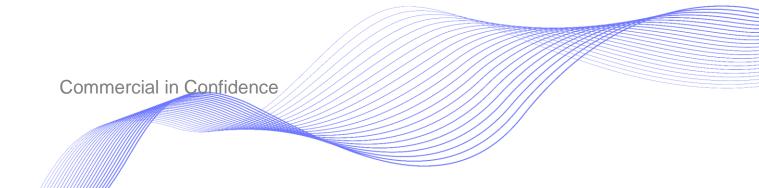
Resource Identifier: 100321 Revision 1.4



For the moments that matter

Sapphire-RXD4 Setup Guide







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 Notice about this Publication

While DTC makes every attempt to maintain the accuracy of the information contained in its product manuals, the information is subject to change without notice.

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

0.3 Copyright

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0.4 Related Documents

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.

All DTC documents can be downloaded from WatchDox. See Section 9.1.



0.5 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	08/09/2022	IR	First release
1.1	17/10/2022	IR	Corrected multicast streaming end address. Corrected PKT IN note.
1.2	28/03/2023	IR	Corrected power cable. Updated for RXD4.
1.3	26/06/2023	IR	Firmware upgrade details.
1.4	30/11/2023	IR	Touchscreen bar graph colour-coded thresholds.



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1. Product Overview

1.1 Description

Sapphire-RXD4 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-RXD4 cleverly combines an 8-way diversity COFDM receiver and DBS' Sapphire Ultra-Low Latency HEVC decoder in a single 2RU $\frac{1}{2}$ 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.

Eight-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-RXD4 will decode up to 8 stereo audio pairs and output them embedded on SDI, 1 pair of analogue audio outputs are also provided on XLR.

The Sapphire-RXD4 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-RXD4 enables onward streaming of video and audio and supports multiple streaming formats including SRT. Timecode and HDR signalling are also fully supported. The Sapphire-RXD4 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	1/2 19" rack 2RU
Weight	4kg

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

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 9.2*.

2.2 Variants

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

Part Number	Description
SAPPH-RXD4-2	Sapphire RX HEVC decoder 2-way diversity
SAPPH-RXD4-4	Sapphire RX HEVC decoder 4-way diversity
SAPPH-RXD4-6	Sapphire RX HEVC decoder 6-way diversity
SAPPH-RXD4-8	Sapphire RX HEVC decoder 8-way diversity

2.3 Parts List

These items will be in the package.

Part Number	Description	
Primary unit	Sapphire-RXD4 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.

Product Code	Description
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. 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 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.



3.3 Rear Panel



No.	Item	Notes
1	XLR 4-way (male)	Connect the supplied PSU (CA4065) for 12V power. See <i>Section 3.4.1</i> for pinout.
		CAUTION : To prevent damage to internal regulators, ensure the supply can provide a minimum 10A.
		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.



No.	Item	Notes
11	BNC socket (75Ω)	ASI output.
12	BNC socket (75Ω)	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 (male)	Audio stereo line level audio output left. See Section 3.4.3 for pinout.
14	XLR 3-way (male)	Audio stereo line level audio output right. See Section 3.4.3 for pinout.
15	Hirose 4-way (male)	RS-232 data port. See Section 3.4.2 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	ТХ
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-RXD4 requires 12VDC power which can be supplied 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.

4.2 Introduction

The Sapphire-RXD4 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.



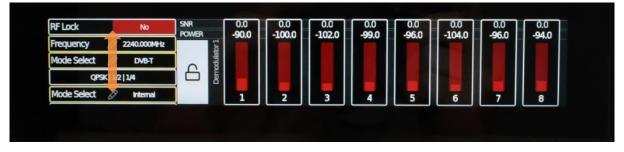
The home screen will show colour-coded information and is divided into two zones, Left and Right.





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.

	RF Lock No SNR POW						
	Frequency 🖉 2240.000MHz						
	Mode Select 🖉 DVB-T						
	QPSK : /2 1/4						
	Mode Select 🖉 Internal						
Demodulator: Frequency	Downconverter: Manual Mode: LO Free	uency	7	8	9	\leftarrow	(mat
2240	✓ × 0	/×	4	5	6	1	វសិរដ
And a second sec			10 10 10 10 10 10 10 10 10 10 10 10 10 1	1100000000	111111111	100000000000000000000000000000000000000	
Downconverter: Type	Downconverter: Manual Mode: LO Side		14	2	3		
Downconverter: Type BWSDC-200270	Downconverter: Manual Mode: LO Side	\$	1	2	3	-	\odot

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



4.4 Touchscreen Right Zone

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



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
16QAM	1/2	13.8	17.3	>17.3
16QAM	2/3	16.7	20.2	>20.2
16QAM	3/4	18.2	21.7	>21.7
16QAM	5/6	19.4	22.9	>22.9
16QAM	7/8	20.2	23.7	>23.7

Table 4-1: 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 4-2: 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-RXD4 to factory settings.

