

# Qx | QxL

ADVANCED RASTERIZERS FOR  
HYBRID IP/SDI, 4K/UHD, HDR/WCG  
GENERATION, ANALYSIS & MONITORING



# Qx | QxL

## IP/SDI, 4K/UHD, HDR/WCG Generation, Analysis & Monitoring

Qx rasterizers bring together all the advanced Test & Measurement tools required for transitioning to the next generation of video formats. Designed for HD/3G/6G/12G-SDI and HD/UHD IP ST 2110/2022-7/2022-6 and AMWA NMOS\* environments, the instrument set includes tools for rapid fault diagnosis, compliance monitoring and product development. The Qx is now available in two platforms, with a powerful common look and feel providing an accessible user interface and toolsets for full operational flexibility and easy migration from an SDI centric to IP centric operation.



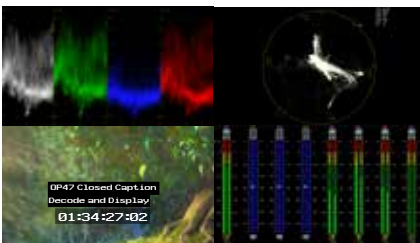
If your focus is on a classical SDI based HD facility and would like to future proof your operation for real-time IP then the classic Qx will address your needs with HD/3G SDI as standard and options for UHD 12G-SDI, HD/3G 2110 and 2022-6 payloads on 10G SFP+ interfaces.



For real-time IP with UHD and some SDI edge workflow then the class leading QxL provides support for HD/3G 2110 and 2022-6 payloads on 10G/25G SFP28 interfaces as standard, with options for IP to SDI gateway factory

fitted quad SDI BNC/dual SDI SFP+ with seamless hybrid operation, UHD payloads for both IP\* and SDI, and QSFP interfaces\*.

Out of the box, the Qx Series offers media analysis for broadcast operator HD/3G environments, with a flexible user-defined instrument layout displaying up to 16 simultaneous windows, and the ability to rapidly change between bespoke layouts for different operational tasks with user presets.



Picture view, waveform monitor, vectorscope, 32 channel audio metering, decoded audio channel status information, detection of common Dolby formats, ANC status and payload, on screen display of OP47 and CEA-608 in 708 closed captions and Ancillary Time Code (ATC), Loudness monitoring\*, and advanced control and logging with human readable event logs, remote operator GUI access over VNC and a full REST API are all provided as standard.

The flexible architecture offers upgrades for UHD/4K, HDR, AV test signal generation as well as engineering grade data view and ANC packet inspection tools. A factory fitted hardware option provides RTE™ real time SDI eye and jitter analysis with the further option of a highly advanced SDI-Stress toolset.

### Advanced High Dynamic Range (HDR) visualization & analysis toolset

The Qx's comprehensive HDR toolset includes a signal generator, CIE chart, Luma false color highlighting or "heat map", waveform monitor and vectorscope. All the main broadcast SDR and HDR production formats are supported: Standard Dynamic Range (SDR) BT.709, BT.2020 as well as HDR BT.2100 HLG, PQ



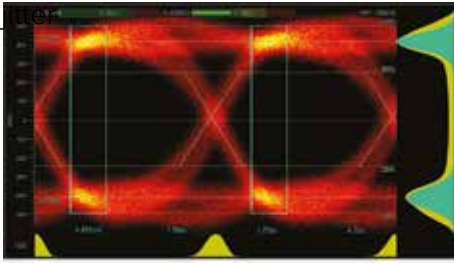
and Sony S-Log3 and SR Live. The Waveform provides a Cd/m2 (nits) graticule along with BT.2048 diffuse white markers. The heat-map provides 7 simultaneous programmable color overlay bands with presets for HDR and SDR ranges, plus a user custom preset. The CIE 1931 x,y display provides overlays for BT.709, BT.2020 and ST.2086 gamut (P3).

An extensive set of test patterns include BT.2111 HDR color bars for HLG, PQ and SR Live as well as a full set of SDR 709 patterns

mapped via 'display light' to each of the four HDR formats for line checks, comparative monitor set-up and the evaluation of HDR to SDR converters.

## Fast, automated 12G-SDI physical layer analysis and SDI-Stress Toolset

The Qx Physical Layer Toolset offers the fastest 12G/6G/3G/HD-SDI physical layer testing, with its RTE™ (Real-Time Eye) Technology instantly highlighting any SMPTE compliance issues. Built-in automation control allows testing to be performed faster, more reliably and at lower cost. Included in the option are a full range of SDI eye measurements including amplitude, DC offset, transition times and overshoot and health indication with both amplitude and time histograms, as well as choice of color, heat-map overlays and infinite persistence display.



The Generator Toolset option provides not only the core full screen SDI Pathological stress patterns (Eq, PLL, Clk, checkfield and combined), but also allows the user to define a combination of the SDI stress and conventional generator patterns up to full frame. These patterns can be duplicated on all four SDI outputs.

The advanced SDI-STRESS option is available for stress testing and R&D evaluations of SDI interfaces up to 12G. It includes the ability under automation control to insert SDI clock jitter, mute any of the SDI outputs, and control the SDI scrambler, sync-bit insertion, pre-emphasis, rise time and driver amplitude. The SDI-STRESS Eye amplitude measurement provides both Shorth mean and mode, with a histogram overlay and a user-defined window for the exploration of eye amplitude.

Pseudo-Random Binary Sequence (PRBS) generation and analysis of PRBS-7, 9, 15, 23, 31 allows for deterministic measurement of link Bit Error Rates (BER).

## ST 2110 IP Toolset

The Qx ST 2110 “JT-NM Tested”+ core IP feature set provides an operator all of the ST 2110 confidence status monitoring in an intuitive and accessible manner. The core toolset supports simultaneous decapsulation of 1 video, 2 audio and 1 ANC Data flow supported SMPTE protocols include ST 2059 (PTP), ST 2110-20 (Uncompressed Video), -30 (PCM Digital Audio), -31 (AES3 Transparent Transport) and -40 (ANC Data). ST 2022-7 seamless protection (SIPS) is provided for all four flows over two media network interfaces using industry standard SFPs.



Audio handling conforms to ST 2110-30 Class C with support for 48Khz streams from 1 to 10 channels at packet times of 1ms and 1 to 80 channels at packet times of 125us.

Also provided is an indication of the timing relationship of each of the eight ST 2022-7 flows to PTP with status information, as well as a ST 2022-7 status tool that reports the health and relative timing skew of each ST 2022-7 pair all with hardware time stamping.

Advanced Qx ST 2110 measurement tools include the provision of up to four simultaneous dual Packet Interval Timing measurement windows, detailed data reporting of flow packet, clock rates and PTP timing relationship, as well as IP Receive statistics that includes the measurements of the ST 2110-21 Network Compatibility model (Cinst) and Virtual Receiver Buffer Model (VRX)\*.

