FRC-7000
HD Frame Rate Converter

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TV TECHNOLOGY
STAR 2006
Superior Technology Award Recipient

Supporting High-Definition Frame Rate Conversion

Using the highest quality video processing to achieve superior image conversion results.

The HD Frame Rate Converter FRC-7000 is the ultimate product incorporating the essence of FOR-A's expertise in video processing technology. Frame synchronizer, video stabilizer, DVEs in video switchers, and other FOR-A products used around the world have already served as a testament to our high-definition conversion performance.

At first glance, the FRC-7000 looks like a simple product that only converts the frame rate. Inside, however, it features numerous video processing technologies that cannot be matched by anyone else.

Supported Formats

1080i to 1080i	*720p to 720p*
1080p/PsF to 1080i*	*1080p/PsF to 1080p/PsF**
1080i to 1080p/PsF*	*∗ FRC-70PSFC option is required*

Motion Compensation Technology

One major problem with linear converters performing simple frame rate conversion is their inability to perform suitable conversion on moving objects. In the FRC-7000, FOR-A's long experience in video processing technology was used to develop a motion compensation processing technique based on motion vectors. The motion vector of the object is detected, and movement of the interpolation frame object is generated based on the objects amount of vector movement in the frames just before and after the calculated area. The result is frame rate conversion with minimum judder.

Scene Cut Detection

Another problem in frame rate conversion is the processing of scene changes. Because an interpolation frame is generated from the frames before and after, the process can fail to convert the video properly by combining the frames before and after the scene boundary. The FRC-7000 incorporates a scene cut detection function. Scene changes are automatically detected so that frame rate conversion is performed without using motion compensation processing on unrelated data for the frames before and after scene cuts.

Progressive Format Support

Improvements to motion estimation/compensation performance now enable smooth motion conversion even when converting from low frame rates to high frame rates such as from 1080/23.98PsF to 1080/59.94i. (1080p/1080PsF format support requires the FRC-70PSFC option.) These improved functions provide better conversion accuracy even when converting between interlaced formats such as from 1080/59.94i to 1080/50i.

Conversion of Video with Subtitles

A function is available for converting video with imposed elements such as subtitles. Appropriate image processing is performed by the specifying the corresponding area so that conversion is performed without harming the visibility of the subtitles.

AES/EBU Digital Audio Support

Installation of the optional FRC-70DA or FRC-70DA16 enables input of asynchronous/synchronous digital audio signals. This enables building of a flexible audio system by combining with stereo four-channel internal processing (sample rate conversion/individual delay adjustment function) and a remapping function.

Other Features

Embedded Audio Support

Support is provided for 8-channel 48-kHz 24-bit embedded audio signals. It also includes a delay function for synchronization with video processing. Conversion is possible without phases between the video and audio. (Please inquire when support will be available for asynchronous embedded audio signals.)

Dolby E and AC-3 Support

Adding the FRC-70D-D or FRC-70DE-E to the FRC-70DA or FRC-70DA16 option enables Dolby E data decoding/encoding and AC-3 decoding using only the FRC-7000.
The FRC-70DA/70DA16 also includes a BB output terminal in synchronization with input and output SDI. Synchronous signals can be supplied to external Dolby E/AC-3 equipment. Even when users already have Dolby E decoder/encoder equipment, this allows significant simplification when building Dolby E systems, which tend to grow in complexity when performing rate conversion.

Genlock

The video and audio signals in frame rate conversion are output in synchronization with synchronizing signals supplied internally or externally. Two independent input terminal channels are provided for synchronizing signals, and tri-level sync or BB can be selected for input.

Process Control

Process control is possible for post-conversion video. The video level, chroma level, chroma phase, setup level, and clips can be adjusted to produce the optimum video.

Alarm Output

Includes alarm tally output for indicating power supply, fan, and temperature errors.

Test Signals

Includes a color bar, lamp signals, and 1kHz embedded audio output for signal checking.

