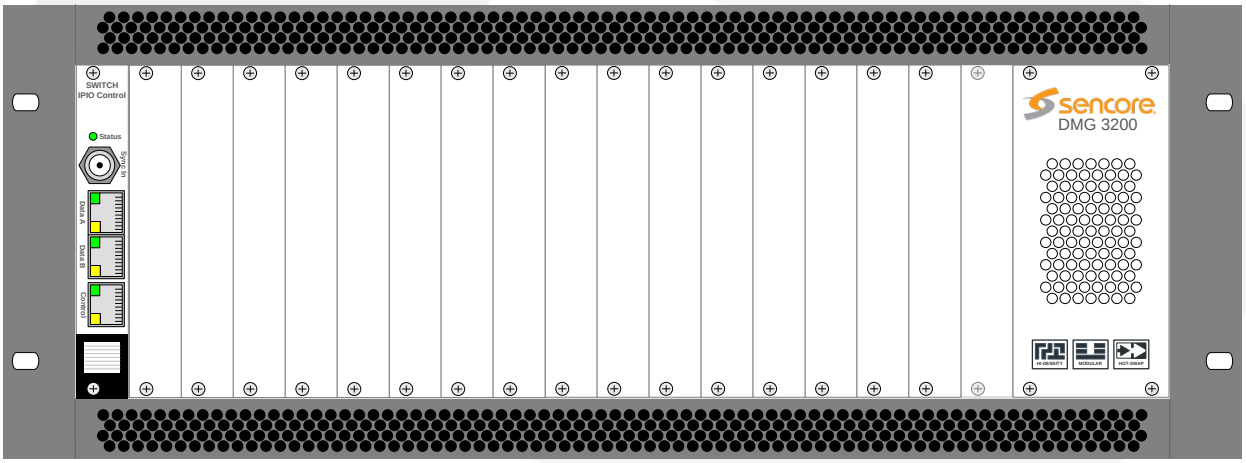
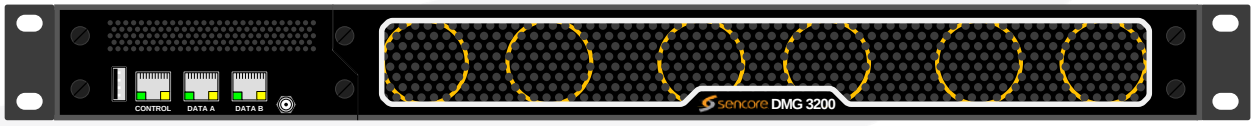
DMG 3200/3100/3000
Digital Media Gateway

User Manual





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About Sencore

Sencore is an engineering leader in the development of high-quality signal transmission solutions for the broadcast, cable, satellite, IPTV, and telecommunications markets. The company's world-class portfolio includes video delivery products, system monitoring and analysis solutions, and test and measurement equipment, all designed to support system interoperability and backed by best-in-class customer support. Sencore products meet the rapidly changing needs of modern media by ensuring the efficient delivery of high-quality video from the source to the home. More information about Sencore is available at the company's website, www.sencore.com.

Revision History

Date	Version	Description	Author
01/09/12	1.0	Initial Release	ACD
12/01/14	2.0	DMG 3200 Release	ACD

FCC Class A Information

The DMG 3200/3100/3000 has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

Shielded cables must be used with this unit to ensure compliance with the Class A FCC limits.

⚠***Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.***

WARNING ⚠

PLEASE OBSERVE THESE SAFETY PRECAUTIONS
There is always a danger present when using electronic equipment.

Unexpected high voltages can be present at unusual locations in defective equipment and signal distribution systems. Become familiar with the equipment that you are working with and observe the following safety precautions.

- Every precaution has been taken in the design of your 3200/3100/3000 to ensure that it is as safe as possible. However, safe operation depends on you the operator.

- Always be sure your equipment is in good working order. Ensure that all points of connection are secure to the chassis and that protective covers are in place and secured with fasteners.

- Never work alone when working in hazardous conditions. Always have another person close by in case of an accident.

- Always refer to the manual for safe operation. If you have a question about the application or operation call SENCORE for assistance.

- Never allow your equipment to be exposed to water or high moisture environments. If exposed to a liquid, remove power safely (at the breaker) and send your equipment to be serviced by a qualified technician.

Package Contents

The following is a list of the items that are included along with the DMG 3200/3100/3000:

1. User Manual
2. Quick Install Guide
3. AC Power Cable (2 for DMG 3200 and 3000, 1 for DMG 3100)

Note: If any option cables were ordered with the DMG 3200/3100/3000, they will be included in the box as well.

If any of these items were omitted from the packaging of the DMG 3200/3100/3000 please call 1-800-SENCORE to obtain a replacement.

1) Documentation CD

2) Quick Install Guide

3) AC Power Cable

Table of Contents

1 Introduction

Thank you for purchasing the DMG 3200/3100/3000. This manual describes how to install, configure, and operate your new equipment. It is written for professional operators of video distribution systems and assumes a prerequisite level of technical knowledge.

2 Installation and Safety

2.1 Installation and Safety

The unit is designed to offer operators reliability and flexibility. It consists of a chassis in which a number of modules can be installed. To cater to specific system requirements, the chassis can be configured to host functional modules best suited for a given scenario.

Sencore products can be delivered in different chassis variations - 1RU chassis and a 4RU chassis. The product models **DMG 3000** and **DMG 3200** represents the 4RU chassis, while the product models **DMG 3100** and **DMG 3200** represents 1RU chassis.

2.1.1 The 4RU Chassis

The 4RU chassis consists of a total of 18 slots all of which can host functional modules. Slot number 0 is dedicated to host the switch module and slot number 17 can only host multi-slot input modules. Alternatively a second switch module can be placed in slot 17 for some redundancy configurations. The remaining 16 slots are identical and can be occupied by any of the functional modules available. A 4RU chassis including a mandatory switch module, power supply connectors, and module slots is shown in *Figure 2.1 and 2.2*. Power modules and fan modules are inserted from the back (figure 2.3 showing the DMG 3200 4RU).

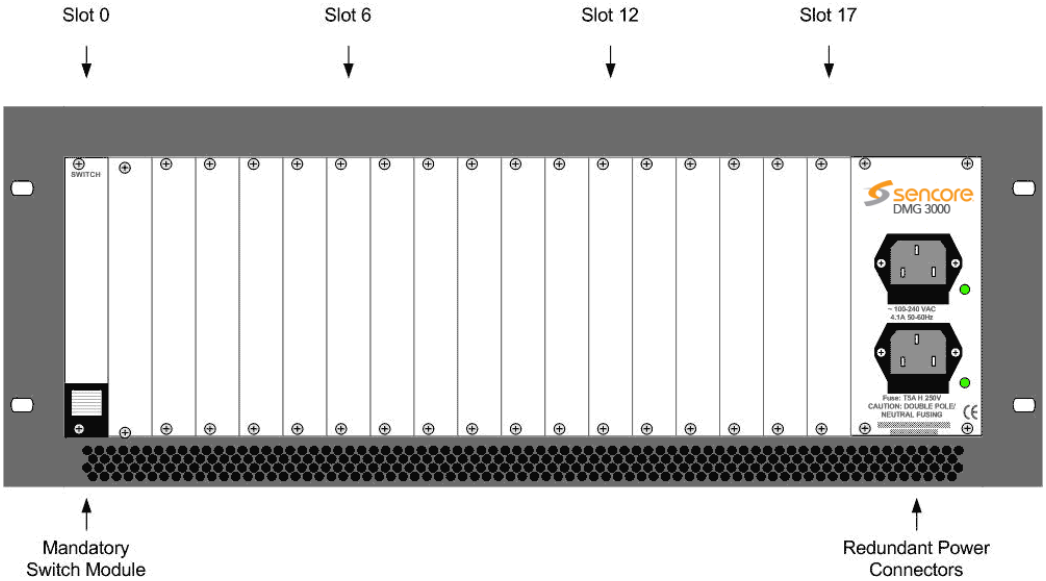


*Figure 2.1 – 4RU chassis (DMG 3000**)** with power connectors, switch module and available slots.*

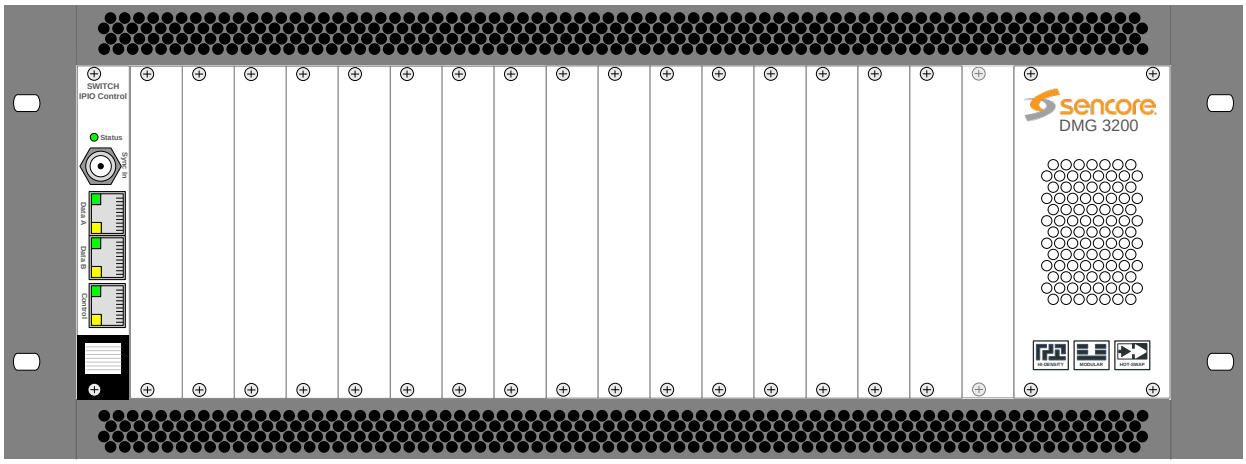


*Figure 2.2 – 4RU chassis (*DMG 3200*) with front view*

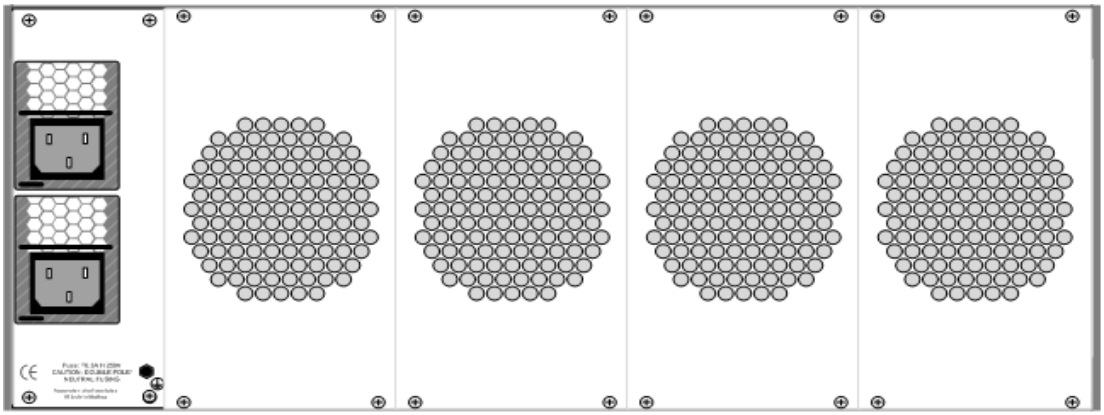


*Figure 2.3 – 4RU chassis (*DMG 3200*) with rear view*

2.1.1.1 Product models

4RU chassis models: DMG 3000 and DMG 3200

2.1.1.2 Ventilation

The 4RU chassis with Telco mounting has forced air flow from front to back in the chassis, allowing for multiple units to be stacked above each other with no space in between. However, adequate space must be provided in front of and behind the unit for effective ventilation. For Broadcast mounting, air flow will be from back to front.

2.1.1.3 Replacing the power supply module

The 4RU chassis can be installed with one or two power supply modules (DMG 3200 always comes with two power supply modules). The modules can be exchanged from the rear of the unit. The chassis delivered with a single power module can be updated by acquiring additional power module.

If power is lost in one of the Power supplies, the other can feed the entire chassis. It is recommended to connect each input power at different circuits.

2.1.2 1RU Chassis DMG 3200

The 1RU chassis for the DMG 3200 holds of a total of 6 slot positions plus a slot for the Switch/IP module. The Switch/IP module is inserted in the front of the chassis, while the modules for the other 6 positions are inserted in the back of the chassis. All modules are hot-swappable, including power supplies and the fan module in front.

The 1RU chassis is equipped with dual 400W AC or 500W DC power supplies

Figure 2.5 shows the front and rear view of the 1RU chassis including a mandatory switch module, power supply connectors, and module slots.

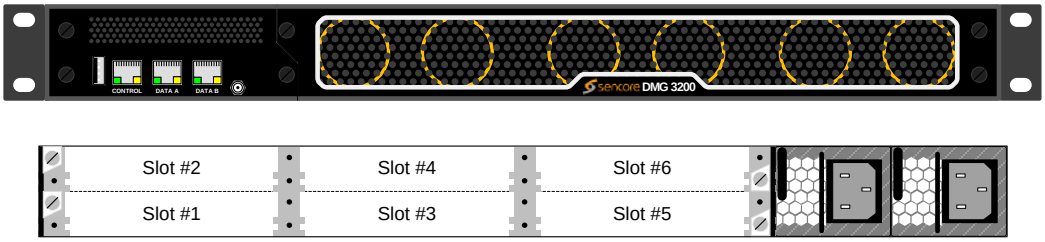


Figure 2.5 - 1RU chassis for DMG 3200 with dual power, switch module and available slots; front and rear view.

This chassis can hold 2 power supply modules for redundancy purpose

2.1.2.1 Ventilation

This DMG 3200 has forced air flow from front to back allowing for multiple units to be stacked above each other with no space in between. However, adequate space must be provided in front of and behind the unit for effective ventilation.

The DMG 3200 has 6 fans in front. Fan speed is temperature controlled. If one fan fails, remaining fans will increase speed to compensate. The whole Fan module, containing all 6 fans, can be hot swapped. If, during fan module replacement, the temperature on the inserted modules exceeds a certain critical temperature, the unit will shut down, to prevent damage of the inserted modules.

2.1.2.2 Replacing the power supply module

This 1RU chassis can be installed with one or two hot swappable power supply modules. The modules can be exchanged from the rear of the unit. The chassis delivered with a single power module can be updated by acquiring additional power module.

If power is lost in one of the Power supplies, the other can feed the entire chassis. It is recommended to connect each input power at different circuits.

2.1.3 Safety Considerations

The unit **must** be connected to a grounded power connection. The power input connector is a **disconnect device**. To remove the power from the device, the power cables needs to be physically removed from the power input connector.

	Mandatory Safety Instructions
1	The equipment must be installed by a qualified person.
2	For that equipment with grounding, connect the driver before connecting the power cord. So opposite the power cord must be removed before removing the driver of the ground.
3	The equipment must be installed in a restricted area where: • Only qualified technicians have access or who know the most important safety measures. • Access to the area where the devices are installed will be using a tool, lock and key, or any other safety device, and in addition the site will be controlled by an authorized person.

2.1.4 Installation

2.1.4.1 Power supply rating

The 4RU chassis is supplied with either a 100-240V AC 50/60 Hz power or -48V DC power. The 100-240V AC 50/60 Hz power supply is rated for maximum 300W, 400W or 800W[1]. The -48V DC power is rated for maximum 400W. Figures 2.6. 2.7, 2.8, 2.9, 2.10, 2.11 and 2.12 below shows the power supply inlets.

The 1RU chassis is supplied with a 100-240V AC 50/60 Hz power rated for maximum 200W for product models DMG 3100.

The 1Ru chassis, product model DMG 3200, is supplied with single or dual 100-240V AC, 47-63Hz , 400W power, or with single or dual -48V DC, 500W power.

2.1.4.2 4RU chassis with 300 and 400W AC Power

The chassis can be hold two power supplier for redundancy and has independent power inlets for the two supplies.

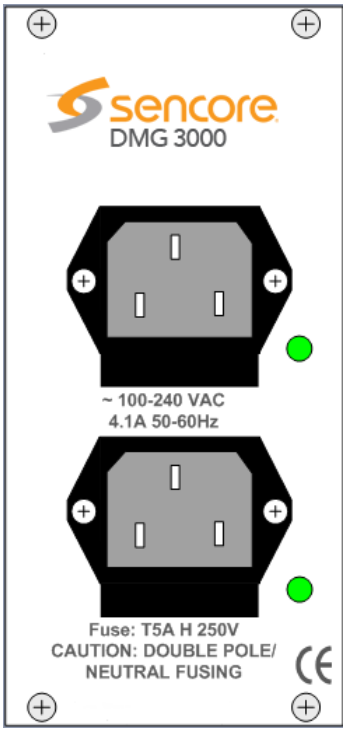


Figure 2.6 - Power Input for 4RU chassis with 300 and 400 Watt AC power

[1] Contact Sencore for more information.

2.1.4.3 4RU chassis with 800W AC Power

The chassis has two power supplies for redundancy with independent power inlets. The power supplies and power inlets are located at the back of the chassis.

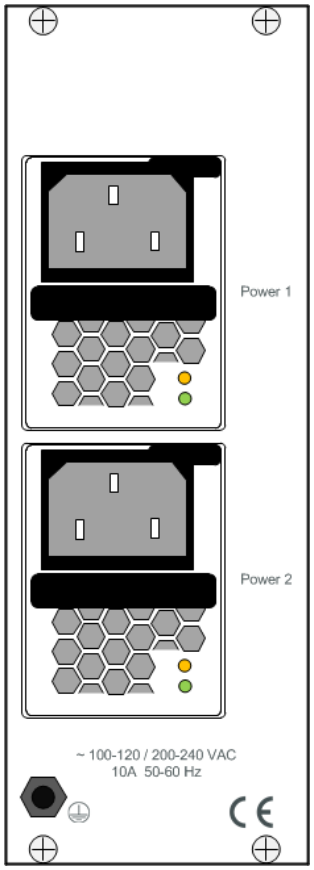


Figure 2.7- Power input for 4RU chassis with 800W power supplies

2.1.4.4 4RU chassis with 400W DC (-48Volt) Power supply

The chassis can be hold two power supplier for redundancy and has independent power inlets for the two supplies.

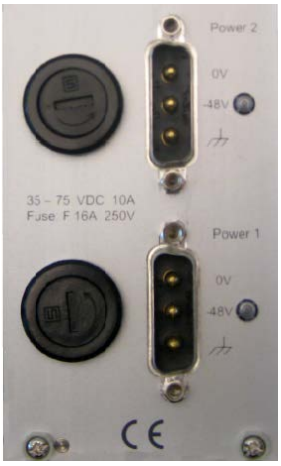


Figure 2.8– Front plate of dual 48V Power Supply in a DMG 3000

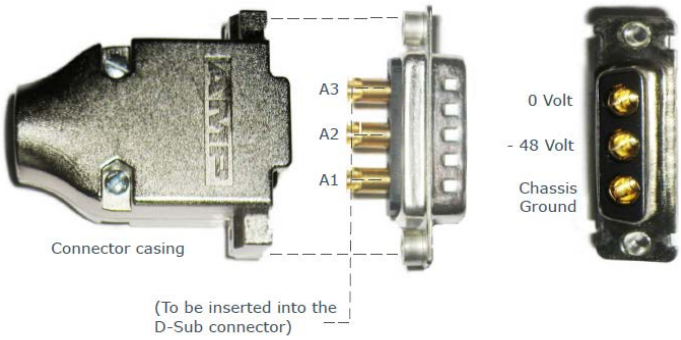


Figure 2.9 - Layout of 48V DC Power Supply Connector

2.1.4.5 1RU chassis Product model DMG 3200 with AC power

The power input connectors are located at the back of the unit.

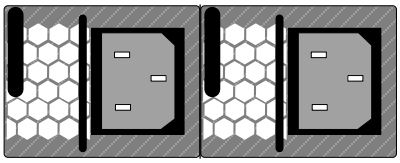


Figure 2.10 Power Input Connector for 1RU Chassis, product models DMG 3200 with AC power

2.1.4.6 1RU chassis Product model DMG 3200 with DC power

The power input connectors are located at the back of the unit.

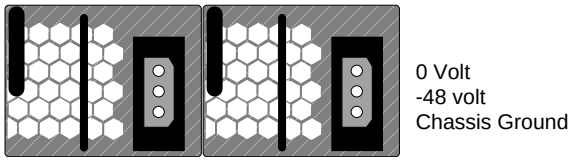


Figure 2.11 Power Input Connector for 1RU Chassis, product models DMG 3200 with DC power

2.1.5 Information on Disposal

This product must not be disposed of with other household waste. According to the WEEE-directive, everyone that sells electrical and electronic products shall ensure that the same products are disposed of in an environmentally sound manner.

2.1.6 Laser Safety

The Optical SFP modules used in the DMG 3000/3100/3200 products are classified as class 1 laser products according to IEC 60825-1 and are classified as class 1 laser products per CDRH, 21 CFR 1040 Laser Safety requirements.

Depending on the products configuration, the DMG 3000/3100/3200 products can be equipped with multiple insertion modules containing housing for optical SFPs.

When installing SFP modules, please ensure that the module be placed in the housing present at the front of the IP input/output module. Once inserted, the SFP module will become active.

2.1.6.1 FDA/CDRH Compliant SFP modules

The below list of Optical SFP modules have been selected with regards to the FDA/CDRH laser safety requirements as the only optical modules allowed used with the Sencore products in the USA, and any other countries and states that require compliance according to FDA/CDRH laser safety regulations.

Manufacturer	Model	wave length [nm]	Max output power (1)
Finisar	FTLF8519P2xCL	850 nm	-3 dBm
Finisar	FTLF8519P2xNL	850 nm	-3 dBm
Finisar	FTLF8519P2xTL	850 nm	-2.5 dBm
Finisar	FTLF1318P2xCL	1310 nm	-3 dBm
Finisar	FTLF1318P2xTL	1310 nm	-3 dBm
Finisar	FTLF1419P1xCL	1310 nm	5 dBm
Finisar	FTLF1518P1BTL	1550 nm	5 dBm
Finisar	FTLF1519P1xCL	1550 nm	5 dBm
Finisar	FTLF1519P1xNL	1550 nm	5 dBm
Finisar	FTLF1619P1xCL	1550 nm	5 dBm
Finisar	FWLF15217Dxx	1471, 1491, 1511, 1531 1551, 1571, 1591, 1611	5 dBm
Finisar	FWDM16197Dxx	1471, 1491, 1511, 1531 1551, 1571, 1591, 1611	5 dBm
Avago Technologies	AFBR-5710Z	850 nm	-3 dBm
Avago Technologies	AFBR-5715Z	850 nm	-3 dBm
Avago Technologies	AFCT-5710Z	1310 nm	-3 dBm
Avago Technologies	AFCT-5715Z	1310 nm	-3 dBm
OCP	TRXAG1SX	850 nm	-4 dBm
OCP	TRPEG1KVX-E1G	1550 nm	5 dBm
(1) Class 1 Laser Safety per FDA/CDRH and EN (IEC) 60825 regulations			

2.1.6.2 Warning: Radiation

!	**Caution** – use of controls or adjustment or performance of procedures other than those specified herein may result in hazardous radiation exposure.

2.1.6.3 Labels

The following illustrations show the labels attached to the Sencore products, according to the standards.

A classification label is attached to the top cover of the DMG 3000/3100/3200 products.

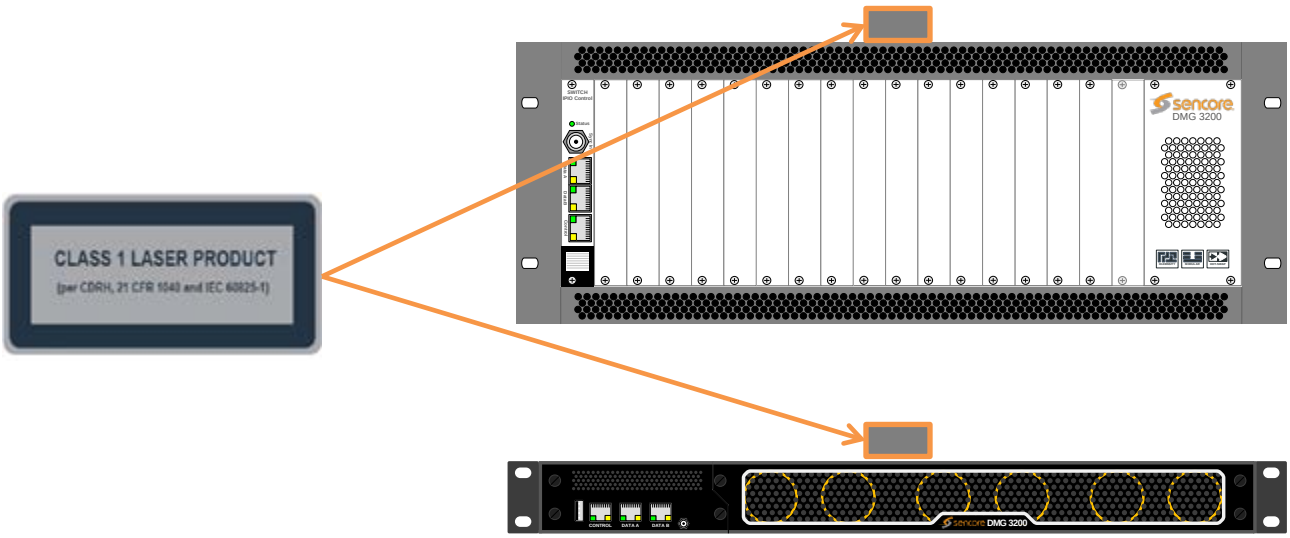


Figure 2.12 - classification label

3 Physical Module Configuration

3.1 Connecting switch modules

Configuration, management and monitoring of your Sencore unit is done via the management port on the switch module. The switch module will contain the database for the full configuration of the unit. One switch module (in some configuration two switch modules) must be installed in all 1 RU and all 4 RU chassis.

Please refer to product datasheets for module identification.

3.1.1 Switch module with MMI

The switch module is equipped with one electrical connector (RJ45) for management. Automatic sensing of 10/100/1000Mbit Ethernet connections is supported. For a 1000Mbit connection, the Ethernet cable must be a category 6 cable.

The management port should be connected to your management network. Please refer to section 4 for configuration.

3.1.2 Switch module with MMI and IP IO

The switch module with management and two data ports is equipped with three electrical connectors (RJ45) or one electrical connector (RJ45) and two SFP connectors. Two RJ45 electrical connectors or two SFP connectors are for data. The last RJ45 electrical connector is for management

Automatic sensing of 10/100/1000Mbit Ethernet connections is supported on all RJ45 ports. For a 1000Mbit connection, the Ethernet cable must be a category 6 cable.

The management port should be connected to your management network and the data port to you data network carrying the video streaming content. Please refer to section 4 for configuration.

Each port have a unique IP address and both data ports can be used at the same time as wither 2 IP input ports (seamless or standalone), 2 IP output ports (cloned or standalone) or 1 IP input and 1 IP output port.

3.2 MMI MicroSD Installation

In order to enable Logo Insertion for the Encoder modules, a MicroSD card will need to be installed in the MMI module. This will require physical removal of the MMI module from the unit.

Once the module has been removed, you will need to take the MicroSD card provided by Sencore and insert this into and 'click' this into the MicroSD holder as shown below:

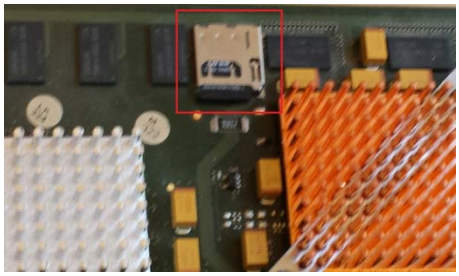


Figure 3.1 – MicroSD slot

In order to remove the MicroSD card, this can be pushed and then removed.

3.3 Connecting Input Signals

Please refer to product datasheets for module identification.

3.3.1 IP Input

This applies to the following modules::

- Standalone IP Input
- Dual IP module (Input mode)

The standalone IP input module is equipped with two electrical connectors (RJ45) and one SFP connector. One RJ45 electrical connector and the SFP connector are for data. The second

RJ45 electrical connector marked “control” is not in use. It is not required to configure the IP address or connect the port to the IP network.

The Dual IP module is equipped with two electrical connectors (RJ45) and two SFP connector.

Automatic sensing of 10/100/1000Mbit Ethernet connections is supported. For a 1000Mbit connection, the Ethernet cable must be a category 6 cable.

The IP address for both the electrical (RJ45) and the optical (SFP) connectors for data is the same. Consequently both connectors cannot be used simultaneously. These inputs are automatically activated by IP connection. The first port activated (by establishing a link to the router) will be the active port. To activate the other port, remove the cable from the active port.

3.3.2 ASI Input

Each ASI input module has three independent ASI inputs. The ASI connector is a 75Ω BNC connector. The maximum input rate per connector is 212Mbit/s in burst mode.

The ASI module is equipped with an electrical connector (RJ45) marked “control” that is not in use. It is not required to configure the IP address or connect the port to the IP network.

3.3.3 DVB-S/S2 Input

The DVBS-S/S2 supports both DVB-S (QPSK) and DVB-S2 (with DVB-S2 license). Each DVB-S/S2 input module has 4 independent L-Band inputs. Each input is a 75Ω F that can be connected either directly to an LNB, an L-Band distribution amplifier, or switch. The maximum input level is -25dBm. The recommended input level is between -30dBm and -40dBm.

One ASI output port is available for monitoring. Any of the four L-Band inputs can be copied to the ASI output without affecting the services in use. The ASI connector is a 75Ω BNC connector.

The DVB-S/S2 module is equipped with an electrical connector (RJ45) marked “control” that is not in use. It is not required to configure the IP address or connect the port to the IP network.

3.3.4 COFDM Input

Each COFDM input module has one 75Ω F connector. The input is distributed to four tuners internally, so each module can receive four independent frequencies. The maximum input level is -15dBm. The recommended input level is between -30dBm and -50dBm. (An older version of this module exists with different input levels.)

One ASI output port is available for monitoring. Any of the four COFDM inputs can be copied to the ASI output without affecting the services in use. The ASI connector is a 75 Ω BNC connector.

The COFDM module is equipped with an electrical connector (RJ45) marked “control” that is not in use. It is not required to configure the IP address or connect the port to the IP network.

3.3.5 DVB-T/T2 Input

Each DVB-T/T2 input module has one or four 75Ω F connector. For the module having one input connector, the input is distributed to four tuners internally, so each module can receive four independent frequencies. For the module with 4 inputs, each input is directly connected to a tuner. The maximum input level is -10dBm (both modules). The recommended input level is between -20dBm and -40dBm (optimal lever will depend on modulation used).

3.3.6 QAM A/C Input

Each QAM input module has one 75Ω F connector. The input is distributed to four tuners internally, so each module can receive four independent frequencies. The maximum input level is -15dBm. The recommended input level is between -30dBm and -50dBm.

One ASI output port is available for monitoring. Any of the four QAM inputs can be copied to the ASI output without affecting the services in use. The ASI connector is a 75Ω BNC connector.

The QAM module is equipped with an electrical connector (RJ45) marked “control” that is not in use. It is not required to configure the IP address or connect the port to the IP network.

3.3.7 8VSB Input

Each 8VSB input module has four independent 75Ω F connectors.

One ASI output port is available for monitoring. Any of the four 8VSB inputs can be copied to the ASI output without affecting the services in use. The ASI connector is a 75Ω BNC connector.

The 8VSB module is equipped with an electrical connector (RJ45) marked “control” that is not in use. It is not required to configure the IP address or connect the port to the IP network.

3.3.8 QAM-B Input

Each QAM-B input module has four independent 75Ω F connectors.

One ASI output port is available for monitoring. Any of the four QAM-B inputs can be copied to the ASI output without affecting the services in use. The ASI connector is a 75Ω BNC connector.

The 8VSB module is equipped with an electrical connector (RJ45) marked “control” that is not in use. It is not required to configure the IP address or connect the port to the IP network.

3.3.9 SDI Encoder

The SDI Encoder module has 4 BNC inputs that vary in functionality depending on the mode. These functions are as follows:

- SD Encoder – Port A, B, C and D are in SDI mode and link to the 4 corresponding internal encoder ports
- HD Encoder – Port A and B are in HD-SDI mode and link to the 2 corresponding internal encoder ports

- HD + AES Encoder – Ports marked HDSDI A and AES A link to channel A internally while HDSDI B and AES B link to channel B

3.3.10 Analog Encoder

The Analog encoder module has 4 High Density BNC input ports which correspond to the internal ports. As well as this, there is one HD DSUB 26 male connector for audio. The pin-out for this is as follows:

Pin #	Function
1	A Right +
2	A Right -
3	B Right +
4	B Right -
5	GND
6	C Right +
7	C Right -
8	D Right +
9	D Right -
10	GND
11	GND
12	AES 1 +
13	AES 1 -
14	GND
15	AES 2 +
16	AES 2 -
17	GND
18	GND
19	A Left +
20	A Left -
21	B Left +
22	B Left -
23	C Left +
24	C Left -
25	D Left +
26	D Left -

3.4 Connecting Output Signals

3.4.1 IP Output

This applies to the following modules:

- Standalone IP Output
- Dual IP module (Output mode)

The standalone IP output card is equipped with both an electrical connector (RJ45) and one optical (via the SFP module) for data. The RJ45 connector marked “control” is not in use. It is not required to configure the IP address or connect the port to the IP network.

The Dual IP module is equipped with two electrical connectors (RJ45) and two SFP connector.

Automatic sensing of 10/100/1000Mbit Ethernet connections is supported. For a 1000Mbit connection, the Ethernet cable must be a category 6 cable.

The IP address for both the electrical (RJ45) and the optical (SFP) connectors for data is the same. Consequently, both connectors cannot be used simultaneously. These inputs are automatically activated by IP connection. The first port activated (by establishing a link to the router) will be the active port. To activate the other port, remove the cable from the active port.

3.4.2 ASI Output

Each ASI output module has four independent ASI outputs. The ASI connector is a 75Ω BNC connector. The maximum output rate per connector is 212Mbit/s in burst mode.

3.4.3 QAM Output

Each QAM output module has two 75Ω F connectors which carry up to sixteen frequencies.

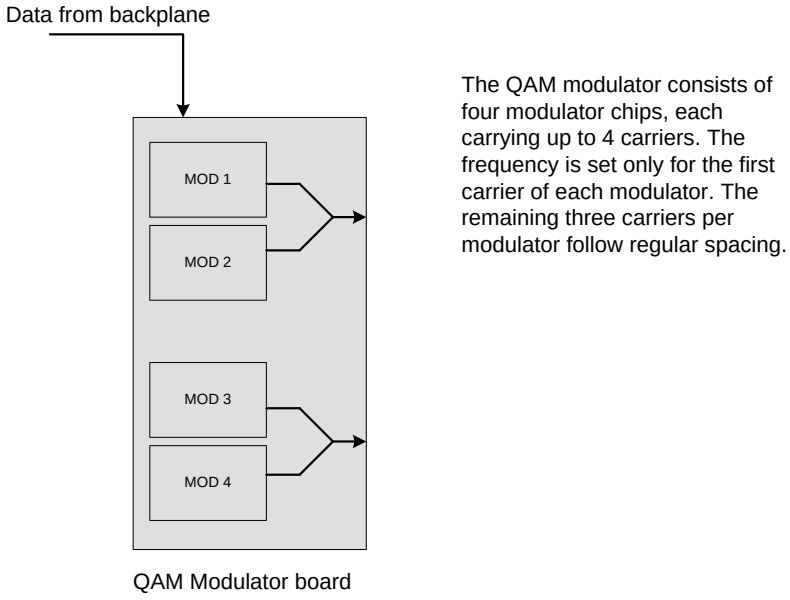


Figure 3.2 - QAM Modulator

3.4.4 COFDM Cable Output

Each COFDM output module has two 75Ω F connectors which carry up to four frequencies.

3.4.5 DVB-T/T2 Output

The DVB-T/T2 output module has 4 50 Ohm BNC outputs, two for output A and two for output B. Both outputs have a RF and Test port. The RF port will output the level configured in the system while the Test port will be 20 dB lower and can be used for monitoring.

3.4.6 DVB-S/S2 Output

There are two variations of the DVB-S/S2 output module:

- L-Band Output – This module has two SMA RF outputs (50 Ohm), one for each of the output channels A and B, and two monitor ports which are F-Type connectors (75 Ohm). The RF level of the monitor ports is 20 dB below that configured in the GUI for the RF outputs.

  The RF output can be muted with an external unit by applying 5V to the mute connector. Channel A and Channel B can be muted individually. The connector for Mute is a 2.5 mm headphone jack. For more information on this functionality, contact Appear TV's Support Team.

- IF Output – This module has 4 F-Type connectors which are 75 Ohm outputs. For each port there is a RF and Test port. The RF port corresponds to the output power level configured in the GUI, while the Test is the same level -20dB.

4 Administrative Settings Configuration

This chapter describes how to conduct initial configuration of the unit, such as setting its IP address, changing the GUI's password, setting the unit's time as well as handling licenses for the modules in the unit.

4.1 Accessing the Web Interface

All modules in the unit are controlled via the web interface provided with it. The unit Man Machine Interface (MMI) software runs on the switch module via the connector marked as "Control"

Default MMI IP address is 192.168.1.100. To change the network settings of the device please follow the steps described below.

Connect a PC directly to the device (the Ethernet port marked "Control" on the switch module) with an Ethernet cable.

Set the IP address of the Ethernet adapter of the PC to a fixed address in the same segment (e.g. 192.168.1.99). Refer to the operating system's manual for details on setting the IP address on the PC.

Start an internet web-browser and type 192.168.1.100 in the address field.

	Ensure that caching is disabled in the web browser.

	If you have previously connected to a unit with the same IP address, the ARP table on your computer might be inaccurate. To delete the old ARP entry, type arp-d 192.168.1.100 in a command prompt.

The following screen will appear though the exact configuration of the unit will vary.

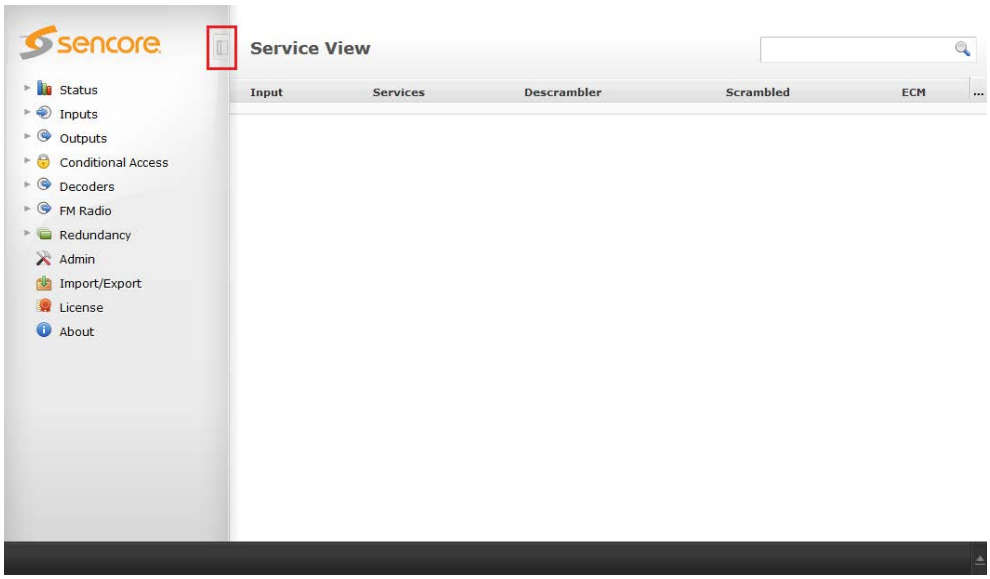


Figure 4.1 - Web Home Page

The screen area is divided into several sub-areas: a **Navigation Pane** on the left, a main display page on the right and footer at the bottom of the page. The **Navigation Pane** is used to access various nodes, while the footer displays alarms. Please note that the alarm area can be expanded by clicking on the arrow in the right bottom corner.

The button highlighted in the above figure toggles between the auto-hiding and always visible **Navigation Pane** modes. In auto-hide mode, the **Navigation Pane** frees up the space for the main pane. This is useful not only for devices with smaller screens such as netbooks but also for viewing large tables of data on the main pane.

By default, this feature is disabled, and the **Navigation Pane** is always visible.

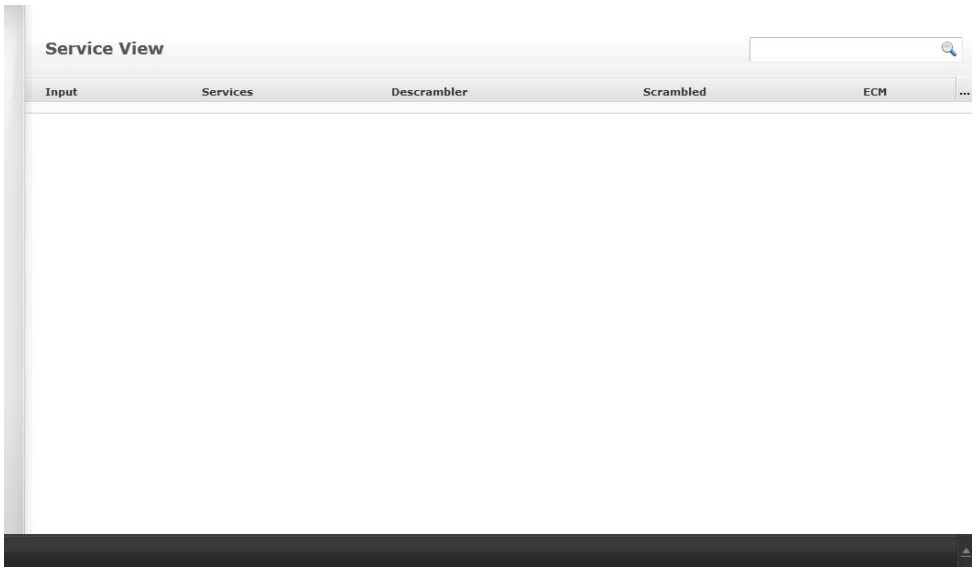


Figure 4.2 - Minimized Navigation Pane when auto-hide is enabled

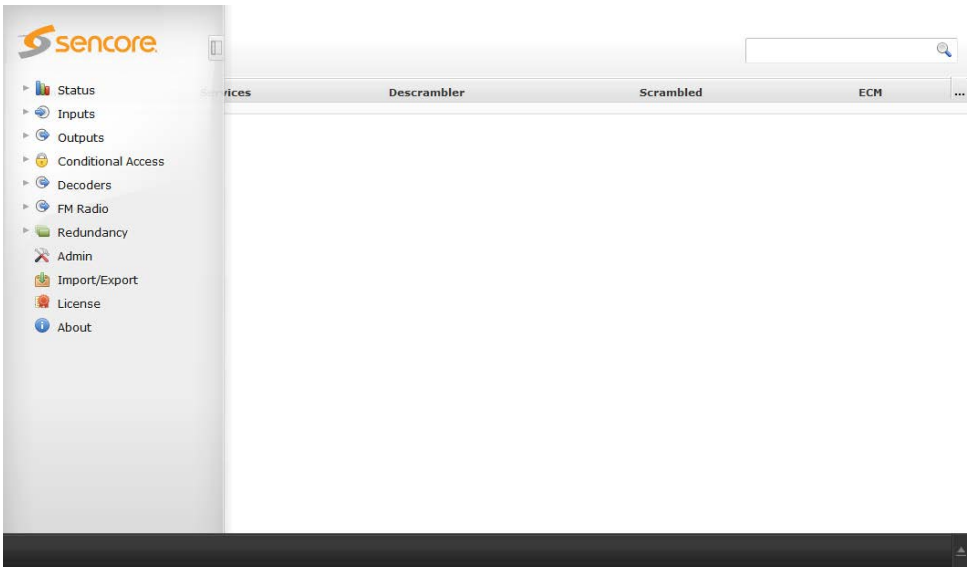


Figure 4.3 - Hovering mouse over the minimized Navigation Pane will show the full pane

4.1.1 Assigning an IP Address

Click on the Admin node in the **Navigation Pane** and the window in Figure 4.4 will be displayed. This window shows all installed modules with their respective network settings; the MMI module is in slot 0 or slot 17 (marked as *mmi* in **Type**).

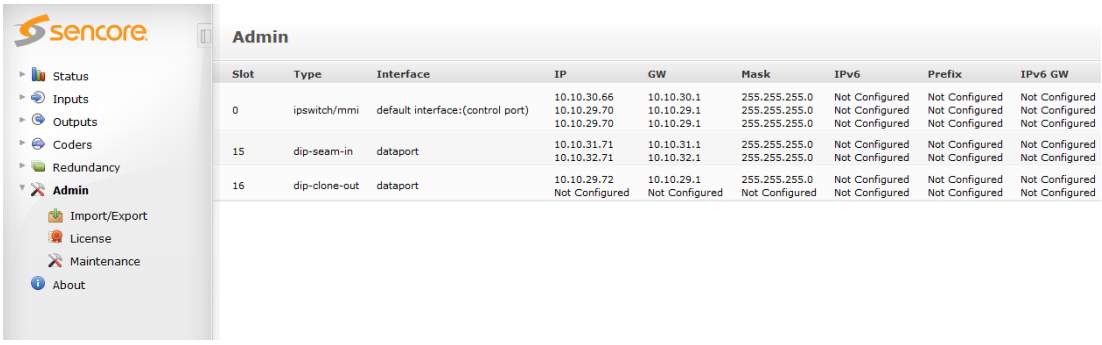


Figure 4.4 - Admin View

Select the switch module hosting the MMI and a module configuration similar to the one below Figure 4.5 will be displayed.

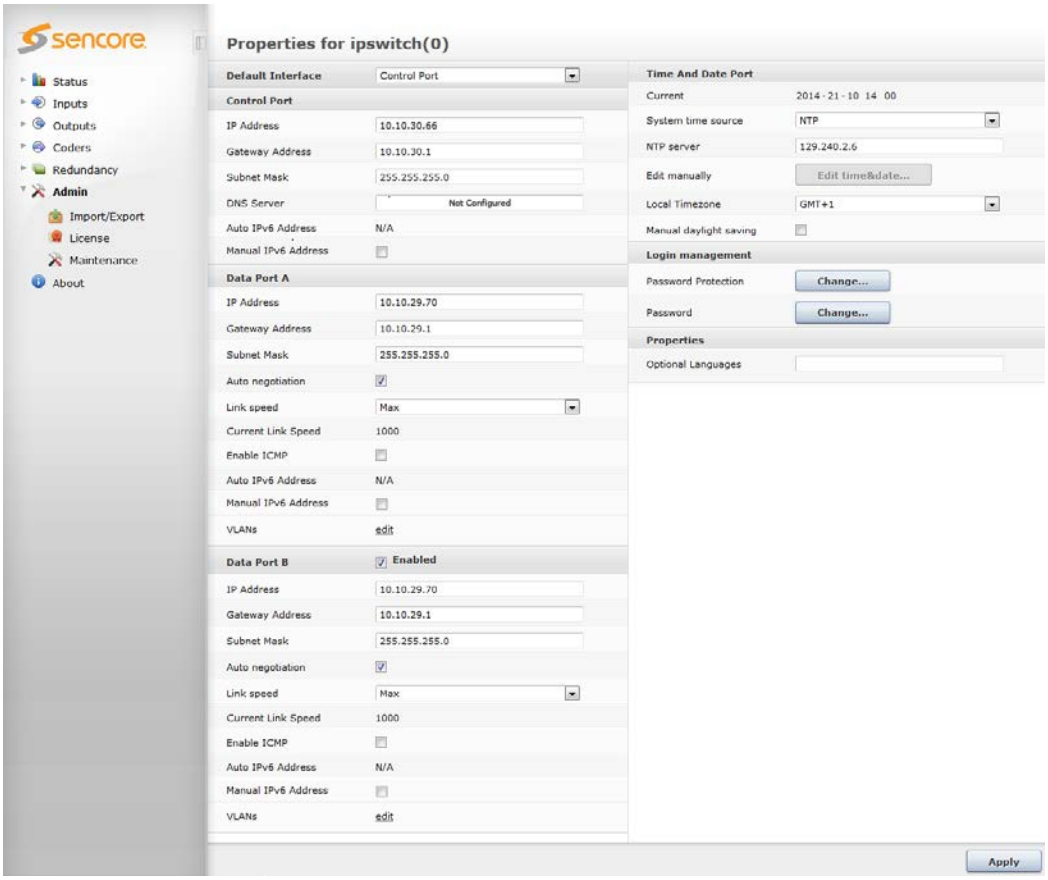


Figure 4.5 - Admin Properties View

In the **Admin Properties** view, it is possible to configure the **Default Interface**, **Control Port**, and **Data Port**. **Control ports** on all input, output and processing except scrambling, bulk descrambling and EPG modules do not need to be configured.

Default Interface	This parameter allows you to select the **Management Port** to be used for managing the Web GUI. For Switch modules with IP interfaces, the **Management Port** can be the **Control Port**, **Data Port**, or a **VLAN** (previously added).

Control Port

IP Address	IP address used solely for management. It cannot be used for multicast reception as it is not for data input.
Gateway Address	Gateway address of the network used for management
Subnet Mask	Subnet mask
DNS Server	Specify DNS Server for Control port applications (ie NTP)

Data Port

IP Address	IP address used for multicast reception
Gateway Address	Gateway address of the network used to access external resources
Subnet Mask	Subnet mask
Auto Negotiation	Enabled or disabled
Link Speed	Choose from: • Max • 100 • 1000
Current Link Speed	Current detected link speed of the Ethernet interface
Enable ICMP	By default all ports on the Dataport are closed (ie firewall). Enabling this option enables the port for 'ping' to be open. See further details in 4.1.4.

VLANs

The IP Input port can support up to 25 Virtual LANs (VLANs) depending on the module type and they can be defined in the **Admin Properties** view. The VLANs may then be associated with IP input streams when configuring input multicasts. To add and remove VLANs, click **edit**. The dialog below will be displayed:

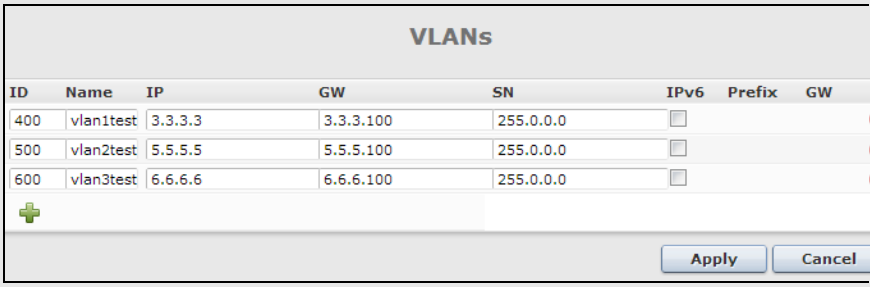


Figure 4.6 - Setting up Virtual LANs

Click to add VLAN tags and to remove them.

If an active VLAN is removed, the associated IP inputs are reset so that they will not be part of that particular VLAN group.

Save the settings and connect the unit to your local network. Reconnect to the Web GUI using the MMI address.

!	Please note that the following addresses ranges are reserved for internal use and not available to be configured: Switch: 192.168.0.xxx Switch w/ IP: 192.168.0.xxx and 192.168.2.xxx

4.1.2 IPv6 Address Support

IPv6 support is available for management and data ports of the Switch module, both Control and IP versions. The following options are supported:

- Support for simultaneous IPv4 and IPv6 addresses, both for management and data ports.
- Management (GUI/SNMP) using IPv6 address
- IP inputs using IPv6 addresses
- IP output using IPv6 addresses

4.1.2.1 Management GUI

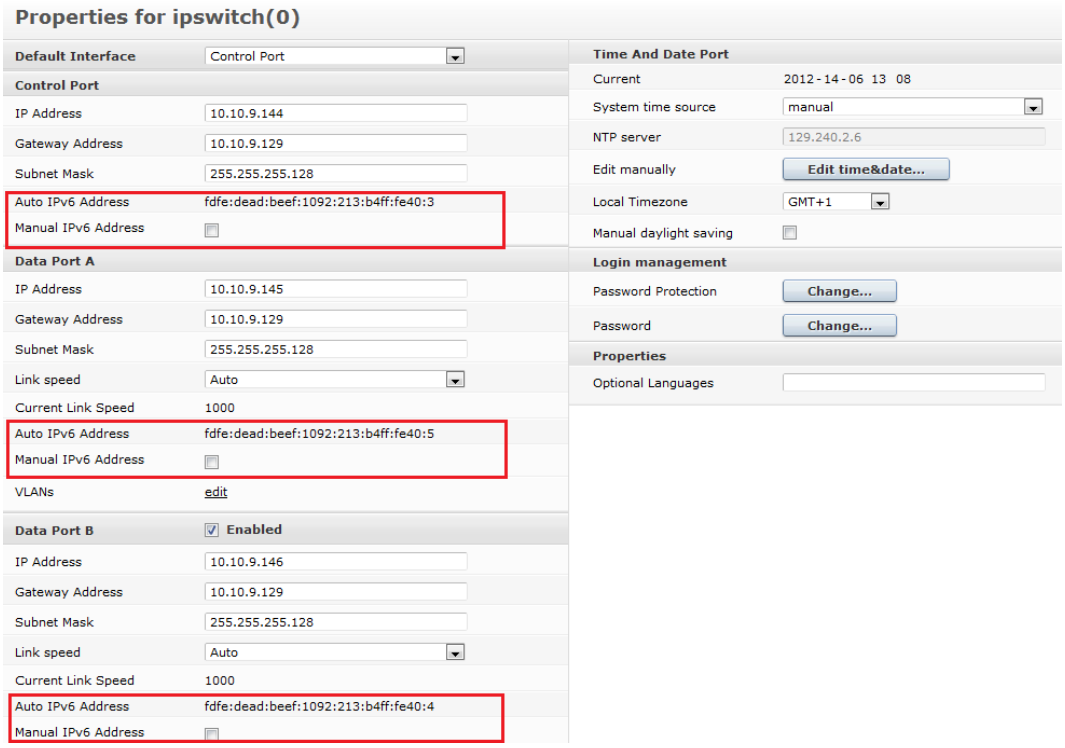


Figure 4.7 – IPv6 Address in Admin Page

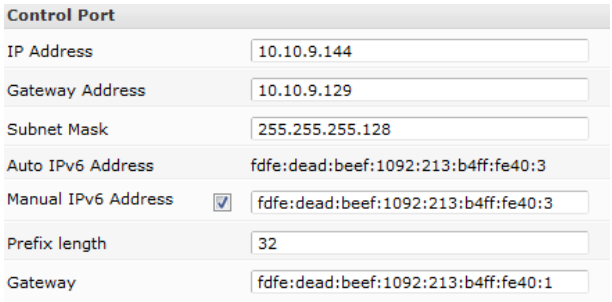


Figure 4.8 – Manual IPv6 Address

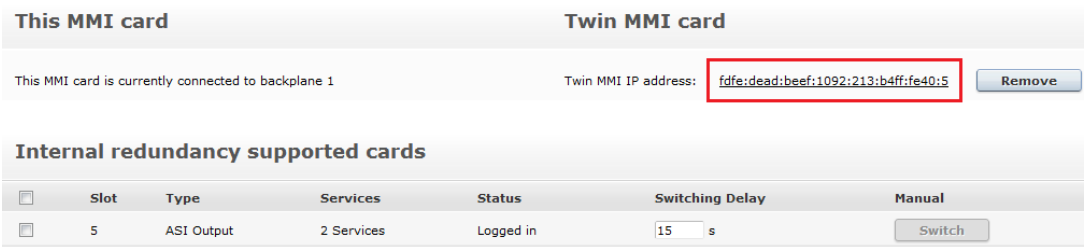


Figure 4.9 – IPv6 Internal Redundancy

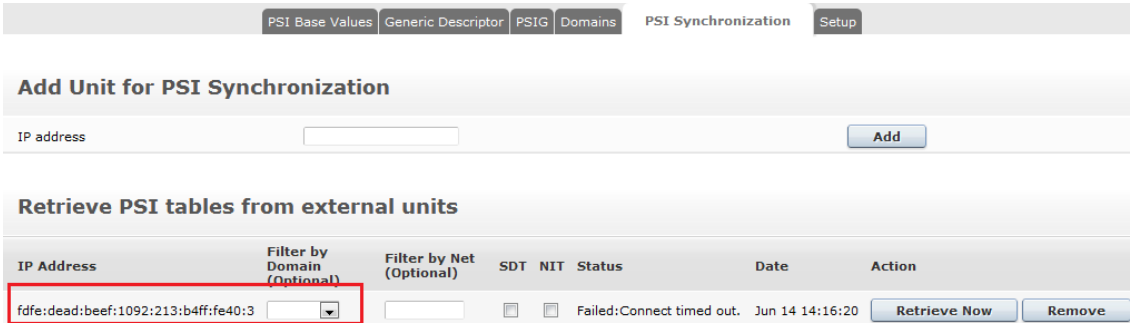


Figure 4.10 – IPv6 PSI Synchronization

Default interface	Default interface for Management interface. This can be selected between control and dataports, as well as any configured VLANs.
Auto IPv6 Address	All interfaces will automatically get an IPv6 address which is generated based on router advertisements. The address will have a correct prefix, and be unique on the connected network.
Manual IPv6 Address	When enabling Manual IPv6 Address, the port can be configured with a manual IPv6 Address. Prefix length and Gateway address is also set.
IPv6 NTP server	The unit can connect to an IPv6 NTP server by inserting a valid IPv6 address in the “NTP server” field.
Internal Redundancy	The twin MMI card can use an IPv4 or IPv6 address.
PSI Synchronization	The PSI Synchronization units can use an IPv4 or IPv6 address

4.1.3 Management over IP-Data Port and VLANs

In the Admin section of the MMI card, it is now possible to set the default interface for the Management interface. This includes the GUI, Maintenance Center and SOAP operations.

This will allow you to configure the IP dataports on the switch card, or a configured VLAN for the default management interface.

After configuring VLANs we can see it in the drop down list in the control port refer below figure.

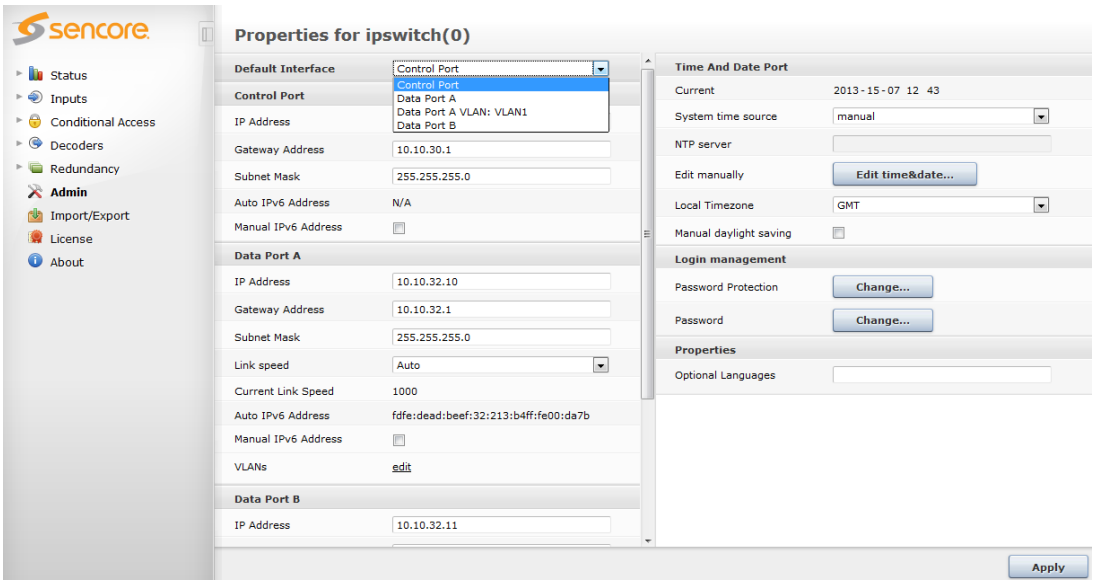


Figure 4.11 - Setting up Virtual LANs via Management port

4.1.4 Broadcast Firewall

Each IP Dataport is by default configured with IP Firewall features. This has the following configuration in terms of ports:

- **Secure** (Default)
  - ARP open by default
  - ICMP (ping) - by default closed, but able to be opened
  - IGMP -enabled on the IP input card
  - OSPF - enabled for output ports when OSPF is selected for Output Redundancy
  - PIM - enabled for output ports when the PIM is enabled for Output Redundancy
  - UDP Filter –Any UDP traffic that is not a configured multicast is blocked

- **Public** (Enabled when data-port is set as MMI port in the Admin Page)
  - All protocols open

4.1.5 Internal Time Clock Setting / Network Time Protocol (NTP) Server

The unit internal time may be configured manually, or it may be configured with a Network Time Protocol (NTP) server to set and update the system's date and time.

Open the Admin view in the **Navigation Pane** and select the module hosting the Man Machine Interface (MMI).

To configure the NTP Server settings, enter the following data below:

IP Address	IP address of the NTP server
Local Timezone	Your local timezone

To set the internal time manually, simply click on **Edit time & date** to produce the dialog below.

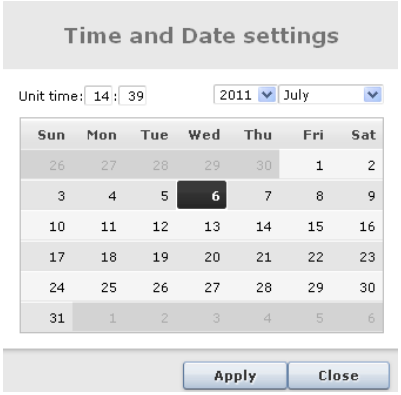


Figure 4.12 – Setting the Time and Date

Set the date and time accordingly.

Once the internal time has been configured, it will be displayed in the **Current Time** field, under the **Time and Date** section.

4.1.6 Automatic Daylight Saving

The Time Zone can also be selected on the Admin page for automatic updates of daylight savings for the system time.

If you required the Time Zone file for a given region, please contact procare@sencore.com. This file can be installed from the Maintenance Center, by selecting and uploading to the MMI slot.

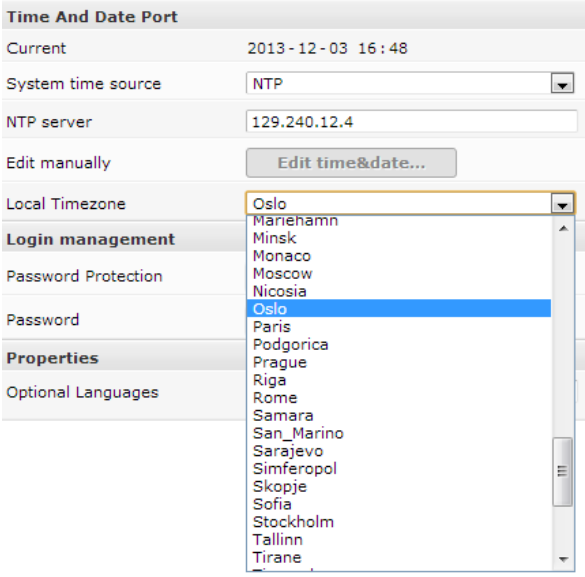


Figure 4.13 - Login Management Section

4.1.7 Password Protection in the GUI

For enhanced security the Web interface supports password protected access. This feature is disabled by default but may be enabled easily from the GUI.

To authenticate GUI access, in the MMI **Admin** view, click **Change** under the **Password Protection** entry in **Login Management**. Check the appropriate checkbox and click **Apply**. Reboot the MMI module for this change to take effect.

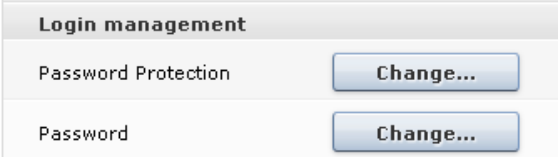


Figure 4.14 - Login Management Section

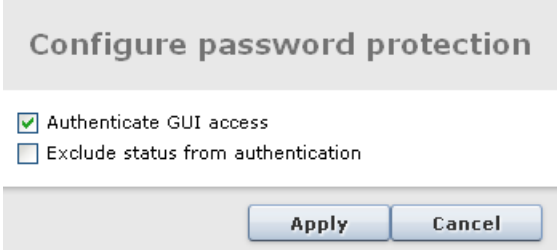


Figure 4.15 Password Configuration

The *Exclude status from authentication* option is provided in cases where only certain parts of the GUI need to be protected. If this checkbox is checked, only the **Service View**, **Hardware View** and **Active Alarm View** will be excluded from authentication. All other pages, including **Alarm History** will require authentication to be viewed.

4.1.8 Changing the Password for the GUI

The secure login supports one pre-defined user account – the admin user. The password protects the web GUI only, i.e., the SOAP interface is not password protected.

User	admin
Default password	admin

To change the password click **Change**. The following dialog will appear:

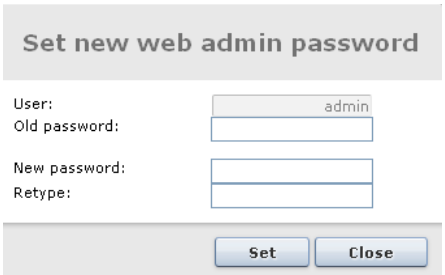


Figure 4.16 - Changing the Password

Type in the new password and click Set. Finally, click **Close** to exit the dialog. Reboot the MMI module for the new password to take effect.

4.1.9 Optional Languages

It is possible to specify one or two default languages which will always be available when configuring decoder modules. Since the drop-down list of available languages only includes languages currently present in the transport stream, this enables the operator to select languages expected to be present in the transport stream at a later point in time.

Open the Admin view in the **Navigation Pane** and select the module hosting the MMI.

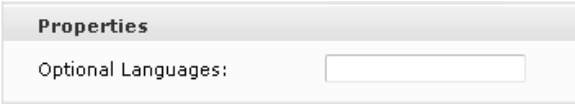


Figure 4.17 - Optional Languages

Enter up to two additional languages for the Optional Languages field. Language codes should be separated by a comma, e.g., *nor,dan*.

	Language codes are defined in the ISO 639 specification.

4.2 Configuration of Clock reference module

Please refer to the Terrestrial Solution Configuration Guide for more information on this module and its configuration.

4.3 Licensing

Licenses for modules in the unit are hosted by individual cards. Hence, the available features will not be determined before the cards are registered or logged into the MMI board. The table below lists all available licenses:

Module	License	Description
audiolevel	number-of-audio-pids	Enables the number of audio PIDs with audio leveling.
bulkdscr	number-of-descrambled-services	Enables the number of services for bulk descrambling.
	verimatrix	Enables communication with the Verimatrix CA system
	latens	Enables commnunication with Latens system
cofdmout-cable	modulation-cofdm	Enables COFDM modulation for the output.
	num-ts	Enables the number of maximum possible output multiplexes.
dvbs2	dvbs2	Enables the DVB-S2 demodulation options
	dvbs2-input-multistream	Enables Multistream reception option for the DVB-S2 module
epg	epg	Enables EPG.
asiout	mip-inserter	Enables MIP on the ASI output port.
switch/ipin	ipin-pro-mpeg-fec	Enables the reception of IP FEC streams on supported hardware
	seamless-ip-in	Enables IP input seamless switching
switch/ipout	ip-out-mpts	MPTS refers to Multiple Program Transport Stream. Without the ip-out-mpts license, only SPTS (Single Program Transport Stream) is available.
	ip-pro-mpeg-fec	Enables IP Forward Error Correction (FEC) option supported hardware
	output-redundancy	Enables output redundancy for the module.
qamout-a	modulation-qam	Enables QAM modulation for the output.
	num-ts	Enables the number of maximum possible output multiplexes.
dvb-t2	dvbt2-input	Enables the DVB-T2 demodulation options.
encoder	number-of-hd-encoders	Enables the number of HD services to be encoded.
	number-of-sd-encoders	Enables the number of SD services to be encoded.
	number-of-statmux-channels	Number of channels with Statistical multiplexing enabled
transcoder	number-of-hd-encoders	Enables the number of HD services to be transcoded.

Module	License	Description
	number-of-sd-encoders	Enables the number of SD services to be transcoded.
	number-of-statmux-channels	Number of channels with Statistical multiplexing enabled
transcoder-ms	hd-encoding	Enables HD encoding of input source
	Dolby Digital Plus Professional Decoder	Enables decoding of Dolby Digital (AC-3) and Dolby Digital Plus (E-AC-3) inputs,
scrambler	number-of-scrambled-services	Enables the number of services to be scrambled and the corresponding encryption algorithm.
	aes-cbc-irdeto	Vendor specific scrambling license.
	pvr-mode, pes-clear	Enables PVR mode for the scrambler and ensures that the pes headers are not scrambled. * pes-clear and pvr cannot be active simultaneously

Table 1 - Types of Licenses available

If a licensed feature is used without the correct license installed, the system will produce a **License Violation** warning. Use the **License** node to find which licenses are acquired and available.

4.3.1 Ordering a License File

Use the License node to order a license file. Flag the required licenses using the check boxes. The **Order License** button will produce a license order file which should be sent to Sencore. A matching license file will then be returned.

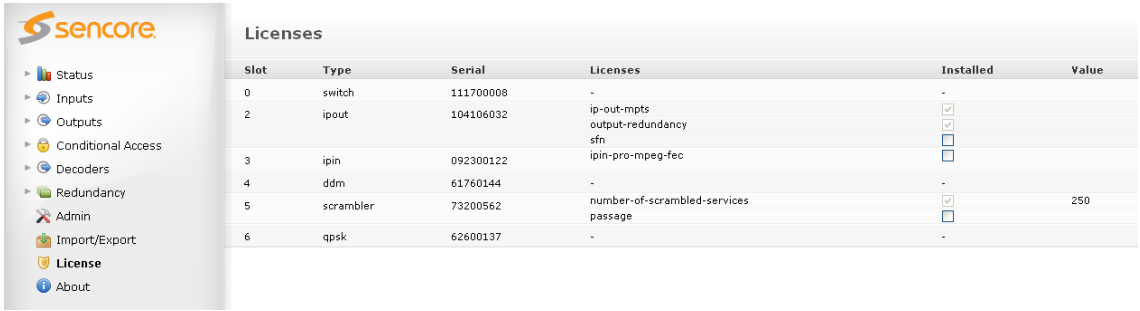


Figure 4.18– Licensing

4.3.2 Installing a License File

A valid license file may contain licenses for one or several cards. This means that one license file may be used for several units. The installation process will scan the file and if a matching serial number is found the license will be installed on the respective card within the unit. The license file is signed; if edited, it will be invalid.

Usually, the license file will be sent in a ZIP file and can be loaded directly to the GUI.

Once a license file is available from a machine with access to the web GUI, select the file and click **Install License**. If no warnings are displayed, the additional privileges should now be available.

4.3.3 Demo Licenses

When required, a time limited demo license can be provided in order to evaluate licensed features. The procedure to load a demo license is the same as a purchased license.

Once installed, the GUI will notify the user by creating an alarm about the presence of the demo license and what date it expires. When the demo license expires, then the card will be rebooted at 4 AM UTC time. After the card has rebooted, the demo license is no longer present on the card.

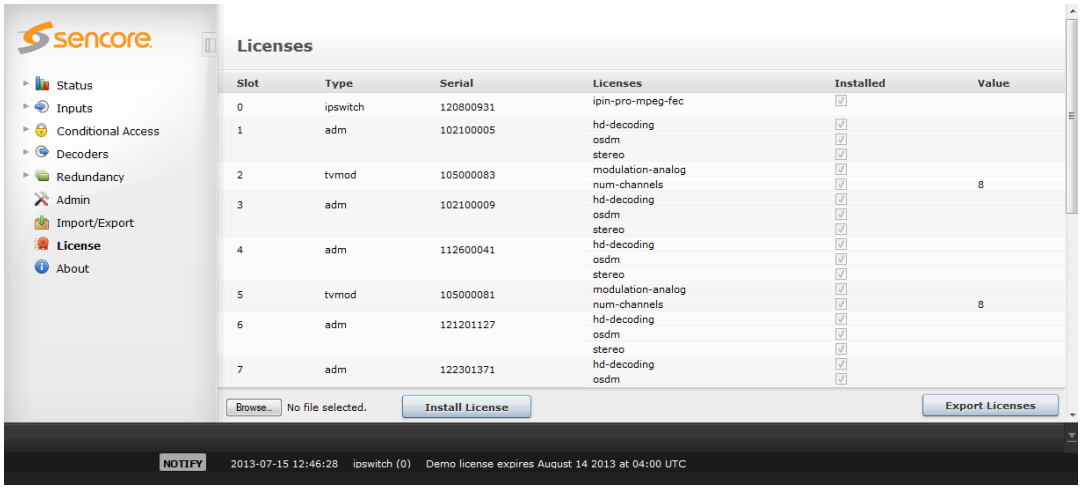


Figure 4.19 – Demo License

5 Input Configuration

This chapter describes the **Inputs** node in the GUI and how to analyze the available inputs.

5.1 The Inputs Node

The unit can be configured to host a number of different input modules. Open the Inputs node from the **Navigation Pane** to view all available input modules

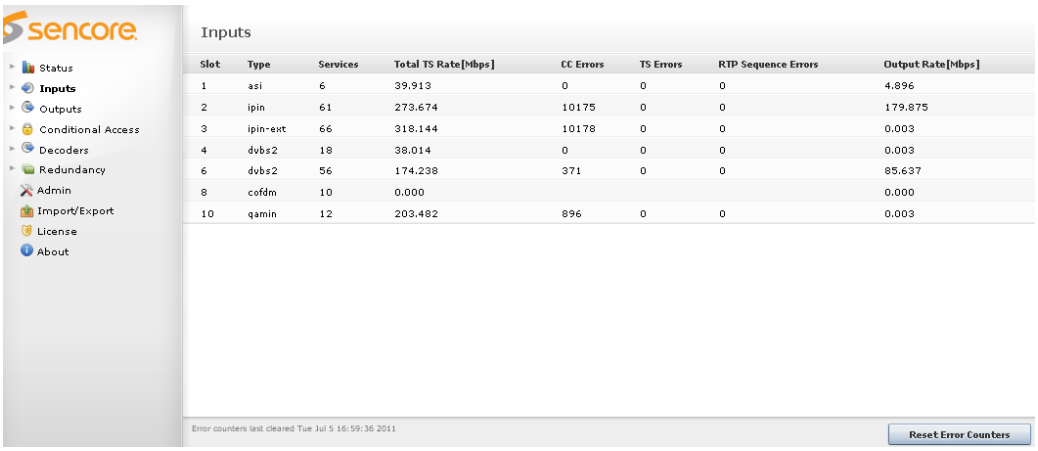


Figure 5.1 - Inputs Node

The following information is available in the **Inputs** node:

Slot	Slot position in the chassis
Type	Type of input module
Services	Number of services present in the transport stream
Total TS Rate [Mbps]	Total bandwidth of the incoming transport stream
CC Errors	Number of Continuity Counter (CC) errors detected on all input ports since last reset; CC errors indicate that one or more packets are lost.
TS Errors	Number of Transport Stream (TS) errors detected on all input ports. TS errors indicate problems with the incoming TS structure of the streams
RTP Sequence Errors	Real-time Transport Protocol sequence errors since last reset *(applies to IP only)*
Output Rate [Mbps]	Rate of active services transmitted to the backplane

Each input module available in the unit has some common analysis features; they all support manual definition of input PSI. The coming sections will describe these common features followed by details on how each input module can be configured.

5.2 Input Analysis

For each input module the unit provides detailed MPEG/DVB/ATSC transport stream analysis for all available input streams. The following information is provided by the input analysis engine:

- Port specific status
- PSI/SI analysis of all input services

- PID display – listing all input PIDs for each input, with implicit highlighting of CC errors, PCR flag and scrambling bits (odd/even)

This information is accessible by expanding the **Inputs** view in the **Navigation Pane**. The following example (Figure 5.2) is based on a DVB-S/S2 input module, but the same applies to all input modules.

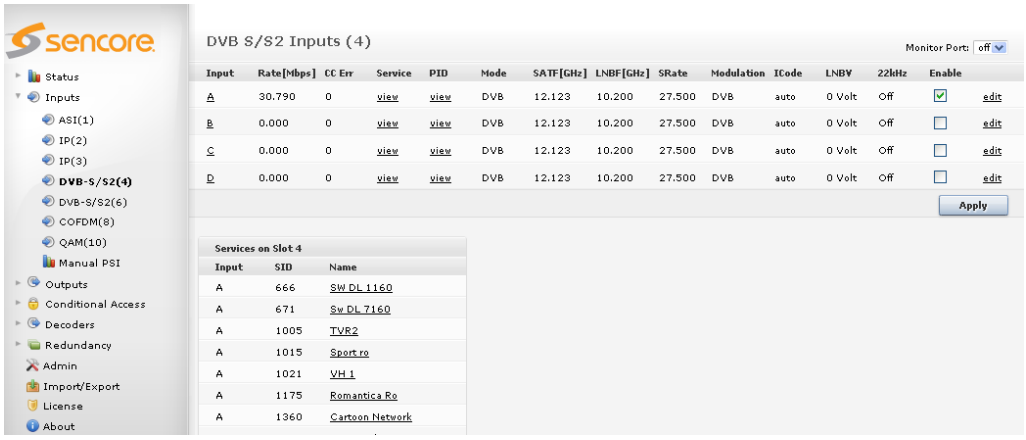
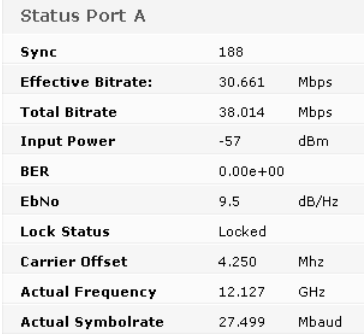


Figure 5.2- Example of DVB-S/S2 Inputs

5.2.1 Input Port Analysis

Within the **Inputs** node, it is possible to access lower level information, e.g. port specific information. To obtain port specific information for input modules with demodulators, click on the port letter in the **Input** column.



Status Port A		
Sync	188	
Effective Bitrate:	30.661	Mbps
Total Bitrate	38.014	Mbps
Input Power	-57	dBm
BER	0.00e+00	
EbNo	9.5	dB/Hz
Lock Status	Locked	
Carrier Offset	4.250	Mhz
Actual Frequency	12.127	GHz
Actual Symbolrate	27.499	Mbaud

Figure 5.3 - DVB-S/S2 Port Detailed View

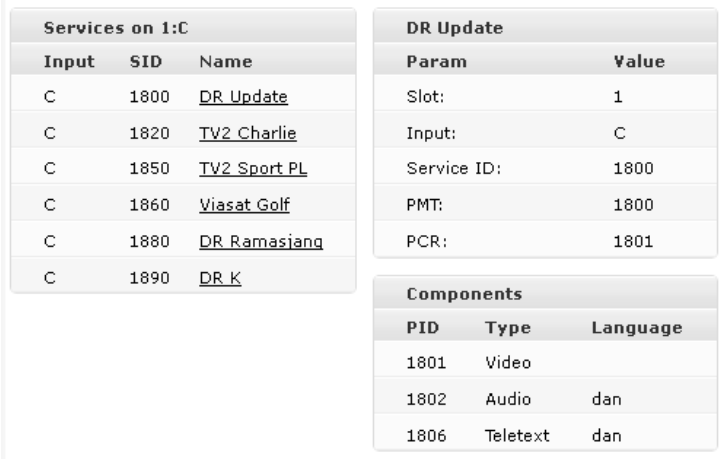
For more details on actual parameters, refer to the configuration section for the respective input type in this chapter.

5.2.2 Input Service Filtering and Analysis

It is possible to apply filters on information displayed in the GUI. Clicking on **view** in the **Service** column for a selected multicast, results in only services associated with this multicast being displayed. Clicking on one of the listed services will display more detailed information about the different PIDs like PMT, PCR, video, audio, etc.

Click on **view** in the **PID** column for ASI inputs will display only PIDs associated with the selected input. Simply choose any PID to obtain more detailed information.

To access detailed PSI/SI analysis of the input services, click the respective service in the lower pane. The detailed analysis result will appear next to it, on the right.



