

Resource Identifier: 100123

Revision 1.0

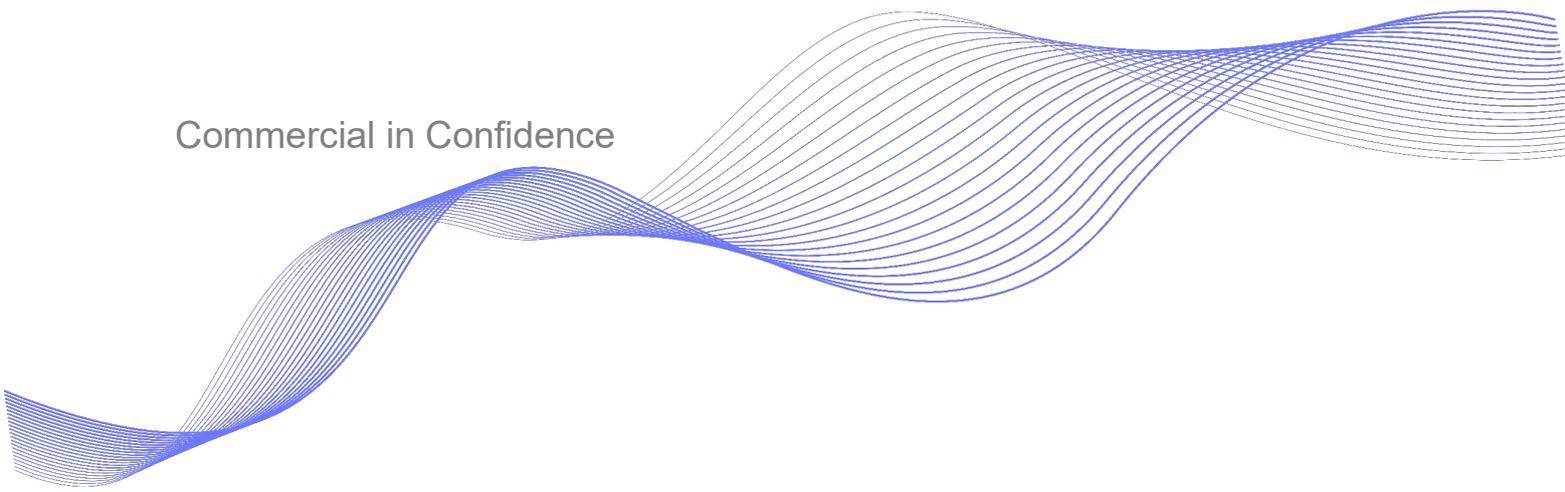


For the
moments
that matter

Sapphire-RXD3 Setup Guide



Commercial in Confidence



0. Preface

0.1 About this Document

This document contains relevant information required to identify and install the equipment or system. Basic configuration settings are provided for typical operation.

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

0.2 Intended Audience

This document is for anyone interested in how the system can be used, but it is of most benefit to:

- Operators who oversee the daily operation of the equipment
- Installers who are responsible for the pre-installation, on-site installation and configuration of the system in the end-user environment
- Maintainers who are responsible for maintaining the equipment or system

0.3 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.

0.4 Text Conventions

This document uses these conventions to identify text that has a special meaning:

Description	Example
Text in capitals represents a key press on a keyboard. The + sign means hold down the first key and press the second key.	ESC, F1, SHIFT CTRL+C
<Text> Serves as a placeholder for variable text that is replaced as appropriate, the text may be written in italics.	Use the filename <system_name>.sys for...
Text in italics can represent a link to a place in the existing document (often these are hyperlinks) or a reference to another document.	Refer to <i>Section 0.4, Text Conventions</i> .
Text in bold emphasises a term of significance.	We call this a protocol and its function is...
Successive software menu selections are shown using arrows to indicate sub-menus. This is often shown in bold.	Select Presets>Streamers then edit...

0.5 Symbols

These symbols are used to highlight important information.

WARNING: A notice of when a situation may result in personal injury or loss of life, or destruction of equipment.

CAUTION: A notice of when a situation may result in loss of data or damage to equipment or systems.

Note: A notice to draw attention to something or to supply additional information.

0.6 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.

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0.7 Related Documents

All DTC documents can be downloaded from WatchDox. See *Section 8.1*.

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.

0.8 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	Author	Summary of Changes
1.0		IR	First release

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1. Product Overview

1.1 Description

Sapphire-RXD3 is a Broadcast quality HEVC receiver decoding system, combining class-leading RF technology with Ultra Low-Latency HEVC decoding, presented in a compact ½ 19" chassis.

The Sapphire-RXD3 cleverly combines an 8-way diversity COFDM receiver and DBS' Sapphire Ultra-Low Latency HEVC decoder in a single 2RU ½ 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 should choose the Sapphire-RXD3D which includes H.264 HD decoding.

8-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 HDR reinsertion, video interfaces are 12G capable. A monitoring port can be provided on SFP which can be down-sampled to HD in the case of a 4K signal.

Sapphire-RXD3 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-RXD3 has a unified web-browser control interface for remote control.

Local control is achieved with a single touch screen 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-RXD3 enables onward streaming of video and audio and supports multiple streaming formats including SRT. Timecode and HDR signalling are also fully supported. The Sapphire-RXD3 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
Dimensions	½ 19" rack 2RU
Weight	4kg

Note: Detailed technical specifications are given in the product datasheet. Please see <https://www.domobroadcast.com>.

1.3 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 are 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 DTC. See *Section 8.2*.

2.2 Variants

This part number will identify the product; it is also on the label.

Part Number	Description
SAPPH-RXD3-2	Sapphire RX HEVC decoder 2-way diversity
SAPPH-RXD3-4	Sapphire RX HEVC decoder 4-way diversity
SAPPH-RXD3-6	Sapphire RX HEVC decoder 6-way diversity
SAPPH-RXD3-8	Sapphire RX HEVC decoder 8-way diversity
SAPPH-RXD3D-2	Sapphire RX HEVC/H.264 decoder 2-way diversity
SAPPH-RXD3D-4	Sapphire RX HEVC/H.264 decoder 4-way diversity
SAPPH-RXD3D-6	Sapphire RX HEVC/H.264 decoder 6-way diversity
SAPPH-RXD3D-8	Sapphire RX HEVC/H.264 decoder 8-way diversity

2.3 Parts List

These items will be in the package.

Part Number	Description
Primary unit	Sapphire-RXD3/D Receiver (see Variants above)
CA4065	120W 12VDC PSU to XLR

2.4 Licensing

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

Description	Included/Optional
M50 Decoder	Included
RX	Included
Pass-through	Included – RXD3D only
IP Streaming	Optional
IP Redundancy	Optional
UHD 4K	Optional

3. Connections, Controls and Indicators

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 LED	The power LED will illuminate when power is on.
2	Power on/off switch	It is recommended to use the power switch to power the device On or Off.
3	Touchscreen display	When fully booted (approx. 90s), the touchscreen display can be used to monitor and configure some of the most used features. See <i>Section 4</i> for a description of operation. Note: The web user interface can be used for more detailed configuration of the Sapphire-RXD3.

3.3 Rear Panel



No.	Item	Notes
1	XLR 4-way jack	Connect the supplied PSU (CA4069) for 12V power. See <i>Section 3.4.1</i> for pinout. 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.
2	SFP+ cage	SFP provides a video output for monitoring. Supports 12G-SDI, 6G-SDI or 3G-SDI video formats.
3	HD-BNC socket	SDI output 1. Supports 12G-SDI, 6G-SDI or 3G-SDI video formats.
4	HD-BNC socket	SDI output 2. Supports 12G-SDI, 6G-SDI or 3G-SDI video formats.
5	HD-BNC socket	SDI output 3. Supports 3G-SDI video formats.
6	HD-BNC socket	SDI output 4. Supports 3G-SDI video formats.
7/8	RJ45 jack	Gigabit Ethernet connection for web user interface control or IP streaming. Note: The CTRL and STREAM labels are notional and are used to differentiate the connections.
9	BNC socket (50Ω)	RF input from a downconverter/antenna assembly. Up to eight antennas can be fitted for maximum receive diversity depending on variant.
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 output.

No.	Item	Notes
12	BNC socket (75Ω) Note: This is not valid for the RXD3 variant and will be plugged.	The packet diversity input (PKT IN) 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.
13	XLR 3-way jack (pins)	Audio stereo line level audio output left. See <i>Section 3.4.3</i> for pinout.
14	XLR 3-way jack (pins)	Audio stereo line level audio output right. See <i>Section 3.4.3</i> for pinout.
15	Hirose 4-way jack (pins)	RS-232 data port. See <i>Section 3.4.2</i> for pinout.

3.4 Pinout

3.4.1 Power

Mating part: Neutrik NC4FX

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

3.4.2 Data

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

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

3.4.3 Audio

Mating part: Neutrik NC3FX

Pin	Function
1	0V
2	AUD OUT+ (L/R)
3	AUD OUT- (L/R)

4. Front Panel Touchscreen Control

4.1 Power

The Sapphire-RXD3 requires 12VDC power which can be supplied via the supplied mains PSU. There is a power switch on the front panel which can be used to power On/Off the unit.

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

4.2 Introduction

The Sapphire-RXD3 has a front panel touchscreen which can be used to monitor and control the device without the need to connect to a PC device.

When the unit has fully booted, the front panel touchscreen will display the home screen and the power LED will be illuminated.

Press the lock symbol, indicated below, for 5 seconds to lock the screen, if required.

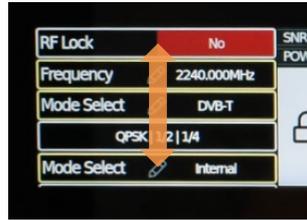


The home screen will show colour-coded information and is divided into two zones, **Left** and **Right**.