Options

FRC-70PSFC *1080p/PsF Support*

Improvements to motion estimation/compensation performance now enable smooth motion conversion even when converting from low frame rates to high frame rates such as from 1080/23.98PsF to 1080/59.94i.

FRC-70DA *Digital Audio Multiplexer/Demultiplexer*

An audio expansion card to add to the FRC-7000. Enables multiplexing /demultiplexing of asynchronous/synchronous digital audio signals (AES/EBU) for the FRC-7000 video signal.

- *Audio channel remapping function*
- *Comes with stereo four-channel individual delay adjustment function*
- *Comes with BB output terminal synchronized to input/output SDI signal. Allows synchronous signal to be sent externally, so that even when users already have Dolby E equipment in their systems, it enables significant simplification when building Dolby E systems, which tend to be complex when performing frame rate conversion.*

FRC-70DA16 *Digital Audio Multiplexer/Demultiplexer*

Expanded function version of the audio expansion card FRC-70DA for adding to the FRC-7000. Supports up to 16 channels of audio signals.

- *In addition to functions of the FRC-70DA, adds the following functions:*
- *Supports AES/EBU eight-channel (16ch) input/output. Supports connections with multi-channel audio equipment such as HDCAM-SR.*
- *Comes with stereo 16 channel (Embedded x4, AES/EBU x8, Dolby E ENC x4) individual delay adjustment function*
- *Comes with automatic assignment function and automatic delay adjustment function for input/output, including Dolby signals*

FRC-70D-D *Dolby E/AC-3 Decoder*

A Dolby E and AC-3 decoder card that can be installed to the FRC-70DA. Input Dolby E or AC-3 signals can be output as AES/EBU or embedded into HD-SDI signals.

FRC-70DE-E *Dolby E Encoder*

A Dolby E encoder card that can be installed to the FRC-70DA. Enables output of audio signal embedded in HD-SDI signal or AES/EBU input signal as Dolby E signal.

FRC-70RU *Remote Control Unit*

Remote control unit for the FRC-7000.

- *Settings of the various parameters of the FRC-7000 can be changed*
- *Saves and calls up 1 - 4 events*
- *One remote control unit can control up to four connected FRC-7000 units*

FRC-70WEB *Remote Control Software*

A Control software for the FRC-7000. Enables remote control and status monitoring of the FRC-7000 from a computer web browser.

- *PC and FRC-7000 connect through a special converter box*
- *Settings of the various parameters of the FRC-7000 can be changed*
- *Saves and calls up 1 - 4 events*
- *No installation necessary: No special software installation required, because the control software is used through a web browser for remote control and status monitoring.*

