio pairs and graphically display the audio level for up to four pairs of AES audio channels.

Dolby Metadata Analysis

If the metadata Dolby analyzer option is installed, selecting **Metadata** from the dropdown list on the meter window will display the encoded Dolby metadata levels for up to eight Dolby channels within the specified embedded audio pair or AES input.

If AES inputs are present then these may also be metered. At the bottom of each meter is the current audio level for that channel in dBFs (decibels relative to 0 dB full-scale).

> **Note:** Dolby audio cannot be heard on the speaker if the Dolby Decoder module is not present.

Dolby Decoder module

If the Dolby Decoder module is installed, the levels of the decoded baseband audio channel pairs can be monitored using the Audio Meters. To do this, select either **Dolby P1**, **Dolby P2**, **Dolby P3**, etc. using the **Setup** menu.

The **Decoder 1** and **Decoder 2** selections from the dropdown list on the meter window will display the levels for the decoded Dolby audio channels. With Decoder 1 or 2 selected the meter display will turn blue to indicate that decoded Dolby audio is in use and channels can be selected as part of a downmix.

SDI Audio Status

The Rx Instrument with an Analyzer Module installed can monitor the selected input audio and detail its audio encoding details.
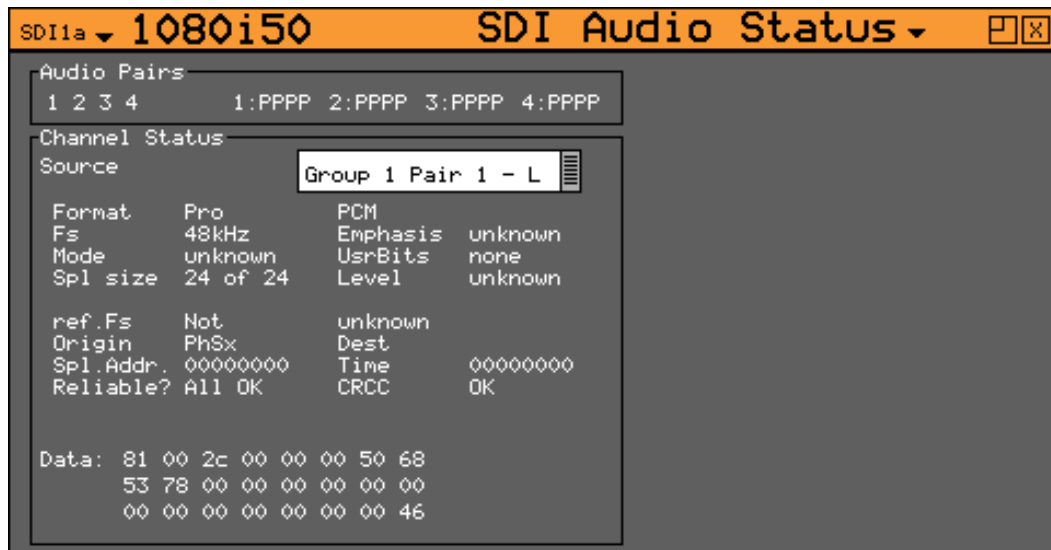
The SDI Audio Status window is accessed by clicking on an **Analyzer** slot on the monitor output task bar and selecting **Audio Status**. This will create a new window panel for the selected input.

The Audio Status menu shows the Channel Status for the selected audio channel is displayed in decoded form as well as a hexadecimal dump of the bytes.

Lissajous

The Lissajous window is accessed by clicking on an **Analyzer** slot on the monitor output task bar and selecting **Lissajous**. This will create a new window panel for the selected input.
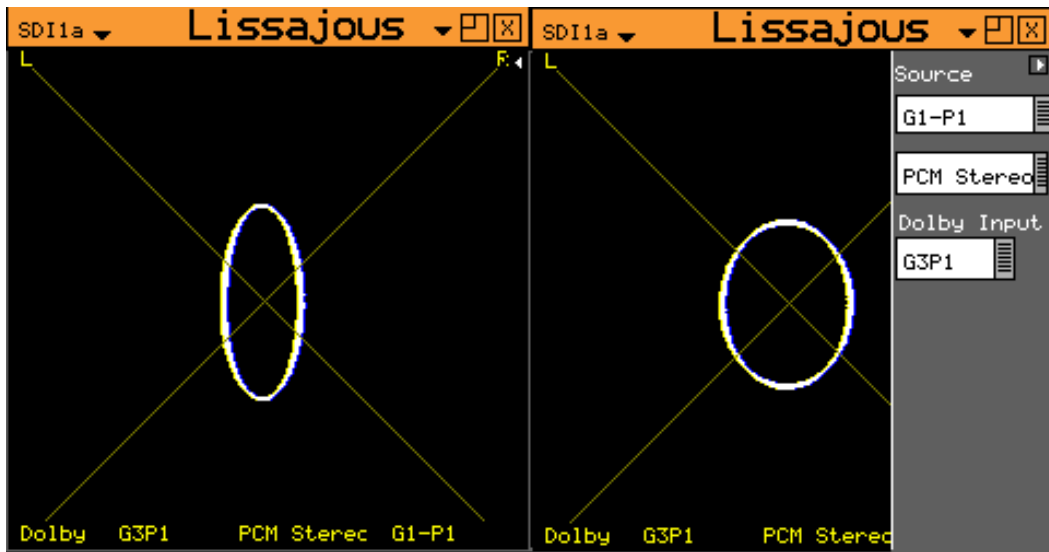
Selecting the white arrow in the top corner of the window will show or hide the menu controls.

The stereo audio pair to be monitored can be selected from the dropdown list.

If a Dolby Decoder module is installed then a mixed-down version of the decoded Dolby digital audio channels can be displayed.

Loudness Meters

The tools provided in the **Loudness** window allow the loudness of the selected source stereo audio pair, 5.1 surround sound audio group or decoded Dolby program (from the Dolby Decoder module) to be monitored and measured. The Rx system provides up to four Loudness meters as standard, allocated as one loudness channel per analyzer module. The **Loudness** meters are accessed from the **Analyzer** module menu on the HDMI® monitor output.
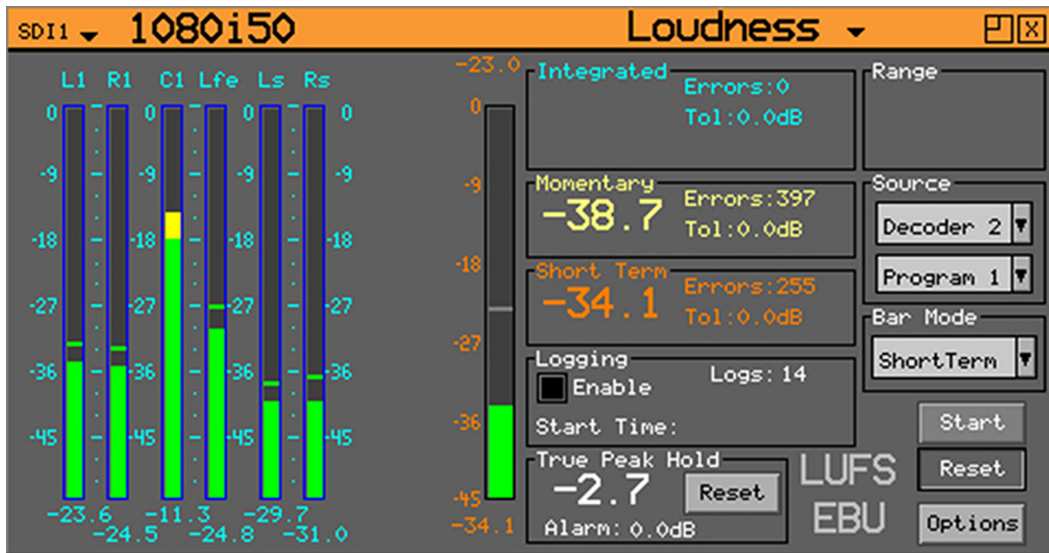
Loudness is measured in accordance with ITU 1770 and EBU Recommendation 128 which define the measurement in terms of Loudness Units (UI), Loudness Units Full Scale (LUFS), or Loudness K-weighted Full Scale (LKFS) over different time periods.

The Loudness display allows the required mode (Integrated, Momentary or Short Term), input (SDI, Fiber or AES) and (for a Dolby Decoder audio source) Dolby program to be selected.

The left-hand side of the window displays the actual audio values of the selected audio channels numerically and graphically. The right-hand part of the window provides the current Integrated, Momentary and Short Term loudness values, a loudness bar graphically displaying the selected loudness mode value, input and source selection, and the loudness logging controls.

The right-hand part of the window also provides a True Peak Hold indicator showing the highest perceived loudness level measured. The value will be displayed in red if it exceeds the True Peak Alarm threshold level shown. The Alarm level is configurable in **Options**. The True Peak Hold indicator can be reset as required.

Loudness Logging

If the **Enable** checkbox is selected in the **Logging** section, the system will log loudness continuously and save **CSV** files every 30 minutes.

As defined in the EBU Recommendation 128, the Loudness Meter provides the following functions:

- **Start:** Starts the integrated loudness measurement.

- **Pause:** Pauses the current integrated loudness logging process. Re-selecting this button will resume the loudness logging process from the point at which it was paused.

- **Reset:** Clears the current Infinitely integrated loudness session.

Loudness logs are stored automatically each time the pre-set duration is reached. The duration can be defined in the **Export Time** setting of the **Options**, to be between 1 minute and 3 hours long, although 30 minute intervals are more practical. These logs will be individual, time-stamped CSV

(comma separated value) files which are held in the **loudness** folder of the Rx operating system (See the section _Rx File Structure_ for details).

Log files can be saved manually at any time by selecting the **Save** button in the **Loudness Options** window; which can be accessed by selecting the **Options** button. Selecting the **Save Name** text box will display an on-screen keyboard to allow the CSV file to be named appropriately. These logs can be copied onto a USB pen drive if inserted into the front panel USB port and selected from the **loudness** folder.

Loudness Modes

The loudness is measured simultaneously with three different time periods:

- **M** (momentary) covering the shortest timescale of 400 ms
- **S** (short term) covering the intermediate timescale of 3 seconds
- **I** (integrated) covering the duration of a program or segment.

The M, S and I values are displayed for the selected audio pair or 5.1 surround sound audio channels.

Input and Source

The SDI input with the embedded audio channels to be monitored is selected from the **Input** dropdown list. The audio channels in the selected input are then selectable from the **Source** dropdown list. The loudness meter can display and log the loudness of stereo pairs (for example **G1-P1**), 5.1 surround sound audio channels.
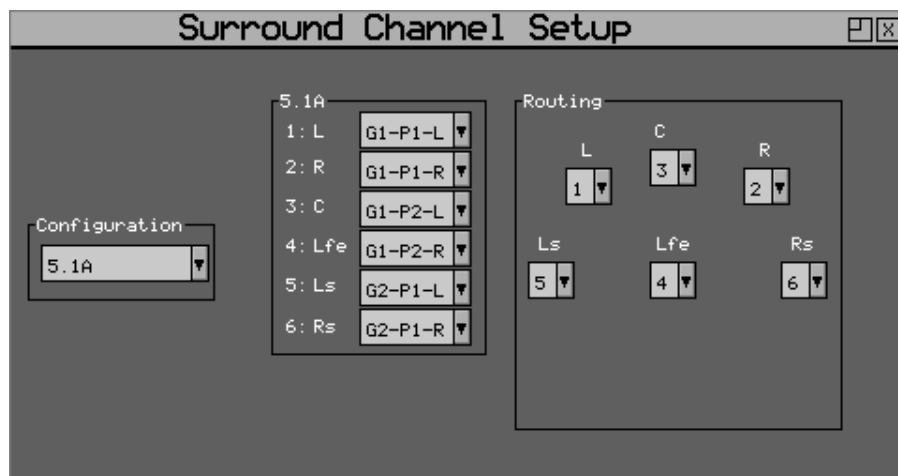
Note that the channel mapping for the 5.1 surround sound channels is defined in the **System ➜ Surround Channel Setup** window.

This allows the individual audio channels from the selected SDI input(s) to be mapped to the L (left), R (right), C (center), Lfe (low frequency effects), Ls (left surround), Rs (right surround), Bsl (back surround left) and Bsr (back surround right).

Loudness Options

The **Options** menu allows the selection of meter scale (LU, LUFS or LKFS), measurement standard (EBU or ITU) and Meter Range as well as user-defined threshold values for Integrated, Momentary and Short Term loudness. This menu also allows the manual or automatic deletion of Loudness logs.

The **Mode** dropdown allows the selection of the displayed scale of LU (Loudness Unit), LUFS (Loudness Unit Full Scale) or LKFS (Loudness K-weighted Full Scale). These affect the loudness values measured. Note that LUFS and LKFS have a −23 dB weighting to standardize broadcast loudness measurement and prevent digital clipping. So if a −23 dB test tone is measured it will give 0 LUFS or 0 LKFS.

The **Standard** dropdown menu allows the EBU RP128 or ITU 1770 loudness measurement standard to be selected. These affect the loudness values measured.

The **Audio** and **dBFS** dropdowns in the **Scales** section allow the scales of the audio channel meters to be selected. The actual scale of the Loudness meter is defined by the loudness mode selection.

The **Integrated** (Infinity), **Momentary** and **Short Term** target values define the level, above which, a loudness error is logged as exceeding the defined upper limits. The errors count is displayed on the Loudness window. If theTargets **Enable** checkbox is selected in the **Local Options** section, cursors will be displayed on the meter bar and the loudness values will flash red when the target level is exceeded. The dB values next to the Integrated (Infinity), Momentary and Short Term values allow a guard band to be set above the target value.

The **True Peak Alarm** threshold can be set in the **True Peak** section, .

Select the **OK** button to save the current changes or the **Cancel** button to discard any changes.

Loudness logs that have been manually or automatically saved can be deleted manually using the **Delete** and **Delete All** buttons. When continuously logging program loudness, the **Auto Delete** function can be used to delete log files older than 1 to 10 days. To narrow down the search when looking for existing log files, enable the **Filter** checkbox and then enter file name text in the **Filter** text box.

GPIO Loudness Control

The loudness meters can be controlled by way of the GPIO interface using pins 0 and 1 or pins 2 and 3. The control mechanism functions as follows:

Pin 0 / 2 Enable/Reset	Pin 1 / 3 Run-/Pause	Loudness Operation
1	1	Reset
1	0	Reset
0	1	Paused
0	0	Running

Where:

- **0** Represents Active **LOW** (grounded)

- **1** Represents NOT 0 (**HIGH**)

- Pin **0 / 2** default (**HIGH**): Reset

- Pin **1 / 3** default (**HIGH**): Run

When using the Loudness GPIO Control, the default state is Reset.

This is equivalent to the default state of the Loudness user interface at power-on of the Rx. While Enable / Reset is HIGH (Reset) the state of Run / Pause is ignored.

To start Loudness monitoring:

The Enable / Reset Pin is asserted LOW (Enable, leaving Run / Pause HIGH (Run).

To pause Loudness monitoring:

The Run / Pause Pin is asserted LOW (Pause) and it will remain paused until the Run / Pause pin goes HIGH (Run).

To reset Loudness monitoring:

The Enable / Reset Pin is asserted HIGH (RESET). Loudness will remain stopped (in RESET) while the Enable / Reset Pin remains HIGH (RESET).

While Loudness GPIO Control is enabled, the two buttons which allow the user to start, stop, pause, resume and reset Loudness in the GUI are hidden and replaced by the GPI Control state.
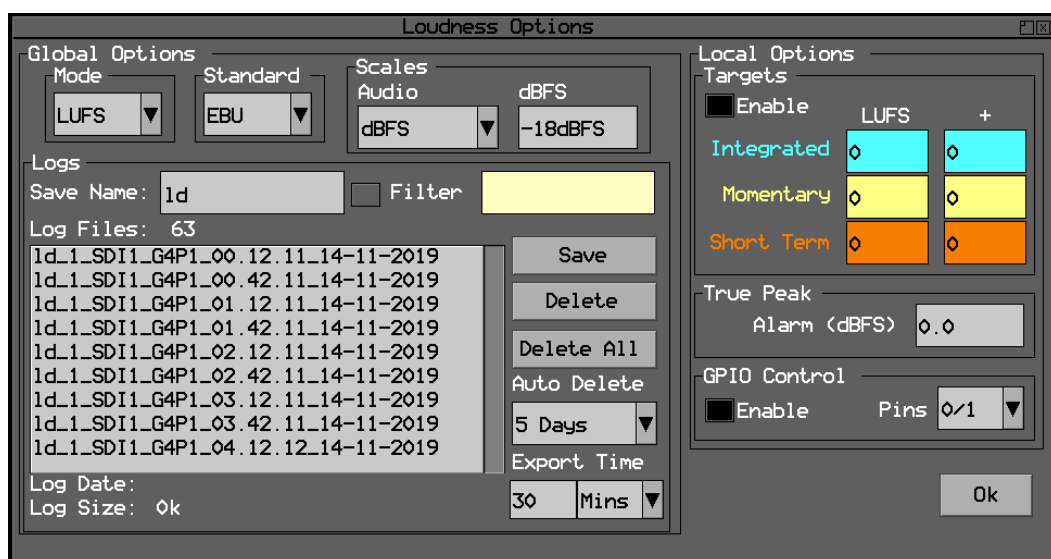
The **Options** menu has a new local configuration section for GPIO Control where the user can Enable / Disable external control and select which two of the four GPI Pins to use (the choice is 0/1 or 2/3). This enables the user to control two different loudness monitors independently via GPIO or control multiple loudness monitors from the same GPIO control.

When Pins 2/3 are selected, Pin 2 is Enable / Reset and Pin 3 is Run / Pause

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The following screen shows GPIO Control in the running state:
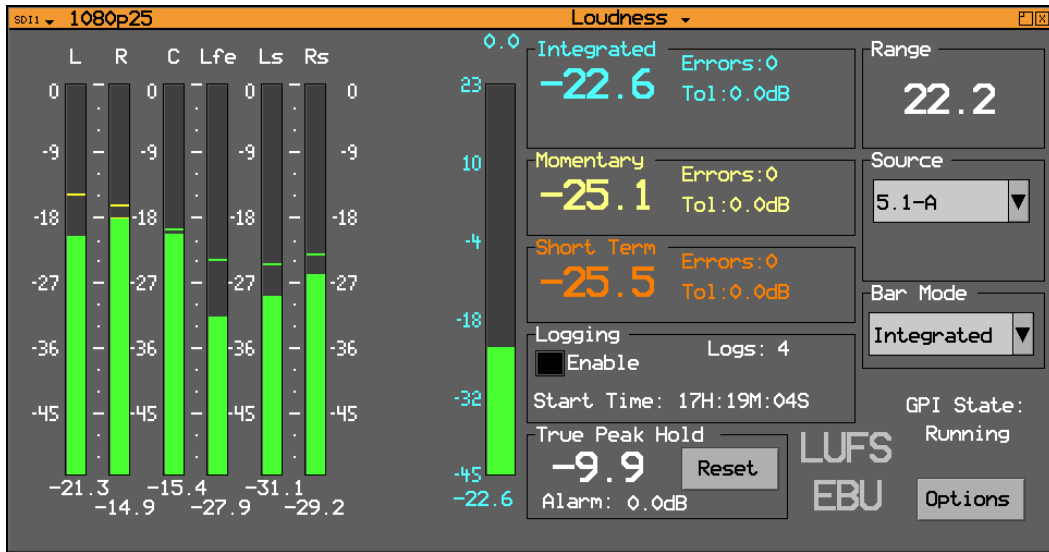
When the Loudness Meter(s) are under GPIO Control, the current GPI state is displayed in the bottom-right corner of the window, for example:

- GPI State: Running

- GPI State: Paused

- GPI State: Reset

Configuration Conflict Handling for GPIO Preset and Loudness Control

The user can now select GPIO Input control from either the **Presets** screen or the **Loudness Options** screen. It is possible to enable GPIO control for both Presets and Loudness at the same time but, on experiencing a conflicting setting, the system displays an error dialog stating that the current configuration is invalid:
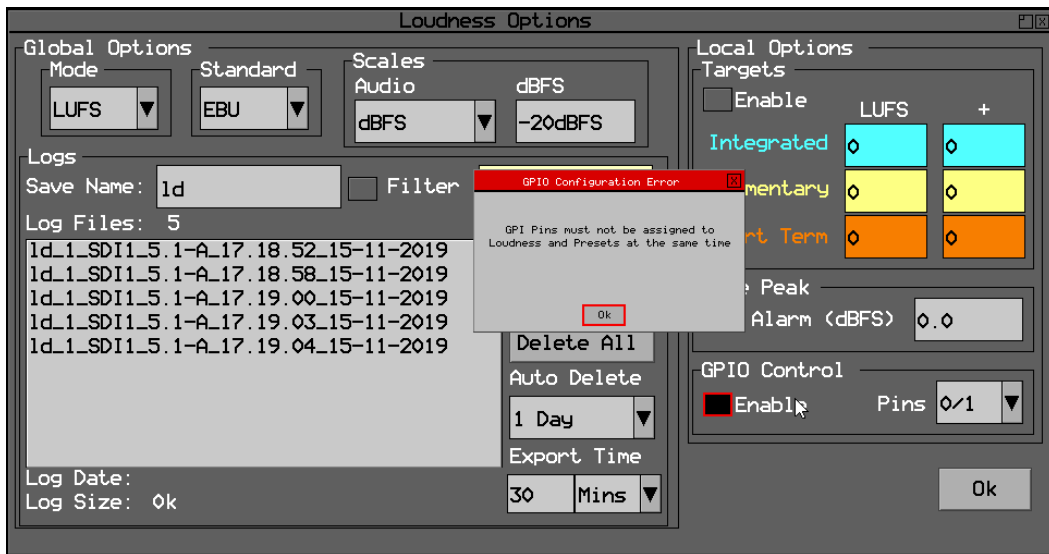
Click Ok to close the error dialog and resolve the GPIO conflict between the Loudness and Preset controls.

Logging with GPIO Loudness Control Enabled

The GPIO Loudness Control will begin a new log file on starting or resuming Loudness monitoring (if configured in the Loudness options.) The GPIO pins can also be used to force a new log file while Loudness is running by pulsing the Run/Pause control for 100 ms.

Confidence Check

These different measure modes can give unpredictable results dependent on the type of program and the combination of narrative, music and loud audio events such as explosions. The actual values measured are also affected by the meter scale.

As a simple confidence check, use a stereo sine wave, 1000 Hz, −23.0 dBFS (per-channel peak level), in phase as the test tone applied to both channels simultaneously for 20 second duration. This should give the following results:

- M, S, I = −23.0 ±0.1 LUFS or
- M, S, I = 0.0 ±0.1 LU

Dolby Metadata (Dolby Analyzer Option)

The Rx Instrument with an Analyzer Module installed and Dolby Analyzer Option can monitor the selected input audio and provide details of its Dolby E , Dolby Digital or Dolby Digital Plus audio encoding.
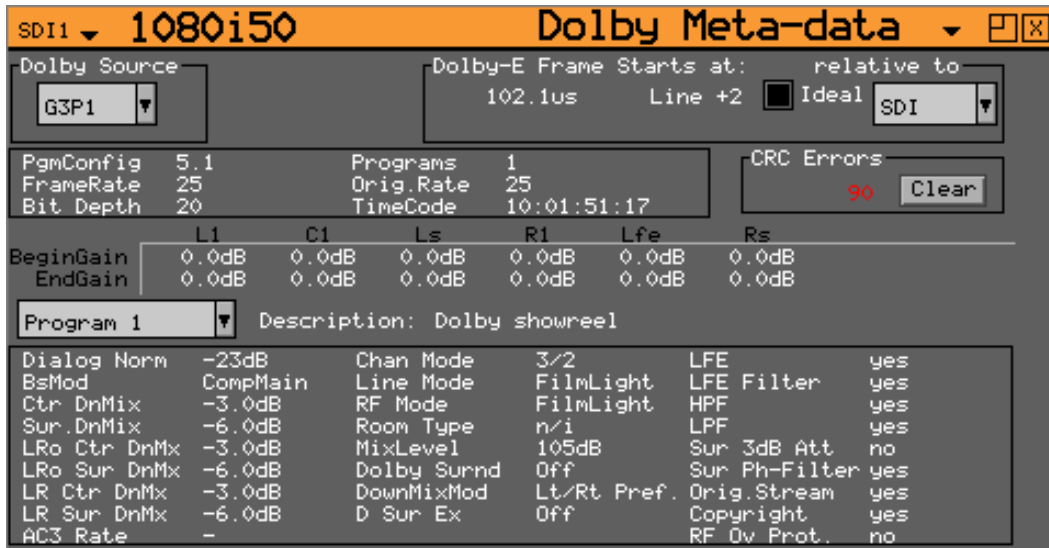
The Dolby Metadata window is accessed by clicking on an **Analyzer** slot on the monitor output task bar and selecting **Dolby Metadata**. This will create a new window panel for the selected input.

The Dolby Metadata window allows display of the Dolby metadata present in the selected audio stream.

This window also allows the correct timing of the Dolby E packets within the SDI signal to be checked at all stages in a broadcast chain. Checks can be made to see that the Dolby E has been created correctly and transferred transparently through the broadcast chain unaffected by routers/switchers, satellite links, etc.

Overview

Dolby E, Dolby Digital and Dolby Digital Plus digital audio standards can be transported as audio data over an SMPTE 337M AES carrier with a 48 kHz sample rate.

These standards can be used to transport mono, stereo, 5.1 and 7.1 audio programs:

- **Dolby 5.1** - involves five channels for normal-range speakers (20 Hz – 20,000 Hz) (right front, center, left front, rear right, rear left) and one channel (20 Hz – 120 Hz allotted audio) for the sub-woofer driven low-frequency effects.

Dolby E

Dolby E is a production audio encoding and decoding technology developed by Dolby Laboratories that allows up to 8 channels of audio (mono, stereo, 5.1 or 7.1) that for a primary program (Programme 1) and optional ancillary programs. These 8 channels are compressed (low loss) into a digital stream that can be transferred between compatible devices and stored on a standard stereo pair of audio tracks.

This format is video frame based and allows switching a further processing/compression.

Dolby Digital

Dolby Digital (AC-3) is a 'perceptual audio' system for digital audio that allows the reduction of data needs to deliver high-quality sound. This system was developed primarily for DTV, DVD and HDTV.

This format allows up to six channels of sound (mono, stereo or 5.1) in the form of a single 'program' that can be delivered at different bit rates. These 6 channels are compressed (lossy) into a digital stream that can be broadcast. The most elaborate mode in common use is Dolby 5.1 with uses all six channels to provide surround sound.

Dolby Digital Plus

Dolby Digital Plus (E-AC-3) is a more advanced version of Dolby Digital that provides a more efficient encoding algorithm with enough bandwidth to allow up to 20 channels of audio (mono, stereo, 5.1, 7.1 up to 13.1) for a primary program (Programme 1) and optional ancillary programs that can be delivered at lower bit rates than Dolby Digital. These 20 channels are compressed (lossy) into an independent digital datastream plus up to 8 dependent sub stream that can be transferred between compatible devices and stored on a standard stereo pair of audio tracks.

Analyzer Reference

For the Dolby E data to be decoded correctly, the internal audio circuitry requires a reference that is synchronized to the input SDI signal for embedded audio and the external system reference for AES audio. The Generator Reference *must not* be set to Free-Run or Dolby errors may be detected. Note that the description field will display "Invalid Reference" if an incorrect reference is selected.
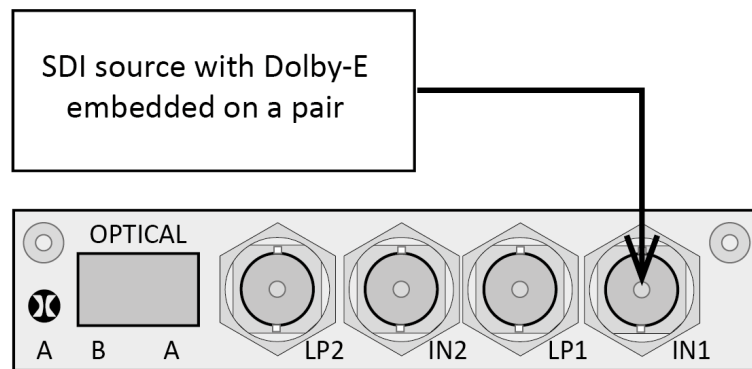
In this example, the SDI signal contains embedded audio with Dolby E, Dolby Digital or Dolby Digital Plus present on one or more audio pairs. The Rx instrument needs to lock its internal audio clock to the SDI signal and the Rx needs to be configured to select the specific audio channels containing the Dolby audio.