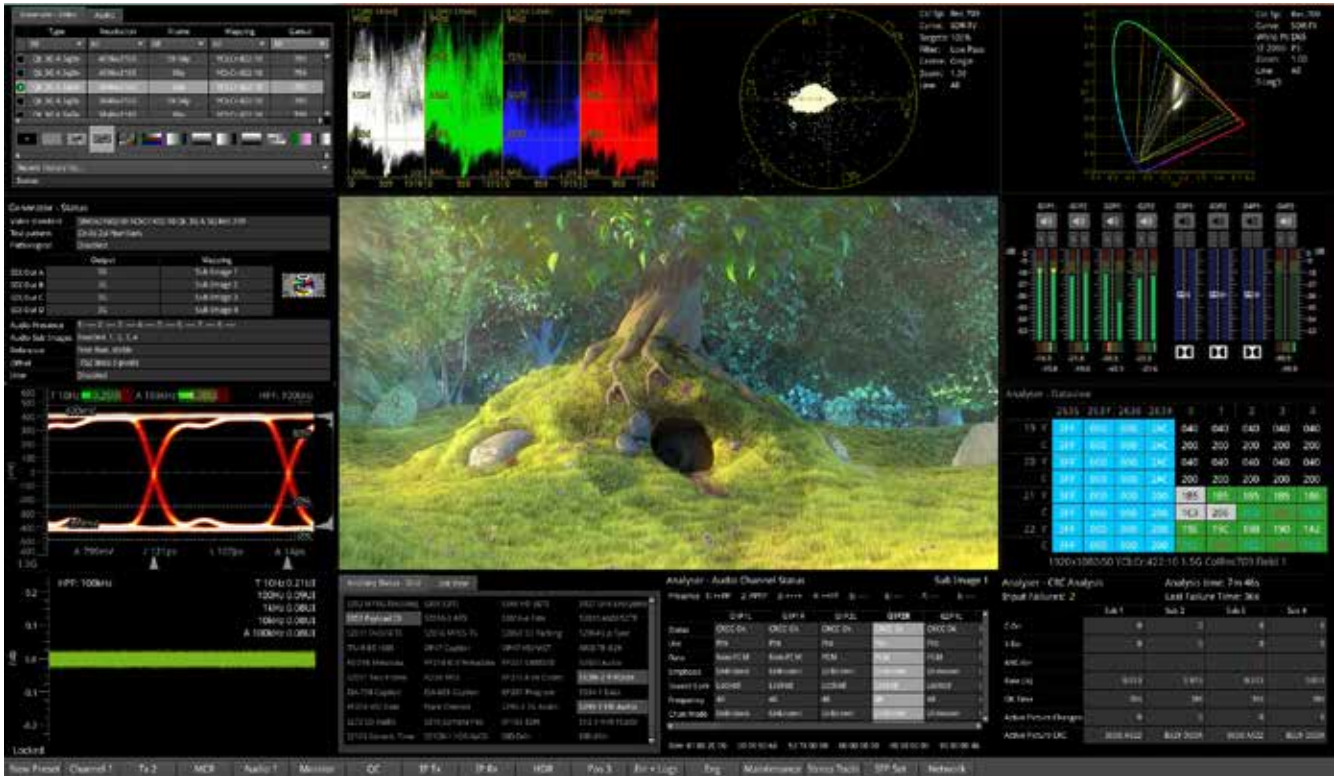
\*Upcoming software release

+JT-NM Tested - For more details on the JT-NM Tested program at IBC 2019 and its test results please see [http://jt-nm.org/jt-nm\\_tested/](http://jt-nm.org/jt-nm_tested/)

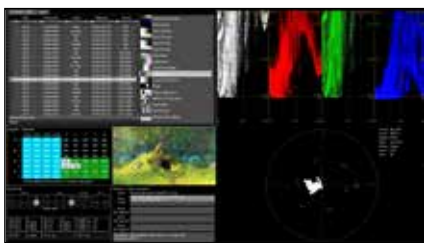
# User-defined Instrument Display Layout

Optimized instrument display with scalable windows to suit individual operators

## SDI Analysis



## Instruments Display



### Display Options

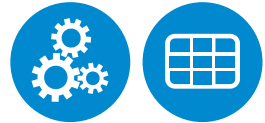
- GUI output frame rate 50, 59.94, 60Hz to match video format
- User-selectable colors of window frames for Analyzer and Generator tools
- Brightness control for office or controlled lighting environments
- GUI on HDMI, SDI and ST 2110-20/30 media flows

### Presets

- Multiple display layouts can be saved as presets
- This allows users to save bespoke layouts for different operational tasks
- Useful for rapidly changing between different screen layouts eg. Audio, HDR or IP focus

### Up to 16 Instruments

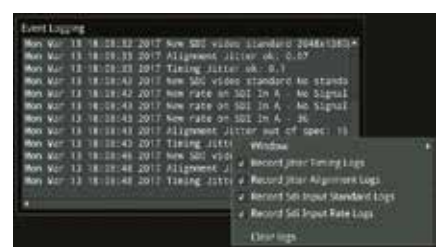
- Fully flexible user-defined instrument layouts
- Display up to 16 instruments on a single 1920x1080 display
- Individual instruments can switch between sixteenth, quarter or full screen (selected instruments)



## IP Analysis



## Control and Logging



### REST API

- The Qx can be controlled remotely over a network via a REST API
- Integrated control, monitoring and automated manufacturer testing

### USB File Manager

- Copy presets, instrument logs, screenshots and user TIFF images via USB memory stick

### VNC and Instrument Screenshots

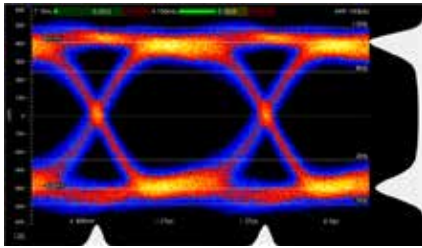
- Interface employs VNC technology to deliver 16 simultaneous scalable instrument windows over a remote network
- SFTP and Browser network access to event logs, screenshots and user presets

### Event Logger

- SDI Input standard/status
- SDI physical layer timing and alignment jitter
- Rest API requests
- IP-Tx, IP-Rx, Flow and SFP records
- Reference Locking
- Audio input presence

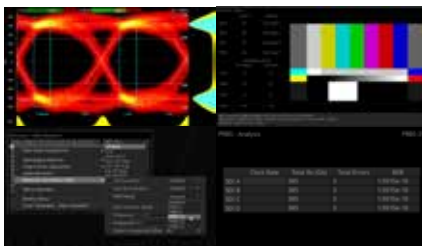
# Optional Toolsets

## Physical Layer Testing (PHQX01E & PHQXL-01E Only)



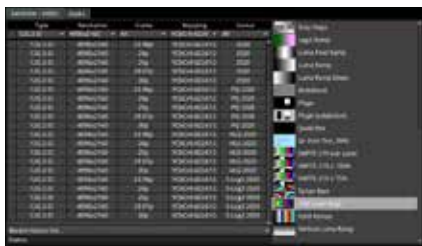
- Factory fitted option for fast 12G/6G/3G/HD-SDI physical layer commissioning, testing and development
- RTE™ (Real-Time Eye) Technology instantly highlights any SMPTE compliance issues including eye amplitude, transition times and overshoot
- Built-in controls for automation allows more reliable, faster testing and at lower cost
- A versatile eye display offers single eye with auto centering, or multiple eyes and can be displayed with a choice of color and heat-map overlays with infinite persistence
- Realtime SDI jitter window provides simultaneous monitoring across five specified frequency bands, jitter histogram and video trigger options

## SDI Stress Testing up to 12G (PHQXO-SDI-STRESS)



- Advanced suite of engineering tools for developers and manufacturers evaluating SDI interfaces
- Comprehensive API for rapid automated testing
- Insert up to 128UI peak to peak SDI clock jitter from 10Hz to 10MHz, mute any of the SDI outputs, control the SDI scrambler, sync-bit insertion, pre-emphasis, rise time and driver amplitude, all under automated control
- Pseudo-Random Binary Sequence (PRBS) generation and analysis of PRBS-7, 9, 15, 23, 31 allows for deterministic measurement of link Bit Error Rates (BER)
- Shorth mean RTE™ amplitude measurement with histogram overlay and a user-defined window for eye amplitude exploration
- Realtime reporting of the rate of creation of SDI pathological conditions

## UHD/4K Upgrade (PHQXO-UHD)



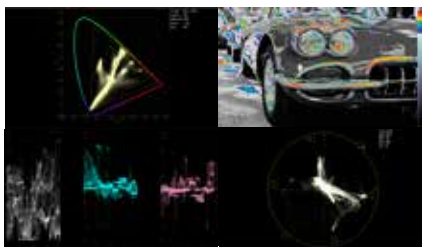
- Support for an additional 36 UHD and 4K SDI formats for a wide range of post production and broadcast applications (see supported formats table on page 15)
- Quad 1.5G and 3G, single 6G, dual 6G and single 12G interfaces at all frame rates including 48 and 49.97Hz
- Extended modes support all color formatting including 4:2:2, 4:2:2:4, 4:4:4, 4:4:4:4 at 10 and 12-bits
- All SDI link configurations fully support Levels A & B with square division and 2 sample interleave (2SI)

## Data View Analyzer with ANC Inspector (PHQXO-DATA)



- Sophisticated engineering grade analysis tools providing easily accessible visualization of the data on an SDI interface and associated ANC packets
- Deep SDI data inspection with full freedom to inspect Active Picture, VANC and HANC
- API controls to read back Active Picture Data under automation control
- ANC packet decapsulation and error reporting for detailed analysis and debug of ANC payloads

