HANDBOOK

# Redbox
## User Handbook No 7

| | |
|---|---|
| **RB-VHDA8** | 3G/HD/SD-SDI 1 Input, 8 Output Distribution Amplifier |
| **RB-VHDA2X4** | 3G/HD/SD-SDI 2 Input, 8 Output Video Distribution Amplifier |
| **RB-VHDMA8** | 3G/HD/SD-SDI De-Embedder 8 Channel Analogue Outputs |
| **RB-VHEMA8** | 3G/HD/SD-SDI Embedder 8 Channel Analogue Inputs |
| **RB-VHCMA4** | 3G/HD/SD-SDI Embedder & De-Embedder 4 Channel Analogue I/O |
| **RB-VHCMD16** | 3G/HD/SD-SDI Embedder & De-Embedder 16 Channel Digital I/O |

Manufacturers of audio & video products for radio & TV broadcasters

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# Register Online for an Extended 2 Year Warranty

As standard, Sonifex products are supplied with a 1 year back to base warranty.

If you register the product online, you can increase your product warranty to 2 years and we can also keep you informed of any product design improvements or modifications.

Product: _____

Serial No: _____

To register your product, please go online to www.sonifex.co.uk/register

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# Product Warranty - 2 Year Extended

As standard, Sonifex products are supplied with a 1 year back to base warranty. In order to register the date of purchase and so that we can keep you informed of any product design improvements or modifications, it is important to complete the warranty registration online. Additionally, if you register the product on the Sonifex website, you can increase your product warranty to 2 years. Go to the Sonifex website at: https://www.sonifex.co.uk/technical/register/index.asp to apply for your 2 year warranty.

**Note:** For your own records the product serial number is recorded on the CE certification page of this handbook.

## Sonifex Warranty & Liability Terms & Conditions

### 1. Definitions

'the Company' means Sonifex Ltd and where relevant includes companies within the same group of companies as Sonifex Limited.

'the Goods' means the goods or any part thereof supplied by the Company and where relevant includes: work carried out by the Company on items supplied by the Purchaser; services supplied by the Company; and software supplied by the Company.

'the Purchaser' means the person or organisation who buys or has agreed to buy the Goods.

'the Price' means the Price of the Goods and any other charges incurred by the Company in the supply of the Goods.

'the Warranty Term' is the length of the product warranty which is usually 12 months from the date of despatch; except when the product has been registered at the Sonifex website when the Warranty Term is 24 months from the date of despatch.

'the Contract' means the quotation, these Conditions of Sale and any other document incorporated in a contract between the Company and the Purchaser.

This is the entire Contract between the parties relating to the subject matter hereof and may not be changed or terminated except in writing in accordance with the provisions of this Contract. A reference to the consent, acknowledgement, authority or agreement of the Company means in writing and only by a director of the Company.

### 2. Warranty

a. The Company agrees to repair or (at its discretion) replace Goods which are found to be defective (fair wear and tear excepted) and which are returned to the Company within the Warranty Term provided that each of the following are satisfied:

   i. notification of any defect is given to the Company immediately upon its becoming apparent to the Purchaser;

   ii. the Goods have only been operated under normal operating conditions and have only been subject to normal use (and in particular the Goods must have been correctly connected and must not have been subject to high voltage or to ionising radiation and must not have been used contrary to the Company's technical recommendations);

   iii. the Goods are returned to the Company's premises at the Purchaser's expense;

   iv. any Goods or parts of Goods replaced shall become the property of the Company;

   v. no work whatsoever (other than normal and proper maintenance) has been carried out to the Goods or any part of the Goods without the Company's prior written consent;

vi. the defect has not arisen from a design made, furnished or specified by the Purchaser;

vii. the Goods have been assembled or incorporated into other goods only in accordance with any instructions issued by the Company;

viii. the defect has not arisen from a design modified by the Purchaser;

ix. the defect has not arisen from an item manufactured by a person other than the Company. In respect of any item manufactured by a person other than the Company, the Purchaser shall only be entitled to the benefit of any warranty or guarantee provided by such manufacturer to the Company.

b. In respect of computer software supplied by the Company the Company does not warrant that the use of the software will be uninterrupted or error free.

c. The Company accepts liability:

(i) for death or personal injury to the extent that it results from the negligence of the Company, its employees (whilst in the course of their employment) or its agents (in the course of the agency);

(ii) for any breach by the Company of any statutory undertaking as to title, quiet possession and freedom from encumbrance.

d. Subject to conditions (a) and (c) from the time of despatch of the Goods from the Company's premises the Purchaser shall be responsible for any defect in the Goods or loss, damage, nuisance or interference whatsoever consequential economic or otherwise or wastage of material resulting from or caused by or to the Goods. In particular the Company shall not be liable for any loss of profits or other economic losses. The Company accordingly excludes all liability for the same.

