

# SxE

## User Manual

Software Release 14.03



# Preface

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## About this Manual

This User Manual is a guide to the functions provided by your Sx 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

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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	August 2012	0.10.0109	First release of manual
2	June 2013	0.11.0003	2K Formats Option
3	October 2013	0.12.0013	Dolby Digital and Digital Plus support
4	January 2018	14.00.13938	AV Delay
5	March 2019	14.01	AV Delay Generation and Analysis
6	June 2019	14.01	AV Delay Analysis update
7	October 2021	14.02	Free-run frequency control for Generator; support for additional dual- and quad-link 4K SMPTE standards; support for SMPTE 352 VPID on single interface of 4 x 3G and 4 x 1.5G links; support for Percon VK 5 and Draka 0.6/2.8 AF cable types; jitter logging facility; bug fixes; and reformatting.
8	July 2023	14.02	Minor user manual revisions
9	February 2024	14.03	Updated battery temperature optimization measures.

# Getting Started

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## Package Contents

The shipping box should include the following:

One black carrying bag containing:

- PHABRIX SxE unit: PHSXE
- Power Supply Unit
- Mains lead
- 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 SxE software.

## General Safety



### 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. Charging the unit at a higher temperature will reduce the life of the battery and could cause permanent damage. 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 recommended charging temperature is exceeded a warning dialog will be displayed. If this occurs, disconnect the power adapter and allow the unit to cool before resuming charging.**

If the temperature rises above **55°Celsius** a warning dialog will be given. If the temperature rises above **65°Celsius** the unit is automatically switched 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.

### 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.

# 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.

Contains hazardous substance information

Part number: **PHSX**

Description: PHABRIX SxE



China RoHS is a two-step process that identifies concentration limits of certain hazardous substances in electronic information products that are sold into China. Per the deadline set by the Chinese government, March 1, 2007, PHABRIX Limited has implemented step one of China RoHS, self declaration of hazardous materials and marking of the product.

PHABRIX products that are sold into the China market have the required marking as indicated by the symbol shown left applied to the product designating that the product meets the China RoHS requirements.

Toxic or Hazardous Substances or Elements

Parts	Hazardous Substances in each Part					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent chrome (Cr(VI))	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
Assembled board	○	○	○	○	○	○
Mainframe	○	○	○	○	○	○
LCD	○	○	○	○	○	○
Fan	○	○	○	○	○	○
Wire assembly	○	○	○	○	○	○
Enclosure	○	○	○	○	○	○
Accessory	○	○	○	○	○	○
Packaging	○	○	○	○	○	○
Battery	○	○	○	○	○	○

O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.

X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006.

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## Description

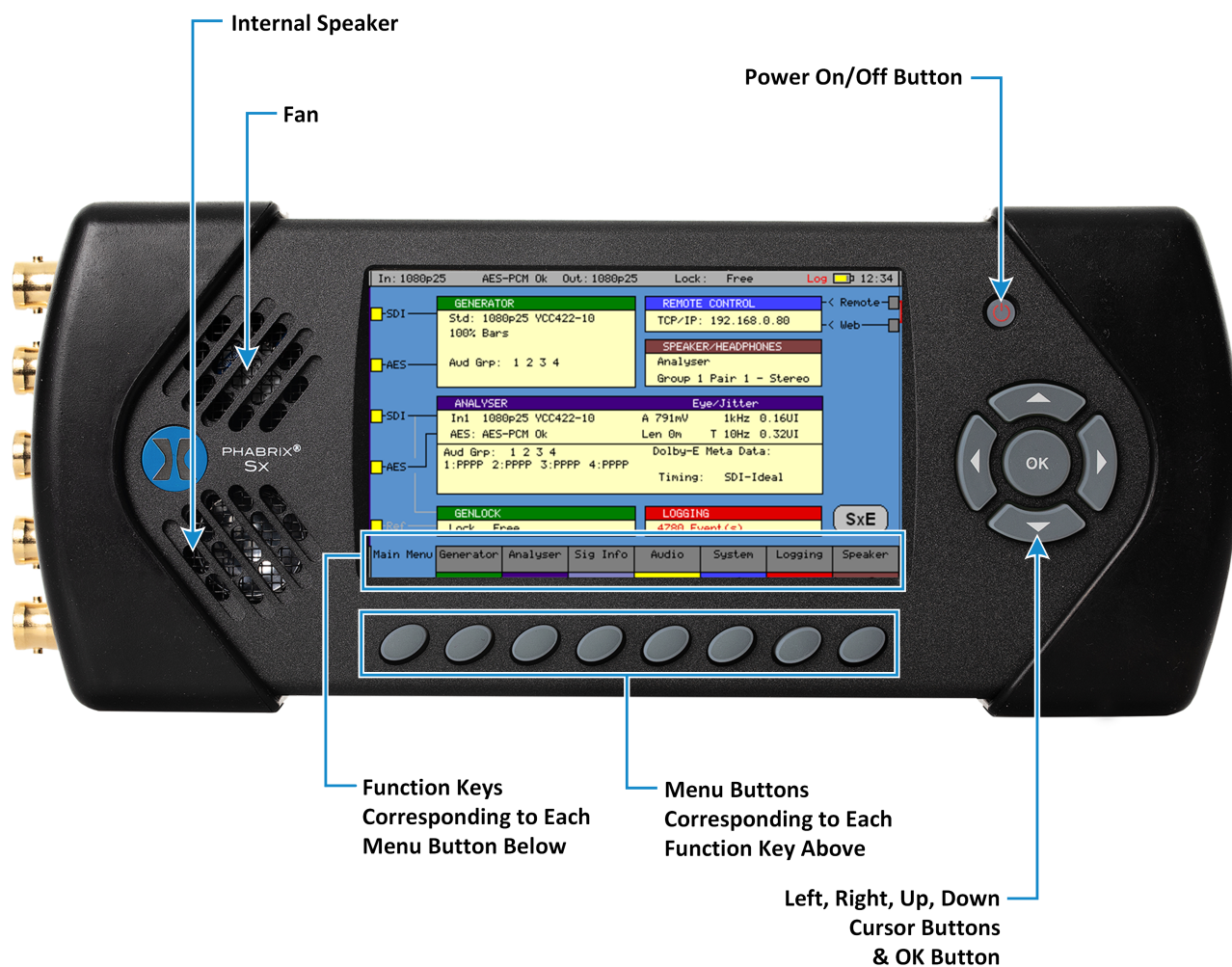
### SxE Instrument Overview

The PHABRIX SxE represents the most comprehensive handheld instrument available in the world today.

The PHABRIX SxE is a handheld multi-standard video (3G-SDI, HD-SDI and SD-SDI supported as standard) test signal generator, analyzer and monitor including AES audio testing, monitoring plus physical layer analysis on its large 4.3 inch best of class 16:9 color TFT screen, it is unique in offering laboratory level testing.

The PHABRIX SxE eye and jitter diagrams allow optional filter selection for timing and alignment measurements with cursors and histogram functions to allow detailed measurements to be made.

The ability of the SxE to produce eye patterns from a 3G signal is particularly significant for those users requiring a solution to testing high end products in the 3G arena. Jitter too is one of the most important issues in the design and operation of high-speed serial links and the SxE jitter tools can be applied from SD-SDI, HD-SDI to 3G-SDI. These comprehensive features propel the SxE into the domain of much more expensive bench bound products and has resulted in it achieving many technological awards.



# Switching the Instrument On and Off

To switch on your PHABRIX Sx Instrument press the red button at the top right-hand corner of the front panel.

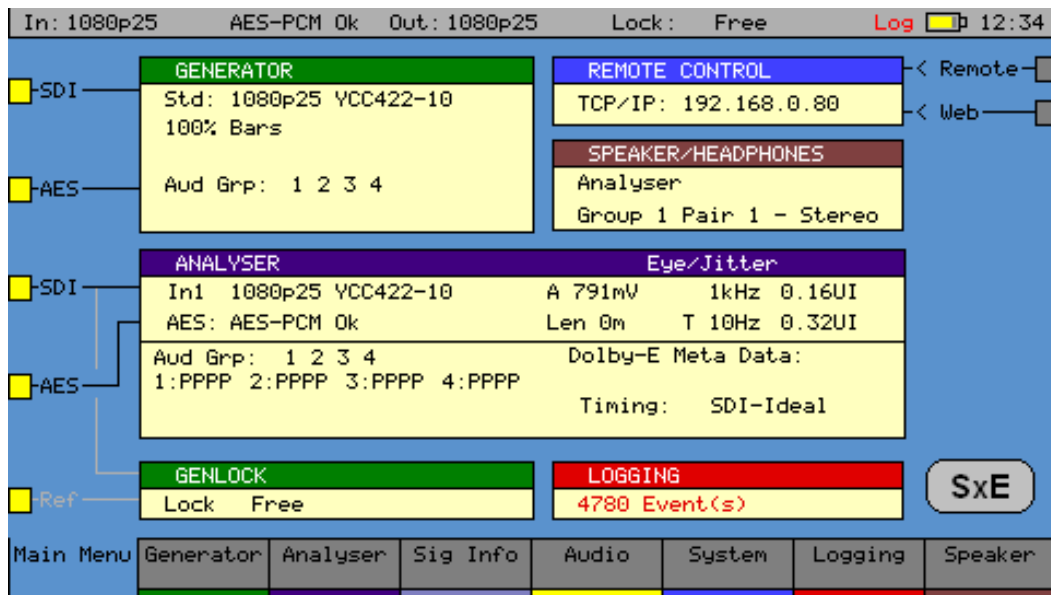
Once the system has started, pressing the button again will turn it off. If for some reason the instrument stops responding, pressing and holding the button for a few seconds will turn it off.

The unit is battery operated and the battery should last for between 1.5 and 3 hours dependent on which video standard is being used and whether the input and outputs are active. If the unit is switched on and the battery is almost discharged, it will turn itself off. If the battery level becomes too low for operation a dialog will be displayed prompting the user to turn off the unit. The current settings will also be saved. The unit should then be connected to the power supply unit as soon as possible to recharge the battery. The battery should be fully charged in about four hours. The battery will charge faster if the unit is switched off while charging.

## Menu Operation

### Main Menu

The Main menu, displayed on the TFT LCD screen gives access to the software modules available on the SxE instrument. The buttons below the screen correspond to the menu areas. Pressing on any of these buttons will display the corresponding menu.



The Main Menu provides an overview for the system. It shows the video input and output standards and frame rate. The audio status for the generator shows which audio groups are being generated whilst the audio status for the input shows which groups are present and an overview of the channel status for each audio channel.

Audio channel status is displayed as:

- **P** if PCM audio is present
- **N** if Non-PCM audio is present
- **E** if Dolby E packets are present
- **D** if Dolby Digital packets are present
- **+** if Dolby Plus packets are present
- **V** if the validity bit is set

Dolby E program configuration and Timing status is also displayed if the Dolby E analysis option has been purchased and a Dolby E signal has been detected on the selected input. If the generator is generating errors, then the video standard is displayed in red. If the input detects errors, then the input standard will be displayed in red if the analyzer is monitoring the input.

If the unit is connected to the network, the current TCP/IP address of the unit is displayed in the Remote Control box. If the unit is NOT connected to a network and is set to DHCP mode, it will show 'acquiring' to show that the connection hasn't been made yet. The model type is displayed at the bottom right corner of the screen.

## Instrument Status

The top line of the menu shows the unit status and includes the Input Video status, Genlock status, battery status and current time. If the unit is being powered by the AC adapter, the battery status icon will change color to yellow. If a command script is being run, this is shown on the top line to the left of the time as **Script**. A red **Log** label is displayed on the status line if there are any events in the event log.



In: 525i59    AES Ok    Out: 625i50    Lock: Free     16:34

If a 3G video standard is selected the video standard display will be shown as 3GA if it is a 3G-Level A standard, 3GB if it is a 3G-Level B dual link standard, 3G2 if it is a 3G-level B dual stream (two patterns) standard or DL if it is a dual link output.

The input video standard will be shown in red if the input signal has errors, but only if the analyzer is connected to the input. If the analyzer is set to monitor the output, the input standard will be shown in brown.

The output standard will be shown in red if the instrument is generating errors. The output standard will show OFF if the generator output is Off.

Any Jitter values outside the values specified in the Log Setup page for the relevant jitter meter are displayed in a red font.

## Using the Menus

The Menu buttons select which instrument is in use as well as selecting the options for the instrument. The bottom of the display shows the function of each Menu button.

When in a specific function e.g., Generator, Analyzer etc., the cursor controls on the right-hand side of the instrument select a field to edit. The current field has a red box around it. Pressing the OK button starts or ends editing of that field. Checkboxes are always in edit mode and pressing the OK button inverts the current state.

When editing some types of fields, the menu buttons at the bottom take on different functionality to allow canceling edit mode or setting the value for the field. When lists of options are displayed the menu buttons allow selection of the first/last item in the list as well as paging through the available options. If the list of items is small, the available items may be displayed on the menu buttons for instant access.

The buttons along the bottom of the display change the currently displayed page when not editing a data field. The left-hand button always selects the top-level menu and system overview page. So, for example pressing the first button will select the **Main Menu**, selecting the second button will select the **Generator** menu, etc.

### **Generator:**

(Only present if a Generator module is fitted) Allows video test pattern selection to be made and audio test tones to be selected.

### **Analyzer:**

Allows the selected input signal to be analyzed in the form of a Picture, Waveform monitor, Vectorscope and Eye Pattern display (option).

### **Sig Info:**

Allows detailed signal information about the video and audio status for the analyzer source to be displayed.

### **Audio:**

Gives access to the Audio Meters and Audio Status displays.

### **System:**

Allows the setup of system wide settings including memories, date/time and software.

### **Logging:**

Selects the logging page to view and setup the error logging system.

### **Speaker:**

Selects the speaker/headphone setup page.

See [Menu Reference](#) for full details of these menus.

# Sx Software Options

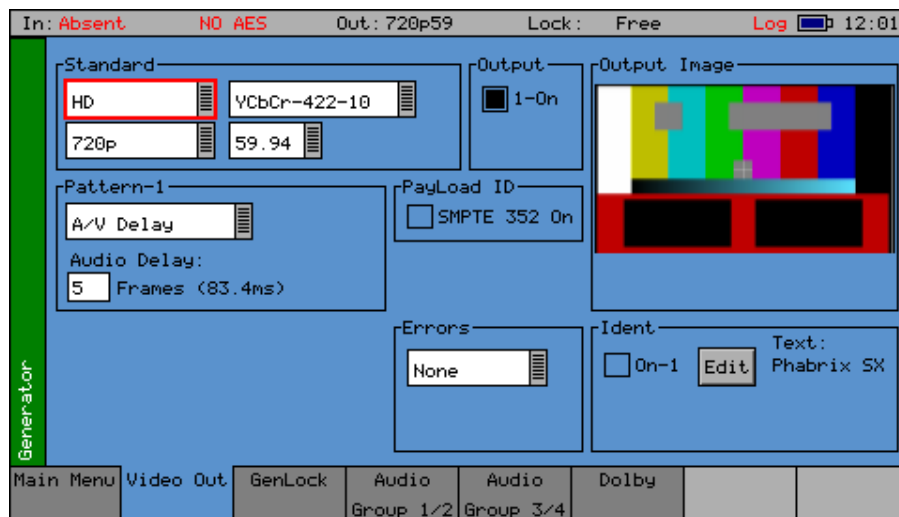
## Overview

The instrument has a range of software options that can enhance its functionality for specific applications.

## AV Delay Analysis (Option: PHSXO-AVD)

The AV Delay Analysis option (**PHSXO-AVD**) offers an end-to-end solution for the measurement of the Audio to Video differential delay through a broadcast system, when used in conjunction with the AV Delay Generator. The analyzer tool provides a real-time update of the differential delay between the video and the selected audio channel pair. When using the SxA and SxE, this tool can also be used to measure the propagation or pipeline delay of either video or audio.

Both the AV Delay signal generator and analyzer can be used with all Sx supported video formats and frame rates on SDI and AES interfaces.



The AV Delay Generator produces an adapted EBU Tech 3305 AV Sync *clapperboard* Test Pattern. This is compatible with third party AV delay analyzers such as the LAWO V\_pro8.

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, plus the AES out.



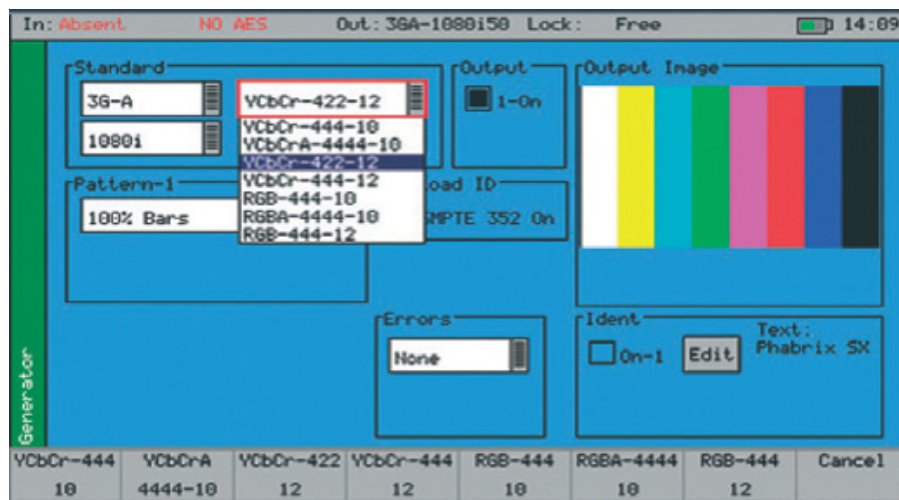
AV Delay measurement (**PHSXO-AVD**) is available in the Picture instrument. Measurement of two AV Delay test patterns is supported:

- EBU Tech 3305
- LAWO V\_line AV Sync test pattern

The tool provides a real-time update of the differential delay between the video and the selected audio channel pair.

The source of the audio can be either an embedded SDI audio or AES channel pair. The differential delay between the video and the selected audio is measured in 0.1 ms steps (to an accuracy of 1 ms) with a measurement range of +/- 400 ms.

## Advanced Video Formats and 2K (Option: PHSXOF)



This option (**PHSXOF**) provides advanced formats including: 4:2:2 YUV, 4:4:4 RGB and 4:4:4 YUV at 10/12 bit, and 2K formats including: 4:2:2 YCbCr, 4:4:4 RGB' and 4:4:4 YCbCr at 10/12 bit as well as 4:4:4 XYZ at 12-bit. For broadcast manufacturers this option allows rigorous testing of many more formats beyond the standard signals used in traditional broadcasting.

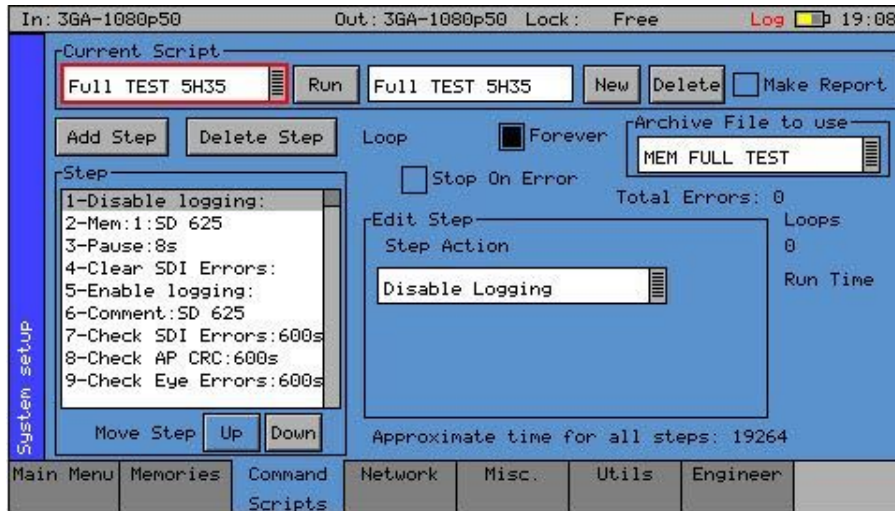
The 2K-SDI support provides analysis of, and test pattern generation for, 2K Digital Cinema as defined in the SMPTE ST 2048-2:2011 standard *2048 x 1080 Digital Cinematography Production Image FS/709 Formatting for Serial Digital Interface* and SMPTE 428-9 *D-Cinema Distribution Master - Image Pixel Structure Level 3 - Serial Digital Interface Signal Formatting*.

Among the support for 3G Level B on the SxE is the ability to generate and analyze signals such as SMPTE 425-B carrying 1x 372M dual link payload.

Uniquely the PHABRIX units create three pathological signals in all formats which will be of great interest to broadcast manufacturers. The first is as defined in SMPTE RP198 and is the split field signal with the equalizer test in the first half and the PLL test in the second half. The second and third are separate full-frame EQ test and PLL tests signals. To maintain a regular parity distribution and mitigate any DC offset, the EQ part of the pattern inverts a bit at the start of the first line in each alternate frame. This is the form of 3G Level B Pathological signal that many video manufacturers are adopting as their test signal of choice as it stresses electronic circuits more thoroughly.



## Command Scripts with Print Report (Option: PHSXOS)



The Command Script and Reports option (**PHSXOS**) allows a series of predefined actions to be run through within the PHABRIX Sx using a script stored in internal memory.

The command scripts option can be used to automatically step through a sequence of instrument states, controlling the generator, analyzer and logging functions. If required, the instrument will prompt the user before going onto a subsequent state.

Applications include repeated test sequences as required by manufacturer Test Departments, Research and Development Departments, Systems Integrators and Commissioning/Support Engineers.

A script requires a set of memories to configure the unit and then a script file which recalls those memories and specifies times and actions for each step. The process of creating a command script requires these two files to activate the sequence.

Additionally, a script can be created as a simple text file on a PC and then transferred to the unit over the network and recalled at any time. Many named scripts and memories may coexist in the instruments store to be recalled as required.

Access to the Command Scripts functionality is the menu: **System** → **Command Scripts**. See the chapter [Menu Reference](#) for details.

## SDI Data Display and VANC/ANC Inspector (Option: PHSXOSD)

The screenshot shows the 'Analyser' window displaying SDI data. The top bar shows 'In: 1080p50', 'Out: 1080p50', 'Lock: Free', and '10:01'. The main display is a grid with columns for memory addresses (2635-2639) and data values (0-6). The data values are displayed in hexadecimal. The grid is titled 'Type' and has a 'Grid' button. The 'Sample' field is set to '0'. The 'Hex' button is selected. The '10bit' button is also visible. The bottom of the window has navigation buttons: < 10, > 10, < 100, > 100, < 10, > 10, < 100, > 100.

	2635	2636	2637	2638	2639	0	1	2	3	4	5	6	Type
36	040	3FF	000	000	2AC	040	040	040	040	040	040	040	Grid
37	040	3FF	000	000	2AC	200	200	200	200	200	200	200	Line
30	040	3FF	000	000	2AC	040	040	040	040	040	040	040	41
39	040	3FF	000	000	2AC	040	040	040	040	040	040	040	Sample
40	040	3FF	000	000	2AC	040	040	040	040	040	040	040	0
41	040	3FF	000	000	2AC	040	040	040	040	040	040	040	Hex
42	040	3FF	000	000	2AC	040	040	040	040	040	040	040	10bit
43	040	3FF	000	000	2AC	040	040	040	040	040	040	040	Inf
44	040	3FF	000	000	2AC	040	040	040	040	040	040	040	
45	040	3FF	000	000	2AC	040	040	040	040	040	040	040	

The SDI Data Display and VANC/ANC Inspector option (**PHSXOSD**) 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 research and development environment. Detail in 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 data stream 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).

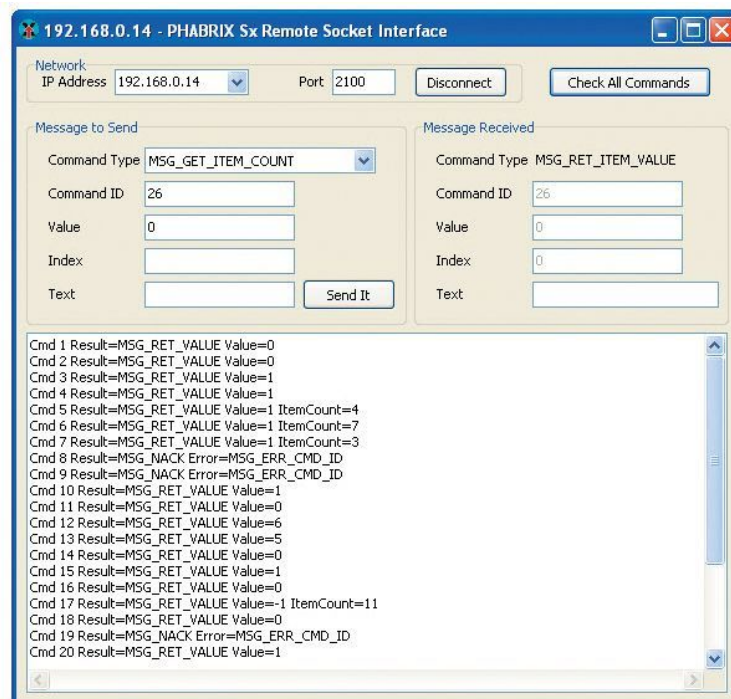
**Ancillary Status:**

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

Access to the SDI analysis functionality is through the menu **Analyzer → Signal Data**. See the section [Signal Data](#) for details.

This option also provides a VANC/ANC Inspector - allowing Ancillary data packets to be detected and checked for errors.

## Enhanced Remote Control (Option: PHSXOR)



The Enhanced Remote Control Integration option (**PHSXOR**) gives users full remote control of the unit through 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.

PHABRIX products 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 Sx range can provide a variety of information to the

control device to which it is connected 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. For example, if you SET a value, the unit will be configured accordingly and a reply returned and if you GET a value from the unit, it will reply with that value. All messages are acknowledged to increase the security of the interface i.e., using closed-loop communication.

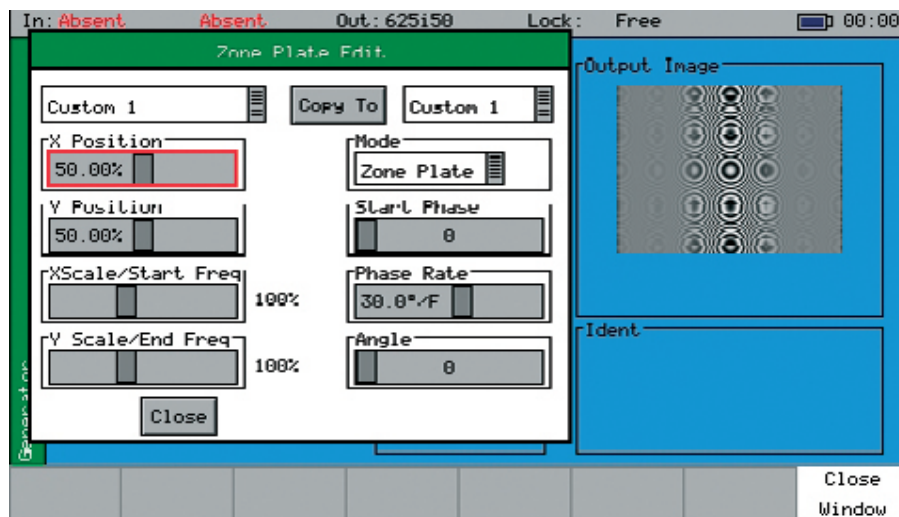
The control structure can be selected as Passive or Active. Passive control allows simple remote control where the host PC is in control and sends commands when it wants to change data or get information. It is this method which is the most popular use for remote control.

Active control is when the PHABRIX unit synchronizes with the host PC. Any changes on the PHABRIX unit will result in a message being sent to the host PC. This method is useful for controlling a PHABRIX 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 with 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 *Sx Remote Control Guide* for details.