## HDR Generation & Analysis (PHQXO-HDR)



- The comprehensive HDR and Wide Color Gamut (WCG) toolset supports all modern live production formats: SDR BT.709, BT.2020 as well as HDR BT.2100 HLG, BT.2100 PQ and Sony S-Log3 and SR Live
- CIE chart, vectorscope and waveform tools to enhance the visualization and analysis of your HDR/WCG content
- Flexible user-controlled HDR heatmap, highlighting signals beyond SDR with 7 simultaneous programmable color overlay bands with presets for HDR/SDR ranges, plus user custom presets
- HDR test pattern generator with both mapped and ITU-R native HLG, PQ and SR Live patterns for checking BT.709 conformity of a HDR Wide Color Gamut System

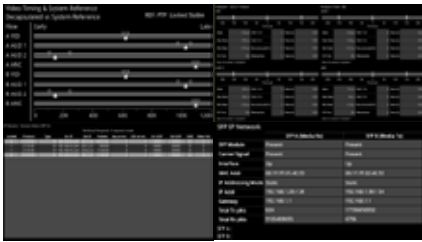
# Qx Optional Toolsets

## Audio and Video Generation (PHQXO-GEN)



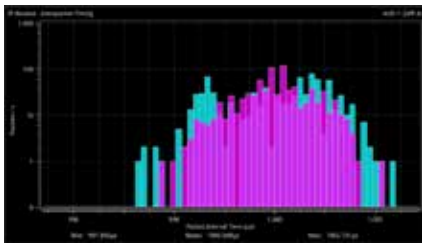
- Simultaneously generate and analyze a comprehensive set of SDI and IP formats with an intuitive, user friendly interface
- Moving test patterns with up to 32 channels of embedded audio per link or sub-field (up to 128 channels on 12G interfaces)
- The Generator Toolset option provides not only the core full screen SDI Pathological SDI stress patterns (Eq, PLL and check field), but also allows the user to define a combination of the SDI stress and conventional generator patterns up to full frame
- Import of TIFF files for checking of HDR/WCG graphics or display and evaluation of user-created test images

## ST 2110 and ST 2022-6 Monitoring (PHQXO-IP-STND)



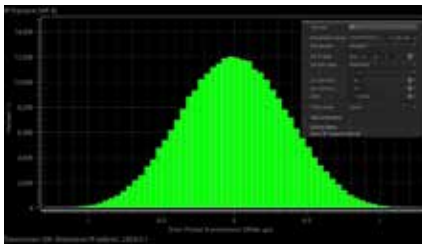
- Operator suite of stream monitoring tools for next generation professional IP media environments
- Simultaneously monitor 1 video, 2 audio and 1 ANC ST 2110 flows with ST 2022-7 seamless IP protection switching (SIPS)
- Easily accessible status reporting of flow health and SIPS and PTP Status
- Operational Audio flexibility with ST 2110-30 Class C (up to 80 channels at 125us) and support for ST 2110-31 AES encapsulation of Dolby® Audio
- TR-1001: NMOS IS-04 and IS-05 with LLDP and PTP system resource\*

## ST 2110 Analysis (PHQXO-IP-MEAS)



- Engineering suite of tools for ST 2110 analysis and debug
- Display up to four simultaneous Packet Interval Timing measurements per input for easy visualization of network congestion and sender packet distribution with max, mean and min inter-packet arrival times
- Receive statistics that include the measurements of the ST 2110-21 Network Compatibility model (Cinst) and Virtual Receiver Buffer Model (VRX)
- Advanced measurement of IP flow latency and RTP clock timing relationships for debug of Audio, Video and ANC alignment, source PTP and encapsulation

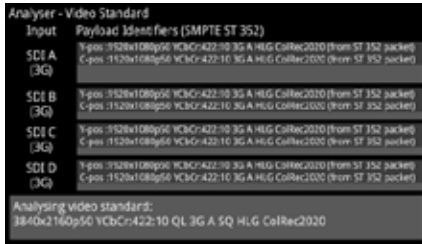
## ST 2022-6 Packet Interval Profile Generator (PHQXO-IP-NGT)



- Advanced ST 2022-6 packet generation tool for evaluating the ability of a receiver to handle a jittered ST 2022-6 flow
- Simulate IP video network packet jitter under a variety of network conditions by providing the ability to adjust the transmission distribution profile
- View the interval timing distribution of the packets being generated, the number of packets being generated each second, against the deviation of each packet interval from the expected interval time

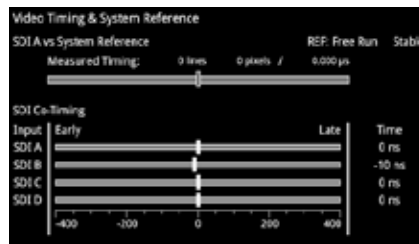
\*Upcoming software release

# I/O Options



## Analyzer - Video Standard

- Display of detected SMPTTE S352 Payload ID for each SDI Link and Subframe
- Manual over-ride of S352 ID
- Selection of SMPTTE video format
- Indication of S352 errors
- Qx, QxL-01, QxL-01E Only



## SDI Video Timing & System Reference

- Measurement of the timing of inputs against reference
- Indication of reference status and stability
- Indication of the relative co-timing of input SDI channels
- Graphical and numeric display
- Qx, QxL-01, QxL-01E Only



## System IO

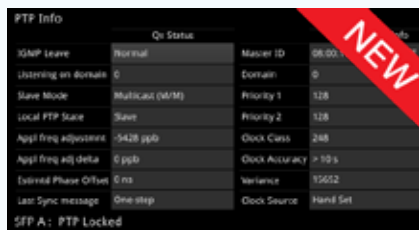
- Shows the status of signal inputs and outputs, external reference, cable length, and connector details
- SDI mode: Select BNC or SFP I/O, cable type, loop through and generator copy outputs
- IP mode: Active IP SFP receive inputs and transmit outputs are indicated
- Qx, QxL-01, QxL-01E Only

## IP license for ST 2022-6, ST 2110 Decap with ST 2022-7 and PTP [PHQXO-IP-STND]



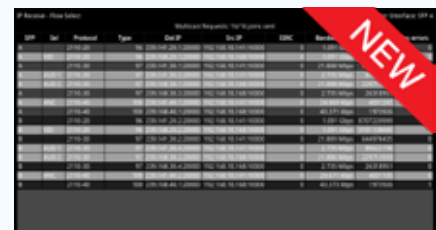
## SFP IP Network

- Reporting of presence of SFPs, SFP MAC and IP addresses (flow source IP address), and interface status
- Tx and Rx packet counters for indication of traffic activity
- User configuration of SFP IP Addresses, Masks and Gateway Addresses



## ST 2110 PTP Info - 2 port

- Control of PTP domain and communication mode (multicast, hybrid w/o negotiation)
- Indication of lock status
- Grandmaster information including master ID and time source
- Indication of estimated frequency and phase lock offsets
- Indication of one step or two step traffic
- 2 independant PTP slaves



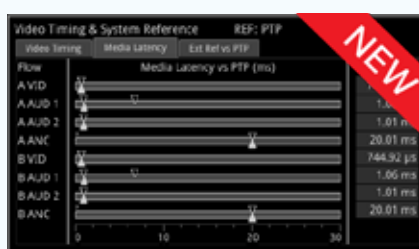
## IP Receive Multi Flows

- Reporting of the IP Flows available to the receiver and user selection of the required flows
- Indication of Qx locked status, Protocol, Src and Dst IP and Port Numbers, SSRC, Packet Counts, Sequence, payload and CRC errors
- Configuration of Multicast Destination IP addresses and subsequent Multicast Join requests



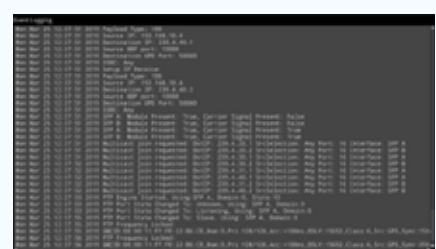
## ST 2022-7 Status

- Indication of the health of ST 2022-7 seamless protection
- Warning of ST 2022-7 flow-pair mis-match
- Warnings of errors on flows and errors on reconstructed output and error rates/second
- Relative measure of Path Differential of flows on SFPB (Blue Network) relative to SFP A (Amber Network)
- Class A, B, C, D markers