e. At the request and expense of the Purchaser the Company will test the Goods to ascertain performance levels and provide a report of the results of that test. The report will be accurate at the time of the test, to the best of the belief and knowledge of the Company, and the Company accepts no liability in respect of its accuracy beyond that set out in Condition (a).

f. Subject to Condition (e) no representation, condition, warranty or other term, express or implied (by statute or otherwise) is given by the Company that the Goods are of any particular quality or standard or will enable the Purchaser to attain any particular performance or result, or will be suitable for any particular purpose or use under specific conditions or will provide any particular capacity, notwithstanding that the requirement for such performance, result or capacity or that such particular purpose or conditions may have been known (or ought to have been known) to the Company, its employees or agents.

g. (i) To the extent that the Company is held legally liable to the Purchaser for any single breach of contract, tort, representation or other act or default, the Company's liability for the same shall not exceed the price of the Goods.

(ii) The restriction of liability in Condition (g)(i) shall not apply to any liability accepted by the Seller in Condition (c).

h. Where the Goods are sold under a consumer transaction (as defined by the Consumer Transactions (Restrictions on Statements) Order 1976) the statutory rights of the Purchaser are not affected by these Conditions of Sale.

## Unpacking Your Product

Each product is shipped in protective packaging and should be inspected for damage before use. If there is any transit damage take pictures of the product packaging and notify the carrier immediately with all the relevant details of the shipment. Packing materials should be kept for inspection and also for if the product needs to be returned.

The product is shipped with the following equipment so please check to ensure that you have all of the items below. If anything is missing, please contact the supplier of your equipment immediately.

| Item | Quantity |
|---|---|
| Product unit | 1 |
| IEC mains lead fitted with moulded mains plug | 1 |
| Handbook and warranty card | 1 |

If you require a different power lead, please let us know when ordering the product.

## Repairs & Returns

Please contact Sonifex or your supplier if you have any problems with your Sonifex product. Email technical.support@sonifex.co.uk for the repair/upgrade/returns procedure, or for support & questions regarding the product operation.

# CE Conformity

The products in this manual comply with the essential requirements of the relevant European health, safety and environmental protection legislation.

The technical justification file for this product is available at Sonifex Ltd.

The declaration of conformity can be found at:
https://www.sonifex.co.uk/declarations

# Safety & Installation of Mains Operated Equipment

There are no user serviceable parts inside the equipment. If you should ever need to look inside the unit, always disconnect the mains supply before removing the equipment covers. The cover is connected to earth by means of the fixing screws. It is essential to maintain this earth/ ground connection to ensure a safe operating environment and provide electromagnetic shielding.

## Voltage Setting Checks

Ensure that the machine operating voltage is correct for your mains power supply by checking the box in which your product was supplied. The voltage is shown on the box label. The available voltage settings are 115V, or 230V. Please note that all products are either switchable between 115V and 230V, or have a universal power supply.

## Fuse Rating

The product is supplied with a single fuse in the live conducting path of the mains power input. For reasons of safety it is important that the correct rating and type of fuse is used. Incorrectly rated fuses could present a possible fire hazard, under equipment fault conditions. The active fuse is fitted on the outside rear panel of the unit.

## Power Cable & Connection

An IEC power connector is supplied with the product which has a moulded plug attached.

The mains plug or IEC power connector is used as the disconnect device. The mains plug and IEC power connector shall remain readily operable to disconnect the apparatus in case of a fault or emergency.

The mains lead is automatically configured for the country that the product is being sent to, from one of:

| Territory | Voltage | IEC Lead Type | Image |
|---|---|---|---|
| UK & Middle East | 230V | UK 3 pin to IEC lead | |
| Europe | 230V | European Schuko round 2 pin to IEC lead | |
| USA, Canada and South America | 115V | 3 flat pin to IEC lead | |
| Australia & New Zealand | 230V | Australasian 3 flat pin to IEC lead | |

Connect the equipment in accordance with the connection details and before applying power to the unit, check that the machine has the correct operating voltage for your mains power supply.

This apparatus is of a class I construction. It must be connected to a mains socket outlet with a protective earthing connection.

**Important note:** If there is an earth/ground terminal on the rear panel of the product then it must be connected to Earth.

## WEEE Directive

The Waste Electrical and Electronic Equipment (WEEE) Directive was agreed on 13 February 2003, along with the related Directive 2002/95/EC on Restrictions of the use of certain Hazardous Substances in electrical and electronic equipment (RoHS). The Waste Electrical and Electronic Equipment Directive (WEEE) aims to minimise the impacts of electrical and electronic equipment on the environment during their life times and when they become waste. All products manufactured by Sonifex Ltd have the WEEE directive label placed on the case. Sonifex Ltd will be happy to give you information about local organisations that can reprocess the product when it reaches its “end of use”, or alternatively all products that have reached “end of use” can be returned to Sonifex and will be reprocessed correctly free of charge.

