# MRD 6000
# 4K UHD Receiver Decoder

## User Manual


Form 8187C
www.sencore.com | 1.605.978.4600
January 2020
Revision 1.2

## Copyright


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www.sencore.com



## 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 |
|---|---|---|---|
| 11/06/2018 | 1.0 | Initial Release | GAK |
| 10/9/2019 | 1.1 | Update for 4.1.0 and 4.2.0 Release | BCR |
| 1/27/2020 | 1.2 | Appending to S2X Module Specs | BCR |

# 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 MRD 6000 to ensure that it is as safe as possible. However, safe operation depends on you the operator.
- Always be sure your equipment is in good working order. Ensure that all points of connection are secure to the chassis and that protective covers are in place and secured with fasteners.
- Never work alone when working in hazardous conditions. Always have another person close by in case of an accident.
- Always refer to the manual for safe operation. If you have a question about the application or operation call Sencore for assistance.
- 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 MRD 6000 must be connected to a mains socket outlet with a protective earthing connection.
- For the MRD 6000 the mains plug is the main disconnect and should remain readily accessible and operable at all times.
- The MRD 6000 is equipped with an internal system battery. The MRD 6000 must be sent to Sencore service for replacement of this battery.
- When installing the MRD 6000 utilizing the DC power supply, the power supply MUST be used in conjunction with an over-current protective device rated at 50V, 5A, type: Slow-blo, as part of battery-supply circuit.
- To reduce the risk of shock and damage to equipment, it is recommended that the chassis grounding screw located on the rear of the MRD 6000 – be connected to the installation's rack, the vehicle's chassis, the battery's negative terminal, and/or earth ground.

**CAUTION** – Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type.

## FCC Class A Information

The MRD 6000 has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

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

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

## Dolby Digital Information

This product has been manufactured under license from Dolby Laboratories.

"Dolby Digital", "AC-3", and "Dolby Digital Plus" are licensed trademarks of Dolby Laboratories.

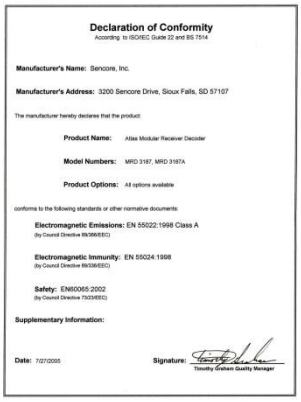
# Package Contents

The following is a list of the items that are included along with the MRD 6000:

1. Declaration of Conformity
2. AC Power Cable
3. Quick Start Guide

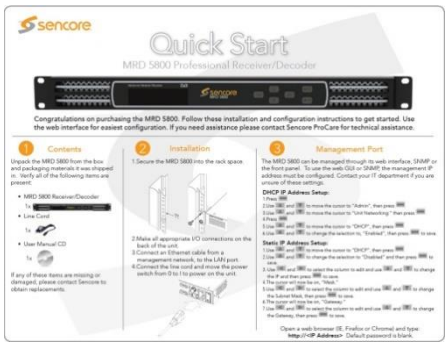
*Note: If any option cables were ordered with the MRD 6000, they will be included in the box as well.*

If any of these items were omitted from the packaging of the MRD 6000 please call 1-800-SENCORE to obtain a replacement. Manuals for Sencore products can be downloaded at www.sencore.com




**1) Declaration of Conformity**

**2) AC Power Cable**




**3) Quick Start Guide**

# Table of Contents

# Section 1 Overview


## Introduction

This section includes the following topics:

## 1.1 Product Introduction

The MRD 6000 4K/UHD receiver decoder continues Sencore's long history of leadership and innovation in professional receiver/decoders. It is built with the latest-generation 4K/UHD ASIC decoder technology delivering reliable, cost-effective monitoring, turn-around, signage, hospitality, and enterprise solutions.

The product boasts a full complement of cutting-edge features, including HEVC decoding up to MP@HT and M10P@HT to L4.1 on streams to 40 Mbps for decoding professional 4K and consumer UHD formats with 4:2:0 chroma 8 and 10 bit. It outputs HDMI 2.0 and 4x3G-SDI of 4K/UHD to 4Kp60 and 2160p60 formats. It includes legacy format decoding of MPEG 2 and H.264 up to HP@L4.2.

The MRD 6000 decodes and outputs 4K/UHD video and includes core features required in professional video delivery networks. Every MRD 6000 ships with a full complement of basic inputs and outputs, including ASI input and output, SD-SDI/HD-SDI outputs, and an HDMI digital video output. The HDMI output makes monitoring as easy as finding the nearest standard consumer television or PC monitor.

The MRD6000 further features MPEG/IP I/O, DVB-S/S2/S2X satellite inputs, QAM/VSB RF receiver, DVB-T/T2, C/C2, & ISDB-T inputs, BISS descrambling, and dual DVB-CI CAM slot options. Its configurable feature set makes the MRD 6000 the ideal choice for contribution reception or demanding distribution applications which require a future-proof set of specifications.

The receiver 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 via the front panel keypad, and is backed by Sencore's best-in-class staff of ProCare support engineers.

## 1.2 Front Panel Overview

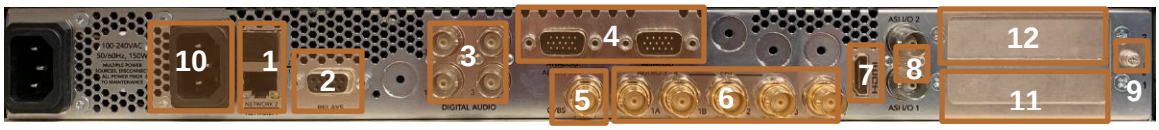
The MRD 6000 can be controlled from the front panel using the LCD screen and buttons that are shown below. A detailed description of using the front panel can found in Section 3. All hardware listed below comes standard except for the DVB-CI slots which are a factory installed option.


**MRD6000 Chassis Front Panel**

1. LCD screen:  Shows menus for user status and unit control
2. Input Indicator: Light indicates input signal presence (green) or absent (red)
3. Error Indicator: Light indicates red when unit is in alarmed condition
4. Up, Down, Left, Right buttons: Provides navigation/entry within LCD screen menus
5. Back and Enter Buttons: Provides navigation within LCD screen menus
6. 2 DVB-CI Slots (Factory Option)

## 1.3 Rear Panel Overview

The MRD 6000 comes standard with all of the hardware back panel features shown and listed below except where noted as a factory installed option.  Option cards are available for the MRD 6000.  Examples include a Quad Input DVB-S/S2/S2X card or dual port MPEG/IP Input/Output card. ASI is a standard input and output on all MRD 6000 units.

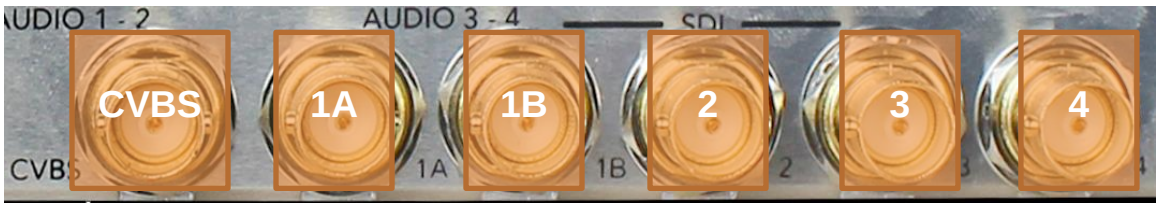



**MRD6000 Chassis Back Panel**

1. RJ45 Management Port(s)
2. Relay Output Connector
3. Digital Audio Outputs
4. 15-Pin Analog Audio Connectors (See Appendix D)
5. CVBS BNC Output
6. SDI Outputs (Five BNC provide Quad3G/3G/HD-SDI/SD-SDI)
7. Digital Video Output Connector (HDMI)
8. ASI Input and ASI Output Connectors
9. Chassis Ground
10. Optional Dual Power Supply
11. Option Card Slot #1 (factory installed)
12. Option Card Slot #2 (factory installed)

## 1.4 Baseband Video Outputs

Each of the six BNC ports, as seen in the figure from section 1.3, fall into one of three categories: Primary SDI ports, Secondary SDI ports or CVBS ports.




**SDI/CVBS BNC Outputs from Back Panel**

Ports 1A, 1B and 2 are Primary SDI ports while ports 3 and 4 are Secondary SDI ports. The CVBS port is for the composite video output. The output behavior of these BNC ports is directly related to the Primary Video output settings (see section 4.2.12) and the Simultaneous HD/SD License.

### 1.4.1 SD-SDI Output

When an SD video resolution is set on the Primary Video output format, both Primary SDI ports and Secondary SDI ports will output SD-SDI. The CVBS port will output composite video at the same frame rate and resolution as the Primary Video output format.

### 1.4.2 HD-SDI Output

When an HD resolution is set on the Primary Video output format, the baseband video output port behavior will depend on whether the MRD 60601 Simultaneous HD/SD license is licensed or unlicensed.

#### 1.4.2.1 Simultaneous HD/SD Unlicensed

When an HD video resolution is set on the Primary Video output format and MRD 60601 Simultaneous HD/SD is unlicensed, both Primary SDI ports and Secondary SDI ports will output HD-SDI. The CVBS port will have no video output.

#### 1.4.2.2 Simultaneous HD/SD Licensed

When an HD video resolution is set on the Primary Video output format and MRD 60601 Simultaneous HD/SD is licensed, the Primary SDI ports will output HD-SDI. The Secondary SDI ports will downconvert the resolution set on the Primary Video output, and output SD-SDI. The CVBS port will output composite video at the same frame rate and resolution as the Secondary Video output format.

### 1.4.3 UHD/4K Output

When a UHD/4K video resolution is set on the Primary Video output format, SDI output ports labeled 1A, 2, 3, and 4 are used to output UHD via quad 3G-SDI.

**Simultaneous HD-SDI Output with UHD/4K**

When using Two Sample Interleave (see section 4.2.15.3 for configuring Output Mapping), the MRD 6000 provides a simultaneous HD-SDI output. In Two Sample Interleave mode, Port 1A contains ¼ of the image pixels. Port 1B will output a mirror image of the signal on port 1A. Therefore, when using any UHD/4K output formats with Two Sample Interleave, the Port 1B output will be a HD 1080 formatted signal at the same frame rate as the UHD/4K format.

For example, if the MRD 6000 has a Primary Video output format set to 3180x2160p 50 fps, SDI port 1B will output HD-SDI at 1080p 50 fps.

## 1.5 Cooling

The MRD 6000 is cooled via forced induction through the front of the unit and exhausted through the vents in the rear of the chassis. The MRD 6000 is equipped with a temperature controlled status indicator. If the temperature inside the unit exceeds 60°C the red “Error” text will illuminate on the front panel and a description of the error will appear in the “Error List.”

## 1.6 Rack Information

The MRD 6000 is intended to be mounted in a standard 19” rack. It occupies 1RU of rack space and the connections are all on the rear of the unit.

# Section 2 Installation

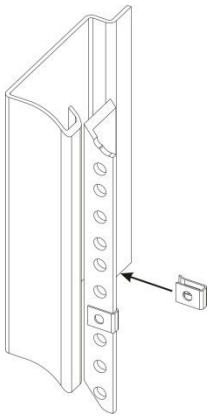

## Introduction

This section includes the following topics:

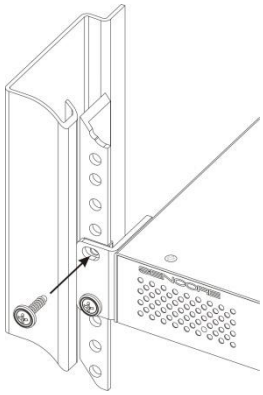
## 2.1 Rack Installation

To install the MRD 6000 into a rack use the following steps:

1. Determine the desired position in the rack for the MRD 6000 making sure that the air intake on the front of the unit and the exhausts on the sides of the unit will not be obstructed.
2. Insert the rack mount clips into place over the mounting holes in the rack.
3. Slide the MRD 6000 into position in the rack.



4. Secure the MRD 6000 to the rack by installing the four supplied screws through the front mounting holes and tightening.
5. If needed, secure a grounding wire use the grounding location on the rear panel of the MRD 6000. See Section 1.3 for grounding location.



## 2.2 Power Connection

Using the proper power connections is vital to the safe operation of the MRD 6000. Only use the supplied 3-prong power connector or one with equal specifications. NEVER tamper with or remove the 3rd – prong grounding pin. This could cause damage to the MRD 6000, personnel and/or property.

## 2.3 AC Power Connection

The MRD 6000 is intended for use on either 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 cord that was included with the MRD 6000.
2. Plug the female end of the power cord (end with no prongs) into the back of the unit.
3. Locate a protected outlet (usually inside of the rack) to plug the male end of the power cable into.

## 2.4 AC Dual Redundant Power Connection (optional)

The Dual Redundant option allows the MRD 6000 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 cord that was included with the MRD 6000.
2. Plug the female end of the power cord (end with no prongs) into the back of the unit.
3. Locate a protected outlet (usually inside of the rack) to plug the male end of the power cable into.

## 2.5 Maintenance

The MRD 6000 is a maintenance-free piece of equipment. There are no user serviceable parts on the inside of the unit.

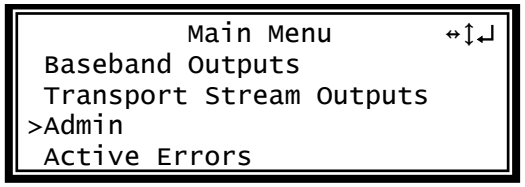
## 2.6 Network Setup via Front Panel

The MRD 6000 can be setup on a network connection to allow remote management and SNMP configuration. For these features to work, the network settings for the MRD 6000 must first be configured properly for the network it is connected to.

### 2.6.1 Static IP Address/Subnet Mask/Gateway

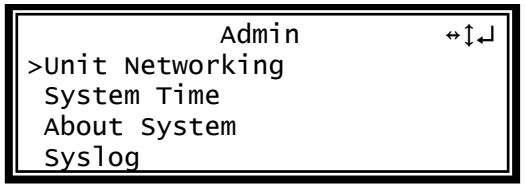
To setup the MRD 6000 with a static IP address, use the following steps:

1. Press the ENTER button.

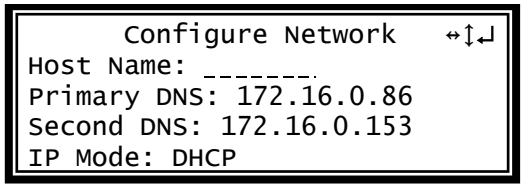



2. Use the ▲ and ▼ buttons to move the cursor to “Admin”, then press the ENTER button.

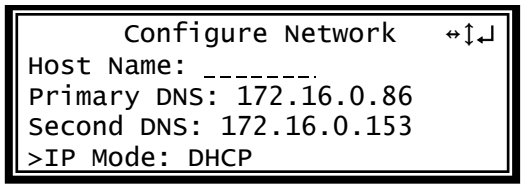
3. Use the ▲ and ▼ buttons to move the cursor to “Unit Networking”, then press the ENTER button.



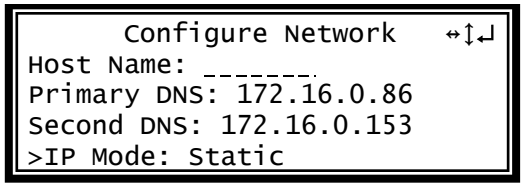

**Note: The first menu displayed is status menu. In order to begin making changes to networking settings press the ENTER button and the ‘>’ cursor will appear.**



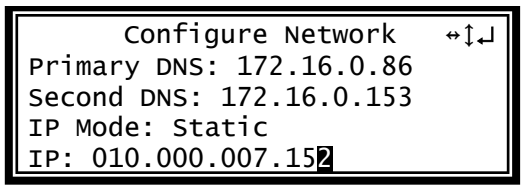
4. Use the ▲ and ▼ buttons to move the cursor to “IP Mode”, then press the ENTER button.



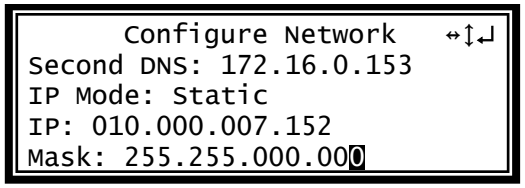

5. Use the ▲ and ▼ buttons to change the selection to “Static” then press the ENTER button.



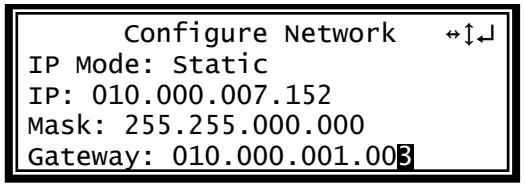

6. The cursor will now be on “IP”.
7. Use the ◄ and ► buttons to select the column and the ▲ and ▼ buttons to change the IP Address, then the ENTER button to save the selection.




8. The cursor will now be on “Mask”.
9. Use the ◄ and ► buttons to select the column and the ▲ and ▼ buttons to change the Subnet Mask, then the ENTER button to save the selection.




10. The cursor will now be on “Gateway”.
11. Use the ◄ and ► buttons to select the column and the ▲ and ▼ buttons to change the Default Gateway, then the ENTER button to save the selection.

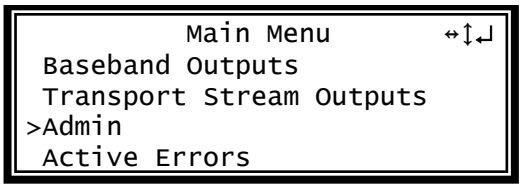



*Note: It may take up to a minute for the MRD 6000 to obtain an IP address. During this time the unit will display a “busy” message under “Gateway”.*

## 2.6.2 DHCP

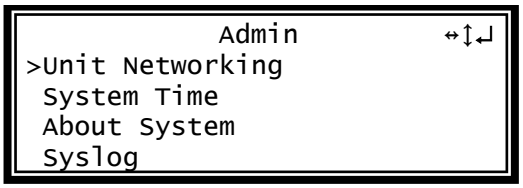
The MRD 6000 can be configured to use DHCP to obtain an IP address/Subnet Mask/Gateway.

1. Press the ENTER button.

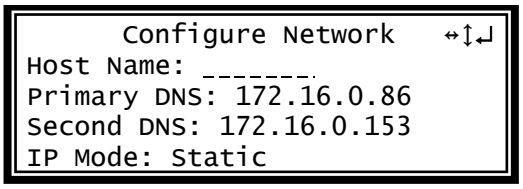



2. Use the ▲ and ▼ buttons to move the cursor to “Admin”, then press the ENTER button.

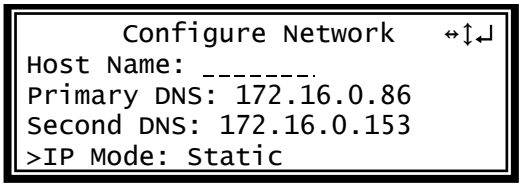
3. Use the ▲ and ▼ buttons to move the cursor to “Unit Networking”, then press the ENTER button.



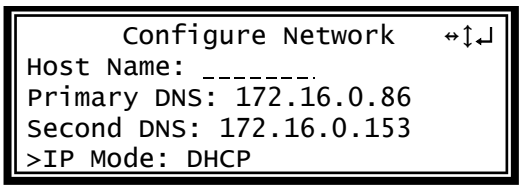

**Note: The first menu displayed is status menu. In order to begin making changes to networking settings press the ENTER button and the ‘>’ cursor will appear.**




4. Use the ▲ and ▼ buttons to move the cursor to “IP Mode”, then press the ENTER button.




5. Use the ▲ and ▼ buttons to change the selection to “DHCP” then press the ENTER button.




*Note: It may take up to a minute for the MRD 6000 to obtain an IP address. During this time the unit will display a “busy” message next to DHCP.*

# Section 3 Operating the Front Panel


**Introduction**

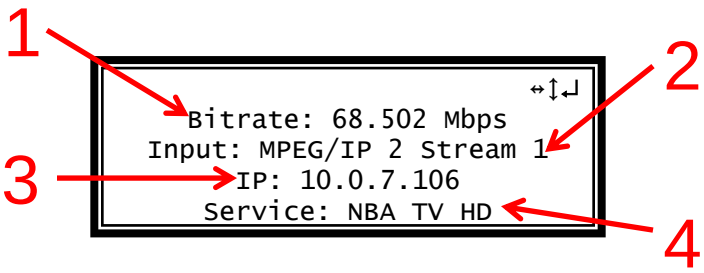
This section includes the following topics:

## 3.1 MRD 6000 Front Panel Overview

The MRD 6000 front panel allows the user to configure all settings that are present in the web interface using the buttons located on the front of the unit.

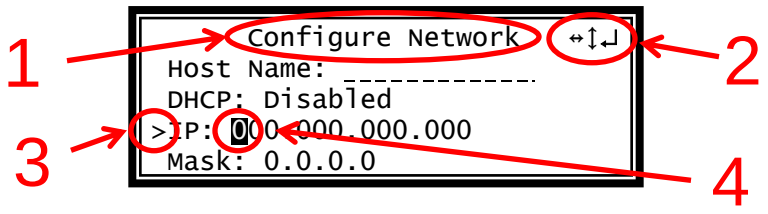

**Front Panel Navigation Keys**

The screen below is the idle screen of the MRD 6000. This idle screen allows the user to view the incoming bitrate of the active input, which input is set to active, the management IP address of the unit and the service currently set to decode.




1. Bitrate of incoming stream displayed in Mbps.
2. Current active input.
3. IP address of management port.
4. Current decoded service.

The figure on the next page shows a typical screen on the front panel. Several important features have been circled and noted below. These features are common to all screens and assist when navigating, viewing and editing unit information. The BACK button allows the user to return to the home screen, cancel settings and go back a menu. In order to edit a selected parameter the ENTER button must be pressed. Once a parameter has been changed the ENTER button must be pressed again before the change takes effect on the unit.




1. Screen title.
2. Icons indicate which control buttons are currently valid for entry.
3. Cursor shows which line is active.
4. When editing, active character or item is highlighted.

# Section 4 Operating the Web Interface


## Introduction

This section includes the following topics:

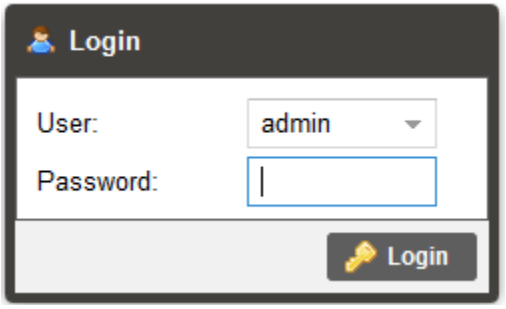
## 4.1 MRD 6000 Web Interface Overview

### 4.1.1 Logging into the MRD 6000 Web Interface

To open the MRD 6000 web interface use one of the following supported browsers and navigate to the unit's IP address:

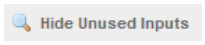
- Internet Explorer 7 & above
- Firefox 3.5 & above
- Google Chrome

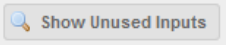
The user will need to login to the web interface. By default the admin user account is available without a password. Press the login button in order to login to the web interface.




**User Login Prompt**

### 4.1.2 Hiding Unused Inputs

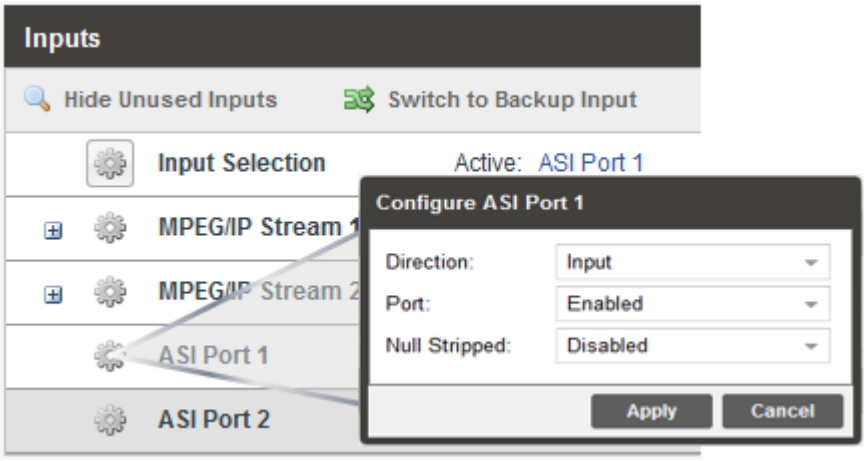
The MRD 6000 web interface allows the user to hide inactive inputs using the 

button or show all available inputs by click the 

button. Only the inputs configured as the Primary Input and Backup Input (see Section 4.2.1) will be displayed when unused inputs are hidden.

### 4.1.3 Buttons and Status Indicators

When the icon is shown user configuration is available. Clicking this button will open menus where settings can be changed by the user. An example of this can be viewed on the next page.




