OTM 1000

Advanced Waveform Monitor & Signal Generator

3Gb/s • Dual-Link • HD • SD • Standard case

Introducing the OTM 1000...

The OmniTek OTM 1000 offers a unique combination of high-precision video and audio analysis tools, and comprehensive full-motion signal generator system. The OTM 1000 is compatible with all single and dual-link SDI formats at 270Mb/s, 1.5Gb/s, and 3Gb/s. The system also contains an optional physical layer analysis package, providing jitter measurements and the industry's first production eye diagram display for 3Gb/s signals.

System Overview

The OTM 1000 is supplied in an industry-standard half-width 3RU enclosure with a familiar, easy-to-use control panel interface and high-resolution built-in colour LCD display. There are two SDI inputs and two SDI outputs, plus a reference sync input loop-thru (bi-level or tri-level) and an analog RGB/YPbPr component monitoring output. There is an internal loudspeaker and a headphone socket for audio monitoring. External data interfaces include dual gigabit ethernet ports, three USB ports, and an RS-232 serial interface.

The capabilities of the system are defined by a wide range of performance options, to allow users to configure the system to meet their exact needs. Most of these options are enabled as a software download.

The digital audio I/O interfaces and physical layer analysis package are in the form of additional plug-in circuit cards. Other mechanical options available include a 19" rack-mount kit, rugged flight case, and mounting sleeve with carrying handle and angled feet.

The OTM 1000 contains a unique flexible display manager, which allows the user to configure the screen displays to best suit their needs. Each window tile can be positioned and sized individually, and stored as a preset. There is also an external VGA port for connection to an external display screen. All functions of the system can be remote controlled from the Ethernet port, either using SNMP or a simple web browser interface.

Signal Analysis Functions

Input Signal Status

Input signals are checked for errors and the presence of various types of metadata. Checks include SDI formatting, TRS and CRC/EDH validity; Picture freeze/mono/black detect; SMPTE 352M "payload ID" display; AFD, Video Index, and WSS aspect ratio controls; VITC, LTC, and ATC timecode monitoring; Range and gamut checks in RGB & YCbCr colour spaces; and EIA-608, 708, teletext and OP47 subtitle display.

Picture Monitor

The OTM 1000 includes a high quality full frame-rate picture monitor display, which can be configured to show either the active picture or the entire raster with horizontal and vertical "pulse-cross" modes. Gamut and range errors can be highlighted on the picture, and there is a unique *zoom view* mode for high magnification of a user-selectable area of the picture.

Waveform Displays

The OTM 1000 contains OmniTek's award-winning high resolution, user-adjustable waveform displays in YCbCr, RGB, Composite, and XYZ colour spaces. Multi-line, single-line, two-line, and frame-scan modes are available, and the colour components may be displayed as a horizontal parade, overlay, or vertical stack. There is fully functional H & V magnification, plus our unique *region of interest* control. There are also timebase and amplitude cursors.

The internal signal processing is performed to 12-bit precision, to maximize waveform accuracy. Arbitrary combinations of colour components may be displayed simultaneously and each may be individually colour-coded. Gain, gamma, and persistence controls are available.

OTM 1000 default analysis configuration

Colour Analysis Functions

The OTM 1000 provides up to four separate colour monitoring and analysis displays, to support users working in broadcast, QC, post-production, or digital cinema environments. There is a high resolution *vectorscope* with 75% and 100% graticules, including region-of-interest, zoom, gain control, and luma-level masking modes. The system also provides a colour *gamut indicator* display, which gives a real-time indication of the percentage of pixels which are outside gamut in any of the monitored colour spaces (for example as specified in EBU Recommendation 103).

For post-production users, the **VIEW_XR_DCI** software option provides *histogram* displays in RGB, YCbCr, XYZ, and Composite colour spaces, and the real-time *CIE colour chart* display provides a unique method for showing which source pixels fall inside or outside the colour gamut of a range of different display types and formats.

Pixel Data Display

The **VIEW_DATA** option adds a detailed pixel data display, showing the exact values present on the SDI inputs in decimal, hex, or binary numbers. The colour-coded display indicates different types of data, while a user-programmable ANC data packet reader decodes Metadata for easy analysis.

