SEL-TCIP1-S

Single-Channel TICO Mezzanine Format for UHD 3G-SDI and 10 Gig-E

The Selenio SEL-TCIP1 is a single-channel module for the Selenio MCP1 and MCP3 platforms that supports the TICO mezzanine format for UHD over 3G-SDI and 10 Gig-E. TICO is a low-latency, light-weight compression technology from IntoPIX.

The Transmitter (encoder mode) version of this product supports one Quad-Link (4x 3G-SDI) UHD video input channel and uses the IntoPIX TICO lightweight mezzanine compression codec and SMPTE 2022-6 Encapsulation and 2022-5 Forward Error Correction (FEC) for transport over IP. Alternatively, the TICO compressed signal can be transported as a 3G-SDI stream through conventional 3Gb/s-capable SDI infrastructure, including distribution amplifiers, baseband routers and frame synchronizers.

The Receiver (decoder mode) version of this product supports SMPTE 2022-6 de-encapsulation and SMPTE 2022-7 seamless switching, and it uses TICO decompression for the reconstruction of one Quad-Link (4x 3G-SDI) UHD video output channel.

The module can be configured in-field as either an encoder or decoder (Transmitter or Receiver).

Features

Utilizing IntoPIX's low-latency, lightweight compression technology in connection with SMPTE 2022-5/6/7, this module enables the transport of a UHD stream over a single 10GbE link, or over existing 3G SDI infrastructure. The low compression ratio of 4:1 is visually lossless.

Two SFP+ ports for IP network connection can support 10GbE in a primary (main) and secondary (back-up) configuration, supporting Link Redundancy and hitless switching per SMPTE 2022-7 standard on an IP network.

- Supports a variety of SFPs providing electrical/fiber interfaces
- Supports Selenio MCP standard module/service redundancy schemes
- Support for Multicast and Unicast
- Supports up to 6 VLANs on module external interfaces
- Single slot module operates in any slot of the Selenio MCP1 and Selenio MCP3 chassis
- Supports Imagine's 'SEAM' protocol

Details

Transmitter (Tx) Features (Encoder Mode)
The Tx supports one UHD Quad-Link interface input, utilizing 4 out of the 8 bi-directional HD-BNCs. The spare HD-BNCs serve as outputs for transmitting the TICO code stream encapsulated into the active portion of a 3G-SDI Level A stream (in accordance with SMPTE 424M and 425M).

The supported image format is a "2-sample interleave" (2SI) or "Square division" (SQD), as specified in SMPTE ST 425-5 & ST 435-1, respectively.

The UHD stream is compressed using IntoPIX's virtually lossless and low-latency TICO technology to a ratio up to 4:1 before encapsulating the compressed stream into a 10GbE stream.

The Transmitter transparently passes on the audio data and control packets from one of the four links (user selectable), alongside the compressed video data. It can automatically map/re-order individual links of a Quad-Link stream, based on the embedded Payload ID (channel assignment info), for proper source image reconstruction. Note that only the 2-sample interleave format specifies channel assignment information.

- Lightweight compressed (TICO) UHD signals over 10GigE link and 3G-SDI
- Support for SMPTE 2022-6 transmit over 10GigE IP links
- Support for SMPTE 2022-5 Forward Error Correction
- Support for SMPTE ST 425-5 2-sample interleave mapping (2SI) @ 50, 59.94 or 60 Hz, Level A or B
- Support for SMPTE ST 435-1 Square Division mapping (SQD) @ 50, 59.94 or 60 Hz, Level A or B
- Auto mapping of mixed-up Quad-Link signals (Any-Link to Any-BNC), based on Payload ID (2SI mode only)
- Auto-detect, status and monitoring of the SDI input standard
- Support for transparent transport of VANC/HANC data from one of the four links (user-selectable), though a maximum of 16 Audio channels
- Thumbnail monitoring of video input(s). The SMPTE ST 425-5 2-sample interleave mapping of the source image already provides a 'down-scaled' version of the UHD source with every of the four 3Gb/s signals in the Quad-Link.
- Optional bypass of Link #1 to SDI Output

Receiver (Rx) Features (Decoder Mode)
The Rx supports one UHD Quad-Link interface output, utilizing 4 out of the 8 bi-directional HD-BNCs. One of the spare HD-BNCs serves as an input, for an alternative method for receiving the TICO code stream encapsulated into the active portion of a 3G-SDI Level A stream (in accordance with SMPTE 424M and 425M).

