hai vision systems inc.

MAKO-HD

"Zero Latency" High Definition Video Encoding for Telepresence, Medical, and Interactive Broadcast

*The **MAKO-HD™** for the **hai** 1000™ series multi-stream encoder systems defines a new era of video communications where latency is imperceptible and full motion image quality is pristine. Ideally suited for the demands of telepresence, medical, and interactive broadcast applications, the **MAKO-HD** supports up to 1080p high definition with 70 milliseconds of end to end latency. This is the lowest latency ever achieved by an H.264 codec system providing truly interactive sessions between remote sites.*

Designed using revolutionary encoding technology the **MAKO-HD** delivers ultimate high definition video quality, super wideband audio, and even computer graphics content over common networks. Some latency is introduced in any video encoding process, but the key is to strive to limit the latency in order to provide seamless communication. Systems that contain excessive delay (traditional conferencing systems and satellite based systems observed in remote news broadcast for example) lead to extremely poor communications and dramatic fatigue. As a result such systems can only be used for very short durations. With **MAKO-HD** configured **hai** 1000 systems, "zero latency" high definition communications is now readily available for telepresence conferencing, medical training and consultation, and interactive broadcast solutions. "Zero latency" can be considered within systems that operate assuring hand eye coordination (below 90ms) or operating within a blink of an eye (100 ms). The **MAKO-HD** performs at least 5 to 10 times faster than traditional conferencing codecs and "low latency" broadcast encoders.

The **MAKO-HD** achieves its revolutionary latency performance though the implementation of Progressive Encoding technology. Unlike other video encoders that need to await a number a frames in order to commence the encoding process, HaiVision's Progressive Encoding engine starts encoding well before the first frame has even been completely delivered.

The **MAKO-HD** is unlike traditional video conferencing codecs. The **MAKO-HD** supports full frame rate, high definition video, critical when any scene motion is introduced. The **MAKO-HD** provides 100% fluid results. The **MAKO-HD** also supports all major HD standards up to and including 1080p at video bit rates from below 1Mbps to 10 Mbps. To achieve the highest quality video given any particular bandwidth constraints and content requirements, the **MAKO-HD** allows full control over the encoding parameters.

Incorporating industry standard compression, encapsulation, and signaling protocols such as H.264 (MPEG-4 AVC or MPEG-4 part 10) video, AAC audio, Transport Stream, and SIP, the **MAKO-HD** not only enables the highest caliber of video communications, but also, where needed, provides simple integration with low cost set top box decode appliances, soft players, QuickTime™ and QuickTime Streaming Server™ (QTSS) environments, storage systems, and, through **INVITATION**, traditional video conferencing systems. Designing communication infrastructure around HaiVision's **MAKO-HD** enables clients to leverage to true power and ubiquity of IP video.

TELEPRESENCE SUITES

…where you need to present, discuss and debate ideas clearly and completely without having to cut corners because the technology gets in the way

MEDICAL SYSTEMS

…bringing procedures to critical audiences where reliability, quality and precision is a must.

INTERACTIVE BROADCAST

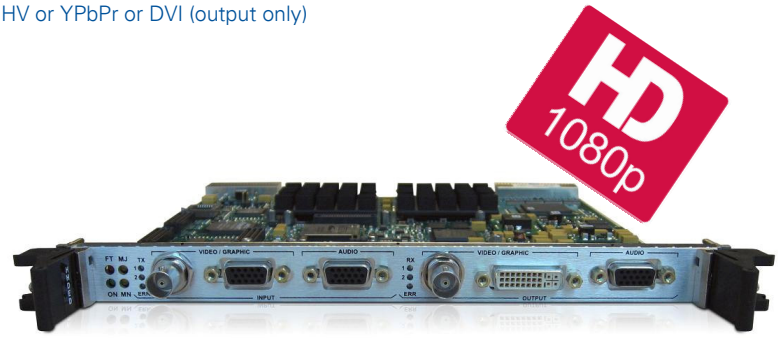
…connecting facilities, affiliates, and event locations to enable flexible video distribution and interactive real-time commentary without the costs and inherent delay of satellite.

hai*1000* features

- hai1060 – up to 5 *MAKO-HD* blades
- hai1020 – for a single MAKO-HD blade
- INVITATION Videoconference Interoperability
- Logical multicast / multiple unicast
- Telecom grade reliability
- Robust and extensible frame & blade design
- Web, CLI, and SNMP interfaces