The display is compatible with dual-link inputs, and provides decoding pf 12-bit pixel values or 4:4:4:4 data with alpha channel in YCbCr, RGB, and XYZ formats.

Physical Layer Analysis

The **EYE** option on the OTM 1000 system provides a full range of physical layer analysis tools for the SDI inputs. An additional hardware plug-in card is required, available in SD-only, SD/HD, and SD/HD/3G versions.
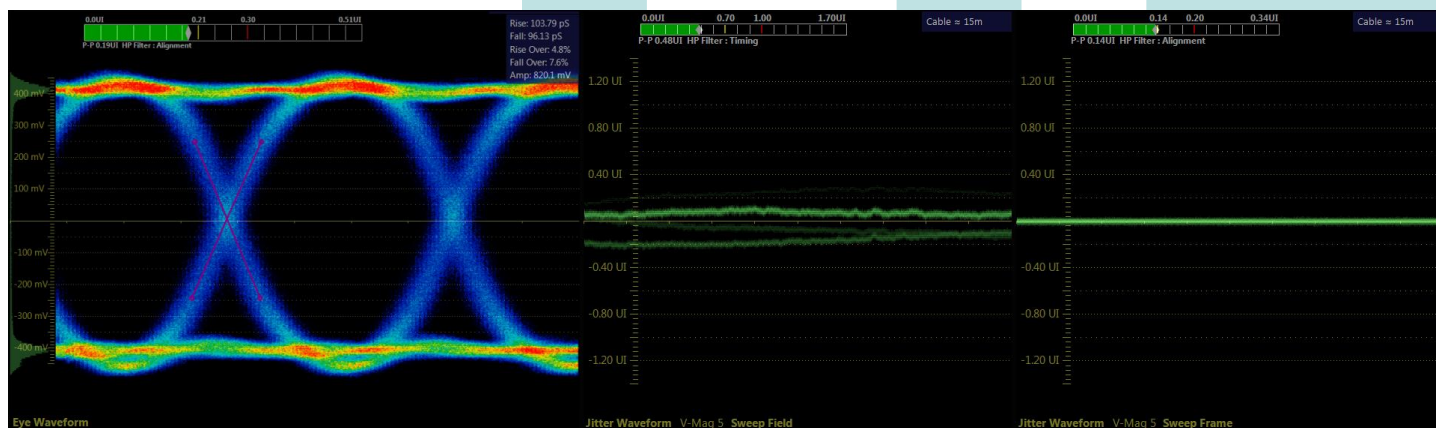
3Gb/s Eye diagram with auto amplitude & rise-time calculation plus jitter displays with Timing and Alignment filtering

The **EYE** option provides accurate, automatic measurement of the amplitude of the incoming SDI signal, the bitstream rise and fall times, the overshoot/undershoot level, and the calibrated input cable length. The option also gives a detailed analysis of the bitstream jitter characteristic over various frequency bands, including the SMPTE recommendation timing and alignment filters.

Two display windows are available with the **EYE** option: Firstly the Eye Diagram display itself, showing the waveform of the input SDI bitstream calculated with an input bandwidth in excess of 10GHz. 2, 4, and 8-Eye displays are available, in both equalised and non-equalised modes. Secondly a Jitter Waveform display is available, showing the jitter amplitude with respect to time using a range of different horizontal timebases.

Logging, Alarms, & Closed Caption Decoding

Comprehensive error detection and logging is a standard feature on the OTM 1000. All the video, audio, and metadata parameters monitored by the system can be saved to an XML log file, with time-stamping from input timecode or the system internal clock. Multiple simultaneous event logging processes are allowed. In addition, events may be configured to trigger alarms or SNMP network traps. Thresholds and timeouts for each monitored parameter are fully adjustable in the configuration menus.

