

# TONER

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## DMG 3200

### SYSTEM OF CHOICE FOR PROFESSIONAL OPERATORS

Sencore is dedicated to providing world class equipment that enable operators to deliver professional broadcast services at the highest possible quality. The DMG 3200 is built around a modular platform hosting a wide selection of interoperable modules that give unparalleled configuration possibilities. Through its clever and robust design, the integrated architecture offers superior reliability that can meet even the most demanding operator requirements.

A key feature of the DMG 3200 is the ability to accommodate customers preferred system architectures while reducing complexity. It is possible to build an entire broadcast system within a single chassis or distribute it between several discreet stages or distributed architectures. Sencore's deep understanding of the market and close co-operation with operators in the design of products ensures the ability to provide optimal solutions for a wide array of fixed or wireless networks. Our philosophy greatly reduces the cost of ownership and ensures that operators can simultaneously handle legacy challenges and evolve through the introduction of brand new services.

Sencore's DMG 3200 is our latest generation carrier grade platforms with 1RU and 4RU chassis options of unmatched power and versatility. There are no restrictions even for the most intensive processing requirement. Both units feature uprated dual-redundant and hot swappable power supplies, increased cooling, enhanced redundancy and a number of other features.

An advanced user friendly GUI offers an intuitive and comprehensive management of the many features of the system. The exhaustive multi-level alarm system, together with the easiness for integration to 3rd party management systems, enables full automatic control. The possibility of centralized monitoring simplifies deployment and streamlines maintenance.

Sencore classifies its modules into different categories depending on the functionality. These include switching, input for content aggregation, compression, processing, and output modules. All modules can be combined freely to provide the desired functionality. The latest innovations include the possibility to deliver and convert both analog and digital broadcast services, from point to point, or from point to multipoint and in any format to any screen.

All modules and functions are further described within the 'modules' section of this brochure.

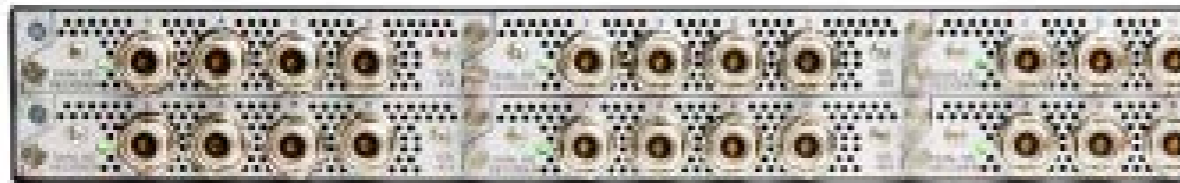
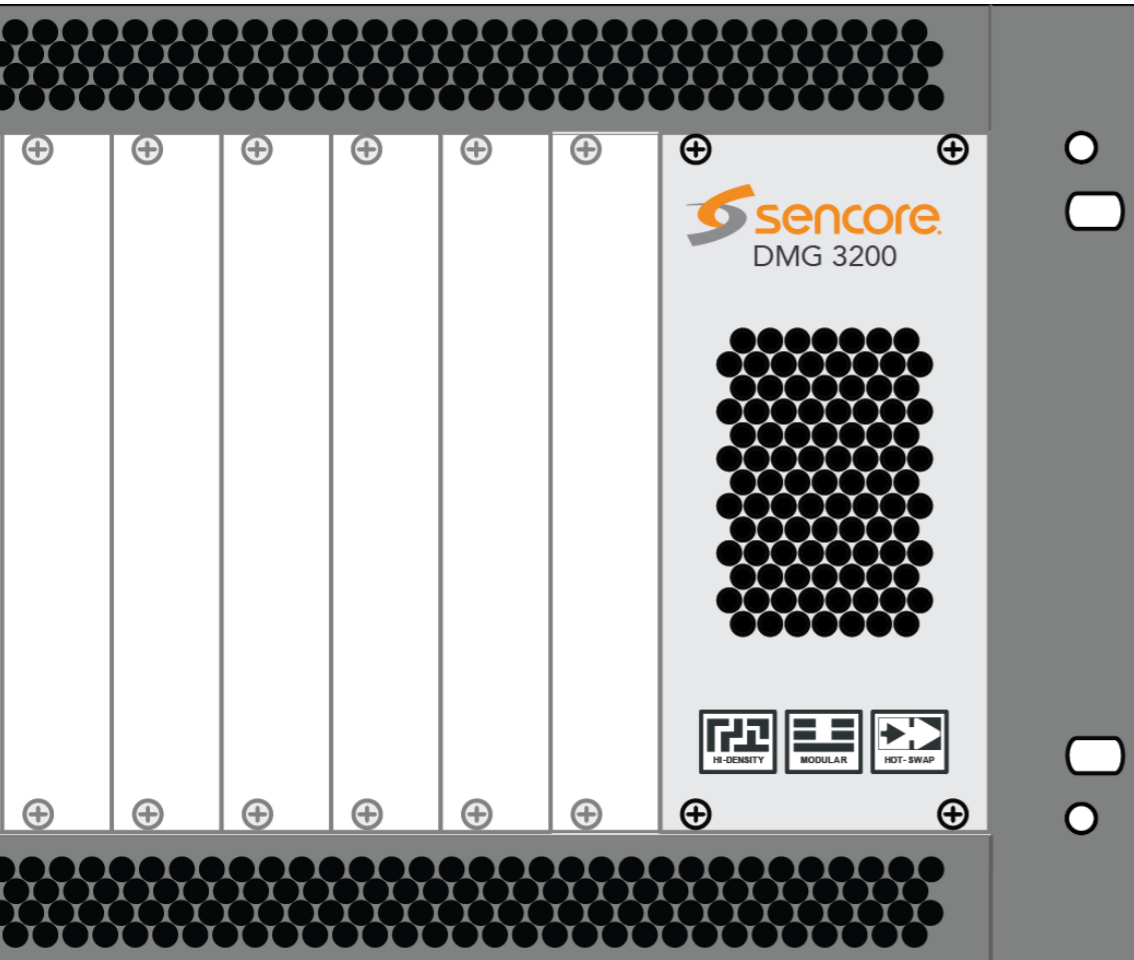


Complete solutions for every  
major broadcast segment





Advanced architecture  
designed to save space, energy  
and resources



## CHASSIS

Sencore offers two different chassis: the 4RU chassis which can hold 16 modules and the 1RU chassis which can hold 6 modules. In addition, each of the chassis houses a switch and management module that can be equipped with dual IP I/Os. Both chassis variants have dual-redundant and hot swappable power supplies. Each unit with its hot swappable modules allows for various redundancy scenarios.

Any of the modules listed under the Input, Encoding/Transcoding, Processing, and Output sections can be combined into the same chassis. Only chassis space or total throughput will limit the number of modules that can be fitted. The chassis has been designed for a throughput of 850 Mbit/s of MPEG TS data and 250 services. In selected configurations, capacity can be increased to 1700 Mbit/s and 500 services (please contact Sencore for more information).

The 4RU chassis has four independent fan modules that operate and are monitored independently. The four fan modules are identical and support hot-swap. The 1RU chassis has one preassembled fan module consisting of 6 fans. The fan module is hot-swappable as one complete module. The internal temperature is monitored and if a fan fails, the remaining fans will compensate by increasing the speed.

## FEATURES

### 4RU

- Modular configuration with up to 16+2 board positions
- WEB based configuration, SNMP Alarms, SOAP/XML interface
- Forced air-cooling (front to back)
- Dual redundant hot-swappable power supply
- Remote reset of power
- 4 individually monitored hot-swappable fans
- Hot-swappable modules
- 100-240V AC power

### 1RU

- Modular configuration with up to 6+1 board positions
- WEB based configuration, SNMP Alarms, SOAP/XML interface
- Forced air-cooling (front to back)
- Dual redundant hot-swappable power supply
- Remote reset of power
- Swappable fan module
- Hot-swappable modules
- 100-240V AC or -48V DC power

## DIMENSIONS

### 4RU

440 × 177 × 400 (w × h × d mm)

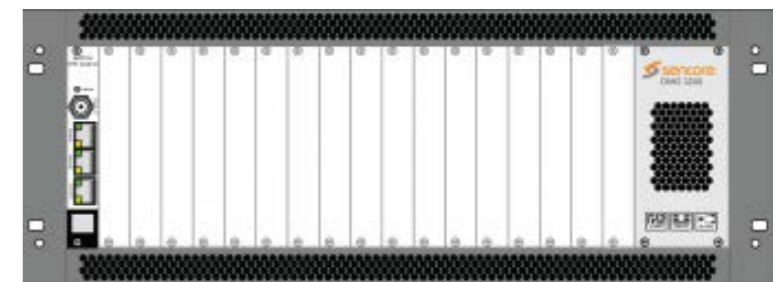
### 1RU

440 × 44 × 480 (w × h × d mm)

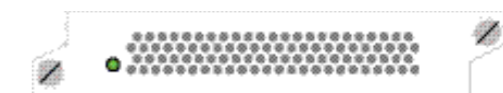
The 4RU and 1RU use the same set of modules and same SW, but the front plates are different.