Services on 1:C

Input	SID	Name
C	1800	DR Update
C	1820	TV2 Charlie
C	1850	TV2 Sport PL
C	1860	Viasat Golf
C	1880	DR Ramasjang
C	1890	DR K

DR Update

Param	Value
Slot:	1
Input:	C
Service ID:	1800
PMT:	1800
PCR:	1801

Components

PID	Type	Language
1801	Video	
1802	Audio	dan
1806	Teletext	dan

Figure 5.4 - Detailed PSI/SI Analysis of Input Services

The Audio language descriptor is decoded. In Figure 5.4, the audio is listed as *dan*, ie Danish. However, if no language descriptor is present the unit will auto-generate a descriptor for internal usage and they will be named A01, A02, etc.

i	Details of the PSI/SI analysis are not 100% DVB compliant, but it does include the most commonly used tables and descriptors.

5.2.3 Input PID Analysis

The **PID** view lists all PIDs detected for a given port. This list is accessible via the PIDs column in the top pane.

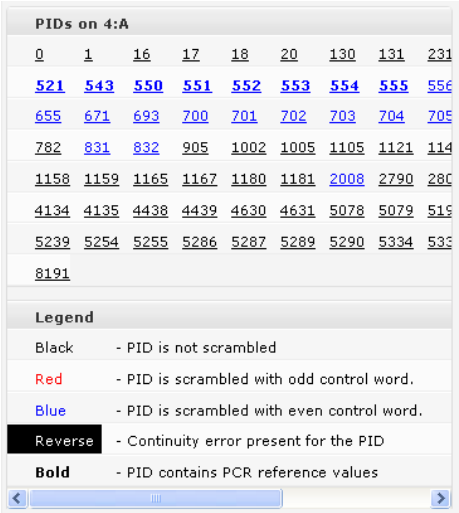


Figure 5.5 - PID Scrambled with Even Control Word

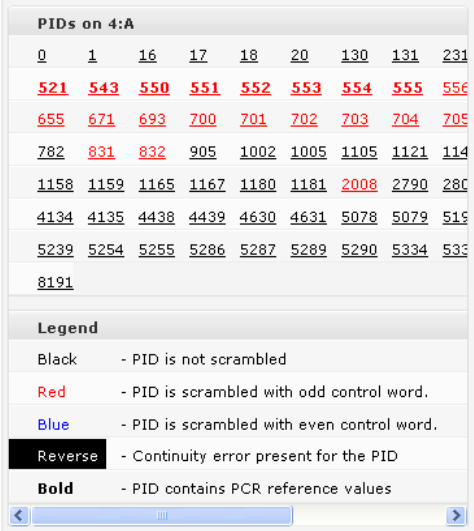


Figure 5.6 - PID Scrambled with Odd Control Word

For an input containing scrambled services the color of the scrambled PIDs will toggle between Blue and Red as the ODD/EVEN bit toggles.

In Figure 5.5 and Figure 5.6 we can for example see that PID 521:

- is scrambled as it is colored,
- contains PCR as it is **bold**, and

- no CC errors have occurred since none of the PID numbers are inverted in color.

It is possible to reset the CC error counters. This reset is a global operation for all inputs and is done with the Reset CC button in the **Inputs** node.

To obtain PID specific details, simply click on **view** in the **PID** column.

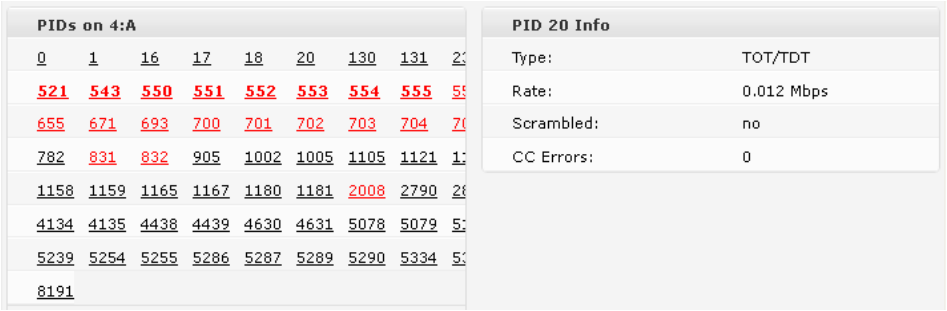


Figure 5.7 - Selecting PID 20

Selecting PID 20 (Figure 5.7), we see that it is a TDT PID. Also, its bitrate and number of CC errors are presented.

Selecting PID 550 gives a slightly different info as it is a video PID:

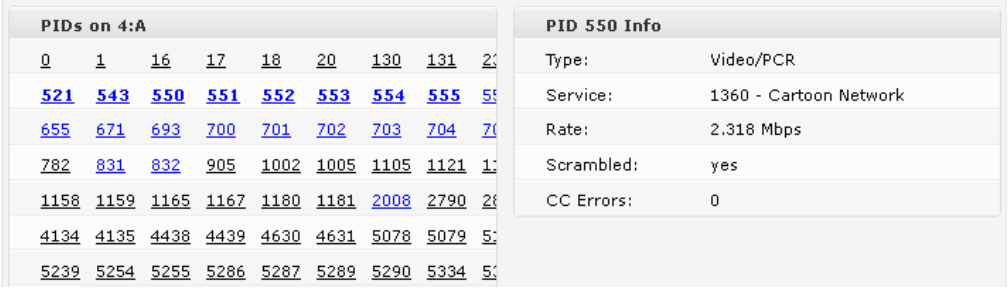


Figure 5.8 - Selecting PID 550

5.3 Manual PSI

To manually define input PSI select Inputs → Manual PSI from the Navigation Pane.

In case the input PSI information is not available, a predefinition of the PSI is necessary in order to configure a service that is occasionally available. This could be used, for instance, to predefine some services for dynamic VOD usage.

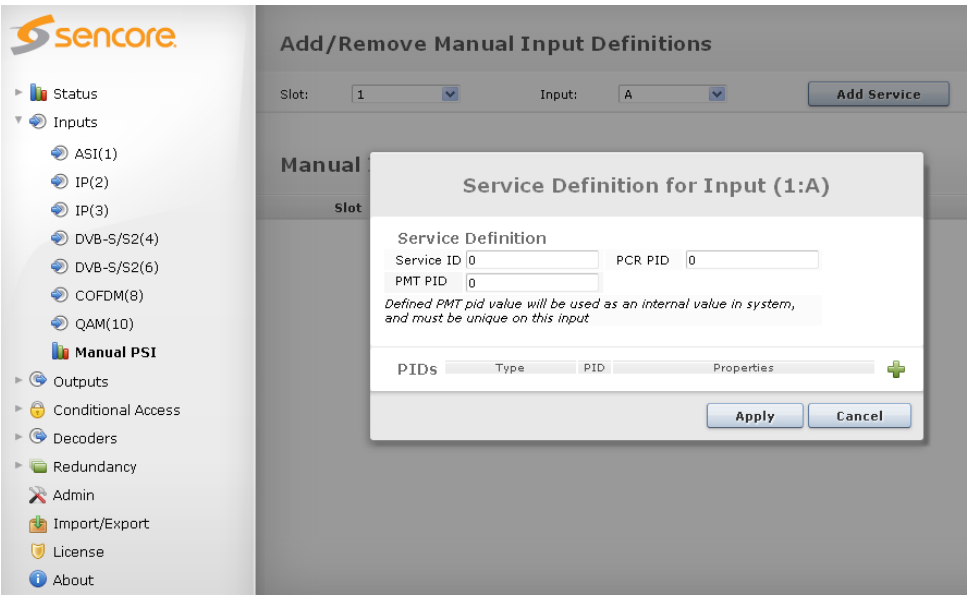


Figure 5.9 - Manually define Input PSI

In the **Manual PSI** node, click **Add Service** and enter the appropriate values matching the incoming stream. The following information is displayed:

Service Id	Service ID for the manual service
PCR PID	PCR PID for the manual service
PMT PID	PMT PID for the manual service
Type	Select one of the following component types: • Video (MPEG-2) • H264 • Audio (MPEG-2 audio) • AAC • AC-3 • Private Sections • PES Private • Manual
PID	PID number for the component
Properties	Additional information for the component, if necessary.

	The PMT PID may be defined with any value from 32 to 8190, but ensure that it is unique in an MPTS configuration scenario. Also, if this input is part of an outgoing digital stream, the PMT PID here is the PID value that will be assigned for the outgoing PMT.

When an input service is defined the following tables are generated:

- PAT
- PMT

All other table analysis is cancelled for this input port. The result is listed in the GUI (see Figure 5.10).

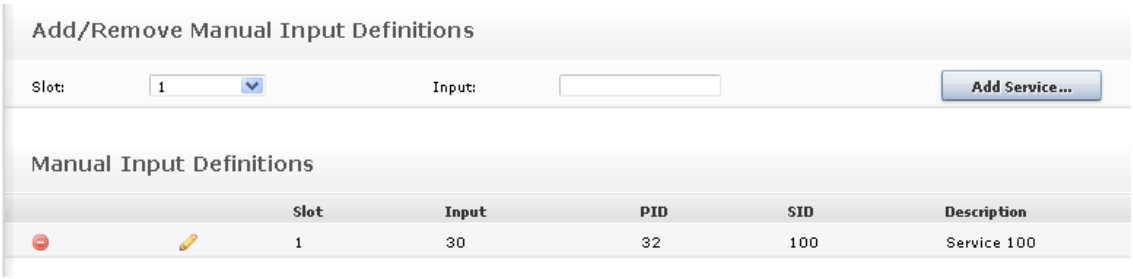


Figure 5.10 - Table Analysis when an Input Service is defined

This entry may be edited or deleted later using the corresponding icons on the left.

5.3.1 MPTS Support

If multiple services are defined for one input, they effectively represent a MPTS.

To check that the manually defined input has entered the system correctly, select the **Inputs** node and ensure that the service information is present. In the example below (Figure 5.11) Service number 30 (under the **Services** panel) is represented with PSI even though the input has not yet been added to the system.

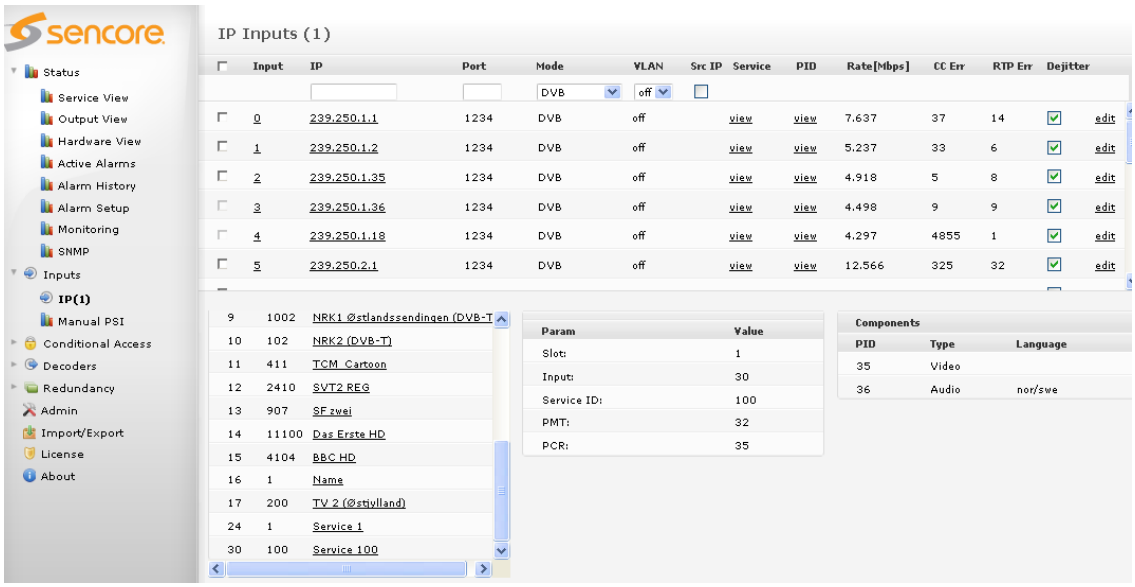


Figure 5.11 - Verifying manually defined Inputs

	If manual PSI is defined for an input port, all incoming services must be defined. It is **not** possible to define only **one** service manually and use the incoming PSI to represent the rest.

5.3.2 PSI Modifications of input services

This PSI modification feature allows the user to modify existing incoming PSI, keeping the other PSI information intact. The feature is currently implemented to solve two specific scenarios.

- Add signaling to incoming “DVB Subtitling” and “EBU teletext” components in PMT. Other component types can also be added but without any descriptors only.
- Change audio language descriptor of an incoming audio component.

5.3.3 Defining a component type for an incoming PID.

To define the PSI for an incoming PID

1) Select the input reference from the Input->PSI navigation Page.
2) Press the Add button and insert the appropriate information.

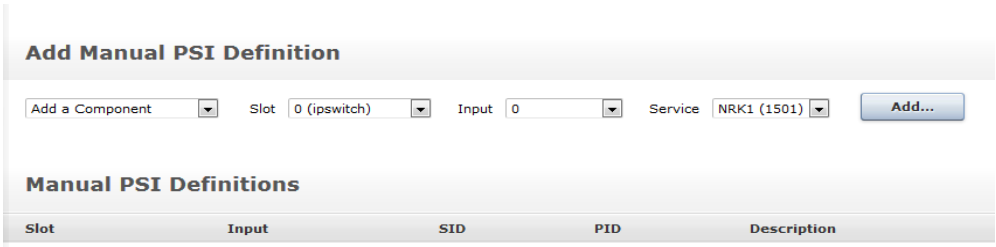


Figure 5.12– Defining Manual PSI

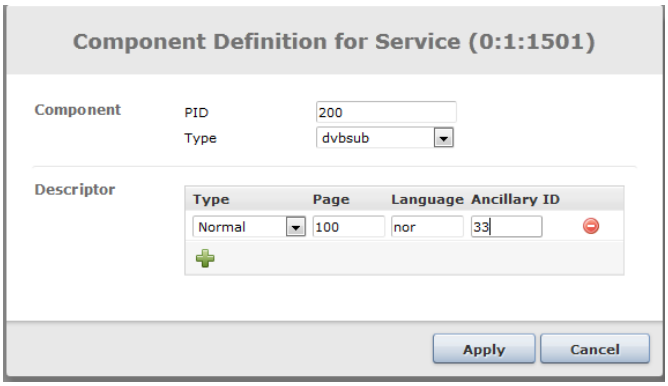


Figure 5.13– Defining component for service

Component PID	Enter the PID value of the incoming PID to which the signaling shall be defined.
Component Type	Specify the type of component.
Descriptor Type	Depending on the type of components different descriptor options will emerge.

5.3.4 Changing the language descriptor of an incoming audio

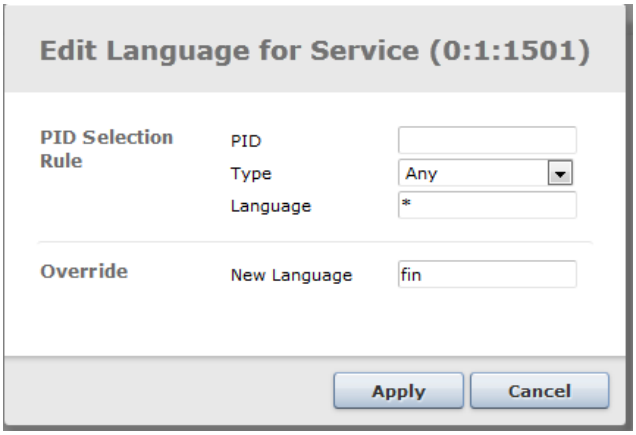


Figure 5.14 – Edit Language descriptor

PID	The input PID to update.
Type	The audio type where the language descriptor shall be replaced. • Any • mpeg-audio • ac-3 • aac_latm

	• aac_adts • e-ac3-e
Language	The language signaled on the input. If this is not a filtering criteria then use wildcard "*"
Override	The new language descriptor to be used for the incoming component.

Note

- If several PIDs are matching the input filtering criteria's, then the signaling for all these components will be updated.
- If the input signaling is dual mono, and no Language (source) is specified, then the right channel descriptor will be replaced.

5.3.5 Edit options on existing manual PSI

Under the Manual-PSI node all current manual PSI rules will be listed. Not all rules can be changed once they are defined. These are indicated with a blue circle with the "?" mark. To change these components they need to be removed and re-added. The rules indicated with a pencil can be changed without remove / add operation.

Figure 5.15 – Editing existing Manual PSI

5.4 Input Modules

5.4.1 DVB-S/S2 Input

The DVB-S/S2 module supports both DVB-S and DVB-S2 inputs. The DVB-S2 functionality is licensed and will only be visible in the GUI if a correct license is installed for the module.

The hardware revision 2.0 DVB-S/S2 input module includes a new advanced DVB-S2 demodulator. This input module is compatible with the DVB-S/S2 input card. The hardware revision of the module is available on the About page in the web GUI.

In addition to the standard DVB-S2 the advanced module supports

- 16_APSK and 32_APSK mode.
- Multistream input
- Auto modulation detection mode.

Each DVB-S/S2 module can receive up to four individual L-Band satellite input streams. To configure the module:

Switch to the Inputs node in the Navigation Pane

Select DVB S/S2 to display the module configuration (see Figure 5.17). Services available on all four input ports will be listed in this view.

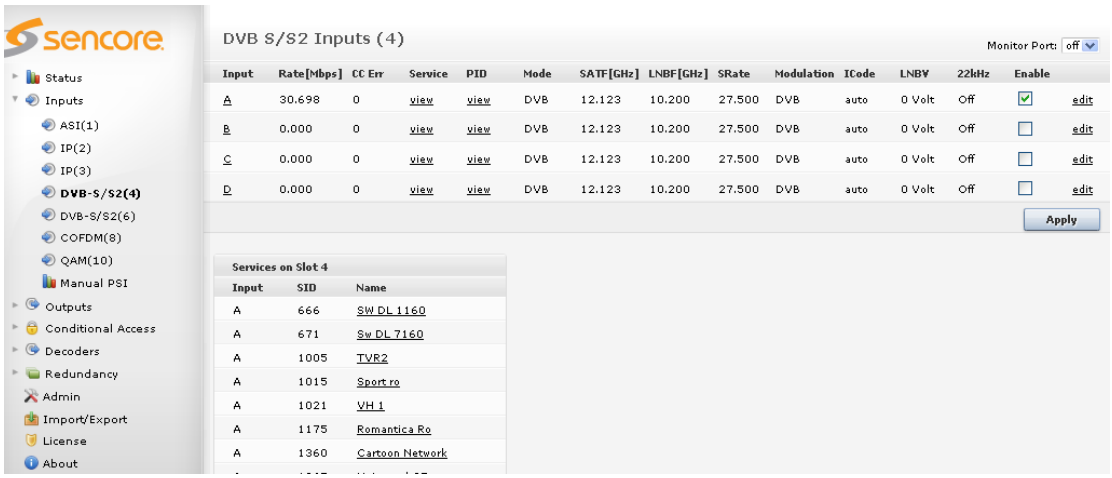


Figure 5.16- DVB-S2 Input

The DVB-S/S2 node shows all major configuration settings as well as the current bitrate and service information. The following parameters are available:

Input	Port on the DVB-S/S2 input module
Rate [Mbps]	Incoming data rate
CC Err	Continuity Counter Error – indicates that one or more packets are lost
Mode	PSI/SI Analysis mode.
SATF [GHz]	Satellite Frequency
SRate	Symbol Rate – specify the symbol rate of the incoming DVB-S/S2 signal. The demodulator's range is 950 – 2150 MHz.
Modulation	Select one of the following modes: Auto (only for HW Rev. 2.0) DVB-S DVB-S/S2_QPSK DVB-S/S2_8PSK DVB-S/S2_16APSK (only for HW Rev. 2.0) DVB-S/S2_32APSK (only for HW Rev. 2.0)
ICode	Inner Code – specify the FEC overhead fraction
LNBV	LNB Voltage – select the output voltage from the dropdown box
22kHz	Switch the 22kHz output signal on or off
Enable	Enable the corresponding input port

The above list of parameters can be configured by clicking on the **edit** link to the right of each input. The pop up dialog below will be displayed:

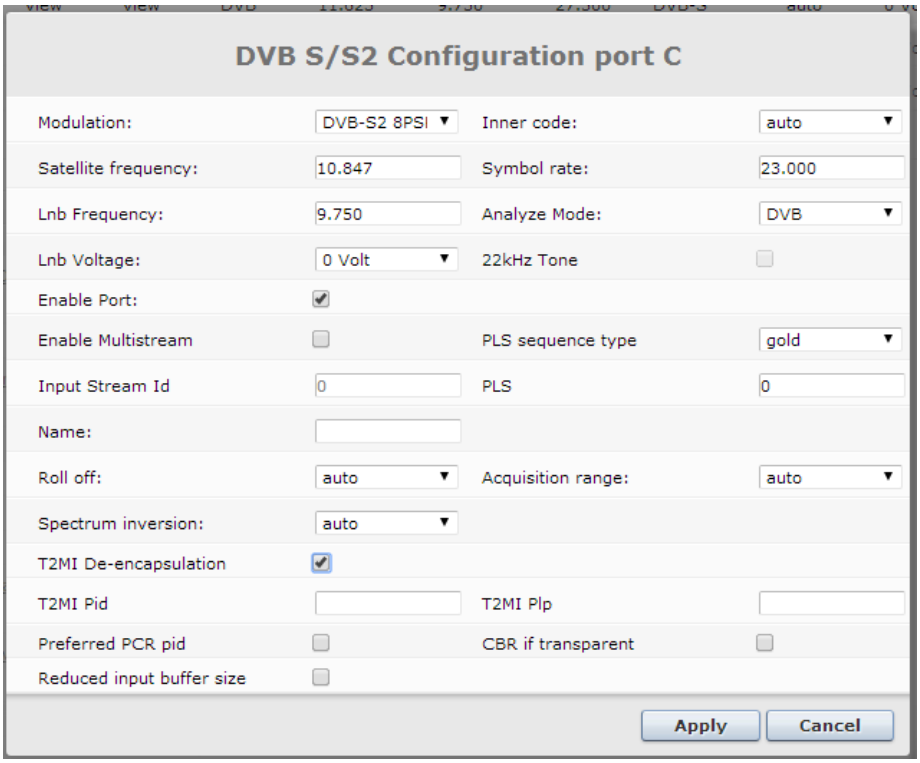


Figure 5.17 - Edit DVB-S/S2 Port Configuration

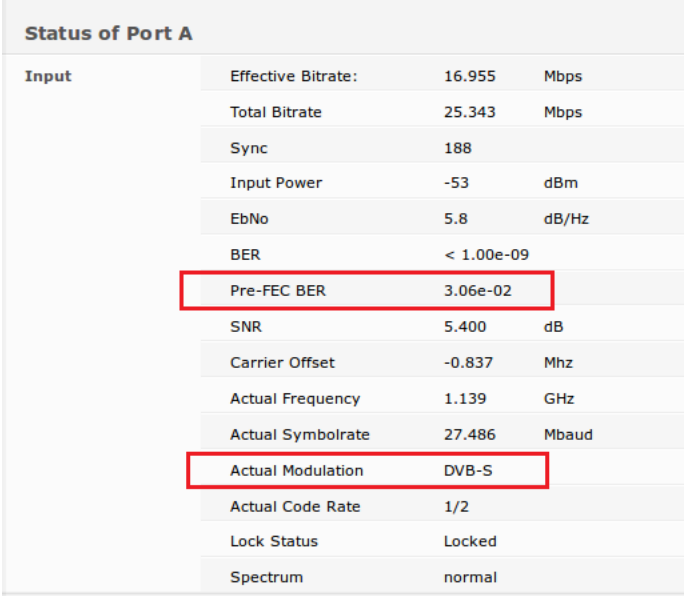
In this dialog, additional parameters can also be modified depending on the configured mode and hardware version.

Pilot	Activates the use of distributed pilot symbols (of the DVB-S/S2 standard) for fine frequency estimation and for detection of the presence of strong phase noise. This is available on HW revision 1.0 only
Enable Multistream	Enable the Multistream
PLS Sequence type	Either 'gold' or 'root' mode can be selected.
Input Stream ID	Multistream Input Stream ID. Note it is only possible to tune into one Stream ID
PLS	Multistream PLS (Physical Layer Scrambling). PLS is often referred to as the 'gold' or 'root' code and will be provided by your content provider if required. Default value is 0
Name	This parameter allows for each port in a module to be labeled. This label is visible as a tooltip when the mouse cursor hovers over the port. Port names are shown in the alarms when a non-empty string is set as the name..
Roll Off:	Select one of the following options: • 0.15 • 0.20

	• 0.25 • 0.35
Acquisition range	Select one of the following options: • Auto • 1 MHZ • 2 MHZ • 2.5 MHZ • 5 MHZ
Spectrum Inversion	The following options are available: • Auto • Normal • Inversed
T2MIDe-encapsulation	T2 de-encapsulation specifies to extract one PLP from T2MI stream
T2MI PID	This is T2MI stream PID
T2MI PLP	This is T2MI stream PLP ID of the requires stream
Preferred PCR pid	This allows you to set a PCR PID in the input multiplex as a priority to use for de-jittering. If this PID is not available, then the next valid detected PCR will be used. This is only valid for transparently mapped streams.
CBR if transparent	This de-jitter mechanism will use the incoming CBR total bitrate as a guide for the clock source of the stream. This is only valid for transparent mapped and PID imported outputs.
Reduced input buffer size	Enable or disable Reduced Input Buffer for introducing a low latency dejitter function.

To monitor any of the demodulated **DVB-S/S2** input signals, one of the **DVB-S/S2** input ports can be assigned to the output ASI monitor interface. The demodulated **DVB-S/S2** input signal will then be copied onto the monitor port for further analyzing or monitoring of the transport stream. Normal operation will not be affected if the monitoring port is used.

Refer to the general input analysis description at the start of this chapter to analyze the input. Click on the letter representing the input channel (A, B, C or D) to display the status parameters for the specific input port. The resulting display is shown in the figure below.



Status of Port A

Input	Effective Bitrate:	16.955	Mbps
	Total Bitrate	25.343	Mbps
	Sync	188	
	Input Power	-53	dBm
	EbNo	5.8	dB/Hz
	BER	< 1.00e-09	
	Pre-FEC BER	3.06e-02	
	SNR	5.400	dB
	Carrier Offset	-0.837	Mhz
	Actual Frequency	1.139	GHz
	Actual Symbolrate	27.486	Mbaud
	Actual Modulation	DVB-S	
	Actual Code Rate	1/2	
	Lock Status	Locked	
	Spectrum	normal	

Figure 5.18 – DVB-S/S2 Status View

The following information is displayed:

Sync	MPEG sync number: 188 or 204
Effective Bitrate	Effective bitrate of the input stream
Total Bitrate	Total bitrate of the input stream
Input Power	Input power for the DVB-S/S2 signal in dBm
EbNo	Energy per bit/(Noise per 1Hz BW)
BER	Bit Error Rate
SNR	Signal to Noise Radio, indicated in dB
Carrier Offset	Carrier offset
Actual Frequency	Frequency reported by the demodulator
Actual Symbolrate	Symbol rate reported by the demodulator
Actual Modulation	Modulation reported by the demodulator
Lock Status	Lock status of the tuner

The status parameters EbNo and SNR will be 0 when the tuner is not locked.

In this dialog, additional parameter is present with only DVB-S Modulation:

Pre-FEC_BER	Bit error rate on the channel, before any FEC decoding.

5.4.2 ASI Input

The ASI input module can receive up to three/four individual ASI input streams depending on the hardware revision. Each ASI input can support up to 213Mbit/s. To configure the module:

- Switch to the **Inputs** node in the **Navigation Pane**
- Select the **ASI** module you want to configure to display the module configuration. Services available on all three ASI input ports will be listed in this view.

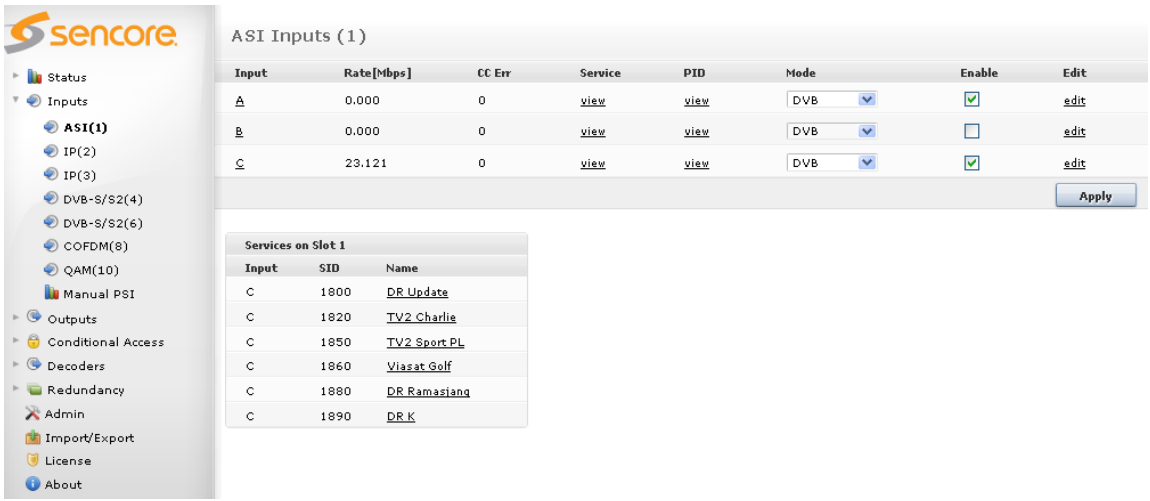


Figure 5.19 - ASI Input

The ASI node shows all configurable settings as well as the current bitrate and service information. The following parameters are available:

Input	Port on the ASI input module
Rate [Mbit/s]	Incoming data rate
CC Err	Continuity Counter Error – indicates that one or more packets are lost
Mode	Select one of the following modes: o DVB o DVB (SDT) o MPEG o ATSC o OFF The default mode is DVB. If the incoming transport stream is not DVB compliant, use MPEG mode instead.
Enable	Enable the corresponding input port

Clicking the **edit** link on the right displays the dialog below, allowing for the **Mode**, **Enable,** and **Name** parameters to be edited.

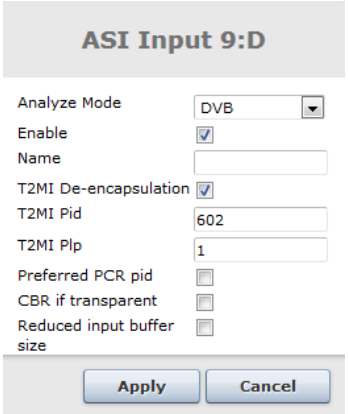


Figure 5.20- ASI Edit Dialog

Name	This parameter allows for each port in a module to be labeled. This label is visible as a tooltip when the mouse cursor hovers over the port. Port names are shown in the alarms when a non-empty string is set as the name..
T2MIDe-encapsulation	T2 de-encapsulation specifies to extract one PLP from T2MI stream
T2MI PID	This is T2MI stream PID
T2MI PLP	This is T2MI stream PLP ID of the required stream
Preferred PCR pid	This allows you to set a PCR PID in the input multiplex as a priority to use for de-jittering. If this PID is not available, then the next valid detected PCR will be used. This is only valid for transparently mapped streams.
CBR if transparent	This de-jitter mechanism will use the incoming CBR total bitrate as a guide for the clock source of the stream. This is only valid for transparent mapped and PID imported outputs.
Reduced input buffer size	Enable or disable Reduced Input Buffer for introducing a low latency dejitter function.

The status parameters for the **ASI** module are shown in the figure below. Click on the *letter* representing the input channel (A, B or C) to display the status parameters for the specific input port. The resulting display is shown in figure below.

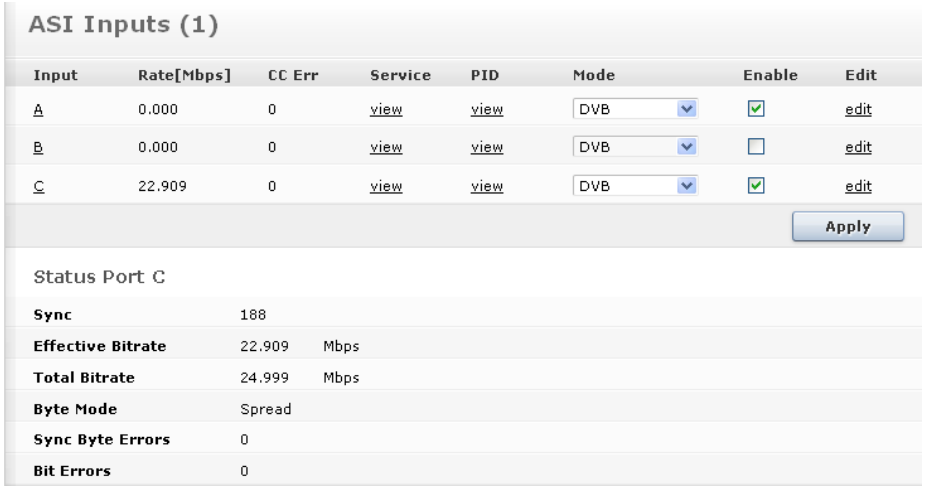


Figure 5.21 - ASI Status View

The following information is displayed:

Sync	MPEG sync number: 188 or 204
Effective Bitrate	Effective bitrate of the input stream
Total Bitrate	Total bitrate of the input stream
Byte Mode	The byte mode specifies how the TS data is transported over the ASI link. **Burst Mode** – All TS data bytes are sent without any idle symbols in between **Spread Mode** – The SI specification requires at least one idle byte between each data byte, and each packet start indicator (0x47) is preceded with at least two idle bytes. The ASI output stream in **Spread Mode** guarantees that each data byte is preceded with two idle symbols. This effectively reduces the maximum data rate to 1/3 of the maximum ASI output rate, i.e. (213/3) Mbps. If higher rates are required, use **Burst Mode**.
Sync Byte Errors	Number of sync byte errors on the incoming stream
Bit Errors	Number of bit errors on the incoming stream

5.4.3 QAM/DVB-C Input

The **QAM/DVB-C** input module can receive up to four individual **QAM** frequencies. The QAM/DVB-C input modules comes in 2 HW versions; a 2 slot version referred to as QAM input and a 1 slot version referred to as DVB-C input. To configure the module:

- Switch to the **Inputs** node in the **Navigation Pane**
- Select the **QAM** module you want to configure and the module configuration window will be displayed (see figure below). The services available on all four **QAM** input ports will be listed in this view.

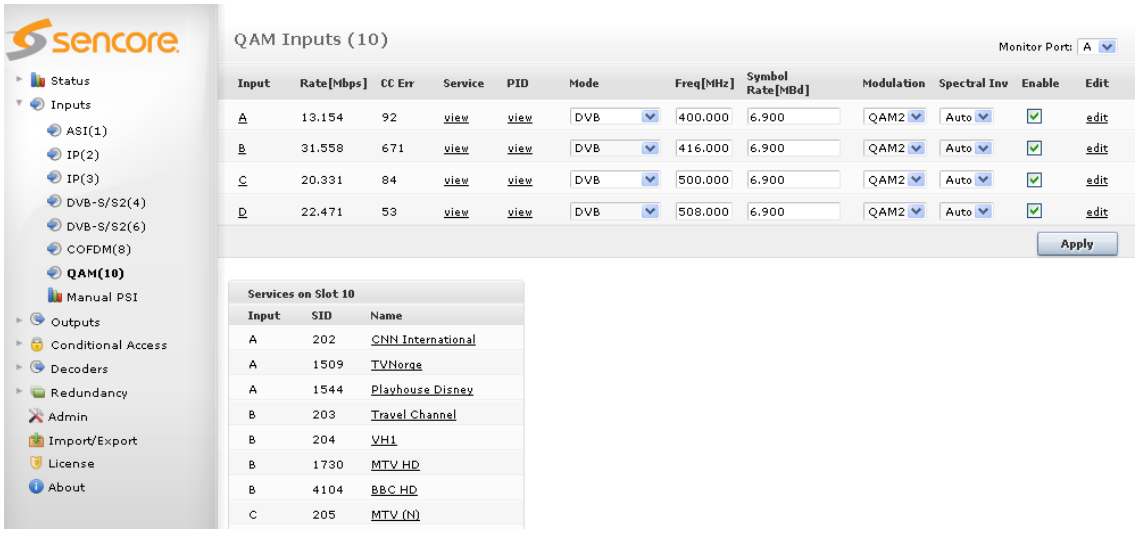


Figure 5.22 - QAM Input

The QAM/DVB-C input window shows all configurable settings as well as the current bitrate and service information. The following parameters are available:

Input	Port on the QAM input module
Rate [Mbps]	Incoming data rate
CC Err	Continuity Counter Error – indicates that one or more packets are lost
Mode	Select one of the following modes: o DVB o DVB (SDT) o MPEG o ATSC o OFF The default mode is DVB. If the incoming transport stream is not DVB compliant, use MPEG mode instead.
Freq [MHz]	Specify the QAM frequency in MHz, valid range is 170k – 887Mhz

Symbol Rate [MBd]	Specify the Symbol Rate in MBd, valid range is 0.452 – 7.23 MBd
Modulation	Specify the type of modulation, select from one of the following: o QAM16 o QAM32 o QAM64 o QAM128 o QAM256
Spectral Inv	Specify the Spectral Inversion, choose from Auto, Normal, or Inverted
Enable	Enable the corresponding input port

Clicking the **edit** link on the right displays the dialog below, allowing for the **Mode**, **Freq [MHz]**, **Symbol Rate [MBd]**, **Modulation**, **Spectral Inv**, **Name**, and **Enable** parameters to be edited.

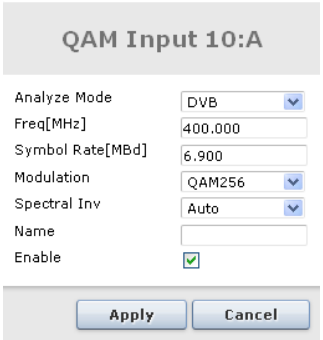


Figure 5.23 - QAM Edit Dialog

Name	This parameter allows for each port in a module to be labeled. This label is visible as a tooltip when the mouse cursor hovers over the port. Port names are shown in the alarms when a non-empty string is set as the name..

The status parameters for the **QAM** module are shown in the figure below. Click on the *letter* representing the input channel (A, B, C or D) to display the status parameters for the specific input port.

Status Port A

Input	Frequency	429.000	MHz
	Symbol Rate	6.900	MBd
	Frontend Locked	Locked	
	Carrier Status	Locked	
	BER	< 1.00e-09	
	SNR	37.82	dB
	Sync	188	
	Effective Bitrate	13.771	Mbps
	Total Bitrate	38.153	Mbps
	Frequency Offset	-1	kHz
	Timing Offset	4	ppm
	Spectral Inversion	Normal	
	Modulation	QAM64	

Figure -5.24 - QAM Status View'

The following information is displayed:

Sync	MPEG sync number: 188 or 204
Effective Bitrate	Effective bitrate of the input stream
Total Bitrate	Total bitrate of the input stream
Frequency	Currently tuned frequency in MHz
Symbol Rate	Symbol Rate in MBd
Modulation	Modulation of the currently tuned channel
BER	Bit Error Rate
SNR	Signal to Noise Ratio
State	Current state – possible values are: o Not Initialised o Initialised o Tuning o Scanning o Idle o Unknown
Carrier Status	Status of the tuning process
Frontend Locked	Lock status of the tuner

Additional parameters for DVB-C Input card (1 slot version).

Frequency Offset	The value of frequency offset is in KHz, will depend on the input stream.
Timing Offset	The Value of timing offset is in ppm, will depend on the input stream.
Spectral Inv	The Spectral Inversion can be from Auto, Normal, or Inverted.

5.4.4 COFDM / DVB-T Input

The COFDM / DVB-T input module can receive up to four individual COFDM frequencies. The COFDM / DVB-T input modules comes in 2 HW versions; a 2 slot version referred to as COFDM input and a 1 slot version referred to as DVB-T input. To configure the module:

- Switch to the Inputs node in the **Navigation Pane**
- Select the COFDM module you want to configure and the module configuration window will be displayed. Services available on all four COFDM input frequencies will be listed in this view.

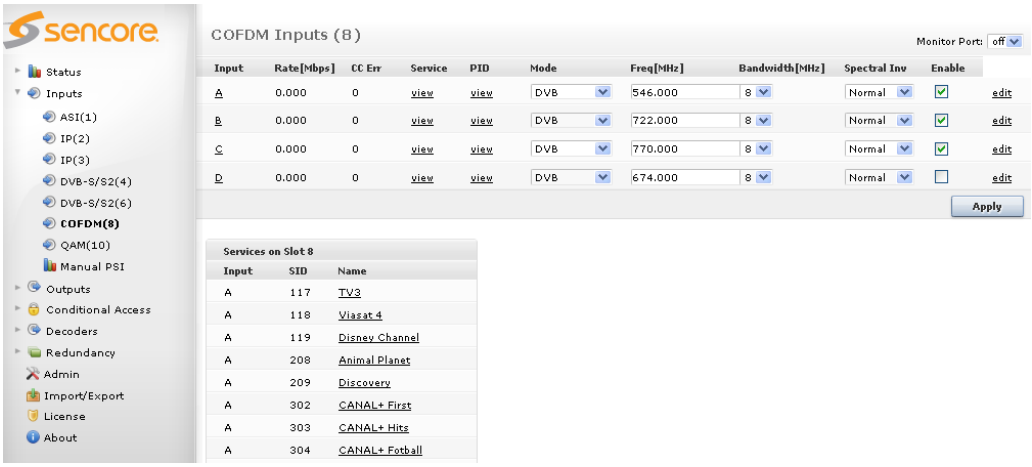


Figure 5.25 - COFDM Input

The COFDM / DVB-T input window shows all configurable settings as well as the current bitrate and service information. The following parameters are available:

Input	Port on the COFDM input module
Rate [Mbps]	Incoming data rate
CC Err	Continuity Counter Error – indicates that one or more packets are lost
RF Freq [MHz]	Specify the COFDM frequency in MHz, valid range is 47 – 862Mhz.
Bandwidth [MHz]	Specify the bandwidth, select from 6, 7, or 8MHz
Spectral Inv	Specify the Spectral Inversion, choose from Auto, Normal, or Inverted
Mode	Select one of the following modes: o DVB o DVB (SDT) o MPEG o ATSC

	o OFF The default mode is DVB. If the incoming transport stream is not DVB compliant, use MPEG mode instead.
Enable	Enable the corresponding input port

Clicking the **edit** link on the right displays the dialog below, allowing for the **Mode**, **Freq [MHz]**, **Symbol Rate [MBd]**, **Bandwidth [MHz]**, **Spectral Inv**, **Enable,** and **Name** parameters to be edited.

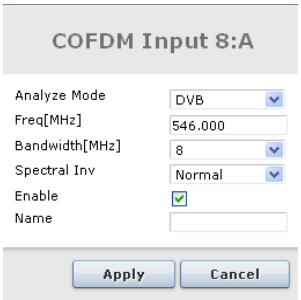


Figure 5.26 - COFDM Edit Dialog

Name	This parameter allows for each port in a module to be labeled. This label is visible as a tooltip when the mouse cursor hovers over the port. Port names are shown in the alarms when a non-empty string is set as the name..

The status parameters for the **COFDM** module are shown in

Figure 5.24 below. Click on the *letter* representing the input channel (A, B, C or D) to display the status parameters for the specific input port.

Status Port C

Input	Frequency	682.000	MHz
	Frontend Locked	Locked	
	Carrier Status	Locked	
	BER	< 1.00e-09	
	SNR	36.61	dB
	FFT	2k	
	Sync	188	
	Effective Bitrate	22.545	Mbps
	Total Bitrate	31.669	Mbps
	Frequency Offset	-1	kHz
	Timing Offset	2	ppm
	Bandwidth	8	MHz
	Stream	hp	
	Modulation	QAM64	
	Guard Interval	1/32	
	Hierarchy	None	
	Code Rate HP	7/8	

Figure 5.27 - COFDM Status View

Sync	MPEG sync number: 188 or 204
Effective Bitrate	Effective bitrate of the input stream
Total Bitrate	Total bitrate of the input stream
Frequency	Currently tuned frequency in MHz
Frequency Offset	Offset between the configured frequency and the actual lock in kHz
Bandwidth	Bandwidth of the currently tuned channel
Spectral Inversion	Current spectral inversion, Normal or Inverted
Modulation	Modulation of the currently tuned channel
Guard Interval	Guard Interval of the currently tuned channel
FFT	Current FFT size of the downstream signal
BER	Bit Error Rate – represents the amount of bits that have errors in relation to the total number of bits received in transmission. The BER is usually expressed in ten to a negative power. (The value displayed is prior to Viterbi corrections.)
CBER	Channel Bit Error Rate is the Bit Error Rate post Viterbi corrections, indicating strength and quality of the original signal.
SNR	Signal to Noise Ratio – represents how much the signal has been corrupted by noise.
Power Level	Power level of the COFDM input signal. This value refers to the COFDM module's power level, **not** the input power level.
State	Current state – possible values are: o Not Initialised o Initialised o Tuning o Scanning o Idle o Unknown
Carrier Status	Status of the tuning process
Frontend Locked	**Lock status of the tuner**

Additional parameters for DVB-T Input card (1 slot version).

Timing Offset	The value of timing offset is in ppm, will depend on the input stream.
Stream	Input Stream.
Hierarchy	Hierarchy of the currently tuned channel.
Code rate	Code rate of the currently tuned channel.

5.4.5 IP Input

There are two different types of modules supporting IP input, the switch with IP module and the standalone IP module (with and without FEC option). The following description is valid for all.

The input streams can be either SPTS (VBR or CBR mode) or MPTS. To configure the module:

- Switch to the **Inputs** node in the **Navigation Pane**
- Select the IP input module you want to configure and the module configuration window will be displayed (see Figure 5.28). Services available on all inputs will be listed in this view.

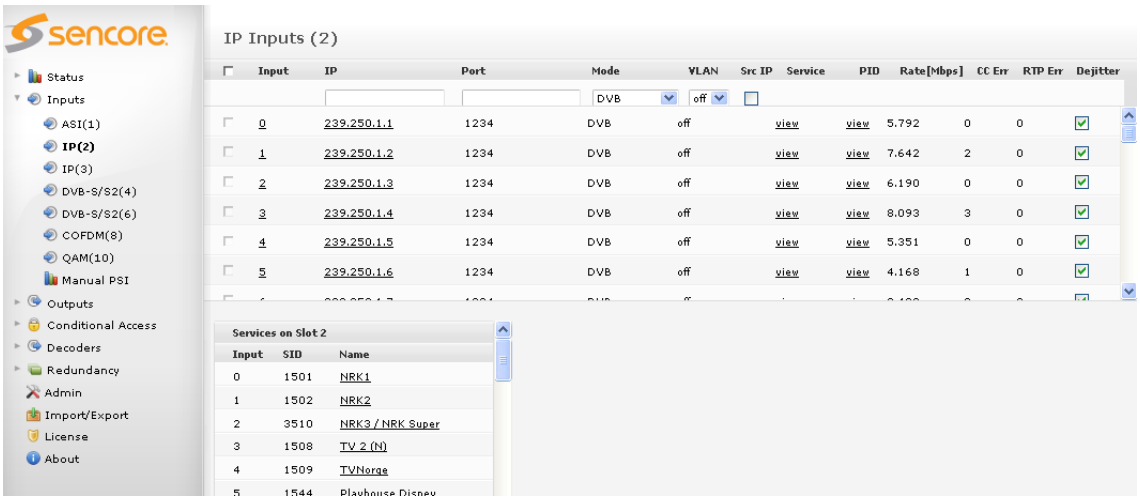


Figure 5.28 - IP Input

When adding an IP input, the following parameters are available:

IP	IP address corresponding to the input
Port	Port corresponding to the input
Src IP	Check to enable Source filtering (IGMPv3 / SSM)
Mode	Select one of the following: o DVB o MPEG o ATSC o DVB (SDT) o OFF
Increment	After a multicast is added, the current **IP** and **Port** values will be incremented by one of the following: o IP o Port o Port by 2

VLAN	Displays available VLANs; the default value is off. Select a suitable VLAN if required.

The IP input window shows all configurable settings as well as the current bitrate and service information. The following parameters are available:

Input	Port on the IP input module – assigned automatically when joining a unicast or multicast. For Switch with IP modules, the Port A will use input numbers 0 to 249, Port B will use input 1000 to 1249.
IP	IP address of the multicast or unicast
Port	Port of the multicast or unicast
Rate [Mbps]	Incoming data rate
CC Err	Continuity Counter Error – indicates that one or more packets are lost
RTP Err	Real-time Protocol Error – represents the number of discontinuities on the RTP counter if RTP is enabled on source. If RTP is not enabled on the source, **N/A** is displayed.
Mode	The mode of the input stream.
De-Jitter	Checking this check box activates the de-jitter algorithm on the input port. Enabling this algorithm is recommended in order to achieve the best results. However, in some cases, if the input quality is very poor or missing PCR PID, a better result may be achieved by disabling this feature. Note that the output from the streamer will be very poor as well.

For IP input modules, clicking on the IP address under the **IP** column allows for the **IP**, **Port**, **Mode**, **Dejitter**, **Name**, **IGMPv3/SSM,** and **VLAN** parameters to be edited.

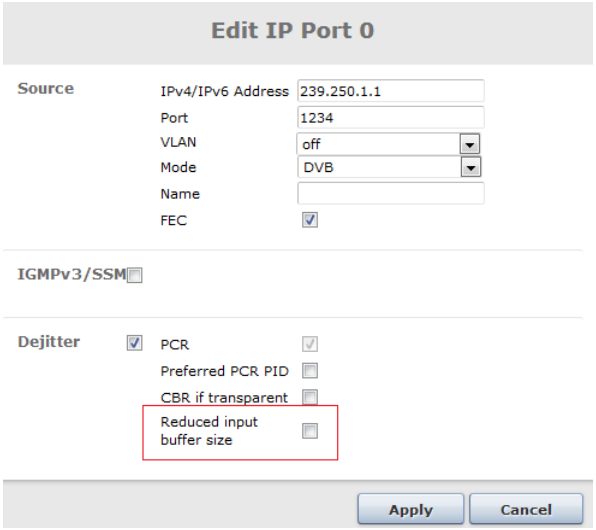


Figure 5.29 - Edit IP Port

The following additional parameters are available for configuration:

Name	This name is displayed as a tooltip when the mouse cursor hovers over the port.
IGMPv3/SSM	Enable or disable IGMPv3/SSM on the port, Please see 5.4.5.3 for more information and options
Dejitter	If input de-jittering is enabled, the following options are displayed: o PCR. This is automatic for regular streams o Preferred PCR PID. This allows you to set a PCR PID in the input multiplex as a priority to use for de-jittering. If this PID is not available, then the next valid detected PCR will be used. This is only valid for transparently mapped streams. o CBR (if transparent). This de-jitter mechanism will use the incoming CBR total bitrate as a guide for the clock source of the stream. This is only valid for transparent mapped and PID imported outputs. This feature is only available on the Switch+IP module.
Reduced Input Buffer	Enable or disable Reduced Input Buffer for introducing a low latency IP dejitter function on the Switch+IP and Dual IP modules.

The status parameters for the IP module are shown in Figure 5.30 below.

Status Port 0		
Sync	188	
Effective Bitrate:	5.256	Mbps
Total Bitrate	5.256	Mbps
Active Source	10.10.70.10	

Figure 5.30 - IP Input Port Status

The following parameters are available:

Sync	Interval of the sync byte, usually 188
Effective Bitrate	Effective bitrate of the input stream
Total Bitrate	Total bitrate of the input stream
Active Source	IP address for the MPTS/SPTS source (Used for IGMP v3)

5.4.5.1 Setup of IPv6 input

The Switch+IP input module supports IPv6 multicast and unicast inputs. When using standard IPv6 address syntax (128 bits, ':' instead of '.'), the GUI will interpret the address as an IPv6 address.

The VLAN setup is independent on the choice of IPv4 or IPv6.
Source IP address has to match the IP format used for the destination IP address.

5.4.5.2 Modification of input

The defined inputs may be modified to use another IP address. The new IP address may be chosen freely between IPv4 and IPv6 addresses.

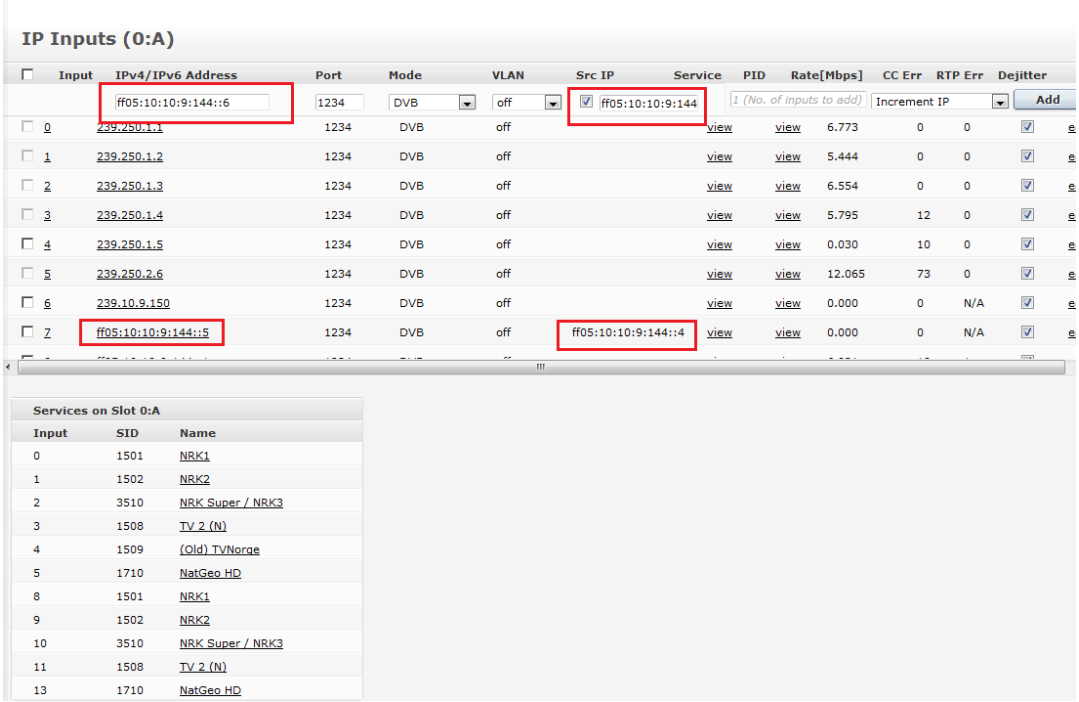


Figure 5.31 -Setup of IPv6 input

5.4.5.3 Source filtering on Switch IP input.

On the IP input, it is possible to use different mechanisms in order to filter on the Source IP address of the incoming multicast.

Source filtering (relevant where 1 source is specified) is only available in Switch+IP input cards .

System behavior for different combinations of IGMP (version 2 or 3) input configurations:

Sources	Source filter	Comment
0	Off	GUI has not enabled filtering and no source is specified.
1	On	Only the multicast with the matching source address is available on the input. This does not require IGMPv3
>1	Off	In this mode all IGMPv3 sources are mapped to the same port. I.e. it is not possible to reuse the MCAST:PORT pair on other inputs Please note, only one of these sources should be active at a given time.

IGMPv3/SSM Source filtering is shown in figure below

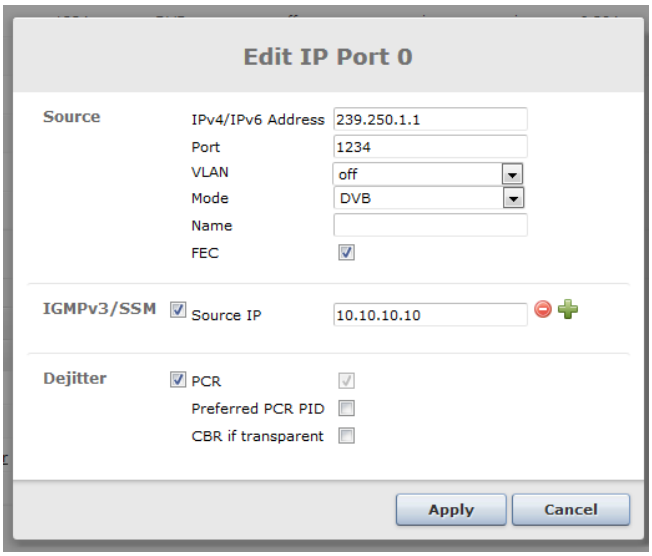


Figure 5.32 - Edit IP Port for IGMP source filtering

If it is required that multiple sources of the same multicast be enabled concurrently, then these will need to be subscribed to on unique input ports, each specifying their source IP address.

5.4.5.4 IP Input with FEC

For **IP** input modules with FEC, the input window has an additional column with a checkbox for each stream, allowing you to enable FEC.

IP Inputs (3)

Input	IP	Port	Mode	VLAN	Src IP	Service	PID	Rate[Mbps]	CC Err	RTP Err	Dejitter	FEC
			DVB	off								
0	239.250.1.1	1234	DVB	off		view	view	6.745	3	0	✓	
1	239.250.1.2	1234	DVB	off		view	view	5.679	7	0	✓	
2	239.250.1.3	1234	DVB	off		view	view	6.037	2	0	✓	
3	239.250.1.4	1234	DVB	off		view	view	5.711	6	0	✓	
4	239.250.1.5	1234	DVB	off		view	view	5.339	0	0	✓	
5	239.250.1.6	1234	DVB	off		view	view	4.174	15	0	✓	
6	239.250.1.7	1234	DVB	off		view	view	3.433	4072	0	✓	

Figure 5.33 - IP Input Page (for Modules with FEC)

For the **IP** input module with FEC there are additional status parameters are available, on top of the generic **Sync**, **Effective Bitrate**, **Total Bitrate**, and **Active Source**, as shown in Figure 5.34.

Sync	188	
Effective Bitrate:	19.663	Mbps
Total Bitrate	20.910	Mbps
Active Source	10.10.34.21	
Unrecoverable Packets	0	
Recovered Packets	0	
FEC RTP Errors	0	
FEC Column IP Packets	211	IP packets/s
FEC Row IP Packets	316	IP packets/s

Figure 5.34- IP Input Port Status (for Modules with FEC)

The additional parameters are described in further detail below:

Unrecoverable Packets	Number of lost data packets that cannot be recovered with FEC
Recovered Packets	Number of data packets recovered with FEC
FEC RTP Errors	Number of missing FEC packets
FEC Column IP Packets	Number of Column FEC packets per second (packet rate)
FEC Row IP Packets	Number of Row FEC packets per second (packet rate)

FEC Matrix Rows (D)	Number of rows in the FEC matrix of the incoming stream
FEC Matrix Columns (L)	Number of columns in the FEC matrix of the incoming stream

The combination of Unrecoverable Packets, Recovered Packets, and FEC RTP Errors is a good indication of network quality.

5.4.5.5 Adding a New Input Stream

In the **Input Control** pane add the multicast/unicast IP address and port. Click **Add**. The input module will now issue an IGMP join request for the selected multicast and start to analyze the incoming stream. The service found on the selected multicast will be listed in the service view in the lower part of the input page.

5.4.5.6 Removing a Multicast Input

Select the input to be removed by clicking on the check box on the left of the input entry (in the **Existing IP Inputs** pane).

Click the **Remove** button in the **Remove** section to remove a selected input.

Please note that you can only remove inputs that are currently not in use. To delete these streams, the associated output service must first be removed/disabled.

5.4.5.7 T2MI De-encapsulation

The following additional information is displayed in edit option for Dual IP modules configured in dip-t2mi-decap mode.

T2MIDe-encapsulation	T2 de-encapsulation specifies to extract one PLP from T2MI stream
T2MI PID	This is T2MI stream PID
T2MI PLP	This is T2MI stream PLP ID of the requires stream

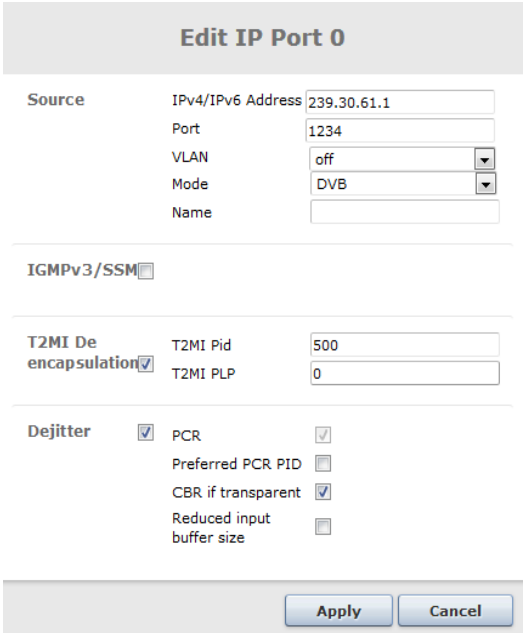


Figure 5.35- T2MI De-Encapsulation for IP Input configuration

5.4.6 Seamless IP Input

The Seamless IP input module allows two input interfaces to be connected to different network sources, but for the system, this is a single module. The same multicasts are subscribed to on both interfaces. These multicasts **must** come from the **same source**.

All function and status normally associated with IP input cards are present for the logical module. In addition data rate, sequence errors, and relative delay for each stream are reported for every input.
Moreover, alarms related to the network interface and stream alarms (e.g. “No bitrate”) appear as warnings if they occur only on a single interface. “Link down on interface A or B” is a major alarm. If alarms appear on both interfaces, they will act as for normal IP input cards, and be a single alarm with the same alarm ID as used on other IP input cards.

The following information is displayed in status parameters for Seamless IP Input configuration:

Slot	Slot position in the chassis
Module	A and B both will be displayed.
Type	Type of input module : ipswitch
Services	Number of services present in the transport stream
Input Rate	Input Rate of active services for both A and B will be displayed.
Effective Rate	Total bandwidth of the incoming transport streams.
CC Errors	Number of Continuity Counter (CC) errors detected on all input ports since last reset; CC errors indicate that one or more packets are lost.
TS Errors	Number of Transport Stream (TS) errors detected on all input ports. TS errors indicate problems with the incoming TS structure of the streams
RTP Errors	Real-time Transport Protocol sequence errors since last reset *(applies to both Port A and port B)*
BP Rate	Rate of active services transmitted to the backplane

Inputs

Slot	Module	Type	Services	Input Rate	Eff. Rate	CC Errors	TS Errors	RTP Errors	BP Rate
0	A B	ipswitch	1	5.907 5.907	5.929	0	0	0 0 → 0	0.000

Figure–5.36 IP Input Seamless module Status Parameter view

Status of Input 0

Input	Sync	188	
	Effective Bitrate:	4.270	Mbps
	Total Bitrate	4.270	Mbps
	FEC Column IP Packets	0	IP packets/s
	FEC Row IP Packets	0	IP packets/s
	Unrecoverable Packets	19	
	Recovered Packets	0	
	Sequence Errors	0	
	Seamless Relative Delay	0	ms
Port A	Active Source	10.10.70.22	
	Input Bitrate	4.452	Mbps
	Sequence Protocol	RTP	
	Sequence Errors	51	
	Port Status	Master	
Port B	Active Source	10.10.70.22	
	Input Bitrate	4.452	Mbps
	Sequence Protocol	RTP	
	Sequence Errors	51	
	Port Status	Slave	

Figure–5.37 IP Input Seamless module Status Parameter detailed view.

Additional status parameters for IP Input seamless module:

Seamless Relative delay	Seamless relative delay in ms will be displayed.
Active source	Source IP address
Input Bitrate	Source Input Bitrate in Mbps.
Sequence Protocol	Seamless protocol in use, either **RTP** or **UDP**.
Sequence Errors	Source sequence errors since last reset
Port Status	Either Master or Slave depending on which is the main port

5.4.6.1 Unique Configuration of input ports

IP settings can be configured different on the two IP ports in Seamless Input mode. If required to be different from port A, the checkbox can be enabled and the new parameter entered.

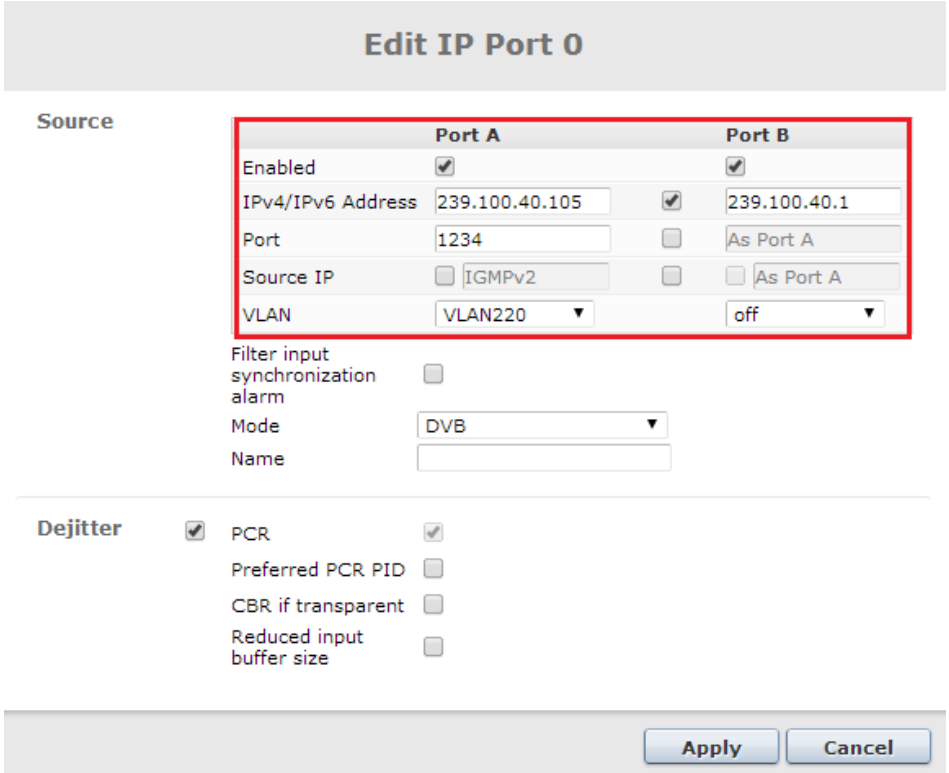


Figure - 5.38 Unique configurations on two ports.

Enabled	Specify that which Port is enabled.
IP	IP address of the Port A and Port B
Port	IP port number
Source Port	The IP source port of the output multicast
Source IP	The source IP address override feature allows configuration of the source address of an IP output multicast or unicast to any IP address.
VLAN	Displays available VLANs; the default value is off. Select a suitable VLAN if required.

5.4.6.2 Non-Syncronized Inputs

With the Seamless IP Input module, it is possible to configure two non-synchronized multicasts. In this mode it is required to enable the 'Filter input synchronization' option for the port in order to filter the normally present alarm.

In this mode, the behavior differs from the Seamless IP mode in that the current source will switch if there is a 100ms with 0 bitrate on the input multicast.

More details on this can be found in Chapter 12.1.5.

5.4.7 Dual IP Input

The Dual IP input module allows two individual input interfaces to be connected to network sources, but for the system, this is exactly as two IP input cards. The input streams can be either SPTS (VBR or CBR mode) or MPTS. to configure the module.

All function and status normally associated with IP input cards are present for the module but the total Input Bitrate for both IP ports cannot exceed 850 Mbps or 250 services, ie the limit is shared between the two ports.

An alarm ("Back-plane bitrate exceeded. Packet dropped.") will be raised when the 850Mbps backplane limitation is exceeded.

Inputs

Slot	Type	Services	Eff. Rate	CC Errors	TS Errors	Seq Errors	BP Rate	Used Ports
0	ipswitch	30	148.391	0	0	0	552.275	103/250
5	asi	0	0.000	0	0	0	0.002	0/250
10	dip-in	90	459.385	0	0	0	0.003	0/250
10	dip-in	90	404.987	0	0	0		0/250
11	dvbs2	0	0.000	0	0	0	0.002	0/250
14	ipin-ext	30	133.017	0	0	0	418.003	90/250

Figure - 5.41 Dual IP Input Configurations

5.4.8 8VSB Input

The **8VSB** input module can receive up to four individual **8VSB** input streams. To configure the module:

- Switch to the **Inputs** node in the **Navigation Pane**
- Select the **8VSB** module you want to configure to display the module configuration (see *Figure* 5.42). Services available on all four **8VSB** input ports will be listed in this view.

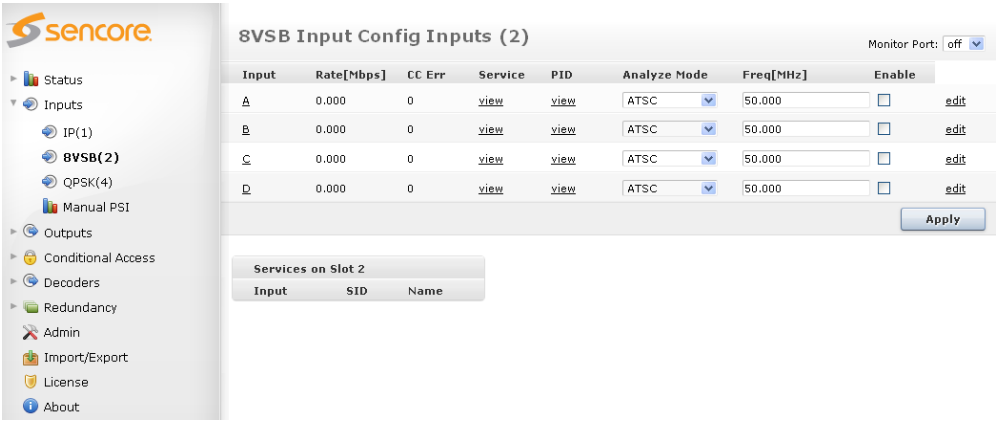


Figure 5.42- 8VSB Input

The 8VSB input window shows all configurable settings as well as the current bitrate and service information. The following parameters are available:

Input	Port on the 8VSB input module
Rate [Mbps]	Incoming data rate
CC Err	Continuity Counter Error – indicates that one or more packets are lost
Mode	Select one of the following modes: o DVB o ATSC o MPEG o No PSI analysis The default mode is ATSC. If the incoming transport stream is not ATSC compliant, use MPEG mode instead.
Freq[MHz]	Specify the currently tuned frequency in MHz, valid range is 47 – 861MHz.
Enable	Enable the corresponding input port

To monitor any of the demodulated 8VSB input signals, one of the 8VSB input ports can be assigned to the output ASI monitor interface. The demodulated 8VSB input signal will then be copied onto the monitor port for further analyzing or monitoring of the transport stream. Normal operation will not be affected if the monitoring port is used.

The status parameters for the **8VSB** module are shown in below. Click on the *letter* representing in the input channel (A, B, C or D) to display the status parameters for the specific input port.

Status Port A

Sync	No	
Effective Bitrate:	0.000	Mbps
Total Bitrate	0.000	Mbps
Lock Status	No	
Level	-105	dBmV
MER	0	dB

Figure 5.43- 8VSB Status View

The following information is displayed:

Sync	MPEG sync number: 188 or 204
Effective Bitrate	Effective bitrate of the input stream
Total Bitrate	Total bitrate of the input stream
Lock Status	Lock status of the tuner
Level	RF level measured in dBmV
MER	Modulation Error Radio in dB - a typical good reading is between 30 and 40 (the higher the better).

5.4.9 QAM-B Input

The **QAM-B** input module can receive up to four individual **QAM-B** input streams. To configure the module:

- Switch to the **Inputs** node in the **Navigation Pane**
- Select the **QAM-B** module you want to configure to display the module configuration .Services available on all four **QAM-B** input ports will be listed in this view.

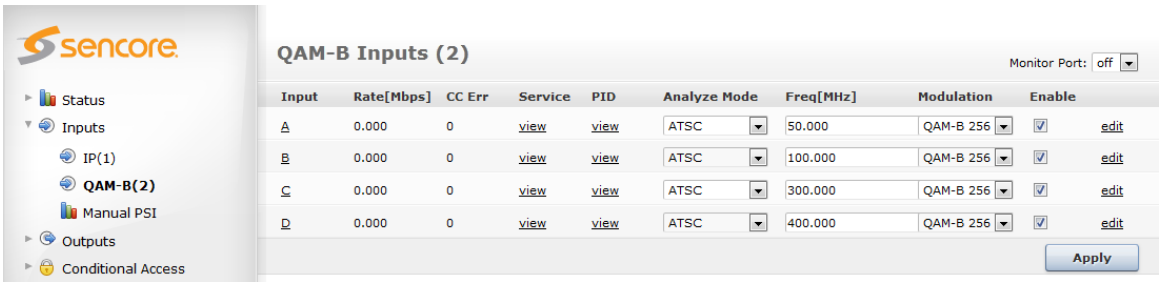


Figure 5.44 – QAM-B Input

The QAM-B input window shows all configurable settings as well as the current bitrate and service information. The following parameters are available:

Input	Port on the QAM-B input module
Rate [Mbps]	Incoming data rate
CC Err	Continuity Counter Error – indicates that one or more packets are lost
Mode	Select one of the following modes: o DVB o ATSC o MPEG o No PSI analysis The default mode is ATSC. If the incoming transport stream is not ATSC compliant, use MPEG mode instead.
Freq[MHz]	Specify the currently tuned frequency in MHz, valid range is 47 – 861MHz.
Enable	Enable the corresponding input port

To monitor any of the demodulated QAM-B input signals, one of the QAM-B input ports can be assigned to the output ASI monitor interface. The demodulated QAM-B input signal will then be copied onto the monitor port for further analyzing or monitoring of the transport stream. Normal operation will not be affected if the monitoring port is used.

The status parameters for the **QAM-B** module are shown in below. Click on the *letter* representing in the input channel (A, B, C or D) to display the status parameters for the specific input port.

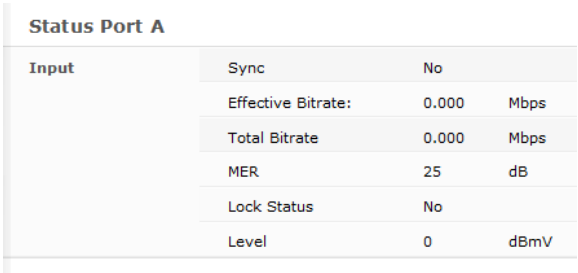


Figure 5.45 – QAM-B Status View

The following information is displayed:

Sync	MPEG sync number: 188 or 204
Effective Bitrate	Effective bitrate of the input stream
Total Bitrate	Total bitrate of the input stream
Lock Status	Lock status of the tuner
Level	RF level measured in dBmV
MER	Modulation Error Radio in dB - a typical good reading is between 30 and 40 (the higher the better).

5.4.10 DVB-T2 Input

The DVB-T2 input module can receive up to four individual Frequencies. It comes in two different HW configurations. One version has a single input connector that is distributed to the 4 demodulators internally while the second version has 4 input connectors; one for each tuner. To configure the module:

- Switch to the **Inputs** node in the **Navigation Pane**
- Select the **DVB-T2** module you want to configure to display the module configuration (see Figure below). Services available on all four **DVB-T2** input ports will be listed in this view for each port type.
- Supports PLP input selection. Note that in multi PLP environment it can only tune one PLP at a time.

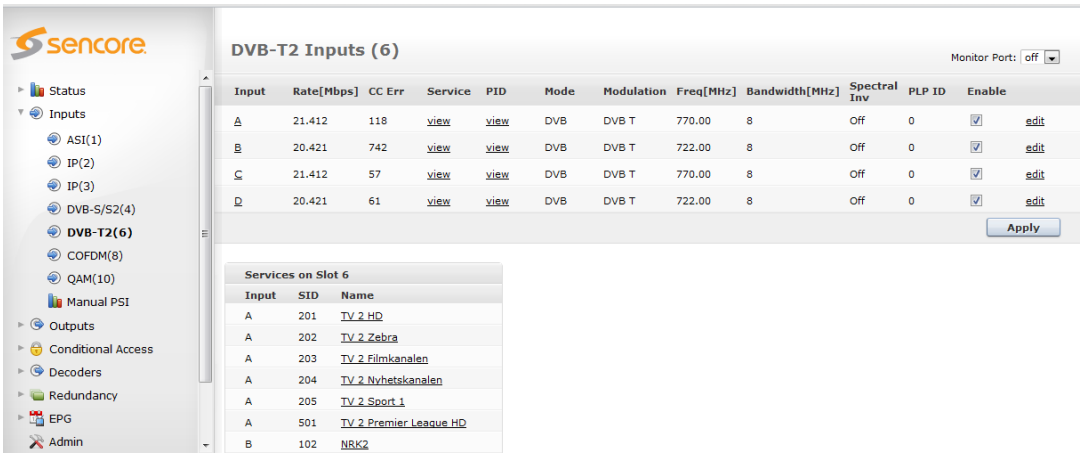


Figure 5.46- DVB-T2 Input

The DVB-T/T2 mode shows all major configuration settings as well as the current bitrate and service information. The following parameters are available:

Input	Port on the DVB-T2 input module
Rate [Mbps]	Incoming data rate
CC Error	Number of Continuity Counter (CC) errors detected on all input ports since last reset. CC errors indicate that one or more packets are lost.
Service	Number of services present in the transport stream
PID	Listing all input PIDs for each input.
Mode	The mode of the input stream , either: o DVB o MPEG o ATSC o DVB (SDT) o OFF
Modulation	Select any of the following modes. • DVB-T • DVB-T2
Frequency	Specify the DVB-T/T2 frequency in MHz, valid range is 42 – 870Mhz.
Bandwidth [MHz]	Specify the bandwidth, select from 6, 7, or 8MHz New T2 Module can specify the bandwidth 5, 6, 7, or 8 Mhz.
Spectral Inv.	Checking this check box activates the spectral Inversion.
PLP ID	Specify the PLP from the input.
Enable	Enable the corresponding input port.

The above list of parameters can be configured by clicking on the **edit** link to the right of each input. The pop up dialog below will be displayed:

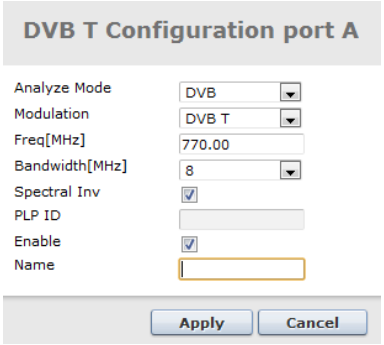


Figure 5.47 – DVB-T/ Input Port Configuration

Name	This parameter allows for each port in a module to be labeled. This label is visible as a tooltip when the mouse cursor hovers over the port. Port names are shown in the alarms when a non-empty string is set as the name..

The status parameters for the **DVB-T/T2** module are shown in the figure below. Click on the *letter* representing the input channel (A, B, C or D) to display the status parameters for the specific input port.

Status Port A

Input	Lock Status:	Locked	
	Effective Bitrate:	21.406	Mbps
	Total Bitrate	22.118	Mbps
	Modulation Error Rate:	24.0	dB
	Signal Noise Ratio:	24.8	dB
	Pre-Viterbi BER:	2.93e-03	
	Pre-RS BER:	< 1.00e-09	
TPS Info	Hierarchy:	None	
	FFT Mode:	8K	
	Guard Interval:	1/8	
	Constellation:	64-QAM	
	Code Rate:	2/3	

Figure 5.48 – DVB-T Status Parameter view

The following information is displayed in status parameters for DVB-T/T2:

Locked Status	Lock status of the tuner
Effective Bitrate	Effective bitrate of the input stream
Total Bitrate	Total bitrate of the input stream
Modulation Error Rate	Modulation Error Radio in dB - a typical good reading is between 30 and 40 (the higher the better).
Signal Noise Ratio	Signal to Noise Ratio – represents how much the signal has been corrupted by noise.
Pre-Viterbi BER	Bit error rate before Viterbi error correction.
Pre-RS BER	Bit error rate after Viterbi / before Reed Solomon error correction
Hierarchy	Hierarchy of the currently tuned channel.
FFT Mode	Fast Fourier Transform Mode of the currently tuned channel.
Guard Interval	Guard Interval of the currently tuned channel.
Constellation	Constellation of the currently tuned channel.
Code rate	Code rate of the currently tuned channel

Status of Port A

Input	Lock Status:	Locked	
	Effective Bitrate:	8.389	Mbps
	Total Bitrate	14.748	Mbps
	Signal Noise Ratio:	40.0	dB
	Pre LDPC BER:	1.90e-06	
	Pre BCH BER:	< 1.00e-09	
	FFT Mode:	2K	
	Guard Interval:	1/32	
	Number Of PLPs:	2	
	Profile	T2-Base	
	Post BCH FER	< 1.00e-09	
	Pilot Pattern	PP4	
L1 Parameters	Constellation:	64-QAM	
	Code Rate:	1/2	
PLP Parameters (Active Data)	PLP Id:	66	
	Constellation:	256-QAM	
	Code Rate:	5/6	
	Rotated Constellation:	No	
	FEC:	16K LDPC	

Figure–5.49 DVB-T2 Status Parameter view

Additional status parameters for DVB-T2 demodulation:

Pre LTPC BER	Bit error rate before LDPC error correction
Pre BCH BER	Bit error rate after LDPC / before BCH error correction, should $<10^{-7}$.
Number of PLPs	Specify the count of PLPs
PLP Id	Specify the PLP Id
Rotated Constellation	Rotated Constellation of the currently tuned channel.
FEC	Forward Error Correction.

