Harris continues to set the standard for innovative, top-performing processors - the X50™ intelligent frame synchronizer and converter. This best-in-class, single-channel input with two processed outputs delivers the exceptional quality and functionality that have come to define the popular and award-winning Harris series of 1RU processors, which also includes the X85™ and X75™.

The X50 is compact and cost-effective, yet feature-rich, offering an array of analog and digital baseband video and audio processing capabilities. This 1RU frame synchronizer/converter effectively and reliably supports standard-definition and high-definition formats, including built-in 3 Gb/s 1080p Level A and Level B-DL processing and 3DTV capabilities for hybrid television and production systems. With easy-to-use controls, the X50 comes standard with a myriad of features, including color correction, closed caption/teletext capabilities, control and monitoring via a built-in Silverlight web server, active format description (AFD) support, two fully controllable aspect ratio converters and 24-channel internal audio processing. Available options include CWDM fiber input and output (transceiver) plug-ins, Dolby® Digital and Dolby® E decoders, DTS Neural Surround™, Up/Down Mix, Multimerge and DTS Neural Loudness Control options.

The unique Rules Engine capability puts custom video and audio signal management into the hands of the user so that specially modified code does not need to be uploaded. Any video and/or audio input scenario can be detected with the user determining processing required for the output.

The powerful, affordable and energy-efficient X50 processor can easily be incorporated into the workflow of any broadcast environment — from small stations and OB vans to production studios and networks. Frame sync, proc amp and color correction capability for all 1080p/psf production formats (23.98, 24, 25, 29.97, 30) is now available with a basic frame rate converter that can be used either for graphics, or as a low-cost backup for linear or motion-compensated frame rate conversion in a critical path.

**FEATURES**

- Intelligent frame sync/delay, proc amp, noise reduction, clipping and color correction
- Rules Engine for custom signal flow management
- Line sync and time base corrector (TBC) and "look to input" modes
- 3DTV-capable
  - Left / Right Eye to frame compatible Side/Side, Top/Bottom output
  - Frame compatible Side/Side, Top/Bottom input to Left / Right Eye output
- Advanced 3D adaptive 10-bit motion detection for up/down/cross/aspect ratio conversion
- Two switchable auto-sensing 3G/HD/SD inputs
- Up/down/cross/aspect ratio conversion with two simultaneous, independent output formats
- Noise reduction (mosquito), sharpness and texture controls
- Two aspect ratio converters with full control over H/V size and position
- Audio de-embed/embed, sync, gain, invert and delay with 16 channels (four groups) processing
  - PCM and non-PCM (Dolby® Digital, Dolby® E) passthrough
  - Options for Dolby® Digital, Dolby® E decode and encode (up to 2 Dolby decoders or encoders)
  - Options for DTS Neural Upmix, Downmix, Multimerge and DTS Neural Loudness Control
- Time base corrector for analog composite inputs
- Video Interfaces:
  - Analog composite
  - 3D adaptive comb filter 12-bit color decoder
  - Analog component
  - YPbPr input and output (HD and SD)
  - RGB output
  - Auto-sensing for SD-SDI, HD-SDI, 3G-SDI
  - EDH/CRC error monitoring and insertion
  - HDMI output for video
- Audio Interfaces:
  - Eight-channel analog audio
  - Four groups embedded audio
  - Four AES (75 ohms) inputs
- Data and Metadata:
  - CC (CEA608/708) and Teletext (QTP7)
  - Audio metadata VANC embed/de-embed, generator, serial input/output
  - AFD/Wide Screen Signaling (WSS)/VI
  - Pass one DID/SDID when converting video
- Control and Monitoring:
  - 100/100 Ethernet connectivity
  - SNMP
  - Built-in web server
  - Local control panel
- CCS™-compliant for use with CCS Navigator™ software:
  - X85/X75 control panels
  - NUCLEUS™ and Magellani™ network control panels
  - CCS Navigator software
  - Four GPI inputs and outputs
- Optional fiber input and output
  - 3 Gb/s and 3DTV
  - Built-in video test and audio tone generators
  - Redundant power supply
  - Logo generator/inserter
  - I-Wings side bar insertion when up converting
  - SD memory card for presets

SIGNAL PROCESSING // X50/X85 1RU PROCESSORS

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# X50™
## Intelligent Frame Synchronizer and Converter

