User Guide

DMG-4100 / DMG-4200

System Release 4

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1 INSTALLATION AND SAFETY

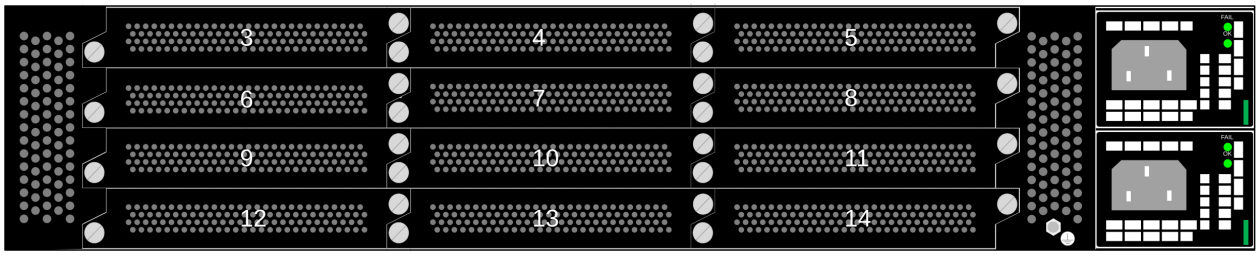
The Sencore DMG 4x00-series products are designed to offer operators reliability and flexibility. The DMG 4x00-series consists of a chassis in which a number of option modules can be installed. To cater to specific system requirements, the chassis can be configured to host functional modules best suited for a given scenario.

Sencore DMG 4x00-series products can be delivered in two chassis versions -2RU chassis and a 1RU chassis. The product model **DMG-4200** represents the 2RU chassis, while the product model **DMG-4100** represents 1RU chassis.

1.1 The DMG-4200 product

The 2RU chassis has a total of 14 slots all of which can host functional insertion blades. Slot number S1 and S2 in the front are dedicated to host the control/switch blades. The unit can be delivered with 1 or 2 control/switch blades. The remaining 12 slots are identical and can be occupied by any of the other functional insertion blades available. The DMG-4200 chassis including control/switch blades, power supply connectors, and slots for insertion blades in the back. Power modules are inserted from the back, while the fan module is inserted in the front (placed above the control/switch blades). The chassis can hold 2 power supply modules for redundancy purpose

DMG-4200 front, with control/switch blade in slot 1 and redundant control/switch blade in slot 2.



DMG-4200 back, with slots 3-14

1.1.1 Ventilation

The DMG-4200 product 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-4200 has 5 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 5 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.

1.1.2 Replacing the power supply module

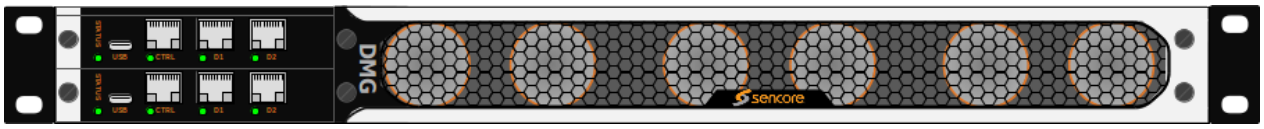
The power supply modules for the DMG-4200 are hot-swappable. Under normal operating conditions they operate in load share mode. In case of one power supply unit is failing, or there is a failure causing loss of power to one of the power supply units, the other power supply unit can feed the entire DMG-4200 product. Replacing one power supply will not affect the operation of the unit. It is recommended

to connect each power supply module to different circuits.

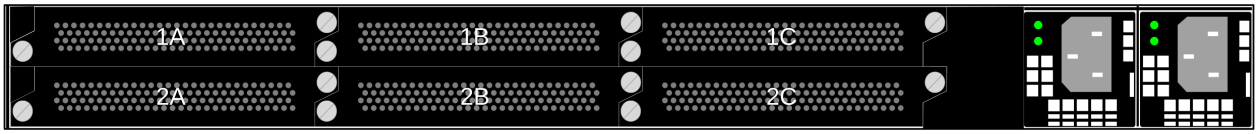
1.2 The DMG-4100 product

The 1RU chassis has a total of 8 slot positions all of which can host functional insertion blades. Slot number S1 and S2 in the front is dedicated to host the control/switch blades. The unit can be delivered with 1 or 2 control/switch blades. The remaining 6 slots are identical and can be occupied by any of other the functional insertion blades available. The DMG-4100 chassis including control/switch blades, power supply connectors, and slots for insertion blades in the back. Power modules are inserted from the back, while the fan module is inserted in the front (next to the control/switch blades). The chassis can hold 2 power supply modules for redundancy purpose

Slot S1: Mandatory control/switch blade



Slot S2: Redundant control/switch blade



1.2.1 Ventilation

This DMG-4100 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-4100 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. Please note that the fan tray must be removed to replace or insert switch module on DMG-4100.

1.2.2 Replacing the power supply module

The power supply modules for the DMG-4100 are hot-swappable. Under normal operating conditions they operate in load share mode. In case of one power supply unit is failing, or there is a failure causing loss of power to one of the power supply units, the other power supply unit can feed the entire DMG-4100 product. Replacing one power supply will not affect the operation of the unit. It is recommended to connect each power supply module to different circuits.

1.3 Safety Considerations

The unit **must** be connected to a grounded power connection. It is recommended that the ground connector on the chassis are connected at installation. 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. Connect the driver (mains) before connecting the power cord to the equipment. For removal, the opposite must be done. Power cord removed from equipment before removing the driver of the ground.
3. The equipment must be installed in a restricted area where:
   - Only qualified technicians should have access.
   - 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.
   - Access to the area where the devices are installed will be using a tool, lock and key, or any other safety device, an in addition the site will be controlled by an authorized person.

警告：接続ケーブルのプラグは、切断するためのものです。
電源プラグが常に手の届きやすい場所にくるように設置してください。

1.4 Power

1.4.1 Power supply rating

The DMG-4200 can be supplied with one of 3 different power supply options referred to as 1) 1200W AC power , 2) 1500W AC power and 3) 1200W DC power.

Their ratings are:

1. 100-240V AC 50/60Hz 12-9A, Max load: 1200W for 200-240VAC / 800W for 100-200VAC
2. 100-240V AC 50/60Hz 15-10A, Max load: 1500W for 120-240VAC / 1260W for 100-120VAC
3. -48 to -60V DC Imax 36.2A, Max load: 1200W

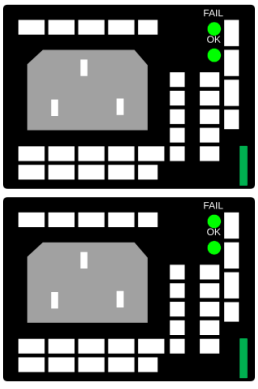
For 100-120VAC, the 1500W power supply should be used

The DMG-4100 is supplied with a 1) 750W AC Power supply rated:

1. 100-240 VAC 50/60Hz, Imax 8.7A, Max load 750W

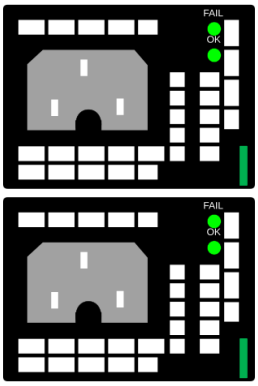
1.4.2 DMG-4200 with 1200W AC Power

The 2RU chassis holds two power supplies with independent power inlet for the two supplies. The power inlet connector is IEC type C14, requiring a Power cable with IEC type C13. Both supplies shall be connected and active. In case of one power supply unit is failing, or there is a failure causing loss of power to one of the power supplies, a single power supply can feed the entire DMG-4200 product.



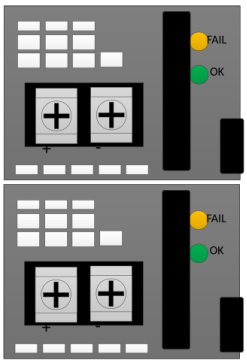
1.4.3 DMG-4200 with 1500W AC Power

The 2RU chassis holds two power supplies with independent power inlet for the two supplies. The power inlet connector is IEC type C16, requiring a power cable with IEC type C15. Both supplies shall be connected and active. In case of one power supply unit is failing, or there is a failure causing loss of power to one of the power supplies, a single power supply can feed the entire DMG-4200 product.



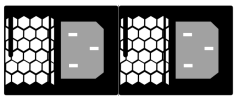
1.4.4 DMG-4200 with 1200W DC Power

The 2RU chassis holds two power supplies with independent power inlet for the two supplies. The power inlet connector is screw terminal. Both supplies shall be connected and active. In case of one power supply unit is failing, or there is a failure causing loss of power to one of the power supplies, a single power supply can feed the entire DMG-4200 product.



1.4.5 DMG-4100 with 750W AC power

The 1RU chassis holds two power supplies with independent power inlet for the two supplies. The power inlet connector is IEC type C14, requiring a Power cable with IEC type C13. Both supplies shall be connected and active. In case of one power supply unit is failing, or there is a failure causing loss of power to one of the power supplies, a single power supply can feed the entire DMG-4100 product.



1.5 Laser Safety

The Optical SFP and SFP+ modules used in the DMG-4100 and DMG-4200 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-4100 and DMG-4200 products can be equipped with multiple insertion modules containing housing for optical SFP and SFP+ modules.

When installing SFP/SFP+ modules, please ensure that the module be placed correctly in the housings present on the insertion blades. Once inserted, the SFP/SFP+ module will become active.

2 DMG 4X00 PLATFORM ARCHITECTURE

The unit is designed with reliability and flexibility in mind. It consists of a chassis in which a number of hot-swappable cards can be installed. The chassis can be configured to host interface and processing cards according to the customer's requirements.

Each switch module provides a backplane communication path which is used for data-transfer and inter-card communication. Units with dual switch cards will thus provide two communication paths on the backplane. If one of the switch modules fails, the other communication path is still active and communication and data-transfer between the remaining cards will not be affected (seamless switching is applied internally).

2.1 User Interface

The main access point of the device is via the control port of one of the switch cards. Once the username and password is entered correctly the desktop will be accessible. The desktop is the main application launcher window. Configuration of the unit is done via opening relevant applications. Card specific applications are running on the cards themselves, so opening an application is essentially a web-redirect to the local card. Thus it does not matter if you access the card via switch card in slot 1 or 2, you end up on the same place anyway; on the card itself.

2.2 Automation Interface

The DMG 4x00 platform offers an automation API (JSON) that supports all features offered via the WEB interface of the unit. For easy integration with NMS systems the DMG 4x00 unit also supports sending SNMPV2 traps to external NMS's.

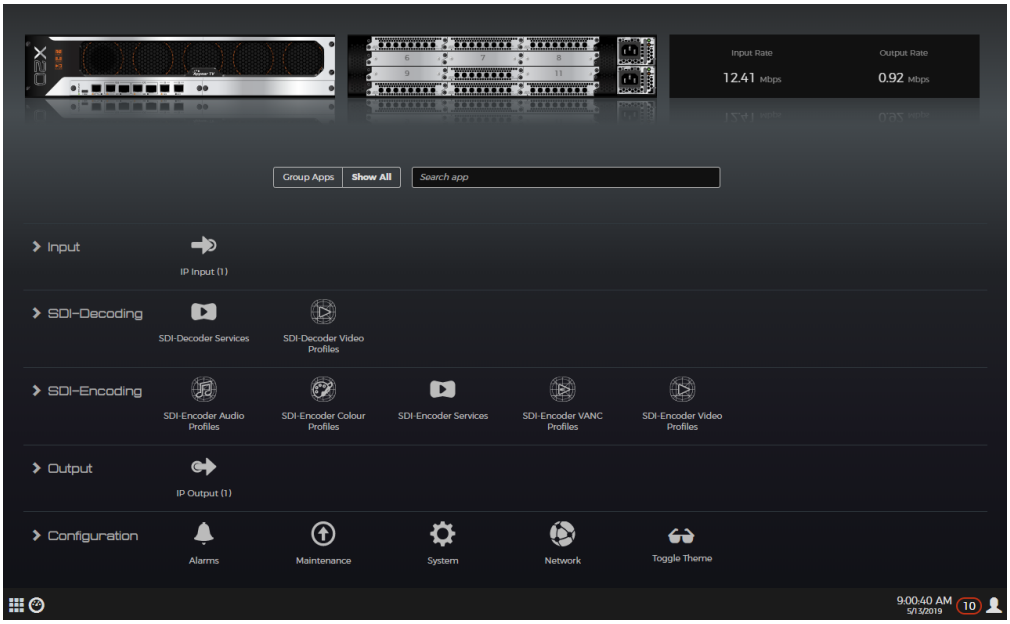
For details regarding the interface please contact Sencore.

2.3 Unit Configuration

All system configurations are store in a central database on the switch card. In the case of dual switch cards the databases are synchronized.

3 CONFIGURATION DESKTOP

3.1 Desktop



The desktop is the main application launcher and system status window. The upper part shows the hardware configuration and key status regarding received and transmitted bitrate of the cards. By hovering the mouse over the bitrate status panel, bitrates will be listed per module.

The centre part is the application launcher section. As applications are launched they will appear along the lower edge of the desktop for easy access later. In case of many applications the search window can be used to search for applications, or applications can be grouped by using the ***Group Apps*** button.

3.1.1 Taskbar

The following elements are present in the taskbar:

Element	Description
	Revert to the desktop from an application
	Open the status page
Time	Shows the unit time.

Element	Description
⑤	Shows the number of active alarms in the system, including alarms for all modules. Multiple alarm bubbles can appear, showing the number of alarms per alarm category.
👤	Open the user status side panel, which shows user information. This is where it is possible to log out from the system.

3.2 Status page

The status page shows the overall bitrate status of a unit. It is grouped into 4 sections

Section	Description
System Flow Graph	Shows the internal routing in the unit. The graph illustrates the flow of data from a source module to a destination module over the internal backplane. Data will flow from the ***Output*** of the source module to the ***Input*** of the destination module. Clicking a module will filter the status information shown in the other sections to the module selected. To undo the selection, click the module again.
Chassis overview	Show total bitrates per module. The following rates are available: • **Input**: Total ***input*** rate • **Output**: Total ***output*** rate • **BP Input**: Total ***backplane input*** rate (received from other:: modules) • **BP Output**: Total ***backplane output*** rate (transmitted to other:: modules) It is possible to expand a module to see bitrates per interface.
Chassis IP Interface Bitrate	Graph displaying the ***input*** and ***output*** bitrate. If a module is selected in the **System Flow Graph** or **Chassis Overview**, bitrates for this module will be presented, otherwise the aggregated bitrates for all modules are displayed.

4 ALARM APPLICATION

4.1 Alarms

Displays alarms generated by the modules in the unit. To filter alarms, click the red remove icon for the alarms to filter.

4.1.1 Alarm Severity

There are multiple alarm types described in the table below

Category	Description
Critical	Signalling a critical, service affecting issue. Critical alarms are also used to trigger redundancy systems, if enabled.
Major	Signalling a major issue, most likely service affecting
Warning	Signalling issues which should be investigated by the operator
Event	Used to signal important events. Events do not have a duration, making set and clear timestamps equal

For a complete list of all possible alarms see the Alarm Description document.

4.1.2 Alarm export

It is possible to export alarms to a file by clicking the **`[Export all alarms]`** button. The file will contain all alarms, including history as a csv file.

4.2 Filters

The **Filters** section shows all active alarm filters defined in the system. It is possible to delete the filter by clicking the delete icon on the left hand side. To temporarily disable the filter, use the Enabled-toggle for each filter.

The alarm filtering does **not** apply to the SNMP trap system.

5 MAINTENANCE APPLICATION

The **Maintenance** application offers functionality to administer all the modules in the unit. The application contains multiple tabs, each offering different functionality

5.1 About

5.1.1 Module information

This tab shows all installed modules in the chassis. The following information is listed:

Key	Description
Slot	The slot where the module is installed
HW	Identifies the type of module installed
SW Image	Shows the the current running SW
Serial	Serial number of the module
Status	Shows the status of the module. Possible values are: • **OK**: The module is logged in • **Stopped** : The module fails to log in, or is blocked from logging in due to compatibility restrictions • **Missing**: The module does not log in, or is physically removed from the unit
Details	If the module is not allowed login, the reason will be described here

It is possible to get more details about each module by clicking on each module. A side panel will appear with more details listed under **Status**.

5.1.2 Module Operations

It is possible to perform maintenance operations on the modules installed in the unit. By selecting one ore more module(s) in the main list, a sidebar will appear on the left side. The maintenance menu for the selected modules can be found in the **Actions** section.

The following actions can be performed:

Action	Description
Reboot card	This will reboot the selected modules
Download debug file	Downloads a debug snapshot which can be used to troubleshoot problems. One file will be downloaded per module.
Delete card	Deletes the configuration for the selected module. This action is only available for modules which are currently not logged in to the system, i.e ***Missing*** or ***Stopped***.

5.1.3 System Operations

Action	Description
Power cycle chassis	This will power cycle the entire unit, making all modules restart.

Action	Description
Export inventory file	Export information about each module to a file.

5.2 Upgrade

To update the SW on the individual modules, it is possible to perform an SW upgrade. This is performed in the **Upgrade** section. Initially, this page will list all available modules in the unit, and list the current running SW on all modules. To perform a SW upgrade, select the SW image to use in the **Select upgrade image** section to the left. The user interface will inspect the SW image chosen and show a list of compatible modules for the image.

Depending on compatibility, the following options are available for each module

Action	Description
Compatible	This module is compatible, and can be upgraded with the selected SW image
Incompatible	It is not possible to upgrade the module with the selected image
Product change	It is possible to upgrade the module, but the product type will change. Is allowed by user consent. The module configuration will be compatible with the current running product SW
Product change, incompatible config	It is possible to upgrade the module, but the product type will change. Is allowed by user consent. The module configuration is not compatible, and after the upgrade has succeeded, the card will be blocked. To resolve the mismatch it will be necessary to delete the module configuration. This is described in the about section.

5.3 Import/Export

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**. To retrieve the configuration from an existing file, select the file by clicking Browse. Two options are available when importing a previous configuration:

Preserve Users
All users configured on the unit will be preserved, otherwise the users from the file will be included.

Preserve IP interfaces
Preserve the IP interfaces on all modules, otherwise all IP interfaces will be configured according to the backup file.

Live Import
Imports the configuration while only applying changes to the configration entities (input,output, etc) that differ between the running configuration and imported, thus limiting service disruptancy to a minumim. No reboot of the modules are required. If disabled, the imported configuration will replace the running configuration and the unit will be rebooted. It is recommended to use the **Live mode**, and only disable it as a last resort if there are problems using the **Live mode**

The import/export feature has two benefits:

- To restore a unit to a previous state, or
- To use the same setup on multiple units

Deselect the **Preserve Users** and **Preserve IP interfaces** options 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, use the ***Preserve IP interfaces*** 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.

5.4 Licenses

The license section shows all modules in the unit, and list the licenses installed on each module respectively. To install additional licenses, click the **Add License** button.

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.

5.4.1 Demo licenses

It is possible to install ***Demo Licenses***. These are time constrained licenses, which will expire on a set time. Demo licenses are currently listed identical to ordinary licenses.

6 SYSTEM APPLICATION

The **System** application offers functionality to administer the unit. The application contains multiple tabs, each offering different functionality

6.1 Access Control

6.1.1 Users

The user configuration application manages the user accounts which can access the user interface.

The page shows the defined users with the following information

Parameter	Description
User Name	The user Id of the user
Group	The authoritative group which the user is member of. See Groups for more information.
Status	The current status of the user. Possible values are • Logged in • Disabled • Password expired

Only users which are members of the ADMIN group will be able to see all users and make changes. Non-admin users will only see them self in this application.

6.1.2 User management

It is possible to edit users by clicking on the user entry in the list. The panel on the right offers a configure section where the following actions can be performed

Action	Description
Change Password	Change the password for this user. The password must be different that the previous password.
Require Password Change	Will force the user to change the password on the next login to the UI
Disable user	Is is possible to disable/enable the user. A disabled user will not be able to log in to the UI.

To add a new user, click the **`[Add User]`** button.

6.1.3 Groups

All users are member of a group defining the permission level for each user. There are 4 different authoritative roles in the system:

Role	Description
Admin	All rights
Expert	As Admin except system configuration.

Role	Description
Engineer	As Expert, but not allowed to add and remove flows in the system, only to change the content.
Operator	View only rights.

For each group is is possible to configure

Password Policy
Set a password policy for all users which are members of this group.

GUI Inactivity Timeout
Enables automatic logout. If the UI is inactive for the defined period, the user will automatically be logged out. A warning message will be shown 1 minute before the actual logout.

6.1.4 Policies

It is possible to set security policies for the users in the system.

6.1.4.1 Global

Minimum user name length
Sets the minimum length of user names.

Changing this parameters does not affect already defined users.

6.1.4.2 Passwords

Password policies can be enabled to enforce password strength for all the users defined. It is possible to define a combination of the following restrictions:

Minimum length
Sets the minimum length allowed for a password.

Require uppercase
Requires at least one upper case character in the password.

Require lowercase
Requires at least one lower case character in the password.

Require digit
Requires at least one digit in the password.

Require non alphanumeric
Requires at least one non alphanumeric character in the password.

Changes to a password policy will not automatically invalidate existing passwords for users which are governed by the password policy. The password restrictions will apply the next time such a user changes password. To force all users to update password, use the `Force password change` in the Users section.

To enforce the users of the system to regularly update their passwords, it is possible to enable password expiration.

Days before password expires
Number of days a password is valid. The time is relative to the last time the user changed password. If the user has not changed password, the time will be relative to when the user was created.

Disable user when password expires
This option controls the behavior when a password expires. The normal behavior is that a users with an expired password is forced to change password on the next login to the system. When this option is enabled, users with expired passwords will be blocked from logging in to the unit. An `Administrator` user will need to unblock each users in the Users section.

It is possible to enable password expiration.

To add a new policy click the **`[Add new policy]`** button at the bottom of the page.

6.1.5 Auto Login

The `Auto Login` feature will, when enabled, automatically log in new users accessing the web interface on the unit, and the login process is automated. These users will be given the authoritative role according to the `Permission Level` parameter.

To log in as a ***normal*** user, click the **`[Logout]`** button, and the normal login screen will be presented.

When this feature is enabled, the browser needs to be restarted for the change to take effect.

6.1.6 Users Sessions

List all login session on this unit. The lists will be reset when the unit is rebooted. The following information is available

User name
The user Id of the user

Access level
The authoritative group which the user is member of.

User type
What type of authentication method was used for this session. Possible values are:

- Local
- LDAP
- Auto

Client IP
The IP address the user connected from

State
The state of the session. Can be

- Active
- Ended

Time started
The time the session started

Time ended
The time the session ended, if session has ended

Details
Some details

6.1.7 LDAP

It is possible to enable LDAP authentication and authorization on the unit.

6.1.7.1 Authentication

To set up the connection with LDAP, the following configuration options are available:

Server address
The DNS server address of the LDAP server.

DNS

Using an IP address will not work, the LDAP server address must be specified as a fully qualified hostname. It is required that at least one DNS server is configured in **Network › DNS**.

Search Base
The LDAP search base for the user search

Search Filter
This field determines the query to be run to identify the user record. Specify a search filter value which contains the marker token `%1%`, which will be replaced with with the user Id entered by the user on login. E.g `(&(objectClass=person)(uid=%1%))`, or for ActiveDirectory `(&(objectClass=person)(sAMAccountName=%1%))`

Attribute Name
Name of the LDAP user's attribute which defines groups that the user is member of. This will be used to determine the access level of the user. Typically this would be either `memberOf` or `isMemberOf`.

If the LDAP server is restricting access to read the user entries, a manager account needs to be declared. Manager user name: The user name of the manager account Manager password:: The password of the manager account

6.1.7.2 Authorization

To be able to determine the access rights of the user using LDAP, there needs to be a mapping between groups defined in LDAP, and the access groups defined on the unit. To control the access right of an LDAP user, it is important to set up these mapping rules correctly. These rules are matched against the LDAP groups retrieved from the LDAP server using the memberOf property defined above.

6.2 Security

6.2.1 SSL Certificates

The communication between the UI and the unit is encrypted using TLS (HTTPS), which is using private and public keys for the actual encryption. The unit's public key is distributed to the UI (browser) using a SSL certificate. In addition to distributing the public key, the SSL certificate is used to authenticate the unit, so it can be verified that the browser is communicating with the correct device. This verification is only possible to achieve if the SSL certificate is signed by trusted authority.

The unit will be using a self signed certificate by default, which triggers a security warning in browsers because it cannot verify the certificate is signed by a trusted party.

The ***security*** section will show the current SSL certificate used by the unit, one per relevant module. By clicking the certificate, more details about the certificate will be shown. To configure the SSL certificate on the unit, click the ***Configure*** handle in the right hand panel.

To install custom SSL certificate, two files needs to be installed. The certificate file (in pem format), and a file containing the private key. File selectors for uploading the files are available once the **Auto**

Generated mode is disabled.

If the certificate is signed using an intermediate certificate(s), these certificates needs to be added to the device certificate file before installation, so that the chain of trust can be completed. Add the intermediate certificates to the pem file below the device certificate.

SSL Certificates

When a browser validates the SSL certificate provided by the unit, it will compare the URL with the **Common Name(CN)** defined in the certificate, which need to match. SSL certificates and static IP addresses in the private domain does not mix well, so it is recommended to add a FQDN in the **Common Name** field (or use wildcard certificates) and add static maps to your network nameservers for IP resolving.

It is possible to generate SSL certificates by specifying the IP addresses in the **Subject Alternate Name** extension. Such a certificate will be difficult to sign using a certificate chain with a publicly trusted root certificate, as they are likely constrained not to allow IP addresses in the private domain. In this case a internal CA can be used, which can sign the SSL certificates. For the browser to trust the certificates signed by the internal CA, the internal CA certificate needs to be added as a trusted CA on the devices communicating with the DMG 4x00 unit.

6.3 Date & Time

Time on all modules are internally synchronized with the MMI module(s). This time is used in the alarm system. It is possible to set the time manually, or to use an external NTP server for time synchronization. It is possible to set up to 5 NTP servers.

The system time is always UTC. The GUI will show the unit time adjusted with the timezone of your computer.

6.4 SNMP/Syslog

It is possible to export the system events to a SNMP client, over traps, or with syslog exports

The unit supports sending alarm traps for all alarms and events generated in the system. Up to 5 destinations can be configured.

7 NETWORK CONFIGURATION

The **Network** application offers functionality to administer all IP related configuration for the modules in the unit.

7.1 DNS

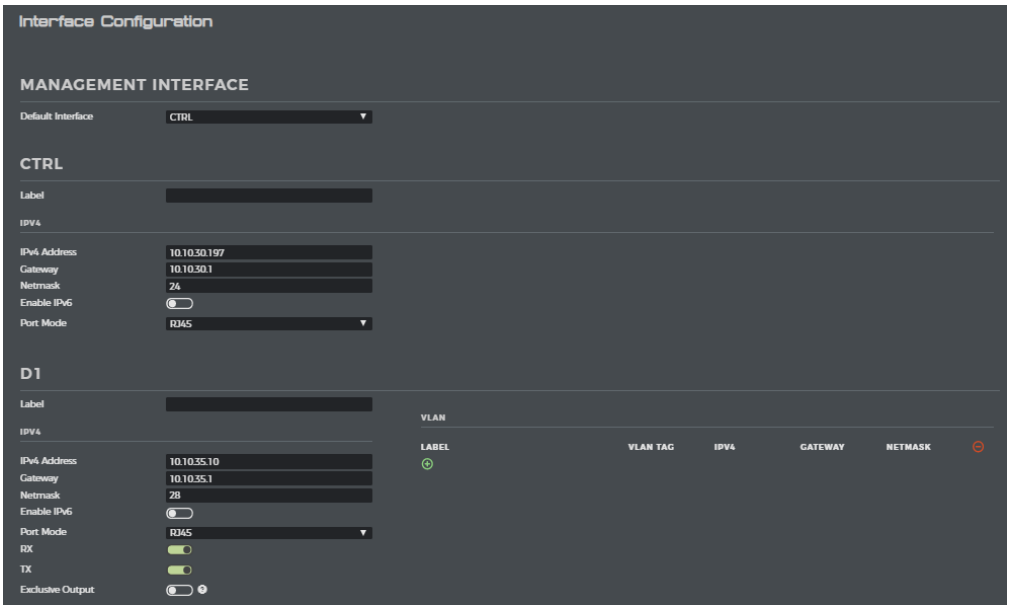
When DNS is enabled, it is possible to define up to 2 DNS servers.

7.2 Network Interface Configuration

The IP interfaces section lists all modules in the unit which have IP interfaces. The modules can be selected in the left navigation panel.

7.2.1 MMI/IP Module Configuration

The following section relates to the network configuration of the MMI and IP modules.



7.2.1.1 Management/Control Port

The below settings apply only to MMI/Switch modules with Control interfaces

Parameter	Description
Management Interface	Configure the required management interface. This option can be used for in-band management. The options here are: • CTRL : Control port • D1 - D4 : Dataport 1 - 4
Label	Assign a label for the port. This label will then be displayed in other views were the port is referenced.
IPV4 Address	The IP address of the magament port. ⚠ For the IPV4 the address block 169.254.0.0/16 is reserved
Gateway	Gateway address of the interface

Parameter	Description
Netmask	Netmask of the interface in CIDIR subnet mask notation Ie /24 = 255.255.255.0
Enable IPv6	Enable IPv6 address on the management port. Once enabled the IPv6 Address, Gateway and Prefix-Length will need to be defined
Port Mode	Port mode fixed to RJ45 for Control port.

7.2.1.2 IP Dataports

For each port the following parameters are configurable:

Parameter	Description
Label	Assign a label for the port. This label will then be displayed in other views were the port is referenced.
IPV4 Address	The IP address of the port. ⚠ For the IPV4 the address block 169.254.0.0/16 is reserved
Gateway	Gateway address of the interface
Netmask	Netmask of the interface in CIDIR subnet mask notation Ie /24 = 255.255.255.0
Enable IPv6	Enable IPv6 address on the management port. Once enabled the IPv6 Address, Gateway and Prefix-Length will need to be defined
Port Mode	Select the physical format. RJ45 , SFP(1Gbps) or SFP+ (10Gbps).
RX	Enable this if the port will be used to as an input port. Only ports that are RX enabled will be a selectable port on the input configuration application.
TX	Enable this if the port will be used as an output port. Only ports that are TX enabled will be a selectable port on the output configuration application.
Exclusive Output	Disabled output from the second interface (D2/D4) if the first interface (D1/D3) has an active link. If link on the first interface is lost, enable output on second interface.

7.2.2 Scrambler Interface Configuration

The **Interface Configuration** application can be found under the 'Configuration' 'Network' section on the dashboard and configures Scrambling Control Group (SCS1 and SCS2).

Parameter	Description
Label	Assign a label for the Scrambling Control Group.
IPV4 Address	The IP address of the magament port. ⚠ For the IPV4 the address block 169.254.0.0/16 is reserved
Gateway	Gateway address of the interface
Netmask	Netmask of the interface in CIDR subnet mask notation Ie /24 = 255.255.255.0
Port Mode	Hardware dependent. If the physical connectors are electrical, this field should always be set to **RJ45**. If the physical connectors are optical, select **SFP** or **SFP+** mode, depending on the physical setup.
Enabled	Disabling will hide the 'No Link' alarm, but does not actually disable the port.