## Programmable Zone Plate (Option: PHSXOZ)



The Zone Plate Generator option (**PHSXOZ**) adds a range of preprogrammed zone plate patterns along with user-defined controls over several parameters which can be saved to custom buffers.

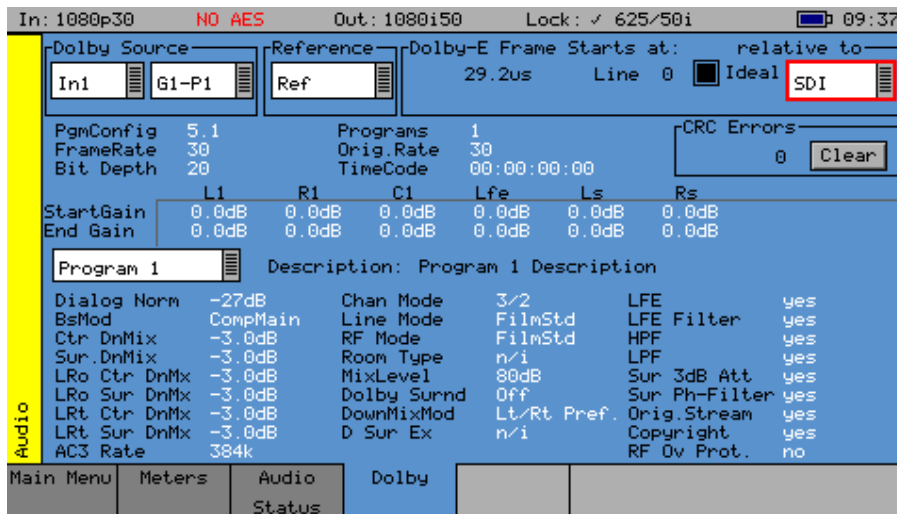
Using the **System → Memories** menu window, multiple saves of zone plates can be saved to the system by checking the video box and saving by name. In use, the zone plate can be used to test a range of video processing requirements using horizontal, vertical and temporal (time) controls. Temporal control is particularly useful for testing up/down converters and applications which compress signals.

Aspect ratios can be tested using the horizontal and vertical controls. Frequency sweep is particularly useful and also available using this option. By feeding in the generated signal, the output of the device can be sent back into the waveform monitor of the Sx instrument to determine the usable bandwidth of the system. Once purchased, the zone plate editor is accessed by selecting the button next to the standard zone plate.

## Dolby Bit-stream Analyzer and Generator (Option: PHSXO-DAG)

The Dolby bit-stream analysis and generation option (**PHSXO-DAG**) displays Dolby E, Dolby Digital and Dolby Digital Plus metadata present in a selected audio stream and determines whether the

Dolby E packet is timed correctly on the SDI video stream. It also uniquely adds significant Dolby E, Dolby Digital, and Dolby Digital Plus metadata generation features to the Sx range.



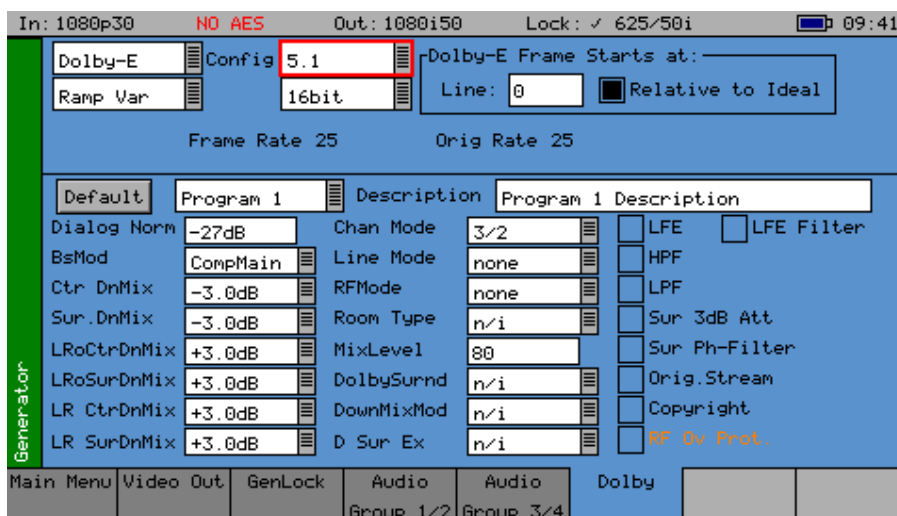
The Dolby audio may be monitored from any of the SDI input embedded audio channel pairs or the AES input. Peak audio levels are also displayed for Dolby E.

The start menu window displays both the V Bit information and PCM values along with a snapshot of the Dolby audio metadata if a Dolby is present. Using the Signal Information - Dolby menu will present the full analysis display which forms the major analytical tool for this option.

The Dolby metadata screen carries primary information including signal source, Dolby E *guard band* timing, CRC errors, program channel and metadata detail. The characters shown in white will only be presented when a Dolby signal is introduced into the unit.

Peak audio levels included in the Dolby E metadata packet are displayed, allowing the user to select the appropriate set of meters to display Dolby levels which will follow the selected Dolby source. Logging for Dolby errors, Dolby E Timing, Common metadata, and Program metadata can also be controlled.

**Note:** This option does not decode Dolby audio



The Dolby generation capability provides broadcast engineers with a highly functional set of tools for Dolby E, Dolby Digital and Dolby Digital Plus streaming. It is unique in being the world's first metadata Dolby generator with editable profiles.

With a selection of Dolby streams to choose from, engineers can quickly enter and adjust parameters to check broadcast infrastructure.

This option allows the display of Dolby metadata present in a selected audio stream and determines whether the Dolby E packet is timed correctly on the SDI video stream.

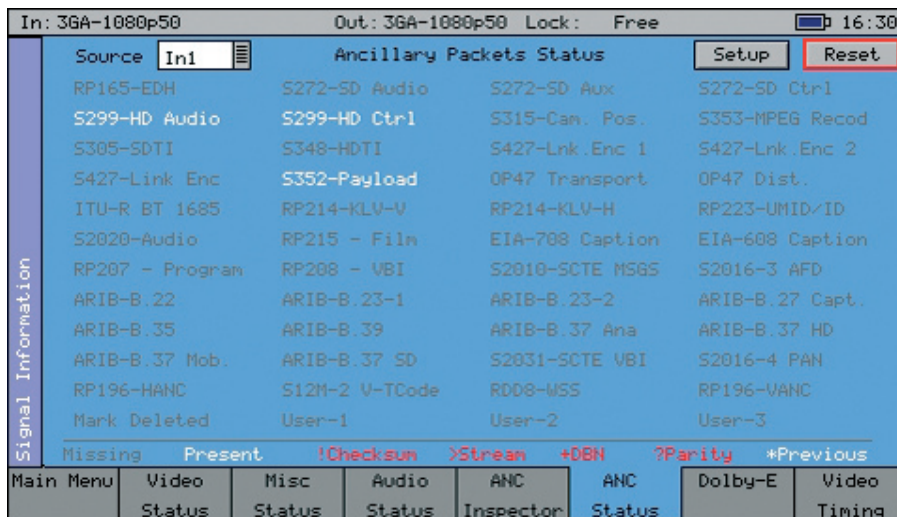
Dolby streams are provided for all program configurations with fixed audio data. Among the tools included in the Dolby E streaming option is the ability to adjust the *start of frame* for Dolby E packets.

The generated Dolby audio follows the video generator reference source. There is also the ability to edit the program configuration and bit depth with fixed audio signal. The PCM stream can be carried on any embedded or AES pair. The option can set the video line number where the internally generated Dolby audio test stream begins. Metadata can be edited by the user and stored in memories.

The option allows a closed loop test scenario with both generation and analysis toolsets.

**Note:** This option does not generate Dolby audio.

## Ancillary Data Status (Now Included as Standard)



The Ancillary Status option (**PHSXOVNC**) provides broadcasters, studios, OB and broadcast manufacturers with a detailed analysis of the ancillary data present in an SDI signal.

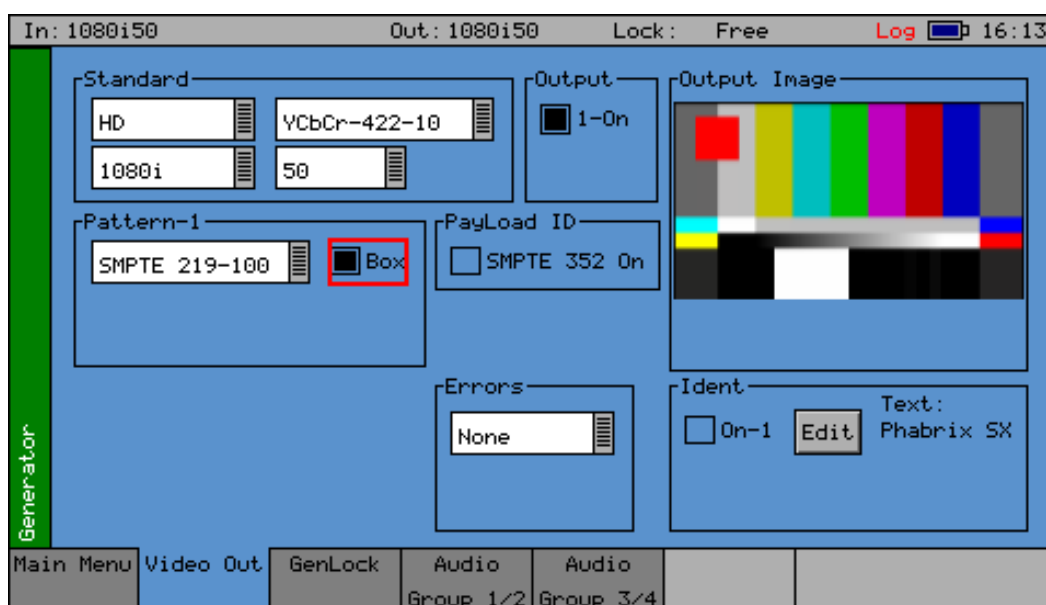
A simple grid layout provides a quick check for an engineer of the available VANC/ANC ancillary data. The packet type is then displayed as present, absent or red if in error. Simple icons next to the packet indicate the fault. Each ancillary packet available from the grid view can be set to enable logging and then presented together with other information in the events window of the logging menu.

This option further allows additional, user-defined selections with the appropriate DID or SDID code. Any ancillary packet code can be saved down for future recall. Note that this option does not fully decode the ancillary data, but instead it is used to identify whether the packet is present in the signal.

# Menu Reference

## Generator Menu

### Video Out Menu



The Sx instrument can create video test signals for all supported SD-SDI, HD-SDI, 3G-SDI and 2K-SDI output standards including the 3 GHz standards at 1080p / 50 / 59 / 60. It will support Y,Cr,Cb, RGB and XYZ formats as well as RGB formats.

### Output On

The Output On function turns ON the output circuitry.

### Standard

The menus in the Standard section are used to select the desired video output format. The top-left box selects the basic mode of the Sx instrument and determines whether it is generating one of the following:

- **SD-SDI:** Standard definition video
- **HD:** High definition video
- **3G-A:** 3G level A video
- **3G-B:** 3G level B video
- **3G-B 2str:** 3G level B dual-stream video
- **3G-B 2str-2k:** 3G level B dual-stream 2k video
- **3GA-2k:** 3G level A 2k video
- **3GB-2k:** 3G level B 2k video
- **HD-2k:** High definition 2k video

- **SD-CVBS:** Standard definition - composite video baseband signal (PAL/NTSC)
- **3GB-2str-2k:** 3G level B dual-stream 2k video

Only valid frame rates for the output standard may be selected.

## Color Format

The instrument supports the YCbCr 4:2:2 10 bit color format as standard.

An Advanced Video Formats option (**PHSXOF**) may be purchased to enable the following color formats. Note that the available color formats are dependent on the selected picture format and frame rate:

- 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
- XYZ 444 12 bit

## 2K-SDI Support (Part of Advanced Video Formats Option: PHSXOF)

The Sx Advanced Video Formats option (**PHSXOF**) includes the generation and analysis of 2K video formats for YCbCr, RGB and XYZ color spaces.

### XYZ Color Space:

A non-linear format that requires additional treatment by the Sx generator and analyzer circuitry to convert between linear and non-linear data formats. Only a limited number of non-linear test patterns are provided for XYZ as the traditional linear test patterns that are usually available in SD, HD and 3G are not applicable and will produce misleading results when analyzed.

### 100% Color Bars:

Generated in RGB color space and needs to be analyzed using the RGB color space selection in the Waveform monitor. This test pattern is provided to check the accuracy of the color paths through the equipment under test.

### Legal Ramp:

Generated in XYZ non-linear format and needs to be analyzed using the X'Y'Z' color space selection in the Waveform monitor. This test pattern is provided to check the accuracy of the data path through the equipment under test.

### Multiburst:

Generated in XYZ non-linear format and needs to be analyzed using the X'Y'Z' color space selection in the Waveform monitor. This test pattern is provided to check the frequency response and sample rate of the data passed through the equipment under test.

### Color Field:

Produces fixed level colors in RGB color space that are converted to equivalent XYZ color space values and needs to be analyzed using the RGB color space selection in the Waveform monitor.

### User File:

Allows user-defined test patterns that have been created in XYZ non-linear color space to be selected.

The XYZ, X, Y and Z settings in the Waveform monitor display the XYZ color space in its native non-linear form. So test patterns such as Legal Ramp will be displayed as curves instead of straight lines.

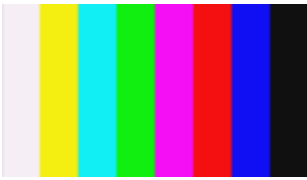








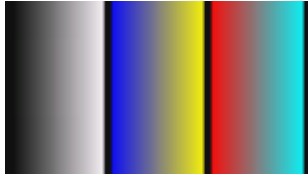










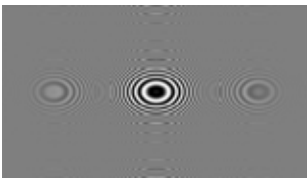
The X'Y'Z', X', Y', and Z' settings in the waveform monitor display the XYZ color space with a reverse transform to convert it to linear form, so test patterns such as Legal Ramp will be displayed as straight lines.

The Picture monitor and Vectorscope instruments will automatically apply the appropriate transforms to display the images in YCbCr, RGB and XYZ color spaces correctly. The color space transform to be applied is defined by the SMPTE 352 payload.



## Pattern

This selects the video pattern that is output by the generator. Many standard patterns are provided by the Sx instrument. You may also upload your own test patterns to the Sx instrument into the **Patterns** directory and then select them using the **User File** option in this field. See the section [Sx File Structure](#) for a list of supported file formats.

			
<b>100% Bars</b>	<b>75% Bars</b>	<b>75% Bars + Red</b>	<b>SMPTE Bars</b>
			
<b>Checkfield Pathological</b>	<b>EQ Test</b>	<b>PLL Test</b>	<b>Luma Ramp</b>
			
<b>Legal Ramp</b>	<b>Valid Ramps</b>	<b>Multiburst</b>	<b>Pluge</b>
			
<b>Bowtie</b>	<b>Tartan Bars</b>	<b>Grey Bars - 5</b>	<b>Grey Bars - 5-Vertical</b>
			
<b>Grey Bars - 11</b>	<b>Grey Bars - 11-Vertical</b>	<b>SMPTE 219/ARIB-28 Bars - 3 Variants</b>	<b>A/V Delay</b>
	<b>Black, Red, Green, Blue, Yellow, Cyan, Magenta, White, Custom</b> <b>Color Field</b>	<b>Downloadable files in bitmap(.bmp), 10bit DPX/YUV (.dpx, .yuv), Targa (.tga) and Phabrix .pat/.rgb/.yc4 compressed files</b>	
<b>Zone Plate</b>		<b>User File</b>	

If a User File has been selected, the **i** button beside the file can be selected to display 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.

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

The available patterns (Checkfield, Pathological, PLL Check, EQ Check, etc.) will only look like the following picture(s) 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. A bouncing box may be overlaid on the current test pattern by selecting the **Box** checkbox.

#### **AV Delay:**

The AV Delay Test pattern and associated audio pulse provided by the Generator module can be used to check the differential delay between video and audio. This animated test pattern provides a constantly moving clapperboard and the corresponding AV Delay Audio pulse and video white line flash when the clapperboard reaches the center of the test pattern.

#### **Color Field:**

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.

#### **Zone Plate:**

The following zone plate pattern is supplied as standard with all Sx instruments.

##### **Moving Zone-2H:**

A moving zone plate pattern, centered on the screen.

#### **Programmable Zone Plate Generator (Option: PHSXOZ)**

An optional, programmable, zone plate generator (**PHSXOZ**) is available for all Sx instruments. The zone plate selector contains several preconfigured zone plates, together with three user-customizable zone plates. Pressing the -> button to the right of the selected zone plate name displays the **Zone Plate Edit** 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, many custom zone plates are available for use. The following additional zone plates are provided with Zone Plate option PHSXOZ:

##### **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:**

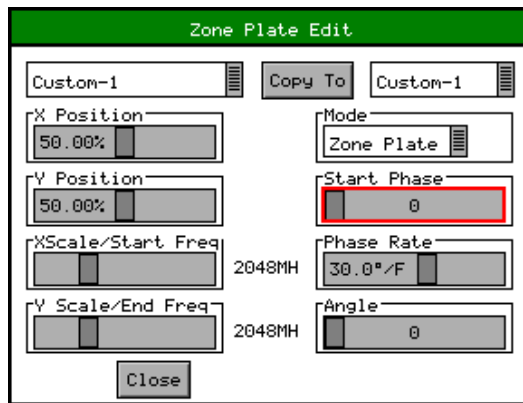
A 1 MHz frequency sine wave when using an HD output.

**Grating-5MHz@HD:**

A 5 MHz frequency sine wave when using an HD output

**Custom-1 through Custom-3:**

This allows editing of Custom zone plate settings. Three custom zone plates can be set up and can be copied from an existing preset 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.

**Phase Rate**

Sets the rate of change of phase of the sine wave, consequently changing the speed at which the zone plate moves. Phase rate is specified in degrees per frame.

**Angle:**

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

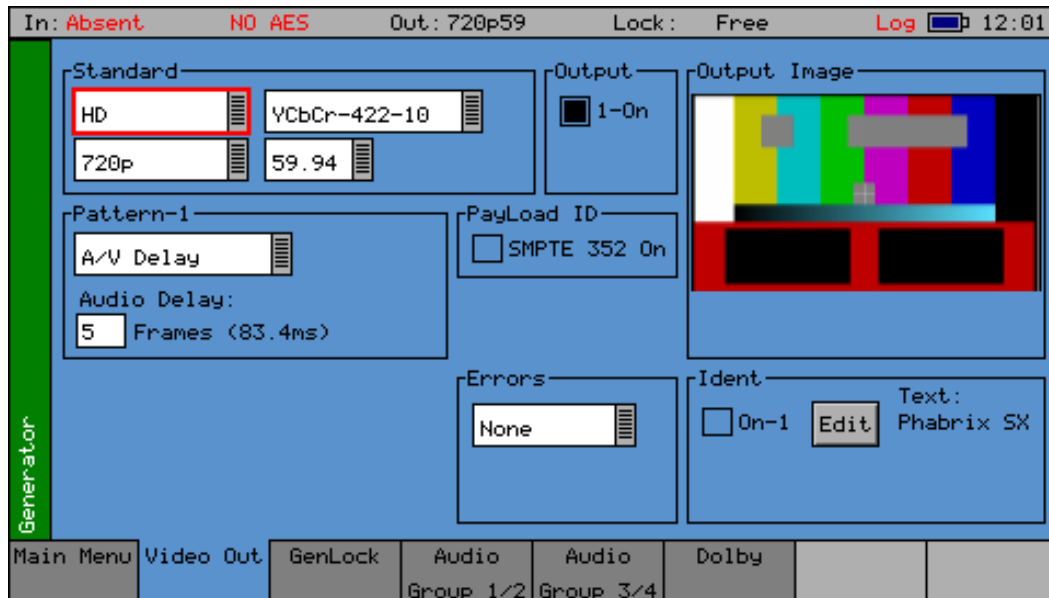
**XScale/Start Freq:**

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.

## AV Delay Generator



The AV Delay Generator produces an adapted EBU Tech 3305 AV Sync *clapperboard* Test Pattern. An audio delay offset with respect to video of up to +/- 40 frames can be applied in increments of one frame.

The AV Delay test pattern and audio pulse provided by the Generator module can be used to measure the differential delay between the video and audio paths in a piece of equipment or an SDI or AES based system.

In the **Video Out** menu page, the AV Delay test pattern and **Audio Delay** offset can be selected.

In the **Audio Group** menu pages, the AV delay audio pulse can be inserted on up to 16 embedded SDI audio channels, plus AES out.

When using the SxE, this new tool can also be used to measure the propagation or pipeline delay of either video or audio.

**Note:** The AV Delay signal is compatible with third party AV delay analyzers such as the LAWO V\_pro8.

The AV Delay Generator creates an adapted EBU Tech 3305 AV Sync pattern. This provides a constantly moving *clapperboard* which, when it closes, shows a vertical white *flash* line for one frame with a corresponding audio pulse.

To access the AV Delay Generator option:

- Select **A/V Delay** in the **Pattern** dropdown menu  
AV Delay can be used with all Sx supported video formats and frame rates on SDI and AES interfaces.  
An **Audio Delay** field is then displayed.

Using the **Audio Delay** field, you can offset the timing of the generated audio pulse relative to the central white flash frame of the test pattern. An audio delay offset of up to +/- 40 frames can be applied in increments of one frame. The delay value in milliseconds is displayed alongside the frame delay value.

- When **Audio Delay** is set to a positive (+) value, the audio pulse will lag the video
- When **Audio Delay** is set to a negative (-) value, the audio pulse will be ahead of the video.

The audio delay offset has several applications:

1. The differential delay of a system or device under test can be quickly measured in TV frames by adjusting the Audio Delay offset until the measurement reads less than a TV Frame. This can quickly confirm that the differential AV delay is an integer number of TV frames
2. The analyzer can measure AV differential delay up to +/- 400 ms. If the system under test has a propagation delay longer than this, setting an offset of up to -40 frames extends the overall measurement window.

On the AV Delay analyzer, a measured delay amount that is not accounted for by the generated Audio Delay offset, will indicate delay introduced by the system under test.

To choose the AV Delay pulse audio channels, go to the **Generator → Audio Group [1/2] [3/4]** menu pages, and select **AV Delay** in the dropdown menu for each audio channel as required.

## EDH

If the output signal is SD (PAL-625 or NTSC-525) the insertion of EDH information may be switched on or off.

## 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 is deliberately corrupted, creating one error count per field or, more precisely, one AP error and one FF error. In HD, a CRC value is calculated for each line. When errors are being inserted the CRC value on line number 1 is 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.

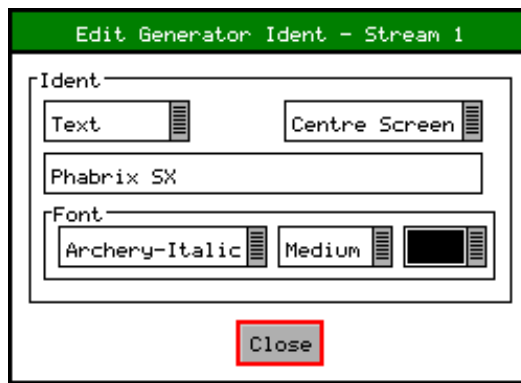
**Note:** For all HD-3G line standards the Payload ID should be switched **on**.

## 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 any changes to the text, font, or bitmap are made in the **Ident** dialog by selecting the **Edit** button. An overview of the Ident can be seen beside the **Edit** button.

**Note:** If Zone Plate or Color Field patterns are selected, text cannot be overlaid on them.

A thumbnail version of the video output signal is displayed on this page with any overlaid Ident.

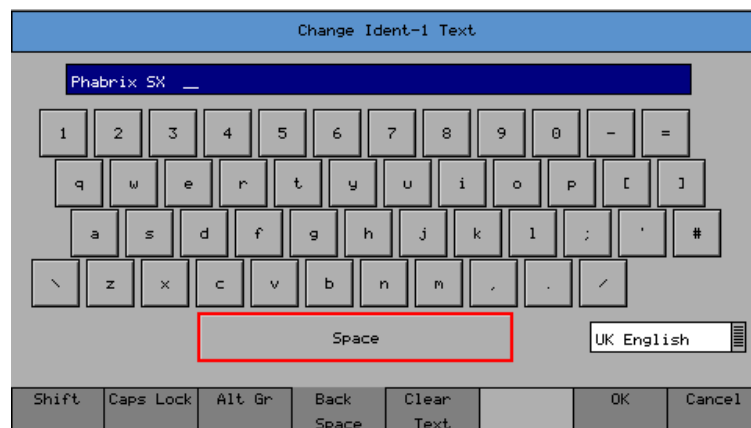


The **Edit Generator Ident** dialog allows selection of either a user-defined bitmap picture, downloaded into the **Idents** directory of the Sx instrument or user-defined text.

For both types, the position of the ident on the screen can be set to one of the following:

- 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, font size and color can be specified. Several fonts are included with the Sx instrument and other true-type (.ttf) fonts may be downloaded as required.

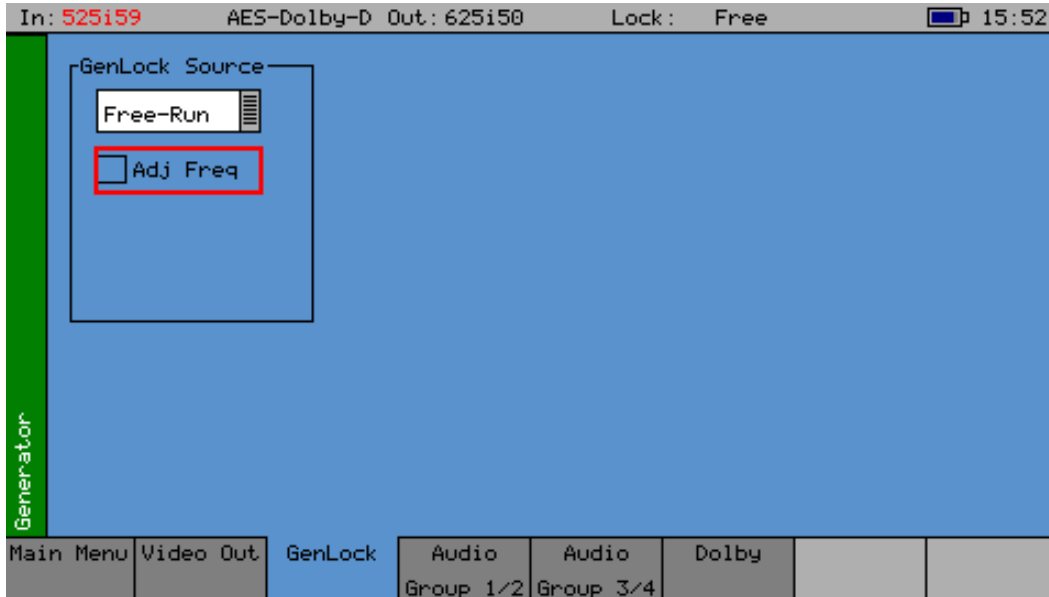


When editing text, the keyboard above is displayed to allow easy editing. Move the cursor to select the key to use and then press **Ok** to *press* it. The **Shift** menu key causes the keyboard to change to shift mode for the next key.

The **Caps Lock** key locks the keyboard in all upper-case mode. The **Alt Gr** key shows any language dependent alternate keys that may be pressed. Several country keyboard styles are provided.