The supported image format is a "2-sample interleave" (2SI) or "Square division" (SQD), as specified in SMPTE ST 425-5 & ST 435-1, respectively.

The Receiver can recover, decompress and synchronize the TICO compressed video data, and re-mux the VANC/HANC data back into the outgoing Quad-Link(s).

- Support for SMPTE 2022-6 reception over 10GigE IP links
- Support for SMPTE 2022-5 Forward Error Correction
- Seamless Switching links support SMPTE 2022-7
- Frame synching of compressed UHD signal (prior to TICO decode).
- VANC data drop / repeat with video sync events
- Provides thumbnail monitoring of video output(s)
- Non-PCM audio (e.g. Dolby E) frame drop/repeat to maintain sync with video
- Sample-rate conversion to maintain sync on PCM signals

Specifications

3G SDI INPUTS	
Number of inputs	4
Connector Type	Amphenol HD-BNC
Standards	SMPTE 424M (3G), 1080p50/59/60
Impedance	75 Ohms
Return Loss	> 18 dB to 1.5 GHz and > 10 dB to 3 GHz (3G)
Signal Level	800 mV ± 10%
Max input cable	> 100m for Belden 1694A co-axial cable (3G) (Adaptive cable equalization)

3G SDI OUTPUTS	
Number of outputs	4
Connector Type	Amphenol HD-BNC
Standards	SMPTE 424M (3G), 1080p50/59/60
Impedance	75 Ohms
Return Loss	> 18 dB to 1.5 GHz and > 10 dB to 3 GHz (3G)
Signal Level	800 mV ± 10%
DC Offset	0.0V ± 0.5 V
Rise and Fall Times	< 135 ps (3G)
Overshoot/Undershoot	<10%
Jitter	< 2UI (673ps) peak-to-peak of timing jitter (>10Hz) (3G) <0.3UI (101ps) peak-to-peak of alignment jitter (>100kHz) (3G)

OP+SFP+TRSM+10G SINGLE MODE OPTICAL TRANSCEIVER

Transmitter

Parameter	Minimum	Typical	Maximum	Unit	Notes
Laser OMA Output Power	-5.2			dBm	1
Laser Mean Output Power	-8.2		+0.5	dBm	1
Laser Off Power			-30	dBm	1
Extinction Ratio	3.5			dB	1
Transmitter and Dispersion Penalty (TDP)			3.2	dB	1
Center Wavelength	1260		1355	nm	1
Optical Return Loss Tolerance			12	dB	1

RECEIVER

Parameter	Minimum	Typical	Maximum	Unit	Notes
Receiver Sensitivity (OMA)			-12.6	dBm	1
Stressed Receiver Sensitivity (OMA)			-10.3	dBm	1,2
Receiver Power Overload			+0.5	dBm	1
Receiver Reflectance			-12	dB	1
Center Wavelength	1260		1355	nm	1
Vertical Eye Closure Penalty	2.2			dB	3
Stressed Eye Jitter	0.3			UIp-p	3
RX_LOS (OMA) Assert			-17	dBm	4
RX_LOS (OMA) De-Assert	-30			dBm	4
RX_LOS (OMA) Hysteresis	0.5			dB	4

1. IEEE 802.3ae Clause 52 compliant
2. Measured with worst ER; BER<10-12; 231-1 PRBS
3. Vertical eye closure and stressed eye jitter are test conditions for stressed sensitivity (OMA) measurement.
4. Loss of Signal (LOS) detection responds only to OMA and the indicator will respond unpredictably with the application of unmodulated optical power.

OP+SFP+TRMM+10G MULTI MODE OPTICAL TRANSCEIVER

Transmitter

Parameter	Minimum	Typical	Maximum	Unit	Notes
Laser OMA Output Power	-4.3			dBm	1
Laser Mean Output Power			-1.0	dBm	1
Laser Off Power			-30	dBm	1
Extinction Ratio	3.0			dB	1
Transmitter and Dispersion Penalty (TDP)			3.9	dB	1
Center Wavelength	840		860	nm	1
Optical Return Loss Tolerance			12	dB	1