### Specifications
Specifications are subject to change without notice.

#### Video Inputs

**3G/HD/SD-SDI**

<table>
<thead>
<tr>
<th>Item</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Note*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of LC connector inputs</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Input wavelength</td>
<td>1260 nm</td>
<td>—</td>
<td>1620 nm</td>
<td></td>
</tr>
<tr>
<td>Optical power monitor accuracy</td>
<td>-2 dB</td>
<td>0</td>
<td>2 dB</td>
<td></td>
</tr>
<tr>
<td>Sensitivity at 270 MHz (SMPTE 259M)</td>
<td>—</td>
<td>-22 dBm</td>
<td>-20 dBm</td>
<td>Pathological</td>
</tr>
<tr>
<td>Sensitivity at 1.5 GHz (SMPTE 292M)</td>
<td>—</td>
<td>-22 dBm</td>
<td>-19 dBm</td>
<td>Pathological</td>
</tr>
<tr>
<td>Sensitivity at 3 GHz (SMPTE 424M)</td>
<td>—</td>
<td>-19 dBm</td>
<td>-18 dBm</td>
<td>Pathological</td>
</tr>
<tr>
<td>Load</td>
<td>0 dBm</td>
<td>—</td>
<td>—</td>
<td>BER = 1E-12 against SDI matrix check field signals for video applications. BER = 1E-12 against PRBS 223-1 for datacom applications</td>
</tr>
</tbody>
</table>

**S-Video**

<table>
<thead>
<tr>
<th>Item</th>
<th>Standard</th>
<th>Connector</th>
<th>Input Level</th>
<th>Impedance</th>
<th>Return Loss</th>
<th>CMRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>NTSC, PAL-B, PAL-M</td>
<td>4-pin DIN</td>
<td>1 V pk-pk</td>
<td>75 ohms</td>
<td>&gt;40 dB, 0.1 to 6 MHz</td>
<td>60 dB @ 50/60 Hz, 5 V pk-pk</td>
</tr>
</tbody>
</table>

**Analog Composite**

<table>
<thead>
<tr>
<th>Item</th>
<th>Standard</th>
<th>Connector</th>
<th>Input Level</th>
<th>Impedance</th>
<th>Return Loss</th>
<th>CMRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>NTSC (SMPTE 170 M), PAL-B (ITU 624-2), PAL-M, PAL-I</td>
<td>BNC (IEC 169-8)</td>
<td>1 V pk-pk</td>
<td>75 ohms</td>
<td>&gt;40 dB, 0.1 to 6 MHz</td>
<td>60 dB @ 50/60 Hz, 5 V pk-pk</td>
</tr>
</tbody>
</table>

### Fiber Input Specifications (OP+SFP+TR13P Module)

<table>
<thead>
<tr>
<th>Item</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Note*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overload</td>
<td>0 dBm</td>
<td>—</td>
<td>—</td>
<td>BER = 1E-12 against SDI matrix check field signals for video applications. BER = 1E-12 against PRBS 223-1 for datacom applications</td>
</tr>
</tbody>
</table>

**Component**

<table>
<thead>
<tr>
<th>Item</th>
<th>Format</th>
<th>Connector</th>
<th>Input Level</th>
<th>Impedance</th>
<th>Return Loss</th>
<th>CMRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Format</td>
<td>Betacam/5MPE</td>
<td>BNC (IEC 169-8)</td>
<td>1 V pk-pk</td>
<td>75 ohms</td>
<td>&gt;40 dB, 0.1 to 6 MHz</td>
<td>60 dB @ 50/60 Hz, 5 V pk-pk</td>
</tr>
</tbody>
</table>

**Genlock**

<table>
<thead>
<tr>
<th>Item</th>
<th>Connector</th>
<th>Input Level</th>
<th>Impedance</th>
<th>Return Loss</th>
<th>CMRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector</td>
<td>BNC (IEC 169-8)</td>
<td>1 V pk-pk</td>
<td>75 ohms</td>
<td>&gt;40 dB, 0.1 to 6 MHz</td>
<td>60 dB @ 50/60 Hz, 5 V pk-pk</td>
</tr>
</tbody>
</table>