**Note:** Some fonts do not support all non-English characters.

# Genlock Menu



The Sx instrument 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.

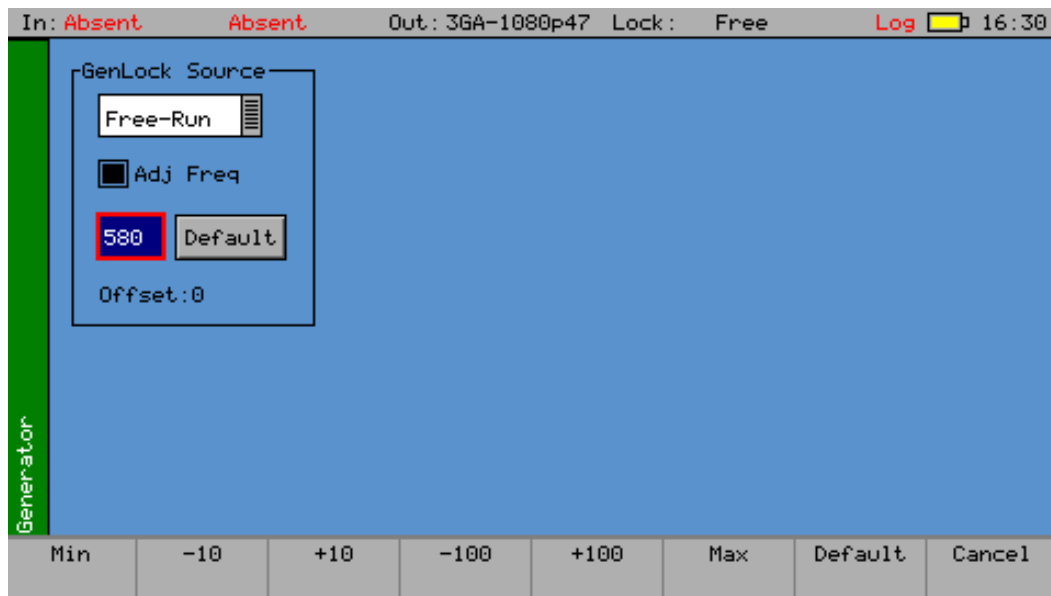
## Source

The generator may be locked to an input reference which may be either the external reference input which is a Bi-Level/Tri-Level sync or may be locked to the video input (Input-1). Alternatively, the generator may free-run.

If **Free-Run** is selected, the user can select the **Adj Freq** checkbox to adjust the frequency of the datastream by more than + / - 100 ppm. This feature enables the user to generate SDI signals that are off-frequency to, for example, test the susceptibility of a system to absolute clock frequency. The adjustable range is from 0 to 1024, with the nominal mid-point at approximately 580. Incrementing the value increases the signal frequency and decrementing value decreases the frequency.

Frequency Adjustment	Offset
0 (Min)	-580
580 (Default)	0
1024 (Max)	+ 444

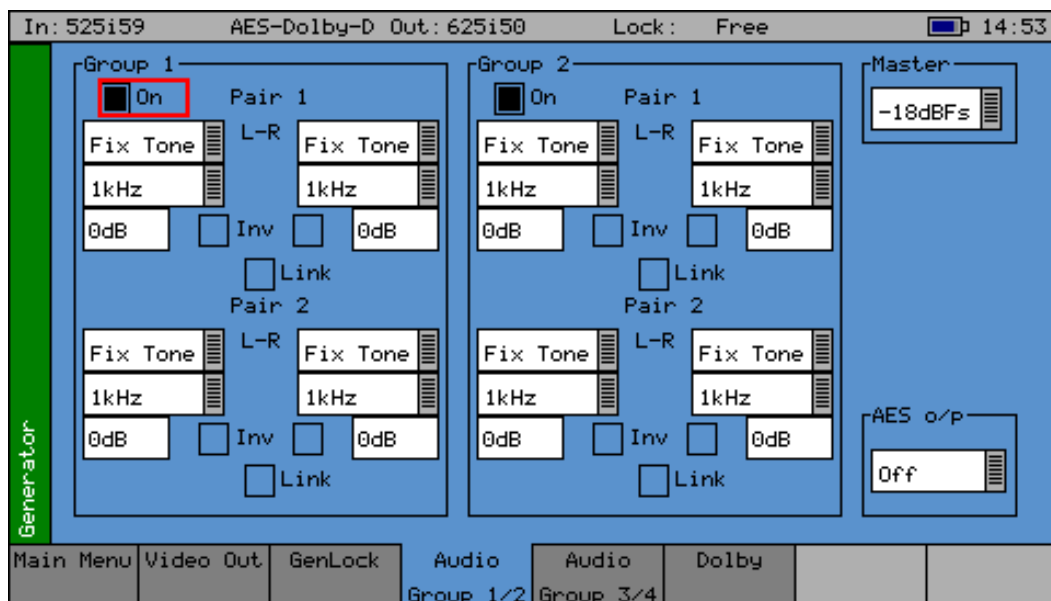
For example, a signal of 2.97 GHz can be adjusted with an offset between 2.969420 GHz and 2.970444 GHz.



## Delay

The SDI and AES outputs generated by the unit can be advanced/delayed with respect to the currently selected locking reference. Controls are provided for line and pixel advance/delay for SDI and AES output.

## Audio Group Menu



The Sx instrument can embed an audio signal on all 16 embedded audio outputs.

The Audio Group menu controls which audio channels, pairs or groups have test tones applied and the type of tone.

## 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 Silence, Fixed tone (a range of fixed frequencies), variable tone (where the frequency can be set on 1 Hz steps from 1 Hz to 23.99 kHz), white noise, or AV Delay. The AES input may also be selected if present. If the Dolby Generation option has been purchased, the source may be set to **Dolby** at which time the other channel in the audio pair is also set to **Dolby** and gain control is disabled.

## AV Delay Audio Pulse

For AV Delay audio pulse generation, choose which audio channel should carry the AV Delay pulse, and then set the source to **AV Delay** in the dropdown menu. Make sure that the **Group** checkbox for this channel is also enabled.

The AV delay audio pulse can be inserted on up to 16 embedded SDI audio channels and an audio pair can also be routed to the AES Out.

To route an AV delay audio group pair to AES Out, select the embedded output pair in the **AES o/p** dropdown menu.

If an Audio Delay offset is required for the generated AV Delay pulse, this can be set in the **Generator** → **Video Out** page after selecting the **A/V Delay** test pattern. An offset of up to +/- 40 frames can be applied in increments of one frame.

## Inv (Invert)

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

## Link

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

## Master

The Master level sets the 0 dB level for all the embedded audio channels, so if the Master level is set to -18 dB and Group 1 Pair 1 output is set to -2 dB, the actual level output on that pair is -20 dB. This feature allows all embedded outputs to be adjusted together, as well as giving a simple method to change from -18 dB to -20 dB based standard levels. The Master level will not adjust the level of an AES input signal selected for embedding on SDI output.

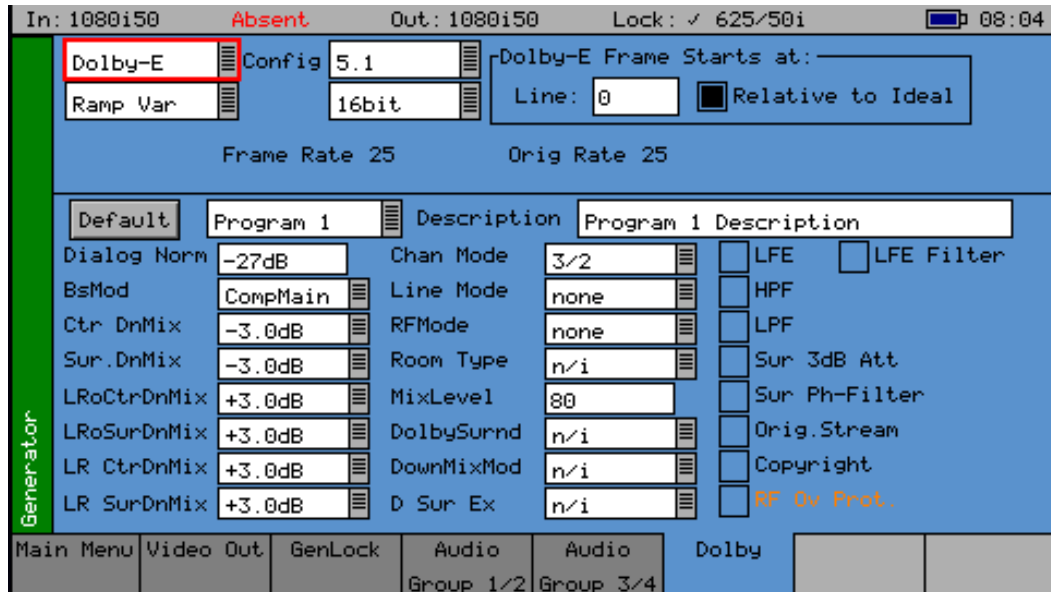
## AES O/P

The **AES o/p** (output) control selects the source for the AES output of the Sx instrument and can be:

- The AES input (through the built-in sample rate converter) to convert to 48 kHz sample rate AES signals.
- A mirrored output of the specified embedded AES stream contained in the SDI output to generate audio tones or white noise.
- One of the embedded input pairs on the SDI input to allow use as a de-embedder.
- Off, if the output is not required.

Note that the AES output is always at a 48 kHz sample rate. The AES input includes a sample rate convertor and so will accept any sample rate between 32 kHz and 192 kHz.

## Dolby (Dolby Generator Option: PHSXO-DAG)



The Sx instrument Dolby Generator software option (**PHSXO-DAG**) allows the 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.

The Audio - Dolby menu controls the generation of Dolby test data.

**Note:** Note that with this software version non-keyed signals are generated which may be incompatible with certain VTRs.

### Overview

There are several 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 – 20,000 Hz) (right front, center, left front, rear right, rear left) and one channel (20 Hz – 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 down-mix.

### Dolby E

Dolby E is an audio encoding and decoding technology developed by Dolby Laboratories that allows up to 8 channels of audio (mono, stereo, 5.1 or 7.1) for a primary program (Program 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. The most elaborate mode in common use is Dolby 7.1 which uses all eight channels to provide surround sound.

### 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 which 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 offering a primary program and optional ancillary programs. These can be optionally delivered at lower bit rates than Dolby Digital.

### Dolby E Synchronization - Generator Reference

The Dolby audio test signal produced by the Sx instrument is affected by a reference signal connected to the Sx instrument and by the following settings:

#### Free Run:

If the generator is not locked to reference, the Dolby signal will be generated synchronous to the generator. If the generator is running at a fast progressive rate (50 - 60 fps) it will generate packets on every other frame.

#### External Reference / Ext SDI Reference:

If the generator is locked to an external signal, the reference signal *must* be of an appropriate standard. 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

## Editing Program Information

### Stream type:

Only Dolby E streams can be generated with this software version.

### 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 -3 dB co-phased/timed and are at the same frequency.

#### -18dB Fixed:

All the tones are at -3 dB co-phased/timed and are at the same frequency.

#### -20dB Fixed:

All the tones are at -3 dB co-phased/timed and are at the same frequency.

Fixed Frequency values for 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.

### 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:

### Dialog Norm:

The normal audio level for dialog. Ideally all transmitted programs would have the same value.

### BsMod:

Bitstream Mode indicates the type of audio service that the bitstream contains. Complete Main (CM) is the standard 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 to simplify the implementation of Dialog 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 to simplify the implementation of Dialog Normalization, Dynamic Range Control, and down-mixing functions, all of which are necessary in Dolby Digital products.

**Room Type:**

Information parameter that 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:**

Controls the Down Mix Mode which is used by the content creator to optimize Center and Surround channel levels for use in stereo down-mix mode for any two-channel programs.

**DSurEx:**

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 by selecting the corresponding checkbox(es):

**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 Att:**

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.

**Orig. 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. Setting one channel of an audio pair to **Dolby** automatically forces the other channel in the pair to select **Dolby**. 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

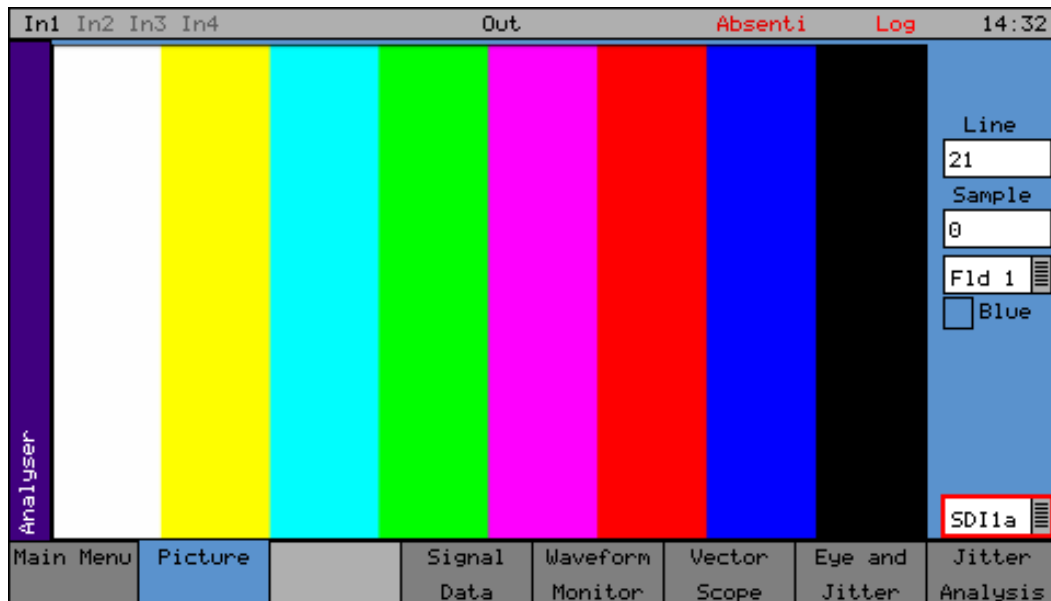
To embed Dolby signals on the AES output, the Audio source for the **AES o/p** (AES output) should be set to **Dolby**. This field is located at the bottom-right of the **Generator → Audio Group [1/2 [3/4]** pages.

# Analyzer Menu

## Overview

The Sx instrument signal analyzer displays the selected video input or output signal. The source for the analyzer is set by the field at the bottom right of the page. The current line and sample are the same for all pages of the analyzer and therefore when selecting a sample on the Signal Data page, the cursor will show where that is on the *Full Picture* page.

## Picture



With **Picture** selected, the video picture is displayed in a window as a down-converted display. The picture will automatically view the horizontal or vertical blanking areas if the line or sample values are in the blanking area.

If the focus cursor is moved to the picture window and **OK** pressed, the cursor may be used to scroll around the window. Press **OK** again to cancel this mode. When in zoom mode, the cursor is always in the center of the window and the picture scrolls behind it. If the cursor is moved to an area of interest on the picture, the same area will be visible on the SDI data option (if purchased).

If the picture window is focused and current tab button is pressed again to enter full-screen mode, the cursors may be moved by pressing the **OK** button again.

**Note:** Note that the normal cursor menu keys may be used but are not visible. Press **OK** again to cancel cursor adjustment mode.

### Line:

Specify the current line for analysis.

### Samp(le):

Specify the current sample for analysis.

### Field:

Only used for interlaced formats 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.

### Aspect Ratio:



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

**Zoom:**

If not checked, the picture displayed is a down-converted picture to fill the window or the full screen as requested. If checked, then a pixel on the LCD display will reflect a pixel in the video signal. In zoom mode, no filtering is used.

**Cursor:**

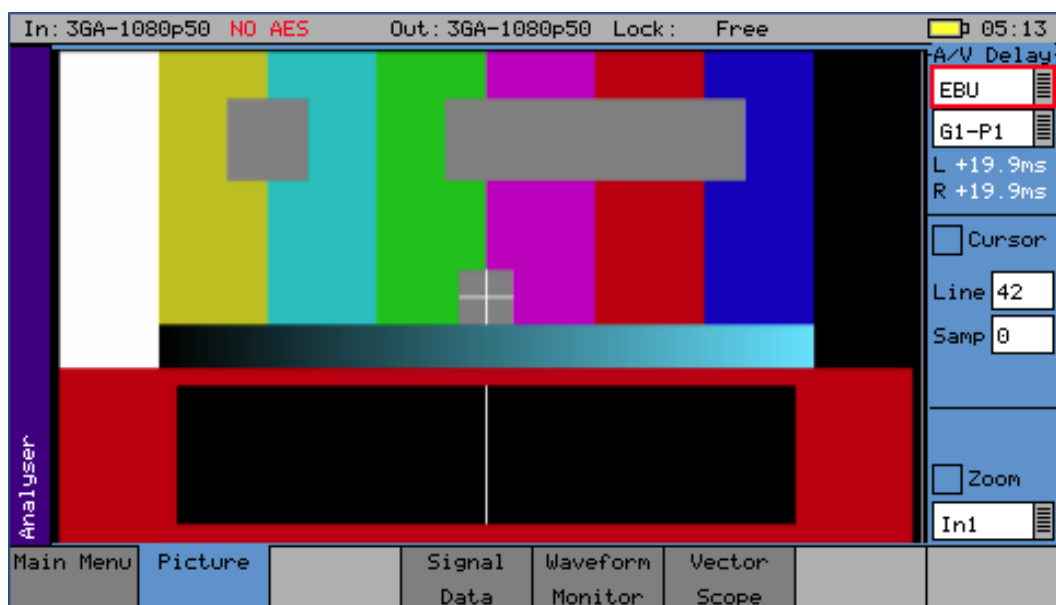
A cross-hair cursor may be activated over the area of the picture defined by the specified line and sample.

**Source:**

The analyzer can view either the video SDI input or the SDI output so that comparisons can be made between input and output.

The Picture monitor will automatically apply the appropriate transforms to display the images in YCbCr, RGB and XYZ color spaces correctly. The color space transform to be applied is defined by the SMPTE 352 payload.

**AV Delay Analyzer (AV Delay Option: PHSXO-AVD)**



AV Delay measurement is available in the Picture instrument.

Measurement of two AV Delay test patterns is supported:

- EBU Tech 3305
- LAWO V\_line AV Sync test pattern

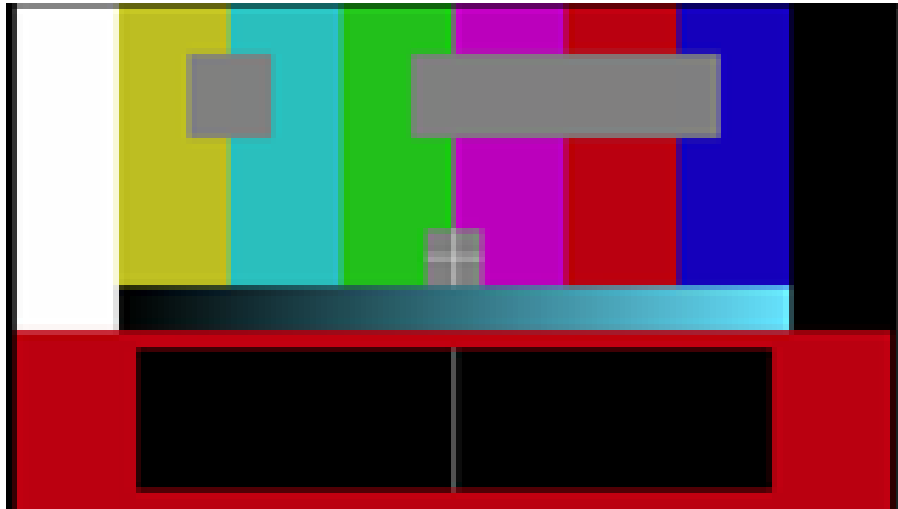
The tool provides a real-time update of the differential delay between the video and the selected audio channel pair.

When analyzing an AV delay video test pattern and audio pulse, the differential delay between the video and the selected audio channel pair will be measured and displayed – with the display updated in real-time.

- A positive (+) measurement indicates that the audio pulse is lagging behind the video
- A negative (-) measurement indicates that the audio pulse is ahead of the video
- When video and audio are completely in sync, zero delay will be measured.

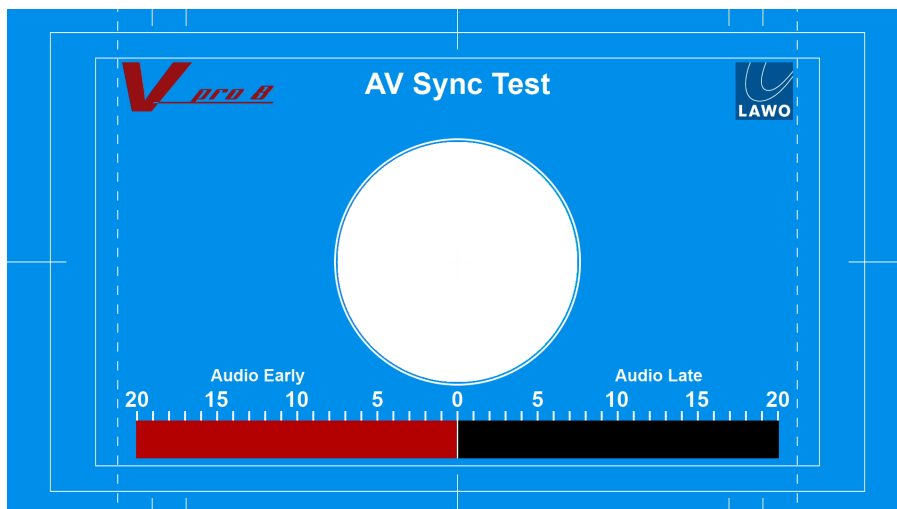
The differential delay between the video and the selected audio is measured in 0.1 ms steps (to an accuracy of 1 ms) with an operating range of +/-400 ms.

An Audio Delay offset can be applied to an Sx generated AV delay test pattern using the **Generator → Video Out** page. In the AV Delay analyzer, any delay amount that is not accounted for by the generated **Audio Delay** offset, will indicate delay introduced by the system under test.



The Sx modified EBU Tech 3305 AV Sync test pattern provides a constantly moving clapperboard that when it closes shows a vertical white flash line for one frame.

When video and audio are in sync, the audio pulse will sound at the exact moment the white flash appears. If video and audio are out of sync, there will be a differential delay between the timing of these two events.



The LAWO V\_line AV Sync test pattern provides a constantly moving progress bar. When the progress bar reaches the center frame of the test pattern, first a vertical white bar then a white flash appears in the center circle.

When video and audio are in sync, the audio pulse should sound at the exact moment the white flash appears. When video and audio are out of sync, there will be a differential delay between the timing of these two events.

To measure AV Delay in the **Picture** instrument, the Picture source should be set to the SDI input to analyze the incoming video signal.

**Note:** The Picture source can also be set to view the generator output.

The **A/V Delay** selection menus and measurements display is located in the top right-hand corner of the Picture instrument.

To measure the differential AV Delay, first ensure that a suitable test source is being used.

For the AV Delay measurement to be valid, the measuring Sx unit must be genlocked to a suitable reference, defined as either of the following:

- the SDI input being analyzed
- the external reference to which the AV Delay test signal source device is locked.

If, however, the measuring Sx is also the source device generating the AV Delay test signal in a loop, then a suitable reference is defined as either of the following:

- External reference
- Free run

Trying to lock the Sx unit to its own input signal is not valid.

The Sx unit reference input can be set in the **Generator → GenLock** page.

Switch on AV Delay measurement by selecting the appropriate test pattern type from the first **A/V Delay** dropdown menu:

- Select either: OFF, EBU, LAWO

In the next dropdown menu, select the required audio group and pair carrying the AV delay audio pulse – the timing of which will be measured relative to the video test pattern.

The AV Delay pulse can be carried on either an embedded SDI audio or AES channel:

- AES In, G1-P1, G1-P2, G2-P1, G2-P2, G3-P1, G3-P2, G4-P1, G4-P2

The Left (L) and Right (R) channel fields will display any measured differential delay between the video and that audio channel in milliseconds (ms).

The status of the AV delay measurement tool (when switched on) is shown by the color of the measurement display fields:

#### **Yellow**

Sampling in preparation for A/V Delay measurement. Not accurate during this period.

#### **White**

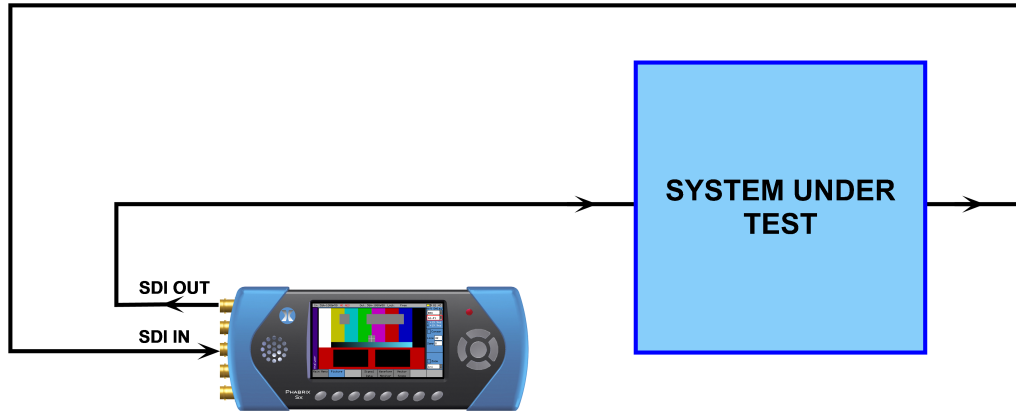
Measured differential delay. No errors detected.

#### **Red**

The correct AV delay pattern has not been detected and/or no AV delay pulse has been detected

#### **Audio-to-Video Differential Delay Testing:**

**Objective:** To measure the imposed differential delay of the audio and video paths in the system under test.



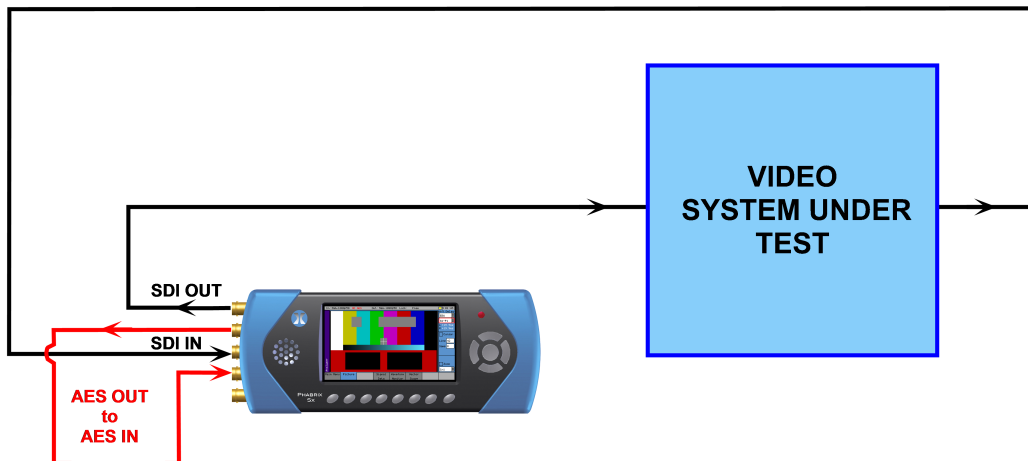
- Audio pulse carried on embedded SDI channel pair
- Genlock to external reference or free run

#### Propagation Delay Testing (of either video or audio):

**Objective:** Measure the propagation delay imposed on the video or audio by the system under test.

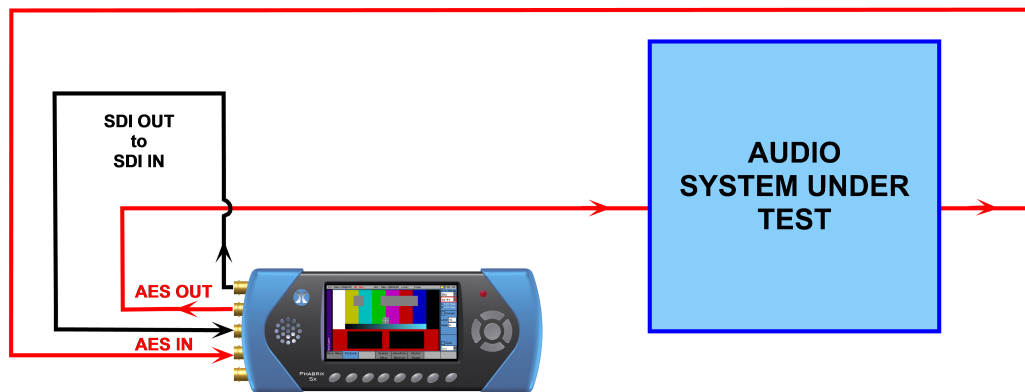
**Note:** The analyzer can measure delay up to  $\pm 400$  ms. If the system under test has a delay longer than this, setting an Audio Delay offset of up to  $-40$  frames will extend the analysis window.