The OTM 1000 supports a full closed caption decoder as standard. This is compatible with "Line 21" analog captions plus EIA/CEA 608-B and 708-B digital caption data. There is also an Enhanced Teletext subtitle decoder supporting specification level 1.5, including support for "OP-47" digital ancillary teletext. Decoded captions may be overlaid on the picture display, and the caption data (raw or decoded) is logged in XML files.
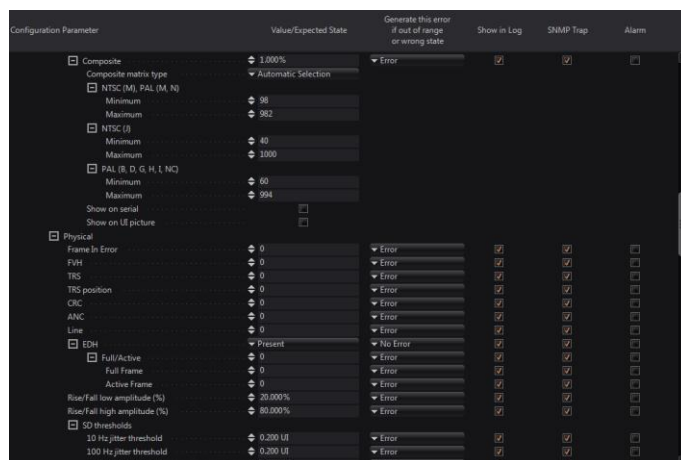
*Main configuration menu for setting log parameters*

Dual Simultaneous Channels

When equipped with the **VIEW_2** option, the OTM 1000 can simultaneously monitor two independent SDI inputs.

The full range of analysis functions are provided for each input, and the two inputs may be in different formats (SD, HD single-link or 3Gb/s type A).

Audio Monitoring Functions

The OTM 1000 provides a comprehensive range of audio monitoring functions. The basic **AUDIO** option supports 16 channels of PCM embedded audio input.

It also provides detailed channel status, a wide range of PPM meter ballistics and graticules, surround-sound display, and Lissajous figures.
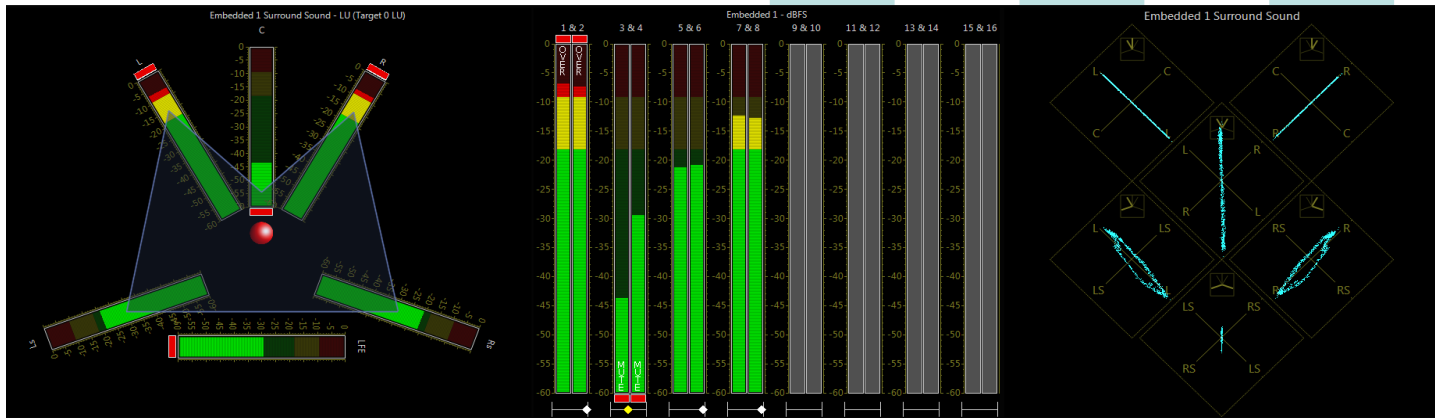
Surround Sound PPM view, 16-channel embedded PPMs and Surround Sound Lissajous

The **AUDIO_LOUD** option includes a detailed loudness monitoring package, based on ITU-R BS.1770 with adjustable timing windows and gating factors as described in EBU recommended practice 128.

