



## Ultra-Compact ISR Video Encoder

The Makito X1 Rugged (MX1) is an ultra-compact H.265/HEVC and H.264/AVC low latency encoder for real-time streaming of MISB-compliant full motion video in the most demanding ISR environments.

**HEVC Encoding at the Edge** Make more informed decisions with better quality video imagery from tactical systems. With dual encoding cores, the Makito X1 can encode HD 1080p60 or SD with H.265/HEVC and H.264/AVC compression simultaneously, offering independent control of scaling, cropping, and encoding parameters. H.265/HEVC support delivers better picture quality at lower bit rates when compared to H.264/AVC, packing more visual information over constrained network links. And with Network Adaptive Encoding, the Makito X1 Rugged can address one of the fundamental challenges of mobile tactical networks: providing quality streams even when network bandwidth is variable or unpredictable. With the Makito X1 Rugged, downstream exploitation systems can receive the best video possible over IP networks, line-of-sight (LOS) and satellite links.

**Small Size, Mighty Encoding** The Makito X1 Rugged is a portable, SWaP-optimized video encoder available as a hardened appliance or OEM board for advanced integrations. About the size of a deck of cards, deploy the Makito X1 appliance in portable and wearable equipment or small platforms in harsh environments around the world. When systems call for tighter integration of ISR capabilities, the OEM board is ideally suited for deep integration within ISR sensor, datalink, or mission systems. The Makito X1 Rugged in either appliance or board form is the smallest, lightest, and most power-efficient (5W) ruggedized H.265/HEVC encoder on the market, leveraging the Makito X heritage for proven reliability, quality and innovation.

**Ultra Low Latency for ISR and Situational Awareness** For real-time decision-making, low latency video is essential. The Makito X1 Rugged video encoder streams high-quality full motion video at encoding latencies suitable for the most demanding Intelligence, Surveillance and Reconnaissance (ISR) applications. Combined with the excellent picture quality at low bit rates, the ultra low latency Makito X1 Rugged addresses the real-time requirements for air, ground, manned or unmanned platforms.

**Compliant Encoding with KLV Metadata from Haivision** Adhering to MISB/STANAG specifications for encoding and KLV metadata, and with support for KLV filtering, Makito X1 Rugged is designed to ensure downstream interoperability with exploitation systems and cross-domain applications. It provides the flexibility to combine H.265/HEVC and H.264/AVC encoded video with synchronous or asynchronous KLV metadata, and optimizes streaming bandwidth through highly efficient encoding options and selective filtering of KLV metadata parameters. Even in the most constrained network environments, it provides the imagery and metadata needed to meet mission requirements.

## FEATURES

## BENEFITS

**Network Adaptive H.265/HEVC Encoding**

Ensures the highest quality video even when streaming at lower bit rates over constrained networks

**Rugged Appliance or Board**

Immediately deploy the Makito X1 Rugged appliance on small ISR platforms and manpack systems, or deeply integrate the OEM board into ISR sensors, datalinks and mission computers

**Ultra Low Latency**

Respond in real-time to mission-critical full motion video

**Interoperable Video & Metadata Filtering**

MISB/STANAG-compliant streams and KLV metadata provide downstream compatibility with bit rate optimization via KLV filtering

**Makito X Heritage**

Proven technology family for ISR workflows deployed in applications worldwide

**INPUT VIDEO INTERFACES**

Composite NTSC/PAL/PAL-M  
SD-SDI SMPTE 259M-C  
HD-SDI SMPTE 292M, 274M, 296M  
3G-SDI SMPTE 424M (Level A Only)  
SMPTE 425M

**INPUT VIDEO RESOLUTIONS\***

1920x1080p 60/59.94/50/30/29.97/25/24/23.98 Hz  
1920x1080i 60/59.94/50 Hz  
1280x720p 60/59.94/50/30/29.97/25 Hz  
720x480/576i 60/59.94/50 Hz

**VIDEO ENCODING**

8-bit or 10-bit pixel depth  
Chroma sub-sampling 4:2:0 or 4:2:2  
BT.709 color space and WCG (BT.2020)  
SDR and HDR - HLG or PQ (ST 2084)  
Configurable Group of Picture (GOP) size  
I, IP, IBBP, IBBBBP, IBBBBP Framing  
Bitrates from 32 Kbps up to 120 Mbps\*\*  
Configurable frame rate  
Intra-refresh  
Slice-based encoding

**H.264/AVC Profiles:**

MPEG-4 AVC part 10 / ISO/IEC 14496-10  
Baseline, Main, High, High 10- Bit and High 4:2:2  
10- Bit Profiles up to Level 4.2 (1920x1080p60)  
and lower intermediate levels

**H.265/HEVC Profiles:**

ISO/IEC 23008-2  
Main, Main 10-Bit, Main 4:2:2 10- Bit Profiles  
up to Level 4.2 (1920x1080p60) and lower  
intermediate levels

\* *interlaced shown in fields per second*  
\*\* *bitrate depends on configuration*