7.2.3 Descrambler Interface Configuration

The **Interface Configuration** application can be found under the 'Configuration' 'Network' section on the dashboard and configures Scrambling Control Group (SCS1 and SCS2).

Parameter	Description
Label	Assign a label for the Scrambling Control Group.
IPV4 Address	The IP address of the magament port. ⚠ For the IPV4 the address block 169.254.0.0/16 is reserved
Gateway	Gateway address of the interface
Netmask	Netmask of the interface in CIDR subnet mask notation Ie /24 = 255.255.255.0
Port Mode	Hardware dependent. If the physical connectors are electrical, this field should always be set to **RJ45**. If the physical connectors are optical, select **SFP** or **SFP+** mode, depending on the physical setup.

7.2.4 IP Encoder Module Configuration

The following section relates to the network configuration of the IP Encoder modules.

For each port the following parameters are configurable:

Parameter	Description
IP link	Choose between 10 Gbps, 40 Gbps, 4x10 Gbps
Label	Assign a label for the port. This label will then be displayed in other views were the port is referenced.
IPV4 Address	The IP address of the port. ⚠ For the IPV4 the address block 169.254.0.0/16 is reserved
Gateway	Gateway address of the interface
Netmask	Netmask of the interface in CIDIR subnet mask notation Ie /24 = 255.255.255.0
Enabled	Enable/Disable the port
RX Rate (Status)	Total input bitrate on the port
Link Speed (Status)	Detected Link Speed of the connection

8 PHYSICAL CONFIGURATION

For all non IP modules, there will be a separate interface setup application specific to the module. These application is found in the **Configuration** section on the desktop.

8.1 S2X Interfaces

The **S2X Interfaces** application can be found under the 'Configuration' section on the dashboard and configures the number of demodulators per module and LNB frequencies for each port.

8.1.1 Input Port Configuration

Each physical input port allows you to set the following fields:

Parameter	Description
Label	Text label to identify the port
LNB Frequency	Frequency of the LNB connected to the physical port
LNB DC	LNB DC signaling
LNB 22kHz Tone	LNB tone signaling

8.1.2 Demodulator Configuration

Each module can be configured with a total number of demodulators and this effects the possible symbol rates that are available to each demodulator. This corresponds to the following:

Number of Demodulators	Maximum baud rates
<= 8 demodulators	• 256-APSK, 32MBaud • 128-APSK, 36.5MBaud • 64-APSK, 42.5MBaud • 32-APSK, 51.5MBaud • QPSK-16APSK, 64MBaud

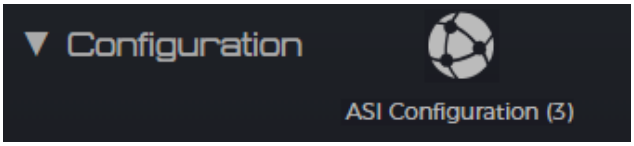
Number of Demodulators	Maximum baud rates
16 demodulators	• 256-APSK, 22MBaud, • 128-APSK, 25.5MBaud • 64-APSK, 29.9MBaud • 32-APSK, 35.9MBaud • 16APSK, 44.9MBaud • 8PSK, 59.9MBaud • QPSK, 64MBaud
32 demodulators	• 256-APSK, 11MBaud • 128-APSK, 12.8MBaud • 64-APSK, max 14.9MBaud • 32-APSK, 17.9MBaud • 16APSK, 22.4MBaud • 8PSK, 29.9MBaud • QPSK, 44.9MBaud

Once applied, the number of demodulators are made available in the Input Application.

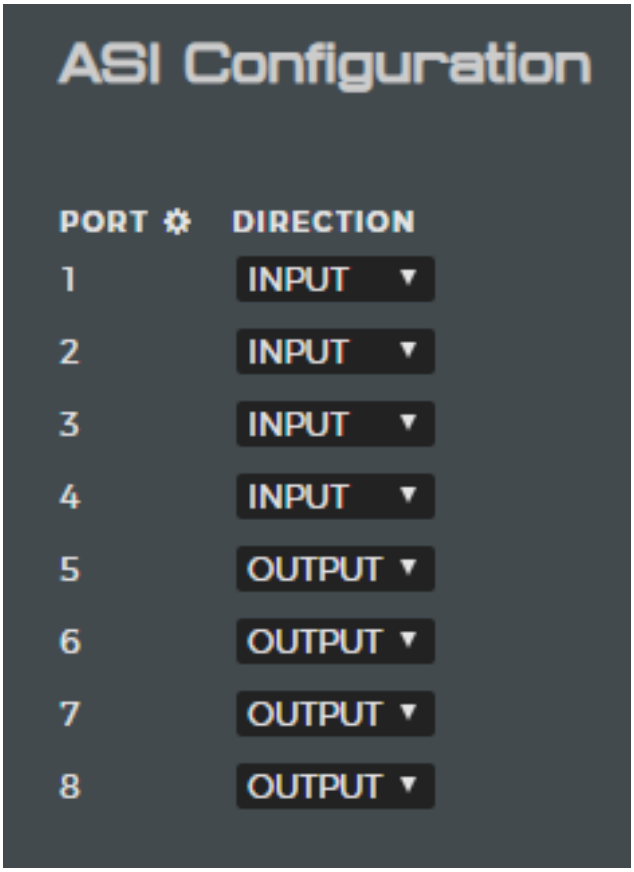
Please note, if the number of demodulators is reduced while configured then this will result in configured services being removed.

8.2 ASI

The ASI Configuration Application is located as part of the Configuration section on the main desktop view.

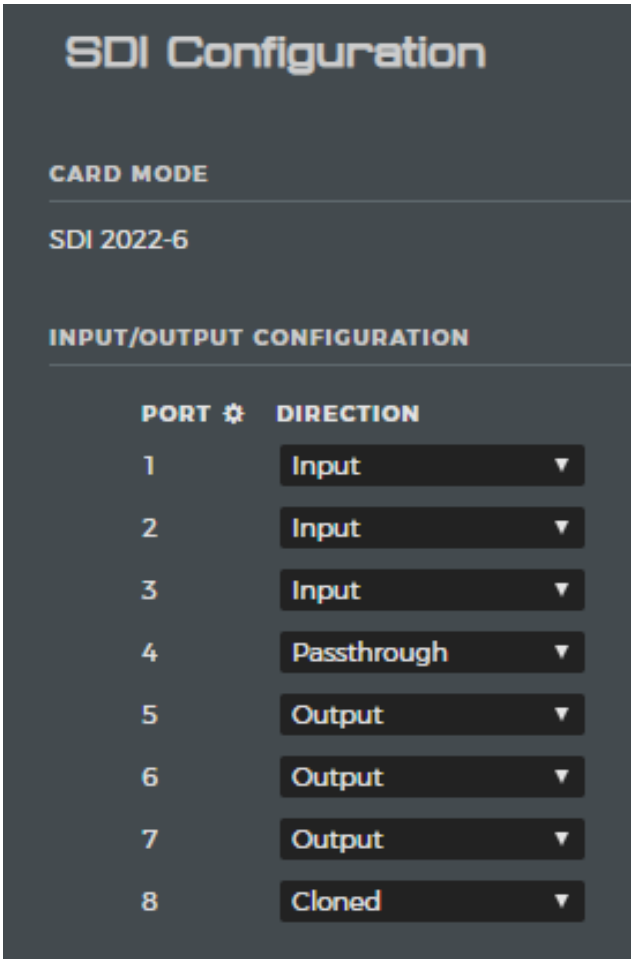


The ASI Configuration Application must be used to configure the flow direction of the ports. Any port listed as input will be available in the ASI Input application, and similarly the once set to output will be available in the ASI Output application.



8.3 SDI

The SDI Configuration application determines the SDI direction of the ports of the module.



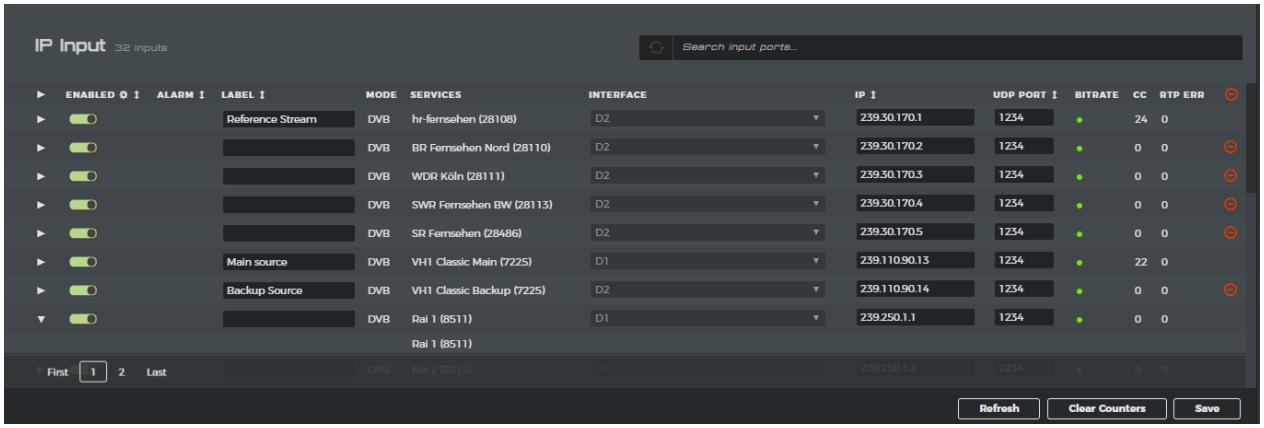
The alternative modes are

Mode	Description
Input	The plug is an input type
Passthrough	This option is valid for even numbered ports where the previous port (n-1) is an input port. Pass-through mode outputs the content of port n-1.
Output	The plug is an output type.
Cloned	This option is valid for even numbered ports where the previous port (n-1) is an output port. Cloned mode outputs the content of port n-1.

Once configured as required, click the 'Save' button to apply.

9 IP INPUT

The 'IP input' application is responsible for the configuration and status overview for IP input sources. For each MMI/IP module in the unit, there will be a separate application marked with the specific slot number. The applications covers DVB, MPEG, RTP (2022-6/2110) input types.



When opening the application, it will list currently active inputs (if configured).

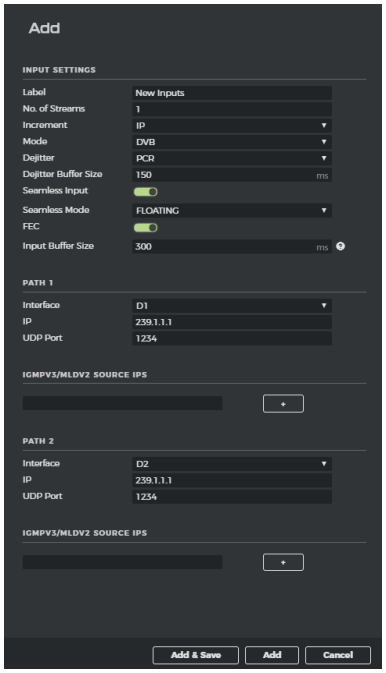
Parameter	Description
Enabled	The enable checkbox lets the operator easily disable an input. In a multicast environment the IGMP message will not be sent such that data is not forwarded from the switch.
Alarm	Indicator if there is an alarm present on the input.
Label	The label can be added during input definition, and changed directly from the list view.
Mode	Indicates what type of content the system expects. RTP / DVB/ MPEG
Services	The services detected in the streams. Valid for DVB and MPEG sources only.
Interface	The actual interface where the stream is being received.
UDP port	The port of the incoming stream.
Bitrate	Green of any bitrate is detected on the stream.
CC errors	The number of times the CC counter has not been continuous.
RTP errors	The number of times the RTP counter has not been continuous.
Red Circle	Action button to remove streams. Once streams are removed (red line) the 'Save' button need to be clicked for the action to be committed.

In order to see individual services in an input, the arrow on the left can be used to expand the view.

9.1 Input Configuration

9.1.1 Adding a new source

To add new sources then left-hand pane can be expanded by hitting the arrow on the left-hand side of the page



Input Settings

Parameter	Description
Label	Assign a label for the port. This label will then be displayed in other views were the port is referenced.
No of Streams	The input application supports adding multiple sources simultaneously. The maximum number of inputs: 2000
Increment	**IP, Port or Port Groups** When adding multiple sources in a single operation this setting defines which parameter to automatically increment. **IP** The IP address will be increased **Port** The UDP port will be increased **Port Groups** The UDP port will be increment in groups defined by the Step Size, Group Size and Group GAP.

Parameter	Description
Mode	This tells the system what type of input is expected, hence what kind of analysis may be performed on the incoming stream. Additionally, it will affect the type of mapping that is supported by the system. The IP source address will be re-generated by the DMG 4x00 unit. **DVB** Analyse PAT/PMT/SDT of the service **MPEG** Analyse PAT/PMT of the service **ATSC** Analyse PAT/PMT/MGT of the service **RTP** No analysis is performed. RTP inputs which are mapped out of the IP chain will preserve the IP headers from the input.
De-jitter	The de-jitter setting configures the de-jitter configurations depending on the type of input data. ***DVB/MPEG/ATSC inputs*** **OFF** No de-jittering applied. **CBR** If the input rate is known, setting this parameter will cause the input chain be quicker to get the rate-control accurate. **PCR** If not set the unit will use one which is signalled in the PMT. ***RTP inputs*** **OFF** No de-jittering applied. **2022-6** The RTP header is used for de-jittering Note currently the timing model supported is for 2022-6 content only. I.e TS based sources cannot be De-jittered using RTP mode.
De-jitter Buffer (ms)	Both the MPEG/DVB and RTP inputs have a configurable input de-jitter buffer. The valid range is 1 to 1500ms and default value of this buffer is 150ms. This buffer should be set to the jitter that needs to be compensated for, allowing for an additional overhead. In PCR dejitter mode the time should be set to at least twice the (PCR interval+network jitter).

Parameter	Description
Seamless Input	When enabled the system is prepared to receive the same content via two interfaces. The seamless input is linked to ports pairs. Both the 10G and 1G ports may be used with this mode. ***Seamless mode:*** **Floating** The seamless logic will change the source only when the currently selected source is faulty. **Path 1** The seamless logic will use input path1, if this source is not faulty **Path 2** The seamless logic will use input path2, if this source is not faulty
FEC	Enable FEC processing on the input
Input buffer size	Buffer size in milliseconds. Only valid in Seamless/FEC mode. The valid range is 1-400ms for Seamless and 300-400ms for FEC inputs. This buffer is in before the dejitter buffer in the input chain.

Path Settings

Parameter	Description
Interface	Select the input interface. This lists included the interfaces and VLANs which are tagged as RX enable in the interface configuration page.
IP / Port	The IP address and port of the incoming stream. This could be a multicast, or a unicast. In the case of unicast, then use the IP address of the selected interface.
IGMPV3 Source IP	In networks where PIM is not used, use this field to enter the source IP address.

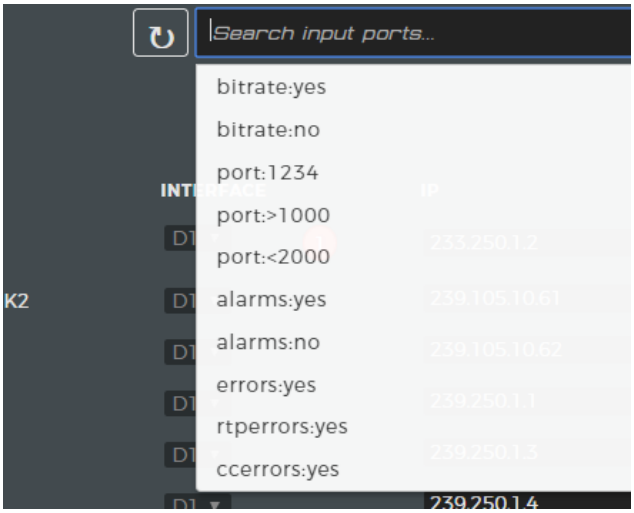
Once the parameters have been entered, you can click either 'Add & Save' to add the sources and commit these to the configuration, 'Save' to add the sources, but not commit them, ie enabling you to edit further parameters before saving, or 'Cancel' to close the dialog box.

Once streams are committed, the streams will be subscribed and status will shown.

9.1.2 Searching for streams

For an ever increasing number of flows through a unit, searching for information gets critical. In the DMG 4x00 applications this has been put into the system from the very start. On top of the input application pane there is a search field which enables the operator to search and filter the list view in order to find the correct sources.

It is possible to search for text or dynamic attributes. Typical valid searches would be to look for a specific input multicast, or look for all inputs with an alarm. The below picture shows some pre-defined searches that are possible to do.



The result is a list view with a filtered amount of flows. Note that the search is a fuzzy search. So the result will not necessarily return only a 100% match, but will return the most relevant on top.

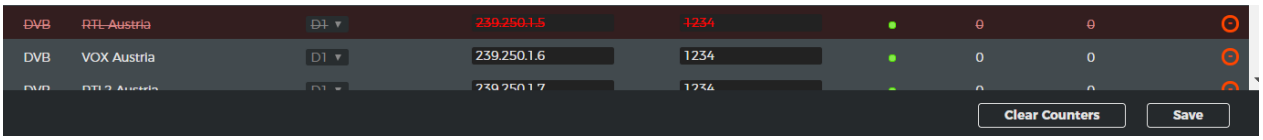
9.1.3 Changing existing input(s)

Once a source has been added it may be changed by selecting the stream to change from the list view. Multiple inputs may be selected simultaneously for multi-edit operations Once a stream or multiple streams are selected the edit dialog will be visible on the right hand pane. The parameters are a subset of the parameters described above.

Once a stream has been linked to an interface/VLAN, eg D1, it is not possible to change and if required a new stream will need to be created on the new interface.

9.1.4 Removing existing input(s)

To remove an input, click on the red circle to the right in the list view. The selected stream will be stroked out with a red line. Then hit 'Save' at the bottom of the page.



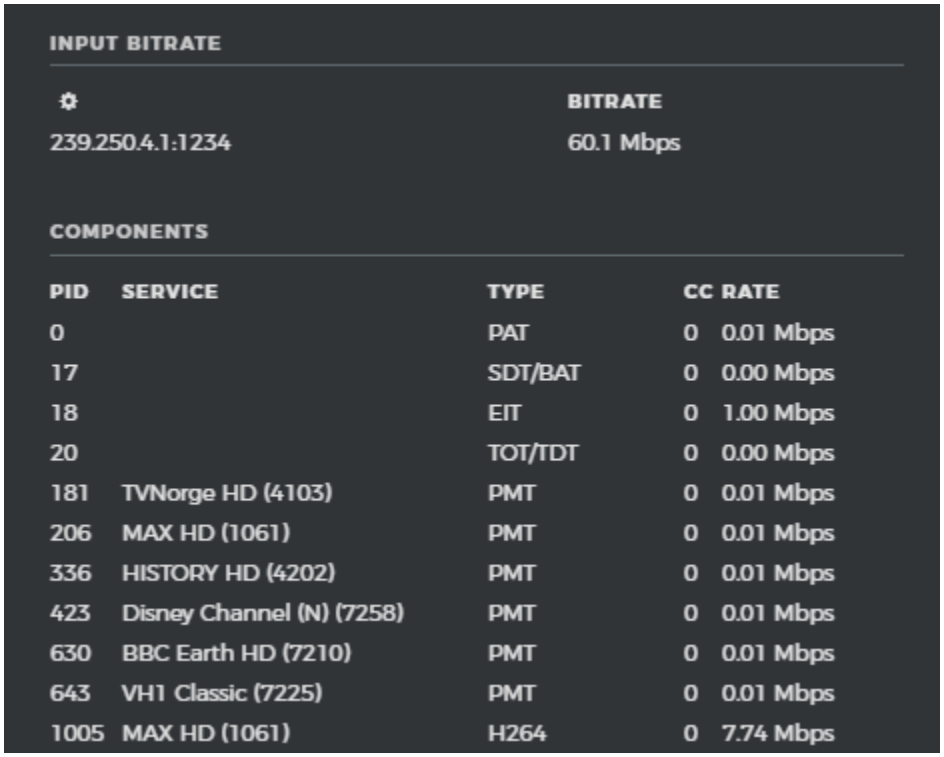
9.2 Input Analysis and Status

9.2.1 Bitrate, CC and RTP indicators

The IP-input application provides some basic input analysis of the configured inputs. The list view indicates if the input contains any bitrate, CC errors or RTP errors. If bitrate is present then the bitrate indicator is green, if not red. Additionally if any alarms are present they will be displayed on the input view directly. Pointing to the Alarm indicator will present more details.

To clear the CC and RTP counters us the 'Clear counters' button at the bottom of the page.

9.2.2 Detailed Status (Bitrate and PSI)



INPUT BITRATE

	BITRATE
239.250.4.1:1234	60.1 Mbps

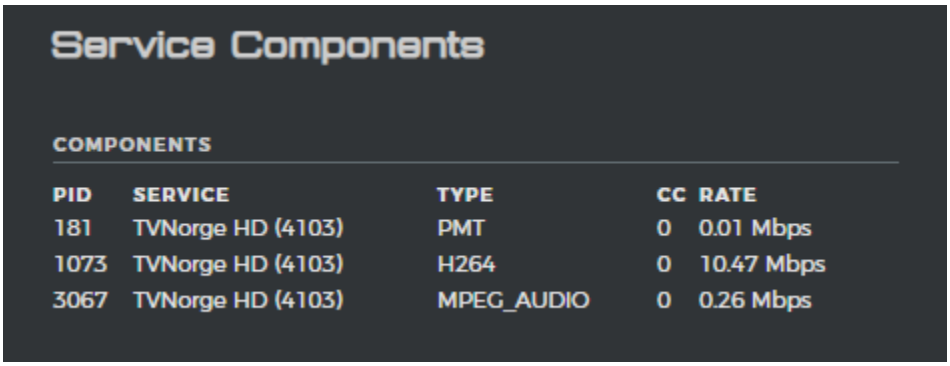
COMPONENTS

PID	SERVICE	TYPE	CC	RATE
0		PAT	0	0.01 Mbps
17		SDT/BAT	0	0.00 Mbps
18		EIT	0	1.00 Mbps
20		TOT/TDT	0	0.00 Mbps
181	TVNorge HD (4103)	PMT	0	0.01 Mbps
206	MAX HD (1061)	PMT	0	0.01 Mbps
336	HISTORY HD (4202)	PMT	0	0.01 Mbps
423	Disney Channel (N) (7258)	PMT	0	0.01 Mbps
630	BBC Earth HD (7210)	PMT	0	0.01 Mbps
643	VH1 Classic (7225)	PMT	0	0.01 Mbps
1005	MAX HD (1061)	H264	0	7.74 Mbps

When clicking on a top level stream, the right hand side shows the stream details. For MPEG/DVB/ATSC sources the total bitrate for the input is shown. The PID view lists the components signalled in the PMT, not the PIDs detected on the input. If signalled PIDs are not present this will also generate a PID missing alarm.

For RTP sources the only status on the bitrate measurement.

When clicking on individual services, the PMT entry and relevant bitrate, CC counters for that service will be shown:



Service Components

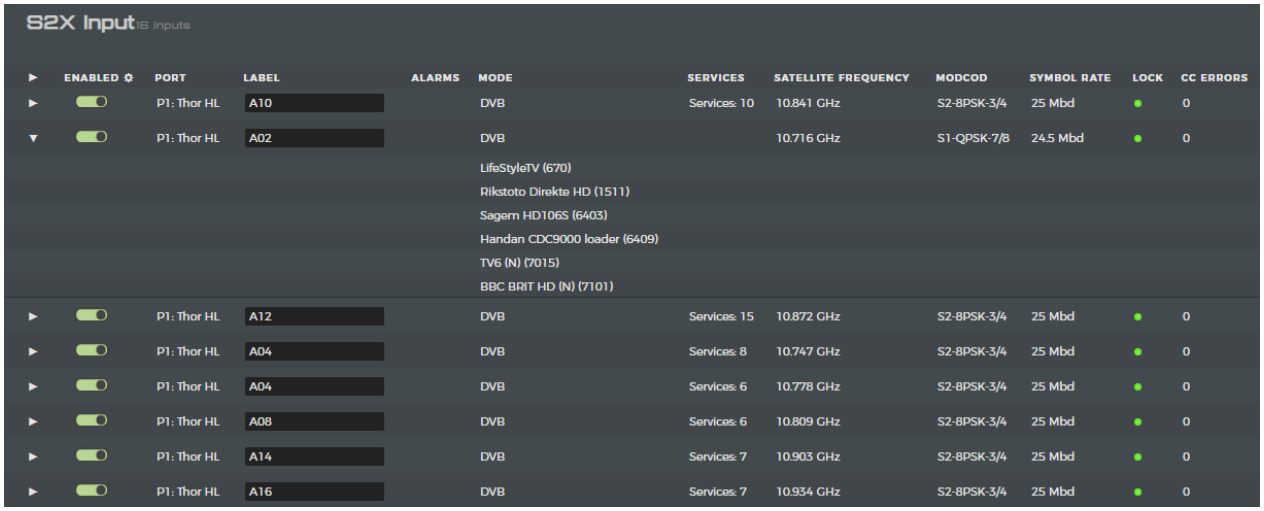
COMPONENTS

PID	SERVICE	TYPE	CC	RATE
181	TVNorge HD (4103)	PMT	0	0.01 Mbps
1073	TVNorge HD (4103)	H264	0	10.47 Mbps
3067	TVNorge HD (4103)	MPEG_AUDIO	0	0.26 Mbps

10 S2X INPUT

10.1 S2X Input Application

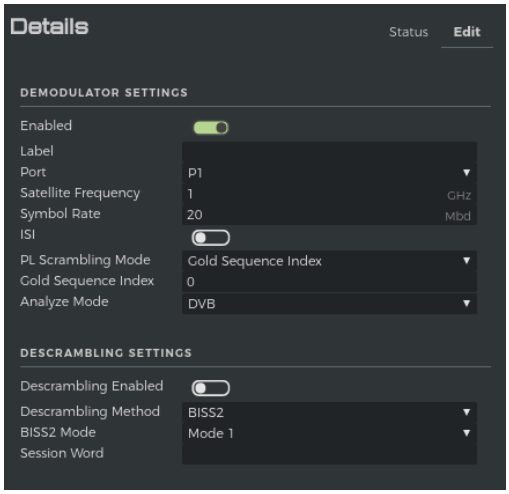
The 'S2X Input' application configures the demodulators on a given module. Each demodulator is represented as a row in the main table view. Each row includes a subset of configuration and status of a demodulator. Expanding a row shows a list of the services in the TS with service name and service ID. The 'S2X Interfaces' application configures the number of demodulators per module and the LNB frequencies per port. When mapping a service from the S2X input card to an output card, the slot, port, satellite frequency and TS label are used as source reference.



Parameter	Description
Enabled	Enable button lets the operator easily disable an input.
Port	Physical port in use. Label of the port is defined in the 'S2X Interfaces' application.
Label	Label of the transport stream (TS)
Alarms	Displays if there are any alarms present on the input transponder
Mode	Configured Analyze Mode (MPEG or DVB)
Services	Number of services detected in the transport stream
Satellite Frequency	Configured satellite frequency
Modcod	Status of detected modulation standard, constellation scheme and FEC rate
Symbol rate	Configured symbol rate
Lock	Green circle if the demodulator has achieved lock
CC errors	Number of times the CC counter of any PID in the TS has not been continuous

10.2 Demodulator Configuration

Select a demodulator to display the 'Details' on the right hand pane. Select the 'Edit' tab to change configuration.



10.2.1 Demodulator Settings

Parameter	Description
Enabled	Enable or disable the demodulator.
Label	Assign a label for the transport stream. Other views will display this label when referencing this TS.
Port	Each demodulator can select a transponder from 2 physical input ports. The first half of the demodulators can select P1 or P2, while the second half can select P3 or P4.
Satellite Frequency	Set the transponder frequency. The sum of LNB frequency and satellite frequency is used to derive the actual L-band frequency on the input connector.
Symbol Rate	Configure the symbol rate.
PL Scrambling Mode	Select a mode to define the PL Scrambling. **Preferred scrambling sequence:** Select from a set of preferred Gold sequence index defined in ETSI EN 302 307-2. **Gold Sequence Index:** Enter Gold sequence index directly. Default index for broadcasting services is 0. **PL root:** Enter the 18-bit PRBS root.
Analyze Mode	This tells the system what type of input is expected, hence what kind of analysis may be performed on the incoming stream. **DVB:** Analyze PAT/PMT/SDT of the service **MPEG:** Analyze PAT/PMT of the service

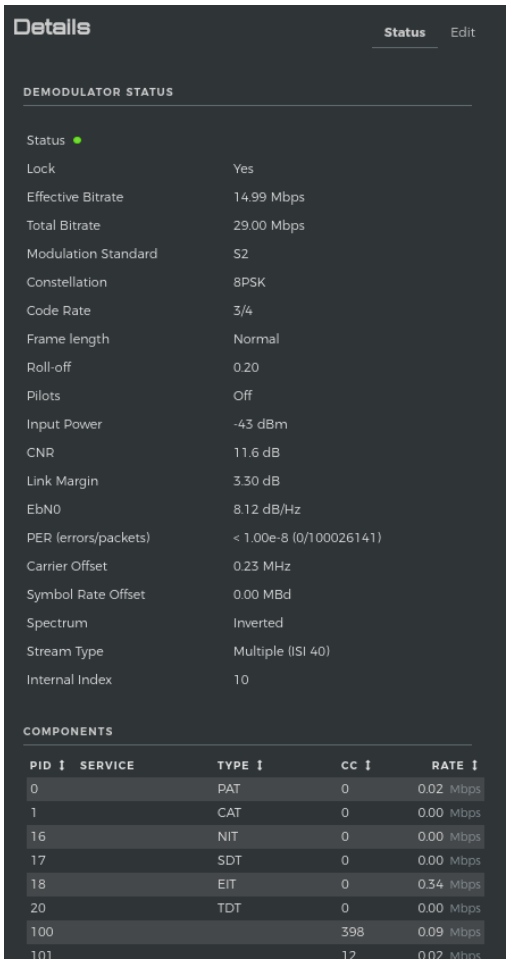
10.2.2 Descrambling Settings

Parameter	Description
Enabled	Select to enable descrambling

Parameter	Description
Descrambling Method	Select descrambling method: Raw Fixed Key, BISS1 or BISS2. **Raw Fixed Key** decrypts the TS content with chosen CA algorithm and given Control Word without any PSI signaling. The control word will be applied to all PIDs in the TS that are scrambled on the input. **BISS1** and **BISS2** are explained in the BISS chapter.

10.3 Status

Select a demodulator to display the 'Details' pane on the right hand side. 'Status' tab shows status of the selected demodulator.