In the example below, the AES signal contains a Dolby digital audio stream. The Rx instrument needs to lock its internal audio clock to the external reference signal. This can be done from the **Ref** menu on the HDMI task bar.
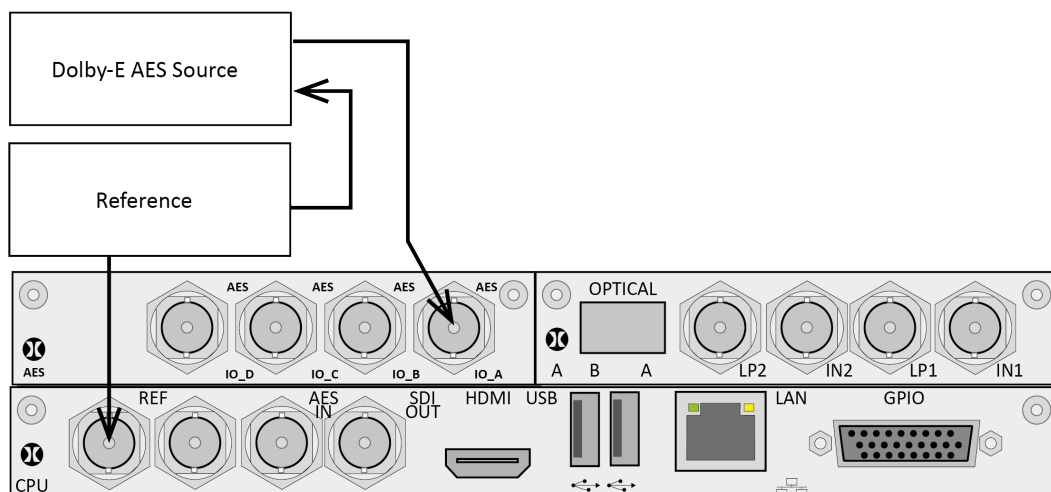
In the Dolby Metadata window, the **Dolby Timing** source should be set to **Ext Ref**.

The AES source *must* be locked to the same reference as the Rx.

Source Selection

The Dolby E may be monitored from any of the SDI input embedded audio channel pairs or the AES input. The two dropdown lists in this section allow the module input and specific audio channels to be selected.

Dolby E Framing Values

It is important for the Dolby E packet to be positioned well away from the video switching line so that Dolby E packets are not corrupted by downstream switchers. At all places in the signal chain where audio can be delayed by a different value to the video, the Dolby E packet needs to be re-timed to make sure that this timing specification is met. The position of the Dolby E packet in the video frame is displayed in lines and microseconds (µs).

Dolby E Timing source

Dolby E timing may be measured relative to the SDI input or the External reference. If the 'Ideal' checkbox is checked, the Dolby E Frame timing is relative to the normal position that it should be, ie it should be as close to 0 as possible. Each video standard has a specified 'Ideal' line number that the Dolby E packet should start on. If the Dolby E timing line is outside the valid range of lines it will be displayed in red. If it is outside the ideal range it will be displayed in dark green – this is still a valid Dolby E position but not recommended by Dolby. The timing measurement is always displayed in terms of the SDI input lines and thus if an AES input is used as the Dolby E source, the line position will *not* be displayed.

If you do not have the same reference as the SDI source, you will have to set the Reference Source and Dolby Timing Source to be the SDI input.

> **Note:** If Dolby E is present on a fast frame rate signal (50p, 59p or 60p) then it should always be referenced to a interlaced reference at the same field rate as the packet length is longer than a single frame and must start at the beginning of an even numbered frame.

Dolby E Program Configuration
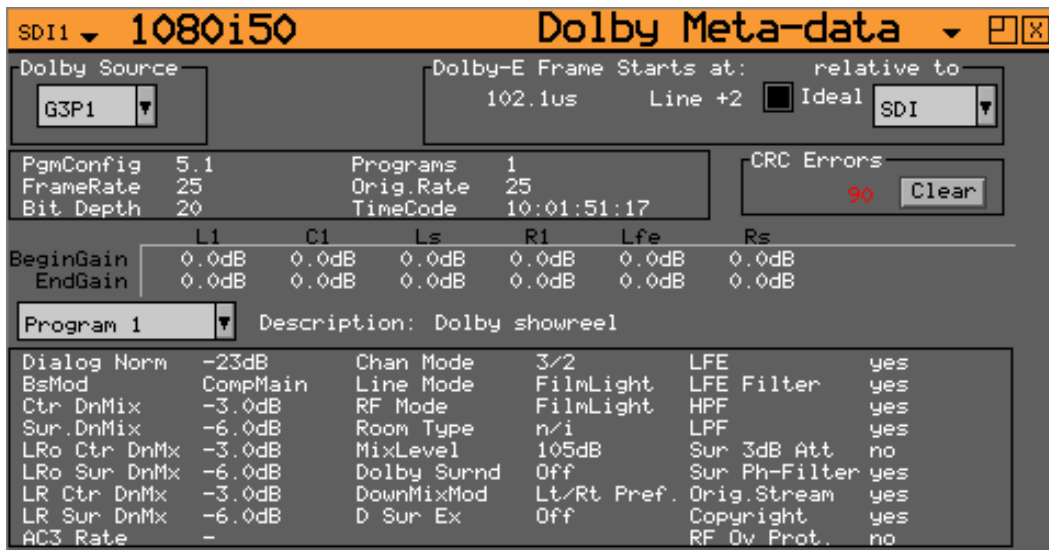
This displays the Program configuration (5.1 etc.), the number of program in the metadata, the frame rates and bit depths and time-code if present.

CRC Errors:

This displays the number of CRC errors detected in the Dolby E metadata.

Begin Gain:

These fields indicate the gain to be applied to the specified channel at the beginning of the audio frame when decoding.

End Gain:

These fields indicate the gain to be applied to the specified channel at the end of the audio frame when decoding.

Program selection:

Selects which set of program metadata is shown. Up to 8 programs can be encoded in the Dolby E packet dependent on the Program Configuration.

Program description:

User-defined description for the selected program.

Dolby Digital Program Configuration
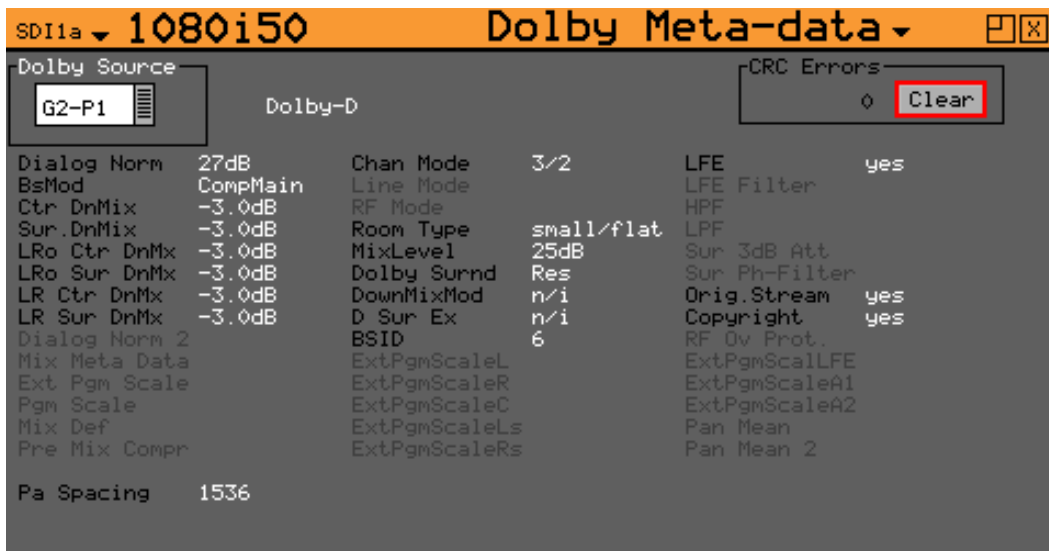
When Dolby Digital metadata is analyzed this displays channel configuration and limited metadata that is sent with Dolby Digital.

Dolby Digital Plus Program configuration

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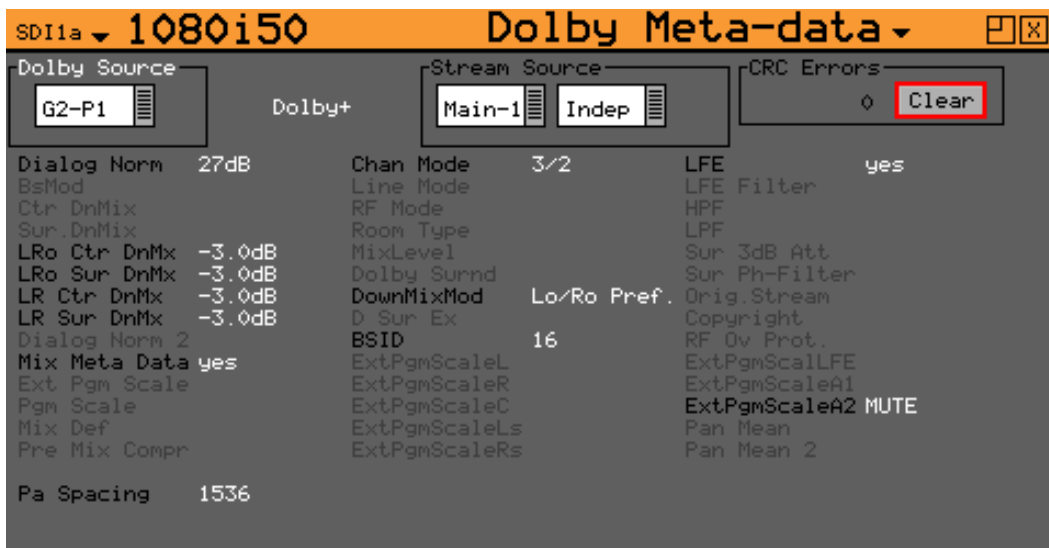
When Dolby Digital Plus metadata is analyzed this displays the Main, Dependent and Independent program stream configuration and limited metadata that is sent with Dolby Digital Plus.

Program Metadata

Program metadata is created as part of Dolby authoring process. The following metadata is typically provided with a Dolby E Program. Dolby Digital and Dolby Digital Plus will use a subset of this metadata:

Dialogue Norm:

>The standard audio level for dialog.

BsMod:

>(Bitstream Mode) indicates the type of audio service that the bitstream contains. Complete Main (CM) is the normal mode of operation and contains a complete audio program including dialog, music, and effects.

Ctr DnMix:

>(Center down-mix) is a weighting value used in the encoding and decoding of surround sound mixes for a Dolby 5.1 Independent Substream.

Sur DnMix:

>(Surround down-mix) is a weighting value used in the encoding and decoding of surround sound mixes for a Dolby 5.1 Independent Substream.

LRoCtrDnMix:

>(Left, right, stereo, center down-mix) is a weighting value used in the encoding and decoding of surround sound mixes for a Dolby 7.1 Dependent Substream.

LRoSurDnMix:

>(Left, right, stereo, surround down-mix) is a weighting value used in the encoding and decoding of surround sound mixes for a Dolby 7.1 Dependent Substream.

LR CtrDnMix:

>(Left, right, center down-mix) is a weighting value used in the encoding and decoding of surround sound mixes for a Dolby 5.1 Independent Substream.

LR SurDnMix:

>(Left, right, surround down-mix) is a weighting value used in the encoding and decoding of surround sound mixes for a Dolby 5.1 Independent Substream.

Chan Mode:

>Defines the channel configuration for Program 1 (i.e., mono, stereo, 5.1 channels).

Line Mode:

>An Operational Mode / Dynamic Compression Mode used by consumer and professional decoder products that simplifies the implementation of Dialogue Normalization, Dynamic Range Control, and down¬mixing functions, all of which are necessary in Dolby Digital products.

RFMode:

>An Operational Mode / Dynamic Compression Mode used by consumer and professional decoder products that simplifies the implementation of Dialogue Normalization, Dynamic Range Control, and down mixing functions, all of which are necessary in Dolby Digital products.

Room Type:

>This informational parameter indicates the type and calibration of the mixing room used for the final audio mixing session.

MixLevel:

The Surround Down mix Level parameter indicates the nominal Lo/Ro down mix level of the Surround channel(s) with respect to the Left and Right channels

DolbySurnd:

The Dolby Surround Mode parameter indicates whether a two-channel Dolby Digital bit-stream is conveying a Dolby Surround encoded program.

DownMixMod:

This controls the Down Mix Mode, used by the content creator, to optimize Center and Sur-round channel levels for use in stereo down mix mode for any two-channel programs.

D Sur Ex:

This controls the Dolby Surround Ex channel that provides an extra audio channel for Dolby 5.1. The extra surround channel of the Dolby Surround Ex system is matrix-encoded onto the discrete left-surround and right-surround channels of the 5.1 mix.

The following control bits can also be set:

LFE:

The LFE Channel parameter enables or disables the Low-Frequency Effects (LFE) channel.

HPF:

This parameter can be used to activate the DC High pass filter for all input channels.

LPF:

The LFE Low Pass Filter parameter can be used to activate a 120 Hz low-pass filter applied to the LFE input channel.

Sur 3dB Alt:

The Surround Channel 3 dB Attenuation function is used to apply a 3 dB attenuation to the Surround channels of a multichannel soundtrack created in a room with film style cal-ibration, when encoding it for consumer home theater playback.

Sur Ph+Filter:

The Surround Channel 90-Degree Phase-Shift feature is used for generating multichannel Dolby Digital bitstreams that can be down-mixed in an external two channel decoder to cre-ate a true Dolby Surround compatible output.

Org Stream:

The Original Bitstream informational parameter sets the value of a single bit within the Dolby Digital bitstream. This bit has a value of 1 (box checked) if the bitstream is an original. If it is a copy of an original bitstream, it has a value of 0.

Copyright:

The Copyright Bit informational parameter sets the value of a single bit within the Dolby Digital bitstream. If this bit has a value of 1 (box checked), the information in the bitstream is indicated as protected by copyright. If it has a value of 0, it is not copyright protected.

RF Ov Prot.:

The RF Over-modulation Protection parameter determines whether an RF pre-emphasis fil-ter is used in the overload protection algorithm to prevent RF over-modulation in set-top box decoders.

Peak Metering

The peak audio levels are included in the Dolby E metadata packet and may be displayed on the Audio - Meters page. Select the appropriate set of meters to display Dolby levels and then they will follow the selected Dolby E source.

Note: Note that audio cannot be decoded by the Rx range of products and so you will not be able to listen to the Dolby E signal. Note also that the LFE channel audio levels do not seem to be metered by current Dolby encoding modules.

See the section *Log Setup* for details on which changes of Dolby E status may be logged.

System Panels

Overview

Clicking on the **System** menu will allow the following window panels to be displayed.
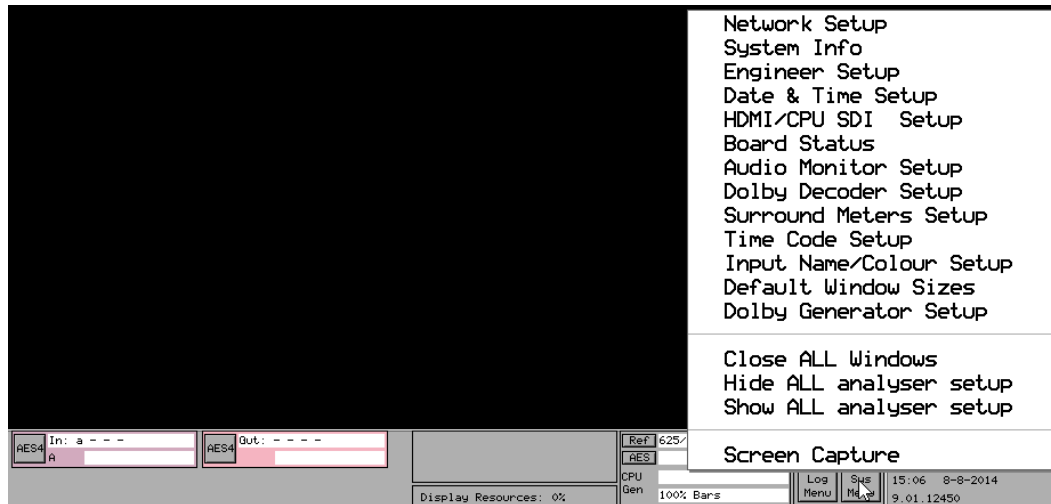
Network Setup

The Rx Instrument is fully network compatible and has a complete network interface to allow control of any Rx instrument from any other unit. The Network menu allows the Rx instrument to be configured as part of a network.
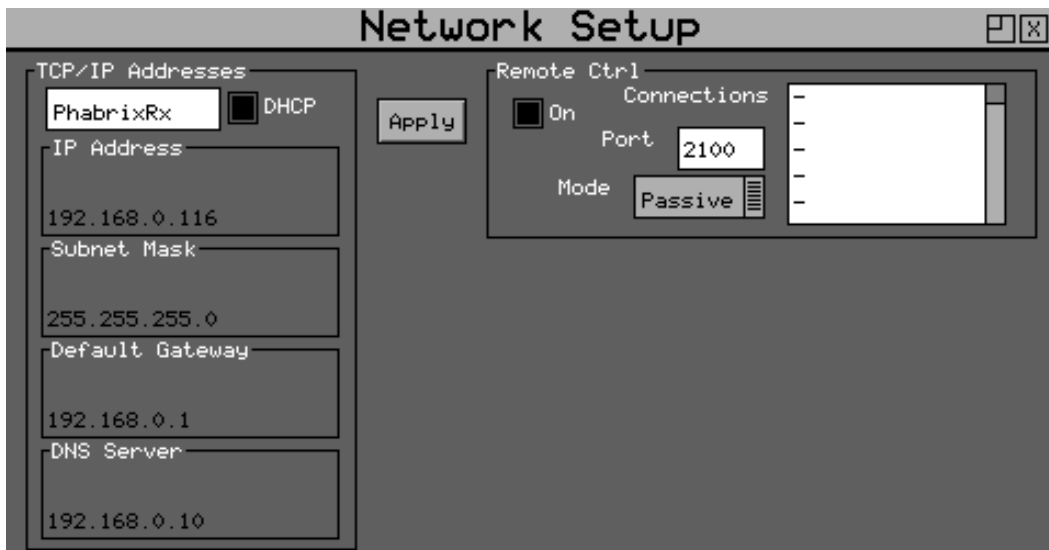
The Network Setup window is accessed by clicking on the **System** menu on the monitor output task bar and selecting **Network Setup**.

Network Setup

On all Rx instruments the network addressing can be setup using the HDMI® monitor output.

> **Note:** If the Rx instrument is turned on without the network connected, you will have to select the **Re-connect** button to set networking up correctly. This is because the Ethernet connection auto-senses whether it has to swap the cable over which means that you can use any Ethernet cable with the Rx instrument but it also requires the Ethernet connection to be present when starting up.

The IP Address for the Rx instrument can be setup using the **Network Setup** window on the HDMI® monitor output. A new **Network Setup** window can be opened by right-clicking in the display area and selecting the **Network Setup** option.

If the **DHCP** checkbox is enabled, then the Rx instrument will attempt to request an IP Address automatically from any network it is connected to. This will only work if a DHCP server is available on the network.

If your network has static (non-changing) addresses, you will need to see your network administrator to get an address assigned to your instrument and to get the Subnet mask and default gateway address. These details can then be entered in the corresponding boxes in the menu. Select each numeric box in turn and use the up and down cursors to pick the required value.

When the IP Address, Subnet Mask, Default Gateway and DNS Server values have been setup, use the **Apply** button to attach the Rx instrument to the network.

Remote Control of the Rx Instrument

To allow remote control of an Rx instrument, you must have the TCP/IP address of the instrument set and the Remote Control **On** checkbox must be checked.

The list box shows a list of current connections made to the instrument. This includes the web browser connection (127.0.0.1) which may be seen intermittently as the web browser connects every

few seconds and then disconnects again. See the remote control documentation available for download for more information on the protocol and method of control.

The Rx instrument uses a default Port Number of 2100 for remote control access (See the *Remote Control SDK* documentation on the Download section of the PHABRIX website) This port number may now be changed if it conflicts with other applications in your system.

Engineer Setup

The Engineer menu is used to manage the Rx instrument and allows user access to be setup and the installation of new versions of software.
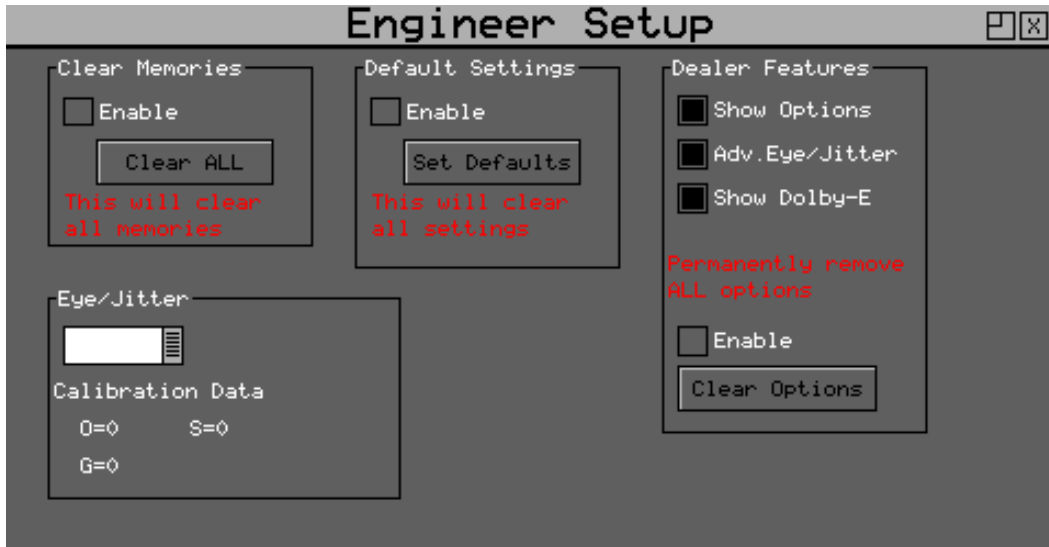
The Engineer Setup window is accessed by clicking on the **System** menu on the monitor output task bar and selecting **Engineer Setup**.

Clear Memories

This section of the menu allows the defined users who can access the Rx instrument to be cleared. To use this function, select the **Enable** checkbox and press the **Clear ALL** button. This will clear all the user memories.

Default Settings

This section of the menu allows you to reset the Rx instrument back to its default settings. To do this, select the **Enable** checkbox and press the **Set Defaults** button and the factory defaults will be recalled. This will not affect the system Security Code or Free Run frequency.

Rear Audio Calibration

The **Cal** value is use to calibrate the analog circuitry on the CPU Module to ensure that analog audio signal level matches the digital audio level being produced by the Generator module.

Software Upgrade

This section of the menu allows new software versions to be installed. The Rx instrument may download and install new versions of software when available. This process is a two-stage process: Download the software and then install it.

> **Note:** Note that on the HDMI® monitor output this controlled from the System Info menu.

1. To download the latest software version, make sure that the network settings are correct and that the Rx instrument is connected to the internet via the Ethernet connection.

   Pressing the Download button will cause the current release of software to be downloaded from the Phabrix website. This will take a short time depending on the connection to the Internet. Once the download has completed, the software will be checked for errors before being stored on the Rx instrument for future installation.

If the latest software is already present on the Rx instrument, no software will be downloaded and a message will be shown.

> **Note:** Multiple releases of software may be stored on the Rx instrument, so that you can re-install a previous release if required.

2. To install the downloaded software on the Rx instrument, select the release using the field with releases listed. The largest number is the latest release. Select the **Install** button and a confirmation dialog is displayed. Press **Yes** and the installation will start. This process takes several minutes to decompress the software, extract the files and then reprogram the hardware. If an error is given during the installation, retry the installation and or download. Do *not* switch off the Rx instrument until an installation has completed correctly.

   Once the installation has competed, if **Reboot after Install** is checked the Rx instrument will re-start with the new software installed. If not checked then the instrument should be switched off and on again, manually.

   > **Note:** As part of the installation procedure, all memories are archived to a backup file and then deleted. They can be restored from the **System-Memories** page using the **Restore** button and selecting the **_Before_ Upgrade** archive.

The software release notes can be viewed by selecting the **Changes** button.

HDMI/CPU SDI Setup / HDMI/SDI Output

HDMI Output

The Rx range of products provides a Monitor output in the form of an HDMI output that can display up to 16 instrument windows at 1920 x 1080 resolution. This menu also controls the use of the SDI output on the CPU board and allows the built-in generator to be used.
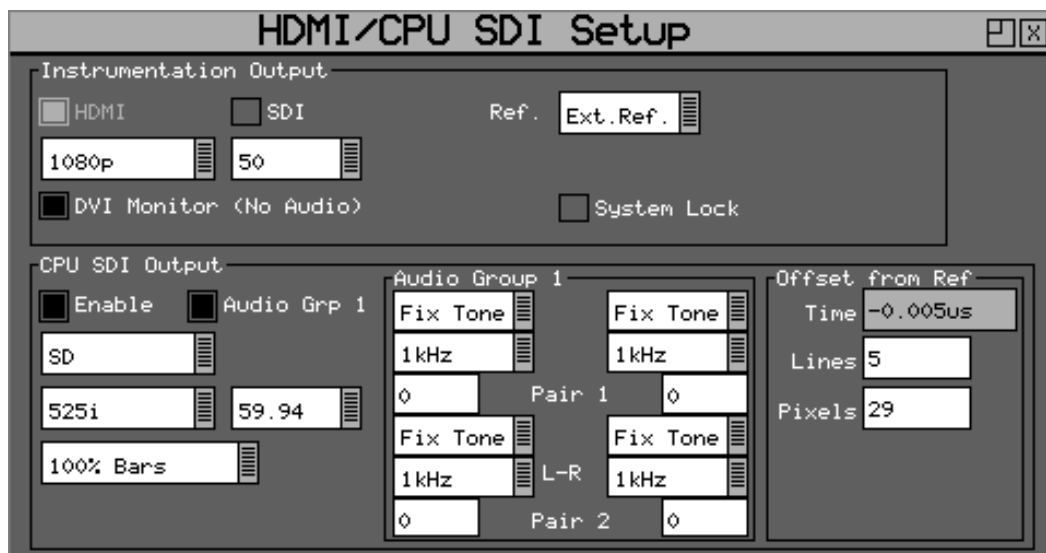
The HDMI/CPU SDI Output Setup window is accessed by clicking on the **System** menu on the monitor output task bar and selecting **HDMI/CPU SDI Output Setup**.

The Monitor output display can display the presets selected by the Pre-set Buttons and can be controlled by a USB mouse and keyboard connected to the Rx instrument.

> **Note:** On the Rx 500 and Rx 1000 instruments, the Monitor Output is always enabled.

The HDMI® monitor output can only be in the following formats:

- 1080p, 50, 59.94 or 60
- 1080i, 50, 59.94 or 60

If the **System Lock** checkbox is selected the HDMI output will be locked to the system's locking reference input signal. See the section *External Locking Reference*.

CPU SDI Output

The built-in video signal Generator on the CPU board (standard on all Rx instruments) provides an SDI test output. This is tied to the HDMI® monitor output and can only produce test signals in a range of video formats matching those of the HDMI output. If an unrestricted range of test signal video formats is needed, then either the HDMI out needs to be disabled or an additional Generator module is required.

With the HDMI output enabled (always enabled on the Rx 500 and Rx 1000 instruments) then the frame rate of the SDI output is limited to match the HDMI output. The HDMI standard and frame rate combo-boxes are limited to 1080p 50/59/60. If the HDMI output is disabled , the SDI output may be any frame rate.

Using SDI Output as Test Pattern Generator

The SDI output on the CPU module can be used as a test pattern and audio tone generator. This output is limited to specific test patterns and can only provide audio tones for **Audio Group 1**.

Select the required video format, line rate and frame rate from the dropdown menus in the **CPU SDI Output** section then select **100% Bars**, **75% Bars** of **CheckField** as the test pattern.

The audio source for each channel may be Silence, Fixed tone (a range of fixed frequencies), variable tone (set in 1 Hz steps from 1 Hz to 23.99 kHz) or white noise.

If the checkbox **Lock to Ref** is enabled, the test pattern will be locked to the system's locking reference input signal, see the section *External Locking Reference*.

Using HDMI Over SDI
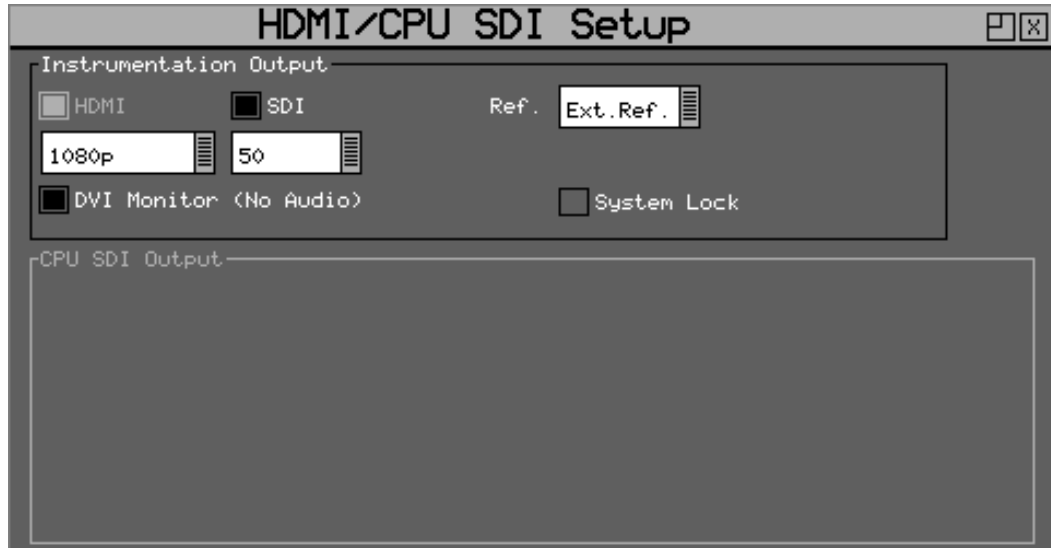
Select the **SDI** checkbox in the **Instrumentation Output** section if you wish to route the HDMI® monitor output over SDI. This will disable the on-board test pattern generator.

