MRD 7000
Receiver Decoder Software

User Manual

About Sencore

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

Revision History

Date	Version	Description	Author
09/11/17	0.1	First Draft	JDF
09/14/17	0.2	Revisions	JDF
09/15/17	1.0	Initial Release	JDF
11/03/17	1.1	Feature Release	JDF
01/03/18	1.2	Feature Release	ACD
04/20/18	1.3	Feature Release	ACD
5/21/19	1.4	Feature Release	BRW
3/10/2019	1.5	Feature Release	JF

Safety Instructions

- Read these instructions
- Keep these instructions
- Heed all warnings
- Follow all instructions
- Do not use this apparatus near water
- Clean only with dry cloth
- Do not block any ventilation openings. Install in accordance with the manufacturer's instructions
- Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat
- Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
- Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
- Only use attachments/accessories specified by the manufacturer.
- Unplug this apparatus during lightning storms or when unused for long periods of time.
- Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
- Do not expose this apparatus to dripping or splashing and ensure that no objects filled with liquids, such as vases, are placed on the apparatus.
- To completely disconnect this apparatus from the AC Mains, disconnect the power supply cord plug from the AC receptacle.
- The mains plug of the power supply cord shall remain readily operable.
- **Damage Requiring Service**: Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:
    - When the power-supply cord or plug is damaged.
    - If liquid has been spilled, or objects have fallen into the product.
    - If the product has been exposed to rain or water.
    - If the product does not operate normally by following the operating instructions. Adjust only those controls that are covered by the operating instructions as an improper adjustment of the controls may result in damage and will often require extensive work by a qualified technician to restore the product to its normal operation.
    - If the product has been dropped or damaged in any way.
    - The product exhibits a distinct change in performance.
- **Replacement Parts**: When replacement parts are required, be sure the service technician uses replacement parts specified by Sencore, or parts having the same operating characteristics as the original parts. Unauthorized part substitutions made may result in fire, electric shock or other hazards.

SAFETY PRECAUTIONS

There is always a danger present when using electronic equipment.

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

- Every precaution has been taken in the design of your product to ensure that it is as safe as possible. However, safe operation depends on you the operator.
- Always be sure your equipment is in good working order. Ensure that all points of connection are secure to the chassis and that protective covers are in place and secured with fasteners.
- Never work alone when working in hazardous conditions. Always have another person close by in case of an accident.
- Always refer to the manual for safe operation. If you have a question about the application or operation email ProCare@Sencore.com
- WARNING – To reduce the risk of fire or electrical shock never allow your equipment to be exposed to water, rain or high moisture environments. If exposed to a liquid, remove power safely (at the breaker) and send your equipment to be serviced by a qualified technician.
- To reduce the risk of shock the power supply must be connected to a mains socket outlet with a protective earthing connection.
- For the mains plug the main disconnect and should remain readily accessible and operable at all times.
- When utilizing DC power supply, the power supply MUST be used in conjunction with an over-current protective device rated at 50 V, 5 A, type: Slow-blo, as part of battery-supply circuit.
- To reduce the risk of shock and damage to equipment, it is recommended to ground the unit to the installation's rack, the vehicle's chassis, the battery's negative terminal, and/or earth ground.

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

Package Contents

The following is a list of the items that are included:

1. MRD 7000 Chassis
2. MRD 7000 Software
3. AC Power Cable
4. Breakout or Adapter Cables Depending on Option Modules
5. Quick Start Guide

If any of these items were omitted from the packaging please email ProCare@Sencore.com to obtain a replacement.

Table of Contents

Section 1 Overview

Introduction

This section includes the following topics:

1.1 Product Introduction

The new MRD 7000 is designed to be agile, supporting new codecs and video formats through software-based updates versus traditional fixed ASIC hardware design.

The MRD 7000 maintains Sencore's long tradition of ease of use, with a straight-forward web interface accessible via all major browsers and complete control of the unit.

Support video codecs included HEVC, H.264, MPEG2 and JPEG2000.

Output resolutions and formats include 4K and HD applications with 12G-SDI, 6G-SDI, Quad 3G-SDI, 3G-SDI, HDMI 2.0a and SMPTE 2110 support.

Every MRD 7000 ships with the software suite pre-loaded on appropriate hardware. There are optional output configurations that will change the physical connectors available on the back of the chassis.

Input Capabilites:

- ✓ 4x ASI
- ✓ 2x RJ45 GigE Ethernet Ports
  - ✓ UDP/RTP MPEG-IP Transport Streams
  - ✓ Unicast
  - ✓ Multicast
  - ✓ SMPTE 2022-7 hitless switching
  - ✓ FEC
- ✓ SRT Input
- ✓ File Input Playback
  - ✓ .ts and .trp transport stream files

Supported Codecs:

- ✓ HEVC/H.265
- ✓ MPEG-4/H.264
- ✓ MPEG-2
- ✓ JPEG 2000

Output Options:

- ✓ HDMI 2.0 up to 4Kp60
- ✓ QUAD 3G-SDI for UHD outputs
- ✓ Single-Link
  - HD-SDI up to 1080i59.94
  - 3G-SDI up to 1080p60
  - 12G-SDI up to 4Kp60
- ✓ SMPTE 2110
  - Dual 25GB SFP28 up to 4Kp60
  - Dual 10GB SFP up to 1080p60
  - Redundant outputs for hitless switching of downstream devices

Power Supply:

- ✓ 120/240V Switching Power Supplies
- ✓ Redundant power design utilizing two independent cables

1.2 Front Panel Overview

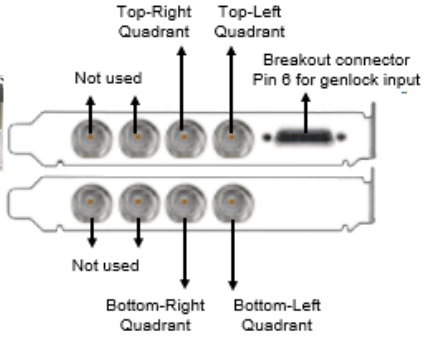
The MRD 7000 product is a software-based solution; designed to run on a PC server chassis. Initial network configuration is done with keyboard, monitor, and mouse. Once the IP is configured all operation and setup is via web-interface over a network.

To obtain the associated documentation from the server manufacturer or detailed information regarding front of chassis indicator lights email ProCare@Sencore.com

1.3 Rear Panel Overview

The MRD 7000 server has multiple options for the backplane configuration. Both options include dual network ports on the motherboard. Either port can be used to access the web-interface or send and receive MPEG/IP.

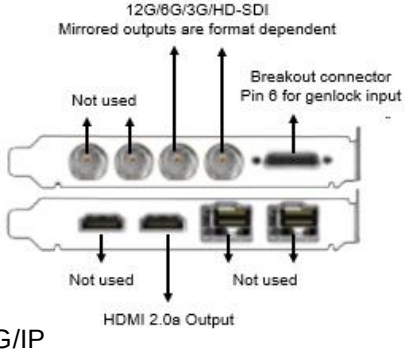
For QUAD-3G (4x BNC cables to carry one video format such as 4K)



1. Breakout connector used for Genlock Input (requires breakout cable)
2. Top-left quadrant in Quad Link Mode or
   12G/6G/3G/HD-SDI w/ audio in Single Link Mode
3. Top-right quadrant of 4K image (or single link copy w/out audio)
4. Bottom-left quadrant of 4K image (or single link copy w/out audio)
5. Bottom-right quadrant of 4K image (or single link copy w/out audio)
6. Eth0: One of two available RJ45 Ethernet ports for management or MPEG/IP
7. Eth1: One of two available RJ45 Ethernet ports for management or MPEG/IP
8. Local monitor output uses VGA (D-SUB) connector
9. Redundant power supplies (120/240 AC Switching PS)

VGA and keyboard are only used for setting the network configuration; operation of the device is performed through the web interface

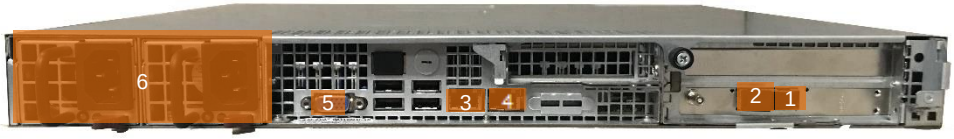
For Single-Link SDI and HDMI 2.0 4K Playback



1. Breakout connector used for Genlock Input (requires breakout cable)
2. 2x BNC ports for mirrored 12G/6G/3G/HD-SDI w/ embedded audio
3. HDMI 2.0 for up to 4K resolutions
4. Eth0: One of two available RJ45 Ethernet ports for management or MPEG/IP
5. Eth1: One of two available RJ45 Ethernet ports for management or MPEG/IP
6. Local monitor output uses VGA (D-SUB) connector
7. Redundant power supplies (120/240 AC Switching PS)

VGA and keyboard are only used for setting the network configuration; operation of the device is performed through the web interface

For SMPTE 2110 Playback



1. Data Path A: One of two SFP ports for SMPTE 2110 uncompressed video over IP
2. Data Path B: One of two SFP ports for SMPTE 2110 uncompressed video over IP
3. Eth0: One of two available RJ45 Ethernet ports for management or MPEG/IP
4. Eth1: One of two available RJ45 Ethernet ports for management or MPEG/IP
5. Local monitor output uses VGA (D-SUB) connector
6. Redundant power supplies (120/240 AC Switching PS)

VGA and keyboard are only used for setting the network configuration; operation of the device is performed through the web interface

For 12-G SDI and HDMI 2.0b Playback

1. SDI port 1 for 12G HD-SDI w/ embedded audio
2. SDI port 2 for 12G HD-SDI w/ embedded audio
3. Bi-level and tri-level genlock input port
4. Eth0: One of two available RJ45 Ethernet ports for management or MPEG/IP
5. Eth1: One of two available RJ45 Ethernet ports for management or MPEG/IP
6. Local monitor output uses VGA (D-SUB) connector
7. Redundant power supplies (120/240 AC Switching PS)

VGA and keyboard are only used for setting the network configuration; operation of the device is performed through the web interface

For Quad 3-G SDI Playback and Genlock

1. ASI or SD/HD/3G-SDI w/ embedded audio. Quadrants labeled 1 through 4
2. Bi-level and tri-level genlock input port
3. Eth0: One of two available RJ45 Ethernet ports for management of MPEG/IP
4. Eth1: One of two available RJ45 Ethernet ports for management or MPEG/IP
5. Local monitor output uses VGA (D-SUB) connector
6. Redundant power supplies (120/240 AC Switching PS)

For Decoding 4xASI Input

1. 4x ASI input ports. ASI ports labeled 1 through 4
2. Local monitor output uses VHA (D-SUB) connector
3. Eth0: One of two availabler RJ45 Ethernet Ports for management of MPEG/IP
4. Eth1: One of two available RJ45 Ethernet ports for management or MPEG/IP
5. Redundant power supplies (120/240 AC Switching PS)

VGA and keyboard are only used for setting the network configuration; operation of the device is performed through the web interface

Section 2 Installation

Introduction

This section includes the following topics:

2.1 Rack Installation

The MRD 7000 software product runs on Supermicro brand hardware. Please consult the Supermicro 1028R-WMR(T) Revision 1.0b user manual for complete detail on the rack installation and power cable connections.

https://www.supermicro.com/manuals/superserver/1U/MNL-1723.pdf

2.2 AC Dual Redundant Power Connections

The Dual Redundant option allows the MRD to be powered by two separate supplies either operating 120V or 240V systems. The power supply will automatically detect the system it is connected to. To hook up the power use the following steps:

1. Locate the AC power cords that are included.
2. Plug the female end of the power cords (end with no prongs) into the back of the unit.
3. Locate a protected outlet (usually inside of the rack) to plug the male ends of the power cables into.

2.3 Maintenance

Refer to the server manufacturer documentation for detailed information regarding server hardware maintenance.

To request a copy of the latest MRD software or release notes from Sencore email ProCare@Sencore.com

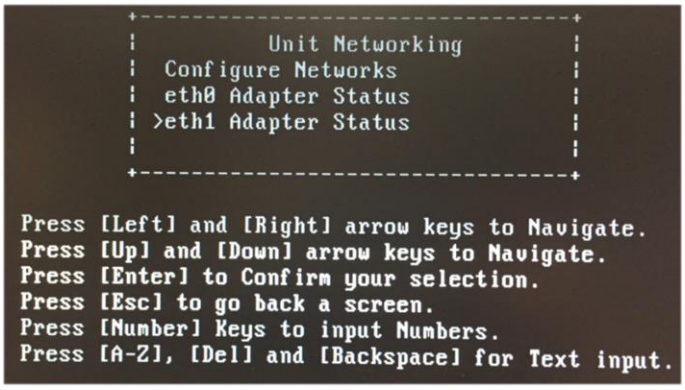
2.4 Network Setup via KVM

Connect the VGA (D-SUB) cable to a monitor and a USB keyboard.

The VGA will display the current ethernet settings and provide a text-based menu to configure IP addressing, Subnet Mask, Gateway, and DNS settings.

Sencore recommends configuring the Eth0 port (Leftmost NIC when facing the rear of the unit) be set to a static IP for web-interface access. Ensure the user machine is also on the same network.

For additional information on initial network configuration menu see the Sencore MRD 7000 Quick-Guide documentation.



Section 3 Web-Interface Operation

Introduction

This section includes the following topics:

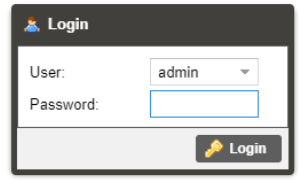
3.1 MRD 7000 Web Interface Overview

3.1.1 Logging into the MRD Web Interface

To open the MRD 70000 web interface use one of the following supported browsers and navigate to the unit's IP address:

- Internet Explorer 7 & above
- Firefox 3.5 & above
- Google Chrome
- Microsoft Edge

The user will need to login to the web interface. By default, the admin user account is available without a password. Press the login button in order to login to the web interface.



Default Credentials

Username: admin

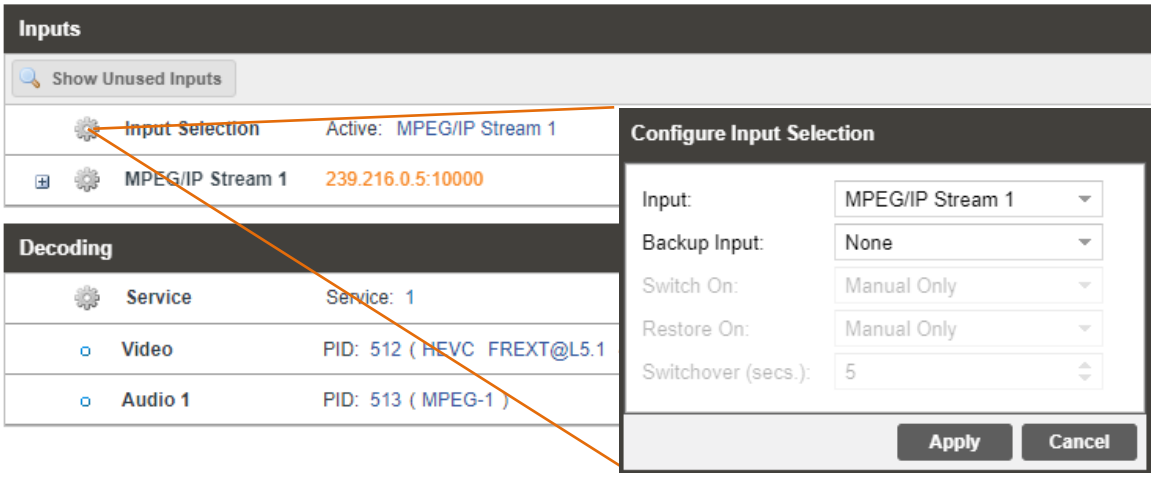
Password: (none / leave blank)

3.1.2 Hiding Unused Inputs

The MRD 7000 web interface allows the user to hide inactive inputs using the Hide Unused Inputs button or show all available inputs by click the Show Unused Inputs button. Only the selected input will be displayed when unused inputs are hidden.

3.1.3 Buttons and Status Indicators

When the icon is shown user configuration is available. Clicking this button will open configuration menus where settings can be changed by the user.



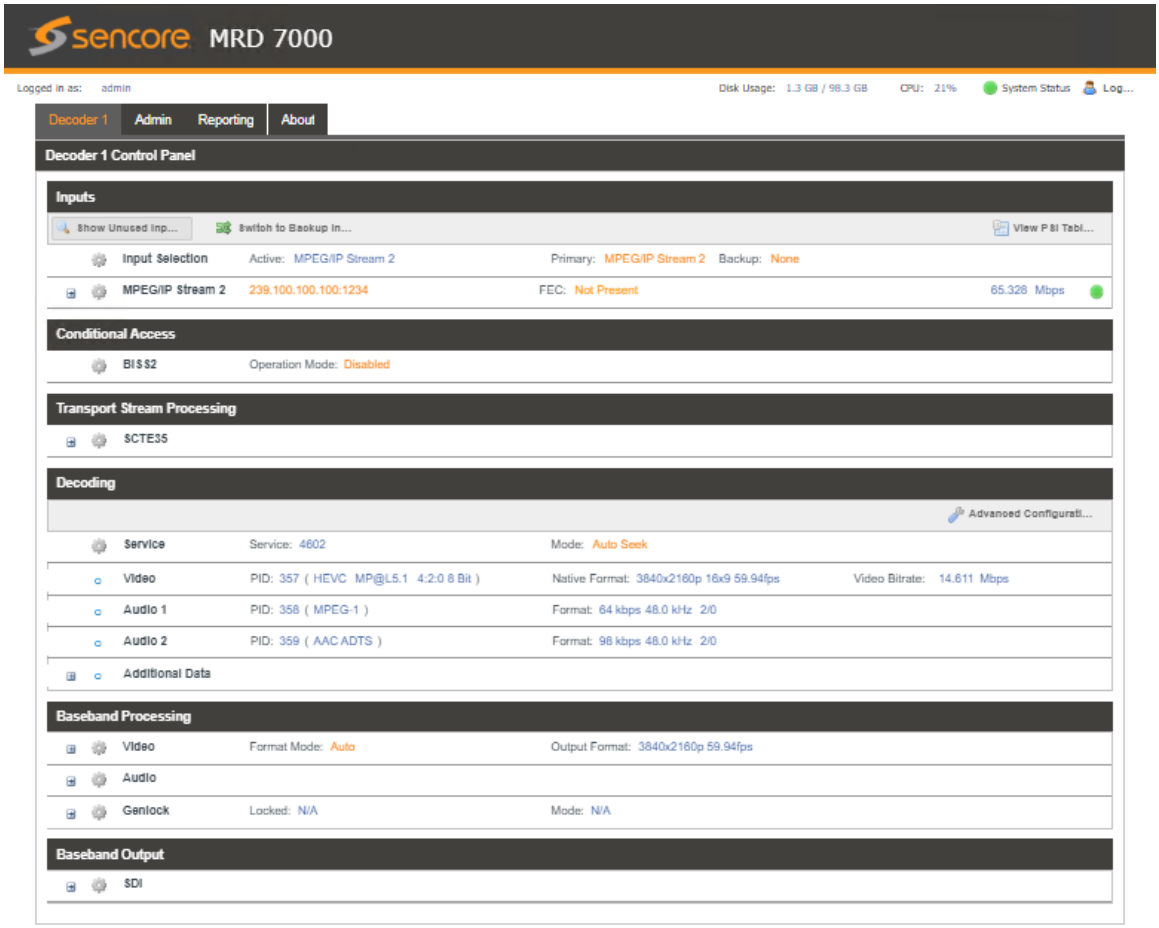
When the  icon is shown additional status information can be viewed. Click this button will expand the menu to display the additional status information. All text in status menus shown in **ORANGE** are user configurable settings. Text shown in **BLUE** is not user configurable and is strictly a status or value. To minimize the status windows again click the  icon.

Status in the MRD 7000 web interface is shown with LED status indicators:

Green LED		Status is good. No errors are present and function is operating normally.
Red LED		Status indicates function is affected by active error. To view the errors, navigate to Alarms panel to view Active Errors.
Grey LED		Status is inactive. Function is currently disabled or unavailable.

3.2 Decoder Panel

The Decoder panel of the MRD 7000 web interface is used to configure the unit to decode and what output format to use. Each functional piece has a heading: Inputs, Conditional Access, Transport Stream Processing, Decoding, Baseband Processing and Baseband Output sections are listed from the top down.

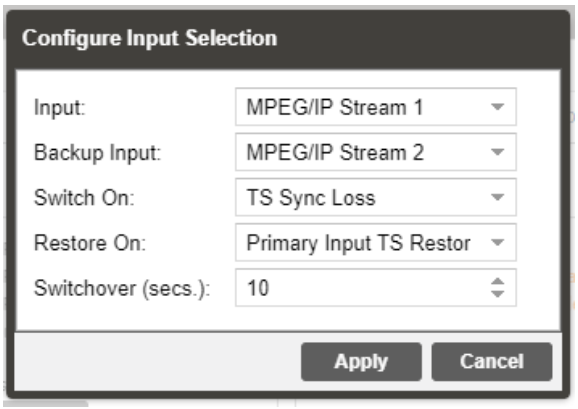


3.2.1 Configuring Active Input

This menu allows the user to configure a primary and backup input. In case there is an input failover the MRD 7000 is capable of detecting the failed state and switching to a secondary backup input in order to provide a continuous output. Which input is primary and backup, how the inputs switchover and restore and switchover timing is all user configurable. Input options include MPEG/IP Stream 1, MPEG/IP Stream 2, Input File, SRT Input 1, SRT Input 2, Seamless RTP stream

Each MPEG/IP Stream Input, SRT Stream Input and Seamless RTP Stream can be configured to use either Eth0 or Eth1 ports on the back of the chassis.

Input File can play a stored .TS or .TRP transport stream file by uploading to the MRD 7000 internal storage. This is done by browsing to the MRD's IP address using FTP or Windows file sharing.