## IP Flow Latency

- Indication of media latency
- Relative timing of audio and ANC flows wrt video
- Indication of relationship of underlying media to PTP



## IP Event Logging

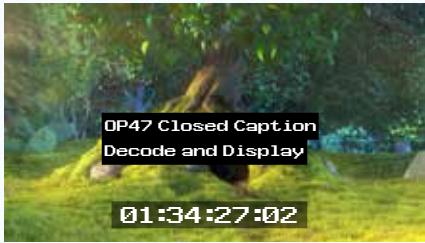
- Event logs of: PTP, IP Interfaces, Rx Traffic, Tx Traffic, SFP records
- Syslog export



# Core Toolset

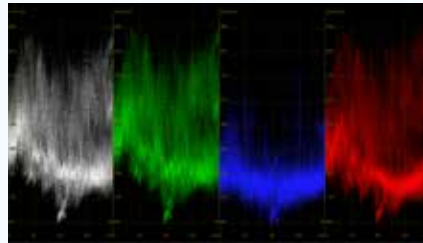


## Video



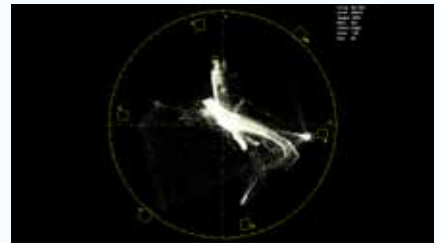
### Analyzer - Picture

- Cursors linked to Waveform and Data View
- ANC Timecode with OSD
- Closed Captions OP47, CEA-608 in 708
- 2 simultaneous Closed Caption decode picture windows
- Paint, Pop and Scroll Display Modes
- Italic and underlined character sets
- Action and title safe areas
- SCTE 104 indicator\*



### Analyzer - Waveform

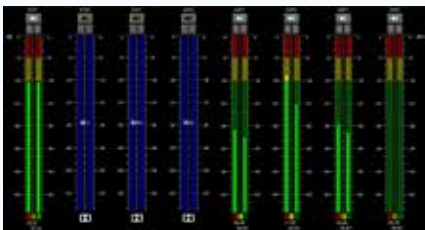
- YCbCr, YGBR and GBR parade modes
- Cursor linked to Picture and Data View
- Single line mode linked to Picture Cursor
- Configurable H and V Graticules
- User markers
- Overlay\*, Stacked\*, Parade, Single line, H & V Mag, Brightness, Persistence and Monochrome controls
- 12-bit processing



### Analyzer - Vectorscope

- 75% and 100% Targets for ITU-R Rec. 709, Rec. 2020 and HDR formats
- User targets linked to Waveform
- 0.5x to 4x Mag, center on chosen target
- Single line mode linked to Picture Cursor
- Tooltip display of Cb, Cr and Hue Angle
- IQ axis on/off
- 12-bit processing

## Audio



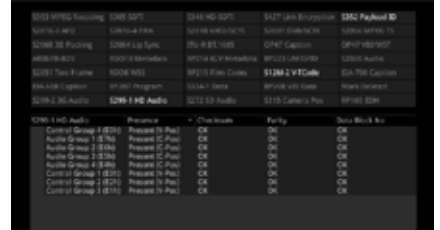
### Analyzer - Audio Meters

- 32 channel audio metering, embedded/AES
- Metering Ballistics: PPM-I, PPM-II, Vu, Vu-Fr
- Scales: dBFS, dBu -18, dBu -20, BBC, DIN45406, NordicN9
- Adjustable peak hold times: Off, 0.1 s to Inf
- Audio pair phase meters, numerical level
- Detection of Dolby DE, DD, DD+, DE line pos
- Stereo/mono audio preview bus



### Audio Status

- 32 channel indication of audio type and presence, PCM, Dolby DE, DD, DD+
- Decoded channel status information for up to 128 channels
- Clear indication of useful audio parameters including CRCC, PCM/data, sample frequency, word length
- Channel Status data view (Hex)



### Analyzer - Ancillary Status

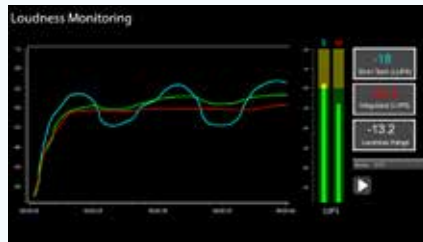
- SMPTE ST 291 VANC/HANC ancillary data presence/status window
- Grid View – clear visual overview, present/absent/fault indication
- List View – ANC present list with location and status information for Checksum, Parity, DBN
- Link to ANC Inspector
- Tool tip provides ST 291 ANC type overview

NEW



### CRC Analysis

- Check for CRC errors on Y, C and ANC
- Reporting of the number of SDI input failures, the last failure time, total analysis time and error rates
- Detect active picture changes and view the active picture CRC to observe any changes in the expected active picture CRC value



### Loudness Monitoring\*

- EBU R128 and ITU-R BT.1770
- Indicators for true peak, range, momentary, short term and integrated loudness
- User control of integrated, momentary and short term targets
- User adjustable true peak alarm threshold
- Loudness logging stored automatically



### AES IO Config

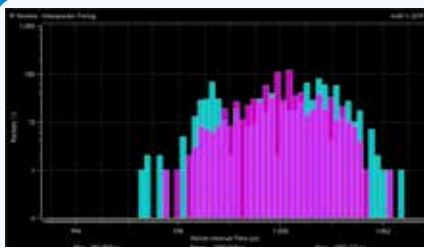
- 4 versatile bi-directional AES unbalanced interfaces
- Audio meter monitoring pair, or generator audio outputs or an AES input
- SDI Input to AES Output audio conversion for both PCM and Dolby encoded audio
- AES Input signals can be routed to other AES outputs providing a single loop output or up to 3 copy outputs

\*Upcoming software release

# Optional Toolsets

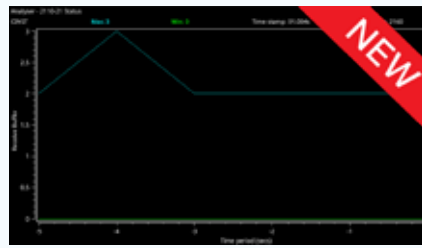


## IP Network Traffic Measurement [PHQXO-IP-MEAS]



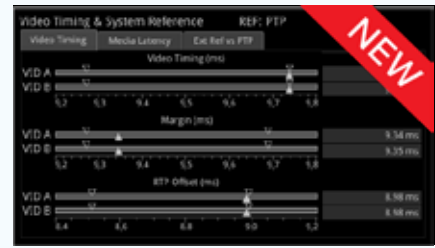
### Inter-packet Timing

- Stream health reporting using histogram to visualize the distribution of inter-packet arrival times
- Simultaneous reporting of ST 2022-7 primary and secondary flow
- Packet counts (log or linear scales) mapped against arrival times ( $\mu$ s)
- Easy diagnosis of congestion with max, mean and min inter-packet arrival times



### IP Receive Statistics

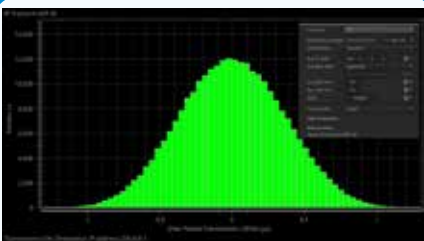
- Reporting of receiver flow video statistics and stability
- ST 2022-6 measurement of total and active samples per line and lines per frame and indication of ST 352 Payload ID
- ST 2110-21 measurement of Network Compatibility Model (Cinst) and Virtual Receiver Buffer Model (VRX)
- PCAP export of kernel traffic\*



### Adv. PTP Media Timing

- Measurement of the timing relationship of flows against PTP
- PTP timing vs external analog reference\*
- Data showing the relationship of the transmitter encapsulation and media to PTP
- Measured number of RTP packets and RTP clock rate per second
- Measured RTP clocks per packet per second