Specifications

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Standards	1080/60i, 1080/59.94i, 1080/50i, 720/60p, 720/59.94p, 720/50p
Standards (FRC-70PSFC)*1	1080/30p, 1080/30PsF, 1080/29.97p, 1080/29.97PsF, 1080/25p, 1080/25PsF, 1080/24p, 1080/24PsF, 1080/23.98p, 1080/23.98PsF
Conversion Directions	1080i to 1080i, 720p to 720p
Conversion Directions (FRC-70PSFC)*1	1080p/PsF to 1080i, 1080p/PsF to 1080p/PsF, 1080i to 1080p/PsF
Video Inputs	HD SDI: 1.485Gbps or 1.485/1.001Gbps, 75Ω, 1 input, BNC
Reference Input	BB: NTSC: 0.429Vp-p/PAL: 0.45Vp-p or Tri-level sync: ±0.3V, 75Ω or loopthrough, 2 inputs, BNC
Reference Output (FRC-70DA or FRC-70DA16)*2	BB: NTSC: 0.429Vp-p/PAL: 0.45Vp-p, 75Ω, 2 outputs, BNC (switching between input synchronization/output synchronization is possible)
Video Output	HD SDI: 1.485Gbps or 1.485/1.001Gbps, 75Ω, 1 channel, 4 outputs, BNC (Output 1 functions as bypass output)
Quantization	Y: 10-bit, C: 10-bit
Sampling Frequency	Y: 74.25MHz or 74.25/1.001MHz, C: 37.125MHz or 37.125/1.001MHz
Process Control	Video level: ±30% (0.5% step)
	Chroma level: ±30% (0.5% step)
	Chroma phase: ±30° (0.5° step)
	Setup level: ±30% (0.5% step)
	Clip: Y100% ON/OFF, Y0% ON/OFF, C100% ON/OFF
Phase Control	System horizontal phase: -512 clk - +511 clk, System vertical phase: -512 H - +511 H
I/O Delay	+100 - +340 ms (Based on input/output format) (i.e., Delay during conversion from 1080/59.94i to 1080/50i: Approx. 105 ms)
Audio Input	Embedded audio: Group x 2 (4 stereo channels)
Audio Output	Embedded audio: Group x 2 (4 stereo channels)
Audio Input (FRC-70DA)*2	1/2 - 7/8: AES/EBU Unbalanced, 75Ω, 4 inputs, BNC (4 stereo channels)
	AUX (AES/EBU 1 channel or Dolby E): Unbalanced, 75Ω, 1 input, BNC
Audio Output (FRC-70DA)*2	1/2 - 7/8: AES/EBU Unbalanced, 75Ω, 4 outputs, BNC (4 stereo channels)
	AUX (AES/EBU 1 channel or Dolby E): Unbalanced, 75Ω, 1 output, BNC
Audio Input (FRC-70DA16)*2	1/2 - 15/16: AES/EBU Unbalanced, 75Ω, 8 inputs, BNC (8 stereo channels or Dolby E or AC-3)
Audio Output (FRC-70DA16)*2	1/2 - 15/16: AES/EBU Unbalanced, 75Ω, 8 outputs, BNC (8 stereo channels or Dolby E or AC-3)
Audio Sampling Frequency / Quantization	48 kHz (AES/EBU input only 32 kHz, 44.1 kHz possible)*2 / 20bit, 20bit, 16bit
Audio Delay	+5 - +350 ms (1 ms steps, four stereo channel pairs can be adjusted separately)
Audio Remapping Function	Individual settings are possible for embedded output, AES/EBU output*2, internal Dolby E encoder input*2
Time Code Input/Output (FRC-70DA or FRC-70DA16)*2	Ancillary time code support, reader/generator function
Interfaces	Alarm output: 1 port, 15-pin D-sub (female) (Power, fan, and temperature alarm)
	RS-422/Remote: 1 port, 9-pin D-sub (female) (shared RS-422/Remote)
Temperature / Humidity	10°C - 40°C / 30% - 85% (no condensation)
Power / Consumption	100VAC - 240VAC ±10%, 50/60Hz / Approx. 440VA (Approx. 440W) (When 100VAC supplied, at maximum output current)
Dimensions / Weight	430 (W) x 132 (H) x 500 (D) mm EIA 3RU / Standard: Approx. 17kg (with one power supply unit), Full option: Approx. 20kg
Accessories	Operation manual, AC cord, Rack mount brackets
Options	FRC-70PS: Redundant power supply unit / FRC-70DA: Digital audio card (8 channels)
	FRC-70DA16: Digital audio card (16 channels) / FRC-70D-D: Dolby E/AC-3 decoder
	FRC-70DE-E: Dolby E encoder / FRC-70PSFC: 1080p/PsF support option
	FRC-70WEB: Control GUI / FRC-70RU: Remote control unit