Module plate for 4RU



The modules can therefore not be interchanged between 4RU and 1RU.



Module plate for 1RU



## SWITCH MODULES

The switch module is used to enable MPEG traffic distribution within the chassis and provides the Man Machine Interface (MMI), enabling configuration and management of the chassis.

The 4RU chassis has dedicated positions for the switch module in slot 0 with an optional (for selected configurations) redundant switch module in slot 17. The switch module can be equipped with two independent IP IO ports as an option. The 1RU chassis provides an integrated switch module in the front with IP IO as standard. The switch module for 1RU is functionally identical to the switch module used in the larger 4RU chassis, but has a different hardware layout.

At least one switch module is required in all chassis. In addition to being the active part of the internal backplane, the switch module provides the central control and management interface. When equipped with two IP IO data ports, reception or streaming of MPEG compliant transport streams over UDP/RTP is supported by the module. Each port operates independently and can be configured as either IP in or IP out supporting full 850 Mbit/s TS data rate and up to 250 MPEG services. The switch module can be provided with either RJ45 connectors or SFP connectors on the two data ports. When equipped with two data ports, the module also has a Gen Lock input port. The switch module is hot-swappable for easy maintenance.

The Switch IP IO MMI module can also be ordered to include a GPS receiver for terrestrial SFN applications. For the 4RU, this is a separate module that must be placed in slot 1, while for 1RU, it is an add-on module for the switch module. One SMA connector for connecting either a GPS antenna or a 1 PPS reference is then available. It is also possible to order without the GPS radio module so that it just provides a high stability oscillator providing locking to a 1 PPS or 10MHz reference signal.

### SWITCH MODULES FOR DMG 3200 4RU

#### Switch Module with Management

- Gbit/s routing between modules in a chassis
- Enables WEB management
- 10/100/1000BaseT management port (RJ45)
- 1 slot wide



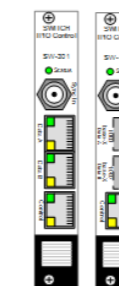
#### Clock Reference Module

- GPS antenna input
- 1 pps input reference
- 10 MHz test output
- 1 pps test output
- 1 slot wide



#### Switch Module with Management and IPIO

- Gbit/s routing between modules in a chassis
- 2 x Gbit RJ45 or SFP input or output port for data
- Frame Synchronization input (genlock)
- Up to 850 Mbit/s TS rate per data port
- Supports UDP/RTP Multicast/Unicast
- Supports reception of MPTS and SPTS
- Supports streaming of MPTS and SPTS
- Supports seamless (hitless) input redundancy and cloned output
- Multiplexing on output with PSI/SI regeneration (license)
- Service filtering
- FEC encoding and decoding (license)
- Enables WEB management
- 10/100/1000 BaseT management port (RJ45)
- 1 slot wide



### SWITCH MODULES FOR DMG 3200 1RU

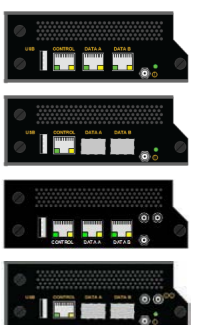
#### Switch Module with Management

- Gbit/s routing between modules in a chassis
- Enables WEB management
- 10/100/1000 BaseT management port (RJ45)



#### Switch Module with Management and Dual IPIO

- Gbit/s routing between modules in a chassis
- 2 x Gbit RJ45 or SFP input or output port for data
- Frame Synchronization input (genlock)
- Up to 850 Mbit/s TS rate per data port
- Supports UDP/RTP Multicast/Unicast
- Supports reception of MPTS and SPTS
- Supports streaming of MPTS and SPTS
- Supports seamless (hitless) input redundancy and cloned output
- Multiplexing on output with PSI/SI regeneration (license)
- Service filtering
- FEC encoding and decoding (license)
- Enables WEB management
- 10/100/1000 BaseT management port (RJ45)
- Optional GPS Receiver
- PTP Support



Hardware-managed  
redundancy for unbeatable  
speed and long-term reliability

## MPEG INPUT MODULES

Sencore has a wide range of input modules making it the most effective content aggregation solution on the market. An input module analyzes incoming transport streams and extracts selected MPEG services from the desired physical input interface (eg. ASI, IP, DVB-S/S2/S2X, DVB-C, DVB-T/T2, ISDB-T and 8VSB). Each input module type is based on embedded hardware design offering high density and reliability. The ability to mix input types freely within a chassis enables multiple MPEG transport streams originating from a variety of sources to be received and processed in parallel. Received signals can be demodulated, de-multiplexed and distributed to other modules inside the chassis via the backplane.

A wide range of input modules are available including IP, ASI, DVB-S/S2/S2X, DVB-C, DVB-T/T2, ISDB-T and 8VSB. The chassis supports any combination of input modules limited only by available slot space. Each input module is designed to receive up to 850Mbit/s of MPEG TS rate or 250 services. In re-multiplexing mode, all services are de-multiplexed by the input module before passed onto the backplane. Unused services are blocked by the input module to avoid propagating them further, which increases efficiency. The full content of an input port can be mapped transparently to an output port with the option to perform PID filtering or service filtering.



## FEATURES

- Modular
- Scalable
- Compact with multiple inputs per module
- Advanced input analysis and status information
- Easy to configure from one common web GUI interface
- Hot swappable
- Wide range of input types
- Mix and match card types freely, and add as many as you need

## INPUT MODULES

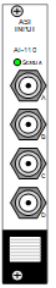
### Dual IP IO

- 2 x Gbit RJ45 or SFP input port for data (or 1x in and 1x out)
- Up to 850 Mbit/s TS rate per data port
- Supports UDP/RTP Multicast/Unicast
- Supports reception of MPTS and SPTS
- Supports seamless (hitless) input redundancy
- Service filtering
- Supports FEC (SMPTE 2022) (license)
- Input analysis
- 1 slot wide



### ASI Input

- 4 x ASI inputs
- 4 x BNC connectors
- 213 Mbit/s Burst mode or 72 Mbit/s Spread mode per input
- Supports reception of MPTS and SPTS
- Service filtering
- Input analysis
- 1 slot wide



### DVB-C Input

- 4 x QAM Annex A/C inputs
- 1 x F connector
- 0.87-6.9 Ms/s
- Supports reception of MPTS and SPTS
- Service filtering
- ASI monitoring port
- Input analysis
- 1 slot wide



### ISDB-T Input module

- 4 x ISDB-T receivers per module
- 1 F-type, 75 ohm female input port (all 4 channels on one input cable)
- Frequency range 47-860MHz
- Supports reception of MPTS and SPTS
- Service filtering on input
- Input analysis
- 1 slot wide



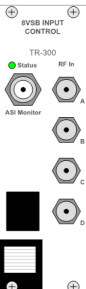
### DVB-S/S2X Input

- 4 x DVB-S/S2/S2X inputs, 1 F connector per input
- Satellite Standards:
  - DVB-S EN 300 421
  - DVB-S2 EN 302 307-1
  - DVB-S2X EN 302 307-2, Broadcast Services
- Constellation: QPSK, 8PSK, 16APSK and 32APSK
- 950 – 2150 MHz Frequency Range
- Symbol rate:
  - DVB-S/S2/S2X: 1-45 MSym/s for QPSK, 8PSK, 16APSK
  - 1-39.9 MSym/s for 32APSK
- FEC:
  - According to EN300421 & EN302307 part 1 & part 2 for Broadcast Services
- Supports reception of MPTS and SPTS
- Supports multistream reception
- Service filtering
- Input analysis
- 1 slot wide



### 8VSB/QAM Annex B Input

- 4 x 8VSB or QAM Annex B Inputs
- 4 x F connectors
- 50 to 860 MHz Frequency Range
- Supports reception of MPTS and SPTS
- ASI monitoring port
- Service Filtering
- 2 slots wide