A range of dedicated displays for loudness are provided, including long-term histograms and time-history graphs with logging features.
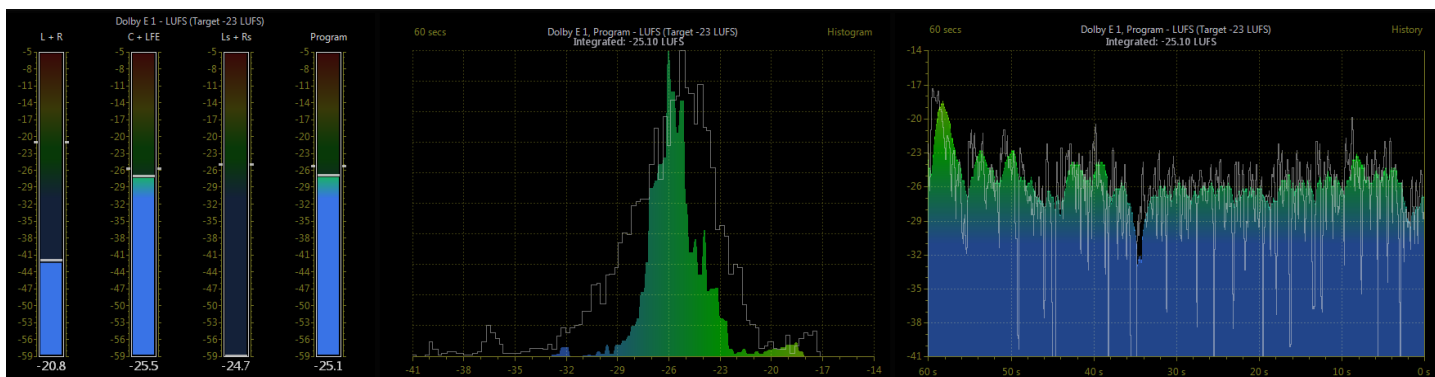
Loudness PPMs, histogram and history displays

Options **AUDIO_DOLBY_D** and **AUDIO_DOLBY_E** provide full decoding of compressed audio inputs, including detailed metadata analysis and display (guard band timing etc.). A decoded analog stereo pair is available at the headphone/line-out socket.

The **AUDIO_AES** option is a separate hardware card providing 16 channels of digital audio I/O. Digital input signals are routed to the various analysis displays, and the digital outputs may be selected from the Dolby decoder options or PCM embedded audio input.

In-service Audio/Video delay measurement

Lip-Sync measurements typically either use a dedicated test sequence, the details of which are known very precisely, or involve watermarking the video digitally. Both methods have drawbacks.

Where the OTM 1000 includes the **AV_ISD** software option, neither a test sequence nor a watermark are required. Instead the OTR 1001 takes all the information it needs to determine the A/V delay from whatever video is currently being processed. An accuracy of approximately 20µs is achieved.

The **AV_ISD** option also allows you to determine the Loop Delay applied to the audio and video streams as the video is transmitted through one or more items of equipment.
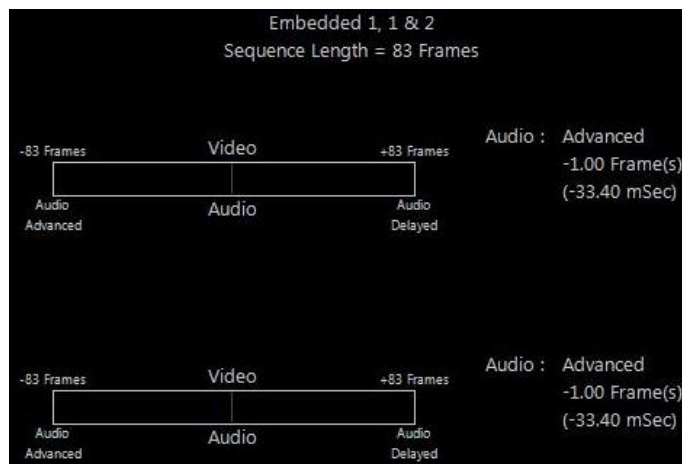
Audio/video delay measurement tile

Input Capture Functions

The standard OTM 1000 system can freeze & capture both the user interface display and also video frames from the SDI inputs. With the **CAP_MOTION** option, full-motion sequences of frames may be captured directly into system memory for subsequent analysis. Sequence duration limits are the same as for the **GEN_MOTION** option.