#### Video Propagation Delay Testing:



- Audio pulse carried on AES channel pair
- Genlock to external reference or free run.

## Audio Propagation Delay Testing:



- Audio pulse carried on AES channel pair
- Genlock to external reference or free run.

## Signal Data (Option: PHSXOSD)



The Signal Data menu shows the video signal as a data stream in several formats as described below. 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.

To simplify scrolling around the SDI signal view, use the cursor keys to move the red focus rectangle to the data display and press **OK**. The focus rectangle should change to a blue color and the cursor keys allow the display to be scrolled in any direction. The menu keys at the bottom allow the Line / Sample to be adjusted by 10 or 100 in any direction.

**Note:** Note that the line number of a line of video changes at the end of active video. This gives the unusual side-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. This is a representation of the picture but 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 in with a red or blue tint respectively.

#### Strm:

This is 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:

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

#### Split:

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

## Source

The analyzer can view either the video SDI input or the Generator output so that comparisons can be made between input and output.

### In1:

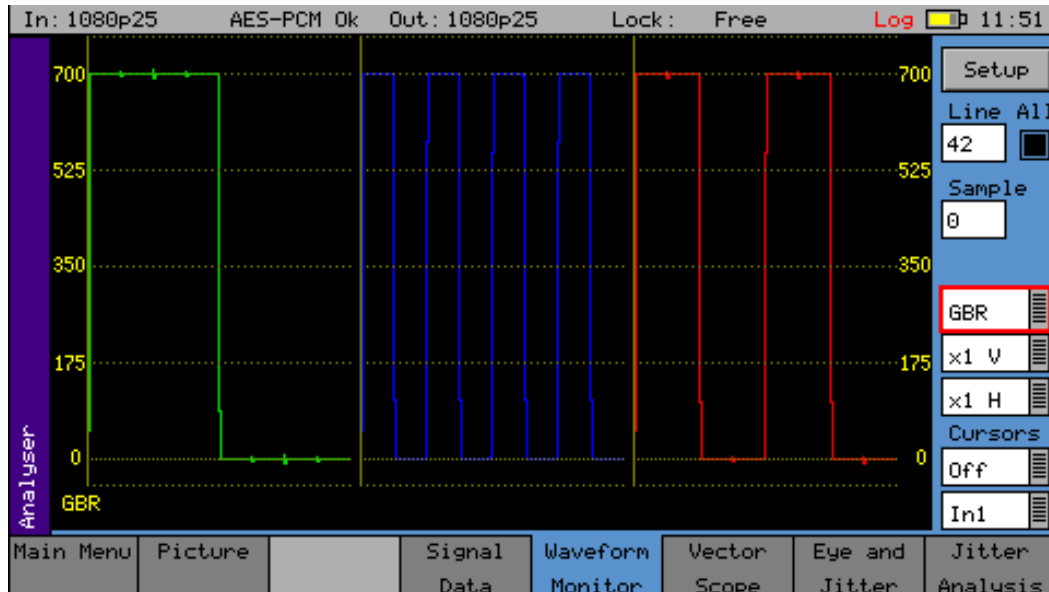
SDI Input

### Out1:

SDI Output

**Note:** Note that 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 selected the values in the active picture are unpacked to RGB or YCbCr values.

## Waveform Monitor



The **Waveform Monitor** menu displays the selected input in the form of a waveform monitor.

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.

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

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

### YCbCr

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

### Y

Only the luminance channel is displayed

### Cb

Only the blue chroma channel is displayed

### Cr

Only the red chroma channel is displayed

### GBR

The green, blue and red waveforms are displayed as three separate waveforms in a Parade format

### Red

Only the red channel is displayed

### Green

Only the green chroma channel is displayed

### Blue

Only the blue chroma channel is displayed

### RGB



The red, green and blue chroma channels are displayed as three separate waveforms in a Parade format

### XYZ, X, Y, Z

Settings in the Waveform monitor display the 2K-SDI XYZ color space in its native non-linear form, so test patterns such as 2K. XYZ Legal Ramp will be displayed as curves instead of straight lines.

### X'Y'Z', X', Y, Z'

Settings in the waveform monitor display the 2K-SDI XYZ color space with a reverse transform to convert it to linear form, so test patterns such as 2K, XYZ Legal Ramp will be displayed as straight lines.

The next two controls show the vertical and horizontal magnifications. If either value is set to a value other than **x1**, a vertical or horizontal offset is displayed at the bottom-right edge of the waveform display. The offsets are set by moving the focus cursor to the waveform window and pressing **OK**. The menu keys can then be used to scroll around the window. The offset is the same for all magnification values so switching between **x1** and **x5** will not lose the offset used in **x5** mode.

The vertical offset values are in signal level bits but displayed in the current scale units so switching between scales will keep the same offsets.

## Cursors

Cursors may be displayed over the waveform to allow measurement of time or amplitude values. The cursor may be set to several modes:

### Off:

Cursors are hidden

### Pict.:

The cursor is displayed at the current pixel point. If in YCbCr or RGB mode, three cursors are displayed. Otherwise a single cursor is displayed. The cursor position tracks across the picture monitor and Signal Data tabs.

### Ampl.:

Two cursors are displayed to allow measurement of signal amplitudes.

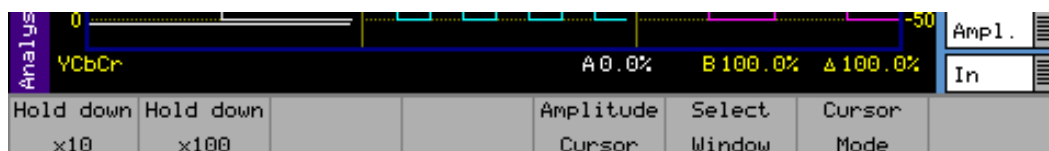
### Time:

Two cursors are displayed to allow measurement of signal timing.

### Both:

Amplitude and time cursors are displayed.

To use the cursors, use the navigation keys to move the focus to the waveform display and press **OK**. You should then get a display similar to that below. Note that the menu keys shown depend on the display mode and cursor mode.



The navigation keys now move the selected cursor around the waveform display which will scroll if moved out of the visible area. The **x10** and **x100** buttons magnify the action of the navigation keys if held down.

The **Select Window** button is only available in YCbCr or RGB modes and selects the window in which the cursor is displayed.

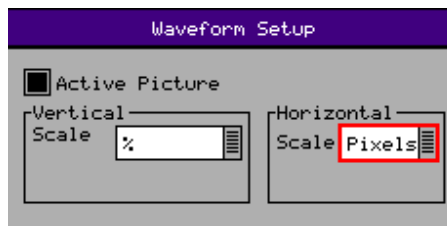
The **Amplitude Cursor** and/or the **Timing Cursor** buttons switch the currently active cursor. In each direction two cursors are displayed. The currently active cursor is the one displayed as a full line (rather than the dotted cursor). The bottom of the waveform screen shows the cursor measurements in the current format which may be Decimal, Percentage or Hexadecimal for amplitude measurements or Pixels/ $\mu$ s for timing measurements. The difference between the two cursors is also displayed in absolute form.

The **Cursor Mode** button changes the current mode without having to leave the navigation window.

**Source:**

The analyzer can view either the video SDI input or the Generator output so that comparisons can be made between input and output.

### Waveform Setup Dialog



The **Waveform Setup** menu allows the vertical and horizontal scale of the waveform display to be set up.

**Active Picture:**

If checked, only the active picture is displayed for picture view and waveform monitor, all other VBI data such as TRS words ANC data and audio is blanked. This control tracks the state of the ActPix control on the Picture.

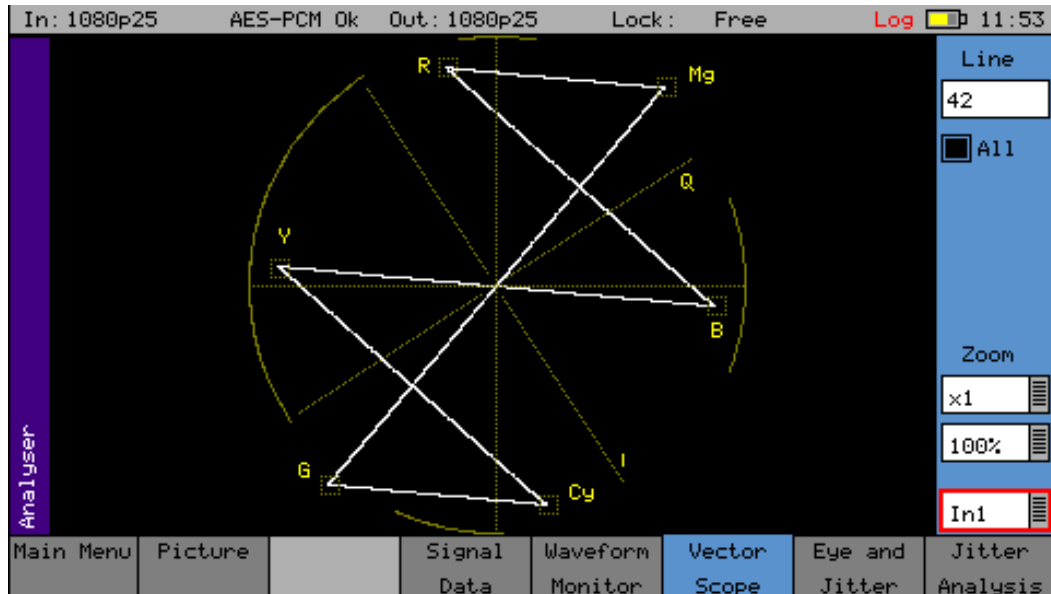
**Vertical Scale:**

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 ( $\mu$ s)

# Vectorscope



The Vectorscope menu displays the selected input in the form of a vectorscope. This 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. Otherwise the specified line is displayed.

## Field

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

## Zoom

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

## 100%/75%

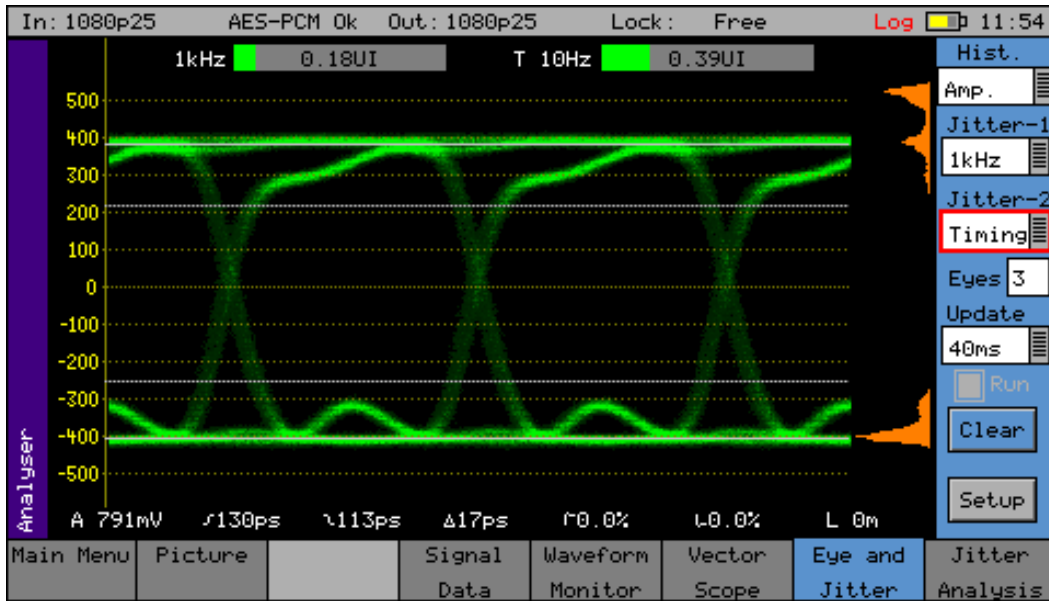
Selects the graticule scale to match the color bars being analyzed.

## In1 / Out 1

Selects either the input to the Sx analyzer or the output of the Sx generator as the display.

The Vectorscope will automatically apply the appropriate transforms to display the images in YCbCr, RGB and XYZ color spaces correctly. The color space transform to be applied is defined by the SMPTE 352 payload.

# Eye and Jitter



The **Eye and Jitter** menu displays the selected input in the form of an *Eye Pattern* display.

The name 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.

An *open eye* is displayed when monitoring a jitter-free SDI signal and the eye *closes* increasingly as the severity of the jitter on the SDI signal increases.



The Eye Pattern is formed by displaying the clock signal from the SDI data stream then superimposing a delayed version of the clock signal at exactly halfway through the duty cycle (or unit interval) of the clock signal, forming the recognizable eye shape.

When the SDI datastream is actually generated by a piece of equipment, ideally the leading edge of the SDI clock is aligned exactly halfway through the data sample. Distribution of the SDI datastream using cabling, infrastructure, repeaters and distribution amplifiers can cause distortions to the waveform and cause the datastream to be sampled earlier or later in the duty cycle (or unit interval) which, in turn, causes the wrong data samples to be taken.

The result of the incorrect data samples being taken is displayed as faint lines before and after the ideal waveform. The greater the number of incorrect data samples that are taken the more the eye closes.

The eye pattern can be used to display a range of different artifacts that can be isolated using filters. Jitter occurs when a signal varies in time or amplitude outside of the ideal waveform shape. The integrated circuits used within equipment contain tens of thousands of individual transistors that can all cause errors. Problems occur when these errors cause a level of jitter outside the specified acceptable parameters.

### 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 due to incorrect sampling of the datastream because the SDI Clock transition occurs on the edge of the data sample instead of in the center of the data sample.

### Wander

Refers to a long-term time interval error, i.e., artifacts 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.

### Random Jitter

Refers to artifacts 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.

## 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:

#### 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 cable will be shown to have a length of 0 m. The cable type affects the length displayed which has been calibrated for Belden 1694A cables.

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

**Note:** If the 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 using a 1 m cable length; 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 Sx instrument to view the signal post-equalizer.

## Histogram

Amp, Timing, or Both histogram types enable the operator to observe the distribution of samples in both amplitude (Amp) and time (Time).

### Amp:

The amplitude histogram shows the distribution of samples over the complete visible eye picture.

### Timing:

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

## Jitter Filters

The **Jitter-1** and **Jitter-2** filter options allow the specific type of jitter to be applied to the waveform and the thermometers displays.

### Jitter-1:

Timing / Align / 10Hz / 100Hz / 1kHz / 10kHz / 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 / 100Hz / 1kHz / 10kHz / 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.

### 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 the 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 shown in green; when close to specification it is yellow, and when out of specification, red.

	3G-SDI (2.97 Gbps)	HD-SDI (1.485 Gbps)	SD-SDI (270 Mbps)
<b>Alignment Jitter</b>	SD-SDI (270 Mbps)	100 kHz high pass	1 kHz high pass
<b>Alignment Jitter</b>	10 Hz high pass	10 Hz high pass	10 Hz high pass
<b>Upper Limit</b>	-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 where on the eye the rise time measurements are being made. Note that the Sx 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)
<b>Alignment Full-Scale</b>	0.52 UI	0.34 UI	0.34 UI
<b>Alignment (Red Threshold)</b>	0.3 UI	0.2 UI	0.2 UI
<b>Alignment (Yellow Threshold)</b>	0.2 UI	0.14 UI	0.14 UI
<b>Timing Full Scale</b>	3.4 UI	1.7 UI	0.34 UI
<b>Timing (Red Threshold)</b>	2 UI	1 UI	0.2 UI
<b>Timing (Yellow Threshold)</b>	1.4 UI	0.7 UI	0.14 UI

## Eyes

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

## Update

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

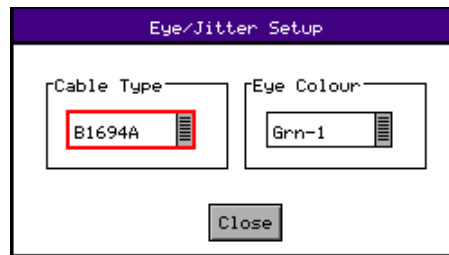
## Run

Select to stop the display from updating so that a waveform may be investigated in more detail. Enabled only when the update mode is set to infinite.

## Clear

Clears the eye display. Enabled only when the update mode is set to infinite.

## Setup



The **Setup** button opens a dialog box allowing the eye color and cable type to be specified.

### Cable Type:

Selects the cable type used which affects the cable measurements.

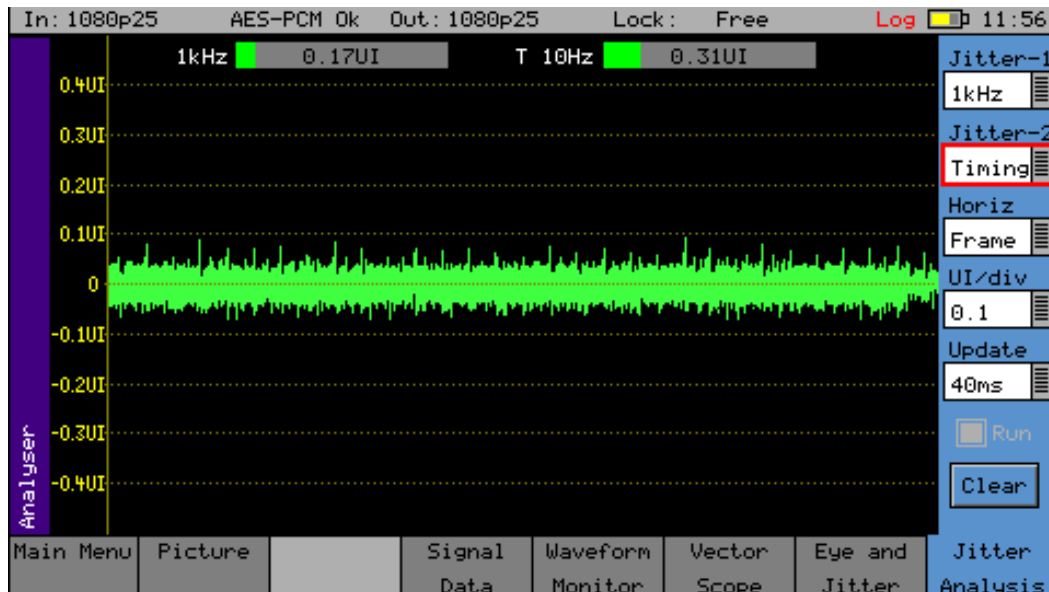
Cable Type	Description	Cable Type	Description
<b>B8281</b>	Belden 8281	<b>B1505</b>	Belden 1505
<b>B1694A</b>	Belden 1694A	<b>B1855A</b>	Belden 1855A 0.2 UI
<b>CL5CFB</b>	Canare L-5CFB	<b>I-1000</b>	Image 1000
<b>Percon VK5</b>	Percon VK 5/0.6	<b>Draka 0.6/2</b>	Draka 0.6/2.8 AF S

### 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 the majority of the signal data is found.



## Jitter Analysis



The Jitter Analysis display shows a trace of jitter amplitude versus time along with two jitter thermometers and has the following controls:

### Jitter Filters

The **Jitter-1** and **Jitter-2** filter options allow the specific type of jitter to be applied to the waveform and thermometer displays.

#### Jitter-1:

Timing / Align / 10Hz / 100Hz / 1kHz / 10kHz / 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 / 100Hz / 1kHz / 10kHz / 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.

### Display Controls

The resolution and timebase of the display can be controlled by the following:

#### Horiz:

1H / 2H / 1V / Frame – horizontal sweep control for jitter trace.

#### UI/Div:

0.1 / 0.2 / 0.5 / 1.0 – vertical gain control for the sweep trace.

### Update

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

**Run:**

Select to stop the display from updating so that a waveform may be investigated in more detail. Enabled only when the update mode is set to infinite.

**Clear:**

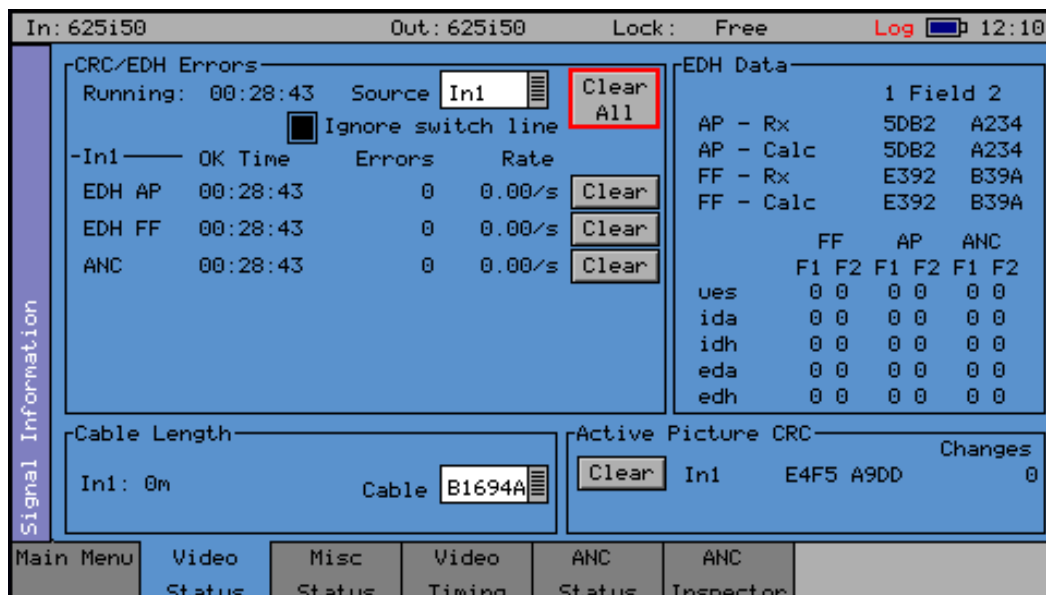
Clears the eye display. Enabled only when the update mode is set to infinite.

# Signal Information Menu

## Overview

The **Sig Info** pages give a detailed view of the status of the input (or generator output) signal. They are sub-divided into Video, Misc, and Ancillary (ANC) Status.

## Video Status



The Video Status menu shows the status of the selected video input and displays any errors found in the datastream.

## CRC/EDH Errors

The **CRC/EDH Errors** section displays the EDH or CRC status of the analyzer input as appropriate for the video standard being monitored. The status of each CRC/EDH 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 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.

## 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:

**ues:**

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

**ida:**

Internal Error Detected Already: Set to 1 if an idh flag was received by the previous device.

**idh:**

Internal Error Detected Here: Set to 1 if a hardware error was detected in the previous device.

**eda:**

Error Detected Already - Set to 1 if an SDI error was detected in the signal received by the previous device.

**edh:**

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

Note that there is only one EDH detector which is connected to the input currently being analyzed. On an Sx instrument with multiple video inputs, only the current input being analyzed can check for EDH errors.

## Cable Length

The Sx 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
- Percon VK 5
- Draka 0.6/2.8 AF

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 **Misc Status** menu displays the auto-detected and SMPTE ST352 (VPID) parameters of the selected SDI source and highlights any detected errors or unsupported parameters.

When analyzing a 3G-Level A or B signal, the SMPTE 352 status is displayed for each link or stream present according to the input video format.

**Note:** The unit now supports the SMPTE 352 video payload identifier (VPID) on a single interface of 4 x 3G and 4 x 1.5G links.



## Payload ID – SMPTE 352

If the unit detects a SMPTE 352 ancillary packet, the detail of the packet content is displayed in this section in both hex and decoded format.

The display lists the following elements contained in the SMPTE 352 packet in decoded form:

- SMPTE Standard
- Digital interface transport mapping structure
- Digital interface transport structure (progressive or interlaced)
- Digital interface picture structure (progressive or interlaced)
- Transfer characteristics (SDR, HDR, etc.)
- Picture frame rate
- Picture aspect ratio
- Number of active pixels in picture
- Number of lines in picture
- Sampling structure
- Bit depth
- Colorimetry
- Payload channel number for multiple payloads
- Audio channel usage

## Video Format

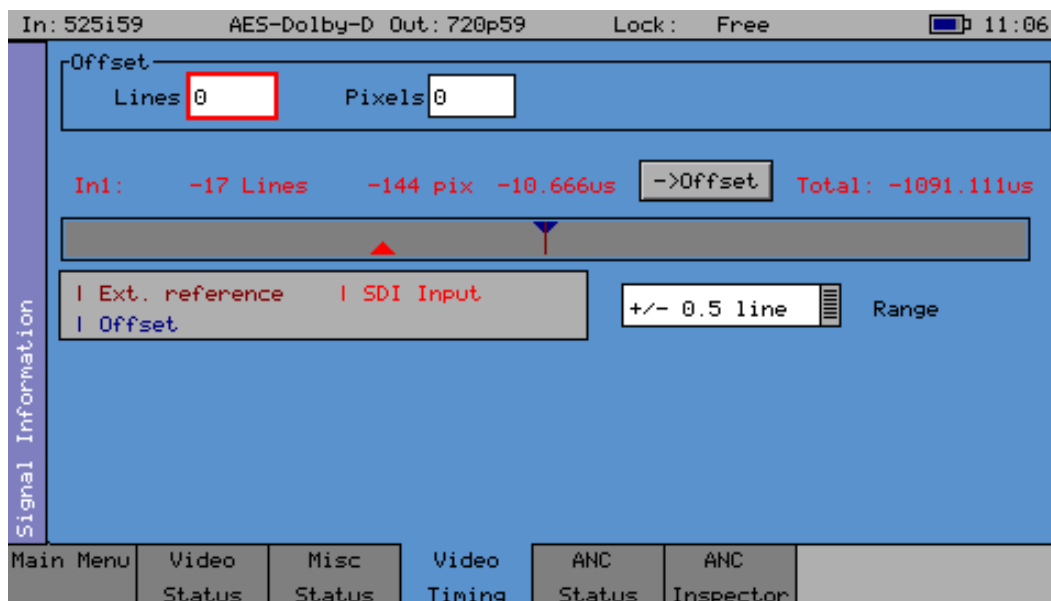
These sections display the currently auto-detected pixel counts, active line count and the frequency of the selected input source.

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

If the input signal is not a known signal, for example, if 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. Press **Clear** to reset this counter.

## Video Timing



The Video Timing menu displays the relationship between the selected video input with respect to the locking reference input.

The timing of the 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  $\pm 2$  samples the values are displayed in a black font, 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 ( $\pm 0.1$  lines or  $\pm 0.5$  lines) or frame timing ( $\pm 0.5$  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**.