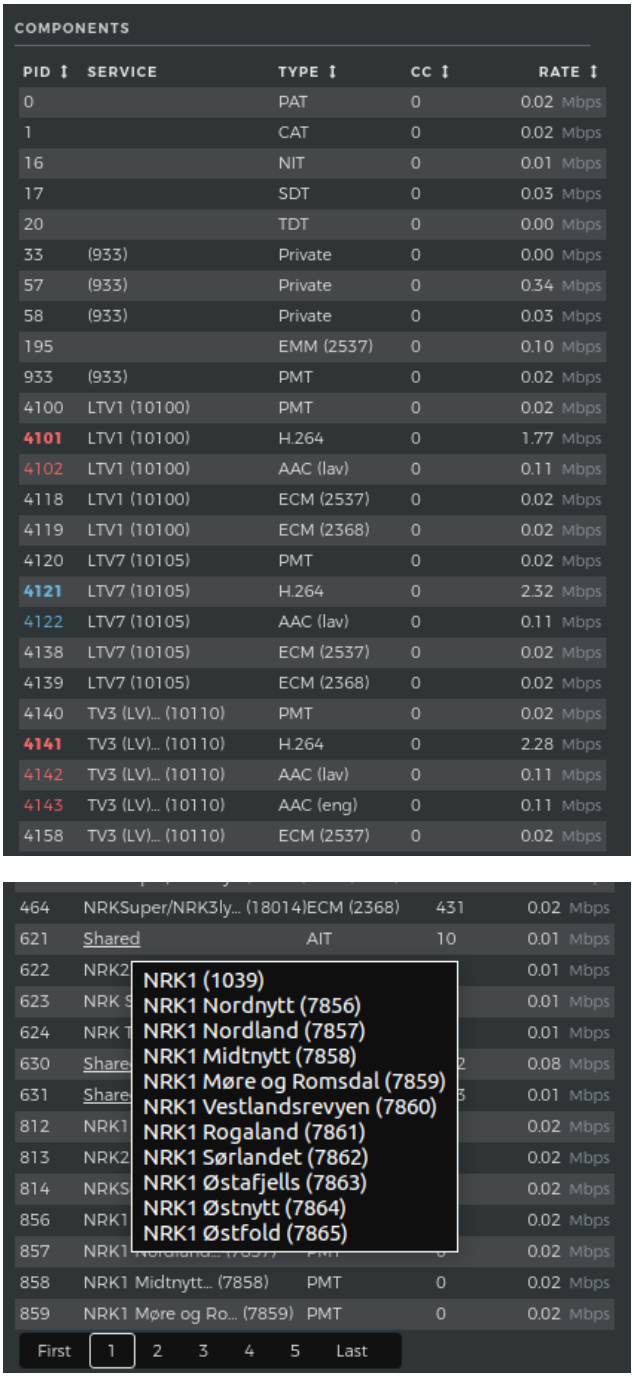
10.3.1 Demodulator Status

Parameter	Description
Lock	Lock state of the demodulator
Effective Bitrate	Accumulated bitrate of all PIDs in the TS that are not the NULL PID
Total Bitrate	Total bitrate of all PIDs including NULL PIDs
Modulation Standard	Detected modulation standard can be S, S2 or S2x
Constellation	Detected symbol constellation, signaled in the PLHEADER for S2/S2x

Parameter	Description
Code Rate	Detected FEC code rate, signaled in the PLHEADER for S2/S2x
Frame length	Size of the FEC frame (not applicable for S1)
Roll-off	Detected roll-off of the SRRC filter, signaled in the BBHEADER for S2/S2x
Pilots	Detected pilot configuration, signaled in the PLHEADER for S2/S2x
Input power	Power level of the transponder
CNR	Carrier to noise ratio
Link Margin	Margin in between required and measured carrier to noise ratio
EbN0	Information bit energy to noise ratio
PER/BER	**DVB-S**: Bit error rate during the last X bits **DVB-S2(x)**: TS Packet error rate during the last X TS packets
Carrier Offset	Offset of the input carrier frequency to the configured frequency
Symbol Rate Offset	Offset of the input symbol rate to the configured symbol rate
Spectrum	Inverted or normal
Stream Type	**Single**: Single Input Stream **Multiple**: Multiple Input Stream
Internal Index	Used for debugging

10.3.2 Components

The lower section of the 'Status' pane shows detailed MPEG TS status.
The PID view lists all PIDs both referenced and unreferenced with following descriptions:
- PCR PIDs are highlighted in bold
- encrypted PIDs are listed in toggling colors Red/Blue representing Odd/Even cryptoperiod; hovering mouse shows details
- 'Type' shows number in parenthesis following ECM/EMM is the associated CAS ID
- three letters in parenthesis are language descriptor
- CC counter for each PID
- 'Shared' in the column 'Service' indicates a PID shared between multiple services; hovering mouse shows the list of the services sharing the same PID
- if a signaled PID is missing, 'Rate' value is replaced with 'Missing'

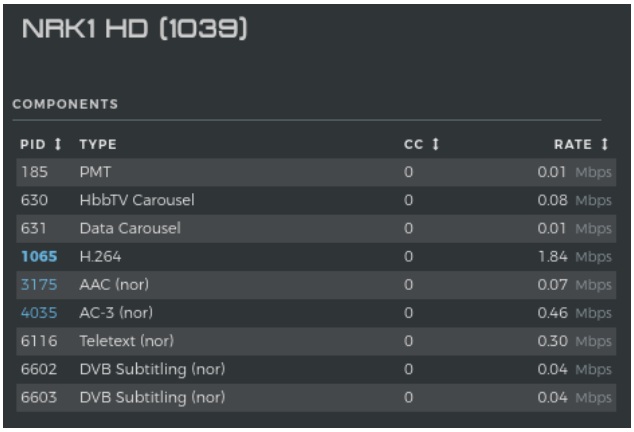


COMPONENTS

PID	SERVICE	TYPE	CC	RATE
0		PAT	0	0.02 Mbps
1		CAT	0	0.02 Mbps
16		NIT	0	0.01 Mbps
17		SDT	0	0.03 Mbps
20		TDT	0	0.00 Mbps
33	(933)	Private	0	0.00 Mbps
57	(933)	Private	0	0.34 Mbps
58	(933)	Private	0	0.03 Mbps
195		EMM (2537)	0	0.10 Mbps
933	(933)	PMT	0	0.02 Mbps
4100	LTV1 (10100)	PMT	0	0.02 Mbps
4101	LTV1 (10100)	H.264	0	1.77 Mbps
4102	LTV1 (10100)	AAC (lav)	0	0.11 Mbps
4118	LTV1 (10100)	ECM (2537)	0	0.02 Mbps
4119	LTV1 (10100)	ECM (2368)	0	0.02 Mbps
4120	LTV7 (10105)	PMT	0	0.02 Mbps
4121	LTV7 (10105)	H.264	0	2.32 Mbps
4122	LTV7 (10105)	AAC (lav)	0	0.11 Mbps
4138	LTV7 (10105)	ECM (2537)	0	0.02 Mbps
4139	LTV7 (10105)	ECM (2368)	0	0.02 Mbps
4140	TV3 (LV)... (10110)	PMT	0	0.02 Mbps
4141	TV3 (LV)... (10110)	H.264	0	2.28 Mbps
4142	TV3 (LV)... (10110)	AAC (lav)	0	0.11 Mbps
4143	TV3 (LV)... (10110)	AAC (eng)	0	0.11 Mbps
4158	TV3 (LV)... (10110)	ECM (2537)	0	0.02 Mbps

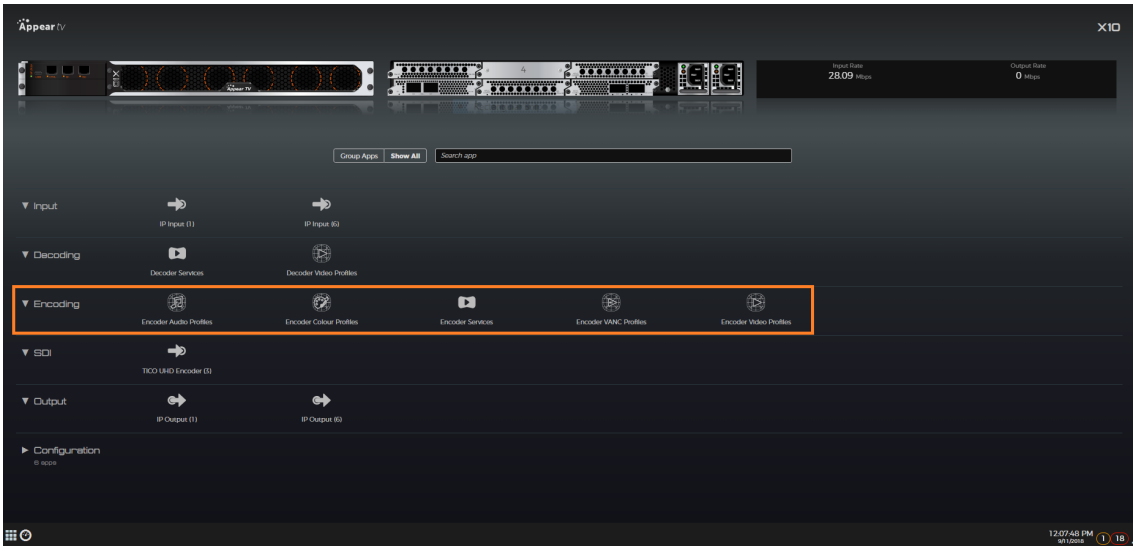
10.3.3 Service Components

Expending a demodulator displays a list of services which can be selected individually. The right hand pane will display a list of the components signaled in the selected service.


NRK1 HD (1039)
COMPONENTS
PID
TYPE
CC
RATE
185 PMT 0 0.01 Mbps
630 HbbTV Carousel 0 0.08 Mbps
631 Data Carousel 0 0.01 Mbps
1065 H.264 0 1.84 Mbps
3175 AAC (nor) 0 0.07 Mbps
4035 AC-3 (nor) 0 0.46 Mbps
6116 Teletext (nor) 0 0.30 Mbps
6602 DVB Subtitling (nor) 0 0.04 Mbps
6603 DVB Subtitling (nor) 0 0.04 Mbps

11 ENCODERS

Encoders are configurated using the Encoding applications in the dashboard. When an encoder has been configured and enabled it will deliver a service to the backplane. This service can be picked up and sent out through an output module.



11.1 Configuration Flow

Much of the Configuration of an Encoder is done through reusable Profiles. This way the same encoder configuration can be applied to multiple services. If a Profile is altered, the change is automatically applied to all the services using the Profile.

Profiles define parameters that are likely to be identical for many services. In contrast, ***service specific*** parameters are not configured through Profiles but rather on an individual service level. Examples of service specific parameters are which physical SDI input connector is used, service ID, language codes etc.

The starting point of building a service is to first define the necessary profiles, alternatively reuse existing Profiles. Typically and as a minimum, a video profile and an audio profile are required to build a service.

For IP based Encoders (ECx210) the network interfaces must also be defined before configuration. This can be performed on the 'Configuration→Network' application.

Typical Service Configuration Sequence:

1. Define one or more Video Profiles
2. Define one or more Audio Profiles
3. Define one or more Colour Profiles
4. Define one or more VANC profiles
5. Configure Service using specific module and input connector, and the profiles defined above.
6. Repeat Step 5 to configure multiple services

11.2 Profiles

11.2.1 Encoder Video Profile

The Encoder Video Profile defines the **output** characteristics of a video component. Encoder Video Profiles are defined using the Encoder Video Profile App on the dashboard.

11.2.1.1 Encoder Video Profile - General

General	
Label	Name of the Profile.
Latency	Latency mode. Use Normal for highest VQ.

11.2.1.2 Encoder Video Profile - Video

Video	
Follow Input	Enable tracking of the input video parameters (resolution, famerate) and use this for the encoding profile
Frame Rate	Frame rate in frames per second (fps). Note that HD 1080i and SD are 25fps or 29.97fps.
Vertical Resolution	Vertical resolution of encoded video.
Horizontal Resolution	Horizontal resolution of encoded video.
Scanning Mode	Progressive or Interlaced.
Chroma Sampling	Use 4:2:0 for applications transmitting to consumer equipment.
Bit Depth	Use 8-bit for AVC applications transmitting to consumer equipment.

Video	
Aspect Ratio	Configures display aspect ratio of encoded video.
Fallback Aspect Ratio	Configures display aspect ratio of encoded video when input is lost.
WSS Blanking	Enable WSS blanking on the service

11.2.1.3 Encoder Video Profile – HEVC

Codec - HEVC	
Profile	Profile controls stream complexity. Available Profiles is restricted by Chroma Sampling and Bit Depth above.
Level	Auto – Encoder selects appropriate Level based on resolution, bitrate etc.
Tier	Main or High Tier. The choice affects bitrate range allowed.
IDR Frequency	Selects how frequently I frames are upgraded to IDR frames. Value of '0' means no IDR frames. Value of 4 means every 4th I frame is upgraded to IDR frame.
Bitrate	Elementary stream bitrate. Configurable range depends on resolution, tier, latency mode etc.
GOP Mode	In Dynamic mode encoder alters GOP to optimize VQ.
GOP Structure	Selects GOP composition. (Latency mode restricts options.)
Max B Frames	Maximum number of successive B frames.
GOP Size	GOP size. Average distance between I/IDR frames.
Hierarchical GOP	Enables hierarchical GOP. (Also referred to as Reference B frames.)
LDB	Low Delay B frames.

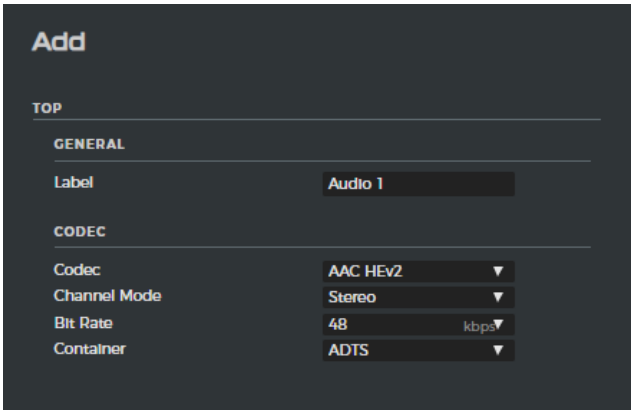
11.2.1.4 Encoder Video Profile – AVC

Codec - AVC	
Profile	Profile controls stream complexity. Available Profiles is restricted by Chroma Sampling and Bit Depth above.
Level	Auto – Encoder selects appropriate Level based on resolution, bitrate etc.
CABAC	Selects entropy coding mode. CABAC off results in CAVLC being used. Less computational complexity for the decoder.
IDR Frequency	Selects how frequently I frames are upgraded to IDR frames. Value of '0' means no IDR frames. Value of 4 means every 4th I frame is upgraded to IDR frame.
Bitrate	Elementary stream bitrate. Configurable range depends on resolution, tier, latency mode etc.
GOP Mode	In Dynamic mode encoder alters GOP to optimize VQ.
GOP Structure	Selects GOP composition. (Latency mode restricts options.)
Max B Frames	Maximum number of successive B frames.
GOP Size	GOP size. Average distance between I/IDR frames.

11.2.2 Audio Profile

The Encoder Audio Profile defines the **output** characteristics of an audio component. Encoder Audio Profiles are defined using the Encoder Audio Profile application on the dashboard. Note that if a service consists of multiple audio tracks, multiple audio profiles may be used for the same service.

Depending on audio codec, different parameters are available for configuration.



11.2.2.1 Encoder Audio Profile – General

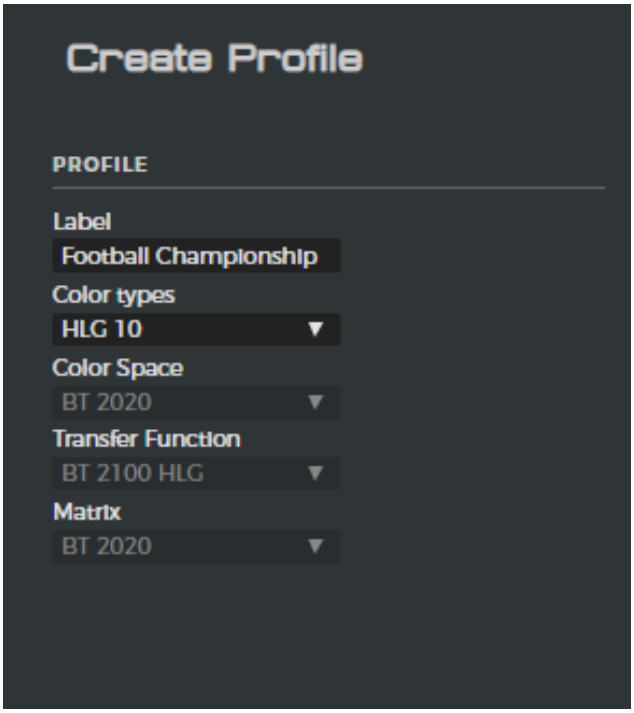
General	
Label	Name of the Profile.
Codec	
Codec	MPEG1, AAC LC, AAC HEv1, AAC HEv2, Dolby Digital, Dolby Digital Plus.
Channel Mode	Stereo (2.0), 5.1 or 7.1 (Available options depending on codec)
Bit Rate	Bitrate (Available range depending on codec.)
Container	ADTS or LATM (for AAC codecs only.)

11.2.2.2 Encoder Audio Profile – Dolby ®™

Codec parameters available for Dolby codecs.

11.2.3 Encoder Colour Profile

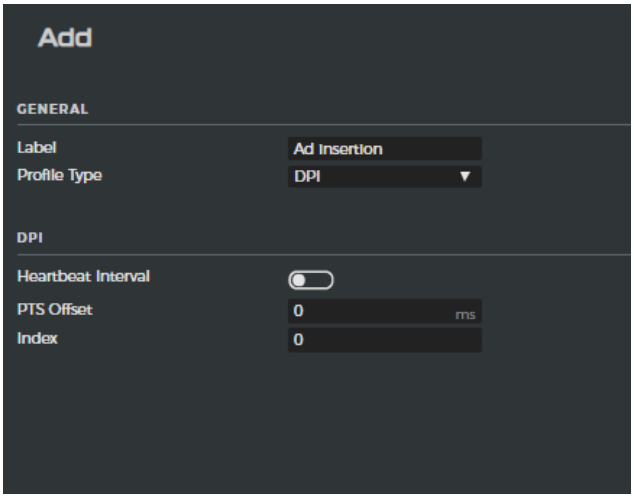
The Encoder Colour Profile defines the **output** colour space, transfer function (SDR/HDR/WCG) characteristics of the video component.



Create Profile	
Label	Name of the Profile.
Colour types	Choose between predefined combinations (commonly used SDR and HDR modes) or Manual. BT709, BT 2020 (WCG)
Transfer Function	BT 2100 HLG (HDR), BT 2100 PQ (HDR), BT 2020 (SDR)
Matrix	BT709, BT 2020 (WCG)

11.2.4 Encoder VANC Profile

The Encoder VANC Profile defines how to process incoming VANC data.



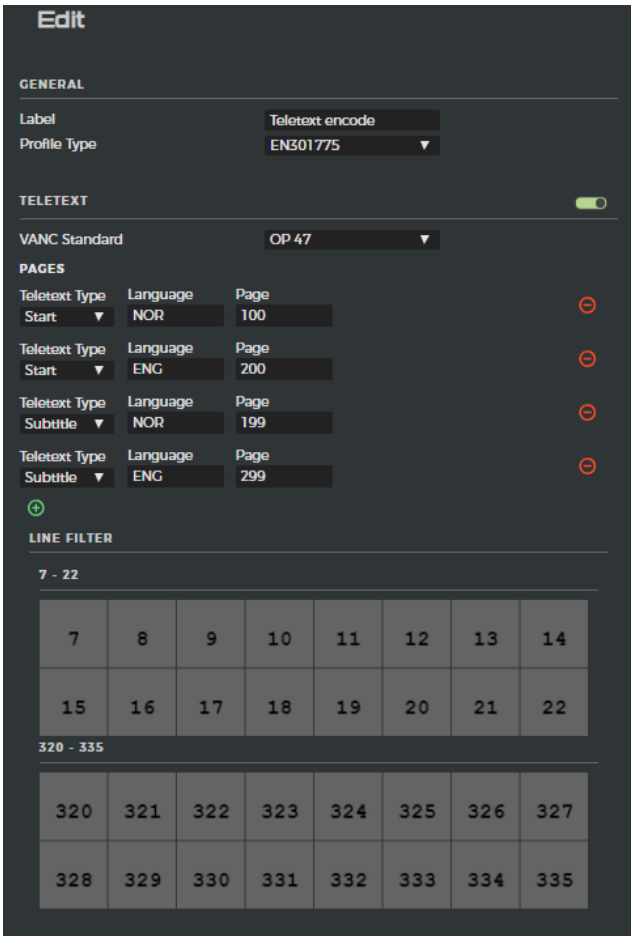
11.2.4.1 Encoder VANC Profile – General

General	
Label	Name of the Profile.
Profile Type	Two types of output data can be generated Digital Programme Insertion (SCTE 104 to SCTE 35 translation), or EN301775 Teletext.

11.2.4.2 Encoder VANC Profile – DPI

DPI	
Heartbeat Interval	Enables/disables heartbeat messages and defines interval between heartbeat messages if enabled.
PTS Offset	Allows a PTS offset to be added to the output data.
Index	Configures a unique source index for the DPI data.

11.2.4.3 Encoder VANC Profile – EN301775 TTX

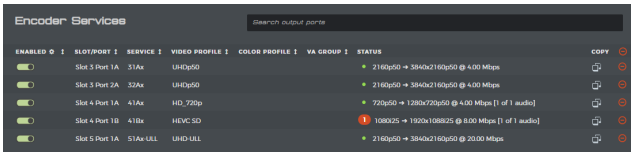


EN301775	
VANC Standard	Configures format of the source VANC data. OP47 or SMPTE2031. All VANC lines containing correctly formatted data will be processed.
Pages	Configures pages for Start, Subtitle, and Hearing Impaired Subtitles together with languages.
Line Filter	Allows captured input data to be filtered allowing unwanted data to be removed.

11.3 Encoder Services

Once audio and video profiles have defined, services can be configured. Service configuration links physical **inputs** (SDI ports) to profiles. Services are defined using the Encoder Service application.

If there is a mismatch between input resolution (e.g. HD) and configured output resolution (e.g. SD) the encoder will try to convert resolution. When resolution conversion is not possible, alarms will be raised.



When opening up the application, you will be presented with a list of active encoded services. If none are present, they can be created on the left hand panel.

To remove active services from the configuration, you can click on the red '-' on the required channel and click 'Save'.

11.3.1 Encoder Configuration

The configuration of the encoder has two modes

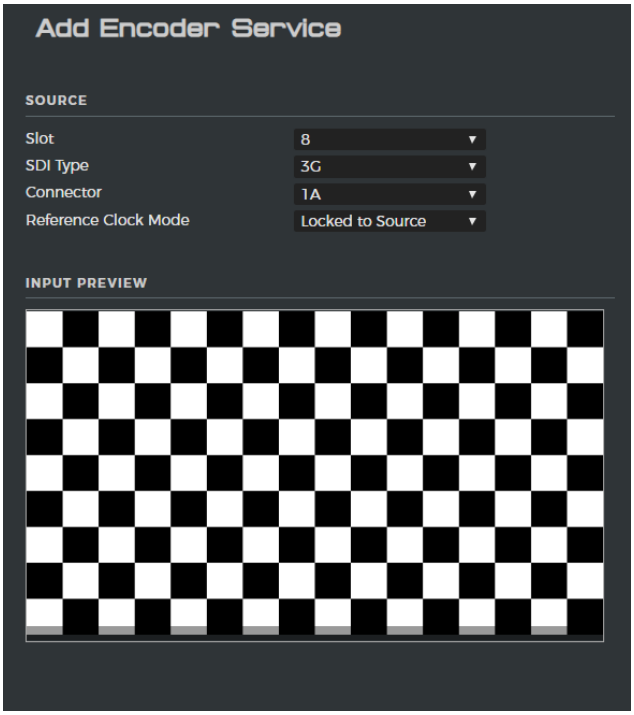
- Initial configuration
- Configuration modification

For initial configuration, you must first define the physical input source and the configuration is performed on the left hand panel.

For already configured serivces, these can be modified by selecting the service and selecting the 'Output' tab on the right hand panel. Once changed are made here, you will need to click the 'Save' button for the settings to be applied.

Both mechanisms have the same parameters and these are described below.

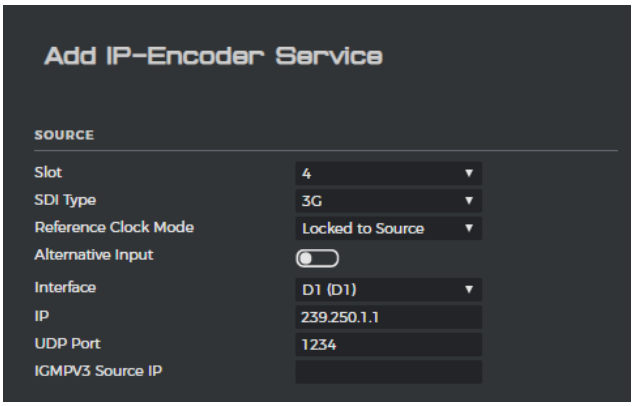
11.3.1.1 Source Configuration (SDI)



Source	
Slot	Selects the physical encoder where the service should run.
SDI Type	Selects the port mode. 12G SDI (used for UHD) or 3G SDI (used for FHD/ HD/SD) or Quad Link used for quad link UHD (2SI or four quadrants).
Connector	Select between available connectors. Only 1A and 2A supports 12G SDI. For Quad Link UHD, connectors 1ABCD or 2ABCD are combined.
Reference Clock Mode	Select between Locked To Source (standard operation) or Video Alignment where all services with the same group ID are aligned in terms of PTS/PCR.
Group ID	Used together with Video Alignment to create multiple aligned groups.
Input Preview	Shows thumbnails of the video present on the input. If no input is available, the thumbnail will show a chequered board.

When the input source of a service has been selected, press 'Create' and continue to next step.

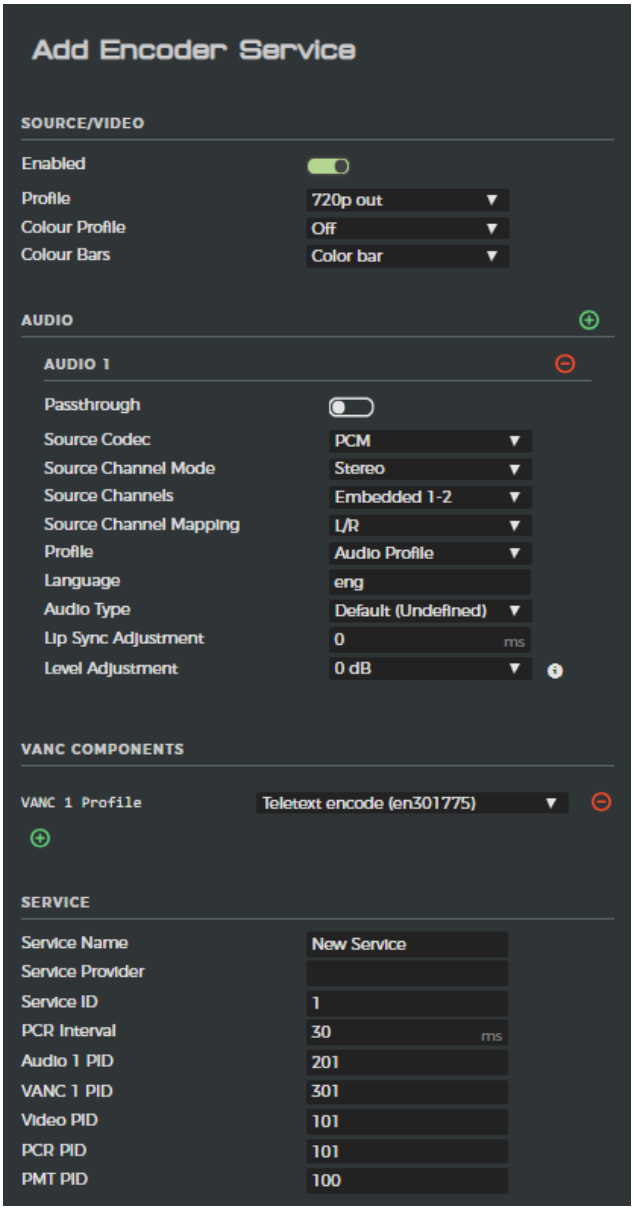
11.3.1.2 Source Configuration (IP)



Source	
Slot	Selects the physical encoder where the service should run.
SDI Type	Selects the port mode. 12G SDI (used for UHD) or 3G SDI (used for FHD/ HD/SD) or Quad Link used for quad link UHD (2SI or four quadrants).
Reference Clock Mode	Select between Locked To Source (standard operation) or Video Alignment where all services with the same group ID are aligned in terms of PTS/PCR.
Alternative Input	When enabled, allows to configure a backup input stream, both Seamless and non-Seamless options.
Interface	IP Interface of the stream
IP	Input multicast/unicast address of source
UDP Port	Input UDP port of source
IGMPv3 Source IP	Source IP (if required)
Seamless SMPTE 2022-7	When using Alternative Input, allows to enable 2022-7 Seamless IP Option
Input Buffer Size	When using Alternative Input, allows to set the input buffer size
Path 1 / Path 2	When using Alternative Input, two sources of the stream can be configured

When the input source of a service has been selected, press 'Create' and continue to next step.

11.3.1.3 Video Configuration



Source/Video	
Enable/Disable	Enables/Disables service.
Profile	Selects which Encoder Video Profile to use.
Colour Profile	Selects which Encoder Colour profile to use.
Colour Bars	Selects what the encoder should produce when no SDI input is present. Select between Colour Bars and Black.

11.3.1.4 Audio Configuration

One of more audio encoding profiles can be added here by clicking on the '+' icon.

Audio Encoding	
Source Codec	PCM (uncompressed), Dolby E. In the case of Dolby E input, source will be transcoded to the codec defined in the Profile used.
Source Channel Mode	Selects channel mode for source data.
Source Channels	Selects data source in embedded audio.
Source Channel Mapping	Defines channel mapping/layout in source.
Profile	Selects which Encoder Audio Profile to use.
Language	Define which language to signal for the audio component.
Audio Type	Select which audio type to signal for the audio component.
Lip Sync Adjust	Allows lip sync adjustment to compensate for offsets in the input.
Level Adjustment	Static level adjustment to the encoded audio.

Audio Passthrough	
Source Codec	Dolby Digital, Dolby Digital Plus, Dolby E
Source Channels	Selects data source in embedded audio.
Language	Define which language to signal for the audio component.
Audio Type	Select which audio type to signal for the audio component.
Lip Sync Adjust	Allows lip sync adjustment to compensate for offsets in the input.

Note that when a passthrough component is generated, no Audio Profile is used since no audio encoding is performed.

11.3.1.5 VANC Component Configuration

VANC Components	Multiple VANC components can be added. Select VANC profiles to configure.

