

Resource Identifier: 100336

Revision 1.1

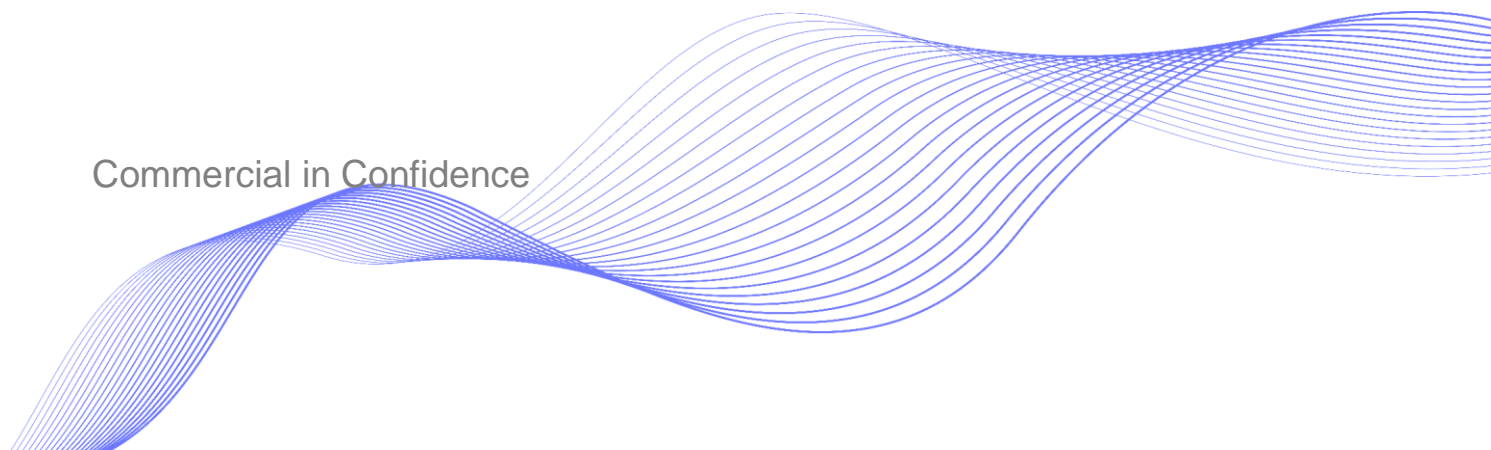


For the
moments
that matter

Sapphire-RXD5 Setup Guide



Commercial in Confidence



0. Preface

0.1 About this Document

This document contains relevant information required to identify, install, and control the equipment or system.

Since the available functions can be licensed and depend on the specific implementation, not all the functions and or applications contained in this document may be relevant or applicable to the system you will be working with.

The actual presentation may differ from those in this document due to hardware or software changes.

0.2 Notice about this Publication

While every attempt is made to maintain the accuracy of the information in this product manual, it is subject to change without notice.

Performance specifications are included for guidance. All particulars are given in good faith, actual performance may vary.

0.3 Copyright

This document contains information that is proprietary to Domo Tactical Communications (DTC) Limited trading as Domo Broadcast Systems (DBS). Any copying or reproduction in any form whatsoever is prohibited without the written permission of DTC.

© 2024 Copyright Domo Tactical Communications (DTC) Limited. All rights reserved.

0.4 Document History

This is a controlled document, written and produced by the DTC Technical Publications team. Changes are recorded in the table below.

Revision	Date	Summary of Changes
1.0	06/06/2024	First release
1.1	17/06/2024	Improved SMPTE 2022-7 section.

CONTENTS

- 0. Preface0-1
 - 0.1 About this Document..... 0-1
 - 0.2 Notice about this Publication..... 0-1
 - 0.3 Copyright..... 0-1
 - 0.4 Document History..... 0-1
- 1. Product Overview..... 1-1
 - 1.1 Description 1-1
 - 1.2 Basic Specifications 1-1
 - 1.3 Related Documents..... 1-2
 - 1.4 Approval Notices 1-2
- 2. Product Package.....2-3
 - 2.1 Overview 2-3
 - 2.2 Parts List 2-3
 - 2.3 Hardware Option 2-3
 - 2.4 Licensing Options..... 2-3
- 3. Hardware 3-4
 - 3.1 Introduction..... 3-4
 - 3.2 Front Panel..... 3-4
 - 3.3 Rear Panel 3-5
 - 3.4 Pinout 3-7
- 4. Getting Started..... 4-8
 - 4.1 Introduction..... 4-8
 - 4.2 Initial Setup Connections 4-8
 - 4.3 IP Address Identification 4-9
 - 4.4 Open Web Interface 4-13
 - 4.5 IP Address Configuration 4-15
- 5. Web User Interface 5-16
 - 5.1 Home Page 5-16
 - 5.2 Status Pages..... 5-17
 - 5.3 Config Pages..... 5-18
 - 5.4 Command Pages 5-19
 - 5.5 Manage Pages 5-20
- 6. Touchscreen Control.....6-21
 - 6.1 Power 6-21
 - 6.2 Introduction..... 6-21
 - 6.3 Touchscreen Left Zone 6-22
 - 6.4 Touchscreen Right Zone..... 6-23
- 7. Basic Operation 7-26
 - 7.1 Introduction..... 7-26
 - 7.2 Receiver Setup..... 7-26
 - 7.3 SDI Video 7-29
 - 7.4 Streaming..... 7-31
 - 7.5 SMPTE-2022-7 Networks 7-36

7.6	Firmware Upgrade	7-39
8.	Appendix A: Reference Material.....	8-40
8.1	How to Configure a PC IP Address.....	8-40
8.2	CIDR with Subnet Mask.....	8-41
9.	Appendix B: After Sales Support.....	9-42
9.1	Documentation and Software.....	9-42
9.2	Contact Technical Support.....	9-42
9.3	Using the DBS RMA Service.....	9-42
10.	Appendix C: Safety and Maintenance	10-43
10.1	Cautions and Warnings.....	10-43
10.2	Repairs and Alterations.....	10-44
10.3	Caring for your Equipment	10-44
10.4	Charging.....	10-44
10.5	Working with Lithium Batteries.....	10-45
10.6	Cleaning	10-45
10.7	Storage.....	10-45

1. Product Overview

1.1 Description

Sapphire-RXD5 is a Broadcast quality HEVC receiver decoding system, combining class-leading RF technology with Ultra Low Latency HEVC decoding, presented in a compact 1U 19" chassis.

The Sapphire-RXD5 cleverly combines an 8-way (upgradeable to 16-way) diversity COFDM receiver and DBS' Sapphire Ultra-Low Latency HEVC decoder in a single 1RU 19" package, offering end to end latency of less than 40ms which makes it ideal for live action scenarios. Operators requiring legacy support for H.264 decoding can add this via an optional licence.

8-way (optional 16 way) Maximum Ratio Combining diversity inputs, ensure reception in the most difficult RF environments whilst configurable LO frequencies and variable power ensures support for a variety of external downconverters.

The Ultra-Low Latency H.265 decoder supports resolutions up to 4K in 10-bit 4:2:2 format and with full support for HOR reinsertion, video interfaces are 12G capable. A monitoring port can be provided on SFP which can be downsampled to HD in the case of a 4K signal.

Sapphire-RXD5 will decode up to eight stereo audio pairs and output them embedded on SDI, one pair of analogue audio outputs are also provided on XLR.

The Sapphire-RXD5 has a unified web-browser control interface for remote control. Local control is achieved with a single touchscreen interface offering immediate status on transmitter performance and receiver status. The display can be set to operate in day or night modes, with intuitive configuration entry.

The Sapphire-RXD5 enables onward streaming of video/audio and supports multiple streaming formats including SRT. Timecode and HOR signalling are also fully supported. The Sapphire-RXD5 can support ST2110 interfaces for users requiring high rate video over IP solutions using the SFP interface provided.

1.2 Basic Specifications

DC Input	12VDC nominal
Power consumption	50-80W depending on number of downconverters (up to 8-way)
Dimensions	430mm x 315mm x 43mm (19" rack 1RU)
Weight	3.1kg

Note: Detailed technical specifications are given in the product datasheet. Please contact DBS for latest specifications.

1.3 Related Documents

All DTC documents can be downloaded from WatchDox, see *Section 9.1*.

Document	Description
MASH Serial Guide	Describes the serial control protocol
MASH REST API Guide	Describes the REST API control over IP
MASH Schemas Guide	Explains the contents of schemas from the unit. Schemas are used to generate all the status/config/command web pages, options, help text etc.

1.4 Approval Notices

The equipment has been designed to meet and has been tested against harmonized EMC and safety standards. The CE Declaration of Conformity as well as the technical file is available on request.

2. Product Package

2.1 Overview

Carefully open the packaging and verify that all the parts have been included, as ordered. Retain the packing materials for storage.

Note: If you do not have all the parts or are not happy with the condition of your delivered product, please contact DBS. See *Section 9.2*.

2.2 Parts List

These items will be in the package.

Part Number	Description
SAPPH-RXD5-8	Sapphire RX HEVC decoder 8-way diversity
CA4065	4-way XLR (f) to 120W 12VDC PSU
CA0512	5-way Lemo (m) to 2x 3-way XLR (m) audio left/right cable

2.3 Hardware Option

Part Number	Description
DEM0D-8	Additional 8-way demodulator input PCB

2.4 Licensing Options

Some product functions are enabled by licenses. The license for your product can be viewed in the control software.

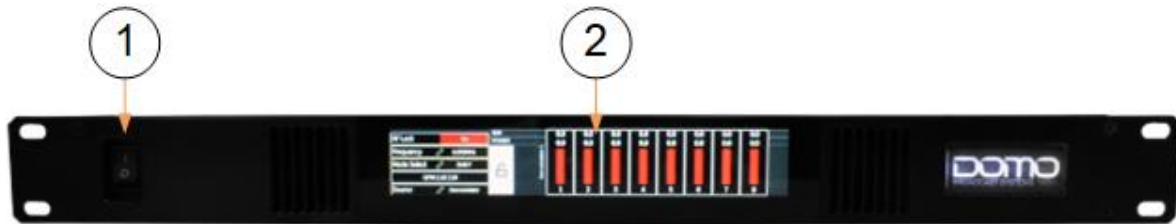
Part Number	Description
Base licenses (included)	HEVC HD Decode, DVB-T Demodulation, Ultra Mobile Video Link (UMVL) Demodulation, 8-way Diversity
LIC-4K-RX	4K Decoding
LIC-ASIPS	ASI Packet Switching
LIC-DPED-RX	Dual Pedestal Demodulation
LIC-H264-HD	H.264 HD Decoding
LIC-IP	IP Streaming

3. Hardware

3.1 Introduction

This chapter will help identify all the connections and interfaces of the product needed to install, control, and monitor the device.

3.2 Front Panel



No.	Item	Notes
1	Power on/off switch	It is recommended to use the switch to power the device On/Off.
2	Touchscreen display	When fully booted (approx. 90s), the touchscreen display can be used for limited configuration and monitoring. See <i>Chapter 6</i> for a description of features. Note: The web user interface can be used for more detailed configuration.

3.3 Rear Panel



Rear Panel: Full



No.	Item	Connection
1	4-way XLR (m)	<p>Connect the supplied PSU CA4065 for 12V power. See <i>Section 3.4.1</i> for pinout.</p> <p>CAUTION: To prevent damage to internal regulators, ensure the supply can provide a minimum 10A.</p> <p>IMPORTANT: Please ensure the power switch on the front panel is set to Off when connecting the power source. The power switch should be used to control power to the device.</p>
2	RJ45 jack	<p>Gigabit Ethernet connection.</p> <p>Note: The label is notional and is used to differentiate the connection.</p>
3	5-way Lemo (f)	<p>Connect supplied CA0512 Lemo to 2x XLR adaptor cable for audio left/right stereo line level output. See <i>Section 3.4.2</i> for pinout.</p>
4	SFP+ cage	<p>SFP provides a video output for monitoring.</p>
5	High density BNC (f)	<p>A 12G-SDI video output for monitoring.</p>
6	High density BNC (f) x 4	<p>SDI output 1-4.</p> <p>1/2: Supports 12G-SDI, 6G-SDI, or 3G-SDI video formats.</p> <p>2/3: Supports 3G-SDI video formats.</p>
7	RJ45 jack	<p>Gigabit Ethernet connection.</p> <p>Note: The label is notional and is used to differentiate the connection.</p>

No.	Item	Connection
8	RJ45 jack	Gigabit Ethernet connection. Note: The label is notional and is used to differentiate the connection.
9	4-way Hirose (m)	RS-232 data port. See <i>Section 3.4.3</i> for pinout.
10	BNC socket (75Ω)	Connect a Genlock device to this port to keep the receiver synchronised with all the other equipment in your facility.
11	BNC socket (75Ω)	ASI input. Packet diversity allows you to double the diversity of the system by linking a remote receiver via ASI. Each unit will provide coverage in a different area but will act like a single receiver.
12	BNC socket (75Ω)	ASI output.
13	BNC socket (50Ω)	RF input from a downconverter/antenna assembly. Up to eight antennas can be fitted for maximum receive diversity. Note: Additional 8-way as a hardware option (16-way total), see <i>Section 2.3</i> .
14	LED indicator	Blue LED indicator. <ul style="list-style-type: none"> On: LNB power is on (also when booting) Off: LNB power off. The LED can also help identify the receiver in a rack system when a flash LED command is invoked from the WUI Command>Unit page, see <i>Section 5.4</i> , or by right-clicking the device in Node Finder application, see <i>Section 4.3.3</i> .