**ASI Port 1 Configuration Pop-Out**

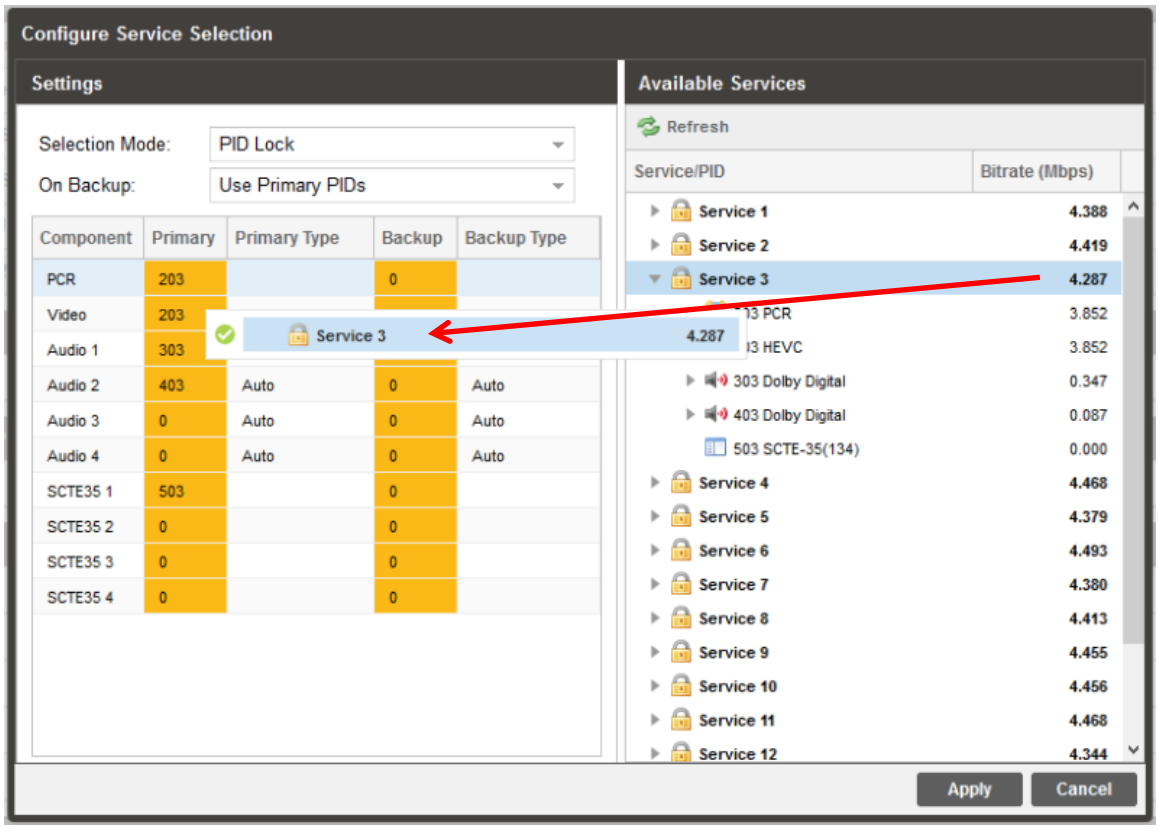
When the icon is shown additional status information can be viewed. Clicking this button expands the menu to display the additional status information. All text in status menus shown in **ORANGE** are user configurable settings. Text shown in **BLUE** is not user configurable and is strictly a status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

Status in the MRD 6000 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. |

### 4.1.4 Drag and Drop Menus

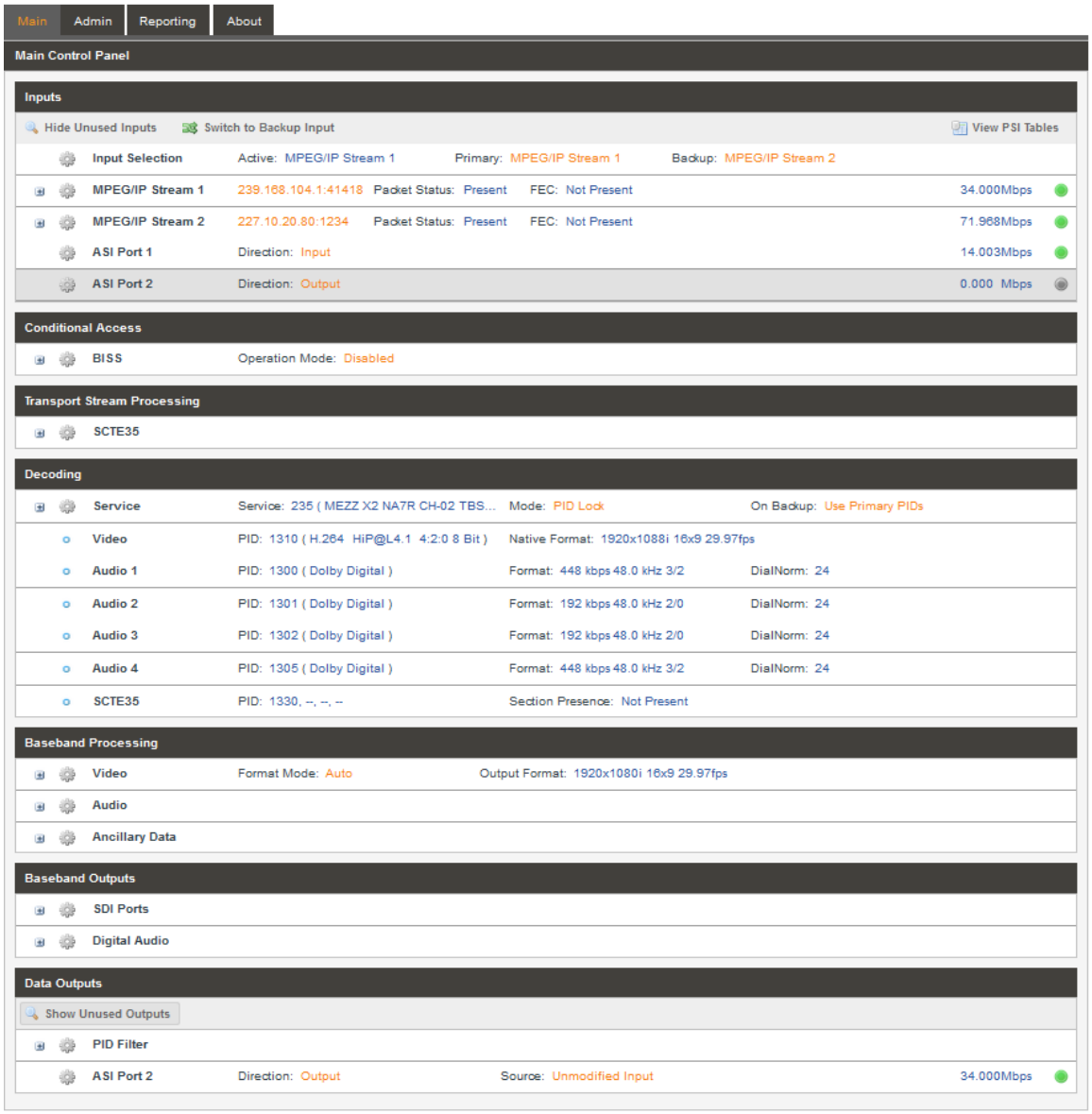
Certain menus in the MRD 6000 allow the user to drag and drop items to auto populate fields. Conditional Access and Service Selection menus are some examples of menus that drag and drop can be used. In the example on the next page, a service in the transport stream view on the right hand side of the window is selected and dragged over to auto populate the PIDs in the service selection section.




**Service Selection Menu**

## 4.2 Main Panel

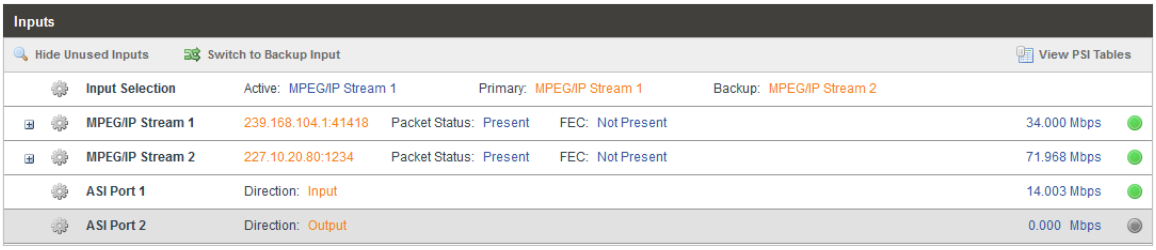
The Main panel of the MRD 6000 web interface is used to configure the unit to decode, de-encapsulate and demodulate. When configuring the MRD 6000 the user begins at the top of the menu and works down. The inputs are configured, then descrambling (if present), then service or PIDs are selected for decode, then outputs are configured. Pictured below is a fully populated unit with all options licensed.




**GUI Main Page**

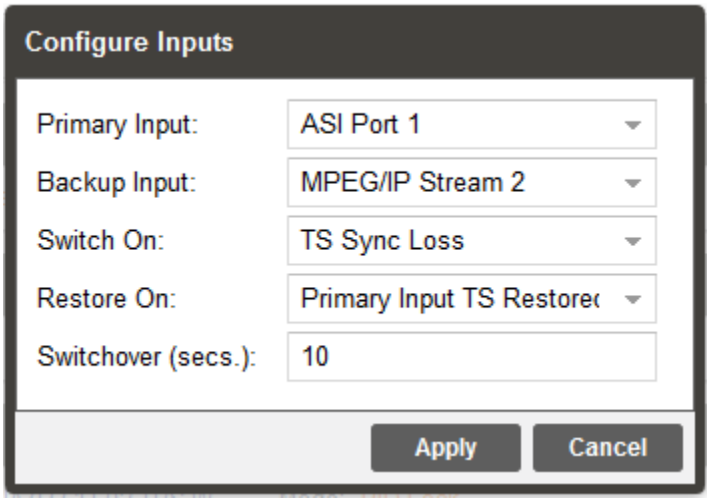
### 4.2.1 Configuring Active Inputs

The user can see which inputs are currently primary or backup inputs using the active input indicator. The user can quickly switch between the Primary and Backup Inputs by clicking the Switch to Backup Input button.




**Active Input Indicator**

To configure the primary and backup inputs, click the icon next to Input Selection. In this same menu, the "Switch On", "Restore On" and "Switchover" options present have the purpose of toggling to and from the backup input in the case of an input failover or input return.




**Active Input and Failover Configuration Menu**

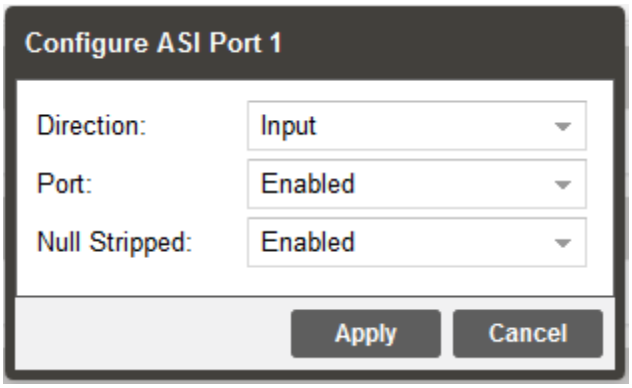
A table with descriptions of each option can be found on the next page.

| Setting | Range | Description |
|---|---|---|
| **Primary Input** | ASI Port X<br>MPEG/IP Stream X<br>DVB-S2 Slot X Port X<br>DVB-S2X Stream X<br>8VSB/QAM Slot X<br>DVB-T2/C2/ISDB-T Slot X<br>None | Used for both normal operation and input failover settings. During normal operation this input will be the active input. |
| **Backup Input** | ASI<br>MPEG/IP Slot X Stream X<br>DVB-S2 Slot X Port X<br>DVB-S2X Slot X Stream X<br>8VSB/QAM Slot X<br>DVB-T2/C2/ISDB-T Slot X<br>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 “Switch On” setting. |
| **Switch On** | Manual Only<br>TS Sync Loss<br>Decode Failure | *Manual Only*: the unit will not switch inputs automatically. The user must manually switch inputs.<br>*TS Sync Loss*: the MRD 6000 will switch from the primary to the backup input if the primary stream loses synchronization for the duration of the Switchover Interval.<br>*Decode Failure*: the unit will switch to the backup input when it encounters decoding errors on the primary input. |
| **Restore On** | Manual Only<br>Primary Input TS Restored<br>Backup Input TS Sync Loss<br>Decode Failure | *Manual Only*: the unit will not restore to the primary input automatically. The user must manually switch inputs.<br>*Primary Input TS Restored*: the MRD 6000 restores to primary when the Primary input regains transport stream synchronization.<br>*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.<br>*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 6000 switches between the Primary Input and Backup Input or vice versa. |

### 4.2.2 Configuring ASI Input

This menu allows the user to either Enable or Disable the ASI Input on the MRD 6000. The ASI ports can be configured as either an input or output. ASI inputs can be configured to enable or disable the null stripped feature.

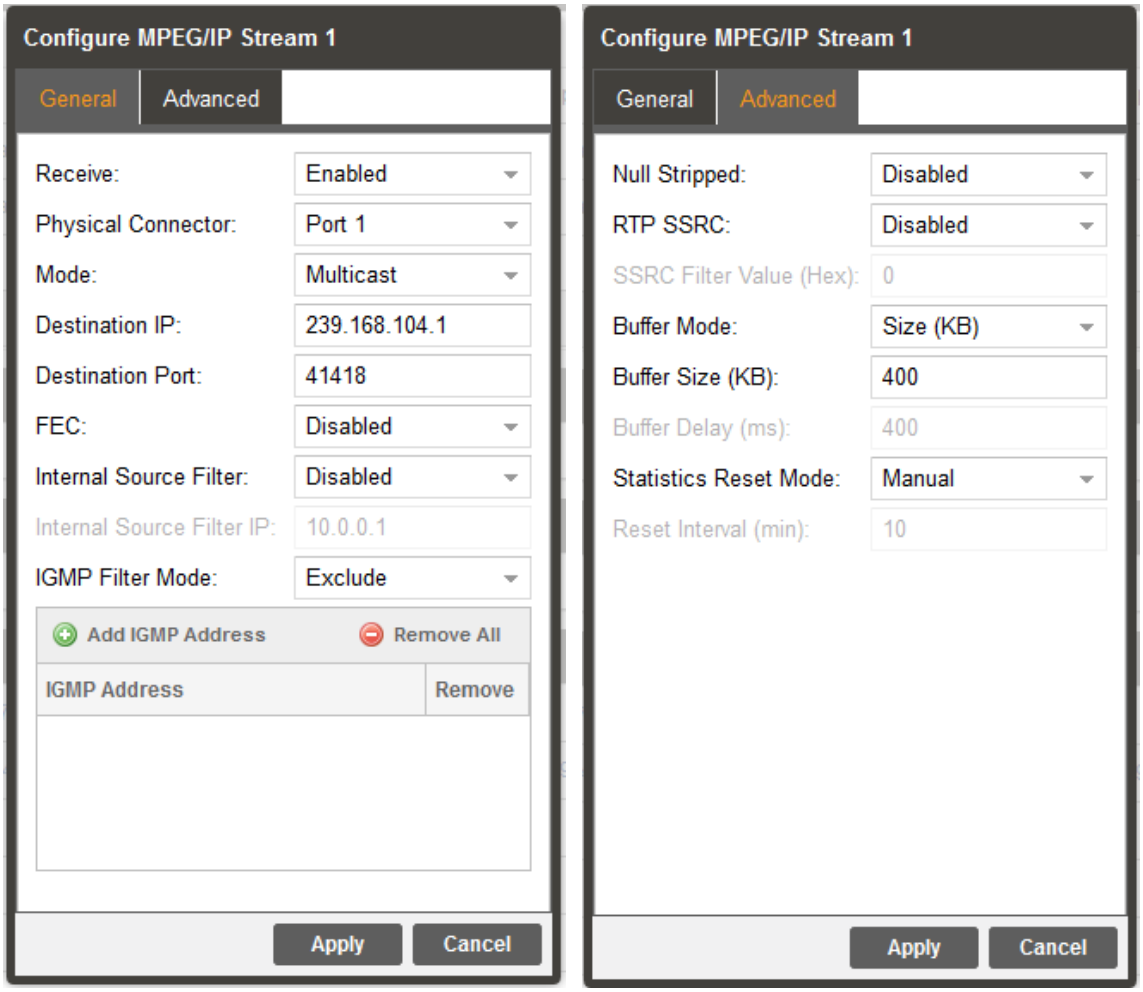



**ASI Port 1**

| Setting | Range | Description |
|---|---|---|
| **Direction** | Input<br>Output | Configure the ASI port to either an input or an output. Main board version can be located on the “About” tab of the GUI under the “Options” section. |
| **Port** | Enabled<br>Disabled | This setting allows the user to enable or disable the ASI Input to the MRD 6000. |
| **Null Stripped** | Disabled<br>Enabled | Enabling Null Stripped allows the MRD 6000 to receive streams that do not contain null packets. (i.e. VBR Transport Streams) |

### 4.2.3 Configuring MPEG/IP Input

If the MPEG/IP Input card was selected as a factory installed option, the menu on the next page and options will be available for configuration. This menu allows the user to configure the MPEG/IP inputs. Each MPEG/IP card has two ports that can be set to receive and/or transmit. The menu is for setting up the reception of MPEG/IP unicast or multicast transport streams. The menus for Stream 1 and 2 have the same settings. IGMPv2 is used to join/leave multicast streams by default if no IGMP Filter addresses are entered. If IGMP Filter Mode addresses are specified then IGMPv3 is used.



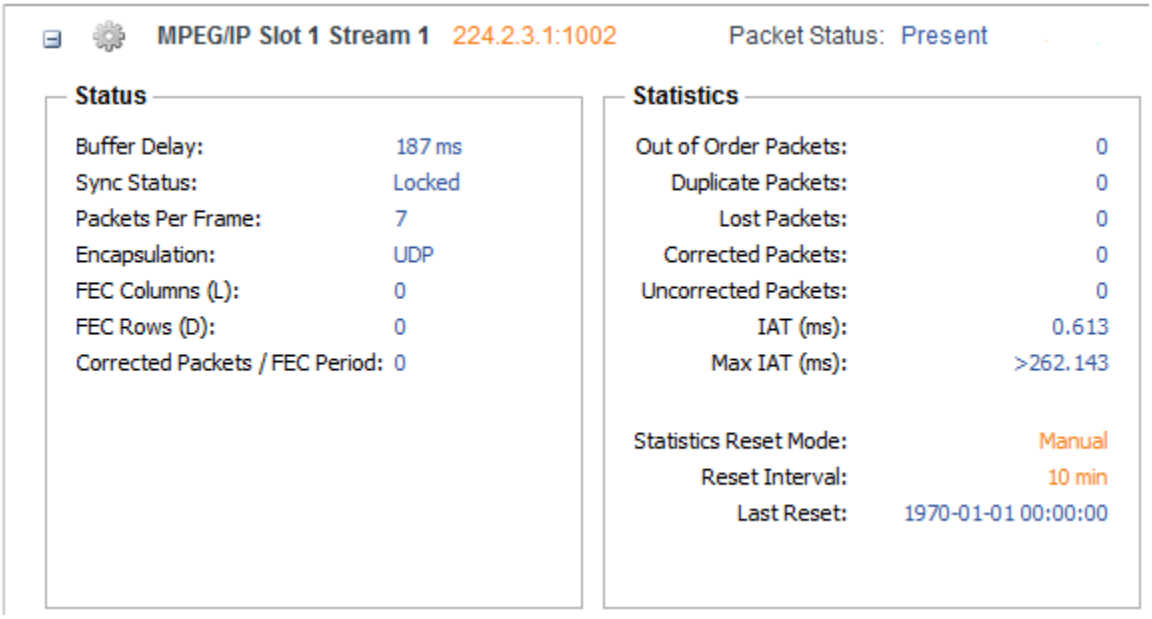

**General and Advanced options for IP input**

| Setting | Range | Description |
|---|---|---|
| **Receive** | Enabled<br>Disabled | This setting allows the user to enable or disable these input stream settings. |
| **Physical Connector** | Port 1<br>Port 2 | The physical connector on the MPEG/IP card that will be used to receive the input. |
| **Mode** | Multicast<br>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 sending to. |

| | | |
|---|---|---|
| **Destination Port** | 0 - 65535 | This is the UDP port the source device is sending to. This is the only setting required to receive a unicast stream. |
| **FEC** | Enabled<br>Disabled | Enabling FEC (Forward Error Correction) tells the MRD 6000 to look at Destination Port +2 and Destination Port +4 for a SMPTE 2022 FEC Matrix. |
| **Internal Source Filter** | Enabled<br>Disabled | Enabling Source filtering disables IGMP V3 filtering and allows a user to whitelist a single IP address for a given multicast and block all other source IP's |
| **Internal Source Filter IP** | 0.0.0.0 – 255.255.255.255 | Source IP for whitelist. All other source IP addresses are blocked |
| **IGMP Filter Mode** | Exclude<br>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. |
| **Null Stripped** | Enabled<br>Disabled | Enabling Null Stripped allows the MRD 6000 to receive streams that do not contain null packets. (i.e. VBR TS Streams) |
| **RTP SSRC** | Enabled<br>Disabled | Enabling RTP SSRC allows the MRD 6000 to filter the input by the user defined value. Only streams containing the user defined value will be received by the MRD 6000. |
| **SSRC Filter Value** | 0 - 4294967295 | The Filter Value the MRD 6000 checks for before receiving a stream with RTP SSRC. |
| **Buffer Mode** | Size (KB)<br>Delay (ms) | Allows option to set buffer mode to Size in KB or Delay ms |
| **Buffer Size (KB)** | 1 – 4000 KB | This setting determines how much data is received before the MRD 6000 starts decoding. Increasing this value will allow the MRD 6000 is receive streams on networks with high network jitter. Increasing this value also increases the latency of the MRD 6000. |
| **Buffer Delay (ms)** | 1 – 4000 ms | The buffer delay setting allows the buffer size to be set by delay time. The Buffer delay time will be determined by the input data rate. |

| | | |
|---|---|---|
| **Statistics Reset Mode** | Manual<br>Auto | Statistics can be viewed by hitting the + symbol next to the MPEG/IP option card on the main window. Selecting Auto will reset the statistics on a chosen interval. When the reset occurs, statistical information for that period will be logged. Selecting Manual will only clear the statistics by hitting the refresh button. |
| **Reset Interval (min)** | 5-65535 | Interval in which the Auto option will reset and log the statistics displayed on the main window |

The IP Statistics menu can be used to view a number of important details about the incoming IP input that will help the user to determine the quality of the stream and connection.

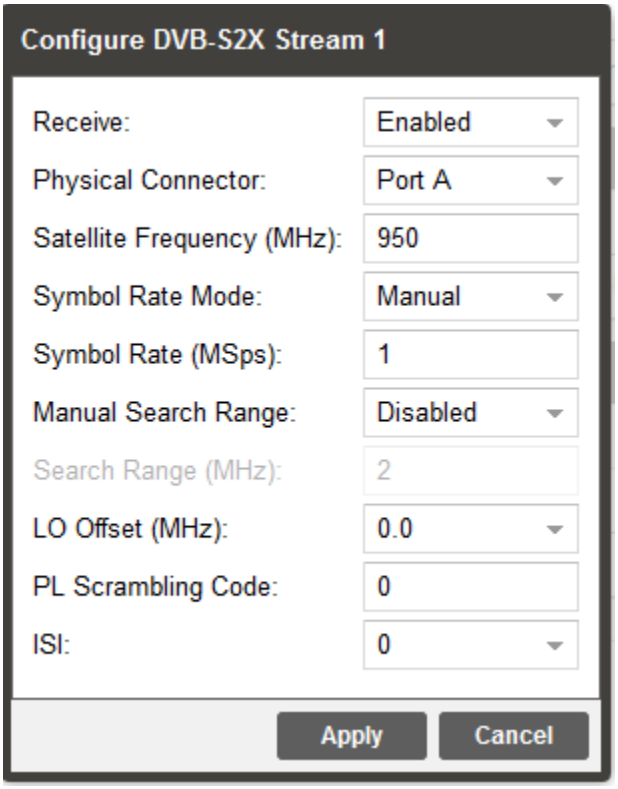



**IP statistics menu**

## 4.2.4 Configuring DVB-S/S2/S2X Input

If the DVB-S/S2/S2X input card was selected as a factory installed option, the following menus and options will be available for configuration. This menu allows the user to configure the DVB-S/S2/S2X inputs. The input card is equipped with dual demodulators and four ports (labeled A, B, C and D). This configuration allows the card to receive two signals simultaneously for fast switching between primary and backup inputs. The menu for both demodulators have the same settings.

The input card will automatically detect modulation and symbol rate during signal acquisition. LNB Power configuration for this input card is done in the “Admin” tab of the GUI.



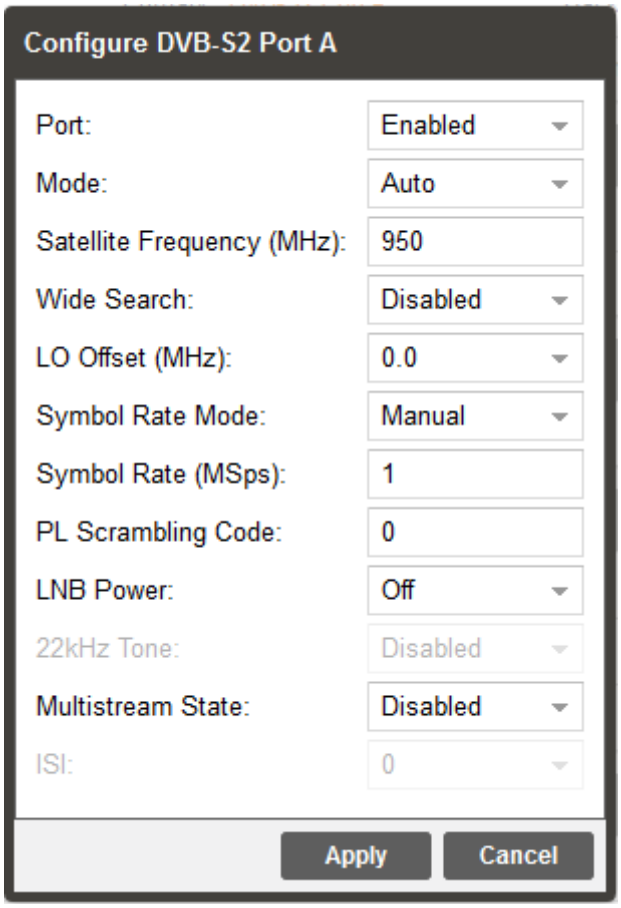

**Configuration of DVB-S2X**

| Setting | Range | Description |
|---|---|---|
| **Receive** | Enabled<br>Disabled | This setting allows the user to enable or disable this input stream. |
| **Physical Connector** | Port A<br>Port B<br>Port C<br>Port D | This setting allows the user to select which physical RF connector will be used to receive the stream. |
| **Satellite Frequency** | C-Band: 4GHz – 8GHz<br>Ku Band: 11.2Ghz – 14.5Ghz<br>L-Band: 950MHz – 2150MHz<br>Dependent on LO Offset | If LO Offset is set to 0 then L-Band frequency is entered into the Satellite Frequency dialog box. If LO Offset to set to a pre-defined option then enter C-band or Ku-Band frequency. |

| | | |
|---|---|---|
| **Symbol Rate Mode** | Auto<br>Manual | This setting allows user to select if the satellite tuner automatically searches and determines the received signal symbol rate or if it is entered manually in the space below |
| **Symbol Rate (Msps)** | 0.5 to 60 | If Symbol Rate Mode is set to Manual then enter the satellite receive signal symbol rate |
| **Manual Search Range** | Enabled<br>Disabled | This setting determines the satellite receiver automatic fine tuning (AFT) search range. Disabled by default – permits the receiver to auto tune or AFT range (+/- 20 MHz). Enabled allows the user to enter a manual range limiting or expanding the AFT search range |
| **Search Range (MHz)** | .5 – 70 MHz | If the Manual Search Range is set to Enabled then enter a MHz value for an AFT search range. The entered value includes a positive and negative search total range. For example: 10 MHz enables a +/- 5 MHz search range. |
| **LO Offset** | 5150<br>9750<br>10600<br>10750<br>11250 | The offset in MHz that the local oscillator is operating. Set to the LO frequency when you want to enter the Satellite transponder frequency in the Satellite Frequency field. Set to 0.0 when you want to enter the L-Band frequency in the Satellite Frequency field. *Note that this setting and the Satellite Frequency setting determine the L-Band frequency input to the receiver.* |
| **PL Scrambling Code** | 0 – 262141 | The MRD has the ability to receive satellite signals scrambled using PL Scrambling. In order to receive the stream, enter the value of the incoming signals PL Scrambling code. |
| **ISI** | Enter input stream identifier (ISI) | Enter unique ID of the stream you want to receive within the DVB-S2/S2X satellite multi-stream (Advanced MRD 60916 licensed feature) |

### 4.2.5 Configuring DVB-S/S2 Input

If the DVB-S/S2 Input card was selected as a factory installed option, the following menus and options will be available for configuration. This menu allows the user to configure the DVB-S/S2 inputs. Each DVB-S/S2 input card has four ports (labeled A, B, C and D) which only one port can be active at a time. This menu is for setting up the reception of DVB-S/S2 satellite signals. The menu for Port A, B, C and D have the same settings.



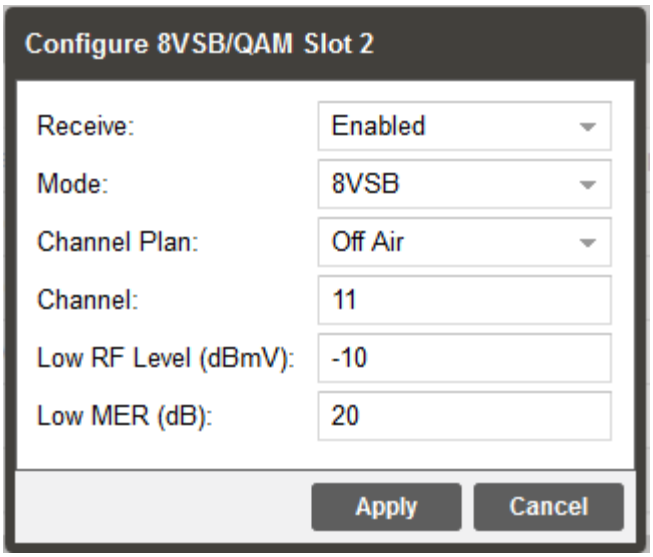

**Configuration of DVB-S2**

| Setting | Range | Description |
|---|---|---|
| **Port** | Enabled<br>Disabled | This setting allows the user to enable or disable this reception port. |
| **Mode** | DVB-S<br>DVB-S2<br>Auto | This setting allows the user to choose between *DVB-S* or *DVB-S2* modulation schemes. Setting to Auto will have the unit automatically detect whether the input is DVB-S or DVB-S2. |
| **Satellite Frequency** | C-Band: 4GHz – 8GHz<br>Ku Band: 11.2Ghz – 14.5Ghz<br>L-Band: 950MHz – 2150MHz<br>Dependent on LO Offset | If LO Offset is set to 0 then L-Band frequency is entered into the Satellite Frequency dialog box. If LO Offset to set to a pre-defined option then enter C-band or Ku-Band frequency. |

| | | |
|---|---|---|
| **Wide Search** | Enable<br>Disable | When Enabled the search range may be extended depending on the symbol rate. See appendix C for more information. |
| **LO Offset** | 5150<br>9750<br>10600<br>10750<br>11250 | The offset in MHz that the local oscillator is operating. |
| **Symbol Rate Mode** | Manual<br>Auto | The Manual option allows the user to choose the symbol rate. The Auto option automatically detects the incoming symbol rate.<br>Note: Acquisition time may be longer in auto mode, especially when the symbol rate is below 1MSps or above 55MSps. |
| **Symbol Rate** | 0 - 60 | The symbol rate of incoming satellite signal in Msps. Accurate to one decimal place (ksps). Used when Symbol Rate Mode is set to Manual. |
| **PLS Code** | 0 – 262141 | The MRD 6000 has the ability to receive satellite signals scrambled using PL Scrambling. In order to receive the stream, enter the value of the incoming signals PL Scrambling code. |
| **LNB Power** | Off<br>13 VDC<br>14 VDC<br>18 VDC<br>19 VDC | The MRD 6000 has the ability to provide the necessary voltage to power an LNB. Select the correct voltage to supply to the LNB. |
| **22kHz Tone** | Enabled<br>Disabled | Enabling or disabling the 22khz tone allows the MRD 6000 to trigger the LNB to switch polarities. |
| **Multistream State** | Enabled<br>Disabled | The MRD 6000 has the ability to receive multistream satellite signals. If the signal is multistream capable, enable this setting. This option is only available in DVB-S2 Mode.<br>*NOTE: This is a licensed feature*. |
| **ISI** | 0-255 | This setting is the ISI (Input Stream Identifier) the MRD 6000 uses to filter multistream input. This option is only available if Multistream is licensed and enabled. |

### 4.2.6 Configuring 8VSB/QAM Input

If the 8VSB/QAM Input card was selected as a factory installed option, the following menus and options will be available for configuration. This menu allows the user to configure the 8VSB/QAM input and is for setting up the reception of 8VSB off air signals or QAM cable signals.



