

Crystal Vision



TANDEM

Twin ANalogue and Digital EMBEDder/de-embedder

A complete innovation in audio thinking.

That's the TANDEM from Crystal Vision, the world's first dual embedder/de-embedder system.

Two versions are available. Choose the low cost TANDEM-100 for most embedding and de-embedding applications. If you require more complex functionality you'll need the TANDEM-200. Both will save you space and money, by giving you up to 24 embedders/de-embedders in 2U.

TANDEM-100

The flexible TANDEM-100 can be configured as a single embedder, a single de-embedder, a dual embedder, a dual de-embedder or a mixed embedder/de-embedder.

Buy the basic 100mm x 266mm motherboard and then select any two piggybacks providing external inputs or outputs from a choice of six to suit your application. The DIP2 piggyback allows the embedding of digital audio into SDI (with the DIP2-RS featuring a resampler for asynchronous audio inputs), while the DOP2-110 and DOP2-75 allow you to de-embed 110ohm or 75ohm AES. For analogue audio, use the AIP2 for embedding and the AOP2 for de-embedding. The DCDCV18 PSU is required for all analogue I/O configurations. The kit format means that you can build the exact product you require, wherever you are - remove one piggyback and fit another. For example, combine two DIP2 piggybacks for a dual embedder, or an AIP2 with an AOP2 for a mixed embedder/de-embedder.

TANDEM-100 guarantees a high quality output every time with sophisticated audio error masking and contiguous packing of audio data to ensure correct transport of multiple audio groups. The built-in audio delay of up to 681 milliseconds will compensate for any video processing, such as a video feed going through an ARC, a DVE or being converted to and from MPEG.

TANDEM-100 has a Toolbox Analyser which can be used to investigate the state of audio and other data embedded within a video signal. This powerful troubleshooting tool allows engineers who are not getting expected results to diagnose the system fault responsible.

Auto configuration detects which piggybacks are fitted and selects the basic function (embed/de-embed) and the most common setup for the groups, delays etc. Further adjustments can be made from either board edge, the frame's active front panel, a remote control panel or the Statesman PC Control System, with settings saved on power down. A stereo analogue audio monitoring output - available on the frame rear modules or on the headphone socket at the front of the board - can be used to preview any of the sources. It is possible to connect the monitor signals of several TANDEM's to allow complete frame monitoring.

TANDEM-200

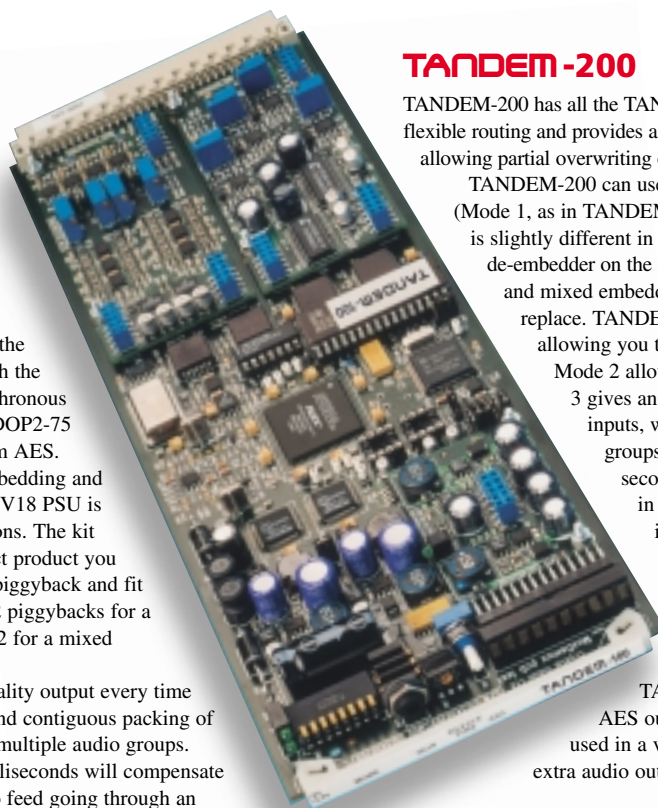
TANDEM-200 has all the TANDEM-100 features, but additionally offers more flexible routing and provides a de-embedder on the SDI input of all embedders allowing partial overwriting of audio groups and channel shuffling.