3.4 Pinout

3.4.1 PWR 12V

Mating part: Neutrik NC4FX

Pin	Function
1	0V
2	N/C
3	N/C
4	VIN (12VDC nominal)

3.4.2 AUD

Mating part: Lemo FGA.0B.305.CLAD52 or ODU S20LAC-P05MFGO-520S

Pin	Function
1	AUD OUT L+
2	AUD OUT L-
3	0V
4	AUD OUT R+
5	AUD OUT R-

3.4.3 DATA

Mating part: Hirose HR10-7P-4S(73)

Pin	Function
1	GND
2	RX
3	TX
4	N/C

4. Getting Started

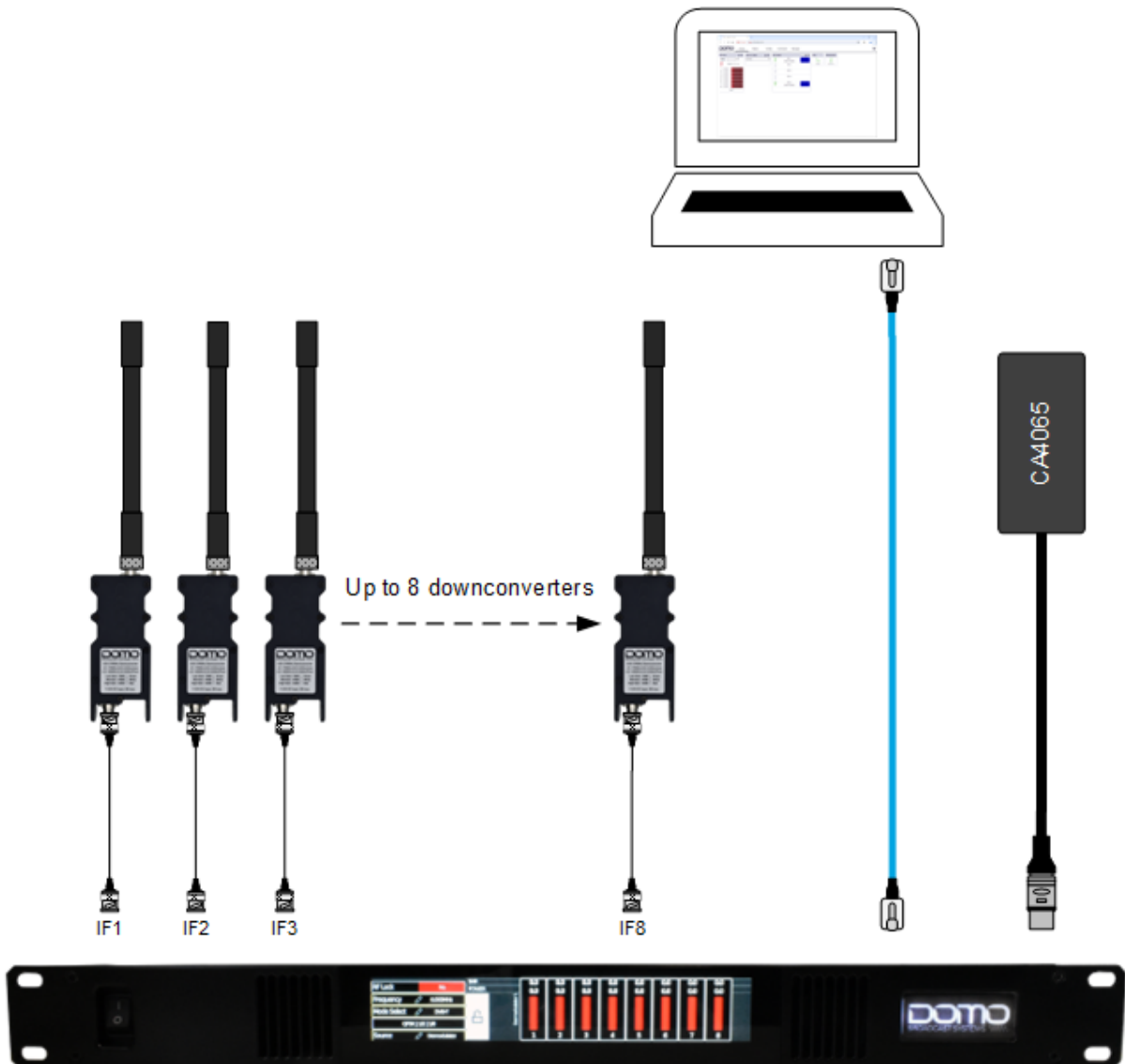
4.1 Introduction

This chapter will help the user power up and communicate with the product. It will explain software installation instructions for relevant applications.

4.2 Initial Setup Connections

The Sapphire-RXD5 requires 12VDC power which can be supplied via the supplied mains PSU CA4065. There is a switch on the front panel which can be used to power the unit On or Off; it will take approximately 90s to boot-up.

Up to eight downconverter/antenna assemblies can be attached for receive diversity. Connect by Ethernet to a laptop/PC for initial setup using a web user interface (WUI).



4.3 IP Address Identification

4.3.1 Introduction

The Sapphire-RXD5 has a comprehensive web user interface (WUI) for detailed monitoring and control. The WUI is accessed via a web browser using the IP address, so an Ethernet connection from the **CTRL**, **Stream A** or **Stream B** port to a PC device is required.

Our devices are shipped to you with the IP DHCP setting enabled. This means that if the Sapphire-RXD5 is connected to a network which is administered by a DHCP server, the IP address will be automatically assigned. If the device is connected to a network which does **not** have a DHCP server, contact your Network Administrator for an IP address you can use.

Re-configuration of the IP settings can be achieved via Node Finder or via the touchscreen (see below), or via the web interface (see *Section 4.5*).

Note: If you are using a standalone PC or laptop, you will need to set the IP address of the PC to match the IP address range of the device. Refer to *Section 8.1* to find out how to do this.

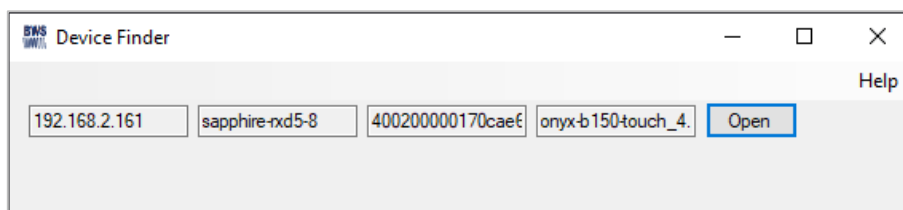
4.3.2 Device Finder

Device Finder application can be used to identify DBS product IP addresses on a network.

Device Finder comes as a simple executable file which can be downloaded from DBS's WatchDox facility, see *Section 9.1*. This can be saved to the PC desktop.



Double-click the Device Finder executable to open the application. All DBS devices attached to the network will be detected. Click **Open** to initialise communications with your PC's default web browser.

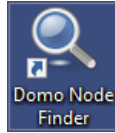


4.3.3 Node Finder

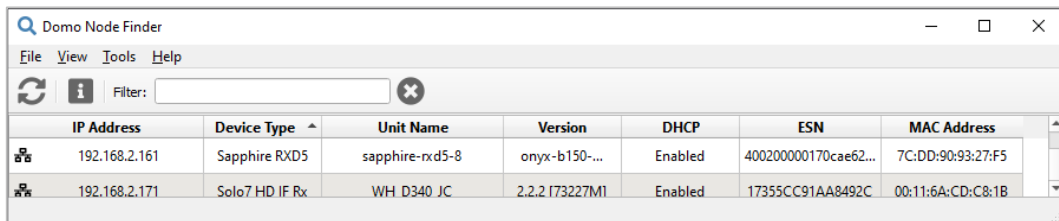
Node Finder application can be used to identify a device IP address or disable DHCP if you are not connected through a DHCP server or using a standalone PC or laptop.

Node Finder comes as a simple executable file which can be downloaded from DBS's WatchDox facility, see *Section 9.1*. Run the executable to install the application to the PC's desktop.

Double-click the Node Finder desktop shortcut to open.

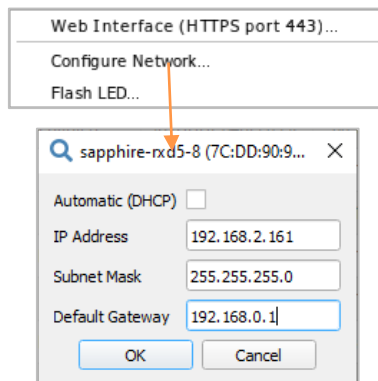


All DBS devices attached to the network will be detected. Double-click on the RXD5 to initialise communications with your PC's default web browser.



IP Address	Device Type	Unit Name	Version	DHCP	ESN	MAC Address
192.168.2.161	Sapphire RXD5	sapphire-rxd5-8	onyx-b150-...	Enabled	400200000170cae62...	7C:DD:90:93:27:F5
192.168.2.171	Solo7 HD IF Rx	WH D340 JC	2.2.2 I73227MI	Enabled	17355CC91AA8492C	00:11:6A:CD:C8:1B

Right click on the RXD5 IP address to reconfigure the IP settings, if required. The rear panel LED flash command can also be invoked.

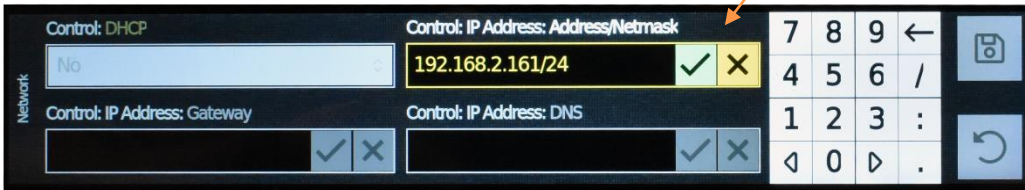
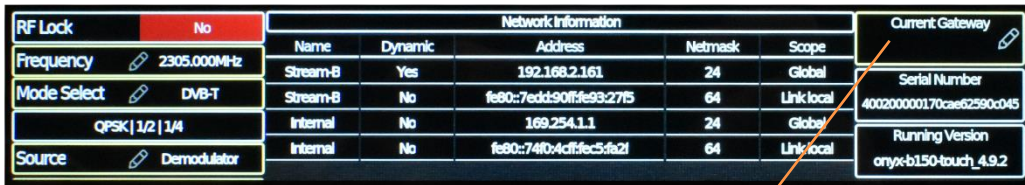


4.3.4 Touchscreen

The IP address of the Sapphire can be found and edited, if required from the front panel touchscreen. This can be useful if the device is not connected via a DHCP server, or the IP address does not match the subnet of the PC and the IP address settings need to be changed.

The IP address can be discovered by swiping up on the touchscreen to find the **Network Information** page.

The IP settings can be edited by pressing the **Current Gateway** parameter. IP addresses must be entered in CIDR notation, see description in *Section 8.2*.



4.3.5 IPv6 Address

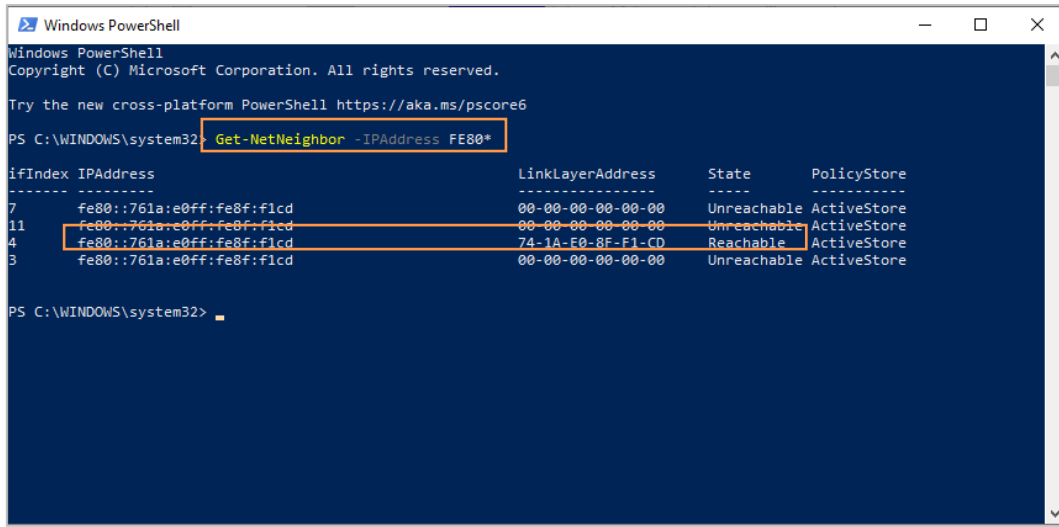
DBS products support link-local IPv6 addressing. This will allow web browser control if the device is not connected via a DHCP server, or the IP address does not match the subnet of the PC and the IP address settings need to be changed.

The IPv6 address of the Sapphire-RXD5 can be discovered from the front panel touchscreen **Network Information** page, see *Section 4.3.4* above.

Alternatively, the IPv6 address can be discovered from Windows Powershell by entering the command:

```
Get-NetNeighbor -IPAddress FE80*
```

The IP address for the Sapphire-RXD5 must have a **Reachable** state.



```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Try the new cross-platform PowerShell https://aka.ms/powershell

PS C:\WINDOWS\system32> Get-NetNeighbor -IPAddress FE80*

ifIndex IPAddress                               LinkLayerAddress      State      PolicyStore
-----
7         fe80::761a:e0ff:fe8f:f1cd 00-00-00-00-00-00    Unreachable ActiveStore
11        fe80::761a:e0ff:fe8f:f1cd 00-00-00-00-00-00    Unreachable ActiveStore
4         fe80::761a:e0ff:fe8f:f1cd 74-1A-E0-8F-F1-CD    Reachable   ActiveStore
3         fe80::761a:e0ff:fe8f:f1cd 00-00-00-00-00-00    Unreachable ActiveStore

PS C:\WINDOWS\system32>
```

Note: If using the IPv6 address, enter the IP address into your web browser using square brackets around the address, e.g., [https://\[fe80::761a:e0ff:fe8f:f1cd\]](https://[fe80::761a:e0ff:fe8f:f1cd]).