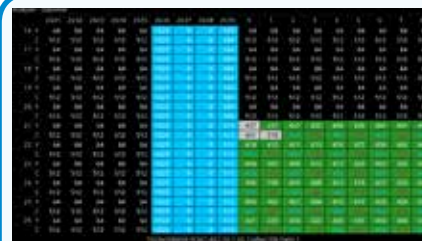
## Packet Interval Profile Generator [PHQXO-IP-NGT] (Requires PHQXO-GEN)



### IP Transmit (ST 2022-6)

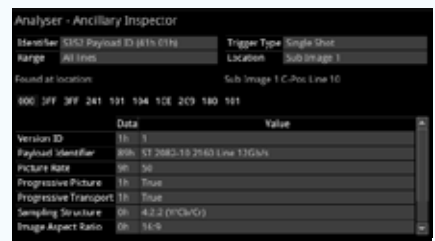
- Configuration of Transmission flow addresses, port numbers and SSRC
- Injection of Inter-packet jitter onto outgoing flow
- Gaussian or uniform distribution
- Flow control on/off

## Data [PHQXO-DATA]



### Analyzer - Data View

- Allows analysis of complex faults particularly in an R&D environment
- Detailed view of data words in the SDI stream with tooltip hint
- Navigate function for rapid access to a required line, pixel or TRS word
- Color coding to help identification
- Cursor linked to Picture and Waveform



### ANC Inspector

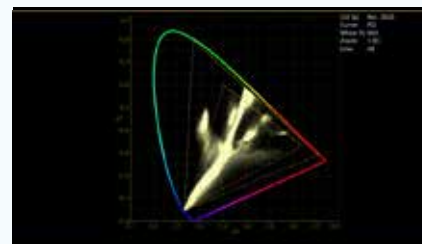
- Ancillary data packet analyzer
- Link from ANC Status window
- User-defined DID/SDID windowed search
- Trigger on error, single shot, continuous
- ANC packet capture with Hex view
- ANC packet decode view

## HDR Toolset [PHQXO-HDR]



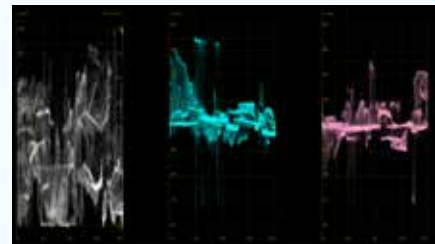
### False Color Highlighting

- Programmable 'Heat Map' to highlight luminance zones providing quick identification of shadows, skin or mid-tones or specular highlights
- 7 simultaneous programmable color overlay bands
- Presets for HDR and SDR ranges plus user custom



### Analyzer - CIE Chart

- CIE 1931 x,y display
- Single line mode linked to picture cursor
- Pan and zoom
- ITU-R BT. 709, BT. 2020 and ST 2086 gamut overlays
- Tooltip co-ordinate display
- Support for BT. 1886, BT. 2100 HLG and PQ, Sony S-Log3, SR Live



### HDR Waveform and Gen.

- Waveform HDR gratitudes with Nits ( $Cd/m^2$ )
- BT. 2408 diffuse white markers
- SDR patterns mapped to HDR Rec. BT. 2020 containers – useful for like for like set-up of HDR and SDR monitors and line checks
- Full Rec. 2020 patterns
- Support for BT. 1886, BT. 2100 HLG and PQ, Sony S-Log3, SR Live

# Optional Toolsets

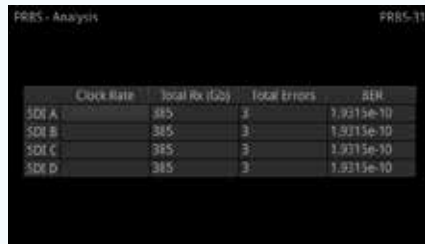


SDI-STRESS Toolset [PHQXO-SDI-STRESS - requires PHQX01E/PHQXL-01E and PHQXO-GEN license]



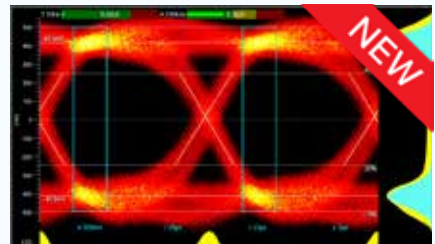
## Adv. Generator Tools

- Generation of PRBS-7, 9, 15, 23, 31
- SDI scrambler and sync bit insertion on/off
- Control of SDI driver amplitude +/-15%
- Control of jitter insertion frequency, amplitude and type
- Control of pre-emphasis, rise/fall time



## PRBS Analyzer

- Indication of PRBS cumulative received data and PRBS type
- Reported cumulative errors
- Calculated Bit Error Rate (BER)



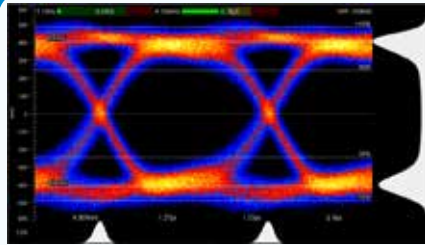
## Advanced Eye Analysis

- Choice of Shorth Mean or Mode amplitude measurements
- User-definable time measurement window for exploring amplitude measurement



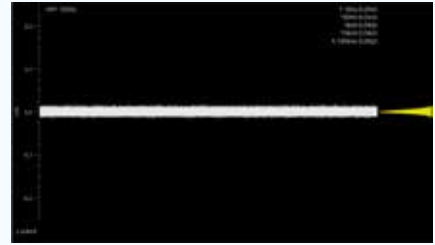
## Pathological Detector

- Generator status indication of rate at which the video pattern generator is creating SDI pathological conditions
- Indication of PLL and EQ pathological rates/second
- Detection on each active SDI link
- Realtime GPI outputs of pathological detect for external equipment triggering



## SDI EYE Analysis

- Real-Time Eye (RTE) for testing SMPTE compliance with indication of DC offset
- DC coupled and automatic measurements of: amplitude, rise and fall time, jitter and under/overshoot, visual rise time indication
- Amplitude and time histograms
- Single or multiple eyes with choice of color, heat-map overlay and infinite persistence



## SDI Jitter Analysis

- Realtime SMPTE jitter measurements down to 10Hz
- 10Hz, 100Hz, 1kHz, 10kHz, 100kHz filters
- H, 2H, F, V Trigger
- Infinite persistence modes
- +/- 0.25 to +/- 8 UI vertical scale adjustment
- Jitter amplitude histogram

## SDI Physical Layer Analysis Toolset [Requires PHQXM-01E Mezzanine]

## Generator Toolset [PHQXO-GEN]



## Video Generation

- 12G/6G/3G/1.5G 4K/UHD and 2K/HD SDI signal generation
- Support for Single, Dual and Quad links with single, square and 2SI sub-images, Level A and B
- Moving test patterns
- 422, 444, 4224 and 4444, YCbCr and RGB Formats
- Import and display of TIFF images



## Audio Generation

- 32 channel audio generation, 128 channel embedder
- Choice of fixed tones or chromatic scale – to help with channel identification
- Choice of fixed or ramp levels – to help with channel identification
- Custom config of number of active audio groups and channels
- Master gain control



## Pathological Generation

- Proposed SMPTE pathological stress pattern; Eq, PLL, Clock
- SDI pathological stress patterns, Eq, PLL, SMPTE 12G/6G/3G and CheckField
- User-definable combination of SMPTE or SDI stress and conventional patterns up to full frame