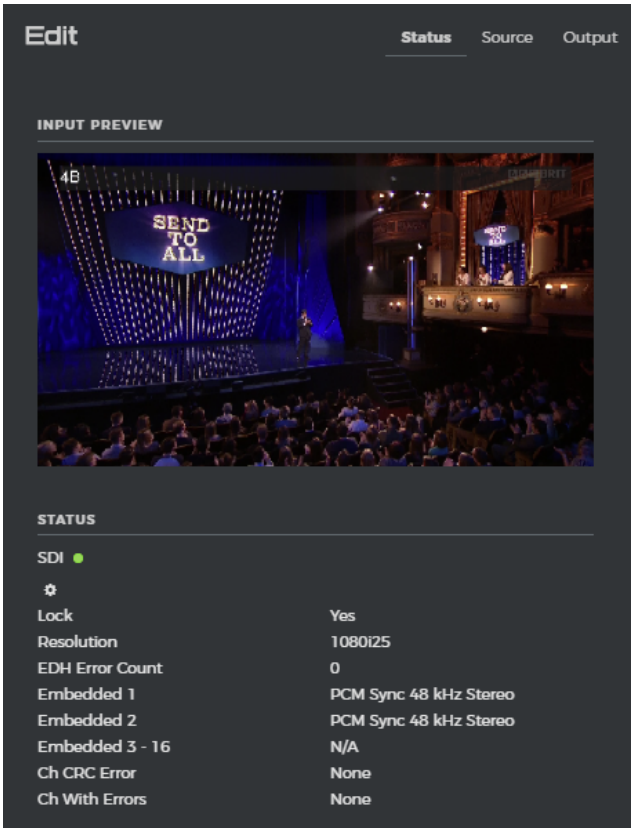
11.3.1.6 Service Parameter Configuration

Service	
Service Name	Configures service name in PSI/SI
Service Provider	Configures Service Provider in PSI/SI.
Service ID	Configures Service ID in PSI/SI
PCR Interval	Configures PCR interval (average)
Audio # PID	Configures PID for each audio component
VANC # PID	Configures PID for each VANC component
Video PID	Configures PID for Video Component
PCR PID	Configures PID for PCR. If configured to be the same as the video PID, this will be embedded.

Service	
PMT PID	Configures PID for PMT for service.

11.3.2 Encoder Status

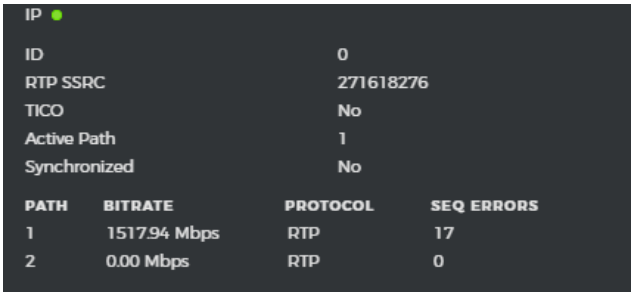
When clicking on an active encode service, the right hand panel will open with the current encoder status, input parameters and service parameters.



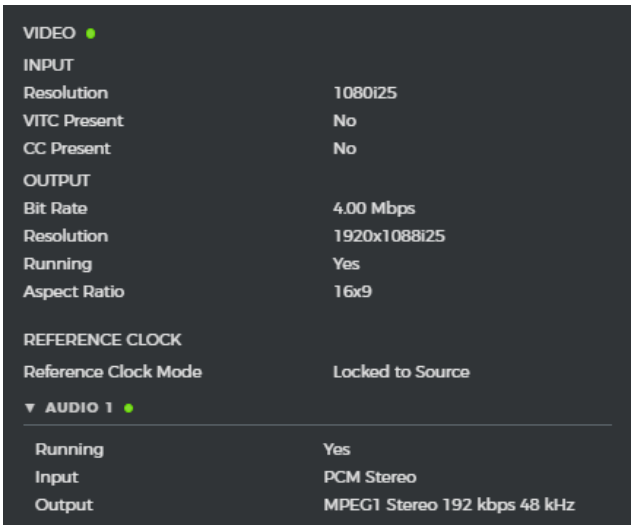
On the 'Status' tab, the following information is displayed

Input Preview	
Preview	Thumbnail image from SDI stream

SDI	
Lock	SDI Lock Status
Resolution	SDI Input resolution
EDH Error Count	Number of input SDI errors
Embedded Channel	Status of detected input audio per channel
Ch CRC Error / Ch With Errors	Number of CRC errors detected and which channel



IP (IP Encoder only)	
ID	
RTP SSRC	RTP Synchronization source
TICO	Flag if TICO input is detected and decoded
Active Path	If Alternative Input active, current active source
Synchronized	In Seamless Input active, current synchronisation status
Path / Bitrate	Current bitrate, protocol and Sequence Errors for active paths



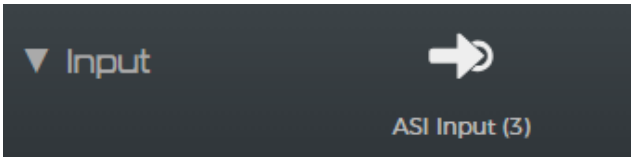
Video	
Input	
Resolution	Resolution of encoded video
VITC Present	Status if VITC is present
CC Present	Status if CC is present
Output	
Bit Rate	Configured output video bitrate
Resolution	Configured output video resolution
Running	Flag if video is being encoded
Aspect Ratio	Configured output aspect ratio
Reference Clock	

Video	
Reference Clock Mode	Displays currently configured clock mode
Audio	
Running	Flag if audio is being encoded
Input	Input audio type
Output	Configured output audio coding mode
VANC Input	
VANC	Status for VANC if configured

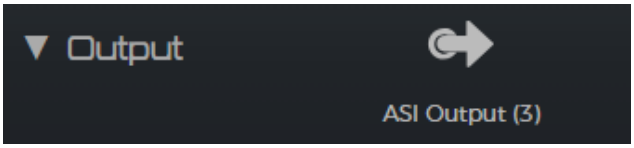
12 ASI

The configuration of the module is split into two main applications. Please note that ports must first be configured in the correct direction before continuing with service configuration

- ASI Input – this is the configuration of the ASI input streams



- ASI output – this is the setup of the ASI output streams.



12.1 ASI Input Configuration

Once a port is defined as Input, the port will be available on the ASI Input Application.

The configuration parameters avaliable are

Parameter	Description
Enabled	The checkbox allows the operator to enable the input port.
Label	The label can be added during definition, and changed directly from the list view.
Type	Analysis mode of the input. Options are DVB or MPEG

Once a port is enabled the system will start to analyze the input PSI accordingly. Clicking on an input port will allow you to show status and service/components available on the input.

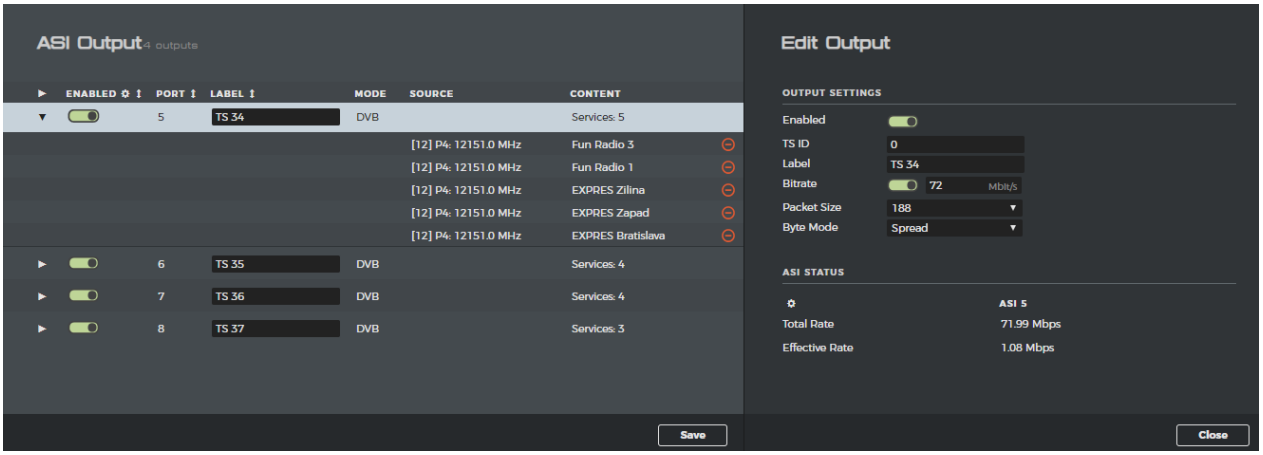
12.2 ASI Output Configuration

The ASI Output configuration application will show all ports that have been configured to be in output mode and allow services to be added from the left hand service panel. On the main panel, the output port can be enabled/disabled as required.

Outputs with services configured can be expanded to show/edit contents of the output port. Services can be removed here by clicking on the red '-' icon and clicking 'Save'.

12.2.1 ASI output port settings

By clicking on an output port, you can open the right hand panel and or each ASI output port the following parameters are available to be configured.



Parameter	Description
Enabled	The enable checkbox lets the operator easily disable an output. If disabled, the stream is still defined in the system, but the output is muted.
Label	The label can be added during definition, and changed directly from the list view.
TS ID	The MPEG transport stream ID which will be signalled in PAT.
Bitrate	If enabled the output transport is set to a fixed CBR rate. In Burst mode the output may be configured all the way up to 213 Mbps, while in Spread byte mode it is limited to 72Mbps.
Packet size	188 or 204
Byte mode	The ASI output supports both Spread byte mode and or Burst byte mode.

12.2.2 ASI output status

The ASI status pane on the output configuration page shows both the Total and Effective transport stream bitrate. The Total bitrates equals the effective bitrate with the additional NULL-packets.

13 SDI

The SDI module is a flexible module that allows both uncompressed and lightly compressed streams to be routed over both IP and SDI (BNC/Optical) interfaces. The SIx100 (BNC) module is fitted with 8 HD-BNC female connectors while the SIx200 (Optical) module has three Optical SDI SFP modules, giving 6 ports. In uncompressed SDI mode, each port can be individually programmed as input or output.

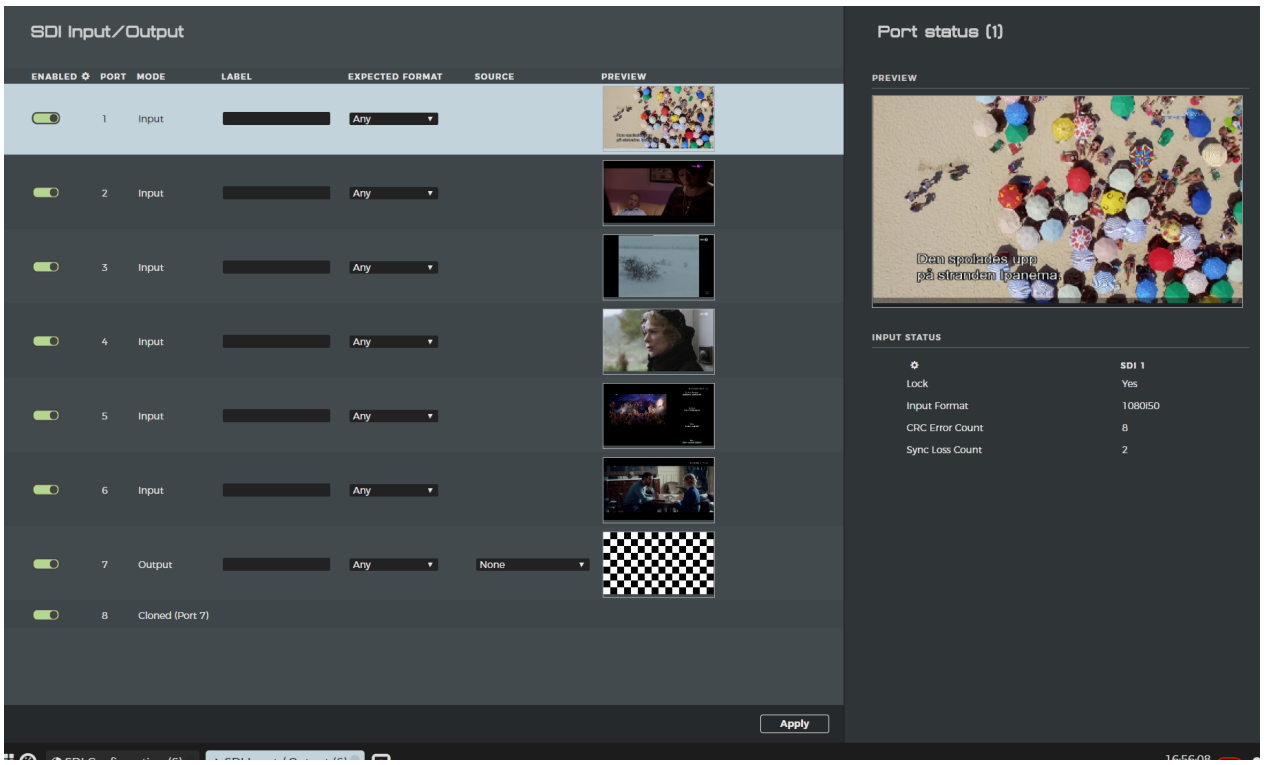
The SDI module also support 2110 Encapsulation (HD) and TICO lightweight compression (UHD/HD). When used with compression then the cards are unidirectional, and the SDI configuration applications will not be required for the initial setup.

The SDI modules currently support the following modes

Hardware	Product
SIx100	SDI (2022-6) Uncompressed
SIx100	SDI (2110) with TICO HD Encoder
SIx100	SDI (2022-6) TICO UHD Encoder
SIx100	SDI (2022-6) TICO UHD Decoder
SIx200	SDI Optical (2022-6) Uncompressed
SIx200	SDI Optical (2110) with TICO HD Encoder
SIx200	SDI Optical (2022-6) with TICO UHD Encoder
SIx200	SDI Optical (2022-6) with TICO UHD Decoder

13.1 SDI - Input / Output Application

In Uncompressed mode, the ports will first have their directions defined and then be available for configuration. Once the input ports are enabled the Thumbnail view will display the detected input and the status on the right hand side of the main list view will present basic input analysis info.

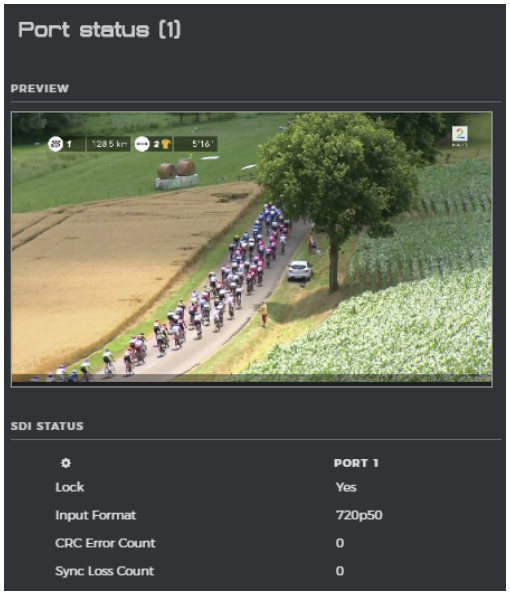


Parameter	Description
Enable	Enable the input stream analysis. Note that disabling input ports will prevent routing of data to the backplane, but the thumbnails will still be active.
Port	The input port ID
Mode	Reflects the settings done in the SDI Configuration application.
Label	User created label for the stream.
Expected format	Define the expected format of the input. If the input of the plug does not match the setting then the card will raise an alarm. The source will not be blocked by an unexpected input format.
Source	Valid for output flows only. Drop-down dialog to choose the source from an input card. Only inputs to the unit of type RTP (as listed in the IP Input application) will be listed as valid sources for the SDI output plugs.

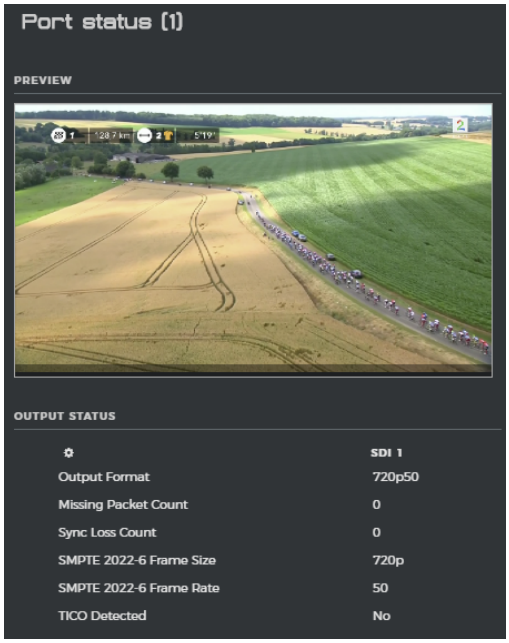
13.1.1 Port Status

When clicking on an input or output port, the Status presented on the right hand panel.

13.1.1.1 Input Port Status

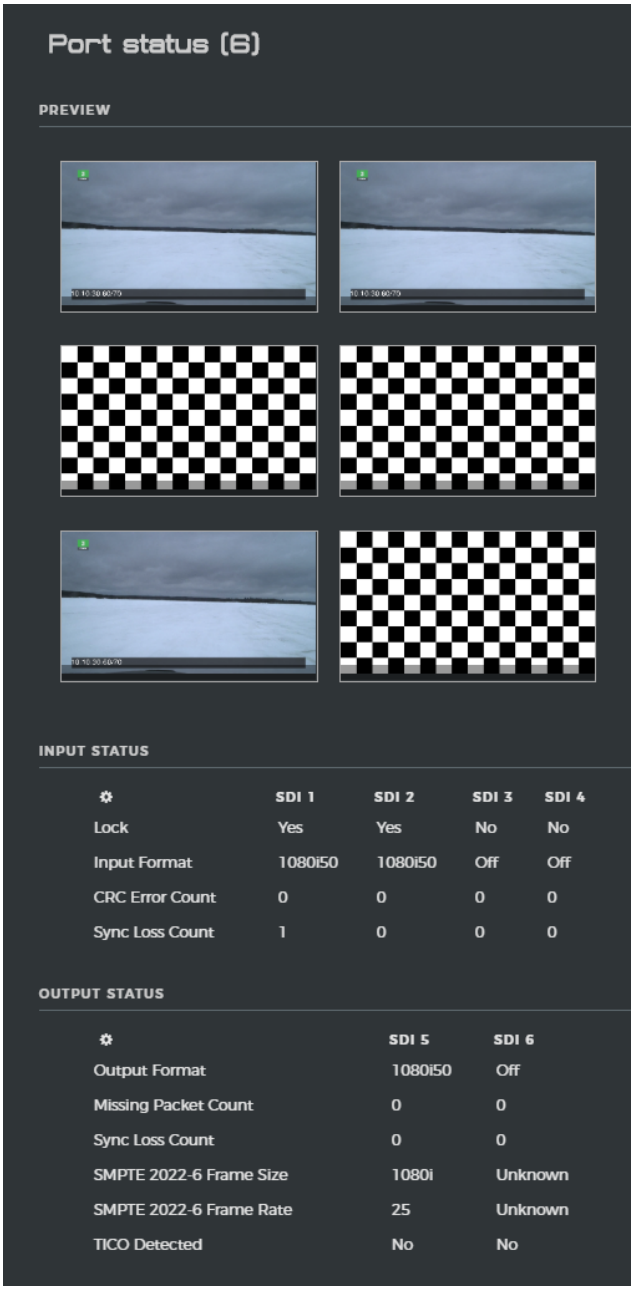


13.1.1.2 Output Port Status



13.1.2 Status of multiple ports

Multi-select is supported in the SDI application. This provides an easy overview of the status for all ports. In this case 6 ports are selected in the main flow view...



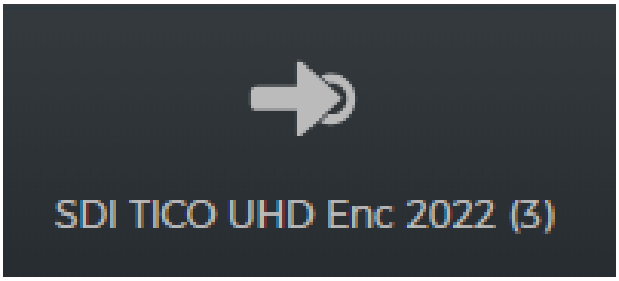
13.2 SDI (2022-6) with TICO UHD

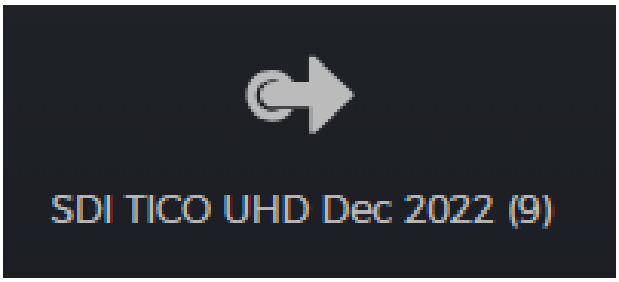
The TICO UHD Encoder/Decoder is a unidirectional card. i.e. the flow direction is defined by the software image loaded to the card.

The UHD encoder encapsulates the SDI in to IP according to 2022-6. I.e the entire SDI is placed into one IP flow.

The UHD encoder/decoder will automatically TICO encode the signal if a 12G source is detected. If not the card will operate in the same way as an SDI card. The 12G sources must be connected to port 1 and 5 only. For Quad UHD signals, 4 ports are used per service (1-4 and 5-8 respectively).

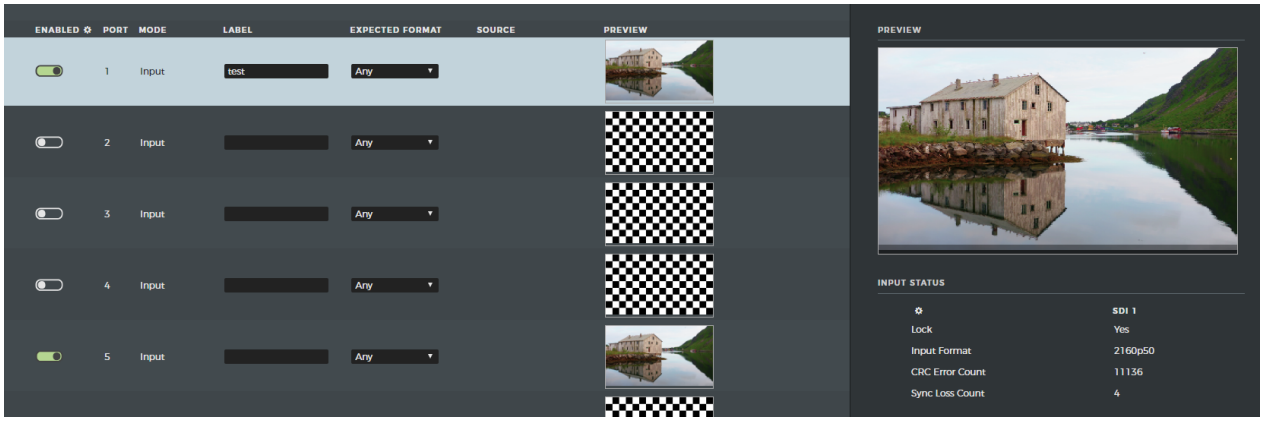
The UHD encoder and decoder applications are separate apps listed on the start page.



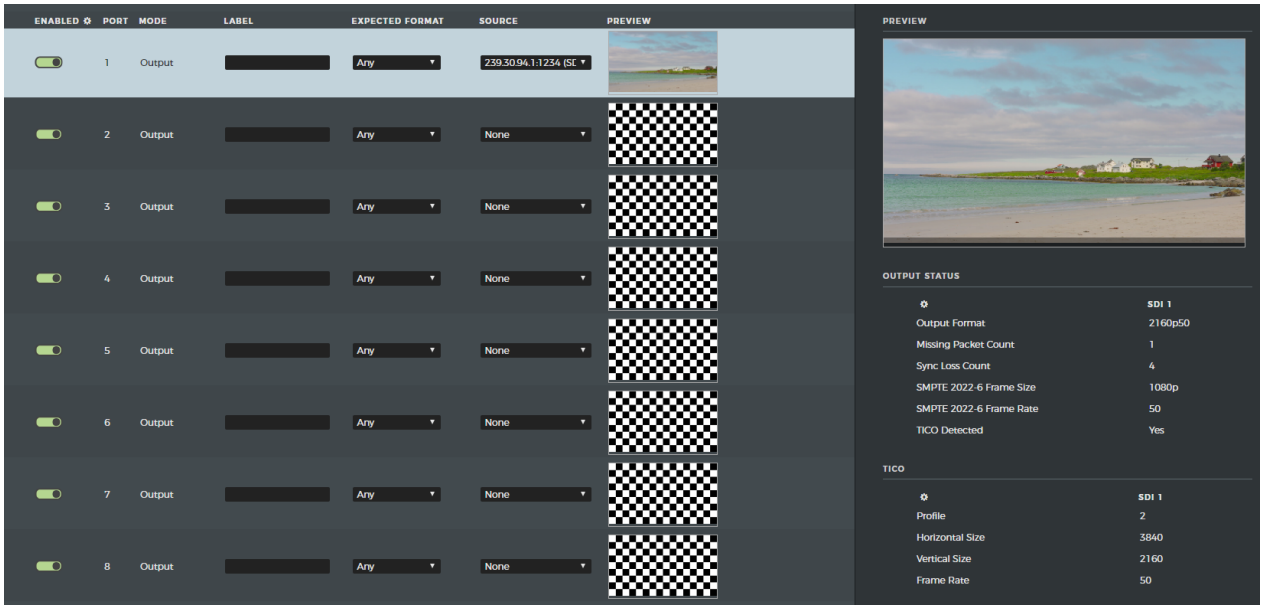


As for the SDI products the flows can be labelled and configured with an expected format. If the content does not match the expected format an alarm will be raised.

13.2.1 UHD Encoder



13.2.2 UHD Decoder



The status of the decoder indicates if the source is TICO encoded and with which profile.

13.3 SDI (2110) with TICO HD Encoder

The SDI (2110) module differs from the 2022-6 version as according to 2110 each part of the SDI signal (the essences) is encapsulated into separate IP flows. This makes the configuration process of the IP flows different from the 2022-6 case.

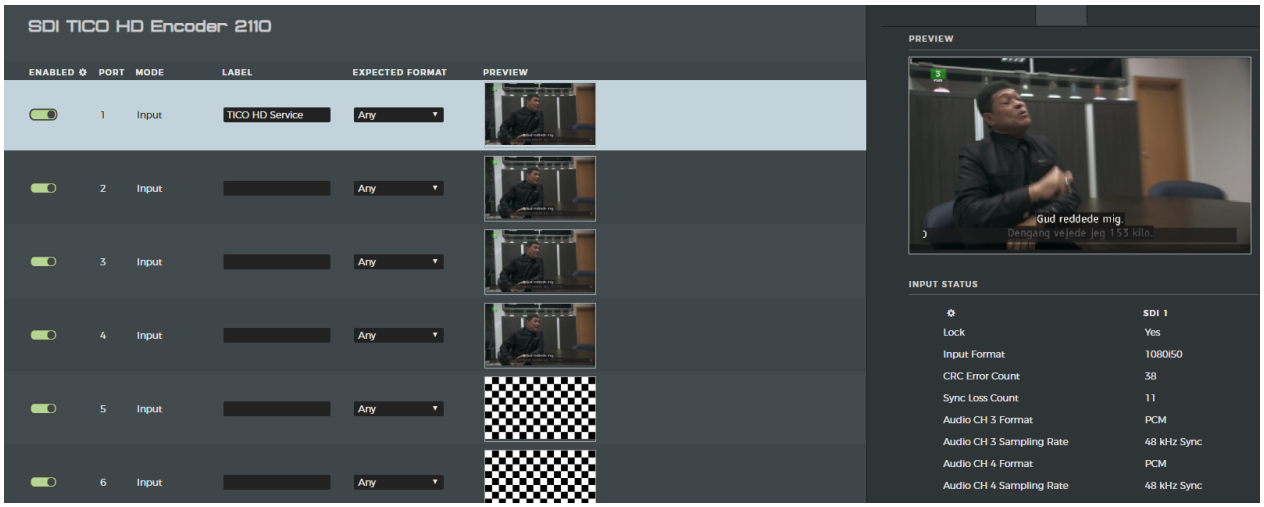
13.3.1 Stream Labels

In a ST2110 configuration all the SDI components will be transferred as unique flows. The label will be configured for the SDI input, similar to the standard SDI in/out cards. This input label will then be mapped to the individual flows according to the type of data.

Example: Label the stream 'Service1'. Then the label of the components will be

- Service1.Video
- Service1.Audio.1&2 , Service1.Audio.3&4 ...etc
- Service1.Anc

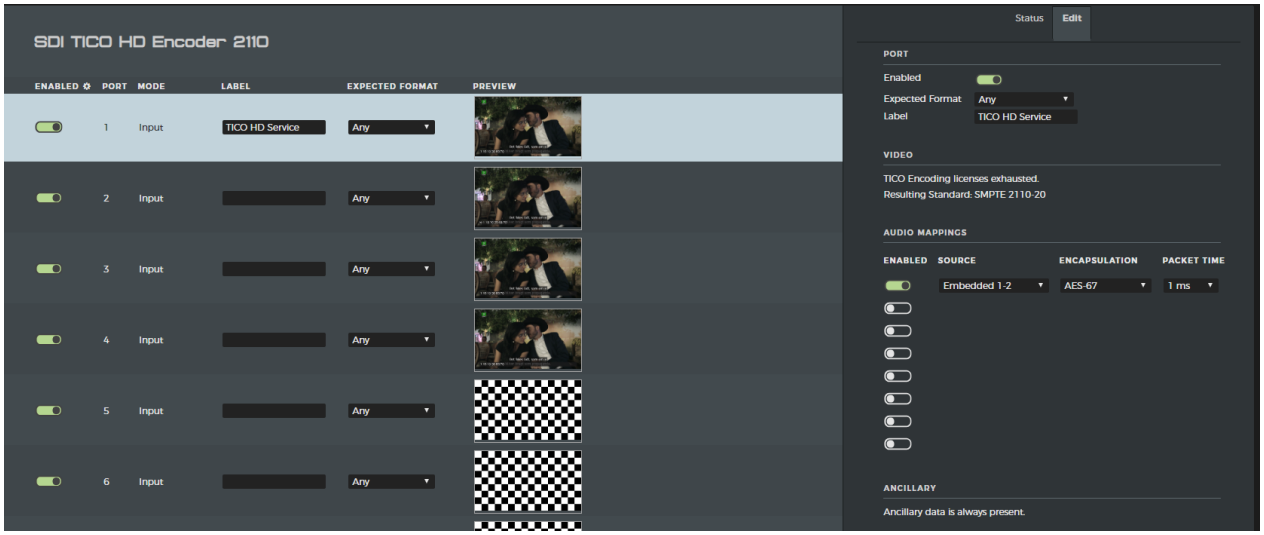
13.3.2 SDI input status



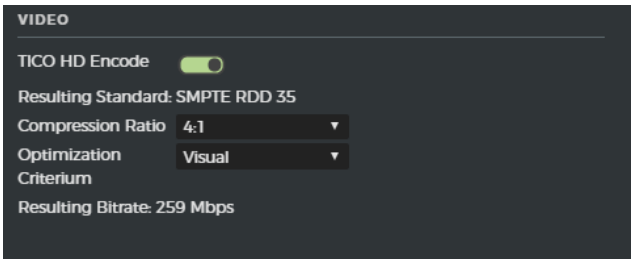
Once the HD signal is connected to the SDI input the card will perform basic analysis of the input signal. This is helpful to see what video format is present, and also where the audio is located in the SDI source.