## Atmosphere/Environment

This apparatus should be installed in an area that is not subject to excessive temperature variation (<0°C, >50°C), moisture, dust or vibration.

This apparatus shall not be exposed to dripping or splashing, and no objects filled with water, such as vases shall be placed on the apparatus.

## Fitting Redboxes

Redboxes can be fixed to the underside of a desk, or other surfaces using 4.2mm holes in the sides and fixed with 2 x M4 screws or 2 x No. 6 countersink wood screws.

They can also be rack-mounted, with either the front, or rear of the Redbox positioned at the front of the rack (Note: this product is front rack-mounted as standard):

*Fig A: RB-RK1 Small Redbox Front Rack-mount Kit .*

**Front Mounting Redboxes**: For rack mounting smaller (28cm) units the optional **RB-RK1** (Red) or **RB-RK1B** (Black) kit can be used (which include 4 off M6 panel fixing screws).

**Rear Mounting a Redbox**: For rear panel mounting you can use either the **RB-RK2** (in this case), or **RB-RK3**, depending on the size of your Redbox.

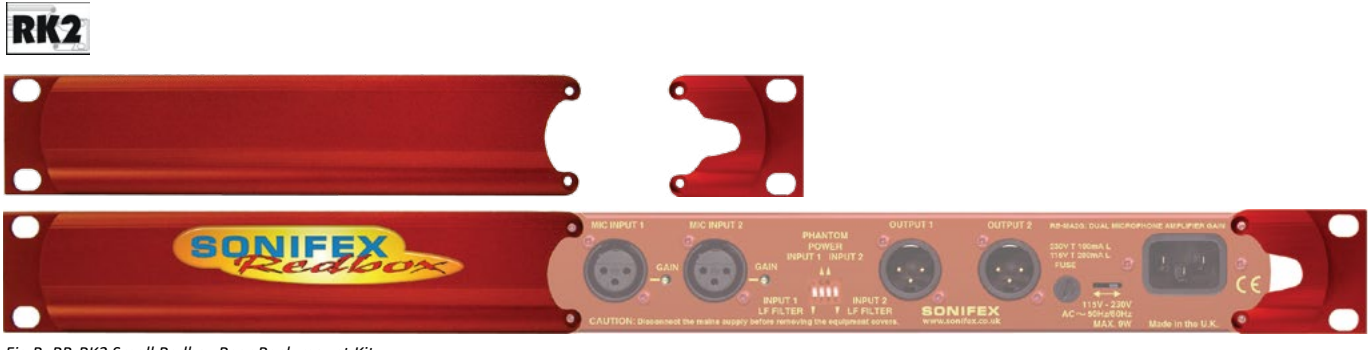


*Fig B: RB-RK2 Small Redbox Rear Rack-mount Kit.*

*Fig C: RB-RK3 Large Redbox Rear Rack-mount Kit.*

# 1 RB-VHDA8 3G/HD/SD-SDI 1 Input, 8 Output Video Distribution Amplifier

## Introduction

*Fig 1-1: RB-VHDA8 Front Panel*

The RB-VHDA8 is a high performance, reliable eight way digital video distribution amplifier for re-clocking and distributing a 3G, HD (high definition) or SD (standard definition) SDI source to eight outputs. The unit provides automatic input detection, re-clocking and cable equalisation of the input signal to 100/350 meters (HD/SD) of coax cable.

The full range of SD, HD and 3G standards are supported by the unit, allowing NTSC and PAL composite digital signals right up to component digital signals at 1080p 60Hz.

The rear panel has a single female BNC connector for the 3G/HD/SD-SDi input and a further eight female BNC connectors for the outputs. Each output is buffered providing driven outputs for greater reliability.

As well as an AC power input on a filtered IEC, the unit also has an adjacent 12V DC input on a 2.5mm co-axial connector, for use, for example, in outside broadcast vehicles. Both power inputs can be used to give a dual redundant power supply; whichever voltage is higher will be used.

The front panel of the case has a single bi-colour LED which indicates amber to show power is present, then green should a valid incoming SDI signal be detected.