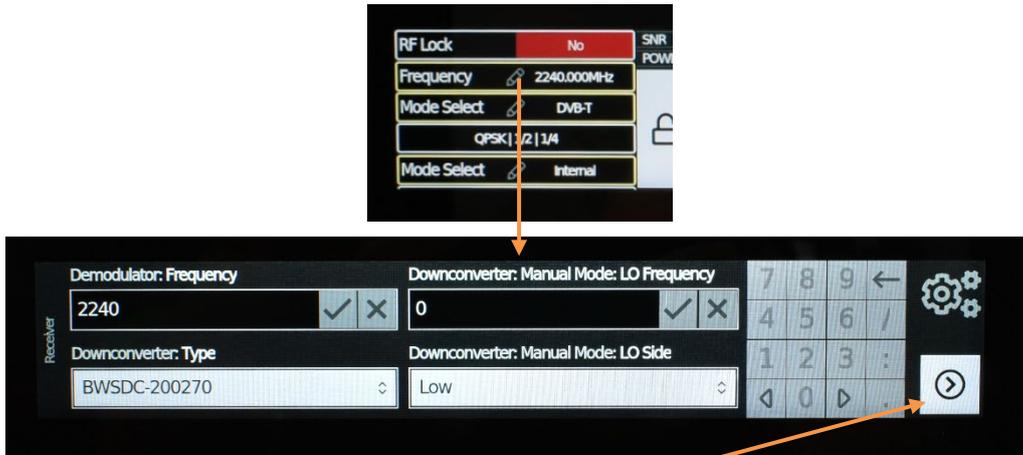


4.3 Touchscreen Left Zone

The left zone holds key information about the RF and genlock settings and 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.

4.4 Touchscreen Right Zone

The right zone displays the SNRs and levels for the received signals with a colour-coded bar graph.



Further information 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-RXD3 to factory settings.

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

The sequence of screenshots shows the following information:

- Top Screenshot:** RF Lock: No; Frequency: 2240.000MHz; Mode Select: DVB-T; QPSK | 1/2 | 1/4; Mode Select: Internal. SNR and Level display for Demodulator 1.
- Second Screenshot:** RF Lock: No; Frequency: 2265.000MHz; Mode Select: DVB-T; 16-QAM | 3/4 | 1/2; HEVC | 422 | 108i. Video test pattern and MPEG1 bitrate display (all Locked).
- Third Screenshot:** RF Lock: No; Frequency: 2240.000MHz; Mode Select: DVB-T; QPSK | 1/2 | 1/2; Mode Select: Internal. Network information table:

Network Information				Current Gateway
Name	Dynamic	Address	Netmask	Scope
Control	Yes	10.168.28.86	24	Global
Control	No	fe80:761a:e0ff:fe8f:21ce	64	Link local
Internal	No	169.254.1.1	24	Global
Internal	No	fe80:20ecc0:fffe:89d0:fc	64	Link local

Additional info: Running Version: onyx-b130-touch_1.19.1
- Bottom Screenshot:** RF Lock: No; Frequency: 2240.000MHz; Mode Select: DVB-T; QPSK | 1/2 | 1/2; Mode Select: Internal. A "Restore Defaults" button is visible.

5. Web Browser Control

5.1 Power

The Sapphire-RXD3 requires 12VDC power which can be supplied via the supplied mains PSU. There is a power switch on the front panel which can be used to power On/Off the unit.

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

5.2 Introduction

The Sapphire-RXD3 has a comprehensive web user interface (WUI) for detailed monitoring and control. The WUI is accessed via a web browser using the IP address of the Sapphire, so an Ethernet connection from the **CTRL** or **STREAM** 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-RXD3 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 the web interface (see *Section 5.3.4*), or via the touchscreen (see *Section 5.3.2*).

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 7.1* to find out how to do this.

5.3 IP Address Identification/Configuration

5.3.1 Device Finder

DBS' **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 DTC's WatchDox facility, see *Section 8.1*. 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.

BWS Device Finder				Help
10.168.26.150	Rack_Encoder	abaa4887	v3.2	Open
10.168.26.151	Rack_Decoder	2592fd7d	v3.2	Open
10.168.26.152	Test_Encoder	5b4d88d8	v3.0	Open
10.168.26.20	0x42656e	40020000015df6a7244044c5	onyx-b150-touch_Y:	Open
10.168.26.205	adams-b150	40020000014c168935114445	ruby-b150_Y80fde0	Open
10.168.26.206	b150	40020000014c168935114485	ruby-b150_1.20.0	Open
10.168.26.210	sapphire-rxd3d-8	40020000015228422d608645	onyx-b150_Y30e21f	Open
10.168.26.62	jade-cm3	0000000e439b1a8	jade-cm3_Y58ab2a:	Open
10.168.26.63	onyx-hevc-d-1ru	40020000015228422d10c105	onyx-b150_1.16.1	Open
10.168.26.81	b150	40020000015144232cc0e245	onyx-b150_1.19.1	Open
10.168.28.62	onyx-hevc-d-1ru	40020000015228422d10c105	onyx-b150_1.16.1	Open
192.168.3.101	0x42656e	40020000015df6a7244044c5	onyx-b150-touch_Y:	Open

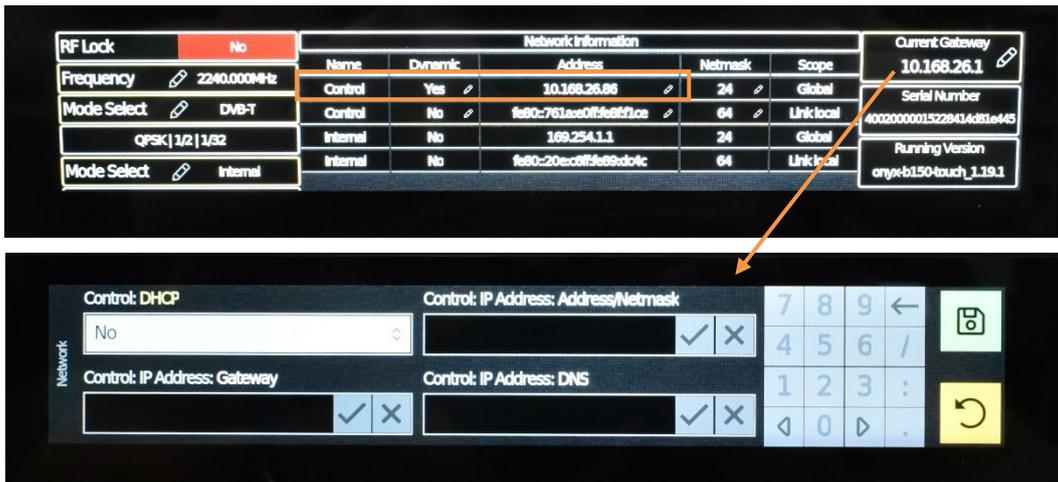
5.3.2 Front Panel Touchscreen

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 right zone to find the **Network Information** page. If the Ethernet cable is attached to the CTRL port, the IP address will appear adjacent to the **Control** parameter (highlighted below). If the Ethernet cable is attached to the Stream port, the IP address will appear adjacent to the **Stream** parameter.

The IP settings can be edited by pressing the **Current Gateway** parameter.

Note: Some IP parameters indicated with the pencil are not currently active and are for future development.



5.3.3 IPv6 Address

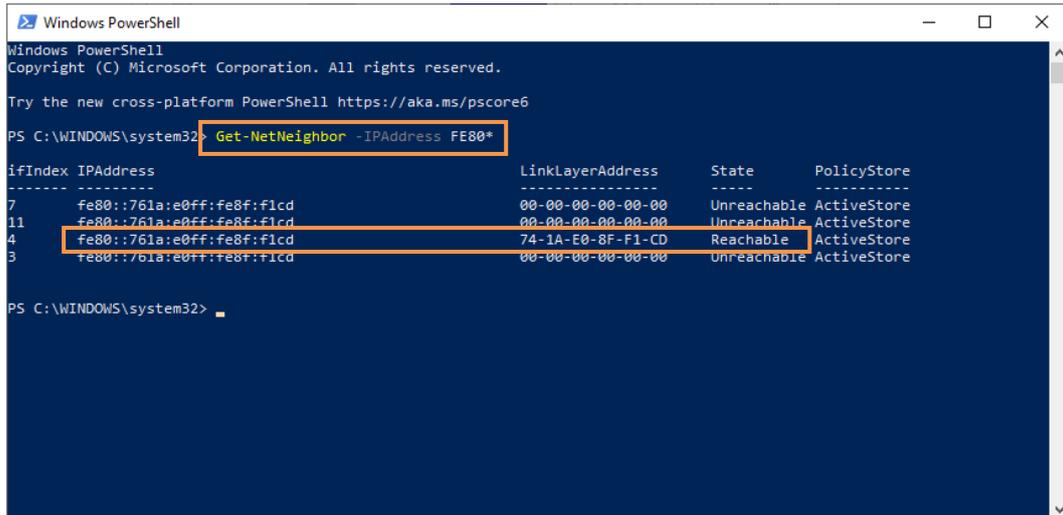
DBS products support link-local IPv6 addressing. This will allow web browser control if the device is not connected via a DHCP server, or the IP address does not match the subnet of the PC and the IP address settings need to be changed.

The IPv6 address of the Sapphire-RXD can be discovered from the front panel touchscreen, see [Section 5.3.2](#) above.

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

Get-NetNeighbor -IPAddress FE80*

The IP address for the Sapphire-RXD3 must have a **Reachable** state.



```

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

Try the new cross-platform PowerShell https://aka.ms/pscore6

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

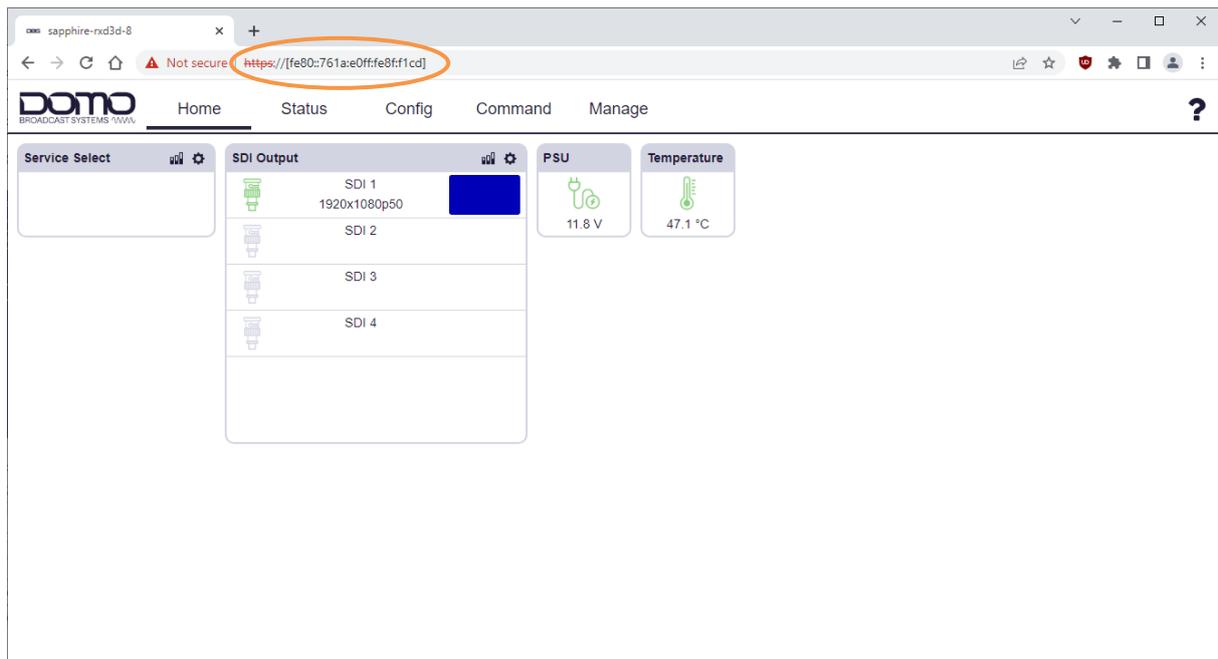
PS C:\WINDOWS\system32>

```

Once the IPv6 address has been discovered, 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])

Note: If this is the first time the web interface has been opened, follow the prompts explained in [Section 5.4](#).