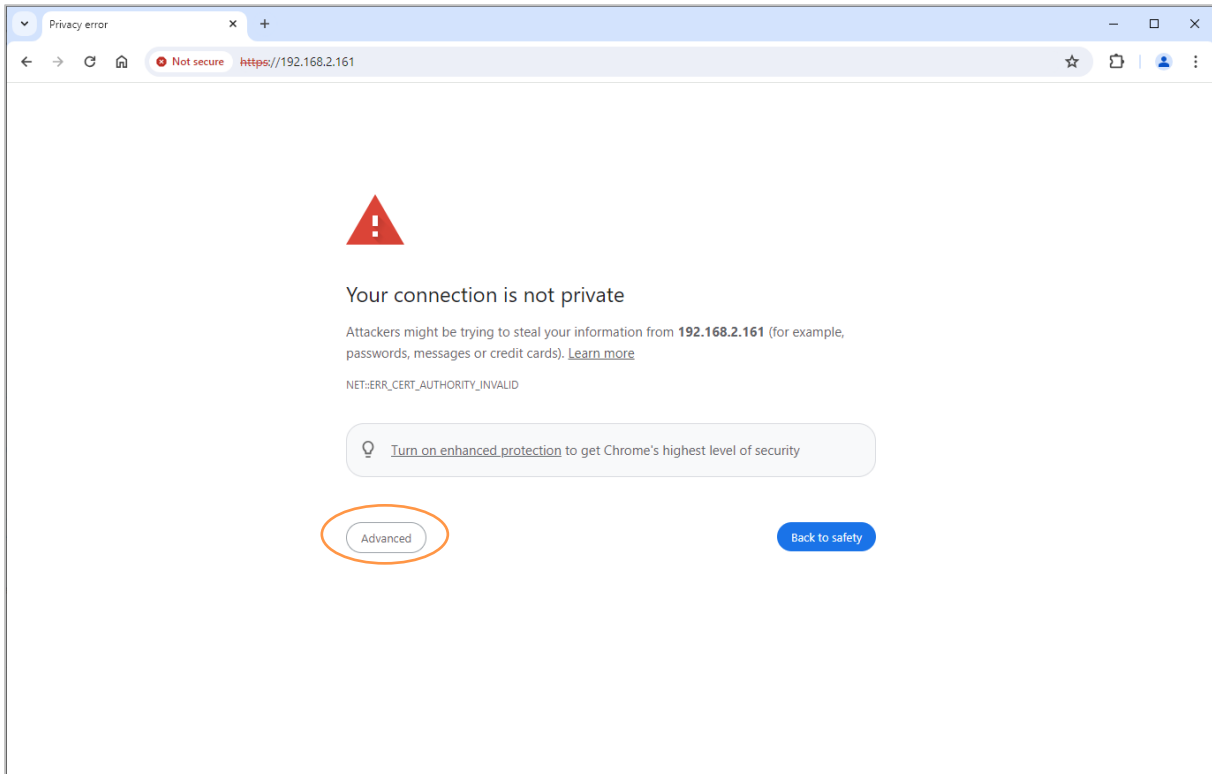
4.4 Open Web Interface

Once the IP address has been confirmed, open a web browser on a PC device and enter the IP address of the Sapphire-RXD5 in the address bar.

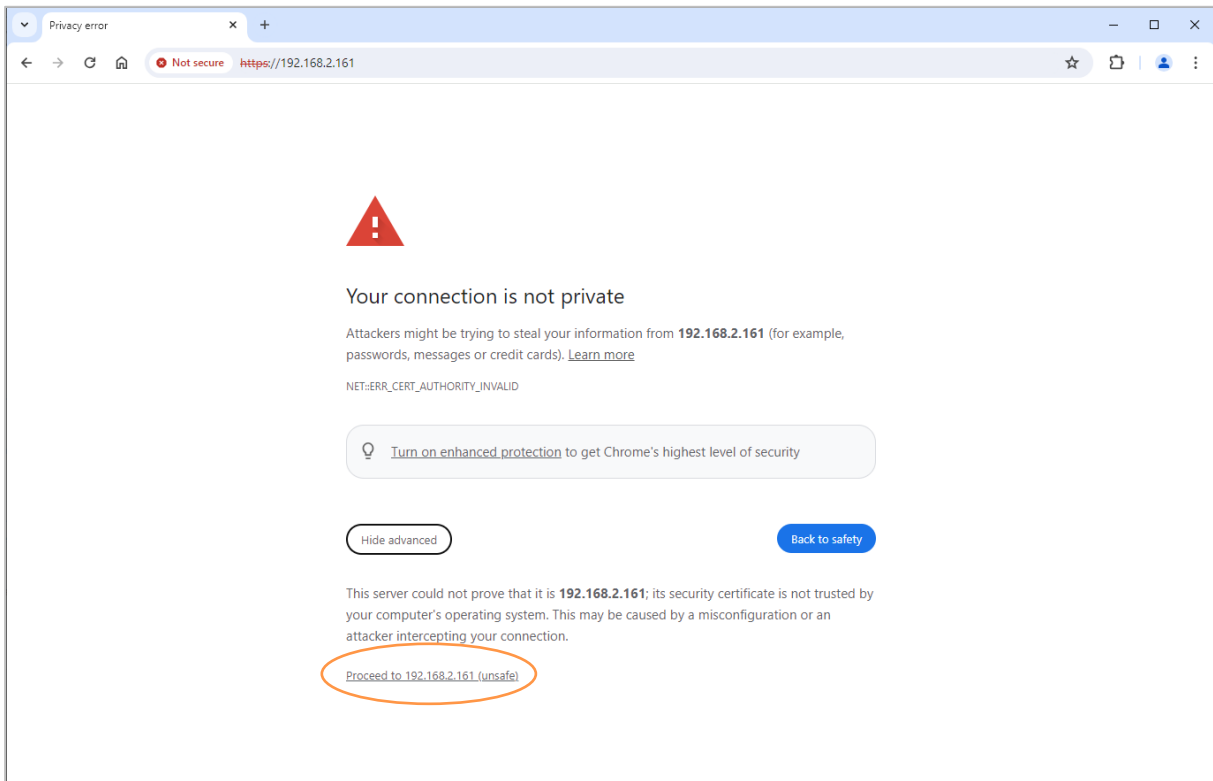
Note: If using the IPv6 address, enter the IP address into your web browser using square brackets around the address, e.g., `https://[fe80::761a:e0ff:fe8f:f1cd]`.

Alternatively, open direct from Node Finder or Device Finder, explained in *Section 4.3*.

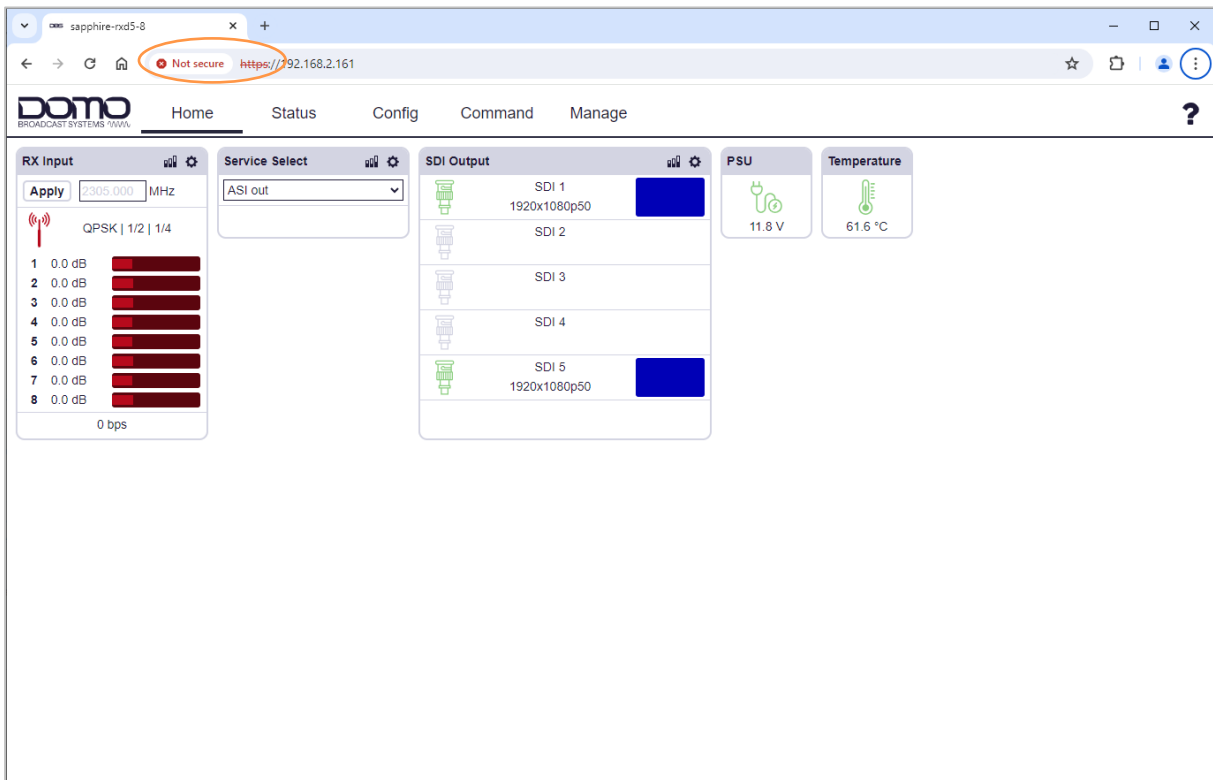
DBS devices have a pre-installed self-signed HTTPS certificate, the first time web communications are established, it will be necessary to trust the address. The presentation of the web page will differ depending on the browser application; the following example is Google Chrome. Click on **Advanced** to proceed.



Click **Proceed to <ip_address> (unsafe)** to open the web user interface.



The browser will indicate that the site is connected by HTTPS but is not secure.

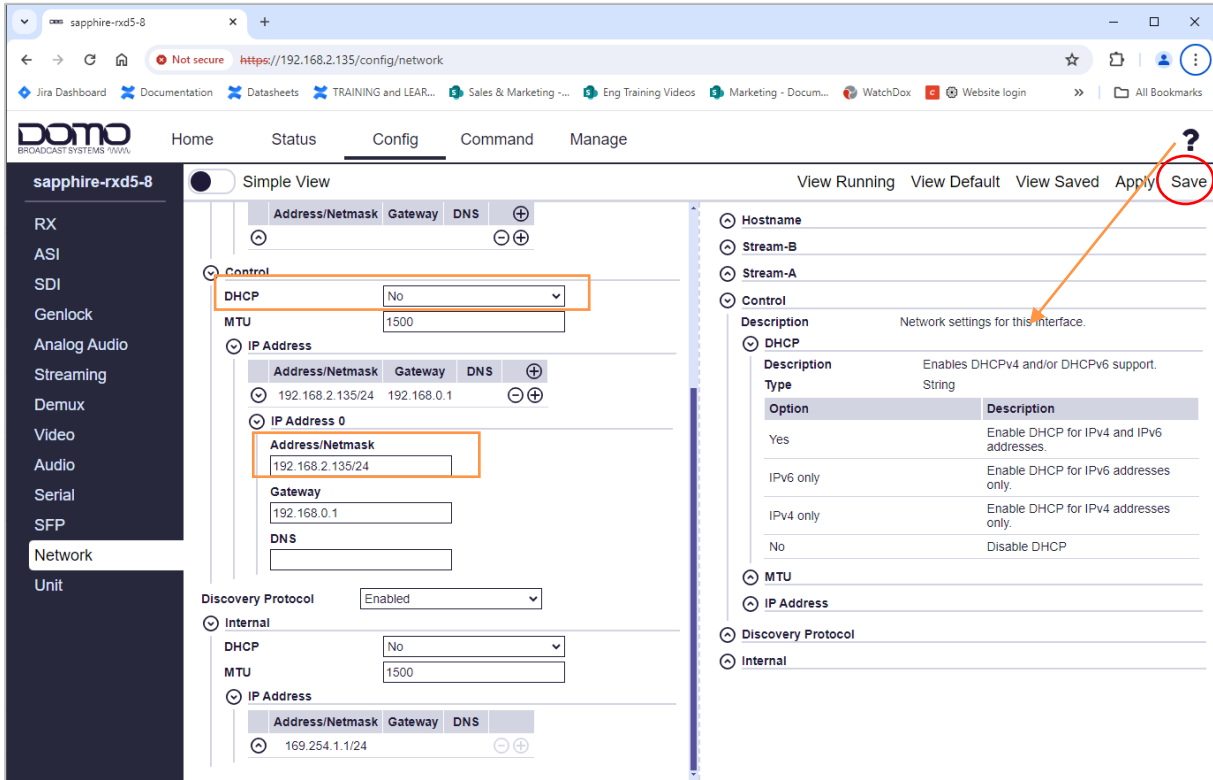


4.5 IP Address Configuration

The IP address can be configured via the front panel, explained in *Section 4.3.4*, or via the web interface.

To re-configure the IP address via the web interface, go to the **Config>Network** page.

Note: It may be useful to open the **Help (?)** menu for descriptions of settings.



Change the **DHCP** setting to **No** if you do not want the unit to try and get an IP Address, Gateway, or DNS from a DHCP server.

The **IP Address/Netmask** parameter is written in CIDR notation. This is a compact representation where the IP address is followed by a slash (/) and then a decimal number which indicates the count of leading 1-bits in the network mask.

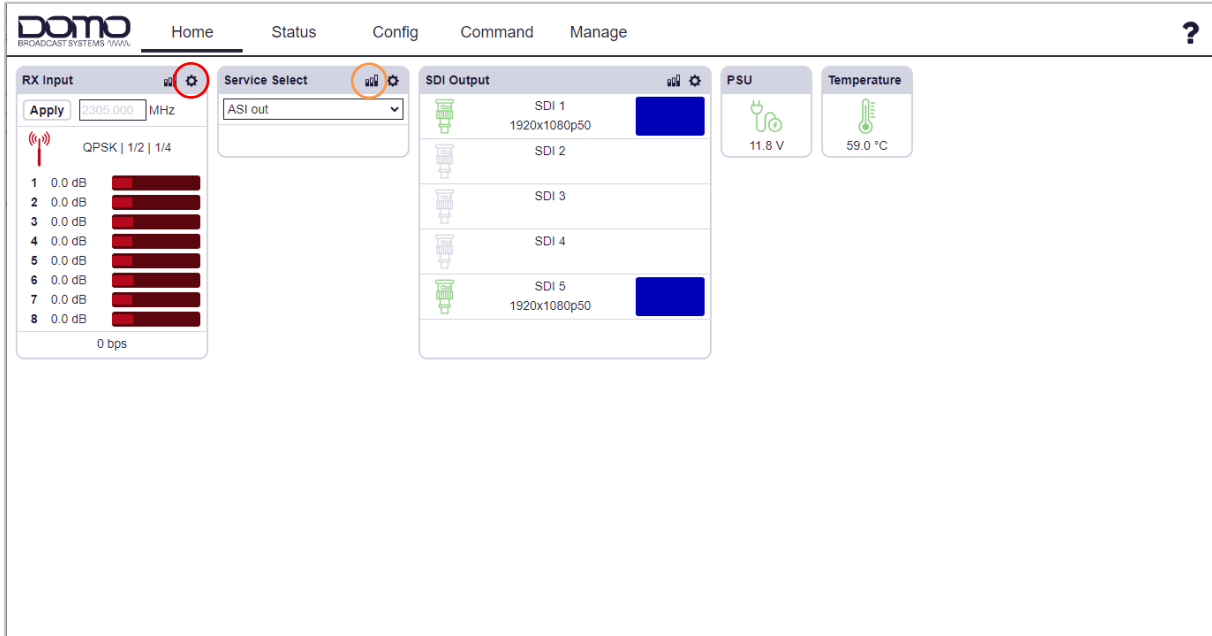
For example, an IP address 192.168.2.135 with a netmask of 255.255.255.0 would be written in CIDR notation as 192.168.2.135/24, where the first 24-bits of the IP address are masked. See *Section 8.2* for a table of subnets mapped to CIDR values.