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

RF Lock No Frequency 🖉 2240.000MHz	SNR POWER		0.0 0.0 0.0 00.0 -102.0 -99.0	0.0 -96.0	0.0 -104.0	0.0 -96.0 -94.0	
Mode Select 🖉 DVB-T	tukat						
QP5K 1/2 1/4	Demodulator 1						
Mode Select 🖉 Internal							
Houe Select & Thema		1	2 3 4	5	6	7 8	
		87					
RF Lock	P: 12.86.04.84 Science: 255.255.255.0 Bro	ochust Wreiens Statemal M			ked Looked	Locked Locked	Locied
Frequency 🖉 2265.000MHz		and the state					
Mode Select 🖉 DVB-T	1						
16-QAM 3/4 1/32							
And a state of the second		elessiystere o		10001			
HEVC 4:22 10bit			MPEG1 MPEG1	MPEG-1 MP	EG-1 MPEG-1	MPEG-1 MPEG-1	MPEG-1
HEVC 422 10bit			COM MPECI MPECI 4480000ps 448000ps	448000bps 4480	00bps 448000bps	MPEG-1 448000bps 448000bps	MPEG-1 448000bps
HEVC 422 10bit			Network Information	448000bps 4480	00bps 448000bps	(448000.pz) (448000.pz)	448000bps
RFLock No	Name	Dynamic	Network information Address	448000bps 4480	COLDE 44800042	(448000bps) (448000bps)	448000bps
RFLock No Frequency 🔗 2240.000MHz	Control	Dynamic Yes <i>d</i>	Network information Address 10.168.26.86 /	448000bps 4480 Netmask 24 4	CODpe 4480000pe Scope Giobal	4480000;;; (480000;;;) 	448000pc teway 26.1
RF Lock No Frequency & 2240.000MHz Mode Select & DVB-T	Control Control	Dynamic Yes & No &	Network information Address 10.168.26.96 // fe90:761.ace0ff:fe9151.ce //	448000tps 4480 Netmask 24 4	COORDE Scope 9 Global 9 Linkiccal	445000pr 445000pr	448000pc teway 26.1
RF Lock No Frequency & 2240.00044z Mode Select & DV6-T QPSK 1/2 1/32	Control	Dynamic Yes <i>d</i>	Network information Address 10.168.26.86 /	448000bps 4480 Netmask 24 4	CODpe 4480000pe Scope Giobal	4480000pz (4480000pz) Current Ge 10.168. Serial Nur 4002000015228 Running Ve	4480000pz tesway 26.1 114/81044 arsion
RF Lock No Frequency & 2240.000MHz Mode Select & DVB-T	Control Control Internal	Dynamic Yes / No / No	Network information Address 10.166.26.96 / fe90:761.ace0lf:fe91:fl.ce / 1692254.1.1	448000bps 4480 Netmask 24 4 64 4	CODER SCOPE Cibbel Cibbel Cibbel	4480000;pz (448000;pz 	4480000pz tesway 26.1 114/81044 arsion
RF Lock No Frequency & 2240.00044z Mode Select & DV6-T QPSK 1/2 1/32	Control Control Internal	Dynamic Yes / No / No	Network information Address 10.166.26.96 / fe90:761.ace0lf:fe91:fl.ce / 1692254.1.1	448000bps 4480 Netmask 24 4 64 4	CODER SCOPE Cibbel Cibbel Cibbel	4480000pz (4480000pz) Current Ge 10.168. Serial Nur 4002000015228 Running Ve	4480000pz tesway 26.1 114/81044 arsion
RF Lock No Frequency & 2240.00044z Mode Select & DV6-T QPSK 1/2 1/32	Control Control Internal	Dynamic Yes / No / No	Network information Address 10.166.26.96 / fe90:761.ace0lf:fe91:fl.ce / 1692254.1.1	448000bps 4480 Netmask 24 4 64 4	CODER SCOPE Cibbel Cibbel Cibbel	4480000pz (4480000pz) Current Ge 10.168. Serial Nur 4002000015228 Running Ve	4480000pz tesway 26.1 114/81044 arsion
RF Lock No Frequency & 2240.00044z Mode Select & DV6-T QPSK 1/2 1/32	Control Control Internal	Dynamic Yes / No / No	Network information Address 10.166.26.96 / fe90:761.ace0lf:fe91:fl.ce / 1692254.1.1	448000bps 4480 Netmask 24 4 64 4	CODER SCOPE Cibbel Cibbel Cibbel	4480000pz (4480000pz) Current Ge 10.168. Serial Nur 4002000015228 Running Ve	4480000pz tesway 26.1 114/81044 arsion
RF Lock No Frequency & 2240.00044z Mode Select & DV6-T QPSK 1/2 1/32	Control Control Internal	Dynamic Yes / No / No	Network information Address 10.166.26.96 / fe90:761.ace0lf:fe91:fl.ce / 1692254.1.1	448000bps 4480 Netmask 24 4 64 4	CODER SCOPE Cibbel Cibbel Cibbel	4480000pz (4480000pz) Current Ge 10.168. Serial Nur 4002000015228 Running Ve	4480000pz tesway 26.1 114/81044 arsion
RF Lock No Frequency Ø 2240.000MHz Mode Select Ø DVB-T GPSK 1/2 1/32 Mode Select Ø Internal	Control Control Internal	Dynamic Yes / No / No	Network information Address 10.166.26.96 / fe90:761.ace0lf:fe91:fl.ce / 1692254.1.1	448000bps 4480 Netmask 24 4 64 4	CODER SCOPE Cibbel Cibbel Cibbel	4480000pz (4480000pz) Current Ge 10.168. Serial Nur 4002000015228 Running Ve	4480000pz tesway 26.1 114/81044 arsion
RF Lock No Frequency & 2240.000442 Mode Select & DVB-T QPSK 1/2 1/32 Mode Select & Internal Mode Select & Internal	Control Control Internal	Dynamic Yes / No / No	Network information Address 10.168.26.96 fe90:761aceOffreeff.toc 169254.1.1 fe90:20ecoff.fe99xidAt	445000bps) 4450 Netmask 24 4 64 4 64	CODER SCOPE Cibbel Cibbel Cibbel	4480000pz (4480000pz) Current Ge 10.168. Serial Nur 4002000015228 Running Ve	4480000pz tesway 26.1 114/81044 arsion
RF Lock No Frequency & 2240.00044z Mode Select & DVB-T GPSK 1/2 1/32 Mode Select & Internal FLock No Fequency & 2240.00044z Mode Select & DVB-T	Control Control Internal	Dynamic Yes / No / No	Network information Address 10.166.26.96 / fe90:761.ace0lf:fe91:fl.ce / 1692254.1.1	445000bps) 4450 Netmask 24 4 64 4 64	CODER SCOPE Cibbel Cibbel Cibbel	4480000pz (4480000pz) Current Ge 10.168. Serial Nur 4002000015228 Running Ve	4480000pz tesway 26.1 114/81044 arsion
RF Lock No Frequency S 2240.0004Hz Mode Select DVB-T QPSK 1/2 1/32 Mode Select I Internal RF Lock No Tequency S 2240.0004Hz Mode Select D DVB-T QPSK 1/2 1/16	Control Control Internal	Dynamic Yes / No / No	Network information Address 10.168.26.96 fe90:761aceOffreeff.toc 169254.1.1 fe90:20ecoff.fe99xidAt	445000bps) 4450 Netmask 24 4 64 4 64	CODER SCOPE Cibbel Cibbel Cibbel	4480000pz (4480000pz) Current Ge 10.168. Serial Nur 4002000015228 Running Ve	4480000pz tesway 26.1 114/81044 arsion
RF Lock No Frequency & 2240.00044z Mode Select & DVB-T GPSK 1/2 1/32 Mode Select & Internal FLock No Fequency & 2240.00044z Mode Select & DVB-T	Control Control Internal	Dynamic Yes / No / No	Network information Address 10.168.26.96 fe90:761aceOffreeff.toc 169254.1.1 fe90:20ecoff.fe99xidAt	445000bps) 4450 Netmask 24 4 64 4 64	CODER SCOPE Cibbel Cibbel Cibbel	4480000pz (4480000pz) Current Ge 10.168. Serial Nur 4002000015228 Running Ve	4480000pz tesway 26.1 114/81044 arsion



5. Initial Communications

5.1 Introduction

The Sapphire-RXD4 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-RXD4 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 5.5), 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 8.1* to find out how to do this.