External Locking Reference

When using an external locking reference signal, the Rx system will provide the best possible locking regardless of the locking reference frame rate and the generated frame rate.

- When the frame rate of the locking reference is exactly the same as the generated frame rate, there will be an exact lock vertical and horizontal between them.

- When the frame rate of the locking reference and the generated frame rate are divisible (for example 50/25, 60/30, 59.94/23.98) there will be an exact lock vertical and horizontal between them.

- When there is no relationship between the frame rate of the locking reference and that of the generated frame rate (for example a 625/50 locking reference and a 23.98 generated test pattern) then there will be a static lock between them but this will not be consistent.

System Info

The System Info window displays the system software status and options that are installed on the HDMI® monitor output.
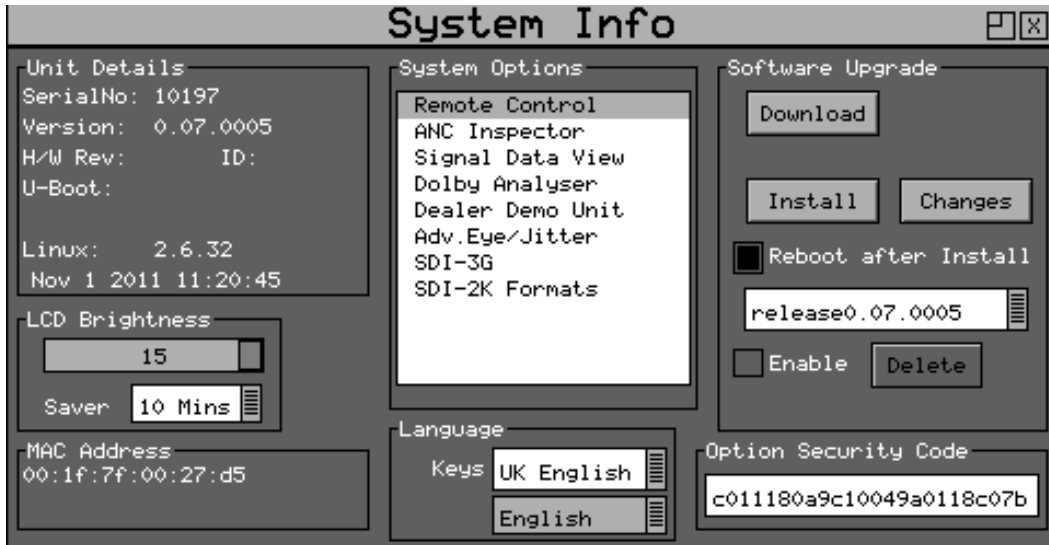
The System Info window is accessed by clicking on the **System** menu on the monitor output task bar and selecting **System Info**.

Setting the User Language

The language used to display the menus in may be changed to one of the supported languages. (Currently only English is supported.)

Changing Options Security Code

When new options are purchased for the Rx instrument a new Security Code will be supplied. This is specific to this instrument and cannot be used on other units. The security code is entered using the **Edit** field below the **System Option** list and is edited by pressing **OK** and using the menu function keys. If an incorrect Security code is entered a dialog will be displayed. The new Security code will only be saved if it is valid, the old code will be used until a valid code is entered. Once a valid new code has been entered, the list of options provided by that code will be displayed. The options code is stored independently to memories and system settings.

Software Upgrade

This section of the menu allows new software versions to be installed. The Rx instrument may download and install new versions of software when available. This process is a two stage process: Download the software and then install it.

1. To download the latest software version, make sure that the network settings are correct and that the Rx instrument is connected to the internet via the Ethernet connection.

   Pressing the Download button will cause the current release of software to be downloaded from the Phabrix website. This will take a short time dependent on the connection to the Internet. Once the download has completed, the software will be checked for errors before being stored on the Rx instrument for future installation. If the latest software is already present on the Rx instrument, no software will be downloaded and a message will be shown.

> **Note:** Multiple releases of software may be stored on the Rx instrument, so that you can re-install a previous release if required.

2. To install the downloaded software on the Rx instrument, select the release using the field with releases listed. The largest number is the latest release. Select the **Install** button and a confirmation dialog is displayed. Press **Yes** and the installation will start. This process takes several minutes to decompress the software, extract the files and then reprogram the hardware. If an error is given during the installation, retry the installation and or download. Do *not* switch off the Rx instrument until an installation has completed correctly.

   Once the installation has competed, if **Reboot after Install** is checked the Rx instrument will re-start with the new software installed. If not checked then the instrument should be switched off and on again manually.

   > **Note:** As part of the installation procedure, all memories are archived to a backup file and then deleted. They can be restored from the **System-Memories** page using the **Restore** button and selecting the archive**_Before_ Upgrade**.

The software release notes can be viewed by selecting the **Changes** button.

Board Status

The Board Status window displays the current status of the hardware modules on the HDMI® monitor output. This can then be used to inspect which Modules have been installed in the Rx instrument.

```
Board Status                    ⊟⊠
Board                           System Temperature
┌─────────┐    Board ID    9    49.2 C      120.5 F
│ Board 1 │    SDI 2-In 1-Eye        Fan    OK
└─────────┘                     Voltages
   0046 0053 1936 3034 3333 3232    1.2V    1.216V
                                    1.5V    1.494V
Hardware Status                     1.8V    1.781V
   Error Slots:                     2.5V    2.494V
                                    3.3V    3.297V
              Errors    Messages
HSI Master │  0
HSI Slave  │  0
Bulk Xfer  │                    SFP
                                Gennum G02929
```
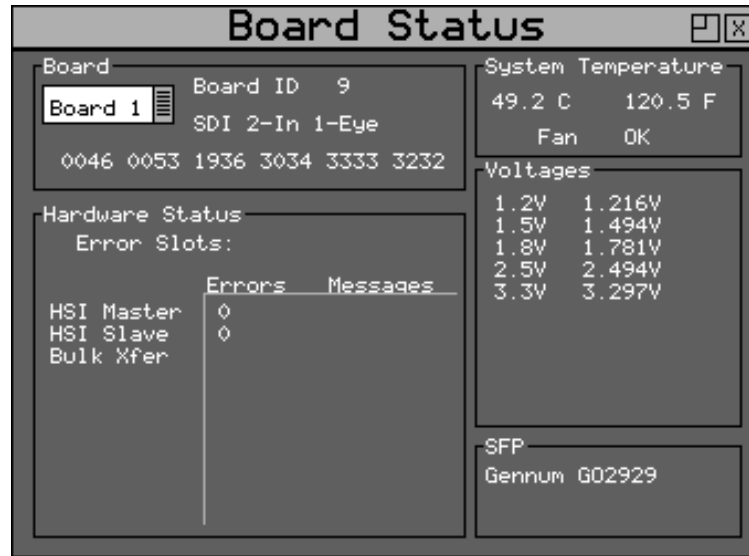
The Board Status window is accessed by clicking on the **System** menu on the monitor output task bar and selecting **Board Status**.

Board (Module)

This section of the menu details the Modules that are currently installed in the Rx chassis.

Front:

Displays the hardware details of the front panel board.

CPU:

Displays the hardware details of the CPU Board.

Board 1:

Displays the hardware details of the Module fitted in chassis slot 1.

Board 2:

Displays the hardware details of the Module fitted in chassis slot 2.

Board 3:

Displays the hardware details of the Module fitted in chassis slot 3.

Board 4:

Displays the hardware details of the Module fitted in chassis slot 4.

Hardware Status

This section of the menu shows any hardware errors that have been recorded by the Rx instrument. If the error count is greater than 0, contact you local dealer for advice.

System Temperature

This section of the menu displays the current Rx instrument temperature. This information is provided for diagnostics purposes only.

Voltages

This section of the menu displays the current voltages for the currently selected board in the **Board** section of the menu. This information is provided for diagnostics purposes only.

SFP

This section of the menu displays the type of SFP (Small Form Factor Package) module is installed in the board currently selected board in the **Board** section of the menu. This information is provided for diagnostics purposes only.

Date and Time Setup

The Date and Time Setup window displays the current status of the hardware modules on the HDMI® monitor output. This can then be used to set the date and time of the Rx instrument.
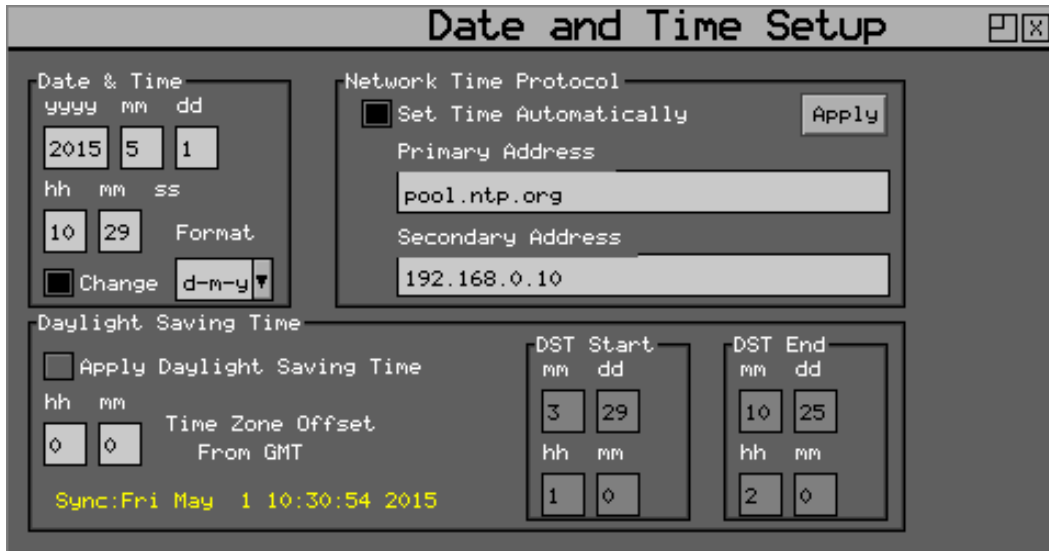
The Date and Time Setup window is accessed by clicking on the **System** menu on the monitor output task bar and selecting **Date & Time Setup**.

This menu can also be displayed by clicking on the date displayed in the bottom right of the Monitor Output display.

Changing the Date and Time

Check the **Enable Change** checkbox under the date and time fields and then use the cursor to move around the date and time. Press **OK** to edit a field and again to complete the change. When all fields have been edited, uncheck the **Enable Change** checkbox and the new date and time will be set.

Changing the Date Format

The date format used on logging screens etc may be set using the Format selection control. Three formats are available: Date-Month-Year, Month-Date-Year and Year-Month-Date.

Daylight Saving Time

Daylight saving times can be implemented as well as the introduction of a fixed time offset with respect to GMT. Select the **Apply Daylight Saving Time** checkbox and set daylight saving time start and end dates in the **DST Start** and **DST End** sections. If there is a fixed time offset between local time and Greenwich Mean Time this can also be applied.

Uncheck the **Change** checkbox to action the Date and Time change.

Network Time Protocol

The Date and Time Setup window allows the selection of Network Time Protocol to control the Rx system time. Select the checkbox **Set TIme Automatically** enter the primary and secondary addresses for the network time, then select the **Apply** button to apply these changes.

The primary and secondary address fields can be populated with IP addresses or with a web address (for example: **pool.ntp.org**).

Note that if the Rx network is set to a static IP address, then the network **Default Gateway** address and **DNS Server** address must have valid addresses.

The system will automatically try and retry the primary and secondary addresses until local system time can be synchronized to network time. The system will check every 24 hours to ensure that the system time is synchronized.

Uncheck the **Change** checkbox to action the Date and Time change.

Audio Monitoring Setup

The Speaker menu controls which audio pair that can be heard on the loud speakers and headphone output of the Rx instrument.
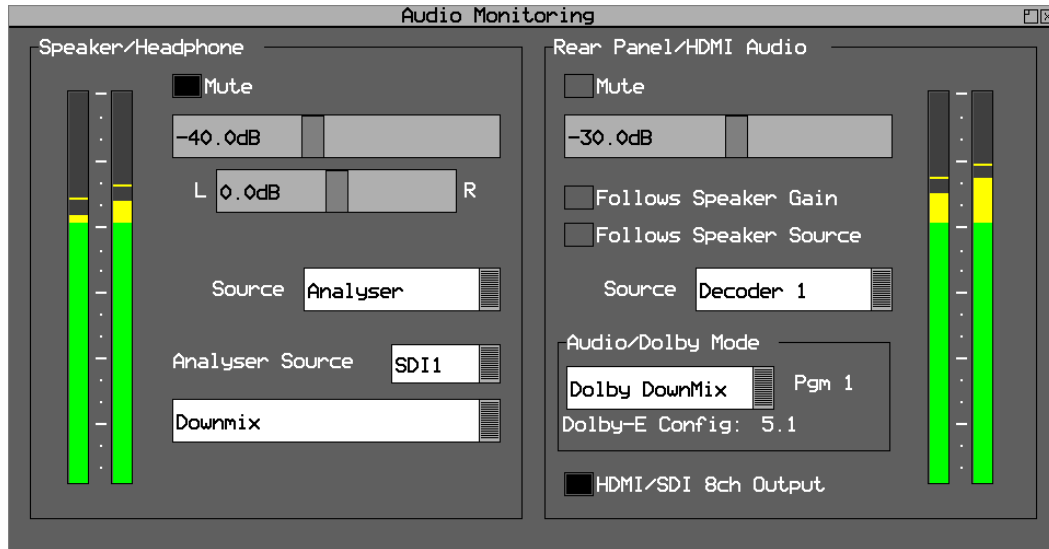
The Audio Monitoring Setup window is accessed by clicking on the **System** menu on the monitor output task bar and selecting **Audio Monitor Setup**.

Speaker / Headphone

The Rx 1000 and Rx 500 instruments have a single stereo headphone socket.

The **Mute** checkbox allows both signals to be muted.

A volume control is provided to adjust the level to headphones and speaker together. The balance control can be used to adjust the Left-Right balance for the source being monitored.

The monitored source can be set to the input or output of the Rx instrument and the input and output sources can be set independently to either a stereo pair or single audio channel.

The **Source** dropdown is used to select Analyzer, AES Input or Dolby Decoder output as the audio source. The **Analyzer Source** is used to select the specific channels of the source that is to be heard.

The speaker can be muted when headphones are plugged in by checking the **Mute** checkbox.

> **Note:** When listening to an audio source, the Rx system needs to be locked to the same reference as the audio otherwise audio *clicks* may be heard on the speaker.

Rear Panel Audio

The controls in the Rear Panel Audio section of the menu are used to setup the audio levels of the unbalanced analog audio available on the D-type connector on the CPU module.

The **Follows Speaker Gain** checkbox, if enabled, will cause the audio level of the analog signal to follow the level set by the volume control on the front panel of the Rx unit. If the checkbox is not enabled the analog audio level will remain the same regardless of the front panel volume control.

The **Follow Speaker Source** checkbox, if enabled, makes the rear panel audio the same as the Speaker/Headphone selection.

The volume slider below the **Follows Speaker Gain** checkbox can be adjusted to set the nominal output volume of the analog output signal.

The **Source** dropdown is used to select Analyzer, AES Input or Dolby Decoder output as the audio source. The **Analyzer Source** is used to select the specific channels to be routed through to the rear panel and HDMI audio.

The **HDMI/SDI 8ch Output** checkbox, if enabled, allows eight audio channels to be routed to the rear panel / HDMI audio instead of a stereo pair.

Dolby Decoder Setup

If the Dolby Decoder module is installed in the Rx system, it can be configured to decode specific SDI or AES inputs of Analyzer or 4AES modules.
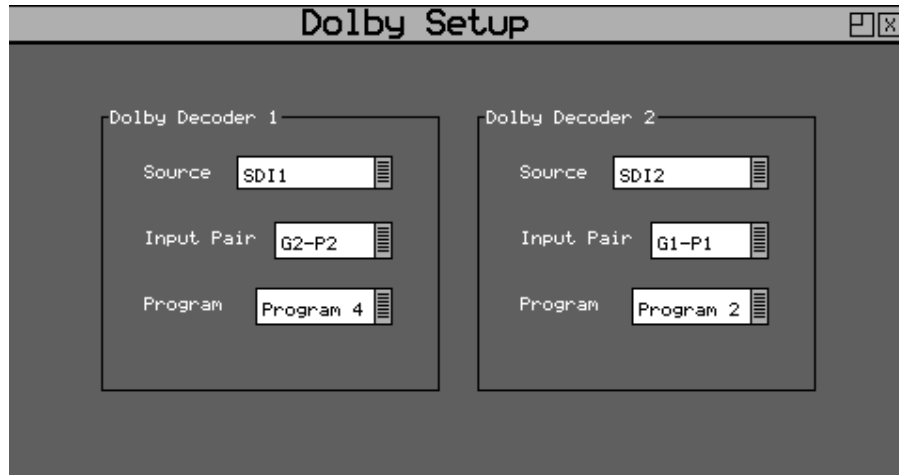
The Dolby Decoder Setup window is accessed by clicking on the **System** menu on the monitor output task bar and selecting **Dolby Decoder Setup**.

Source:

Defines the specific Analyzer input channel or 4AES module to use.

Input Pair:

Defines the specific SDI audio pair or 4AES module input to use.

Program

Defines the specific Dolby program to decode.

> **Note:** The two Dolby Decoders cannot be assigned to the same Analyzer or 4AES module.

Throughout the Rx system audio instruments, the decoded output of these two Dolby Decoders can be selected so that the individual decoded Dolby channels, pairs of channels or a mixed-down version can be selected.

> **Note:** The Dolby Decoder settings are stored as part of the system configuration and cannot be saved in presets.

Surround Channel Setup

Throughout the Rx instrument, wherever 5.1 surround sound audio is selected, the actual physical audio channel mapping that is used is defined in the **Surround Channel Setup** menu.
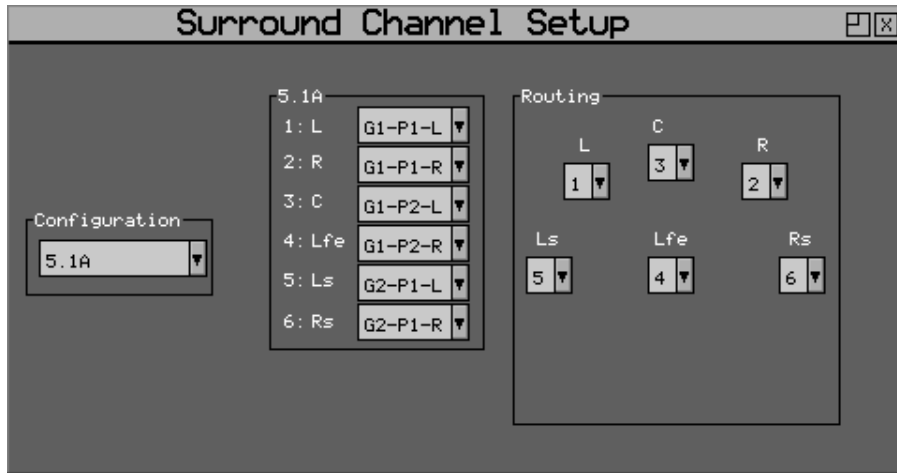
The Surround Channel Setup window is accessed by clicking on the **System** menu on the monitor output task bar and selecting **Surround Channel Setup**.

This menu is used to route specific embedded SDI audio channels to the 5.1 channels these are stored as two different configurations, 5.1A and 5.1B which can be selected from the **Configuration** dropdown menu.

The center section of the menu displays a table of meter channels against SDI input channel. These can be setup to match the 5.1 channels of the SDI inputs to the corresponding meter labels so that Loudness measurements can be made correctly.

The right-hand section of the menu show the routing of these meter channels. Typically the Dolby E 5.1 configuration is as follows:

- AES 1/2 - G1P1 - Front left / Front right
- AES 3/4 - G1P2 - Center / LFE (low frequency effects)
- AES 5/6 - Rear left / Rear right.

Time Code Displays

The Time Code Displays window controls the display of time code information on the HDMI® monitor output. Time code is available on the locking reference input and on each video input that is analyzed.
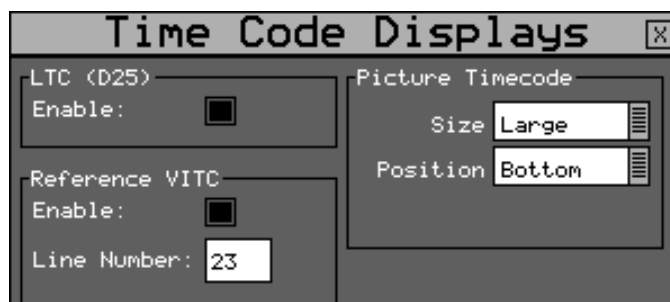
The Time Code Displays window is accessed by clicking on the **System** menu on the monitor output task bar and selecting **Time Code Displays**. This window is also displayed when selected from the Picture instrument.

The Time Code Displays window allows Vertical Interval Timecode (VITC) present on the analog (625i/50 and 525i/59.94) locking reference signal connected to the **REF** connection on the rear of

the Rx unit, and Longitudinal Timecode (LTC) present on the **GPIO** D-type connector, to be displayed on the Task Bar of the HDMI® monitor output.

The line number where the VITC is located on the analog locking reference signal can be selected using the **Line Number** field.

This window also allows the ANC Timecode from the video input to be displayed in three different positions and three different sizes on the picture window.

Default Window Size

The Default Window Sizes window controls how instrument windows are added to the HDMI® monitor output and their starting size.
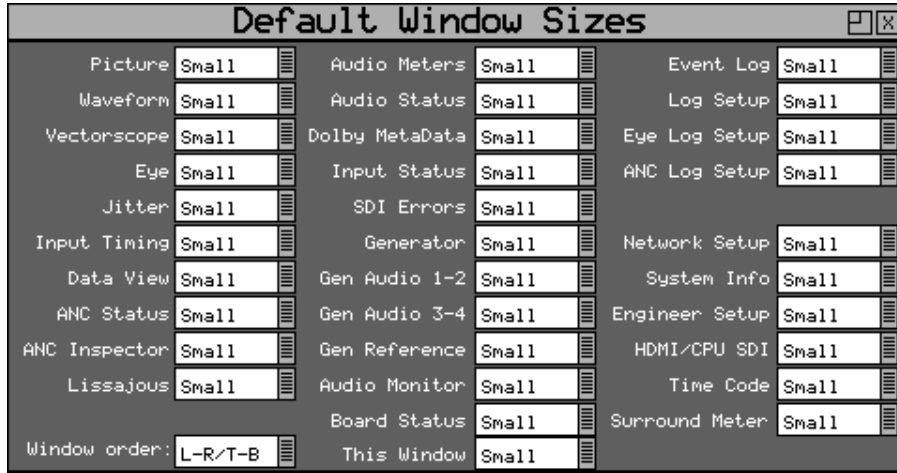
Instrument windows can be automatically assembled on screen either left to right or top to bottom.

The default size of Picture, Waveform, Vectorscope, Eye and Jitter windows can be set as **Small** (1/16 screen size) or **Quad** (1/4 screen size). The default size of the Picture and Waveform windows can also be set to **Large** (3/4 screen size) or **Full** (full screen native video format display).

PHABRIX Rx 500 1000
User Manual

Dolby Generator Setup (Dolby Generator Option)
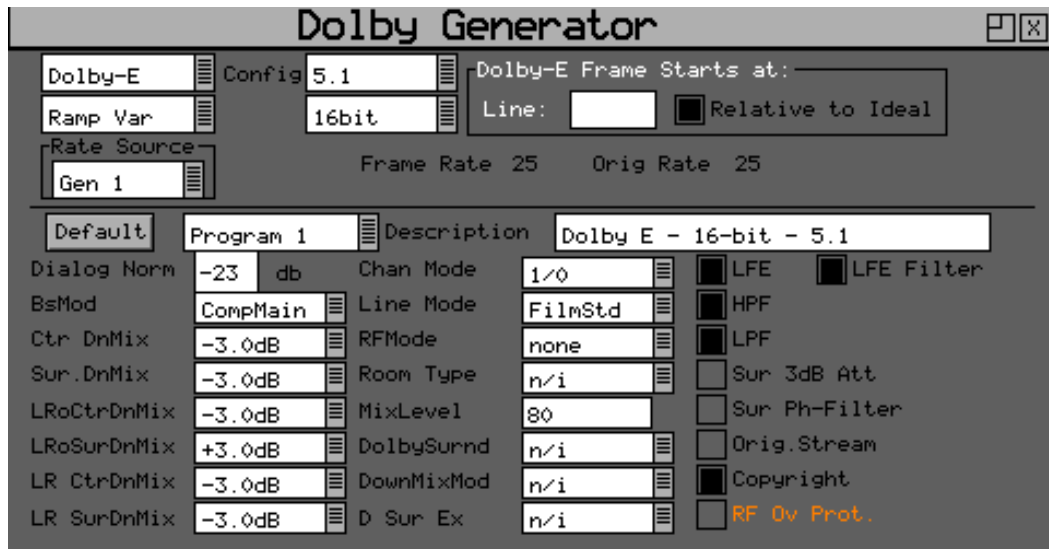
The Dolby Metadata Generator software option allows generation of Dolby-E, Dolby Digital and Dolby Digital Plus pre-encoded test signals to check that they are transferred transparently through the broadcast chain unaffected by routers/switchers, satellite links, etc.

> **Warning:** With this software version Dolby E can be embedded within 50, 59.94 and 60 frames per second progressive video formats but this mode of working has not been supported by Dolby since 2008. This mode of operation of Dolby Generator is only provided to support legacy Dolby equipment produced prior to 2008.
>
> For high progressive frame rates an external locking reference must be used.

> **Note:** With this software version Non-keyed signals are generated which may be incompatible with certain VTRs.

Overview

There are a number of Dolby broadcast digital audio standards that transport audio data over an SMPTE 337M AES carrier with a 48 kHz sample rate. The type of Dolby to be generated can be selected from the dropdown list in the top-left corner of the menu:

- Dolby E
- Dolby Digital
- Dolby Digital Plus

These standards can be used to transport mono, stereo, 5.1 and 7.1 audio programs:

- **Dolby 5.1** - involves five channels for normal-range speakers (20 Hz to 20,000 Hz) (right front, center, left front, rear right, rear left) and one channel (20 Hz to 120 Hz allotted audio) for the subwoofer driven low-frequency effects.

- **Dolby 7.1** - uses six channels in the primary program (Independent Substream) for a standard 5.1 surround sound mix and then the remaining two channels in an ancillary program (Dependent Substream) to provide the additional downmix.

Dolby E

Dolby E is an audio encoding and decoding technology developed by Dolby Laboratories that allows up to eight channels of audio (mono, stereo, 5.1 or 7.1) that for a primary program (Programme 1) and optional ancillary programs. These eight channels are compressed (lossless) into a digital stream that can be transferred between compatible devices and stored on a standard stereo pair of audio tracks.

Dolby Digital

Dolby Digital (AC-3) is a *perceptual audio* system for digital audio that allows the reduction of data needs to deliver high-quality sound. This system was developed primarily for DTV, DVD and HDTV. This format allows up to six channels of sound (mono, stereo or 5.1) in the form of a single *program* that can be delivered at different bit rates. These six channels are compressed (lossy) into a digital stream that can be broadcast. The most elaborate mode in common use is Dolby 5.1 with uses all six channels to provide surround sound.

Dolby Digital Plus

Dolby Digital Plus (E-AC-3) is a more advanced version of Dolby Digital that provides a more efficient encoding algorithm that provide enough bandwidth that allows up to 20 channels of audio (mono, stereo, 5.1, 7.1 up to 13.1) that for a primary program (Programme 1) and optional ancillary programs that can be delivered at much lower bit rates than Dolby Digital. These 20 channels are compressed (lossy) into an independent digital datastream plus up to eight dependent sub-stream that can be transferred between compatible devices and stored on a standard stereo pair of audio tracks.

Dolby E Synchronization - Generator Reference

The Dolby audio test signal produced by the Rx instrument is common to all generator modules within the system and is locked to either one of the generator video formats or to the System Reference (typically external reference).