TANDEM-200 can use the duplicate signal paths either independently (Mode 1, as in TANDEM-100) or together (Modes 2, 3 and 4). Mode 1 is slightly different in TANDEM-200 as it additionally provides a de-embedder on the SDI input in the single embedder, dual embedder and mixed embedder/de-embedder configurations for audio replace. TANDEM-200 features three extra modes of operation allowing you to link the two SDI channels within TANDEM.

Mode 2 allows you to embed or de-embed two groups. Mode 3 gives an audio bridge with delay between the two SDI inputs, with the ability to de-embed and transfer two groups, shuffled in any way, to two more groups on the second SDI feed. Mode 4 splits the two piggybacks in half so that each half has two external audio inputs and two external audio outputs.

The Statesman PC Control System removes any potential complexity involved in controlling TANDEM-200 by allowing simple selection of options.

In addition to the audio monitoring of the TANDEM-100, TANDEM-200 has an extra four AES outputs on the RM04 rear module that can be used in a variety of ways. Application notes for these extra audio outputs are available on the website.



Embed analogue audio

De-embed digital audio



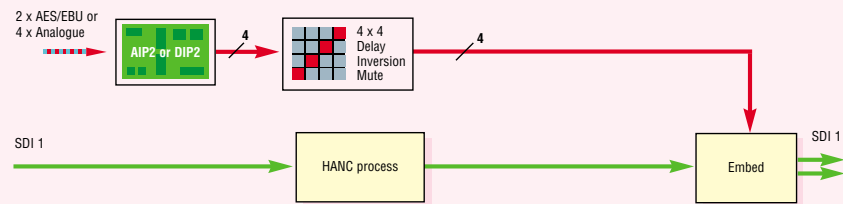
De-embed analogue audio

Embed digital audio

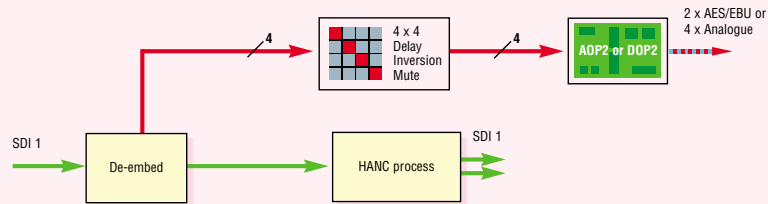
OPERATION MODES

TANDEM-100 Mode 1 - Independent mode

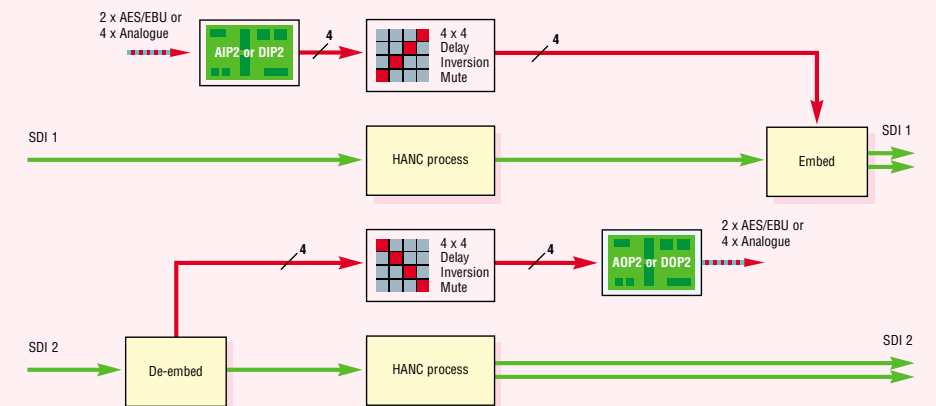
Configure TANDEM-100 to be a single embedder, single de-embedder, dual embedder, dual de-embedder or mixed embedder/de-embedder by fitting the appropriate piggybacks - AIP2, DIP2 or DIP2-RS for embedding and AOP2, DOP2-110 or DOP2-75 for de-embedding.
Ideal uses: Most embedding/de-embedding applications.