5.2 Power

The Sapphire-RXD4 requires 12VDC power which can be supplied 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.



5.3 **IP Address Identification**

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 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.

					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_Y30e21(Open	
10.168.26.62	jade-cm3	00000000e439b1a8	jade-cm3_Y58ab2aa	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.

RF Lock		No	State of the local division of the local div	and the second second		Network Information					Currer	t Gateway
	0.0		Name	Dynam		Address		Netma	sk	Scope	10.1	68.26.1
Frequency	-	240.000MHz	Control	Yes	0	10.168.26.86	0	24	0	Global	Serial	Number
Mode Select	Ø	DVB-T	Control	No	0	fe80::761a:e0iffe8tf1ce	0	64	0	Linkiccai		228414d81e445
q	SK 1/2 1	1/32	Internal	No		169.254.1.1		24		Global	Dumpin	ng Version
Mode Select	Ø	Internal	Internal	No		fe80:20ex6ff;fe89;do4c		64		Linkical	and the second second	touch_1.19.1
												Contraction of the local division of the
										/		
Control: D	HCP			Con	trol: If	P Address: Address/Netm	nask			7 8	9 ←	
No				2				~ >				6
Control: IF				<u> </u>						4 5	6 /	No. of Concession, Name
Control II	Addres	s: Gateway		Con	trol: II	Address: DNS				1 2	3 .	
										1 4		n
				/				$\langle \rangle$				-)



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-RXD4 can be discovered from the front panel touchscreen, see *Section 5.3.2* 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-RXD4 must have a **Reachable** state.

<u>></u> w	/indows PowerShell			_	×
	ws PowerShell ight (C) Microsoft Corporation. All rights reserved.				
y ti	he new cross-platform PowerShell https://aka.ms/pscor	re6			
C:	\WINDOWS\system32> Get-NetNeighbor -IPAddress FE80*				
Ind	ex IPAddress	LinkLayerAddress	State	PolicyStore	
C:'	<pre>fe80::761a:e0ff:fe8f:f1cd fe80::761a:e0ff:fe8f:f1cd fe80::761a:e0ff:fe8f:f1cd te80::761a:e0ff:fe8f:f1cd te80::761a:e0ff:fe8f:f1cd te80::761a:e0ff:fe8f:f1cd</pre>	00-00-00-00-00-00 00-00-00-00-00-00 74-1A-E0-8F-F1-CD 00-00-00-00-00-00	Unreachable Reachable	ActiveStore ActiveStore ActiveStore ActiveStore	

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].



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-RXD4 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].

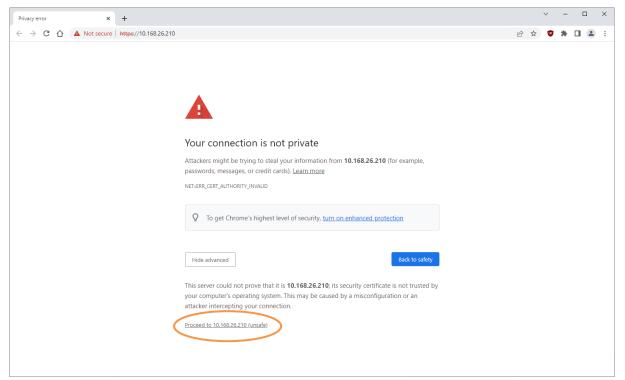
Alternatively, if running Device Finder, click **Open** on the line of the device address.

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.

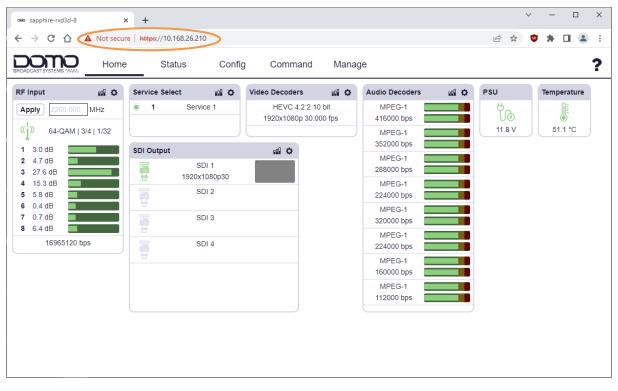
Privacy error	×	+		`	~	-	×
← → C ☆ ▲	Not secure	https://10.168.26.210	Ê	\$	9	* I	:
		Attackers might be trying to steal your information from 10.168.26.210 (for example, passwords, messages, or credit cards). Learn more NET:ERR_CERT_AUTHORITY_INVALID Image: Chrome's highest level of security, turn on enhanced protection			-		



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 IP Address Configuration

The IP address can be configured via the front panel, explained in *Section 5.3.2*, or via the web interface.