If the Dolby Generator is locked to an external signal, the reference signal *must* have a compatible frame rate. See the table below for examples.

Video Output Format	Valid Reference Formats
1080i50	1080i50, 625i50(PAL)
1080i59	1080i59, 525i59(NTSC)
1080p25	1080p25, 1080i50, 625i50(PAL)
1080p29	1080p29, 1080i59, 525i59(NTSC)
720p50	1080p25, 720p25, 1080i50, 625i50(PAL) — due to length of packet being over one frame long
720p59	1080p29, 720p29, 1080i59, 525i59(NTSC) — due to length of packet being over one frame long
1080p50	1080p25, 720p25, 1080i50, 625i50(PAL) — due to length of packet being over one frame long
1080p59	1080p29, 720p29, 1080i59, 525i59(NTSC) — due to length of packet being over one frame long

Note: For high frame rate, progressive video formats being generated the Rx chassis *must have* a compatible frame rate locking reference and the Dolby Generator *must be* set to External Reference.

Editing Program Information

Stream type:

Dolby-E, Dolby Digital and Dolby Digital Plus streams can be generated.

Config, Bit Depth:

The program configuration and Bit Depth can be changed to load the pre-encoded file.

Stream contents:

The tones generated are of a fixed predefined frequency. Four sets of pre-encoded streams are provided:

Ramp Var:

Each channel has a different frequency to allow checking of channels. The levels are ramped so that different channels have different levels.

−3dB Fixed:

All the tones are at −3dB co-phased / timed and are at the same frequency.

−18dB Fixed

All the tones are at −3dB co-phased / timed and are at the same frequency.

−20dB Fixed

All the tones are at −3dB co-phased / timed and are at the same frequency.

The following table lists fixed frequency values for the **Fixed level** streams above:

Frame Rate	Normal Frequency	LFE Frequency
23.98	4.8 kHz	211 Hz
24	6 kHz	240 Hz
25 / 50	6 kHz	240 Hz
29.97 / 59.84	6 kHz	133 Hz
30 / 60	6 kHz	240 Hz

Dolby-E start line:

The start line can be used to set valid or invalid ranges to allow checking of the Dolby-E guard band on downstream equipment. If the start line is set outside the valid range specified by Dolby, the line number will be displayed in red font.

Relative to Ideal:

If this checkbox is checked, the line number displayed is relative to the Dolby specified ideal line. A value of **0**, therefore, starts the Dolby-E packet on the *Ideal Line* for that video format.

Frame Rate:

This is set by default to the currently generated frame rate but may be modified by the user to test downstream equipment.

Original Rate:

This is set by default to the currently generated frame rate but may be modified by the user to test downstream equipment.

> **Note:** When generating a progressive fast rate video standard such as 720p50, 720p59 or 720p60 etc. the Dolby-E signal will always be generated at the related slower rate. This is a Dolby restriction as the packets are over one frame in length for these video formats.

Program Metadata Editing

Many of the metadata fields may be edited to test downstream equipment. The Channel Mode field may be edited to invalid settings but they will be shown in red to show that they are invalid. The settings currently being edited are for the selected program but multiple program metadata values can be modified and the settings for all programs are stored in memories.

Metadata changes and line changes will happen cleanly so that no corruption to the Dolby signal will occur.

A maximum of 30 characters may be used for program description text. If the text is longer than this, extra characters will be ignored.

The **Generator → Dolby** menu allows the metadata for a Dolby E datastream to be setup for testing purposes. The main purpose of setting these metadata fields is to check that they are transferred transparently through the broadcast chain unaffected by routers/switchers, satellite links, etc. For any program this metadata would be created as part of Dolby E authoring process. Using the Dolby generator, the following metadata can be setup for Program 1:

Dialogue Norm:

> The standard audio level for dialog.

BsMod:

> (Bitstream Mode) indicates the type of audio service that the bitstream contains. Complete Main (CM) is the normal mode of operation and contains a complete audio program including dialog, music, and effects.

Ctr DnMix:

> (Center down-mix) is a weighting value used in the encoding and decoding of surround sound mixes for a Dolby 5.1 Independent Substream.

Sur DnMix:

> (Surround down-mix) is a weighting value used in the encoding and decoding of surround sound mixes for a Dolby 5.1 Independent Substream.

LRoCtrDnMix:

> (Left, right, stereo, center down-mix) is a weighting value used in the encoding and decoding of surround sound mixes for a Dolby 7.1 Dependent Substream.

LRoSurDnMix:

> (Left, right, stereo, surround down-mix) is a weighting value used in the encoding and decoding of surround sound mixes for a Dolby 7.1 Dependent Substream.

LR CtrDnMix:

> (Left, right, center down-mix) is a weighting value used in the encoding and decoding of surround sound mixes for a Dolby 5.1 Independent Substream.

LR SurDnMix:

> (Left, right, surround down-mix) is a weighting value used in the encoding and decoding of surround sound mixes for a Dolby 5.1 Independent Substream.

Chan Mode:

Defines the channel configuration for Program 1 (i.e., mono, stereo, 5.1 channels).

Line Mode

An Operational Mode / Dynamic Compression Mode used by consumer and professional decoder products that simplifies the implementation of Dialogue Normalization, Dynamic Range Control, and down¬mixing functions, all of which are necessary in Dolby Digital products.

RFMode:

An Operational Mode / Dynamic Compression Mode used by consumer and professional decoder products that simplifies the implementation of Dialogue Normalization, Dynamic Range Control, and down mixing functions, all of which are necessary in Dolby Digital products.

Room Type:

This informational parameter indicates the type and calibration of the mixing room used for the final audio mixing session.

MixLevel:

The Surround Down mix Level parameter indicates the nominal Lo/Ro down mix level of the Surround channel(s) with respect to the Left and Right channels

DolbySurnd:

The Dolby Surround Mode parameter indicates whether a two-channel Dolby Digital bit-stream is conveying a Dolby Surround encoded program.

DownMixMod:

This controls the Down Mix Mode, used by the content creator, to optimize Center and Surround channel levels for use in stereo down mix mode for any two-channel programs.

D Sur Ex:

This controls the Dolby Surround Ex channel that provides an extra audio channel for Dolby 5.1. The extra surround channel of the Dolby Surround Ex system is matrix-encoded onto the discrete left-surround and right-surround channels of the 5.1 mix.

The following control bits can also be set:

LFE

The LFE Channel parameter enables or disables the Low-Frequency Effects (LFE) channel.

HPF

This parameter can be used to activate the DC High pass filter for all input channels.

LPF

The LFE Low Pass Filter parameter can be used to activate a 120 Hz low-pass filter applied to the LFE input channel.

Sur 3dB Alt

The Surround Channel 3 dB Attenuation function is used to apply a 3 dB attenuation to the Surround channels of a multichannel soundtrack created in a room with film style calibration, when encoding it for consumer home theater playback.

Sur Ph+Filter

The Surround Channel 90-Degree Phase-Shift feature is used for generating multichannel Dolby Digital bitstreams that can be down-mixed in an external two channel decoder to create a true Dolby Surround compatible output.

Org Stream

The Original Bitstream informational parameter sets the value of a single bit within the Dolby Digital bitstream. This bit has a value of 1 (box checked) if the bitstream is an original. If it is a copy of an original bitstream, it has a value of 0.

Copyright

> The Copyright Bit informational parameter sets the value of a single bit within the Dolby Digital bitstream. If this bit has a value of 1 (box checked), the information in the bitstream is indicated as protected by copyright. If it has a value of 0, it is not copyright protected.

RF Ov Prot.

> The RF Over-modulation Protection parameter determines whether an RF pre-emphasis filter is used in the overload protection algorithm to prevent RF over-modulation in set-top box decoders.

Default Program Metadata

Pressing the **Default** button will return program metadata settings to their default values.

Embedding Dolby on SDI Stream

To embed Dolby signals on an SDI stream, the Audio source for that channel should be set to **Dolby**. These source selections are found on the Generator – Audio Group 1, 2, 3, 4 pages. Selecting one channel of an audio pair to **DolbyGen** will force the other channel in the pair to select **DolbyGen** also. As the Dolby streams are data, the volume and phase controls are disabled. Changing a channel from Dolby to another source will cause the other channel in the pair to select silence.

Embedding Dolby Signals on AES Stream

To embed Dolby signals on the AES output, the Audio source for the AES output should be set to **DolbyGen**. This selection is found on the right-hand side of the **Generator ➜ Audio Group 1,2,3,4** pages.

> **Note:** If DolbyGen is selected as the Source for any AES output, the **Dolby Generator** in the **System** menu needs to be set to **External reference** otherwise the Dolby audio packet may not be embedded into the AES stream in the correct place.

Logging Panels

Overview

Clicking on the Logging menu will allow the following window panels to be displayed.
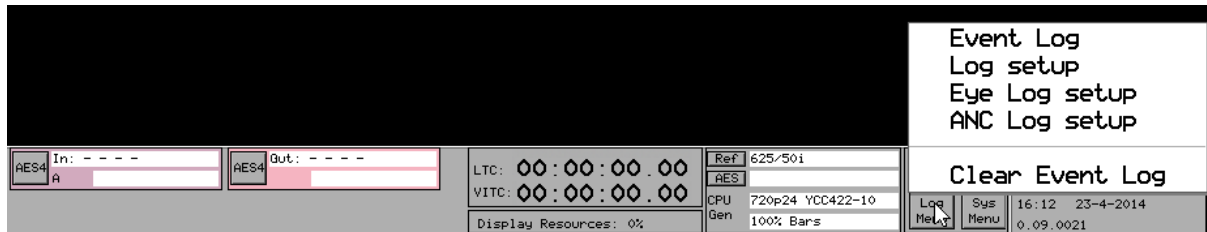
Logging allows events to be detected and recorded for future examination. The events to be logged can be specified so that unwanted events do not appear in the event log. If a system has a problem with intermittent signals, the Rx instrument can be connected to that source and can be left for several days to log any errors. At the end of that period the log can be examined and the time and date of each error noted.

Event Log

The Event Log is where events, that have triggers setup in the **Log Setup** menu, are recorded.
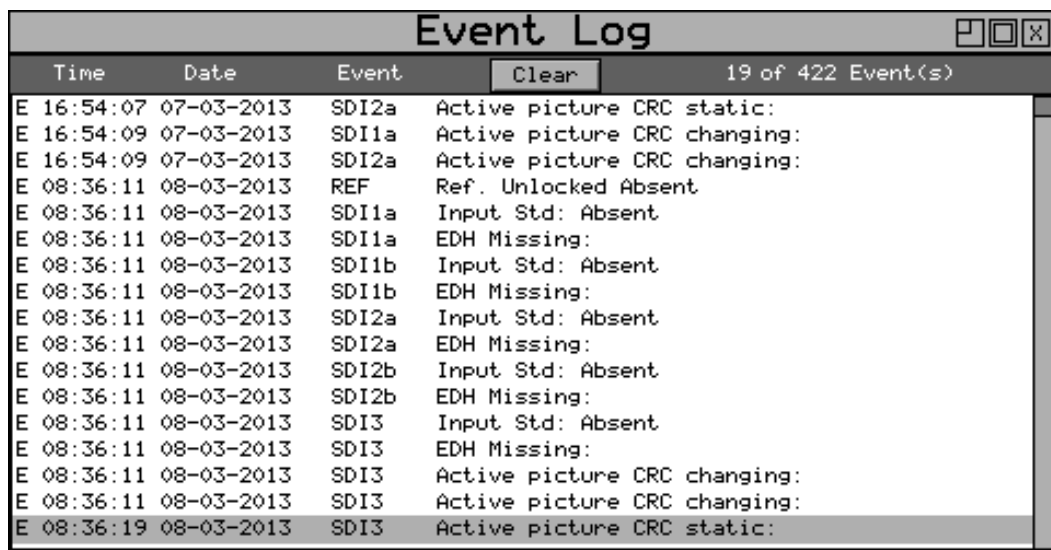
The Event Log window is accessed by clicking on the **Logging** menu on the monitor output task bar and selecting **Event Log**.

The event log may be cleared by pressing the**Clear Log** button; a dialog is displayed asking the user to confirm the action. A date stamped *mark* may be inserted into the event log to allow users to see when a test started or when a significant event happened using the **Add Mark in log** button.

> **Note:** The event log only shows changes in status, so if the input is always in error and never good, an event will not be shown. To get the full state of the instrument will require looking at the current status as well as the event log.

Event Log Setup - General

The Log Setup menu allows specific events to be tracked by the Rx instrument. The events to be logged are set up on this page by checking the appropriate **Log** checkboxes.
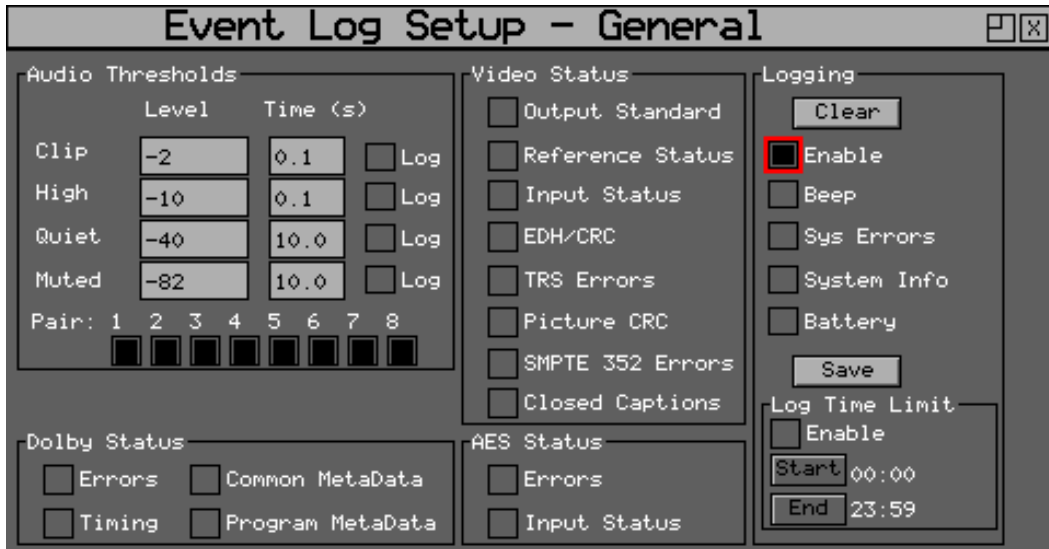

The Log Setup window is accessed by clicking on the **Logging** menu on the monitor output task bar and selecting **Log Setup**.

Audio Thresholds

This section allows the thresholds for audio events to be set. If the audio level for a channel is higher than that specified for the **Clip** or **High** fields for the number of seconds specified then an event will be added to the event log. If the audio level for a channel is lower than that specified for the **Quiet** or **Muted** fields, then an event will be added to the event log. Logging may be limited to specified audio pairs.

Video Status

This section allows specific video status events to be logged:

Output Standard:

> A log event will be added whenever the generator video standard changes.

Reference Status:

> A log event will be added whenever the external reference standard changes or the external reference input is lost or re-appears.

Input Status:

> A log event will be added whenever the input video standard changes or if the input is lost or re-appears.

EDH/CRC:

> A log event will be added whenever a EDH/CRC error state changes. If the EDH/CRC state is correct, the event will show OK, else it will show FAIL. Separate Luma and Chroma CRC events may be shown. Note that EDH/CRC events may occur when an SDI signal is connected or removed.

TRS Errors:

> If the number of lines changes or line length changes during a frame, the input video will be detected as the TRS changing and an event logged. If the signal stays changing only a single event will be logged. If the SDI signal has a static line count and line length for five

seconds, a TRS OK event will be added to the log. This reduces the number of log events for a bad SDI signal.

Picture CRC

This should only be used for static single frame test patterns (do not use for Zone Plate, dynamic broadcast signals or CheckField / Pathological test patterns which are two frames long at HD). This can be used to log changes in the CRC for the active picture (a value which is unique for each test pattern). If the CRC changes and was previously OK an error is added to the event log. If the CRC is the same as the last frame for five seconds an OK event will be added to the event log. Thus, if the active picture CRC is continuously changing there will only be one event in the log until the picture remains static when an OK event will be added.

AES Status

This section allows AES audio errors to be logged:

Errors

A log event will be added whenever the embedded audio error status changes. This may be due to a Data Block Number error, ECC error or phase error status change. The event entry will detail which state has changed.

Input Status

A log event will be added if the AES signal disappears or appears.

Dolby E Status (Requires Dolby E Analysis Option)

This section allows Dolby E errors to be logged.

Errors:

Adds an event to the event log when a Dolby E input stream is detected or lost. An event will also be added if a CRC error is detected in the Dolby E metadata stream. If an error is detected in the Dolby E stream, it may mean that the Dolby E stream has not been synchronized with the embedded audio clocks.

Timing:

Will log if the Dolby E frame timing is outside the Dolby specified *Ideal* range. A Warning event will be given if the signal is OK but slightly outside the range and an Error event if it is on an invalid line.

Common Metadata:

Will log any changes of the common metadata (Program Configuration, Bit Depth, Frame Rates)

Program Metadata:

Will log any changed program metadata. This can be useful for following changes to a program stream over a long period of transmission.

Logging

This section controls *all* logging events:

Clear

Clears all entries in the event log.

Enable

Enables the logging process. If this is not checked, no events will be added to the log. This is a simple method of turning off *all* logging temporarily.

Beep

> Causes the Rx will emit a short tone when an Event is added to the log. Note that the beep will happen even if the Speaker is set to Mute.

SYS Errors

> Allows system errors to be displayed in the Event Log if they happen. If you are having problems with your Rx, checking this box can add events that can help PHABRIX determine the nature of the problem.

System Info

> Allows system to report additional internal messages in the Event Log if they happen. If you are having problems with your Rx instrument, checking this box can add events that can help PHABRIX determine the nature of the problem.

Save

> Saves the current event log to a text file in the currently specified language. The log file created, logfile.txt may be downloaded using a FTP connection.

Log Time Limit

The time when logging is enabled may be limited by time of day. Logging will start at the specified start time and end at the specified end time. The specified times must be after the current time. Uncheck the checkbox to log at all times. Logging must be enabled using the checkbox above for this to work.

Event Log Setup - Eye / Jitter

The Eye Log Setup menu allows specific Eye and Jitter events to be tracked by the Rx instrument. The events to be logged are set up on this page by checking the appropriate **Log** checkboxes.
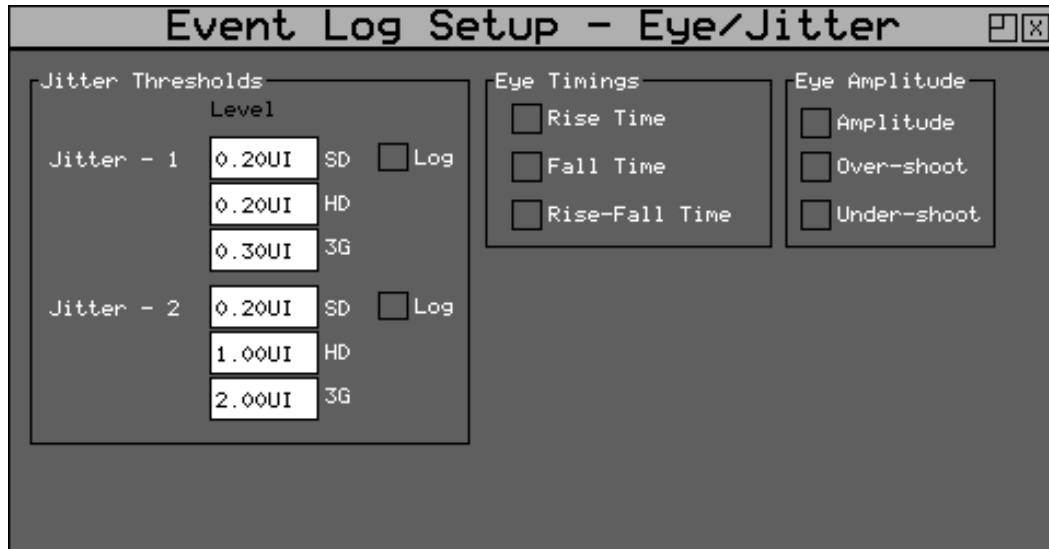
The Eye / Jitter logging window is accessed by clicking on the Logging menu on the monitor output task bar and selecting **Eye Log Setup**.

Jitter Thresholds

The jitter level at which an event is added may be set independently for each meter. (Note, only one meter is provided as standard.) This allows you to set the maximum allowed jitter level and then test for invalid values over a period of time.

A different jitter threshold may be set for each of the three SDI data rates (SD / HD / 3G) for both Jitter1 and Jitter2. The defaults are the maximum values specified by the SMPTE standard.

Jitter errors are detected within 200 ns and so intermittent peak errors can be detected.

Eye Timings

If checked, these controls will enable logging of invalid timing values. An event will be logged if the value exceeds the valid SMPTE range and an event will be logged when the signal becomes valid again.

Eye measurements are performed using statistical calculations on the waveforms and are thus performed at a slower rate than jitter measurements. Measurements can take a few seconds to stabilize and this should be taken into account.

Eye Amplitude

If checked, these controls will enable logging of invalid amplitude or overshoot / undershoot values. An event will be logged if the value exceeds the valid SMPTE range and an event will be logged when the signal becomes valid again.

Eye measurements are performed using statistical calculations on the waveforms and are thus performed at a slower rate than jitter measurements. Measurements can take a few seconds to stabilize and this should be taken into account.
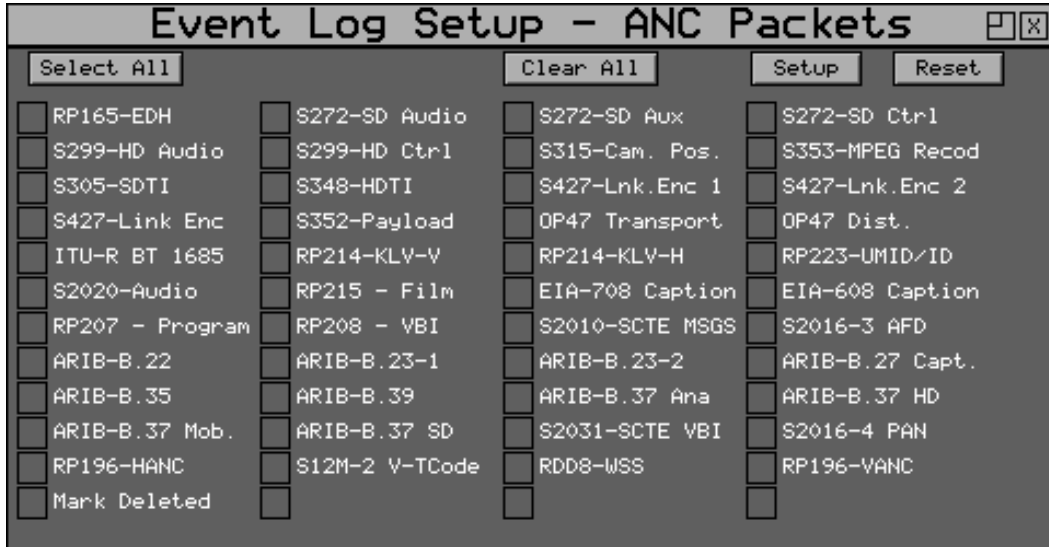
Event Log Setup - ANC Packets

The Log ANC Status menu allows specific ANC data events to be tracked by the Rx instrument. The events to be logged are set up on this page by checking the appropriate **Log** checkboxes.

The ANC Packets logging window is accessed from the **Logging** menu on the monitor output task bar and selecting **ANC Log Setup**.

The Log ANC Status menu allows you to select which ANC packets to log when changes in status occur (e.g., Present, Checksum Error, Missing, Parity Error). Individual checkboxes are provided to determine which packet DID/SDID combinations are logged.

See the section *ANC Status* for definitions of these checkboxes.

Select All

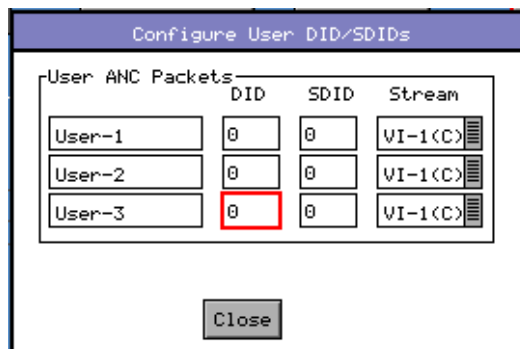Toggles the checkboxes for all packets on or off.

Select Active

Causes the checkboxes for all packets currently present to be checked.

Setup

Allows the user to define and name their own DID/SDID values for an ANC packet type.

Reset

Clears the state for all packet types; consequently a packet previously displayed as in error is shown as OK.
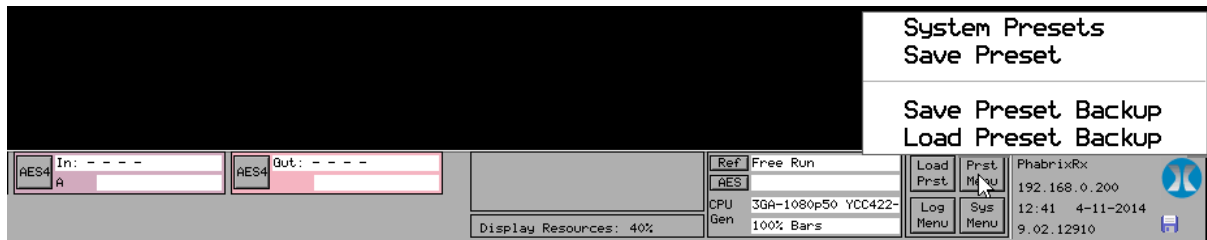
Preset Memories

Overview

The Rx Instrument settings for Generator, Analyzer and HDMI® monitor output can be saved and recalled as required.

Selecting the **Save Preset** function will allow the current Analyzer, Generator and HDMI settings to be saved using a named preset.

Selecting the **System Presets** function displays the **System Presets** window to allow presets to be edited.
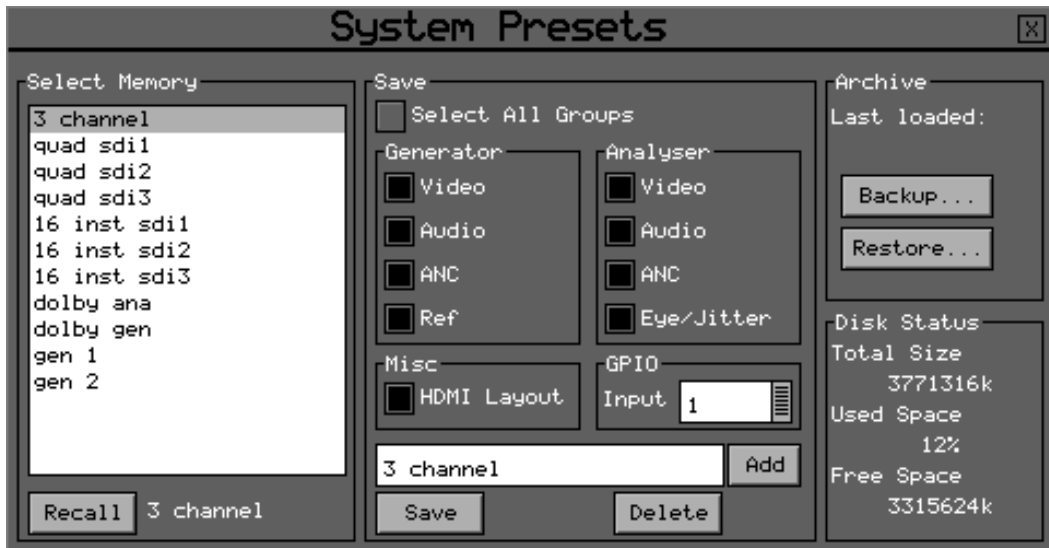
The **System Presets** menu displays the current settings in the Rx instrument that may be saved for future recall.

Defining Preset Content

The checkboxes on the right-hand side determine what is saved in the memory. Non-overlapping presets may then be combined. For example, saving generator settings or HDMI setting separately without affecting analyzer settings.

Generator Section

The Generator section controls the settings of all Generator modules installed in the system, but does not include the on-board test pattern generator which is considered a system-wide function with only its current state saved:

- **Video** - if this checkbox is selected then the Generator video format, line rate and frame rate settings for all Generator modules will be saved as part of the preset.

- **Audio** - if this checkbox is selected then the Generator Audio tone settings for Group 1, 2, 3 and 4 for all Generator modules (including 4AES modules) will be saved as part of the preset. This also covers any Dolby metadata settings.

- **ANC** - not currently used.

- **Ref** - if this checkbox is selected then the Generator Genlock settings for all Generator modules will be saved as part of the preset.

Analyzer Section

The Analyzer section controls the settings of all Analyzer modules installed in the system:

Video

When selected, the configuration of the Picture, Waveform, Vectorscope and Video Timing instruments for all modules are saved as part of the preset. This also saves the System Reference selection.