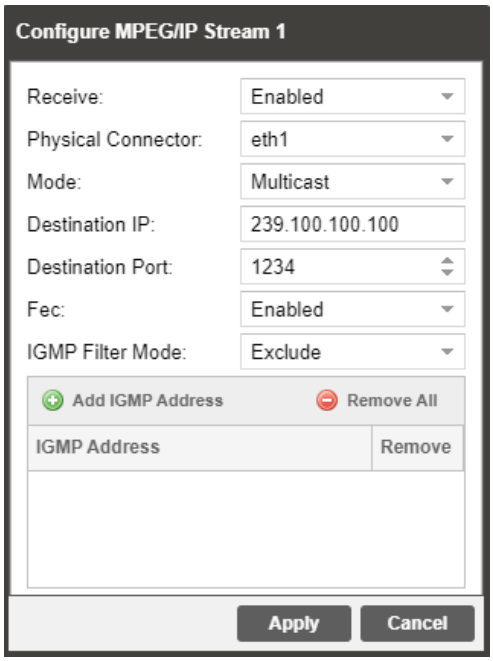
Active Input and Failover Configuration Menu

Setting	Range	Description
Primary Input	MPEG/IP Stream 1 MPEG/IP Stream 2 Input File ASI Port 1-4 SRT Input 1 SRT Input 2 Seamless RTP Stream None	Used for both normal operation and input failover settings. During normal operation this input will be the active input.
Backup Input	MPEG/IP Stream 1 MPEG/IP Stream 2 Input File ASI Port 1-4 SRT Input 1 SRT Input 2 Seamless RTP Stream None	During failover operation this input will become the active input. The catalyst for what causes the unit to switch to this input is configured in the following setting.
Switch On	Manual Only TS Sync Loss Decode Failure	*Manual Only*: the unit will not switch inputs automatically. The user must manually switch inputs. *TS Sync Loss*: the MRD 5800 will switch from the primary to the backup input if the primary stream loses synchronization for the duration of the Switchover Interval.

		Decode Failure: the unit will switch to the backup input when it encounters decoding errors on the primary input.
Restore On	Manual Only Primary Input TS Restored Backup Input TS Sync Loss Decode Failure	*Manual Only*: the unit will not restore to the primary input automatically. The user must manually switch inputs. *Primary Input TS Restored*: the MRD 5800 restores to primary when the Primary input regains transport stream synchronization. *Backup Input TS Sync Loss*: the unit will switch from backup to primary when the backup stream loses synchronization for the duration of the Switchover interval. *Decode Failure*: the unit restores to the Primary Input when the Backup Input experiences a decoding error.
Switchover	1-20 seconds	The time in seconds which *Switch On* or *Restore On* value must remain in the configured state before the MRD 5800 switches between the Primary Input and Backup Input or vice versa.

3.2.1.1 Configuring MPEG/IP Inputs

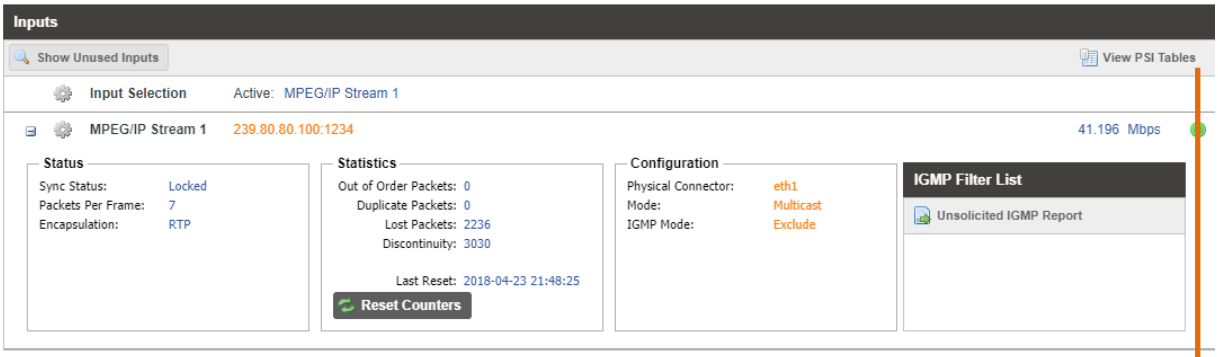
When either MPEG/IP streams are selected as the active input click on the IP address and gear icon should be visible. Clicking on the gear allows the user to configure the desired input port and network destination parameters.



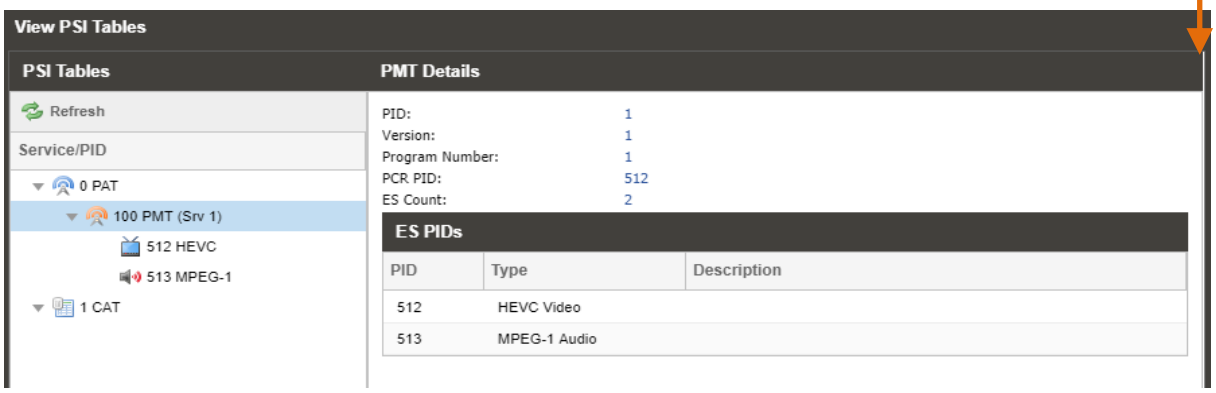
Setting	Range	Description
Receive	Enabled Disabled	This setting allows the user to enable or disable these input stream settings.
Physical Connector	Eth0 Eth1	The physical connector on the MPEG/IP card that will be used to receive the input.
Mode	Multicast Unicast	*Multicast* setting allows the unit to receive multicast streams. Multicast streams originate from the IP range 224.0.0.0 – 239.255.255.255. *Unicast* allows the unit to receive unicast streams. Unicast streams originate directly from a source device.
Destination IP	224.0.0.0 – 239.255.255.255	This setting is only available when receiving a multicast stream. This address is the IP address the source device is receiving from.
Destination Port	0 - 65535	This is the UDP port the source device is receiving from. This is the only setting required to receive a unicast stream.

FEC	Disabled Enabled	Enabling FEC (Forward Error Correction) tells the MRD 7000 to look at Destination Port +2 and Destination Port +4 for a SMPTE 2022 FEC Matrix.
IGMP Filter Mode	Exclude Include	Used on networks supporting IGMPv3. If this setting is set to *Exclude* any streams originating from the user defined IP addresses will be rejected. If this setting is set to *Include* any streams originating from the user defined IP addresses will be received.

Once the MRD is locked on an MPEG/IP signal the indicator light on the right will turn green, and the received bitrate is displayed. Sync status, the number of transport stream packets inside the UDP payload, and encapsulation type are shown under Status. Statistics are displayed representing Out of Order Packets, Duplicate Packets, Lost Packets and Discontinuity in RTP IP streams. These counters can be manual reset using the Reset Counters button. The last reset of these error counters is displayed in a date/time format.

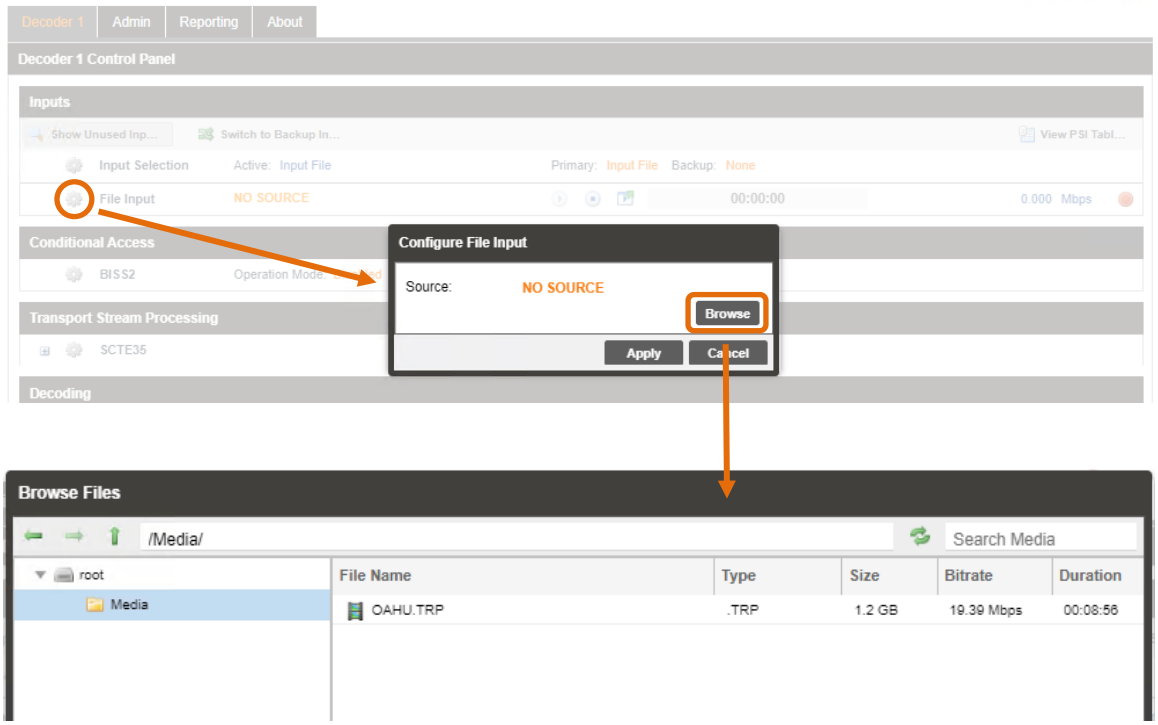


The MRD 7000 can also display the individual PID values and Program/Service numbers by clicking on the View PSI Tables hyperlink.



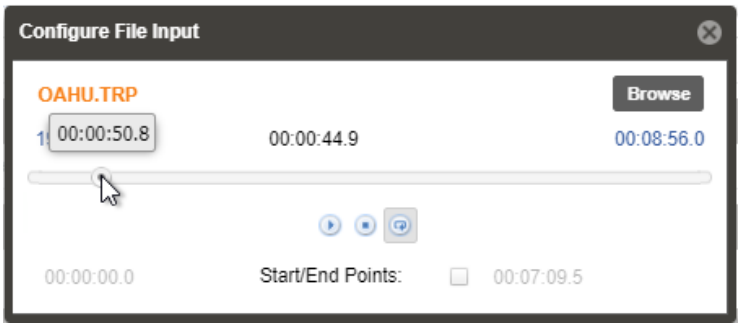
3.2.1.2 Configuring File Input

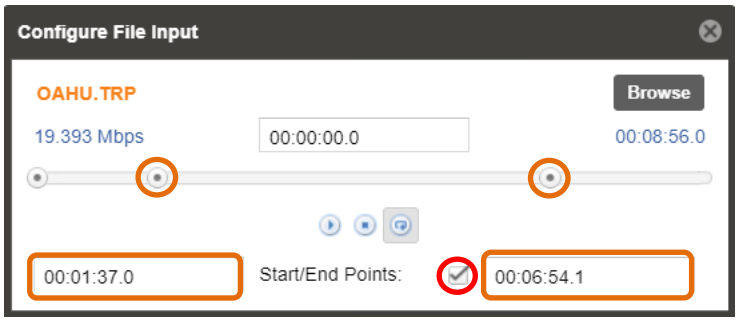
When File Input is selected as the active input, clicking on the gear icon allows the user to choose source file.



After Input File has been chosen user has a possibility to:

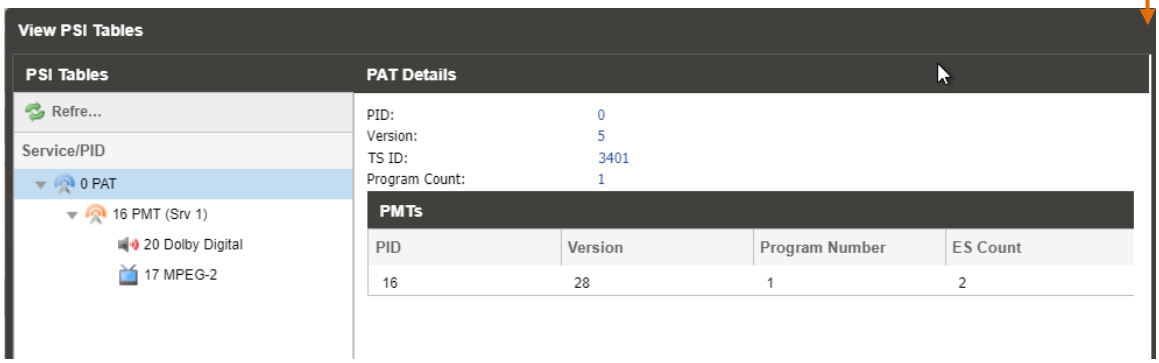
- Play
- Stop
- Set Start / Stop End Points.





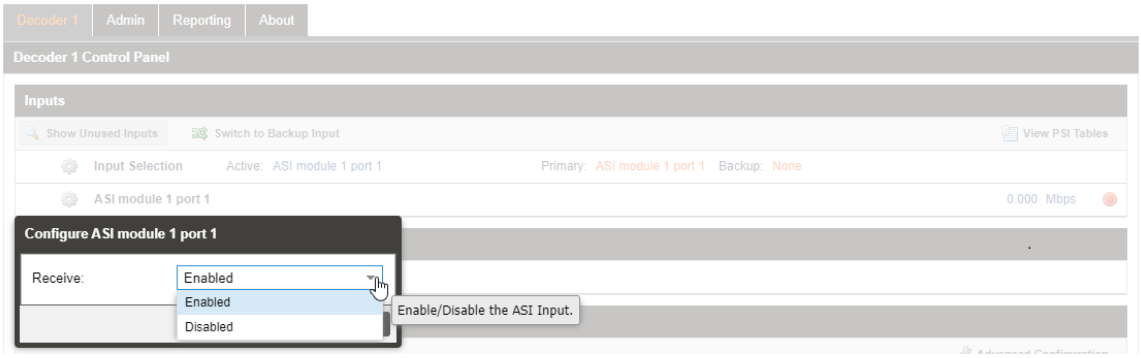
Once the File Input is played out the indicator light on the right will turn green, and the progress bar will be activated

The MRD 7000 can also display the individual PID values and Program/Service numbers by clicking on the View PSI Tables hyperlink.

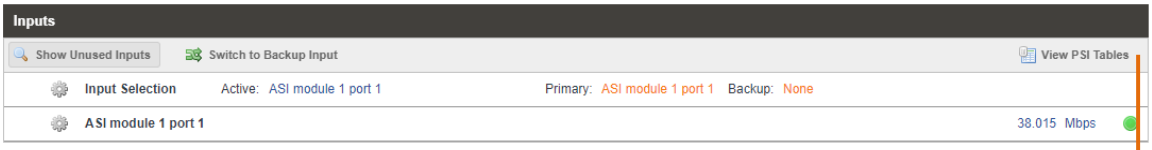


3.2.1.3 Configuring ASI Input

When ASI Input is selected as the active input, clicking on the gear icon allows the user to enable/diable ASI port.



Once the MRD is locked on ASI signal the indicator light on the right will turn green, and the received bitrate is displayed.



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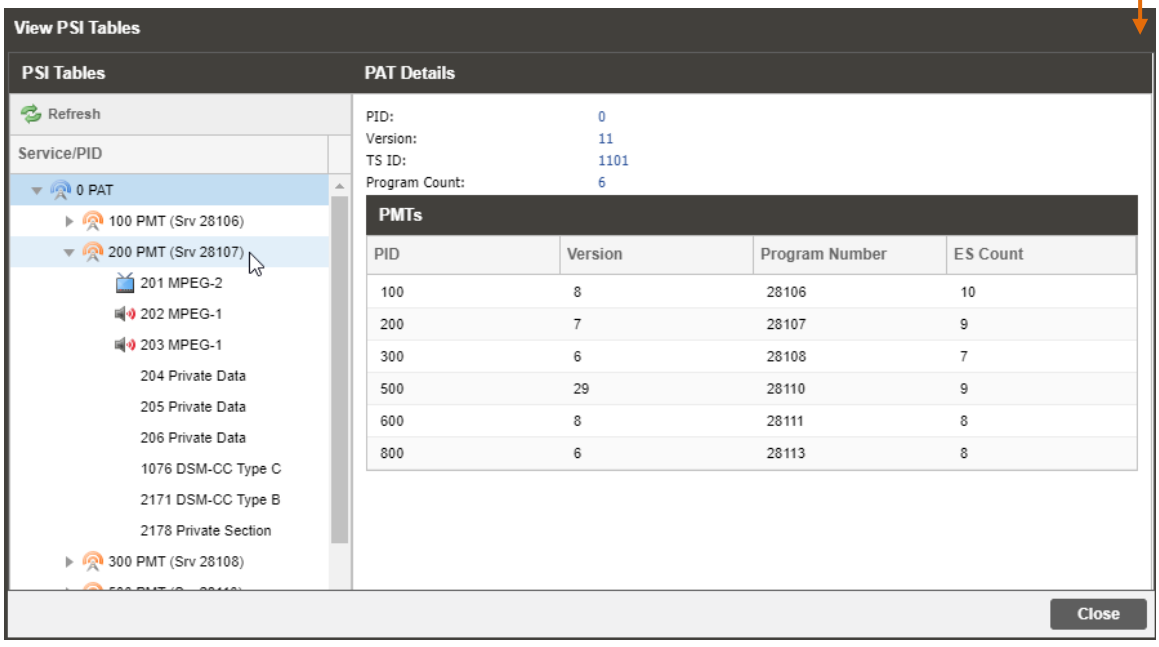
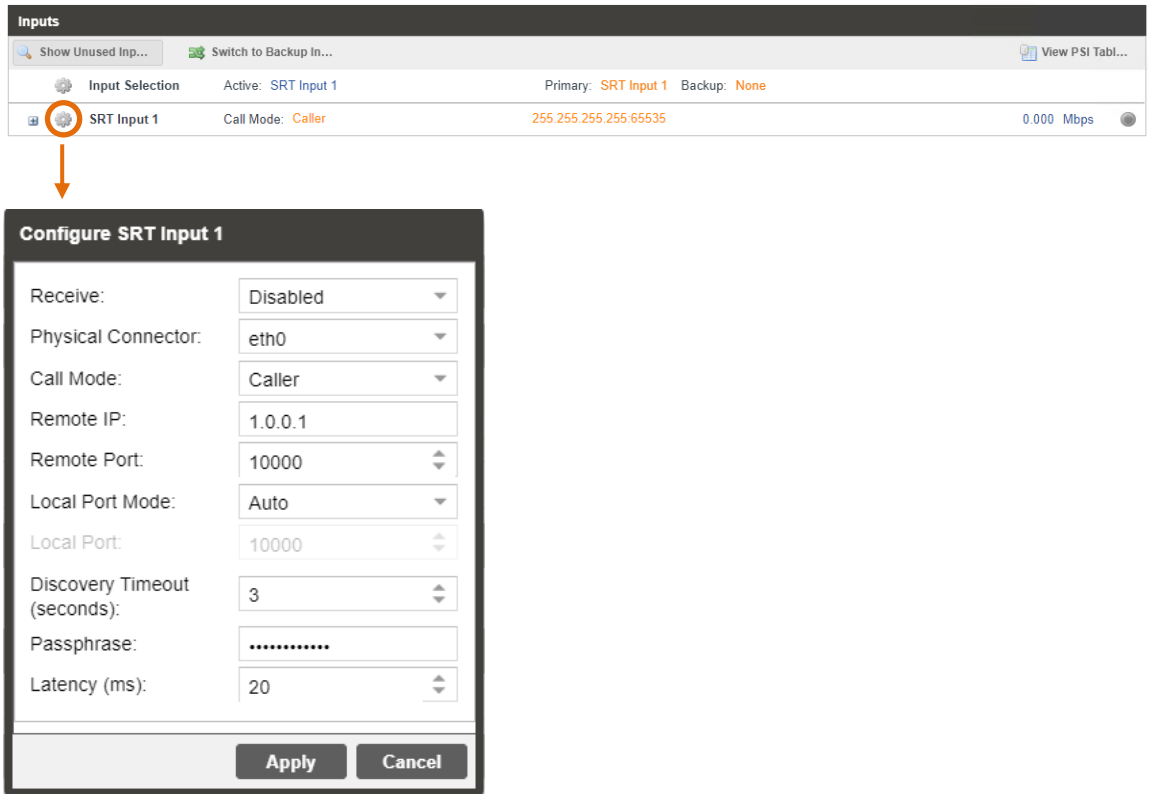


3.2.1.4 Configuring SRT Input

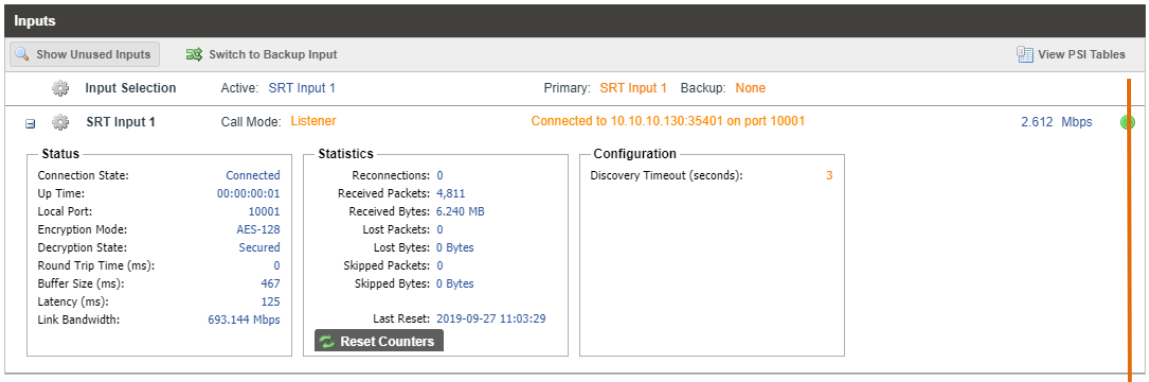
When SRT Input is selected as the active input, clicking on the gear icon allows the user to configure SRT dialog.