RECEIVER					
Parameter	**Minimum**	**Typical**	**Maximum**	**Unit**	**Notes**
Receiver Sensitivity (OMA)			-11.1	dBm	1
Stressed Receiver Sensitivity (OMA)			-7.5	dBm	1,2
Receiver Power Overload	-1.0			dBm	1
Receiver Reflectance			-12	dB	1
Center Wavelength	840		860	nm	1
Vertical Eye Closure Penalty	3.5			dB	3
Stressed Eye Jitter	0.3			UIp-p	3
RX_LOS (OMA) Assert			-12	dBm	4
RX_LOS (OMA) De-Assert	-30			dBm	4
RX_LOS (OMA) Hysteresis	0.5			dB	4

1. IEEE 802.3ae Clause 52 compliant
2. Measured with worst ER; BER<10-12; 231-1 PRBS
3. Vertical eye closure and stressed eye jitter are test conditions for stressed sensitivity (OMA) measurement.
4. Loss of Signal (LOS) detection responds only to OMA and the indicator will respond unpredictably with the application of unmodulated optical power.

POWER CONSUMPTION	
Module Power Consumption	40W maximum

Ordering Information

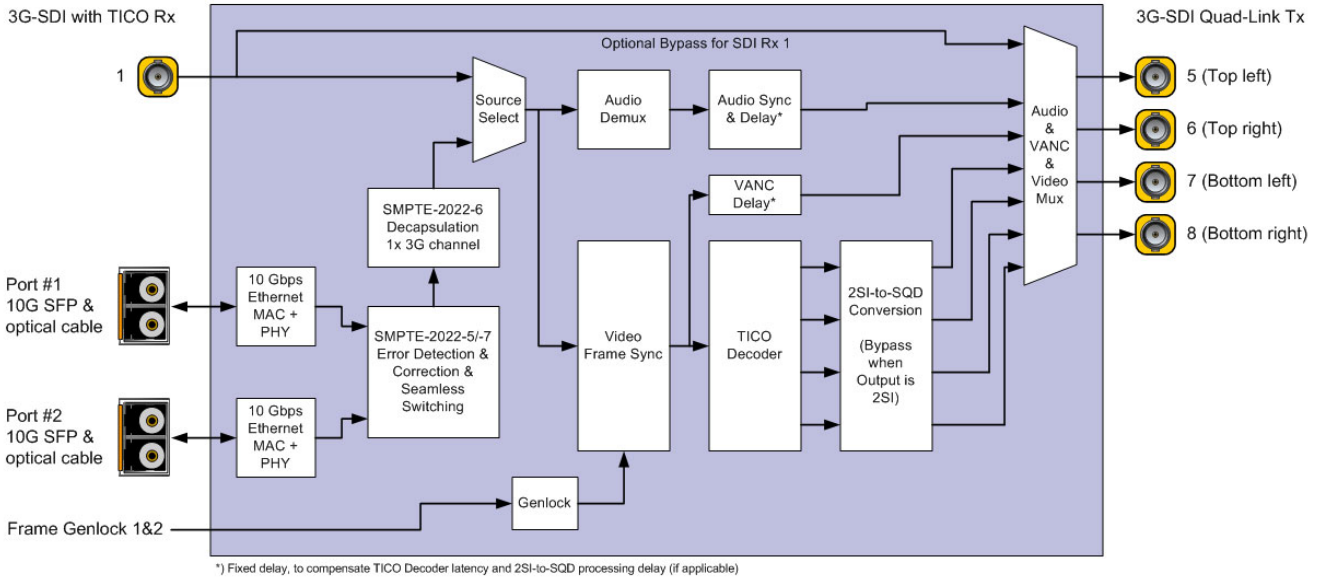
SEL-TCIP1-S	Single channel TICO mezzanine format processor (can be setup as an encoder or decoder), includes front module and single back module with eight HD-BNC connectors and dual 10 GBE ports, SFP+ ordered separately (OP+SFP+TRMM+10G for Multi Mode, OP+SFP+TRSM+10G for Single Mode, SEL+AOC+10G Direct Attach Active Optical Cable)

SMALL FORM-FACTOR PLUGGABLE	
SEL+AOC+10G	10GbE Small Form Factor Pluggable SFP+ transceiver Direct Attach Active Optical Cable, designed for high speed, short range data link.
OP+SFP+TRSM+10G	SFP+ transceiver. 10-Gigabit Ethernet links up to 10km over Single Mode fiber.
OP+SFP+TRMM+10G	10BASE-SR Fiber Enhanced Small Form Factor Pluggable SFP+ transceiver. 10-Gigabit Ethernet links over multimode fiber. Maximum link length of 300m on 2000 MHz-km MMF.

