ST2110 IP Analyzer

AI100

Operations Manual

Rev. 1.0.1 Draft

Village Island Co., Ltd.

Introduction

Welcome to the AI100 Operations Manual. The AI100 offers comprehensive real-time analysis, generation, and monitoring of ST-2110 IP media streams, including compressed JPEG-XS (-22), uncompressed video (-20), audio (-30), and ancillary data (-40). Engineered to support critical analysis and signal generation for both video broadcast operations and manufacturer research and development, this manual will guide you through the safe and effective setup, operation, and maintenance of your AI100 device.

The AI100 has the following functionality:

- Provides real-time data analysis for ST2110 RTP streams, including ST2110-22 for JPEG-XS.
- Supports 8K, 4K, 3G, and HD video signal formats.
- Supports ST2110-20/21/22/30/40 RTP streams.
- Supports the generation of any 8K, 4K, 3G, or HD ST2110 (uncompressed and JPEG-XS) stream.
- Supports Ethernet PHY layer analysis.
- Supports the analysis of UDP, RTP, and payload for ST2110 Video, Audio, and ancillary (ANC).
- Supports ST2110-22 JPEG-XS data packet status, payload information, codestream, and support boxes information analysis (ISO/IEC 21122).
- Provides ST2110-21 encoder traffic buffer modeling analysis.
- Provides ST2022-7 IP data status analysis.
- Provides a joint Server and Client PTP timing analysis.
- Provides a reference for the standard values to support users in IP facilities.
- Provide a waveform visualization of the unit's PTP timing precision.
- Enables the capture of over 1 GB of data (USB storage is required).
- Provides a friendly user interface that can be displayed on either the front panel touchscreen(3RU) or a large screen through the HDMI port simultaneously. The GUI can also be displayed remotely through a web browser.
- Enables the user to take a screenshot of any analysis status.
- The analyzer is available as a 1RU rack-mountable chassis unit or as a portable 3RU unit with an 8-inch touchscreen.

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VILLAGE island

Safety Instructions

［1］Safety guidelines before using the device

· Before using your new device, please read the safety guidelines below carefully and use your device accordingly.

· This guide's target audience is anyone using the device. Its primary purpose is to help users avoid personal injury or property damage resulting from improper handling and operation. Make sure you read this guide carefully and as many times as necessary. Please keep this guide handy.

· The guidelines presented here will explain the different warning levels for cases where the wrong operation could cause danger of injury or damage.

· The security guidelines are classified for different degrees using the pictures below.

Warning	Critical injuries or even death may occur if the guidelines presented in this picture are not appropriately followed.
Caution	An injury may occur if the guidelines presented in this picture are not appropriately followed.

Examples:

	This symbol will tell you that your reading content contains a warning or caution.
	This symbol will tell you that a particular operation or action is forbidden.
	A blue symbol will tell you to perform a specific action. The symbol on the left instructs the user to unplug the device.

Warning

Connect your device to a properly grounded power outlet. ●Failure to do so can cause fire or electric shock from short circuits or lightning strikes.	Never touch the unit and the power plug during thunderstorms. ● Electrical shock may result.
Never use the product with a line voltage other than indicated ●Fire or electric shock may occur	Stop operating immediately if fumes or abnormal sounds come from the device. ●Unplug the unit immediately and make sure there are no more fumes, etc., coming out of the unit. At this point, please get in touch with your dealer
The device is intended for indoor use only and should never be used near water. ●Fire or electric shock may occur	When left unattended for an extended period, dust and dirt can accumulate at the power plug and AC outlets, and operating under these conditions may result in fire or electrical shock. Periodically clean and check the electrical contacts. ●Fire may occur
Do not block the air vents on the cover or insert foreign objects inside. ●Fire or electric shock may occur	If water or artifacts get inside, unplug the power plug. ● Fire or electric shock may occur Please get in touch with your dealer.
Do not damage, heat, pinch, or place heavy things on the power cord. ● The power cord may be damaged by fire or electric shock.	Never allow anyone other than an authorized repair professional to disassemble, repair, or modify the unit. ●Fire or electric shock may occur Contact your dealer for internal inspection, maintenance, and repair.
Do not use this product when the power cord or plug is damaged or the power inlet is loose. ●Fire or electric shock may occur. Please get in touch with your dealer.	Please do not use the unit in a damaged or broken state after having dropped it ● Fire or electric shock may occur. Please get in touch with your dealer.

Do not place containers or objects containing water on the equipment. ● If water spills into the product, fire or electric shock may occur.	Unplug the power plug and use the same rating and shape when replacing the fuse. ● Using the wrong fuse may cause a fire or an electric shock.
Do not place indoor equipment in a humid or dusty place. ● Fire or electric shock may occur.	Install the device in a location that can withstand its weight. ● Falling may cause injury.

Caution

Unplug by grabbing the power plug and pulling it until it is free from the connection. Never unplug by pulling the power cord. ● The power cord may be damaged by fire or electric shock.	Do not insert or remove the power plug with wet hands. ● It may cause an electric shock.
Unplug the power plug from the outlet when installing, moving, or cleaning the device. ● Not doing this may cause injury, fire, or electric shock.	Be sure to unplug the power cord from the outlet when the device is not in use for an extended period. ● It may cause fire or electric shock.

