Space-saving, modular platform for advanced signal processing.

The FRS-3901 from Grass Valley, a Belden Brand, is a highly integrated module which offers frame synchronization and video/audio processing, including color correction and delay, for 3G, HD and SD signals in 3G/HD/SD hybrid plants. The FRS-3901 features an advanced embedded audio processor which can simultaneously process up to 32 channels of audio (16 channels of embedded audio from the video plus others generated internally). Functions include downmixing, proc amp, channel shuffling and mixing, and loudness measurement. Options include automatic loudness control (ALC) and dynamic processing (limiter, compressor and expander). The FRS-3901 generates audio/video fingerprints (via an iControl option) to detect and measure lip-sync errors in a broadcast facility.

The loudness measurement function allows the measurement and logging of up to four audio programs with iControl loudness monitoring software to analyze and report compliance with respect to various loudness legislations around the world.

The FRS-3901 has one on-board socket for optional modules, including Dolby E and Dolby Digital decoding, upmixing using Linear Acoustic upMAX technology, Dolby E encoding, Dolby Digital and Dolby Digital Plus encoding. In addition to Grass Valley’s own automatic loudness control (ALC) solution for up to eight programs, the AMX-3981 offers ALC using the AEROMAX technology module by Linear Acoustic, capable of maintaining constant loudness across different audio programs.

The card will pass and delay automatically all 32 internal audio channels to preserve lip-sync between the channels. Each channel can be delayed independently to correct any lip-sync issues. All audio channels can be mixed and shuffled to provide 16 channels for embedding in the video output.

An automatic preset recall feature provides basic automation to select user preset based on the status of the incoming audio. When genlocked to an external reference or to the frame reference using the internal URS signal, the FRS-3901 can handle video hot switches at the input without losing sync at the output. In absence of the video input, the card can freeze the output to the last good frame, field or black.

The card has a frame buffer which allows an increase in the video delay of up to 15 frames to compensate for the long audio processing delay required by some modules. The FRS-3901 has three GPIOs that can be used as input or output to embed or extract GPIO events to/from the timecode user bits in transport applications, or they can be used simultaneously to trigger the card's user presets.

Dolby metadata insertion in the VANC is possible from multiple sources, such as a Dolby E decoder module, an embedded VANC stream, an external RS-422 link, or from the integrated metadata generator. All parameters in the metadata stream can be probed and monitored. Dolby metadata can be used to steer the behavior of the audio downmix and upmix modules.

The FRS-3901-3SRP-R rear module has a bypass relay that can be used to bypass the main input directly to the output in the event of card failure, loss of power or card removal.

The FRS-3901-3SRP-F rear module has a fiber input/output cartridge. Once the cartridge is installed, the inputs or outputs are selectable through the control interface. The input of the card allows you to select between fiber and copper inputs. The outputs are via copper and fiber simultaneously (with appropriate fiber cartridge).

There are many benefits to the FRS-3901’s high level of feature integration. A lower purchase cost per channel is obviously highly desirable but there are many other dimensions to cost savings that are readily achievable. These include reduced space and cooling costs, less cabling and a reduced spares inventory. By simplifying video and audio synchronization, and reducing the number of vendors, the system integration is also simplified significantly.
## KEY FEATURES

### Video
- 3G/HD/SD frame synchronizer, delay and line sync
- Supports 3 Gb/s level A (mapping 1) and level B
- Flexible HD/SD/URS reference input
- Video delay up to 15 frames
- Audio/video de-glitcher to handle video hot switch at the input
- Automatic detection of input video loss and switchover to local grey for continuity of embedded audio
- Built-in proc amp with YUV/RGB color correction
- Bypass relay with FRS-3901-3SRP-R rear module
- Optional optical fiber module I/O with FRS-3901-3SRP-F rear module
- Compatible with iControl end-to-end AV fingerprint analyzer for lip sync error detection and measurement

### Metadata
- AFD (SMPTE ST 2016), VLI (RP-186) and WSS insertion
- Audio metadata insertion and extraction (SMPTE ST 2020-A)
- RS-422 serial data input and output to carry audio metadata
- 3 GPI inputs and outputs that can be inserted or extracted in the timecode user bits. They can also be used for automation, user preset recall and loudness reset

