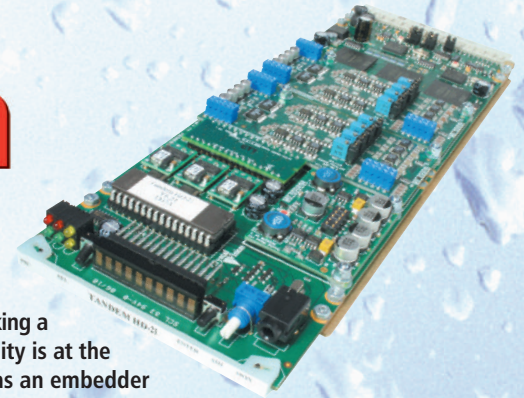# Crystal Vision

TANDEM HD-21

HD/SD AUDIO EMBEDDER/DE-EMBEDDER

TANDEM HD-21 is the ideal product for all High Definition embedding and de-embedding applications – whether you need a straightforward embedder/de-embedder or whether you're seeking a feature-packed product with two group handling, audio processing and sophisticated routing. Flexibility is at the heart of TANDEM HD-21, with its ability to be configured in many different ways. It can be used as an embedder for one or two groups of AES or analogue audio. Alternatively it can be used as a de-embedder for one or two groups of analogue or digital audio. Should you need it, TANDEM HD-21 can even embed one group and de-embed the other.

The functionality is defined by input and output piggyback modules which fix on to the 100mm x 266mm motherboard. Fit one piggyback for one audio group and two piggybacks for two groups. There is a choice of six piggybacks to suit every application.

Use the HD-DIP2 to embed AES, the HD-DIP2-RS to embed asynchronous AES and the HD-AIP2 to embed analogue audio. Use the HD-DOP2-110 to de-embed 110 ohm AES, the HD-DOP2-75 to de-embed 75 ohm AES and the HD-AOP2 to de-embed analogue audio.

Need something different? Just fit alternative piggybacks to completely transform the product. The ability to work with SD as well as all common HD formats brings further flexibility to this versatile board.

No other product offers such powerful audio routing. Full channel shuffling is provided by a 16 x 8 mono router which will allow you to rearrange the audio tracks between the two groups. With audio replace an input piggyback can be used to overwrite some of the original audio channels from the HD or SD feed. An optional audio delay of up to 64ms will compensate for any video processing, with each audio channel routed either directly or via the delay.

TANDEM HD-21 includes full audio processing. The audio level can be increased or decreased to match the rest of your system: each mono audio channel offers individual gain control, adjustable between +18dB and -18dB in 0.1dB steps. Audio channels can be muted, while stereo to mono conversion helps those broadcasting a multi-language service. TANDEM HD-21 can be used without piggybacks for applications with a requirement simply to change the gain or shuffle the audio channels.