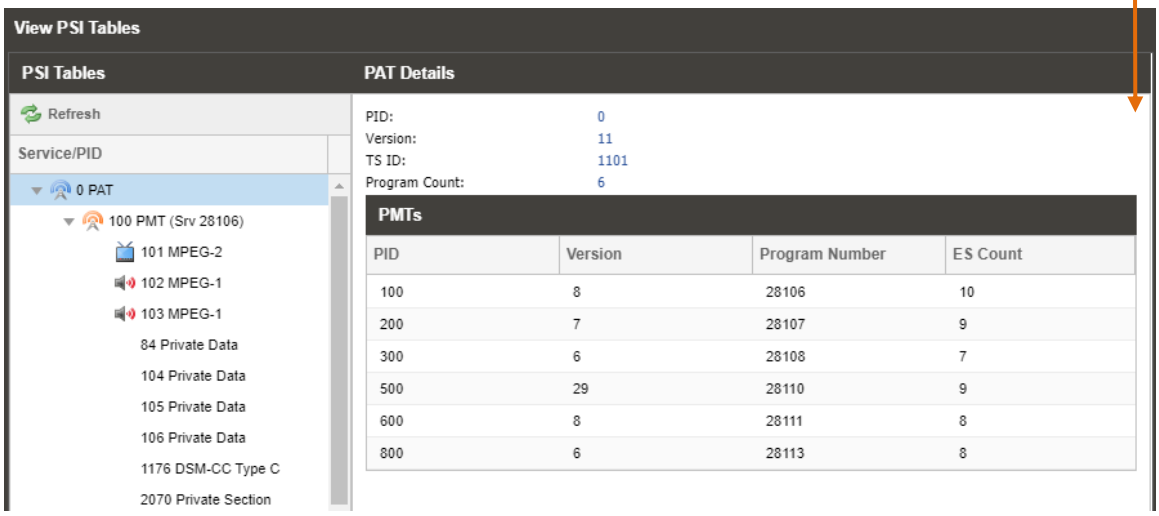
Setting	Range	Description
Receive	Enabled Disabled	This setting allows the user to enable or disable these input stream settings.
Physical Connector	Eth0 Eth1	The physical connector on the MPEG/IP card that will be used to receive the input.
Call Mode	Caller, Listener, Rendezvous	Defines the 'handshake' mechanism to be used when establishing connection
Remote IP	xxx.xxx.xxx.xxx	Defines the IP address of the stream on the remote device
Remote Port	1 - 65535	Defines the port of the stream on the remote device
Local Port Mode	Auto, Manual	In Auto Mode the local port number will be assigned In Manual Mode the local port number will be defined by the user

Local Port	1 – 65535	Defines the local port number
Discovery Timeout (seconds)	1 – 100, use 0 for infinite	Defines the length of time to wait for the stream to be discovered
Passphrase	10 – 79 characters	Defines the encryption passphrase
Latency (ms)	1 - 8000	Defines buffer size in milliseconds

Once the MRD is locked on an SRT signal the indicator light on the right will turn green, and the received bitrate is displayed. Connection state, up time, local port, encryption mode, decryption state, Round Trip Time, Buffer Size, Latency and Link Bandwidth are shown under Status. Statistics are displayed representing number of Reconnections, number of Received Packets, amount of Received Bytes, number of Lost Packets, amount of Lost Bytes, number of Skipped Packets and amount of Skipped Bytes. These counters can be manual reset using the Reset Counters button. The last reset of these error counters is displayed in a date/time format.

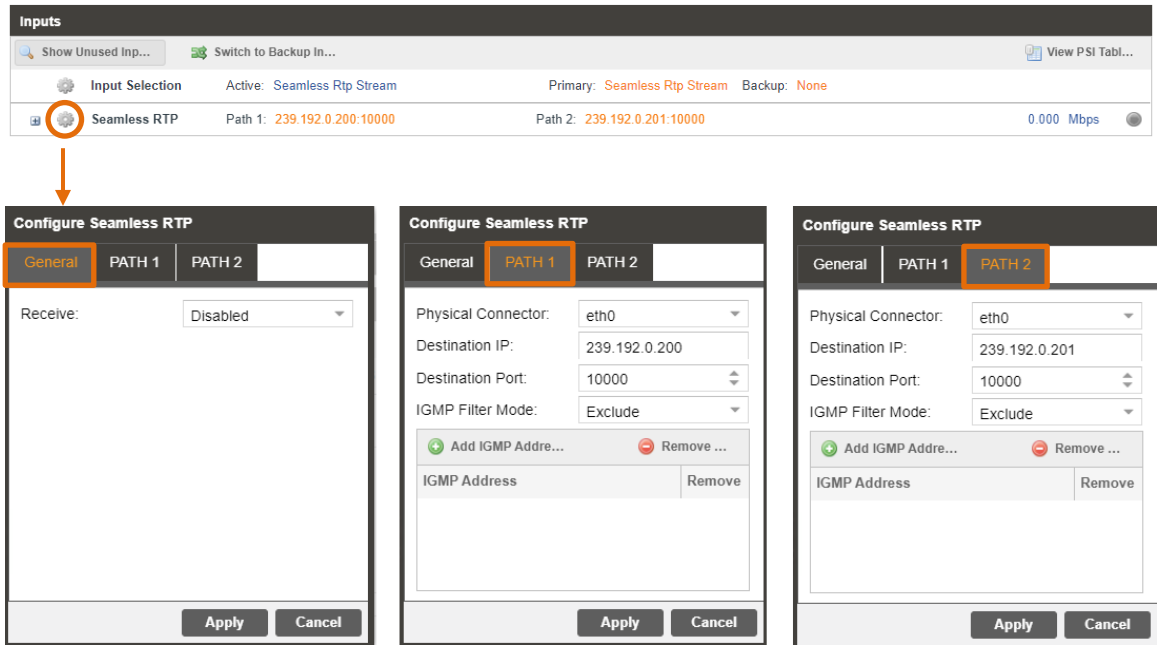


The MRD 7000 can also display the individual PID values and Program/Service numbers by clicking on the View PSI Tables hyperlink.



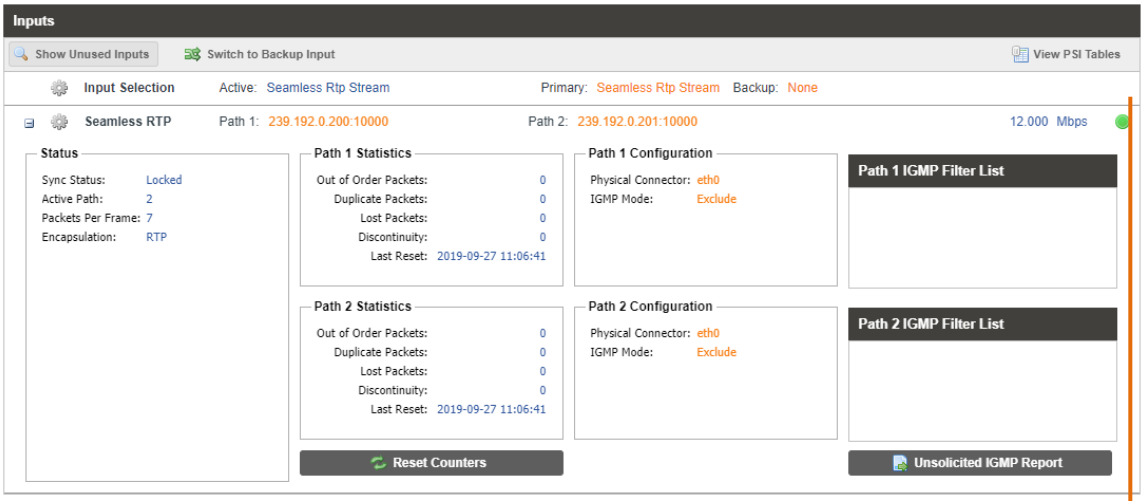
3.2.1.5 Configuring RTP Seamless Input (SMPTE 2022-7)

When RTP Seamless Input is selected as the active input, clicking on the gear icon allows the user to configure RTP Seamless dialog.

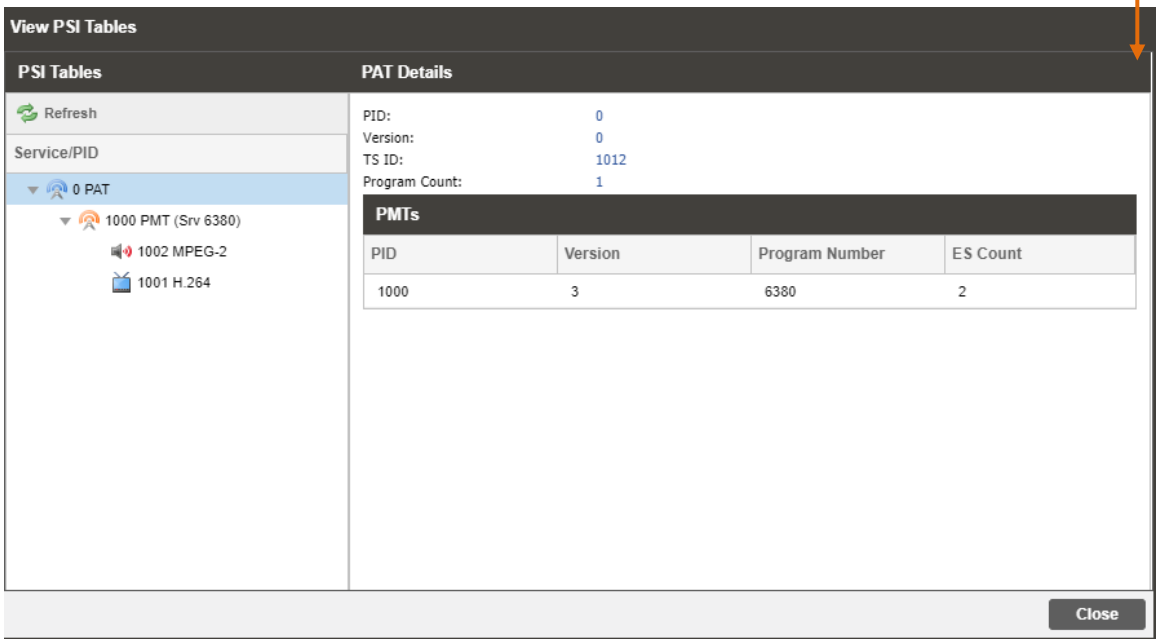


Setting	Range	Description
Receive	Enabled Disabled	This setting allows the user to enable or disable these input stream settings.
Physical Connector	Eth0 Eth1	The physical connector on the MPEG/IP card that will be used to receive the input.
Destination IP	224.0.0.0 – 239.255.255.255	This address is the IP address the source device is receiving from.
Destination Port	0 - 65535	This is the UDP port the source device is receiving from.
IGMP Filter Mode	Exclude Include	Used on networks supporting IGMPv3. If this setting is set to *Exclude* any streams originating from the user defined IP addresses will be rejected. If this setting is set to *Include* any streams originating from the user defined IP addresses will be received.

Once the MRD is locked on an RTP Seamless signals the indicator light on the right will turn green, and the received bitrate is displayed. Sync status, number of active paths, the number of transport stream packets inside the UDP payload, and encapsulation type are shown under Status. For both paths statistics are displayed representing Out of Order Packets, Duplicate Packets, Lost Packets and Discontinuity in RTP IP streams. These counters can be manual reset using the Reset Counters button. The last reset of these error counters is displayed in a date/time format.

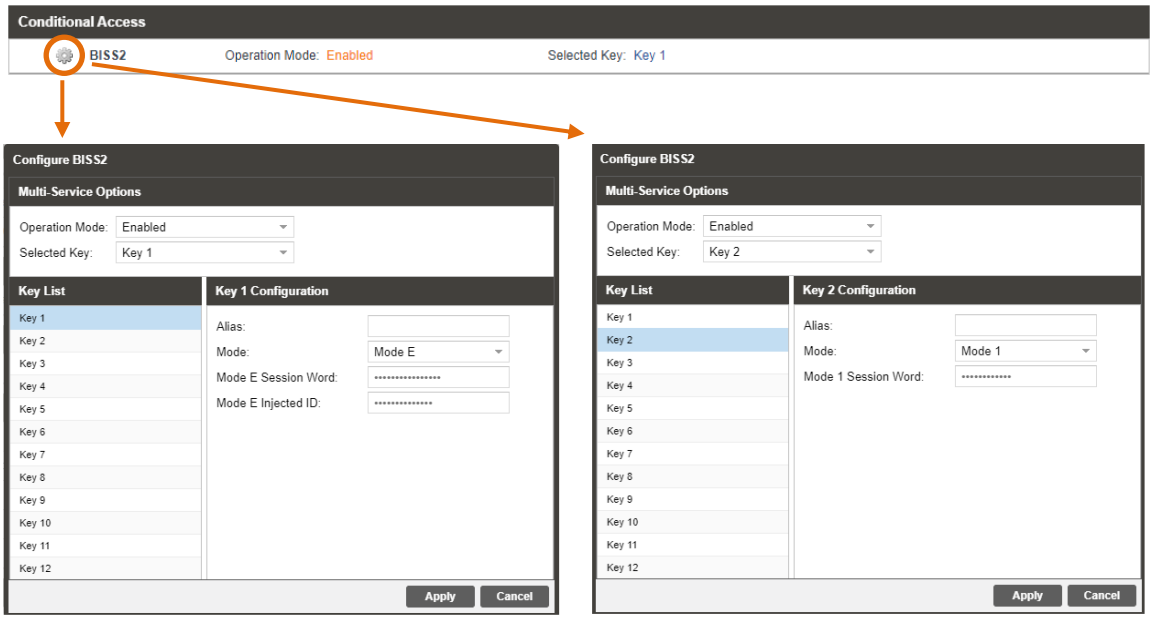


The MRD 7000 can also display the individual PID values and Program/Service numbers by clicking on the View PSI Tables hyperlink.



3.2.2 Configuring Conditinal Access (BISS2 descrambling)

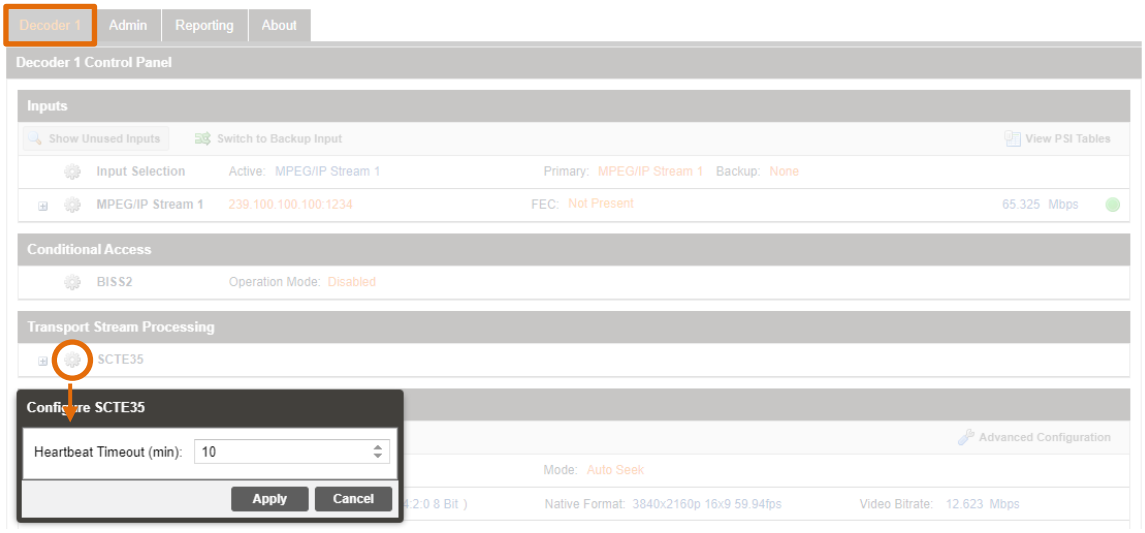
This menu allows the user to configure BISS descrambling. 12 unique BISS keys can be entered. Clicking on the gear icon allows the user to configure BISS2 dialog



Setting	Range	Description
Operation Mode	Enabled Disabled	Enable / Disable BISS descrambling
Select Key	Key 1 - 12	Select a key to configure
Alias	16 characters	Set an Alias for the selected key
Mode	Mode 1 Mode E	This setting sets the Mode of the BISS key that has scrambled the transport stream.
Mode 1 Session Word	N/A	If Mode 1 is selected the user enters the BISS session word here.
Mode E Session Word	N/A	If Mode E is selected the user enters the BISS session word here
Mode E Injected ID	N/A	If Mode E is selected the user enters the BISS injected ID here.

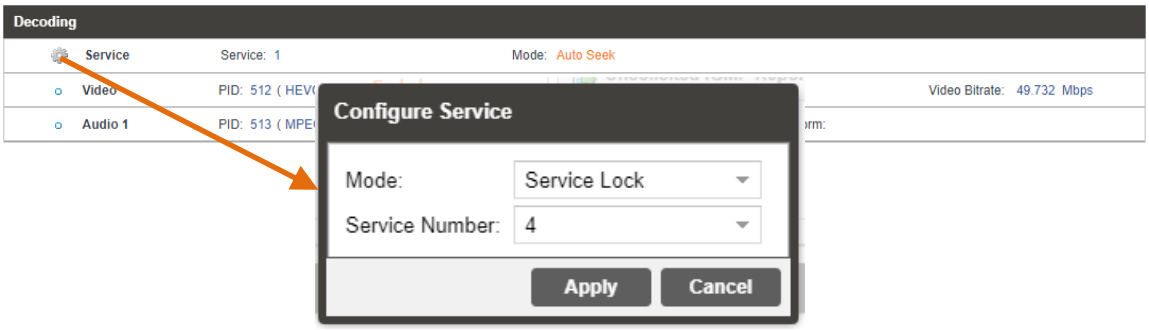
3.2.3 Configuring Transport Stream Processing

Setting Heartbeat timeout will determine the time in minutes between SCTE35 messages before the MRD 5800 will report an error. Timeout can be configured in the following way:



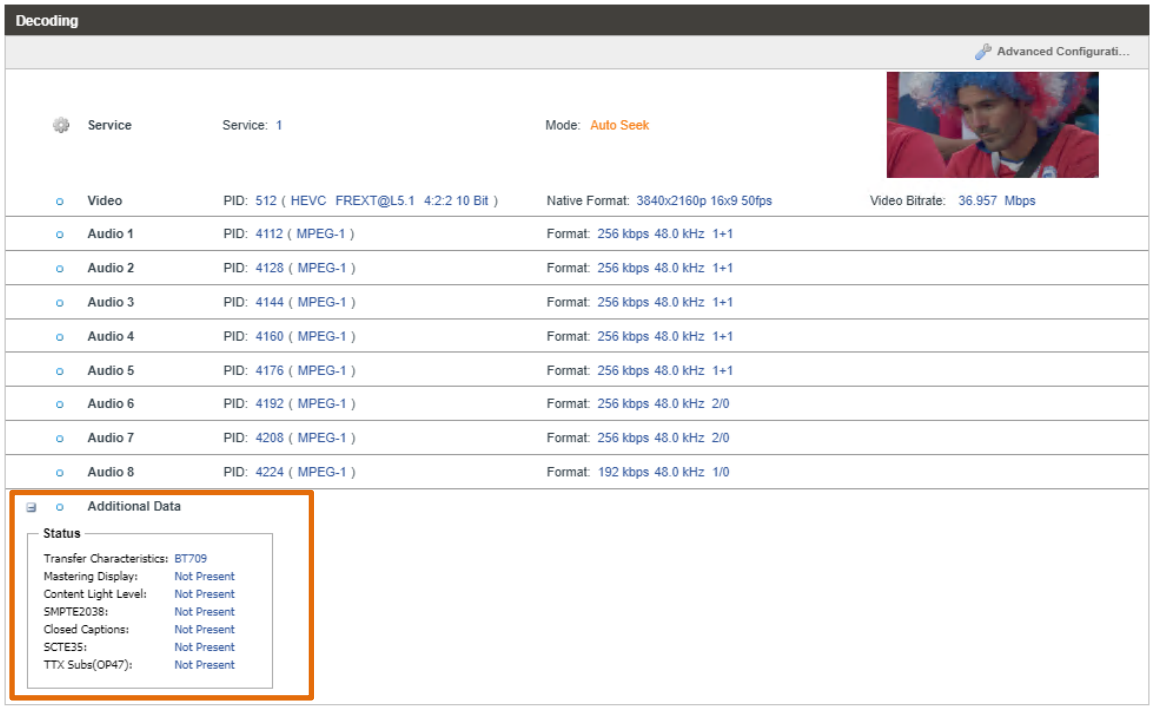
3.2.4 Configuring Decoding and Service Selection

This menu allows the user to configure which service the MRD 7000 will decode. There are two editable fields in this menu.



Setting	Range	Description
Mode	Auto Seek	The MRD will decode the first service found
	Service Lock	Locks the decoder to defined service number
Service Number	#	Click the drop-down to select a service number . This list will be populated by all services in the incoming transport stream.

When the MRD 7000 begins decoding a service, the Additional Data status will report HDR metadata, SMPTE 2038, Closed Captions, SCTE35 and Subtitles presence.