### Video Outputs

**3G/HD/SD-SDI**

<table>
<thead>
<tr>
<th>Item</th>
<th>Standard</th>
<th>Connector</th>
<th>Input Level</th>
<th>Impedance</th>
<th>Return Loss</th>
<th>CMRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>3 GHz: SMPTE 424M (2.97, 2.97/1.001 Gb/s), SMPTE 425 Level A, Level B-DL (YCbCr, 4:2:2, 10-bit with 16 channels of embedded audio)</td>
<td>BNC (IEC 169-8)</td>
<td>1 V pk-pk</td>
<td>75 ohms</td>
<td>&gt;40 dB, 0.1 to 6 MHz</td>
<td>60 dB @ 50/60 Hz, 5 V pk-pk</td>
</tr>
</tbody>
</table>

**S-Video**

<table>
<thead>
<tr>
<th>Item</th>
<th>Standard</th>
<th>Connector</th>
<th>Input Level</th>
<th>Impedance</th>
<th>Return Loss</th>
<th>CMRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>NTSC, PAL-B, PAL-M</td>
<td>4-pin DIN</td>
<td>1 V pk-pk</td>
<td>75 ohms</td>
<td>&gt;40 dB, 0.1 to 6 MHz</td>
<td>60 dB @ 50/60 Hz, 5 V pk-pk</td>
</tr>
</tbody>
</table>

**Analog Composite**

<table>
<thead>
<tr>
<th>Item</th>
<th>Standard</th>
<th>Connector</th>
<th>Input Level</th>
<th>Impedance</th>
<th>Return Loss</th>
<th>CMRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>NTSC (SMPTE 170 M), PAL-B (ITU 624-2), PAL-M, PAL-I</td>
<td>BNC (IEC 169-8)</td>
<td>1 V pk-pk</td>
<td>75 ohms</td>
<td>&gt;40 dB, 0.1 to 6 MHz</td>
<td>60 dB @ 50/60 Hz, 5 V pk-pk</td>
</tr>
</tbody>
</table>

**SIGNAL PROCESSING // X50/X85 1RU PROCESSORS**

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## X50™
### Intelligent Frame Synchronizer and Converter

### Fiber Output Specifications (OP+SFP+TR13P Module)

<table>
<thead>
<tr>
<th>Item</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Note*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of LC connector outputs</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Standards</td>
<td>3 Gb/s: SMPTE 424M HD; SMPTE 292M SD: SMPTE 259M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak wavelength</td>
<td>1280 nm</td>
<td>1310 nm</td>
<td>1340 nm</td>
<td>Measured at 25°C</td>
</tr>
<tr>
<td>Spectrum width (RMS)</td>
<td>—</td>
<td>1.5 nm</td>
<td>3 nm</td>
<td></td>
</tr>
<tr>
<td>Average output power</td>
<td>-7 dBm</td>
<td>—</td>
<td>0 dBm</td>
<td></td>
</tr>
<tr>
<td>Optical rise/fall time (3 Gb/s HD-SDI)</td>
<td>—</td>
<td>105/120 ps</td>
<td>165/180 ps</td>
<td></td>
</tr>
<tr>
<td>Extinction ratio</td>
<td>5 dB</td>
<td>7 dB</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Jitter</td>
<td>—</td>
<td>&lt;110 ps</td>
<td>180 ps</td>
<td>SD-SDI, pathological</td>
</tr>
<tr>
<td>—</td>
<td>—</td>
<td>&lt;60 ps</td>
<td>100 ps</td>
<td>1.5 Gb/s SDI, pathological</td>
</tr>
<tr>
<td>—</td>
<td>—</td>
<td>&lt;45 ps</td>
<td>70 ps</td>
<td>3 Gb/s HD-SDI, pathological</td>
</tr>
<tr>
<td>Laser safety level</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Class 1</td>
</tr>
</tbody>
</table>

### HDMI
- Number of Outputs: 1
- Standards: 525, 625, 1080/59.94, 1080/50, 1080p/23.98 /50/59.94, 720p/59.94, 720p/50
- Connector: BNC
- Compliance: HDMI 1.3

### S-Video
- Standard: NTSC, PAL-B, PAL-M
- Connector: 4-pin DIN

### Composite
- Standard: NTSC, PAL-B, PAL-M, PAL-I
- Connector: BNC (IEC 169-8)
- Quantization: 12 bits
- Impedance: 75 ohms
- Return Loss: >40 dB, 0.1 to 6 MHz
- Frequency Response: -1.6 dB at 6 MHz
- DC Offset: <0.5 mV
- Differential Gain: <0.5%
- Differential Phase: <0.5°
- Y/C Delay: <10 ns (NTSC), <23.1 ns (PAL)
- Y/C Gain: <1%, typical
- Transient Response: <0.5% K Factor
- SNR: >63 dB, 0.1 to 6 MHz