Dual embedder



Dual de-embedder

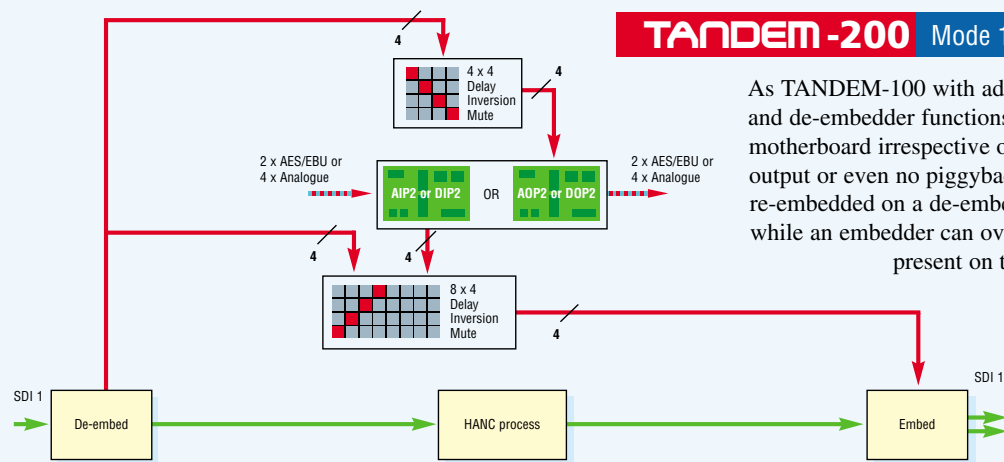


Mixed embedder/de-embedder

TANDEM-200 Mode 1 - Independent mode

As TANDEM-100 with additional processing. Both embedder and de-embedder functions are always available on the motherboard irrespective of whether an audio input, audio output or even no piggyback is fitted. This allows audio to be re-embedded on a de-embedder, with shuffling if required, while an embedder can overwrite individual channels of audio present on the SDI input i.e. we have both shuffle and replace.

Ideal uses: Most embedding/de-embedding applications, especially where channel shuffling or replace required.