5.3.4 IP Address Configuration via 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.

The screenshot shows the configuration page for 'sapphire-rxd3d-8'. The 'Control' section has 'DHCP' set to 'No'. Under 'IP Address', the 'Address/Netmask' is '192.168.0.15/24'. The 'Stream' section has 'DHCP' set to 'No'. The 'Internal' section has 'DHCP' set to 'No'. The 'Save' button is circled in red with a question mark icon pointing to it.

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.

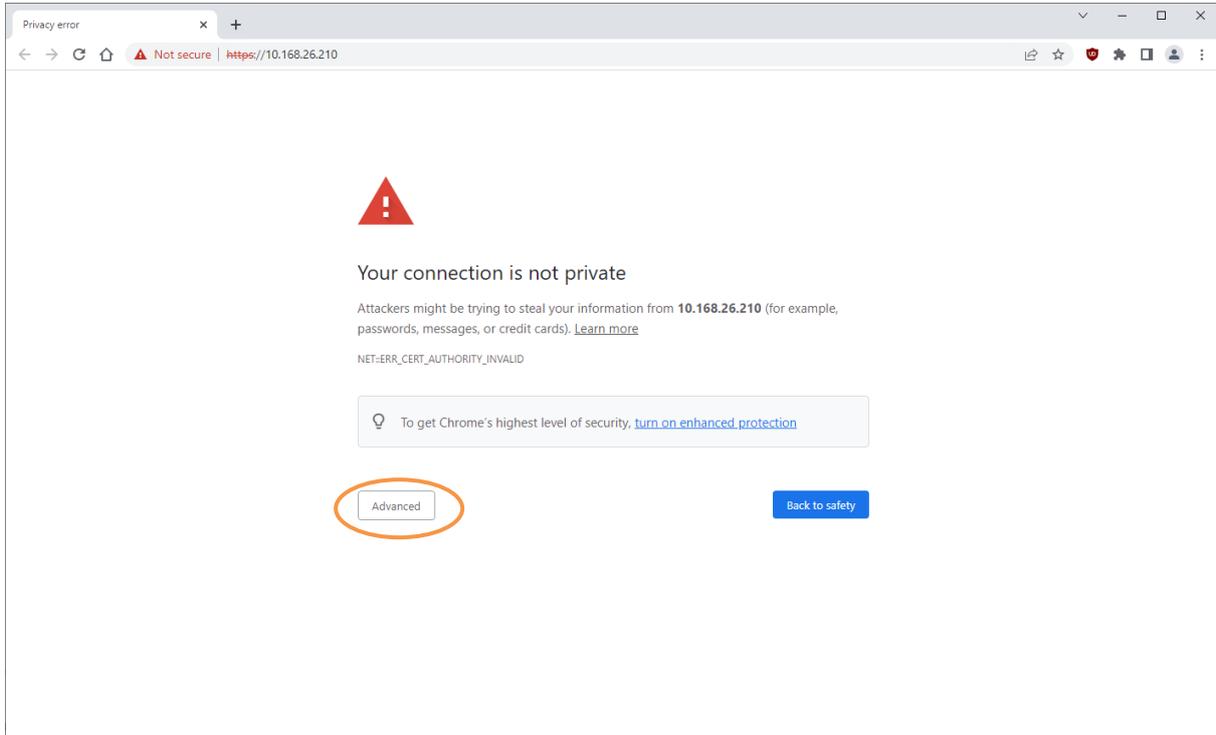
For example, an IP address 192.168.0.15 with a netmask of 255.255.255.0 would be written in CIDR notation as 192.168.0.15/24, where the first 24-bits of the IP address are masked. See *Section 7.2* for a table of subnets mapped to CIDR values.

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

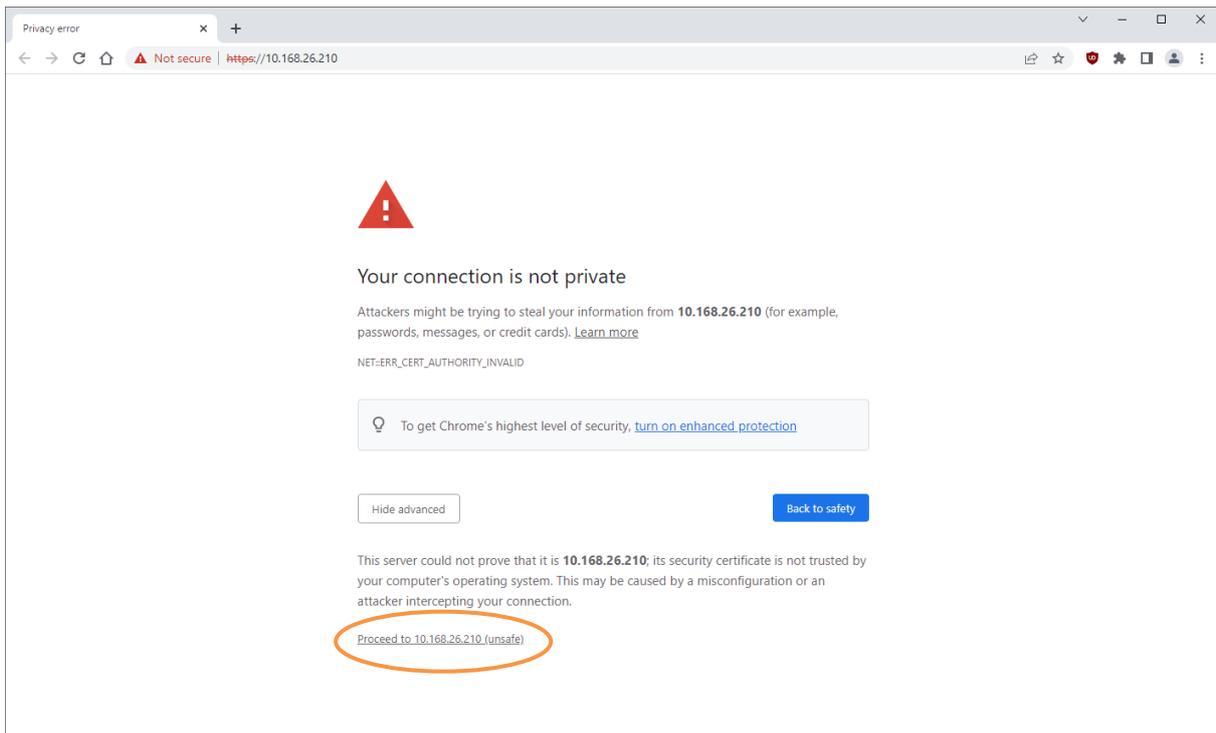
5.4 Open Web Interface

Once the IP address has been confirmed, open a web browser on a PC device and enter the IP address of the Sapphire-RXD3 in the address bar. Alternatively, if running Device Finder, click **Open** on the line of the device address.

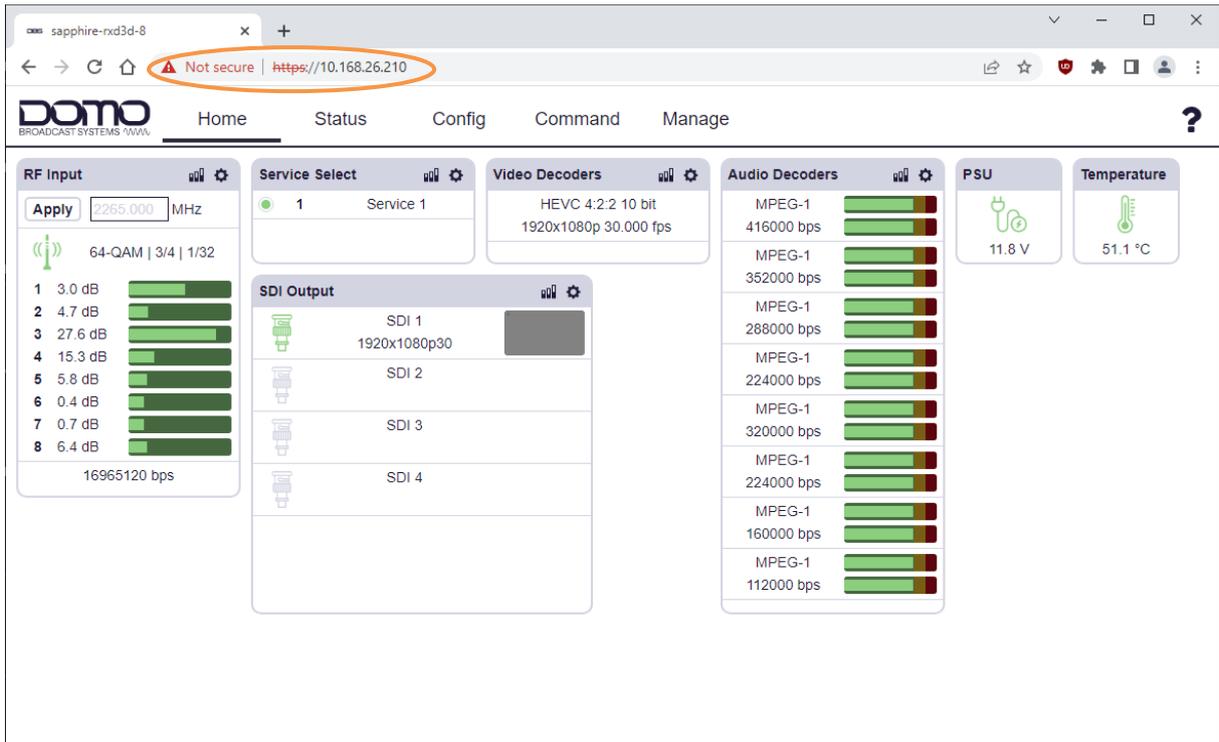
DBS devices have a pre-installed self-signed HTTPS certificate, the first time web communications are established, it will be necessary to trust the address. The presentation of the web page will differ depending on the browser application; the following example is Google Chrome. Click on **Advanced**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