### Enhanced DVB-S/S2 Input

- 4 x DVB-S/S2 inputs, 1 F connector per input
- 4 x F connectors
- DVB-S, DVB-S2 QPSK, 8PSK modes, 16APSK and 32APSK modes
- Frequency range 950 – 2150 MHz
- Symbol rate:
  - DVB-S: 1-45 MSym/s
  - DVB-S2: 1-45 MSym/s
- FEC:
  - DVB-S: 1/2, 2/3, 3/4, 5/6, 7/8
  - DVB-S2 QPSK: 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10
  - DVB-S2 8PSK: 3/5, 2/3, 3/4, 5/6, 8/9, 10/9
  - DVB-S2 16PSK: 2/3, 3/4, 4/5, 5/6, 8/9, 10/9
  - DVB-S2 32PSK: 3/4, 4/5, 5/6, 8/9, 10/9
- Supports reception of MPTS and SPTS
- Supports multistream reception
- Service filtering
- ASI monitoring port
- Input analysis
- 2 slots wide



### DVB-T/T2 Input

- 4 x DVB-T/T2 receivers per module.
- Input ports option:
  - 1 x F connector, signal is split and distributed internally
  - 4 x F connectors, one per demodulator
- Frequency range 47-862 MHz
- Carrier mode:
  - DVB-T: 2k, 8k
  - DVB-T2: 1k, 2k, 4k, 8k, 16k, 32k
- Modulation:
  - DVB-T: QPSK, 16QAM, 64QAM
  - DVB-T2: QPSK, 16QAM, 64QAM, 128QAM, 256QAM
- Supports reception of MPTS and SPTS
- Service filtering on input
- Input analysis
- 1 slot wide



# UNIVERSAL ENCODER & TRANSCODER

## Linear Broadcast

In order to optimize the performance of their networks, it is essential for professional broadcasters to deploy the latest advances in compression technology. Whether the aim is to add new channels to existing multiplexes or provide genuine video quality improvements, operators should always strive to utilize the best in class technology to offer superior viewing experience whilst improving bandwidth efficiency.

Sencore has developed an encoding/transcoding solution providing leading class performance for video quality and channel density on a specifically designed module targeting a wide range of applications. This allows users to maintain the best possible quality of service in combination with low power consumption and integrated multi-level redundancy.

The immense computational power of the platform runs all-new and highly evolved encoding algorithms, boosting performance to the limit for both AVC and MPEG2 video. The highly programmable and flexible audio encoder offers high density per channel and includes Dolby® codecs, making this one of the most powerful encoder platforms on the market.

A brand new architecture offers full flexibility for configuration, with adaptable application modes. The Universal Encoder and Universal Transcoder module can operate in either a High Video Quality mode, or alternatively in high density broadcast mode. Channel density is significantly increased with a small adjustment in performance whilst Multiscreen mode enables operators to increase content reach to multiple media devices in the fixed and mobile domain.

The new second generation statistical multiplexing provides ultra-fast refresh rate from a multi-pass look-ahead design minimizing inherent latency. Mixed encoder/ transcoder populations can be used within the platform supporting several single or mixed format SD/HD statistical multiplexing groups so that low-bitrate encoding can be applied to specific services within any given group.

All new Universal Encoder/Transcoder modules can be used in new or existing 4RU or 1RU Series platforms and can work in combination with any other modules from Sencore's comprehensive range.

## Multiscreen (OTT):

Increased internet access together with more powerful computers, integrated TVs, tablets and mobile phones makes it possible for consumers to receive video content from broadcasters anywhere, at any time and on any screen. This introduces new challenges for content and network infrastructure providers who need to offer a wide range of different distribution formats with the best possible live video experience regardless of the distribution networks and viewing devices that are being used.

The latest innovative Universal Encoder/Transcoder running in Multiscreen mode from Sencore enables broadcasters and IP network operators to provide high quality multiscreen services. The transcoder module supports MPEG-2/4 TS input and transcodes to multiformat MPEG-4 TS output with IDR alignment. The encoder module accepts SDI/HDSDI inputs directly, and encodes these into multiple profiles as a single pass, avoiding the need to concatenate compression stages which always causes inefficiencies and reduces VQ. The unique architecture delivers significant VQ and efficiency benefits for all real-time applications.

Sencore now offers a truly optimized OTT solution capable of accepting any input signal format. These benefits are magnified further by a modular architecture that lets you fit encoding or transcoding options freely according to actual need. The Sencore Multiscreen encoder/transcoder simultaneously prepares multiple signals from any source in any format for distribution to high definition televisions, high resolution computers and low resolution web and mobile devices.

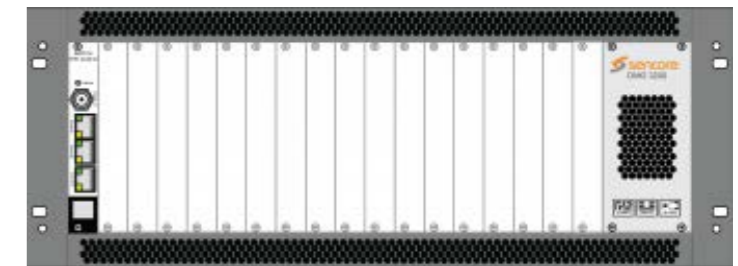
The highly programmable functions include input service replication, resolution change, interlaced to progressive conversion, rescaling and key frame alignment. The end result provides key-frame aligned outputs in transport stream format with the required metadata to support either IPTV distribution directly, or interface with the customers preferred packagers to perform segmentation.

The proven ability to interface with several leading segmenters/originserver is another major feature of the Sencore solution. It enables customers to freely create a best of breed solution, combining best in class compression with their choice of latest features such as targeted advertising and common encryption with MPEG DASH.



## FEATURES

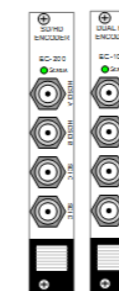
- Modular
- Exceptional video quality
- Compact HW based encoding/transcoding
- Supports MPEG-2 and MPEG-4 SD and HD
- Power and space efficient
- Scalable
- Segmentation agnostic: Can be used with customers having existing segmentation infrastructure
- Complete: Use with other modules to build a complete solution within a chassis
- Can be used to create hybrid broadcast / OTT capable platforms



## ENCODING/TRANSCODING MODULES

### HD/SD SDI Encoder

- Encodes up to 2 HD or 4 SD channels
- 2 HD-SDI or up to 4 SD-SDI inputs, BNC connectors
- Available variants:
  - Dual HD Encoder with AES option
  - Quad SD upgradable to Dual HD
- Operates in three different Encoder Rate control modes:
  - Constant Bit Rate (CBR)
  - Capped Variable Bit Rate (CVBR)
  - Statistical Multiplexing
- MPEG-2/4 SD/HD encoding
- Picture in picture support
- Logo insertion
- 1 slot wide



### SD/HD Transcoder

- Transcodes up to 2 HD or 4 SD channels
- Full decode and re-encode
- MPEG-2/4 SD/HD transcoding
- Operates in three different Encoder Rate control modes:
  - Constant Bit Rate (CBR)
  - Capped Variable Bit Rate (CVBR)
  - Statistical Multiplexing
- 1 slot wide



## Encoder -RF input

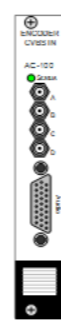
- Encodes up to 2 SD + PIP or 4 SD channels
- 4 F 75Ω input connectors, one per service
- Input frequency range 47-862MHz
- PAL B/G, PAL I and SECAM D/K input\*
- MPEG-2 and MPEG 4 SD encoding
- Operates in two encoder rate control modes:
  - Constant bit-rate (CBR)
  - Capped variable bit-rate (CVBR)

\*Other TV standards can be supported upon request



## Analog Encoder

- Encodes up to 2 SD + PIP or 4 SD channels
- 4 HD BNC with composite video input
- 25 pin mini D-sub for audio:
  - 4 balanced analog audio
  - 2 AES/EBU audio
- MPEG-2 and MPEG 4 SD encoding
- Constant bit-rate (CBR)
- Capped variable bit-rate (CVBR)
- Logo insertion
- 1 slot wide



## Universal Transcoder - Multiscreen (OTT)

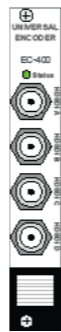
- Transcodes up to four services into multiple profiles
- Transcodes single service into 4 HD or 28 sub SD profiles
- Profile range from 1920x1080p to 240x180p\*
- Resolution conversion
- Frame rate reduction
- GOP alignment
- Audio transcoding
- 1 slot wide