### Audio
- Full audio shuffling and mixing on a channel basis
- 32 channels internal audio processing
- Audio 5.1 surround downmix to Lf/Rt or Lo/Ro
- Optional on-board automatic loudness control with Grass Valley Wideband processing
- Loudness measurement of up to 4 audio programs and logging with iControl loudness monitoring option
- Loudness compliant to EBU R128-2014, ATSC A/85:2013 (FCC CALM compliant) and ARIB TR-B32 (ITU-R BS.1770-3)
- Audio dynamic processor option (compressor/limiter/expander)
- Automation capabilities based on audio signal type detection
- Audio delay adjustments of up to 2 seconds to compensate for lip sync issues
- On-board socket for 1 optional module expansion:
  - Dolby E and Dolby Digital decoder
  - Dolby Digital and Dolby Digital Plus encoder
  - Dolby E encoder
  - Linear Acoustic upMAX
  - Linear Acoustic AEROMAX automatic loudness control

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### FRS-3901 Functional Block Diagram

Options (hardware & software)
- FRS-3901-3SRP-R rear module
- FRS-3901-OPT-ALC
- MOD-DOLBY-ENC-E-2
- MOD-DOLBY-DUP-F-701
- MOD-DOLBY-DEC-2
FRS-3901 3G/HD/SD Frame Synchronizer with Embedded Audio Processor

**SPECIFICATIONS**

**Video Input/Output**

**Signal (1):**
- SMPTE ST 259-C (270 Mb/s)
- SMPTE ST 292 (1.485, 1.485/1.001 Gb/s)
- SMPTE ST 424 (2.970, 2.970/1.001 Gb/s)

**Supported formats:**
- SD: 481059.94, 57650
- HD: SMPTE ST 274: 1080i59.94, 1080i50
- HD: SMPTE ST 296: 720p59.94, 720p50
- 3G: SMPTE ST 425 level A (mapping 1), level B: 1080p59.94, 1080p50

**Cable length:**
- 300m (984 ft.) Belden 1694A at 270 Mb/s
- 150m (492 ft.) Belden 1694A at 1.485 Gb/s
- 120m (393 ft.) Belden 1694A at 2.970 Gb/s

**Return loss:** >15 dB up to 3 GHz

**Jitter:**
- HD/SD: <0.2 UI
- 3G: <0.3 UI

**Reference Input**

**Signal:**
- SMPTE ST 170/SMPTE ST 318ITU 624-4 blackburst
- SMPTE ST 274/SMPTE ST 296 tri-level sync

**Return loss:** >35 dB up to 5.75 MHz

**Optical**

**Signal:** Refer to SFP module specifications

**GPIO**

**Signal (3):**
Contact closure to ground

**Connector:** RJ45

**Direction:** Bidirectional (application specific)

**OPTIONS**

**Densité 3 Frame**
- 3G/HD/SD frame synchronizer with embedded audio processor
- Single rear connector panel
- Single rear connector panel with fiber connector
- Single rear connector panel with bypass relay

**Options (Software)**
- Dynamic audio processing option
- 2-channel on-board ALC option by Grass Valley
- 8-channel on-board ALC option by Grass Valley
- 16-channel on-board ALC option by Grass Valley

**Options (Hardware)**
- Dual fiber Rx (input) cartridge with LC/PC connector
- Dual fiber Tx (output) cartridge at 1310 nm with LC/PC connector
- Single fiber Rx (input) cartridge with LC/PC connector
- Single fiber Tx (output) cartridge at 1310 nm with LC/PC connector
- Other types of SFP Optical Plug-In Cartridges may be available for this product

**MOD-DOLBY-ENC-E-2**
- Dolby E encoder

**MOD-DOLBY-ENC-D-2**
- Dolby Digital and Dolby Digital Plus encoder

**MOD-DOLBY-DEC-2**
- Dolby E and Dolby Digital decoder

**MOD-LA-DUP-701**
- Upmixing using Linear Acoustic Technology upMAX

**MOD-LA-ALC-2**
- 2-channel ALC licensed by Linear Acoustic

**MOD-LA-ALC-8**
- 8-channel ALC licensed by Linear Acoustic

**MOD-LA-ALC-2-DUP**
- 2-channel ALC and upmix licensed by Linear Acoustic

**MOD-LA-ALC-8-DUP**
- 8-channel ALC and upmix licensed by Linear Acoustic

**Housing Frame**
- Densité 3 Frame

**Remote Control**
- iControl, iControl Solo

**Audio Processing Performance**

**Quantization:** 24 bits

**Sampling:** 48 kHz, synchronous

**Audio delay:** Up to 2s (1 ms steps)

**Electrical**

**Power:** 12.5W

*Cable length and return loss specifications will be reduced when using the FRS-3901-3SRP-R rear connector. Refer to the manual for more details.*