13.3.3 HD TICO Configuration

To configure the TICO encoder select the Edit tab above the thumbnail.



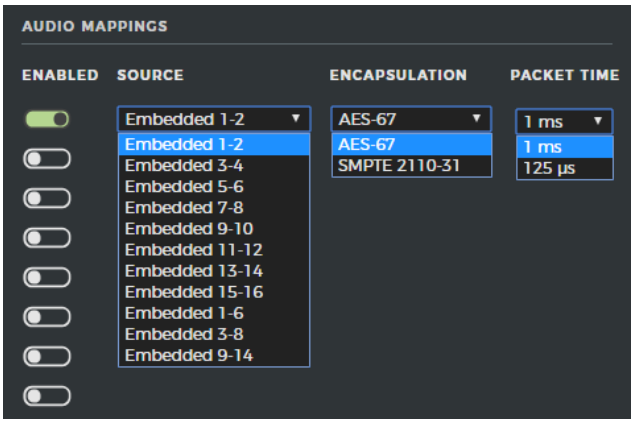
If the TICO license is not installed the card can still be used for 2110 encapsulation, but the actual TICO encoding will not be available. With the TICO license the TICO compression can be enabled.



- Supported Input formats, 1080i or 720p50
- Uses a TICO Profile 2 encoder
- Compression ratio, default 4:1, configurable [2:1, 4:1, 5:1]. The bitrate will be auto-adapted by the system based on the format of the source.
- Encoding characteristics can be optimized for PSNR or Visual.
- RTP encapsulation according SMPTE RDD35 35:2016

13.3.4 Audio configuration

The audio configuration is per audio stream. Each audio stream will be mapped to separate RTP flows where the following configuration must be set.



- **Select source** channel Source:
  - Stereo channels from (1&2) → (15&16)
  - 5.1 channels from (1→6), (3→8) and (9→14)
- **Audio packet repetition rate**

- Packet rate: (1 ms or125 us).
  - SMPTE 2110 Conformance Level B requires support for both repetition rates. Level A = 1ms.
- **Output encapsulation format**:
  - AES67(SMPTE 2110-30):
    - Valid audio sources: Uncompressed only. AES67/PCM
    - Stereo or 5.1
  - Compressed (SMPTE 2110-31):
    - Valid for both compressed AND uncompressed input. Dolby-E, AES67/PCM
    - Stereo only....

13.3.5 2110-40 Ancillary data

The ancillary data is by default included in the encoder. Stopping this essence is possible to do on the output when mapping the essences to the IP destination addresses.

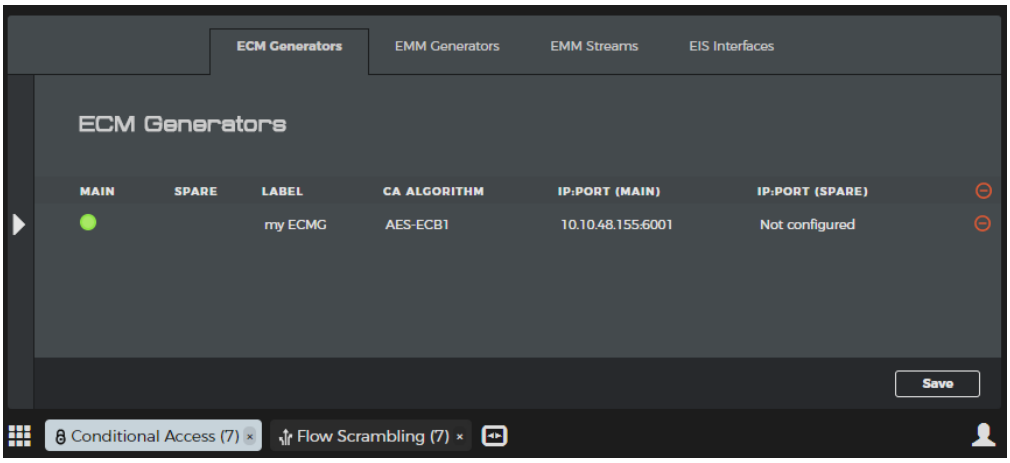
14 SCRAMBLING

14.1 Conditional Access Application

The Conditional Access application allows you to configure the interfaces to the Condition Access System(s) (CAS). The application has 4 tabs to configure; ECMG, EMMG, EMM streams and EIS. Add a new configuration by expanding the left window pane with the arrow on the left-hand side. Edit a configured entry by closing the 'Add' pane and selecting an entry from the center window pane. The parameters available in the 'Add' pane are also available in the 'Edit' pane.

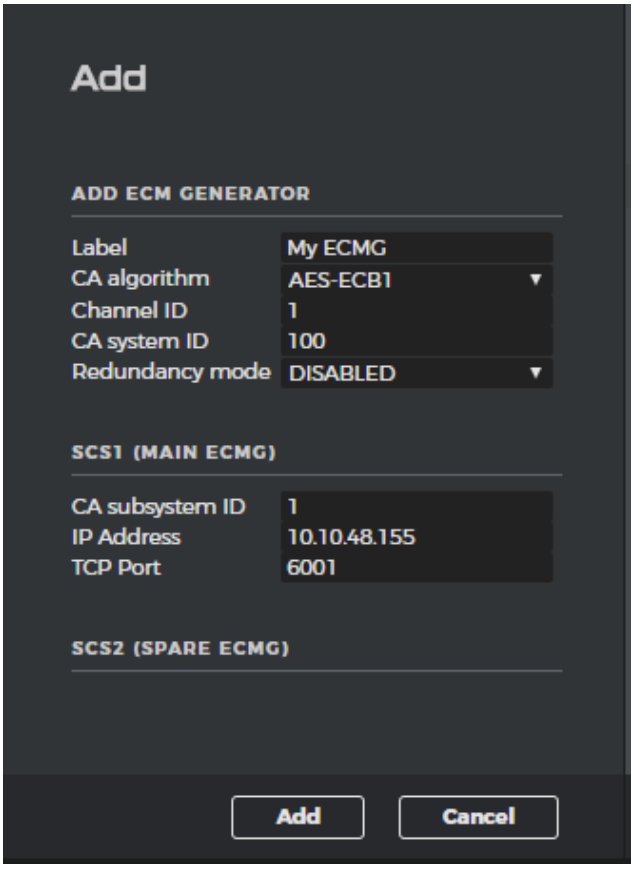
14.1.1 ECM Generators

An ECMG (Entitlement Control Message Generator) is an external CA server that generates ECMs containing the control word and entitlement information. Several ECMGs from different CA systems can be used at the same time, converting the same control words to unique ECMs, by the use of DVB Simulcrypt.



Parameter	Description
Main	Status LED to indicate the state of the ECMG connection **Green:** Connection established and in use **Red:** No connection to the server
Spare	Status LED for the spare ECMG connection. **Green** **If main has connection** Spare connection test successful, ready to be used when main disconnects. **If main is disconnected** Spare is connected to the server and is in use. **Red:** No connection to the server
Label	A user defined label of the ECM generator.
CA algorithm	The scrambling algorithm used to scramble services that use this ECMG.
IP:port	The TCP socket for each ECMG server, Main and Backup (if required).

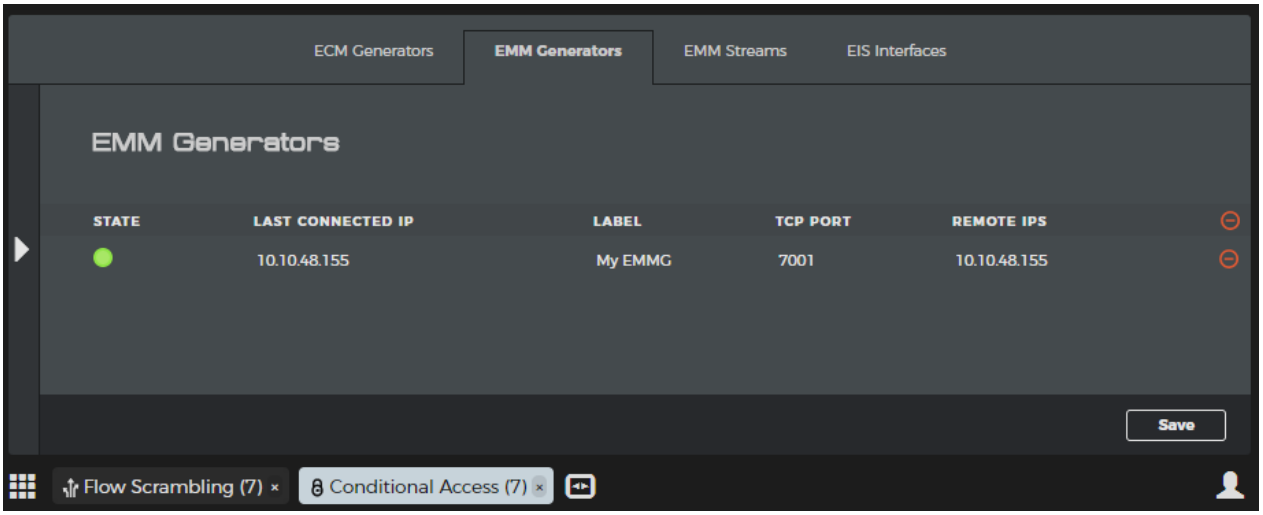
14.1.1.1 Add new ECMG



Parameter	Description
Label	A user defined label of the ECM generator.
CA algorithm	The scrambling algorithm used to scramble services that use this ECMG.
Channel ID	The ID of the ECM Simulcrypt channel.
CA system ID	The CA system ID allocated by DVB to identify copy protection systems.
Redundancy mode	**DISABLED** Only one connection to the CA server can be established. **COLD** Enabled connection to two ECMG servers over two Ethernet ports, main (SCS1) and spare (SCS2). While main is in use, only a test connection is established to the spare server. If the main servers disconnects, the spare server will be used instead.
CA subsystem ID	Defines the Super CAS id in combination with the CA system ID, which uniquely identifies the ECMG.

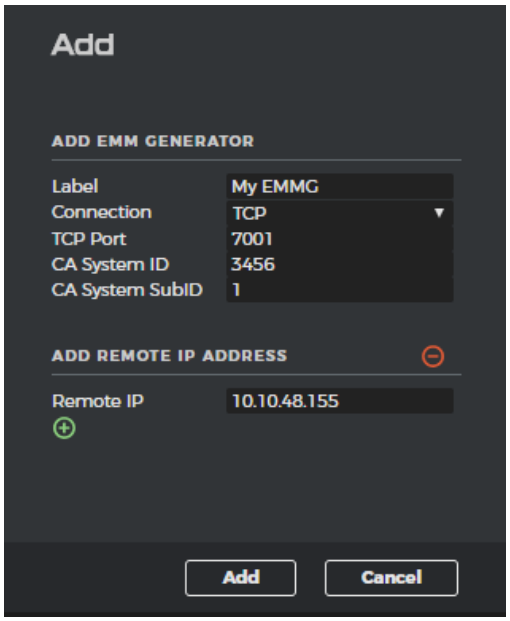
14.1.2 EMM Generators

An EMM generator can produce EMM streams that specifies the authorization levels for subscribers of the transport streams. The EMM stream produced by the generator is described in the “EMM Streams” section.



Parameter	Description
State	**Green:** Connected to server. **Red:** Not connected to server.
Last connected IP	The IP address of the last EMMG server connected to the module.
Label	A user defined label of the ECM generator.
TCP port	The local TCP port of the module to which the server can connect.
Remote IPS	A list of server IP addresses that can connect to the module.

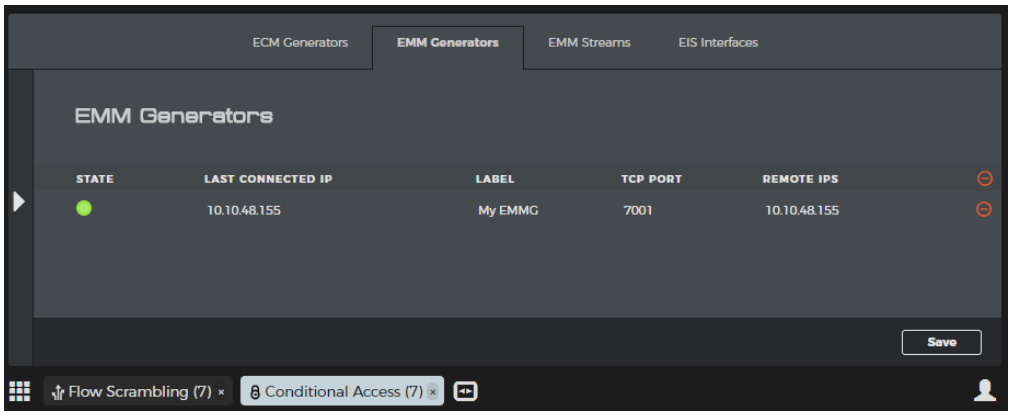
14.1.2.1 Add new EMM generator



Parameter	Description
Label	A user defined label of the EMM generator.

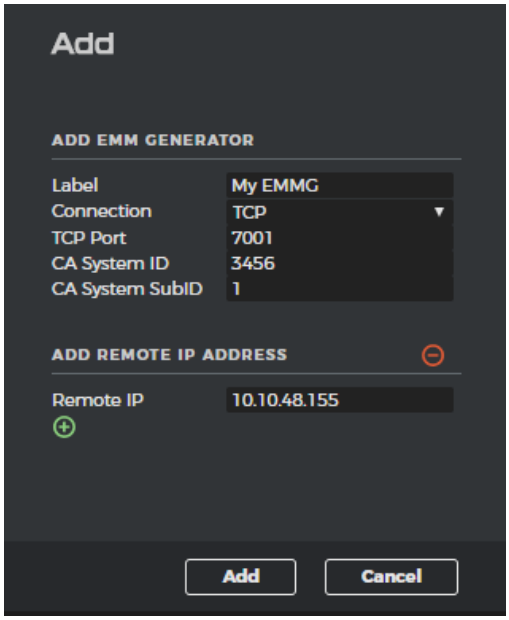
Parameter	Description
Connection	Select connection type to the EMM server. TCP, UDP or TCP/UDP. With TCP/UDP the initial setup uses TCP while data transfer is using UDP as defined by the Simulcrypt standard.
TCP port	The local TCP port of the module to which the server can connect.
CA system ID	The CA system ID allocated by DVB to identify copy protection systems.
CA subsystem ID	An identifier per connection in redundancy mode where there are multiple connection to an EMMG with the same CA system ID.
Remote IP	Enter the EMM server's IP address. Click the green "plus" button to add more server IP addresses for redundancy.

14.1.3 EMM Streams



Parameter	Description
Label	A user defined label of the EMM generator.
UDP port	Local UDP port of the module used by the EMMG. Defined only if the EMMG is in UDP or TCP/UDP mode.
RX bytes	Accumulated byte counter for received data.

14.1.3.1 Add a new EMM stream



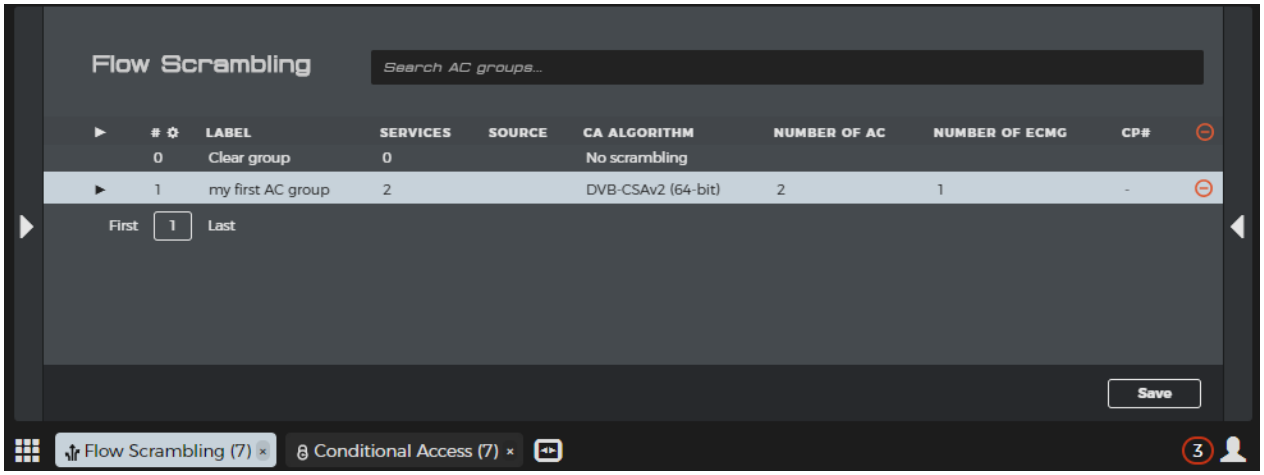
Parameter	Description
Label	A user defined label of the EMM generator.
EMM Generator	Select a generator defined on the “EMM Generators” tab.
EMM stream ID	An ID defined by the EMM server that identifies the stream.
Max bitrate	The maximum bitrate for the EMM stream.
CAT private data	***(Optional)*** User defined HEX string inserted in the private data section of the CAT table.
PID	***(Optional)*** The EMM packet identifier.

14.2 Flow Scrambling Application

The Flow Scrambling start page shows a list of all defined Access Control groups. An Access Control Group is a group of services that share the same ECMGs and Access Criteria.

To add new groups or services, expand the left hand pane. To edit an existing group or service, select it in the center pane, such that the edit pane appears on the right-hand side.

A special Access Control Group named 'Clear group' is predefined. No scrambling will be applied to services in this group and no ECMs will be generated. This group can be useful during initial setup to test service routing before enabling scrambling. When using EIS this group is a holding area for services that are not configured with scrambling.



Parameter	Description
Label	A user defined label of the AC group. The label is only used by the GUI and will not affect the stream.
Services	A group row displays the number of services in this group. A service row shows the name of the service.
Source	The source slot number and multicast address per service.
CA algorithm	The algorithm used from scrambling all services in the given group.
Number of AC	Number of Access Criteria in each group.
Number of ECMG	Number of ECM generators used in each group.
CP#	Crypto period counter that increments when the crypto period changes.

14.2.1 Create Access Control group

Expand the left window pane by pressing the arrow on the left hand side. Highlight the input services that should be included in the AC group and click 'Create AC group'. To add services to an existing AC group, highlight the existing group and click 'Add to AC Group'.

Parameter	Description
Label	A user defined label of the AC group.
Mode	Select ECM or fixed-key scrambling.
ECMG	Select an ECMG from a list defined in the Conditional Access application.
Preferred PID	***(Optional)*** Define the ECM packet identifier.
CP duration	***(Optional)*** Define minimum crypto period in seconds. Minimum value is 5 seconds.
AC type	Select the AC type, HEX or 32-bit INT.
Access Criteria	An ID used by the CA system to manage access rights for the services in the AC group.
Private Data	User defined HEX data added to the CA descriptor in the PSI.

14.2.2 Edit Access Control group

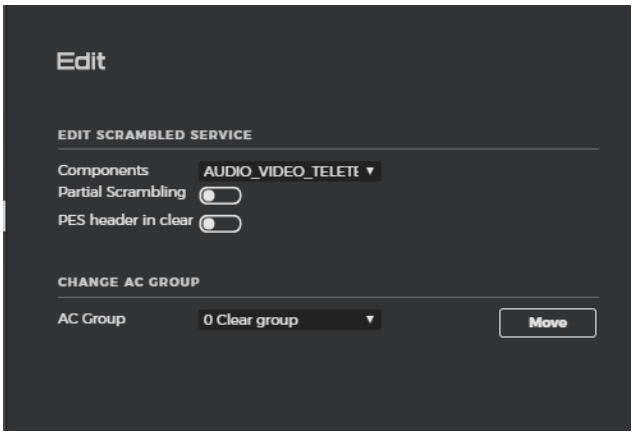
Click on a defined AC group to enable the edit pane on the right-hand side. All the parameters that was defined when the AC group were created can be edited in this view.

Click the save button on the bottom of the center window to apply changes.

14.2.3 Edit service

Expand the AC group in the overview window and click on a service. An edit pane on the right-hand side appears with service specific settings.

Changes are applied after clicking the save button on the bottom of the center window.



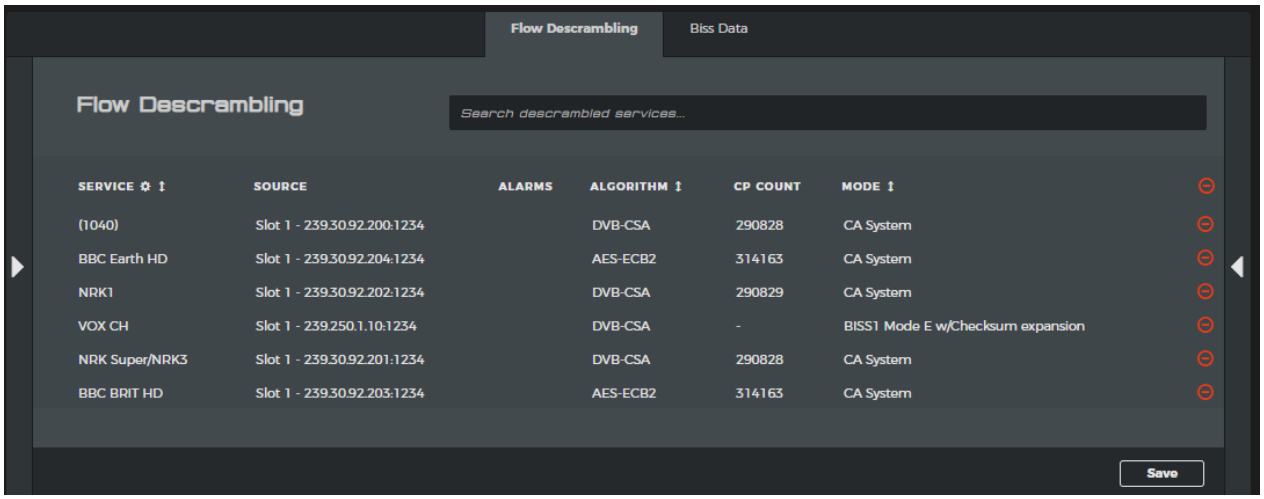
Parameter	Description
Components	Select what type of PIDs to scramble, 'Audio_Video_Teletext', 'Audio_Video' or 'Video'.
Partial Scrambling	Reduce the amount of packets to scramble. No packets will be scrambled if set to 0%, but ECM and PSI are still generated.
PES header in clear	If enabled, the PES header and a user defined number of packets the number of packets in clear after the PES header must be configured. If the number of packets is set to 0, then only the PES header will be sent in clear.
AC Group	Select an Access Control group to move the selected service(s) to that group.

15 DESCRAMBLING

15.1 Flow Descrambling Application

The Flow Descrambling start page shows a list of all services configured for descrambling.

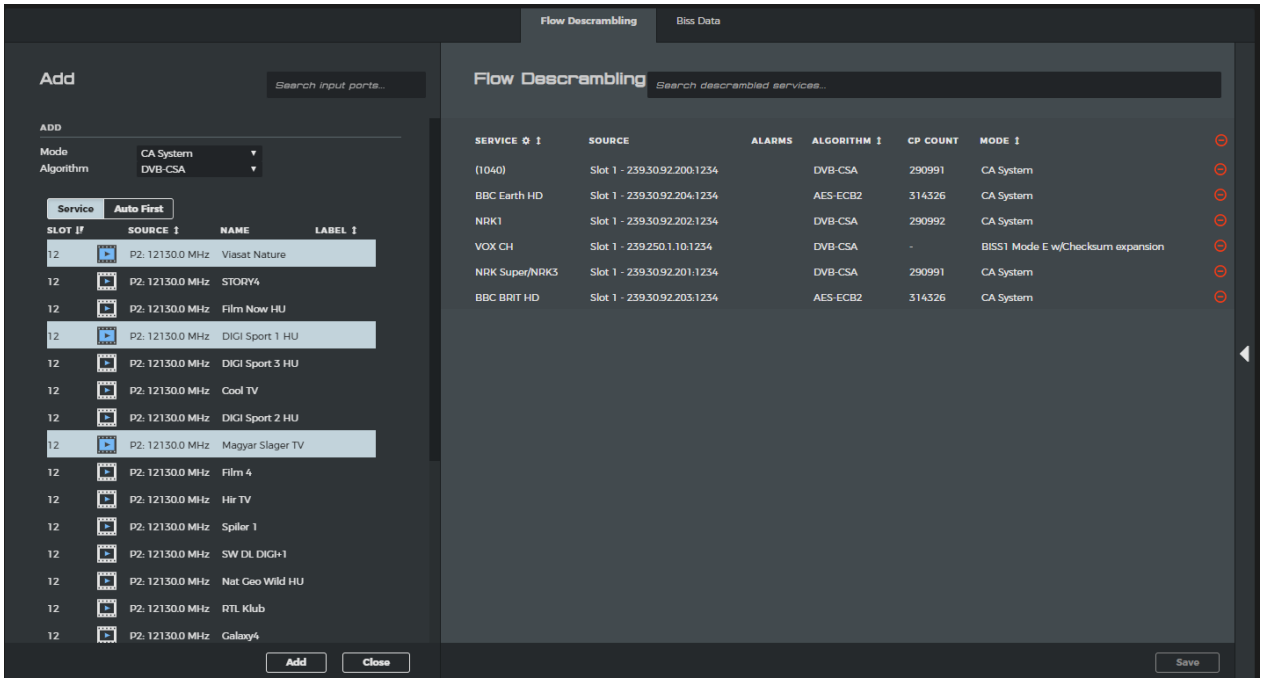
To add new service(s), expand the left hand pane. To edit existing service(s), select one or more in the center pane, such that the Edit pane appears on the right-hand side.



Parameter	Description
Service	Service Name of the configured service (if available)
Source	The source slot number and multicast address
Alarms	Displays any alarms if present
Algorithm	The algorithm used for descrambling the service
CP Count	Crypto period counter that increments when the crypto period changes.
Mode	Descrambling mode **CA System:** CA system defined in the Server application (eg Verimatrix). Allows to choose the required decryption algorithm. **Raw Fixed Key:** Allows to choose the required decryption algorithm and Control Word **BISS1:** Allows to choose the required version (Mode 1 or Mode E) and Session Word. If BISS Mode E is chosen, a Session ID and Word must first be defined in the 'BISS Data' tab. **BISS2:** Allows to choose the required version (Mode 1 or Mode E) and Session Word. If BISS Mode E is chosen, a Session ID and Word must first be defined in the 'BISS Data' tab.

15.1.1 Adding New Services

Expand the left window pane by pressing the arrow on the left hand side. First select the required Mode and Algorithm and then highlight the input services that should be descrambled. Once all the required services are higlighted, click 'Add' and these will be added to the main pane.

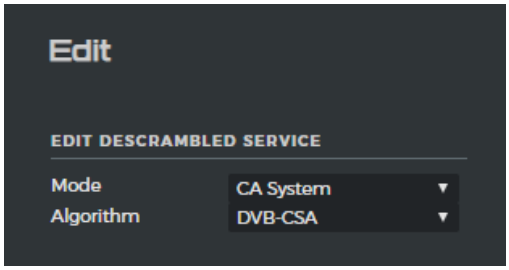


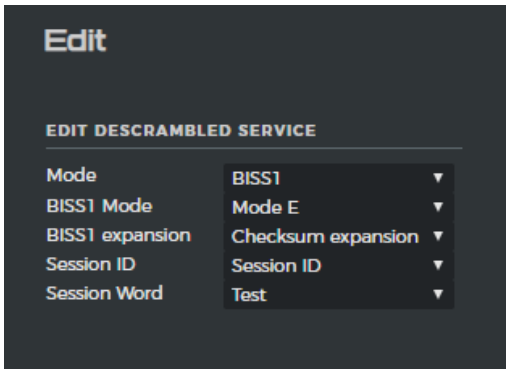
15.1.2 Edit service

In the center pane you can click on one ore more services to edit these. An edit pane on the right-hand side appears with service specific settings.

Changes are applied after clicking the save button on the bottom of the center window.

If multiple services are selected then the common parameters will be able to be selected and changed for all services.





15.2 Verimatrix Server Application

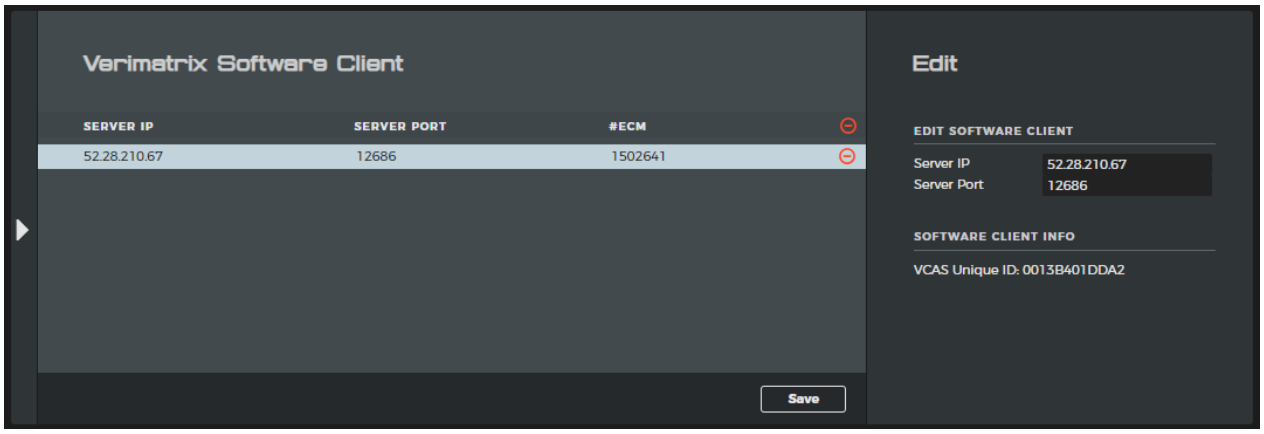
The Verimatrix Server application allows you to configure the interfaces to the Condition Access System(s) (CAS). The start view will show any configured Verimatrix Server configurations if already present, if not, these can be added by expaning the left hand pane by clicking on the arrow.

The available configuration parameters are:

Parameter	Description
Server IP	IP address of the Verimatrix Authorization Server
Server Port	IP port of the Verimatrix Authorization Server. This is generally 12686, but check with your local server operator.

15.2.1 Server Status

Once a server has been configured it will be shown in the main pane and the ECM Status shown. To edit or show status on the service, click on the entry and the right hand pane will open.



