# Mako

## HD H.264 Codec

**Intelligent IP Video**

## "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 video 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.

**Zero Latency.** 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 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.

**Industry Standard.** 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.

**Up to 1080p High Definition with Dual Stream 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 RBG. 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 30 frames per second and simultaneously encode an RGB source at 1024x768 30 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**
Connecting conference rooms with pristine audio video connections over networks with multi-stream capabilities.

**MEDICAL SYSTEMS**
Replacing traditional audio video infrastructure with IP, reducing cost, increasing reach, and maintaining highest quality performance.

**LIVE VENUES**
Bringing together event sites, church campuses, and remote commentators and delivering seamless multi-site interactivity.

**Hai1000 Multi-Stream 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.

## 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 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

![Haivision NETWORK VIDEO]

Mako

## Specifications

**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
*Rate Control:*
  Traffic Shaping
*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**

*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

**NETWORK & MANAGEMENT INTERFACES**

*IP Network Interface:*
  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:*
  RS-232
  RJ45 to RS-232 DB-9 Management Cable Req'd
*Management:*
  HTTP (web browser)
  Command line over SSH/Telnet/RS-232
  FTP/TFTP
  SNMP v3

**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

**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; 125W 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

**Ordering information** (please obtain complete system quotations from Haivision or an authorized Haivision integration partner)

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|---|---|
| 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) |