[２] Safety Notes

(1)When using the device

- Do not use the device in a dusty environment or a location with too much vibration.
- When cleaning the unit, please use a soft, dry cloth.
- Do not use benzine, thinner, alcohol, detergent, etc., to clean the unit as the exterior may deteriorate.
- Do not use or store the device in a place susceptible to static electricity or electrical noise.
- It may cause failure or affect device performance.
- Do not place the device near corrosive chemicals or where corrosive gas is generated. It may cause device failure.

(2)Operation Environment

Use in an environment that does not deviate from the operating temperature range specified for this device. Also, avoid exposing the device to sudden temperature changes. This is necessary to prevent problems such as condensation.

(3)Heat Dissipation

This device is cooled by the low air using fans. Be careful not to block the exhaust or air intake.

Be careful not to touch the air-cooling fan during operation. It may cause injury or damage to the device. The chassis may warm up during use, but this is not a malfunction.

(4)Grounding

Ensure the device is properly grounded.

(5)Items included with the product

・AI100 : 1 set

If any of the above is missing, please inform your dealer.

Physical Specification

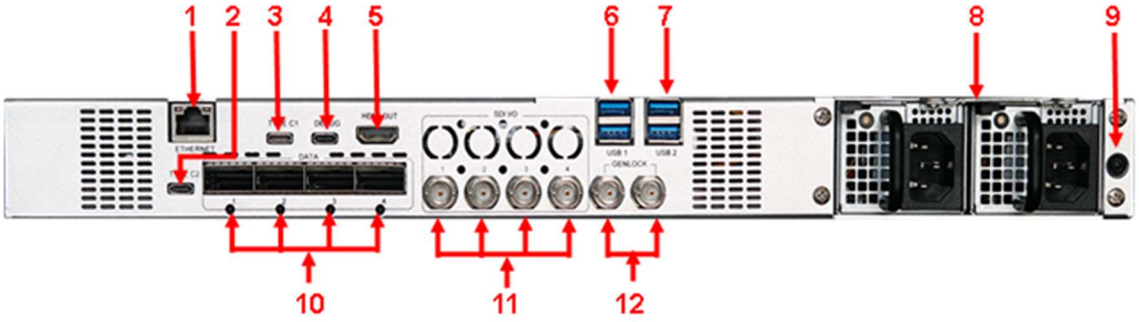
The AI100 series is available in two configurations:

1. A 1RU chassis
2. A 3RU chassis with an 8-inch LCD touchscreen panel.

[1]1RU chassis

Front Panel

Back Panel



1	RJ45 – Ethernet remote control interface, or GUI upgrade interface.
2	TYPE C2 – Hardware upgrade TYPE C interface.
3	TYPE C1 – Reserved hardware TYPE C interface.
4	DEBUG – User debug TYPE C interface.
5	HDMI OUT – Output HDMI 2.0 interface.
6	USB 1 – 2 x USB interfaces for keyboard, mouse, or USB disk.

7	USB 2 – 2 x USB interfaces for keyboard, mouse, or USB disk.
8	Power Supply – 1RU model provides a dual power supply with 110V to 240V.
9	Power Alarm.
10	DATA 1 & 2 – Available for receiving JPEG-XS IP data stream through SFP+ 10G network interface. DATA 3 & 4 – Hardware reserved network data interface. (DATA 1/2/3/4 can be upgradable to SFP28 25G or QSFP28 100G network interface as an additional option feature.)
11	SDI I/O – JPEG-XS Decoded signal 8K 4 x 12G-SDI, 4K 12G-SDI, or HD-SDI output.
12	GENLOCK – External reference signal I/O.