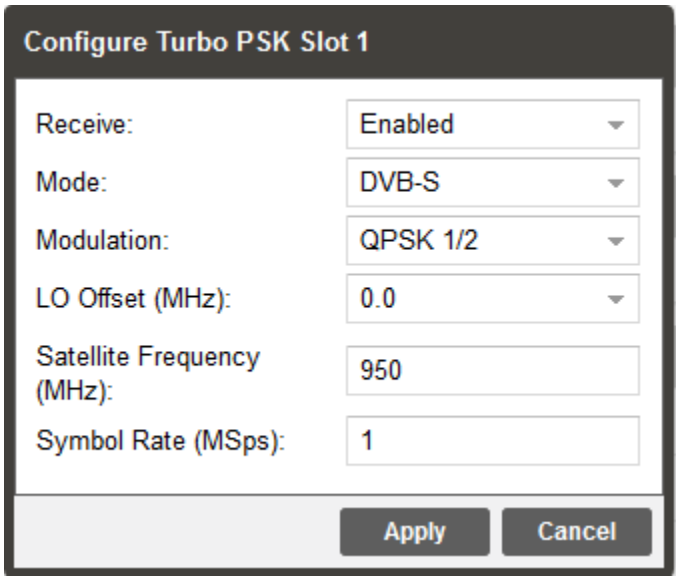

**Configuration of 8VSB**

| Setting | Range | Description |
|---|---|---|
| **Receive** | Enabled<br>Disabled | This setting allows the user to enable or disable this reception port. |
| **Mode** | 8VSB<br>64-QAMB<br>256-QAMB | This setting allows the user to choose between *8VSB or QAM* modulation schemes. |
| **Channel Plan** | Off Air<br>FCC Cable<br>HRC Cable<br>IRC Cable | If *8VSB* is the selected Mode, the only available option is *Off Air*. If either *64-QAMB or 256-QAMB* is the selected Mode, this setting allows the user to choose which Cable scheme is used. |
| **Channel** | Off Air: 2-69<br>FCC, HRC, or IRC Cable: 2-158 | This setting is for the desired channel to be received. |
| **Low RF Level (dBmV)** | -34 - +40 | This is the Low RF Level threshold when the *Low Level* Alarm will be triggered in dBmV |

| | | |
|---|---|---|
| **Low MER (dB)** | 0 – 40 | This is the Low MER threshold when the *Low MER* Alarm will be triggered in dB. |

### 4.2.7 Configuring Turbo PSK Input

If the Turbo PSK Input card was selected as a factory installed option, the following menus and options will be available for configuration. This menu allows the user to configure the Turbo PSK input. This menu is for setting up the reception of DVB-S and Turbo PSK satellite signals.




**Turbo PSK Configuration Menu**

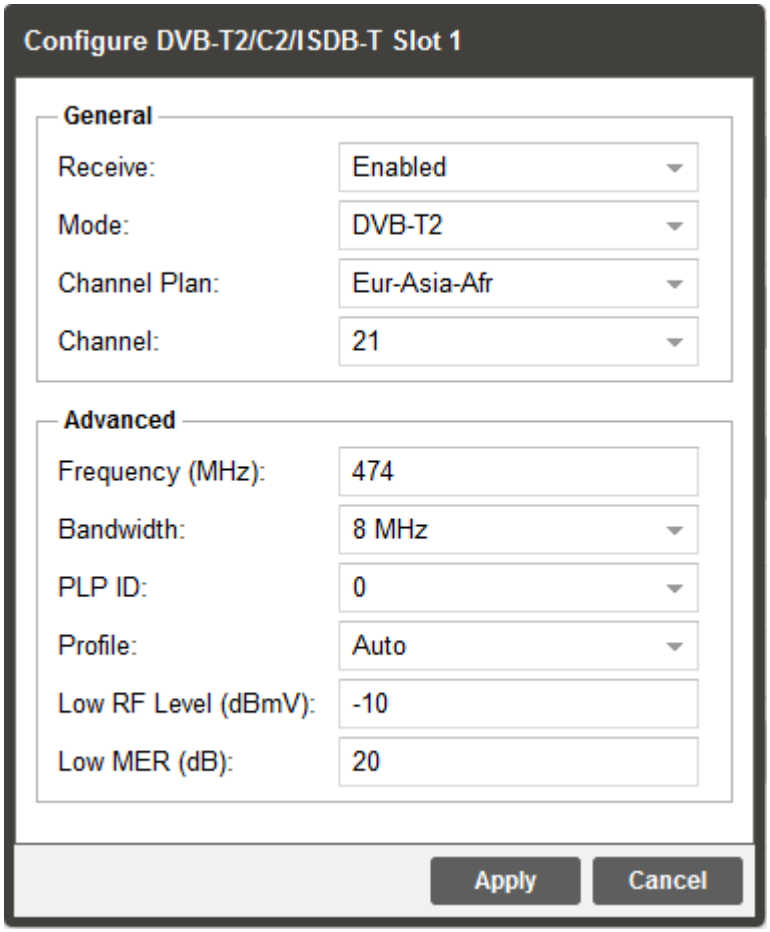
| Setting | Range | Description |
|---|---|---|
| **Receive** | Enabled<br>Disabled | This setting allows the user to enable or disable this reception port. |
| **Mode** | DVB-S<br>TurboPSK | This setting allows the user to choose between *DVB-S* or *TurboPSK* modulation schemes. |
| **Modulation** | QPSK 1/2, QPSK 2/3,<br>QPSK 3/4, QPSK 5/6,<br>QPSK 7/8, 8PSK 2/3,<br>8PSK 3/4 (2.05),<br>8PSK 3/4 (2.10),<br>8PSK 3/4 (2.20),<br>8PSK 5/6, 8PSK 8/9 | This setting allows the user to select which modulation parameters are used for the incoming signal and the dropdown list is dependent on the mode that is selected. |

| | | |
|---|---|---|
| **LO Offset** | 5150<br>9750<br>10600<br>10750<br>11250 | The offset in MHz that the local oscillator is operating. |
| **Satellite Frequency** | C-Band: 4GHz – 8GHz<br>Ku Band: 11.2Ghz – 14.5Ghz<br>L-Band: 950MHz – 2150MHz<br>Dependent on LO Offset | If LO Offset is set to 0 then L-Band frequency is entered into the Satellite Frequency dialog box. If LO Offset to set to a pre-defined option then enter C-band or Ku-Band frequency. |
| **Symbol Rate** | 0.256 - 30 | The symbol rate of incoming satellite signal in Msps. Accurate to one decimal place (ksps). |

Note: Reception may not be possible at rates less than 1Msps.

### 4.2.8 Configuring DVB-T2/C2/ISDB-T Input

If the DVB-T2/C2/ISDB-T Input card was selected as a factory installed option, the following menus and options will be available for configuration. This menu allows the user to configure a DVB-T/T2/C/C2 or ISDB-T input.




**Configuration of DVB-T2/C2/ISDB-T**

| Setting | Range | Description |
|---|---|---|
| **Receive** | Enabled<br>Disabled | This setting allows the user to enable or disable this reception port. |
| **Mode** | DVB-T<br>DVB-T2<br>DVB-C<br>DVB-C2<br>ISDB-T | This setting allows the user to choose between *DVB-T/T2/C/C2 or ISDB-T* modulation schemes. |

| | | |
|---|---|---|
| **Channel Plan** | Australia<br>Eur-Asia-Afr<br>Ireland<br>New Zealand<br>Taiwan<br>South Africa<br>South America<br>United Kingdom<br>European Cable<br>Japan<br>Philippines | This setting allows the user to select which channel plan they would like to use. Channel Plan options are tied to which modulation mode is selected. |
| **Channel** | | Select a channel from the channels available in the dropdown. The list of available channels will be based on which channel plan is selected |
| **Frequency (MHz)** | 42-1002 | Selecting a channel from the channel dropdown will populate this field automatically based on the user selected channel. A user can manually select a frequency if desired |
| **Bandwidth** | 1.7 MHz<br>5 MHz<br>6 MHz<br>7 MHz<br>8 MHz | Selecting a channel from the channel dropdown will populate this field automatically based on the user selected channel plan. A user can manually select channel bandwidth if desired. |
| **PLP ID** | | Unique PLP ID used to select a particular stream within the DVB-T2 or DVB-C2 input signal |
| **Profile** | Auto<br>Base<br>Lite | Select the DVB-T2 profile to use |
| **Low RF Level (dBmV)** | -34 - +40 | This is the Low RF Level threshold when the *Low Level* Alarm will be triggered in dBmV |

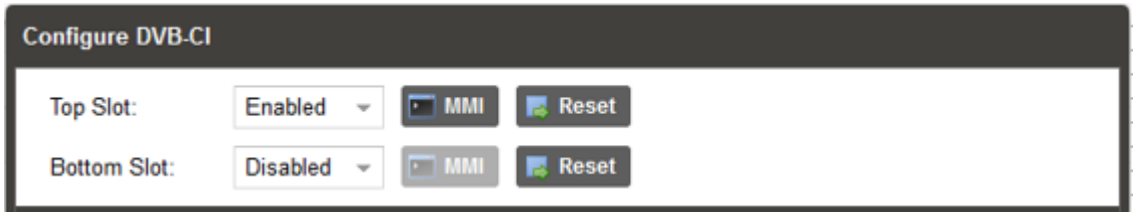
| | | |
|---|---|---|
| **Low MER (dB)** | 0 - 40 | This is the Low MER threshold when the *Low MER* Alarm will be triggered in dB. |

## 4.2.9 Configuring DVB-CI Descrambling

This section will describe how to configure DVB-CI descrambling in the MRD 6000. First, the user will need to configure the CAM slots and descrambling mode. Once this is complete the user can configure which services or PIDs to descramble.

### 4.2.9.1 Configuring DVB-CI Slots

This menu allows the user configure the DVB-CI slots in the MRD 6000. The MRD 6000 has two DVB-CI slots, a top and bottom, where CAM Modules can be inserted. Both slots are individually configurable using the Bottom Slot and Top Slot tabs. CAM Modules can be reset manually using the Reset button. The MMI button opens the MMI (Man Machine Interface) for the CAM in the respective slot. MMI support is dependent on what is supported by the CAM module.



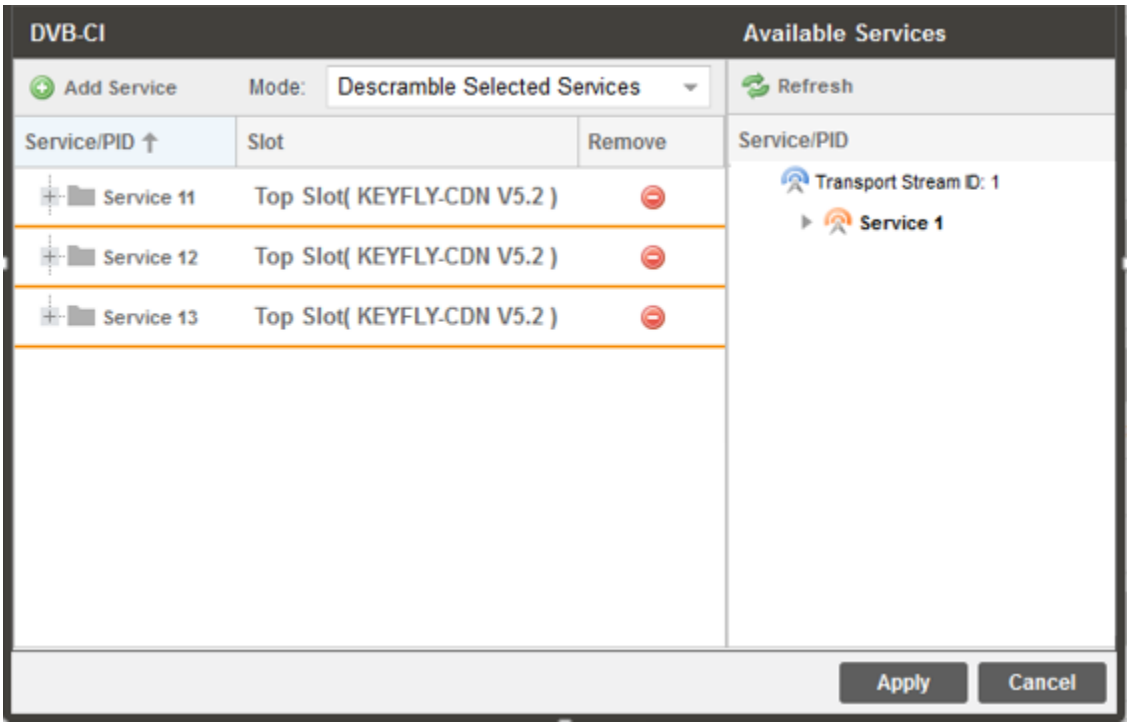

**Configuring CAM Slots**

| Setting | Range | Description |
|---|---|---|
| **Top Slot** | Enabled | This setting allows the user to enable or disable the DVB-CI slot. |
| **Bottom Slot** | Disabled | |

### 4.2.9.2 Configuring Service Descrambling

This menu allows the user to select the services the MRD 6000 will descramble using the CAM Modules and Smart Cards inserted into the DVB-CI slots. See Section 4.2.9.1 to configure these slots. These options are applicable only if the Mode in the DVB-CI settings is set to Selected PIDs or Selected Services (refer to figure and table below). The drag and drop method can be used to drag services from the right column to the left column. The drop down menu next to each selected service allows the user to choose either the bottom or top slot to descramble the service. If in Selected PIDs mode, PIDs to descramble can be added manually by clicking Add PID button. If in Selected Services mode, Services to descramble can be added manually by clicking the Add Service button. The icons next to each service indicate whether the service is scrambled or not scrambled. Scrambled services will show the icon next to them.

Services that are not scrambled will show the icon. Clicking the Refresh button causes the MRD 6000 to rescan the transport stream for changes.




**DVB-CI Service Descrambling Menu**

| Setting | Range | Description |
|---|---|---|
| **Mode** | Descramble Decoded PIDs<br>Descramble Selected PIDs<br>Descramble Selected Services | *Decoded PIDs* sets the MRD to descramble only the PIDs of the service that is currently set to decode. If the PIDs change in the incoming stream the MRD will adapt to these changes, provided that Service Selection is set to “Service Lock” (Refer to Section 4.2.11). *Selected PIDs* sets the MRD to descramble PIDs set in the Service Descrambling Menu. If the PIDs change in the incoming stream the MRD will not adapt to these changes and will not be able to descramble. *Selected Services* sets the MRD to descramble Services set in the Service Descrambling Menu. If the Services change in the incoming stream the MRD will not be able to descramble. |

### 4.2.10 Configuring BISS Descrambling

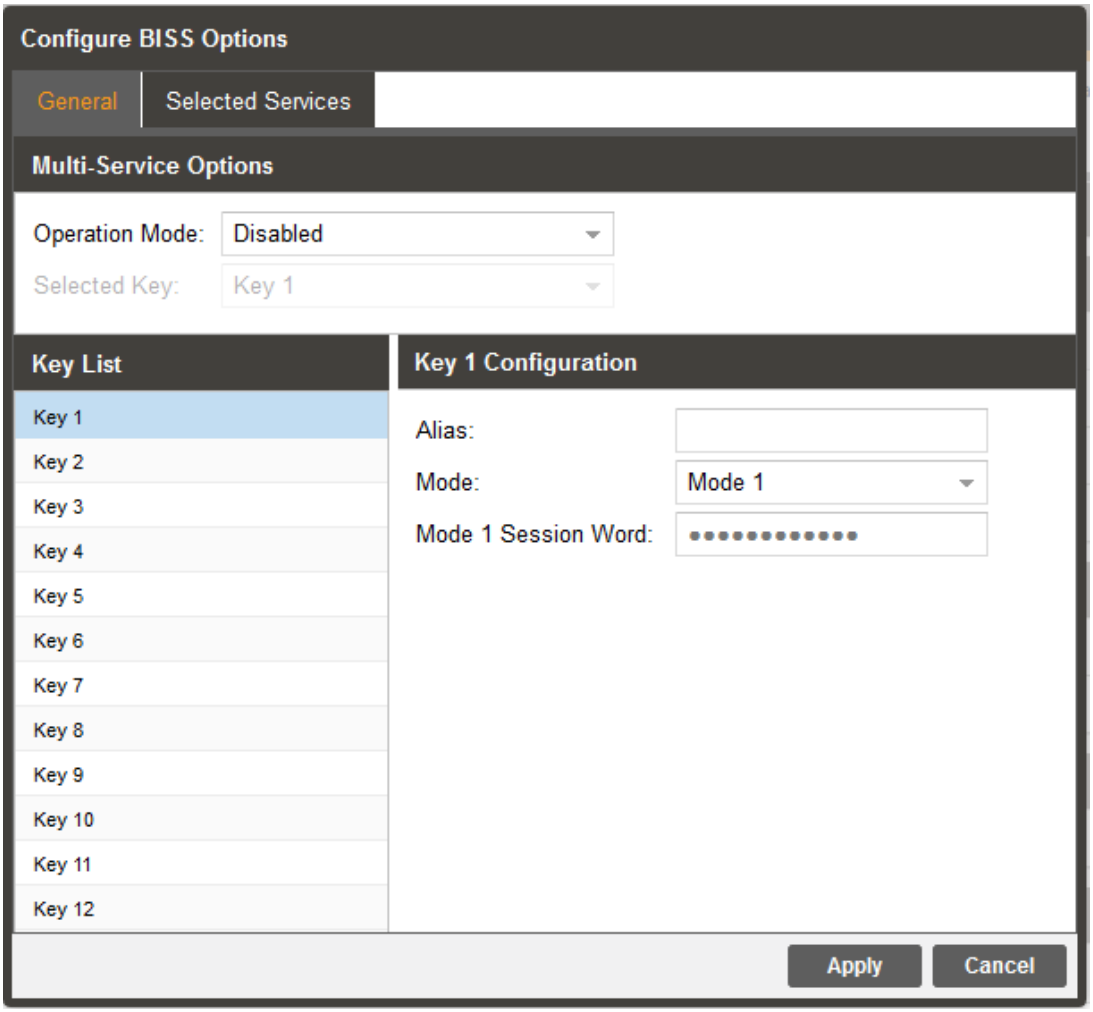
This section will describe how to configure BISS descrambling in the MRD 6000. There are two types of BISS descrambling.

In “Descramble All PIDs” or “Descramble Decoded PIDs” mode, the user simply configures a BISS key set and selects it from the drop down.

For streams with multiple, per-service keys the user must first configure the key sets, and then assign them to services.

#### 4.2.10.1 Configuring BISS Keys

This menu allows the user to configure BISS descrambling. 12 unique BISS keys can be entered. If the BISS mode is set to Mode E a  icon will appear next to Mode E Injected ID. This icon allows the user to unlock and modify the Injected ID.

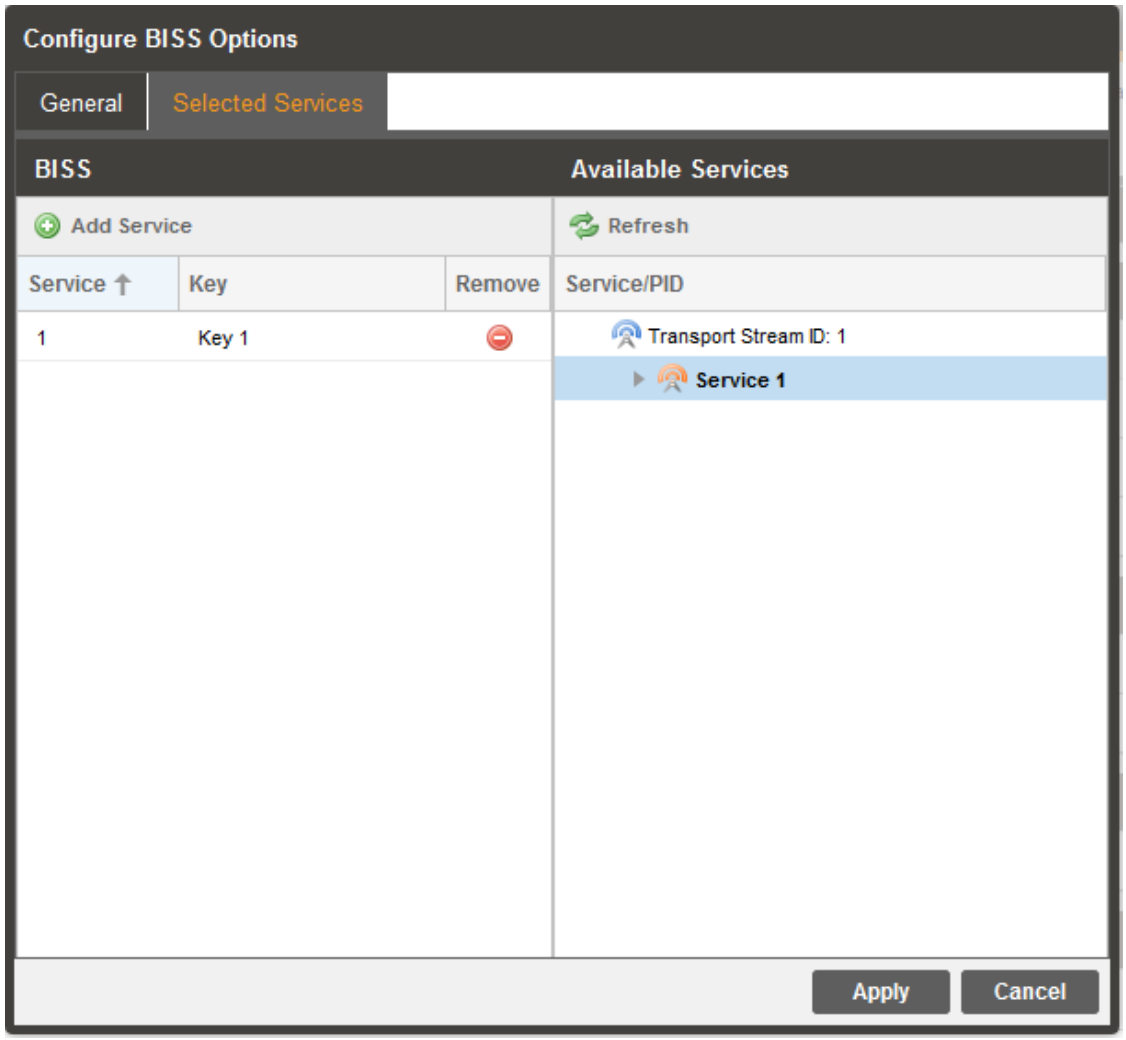



**BISS Menu**

| Setting | Range | Description |
|---|---|---|
| **Operation Mode** | Disabled<br>Descramble Decoded PIDs<br>Descramble Selected Services<br>Descramble All PIDs | Descramble Decoded PID's will descramble the PIDs that are currently assigned to be decoded by the MRD 6000.<br>Descramble Selected Services will allow the user to select service(s) to be descrambled on the Selected Services tab.<br>Descramble All PIDs will apply the selected key to the entire transport stream. |
| **Selected Key** | Key 1-12 | Select a key to configure. |
| **Alias** | 16 characters | Set an Alias for the selected key. |
| **Mode** | Mode 1<br>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 Injected ID** | N/A | If Mode E is selected the user enters the BISS injected ID here. |

### 4.2.10.2 Configuring Per-Service Descrambling

This menu allows the user to select the services the MRD 6000 will descramble using the BISS keys configured in Section 4.2.10.1. These options are applicable only if Operation Mode in the BISS settings is set to Descramble Selected Services (Refer to Section 4.2.10.1). The drag and drop method can be used to drag services from the right column to the left column. The BISS key to descramble services can be selected using the drop down menu next to each service. Services can be added manually by clicking Add Service button. Clicking the Refresh button forces the MRD 6000 to rescan the transport stream for changes.



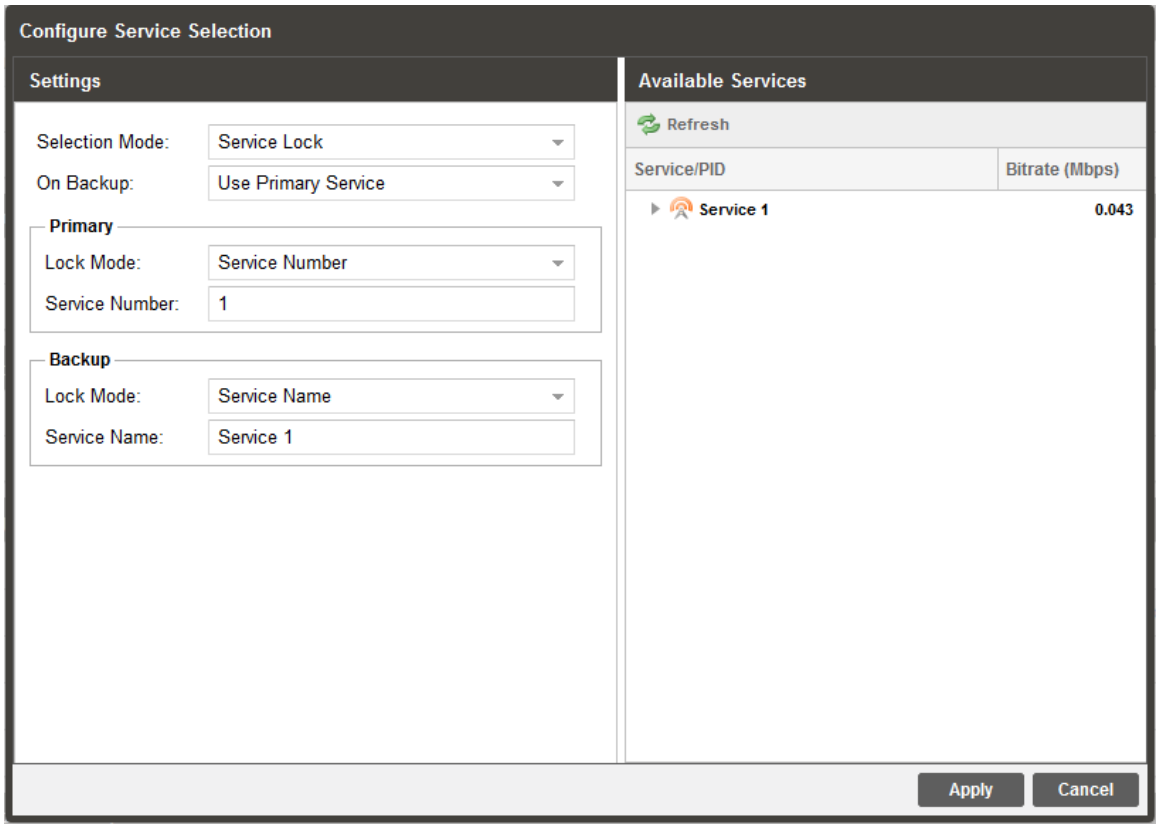

**BISS Service Descrambling Menu**

## 4.2.11 Configuring Service Selection

This menu allows the user to configure the PIDs or Service the MRD 6000 decodes. Depending on the Selection Mode that is selected, the menu changes to reflect the applicable settings.