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

RX Asi ASI Soli SDI DHCP IP Streaming Genlock Analog Audio Description Demux '0 IP Address Video Audio SFP Network Network '0 Stream DHCP \(0 + P + Q) Q IP Address Q + P Address Demux '0 IP Address 0 Audio Serial SFP Discription Network '0 Stream DHCP No MTU '1500 Discription IP address settings. Type List O P Address 0 Astalic IP-4 or IP-6 address and length separated by a '' charact'' the address and length separated by a '' charact'' the address and length separated by a '' charact'' the address and length separated by a '' charact'' the address and length separated by a '' charact'' the address and length separated by a '' charact'' the address and length separated by a '' charact'' the address and length separated by a '' charact'' the address and length separated by a '' charact'' the address and length separated by a '' charact'' the address and length separated by a '' charact'' the address and length separated by a '' charact'' the address and length separated by a '' charact'' the address and length separated by a '' charact'' the address and	BROADCAST SYSTEMS 1000	Home Status Config Command Manage	
ASI ASI SDI IP Streaming Genlock Analog Audio Demux Video Audios Serial SFP Network C Stream Unit DHCP No O IP Address Address/Netmask Cateway DNS C Stream DHCP No Network C DHCP C Control Description IP Address C DHCP C DHCCP C DHCP C DH	sapphire-rxd3d-8		View Running View Default View Saved Apply
ASI DHCP No ▼ SDI IP Streaming IP address IP address Genlock Address/Netmask Gateway DNS ⊕ IP address settings. IP address settings. Analog Audio IP Address 0 IP address settings. IP address settings. Video Audio Serial IP address/Netmask Description A static IPv6 or IPv6 address and height, are character with a static IPv6 or IPv6 address and height, are character with a static IPv6 or IPv6 address and height, are character with a static IPv6 or IPv6 address and height, are character with a static IPv6 or IPv6 address and height, are character with a static IPv6 or IPv6 address and height, are character with a static IPv6 or IPv6 address and height, are character with a static IPv6 or IPv6 address and height, are character with a static IPv6 or IPv6 address and height, are character with a static IPv6 or IPv6 address and height, are character with a static IPv6 or IPv6 address and height, are character with a static IPv6 or IPv6 address and height, are character with a static IPv6 or IPv6 address and height, are character with a static IPv6 or IPv6 address and height, are character with a static IPv6 or IPv6 address and the static IPv6 or IPv6 address and height, are character with a static IPv6 or IPv6 address and the static IPv6 or IPv6 address and TPv6 address and TPv6 address a	RX	Hostname sapphire-rxd3d-8	⊘ Hostname
SDI IP CP No ✓ IP Streaming Genlock Address/Netmask Gateway DNS ✓ Analog Audio IP Address 0 ✓ IP address settings. O IP Address 0 ✓ IP address Netmask Description IP address settings. Video Address/Netmask O O IP address and length.separated by a "" charact 192.168.0.15/24 Serial Serial Dis Ist O address/Netmask Dus Dis Type String Regex Pattern *Sig(*(250-5))(2/0-4)(1/0-9)(1-9)(1/0)(0/0)(1/1)(1/0/0)(1-9)(1-1)(0/0)(1-9)(1-9)(0/0)(1/1)(1/1)(1/1)(1/1)(1/1)(1/1)(1/1	ASI	⊘ Control	
P Streaming Genlock Analog Audio Demux Video Address/Netmask Gateway IP Address Gateway DNS SFP Network Or Stream DHCP MTU Init Or Address Or Indexes Or Indexes Or Indexes Or Indexes		DHCP No V	
Senlock Address/Netmask Gateway DNS ⊕ O 192.168.0.15/24 O ⊕ O 192.168.0.15/24 O ⊕ Address/Netmask Description 192.168.0.15/24 O ⊕ Address/Netmask Description 192.168.0.15/24 O ⊕ Address/Netmask Description 192.168.0.15/24 O ⊕ Serial Serial DNS O NS DNS O IP Address MTU 1500 MTU 1500 O IP Address O IP Address O IP Address O IP Address O Stream Packarpit (A)(1, A)(1, A			<u> </u>
Analog Audio Demux //ideo Audio Serial SFP Network © stream DHCP MTU 1500 MTU 1500 MTU 1500 O IP Address/Netmask Gateway DNS Control Notice O Stream DHCP MTU 1500 O Internal O Internal O Internal	0	· · · · · · · · · · · · · · · · · · ·	
Wratog Audio ○ 102.108.0.102.4 ○ 0 0 102.108.0.102.4 0 0 0 0 102.108.0.102.4 0 0 0 0 Address/Netmask Description A static IPV4 or IPV6 address and Iength, separated by a "" character in the separater in the separater in the separater in th	Genlock		
Demux C P Address 0 Address/Netmask Astatic IPV4 or IPV6 address and log 192 168.0.15/24 udio Gateway Gateway This may be left blank if not used. This may be left blank if not used. The set of the s	nalog Audio		
fideo Image: Instant Image: Instant Image: Ima)emux		
Serial Type String DNS DNS Provide String Vetwork Stream Stream DHCP No No MTU 1500 (1,4)(1,2)(10,9a;4A-F](1,4)(1,2)(1,2)(1,4)(1,4)(1,4)(1,4)(1,4)(1,4)(1,4)(1,4		192.168.0.15/24	length, separated by a "/" character. e.g 192.168.1.2/24 or 1111:2222::3333/32
FP DNS *\$!(*(250-51)(2)-4)!(10-9)!(1-9)!) letwork • Stream 9a-fA-F[1,4)(1,7)!(0-9a-fA-F[1,4);(1-2)!(0-9a-fA-F[1,4);(1-2)!(0-9a-fA-F[1,4);(1-2)!(0-9a-fA-F[1,4);(1-2)!(0-9a-fA-F[1,4);(1-2)!(0-9a-fA-F[1,4);(1-2)!(0-9a-fA-F[1,4);(1-2)!(0-9a-fA-F[1,4);(1-2)!(0-9a-fA-F[1,4);(1-2)!(0-9a-fA-F[1,4);(1-2)!(0-9a-fA-F[1,4);(1-2)!(0-9a-fA-F[1,4);(1-2)!(0-9a-fA-F[1,4);(1-2)!(0-9a-fA-F[1,4);(1-2)!(1-2)!(0-9a-fA-F[1,4);(1-2)!(0-9a-fA-F[1,4);(1-2)!(1-2)!(0-9a-fA-F[1,4);(1-2)!			
Jnit 9a-A-F[(1,4)](1,3)(1,9a-A-F[(1,4))(1,3)(1,3)(1,9a-A-F[(1,4))(1,3)(1,9a-A-F[(1,4))(1,3)(1,9a-A-F[(1,4))(1,3)(1,9a-A-F[(1,4))(1,3)(1,3)(1,9a-A-F[(1,4))(1,3)(1,3)(1,9a-A-F[(1,4))(1,3)(1,3)(1,3a-A-F[(1,4))(1,3)(1,3a-A-F[(1,4))(1,3)(1,3a-A-F[(1,4))(1,3)(1,3a-A-F[(1,4))(1,3)(1,3a-A-F[(1,4))(1,3)(1,3a-A-F[(1,4))(1,3a-A	SFP	DNS	(?i/) /)\{4}(3[0-2])[1-2] 0-9])\$)((^(([0 9a-fA-F]{1,4}:){7,7}[0-9a-fA-F]{1,4})([0-9
DHCP No ✓ MTU [1500] [14](13](10]) [14](13](10]) [14](13](10]) [14](13](10]) [14](13](10]) [14](13](10]) [14](13](10]) [14](13](10]) [14](13](10]) [14](13](10]) [16](1	Vetwork	⊙ Stream	fA-F]{1,4}:)[1,7}:]([0-9a-fA-F]{1,4}:)[1,6]:[9a-fA-F]{1,4}]([0-9a-fA-F]{1,4}:)[1,5]:[0-
MTU 1500 (1,3)(1,0-3i-4.F](1,4))(1,4)(1,4)(0-3i-4.F](1,4))(1,4)(0-3i-4.F](1,4))(1,4)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(0-3i-4.F](1,4))(1,5)(1,5)(0-3i-4.F](1,4))(1,5)(1,5)(0-3i-4.F](1,4))(1,5)(1,5)(0-3i-4.F](1,4))(1,5)(1,5)(0-3i-4.F](1,4))(1,5)(1,5)(0-3i-4.F](1,4))(1,5)(1,5)(0-3i-4.F](1,4))(1,5)(1,5)(0-3i-4.F](1,4))(1,5)(1,5)(0-3i-4.F](1,4))(1,5)(1,5)(0-3i-4.F](1,4))(1,5)(1,5)(0-3i-4.F](1,4))(1,5)(1,5)(0-3i-4.F](1,4))(1,5)(1,5)(1,5)(1,5)(1,5)(1,5)(1,5)(1,	Jnit	DHCP No Y	9a-fA-F]{1,4}}([0-9a-fA-F]{1,4}){1,4} [0-9a-fA-F]{1,4}){1,3}]([0-9a-fA-F]{1,4})
		MTU 1500	{1,3}(:[0-9a-fA-F]{1,4})(1,4)([0-9a-fA-F] {1,4})(1,2)(:[0-9a-fA-F]{1,4})(1,4)([0-9a-fA-F]{1,4})(1,5)(1,5)(1,5)(1,5)(1,5)(1,5)(1,5)(1,5
Address/Netmask Gateway DNS ⊕ [0-9])\$) ⊙ 10.168.26.210/24 10.168.26.1 ⊙ ⊕ ⓒ Gateway ○ Internal ⓒ DNS ○ DNS ○		○ IP Address	F]{1,4}:((:[0-9a-fA-F]{1,4})(1,6)):((:[0-9a-
⊘ Internal		Address/Netmask Gateway DNS 🕀	
		⊙ 10.168.26.210/24 10.168.26.1 10.168.26.1 ⊙ ⊕	Gateway Gateway
		() Internal	
			Stream
			O Internal