Click **Apply** to activate a running config and **Save** to retain.

5. Web User Interface

5.1 Home Page

The Home page is a dashboard of information relating to currently active configurations. There are shortcuts to Config pages (red circle) or Status pages (orange circle).



5.2 Status Pages

The Status pages are provided giving detailed information for the Sapphire-RXD5. Select the category you want to view from the list on the left panel.

Menus can be expanded or collapsed using the arrows adjacent to the header of each parameter.

Note: It may be useful to open the **Help (?)** menu for descriptions of settings.

The screenshot displays the Domo web interface for the 'sapphire-rxd5-8' device. The top navigation bar includes 'Home', 'Status', 'Config', 'Command', and 'Manage'. The left sidebar lists various system components: RX, ASI, SDI, Genlock, Streaming, Demux, Video, Audio, Ancillary Data, Return Data, Metadata, GPS, Serial, SFP, Network, Licence, Unit, Storage, USB, Time, and Certificate. The 'Status' page is active, showing a 'Simple View' toggle. The 'Input' section is expanded, displaying a table with the following data:

Name	Lock	Transmission Mode	Signal Polarity	Bitrate
RX	No	Continuous	Normal	0 bps
ASI in	No	Continuous	Normal	0 bps

The 'Input 1' section is also expanded, showing details for 'ASI in':

Name	ASI in
Lock	No
Transmission Mode	Continuous
Signal Polarity	Normal
Bitrate	0 bps

The 'Output' section is expanded, showing a table with the following data:

Name	Bitrate
ASI out	0 bps

The 'Lock' section is expanded, showing a table with the following data:

Option	Description
Yes	Source is present and valid.
No	Source is missing or invalid.

An orange arrow points to the 'Lock' section header in the right-hand pane.

5.3 Config Pages

The Config pages are used to make changes to configuration settings. Select the category you want to edit from the list on the left panel and select **simple** or **advanced** settings.


Menus can be expanded or collapsed using the arrows adjacent to the header of each parameter.

Note: It may be useful to open the **Help (?)** menu for descriptions of settings.

Option	Description
None	No downconverter is connected.
Manual	Use manual settings for the connected downconverter.
Individual	Use individual settings for each connected downconverter.
BWSDC-200270	BWSDC-200270 downconverter connected, supporting 2.00GHz to 2.70GHz.
BWSDC-680750	BWSDC-680750 downconverter connected, supporting 6.80GHz to 7.50GHz.
DC-100140	DC-100140 downconverter connected, supporting 1.00GHz to 1.40GHz.
DC-225265	DC-225265 downconverter connected, supporting 2.25GHz to 2.65GHz.
DCB-100150	DCB-100150 downconverter connected, supporting 1.00GHz to 1.50GHz.
DCB-150200	DCB-150200 downconverter connected, supporting 1.50GHz to 2.00GHz.

Changes to settings can be applied or saved. It is important to understand the differences:

- **Apply:** applies the setting to the running config, this does not save the setting. On reboot the unit will return to the saved settings.
- **Save:** saves the settings in the running config, this will restore these settings on reboot. To save a change, it must be applied first.

Note: Categories on the left panel marked with a save icon , indicate that they have been applied but not saved. To carry out a save to all configs, go to the **Manage>Config** page.

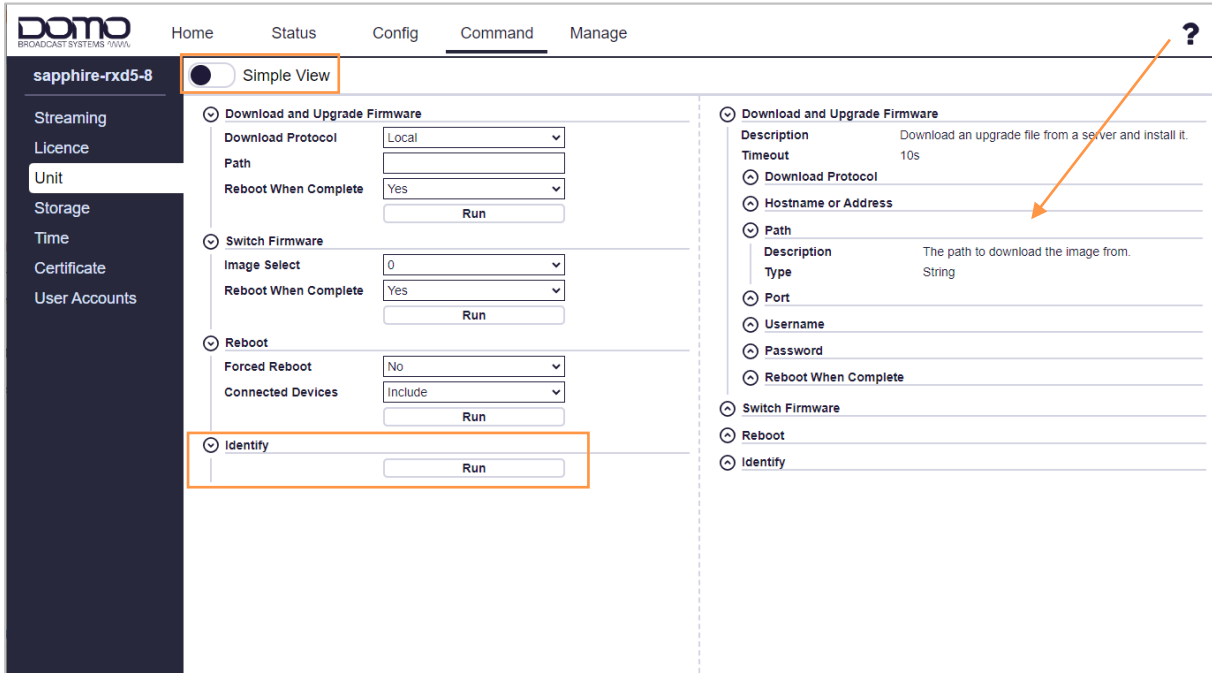
5.4 Command Pages

The Command pages are used to send commands to the device, or upgrades via external servers.

Select the category you want to send commands to from the list on the left panel and select **simple** or **advanced** settings.

Menus can be expanded or collapsed using the arrows adjacent to the header of each parameter.

Note: It may be useful to open the **Help (?)** menu for descriptions of settings.



The **Identify** command in the **Command>Unit** page, shown above, will flash the LED on the rear panel (see *Section 3.3*) to identify a receiver in a rack system.

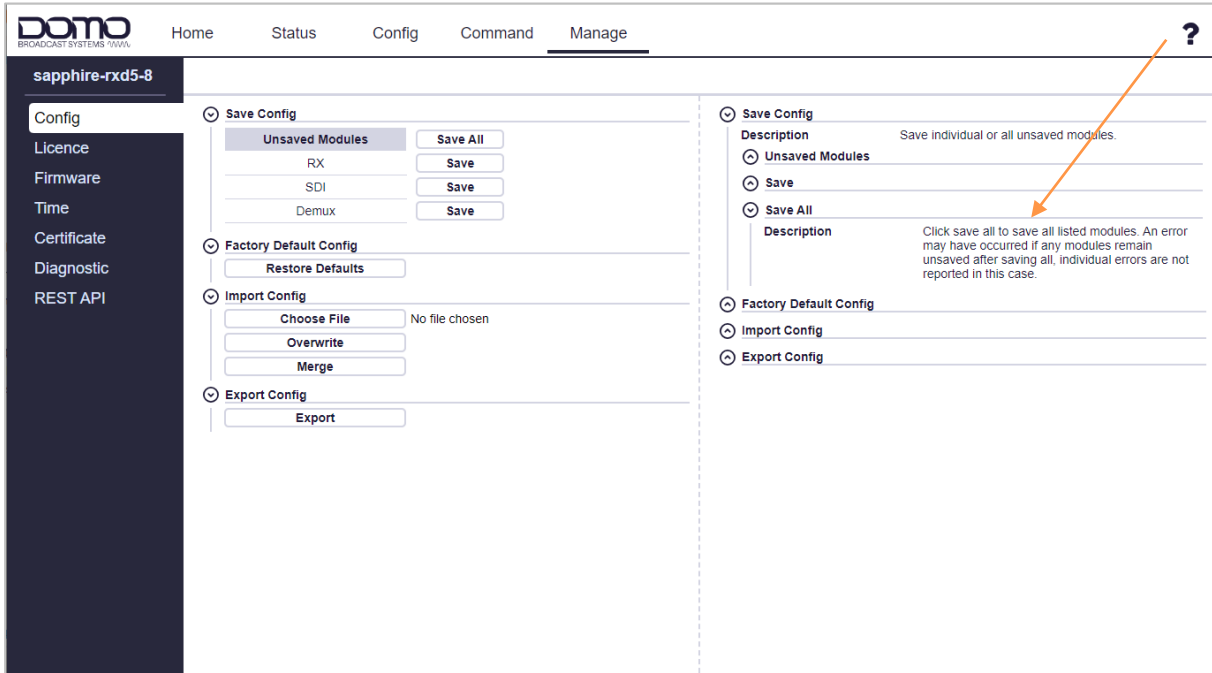
5.5 Manage Pages

The Manage pages are used for maintenance of the Sapphire-RXD5 internal software and settings. See *Section 0* for a firmware upgrade example.

Select the category you want to manage from the list on the left panel.

Menus can be expanded or collapsed using the arrows adjacent to the header of each parameter.

Note: It may be useful to open the **Help (?)** menu for descriptions of settings.



6. Touchscreen Control

6.1 Power

The Sapphire-RXD5 requires 12VDC power which can be provided via the supplied mains PSU. There is a switch on the front panel which can be used to power the unit On or Off.

When the unit has been switched on, it will take approximately 90s to boot-up.

6.2 Introduction

The Sapphire-RXD5 has a front panel touchscreen which can be used for limited configuration and monitoring of the device without the need to connect to a PC.

When the unit has fully booted, the touchscreen will display the home screen which shows the demodulator receiver status.

Press the lock symbol for 2s to turn the screen off, if required.

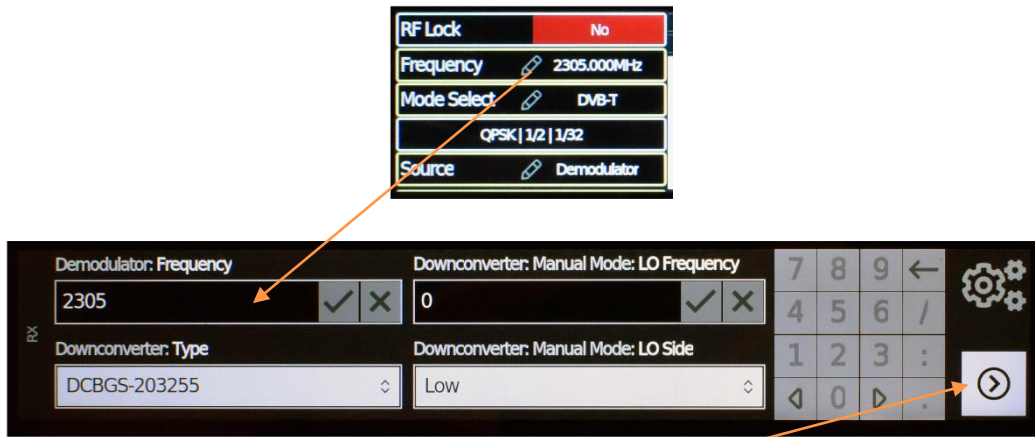


6.3 Touchscreen Left Zone

The touchscreen left zone holds key information about the RF and genlock settings. The menu can be navigated by swiping up/down.



Parameters which are detailed with the pencil icon can be edited, press the parameter to open the settings.



To return to the home screen, select the right arrow icon.

6.4 Touchscreen Right Zone

The touchscreen right zone initial view displays the SNRs and levels for the received signals with a colour-coded bar graph. The menu can be navigated by swiping up/down.



The colour will indicate the received signal quality needed to achieve the transmitted constellation and FEC. The minimum will be indicated by an amber bar but for optimum performance, a green bar is desired.

For example, a 16QAM signal with 3/4 FEC requires SNRs greater than 12.6dB but preferably greater than 16.1dB. To achieve improved SNRs the system setup and configuration may need to be reconsidered, e.g., increase receive diversity or introduce dual pedestal operation.

Constellation	FEC	SNR red threshold (dB)	SNR amber threshold (dB)	SNR green threshold (dB)
QPSK	1/2	3.5	7	>7
QPSK	2/3	5.3	8.8	>8.8
QPSK	3/4	6.3	9.8	>9.3
QPSK	5/6	7.3	10.8	>10.8
QPSK	7/8	7.9	11.4	>11.4
16QAM	1/2	9.3	12.8	>12.8
16QAM	2/3	11.4	14.9	>14.9
16QAM	3/4	12.6	16.1	>16.1
16QAM	5/6	13.8	17.3	>17.3
16QAM	7/8	14.4	17.9	>17.9
64QAM	1/2	13.8	17.3	>17.3
64QAM	2/3	16.7	20.2	>20.2
64QAM	3/4	18.2	21.7	>21.7
64QAM	5/6	19.4	22.9	>22.9
64QAM	7/8	20.2	23.7	>23.7

Table 6-1: Receiver Thresholds DVB-T

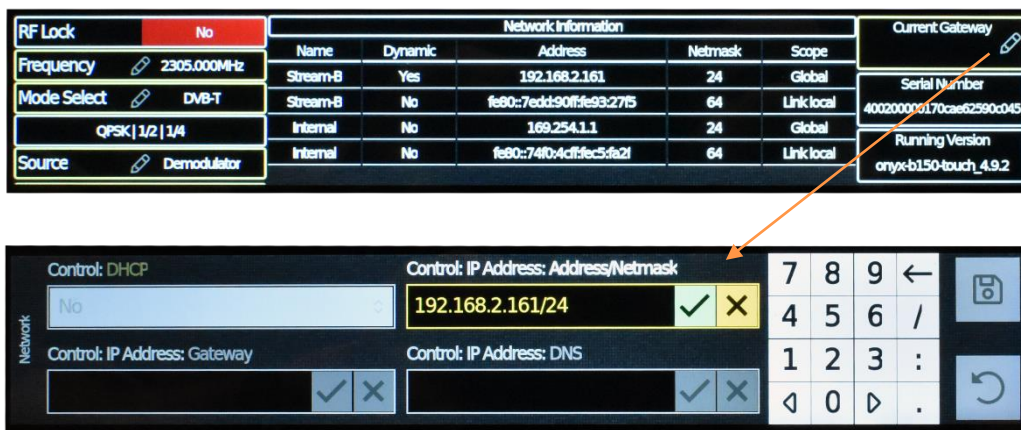
Constellation	FEC	SNR red threshold (dB)	SNR amber threshold (dB)	SNR green threshold (dB)
BPSK	1/2	2	5	>5
BPSK	2/3	3.5	6.5	>6.5
QPSK	1/2	3.5	6.5	>6.5
QPSK	2/3	5	8	>8
8PSK	1/2	6	9	>9
8PSK	2/3	7.5	10.5	>10.5
16QAM	1/2	8.5	11.5	>11.5
16QAM	2/3	10	13	>13
64QAM	1/2	13	16	>16
64QAM	2/3	14.5	17.5	>17.5

Table 6-2: Receiver Thresholds UMVL/Narrowband

Further information from the right zone can be viewed by swiping up/down to view video/audio and network information. The bottom page will allow you to restore defaults, this will return the Sapphire-RXD5 to factory settings.