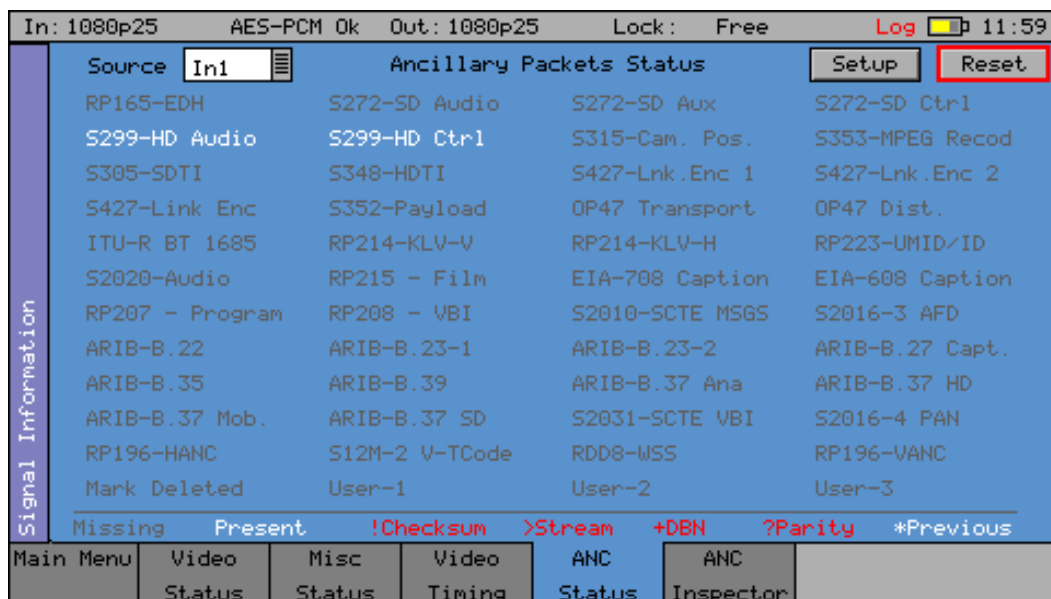
**Note:** All timing measurements are relative to line 1 on the SDI signal and line 1 on the reference signal. This can lead to different values from other test and measurement instruments that include an SD (PAL/NTSC) offset in their calculations. By comparing line 1 timings, the Sx instrument can be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

## ANC Status

The Ancillary Packets Status tool provides broadcasters, studios, OB and broadcast manufacturers with a detailed analysis of the ancillary data present in an SDI signal.

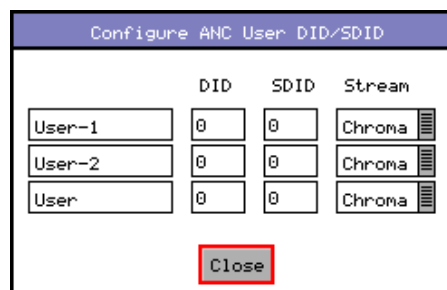
A simple grid layout provides a quick overview of the available VANC/ANC ancillary data for an engineer. The packet type is then displayed as present, absent or red if in fault. Simple icons next to the packet indicate the fault. Each ancillary packet available from the grid view can be set to enable logging and then presented together with other information in the events window of the logging menu.

This tool further allows additional user-defined selections with the appropriate DID or SDID code. Any ancillary packet code can be saved down for future recall. Note that the Ancillary Packets Status tool does not fully decode the ancillary data but is used to identify whether the packet is present in the signal.



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 (Grey), has errors (Red), or has previously had errors (yellow).

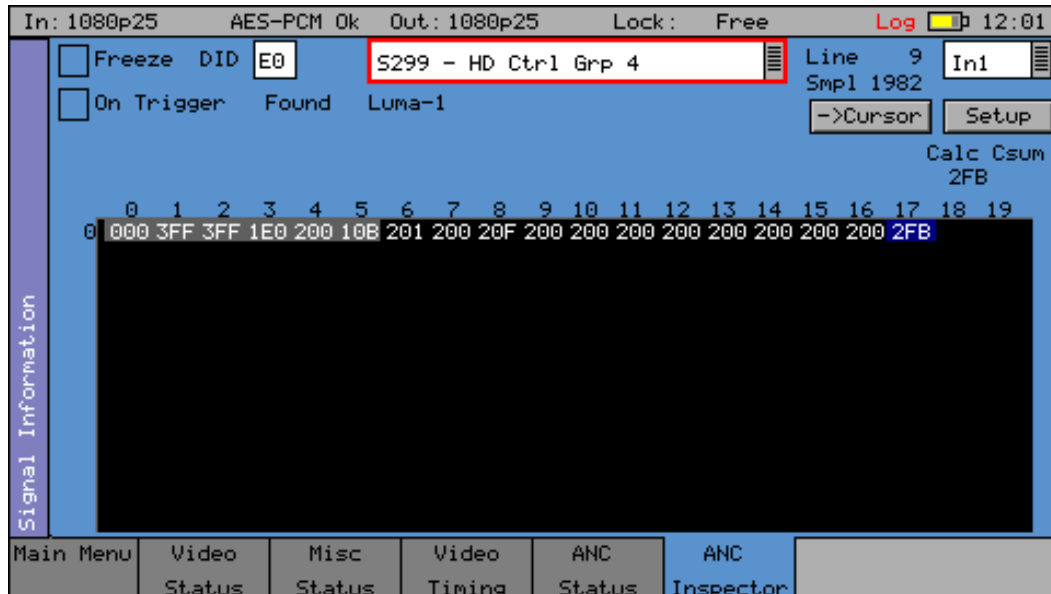
If the field has errors then a symbol beside the field shows which error type it is. The bottom of the page shows the symbol for each type of error. The **Reset** button resets the Previous Errors state.



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.

## ANC Inspector (SDI Data Option: PHSXOSD)



The SDI Data Option **PHSXOSD** allows Ancillary data packets to be detected and checked for errors.

The ANC Inspector menu displays details of the ANC packets.

The packet type can be selected using either the dropdown list of known packets or the DID/SDID number fields. 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.

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.

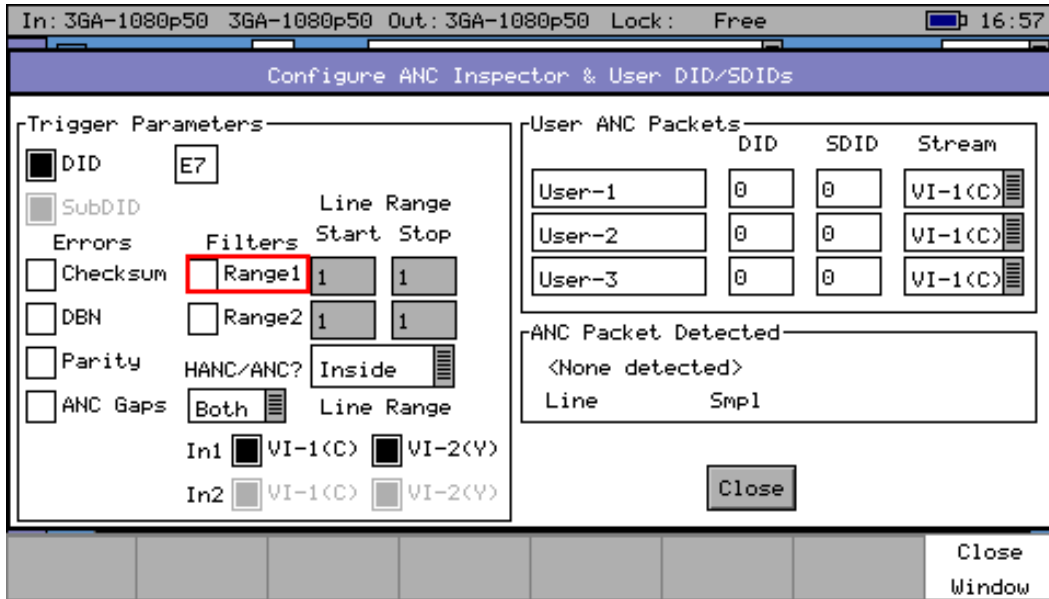
The detected ANC packets may be filtered using the **Setup** dialog. This allows a great deal of freedom in setting when the display will be triggered.

If the **On Trigger** checkbox is selected the data packet will cause the display to be frozen and the **Freeze** checkbox will turn red when a trigger condition is met as described below. Uncheck **Freeze** to 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



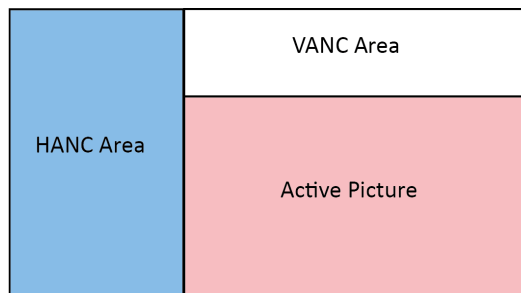
If the **Setup** button is pressed a dialog box allows the ANC packet trigger parameters to be set. The trigger parameters allow only selected lines to be checked or excluded when checking for the presence of packets.

### 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 restricted to that range. If the dropdown below the range is set to **Inside** then it will only check ANC packets within the range (including the start and end lines). If set to **Outside** it will check only ANC packets outside the specified range.

### HANC/VANC Filter:

Provides another filter for simpler selection of the area in which to search for packets. It may be selected to search the HANC area, the VANC area, or both areas.



## Error Triggers

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

### Checksum:

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

### 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 to 255 and then start at again at one.

### Parity:

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

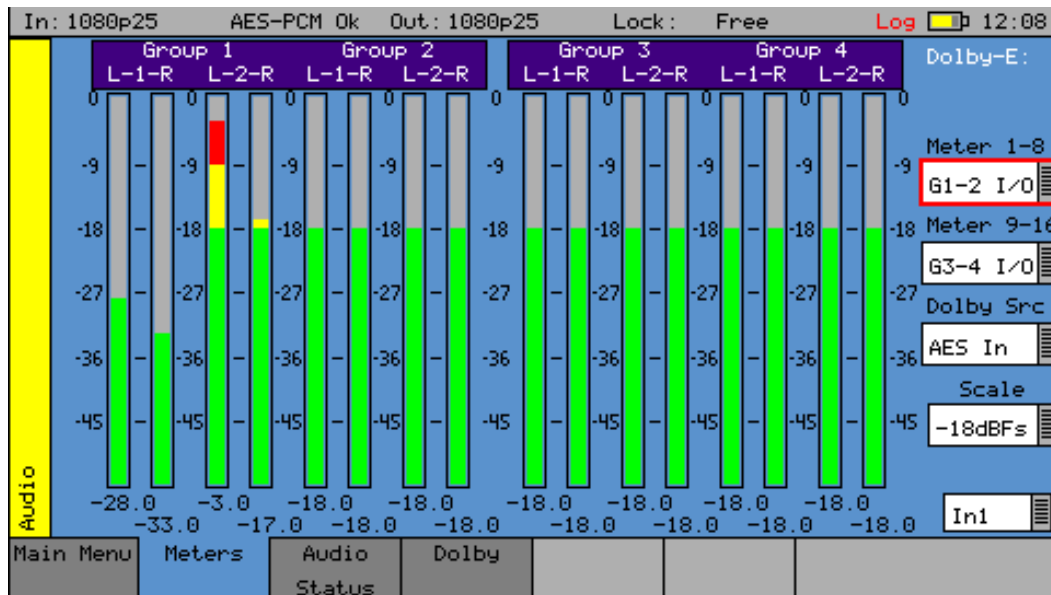
**ANC Gaps:**

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.

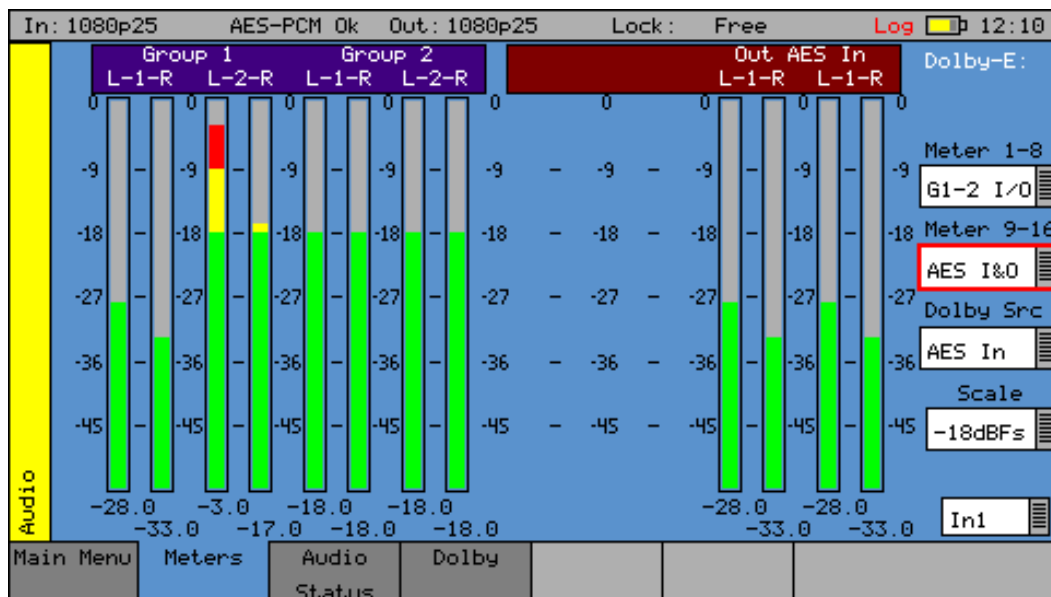
The Setup dialog also shows when an ANC packet has been detected and where it was found. This makes changing a filter simpler as the effect of the filter can be determined without closing the dialog. This dialog also allows the user defined ANC packets to be configured.

# Audio Menu

## Meters



The audio **Meters** menu displays up to 16 audio channels. The source for each block of eight meters may be independently set to allow simultaneous metering of eight inputs and eight outputs or all 16 channels in an embedded SDI stream.



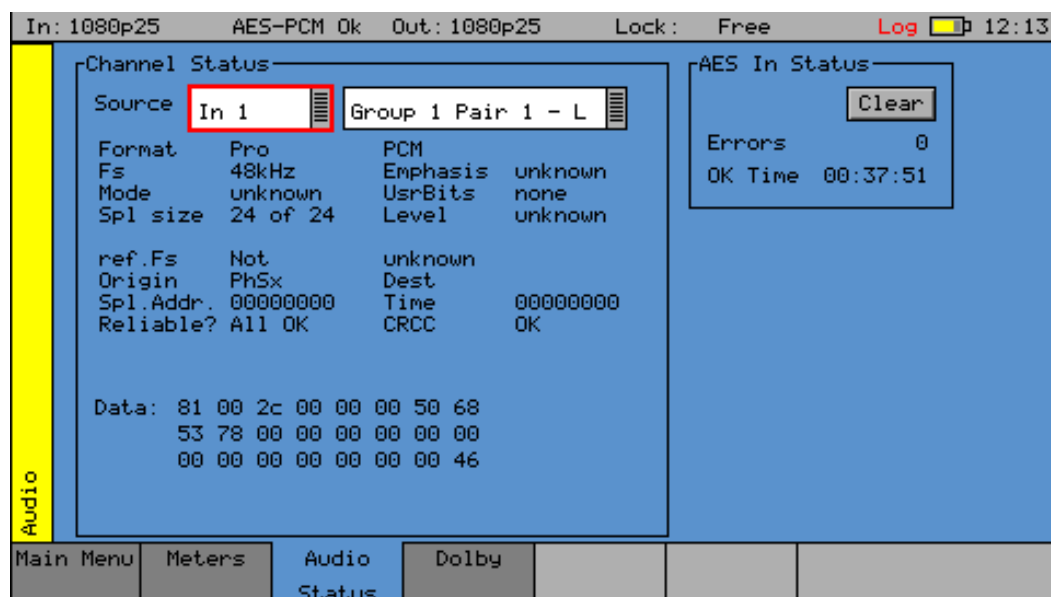
If AES inputs or outputs are present, then these may also be metered. At the bottom of each meter is the current audio level for that channel in dBFS (decibels relative to 0 dB full-scale).

The scale used by the meters may be set to -18 dB or -20 dB according to the standard operating level used.

If the Dolby option (**PHSXO-DAG**) has been purchased, the meters may be set to display the encoded Dolby levels for the specified audio pair or AES input.

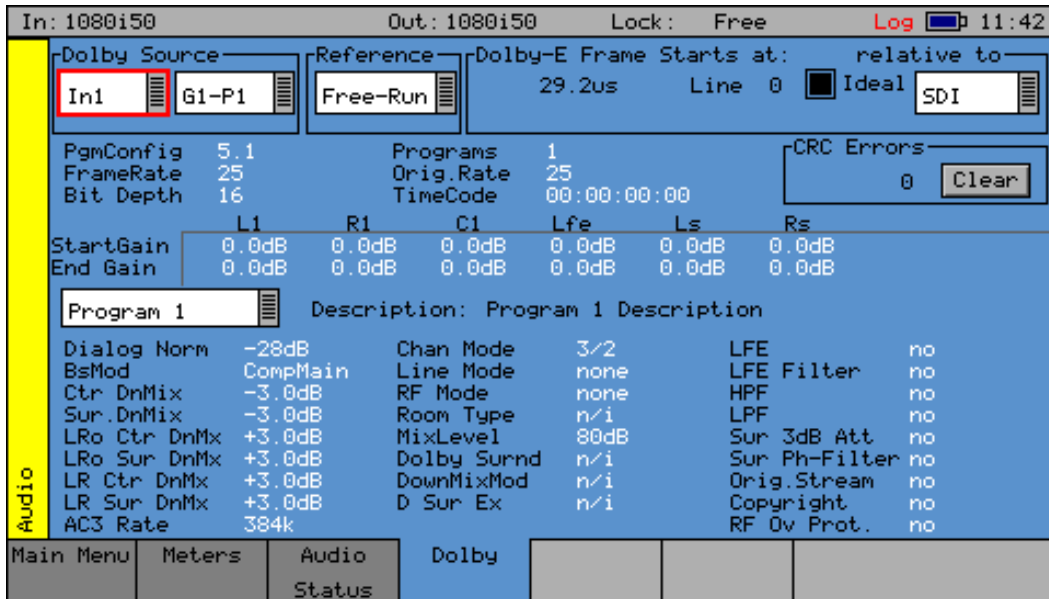
**Note:** Dolby audio cannot be heard on the speaker as a Dolby decoder is not present.

## Audio Status



The **Audio Status** menu shows the Channel Status for the selected audio channel displayed in decoded form as well as a hexadecimal dump of the bytes. The source may either come from the input signal or from the generator for comparison purposes.

## Dolby (Dolby Analyzer Option: PHSXO-DAG)



The **Dolby** Analysis option allows display of the Dolby E metadata present in the selected audio stream and determines whether the Dolby E packet is timed correctly on the SDI video stream.

This option therefore allows the Dolby E aspect of the signal to be timed correctly 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

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:

- 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 standard-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 down-mix.

### 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 (Program 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. The most elaborate mode in common use is Dolby 7.1 which uses all eight channels to provide surround sound.

## Dolby Digital

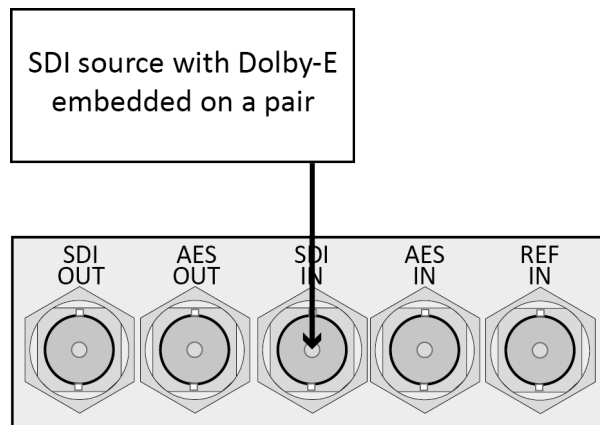
Dolby Digital (AC-3) is a *perceptual audio* system for digital audio that allows the reduction of data needs to deliver high-quality sound. This system was developed primarily for DTV, DVD and HDTV. This format allows up to six channels of sound (mono, stereo or 5.1) in the form of a single 'program' 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

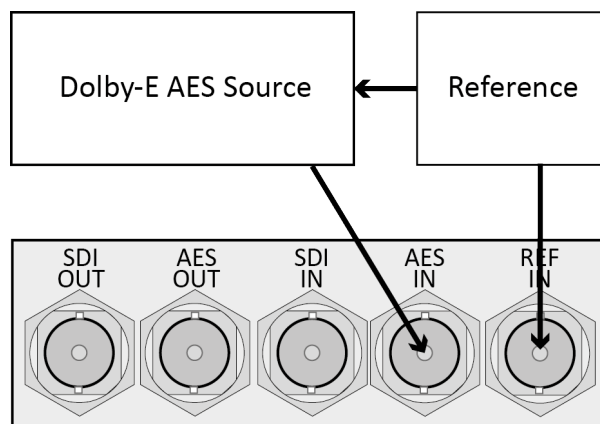
Dolby Digital Plus (E-AC-3) is a more advanced version of Dolby Digital that provides a more efficient encoding algorithm offering a primary program and optional ancillary programs. These can be optionally delivered at lower bit rates than Dolby Digital.

## Analyzer Reference

For correct decoding of Dolby E data, the internal audio circuitry requires a reference that is synchronized to the input signal. The Generator Reference must not be set to Free-Run or Dolby E errors may be detected. 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 present on one or more audio pairs. The Sx instrument needs to lock its internal audio clock to the SDI signal **Generator → GenLock → GenLock Source → Input-1** and the Dolby Timing source should be set to **SDI**.



In the example above, the AES signal contains a Dolby E stream. The Sx instrument needs to lock its internal audio clock to the external reference signal **Generator → GenLock → GenLock Source → 1Ref** and the Dolby Timing source should be set to **Ext.Ref**. The AES source *must* be locked to the same reference as the Sx.

## Source Selection

The Dolby E may be monitored from any of the SDI input embedded audio channel pairs or the AES input.

## 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 ensure that this timing specification is met. The position of the Dolby E packet in the video frame is displayed in lines and microseconds ( $\mu$ s).

## 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, i.e., it should be as close to 0 as possible. Each video standard has a specified *Ideal* line number on which the Dolby E packet should start. 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 an 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

The screenshot shows a configuration menu for Dolby E. At the top, it displays 'In: 1080i50', 'Out: 1080i50', 'Lock: Free', and 'Log' with a battery icon and time '11:42'. Below this, there are three dropdown menus: 'Dolby Source' (set to 'In1'), 'Reference' (set to 'G1-P1'), and 'Dolby-E Frame Starts at:' (set to '29.2us'). To the right, there are checkboxes for 'Line 0' and 'Ideal' (checked), and a dropdown for 'SDI'. Below these are fields for 'PgmConfig' (5.1), 'FrameRate' (25), 'Bit Depth' (16), 'Programs' (1), 'Orig. Rate' (25), and 'TimeCode' (00:00:00:00). There is a 'CRC Errors' field with '0' and a 'Clear' button. A table shows gain settings for L1, R1, C1, Lfe, Ls, and Rs, with 'StartGain' and 'End Gain' all set to 0.0dB. Below the table is a 'Program 1' section with a 'Description' field. The program configuration includes various audio parameters like Dialog Norm, BsMod, Ctr DnMx, Sur. DnMx, LRo Ctr DnMx, LRo Sur DnMx, LR Ctr DnMx, LR Sur DnMx, AC3 Rate, Chan Mode, Line Mode, RF Mode, Room Type, MixLevel, Dolby Surnd, DownMixMod, D Sur Ex, LFE, LFE Filter, HPF, LPF, Sur 3dB Att, Sur Ph-Filter, Orig. Stream, Copyright, and RF Ov Prot.. At the bottom, there are buttons for 'Main Menu', 'Meters', 'Audio', 'Dolby', and 'Status'.

This displays the Program configuration (5.1+2 etc.), the number of programs in the metadata, the frame rates and bit depths and timecode if present.

**CRC Errors:**

Displays the number of CRC errors detected in the Dolby E metadata.

**Start 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 eight programs can be encoded in the Dolby E packet dependent on the Program Configuration.

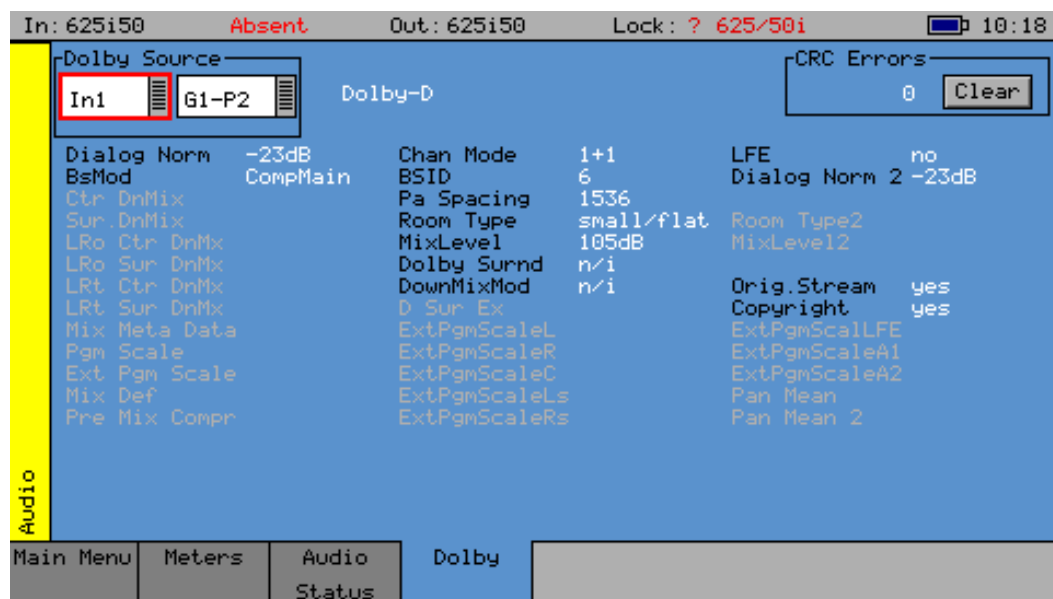
**Program Description:**

User-defined description for the selected program.

**Program Metadata:**

The metadata is displayed in a Dolby specified order. Any data not required for the Program Configuration specified is grayed-out and the data hidden.

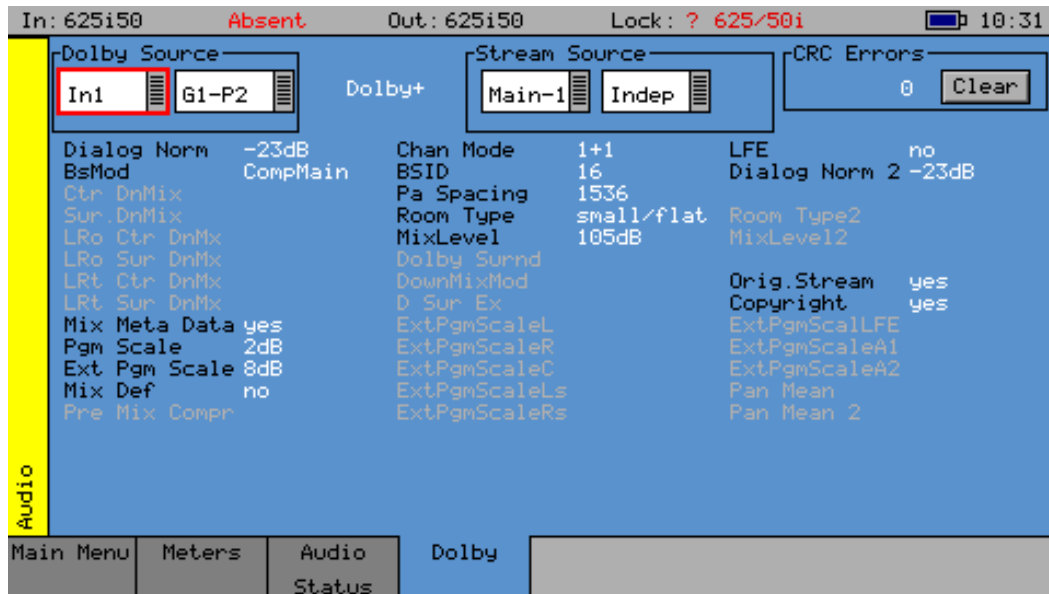
### Dolby Digital Program Configuration



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



## Dolby Digital Plus Program Configuration



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

The **Audio → Dolby** menu allows the metadata for a Dolby datastream to be viewed. For any program this metadata would be created as part of Dolby authoring process. The following metadata can be viewed for a Dolby E Program 1:

#### Dialog Norm:

The normal audio level for dialog. Ideally all transmitted programs would have the same value.