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



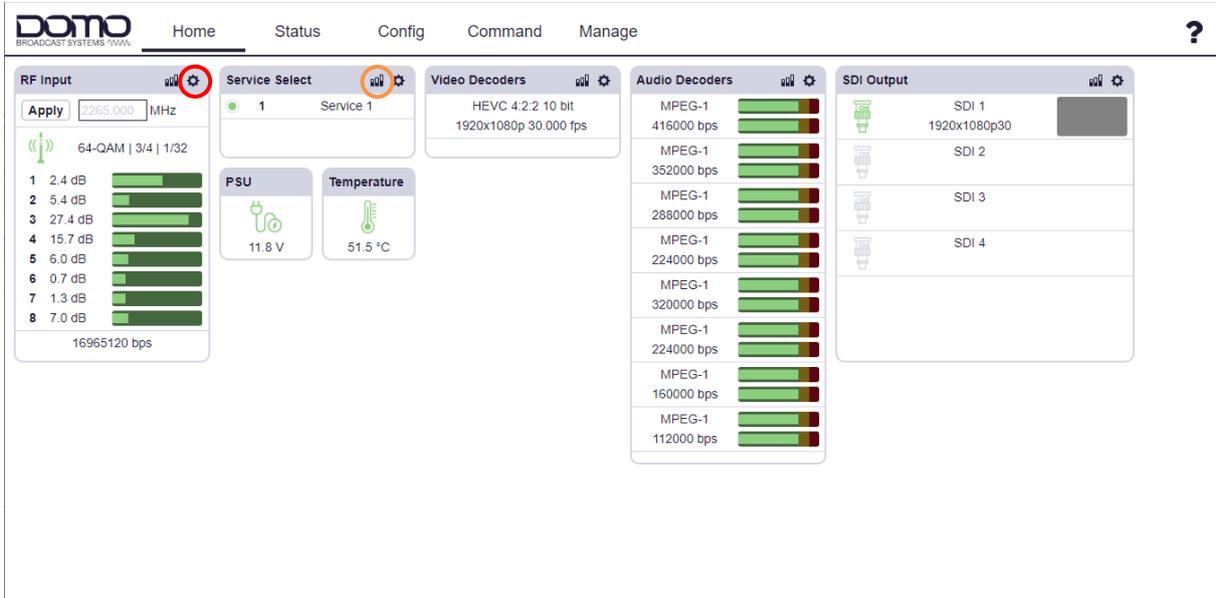
The browser will indicate that the site is connected by HTTPS but is not secure.



5.5 Web User Interface Overview

5.5.1 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).

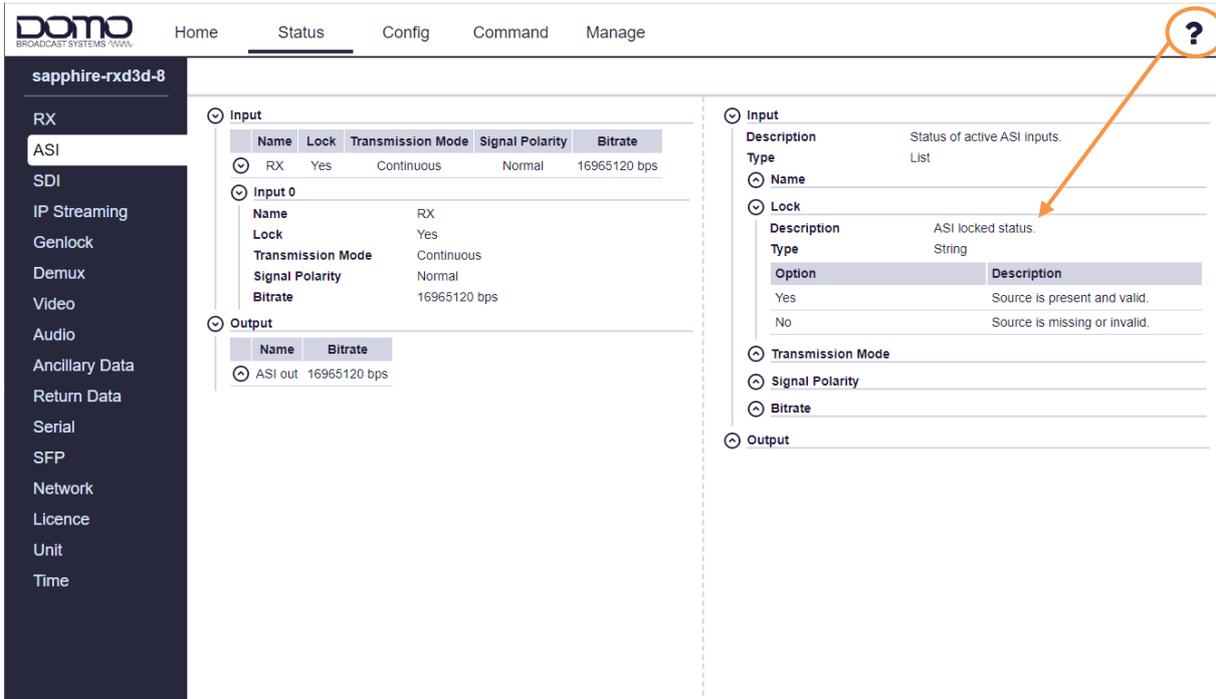


5.5.2 Status Pages

The Status pages are provided giving detailed information for the Sapphire-RXD3. 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.

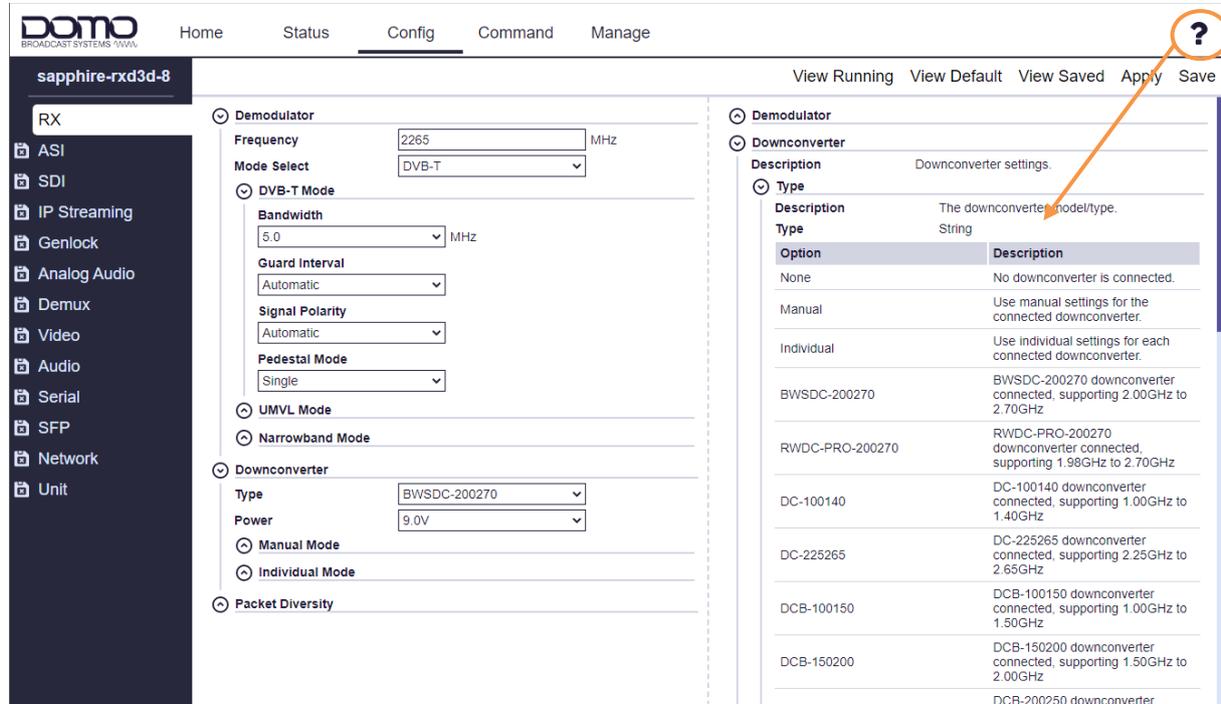


5.5.3 Config Pages

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.

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 configuration interface for the Sapphire-RXD3 device. The top navigation bar includes 'Home', 'Status', 'Config', 'Command', and 'Manage'. The 'Config' page is active, showing a sidebar with various configuration categories. The main content area is split into two columns. The left column shows the 'Demodulator' settings, which are currently expanded. The right column shows the 'Downconverter' settings, which are also expanded. A red circle with a question mark highlights the 'Help (?)' icon in the top right corner of the interface.

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 marked with a save icon with a cross , indicate that they have been applied but not saved. To carry out a global save, go to the **Manage>Config** page.

5.5.4 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.

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 'Command' page for a device named 'sapphire-rxd3d-8'. The interface includes a top navigation menu with 'Home', 'Status', 'Config', 'Command', and 'Manage'. A left sidebar lists 'Licence', 'Unit', 'Time', and 'User Accounts'. The main content area is divided into two panels. The left panel features three expandable sections: 'Download and Upgrade Firmware' (with fields for Download Protocol, Hostname or Address, Path, Port, Username, Password, and Reboot When Complete), 'Switch Firmware' (with Image Select and Reboot When Complete), and 'Reboot' (with Forced Reboot). The right panel provides a detailed view of the 'Download and Upgrade Firmware' section, including a description, timeout, and a table of download protocols. A red circle with a question mark is placed over the top right corner of the interface, with an arrow pointing to the 'Download Protocol' table.