### Component
- Format: Betacam/SMpte/RGB
- Connector: BNC (IEC 169-8)
- Quantization: 12 bits
- Impedance: 75 ohms
- Return Loss: >40 dB, 1 kHz to 6 MHz
- Frequency Response: Y: ±0.5 dB to 5.5 MHz; Pb/P: -3.27 dB to 3 MHz
- DC Offset: <0.5 ± mV
- Relative Delay: <10 ns
- SNR: >63 dB, typical, luma ramp

### Audio Inputs
#### AES/DARS
- Number of Inputs: 4 AES, 1 DARS
- Standard: AES-3, SMPTE 276M
- Type: Unbalanced, AC coupled
- Connector: 1.0/2.3 DIN
- Sensitivity: <100 mV
- Impedance: 75 ohms
- Return Loss: >25 dB, 0.1 to 6 MHz
- Input Audio Rate: 16 to 96 kHz
- Channel Status and User Bit: Maintained, but professional mode, 48 kHz

#### Analog
- Number of Inputs: 8 mono channels
- Type: Balanced
- Connector: DB-25, Tascam-style cable snake for balanced
- Input Audio Level: 28 to 12 dBu (adjustable in 5 dB increments)
- Input Impedance: High-impedance or 600 ohms, jumper selectable
- OMRR: >80 dB @ 60 Hz, typical

### Audio Outputs
#### AES
- Number of Outputs: 4
- Standard: AES-3, SMPTE 276M
- Type: Unbalanced, AC coupled
- Connector: 1.0/2.3 DIN
- Signal Level: 1 V ±10% (pk-pk)
- Impedance: 75 ohms
- Return Loss: >25 dB, 0.1 to 6 MHz
- Jitter: <20 ns
- DC Offset: 0 ±50 mV
- Rise and Fall Time: 30 to 44 ns (10% to 90%)
- Audio Rate: 48 kHz
- Bits: 24, 20 or 16
- Channel Status and User Bit: Maintained, but professional mode, 48 kHz

#### Analog
- Number of Inputs: 8 mono channels
- Type: Balanced
- Connector: DB-25, Tascam-style cable snake for balanced
- Output Audio Level: 28 dBu to 16 dBu (adjustable in 2 dB increments)
- Output Impedance: 66 ohms
- Frequency Response: 0.15 dB, 20 Hz to 20 kHz
X50™
Intelligent Frame Synchronizer and Converter

THD .............................. ≥80 dB, 20 Hz to 20 kHz
SNR .............................. >100 dB, typical
Crosstalk ......................... ≥90 dB, 20 Hz to 20 kHz, typical
Linearity .......................... <1 dB (-80 dBU to +20 dBU), typical

Connectors and I/O

GPI (General Purpose Interface)
Connector ....................... DB-9
Number of Inputs ............... 4
Number of Outputs ............. 4
RS-422
Standard ......................... RS-422
Connector ....................... DB-9
LAN
Connector ....................... RJ-45
Type .............................. 10/100Base-T Ethernet

ORDERING INFORMATION

X50-AV-2PS .......................... X50, the powerful, affordable and energy-efficient processor. This 1RU frame sync/converter supports NTSC/PAL, SD and HD formats including 3 Gb/s 1080p Level A and Level B-DL and 3DTV for hybrid television and production systems. The X50 comes standard with color correction, closed caption/teletext capabilities, local control panel plus control and monitoring via a built-in Web server or CCS Navigator, Active Format Description (AFD) support, two fully controllable Aspect Ratio Converters, HDMI monitoring port, dual power supplies and 16-channel embedded audio processing. Available options include CWDM fiber transceivers, Dolby® Digital and Dolby® E codecs, DTS Neural Surround™ UpDown Mix, Multimerge and DTS Neural Loudness Control

X85-RCP ............................. Remote control panel for X85, X75, DPS-475/575 and X50

AES Interface Cable
X500PTCAB-AES .................. AES interface cable - BNC to 1.0/2.3 DIN for X50