\*For complete list of available profiles, please contact Sencore



## Universal Encoder - Multiscreen (OTT)

- Encodes up to four services into multiple profiles
- 4xSDI or 2xHDSDI input with embedded audio
- Supports an extensive range of resolutions and frame-rates from full 720p60/50 HD down to 144p15/12.5
- Resolution conversion
- Dynamic Encoder GOP Control Modes
- Key frame alignment
- Audio encoding
- 1 slot wide



## Universal Transcoder – High VQ Broadcast

- Transcodes up to:
  - 1 HD with PIP
  - 2 SD with PIP
- Full decode and re-encode
- Optional H.264 4:2:2 8bit/ 10bit decoding
- Resolution conversion
- MPEG-1, AAC and Dolby audio transcoding
- Component pass-through
- Operates in 3 different Encoder Rate Control modes:
  - Constant Bit Rate (CBR)
  - Statistical
  - Multiplexing
- 1 slot wide



## Universal Encoder - High VQ Broadcast

- Encodes 1 HD or 2 SD into MPEG-2 or MPEG-4
- SDI/HDSDI input with embedded audio
- 2 BNC, 75 ohm female input ports (plus 2 unused BNC)
- Operates in three encoder rate control modes:
  - Constant Bit Rate (CBR)
  - Capped Variable Bit Rate (CVBR)
  - Statistical Multiplexing
- Resolution conversion
- Picture in Picture
- Logo insertion
- Advanced audio encoding with support for all common audio codecs
- 1 slot wide



## Universal Transcoder - Dense Broadcast

- Transcodes up to:
  - 4 HD with PIP
  - 12 SD with PIP
  - 16 SD no PIP
- Full decode and re-encode
- Audio transcoding
- Component pass-through
- Operates in 3 different Encoder Rate Control modes:
  - Constant Bit Rate (CBR)
  - Capped Variable Bit Rate (CVBR)
  - Statistical Multiplexing (in future release)
- Mediaroom approved
- 1 slot wide



## Universal Encoder - Dense Broadcast

- Encodes 2 HD or 4 SD into MPEG-2 or MPEG-4
- SDI/HDSDI input with embedded audio
- 4 BNC, 75 ohm female input ports
- Operates in three encoder rate control modes:
  - Constant Bit Rate (CBR)
  - Capped Variable Bit Rate (CVBR)
  - Statistical Multiplexing
- Resolution conversion
- Picture in Picture
- Logo insertion
- Advanced audio encoding with support for all common audio codecs
- 1 slot wide



## PROCESSING MODULES

### Descrambling and Scrambling

Sencore provides two types of descramblers: CAM-based (DVB-Common Interface) and bulk descrambling. The CAM based descrambler module is integrated with professional CAM modules from vendors such as SMIT, SmarDTV, Aston etc. and supports descrambling of up to 10 services per CAM. The bulk descrambler is aimed at software-based CA systems or CA vendors open for an embedded integration. It is used for the descrambling of multiple services protected by one or more CA systems and offers very high descrambling density of up to 250 services per module, making it an efficient, space and energy saving solution. The scrambler module supports both DVB CSA and all common flavors of AES scrambling algorithms. The scrambler module is fully simulcrypt compliant and has been integrated with all major CA vendors.

### EPG and audio leveling

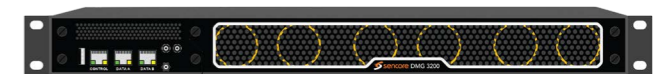
The Electronic Program Guide (EPG) module allows a network operator to receive several channel bouquets from multiple sources and reuse the existing EPG information. The EPG will receive EIT tables from any available input automatically and filter out unused services and re-generate the EIT schedule to reflect the current channel lineup for the selected network. For channels without EPG information on air, the information can be imported via a dedicated IP interface using XMLTV format.

Sencore's audio leveling simplifies the process of changing the audio levels of hundreds of channels by eliminating the need to decode and re-encode these TV and radio channels prior to transmitting them. The solution lets operators tune the audio level of up to 250 audio tracks individually, within the MPEG domain. The audio leveling module supports MPEG-1 layer 1 or 2 audio with an adjustment range of ±30dB.



## FEATURES

- Modular
- Customizable to specific operator demands
- High density
- Provides integrated functionality normally requiring separate chassis or servers
- Powerful MPEG processing with high throughput



## PROCESSING MODULES

### Bulk Descrambler

- Descrambles up to 250 services (850 Mbit/s)
- Integrated with soft clients for ECM handling (no smart card required)
- Support for both DVB-CA and AES descrambling
- Integrated with Verimatrix and Latens
- BISS descrambling
- 1 slot wide



### SIM Bulk Descrambler

- Descrambles up to 250 services (850 Mbit/s)
- Smart Card based descrambling (SIM)
- 16 SIM readers; 8 in front and 8 behind the front
- Support for both DVB-CA and AES descrambling
- Integrated with Conax
- BISS descrambling
- 2 slot wide



### Scrambler

- DVB CA compliant scrambling (CSA) and AES compliant scrambling
- Scrambles up to 250 services, maximum 850 Mbit/s
- Supports scrambling of MPEG-2 and H264 in SD & HD
- DVB Simulcrypt compliant
- 10/100/1000BaseT IP interface towards CA system (RJ45)
- Handles up to 250 ECMs
- 1 slot wide



### Descrambler

- 2 x DVB Common interface
- Descrambling of 10 services per CAM (depends on common interface)
- Support for all major CA systems and CAMs
- 1 slot wide



### Digital Audio Leveling

- For equalisation of audio in TV and Radio services within a digital head-end
- Audio volume control in an MPEG domain
- Audio leveling of 250 channels
- Supports MPEG 1, layer 1 / 2 audio
- Adjustment range  $\pm 30$  dB
- 1 slot wide

**Note: For Dynamic audio leveling (Interface options), please contact Sencore.**



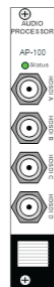
### EPG

- Re-generation of EIT schedule on selected output ports
- Gathers EIT information from all input ports
- EPG data is filtered and regenerated to reflect new channelplan
- Supports multiple of networks
- Configurable play out rate with prioritization
- Configurable period to be played out
- EPG synchronization between multiple ATV units
- 1 slot wide



### Audio Processor

- Encodes up to 32 stereo channels
- 4x SDI/HDSDI input with embedded audio
- 4x BNC, 75 Ohm female input ports
- 8 stereo audio tracks per SD/HDSDI feed
- Audio codec support
  - MPEG-1 - Layer 2
  - MPEG-1 - Layer 3 (MP3)
  - AAC-LC
  - HE-AAC v1
  - HE-AAC v2
- Audio channel modes:
  - Stereo
  - Mono
- Audio Level Adjustment,  $+6/-10$ dB
- 1 slot wide



## MPEG OUTPUT MODULES

Sencore offers a large number of different output modules that can be used in various applications. All output modules have powerful MPEG multiplexing and PSI/SI/PSIP capabilities to enable operators to maximize the potential of their network. Each output module has been designed to support 850 Mbit/s transport stream data-rate and 250 services.

### IP and ASI output

The IP output module is a high capacity module with full multiplexing and PSI/SI regeneration targeted at linear broadcasting. The IP output modules support any combination of MPTS and SPTS as long as the total number of services is less than 250 and the total transport stream bit-rate is less than 850 Mbit/s. Each output port supports IPv4, IPv6, source specific multicast, generation of FEC according to SMPTE 2022 and Sencore's unique IP output redundancy solution.

For legacy systems an ASI output module with 4 independent ASI outputs is available. Each ASI output supports up to 213 Mbit/s in burst mode or 72 Mbit/s in spread (byte) mode.

### Modulated output

All Sencore's modulated output modules are based on a full digital modulation and up-conversion architecture developed in house to provide the best possible output quality. Sencore's leading edge DVB-T/T2 modulator is fully frequency agile for terrestrial transmitters, MMDS systems or for DVB-T/T2 modulation into cable networks. This high density modulator is capable of producing up to 4 DVB-T or 2 DVB-T2 modulated channels, offering more throughput and improved error resiliency. For terrestrial operation, the modulator supports SFN with either MIP TS or T2MI as input.

Sencore's advanced DVB-S/S2 modulator is a fully frequency agile modulator aimed at modulating SD/HD services on to satellite. This high density modulator is capable of producing up to 2 DVB-S or DVB-S2 modulated channels. The solution offers broadcasters a higher rack density and lower power consumption, compared to alternative solutions and comes with advanced functionality like pre-compensation. The DVB-S/S2/S2X modulator is available in two different output configurations: IF or L-band.