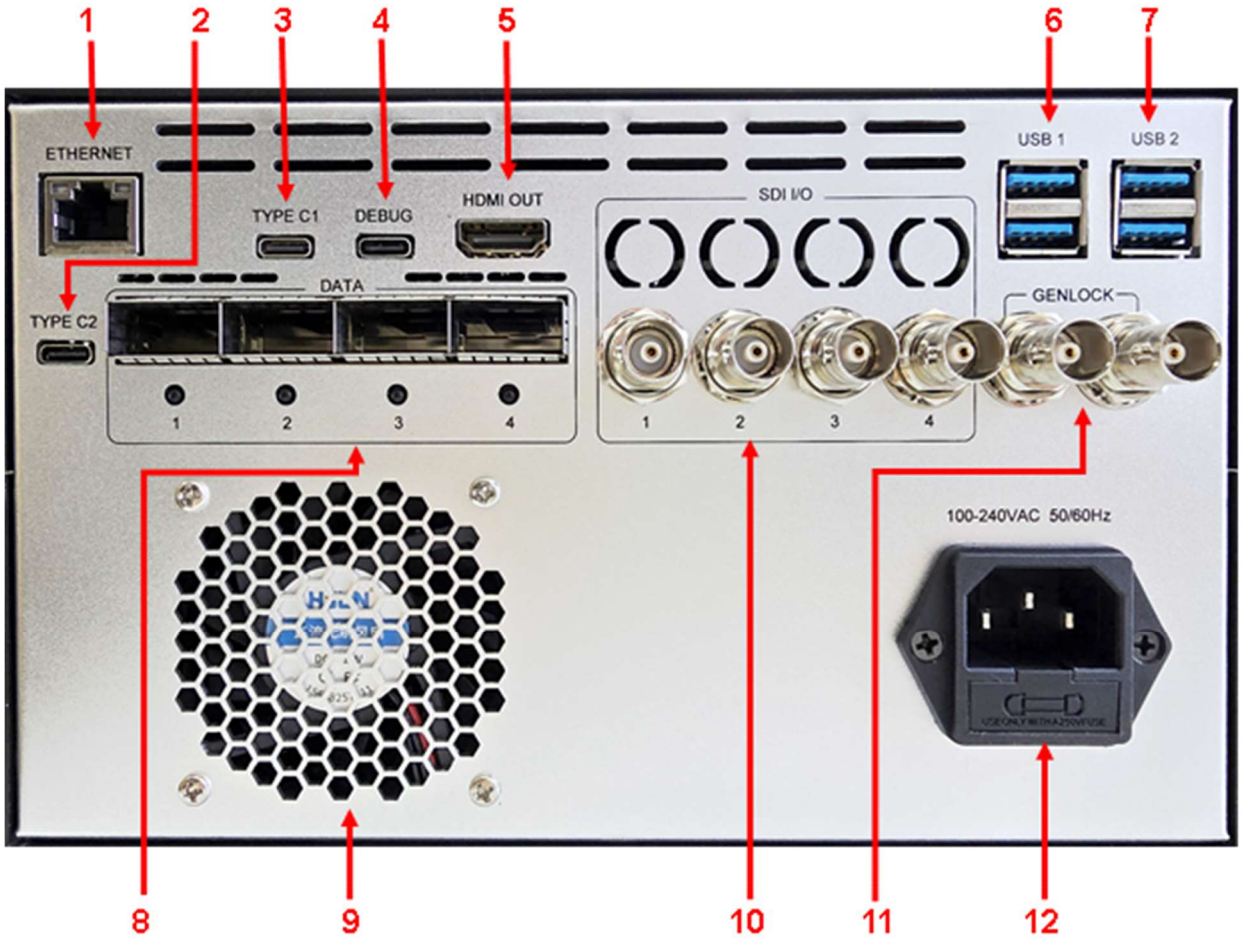
[2]3RU chassis

Front Panel:

1	**POWER** – Power ON / OFF.
2	**LCD Touch Screen** – Multi-touch screen displaying the data analysis results and status in a Four-Window or Single-Window mode. There is a hidden menu on each quadrant of the home display. If you move your mouse and click on top of each window, a secret menu will appear, allowing you to customize the window to display different content.

3	**3.5' Audio Monitor Output** – The AI100 provides a 3.5' headphone jack for the audio monitoring of any two channels from the 32-channel selection. 1. Press the page System -> Headphones. **2.** Select the audio channels to monitor: ● CH 1 to CH 32: Choose specific audio channel numbers. ● Mute: Mute the audio monitoring output. 3. Volume Control: ● Adjust the volume level using the slider or input box. The valid range is 0 to 100. ● Mute: Click the Mute button to mute the audio output.

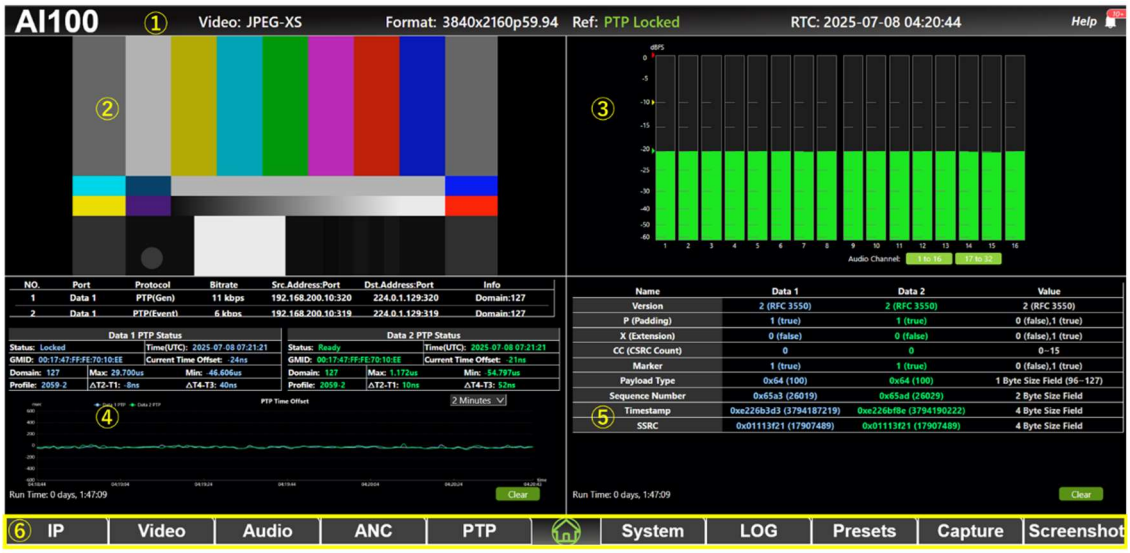
Back Panel:



1	RJ45 – WebUI, NMOS, SNMP Trap port
2	(Reserved) TYPE C2 – Hardware upgrade TYPE C interface.
3	(Reserved) TYPE C1 – Reserved hardware TYPE C interface.
4	(Reserved) DEBUG – User debug TYPE C interface.
5	HDMI OUT – Output HDMI 2.0 interface.
6	USB 1 – 2 x USB interfaces for keyboard, mouse, or USB disk.
7	USB 2 – 2 x USB interfaces for keyboard, mouse, or USB disk.
8	DATA 1 & 2 – Available for receiving JPEG-XS IP data stream through SFP+ 10G or SFP28 25Gnetwork interface. DATA 3 & 4 – Hardware reserved network data interface. (DATA 1/2/3/4 can be upgradable to SFP28 25G or QSFP28 100G network interface as an additional option feature.)
9	Cooling fan's holes.
10	SDI I/O – JPEG-XS Decoded signal 8K 4 x 12G-SDI, 4K 12G-SDI, or HD-SDI output.
11	GENLOCK – External reference signal I/O.
12	Power Supply with 110v ~ 240v.

[3]User Interface

The home Screen view



1	**Status Panel:** The Status panel shows: 1. The video type (uncompressed or JPEG-XS) 2. The format (Width, Height, framerate, and whether it is progressive or interlaced) 3. The PTP status (locked, unlocked, etc.) 4. The current clock (Automatic, PTP, or RTC)
2	**Quadrant 1 Panel:** Can be set to any available status panel. The figure above shows the “Video-Picture” status page.
3	**Quadrant 2 Panel:** Can be set to any available status panel. The figure above shows the “PTP Status” status page.
4	**Quadrant 3 Panel:** Can be set to any available status panel. The figure above shows the “Audio-Audio Meters” status page.
5	**Quadrant 5 Panel:** Can be set to any available status panel. The figure above shows the “IP Timing Comparison” status page.
6	**Menu Bar:** From the menu bar, the user can access:

1. **IP**: The IP menu contains status IP information, ST2110 Virtual Buffer information, and timing comparison of all input streams of the current input signal

2. **Video**: The video menu contains:

   - The picture display of the received video streams.
   - The status and parameters' information (video format, errors, bitrate, etc.), the contents of packet headers (from the IP to the RTP layer), the payload information, and the format comparison of the stream.
   - The video signals' baseband CIE Diagram scope, Vector scope, and Waveform scope.

3. **Audio**: The audio menu contains the audio meters, audio stream status, and header information.

4. **ANC**: The ANC menu contains stream status and the header information.

5. **PTP**: The PTP menu contains the status of the PTP services.

6. **The Home button**: This button takes you to the home screen view.

7. **System**: The System menu provides the means to configure the input signal, the test signal generator, the network, genlock, and other settings.

8. **LOG**: The log menu provides error information and debug events.

9. **Presets**: The "Presets" menu allows you to store various device configurations.

10. **Capture**: The "Capture" menu enables the user to store data from the device's data ports (a USB stick is required).

11. **Screenshot**: The screenshot menu enables users to capture an image of the current screen and save it to a USB stick.

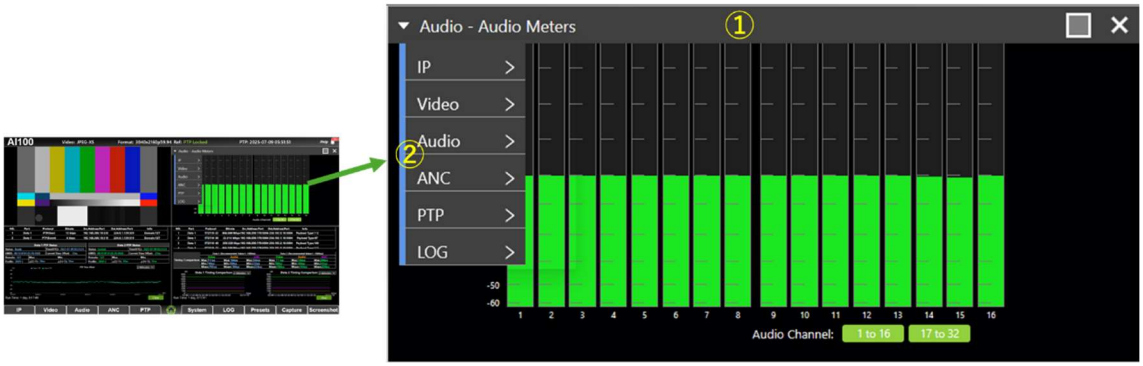
Custom Panel display

The home display view can be customized to show different panel statuses.