6 Conditional Access Configuration

The unit supports descrambling and scrambling given that the required modules have been installed. Descrambling and scrambling are processing elements; hence they are not listed in the **Input** or **Output** nodes. These functions are found as part of the output service configuration.

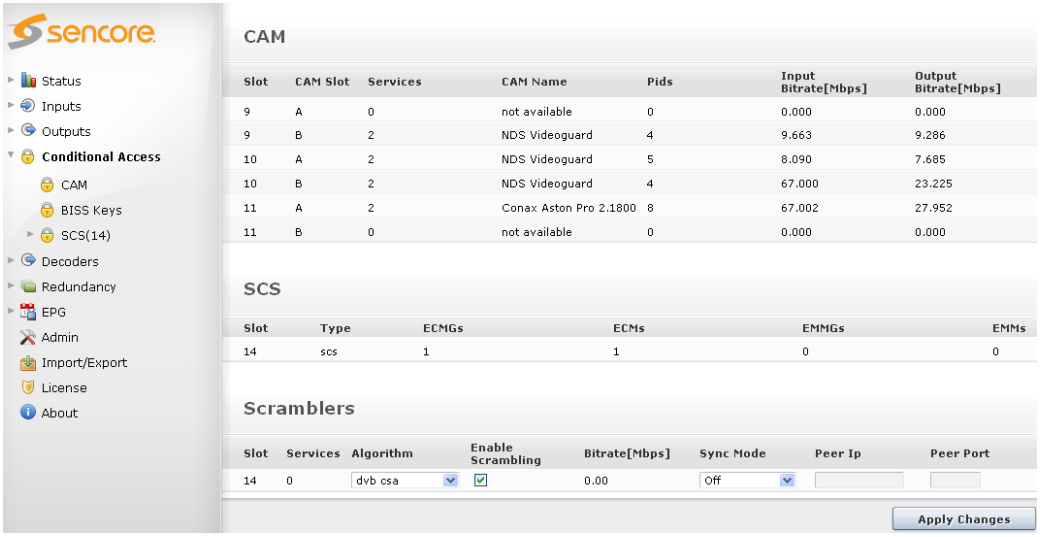


Figure 6.1 - Conditional Access Node

The **Conditional Access** node displays existing configuration for CAMs, SCSs, Scramblers and Descramblers.

The following parameters are available:

CAM:

Services	Number of services being descrambled by the CAM

CAM Name	Name/provider of CAM module
PIDs	Number of PIDs currently being descrambled
Input Bitrate	Input bitrate into the CAM module
Output Bitrte	Output bitrate from the CAM module

Scramblers:

Algorithm	Select the correct algorithm to be used for Scrambling based on the currently installed licenses. If you feel your chosen algorithm is missing, please contact Sencore support.

Descramblers:

Algorithm	Select the correct algorithm to be used for bulk descrambling based on the currently installed licenses. If you feel your chosen algorithm is missing, please contact Sencore support.

6.1 Descrambling – Common Interface Module

The unit is capable of descrambling a number of incoming services with the installation of a descrambler module. The descrambler module comes with two Common Interface slots and can therefore host two Conditional Access Modules (CAM's). Each Common Interface slot supports the descrambling of one or more services depending on the CAM module used.

6.1.1 Descrambling a Service

To descramble a service first insert the CAM into an available Common Interface slot, then insert your Smart Card into the CAM.

To assign the Common Interface slot to a service to be descrambled, double click on that service and within the **Outputs** page to display the **Service Properties** dialog (Figure 6.2).

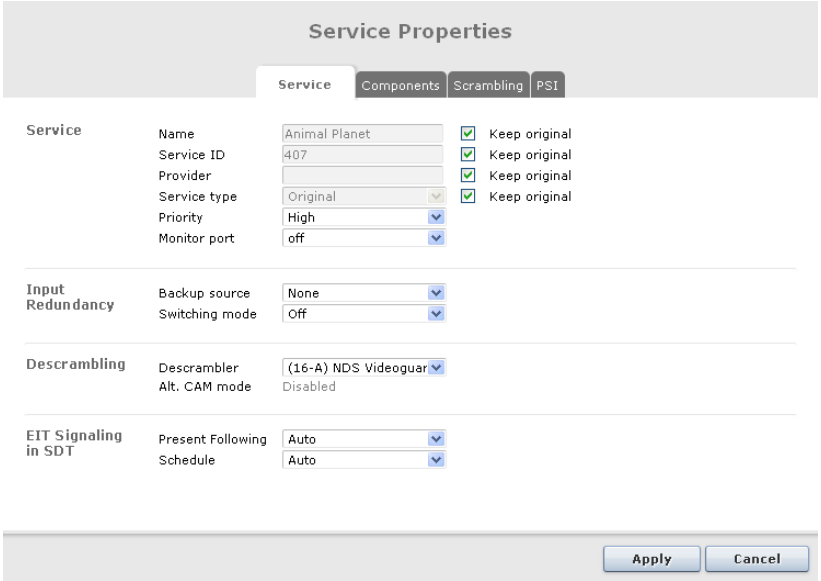


Figure 6.2 - CAM Configuration within the Service Properties Dialog

6.1.2 Transporting a Descrambled Service to Multiple Output Modules/Ports

A descrambled service may be sent to up to four individual outputs. In other words, if the unit is configured with an IP output module and a QAM output module, then the descrambler module will be able to copy the descrambled service and send it to both the IP output and QAM output destinations. Alternatively, the same service can be sent to different ports on the same output module.

When an input service is configured to be sent to different outputs, the configuration is automatically performed by the system – as long as the same descrambler is selected. This copy function is based on per service, i.e. if a Smart Card is able to descramble up to 10 services, then the maximum number of output streams from the descrambler will be 40 (10 x 4).

6.1.3 CAM Configuration

The CAM configuration page below (accessible by selecting **Conditional Access → CAM** in the **Navigation Pane**) displays the following:

- A list of available CAM modules with its corresponding name,
- The chassis slot where the Descrambler module is installed, and
- The CAM slot (each Descrambler module has two CAM slots labeled A and B).

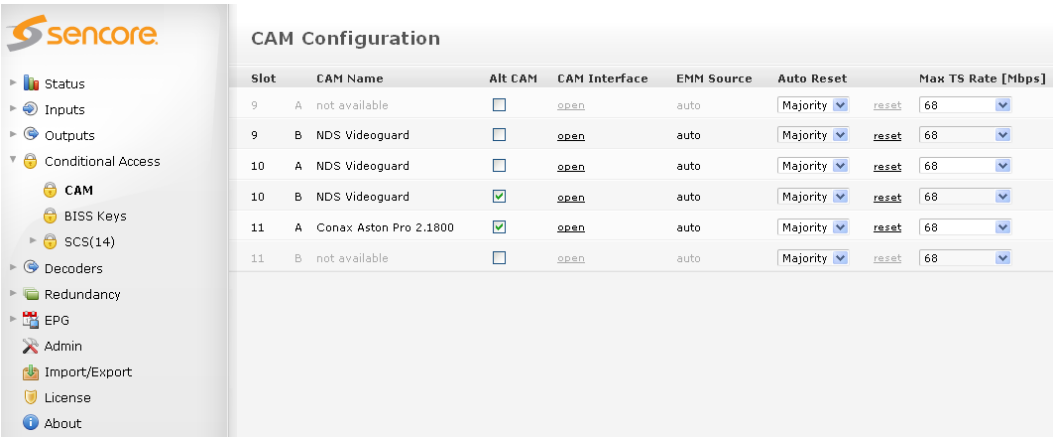


Figure 6.3 - CAM Configuration Page

If there is no CAM module in the Descrambler module, **CAM Name** will be displayed as **not available**.

The **Alt CAM Mode**, **CAM Interface**, **EMM Source**, **Auto Reset**, **Reset** and **Max TS Rate** are the configuration fields available in this page (Figure above).

Slot	Slot in which the Descrambler is installed
CAM Slot	Slot in which the CAM module is installed – either slot A or B
CAM Name	Name of the CAM module
Alt CAM Mode	Activate sending of the entire input stream to the CAM without PID filtering - explained in detail in Section 6.1.4.
CAM Interface	Displays the menu defined by the CAM manufacturer – explained in detail in Section 6.1.5.
EMM Source	Displays the source of the EMM, the default value is **auto**.

Auto Reset	Automatic CAM Reset – enables the CAM to reset if there are failures in the descrambling process. This helps the CAM to recover automatically without requiring the user to reset manually. **Auto Reset** provides the following options: **Off** – automatic reset is disabled; the CAM can be reset manually. **One** – if one or more services have descrambling failures, the CAM will reset. **Majority** – if more than half the services configured to be descrambled in the CAM fail, the CAM will reset. **All** – in this mode, the CAM will simply reset if all services configured in the CAM fail to be descrambled.
Man Reset	Manual CAM Reset – sometimes resetting the CAM Module is necessary, e.g. if the CAM is not responding. Click **reset** to power recycle the CAM module.
MAX TS rate [Mbps]	Maximum Transport Stream Range can be used if the rate of the transponder exceeds the default CAM input rate. The user can choose one of three values: • 43 Mbps • 58 Mbps • 68 Mbps The default value is 43; however, not all CAMs support these rates.

6.1.4 Alt CAM Mode

In a normal configuration, when an input stream is sent to the CAM, only a selection of PIDs that comprise the services being descrambled are actually transmitted, together with CA-related PIDs listed in the PSI.

In **Alt CAM Mode**, the entire input stream is sent to the CAM without PID filtering. This feature can be useful in the following scenarios:

Some CA systems do not list all the required PIDs in the PSI. Often this will involve the EMM PIDs, resulting in problems keeping the subscription updated over time. **Alt CAM Mode** can prevent this problem.

Sending all the PIDs changes the packet timing of data streaming into the CAM to more closely resemble that of the input. Testing has shown that very few CAMs require this to work reliably over time.

Not filtering PIDs sent to the CAM simplifies the input card configuration due to all input PIDs being sent. This may slightly improve response time on service changes. The effect may be marginal, but it could be of value, especially for inputs where most of the services are descrambled in the same CAM anyway.

The drawback of **Alt CAM Mode** is increased bandwidth usage from the input card(s) into the system. In most systems, this is not a significant limitation; however, it should be taken into consideration for large systems.

	It is generally advised to disable **Alt CAM Mode** as this creates a higher bandwidth requirement in the unit. We recommend you enable this option if you have problems with: o descrambling a service o keeping the subscription updated reliability

6.1.5 CAM Interface

Each CAM Module has its own menu structure defined by its manufacturer to access module information, e.g. subscription status and to insert configuration data, e.g. a new PIN Code, maturity rate, and a key to descramble a service.

*The CAM Interface feature allows operators to access and interact with these menus easily via the web GUI. By clicking on **Open** under the CAM Interface column**,** a pop-up box appears over the **CAM Configuration** page. This is the CAM Interface dialog.*

6.1.6 Navigation

Based on Figure 6.1*, the standard CAM Interface provides two buttons at the bottom and a list of clickable menu options.*

- *The **Back/Exit** button returns to the previous menu*
- *If the **Back/Exit** button is pressed on a top-level menu, the same menu screen will be displayed*
- *The **Close** button stops interaction with the CAM Module, closes the CAM Interface dialog, and displays the CAM Configuration page*

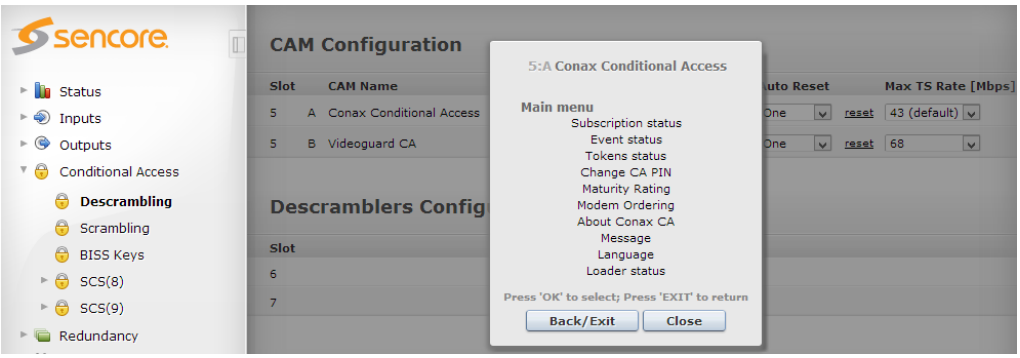


Figure 6.5 - Example of a Menu from Conax

It is possible that the dialog above varies depending on the CAM manufacturer. Menus that do not allow user interaction are called Lists. Since Lists are bottom-level menu items, possible operations are either to go back to the previous menu or close the CAM Interface.

Figure 6.6 - Example of List from CryptoWorks

*Another type of dialog is the Enquiry dialog (*Figure 6.7*). This dialog is displayed when the CAM Module requires user input such as a PIN code. The CAM defines the maximum length of the input data and whether actual characters are displayed as the user types.*

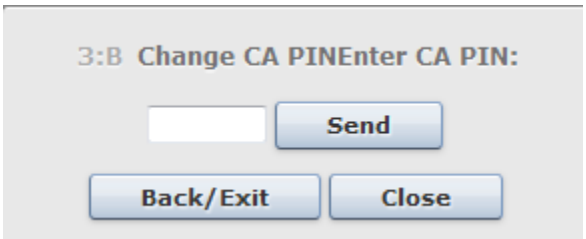


Figure 6.7 - Example of Enquiry

6.1.6.1 Multiple Users and CAM access

The CAM Interface supports multiple users but not multiple sessions. This means that it is possible to access the CAM Interface of the same CAM Module from different computers or browsers simultaneously, but users cannot be on different levels of the menu. For this reason the CAM Interface is refreshed every 10 seconds to request the current valid menu screen.

Due to this synchronization scheme the menu screen will change for all current users even if just one of them interacts with the CAM Interface dialog.

Multiple users interacting with a single CAM Module can lead to synchronization errors. For instance, when one user tries to access a menu that has not been refreshed after another user has interacted with it, a synchronization error will occur. This will display a ***Status*** *error. This and other errors are handled by the* ***CAM Interface*** *to provide safe and consistent interaction.*

6.1.7 *Error Handling*

When a situation results in an error and does not permit proper communication with the CAM Module, an error message will be displayed. There are different conditions that can lead to errors. Table 1 lists the possible error messages and their descriptions.

Error Message	Description
Error: No session. Refresh to recover communication	The user is trying to answer a menu or enquiry and the session has been closed.
Error: Session ID. Refresh to recover communication.	The user is trying to access a session that is no longer available.
Error: Status. Refresh to recover communication.	The status count value received from GUI is not the same as the one in the CAM Interface. This means that the GUI could be in another level of the menu which can lead to a non desired operation.
Error: Invalid message format.	The message parsing process is not successful.
Error: CAM No response. Refresh to recover communication.	Within a specified timeout, the CAM Interface failed to respond.
No CAM/PC Card in slot.	There is no CAM Card in the slot.
CAM not identified, or identified as non-CAM.	The PC Card is not identified, or identified as non-CAM.

Table 2 - Error Messages and their Descriptions

*When an error message is displayed, the **Back/Exit** button is replaced by **Refresh**. The operator can either close the CAM Interface, or try to **Refresh** the session. If a synchronization error occurs, **Refresh** is the ideal solution. Otherwise, the operator can wait for the CAM Interface to request a **Refresh** automatically.*

6.2 Bulk Descrambling

Sencore's bulk descrambler is able to descramble up to 250 services per card. Actual descrambling is performed in firmware while extraction of the Control Word from the ECMs is done by integrated soft clients provided by the CA vendors. The bulk descrambler runs on a dedicated module, providing an external Ethernet port used for the communication between the soft client and the CA server for exchange of access criteria.

The maximum number of ECMs that can be descrambled depends on the processing power requirement of the CA client.

Currently the descrambler algorithms supported are: DVB-CSA or AES-ECB; but not both simultaneously.

Below are the CA systems integrated with the bulk descrambler module:

CA System	Number of Services Supported
BISS	250 services
Latens	250 services
Verimatrix	250 services

Preparing the bulk descrambler module to descramble services requires some initial configuration to establish a link to the CA vendor's server. To be able to view the GUI and enter necessary parameters, the correct licenses must be installed as the bulk descrambler functionality is licensed together with the number of services.

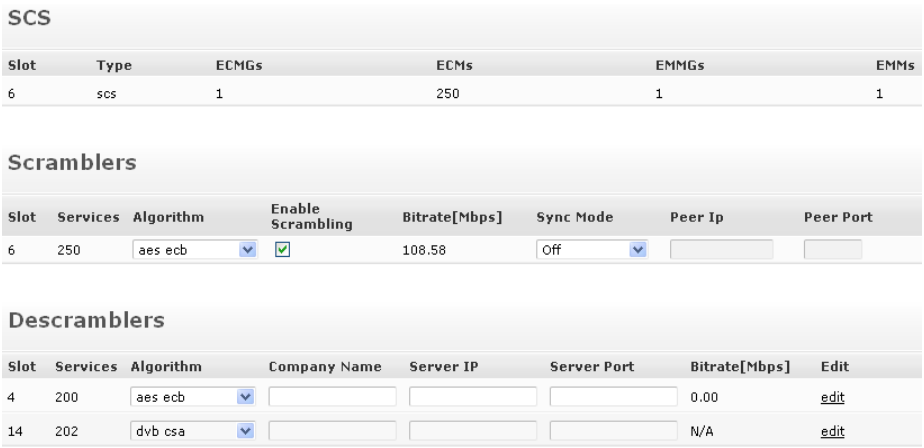


Figure 6.8 - Setting up the Bulk Descrambler Module

6.2.1 Verimatrix Configuration

The following parameters are available:

Slot	Slot in which the descrambler module is installed
Services	Number of services currently active
Algorithm	Descrambling is performed in FPGA. Depending on the FPGA installed, different algorithms will be available. Select an algorithm after installing a descrambler.
Company Name	A unique key that will be exchanged with the CA system (provided by your CA vendor)
Server IP	IP address of the CA vendor's server
Server Port	CA vendor port to be used
Bitrate [Mbps]	Total bitrate passing through the descrambler
Edit	*This is a Verimatrix specific parameter.* It is possible to configure the verimatrix.ini file via the **edit** link. The dialog shown in Figure 6.9 will be displayed.

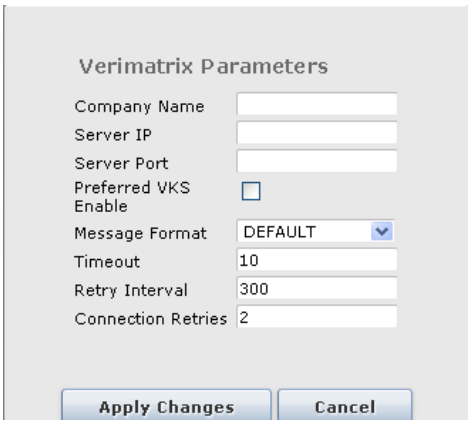
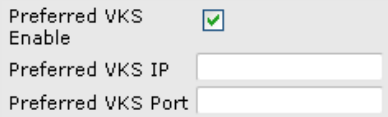


Figure 6.9 - Configuring Verimatrix Parameters

Company Name	A unique key that will be exchanged with the CA system (provided by your CA vendor)
Server IP	IP address for the CAS server
Server Port	IP port for the CAS server
Preferred VKS Enable	Enables connection to an external Verimatrix Key Server (VKS). Checking this checkbox displays the following additional parameters (Figure 6.10): **Preferred VKS IP** – IP address for the external key server **Preferred VJS Port** – IP port for the external key server  *Figure 6.10 – Additional VKS Parameters*
Message Format	The communication format for messages sent to the CAS server. Choose one of the following: • DEFAULT • 1153 • 1154 • 1155 • 1156 • 1157
Timeout	Duration of timeout for connecting to the CAS server.
Retry Interval	If the previous attempt to connect to the CAS server failed, the retry interval is the time it takes before the client attempts to connect again.
Connection Retries	Number of times the client will attempt to connect to the CAS server before giving up.

Once the bulk descrambler has been initialized, outgoing services can be descrambled in the same manner as the standard CAM based solutions – by selecting the descrambler module to be used for descrambling in the **Service Properties** dialog (on the output configuration page).

6.2.2 BISS Scrambling and Descrambling

6.2.2.1 Key Handling

The unit supports BISS scrambling and descrambling (Mode 1 and Mode E), which is the simplest form of fixed key scrambling available. The scrambling solution is based on the standard scrambler card, while the descrambling is based on the bulk descrambler card.

i	BISS descrambling can also be done via a CAM based system where the key is inserted using the CAM interface. Detailed explanation on BISS descrambling with CAM systems is beyond the scope of this manual.

The key handling procedure is identical for both scrambling and descrambling. A key can be defined and associated with a name, which is the reference used for the stream's configuration.

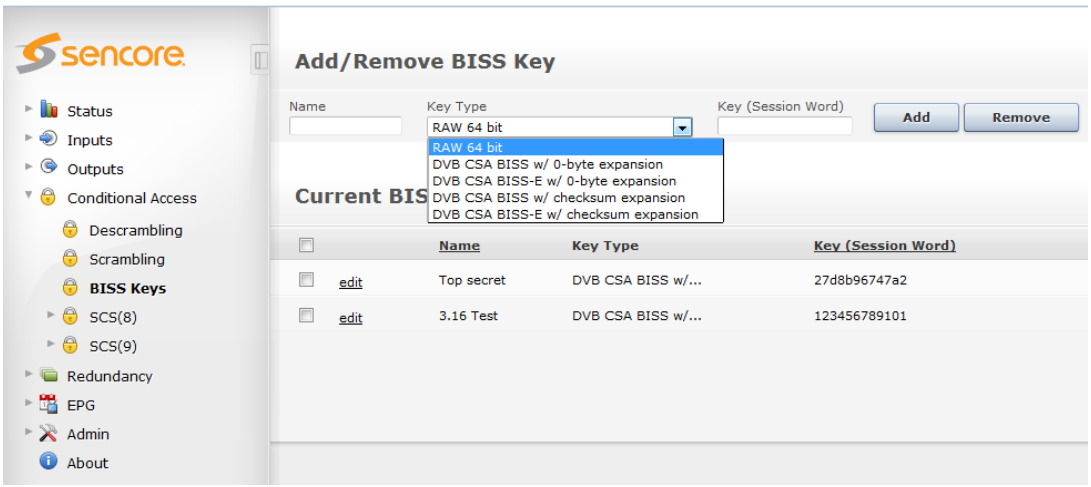


Figure 6.10 – Creating a BISS Mode 1 Key

The figure above illustrates a GUI with one existing key named test. The "test" key may be used both for descrambling and scrambling.

The following parameters are available:

Name	Name for the key
Key Type	Select one of the following: • RAW 64 Bit • DVB CSA BISS w/0 byte expansion • DVB CSA BISS-E w/0 byte expansion • DVB CSA BISS w/ checksum expansion • DVB CSA BISS-E w/ checksum expansion
Key (Session Word)	Control word used for scrambling or descrambling

In BISS Mode E the key (Session Word) is protected by encrypting it using a key ID. An encrypted key is generated by selecting DCB CSA BISS-E as key type, and using the **Encode** mode, and supplying the key ID and key. The resulting encrypted key is displayed to the user in a popup when the key is added, but is not available to the user later in time. The same procedure is used in order to retrieve a clear key from an encrypted key and key ID by selecting the **Decode** mode.

6.2.2.2 Setting up a BISS Scrambler

To configure an outgoing stream with the defined BISS key, check the **Fixed Key** checkbox in the scrambler setup page.

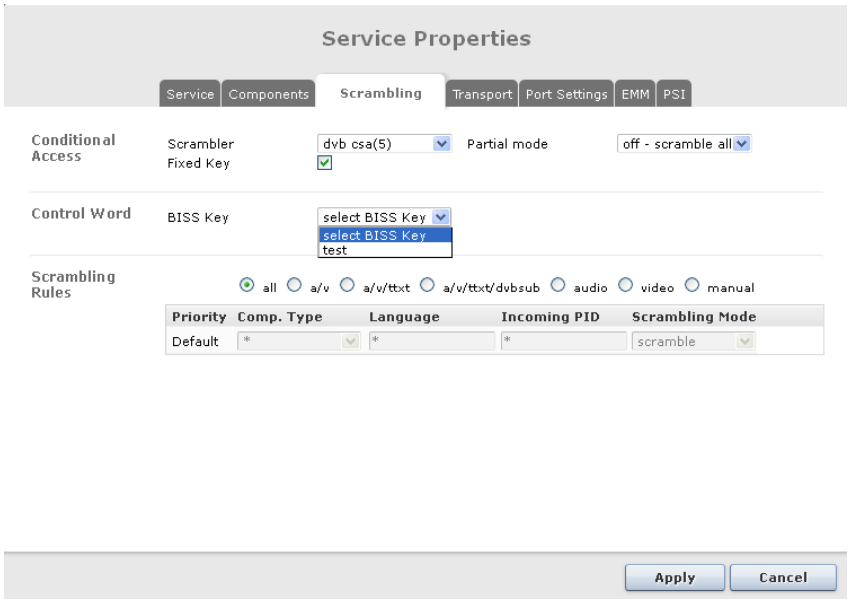


Figure 6.11 – Setting up a BISS Scrambling Service

The BISS Key dropdown box will list all previously defined keys.

6.2.2.3 Setting up a BISS Descrambler

To descramble an outgoing stream with the defined BISS key, select the appropriate descrambler card and key to be used in the output service configuration page.

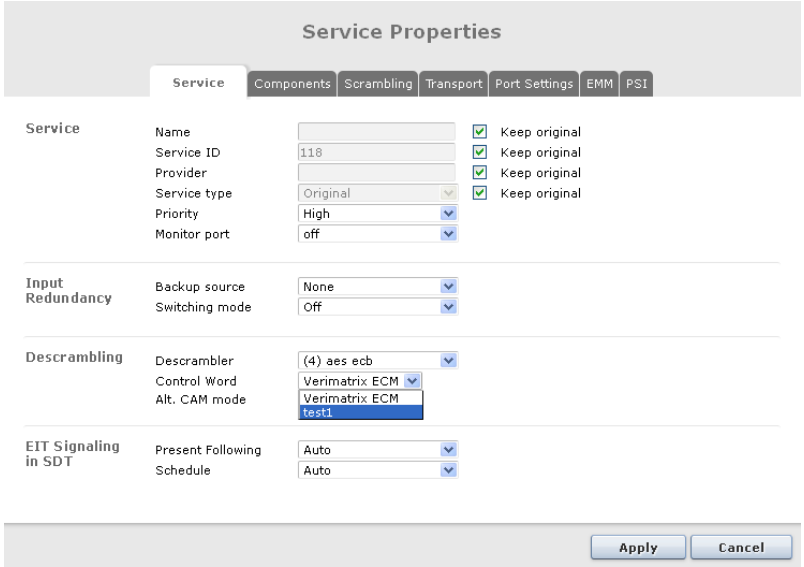


Figure 6.12 – Setting up a descrambling in the output service

6.2.3 SIM bulk Descrambler

The SIM Bulk Descrambler Module has the ability to add up to 16 SIM form smart cards, which are used in conjunction with a supported CA system in order to descramble services. These SIM cards are able to be loaded on both the front of the module (ports A – H), and on the module itself (ports I – P). In order to access the slots on the module, this must be removed from the chassis.

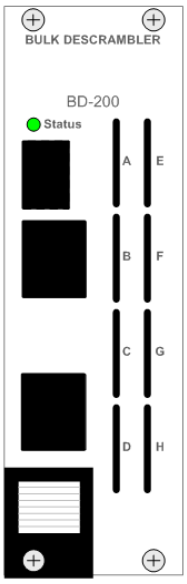


Figure 6.13– Hardware view of SIM Bulk Descrambler.

Currently, the SIM Bulk Descrambler is compatible with the following CA Systems:

- Conax (DVB-CSA)

When descrambling a service, the selection of the SIM card is done on the output services **Service** tab, in a similar way as for CAM descrambling.

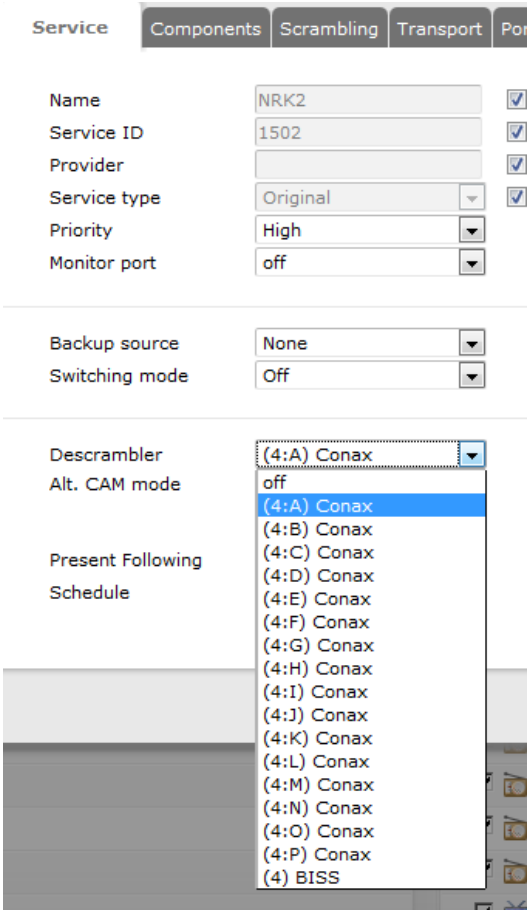


Figure 6.14 –SIM Bulk Descrambler selection for output

Configuration and Status of the SIM cards is available on the **Conditional Access->Descrambling** page. This will display a list of valid SIM cards and their serial numbers.

The choice of the EMM source is done in the **Descrambling** page of the GUI. In this page is also reported the number of ECMs assigned to each smart card.

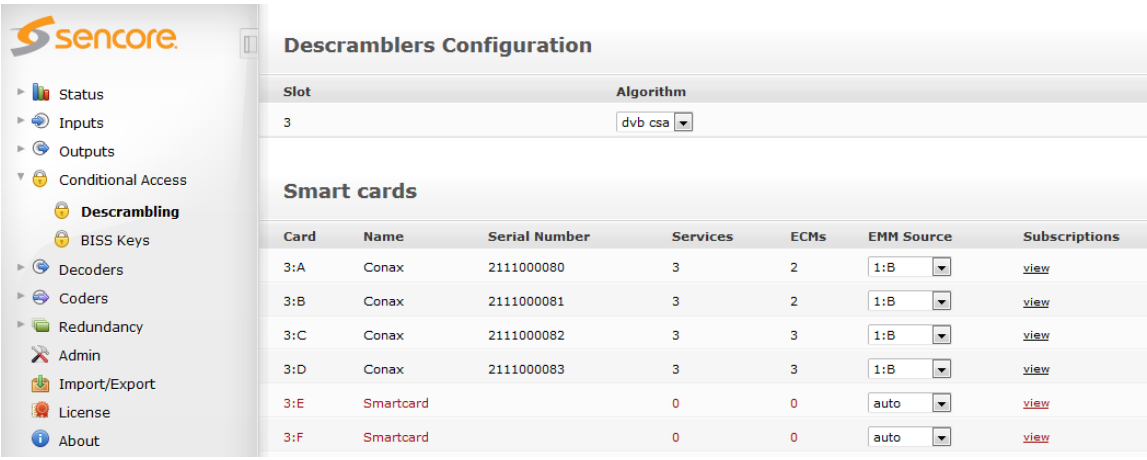


Figure 6.15–SIM Bulk Descrambler configuration status

The following parameters are available:

Card	Slot number for the card
Name	Name of the card i.e.: Conax
Serial Number	Serial number of the Smart card
Services	Number of services used by that Smart card.
ECMs	Number of ECMs used by that Smart card.
EMM Source	Specify Selected valid EMM input source
Subscriptions	Status of Subscriptions for the card

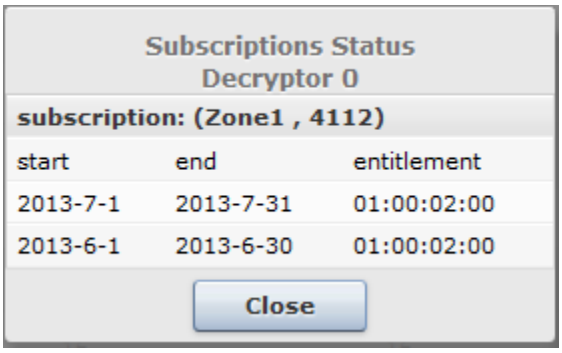


Figure 6.16 –Subscription status for smart card

6.3 Scrambling

This section provides a brief overview on how scrambling is performed within the unit. It introduces the different components required and their purpose and explains how to setup the scrambler card to establish ECM and EMM channels as well as their actual streams.

For information on how to conduct scrambling, add an EMM to an output transport stream, etc. refer to Chapter 8.3.

The scrambler module is composed of two components:

- SCS – a software component responsible for managing the interfaces used by external ECMG, EMMI, and EIS services.
- SCR – a hardware component responsible for encryption (DVB-CSA or AES) of the services.

The functional diagram below shows these components and their relations with the rest of the system.

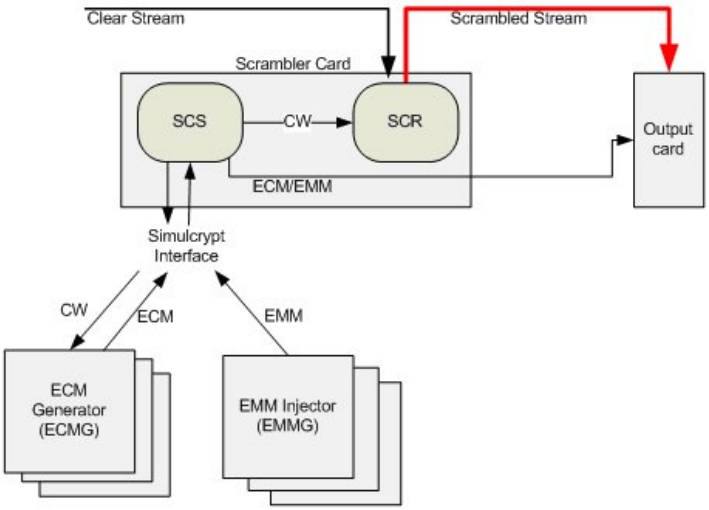


Figure 6.17- Scrambler Module Architecture

The SCS module is the master of the scrambling system. It is aware of the ECMG and the scrambler module. Upon configuration, the SCS card generates a CW, sends it to the ECMG, which returns the ECM. The SCS then sends the CW to the hardware component scrambling the live content and transfers the ECM to the correct output card for playout.

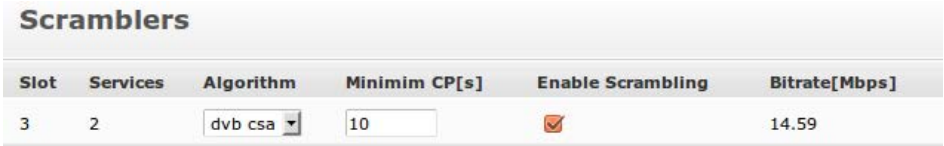
Before it is possible to define an output stream with the scrambling properties it is necessary to define the ECM generator, as the SCS needs to know where to contact the encryption system. Next step is to define an ECM. The ECM definition associates a CW id and access criteria. The output can now be defined and scrambled. When configuring the output to be scrambled the ECM selection list implicitly represents the CW and access criteria while the scrambler indicates the scrambler card.

6.3.1 Scrambler Module Configuration

The scrambler module runs both the SCS functionality and the scrambler functionality on one single card. The Scrambler supports both the DVB-CSA and AES scrambling algorithms – but only one at a time.

The scrambler card supports up to 250 scrambled services, with a maximum total bitrate of 850Mbps.

An overview of the scramblers present in the unit is available in the **Conditional Access** node in the **Navigation Tree**.



Scramblers

Slot	Services	Algorithm	Minimim CP[s]	Enable Scrambling	Bitrate[Mbps]
3	2	dvb csa	10	☑	14.59

Figure 6.18- Scramblers Overview

This configuration page gives a general overview of how many ECMs and EMMs have been configured as well as providing a dialog to select which scrambling algorithm to run on the card (available algorithms depend on the licenses and SW version installed). The options provided here are based on the information reported by the scrambler card during startup.

6.3.1.1 Configurable crypto period on the scrambler

It is possible to configure a user definable minimum crypto period (CP) per scrambler card, under Conditional Access → Scrambling (Figure 6.18). The minimum crypto period default is 10 seconds, which is the minimum crypto period supported, but can be set as high as 6553 seconds.

If the nominal CP duration is changed as a consequence of a user changing the minimum CP, the change takes effect the next CP. Thus, the current CP is not interrupted (neither shortened nor lengthened in time).

6.3.1.2 Selective Scrambling/Partial Scrambling

The scrambler card supports both selective and partial scrambling, implying that parts of the content are sent in clear. Selection is done per service and is enabled during the configuration of the output stream. Selective scrambling is only available for selected CA systems and requires a license.

6.3.1.3 Configuring an ECM Generator Channel

A connection to an ECM generator is defined in the **ECMG** node located under the **Conditional Access → SCS** node in the **Navigation Tree**. The connection to an ECMG establishes a channel over which ECMs will be sent.

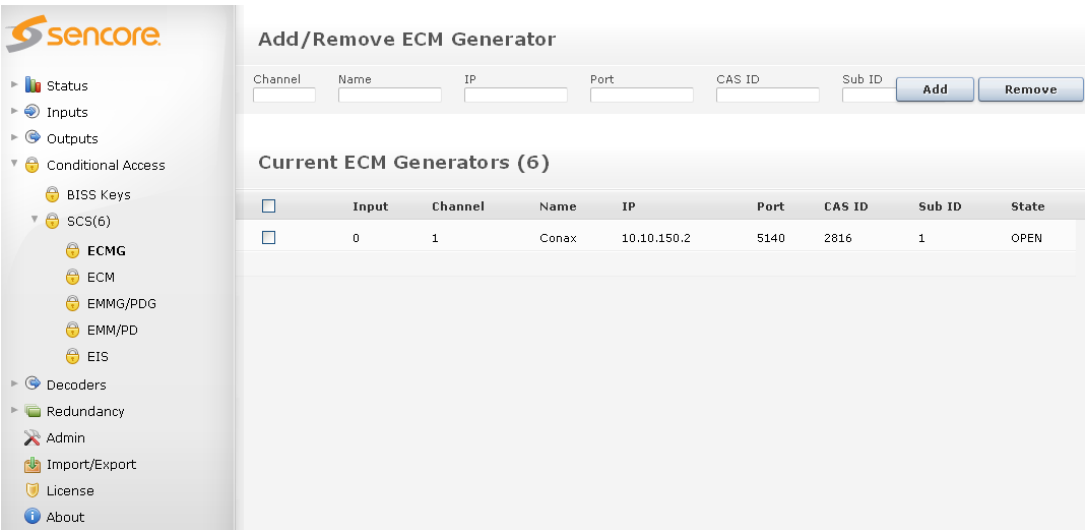


Figure 6.19- Adding an ECM Generator

The following information is displayed:

Input	Logical port representing the connection to the ECMG – assigned automatically. This number is used internally as well as for generating alarms.
Channel	The SimulCrypt Channel ID used for the CA system
Name	For reference in the GUI only
IP	IP address of the ECMG
Port	TCP port of the ECMG
CAS ID	CA vendor specific ID
Sub ID	CA vendor specific sub ID
State	Status of ECMG connection, either **OPEN** or **NOT CONNECTED**.

To change an, ECMG channel connection click on the existing ECMG entry and enter the new configuration.

	It is possible to have several ECMG connections simultaneously but the CAS ID has to be uniquely defined. If the same CAS ID is used, a real SimulCrypt will not work as the CA Descriptor in the PMT will be identical for both ECMs. In this case, private data must be used by STBs to distinguish ECMs.

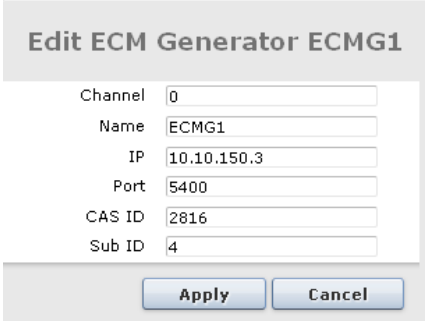


Figure 6.20- Editing ECMGs

Configuring the CryptoLITE embedded ECM Generator

CryptoLITE is an embedded ECM Generator running on the scrambler card. To establish a channel connection to CryptoLITE, use the following mandatory parameters:

- IP: 127.0.0.1
- Port: 5555
- CAS ID: 19178

The ECMG will accept one channel only; up to 250 ECM streams are supported. When adding an ECM, the **Access Criteria** field may be left empty. However, it is possible to enter a fixed 8-byte (16 HEX characters) user specified scrambling key in the **Access Criteria** field.

6.3.1.4 Configuring an ECM Stream

An ECM is defined from the **ECM** node in the **Navigation Tree**. The ECM entry links a CW and Access criteria to an ECM Generator.

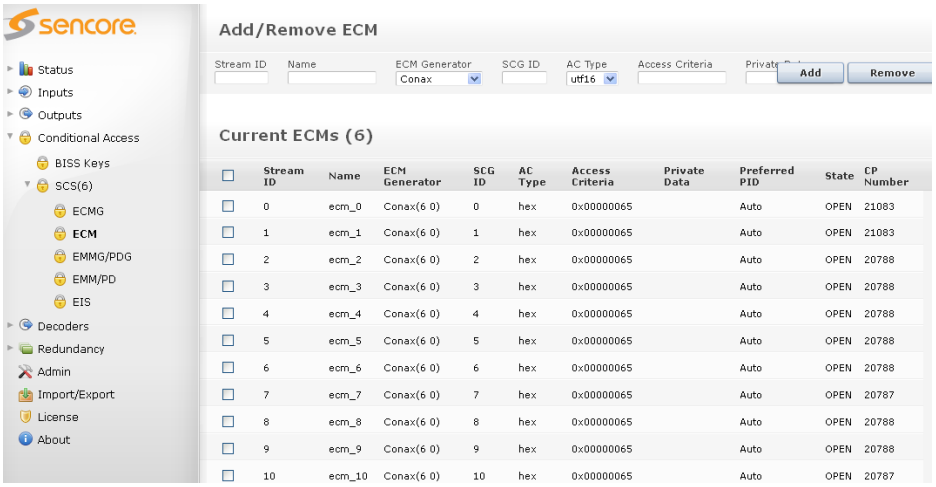


Figure 6.21 - Adding an ECM

The following information is displayed:

Stream ID	The SimulCrypt Stream ID used towards the CA system. Its value is also set to the SimulCrypt EcmId.
Name	For reference in the GUI only
ECM Generator	Links the ECM to the predefined ECMG
SCG ID	CW selection; all ECMs with the same SCG id will share the same CW.
AC Type	Access Criteria type – refers to the data type used over the SimulCrypt protocol when the access criteria are transferred. Available types are: UTF16, INT32, or HEX.
Access Criteria	Specified in decimal or HEX (use 0x prefix)
Private Data	Private descriptor data added to the ca_descriptor in the PMT; enter in HEX using the 0x prefix.
PID	Preferred ECM PID value transmitted at the output module; the maximum value is 8191.
State	OPEN or CLOSE
CP Number	This is a reference number for both CAS and scrambler. It represents the number of exchanges between the ECMG and the scrambler; the value is either Automatic or configurable.

If multiple ECMG connections have been defined, the same SCG ID may be used for two ECMs as long as they are connected to different ECMGs.

i	At this point, the ECM stream is defined and the CA system as well as the SCS module can begin to exchange CW and ECMs. However, the ECM is still not associated to any output. Refer to the Output Configuration chapter for details on how to associate ECMs to outputs.

To change an, ECM configuration click on the existing ECM entry and enter the new configuration.

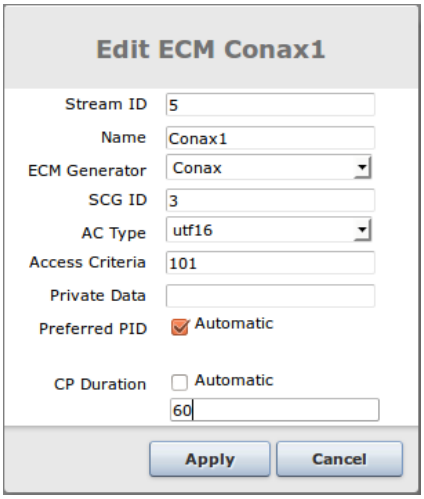


Figure 6.22 - Editing an existing ECM with configurable CP value.

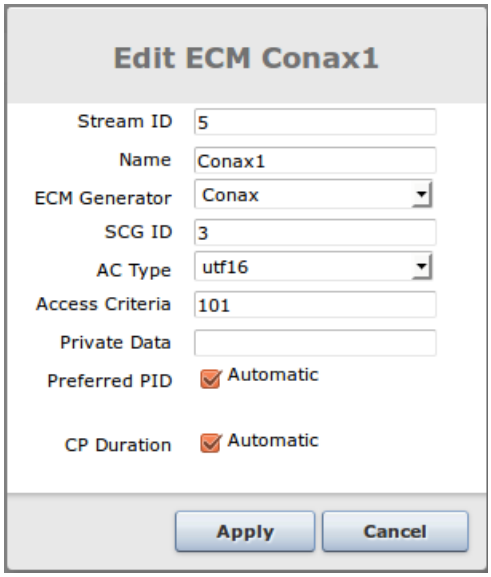


Figure 6.23 - Editing an existing ECM with automatic CP value.

6.3.1.5 Configuring an EMM Generator (EMMG) Channel

To establish a connection to an EMM Generator (or Private Data Generator), go to **Scrambler → SCS → EMMG/PDG** node in the **Navigation Tree**, enter appropriate values and click **Add**.

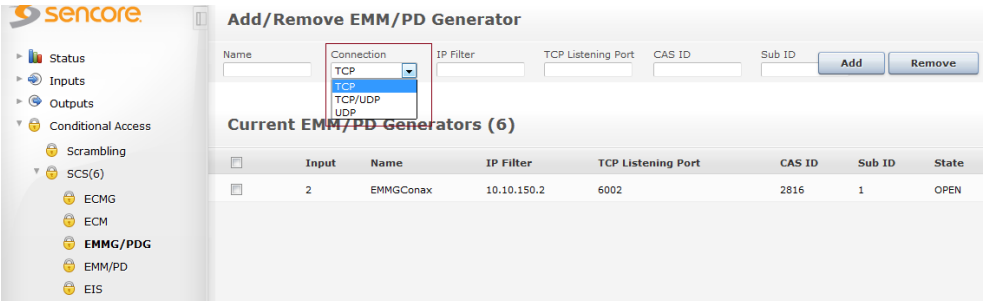


Figure 6.24 - Adding an EMM Generator

The following information is displayed:

Input	Logical port representing the connection to the EMMG – assigned automatically. This number is used internally as well as for generating alarms.
Name	For reference in the GUI only
Connection	EMM transfer connection can be either of the below -TCP -TCP/UDP -UDP
IP Filter	IP address of the EMMG to be connected to. If the value 0.0.0.0 is used, the unit will accept a connection from any IP address. When multiple sources are trying to connect, it is first come first serve.
Listening Port	TCP port for the EMMG to connect to
CAS ID	CA vendor specific ID
Sub ID	CA vendor specific sub ID
State	Status of the EMMG/PDG connection, either OPEN or NOT CONNECTED.

To change an, EMMG channel connection, click on the existing EMMG entry and enter the new configuration.

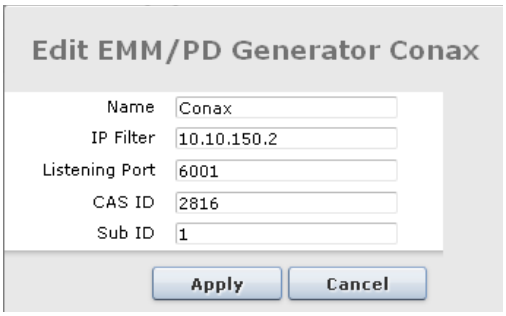


Figure 6.25 - Editing an EMM Generator

EMM/PD Bandwidth

During the EMM/PD stream configuration the SCS and the EMM/PD generator will negotiate the maximum bandwidth allowed for a given stream. This bandwidth has a default value of 100kbits/s and can be also set explicitly from the GUI. **The maximum total bandwidth available per card is 3 Mbits/s** for these streams.

In the case where the CA system is transmitting more data than the SCS card can handle, the CA system will indirectly be notified as the flow control mechanism in the TCP stack will notify the transmitter; hence the CA system can take appropriate measures to avoid overflow.

6.3.1.6 Configuring an EMM/PD Stream

An EMM/PD is defined from the **EMM/PD** node in the **Navigation Tree**.

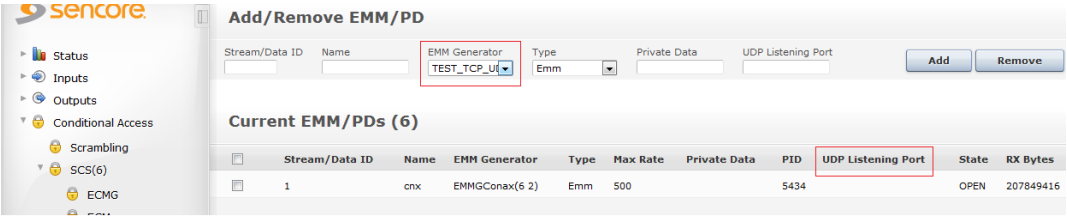


Figure 6.26- Adding an EMM/PD

The following information is displayed:

Stream ID	The SimulCrypt Stream ID used towards the CA system. Its value is also set to the SimulCrypt DataId.
Name	For reference in the GUI only
EMM Generator	Links the EMM to the predefined EMMG
Type	Expected type of generator – EMM or PD
Max Rate	Maximum bandwidth allowed for this stream
Private Data	Private descriptor data added to the ca_descriptor in the CAT; enter in HEX using the 0x prefix.
PID	Preferred ECM PID value transmitted at the output module. The default PID

	value is 7500 (unless manually assigned) while the maximum PID value is 8191. If several ECMs are used in an MPTS output, the ECM values will be incremented: 7501, 7502, … etc.
Listening Port	For EMM transfer over UDP configured, then the UDP port must be defined when configuring the actual EMM
State	OPEN or CLOSE
RX Bytes	The total number of bytes received by the generator

	At this point, the EMM/PD stream is defined and the CA system is able to push content to the SCS module. However, the EMM/PD is still not associated to any output. Refer to the Output Configuration chapter for details on how to associate EMMs to outputs.

To change an, EMM/PD configuration click on the existing EMM/PD entry and enter the new configuration.

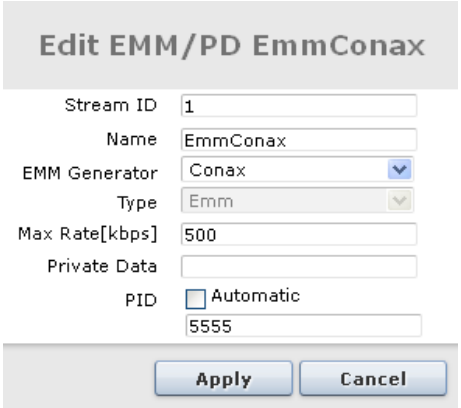


Figure 6.27 - Edit an existing EMM/PD

6.3.1.7 Support for Multiple CA Systems (Simulcrypt)

The scrambling solution supports four CA systems simultaneously. No particular configuration is required for this. Simply define the appropriate ECMGs, ECMs, EMMGs and EMM connections required. The system to be used for actual scrambling is defined as part of the output configuration process.

When configuring services that are to contain information for multiple CA systems, the following must be done:

- The corresponding ECMs for each service / CA system must have identical SCG ID values
- All ECMs must be assigned to the service
- If applicable, valid EMMs must be added to the output for each CA system

6.3.1.8 Configuring an EIS service Channel

The Event Information Scheduling (EIS) interface is a scheduling interface for associating ECMs to outputs. The configuration of the EIS is similar to setting up an ECMG/EMMG connection.

The EIS interface provides the following functions.

- Create a new ECM
- Modify an ECM's access criteria
- Remove an existing ECM

Control scrambling of an output service. The output triplet (Net ID, TS ID, and SID) is used as the output service identifier.

As the EIS is not able to create the ECMG channel configuration, this needs to be done from the web GUI before the EIS can be used.

	Based on the DVB Simulcrypt standard, only **one** EIS is permitted per chassis.

To establish a connection to an EIS service, go to **Scrambler → SCS → EIS** node in the **Navigation Tree**, enter appropriate values and click **Add**.

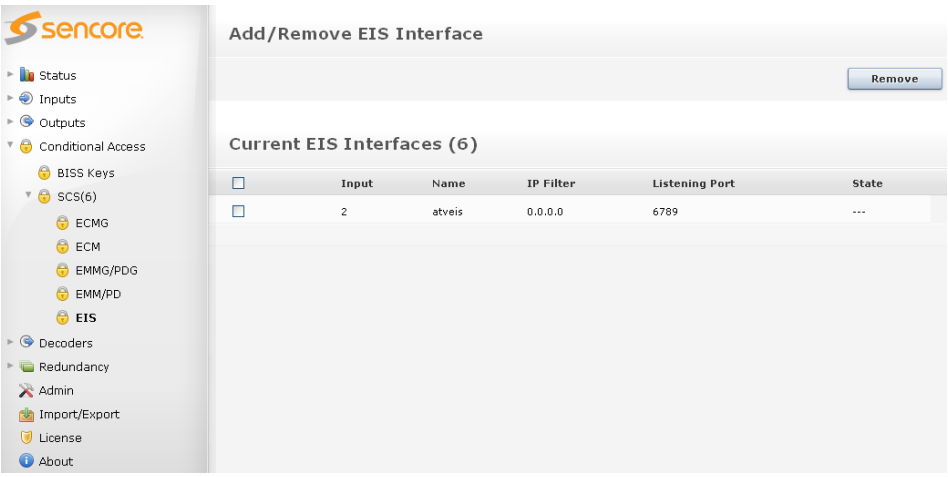


Figure 6.28 - Adding an EIS

The following information is displayed:

Input	Logical port representing the connection to the EMMG – assigned automatically. This number is used internally as well as for generating alarms.
Name	For reference in the GUI only
IP Filter	IP address of the EIS service to be connected to
Listening Port	TCP port for the EIS to connect to
State	OPEN or CLOSE

To change an, EIS connection, click on the existing EIS entry and enter the new configuration.

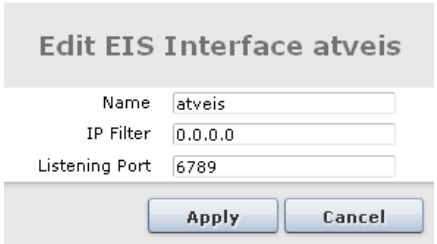


Figure 6.29 - Edit an EIS service

Once the service is connected, the EIS can schedule ECMs to the outputs.

7 Digital Output Configuration

The Sencore platform can be used to host a number of different output modules. Select **Outputs** from the Navigation Pane to view all available output modules along with key information on the current configuration for each output module. When expanded, this menu also provides a list of the output cards, including type and installed slot.

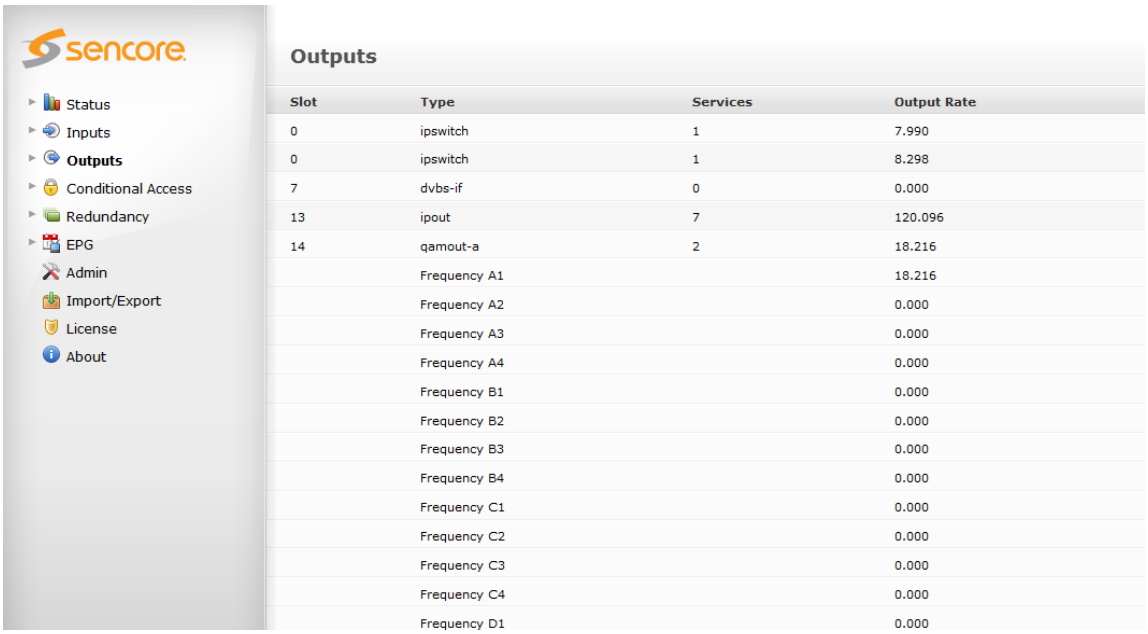


Figure 7.1 - Outputs View

The following information is available from the Outputs view:

Slot	Slot position in the chassis
Type	Type of output module / output port
Services	Number of services assigned to the output module
Output Rate [Mbps]	Total data rate of all configured services - the rate shown includes all overhead data such as IP headers.

Creating an output transport stream is done via the **Outputs** view present for each output module. Before an output can be created, the input module(s) must be configured correctly such that the list of input services is present.

The unit supports two types of output streams: Multiple Program Transport Stream (MPTS) and Single Program Transport Stream (SPTS). MPTS is available for all MPEG output modules while SPTS is only available for IP output modules in addition to MPTS.

MPTSs are always Constant Bit Rate (CBR) streams. By default SPTSs are Variable Bit Rate (VBR), i.e. the same as the input source, but can be configured to be CBR.

7.1 Input Stream Selection

When you select an output module, you will be presented with a list of Inputs. This will consist of ports (for MPTS inputs) or services (IP SPTS inputs). In order to expand the services in an MPTS input, you can click the  symbol. In order to output a service from the available

input services, you only need to drag a service from the **Inputs** panel and drop it on the **Output** panel (Figure *8.2*)

- To add a service to an MPTS, drop it on the MPTS symbol . This applies to IP MPTS outputs as well as QAM/COFDM/ASI/etc outputs.
- To add an IP SPTS to an IP output module, drop the service anywhere in the empty space on the Output panel.
- To add a Transparent output drag and drop the input port to an empty space on the Output panel (IP output) or the output MPTS (other modules).

To toggle transmission of an output stream on or off, use the checkboxes on the left of that particular stream to enable or disable it.

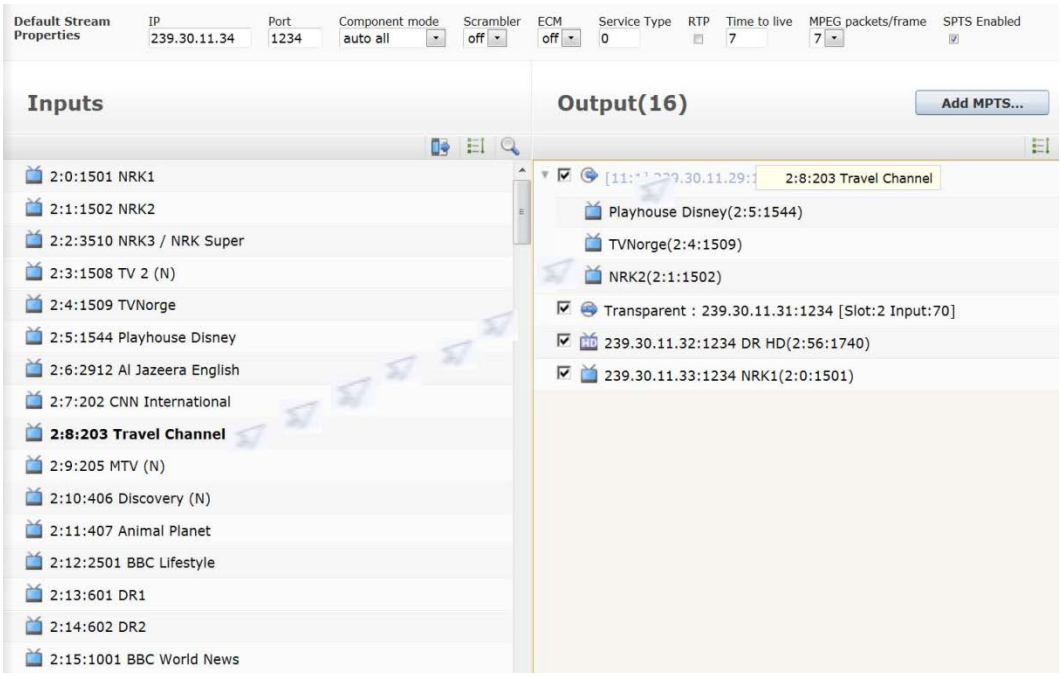


Figure 7.2 - Dragging and Dropping a Service

Once the output is configured, the system will automatically generate PSI/SI as well as add the service related PIDs to the output (as configured in **Outputs → PSI**). For more information on PSI/SI configuration, refer to Sections 7.3.4.

	If you are unable to drag and drop an input service to an output, there could be a conflict in your output setup, most likely due to a duplicate ServiceID/Program Number. For example, if you already have an output service with ServiceID 100, and you attempt to drag and drop an input service, with ServiceID 100 – the system will assume that you are trying to create two output services with the same ID. To get around this, first remap the output service ID for the existing one. Then, add the new service. This is only relevant when adding the same ServiceID to an MPTS.

7.2 Auto Service Modes

The Auto-Service modes are available to automate the process of adding services to the output. I.e., instead of manually selecting a service from the input, the user instructs the system to add services from the input automatically.

Two implementations of the auto-service exist:

- Auto-First Service
- Auto-All Services

These modes are available for each input port when expanded, ie:

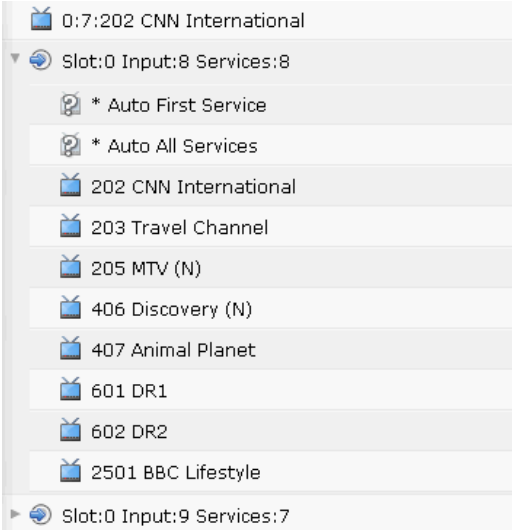


Figure 7.3 – Auto Service modes

These "services" can be added to the output in the same way as regular services, and can be used in the following ways:

Auto-First Service will map the first available service in the input port. This feature is intended for VOD, where the source never will contain more than one service. In this mode the output service can be changed and edited like any other output service. I.e the service name can be changed; the component/PID mapping can be specified etc.

Auto-All Services will map all incoming services for the input port to an output. Here it is not possible to do any service editing at all. The service dialogs will be replaced with another dialog to block selected services.

7.2.1 Configuring an output with Auto All Services

The Auto All Services configuration is done via drag-and-drop of the source "Auto All Services" to the output. The "Auto All Services" is then enabled for the given source.

With an “Auto All Services” configured the system will automatically add all these input port services to the output.

Note: It is not possible to add more than one “Auto All Services” per output.

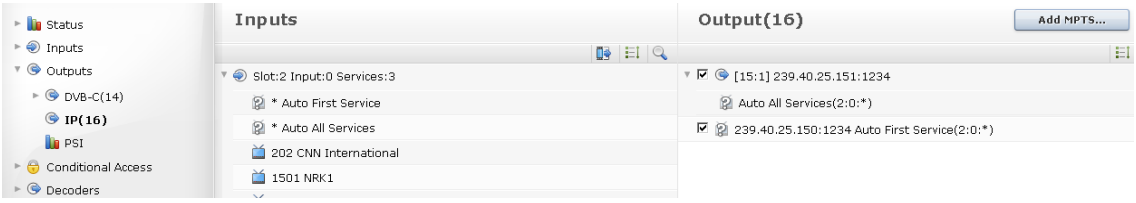


Figure 7.4 – Auto All Services output configuration

It is possible to filter one or more services to be automatically removed by specifying the incoming service ID in the blocking list. This is available on the edit dialog of the output “auto-service” and can be accessed by double clicking on this.

Figure 7.5 – Stopping a selected service

By removing the “Auto All Services” node all the services from that input will be removed.

In conjunction with an ‘Auto All’ service, it is possible to add additional local or other programs in the normal way i.e. drag and drop to the MPTS node.

	Service ID clashes are not automatically handled when using a combination of ‘Auto All’ and additional services.

7.3 Transport Stream Generation

To begin generating MPTS outputs, we set the **Transport** related parameters via the **Edit Multiplex** [2]dialog, accessible by double clicking on the MPTS.

The procedure for adding services/multiplexes varies according to the type of module.

For non-IP modules, services are added to the output stream by dragging and dropping, as illustrated in Figure 8.2. This method is possible because entries in the **Output** panel already exist for these modules, corresponding to their physical ports. The **Default Stream Properties** panel for these modules is used for adding new services.

For IP modules, output multiplexes can be added by entering appropriate values in the **Default Stream Properties** panel and clicking **Add MPTS** (if MPTS license installed).

Figure 8.7 and Figure 8.8 below show the different Default Stream Properties panels for these modules.

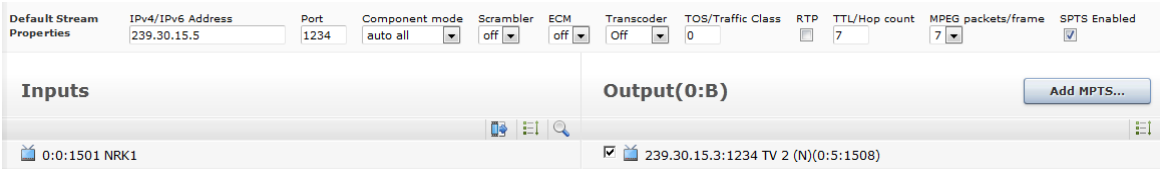


Figure 8.6 - Default Stream Properties for IP Modules

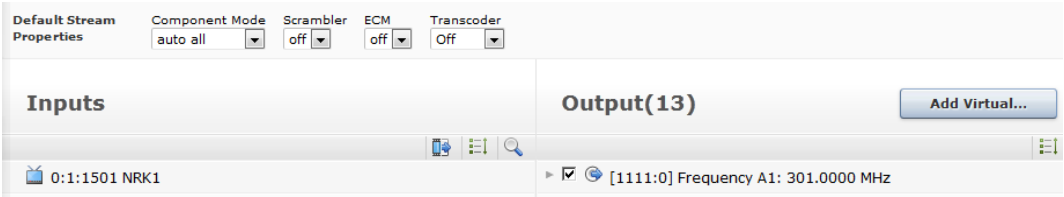


Figure 7.7 - Default Stream Properties for all other Modules

When creating an SPTS, the **Default Stream Properties** will be used and the IP address will be incremented.

	To add a unicast service, enter the destination port together with the destination IP address.

The following fields are available for **Default Stream Properties**; these fields vary depending on the module type:

---

2 For ASI, COFDM, and QAM modules, "Multiplex" is replaced with the module type.

IP	IP address of the SPTS/MPTS
Port	IP port number
Component Mode	PID forwarding mode: **auto all** – all components are forwarded **auto a/v** – only audio and video components are forwarded **auto a/v/ttxt** – audio, video and teletext components are forwarded
Scrambler	If a scrambler module is installed, it is possible to scramble the selected service by choosing one of the available scramblers from the pull down menu.
ECM	If scrambling has been selected, assign the output stream to the appropriate scrambled subscriber package
Transcoder	If a transcoder module is installed, it is possible to assign this to the new service.
MPEG Packets/Frame	Number of MPEG packets per UDP frame; default is 7.
Service Type	Specifies the Type-of-Service (TOS) value to prioritize between Delay, Throughput, and Reliability. Refer to the IP protocol specification for more details.
RTP	Enable Real Time Protocol, adds RTP header to the UDP packets.
TTL/Hop Count	Set the Time-to-Live (TTL/IPv4) or Hop Count (IPv6) value for the IP output packets
SPTS Enabled	Enable SPTS output, streaming will start when enabled.

The properties of MPTSs and SPTSs are organized differently in the GUI to simplify the process of configuring and maintaining these streams.

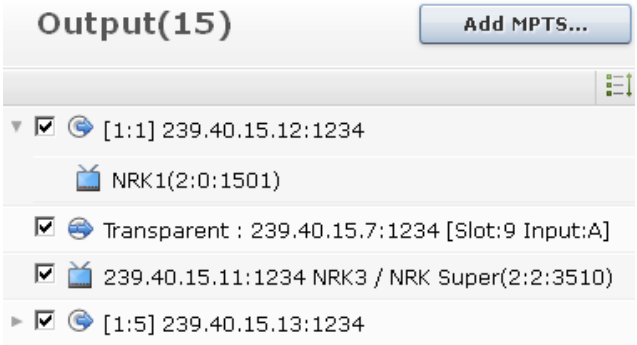


Figure 7.8 - Service Grouping

MPTSs can be expanded to reveal the individual services they encompass. An MPTS stream provides more PSI options compared to an SPTS. Both MPTS and SPTS provide the option to map through external PIDs which will not be signaled in the PSI.

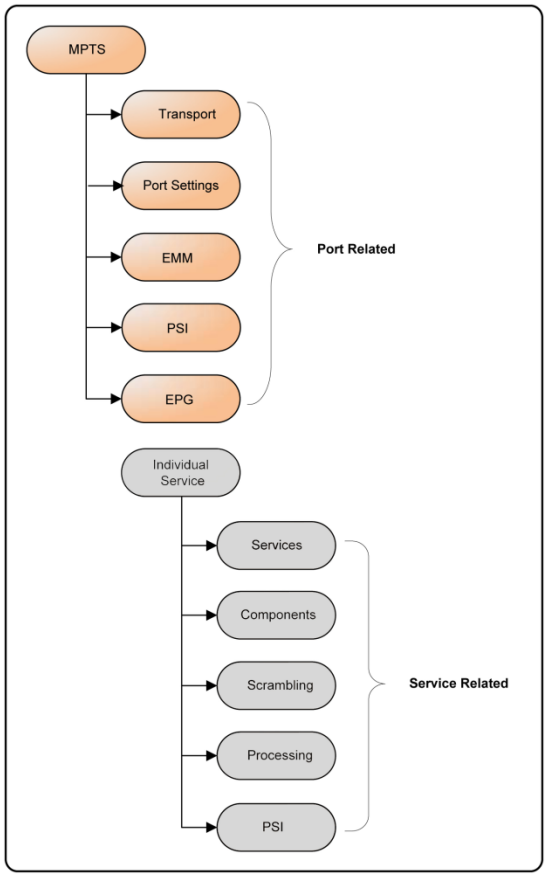


Figure 7.9 - Layout of Properties Dialog for an MPTS

Double clicking on an MPTS reveals port related settings (**Edit Multiplex** dialog); double clicking on an individual service inside the MPTS reveals service related settings (**Service Properties** dialog), as illustrated in *Figure above.*

The figure below shows the layout of properties dialog for SPTS. Double click on an SPTS to access its properties. The tabs available for both MPTS and SPTS properties are almost identical; wherever there are differences, they are pointed out in the text.

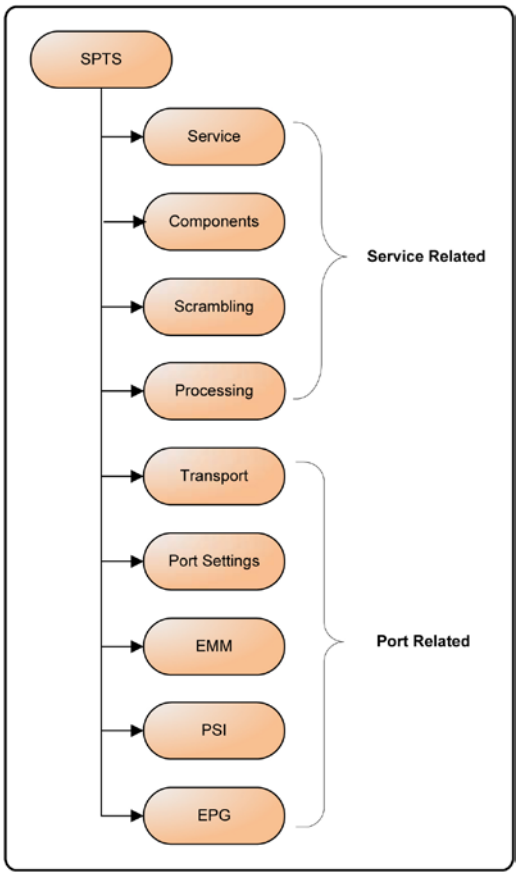


Figure 7.10 - Layout of Properties Dialog for an SPTS

The SPTS output is only supported by the IP output module

7.3.1 Transport Settings

The generic **Transport** tab for all output modules contains the **Network ID, Orig. Network ID** and **TS ID** fields as well as the **Import TS PIDs** checkbox. For IP and ASI output modules, the tab holds the additional **Delivery Descriptors** panel as well (described in the following subsection).

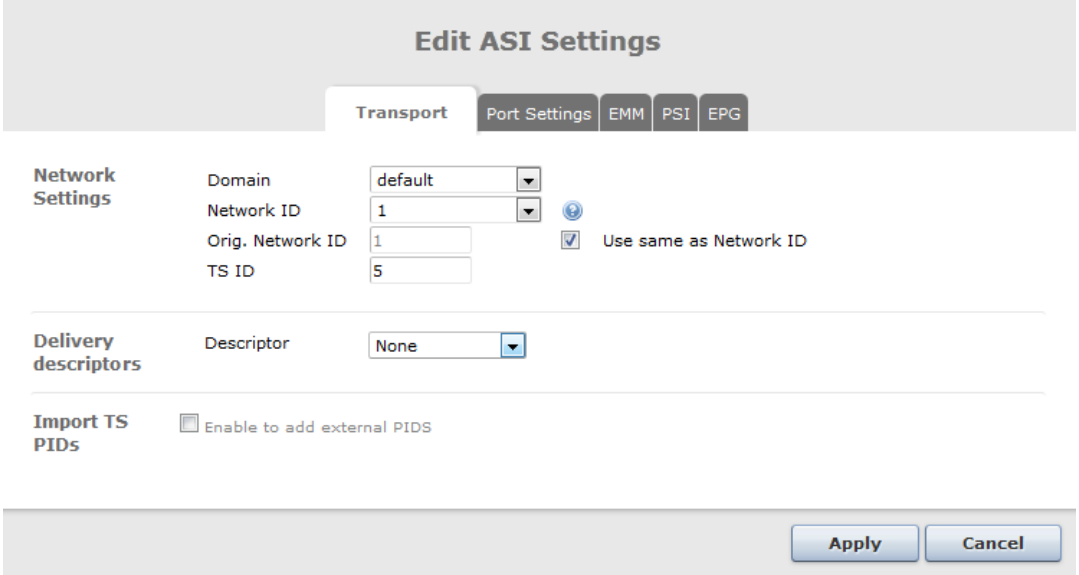


Figure 7.11- Transport Tab for ASI Modules

Domain	If a domain has been configured, an additional drop down box will be visible. Refer to 8.6.10 for information on how to add a domain.
Network ID	Network identification selector
Orig. Network ID	Original Network identification tag. To disable, check **Use same as Network ID**.
TS ID	Transport Stream identification tag

7.3.1.1 Delivery Descriptors

If the MPTS stream is to be converted to another network type modulation further down the signal chain, it is possible to add Cable, Satellite or Terrestrial parameters, which will then be added into the NIT. Select one of the three options under **Delivery Descriptors** from the **Descriptor** drop down box and enter the required parameters. *Figure 8.13, Figure 8.14, and Figure 8.15* illustrate the differences between the three options; correct values for these parameters can be obtained from respective network operators.

Figure 7.12- Delivery Descriptors for Cable

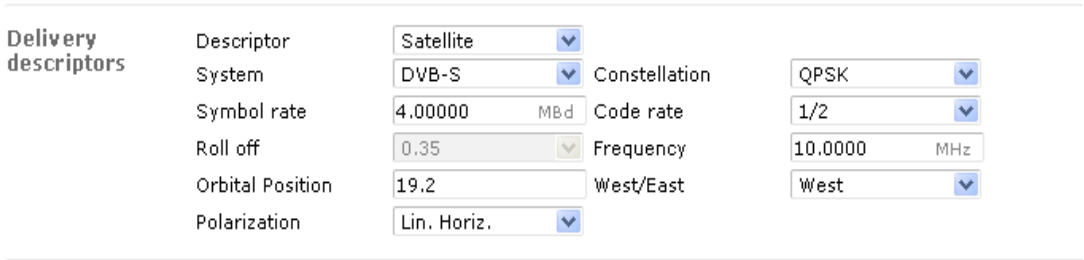


Figure 7.13 - Delivery Descriptors for Satellite

Figure 7.14- Delivery Descriptors for Terrestrial

7.3.1.2 Import TS PID

Checking the **Import TS PIDs** on the **Transport** tab allows you to define PIDs to be manually added to the output transport stream. These PIDs will not be signalled in the PSI/SI. Click **+** to add additional PIDs and - to remove them.

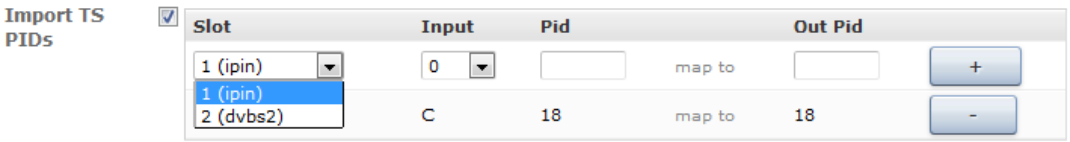


Figure 7.15 - Import TS PIDs

Slot	Contains a selection of the available input modules
Input	Contains a selection of the enabled input ports on the corresponding slot.
PID	Input PID to be forwarded
Out PID	The input PID is mapped to this output PID number; each output PID occupies one channel through the output module like any other channel. The maximum number of channels through the output module is 250.

!	Manually mapped PIDs on outgoing Transport Streams are not checked for PID conflicts. These PIDs are not signaled in the generated PSI/SI table. Importing PIDs is treated as a service by the system consequently reducing the number of services handled by the module with one.

7.3.2 Port Settings

The **Port Settings** tab is module specific and differs accordingly. Please see 8.4 for the specific output module settings.

7.3.3 EMM

The **EMM** tab is only present if one or more scrambler modules are present in the unit, or if using IP SPTS.

This tab makes it possible to add EMM streams inserted by the CA server via the unit's scrambling module by selecting the desired EMM(s) from **Available EMMs** and clicking on the appropriate arrow to move it to **Selected EMMs**.