Parameters which are detailed with the pencil icon can be edited, press the parameter to open the settings. Press the setting to make it active for editing.



7. Basic Operation

7.1 Introduction

The sections in this chapter can be used in conjunction as a workflow to complete a system configuration.

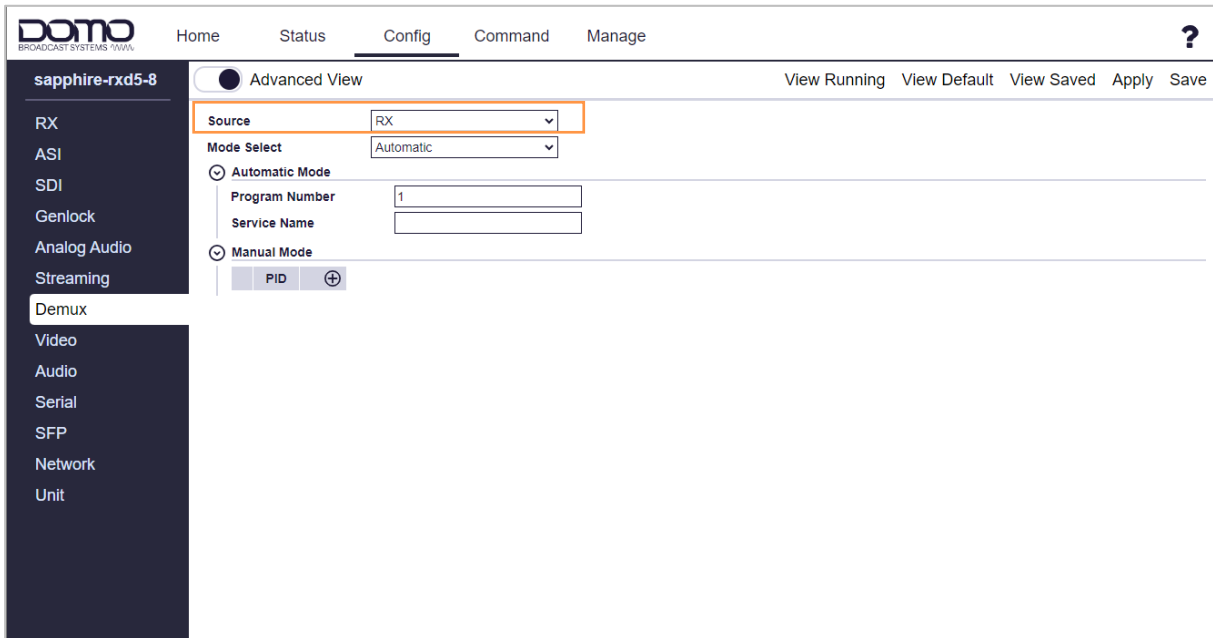
Currently only limited RF setup can be achieved via the front panel touchscreen, therefore, only WUI configuration is covered.

Only settings for the Sapphire-RXD5 are explained, it is assumed that the inputs to the system are provided.

7.2 Receiver Setup

Sapphire-RXD5 RF receiver (RX) can be used as a source for the ASI output, the IP streaming output or the Demux service.

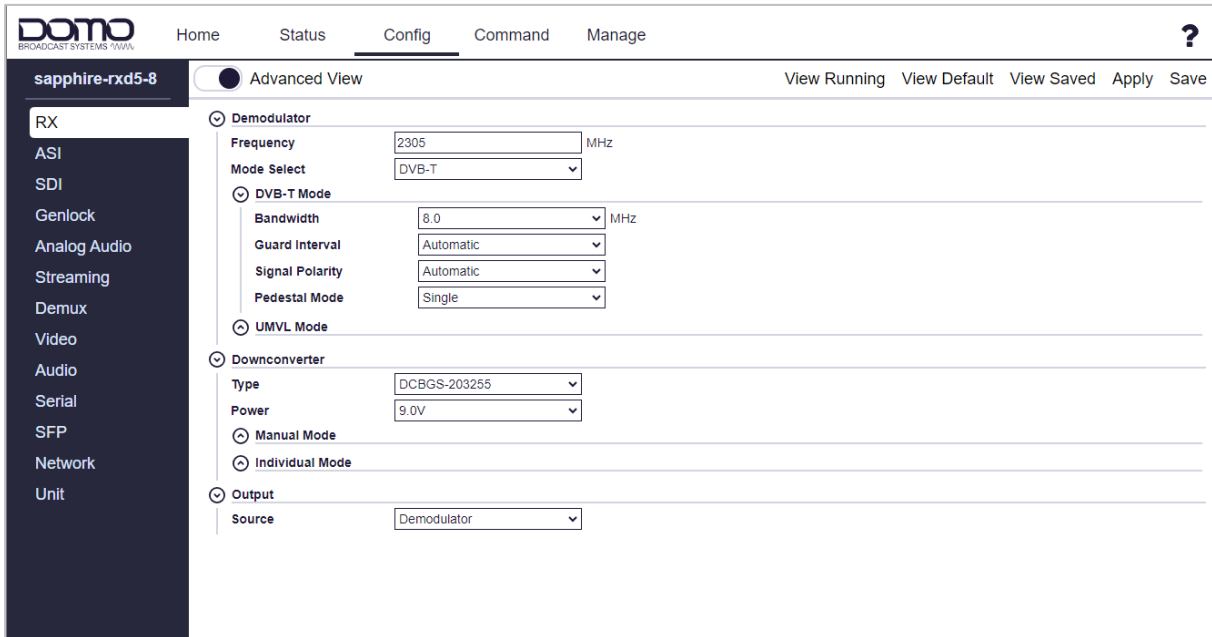
Setting the Demux to RX will allow you to decode from the receiver, shown below.



Go to the **Config>RX** page and configure the **Demodulator** settings to match the transmitter.

Downconverter presets are available for standard DBS downconverters; however, manual settings can be applied.

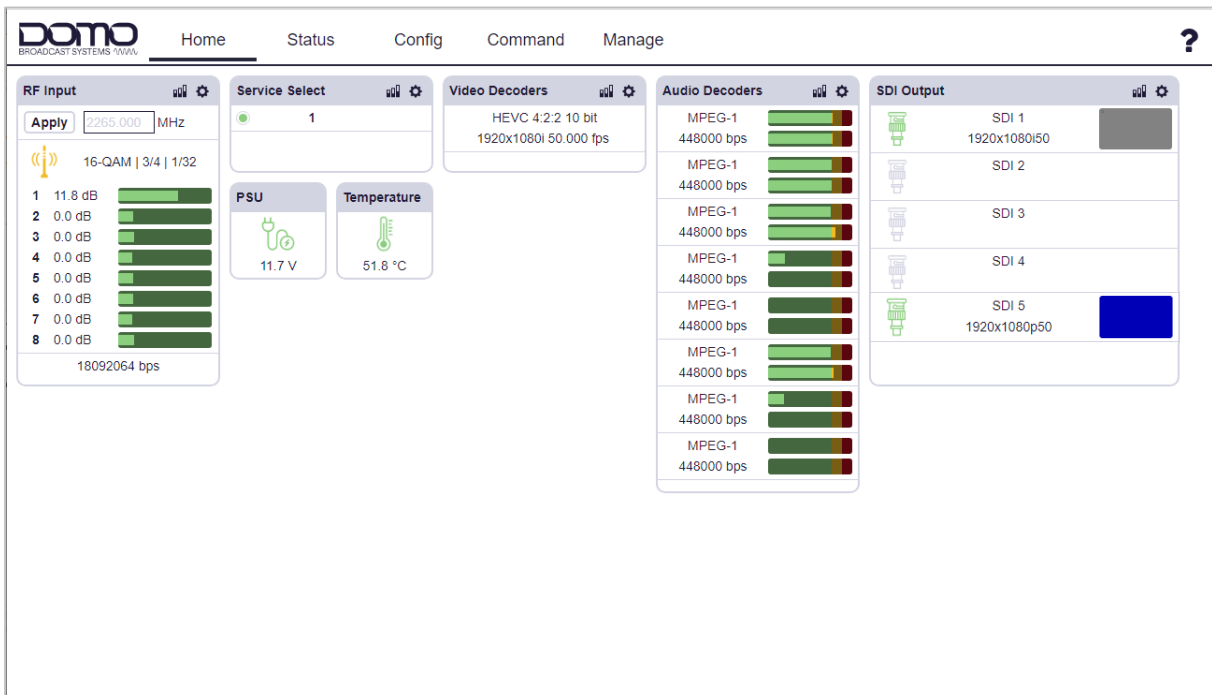
Click **Apply** to activate a running config and **Save** to retain.



RF Input can be verified on the front panel touchscreen, and on the WUI **Status** and **Home** page.

Note: The Home page will only display used parameters. The **RF Input** will not be displayed if RX has not been selected as a source for the ASI output, the IP streaming output or the Demux service.

Note: The example below is for a receiver with only one RF input for illustration.



Diagnostics

Achieving a good receive signal is key to RF performance. The **Status>RX** page is a good place to monitor critical RF performance indicators.

The screenshot shows the DOMO web interface for a Sapphire-RXD5-8 device. The navigation menu on the left includes options like RX, ASI, SDI, Genlock, Streaming, Demux, Video, Audio, Ancillary Data, Return Data, Metadata, GPS, Serial, SFP, Network, Licence, Unit, Storage, USB, Time, and Certificate. The main content area is titled 'Simple View' and shows the 'Demodulator' configuration for 'D380-1@169.254.1.3'. The configuration includes: RF Lock: No, Frequency: 2305.000 MHz, Constellation: QPSK, FEC: 1/2, Guard Interval: 1/32, and Bitrate: 6032085 bps. Below this is a table of 'Input Channel' settings:

Name	LO Frequency	LO Side	Signal Strength	SNR	FFT File
1	1720.000 MHz	Low	-100.0 dBm	0.0 dB	/files/d380rx/demodulator/0/input/0/fft.svg
2	1720.000 MHz	Low	-100.0 dBm	0.0 dB	/files/d380rx/demodulator/0/input/1/fft.svg
3	1720.000 MHz	Low	-99.0 dBm	0.0 dB	/files/d380rx/demodulator/0/input/2/fft.svg
4	1720.000 MHz	Low	-100.0 dBm	0.0 dB	/files/d380rx/demodulator/0/input/3/fft.svg
5	1720.000 MHz	Low	-100.0 dBm	0.0 dB	/files/d380rx/demodulator/0/input/4/fft.svg
6	1720.000 MHz	Low	-99.0 dBm	0.0 dB	/files/d380rx/demodulator/0/input/5/fft.svg
7	1720.000 MHz	Low	-100.0 dBm	0.0 dB	/files/d380rx/demodulator/0/input/6/fft.svg
8	1720.000 MHz	Low	-99.0 dBm	0.0 dB	/files/d380rx/demodulator/0/input/7/fft.svg

Below the input channels table, the 'Error Rates' section shows: Pre Viterbi: 0, Post Viterbi: 0, and Transport: 0.

With no RF lock, the Signal Strength should have a value of around -110dBm which indicates a low noise floor at the input. If this level is raised significantly, it could indicate that noise will adversely affect the SNR (signal-to-noise) level when a RF signal is received which will need to be investigated.

The RF noise floor can also be monitored by clicking the **FFT File** for the input. This will open a spectrum analysis of the received COFDM signal. An ideal receive signal should have a uniform shape with strong shoulder height. Example below.



Another key indicator of RF performance is the Post Viterbi errors, these are errors that cannot be corrected by the receiver's signal processor. Pre Viterbi can be monitored to ensure Post Viterbi errors do not occur.

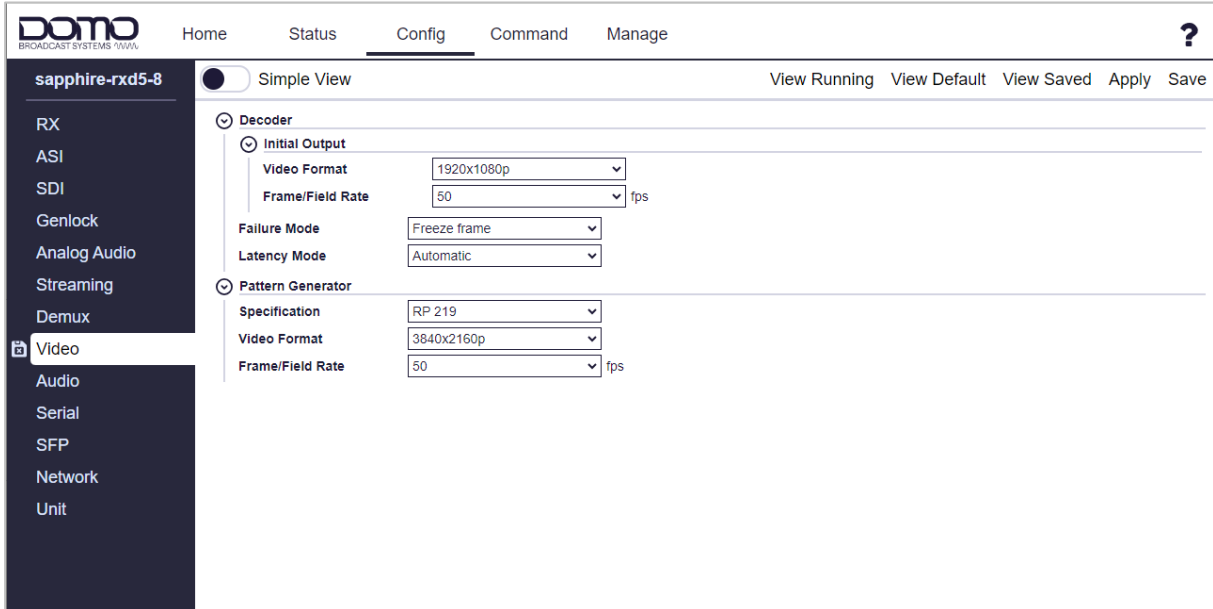
7.3 SDI Video

The SDI video outputs on the rear panel can be configured for 12G/6G/3G-SDI signals.