Option	Description
HTTP	Hypertext Transfer Protocol.
HTTPS	Hypertext Transfer Protocol Secure.
FTP	File Transfer Protocol
FTPS	File Transfer Protocol Secure
Local	Use a file on a local file-system, at the given path (host/port/username/password arguments are ignored). E.g. SD-card or USB drive.

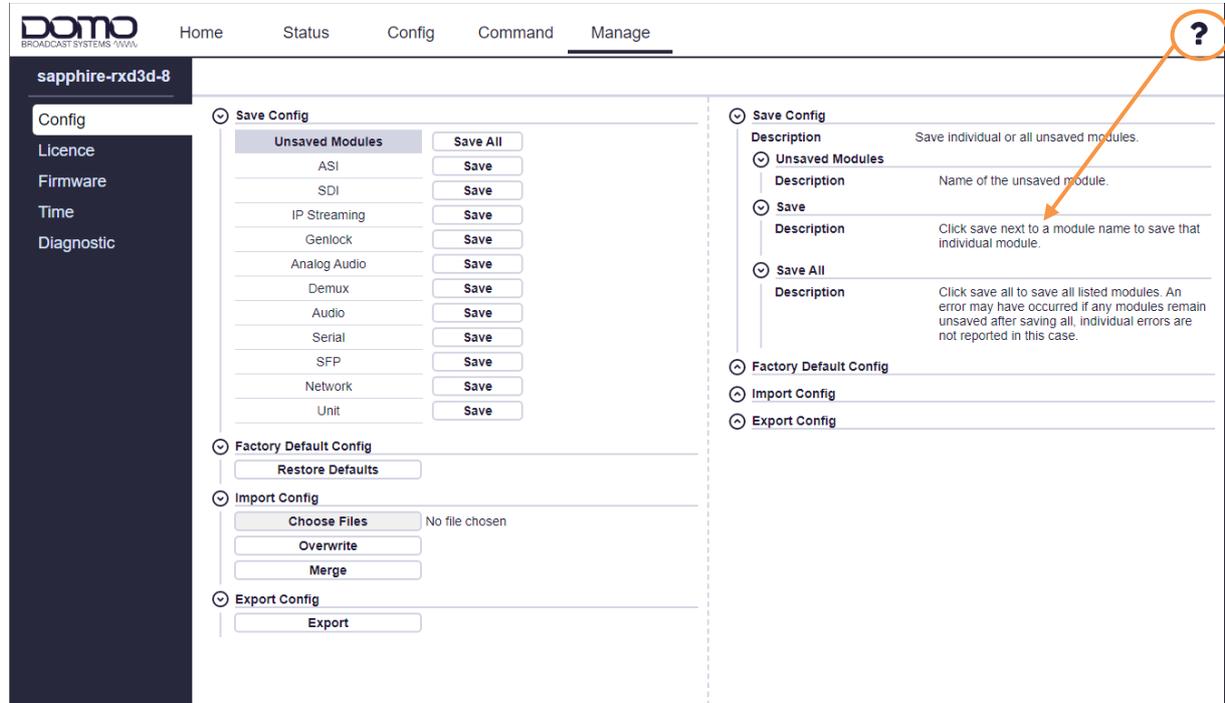
5.5.5 Manage Pages

The Manage pages are used for maintenance of the Sapphire-RXD3 internal software and settings.

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. Basic Setup Guide

6.1 Introduction

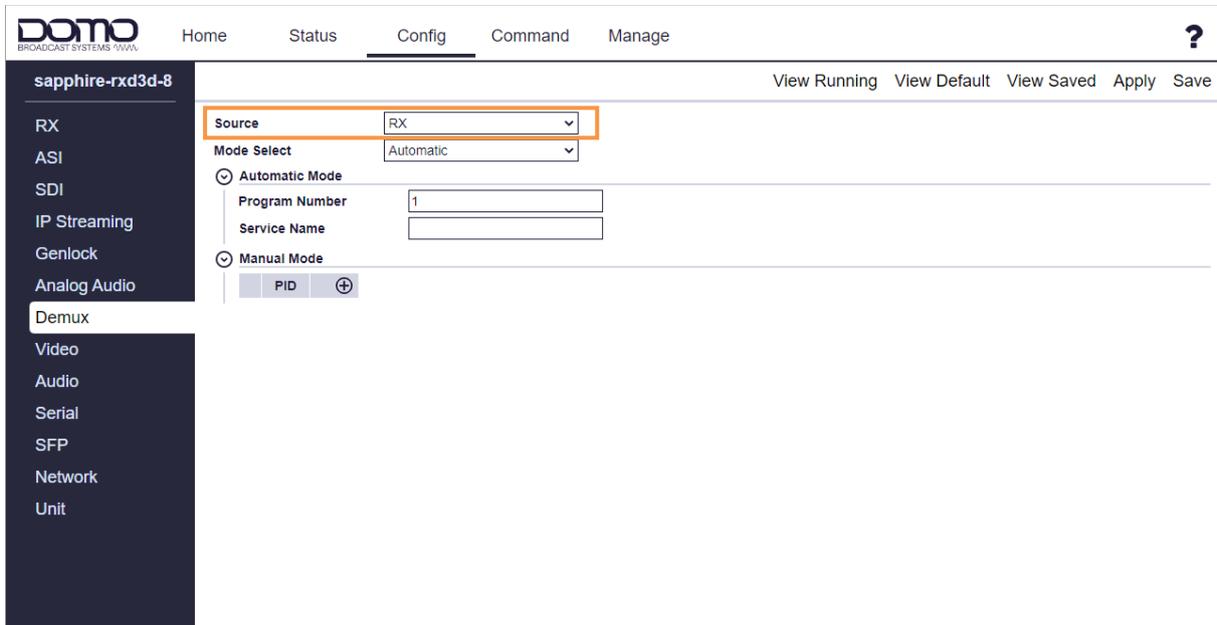
The sections in this chapter can be used in conjunction as a workflow to complete a system configuration.

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

Only settings for the Sapphire-RXD3 are explained, it is assumed that the inputs to the system are provided.

6.2 Receiver Setup

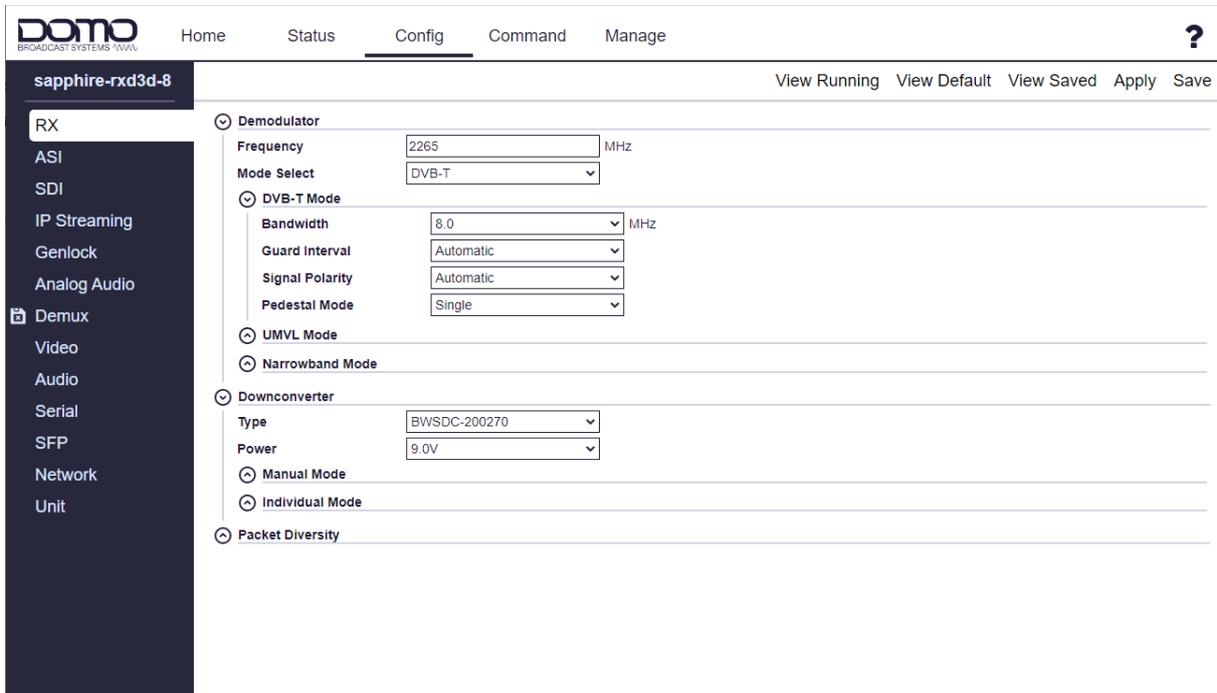
Sapphire-RXD3 can be configured as an RF receiver (RX) which can be used as a source for the ASI output, the IP streaming output or the Demux service. Setting the Demux to RX will allow you to decode from the receiver.



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

Downconverter presets are available for standard downconverters. If a different manufacturer is used, then manual settings can be applied.