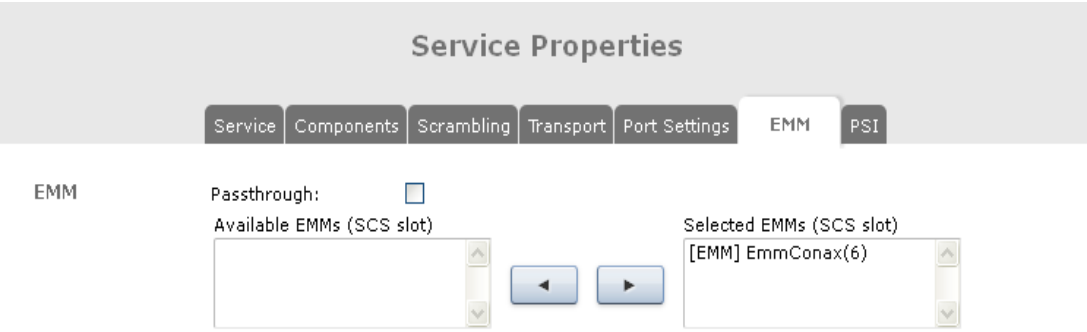


Figure 7.16 - EMM Tab for IP Modules

Available EMMs	A list of EMMs received from the CA server via the unit's scrambling card, configurable under: **Conditional Access → SCS → EMMG/PDG**; multiple EMMs may be added.

The **EMM** tab is the same on all modules. However for IP SPTS, there's an additional **Passthrough** option as shown in the figure below.

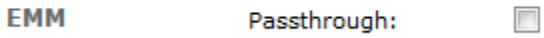


Figure 7.17- Passthrough Option for EMMs in SPTS

Passthrough	EMM Passthrough enables an incoming service to be transmitted with its original CA including EMM and CAT without being descrambled in the unit, so that receivers further down the chain can carry out the descrambling process instead.

!	When passthrough is enabled, the internal generation of the CAT table is automatically disabled.

7.3.4 HbbTV Apps

On the HbbTV Apps tab, one or more HbbTV applications can be configured. These applications will be signaled on the output AIT table for the selected service.

When you configure an application, please note that you can only use URLs to specify the location of the content.

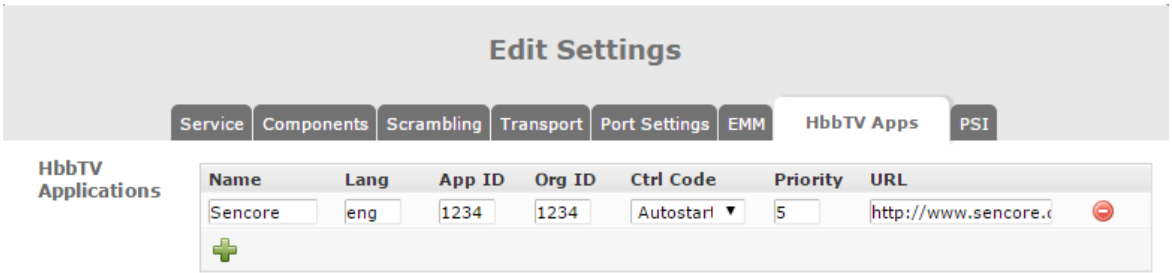


Figure 7.18 – HbbTV Application Tab

Name	Specify the name of HbbTV App
Lang	Specify the Language
App ID	Specify the App ID
Org ID	Specify the Org ID
Ctrl Code	Choose any of the below Ctrl Code • Auto start • Present • Destroy • Kill • Prefetch • Remote • Playback auto start
Priority	Specify the priority
URL	URLs to specify the location of the content.

7.3.5 PSI

The **PSI** tab allows the base values defined in the **Outputs->PSI** node to be overwritten for each specific output stream. The list in the table reflects the currently selected mode: **MPEG**, **DVB**, **ATSC** or **Default**.

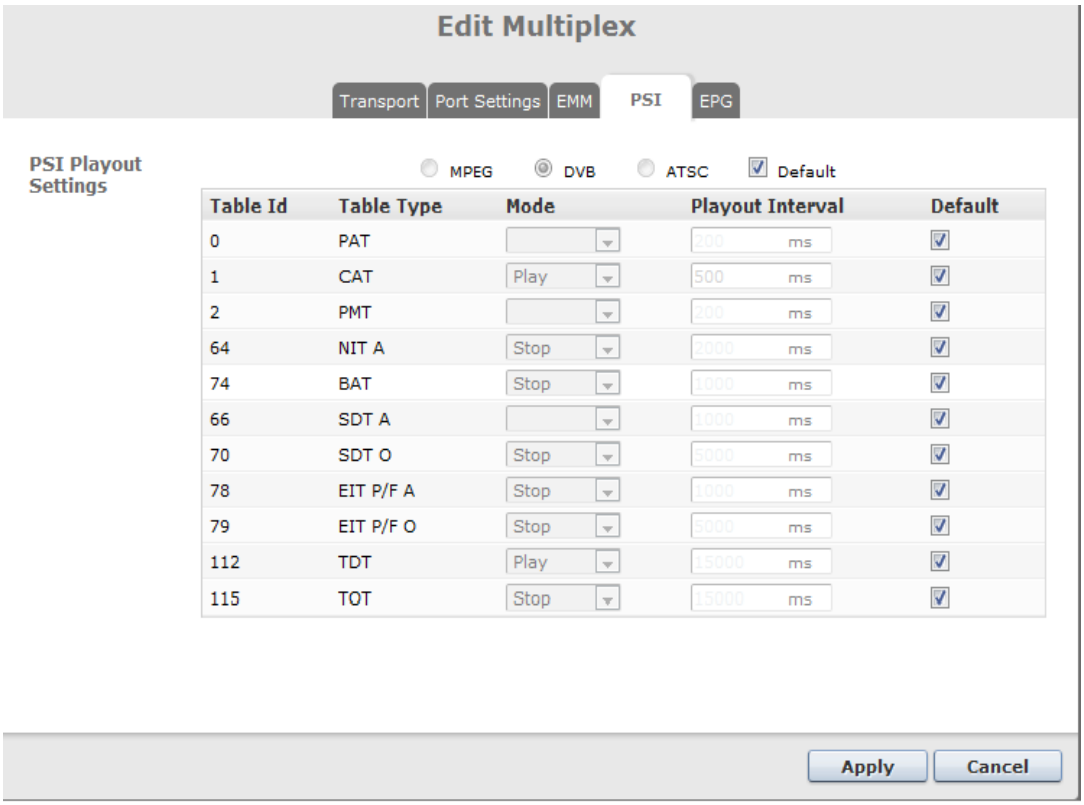


Figure 7.19- PSI Tab for IP Modules

To modify any of the base values (default values), disable **Default** and set the values as needed.

If the change in base value is applicable to all outputs, it is simpler and neater to change it from the **PSI** node in the **Navigation Pane**, where the base values are configured. A change in the base value from this page will automatically propagate to all outputs applicable.

The **PSI** tab is identical for both MPTS and SPTS.

7.3.5.1 PSI configuration for services in an MPTS

Individual services within an MPTS have a PSI tab that allows for the PMT's Mode and Playout Interval to be modified.

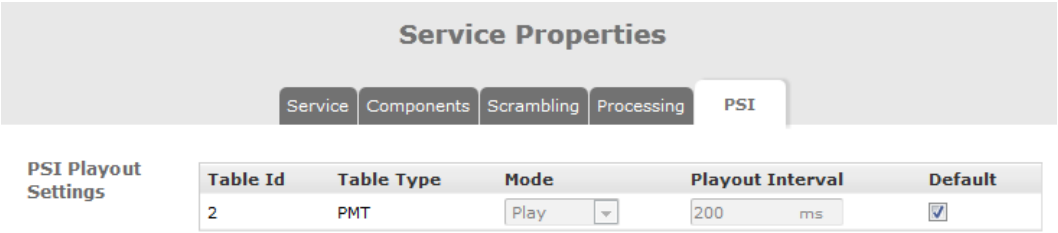


Figure 7.20 - PSI Tab for a service encapsulated within an MPTS

	If the Global PMT (accessible via **Outputs → PSI**) mode is set to **Stop**, PMTs for services within the MPTS will not be played, regardless of their mode.

7.3.6 EPG

The **EPG** tab enables transmission of EIT schedule information on a particular output stream, if an EPG module is installed. Further information on these parameters is available in Section 9.3.

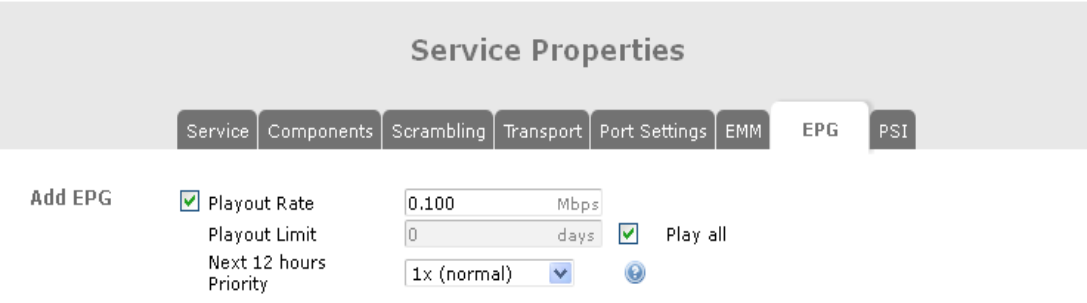


Figure 7.21 - EPG Tab for IP Modules

The **EPG** tab is identical for both MPTS and SPTS.

7.3.7 Service

To modify the settings for individual services, double click on the service and the **Service Properties** dialog will be displayed. The **Service** tab is identical for both MPTS and SPTS.

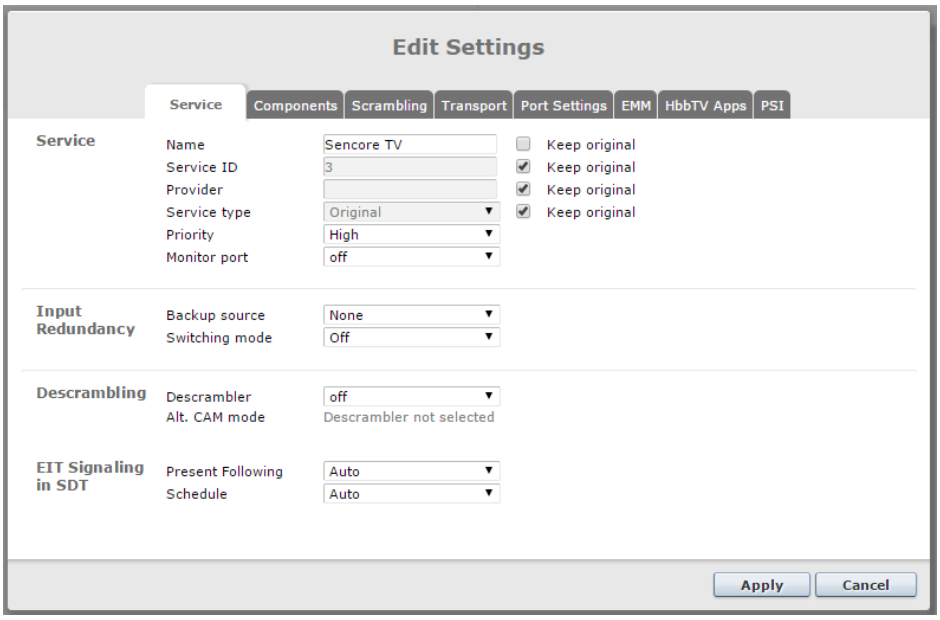


Figure 7.22- Service Tab for IP SPTS

The following parameters are available for configuration:

Name **Service Id** **PMT PID** **Provider**	By default, these four values are extracted from the incoming streams automatically. They can be overwritten manually by deselecting **Keep Original** and entering a new value.
Service type	
Priority	An internal system parameter which may be used for different purposes. Currently it is an attribute used by the Output Redundancy system only.
Monitor Port	Provides a way to monitor a service if the system is configured with a decoder module. If enabled, a copy of the service is sent to the selected decoder. If the service is descrambled, the service is copied after descrambling.

Refer to the Input Redundancy (Section 10.1) for more information on the **Backup source** and **Switching mode** parameters.

Descrambler	Select which descrambler to be used for removing the incoming encryption. If multiple services are being descrambled, they must originate from the same input port (same MPTS).
Alt. CAM mode	Configuration of these values is moved to the main conditional access page in the **Navigation Pane**.

Transcoder	If there is a transcoder module available in the unit, this will allow you to allocate the service to an available transcoder port.

For each outgoing service, it is possible to manually set the signaling of EIT Present Following or Schedule in the SDT:

Present Following	Choose one of the following: • Auto – If the EIT table configuration on the PSI page is set to Play or Pass, then the SDT flag is set to 1. Otherwise, it is set to 0. • Present – the EIT present/following flag in the SDT is set to 1 • Not Present – the EIT present/following flag in the SDT is set to 0
Schedule	Choose one of the following: • Auto – If the EIT table configuration on the PSI page is set to Play or Pass, then the SDT flag is set to 1. Otherwise, it is set to 0. • Present – the EIT schedule flag in the SDT is set to 1 • Not Present – the EIT schedule flag in the SDT is set to 0

If an EPG module is available and the schedule is enabled on the output, then both Present Following and the Schedule flags are set to 1 in the SDT.
For each outgoing service, it is possible to manually set the Major and Minor channel number if **ATSC** profile is active for corresponding transport stream.

If “Channel number” is set to “Auto” the numbers will be copied from the input TVCT/CVCT tables. In “Manual” mode the values are entered in the GUI.

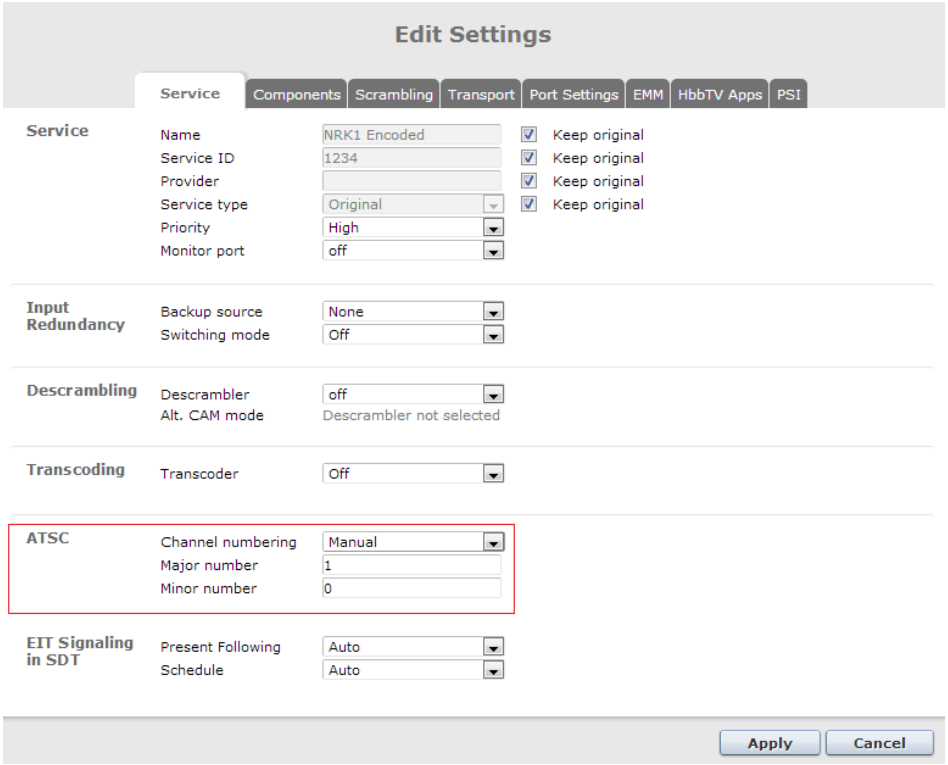


Figure 7.23 - ASTC Specific Service Parameters

Channel numbering	Choose either **Auto** or **Manual**
Major number	The major number must be in the range [1, 1023]
Minor number	The minor number must be in the range [0, 999]

7.3.8 Components

The **Components** tab allows for the mapping of components through the unit, i.e. video, audio, etc. This mapping includes manual and automatic modes. The **Components** Tab is identical for both MPTS and SPTS.

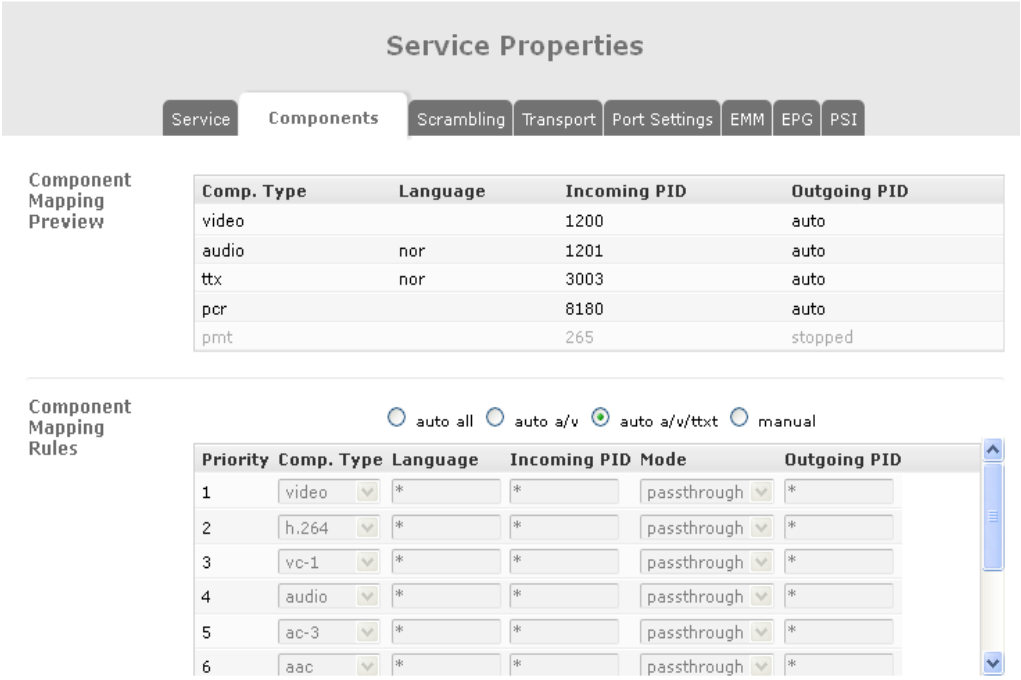


Figure 7.24 - Components Tab for IP SPTS

The following mapping modes are available:

Auto All	All PIDs will be mapped to the output
Auto A/V	Only Audio and Video PIDs will be mapped. If multiple Audio PIDs are available on the inputs, all will be mapped through.
Auto A/V/TTXT	Audio, Video, Teletext and DVB Sub PIDs will be mapped. If multiple Audio PIDs are available on the inputs, all will be mapped through.
Manual	It is possible to define your own custom filtering and mapping rules to get the desired output. Refer to the detailed description below.

7.3.8.1 Manual Mapping

In **Manual** mode it is up to the user to define the mapping rules for the components of the outgoing service. Each outgoing PID requires a dedicated rule; otherwise the default rule applies.

A component-type PID mapping mode can be set, i.e. the input component type is used to identify the input PID itself, instead of using the input PID value only. This feature is typically used to provide a fixed PID line-up at the output, even if the input PID values are changing dynamically at the input.

To achieve component-type PID mapping, a set of mapping rules are applied to the incoming PID which matches a specific filter. Several rules/filters can be added, and one PID may match

more than one rule. However, only one rule (the one with the higher priority) will be applied to the mapping of the PID.

For example:

Input	Output
Daytime	
501 (Video)	600 (Video)
502 (Audio, nor)	601 (Audio, nor)
503 (Audio, swe)	
510 (TTX)	
Evening	
501 (Video)	600 (Video)
502 (Audio, eng)	601 (Audio, eng)
505 (TTX)	505 (TTX)

A set of rules fulfilling this purpose would be:

Input	Component Type	Language	Incoming PID	Mode	Outgoing PID
1	mpeg-audio	nor	*	REMAP	601
2	mpeg-audio	eng	*	REMAP	601
3	mpeg-video	*	*	REMAP	600
4	ttx	*	505	PASSTHROUGH	*
Default	*	*	*	STOP	*

The default rule will in this example stop the input PID 503 as no rule finds a match. Also the TTX PID will be stopped during daytime as the input PID does not match the PID based rule.

With many rules potentially being active at the same time, it may be hard to foresee the result. Consequently the GUI reflects the evaluated output PID line-up dynamically as the rules are defined.

The following manual mapping modes are available:

Stop	The input component referenced will be stopped
Remap	The input component referenced will be remapped to a specified output PID – this PID will not be reallocated by the system to prevent PID clashes.
Passthrough	The component will be mapped to the same output PID as its input PID – this PID may be reallocated by the system to prevent PID clashes.

In systems with dynamic behavior on the input, it is recommended to create a rule for all PIDs to be added to the output if a fixed and dedicated line-up is required. This way, it is easier for this system to decide what action to take when the input changes. In some cases, a lack of definition will force the system to temporarily stop PIDs.

For example, a TTX PID in Passthrough mode changes on the input to a PID value already assigned manually on the output. In this case, the PSI system will stop the signaling of that TTX PID until the system has decided what to do with the TTX PID – i.e. automatically map it to a new, free PID value.

i	In an output service, if a video PID with PCR is stopped then this will be stopped on the output, but the PCR can be extracted and output. This can be used in cases where you would like to create a radio service using a PCR from a signaled video PID in the service.

7.3.8.2 Component multiplexing

With Service component multiplexing it is possible to add an Audio, Teletext, DVB Subtitle, AIT, HbbTV-carousels or private component from another input source to an outgoing service. This PID will be multiplexed into the outgoing stream and signalled in the PMT of the service.

Adding components to an outgoing service is done on the Components Mapping section by clicking the plus button. This will show a selection dialog where all valid Audio, Teletext, DVB Subtitle, AIT, HbbTV-carousels or private PID that can be selected for output.

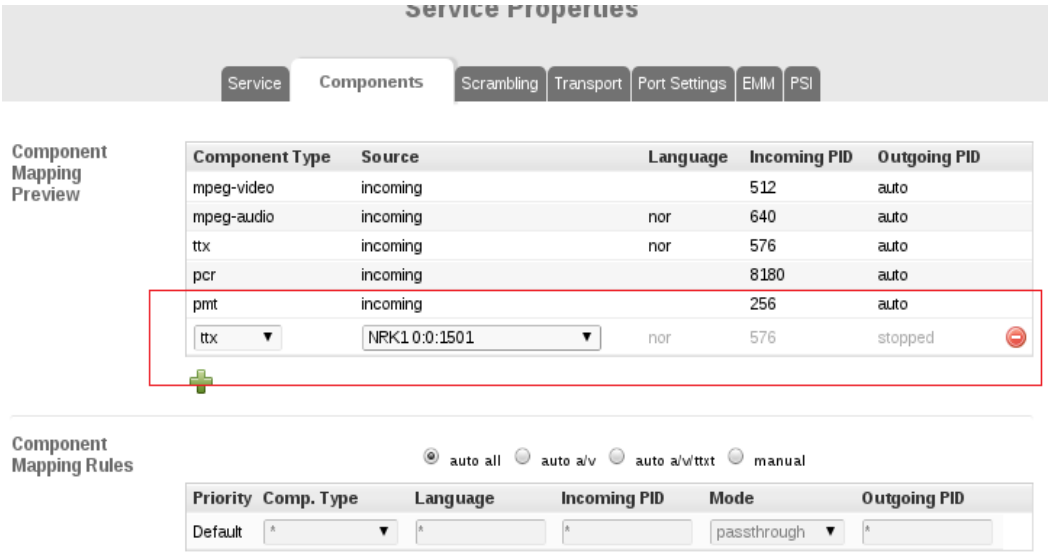


Figure 7.25 - Component multiplexing

	Any input Audio, Teletext/DVB Subtitle source that is not synchronized with the output video (ie PTS) could possibly have issues with display. Users must ensure that the added component is synchronized for this feature to be enabled correctly. If the PID is not synchronized with the output video, no alarms will be raised.

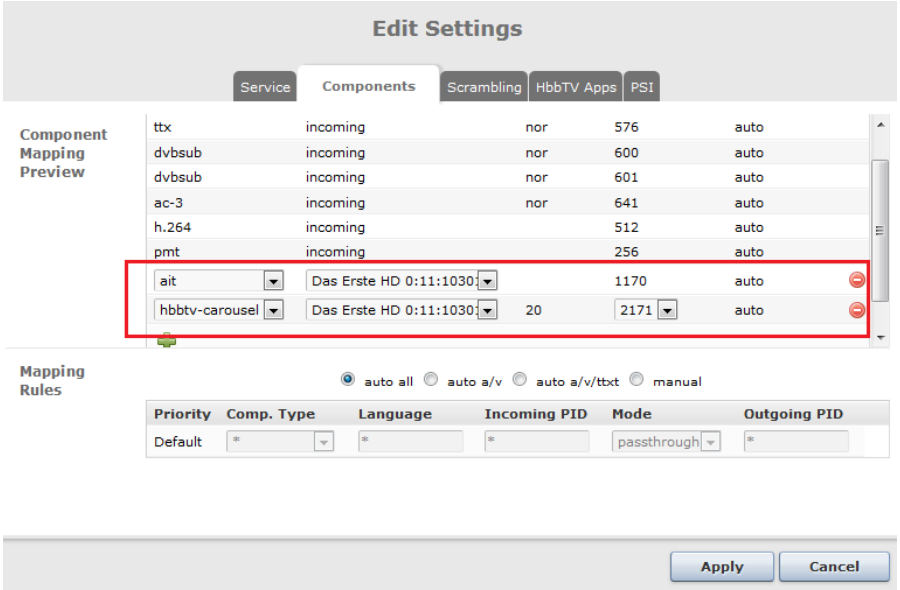


Figure 7.26 - AIT, HbbTV Component Multiplexing

7.3.8.3 Component mapping for Teletext descriptors

When adding a manual component mapping for Teletext components, it is possible to override the teletext descriptor and create a new description for the PMT.

The following mapping modes are available on after enabling the PSI override and clicking the 'edit' button:

Type	Specific type as Teletext or VBI data.
Type of Teletext	Specific type as Teletext • Initial • Subtitle • Additional Info • Programme Schedule • Hearing Impaired Subtitle
Language	Specific Language for teletext descriptor.
Page	Specific page number for teletext descriptor.

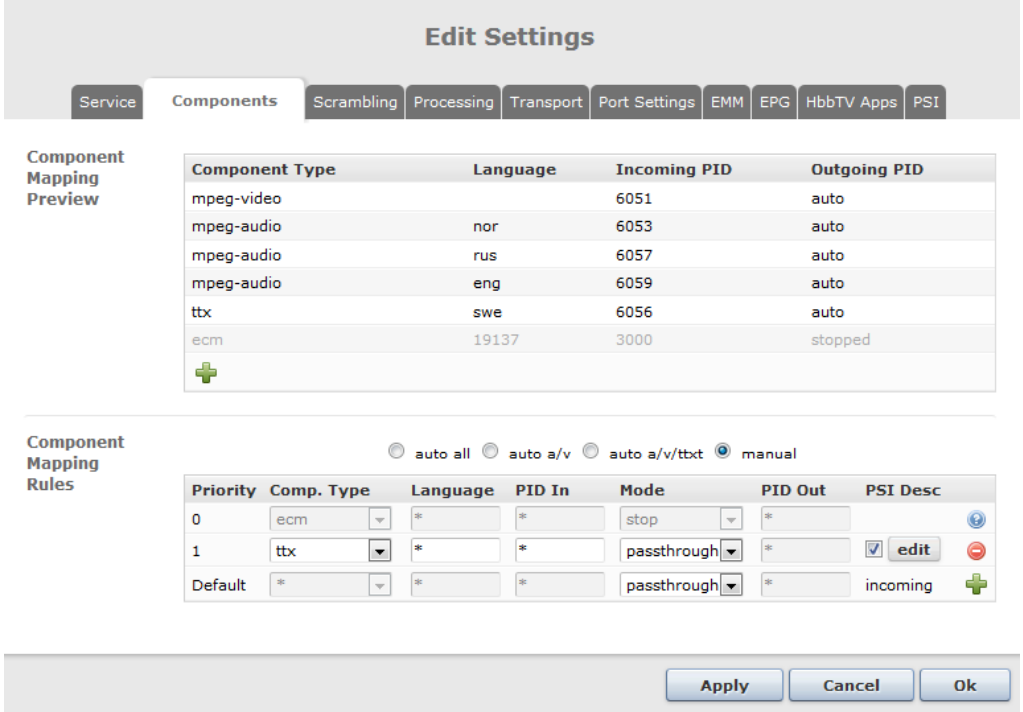


Figure 7.27 - Components Tab teletext descriptor

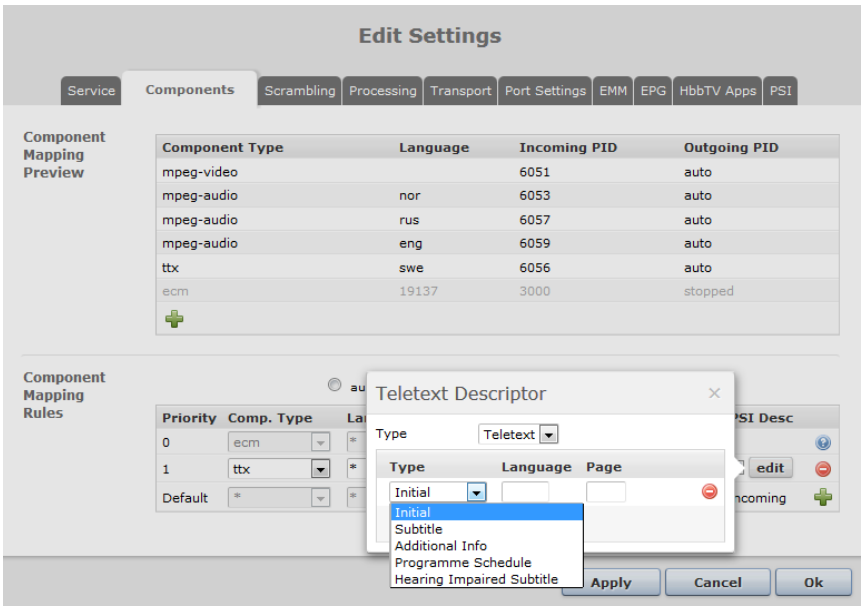


Figure 7.28- Components Tab teletext descriptor properties

7.3.9 Scrambling

The **Scrambling** tab handles all aspects of encryption apart for the EMM which is handled by a separate **EMM** tab (Section 7.3.2).

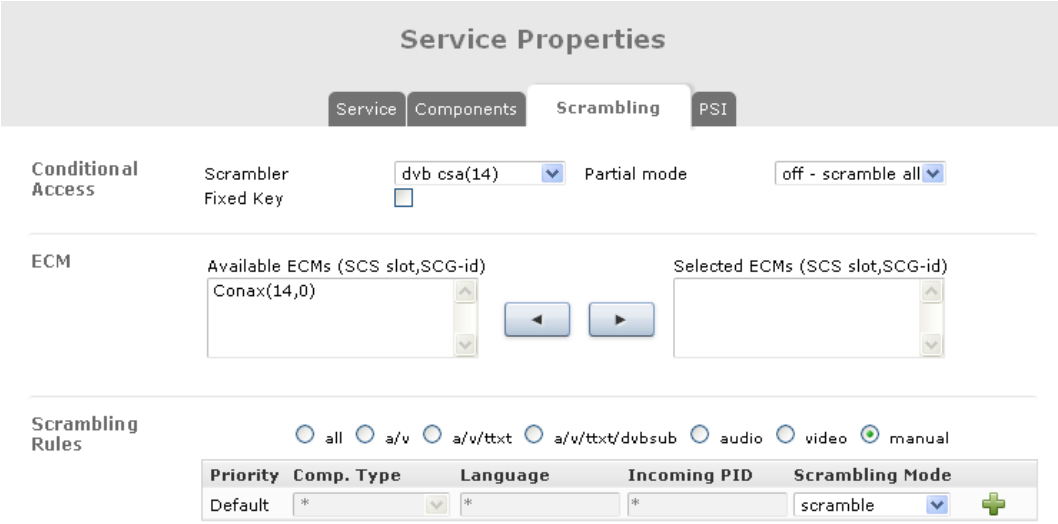


Figure 7.29- Scrambling Tab for IP SPTS

Scrambler	The scrambler card to be used for the scrambling of this service
Partial Mode	Defines the percentage of the packets to be scrambled. A service which is partially scrambled requires less processing capacity for the receivers.
Fixed Key	Enables BISS scrambling Contents of the Scrambling tab will change accordingly (see figure below) with the **ECM** section being replaced by the **Control Word** section.
Available ECMs	A list of predefined ECMs – select which ECM to use for the encryption. Multiple ECMs may be selected but only if they are defined with the same CW, i.e. they are created with the same SCG_ID. When an ECM is selected, all ECMs not containing the same CW will be tagged red, and will not be selectable.
Scrambling Rules	Specifies which component types to scramble • all – automatic for all components • a/v – audio and video only • a/v/ttxt – audio, video and teletext • a/v/ttxt/dvbsub – audio, video, teletext, and DVB subtitling • audio – audio only

- video – video only
- manual – set the scrambling rules manually

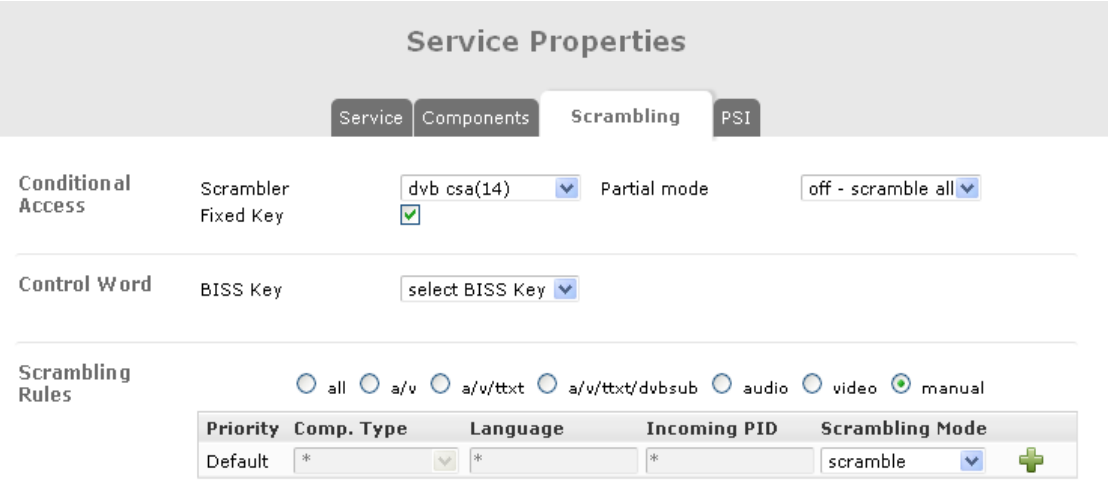


Figure 7.30 - Scrambling Tab for IP SPTS with BISS

BISS Key	Lists all BISS keys available.

7.4 Output Port Settings

7.4.1 IP Output module

The following parameters: **IP**, **Port**, **RTP**, **Time to Live**, **Type of Service** and **MPEG packets/Frame** are populated based on the values given in **Default Stream Properties** panel (see Section 7.3). The remaining parameters: **Rate [Mbps]** and **Source Port** are described below.

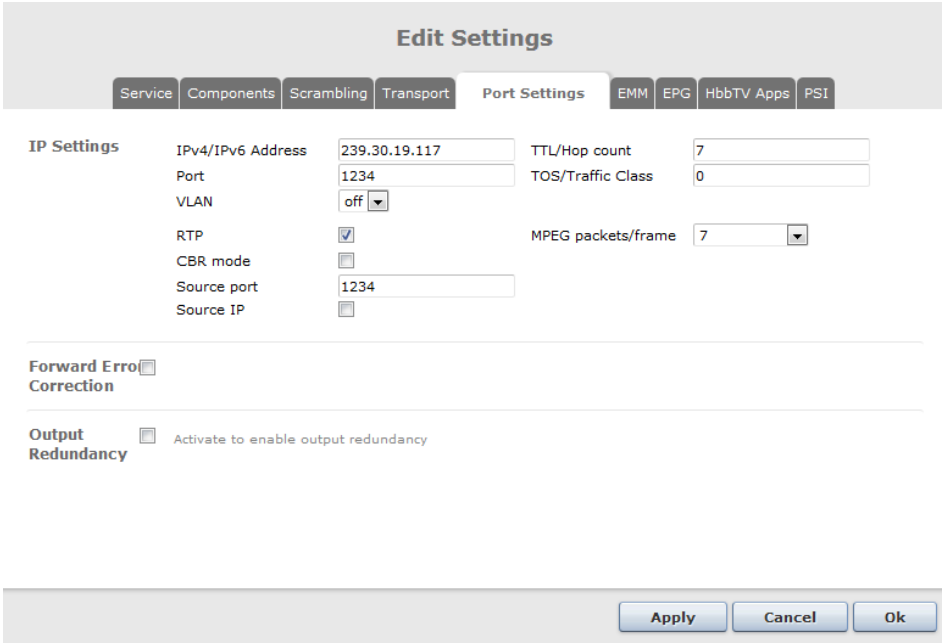


Figure 7.31 - Port Settings Tab for IP Modules

Rate (Mbps only)	Total CBR output rate
CBR Mode (SPTS only)	Enables an SPTS output to be sent with constant bit rate. CBR mode ☑ Rate 0.00 Mbps *Figure 8.32 - Enabling CBR Mode* Enter the desired output rate. If the service exceeds this rate, the system will report an output buffer overflow alarm and drop the packets.
Source Port	The IP source port of the output multicast. In an Output Redundancy configuration, this value will be replaced with the virtual source address.
Source IP	The source IP address override feature allows configuration of the source address of an IP output multicast or unicast to any IP address.

	If no value is set, the address of the data port is used.
VLAN	Displays available VLANs; the default value is off. Select a suitable VLAN if required.

Refer to Section 7.3 for details on the parameters for **Port Settings**.

7.4.1.1 Forward Error Correction (FEC) Related Parameters

If the IP output module contains the Forward Error Correction (FEC) license, the Port Settings tab will contain FEC parameters. This feature can be enabled with the **Forward Error Correction** checkbox, the following parameters will appear.

Figure 7.32 - Forward Error Correction Panel for IP Modules

The following parameters are available:

FEC Mode	FEC mechanism can be used to correct errors that occur during transport. Choose either one: • COP3 – Level A: Use FEC Columns only (protects again burst loss) • COP3 – Level B: Use both FEC Columns and Rows (provides additional protection against Random Packet Loss) A FEC Matrix is generated and transmitted on two separate UDP ports: • FEC columns on UDP Port +2, and when using level B: • FEC Rows on UDP Port +4. When FEC is enabled, it is important that the UDP ports reserved for the FEC system is not occupied by other traffic.
Dimensions (LxD)	The FEC matrix, L=Columns, D=Rows; value ranges from 1 to 20.

7.4.1.2 Output Redundancy Related Parameters

The Output Redundancy fields are to be used in a system configuration where two IP modules or services are configured in a redundancy scenario. Refer to Section 10.4 for further details.

Figure 7.33 - Output Redundancy Panel for IP Modules

The following parameters are available:

Redundancy Control	Provides the criteria for when to disable the output. Choose from: • All – Output TS is disabled if all services are in error • Majority - Output TS is disabled if majority of services (with high priority) are in error • One - Output TS is disabled if one service is in error • None - Output TS is not automatically controlled

Please note that Source IP needs to be enabled and configured correctly if Output Redundancy (OSPF) is enabled.

7.4.1.3 Port Settings for IPv6 output

For IP output modules with IPv6, the Port Settings tab is shown below. When using standard

IPv6 address syntax (128 bits, ':' instead of '.'), the GUI will interpret the address as an IPv6 address.

7.4.2 Cloned IP Output Module

The Cloned IP Output module has two physical data ports which both contain the same output represented by one internal port. Service configuration is performed to the internal data port, and the same service is then output on both physical data ports.

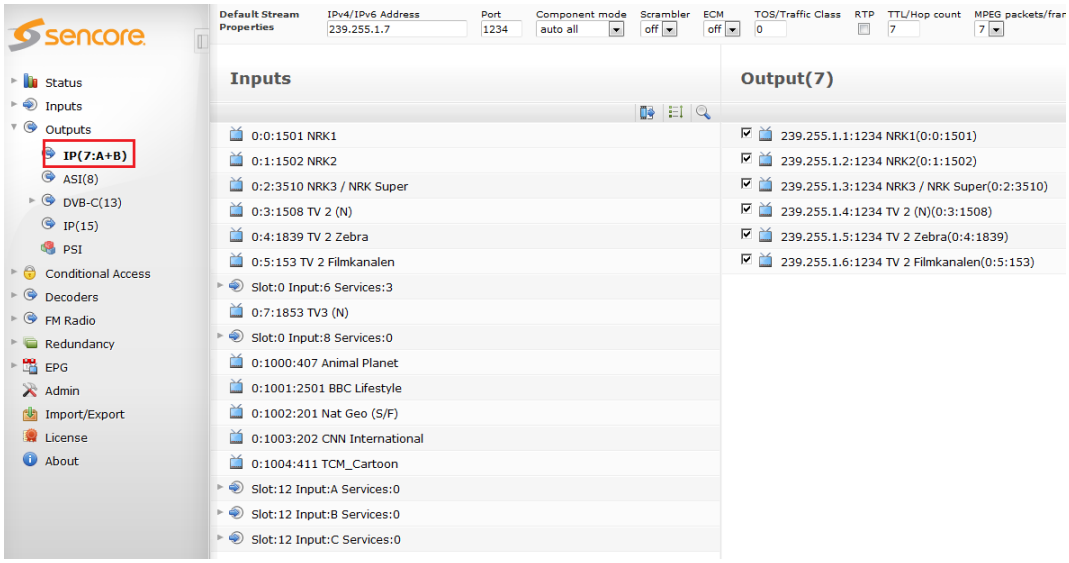


Figure 7.34 – Cloned IP Output Module.

Configuration of the output streams and ports are similar to that of the standard IP output and these details are shown in 8.4.1.

7.4.2.1 Unique Configuration on two ports

IP settings can be configured different on the two IP ports in cloned output mode. Parameters that are able to be changed, can be selected and the new value entered. By default, the properties of port A are used.

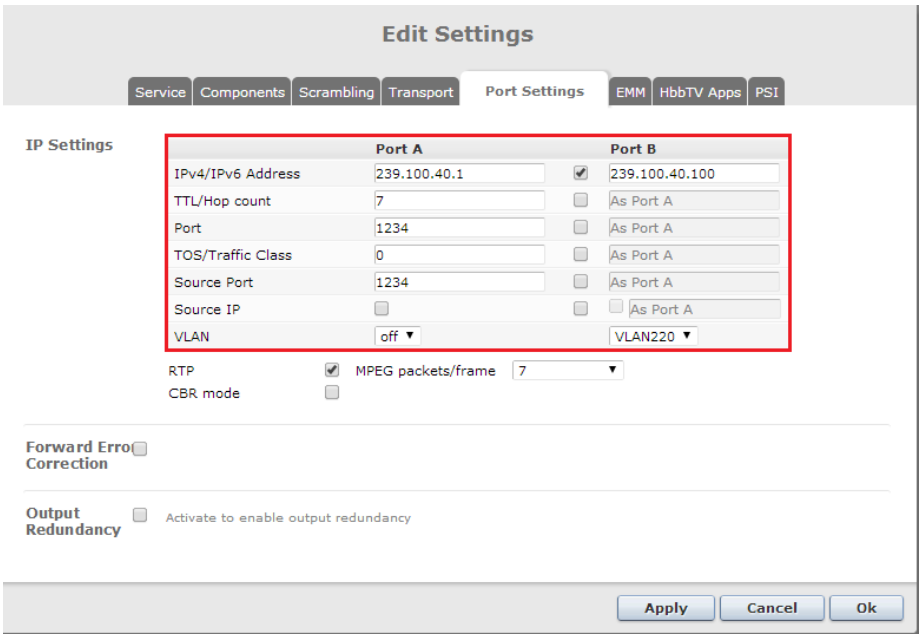


Figure 7.35 –Unique configuration on two output ports

7.4.2.2 Exclusive Output Port Mode

While in Cloned IP output mode, it is possible to enable Exclusive Output in which the following rules are followed:

Link on both ports (Default)	Port A is active Port B is inactive (ie no output bitrate)
Link on B port only (link down on A port)	Port A is inactive (link down) Port B is active
Link on A port only (link down on B port)	Same effect as default

When the module is in exclusive output mode only one port is outputting transport streams at once. If link is down on one port, the other port will take over.

Where port A is the default port and port B is a backup, used only when port A has link problems. When link of port A comes back, the system will switch back to use port A (ie reverting)

In order to enable Exclusive Output Port, the Cloned IP Output module must first be changed to this mode. This is configured in the Maintenance Center and you can find further details on this procedure in the Upgrade Guide.

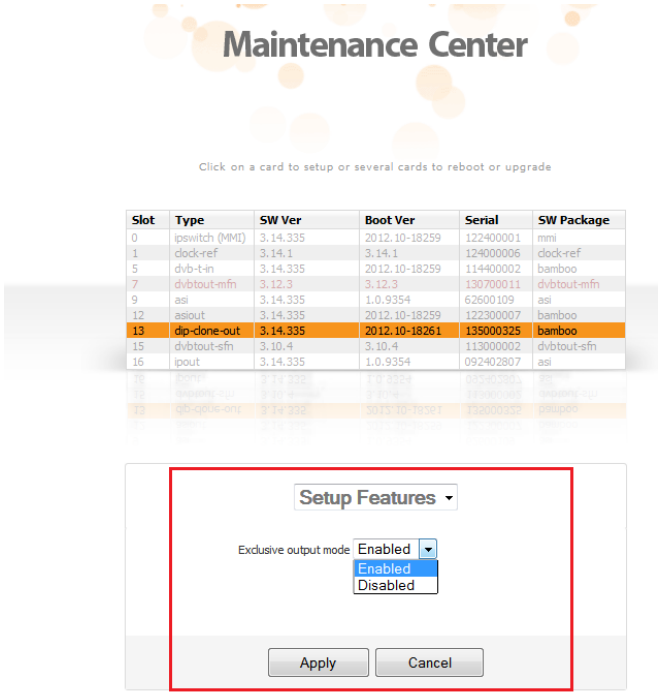


Figure 7.36 – Conversion to Exclusive IP Output Module.

When this feature is enabled this will be displayed in the **Redundancy->Output Redundancy** status page.

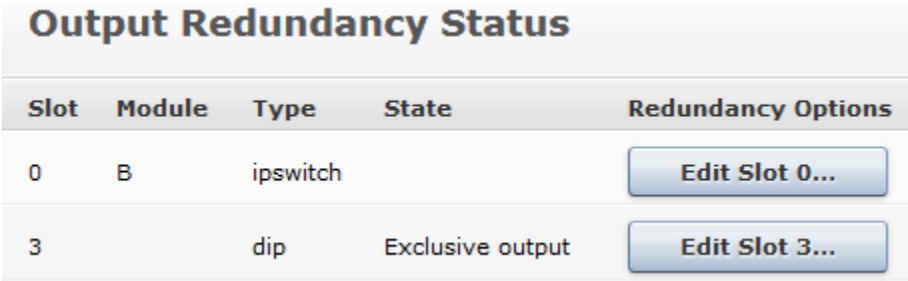


Figure 7.37 –Exclusive IP Output Module.

7.4.3 Dual IP Output

The Dual IP output module allows two individual output interfaces to be connected to network sources, but for the system, this is exactly the same as two IP output cards. The output streams can be either SPTS (VBR or CBR mode) or MPTS.

All function and status normally associated with IP output modules are present but the total Output Bitrate for both IP ports cannot exceed 850 Mbps or 250 services, ie the limit is shared between the two ports.

Outputs

Slot	Type	Services	Tot Rate	Max Rate	Min Rate	CC Errors	ATV CC Errors	Output Rate	Used Ports
0	ipswitch	7	42.996			0	0	91.192	7/250
4	asi-t2gw	0	0.000			0	0	0.000	0/250
	Port A - PLP 0	0	0.000					0.000	
	Port B - PLP 0	0	0.000					0.000	
8	dip-out	90	454.840			0	0	476.124	90/250
8	dip-out	90	394.726			0	0	420.893	90/250
15	ipout	0	0.000			0	0	0.000	0/250

Figure 7.38–Dual IP Output Configuration

7.4.4 ASI Output Module

For ASI modules, the **Port Settings** tab is shown below:

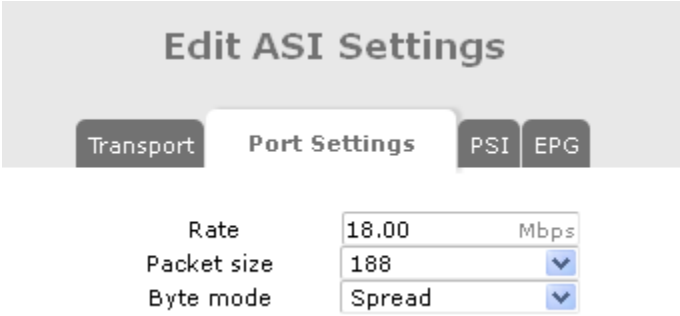


Figure 7.39 - Port Settings Tab for ASI Modules

An ASI output module can output up to four separate MPTSs. The ASI output configuration is similar to that of an IP MPTS output, except for a different **Port Settings** tab.

The following ASI parameters are available:

Rate [Mbps]	Total ASI output rate - the stream will be stuffed with NULL packets to maintain the correct fixed bit rate.
Packet Size	TS packet size (188 or 204)
Byte Mode	Byte mode specifies how the TS data is transported over the ASI link: **Burst Mode** – In burst mode, all TS-data-bytes are sent without any idle symbols in between. Maximum data rate in burst mode is 213 Mbps per port. **Spread Mode** – In spread mode, the ASI specification requires at least one idle byte between each data-byte, and each packet start indicator (0x47) is preceded with at least two idle bytes. The ASI output stream in spread mode guarantees that each data-byte is preceded with two idle symbols. This effectively reduces the maximum data rate to 1/3 of the maximum ASI output rate, i.e., (213/3) Mbps. If higher rates are required, use burst mode.

7.4.4.1 MIP Inserter for ASI Output

Please refer to the Terrestrial Solution Configuration Guide for more information

7.4.4.2 ASI Cloned Output

The ASI cloned Output mode allows you to set any available output port as a “monitor” port for an active one. Service configuration that is performed to the active port is then output on both physical ports.

In order to configure this, on the active port you can select the **Port Settings** tab. Here you have the option to choose an inactive port in which to be used as a monitor port. Once this

setting is applied, the inactive port will not be able to be configured in the GUI, but will be a duplication of the active port.

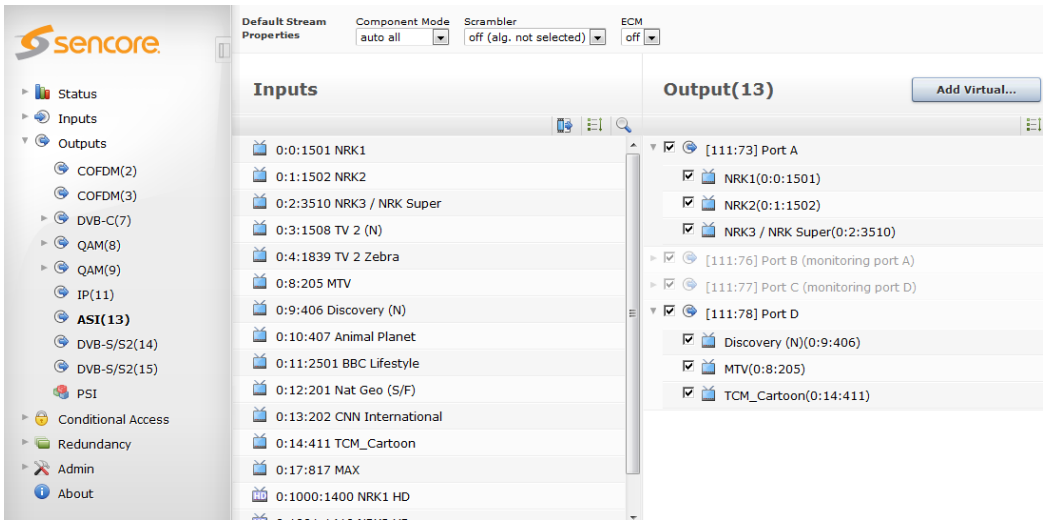


Figure 7.40 – ASI Cloned Output status

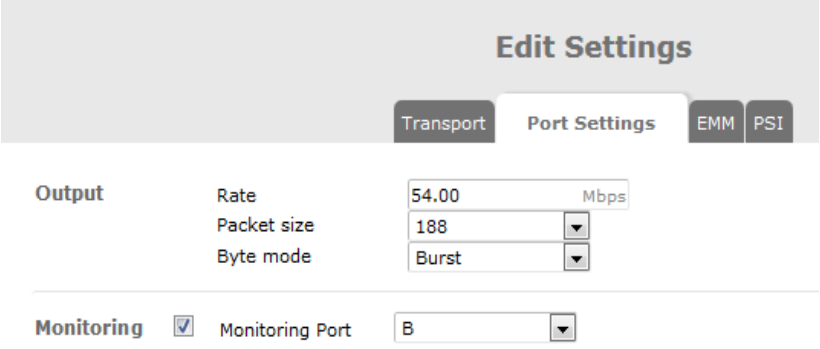


Figure 7.41 –ASI cloned Output configuration

7.4.5 QAM Output Module

Unlike other modules, the QAM module's **Port Settings** tab is not modifiable as the parameter values are set under **Outputs → QAM → Device setup.**

Although the QAM output has two physical outputs, it carries up to sixteen transport streams. Internally these streams are modulated by four block QAM modulators each carrying up to four channels.

The RF connectors on the output are configured as such: the first two block modulators A and B, output on the port marked as **A+B**, the last two block modulators C and D output on the port marked as **C+D**.

The configuration of the QAM modulator parameters is available in a separate node in the **Navigation Pane**, called **Device Setup**, which is beneath each QAM output node.

The QAM module supports the ITU-T J.183/JCTEA standard where output several transport streams can be multiplexed into one transport stream using Time Division Multiplexing (TDM). Currently, this standard is supported for transparent streams only. To enable J.183/JCTEA support, simply click the corresponding check box.

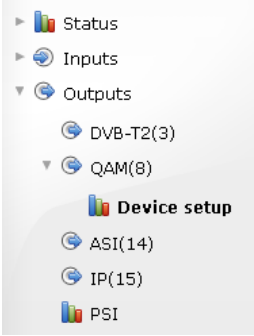


Figure 7.42 - Device Setup Node

When **Device Setup** is selected, both modulators can be configured from the resulting dialog. The figures below show the **Device Setup** node for Annex A/C and Annex B QAM modulators; correct values for these parameters can be obtained from respective network operators.

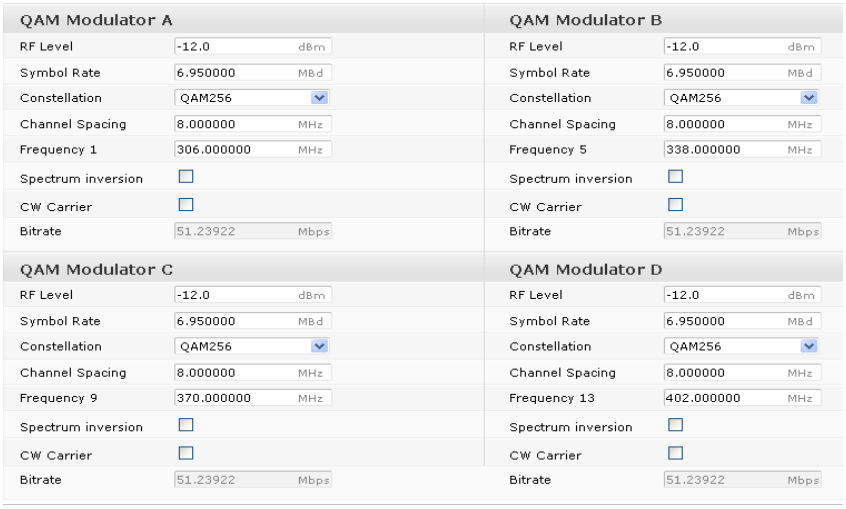


Figure 7.43- 16QAM Annex A/C Setup

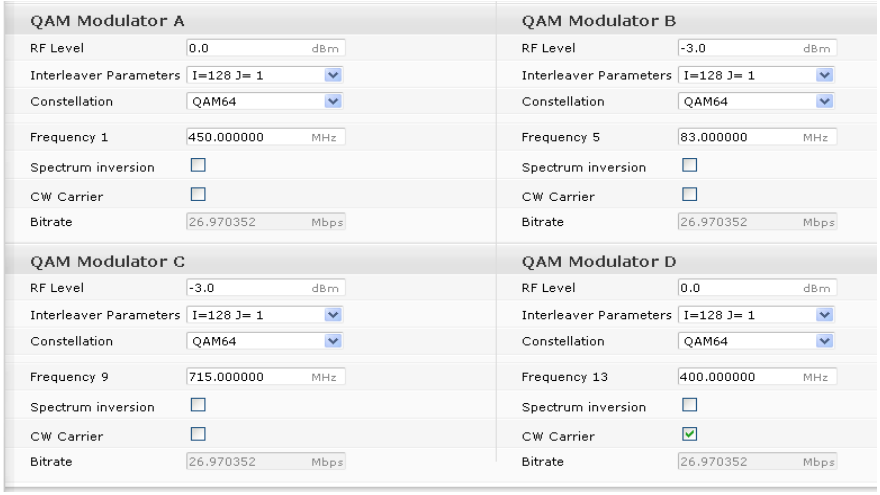


Figure 7.44- 16QAM Annex B Setup

Listed below are the parameter limit-values for the QAM Output Module:

Annex A/C		**Annex B**	
Symbol rate	4.7 → 7.0 MBd	**RF Level**	-12 → +2.2dBm
RF Level	-12 → +2.2 dBm	**Interleaver**	I_{max} = 128 J_{max} = 16
Constellation	QAM16 → QAM256	**Constellation**	QAM64 & QAM256
Channel spacing	5 → 8 MHz		

7.4.6 COFDM Output Module

For COFDM modules, the **Port Settings** tab is shown below:

-

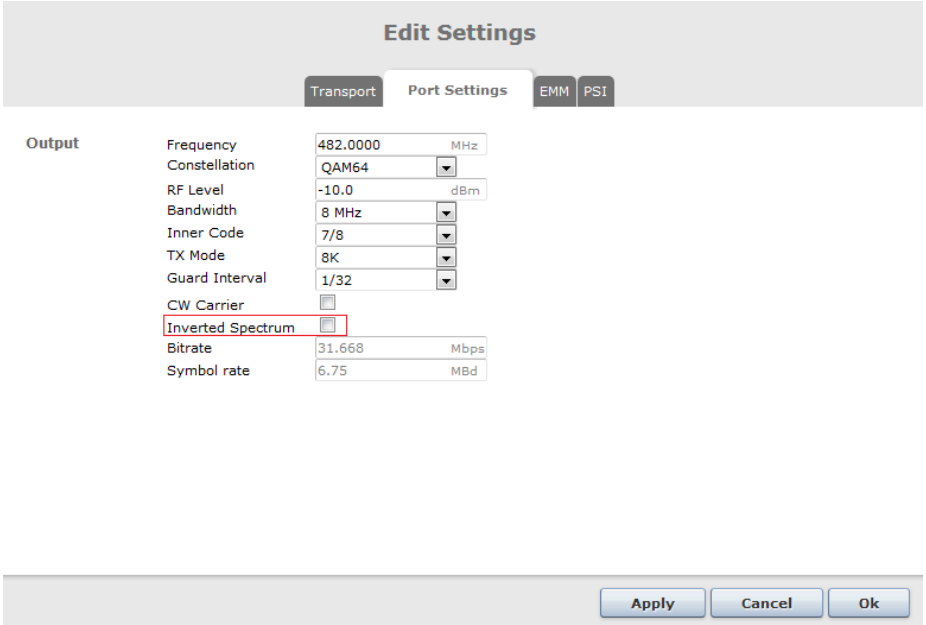


Figure 7.45 - Port Settings Tab for COFDM Modules

The COFDM output module outputs four modulated channels carrying one MPTS each. The module is equipped with two physical RF connectors: the first two channels A and B, output on the port marked as **A+B**; the last two channels C and D output on the port marked as **C+D**.

The **Port Settings** tab for a COFDM module allows for modulation settings of each individual channel to be modified.

The following parameters are available:

Frequency	47 → 862MHz
Constellation	Choose either: • QPSK • QAM16 • QAM64
RF Level	-10 → +2.2dBm
Bandwidth	5, 6, 7, or 8MHz
Inner Code	1/2, 2/3, 3/4, 5/6, or 7/8
Tx Mode	2K or 8K
Guard Interval	1/32, 1/16, 1/8, or ¼
CW Carrier	Enables Continuous wave signal, disable modulation and only output a single carrier at the configured frequency (for test only).
Inverted Spectrum	Enables Inverted Spectrum on Output signal.

Bitrate and **Symbol rate** cannot be modified as these two parameters are dependent on other modulation parameters; hence they are calculated accordingly. In addition, the RF level is subject to change in future releases – refer to the most recent data sheet for the correct value.

7.4.7 DVB-S/S2 Output Module

The DVB-S/S2 output module is available in two with two different output bands, IF and L-Band. Depending on the module there are different parameters available for configuration. For the IF DVB-S/S2 output module, the **Port Settings** tab is shown below:

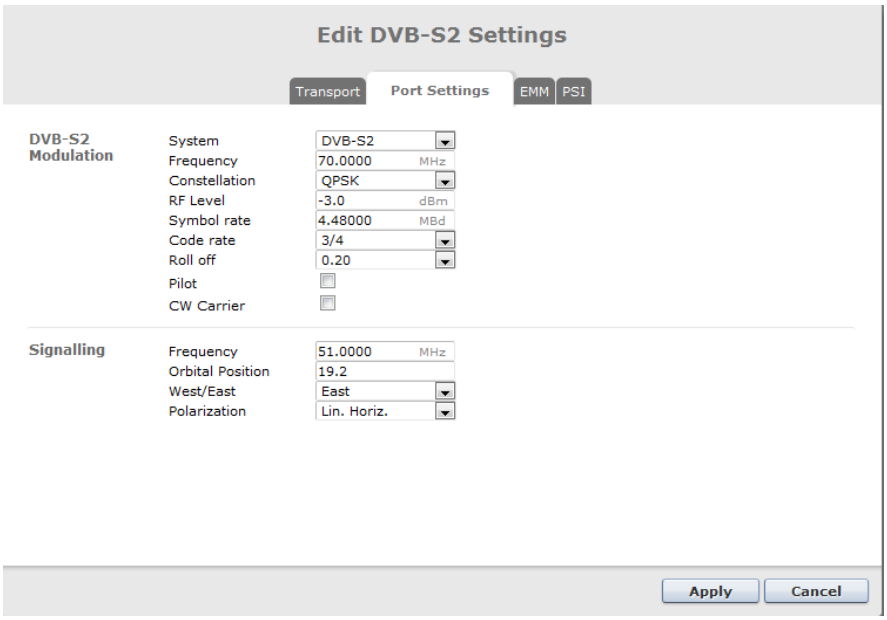


Figure 7.46- DVB-S2 Output –Port Setting Configuration

The following parameters are available.

Modulation:

System	The following option can be selected from system • DVB-S • DVB-S2
Frequency	Specify the DVB-S2 frequency in MHz. For the IF output, valid range is 42 – 200Mhz. Default value is 70 MHz. For the L-Band output, the valid range is 950 – 2150 MHz.
Constellation	Specify the Constellation as below • DVB-S: QPSK only • DVB-S2: QPSK, 8PSK,16 APSK, 32 APSK
RF Level	Specify the RF Level in dBm, valid range is -15 – 0 dBm.
Symbol Rate	Specify the symbol rate in MBd, valid range is 1-45 MBd.
Code rate	Specify the Code rate as below • DVB-S: ½, 2/3, ¾, 5/6, 7/8 • DVB-S2: ¼, 1/3, 2/5, ½ 3/5, 2/3, ¾, 4/5, 5/6, 8/9, 9/10

Roll off	Specify the Roll off as below • DVB-S:0,35 • DVB-S2: 0.2, 0.25, 0.35
Pilot	Enables the pilot carrier
CW Carrier	Enables Continuous wave signal. This will disable the modulation and only output a single carrier at the configured frequency
Inverted Spectrum	If enabled, the output spectrum is inverted

Signaling:

Frequency	Downstream frequency to be signaled in the output NIT
Orbital Position	Ex.19.2
West/East	West or East
Polarization	Lin Horizontal/vertical Circular Left/ Right

7.4.7.1 Linear Pre-correction on DVB-S/S2 Output.

In order to compensate both linear and nonlinear distortions in the transmission chain, it is possible to adjust the modulator output to match these characteristics. This is done via the precorrection configuration page. When using the linear precorrection algorithm, both Gain and Group Delay correction is supported.

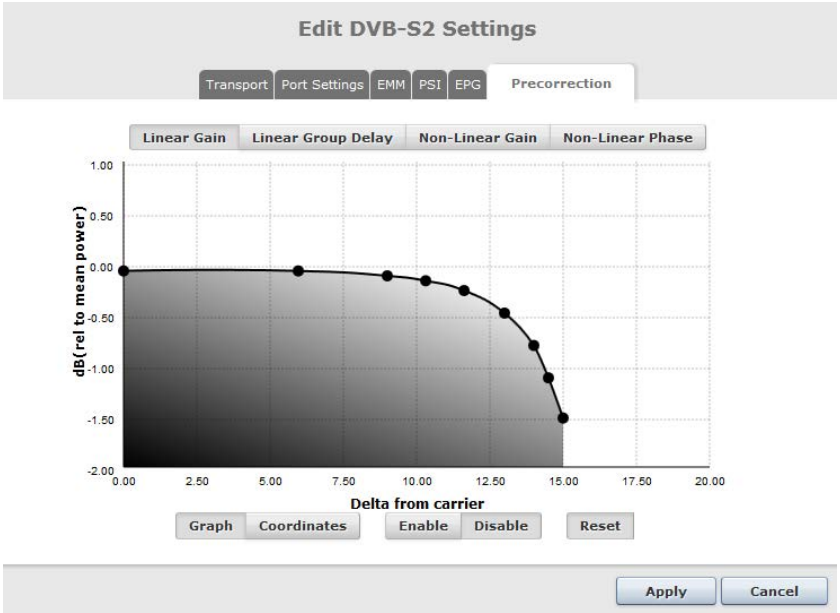


Figure 7.47- DVB-S2 Output –Linear Precorrection

The graphical view for Gain and Group delay consist of two graphs, the filter characteristics of a transmission chain (provided by the user) and the system response utilizing the optimized precorrection filter computed on the MMI card.

!	Please note that the optimization algorithm for group delay contains some random elements and might not give the desired result 100% of the time. Since the optimization runs only if new information is provided, to the user will have to change one value slightly before pressing **Apply** to re-optimize and obtain the desired result.

The graphical view may also be switched to a textual view where the points can be added and changed. This can be done by pressing the co-ordinates button. In this view, the graph window ranges may also be changed through “Min X, Max X” and “Min Y, Max Y”. This values can be chosen freely within reasonable values (Gain: Min X ≥ 0, Max X ≤ 35, Min Y ≥ -5, Max Y ≤5 and for Group Delay: Min X ≥ 0, Max X ≤ 35, Min Y ≥ 0, Max Y ≤ 300). The restrictions for the points are as following:

Gain:

- Each X-value has to be unique.
- Y has to decrease with increasing X
- At least 5 points.
- Only two decimals places.

Group Delay:

- Each X-value has to be unique.
- Y has to increase with increasing X
- At least 5 points.
- Only two decimals places.

7.4.8 DVB-T2 Output Module

For DVB-T2 output modules, the **Port Settings** tab is shown below:

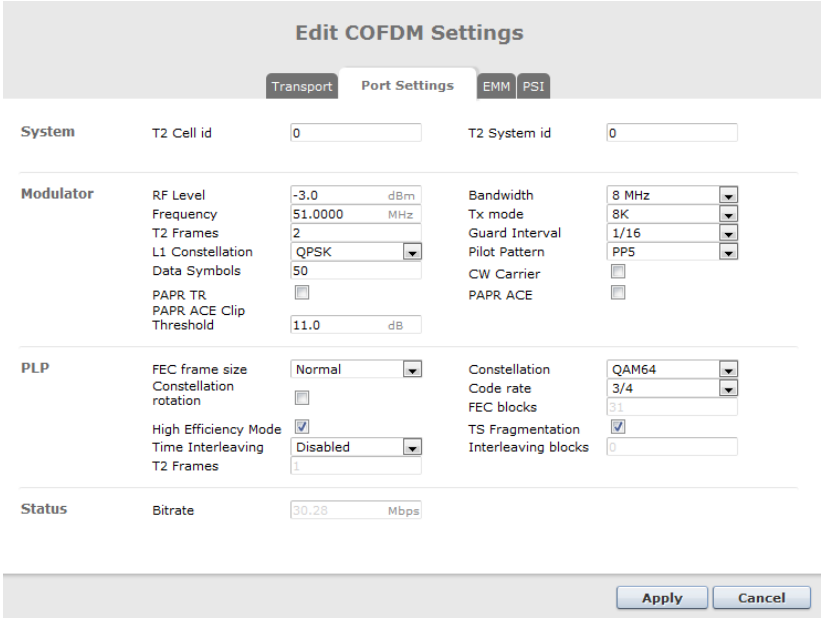


Figure 7.48- DVB-T2 Output – Port Setting Configuration

Modulator

RF Level	RF level measured in dBmV
Frequency	Currently tuned frequency in MHz
Bandwidth	Bandwidth of the currently tuned channel
CW Carrier	Enables continuous wave signal (For test only).

Status

Bitrate	Shows the current effective bitrate of the output port

The available configuration parameters in the GUI will not be documented in detail. The parameters are according to the DVB-T2 specification, ETSI EN 302 755 v. 1.2.1 (2010-10). The configuration of a DVB-T2 transmitter requires a good working knowledge of this specification as well as the DVB-T2 implementation guidelines, ETSI TS 102 831. Chapters 4 through 6 of the implementation guidelines is a good place to start with regard to a high level understanding of the parameters involved.

The user interface attempts to verify that the chosen combination of parameters is valid. Invalid entries will be highlighted in red and “Apply” will not work unless errors have been corrected.

The “FEC blocks” and “Bitrate” are status parameters that indicate the expected payload carrying capacity of the chosen parameters.

More information regarding the configuration of the T2 output module can be found in the Terrestrial Solution Configuration Guide

7.5 Output Options

7.5.1 Enable/Disable Services in Outgoing MPTS.

It is possible to enable and disable a service in an MPTS output in addition to enable/disable the complete MPTS.

In order to do this, use the tick box on the output of each service in a MPTS once expanded.

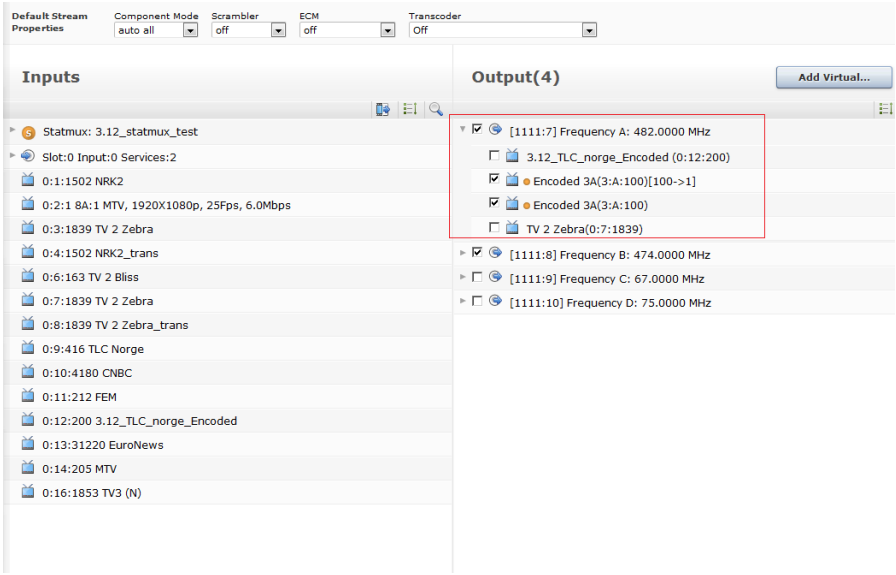


Figure 7.49 – Enable/ Disable services in MPTS.

7.5.2 Virtual MPTS Output

This feature provides the capability to generate the NIT including Delivery System Descriptor for MPTS outputs currently not configured by the unit. The Delivery System Descriptor is defined as part of the MPTS setup; data inserted will be included in the NIT.

For the ASI, COFDM, or QAM output, the virtual output provides this feature. It may be added from the **Outputs** page using the **Add Virtual** button enabling the signaling of other transports not present in the same unit.

Clicking the **Add Virtual** button displays a dialog similar to the one shown below, allowing you to insert the **Network ID**, **TS ID** in the **Transport** tab, followed by the QAM configuration (for this example) in the **Port Settings** tab.

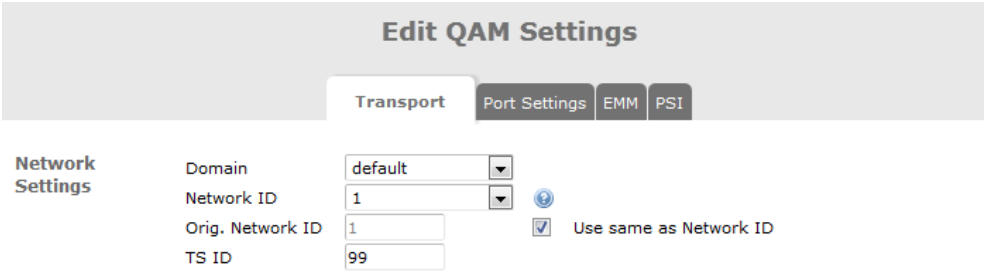


Figure 7.50 - Transport Tab for the Virtual QAM Output

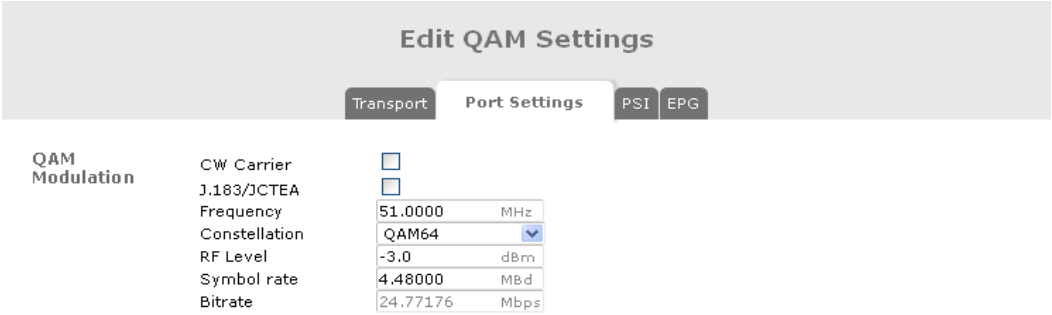


Figure 7.51- Port Settings Tab for the Virtual QAM Output

7.5.3 MPTS Transparent Mode

With MPTS Transparent Mode, an input stream is forwarded to the output without any processing, i.e. output equals input, including null packets (for modulated outputs, null packets will be removed and re-added to exactly fit the configured modulation bit rate).

When setting up a transparent stream, the **Add MPTS** button is **not** used. As with an SPTS, simply drag an MPTS from the list of available MPTS's over to the output pane. In the output pane, the name of a stream will indicate whether it is transparent or not (as shown in the figure below).

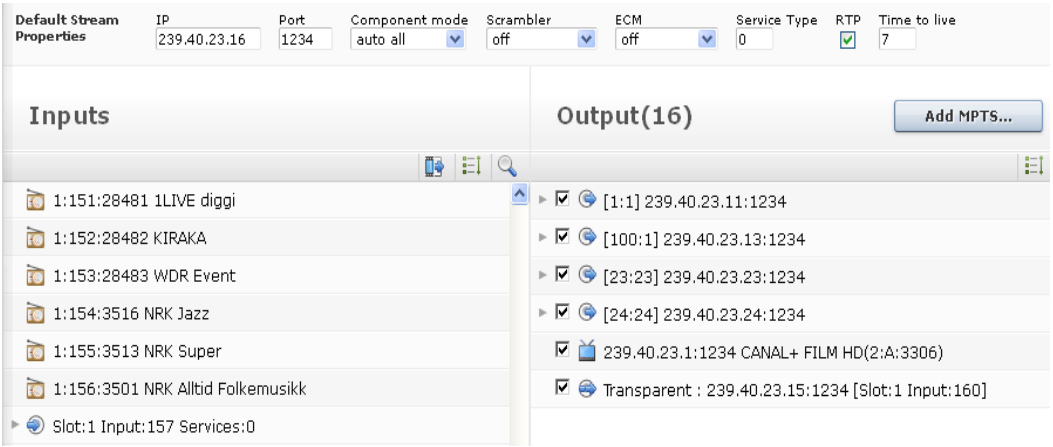


Figure 7.52 - Transparent Mode

7.5.4 MPTS Semi-Transparent Mode

The semi-transparent mode is a subset of the transparent mode. The semi-transparent mode allows the user to replace some selected components. Currently this feature allows for replacement of the *NIT table only*.To configure semi-transparent mode, create a transparent output, and then double click on it to access the **Stream Properties** dialog**.** Then, go on to the **Transparency** tab to configure the new NIT Source (**Generate NIT A**). In this mode, for IP and ASI output modules, null packets are always removed and re-added.

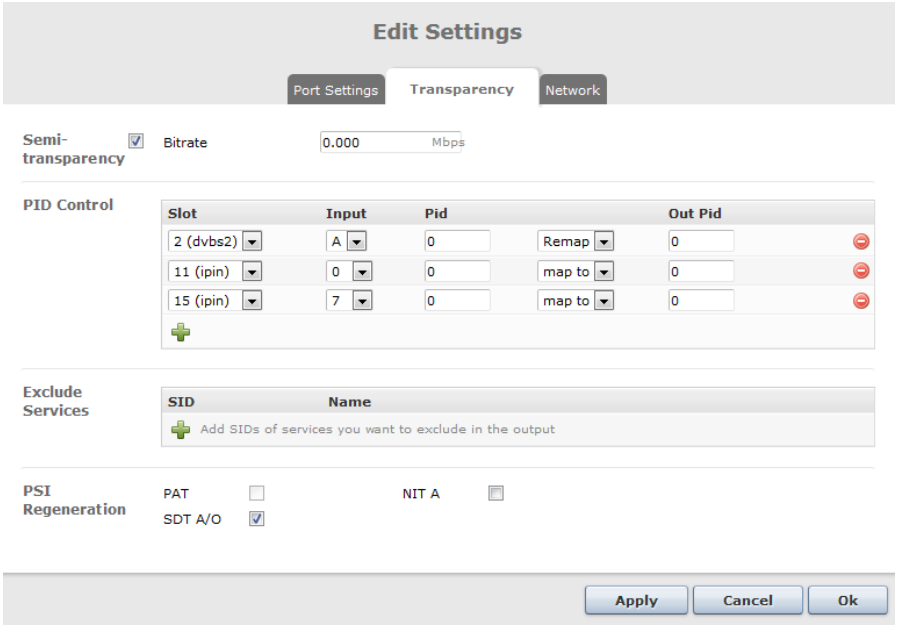


Figure 7.53- Stream Properties for Semi-transparent MPTS

The following parameters are available if enabled:

Bitrate	Bitrate in Mbps. This parameter is mandatory in Semi-transparent mode for IP output.
PID Control	When Semi-transparency is enabled, it is possible to both: - Stop PIDs from the transparent input source - Re-map PIDs from the transparent input source to a different PID ID - Import PIDs from another input source to the transparent output. It is possible to add multiple rules by clicking on the icon

Exclude Services	See below
PSI Regeneration	Depending on the Semi-transparent options chosen, it may be required to regenerate the following PSI tables: - PAT - SDT-Actual/Other - NIT-Actual This option is available to be enabled/disabled per table.