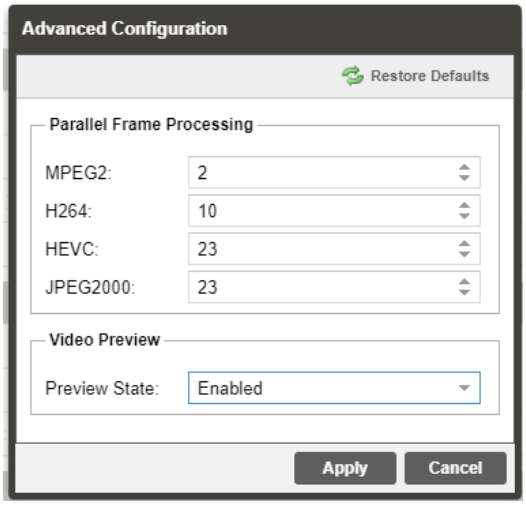


3.2.4.1 Advanced Configuration

This section allows the user to configure advanced settings of the MRD 7000.

Parallel Frame Processing allows the user to tune the decode latency of the MRD 7000. Lower Parallel Frames results in lower latency. Setting these values too low can result in dropped video frames. Default settings are recommended unless minimal latency is crucial to the application.

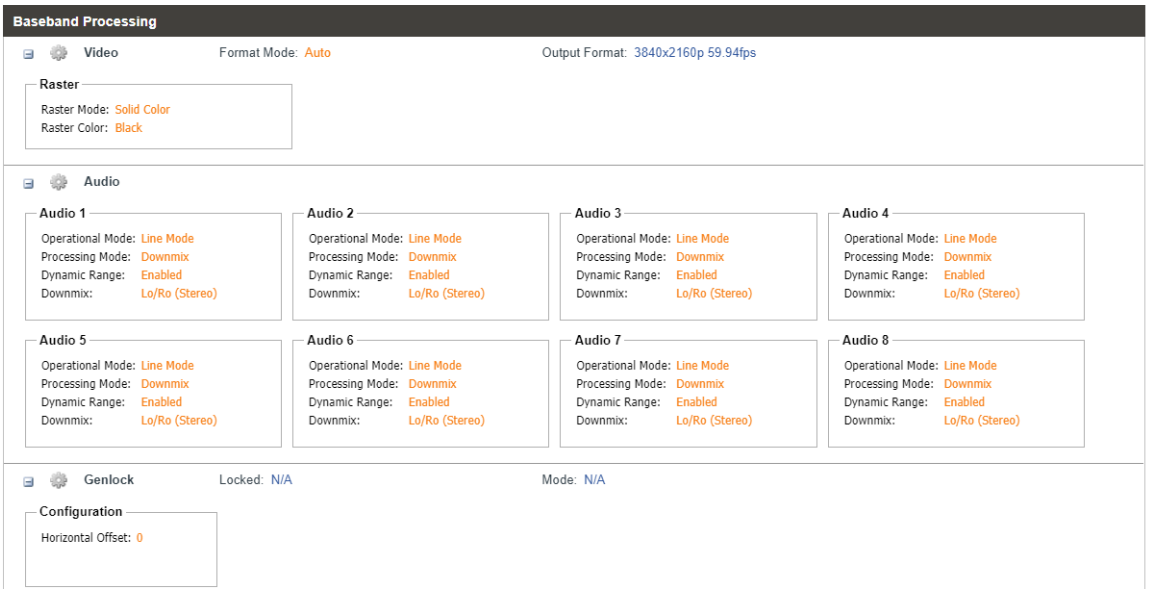
Clicking the Restore Defaults button will reset all values to the default values.



Setting	Range	Description
MPEG2	1-50	This setting changes the parallel frames processed when decoding MPEG2 video.
H264	1-50	This setting changes the parallel frames processed when decoding H264 video.
HEVC	1-50	This setting changes the parallel frames processed when decoding HEVC video.
JPEG2000	1-50	This setting changes the parallel frames processed when decoding JPEG2000 video.
Preview State	Enabled/Disabled	This section allows the user to view a thumbnail preview of the video being decode by the MRD 7000. Enabling the Preview State will cause the MRD 7000 to display a thumbnail in the Decoding section.

3.2.5 Configuring Baseband Processing

The section of the main tab allows the user to configure the video and audio baseband processing.

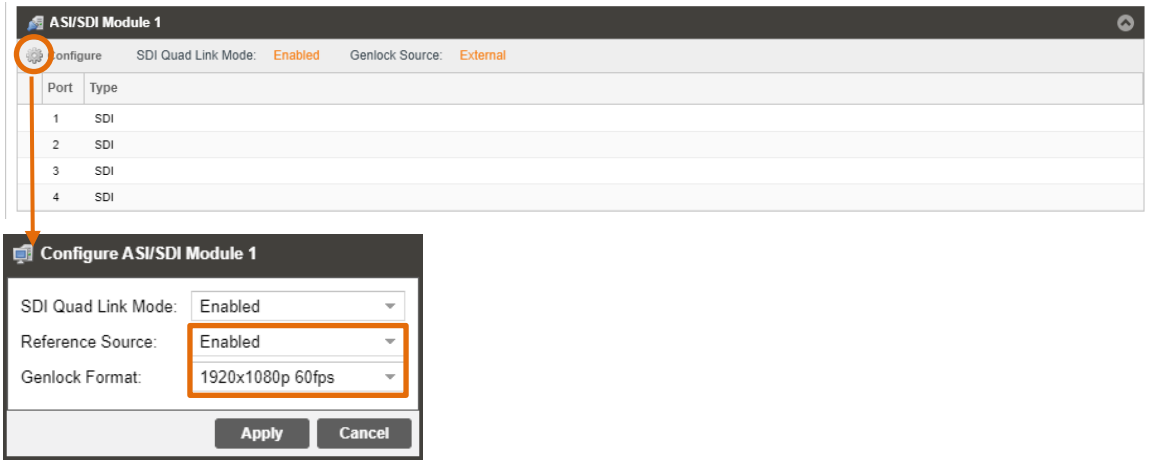


Genlock status is reported as Locked/Unlocked (reference source enabled) or N/A (refence source disabled) and Mode status.

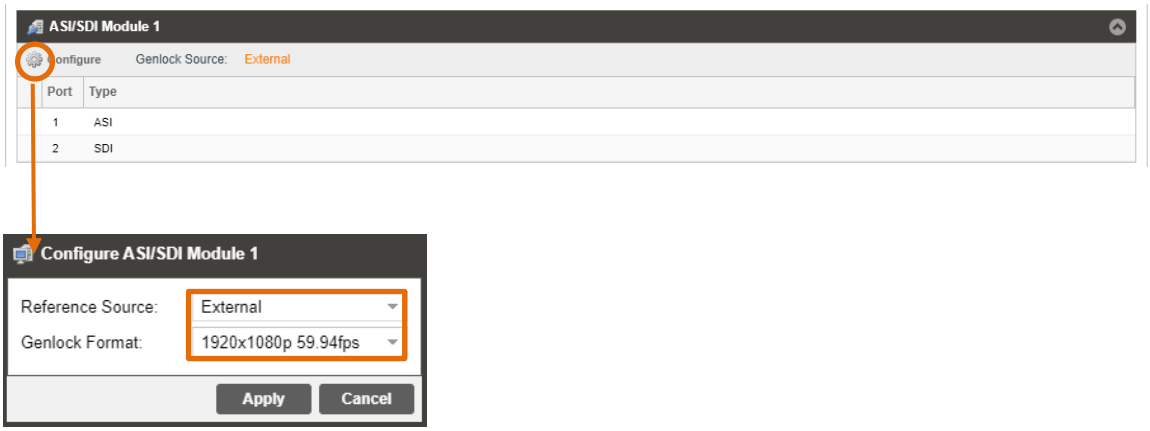
On **MRD 70150** module (Basic 12G-SDI and HDMI 2.0a Output Module) Genlock reference input is automatically detected and applied by the MRD 7000.

On **MRD 70130** (12G-SDI and HDMI 2.0b Output Module) and **70140** (Quad 3G-SDI Output Module) modules with the “Reference Source” configured as External, the Genlock Format must be manually defined in order for the card to lock to the Genlock signal. In multi-channel decode applications, the same Genlock reference is used for all SDI outputs.

MRD 70130:

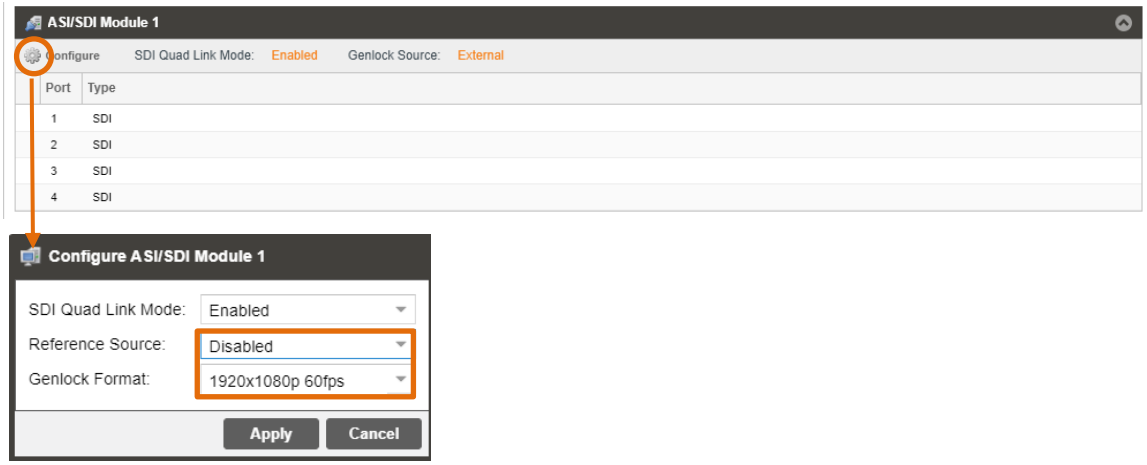


MRD 70140:

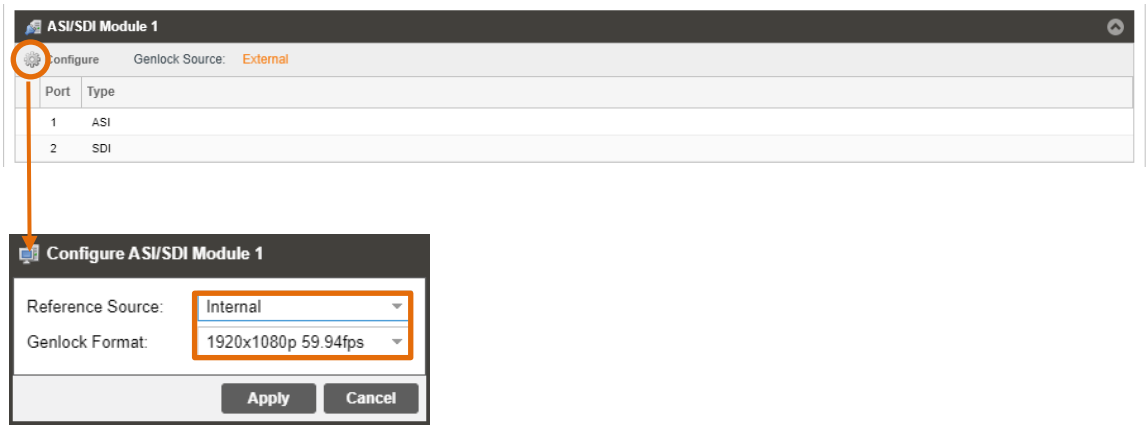


When reference signal cannot be provided, internal signal should be activated instead. On **MRD 70130** (12G-SDI and HDMI 2.0b Output Module) and **70140** (Quad 3G-SDI Output Module) modules internal Genlock reference input can be activated in Admin**->**ASI/SDI module tab. Genlock output framerate should match output video framerate.

MRD 70130:

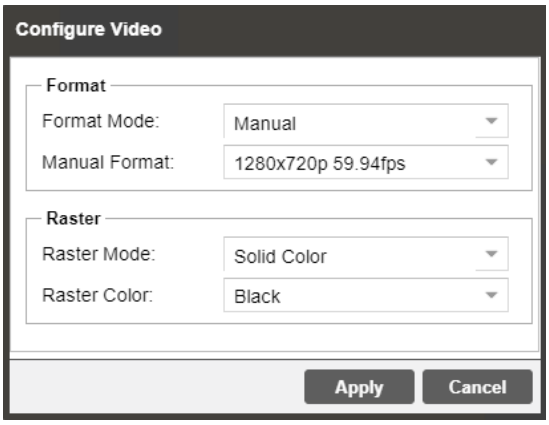


MRD 70140:



3.2.5.1 Configuring Video Baseband Processing

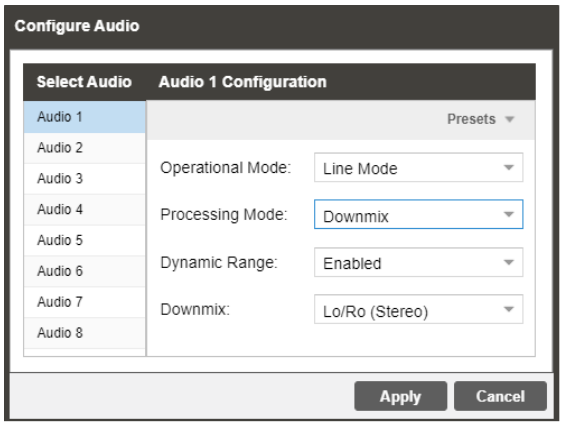
The Configure Video menu is opened by clicking on the gear icon just under the Baseband Processing section title.

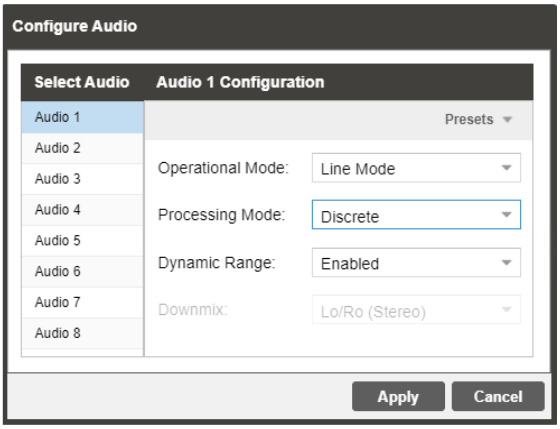


Setting	Range	Description
Format Mode	Auto	The MRD will match output format to input
	Manual	MRD uses specified Manual Format value
Manual Format	3840x2160p 60fps	Refer to Specification for complete list
	1280x720p 59.94fps	
Raster Mode	Solid Color	Selected color outputs if no input is locked
	Last Frame	Last decoded frame is shown when no input
Raster Color	Black	Choose color to display when raster mode is set to Solid Color
	White	
	Yellow	
	Cyan	
	Magenta	
	Red	
	Blue	
	Green	
	Gray	

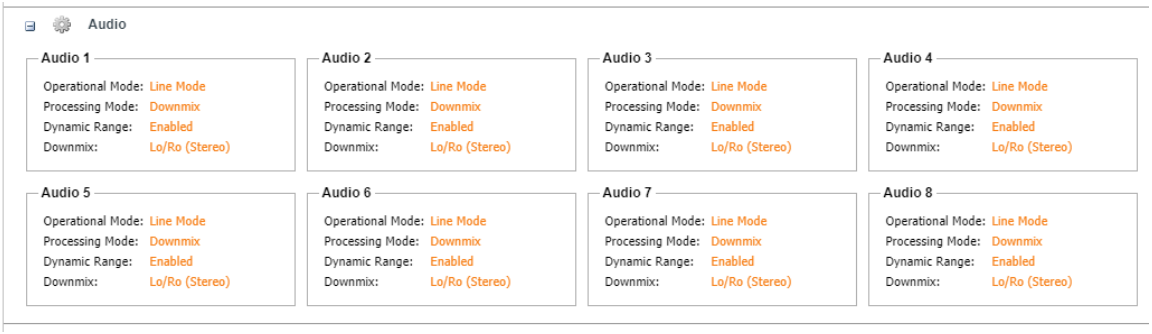
3.2.5.2 Configuring Audio Baseband Processing

The audio menu allows the user to configure the audio processing mode (decode / discrete) settings of the MRD 7000. Up to 8 audio PID's inside of the decoded service can be processed.





The configured settings are displayed when expanding the audio status by clicking the **+** button.

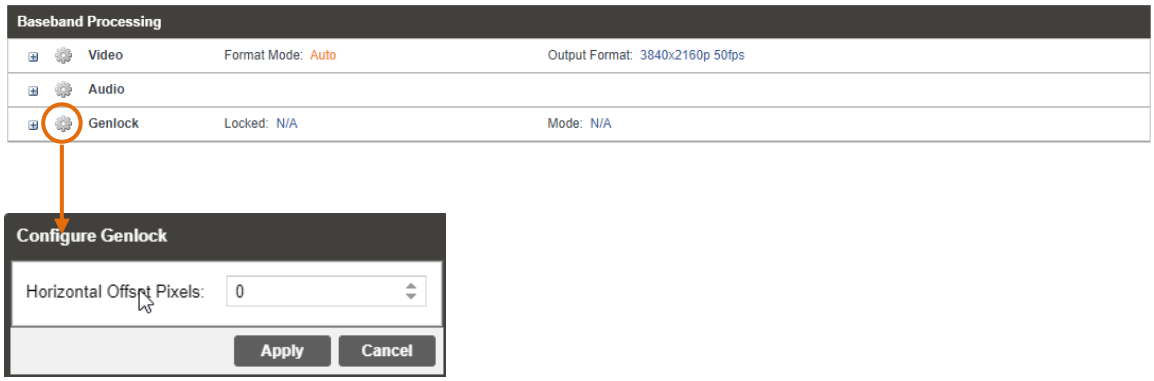


Setting	Range	Description
Operational Mode	Line Mode	Refer to Appendix E for explanation.
	RF Mode	
	Custom 1	
	Custom 0	
Processing Mode	Downmix	Refer to Appendix D for explanation.
	Discrete	Refer to Appendix E for explanation
Dynamic Range	Enabled	Use dynamic range for AC-3 downmix
	Disabled	
Downmix	Lo/Ro (Stereo)	When the audio is downmixed in the MRD 7000 two audio channels are created. The

	Lt/Rt (Dolby Surround) Lt/Rt (Auto) Dual Mono Dual Left Dual Right	channels can be configured using the settings available in the drop-down menu.. (Refer to Appendix E)

3.2.5.3 Configuring Genlock Processing

The Genlock menu allows the user to configure Horizontal Offset Pixels. The configure menu is opened by clicking on the gear icon.

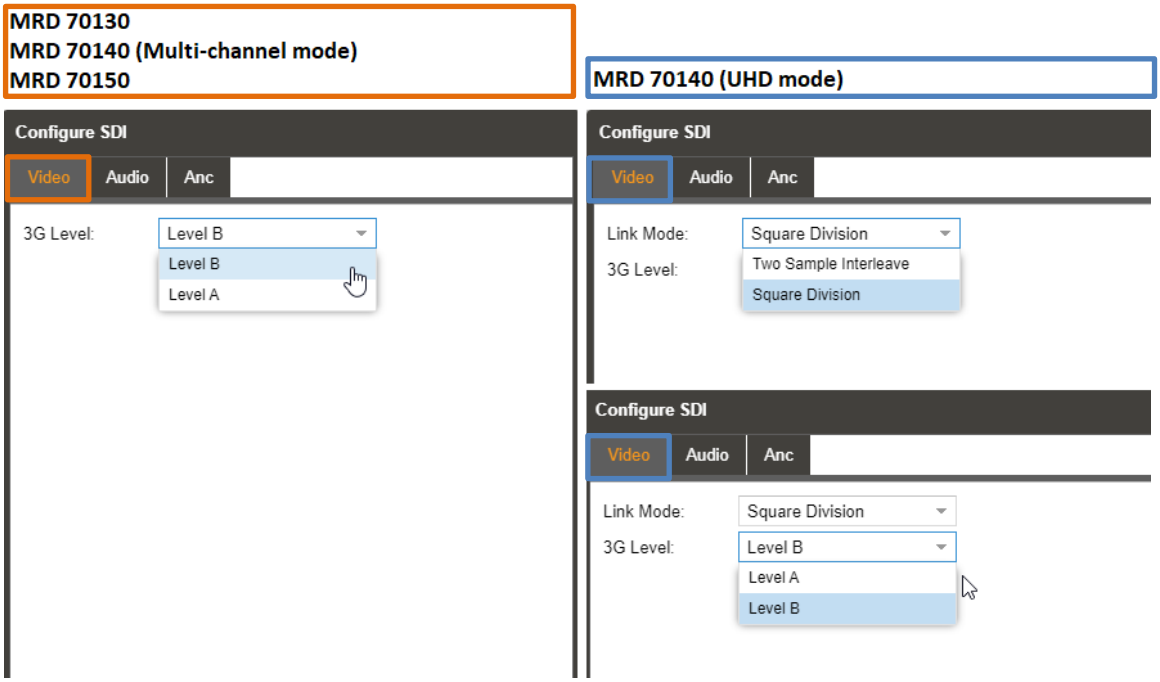


3.2.6 Configuring Baseband Output

This menu allows the user to configure the SDI output settings for the MRD 70130, MRD 70140 and MRD 70150 modules.

3.2.6.1 Configuring SDI video

The MRD 7000 comes with the ability to decode SDI Level A or SDI Level B. The MRD 70140 module has an option to select Two Sample Interleave or Square Division for the SDI Link Mode when it's configured for UHD (SDI Quad Link Mode -> Enabled). Picture below displays how SDI video can be configured depends on output module.