### Service Lock

In Service Lock mode the MRD is set to decode a specified service number or service name. If the PIDs within the service change at any time, the MRD continues to decode the service. The drag and drop method can be used to populate the Service Name or Service Number dialog boxes.



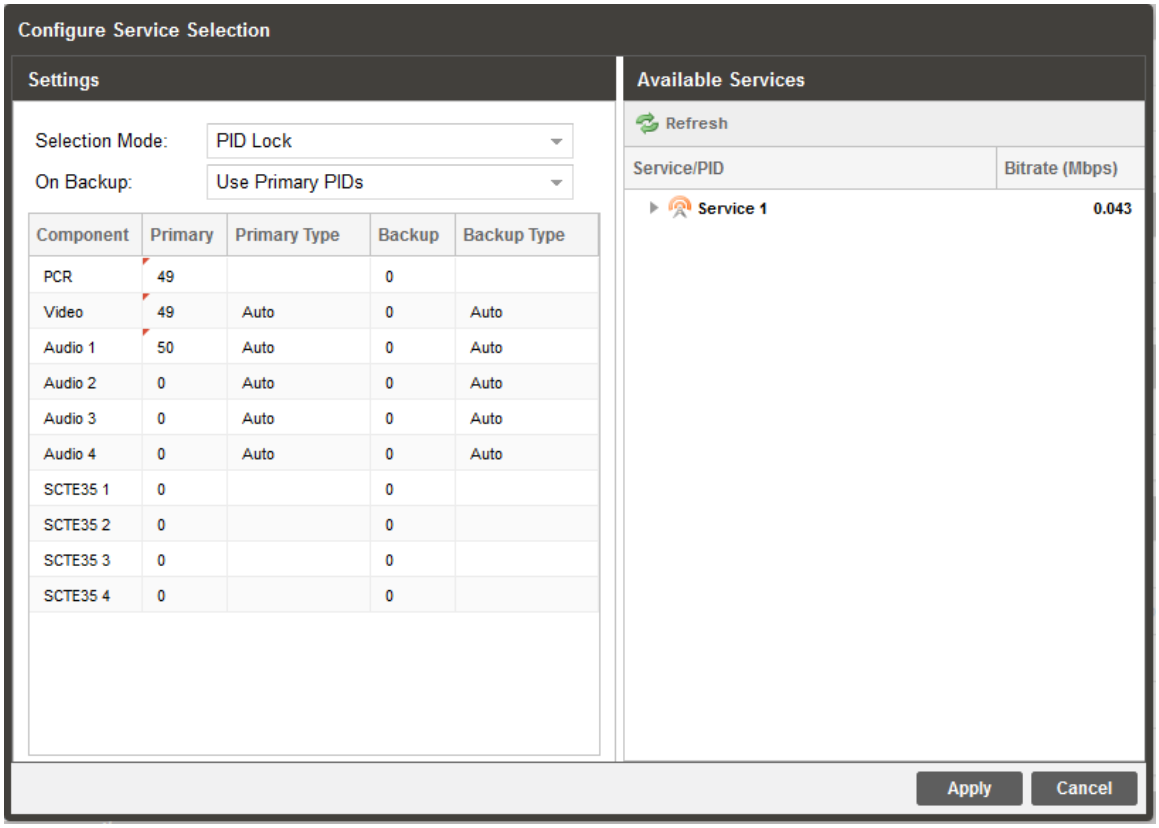

**Service Lock Selection Menu**

| Setting | Range | Description |
|---|---|---|
| **Selection Mode** | Service Lock<br>PID Lock<br>Auto Seek | *Service Lock* sets the unit to decode PIDs associated with a service number or service name. Setting to *PID Lock* sets the unit to decode only the PIDs specified in the PID Lock Configuration matrix. *Auto Seek* mode tunes the unit to the first service listed in the PAT if a transport stream is present. |

| | | |
|---|---|---|
| **On Backup** | Use Primary Service<br>Use Backup Service | Sets the service the MRD 6000 will tune to in case of an input failover. If *Use Primary Service* is selected the MRD 6000 will tune to the service name specified in the Primary section. If *Use Backup Service* is selected the service name specified in the Backup section will be tuned. |
| **Lock Mode** | Service Name<br>Service Number | If set to *Service Name* the MRD will decode only services matching the name specified (SDT in DVB or TVCT in ATSC tables must be present in this mode). If set to *Service Number* the MRD will decode only services matching the number specified. |

### PID Lock Mode

In PID Lock mode the MRD decodes only the PIDs specified by the user in the PID Lock Configuration matrix. The drag and drop method can be used to auto-populate the cells in the matrix. Stream types can be manually defined under the Primary Type and Backup Type columns. Individual cells under Primary and Backup columns can be selected and PIDs can be typed in manually.

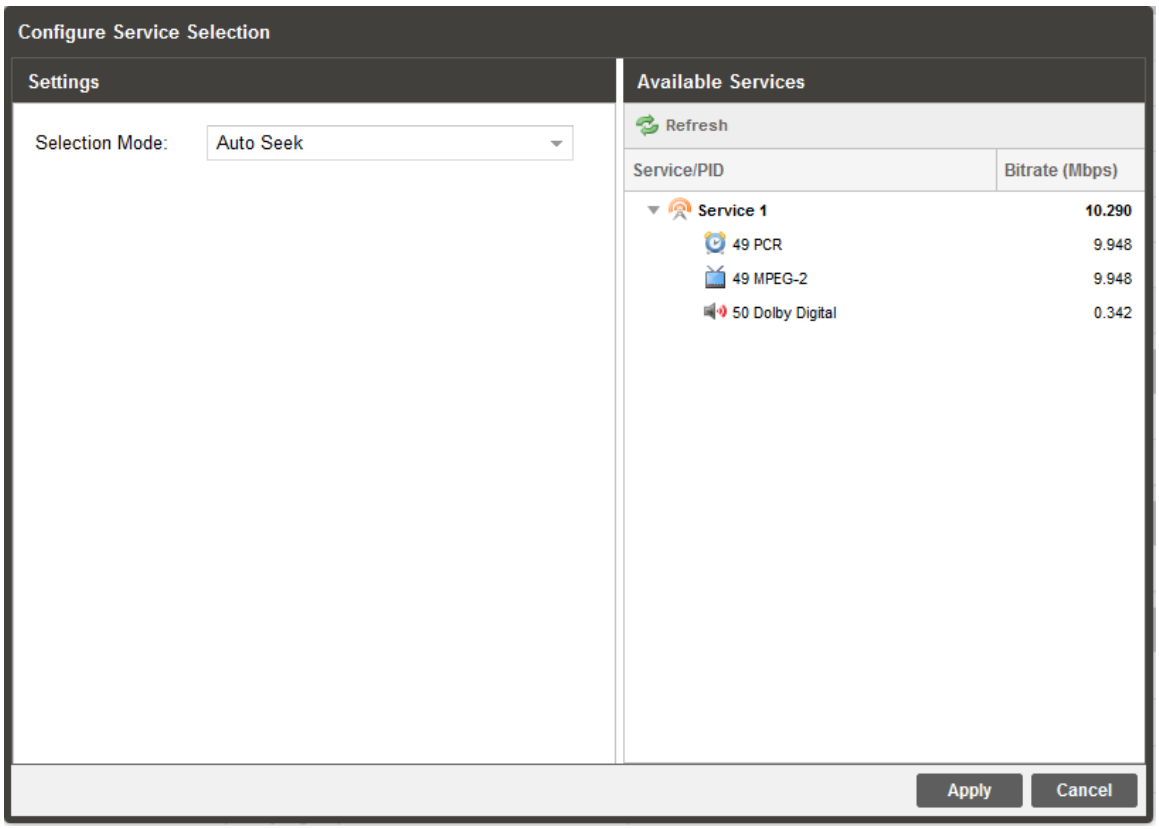



**PID Lock Selection Menu**

| Setting | Range | Description |
|---|---|---|
| **On Backup** | Use Primary PIDs<br>Use Backup PIDs | Sets the PIDs the MRD 6000 will tune to in case of an input failover. *If Use Primary PIDs* is selected the MRD 6000 will tune to the PIDs specified in the Primary PID column. If *Use Backup PIDs* is selected the service name specified in the Backup PID column will be tuned. |

**Auto Seek Mode**

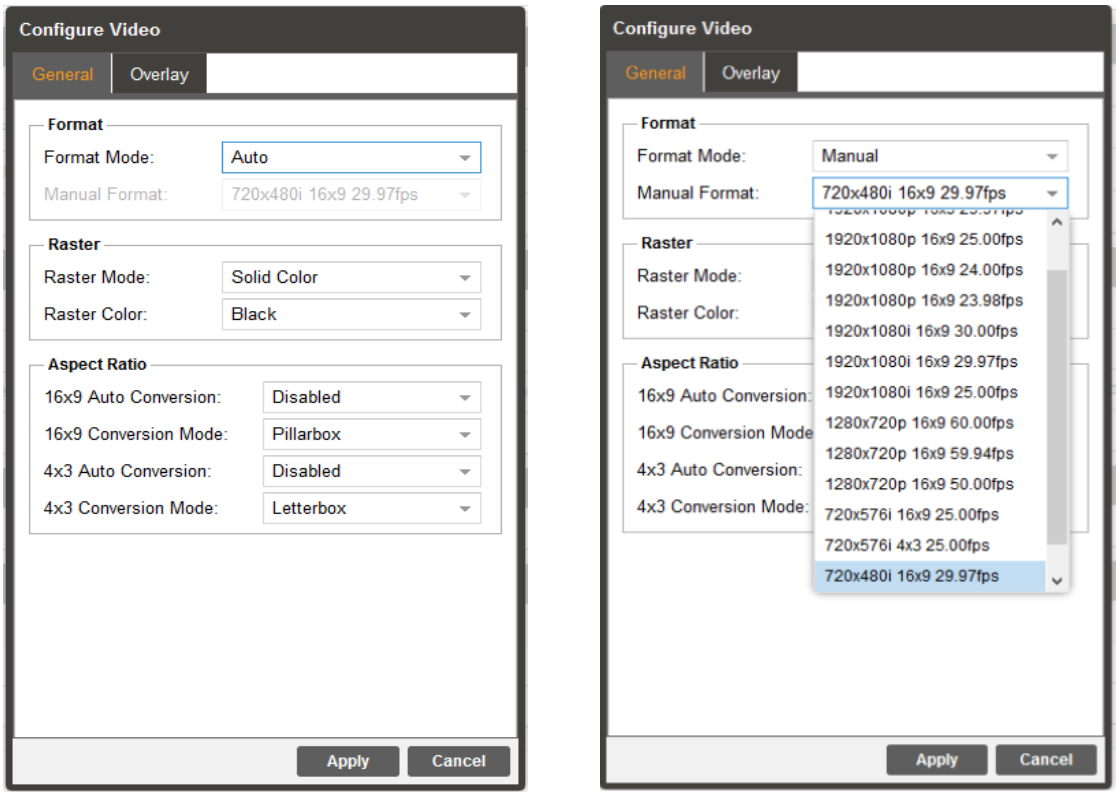
In Auto Seek mode the MRD decodes the first service listed in the PAT. All PIDs in this service are automatically selected for decoding. No other configurations are available in this mode. This mode is recommended to verify the MRD is receiving a valid signal and is able to decode. This mode is not recommended for a professional environment as changes in the PAT's listings and order of listings can unexpectedly cause changes the service being decoded.




**Auto Seek Menu**

## 4.2.12 Configuring Primary Video

The menu allows the user to configure the SDI, Digital Video and Composite output formats of the MRD 6000.

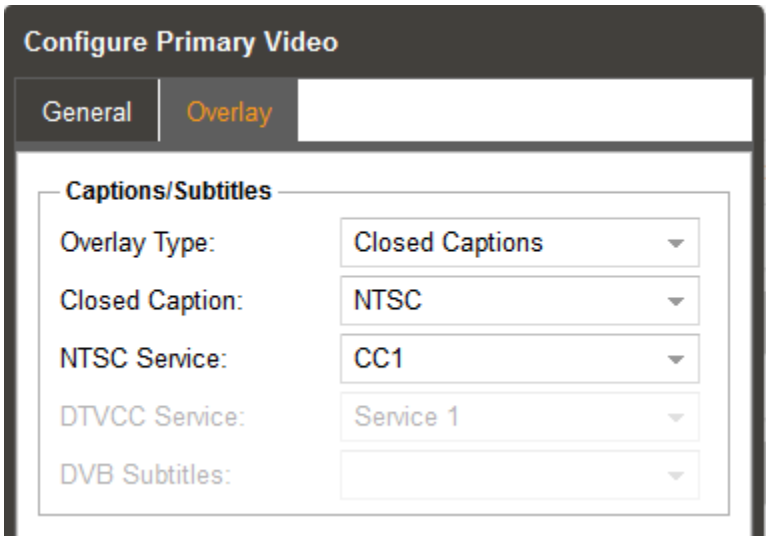



**Manual and Auto Format Modes**

| Setting | Range | Description |
|---|---|---|
| **Format Mode** | Auto<br>Manual | When set to *Auto,* the MRD 6000 will output video to match the incoming native video format. When set to *Manual,* the user can select the video format the MRD 6000 will output. |
| **Manual Format** | Refer to Appendix C for supported formats. | This setting is the video format the MRD 6000 will output. |
| **16x9 Conversion Mode** | Pillar-box<br>Center-Cut<br>Anamorphic | *Center-Cut* cuts off top and bottom of the video. *Pillar-box* adds bars at the left and right of the video. *Anamorphic* stretches the video height and width to match the format mode. |

| | | |
|---|---|---|
| **4x3 Conversion Mode** | Center-Cut<br>Letterbox<br>Anamorphic | *Center-Cut* cuts off top and bottom of the video. *Letterbox* adds bars at the top and bottom of the video. *Anamorphic* stretches the video height and width to match the format mode. |

By configuring the overlay settings, the user can choose to burn either closed captions or subtitles into the video.




**Overlay**

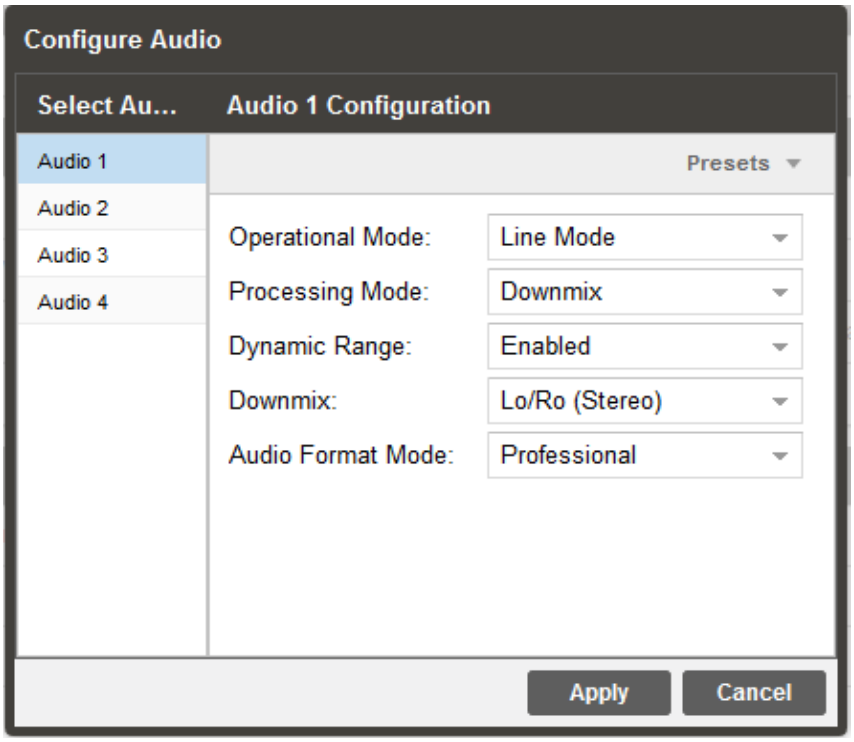
| Setting | Range | Description |
|---|---|---|
| **Overlay Type** | None<br>Closed Captions<br>DTB Subtitles | *Closed Captions* overlays burns closed captioning in the video output. *DVB Subtitles* burns subtitles in video output. *None* disables overlays completely. |
| **Closed Caption** | NTSC<br>DTVCC | Sets the type of closed captions that will be in the overlay. |
| **NTSC Service** | CC1~CC4 | Sets the NTSC closed caption service that will be displayed in the overlay. This setting is only available if the Closed Caption option is set to NTSC. |
| **DTVCC Service** | Service 1~6 | Sets the DTVCC closed caption service that will be displayed in the overlay. This setting is only available if the Closed Caption option is set to DTVCC. |

| | | |
|---|---|---|
| **DVB Subtitles** | Language Codes | If DVB Subtitles overlays are enabled this setting choosing the language which the subtitles are displayed. Only the languages present in the stream are given. |

## 4.2.13 Configuring Audio

This menu allows the user to configure the audio downmix settings of the decoder. Two audio presets are available: Transmission and Monitor. These presets can be applied by clicking the Presets button. The menus for Audio 1 through Audio 4 all contain the same settings.

Note: The number of audio services decoded and listed by the MRD 6000 may vary with licensing.




**Audio Configuration Menu**

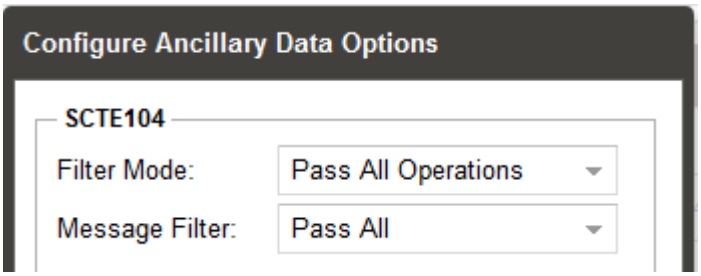
Note: When selecting processing mode, the selection of Audio 1 is the most important, as it affects the other three Audios. Only Audio 1 can select “Discrete” mode. While Audio 1 is set to “Discrete” mode, Audio 2 will be locked into “Downmix” mode, and Audio 3 and Audio 4 will be grayed out as indication of all 8 audio channels being fully utilized. If Audio 1 is set to “Downmix” mode, then Audio 2, Audio 3 and Audio 4 will be locked into “Downmix” mode as well.

**Audio 1 Configuration**

| Setting | Range | Description |
|---|---|---|
| **Operational Mode** | Line Mode<br>RF Mode<br>Custom 1<br>Custom 0 | Refer to Appendix E for explanation. |
| **Processing Mode** | Downmix<br>Discrete | Refer to Appendix E for explanation.<br>Refer to Appendix F for explanation, only Audio 1 can choose discrete. |
| **Dynamic Range** | Enabled<br>Disabled | Refer to Appendix E for explanation. |
| **Downmix** | Lo/Ro (Stereo)<br>Lt/Rt (Dolby Surround)<br>Lt/Rt (Auto)<br>Dual Mono<br>Dual Left<br>Dual Right | When the audio is downmixed in the MRD 6000 two audio channels are created. The channels can be configured using the settings available in the drop down menu. (Refer to Appendix E) |
| **Format Mode** | Consumer<br>Professional | This option selects the PCM or Dolby Digital format mode. (Refer to Appendix E) |

## 4.2.14 Configuring Ancillary Data

The following menus are present where ancillary data carried separately from the video and audio PIDs can be configured.




**SCTE104**

**SCTE104**

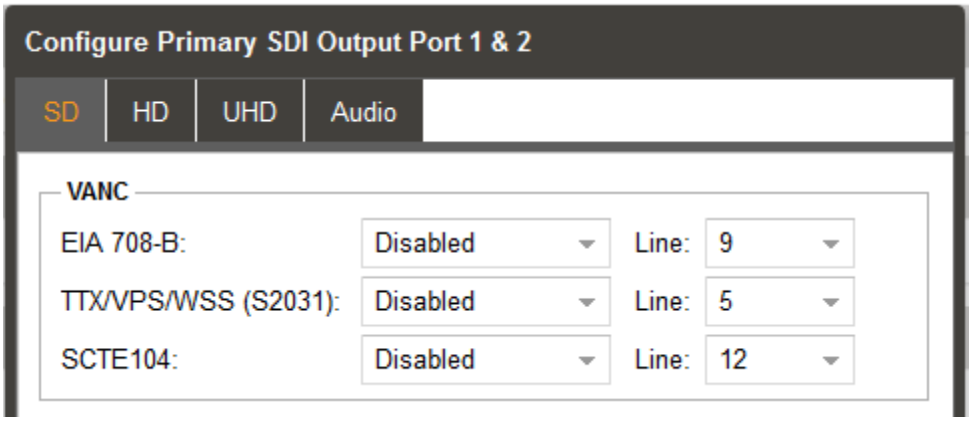
| Setting | Ranges | Description |
|---|---|---|
| **Filter Mode** | Pass First Operation<br>Pass All Operations | *Pass First Operation* ensures that embedded SCTE104 messages will contain no more than one operating ID. *Pass All Operations* allows embedded SCTE104 messages to contain all operations on output. |
| **Message Filter** | Pass Splice Insert Only<br>Pass All | *Pass Splice Insert Only* selection will filter out all SCTE104 message types except for Splice Inserts. *Pass All* selection will allow all SCTE104 message types to pass to the output. |

## 4.2.15 Configuring Primary SDI Ports 1 & 2

Under the “Configure Primary SDI Output Port 1& 2” menu, there are four selection tabs: SD, HD, UHD and Audio. The SD and HD tabs are for configuring VANC settings of the primary SDI video output from ports 1A, 1B and 2. See section 4.2.12 for information on output selection. The UHD tab allows the user to select which type of output mapping they wish to use. Finally, the Audio tab allows the user to assign audio services to the SDI output. For SD-SDI or HD-SDI formats, a single link connection is used as per SMPTE 259 or SMPTE 292.

### 4.2.15.1 Primary SD-SDI VANC Embedding

The SD selection tab allows for configuration of the VANC settings for the SD-SDI output from the primary ports.



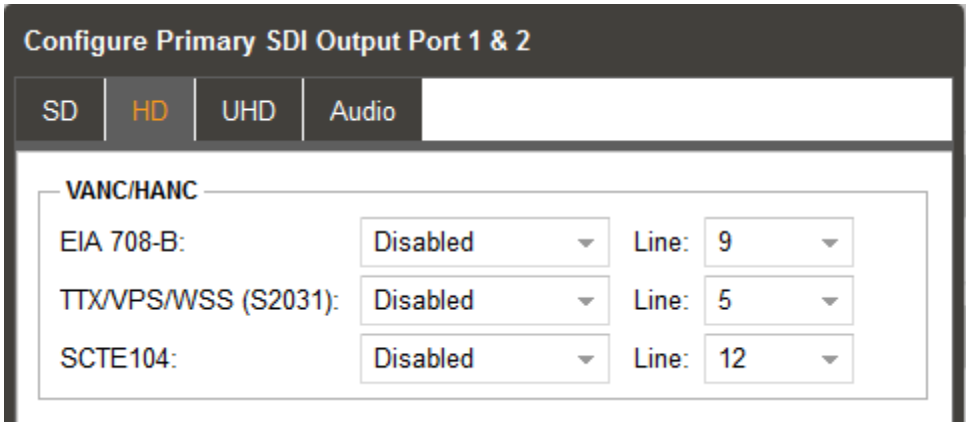

**Primary SD Selection Tab**

**VANC**

| Setting | Ranges | Description |
|---|---|---|
| **EIA 708-B** | Disabled/Enabled<br>Line Number (4~21) | When enabled, EIA 708-B captions will be embedded in the VANC.<br>Selecting Line number determines which line the captions start on. |
| **TTX/VPS/WSS (S2031)** | Disabled/Enabled<br>Line Number (4~21) | When enabled, SMPTE 2031 Teletext data will be embedded in the VANC.<br>Selecting line number determines which line the SMPTE 2031 Teletext data starts on. |
| **SCTE104** | Disabled/Enabled<br>Line Number (4~21) | When enabled, SCTE35 to 104 Embedding occurs.<br>Selecting line number determines which line SCTE104 data starts on. |

### 4.2.15.2 HD-SDI VANC/HANC Embedding

The HD selection tab allows for configuration of the VANC/HANC settings for the HD-SDI output from the primary ports:




**HD Selection Tab**

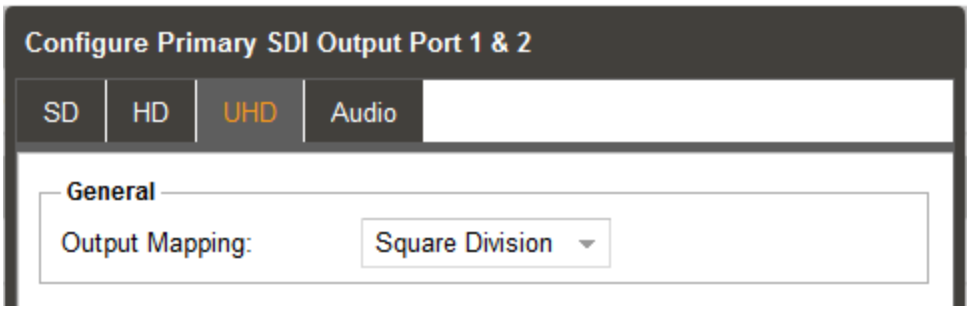
**VANC/HANC**

| Setting | Ranges | Description |
|---|---|---|
| **EIA 708-B** | Disabled/Enabled<br>Line Number (4~21) | When enabled, EIA 708-B captions will be embedded in the VANC.<br>Selecting Line number determines which line the captions start on. |

| | | |
|---|---|---|
| **TTX/VPS/WSS (S2031)** | Disabled/Enabled<br>Line Number (4~21) | When enabled, SMPTE 2031 Teletext data will be embedded in the VANC.<br>Selecting line number determines which line the SMPTE 2031 Teletext data starts on. |
| **SCTE104** | Disabled/Enabled<br>Line Number (4~21) | When enabled, SCTE35 to 104 Embedding occurs.<br>Selecting line number determines which line SCTE104 data starts on. |

### 4.2.15.3 UHD/4K Output Mapping

The UHD selection tab provides configuration of the UHD/4K outputs. The Output Mapping selection configures the quad 3G-SDI outputs to carry a 4K format to a compatible quad 3G-SDI input device/monitor.




**UHD Selection Tab**

**General**

| Setting | Ranges | Description |
|---|---|---|
| **Output Mapping** | Square Division<br><br>Two Sample Interleave | Setting to *Two Sample Interleave* configures the SDI output for quad 3G-SDI format in which each of 4 stream outputs carries ¼ pixels and the picture resolution. Setting to *Square Division* configures a quad 3G-SDI output format in which each of 4 streams carries a quarter section of the picture in full resolution. Quad 3G-SDI Formats conform to SMPTE 425-3 and SMPTE 425-5. |

Quad 3G-SDI requires 4 SDI output port/connections. Ports 1A, 2, 3, and 4 on the MRD 6000 provide the respectable outputs for the 4K formats when selected. SDI Link connections 1A, 2, 3, and 4 from the MRD 6000 must appropriately match the quad 3G-SDI inputs of the receiving/monitor device so the 4K image can be properly processed/rendered. The following section provides a brief explanation of the two methods commonly used to interface a 4K-SDI signal over four 3G-SDI link connections.

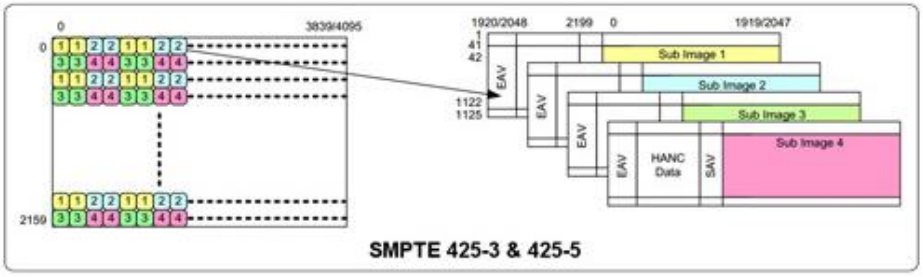
SMPTE 425-3 and SMPTE 425 define new image mapping structures which provide a means to interface 4K over an SDI interface. Interfacing 4K-SDI up to 60 fps requires using four 3G-SDI links. Two methods of carrying 4K via 4 link connections include

1. Two Sample Interleave

2. Four Quadrant Division (Square Division).

In each of these methods ¼ of the picture image is carried by each of the four link connections. A brief explanation of each follows.