7.5.5 Service Filtering in Semi-Transparent Mode

Service filtering in Semi- Transparent mode enables user to enter SID of the services to be stopped. It is possible to click magnifying icon and select from list of services found on the input. When a service is added to the filter list, the following will occur:

- All PIDs that are part of a filtered service will be stopped.
- PIDs shared with non-filtered services are not stopped.
- PIDs explicitly mapped through/remapped by user (in the PID Import/Remap section), that belongs to a filtered service, will not be stopped.
- If PAT re-generation is enabled, PMT PIDs of the filtered services is stopped.

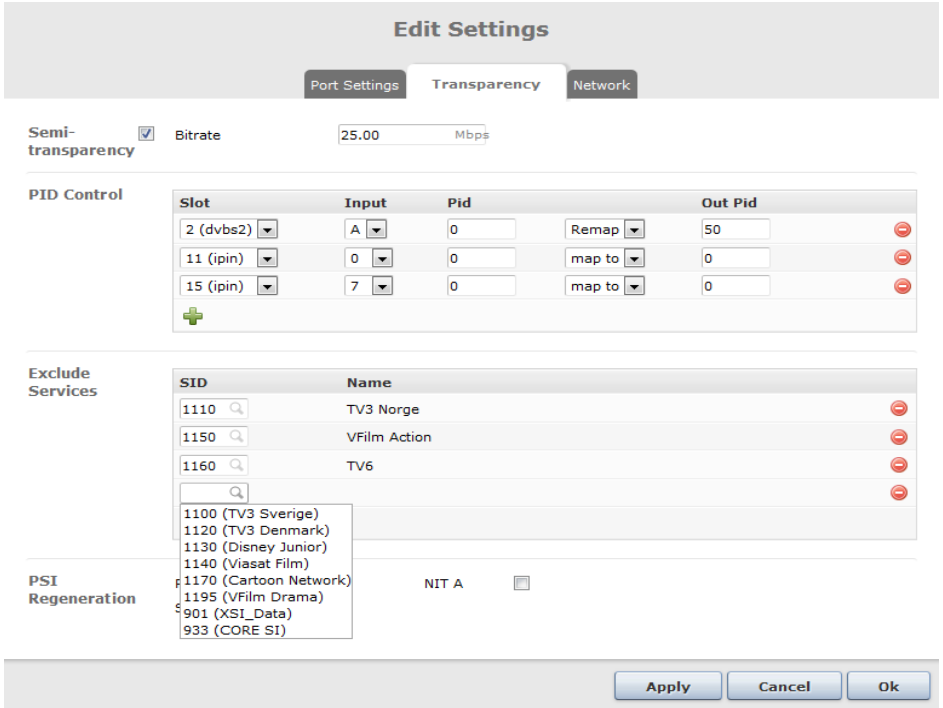


Figure 7.54 – Service Filtering

7.5.6 Service Priority Selection

For each service on the output it is possible to set the service priority and this determines from which services packets are dropped if the total rate exceeds the constant bit rate of the output MPTS.

This is configured from the Service tab under Service Properties for each program under an output MPTS.

Service priority is supported on all output cards. The default value for all services is high priority.

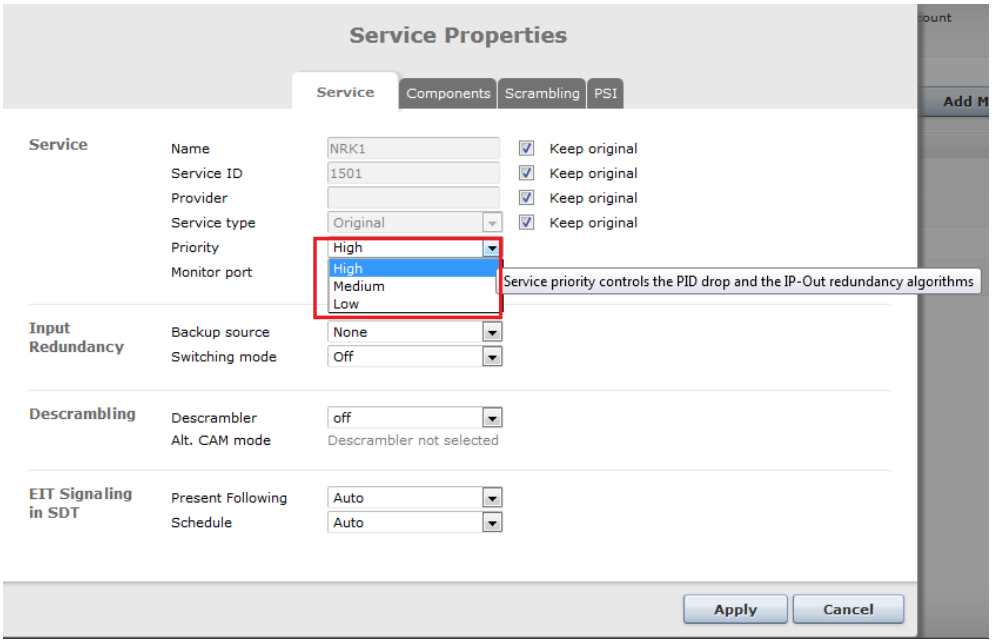


Figure 7.55– Service Priority Selection in service Properties.

If low or medium priority packets are discarded due to exceeding the band with limitations, the major alarm “Low/medium priority packets dropped” is set.

If the link is so overloaded that discarding all low/medium priority packets is not enough, the behaviour is to empty the output buffer.. If this happens, the critical alarm “Output buffer overflow” is set. This alarm will mask the “Low/medium priority packets dropped” alarm.

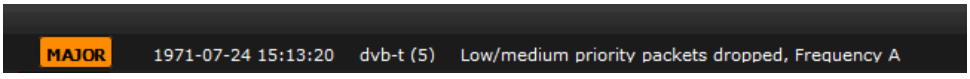


Figure 7.56– Alarm with Low/ Medium Packets dropped.

Any packets dropped due to service priority will be counted, and the total number is displayed per MPTS on the Output View.

Figure 7.57 – Packets dropped in Output View.

7.6 PSI/PSIP Configuration

The unit offers PSI/SI as well as initial PSIP regeneration support – with a table profile mode of either DVB or ATSC. This setting determines which tables are available for regeneration and subsequently, which tables will be listed in the GUI dialogs.

Below is an outline of the supported tables together with which profile(s) they are available in. DVB or ATSC tables that are not listed below are currently not supported.

Table	Available in Profile(s)	Default Playout Interval (ms)	Supported function
PAT	DVB ATSC	200	Generated by the unit
CAT	DVB	500	When CAT is in play mode then the CAT is generated by the unit. When the EMM is mapped from the input, using the include EMM on the Transport node, then the CAT Mode should be set to stop as the CAT and EMM is copied from the input.
PMT	DVB ATSC	200	Regenerated from input. Service ID and component PIDs and PMT PID may be remapped. Table is automatically updated to reflect any PID filtering/remapping done in the GUI.
BAT	DVB	1000	Generated by User Input from GUI.
NIT-A	DVB	2000	NIT is generated based on the values entered by user. All transports defined in the same network will be included in NIT. NIT Other is not supported IF NIT is not enabled then PID 16 (0x0010) will not be transmitted. The NIT supports the following descriptors: • Delivery descriptors • Logical Channel Descriptors
SDT-A	DVB	1000	Regenerated from input, if available, otherwise generated. The Service ID, name, provider and type can be modified.
SDT-O	DVB	5000	Content is identical to corresponding SDT-A.
EIT P/F-A	DVB	1000	Regenerated from input

EIT P/F-O	DVB	5000	Regenerated from input. Supported in MPTS mode only.
TDT	DVB	15000	Generated based on system time
TOT	DVB	15000	Generated based on system time A single TOT with a single Local Time Offset Descriptor can be defined globally per unit. The playout mode of the globally defined TOT is still configurable per Transport Stream.
MGT	ATSC	100	PSIP Master Guide Table. Generated based on currently active PSIP tables.
TVCT	ATSC	200	Terrestrial Virtual Channel Table, Regenerated based on input, if available, otherwise generated. Short Channel Name and program_number can be modified (use DVB Service Name and Service ID editing - see section 7.3.7 for details). Input Service Location Descriptor is regenerated based on desired PID mapping, but not generated if there is no input.
CVCT	ATSC	200	Same as TVCT. Cable specific parameters are copied from input or assigned default values (path_select = path1 and OOB = false)

The PSI is designed to offer a global default configuration as well as configurations of individual tables for each transport stream. The global configuration can be used as a default, but if needed, the individual tables on each MPTS/SPTS output can be configured independently.

	PAT and PMT tables should always be included on an outgoing transport stream. Event Information related tables like EIT P/F-A and EIT schedule are configured in the EPG section (requires EPG module for EIT schedule).

7.6.1 Editing the PSI Network configuration

To access this information, select **Outputs→PSI** and select the PSI Networks tab. PSI Networks can be added and removed via this dialog shown in the figure below. To add a new PSI Network, fill in the Net ID (Name field is optional) and click Add:

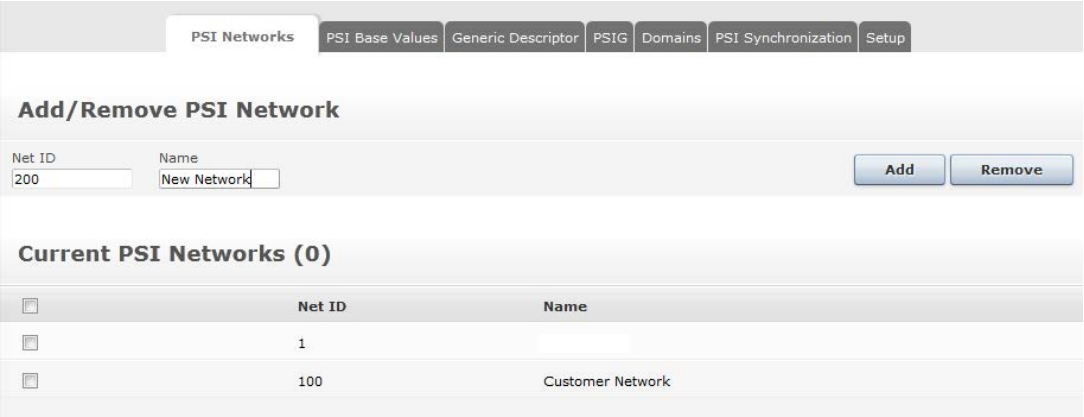


Figure 7.58– PSI Networks

This feature allows the operator to edit the network name that is signalled in the PSI via the network_name_descriptor in the DVB Network Information Table (NIT). The name is configurable per DVB network and is typically used by IRDs when displaying tuning results.

To edit the network name, go to the PSI Networks tab of the PSI settings (accessed via **Outputs->PSI** node in the navigation bar). There is an entry for every PSI network defined in the system which can be clicked to access an edit dialog:

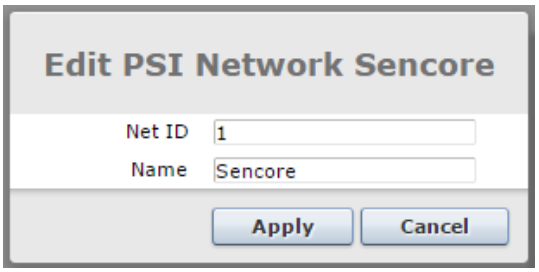


Figure 7.59 – Edit PSI Networks

In order to remove a PSI Network, select the desired network checkbox and click **Remove**.

When associating transport streams with PSI networks, the operator is offered a drop down box with the available selections:

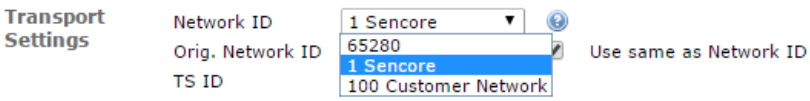


Figure 7.60– Associate transport stream with PSI network

If no PSI networks are defined, it is still possible to easily create SPTS outputs via a simple drag and drop – the system will automatically associate these with a PSI network within the default

PSI domain. The system will also automatically create a default network within a newly defined domain with network ID 65280.

7.6.2 Editing the PSI Default Values

The PSI Default Values tab displays the default playout mode and interval for each PSI/SI table

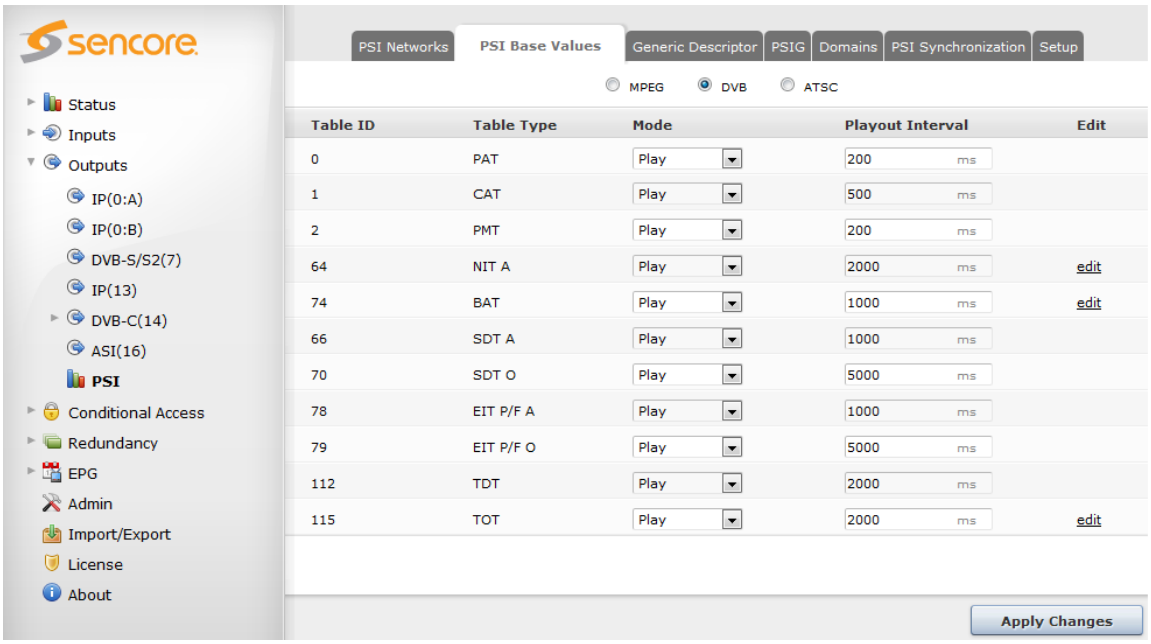


Figure 7.61- PSI Base Values tab (DVB Profile)

The following fields are available:

Table Id	For reference only, not configurable
Table Type	For reference only
Mode	Select one of the three or four available modes, depending on the table: **Stop** – playout is disabled **Pass** – the table PID will be forwarded from the input, without any modification. This means that tables sharing a common PID (e.g. SDT A and SDT O, EIT PF A and EIT PF O, as well as TDT and TOT) must have common Pass settings to avoid a PID clash with regenerated tables from the playout carousel. In addition, Pass is not supported for PMT, MGT, TVCT, and CVCT. **Play** – the table will be enabled for playout **PSIG** – the table will be generated externally via a PSIG server
Playout Interval	Interval in ms between transmissions of each section of the table by

	the playout carousel.
Edit	Detail configuration of the values: The **BAT Settings** dialog provide access to the ability to define bouquets The **NIT Settings** dialog provides access to the Logical Channel Descriptor's edit dialog The **TOT Settings** dialog provides access to the TOT Local Time Offset Descriptor's edit dialog

7.6.3 Editing the Logical Chanel Descriptor (NIT)

The Logic Channel Descriptor in NIT is used to signal to the receiver which service should be assigned to which channel number. To add a channel assignment in the outgoing NIT, click on the **edit** NIT option.

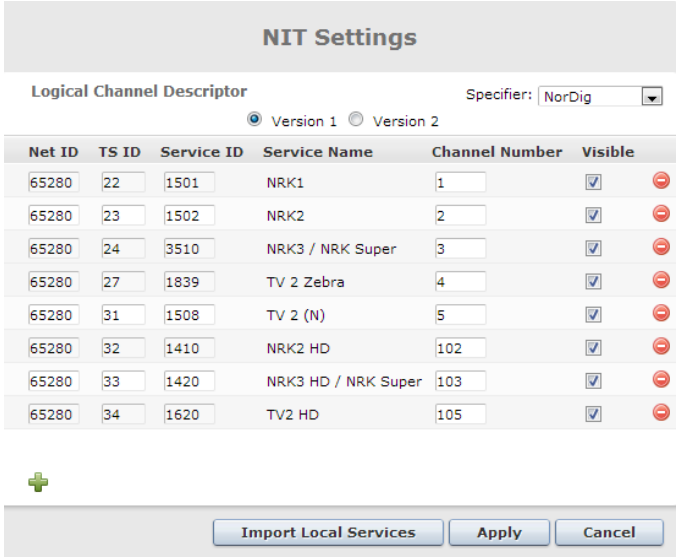


Figure 7.62- Edit NIT Settings

Specifier	Four possible options are available: • NorDig – the Nordic region descriptor (version 1 and 2) • DigitalEurope (with HD Simulcast support) • Ofcom • LCD – UK specific LCN descriptor
Net ID	Output Network ID
TS ID	Output Transport Stream ID
Service ID	Output Service ID
Service Name	Service Name, obtained from the stream itself. This parameter is

	empty if the service is added manually by clicking on the ✚ button.
Channel Number	This number is the actual number assigned to a channel for the viewer.
Visible	Each logical channel has a checkbox associated with it, which represents the visibility state of the channel. The default value of this flag is visible.

Select the specifier to be used from the selection box. To add channel already configured on the output, select **Import Local Services**. Then all the services currently configured on output will be listed and it is possible to edit the channel numbers directly. For services not handled by this unit or pre-configure a service that will be added later, click on ✚ and manually insert all data required for each service.

To modify an existing setup, simply change the channel number or click ⊖ to remove an existing channel number entry.

i	If the service re-multiplexing layout changes, this configuration needs to be updated manually (e.g. if a service is added or removed).

When selecting Digital Europe, this will enable support for HD Simulcast descriptor by clicking on Check box before HD Simulcast seen in figure below.

It is possible to add all configured output services to this list be clicking on the Import Local Service and it will import all data as shown in below.

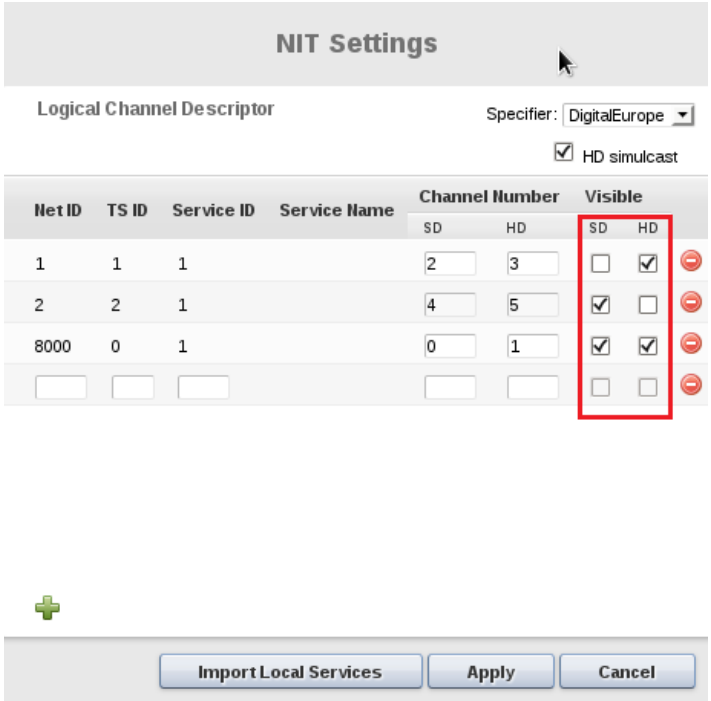


Figure 7.63- Edit NIT Settings with DigitalEuorpe having HD simulcast services

7.6.4 Editing the BAT table

When a bouquet has been defined it is possible to add services to the bouquet. It is then possible to add the services with the software package for the respective STB's.

Irdeto has defined a special bouquet which is used for STB software download. To add this use the Irdeto OTA check box. It is only possible to add one Irdeto OTA bouquet.

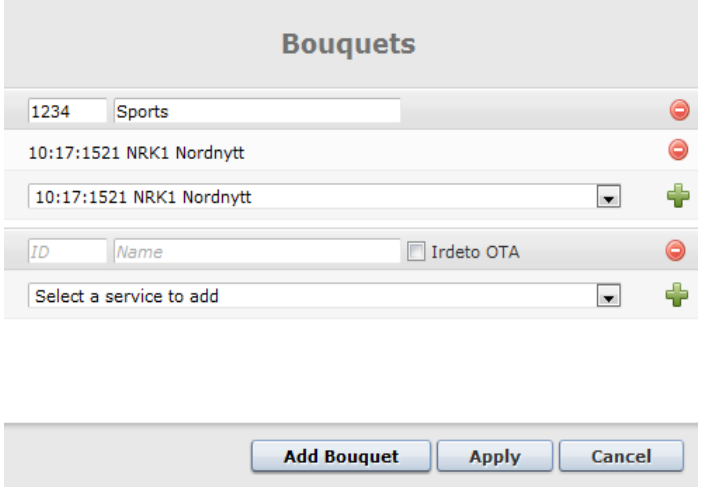


Figure 7.64- Edit BAT Settings

ID	Bouquet ID
Name	Name of the bouquet
Service to add	Service can be selected from the drop down available list of service from Input port. This parameter is empty if the service is added manually by clicking on the + button.
Irdeto OTA	Irdeto defined special bouquet which is used for STB software download.

7.6.5 Editing the TOT Local Time Offset Descriptor

It is possible to use Time Zones for automatic generation and updating of the **Local Time Offset descriptor.**

Once the correct Time Zone information has been loaded to the unit, the PSI Base Value tab will present these and the user can edit the Time Offset Table (TOT) and generate information for several Countries/Regions.

If you required the Time Zone file for a given region, please contact ProCare@sencore.com . This file can be installed from the Maintenance Center, by selecting and uploading to the MMI slot.

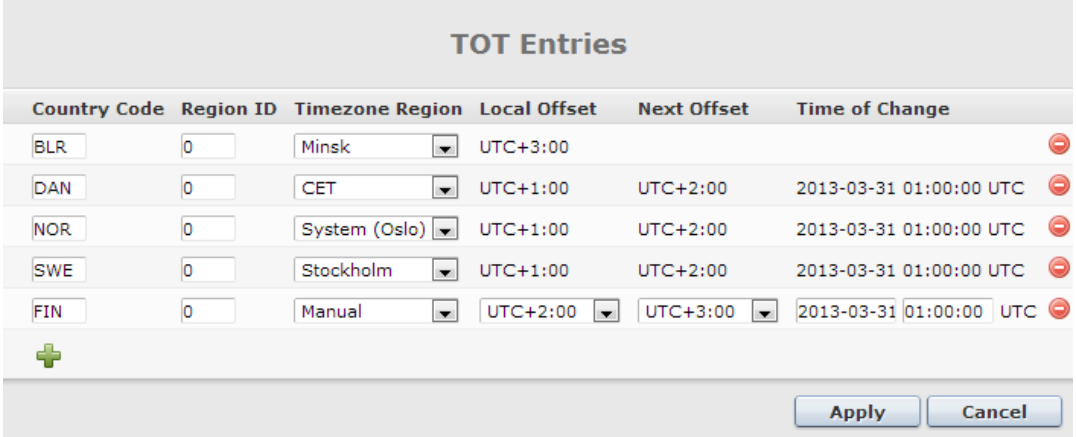


Figure 7.65– TOT Settings Dialog

The following fields are displayed for TOT Entries settings:

Country Code	DVB country code. See the Alpha-3 code listed at http://en.wikipedia.org/wiki/ISO_3166-1 for more information.
Region ID	DVB region. See ETSI EN 300 468 for more information.
Timezone Region	If installed, set the correct timezone region. It is also possible to select Manual and specify these values.
Local Time Offset	Current offset (from GMT/UTC)
Next Time Offset	Next offset (from GMT/UTC), e.g. Summer Time can be expressed as +1 hour.
Time of Change	Time (GMT/UTC) when the transition takes place and the Next Time Offset becomes valid.

The TOT settings offer the possibility to configure any future changes in time, such as Summer Time and leap years, in two sections – Local Time Offset Change and Time of Change. For more information, refer to ETSI EN 300 468 v1.7.1 (2006-05) **Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems**.

i	It is also possible to enter Manual changes, but these entries will not be automatically updated. This information is used to generate the TOT and automatically update the table on the next time of change.

7.6.6 PSI Synchronization

PSI Synchronization allows the operator to synchronize NIT and/or SDT tables between units that are part of the same DVB network(s) – enabling generation of a complete NIT and/or SDT table. If two or more units perform PSI synchronization with each other, they will both signal all transport streams in shared DVB networks.

Important points to note when using this functionality:

The management interface on the MMI card is used to establish TCP/IP connections between units to be synchronized; hence the required network connectivity is a prerequisite.

All synchronization is initiated manually by the operator. Changes do not take effect until either Retrieve Now or Remove (explained below) is clicked. This also means that if PSI is updated on an external unit (e.g. a new transport stream is added/removed, remap SDT parameters, etc.) the operator must manually perform another synchronization to retrieve these updates.

The version number of NIT may be different between units, but the table content is the same. This may cause a small delay for a STB when zapping between transport streams provided by different units as it would appear to the STB that a NIT update has occurred.

The PSI Synchronization functionality is accessible from the PSI dialog by clicking on the respective tab:

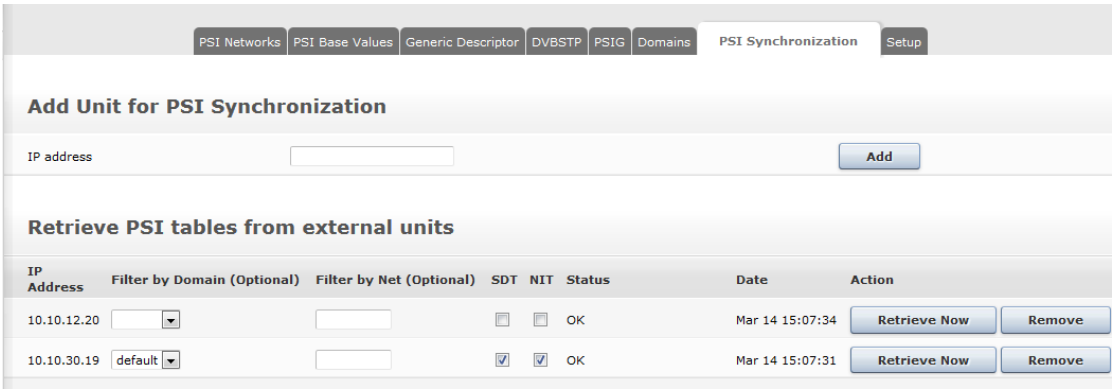


Figure 7.66- PSI Synchronization Tab

To add a unit for PSI synchronization, enter in the MMI IP address of the external unit (in dotted quad format) and click **Add**.

Now a table entry will be visible in the **Retrieve PSI tables from external units** section of the dialog, identifiable by the IP address.

The following parameters are displayed:

IP Address	IP address of the external unit MMI management interface
Filter by Domain (Optional)	Optionally select the PSI to synchronize from a specific domain from the remote unit
Filter by Net (Optional)	DVB network ID – if specified, only download external sections from this network. Otherwise, all sections are downloaded

	regardless of the network.
SDT	Check this box to synchronize SDT
NIT	Check this box to synchronize NIT
Status	Provides feedback on result of last synchronization attempt; if no attempt has been made, **Not Synced** is displayed.
Date	Time and date of last synchronization attempt; if no attempt has been made, this field is empty.
Action	**Retrieve Now** initiates a download of selected sections from the external unit. If the operation succeeds, the **Status** displays **OK** and the output PSI will automatically be regenerated using the received external sections. **Remove** removes the table entry and the output PSI is automatically regenerated so that all traces of external transport streams from the external unit are removed.

7.6.7 Inserting Generic Descriptors

The Generic Descriptor insertion functionality (accessible from the PSI dialog by clicking on the respective tab) allows insertion of arbitrary PSI descriptors into selected DVB output table descriptor loops. This feature is useful when an important descriptor is private or currently unsupported.

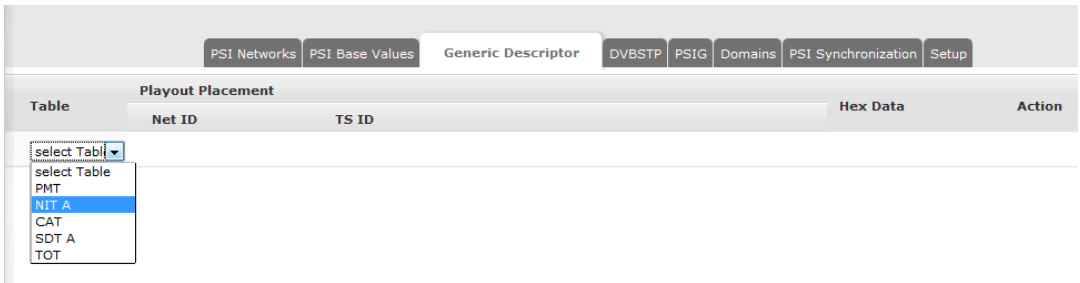


Figure 7.67 - Generic Descriptor Tab

Each entry displayed in the table corresponds to a single generic descriptor placement.

Clicking on ✚ allows new descriptor entries to be inserted, initiating a sequence of context dependent configuration options via drop down boxes described in the following tables:

Table	Selected desired output table
Playout Placement	A series of table dependent drop down boxes to select the desired descriptor loop locations: **Net ID/TS ID** – DVB Network and Transport Stream ID of

	desired output TS **Service ID** – DVB service ID of desired output service **Component** – input PID of an elementary_stream (not remapped value) All drop down boxes provide a list of currently available options together with the option to manually define an explicit value. After manually defining a value, click **Next** to continue the configuration process. Individual table placement instructions are provided in the **Generic Descriptor Loop Placement Instructions** below.
Hex Data	The descriptor in HEX format without a leading “0x”. This should contain the correct 2 byte tag and 2 byte length. Descriptors with invalid descriptor_length will be rejected.
Action	Depending on the current configuration step, one of the following buttons will be displayed: Next – displayed when defining a new descriptor; click to validate the descriptor. Retry – displayed when a new descriptor fails descriptor_length validation; correct the error and click to retry validation. Add – displayed when a new descriptor passes descriptor_length validation; click to add the descriptor to output PSI. – Click to remove a previously defined descriptor

Generic Descriptor Loop Placement Instructions

Table	Loop Name	Loop Description	Placement Instructions
CAT	-	Only one loop	Specify explicit **Net ID** and **TS ID**
PMT	program_info	Descriptors for all elementary_streams	Specify explicit **Net ID**, **TS ID**, and **Service ID** Select "None" from **Component**
	ES_info	Descriptors for current elementary_stream block	Specify explicit **Net ID**, **TS ID**, and **Service ID** Specify the PID of the elementary stream from **Component**
NIT	network	Descriptors for entire network	Specify an explicit **Net ID** and **TS ID** Select "All" from the **TS ID** drop down box
	transport	Descriptors for current transport_stream block	Specify explicit **Net ID** and **TS ID**
SDT	service	Descriptors for current service block	Specify explicit **NET ID** and **TS ID**
TOT	-	Only one loop	No placement option since TOT is globally defined for the unit

Generic descriptor play out placement is static and the operator must maintain play out placement in terms of Net, TS and/or Service ID as well as input PID updates.

Insertion of a generic descriptor will not overwrite any existing descriptors that are configured on the output.

7.6.8 Inserting DVP STP

If required, the DVBSTP tab allows selection of which network to generate the DVB STP xml description file.

A ne DVB STP multicast can be added by entering the initial values and clicking on the **Add** button. Once added, this will be automatically enabled on the selected IP output.

If it is required to change this multicast, you can click the **edit** link in which the following selection is displayed:

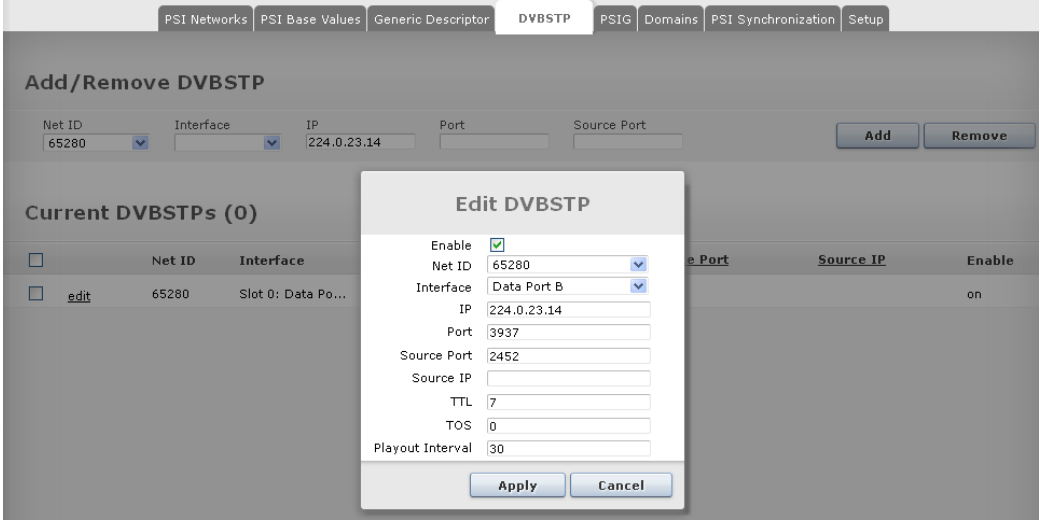


Figure 7.68 - DVBSTP Tab

Enable	Enables DVBSTP
Net ID	Specify a Net ID
Interface	Specify an Interface (Port)
IP	Specify an IP address.
Port	Specify a Port.
Source Port	Specify a source port
TTL	Set the Time-to-Live (TTL/IPv4)
TOS	Specifies the Type-of-Service (TOS)
Payout Interval	Interval in ms between transmissions of each section of the table by the play out carousel.

7.6.9 PSI Generation Setup

The Setup tab allows for modification of PSI generation settings like table versioning scheme, CA descriptor placement, PMT caching, and so on.

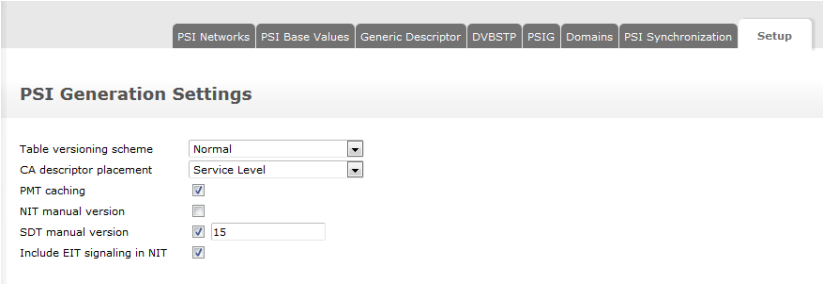


Figure 7.69- Setup Tab

Table versioning scheme	Normally the version numbers of the PSI/SI tables are incremented by one for each change. This parameter provides the means to force outgoing tables to use Odd or Even numbers. This configuration is used in conjunction with *Output Redundancy* to differentiate two sources (Main and Backup) from each other, ensuring that receivers will detect if a redundancy switch has occurred. Should a switch occur, the receivers will reprocess the PMT and detect a potentially new PID line-up. The drop down box provides three options: **Normal** – version numbers are incremented normally **Force Odd** – version numbers are incremented using odd numbers only **Force Even** – version numbers are incremented using even numbers only
CA descriptor placement	Some STBs have specific requirements on the location of the CA descriptor in the PMT. By default, the unit will place the CA descriptor in both **Service** and **Component** level in the PMT. The drop down box provides three options: **Service Level** – CA descriptor is in the service loop only **Component Level** – CA descriptor is in the component loop only **Service and Component Level** – CA descriptor is in both loops
PMT caching	Checking this option ensures that the output will not lose the PMT even if the stream's input disappears.
NIT manual version	Forces the NIT version number to the given value
Include EIT signaling in NIT	Enables the EIT linkage descriptor (0x04) to be excluded or included in the NIT generation. If EIT schedule information is present, by default, the system adds a linkage descriptor in the NIT. If EIT is present in multiple transports, then according to the DVB standard, the NIT will contain multiple linkage descriptors. When all transport streams contain the EIT schedule, some STBs jump to a different transport when using the EPG, causing the current program not to be displayed concurrently with the EPG. To prevent this behavior, we recommend that the linkage descriptor be excluded from the NIT.

7.6.10 DVB → ATSC, ATSC → DVB Conversion

When the output PSI mode is set to ATSC, some selected information will be translated from the DVB format to the ATSC format. Also the DVB has a larger reserved PID range than ATSC.

The following information is translated:

Service name

(DVB) SDT → (VCT) Short channel name

(VCT) Short channel name → (DVB) SDT

Audio AC3 descriptor

The AC3 audio component is signaled with different stream type in DVB and ATSC.

DVB stream type in PMT: 0x06

ATSC stream type in PMT: 0x81

In DVB the AC3 component has an additional AC3 descriptor in the PMT.

DVB → ATSC: Changes stream type and removes AC3 descriptor.

ATSC → DVB: Changes stream type and adds the Additional AC3 descriptor.

PID Ranges

DVB reserved PID range: 0 → 31

MPEG/ATSC reserved PID range: 0 → 16

The conversion from ATSC → DVB may therefore involve remapping of component PIDs if the incoming PIDs are in the reserved output range.

7.6.11 SI Domain Support

The SI Domain allows for multiple outputs to be defined with the same DVB triplet (NET ID, TS ID, SID) as some system designs require one unit to transmit on two different output domains, e.g. IP and cable.

In the *domain* concept, each domain is independent of each other with respect to SI validation and generation. In other words, within a unit the same output triplet, ie Network/Transport/Service ID, can be used as long as they belong to a separate domain.

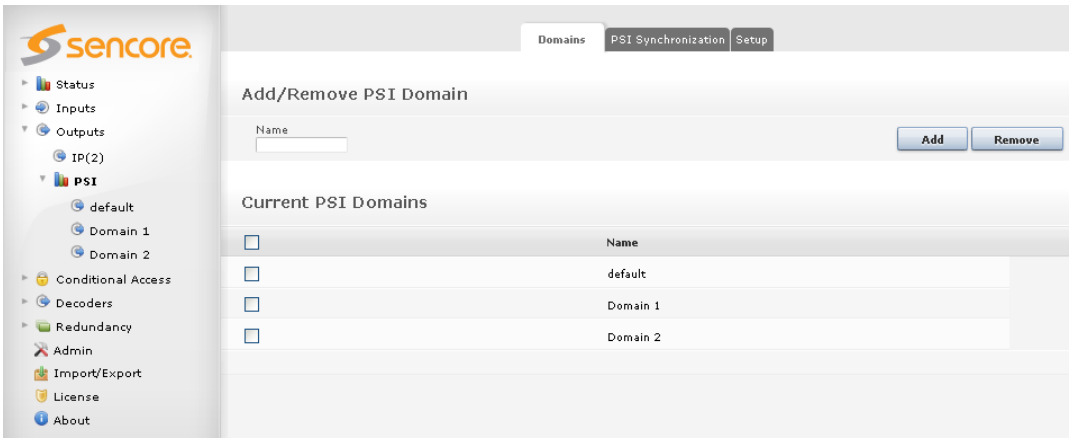


Figure 7.70- PSI Domains

This feature is not visible unless an additional output domain has been created. To create a domain, select **Outputs → PSI → Domains**. Then, enter an appropriate name for your domain in the **Name** field and click **Add.**

Once a new domain is created, the domain parameter will appear on the **Transport** tab (8.3.1). It is possible to add multiple output domains.

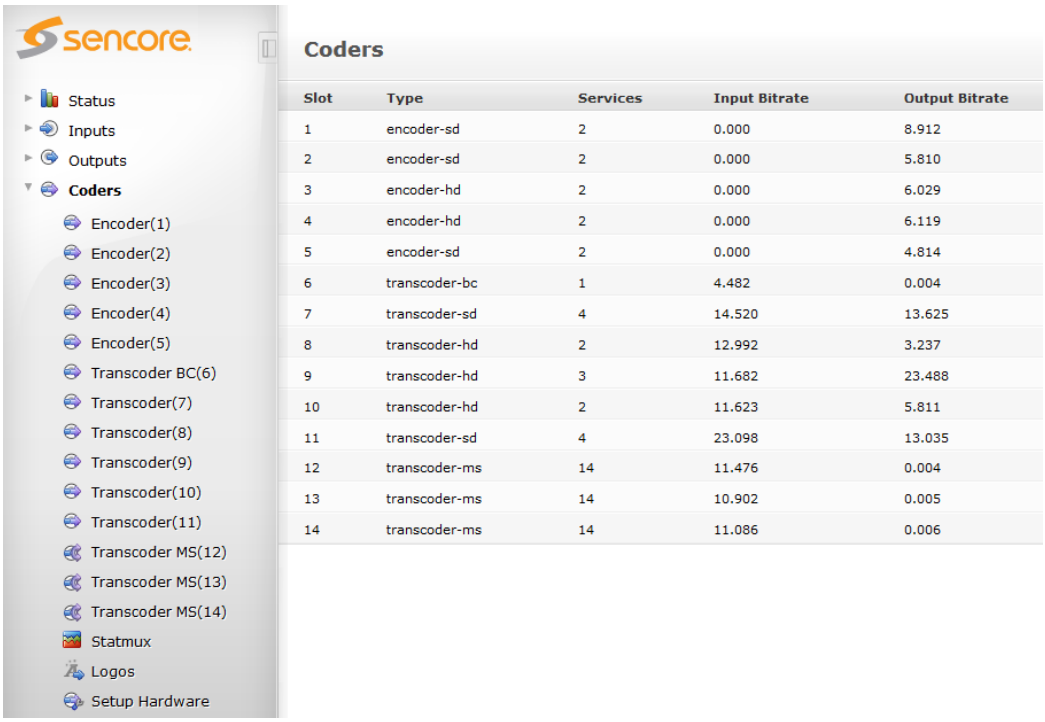
8 Encoder and Transcoder Configuration

8.1 General information

In the Sencore platform, there are three types of Coder modules available. The encoder module takes uncompressed digital signals from SDI input ports while the transcoder and multiscreen transcoder modules take compressed digital signals from the input cards. The output from all module types are compressed digital signals than can be routed to any of the output cards in the unit.

Encoding capabilities (HD/SD and the number of channels) of the encoder and transcoder modules can be changed via options and licenses. These modules are configured separately but have the same video encoding parameters. The common parameters for the encoder and transcoder are described in section 8.4 while section 8.6 covers the multiscreen transcoder module and its specific configuration parameters.

The Coders view in the Navigation Pane gives a summary of the encoders and transcoders present.



Slot	Type	Services	Input Bitrate	Output Bitrate
1	encoder-sd	2	0.000	8.912
2	encoder-sd	2	0.000	5.810
3	encoder-hd	2	0.000	6.029
4	encoder-hd	2	0.000	6.119
5	encoder-sd	2	0.000	4.814
6	transcoder-bc	1	4.482	0.004
7	transcoder-sd	4	14.520	13.625
8	transcoder-hd	2	12.992	3.237
9	transcoder-hd	3	11.682	23.488
10	transcoder-hd	2	11.623	5.811
11	transcoder-sd	4	23.098	13.035
12	transcoder-ms	14	11.476	0.004
13	transcoder-ms	14	10.902	0.005
14	transcoder-ms	14	11.086	0.006

Figure 8.1: Coders View

The Coders View contains the following information:

Slot	Slot in which encoder is placed
Type	Type of coder module.
Service	Encoder: Number of services generated by the encoder module. Transcoder: The number of transcoded services.
Input Bitrate [Mbps]	The input bit-rate to Transcoder modules. Nothing is reported for encoders.
Output Bitrate[Mbps]	Total bit-rate including PSI/SI, transmitted to the backplane. The bit-rate may increase when a service is copied to multiple outputs.

8.2 Encoder Configuration

The encoder modules have input ports that take a digital input signal, in the HD-SDI and SDI format, and convert this signal into a compressed transport stream. One SDI input can receive one video channel and multiple audio channels.

The encoder modules can, in addition to the main video, produce a low resolution version of the video – PiP (picture in picture). The PiP video is multiplexed with the same audio as the main service. The resulting PIP service is then also available to select as an output service. PCR is embedded on the PIP video PID.

The HD-SDI encoder module with 2 channels supports both HD-SDI and SD inputs. The SDI encoder module with 4 channels supports only SD inputs.

The encoder status and configuration page is accessed by clicking on an encoder module in Navigation Pane. The number listed here refers to the slot that the module is installed in.

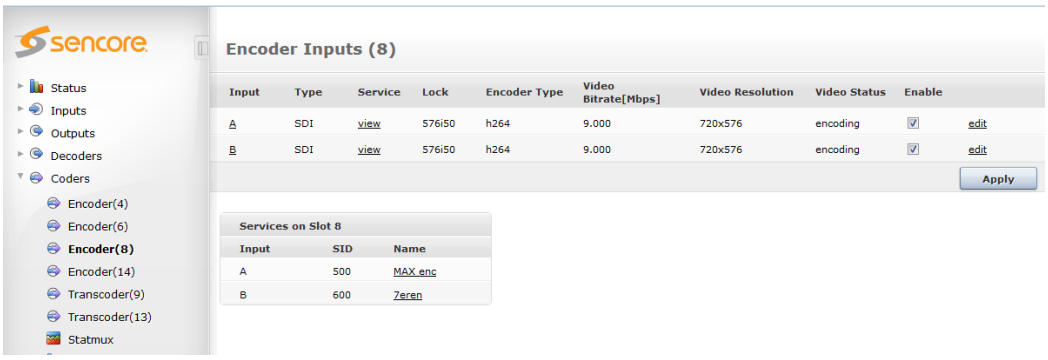


Figure 8.2: Encoder status and configuration

Input	Port corresponding to the SDI/HD-SDI input. Detailed status can be displayed by clicking on the Port.
Type	Signal Type : SDI
Service	Lists all services generated by the encoder channel, including the service IDs and the service names.
Lock	Lock status on incoming SDI. If locked, the received video format is shown. The configured Video Format and Frame Rate must match the incoming SDI video format.
Encoder Type	Configured video encoder standard; available standards are MPEG-2 or H264 (MPEG-4 part 10)
Video Bitrate [Mbps]	Configured video bit-rate.
Video Resolution	Encoded video resolution; Depends on the configured video format and horizontal rescaling. Horizontal Resolution x Vertical Resolution.
Video Status	Video encoder status: encoding – normal operation stopped – error (also status during reconfiguration off – encoder is disabled
Enable	Enable or disable the encoder.
Edit	Edit option to change the encoder parameters.

The detailed status, found by clicking on the Input Port (ie A. B. etc), includes information about the SDI input, main video encoder; pip video encoder, audio input, audio encoder and VBI input.

Click edit and the encoder configuration pages will be displayed. The configuration parameters are organized into different sections selectable from the tab menu on top. Common sections

for encoder module and transcoder module are described in section 8.3.34. The following sections describe only information specific to the encoder.

8.2.1 Source Parameters

This page is used to configure the input source parameters for the encoder port.

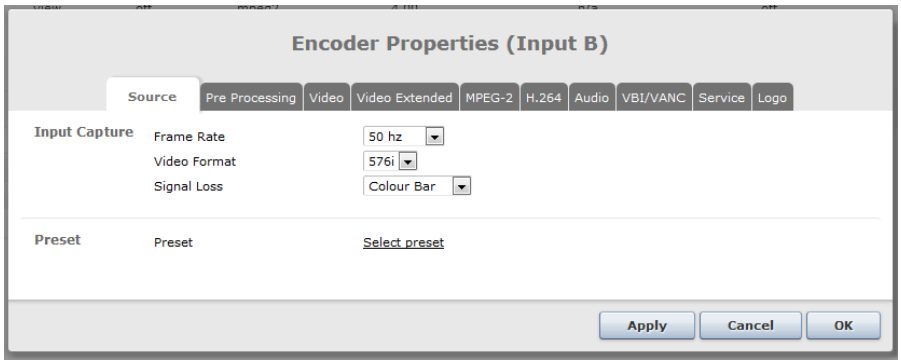
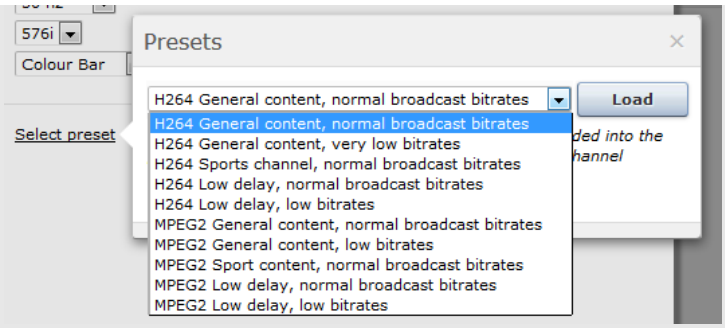


Figure 8.3 – Encoder Source Configuration

The following parameters are available for source configuration:

Frame rate	Specify incoming frame rate from drop down list. 50Hz 59.94Hz 60Hz
Video Format	Available HD formats are: 1080i 720p Available SD formats are: 576i 480i A HD Encoder supports both SD and HD formats. A SD encoder supports SD formats only.
Signal Loss	Available options are: Colour Bar: Encoder Produces Colour Bar when input signal is lost. Black Picture: Encoder Produces Black Picture when input signal is lost.
Preset	Configuration Presets can be used to help configuring the encoder/transcoder optimally for a specific scenario with respect to content and/or bitrate:



These Presets are applied as a template in the sense that even after a preset has been chosen; the user can access and alter all the parameters as normal.

The SDI input format must be explicitly configured, it is not auto detected. The encoder does not support any video format conversion. The input format must match the encoding format.

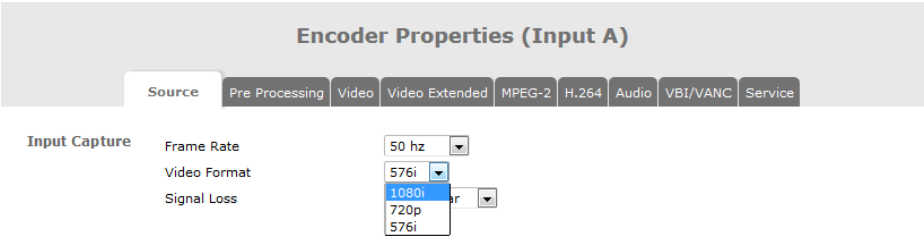


Figure 8.4 -Encoder Frame Rates

8.2.2 Pre Processing Parameters

Pre-processing is a collective term covering all processing of the video signal done prior to the encoding process. The purpose of pre-processing is twofold.

- Make the video signal easier to encode.
- Analyze the video and give advance information to the encoding process

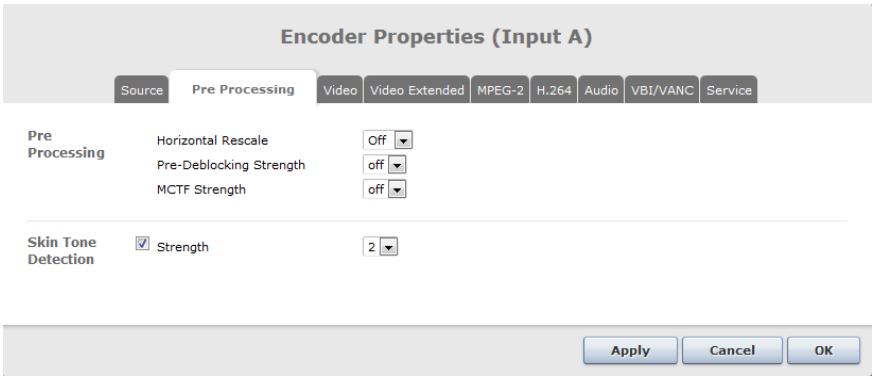


Figure 8.5 – Encoder Pre Processing parameters

Horizontal Rescale	The horizontal resolution (pixels per line) is defined by the selected video format, but can be reduced. The available options depend on the selected video format on the Source Tab. Reducing horizontal resolution will make it possible to use lower bitrates when encoding since resolution is reduced before encoding.
Pre-Deblocking Strength	The Pre-Deblocking filter attempts to smoothen macro block edges introduced by (MPEG) encoders earlier in the chain. The deblocking filter applies a “smoothing” effect to the incoming video. Its purpose is to blend in sharp, high-frequency (sharp edged) blocking artefacts to make them less visible. Too much filtering will make the images “soft”.
MCTF Strength	MCTF (Motion Compensated Temporal Filter) is a filter that can be used to remove noise in the incoming video signal. It recommended to only use MCTF on source signals with a significant noise problem, or when extremely low encoder bitrates are configured
Skin Tone Detection	When enabled, the encoder detects portions of the video containing skin tones and may increases the subjective video quality.

8.2.3 Audio Parameters

On the encoder module, there are one (for SD mode) or two (for HD mode) general purpose audio encoders per channel. These channels support MPEG-1, AAC-LC, HE-AACv1 and HE-AACv2 encoding and AC-3 (Dolby Digital) pass through. In addition there are up to 12 MPEG-1 encoders or 4 AAC-LC encoders that can be distributed among the channels on a board. A mixture of MPEG-1 and AAC encoders are allowed per board and this is outlined in the table below.

AAC-LC codec	MPEG-1 codec	Total encoders per card.
0	12	12
1	9	10
2	6	8
3	3	6
4	0	4

All audio encoders can receive embedded PCM audio from the SDI signal. The embedded source pair can be copied to more than one audio encoder. The various parameters that are configurable for the codecs are as follows:

MPEG-1 encoder	MPEG-1 layer II
Bitrate	64-384 kbps (Stereo) (Hardware encoder 0/1) 32-384 kbps (Stereo) (Software encoder 2+)32-192 kbps (Mono)
Channel Mode	Stereo Mono Dual mono (from same pair)

LC-AAC encoder	LC-AAC
Bitrate	32-384 kbps (Stereo and Dual Mono) 32 – 192 kbps (Mono)
Channel Mode	Stereo Mono Dual mono (from same pair).

AAC encoder	AAC-LC/HE-AACv1/HE-AACv2
Bitrate	64-384 kbps (AAC-LC) 32-192 kbps (HE-AACv1) 32-96 kbps (HE-AACv2)
Container	ADTS/LATM
Channel Mode	Stereo Mono, Dual mono (from same pair).

If AC-3 audio is present on the input signal (embedded SDI or AES), this can be passed through to the encoded output service.

8.2.3.1 Audio Configuration

The one (SD mode) or two (2xHD) general purpose audio encoders per SDI input channel shall always be available in the GUI. These encoders can be turned off by configuring the Encoder Type to off.

The MPEG-1 and AAC-LC encoders that can be dynamically distributed between the channels are added to a channel by using the “Create” button in the bottom of the Audio page. The “-“ button to the right of each encoder will remove the audio encoder from the channel. After an audio encoder is removed from one channel, it can be used on another channel. Up to 8 encoders can be added to one channel.

Encoder Type	The codec type. All encoders supports: MPEG-1 and AAC-LC, General purpose encoders support also HE-AACv1, HE-AACv2, Pass through and off.
Container	AAC container. LATM and ADTS are supported.
Delay	The Audio Delay Adjustment is valid for encoder with SDI input and Audio encoder instances greater than 2 (ie software encoders). The valid range available is from +50 to +50 ms.
Bitrate	Supported range of bitrate for each encoder type. See details per codec in above sections.
Mode	Channel Mode: Stereo, Mono or Dual Mono.
Source	Embedded audio selection. 8 embedded stereo pairs can be chosen for stereo and dual mono. One of the 16 channels can be selected for mono encoding.
PID	The PID value of the compressed audio stream.
Language	Three letter audio code used in PMT. Example “nor”, “eng”

Audio Type	Audio Type Parameter values • Normal: Describes normal audio • Clean Effect • Hearing Impaired • VI Commentary More details can be found in Ref. ITU-T Rec. H.222.0

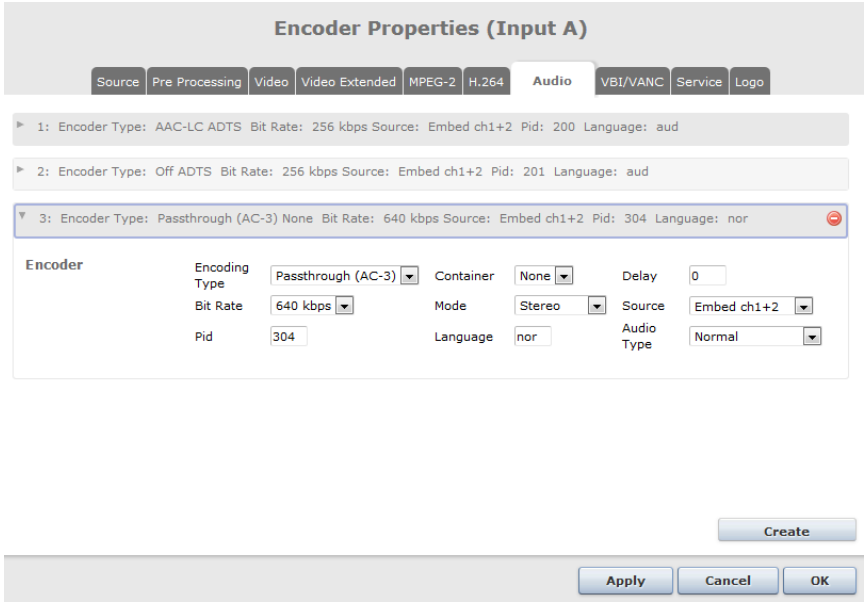


Figure 8.6– Encoder Audio Parameters

8.2.4 VBI/VANC Parameters

The “VBI/VANC” tab allows you to create Private Data PIDs and configure the PSI/SI descriptors based on VBI or VANC information in the input SDI signals.

The source data can be embedded in the SDI signal in the VBI (Vertical Blanking Interval) or in the VANC (Vertical Ancillary)

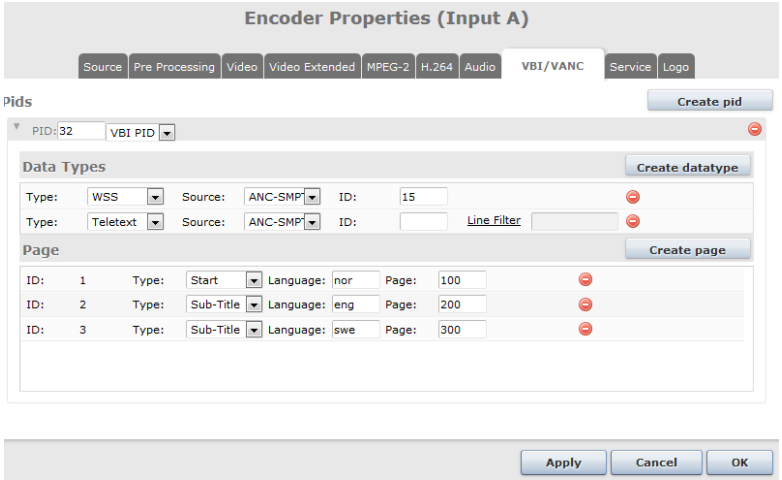


Figure 8.7– VBI/VANC configuration for Encoders with line filter

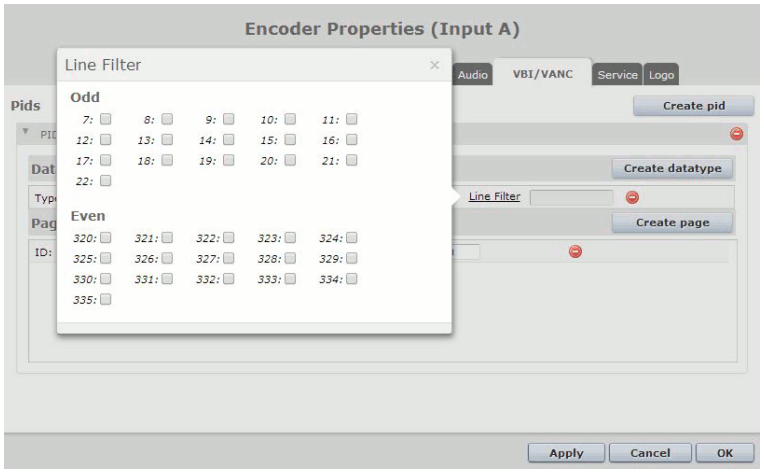


Figure 8.8– VBI/VANC configuration for Encoders with line filter

A PID can be created by clicking on the “Create pid” button and it is possible to create up to 3 unique PIDs. The figure above shows the GUI to configure the Data information and Page information. Click on the “Create datatype” button to add a new data type. If the data type is teletext, click on the “Create page” button to create page information for the descriptor.

Only one PID definition is displayed in detail. To show another definition, click on the PID header.

The following parameters are available for VBI/VANC configuration:

PID	Private Data PID value. Range: 32-8190
Data Type	Options: Teletext, WSS or VPS

Data Source	Where in the SDI signal to receive the data from. Options: VBI, OP-47 and SMPTE-2031.
Line Filter	Specify teletext line/s to be filtered.
Data ID	Needed for SMPTE-2031 to uniquely identify the data type as the standard allows one data type to appear more than once.
Page	Page information used to create the teletext descriptor. Up to 6 pages can be created.
Page Type	Type of teletext page. Options: Start and Sub-Title. Start page for teletext defining which page the TV/Receiver shall show when teletext is switched on. Subtitling page specifying the page the TV/Receiver shall show when a specific subtitling language is selected.
Page Language	Three letter language code for the start page and subtitling page. There can be several start pages and subtitling pages in a teletext stream with different languages.
Page Number	The page number for the start pages and the subtitling pages. Range:100-899

Digital program insertion (DPI) receives the DPI information as ancillary data according to SCTE-104 and converts the data into SCTE-35. The DPI data PID is added to the transport stream.
The user can enable or disable DPI, select the PID value and select the source PID index on the VBI/VANC page in the GUI. The SCTE-104 supports data transmission of more than one source PID index. The list of incoming indexes is shown on the status page. This PSI/SI for DPI is added to the output PMT.

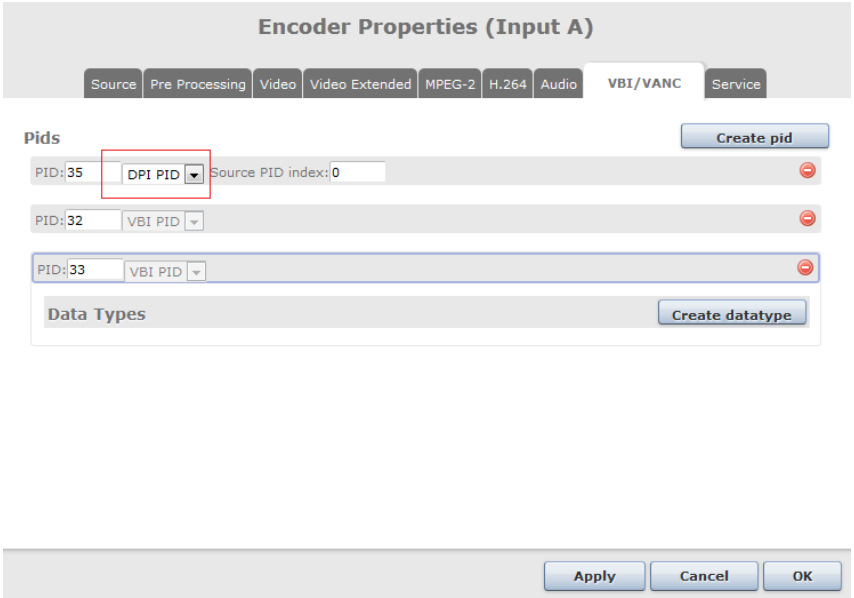


Figure 8.9- Encoder DPI settings

The status found by clicking on the Port on the status and configuration page provides useful information when configuring the VBI/VANC. Teletext, subtitling pages, WSS and VPS status is given for VBI, SMPTE-2031 and OP-47.

8.2.5 Service Parameters

The following default parameters are available for service configuration. The Components tab of the output card can also be used configure different PID values and components on each output port.

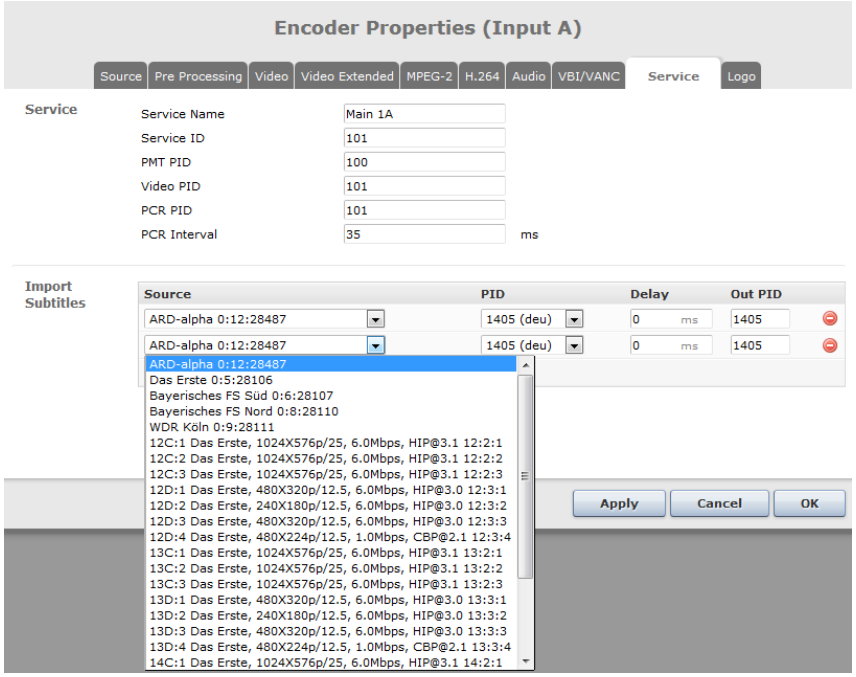


Figure 8.10 – Service name configuration for Encoders

Service Name	Service Name for the encoded stream.
Service ID	Service ID for the encoded stream.
PMT PID	Default PMT PID for the encoded stream.
Video PID	Default Video PID for the encoded stream. Rage: 32-8190
PCR PID	Default PCR PID for the encoded stream. If PCR and video PID have the same value, PCR is embedded with the video. Rage: 32-8190
PCR Interval	PCR Interval for the encoded stream. Rage: 1-250ms.
PIP PID	Default PIP Video PID for the encoded stream. Rage: 32-8190. PCR is

	always embedded on the PIP Video PID.
PIP PMT PID	Default PIP PMT PID for the encoded stream. Rage: 32-8190

Additional parameters for importing subtitle PIDs under **Import Subtitles**:

Source	Drop down list for selecting source of subtitle PID
PID	PID number with subtitle.
Delay	Delay time must be specified in milliseconds.
Out PID	Outgoing PID with subtitle.

8.2.6 Analog Encoder Configuration

The Analog encoder status and configuration page is accessed by clicking on an encoder module in Navigation Pane. The number listed here refers to the slot that the module is installed in.

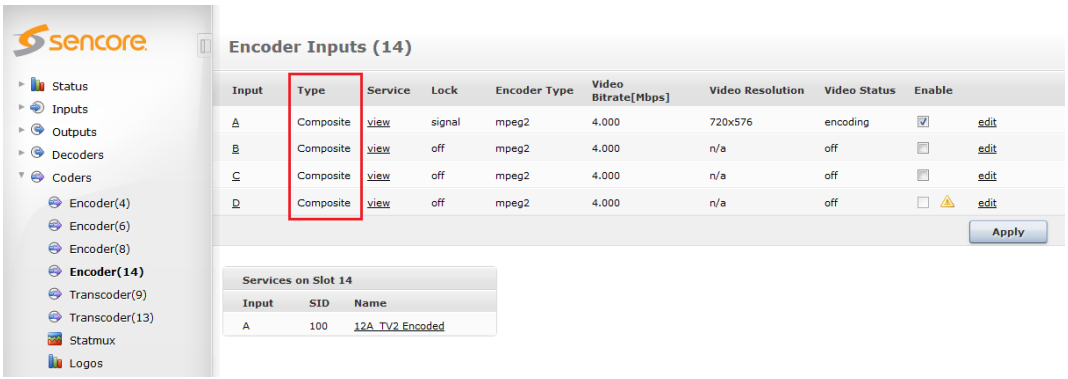


Figure 8.11: Analog Encoder status and configuration

Input	Port corresponding to Composite input. Detailed status can be displayed by clicking on the Port.
Type	Signal Type : Composite
Service	Lists all services generated by the encoder channel, including the service IDs and the service names.
Lock	Lock status on incoming composite. If locked, the received video format is shown. The configured Video Format and Frame Rate must match the incoming composite video format.
Encoder Type	Configured video encoder standard; available standards are MPEG-2 or H264 (MPEG-4 part 10)
Video Bitrate [Mbps]	Configured video bit-rate.
Video Resolution	Encoded video resolution; Depends on the configured video format and horizontal rescaling. Horizontal Resolution x Vertical Resolution.
Video Status	Video encoder status: encoding – normal operation stopped – error (also status during reconfiguration off – encoder is disabled
Enable	Enable or disable the encoder.
Edit	Edit option to change the encoder parameters.

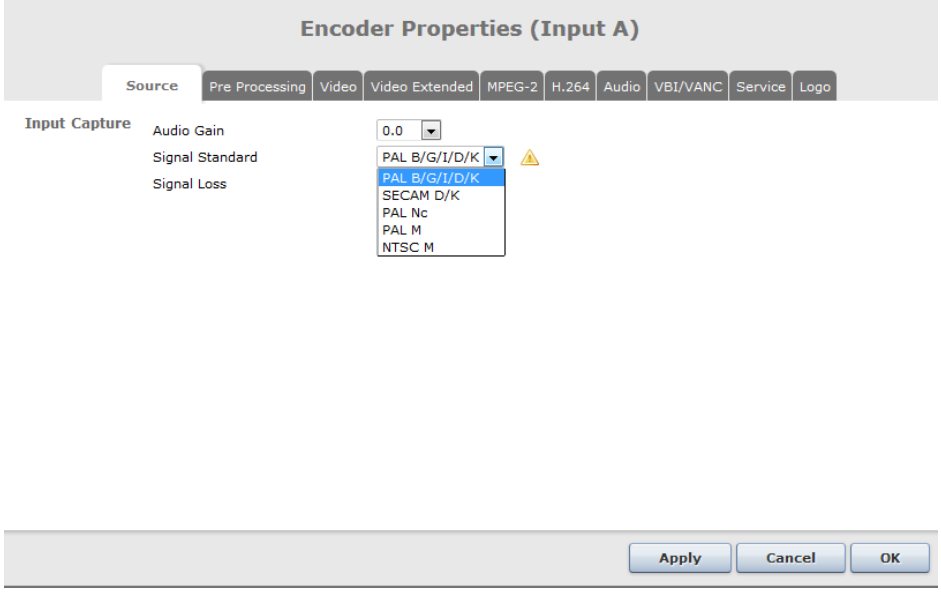


Figure 8.12: Analog Encoder Source configuration

The following parameters are available for source configuration:

Audio Gain	Audio gain can be specified from range of -11.0 to + 11.0
Signal Standard	Available Signal standard are: • PAL B/B/I/D/K • SECAM D/K • PAL Nc • PAL M • NTSC M
Signal Loss	Available options are: • Color Bar: Encoder Produces Color Bar when input signal is lost. • Black Picture: Encoder Produces Black Picture when input signal is lost.

8.2.7 Logo Insertion

Once there is a valid logo on the MMI (section 8.8), then it is possible to assign this to an encoder channel. This is configured on the **Logo** tab in the Encoder properties:

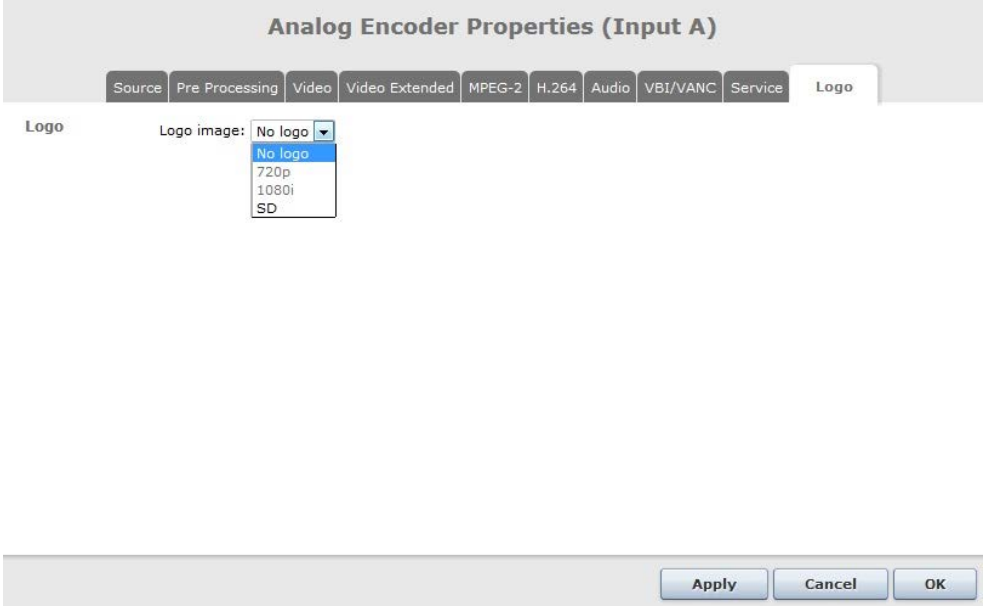


Figure 8.13: Logo tab in Encoder properties.

You will first need to select the chosen resolution, then enable the required logo:

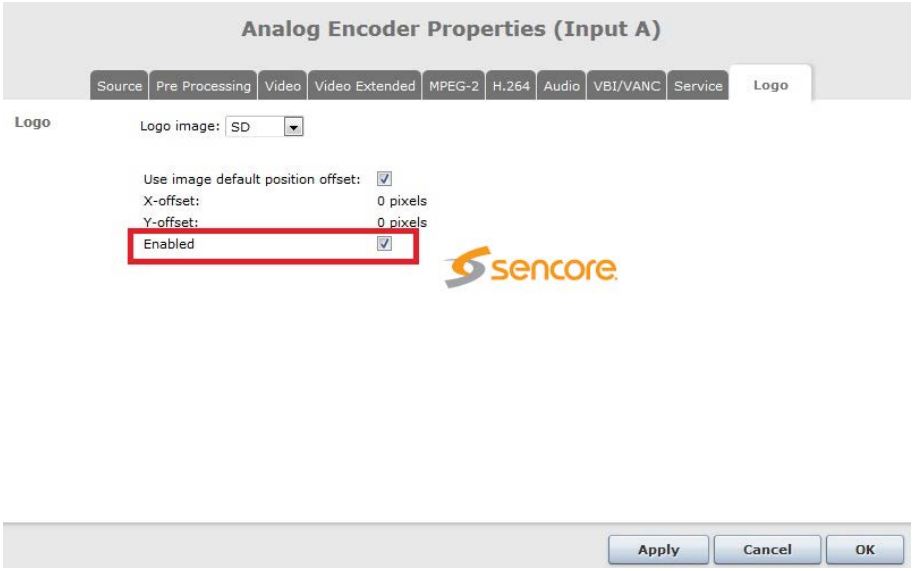


Figure 8.14: Logo enabling in Encoder properties.

8.3 Transcoder Configuration

In the DMG platform, the transcoder module is used to receive services from any of the input cards and change the codec, bit-rate or resolution of the service which can then be routed to any of the output modules. When configured, the input video is decoded, rescaled and then re-encoded.

The transcoder can operate as a 2 channel HD transcoder module or a 4 channel SD transcoder module depending on options and licenses. The HD and SD transcoders can both decode HD and SD video. The HD transcoder can encode HD and SD, while the SD Transcoder can encode SD only. All incoming PIDs that are not transcoded will be kept in sync with video after transcoding.

The transcoder status and configuration page is accessed by clicking on an encoder module in **Navigation Pane.**

The page contains the following information:

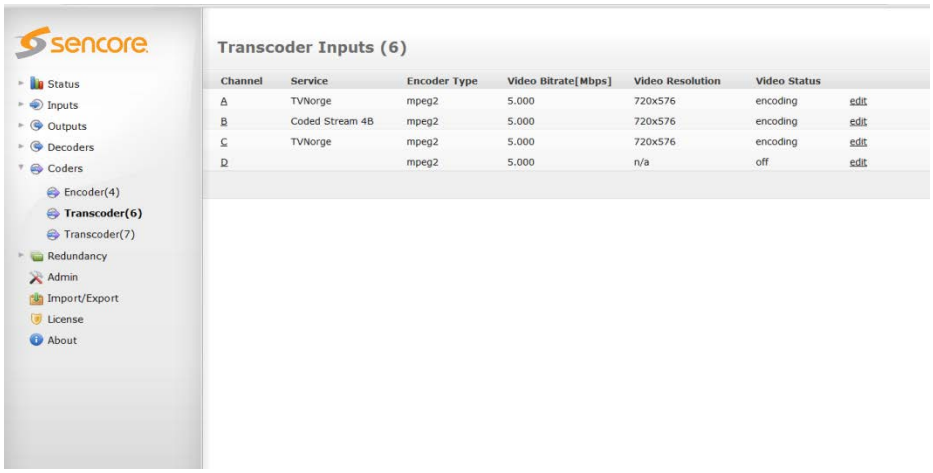


Figure 8.15- Transcoder Status and Configuration

Channel	Channel number. Detailed status can be displayed by clicking on the Port.
Service	The service name of the service routed to the Transcoder. The field is empty if no service is routed.
Encoder Type	Configured encoder standard; available standards are MPEG-2 or H264 (MPEG-4 part 10).
Video Bitrate [Mbps]	Configured video bit-rate of the transcoded video.
Video Resolution	Encoded video resolution; Depends on the configured video format and horizontal rescaling. Horizontal Resolution x Vertical Resolution.
Video Status	Video encoder status:

	encoding – normal operation stopped – error unless reconfiguring off – encoder is disabled
Edit	Edit option to change the transcoder parameters.

The detailed status found by clicking on the Input Port (ie A. B. etc), includes information about the input video parameters and output video parameters.

Click **edit** and the transcoder configuration pages will be displayed. The configuration parameters are organized into different sections selectable from the tab menu on top. Common sections for encoder module and transcoder module are described in section 8.3.34. The following sections describe only information specific to the transcoder.

8.3.1 Source Parameters

For viewing transcoder source parameters, please select the **Source** tab.

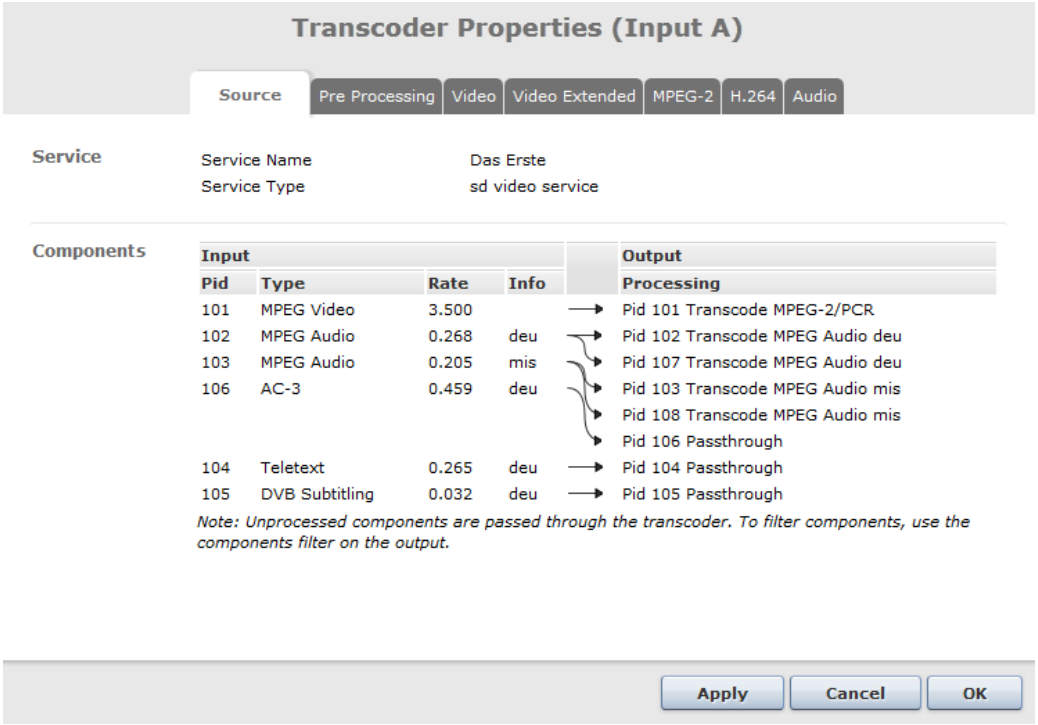


Figure 8.16 – Transcoder Source View

The following parameters are available:

Service Name	The name of the incoming service that are transcoded. This field is empty if no service is selected.
Service Type	Service type received for this service. This is meta data in DVB SI and may not correspond to the actual video codec and format received. The service type corresponds to the Service type settings in the

	Service tab of each output board and can be changed if required
Component	Details on received components for the selected service: • PID -> PID number received • Type -> Type of component for selected PID • Rate -> Bit-rate for selected PID • Info -> additional information such as language code • Output -> PID reference of the output component and processing

If AFD is present in the incoming video, the transcoder will encode the AFD in the picture according to ETSI TS 101 154 V1.9.1 and A/53 Part 4 2009. The transcoder does not support to change the incoming AFD or to add a default AFD value when AFD is not present in incoming video.