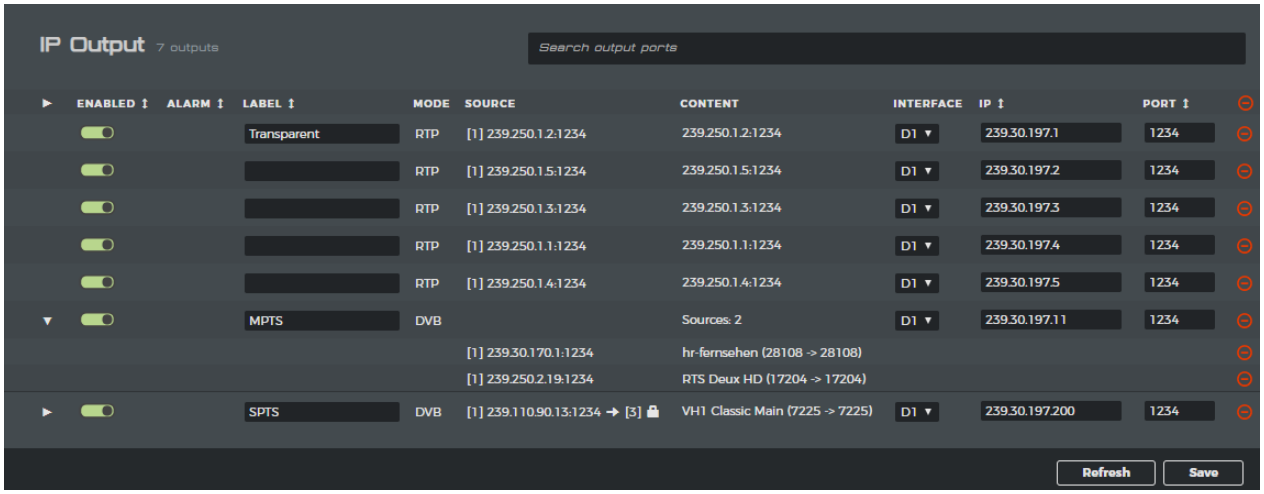
The additional parameters displayed are as follows:

Parameter	Description
#ECM	A counter of the number of ECMs that have been received from the server
Software Client Info	This displays the MAC address of the Bulk Descrambler module that should be used in the server if required for authorization.

If any changes need to be made to the Server IP or Port, or the server removed, these can be done and then applied by clicking the 'Save' button.

16 IP OUTPUT

The IP output application is responsible for the configuration and status overview for IP output sources. For each MMI/IP modules in the unit there will be a separate application marked with the specific slot number.



When opening the application, it will list currently active outputs (if configured).

Parameter	Description
Enabled	The enable checkbox lets the operator easily disable an output. The stream is still defined in the system, but the stream output is muted.
Alarm	Indicator if there is an alarm present on the input.
Label	The label can be added during definition, and changed directly from the list view.
Mode	Indicates what type of content the system transmits. • MPEG • DVB - includes SDT • ATSC • RTP - TS over IP • RTP (SMPTE2110) • RTP (SMPTE2022-6)
Content	This column will display the service id + name (if available) for MPEG/DVB content. For other types of content this column will list the type of mapping that is performed.
Interface	The interface where the stream is being transmitted.
IP	The destination IP address of the outgoing stream.
port	The port of the outgoing stream.
Red Circle	Action button to remove streams from the output.

In order to see individual services in an input, the arrow on the left can be used to expand the view.

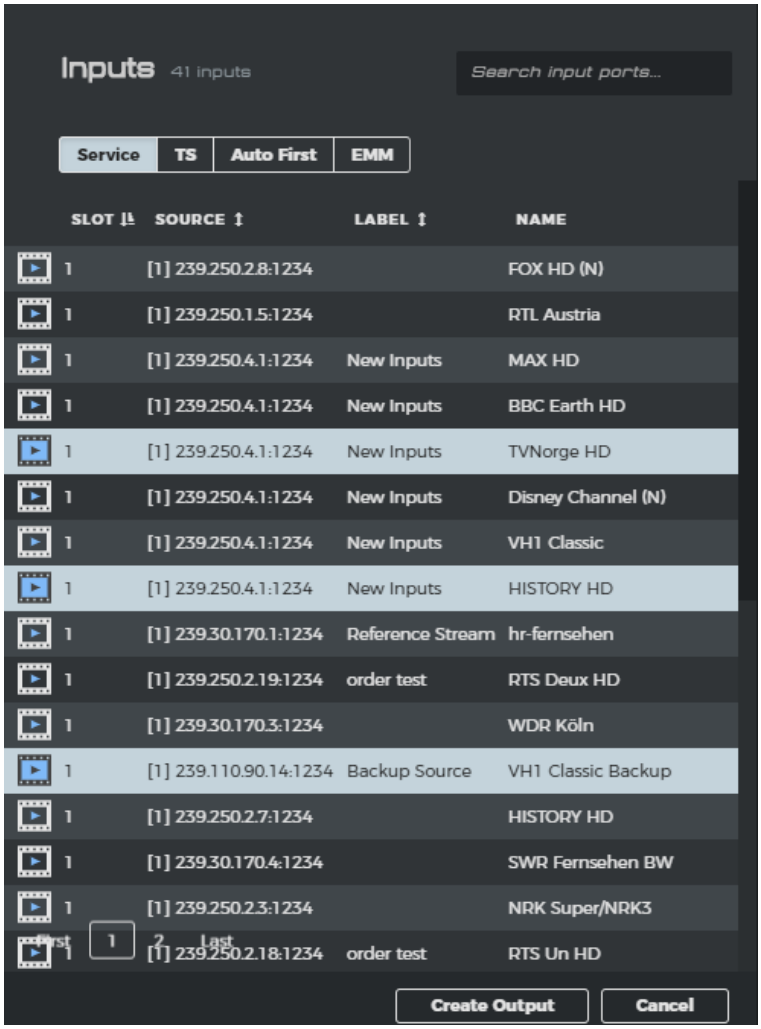
16.1 Output Configuration

16.1.1 Adding New Outputs

For the output application the action buttons are located behind the expansion arrow on the left hand side. If no streams are configured this panel will open by default.

16.1.1.1 Source Selection

The first stage of creating an output stream is to select the source type and then select the required streams. One or more streams can be selected and it is possible to use the search filed at the top (eg, 'slot:3' or service name), or by column sorting to find selected streams. Once the streams have been selected, click the 'Create Output' button.



Source types

Parameter	Description
Service	Selecting the service selector then all services known to the system will be listed. Then the source service of interest can be picked from the service list view.
TS	TS selector will show all MPEG/DVB transports known to the system. The source transport of interest can be selected from the list of transports in the source list view. When a TS source is mapped to an output the entire MPEG/DVB transport stream will be mapped, including NULL packet.

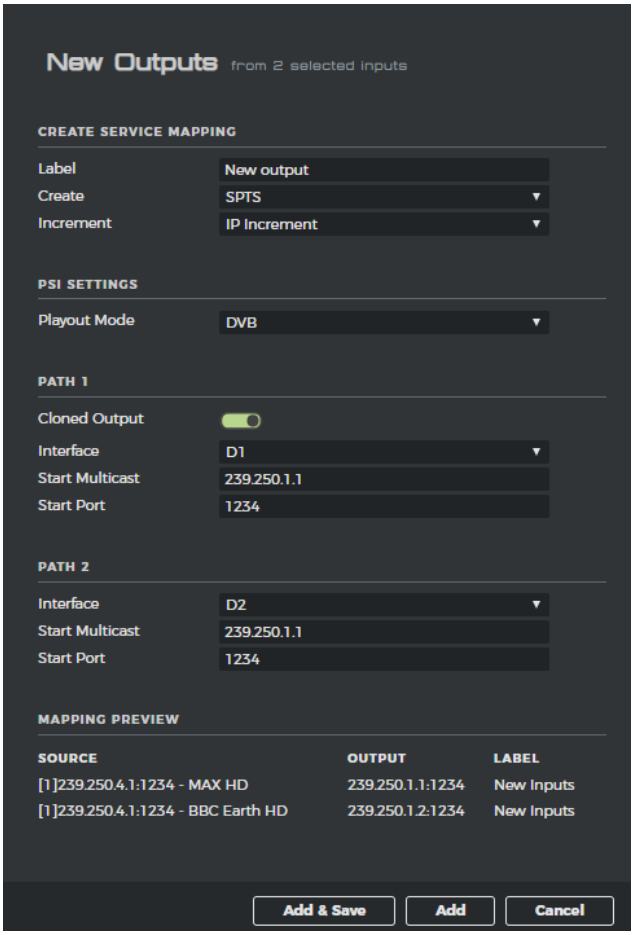
Parameter	Description
Auto-first	In some system configurations the input is not present at the time of configuration of the system. This is typically for VOD systems were the source is activated by the end user. For this scenario the system must be configured in the same way as a service mapping, only that the service to choose will be the first one that is detected on a source. When doing an auto-first mapping the output service ID is by default set to 1 and this value can be overwritten by changing the outgoing service ID in the edit output configuration dialog.
RTP	This type field will show if RTP content is available in the unit. When selecting the RTP source type the system will list all RTP flows in the system. This can be input streams defined to be RTP, or streams available from the SDI over IP input card.
SMPTE 2110	The SMPTE2110 source type is a group where all the flows of a 2110 service is encapsulated. Adding such a source will add all the flows part of the 2110 service. This source type is delivered by the 2110 SDI modules.
EMM	The EMM type selector is available only if EMMs are detected by the system. This can be either from an input module or scrambler module.

On the source selection panel, depending on how many services are selected and if an active output is selected then there will be the following options:

Source	Action	Mapping action
Service	Create Output	When a source service is created then a new DVB output is created. By default it is a VBR stream for one service and an MPTS for multiple services.
Service	Add to Multiplex	With a service to transport mapping, use the Add to Multiplex action button to add the service to the selected output transport.
Service	Replace Content	When an output service is selected, use the 'Replace Content' button to replace the destination service with the selected source service.
TS	Create Output	When a TS source is created the entire MPEG/DVB transport stream will be mapped, including NULL packet.
RTP	Create Output	When a TS source is created the entire RTP transport stream will be mapped.
SMPTE 2110	Create Output	Either the top level 2110 note, or individual components (eg Video) can be selected to be output.
EMM	Create Output	Selecting this option allows the user to create a unique output with only the EMM present, ie out of band.
EMM	Add to Multiplex	Selecting this option allows the user to add the EMM to the selected output, in band.

16.1.1.2 Create Output

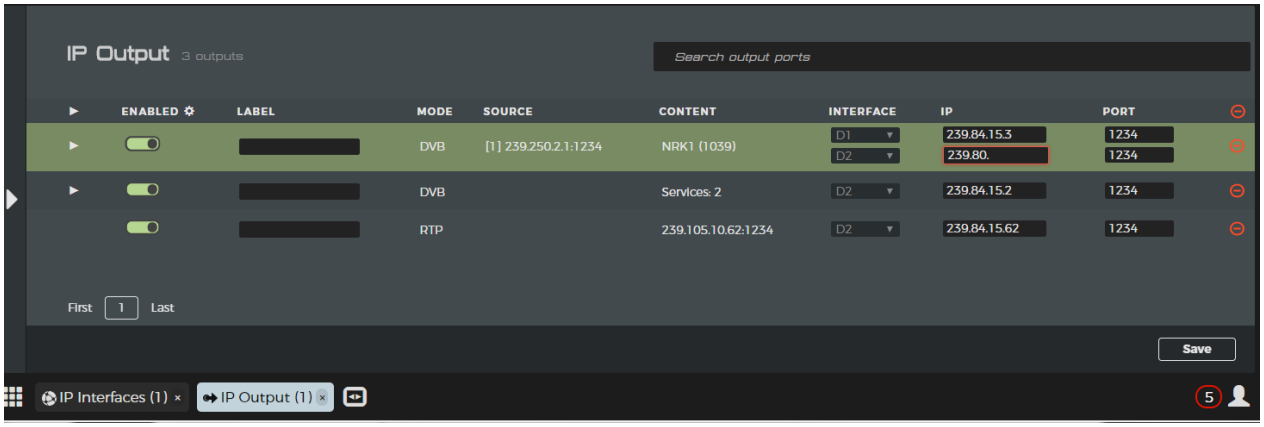
When a new output is created, you will be presented with a dialog to define the output stream properties.



Parameter	Description
Label	Assign a label for the port. This label will then be displayed in other views were the output is referenced.
Create	If multiple services are selected, this will give the option to create an SPTS or MPTS
Increment (SPTS only)	Define how subsequent services will be incremented from the initial service.
Bitrate (MTPS Only)	Define the output CBR bitrate of the MTPS.
Playout Mode (Service Only)	Select from DVB, ATSC or MPEG playout modes
Cloned Output	Option to enable Cloned IP Output (2022-7). This will enable the Path 2 option
Interface	Defines which physical IP output port will be used
Start Multicast	First multicast/unicast IP address for output. If Increment by IP is enabled, subsequent IP addresses will be based on this.
Start Port	First IP port for output. If Increment by Port is enabled, subsequent ports will be based on this.
Mapping Preview	Preview a list of the created outputs.

Once configured there is an option to click the 'Add & Save' or 'Save' buttons. The 'Add & Save' will add the new streams to the output configuration pane and commit the changes. The 'Save' option will add the streams to the output configuration but allow the user to review and complete the last pieces of the configuration before using the separate 'Save' option. This makes it possible to do more advanced

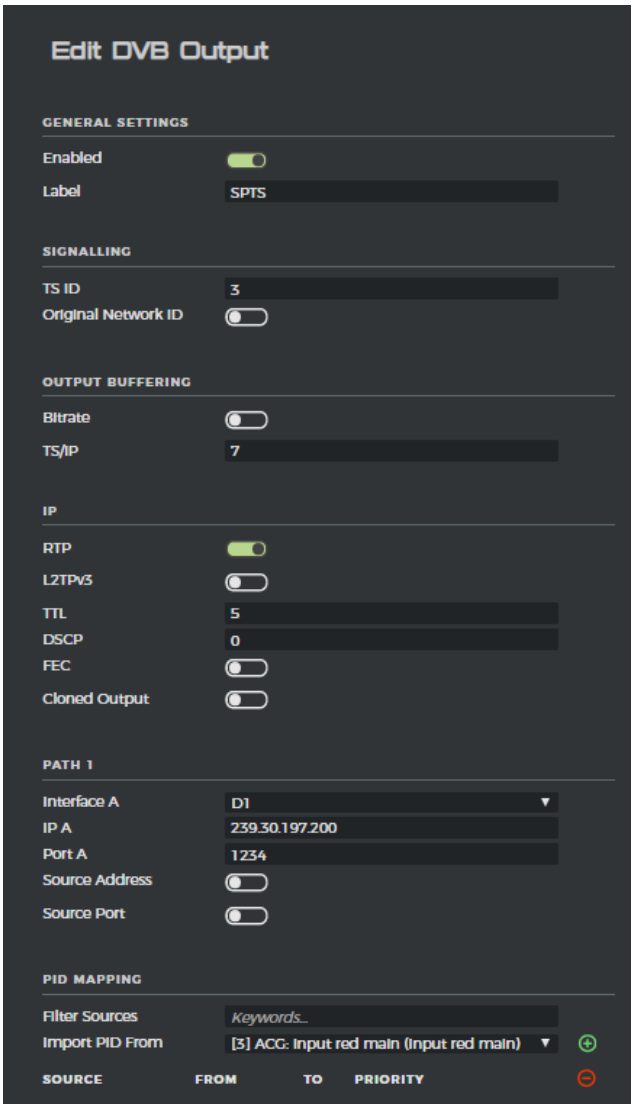
configuration such as component mapping etc if required.



16.1.2 Changing existing output(s).

Configured outputs are listed in the main list view when opening the IP Output application. The list view shows all streams and if the list extends beyond one page, an option in the bottom left will become available to navigate multiple pages.

To edit an output, click the object and the edit dialog will appear on the right-hand side.



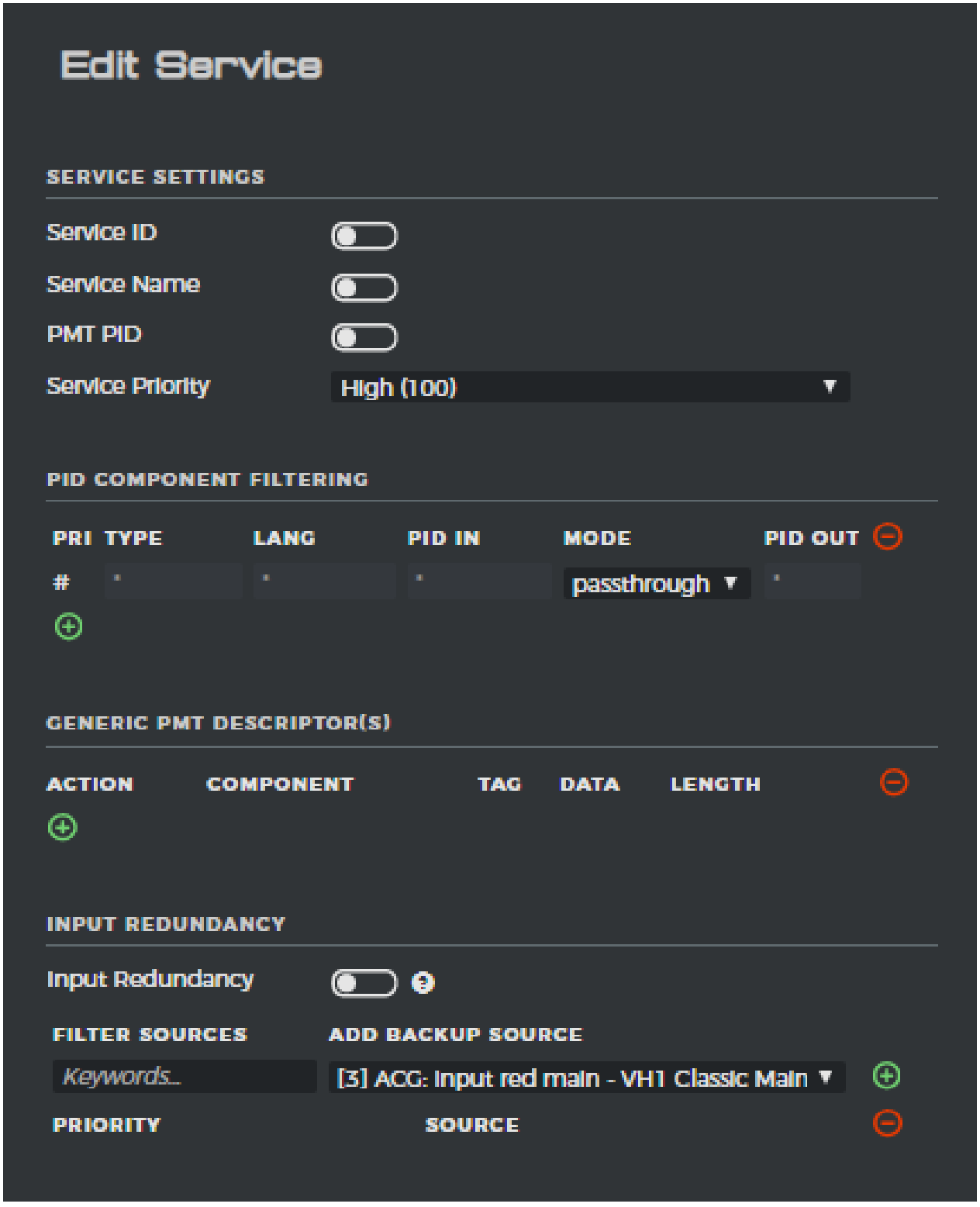
For DVB outputs the transport layer edit dialog contains both the DVB transport and the IP specific parameters. The majority of the parameters are similar to above with the following additional parameters

Parameter	Description
TS ID	Transport Stream ID of the output
Original Network ID	Override the default Original Network ID used in the generated SDT (DVB Only)
TS/IP	Number of TS packets per IP frame (default 7)
RTP	RTP enable flag. If disabled, output will be UDP
L2TPv3	Enable L2TP output mode. Opens additional settings for Flow/Session IDs
TTL	IP Time To Live of the output stream
DSCP	Differentiated services code point value used in the output IP stream
PID Mapping	This option allows you to import any PID available from an input source to the output stream. The first step is to select an input port/service and then the required 'From' and 'To' PID values. This feature can be used to import PSI/SI PIDs (eg EIT, NIT) to the output stream. Please note that any service component PID will not be signalled in the generated PAT/PMT.

It is possible to use multiselect to edit multiple output streams simultaneously. This will show common parameter and allow you to edit multiple streams simultaneously.

Once any changes are made, to commit click the 'Save' button.

Selecting a service object will produce the following edit dialog.



Parameter	Description
Service ID	***Optional.*** Use this to override the output service ID.
Service Name	***Optional.*** Use this to override the output service ID.
PMT PID	***Optional.*** Use this to override the output PMT PID.
Service Priority	Set the priority of the service to reflect the value according to the trigger threshold.

Parameter	Description
PID Component Filtering	Use the component filter to stop and remap component PID values. The filter can operate in PID to PID mapping or component type to PID mapping . The filters are applied on chronological order.
Generic PMT Descriptors	This feature allows the user to Add, Remove or Change signalling in the PMT for the selected service. In order to use this feature, the component must first be configured using the PID Component Filtering to have a static output PID value. When adding or changing the descriptor of a component, you will need to first select the location in the PMT, ie outer loop or specific component and then the PMT Tag and hex data according to the PSI standard.
Input Redundancy	Allows you to configure one or more backup sources. This is discussed in more detail in the Redundancy chapter. Please note that if Input Redundancy is enabled, the Service ID will have to be configured to a static value.

17 DECODERS

Decoders are configured using the Decoding applications in the dashboard. When a decoder has been configured and enabled it will deliver decoded video and audio through the SDI output connectors. The input to the decoder comes from one of the input interfaces in the chassis and is delivered to the decoder over the backplane.

17.1 Configuration Flow

Parts of the Configuration of a Decoder is done through reusable Profiles. This way the same decoder configuration can be applied to multiple services. If a Profile is altered, the change is automatically applied to all the services using the Profile.

Profiles define parameters that are likely to be identical for many services. In contrast, ***service specific*** parameters are not configured through Profiles but rather on an individual service level. Examples of service specific parameters are which physical SDI output connector is used, audio output format etc.

The starting point of configuring a service to be decoded is to first define the necessary profiles, alternatively reuse existing Profiles.

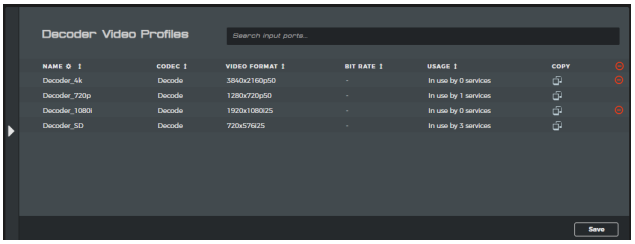
Typical Service Configuration Sequence:

1. Define one or more Video Profiles
2. Select which input service to decode
3. Configure Service using specific module and output connector, and a profile defined above.
4. Repeat from Step 2 to configure multiple services

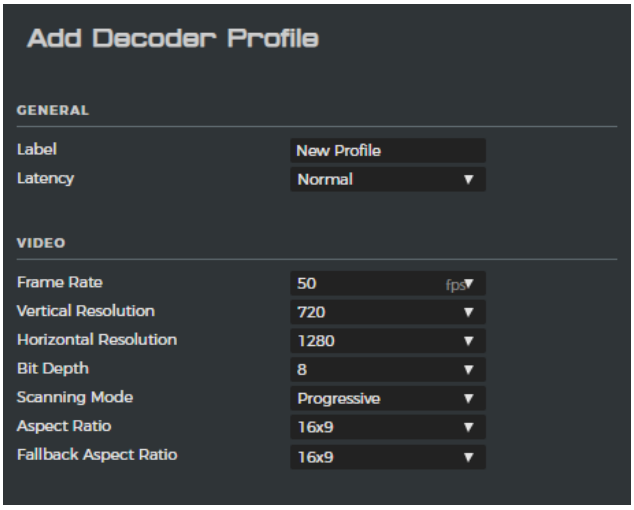
17.2 Profiles

17.2.1 Decoder Video Profile

The Decoder Video Profile defines the **output** characteristics of a video component. When the application is opened, this lists the profiles created.



New profiles can be added on the left hand pane and can be opened by clicking on the arrow. The following parameters can be defined:



General	
Label	Name of the Profile.
Latency	Latency mode. This should match the latency mode of the Encoder. For broadcast applications use Normal.

Video	
Frame Rate	Frame rate in frames per second (fps). Note that HD 1080i and SD are 25fps or 29.97fps.
Vertical Resolution	Vertical resolution of encoded video.
Horizontal Resolution	Horizontal resolution of encoded video.
Bit Depth	8 or 10 bit. Use 8-bit for AVC applications transmitting to consumer equipment.
Scanning Mode	Progressive or Interlaced.
Aspect Ratio	Configures display aspect ratio of encoded video.
Fallback Aspect Ratio	Configures display aspect ratio of encoded video when input is lost.

Once created, profiles can be edited by clicking on the profile and editing the parameters on the right hand pane.

To delete a profile, click on the red '-' and then click the 'Save' button.

17.2.1.1 Copying a Decoder Video Profile

To copy a profile, click on the icon in the 'Copy' column. This will create a new profile which can be edited and then when finished, click the 'Save' button to apply.

17.3 Decoder Services

Once video profiles have been defined, services can be configured. Service configuration links service inputs to decoder profiles and physical outputs. Services are defined using the Decoder Service Application.

17.3.1 Input Service Selection

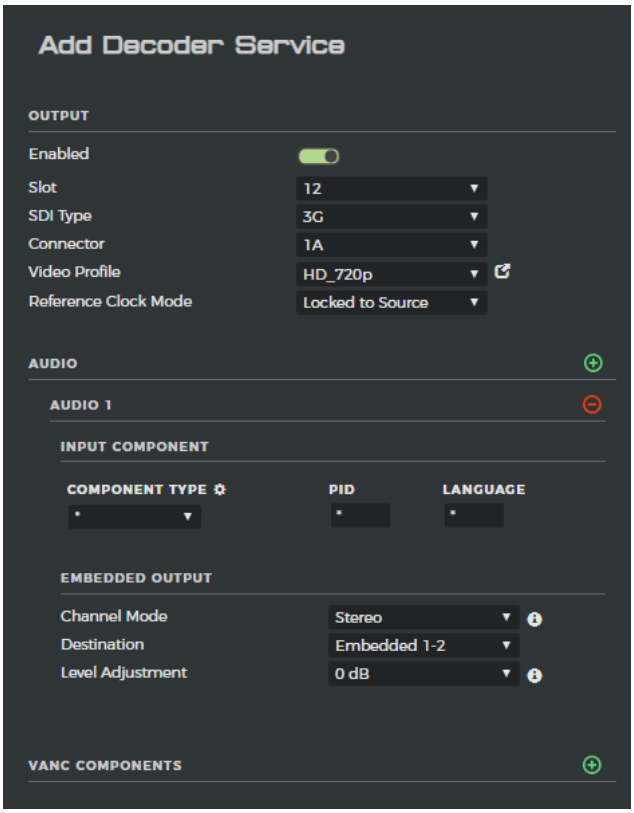
The source view on the left hand pane lists all services available from all active input interfaces in the chassis.

[image2] | ***images/decoder_service_list.PNG***

Once a service is selected, click the 'Create' button.

17.3.2 Decoder Configuration

After a service is selected you will need to configure the decoder service properties:



Output	
Enabled	Enable/Disable decoder.
Slot	Selects the physical encoder where the service should run.
SDI Type	Selects the port mode. For UHD output use 12G SDI , Quad Link Square Division or Quad Link Two Sample Interleaved. For FHD/ HD/SD use 3G SDI
Connector	Select between available connectors. Only 1A and 2A supports 12G SDI. For Quad Link UHD, connectors 1ABCD or 2ABCD are combined.
Video Profile	Video profile which matches service parameters
Reference Clock Mode	Select between: • Locked To Source (standard operation • Genlocked (Black burst reference on switch) • Video Alignment where all services with the same group ID are aligned in terms of PTS/PCR.

Output	
Group ID	Used together with Video Alignment to create multiple aligned groups.
Genlock offset	Used together with Genlock mode to allow alignment adjustment in pixels.

17.3.2.1 Audio

Multiple audio components can be added by pressing the '+' icon. The input component filter allows automatic filtering/selection between multiple audio components based on PSI/SI data.

Input Component	
Component Type	Selects component based on type (codec)
PID	Selects component based on PID.
Language	Selects component based on Language ISO.

Audio data output is put into SDI embedded audio.

Embedded Audio	
Channel Mode	Output decoded audio as Stereo or 5.1
Destination	Selects data in embedded audio.
Level Adjustment	Allows audio level adjust after decode.

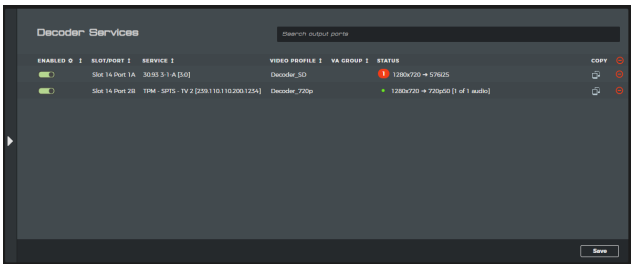
17.3.2.2 VANC Components

It is possible to configure VANC components on the decoder output. The options are:

Parameter	Description
VANC Standard	Select from the following options • OP47

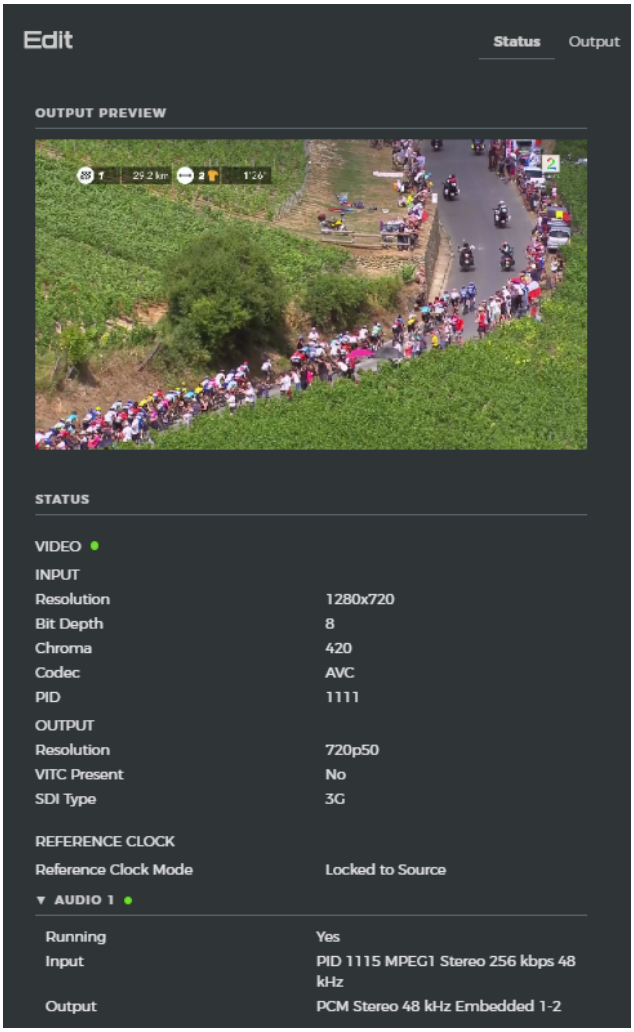
17.4 Decoder Status

When opening the Decoder Services application, if services are configured you will see these in the overview window

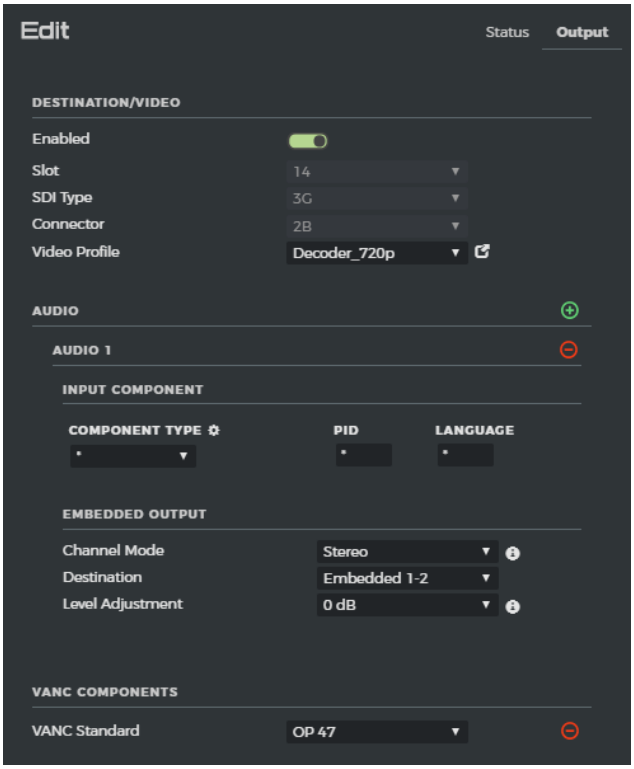


This view shows the configured services, ports, profiles, alarms and status. To see alarm details, hover over the red alarm icon.