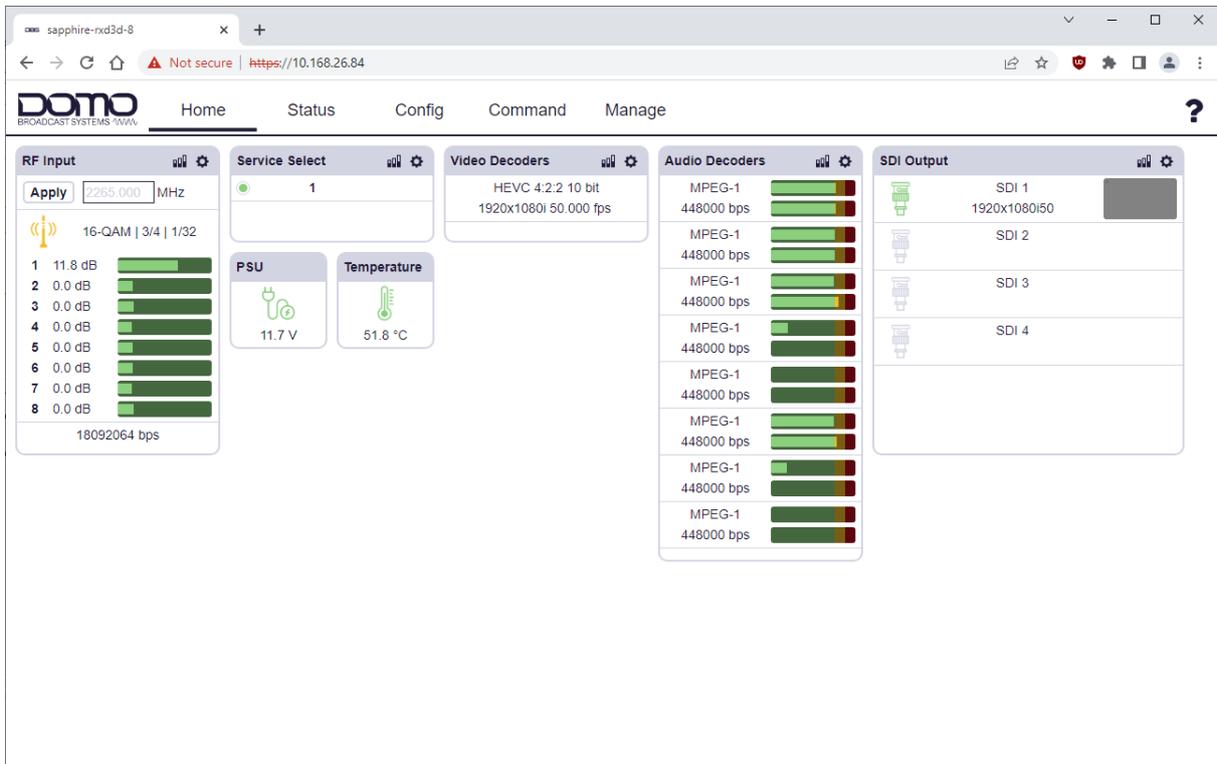
Click **Apply** to activate a running config and **Save** to retain.



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 **RX>Status** page is a good place to monitor critical RF performance indicators.

The screenshot shows the DOMO web interface for device 'sapphire-rxd3d-8'. The 'Status' page is active, displaying details for 'Demodulator 0'. The configuration includes:

- Device Name: D330-1@169.254.1.3
- RF Lock: Yes
- Frequency: 2265.000 MHz
- Constellation: 16-QAM
- FEC: 3/4
- Guard Interval: 1/32
- Bitrate: 18096256 bps

The 'Input Channel' section contains a table with 8 entries:

Name	LO Frequency	LO Side	Signal Strength	SNR	FFT File
1	1833.000 MHz	Low	-47.0 dBm	27.4 dB	/files/d330rx/demodulator/0/input/0/fft.svg
2	1833.000 MHz	Low	-108.0 dBm	0.0 dB	/files/d330rx/demodulator/0/input/1/fft.svg
3	1833.000 MHz	Low	-111.0 dBm	0.0 dB	/files/d330rx/demodulator/0/input/2/fft.svg
4	1833.000 MHz	Low	-110.0 dBm	0.0 dB	/files/d330rx/demodulator/0/input/3/fft.svg
5	1833.000 MHz	Low	-112.0 dBm	0.0 dB	/files/d330rx/demodulator/0/input/4/fft.svg
6	1833.000 MHz	Low	-112.0 dBm	0.0 dB	/files/d330rx/demodulator/0/input/5/fft.svg
7	1833.000 MHz	Low	-111.0 dBm	0.0 dB	/files/d330rx/demodulator/0/input/6/fft.svg
8	1833.000 MHz	Low	-112.0 dBm	0.0 dB	/files/d330rx/demodulator/0/input/7/fft.svg

The 'Error Rates' section shows:

- Pre Viterbi: 1861 (with a red triangle icon)
- Post Viterbi: 0
- 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 if 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.

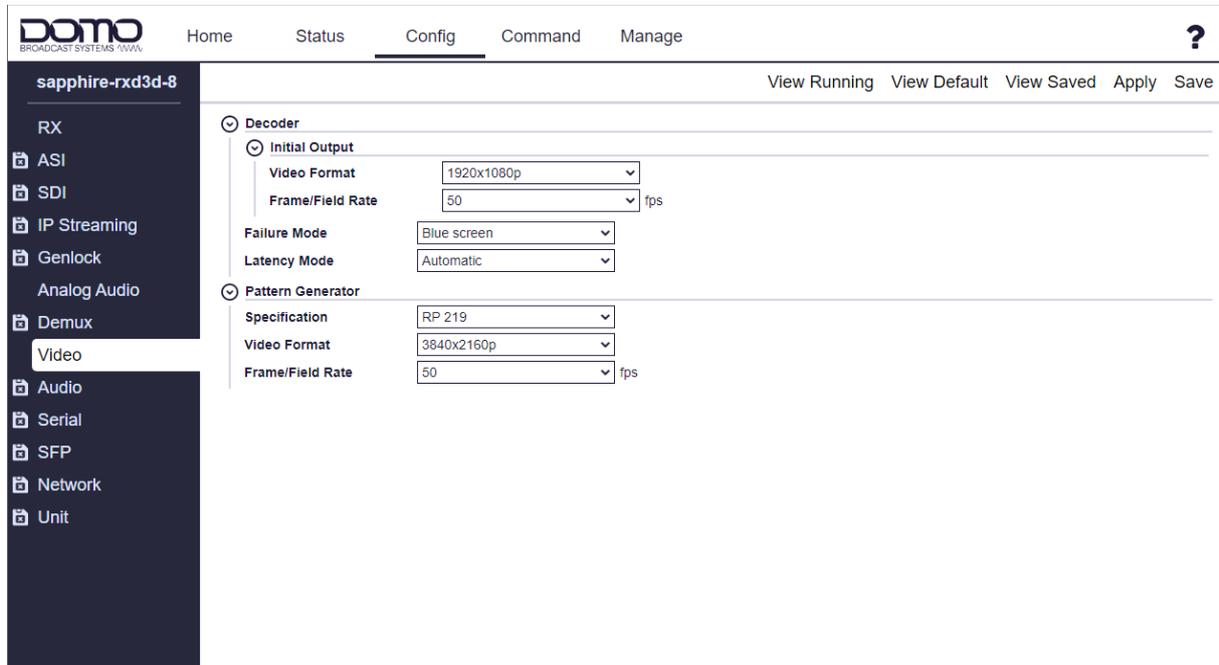
6.3 SDI Video

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**.

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.



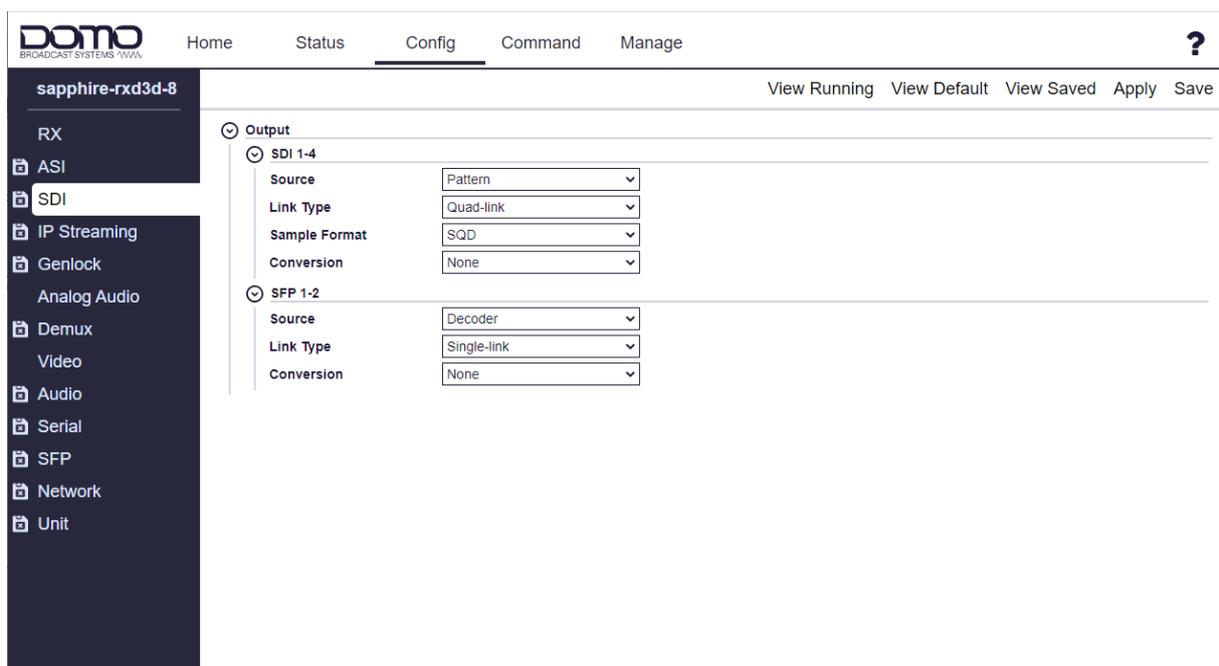
The screenshot shows the Domo web interface for the 'sapphire-rxd3d-8' device. The 'Config' tab is active, and the 'Video' section is selected in the left sidebar. The main content area displays the configuration for the 'Decoder' and 'Pattern Generator'.

Section	Parameter	Value
Decoder	Initial Output	
	Video Format	1920x1080p
	Frame/Field Rate	50 fps
	Failure Mode	Blue screen
	Latency Mode	Automatic
Pattern Generator	Specification	RP 219
	Video Format	3840x2160p
	Frame/Field Rate	50 fps

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.



The screenshot shows the Domo web interface for the 'sapphire-rxd3d-8' device. The 'Config' tab is active, and the 'SDI' section is selected in the left sidebar. The main content area displays the configuration for the 'Output' section, specifically for 'SDI 1-4' and 'SFP 1-2'.

Section	Parameter	Value
SDI 1-4	Source	Pattern
	Link Type	Quad-link
	Sample Format	SQD
	Conversion	None
SFP 1-2	Source	Decoder
	Link Type	Single-link
	Conversion	None

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 and 16-QAM modulation. A list of 8 channels shows signal levels, with channel 1 at 25.0 dB and channels 2-8 at 0.0 dB. Total throughput is 18096464 bps.
- Service Select:** Shows 'Service 1' selected.
- Video Decoders:** Shows HEVC 4:2:2 10 bit at 1920x1080i 50.000 fps.
- Audio Decoders:** Shows 10 MPEG-1 decoders, each at 448000 bps.
- PSU:** Shows 11.8 V.
- Temperature:** Shows 47.6 °C.
- SDI Output:** Shows 4 SDI outputs (SDI 1-4) at 1920x1080p50, each with a corresponding color bar icon.