8.3.2 Pre-Processing Parameters

Pre-processing is a collective term covering all processing of the video signal done prior to the encoding process. The purpose of pre-processing is twofold.

- Make the video signal easier to encode.
- Analyze the video and give advance information to the encoding process

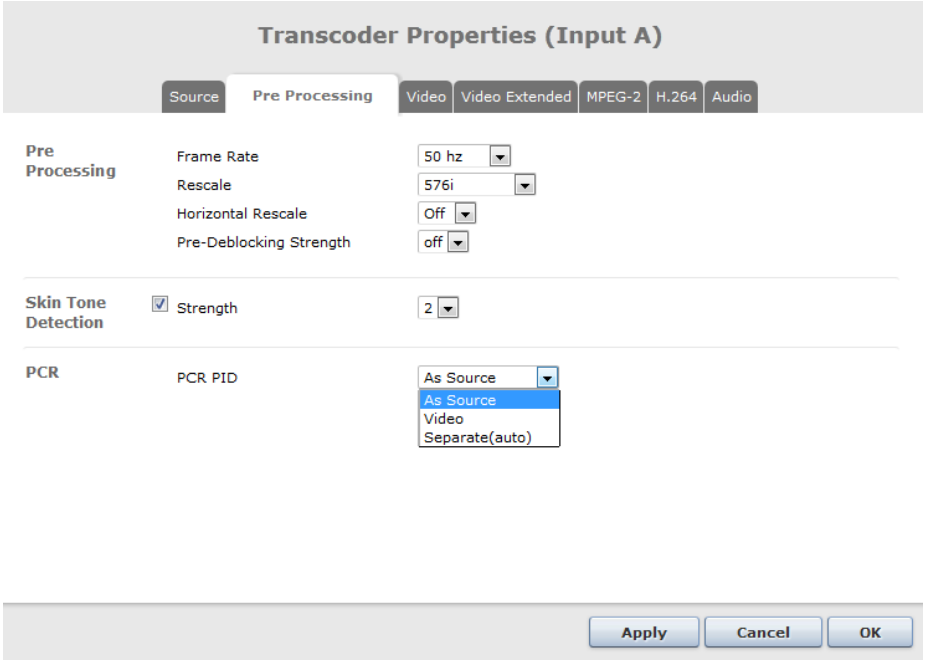


Figure 8.17– Pre-Processing configuration for transcoder

The following parameters are available for configuration:

Frame rate	Specify incoming frame rate from drop down list. • 50Hz • 59.94Hz • 60Hz
Rescale	Configure the format the video shall be transcoded to. • HD Module: 1080i, 720p, 576i, 480i and Transparent. • SD Module: 576i, 480i and Transparent.
Horizontal Rescale	The horizontal resolution (pixels per line) is defined by the selected video format, but can be reduced. The options depend on the selected video format on the Source Tab. Reducing horizontal resolution will make it possible to use lower bitrates when encoding since information is removed before encoding.
Pre-Deblocking Strength	The Pre-Deblocking filter attempts to smoothen macro block edges introduced by (MPEG) encoders earlier in the chain. The deblocking filter applies a “smoothing” effect to the incoming video. Its purpose is to blend in sharp, high-frequency (sharp edged) blocking artifacts to make them less visible. Too much filtering will make the images “soft”.
Skin Tone Detection	When enabled, the encoder detects portions of the video containing skin tones and may increases the subjective video quality.

i	Rescale: Down scaling is supported. De-interlacing is not supported, so an interlaced format must be transcoded to another interlaced format. A progressive format may be transcoded into either interlaced or progressive.

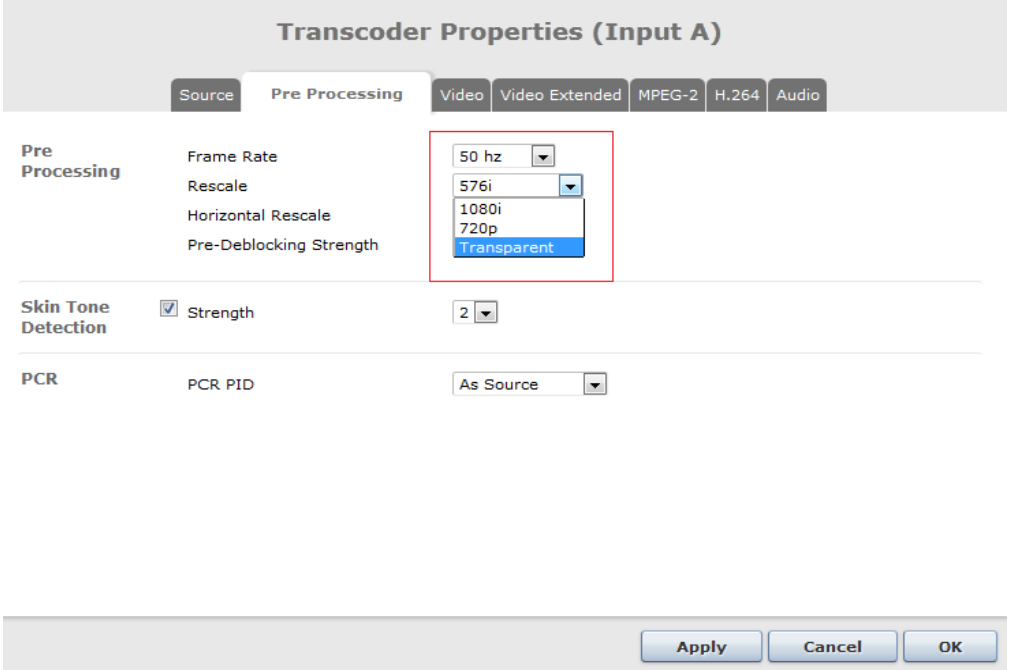


Figure 8.18- Transcoder configuration of Frame Rates.

The picture above shows how the configured Frame Rate defines the allowed Rescale options. The horizontal rescale option list is defined after the Frame Rate and Rescale are selected. The Frame Rates can be selected between 50/59.94/60. The Rescale can be selected after the Frame Rate is selcted.

In Transparent mode, an warning alarm will be given if the input format cannot be matched. This can for example be the situation on a SD transcoder if the input signal is HD. The transcoder will keept the last format in this case.

The following options are available for PCR :

As source	The PCR is passed through on the incoming PID value.
Video PID	The PCR is embedded on the video PID regardless of origin.
Separate PID	The PCR is sent on a separate PID regardless of origin. Default PCR PID is 8180. It will only get this default value if that PID value is not already in use in the transport stream.

8.3.3 Audio Parameters

The following parameters are available for Audio configuration:

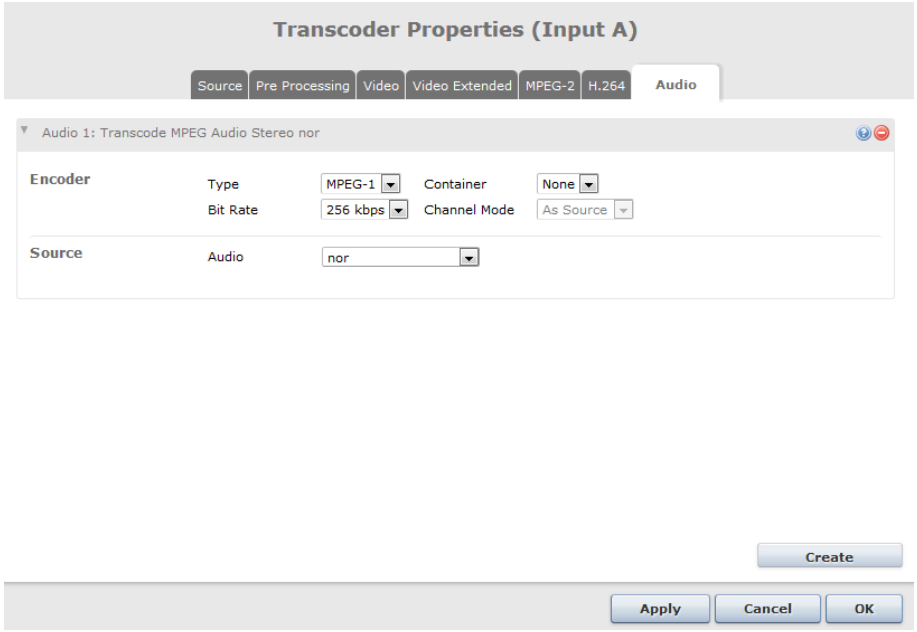


Figure 8.19– Audio configuration for transcoder

There are up to 12 MPEG-1 encoders or 4 AAC-LC encoders that can be distributed among the channels on a module. A mixture of MPEG-1 and AAC encoders are allowed per board. See table below.

AAC-LC codec	MPEG-1 codec	Total encoders per card.
0	12	12
1	9	10
2	6	8
3	3	6
4	0	4

Supported transcoding:

- MPEG-1 to MPEG-1
- MPEG-1 to AAC-LC
- AAC(LC/HEv1/HEv2) to MPEG-1
- AAC(LC/HEv1/HEv2) to AAC-LC

The audio transcoder can receive MPEG-1/AAC compressed audio from the transport stream. The audio source can be any of the available supported audio PID. The various parameters that are configurable for the codecs are as follows:

Encoder	MPEG-1 layer II
Bitrate	64-384kbps
Channel Mode	• Stereo • Mono,

	• Dual mono
Encoder	LC-AAC
Container	ADTS/LATM
Bitrate	64-384kbps
Channel Mode	• Stereo • Mono, • Dual mono

	The transcoder supports decoding for HE-AACv1/HE-AACv2, but only encoding only for AAC-LC

Audio streams in the transport stream that are not transcoded are always passed through to the output. This includes AC-3 (Dolby Digital) audio components.

8.3.3.1 Audio Configuration

The audio transcoders are shared between the channels of the board. The user can allocate different numbers of transcoders per channel as long as the maximum number is not exceeded. An audio transcoder is added by clicking on the "Create" button on the bottom of the Audio page. An audio Transcoder is removed by clicking on the "-" button to the right of the Transcoder. When a Transcoder is removed from one channel, it can be used on another channel.

Output	The codec type. Available options: MPEG-1 and AAC-LC. AAC-LC includes container selection.
Bitrate	Supported range of bitrate for each encoder type. See details per codec in above sections.
Channel Mode	Channel Mode: Stereo, Dual Mono or As Source. As Source – output channel mode follows input channel mode.
Audio Source	Select the audio PID to be transcoded based on either language or a more advanced priority list. "Select Any Language" - a random language in the original service. "Current languages" - select from a list of incoming audio languages. "Advanced Selection" - possibility to set up a prioritized selection based on codec type, PID value and/or language

8.3.4 Configuring a service for transcoding.

In order to assign a transcoder resource to a stream, you will first need to configure an output service. Transcoding is then enabled by selecting an available transcoder channel on the **Service** tab of the Service Properties page.

The parameters for the Transcoder channel as described in 9.3 can be configured before or after the Transcoder is selected on an output.

The Name, Service ID, Service type and PID values of the input stream are all kept unchanged unless it is changed in the Service Properties page. The PSI/SI will be changed for the PIDs that are changed by the Transcoder.

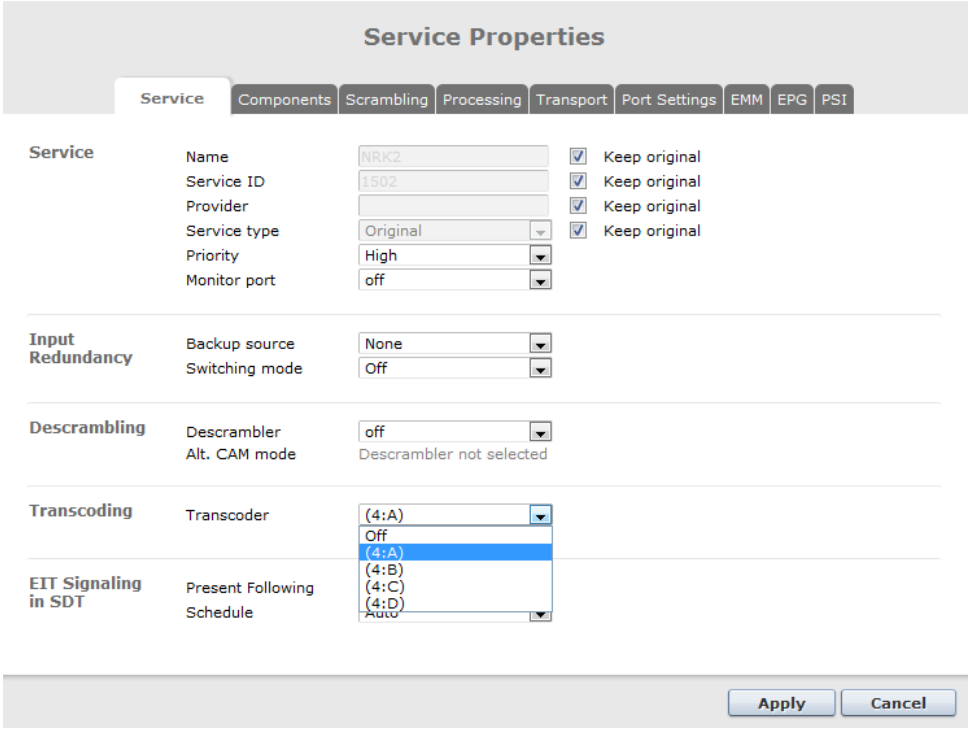


Figure -8.20 – Assigning a transcoder to an output service

8.4 Common Encoder/Transcoder Configuration

8.4.1 Video Parameters

The following parameters are available for video configuration:

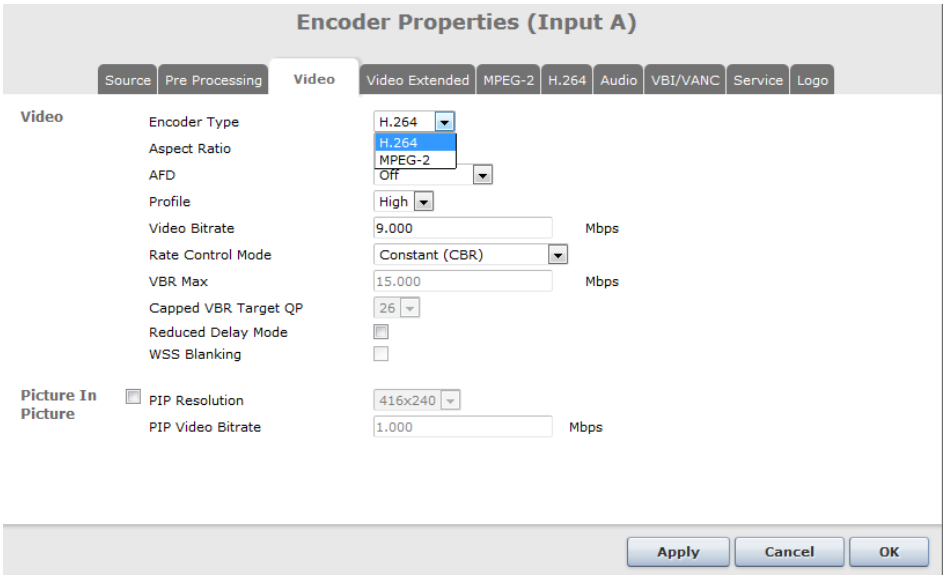


Figure 8.21– Video encoder configuration-Aspect Ratio

Encoder Type	Selects compression standard to use. Available options are: H.264 (MPEG-4 part 10) or MPEG-2 video codec.
Aspect Ratio	Selects the aspect ratio to be signalled in the output video: • 16x9 • 4x3 • 1x1 • WSS (Encoder only) • WSS (line 18) (Encoder only) • Video Index 11/324 (Encoder only) • Video Index 8/321 (Encoder only) • Transparent (Transcoder only)
AFD	AFD codes has below options: • Pass through: AFD codes transparent from SDI input to Video output stream. • Off: AFD codes are not passed from SDI input to video output stream.
Profile	Selects the encoder profile to be used. The profile determines the range of tools from the codec “toolkit” that the encoder is allowed to utilize when encoding. The level is set automatically depending on the current configuration.

	MPEG-2: Simple, Main and High. H264: Constrained Baseline, Main and High.
Video Bitrate	Sets output bit-rate in CBR mode. HD Encoder: 250kpbs – 38Mbps SD Encoder and Transcoder: 250kbps – 19Mbps
Rate Control Mode	Video CBR (Constant Bit Rate) or CVBR (Capped Variable Bit Rate).
VBR Max	Sets the bounds of the output bit-rate when the encoder operates in CVBR.
Capped VBR	When in CVBR mode, this sets the target Quantization Parameter of the encoder. High QP will result in more compression at the expense of quality. Low QP will result in higher bit-rate and better quality.
Target QP.	The encoder will use the selected QP unless the resulting bit-rate is outside the upper bound set by VBR Max.
Reduced Delay Mode	Enabling this mode reduces the encoding delay. Please note that enabling this feature will lead to less processing and therefore could impact picture quality at lower bitrates.
WSS Blanking	Enables WSS Blanking on the encoded output (Encoder only)
Picture In Picture	Enable PIP video. This will generate a new selectable service for use on any of the output modules. Both share the same audio.
PIP Resolution	Sets the resolution of the PIP video. • 416x240 • 352x288 • 352x240 • 192x192 • 128x128 • 128x96 • 96x96
PIP Video Bitrate	Sets the bit-rate of the PIP video. Range: 250kbps to 1Mbps

	The CBR video bit-rate affects only the video PID. An IP output may still be a VBR transport stream. Some IP receivers require that the IP output is set to CBR mode. This can be set on the **Port Settings** tab of the output stream

	Transcoder PIP is from the default PID values as the Main service whereas Encoder PIP PID value is configured on the service page.

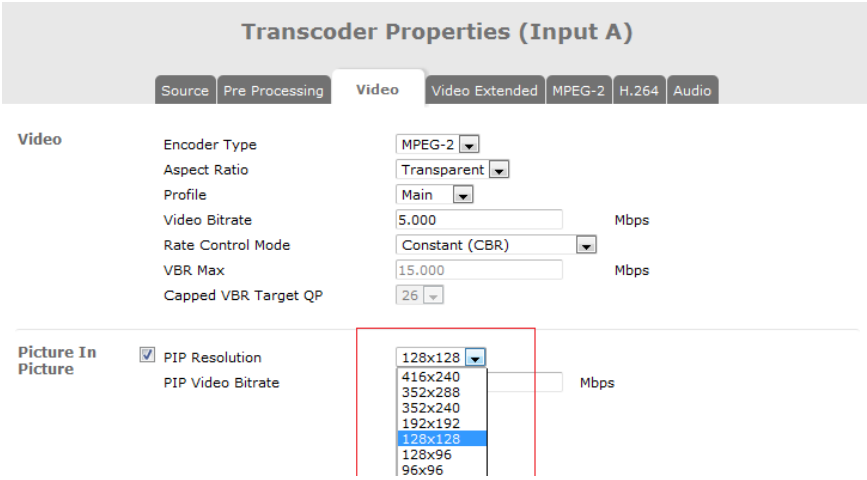


Figure 8.22- Transcoder configuration of PIP resolutions

The PIP service appears on the Input list and can be sent to the output as any other input service.

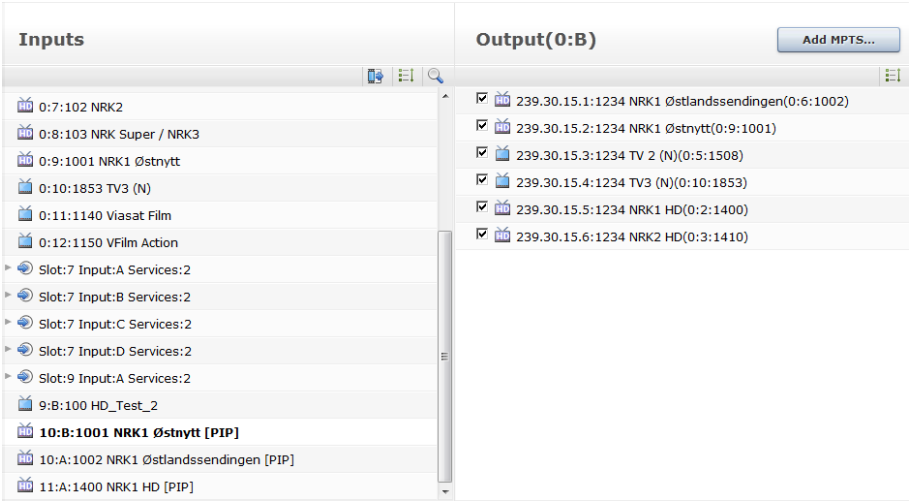


Figure 8.23-Transcoder PIP service selection on outputs

The output page for a PIP service is different to a normal input as transcoding is not allowed and descrambling is not necessary.

8.4.2 Video Extended Parameters

This tab contains the video parameters common to both H.264 (MPEG-4 part 10) and MPEG-2.

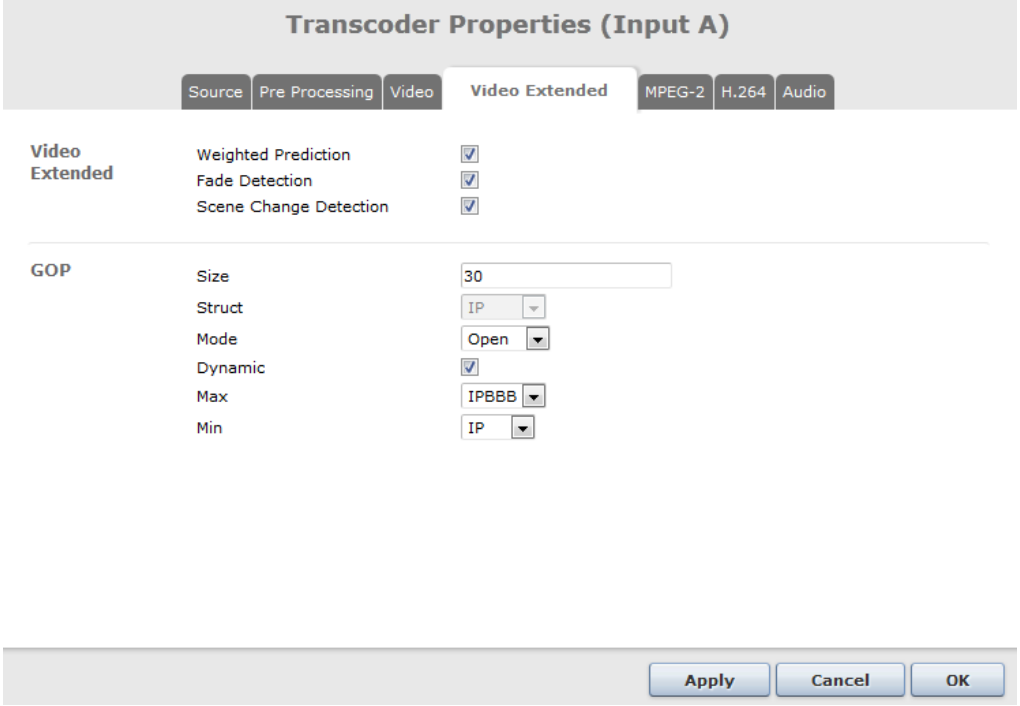


Figure 8.24 – Video Extended configuration

The following parameters are available for video extended configuration:

Weighted Prediction	In H264 mode, the encoder can employ Weighted Prediction to improve the coding efficiency of fades and dissolves. It is recommended to have this enabled.
Fade Detection	When a fade is detected, the GOP structure is adjusted to improve the encoding efficiency of the fade. It is recommended to have this enabled.
Scene Change Detection.	When a scene change is detected, the GOP sequence is adapted so that the new scene starts with an I frame. It is recommended to have this enabled.
GOP Size	Sets the number of frames in a GOP.
GOP Struct	Sets how many B frames there should be between P frames
GOP Mode	Selects open or closed GOP. It is recommended to have this to “open”. Only use closed if STB’s do not support open GOP.
Dynamic	Dynamic GOP mode lets the encoder adjust the GOP structure depending on content. Most GOPs will be of the length set in “GOP Size”, but when the content requires a different structure, the encoder will adjust the GOP to achieve better video quality. It is recommended to have this enabled.
Max/Min	Applicable in Dynamic GOP mode. Sets the min and max number of successive B frames allowed in the GOP structure.

8.4.3 MPEG-2 Parameters

The following parameters are available for MPEG-2 configuration:

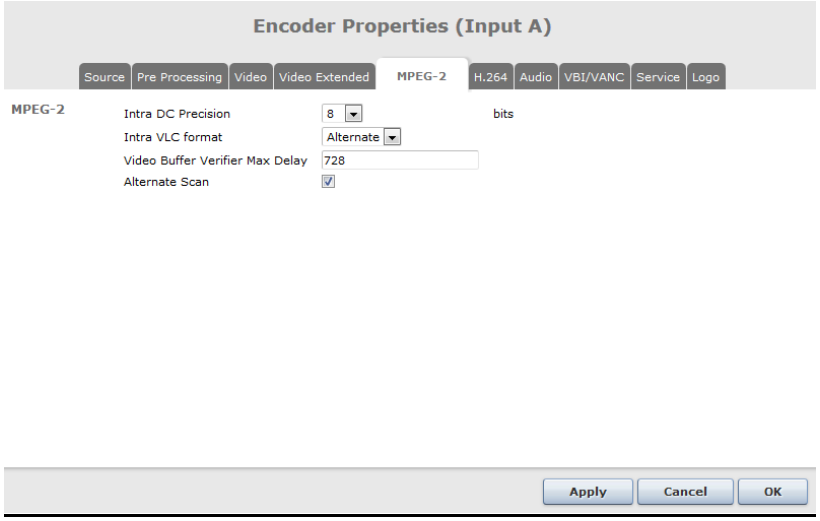


Figure 8.25 – MPEG-2 configuration

Intra DC Precision	Quantization resolution of the DC (luminance) component in intra frames. Normal setting is 8 bits. Consider to increase precision when encoding at high bitrates
Video Buffer Verifier Max Delay	This sets the size of the VBV buffer. The value should be left at the default (728ms). Reducing the VBV buffer is a technique often used to lower the video delay, but it can seriously compromise video quality by forcing excessive quantisation to accommodate I-frames. This can cause poor references, poor video and I-frame pulsing artefacts.
Alternate Scan	Defines how transform coefficients are handled. Two modes are available ; MPEG-1 or alternate. Alternate provides superior results with interlaced video and should be the default setting.

8.4.4 H.264 Parameters

The following parameters are available for H.264 configuration:

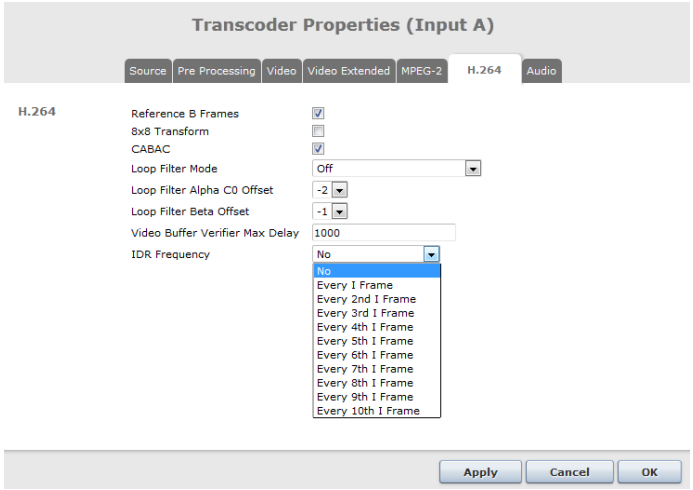


Figure 8.26– H.264 configuration for Encoders

Reference B-Frames	Enables B frames to be referenced to I, P or B frames. When disabled, B and P frames can only reference I or P frames.
8x8 transform	Available in high profile mode only. This enables 8x8 transform for residual coding. This can provide significant advantages for HD encoding.
CABAC	CABAC (Context Adaptive Binary Arithmetic Coding) is an entropy coding scheme introduced in H264. When enabled, CABAC is used instead of CAVLC. CABAC is the most efficient of the two, and should be the default choice. Some legacy decoders might not support CABAC.
Loop Filter Mode	This controls the encoder output de-blocking loop filter. The loop filter is designed to remove blocking artefacts resulting from the compression process. Settings should reflect customer preferences and content. The trade-off is between visible artefacts and a softening of the video, especially sports and other difficult, high-motion content. Detail, especially grass, can look better with this feature disabled.
Loop Filter Alpha CO offset.	When the loop filter is enabled, the Alpha offset allows the user to adjust the strength of the loop filter i.e. how much the video is softened. Negative values will soften the video less, but at the risk of showing more blocking artefacts. Positive values will soften video more, but at the risk of removing more detail. The value '0' is often considered to be a good compromise.
Loop Filter Beta Offset.	When loop filter is enabled, the Beta offset allows the user to adjust the threshold for what the filter considers a blocking artefact. A negative value will lower the threshold and preserve more detail but at the risk of showing more blocking artefacts. A positive value will remove more blocking artefacts but may also

	remove more detail. A value of '0' is often considered to be a good compromise.
Video Buffer Verifier Max Delay	This sets the size of the VBV buffer. The value should be left at the default (1000ms). Reducing the VBV buffer is a technique often used to lower the video delay, but it can seriously compromise video quality by forcing excessive quantisation to accommodate I-frames. This can cause poor references, poor video and I frame pulsing artefacts.
IDR Frequency	Sets how often I frames shall be converted to IDR (Instantaneous Decoder Refresh) frames. IDR points are intra frames without past references. The IDR frequency can be important for decoders offering fast trick play (fast forward / rewind).

8.5 Universal Broadcast Transcoder Configuration

The Universal Broadcast Transcoder can transcode up to 16 SD service without PIP, 12 SD services with PIP or 4 HD/SD services with PIP. The transcoder can take any conventional DVB service (HD/SD, MPEG-2 or H264) as input. The module consists of four separate transcoder blocks A, B, C and D.

On the **Coders->Setup Hardware** page, the Universal Broadcast Transcoder can be configured either HD or SD mode per block. Once configured, the transcoded services will appear as SPTS/MPTS inputs to the unit. These services can be output through an output interface just like any other service.

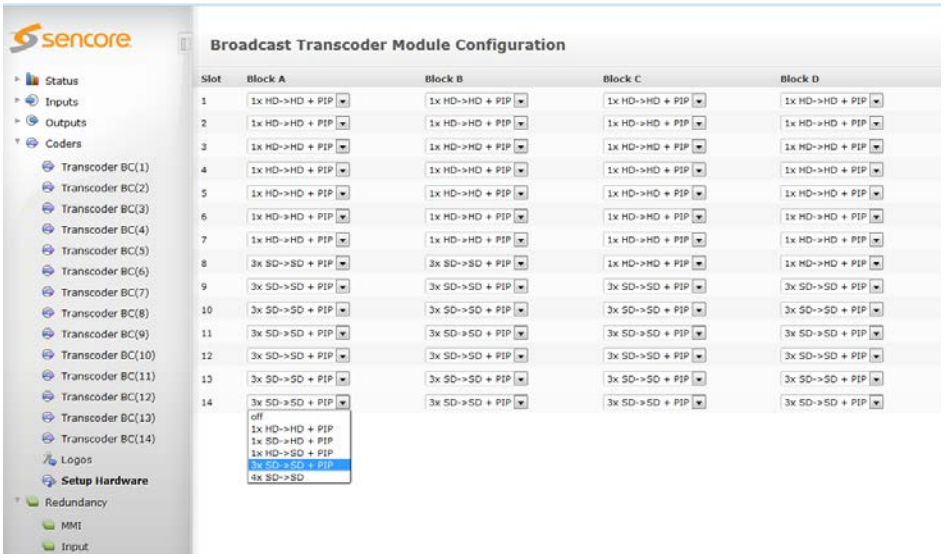


Figure 8.27 - Universal Transcoder- dense broadcast setup hardware page

Slot	Specifies the slot of Universal Transcoder- dense broadcast

Block A **Block B** **Block C** **Block D**	Any of these Block can be configured from below configurations • Off • 1xHD->HD+PIP (HD/SD input to HD/SD output + PIP) • 1xSD->HD+PIP (SD input to HD/SD output + PIP) • 1xHD->SD+PIP (HD input to SD output + PIP) • 3xSD->SD+PIP(3 SD inputs to 3 SD outputs + 3 PIP) • 4xSD->SD (4 SD inputs to 4 SD outputs). Requires Dense SD license

The HD modes support SD inputs and outputs with horizontal resolution from 704 to 720. For SD video with lower horizontal resolutions than 704, use one of the SD modes.

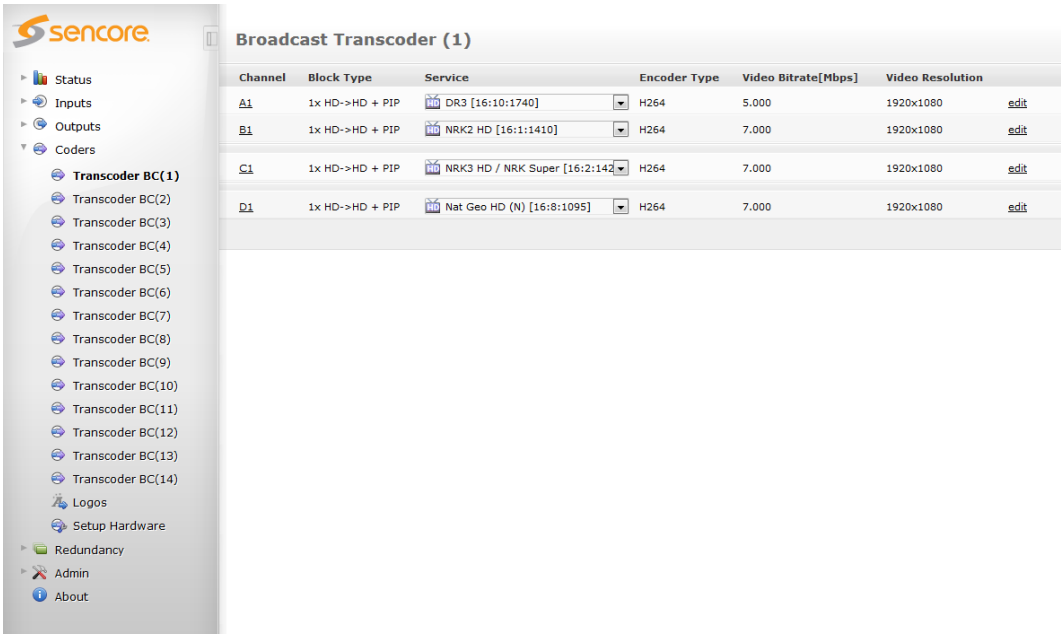


Figure 8.28 - Universal Transcoder- dense broadcast status configuration

Channel	Channel number. Detailed status can be displayed by clicking on the Port
Block Type	Block Type. Detailed status comes from setup hardware setting
Service	The service name of the service routed to the Transcoder. There is drop down option to service the service.
Encoder Type	Configured encoder standard; available standards are MPEG-2 or H264
Video Bitrate	Configured video bit-rate of the transcoded video.

Video Resolution	Encoded video resolution; Depends on the configured video format and horizontal rescaling. Horizontal Resolution x Vertical Resolution.
Edit	Edit option to change the transcoder parameters.

Click edit and the configuration pages will be displayed. The configuration parameters are organized into different sections selectable from the tab menu on top. Source Parameters

8.5.1 Source Parameters

For viewing transcoder source parameters, please select the **Source** tab.

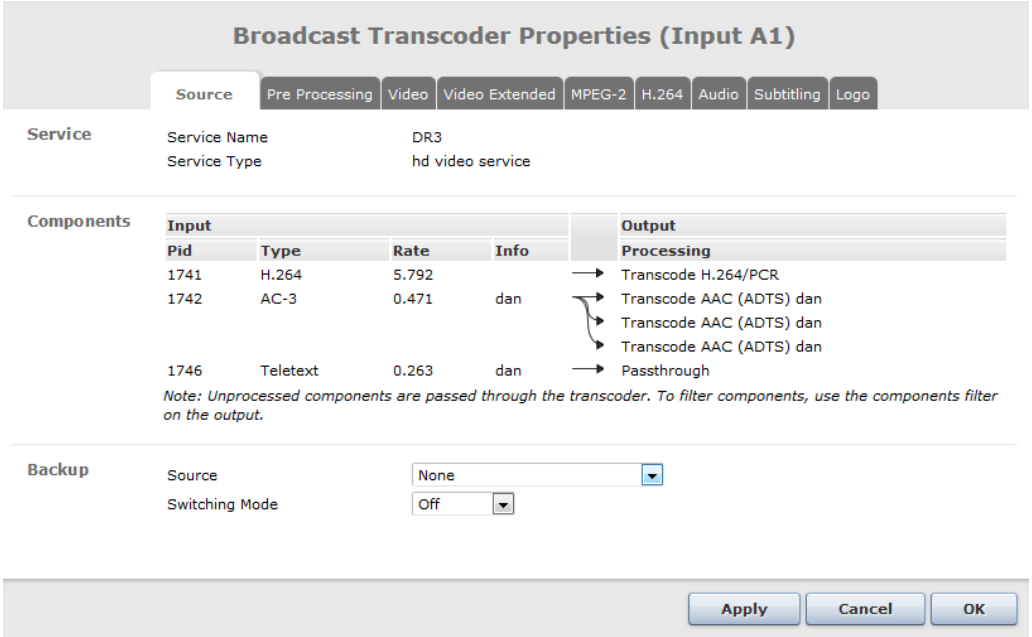


Figure 8.29 - Universal Broadcast Transcoder source parameters

The following parameters are available:

Service Name	The name of the incoming service that are transcoded. This field is empty if no service is selected.
Service Type	Service type received for this service. This is meta data in DVB SI and may not correspond to the actual video codec and format received. The service type corresponds to the Service type settings in the Service tab of each output board and can be changed if required
Component	Details on received components for the selected service: • PID -> PID number received • Type -> Type of component for selected PID • Rate -> Bit-rate for selected PID • Info -> additional information such as language code

	• Output -> PID reference of the output component and processing
Backup Source	This list displays the source available for the chosen backup service.
Switching mode	This list displays the available switching mode: • Off • Once • Floating • Reverting

8.5.2 Pre-Processing Parameters

Pre-processing is a collective term covering all processing of the video signal done prior to the encoding process. The purpose of pre-processing is twofold.

- Make the video signal easier to encode.
- Analyze the video and give advance information to the encoding process

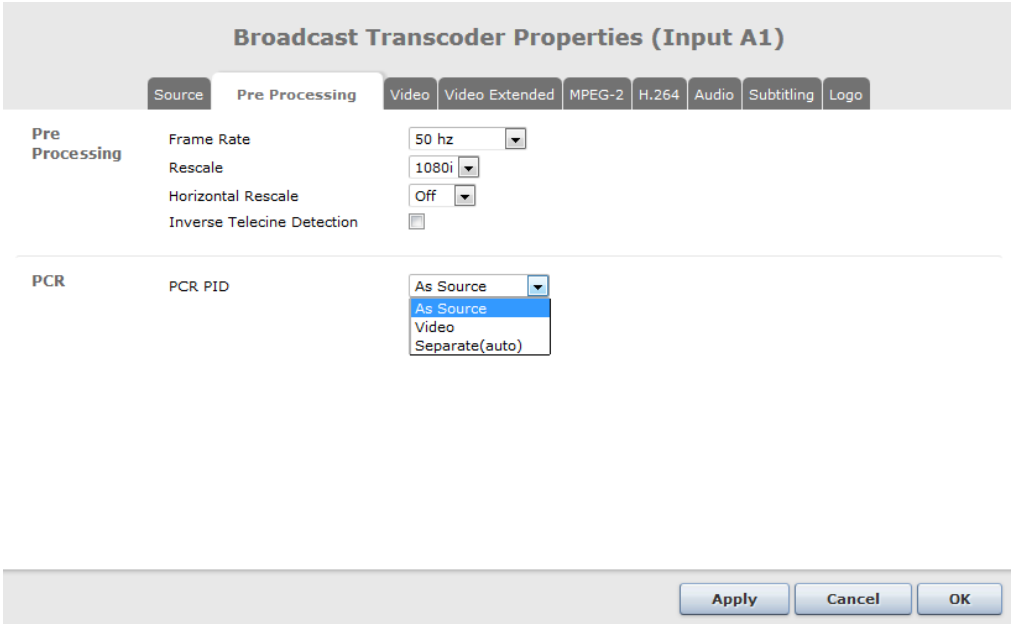


Figure 8.30 - Universal Transcoder- dense broadcast preprocessing parameters

The following parameters are available for configuration:

Frame rate	Specify output frame/field rate from drop down list. (Frame rate for progressive output and field rate for interlaced output) • 50Hz • 59.94Hz • 60Hz • Transparent
Rescale	Configure the format the video shall be transcoded to. • HD Module: 1080i, 720p. • SD Module: 576i,
Horizontal Rescale	The horizontal resolution (pixels per line) is defined by the selected video format, but can be reduced. The options depend on the selected video format on the Source Tab. Reducing horizontal resolution will make it possible to use lower bitrates when encoding since information is removed before encoding.

Inverse Telecine Detection	Check box for enable/disable of Inverse Telecine Detection.
PCR PID	PCR PID can be selected from below options • As Source • Video • Separate (auto)

8.5.3 Video Parameters

The following parameters are available for video configuration:

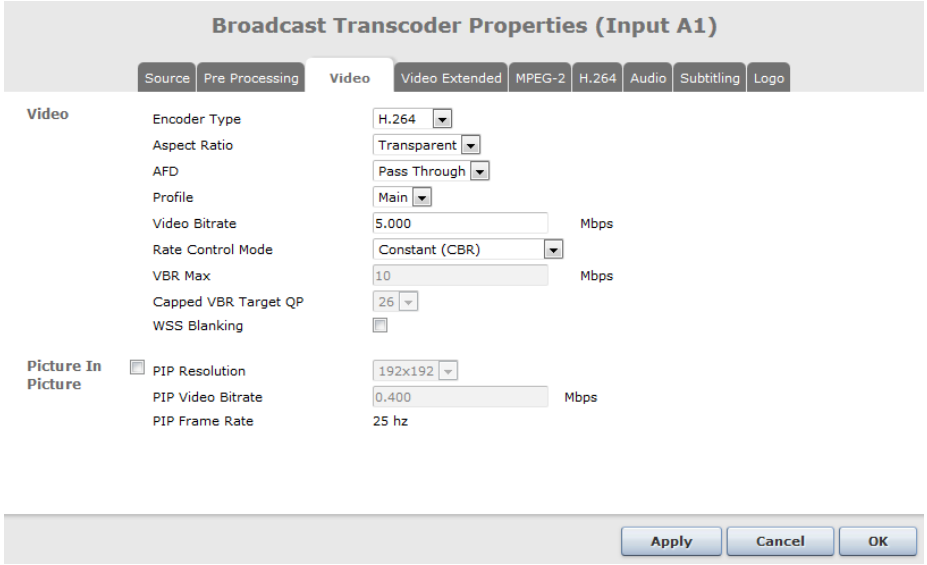


Figure 8.31 - Universal Transcoder- dense broadcast video parameters

Encoder Type	Selects compression standard to use. Available options are: H.264 or MPEG-2.
Aspect Ratio	Selects the aspect ratio to be signalled in the output video: • 16x9 • 14x9 • 4x3 • Transparent
AFD	AFD codes has below options: • Pass through: Incoming AFD codes are not applied, but passed through to video output stream. • Apply: Incoming AFD codes are applied to video output stream. • Remove: Incoming AFD codes are not applied and removed from the video output stream.
Profile	Selects the encoder profile to be used. The profile determines the range of tools from the codec "toolkit" that the encoder is allowed to

	utilize when encoding. The level is set automatically depending on the current configuration. MPEG-2: Main. H264: Main and High.
Video Bitrate	Sets output bit-rate in CBR mode.
Rate Control Mode	Video CBR (Constant Bit Rate) or CVBR (Capped Variable Bit Rate).
VBR Max	Sets the bounds of the output bit-rate when the encoder operates in CVBR.
Capped VBR Target QP	When in CVBR mode, this sets the target Quantization Parameter of the encoder. High QP will result in more compression at the expense of quality. Low QP will result in higher bit-rate and better quality. The encoder will use the selected QP unless the resulting bit-rate is outside the upper bound set by VBR Max.
WSS Blanking	Enables WSS Blanking on the encoded output
Picture In Picture	Enable PIP video. The video is a downscaled version of the main video. This will generate a new selectable service for use on any of the output modules. Both share the same audio. PIP is only supported for H264.
PIP Resolution	Sets the resolution of the PIP video. • 192x192 • 176x144 • 128x96 • 96x96 (not supported if main output is 1080i)
PIP Video Bitrate	Sets the bit-rate of the PIP video. Legal range is 96kbps to 400kbps.
PIP Frame Rate	Shows the frame-rate of the PIP video.

The PIP format is always progressive and the profile is Main.

8.5.4 Video Extended Parameters

This tab contains the video parameters common to both H.264 and MPEG-2.

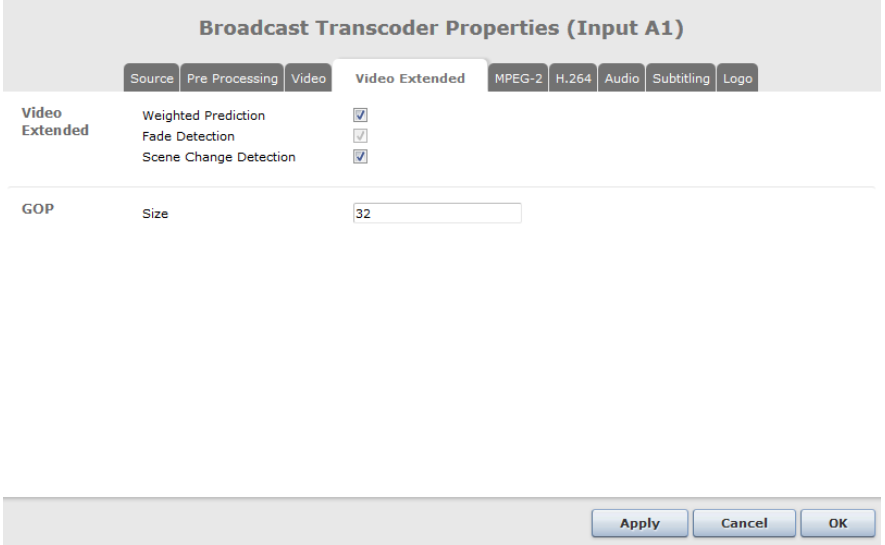


Figure 8.32 - Universal Transcoder- dense broadcast video extended parameters

The following parameters are available for video extended configuration:

Weighted Prediction	In H264 mode, the encoder can employ Weighted Prediction to improve the coding efficiency of fades and dissolves. It is recommended to have this enabled.
Fade Detection	When a fade is detected, the GOP structure is adjusted to improve the encoding efficiency of the fade. It is always enabled.
Scene Change Detection.	When a scene change is detected, the GOP sequence is adapted so that the new scene starts with an I frame. It is recommended to have this enabled.
GOP Size	Sets the number of frames in a GOP. Higher GOP will deliver better VQ, but STB channel change will be longer due to larger gap between I frames. The GOP size may vary if Scene Change Detection is enabled because I frames will be inserted to improve VQ.

8.5.5 MPEG-2 Parameters

The following parameters are available for MPEG-2 configuration:

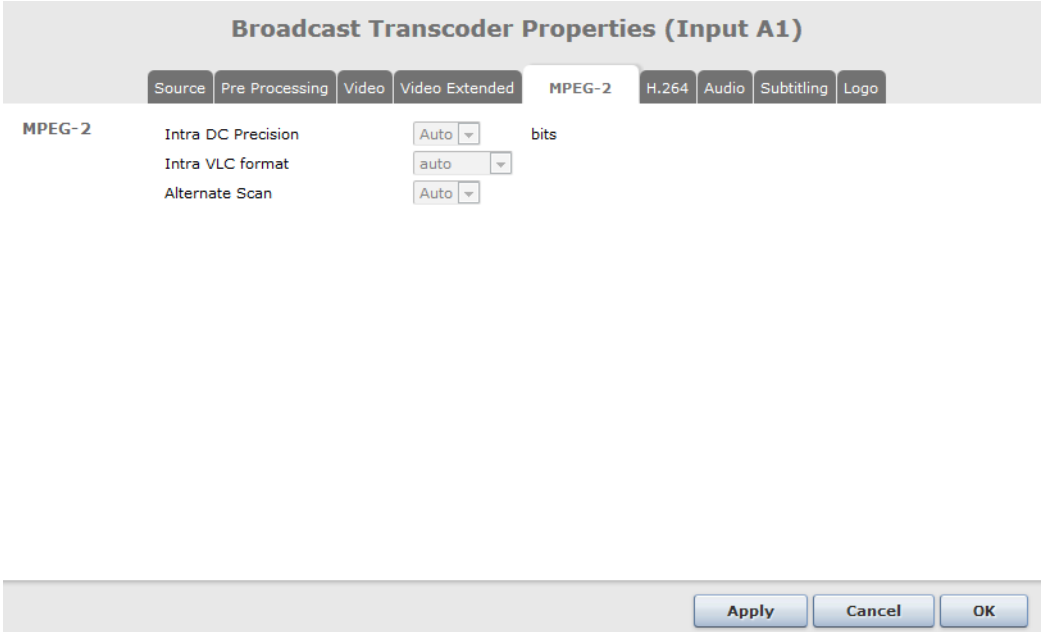


Figure 8.33- Universal Transcoder- dense broadcast MPEG-2parameters

Intra DC Precision	Quantization resolution of the DC (luminance) component in intra frames. Normal setting is 8 bits. Consider to increase precision when encoding at high bitrates. Valid range: 8 - 10bits and Auto.
Intra DC Precision	Number of bits to use for Intra-DC values. Modes to use for Intra-VLC: MPEG-1, Alternate or Auto.

Alternate Scan	Defines how transform coefficients are handled. Three modes are available; ON, OFF and Auto

8.5.6 H.264 Parameters

The following parameters are available for H.264 configuration:

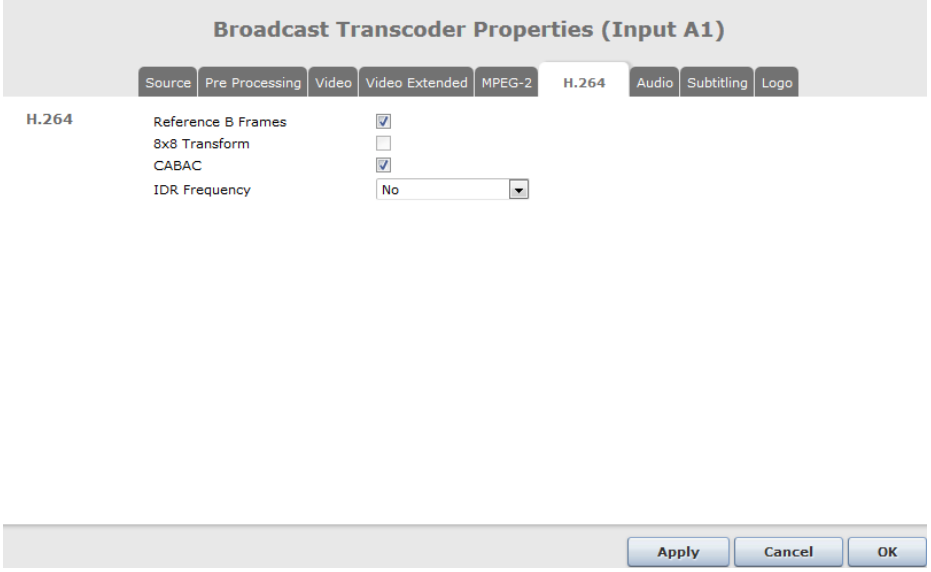


Figure 8.34 - Universal Transcoder- dense broadcast H264g parameters

Reference B-Frames	Enables B frames to be referenced to I, P or B frames. When disabled, B and P frames can only reference I or P frames.
8x8 transform	Available in high profile mode only. This enables 8x8 transform for residual coding. This can provide significant advantages for HD encoding.
CABAC	CABAC (Context Adaptive Binary Arithmetic Coding) is an entropy coding scheme introduced in H264. When enabled, CABAC is used instead of CAVLC. CABAC is the most efficient of the two, and should be the default choice. Some legacy decoders might not support CABAC.
IDR Frequency	Sets how often I frames shall be converted to IDR (Instantaneous Decoder Refresh) frames. IDR points are intra frames without past references. The IDR frequency can be important for decoders offering fast trick play (fast forward / rewind).

8.5.7 Audio Parameters

The following parameters are available for Audio configuration:

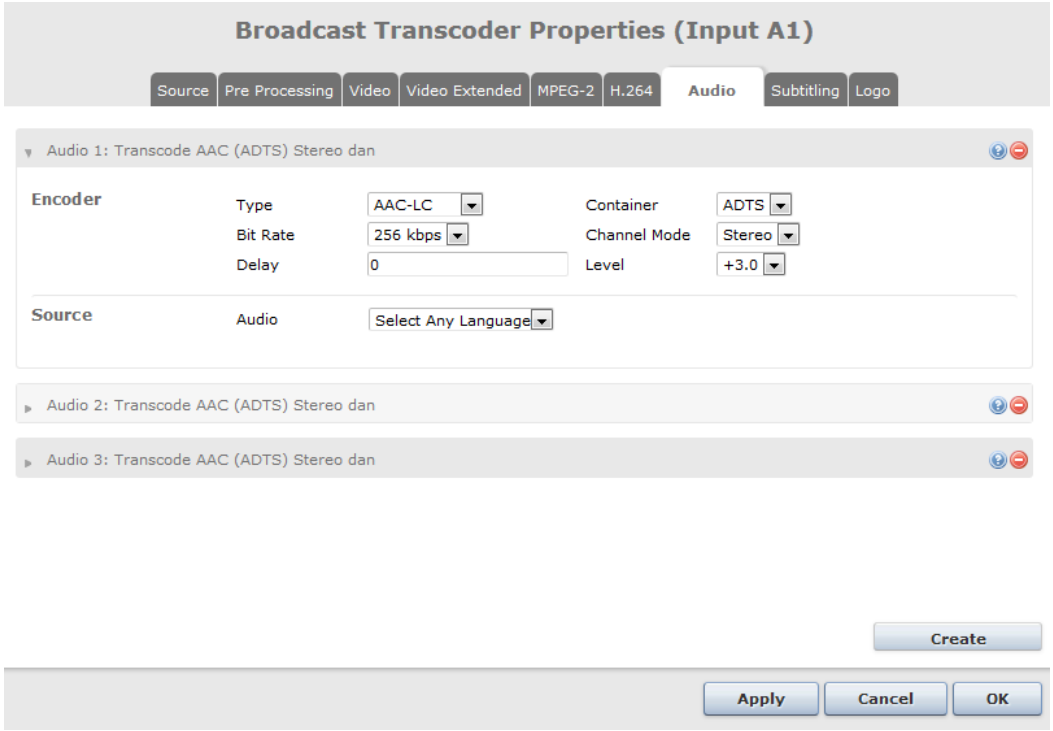


Figure 8.35 - Universal Broadcast Transcoder Audio parameters

Audio transcoders are added to a service by using the Create button. Up to 4 audio transcoders can be added to a service. Block A and B share in total 6 audio transcoders. Block C and D share in total 6 audio transcoders. These audio transcoders can be dynamically moved between the channels of block A-B (and C-D).

The format of the audio to be transcoded is automatically detected. The following audio input is supported:

- Input Codec Types: MPEG-1 layer II, AAC-LC(2.0), He AAC-v1/v2 (2.0) and AC-3 (2.0/5.1).
- Input Sample rate: 32 kHz 44.1kHz and 48kHz.

The output sample rate of the transcoded audio is 48kHz.

The various parameters that are configurable for the codecs are as follows:

Encoder	Codec Type: MPEG-1 layer II, AAC-LC, He AAC-v1/v2
Container	AAC container: ADTS/LATM
Bitrate	Bit-rate of the encoded audio stream. Legal range depends on Codec Type and Channel Mode.
Channel Mode	Channel Mode: Stereo or Mono.
Delay	Audio/Video sync can be adjusted from -300ms to + 300ms

Level	Audio level can be set from -6dB to + 6dB, 1dB step
Audio Source	Select the audio PID to be transcoded based on either language or a more advanced priority list. • "Select Any Language" - a random language in the original service. • "Current languages" - select from a list of incoming audio languages. • "Advanced Selection" - possibility to set up a prioritized selection based on codec type, PID value and/or language

8.5.8 Subtitling Parameters

The user can adjust the subtitle language priority on type basis. If a service contains both DVB subtitling and EBU subtitling on same language, the transcoder will select subtitling source based on the type priority configured.

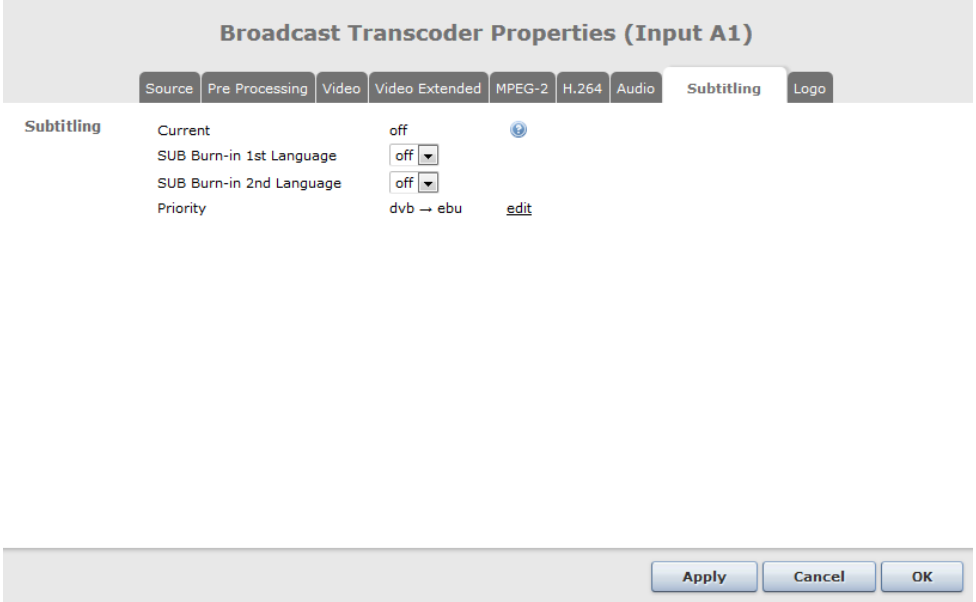


Figure 8.36- Universal Transcoder- dense broadcast subtitling parameters

Sub Burn-in 1st Language	Specify the 1st Language for Sub Burn in from drop down list.
Sub Burn-in 2nd Language	Specify the 2nd Language for Sub Burn in from drop down list.
Priority	Specify the Subtitling Selection Priority.

i	Please note that there is a limit of 4 subtitle burn-in components per module

8.5.9 Logo Insertion

Once there is a valid logo on the MMI (section 8.8), then it is possible to assign this to a transcoder channel. This is configured on the Logo tab:

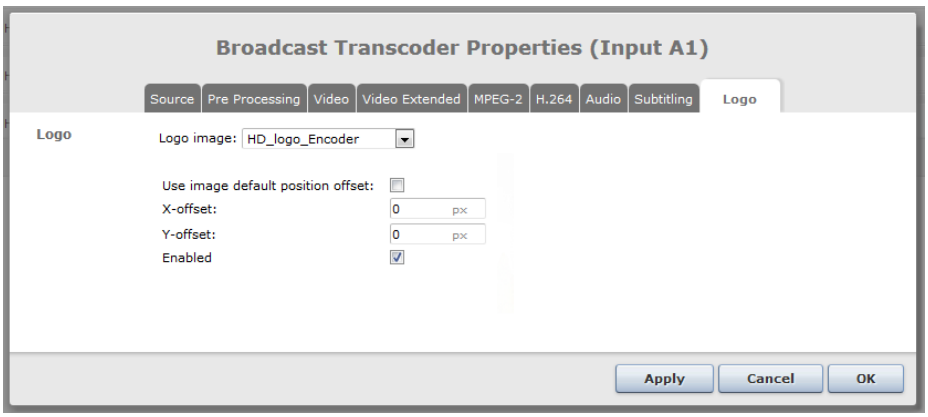


Figure 8.37- Universal Broadcast Transcoder logo insertion

Once the correct logo resolution is chosen for the service and the offset set, the logo can then be enabled.

8.6 Universal Multiscreen Transcoder Configuration

The Universal Transcoder- Multiscreen can take up to four traditional broadcast services (HD or SD) as inputs and convert/transcode these into several new services with profiles suitable for reception by multiple different devices. These profiles normally differ in bitrate, resolution, profile, level etc.

The Universal Transcoder- Multiscreen can take any conventional DVB service (HD/SD, MPEG-2 or H264) as input. The module consists of four separate transcoder paths A, B, C and D. All the profiles generated by the same path will be key frame aligned. If a single path does not have enough processing power to generate the required profiles, the processing power of several paths on the same module can be combined. Profiles generated by combined paths will be key frame aligned.

When the Universal Transcoder- Multiscreen is configured and enabled, the profiles generated will appear as MPTS inputs to the unit. These services can be output through an output interface just like any other service.

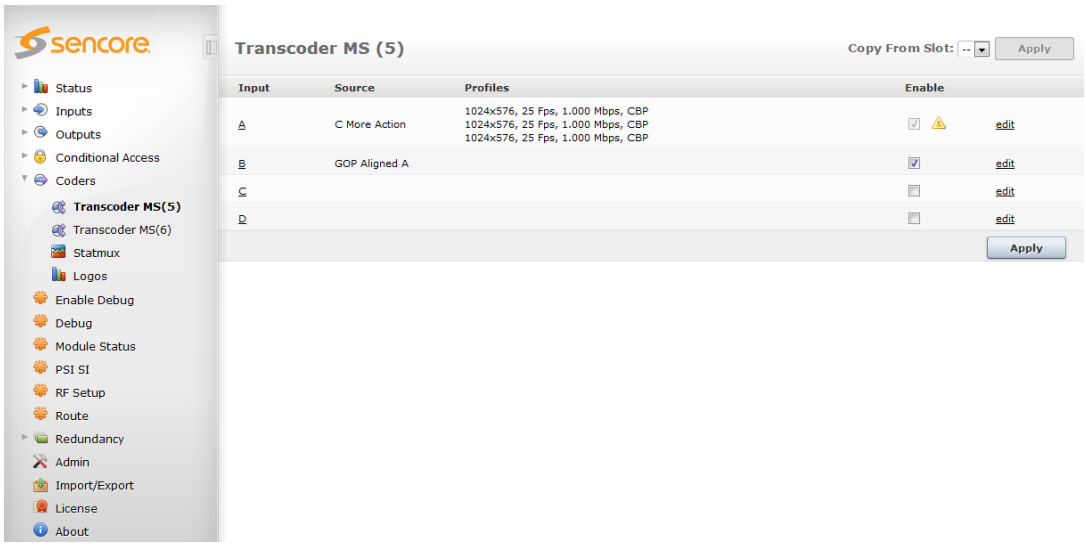


Figure 8.38 - Universal Transcoder- Multiscreen status and configuration

Input	Clicking A, B, C or D displays detailed information about the input services currently decoded by the transcoder path.
Source	Clicking on the service name for A, B, C or D shows the profiles currently produced by the path.
Profiles	Specifies the profiles associated with that source.
Enable	Enables each path (A, B, C or D) individually.
Edit	Clicking Edit opens the detailed configuration page for each path.

Click edit and the Universal Transcoder- Multiscreen configuration pages will be displayed. The configuration parameters are organized into different sections selectable from the tab menu on top. Source Parameters

This page is used to configure the input source parameters for each Universal Transcoder-Multiscreen path.

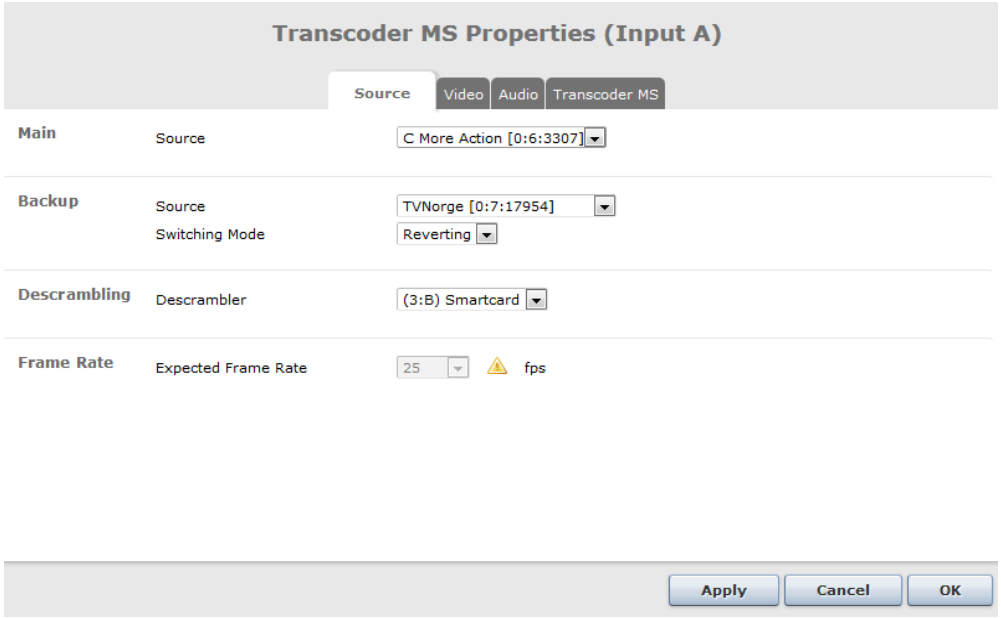


Figure 8.39 – Universal Transcoder- Multiscreen Source configuration

The following parameters are available for source configuration:

Main Source	Select the service to be transcended into multiscreen profile.
Backup Source	This list displays the source available for the chosen backup service.
Switching mode	This list displays the available switching mode: • Off • Once • Floating • Reverting
Descrambler	This list displays the available descramblers for the descrambling the vice.
Frame Rate	This list displays below options of Expected frame rate: • 59.94 fps • 50 fps • 29.97 fps • 25 fps

	When configuring the expected frame rate, the detailed information about the input service in the Universal Transcoder- Multiscreen status and configuration page could be of help.

8.6.1 Video Parameters

This page contains the parameters governing the common timing of the profiles. If the path to configure is GOP aligned to another path, then the parameters in this page are copied from the reference path.

All Data PIDs (TTX, DVB sub, DPI/LPI) from input service will be passed through to all transcoded output profiles by default. User can stop these PIDs in the component mapping filter on the transcoded output stream.

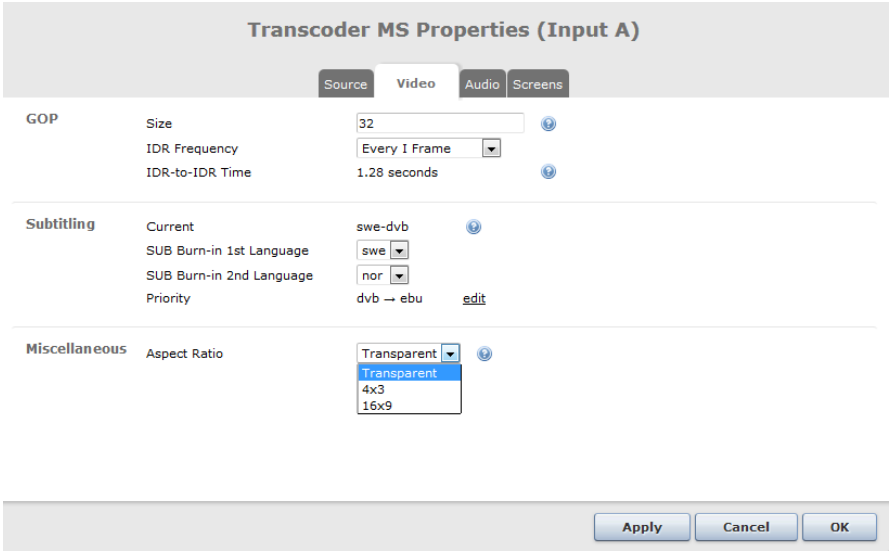


Figure 8.40 – Universal Transcoder- Multiscreen video parameters

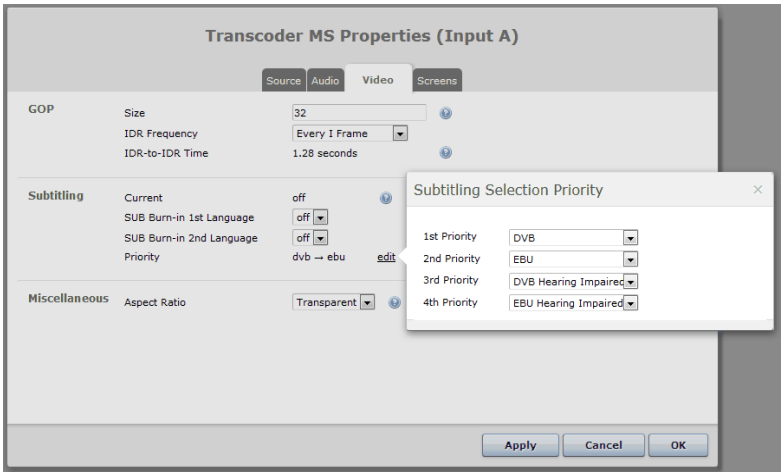


Figure 8.41 – Universal Transcoder- Multiscreen *subtitling parameters*

GOP	
GOP Size	Controls the GOP length (distance between I or IDR frames). The selected GOP size will be applied to output profiles with frame rate equal to expected frame rate (configured in the Source page). For output profiles with lower frame rate, the GOP size will be adjusted to achieve GOP alignment.
IDR Frequency	Sets how often I frames should be upgraded to IDR frames.
IDR-to-IDR Time	Status field presenting the distance in time between IDR frames; calculated on the basis of configured GOP size and IDR frequency.
Subtitling	
Sub Burn-in 1st Language	Specify the 1st Language for Sub Burn in from drop down list.
Sub Burn-in 2nd Language	Specify the 2nd Language for Sub Burn in from drop down list.
Priority	Specify the Subtitling Selection Priority.
Miscellaneous	
Aspect Ratio	Aspect Ratio can be selected from below options • Transparent • 16 x 9 • 4 x 3

The user can adjust the subtitle language priority on type basis. If a service contains both DVB subtitling and
EBU subtitling on same language, the transcoder will select subtitling source based on the type priority configured.

To ensure interoperability with segmenters and multiscreen clients, the values of GOP Size and IDR Frequency have to be selected with these devices in mind. The IDR-to-IDR Time represents the smallest segment size that can be produced.

8.6.2 Audio Parameters

On the Universal Transcoder- Multiscreen there are two audio transcoders per path. These support MPEG-1, AAC-LC, HE-AACv1 and HE-AACv2 as input and output codec. AC-3 and E-AC-3 input is also supported (decoding only - not encoding) if the *Dolby® Digital Plus Professional Decoder* license is installed on the module. Multichannel inputs (e.g. 5.1) will be downmixed to 2.0 as part of the transcode process.

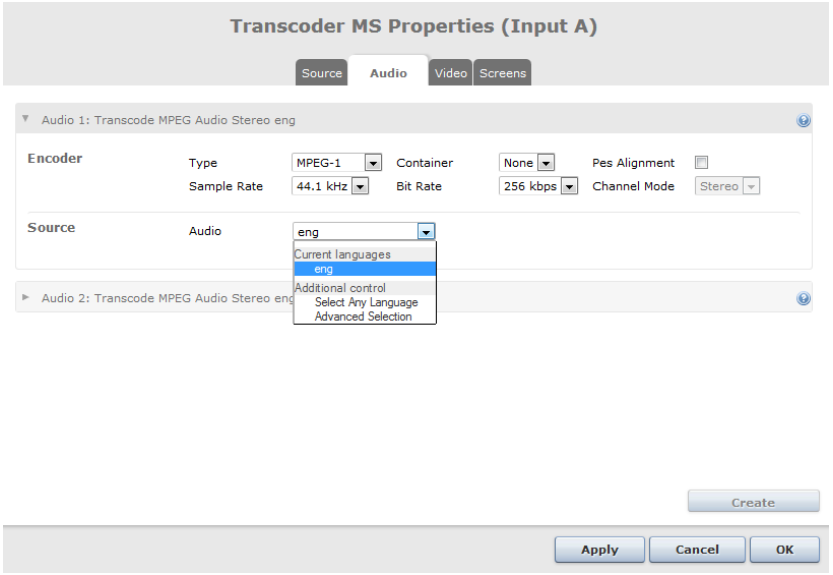


Figure 8.42 – Universal Transcoder- Multiscreen *Audio Parameters*

The following parameters are available for Audio configuration:

Encoder Type	The output codec type. MPEG-1, AAC-LC, HE-AACv1 and HE-AACv2 are supported
Container	AAC container. LATM and ADTS are supported.
Pes Alignment	Enable or Disable Pes Alignment
Sample Rate	The sample rate of the output. The audio is sample rate converted.
Bit Rate	Supported range of bit rates for each codec. See details per codec in below sections.
Channel Mode	Currently only stereo is supported.
Audio Source	Select the audio PID to be transcoded. “Select Any Language” - a random language in the original service. “Current languages” - select from a list of incoming audio languages.

The codec specific parameter values are as follows:

MPEG-1 encoder	MPEG-1 layer II
Bitrate	64-384 kbps

AAC encoder	AAC-LC/HE-AACv1/HE-AACv2
Bitrate	32-384 kbps (LC-AAC) 32-192 kbps (HE-AACv1) 32-96 kbps (HE-AACv2)

Container	ADTS or LATM

In the current software it is not possible to pass through any audio components and only encoded audio is possible to output.

8.6.3 Profile Parameters

This page is used to configure the multiscreen profiles.

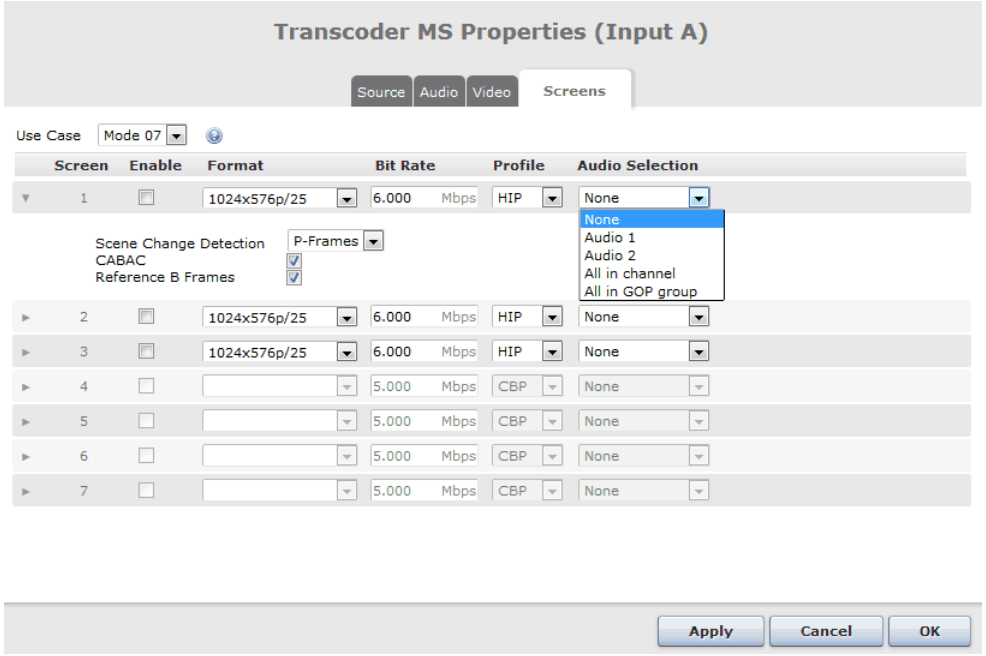


Figure 8.43 – Universal Transcoder- Multiscreen profiles configuration

The following parameters are available for profile configuration:

Use Case	Select among 16 modes for the desired use case. See below for detailed explanation of this setting.
Screen	Available entries depend on the selected use case.
Enable	Enable or disable each screen individually.
Format	Select resolution and frame rate of each screen. Range of resolution and frame rate depends on selected use case.
Bit Rate	Configure bit rate for each screen. Legal bit rate range depends on resolution.
Profile	Configure H264 Profile (encoding complexity) for the respective screen. The choices are Main Profile (MP), Constrained Baseline Profile (CBP) and High Profile (HP). The H264 Level is calculated based on bitrate, resolution and frame rate.
Audio Selection	The "Audio Selection" parameter available for each profile and controls which of the transcoded audio tracks are associated with a profile

	• None: No audio will be associated with profile. • Audio 1: Audio 1 transcoded by this block (A/B/C/D) will be associated with profile. • Audio 2: Audio 2 transcoded by this block (A/B/C/D) will be associated with profile • All in Channel: Audio 1 and generated by this block (A/B/C/D) will be associated with profile • All in GOP Group: All audio transcoded by GOP aligned blocks will be associated with profile.
Scene Change Detection	Specify any of the below options: • P-Frames • Disabled.
CABAC	Enable or disable CABAC entropy coding.
Reference B Frames	Enable or disable hierarchical B frames.

i	All non-transcoded audio and other components are passed through and associated with all profiles.

Reference B Frames and CABAC parameters are available for each screen by expanding the settings view through clicking on the icon in the left most column.

The question mark icon opens up a detailed explanation of the various modes configurable through the Use Case setting. Each path consists of a finite amount of video processing power. Fundamentally the encoding complexity of a HD profile is much higher than the complexity of a low resolution profile. Therefore the Universal Transcoder- Multiscreen can encode more low resolution profiles than high resolution profiles.

The resource can be configured in 16 different Use Cases or modes. The various modes give the possibility of partitioning the processing power to match the multiscreen profile requirements of any device. The Use Cases available are:

Mode 1	1x HD
Mode 2	2x Half HD
Mode 3	1x Half HD, 2x Wide SD
Mode 4	1x Half HD, 2x SD
Mode 5	1x Half HD, 2x VGA
Mode 6	1x Half HD, 4x Half SD
Mode 7	3x Wide SD
Mode 8	2x Wide SD, 2x SD

Mode 9	2x Wide SD, 2x VGA
Mode 10	2x Wide SD, 4x Half SD
Mode 11	4x SD
Mode 12	2x SD, 2x VGA
Mode 13	3x SD, 3x Half SD
Mode 14	5x VGA
Mode 15	4x VGA, 2x Half SD
Mode 16	7x Half SD

The modes listed above are defined by:

Category	Max Resolution in Category	Comment
HD	1920x1080p25	HD (25 frames per second)
	1280x720p50	Broadcast HD
Half HD	960x1080p25	Half H-res HD
	1280x720p25	Half frame rate Broadcast HD
Wide SD	1024x576p25	16:9 SD
SD	720x576p25	Broadcast SD (progressive)

If a single use case or path alone is not enough to produce all the required profiles, use the GOP alignment feature present in the Source page to combine several paths.