Go to the **Config>Video** page to configure the **Decoder** settings.

The **Pattern Generator** can be used to test the video through to the output stage of the system prior to receiving a live transmission.

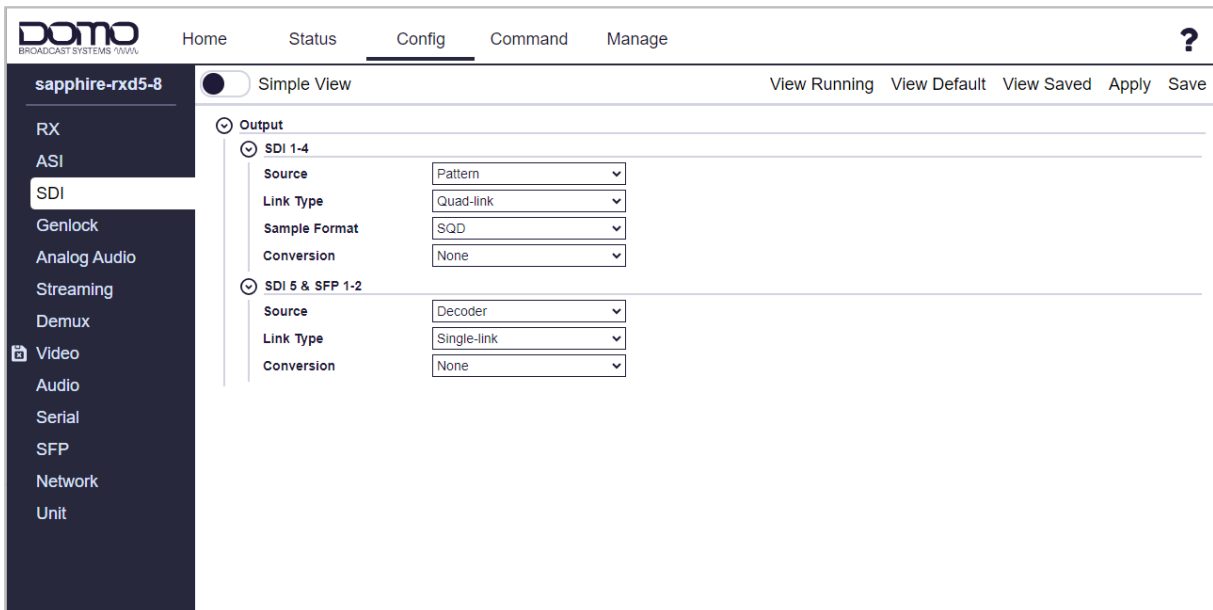
Click **Apply** to activate a running config and **Save** to retain.



Go to the **Config>SDI** page and configure the SDI output, these settings will depend on how the outputs will be viewed. If using the SFP port, an SFP adaptor must be fitted.

Set the **Source** to **Pattern** if testing the received video, or **Decoder** to view live video.

Click **Apply** to activate a running config and **Save** to retain.



SDI Output can be verified on the front panel touchscreen, and on the WUI **Status** and **Home** page.

The screenshot displays the Domo WUI Home page with the following sections:

- RF Input:** Shows a frequency of 2265.000 MHz, 16-QAM modulation, and a total rate of 18096464 bps. Individual channel rates are listed from 1 to 8, all at 0.0 dB.
- Service Select:** Shows '1 Service 1'.
- Video Decoders:** Shows HEVC 4:2:2 10 bit at 1920x1080i 50.000 fps.
- Audio Decoders:** Shows five MPEG-1 decoders, each at 448000 bps.
- PSU:** Shows 11.8 V.
- Temperature:** Shows 47.6 °C.
- SDI Output:** Shows five SDI channels (SDI 1-5) with their respective video test patterns and resolution (1920x1080p50).

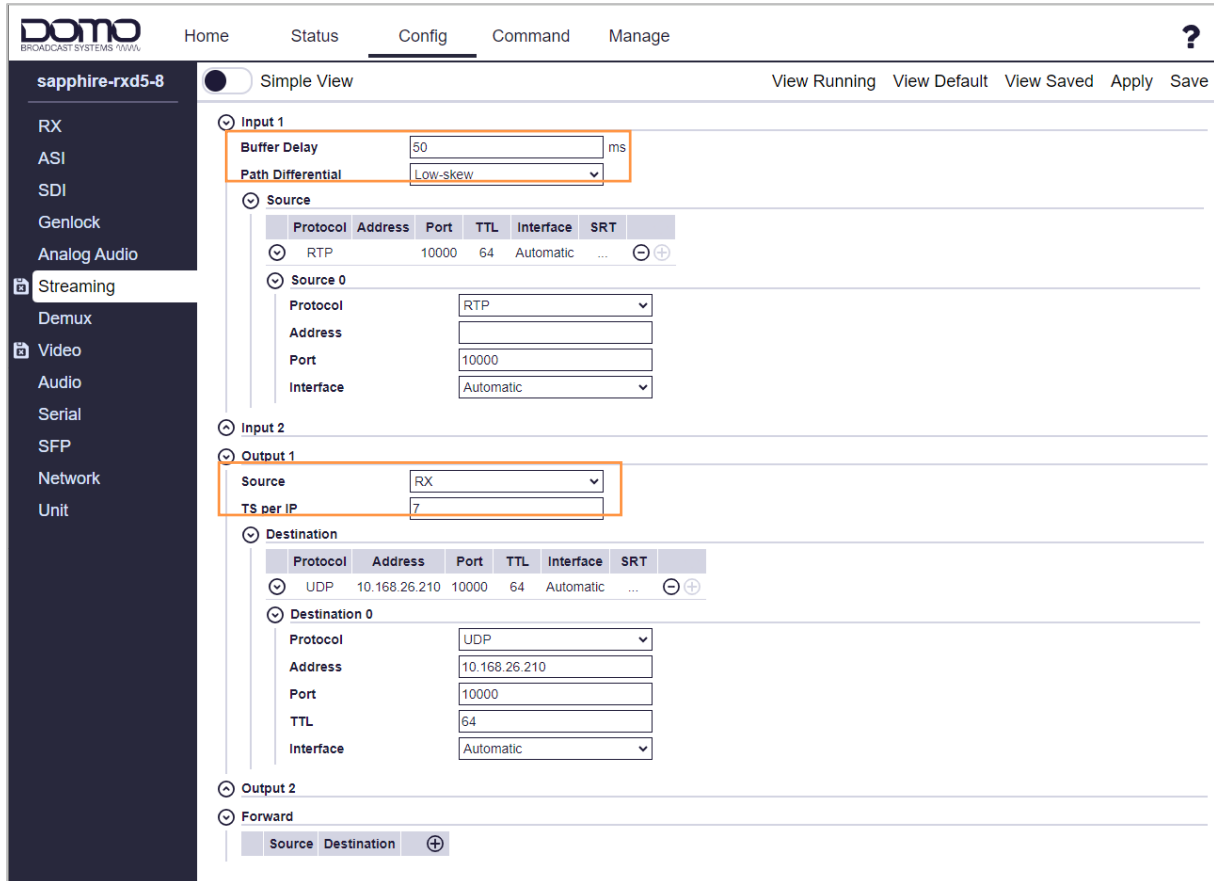
7.4 Streaming

7.4.1 Streaming Overview

Sapphire-RXD5 can be configured as an IP streaming input which can be used as a source for the ASI output, the Streaming output or the Demux service. Setting the Demux to Stream 1 or Stream 2 will allow you to decode from the IP input.

Go to the **Config>Streaming** page, click the **+** button to create new input/output settings. Two input/output streams can be applied for redundancy or in SMPTE 2022-7 networks, see *Section 7.5*.

Once settings have been entered, click **Apply** to activate a running config and **Save** to retain.



The screenshot shows the DOMO Streaming configuration interface for device 'sapphire-rxd5-8'. The 'Config' tab is active, and the 'Streaming' section is expanded. The 'Simple View' toggle is on. The 'Input 1' section is expanded, showing 'Buffer Delay' set to 50 ms and 'Path Differential' set to 'Low-skew'. Below this, the 'Source' section is expanded, showing a table with one entry: RTP, 10000, 64, Automatic. The 'Output 1' section is expanded, showing 'Source' set to 'RX' and 'TS per IP' set to 7. Below this, the 'Destination' section is expanded, showing a table with one entry: UDP, 10.168.26.210, 10000, 64, Automatic. The 'Forward' section is also visible at the bottom.

Note: Streaming status can be monitored in the **Status>Streaming** page, see *Section 7.4.4*.

Input/Output Settings

Item	Notes
Buffer Delay	IP packets can be received unevenly which causes jitter. This setting will make the flow of data smoother by adding a delay to the input stream.
Path Differential	The path differential (RTP only) is a delay difference between sources when there are different routes to the destination, for example in SMPTE 2022-7 systems, see <i>Section 7.5</i> .
Source	Set the source of the output stream. If using Stream 1 or Stream 2, ensure the input settings are configured.
TS per IP	The number of transport stream packets in each IP packet. Leave this at the default value of 7 unless an advanced user.

7.4.2 UDP/RTP IP Streaming

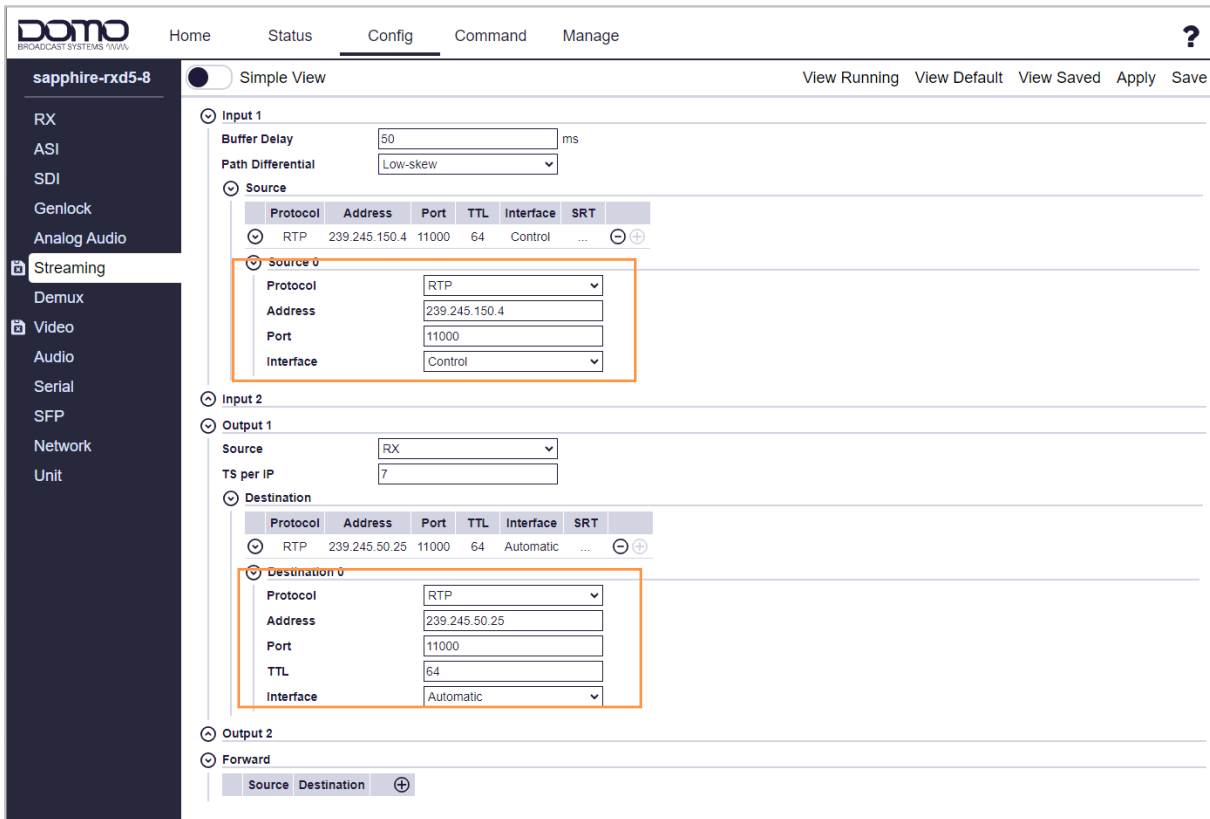
Unicast Streaming

Unicasting is one-to-one streaming between a sender and receiver. The Sapphire can be configured as an input, output, or both.

Item	Notes
Protocol	UDP, RTP or SRT. Note: SRT streaming requires additional settings, see Section 7.4.3 .
Address	When configuring an Input , it is not necessary to enter an address. When configuring an Output , enter the IP address of the destination device.
Port	Port numbers are used to identify IP address connections.
TTL	The time to live value limits how long data circulates in a system.
Interface	This will set the physical interface that the unicast is received on.

Multicast Streaming

Multicasting is one-to-many streaming between a sender and multiple receivers. The Sapphire can be configured as an input, output, or both.



Item	Notes
Protocol	UDP or RTP.
Address	Enter the multicast stream address that is being received or sent. The multicast address range is 224.0.0.0 to 239.255.255.255, see <i>Table 7-1</i> .
Port	Port numbers are used to identify IP address connections.
TTL	The time to live value limits how long data circulates in a system.
Interface	This will set the physical interface that the multicast is expected on. When multicast streaming, it is particularly important to select the actual interface being used.

Start Address	End Address	Description
224.0.0.0	224.0.0.255	Reserved for special well-known multicast addresses
224.0.1.0	238.255.255.255	Globally scoped (Internet-wide) multicast addresses
239.0.0.0	239.255.255.255	Administratively scoped (local) multicast addresses

Table 7-1: Multicast Address Uses

7.4.3 SRT Protocol

SRT (Secure Reliable Transport) is a video streaming transport protocol that delivers secure low latency streaming over noisy or unpredictable (lossy) networks such as the public internet. SRT utilises the UDP transport protocol but adds error checking for reliability.