*Fig 1-2: RB-VHDA8 Rear Panel*

## System Block Diagram

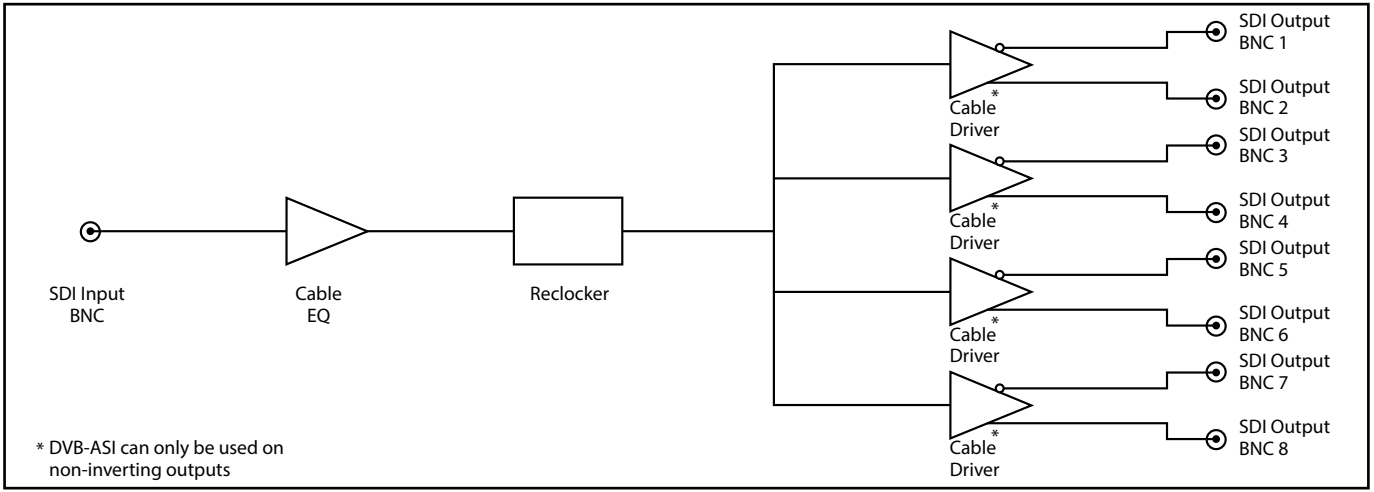


*Fig 1-3: RB-VHDA8 System Block Diagram*

## Front Panel Controls & Indicators

The front panel of the case has a single bi-colour LED which indicates amber to show power is present, then red should a valid incoming SDI signal be detected.

## Rear Panel Connections

**3G/HD/SD-SDI Input**

The single input uses a BNC connector.

**3G/HD/SD-SDI Outputs**

The eight outputs use BNC connectors.

## Technical Specification For RB-VHDA8

| | |
|---|---|
| Compatible Standards: | SMPTE-424M (3G)<br>SMPTE-292M (HD-SDI)<br>SMPTE-259M-AC1 (SD-SDI)<br>SMPTE 344M1<br>DVB-ASI2 at 270Mb/s |

[1] Other rates will be passed without reclocking.
[2] Non inverted outputs only.

| | |
|---|---|
| Impedance: | 75Ω terminating |
| Equalisation: | Up to 100m of Belden 1694A at 1.485Gbps<br>Up to 350m of Belden 1694A at 270 Mbps |
| Data Rates: | Fully supported: 143, 270, 1483.5, 1485, 2967 & 2970Mbps<br>Passed but not reclocked: 177, 360 & 540Mbps |

Reclocking & Equalisation: Automatic

| | |
|---|---|
| Resolution: | Automatic |
| Return Loss: | >15dB at 1500MHz |
| Output Jitter: | <0.2UI |
| Signal Level: | 800mV ±10% |

**Front Panel Indicators**

| | |
|---|---|
| Power LED: | Amber indicates power is present, Red indicates detection of valid incoming SDI signal |

**Rear Panel Connections**

| | |
|---|---|
| HD/SD-SDI Video Input: | 1 x BNC (Unbalanced) |
| HD/SD-SDI Video Outputs: | 8 x BNC (Unbalanced) |
| Power Supply:<br>AC: | Filtered IEC, continuously rated 85-264VAC, 47-63Hz, fused |
| Fuse Rating: | Anti-surge fuse 1A 20 x 5mm |
| DC: | 12V 300mA max, DC supply, 2.5mm socket fused |

**Equipment Type**

| | |
|---|---|
| RB-VHDA8: | 3G/HD/SD-SDI 1 Input, 8 Output Video Distribution Amplifier |

**Physical Specification**

| | |
|---|---|
| Dimensions (Raw): | 48cm (W) x 10.8cm (D) x 4.3cm (H)<br>19” (W) x 4.3” (D) x 1.7” (H) (1U) |
| Dimensions (Boxed): | 59cm (W) x 20.5cm (D) x 6cm (H)<br>21” (W) x 8” (D) x 2.4” (H) |
| Weight : | Nett: 1.3kg Gross: 1.9kg<br>Nett: 2.9lbs Gross: 4.2lbs |

**Accessories**

| | |
|---|---|
| RB-RK3: | 1U Rear panel rack kit for large Redboxes |

# 2 RB-VHDA2x4 3G/HD/SD-SDI 2 Input, 8 Output Video Distribution Amplifier

## Introduction

*Fig 2-1: The RB-VHDA2x4 3G/HD/SD-SDI 2 Input, 8 Output Video Distribution Amplifier*

The RB-VHDA2x4 is a high performance, reliable dual input and eight output digital video distribution amplifier for re-clocking and distributing up to two 3G, HD (high definition) or SD (standard definition) SDI sources.