Audio

When selected, the configuration of the Audio Meters, Loudness Meters, Dolby Metadata Analyzer, Lissajous display instruments are saved for all Analyzer modules (including 4AES modules) as part of the preset.

ANC

When selected, the configuration of the ANC Inspector and ANC Logging setup for all Analyzer modules are saved as part of the preset.

Eye / Jitter

When selected, the configuration of the Eye and Jitter instruments and Eye Log Setup settings for all Eye modules are saved as part of the preset.

Misc Section

The **Misc** section, **HDMI** checkbox if selected will save the screen layout as part of the preset.

GPIO Section

The dropdown menu in the GPIO section allows one of fourteen different values to be allocated to the Presets. The values are a decimal representation of the four GPIO inputs 0, 1, 2 and 3 (rear panel 26-way D-type connection) which if taken low (0 volts or logical zero) with automatically select and display the corresponding preset.

- GPIO 0 = 1

- GPIO 1 = 2

- GPIO 2 = 4

- GPIO 3 = 8

Saving Presets

Select the memory to save settings to by moving the cursor to the **Select Memory** list and pressing **OK**. Use the Up / Down cursor keys to select the memory and then press **OK**. The name edit field next to the memory list will be updated with the name of the selected memory.

Specify which aspects of the Rx instrument are to be saved in the memory using the checkboxes on the right-hand side. If you want to change the name of the memory, see the section *Renaming Presets* below before saving.

Move the cursor to the **Save** button and press **OK**. The text field under the Memory list will change to show the last Saved or Recalled memory.

Recalling Presets

Presets can be recalled in a range of different ways depending on which part of the Rx control system you are using:

- Using the **System Presets** menu:

    1. Select the memory to be recalled by moving the cursor to the **Select Memory** list and pressing **OK**. Use the Up / Down cursor keys to select the memory and then press **OK**. The name edit field next to the memory list will be updated with the name of the selected memory.

    2. Move the cursor to the **Recall** button and press **OK**. The text field under the Memory list will change to show the last Saved or Recalled memory.

- Using the **Load Prst** button in the bottom-left corner of the HDMI output display.

- Using the preset buttons along the bottom of the HDMI output display.

- Using the Rx front panel controls.

Renaming Presets

Select the memory to be renamed by moving the cursor to the **Select Memory** list and pressing **OK**. Use the Up / Down cursor keys to select the memory and then press **OK**. The name edit field next to the memory list will be updated with the name of the selected memory.

Move the cursor to the edit field and press **OK**. The menu keys at the bottom of the screen will change to show text keys similar to a mobile phone. Pressing a key repeatedly will cycle through the characters for that key. Pressing a different key will move the cursor to the next position and insert the first key value for that key. The cursor left and right keys can be used to move the position of the text cursor which is where the next character will be inserted. The **Back Space** key will delete the key to the left of the cursor. The **Cancel** key will cancel edit mode and restore the original text. Once you have finished editing the name, press **OK** to rename the memory.

Adding Additional Presets

To add a new memory, press the **ADD** button. This will use the current memory name and settings.

Clearing Presets

Select the memory to be cleared by moving the cursor to the **Select Memory** list and pressing **OK**. Use the Up / Down cursor keys to select the memory and then press **OK**. The name edit field next to the memory list will be updated with the name of the selected memory.

Move the cursor to the **Clear** button and press **OK**. The memory list will show the default name for that memory. A cleared memory cannot be recalled.

Exporting Presets

Presets can be exported to a single file for backup purposes and re-imported into the internal format. This allows different sets of memories to be used for different tasks, such as command scripts. In addition, presets can be exported from one Rx instrument and imported onto another Rx, as described below. Exported memories are in a text format and so may be edited on a PC and downloaded to / from the **backups** directory on the Rx instrument using FTP or USB.
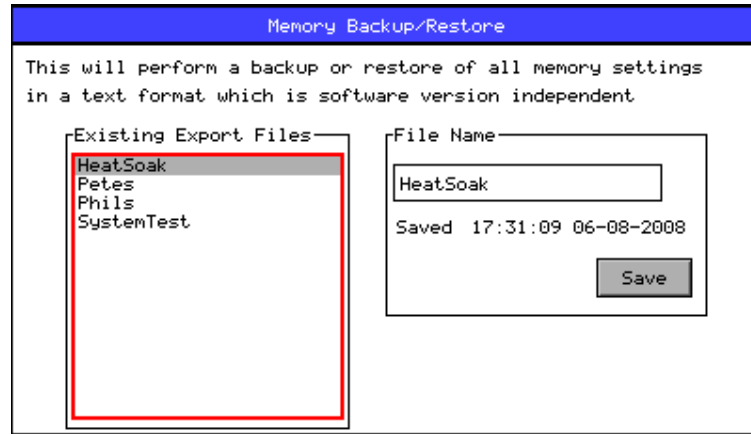
To export memories, select the **Backup...** button which will open a window to select the file to create. Existing files are shown and a new filename may be selected using the **File Name** edit box. Select the **Save** button to create the backup file. The filename created will have a **.mem** file extension.

To import memories, select the **Restore...** button which will open a window to select the file to import. Existing files are shown and one should be selected before the Load button is pressed. Select the **Load** button to import the backup file.

> **Note:** When importing a backup file, all existing memories are deleted before the backup file is loaded so make sure that they are backed-up first.

Transferring Presets to a Different Rx

> **Warning:** Before attempting to copy presets from one Rx to another, ensure that the target Rx has an identical hardware configuration as the source Rx and is also running the same software version. If there are any hardware or software differences between the source and target devices, you may experience configuration issues.

1. Save your backed-up presets to a USB pen drive. Insert a USB pen drive into one of the USB ports on the front or rear panel of the Rx. This opens the **USB Disk Connected** dialog box.

2. From the **Types** dropdown menu, select: **Archives**.
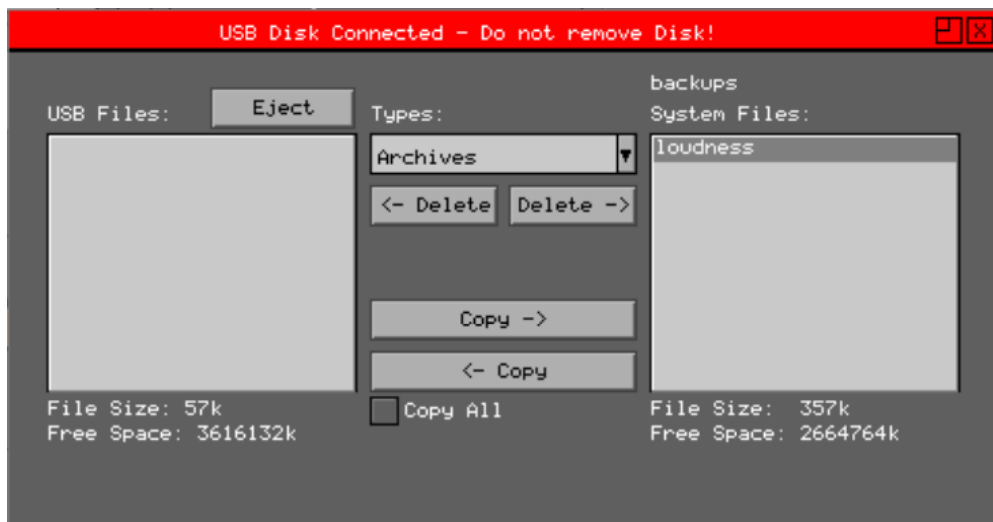
3. With **Archives** selected, highlight the desired preset backup in the right-hand list under **backups System Files**, for example: **loudness**. Click the button **<– Copy** to copy the backed-up preset file to the USB device.

4. Click **Eject** and remove the USB device from the Rx.

5. Locate the next Rx instrument onto which to import the presets and insert the USB pen drive into one of the available USB ports. Again the USB Disk Connected dialog is automatically displayed.

6. From the **Types** dropdown menu, select: **Archives**.

7. With **Archives** selected, highlight the desired preset backup in the left-hand list under **USB Files**, for example: **loudness**. Click the button **Copy –>** to copy the backed-up preset file from the USB device to the new Rx system files.

8. Click **Eject** and remove the USB device from the Rx.

Once the presets file(s) are loaded onto the new Rx instrument, they can be used as previously described in this section.
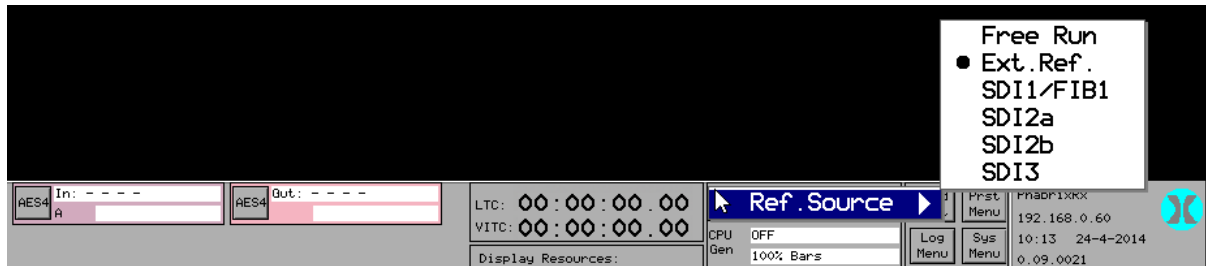
Disk Space Considerations

The disk space section shows total size of the internal flash disk, the ammount used as a percentage and the amount free.

System Reference Source

Selecting the System Reference

Pressing the "Ref" button on the HDMI monitor task bar allows the Rx System Reference source to be selected.

The System Reference defines the video source to which the Rx system is synchronized and affects all Rx outputs:

- On-board test pattern generator output from the CPU SDI connector
- Generator module SDI outputs
- HDMI monitor output
- AES audio outputs.

The System Reference can be set to one of the following depending on the type of modules installed in the Rx chassis:

- **Free Run** - where the Rx system uses its own internal locking reference.
- **Ext. Ref** - where the Rx system is locked to an analog studio reference signal connected to the **Ref** input on the CPU module.
- **SDI1** - where the Rx system is locked to the SDI input on a single input Analyzer module fitted in module slot 1.
- **FIB1** - where the Rx system is locked to SFP optical input on a single input Analyzer module fitted in module slot 1.
- **SDI2a** - where the Rx system is locked to the SDI **A input** on a dual input Analyzer module fitted in module slot 2.
- **SDI2a** - where the Rx system is locked to the SDI **B input** on a dual input Analyzer module fitted in module slot 2.

> **Note:** System Reference selection can be saved as part of a preset. To do this ensure that the **Video** checkbox is selected in the **Analyzer** section of the **System Presets** menu.

Ideally the Rx system should be locked to an external studio reference all analyzer inputs should be of the same frame rate as the locking reference and synchronous to the locking reference.

External Reference can be used in most applications where a studio locking reference is available and is used to ensure that all outputs from the system are locked to the studio itself.

In applications where Dolby E, Dolby Digital or Dolby Digital Plus is being analyzed or decoded, the System Reference should be set to external reference unless one is not available in which case the System Reference should be set to the specific SDI input where the Dolby digital audio is embedded.

In situations where there is no studio reference or when the SDI input is asynchronous and when decoding Dolby audio or routing embedded SDI audio channels to the AES output (4AES module)

then the System Reference should be set to the SDI input containing the Dolby audio or embedded audio channels.

> **Note:** Note that the level of Generator jitter produced by the Rx is determined by the System Reference being used. If the Rx is locked to an SDI or SFP Fiber input, while jitter measurements are being made, then the measured jitter will include the input locking jitter from the Rx chassis plus SDI output jitter. This mode of operation may produce out-of-specification jitter.

Free Run should be used when using Analyzer / Generator modules to perform closed loop testing especially if Eye and Jitter measurements are being made.

Admin Menus

USB Disk Connected Window
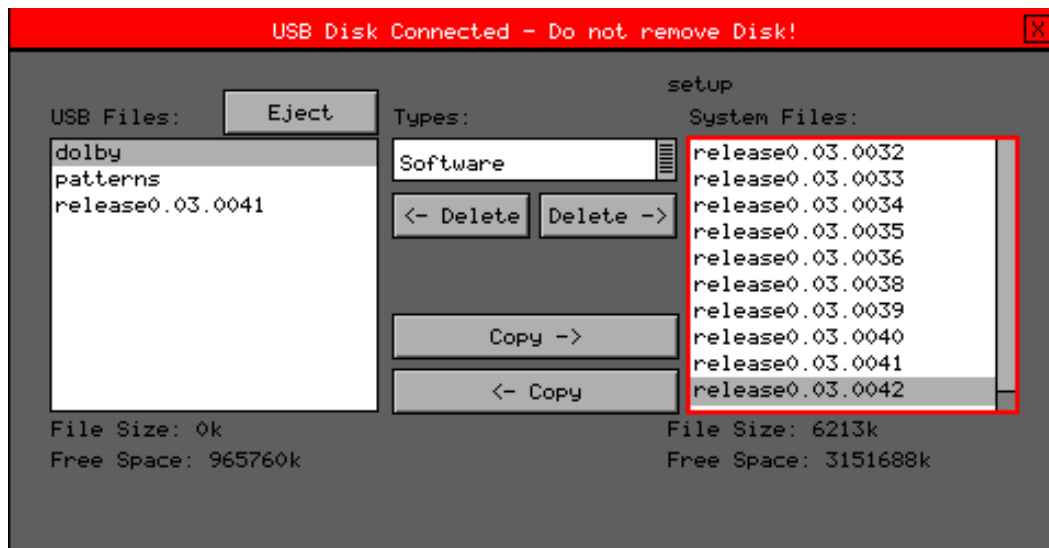
If a USB pen drive is plugged into the Rx unit, the **USB Disk Connected** window will be displayed. This allows items to be copied between the USB root directory and specific Rx folders.

The left-hand pane shows the files in the root directory of the USB pen drive and the right-hand pane shows the files in the currently selected Rx folder.

The **Types** dropdown box allows the selection of the following Rx folders:

- Software - System operating software (**.GZ**)
- Screen Captures - HDMI screen captures (**.BMP**)
- Archives - system archive files (**.MEM**)
- Loudness - program audio loudness logs (**.CSV**)
- Pattern NTSC - 720 x 525 test patterns (**.PAT**)
- Pattern PAL - 720 x 625 test patterns (**.PAT**)
- Pattern 720 YCC - 1280 x 720 YCrCb test patterns (**.YC4**)
- Pattern 720 RGB - 1280 x 720 RGB test patterns (**.RGB**)
- Pattern 1080 YCC - 1920 x 1080 YCrCb test patterns (**.YC4**)
- Pattern 1080 RGB - 1920 x 1080 RGB test patterns (**.RGB**)
- Pattern 1035 YCC - 1920 x 1035 YCrCb test patterns (**.YC4**)
- Fonts - Generator Ident fonts (**.TTF**)
- Grabs - Video clips or frames captured using Frame Grab (**.GRB**)

Files can be deleted from either the USB root directory or the currently selected Rx folder using the two delete buttons:

<− Delete

Permanently deletes the selected file in the USB root directory.

Delete −>

Permanently deletes the selected file in the USB root directory.

Great care must be taken not to delete files use by the Rx operating system.

Files can be copied between the USB root directory or the currently selected Rx folder using the two copy buttons:

Copy −>

> Copies the currently selected file in the USB root directory to the currently selected Rx folder.

<− Copy

> Copies the currently selected file in the selected Rx folder to the USB root directory.

Before the USB pen drive is removed from the Rx unit, select the **Eject** button to close the session. This will prevent accidental damage or corruption of the files on the USB pen drive.

Browser Control

4

Browser Control Overview

The Rx 1000 and Rx 500 instruments can be controlled using a web browser that accesses the built-in web server. To connect to the Rx instrument, find out the IP address (displayed in the bottom-right corner of the Monitor output and in the **System ➜ Network** menu) and enter the IP address into the web browser search field. When connected, you should see the following displayed:

Browser operation has been tested using Firefox, Opera, Safari, Chrome and Internet Explorer but should work with any browser which supports JavaScript.

HDMI Link

The **HDMI** link displays a copy of the HDMI output in the browser window.

Clicking on the position where a menu box appears on the browser HDMI display will control the corresponding menu on the actual Rx HDMI menu. This browser display will take a few seconds to update.

See the chapter *HDMI Monitor Output* for full details of each of the menus.

Event Log Link

The **Event Log** link may be selected to fetch the current Event Log from the Rx instrument.

Browser Control Status Link Rx 500 / Rx 1000

The **Status** link may be selected to fetch the current instrument status in XML format. It can be saved to a local PC for further processing. The control IDs displayed in the XML file are determined by the file **/mnt/mmc/xmlformat.ini** which may be edited by the user although note that it should be backed up as it will be overwritten when software updates take place.

Screen Dumps Link

The **Screen Dumps** link displays a further page allowing screen dumps and report files (Command script option) to be viewed.

Glossary of Terms

The following terms are used in the Sx Series user manuals:

2K-SDI

> 2K digital cinema can be transmitted via SDI as defined in the SMPTE ST 2048-2:2011 standard ("2048 x 1080 Digital Cinematography Production Image FS/709 Formatting for Serial Digital Interface") and SMPTE 428-9 (D-Cinema Distribution Master - Image Pixel Structure Level 3 - Serial Digital Interface Signal Formatting).

3G-SDI

> A single 2.970 Gbit/s serial link (standardized in SMPTE 424M) that will replace the dual link HD-SDI (is standardized in SMPTE 372M).

AES

> Audio Engineering Society

AES3-2003

> Standard for digital audio — Digital input-output interfacing —Serial transmission format for two channel, linearly represented digital audio data.

Alignment Jitter

> Artefacts above the specified threshold frequencies of (1 kHz for SD-SDI signals and 100 kHz for HD-SDI signals). Typically, video equipment cannot tolerate Alignment Jitter which cause decoding errors due to incorrect sampling of the data stream because the SDI Clock transition occurs on the edge of the data sample instead of in the center of the data sample.

ANC (Ancillary Data)

> refers to a means by which non-video information (such as audio, EDH and other forms of essence and metadata) are embedded within the serial digital interface. There are two types of Ancillary Data, HANC (Horizontal Ancillary Data) and VANC (Vertical Ancillary Data). See SMPTE 291M: *Ancillary Data Packet and Space Formatting*.

ARIB-B.22

> The ARIB defined Sub information data packet in the VANC space.

ARIB-B.23-1

> The ARIB defined user data 1 packet in the VANC space.

ARIB-B.23-2

> The ARIB defined user data 2 packet in the VANC space.

ARIB-B.27 Capt.

> The ARIB defined caption data in the VANC space.

ARIB-B.35

> The ARIB defined trigger signal data packet for data broadcasting.

ARIB-B.39

> The ARIB defined inter-stationary control data packet in the VANC space.

ARIB-B.37

> The ARIB defined analog signal data in the VANC space.

ARIB-B.37 HD

The ARIB defined HD data packet in the VANC space.

ARIB-B.37 Mob

The ARIB defined closed captioning information data packet.

ARIB-B.37 SD

The ARIB defined SD data packet in the VANC space.

ASI (Asynchronous Serial Interface)

A streaming data format which often carries an MPEG Transport Stream (MPEG-TS). An ASI signal can carry one or multiple SD, HD or audio programs that are already compressed.

Audio Jack

The front panel ¼ inch headphone socket used for local audio monitoring.

Bar Data

Defines the extent of the image within the coded frame as part of the AFD (active format description as defined by SMPTE S2016.

Chassis

The physical enclosure of the Rx range that is used to mount various hardware modules.

CPU

Central Processor Unit

CRC

Cyclic redundancy check is an error-detecting code commonly used in digital networks and storage devices to detect accidental changes to raw data. Blocks of data entering these systems get a short check value attached, based on the remainder of a polynomial division of their contents; on retrieval the calculation is repeated, and corrective action can be taken against presumed data corruption if the check values do not match.

DBN

(Data Block Number) is a data word within the ANC Data. See DID for more information.

DID

Data ID is part of the Ancillary Data that is transmitted with the SDI data.

Dolby Digital

(AC-3) is a perceptual audio system for digital audio that allows the reduction of data needs to deliver high-quality sound. This system was developed primarily for DTV, DVD and HDTV.

Dolby Digital Plus

(E-AC-3) is a more advanced version of Dolby Digital that provides a more efficient encoding algorithm that provides enough bandwidth that allows up to 20 channels of audio (for a primary program (Program 1) and optional ancillary programs that can be delivered at much lower bit rates than Dolby Digital.

Dolby E

An audio encoding and decoding technology developed by Dolby Laboratories that allows up to 8 channels of audio to be compressed into a digital stream that can be transferred between compatible devices and stored on a standard stereo pair of audio tracks.

DVI

Digital visual interface.

EDH

Error Detection and Handling protocol is an optional but commonly used addition to the Standard Definition-Serial Digital Interface (SDI) standard. This protocol allows an SD-SDI receiver to verify that each field of video is received correctly.

EIA-708 Caption

The EIA standard defined closed caption data for HD-SDI in VANC space.

EIA-608 Caption

The EIA standard defined closed caption data for SD SDI 525i (NTSC) in VANC space.

FPGA

A field-programmable gate array (FPGA) is an integrated circuit designed to be configured by the customer or designer after manufacturing.

Function Buttons

The set of eight buttons below the Instrument Display on the Sx and Rx Ranges that are used to select the Instrument Display menu options.

GPI

General Purpose Input

Graticule

The scale displayed on an oscilloscope, vectorscope or waveform monitor that provides a visual indication of the signal amplitude, time base and phase relationship.

HANC (Horizontal Ancillary Data)

Non-video data that is transmitted within the horizontal blanking interval of the video data. See ANC for further information.

HDMI® (High-Definition Multimedia Interface)

A compact audio/video interface for transferring uncompressed digital audio/video data from a HDMI-compliant device ("the source" or "input") to a compatible digital audio device, computer monitor, video projector, and digital television.

IEC 60268-10

Defining Type I PPM style audio meters typically used by German broadcasters and Type II PPM style audio meters typically used by UK broadcasters.

IEC 60268-17

Defining VU style audio meters typically used by American and Australian broadcasters.

Input Status Bar

The bottom part of the Monitor Output display that shows the format and status of the input signals currently connected to the Rx chassis.

Instrument Display

The TFT monitor available on the Rx 2000.

Integrated Loudness

Covering the duration of a program or segment as defined in ITU-R Recommendations 128.

ITU-R Rec 128

Defining the measurement in terms of Loudness Units (UI) and Loudness Units Full Scale (LUFS) over different time periods.

ITU-R Rec. BS.645

Defining VU style audio meters typically used by French broadcasters.

ITU-R Rec. BS.645

Defining VU style audio meters typically used by French broadcasters.

ITU-R BT 1685

The ITU-R BT 1685 defined Structure of inter-station control data packets.

LTC / GPIO / Analog

Longitudinal Time Code/General Purpose Input Output

MADI (Multichannel Audio Digital Interface)

Or AES10 is an Audio Engineering Society (AES) standard electronic communications protocol that defines the data format and electrical characteristics of an interface that carries multiple channels of digital audio.

Module

A factory fitted hardware component for the Rx series chassis.

Momentary Loudness

Covers the shortest timescale of 400 ms as defined in ITU-R Recommendations 128.

Integrated Loudness

Covering the duration of a program or segment as defined in ITU-R Recommendations 128.

ITU-R Rec 128

Defining the measurement in terms of Loudness Units (UI) and Loudness Units Full Scale (LUFS) over different time periods.

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Defining VU style audio meters typically used by French broadcasters.

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The ITU-R BT 1685 defined Structure of inter-station control data packets.

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MADI (Multichannel Audio Digital Interface)

Or AES10 is an Audio Engineering Society (AES) standard electronic communications protocol that defines the data format and electrical characteristics of an interface that carries multiple channels of digital audio.

Module

A factory fitted hardware component for the Rx series chassis.

Momentary Loudness

Covers the shortest timescale of 400 ms as defined in ITU-R Recommendations 128.

Navigation Buttons

The up, down, left, right arrow buttons available on the Rx Range.

OP47 Transport

The Free TV Operational Practice OP-47 defined transport of Closed Caption/Subtitling data in the VANC space.

OP47 Dist.

The Free TV Operational Practice OP-47 defined distribution of Closed Caption/Subtitling data in the VANC space.

PHRXKT1

The rack mounting kit for the RX 1000 unit.

PHRXKT2

The rack mounting kit for the RX 2000 unit.

PHRXM-A

The Dual Input, single Analyzer module.

PHRXM-AE

The Dual Input, single Analyzer module with eye/jitter functionality.

PHRXM-AG

    The single input Analyzer module plus Generator module.

PHRXM-AGE

    The single input Analyzer module with eye/jitter functionality + Generator module.

PHRXM-DOLBY

    PHRXM-DD and PHRXO-BDA option bundle

PHRXM-DD

    Dolby-E decode module

PHRXO-3G

    3G-SDI software option providing support for SMPTE 424M

PHRXO-EA

    Advanced eye pattern analyzer software option (now included with PHRXM-AE or PHRXM-AGE)

PHRXO-DATA

    SDI Data viewer software option

PHRXO-BDA

    Basic Dolby analysis software option

PHRXO-BDG

    Dolby Generator software option

PHRXO-4LOU

    Four channel loudness Monitor software option (now as standard)

PHABRIX Rx 500

    A 1U height half rack mount Rasterizer which is small and light enough to fit a variety of applications from camera shading in OB environments or studio editing suites as well as manufacturing research and development departments. The Rx 500 has two input slots with 4 simultaneous inputs. All inputs are switchable and each can be independently controlled as picture or analysis instruments on an HDMI Monitor Output.

PHABRIX Rx 1000

    A 1U height 19" (482cm) rack mount Rasterizer with the ability to monitor up to 8 simultaneous inputs with loop through and is powerful enough to support simultaneous display of instruments across each module on HDMI Monitor Output. All inputs are switchable and each can be independently controlled as picture or analysis instruments with central control and report logging.

PHABRIX Rx 2000

    A 2U height 19" (482cm) rack mount Rasterizer with 2 on-board displays and the ability to monitor up to 8 simultaneous inputs with loop through and is powerful enough to support simultaneous display of instruments across each module on HDMI Monitor Output. All inputs are switchable and each can be independently controlled as picture or analysis instruments with central control and report logging.

Pre-set Buttons

    The set of eight buttons below the Video Confidence display on the Rx 2000 that are used to select predefined inputs for display.

PSU

    Power Supply Unit

Random Jitter

Refers to artefacts caused by random events or processes such as thermal or shot noise that cause small amplitude variations in the clock edge position or could cause large signal amplitude variations, though these typically would be infrequent.

Rasterizer

An electronic device used to display (either as picture or waveform) the video/audio data in a 3G-SDI, HD-SDI and SD-SDI stream. Typically, a Rasterizer will display multiple output forms of the same input data stream.

RDD8-WSS

The SMPTE defined wide screen switching data packet in the VANC space.

RP165-EDH

The SMPTE RP165-EDH packet containing EDH (error data handling) and CRC (cyclic redundancy counts). This only appears on SD-SDI signals.

RP196-HANC

The SMPTE defined recommended practice Time Code data packet in HANC space.

RP196-VANC

The SMPTE defined recommended practice Vertical Timecode data packet in VANC space.

RP207 Program

The SMPTE RP207 defined program description data packet in VANC space.

RP208 – VBI

The SMPTE defined recommended practice VBI Data (vertical blanking interval data) in VANC space.

RP214-KLV-V

The SMPTE defined KLV Metadata transport in VANC space.

RP214-KLV-H

The SMPTE defined KLV Metadata transport in HANC space.

RP215 – Film

The SMPTE defined recommended practice data pack for film codes in VANC space.

RP233-UMID/ID

The SMPTE defined UMID (Unique Material Identifier) in VANC space

S272-SD Audio

The SMPTE 291M defined SD audio data in HANC space.

S272-SD Aux

The SMPTE 291M defined SD auxiliary data in HANC space.

S272-SD Ctrl

The SMPTE 291M defined SD control data in HANC space.

S299-HD Audio

The SMPTE 291M defined HD audio data in HANC space.

S299-HD Ctrl

The SMPTE 291M defined HD control data in HANC space.

S305-SDTI

The SMPTE 291M defined SDTI transport data packet in active frame space.

S348-HDTI

The SMPTE 291M defined HD-SDTI transport

S315-Cam. Pos

The SMPTE 291M defined camera position data in HANC and VANC space.

S353-MPEG Record

The SMPTE 291M defined MPEG recoding data in HANC and VANC space.

S427-Lnk. Enc 1

The SMPTE S427 defined link encryption data packet.

S427-Lnk. Enc 2

The SMPTE S427 defined link encryption data packet.

S427-Link Enc

The SMPTE S427 defined link encryption data packet.

S2010-SCTE MSGS

The SMPTE S2010 defined standardized API message data in VANC space.

S2016-3 AFD

The SMPTE S2016 defined standardized AFD (active format description) and Bar data packet (defining active area of image).

S2016-4 PAN

The SCTE S2016 standard defined pan and scan data packet.