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 8.2* for a table of subnets mapped to CIDR values.

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



6. Web User Interface Overview

6.1 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).

Finput 🖬 🗘	Service Select	Video Decoders	ei 🗘	Audio Decoders	el O	SDI Output	<u>د</u>	e0 🗘
Apply 2265.000 MHz	1 Service 1	HEVC 4:2:2 10 to 1920x1080p 30.000		MPEG-1 416000 bps			SDI 1 1920x1080p30	
(()) 64-QAM 3/4 1/32	PSU Temperature			MPEG-1 352000 bps			SDI 2	
2 5.4 dB 3 27.4 dB	Ϋ́ο 👔			MPEG-1 288000 bps			SDI 3	
4 15.7 dB 5 6.0 dB	U € (i) 11.8 V 51.5 °C			MPEG-1 224000 bps			SDI 4	
6 0.7 dB				MPEG-1 220000 bps				
8 7.0 dB 16965120 bps				MPEG-1 224000 bps				
				MPEG-1 160000 bps				
				MPEG-1 112000 bps				
				MPEG-1				

6.2 Status Pages

The Status pages are provided giving detailed information for the Sapphire-RXD4. 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.

AST SYSTEMS WWW	Home	Sta	tus	Config	Command	Manage				
ophire-rxd3d-8	B	nput					⊙ Input			/
I Streaming nlock mux leo		 RX Input 0 Name Lock 	Yes	Ansmission Mode Continuous RX Yes te Continuo Normal 16965120	Normal	Bitrate 16965120 bps	Тур	ck scription pe ption	List	ed status. Description Source is present and valid. Source is missing or invalid.
dio cillary Data turn Data rial p twork twork tence it ne		Name	Bitrat						ie	



6.3 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. DOMO ? Home Status Config Command Manage View Running View Default View Saved Apply sapphire-rxd3d-8 Save Demodulator O Demodulator RX 2265 Frequency MHz 🔁 ASI O Downconverter Mode Select DVB-T ~ Description Downconverter settings 🗟 SDI 📀 Туре O DVB-T Mode Description The downconverter nodel/type. IP Streaming Bandwidth Туре String ✓ MHz 5.0 🗟 Genlock Option Description Guard Interval Analog Audio None No downconverter is connected Automatic ~ Use manual settings for the connected downconverter. 🗟 Demux Manual Signal Polarity 🕅 Video Automatic ~ Use individual settings for each connected downconverter. Individual Pedestal Mode 🖹 Audio BWSDC-200270 downconver ~ Single 🗟 Serial BWSDC-200270 connected, supporting 2.00GHz to 2.70GHz O UMVL Mode 🖾 SFP RWDC-PRO-200270 O Narrowband Mode RWDC-PRO-200270 downconver er connected 🖹 Network supporting 1.98GHz to 2.70GHz Downconverter DC-100140 downconverter connected, supporting 1.00GHz to 1.40GHz 🗟 Unit Туре BWSDC-200270 ~ DC-100140 ~ Power 9.0V DC-225265 downconverter connected, supporting 2.25GHz to 2.65GHz A Manual Mode DC-225265 🔿 Individual Mode DCB-100150 downconverter connected, supporting 1.00GHz to 1.50GHz Packet Diversity DCB-100150 DCB-150200 downconverter connected, supporting 1.50GHz to 2.00GHz DCB-150200 DCB-200250 downconverter

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



6.4 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.

æ	Download and Upgrade F	irmware	O Download and Upgr	rade Firmware
	Download Protocol	HTTP 🗸	Description	Download an upgrade file from a server and insta it
	Hostname or Address	127.0.0.1	Timeout	n. 10s
	Path		O Download Proto	
Accounts	Port	0	Description	The protocol to use for downloading the ima
	Username		Туре	String
	Password		Option	Description
	Reboot When Complete	Yes 🗸	HTTP	Hypertext Transfer Protocol.
		Run	HTTPS	Hypertext Transfer Protocol Secu
	Switch Firmware		FTP	File Transfer Protocol
	Image Select	0 ~	FTPS	File Transfer Protocol Secure
	Reboot When Complete	Yes V		Use a file on a local file-sytem, at the given path
	Rebot when complete	Run	Local	(host/port/username/password arguments are ignored). E.g. SD- card or USB drive.
	Reboot		(A) Hostname or Ad	Idrass
	Forced Reboot	No 🗸	Ŭ	
		Run	O Path	
			Port	
			O Username	
			Password	
			Reboot When C	omplete





6.5 Manage Pages

The Manage pages are used for maintenance of the Sapphire-RXD4 internal software and settings. See *Section 7.5* 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.

nfig	Save Config		Save Config
ence	Unsaved Modules	Save All	Description Save individual or all unsaved modules.
	ASI	Save	O Unsaved Modules
nware	SDI	Save	Description Name of the unsaved module.
e	IP Streaming	Save	⊙ Save
nostic	Genlock	Save	Description Click save next to a module name to save th individual module.
	Analog Audio	Save	Save All
	Demux	Save	Description Click save all to save all listed modules. An
	Audio	Save	error may have occurred if any modules rem unsaved after saving all, individual errors are
	Serial	Save	not reported in this case.
	SFP	Save	
	Network	Save	 Import Config
	Unit	Save	 Export Config
	Sectory Default Config		
	Restore Defaults)	
	⊘ Import Config		
	Choose Files	No file chosen	
	Overwrite		
	Merge	5	
	• Export Config		
	Export		



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 web interface configuration is covered.