There is also a **CAP_ADVANCED** option, to enable users to capture frames or sequences as full-raster RVF files with all blanking and ancillary data.

Note that to play out any captured images or sequences, the appropriate generator option must also be installed.

Test Signal Generator

The OTM 1000 provides several test signal generator options. **GEN_BASIC** simply provides colour bars and pathological matrix in the selected output video format.

The more comprehensive **GEN** option provides a wide range of capabilities including many standard test patterns, fully programmable zone plate generator, still image play-out from a variety of different file formats, embedded audio tone generator, user-selectable levels of gain, noise and bounce, and insertion of various types of metadata.

The **GEN_2** option builds on this further by enabling generation of two independent test signals.

The **GEN_MOTION** option allows the playing out of full-motion uncompressed video sequences.

Finally the **GEN_ADVANCED** option contains our unique RVF file editor, enabling users to create and edit video frames comprising the entire raster with H & V blanking. The option also allows User-defined ANC packets may to be inserted onto the output.

Generator Window

Still Image Play-out
The OTM 1000 can play out images stored in any standard PC file format (.bmp, .jpg, .tif, .yuv, .sgi etc.). When the images are loaded into the system they may be re-sized to fit the current video output format, and the colour space is automatically converted using Rec. 601 or Rec. 709 matrices

Full-Motion Play-Out
The OTM 1000 can play out full-motion uncompressed video sequences in any format. The system provides 8GByte of RAM for sequence playout, but the actual sequence duration will depend on the selected video format and sampling structure. Approximate figures are 60 seconds for SD, 11 seconds for single-link HD, and 6 seconds of 1080p50.
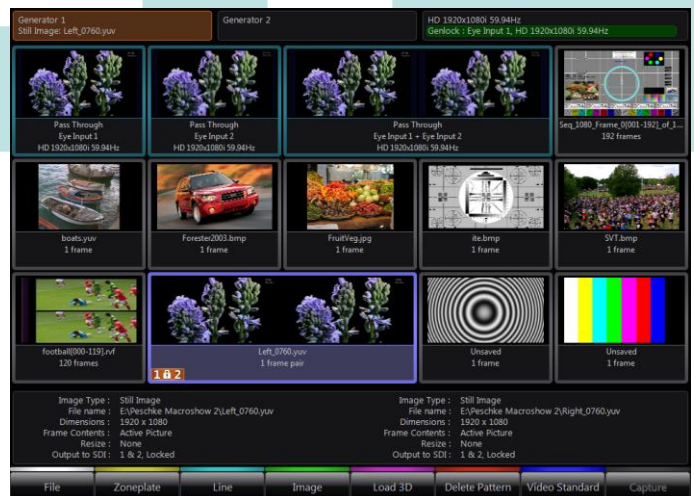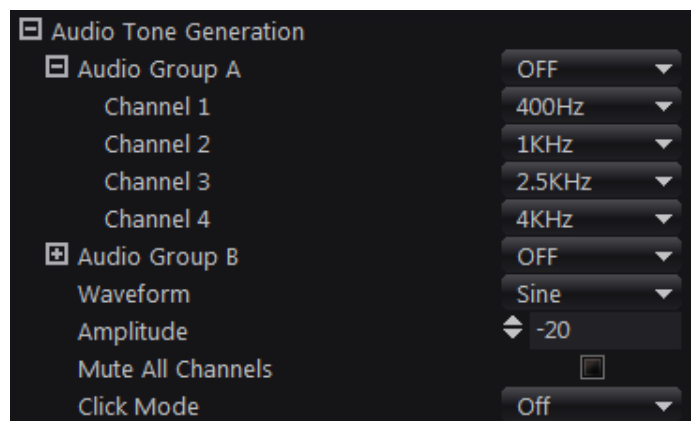
Standard Line Patterns
The standard patterns include a range of colour bars, frequency sweeps, multiburst, luma and chroma steps & ramps, pathological, and pulse & bar. Patterns are available in all video formats at full bit-precision in the colour space of the currently-selected format.