S2020-Audio

The SMPTE S2020 defined standardized data packet defining the encoding for a Dolby stereo or a multi-channel surround group of audio channels.

S2031-SCTE VBI

The SCTE S2031 standard defined VBI (vertical blanking interval) data packet for closed captioning.

SDI

(Serial Digital Interface) capable of transferring SD or HD broadcast video and broadcast audio between compatible devices.

SDID (Secondary Data Identifier)

A data word within the ANC Data packet. See DID for more details.

SMPTE

Society of Motion Picture & Television Engineers

SMPTE RP211

Implementation of 24P, 25P and 30P Segmented Frames for 1920 x 1080 Production Format

SMPTE 259M

Implement a SMPTE 259M Serial Digital Interface Using SMPTE HOTLink™ and CY7C9235/9335

SMPTE 260M

Television - 1125/60 High-Definition Production System - Digital Representation and Bit-Parallel Interface

SMPTE 274M

High Definition (HD) Image Formats for Television Production

SMPTE-276M

Television - Transmission of AES-EBU Digital Audio Signals Over Coaxial Cable

SMPTE 292M

Bit-Serial Digital Interface for High-Definition Television Systems

SMPTE 296M

1280 × 720 Scanning, Analog and Digital Representation and Analog Interface

SMPTE 297

Serial Digital Fiber Transmission System for SMPTE 259M, SMPTE 344M, SMPTE 292 and SMPTE 424M Signals

SMPTE 352

Payload Identification Codes for Serial Digital Interfaces —Amendment 1

SMPTE 424M

3 Gb/s Signal/Data Serial Interface

SMPTE 425-B

Mapping of 2 x SMPTE 292M HD SDI interfaces. Level-B can carry a Dual Link 1.485 Gb/s payload or two HD 1.485 Gb/s payloads.

SMPTE 425M-A

Direct mapping of source image formats

SMPTE 428-9

D-Cinema Distribution Master – Image Characteristics

TFT

Thin Film Transistor is a type of LCD (Liquid Crystal Display) monitor.

Timing Jitter

A short-term time interval error above a low frequency threshold of 10 Hz (as defined in the SMPTE standards for SDI signals).

UDW (User Data Words)

Contains the actual "payload" data of the ANC Data package. See DID for more information.

UI

(Unit Interval) is time between consecutive clock cycles used to sample the SDI data stream. The UI measurement is used for Eye Pattern measurement.

VANC (Vertical Ancillary Data)

Non-video data that is transmitted within the vertical blanking interval of the video data. See ANC for further information.

Video Confidence Display

The TFT monitor available on the Rx 2000 that allows the picture to be displayed for the selected input.

Wander

A long-term time interval error, i.e., artifact below 10 Hz. Typically, all video equipment has the tendency to cause wander over a long period; these artifacts are not easily displayed in a meaningful way but are better logged as errors that exceed tolerances over a long period.

Specifications

B

Rx Platform Overview

The Rx platform has been designed to serve the varied test and measurement needs of the broadcast industry. PHABRIX has developed not a single product in the traditional sense but a modular system from which specific broadcast client requirements can be satisfied.

The Rx platform allows a flexible approach to test and measurement on a new technological platform designed for longevity. The system has been created to allow broadcast engineers to specify features according to the complexity of the required test and measurement application by simply adding additional modules and software licenses to their chosen core chassis.

Adding modules is like adding independent new instruments, each module providing a dedicated set of instruments for the task required.

The Rx Platform is available in a choice of chassis types:

- **Rx 2000** – a unique audio video monitoring solution combining front panel instrumentation, via dual TFT screens, and integrated full range stereo speakers. Unique 2U tapered *tilt-in-bay* engineering with four Rx module bays.

- **Rx 1000 Rasterizer** – a compact 1U, 19 inch rack-mount chassis with OLED display interface with four Rx module bays.

- **Rx 500 Rasterizer** – a compact 1U, half-rack width chassis with OLED display interface with two Rx module bays.

Rx 500

Description

The Rx 500 is a 1U, half rack width instrument (available with optional rack mount kit) that provides the following:

- OLED display to allow the monitoring inputs and the selection of Monitor display, Analyzer and Generator presets.

- Rasterized HDMI/SDI outputs to allow up to 16 individual instrument panels (windows) to be displayed on a single DVI 1920 x 1080 resolution monitor. ideal for outside broadcast facilities and engineering bays where space is at a premium.

- Individual input selection, for instant confidence and monitoring of feeds, using dedicated source selection buttons.

- Control via front panel controls, for in-bay use and remotely via a network connection using a web browser.

- Front panel headphone socket to allow monitoring of the selected Audio channel.

- Two Module slots allowing the installation of Analyzer and Generator modules.

Rx 1000 Rasterizer

Description

The Rx 1000 is a 1U rack-mounted instrument that provides the following:

- OLED display to allow the monitoring inputs and the selection of Monitor display, Analyzer and Generator presets.

- Rasterized HDMI/SDI outputs to allow up to 16 individual instrument panels (windows) to be displayed on a single DVI 1920 x 1080 resolution monitor. ideal for outside broadcast facilities and engineering bays where space is at a premium.

- Individual input selection, for instant confidence and monitoring of feeds, using dedicated source selection buttons.

- Control through front panel controls, for in-bay use and remotely using a network connection using a web browser.

- Front panel headphone socket to allow monitoring of the selected Audio channel.

- Four Module slots allowing the installation of Analyzer and Generator modules.

Environmental Requirements

Operating Temperature:

0° to 40°C

Operating Humidity:

< 85% RH (non-condensing)

Power Requirements:

AC 90 to 250 V at 50/60 Hz 70 W (max)

Height:

Rx 500 and Rx 1000: 1U, 44 mm (1.75 inch)

Width:

Rx 500: 241 mm (8.5 inch)

Rx 1000: 443 mm (17.4 inch)

Depth:

Rx 500: 165 mm (6.5 inch)

Rx 1000:170 mm (6.7 inch)

Weight:

Rx 500: 0.75 kg (1.65 lb)

Rx 1000: 1.7 kg (3.75 lb)

Rx 1000 Dimensions

Front Panel Dimensions
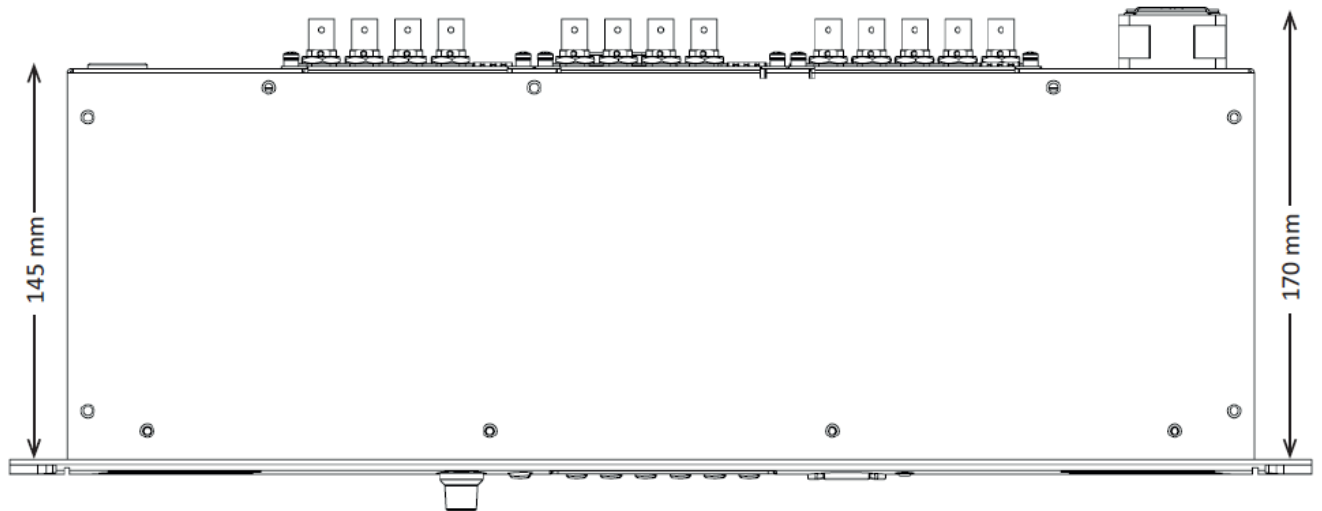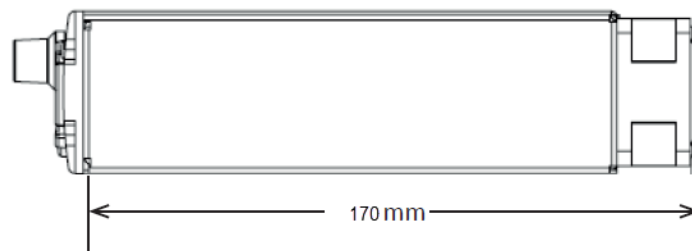
44 mm

483 mm

Top Panel Dimensions

145 mm

170 mm

Side Panel Dimensions

170 mm

Rx 500 Dimensions

Front Panel Dimensions

44mm

241 mm

Top Panel Dimensions

170 mm

145 mm

165 mm

Side Panel Dimensions

164 mm
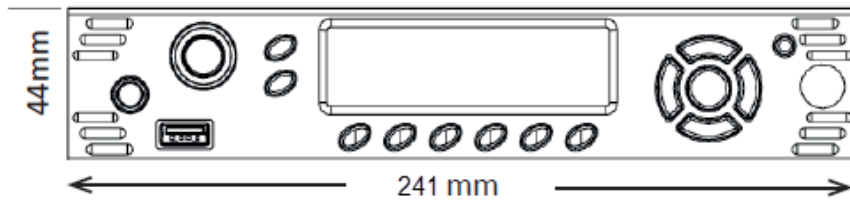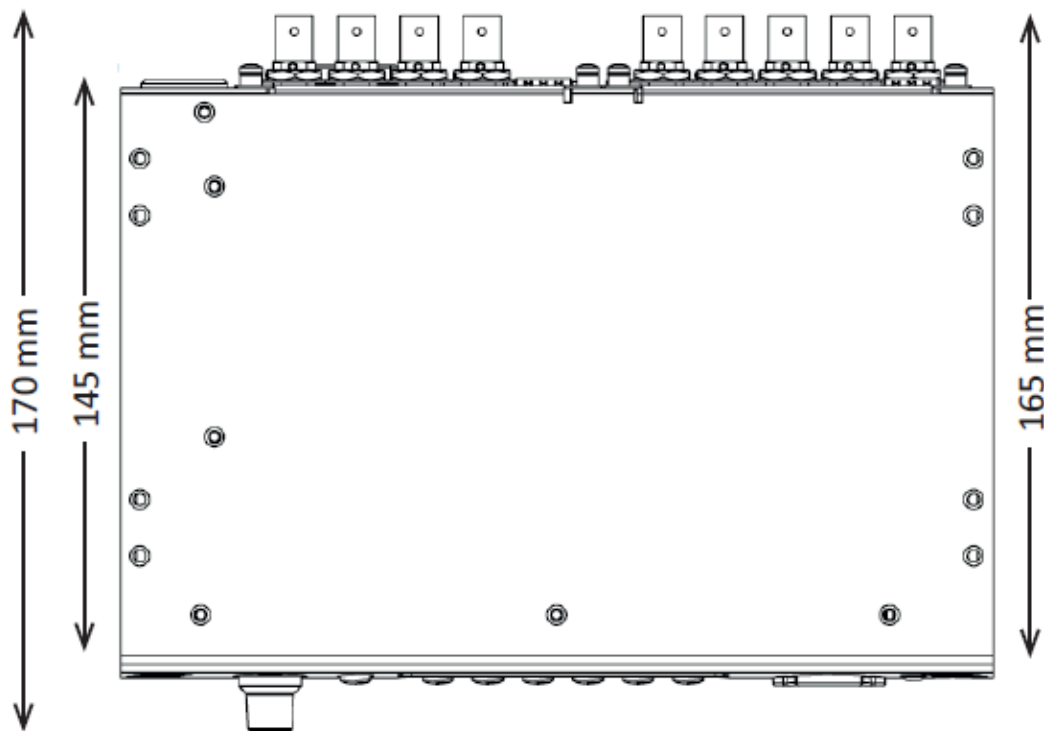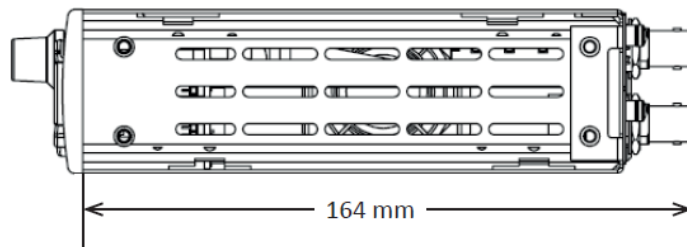
Rx 1000 Front Panel

The front panel provides access to the OLED Display and menu system to allow preset Monitor display, Analyzer and Generator settings to be recalled.

Front Panel Display

Display Type:

OLED Dispaly

Quantity:

One

Backlight:

Variable brightness

Screen Saver:

Reduces brightness after user adjustable time operation.

Headphone Output

Connector:

1/4 Inch Stereo Jack

Level:

Adjustable

Quantity:

One (front mounted)

Purpose:

Local monitoring of audio

Rx 500 Front Panel

The front panel provides access to the OLED Display and menu system to allow preset Monitor display, Analyzer and Generator settings to be recalled.

Front Panel Display

Display Type:

OLED Dispaly

Quantity:

One

Backlight:

Variable brightness

Screen Saver:

Reduces brightness after user adjustable time operation.

Headphone Output

Connector:

1/4 Inch Stereo Jack

Level:

Adjustable

Quantity:

One (front mounted)

Purpose:
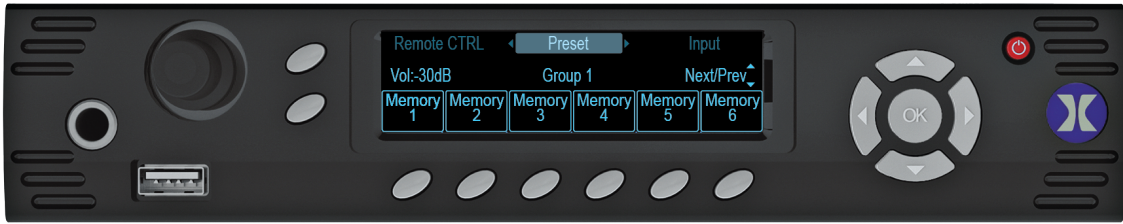
Local monitoring of audio

Rear Panels

Rx 1000 Rear Panel

The rear panel provides the Rx instrument's connections via the CPU module and the installed Analyzer or Generator modules. See the section *HDMI Monitor Output* for details of the different modules.

Rx 500 Rear Panel
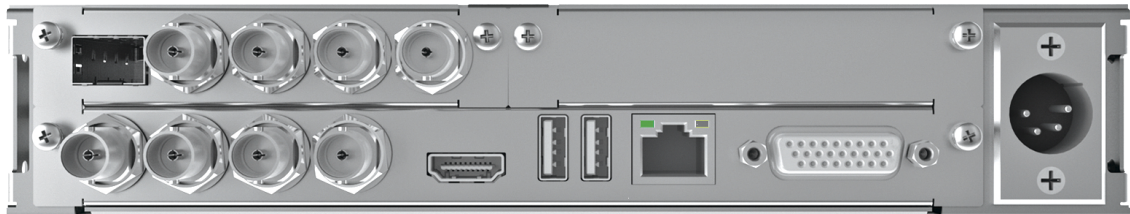
Power Connection

Connector:

> 4-pin XLR, Male

Voltage:

> 12 V +/− 5% AC. DC Power Adapter supplied

External Locking Reference

Label:

> REF

Purpose:

> Allows the Rx instrument to be locked to a studio reference.

Input Signal:

> Tri-level or Bi-Level (black burst) syncs 50 / 59.94 / 60 Hz

Connector:

> BNC

Input Impedance:

> 75 ohm terminated

Input Return Loss:

> > 40 dB to 6 MHz (typical)

Maximum Input Voltage:

> +/− 2 V

Specification:

Tri-level syncs (SMPTE 274M and SMPTE 296M) 600 mV pk-pk,
PAL Black Burst (ITU624-4/SMPTE318) 1 V pk-pk,
Composite NTSC (SMPTE 170M) 1 V pk-pk

AES Input

Label:

AES IN

Connector:

BNC

Input Impedance:

75 ohm terminated

Maximum Input Voltage:

+/− 2 V

Sample Rates:

The input has a sample rate converter and so will accept any sample rate from 32 kHz to
192 kHz.

Specification:

Conforming to AES3-2003 and SMPTE-276M

SDI Out

Label:

SDI OUT

Connector:

BNC

Input Impedance:

75 ohm terminated

Output Level:

+/− 400 mV

Purpose:

A basic SD-SDI or HD-SDI signal generator output that provides test signals generated by
the on-board Generator. This output can also be used to provide an SDI monitor output
tied to the HDMI® monitor output.

Test Signals:

100% Color Bars, 75% Color Bars. or Check Field Pathological

HDMI

Connector:

Type A

Video Format:

1920 x 1080 RGB 4:4:4

Audio Format:

4 x PCM stereo audio at 48 kHz

Purpose:

Monitor output that allows up to 16 individual instrument panels (or windows) to be dis-
played.

Local Control

USB Connector:

USB 2 Type A

Quantity:

Three (1 x front mounted, 2 x rear mounted)

Purpose:

Keyboard and mouse control for HDMI® monitor output of instrument and software installation.

Networking

Ethernet:

IEEE 802.3 10 / 100 Mb/s (10 / 100-base-T connection)

Ethernet Connector:

RJ-45

Purpose:

Browser control of instrument and FTP access to system files and allowing the Rx instrument to be connected into a network and accessed over TCP/IP so that it can be controlled remotely.

GPIO

Connector:

26-way D-type

Purpose:

Provides a GPI (general purpose input), LTC control and analog audio connections.
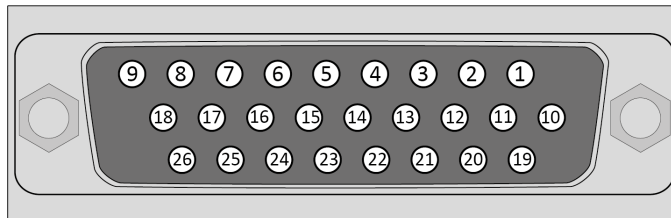
Pin Number	Function
1	Data Terminal Equipment - Transmit (TX) (RS-232 compatible)
2	Data Terminal Equipment - Receive (RX) (RS-232 compatible)
3	Data Terminal Equipment - Request to Send (RTS)
4	Data Terminal Equipment - Clear to Send (CTS)
5	Longitudinal Timecode (LTC) - Receive (RX) P (RS-422 compatible)
6	Longitudinal Timecode (LTC) - Receive (RX) N (RS-422 compatible)
7	Audio Line Out - Right (1 V peak-to-peak analog, full scale 0 dBFS)

Pin Number	Function
8	Audio Line Out - Left (1 V peak-to-peak analog, full scale 0 dBFS)
9	5 Volt, current-limited GPIO supply for *open drain* input/outputs.
10 - 18	Signal ground / 0 Volt
19	GPIO - 0 (open drain with 10 kohm pull-up to +5 Volts)
20	GPIO - 1 (open drain with 10 kohm pull-up to +5 Volts)
21	GPIO - 2 (open drain with 10 kohm pull-up to +5 Volts)
22	GPIO - 3 (open drain with 10 kohm pull-up to +5 Volts)
23	GPIO - 4 (open drain with 10 kohm pull-up to +5 Volts)
24	GPIO - 5 (open drain with 10 kohm pull-up to +5 Volts)
25	GPIO - 6 (open drain with 10 kohm pull-up to +5 Volts)
26	GPIO - 7 (open drain with 10K ohm pull-up to +5 Volts)

GPIO pins 0, 1, 2 and 3 can be used to select specific system memory presets, for example to remotely control the Rx unit using contact closure or logic levels. See the section *Preset Memories* for details.

GPIO Pin 0	GPIO Pin 1	GPIO Pin 2	GPIO Pin 3	Preset Controlled
Low	High	High	High	Preset 1
High	Low	High	High	Preset 2
Low	Low	High	High	Preset 3
High	High	Low	High	Preset 4
Low	High	Low	High	Preset 5
High	Low	Low	High	Preset 6
Low	Low	Low	High	Preset 7
High	High	High	Low	Preset 8
Low	High	High	Low	Preset 9
High	Low	High	Low	Preset 10

GPIO pins 0 and 1 (or pins 2 and 3) can also be used to control the loudness function as follows:

GPIO Pin 0 / 2 Enable/Reset	GPIO Pin 1 / 3 Run/Pause	Loudness Operation
High	High	Reset

| GPIO Pin 0 / 2 Enable/Reset	GPIO Pin 1 / 3 Run/Pause	Loudness Operation
High	Low	Reset
Low	High	Paused
Low	Low	Running

Note also that the GPIO 4, 5, 6 and 7 output tally is set low when an error state occurs on an analyzer:

- Pin 4 = Analyzer 1
- Pin 5 = Analyzer 2
- Pin 6 = Analyzer 3
- Pin 7 = Analyzer 4

GPIO Pin 4	GPIO Pin 5	GPIO Pin 6	GPIO Pin 7	Analyzer Slot
Low	High	High	High	Analyzer Slot 1
High	Low	High	High	Analyzer Slot 2
High	High	Low	High	Analyzer Slot 3
High	High	High	Low	Analyzer Slot 4

Rx Modules

Single Analyzer, Dual Input
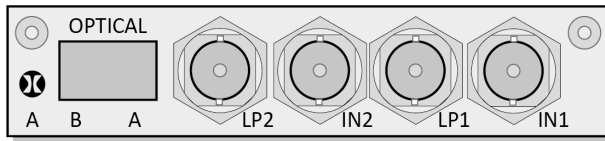
The **PHRXM-A** module allows two connected SDI or Optical video signals to be present continuously and switched for analysis or display by the single analyzer channel.

Analyzer SDI Inputs

Label:

IN1 and IN2

Supported standards:

SD-SDI or HD-SDI. See Supported formats

Connector:

BNC

Input Impedance:

75 ohm terminated

Input Return Loss:

Better than 15 dB (5 MHz to 1485 MHz) and 10 dB (1485 MHz to 2970 MHz)

Maximum Input Voltage:

+/− 2 V

Analyzer SDI Outputs

Label:

LP1 and LP2

Purpose:

Loop through of IN1 and IN2

Connector:

BNC

Output Impedance:

75 ohm terminated

Analyzer Optical Inputs

Label:

OPTICAL A and B

Purpose:

To provide two optical video/audio inputs

Type:

SFP Optical Dual Receiver Module (option PHSFP-2R30-1310)

Specifications:

SMPTE 424M, SMPTE 292M, and SMPTE 259M

Analyzer Functionality

With the module installed the Analyzer menu allows the follow monitoring to be displayed:

The Picture viewer is provided to allow you to monitor the selected input to give confidence that the signal is present, is the correct subject (or feed), it is moving and looks OK.

The Vectorscope allows you to check the hue, saturation and phase of the selected input. Controls are provided to allow you to select the line (s) to be monitored (ideal for checking any embedded test pattern in the selected feed), the field to be checked and the graticule scale.

The Waveform Monitor allows you to check the levels of the video content are correct. Controls are provided to allow you to select the waveform (YCbCr, Y, Cb, Cr, GBR, Red, Green or Blue), the horizontal and vertical scale and the line(s) to be monitored.

The Audio monitor (16 embedded audio channels, 48 kHz, 20-bit (SD-SDI) 24-bit (HD-SDI)) allows you to check the audio levels of the selected input. In addition to the visual display, the selected audio channel can be monitored via the front panel loudspeakers or headphone jack.

Single Analyzer, Dual Input, Physical Layer Measurement
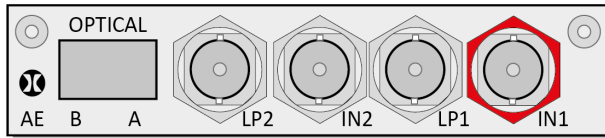
The **PHRXM-AE** module allows two connected SDI or Optical video signals to be present continuously and selected for analysis or display by the single analyzer channel as required.

The PHRXM-AE module provides the following connections:

Analyzer SDI Inputs

Label:

IN1 and IN2

Supported standards:

SD-SDI or HD-SDI. See Supported formats

Connector:

BNC

Input Impedance:

75 ohm terminated

Input Return Loss:

Better than 15 dB (5 MHz to 1485 MHz) and 10 dB (1485 MHz to 2970 MHz)

Maximum Input Voltage:

+/− 2 V

Purpose:

Analyzer Inputs

Analyzer SDI Outputs

Label:

LP1 and LP2

Connector:

BNC

Output Impedance:

75 ohm terminated

Purpose:

Loop through of IN1 and IN2

Analyzer Optical Inputs

Label:

OPTICAL A and B

Type:

SFP Optical Dual Receiver Module (Option PHSFP-2R30-1310)

Specifications:

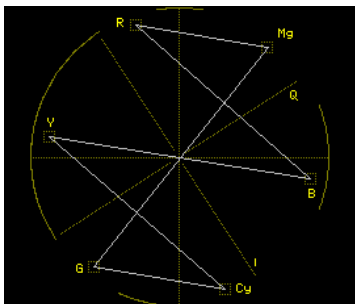SMPTE 424M, SMPTE 292M, and SMPTE 259M

Purpose:

To provide two optical video / audio inputs
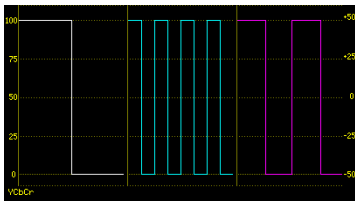
Analyzer Functionality

The PHRXM-AE module provides analyzer functionality for two concurrently connected SD-SDI, HD-SDI or Optical inputs. With the module installed the Analyzer menu allows the follow monitoring to be displayed:
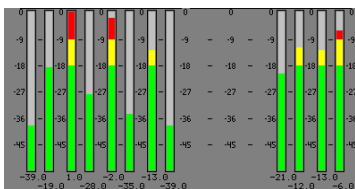

The Picture viewer is provided to allow you to monitor the selected input to give confidence that the signal is present, is the correct subject (or feed), it is moving and looks OK.
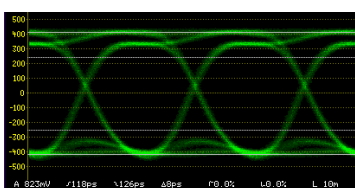

The Vectorscope allows you to check the hue, saturation and phase of the selected input. Controls are provided to allow you to select the line (s) to be monitored (ideal for checking any embedded test pattern in the selected feed), the field to be checked and the graticule scale.
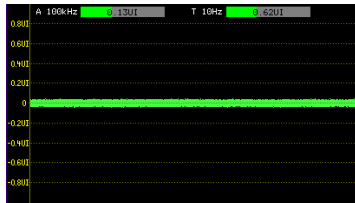

The Waveform Monitor allows you to check the levels of the video content are correct. Controls are provided to allow you to select the waveform (YCbCr, Y, Cb, Cr, GBR, Red, Green or Blue), the horizontal and vertical scale and the line(s) to be monitored.

The Audio monitor (16 embedded audio channels, 48 kHz, 20-bit (SD-SDI) 24-bit (HD-SDI)) allows you to check the audio levels of the selected input. In addition to the visual display, the selected audio channel can be monitored via the front panel loud speakers or head phone jack.

The Eye Pattern monitor allows you to check the level of jitter present in the selected source. Controls are provided to allow you to isolate specific frequencies of jitter to ensure that they are within acceptable tolerances.

The Jitter monitor allows you to measure the amplitude of jitter present in the selected source against time. Controls are provided for scaling and filtering to isolate specific jitter types.

Single Analyzer, Single Generator
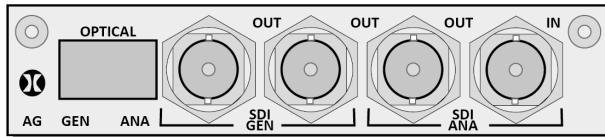
The **PHRXM-AG** module allows a single connected SDI or Optical video signal to be monitored continuously and allows the generation of a single SDI or Optical video test signal.