Advanced Audio Options
X500PT-ADVAUD .................. APM (Audio Processing Module) plug-in advanced audio processing for X50-AV-2PS (requires software key license option(s))
X500PT-SK-DEE .................. 1 Software key license for 1 Dolby® E encoder for X50-AV-2PS
X500PT-SK-DED .................. 1 Software key license for 1 Dolby® E decoder for X50-AV-2PS
X500PT-SK-DDE .................. 1 Software key license for 1 Dolby® Digital Pro encoder (5.1 or 2.0) for X50-AV-2PS
X500PT-SK-DDD .................. 1 Software key license for 1 Dolby® Digital Pro decoder (5.1 or 2.0) for X50-AV-2PS
X500PT-SK-DTS .................. 1 Software key license for DTS Neural Technologies option (3 software key licenses required for DTS Neural Surround™ UpMix or DownMix or 5.1 DTS Neural Loudness Control), 4 software key licenses required for DTS Neural Surround™ Multimerge, 1 software key license required for 2.0 DTS Neural Loudness Control

Weight and Dimension Measurements
Weight ............................. 8.45 lbs (3.83 kg) (excluding rack and cable supports)
Height ............................. 1.72 in. (4.37 cm)
Width .............................. 17.47 in. (44.4 cm); 17.6 in. (44.7 cm) with rear supports (excluding mounting ears)
Depth .............................. 21.25 in. (54 cm) (including front controls and rear BNC connectors)

Power and Temperature
Power Consumption ............. 100 to 240 VAC, 47 to 63 Hz, 75 W
Electrical Requirements ........ 100 to 240 VAC, 47 to 63 Hz, 3 amps maximum
Ambient Temperature .......... 41° to 95°F (5° to 35° C) with a relative humidity of 10% to 90% (non-condensing)

Optical Fiber Transceiver Options
OP+SFP+TR13P ..................... Small Form Factor (SFP) for Harris Fiber Optic Products; 1310nm wavelength transceiver with pathologic support for baseband video
OP+SFP+TR27P ..................... Small Form Factor (SFP) for Harris Fiber Optic Products; 1270nm wavelength transceiver with pathologic support for baseband video
OP+SFP+TR29P ..................... Small Form Factor (SFP) for Harris Fiber Optic Products; 1290nm wavelength transceiver with pathologic support for baseband video
OP+SFP+TR31P ..................... Small Form Factor (SFP) for Harris Fiber Optic Products; 1310nm wavelength transceiver with pathologic support for baseband video
OP+SFP+TR33P ..................... Small Form Factor (SFP) for Harris Fiber Optic Products; 1330nm wavelength transceiver with pathologic support for baseband video
OP+SFP+TR35P ..................... Small Form Factor (SFP) for Harris Fiber Optic Products; 1350nm wavelength transceiver with pathologic support for baseband video
OP+SFP+TR37P ..................... Small Form Factor (SFP) for Harris Fiber Optic Products; 1370nm wavelength transceiver with pathologic support for baseband video
OP+SFP+TR43P ..................... Small Form Factor (SFP) for Harris Fiber Optic Products; 1430nm wavelength transceiver with pathologic support for baseband video
OP+SFP+TR45P ..................... Small Form Factor (SFP) for Harris Fiber Optic Products; 1450nm wavelength transceiver with pathologic support for baseband video
OP+SFP+TR47P ..................... Small Form Factor (SFP) for Harris Fiber Optic Products; 1470nm wavelength transceiver with pathologic support for baseband video
OP+SFP+TR49P ..................... Small Form Factor (SFP) for Harris Fiber Optic Products; 1490nm wavelength transceiver with pathologic support for baseband video
OP+SFP+TR51P ..................... Small Form Factor (SFP) for Harris Fiber Optic Products; 1510nm wavelength transceiver with pathologic support for baseband video
OP+SFP+TR53P ..................... Small Form Factor (SFP) for Harris Fiber Optic Products; 1530nm wavelength transceiver with pathologic support for baseband video

Optic \& Fiber Options

Optic \& Fiber Options

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**X50™**

Intelligent Frame Synchronizer and Converter

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**Images/Diagrams**

**Audio Block Diagram**

**Video Block Diagram**

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**Field Service Items**

- X50SPR-FAN ................. Spare/Replacement fan for X50
- X50SPR-PSU ................. Spare/Replacement power supply for X50
- X50SPR-SE ................. Spare/Replacement shaft encoder, knob and cap, shoulder washer for X50
- X50SPR-DISP ................. Spare/Replacement blue OLED display PCB, includes shaft encoder for X50

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