

“Zero Latency” High Definition H.264 Video The Telepresence Codec

The MAKO™ codec defines a new era of video communications where latency is imperceptible and full motion image quality is pristine. It is ideally suited for the demands of telepresence, medical, and interactive broadcast applications. The MAKO 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 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 minimize latency in order to provide seamless communication. Systems that contain excessive delay (such as traditional conferencing and satellite based systems) deliver extremely poor, ineffective, communications and cause dramatic participant fatigue. As a result, such systems can only be used for very short durations. With the MAKO, “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 performs at least 5 to 10 times faster than traditional conferencing codecs and “low latency” broadcast encoders.

The MAKO achieves its revolutionary latency performance through the implementation of progressive encoding technology. Unlike other video encoders that need to await a number of 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.



Incorporating industry standard compression, encapsulation, and signaling protocols such as H.264 (MPEG-4 AVC or MPEG-4 part 10) video, AAC audio, and Transport Stream, the MAKO 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 HaiVision’s Furnace IP video system. Designing communication infrastructure around HaiVision’s MAKO enables clients to leverage the true power and ubiquity of IP video.

MAKO – up to 1080p High Definition with Media Sharing

The MAKO is the highest performance HD codec available supporting up to 1080p and achieving end-to-end latency of 70 milliseconds. Each MAKO 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 can encode up to 1080p video and up to 1280x768 on RGB. Uniquely, the MAKO 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 720p30 and the YPbPr at 720p30. Effectively, this gives integrators extreme flexibility in addressing their clients’ exact needs and maximizing resources.



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 an absolute 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.

MAKO features

- ~ Latency less than 70 milliseconds
- ~ SD and HD up to 1080p
- ~ Full frame rate video
- ~ 150 kbps to 10 Mbps video bitrate
- ~ Additional RGBHV input up to 1280x768 60Hz
- ~ I/O #1 – HD-SDI, SD-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



hai1000 Encoding Systems

The MAKO is an HD encoder/decoder blade that resides in a hai1000 series of encoding systems. These are available in two varieties: hai1020 and hai1060. The hai1060 model supports up to 5 MAKO blades and 10 HD video channels in a single 3 RU frame and a single IP port without the need for any external devices (no MCU required). The hai1020 provides the most cost-effective solution for deploying a single encoder/decoder in a compact 1RU chassis with up to 2 HD video channels.

The hai1000 is designed to meet the exact requirements of leading systems integrators. Matched with excellent audio visual products and attention to details with respect to room design, lighting, acoustics, and room control systems, the hai1000 is the heart of the most critical A/V projects, where quality and reliability are paramount. With the MAKO, the hai1000 offers flawless bi-directional communications, achieves the lowest end-to-end latency, and adheres tightly to industry standards for H.264 video and AAC audio.



The hai1000 offers the ultimate network video system and global standard for “extreme conferencing” within the world’s foremost boardrooms, telepresence suites, classrooms, control rooms, and medical operating theaters. With the hai1000 and TRUE-H.264, such performance is now available using less than 50% of the required bandwidth, enabling deployments of this technology even to the most remote locations. The hai1000 delivers a True-to-life video communication experience at remarkably low bandwidth.

hai1000 features

- ~ hai1060 – up to 5 MAKO blades (10 channels)
- ~ hai1020 – for a single MAKO blade (2 channels)
- ~ Multi-Stream System
- ~ Telecom grade reliability
- ~ Robust and extensible frame & blade design
- ~ Web, CLI, and SNMP interfaces
- ~ 1080p, 1080i, 720p, 480i



Ordering Information (please obtain complete system quotations from HaiVision or an authorized HaiVision integration partner)

B-1000-HDED	MAKO - MPEG-4 AVC (H.264) HD Encoder/Decoder Blade - HD-SDI w/ AES/EBU and YPbPr/RGBHV w/ 4 Channel Analog Audio - 720p/1080i/1080p
CA-HD-OUTSET	Output cable kit for MAKO, includes DVI to HDMI, DVI to DB15, and DB15 to 5BNC
F-1060-AC	hai1060 6 slots chassis with CPU & IP Ethernet Network Interface Blade (AC Power Supply)
F-1060-DC	hai1060 6 slots chassis with CPU & IP Ethernet Network Interface Blade (DC Power Supply)
F-1020	hai1020 2 slots chassis with CPU & IP Ethernet Network Interface Blade (AC Power Supply)
F-1020-MED	hai1020 2 slots chassis with CPU & IP Ethernet Network Interface Blade (AC Medical Grade Power Supply)