\*Upcoming software release

# Specifications

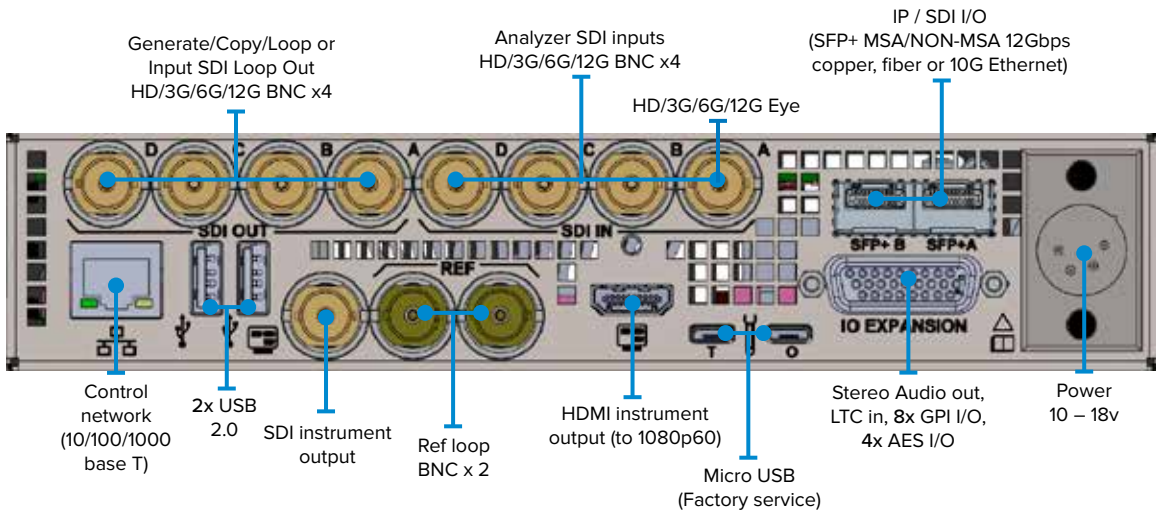


	Qx	QxL
<b>Formats supported (Generation, Analysis &amp; Monitoring)</b>		
IP SMPTE 2110/2022-7	○	●
IP SMPTE 2022-6	○	●
3G/HD-SDI	●	Factory Option
12G/6G-SDI	○	Factory Option
SDI Eye and Jitter Physical Layer Analysis	Factory Option	Factory Option
UHD over 25G IP	-	○
<b>Software Options Supported</b>		
Audio/Video Generator (SDI, ST 2022-6, ST 2110)	○	○
Eye and Jitter Toolset	○	○
UHD/4K Upgrade	SDI Option	○
SDI-STRESS Testing Toolset	○	○
Data View Analyzer with ANC Inspector	○	○
HDR/WCG Support	○	○
IP ST 2022-6 Decap, ST 2110-20/30/31/40 Decap with ST 2022-7 and PTP	○	●
IP Network Traffic Measurement Toolset	○	○
IP Network Traffic Generation Toolset	○	○
Advanced IP Stress Toolset	○	○
<b>Video inputs / outputs</b>		
4 x SDI inputs, HD/3G, 75 Ohm terminated BNC	●	Factory Option
4 x SDI inputs, HD/3G/6G/12G, 75 Ohm terminated BNC	○	Factory Option
4 x SDI outputs, HD/3G, 75 Ohm BNC	●	Factory Option
4 x SDI outputs, HD/3G/6G/12G, 75 Ohm BNC	○	Factory Option
RTE™ Real-Time Eye input (12G/6G/3G/HD-SDI) x 1 (SDI input A) BNC	Factory Option	Factory Option
1 x SDI output, HD/3G/12G, 75 Ohm Micro-BNC (shared with instrument out)	-	○
2 x SFP+ MSA/NON-MSA cages (supports 12Gbps copper or fiber SDI interfaces)	-	○
<b>Ethernet IP inputs/outputs (accepts generic SFPs)</b>		
2 x SFP+ 10G Cages (also supports MSA/NON-MSA 12Gbps copper or fiber SDI SFPs)	●	N/A
2 x SFP28 10/25G cages	-	●
2 x QSFP28 10/25/40/50/100G cages	-	○
<b>Audio inputs/outputs</b>		
4 x 75 Ohm AES selectable I/O (26 pin high density 'D' Type socket)	●	●
1 x Stereo analog audio output (26 pin high density 'D' Type socket)	●	●
8 channel 48kHz PCM audio on HDMI and SDI Instrument output	●	●
<b>User interface</b>		
HDMI 1.4 instrument output, 1920 x 1080, 4:4:4 RGB, Type A	HDMI 1.4	HDMI 2.0b SDR/HDR
SDI 3Gbit SDR/HDR instrument out, 1920 x 1080, 4:2:2 YCbCr	BNC	
ST 2110-20 SDR/HDR, ST 2110-30 instrument out, 1920 x 1080, 4:2:2 YCbCr	○	●
<b>Reference</b>		
2 x 75 Ohm BNC high impedance looping reference input, tri-level or B&B with cross lock	●	-
1 x 75 Ohm Micro-BNC terminating ref input, Tri/B&B with cross lock	-	●
<b>Networking &amp; control</b>		
10/100/1000 BASE-T	●	●
8 x bi-directional GPI (26 pin high density 'D' Type socket)	●	●
<b>Monitoring</b>		
Internal Beeper	●	●
<b>Form factor</b>		
Size (Width x Height x Depth - excluding projections)	253 x 44 x 211 mm	253 x 44 x 211 mm
Weight	1.9 kg	1.9 kg
<b>Electrical</b>		
Power consumption	50W typical, 70W max	50W typical, 70W max
4 Pin XLR power connector	12V nominal (10V-18V)	12V nominal (10V-18V)
AC Power adapter	90-264VAC, 120W	90-264VAC, 120W
<b>Warranty</b>		
Warranty (1 year)	●	●
Extended Warranty Package (3 - 5 years)	○	○

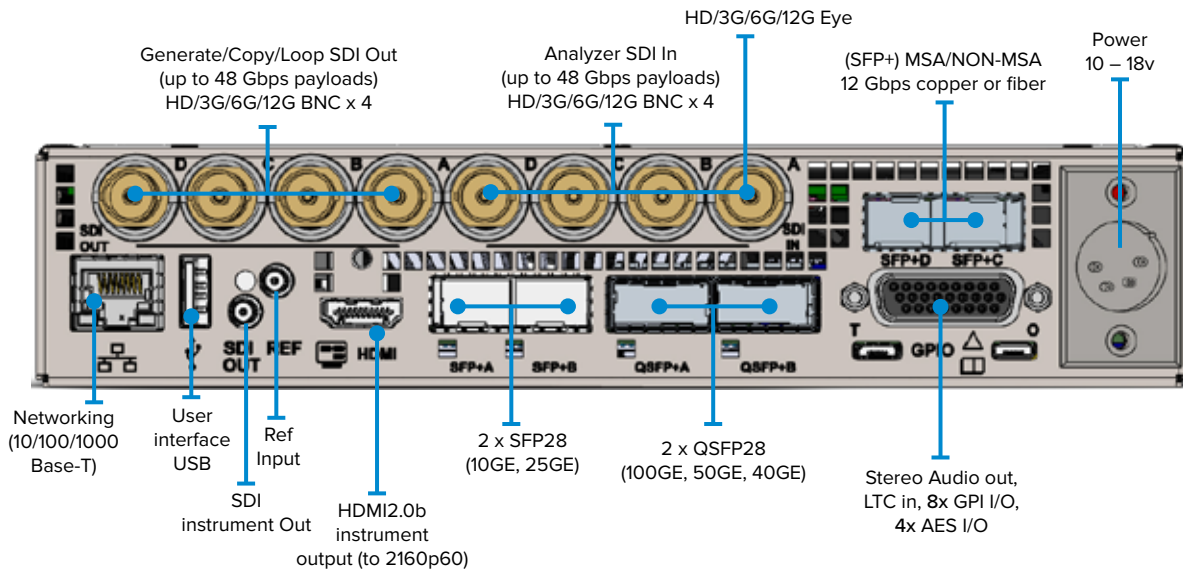
● Standard  
○ Optional

# Rear panel

## Qx



## QxL



# Ordering Qx

## Qx Chassis (includes PHQXO-SDI-STND)

PHQX01-3G	Qx 1U ½ rack HD/2K rasterizer, SDI analyzer only
PHQX01-12G	Qx 1U ½ rack UHD/4K rasterizer, SDI analyzer only
PHQX01E-3G	Qx 1U ½ rack HD/2K rasterizer, SDI analyzer with Eye & Jitter
PHQX01E-12G	Qx 1U ½ rack UHD/4K rasterizer, SDI analyzer with Eye & Jitter

## Qx SDI Software Options

PHQXO-UHD	UHD/4K upgrade for PHQX01-3G or PHQX01E-3G
PHQXO-SDI-STRESS	Advanced SDI Stress Testing Toolset (requires PHQX01E-12G and PHQXO-GEN)