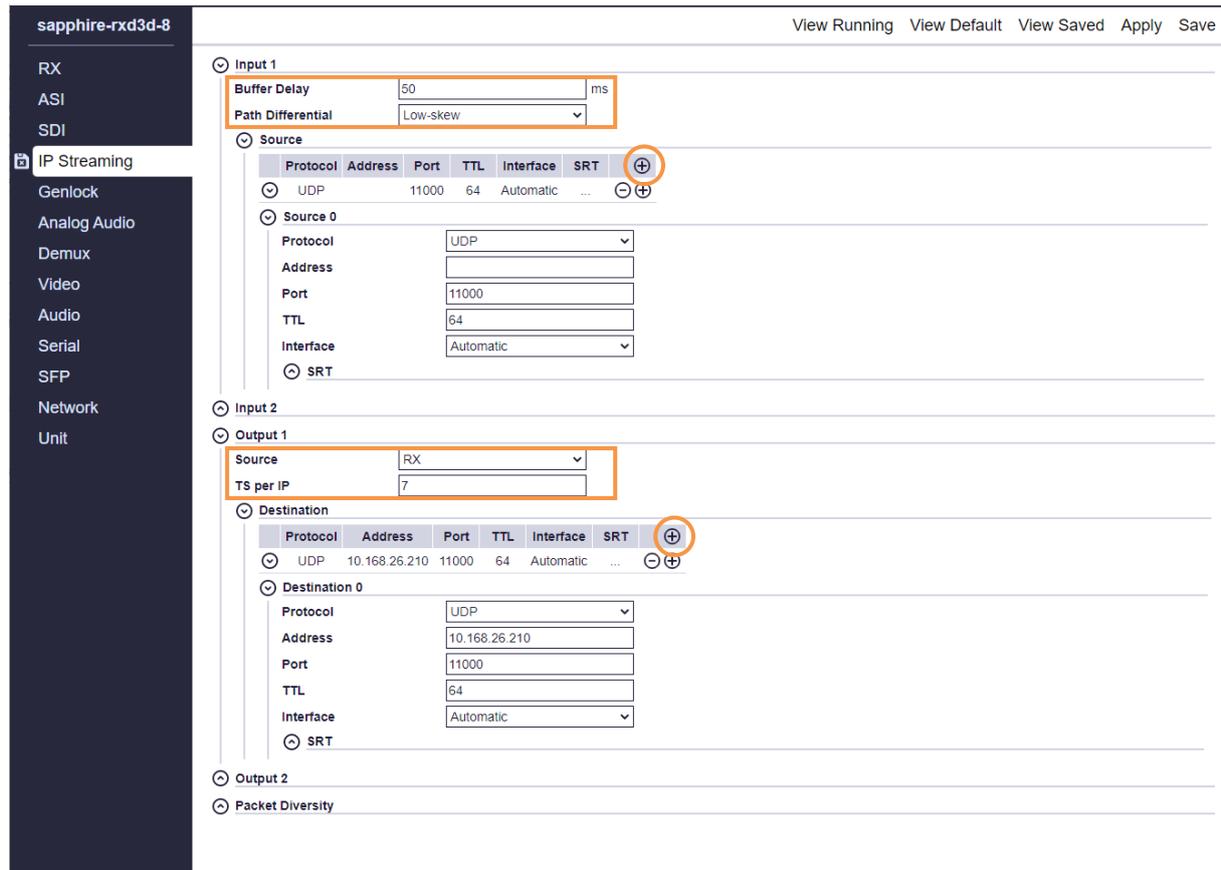
6.4 IP Streaming

6.4.1 IP Streaming Overview

Sapphire-RXD3 can be configured as an IP streaming input (IP1/IP2) which can be used as a source for the ASI output, the IP streaming output or the Demux service. Setting the Demux to IP1/IP2 will allow you to decode from the IP input.

Go to the **Config>IP Streaming** page, click the **+** button (orange circle) to create new input/output settings. Up to two streams per input/output can be applied for redundancy or in SMPTE 2022-7 networks, see *Section 6.4.4*.

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



Note: Streaming status can be monitored in the **Status>IP Streaming** page, see *Section 6.4.5*.

Global 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 is a delay difference between sources when there are different routes to the destination, for example in SMPTE 2022-7 systems, see <i>Section 6.4.4</i> .
Source	Set the source of the output stream. If using IP1 or IP2, 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.

6.4.2 UDP/RTP IP Streaming

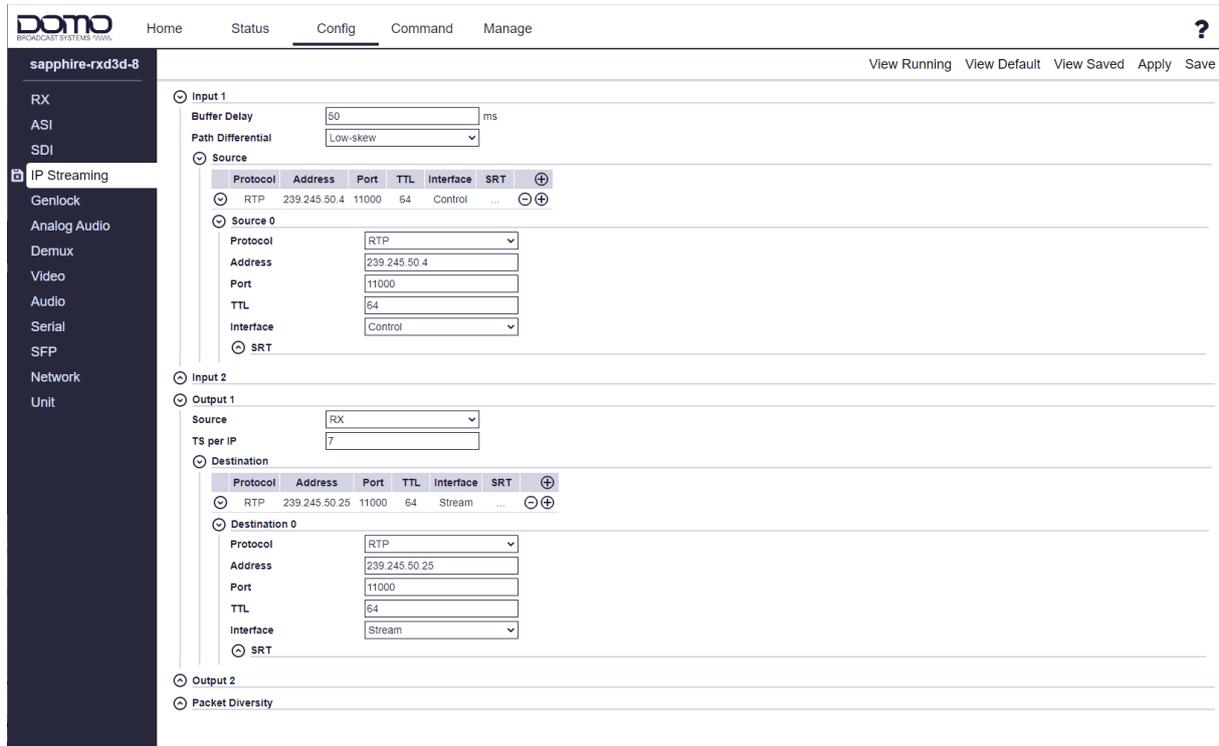
Unicast Streaming

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: When using SRT, the SRT settings will need to be configured, see Section 6.4.3 .
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, RTP or SRT. Note: When using SRT, the SRT settings will need to be configured, see Section 6.4.3 .
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. For more guidance on multicast addressing, see Table 6-1 .
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 expected on. When multicast streaming, it is particularly important to select the actual interface being used.

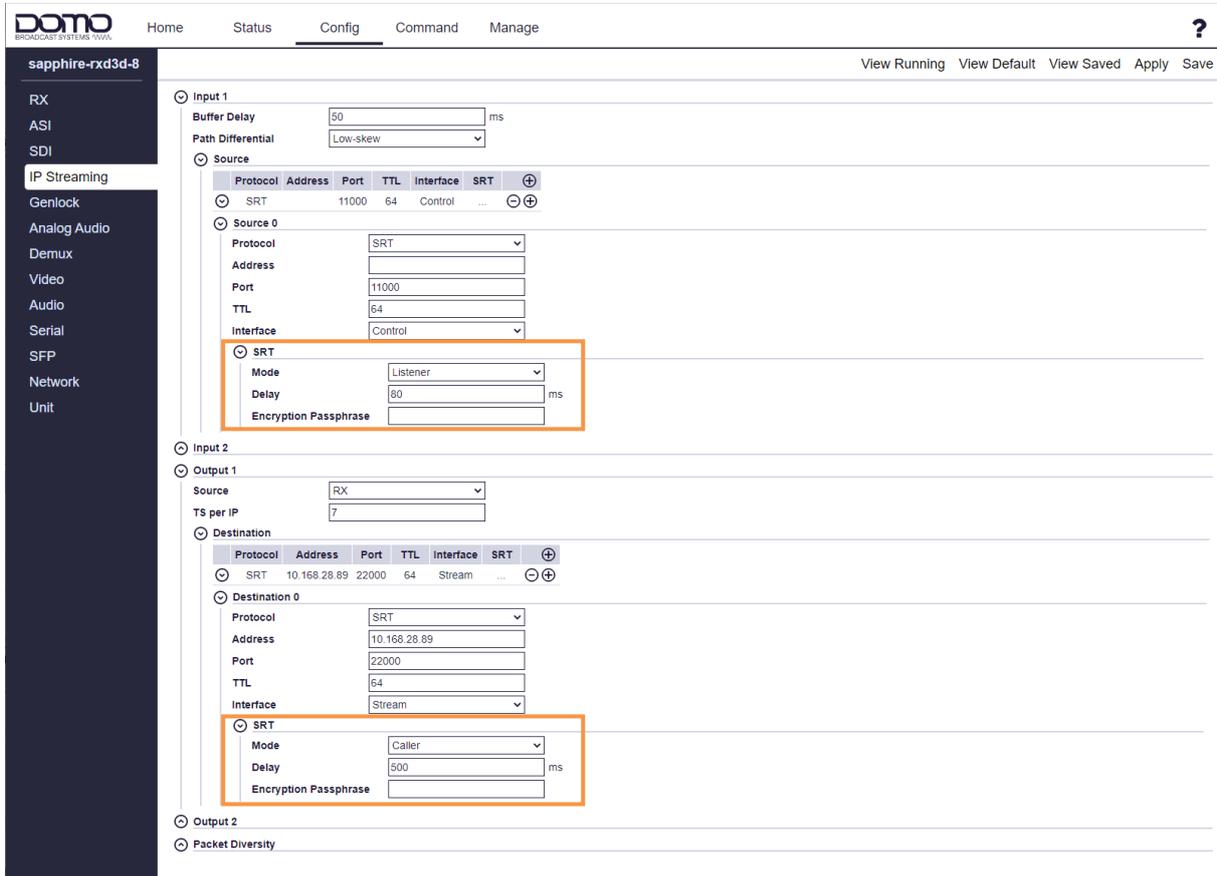
Start Address	End Address	Description
224.0.0.0	224.0.0.255	Reserved for special well-known multicast addresses
224.0.1.0	238.255.255.255	Globally scoped (Internet-wide) multicast addresses
239.0.0.0	239.255.255.255	Administratively scoped (local) multicast addresses

Table 6-1: Multicast Address Uses

6.4.3 SRT (Secure Reliable Transport) Protocol

SRT 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.