Zone Plates
The zone plate generator provides a complete set of X, Y, and T adjustments. The basic waveform is selectable as sine, square, or triangular, and may be applied to luma and chroma channels independently. User settings can be saved in custom setup files.

Embedded Audio Generator
The system provides an 8-channel embedded audio tone generator, with 20 or 24 bits per sample at 48kHz. Output audio group number, tone frequency, and wave shape (sine, square, triangle) are user-selectable. It is also possible to switch the audio on or off for a single frame when playing a video sequence, to provide a 'blip' for A/V delay measurement purposes.

Audio generation properties

System Options & Configurations

The OTM 1000 has many different configuration options, as explained above and summarized on the back page of this brochure.

For a complete list of all the available options and prices, or to arrange a system demonstration, please consult your local dealer.

OTM 1000 TECHNICAL SPECIFICATION

Serial Digital Inputs
Connection	2 x BNC with 75ohm termination
Return Loss	>15dB to 1.5GHz, >10dB to 3GHz
Bit Rates	270Mb/s, 1.485Gb/s, 2.97Gb/s (SMPTE 259M, 292M, 424M)

Serial Digital Outputs
Connection	2 x BNC with 75ohm termination
Bit Rates	270Mb/s, 1.485Gb/s, 2.97Gb/s (SMPTE 259M, 292M, 424M)
Timing Jitter	< 0.2UI (SD), < 1.0UI (HD), < 2.0UI (3Gb/s)
Alignment Jitter	< 0.2UI (SD), < 0.2UI (HD), < 0.3UI (3Gb/s)

Monitor Out Connector
Connection	8-pin Lemo
Video Output	RGB with bi- or tri-level sync on green, 0.7Vpk-pk video; or YPrPb with bi- or tri-level sync on Y, 0.7Vpk-pk video

AES Audio (optional)
Connection	8 input channels, 16 output channels, break-out cable provided.

Reference Loop
Connection	2 x BNC, high impedance loop-through
Sync Input	Black with bi-level (0.3 Vpk-pk) or tri-level (0.6 Vpk-pk) composite sync.
Return Loss	>30dB up to 30MHz, with suitable termination on one BNC

LTC unit (optional)
Connection	RS-422 interface. Differential, input impedance 24kohm

Audio
Connection	Analog headphone output signal, output impedance <50ohm

Network connectivity
|	
Connection	2 ports as 10/100/1000Mbps

Performance
Raster Formats	486i / 59.94, 576i / 50 (ITU-R BT.601)
	720p / 23.98, 24, 25, 29.97, 30, 50, 59.94, 60Hz (SMPTE 296M)
	1035i / 59.94, 60Hz (SMPTE 260M)
	1080sF / 23.98, 24, 25, 29.97, 30Hz (SMPTE 274M, RP211)
	1080i / 50, 59.94, 60Hz (SMPTE 274M)
	1080p / 23.98, 24, 25, 29.97, 30, 50, 59.94, 60Hz (SMPTE 274M, 425M)
Sampling	4:2:2, 4:4:4, and 4:4:4 + Alpha (SMPTE 372M)
Resolution	8-, 10-, or 12-bits per pixel (SMPTE 372M)
Generator	Total image storage capacity = 2GByte. Sequence capture/play-out duration depends on video format & sampling structure.
Genlock	Output timing adjustable (with respect to sync input) in clock increments from 0 to 1 video frame.
UI resolution	1024 x 768 (on-board LCD), 1920 x 1200 (VGA).