*1: When the FRC-70PSFC option is installed *2: When the FRC-70DA or FRC-70DA16 option is installed
*The FRC-70D-D/FRC-70DE-E is an added option for the FRC-70DA.
*Please inquire when support will be available for 1080i to 1080p/PsF conversion and time code related functions.
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Rear View (Full Option)
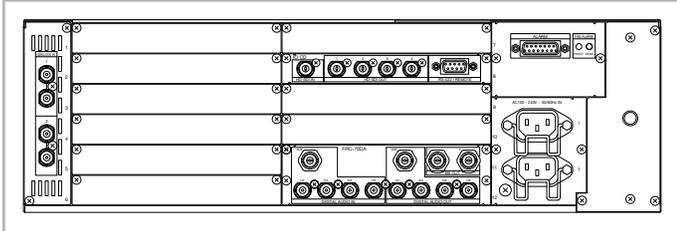
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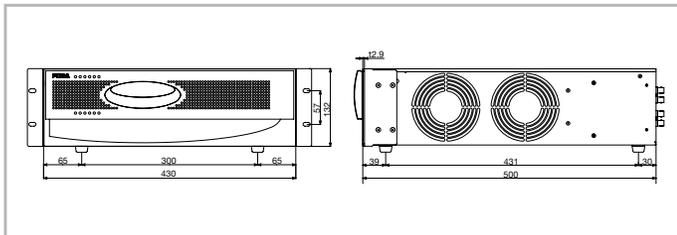
Block Diagram

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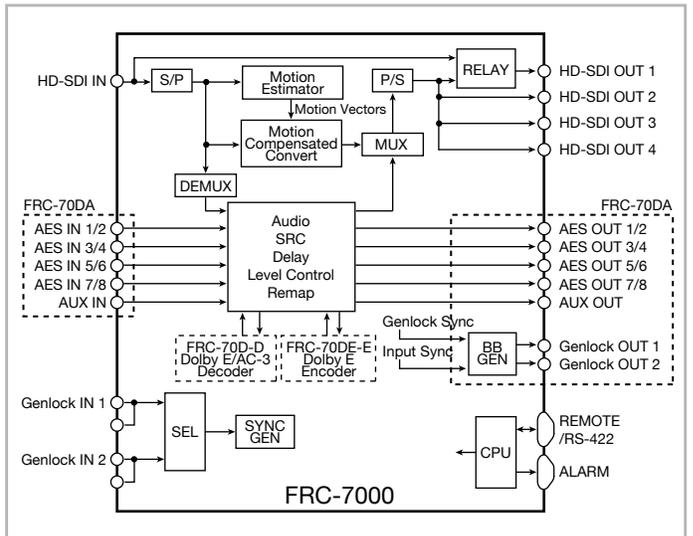
Head Office : 3-8-1 Ebisu, Shibuya-ku, Tokyo 150-0013, Japan +81 (0)3-3446-3936 Fax : +81 (0)3-3446-1470
FOR-A America Corporate Office : 11125 Knott Ave., Suite #A, Cypress, CA 90630, USA +1 714-894-3311 Fax : +1 714-894-5399
FOR-A America East Coast Office : 2 Executive Drive, Suite 670, Fort Lee Executive Park, Fort Lee NJ 07024, USA +1 201-944-1120 Fax : +1 201-944-1132
FOR-A America Distribution & Service Center : 2400 N.E. Waldo Road, Gainesville, FL 32609, USA +1 352-371-1505 Fax : +1 352-378-5320
FOR-A Latin America & the Caribbean : 5200 Blue Lagoon Drive, Suite #760, Miami, FL 33126, USA +1 305-931-1700 Fax : +1 305-264-7890
FOR-A Corporation of Canada : 425 Queen St. W. #210, Toronto, Ontario M5V 2A5, CANADA +1 416-977-0343 Fax : +1 416-977-0657
FOR-A UK Limited : UNIT C71, Barwell Business Park, Leatherhead Road, Chessington Surrey, KT9 2NY, UK +44 (0)20-8391-7979 Fax : +44 (0)20-8391-7978
FOR-A Italia S.r.l. : Viale Europa 50 20093, Cologno Monzese (MI), Milan, Italy +39 02-254-3635/6 Fax : +39 02-254-0477
FOR-A Corporation of Korea : 801 Dangsan Bld., 53-1 Dangsan-Dong, Youngdeungpo-Gu, Seoul 150-800, Korea +82 (0)2-2637-0761 Fax : +82 (0)2-2637-0760
FOR-A China Limited : Room C302 Tia Hao International Bld., 116 Zizhu-Yuan Road, Haidiang District, Beijing, China +86 (0)10-5170-9870 Fax : +86 (0)10-5170-9772