To accomplish this, touch the touchscreen located at the top of the panel (① in the figure below).

If using a mouse, point to the top of the panel (shown as ①) and click it.

A small menu should appear, allowing you to select from various options (see ② in the figure below) to display on the home display view.



[4]IP Analysis Menu

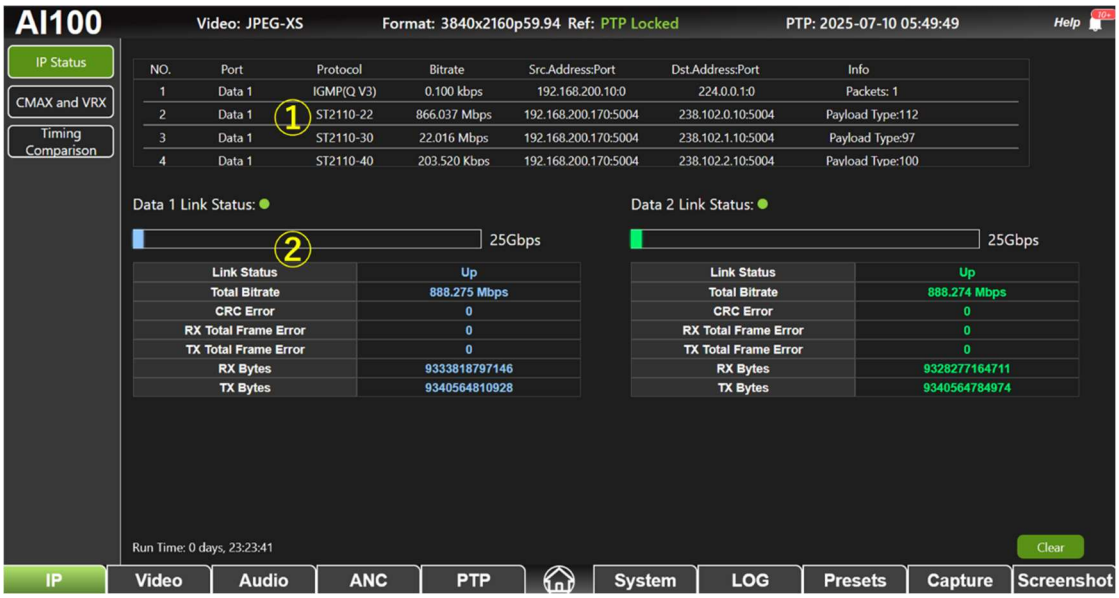
The IP Analysis Menu consists of 3 submenus:

1. **IP Status**: This submenu contains the status of all signals coming through Data 1 (ST2110-20/-22) and Data 2 (ST2022-7) Ports. It displays the different stream types, their IP addresses, bitrates, and protocols. It also shows the Ethernet status of each port (Data 1 and Data 2).

2. **CMAX and VRX**: This submenu displays the two models used to quantify the packet delivery characteristics of video RTP streams as they exit the physical interface of the sender (TX). One is a network compatibility model, and the other is a buffer model used to analyze packet read schedules (see the SMPTE ST2110-21 Standard for further details).

3. **Timing Comparison**: This submenu displays the estimated timings for each of the ST2110 streams (video, audio, ancillary data).

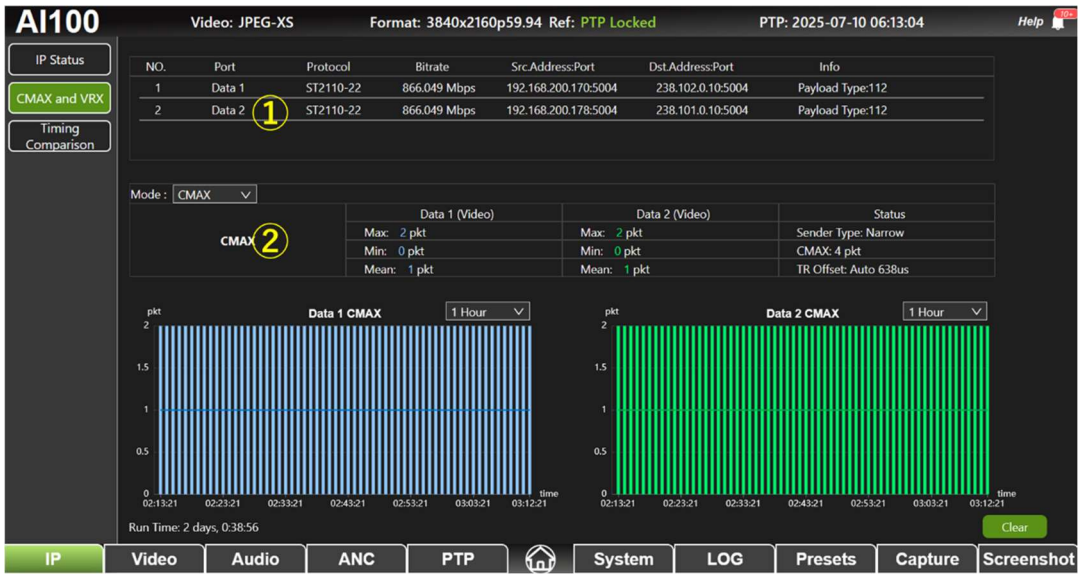
IP status submenu



① Shows the current data streams arriving at Data 1 and Data 2 ports. It provides details about their protocol type, source and destination IP addresses, and respective ports, as well as basic information, such as payload type.