By default, the RB-VHDA2x4 acts as two independent video distribution amplifiers, with input 1 routed to outputs 1-4 and input 2 routed to outputs 5-8. Either input can also be routed to all outputs if desired which can be selected by the Input Select switch on the front panel or via the built-in webserver. The webserver also provides status information for the unit.

The unit provides automatic input detection, re-clocking and cable equalisation of the input signals to 100/350 meters (HD/SD) of coax cable.

The full range of 3G, SD and HD standards are supported by the unit allowing PAL and NTSC signals up to 1080p 60Hz to be distributed. Each output is individually buffered providing separately driven outputs for greater reliability.

As well as an AC power input, the unit also has a 12V DC input for use, for example, in outside broadcast vehicles. Both power inputs can be used to give a dual redundant power supply.

## System Block Diagram

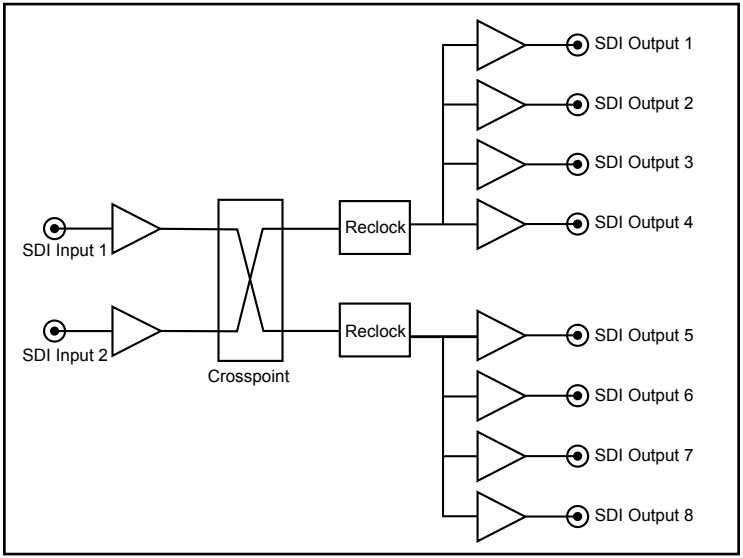


*Fig 2-2: The RB-VHDA2x4 System Block Diagram*

## Front Panel Controls and Indicators

*Fig 2-3: The RB-VHDA2x4 Front Panel*

**Power LED**

The POWER LED illuminates whilst internal power is present within the unit. If this indicator is not on, the most likely reason is simply the absence of mains power, but under fault conditions it may also indicate a ruptured mains fuse or a problem with the internal power supply module.

**Reset Button**

In the unlikely event that the unit fails to respond, press the reset button to reboot the unit.

**Input Status**

There are two LED indicators on the front panel to provide input lock status. When a valid input signal has been applied to either input then the corresponding LED will be lit solid green. When an input has not detected a valid signal the LED will flash green. Each input has its own status indication.

**Mode Select**

This button provides local control to allow the user to cycle through the routing modes available. Pressing the button once will indicate the current mode selected using the two front panel status LEDs. Pressing again while the current mode is displayed will cycle though the modes. The modes and the corresponding LED states are described below.

| Mode Selection Table | | |
|---|---|---|
| **Mode** | **Input 1 Status** | **Input 2 Status** |
| **Input 1**<br>Input 1 to Outputs 1-8 | ON | OFF |
| **Input 2**<br>Input 2 to Outputs 1-8 | OFF | ON |
| **Dual**<br>Input 1 to Outputs 1-4<br>Input 2 to Outputs 5-8 | ON | ON |

## Rear Panel Connections

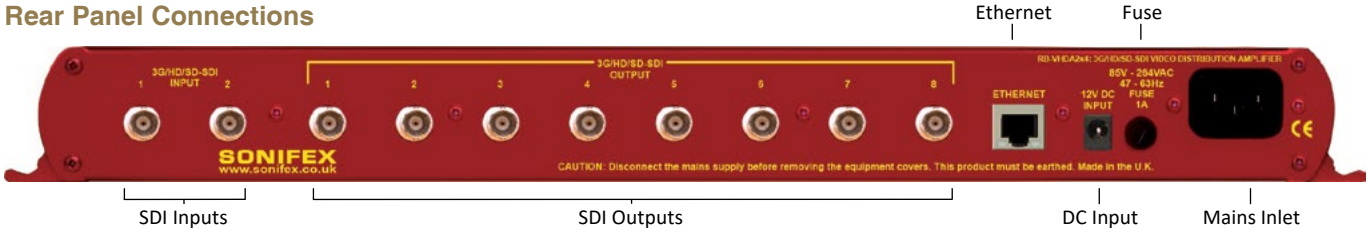


*Fig 2-4: The RB-VHDA2x4 Rear Panel*

**Mains Power**

Power is applied via a standard three-pin IEC male socket. Mains voltages between 85V and264V AC and frequencies between 47 and 63Hz are accepted without adjustment. A 1A, 5 x 20mm SB fuse is used. The Earth pin MUST be connected to ensure safety.