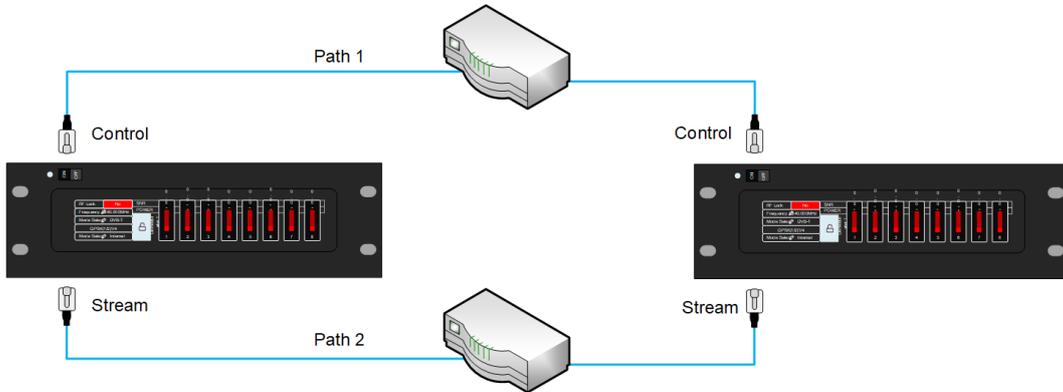
If SRT streaming is required, the settings for unicast or multicast streaming will also need to be configured, see *Section 6.4.2*.



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>
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>

6.4.4 SMPTE-2022-7 Networks

The Sapphire-RXD3 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>IP Streaming** page).



Adjust the **Path Differential** setting depending on the distance between the sources, the path delay options are explained in the Sapphire web page help guide.

UDP/RTP settings for unicast or multicast will also need to be configured, see *Section 6.4.2*.

The screenshot shows the configuration page for 'sapphire-rxd3d-8'. On the left, a sidebar lists various settings like RX, ASI, SDI, IP Streaming, Genlock, Analog Audio, Demux, Video, Audio, Serial, SFP, Network, and Unit. The main area is divided into 'Input 1' and 'Source 0' sections. In the 'Input 1' section, the 'Path Differential' dropdown is set to 'Moderate-skew' and is highlighted with an orange box. An orange arrow points from this box to the 'Path Differential' section in the right-hand pane. The right-hand pane contains a table with the following data:

Option	Description
Low-skew	Path delay difference <= 10ms. Use for direct network connection.
Moderate-skew	Path delay difference <= 50ms. Use for private network with 1 or more routers in the path.
High-skew	Path delay difference <= 450ms. Use when streaming across the internet or public networks.

6.4.5 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 'sapphire-rxd3d-8' configuration page in the 'Status' tab. The left sidebar lists various system components, with 'IP Streaming' selected. The main content area displays the following sections:

- Input 1**
 - Source**: A table with columns State, Address, Bitrate, Jitter, Error Counts, and SRT. One row shows 'Okay' at address 0.0.0.0 with a bitrate of 18092971 bps and jitter of 8.333 ms.
 - Redundancy**: A sub-section with an expandable 'Error Counts' table.
- Input 2**: A collapsed section.
- Output 1**
 - Destination**: A table with columns State, Address, Bitrate, and SRT. One row shows 'Okay' at address 10.168.26.210 with a bitrate of 18093327 bps.
- Output 2**: A collapsed section.
- Packet Diversity**: A collapsed section.

7. Appendix A – Reference Material

7.1 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 do not 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.

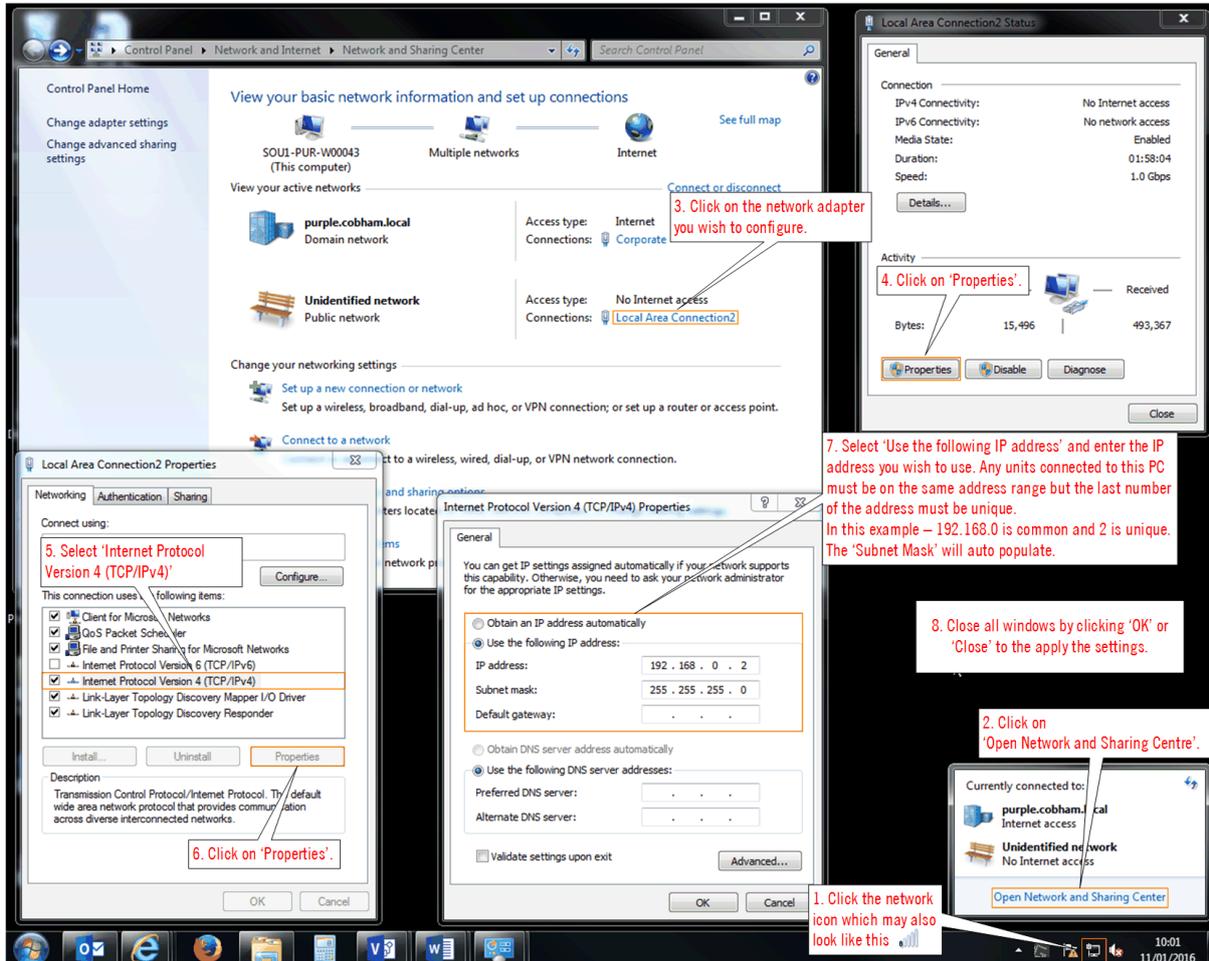


Figure 7-1 How to configure a PC IP address

7.2 Subnet with CIDR Values

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

8. Appendix B – After Sales Support

8.1 Documentation and Software

It is DTC'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 uk.technical.support@domotactical.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.

8.2 Contact Technical Support

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

- **Phone:** +44 1489 884 550. Monday to Friday 0900-1730 (UK time)
- **Email:** support@domobroadcast.com (no restricted content)

8.3 Using the DTC RMA Service

8.3.1 Contact DTC

If there is a problem and our technical support team have been unable to resolve the issue, email dtc.rma@domotactical.com (US) or solent.customerhub@domotactical.com (UK/ROW) to request a Return Material Authorisation (RMA) form.

Note: Alternatively, use the online form at <https://www.domotactical.com/support/>.

8.3.2 Complete and Return the RMA Form

Complete the RMA form with the following information and return to the customer hub:

- Name
- Address
- Unit serial number
- Date of purchase or the original invoice number
- Date of failure
- A detailed description of the problems you have encountered
- A list of the hardware/software configuration if applicable

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

8.3.3 Pack the Device

Note: Before packing, remove all personal non-DTC 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.

8.3.4 Put the RMA Number on the Box

Clearly mark the outside of the shipping box with the RMA number. If an RMA number is not present on the shipping box, receiving will be unable to identify it and it might be returned.

8.3.5 Send the Box to DTC

Send the box using your normal shipping process.

9. 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.

9.1 Cautions and Warnings

Area	Note
Aircraft safety	Use of this equipment on board aircraft is strictly forbidden without the required testing and qualification for aircraft type. 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.
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	Do not remove any factory installed screws or fastenings as this may void any warranties. There are no functions that require the user to gain access to the interior of the product. There are no user serviceable parts inside.
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	If you operate this device in an enclosed space, you must ensure it has adequate airflow to keep it cool. If worn close to the body, care must be taken to protect the operator from excessive temperatures.
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.

9.2 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 8.2*.

9.3 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.

9.4 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

9.5 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.

9.6 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

9.7 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