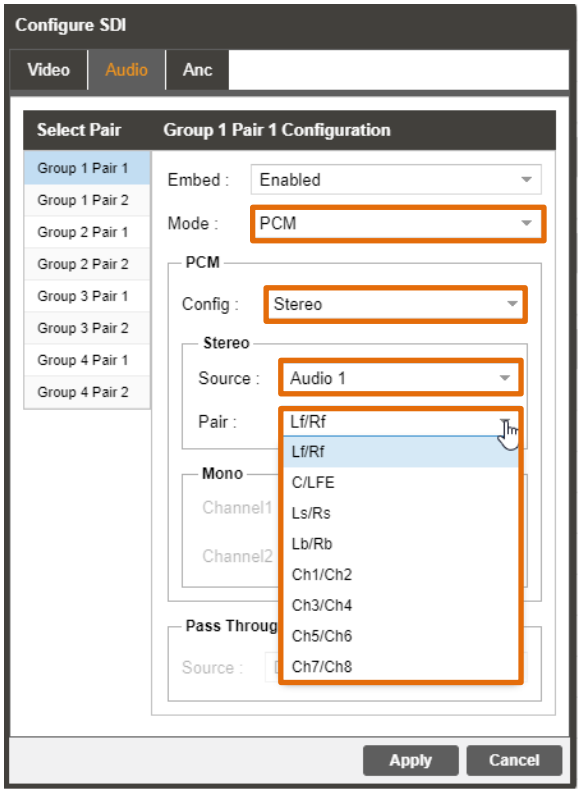


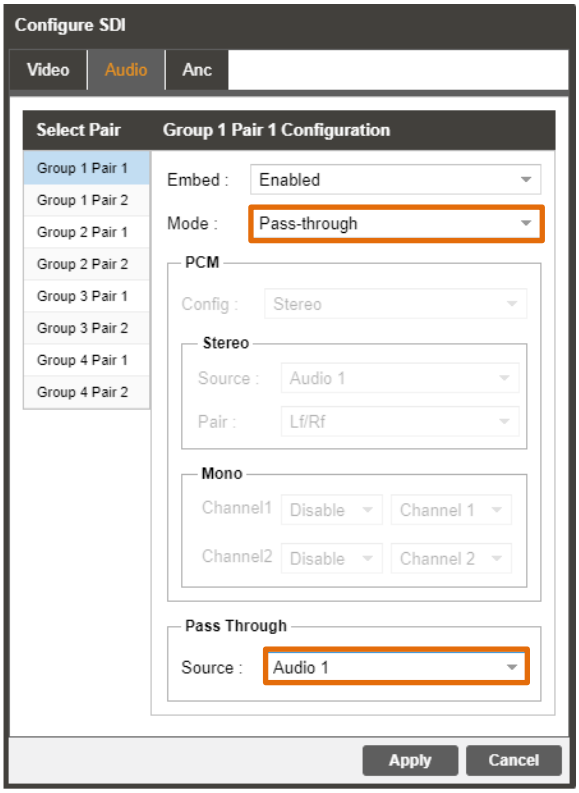
Setting	Range	Description
Level	A or B	This setting changes the SDI output level.
Link Mode	Two Sample Interleave Square Division	This setting changes the SDI link mode.

3.2.6.2 Configuring SDI Audio

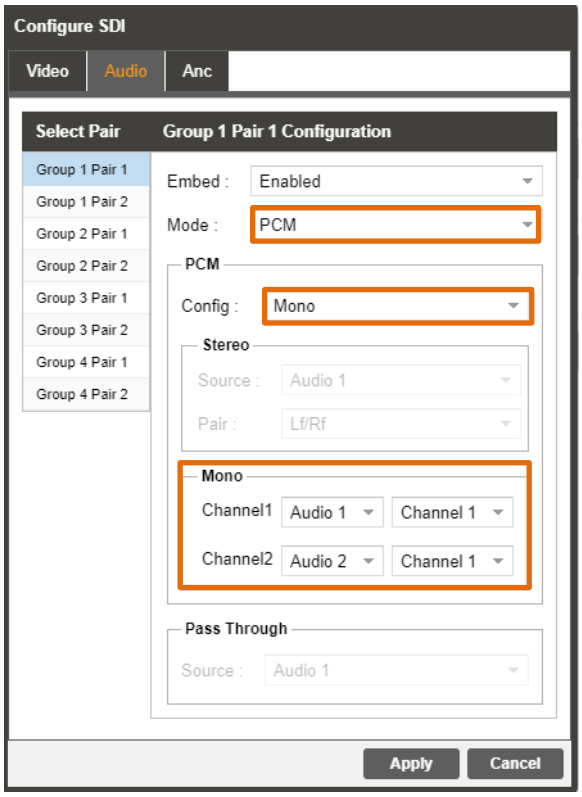
This menu allows the user to configure the SDI embedded audio settings. The MRD 7000 comes standard with the ability to handle up to eight audio services. Eight audio pairs can be embedded into four Group Pairs. Each Group Pair can contain a PCM (either downmixed or discrete decode) or passthrough audio (Dolby E, Dolby ATMOS).

In the case where a discrete audio pair is being embedded, the channel pair in the column must be selected. For audio services that indicate the specific channels (Lf, Rf, C, Ls, Rs, LFE) the user can select the audio channels to assign to a output using the named discrete options. The following audio formats identify specific channels: Dolby Digital, Dolby Digital Plus, AAC-LC, HE-AAC. If the specific channels are not identified (LPCM Audio for example) than the user can use the multi-channel audio service to select the channel pair of the audio service to output. When the user has selected a named discrete option but the audio channels are not identified in the service the unit will output Ch1/Ch2 (if present) if Lf/Rf is chosen, Ch3/Ch4 (if present) if C/LFE is chosen and Ch5/Ch6 (if present) if Ls/Rs is chosen.



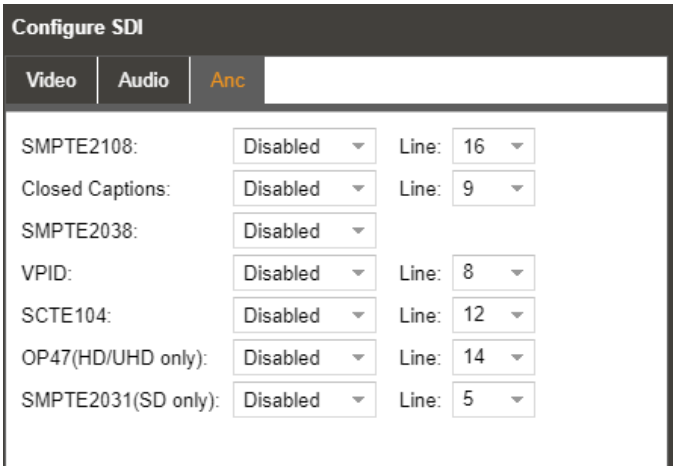


Advanced Audio embedding allows to embed mono audio channels from multiple audio PIDs in the same group/pair, i.e. a user can use mono audio left from audio PID 1 and mono audio right from audio PID 2 and embed them as Group 1 Pair 1.



3.2.6.3 Configuring SDI ANC

The Configure SDI menu also allows for the ability to enable or disable ANC data.



Setting	Range	Description
SMPTE2108	Enabled Disabled	This setting enabled SMPTE 2038 embedding on a selected line.
Closed Captions	Enabled Disabled	This setting enables Closed Captions embedding on a selected line.
SMPTE2038	Enabled Disabled	This setting enables SMPTE 2038 embedding
VPID	Enabled Disabled	This setting enables VPID embedding on a selected line
SCTE104	Enabled Disabled	This setting enables SCTE104 embedding on a selected line
OP47	Enabled Disabled	This setting enables OP47 embedding on a selected line
SMPTE2031	Enabled Disabled	This setting enables SMPTE2031 embedding on a selected line

SMPTE 2038 VANC Embedding

The MRD 7000 supports extraction of SMPTE 2038 metadata from the input video PID and embedding in SDI. User configuration is needed for enabling SMPTE 2038 data to be embedded in SDI. Presence of the incoming SMPTE 2038 data is reported in the Additional Data status in the Decoding section.

SMPTE 2108 VANC Embedding

The MRD 7000 supports extraction of SMPTE 2108 metadata from the input video PID and embedding in SDI. User configuration is needed for enabling SMPTE 2038 data to be embedded in SDI. Presence of the incoming SMPTE 2108 data is reported in the Additional Data status in the Decoding section (Transfer Characteristics).

SCTE35/104 VANC Embedding

The MRD 7000 extracts SCTE 35 messages from the transport stream then converts them to SCTE104 messages, and embeds them as VANC packets on the SDI output. User configuration is needed for enabling SCTE104 data to be embedded in SDI. Presence of the incoming SCTE35 data is reported in the Additional Data status in the Decoding section.

OP47 VANC Embedding

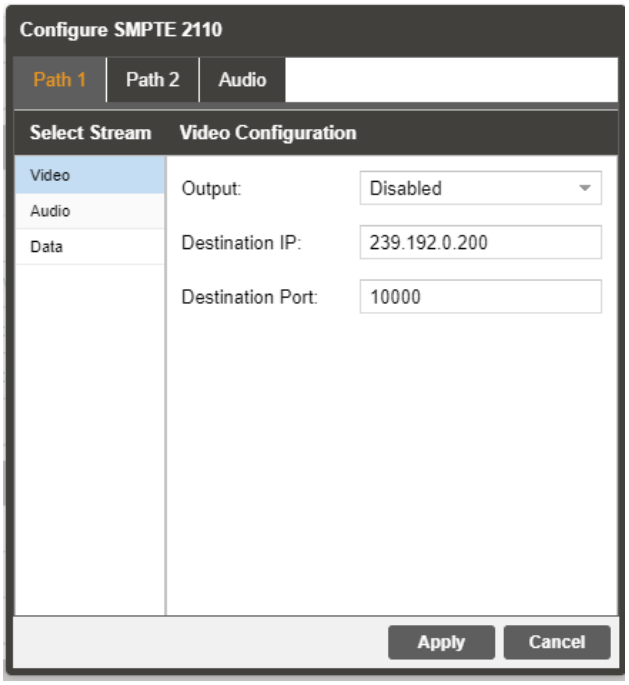
The MRD 7000 supports extraction of OP47 subtitles (UHD/HD) from the input PID and embedding in SDI. User configuration is needed for enabling OP47 data to be embedded in SDI. Presence of the incoming OP47 data is reported in the Additional Data status in the Decoding section

SMPTE2031 VANC Embedding

The MRD 7000 supports extraction of SMPTE2031 subtitles (SD only) from the input PID and embedding in SDI. User configuration is needed for enabling SMPTE2031 data to be embedded in SDI. Presence of the incoming SMPTE2031 data is reported in the Additional Data status in the Decoding section

3.2.7 Configuring SMPTE 2110

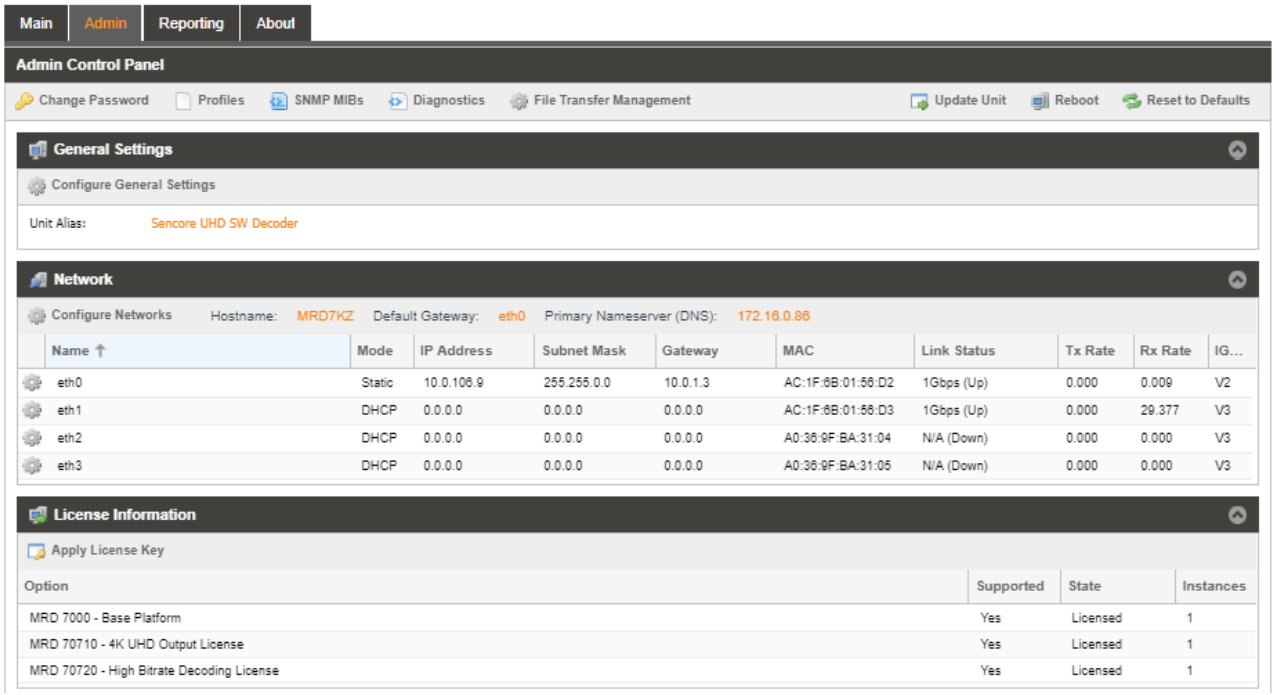
This menu allows the user to configure the SMPTE 2110 output settings. The MRD 7000 comes with the ability to configure two separate paths for SMPTE 2110. Also with SMPTE 2110 is the ability to configure eight audio pairs. Audio, Video, and Data Streams are all configurable to enable or disable the output, set Destination IP, and Destination Port.



Setting	Range	Description
Output	Enabled Disabled	This setting allows the user to enable or disable the output.
Destination IP	224.0.0.0 - 239.255.255.255	This setting allows a user to configure the output destination IP address.
Destination Port	0-65535	This is the UDP port the source device is sending to.

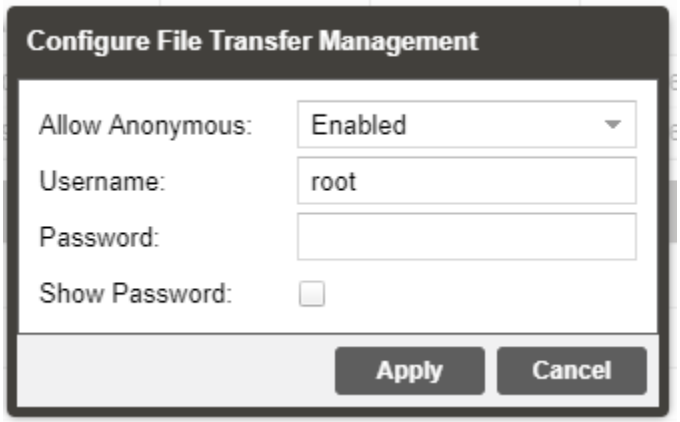
3.3 Admin Panel

To access the Admin Control Panel, click on the Admin tab. This menu allows the user to control many global settings and maintenance tasks on the MRD 7000.



3.3.1 File Transfer Management

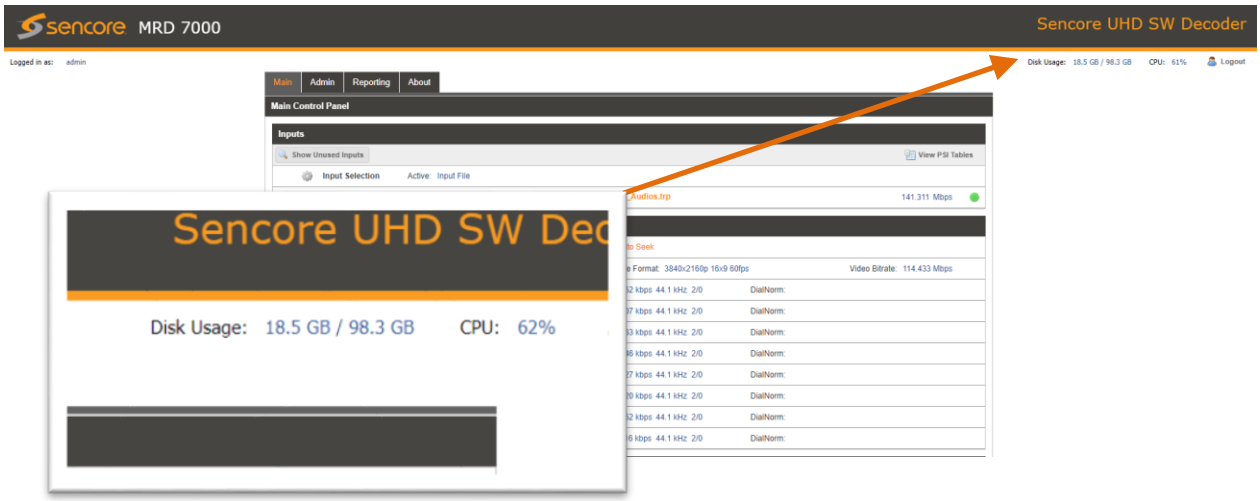
The File Transfer Management configuration button opens up a menu in which you can enable or disable authentication for uploading pre-recorded media files.



Setting	Range	Description
Allow Anonymous	Enabled	Anyone can upload or download media
	Disabled	Requires username and password to access
Username	Alpha-Numeric Entry	User-defined user name for access the media storage
Password	Alpha-Numeric Entry	User-defined password for accessing the media storage

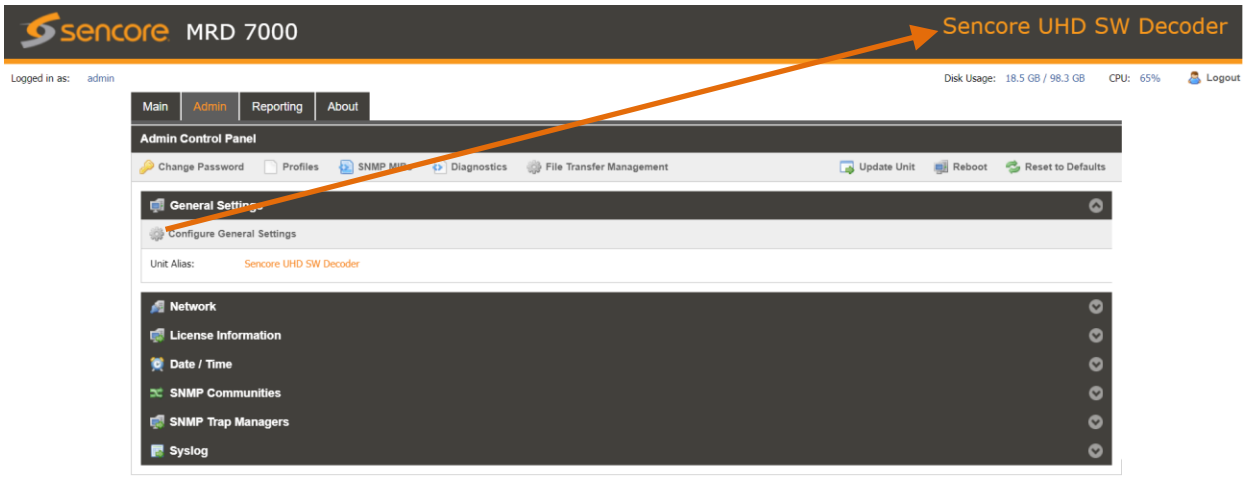
3.3.2 Disk Usage Statistics

The current available and used disk space of the server is shown throughout the user-interface on the top right corner of the page



3.3.3 Unit Alias

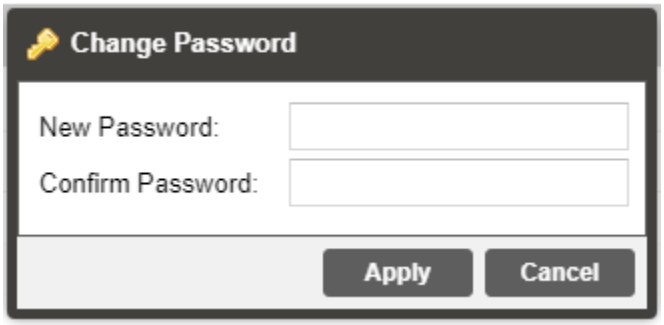
The Unit Alias allows a unique name or description to be entered which shows on the web-interface title pane. This is configured inside the Admin page.



3.3.4 Changing Unit Password

The MRD can be assigned an access password and the current access password can be changed. In order to make changes to passwords, click the change password button. A window will appear to enter the current password and new password.

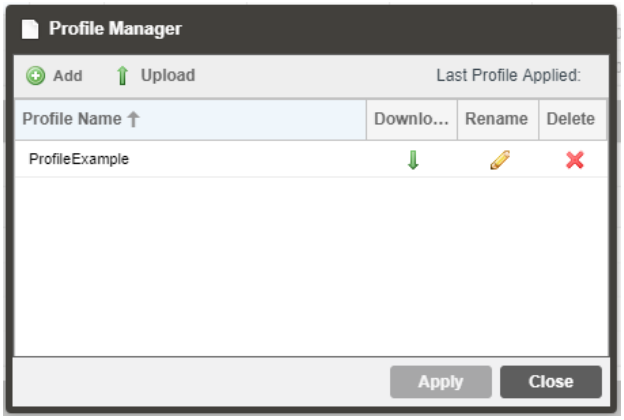
Note: the username for MRD web-login is always **admin**



3.3.5 Profiles

The MRD 7000 has the ability to save all configured settings to multiple profiles. Profiles can be saved locally, renamed and saved to external storage to be used on other MRD 7000s.

Profiles can be used to quickly and easily change the configuration of an MRD to suit different inputs and decoding requirements.