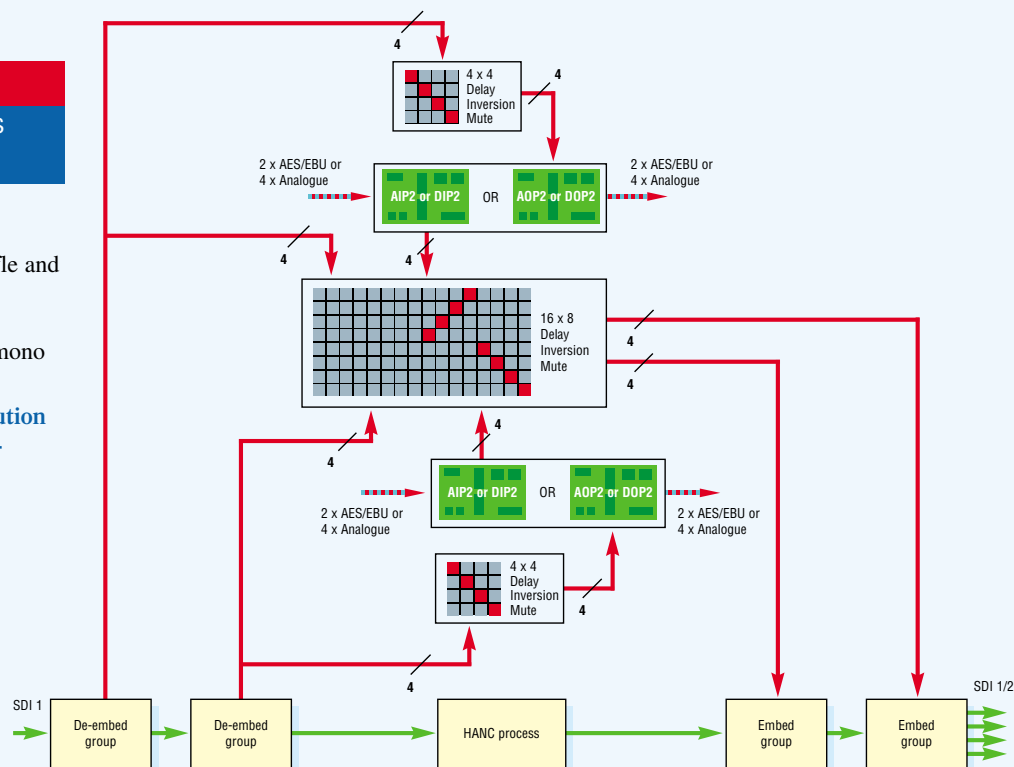


TANDEM-200 Mode 2 - Two audio groups for a single SDI

Combine the two halves of TANDEM-200 to get two group embed and de-embed with shuffle and replace. Any combination of piggybacks allow flexible configuration of eight external mono audio channels.

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Ideal uses: Multi-track distribution or dual group embedder or de-embedder when used with two group VTRs.

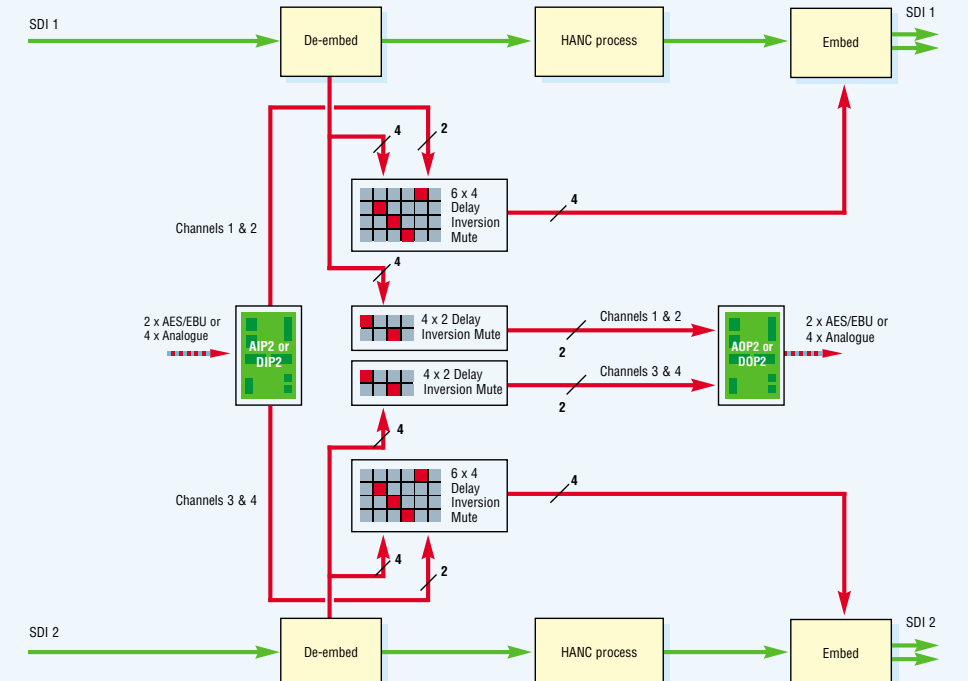


TANDEM-200 Mode 4 - Audio break-out and embed

Allows embedded audio to be replaced from external source. By using only half of one audio input piggyback each, and half an audio output piggyback each, both SDI channels can have both the de-embedder and embedder. This replaces four cards in most embedder systems.

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Ideal uses: Monitor background audio of a sports event on two channels (de-embed) and add commentary on other two channels (embed). Uses only half of TANDEM-200 and therefore can be done twice.