Sencore's compact QAM solution generates 16 QAM frequencies for cable networks. The module support both full re-multiplexing and transparent mapping with optional NIT replacement and PID/Service blocking making it one of the most versatile QAM modulation solutions for linear broadcasting on the market. Sencore's QAM solution is ideal for regional cable head-ends where additional processing are required like service filtering, local re-multiplexing, local encoding, SI regeneration, EPG regeneration, etc.

### Terrestrial GW solutions

The gateway module transforms an Sencore chassis into a complete solution for DVB-T and T2. It combines the MPEG multiplexing, PSI/SI generation and gateway roles into a single module. Combining this with modules to perform encoding, transcoding and scrambling enables a unique integrated head-end design eliminating the need for a traditional multiple box approach with the added complexity. The Sencore gateway module supports DVB-T with MIP timestamp insertion or DVB-T2 T2MI encapsulation with SFN timestamps together with multi PLP support. The terrestrial gateway module is available with ASI or IP outputs and can support up to 4 separate gateways per module (2 on ASI out). Integrated redundancy schemes are available to go beyond what is commonly available today and provide seamless protection of the distribution chain as well as the SFN network.

## FEATURES

- Modular
- Integrated
- Scalable
- High density
- Flexible
- Seamless redundancy options
- Intelligent, automatic redundancy solutions
- Powerful multiplexing with high throughput
- Integrated multiplexing & PSI/SI re-generation

# OUTPUT MODULES

## Dual IP IO

- 2 x Gbit output port for data (or 1xin and 1xout)
- 10/100/1000BaseT (RJ45) or SFP output
- Up to 850 Mbit/s per data port TS
- Supports UDP/RTP Multicast/Unicast
- Supports streaming of MPTS and SPTS
- Supports cloned output
- Supports multiplexing and transparent pass-through
- PSI/SI/PSIP regeneration
- Supports FEC (SMPTE 2022) (license)
- 1 slot wide



## ASI Output

- 4 x ASI outputs
- 4 x BNC connectors
- 213 Mbit/s Burst mode or 72 Mbit/s Spread mode per output
- 4 different multiplexed outputs
- Supports multiplexing and transparent pass-through
- PSI/SI/PSIP regeneration
- 1 slot wide



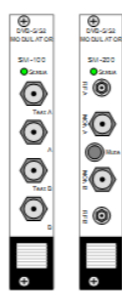
## QAM Modulator

- 16 QAM modulators, 4 and 4 paired
- 2 x 75 Ω RF output (EN/IEC 60728-5) - F connector
- Full digital modulation and up-conversion
- DOCSIS 3.0 RF compliant
- 32 / 64 / 128 / 256 QAM modulation
- Frequency range of 47 – 862 MHz
- Supports multiplexing and transparent pass-through
- PSI/SI/PSIP regeneration
- ITU-TJ83. Annex A/B/C
- 1 slot wide



## DVB-S/S2 Modulator

- 2 DVB-S/S2 modulated carriers per module
- Connectors:
  - IF > 1 x F connector + 1 x F for monitoring per output
  - L-band > 1 x SMA connector + 1 x F for monitoring per output
- Output options:
  - IF > 50-200 MHz
  - L-band > 950-2150 MHz
- Modulation:
  - DVB-S > QPSK
  - DVB-S2 > QPSK, 8-PSK, 16-APSK, 32-APSK
- Symbol rate: 0.5-45 Mbaud
- Linear static precorrection
- Supports multiplexing and transparent pass-through
- PSI/SI/PSIP regeneration
- 1 slot wide



## DVB-T/T2 Terrestrial Modulator

- 2 DVB-T2 or 2 DVB-T independent outputs
- 1 x BNC connector + 1 x BNC for monitoring per output
- Monitoring ports for each output
- VHF/UHF, 50 Ω BNC, 47-862 MHz
- Output levels: -15 to 0 dBm
- Supports multiplexing and transparent pass-through (mode A)
- Support for SFN (ETSI TS 102 733 T2-MI)
- Support for multiple PLPs
- Supports multiplexing and transparent
- PSI/SI regeneration
- 1 slot wide



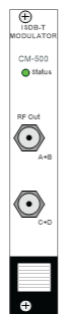
## DVB-T/T2 Cable Modulator

- 4 DVB-T modulators (TM-101)
- 2 DVB-T/T2 modulators (TM-200)
- Connectors:
  - COFDM > 1 x F connector + 1 x F for monitoring per module
  - DVB-T2 > 1 x BNC connector + 1 x BNC for monitoring per output
- Full digital modulation and up-conversion
- 5, 6, 7, 8 MHz bandwidth
- Frequency range 47-862 MHz, fully agile
- Output levels: -12 to 2.2 dBm
- PSI/SI regeneration
- 1 slot wide



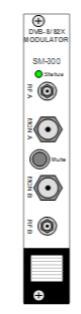
## ISDB-T Modulator

- 8 ISDB-T modulated carriers per module
- 2 x 75 Ω RF output - F connector
- Full digital modulation and up-conversion
- DOCSIS 3.0 RF compliant
- QPSK, 16QAM, 64 QAM modulation
- Frequency range of 47 – 862 MHz
- Supports multiplexing and transparent pass-through
- PSI/SI/PSIP regeneration
- Relevant Standards:
  - ARIB STD-B31
  - ARIB STD-B10
- 1 slot wide



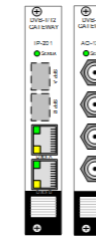
## DVB-S/S2/S2X Modulator

- 2 DVB-S/S2/S2x modulated carriers per module
- Output connectors:
  - IF > 1 x 75 F connector + 1 x 50 SMA for monitoring per output
  - L-band > 1 x 50 SMA connector + 1 x 75 F for monitoring per output
- Satellite standards:
  - DVB-S EN 300 421
  - DVB-S2 EN 302 307 – 1
  - DVB-S2X EN 302 307 -2, Broadcast Services
- Output options:
  - IF > 50-200 MHz
  - L-band > 950-2150 MHz
- Modulation:
  - DVB-S > QPSK
  - DVB-S2X > QPSK, 8-PSK, 16/32/64/128/256-APSK
- Symbol rate: 0.1-68 Mbaud
- 24V DC and 10MHz reference output
- DVB Carrier ID, NIT Carrier ID
- Linear static precorrection
- Supports multiplexing and transparent pass-through



## DVB-T/T2 GW

- IP or ASI out options:
  - 10/100/1000 BaseT (RJ45) or SFP output on IP
  - 2 x (1+1) ASI out
- Supports DVB-T MIP insertion and DVB-T2 T2MI generation
- 4 independent gateways per module (2 for T2MI on ASI out)
- Supports up to 240 PLPs
- Regionalization options
- PAPR and MISO support
- Full (Re-)multiplexing support (per PLP)
- PSI/SI regeneration
- Supports SMPTE 2022 FEC (license)
- 1 slot wide



## DAB/DAB+ Modulator

- Standards: DAB/DAB+
- EDI input
- 8 x DAB/DAB+ modulated carriers
- Frequency range 174-239 MHz
- Output level -4 dBm to -15 dBm
- 1 slot wide



# END TO END TERRESTRIAL SOLUTIONS

Sencore offers the most integrated, powerful and flexible range of DVB-T2 solutions. The compact modular approach makes it possible to provide complete head-ends consisting of content acquisition, premium compression with statistical multiplexing, DVB-T2 gateways, and modulation in single or multiple units to provide an end to end solution.

Terrestrial signals for DVB-T2 can be distributed via satellite, ASI or IP to transmitter sites where regional processing is performed before being delivered to the transmitter. In addition Sencore can provide a complete low-power transmitter solution with all necessary components integrated into a compact 1RU chassis if applicable. All components are developed in house, giving customer's access to our design level expertise with the added benefit of being able to customize the solution to meet specific customer requirements.

The solution offers many highly distinctive features including a new option for providing regionalization using the 'common PLP' mechanism, an integrated seamless DVB-T2 gateway redundancy option and sophisticated seamless IP packet re-construction to dramatically increase signal distribution robustness over IP links. Because the entire solution is modular, Sencore offers the market an easy to manage, easy to upgrade, ultra-compact solution that provides the best possible standards of technical performance whilst consuming a fraction of the space and power of competing systems.