② Shows the link statuses of both Data 1 and Data 2 ports.

CMAX and VRX Submenu



Within this submenu, two traffic shaping models are used:

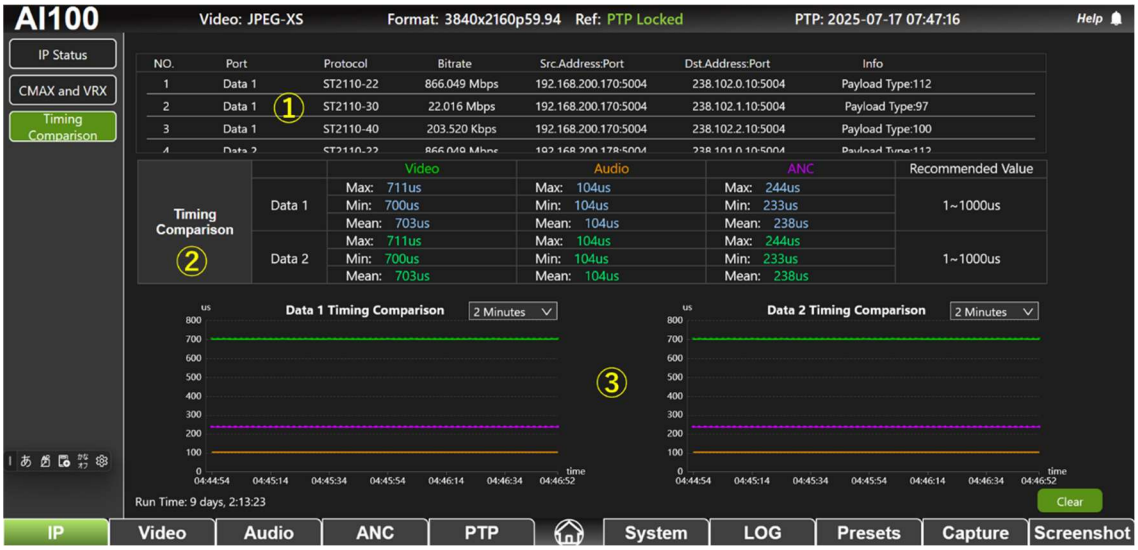
1. Network Compatibility Model (CMAX/CINST): This model provides information about how a sender manages its output packet burst and how compatible it is with the buffer in standard switching devices.

2. Virtual Receiver Buffer Model (VRX): This model provides information about the pacing of the packets (scheduling).

Item ① displays the information regarding the currently received RTP streams on Data 1 and Data 2 ports, and it also provides basic information about bitrate and payload types.
Item ② displays the model information for each data port, as well as their statuses.

The mode can be selected from the “Mode” pull-down menu as shown in the figure below.

Timing comparison



The Timing Comparison submenu provides the delay comparison between the different ST2110 streams on ports Data 1 and Data 2. The comparison is accomplished by checking the timestamps in the RTP headers with the timestamps from the PTP system.

There are three main areas in the submenu:

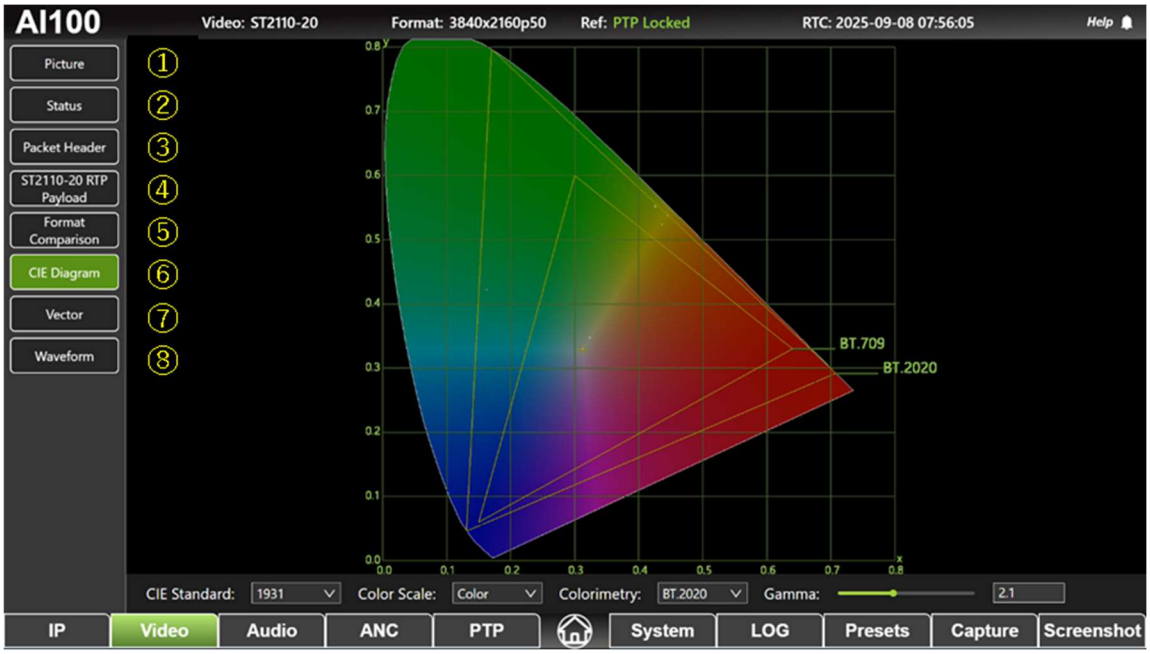
① **The Stream information Area**: This display shows the connection information as well as protocol type, bitrate, and payload type available from the streams in port Data 1 and Data 2.