More profile information is available in the GUI at Edit->MS Transcoder->Screens->Use case ->Click on? (Question mark) as shown in below figure.

Then page with multiscreenUserGuide will come up.

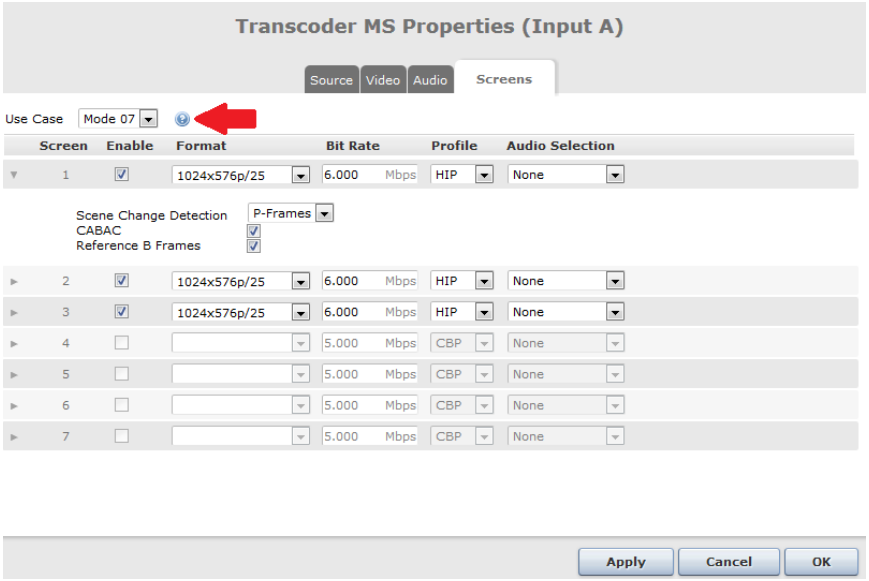


Figure 8.44 – Universal Transcoder- Multiscreen profiles –mode selection

8.6.3.1 Support for Broadcast Profiles (576i/1080i)

In the Universal Transcoder- Multiscreen profiles, it is possible to select Broadcast based profiles. In order to configure these, the following modes must be selected:

- 576i is only available in Mode 8
- 1080i is only available in Mode 1

Please note that the broadcast profiles have the same GOP length (due to Key Frame Alignment) as the Progressive profiles.

8.6.4 Configuration Copying

This feature enables the user to copy a configuration from one Universal Transcoder- Multiscreen to another. This feature is useful whenever the same set of profiles is to be configured on several modules.

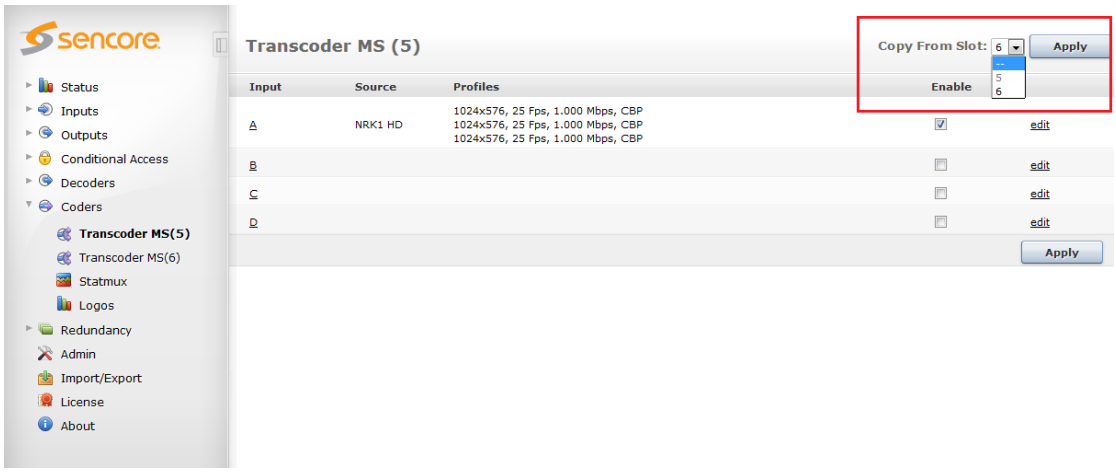


Figure 8.45 – Universal Transcoder- Multiscreen copy configuration

Copy from slot	Specify the slot from which we need to copy profiles.

Once the source slot is selected and the 'Apply' button clicked, this will copy this configuration to the destination/current module.

8.7 Statistical Multiplexing

The principle of statistical multiplexing is that a group of video encoders/transcoders (referred to as a StatMux group) shares a fixed quantity of TS bandwidth. The bandwidth is distributed by a centralized StatMux controller, and the program with the most complex video may be allowed to use more bandwidth than programs with less complex video or with a lower priority.

The statistical probability that all programs in a multiplex shall demand a high bit rate at the exact same time decreases when the size of the multiplex group increases.

The motivation for a StatMux system is to either:

- Avoid spending bandwidth on simple video sequences in order to free up capacity for new programs in the multiplex.
- Distribute available multiplex bandwidth between programs in order to increase overall video quality (VQ), by minimizing overall quantization (QP)

8.7.1 Modules Supported

The StatMux controller is located on the MMI module of the unit. This is responsible for the control of the StatMux groups and modules.

The following encoder/transcoder modules types are supported:

- encoder-hd (Dual HD-SDI encoder)
- encoder-hd (Dual HD-SDI encoder with AES)
- encoder-sd (QUAD SD-SDI encoder)
- transcoder-hd (HD transcoder)
- transcoder-sd (SD transcoder)

8.7.2 Statmux group configuration

The Statmux tab is available under the top level Coders menu, below all encoders/transcoders. Clicking the Statmux tab will bring up the StatMux GUI page. This is where the StatMux groups are generated. On this page, the encoder and transcoder modules are listed on the left hand side, under Coder Inputs. All Statmux groups are listed on the right hand side, under StatMux Output.

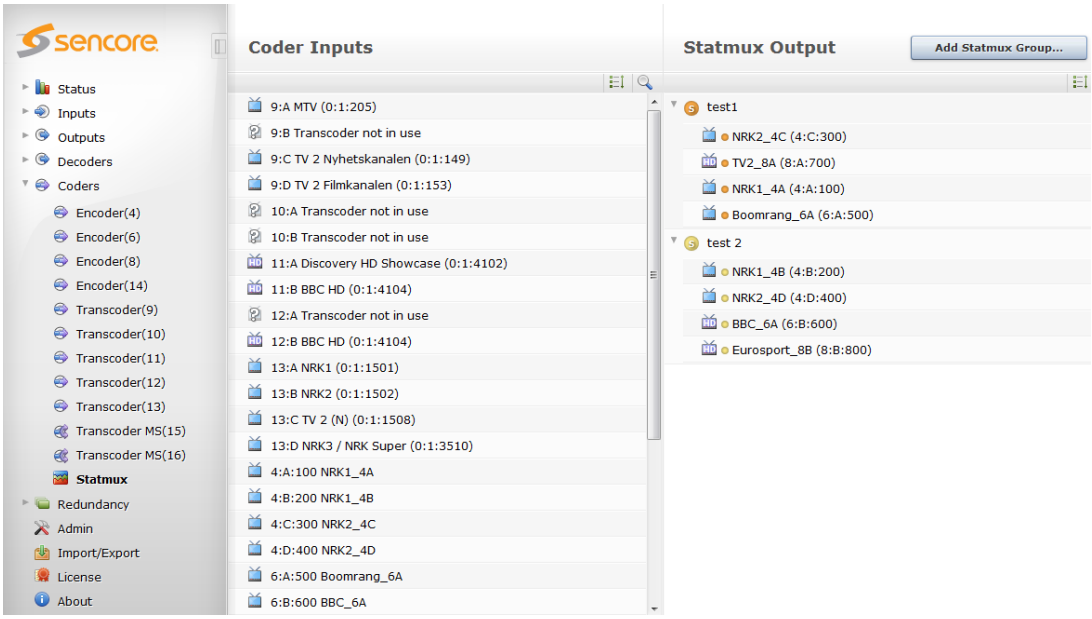


Figure 8.46 – Statmux configuration

The Add StatMux Group button will create up to 4 StatMux groups per chassis. A maximum of 32 programs may be added into StatMux groups, by dragging them from the coder input and dropping them into a StatMux group.

For services from the transcoder module, please note that you will have to configure these on the output before they are able to be added to a Statmux group.

8.7.2.1 Editing a StatMux Group

Double clicking any of the StatMux group top level nodes (eg Main Group below) will bring up the Edit StatMux Group dialog:

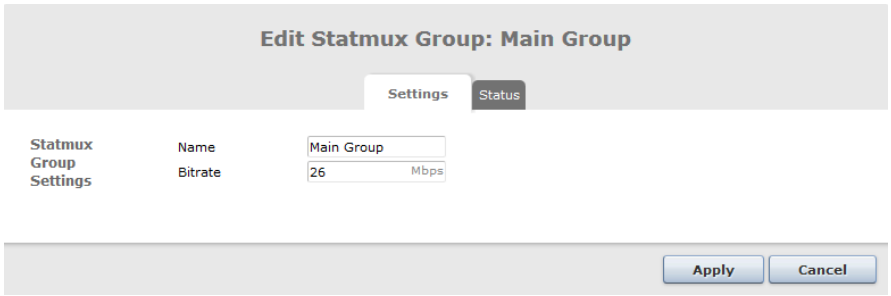


Figure 8.47 – Statmux Settings

Two parameters are available under the Settings tab:

Name	User generated name that identifies the StatMux group in the GUI.

Bitrate	Total bitrate (Mbps) that will be shared between all coders in this StatMux group.

8.7.2.2 StatMux Group Status

The status tab will bring up the group status with the current bitrate allocation. The following status is available:

Video Bitrate	Bitrate allocated by the video PID in this program.
Activity	Informal measurement of frame-to-frame video activity and estimated bitrate requirements for this program. A low activity indicates a still picture while a high activity indicates rapid scene changes. A HD channel will have a higher video activity (and higher bitrate requirements) than a SD channel..
Distortion	Informal measurement of video distortion after encoding, based on the amount of quantization introduced per video frame. A low distortion value indicates that a low QP and a high VQ was achieved

The statistics can be reset using the Reset Stats button

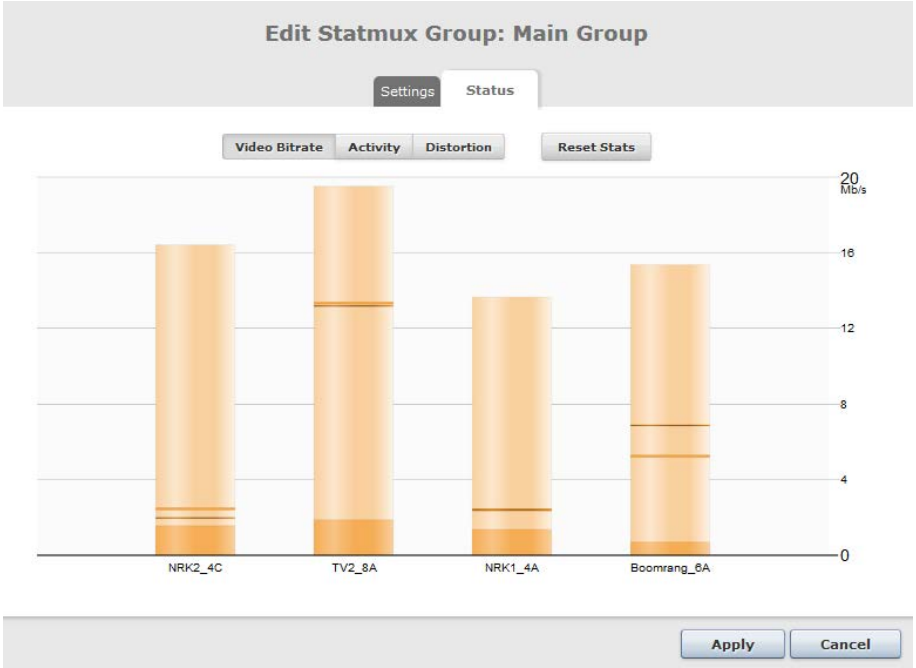


Figure 8.48 – Statmux Group status

For each bar, the following information is shown:

- Maximum bitrate since last reset
- Current live bitrate

- Average bitrate since last reset
- Minimum bitrate since last reset

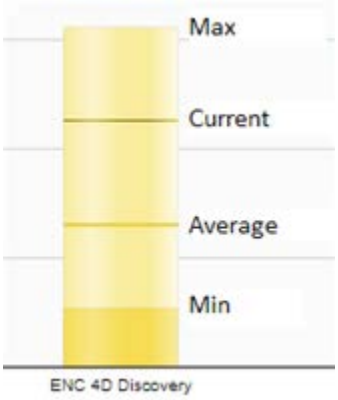


Figure 8.49 – Statmux Status properties

8.7.2.3 StatMux Service configuration

By double clicking any programs within a StatMux group (on the StatMux page) will bring up the Edit Coder Properties dialog:

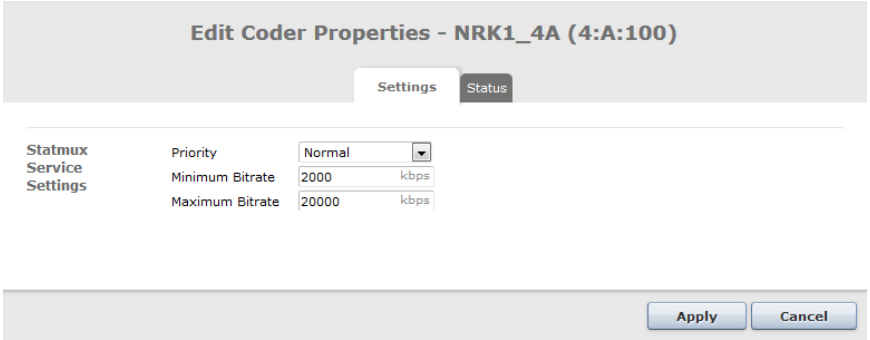


Figure 8.50– Statmux Coder settings

The following service related parameters are available under the Settings tab:

Priority	The priority will adjust the video priority of this channel in the range [-5,-4,-3,-2,-1-,Normal,+1,+2,+3,+4,+5]. A higher priority will increase the allocated video bitrate and video quality of this program compared to other programs in the StatMux group. The priority parameter will directly affect the amount of quantization (QP) allowed for this program, in QP steps.
Minimum Bitrate	This is the minimum allowed bitrate allocated by this program. All audio and video PID's will count as specified in the table below.
Maximum Bitrate	This is the maximum allowed bitrate allocated by this program. All audio and video PID's will count as specified in the table below.

The following table shows which PIDs will count as part of the StatMux group, and which PIDs will not count as part of the StatMux group:

Module	PIDs inside StatMux group	PIDs outside StatMux group
Encoder	Video PCR Audio Passthrough AC-3[1]	PIP VBI/VANC PSI/SI (PAT, CAT, PMT, NIT, EIT etc.)
Transcoder	Video PCR Audio Passthrough PIDs[3]	PIP PSI/SI (PAT, CAT, PMT, NIT, EIT etc.)

When AC-3 passthrough audio is enabled, a fixed bitrate of 640kbps is reserved for AC-3 inside the group

Transcoder pass-through PID's are shown under the transcoder properties dialog by clicking any transcoder under the Coders tab

8.7.2.4 StatMux Service Status

The status tab will bring up the program status with history view up to 24 hours. The following status is available per program:

- *Video Bitrate*: Bitrate allocated by the video PID in this program.
- *Activity*: Informal measurement of frame-to-frame video activity and estimated bitrate requirements for this program. A low activity indicates a still picture while a high activity indicates rapid scene changes. A HD channel will have a higher video activity (and higher bitrate requirements) than a SD channel.
- *Distortion*: Informal measurement of video distortion after encoding, based on the amount of quantization introduced per video frame. A low distortion value indicates that a low QP and a high VQ was achieved.

Four different time scales are available: 5 min (Live), 1 hour, 5 hours and 24 hours.

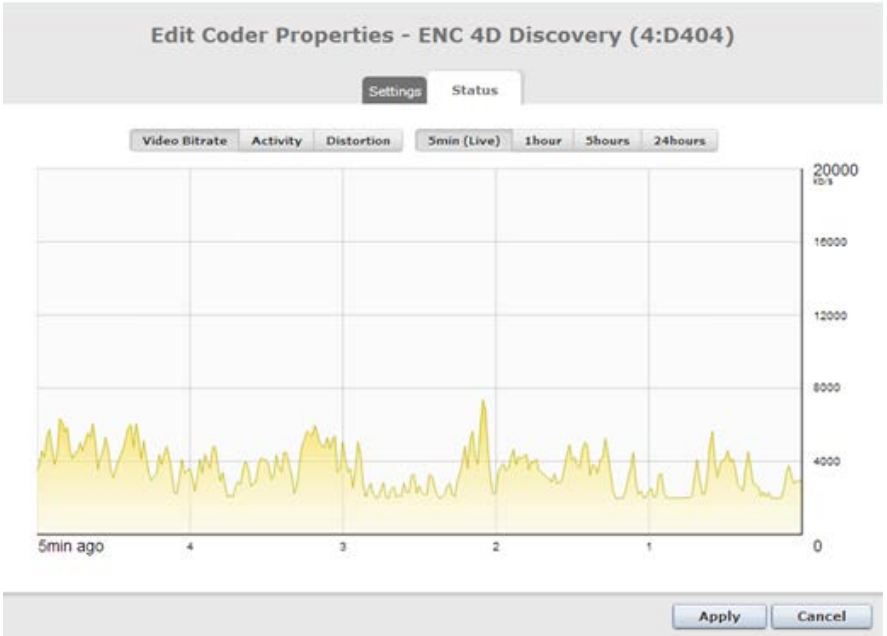


Figure 8.51 – Statmux Service status

8.7.3 StatMux service output configuration

Programs that are part of a StatMux group are treated as any other program in the output multiplexer. Any output can contain a combination of non-StatMux and StatMux channels from different StatMux groups.

StatMux programs are grouped under the input column, and colour markers are used to mark StatMux group membership.

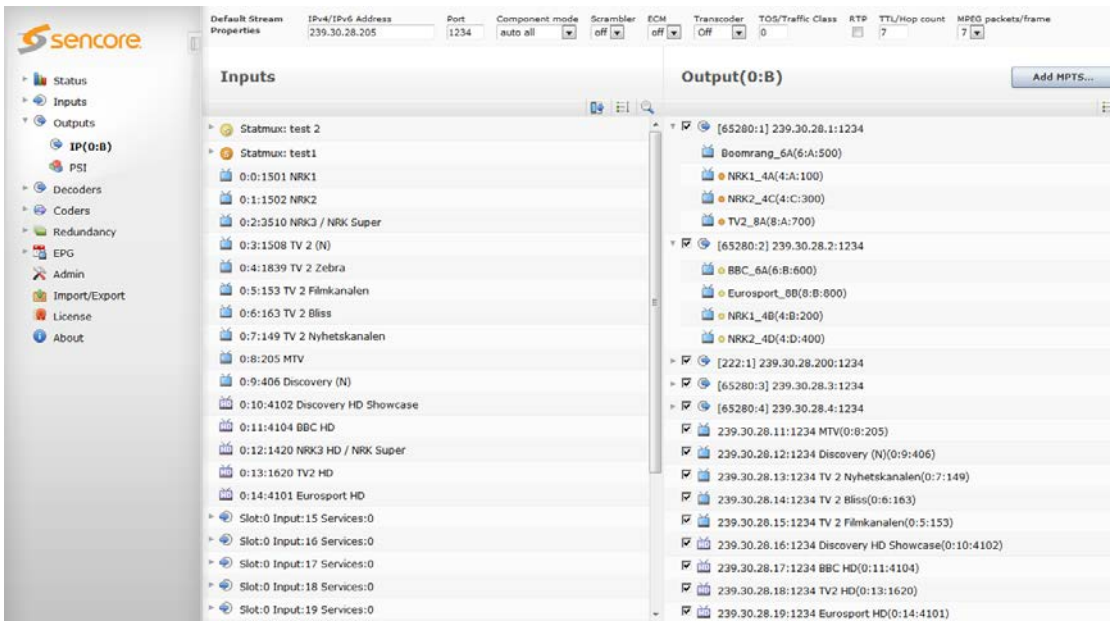


Figure 8.52 – Statmux Output service creation

8.8 Adding Logo Images

In order to add logo images to an encoded/transcoded service, an image of the corresponding resolution will first need to be uploaded to the MMI mode.

	A **MicroSD card** has to be available on the MMI module. All logos are stored on the MMI module. Please contact ProCare@sencore.com for details.

8.8.1 Uploading Logo to the MMI

The file format supported by the Logo Insertion is 8-bit PNG with correct resolution (listed below). If the PNG file is in ARGB format, the logo will be transparent depending on the alpha channel in the PNG file.

In order to upload the file, first navigate to the **Coders->Logos** page:

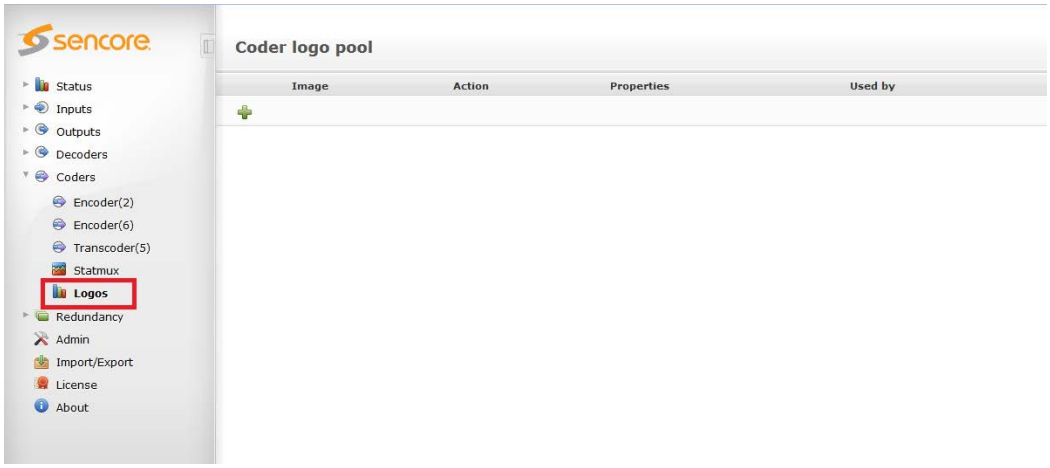


Figure 8.53: Logo for Encoders

Note: If no micro SD card is present on the MMI, the following message will appear.

"No microSD card inserted into card reader. Please contact support."

The next step is to click the  and navigate to the PNG file with appropriate resolution. Once uploaded, this will create a new entry in the logo table.

Required size depends on resolution of encoder SD/720P/1080i.

Encoder->Edit->Source->Video Format	Logo Resolution
576i/480i	192x128
720p	360x180
1080i	480x270

Once uploaded, it is possible to edit the information/details of the logo.

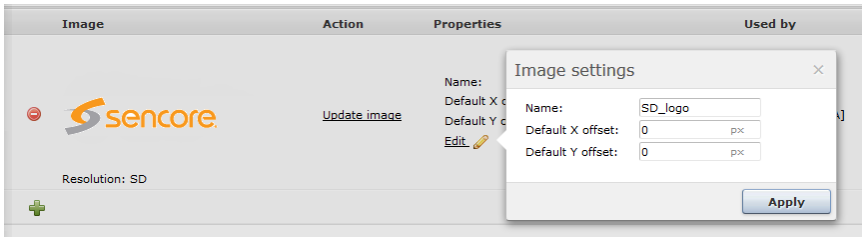


Figure 8.54 Edit Logo details

For each downloaded logo the user can define a default position. The position defined with pixel accuracy. X (horizontal) and Y (vertical) defines position of **top left corner** (**TLC**) of logo in active video.

- Example 1: Position (X=0, Y=0) positions logo's TLC in TLC of active video.
- Example 2: Position (X=200, Y=100) positions logo's TLC 200 pixels from LHS, and 100 pixels down from first line of active video.

The logo can be updated at any time by clocking on the 'Update image' text.

9 Digital Processing Modules

9.1 Audio Leveling Module

The Audio Leveling card is able to adjust the audio level for up to 250 audio PIDs. The leveling process operates purely in the digital domain which means there is no signal degradation associated with this process.

The concept with the Audio Leveling card is to be able to adjust all the outputs to the same audio level so that zapping between channels will be more comfortable.

Figure 9.1 - Audio Leveling Effect

The audio leveling card is intended to be used with all available outputs.

The audio leveling parameters are configured as part of the service output setup.

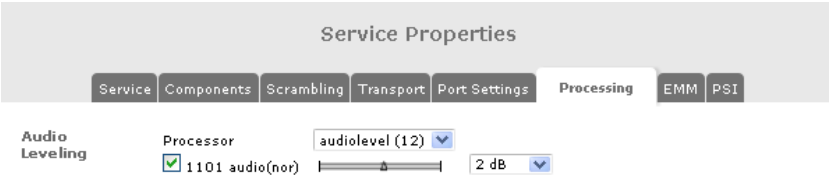


Figure 9.2 – Setting up Audio Leveling

The following parameters are available:

Processor	Select the audio leveling card to route the input stream through – the unit supports multiple cards per chassis.
Check box	Enable the audio leveling algorithm
Slider/Dropdown box	Adjustment level – the range is +/- 30dB, in steps of 2dB

9.2 Electronic Program Guide (EPG)

The Electronic Program Guide (EPG) module is responsible for collecting event information from all incoming transport streams, usually via PID 18, and regenerating this information for EPG-enabled outgoing networks.

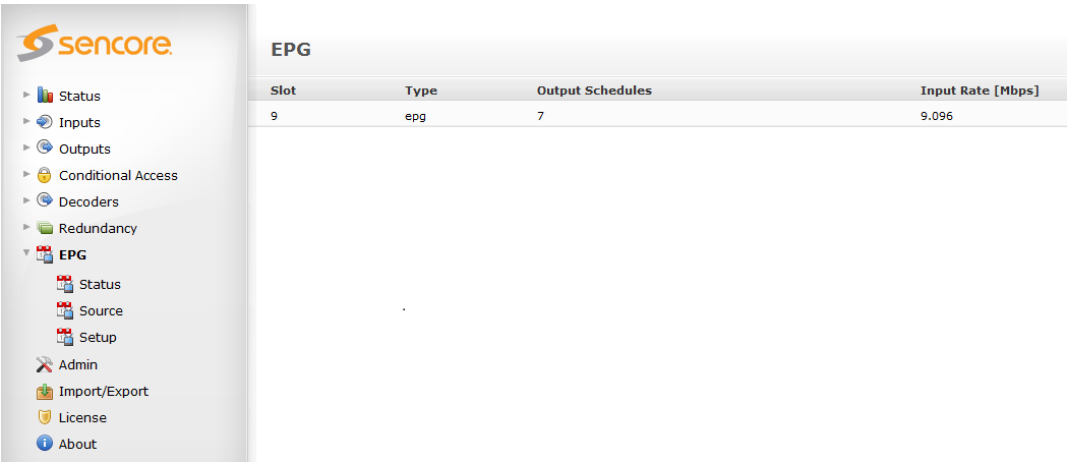


Figure -9.3 - EPG Node

The EPG node has three sub-nodes:

- Status – the Status node displays the EPG status for all outgoing transport streams aggregated according to each network.
- Source – the Source node displays
- Setup – Configure matching criteria for incoming EIT tables, manually defining EIT PIDs, EPG synchronisation and other miscellaneous parameters

9.2.1 EPG Status

The EPG Status node (Figure 9.4) displays all outgoing transport streams carrying EPG data. The data is aggregated according to each network service configuration.

Figure 9.4 - EPG Status Node

The following information is displayed per output Network:

kb	Size of the EPG carousel to be played out in kb
Mbps	Outgoing bitrate, as defined during output configuration
Rotation time	The time required for the EPG playout to complete one cycle. If the priority of the first 12 hours is activated, then the cycle time of these 12 hour events will be reported.
Service	Service name will be displayed for EPG.
EIT Source	Event Information Table source.
Current program	Service name of current program being displayed.
P/F	Present/ Following status.
Sch	Schedule status.
Validity	Specify the Validity of the scheduled service.

9.2.2 Setting up EPG

To set up EPG for your output transport stream, select **EPG → Setup**.

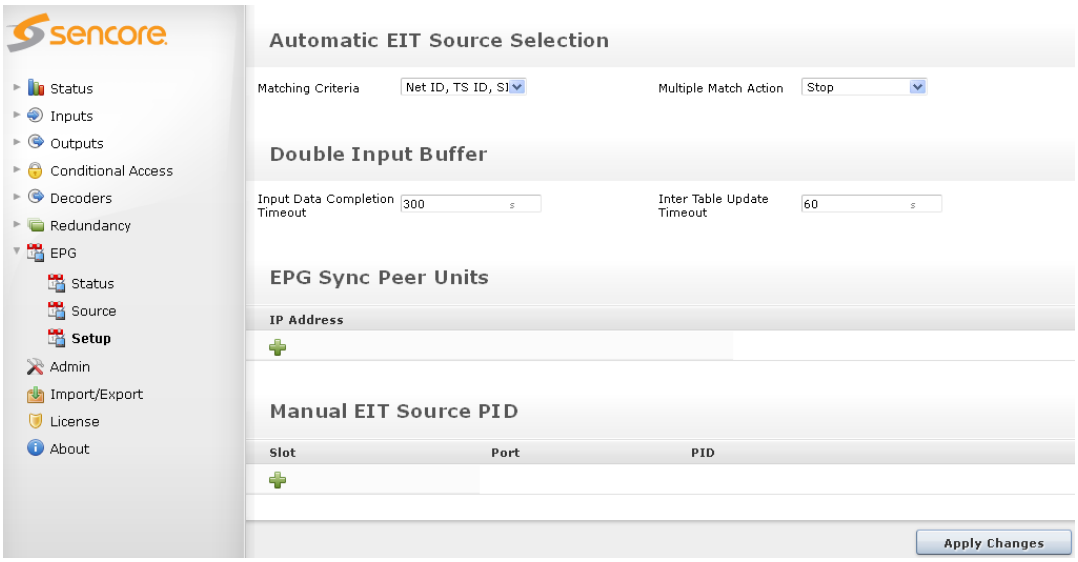


Figure 9.5 - EPG Setup

The following parameters are available for configuration:

Automatic EIT Source Selection

Matching Criteria	Used to determine which component(s) of the triplet (NET ID, TS ID, and SID) will be used to match EPG information with its service.
Multiple Match Action	Lists the course of action that should be chosen if there is more than one service available for the matching criteria.

i	The fewer parameters you match on, the higher the chance is to get multiple matches

Double Input Buffer

Double input buffering allows for a more intelligent EPG update algorithm. In addition, it also enables the system to flag warnings if the input is corrupt.

The following parameters are available:

Input Data Completion Timeout	If the EPG for a particular service is not complete within this timeout, then the system will play the already received data. The default value is 60 seconds.
Inter Table Update Timeout	The EPG data is transmitted in different tables, according to the time which the data describes. For example: EPG for day one is transmitted in a different table_id compared to EPG for day six. This parameter specifies the duration the system should wait between table_ids before it starts to regenerate the content. If the parameter's value is low, it is likely that the system will regenerate several times during the transfer of EPG covering many days. The default value is 300 seconds.

EPG Sync Peer Units

In a system with many units, e.g. in a QAM network, there may be a few units belonging to the same network. In this system, the outgoing EPG should signal all the services.

To synchronize your units, go to **EPG → Setup** and list the IP address for each remote EPG module (*not* IP address for the MMI) under **EPG Sync Peer Units**.

Figure 9.6 - EPG Sync Peer Units

The EPG module's IP address can be configured under the **Admin** node.

	Currently the system only supports synchronization of up to *five* remote EPG modules.

Manual EIT Source PID

By default, all PID 18 information is automatically sent to the EPG processing card. If EPG information for certain inputs is not on PID 18, it is possible to manually set the PID value using the **Manual EIT Source PID** box.

Figure 9.7 - Manually adding an EIT Source PID

	Design of the EPG behavior is based on the ETSI EN 300 458 V1.9.1 (2009-03) standard along with ETSI TR 101 211 V1.9.1 (2009-06) guideline.

9.3 Adding EPG information to a Transport Stream

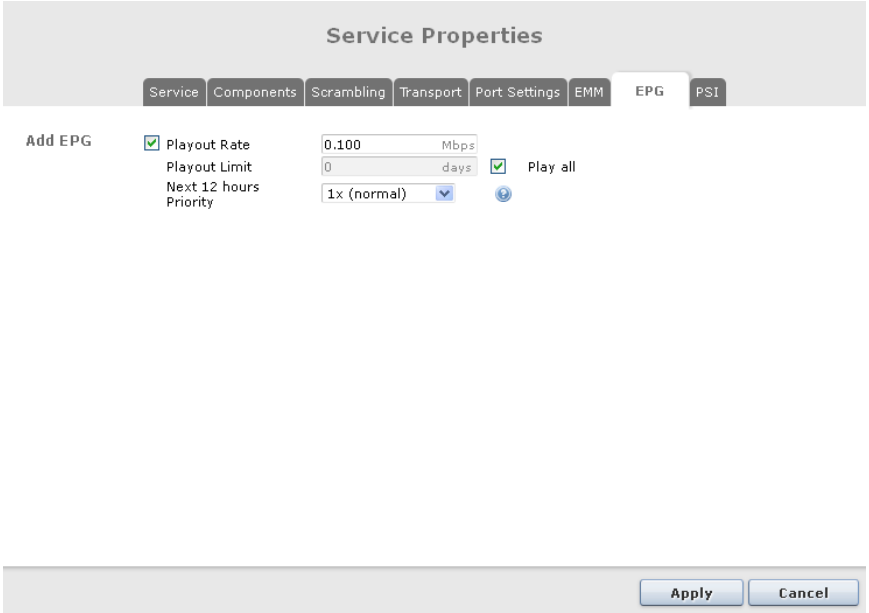


Figure 9.8 - Setting up EPG within the Outputs Node

Typically, schedule information is carried only on one transport stream per network. To enable EPG regeneration, select the outgoing transport stream on which EPG information will be broadcast using the following steps:

1. Select **Outputs** from the **Navigation Pane**
2. Select the particular output module
3. Double click on the output transport stream of your choice
4. Select the **EPG** tab
5. Check the **Add EPG** checkbox
6. Finally, set the parameters accordingly

The output transport stream will contain schedule information for all channels within the same network, grouped according to outgoing Network ID.

EPG can be enabled on more than one transport stream within a network – all these streams will then carry full schedule information, if they are available from the source.

The EIT schedule will be merged with the EIT Present/Following and Actual/Other.

9.3.1 Playout Rate, Playout Limit, and Priority

There are three parameters that can be modified when configuring your schedule information:

Playout Rate	The amount of bandwidth you want to allocate for schedule and present/following information (the higher the playout rate, the shorter the rotation time).
Playout Limit	The amount of schedule information being sent out.
Priority	The number of times schedule information for the next 12 hours is repeated in your carousel.

Assuming 1 rotation = *r*, the figures below illustrate these three parameters and how they can influence the output of schedule information.

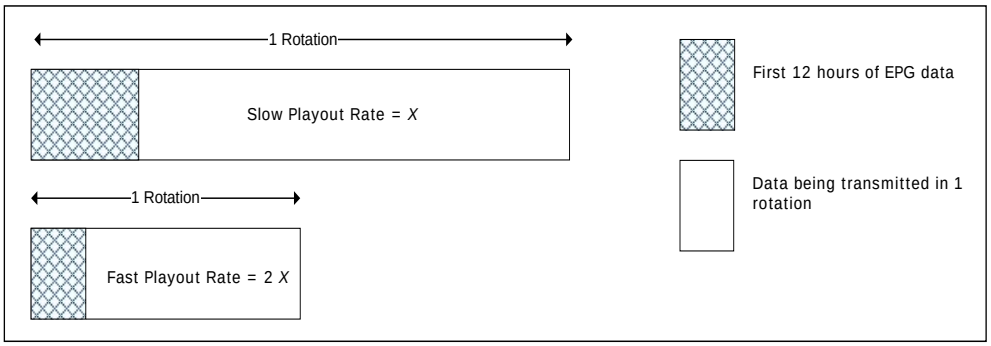


Figure 9.9 - Setting a Playout Rate

Figure 9.9 above illustrates the amount of schedule information sent in one rotation if the **Playout Rate** is modified.

- In the first box, suppose the **Playout Rate** is *X*.
- In the second box, we double the **Playout Rate**, effectively increasing it to 2 *X*. Consequently the size of one rotation will be halved, making it equivalent to ½ *r*.

When choosing a suitable **Playout Rate**, be aware that this also includes present/following – Actual and Other.

If the **Playout Rate** is too low, present/following actual will be given priority over present/following other; schedule will be inserted if/where there is room.

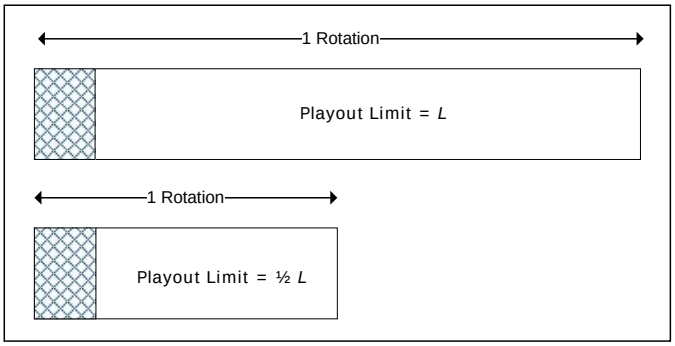


Figure 9.10 - Setting a Playout Limit

***Figure 11.10** illustrates the amount of schedule information sent in one rotation if the Playout Limit is modified.*

- In the first box, suppose the **Playout Limit** is *L*.
- In the second box, we reduce the **Playout Limit** to ½ *L*. This reduces the amount of schedule information being output. Consequently the size of one rotation will be halved as well, making it equivalent to ½ *r*.

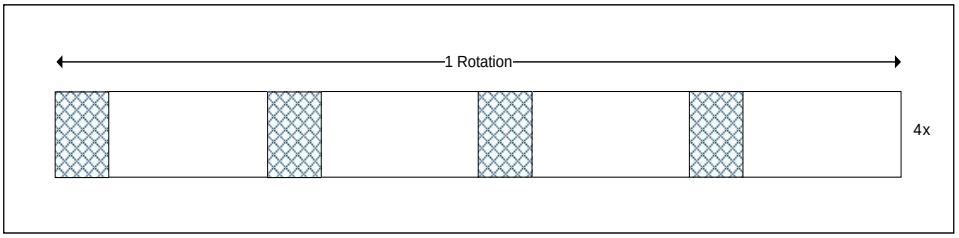


Figure 9.11 - Setting a Priority

To improve the time it takes for schedule information to load, you can assign a **Priority** value for the next 12 hours of data. Suppose you choose **4x**, then the 12 hours of data will be repeated four times in one rotation. Consequently, this will increase the size of your rotation.

9.3.2 EIT Source Setup

Once the output transport stream is setup, the information will be displayed in the **EPG** node.

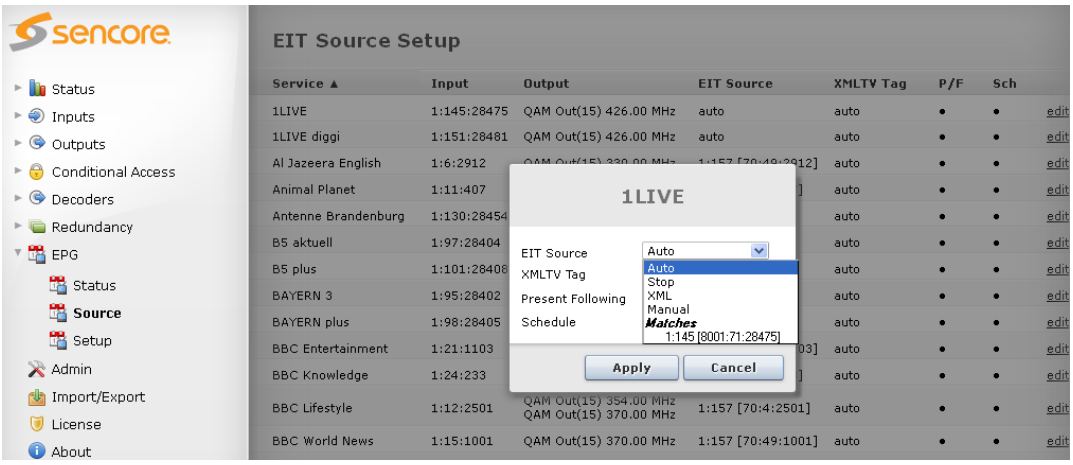


Figure 9.12 - EPG Node

If multiple services are available for the matching criteria, a drop down box is displayed under EIT Source; pick the best course of action:

Auto	Corresponds to the value chosen in the **Setup** node, under **Multiple Match Action** .
Stop	Ensures that no schedule information is transmitted from this service. If no drop down box is displayed, it means that there is only *one* source available based on the matching criteria.
XML	Specify an XMLTV tag name for schedule information. This relies on EPG XMLTV import which is covered in the Sencore EPG XMLTV Interface document. By default, if no tag is specified, this will be <NetID>.<TSID>.<ServiceID> corresponding to the output service,
Manual	Manually specify an incoming source (Slot, Port, NetworkID, TSID, ServiceID) of EIT information

10 Redundancy Support

The unit supports several types of redundancy. While each redundancy module is aimed to solve different problems, the system handles all of the modules in a similar way, providing some general parameters to control the switch delay and which triggers should be active for each module.

10.1 Input Redundancy

The goal of input redundancy is to prevent failures outside the system from resulting in errors on input cards.

Input redundancy is managed by the Man Machine Interface (MMI) board which determines when to switch:

- From one service (**Main**) to another service (**Backup**), or
- From one port (**Main**) to another port (**Backup**).

However, it is possible that both these services and ports have different content.

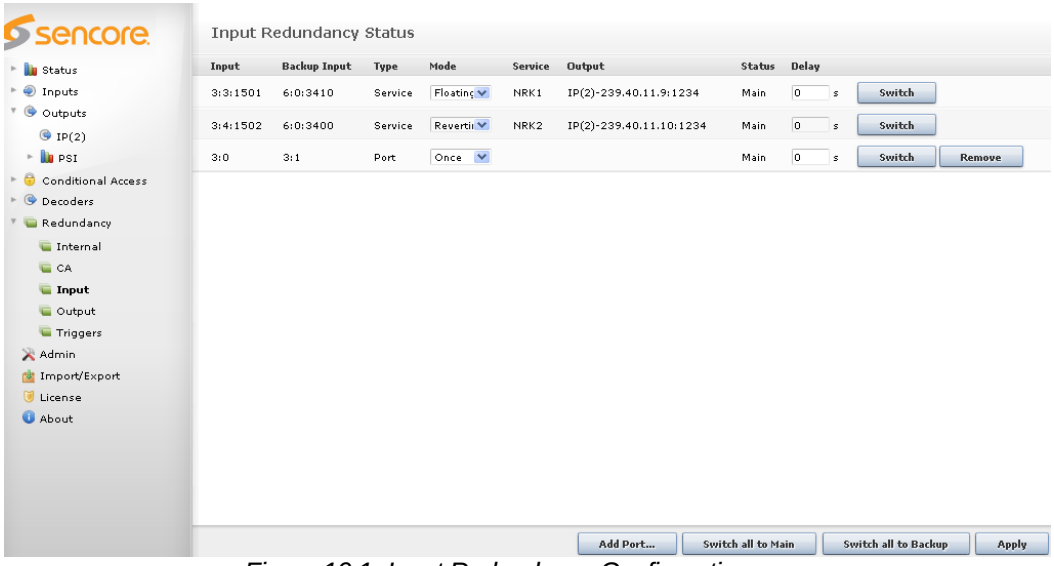


Figure 10.1- Input Redundancy Configuration

Input	Input port or service; the notation is <X:Y:Z> where: • X – input module's slot position • Y – input module's port • Z – service SID
Backup Input	Backup input port or service; the notation is <X:Y:Z> where: • X – input module's slot position • Y – input module's port • Z – service SID
Type	Type of input redundancy, either **Service** or **Port**.
Mode	Displays the switching mode being used.
Service	Outgoing value
Output	Outgoing value
Status	Shows the current redundancy status, either: **Main** – inputs are routed from the main input source

	Backup – inputs are routed from the backup input source

Click **Switch** to change the current active input. If the current active input is **Main**, the input source will switch to **Backup** and vice versa. For port-based input redundancy entries, an additional **Remove** button is visible. Click **Remove** to remove the port for which input redundancy is configured.

10.1.1 Configuring Service-based Input Redundancy

Service-based redundancy is set up under the **Outputs** node. Double click on a service of your choice to access the **Service Properties** dialog. Under the **Input Redundancy** section, select the appropriate parameters.

Figure 10.2 - Configuring Service-based Input Redundancy

The following parameters are available:

Backup source	Assign a backup service; choose **None** to disable input redundancy.
Switching mode	Select a suitable mode for each redundancy pair. The following modes are available: **Off** – Stop switching whether it is on main or backup **Once** – Switch from main to backup when an alarm occurs on main and remain there **Floating** – Switch when an alarm is set on the service that is active, ignore clear alarms **Reverting** – Switch to backup only if there is an alarm on main but not on backup; switch back when alarms on main are removed or set on backup (this is the recommended mode).

	Input redundancy on Scrambled MPTS inputs must be configured carefully. This is because if the input must be descrambled it is not possible to select different descrambler modules for each service (main and backup). In other words, all inputs to the descrambler must be routed from the same input source. Currently the system does not enforce this requirement; hence it is recommended that caution be exercised when combining descrambling with input redundancy.

10.1.2 Configuring Port-based Input Redundancy

Port-based redundancy is set up under the **Redundancy → Input** node. Click on the **Add Port** button (see Figure 12.3) and the **Add Port Redundancy** dialog below will appear.

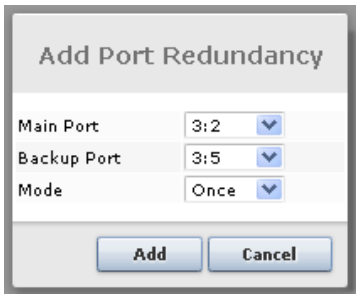


Figure 10.3 - Configuring Port-based Input Redundancy

Main Port	Assign a main port
Backup Port	Assign a backup port
Mode	Select a suitable mode for each redundancy pair. The following modes are available: **Once** – Switch from main to backup when an alarm occurs on main and remain there **Floating** – Switch when an alarm is set on the service that is active, ignore clear alarms **Reverting** – Switch to backup only if there is an alarm on main but not on backup; switch back when alarms on main are removed or set on backup (this is the recommended mode).

i	When using port-based input redundancy, it is intended to have the same input structure for both main and backup ports. Port-based input redundancy applies to transparent transport streams and imported PIDs.

10.1.3 Alarms that cause Switching

The system will automatically switch from main source to backup source based on the presence of alarms that are selected in the **Redundancy Switching Triggers** page below.

Switching Delay	Parameter is added to mention the number of **seconds** for the module to switch connections from one backplane to another when alarm occurs.

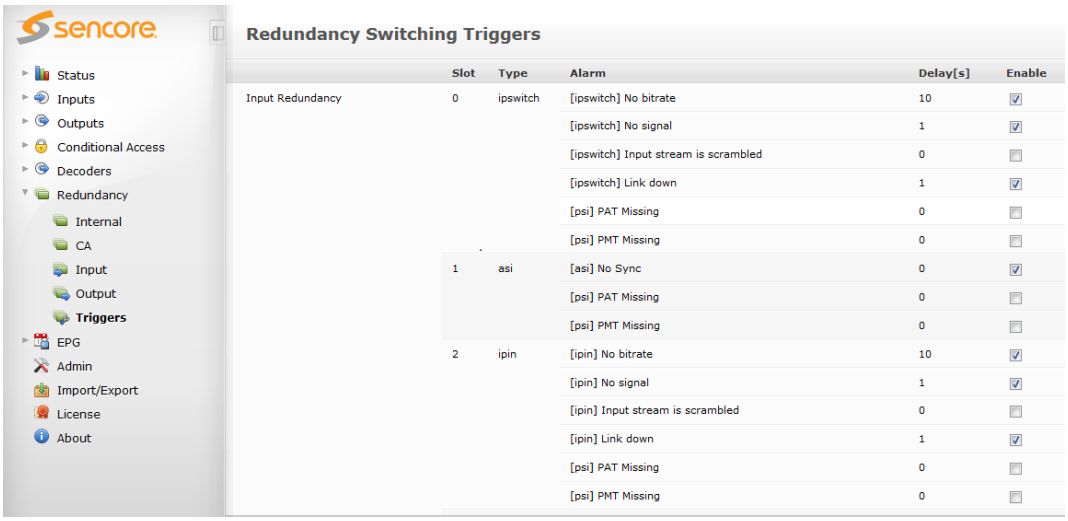


Figure 10.4 - Redundancy Switching Triggers

	The switching hysteresis is not configurable MMI functionality remains on the same card after a switch Switching can be done manually via the GUI Switching behavior depends on the switching mode set individually for each pair Alarms that are filtered through the alarm filter GUI will not trigger source switching

10.1.4 Input Redundancy and the MMI

Input redundancy does not affect MMI functionality. If the main input module is configured as supporting the Man Machine Interface (MMI), this configuration will remain even though all input sources are switched from Main to Backup card.

10.1.5 Seamless Input Redundancy

The Seamless IP input module allows two input interfaces to be connected to different network sources, but for the system, this is a single module. Configured multicasts are subscribed to on both interfaces. Depending on the configuration, there are options for these multicasts must come from the same or different source.

10.1.5.1 Seamless IP Interface selection

For all Seamless IP input modules, it is possible to set the preferred port and/or redundancy switching mechanism. This is available on the **Admin** page of the Seamless IP Input module:

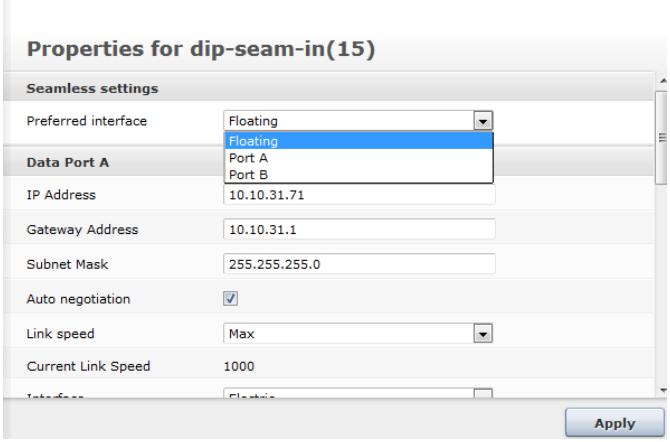


Figure – 10.5 Seamless IP interface selection

The values here represent the following modes:

Floating	Port A is the default port and on a failure, Port B will be used. The redundancy will not switch to Port A again until Port B fails.
Port A	Port A is the default port and on a failure Port B will be used. Once the failure condition is cleared on Port A, the source will be switch back to this. (Reverting)
Port B	Port B is the default port and on a failure Port A will be used. Once the failure condition is cleared on Port B, the source will be switch back to this. (Reverting)

10.1.5.2 Port configuration

When adding a source the default is that the multicast is configured by be received on both input interfaces on the input card, i.e both Port A and Port B. These defaults may be overwritten by editing the input. The following seamless specific attributes is shown in figure below.

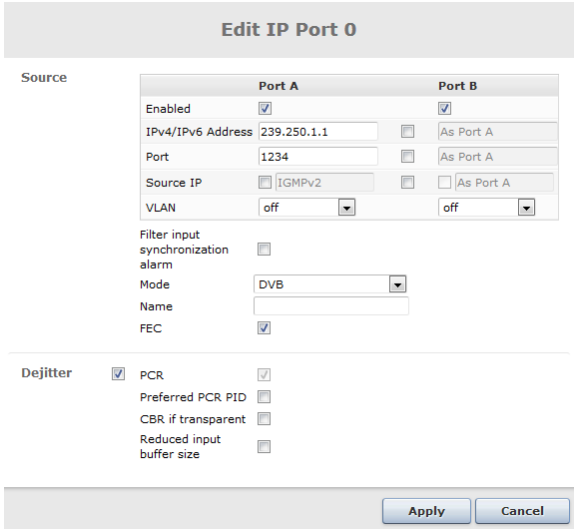


Figure 10.6 - Port Configuration seamless input Redundancy

Enable Port	This option is added to enable the operator to block one path -> hence forcing the input to be taken from the other port
Source IP	The source IP should be defined.
Filter input synchronization alarm	If source is not cloned output then if it is checked then will raised alarm for it. This option can be used to use Input Redundancy for multicasts from different sources. When in this module, the resulting stream will not be seamless. The switching time when 'No bitrate' on the main port is 100ms.

10.2 Internal Redundancy

Internal redundancy refers to the process by which a QAM, ASI, IP Output modules, can receive configuration from two different MMI boards, but not at the same time. This section describes internal redundancy for these cards in detail.

The chassis will have two switches/MMI modules. One switch will be configured as the main switch while the other switch will be configured to be the redundant switch. Please note that internal redundancy configuration is currently only supported for IP input modules, ie Switch+IP or IP Input.

10.2.1 Dual backplane configuration

The figure below shows the signal flow within the unit when having two backplanes, one MMI card connected to backplane 1 and second MMI card to backplane 2 respectively.

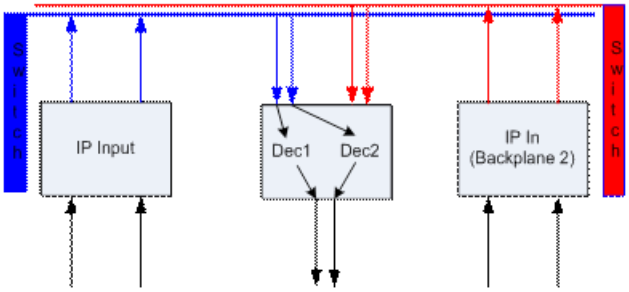


Figure 10.7- Signal Flow within a Unit with Two Backplanes

10.2.2 Hardware Requirements

The following hardware is required to implement internal redundancy, either:

Two Switch management cards and **Two** IP input modules

or

Two Switch + IP modules

In addition, one or more output modules are required to implement internal redundancy.

10.2.3 Configuring Modules for Internal Redundancy

Configuring internal redundancy is done by selecting Redundancy → Internal in the **Navigation Pane**. This will load the configuration page displayed below.

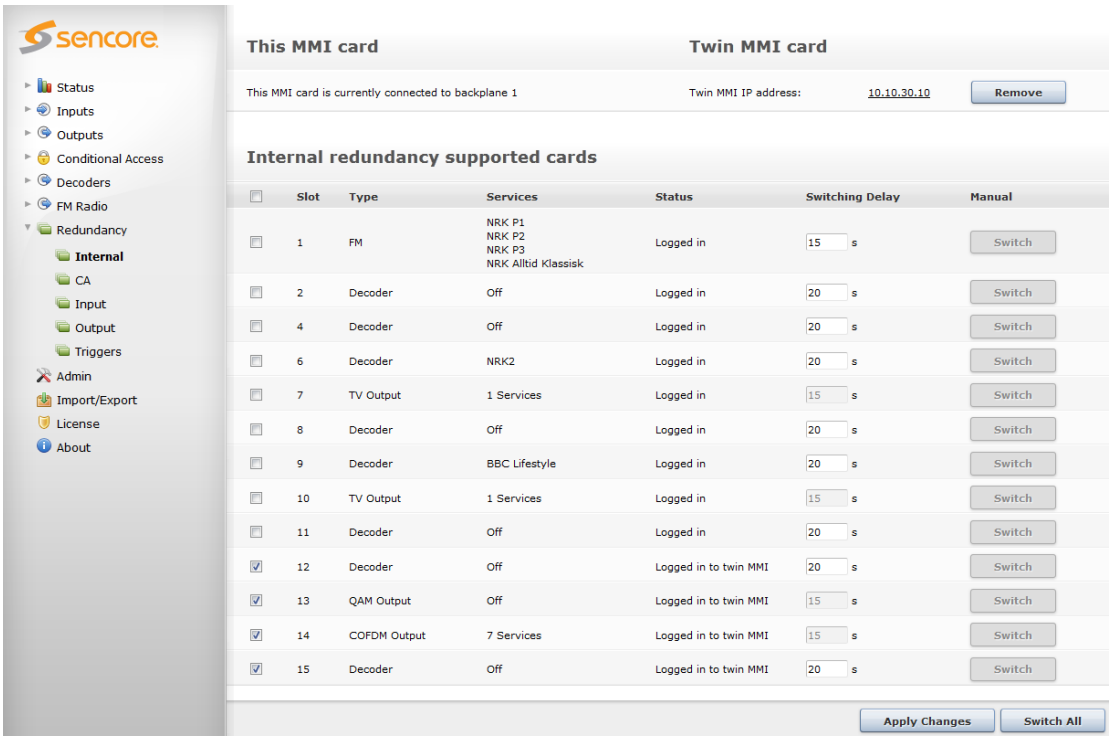


Figure 10.8 - Internal Redundancy

There are three sections on the Internal Redundancy configuration page:

This MMI card – displays the status of the MMI module in the chassis. This section is used as an indicator for MMI correlation. MMI correlation is needed to get rid of the card missing alarms on the spare MMI module. The status of the MMI module depends on which backplane it is logged in to.

Twin MMI card – displays the status of the Twin MMI card linked to this chassis, if there is one. The IP address of the redundant MMI module is used to notify the internal redundancy GUI about the module. This other MMI module is referred to as **Twin MMI**. Once a **Twin MMI** is added, both MMI modules will exchange their module list; all other configuration must be done separately on each MMI module.

Internal redundancy supported cards – displays a list of modules on which internal redundancy is supported, along with the service name (or number of services for QAM output modules), status, and switching delay. If internal redundancy is not enabled, the service name value is **off**.

An alarm with the message *Unable to communicate with TWIN MMI* is generated whenever connection breaks between MMI Input cards.

Enable	The check box must be checked to enable internal redundancy on the module. Each module can be configured at any time no matter which backplane it is logged in to.
Slot	The slot in which the module has been installed
Type	The type of module on which internal redundancy is being enabled

Services	Services currently running on that particular module
Status	The status of the module – whether it is logged into the main MMI or the Twin MMI module.
Switching Delay	Once the QAM output module meets the described conditions to log in to the Twin MMI automatically, it still needs to wait a determined period of time. This switching delay is the number of *seconds* for the module to switch connections from one backplane to another. Once the switch delay time is reached, the module will switch backplanes. If the login succeeds and the input signal is correct, the video and sound will be back on the screen. The minimum value allowed for **Switching Delay** is: • QAM/COFDM output fixed 15 seconds The default value is 15 seconds. If needed, the same module can have different **Switching Delay** values for each backplane. This parameter can be modified in the MMI even if the module is connected to another backplane.
Manual	This **Switch** button enables the operator to perform a manual switch from the GUI. When internal redundancy is enabled, this button will be available. The module will switch right after the operator clicks the button – without any **Switching Delay**.

Reboot

The QAM Output modules are designed to log into the first available MMI board. They will always try to login to the Main MMI board first, which is connected to default backplane. But only during the boot process, if login fails through the default backplane, it will try to connect to the backup even if internal redundancy is disabled in order to find a MMI to login to.

i	For the Twin MMI to work properly, it is essential that both MMI modules have an IP connection.

10.2.4 QAM/COFDM/IP/ASI Output Internal Redundancy

When using QAM,COFDM , IP or ASI Output with internal redundancy the switching will be triggered with the following alarms/events:

- No signal
- No contact with MMI module

If **all** services configured for the output card stop receiving data, the **No Signal** alarm will be raised and the internal redundancy module will switch backplanes. This means that even if the services configured are not enabled to the output signal of the card, it will switch.

Another condition that will make the output card switch is when the card looses communication with the MMI Card. This could happen when the card cannot login to the MMI, when the switch is not working properly, or when the MMI card has been removed.

Digital Output Switch alarms

The table below lists the alarms displayed as a result of the switch:

Switched, reason: logout	The output module is logged out from the input card that hosts the MMI – for this module, it also refers to internal link failure.
Switched, reason: No bitrate	This alarm refers to input stream failure having caused the switch
Switched, reason: operator	This alarm refers to the operator having performed a manual switch

There is a delay of 15 seconds before the alarm appears.

10.3 Output Redundancy

The output redundancy solution provided for the output cards is based on sending state events to an external switch which can then perform the appropriate redundancy switch. For the IP output card this event is the OSPF messages and for all other outputs the event is in the form of an SNMP alarm. This allows external equipment and switches to be configured to switch to a redundant source when these messages are received.

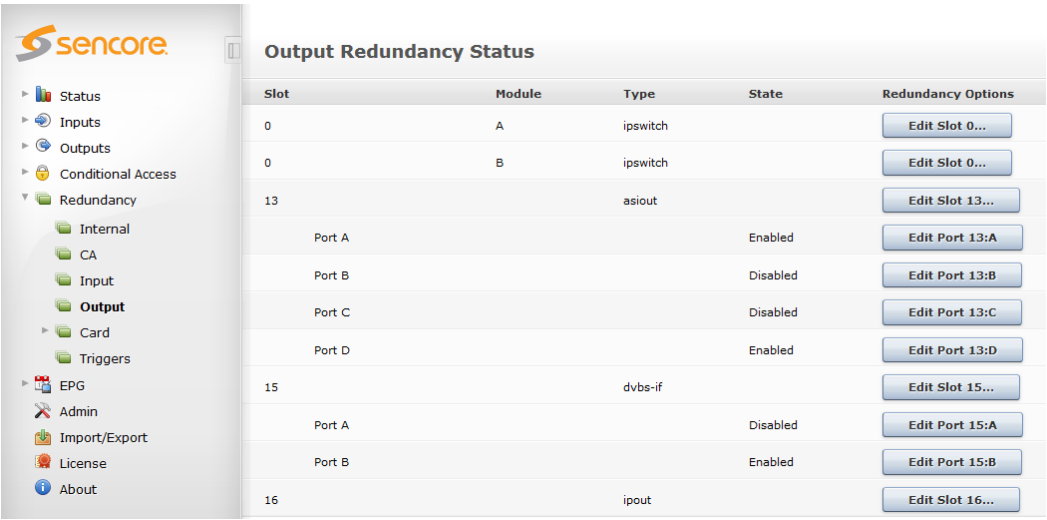


Figure 10.10 – Output Redundancy Status

10.3.1 Non-IP cards Output Redundancy

For non-IP output modules, when there is an error with the output, the system will signal an 'Output Faulty' alarm for the specified output port. This is then read by external equipment using either the SNMP or SOAP interfaces in order to perform the redundancy switching. It is possible to configure the following options:

- Configurable switch and Switchback delay - per card

- Configurable switch mode (one/majority/all) - per port
- Manual triggering of the "output faulty alarm" trigger by disabling the output port.
    - For the QAM output card 8 transports is grouped into one Physical port. For this output all transports must be disabled before the "output faulty alarm will" trigger.

To configure the Redundancy options, select **Redundancy → Output** and click on the **Edit Slot X** button for a particular output module. This will open the **Edit Redundancy Options** dialog displayed below:

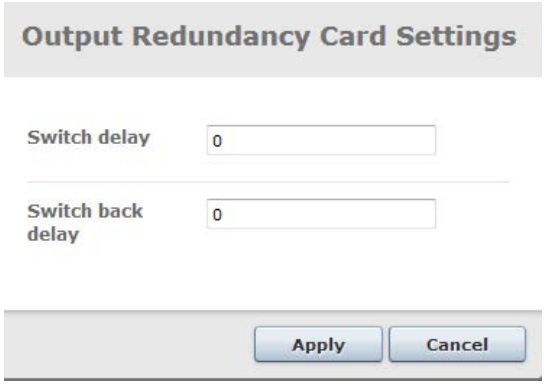


Figure 10.11 Output Redundancy Card Settings

The following **Output Redundancy card setting** parameters are available:

Switch delay	Specify the Switch delay
Switch back delay	Specify the Switch back delay

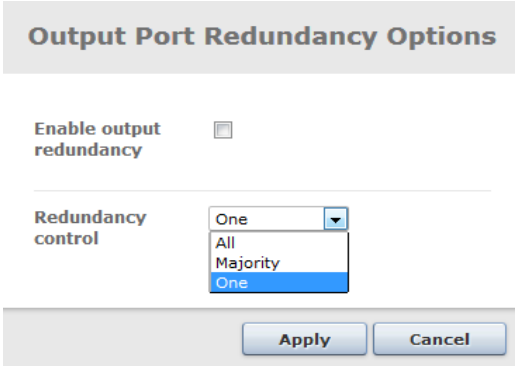


Figure 10.12– Output Port configuration

The following **Output Port Redundancy options** parameters are available:

Enable output Redundancy	Option to Enable Redundancy on the port.
Redundancy Control	Choose one of the following options: All – The port is signaled to be faulty if all of the outgoing services are faulty Majority – The port is signaled to be faulty if the majority of the outgoing services are faulty. One – The port is signaled to be faulty if one of the outgoing services are faulty

10.3.2 IP Output Redundancy

The DMG's "always-on" intelligent redundancy software is a seamless integration between broadcast equipment and IP networks; providing unmatched reliability of service up-time using the minimum amount of operating resources possible.

The IP output redundancy functionality makes it possible to have multiple units with IP output modules multicasting the same services and letting the network handle data loss.

By adding one or more redundant units with IP output modules, service outage may be prevented; given the error is an isolated one.

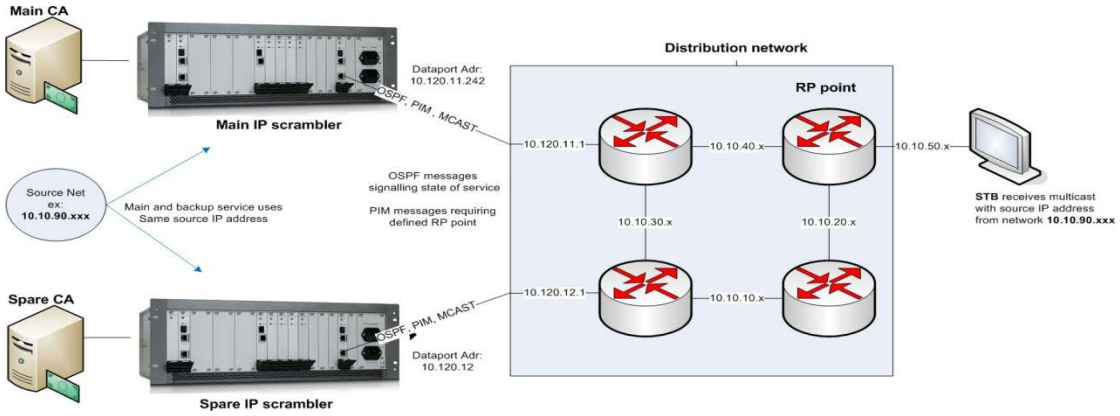


Figure 10.13 - Output Redundancy

The IP output module sends services out as IP multicasts, relying on OSPF and PIM messages to configure the network. The routers use this information to route the multicasts. The network automatically detects the presence of more than one route and redundant packets are thrown away by the routers before they reach the STBs.

A typical scenario is to broadcast a Digital TV service from two locations using the same multicast destination address. The network is designed to route only one copy of the multicast stream to the receiver. In case of a source failure, with IP output redundancy implemented, the network should automatically switch to the spare source.

By assigning the same (Source, Group) address from the virtual segment for the "main" and "backup" service the routers regard the multicast from the "main" and the "backup" unit as one multicast origin from the virtual source network and will automatically chose to forward packets only from the one with the lowest cost. This is important and must be ensured when the unit is configured.

The output redundancy configuration is split on two locations. The global settings that applies to an output card, and the per stream settings applied on a particular output.

10.3.2.1 Global Settings

The global settings are available on the **Redundancy->Output** page in the GUI and are configured per output module.

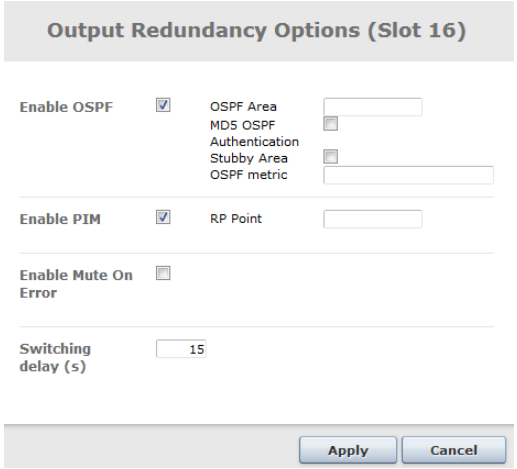


Figure 10.14 - Edit Redundancy Options

Enable OSPF	Enables OSPF routing – checking this box allows the following parameters to be configured: **OSPF Area**, **MD5 OSPF Authentication**, and **Stubby Area**. OSPF is used to update the routing tables in the routers. The redundancy scheme currently does not support any other routing protocols. Provided PIM is not controlled by the Sencore equipment, it is possible to support multiple OSPF neighbours. *This feature requires the output redundancy license.*
OSPF Area	Designated OSPF area
MD5 OSPF Authentication	Check to enable MD5 OSPF authentication. Following are the parameters necessary to configure this feature: • Key Id – secret keyword version • Key – secret keyword *It is possible to have two sets of MD5 keys – the second set is required to change the key in switch modules.*
Stubby Area	Enable this option if the output is connected to a stubby network
OSPF Metric	Defines the cost of this route in the network

Enable PIM	Enable or disable Protocol Independent Multicast (PIM).In a PIM enabled environment, each subnet must have a designated PIM router (PIM DR). Many routers today supports taking the role as the PIM DR and for those cases the PIM should not be enabled in the Sencore unit. For routers that cannot act as PIM DR the PIM should be enabled in the Sencore unit. In this case the Sencore takes over the role as the subnet PIM DR. The Sencore PIM DR is signaling its own multicasts only; hence other sources on the same network will be time out and become unavailable. *This feature requires the output redundancy license.*
RP Point	RP Point – Rendezvous point
Enable Mute On Error	Check to enable or disable Mute on Error
Switching delay(s)	Number of seconds to wait before the output is switched to the backup path, in case of errors.

10.3.2.2 Stream specific settings

When the global redundancy attributes are defined, output redundancy must be enabled for all outgoing streams. When enabled the output redundancy will monitor the stream status and if any errors perform the appropriate action.

Depending on the configuration, the results of an alarm trigger would be:

- Send an OSPF to the next hop router and announces that the source is no longer present.
    - Note that the multicast will still be transmitted.
    - Note that in a multicast system it is the source that is disabled, which means if multiple outputs are given the same source address then both/all streams will be regarded stopped by the router.
- Mute the output, ie 0 bitrate, when 'Mute On Error' is enabled

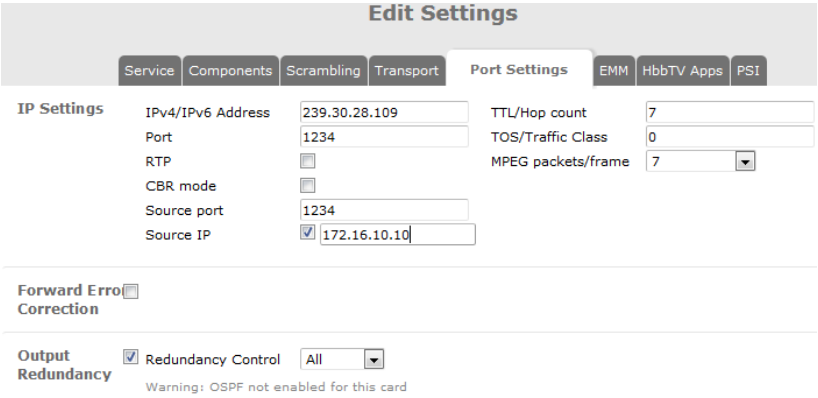


Figure 10.15 – Output Redundancy Port Settings

The **Port Settings** parameters have been described in detail in Section 7.4.

The following **Output Redundancy** parameters are available:

Source IP	When OSPF is used the source IP should be defined. If not set then the IP address of the Dataport will be used for all streams. The effect that a single stream failure will disable all sources. The Source IP address set here should correspond to the Source IP address of the other stream source.
Output Redundancy	The output redundancy logic may decide to stop an output due to some conditions. One reason could be that a service failed to be descrambled. If this service is the only service being transmitted on an output the choice is simple: the system can easily just stop the output. On the other hand, if the output is an MPTS containing 10 services, for example. Then the choice is not so simple should one failure result in all 10 services to be stopped on the output. The redundancy control option lets the operator decide which conditions should be met in order for the output to be stopped. Choose one of the following options: **All** – all services must fail **Majority** – only majority services must fail **One** – one service failure is sufficient **None** – automatic redundancy is disabled These switching rules apply to the services with the highest priority ranking within the Output TS. For more information about service priority, refer to the service configuration property page.

10.3.2.3 Mute on Error

Mute on Error is a form of output redundancy, apart from OSPF, where the output is disabled if there is an error with the input stream. This feature can be used in situations where the equipment receiving the signals require an incoming bitrate of zero (no bitrate), so that a switch to a backup service or input can take place.

To enable or disable Mute on Error, use the check box in the **Edit Redundancy Options** dialog .This feature must also be enabled or disabled for each port on the IP output settings.

The Mute on Error functionality does not require the 'Output Redundancy' license.

	Enabling Output Redundancy on ASI-Cloned output module and ASI output modules enables Mute on Error by default.

10.4 N+m Module Redundancy

The N+m Module Redundancy protects the system against possible hardware failure for selected card types. Module redundancy is currently supported by the following modules:

- encoder-sd
- encoder-hd
- transcoder-sd
- transcoder-hd
- Universal Transcoder- Multiscreen Universal Transcoder- Broadcast

Before the redundancy will take effect the user must specify which cards should be part of a redundancy group and which of them shall be **active/main devices** and which should be **spare devices**.

For the encoder switching an external SDI switch is required. This switch will be configured and managed by the unit hence no external management system is required. For details on supported SDI Switches, please contact the Sencore Support department.

All redundancy configurations are performed from the **Redundancy->Card** navigation pane. The **Card** page configures the general group settings while the switch page defines external switches.

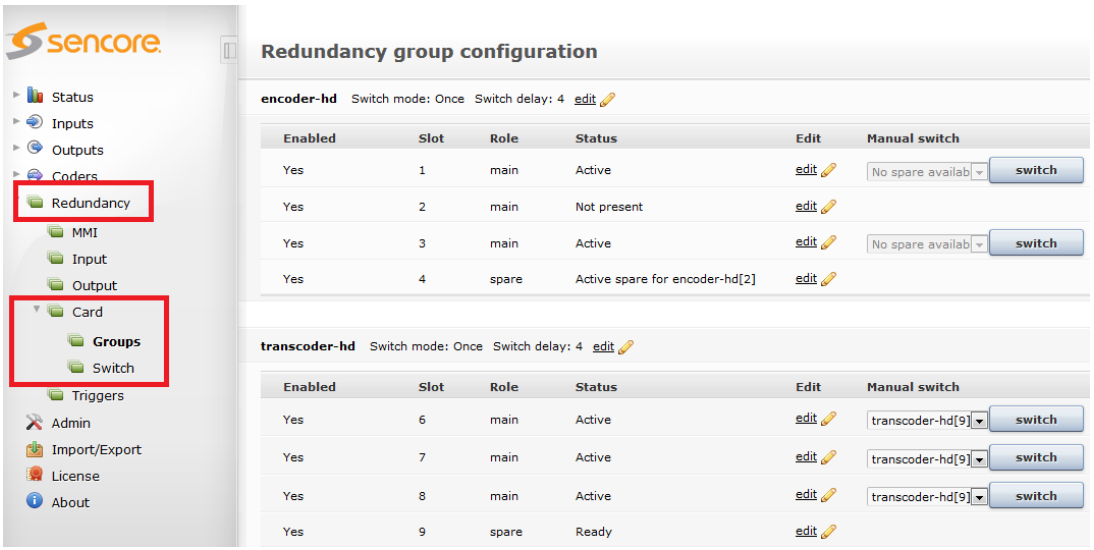


Figure 10.16 – Redundancy group configuration.

The system will automatically populate the internal modules into groups based on the module type. In the figure above it shows the "**encoder-hd**" and "**transcoder-hd"** groups.

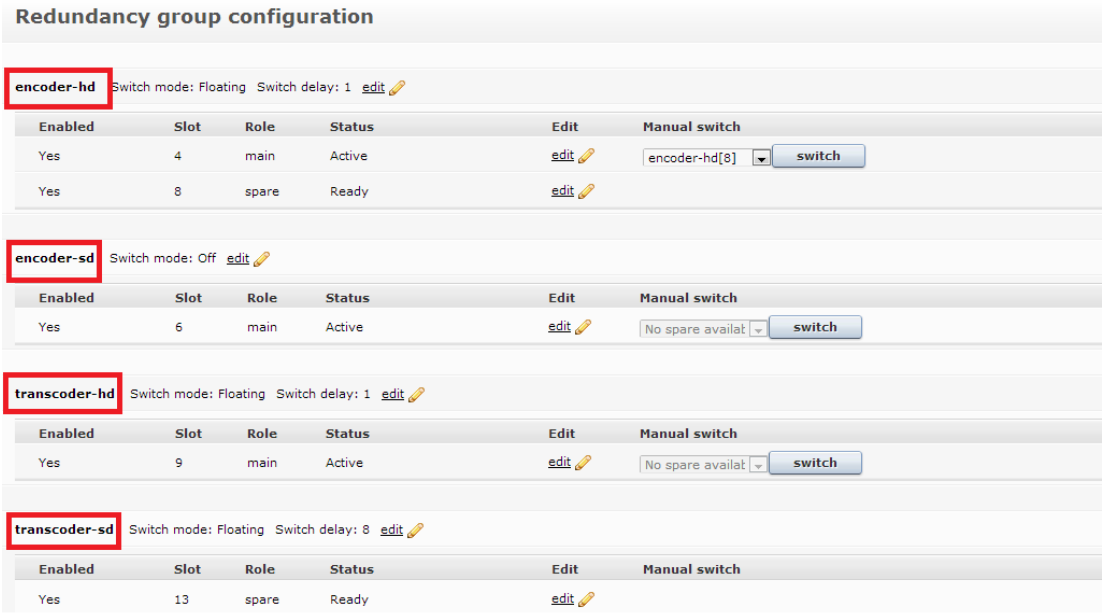


Figure 10.17 – Redundancy group configuration for each card type.

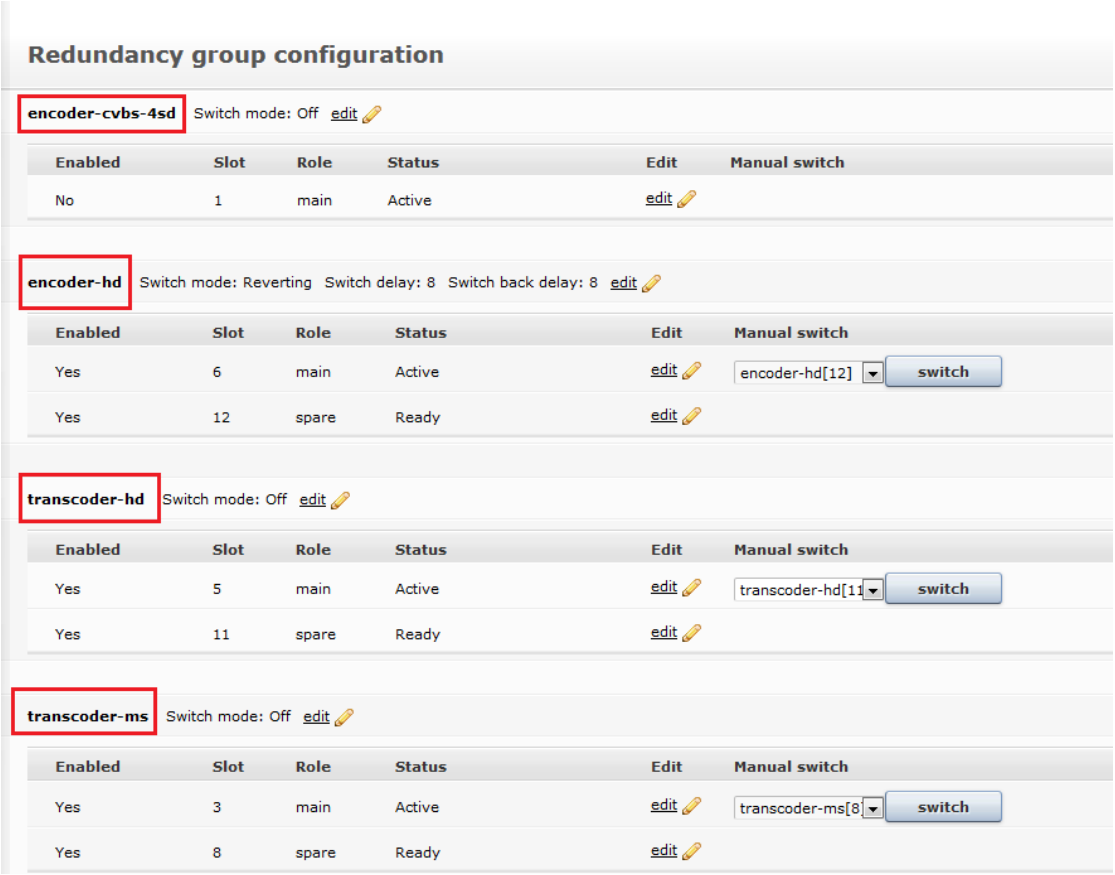


Figure 10.18 – Redundancy group configuration for each card type with Universal Transcoder-Multiscreen.