If SRT streaming is required, the unicast settings will also need to be configured, see *Section 7.4.2*.

The screenshot shows the configuration page for 'sapphire-rxd5-8' in 'Simple View'. The interface includes a navigation sidebar on the left with categories like RX, ASI, SDI, Genlock, Analog Audio, Streaming, Demux, Video, Audio, Serial, SFP, Network, and Unit. The main content area is divided into sections for Input 1, Output 1, Output 2, and Forward. Under 'Input 1', there is a 'Buffer Delay' field set to 50 ms. Below it, a 'Source' table lists an SRT source with address 239.245.150.4, port 11000, TTL 64, and interface Control. Underneath, 'Source 0' settings are shown: Protocol SRT, Port 11000, TTL 64, Interface Control, and SRT Mode Listener with a Delay of 80 ms. Under 'Output 1', the 'Source' is set to RX and 'TS per IP' is 7. The 'Destination' table lists an SRT destination with address 10.168.28.89, port 22000, TTL 64, and interface Stream-A. Below, 'Destination 0' settings are shown: Protocol SRT, Address 10.168.28.89, Port 22000, TTL 64, Interface Stream-A, and SRT Mode Caller with a Delay of 500 ms. Orange boxes highlight the SRT Mode and Delay fields in both Source 0 and Destination 0 sections.

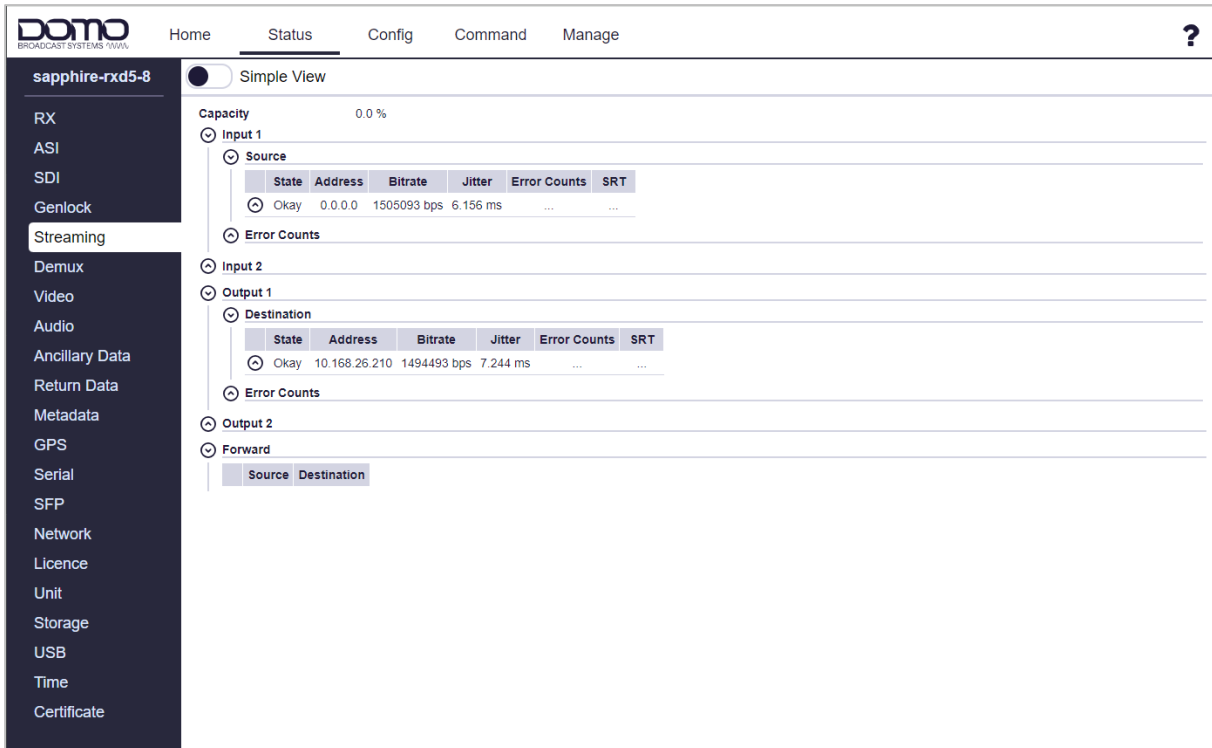
Item	Notes
Mode	<p>The Caller initiates the outbound call to the Listener. The Caller can be an input (receiver) or output (sender).</p> <p>The Listener waits for an inbound connection from the Caller. The Listener can be an input (receiver) or output (sender).</p> <p>Note: In a one-to-one setup, it is arbitrary whether the Caller and Listener device is the input or output. However, the input or output must be set to Listener if it is ingesting multiple Callers.</p> <p>A Rendezvous server will allow the delivery of messages from one source to another. This can be used to avoid port forwarding via a router.</p>
Delay	<p>The delay can be adjusted to account for dropped packets. The delay will depend on the round-trip time (RTT) and the packet loss. This is advised in the web page help guide.</p>

Item	Notes
Encryption Passphrase	<p>SRT includes an AES128 encrypted passphrase. This must be matched in the input and output device.</p> <p>If this is left blank, no encryption will be applied.</p>

7.4.4 IP Streaming Status

The streaming input and output status can be monitored in the **Status>IP Streaming** page.

Jitter and error count measurements are key performance indicators which can be corrected by adjusting buffer delay parameters in the setup.



The screenshot shows the 'IP Streaming Status' page for device 'sapphire-rxd5-8'. The interface includes a navigation menu on the left with options like RX, ASI, SDI, Genlock, Streaming (selected), Demux, Video, Audio, Ancillary Data, Return Data, Metadata, GPS, Serial, SFP, Network, Licence, Unit, Storage, USB, Time, and Certificate. The main content area shows 'Capacity' at 0.0% and several expandable sections:

- Input 1**:

State	Address	Bitrate	Jitter	Error Counts	SRT
Okay	0.0.0.0	1505093 bps	6.156 ms
- Output 1**:

State	Address	Bitrate	Jitter	Error Counts	SRT
Okay	10.168.26.210	1494493 bps	7.244 ms
- Output 2**: (Empty table)
- Forward**: (Empty table)

7.5 SMPTE-2022-7 Networks

The Sapphire-RXD5 receiver is SMPTE-2022-7 compliant. SMPTE 2022-7 IP networks allow for the recovery of lost packets by generating two streams with the same data using different routes to the destination. If a packet was lost at the receiver on path 1, the packet is taken from path 2 and vice versa. To be able to switch between path 1 and path 2 packets seamlessly, some buffering is needed to deal with the delay difference or jitter (can be observed in the **Status>Streaming** page).

The following diagram and screenshots provide an example setup.

Note: The example is for an Onyx Encoder and Decoder, but the settings will be the same for RXD5.

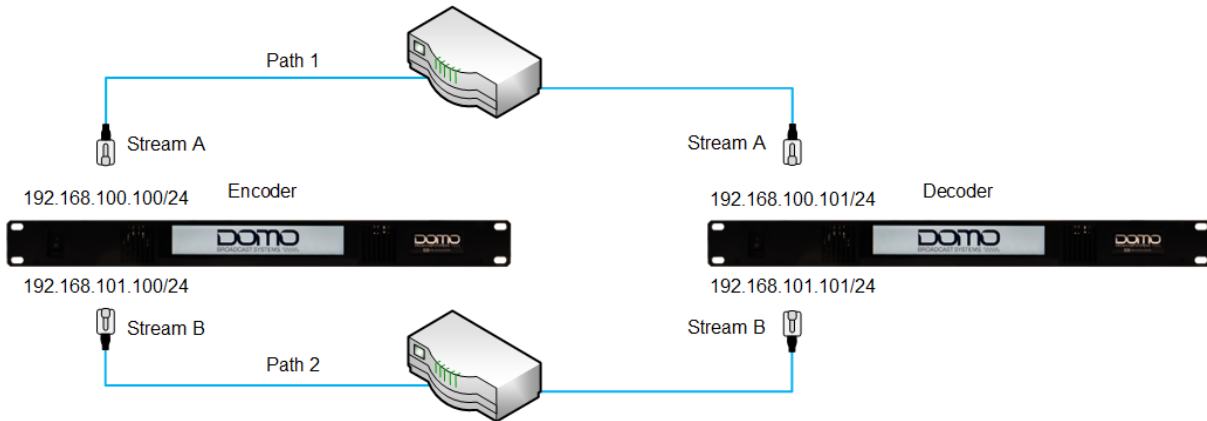
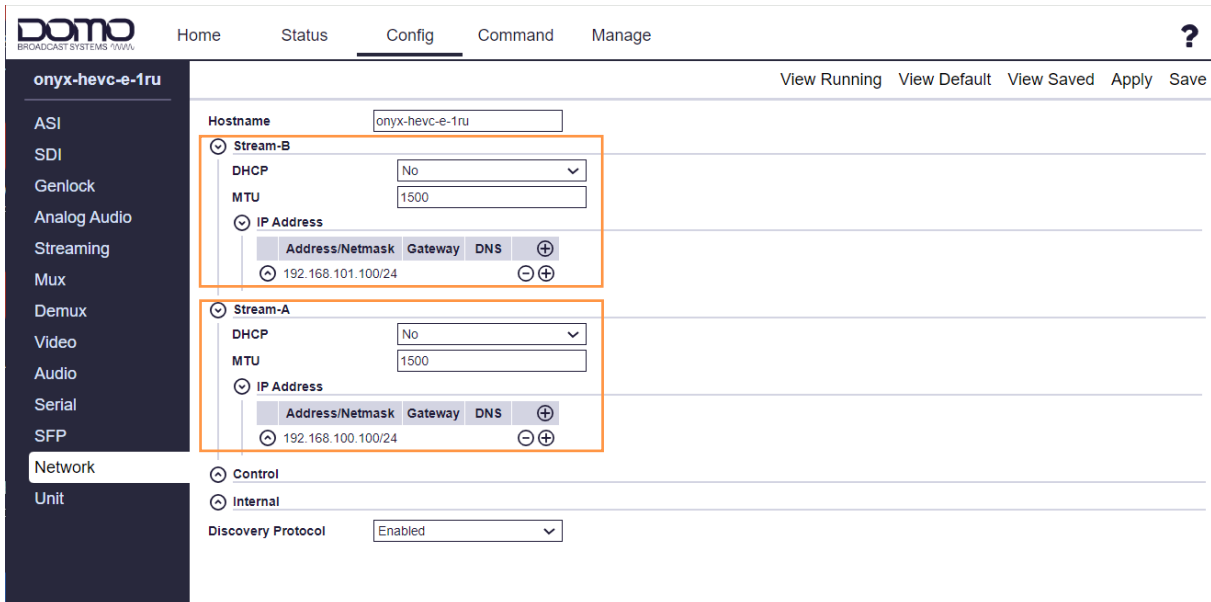


Figure 7-1: Example SMPTE 2022-7 System

Encoder Config>Network Settings

The Stream A and Stream B ports for the Encoder and Decoder are configured as per Figure 7-1.



Decoder Config>Network Settings

onyx-hevc-d-1ru

Home Status **Config** Command Manage

View Running View Default View Saved Apply Save

Hostname: onyx-hevc-d-1ru

Stream-B

DHCP: No

MTU: 1500

IP Address: 192.168.101.101/24

Stream-A

DHCP: No

MTU: 1500

IP Address: 192.168.101.101/24

Control

Discovery Protocol: Enabled

Encoder Config Streaming Settings

The encoder streams are both outputs and the streaming protocol must be **RTP**. In this example we are **unicasting**, therefore, the RTP address must point to the decoder.

onyx-hevc-e-1ru

Home Status **Config** Command Manage

View Running View Default View Saved Apply Save

Input 1

Input 2

Output 1

Source: ASI out

TS per IP: 7

Protocol	Address	Port	TTL	Interface	SRT
RTP	192.168.100.101	10100	64	Stream-A	...
RTP	192.168.101.101	10101	64	Stream-B	...

Output 2

Source: None

TS per IP: 7

Protocol	Address	Port	TTL	Interface	SRT

Forward

Source	Destination

Decoder Config>Streaming Settings

The decoder streams are both inputs and the streaming protocol must be **RTP**. In this example we are unicasting, therefore, the RTP address for the decoder can be left blank.

Adjust the **Path Differential** depending on the distance between the sources; buffer delay and path differential are explained in the WUI help guide and in *Section 7.4.1*.

The screenshot shows the configuration interface for the 'onyx-hevc-d-1r u' unit. The 'Config' tab is active. The 'Streaming' section is expanded, and 'Input 1' is selected. The 'Buffer Delay' is set to 50 ms, and the 'Path Differential' is set to 'Low-skew'. A table under 'Source' lists two RTP streams:

Protocol	Address	Port	TTL	Interface	SRT
RTP		10100	64	Stream-A	...
RTP		10101	64	Stream-B	...

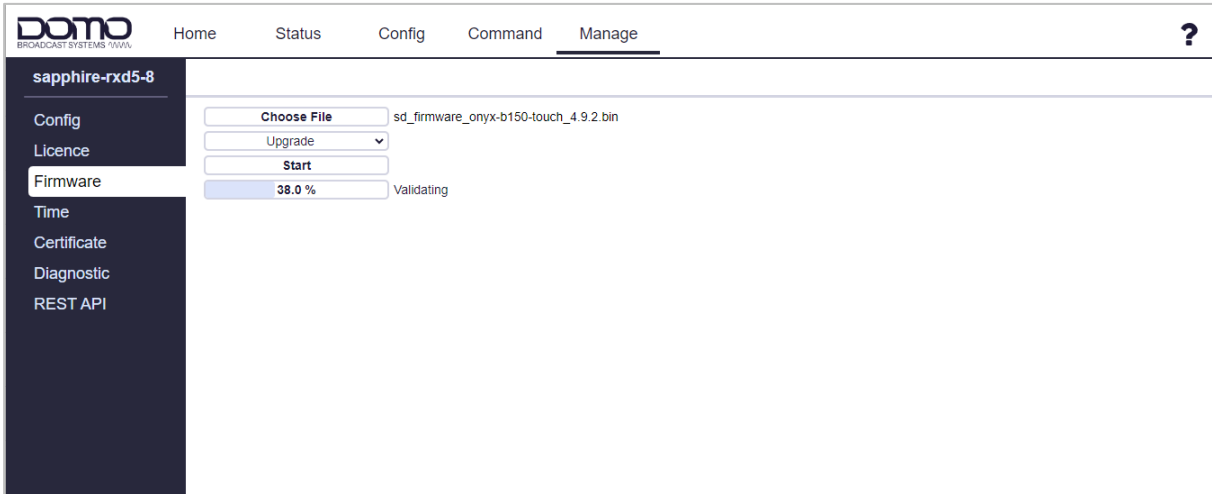
Below the 'Source' table, there are sections for 'Input 2', 'Output 1', 'Output 2', and 'Forward'. The 'Forward' section has a 'Source' and 'Destination' field with an expand icon.