HD blade (MAKO-HD) features

- 1080p, 1080i, 720p, 480p, 480i
- Full frame rate video
- 256 kbps to 10 Mbps video bitrate
- Add'l RGBHV input up to 1280x768 60Hz
- I/O #1 - HD SDI, SDI, embedded digital audio
- I/O #2 – RGBHV or YPbPr or DVI (output only)
- Separate 4 channel analog audio
- Unique Dual Stream – 2 Channel Encoding (Video & RGB)
- Encoder/decoder design
- Latency of 70 milliseconds



MAKO-HD – up to 1080p High Definition with Media Sharing

The ***MAKO-HD*** is the highest performance HD codec available supporting up to 1080p and achieving end to end latency of 70 milliseconds. Each ***MAKO-HD*** has a digital (HD-SDI/SD-SDI) and an analog (RGBHV/YPbPr) input port. The output design is similar with the addition of DVI support. The ***MAKO-HD*** can encode up to 1080p video and up to 1280x768 on RBG. Uniquely and with the Dual Stream option, the MAKO-HD can share its compression power between both input ports simultaneously – each at adjusted frame rates. So, for example, one may wish to encode the video at 720p 50 frames per second and simultaneously encode an RGB source at 1024x768 10 frames per second with perfect synchronization between the video and computer graphics. Or perhaps encode the HD-SDI at 720p 30 and the YPbPr at 720p 30. Effectively this gives integrators extreme flexibility in addressing their client's exact needs and maximizing resources.

Specifications - **hai*1000* series *MAKO-HD* codec blades** (encode with decode)

VIDEO ENCODING / DECODING

H.264 AVC (MPEG-4 part 10)

HD-SDI/SDI Resolution:

720x480/576i	25, 30 frames per sec.
1280x720p	25, 30, 50, 60 frames per sec.
1920x1080i	50, 60 fields per sec.
1920x1080p	25, 30 frames per sec.

YPbPr Resolution:

720x480/576p	25, 30, 50, 60 frames per sec.
720x480/576i	50, 60 fields per sec.
1280x720p	25, 30, 50, 60 frames per sec.
1920x1080i	50, 60 fields per sec.

RGBHV Resolution:

VGA	640x480	Up to 85 Hz
SVGA	800x600	Up to 85 Hz
XGA	1024x768	Up to 85 Hz
WXGA	1280x768	Up to 60 Hz

Bit Rates
HD from 256 kbps to 10 Mbps
SD from 64 kbps to 6 Mbps

Traffic Shaping
Constant (CBR)
Variable (VBR)

Latency (end to end)
As low as 70ms

Compression Standard
H.264 AVC (MPEG-4 part 10)
ISO/IEC 14496-10
Baseline Profile
Level 4.1 and lower Intermediate Levels
I, IP framing
Variable Group of Picture (GOP) size

AUDIO ENCODING / DECODING

MPEG-4 AAC

Audio Channels
Up to 4 per video channel

Compression Standard
MPEG-4 AAC-LC
ISO/IEC 14496-3

Bit Rates
From 32 to 256 kbps per audio pair

Frequency Response
From 20 Hz to 22 kHz

A-V Synchronization
Under 20 milliseconds

ADVANCED FEATURES

Text / Logo Insertion
Closed Captioning Support
Video Noise Filtering and Noise Reduction
Start-up Effects (fade/zoom)
Deblocking Filter
Video noise filtering - MCTF (motion-compensated temporal filter)
Dual Stream encoding optional (HD-SDI with YPbPr or RGBHV)

AUDIO/VIDEO INTERFACES

MAKO-HD Inputs/outputs

SDI / HD-SDI (Input/Output)

SMPTE-259M-C	75Ω BNC
SMPTE-296M	75Ω BNC
SMPTE-274M	75Ω BNC

Embedded Audio Supported

YPbPr (Input/Output)
CEA_770.2-C
CEA_770.3-C
DB15 to 3xBNC breakout req'd on input
DVI-I to 3xBNC breakout req'd on output

RGBHV (Input/Ouput)
VGA
SVGA
XGA
WXGA
No breakout req'd on input
DVI-I to VGA DB-15 breakout req'd. on output)

Audio (Input/Output)
4 analog audio channels
Balanced XLR connectors
Unbalanced RCA connectors
DB15 breakout req'd, specify when ordering
Embedded Audio Supported on SDI

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