Only settings for the Sapphire-RXD4 are explained, it is assumed that the inputs to the system are provided.

7.2 Receiver Setup

Sapphire-RXD4 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.

BROADCAST SYSTEMS 1000	Home	Status	Config	Command	Manage					?
sapphire-rxd3d-8						View Running	View Default	View Saved	Apply	Save
RX	Source		RX	~						
ASI	Mode S		Automatic	~						
SDI	Ŭ _	tomatic Mode	[.		7					
IP Streaming		ogram Number vice Name	1]					
Genlock	⊙ Ma	nual Mode								
Analog Audio		PID 🕂								
Demux										
Video										
Audio										
Serial										
SFP										
Network										
Unit										



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.

BRO	DADCAST SYSTEMS "WWW	Home	Status	Config	Command	Manage					?
	sapphire-rxd3d-8						View Running	View Default	View Saved	Apply	Save
	RX	⊘	Demodulator								
	ASI		Frequency	2265		MHz					
	SDI		Mode Select	DVB-T		~					
			OVB-T Mode								
1	IP Streaming		Bandwidth	8.0		✓ MHz					
	Genlock		Guard Interval	Aut	tomatic	~					
	Analog Audio		Signal Polarity	Aut	tomatic	~					
₿	Demux		Pedestal Mode	Sin	gle	~					
	Video		O UMVL Mode								
	Audio		O Narrowband Mode	•							
		\odot	Downconverter								
	Serial		Туре	BWSDO	C-200270	~					
	SFP		Power	9.0V		~					
	Network		Manual Mode								
	Unit		Individual Mode								
		\odot	Packet Diversity								
		Ŭ	,								

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.

sapphire-rxd3d-8	× +	∨ – □ ×
← → C ☆ ▲ Not secu	re https://10.168.26.84	🖻 🖈 🔍 🛊 🖬 😩 🗄
BROADCAST SYSTEMS 7000	e Status Config Command Manage	?
RF input adi \$ Apply 2265.000 MHz ((i)) 1 11.8 dB 2 0.0 dB 3 0.0 dB 4 0.0 dB 6 0.0 dB 7 0.0 dB 8 0.0 dB 18092064 bps	Service Select will \$ 1 HEVC 4:2:2 10 bit 1920x1080i 50.000 fps PSU Imperature 51.8 °C 51.8 °C MPEG-1 448000 bps MPEG-1 448000 bps Imperature 448000 bps	SDI 1 1920x108050 SDI 2 SDI 3 SDI 4



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.

RX (🕑 Dem	odulato	r									
ASI		Devi	ce Nam	e RF Lock	Freque	ncy Constellat	ion FEC	Guard Interval	Bitrate	Input Channel	Error Rates	
SDI	0	0330-1@	0169.25	54.1.3 Yes	2265.000	MHz 16-QAM	3/4	1/32	18096256 bps			
		Demodu										
P Streaming		evice N			0-1@169.2	54.1.3						
enlock		F Lock		Yes	5.000 MHz							
emux		onstell	1									
ideo	F	EC		3/4								
udio		Suard In	terval	1/32								
		Sitrate) Inpu	t Chani		96256 bps							
ncillary Data					LO Side	Signal Strength	SNR	FF	TFile			
eturn Data		\odot	1	1833.000 MHz	Low	-47.0 dBm		/files/d330rx/demo		/fft sva		
erial		$\overline{\odot}$	2	1833.000 MHz	Low	-108.0 dBm		/files/d330rx/demo				
FP		0	3	1833.000 MHz	Low	-111.0 dBm		/files/d330rx/demo				
etwork		\odot	4	1833.000 MHz	Low	-110.0 dBm	0.0 dB	/files/d330rx/demo	dulator/0/input/3	/fft.svg		
cence		\odot	5	1833.000 MHz	Low	-112.0 dBm	0.0 dB	/files/d330rx/demo	dulator/0/input/4	/fft.svg		
		\odot	6	1833.000 MHz	Low	-112.0 dBm	0.0 dB	/files/d330rx/demo	dulator/0/input/5	/fft.svg		
nit		\odot	7	1833.000 MHz	Low	-111.0 dBm	0.0 dB	/files/d330rx/demo	dulator/0/input/6	/fft.svg		
ime		\odot	8	1833.000 MHz	Low	-112.0 dBm	0.0 dB	/files/d330rx/demo	dulator/0/input/7	/fft.svg		
	(S Erro	r Rates									
			/iterbi		1861 🔺							
			Viterbi		0							
		Iran	sport		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.



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**.

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.

	BROADCAST SYSTEMS WWW	Home	e Status	Config	Command	Manage					?
	sapphire-rxd3d-8						View Running	View Default	View Saved	Apply	Save
ize ≍e	RX ASI SDI IP Streaming Genlock Analog Audio Demux	(Decoder Secoder Initial Output Video Format Frame/Field Rate Failure Mode Latency Mode Pattern Generator Specification	1920 50 Blue scre Automati		v fps					
کو کو کو	Video Audio Serial SFP Network Unit		Video Format Frame/Field Rate	3840x21 50	60p	v tps					

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.

		Home	Status	Config	Command	Manage					?
	sapphire-rxd3d-8						View Running	View Default	View Saved	Apply	Save
1× 1× 1× 1×	sapphire-rxd3d-8 RX ASI SDI IP Streaming Genlock Analog Audio Demux Video Audio Serial	⊙ ⊙	SDI 1-4 Source Link Type Sample Format Conversion	Patter Quad SQD None Decoc Single None	link	> > > > > >	View Running	View Default	View Saved	Apply	Save
) X	SFP Network										

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

RF Input	al 🗘	Service Select	e0 🗘	Video Decoders	e0 🗘	Audio Decoders	e0 🌣	SDI Output		e00 <
	ИНZ	1 Servi	ice 1	HEVC 4:2:2 10 1920x1080i 50.00		MPEG-1 448000 bps			SDI 1 1920x1080p50	
(()) 16-QAM 3/4 1 25.0 dB	1/32	PSU Ten	nperature			MPEG-1			SDI 2 1920x1080p50	
2 0.0 dB 3 0.0 dB						MPEG-1			SDI 3 1920x1080p50	
4 0.0 dB 5 0.0 dB			47.6 °C			MPEG-1 448000 bps			SDI 4 1920x1080p50	
6 0.0 dB 7 0.0 dB 8 0.0 dB						MPEG-1 448000 bps				
18096464 bps						MPEG-1 448000 bps				
						MPEG-1 448000 bps				
						MPEG-1 448000 bps				



7.4 IP Streaming

7.4.1 IP Streaming Overview

Sapphire-RXD4 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 7.4.4*.