The PHRXM-AG module provides the following connections:

Analyzer SDI Input

Label:

SDI ANA IN

Supported standards:

SD-SDI or HD-SDI. See Supported formats

Connector:

BNC

Input Impedance:

75 ohm terminated

Input Return Loss:

Better than 15 dB (5 MHz to 1485 MHz) and 10 dB (1485 MHz to 2970 MHz)

Maximum Input Voltage:

+/− 2 V

Purpose:

Analyzer Input

Analyzer SDI Output

Label:

SDI ANA OUT

Connector:

BNC

Output Impedance:

75 ohm terminated

Purpose:

Loop through of SDI ANA IN

Analyzer Optical Input

Label:

OPTICAL ANA

Type:

SFP Optical Single Receiver Module/Single Transmitter (Option PHSFP-RT30-1310)

Specifications:

SMPTE 424M, SMPTE 292M, and SMPTE 259M

Purpose:

To provide a single optical video/audio input

Generator SDI Outputs

Label:

SDI GEN OUT

Supported standards:

SD-SDI or HD-SDI. See Supported formats

Connector:

BNC x 2

Output Impedance:

75 ohm terminated

Output Level:

+/− 400 mV

Purpose:

Generator Output

Generator Optical Ouput

Label:

OPTICAL GEN

Type:

SFP Optical Single Receiver Module/Single Transmitter (option PHSFP-RT30-1310)

Specifications:
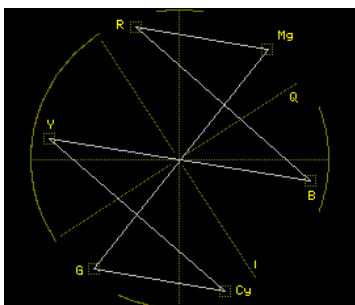
SMPTE 424M, SMPTE 292M, and SMPTE 259M

Purpose:

To provide a single optical video/audio output
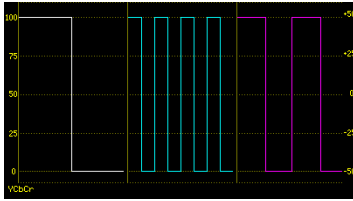
Analyzer Functionality

The PHRXM-AG module provides analyzer functionality for two concurrently connected SD-SDI, HD-SDI or Optical inputs. With the module installed the Analyzer menu allows the follow monitoring to be displayed:
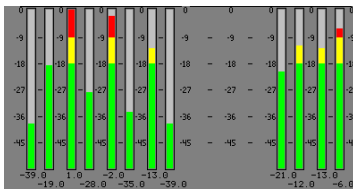

The Picture viewer is provided to allow you to monitor the selected input to give confidence that the signal is present, is the correct subject (or feed), it is moving and looks OK.

The Vectorscope allows you to check the hue, saturation and phase of the selected input. Controls are provided to allow you to select the line (s) to be monitored (ideal for checking any embedded test pattern in the selected feed), the field to be checked and the graticule scale.
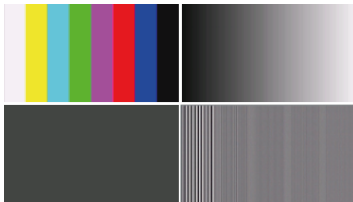

The Waveform Monitor allows you to check the levels of the video content are correct. Controls are provided to allow you to select the waveform (YCbCr, Y, Cb, Cr, GBR, Red, Green or Blue), the horizontal and vertical scale and the line(s) to be monitored.

The Audio monitor (16 embedded audio channels, 48 kHz, 20-bit (SD-SDI) 24-bit (HD-SDI)) allows you to check the audio levels of the selected input. In addition to the visual display, the selected audio channel can be monitored via the front panel loudspeakers or headphone jack.
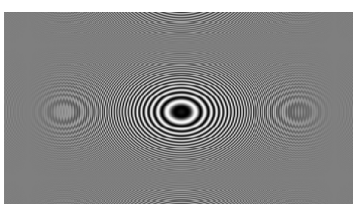
Generator Functionality

The PHRXM-AG module provides a single video/audio signal generator functionality. The Generator menu allows the following test signals to be generated. The Generator provides:
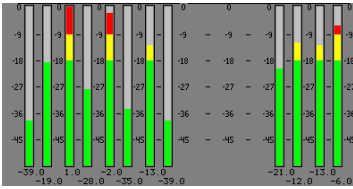

32, 10-bit Line-based video test patterns such as color bars, ramp, color plate, multiburst and user defined (DPX, YUV, TGA, BMP) that can be used to check video levels, linearity, saturation, hue, color phase and frequency response.

Pathogenic video test patterns such as Bars+Red, SMPTE Bars, Check Field that can be used to check that decoding, encoding and transmission processes are correct.
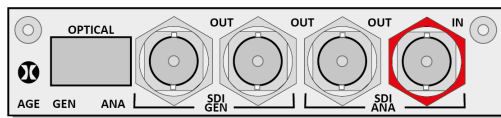

Zone Plate generator test patterns are provided and allow the selection of several predetermined zone plates as well as 3 user customizable zone plates.

17 fixed Audio test tones (fixed 100 Hz to 20 kHz), variable tones (1 Hz to 24 kHz in 1 Hz steps), intermittent tone, white noise or silence on audio pairs and audio groups. Audio level variable (0 to −100 dB in 1 dB steps).

Single Analyzer, Single Generator, Physical Layer Measurement

The **PHRXM-AGE** module allows a single connected SDI or Optical video signal to be monitored continuously and allows the generation of a single SDI or Optical video test signal.

The PHRXM-AGE module provides the following connections:

Analyzer SDI Input

Label:

SDI ANA IN

Supported standards:

SD-SDI or HD-SDI. See Supported formats

Connector:

BNC

Input Impedance:

75 ohm terminated

Input Return Loss:

Better than 15 dB (5 MHz to 1485 MHz) and 10 dB (1485 MHz to 2970 MHz)

Maximum Input Voltage:

+/− 2V

Purpose:

Analyzer Input

Analyzer SDI Output

Label:

SDI ANA OUT

Connector:

BNC

Output Impedance:

75 ohm terminated

Purpose:

Loopthrough of SDI ANA IN

Analyzer Optical Input

Label:

OPTICAL ANA

Type:

SFP Optical Single Receiver Module/Single Transmitter (option PHSFP-RT30-1310)

Specifications:

SMPTE 424M, SMPTE 292M, and SMPTE 259M

Purpose:

To provide a single optical video/audio input

Generator SDI Outputs

Label:

SDI GEN OUT

Supported standards:

SD-SDI or HD-SDI. See Supported formats

Connector:

BNC x 2

Output Impedance:

75 ohm terminated

Output Level:

+/− 400 mV

Purpose:

Generator Output

Generator Optical Output

Label:

OPTICAL GEN

Type:

SFP Optical Single Receiver Module/Single Transmitter (option PHSFP-RT30-1310)
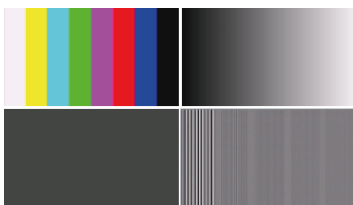
Specifications:

SMPTE 424M, SMPTE 292M, and SMPTE 259M

Purpose:

To provide a single optical video/audio output
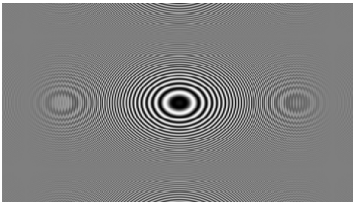
Generator Functionality

The PHRXM-AGE module provides a single video/audio signal generator functionality. The Generator menu allows the following test signals to be generated. The Generator provides:

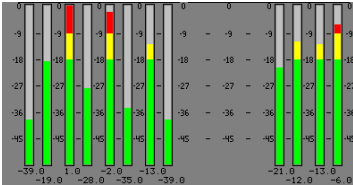32, 10-bit Line-based video test patterns such as color bars, ramp, color plate, multiburst and user defined (DPX, YUV, TGA, BMP) that can be used to check video levels, linearity, saturation, hue, color phase and frequency response.

Pathogenic video test patterns such as Bars+Red, SMPTE Bars, Check Field that can be used to check that decoding, encoding and transmission processes are correct.

Zone Plate generator test patterns are provided and allow the selection of several predetermined zone plates as well as 3 user customizable zone plates.
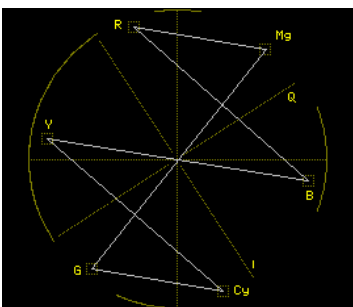

17 fixed Audio test tones (fixed 100 Hz to 20 kHz), variable tones (1 Hz to 24 kHz in 1 Hz steps), intermittent tone, white noise or silence on audio pairs and audio groups. Audio level variable (0 to −100 dB in 1 dB steps).

Analyzer Functionality

The PHRXM-AGE module provides analyzer functionality for two concurrently connected SD-SDI, HD-SDI or Optical inputs. With the module installed the Analyzer menu allows the follow monitoring to be displayed:

The Picture viewer is provided to allow you to monitor the selected input to give confidence that the signal is present, is the correct subject (or feed), it is moving and looks OK.

The Vectorscope allows you to check the hue, saturation and phase of the selected input. Controls are provided to allow you to select the line (s) to be monitored (ideal for checking any embedded test pattern in the selected feed), the field to be checked and the graticule scale.

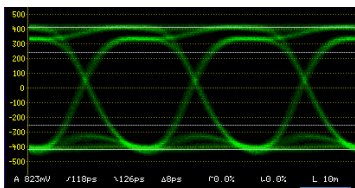The Waveform Monitor allows you to check the levels of the video content are correct. Controls are provided to allow you to select the waveform (YCbCr, Y, Cb, Cr, GBR, Red, Green or Blue), the horizontal and vertical scale and the line(s) to be monitored.

The Audio monitor (16 embedded audio channels, 48 kHz, 20-bit (SD-SDI) 24-bit (HD-SDI)) allows you to check the audio levels of the selected input. In addition to the visual display, the selected audio channel can be monitored via the front panel loud speakers or head phone jack.

The Eye Pattern monitor allows you to check the level of jitter present in the selected source. Controls are provided to allow you to isolate specific frequencies of jitter to ensure that they are within acceptable tolerances.

The Jitter monitor allows you to measure the amplitude of jitter present in the selected source against time. Controls are provided for scaling and filtering to isolate specific jitter types.

Dual Output Generator Module

The **PHRXM-GDL** module allows the generation of a two independent SDI or Optical video test signals with the same video format, color space and frame rate for Dual link use.

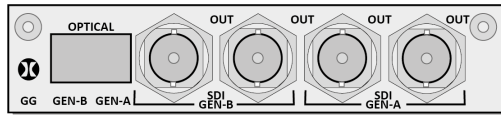The PHRXM-GDL module provides the following connections:

Generator SDI Outputs

Label:

SDI GEN-A OUT and SDI GEN-B OUT

Supported standards:

SD-SDI or HD-SDI. See Supported formats

Connector:

BNC x 4

Output Impedance:

75 ohm terminated

Output Level:

+/− 400 mV

Purpose:

Generator Outputs

Generator Optical Outputs

Label:

OPTICAL GEN-A and OPTICAL GEN-B

Type:

SFP Optical Dual Transmitter Module (option PHSFP-2T30-1310)

Specifications:

SMPTE 424M, SMPTE 292M, and SMPTE 259M

Purpose:

To provide 2 optical video / audio outputs

Generator Functionality

The PHRXM-GDL module provides a dual video/audio signal generator functionality. The Generator menu allows the following test signals to be generated. The Generator provides:

32, 10-bit Line-based video test patterns such as color bars, ramp, color plate, multiburst and user defined (DPX, YUV, TGA, BMP) that can be used to check video levels, linearity, saturation, hue, color phase and frequency response.

Pathogenic video test patterns such as Bars+Red, SMPTE Bars, Check Field that can be used to check that decoding, encoding and transmission processes are correct.

Zone Plate generator test patterns are provided and allow the selection of several predetermined zone plates as well as 3 user customizable zone plates.

17 fixed Audio test tones (fixed 100 Hz to 20 kHz), variable tones (1 Hz to 24 kHz in 1 Hz steps), intermittent tone, white noise or silence on audio pairs and audio groups. Audio level variable (0 to −100 dB in 1 dB steps).

AES Digital Audio Input / Output
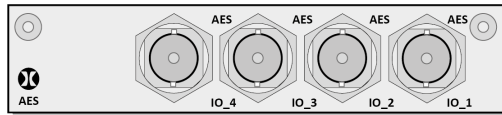
The **PHRXM-4AES** module allows 4 x AES digital audio pairs to be routed to the Audio Meter and Loudness instruments.

Label:

AES IO_1 to AES IO_4

Connector:

BNC x4

Standard:

AES3-4-2009 *Annex D Coaxial transmission*

Input Impedance:

75 ohm terminated

Input Return Loss:

Better than 15 dB (5 MHz to 1485 MHz)

Maximum Input Voltage:

+/− 2 V

Input Sample Rate:

32 kHz to 192 kHz

Output Sample Rate:

48 kHz

Input Bit Depth:

20 bit or 24 bit

Output Bit Depth:

24 bit

Purpose:

AES digital audio pair Input and Output

Supported Video Formats

SD 270 Mb/s

Standard	Resolution	Color Space	Rate
EBU Tech. 3267-E	720 x 576	4:2:2 (Y'C'BC'R') / 10-bit	I 50.00
SMPTE 259M	720 x 483	4:2:2 (Y'C'BC'R') / 10-bit	I 59.94

HD 1.485 Gb/s (SMPTE 292M)

Standard	Resolution	Color Space	Rate
SMPTE 296M	1280 x 720	4:2:2 (Y'C'BC'R') / 10 bit	P 23.98, P 24.00, P 25.00,P 29.97, P 30.00, P 50.00, P 59.94, P 60.00
SMPTE 260M	1920 x 1035	4:2:2 (Y'C'BC'R') / 10 bit	I 59.94, I 60.00
SMPTE 274M	1920 x 1080	4:2:2 (Y'C'BC'R') / 10 bit	I 50.00, I 59.94, I 60.00
SMPTE 274M	1920 x 1080	4:2:2 (Y'C'BC'R')/ 10 bit	P 23.98, P 24.00, P 25.00, P 29.97, P 30.00
SMPTE RP211	1920 x 1080	4:2:2 (Y'C'BC'R')/ 10 bit	sF 23.98, sF 24.00, sF 25.00, sF 29.97, sF 30.00
SMPTE 2048-2	2048 x 1080	4:2:2 (Y'C'BC'R') / 10 bit	P 23.98, P 24.00, P 25.00, P 29.97, P 30.00

Dual Link 1.485 Gb/s (SMPTE 327M)

Standard	Resolution	Color Space	Rate
SMPTE274M	1920 x 1080	4:2:2 (Y'C'BC'R') / 10 bit	P 50.00, P 59.94, P 60.00
SMPTE 274M	1920 x 1080	4:4:4 (R'G'B'), 4:4:4:4 (R'G'B'+A) / 10-bit	P or sF 23.00, P or sF 24.00, P or sF 25.00, P or sF 29.97, P or sF 30.00, I 50.00, I 59.94, I 60.00
SMPTE 274M	1920 x 1080	4:4:4 (R'G'B') / 12-bit	P or sF 23.00,

Standard	Resolution	Color Space	Rate
			P or sF 24.00, P or sF 25.00, P or sF 29.97, P or sF 30.00, I 50.00, I 59.94, I 60.00
SMPTE 274M	1920 x 1080	4:4:4 (Y'C'BC'R'), 4:4:4:4 (Y'C'BC'R'+A) / 10-bit	P or sF 23.00, P or sF 24.00, P or sF 25.00, P or sF 29.97, P or sF 30.00, I 50.00, I 59.94, I 60.00
SMPTE 274M	1920 x 1080	4:4:4 (Y'C'BC'R') / 12 bit	P or sF 23.00, P or sF 24.00, P or sF 25.00, P or sF 29.97, P or sF 30.00, I 50.00, I 59.94, I 60.00
SMPTE 274M	1920 x 1080	4:2:2 (Y'C'BC'R') / 12 bit	P or sF 23.00, P or sF 24.00, P or sF 25.00, P or sF 29.97, P or sF 30.00, I 50.00, I 59.94, I 60.00
SMPTE 428-9	2048 x 1080	4:4:4 (X'Y'Z') / 12 bit	P or sF 23.98, P or sF 24.00

3G Level-A 2.97 Gb/s (SMPTE 425M-A)

Standard	Resolution	Color Space	Rate
SMPTE274M	1920 x 1080	4:2:2 (Y'C'BC'R') / 10 bit	P 50.00, P 59.94, P 60.00
SMPTE 296M	1280 x 720	4:4:4 (R'G'B'), 4:4:4:4 (R'G'B'+A) / 10 bit	P 23.00, P 24.00, P 25.00, P 29.97, P 30.00, P 50.00, P 59.94, P 60.00
SMPTE 296M	1280 x 720	4:4:4 (Y'C'BC'R'), 4:4:4:4 (Y'C'BC'R'+A) / 10 bit	P 23.00 *, P 24.00 *, P 25.00 *, P 29.97 *, P 30.00 *, P 50.00 *, P 59.94 *, P 60.00 *
SMPTE 274M	1920 x 1080	4:4:4 (R'G'B'), 4:4:4:4 (R'G'B'+A) / 10-bit	P or sF 23.00 *, P or sF 24.00 *,

Standard	Resolution	Color Space	Rate
			P or sF 25.00 *, P or sF 29.97 *, P or sF 30.00 *, I 50.00 *, I 59.94 *, I 60.00 *
SMPTE 274M	1920 x 1080	4:4:4 (Y'C'BC'R'), 4:4:4:4 (Y'C'BC'R'+A) / 10-bit	P or sF 23.00 *, P or sF 24.00 *, P or sF 25.00 *, P or sF 29.97 *, P or sF 30.00 *, I 50.00 *, I 59.94 *, I 60.00
SMPTE 274M	1920 x 1080	4:4:4 (R'G'B') / 12-bit	P 23.00 *, P 24.00 *, P 25.00 *, P 29.97 *, P 30.00 *, I 50.00 *, I 59.94 *, I 60.00 *
SMPTE 274M	1920 x 1080	4:4:4 (Y'C'BC'R') / 12 bit	P 23.00 *, P 24.00 *, P 25.00 *, P 29.97 *, P 30.00 *, I 50.00 *, I 59.94 *, I 60.00 *
SMPTE 428-9	2048 x 1080	4:4:4 (X'Y'Z')/12 bit	P or sF 23.98 *, P or sF 24.00 *
SMPTE 274M	1920 x 1080	4:4:4 (R'G'B') / 12-bit	P or sF 23.00, P or sF 24.00, P or sF 25.00, P or sF 29.97, P or sF 30.00, I 50.00, I 59.94, I 60.00
SMPTE 274M	1920 x 1080	4:4:4 (Y'C'BC'R'), 4:4:4:4 (Y'C'BC'R'+A) / 10-bit	P or sF 23.00, P or sF 24.00, P or sF 25.00, P or sF 29.97, P or sF 30.00, I 50.00, I 59.94, I 60.00
SMPTE 274M	1920 x 1080	4:4:4 (Y'C'BC'R') / 12 bit	P or sF 23.00, P or sF 24.00, P or sF 25.00, P or sF 29.97, P or sF 30.00, I 50.00, I 59.94, I 60.00
SMPTE 274M	1920 x 1080	4:2:2 (Y'C'BC'R') / 12 bit	P or sF 23.00, P or sF 24.00, P or sF 25.00, P or sF 29.97,

Standard	Resolution	Color Space	Rate
			P or sF 30.00, I 50.00, I 59.94, I 60.00
SMPTE 428-9	2048 x 1080	4:4:4 (X'Y'Z') / 12 bit	P or sF 23.98, P or sF 24.00
SMPTE 274M	1920 x 1080	4:2:2 (Y'C'BC'R') / 12 bit	P or sF 23.98 *, P or sF 24.00 *, P or sF 25.00 *, P or sF 29.97 *, P or sF 30.00 *, I 50.00 *, I 59.94 *, I 60.00 *

> **Note:** * Advanced Format Option required

3G Level-B 2.97 Gb/s (SMPTE 425-B)

Payload Yype:

- 1 x SMPTE 372M dual-link payload
- 2 x SMPTE 292M HD 720 payloads
- 2 x SMPTE 292M HD 1080 payloads

Built-in Generator Formats (CPU Module)

The following test patterns are available:

- 100% Color Bars

- 75% Color Bars

- Check Field

Standard	Resolution	Color Space	Rate
EBU Tech. 3267-E	720 x 576	4:2:2 (Y'C'BC'R') / 10 bit	I 50.00
SMPTE 259M	720 x 483	4:2:2 (Y'C'BC'R')/10-bit	I 59.94
SMPTE 296M	1280 x 720	4:2:2 (Y'C'BC'R') / 10 bit	P 23.98, P 24.00, P 25.00, P 29.97, P 30.00, P 50.00, P 59.94, P 60.00
SMPTE 274M	1920 x 1080	4:2:2 (Y'C'BC'R') / 10 bit	I 50.00, I 59.94, I 60.00
SMPTE 274M	1920 x 1080	4:2:2 (Y'C'BC'R') / 10 bit	P 23.98, P 24.00, P 25.00, P 29.97, P 30.00
3G-A SMPTE 274M	1920 x 1080	4:2:2 (Y'C'BC'R') / 10 bit	P 50.00, P 59.94, P 60.00
3G-B SMPTE 274M	1920 x 1080	4:2:2 (Y'C'BC'R') / 10 bit	P 50.00, P 59.94, P 60.00

Maintenance

C

Warranty

Overview

The Rx range benefits from a one-year warranty including telephone and email support. Each Rx leaves our UK factory with its own unique list of quality-controlled settings which are recorded by our manufacturing department. Should the unit require calibration, these settings are compared with its pre- calibration state to ensure consistency and traceability.

The product has been designed and manufactured to be of the highest quality. However, should the instrument develop a fault during the warranty period, please return to your local PHABRIX agent for repair.

Calibration services are available throughout the PHABRIX network of distributors, see: https://www.phabrix.com

Warranty Exceptions

PHABRIX is not responsible for free service during the warranty period under the following conditions:

- Incorrect voltage applied to instrument.
- Incorrect power adaptor used.
- Fire, natural disaster.
- Repair of instrument by non-PHABRIX approved agent
- Repair of damage caused by third party products.
- Repair of damage caused by improper use.
- Repair without proof of purchase.

Product Registration

Please register your product online at: https://www.phabrix.com

Registering your product with PHABRIX ensures that you receive free email and telephone technical support, plus free software updates during your product's warranty lifetime.

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Maintenance

General Maintenance

The Rx 2000, Rx 1000 and Rx 500instruments have been designed to need minimum maintenance. The use of low power components means that there is no need for large amounts of cooling and therefore there is no need to clean fan filters.

The case can be cleaned by wiping gently with a soft cloth, lightly dampened with a neutral cleaning agent. A screen cleaning cloth may be used to clean the LCD. Do not apply force to the LCD when cleaning or it may be damaged.

> **Warning:** Always remove the power supply from the instrument and turn OFF before cleaning. Do not allow any water or other liquid to enter the instrument while cleaning.

Preventative Maintenance

For long reliable use of the Rx instrument please take the following precautions:

- Install the Rx instrument in a position which has adequate air flow and is not in direct sunlight.

- Ensure that connecting cables are tied back so that they do not put strain on the rack mounts and that they do not obstruct air flow.

- Ensure that the fan grilles are not obstructed.

- Avoid installations where there are dramatic changes in temperature, high humidity and areas contaminated by dust, smoke or construction debris.

- Avoid installations that may be affected by vibration.

- Do not exceed the rated operation of the Rx instrument, i.e., temperature and signal levels.

> **Warning:** The instrument should only be operated between 0 and 40° Celsius. If the instrument is operated at a higher temperature, there is a possibility of a fire hazard. If the temperature is changed rapidly from a cold environment to a hot environment, moisture can be created internally which can cause malfunction or damage the instrument. Allow the instrument to sit for 30 minutes without power applied to reduce any possibility of condensation. If the temperature rises above 60° Celsius a warning dialog will be given. If the temperature rises above 65° Celsius the instrument will be switched off. Under both conditions, an event will be added to the event log to show what happened.

Software Maintenance

Installing New Software

New software can be installed on the Rx instrument using any of three different methods, depending on the location of the instrument, the type of network access and your company's IT policy.

Note that during the installation process the instrument will **not** be available for use.

> **Note:** Any existing Presets stored will be archived and will need to be restored if they are required. See the section *Recalling Presets* for details on restoring presets archived by the installation of a new version of software.

Software Download Using a USB Pen Drive

If you have direct access to the equipment bay where the Rx instrument is housed, place a new version of software into the root directory of a USB pen drive and then simply plug the pen drive into the front USB port of the Rx instrument. Install the software as follows:

1. Download the latest Rx software version from the PHABRIX website and place the un-zipped software file(s) in the root directory of a USB pen drive. Makes sure the files are in the root directory and not still in their unzipped folder.

2. Plug the USB pen drive into the USB socket on the front panel of the Rx instrument.
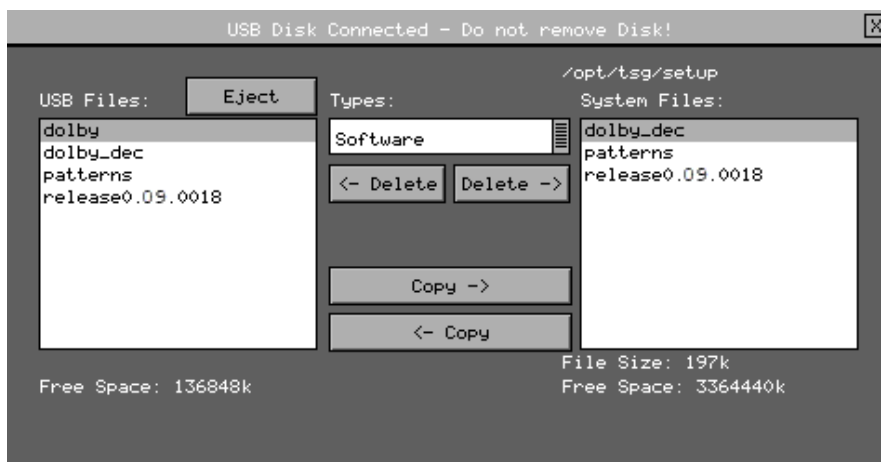
After about 30 seconds a copy utility is displayed on the Rx 2000 front panel and on the HDMI output monitor.

3. Using the **Copy –>** utility, copy the new software release file (e.g., **release 0.09.0018**) displayed in the left panel to the Rx **System Files**. (You will be given the option to overwrite the **dolby**, **dolby_dec**, and **patterns** files in a confirmatation dialog window. Select **Yes**.)

> **Note:** If the file copy process fails, restart the unit and try again. If the copy process fails a second time, contact PHABRIX Support.

4. Once the copy process has completed, select **Eject** and then remove the USB pen drive from the front of the Rx instrument.

5. To install the new software on the unit, select it from the dropdown list in the **System Info** menu on the HDMI output monitor. The highest number is the latest release. Select the **Install** button and a confirmation dialog is displayed. Press **Yes** and the installation will start. You will see the following progress messages displayed:

- Loading new software if found

- Program CPU FPGA

- Program FPGA Slot 1

- Program FPGA Slot 2

- Program FPGA Slot 3

- Program FPGA Slot 4

During this time the software is decompressed, files are extracted and the hardware (FPGAs) are reprogrammed. If an error is given during installation, retry the installation and or download. Do not switch the instrument off until an installation has completed correctly.

Wait for the new software to be installed (this can take up to 10 minutes depending on the number and type of Rx Modules installed). The progress will be indicated on the front panel screen and on the Monitor output:

> **Warning:** Do not use a USB hard drive as the Rx instrument cannot support this and it will damage the Rx instrument.

Software Download from the Internet

If you have access to the Monitor output of the Rx instrument (or can access the unit remotely using a web browser) and the unit has Internet network access, you can download and install software directly to the Rx instrument from the browser:

This is a two-stage process, first the new software needs to be downloaded then the new software needs to be installed on the unit.

1. In the **System - Network** menu (Network window on Monitor Output) check that the network settings are correct and that the instrument is connected to the internet through the Ethernet connection.

2. From the **System Info** menu, select the **Download** button to download the current release of software from the PHABRIX website.

   > **Note:** Multiple releases of software may be stored on the Rx instrument so that a previous release can be re-installed if required.

   This will take about 5 minutes depending on the connection to the Internet. Once the download has completed, the software will be checked for errors before being stored on the instrument for future installation. If the latest software is already present on the Rx instrument, no software will be downloaded and a message will be displayed.

3. To install the downloaded software on the instrument, select it from the dropdown list in the **System Info** menu on the HDMI output monitor. The highest number is the latest release. Select the **Install** button and a confirmation dialog is displayed. Press **Yes** to start the installation.

   During this time the software is decompressed, files are extracted and the hardware (FPGAs) are reprogrammed. If an error is given during installation, retry the installation and or download. Do not switch the instrument off until an installation has completed correctly.

   Once the installation has competed, if **Reboot after Install** is checked the instrument will restart with the new software installed. If unchecked, switch the instrument off and on again manually.

> **Note:** As part of the installation procedure, all memories are archived to a backup file and then deleted. They can be restored from the **System Memories** page using the **Restore** button and selecting the archive **_Before_Upgrade**.

You can view the software release notes by selecting the **Changes** button.

Reverting to an Earlier Version of Software

If you need to revert to an earlier version of software:

1. Use the **System Info** menu to find the version of software you require in the **Software Upgrade** section of the menu then select **Install**.