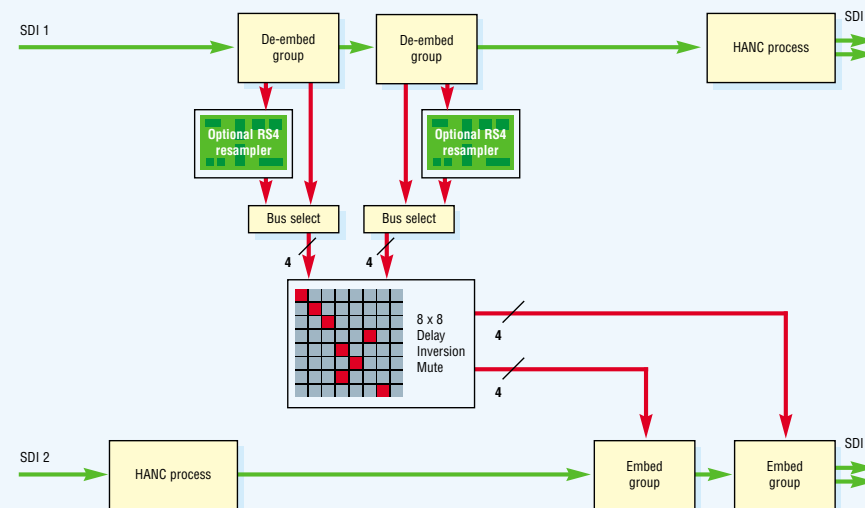


TANDEM-200 Mode 3 - Audio bridge

Allows embedded audio to be transferred from one video stream to another with an optional delay of 681 milliseconds.

De-embed two groups, shuffled in any way, to two more groups on the second SDI feed. For fully synchronous applications no piggyback modules are required. For asynchronous inputs, such as standards converters and frame synchronisers, one or two RS4 resampler modules can be fitted. Replaces three boards (de-embedder, delay, embedder) in any other system.

Ideal uses: Bypass DVE or ARC that does not process embedded audio or transfer audio from one video source to another.



S P E C I F I C A T I O N

TANDEM-100 AND TANDEM-200 MOTHERBOARDS (EMBEDDER AND DE-EMBEDDER)

MECHANICAL

Standard Crystal Vision modules 266mm x 100mm
Weight (with two piggyback modules fitted): 250g
Power consumption: 11 Watts

VIDEO SDI INPUT

2 channels SDI 270Mbit to EBU 3267-E & SMPTE 259M
Cable equalisation >200m Belden 8281 or equivalent
Auto 625/525 line selection
Automatic de-embedding of SMPTE or Sony format

VIDEO SDI OUTPUT

2 channels SDI 270Mbit to EBU 3267-E & SMPTE 259M
Audio is embedded to SMPTE or Sony format
2 outputs of each with suitable rear connector

EMBEDDER TIMING PERFORMANCE

Interchannel: <1 clock cycle
Audio to video: Min 160µs for Sony data format AES audio input.
Min 1ms for analogue audio input

MONITORING

1 x miniature front mounted audio jack and switch selects individual stereo audio analogue monitoring on both embedder and de-embedder. Also available on frame rear module. 4 x AES on TANDEM-200 only

EDH

EDH insertion on embedder and EDH error and rate of error checking for de-embedder

STATUS MONITORING

Front card edge visual monitoring with alphanumeric and LED indicators to indicate:

- PSU rails present: LED
- SDI inputs: Alphanumeric display
- AES audio inputs: Alphanumeric display
- Audio silence: Alphanumeric display
- Piggyback card types: Alphanumeric display

DIGITAL AUDIO DELAY

Pre-settable and controllable via the card, active front panel, remote panel and Statesman. Each half of TANDEM has its own adjustable delay up to 0.68 seconds max