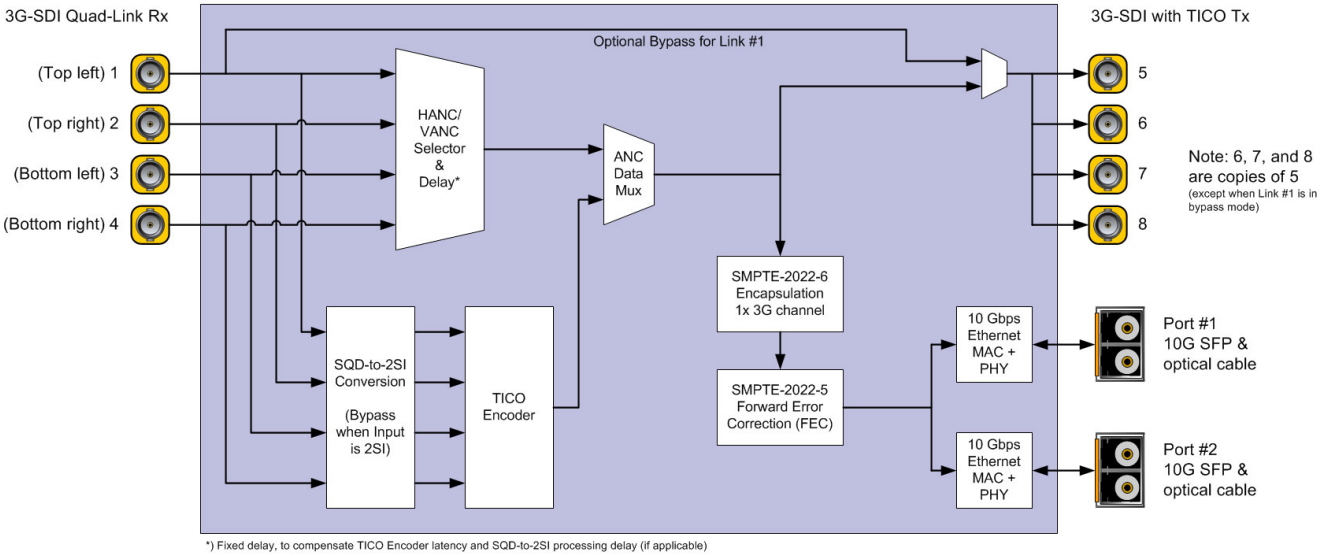
Images/Diagrams

Selenio™ MCP3

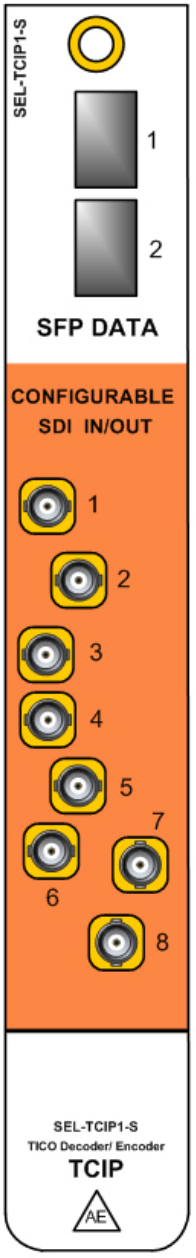
SEL-TCIP1-S Rx Parameter Signal Flow



SEL-TCIP1-S Tx Parameter Signal Flow



SEL-TCIP1-S Back Module



SEL-TCIP1-S
SFP CONNECTOR ASSIGNMENTS

SFP 1
- Primary Transceiver (Encoder and Decoder)

SFP 2
- Secondary Transceiver (Encoder and Decoder)

SEL-TCIP1-S
HD-BNC CONNECTOR ASSIGNMENTS

TCIP-TX

3G SDI Inputs

1	Link #1 (top left)
2	Link #2 (top right)
3	Link #3 (bottom left)
4	Link #4 (bottom right)

3G SDI Outputs

5	3G SDI w. TICO
6	Copy of 5
7	Copy of 5
8	Copy of 5

SEL-TCIP1-S
HD-BNC CONNECTOR ASSIGNMENTS

TCIP-RX

3G SDI Inputs

1	3G w. TICO
2	n/a
3	n/a
4	n/a

3G SDI Outputs

5	Link #1 (top left)
6	Link #2 (top right)
7	Link #3 (bottom left)
8	Link #4 (bottom right)