## DVB-T2 Integrated Multiplexer and DVB-T2 Gateway Module

Sencore has improved upon typical DTT architectures that rely on multiple boxes and complex NMS to provide an integrated solution. In contrast, Sencore solutions are optimally integrated from the beginning. Sencore gateway module is an integrated MPEG multiplexer, PSI/SI generator and DVB-T2 gateway on a single slot.

The advanced Sencore DVB-T2 gateway module is representative of Sencore's modular approach enabling operators to combine reception, descrambling, encoding/transcoding, scrambling, multiplexing, PSI/SI generation, T2 gateway and modulation stages within a single chassis with integrated management.

Sencore modules offer high channel and carrier density. The gateway module supports multiplexing and T2MI generation of up to 4 independent complete T2MI streams on IP or 2 T2MI streams on ASI and provides up to 140 regional PLPs per module. The combination of integration and performance offered by the module is unique, making it the most powerful, yet easiest to use, DVB-T2 Gateway solution on the market. The modules are usually provided in 1+1 redundancy configuration using the Sencore seamless T2MI redundancy option.

The gateway's many features can be used to complement the requirements and distribution methods required by individual customers, and can support centralized (backhaul) and 'in region' (edge) content replacement models using any distribution mechanism including support for TS replacement or deterministic PLP replacement techniques as appropriate.

## Architectures and Regionalization

Sencore network delivery enhancements include support for the DVB-S/S2 standard and are incorporated into the satellite modulator and demodulator modules. For IP distribution our 'seamless' packet re-construction technology provides superior protection against network packet loss and enables FEC levels to be reduced, re-claiming useful bandwidth



# REDUNDANCY

Sencore's intelligent redundancy software provides seamless integration between broadcast equipment and IP networks. It protects every stage and provides automatic backup in case of service stream failure at input, protection from internal failures, and intermittent or permanent data losses within distribution networks without requiring complex control software.

Sencore's redundancy solution is unique in being the only solution in the IP television market to take a holistic view of operation and network management. Redundancy configuration is simplified and automated, and operational routines are significantly reduced. The integrated redundancy solutions offer operators compelling quality of service benefits and improved network reliability. The individual elements of this integrated solution are further described below. For more detailed information please contact Sencore.

## Input redundancy

The Sencore system is equipped with an advanced input redundancy switching mechanism. Any output service can be configured to have a backup service from a different input TS regardless of input type. Input switching can also be performed on TS level using 'input port redundancy'.

Redundancy switching can be set to automatic or manual. In automatic mode it is possible to choose from the following switching modes: Once (switch and stop), Floating or Reverting.

## Seamless IP input redundancy (License)

The Sencore Seamless IP Switch module makes it possible to achieve seamless IP input redundancy switching between two distribution networks. The Seamless IP Switch combines an innovative alignment technique with a fast acting data switch making it possible to reconstruct a perfect outgoing stream even from two imperfect network feeds.

The Seamless IP Switch can regenerate the traffic received via two networks, so that both networks are used 100% of the time to back each other up. Using the data provided by both networks simultaneously, rather than just one, enables dramatic improvements in QoS.

## Internal Redundancy (4RU chassis feature)

By using Sencore's Internal Redundancy feature, all critical single points of failure in the 4RU chassis are eliminated. This clever mechanism facilitates configurations with redundant switch modules, redundant backplanes, redundant IP inputs, redundant MMI (i.e. management & control) as well as redundant power supplies. In case of input, switch or MMI failure, all output modules will switch backplane and log into the other MMI where it will receive the services from the backup inputs and switch.

By having 1+1 redundancy on inputs and switch modules, all components of the chassis are backed up, except for the output modules which normally handle a subset of the available channels. In case of failure of output modules, they can easily be hot-swapped, and the affected services will be up and running in seconds.

## N+M redundancy (4RU chassis feature) (License)

The Sencore self-managed N+M redundancy for encoding and transcoding provides a powerful option for broadcasters needing the economies of N+M compression redundancy without the expense, complexity and long term reliability concerns of a conventional NMS. Rather than relying on external PC hardware, Sencore have integrated the redundancy control into the built in management system thus simplifying system configuration eliminating integration and operational issues between HW and management PC. It is the perfect method for creating the intelligent 'device islands' that are increasingly being favored by broadcasters when architecting new solutions.

The encoders and transcoders will be the only items within the chassis in N+M configuration. Everything else will be 1+1. This includes any input and output ports, all control and management functions, the backplane and the power supplies. Each 4RU chassis will be equipped with backup encoder or transcoder module(s) capable of providing module level replacement for any of the active encoders or transcoders within the chassis. Multiple redundancy groups can be combined in the chassis by automatically creating groups of encoders and transcoders. For encoding, the redundant control modules can drive a (HD)SDI video router directly

## IP Output redundancy (License)

The IP output redundancy system presents a network with multiple sources from which it is possible to obtain the same service. Should the service from one source be corrupted, the network can receive the service from another source. The redundancy solution is service based (multicast based) where the same service will be available for two or more sources. As long as all sources with the same channel have the same IP source address, the network will route just a single copy of the multicast stream forward to the receiver based on routing cost. In the event of a service issue within, or prior to, the Sencore chassis, the IP output module exploits standard IP protocols to trigger external routers to switch to secondary sources. The "Monitor-in-out" functionality may be used for those networks not utilizing routing protocols.

Where full redundancy is not required, partial redundancy strategies can be implemented. Systems can be configured to provide full redundancy of only selected premium or 'must-carry' services. Operators can then choose not to replicate the input and descrambling functions of lower priority services, but still equip the chassis with

# SWITCH MODULE SPECIFICATIONS

Switch Module	Bitrate Placement	: Gbit/s routing between modules in a chassis : 1 slot wide (4RU switch module must be placed in slot 0; redundant module in slot 17)
	<b>IP Input/Output</b> Interface	: 2 x 10/100/1000 Base-T Ethernet or SFP : Optical SFP (class 1 laser product)
	Maximum data rate per port Maximum number of services per port	: Up to 850 MBit/s per port TS rate : 250
	Data format Transport stream Service filtering Video format	: UDP/RTP Multicast/Unicast : SPTS and MPTS : Yes : Transport stream; MPEG-2, MPEG-4, HEVC
	<b>IP Input</b> IP de-jittering Forward Error Correction	: PCR or CBR : SMPTE 2022-1 : 250 input streams per data port
	<b>IP Output</b> Multiplexing Forward Error Correction	: Yes (licensed) : SMPTE 2022-1 : 250 output streams per data port
	Tables Supported - PSI - SI - PSIP	: PAT, PMT, CAT : SDT, NIT, EIT pf, TOT, TDT, BAT, AIT : MGT, TVCT, CVCT
	<b>Reference Clock</b> Frame Synchronization Input (Genlock) Internal Clock Reference MMI Clock Synchronization	: Accepts black burst and Tri-Level reference signal.* : 10 MHz : Yes
	<b>Management</b> Interface Built-in user interface External interface	: 10/100/1000 Base-T Ethernet : Web : SNMP for alarms, SOAP for configuration and status
	* If SDI reference signal support is needed, contact your sales representative.	
	<b>Licensed features</b>	: 2xIP In, 1xIP In/1xIP Out, 2xIP Out, Seam. IP In, Cloned IP Out : FEC in, FEC out, FEC in/out : Multiplexing : IP Out Redundancy
Clock Reference	<b>GPS reference input</b> Antenna connector Impedance 1pps timing accuracy Active Antenna Voltage output Internal reference hold-over	: SMA female : 50 Ω : < 100 ns RMS : 0V, 3.3V(default) or 5V : ≤1us in 4 hrs @ΔT= 0°C
	<b>1pps reference input</b> Number of input ports Input connector type Impedance Input level 1pps (1Hz) Internal reference hold-over	: 1 : BNC female : TTL or 50 Ω : TTL : ≤1us in 4 hrs @ΔT= 0°C
	<b>Licensed features</b>	: GPS receiver, OCSO oscillator, OCXO oscillator (stability 0.2ppb/day)