AUDIO PROTECTION IN DE-EMBEDDERS

A variety of sophisticated techniques are employed to protect and minimise the effects of cuts to un-timed and asynchronous SDI, SDI corruption and TRS loss in the SDI signal. An AES/EBU reference can be applied to maintain audio integrity (silence) with loss of video

TOOLBOX ANALYSER FUNCTIONS

The Toolbox Analyser provides a detailed analysis of the SDI input. Reports include: SDI present, audio groups present, selected audio present, selected audio silent, non audio HANC data present, audio marked for deletion, audio data rate OK/high/low, checksum and format errors, parity error, TRS OK, Video standard = 625/525 lines, Video Picture Luma Content present/low or missing, Video Picture Chroma Content present/low or missing, valid/invalid audio source for embedder, embedding error (eg. no HANC space)

CONTROL

All functions available from board edge and Statesman PC Control System. All main functions available from frame active front panel and remote panel

GPI CONTROL

4 GPI inputs can be used to recall stored presets
2 GPI outputs have programmable alarm outputs

ADDITIONAL FEATURES ON TANDEM-200 MOTHERBOARD

AUDIO REPLACE

Embedder can replace individual audio channels already present on SDI input with audio from the I/O piggyback. Individual channels can be swapped or delayed. This unique facility saves previous demand to de-embed and then re-embed. (Audio replace can even be used when the AES input is not synchronous to the SDI input. As with all asynchronous AES inputs, best results will be obtained using the DIP2-RS resampling input piggyback)

AUDIO PROTECTION IN DE-EMBEDDERS

An on board crystal controlled oscillator provides redundant free running SDI signal at embedder to support extended video loss and allow an SDI transport for the audio signals. This can ensure continuous AES/EBU output at all times

AIP2 DUAL ANALOGUE AUDIO INPUT PIGGYBACK

AUDIO INPUT

2 analogue stereo pairs or 4 mono channels. 20 bit quantising A to Ds. High input impedance (20Kohm) balanced

INPUT LEVEL RANGE

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

SIGNAL TO NOISE

-89dBu / -107dBFS (+18dBu) rms., 22Hz to 22kHz typ.

TOTAL HARMONIC DISTORTION

0.003% THD+N rms., 22Hz to 22kHz typ.

INTERCHANNEL CROSSTALK

-118dB at 1kHz, -98dB at 20kHz, rms., typ.

SYNCHRONISATION

Digitised output of analogue A to D is automatically locked to video

DIP2 AND DIP2-RS DUAL DIGITAL AUDIO INPUT PIGGYBACKS AND RS4 RESAMPLER

AUDIO INPUT (DIP2 AND DIP2-RS)

2 x 20 bit stereo pairs. AES3 110ohm or HiZ (balanced) D-Type, or AES3-id (unbalanced) 75ohm BNC. Set by on board jumper links

Synchronous audio to video 48kHz
Asynchronous audio to video 48kHz + or - 50ppm
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)

GAIN (DIP2-RS AND RS4)

-0.072dB

TOTAL HARMONIC DISTORTION (DIP2-RS AND RS4)

0.00017%

SIGNAL TO NOISE (DIP2-RS AND RS4)

-117dBFS

AOP2 DUAL ANALOGUE AUDIO OUTPUT PIGGYBACK

AUDIO OUTPUT

2 analogue stereo pairs or 4 mono channels. 20 bit quantising D to As. Low output impedance (66ohm) balanced

INPUT LEVEL RANGE

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

SIGNAL TO NOISE

85dBu / -103dBFS (+18dBu) rms., 22Hz to 22kHz typ.

TOTAL HARMONIC DISTORTION

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

INTERCHANNEL CROSSTALK

-112dB at 1kHz, -98dB at 20kHz, rms., typ.