#### 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 Dialog 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 Dialog Normalization, Dynamic Range Control, and down mixing functions, all of which are necessary in Dolby Digital products.

**Room Type:**

An informational parameter indicating 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 or not a two-channel Dolby Digital bitstream is conveying a Dolby Surround encoded program.

**DownMixMod:**

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:**

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 viewed:

**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 Att:**

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.

**Orig. 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 or not an RF pre-emphasis filter is used in the overload protection algorithm to prevent RF over-modulation in set-top box decoders.

## Peak Metering

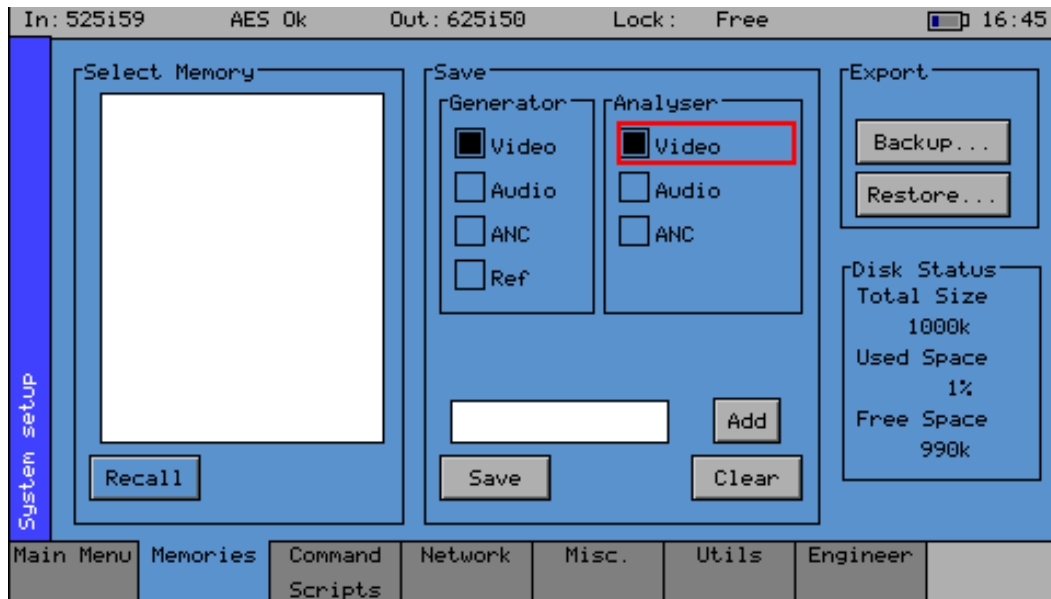
The peak audio levels are included in the Dolby E metadata packet and may be displayed on the Analyzer-Audio-Meters page. Select the appropriate set of meters to display Dolby levels and then they will follow the selected Dolby E source.

**Note:** Audio cannot be decoded by the Sx range of products and so you will *not* be able to listen to the Dolby E signal.

See the section [Log Setup - Dolby Status \(PHSXO-DAG\)](#) for details on which changes of Dolby E status may be logged.

# System Menu

## Memories



The **Memories** menu displays the current settings in the Sx instrument, which may be saved for future recall.

The checkboxes on the right-hand side determine what is saved in the memory. Non-overlapping memories may then be combined.

**Note:** If login has been enabled for an instrument, memories may only be added, edited, renamed or cleared and archives backed-up by a user with **Modify Memories** permissions.

### Saving Memories

1. Select the target memory to which to save settings by moving the cursor to the **Select Memory** list and pressing **OK**. Use the Up/Down cursor keys to select an existing 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. Specify which aspects of the Sx 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 Memories](#) below before saving.
3. Move the cursor to the **Save** button and press **OK**. The text field below the Memory list will change to show the last Saved or Recalled memory.

### Recalling Memories

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 below the Memory list will change to show the last Saved or Recalled memory.

## Renaming Memories

1. 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.
2. Move the cursor to the edit field and press **OK** to display a keyboard. Use the keyboard to enter the new name of the Memory using the menu keys at the bottom of the screen as required. 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 Memories

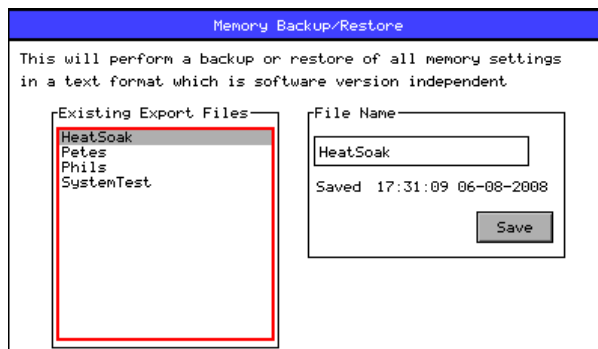
To add a new memory, press the **Add** button. This will use the current memory name and settings.

## Clearing Memories

1. 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.
2. 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 Memories

Memories 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. Exported memories are in a text format and so may be edited on a PC and downloaded to/from the backups directory on the Sx instrument using FTP or a USB stick.



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.

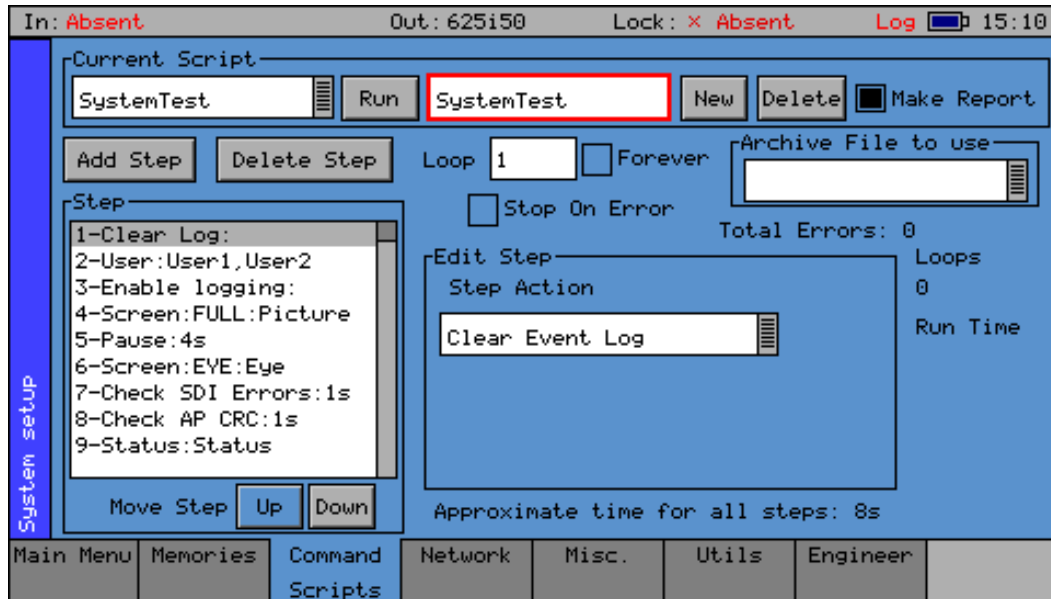
To import memories, select the **Restore...** button which will open a window to select the file to import. Existing files are listed and one should be selected before pressing the **Load** button. Select the **Load** button to import the backup file.

**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.

## Disk Status

The **Disk Status** section shows total size of the internal flash disk and the percentages used and free.

## Command Scripts (Option: PHSXOS)



The **Command Scripts** menu allows the Sx instrument to run predefined scripts. This can be used to automate testing of signals.

### Steps, Actions and Parameters

Command scripts are text files with a file extension of **.cmd**. They are formatted with one step per line. The line is formatted as: **<StepNumber>-<StepAction>:<StepParameters>** for example: **5-Pause:4s**

**StepNumber** is a numeric value representing the numeric order of steps in the command script, starting at **1**.

**Step Action** is one of:

#### ARCHIVE:

Used to specify the archive file to be loaded when the script is run. This makes sure that all the memories required for the test have been loaded. The archive file is loaded *everytime* the script is run so if you make changes to any memories you *must* use the Export/Archive section on the System-Memories tab to backup the current memories.

#### LOADMEM:

Loads the memory specified in the StepParameters field – must be a numeric value 1...num memories.

#### CHECKERRS:

Check for CRC/EDH/ANC checksum errors in StepTime seconds. If there are any errors an event is added to the event log and the sequence pauses with a message to continue or abort. If the SDI input signal is missing, this is treated as an error.

#### CHECK\_AP\_CRC:

Check for changes to the active picture CRC value in StepTime seconds. An event is added to the event log.

#### PROMPT:

This will put a short prompt on screen in a dialog asking the operator a question and waiting for OK to be pressed to continue. The time field is ignored and the parameter following is the text displayed.

#### CLEARLOG:

This clears the Event Log

**DISABLEEVT:**

This disables Event logging

**ENABLEEVT:**

This enables Event logging

**CLEARERRORS:**

This clears all error counts (EDH/CRC etc.)

**LOGCOMMENT:**

Add the specified comment to the log file – useful to document the stage in the test process

**PAUSE:**

Pause for the specified number of seconds to allow another process such as loading test patterns to complete.

**SAVESTATUS:**

Save the current system status as an XML file.

**SAVEIMAGE:**

Save the selected image as a bitmap file in the current scripts directory. Filename must be specified.

**SELECTTAB:**

Show the selected tab to allow the user to view something.

**SEL\_USER:**

Select user – users are comma separated

**CHECK\_EYE:**

Checks that the eye amplitude, overshoot, undershoot and rise/fall and difference between rise and fall times are within the SMPTE specifications for the time period specified.

**CHECK\_JITTER:**

Checks that the jitter levels are under those set in the logging jitter threshold fields for the time period specified. See the section [Log Eye Jitter](#) for further details.

**CHECK\_METER\_LEVEL:**

This action checks that the level for any visible meters is at the level set by the meter scale. This level may be -18 dB or -20 dB. If the level is over 1 dB greater or less than that value an error will be inserted in the log and report files. If any groups are missing, these will be ignored by the test. Testing may be limited to specified audio pairs as set up on the Log Setup page.

**CHECK\_METERS\_OFF\_LEVEL:**

This action checks that the level for any visible meters is below -70 dB. If the level is above that value an error will be inserted in the log and report files. If any groups are missing, these will be ignored by the test. Testing may be limited to specified audio pairs as set up on the Log Setup page.

**CHECK\_AES\_INP:**

This action checks that the AES input signal is present and has no errors for the specified time period.

**Step Time** is a numeric parameter value in seconds for steps that are time-controlled **0...n**

## Creating Command Scripts

To create a new script:

1. Select the **New** button.  
This creates a blank script with the title **NewScript1\_**.
2. Select this title and a keyboard is displayed. Enter the title you require and then select **OK** to save this title.  
The first step in the script will be displayed in the Step Editor window.
3. Use the **Edit Step** section to select the required Step Action.
4. Select the **Add Step** function to add a new step to the script.  
This adds the new step directly below the currently highlighted step in the Step Editor window.

## Editing Command Scripts

To edit the title, select it, enter the title you require and then select **OK** to save this title.

To change the order of the steps within the script, highlight the step to be reordered and then use **Move Step Up/Down**.

Unwanted steps can be removed by highlighting them and then selecting **Delete Step**.

An unwanted Command Script can be deleted by selecting the script (to make it the current script) and then selecting **Delete**.

## Running a Script

To run an existing Command Script, select it so that it is the Current Script, and then select **Run**.

### Loop:

If the **Forever** checkbox is selected, the Command Script will run repeatedly until it is stopped. If the checkbox is not set, the number of repeats can be set.

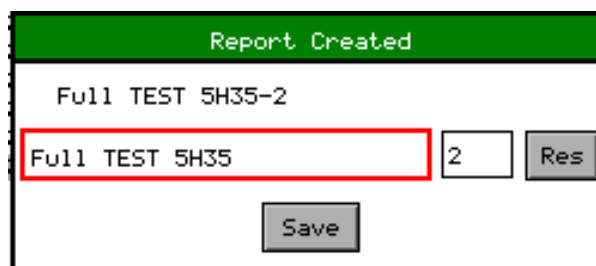
### Stop on Error:

If the **Stop on Error** checkbox is selected, the script will stop if an error is encountered.

**Note:** An error instance is a failure of a single step, irrespective of the number of errors found. As with reporting and logging, the number of errors found in a script execution reflects the number of steps that reported errors.

### Make a Report:

If the **Make a Report** checkbox is selected, a report will be generated with the results of the Command Script when it is run.



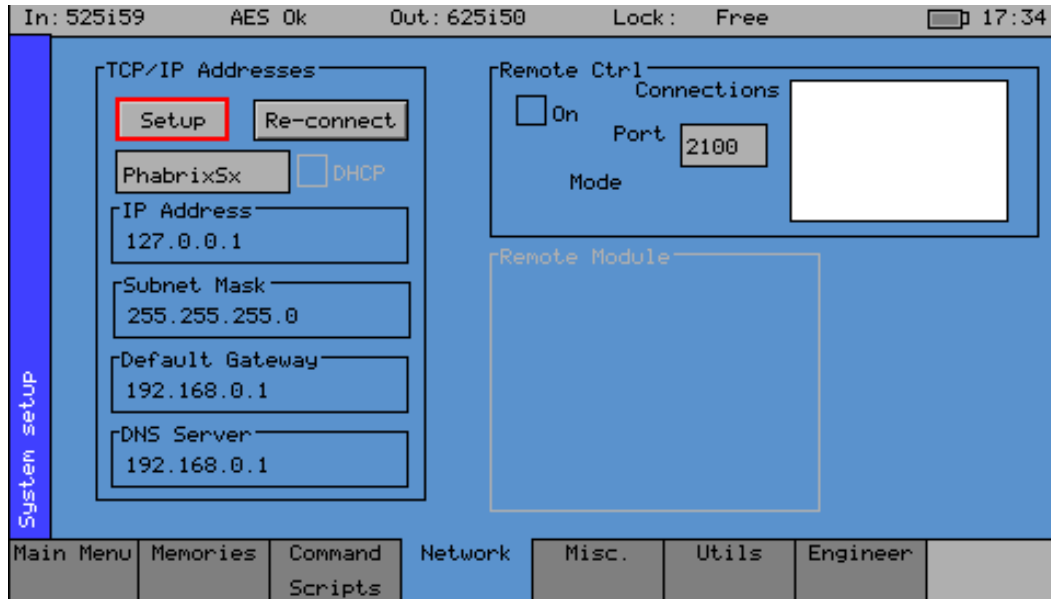
When the report is created its title can be edited by selecting the title and using the keypad.

The report can also be numbered automatically using the auto-increment value to the right of the report title. Subsequent reports will have the same but will have an incremental number.

The **Res** (reset) button can be used to reset the number to 1.



# Network



PHABRIX Sx is fully network compatible and has a complete network interface to allow control of any Sx instrument from any other unit.

The **Network** menu allows the Sx instrument to be configured as part of a network.

**Note:** If the Sx instrument is switched on without the network connected, you will have to select **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 Sx instrument, but it also requires the Ethernet connection to be present when starting up.

If the **DHCP** checkbox is enabled, then the Sx instrument will automatically attempt to request an IP Address from any network to which it is connected, as long as a DHCP server is available on the network.

If your network uses static (nonchanging) addresses, you will need to contact your network administrator to get an address assigned to your instrument, and to get the Subnet mask and default gateway address. To edit the settings, select **Setup**. These details can then be entered in the corresponding boxes in the menu. If the **DHCP** checkbox is enabled, these values will not be editable. 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 **Re-connect** to attach the Sx instrument to the network.

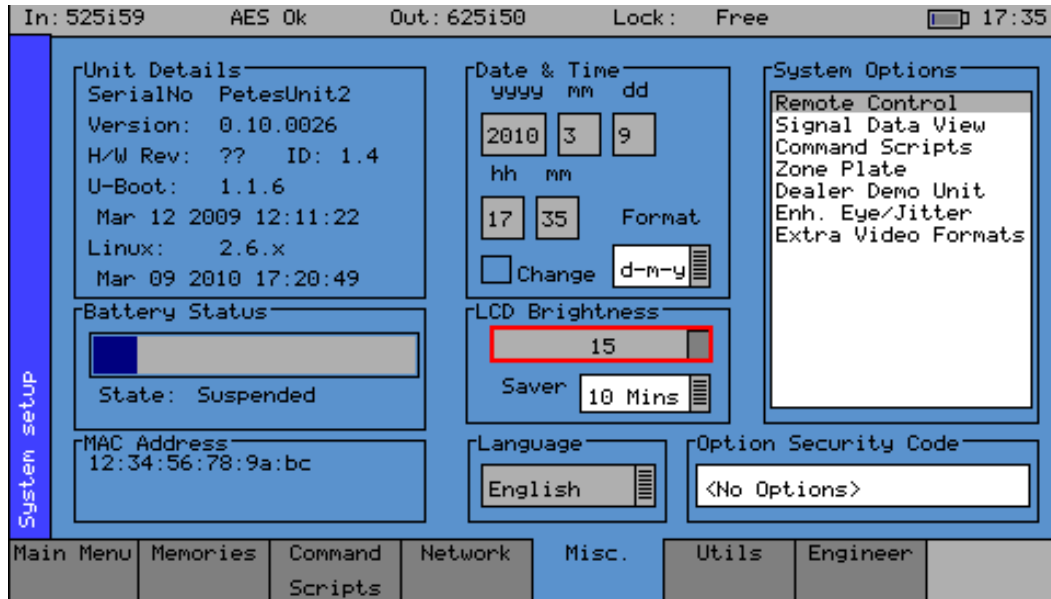
## Remote Control of Sx Instrument (Option: PHSXOR)

To allow remote control of an Sx instrument, you must have the TCP/IP address of the instrument set and the **Remote Ctrl On** checkbox selected.

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

## Misc



The **Misc.** menu shows serial numbers, Sx instrument MAC address, version information and battery state. It also allows the date and time to be set and factory default settings to be recalled. The **Options Security Code** is entered on this page to activate purchased options.

### Changing the Date/Time

Select the **Change** checkbox under the date and time fields and then use the cursor to modify the date and time. Press **OK** to edit a field and again to complete the change. When all fields have been edited, deselect the **Change** checkbox and the new date and time will be set.

**Note:** The date may not be changed while a 30-day trial option is active.

### Changing the Date Format

The date format used on logging screens, etc. can be set using the **Format** selection dropdown. The following formats are available:

- Day-Month-Year (**d-m-y**)
- Month-Day-Year (**m-d-y**)
- Year-Month-Day (**y-m-d**)

### Setting the LCD Brightness

Use the **LCD Brightness** slider to set the LCD brightness, using a lower brightness will reduce the current drawn from the battery and help to extend the battery life.

### Setting Screen Saver Mode

When the unit is battery-powered the screen saver will operate after a user-defined time period and reduce the LCD brightness down to its lowest level. This will help to extend the battery life. Pressing any key will restore the previously set LCD brightness. The screen saver start time, defining the period when the screen is not in use, can be adjusted in the **Saver** dropdown.

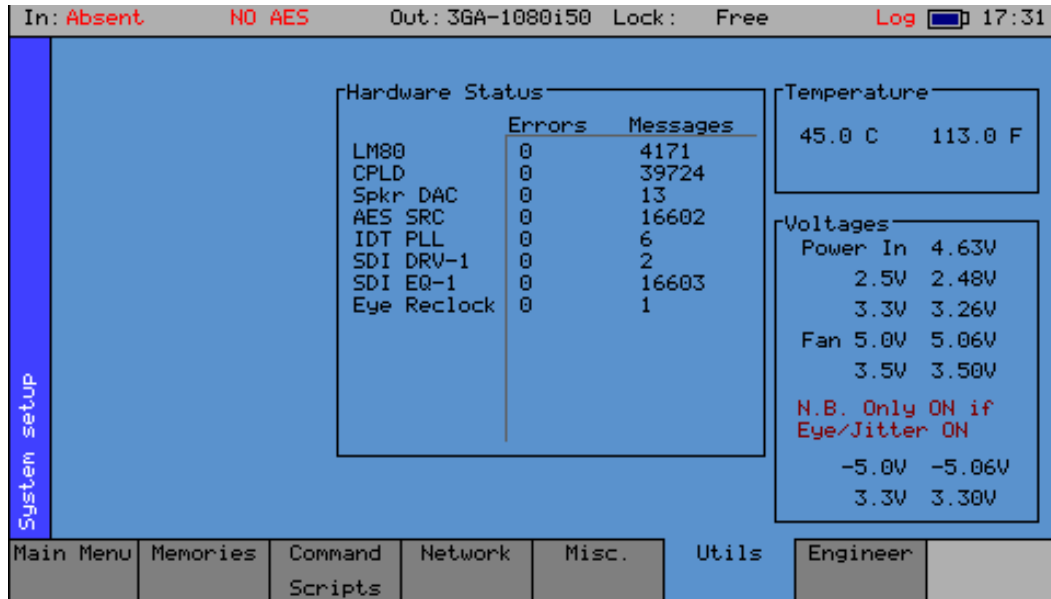
## Setting User Language

The language used to display the menus 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 Sx instrument a new Security Code will be supplied. This is specific to the unit and cannot be used on other units. The security code is entered into the **Option Security Code** field below the **System Options** list, and is edited by pressing **OK** and using the keypad and function buttons. 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 of memories and system settings.

# Utils



The **Utils** menu displays details of the instrument’s operating status and displays the temperature and individual voltages. This menu also allows you to disable selected options.

## Dealer Features

This section of the menu details the features that can be used by suppliers of the Sx instrument.

### Show Options:

This checkbox, if selected, will enable the features throughout the menu system.

### Enable:

This checkbox, if selected, allows options to be cleared from the Sx instrument.

### Clear Option:

This function, when pressed, will remove the selected options from the Sx instrument.

## Hardware Status

This section of the menu shows any hardware errors that have been recorded by the Sx instrument. If the error count is greater than 0, contact your local dealer for advice.

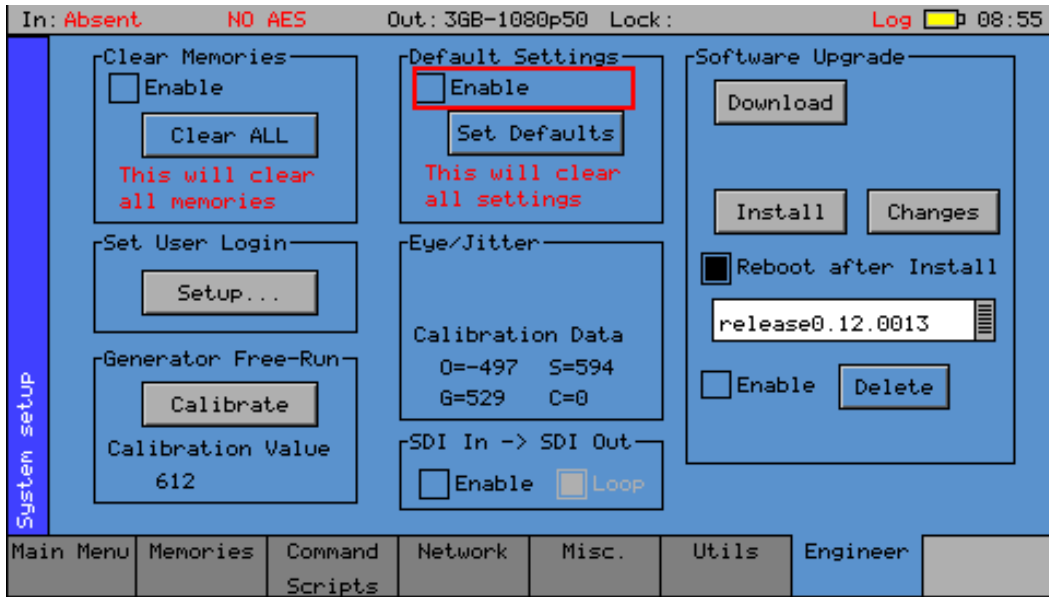
## System Temperature

This section of the menu displays the current Sx 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.

# Engineer



The **Engineer** menu is used to manage the unit and allows user access to be setup and the installation of new versions of software.

## Clear Memories

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

## Default Settings

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

## SDI In -> SDI Out

The Loop checkbox in the **SDI In -> SDI Out** section of the **Engineer** menu allows the video signal on the SDI Input to be looped through to the SDI Out connector. In this mode the Generator menu will be disabled.

## Set User Login

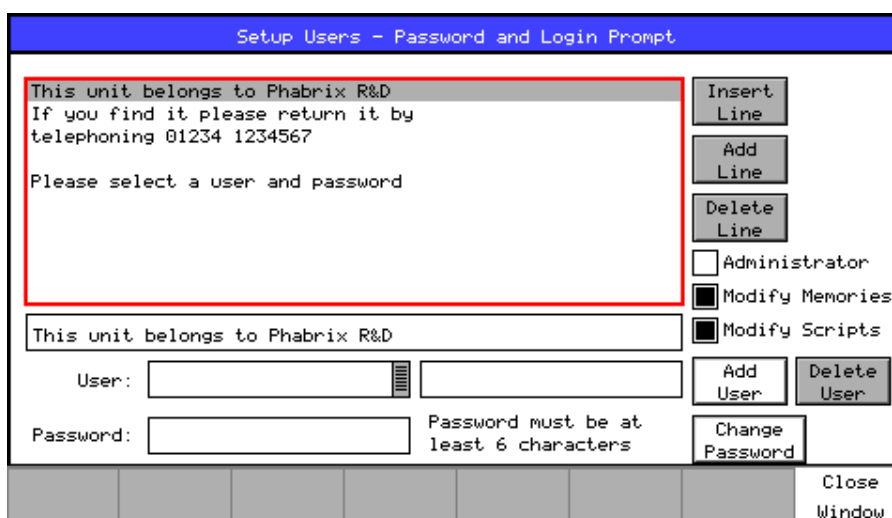
User access can be setup for the Sx instrument by adding users to the system. With User log-in enabled, a log-in screen will be displayed when the Sx instrument is switched on. This will then require a valid user and password to be entered. Each user has an encrypted password and permissions which may be set.



Using the User Login feature allows the Sx to be protected from unauthorized operation of the Front Panel controls. The prompt feature can allow a message to be displayed so that if the Sx instrument gets lost or stolen, someone finding it knows where to return it.

### Adding/Deleting Users

Add a user by editing a new name in the **User Edit** box next to the **Add User** button and then entering a new password. Once the password is **six** characters or longer, the **Add User** button will become enabled and may be pressed. Make sure that your password is memorable. If all passwords to an Sx instrument are forgotten, you can contact Phabrix for an override password. Users with administrator permission may add/delete users.



Once user login has been set up on your Sx a **Log out** button is added to the main menu which displays a Login screen. This may be used to protect systems settings from being modified by other users. The system is still operating while the login screen is visible.