To view status, or change an active decoders configuration, you can click on the service.



In the Status view you will see a thumbnail of the service along with video and audio details/status.



The Output tab allows you to modify the decoder settings of an active service. Once complete, click the 'Save' button to apply the settings.

18 S2X OUTPUT

18.1 S2X Output Application

The 'S2X Output' application configures modulators on a given module. Each modulator is represented as a row in the main table view. Each row includes a subset of configuration of a modulator. Expanding a row shows a list of services in the TS with Service Name, Service ID and source IP address.

The configuration process starts by creating following profiles:

1. Port profile
2. Carrier ID profile
3. Precorrection profile

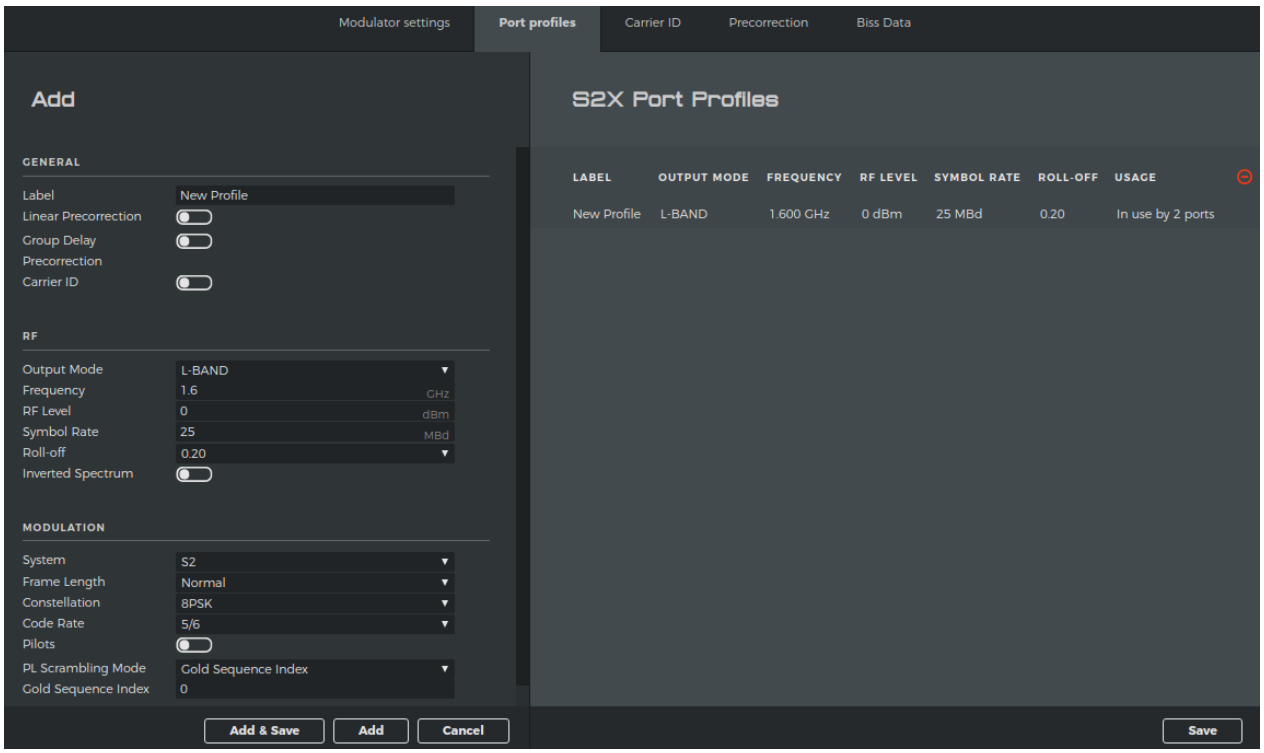
Creating profiles provides predefined parameter sets, minimizing the chance of human error and greatly increasing the speed of set-up.

18.2 Port Profiles

The first step in configuring a modulator is to define a Port Profile. Select the 'Port profiles' tab and expand the left pane with the arrow button.

Port Profile can be defined without being applied to a modulator or it can be applied to both modulators at the same time. If the configuration of a Port Profile in use is changed, the change propagates to the affected modulators immediately. A Port Profile can link to Carrier ID and Precorrection profiles completing the full RF and modulation configuration.

A Port Profile must be defined before configuring the 'Modulator settings'.

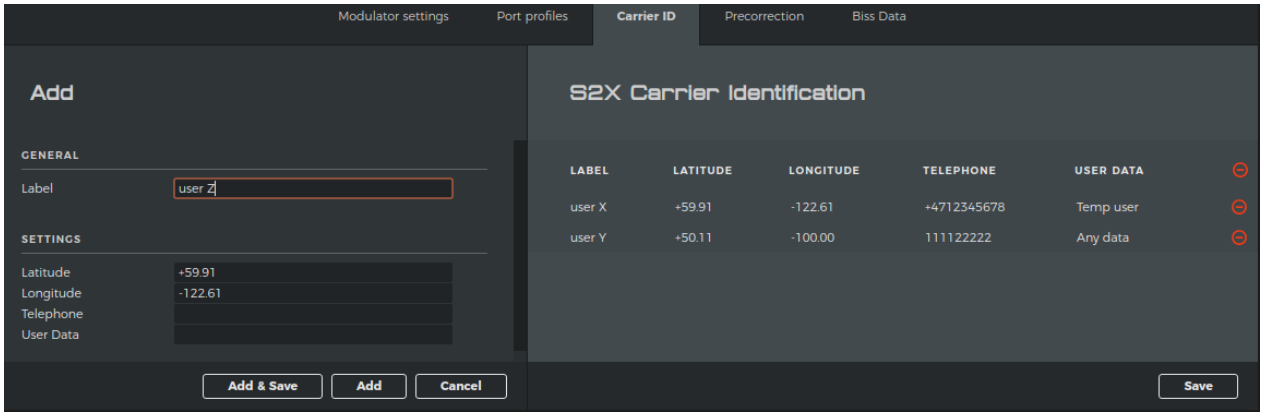


Parameter	Description
GENERAL	
Label	Label of the Port Profile

Parameter	Description
Linear Precorrection	Enable Linear Precorrection and link to a defined Precorrection profile from the dropdown.
Group Delay Precorrection	Enable Group Delay Precorrection and link to a defined Precorrection profile from the dropdown.
Carrier ID	Enable Carrier ID and link to a defined Carrier ID profile.
RF	
Output Mode	Output mode IF or L-BAND defines different frequency ranges
Frequency	Frequency (in GHz) Frequency range in case of IF Output Mode: [0.07-0.2] Frequency range in case of L-BAND Output Mode: [0.95-2.15]
RF Level	RF level (in dBm)
Symbol Rate	Symbol rate (in MBd)
Roll-off	Select a Roll-off value from the dropdown
Inverted Spectrum	Enable/disable Inverted Spectrum
MODULATION	
System	Select modulation standard from the dropdown (S1, S2 or S2X)
Frame Length	Size of the FEC frame (not applicable S1). Select from the dropdown (Normal or Short)
Constellation	Symbol constellation
Code Rate	Select a fraction value from the dropdown
Pilots	Enable/disable pilots
PL Scrambling Mode	Select a mode to define the PL Scrambling. **Preferred scrambling sequence:** Select from a set of preferred Gold sequence index defined in ETSI EN 302 307-2. **Gold Sequence Index:** Enter Gold sequence index directly. Default index for broadcasting services is 0. **PL root:** Enter the 18-bit PRBS root.

18.3 Carrier ID

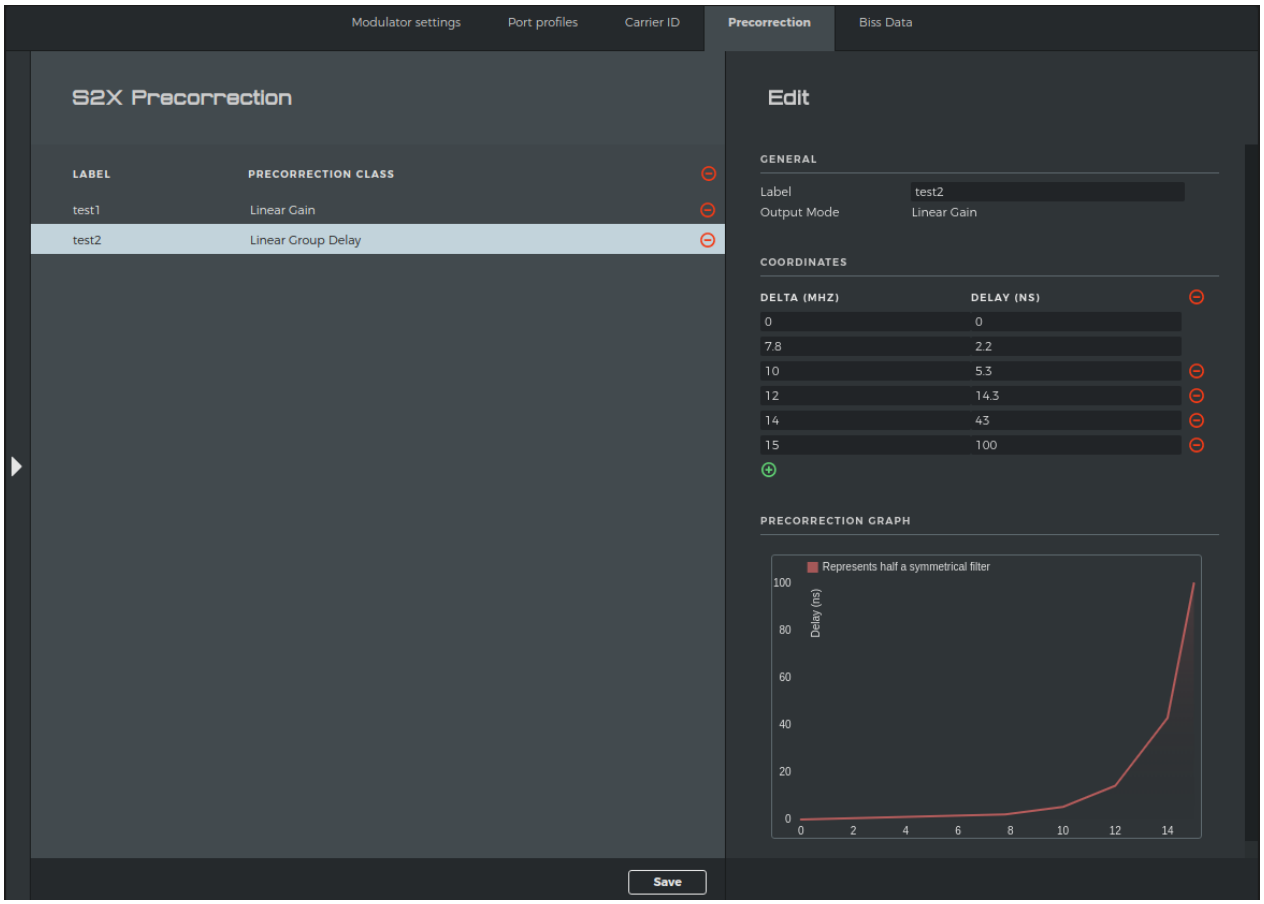
Predefine operator information and apply the same parameter set to multiple Port profiles. To define a DVB Carrier Identification profile, select the 'Carrier ID' tab and expand the left pane with the arrow button. Multiple profiles can be defined and applied to Port profiles for fast and easy reconfiguration.



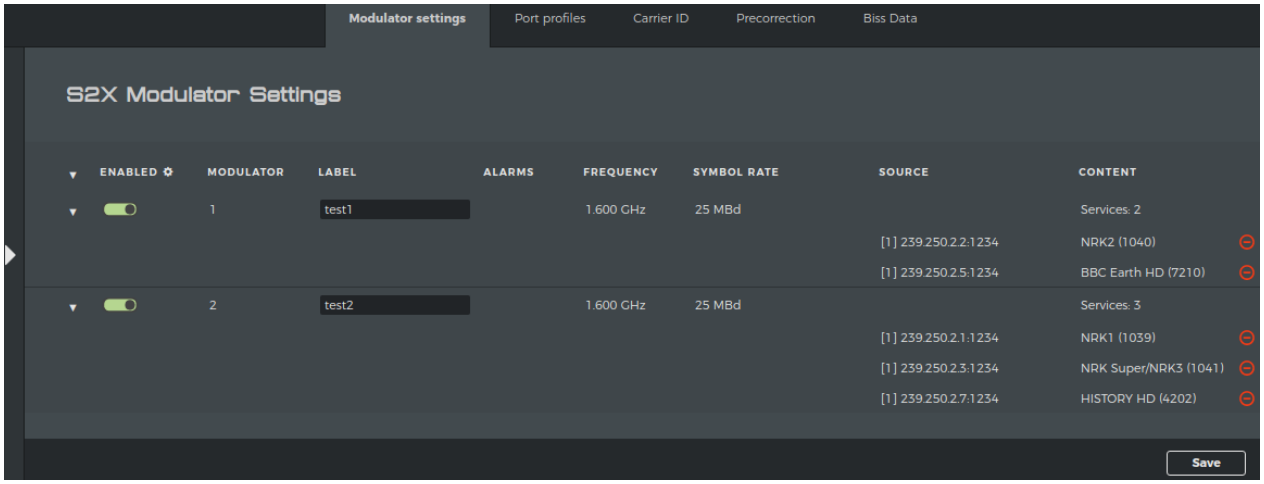
Parameter	Descripton
Label	Label of the Carrier ID profile
Settings	Operator information: Latitude, Longitude, Telephone, User Data

18.4 Precorrection

To define a Precorrection profile, select 'Precorrection' tab and expand the left pane with the arrow button. Select 'Output Mode' Linear Gain or Linear Group Delay.
The distortion specification is defined as coordinates in the edit pane on the right hand side. The entered coordinates are visualized in a graph for verification. Both types of precorrection are symmetric filters, hence the channel response only needs to be defined from the center frequency to the highest frequency component. The channel response can be defined independent of the actual bandwidth in use.



18.5 Modulator Settings



Parameter	Descripton
Enabled	Enable button lets the operator easily disable an output. The stream is still defined in the system, but the data stream is stopped and the RF output is muted.
Modulator	Physical RF port where the stream is being transmitted
Label	Label can be added during definition, and changed directly from the list view.
Alarms	Each output will get a red balloon in this column if an alarm that affects this output is raised.
Frequency	Carrier frequency of the RF signal
Symbol Rate	Symbol rate of the modulated signal
Source	Internal source of a service
Content	Service names and service IDs for mux content

18.6 Adding Outputs

To add a new output, expand the left pane in the 'Modulator settings' tab, select a source type and then select services to add. It is also possible to remove an existing service and add the new service in one operation by using button 'Replace Content'. To discard non-saved changes, close the application.

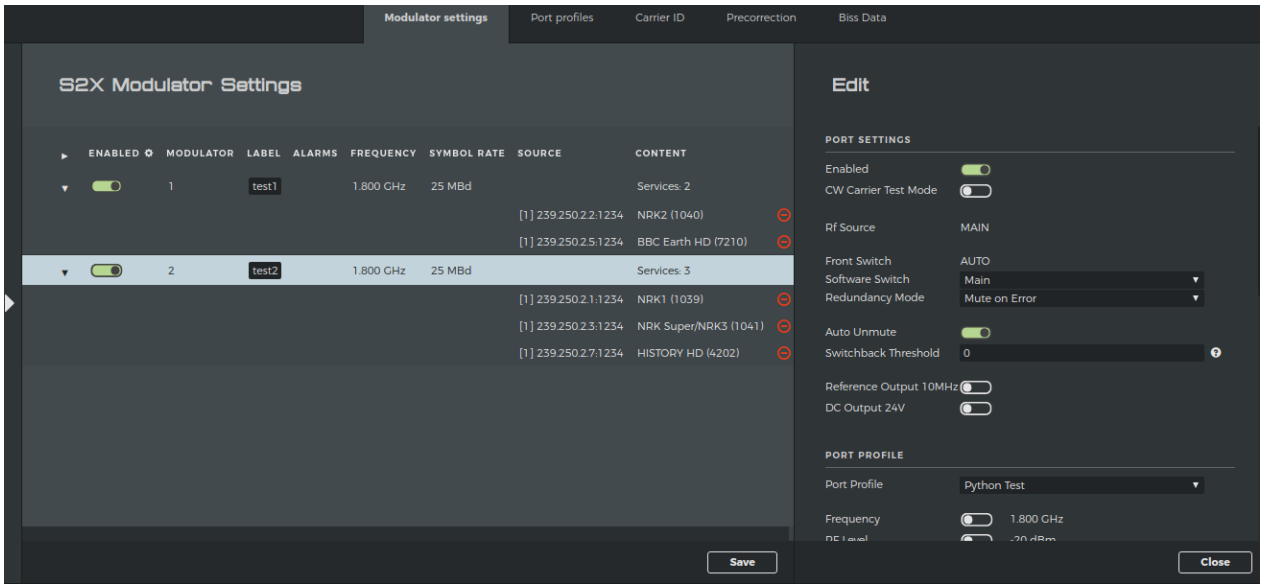
18.6.1 Source types

Parameter	Description
Service	All services known to the system will be listed. A source service of interest can be picked from the service list view.
TS	TS selector will show all MPEG/DVB transports known to the system. The source transport of interest can be selected from the list of transports in the source list view. When a TS source is mapped to an output the entire MPEG/DVB transport stream will be mapped.

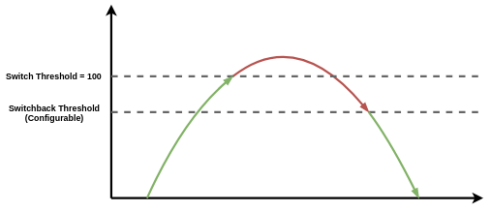
Parameter	Description
Auto-first	In some system configurations the input is not present at the time of configuration of the system. This is typically for VOD systems were the source is activated by the end user. For this scenario the system must be configured in the same way as a service mapping, only that the service to choose will be the first one that is detected on a source. When doing an auto-first mapping the output service ID is by default set to 1 and this value can be overwritten by changing the outgoing service ID in the edit output configuration dialog.

18.7 Edit Modulator Configuration

To change atributes of a Modulator, select a Modulator object and the 'Edit' dialog will appear on the right hand pane. Use multiselect to edit both modulator outputs simultaneously.

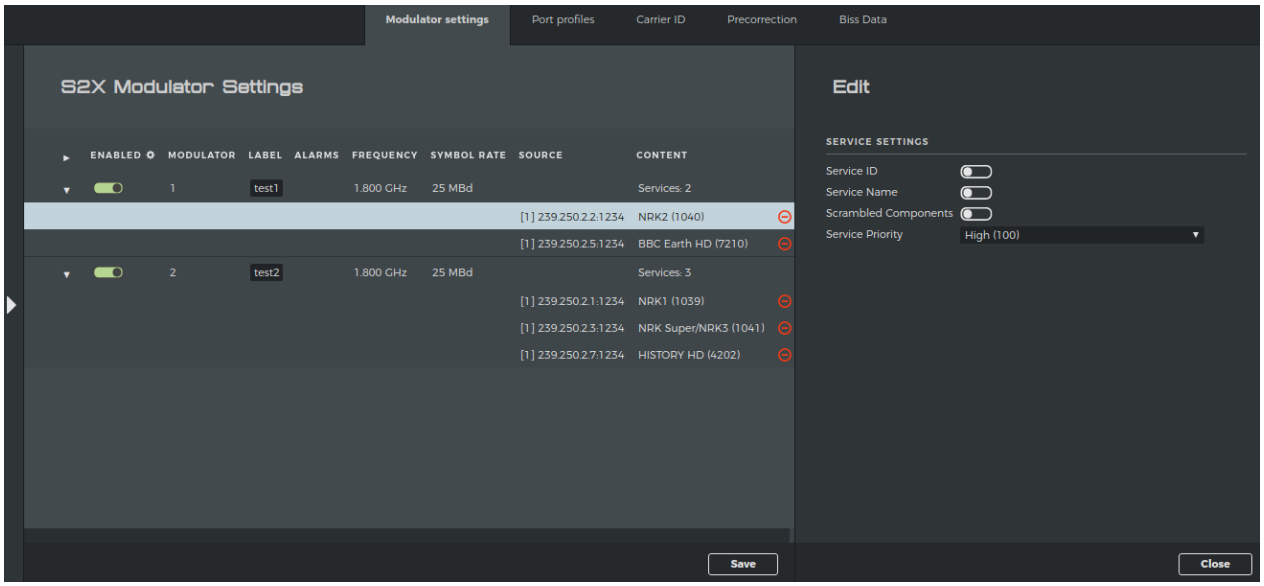


Parameter	Description
PORT SETTINGS	
Enabled	Enable/disable RF output
CW Carrier Test Mode	Enable Continuous Wave Carrier test mode to disable modulation and only output a single carrier wave.
RF Source	Status of the RF output active source **MAIN**: Output RF is generated on this module **BACKUP**: Input RF signal is routed from RF input **MUTE**: The RF output is muted
Front Switch	Position of the rotary switch on the front panel Up = **AUTO**: Redundancy switch is controled by the Software Switch Right = **MAIN**: Force Main Left = **BACKUP**: Force Backup Down = **MUTE**: Force Mute **FAILURE**: Indicates a failure in the rotary switch

Parameter	Description
Software Switch	Controlling redundancy switch from the software is only applicable if the Front Switch is in AUTO mode. Dropdown to select Software Switch mode: **Auto**: Depending on 'Redundancy Mode', the output will switch to backup or it will be muted **Main**: Force Main **Backup**: Force Backup **Mute**: Force Mute
Redundancy Mode	Only applicable if 'Software Switch' is in Auto mode. Select a mode: **Switch to Backup** **Mute on Error** Depending on the 'Redundancy Mode', the output will be switched to backup/muted when its accumulated 'failure index' is above Switch Threshold value (fixed at 100). Each failing service increases 'failure index' by a Service Priority value (see 'Service Priority' field below). Failing service can be no bitrate or any critical alarm on the service. Accumulated 'failure index' per output is a sum of all services failure index in the output. 
Backup Present Threshold	Applicable when Switch to Backup 'Redundancy Mode' is selected. Define RF level threshold for backup present detection.
Backup	Applicable when Switch to Backup 'Redundancy Mode' is selected. Backup present status. Status is Present if measured RF level of backup is higher than configured threshold.
Backup Port Level	Applicable when Switch to Backup 'Redundancy Mode' is selected. Status of current measured backup RF level.
Auto Switchback to Main	Applicable when Switch to Backup 'Redundancy Mode' is selected. When accumulated 'failure index' becomes less or equal to Switchback Threshold value, the output will switch back to Main.
Auto Unmute	Applicable when Mute on Error 'Redundancy Mode' is selected. When accumulated 'failure index' becomes less or equal to Switchback Threshold value, the output will be unmuted.
Switchback Threshold	Applicable if 'Software Switch' is in Auto mode. Set 'failure index' threshold of when the RF output shall switch from Backup to Main or when it shall be unmuted.
Reference Output 10MHz	Enable embedded 10MHz output that is synchronous to the modulated RF output.
DC Output 24V	Enable embedded 24V DC output.
PORT PROFILE	

Parameter	Description
Port Profile	Select a predefined Port Profile from the dropdown. The profiles are defined in the 'Port profiles' tab.
Port Profile overrides	Port Profile parameters that can be overridden are: Frequency, RF Level, Symbol Rate, System, Frame Length, Constellation and Code Rate. Enable a checkbox and enter new parameter value.
TS bitrate for config	Calculated TS bitrate for the current configuration. This status is updated immediately when configuration is changed without a need to save the configuration.
BITRATE STATUS	
TS bitrate	Current TS bitrate, including null packets
Effective bitrate	Current measured effective bitrate, not including null packets
TRANSPORT SETTINGS	
PSI Playout Mode	DVB or MPEG
TS ID	Define the TS ID
Scrambling Enabled	Enable embedded scrambling on the TS
Scrambling Method	Select scrambling method: Raw Fixed Key, BISS1 or BISS2. **Raw Fixed Key** encrypts the TS content with chosen CA algorithm and given Control Word without any PSI signaling. **BISS1** and **BISS2** are explained in the BISS chapter.
PID MAPPING	This option allows you to import any PID available from an input source to the output stream. The first step is to select an input port/service, click green plus button and then the required 'From' and 'To' PID values. This feature can be used to import PSI/SI PIDs (eg EIT, NIT) to the output stream. Note that any service component PID will not be signaled in the generated PAT/PMT.

Selecting a service will provide the following 'Edit' dialog.



Parameter	Description
Service ID	Override the output service ID
Service Name	Override the output service Name
Scrambled Components	Select what PID types to scramble: Audio Video Teletext, Audio Video, Video or None
Service Priority	Define the value to increase the 'failure index' when this service has a critical alarm or no bitrate. Set a value to None (0) to prevent switch to backup/mute when this service has issues. Possible values: High (100), Medium (50), Low (25), None (0)

18.8 Status of the front panel LEDs

Color	Description
Green	Auto mode, Main selected Front Switch = AUTO, Software Switch = Main
Green blink	Force Main Front Switch = MAIN
Blue	Auto mode, CPU dead or Backup selected Front Switch = AUTO, Software Switch = Backup
Blue blink	Force Backup Front Switch = BACKUP
Red	No output Front Switch = AUTO, Software Switch = Mute
Red blink	Force Mute Front Switch = MUTE
All colors blinking	Rotary switch failure

19 REDUNDANCY

Sencore offers an extensive toolkit of redundancy options which can serve a hybrid role and protect outgoing services against equipment failure and network failure; these are Input, Mute on Error, Monitor In + Out and OSPF Output Redundancy.

19.1 Input Redundancy

19.1.1 Basic requirements

The input redundancy enables the operator to select an one or more alternative sources which shall automatically be activated in case the main source fails.

Once the redundant sources are configured and the redundancy is enabled then the redundancy shall be activated for the respective output flow.

19.1.1.1 Input types supported.

The input redundancy covers all input types supported by the system in their respective mapping modes.

- MPEG/DVB/ATCS Service
- MPEG/DVB/ATSC Transport
- RTP

For and MPEG, DVB and ATSC output services the redundancy is configured per service, while transparent (TS) mappings this is configured per output multicast.

For RTP sources the input redundancy is able to switch to other RTP sources.

19.1.2 Redundancy behaviour

The redundancy supports reverting mode and when multiple backup sources are defined the system will try to use the one with higher priority, where the original source has the highest priority.

A redundancy switch will occur when a critical alarm is raised for an flow (chain from input to output). Additionally the output card also detects if the flow bitrates disappears from the backplane, and switches based on this.

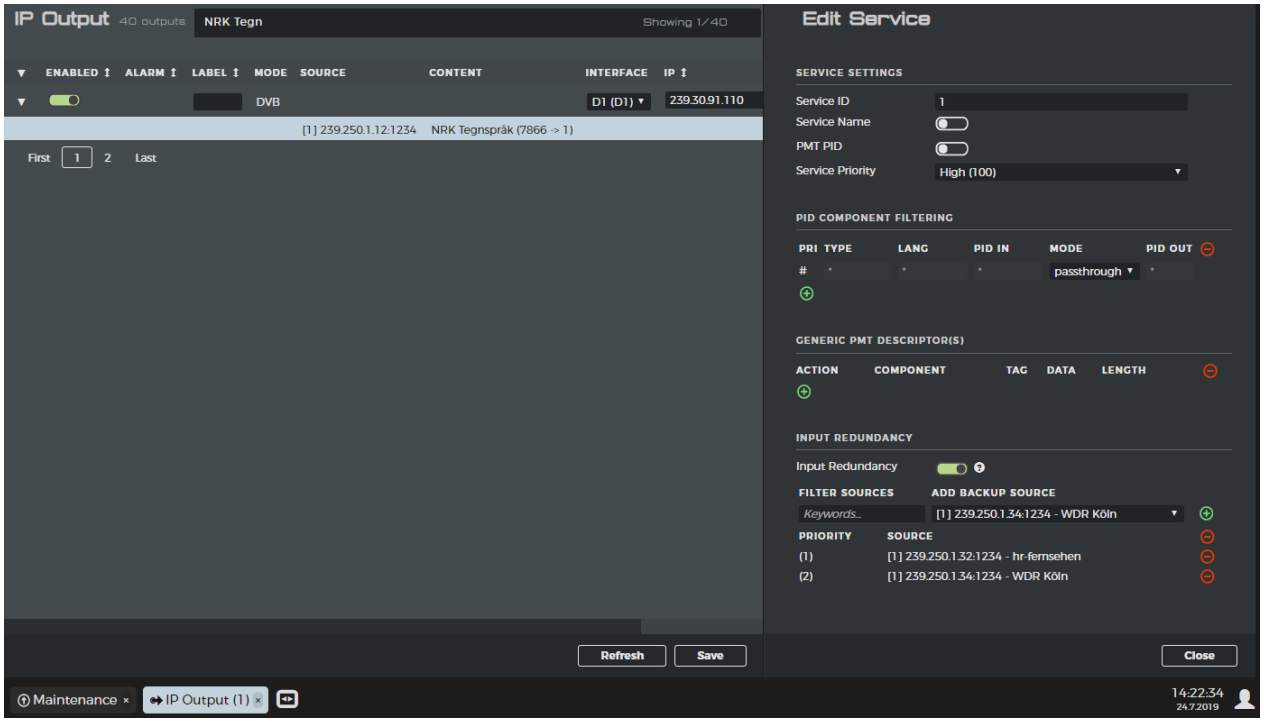
19.1.2.1 Combination with output redundancy systems

When multiple redundancy schemes are operating on the same flow the one closer to the source shall be attempted first. I.e the input redundancy shall try to resolve input problems before potentially mute the output.