	Maximum Number of Services within group	: 32
	Licensed Features	: Number of Encoder Channels HD : Number of Encoder Channels SD : Subtitle transcoding from TTX to DVB : Statistical Multiplexing - Number of Channels : Dolby® Digital Encode : Dolby® Digital Plus Encode
Universal Encoder - MS/OTT	Input Ports Input Format	: 2xHDSDI/4xSDI, 4 BNC 75 Ω : SMPTE 292M (HD SDI), SMPTE 259M (SD SDI)
	<b>Video Pre-processing</b> WSS Blanking	: Removal of line 23 WSS from active video
	<b>Video Encode</b> MPEG-4 AVC Profiles	: High profile up to HP@L4.0 : Main profile up to MP@L4.0 : Base profile up to BP@L4.0
	HD and sub HD resolutions <sup>5)</sup>	: 1920 x 1080i @ 29.97, 25 fps : 1920 x 1080p @ 29.97, 25 fps : 1280 x 720p @ 59.94, 50 fps : 1280 x 720p @ 29.97, 25 fps : 960 x 540p @ 29.97, 25 fps : 852 x 480p @ 29.97, 25 fps : 640 x 360p @ 29.97, 25 fps : 480 x 270p @ 29.97, 25 fps : 416 x 240p @ 29.97 fps
	SD and sub SD resolutions <sup>5)</sup>	: 320 x 180p @ 29.97/14.985, 25/12.5 fps : 720 x 576i @ 25/12.5 fps : 720 x 480i @ 29.97/14.985 fps : 640 x 480p @ 29.97, 25 fps : 640 x 360p @ 29.97, 25 fps : 544 x 416p @ 29.97, 25 fps : 480 x 360p @ 29.97, 25 fps : 480 x 270p @ 29.97, 25 fps : 416 x 240p @ 29.97 fps : 400 x 224p @ 29.97, 25 fps : 400 x 300p @ 29.97, 25 fps : 384 x 216p @ 29.97, 25 fps : 352 x 288p @ 25 fps : 320 x 240p @ 29.97 /14.985, 25/12.5 fps : 320 x 180p @ 29.97, 25 fps : 240 x 180p @ 29.97/14.985, 25/12.5 fps
	Frame rate conversion	: From 60/59.94/50 reduced to ½, ¼ : From 50 reduced to ½ or ¼ : From 30/29.97/50 reduced to ½
	De-interlacing Scene change detection GOP structure Number of output profiles	: Interlaced to progressive conversion : Yes, insertion of P frame : Dynamic : Ranging from 4x HD to 28 sub SD per module, depending on complexity of profiles
	<b>Audio Encode</b> MPEG1 Layer II AAC-LC HE-AAC v1 HE-AAC v2 Sample rates Number of channels per video source	: Modes: 2.0 (stereo), Bit rates: 64 – 384kbps : Modes: 2.0, Bit rates: 32 – 384kbps : Modes: 2.0, Bit rates: 32 - 192kbps : Modes: 2.0, Bit rates: 32 - 96kbps : 32, 44.1, 48kHz : 2 (Audio resources can be combined.)
	<b>Reformatting/ Rescaling</b> Format conversion	: From HD to sub SD

1) One 5.1 encode uses resources of 3x stereo pairs. One 7.1 encode uses resources of 4x stereo pairs.

2) Dolby® Digital also known as AC-3

3) Dolby® Digital Plus also known as E-AC-3

	<b>Aspect Ratio Control</b> Aspect Ratio Modes	: Transparent Input to Output (Controlled by AFD), Manual 4:3 or 16:9
	<b>Ancillary Data and VBI</b> Closed Captioning (EIA 608/EIA 708)	: Extracted from VANC and injected into video stream.
	Active Format Description (AFD)	: Extracted from VANC SMPTE 2016 and injected into video stream.
Encoder– CVBS input	Number of channels Input Port	: 4 SD or 2 SD+PIP : 4 HD BNC 75 Ω, one per channel : 25 Pin Compact D-sub for audio: - 4 balanced analogue audio inputs - 2 AES/EBU inputs
	Video Input	: PAL B/G/I/D/K : SECAM D/K : PAL Nc : PAL M : NTSC M
	<b>Video Pre-processing</b> Inverse Telecine Detection De-blocking Filter Motion Compensated Temporal Filter (MCTF) Horizontal Rescaling WSS Blanking	: Yes : Adjustable : Adjustable : From 720 to 704, 640, 544, 528, 480 or 352 : Removal of line 23 WSS from active video
	<b>Logo Insertion</b> File Format Position Maximum Size	: PNG (8-bit RGBA) file per encoded channel : User defined (pixel resolution) : 192 x 128 (SD)
	<b>Ancillary Data and VBI</b> VBI Extraction and processing	: Closed Captioning (EIA 708) : Teletext, WSS, VPS
	<b>Video Encoder</b> Number of channels per module MPEG-2 profiles MPEG-4 AVC profiles Rate Control Modes	: 4 SD or 2 SD w/PIP (2SD mode gives improved VQ) : up to HP@ML : up to HP@L3.0 : Constant Bit Rate (CBR) : Capped VBR (CVBR) with QP target
	Rate Range	: 4SD: From 250kbps to 10Mbps : 2SD: From 250kbps to 19Mbps
	GOP control	: Fixed or Dynamic with Scene Change Detection and adaptive GOP structure
	Picture-In-Picture	: 416x240, 352x288, 352x240, 192x192, 128x128, 128x96 or 96x96
	Aspect Ratio Control	: Manual or WSS
	<b>Audio Encoder</b> Audio CODECS	: MPEG-1 Layer 2 : AAC-LC : HE-AAC v1 : HE-AAC v2 : Dolby® Digital pass-through (from AES input)
	AAC Data Encapsulation Channel Modes Encoded stereo pairs per video	: ADTS or LATM selectable per encoded channel : Stereo/Dual Mono/Mono : 2 pairs for 2SD+PIP configuration and 1 pair for 4 x SD configuration
	Audio level adjustment Injection of Private Data into service	: +/-11dB : See Universal Encoder High VQ “Auxillary Data Injection”
	<b>Licensed Features</b>	: Number of encoded channels, PIP

6) Other TV standards can be supported upon request

Encoder - RF Input	Number of channels per module	: 4 SD or 2 SD+PIP (2SD mode gives improved VQ)
	<b>RF Input</b>	
	TV systems	: PAL B/G, PAL I and SECAM D/K <sup>®</sup>
	RF inputs	: 4xF female, 75 Ω
	Input frequency	: 47 – 862 MHz
	Frequency tuner step size	: 1kHz
	RF input level	
	– Max	: 110 dBuV
	– Min (for un-weighted video SNR=30dB)	: 44 dBuV
	<b>Video Encoder</b>	
	Please refer to “Encoder -CVBS input”	
	<b>Picture-in-Picture</b>	
	Please refer to “Encoder -CVBS input”	
	<b>Video Pre-processing</b>	
	Please refer to “Encoder -CVBS input”	
	<b>Logo Insertion</b>	
	Please refer to “Encoder -CVBS input”	
	<b>Audio Encoder</b>	
	Audio CODECS	: MPEG-1 Layer 2 Stereo : AAC-LC Stereo : HE-AAC v1 Stereo : HE-AAC v2 Stereo
	AC Data Encapsulation	: ADTS or LATM selectable per encoded channel
	Channel Modes	: Stereo/Mono/Dual Mono
	Encoded stereo pairs per video	: 1
	Audio Level Adjustment	: ± 11 dB
	<b>VBI</b>	
	Please refer to “Encoder -CVBS input”	
	<b>Auxillary Data Injection</b>	
	Injection of Private Data into service	: See Universal Encoder High VQ “Auxillary Data Injection”
	<b>Licensed Features</b>	
		: Number of Encoded channels, PIP

#### Universal Transcoder - High VQ Broadcast

<b>Density</b>	Total Number of Video Transcodes	: Up to 1x HD or 2x SD channels
<b>Video Decoder</b>	MPEG-2 profiles	: MP@HL, 1Mbps – 80Mbps : MP@ML, 600kbps – 15Mbps
	H.264 profiles	: MP@L4.2, 500kbps – 55Mbps : HP@L4.2, 1Mbps – 55Mbps : MP@L3.2, 300kbps – 16Mbps : HP@L3.2, 300kbps – 16Mbps : High 4:2:2@L4.2, 4.5Mbps - 80Mbps CABAC/100Mbps
	SD 50Hz resolutions	: 720/704/640/544/528/480/352 x 576i25
	SD 60Hz resolutions	: 720/704/640/544/528/480/352 x 480i30/29.97
	HD 1080i resolutions	: 1920/1440/1280/960 x 1080i30/29.97/25
	HD 720p resolutions	: 1280/960/640 x 720p60/59.94/50
<b>Audio Decoder</b>	Audio CODECS	: MPEG-1 Layer 2 :AAC-LC : HE-AAC v1 : HE-AAC v2 : Dolby® Digital / Dolby® Digital Plus
	Audio Downmix	: 5.1 to 2.0 for AAC and Dolby®
<b>Video Encoder</b>	MPEG-2 profiles	: MP@HL, 1Mbps – 80Mbps : MP@ML, 600kbps – 15Mbps

Dolby® Digital Plus Professional Decoder. ‘Dolby’ and the ‘double-D’ symbol are registered trademarks of Dolby Laboratories.