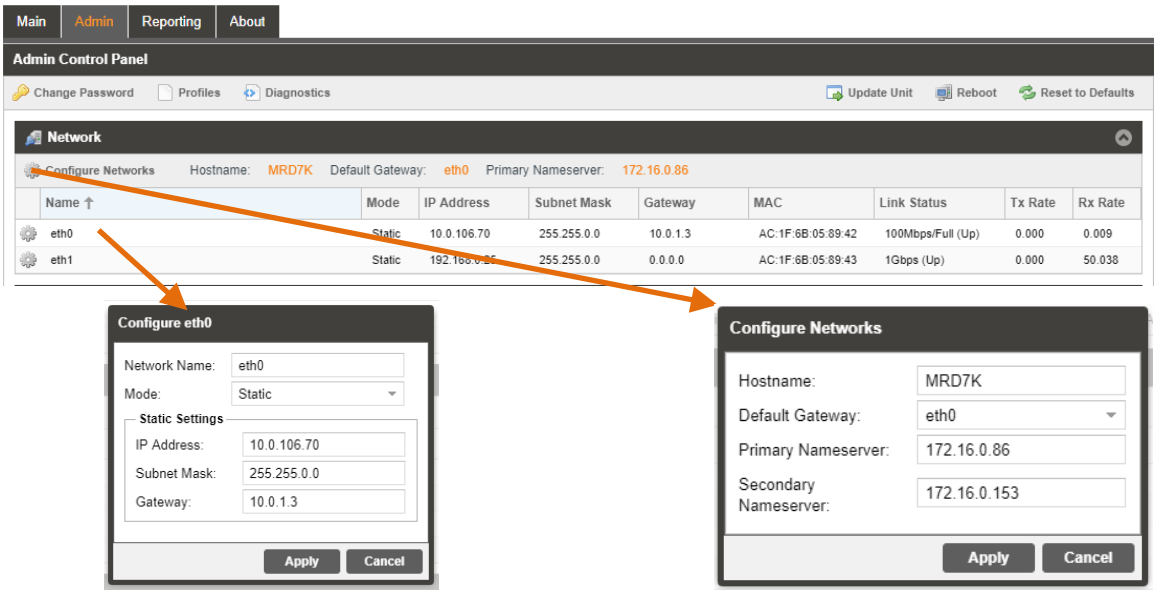


Action	Button	Description
Add New Profile	Add	Adds a new profile from current settings. User must name profile before creation is complete.
Upload Profile	Upload	Allows the user to browse to external storage or workstation to upload profile to MRD.
Apply Profile	Apply	Select a profile from the drop-down menu and click this button. The MRD will apply all settings contained in the profile selected.
Rename Profile		Select a profile from the drop-down menu and click this button. The user will be prompted for a new name for the profile.
Delete Profile		Select a profile from the drop-down menu and click this button. The user will be prompted to confirm deletion of the profile.
Download Profile		Select a profile from the drop-down menu and click this button. The user will be prompted to select a directory to download the profile.

3.3.6 Configure Unit Networks

The MRD 7000 can be assigned a Hostname and DNS servers. To access this menu, click on the Configure Networks gear icon in the Admin page.

The Default Gateway of the web-interface can also be pointed at a chosen network port (Eth0 or Eth1). The web-interface is accessible from the IP address of either Ethernet port; however, be sure to configure the two ports for separate subnets.

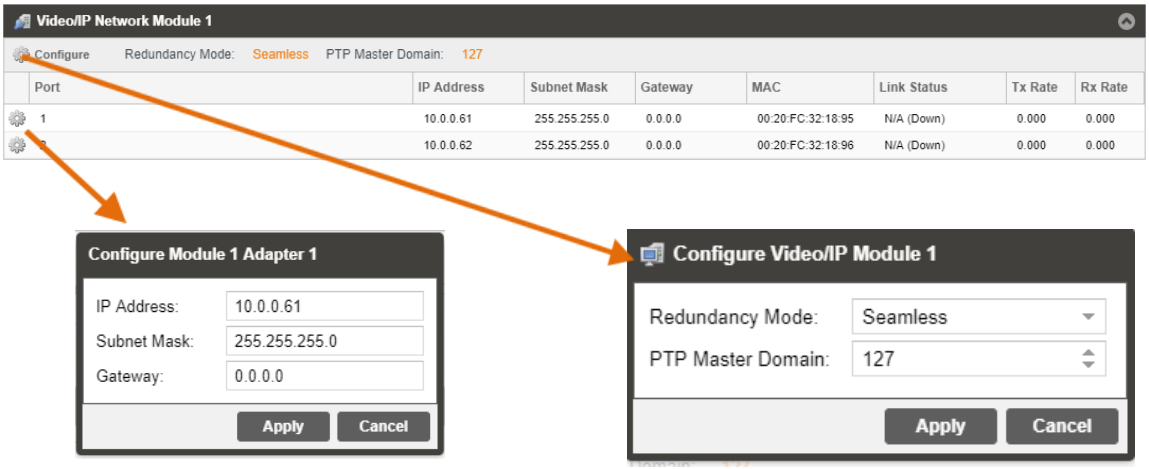


Setting	Range	Description
Network Name	Alphanumeric, no spaces allowed	This setting allows the user to define an optional unit Hostname.
Mode	Static DHCP	IP is entered by user and will not change IP is assigned to MRD by network/router
IP Address	Four decimal octets: XXX.XXX.XXX.XXX	This option is only available if Static Mode is set. This is the IP address assigned to the management port.
Subnet Mask	255.0.0.0 – 255.255.255.254	This option is only available if Static Mode is set. This is the Subnet Mask assigned to the management port.
Gateway	Four decimal octets: XXX.XXX.XXX.XXX	This option is only available if Static Mode is set. This is the Gateway address assigned to the management port.

3.3.7 Configure SMPTE 2110 Video/IP Networks

With the SMPTE 2110 module, a user can configure the Video/IP Redundancy Mode. To access this menu, click on the Configure gear icon under the Video/IP Network Module 1 section in the Admin page.

The PTP Master Domain can also be adjusted to synchronize the grand master PTP clock.



IP Address	Four decimal octets: XXX.XXX.XXX.XXX	This is the IP address assigned to the SFP port on the selected SMPTE 2110 port.
Subnet Mask	255.0.0.0 – 255.255.255.254	This is the Subnet Mask assigned to the SFP port on the selected SMPTE 2110 port.
Gateway	Four decimal octets: XXX.XXX.XXX.XXX	This is the Gateway address assigned to the SFP port on the selected SMPTE 2110 port.

3.3.8 Software Support Agreements

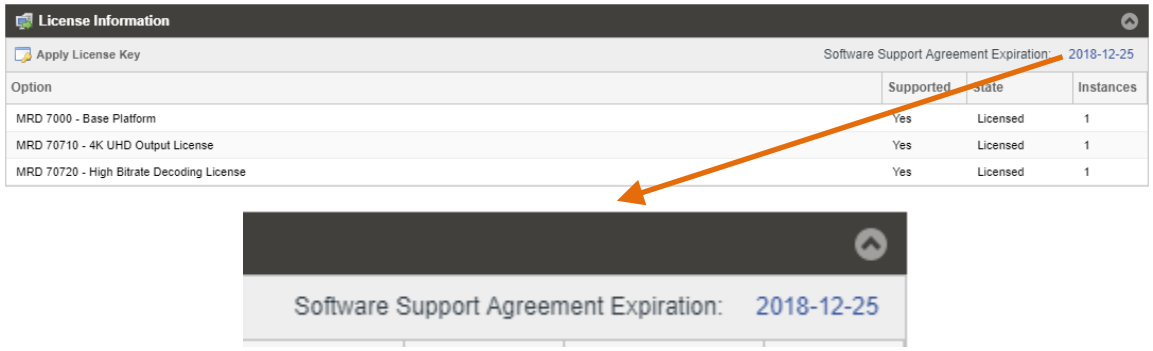
Purchase of the MRD 7000 software includes one year of software support. This provides access to the latest software versions throughout that one-year period. These software versions include:

- Bug fixes
- General updates
- Maintenance releases

The MRD 7000 will only accept software updates which were released during the active SSA period. Software updates released following the expiration of the SSA will be rejected on upload, until the product's SSA has been re-activated. The actual SSA information is maintained on the product itself and can be updated by applying a license key via the web user interface. The product's user interface displays the end date to

ensure the user is always informed of their SSA status. Regardless of the status of the software subscription agreement, Sencore offers phone and email technical support during regular business hours for all products.

Once the SSA period has expired, customers are free to keep using the software version they already have or other versions from before the expiration date but applying newer versions will require an extended SSA.

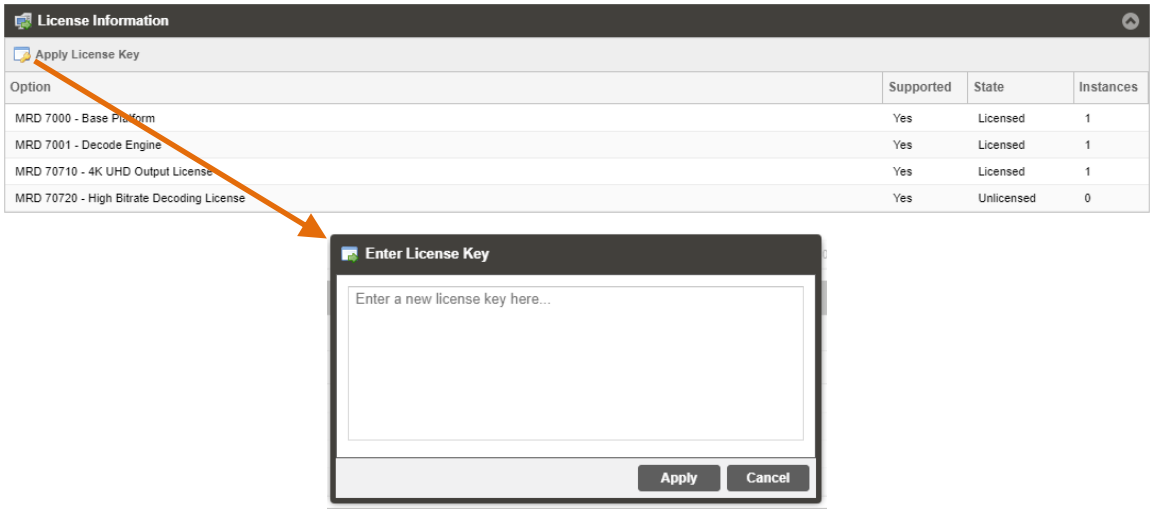


3.3.9 Licensing

Certain features of the MRD require licenses in order to be functional. The interface displays all licenses available as well as the following status:

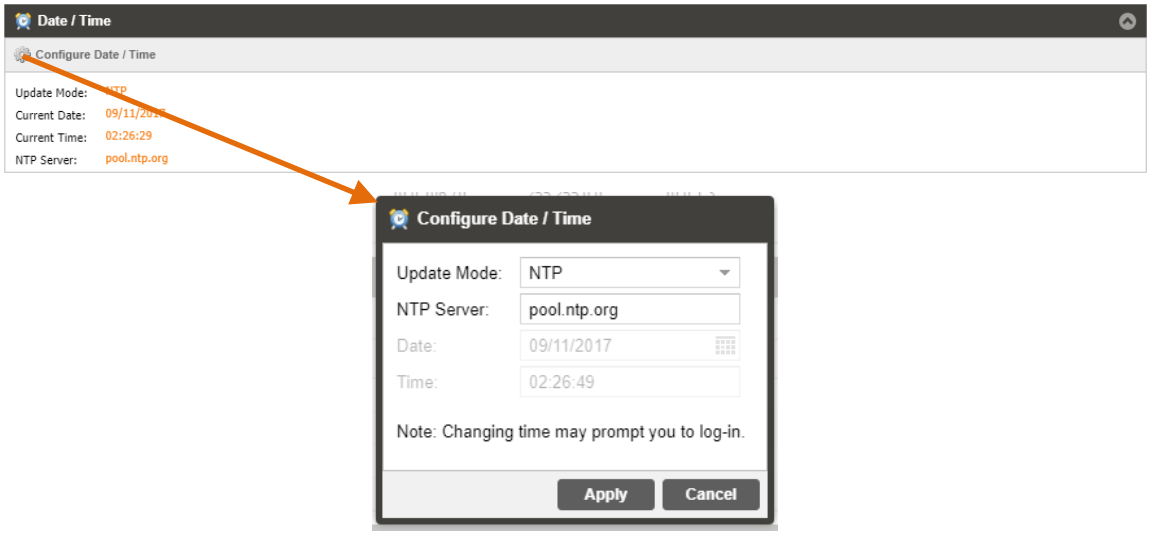
- License Locked or Unlocked
- License is Supported or Unsupported by the installed hardware

If licenses need to be applied to the MRD click Apply License Key button. The menu below will appear where the user can copy and paste the provided license key from Sencore.



3.3.10 Date/Time

The MRD can be set to synchronize with an NTP server or a manual data and time can be defined by the user. Click the Configure Date / Time button to configure the date and time. These values are used to timestamp entries in the Alarm and Event logs under the Reporting tab.



Setting	Range	Description
Update Mode	NTP Manual	Setting to *NTP* uses the local network's NTP server to synchronize date and time. *Manual* allows the user to define a date and time.
NTP Server	Four decimal octets: XXX.XXX.XXX.XXX Domain Name	This is the IP Address or Domain Name of the local NTP Server on the network. This setting is only available if Update Mode is set to NTP.
Date	MM/DD/YYYY	This setting is the user defined date. A calendar widget can be used to select the data by clicking the button. This setting is only available if Update Mode is set to Manual.
Time	00:00:00 – 24:00:00	This setting is the user defined time. The time is based on a 24-hour clock. This setting is only available if the Update Mode is set to Manual.

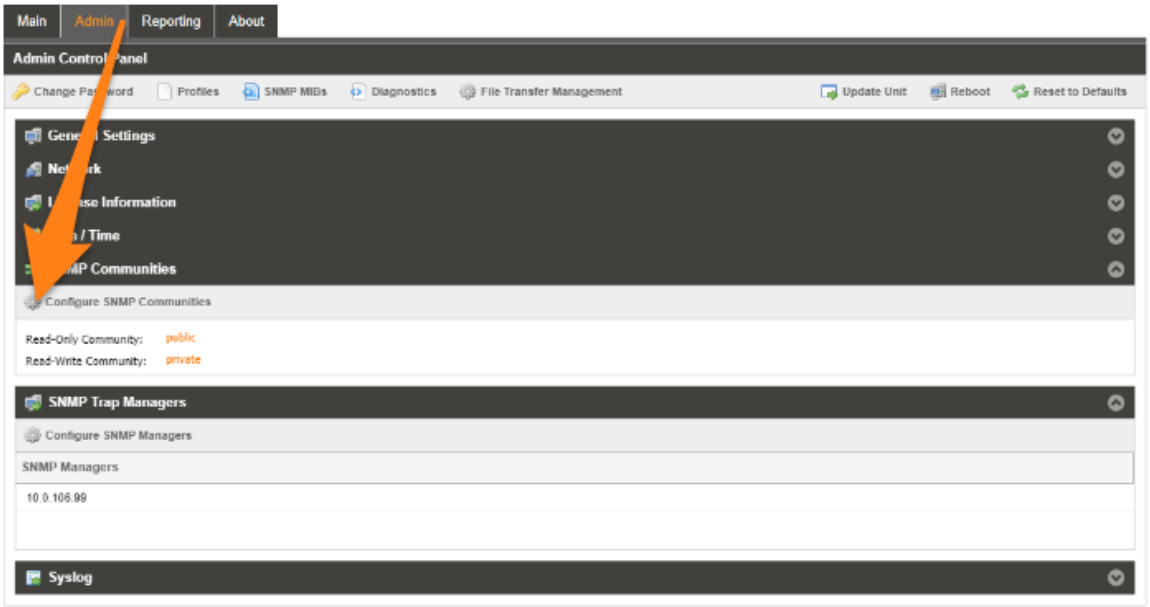
3.3.11 Syslog

The MRD 7000 can be configured to send error and event logs formatted in the syslog protocol to a remote user specified Syslog server.

Action	Range	Description
State	Enabled Disabled	Enable or Disable sending messages to Syslog server.
Network Protocol	UDP TCP	Select which network protocol used to transmit to the Syslog server
IP Address	Four decimal octets: XXX.XXX.XXX.XXX	IP of the Syslog server. 0.0.0.0 and 255.255.255.255 are not permitted
Port	0 - 65535	Destination port of the Syslog server

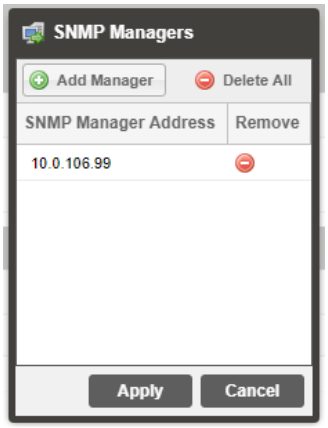
3.3.12 SNMP Community

Click on the SNMP Community configuration under the Admin tab for manual entry of the read and write communities.



3.3.13 SNMP Trap Manager

Click on the SNMP Trap Manager configuration icon to adjust the IP address of the SNMP trap destination. An example is provided below.



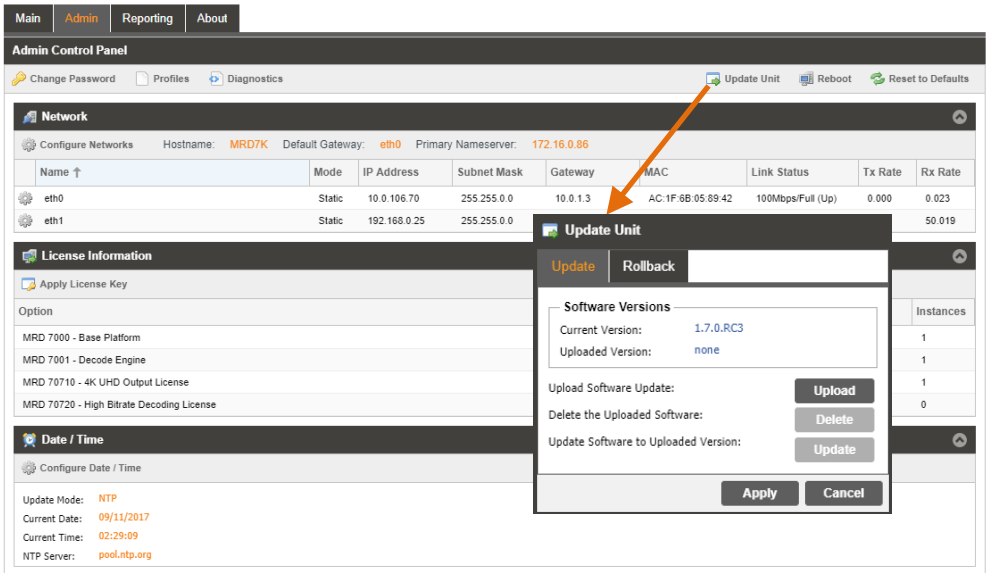
3.3.14 Updating the MRD 7000

Updates to the MRD are performed through the web interface. A software update file is provided by Sencore and then uploaded to the unit.

To request the latest software version or a copy of the release notes email ProCare@Sencore.com

3.3.14.1 Applying Software Updates

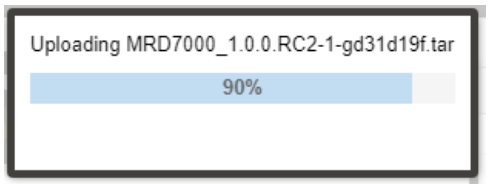
Once the software file is downloaded the update can be performed under the Admin tab of the MRD 7000 Web-Interface. Click on the Update Unit button in the top right of the page.



The current version and uploaded version is displayed in the Software Versions section.

Update Procedure:

1. Click Upload button and browse to the appropriate software file
2. A progress bar will show uploading status
3. Once the file is uploaded click on Yes when prompted to update
4. The MRD will reboot after a software update is complete.

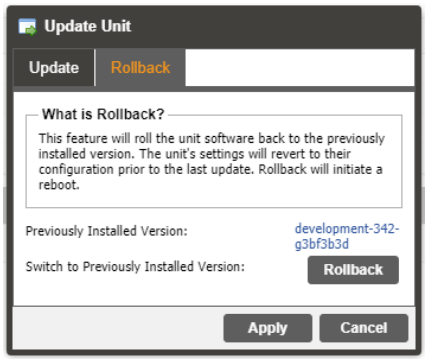


Action	Button	Description
Upload	Upload	To upload software updates to the MRD click this button. The user will be prompted to navigate to an update file. The file will then upload to the MRD. When complete the Update Unit menu will show the Update button available.
Delete	Delete	Clicking this button prompts the user to confirm the deletion of the software update from the MRD. This will also clear the Uploaded Version status of the Software Versions section.
Update Software to Uploaded Version	Update	Clicking the button starts the software update process. The MRD will prompt the user to confirm the update. Click Yes to continue or No to cancel.

3.3.14.2 Rollback Software Updates

The MRD is capable of reverting back to a previous version of software using the Rollback feature. The MRD accomplishes this by maintaining two separate software images; one is the most current version of software with all current settings and the other is the previous version of software with all of the previous settings.

To perform a rollback, click the Update Unit button and then click the Rollback tab. The MRD will reboot after the rollback process is complete.