Environmental
Power	90...250Vac 47...63Hz autodetect. 150W maximum
Size/Weight	Standard case - 430mm x 200mm x 120mm, 9Kg
Temperature	Operational: +5...+35C, humidity <95% non-condensing
	Storage: -20...+50C, humidity <95% non-condensing

All specifications are subject to change without notice.
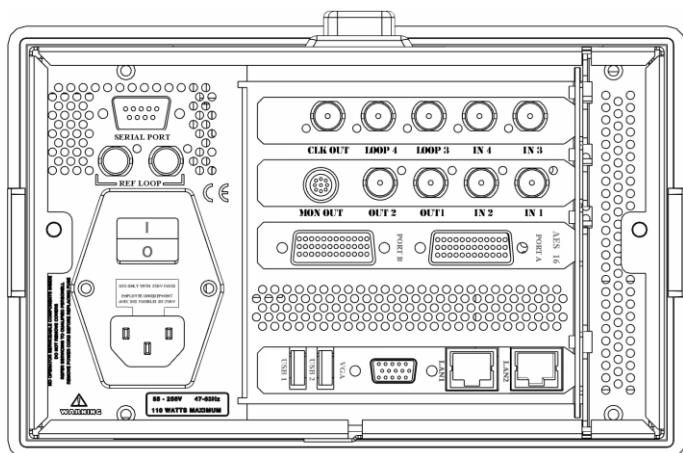
OTM 1000 Rear Panel

V1.3 © Image Processing Techniques Ltd. 2013

SYSTEM OPTIONS

The OTM 1000 is supplied with basic monitoring functions in standard and high-definition only. A wide range of additional options are available, see below. Options may be purchased at any time, and the system upgraded by the customer via software downloads. Please consult your OmniTek dealer for a full list of options and price/delivery information.

PQA	Adds Picture Quality Analysis

Video Format Support
VIDEO_DL	Adds support for Dual Link formats
VIDEO_3G	Adds support for 3Gb/s A & B formats

Video Monitoring Options
VIEW_DATA	Enhanced pixel data display
VIEW_2	Adds support for dual channel simultaneous SDI monitoring.
	Note: 3Gb/s type B and Dual Link formats not supported.
VIEW_XR_DCI	Adds XYZ monitoring, histograms, 12-bit, CIE colour chart
AV_ISD	Adds 'In-Service' audio/video delay measurement.
ALIGNMENT	Adds camera alignment

Audio Monitoring Options
AUDIO_AES	Adds AES digital I/O support on separate card
AUDIO_DOLBY_E	Adds DOLBY E full decode + metadata
AUDIO_DOLBY_D	Full Dolby Digital decode
AUDIO_LOUD	Adds Loudness

Video Pattern Generator Options
GEN_BASIC	Simple generator for colour bars & pathological test patterns only.
GEN	Standard test patterns, zone plates, import of standard image files. Adjustable gain, noise, bounce. Audio tone generation, VITC, ATC, WSS, VINDEX, and SMPTE 352 payload insertion.
GEN_2	Dual independent generators
GEN_MOTION	Uncompressed sequence play-out from system RAM (requires GEN)
GEN_ADV	Play-out of full-motion RVF frames (active + blanking & ANC data) (requires GEN and GEN_MOTION)

Video Capture Options
CAP_MOTION	Full motion capture of active video, recorded uncompressed to RAM (requires GEN).
CAP_ADV	Capture of full-motion RVF frames (active + blanking & ANC data). (requires CAP_MOTION).

Physical Layer Measurements Options
EYE	Eye diagram, eye amplitude and jitter measurements for SD, HD and 3Gb/s type A & B formats.

Other options
LTC	Adds LTC reader (external unit)

WARRANTY

OmniTek systems are warranted for one year from date of purchase. This includes all feature upgrades and bug fixes to the application software, plus repair or replacement of the hardware (at the discretion of OmniTek). Extended warranty agreements are also available, please consult your local dealer.

ABOUT OmniTek

OmniTek is the product division of Image Processing Techniques Ltd., a leading independent consultancy company specializing in the design of products for the broadcast, post-production, and digital film industries. Over the past 12 years, IPT has completed many successful design projects for major equipment manufacturers in Europe, Asia, and the United States. For more information, please see **www.omnitek.tv**

OmniTek

Advanced Measurement Technology