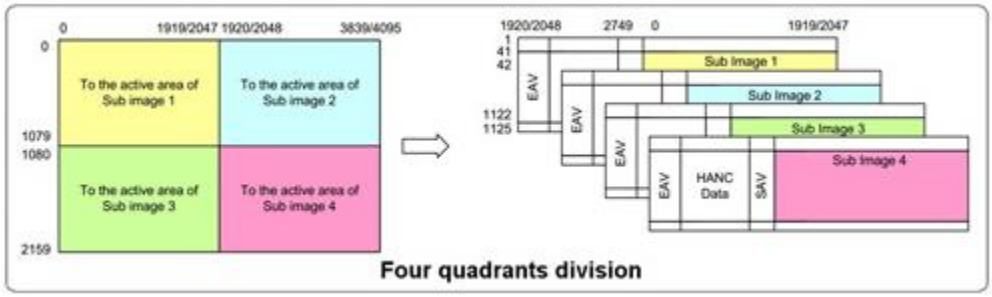
**Two Sample Interleave**




**Two Sample Interleave Diagram**

Two Sample Interleave breaks the image into interleaved samples of the entire picture. A line interleaving system has one line with alternating pixels 1 and 2, while the next line has alternating pixels 3 and 4 as illustrated. 3G-SDI link 1 carries the #1 pixels, while link 2 carries the #2 pixels, link 3 the #3 pixels and link 4 the #4 pixels. In this manner each of the 3G-SDI links carries pixels in ½ the scan lines and ½ the pixels in each line of the (1080p resolution) image or frame.

**Square Division or Four Quadrants Division**

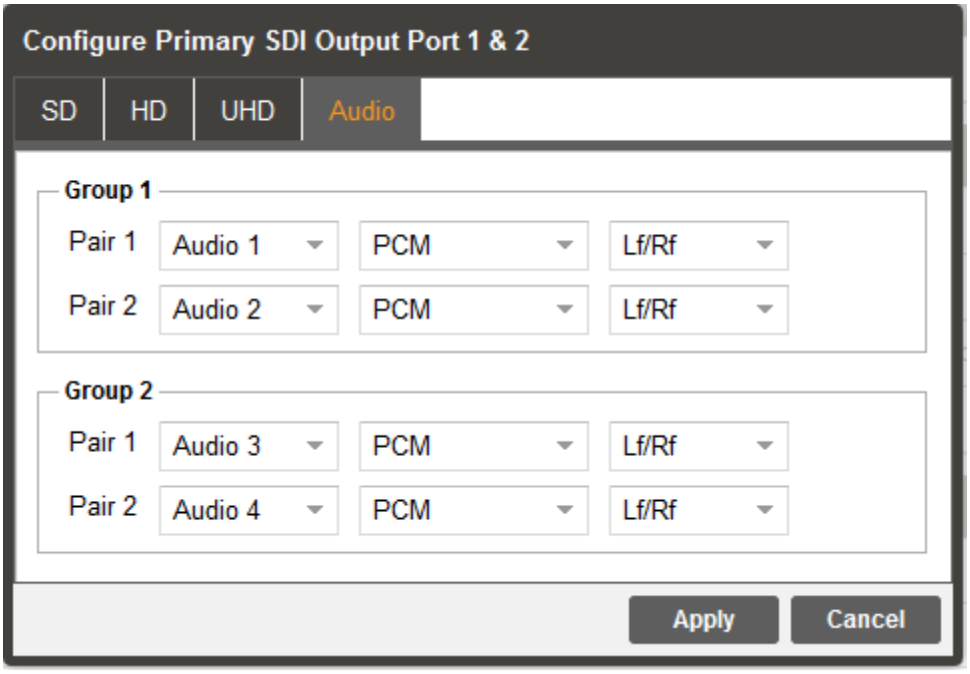



**Square Division Diagram**

The Square Division method, also referenced as Four Quadrant Division, divides the picture equally in quarter sections as illustrated. Each section is ¼ of the 4k image or 1080p. SDI link 1 carries the upper left image pixels, link 2 carries the upper right pixels, link 3 carries the lower left pixels, and link 4 carries the lower right pixels. The SDI receive device assembles the pixels from the 4 links to recreate the image.

### 4.2.15.4 Primary SDI Audio Embedding

The Audio selection tab allows for configuration of SDI embedded audio settings based on the settings chosen from section 4.2.13. The MRD 6000 comes standard with the ability to decode two audio services. With additional licensing the MRD 6000 can handle up to four unique audio services. When licensed for four audio services, the user will have four audio pairs available to embed audio in the SDI. These two SDI groups provide inclusion of four audio pairs, with two pairs to each group. All audio pairs share the same options.




**Primary Audio Selection Tab**

Note: From section 4.2.13, if Audio 1's "Processing Mode" is set to "Discrete", then Audio 3 and Audio 4 will only be capable of "Pass Through".

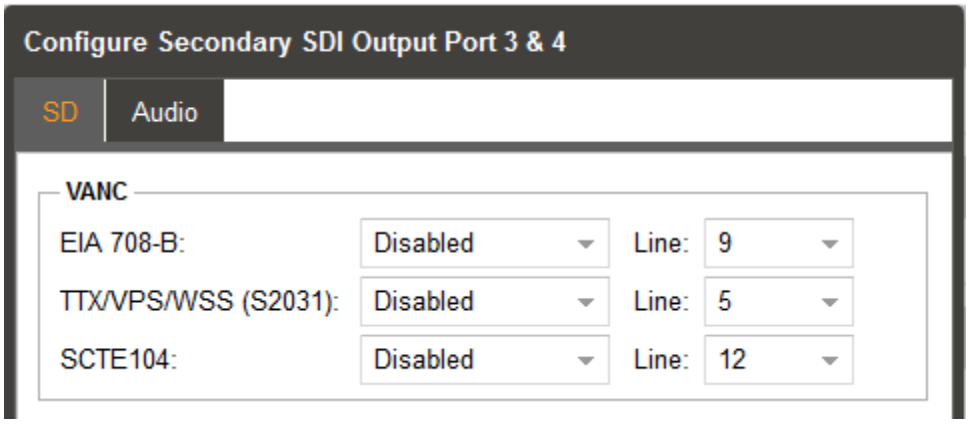
| Setting | Range | Description |
|---|---|---|
| **Group 1-2** | Disabled | Assigning a *PCM* audio to a Group Pair will embed the downmixed four channel audio. Assigning *Pass-Through* to a Group Pair will embed unprocessed compressed audio in the SDI VANC. Selecting Off disables the Group Pair completely. Also present are the options for decoding Dolby 5.1 |
| **Pair 1-2** | Audio 1-4 PCM | |
| | Audio 1-4 Pass-through | |
| | Lf/Rf, C/LFE, Ls/Rs, Ch1/Ch2, Ch3/Ch4, Ch5/Ch6, Ch7/Ch8 | |

## 4.2.16 Configuring Secondary SDI Ports 3 & 4

While the device is licensed for MRD 60601 (Simultaneous HD/SD), options to configure the VANC settings of the Secondary SDI ports will appear. The following menus allow the user to configure the embedded audio and auxiliary data in the Secondary SDI video output.

### 4.2.16.1 Secondary SD-SDI VANC Embedding

The SD selection tab allows for configuration of the VANC settings for the SD-SDI output from the secondary ports.

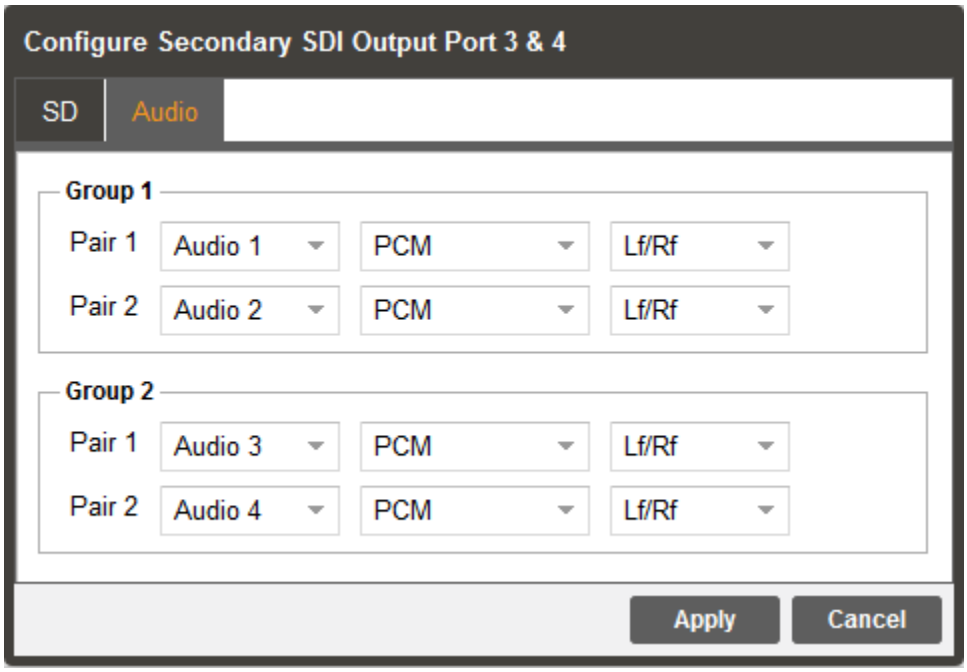



**Secondary SD Selection Tab**

| Setting | Ranges | Description |
|---|---|---|
| **EIA 708-B** | Disabled/Enabled<br>Line Number (4~21) | When enabled, EIA 708-B captions will be embedded in the VANC.<br>Selecting Line number determines which line the captions start on. |
| **TTX/VPS/WSS (S2031)** | Disabled/Enabled<br>Line Number (4~21) | When enabled, SMPTE 2031 Teletext data will be embedded in the VANC.<br>Selecting line number determines which line the SMPTE 2031 Teletext data starts on. |
| **SCTE104** | Disabled/Enabled<br>Line Number (4~21) | When enabled, SCTE35 to 104 Embedding occurs.<br>Selecting line number determines which line SCTE104 data starts on. |

### 4.2.16.2 Secondary Audio VANC Embedding

The Audio selection tab allows for configuration of SDI embedded audio settings. See section 4.2.15.4 for additional details about allowed audio decoding.




**Secondary Audio Selection Tab**

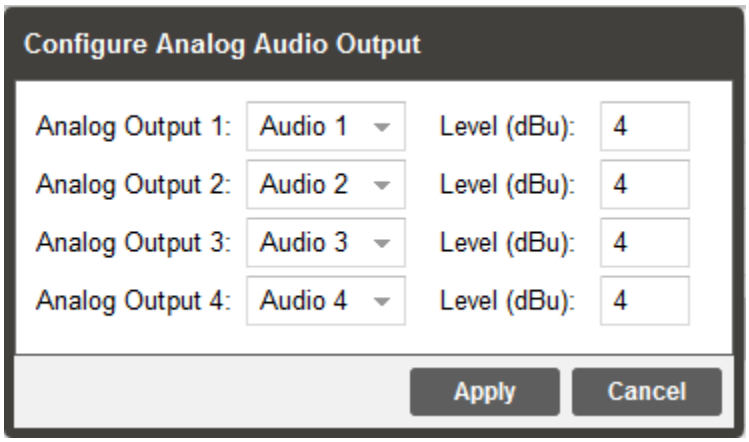
Note: From section 4.2.13, if Audio 1's "Processing Mode" is set to "Discrete", then Audio 3 and Audio 4 will only be capable of "Pass Through".

**Group 1 and Group 2**

| Setting | Range | Description |
|---|---|---|
| **Pair 1-2** | Disabled<br>Audio 1-4 PCM<br>Audio 1-4 Pass-through<br>Lf/Rf, C/LFE, Ls/Rs, Ch1/Ch2, Ch3/Ch4, Ch5/Ch6, Ch7/Ch8 | Assigning a *PCM* audio to a Group Pair will embed the downmixed four channel audio. Assigning *Pass-Through* to a Group Pair will embed unprocessed compressed audio in the SDI VANC. Selecting Off disables the Group Pair completely. Also present are the options for decoding Dolby 5.1 |

## 4.2.17 Configuring Analog Audio Output

This menu allows the user to configure the analog outputs of the MRD 6000. Four analog audio outputs are available. The dBu level of the outputs can be adjusted for each of the four audio outputs. For the Analog Output connector pin out refer to Appendix D.

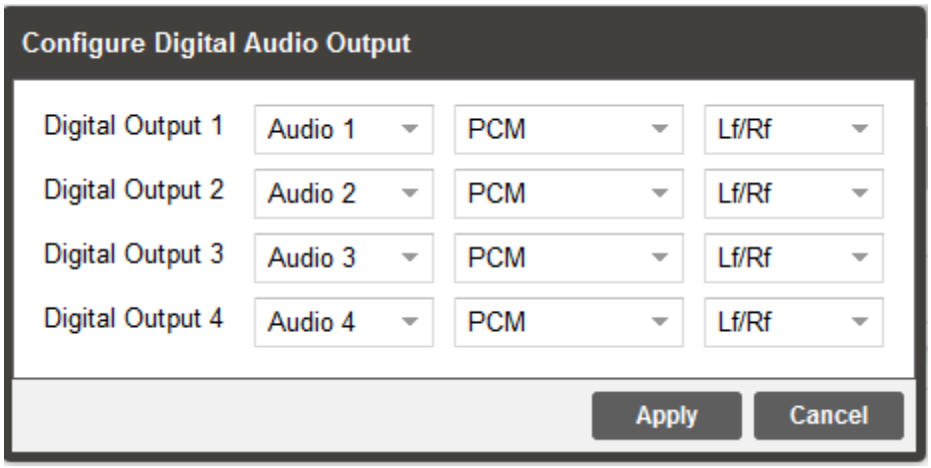



**Analog Audio Configurations**

| Setting | Range | Description |
|---|---|---|
| **Analog Output 1-4** | Off<br>Audio 1-4 | Assign *Audio 1-4* to an analog audio. Select *Off* to disable the analog output completely. |
| **Level** | -10 to 4 | Level of the analog audio output in dBu. |

## 4.2.18 Configuring Digital Audio Output

This menu allows the user to configure the digital audio outputs of the MRD 6000. The number of outputs available directly correlates with the number of audio services the unit is licensed to support. Up to four digital audio outputs are available.

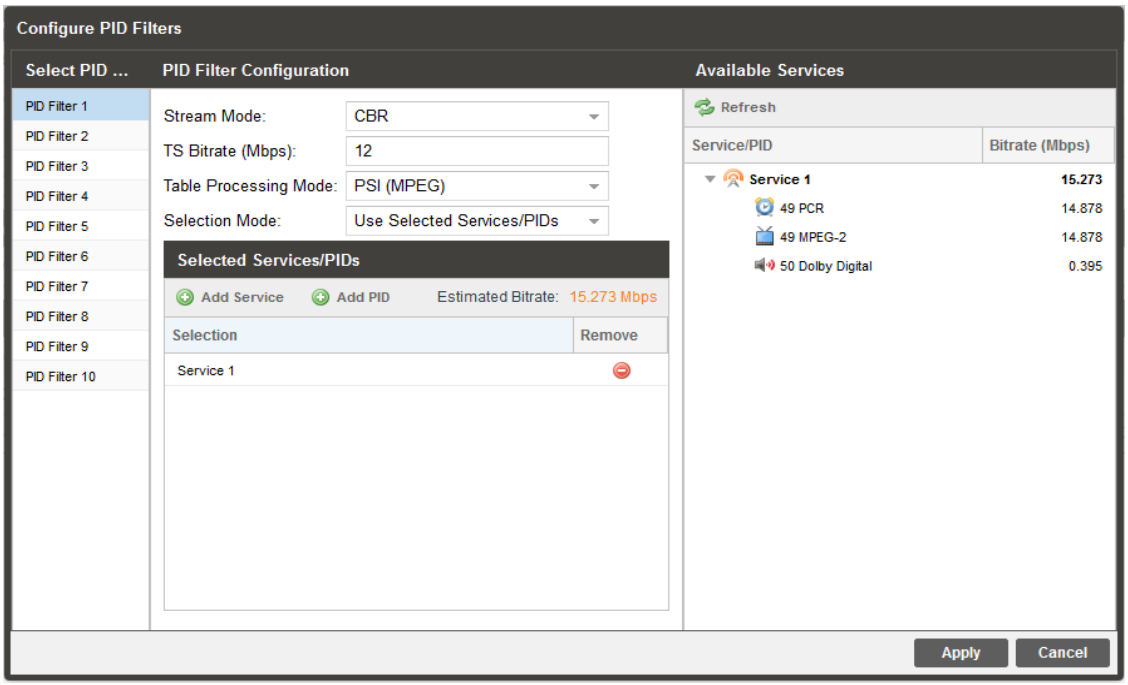



**Digital Audio Configurations**

| Setting | Range | Description |
|---|---|---|
| **Digital Output 1-4** | Off<br>Audio 1-4 PCM<br>Audio 1-4 Pass-through<br>Lf/Rf, C/LFE, Ls/Rs, Ch1/Ch2, Ch3/Ch4, Ch5/Ch6, Ch7/Ch8 | Assigning a *PCM* audio to a digital output will output the decoded or downmixed four channel audio using the settings defined in Section 4.2.13. Assigning *Pass-Through* to a digital output will output unprocessed compressed audio. Selecting Off disables the digital output completely.<br>Also present are the options for decoding Dolby 5.1 |

## 4.2.19 PID Filter

If the PID/Service Filter license is enabled, the menu on the next page and options will be available for configuration. PID filtering will allow the user to create a new output TS by selecting and dragging one or more services/PIDs from the incoming transport stream into the Selected Services/PIDs box or use the currently decoded stream. The user can also configure a TS bitrate for each PID filtered stream and select different table inclusion options.

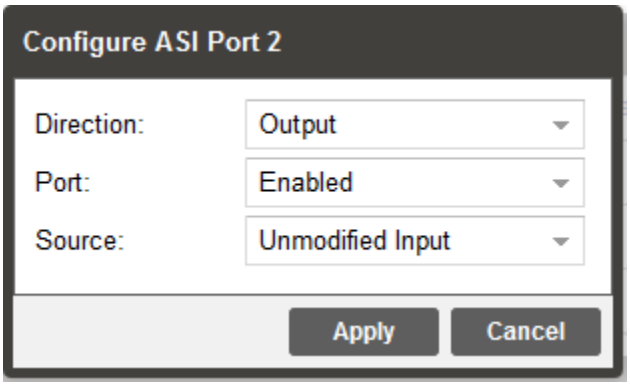



**PID Filter Configuration**

| Setting | Range | Description |
|---|---|---|
| **Select PID Filter** | PID filter 1-10 | Select which PID filter to configure |
| **Stream Mode** | CBR or VBR | Determine if the output TS bitrate will be constant or variable. |
| **TS Bitrate (Mbps)** | 0.25 to 160 | Configure the TS Bitrate for the PID filter stream selected |
| **Table Processing Mode** | PSI (MPEG) | Adjusted tables: PAT, PMT<br>Passed tables: CAT, NIT<br>Discarded tables: all remaining |
| **Table Processing Mode** | SI (DVB) | Adjusted tables: PAT, PMT,SDT<br>Passed tables: CAT, NIT, EIT, RST, TDT, TOT<br>Discarded tables: TSDT, BAT |
| **Selection Mode** | Use Selected Services/PIDs<br>Use Decoded Service | Use Selected Services/PIDs will allow the user to select which services are in the new TS. Use Decoded Service will only include the service that is currently selected for decoding by the MRD 6000 |

## 4.2.20 Configuring ASI Output

This menu allows the user to configure the ASI output of the MRD 6000. When enabled this output acts as an active loop output of the active input. For example, if the DVB-S/S2 input card is the current active input the ASI output port will output a demodulated signal of the satellite input. ASI outputs can be configured to pass the selected TS input directly unmodified to the output or apply PID filtering to the output.

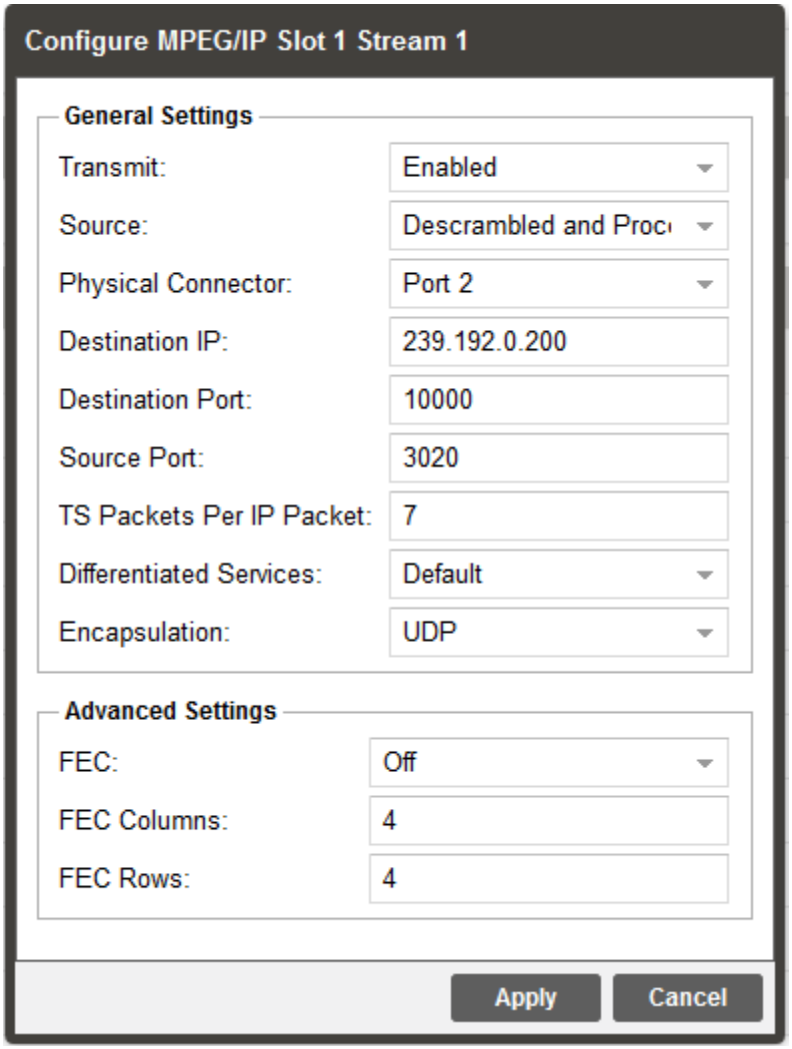



**ASI Output Configuration**

| Setting | Range | Description |
|---|---|---|
| **Direction** | Input / Output | Chooses whether the acting port is input or output. |
| **Port** | Enabled / Disabled | Enable or disable the ASI output port. |
| **Source** | Unmodified Input<br>Descrambled and Processed<br>PID Filter 1-10 | Selecting *Unmodified Input* will pass the incoming TS to the output without applying any BISS or DVB-CI decryption. Choosing *Descrambled and Processed* will output the TS with any applied BISS or DVB-CI decryption. *PID Filter 1-10* will output the TS from the PID filter menu option. |

## 4.2.21 Configuring the MPEG/IP Outputs

The menu on the next page allows the user to configure the MPEG/IP outputs. Each MPEG/IP card has two ports that can be set to receive and/or transmit. This menu is for setting up the transmission of MPEG/IP unicast or multicast transport streams. The menu for Stream 1 and 2 have the same settings. The menu for Streams 3 through 10 will contain the same options as Transmit 1 and Transmit 2 with one exception: Forward Error Correction is only available (if licensed) on Transmit 1 and 2.




**Configuration of MPEG/IP Output**

### General

| Setting | Range | Description |
|---|---|---|
| **Transmit** | Enabled / Disabled | Enable or disable the MPEG/IP transmit group. |
| **Source** | Unmodified Input<br>Descrambled and Processed<br>PID Filter 1-10 | Selecting *Unmodified Input* will pass the incoming TS to the output without applying any BISS or DVB-CI decryption. Choosing *Descrambled and Processed* will output the TS with any applied BISS or DVB-CI decryption. *PID Filter 1-10* will output the TS from the PID filter menu option. |
| **Physical Connector** | Port 1<br>Port 2 | The physical connector on the MPEG/IP card that will be used to transmit the output. |

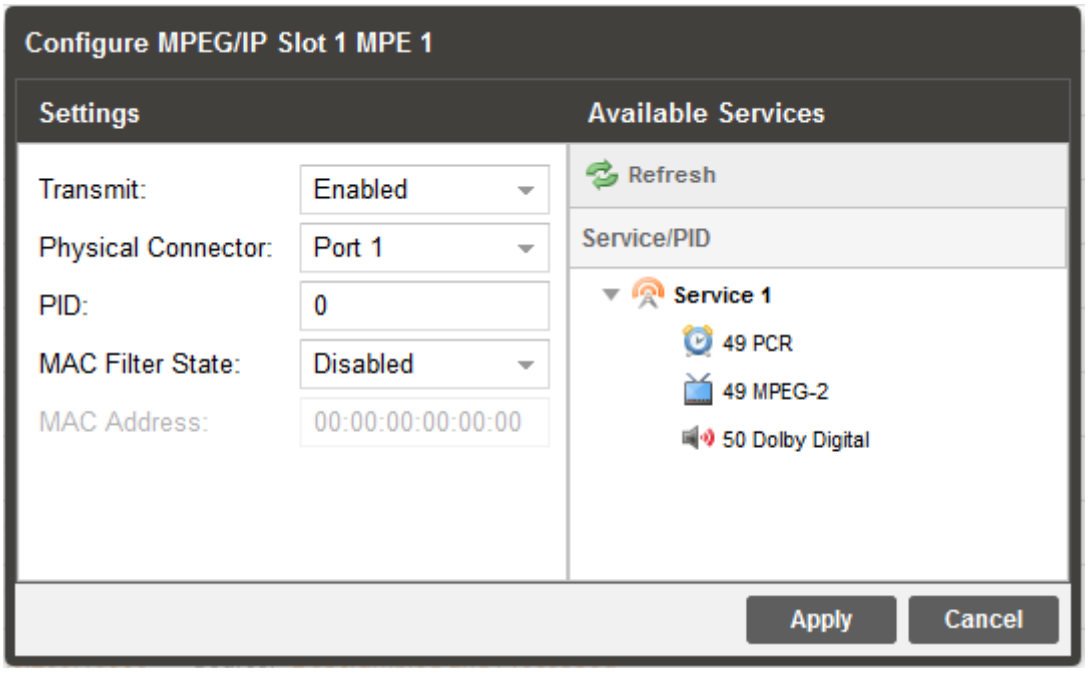
| | | |
|---|---|---|
| **Destination IP** | Multicast - 224.0.0.0 - 239.255.255.255 | When sending to a unicast address the destination IP address must match the receiving device's IP address. When sending a multicast the address must be sent within the multicast IP range. |
| **Destination Port** | 0 - 65535 | When sending to a unicast address, the destination port must match the receiving device's port. When sending a multicast, any port within the accepted range can be used, but it is good practice to always choose a port >1030 and an even number |
| **Source Port** | 0 - 65535 | This is the port used by the MRD 6000 to transmit the MPEG/IP stream. |
| **TS Packets Per IP Packet** | 1-7 | The number of TS packets that are contained with a single IP packet. Default is 7. Lowering this value below default increases network overhead. |
| **Differentiated Services** | Default<br>Assured Forwarding 1-1 to 4-3<br>Expedited Forwarding | Define the quality of service (QoS) classification the packets carry when transmitted. |
| **Encapsulation** | UDP<br>RTP | Sets the Encapsulation to UDP or RTP. |

### Advanced Settings

| Setting | Range | Description |
|---|---|---|
| **FEC** | Off<br>Columns<br>Columns/Rows | Sets the FEC Type or disables FEC. |
| **FEC Columns** | 1-20 (Columns)<br>4-20 (Columns/Rows) | Defines the number of Columns used to construct the FEC Matrix. (Columns * Rows must be ≤ 100.) |
| **FEC Rows** | 4-20 | Defines the number of Rows used to construct the FEC Matrix. (Columns * Rows must be ≤ 100.) |

## 4.2.22 Configuring the MPEG/IP MPE Outputs

This menu allows the user to configure the MPEG/IP Multi-Protocol Encapsulation (MPE) outputs. Each MPE Output allows the user to select an MPE data PID from the transport stream to be output.