DOP2-110 AND DOP2-75 DUAL DIGITAL AUDIO OUTPUT PIGGYBACKS

AUDIO OUTPUT

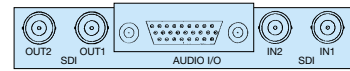
2 x 20 bit AES/EBU stereo pairs (2 buffered outputs of each on some frame rear modules)

AES: DOP2-110 110ohm balanced D-Type or DOP2-75 75ohm unbalanced BNC

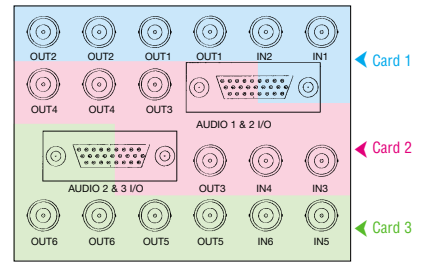
OPTIONAL REFERENCE

Available instead of second buffered output on some frame rear modules. Link select

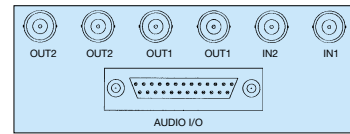
- a) AES reference
- b) Word clock



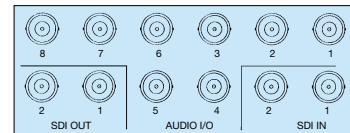
RM04 Rear module



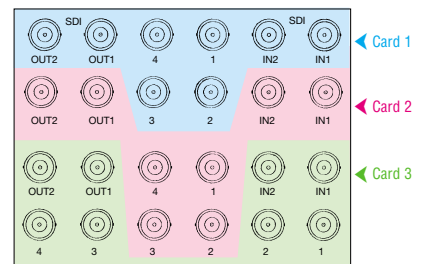
RM05 Rear module



RM06 Rear module



RM07 Rear module



RM08 Rear module

ORDERING INFORMATION

TANDEM-100	Main board with SDI video inputs and outputs (allows up to two audio I/O piggybacks). Standard embedding/de-embedding functionality
TANDEM-200	Main board with SDI video inputs and outputs (allows up to two audio I/O piggybacks). Full functionality, including audio replace and bridge
DIP2	AES/EBU input, 75ohm, 110ohm, HiZ (two stereo pairs) piggyback
DIP2-RS	Resampling version of DIP2
RS4	Optional resampler piggyback for TANDEM-200 Mode 3
DOP2-110	AES/EBU output, 110ohm balanced output (two stereo pairs) piggyback
DOP2-75	AES/EBU output, 75ohm unbalanced output (two stereo pairs) piggyback
AIP2	Analogue audio input (two stereo pairs) piggyback
AOP2	Analogue audio output (two stereo pairs) piggyback
DCDCV18	PSU for analogue audio configurations (NB. one required if any analogue audio piggybacks fitted)
FR2AV	2U frame for up to 12 Crystal Vision modules
FR1AV	1U frame for up to six Crystal Vision modules
DTB-AV	Desk top box for up to two Crystal Vision modules
RM04	Single slot frame rear module. Allows maximum number of TANDEM in frame (12 in 2U, six in 1U, two in desk top box). Suitable for analogue or 110ohm digital audio. All audio connections available, but not second SDI output. Includes AES monitoring on TANDEM-200
RM05	Four slot frame rear module. One rear module used for three TANDEM, allowing nine TANDEM in 2U (fits in 2U frame only). Suitable for analogue or 110ohm digital audio. Allows all audio connections and both SDI outputs
RM06	Two slot frame rear module. Allows six TANDEM in 2U, three in 1U and one in desk top box. Suitable for analogue or 110ohm digital audio. Allows all audio connections and both SDI outputs
RM07	Two slot frame rear module. Allows six TANDEM in 2U, three in 1U and one in desk top box. Suitable for 75ohm digital audio. Allows all audio connections but not second SDI output
RM08	Four slot frame rear module. One rear module used for three TANDEM, allowing nine TANDEM in 2U (fits in 2U frame only). Suitable for 75ohm digital audio. Does not allow second audio output or second SDI output
FP2-LF	Active front control panel for 2U frame
FP1-LAV	Active front control panel for 1U frame
FP1-SAV	Active front control panel for desk top box
REM1U	19" remote control panel
REM1US	Narrow 1U remote control panel
Statesman	PC Control System

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