MAKO specifications (encode and decode)

VIDEO ENCODING / DECODING

H.264 AVC (MPEG-4 part 10)

HD-SDI/SDI Resolution:

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

YPbPr Resolution:

720x480/576i	25, 30 frames per second
1280x720p	25, 30, 50, 60 frames per second
1920x1080i	25, 30 frames per second

RGBHV Resolution:

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 256 kbps to 10 Mbps

Traffic Shaping

Constant (CBR)

Latency (end to end)

Less than 70ms

Compression Standard

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

AUDIO ENCODING / DECODING

MPEG AAC

Compression Standard

MPEG-2 AAC-LC ISO/IEC 13818-7
MPEG-4 AAC-LC ISO/IEC 14496-3

Audio Channels

Up to 4 per video channel

Bit Rates

From 32 to 448 kbps per audio pair

Frequency Response

From 20 Hz to 22 kHz

A-V Synchronization

Under 20 milliseconds

ADVANCED FEATURES

Logo Overlay
EIA-608-8 Closed Captioning (NTSC Line 21)
Deblocking Filter
Dual port encoding
(HD-SDI with YPbPr or RGBHV)
HiLo-Streaming™
Built-in Downscaling

AUDIO/VIDEO INTERFACES

MAKO Inputs/outputs

SDI / HD-SDI (Input/Output)

SMPTE 259M-C	75Ω BNC
SMPTE 296M	75Ω BNC
SMPTE 274M	75Ω BNC
SMPTE 292M	75Ω BNC

Embedded Audio Supported

YPbPr (Input/Output)

CEA_770.2-C
CEA_770.3-C
DB15 to 3xBNC breakout required on input
DVI-I to 3xBNC breakout required on output

RGBHV (Input/Output)

VGA
SVGA
XGA
WXGA
No breakout required on input
DVI-I to VGA DB-15 (breakout required on output)

Audio (Input/Output)

4 analog audio channels
Balanced XLR connectors
Unbalanced RCA connectors
DB15 breakout required, specify when ordering
Embedded Audio Supported on SDI
SMPTE 272M
SMPTE 299M

hai1000 series systems specifications

NETWORK & MANAGEMENT INTERFACES

IP Network Interface

Standard

Ethernet 10/100 Base-T, auto-detect,
Half/Full-duplex

Connector

RJ45

Networking Protocols

H.264 over RTP (RFC 3984)
Transport Stream over UDP / RTP
RTP / RTCP

Management Interface

Standard

RS-232
RJ45 to RS-232 DB-9 Management Cable Required

Management

HTTP (web browser)
Command line over Telnet/RS-232
FTP/TFTP
SNMP

PHYSICAL

hai1060, 6 slot (3RU)

Temperature

0° to 50° C [32° to 122° F] operating
-40° to 70° C [-40° to 158° F] non-operating

Dimensions (H x W x D)

130 x 438 x 343 mm
5.125 x 17.25 x 13.5 inches

Power Requirements

110-240V AC or -48V DC; 200 W max

Weight

Approximately 9.1 kg [20 lbs] fully loaded

Relative Humidity

Up to 95% without condensation

Certification

UL/CSA/CE, RoHS/WEEE

Compliance

EN 55022/55024;
FCC Part 15, Subpart B, Class A

Rackmount

19" included

PHYSICAL

hai1020, 2 slot (1RU)

Temperature

0° to 50° C [32° to 122° F] operating
-40° to 70° C [-40° to 158° F] non-operating

Dimensions (H x W x D)

44 x 438 x 305 mm
1.75 x 17.25 x 12.0 inches

Power Requirements

110-240V AC; 125 W max

Weight

Approximately 4.5 kg [10 lbs]

Relative Humidity

Up to 95% without condensation

Certification

UL/CSA/CE, RoHS/WEEE

Compliance

EN 55022/55024;
FCC Part 15, Subpart B, Class A

Rackmount

19" included

haivision
network video



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