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

	sapphire-rxd3d-8											View Running	View Default	View Saved	Apply	Save
	RX	ΘI	nput	I												
	ASI	E	Buffer	Delay	5)			r	ns						
	SDI			oifferential	L	ow-skew			~							
		(⊘ so													
۵	IP Streaming			Protocol				nterface			Ð					
	Genlock		0			11000	64 A	utomatic		Θ	Ð					
	Analog Audio		e e) Source 0 Protocol		UC	D			~]					
	Demux			Address						•]					
	Video			Port		110	00]					
	Audio			TTL		64]					
	Serial			Interface		Au	tomatic			~						
	SFP										1					
	Network		input :	,												
	Unit	-	Outpu													
	Onic		Sourc		R	х			~	٦						
		1	TS per	IP	7											
		(estination							_					
				Protocol	Address	Por	t TTL	Inter	face	SRT	(①)					
			0	UDP	10.168.26.2	210 1100	0 64	Autor	matic		$\Theta \oplus$					
			0) Destinatio	n 0						1					
				Protocol		U				~						
				Address			168.26.	210								
				Port TTL		110	00]					
				Interface			tomatic			~						
				O SRT			tomatic									
				-												
			Outpu													
		\odot	Packe	t Diversity												

Note: Streaming status can be monitored in the Status>IP Streaming page, see Section 7.4.5.

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 7.4.4</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.



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.

sapphire-rxd3d-8		View Running View Default View Saved Apply Save
	⊙ Input 1	
ASI	Buffer Delay 50 ms	
SDI	Path Differential Low-skew	
	⊘ Source	
IP Streaming	Protocol Address Port TTL Interface SRT	
Genlock	O UDP 11000 64 Automatic O ⊕	
Analog Audio	Source 0 Protocol UDP	
Demux	Address	
Video	Port 11000	
Audio	TTL 64	
Serial	Interface Automatic V	
SFP	⊙ srt	
Network		
	 ⊘ Input 2 ⊙ Output 1 	
Unit	Source RX V	
	TS per IP 7	
	⊘ Destination	
	Protocol Address Port TTL Interface SRT +	
	⊙ UDP 10.168.26.210 11000 64 Automatic ⊙⊕	
	O Destination 0	
	Protocol UDP V	
	Address 10.168.26.210	
	Port 11000	
	TTL 64	
	Interface Automatic ~	
	SRT SRT	
	⊙ Output 2	
	Packet Diversity	

Item	Notes	
Protocol	UDP, RTP or SRT.	
	Note : When using SRT, the SRT settings will need to be configured, see <i>Section 7.4.3.</i>	
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.

BROADCAST SYSTEMS 1000	Home Status	Config Con	nmand Man	age						?
sapphire-rxd3d-8						View Running	View Default	View Saved	Apply	Save
RX ASI	⊘ Input 1 Buffer Delay	50	ms							
SDI	Path Differential	Low-skew	~							
IP Streaming	Protocol		Interface SRT	Ð						
Genlock Analog Audio	Source 0	239.245.50.4 11000 64	Control	$\Theta \oplus$						
Demux	Protocol	RTP	,	•						
Video	Address	239.245.5	0.4							
Audio	тъ	64								
Serial SFP	interface	Control		•						
Network	⊙ Input 2									
Unit	Output 1									
	Source TS per IP	RX 7	~							
	Oestination			-						
	Protocol	Address Port TT 239.245.50.25 11000 64	L Interface SRT	· ⊕ ⊝⊕						
	⊙ Destinati			_						
	Protocol	RTP 239.245.50	0.25	-						
	Port	11000								
	TTL	64 Stream		-						
		ovedin								
	Output 2									
	Packet Diversity									

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. For more guidance on multicast addressing, 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 (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 streaming will also need to be configured, see *Section 7.4.2.*

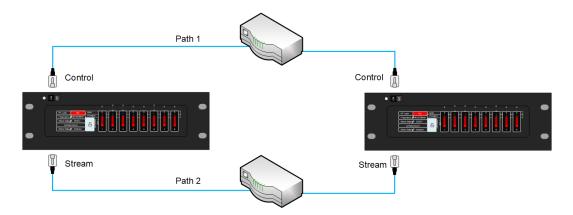
BROADCAST SYSTEMS WWW	Home Status Config Command Manage					?
sapphire-rxd3d-8		View Running	View Default	View Saved	Apply	Save
RX	⊙ Input 1					
ASI	Buffer Delay 50 ms					
SDI	Path Differential					
	⊙ Source					
IP Streaming	Protocol Address Port TTL Interface SRT ⊕ ⊙ SRT 11000 64 Control ⊙ ⊕					
Genlock	⊙ SRT 11000 64 Control ⊙ ⊕ ⊙ Source 0					
Analog Audio	Protocol SRT V					
Demux	Address					
Video	Port 11000					
Audio	TTL 64					
Serial	Interface Control V					
SFP	⊙ srt					
Network	Mode Listener V Delay 80 ms					
Unit	Encryption Passphrase					
	⊙ Input 2					
	⊙ Output 1 Source					
	TS per IP 7					
	⊙ Destination					
	Protocol Address Port TTL Interface SRT 🕀					
	⊙ SRT 10.168.28.89 22000 64 Stream ⊙ ⊕					
	O Destination 0 Protocol SRT V					
	Address 10.168.28.89					
	Port 22000					
	TTL 64					
	Interface Stream V					
	⊙ SRT					
	Mode Caller Caller					
	Delay 500 ms Encryption Passphrase					
	Output 2					
	Packet Diversity					

Item	Notes
Mode	The Caller initiates the outbound call to the Listener. The Caller can be an input (receiver) or output (sender).
	The Listener waits for an inbound connection from the Caller. The Listener can be an input (receiver) or output (sender).
	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.
	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.
Delay	The delay ca 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.
Encryption Passphrase	SRT includes an AES128 encrypted passphrase. This must be matched in the input and output device.
	If this is left blank, no encryption will be applied.



7.4.4 SMPTE-2022-7 Networks

The Sapphire-RXD4 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 7.4.2.