## Qx SDI/IP Software Options

PHQXO-GEN	Audio/Video Generator (SDI, ST 2022-6, ST 2110*)
PHQXO-DATA	Data View Analyzer with ANC inspector
PHQXO-HDR	HDR/WCG support, CIE 1931 chart, HDR Heatmap

## Qx IP Options

PHQXO-IP-STND	IP license for ST 2022-6 Encap and Decap, ST 2110 Decap with ST 2022-7 and PTP
PHQXO-IP-MEAS*	IP Network Traffic Measurement Toolset (requires PHQXO-IP-STND)
PHQXO-IP-NGT	ST 2022-6 Packet Interval Profile Generator (requires PHQXO-IP-STND, PHQXO-GEN)
PHSFP-10GE-SR	10GBASE-SR Ethernet short range SFP+ 850nm, 300m, multi-mode transceiver
PHSFP-10GE-LR	10GBASE-LR Ethernet long range SFP+ 1310nm, 10km, single mode transceiver

## Qx Fitting Kits

PHQXK1	Qx 19" rack mount kit (1x Qx chassis)
PHQXK2	Qx 19" rack mount kit (2x Qx chassis)
PHQXK3	Qx Mounting kit – 9.5" rack (1x Qx chassis)

## Qx Extended Warranty

PHQX-3YEAR	3 Year Warranty**
PHQX-5YEAR	5 Year Warranty**

# Ordering QxL (Preliminary Information - subject to change)

## QxL Chassis (includes PHQXO-IP-STND)

PHQXL	QxL 1U ½ rack HD/2K IP rasterizer, analyzer only
PHQXL-01	QxL 1U ½ rack HD/2K IP/SDI rasterizer, analyzer only
PHQXL-01E	QxL 1U ½ rack HD/2K IP/SDI rasterizer, analyzer with Eye/Jitter

## QxL SDI Software Options

PHQXO-UHD	UHD/4K upgrade
PHQXO-SDI-STRESS	Advanced SDI Stress Testing Toolset (requires PHQXL-01E and PHQXO-GEN)

## QxL SDI/IP Software Options

PHQXO-GEN	Audio/Video Generator
PHQXO-DATA	Data View Analyzer with ANC inspector
PHQXO-HDR	HDR/WCG support, CIE 1931 chart, HDR Heatmap

## QxL IP Options

PHQXO-IP-MEAS*	IP Network Traffic Measurement Toolset
PHSFP-10GE-SR	10GBASE-SR Ethernet short range SFP+ 850nm, 300m, multi-mode transceiver
PHSFP-10GE-LR	10GBASE-LR Ethernet long range SFP+ 1310nm, 10km, single mode transceiver
PHSFP-25GE-SR	25GBASE-SR Ethernet short range SFP28 850nm, 300m, multi-mode transceiver
PHSFP-25GE-LR	25GBASE-LR Ethernet long range SFP28 1310nm, 10km, single mode transceiver

## QxL Fitting Kits

PHQXK1	Qx 19" rack mount kit (1x Qx chassis)
PHQXK2	Qx 19" rack mount kit (2x Qx chassis)
PHQXK3	Qx Mounting kit – 9.5" rack (1x Qx chassis)