The user permissions are as follows:

#### Administrator:

Add/delete users and also edit the Login prompt text.

#### Modify Memories:

Create, save and delete memories and Archives.

#### Modify Scripts:

Create, save and delete script files (if the command scripting option has been purchased.)

Each user may modify their own password by entering a new password (six or more characters) and pressing **Change Password**.

If all users are deleted, the Sx instrument reverts to starting up without a login screen.

## Editing the Prompt Text

The simplest way to edit the prompt text is to FTP a prompt text file named **loginprompt.txt** (all lower-case) onto the Sx instrument. The instrument should then be re-started to initiate the new file.

Users with administrator permissions can also edit the prompt text. To do so, select a line in the prompt text list, then press **OK** to edit in the line edit field using the text keyboard.

Add a new blank line after the selected line by pressing **Add Line**.

Insert a new blank line above the selected line by pressing **Insert Line**.

## Generator Free-Run

Press the **Calibrate** button to calibrate the free-running frequency using the External reference or Video Input as selected by the **Generator → GenLock** page. If no input is present, or the Generator is free-running, an error dialog will be displayed. The calibration will take a few seconds to complete, at which point the calibration value will be displayed. This calibration value is not lost when memories are cleared, or when factory defaults are restored.

## Software Upgrade

**Note:** Make sure that the unit is connected to an AC power source before starting the software upgrade. The software upgrade may take up to an hour to complete.

This section allows new Sx software versions to be installed. The instrument may download and install new versions of software when available in a two stage process:

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

Pressing the **Download** button will cause the current release of software to be downloaded from the PHABRIX website. This can 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 Sx instrument for future installation. If the latest software is already present on the Sx instrument, no software will be downloaded and a message will be displayed. Note that the unit should be connected to the AC adaptor so that the battery state does not affect the installation process. Also note that multiple releases of software may be stored on the Sx instrument so that a previous release can be re-installed if required.

2. To install the downloaded software on the Sx instrument, select the desired release in the available listing. The latest release will have the highest number. Select **Install** and a confirmation dialog will be displayed. Press **Yes** to start the installation. This process takes several minutes to decompress the software, extract the files and then reprogram the hardware. If an error occurs during installation, retry the installation and/or download. Do *not* switch off the Sx instrument until an installation has completed correctly.

Once the installation has completed, if the checkbox **Reboot after Install** is selected the Sx instrument will restart with the new software installed. If not selected, then the instrument should be switched off and on again manually.

**Note:** As part of the installation process, all memories are archived to a backup file and then deleted. They can be restored from the **Memories** page using the **Restore...** button and selecting the archive labeled **\_Before\_Upgrade**.

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

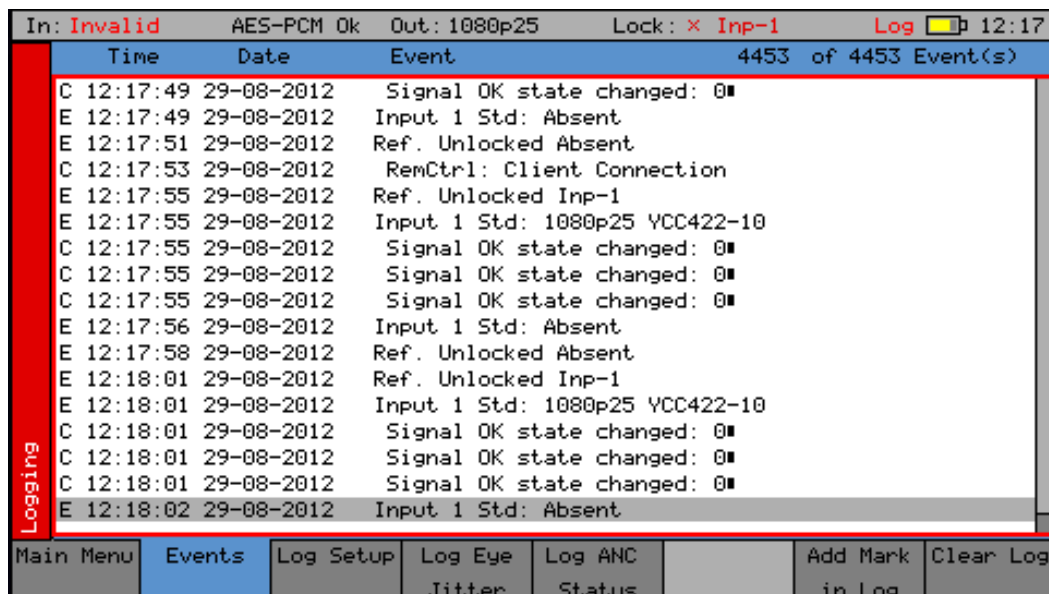


# Logging Menu

## Overview

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 Sx 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.

## Events Log



The screenshot shows the 'Events Log' menu. At the top, it displays 'In: Invalid', 'AES-PCM Ok', 'Out: 1080p25', 'Lock: X Inp-1', and 'Log' with a yellow bar and '12:17'. Below this is a table with columns 'Time', 'Date', and 'Event'. The table contains 15 rows of event data. A vertical red bar on the left side of the table is labeled 'Logging'. At the bottom of the screen, there is a navigation bar with buttons: 'Main Menu', 'Events', 'Log Setup', 'Log Eye', 'Log ANC', 'Add Mark', and 'Clear Log'. The 'Events' button is highlighted.

Time	Date	Event
C 12:17:49	29-08-2012	Signal OK state changed: 0■
E 12:17:49	29-08-2012	Input 1 Std: Absent
E 12:17:51	29-08-2012	Ref. Unlocked Absent
C 12:17:53	29-08-2012	RemCtrl: Client Connection
E 12:17:55	29-08-2012	Ref. Unlocked Inp-1
E 12:17:55	29-08-2012	Input 1 Std: 1080p25 YCC422-10
C 12:17:55	29-08-2012	Signal OK state changed: 0■
C 12:17:55	29-08-2012	Signal OK state changed: 0■
C 12:17:55	29-08-2012	Signal OK state changed: 0■
E 12:17:56	29-08-2012	Input 1 Std: Absent
E 12:17:58	29-08-2012	Ref. Unlocked Absent
E 12:18:01	29-08-2012	Ref. Unlocked Inp-1
E 12:18:01	29-08-2012	Input 1 Std: 1080p25 YCC422-10
C 12:18:01	29-08-2012	Signal OK state changed: 0■
C 12:18:01	29-08-2012	Signal OK state changed: 0■
C 12:18:01	29-08-2012	Signal OK state changed: 0■
E 12:18:02	29-08-2012	Input 1 Std: Absent

The **Events** menu displays a list of events with a time stamp showing when they occurred.

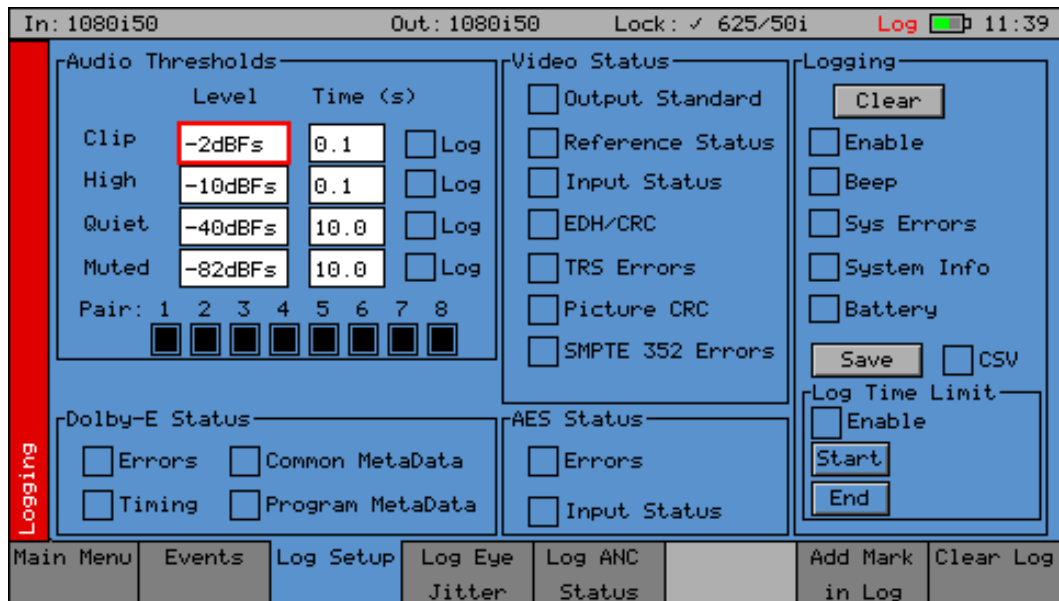
Entries in the Event Log are classified according to their severity with an initial letter as follows:

- **C:** Control (change of state)
- **E:** Event
- **I:** Information
- **W:** Warning

Pressing the **OK** button on the front panel when the highlight is on the event log page allows the event log to be scrolled to view all events in the list. The currently selected event is shown on the event log header. The date format may be changed using the date **Format** dropdown on the **System** → **Misc** page. The event log may be cleared by pressing **Clear Log**; a confirmation dialog will be displayed. 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 occurred using the **Add Mark in log** button.

**Note:** The event log displays only changes in status, so if the input is always in error and never good, an event will not be recorded. To obtain a view of the complete state of the instrument requires reviewing the current status in addition to the event log.

## Log Setup



The **Log Setup** menu allows specific events to be tracked by the Sx instrument.

**Note:** The events to be logged are set-up on this page by checking the appropriate **Log** checkboxes.

### 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 in 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 an 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 continues 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 unique value 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. If the active picture CRC is continuously changing, therefore, only one event will be entered in the log until the picture remains static, at which point 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 Status (Requires Dolby Analysis Option)

This section allows Dolby errors to be logged.

**Errors:**

Will add an event to the event log when a Dolby input stream is detected or lost. An event will also be added if a CRC error is detected in the Dolby 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 Sx to emit a short tone when an Event is added to the log. Note that the beep will occur even if the Speaker is set to **Mute**.

**SYS Errors:**

Allows system errors to be displayed in the Event Log if they occur. If you are having problems with your Sx, checking this box can add events that may help PHABRIX to determine the nature of the problem.

**System Info:**

Allows the system to report additional internal messages in the Event Log if they occur. If you are experiencing problems with your Sx instrument, checking this box can add events that may help PHABRIX to determine the nature of the problem.

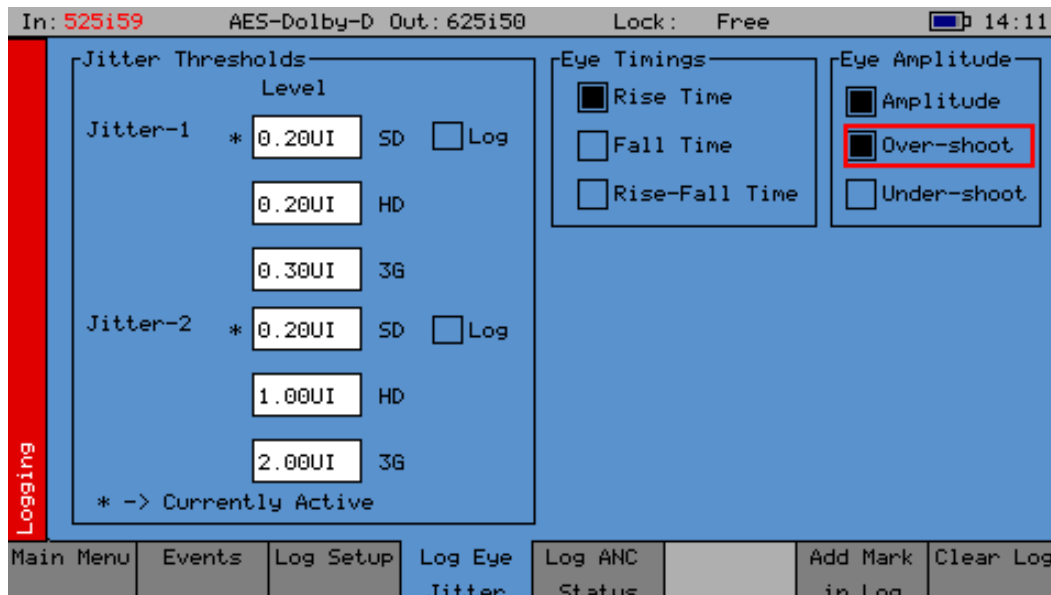
**Save:**

Saves the current event log to a text file in the currently specified language. The log file created, **logfile.txt** may be downloaded using an FTP connection. If the **CSV** checkbox is selected then a comma separated value file will be created.

### Log Time Limit

The time when logging is enabled may be restricted by the 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 **Enable** checkbox to log at all times. Logging must be enabled using the checkbox above for this to work.

### Log Eye Jitter



The **Log Eye Jitter** menu allows Eye Jitter events to be logged.

The events to be logged are set up on this page by checking the appropriate **Log** checkboxes.

### Jitter Thresholds

The jitter level at which an event is added may be set independently for each meter. (Only one is meter 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 the Jitter-1 and Jitter-2 meters. 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 selected, 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.

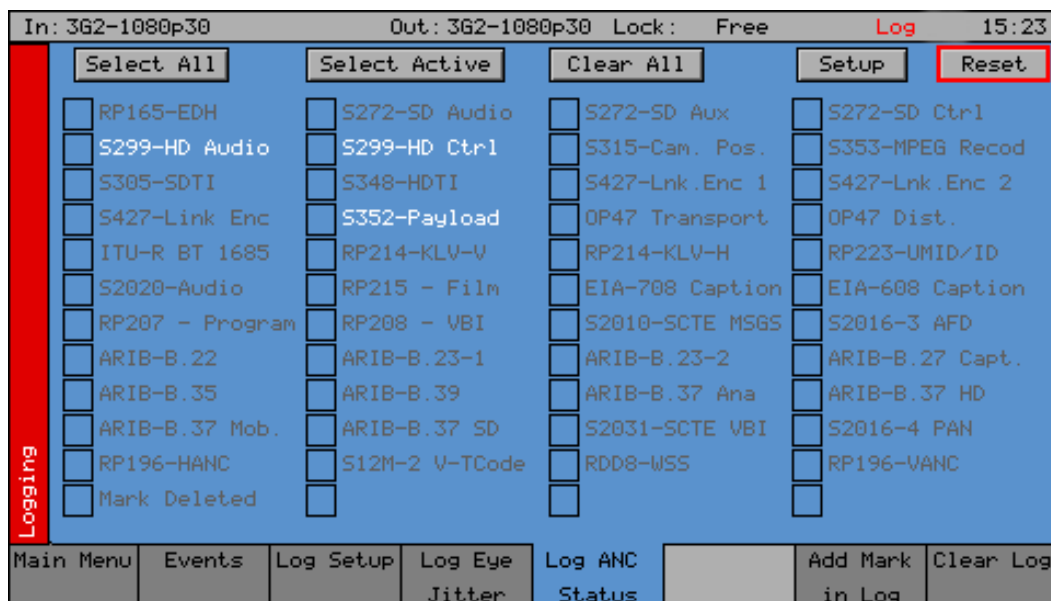
Eye measurements are performed using statistical calculations on the waveforms and are thus performed at a slower rate than jitter measurements. Measurements can take a few seconds to stabilize and this should be taken into account.

## 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.

## Log ANC Status



The Log ANC Status menu allows customization of which ANC packets to log for changes in status (e.g., Present, Checksum Error, Missing, Parity Error). Individual checkboxes are provided to determine which packet DID/SDID combinations are logged.

### Select All:

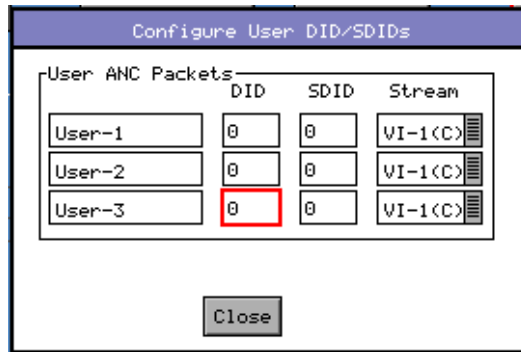
Selects the checkboxes for all packets (toggle).

### Select Active:

Selects the checkboxes for all packets currently present.

### Setup:

Allows the user to define and name their own DID/SDID values for an ANC packet type.

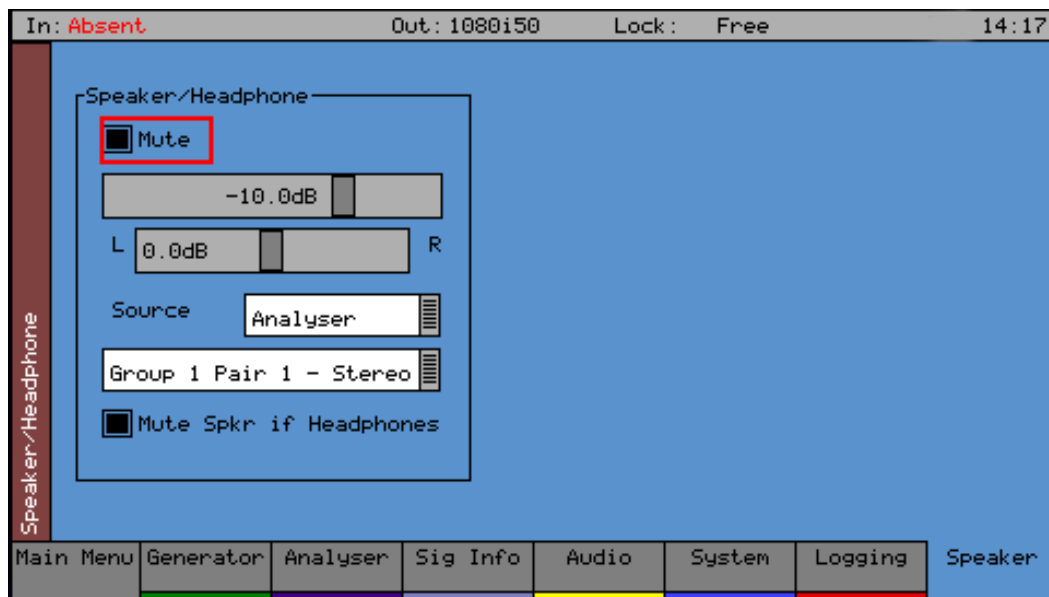


**Reset:**

Clears the state for all packet types so that a packet that was displayed previously as in error is shown as OK.

# Speaker Menu

## Overview



The **Speaker** menu controls which audio pair can be heard on the loudspeakers and headphone output of the Sx instrument. The Sx instrument contains a stereo loudspeaker and associated stereo headphone socket which can be connected to any of the audio input or output channels or pairs.

The **Mute** checkbox allows both signals to be muted.

A volume control is available 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 Sx instrument, and the input and output sources can be set independently to either a stereo pair or single audio channel.

The **Source** is used to select the specific input that is to be heard.

The speaker can be muted when headphones are plugged in by selecting the checkbox **Mute Spkr if Headphones**.

**Note:** When listening to an audio source, the Sx instrument needs the audio to be synchronous with that of the Sx Generator. If this is not the case, clicks will be heard on the speaker. Either connect the Sx instrument reference to the same reference as the SDI input source and set the **Generator → GenLock → GenLock Source** to **External** or **Input-1**.

# Glossary of Terms

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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.

## **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.

## **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.

## **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.

## **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.

## **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 Sx Range of products and on the Rx 2000.

## **IP Address**

An Internet Protocol address is a numerical label assigned to devices connected to a computer network, using the Internet Protocol for communication.

## **Navigation Buttons**

The up, down, left, right arrow buttons available on the Sx and Rx Ranges.

## **PHABRIX SxA**

A 3G-SDI, HD-SDI and SD-SDI handheld SDI test signal generator, analyzer and monitor supporting AES audio.

## **PHABRIX SxD**

A 3G-SDI, HD-SDI and SD-SDI handheld SDI test signal generator, analyzer and monitor supporting dual link.

## **PHABRIX SxE**

A 3G-SDI, HD-SDI and SD-SDI handheld SDI test signal generator, analyzer and monitor supporting eye and jitter measurement.

## **PSU**

Power Supply Unit

## **SDI**

Serial Digital Interface - capable of transferring SD or HD broadcast video and broadcast audio between compatible devices.

## **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.

**SDI**

(Serial Digital Interface) capable of transferring SD or HD broadcast video and broadcast audio between compatible devices.

**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).

## **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.

## **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

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## SxE Instrument

### Operating Environment

**Operating Temperature:**

0° to 40°C

**Operating Humidity:**

< 85% RH (non-condensing)

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 55°Celsius a warning dialog will be given. If the temperature rises above 65°Celsius the unit will be switched OFF.

Under both conditions, an event will be added to the event log to show what happened.

### Expected Behavior

#### LCD Monitor

The LCD may have some pixels that are always turned ON or always turned OFF. This is normal and should not affect normal operation.

#### LCD Flicker

The unit supports many video standards. The input SDI signal is displayed asynchronously and may flicker on the waveform display or picture display. The unit stores the input SDI signal internally, and then reads the internal frame using the LCD sync signal, which is asynchronous to the input SDI signal. LCD flickering may occur if a frame is skipped or repeated.

### Remote Network Operation

Remote network operation is only guaranteed when connected to a local machine.

### Dimensions

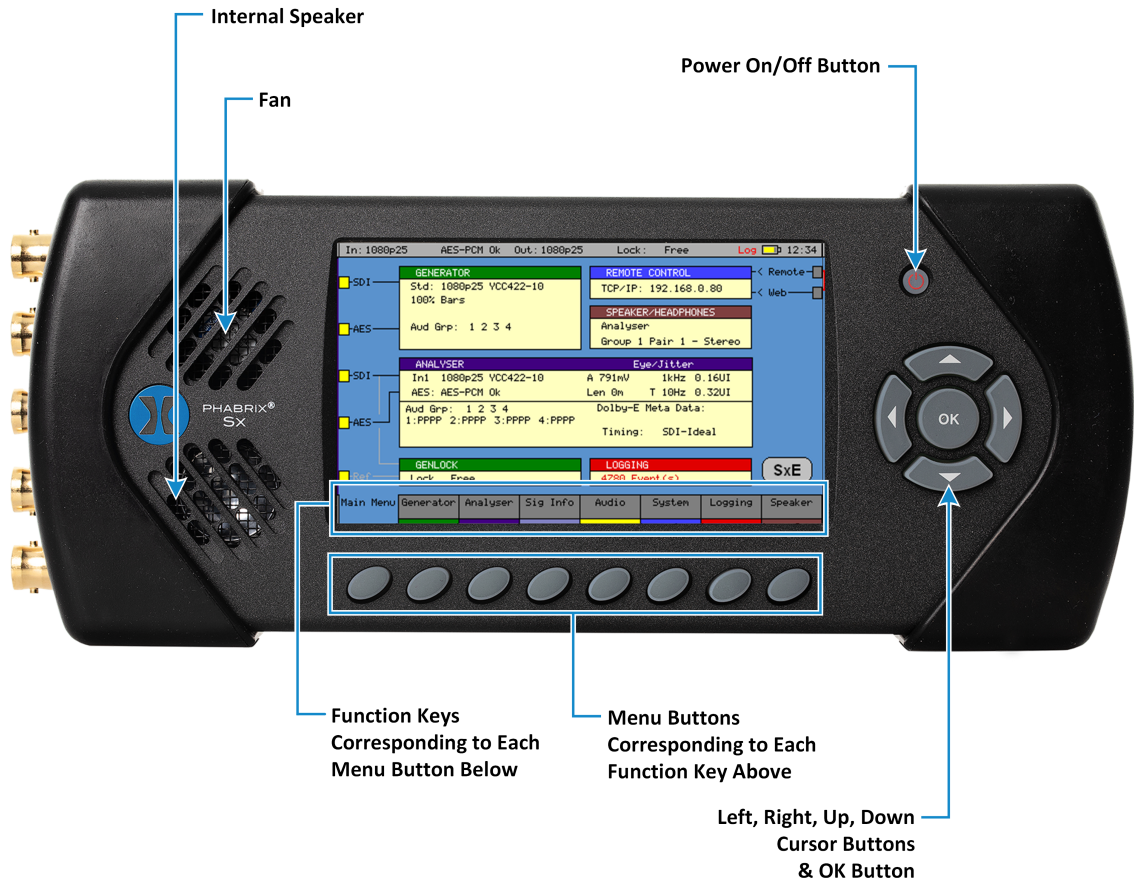
**Dimensions:**

230 (L) x 93(H) x 45(D) mm

**Weight:**

2 kg

## Front Panel



The front panel provides access to the TFT Display and menu system.

### Display Type:

4.3 inch TFT color

### Display Format:

480 x 272 24 bits

### Backlight:

Variable brightness

### Screen Saver:

Reduces brightness after user-adjustable time.

## BNC Panel



The Sx instrument BNC panel provides the following connections:

## External Locking Reference

**Label:**

REF IN

**Input Signal:**

Tri-level or Bi-Level (black burst) syncs 50 / 59.94 / 60 Hz

**Connector:**

BNC 75 ohm type

**Input Impedance:**

75 ohm terminated

**Input Return Loss:**

>40 dB to 6 MHz (typical)

**Maximum Input voltage:**

+/- 2 V

**Specification:**

- Tri-level syncs (SMPTE274M and SMPTE296M) 600 mV pk-pk
- PAL Black Burst (ITU624-4/SMPTE318) 1V pk-pk
- Composite NTSC (SMPTE 170M) 1V pk-pk

## Analyzer SDI Input

**Label:**

SDI IN

**Supported standards:**

SD-SDI or HD-SDI. See [Supported SDI Video Formats](#).

**Connector:**

BNC 75 ohm type

**Input Impedance:**

75 ohm terminated

**Input Return Loss:**

≥ 15 dB (5 MHz to 1.5 GHz)  
≥ 10 dB (1.5 GHz to 2.97 GHz)

**Maximum Input Voltage**

- 2 V

**Purpose:**

Analyzer Input

## Analyzer AES Input

**Label:**

AES IN

**Connector:**

BNC 75 ohm type

**Input Impedance:**

75 ohm terminated

**Maximum Input Voltage:**

+/- 2 V

**Sample Rates:**

The AES input has a sample rate converter and so will accept any sample rate from 32 kHz to 192 kHz.

**Specification:**

Conforming to AES3 and SMPTE-276M

## Generator SDI Output

**Label:**

SDI OUT

**Supported standards:**

SD-SDI or HD-SDI. See Supported formats

**Connector:**

BNC 75 ohm type

**Output Return Loss:**

≥ 15 dB (5 MHz to 1.5 GHz)

≥ 10 dB (1.5 GHz to 2.97 GHz)

**Output Impedance:**

75 ohm terminated

**Output Level:**

+/- 400 mV

**Purpose:**

Generator Output

## Generator AES Output

**Label:**

AES OUT

**Connector:**

BNC 75 ohm type

**Input Impedance:**

75 ohm terminated

**Maximum Input Voltage:**

1V

**Sample Rates:**

48 kHz

**Specification:**

Conforming to AES3 and SMPTE-276M

## Control Panel



The Sx instrument Control panel provide the following connections.

### Power Connection

**Voltage:**

5 V +/- 5%. (DC Power adapter provided)

**Power Requirements:**

AC 90 to 250 V 50/60 Hz 10 W max

### Local Control

**USB:**

USB 1

**USB Connector:**

Mini A/B

**Purpose:**

Software installation.

### Networking

**Ethernet:**

IEEE802.3 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 Sx instrument to be connected into a network and accessed via TCP/IP so that it can be controlled remotely.