**DC Power**

The unit provides a secondary power source for the unit via a DC input. This power input can accept voltages in the range of 9 – 14V and must be able to source 500mA. Both mains and DC power sources can be connected at the same time.

**Ethernet**

The Ethernet port is connected using a standard RJ-45 connector on the rear of the panel.

It is a 10/100Mbps link. The unit can be controlled remotely over the Ethernet connection using the built-in webserver. By default the unit is configured for dynamic addressing using DHCP and Auto-IP. If a static IP address is required then this must be configured through the webserver.

| Ethernet Connector (RJ-45) | |
|---|---|
| **Pin No.** | **Function** |
| 1 | Transmit Data (+) |
| 2 | Transmit Data (-) |
| 3 | Receive Data (+) |
| 4 | No connection |
| 5 | No connection |
| 6 | Receive Data (-) |
| 7 | No connection |
| 8 | No connection |

**SDI Inputs**

The SDI inputs are connected using a female BNC and have a 75Ω input impedance. They are both a triple rate SDI receiver with automatic input rate detection and equalisation. They support the full range of 3G, SD and HD standards from NTSC and PAL up to 1080p 60Hz. The status of the inputs are displayed on the status LEDs on the front panel. When the SDI input rate and format has been detected, the indicator will be lit solid green.

**SDI Outputs 1 to 8**

The eight SDI outputs are connected using the female BNC connectors on the rear panel. They have a 75Ω output impedance in accordance with the SMPTE standard and are both re-clocked and independently buffered.

**Webserver & Unit Discovery**

The RB-VHDA2x4 uses the Zeroconf networking methodology to allow the unit to be a “plug and play” device. Just simply connect it to the network and use it. The unit is assigned an IP address using a DHCP server, or a self-assigned address using AUTOIP when one isn’t available.

The RB-VHDA2x4 uses Bonjour discovery on a network. Once the unit has been connected to the network it will try to obtain an IP address from a DHCP server on the network, if none is found then the unit will use Auto-IP to assign itself an IP address. There is no direct method for the user to determine exactly which IP address has been assigned to the unit. Using a Bonjour discovery application or browser plug-in, the unit can be discovered and connected to with relative ease. Bonjour is available as standard on MAC OS and as plug-in for Internet Explorer for the Bonjour for windows download. You can also use the discovery application provided by Sonifex and available from the download page.

## Technical Specification For RB-VHDA2x4

| | |
|---|---|
| Compatible Standards: | SMPTE-424M (3G)<br>SMPTE-292M (HD-SDI) SMPTE-259M-AC1 (SD-SDI)<br>SMPTE 344M<br>DVB-ASI at 270Mb/s<br>1. Other rates will be passed without reclocking. |
| 1. Other rates will be passed without reclocking. | |
| Impedance: | 75Ω terminating |
| Equalisation: | Up to 100m of Belden 1694A at 1.485Gbps<br>Up to 350m of Belden 1694A at 270 Mbps |
| Data Rates: | 143, 270, 1483.5, |
| Fully supported Passed but not reclocked: | 1485, 2967 & 2970Mbps<br>177, 360 & 540Mbps |
| Reclocking & Equalisation: | Automatic |
| Resolution: | Automatic |
| Return Loss: | >15dB at 1500MHz |
| Output Jitter: | <0.2UI |
| Signal Level: | 800mV ±10% |

| **Front Panel Indicators** | |
|---|---|
| Power LED: | Red indicates power is present |
| Input Status 1 & 2 LEDs: | Green indicates signal is present, flashing green indicates signal is missing. |

| **Rear Panel Connections** | |
|---|---|
| 3G/HD/SD-SDI Video Input: | 2 x BNC (Unbalanced) |
| 3G/HD/SD-SDI Video Outputs: | 8 x BNC (Unbalanced) |
| Ethernet Port: | RJ45 with status LEDs |
| Power Supply: AC: | Filtered IEC, continuously rated 85-264VAC,<br>47-63Hz, fused, max 10W |
| Fuse Rating: DC: | Anti-surge fuse 1A 20 x 5mm 12V 500mA max, DC supply, 2.5mm socket fused |

| **Equipment Type** | | |
|---|---|---|
| RB-VHDA2x4: | RK3 | 3G/HD/SD-SDI 2 inputs, 8 output video distribution amplifier |

| **Physical Specification** | |
|---|---|
| Dimensions (Raw): | 48cm (W) x 10.8cm (D) x 4.3cm (H)<br>19” (W) x 4.3” (D) x 1.7” (H) (1U) |
| Dimensions (Boxed): | 58.5cm (W) x 22.5cm (D) x 7cm (H)<br>23” (W) x 8.9” (D) x 2.8” (H) |
| Weight: | Nett: 1.3kg Gross: 1.9kg<br>Nett: 2.9lbs Gross: 4.2lbs |

| **Accessories** | |
|---|---|
| RB-RK3: | 1U Rear panel rack kit for large Redboxes |