TANDEM HD-21 also gives you the option to delay the video by a frame to compensate for the delay created by converting to or from Dolby E. Dolby E allows multi-channel audio to be compressed into a single AES digital audio stream - however this compression process delays the audio by one video frame. By incorporating the option of a one frame video delay within TANDEM HD-21 the video and audio timing can be brought back into alignment at points where it matters (such as when switching signals or approaching a mixer) and therefore avoid lip-sync errors. TANDEM HD-21
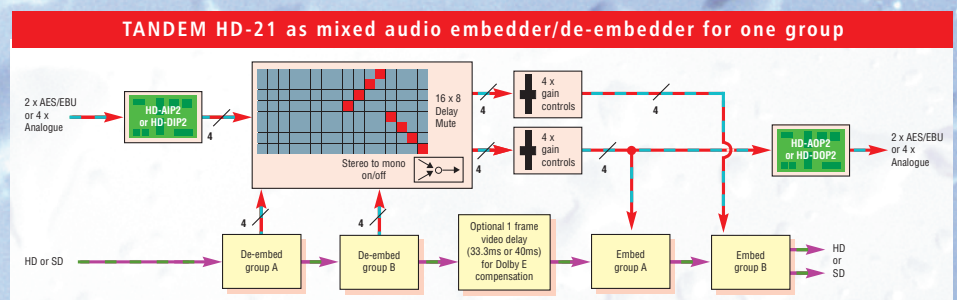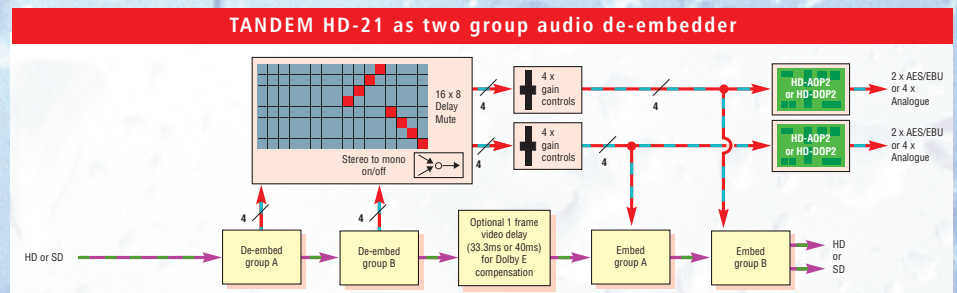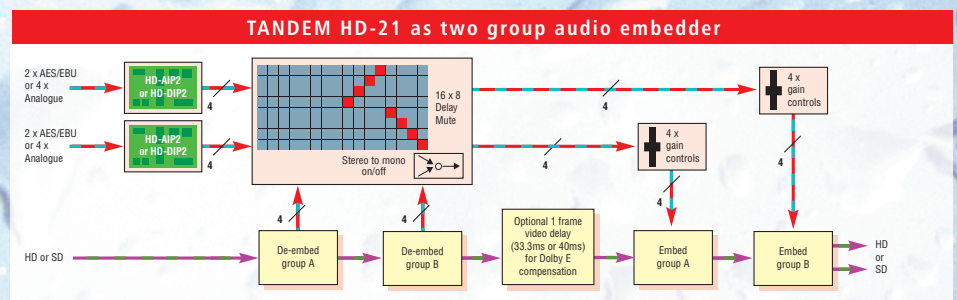
makes it no harder to time a Dolby system than a non-Dolby system, with this one board solution saving Dolby E users both rack space and money.

The additional Dolby E handling includes the ability to embed and de-embed Dolby E, mix AES and Dolby E in a single group and overwrite the Dolby E of a single group. Forward error correction ensures audio quality is maintained, while a headphone socket on the front of the board can be used to preview the audio sources.

Ideal for any environment that uses High Definition with embedded audio, TANDEM HD-21 is extremely straightforward to operate.

It includes Crystal Vision's intuitive board edge interface which allows you to instinctively and quickly locate any option from menus structured in the most logical way possible. Control can additionally be from an active front panel on the frame, a remote control panel, SNMP or the Statesman PC software.

TANDEM HD-21 fits in the standard frames (available in 4U, 2U, 1U and desk top box) and can be used with two frame rear modules to access all the inputs and outputs: select the RM33 if you're using analogue audio or 110 ohm AES and the RM39 if you're using 75 ohm AES.

TANDEM HD-21 as two group audio embedder

TANDEM HD-21 as two group audio de-embedder

TANDEM HD-21 as mixed audio embedder/de-embedder for one group

TANDEM HD-21 MOTHERBOARD

MECHANICAL
Standard Crystal Vision module 266mm x 100mm
Weight (with two piggyback modules fitted): 260g
Power consumption: 12 Watts

VIDEO INPUT
One HD or SD input
270Mb/s or 1.5Gb/s serial compliant to EBU 3267-E, SMPTE 259M and SMPTE 292M
The video formats supported are 625, 525, 720p50, 720p59.94, 720p60, 1080i50, 1080i59.94, 1080i60, 1080PsF23.98 and 1080PsF24
HD cable equalisation up to 140m with Belden 1694 or equivalent (approx. 100m with Belden 8281). SD cable equalisation >250m Belden 8281 or equivalent
Input return loss: -15dB for 50MHz to 1.5GHz
Automatic de-embedding to SMPTE 272M or SMPTE 299M

VIDEO OUTPUTS
Two HD or SD outputs using RM33 or RM39 frame rear modules
Serial output: 270Mb/s or 1.5Gb/s serial compliant to EBU 3267-E, SMPTE 259M and SMPTE 292M
Output follows the input format
Audio is embedded to SMPTE 272M or SMPTE 299M