H.264 profiles	: MP@L4.2, 500kbps – 55Mbps : HP@L4.2, 1Mbps – 55Mbps : MP@L3.2, 300kbps – 16Mbps : HP@L3.2, 300kbps – 16Mbps : Constant Bit Rate (CBR) : Statistical Multiplexing
Rate Control Modes	: Dynamic with Scene Change Detection and Adaptive GOP structure.
GOP structure	: Manual, Transparent input to output : PCR on Video PID or as separate PID : Typically 5500ms (4500ms reduced delay mode)
Aspect Ratio Control	
PCR PID	
End-to-end Encoder Delay	
<b>Audio Encoder</b>	
Audio CODECS	: MPEG-1 Layer 2 : AAC-LC : HE-AAC v1 : HE-AAC v2 : Dolby® Digital : Dolby® Digital Plus : Pass though of all audio types : Stereo, Mono : ADTS or LATM selectable per encoded channel : +/- 300ms : +6/-10dB
Audio Channel Modes	
AAC Data Encapsulation	
Audio Lipsync Adjustment	
Audio Level Adjustment	
<b>Picture-in-Picture</b>	
Codec	: MPEG-4 AVC MP
Bitrate	: Min 96kbps, Max 400kbps (CBR)
Resolutions	: 192x192, 176x144, 128x96, 96x96
<b>Video Re-scaling</b>	
Down Conversion HD to SD	: Including aspect ratio conversion, letter-/pillar boxing
Up Conversion SD to HD	: Including aspect ratio conversion, letter-/pillar-boxing and de-interlacing. : From 60 fps to 60/30 fps : From 59.94 fps to 59.94/29.97 fps : From 50 fps to 50/25 fps : From 30 fps to 60/30 fps : From 29.97 fps to 59.94/29.97 : From 25 fps to 50/25 fps : Frame rate up conversion only for interlaced input (1080i/576i/480i) to 720p output.
Frame Rate Conversion	

#### Audio Transcode Density

The table below describes maximum audio transcode density as a function of codec type. One 5.1 audio use the same resources as 3x 2.0 audio. A combination of audio types are supported.

<b>Logo Insertion</b>	
Maximum Size	: 192x128 (SD) : 360x180 (HD 720P) : 480x270 (HD 1080i)
Positioning	: User selectable (pixel accuracy)
File format	: PNG (8-bit ARGB) file per encoded channel
<b>Subtitling Burn In</b>	
DVB/EBU Subtitling	: Burned into Transcoded Video
<b>Auxillary Data</b>	
Pass Through	: All auxillary data components (EBU Subtitling, DVB Subtitling, Teletext etc.). Lipsync to video is maintained. : EBU Subtitling, DVB Subtitling, Teletext subtitling PIDs from a generator can be added in the mux output
Generation	
<b>Video Processing</b>	
WSS Blanking	: Line 23
<b>Statistical Multiplexing</b>	
Statmux Controller	: Local within chassis. (Management module.)
Maximum # Groups	: Max 16, one group per encoder/transcoder module.
Maximum # Services within group	: 32

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Pass-through	: HE-AAC v1/2. Modes: 2.0, 5.1 (downmixed to 2.0) : Dolby® Digital (AC-3) : Modes: 2.0, 5.1 (downmixed to 2.0) : Dolby® Digital Plus (E-AC-3): Modes: 2.0, 5.1, 7.1 (downmixed to 2.0) : MPEG1 Layer II : AAC-LC : HE-AACv1/2 : Dolby® Digital (AC-3) : Dolby® Digital Plus (E-AC-3)
<b>Video Encode</b> MPEG-4 AVC Profiles	: up to HP@4.0 : up to MP@4.0 : up to BP@4.0
Resolutions @ 59.94 fps or 50.00 fps <sup>8)</sup> Resolutions @ 29.97 fps or 25.00 fps <sup>9)</sup>	: 720p › 1280, 960, 854 : 1080p › 1920, 1440, 1280, 960, 720, 640 : 720p › 1280, 960, 854 : 640p › 960 : 576p › 1024, 768, 720, 352 <sup>9)</sup> : 540p › 960 : 480p › 854, 720, 640, 352 : 432p › 768 : 360p › 640, 480 : 320p › 480 : 288p › 512 : 270p › 480, 360 : 256p › 144 : 240p › 320 : 216p › 384 : 180p › 320, 240
Resolutions @ 14.99 fps or 12.50 fps <sup>8)</sup>	: 640p › 960 : 576p › 1024, 768, 720, 352 : 480p › 854, 720, 640, 352 : 432p › 768 : 360p › 640, 480 : 320p › 480 : 288p › 512 : 270p › 480, 360 : 256p › 144 : 240p › 320 : 216p › 384 : 180p › 320, 240
Frame rate conversion	: From 60/59.94/50 reduced to ½, ¼ : From 50 reduced to ½ or ¼ : From 30/29.97/50 reduced to ½
Number of profiles	: Ranging from 4 × HD to 28 × sub SD per module, depending on complexity of profiles
Key Frame Alignment	: Frame accurate key frame alignment across all profiles. Fixed IDR to IDR distance.
GOP control	: Dynamic GOP structure with Scene Change Detection.
<b>Audio Encode</b> Capacity Output format	: Up to 8 per module
Sample rates	: AAC-LC. Modes: 2.0, Bit rates: 32–384kbps : HE-AAC v1. Modes: 2.0, Bit rates: 32–192kbps : HE-AAC v2. Modes: 2.0, Bit rates: 32–96kbps : 32, 48kHz
<b>Reformatting/Rescaling</b> De-interlacing Format conversion	: Interlaced to progressive conversion : From HD to sub SD
<b>Aspect Ratio Control</b> Aspect Ratio Modes AFD Modes	: Transparent Input to Output, Manual 4:3 or 16:9 : Generated based on incoming AFD and format conversion.

<b>VBI</b> Pass-through	: Components such as EBU Teletext and DVB Subtitling can be passed through. Synchronization to video will be maintained. : EIA-608n and EIA-708 passed through.
Closed Captioning	: EIA-608n and EIA-708 passed through.
<b>Graphics</b> Subtitling Insertion (burn-in)	: DVB Subtitling
<b>Licensed Features</b>	: Dolby® Digital/Dolby® Digital Plus Decode

## PROCESSING MODULES SPECIFICATIONS

Audio leveling	Number of audio tracks Pass-Through Audio format Adjustable range Step Adjustment mode	: 250 stereo : All components signaled in service : MPEG-1 layer 2 : ±30 dB : 2 dB : Static : Integrated with 3rd party SW solutions for automatic adjustment
<b>Licensed Features</b>		: Number of audio channels
Bulk Descrambling	Interface CA system support BISS support Maximum data rate Number of services per module Scrambling algorithms	: SW based smart card : Please contact Sencore* : Mode 1, Mode E : Up to 850 MBit/s : 250 : DVB-CSA and AES
<b>Licensed Features</b>		: Number of descrambled channels : Biss, Verimatrix, Latens : SIM based smart card : 8 in front and 8 behind front plate (Only 8 in front can be replaced while in operation) : Conax : Mode 1, Mode E : Up to 850 MBit/s : 250 : DVB-CSA and AES
SIM Bulk Descrambling	Interface Number of SIM card readers	
<b>Licensed Features</b>	CA system support BISS support Maximum data rate Number of services per module Scrambling algorithms	: Number of descrambled channels : Conax
DVB Descrambling	Interface CA system support*  Number of services per CAM	: DVB Common Interface : BetaCrypt, Conax, Cryptoworks, Irdeto, Mediaguard, Viaccess, NDS Viasat, Nagra : 10 (requires multi service CAM)
Scrambling	Scrambling algorithm Maximum data rate Number of services per scrambler card Video format Interface towards CA System Number of CA systems EMM Entropy reduction	: DVB-CSA and AES : Up to 850 MBit/s : 250 (depending on SW license) : Transport stream; MPEG-2, MPEG-4, HEVC : Simulcrypt interface : 4 CA systems simultaneously : Yes : Yes for DVB : No for AES
<b>Licensed Features</b>		: Number of descrambled channels : PVR assist
EPG	Ingest Output	: EIT table from any port, XMLTV : Re-generated EIT table

8) For complete table please contact Sencore.

9) 352 only available for 25 fps