# 3 An Introduction To Redbox Audio Embedders & De-Embedders

**The Redbox range of audio embedders and de-embedders use the latest technology to offer embedding and de-embedding for analogue and digital audio signals into and out of all 3G, HD and SD-SDI video signals, respectively. There are currently 4 products in the range.**

## Embedding and De-Embedding Overview

Audio embedding is the process of taking one or more audio signals, formatting them into packets and then placing them into the ancillary or blanking space of a video signal. Audio de-embedding is the process of retrieving this audio data from the video signal but not necessarily removing it. These two processes are standardised by two SMPTE documents, SMPTE-272M for SD-SDI and SMPTE-299M for HD-SDI and 3G-SDI.

Both of these standards allow for the embedding of 16 channels of 24-bit, 48kHz audio. Which are divided down into 4 groups of 4 channels.

Each standard consists of a control packet and an audio data packet. The control packets hold certain control information about the audio to aid in the de-embedding process or any other receiving equipment. There is one control packet per group, these packets are optional for SD. The control packet is normally placed in the horizontal blanking period once per field or frame. The audio data packets contain the actual audio sample data. There are considerable differences between SD and HD, the main ones being that SD data packets contain only 20-bit data and are of variable length while the HD data packets contain 24-bit data and are of fixed length. The HD packets also provide an error correction and detection method. The SD standard consists of a further packet, the extended data packet. These packets contain the 4 least significant bits of the audio samples to provide full 24-bit audio.

# 4 RB-VHDMA8 3G/HD/SD-SDI De-Embedder, 8 Channel Analogue Outputs

## Introduction

The RB-VHDMA8 is an 8 channel analogue de-embedder contained in a single 19-inch rack unit. The unit can selectively de-embed up to 8 channels within any audio group of an SDI video signal, to any of the analogue outputs. After which, the video becomes two independent paths, where the audio groups can be selectively deleted or passed through and then sent to the re-clocked SDI outputs.

The de-embedding channel routing is controlled via the front panel buttons and indicators. There is also LED indication for SDI input status and audio group presence.

The unit can be remote controlled via Ethernet or serial port connections using the Sonifex SCi software.

It has a triple rate SDI receiver with automatic input rate detection and equalisation along with two re-clocked and individually buffered SDI outputs. It supports the full range of 3G, HD and SD standards from NTSC and PAL up to 1080p 60Hz.

There is independent level control for each analogue output channel, which can be adjusted from -24dB through to +24dB in 0.5dB steps.

The analogue outputs have three full-scale gain settings which can be set via jumpers inside the unit. Allowable settings are +12dBu, +18dBu and +24dBu reference FSD. The balanced and unbalanced output connections are paralleled, allowing one type to be used per output.