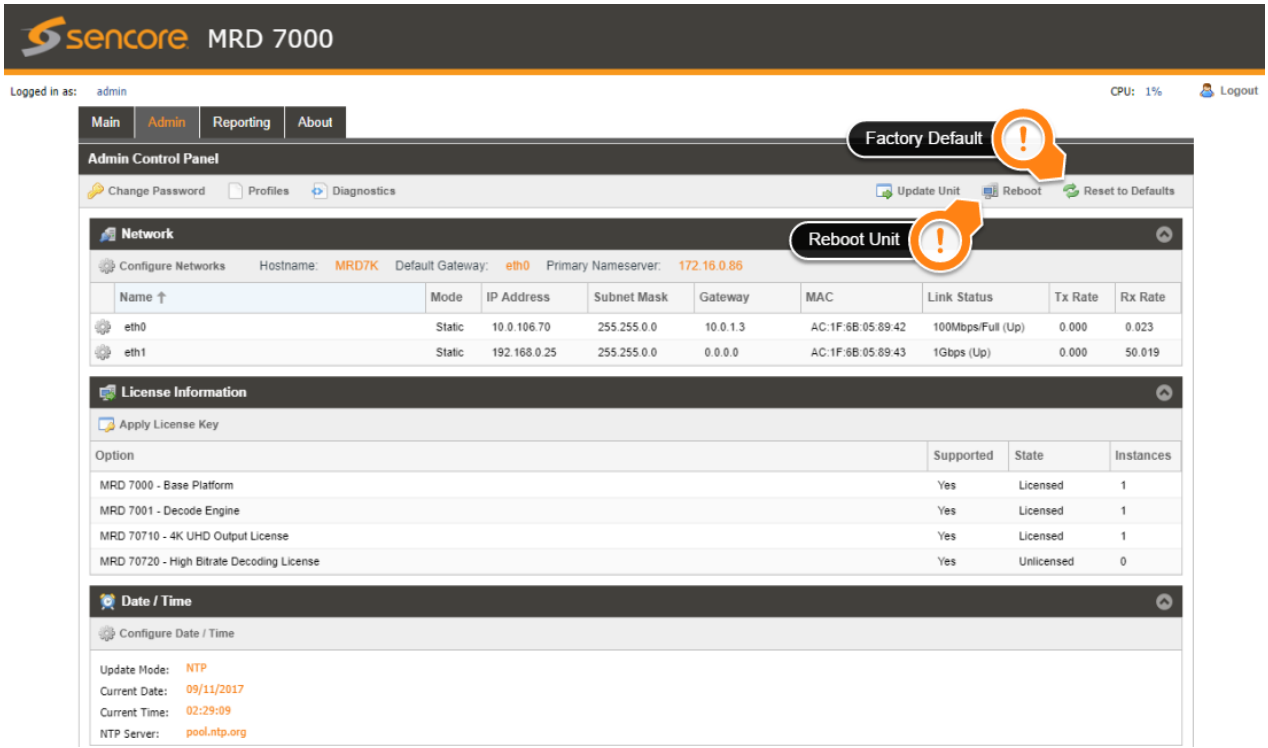
Action	Button	Description
Rollback	Rollback	Clicking this button starts the Rollback process. The MRD will prompt the user to confirm the rollback or click cancel to stop the process.

3.3.15 Reboot Unit

The MRD can be rebooted from the web interface Admin page. In order to perform a reboot, click the reboot button. The MRD will prompt the user to confirm the reboot. Once the reboot is complete the login screen will appear allowing the web interface to be logged into.

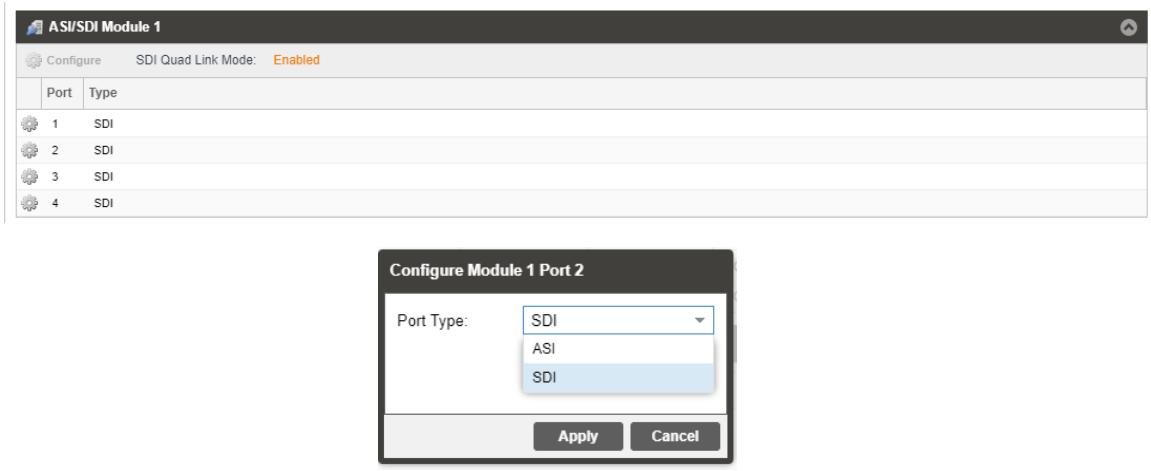
3.3.16 Reset Defaults

The MRD settings can be reset to factory defaults. All settings will be returned to the factory defaults except the network management ports TCP/IP settings. All event logs will be cleared. To reset all settings to default, click the Reset to Defaults button on the Admin page. The MRD will prompt the user to confirm the reset.

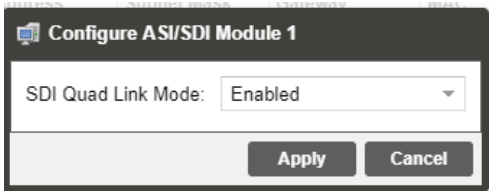


3.3.17 Configuring ASI/SDI Ports and SDI Quad Link Mode

The MRD 7000 allows users to configure the ASI/SDI ports when equipped with the MRD 70140 module. Select ASI/SDI ports 1 through 4 when Quad Link Mode is disabled to enable the ports as either SDI or ASI. A reboot must be applied for the changes to take effect.



A user can enable SDI Quad Link Mode. A reboot must be applied for any changes to the SDI Quad Link Mode to be applied.

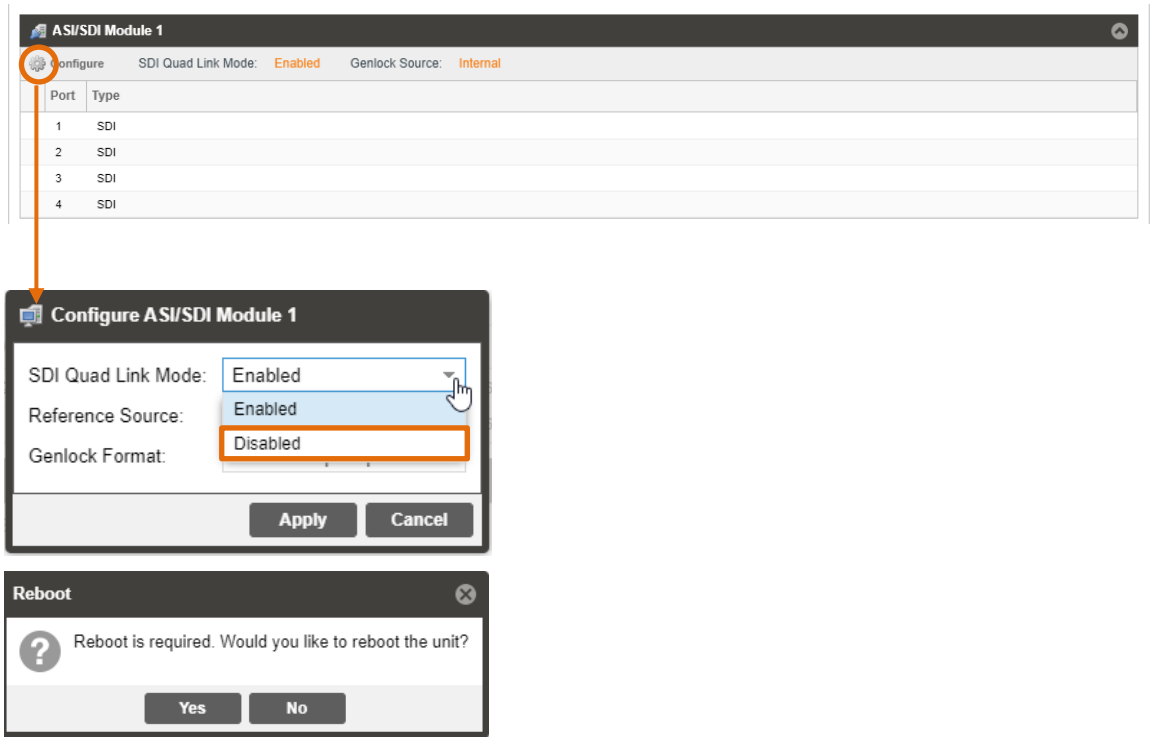


3.3.18 Configuring Multichannel Decoder Outputs

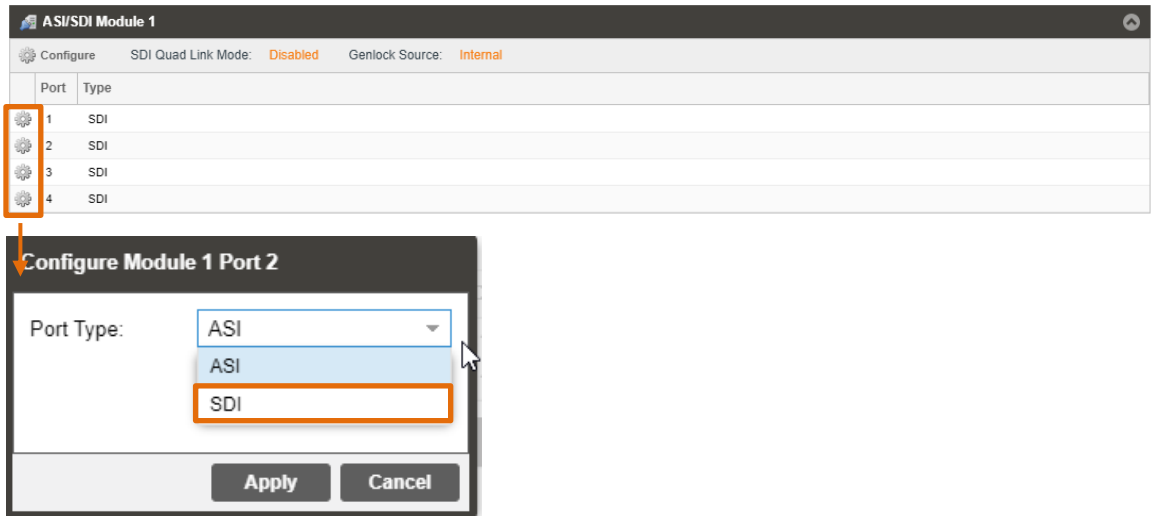
MRD7000 allows to decode single UHD or multi channel HD/SD:

- up to 4 HD/SD channels when unit equipped with the MRD 70140 module
- up to 2 HD/SD channels when unit equipped with the 2x MRD 70130 modules

For decoder equipped with MRD 70140: to change from UHD mode to multichannel mode user needs to disable Quad link mode and make sure all 4 ports are set as SDI.

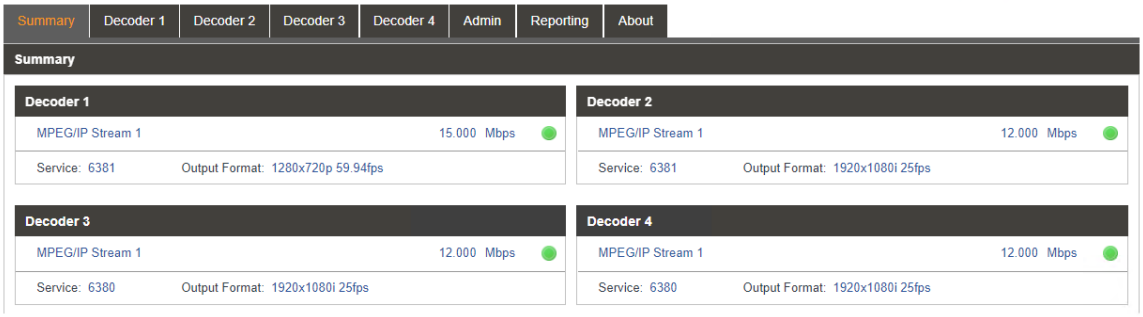


When unit boot up make sure all ports are set as SDI.



!Note: To make all new tabs available clear WEB cache by pressing Ctrl+Shift+R buttons.

When Quad link mode was successfully disabled user gets possibility to configure 4 HD decoders available via Decoder1, Decoder2, Decoder3, Decoder4 tabs. Summary tab displays overall status for all decoders.



3.4 Reporting Panel

The Reporting tab in the MRD 7000 contains logs for active alarms currently affecting the unit and an event log. The active alarms are updated periodically in order to reflect the real-time state of the unit. Once an error is cleared it will be cleared from the active alarms window. The event log can be used to view alarm and event history. Both the active alarm and event logs can be configured to hide or change the behavior of alarms and events.

3.4.1 Active Alarms

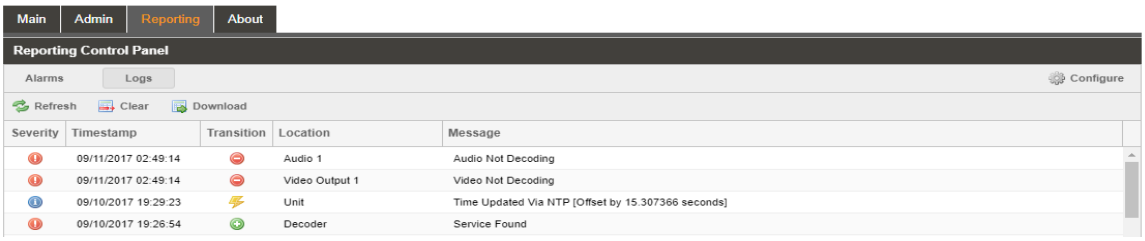
Clicking on the Alarms button displays the Active Alarms menu. This list displays all of the active alarms currently affecting the unit. There are four columns in the log that display different types of information.

Title	Description
State	This column displays the nature of the alarm. The icon means the log entry is informational and is not an error. The icon means the log entry is an active alarm.
Name	This column displays the description of the error. The function that is experiencing an error condition is described here.
Location	This column displays the hardware or function that is experiencing the active error.

Last Changed	This column displays the data and time the error was raised. This data and time correlates with the Date and Time settings configured in Section 3.3.10.

3.4.2 Event Logs

Clicking on the Logs button displays all of the events and alarms that have affected the unit. If the unit is rebooted or powered off and on the event logs are cleared. The logs can be cleared manually by clicking the Clear button. The logs can be downloaded as a ".csv" file and saved to an external location by clicking the Download button.

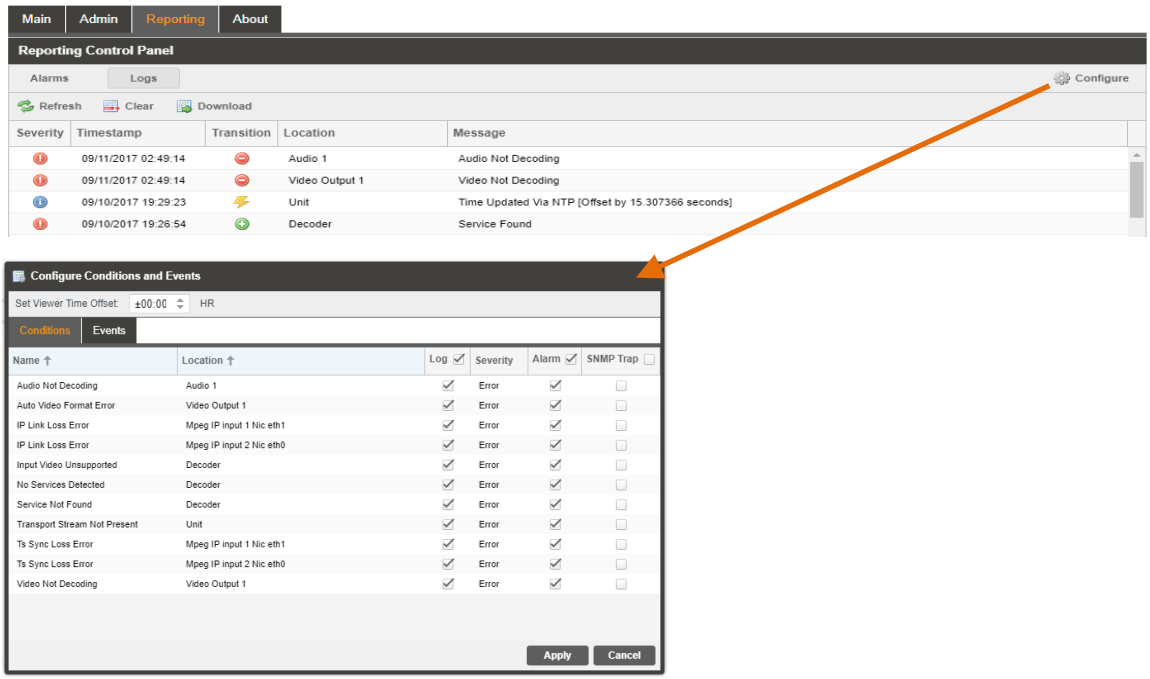


Title	Description
Severity	This column displays the nature of the alarm. The icon means the log entry is informational and is not an error. The icon means the log entry is an active alarm.
Timestamp	This column displays the data and time the error was raised or cleared. This data and time correlates with the Date and Time settings configured in Section 3.3.10.
Transition	This column displays when an alarm transition from a bad to good state. When an error is raised the icon is displayed. When an error is cleared the icon is displayed. When an event takes place the icon is displayed.
Message	This column displays the description of the error or event. The function or hardware that experienced the event or error is described here.
Location	This column displays the hardware or function that experienced the alarm or event.

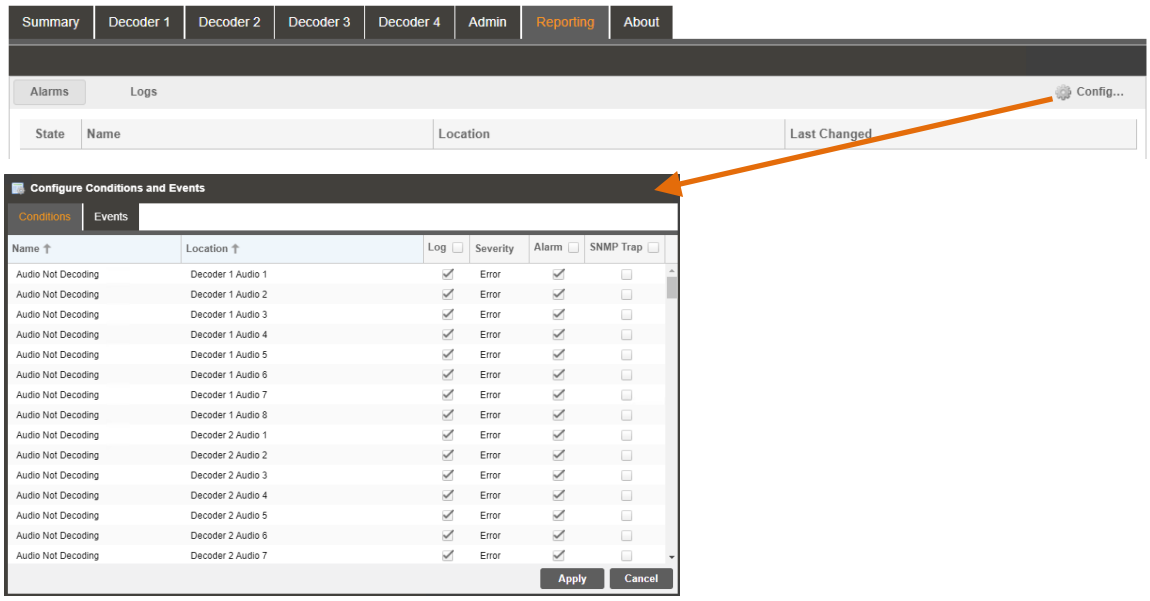
3.4.3 Configuring the Logs

The MRD 7000 allows the user to configure alarms and events. Events and alarms can be Logged, Hidden, or have the Severity adjusted.

In order to configure these options, click the Configure button while in the section of the Reporting tab.



When multi-channel decoder option is enabled then logs and events can be configured separately for every decoder

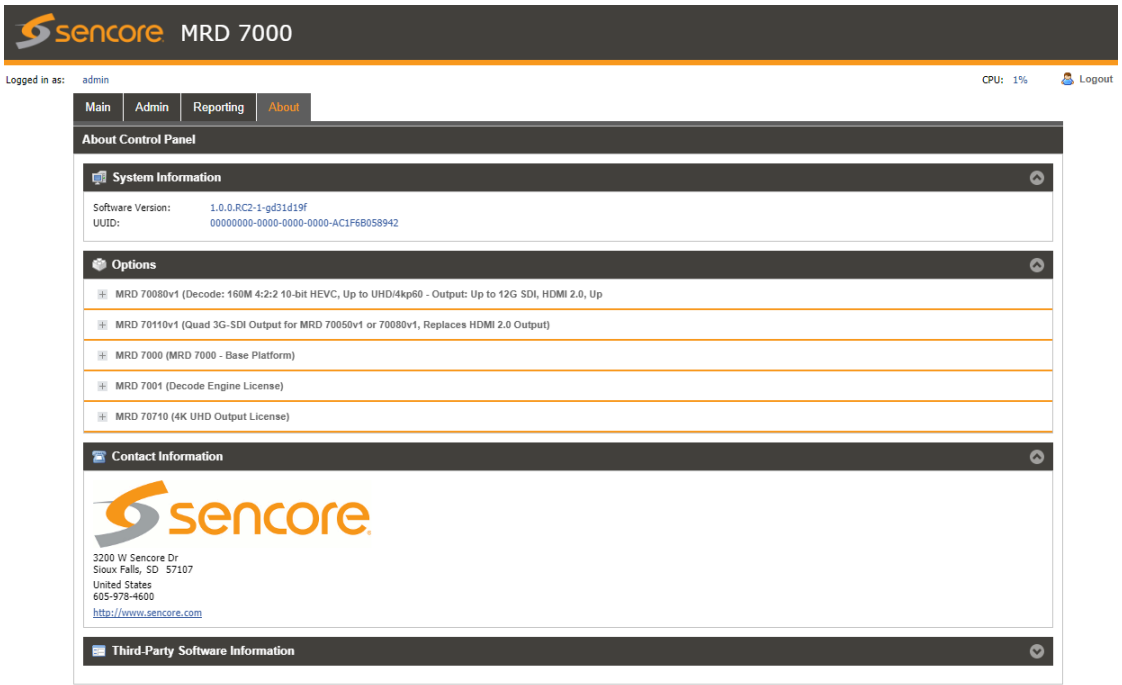


Each column and its function are described below. A user configured time offset can also be applied to allow viewing the logs in a local time zone.