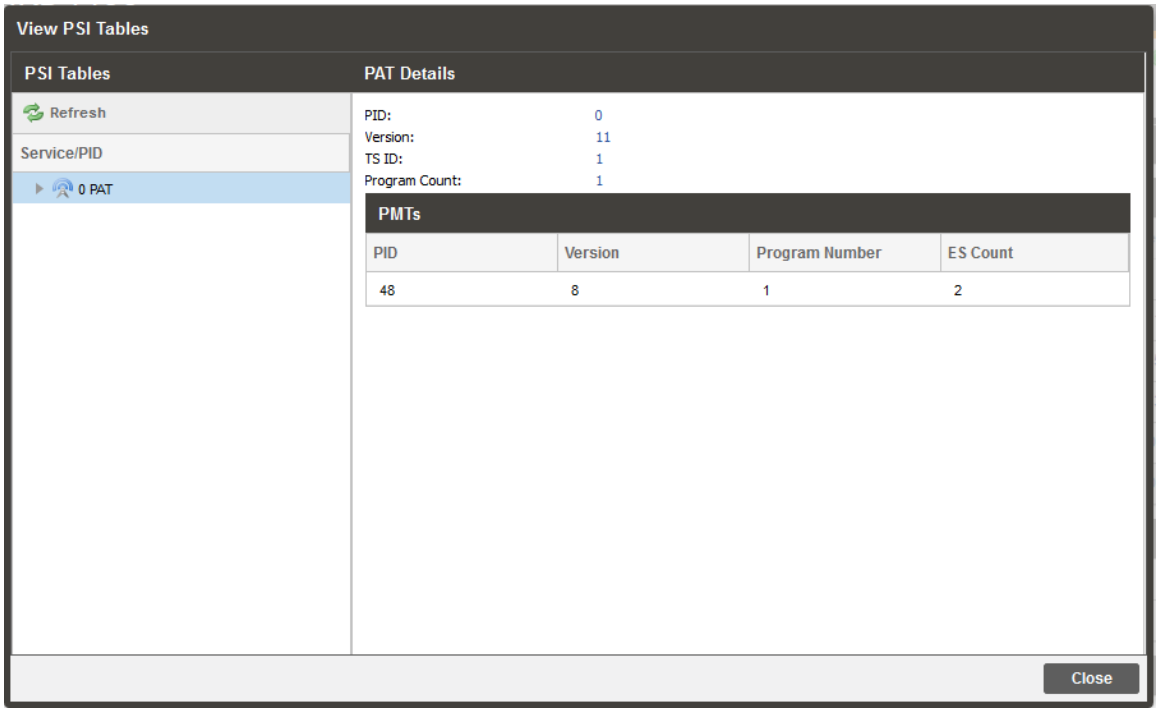



**Configuring MPE Output**

| Setting | Range | Description |
|---|---|---|
| **Transmit** | Enabled<br>Disabled | Enable or disable transmission of de-encapsulated MPE data. |
| **Physical Connector** | Port 1<br>Port 2 | The physical connector on the MPEG/IP card that will be used to transmit the MPE data. |
| **PID** | | Selected MPE PID from the transport stream to use for MPE output. |
| **MAC Filter State** | Enabled<br>Disabled | Enable or Disable the filtering of output data based on a MAC address in the selected MPE PID. |
| **MAC Address** | 00:00:00:00:00:00<br>FF:FF:FF:FF:FF:FF | Filtered MAC address that will be transmitted in the MPE output. All data with other MAC addresses in the selected MPE PID will be discarded. |

## 4.2.23 Viewing PSIP Information

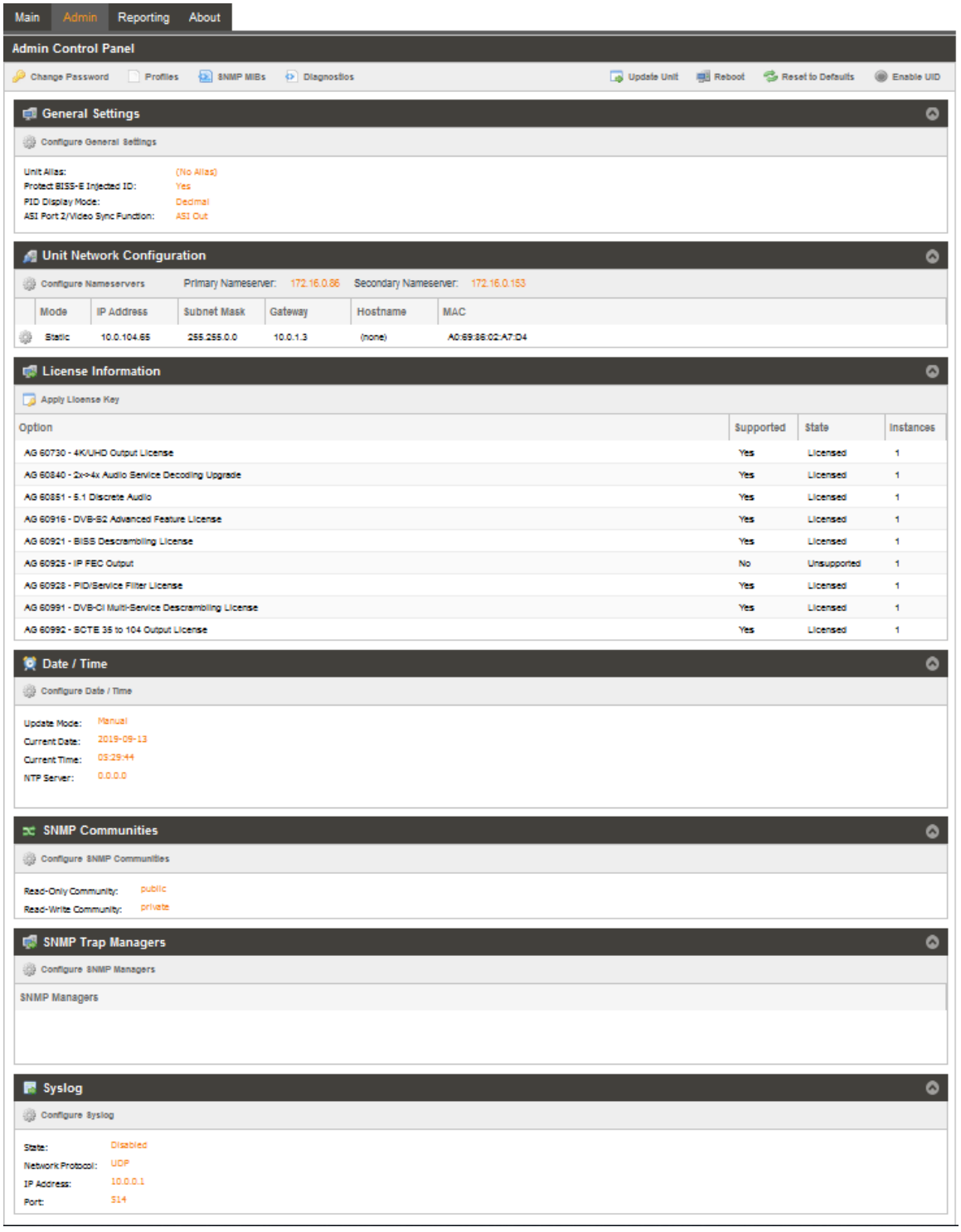
To view the PSIP information for the applied TS, select the View PSI Tables button located on the right hand side of the Inputs section. This will open a new window that displays all of the PSIP information for the applied TS. The tables displayed will include PAT, PMT and CAT and tables associated with the stream type (DVB, ATSC). SDT tables will be displayed for DVB streams while MGT, TVCT, EIT, ETT, and STT tables will be displayed for ATSC streams.




**PSI Tables**

Clicking the Refresh button in the upper left corner will update the tables displayed.

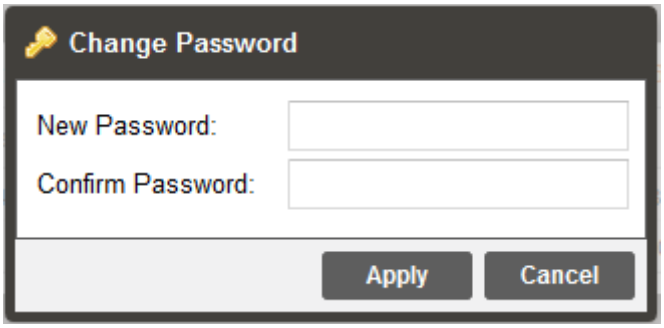
## 4.3 Admin Panel




To access the Admin Control Panel, click on the Admin tab. This menu allows the user to control many aspects of the MRD 6000.

### 4.3.1 Changing Unit Password

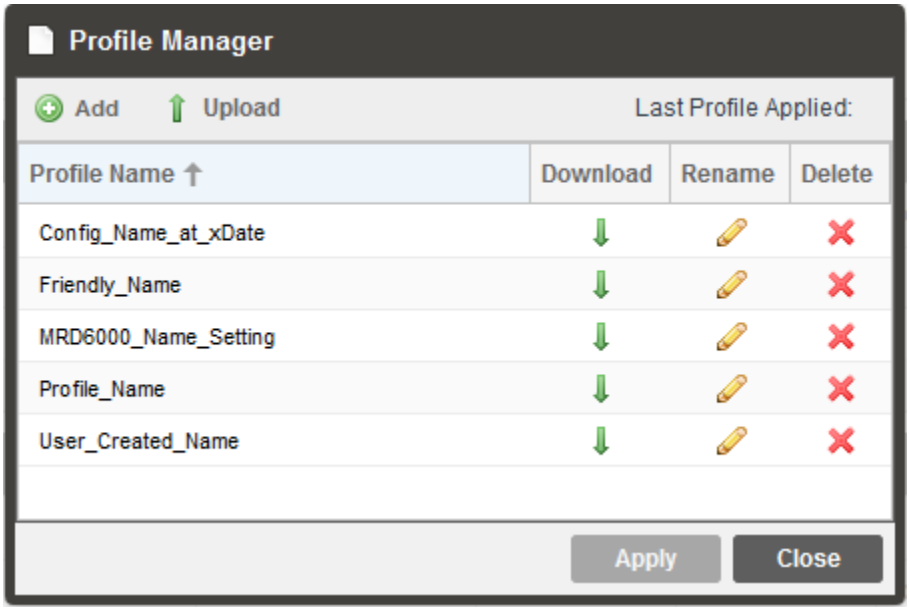
The MRD 6000 can be assigned an access password and the current access password can be changed. In order to make changes to passwords, click the Change Password button. A window will appear to enter the current password and new password.




**Password Change Menu**

### 4.3.2 Profiles

The MRD 6000 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 6000s. Profiles can be used to quickly and easily change the configuration of an MRD 6000 to suit different inputs and decoding requirements.

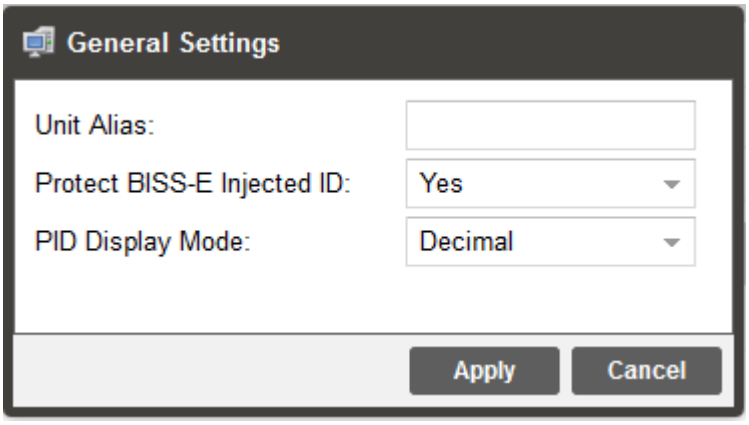



**Profile Management Window**

| 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 6000. |
| **Apply Profile** | Apply | Select a profile from the drop down menu and click this button. The MRD 6000 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. |

### 4.3.3 General Settings

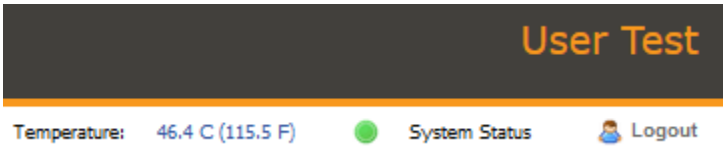
The MRD 6000 can be assigned an alias which is displayed in the upper right hand corner of the web interface. The alias can help define which MRD 6000 the operator is currently logged into. The BISS-E Injected ID for BISS Mode E can also be protected from being accidently changed. Setting the Protect BISS-E Injected ID to “Yes” will force the user to unlock the dialog box in the BISS Descrambling configuration menu before allowing any changes to be made. The edit the Unit Alias or protect the BISS-E Injected ID click on the Configure General Settings button. The PID Display mode changes how PID values are displayed in the web interface. The values can either be displayed in decimal or HEX values.




**General Settings Menu**

| Setting | Range | Description |
|---|---|---|
| **Unit Alias** | User entered | Here a friendly name can be assigned to the unit. |
| **Protect BISS-E Injected ID** | Yes or No | Choose whether or not to protect the BISS-E Injected ID. |
| **PID Display Mode** | Decimal or Hexadecimal | Choose which format the PIDs should be numerically displayed. |

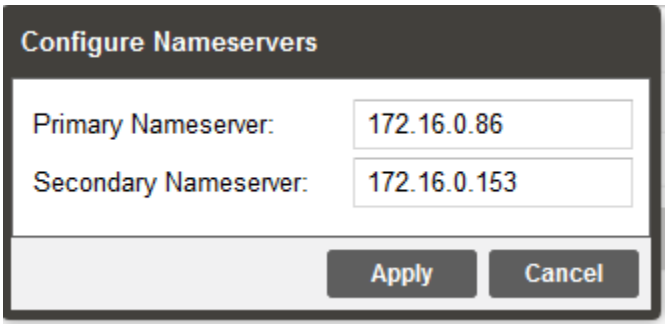
In the image below, the changes made to the “Unit Alias” portion of the general settings are reflected in the top right corner of the GUI.




**Example of Unit Alias (User Test)**

### 4.3.4 Unit Network Configuration

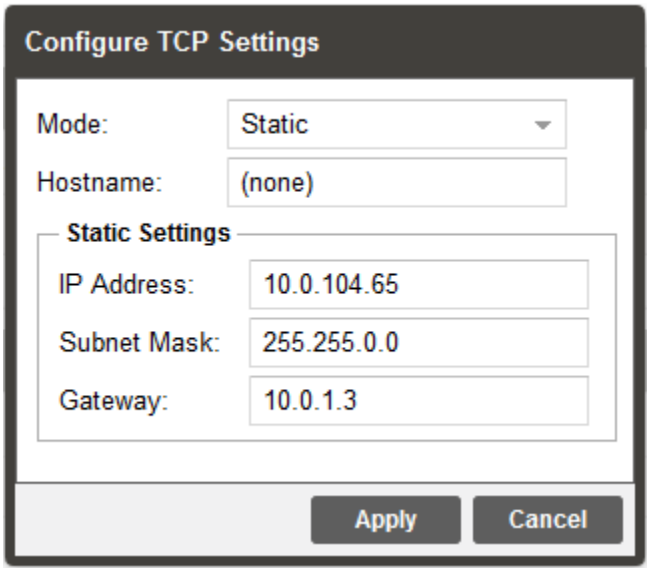
The management port of the MRD 6000 can be configured from the web interface. To make changes to the management port click, the button under the Unit Network Configuration section. Domain name servers can be configured on the MRD clicking the Configure Nameservers button. IP address and web address entries are accepted as Nameserver addresses.




**Nameserver Configuration**

If the MRD 6000 contains a 60127 option card the unit can be configured to have an optional 2nd control port.

***NOTE: Exercise extreme caution when performing changes to this menu as network communication can be lost with the MRD 6000.***



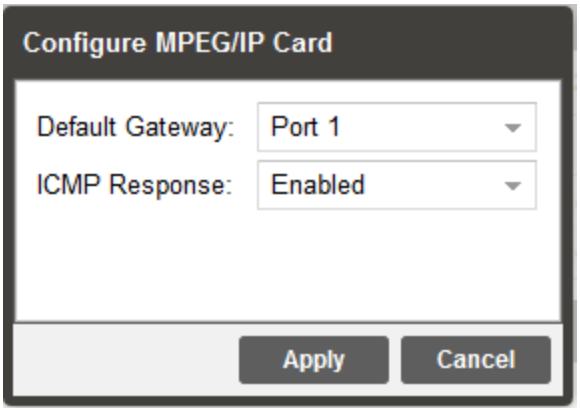

**Control Port TCP Configuration**

| Setting | Range | Description |
|---|---|---|
| **Mode** | DHCP<br>Static | Setting to *DHCP* will allow the network assign an IP address automatically to the MRD 6000 (if supported). Setting to *Static* allows the user to manually define all TCP/IP settings for the management port. |
| **Hostname** | Valid characters:<br>A through Z<br>0 through 9<br>- (hyphen) | This setting allows the user to define an optional unit Hostname. |
| **IP** | Four decimal octets:<br>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:<br>XXX.XXX.XXX.XXX | This option is only available if Static Mode is set. This is the Gateway address assigned to the management port. |

The 2nd management port of the MRD 6000 can be configured from the web interface. To make changes to which port is the 2nd management port click, the configure control ports button under the Unit Network Configuration section.

### 4.3.5 MPEG/IP Network Configuration

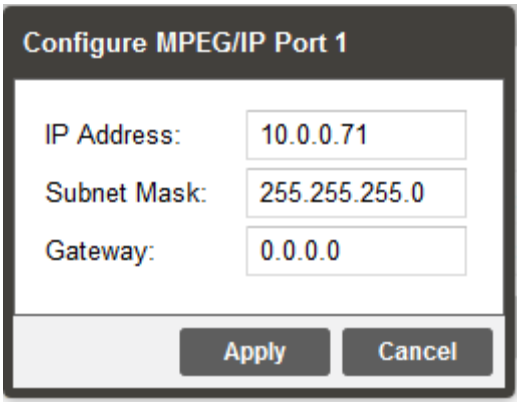
The MPEG/IP card is used to receive MPEG over IP transport streams. The MPEG/IP card supported unicast, multicast, UDP and RTP. The ports of the MPEG/IP card on the MRD 6000 can be configured from the web interface. To configure the Default Gateway and ICMP Response settings click the Configure Card button.




**MPEG/IP Card Configuration**

| Setting | Range | Description |
|---|---|---|
| **Default Gateway** | Port 1<br>Port 2 | Setting to *Port 1* uses the gateway address of port 1 as the default gateway. Setting to *Port 2* uses the gateway address of port 2 as the default gateway. |
| **ICMP Response** | Enabled<br>Disabled | Setting to enabled allows the MRD 6000 to respond to ICMP requests (ping). If disabled the MRD 6000 will not respond to these requests. |

To configure the TCP/IP settings of the MPEG/IP ports click the button under the MPEG/IP Network Configuration section next to the corresponding port. The settings for both ports are the same.




**MPEG/IP Port Configuration**

| Setting | Range | Description |
|---|---|---|
| **IP Address** | 1.0.0.0 - 126.0.0.0<br>128.0.0.0 - 191.255.0.0<br>192.0.1.0 - 223.255.255.0 | This setting is the TCP/IP address assigned to the port. |
| **Subnet Mask** | 255.0.0.0 – 255.255.255.254 | This setting is the subnet mask assigned to the port. |
| **Gateway** | 1.0.0.0 - 126.0.0.0<br>128.0.0.0 - 191.255.0.0<br>192.0.1.0 - 223.255.255.0 | This setting is the gateway address assigned to the port. |

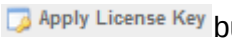
### 4.3.6 Licensing

Certain features of the MRD 6000 require licenses in order to be functional. The interface displays all licenses available as well as the following status:

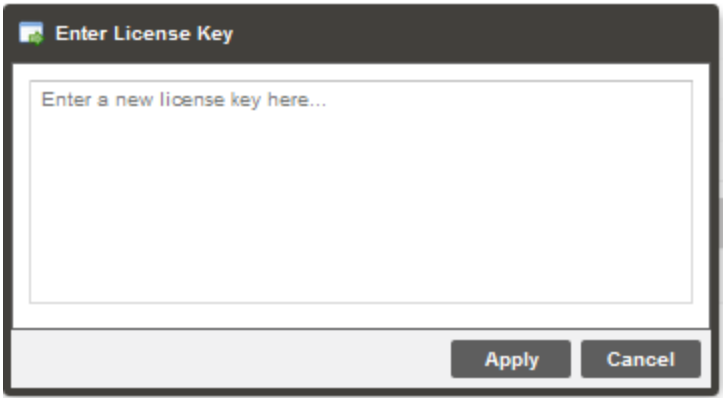
- Feature is Licensed/Unlicensed
- License is Supported or Unsupported by the installed hardware


| Option | Supported | State | Instances |
|---|---|---|---|
| MRD 60601 - Simultaneous HD/SD License | Yes | Licensed | 1 |
| MRD 60730 - 4K/UHD Output License | Yes | Licensed | 1 |
| MRD 60840 - 2x->4x Audio Service Decoding Upgrade | Yes | Licensed | 1 |
| MRD 60851 - 5.1 Discrete Audio | Yes | Licensed | 1 |
| MRD 60916 - DVB-S2 Advanced Feature License | No | Unsupported | 1 |
| MRD 60921 - BISS Descrambling License | Yes | Licensed | 1 |
| MRD 60925 - IP FEC Output | Yes | Licensed | 1 |
| MRD 60928 - PID/Service Filter License | Yes | Licensed | 1 |
| MRD 60991 - DVB-CI Multi-Service Descrambling License | No | Unsupported | 1 |
| MRD 60992 - SCTE 35 to 104 Output License | Yes | Licensed | 1 |

**License Information Tab**

If licenses need to be applied to the MRD 6000 click 

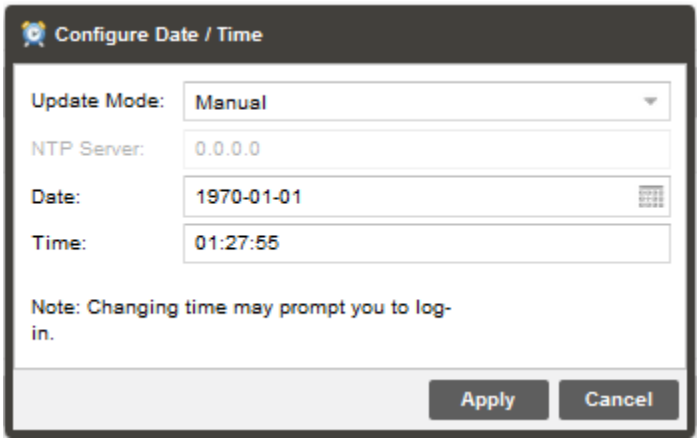
button. The menu below will appear where the user can copy and paste the provided license key from Sencore.




**Updating License Key**

### 4.3.7 Date/Time

The MRD 6000 can either be set to synchronize with an NTP server or set to a manually defined date and time. 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 of the GUI.




**Date and Time Configuration**

| Setting | Range | Description |
|---|---|---|
| **Update Mode** | NTP<br>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:<br>XXX.XXX.XXX.XXX<br>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** | YYYY/MM/DD | 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. |

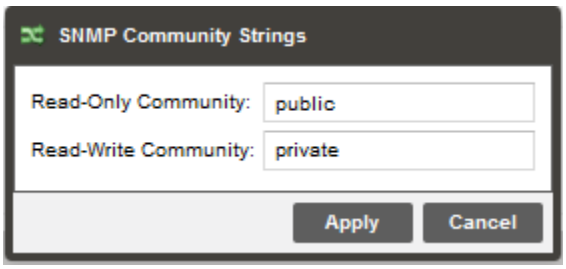
## 4.3.8 Configuring SNMP

### 4.3.8.1 SNMP Communities

SNMP Communities define whether users have read-only or read-write SNMP rights. These two communities are given unique names. The default names for these communities are:

- Read –Only Community: public
- Read- Write Community: private

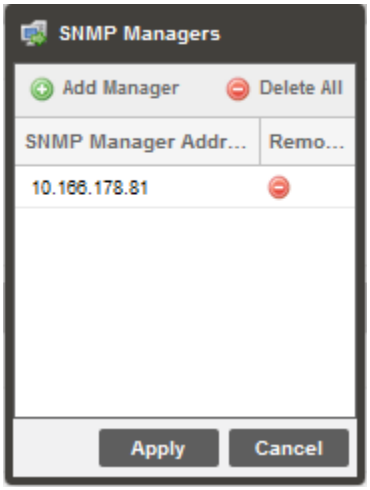
To modify the names of these communities click on the Configure SNMP Communities button.




**SNMP Community Configuration**

### 4.3.8.2 SNMP Trap Managers

The SNMP trap managers are recipients of SNMP traps sent from the MRD 6000. The following menu allows the user to configure the recipient's IP addresses. To add and remove recipients of the SNMP traps click the Configure SNMP Managers button.




**SNMP Trap Configuration**

| Action | Button | Description |
|---|---|---|
| **Add Manager** | Add Manager | Clicking this button prompts the user for the IP address of the SNMP trap manager. |
| **Delete All** | Delete All | Clicking this button prompts the user to confirm the deletion of all SNMP trap manager IP addresses. If the user confirms deletion all SNMP trap manager IP addresses will be removed. |
| **Delete Single Entry** | | Highlight a single SNMP trap manager IP address and click this button to delete the entry. A prompt will appear confirming the deletion of IP address. |

### 4.3.8.3 Download SNMP MIB Files

The MRD 6000 stores the SNMP MIB files for the currently installed version of software on the unit. These files can be downloaded directly from the MRD 6000 by clicking on the SNMP MIBs button. The screen below will appear where the files can be downloaded and saved off of the unit.

**Index of /mibs/**

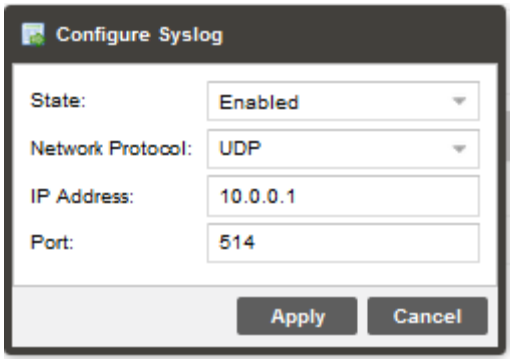
| Name | Last Modified | Size | Type |
|---|---|---|---|
| Parent Directory/ | | - | Directory |
| INET-ADDRESS-MIB.MIB | 2019-Sep-27 18:44:32 | 16.3K | application/octet-stream |
| SENCORE-CSP-MIB.MIB | 2019-Sep-27 18:44:32 | 90.4K | application/octet-stream |
| SENCORE-GLOBAL-REG.MIB | 2019-Sep-27 18:44:32 | 2.3K | application/octet-stream |
| SENCORE-MRD6000-MIB.mib | 2019-Sep-27 18:44:32 | 288.7K | application/octet-stream |
| SNMP-COMMUNITY-MIB.MIB | 2019-Sep-27 18:44:32 | 15.1K | application/octet-stream |
| SNMP-FRAMEWORK-MIB.MIB | 2019-Sep-27 18:44:32 | 21.8K | application/octet-stream |
| SNMP-MPD-MIB.MIB | 2019-Sep-27 18:44:32 | 5.3K | application/octet-stream |
| SNMP-TARGET-MIB.MIB | 2019-Sep-27 18:44:32 | 22.2K | application/octet-stream |
| SNMP-USER-BASED-SM-MIB.MIB | 2019-Sep-27 18:44:32 | 38.2K | application/octet-stream |
| SNMP-VIEW-BASED-ACM-MIB.MIB | 2019-Sep-27 18:44:32 | 33.3K | application/octet-stream |
| SNMPv2-MIB.MIB | 2019-Sep-27 18:44:32 | 28.6K | application/octet-stream |
| SNMPv2-SMI.MIB | 2019-Sep-27 18:44:32 | 8.7K | application/octet-stream |
| SNMPv2-TC.MIB | 2019-Sep-27 18:44:32 | 37.1K | application/octet-stream |

To Download: Right-Click, Save Link As or Save Target As

**Index of MIBs Page**

### 4.3.9 Syslog

The MRD 6000 can be configured to send error and event logs formatted in the syslog protocol to a remote user specified Syslog server. To configure the Syslog settings, click the Configure Syslog button.