**AUDIO INTERFACES**

**Embedded Audio:**  
SD-SDI SMPTE 272M  
HD/3G-SDI SMPTE 299M  
**Analog Audio Input:**  
Unbalanced Stereo

**AUDIO ENCODING**

**Compression Standard:**  
MPEG-2 AAC-LC ISO/IEC 13818-7  
MPEG-4 AAC-LC ISO/IEC 14496-3  
**Audio Channels:**  
8 (4 stereo pairs) embedded (SDI) audio inputs  
1 stereo or mono analog input  
**Bit Rates:**  
From 4 to 576 kbps per audio pair\*\*  
**Frequency Response:**  
From 20 Hz to 22 kHz

**METADATA**

**Input Metadata:**  
CoT to KLV conversion  
KLV or CoT over serial RS-232/422  
KLV or CoT over UDP  
KLV over SDI (SMPTE 336)  
SMPTE 336M compliant  
MISB 0601.10 compliant  
MISB 0604.2 compliant  
SMPTE 12M Timecode  
SMPTE 334-1/2 closed captioning  
SCTE 104 insertion markers  
**Output Metadata:**  
Asynchronous & synchronous modes  
as per MISB 0604.2  
High precision timecode insertion  
as per MISB 0604.2  
KLV Metadata Processing (SMPTE 336,  
MISB 0601, 0102 and 0605 support)  
SCTE 35 insertion markers

**STANDARD COMPLIANCE**

IP67  
RTCA-DO-160G  
STANAG 4609  
MISP 2019  
MIL-STD-810G

**IP NETWORK INTERFACES**

**Standard:**  
Dual Ethernet 10/100/1000 Base-T,  
auto-detect, Half/Full-duplex  
Unicast streaming (IPv4 & IPv6)  
Multicast streaming (IGMPv3 & IPv6)  
Path Redundancy – SRT across multiple networks  
**AVC/H.264 Protocols:**  
MPEG Transport Stream  
Secure Reliable Transport (SRT)  
TS over SRT, UDP or RTP  
RTSP/RTP  
**HEVC/H.265 Protocols:**  
MPEG Transport Stream  
Secure Reliable Transport (SRT)  
TS over SRT, UDP or RTP  
RTSP/RTP

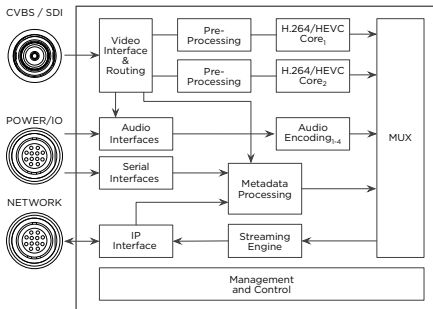
**MANAGEMENT INTERFACES**

**Standard:**  
RS-232  
Ethernet (IPv4 & IPv6)  
**Management:**  
HTTPS (web browser)  
Haivision EMS and Haivision Hub  
Command line over SSH/Telnet/RS-232  
SFTP/TFTP/SCP  
SNMP v3

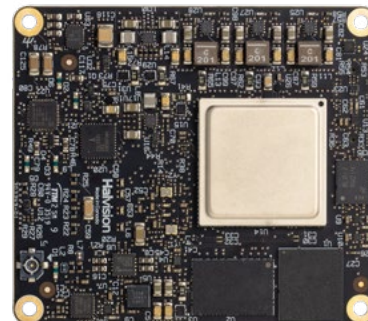
**SIZE, WEIGHT, POWER**

**Appliance Dimensions:**  
31.7 mm H x 72.5 mm W x 90.2 mm D  
(1.25" H x 2.85" W x 3.55" D)  
**Appliance Weight:**  
254g (0.56 lbs)  
**Power:**  
6W at 70°C  
5W at 40°C  
5 VDC  
**Board Dimensions:**  
58.0 mm H x 66.0 mm W  
(2.28" H x 2.60" W)  
**Board Weight:**  
45g (0.11 lbs)  
**Temperature:**  
Operating: -40° to 70°C (-25° to 160°F)  
Non-operating: -45° to 85°C (-49° to 185°F)  
Humidity: 0-100% condensing

**Software Version: 1.2**



Makito X1 Rugged (Actual size)



Makito X1 Board

**Makito X1 Rugged Product Portfolio & Ordering Information \*\***

Makito X1 Rugged Appliance HD Video Encoder w/ Metadata	<b>S-MX1E-R-V2-SDI1-ISR</b>	Makito X1 Rugged appliance encoder with single input; up to 1920x1080p60; 2x H.265/HEVC or H.264/AVC encoding engines; with KLV metadata.
Makito X1 Board HD Video Encoder w/Metadata	<b>B-MX1E-I-SDI1-ISR</b>	Makito X1 board encoder with single input; up to 1920x1080p60; 2x H.265/HEVC or H.264/AVC encoding engines; with KLV metadata; no heatsink for OEM integration

\*\* For complete pricing and ordering, contact us at sales@haivision.com or your certified Haivision reseller.

**DoDIN APL Certified**

Makito X1 Rugged is on the Department of Defense Information Network Approved Product List (DoDIN APL) under tracking number **2118301**.