## QxL Extended Warranty

PHQXL-3YEAR	3 Year Warranty**
PHQXL-5YEAR	5 Year Warranty**

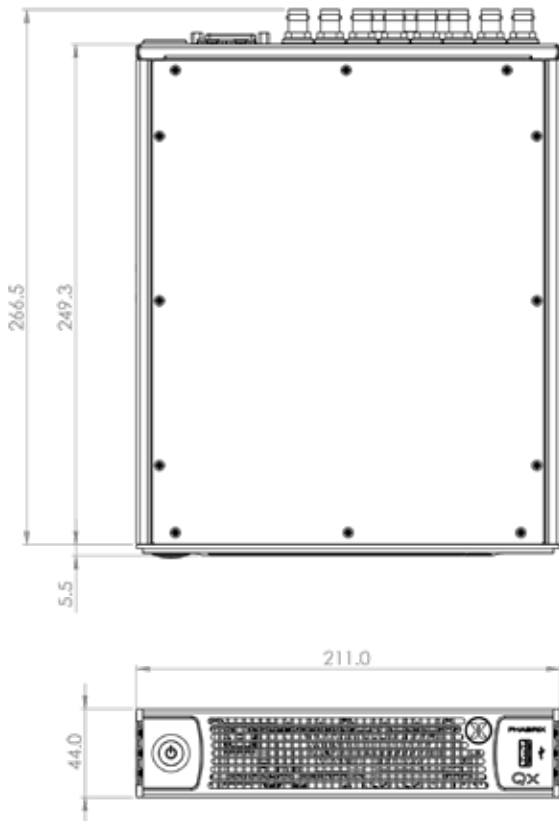
\* Upcoming Software Release

\*\* One year warranty included as standard

# Formats Supported

	SMPTE Stnds. Link (Content)	Interface	Resolution	Sampling Structure	Pixel Depth	Frame/Field Rate	HDR	SDI	2022-6	2110
2K/HD	ST 292 (ST 296)	HD	1280 x 720	4:2:2 (YCbCr)	10	60p, 59.94p, 50p, 30p, 29.97p, 25p,		O	O	O
	ST 292 (ST 274)	HD	1920 x 1080	4:2:2 (YCbCr)	10	60i, 59.94i, 50i		O	O	O
	ST 292 (ST 274)	HD	1920 x 1080	4:2:2 (YCbCr)	10	30p, 29.97p, 25p, 24p, 23.98p		O	O	O
	ST 292 (RP 211)	HD	1920 x 1080	4:2:2 (YCbCr)	10	30psf, 29.97psf, 25psf, 24psf, 23.98psf		O	O	O
	ST 292 (ST 2048-2)	HD	2048 x 1080	4:2:2 (YCbCr)	10	30p, 29.97p, 25p, 24p, 23.98p 30psf, 29.97psf, 25psf, 24psf, 23.98psf		O	O	O
	ST 425-1 (ST 274)	3G Level A (I)	1920 x 1080	4:2:2 (YCbCr)	10	60p, 59.94p, 50p		O	O	O
	ST 425-1 (ST 2048-2)	3G Level A (I)	2048 x 1080	4:2:2 (YCbCr)	10	60p, 59.94p, 50p, 48p, 47.95p		O	O	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		-	O	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, 30p, 29.97p, 25p, 24p, 23.98p, 30psf, 29.97psf, 25psf, 24psf, 23.98psf		O	O	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	30p, 29.97p, 25p, 24p, 23.98p, 30psf, 29.97psf, 25psf, 24psf, 23.98psf		O	O	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	O	O
	ST 425-1 (ST 2048-2)	3G Level A (3)	2048 x 1080	4:4:4 (YCbCr/RGB)	12	30p, 29.97p, 25p, 24p, 23.98p, 30psf, 29.97psf, 25psf, 24psf, 23.98psf		O	O	O
	ST 425-1 (ST 274)	3G Level A (4)	1920 x 1080	4:2:2 (YCbCr)	12	60i, 59.94i, 50i, 30p, 29.97p, 25p, 24p, 23.98p, 30psf, 29.97psf, 25psf, 24psf, 23.98psf		O	O	O
	ST 425-1 (ST 2048-2)	3G Level A (4)	2048 x 1080	4:2:2 (YCbCr) 4:2:2:4 (YCbCrA)	12	30p, 29.97p, 25p, 24p, 23.98p, 30psf, 29.97psf, 25psf, 24psf, 23.98psf		O	O	O
	ST 425-1 (ST 274)	3G Level B-DL	1920 x 1080	4:2:2 (YCbCr)	10	60p, 59.94p, 50p		O	O	O
	ST 425-1 (ST 2048-2)	3G Level B-DL	2048 x 1080	4:2:2 (YCbCr)	10	60p, 59.94p, 50p, 48p, 47.95p		O	O	O
	ST 425-1 (ST 274)	3G Level B-DL (I)	1920 x 1080	4:4:4 (YCbCr/RGB) 4:4:4:4 (YCbCrA/RGBA)	10	60i, 59.94i, 50i, 30p, 29.97p, 25p, 24p, 23.98p, 30psf, 29.97psf, 25psf, 24psf, 23.98psf		O	O	O
	ST 425-1 (ST 2048-2)	3G Level B-DL (I)	2048 x 1080	4:4:4 (YCbCr/RGB) 4:4:4:4 (YCbCrA/RGBA)	10	30p, 29.97p, 25p, 24p, 23.98p, 30psf, 29.97psf, 25psf, 24psf, 23.98psf		O	O	O
	ST 425-1 (ST 274)	3G Level B-DL (II)	1920 x 1080	4:4:4 (YCbCr/RGB)	12	60i, 59.94i, 50i, 30p, 29.97p, 25p, 24p, 23.98p		O	O	O
	ST 425-1 (ST 2048-2)	3G Level B-DL (II)	2048 x 1080	4:4:4 (YCbCr/RGB)	12	30psf, 29.97psf, 25psf, 24psf, 23.98psf 30p, 29.97p, 25p, 24p, 23.98p		O	O	O
ST 425-1 (ST 274)	3G Level B-DL (IV)	1920 x 1080	4:2:2 (YCbCr)	12	60i, 59.94i, 50i, 30p, 29.97p, 25p, 24p, 23.98p, 30psf, 29.97psf, 25psf, 24psf, 23.98psf		O	O	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	O	O	
4K/UHD	ST 425-3 Annex B1 (ST 2036-1)	Quad-link HD-SQ	3840 x 2160	4:2:2 (YCbCr)	10	30p, 29.97p, 25p, 24p, 23.98p		O	O	-
	ST 425-3 Annex B1 (ST 2048-1)	Quad-link HD-SQ	4096 x 2160	4:2:2 (YCbCr)	10	30p, 29.97p, 25p, 24p, 23.98p		O	O	-
	ST 2081-10 M1 (ST 2036-1)	6G-2SI	3840 x 2160	4:2:2 (YCbCr)	10	30p, 29.97p, 25p, 24p, 23.98p		O	O	O*
	ST 2081-10 M1 (ST 2048-1)	6G-2SI	4096 x 2160	4:2:2 (YCbCr)	10	30p, 29.97p, 25p, 24p, 23.98p		O	O	O*
	ST 425-5 (ST 2036-1)	Quad-link 3G-A (I) 2SI	3840 x 2160	4:2:2 (YCbCr)	10	60p, 59.94p, 50p		O	O	-
	ST 425-5 (ST 2048-1)	Quad-link 3G-A (I) 2SI	4096 x 2160	4:2:2 (YCbCr)	10	60p, 59.94p, 50p, 48p, 47.95p		O	O	-
	ST 425-5 (ST 2036-1)	Quad-link 3G-A, B (I) 2SI	3840 x 2160	4:4:4 (YCbCr/RGB)	10	30p, 29.97p, 25p, 24p, 23.98p		O	O	-
	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		O	O	-
	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		O	O	-
	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		O	O	-
	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		O	O	-
	ST 425-5 (ST 2048-1)	Quad-link 3G-A (4) 2SI	4096 x 2160	4:2:2 (YCbCr) 4:2:2:4 (YCbCrA)	12	30p, 29.97p, 25p, 24p, 23.98p		O	O	-
	ST 425-5 Annex B (ST 2036-1)	Quad-link 3G-A, B (I) SQ	3840 x 2160	4:2:2 (YCbCr) 4:2:0 (YCbCr)	10	60p, 59.94p, 50p		O	O	-
	ST 425-5 Annex B (ST 2048-1)	Quad-link 3G-A, B (I) SQ	4096 x 2160	4:2:2 (YCbCr)	10	60p, 59.94p, 50p, 48p, 47.95p		O	O	-
	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		O	O	-
	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		O	O	-
	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		O	O	-
	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		O	O	-
	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		O	O	-
	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		O	O	-
	ST 2081-11 M1, ST 425-5 (ST 2036-1)	Dual-link 6G-2SI (I)	3840 x 2160	4:2:2 (YCbCr)	10	60p, 59.94p, 50p		O	O	-
	ST 2081-11 M1, ST 425-5 (ST 2048-1)	Dual-link 6G-2SI (I)	4096 x 2160	4:2:2 (YCbCr)	10	60p, 59.94p, 50p, 48p, 47.95p		O	O	-
	ST 2081-11 M1, ST 425-5 (ST 2036-1)	Dual-link 6G-2SI (II)	3840 x 2160	4:4:4 (YCbCr/RGB)	10	30p, 29.97p, 25p, 24p, 23.98p		O	O	-
	ST 2081-11 M1, ST 425-5 (ST 2048-1)	Dual-link 6G-2SI (II)	4096 x 2160	4:4:4 (YCbCr/RGB) 4:4:4:4 (YCbCrA/RGBA)	10	30p, 29.97p, 25p, 24p, 23.98p		O	O	-
	ST 2081-11 M1, ST 425-5 (ST 2036-1)	Dual-link 6G-2SI (III)	3840 x 2160	4:4:4 (YCbCr/RGB)	12	30p, 29.97p, 25p, 24p, 23.98p		O	O	-
	ST 2081-11 M1, ST 425-5 (ST 2048-1)	Dual-link 6G-2SI (III)	4096 x 2160	4:4:4 (YCbCr/RGB)	12	30p, 29.97p, 25p, 24p, 23.98p		O	O	-
	ST 2081-11 M1, ST 425-5 (ST 2036-1)	Dual-link 6G-2SI (IV)	3840 x 2160	4:2:2 (YCbCr/RGB)	12	30p, 29.97p, 25p, 24p, 23.98p		O	O	-
	ST 2081-11 M1, ST 425-5 (ST 2048-1)	Dual-link 6G-2SI (IV)	4096 x 2160	4:2:2 (YCbCr) 4:2:2:4 (YCbCrA)	12	30p, 29.97p, 25p, 24p, 23.98p		O	O	-
	ST 2082-10 M1, ST 425-5 (ST 2036-1)	12G-2SI (I)	3840 x 2160	4:2:2 (YCbCr)	10	60p, 59.94p, 50p		O	O	-
	ST 2082-10 M1, ST 425-5 (ST 2048-1)	12G-2SI (I)	4096 x 2160	4:2:2 (YCbCr)	10	60p, 59.94p, 50p, 48p, 47.95p		O	O	-
	ST 2082-10 M1, ST 425-5 (ST 2036-1)	12G-2SI (II)	3840 x 2160	4:4:4 (YCbCr/RGB)	10	30p, 29.97p, 25p, 24p, 23.98p		O	O	-
	ST 2082-10 M1, ST 425-5 (ST 2048-1)	12G-2SI (II)	4096 x 2160	4:4:4 (YCbCr/RGB) 4:4:4:4 (YCbCrA/RGBA)	10	30p, 29.97p, 25p, 24p, 23.98p		O	O	-
ST 2082-10 M1, ST 425-5 (ST 2036-1)	12G-2SI (III)	3840 x 2160	4:4:4 (YCbCr/RGB)	12	30p, 29.97p, 25p, 24p, 23.98p		O	O	-	
ST 2082-10 M1, ST 425-5 (ST 2048-1)	12G-2SI (III)	4096 x 2160	4:4:4 (YCbCr/RGB)	12	30p, 29.97p, 25p, 24p, 23.98p		O	O	-	
ST 2082-10 M1, ST 425-5 (ST 2036-1)	12G-2SI (IV)	3840 x 2160	4:2:2 (YCbCr)	12	30p, 29.97p, 25p, 24p, 23.98p		O	O	-	
ST 2082-10 M1, ST 425-5 (ST 2048-1)	12G-2SI (IV)	4096 x 2160	4:2:2 (YCbCr) 4:2:2:4 (YCbCrA)	12	30p, 29.97p, 25p, 24p, 23.98p		O	O	-	

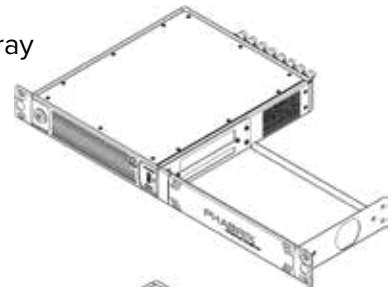
# Dimensions & Installation



Desktop



Single Rack mount tray with cover  
PHQXK1



Dual Rack mount  
PHQXK2



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