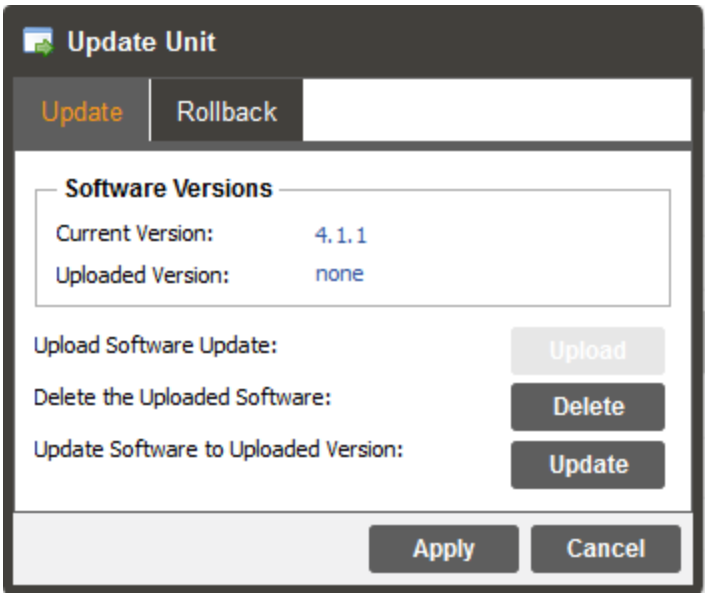

**Syslog Configuration**

| Action | Range | Description |
|---|---|---|
| **State** | Enabled<br>Disabled | Enable or Disable sending messages to Syslog server. |
| **Network Protocol** | UDP<br>TCP | Select which network protocol used to transmit to the Syslog server |
| **IP Address** | Four decimal octets:<br>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 |

### 4.3.10 Updating the MRD 6000

#### 4.3.10.1 Applying Software Updates

Updates to the MRD 6000 are performed through the web interface. The menu for this operation can be viewed on the next page. A software update file is provided by Sencore and then uploaded to the unit. Once uploaded, the software update is applied to the unit. To upload software updates to the unit click on the Update Unit button. The current version and uploaded version is displayed in the Software Versions section. The MRD 6000 will reboot after a software update is complete.

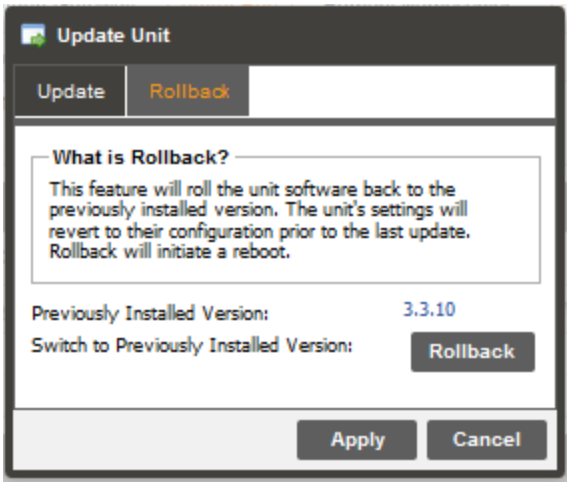



**Update Unit Window**

| Action | Button | Description |
|---|---|---|
| **Upload Software Update** | Upload | To upload software updates to the MRD 6000 click this button. The user will be prompted to navigate to an update file. The file will then upload to the MRD 6000. When complete the MRD 6000 with prompt the user to either apply the update or cancel |
| **Delete the Uploaded Software** | Delete | Clicking this button prompts the user to confirm the deletion of the software update from the MRD 6000. 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 6000 will prompt the user to confirm the update. Click Yes to continue or No to cancel. |

### 4.3.10.2 Rollback Software Updates

The MRD 6000 is capable of reverting back to a previous version of software using the Rollback feature. The menu used to perform this task can be viewed on the next page. The MRD 6000 maintains 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 settings. To perform a rollback, click the Update Unit button and then click the Rollback tab. The MRD 6000 will reboot after the rollback process is complete.




**Rollback Tab of Update Unit Window**

| Action | Button | Description |
|---|---|---|
| **Rollback Software** | Rollback | Clicking this button starts the Rollback process. The MRD 6000 will prompt the user to confirm the rollback or click cancel to stop the process. |

### 4.3.11 Reboot Unit

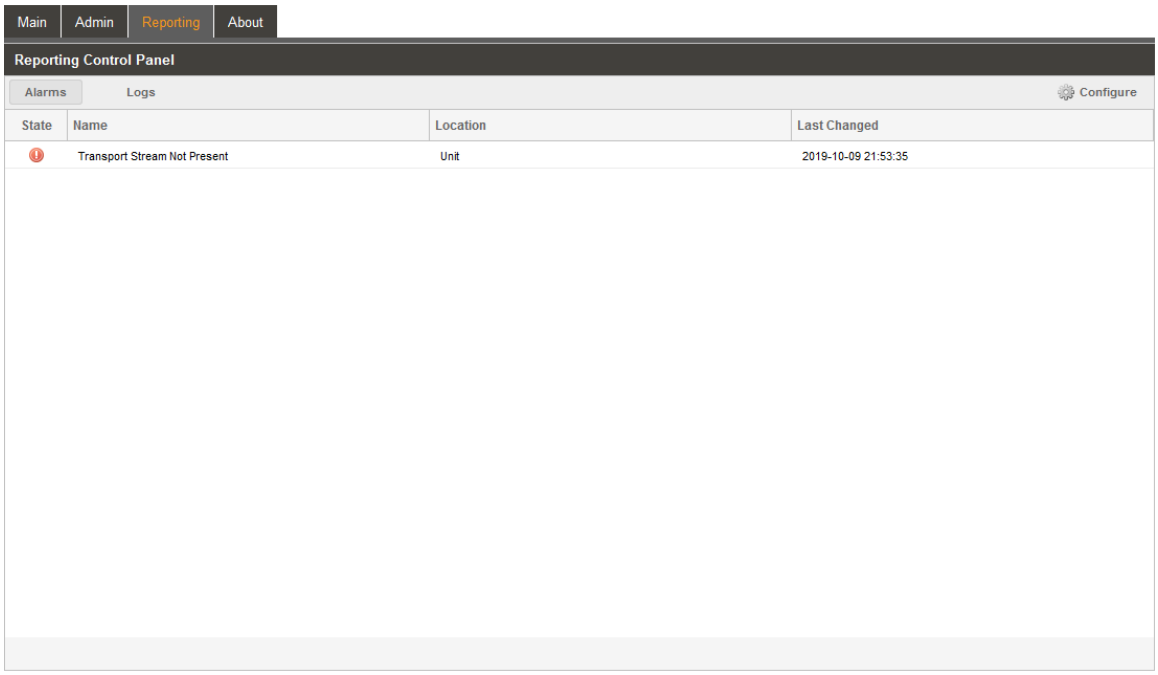
The MRD 6000 can be rebooted from the web interface. In order to perform a reboot click the Reboot button. The MRD 6000 will prompt the user to confirm the reboot. Once the reboot is complete the login screen will appear allowing the web interface to be logged into.

### 4.3.12 Reset Defaults

The MRD 6000 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. The MRD 6000 will prompt the user to confirm the reset.

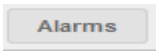
## 4.4 Reporting Panel

The Reporting tab of the GUI, which can be viewed on the next page, 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.




**Reporting Tab of GUI**

## 4.4.1 Active Alarms

Clicking on the 

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.

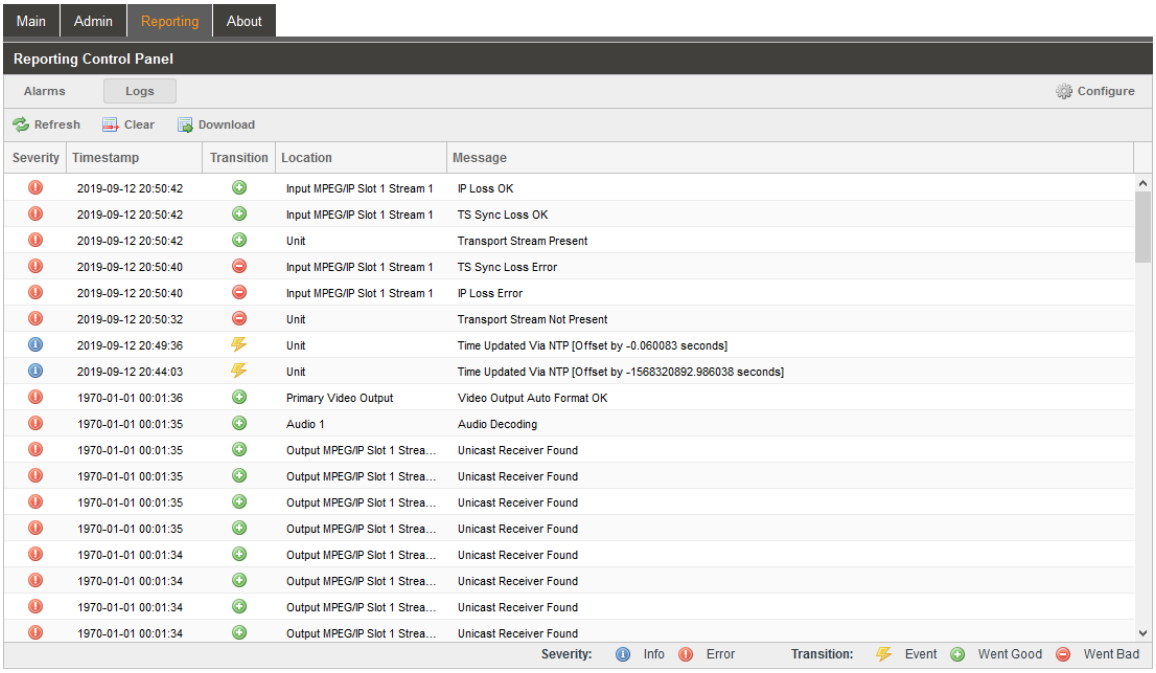

**Alarms Tab of Reporting Panel**

| 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 date and time the error was raised. This date and time correlates with the Date and Time settings configured in Section 4.3.7. |

## 4.4.2 Event Logs

Clicking on the Logs button displays the Event Log menu. This list displays all of the events and alarms that have affected the unit. The MRD 6000 stores up to four thousand messages worth of logs. 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 .tsv file and saved to an external location by clicking the Download button. There are five columns in the log that display different types of information.



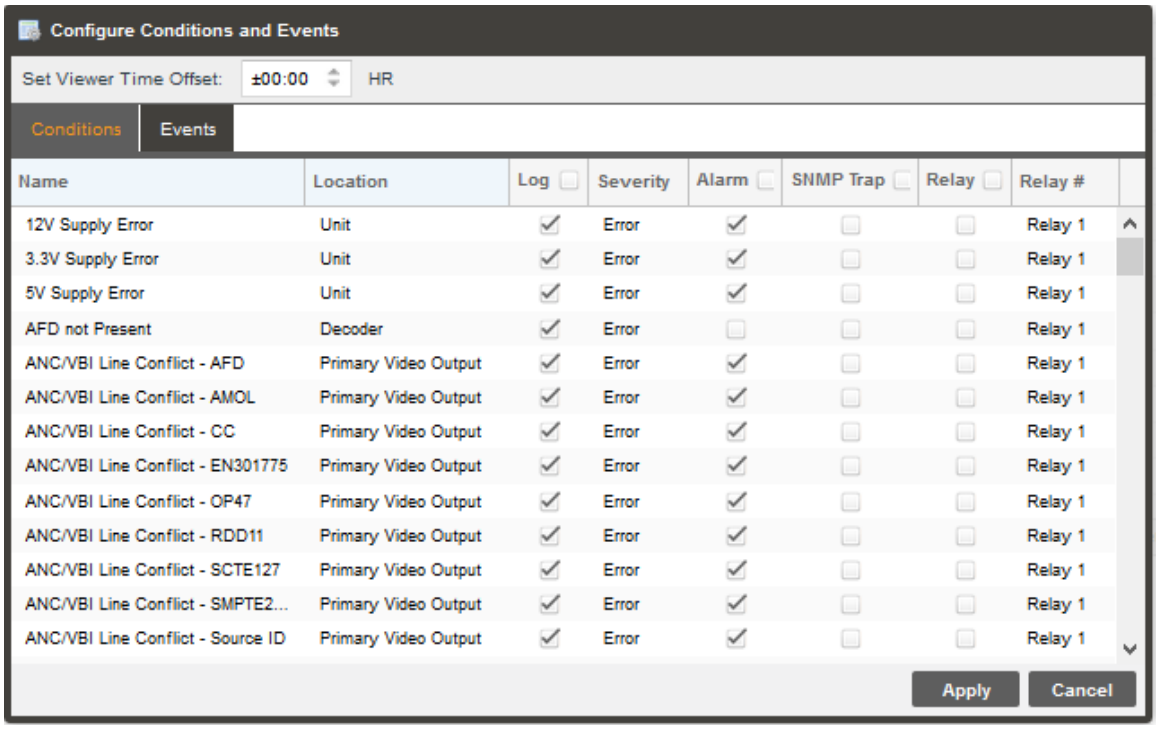

**Logs Tab of Reporting Panel**

| 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 date and time the error was raised or cleared. This date and time correlates with the Date and Time settings configured in Section 4.3.7. |

| | |
|---|---|
| **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. |
| **Location** | This column displays the hardware or function that experienced the alarm or event. |
| **Message** | This column displays the description of the error or event. The function or hardware that experienced the event or error is described here. |

### 4.4.3 Configuring the Logs

The MRD 6000 allows the user to configure alarms and events. Events and alarms can be hidden, set to send SNMP traps or close a relay when active. In order to configure these options click the Configure button while in the Logs section of the Reporting tab. The Conditions tab allows the user to configure the alarms reported by the MRD 6000. The Events tab allows the user to configure the events reported by the MRD 6000. 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.



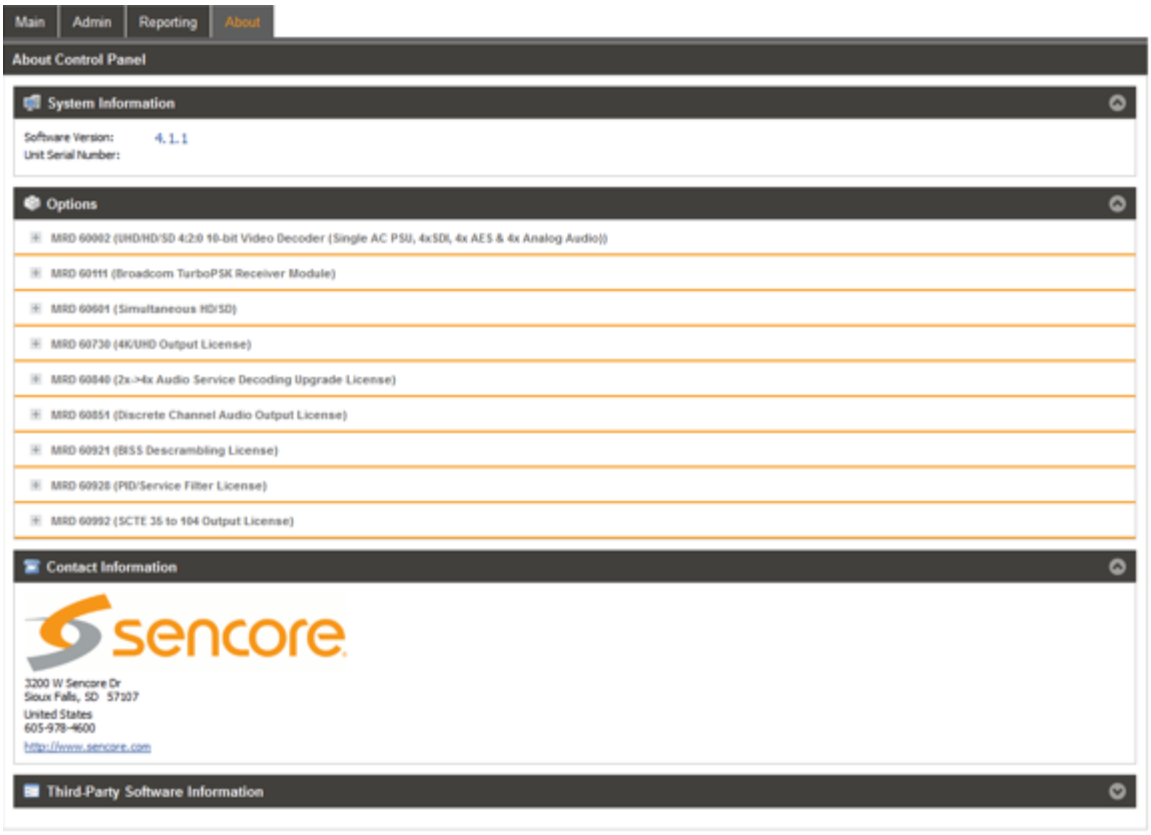

**Conditions Tab of Log Configuration**

| 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. |
| **SNMP Trap** | This column allows the user to send an SNMP Trap if this alarm is raised. If this box is checked an SNMP Trap is sent when this alarm is raised. If this box is unchecked an SNMP is not sent. |
| **Relay** | This column allows the user to set a Relay closure if this alarm is raised. If this box is checked a Relay will be closed. If this box is unchecked a Relay will not be closed. See Appendix D for pinout.<br>. |
| **Relay #** | This column allows the user to select which of the three relays available on the MRD 6000 will be closed when the alarm is raised. |
| **Relay Duration** | This column is only available in the Events tab. This option allows the user to define the length of time in milliseconds the relay will be closed after the event is logged. This setting can be configured from 100-1000 milliseconds. |

## 4.5 About Panel

Under the About tab of the GUI is useful information about the unit software, serial number and licensing. There are no user definable parameters in the “About” panel.

The Panel includes information about the unit software version currently installed, the unit serial and/or ID number, which licenses are installed, and how to contact Sencore. Information regarding third party software is available by clicking on the dropdown menu box.




**About Tab of GUI**

## 4.6 System Recovery

The MRD 6000 has the ability to recover from a complete system software corruption. The system recovery allows a user to start the platform into a prompt where a software update will allow the system to be installed in the event all other images will not work.

To use the system recovery, push and hold two front panel pushbuttons (any 2 buttons) when power is applied to the unit. Hold the buttons for at least 20 seconds and then release.

The unit will boot into a recovery mode indicated by the front panel display and indicate a unit management IP address. The user can press the “Enter” button on the front panel to configure the IP address if necessary. A web browser can then be used to connect to the system and apply an update to the unit.

# Section 5 Appendices


**Introduction**

This section includes the following appendices:

# Appendix A – Acronyms and Glossary

**8VSB:** Vestigial sideband modulation with 8 discrete amplitude levels.
**16VSB:** Vestigial sideband modulation with 16 discrete amplitude levels.
**AAC:** Advanced Audio Coding
**AC-3:** Also known as Dolby Digital
**AES:** Audio Engineering Society
**AFD:** Active Format Descriptor
**ASI:** Asynchronous Serial Interface
**ATSC:** Advanced Television Systems Committee
**AV:** Audio Video
**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
**BPS:** Bits per second.
**CAM:** Conditional Access Module
**CAT:** Conditional Access Table
**CAT6:** Category 6 – Cable standard for gigabit Ethernet
**CC:** Closed Caption
**CI:** Common Interface
**CoP:** Code of Practice
**CRC:** Cyclic Redundancy Check
**CVCT:** Cable Virtual Channel Table
**dB:** Decibel
**DDPlus:** Dolby Digital Plus
**DHCP:** Dynamic Host Configuration Protocol
**DPI:** Digital Program Insertion
**DTVCC:** Digital Television Closed Captioning
**DVB:** Digital Video Broadcasting
**EBU:** European Broadcasting Union
**EIA:** Electronic Industries Alliance
**EIT:** Event Information Table
**EPG:** Electronic Program Guide
**ETM:** Extended Text Message
**ETT:** Extended Text Table
**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
**FEC:** Forward Error Correction
**Field:** For an interlaced video signal, a “field” is the assembly of alternate lines of a frame. Therefore, an interlaced frame is composed of two fields, a top field and a bottom field.
**Frame:** A frame contains lines of spatial information of a video signal. For progressive video, these lines contain samples starting from one time instant and continuing through successive lines to the bottom of the frame. For interlaced video a frame consists of two fields, a top field and a bottom field. One of these fields will commence one field later than the other.
**GUI:** Graphical User Interface
**HANC:** Horizontal Ancillary

**HD:** High Definition
**High level:** A range of allowed picture parameters defined by the MPEG-2 video coding specification which corresponds to high definition television.
**I/O:** Input / Output
**IP:** Internet Protocol
**Kbps:** 1000 bit per second
**LED:** Light Emitting Diode
**LNB:** Low-Noise Block
**MAC:** Medium Access Control
**Main level:** A range of allowed picture parameters defined by the MPEG-2 video coding specification with maximum resolution equivalent to ITU-R Recommendation 601.
**Main profile:** A subset of the syntax of the MPEG-2 video coding specification that is expected to be supported over a large range of applications.
**Mbps:** 1,000,000 bits per second.
**MER:** Modulation Error Ratio
**MGT:** Master Guide Table
**MIB:** Management Information Base
**MP@HL:** Main profile at high level.
**MP@ML:** Main profile at main level.
**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
**MPTS:** Multiprogram Transport Stream
**MRD:** Modular Receiver Decoder
**NTP:** Networking Time Protocol
**NTSC:** National Television System Committee
**OSD:** On Screen Display
**PAL:** Phase-Alternating Line
**PAT:** Program Association Table
**PCM:** Pulse-Code Modulation
**PCR:** Program Clock Reference
**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.
**PMT:** Program Map Table
**Profile:** A defined subset of the syntax specified in the MPEG-2 video coding specification
**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.
**PTS:** Presentation Time Stamp
**QAM:** Quadrature Amplitude Modulation
**QPSK:** Quadrature Phase-Shift Keying
**RDS:** Receiver Decoder System

**RF:** Radio Frequency
**RGBHV:** Red, Green, Blue, Horizontal, Vertical
**RO:** Read Only
**RPM:** Revolutions per Minute
**RRT:** Rating Region Table
**RS-232:** Recommended Standard. A standard for serial binary data interconnection.
**RU:** Rack Unit
**RW:** Read/Write
**SD:** Standard Definition
**SDI:** Serial Digital Interface
**SFP:** Small Form-Factor Pluggable
**SI:** System Information
**SMPTE:** Society of Motion Pictures and Television Engineers
**SNMP:** Simple Network Management Protocol
**SPTS:** Single Program Transport Stream
**SSRC:** Synchronization Source
**STD input buffer:** A first-in, first-out buffer at the input of a system target decoder for storage of compressed data from elementary streams before decoding.
**STD:** System Target Decoder. A hypothetical reference model of a decoding process used to describe the semantics of the Digital Television Standard multiplexed bit stream.
**STT:** System Time Table
**TS:** Transport Stream
**TVCT:** Terrestrial Virtual Channel Table
**UTC:** Coordinated Universal Time
**VANC:** Vertical Ancillary
**VBI:** Video Blanking Interval
**VCT:** Virtual Channel Table. Used in reference to either TVCT or CVCT.
**XLR:** Cannon “X” series connector, with a Latch, and Rubber around the contacts.
**YPbPr:** Component Red, Green, Blue

# Appendix B – Error and Event List

| Error | Description |
|---|---|
| **12V Supply Error** | Voltage on 12V rail has exceeded safe operational range. |
| **3.3V Supply Error** | Voltage on 3.3V rail has exceeded safe operational range. |
| **5V Supply Error** | Voltage on 5V rail has exceeded safe operational range. |
| **Audio Not Decoding** | Audio is corrupted in incoming stream or format is not supported. |
| **Auto Video Format Error** | MRD 6000 is unable to determine the native incoming video in order to format output. |
| **BISS Conflicting PIDs** | PIDs selected to be descrambled by one BISS key are already assigned to be descrambled by another BISS key. |
| **BISS Service Not Found** | Service that BISS key is assigned to descramble is not present in the incoming stream. |
| **Backup Input Active Condition** | Primary input is currently in a failed condition and the MRD 6000 has failed over to the Backup input. |
| **Bitrate Exceeded Error** | Total incoming transport stream bitrate has exceeded 213 Mbps. |
| **CAM Descramble Fail** | CAM Module is not descrambling selected PIDs or services |
| **CAM Not Present** | DVB-CI Descrambling is enabled but CAM Module is not installed. |
| **CAM PID Not Found** | PID selected to be descrambled by the CAM is not present in the incoming stream. |
| **ES Type Mismatch** | Elementary stream type does not match the stream type defined by the user. |
| **FEC Reception Error** | Packets in incoming IP stream cannot be repaired with forward error correction. |
| **Fan Speed Below Lower Limit** | Cooling fan in the MRD 6000 has failed. |
| **IP Loss Error** | No IP packets have been received by the MPEG/IP card for two seconds. |
| **ISI Not Found** | ISI value defined by the user is not found in the incoming multistream signal. |
| **Input Video Unsupported** | Native format of incoming video is not a supported video format. |
| **LNB Power Error** | LNB Power is enabled but the MRD 6000 is detecting power is being provided by another source, there is excessive current drain or an overvoltage has occurred. |
| **Link Loss Error** | Physical IP link is not present on the MPEG/IP card. |
| **Loss of Carrier Lock** | Receiver carrier lock source is lost. |
| **Low Level** | 8VSB/QAM RF Level is below the user settable threshold |
| **Low Mer** | 8VSB/QAM MER is below the user settable threshold |

| | |
|---|---|
| **Multistream Mode Input Mismatch** | Multistream Mode is enabled and input signal is not multistream capable or Multistream Mode is disabled and input signal is multistream capable. |
| **No Services Detected** | Service Lock service selection mode is enabled but no services are present in the active input transport stream. |
| **PID Filter Overflow Error** | Configured PID Filter TS rate is too low. |
| **PID Filter Selection Not Present** | Selected Service or PID is not present for inclusion in the output PID filter TS. |
| **RTP Reception Error** | Uncorrectable out of order or duplicate packets are present in incoming IP stream. |
| **ES Sync Error Condition** | One of the in-use elementary streams is not synchronized to the PCR |
| **Selected Audio PID Not Present** | PID Locked mode is set as service selection mode and audio PID defined by user is not present in the incoming stream. |
| **Selected PCR PID Not Present** | PID Locked mode is set as service selection mode and PCR PID defined by user is not present in the incoming stream. |
| **Selected Video PID Not Present** | PID Locked mode is set as service selection mode and video PID defined by user is not present in the incoming stream. |
| **Service Not Found** | Service Lock service selection mode is enabled but service defined by user is not present in the incoming stream. |
| **Temperature Error** | The MRD 6000 has detected the internal temperature is 60 degrees Celsius or above. |
| **Transport Error Indicator** | The MRD 6000 has detected that the transport stream error indicator is present on the active input. |
| **Transport Stream Not Present** | The MRD 6000 has detected that the transport stream from the active input is no longer present. |
| **TS Sync Loss** | Transport stream sync for IP stream is not detected. |
| **Unicast Receiver Not Found Error** | The MRD 6000 cannot discover the destination for the unicast IP stream within 10 seconds after the initial ARP is sent. |
| **Unlicensed Modulation** | Input stream on active input is either 16APSK or 32APSK and the modulations are no licensed on the MRD 6000. |
| **Unlicensed VCM/Multistream** | Input stream on the active input contains a multistream signal and the MRD 6000 is not licensed for multistream. |
| **Video Not Decoding** | The configured service or video PID to be decoded is not being successfully decoded by the MRD 6000. |