Title	Description
Name	This column displays the name of the error or condition. This is informational data: no options can be set here.
Location	This column displays the hardware or function that the alarm or event applies to. This is informational data; no options can be set here.
Log	Checking the box in this column creates an entry in the event log in the case this error or event is raised. If this box is unchecked this error or event will be hidden and not logged if raised.
Log Severity	This column is only available in the Conditions tab. This option allows the user to set the severity of the error to Info or Error. If Info is selected in the drop-down box the icon will displayed in the event log. If Error is selected the icon will be displayed in the event log.
Alarm	This column is only available in the Conditions tab. This option allows the user to enable or disable this alarm in the Active Alarms log. If checked the alarm will be displayed in the Active Alarms log if raised. If this box is unchecked this error will be hidden.

3.5 About Panel

Under the About tab, there are no user definable parameters but there is information about software versions currently installed, which licenses are installed, how to contact Sencore, and third-party software information.



Section 4 Appendices

Introduction

This section includes the following appendices:

Appendix A – Acronyms and Glossary

AAC: Advanced Audio Coding
AC-3: Also known as Dolby Digital
AES: Audio Engineering Society
ATSC: Advanced Television Systems Committee
Bit Rate: The rate at which the compressed bit stream is delivered from the channel to the input of a decoder.
BNC: British Naval Connector
dB: Decibel
DHCP: Dynamic Host Configuration Protocol
DVB: Digital Video Broadcasting
Event: An event is defined as a collection of elementary streams with a common time base, an associated start time, and an associated end time.
FCC: Federal Communications Commission
HD: High Definition
I/O: Input/Output
IP: Internet Protocol
Kbps: 1000 bit per second
LED: Light Emitting Diode
Mbps: 1,000,000 bits per second.
MPEG: Refers to standards developed by the ISO/IEC JTC1/SC29 WG11, *Moving Picture Experts Group.* MPEG may also refer to the Group.
MPEG-2: Refers to ISO/IEC standards 13818-1 (Systems), 13818-2 (Video), 13818-3 (Audio), 13818-4
NTP: Networking Time Protocol
PCM: Pulse-Code Modulation
PID: Packet Identifier. A unique integer value used to associate elementary streams of a program in a single or multi-program transport stream.
Program specific information (PSI): PSI consists of normative data which is necessary for the demultiplexing of transport streams and the successful regeneration of programs.
Program: A program is a collection of program elements. Program elements may be elementary streams. Program elements need not have any defined time base; those that do have a common time base and are intended for synchronized presentation.
RU: Rack Unit
SD: Standard Definition
SDI: Serial Digital Interface
SI: System Information
SMPTE: Society of Motion Pictures and Television Engineers
SNMP: Simple Network Management Protocol
TS: Transport Stream

Appendix B – Error and Event List

Error	Description
Audio Not Decoding	Indicates selected service is not decoding an audio PID.
Auto Video Format Error	The MRD encountered an error when automatically choosing the output format.
Decoder Latency Too Low	The parallel frames processing setting is too low for the decoded video codec. Recommended action is to set parallel frame processing to default or increase the number of frames.
IP Link Loss Error	MPEG/IP stream sync is not detected.
Input Video Unsupported	The video source format or codec is unsupported.
Insufficient Decoder Performance	The unit does not have enough processing power to decode the transport stream. Contact ProCare@sencore.com for support.
No Services Detected	There are no service detected on the active input.
Port Link Loss Error	Physical Ethernet link is not detected on given Ethernet interface. Check ethernet cable.
RTP Reception Error	RTP IP statistics has detected an out of order, duplicate, or lost packet or discontinuity in the incoming MPEG/IP stream.
Service Not Found	No services were found on the configured input.
Transport Stream Not Present	There is no transport stream present on the configured input.
TS Sync Loss Error	Active input transport stream lost sync. (ETR Priority 1 Error)
Video Not Decoding	The video payload in the selected service cannot decode.

Appendix C – Specifications

MRD 7000 Minimum Requirements

For H.264 1080P60 Decode

CPU:	Dual Intel Xeon D-1520, 2.2GHz
RAM:	16GB DDR4 2133MHz
HDD:	256GB SSD

For HEVC 4K UHD 60MB Decode

CPU:	Intel Xeon E-1650v4, 3.6GHz
RAM:	32GB DDR4 2133MHz
HDD:	256GB SSD

For HEVC 4K UHD 160MB Decode

CPU:	Intel Xeon E5-2600 series v4, 3.4GHz
RAM:	64GB DDR4 2133MHz
HDD:	256GB SSD

Base Video Decoding Features

General –

TS Data Rate: .25-200 Mb/s

Video Decoder –

Video Profiles and Levels:
Base Software –
Up to MPEG-2 422P@HL (HD Formats)
Up to H.264 Hi422P@4.2 (HD Formats)
Up to HEVC Main 4:2:2 10 (HD Formats)
Up to JPEG2000 (HD Formats)

Video Bit Rate:
MRD 70080:
- MPEG-2 1-100Mb/s
- H.264 1-100Mb/s
- HEVC 1-160Mbps

MRD 70050
- MPEG-2 1-100Mb/s
- H.264 1-100Mb/s
- HEVC 1-80Mbps

MRD 70020
- MPEG-2 1-100Mb/s
- H.264 1-100Mb/s
- HEVC 1-70Mbps

Video Formats:
Base Software –
1080p x 1920 (16x9) @ 50, 59.94 and 60Hz
1080i x 1920 (16x9) @ 25, 29.97 and 30Hz
1080p x 1920 (16x9) @ 23.97, 24, 25, 29.97 and 30Hz
720p x 1280 (16x9) @ 50, 59.94, and 60Hz
576i x 720 (4x3 or 16x9) @ 25Hz
576i x 704 (4x3 or 16x9) @ 25hz

	576i x 544 (4x3 or 16x9) @ 25hz 480i x 720 (4x3 or 16x9) @ 29.97Hz SD-SDI – 270Mb/s MRD 70706 License Adds – 2160p x 3840 (16x9) @ 23.97, 24, 25, 29.97, 30, 50, 59.94, and 60Hz
HDR Formats:	HDR10 (SMPTE 2084 & SMPTE 2086) HLG (ARIB STD B67)

MRD 70XX0 SDI Output Features

MRD 70130 Output Features

Ports:	1x 12G-ASI in 1x 12G-SDI out 1x HDMI 2.0 out 1x Genlock in
Connectors:	3x 75-Ω BNC 1x HDMI type A receptacle
Vdieo Standards:	SD-SDI – SMPTE 259M HD-SDI – SMPTE 292M 3G-SDI – SMPTE 424M 12G-SDI – SMPTE 2082 HDMI 2.0B
Video Formats:	480i, 525i, 576i, 625i, 720p, 1080i, 1080p, 1080psf, 2160p. All common formats supported.
Audio Output:	Up to 8 pairs of audio streams
ANC Data Support:	708 Closed Captions SMPTE 2038 SCTE 104 OP47 SMPTE 2031 VPID SMPTE 2108
Genlock Interface –	
Genlock Connector:	75Ω Female BNC
Input Impedance:	10kΩ
Return Loss:	≥20 dB, 0Mhz to 8 Mhz
Drive Level:	1.0 Vpp ±10%
Supported Genlock References:	Tri-sync and Black Burst 1080i x 1920 @ 25, 29.97 and 30fps 1080p x 1920 @ 23.97, 24, 25, 29.97, 30, 50, 59.94 and 60fps 720p x 1280 @ 50, 59.94 and 60fps

MRD 70140 Output Features

Ports:	4x 3G-SDI out / ASI in 1x genlock in
Connectors:	5x 75-Ω DIN 1.0/2.3 Shipped with 5x converter cable 1.0/2.3 to BNC
Vdieo Standards:	SD-SDI – SMPTE 259M HD-SDI – SMPTE 292M 3G-SDI – SMPTE 424M
4K multi-link	SMPTE 425-5 4 quadrant and two sample interleave
Video Formats:	480i, 576i, 525i, 625i, 720p, 1080i, 1080p, 1080psf, 2160p. All common formats supported.
Audio Output:	Up to 8 pairs of audio streams
ANC Data Support:	708 Closed Captions SMPTE 2038 SCTE 104 OP47 SMPTE 2031 VPID SMPTE 2108
Genlock Interface –	
Genlock Connector:	75-Ω DIN 1.0/2.3
Input Impedance:	10kΩ
Return Loss:	≥20 dB, 0Mhz to 8 Mhz
Drive Level:	1.0 Vpp ±10%
Supported Genlock References:	Tri-sync and Black Burst 1080i x 1920 @ 25, 29.97 and 30fps 1080p x 1920 @ 23.97, 24, 25, 29.97, 30, 50, 59.94 and 60fps 720p x 1280 @ 50, 59.94 and 60fps

MRD 70150 Output Features

SDI Output Features

SDI (Serial Digital Interface) Video Out –	
SDI Standards:	HD-SDI ANSI/SMPTE ST 292M Single 3G-SDI ANSI/SMPTE ST 424M Quad 3G-SDI ANSI/SMPTE ST 425-5 (Quadrant) 6G-SDI ANSI/SMPTE ST 2081 12G-SDI ANSI/SMPTE ST 2082
SDI Level:	Level A or Level B (user selectable)
Connector:	75Ω Female BNC

Return Loss:	≥15 dB, 5Mhz to 1.5GHz ≥10 dB, 1.5 GHz to 3.0GHz
Drive Level:	800 mVpp ±10%
Data Bit Rate:	12G-SDI – 12 Gb/s 6G-SDI – 6 Gb/s 3G-SDI – 3.0 Gb/s HD-SDI – 1.5 Gb/s

HDMI 2.0 Output –

Digital Video Standard:	SDA-HDMI-OM-E Rev A
Connector:	HDMI-type Female Type-A

Genlock Interface –

Genlock Connector:	Requires breakout cable, Pin 6 75Ω Female BNC
Input Impedance:	10kΩ
Return Loss:	≥20 dB, 0Mhz to 8 Mhz
Drive Level:	1.0 Vpp ±10%
Supported Genlock References:	Tri-sync and Black Burst 1080i x 1920 @ 25, 29.97 and 30fps 1080p x 1920 @ 23.97, 24, 25, 29.97, 30, 50, 59.94 and 60fps 720p x 1280 @ 50, 59.94 and 60fps

Base Audio Decoding Features

Number of Audio Services:	8 Audio Services
Audio Codecs Supported:	Dolby Digital (AC-3) & Plus (EAC-3) Dolby ATMOS and Dolby E AAC-LC, HE-AAC, & HE-AACv2 MPEG1L2 & MPEG2L2 SMPTE 302M Linear PCM (Pass-through)
Output Formats:	Digital Pass-through PCM (Decoded Discrete channels for 5.1 Sources or Downmixed for 5.1 Sources)

IP Input/Output

General –

Connector:	2x 10/100/1000 auto negotiate Base-T RJ-45 Ethernet Ports

Receive –

Input Format:	UDP, RTP and RTP with extension headers Multicast and Unicast CBR, VBR SMPTE 2022-7 Hitless switching
Multicast Filtering:	Filters based on IP address
Bitrate Range:	.25 – 200 Mb/s
Packets/IP Frame:	1-7 MPEG Packets/IP Frame
IGMP Compatibility:	Version 2 and 3

FEC Receive:	Pro MPEG CoP3 SMPTE2022 Range: L*D≤100 1≤L≤20 4≤D≤20 Annex B

SMPTE 2110 10GB Output Features (MRD 70120)

Connectors:	2x 10GB SFP+ (MSA Compliant)
IP Encapsulation:	SMPTE 2110-10 SMPTE 2110-20 SMPTE 2110-30 SMPTE 2110-40
Packet Pacing:	SMPTE 2110-21 Type N (Narrow)
PTP Synchronization:	SMPTE 2059-2
Output Redundancy	SMPTE 2022-7 Hitless Switching
Video Standards:	8-bit and 10-bit YUV 4:2:2 SMPTE 292M, and SMPTE 425-AB
Video Formats:	1080p x 1920 (16x9) @ 50, 59.94 and 60Hz 1080i x 1920 (16x9) @ 25, 29.97 and 30Hz 1080p x 1920 (16x9) @ 23.97, 24, 25, 29.97 and 30Hz 720p x 1280 (16x9) @ 50, 59.94, and 60Hz
Audio Output:	Up to 8 pairs (16 channels)
ANC Data Support:	708 Closed Captions SMPTE 2038 SCTE 104 OP47 SMPTE 2031

SMPTE 2110 25GB Output Features (MRD 70180)

Connectors:	2x 25GB SFP28 (MSA Compliant)
IP Encapsulation:	SMPTE 2110-10 SMPTE 2110-20 SMPTE 2110-30 SMPTE 2110-40
Packet Pacing:	SMPTE 2110-21 Type N (Narrow)
PTP Synchronization:	SMPTE 2059-2

Output Redundancy:	SMPTE 2022-7 Hitless Switching
Video Standards:	8-bit and 10-bit YUV 4:2:2 SMPTE 292M, and SMPTE 425-AB
Video Formats:	2160p x 3840 (16x9) @ 23.97, 24, 25, 29.97, 30, 50, 59.94, and 60Hz 1080p x 1920 (16x9) @ 50, 59.94 and 60Hz 1080i x 1920 (16x9) @ 25, 29.97 and 30Hz 1080p x 1920 (16x9) @ 23.97, 24, 25, 29.97 and 30Hz 720p x 1280 (16x9) @ 50, 59.94, and 60Hz
Audio Output:	Up to 8 pairs (16 channels)
ANC Data Support:	708 Closed Captions SMPTE 2038 SCTE 104 OP47 SMPTE 2031

ASI Input Module Features (MRD 70170)

General –	
Connector:	4x BNC, Female
Impedance:	75Ω
Return Loss:	≥15dB, 3.5 to 270 MHz
ASI Input –	
Standard:	EN50083-9 (V2:3/98) DVB ASI
Data Bit Rate:	270 Mb/s
Maximum TS Rate:	200 Mb/s
Minimum TS Rate:	250 Kb/s
Packet Sizes	188 bytes
Modes Supported:	Burst, Byte and Inverted

Appendix D – Downmix Audio Setup

There are two primary modes of audio down mix operation for the MRD 7000 receiver/decoders. It will also affect those embedded audio channels that are set to a PCM down mix. The preset modes are Monitor (the default setting) and Transmission.

The first preset, Transmission, allows no changes by the customer. Transmission is intended to provide a limited dynamic range signal to drive a set top box or a transmitter. The Transmission mode does respond to dialog normalization data. It provides a gain boost of 11 dB and has compression to prevent the signal from overdriving a modulator. The 11dB gain boost is applied to the analog outputs, AES digital outputs set to PCM, and any embedded outputs set to PCM. It will not affect the gain of digital outputs or embedded outputs set to Pass-Through. It is intended to provide a similar audio level as a broadcast TV station signal through an RF modulator. The down mix includes the center and surrounds channels if they are present, and is represented as Lt/Rt. (left total, right total)

The second preset is Monitor. It has moderate processing, no gain boost and its down mix involves left and right channels only (Lo/Ro). The mode setting is Line as the default, but may be changed to RF, Custom 0 or Custom 1. In Line mode, the Dolby Dialog Normalization data is followed along with moderate processing. The default down mix setting for Monitor is Lo/Ro. The down mix may be changed to Lt/Rt or Lt/Rt/auto. Lt/Rt auto follows the embedded data in the stream if the producer has a preferred down mix. It will switch automatically between Lo/Ro and Lt/Rt depending on the data in the stream. If no mode is specified, the down mix will be Lt/Rt. In addition, the Dual Mono modes of operation may be selected. They will only have an effect if the stream is encoded as Dual Mono. Dual Left or Dual Right applies that signal to both left and right channels of the digital service, left and right channels of the analog outputs, and left and right channels of any embedded stream set to PCM. Selecting RF as the compression setting will add 11 dB of gain and the same processing as the Transmission mode to the analog outputs, AES digital outputs set to PCM, and any embedded outputs set to PCM.

If you want to run with no processing, choose Custom 1, Lo/Ro, and Dynamic Range disabled. This will still allow gain changes called for in the Dolby metadata via Dial-Norm settings in the stream.

Downmix Reference Table

The following table is applicable for MPEG Audio (Mono and Stereo), Dolby Digital (Mono, Stereo and 5.1), Dolby Digital Plus (Mono, Stereo and 5.1) and AAC (Mono, Stereo and 5.1).

Incoming audio PID -->	Downmix Option	--> Output effect
Stereo	Lo/Ro	OUT = IN
Stereo	Lt/Rt (DS)	OUT = IN
Stereo	Lt/Rt (Auto)	OUT = IN
Stereo	Dual mono	OUT = IN
Stereo	Dual left	OUT L = OUT R = IN L
Stereo	Dual right	OUT L = OUT R = IN R
Mono	Lo/Ro	OUT L = OUT R = IN
Mono	Lt/Rt (DS)	OUT L = OUT R = IN
Mono	Lt/Rt (Auto)	OUT L = OUT R = IN
Mono	Dual mono	OUT L = OUT R = IN
Mono	Dual left	OUT L = OUT R = IN
Mono	Dual right	OUT L = OUT R = IN
5.1	Lo/Ro	OUT L = L + C + Ls OUT R = R + C + Rs (per ATSC A52)
5.1	Lt/Rt (DS)	OUT L = L + C – Ls - Rs OUT R = R + C + Ls +Rs (per ATSC A52)
5.1	Lt/Rt (Auto)	Lo/Ro or Lt/Rt depending on dolby metadata
5.1	Dual mono	OUT L = front left OUT R = front right
5.1	Dual left	OUT L = OUT R = IN Lo
5.1	Dual right	OUT L = OUT R = IN Ro

Appendix E – Discrete Audio

Selecting the discrete option differs from downmix in that it simply decodes the selected audio channels rather than downmixing multiple channels into 2 channels.

Appendix F – Open Source Software

The MRD 7000 includes:

Package	Version	License	Copyright
AT32 UC3B Software Framework	1.7.0	BSD	2009, Atmel Corporation
BusyBox	1.20.1	GPL Version 2, June 1991	Erik Anderson, et. al.
DejaVu Fonts	2.35	Free	2003, Bitstream; 2006, Tavmjong Bah
dfu-programmer	0.5.2	GPL Version 2, June 1991	Weston Schmidt
Dropbear	2016.75	MIT-like	2002-20015 Matt Johnston, et. al (see license)
E2fsprogs	1.41.9	GPL Version 2, June 1991	Theodore Ts'o
ethtool	2.6.34	GPL Version 2, June 1991	David Miller, et. al.
FamFamFam Silk Icons	013	Creative Commons Attribution 2.5	Mark James
FastDB	3.71	MIT-like	Konstantin Knizhnik
FCGI	2.4.6	FastCGI	Open Market, Inc
FFMPEG	3.4	LGPL Version 2.1 Feb 1999	Fabrice Bellard
Iproute2	3.4.0	GPL Version 2, June 1991	Stephen Hemminger, Alexey Kuznetsov
Libusb	0.1.12	GPL Version 2.1, Feb 1999	Johannes Erdfelt, Thomas Sailer, Brad Hards
Lighttpd	1.4.30	BSD	2004, Jan Kneschke
Linux	2.6.30	GPL Version 2, June 1991	Linus Torvalds, et. Al.
Log4cpp	1.0	GPL Version 2.1 Feb 1999	Bastiann Bakker
Monit	5.1.1	GPL Version 3, 29 June 07	2010 Tildeslash Ltd.
Net-SNMP	5.7.1	BSD	1989, 1991, 1992 by Carnegie Mellon Univsty.
NTP	4.2.4p7	NTP License	1992-2009 David L. Mills
OpenSSL	1.0.1c	BSD-Like	1998-2008 The OpenSSL Project, 1995-1998

OProfile	0.9.7	GPL Version 2, June 1991	John Levon, Philippe Elie, et. al
PCRE	8.30	BSD	1997-2012 University of Cambridge, et. al.
POPT	1.14	MIT	1998 Red Hat Software
qDecoder	12.0.4	BSD	200-2012 Seungyoung Kim
Socket-CAN	1171	BSD-like, GPL Version 2, June 1991	2002-2007 Volkswagen Group Electronic Research
Spawn-FCGI	1.6.3	BSD	Jan Kneschke, Stefan Bahler
TCLAP	1.2.0	MIT	2003 Michael E Smoot
U-Boot	2009.11.1	GPL Version 2, June 1991	Wolfgane Denk, et. al.
USB-Utils	0.86	GPL Version 2, June 1991	Thomas Sailer, Johannes Erdfelt, David Brownell,
Zlib	1.2.7	Zlib/libpng License	1995-2005 Jean-loup Gailly and Mark Adler

Appendix G – Warranty

Sencore Hardware One-Year Warranty

Sencore warrants this instrument against defects from any cause, except acts of God and abusive use, for a period of 1 (one) year from date of purchase. During this warranty period, Sencore will correct any covered defects without charge for parts, labor, or recalibration.

Appendix H – Support and Contact Information

Returning Products for Service or Calibration

The MRD 7000 server is a delicate piece of equipment and needs to be serviced and repaired by Sencore. Periodically it is necessary to return a product for repair or calibration. In order to expedite this process please carefully read the instructions below.

RMA Number

Before any product can be returned for service or calibration, an RMA number must be obtained. In order to obtain a RMA number, use the following steps:

1. Contact the Sencore service department by going online to www.sencore.com and select Support.
2. Select Service and Repair from the options given.
3. Fill in the following required information:
    a. First & Last Name
    b. Company
    c. Email
    d. Phone Number
    e. Ship and Bill to Address
    f. Unit Model and Serial Numbers
4. A RMA number will be emailed you shortly after completing the form with return instructions.

Shipping the Product

Once an RMA number has been issued, the unit needs to be packaged and shipped back to Sencore. It's best to use the original box and packaging for the product but if this not available, check with the customer service representative for the proper packaging instructions.

Note: DO NOT return any power cables or accessories unless instructed to do so by the customer service representative

Sencore Inc.
3200 Sencore Drive
Sioux Falls, SD 57107 USA
www.sencore.com
1.605.978.4600