10.4.1 Redundancy Group Configuration

The redundancy group parameters are defined under the **Card->Groups** navigation pane.
To edit the group settings press the edit to the right of the group name.
Following parameters are present under Group setting.

Name	Automatically generated based on card type
Switch mode	Select a suitable mode for each redundancy pair. The following modes are available: **Off** – Stop switching whether it is on main or backup **Floating** – Switch when an alarm is set on the service that is active, ignore clear alarms **Reverting** – Switch to backup only if there is an alarm on main but not on backup; switch back when alarms on main are removed or set on backup (this is the recommended mode).
Switch delay	A delay added when the switch module receives an alarm
Switch back delay	Specify the Switch back delay.
Switch	Select from a list of previously defined switches.

10.4.2 Redundancy Module Configuration

Within the group, the role of each card and for encoder modules, its cabling info must be defined. To edit the group press the **edit** to the right of the card.

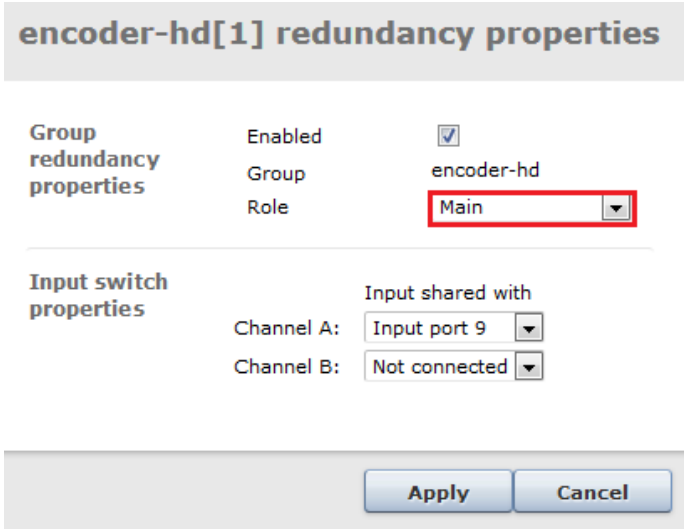


Figure 10.19 – Redundancy group properties-MAIN Encoder.

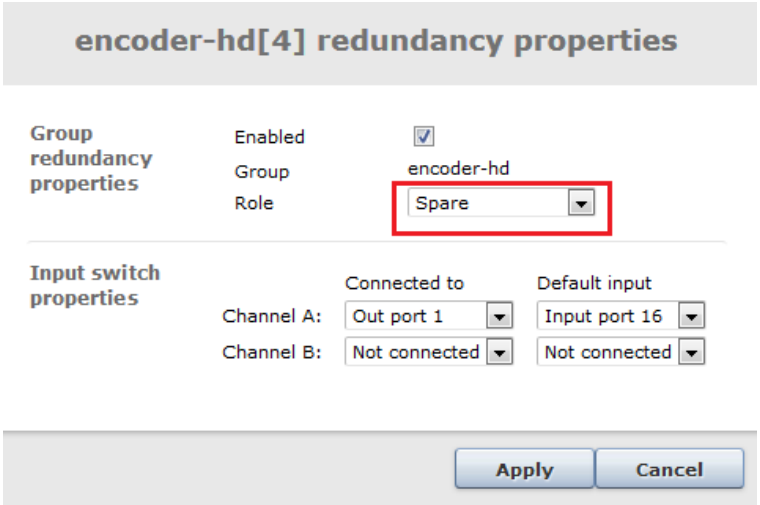


Figure 10.20 – Redundancy group properties-SPARE Encoder

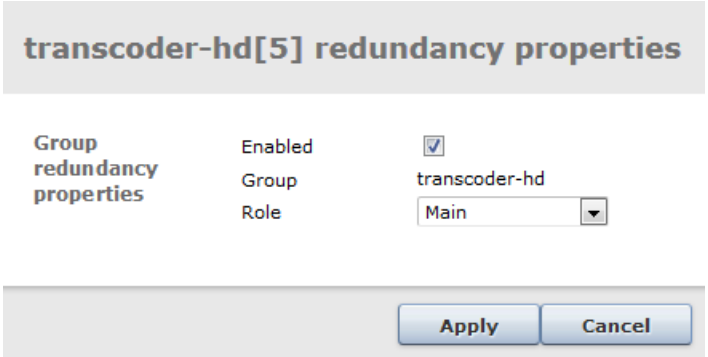


Figure 10.21 – Redundancy group properties-MAIN Transcoder.

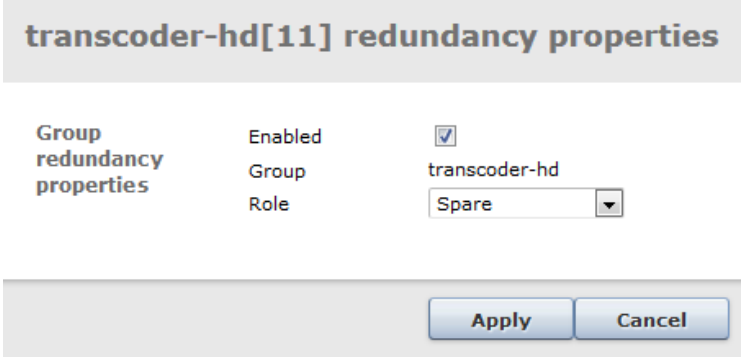


Figure 10.22 – Redundancy group properties-SPARE Transcoder.

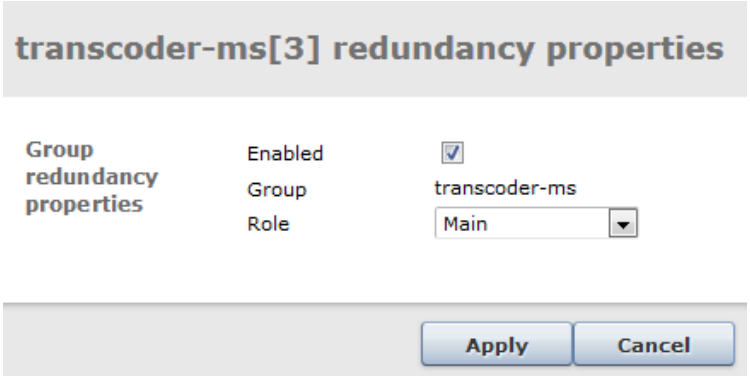


Figure 10.23 – Redundancy group properties-MAIN Universal Transcoder-Multiscreen.

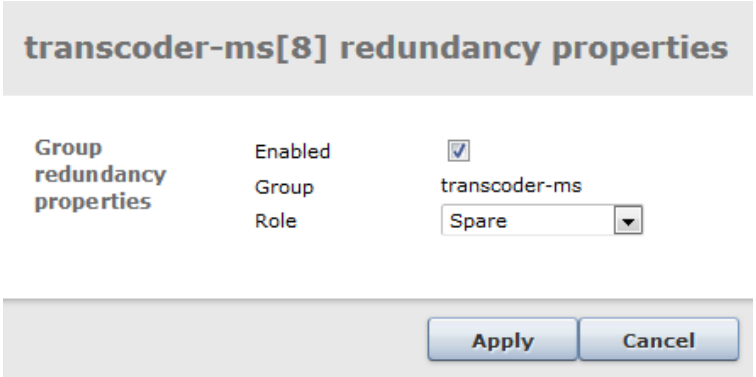


Figure 10.24 – Redundancy group properties-SPARE Universal Transcoder-Multiscreen

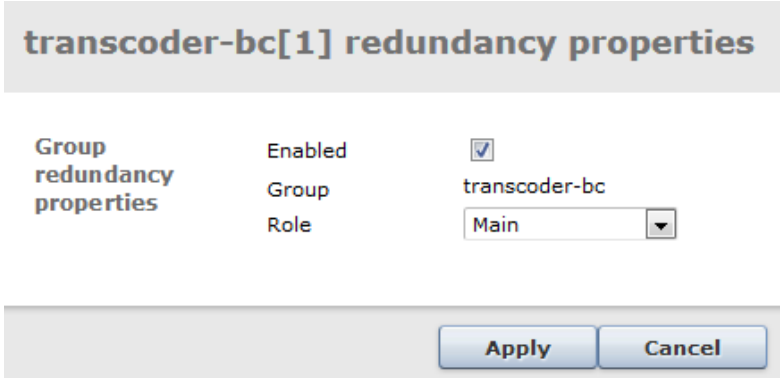


Figure 10.25 – Redundancy group properties-MAIN Universal Transcoder- Broadcast

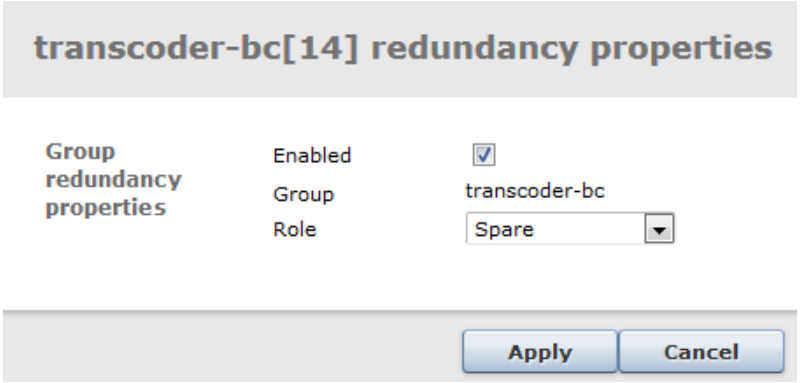


Figure 10.26 – Redundancy group properties-SPARE Universal Transcoder- Broadcast

Following parameters are present under redundancy properties.

Group redundancy properties-

Enabled	When checked this card is part of the redundancy group.
Role	Either of one: **Main/Spare**

Input switch properties for Main Card-

Channel A/B	This defines which input port on the switch receives the same signal as this port on the card.

Input switch properties for Spare Card-

Connected to	This is the output port of the switch which is connected to the input port of the spare encoder.
Default input	This is the source port that will be routed to the encoder port when the encoder is not being actively used due to a system redundancy switch. By changing this setting it is possible to route a test signal to the encoder while not in use.

10.4.3 Manual Switching

Manual switching can be performed using the switch button on the Group page. When an input SDI switch is defined the switch will first be configured, and then when the switch is ready the rest of the system will move to the spare unit. If the switch configuration fails then the switch operation will be aborted.

Changes to encoder/transcoder parameters shall always be performed on the main device, even when this device is switched to a spare. The system will automatically redirect any editing of the spare card to the main card when the spare is running as a backup.

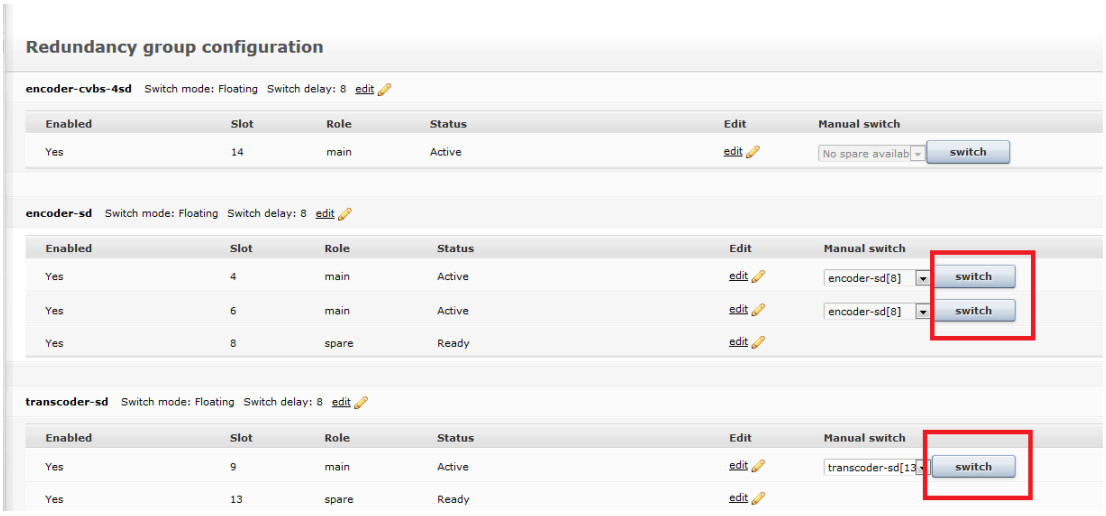


Figure 10.27 – Manual Switch.

10.4.4 SDI Input switch configuration

The following system topology is supported for encoder redundancy requiring an external SDI switch.

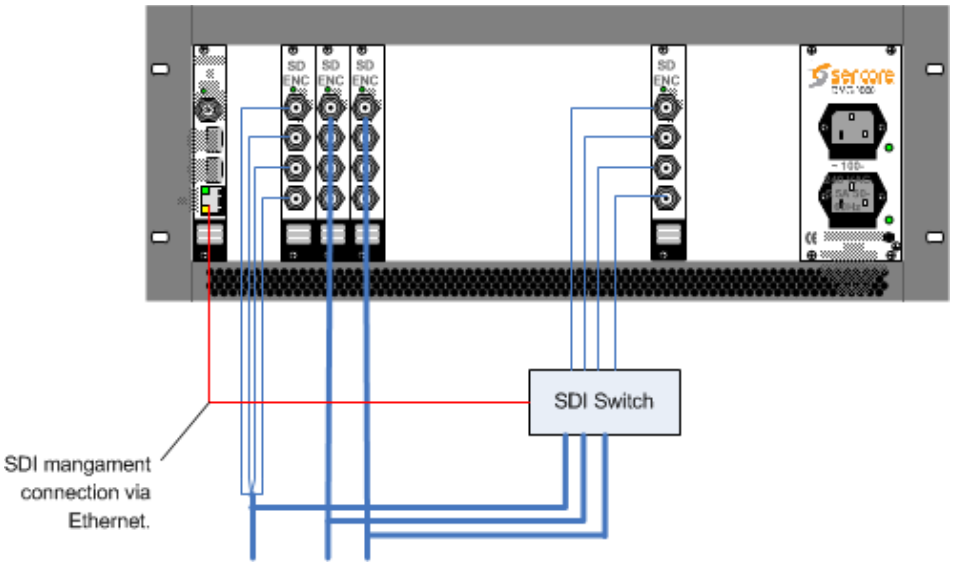


Figure 10.28 – Encoder redundancy topology

The SDI inputs to the main cards are connected directly, while the input to the spare cards is connected via the SDI switch.

To add a new switch press the "+" sign and enter the relevant parameters.

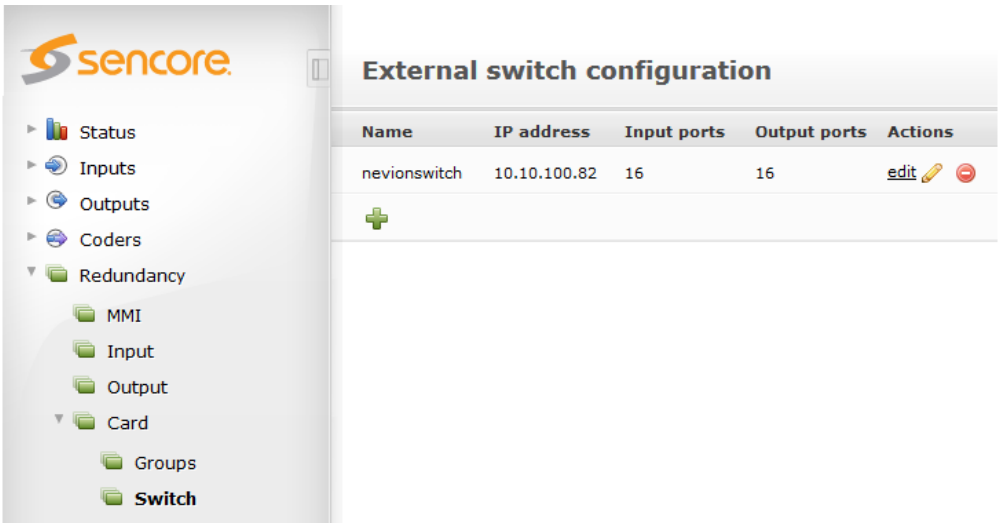


Figure 10.29 – External switch configuration.

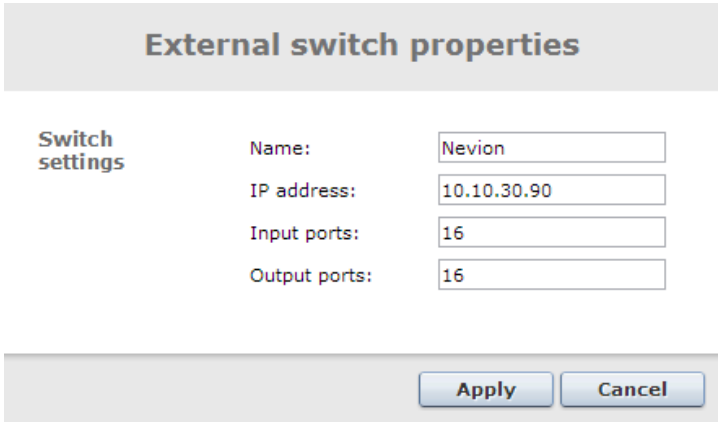


Figure 10.30 – External switch properties.

Name	Specify the Name of the Switch.
IP address	Insert the IP address of the SDI switch
Input ports	Specify the number of Input ports.
Output ports	Specify the number of Outputs ports.

10.5 MMI Redundancy

MMI Redundancy is designed to protect the system from MMI card hardware failures. In case of an MMI card failure the system shall switch to the backup MMI card in slot 17.

MMI Redundancy will also automatically synchronise the configuration database between the two MMI modules.

The following cards support MMI Redundancy:

- Seamless IP Input
- IP output
- Dual IP Clone output
- Encoder (SD/HD)
- Transcoder (SD/HD)
- ADM
- ASI OUT
- Universal Transcoder- Multiscreen
- Universal Transcoder- Broadcast

The two MMI cards must be able to communicate in order to synchronize the database. Currently this is performed via the external management port on the two MMI cards.

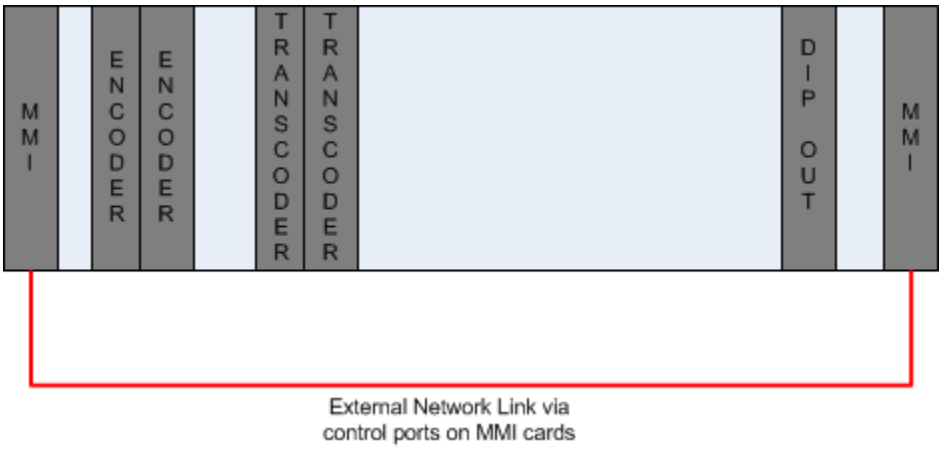


Figure 10.31 – External link to two MMIs.

10.5.1 MMI Redundancy Configuration

In order to configure MMI Redundancy, the Switch module must first be changed to this mode. This is configured in the Maintenance Center and you can find details on this procedure in the Upgrade Guide.

Once configured, the GUI page for MMI Redundancy will replace the Internal Redundancy page. This page will be slightly different depending on which MMI the user is accessing. We will refer as 'Main MMI' for MMI on Slot 0, and 'Backup MMI' for MMI on Slot 17.

The configuration for MMI Redundancy is available under the **Redundancy -> MMI** page in the GUI.

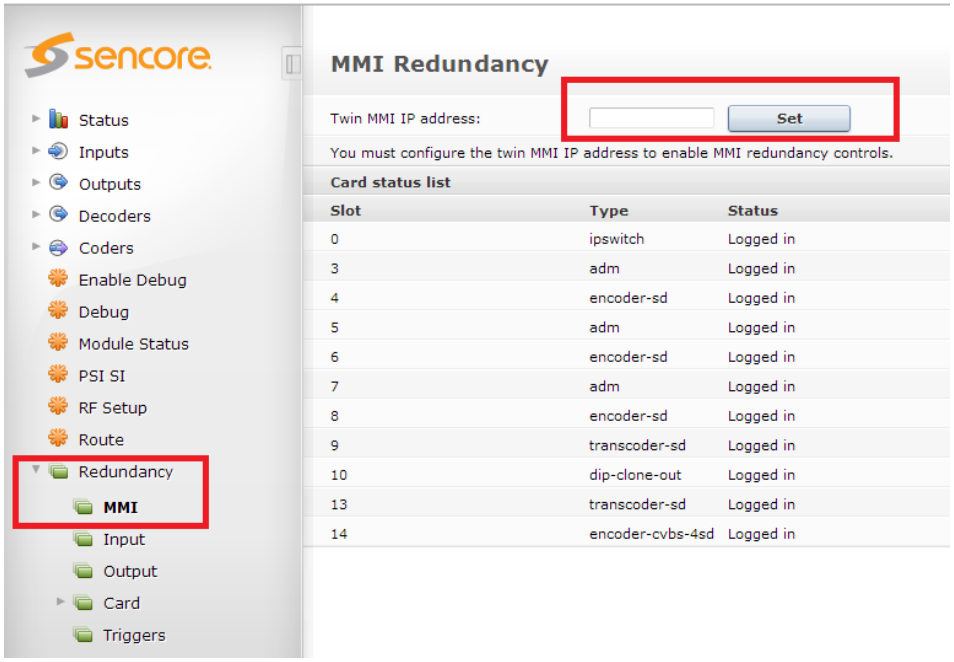


Figure 10.32 – Twin MMI IP address configuration

First the twin MMI IP address must be set, as MMI Synchronizer works based on an external Ethernet connection between both MMIs.

The 'Card status list' shows all cards that are currently logged in and their status. After setting twin MMI IP on both MMI modules, you will see the following new rows available for configuration on the main MMI page:

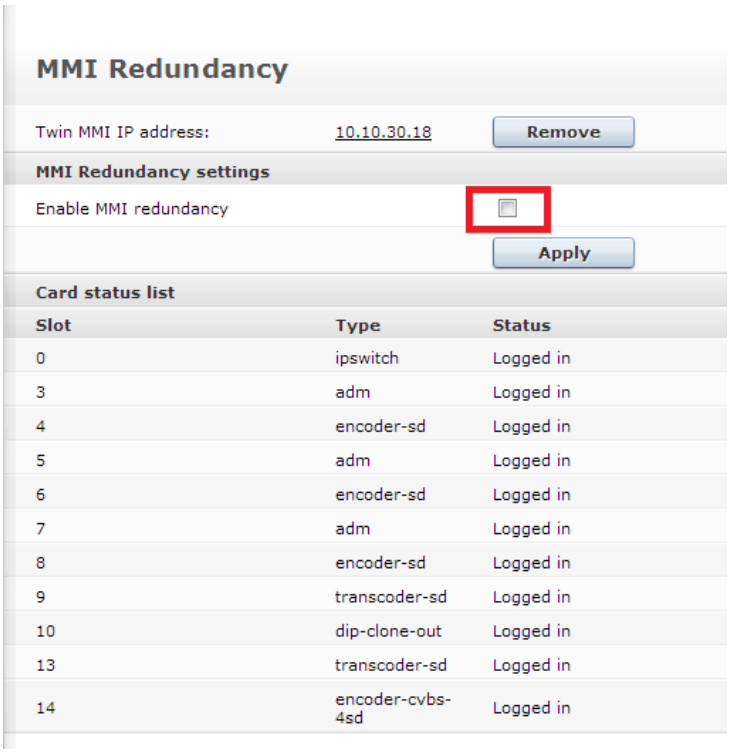


Figure 10.33 – Enable MMI Redundancy

After setting both twin MMI IP addresses, all slave modules will be logged into the same backplane, so this list will show all cards as "Logged in" in one MMI, as "Logged in to twin" in the other MMI.

Finally, after enabling MMI Redundancy, we will get the complete MMI Redundancy GUI page: Main MMI

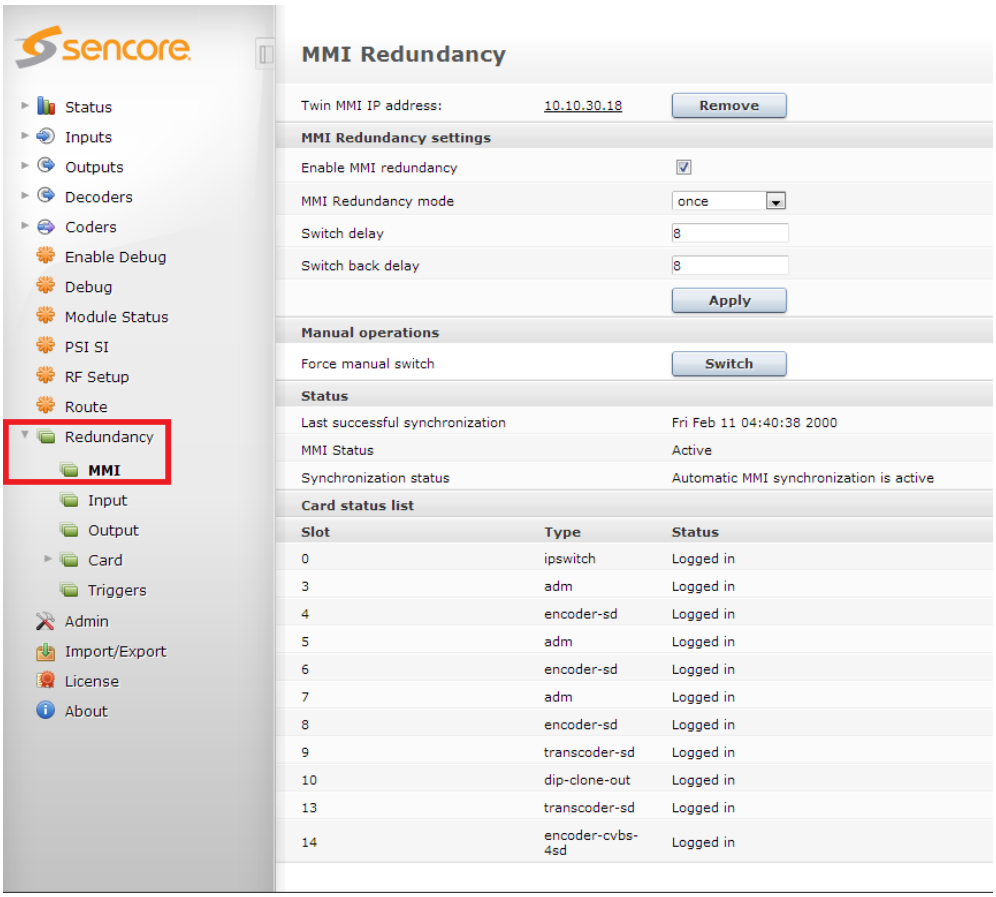


Figure 10.34 – MMI Redundancy settings-MAIN MMI

Following are MMI Redundancy Settings parameters:

Enable	This is the checkbox to enable/disable MMI Redundancy. Enabling means both auto config database synchronization and auto backplane switching for all cards when they lose contact with MMI.
MMI Redundancy mode	Either of one: **Once** or **Reverting**.
Switch delay	This is the delay before a module switches backplane when MMI switch has been triggered. It is not applied when Manual Switch is performed.
Switch back delay	This delay is until now only applied on Reverting mode, working right now only for Alarms trigger.

Following are Manual operations parameters:

Force manual switch	This will perform an immediate MMI switch.

Following are Status parameters:

Last successful synchronization	This shows the time last a synchronization was confirmed.
Last local change	This shows the time last local change in configuration was introduced.
MMI Status	This displays whether the MMI module is currently active or spare.
Synchronization status	Shows the current status: 'Automatic MMI synchronization is active' - Currently no issues 'Unable to automatically synchronize MMI configuration' – Possible issues with synchronization

10.5.2 MMI Switching Criteria

There are three possible triggers that will perform an automatic MMI Switch:

- **Alarms**: There are two alarms which will trigger MMI switch. They can be checked in '**Triggers**' node under '**Redundancy**' tree in the left panel of the GUI, in '**Card redundancy'** for 'switch' card
    - Link down
    - No contact with FPGA
- **Slave modules lose contact with MMI (MMI dead, reboot, upgrading**): All slave modules monitor the connection to the MMI module and can switch if this is lost. All have been configured to have this logout trigger enabled with the same delay, so they will switch at the same time
- **Manual:** Twin MMI is forced to take over and all cards are switched to the other backplane/MMI.

10.5.3 Configuration Database Synchronization

Database synchronisation will be performed automatically in both directions, ie main MMI -> backup MMI and backup MMI -> main MMI. Immediately after introducing a change in the configuration on either MMI, it will be synced to the twin MMI.

MMI's IP interfaces will never be synchronised, however, the IP addresses of the other interfaces on all slave modules will be synchronized.

10.5.4 Link between MMIs

MMI Redundancy is highly dependent on external link between MMI modules. Link down state is notified to the user as an "Unable to communicate with Twin MMI" critical alarm, and there are important consequences on this feature if the link is down:

- Database synchronization will not be available. This will be shown on **Synchronization status**.
- The mechanism to enforce all modules to be logged into the same backplane will not work, as each MMI has no information about the other.
- Cards logged into one MMI will not be shown on the other. This will be shown as **'Not present'** and **'Card missing'** alarms.
- No switch will be available as the mechanism to move modules from one side to the other is not working.

When the link is restored, and Main MMI is running properly, there are two possible situations:

- There is no MMI switch registered, so there is no reason to stay in Backup MMI. All cards will be forced to switch back and Main MMI will be Active again.
- There is a MMI switch registered. This means either manual or automatic (triggered by alarms) MMI switch was performed before losing contact with twin MMI (link down). In order to keep the former state, cards will stay in the second backplane and Backup MMI will be Active.

10.6 Conditional Access (CA) Redundancy

The unit supports CA redundancy, in other words, ECMG and EMMG redundancy. The difference between ECMG and EMMG redundancy is that ECMG redundancy is actively controlled by the unit, whereas EMMG redundancy is simply allowing for multiple EMMG IP addresses to connect to the same port.

10.6.1 ECMG Redundancy

ECMG redundancy involves two ECMGs: one Main and the other Backup. If the connection to the Main ECMG is lost, the multiplexer will automatically switch to the Backup ECMG based on the configuration defined in the GUI.

ECMs cannot be defined specifically for the Backup ECMG; instead they are automatically generated according to those defined for the Main ECMG.

In terms of **alarms**:

When the connection to the Main ECMG is lost, a warning alarm will be displayed in the GUI.

When the multiplexer switches to the Backup ECMG, the earlier warning alarm disappears; it is replaced with another alarm indicating that a switch has occurred.

Connection to the Backup ECMG is only established at the time of switching. In other words, if the Backup ECMG fails while the Main ECMG is still running, no alarm will be triggered.

	Switching between the Main ECMG and Backup ECMG does not affect the service as the CW will not be changed in the stream until a new ECM is received from the ECMG.

10.6.2 Redundancy Configuration

A redundancy rule for ECMGs can be defined from the **Redundancy → CA** tab in the **Navigation Pane**. Insert appropriate values here and click **Add**.

Before defining the rule, it is necessary to define the Main ECMG from **Conditional Access → SCS → ECMG**.

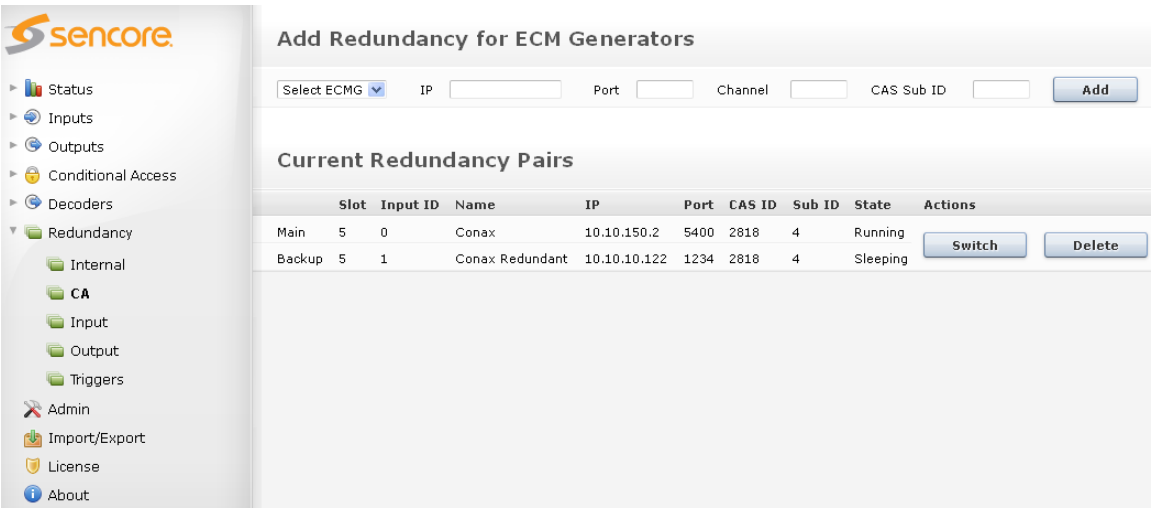


Figure 10.35 - Setting up ECMG redundancy

The following information is displayed:

IP	Backup ECMG's IP address
Port	Backup ECMG's TCP port
Channel	SimulCrypt channel ID for the Backup ECMG
CAS Sub Id	CA vendor specific Sub ID

10.6.3 Manual Switching

Based on Figure 12.8, click **Switch**. The **State** value (Running, Sleeping) should change accordingly.

10.6.4 EMMG Redundancy

When defining the EMMG, it is possible to state its IP address, otherwise known as **IP Filter**. Specifying an IP filter prevents unknown EMMGs from connecting to the Scrambler module.

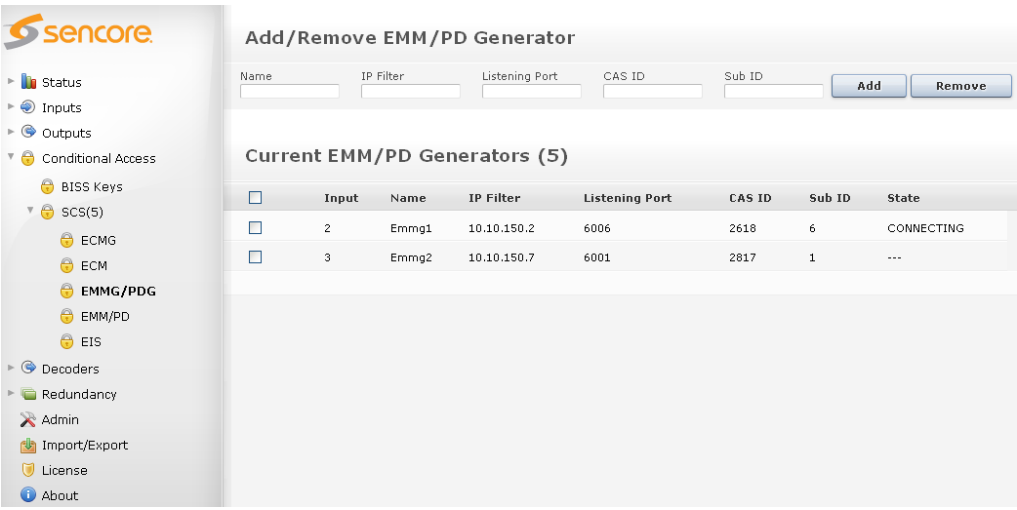


Figure 10.36 - Setting up EMMG redundancy

However, it is not compulsory to add this **IP Filter**. Using the value *0.0.0.0* ensures that the EMMG connection will not validate the Source IP address (of the EMMG). In addition, multiple sources may connect to the same listening port, but not concurrently.

If a Main and a Backup EMMG are present in the system, the first EMMG to connect will be the active one. A connection from the second unit will be rejected as long as an EMMG is currently active.

	It is not possible to manually switch the EMMGs as this connection controlled by the EMMG itself.

11 Control And Monitoring

11.1 System Status

The system status of the unit can be monitored easily from the web GUI's **Status** node. Information regarding services currently configured, active alarms, alarm history, etc. can be found here.

11.1.1 Service View

Expand the **Status** node in the **Navigation Pane** and click on the **Service View** node. The **Service View** will be displayed as shown below.

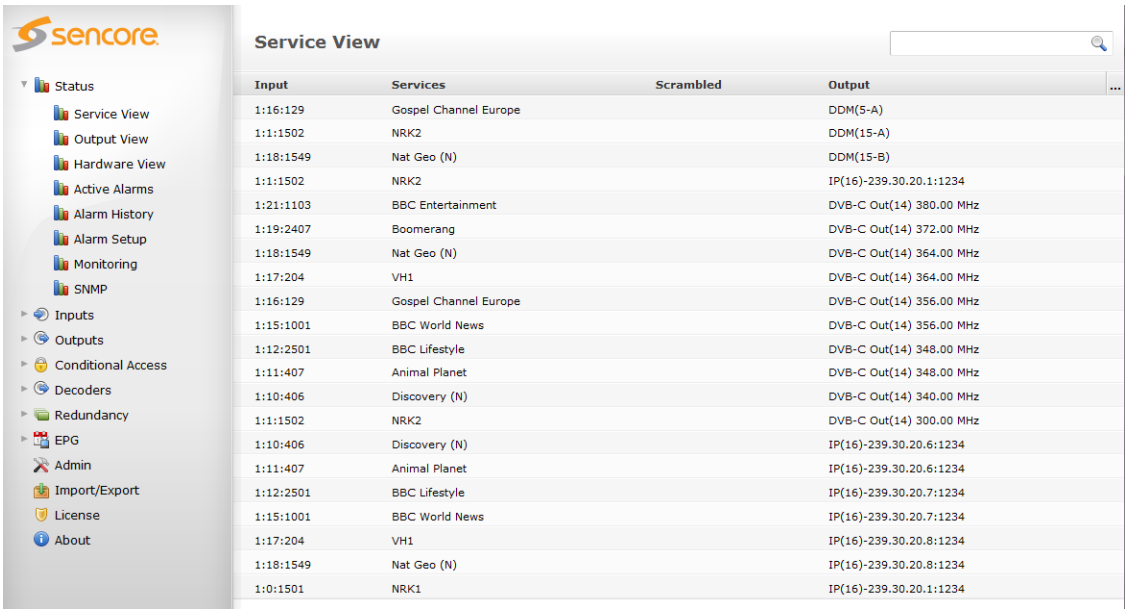


Figure 11.1- Service View

Information in the **Service View** can be sorted by clicking on the column headers. It is possible to search within this page by using the field with the magnifying glass in the top right corner. The **Service View** shows all configured services by default and the following information is available:

Input	Input information about the corresponding service. The notation is <X:Y:Z> where: • X – input module's slot position • Y – input module's port • Z – service PID
Service	Name of the output service
Scramble	Scrambler card assigned
Output	Output information about the corresponding service. The notation is <X:Y:Z> where: • X – output module's slot position • Y – output module's port • Z – service PID

It is possible to select and deselect information in this view by clicking on the '**...**' in the top right hand corner of the title bar. This will bring up the following dialog:

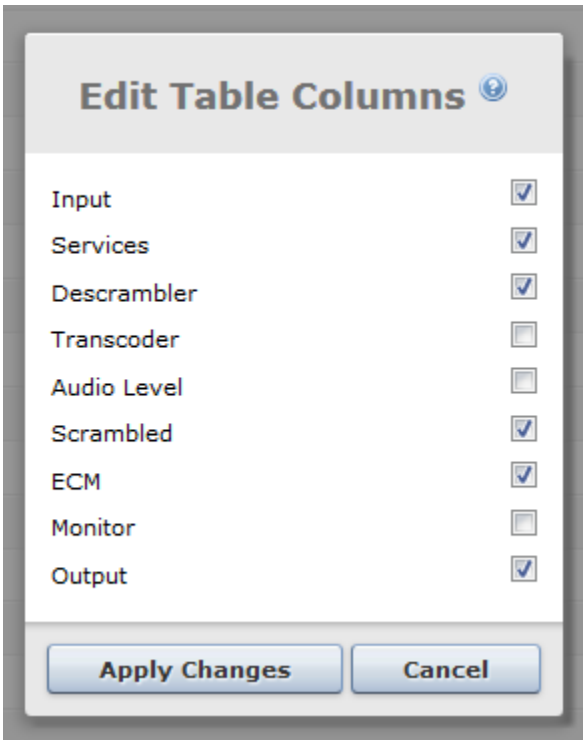


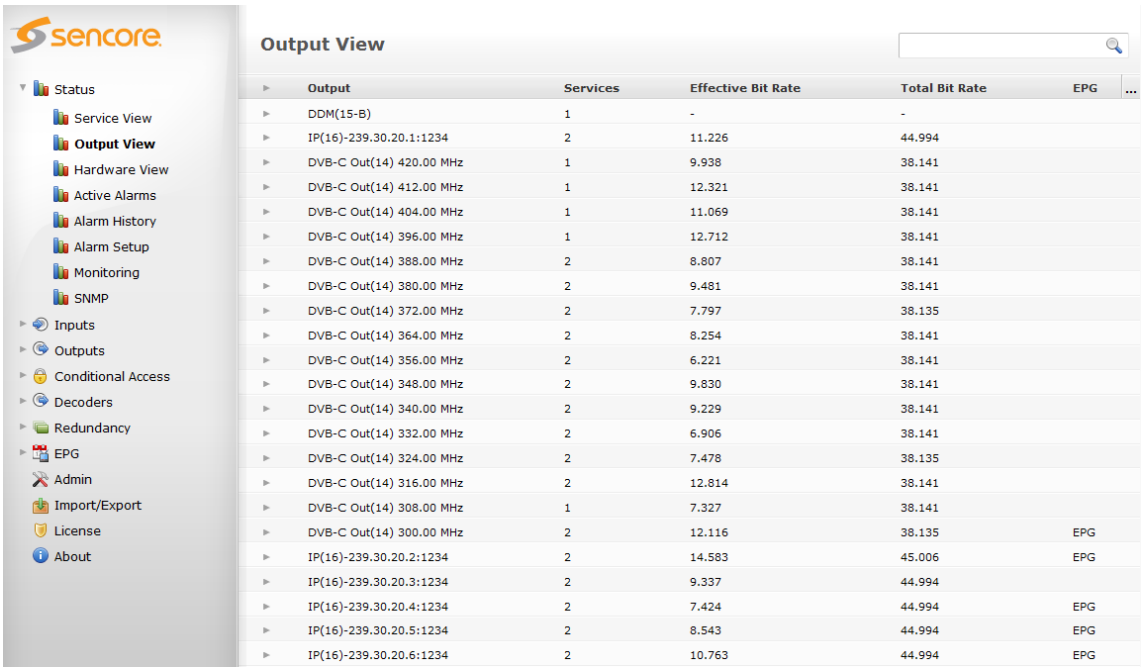
Figure 11.2 Service View Options

In this list, it is possible to sort the options by dragging the line to the desired location. The optional information available is described below:

Descrambler	Descrambler module assigned. The notation is <X:Y> where: • X – descrambler module's slot position • Y – descrambler module's Common Interface (CI) slot
Transcoder	Transcoder module/port assigned to the service
Audio Level	Audio leveling module assigned to the channel
ECM	ECM defined
Monitor	Monitor module used for monitoring the service

11.1.2 Output View

Expand the **Status** node in the **Navigation Pane** and click on the **Output View** node. The **Output View** will be displayed as shown below.



Output	Services	Effective Bit Rate	Total Bit Rate	EPG
DDM(15-B)	1	-	-	
IP(16)-239.30.20.1:1234	2	11.226	44.994	
DVB-C Out(14) 420.00 MHz	1	9.938	38.141	
DVB-C Out(14) 412.00 MHz	1	12.321	38.141	
DVB-C Out(14) 404.00 MHz	1	11.069	38.141	
DVB-C Out(14) 396.00 MHz	1	12.712	38.141	
DVB-C Out(14) 388.00 MHz	2	8.807	38.141	
DVB-C Out(14) 380.00 MHz	2	9.481	38.141	
DVB-C Out(14) 372.00 MHz	2	7.797	38.135	
DVB-C Out(14) 364.00 MHz	2	8.254	38.141	
DVB-C Out(14) 356.00 MHz	2	6.221	38.141	
DVB-C Out(14) 348.00 MHz	2	9.830	38.141	
DVB-C Out(14) 340.00 MHz	2	9.229	38.141	
DVB-C Out(14) 332.00 MHz	2	6.906	38.141	
DVB-C Out(14) 324.00 MHz	2	7.478	38.135	
DVB-C Out(14) 316.00 MHz	2	12.814	38.141	
DVB-C Out(14) 308.00 MHz	1	7.327	38.141	
DVB-C Out(14) 300.00 MHz	2	12.116	38.135	EPG
IP(16)-239.30.20.2:1234	2	14.583	45.006	EPG
IP(16)-239.30.20.3:1234	2	9.337	44.994	
IP(16)-239.30.20.4:1234	2	7.424	44.994	EPG
IP(16)-239.30.20.5:1234	2	8.543	44.994	EPG
IP(16)-239.30.20.6:1234	2	10.763	44.994	EPG

Figure 11.3 Output View

Information in the **Output View** can be sorted by clicking on the column headers. It is possible to search within this page by using the field with the magnifying glass in the top right corner. The **Output View** shows all configured outputs by default and the following information is available:

Output	Information about the output port. This will be specific to the type of output, ie IP will include multicast address, QAM will include frequency.
Services	Lists the number of services in the given output port
Effective Bit Rate	Shows the current effective bitrate of the output port
Total Bit Rate	Shows the current total bitrate configured for the output port
EPG	Displays if there is currently EPG information (EPG Schedule) configured on the output port

It is possible to select and deselect information in this view by clicking on the '…' in the top right hand corner of the title bar. This will bring up the following dialog:

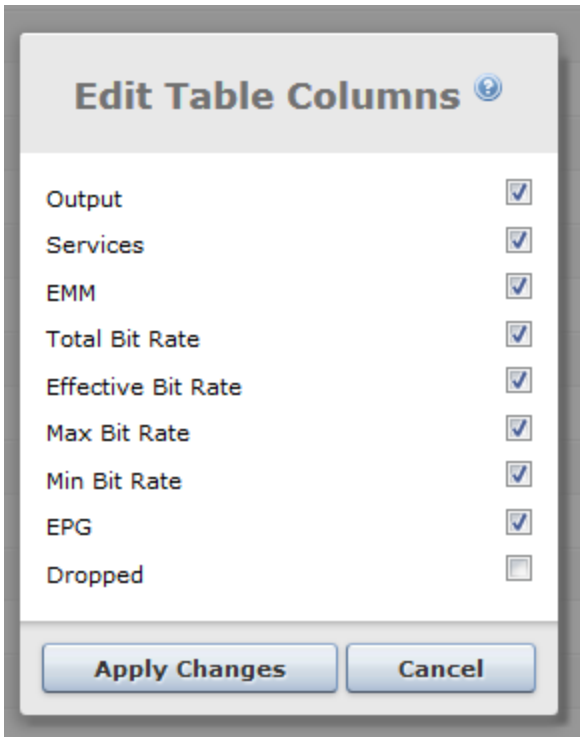


Figure 11.4 Output View Options

In this list, it is possible to sort the options by dragging the line to the desired location. The optional information available is described below:

EMM	EMM defined on the output port
Max Bit Rate	Maximum bitrate of the output port
Min Bit Rate	Minimum bitrate of the output port
Dropped	Counter for packets dropped by the interface in overflow situations

11.1.3 Hardware View

The hardware view shows the unit's status graphically. In the figure below there is one module with critical alarm status, shown in red. A description of the alarm status is shown in the status pane at the bottom of the screen.

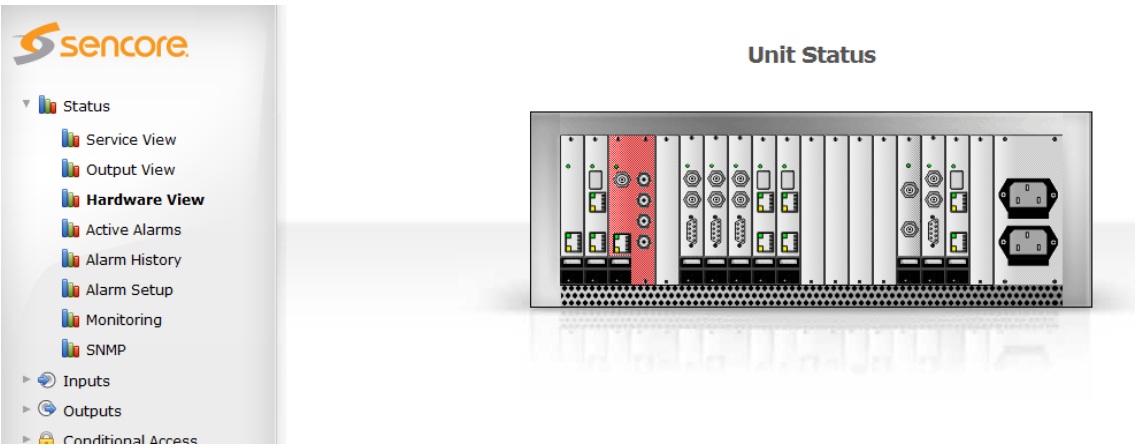


Figure 11.5 - Hardware View

11.1.4 Active Alarms

Expand the Status view in the **Navigation Pane** and click the **Active Alarms** icon. All active alarms will be displayed as shown below. The active alarms are first filtered by the active alarms filter, then by the root cause filter, if enabled. Note that all active alarms will also be displayed in the bottom pane. Refer to the table below for information on the color coding and what it represents.

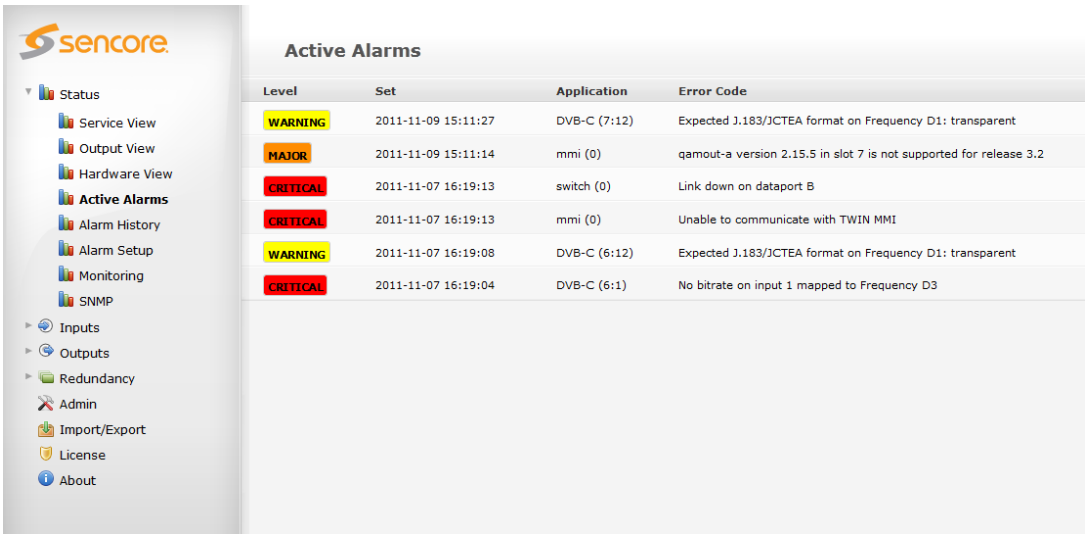


Figure 11.6 - Active alarms

Level	All alarm levels are color coded as follows: • **CRITICAL** – Red • **MAJOR** – Orange • **WARNING** – Yellow • **NOTE** – White

Set	When the alarm was set
Application	Which module and port the alarm is referring to
Error Code	Type of alarm. Refer to Appendix A for further details.

On the module itself, the **Status** LED changes color according to the active alarm:

BLUE – Booting or No contact to backplane

GREEN – No critical alarm(s)

RED – Critical alarm(s)

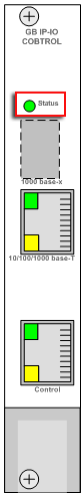
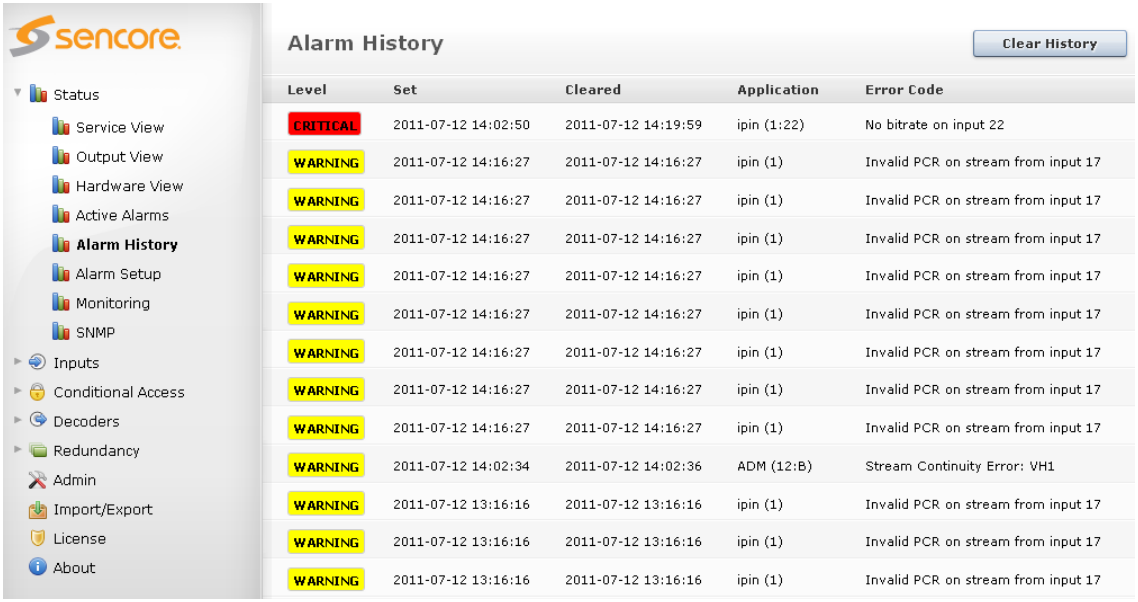


Figure 11.7 - Example of IP Input Module with Status LED

11.1.5 Alarm History

Expand the Status view in the Navigation Pane and select. The alarm history will be displayed as shown below. **Alarm History**



Alarm History

Level	Set	Cleared	Application	Error Code
CRITICAL	2011-07-12 14:02:50	2011-07-12 14:19:59	ipin (1:22)	No bitrate on input 22
WARNING	2011-07-12 14:16:27	2011-07-12 14:16:27	ipin (1)	Invalid PCR on stream from input 17
WARNING	2011-07-12 14:16:27	2011-07-12 14:16:27	ipin (1)	Invalid PCR on stream from input 17
WARNING	2011-07-12 14:16:27	2011-07-12 14:16:27	ipin (1)	Invalid PCR on stream from input 17
WARNING	2011-07-12 14:16:27	2011-07-12 14:16:27	ipin (1)	Invalid PCR on stream from input 17
WARNING	2011-07-12 14:16:27	2011-07-12 14:16:27	ipin (1)	Invalid PCR on stream from input 17
WARNING	2011-07-12 14:16:27	2011-07-12 14:16:27	ipin (1)	Invalid PCR on stream from input 17
WARNING	2011-07-12 14:16:27	2011-07-12 14:16:27	ipin (1)	Invalid PCR on stream from input 17
WARNING	2011-07-12 14:16:27	2011-07-12 14:16:27	ipin (1)	Invalid PCR on stream from input 17
WARNING	2011-07-12 14:02:34	2011-07-12 14:02:36	ADM (12:B)	Stream Continuity Error: VH1
WARNING	2011-07-12 13:16:16	2011-07-12 13:16:16	ipin (1)	Invalid PCR on stream from input 17
WARNING	2011-07-12 13:16:16	2011-07-12 13:16:16	ipin (1)	Invalid PCR on stream from input 17
WARNING	2011-07-12 13:16:16	2011-07-12 13:16:16	ipin (1)	Invalid PCR on stream from input 17

Figure 11.8- Alarm History

11.1.6 Alarm Setup

The alarm setup feature enables operators to customize their alarms either by setting a preferred severity (overriding the default level of severity) or filtering the alarm.

Slot	Lists all modules with their corresponding slot numbers in brackets
Port	Allows for selection of a particular port, depending on the module selected under **Slot**.
Alarm	Lists all possible alarms for the selected module in **Slot**. These alarms are all registered by each module in the system. If no specific module is selected, all alarms are listed.
Action	There are five possible options here: • **Set severity: Notify** – Overrides the alarm's default severity to Notify • **Set Severity: Warning** – Overrides the alarm's default severity to Warning • **Set Severity: Major** – Overrides the alarm's default severity to Major • **Set Severity: Critical** – Overrides the alarm's default severity to Critical • **Filter** – Filtering is based on slot, port and alarm type. If an incoming alarm does not pass the filter, the alarm is discarded. In other words, the alarm is not visible in the **Active Alarms** node, not recorded in **Alarm History**, and not indicated on the LED of the module itself.

The alarm filter page lists all the relevant alarms for the card type selected (if no specific card is selected all alarms are listed). When an alarm filter is removed any active alarms which are filtered will re-appear with the timestamp according to when the filter was removed.

The alarms shown in the alarm drop down list are all alarms registered by each module in the system. A module is most often represented by a card. When an alarm is raised by the respective module detecting an error condition it is possible for the module reporting the alarm to override the alarm description, in order to add some extra information.

In some cases, this may cause the alarm text displayed in the alarm filter not to match the actual alarm text; but it should be obvious which alarm it is.

i	The Alarm Filter also applies for the SNMP trap system.

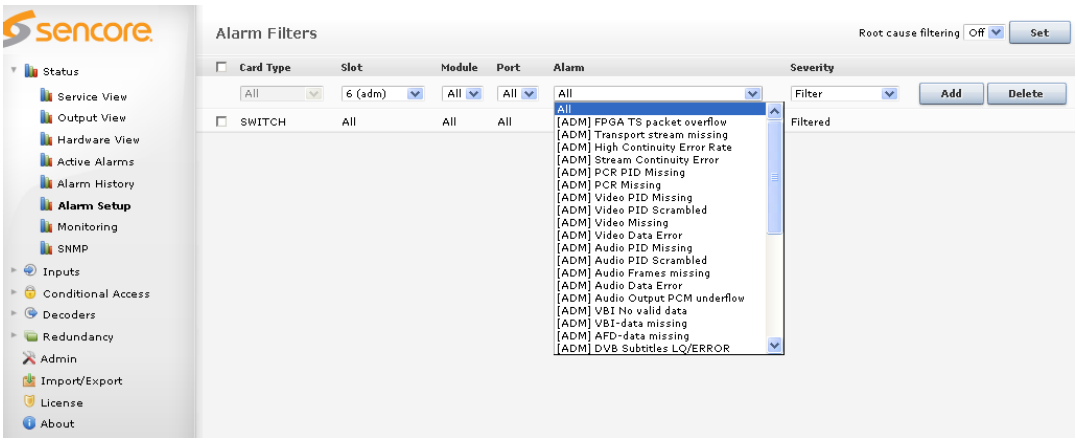


Figure 11.9 - Registered Alarms

Level	Set	Application	Error Code
CRITICAL	2011-07-12 14:24:35	ipin (1:22)	No bitrate on input 22

Figure 11.10 – An alarm with specific alarm description

11.1.7 Root Cause Filter

The root cause filter removes alarms which are caused by alarms earlier in the streams, hence eliminating distracting alarms. It is turned on and off in the **Alarm Setup** page.

11.1.8 Monitoring Setup

Raise alarm for scrambled inputs in IP input ports in below of following condition selected by user.

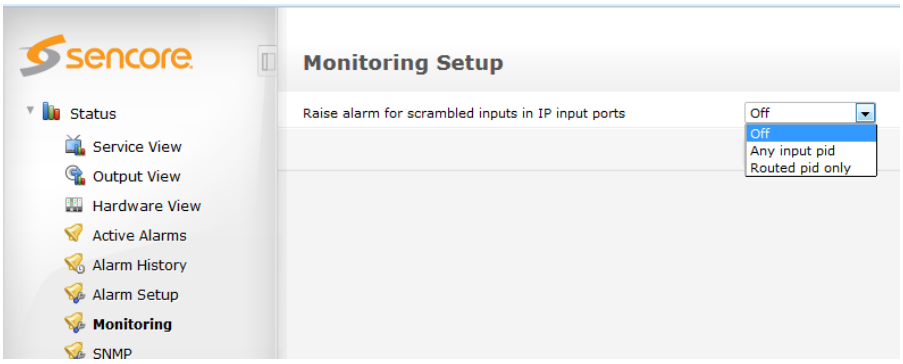


Figure 11.11– Monitoring Setup page

These are the following options supported:

Off	Never raise the alarm
Any input PID	Raise alarm if any of the PIDs are scrambled at the input
Routed PID only	Rise alarm if any of the PIDs are scrambled at the input

11.2 SNMP

The SNMP agent is located on the MMI module, and uses the same IP address. A number of variables can be configured, including the SNMP configuration file (containing the public and private community strings, for user access and alarms); and the trap destination table. This is explained below.

11.2.1 Configuration of SNMP Alarm Filter via the GUI

The ordinary alarm filter and the root cause filter is before the SNMP filter, and any alarms which are filtered away by those mechanisms, and hence are not shown in the active alarm list, are never sent via SNMP.

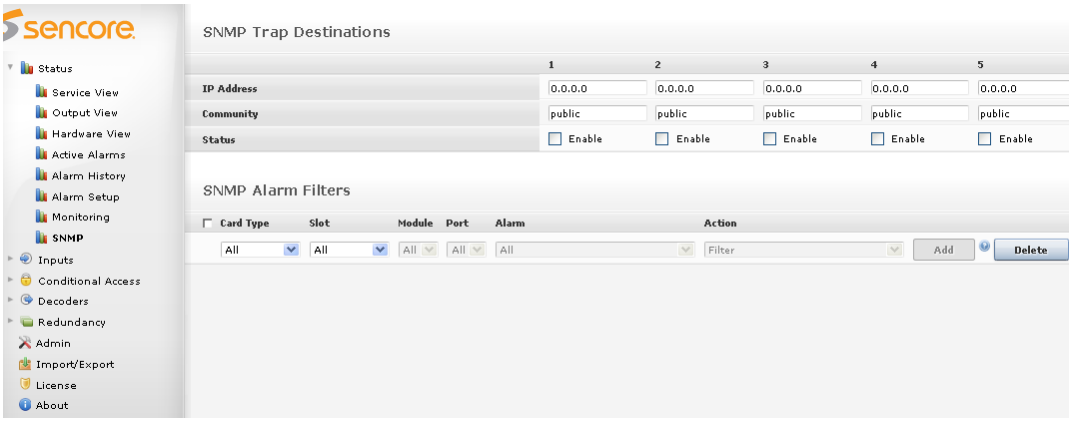


Figure 11.12 – Five Trap Destinations and the Alarm Filter can be set in the GUI.

The SNMP alarm filter provides filtering based on slot, port and alarm ID, like the Alarm Setup before it, and it is operated the same way.

11.2.2 Configuration of SNMP Trap Destination Table via the GUI

Five different trap destinations are set in the GUI. After changing status, or IP address or community, press **Apply** to start forwarding alarms.

11.2.3 Configuration of Trap Destination Table via SNMP

The trap destination table must be edited to receive traps. It has five entries, hence allowing five different trap destinations to be used at the same time. Additional rows cannot be created. The tdIpAddr field contains the IP address of the NMS, while the tdRowStatus field is used to determine whether traps should be forwarded. To enable traps towards a specified address the corresponding tdRowStatus field must be set to active (1). To disable traps, set the tdRowStatus field to notInUse (2). Errors are reported when trying to send traffic towards IP address 0.0.0.0, which is the default IP address.

11.2.4 Interpretation of Traps

Each trap is uniquely identified with the combination of msgId, msgSlot, msgPort, and msgInstance fields. The type of error is specified with the msgId field, while the location is

specified with the rest, where the msgSlot field is the slot, msgPort is the port on the slot, while the msgInstance field is used when further differentiation is necessary.

The other fields correspond to the fields in the GUI: the msgSeverity field to Level, the msgSourceName field to Application, the msgText field to Error Code, and the msgGenerationTime field to Set.

	For more information on using the SNMP agent, refer to the **SNMP Integration Guide**.

11.3 SOAP XML Interface

The SOAP XML interface can be used for external control and monitoring of the unit. For more information on the SOAP XML interface, refer to the **Sencore SOAP XML API** document.

12 Maintenance

This chapter describes how to perform maintenance tasks such as software upgrades, replacing faulty modules, etc.

12.1 Software Upgrades

Software can be uploaded to the unit remotely using the Maintenance Center (MC) available on port 8088 of the unit, ie http://<ip_addr>:8088/. Refer to the **Upgrade Guide** for details.

Required software upgrades for the units will be provided together with instructions by Sencore's support department.

For more details on the upgrade procedure, please refer to the Upgrade Guide document.

12.2 Hot-Swapping

The platform supports module hot-swapping, i.e. the different modules – power supply, fan, input, or switch – can be replaced when the head-end is in operation, without shutting it down. In other words, removing a module and replacing it with a new one will not damage the module. The effects of hot-swapping a module are explained in further detail in the following sections.

12.2.1 Performing a Hot-Swap

To remove a module, first loosen the screws on the top and bottom (one screw is located in the ejector). Next, press the white button inside the module ejector and push the ejector down. The module is now released from the chassis.

To insert a new module into the chassis, it is important to align the module's edges with the module-guides in the chassis. Ensure that the jack on the module is in the open position as illustrated in the figure below. Slide the module into the unit on the module-guides until the jack touches the chassis. Move the jack upwards. This will insert the module all the way into the unit.

12.2.2 Switch+MMI Module Hot-swap

This module manages all the other modules in the unit and stores all configuration information in a database. Replacing the Switch+MMI card will cause all services to stop. Hence replacement of the MMI board must be performed with care, and a full backup of the configuration database is recommended.

All communication between different modules in the unit is facilitated by the switch-module; removing this module will disable all backplane communication resulting in loss of all services (the color of the status LED on the modules will change to blue).

Once a replacement switch card is inserted into the device the LED will change back to red or green and services will resume automatically.

Figure 12.1 - A Module with its Ejector released

12.2.3 Other Module Hot-swap

Modules can be replaced during normal operation with minimal disruption of services, affecting only the relevant modules. The unit will automatically reconfigure the new module with identical values its predecessor. Therefore, the module will automatically begin descrambling the same service descrambled previously.

i	It is important to insert the new module into the same slot as the previous one; and ensure that their configuration is identical.

12.3 Adding, Replacing, or Removing Modules

Before upgrading a unit with additional modules, ensure that there is sufficient space (slots) in the chassis.

When all the new modules have been inserted into the chassis, make sure that the front of the chassis is completely closed with the front panels. Leaving a slot position open without a module or front panel will cause the unit to draw false air and consequently result in over-heating of the modules in the chassis.

To permanently remove modules from a specific slot position, the modules should first be removed from the chassis. Next, go to the **About** page from the **Navigation Pane**. Click ⊗ to remove the modules. Modules flagged for removal will be ~~crossed out~~. Click ⊗ again to deselect a module. Finally click **Apply Changes** to permanently remove the configuration of the module from the chassis.

When replacing an existing module, note that a module configuration always follows the slot position and not the module itself. Consequently, if a module is moved from one slot in the chassis to a new slot, the unit will report the original slot position as hardware missing, while the new slot position will be configured as a new module with default configuration. Hence if a module is to be replaced it is important that the same slot is used.

When replacing a module with a different module type, a mismatch will occur. This will be shown both in the alarms and in the **About** page. A DVB-S/S2 module however, can replace a QPSK module. When this happens, a convert button ↑ will show up in the **About** page along with the remove button. Clicking this button will enable the DVB-S/S2 module to inherit the configuration of the old QPSK module.

It is not possible to undo this process from the web GUI.

12.4 Importing and Exporting Chassis Configuration

The configuration of a unit can be saved onto a file to be retrieved later. This file contains the entire configuration, including the MMI IP address. To save the current configuration, click **Export** (see Figure 14.3).

To retrieve the configuration from an existing file, select the file by clicking **Browse**. Then, check **Include local IP addresses** if the IP addresses should be included, and click **Restore**.

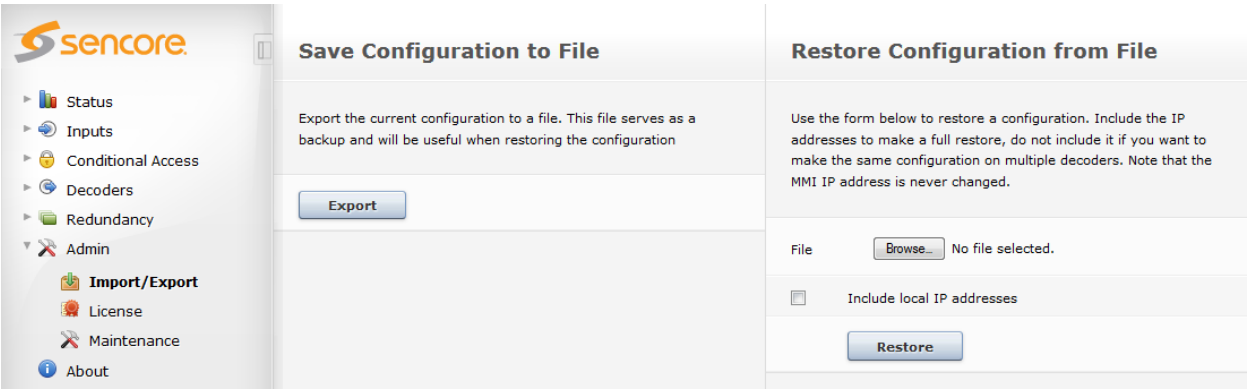


Figure 12.2- Saving Importing and Exporting Chassis Configuration

This feature has two benefits:

- To restore a unit to a previous state, or
- To use the same setup on multiple units

Use the **Include local IP addresses** option to bring a unit back to a previous state when lots of changes need to be undone; or if an upgrade has been unsuccessful.

It is recommended that the configuration be exported before each upgrade and restored after a downgrade (if the downgrade was unsuccessful).

To use the same setup on multiple units, uncheck the **Include local IP addresses** option. This way, only one unit needs to be configured, and all the other units will use the same configuration – but on their existing IP addresses.

12.5 Restoring the Default IP Address

It is possible to restore to the factory-configured IP address on the Switch+MMI module. This can be useful if the software-configured IP address is lost. The restore is done by setting dip switch 2 to ON on the Switch+MMI card. When the setting has been applied, the MMI will be configured according to the tables below regardless of what is stored in memory.

The default IP settings are:

IP Address	192.168.1.100
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.1

After setting the DIP switch the MMI card has to be rebooted. The factory default IP settings will be active as long as the setting is present. While the DIP switch on, all IP parameters in memory can be changed and saved via the web interface. Once the DIP switch is changed back to OFF and the card is rebooted, the IP settings in memory will be activated.

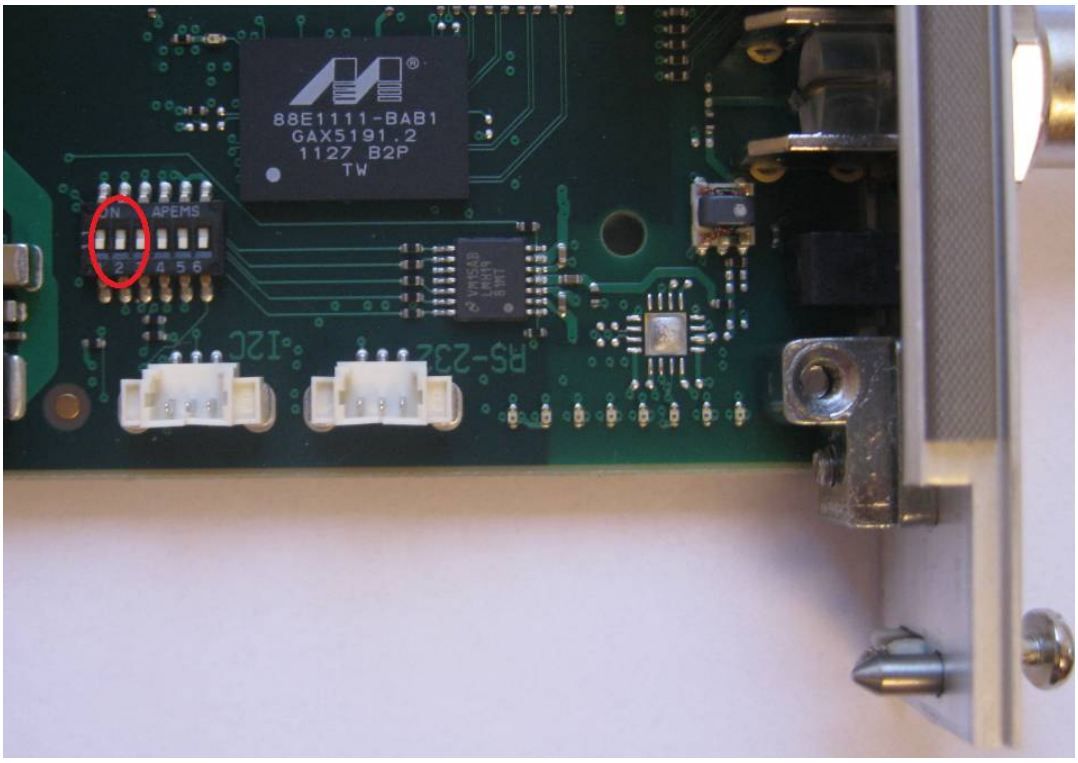


Figure 12.3 - Hardware IP reset DIP switch

12.6 Restoring the Default IP Address for 1RU (3200).

12.6.1 Resetting IP address using USB Cable

The Switch+MMI module control can be accessed via Ethernet over USB. A USB A/A cable (standard-A type connector in both ends) should be connected between a PC and the MMI module.

To access the MMI a driver for **RNDIS Ethernet gadget** must be installed.

On a Windows PC the driver can be installed automatically over Windows Update, or it can be downloaded manually. The Switch+MMI module can then be accessed directly from a web browser, using the IP address **169.254.254.254**.

All MMI functionality is supported over this interface.

12.6.2 Resetting IP address with DIP switch:

It is possible to restore to the factory-configured IP address on the Switch+MMI module. This can be useful if the software-configured IP address is lost. The restore is done by setting DIP switch **2** to 'ON' on the Switch+MMI card. When the setting has been applied, the MMI will be configured according to the tables below regardless of what is stored in memory.

The default IP settings are:

IP Address	192.168.1.100
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.1

After setting the DIP switch the MMI card has to be rebooted. The factory default IP settings will be active as long as the setting is present. While the DIP switch on, all IP parameters in memory can be changed and saved via the web interface. Once the DIP switch is changed back to OFF and the card is rebooted, the IP settings in memory will be activated.

In order to remove the module, the following procedure must be followed:

1. Loosen the thumb screws for the fan assembly and remove the fans
2. Loosen the thumb screws on the MMI module
3. Press on the Switch-MMI module to come out little.
4. Take out complete Switch-MMI module.
5. Set DIP Switch 2 = ON
6. Replace both MMI and fan assembly

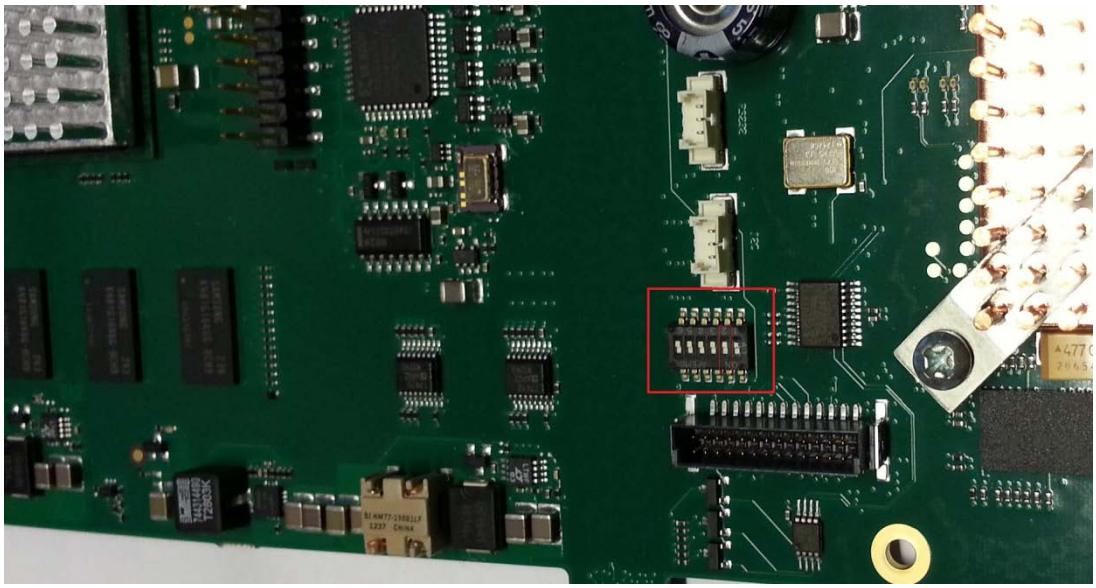


Figure 12.4- DIP switch ON-DMG 3200

Appendix A – Notices

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Appendix B – Alarm messages

Alarm message descriptions are now available in a separate document.

Appendix C – Warranty

Sencore DMG 3200/3100/3000 One-Year Warranty

Sencore warrants this instrument against defects from any cause, except acts of God and abusive use, for a period of 1 (one) year from date of purchase. During this warranty period, Sencore will correct any covered defects without charge for parts, labor, or recalibration.

Appendix D – Support and Contact Information

Returning Products for Service or Calibration
The DMG 3200/3100/3000 is not a field serviceable piece of equipment and needs to be serviced and repaired by Sencore. In order to expedite this process please carefully read the instructions below.

RMA Number
Before any product can be returned for service or calibration, an RMA number must be obtained. In order to obtain a RMA number, use the following steps:

1. Contact the SENCORE service department by calling 1-800-SENCORE.
2. Let the customer service representative know the following things
    a. Product name and model number
    b. Reason for product return
    c. Contact information
    d. Serial number of the unit
3. Get the RMA number and shipping information from the customer service representative.

Or

Visit www.sencore.com and fill out the RMA request form. An RMA number will then be emailed and the product can be shipped in.

Shipping the Product
Once an RMA number has been issued, the unit needs to be packaged and shipped back to Sencore. It's best to use the original box and packaging for the product but if this not available, check with the customer service representative for the proper packaging instructions.

Note: DO NOT return any power cables or accessories unless instructed to do so by the customer service representative.

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