AUDIO INPUTS AND OUTPUTS
Piggybacks can be added to the main board to enable either input or output of 2 x AES or 2 x analogue stereo pairs. Fit one piggyback for one audio group or two piggybacks for two audio groups
Use HD-AIP2, HD-DIP2 or HD-DIP2-RS to input analogue, synchronous AES or asynchronous AES audio
Use HD-AOP2, HD-DOP2-75 or HD-DOP2-110 to output analogue, 75 ohm AES or 110 ohm AES audio

EMBEDDER TIMING PERFORMANCE
Interchannel: <1 clock cycle
Audio to video: embed and de-embed delays approximately 800us in SD and 90us in HD
De-embedder automatically handles asynchronous and synchronous audio

MONITORING
One miniature front mounted audio jack and switch selects individual stereo audio analogue monitoring on both embedder and de-embedder

EDH
EDH insertion on SD output

DOLBY E
Dolby E signals can be processed and routed without corruption

VIDEO DELAY
Optional one frame video delay (33.3ms or 40ms) for Dolby E compensation

AUDIO DELAY
Adjustable audio delay of up to 64ms on each channel. Delay is either on or off for any given channel
Presetable and controllable via the card, frame active front panel, remote panel and Statesman

DELAY THROUGH BOARD
Less than one line

AUDIO REPLACE
Routing of input piggyback audio together with audio or Dolby E from up to two de-embedded groups present on video input to any channel of up to two output embedder groups

AUDIO PROCESSING
Gain level adjustment on each channel between +18dB and -18dB in 0.1dB steps with 0dB calibration
Mute
Stereo to mono conversion

AUDIO PROTECTION IN DE-EMBEDDERS
Full support for data recovery using SMPTE 299M error correction codes
A variety of sophisticated techniques are employed to protect and minimise the effects of cuts to untimed and asynchronous SDI

LED INDICATION OF:
Power supplies on board
HD input present
SD input present

GPI error output (alarm) active
Audio levels calibrated

GPI INPUT LEVELS
Active: pull to ground, pulled up to +5V through 10 kohm

GPI OUTPUT LEVELS
Electrically: Open collector transistors 30V, 270 ohm current limit resistors. Pulled up to +5V through 6800 ohm

GPI INPUTS
Four GPI inputs can be used to recall stored presets

GPI OUTPUTS
Two GPI outputs have programmable alarm outputs

LOCAL CONTROL
Intuitive board edge interface with two select buttons, shaft encoder and 10 character alphanumeric display
All functions available from board edge

REMOTE CONTROL
RS422/485
19200 baud, 8 bits, 1 stop no parity
Control from frame active front panel and remote panel
Statesman allows control from any PC on a network
All functions available from Statesman. All main functions available from frame active front panel and remote panel
SNMP monitoring and control available as a frame option

HD-AIP2 DUAL ANALOGUE AUDIO INPUT PIGGYBACK

AUDIO INPUTS
Two analogue stereo pairs or four mono channels. 24 bit quantising A to Ds. High input impedance (20 kohm) balanced

INPUT LEVEL RANGE
0dBFS = +28dBu max / 0dBFS = +12dBu min
Factory set default: 0dBFS = +18dBu or +24dBu by on board link

SIGNAL TO NOISE
99dB (+18dBu) rms., 22Hz to 22kHz typ.

TOTAL HARMONIC DISTORTION
0.004% THD+N rms., 22Hz to 22kHz typ.

INTERCHANNEL CROSSTALK
-110dB at 1kHz, -90dB at 20kHz, rms., typ.

HD-DIP2 AND HD-DIP2-RS DUAL DIGITAL AUDIO INPUT PIGGYBACKS

AUDIO INPUTS
Two 24 bit stereo pairs. AES3 110 ohm or HiZ (balanced) D-Type, or AES3-id (unbalanced) 75 ohm BNC. Set by on board jumper links
Synchronous audio to video 48kHz
Asynchronous audio to video 48kHz + or - 50ppm
HD-DIP2-RS is used for asynchronous AES inputs or AES at different sample rates (30kHz to 108kHz eg. 44.1kHz CD players or 96kHz DVD players)

TOTAL HARMONIC DISTORTION
0.0002%

HD-AOP2 DUAL ANALOGUE AUDIO OUTPUT PIGGYBACK

AUDIO OUTPUTS
Two analogue stereo pairs or four mono channels. 24 bit quantising D to As. Low output impedance (66 ohm) balanced

INPUT LEVEL RANGE
0dBFS = +28dBu max / 0dBFS = +12dBu min
Factory set default: 0dBFS = +18dBu or +24dBu by on board link

SIGNAL TO NOISE
99dB (+18dBu) rms., 22Hz to 22kHz typ.