BROADCAST SYSTEMS WWW	Home Status Config Command Manage	?
sapphire-rxd3d-8		View Running View Default View Saved Apply Save
RX	⊙ Input 1	⊙ Input 1
ASI	Buffer Delay 50 ms	Description Config for ID streaming input 1.
	Path Differential Moderate-skew	
SDI	⊙ Source	Path Differential
IP Streaming Genlock	Protocol Address Port TTL Interface SRT ⊕ ③ RTP 10000 64 Control ⊙ ⊕	Description Maximum path delay difference between sources in milliseconds. When all streams are RTP, packets are intelligently combined and reordered to cope with dropped packets and out of order delivery.
Analog Audio	⊙ Source 0	Type Integer
Demux	Protocol	Option Description
Video	RTP Y	Low-skew Path delay difference <= 10ms. Use for direct network connection.
Audio	Port	Path delay difference <= 50ms. Use Moderate-skew for private network with 1 or more routers in the path.
Serial SFP	10000 TTL	Path delay difference <= 450ms. Use High-skew when streaming across the internet or public networks.
Network	64	⊘ Source
Unit	Interface Control	·
		⊙ Input 2
		Output 1
		Output 2
	Output 1	Packet Diversity
	Output 2	
	O Packet Diversity	



7.4.5 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.

BROADCAST SYSTEMS 1000	Home Status Config Command Manage	?
sapphire-rxd3d-8		
sapphire-rxd3d-8 RX ASI SDI IP Streaming Genlock Demux Video Audio Audio Ancillary Data Return Data	 O Input 1 O Source State Address Bitrate Jitter Error Counts SRT O Kay 0.0.0 18092971 bps 8.333 ms Max Redundancy Error Counts Input 2 Output 1 O Destination State Address Bitrate SRT O Kay 10.168.26.210 18093327 bps 	
Serial SFP Network Licence Unit Time	 ⊙ Output 2 ⊙ Packet Diversity 	

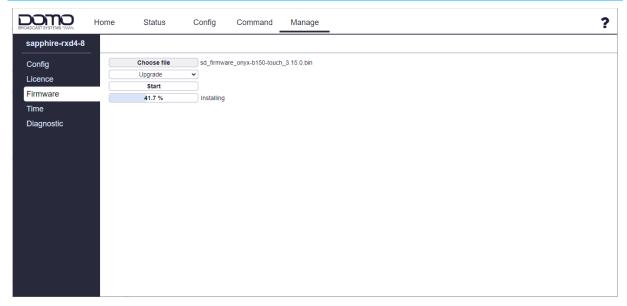


7.5 Firmware Upgrade

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 (**d330**). If both files require upgrade, the codec must be uploaded first. A reboot is required on completion of the upgrade.

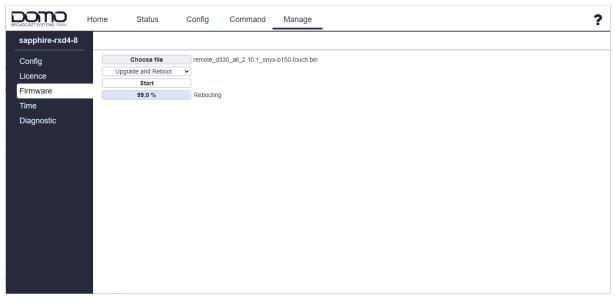
Go to the **Manage>Firmware** page. Select **Choose File** and browse to the *sd_firmware_onyx-b150-touch_x.x.x.bin* file. Set to **Upgrade** and click **Start**. The upgrade status will display accordingly.

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_d330_all_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 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.

			×	ocal Area Connection2 Status	×
Control Panel 🕨 Network and Ir	nternet Network and Sharing Center	✓ 4 Search Control Panel	P	neral	
			0		
Control Panel Home View you	ur basic network information and	set up connections		IPv4 Connectivity:	No Internet access
Change adapter settings		Sec	e full map	IPv6 Connectivity:	No network access
Change advanced sharing		S		Media State:	Enabled
settings SOUI	1-PUR-W00043 Multiple networ nis computer)	ks Internet		Duration:	01:58:04
	active networks	Connect or d	isconnect	Speed:	1.0 Gbps
		3. Click of	n the network adapter	Details	
	purple.cobham.local	Access type: Internet you wish t	o configure.		
	Domain network	Connections: Q Corporate		ctivity	
				. Click on 'Properties'.	
	Unidentified network	Access type: No Internet access			Received
100	Public network	Connections: 🎴 Local Area Connection		Bytes: 15,496	493,367
				5,005.	100,007
Change you	ur networking settings			Properties BDisable	Diagnose
	Set up a new connection or network			W Proper des	Diagnose
		or VPN connection; or set up a router or acco	ess point.		Close
	Connect to a network	I-up, or VPN network connection.		Use the following IP address	
Local Area Connection2 Properties		ap, of the network connection.		ou wish to use. Any units cor	
Networking Authentication Sharing	and sharing options	ocol Version 4 (TCP/IPv4) Properties		n the same address range b	ut the last number
Connect using:	ters located Internet Prot	ocol Version 4 (TCP/IPV4) Properties	of the aut	lress must be unique. ample — 192.168.0 is comm	in and Q is unique
5. Select 'Internet Protocol	ems General			et Mask' will auto populate.	in and 2 is unique.
	network pi You can g	et IP settings assigned automatically if your retw	ork supports	et mask will auto populate.	
This connection uses following items:	onfigure this capat for the ap	vility. Otherwise, you need to ask your petwork as propriate IP settings.	ministrator		
Client for Micros, Networks					
QoS Packet Scher Ver		in an IP address automatically		8. Close all windows	
File and Printer Sharing for Microsoft Networks	s	the following IP address:		'Close' to the app	ly the settings.
Internet Protocol Version 6 (TCP/IPv6) Internet Protocol Version 4 (TCP/IPv4)	IP add			~	
Link-Layer Topology Discovery Mapper I/O Dr	lriver Subnet	mask: 255 . 255 . 255 .	0		
 Link-Layer Topology Discovery Responder 	Defaul	gateway:		2. Click on	
	Obt	in DNS server address automatically		'Open Netwo	rk and Sharing Centre'.
	operties	the following DNS server addresses:			
Description Transmission Control Protocol/Internet Protocol. Tr/	<u> </u>	ed DNS server:		Currently connect	ed to: 🖉 🏤
wide area network protocol that provides commun /	ation	te DNS server:		purple.cob	
across diverse interconnected networks.	Alterna			Internet ac	
6. Click on 'Prop	perties'. 📃 val	date settings upon exit	Advanced	No Internet	ed ne work
			Survey Cold Cold Cold Cold Cold Cold Cold Cold	ivo interne	
ОК	Cancel	ОК	Cancel 1. Click the	network Open Netwo	rk and Sharing Center
			icon which r		
🚳 💽 🥝 🧊			look like this		10:01

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 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 <u>uk.technical.support@domotactical.com</u>.

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 884 550
- Email: support@domobroadcast.com (no restricted content)

9.3 Using the DTC RMA Service

9.3.1 Contact DTC

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

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

9.3.2 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.

9.3.3 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.

9.3.4 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.



9.3.5 Send the Box to DTC

Send the box using your normal shipping 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	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.

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 submerse 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 overheating, 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