### Headphone Output

**Connector:**

Miniature 3.5 mm stereo jack

**Level:**

Adjustable

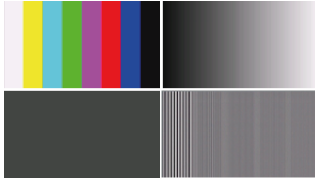
**Purpose:**

Local monitoring of audio

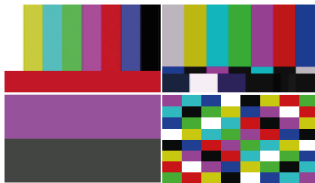


## Generator Functionality

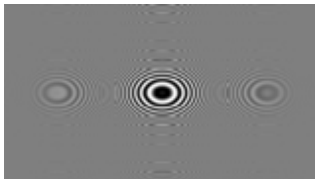
The Sx instrument provides a single video/audio signal generator functionality. The Generator menu (see the chapter [Menu Reference](#) for full details) allows the following test signals to be generated. The Generator provides:



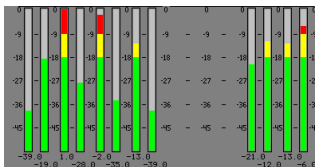
32, 10-bit Line-based video test patterns such as color bars, ramp, color plate, multiburst and user defined (DPX, YUV, TGA, BMP) that can be used to check video levels, linearity, saturation, hue, color phase and frequency response.



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 pre-determined zone plates as well as optionally 3 user customizable zone plates.



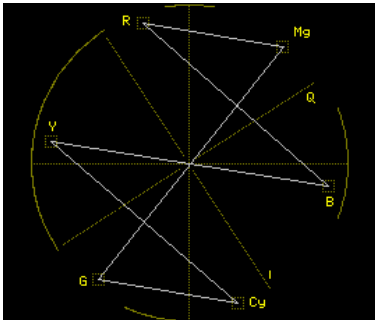
17 fixed Audio test tones (fixed 100 Hz to 20 kHz ), variable tones (1 Hz - 24 kHz in 1 Hz steps), intermittent tone, white noise or silence on audio pairs and audio groups. Audio level variable (0 to -100 dB in 1 dB steps).

## Analyzer Functionality

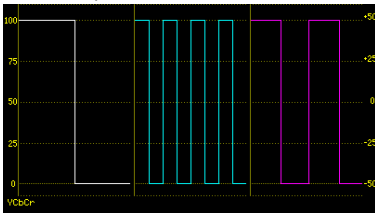
The Sx instrument provides analyzer functionality for two concurrently connected SD-SDI, HD-SDI or Optical inputs. With the module installed the Analyzer menu (see the chapter [Menu Reference](#) for details) allows the follow monitoring to be displayed:



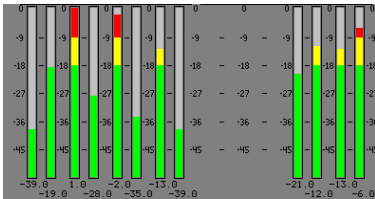
The Picture viewer is provided to allow you to monitor the selected input to give confidence that the signal is present, is the correct subject (or feed), it is moving and looks OK.



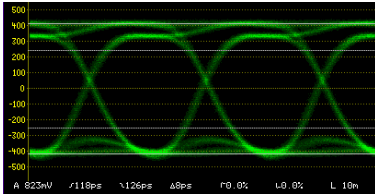
The Vectorscope allows you to check the hue, saturation and phase of the selected input. Controls are provided to allow you to select the line (s) to be monitored (ideal for checking any embedded test pattern in the selected feed), the field to be checked and the graticule scale.



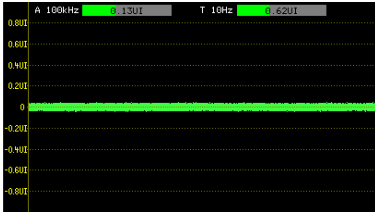
The Waveform Monitor allows you to check the levels of the video content are correct. Controls are provided to allow you to select the waveform (YCbCr, Y, Cb, Cr, GBR, Red, Green or Blue), the horizontal and vertical scale and the line(s) to be monitored.



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.



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.

# Supported SDI Video Formats

SMPTE Standards Link (Content)	Interface	Resolution	Sampling Structure	Pixel Depth	Frame / Field Rate	SxE
<b>SD 270 Mb/s Video Formats</b>						
ST 259 (ST 125)	SD (625i)	720 x 576	4:2:2 (YCbCr)	10	50i	S
ST 259 (ST 125)	SD (525i)	720 x 485	4:2:2 (YCbCr)	10	59.94i	S
<b>HD 1.485 Gb/s (SMPTE 292M)</b>						
ST 292 (ST 296)	HD	1280 x 720	4:2:2 (YCbCr)	10	60p, 59.94p, 50p, 30p, 29.97p, 25p, 24p, 23.98p	S
ST 292 (ST 260)	HD	1920 x 1035	4:2:2 (YCbCr)	10	60i, 59.94i	S
ST 292 (ST 274)	HD	1920 x 1080	4:2:2 (YCbCr)	10	60i, 59.94i, 50i	S
ST 292 (ST 274)	HD	1920 x 1080	4:2:2 (YCbCr)	10	30p, 29.97p, 25p, 24p, 23.98p	S
ST 292 (RP 211)	HD	1920 x 1080	4:2:2 (YCbCr)	10	30PsF, 29.97PsF, 25PsF, 24PsF, 23.98PsF	S
ST 292 (ST 2048-2)	HD	2048 x 1080	4:2:2 (YCbCr)	10	30p, 29.97p, 25p, 24p, 23.98p	S
ST 292 (ST 2048-2)	HD	2048 x 1080	4:2:2 (YCbCr)	10	30PsF, 29.97PsF, 25PsF, 24PsF, 23.98PsF	S
<b>3G Level-A 2.97 Gb/s (SMPTE 425-1)</b>						
ST 425-1(ST 274)	3G Level A (1)	1920 x 1080	4:2:2 (YCbCr)	10	60p, 59.94p, 50p, 48p, 47.95p	S
ST 425-1(ST 2048-2)	3G Level A (1)	2048 x 1080	4:2:2 (YCbCr)	10	60p, 59.94p, 50p, 48p, 47.95p	O
ST 425-1(ST 296)	3G Level A (2)	1280 x 720	4:4:4 (YCbCr/RGB) 4:4:4:4 (YCbCrA/RGBA)	10	60p, 59.94p, 50p, 30p, 29.97p, 25p, 24p, 23.98p	O
ST 425-1(ST 274)	3G Level A (2)	1920 x 1080	4:4:4 (YCbCr/RGB) 4:4:4:4 (YCbCrA/RGBA)	10	60i, 59.94i, 50i 30PsF, 29.97PsF, 25PsF, 24PsF, 23.98PsF 30p, 29.97p, 25p, 24p, 23.98p	O
ST 425-1(ST 2048-2)	3G Level A (2)	2048 x 1080	4:4:4 (YCbCr/RGB) 4:4:4:4 (YCbCrA/RGBA)	10	30PsF, 29.97PsF, 25PsF, 24PsF, 23.98PsF 30p, 29.97p, 25p, 24p, 23.98p	O
ST 425-1(ST 274)	3G Level A (3)	1920 x 1080	4:4:4 (YCbCr/RGB)	12	60i, 59.94i, 50i 30p, 29.97p, 25p, 24p, 23.98p	O
ST 425-1(ST 2048-2)	3G Level A (3)	2048 x 1080	4:4:4 (YCbCr/RGB)	12	30PsF, 29.97PsF, 25PsF, 24PsF, 23.98PsF 30p, 29.97p, 25p, 24p, 23.98p	O
ST 425-1(ST 428-9)	3G Level A (3)	2048 x 1080	4:4:4 (XYZ)	12	24PsF, 23.98PsF	O
ST 425-1(ST 428-19)	3G Level A (3)	2048 x 1080	4:4:4 (XYZ)	12	30PsF, 29.97PsF, 25PsF	O
ST 425-1(ST 274)	3G Level A (4)	1920 x 1080	4:2:2 (YCbCr)	12	60i, 59.94i, 50i 30PsF, 29.97PsF, 25PsF, 24PsF, 23.98PsF 30p, 29.97p, 25p, 24p, 23.98p	O
ST 425-1(ST 2048-2)	3G Level A (4)	2048 x 1080	4:2:2 (YCbCr) 4:2:2:4 (YCbCrA)	12	30PsF, 29.97PsF, 25PsF, 24PsF, 23.98PsF 30p, 29.97p, 25p, 24p, 23.98p	O
<b>3G Level-B 2.97 Gb/s (SMPTE 425-1)</b>						
ST 425-1(ST 274)	3G Level B-DL (I)	1920 x 1080	4:2:2 (YCbCr)	10	60p, 59.94p, 50p	S
ST 425-1(ST 2048-2)	3G Level B-DL (I)	2048 x 1080	4:2:2 (YCbCr)	10	60p, 59.94p, 50p, 48p, 47.95p	O

SMPTE Standards Link (Content)	Interface	Resolution	Sampling Structure	Pixel Depth	Frame / Field Rate	SxE
ST 425-1(ST 274)	3G Level B-DL (II)	1920 x 1080	4:4:4 (YCbCr/RGB) 4:4:4:4 (YCbCrA/RGBA)	10	60i, 59.94i, 50i 30PsF, 29.97PsF, 25PsF, 24PsF, 23.98PsF 30p, 29.97p, 25p, 24p, 23.98p	O
ST 425-1(ST 2048-2)	3G Level B-DL (II)	2048 x 1080	4:4:4 (YCbCr/RGB) 4:4:4:4 (YCbCrA/RGBA)	10	30PsF, 29.97PsF, 25PsF, 24PsF, 23.98PsF 30p, 29.97p, 25p, 24p, 23.98p	O
ST 425-1(ST 274)	3G Level B-DL (III)	1920 x 1080	4:4:4 (YCbCr/RGB)	12	60i, 59.94i, 50i 30p, 29.97p, 25p, 24p, 23.98p	O
ST 425-1(ST 2048-2)	3G Level B-DL (III)	2048 x 1080	4:4:4 (YCbCr/RGB)	12	30PsF, 29.97PsF, 25PsF, 24PsF, 23.98PsF 30p, 29.97p, 25p, 24p, 23.98p	O
ST 425-1(ST 428-9)	3G Level B-DL (III)	2048 x 1080	4:4:4 (XYZ)	12	24PsF, 23.98PsF	O
ST 425-1(ST 428-19)	3G Level B-DL (III)	2048 x 1080	4:4:4 (XYZ)	12	30PsF, 29.97PsF, 25PsF	O
ST 425-1(ST 274)	3G Level B-DL (IV)	1920 x 1080	4:2:2 (YCbCr)	12	60i, 59.94i, 50i 30PsF, 29.97PsF, 25PsF, 24PsF, 23.98PsF 30p, 29.97p, 25p, 24p, 23.98p	O
ST 425-1(ST 2048-2)	3G Level B-DL (IV)	2048 x 1080	4:2:2 (YCbCr) 4:2:2:4 (YCbCrA)	12	30PsF, 29.97PsF, 25PsF, 24PsF, 23.98PsF 30p, 29.97p, 25p, 24p, 23.98p	O
ST 425-1(ST 296)	3G Level B-DS	2x (1280 x 720)	4:2:2 (YCbCr)	10	60p, 59.94p, 50p, 30p, 29.97p, 25p, 24p, 23.98p	S
ST 425-1(ST 274)	3G Level B-DS	2x (1920 x 1080)	4:2:2 (YCbCr)	10	60i, 59.94i, 50i 30PsF, 29.97PsF, 25PsF, 24PsF, 23.98PsF 30p, 29.97p, 25p, 24p, 23.98p	S
ST 425-1(ST 2048-2)	3G Level B-DS	2x (2048 x 1080)	4:2:2 (YCbCr)	10	30PsF, 29.97PsF, 25PsF, 24PsF, 23.98PsF 30p, 29.97p, 25p, 24p, 23.98p	O
<b>3G Level-B 2.97 Gb/s (SMPTE 425-3)</b>						
ST 425-3 Annex B.1, (ST 2036-1)	Quad-link HD-SQ	3840 x 2160	4:2:2 (YCbCr) 4:2:0 (YCbCr)	10	30p, 29.97p, 25p, 24p, 23.98p	SL
ST 425-3 Annex B.1, (ST 2048-1)	Quad-link HD-SQ	4096 x 2160	4:2:2 (YCbCr)	10	30p, 29.97p, 25p, 24p, 23.98p	OL
ST 425-3 Annex B.2, (ST 2036-1)	Dual 3G-B-DS	3840 x 2160	4:2:2 (YCbCr) 4:2:0 (YCbCr)	10	30p, 29.97p, 25p, 24p, 23.98p	SL
ST 425-3 Annex B.2, (ST 2048-1)	Dual 3G-B-DS	4096 x 2160	4:2:2 (YCbCr)	10	30p, 29.97p, 25p, 24p, 23.98p	OL
ST 425-3 (ST 274)	Dual-link 3G-A,B (II)	1920 x 1080	4:4:4 (YCbCr/RGB) 4:4:4:4 (YCbCrA/RGBA)	10	60p, 59.94p, 50p	OL
ST 425-3 (ST 2048-2)	Dual-link 3G-A,B (II)	2048 x 1080	4:4:4 (YCbCr/RGB) 4:4:4:4 (YCbCrA/RGBA)	10	60p, 59.94p, 50p, 48p, 47.95p	OL
ST 425-3 (ST 274)	Dual-link 3G-A,B (III)	1920 x 1080	4:4:4 (YCbCr/RGB)	12	60p, 59.94p, 50p	OL
ST 425-3 (ST 2048-2)	Dual-link 3G-A,B (III)	2048 x 1080	4:4:4 (YCbCr/RGB)	12	60p, 59.94p, 50p, 48p, 47.95p	OL
ST 425-3 (ST 274)	Dual-link 3G-A,B (IV)	1920 x 1080	4:2:2 (YCbCr)	12	60p, 59.94p, 50p	OL
ST 425-3 (ST 2048-2)	Dual-link 3G-A,B (IV)	2048 x 1080	4:2:2 (YCbCr) 4:2:2:4 (YCbCrA)	12	60p, 59.94p, 50p, 48p, 47.95p	OL
<b>3G Level-A/B 2.97 Gb/s Quad Link (SMPTE 425-5)</b>						

SMPTE Standards Link (Content)	Interface	Resolution	Sampling Structure	Pixel Depth	Frame / Field Rate	SxE
ST 425-5 (ST 2036-1)	Quad-link 3G-A,B (1) 2SI	3840 x 2160	4:2:2 (YCbCr)	10	60p, 59.94p, 50p	SL
ST 425-5 (ST 2048-1)	Quad-link 3G-A,B (1) 2SI	4096 x 2160	4:2:2 (YCbCr)	10	60p, 59.94p, 50p, 48p, 47.95p	OL
ST 425-5 (ST 2036-1)	Quad-link 3G-A,B (2) 2SI	3840 x 2160	4:4:4 (YCbCr/RGB)	10	30p, 29.97p, 25p, 24p, 23.98p	OL
ST 425-5 (ST 2048-1)	Quad-link 3G-A,B (2) 2SI	4096 x 2160	4:4:4 (YCbCr/RGB) 4:4:4:4 (YCbCrA/RGBA)	10	30p, 29.97p, 25p, 24p, 23.98p	OL
ST 425-5 (ST 2036-1)	Quad-link 3G-A,B (3) 2SI	3840 x 2160	4:4:4 (YCbCr/RGB)	12	30p, 29.97p, 25p, 24p, 23.98p	OL
ST 425-5 (ST 2048-1)	Quad-link 3G-A,B (3) 2SI	4096 x 2160	4:4:4 (YCbCr/RGB)	12	30p, 29.97p, 25p, 24p, 23.98p	OL
ST 425-5 (ST 2036-1)	Quad-link 3G-A,B (4) 2SI	3840 x 2160	4:2:2 (YCbCr)	12	30p, 29.97p, 25p, 24p, 23.98p	OL
ST 425-5 (ST 2048-1)	Quad-link 3G-A,B (4) 2SI	4096 x 2160	4:2:2 (YCbCr) 4:2:2:4 (YCbCrA)	12	30p, 29.97p, 25p, 24p, 23.98p	OL
ST 425-5 Annex B, (ST 2036-1)	Quad-link 3G-A,B (1) SQ	3840 x 2160	4:2:2 (YCbCr)	10	60p, 59.94p, 50p	SL
ST 425-5 Annex B, (ST 2048-1)	Quad-link 3G-A,B (1) SQ	4096 x 2160	4:2:2 (YCbCr)	10	60p, 59.94p, 50p, 48p, 47.95p	OL
ST 425-5 Annex B, (ST 2036-1)	Quad-link 3G-A,B (2) SQ	3840 x 2160	4:4:4 (YCbCr/RGB)	10	30p, 29.97p, 25p, 24p, 23.98p	OL
ST 425-5 Annex B, (ST 2048-1)	Quad-link 3G-A,B (2) SQ	4096 x 2160	4:4:4 (YCbCr/RGB) 4:4:4:4 (YCbCrA/RGBA)	10	30p, 29.97p, 25p, 24p, 23.98p	OL
ST 425-5 Annex B, (ST 2036-1)	Quad-link 3G-A,B (3) SQ	3840 x 2160	4:4:4 (YCbCr/RGB)	12	30p, 29.97p, 25p, 24p, 23.98p	OL
ST 425-5 Annex B, (ST 2048-1)	Quad-link 3G-A,B (3) SQ	4096 x 2160	4:4:4 (YCbCr/RGB)	12	30p, 29.97p, 25p, 24p, 23.98p	OL
ST 425-5 Annex B, (ST 2036-1)	Quad-link 3G-A,B (4) SQ	3840 x 2160	4:2:2 (YCbCr)	12	30p, 29.97p, 25p, 24p, 23.98p	OL
ST 425-5 Annex B, (ST 2048-1)	Quad-link 3G-A,B (4) SQ	4096 x 2160	4:2:2 (YCbCr) 4:2:2:4 (YCbCrA)	12	30p, 29.97p, 25p, 24p, 23.98p	OL

**Key:**

- **S:** Sx Standard
- **O:** Sx Option
- **SL:** Sx Standard (Single Link Only)
- **OL:** Sx Option (Single Link Only)



# Maintenance

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## Warranty

### Overview

The Sx range benefits from a standard one year warranty including telephone and email support. You can choose to extend the warranty period for your device to either three or five years.

Each Sx leaves our UK factory with its own unique list of quality-controlled settings which are recorded by our manufacturing department. Should the Sx 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 are 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 on-line 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.

## Maintenance

### General Maintenance

The Sx instruments 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 Sx instrument please take the following precautions:

- Install the Sx 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 Sx instrument, i.e., temperature and signal levels.

**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. Charging the unit at a higher temperature will reduce the life of the battery and could cause permanent damage. 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 recommended charging temperature is exceeded a warning dialog will be displayed. If this occurs, disconnect the power adapter and allow the unit to cool before resuming charging.**

If the temperature rises above **55°Celsius** a warning dialog will be given. If the temperature rises above **65°Celsius** the unit is automatically switched OFF. Under both conditions, an event will be added to the event log to show what happened.

# Software Maintenance

## Installing New Software

**Note:** Make sure that the unit is connected to an AC power source before starting the software upgrade. The software upgrade may take up to an hour to complete.

New software can be installed on the Sx instrument using two different techniques depending on the location of the Sx instrument, the type of network access that the Sx instrument has and your company's IT policy.

Note that during the installation process the instrument will not be available for use.

**Note:** Note also that any existing Presets stored will be archived and will need to be restored if they are required. See the section [Memories](#) for details on restoring presets archived by the installation of a new version of software.

### Software Download from the Internet

Using the Sx instrument's LCD screen (access via a web browser), and the Sx instrument has Internet network access, you can download and install directly onto the Sx 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.

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 menu, select **Engineer** (Engineer Setup window on Monitor Output) to download the latest software version. Pressing the **Download** button will cause the current release of software to be downloaded from the PHABRIX website.

**Note:** Note that multiple releases of software may be stored on the Sx instrument so a previous release can be re-installed if required.

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 instrument for future installation. If the latest software is already present on the unit, no software will be downloaded and a message will be shown.

3. To install the downloaded software on the Sx 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 will be shown. 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 the instrument off until an installation has completed correctly.

Once the installation has completed, if **Reboot after Install** is checked the instrument will restart 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**.

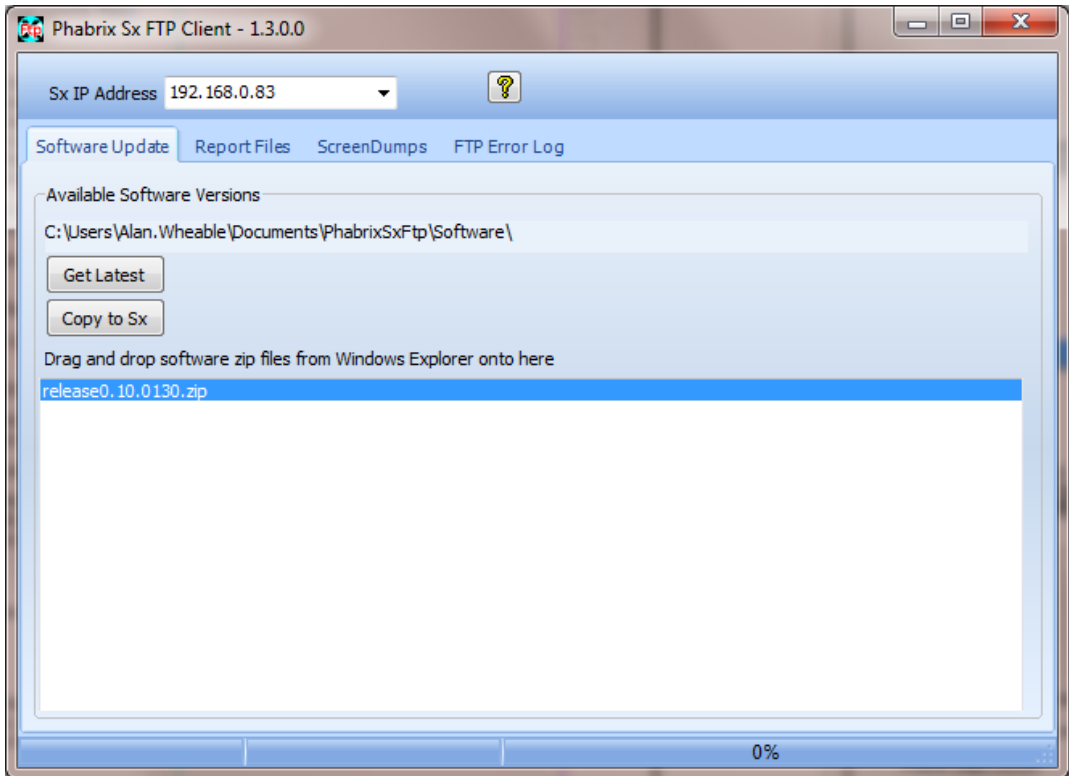


The software release notes can be viewed by selecting the **Changes** button.

## FTP Transfer from a Connected PC

If the software cannot be installed, for example because the Sx instrument does not have Internet access, you can transfer the software files directly to the Setup folder of the Sx instrument using the PHABRIX FTP client:

1. Download the latest Sx software version from the PHABRIX website then drag the zip file to the PHABRIX FTP client (also available from the PHABRIX website).



To connect to the instrument, you will need to use the PHABRIX FTP client available from the PHABRIX website. This connects to the Sx unit using IP address of the unit (as host name) with:

- Username: **sxuser**
- Password: **phabrixsx**

2. In the PHABRIX FTP client enter the IP address of the Sx unit to be updated.

**Note:** If a static IP address has been assigned to your Sx unit, be sure also to set a valid default gateway address. Contact your network administrator for these. If connecting directly between the Sx and your PC, you must set the default gateway to the IP address of your PC. See [System – Network](#) for information on configuring the network settings on the Sx.

3. In the PHABRIX FTP client select the zip file for the new software and press the 'Copy to Sx' button.

This will copy the new software files to the Sx instrument's 'Setup' folder, updating the existing files as necessary. This can take up to 20 minutes depending on the connection speed.

4. Once the PHABRIX FTP client has finished copying the files to the Sx unit, use the menu: **System → Engineer** to locate the new software version in the **Software Upgrade** section of the menu, then select **Install**.

Wait for the new software to be installed. The progress will be indicated on screen.

During this time the software will be decompressed, files will be extracted and the hardware (FPGA) will be reprogrammed. If an error is given during the installation, retry the installation and or download. Do NOT turn the unit off until an installation has completed correctly.

## Reverting to an Earlier Version of Software

If you need to revert to an earlier version of software:

1. Use the menu: **System** → **Engineer** to find the version of software you require in the **Software Upgrade** section of the menu then select **Install**.
2. Wait for the new software to be 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.

## Sx File Structure

The Sx instrument uses Linux as its operating system and several directories in the file system are provided for user-specific files.

### 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. i.e., 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.

**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:** Note that bitmap files are RGB and 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 YUV files are used(.dpx), then all valid values may be output.

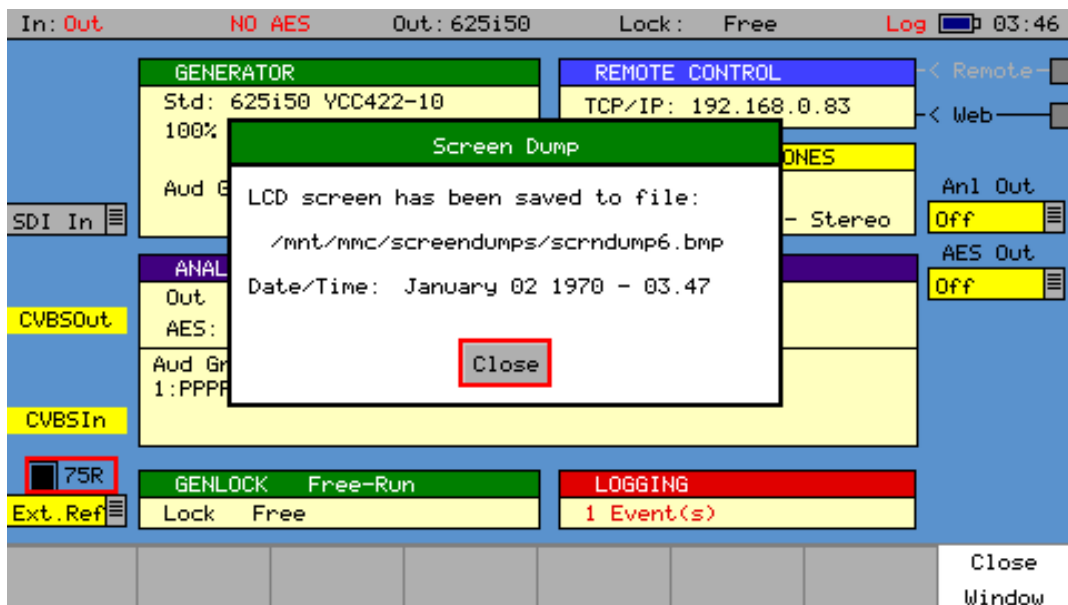
## Fonts

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.

## Screen Captures

The unit enables you to capture a screenshot of the active screen as follows:

1. With the desired screen displayed, hold down the OK button on the unit until you hear a beep.
2. Wait a few seconds for the unit to save the file. It will then display the following dialog showing the name of the saved bitmap file.



Make a note of the path and file name so that you can retrieve the file as described below.

Retrieve a saved screenshot from the unit as follows:

1. Open your web browser and access the unit, enter: **http://<IP\_address>**
2. Click the Downloads button at the bottom right of the Sx display on the website.



3. Click the **Screen Dumps** link to display the available saved screen captures.
4. Click the file name of interest to open the file.
5. Right-click and select **Save Image As...** to save the displayed image in .BMP format to your target location.



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