19.1.3 Configuration

The input redundancy is handled by the IP output module. For a given output it is possible to add one or more alternative sources.

To configure backup sources go to the IP output configuration, and select an output service.



On the edit pane on the right hand side is the 'Input Redundancy' section and here you can enable and add one or more alternative sources. When adding services, these can be selected from any input or processing module and a search filed is provided for quick access to services.

19.2 Mute-On-Error

19.2.1 Description

The Mute-On-Error redundancy scheme ensures that defective output streams are stopped and not sent out of the chassis. This raises three important considerations;

- What granularity does Mute On Error act?
- How and what does Mute on Error monitor within the system to determine if there is a problem?
- Why can muting a failed output help and be beneficial within the overall system?

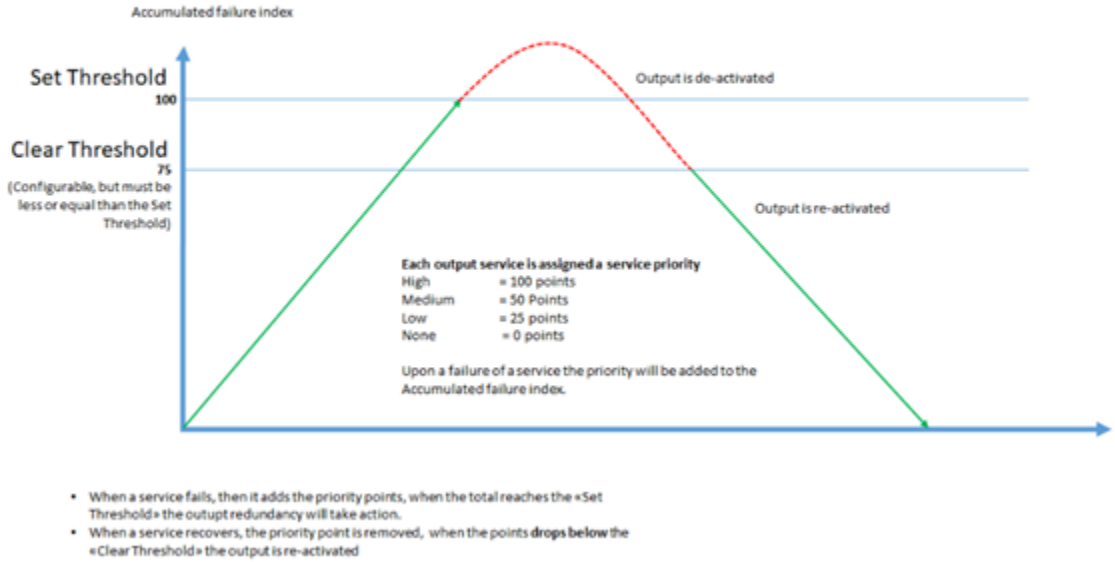
An optimal redundancy scheme should protect outputs at a level where the flow can be easily replaced by switching it to a backup. For example, within the IP domain this is typically a multicast or unicast flow and this is exactly the level at which the Mute on Error redundancy process operates.

The Mute on Error feature is about muting output flows that have issues, such as having missing services because they have failed to be delivered on input. The reason for wishing to mute defective outputs in this way is to enable simple but fast acting downstream redundancy protection mechanisms to act, placing the intelligence to drive them within the Sencore chassis domain. Mute on Error uses the comprehensive Sencore monitoring and alarms infrastructure within the chassis to identify issues. When these occur, stopping the output enables simple IP packet detection systems to act and cause a fast redundancy changeover.

Each protected IP flow could contain a single service (SPTS) or multiple services (MTPS). This means that you may wish the entire IP output flow containing an MPTS of several services to become disabled if only a single service is missing, or you may wish to trigger only if all are absent. Clearly, a degree of user configurability is required. On the DMG 4x00 platform, Sencore offers a refined system allowing each service in the MPTS to be assigned a priority. This means a high priority service could be set to 100, where as a low priority service might be set to say 25.

Mute on error will trigger when a service or services go missing from the MPTS with an aggregated priority of 100 or more. In the example above, the loss of just one high priority service will trigger Mute

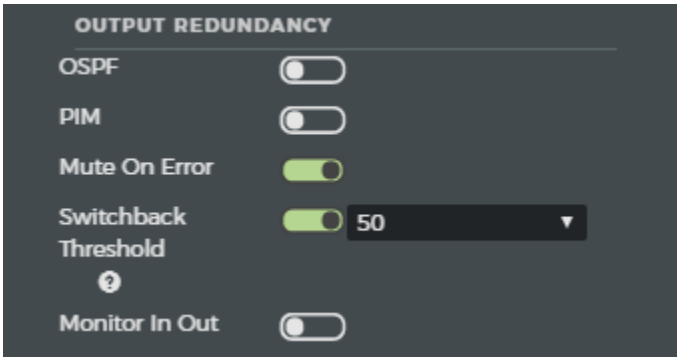
on Error where as four or more low priority services (25) would have to go missing to reach the threshold point of 100 and trigger redundancy protection. The threshold concept has been illustrated below;



Note that the restoration of normal service, or Switchback Threshold, is also based on the priority threshold mechanism and is user definable.

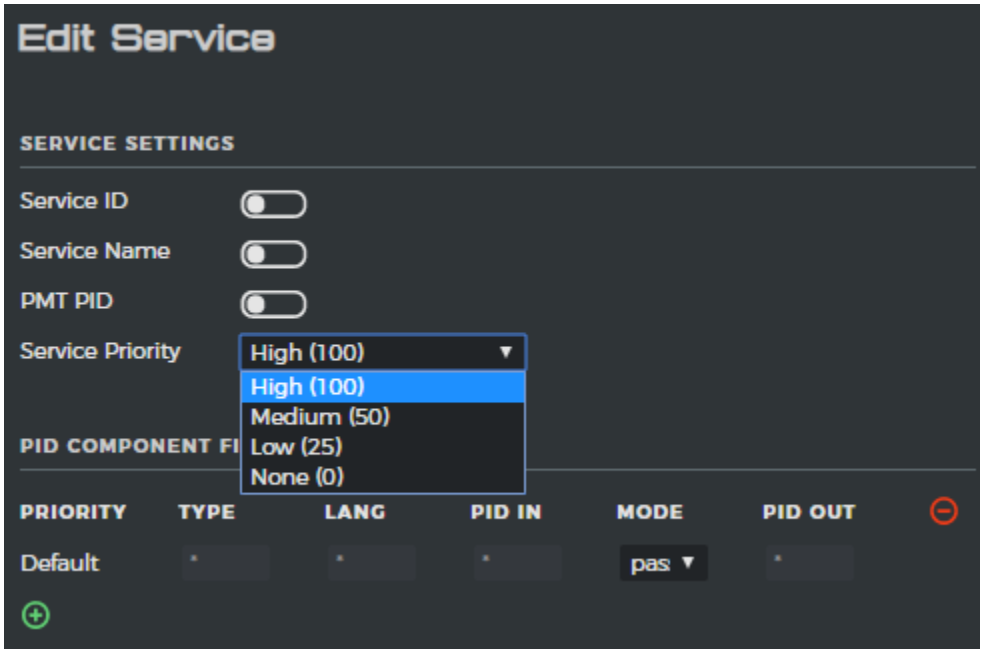
19.2.2 Configuration

Mute on Error setting are per output port and configured on the Interface page of the respective module. For the IP output module the following parameters are available:



With Mute on Error enabled on the port, all IP output flows will be monitored and muted individually should a problem be detected.

The priority value for output services are available to be configured per output service:



The Mute on Error feature is triggered by the chassis alarms system which is aware of the status of each service. If a critical alarm is raised against a service or its components, or the services is not received into the output module then Mute on Error will stop the affected flow so that no packets are output. An alarm will be raise to identify that this has happened.

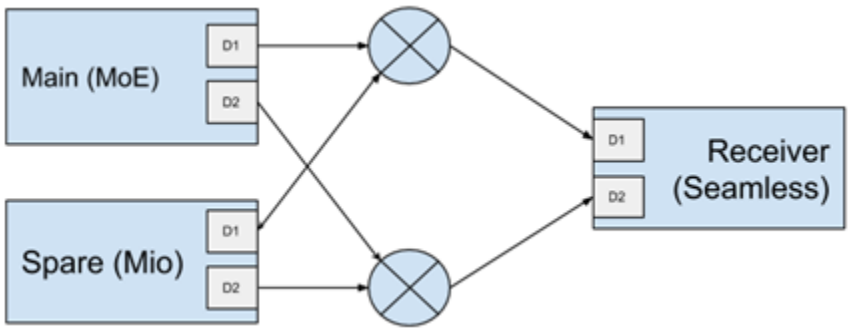
Although switch times vary depending on the state of the chassis and the nature of the alarm causing the triggering, Mute on Error can be expected to act within 500ms.

When using Mute on Error, extra care should be taken in cloned output mode to ensure that both ports have Mute on Error set (if required). Although it is permitted to have a different Mute on Error setting on a cloned output port pair, it is unusual to require this and so a WARNING alarm will be raised whenever this combination is set.

19.3 Monitor In + Out

19.3.1 Description

Monitor In + Out (MIO) is a simple and convenient way to implement a 1+1 active/passive redundancy configuration between chassis, or even a single chassis fitted with 1+1 redundant management modules. The Monitor In + Out redundancy is designed to work together with the Mute on Error redundancy.



The diagram shows a main and backup chassis providing IP flows over a redundant distribution network.

As shown on the diagram, the Main chassis is configured in a standard way; the only feature it has enabled is Mute on Error. In this example it is configured in cloned output mode to derive two coherent

output flows destined to feed the A and B networks. Mute on Error must be enabled on both output ports so any failures cause the affected IP flows to be muted on both.

The spare chassis is configured with Monitor In + Out and have its output ports connected to the distribution network. Its output port will also be configured identically to the main chassis, so it provides an identical and duplicate set of output multicasts.

This control is implemented as follows;

- The output flows from port A of the main chassis are presented to the network and port A of the backup chassis (for input and monitoring).
- The output flows from port B of the main chassis are presented to the network
- The monitoring chassis is placed in Monitor in + Out mode, which is selected by port.

When Monitor In + Out is set, it monitors the input port to see if all of the configured output multicasts are being sent by the Main chassis. If they are, all of the output flows from the Backup chassis will be muted. If a flow disappears from main chassis port A, triggered by Mute on Error or a chassis / network failure, it will not be received on the Backup chassis port B and will cause the backup chassis to lift the mute for this flow and output it instead.

Sencore has made Monitor In + Out easy to configure since when a stream is defined and added to the output of the backup chassis, it will simultaneously join the same IP on the monitoring port (to monitor the expected flow from the main unit). The switching logic is also simple, and is based on the rule:

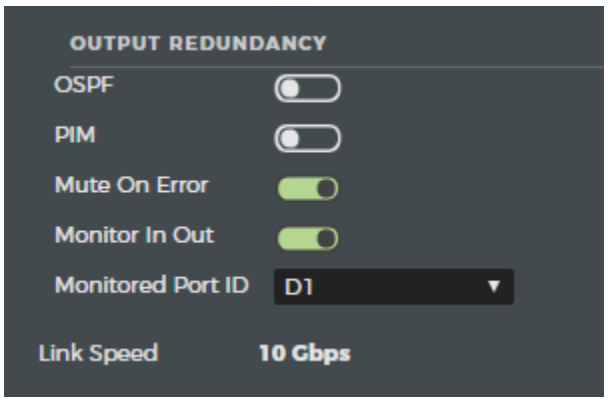
“If bitrate is present on the monitoring port, then mute the output, else activate the output”.

When MIO activates a flow, the following alarm syntax is raised to advise the operator;

“Output <output name/label> activated, no bitrate on monitoring source.”

19.3.2 Configuration

The configuration for Monitor In + Out is done per port on the output interface configuration:



This function should be enabled on the interface with the output multicasts configured and the monitor port configured to the port which can receive the multicasts from the Main unit.

19.4 OSPF Output Redundancy

The Sencore “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.

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.

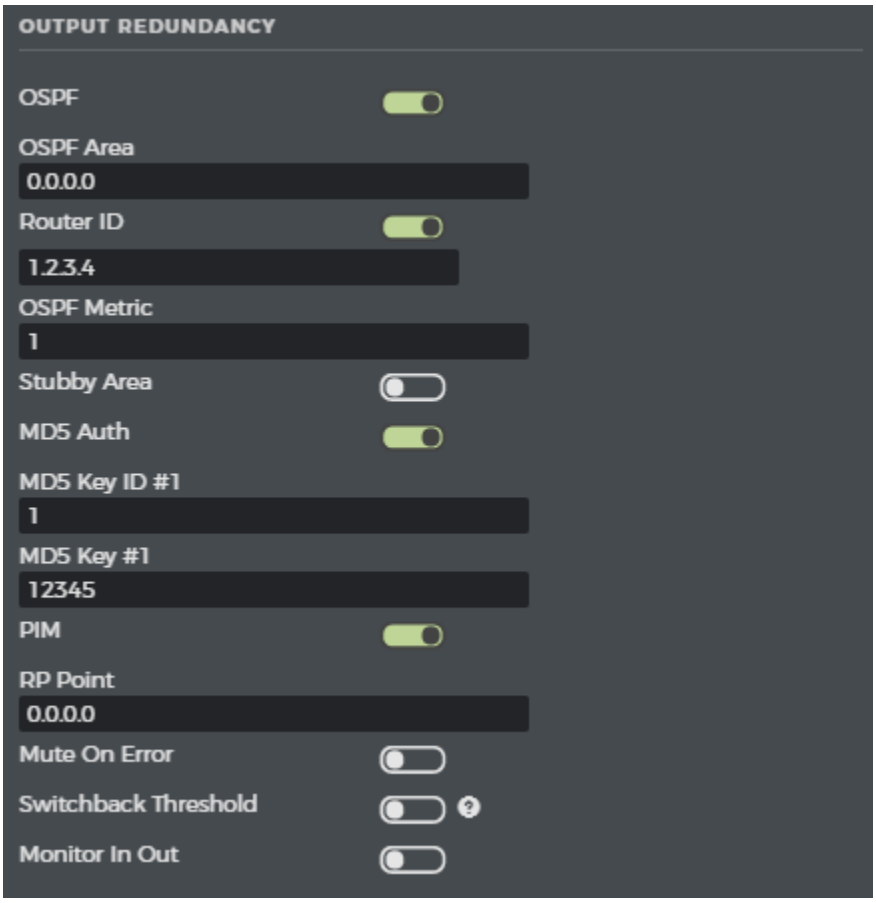
A typical scenario is to broadcast a Digital TV service from two locations using the same multicast destination address. The network is designed to route only one copy of the multicast stream to the receiver. In case of a source failure, with IP output redundancy implemented, the network should automatically 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 IP port, and the per stream settings applied on a particular output.

19.4.1 Port Configuration

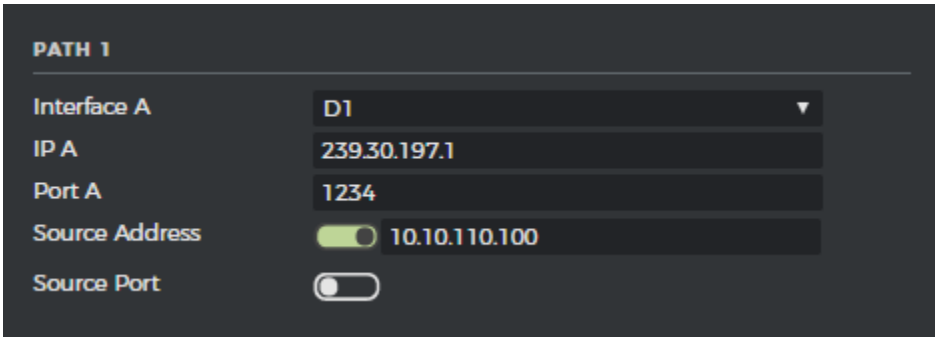
The configuration for OSPF Output Redundancy is done per port and available on the 'Network' application.



Parameter	Description
Enable OSPF	Enables OSPF routing. Checking this box allows the following parameters to be configured: • OSPF Area • MD5 OSPF Authentication • 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
Router ID	If enabled, uses the specified Router ID. If disabled, the local IP interface will be used
OSPF Metric	Defines the cost of this route in the network
Stubby Area	Enable this option if the output is connected to a stubby network
MD5 OSPF Authentication	Check to enable MD5 OSPF authentication. Required fields: • Key Id – secret keyword version • Key – secret keyword
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 ATV PIM DR is signalling its own multicasts only; hence other sources on the same network will be time out and become unavailable.
RP Point	RP Point – Rendezvous point

19.4.2 Stream Configuration

In order for OSPF source redundancy to work, both the main and backup streams are required to have the same Source IP address. This can be edited on the output IP multicast parameters.



This can either be specified per multicast, or per group of multicasts. The benefit of specifying a unique source IP address per multicast is that this will enable per-multicast switching, whereas using the same Source IP for a group of multicasts will require that all in the group must have a redundancy trigger before the output is disabled.

20 BISS

20.1 BISS overview

BISS (Basic Interoperable Scrambling System) is a satellite scrambling system, an open platform encryption system that does not require any third-party integration.

Technical spesification describing BISS is Tech 3292, published by the EBU (European Broadcasting Union).

There are two BISS versions:
- BISS-1 (EBU Tech 3292, rev. 2, 2012)
- BISS-2 (EBU Tech 3292, rev. 3, 2018; supplement 1, EBU Tech 3292-s1, rev. 3, 2018)

There are four different modes of BISS:
- **Mode 0**: No TS scrambling is applied.
- **Mode 1**: Encrypts the TS content with a fixed key, but does not encrypt the Session Word (which is a representation of the key / control word). The Session Word is transferred out-of-band from sender to receiver.
- **Mode E**: Encrypts the TS content with a fixed key and then encrypts the Session Word with a Session ID defined by a receiver. The encryption is done for each receiver. The appropriate Encrypted Session Word is transferred out-of-band from sender to the receiver.
- **Mode CA**: Only exists for BISS-2. TS content is scrambled with a constantly changing Session Word. The Session Word is encrypted with a Session Key. The Session Key is encrypted for each receiver. Both encrypted Session Word and encrypted Session Key are included in the TS stream. Using asymmetric RSA keys, only a given set of receivers are able to decrypt the Session Key, Session Word and the TS content.

The table bellow summarizes different modes for each BISS version.

Mode	Description	BISS-1	BISS-2
Mode 0	TS scrambling: **No**	In clear	In clear
Mode 1	TS scrambling: **Yes** Session Word: **In clear**	DVB-CSA1	DVB-CISSA
Mode E	TS scrambling: **Yes** Session Word: **Encrypted** Session Key: **Fixed**	DVB-CSA1 DES	DVB-CISSA AES-128
Mode CA	TS scrambling: **Yes** Session Word: **Encrypted** Session Key: **Fixed**		DVB-CISSA AES-128 RSA-2048

Mode CA is not supported yet.

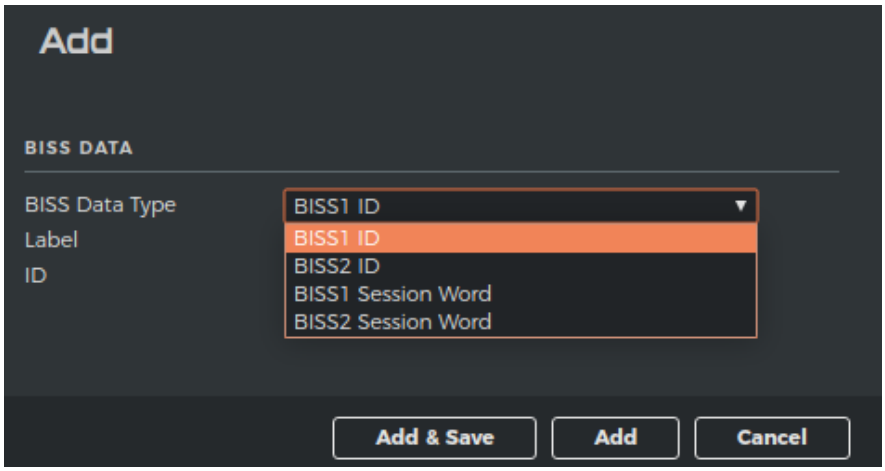
20.2 Adding Biss Data

The term 'Biss Data' is used to collectively refer to Session IDs, Session Words and Encrypted Session Words. Select 'Biss Data' tab and add Biss Data.

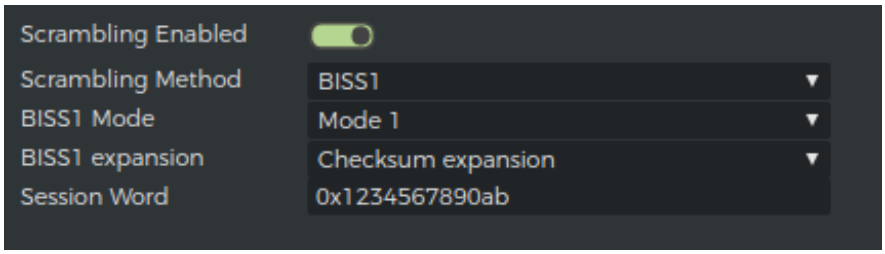
Creating 'Biss Data' is required for **Mode E**.

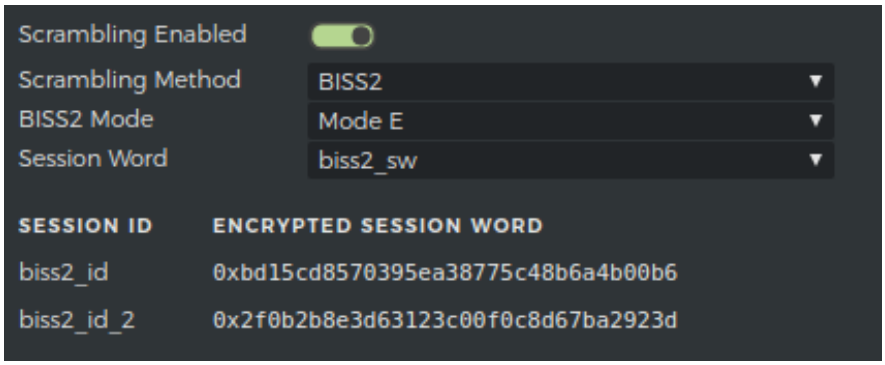
20.2.1 Scrambling

Biss Data	Description
BISS Data Type	**BISS1 ID**: BISS version 1 Identifier, **56-bit** hex value **BISS2 ID**: BISS version 2 Identifier, **128-bit** hex value **BISS1 Session Word**: BISS version 1 Session Word, **48-bit** hex value **BISS2 Session Word**: BISS version 2 Session Word, **128-bit** hex value
Label	Label of BISS Data
ID	Hexadecimal value of appropriate length depending on 'BISS Data Type'



20.2.1.1 Scrambling Settings





Parameter	Description
Scrambling Enabled	Select to enable scrambling
Scrambling Method	Select method: Raw Fixed Key, BISS1 or BISS2.

Following table lists fields available depending on chosen BISS version and BISS mode.

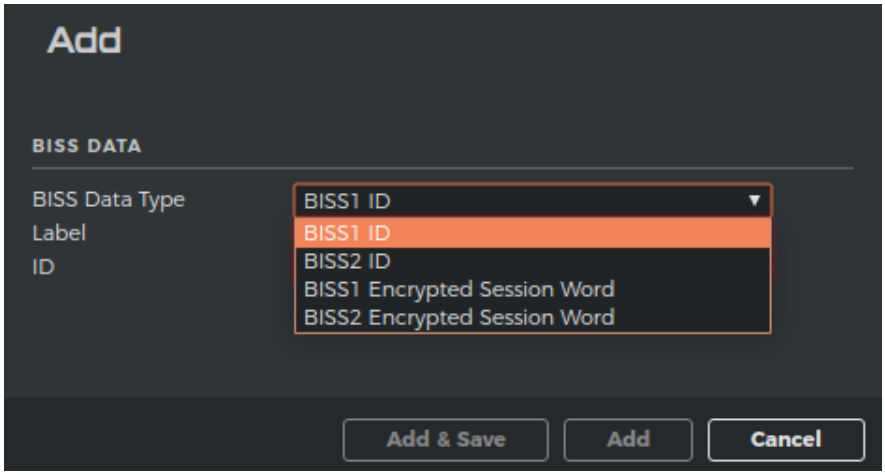
Mode	BISS1	BISS2
Mode 1	BISS expansion Session Word	Session Word
Mode E	BISS expansion Session Word	Session Word

BISS expansion is method of CSA Key Expansion from 48 to 64 bit.
- **Checksum expansion**: Session Word is expanded using checksum
- **Zero expansion**: Session Word is expanded using zeros

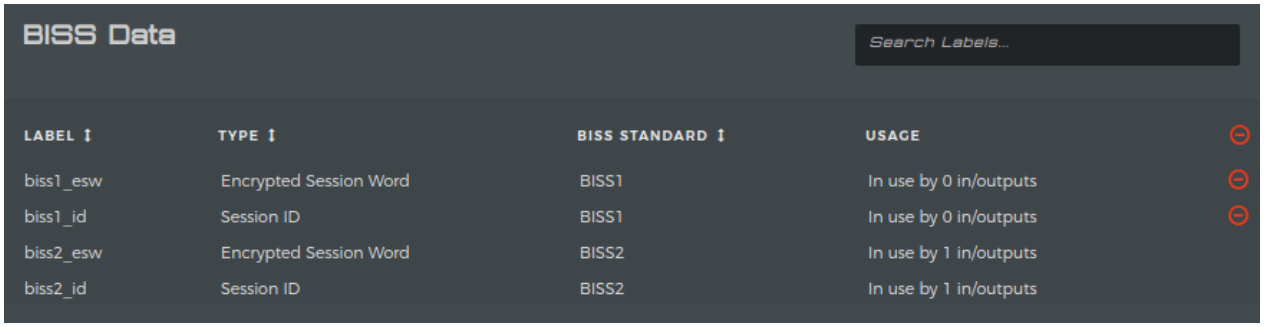
Each receiver defines Session ID visible to the sender. **Session Word** in Mode E is encrypted by Session IDs defined by receivers. Encrypted Session Words are listed below Scrambling Settings. Each Encrypted Session Word is visible to the appropriate receiver (the one with Session ID used to encrypt the Session Word).

20.2.2 Descrambling

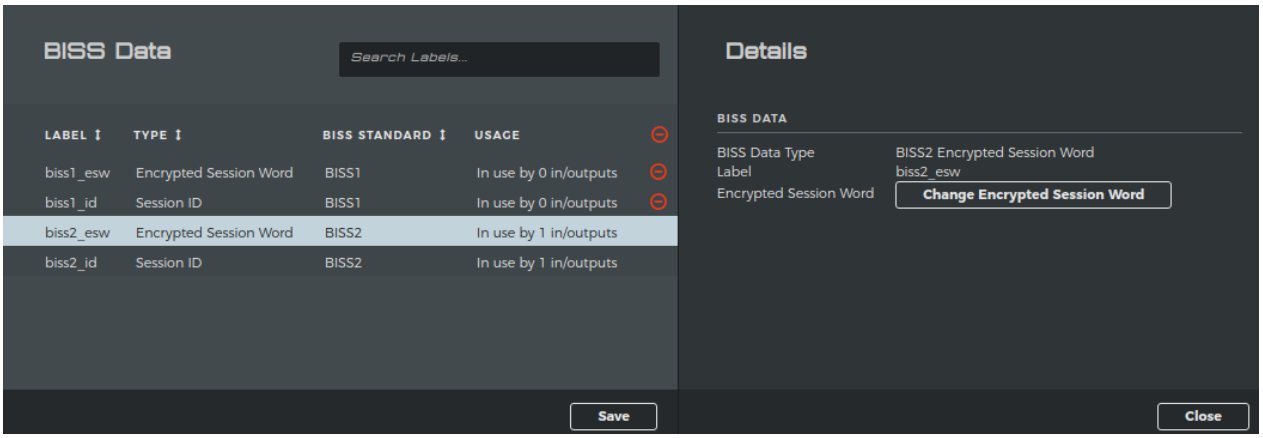
Biss Data	Description
BISS Data Type	**BISS1 ID**: BISS version 1 Identifier, **56-bit** hex value **BISS2 ID**: BISS version 2 Identifier, **128-bit** hex value **BISS1 Encrypted Session Word**: BISS version 1 Encrypted Session Word, **64-bit** hex value **BISS2 Encrypted Session Word**: BISS version 2 Encrypted Session Word, **128-bit** hex value
Label	Label of BISS Data
ID	Hexadecimal value of appropriate length depending on 'BISS Data Type'



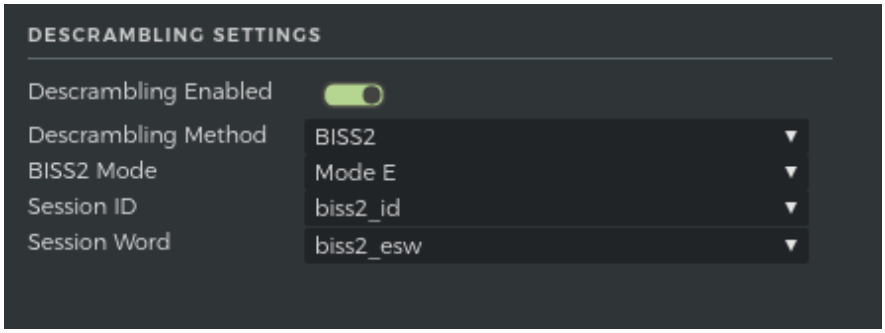
'BISS Data' tab gives overview off all BISS Data created and their usage.



By selecting one of the Biss Data it is possible to change Session ID, Session Word or Encrypted Session Word.



20.2.2.1 Descrambling Settings



Parameter	Description
Descrambling Enabled	Select to enable descrambling
Descrambling Method	Select method: Raw Fixed Key, BISS1 or BISS2.

Following table lists fields available depending on chosen BISS version and BISS mode.

Mode	BISS1	BISS2
Mode 1	BISS expansion Session Word	Session Word
Mode E	BISS expansion Session ID Session Word is Encrypted Session Word	Session ID Session Word is Encrypted Session Word

BISS expansion is method of CSA Key Expansion from 48 to 64 bit.
- **Checksum expansion**: Session Word is expanded using checksum
- **Zero expansion**: Session Word is expanded using zeros

Session ID is defined by the receiver and sent to the sender. Sender encrypts Session Word with Session ID and Encrypted Session Word sends to the receiver.