# Appendix C – Specifications

## MRD 6000 – Base Unit

| | |
|---|---|
| Includes – | Display, keypad, embedded controller, chassis/case, power supply/line cord |
| System – | |
| Display Type: | LCD |
| Display Configuration: | 240 pixels by 64 pixels |
| Keypad: | Snap-dome Membrane |
| Front Panel Lockout: | Password control, up to 8 alpha-numeric characters (no punctuations or spaces allows) |
| Configurations Allows: | Single video decoder with up to two option cards |
| Rear Panel: | Fixed inputs and outputs with two option card slots. Option cards not field upgradeable. |
| Remote Operation/Update Interface – | |
| Type: | Ethernet, 10/100 |
| Rear Panels indicators: | Link (Green LED), Activity (Amber LED) |
| Connector: | RJ45 |
| Front Panel Indicators – | |
| Error LED: | Red indicates error is occurring<br>Off indicates no errors detected |
| INPUT LED: | Green indicates valid input is present<br>Off indicates no valid input |
| Monitor and Control Interfaces – | |
| Web server GUI: | HTTP via web browsing for control & monitoring |
| Front Panel: | Control & monitoring |
| SNMP: | Control & monitoring |
| Operating Altitudes | 0 to 10000 feet |
| AC Power – | |
| Operating Voltage: | 100-240VAC |
| PSU Max Power: | 150W |
| Current Draw: | Base Unit with no option cards –<br>38-40W<br>MPEG/IP option card with active input –<br>2-3W (additional)<br><br>DVB-S/S2 option card with active input and LNB load of 19V @ 500mA –<br>8-9W (additional)<br><br>DVB-CI Module option with 2 CAM Modules installed –<br>2-3W (additional)<br><br>8VSB/QAM option card with active input –<br>2-3W (additional) |
| Max Power Draw: | 70-72W |
| Frequency: | 48-63Hz |
| Connector: | IEC C14 |
| Line Cord: | Detachable, 3-prong |
| | Base Unit with active ASI input –<br>54-55W |

## Video Decoding Features

| | |
|---|---|
| General – | |
| TS Data Rate: | 0.25-200 Mb/s |
| Video Decoder – | |
| Video Profiles and Levels: | Base Unit –<br>MPEG-2: to MP@HL,<br>H.264: to HP@L4.2<br>HEVC : to MP@HT up to L4.1, M10P@HT up to L4.1 |
| Video Bit Rate: | MPEG-2: 1-100Mb/s (dependent on profile)<br>H.264: CABAC Entropy coded 1 - 80Mb/s<br>CAVLC Entropy coded 1 - 100Mb/s<br>HEVC: 0.25 – 40 Mbps |
| Video Formats: | Base Unit –<br>1080i x 1920 (16x9) @ 25, 29.97 and 30Hz<br>1080p x 1920 (16x9) @ 23.97, 24, 25, 29.97 and 30Hz<br>1080p x 1920 (16x9) @ 50, 59.94 and 60Hz<br>720p x 1280 (16x9) @ 50, 59.94, and 60Hz<br>576i x 720 (4x3 or 16x9) @ 25Hz<br>576i x 704 (4x3 or 16x9) @ 25hz<br>576i x 544 (4x3 or 16x9) @ 25hz<br>480i x 720 (4x3 or 16x9) @ 29.97Hz |
| 4K/UHD Video Formats | Licensed formats (MRD 60730)<br>4096p x 2160 (16x9) 50, 59.94, and 60 Hz<br>4096p x 2160 (16x9) 23.98, 24, 25, 29.97, and 30 Hz<br>3840p x 2160 (16x9) 50, 59.94, and 60 Hz<br>3840p x 2160 (16x9) 23.98, 24, 25, 29.97, and 30 Hz |
| SDI (Serial Digital Interface) Video Out – | |
| SDI Standards: | Base Unit –<br>SD-SDI ANSI/SMPTE 259M<br><br>HD-SDI ANSI/SMPTE 292M<br><br>3G-SDI Level A ANSI/SMPTE 424M<br><br>Quad 3G-SDI SMPTE 425-3, SMPTE 425-5<br>Modes: Two Sample Interleave, Square Division |
| Connector: | 75Ω Female BNC (5x) (Ports: 1A, 1B, 2, 3, 4) |
| Return Loss: | ≥15 dB, 5Mhz to 1.5GHz<br>≥10 dB, 1.5 GHz to 3.0GHz |
| Drive Level: | 800 mVpp ±10% |
| Data Bit Rate: | 3G-SDI – 3.0 Gb/s<br>HD-SDI – 1.5 Gb/s<br>SD-SDI – 270Mb/s |
| Display Modes: | HD – Pillar-box, Cropped, Anamorphic<br>SD – Letterbox, Cropped, Anamorphic |
| Simultaneous SDI (Serial Digital Interface) Video Out – | |

| | |
|---|---|
| SDI Standards: | Ports 1A, 1B, 2 -<br>3G-SDI – 3.0 Gb/s<br>HD-SDI – 1.5 Gb/s<br>Ports 3, 4 –<br>SD-SDI – 270Mb/s<br><br>*Note: When outputting 4K format (Two Sample Interleave) the Simultaneous Output is a 1080p format of the 4K mode on port 1B* |
| Connector: | 75Ω Female BNC |
| Return Loss: | ≥15 dB, 5Mhz to 1.5GHz |
| Drive Level: | 800 mVpp ±10% |
| Data Bit Rate: | SD-SDI – 270Mb/s |
| Display Modes: | 16x9 – Pillar-box, Center-Cut, Anamorphic<br>4x3 – Letterbox, Center-Cut, Anamorphic |
| Composite Video Out – | |
| Video Format Standards: | SMPTE 170M-2004, NTSC, PAL-B/G/I/D/M/N |
| Connector: | One 75 Ω ±10% Female BNC (CVBS) |
| Return Loss: | >25dB, 0 to 6.00 MHz |
| Frequency Response: | ± 0.7dB From 0 to 4.00MHz |
| Drive Level: | 140 IRE (1.0Vpp), ±2 IRE |
| Chroma/Luma Delay: | ±26 ns Max |
| Field Time Distortion: | < 2% (± 3 IRE) |
| Line Time Distortion: | < 1% (± 1 IRE) |
| Short Time Distortion: | < 2% (± 3 IRE) |
| Differential Gain: | < 4% |
| Differential Phase: | < 1.5° degrees |
| Signal to Noise Ratio: | ≥55dB luminance weighted |
| K factor | < 2.5% |
| Digital Video Out – | |
| Digital Video Standard: | SDA-HDMI-OM-E Rev A |
| Connector: | HDMI-type Female Type-A |

## Audio Decoding Features

| | |
|---|---|
| Number of Audio Services: | Base Unit –<br>2 Audio Services<br><br>4 Audio Service Decode License (MRD 66840) Adds –<br>2 Audio Services (4 total) |
| Audio Codecs Supported: | Dolby Digital (AC-3) & Plus (EAC-3) AAC-LC, HE-AAC, & HE-AACv2<br>MPEG1L2 & MPEG2L2 |
| Output Formats: | Digital Pass-through<br>PCM (Decoded Discrete channels for 5.1 sources or Downmixed for 5.1 Sources)<br>Analog (Decoded Discrete channels for 5.1 sources or Downmixed for 5.1 Sources) |

## Audio Output Features

| | |
|---|---|
| AES Outputs – | 4x 75Ω BNC AES3/EBU Unbalanced |
| Analog Outputs – | |
| Output Type: | Balanced, 1 channel pairs (+/-, L/R) |
| Connector: | 1x High density 15-pin D-sub, male |
| Impedance: | <100Ω Nominal Output Impedance |
| Max Output Level: | +24dBu @ 0dBFs<br>Adjustable down to +10dBu by 0.5dB steps. |
| Conditions For Measurements | ≥600Ω Load Impedance<br>–20dBFS encoded TS source<br>Output level is adjusted to +4 dBu @ -20 dBFS |
| THD+N: | < 0.015% from 20 Hz to 20khz @ +24dBu |
| Dynamic Range: | 104 dB |
| Signal to Noise | 80 dB |
| Crosstalk: | < -80dB from 20Hz to 20kHz |
| Frequency Response: | ±0.5dB 20Hz to 20kHz, |
| Optional Breakout Cables: | 4x XLR Breakout Cable (MRD_AUD_OPT_XLR)<br>4x BNC Breakout Cable (MRD_AUD_OPT_BNC)<br>1x Terminal Block (MRD_AUD_OPT_TERM) |
| SDI Embedded Audio Output | |
| Standards: | SMPTE 272M (for SD-SDI)<br>SMPTE 299 (for HD-SDI) |
| Density: | 8 Audio Pairs |
| Sampling Frequency: | 48 kHz |

## Ancillary Data Support

| | |
|---|---|
| SDI VANC Data Types: | Closed Captions (CEA-708)<br>Teletext/WSS/VPS (SMPTE-2031)<br>SCTE104 (SMPTE 2010) |

## ASI Input and Output Features

| | |
|---|---|
| General – | |
| Connector: | 2x BNC, Female |
| Impedance: | 75Ω |
| Return Loss: | ≥15dB, 3.5 to 270 MHz |
| ASI Serial TS Input / Output – | |
| Number of ASI Inputs: | 1 |
| Number of ASI Outputs: | 1 (non loop-through) |
| 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 | Input:188 and 204 bytes<br>Output: 188 bytes |
| Modes Supported: | Burst, Byte |

## DVB-CI Descrambling Module Option

| | |
|---|---|
| CAM Decryption – | |
| General – | |
| Compatibility Standard: | DVB-CI EN 50221 |
| Number of CAM Slots: | 2 |
| Auto CAM insertion/removal detection: | Yes |
| CAM Usage: | Selectable, Enable/Disable |
| CAM Name Display: | Yes |
| Multicrypt Support: | Yes |
| Decryption Selection – | |
| Elementary Stream types: | Video (MPEG2 & H264), Audio |
| Selection Modes: | Base Unit –<br>Decoded Elementary Streams<br><br>Multi-Service Descrambling License (MRD 60991) Adds –<br>Individually selectable elementary streams |
| Maximum TS bitrate | DVB-CI – 100Mb/s |
| CAS Supported – | All major CA vendors supported |

## BISS Descrambling Option

| | |
|---|---|
| Compatibility Standard: | DVB-CSA |
| Supported Modes: | Base Unit – None<br><br>BISS Descrambling License (MRD60921) Adds –<br>Mode 1, Mode E, Injected ID<br>No limitation to number of services descrambled per key<br>Multi-BISS descrambling using up to 12 keys |
| Maximum TS bitrate: | 200 Mb/s |

## IP Input/Output Module Option

| | |
|---|---|
| General – | |
| Connector: | 2x 10/100/1000 auto negotiate Base-T RJ-45 Ethernet Ports |
| Receive – | |
| Input Format: | UDP, RTP and RTP with extension headers<br>Multicast and Unicast<br>CBR, VBR, Null Stripped |
| Receiver Capability: | 2 simultaneous MPEG over IP transport streams |
| FEC Receive: | Pro MPEG CoP3 SMPTE2022<br>Range: L*D≤100<br>1≤L≤20<br>4≤D≤20<br>Annex B |
| Multicast Filtering: | Filters based on IP address |
| Buffer size: | 1 - 4000 KB, or 1 – 4000ms, user configurable |
| Bitrate Range: | .25 – 200 Mb/s |

| | |
|---|---|
| Packets/IP Frame: | 1-7 MPEG Packets/IP Frame |
| IGMP Compatibility: | Version 2 and 3 |
| Transmit – | |
| Output Format: | UDP and RTP |
| Bitrate Range: | .25 – 200 Mb/s |
| Packets/IP Frame: | 1-7 MPEG Packets/IP Frame |
| Number of Outputs: | 2 Mirrored TS – Unicast and/or Multicast |
| IP FEC Output (MRD60925) Adds – | |
| FEC: | Columns, Columns/Rows |
| FEC Transmit: | Pro MPEG CoP3 SMPTE2022<br>Range: L*D≤100<br>1≤L≤20<br>4≤D≤20 |

## DVB-S/S2/S2X Input Module Option

| | |
|---|---|
| General – | |
| Frequency Range: | 950 MHz – 2150 MHz |
| Number of inputs: | 4 (A, B, C and D) |
| Connector: | F-81 Type, Female (4) |
| Impedance: | 75 Ohms |
| Return Loss: | >9 dB |
| Separation: | >50 dB adjacent, >60 dB non-adjacent |
| RF frequency: | 950 MHz to 2150 MHz in 100 kHz steps |
| Tuning: | Difference between Satellite frequency and LO frequency |
| Satellite frequency: | 950 – 14500 MHz |
| LO frequency: | 0 – 12000 MHz, with presets of 0, 5150, 9750, 10600, 10750 and 11250 MHz |
| Packet size: | 188 bytes |
| Tuning Step Size: | 125 kHz, maximum |
| Nyquist root filter roll-off factors: | .05, .10, .15, .20, .25, .35 |
| RF Input Level: | -65 dBm to -25 dBm |
| Input RF Spectrum: | Normal/Inverted Auto Detect |
| PL Scrambling Codes supported: | 0-262,141 |
| Image Rejection: | >30dB |
| Noise Figure: | <15dB, maximum |
| Max TS Bitrate: | 160 Mb/s |
| LNB Power and 22 kHz Tone – | |
| LNB Power | Off/13/14/18/19VDC @ >450mA |
| LNB voltage regulation: | ± 4% |
| 22 kHz Tone: | Off/On @ 650 mV (± 250 mV) peak-peak |
| DVB-S – | |
| Standard: | EN 300 421 |
| FEC Code: | Conv. + Reed-Solomon |
| Modulation: | QPSK |
| Modulation/Coding supported: | CCM |
| Code rates: | 1/2, 2/3, 3/4, 5/6, 7/8 |
| QPSK Symbol rate: | 0.5-60 Msps |
| DVB-S2 – | |
| Standard: | EN 302 307 |

| | |
|---|---|
| Decoding type: | LDPC and BCH |
| Modulation: | QPSK, 8PSK |
| Modulation/Coding supported: | CCM |
| FEC Framing Type | Short frame size (16200), Normal frame size (64800) |
| Supported rates: | QPSK: 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10<br>8PSK: 3/5, 2/3, 3/4, 5/6, 8/9, 9/10 |
| Symbol rate: | 0.5-60 Msps |
| Pilot: | On/Off Auto Detect |

DVB-S2X –

| | |
|---|---|
| Standard: | EN 302 307 |
| Decoding type: | LDPC and BCH |
| Modulation: | QPSK, 8PSK |
| Modulation/Coding supported: | CCM |
| FEC Framing Type | Short frame size (16200), Normal frame size (64800) |
| Supported rates: | QPSK: 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10<br>8PSK: 3/5, 2/3, 3/4, 5/6, 8/9, 9/10 |

DVB-S2 Advanced (MRD 60916)

Adds –

| | |
|---|---|
| Modulation: | 16APSK, 32APSK, 64APSK |
| Modulation/Coding: | VCM |
| Supported Rates: | 16APSK: 2/3, 3/4, 4/5, 5/6, 8/9, 9/10<br>32APSK: 3/4, 4/5, 5/6, 8/9, 9/10<br>64APSK: 32/45-L, 11/15, 7/9, 4/5, 5/6 |
| Symbol Rate: | 0.5-60 MSps |
| Multistream reception: | Single ISI (stream specified) |
| ISSY: | Supported |

## DVB-S/S2 Input Module Option

General –

| | |
|---|---|
| Frequency Range: | 950 MHz – 2150 MHz |
| Number of inputs: | 4 (A, B, C and D) |
| Connector: | F-81 Type, Female (4) |
| Impedance: | 75 Ohms |
| Return Loss: | >9 dB |
| Separation: | >50 dB adjacent, >60 dB non-adjacent |
| RF frequency: | 950 MHz to 2150 MHz in 100 kHz steps |
| Tuning: | Difference between Satellite frequency and LO frequency |
| Satellite frequency: | 950 – 14500 MHz |
| LO frequency: | 0 – 12000 MHz, with presets of 0, 5150, 9750, 10600, 10750 and 11250 MHz |
| Packet size: | 188 bytes |
| Tuning Step Size: | 125 kHz, maximum |
| Nyquist root filter roll-off factors: | .05, .10, .15, .20, .25, .35 |
| RF Input Level: | -65 dBm to -25 dBm |
| AFC Tuning Range: | ± .5 MHz in Standard and Wide mode (with SR .5 ≤ 1 Msps) |

| | |
|---|---|
| | ± 1 MHz in Standard and Wide mode (with SR 1 ≤ 2 Msps) |
| | ± 1.5 MHz in Standard and Wide mode (with SR 2 ≤ 3 Msps) |
| | ± 2 MHz in Standard and Wide mode (with SR 3 ≤ 4 Msps) |
| | ± 2.5 MHz in Standard and Wide mode (with SR 4 ≤ 5 Msps) |
| | ± 3 MHz in Standard mode (with SR ≥ 5 Msps) |
| | ± 4 MHz in Wide mode (with SR 5 ≤ 6 Msps) |
| | ± 5 MHz in Wide mode (with SR ≥ 6 Msps) |
| | Standard / Wide modes user selectable |
| Input RF Spectrum: | Normal/Inverted Auto Detect |
| PL Scrambling Codes supported: | 0-262,141 |
| Image Rejection: | >30dB |
| Noise Figure: | <15dB, maximum |
| Max TS Bitrate: | 160 Mb/s |
| LNB Power and 22 kHz Tone – | |
| LNB Power | Off/13/14/18/19VDC @ >450mA |
| LNB voltage regulation: | ± 4% |
| 22 kHz Tone: | Off/On @ 650 mV (± 250 mV) peak-peak |
| DVB-S – | |
| Standard: | EN 300 421 |
| FEC Code: | Conv. + Reed-Solomon |
| Modulation: | QPSK |
| Modulation/Coding supported: | CCM |
| Code rates: | 1/2, 2/3, 3/4, 5/6, 7/8 |
| QPSK Symbol rate: | 0.5-60 Msps |
| DVB-S2 – | |
| Standard: | EN 302 307 |
| Decoding type: | LDPC and BCH |
| Modulation: | QPSK, 8PSK |
| Modulation/Coding supported: | CCM |
| FEC Framing Type | Short frame size (16200), Normal frame size (64800) |
| Supported rates: | QPSK: 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10<br>8PSK: 3/5, 2/3, 3/4, 5/6, 8/9, 9/10 |
| Symbol rate: | 0.5-60 Msps |
| Pilot: | On/Off Auto Detect |
| DVB-S2 Advanced (MRD 60916) Adds – | |
| Modulation: | 16APSK, 32APSK |
| Modulation/Coding: | VCM |
| Supported Rates: | 16APSK: 2/3, 3/4, 4/5, 5/6, 8/9, 9/10<br>32APSK: 3/4, 4/5, 5/6, 8/9, 9/10 |
| Symbol Rate: | 0.5-60 Msps |
| Multistream reception: | Single ISI (stream specified) |

| | |
|---|---|
| ISSY: | Supported |

## 8VSB/QAM Input Module Option

| | |
|---|---|
| General – | |
| Frequency Range: | 50 MHz – 1000 MHz<br>VHF/UHF (Ch2 – Ch69)<br>CATV (Ch2 – Ch158) |
| Channel Plans: | Off Air, FCC, IRC, HRC |
| Number of inputs: | 1 |
| Connector: | F-Type, Female |
| Impedance: | 75 Ohms |
| Sensitivity: | -34dBmV to + 40dBmV (A74 Compliant) |
| Modulation: | 8VSB, QAM-B |
| MER: | Range: 0dB to 40dB<br>Accuracy: +/- 2dB<br>Low Limit Alarm: User Defined Entry |
| RF Level: | Range: -34dBmV to +40dBmV<br>Accuracy: +/- 5dBmV<br>Low Limit Alarm: User Defined Entry |
| QAM – | |
| Standard: | ITU Annex B/SCTE DVS-031 |
| QAM Mode: | 64 and 256 |
| De-interleaver: | I=1-128, J=128/1 |
| Nyquist Roll Off (Alpha): | 12%, 18% |
| 8VSB – | |
| Standard: | ATSC A/53E |
| Decoding Levels: | 8 |
| Nyquist Roll Off (Alpha): | 11.5% |

## Broadcom TurboPSK Receiver Module Option

| | |
|---|---|
| General – | |
| Frequency Range: | 950 MHz – 2150 MHz |
| Number of inputs: | 1 |
| Connector: | F-Type, Female |
| Impedance: | 75 Ohms |
| Sensitivity: | -34dBmV to + 40dBmV (A74 Compliant) |
| DVB-S Modulation: | QPSK: 1/2, 2/3, 3/4, 5/6, 7/8 |
| TurboPSK Modulation: | QPSK: 1/2, 2/3, 3/4, 5/6, 7/8<br>8PSK: 2/3, 3/4 (2.05, 2.10 and 2.20), 5/6, 8/9 |
| Symbol Rate | 1-30 Msps |

## DVB-T2/C2/ISDB-T Input Module Option

| | |
|---|---|
| General – | |
| Frequency Range: | 42 MHz – 1002 MHz |
| Number of inputs: | 1 |
| Connector: | F-Type, Female |
| Impedance: | 75 Ohms |
| Sensitivity: | -34dBmV to + 40dBmV (A74 Compliant) |
| Modulation: | QPSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 1024QAM, 4096QAM |

| | |
|---|---|
| MER: | Range: 0dB to 40dB<br>Accuracy: +/- 2dB<br>Low Limit Flag: User Defined |
| RF Level: | Range: -34dBmV to +40dBmV<br>Accuracy: +/- 5dBmV<br>Low Limit Flag: User Defined |

# Appendix D – Pinouts for Analog Audio and Relay Connectors


**(DB-15) ANALOG AUDIO 1-2**

| PIN | CHANNEL | FUNCTION |
|---|---|---|
| 1 | Channel 1 | Left + |
| 2 | Channel 1 | Right + |
| 3 | Channel 2 | Left + |
| 4 | Channel 2 | Right + |
| 5 | -- | -- |
| 6 | Channel 1 | Left - |
| 7 | Channel 1 | Right - |
| 8 | Channel 2 | Left - |
| 9 | Channel 2 | Right - |
| 10 | -- | -- |
| 11 | -- | Ground |
| 12 | -- | Ground |
| 13 | -- | Ground |
| 14 | -- | Ground |
| 15 | -- | Ground |

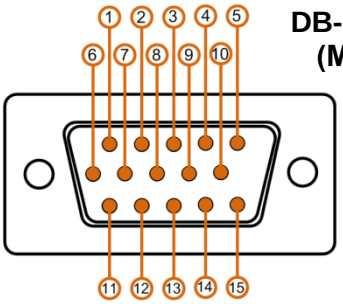
**(DB-15) ANALOG AUDIO 3-4**

| PIN | CHANNEL | FUNCTION |
|---|---|---|
| 1 | Channel 3 | Left + |
| 2 | Channel 3 | Right + |
| 3 | Channel 4 | Left + |
| 4 | Channel 4 | Right + |
| 5 | -- | -- |
| 6 | Channel 3 | Left - |
| 7 | Channel 3 | Right - |
| 8 | Channel 4 | Left - |
| 9 | Channel 4 | Right - |
| 10 | -- | -- |
| 11 | -- | Ground |
| 12 | -- | Ground |
| 13 | -- | Ground |
| 14 | -- | Ground |
| 15 | -- | Ground |

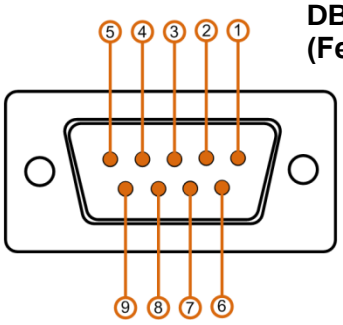
**(DB-9) RELAY PINOUT**

| PIN | RELAY | FUNCTION |
|---|---|---|
| 1 | Relay 1 | Normally Open |
| 2 | Relay 1 | Normally Closed |
| 3 | Relay 2 | Common |
| 4 | Relay 3 | Normally Open |
| 5 | Relay 3 | Normally Closed |
| 6 | Relay 1 | Common |
| 7 | Relay 2 | Normally Open |
| 8 | Relay 2 | Normally Closed |
| 9 | Relay 3 | Common |

***Note***: Relay functions shown represent the MRD in a powered-on state with no active alarms.




**DB-15 Connector (Male) Pin #'s**




**DB-9 Connector (Female) Pin #'s**

# Appendix E – MRD 6000 Audio Explanation

## Downmix Audio Setup

There are two primary modes of audio down mix operation for the MRD 6000 receiver/decoders. These settings only affect the signal if the digital output is set to PCM. It will also affect those embedded audio channels that are set to a PCM down mix. There are no gain changes or decoding if the digital or embedded outputs are set to Pass-through. 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.

There is an additional selection at the bottom of the Dolby setup pull-down menu. This allows selection between Professional Mode and Consumer Mode. In Professional Mode the built-in latency value is 32 ms for all formats. In Consumer Mode, this latency varies depending on the format. If you wish to monitor using a consumer receiver, you should choose Consumer Mode. The output sampling rate will always be 48 kHz, even in consumer. The Consumer/Pro identification bit will be set to Consumer. Normal operation in the air chain will use the Professional setting. This setting affects both Dolby Digital (AC-3) and Dolby Digital Plus.

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.

## Audio Output Settings

The digital audio services may be set to PCM (AES) or Pass-through (AES data) as an output. This applies to all available sources. The PCM setting will decode and automatically down mix an AC-3 or Dolby Digital Plus stream to two channels of AES audio. Pass-through simply passes thru the Dolby AC-3 data in an AES stream to be decoded by an external decoder such as the Dolby 568. Be aware the Dolby DP-568 is a professional decoder and always has a decoding latency of 32 msec. The older Dolby DP-564 has both professional and consumer modes of operation. If it identifies the Pro/Consumer ID bit as Professional, the latency will always be 32 msec. If it identifies the Pro/Consumer bit as Consumer, the latency will vary according to the format. Check the DP-564 manual for the actual latency values for Consumer mode. The analog channels can be assigned to any of the digital sources. The analog gain may be adjusted for the desired level. The gain setting does not affect the level of either the embedded audio or the digital services. A setting of +4 dBu provides an output of +4 dBu for a digital signal level of -20 dBFS. To check the audio output level, place the audio setup in Custom1 mode, down mix set to Lo/Ro, and the Dynamic Range disabled. This will remove any signal processing in the down mix. Set the digital service output being measured to PCM. A test stream of -20dBFS will output from the digital services as -20dBFS. If the analog channels are set to a gain setting of +4 dBu, the output should be +4 dBu plus or minus 0.5 dBu. The analog output level can be set in increments of 0.5 dBu from -10 dBu to +4 dBu referenced to a -20 dBFS digital input level. When you are setting the output levels it is suggested that an AC-3 stereo tone (2.0) be used as the source. Do not use a Dolby AC-3 5.1 tone source as your test signal. The five channels will down mix to a different level structure than a stereo signal depending on the down mix setting.

## 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<br>OUT R = R + C + Rs<br>(per ATSC A52) |
| 5.1 | Lt/Rt (DS) | OUT L = L + C – Ls - Rs<br>OUT R = R + C + Ls +Rs<br>(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<br>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 F – MRD 6000 Discrete Audio Configuration

With MRD license 60851, 5.1 Discrete Audio decoding is available on one audio PID. Discrete audio decoding differs from a normal downmix in that it simply decodes selected audio channels rather than mixing multiple channels into 2 channels. Its primary use is for passing individual audio channels, such as in Dolby 5.1, to separate audio components and/or outputs.

# Appendix G – Open Source Software

The MRD 6000 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** | 2016.74 | MIT-like | 2002-2015 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. |
| **Iproute2** | 3.4.0 | GPL Version 2, June 1991 | Stephen Hemminger, Alexey Kuznetsov |
| **libusb** | 0.1.12 | LGPL 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 2007 | 2010 Tildeslash Ltd. |
| **Net-SNMP** | 5.7.1 | BSD | 1989, 1991, 1992 by Carnegie Mellon |

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|---|---|---|---|
| | | | University, et. al. (see license) |
| **NTP** | 4.2.4p7 | NTP License | 1992-2009 David L. Mills |
| **OpenSSL** | 1.0.1c | BSD-Like | 1998-2008 The OpenSSL Project, 1995-1998 Eric Young |
| **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. (see license) |
| **POPT** | 1.14 | MIT | 1998 Red Hat Software |
| **qDecoder** | 12.0.4 | BSD | 2000-2012 Seungyoung Kim |
| **Socket-CAN** | 1171 | BSD-like, GPL Version 2, June 1991 | 2002-2007 Volkswagen Group Electronic Research, et. al. |
| **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 | Wolfgang Denk, et. al. |
| **USB-Utils** | 0.86 | GPL Version 2, June 1991 | Thomas Sailer, Johannes Erdfelt, David Brownell, Aurelien Jarno |
| **Zlib** | 1.2.4 | zlib/libpng License | 1995-2005 Jean-loup Gailly and Mark Adler |

# Appendix H – Warranty

## Sencore 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 I – Support and Contact Information

## Returning Products for Service or Calibration

The MRD 6000 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*

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**1.605.978.4600**