2. Wait for the old software to be installed (this may take up to 10 minutes depending on the number and type of Rx Modules that are installed.) The progress will be indicated on the front panel screen and on the Monitor output.

   During this time the software will be decompressed, files will be extracted and the hardware (FPGAs) will be reprogrammed. If an error is given during the installation, retry the installation and or download. Do NOT turn the instrument off until an installation has completed correctly.

FTP Connection

Files may be uploaded or downloaded from/to the PHABRIX Sx by a remote PC using the Ethernet connection.

To connect to the instrument you will need to use a FTP client which may be a GUI based one such as FileZilla or that built into windows. Other FTP applications are available for other computer platforms.

- Hostname: This is the IP address that the Rx instrument is using.

- Username: **sxuser**

- Password: **phabrixsx**

Once you have connected to the instrument, you should be able to see the instrument file structure, described below. When downloading software revisions to the Rx instrument you must ensure that your FTP application is set to transfer binary files without corrupting them.

With some FTP clients, such as FileZilla, this requires you to go to the **Edit - Settings** menu and select the **Transfers – File Types** page. Make sure that the checkbox **Treat files without extension as ASCII file** is NOT checked or corruption will occur.

Rx File Structure

The Rx instrument uses Linux as its operating system and a number of directories in the file system are provided for user-specific files.

Backups Directory

The memory / presets that are backed-up using the **System Presets** - **Backup** function are saved as **.mem** files in the **Backups** folder. These can be copied to other Rx units and restored to copy presets from one Rx unit to another.

Patterns Directory

The **Patterns** directory contains several subdirectories for the related video standards. Test pattern files should be placed in the correct directory for the video standard in use, for example, if a 720p video standard is being used, only the test patterns in the 720yuv directory will be available. You may

have a test pattern with the same name in different pattern directories but they should have the correct size and color type (RGB/YUV) for the directory that they are in or they will be converted and may lose color accuracy.

Patterns that are too large for the current standard will be clipped to fit; patterns that are too small will gain a black border and will be centered on the output image.

Test patterns are **.pat** files for the standard line-based pattern files or user files. Supported user file formats are:

- Windows bitmap files (**.bmp**). We support 24 bit uncompressed bitmap formats only.

- 10 bit video files (**.dpx**) We support 10 bit RGB/YUV formats only in Left to Right orientation.

- **Yuv** and **qnt** files (8/10 bit packed yuv only)

- Targa (**.tga**) files which are compressed or uncompressed 8 bit RGB files. We support Left to Right orientation only.

Phabrix specific **.pat**, **.rgb**, **.yc4** files generated by the Phabrix pattern editor/convertor.

> **Note:** Note that bitmap files which are RGB will be converted to YUV internally as appropriate to the output standard. This will mean that not all valid YUV values can be output. If dpx YUV files are used then all valid values may be output.

Scripts Directory

Command scripts may be downloaded into this directory.

Setup Directory

The Setup directory contains the installer files for different releases of the software. Each release is comprised of a **.tar.gz** file and is self-contained. If a release of software is copied onto the instrument, the list of available releases will be updated within a minute.

Idents Directory

The Idents directory contains bitmap idents as used by the generator. Supported user file formats are:

- **.bmp** (Windows bitmap files: 24 bit only)

- **.dpx** files (10 bit video files)

- **.yuv** files (8/10 bit packed yuv)

- **.tga** (targa files)

> **Note:** Bitmap files are RGB and are converted to YUV internally as appropriate to the output standard. This will mean that not all valid YUV values can be output. If YUV files are used(**.dpx**), then all valid values may be output.

Fonts

The fonts available for use by the generator to add text idents may be enhanced by downloading new True Type fonts (**.ttf**) into this directory.

Loudness

The loudness logs recorded by the system are saved as CSV (comma separated value) files that can be used to plot loudness graphs over time. These CSV files have the following columns:

Integrated:

     Contains the integrated loudness values.

Integrated Threshold:

     The level above which alarms are logged in the Integrated Alarm column.

Integrated Alarm:

     Contains the integrated loudness values above the Integrated Threshold value.

Momentary:

     Contains the momentary loudness values.

Momentary Threshold

     The level above which alarms are logged in the Momentary Alarms column.

Momentary Alarm:

     Contains the integrated loudness values above the Momentary Threshold value.

Short Term:

     Contains the Short-term loudness values.

Short Term Threshold:

     The level above which alarms are logged in the Short Term Alarms column.

Short Term Alarm

     Contains the integrated loudness values above the Short Term Threshold value.

FCAP

Frame Grab video clips with the extension **.GRB** are saved into this directory.

D

Applications

Audio Configuration

Overview

The Rx instruments use a module-wide, high speed data bus to transfer video, audio and control data between the installed modules and the CPU module. The bidirectional audio data bus allows audio data (originating as SDI embedded audio or AES audio) to be processed by the system. This bus also allows the routing of audio data to output as embedded SDI audio, AES audio and HDMI audio.

The following graphic shows a simplified audio block diagram of the Rx instrument (the numbering is referenced in the subsequent sections:
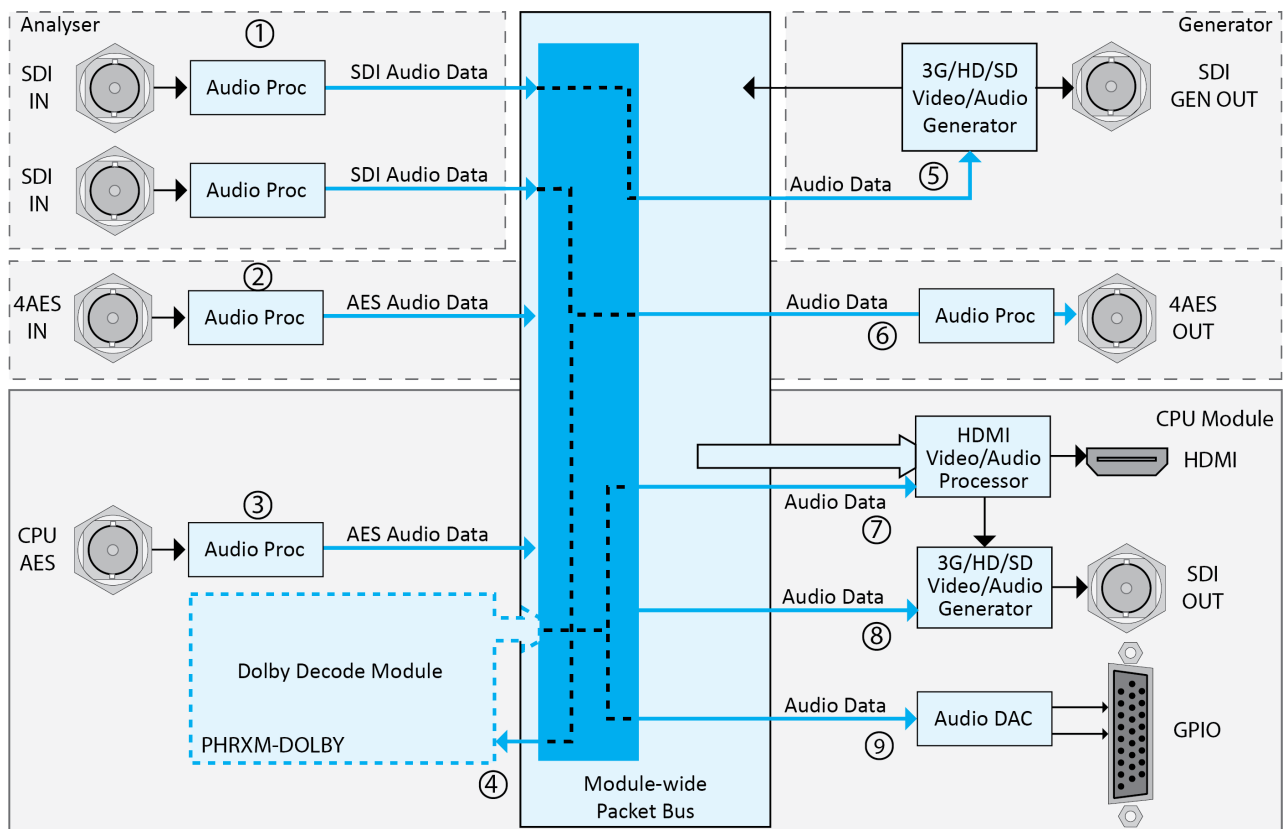
Audio Channel Selection for Measurement and Analysis

Embedded Audio Input

The Analyzer module to which the SDI signal is connected will predetermine which instruments that can have access to the embedded audio channels of the SDI signal. Audio channel selection is made on each instrument.

The levels of the embedded audio channels for the selected input can be viewed using the Audio Meters for that specific Analyzer module. The Meters window can displays the levels all 16 embedded audio channels at the same time. The actual channel pairs to be displayed can be selected using the Setup menu.

The Lissajous display allows the phase relationship of a selected stereo audio pair from the embedded audio channels to be seen.

The loudness levels of the embedded audio channels can be monitored and logged using the Loudness window. The Loudness window allows a stereo pair, a 5.1 channel group to be selected (defined in the Surround Meters Setup window) or the Decoded Dolby audio channels from the Dolby Decoder module to be used.
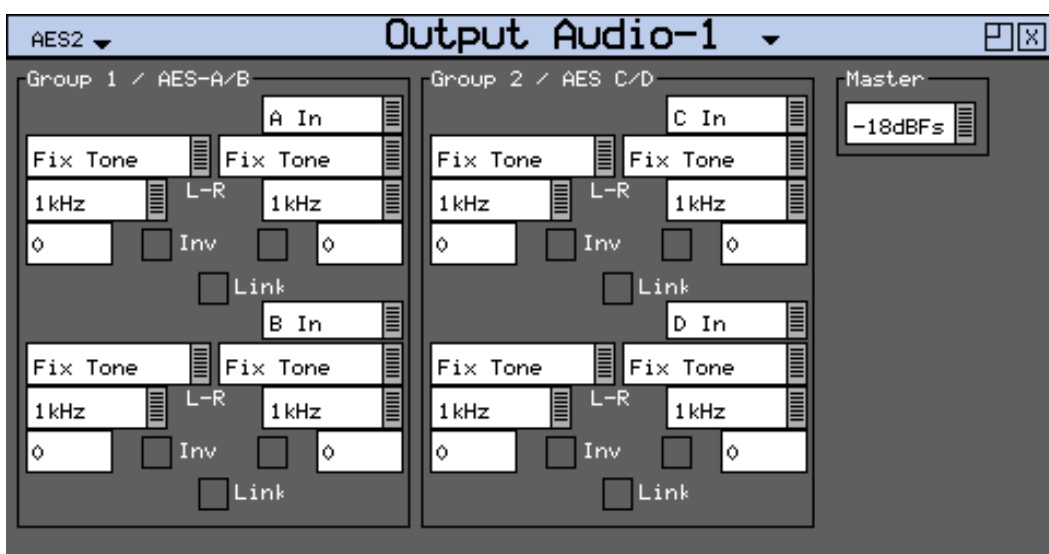
The Audio Status and Dolby Meta-Data (Dolby Metadata Analysis option) windows allow the selection of an individual stereo pair from the embedded audio for analysis.

AES Audio Input

The 4AES module provides audio-only analysis tools and audio-only generation tools.
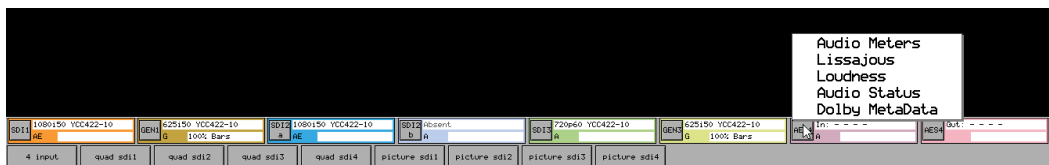
The 4AES module provides four configurable input (analyzer) /output (generator) pairs (see number ❷).

The Generator - Output Audio window of the 4AES module is used to assign the connectors as inputs or outputs. The inputs (A In, B In, C In and D In) can be monitored using the instruments available with the module.

The Audio Meters display allows the levels of the AES audio channels to be viewed. The Meters window can display a maximum of 8 AES audio channels at the same time. The actual channel pairs to be displayed can be selected using the Setup menu.

The Lissajous display allows the phase relationship of a selected stereo AES audio pair (A In, B In, C In or D In) to be seen.

The loudness levels of the selected AES audio pair (A In, B In, C In or D In) can be monitored and logged using the Loudness window.

The Audio Status and Dolby Meta-Data (Dolby Metadata Analysis option) windows allow the selection of an individual AES audio pair for analysis.

Decoded Dolby Audio (Dolby Decoder Module)

The Dolby audio source to be decoded into baseband audio channels can be selected from a pair of audio channels from an Analyzer module SDI input, from the AES input on the CPU module or from a pair of AES audio channels from the 4AES module (see number ④).
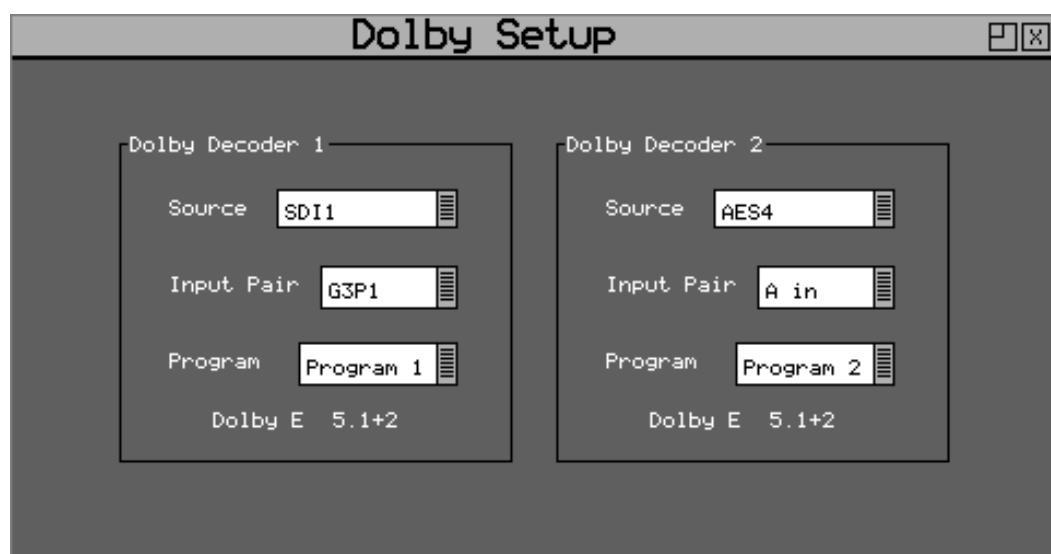
The selection of which audio pair that is decoded is made in the System - Dolby Decoder Setup window. The Source dropdown allows the selection of either Analyzer (ie Analyzer module) or AES In (CPU module).

The Analyzer Source allows the selection of the SDI input holding the Dolby audio data or the 4AES module. The discrete audio pair can then be selected from the dropdown list (for example G1P1 for SDI input or A In for AES input). Where the Dolby digital audio contains more than one program, the require one can be selected.

> **Note:** To ensure that the Dolby audio is decoded correctly, the System Reference locking frame rate must be the same as the SDI input video being decoded.

The levels of the decoded Dolby audio channels can be viewed using the Audio Meters of the corresponding Analyzer module. The Meters window can displays the levels all 8 of the decoded audio channels at the same time. The actual channel pairs to be displayed can be selected using the Setup menu.

The Loudness of the decoded Dolby audio can be measured using the Decoder 1 or Decoder 2 selection in the Loudness window of the corresponding analyzer module configured in the Dolby Decoder menu. For example if Decoder 1 is configured to use SDI1 then Loudness window on analyzer 1 can monitor decoded audio.

The Lissajous display allows the phase relationship of a selected stereo audio pair from the decoded Dolby audio channels to be viewed on the corresponding Analyzer module.

Audio Monitoring

The Audio Monitoring window allows the selection of any Analyzer input any audio group and any audio pair from the selected embedded audio group (see number ❾).
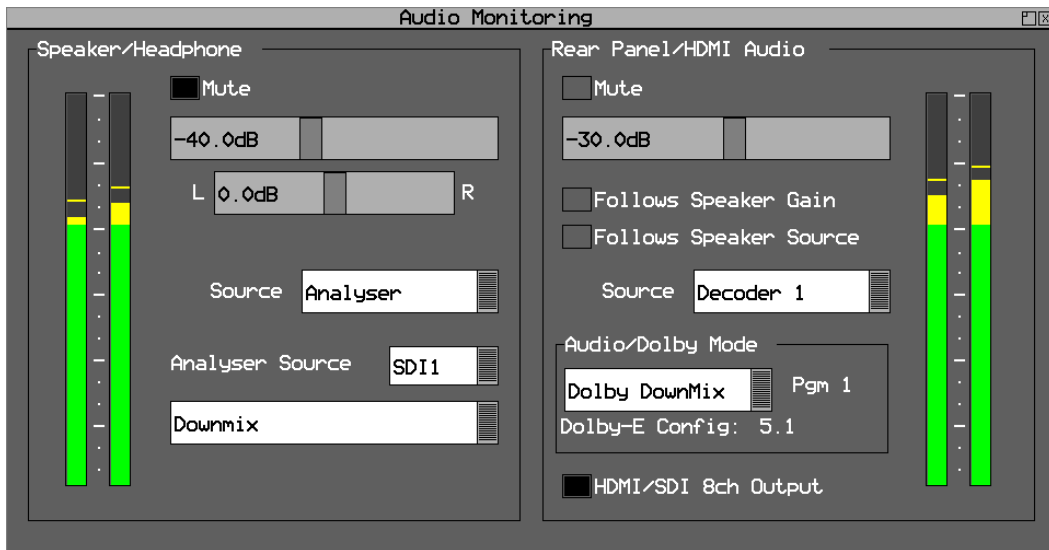
The Audio Monitoring window allows the selection of the headphone / speaker audio and the separate selection of the rear connection audio.

The audio level and source for the rear panel can be made to follow the headphone / speaker source (see number ❸).

The Source dropdown list allows the selection of the audio channels from an Analyzer module, the CPU AES In audio stereo pair or the Dolby Decoder module output (see number ❹).

If the Dolby Decoder module is installed, the embedded Dolby audio pair to be decoded is also selected as a Source.

The Audio Mode / Dolby Decode section controls whether PCM audio or a Dolby Down mix is output. Where the Dolby audio contains multiple programs, the specific program to be decoded can be selected here.

Speaker / Headphone Audio monitoring

The Rx range provides a headphone socket on the front panel. In addition to this the Rx 2000 provides front panel loudspeakers. The audio to be monitored on the Speakers / Headphones is controlled by the Speaker / Headphone section of the Audio Monitoring window.

Rear Panel Monitoring

The Rx range provides an unbalanced audio pair on the CPU module GPIO connector. This can be used to monitor the pair of audio channels selected in the **Rear Panel Audio** section of the Audio Monitoring window (see number ⑨).
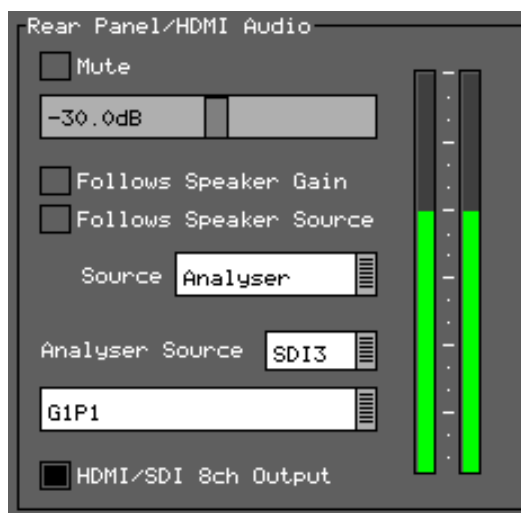
HDMI Output Monitoring

The currently selected Rear Panel Audio pair in the **Speaker/Headphone** section of the Audio Monitoring window is routed via the HDMI output when the **DVI Monitor** checkbox is disabled (see number ⑦).
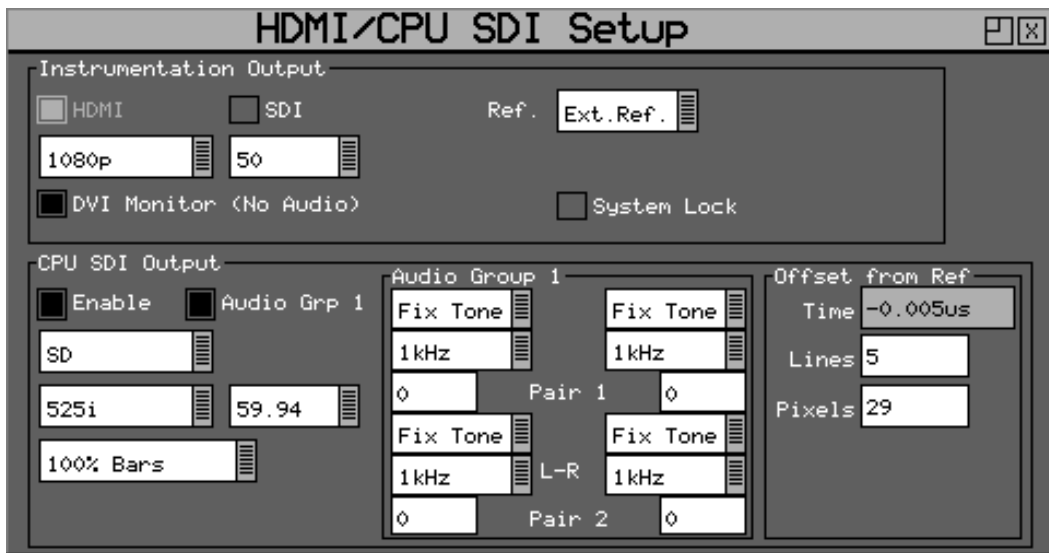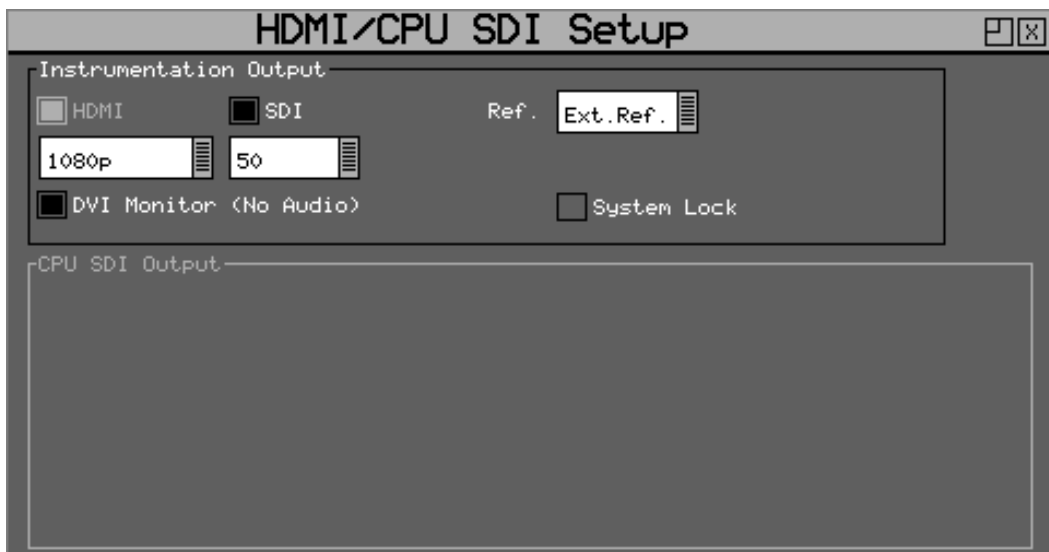
This is done using the HDMI/CPU SDI Setup window.

> **Note:** The audio level of the SDI audio output is the same level as the currently selected audio pair in the Audio Monitoring window.

HDMI Over SDI monitoring

If the HDMI Monitor output is routed over the CPU SDI output then the currently selected Speaker/Headphone audio pair is output as Group 1, Pair 1 of the embedded SDI audio (see number ⑧).



This is done using the HDMI/CPU SDI Setup window.

> **Note:** The audio level of the SDI audio output is the same level as the currently selected audio pair in the Audio Monitoring window.

Audio Routing

The Rx system allows SDI embedded audio and AES audio to be routed from input connection to output connection.

AES Audio Output

Individual embedded audio channels from and SDI Analyzer input can be output as AES audio via the 4AES module (option) using the Output Audio window (see number ❻).
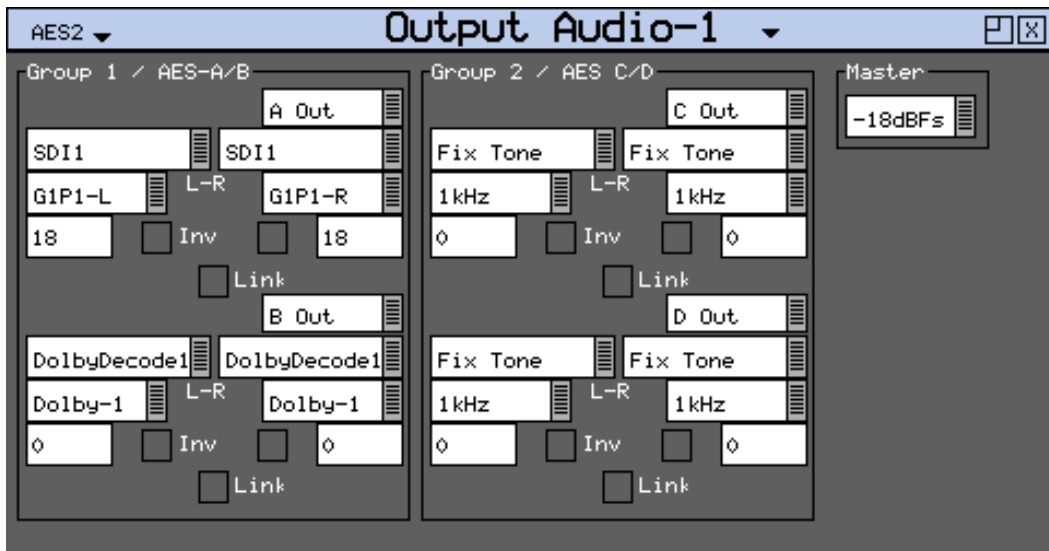

This can be setup in the Output Audio window for the 4AES module.

When outputting SDI as AES audio it may be necessary to adjust the levels. This can be done using the Master level or the individual channel levels.

To ensure that the SDI audio is synchronous with the AES output, the System reference locking frame rate must be the same as the SDI output video being generated. This can be done from the "Ref" menu on the HDMI task bar.

Generator SDI Audio Output

Discrete AES audio channels, from the CPU AES input or 4AES module input, can be embedded into the Generator SDI output signal instead of audio test tones (see number ⑤).
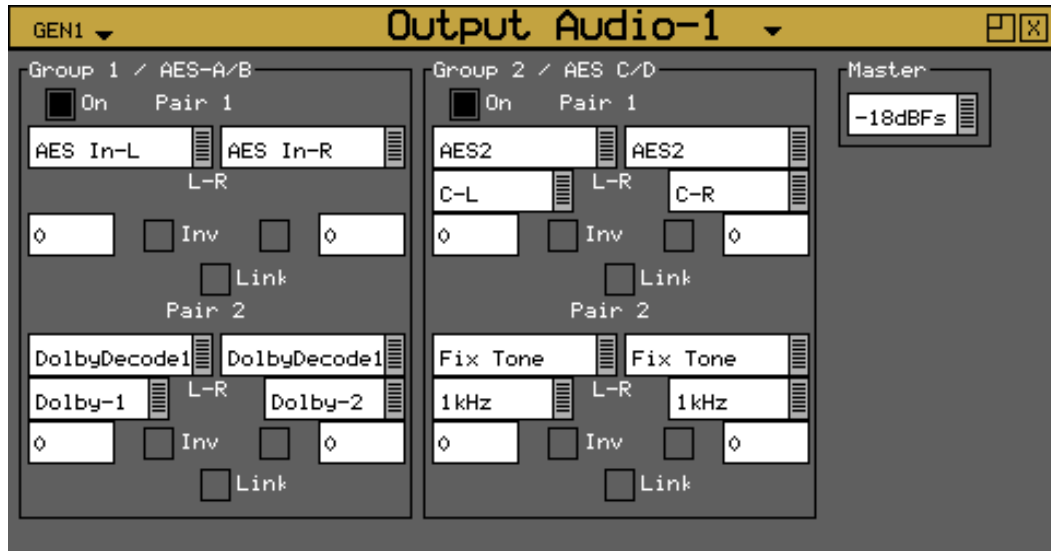
This is done using the Generator Audio Output window.

When embedding AES sourced audio into the SDI signal it may be necessary to adjust the levels. This can be done using the Master level or the individual channel levels.

If the Dolby Decoder module is installed Decoded Dolby audio channels can also be embedded into the Generator SDI output signal.

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