TOTAL HARMONIC DISTORTION
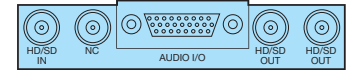0.002% THD+N rms., 22Hz to 22kHz typ.

INTERCHANNEL CROSSTALK
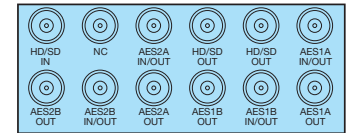-110dB at 1kHz, -90dB at 20kHz, rms., typ.

HD-DOP2-110 AND HD-DOP2-75 DUAL DIGITAL AUDIO OUTPUT PIGGYBACKS
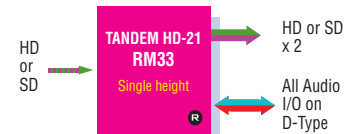
AUDIO OUTPUT
Two 24 bit AES/EBU stereo pairs
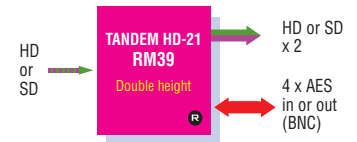AES: HD-DOP2-110 110 ohm balanced D-Type or HD-DOP2-75 75 ohm unbalanced BNC

RM33

RM39

NB. All Audio I/O = 8 x analogue audio in or out, or 4 x AES in or out

ORDERING INFORMATION

TANDEM HD-21	HD/SD single embedder or de-embedder for one or two groups of analogue or digital audio (allows fitting of one or two audio piggybacks)
HD-AIP2	Analogue audio (two stereo pairs) input piggyback
HD-AOP2	Analogue audio (two stereo pairs) output piggyback
HD-DIP2	75 ohm, 110 ohm, HiZ AES/EBU (two stereo pairs) input piggyback. 48kHz only, synchronous to video input
HD-DIP2-RS	Resampling version of HD-DIP2. 30-108kHz AES/EBU
HD-DOP2-110	110 ohm AES/EBU balanced (two stereo pairs) output piggyback
HD-DOP2-75	75 ohm AES/EBU unbalanced (two stereo pairs) output piggyback
HD-DCDCV18	18 Volt regulator for analogue audio configurations (one required if analogue audio piggyback fitted)
Indigo 4	4U frame with passive front panel for up to 24 Crystal Vision modules
Indigo 4SE	4U frame with passive front panel fitted with Statesman CPU for up to 24 Crystal Vision modules
Indigo 2	2U frame with passive front panel for up to 12 Crystal Vision modules
Indigo 2AE	2U frame with active front panel for up to 12 Crystal Vision modules
Indigo 2SE	2U frame with passive front panel fitted with Statesman CPU for up to 12 Crystal Vision modules
Indigo 1	1U frame with passive front panel for up to six Crystal Vision modules. Power supply redundancy available with Indigo 1-DP
Indigo 1AE	1U frame with active front panel for up to six Crystal Vision modules. Power supply redundancy available with Indigo 1AE-DP
Indigo 1SE	1U frame with passive front panel fitted with Statesman CPU for up to six Crystal Vision modules. Power supply redundancy available with Indigo 1SE-DP
Indigo DT	Desk top box with passive front panel for up to two Crystal Vision modules
Indigo DTSE	Desk top box with passive front panel fitted with Statesman CPU for up to two Crystal Vision modules
RM33	Single slot frame rear module. Allows maximum number of TANDEM HD-21 in frame (24 in 4U, 12 in 2U, six in 1U, two in desk top box). Suitable for analogue or 110 ohm digital audio. Allows all audio connections and both SD outputs
RM39	Two slot frame rear module. Allows 12 TANDEM HD-21 in 4U, six in 2U, three in 1U and one in desk top box. Suitable for 75 ohm digital audio. Allows all audio connections and both SD outputs
REMIND	19" remote control panel
REMIND-E	19" Ethernet remote control panel
Statesman	PC Control System
SNMP	SNMP monitoring and control

Performance and features are subject to change. Figures given are typical measured values. TANDEMHD-210511