7.6 Firmware Upgrade

When firmware updates are required, DBS will make them available on WatchDox, see *Section 9.1*. Upgrades may be required for the codec (**b150**) and the demod (**D380**). If both files require upgrade, the codec must be uploaded first. A reboot is required on completion of the upgrade.

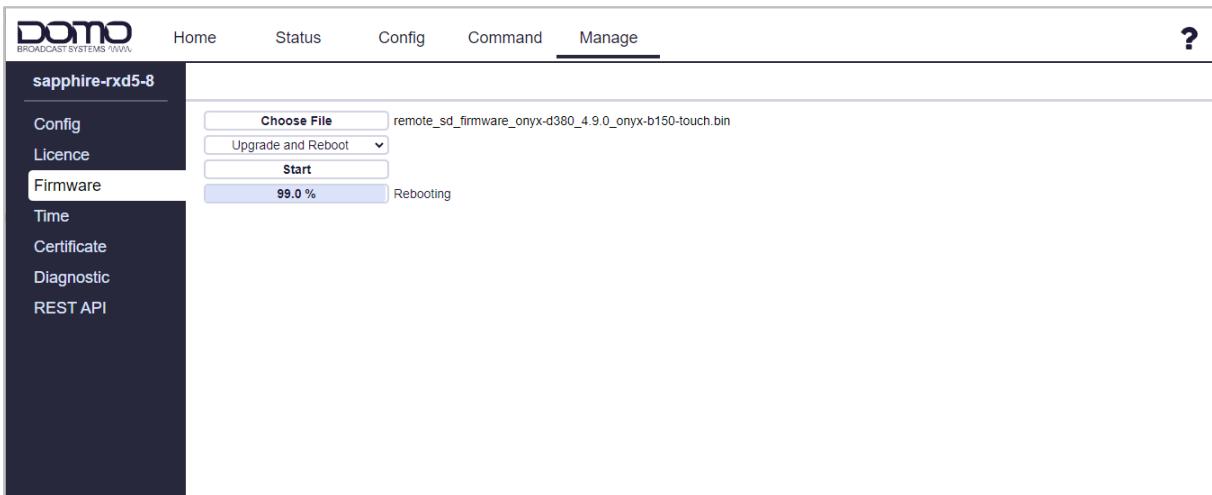
Go to the **Manage>Firmware** page. Select **Choose File** and browse to the *sd_firmware_onyx-b150-touch_x.x.x.bin* file. Set to **Upgrade** and click **Start**. The upgrade status will update accordingly.

Note: If only the codec upgrade is needed, this can be set to **Upgrade and Reboot**.



When the upgrade has completed, the status will read **100% Ready** or will reboot if Upgrade and Reboot was selected.

If the demod requires upgrade, select **Choose File** again and browse to the *remote_sd_firmware_onyx-d380_X.X.X_onyx-b150-touch.bin* file. Set to **Upgrade and Reboot** and click **Start**.



When the upgrade has completed, the unit will reboot. Firmware versions can be verified in the **Status>Unit** page.

8. Appendix A: Reference Material

8.1 How to Configure a PC IP Address

The following guide will tell you how to configure a PC or laptop IP address so that it matches the IP address range of the unit you are connected to. This is important because if they don't match, you will not be able to communicate with your device.

The IP address range given in this example is a good one to use if you are unsure.

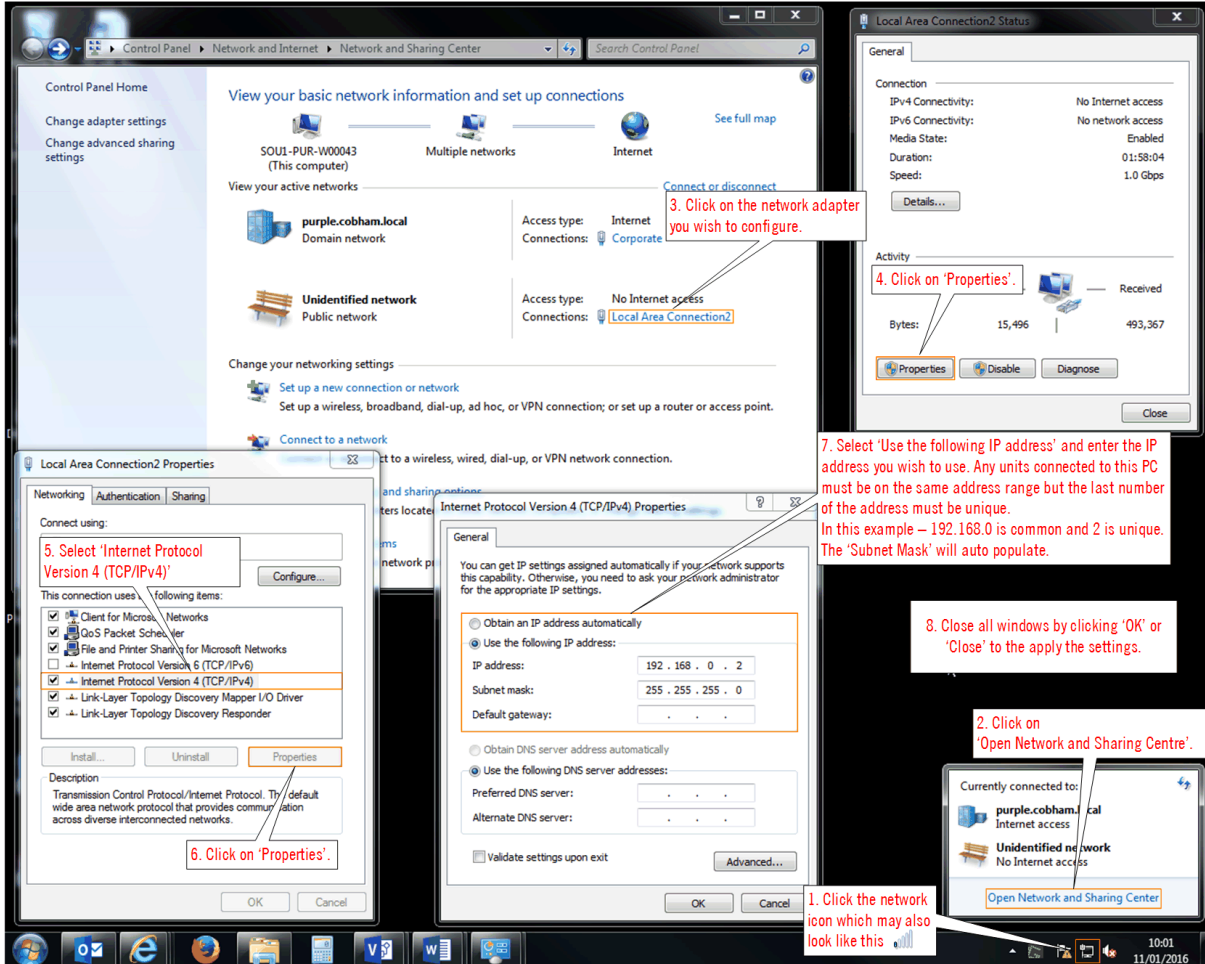


Figure 8-1 How to configure a PC IP address

8.2 CIDR with Subnet Mask

CIDR	Subnet Mask
/32	255.255.255.255
/31	255.255.255.254
/30	255.255.255.252
/29	255.255.255.248
/28	255.255.255.240
/27	255.255.255.224
/26	255.255.255.192
/25	255.255.255.128
/24	255.255.255.0
/23	255.255.254.0
/22	255.255.252.0
/21	255.255.248.0
/20	255.255.240.0
/19	255.255.224.0
/18	255.255.192.0
/17	255.255.128.0
/16	255.255.0.0

CIDR	Subnet Mask
/15	255.254.0.0
/14	255.252.0.0
/13	255.248.0.0
/12	255.240.0.0
/11	255.224.0.0
/10	255.192.0.0
/9	255.128.0.0
/8	255.0.0.0
/7	254.0.0.0
/6	252.0.0.0
/5	248.0.0.0
/4	240.0.0.0
/3	224.0.0.0
/2	192.0.0.0
/1	128.0.0.0
/0	0.0.0.0

9. Appendix B: After Sales Support

9.1 Documentation and Software

It is DBS's practise to make the majority of our latest user guides and software available to customers online, by using our WatchDox facility. To access this site, please contact your Account Manager or send a request to support@domobroadcast.com.

You will be sent a link where you can log in and create your own password followed by a confirmation email. Once you have done this, you can then log in to your account.

9.2 Contact Technical Support

The Technical Support team can be accessed by one of the following:

- **Phone:** +44 1489 566 750
- **Email:** support@domobroadcast.com (no restricted content)

9.3 Using the DBS RMA Service

9.3.1 Contact DBS

If there is a problem and our technical support team have been unable to resolve the issue, email support@domobroadcast.com to request a Return Material Authorisation (RMA) form.

9.3.2 Complete and Return the RMA Form

Complete and return the RMA form including a detailed description of the problem.

When the hub receives the completed form, an RMA number and shipping instructions will be sent.

9.3.3 Pack the Device

Note: Before packing, remove all personal non-DBS kit or media from the device.

Use the original shipping container and packing materials, if possible.

If the original packing materials are not available, wrap the equipment with soft material (e.g., PU/PE form) then put the wrapped equipment into a hard cardboard shipping box.

9.3.4 Mark the Box and Send to DBS

Clearly mark the outside of the shipping box with the RMA number and send the box using your normal process.

10. Appendix C: Safety and Maintenance

Note: The following guidelines may or may not be applicable to your product. However, we would ask that you read them to assess their relevance.

10.1 Cautions and Warnings

Area	Note
Aircraft safety	<p>Use of this equipment on board aircraft is strictly forbidden without the required testing and qualification for aircraft type.</p> <p>Use of radio transmitter equipment in an aircraft can endanger navigation and other systems without appropriate testing, or carry-on certification by a competent certified body.</p>
Cables	Connecting cables should not be positioned where they are likely to become damaged or where they may present a trip hazard.
Electrostatic discharge	ESD guidelines must be followed for this electrostatic sensitive device.
Enclosures	<p>Do not remove any factory installed screws or fastenings as this may void any warranties.</p> <p>There are no functions that require the user to gain access to the interior of the product. There are no user serviceable parts inside.</p>
Environment	The equipment should not be used in hazardous or corrosive atmospheres. Users are reminded of the necessity of complying with restrictions regarding the use of radio devices in fuel depots, chemical plants, and locations where explosives are stored and/or used.
Lightning strike	There is a risk of lightning strike to antennas. The equipment should not be assembled in an area at the time of lightning activity. Antennas should be adequately protected from lightning strikes.
Power supply	Ensure that the power supply arrangements are adequate to meet the stated requirements of each product. Observe all electrical safety precautions.
Risk of eye injury	Care should be taken to avoid eye contact with the antennas.
RF emissions	When using this device please ensure 20cm is maintained between your device and your body while the device is transmitting.
Thermal control system	<p>If you operate this device in an enclosed space, you must ensure it has adequate airflow to keep it cool.</p> <p>If worn close to the body, care must be taken to protect the operator from excessive temperatures.</p>
Working at height	Observe caution when locating the device at height, for example on a mast. Ensure the unit is well secured to prevent it falling and injuring personnel.

10.2 Repairs and Alterations

Attempted repairs, alterations, improper installations, or connections may invalidate the warranty.

Please contact Technical Support if you suspect a faulty or defective component. See *Section 9.2*.

10.3 Caring for your Equipment

- Do not subject the unit to physical abuse, excessive shock or vibration
- Do not drop, jar or throw the unit
- Do not carry the unit by the antenna
- Avoid exposure to excessive moisture or liquids
- Do not submerge the unit unless it is designed to be submersible
- Do not expose the unit to corrosives, solvents, cleaners or mineral spirits
- Avoid exposure to excessive cold and heat
- Avoid prolonged exposure to direct sunlight
- Do not place or leave units on surfaces that are unstable
- Only use accessories intended for the specific make and model of your unit, especially batteries, chargers, and power adapters.

10.4 Charging

- Use approved batteries, chargers and adapters designed specifically for your make and model unit
- Do not attempt to charge a wet unit or battery pack
- Do not charge the unit or battery pack near anything flammable
- Stabilize the battery pack to room temperature (22°C) before charging
- Do not charge units and/or battery packs on wet or unstable surfaces
- Do not leave units and/or batteries in chargers for excessive periods

10.5 Working with Lithium Batteries

- Charge only with the approved charging cable
- Batteries are to be used only for the specified purpose. Incorrect use will invalidate the warranty and may make the battery become dangerous.
- Charge in a clean, dry environment ideally at 10°C (0 to 45°C is permissible).
- Do not store or operate in direct sunlight for extended periods. Battery can be damaged by over-heating, for example if placed on the rear parcel shelf of a motor vehicle.
- Store in a cool dry environment. Storage at elevated temperatures can cause permanent loss of capacity.
- For short term storage (less than six months), store in a fully charged state.
- For extended periods of storage (more than one year), charge before storage and recharge every six to nine months.
- Always fully recharge the battery after any storage period greater than one month before use.
- Do not store the battery with the charge depleted as this can cause failure of the battery and invalidate warranty.
- Do not short circuit
- Do not immerse in water
- Do not incinerate. Cells are likely to explode if placed in a fire.
- Dispose of batteries in accordance with the regulations in place for the country of use. Batteries are normally considered separate waste and should not be allowed to enter the normal waste stream. Either return to the seller or deliver to an approved re-cycling facility.

10.6 Cleaning

- Turn off the unit and remove batteries (if applicable) before maintenance
- Use a clean, soft, damp cloth to clean the unit. A microfiber cloth is recommended.
- Do not use alcohol or cleaning solutions to clean the unit
- Do not immerse the unit in water to clean it
- If the unit becomes wet, immediately dry it with a microfiber or other lint-free cloth

10.7 Storage

- Turn off the unit and remove batteries before storage
- Store units and battery packs in a cool, dry area at room temperature (22°C)
- Do not store units and/or batteries in active chargers