② T**he Time Comparison area:** This display shows the instantaneous time delay for each RTP stream type in microseconds.

③ **The Time Comparison Graph Area:** This display shows the data accumulated time delay for each RTP stream type. The resolution can be adjusted to display the historical graph from 2 minutes to 24 hours from the pull-down menu in the upper right corner.

[5]Video Analysis Menu

The Video Analysis menu offers eight submenus, described below.



① **Picture**: This submenu shows the video raster display.

② **Status:** This submenu shows the stream input type, video format, packet drops, packet sequence errors, and if compressed, it will show the compression format and rate. If the Data 2 input is available, it will display the same information.

③ **Packet Header:** This submenu shows information about the Ethernet frame, IP, UDP, and RTP headers for port Data 1 and Data 2.

④ **JPEG-XS RTP Payload:** This submenu shows information about the JPEG XS Header, the Video Support Box, the Color Specification Box, and the Codestream header. To fully understand the parameters involved in the analysis, you need to comprehend the JPEG XS ISO standard.

⑤ **Format Comparison:** This submenu shows the comparison of the DATA 1 and DATA 2 ports.

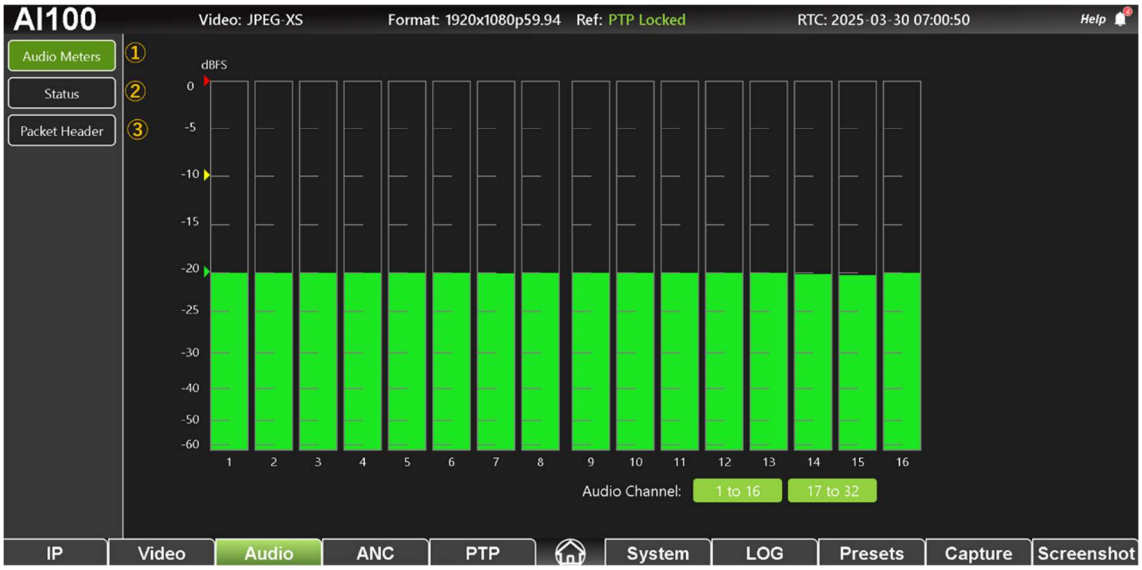
⑥ **CIE Diagram:** This submenu provides the baseband video CIE diagram scope analyzing.

⑦ **Vector:** This submenu provides the baseband video Vector scope analyzing.

⑧ **Waveform:** This submenu provides the baseband video Waveform scope analyzing.

[6]Audio Analysis Menu

The Audio Analysis Menu provides information about three submenus described below.



① **Audio Meter**: This submenu shows the audio meter display for 1 to up to 32 audio channels.

② **Status:** This submenu shows the stream input type, audio format, packet drops, sequence, errors, number of channels, and packet time. If the Data 2 input is available, it will display the same information.

③ **Packet Header:** This submenu shows information about the Ethernet frame, IP, UDP, and RTP headers for port Data 1 and Data 2.

[7]ANC Analysis Menu

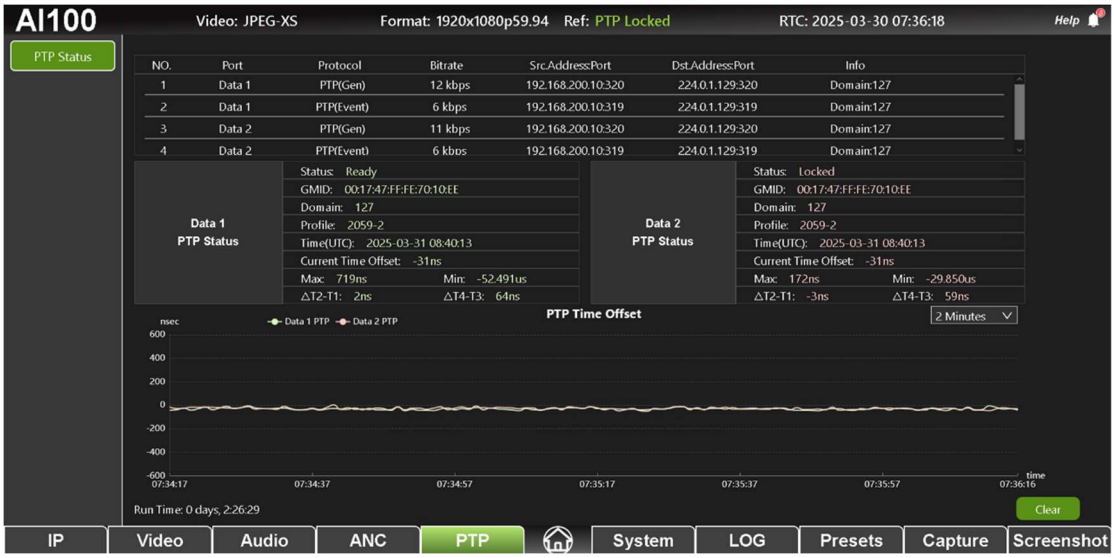
The Audio Analysis Menu provides information about three submenus described below.

① **Status:** This submenu shows the stream input type, payload ID, packet drops, sequence, errors, number of channels, and packet time. If the Data 2 input is available, it will display the same information.

② **Packet Header:** This submenu shows information about the Ethernet frame, IP, UDP, and RTP headers for port Data 1 and Data 2.

[8]PTP Analysis Menu

The PTP Analysis Menu provides information about the PTP Status of the two media ports (DATA 1 and DATA 2).



This analysis provides information on the PTP status, the Grand Master seen on each media port (DATA 1 and DATA 2), the time-step delay measurements (1 and 2 step mechanisms), the Domain Number, the current time obtained through PTP, and, most importantly, it shows the delay offset between the two ports using a graphical display. When both ports are available, the performance of both delay offsets can be compared.

[9]System Configuration Menu

The System Configuration Menu has several submenus. We will describe the first four.

① **Input:** This submenu allows you to configure the input signal. The signal input is defined:

1) **General**: In this configuration, you need to input the signal type (uncompressed ST2110-20, or compressed ST2110-22 for JPEG-XS), the resolution from HD to 8K, and the frame rate (possible values: 50, 60, 59.94 (progressive or interlaced for HD) for video, and also the parameters for Audio and ANC
2) **DATA 1** and **DATA 2** routing information. This information includes the Unicast or Multicast IP address for each media type, the port used for the UDP packets, and, due to the IGMPv3 requirement for ST2110, the Source IP, which is the IP address of the sender device.

② **Test Generator:** This submenu allows you to configure an output test signal.
AI100 provides uncompressed 4K ST2110-20, and up to 8K JPEG-XS ST2110-22 as the additional option IP signal generator.

The output test signal can be compressed or uncompressed, with a resolution of HD to 8K, different frame rates (50, 60, 59.94, progressive or interlaced). You can also select SDR or HDR configurations, as well as BT.709 and BT.2020 color spaces. There are several types of test pattern videos. The test signal can also contain 1 to 32 audio channels, each with its respective configuration. A time code can be added to the ancillary data.

③ **Network:** This submenu is the first configuration you need to set up. Here, you can define the IP for each media port (DATA1 and DATA2) and also the FEC settings if using a 25G

port. The IP address configuration can be manual or by DHCP. The management port can also be configured in a similar manner. The NMOS configuration is also available, and can be configured to support an automatic RDS setting or a particular setting for 2 static RDS systems.

④ **Genlock:** This submenu allows you to use either PTP, Black-Burst, or Tri-level Genlock, as well as the free-running internal clock. For PTP, you also have the option of configuring the PTP parameters in accordance with the network PTP Grandmaster (according to ST2059-1/-2).

Support

In case of problems or malfunctions, please get in touch with us using the information below.

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You can find additional information and news regarding this and other products by accessing our website.

http://www.village-island.com/

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November 11, 2025.
Rev 1.0.1