## System Block Diagram

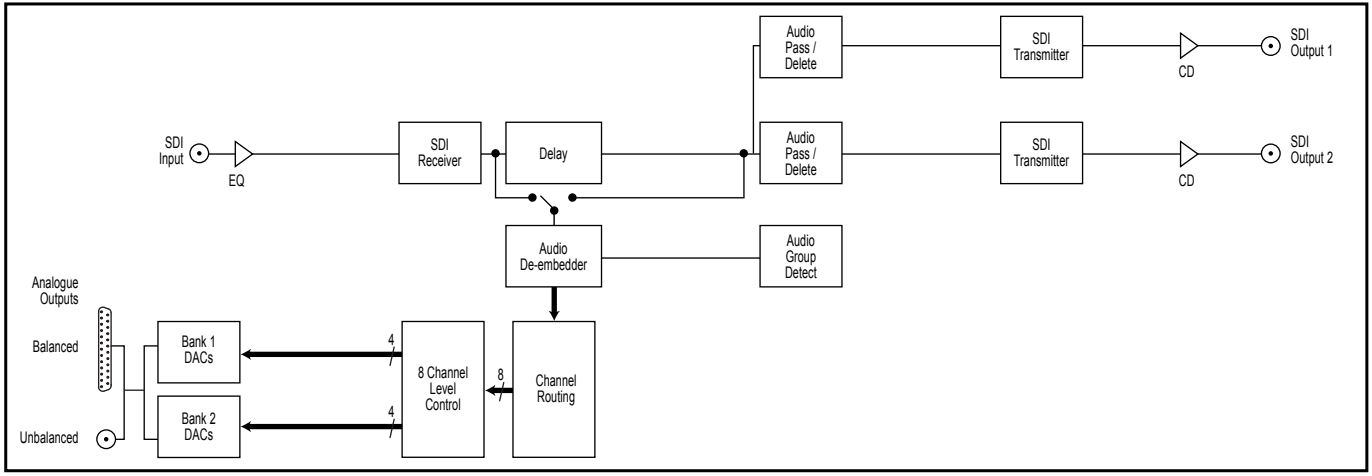


*Fig 4-1: RB-VHDMA8 System Block Diagram*

## Front Panel Indicators & Controls

*Fig 4-2: RB-VHDMA8 Front Panel*

**Power LED**

The POWER LED illuminates whilst internal power is present within the unit. If this indicator is not on, the most likely reason is simply the absence of mains power, but under fault conditions it may also indicate a ruptured mains fuse or a problem with the internal power supply module.

**Reset Button**

In the unlikely event that the unit fails to respond, press the reset button to reboot the unit.

**Bank**

The BANK button and its indicators are used to select the audio output bank when controlling the de-embedding channel routing. The button LED is used show whether the bank is enabled. To enable or disable the bank, press and hold the BANK button for two seconds until the bank number indicator blinks. When lit green it is enabled and when lit red it is disabled. When the bank is disabled, all audio outputs are muted.

**Bank Channel**

The BANK CHANNEL button and its indicators are only used when the unit is operating in Channel mode and are used to select the audio output bank channel when controlling the de-embedding channel routing. The button LED is used to show whether the channel is enabled. To enable or disable the channel, press and hold the BANK CHANNEL button for two seconds until the channel number indicator blinks. When lit green it is enabled and when it is lit red it is disabled. When the channel is disabled, the audio output is muted. The channel will also be muted if the bank is disabled, even if the channel is enabled.

**Group**

The GROUP button and its indicators are used to select the group audio number within the video signal to de-embed and send to analogue outputs in the currently selected bank.

**Group Channel**

The GROUP CHANNEL button and its indicators are used to select the channel number within the currently selected group to de-embed and send to the analogue output in the currently selected bank and bank channel. This button is only used when operating in Channel mode.

**Status**

This button is used to used to enter and exit the group deletion mode, which is discussed later.

**Audio Group Detection**

The four audio group indicators associated with the STATUS button, display the audio groups which are present in the SDI video signal. If an audio group is present, its relevant indicator will be lit. This is useful to determine which groups are available for de-embedding and/or deleting.

## Rear Panel Connections

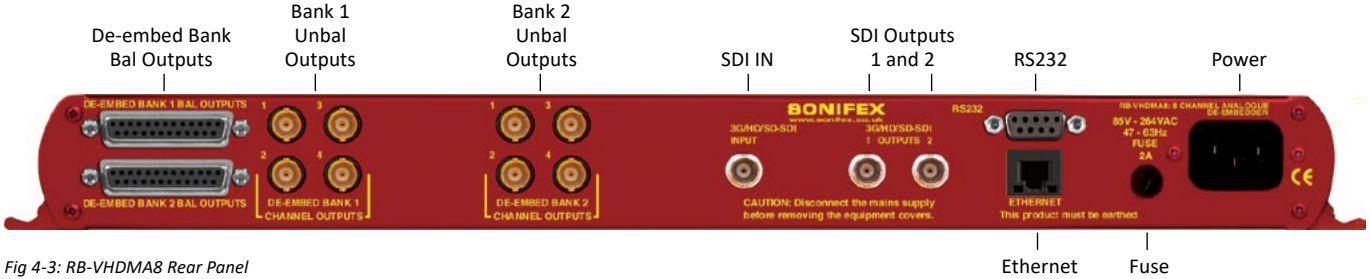


*Fig 4-3: RB-VHDMA8 Rear Panel*

**Lock Indicator**

The lock indicator is lit when the the SDI receiver has detected and locked to the incoming video format. If the input is disconnected or is intermittent then the lock indicator will stay unlit.

**Output Indicators**

These two indicators are used to indicate which one of the two outputs are selected when configuring audio packets for deletion.

**Mains Power**

Power is applied via a standard three-pin IEC male socket. Mains voltages between 85V and264V AC and frequencies between 47 and 63Hz are accepted without adjustment. A 2A, 5 x 20mm SB fuse is used. The Earth pin MUST be connected to ensure safety.

### Remote Control

The unit can be controlled remotely either by serial RS-232 or Ethernet using the Sonifex SCi software. Using remote control allows the user to monitor the status of the unit and also set various options and settings not available via the front panel.

**RS232 Remote Control**

A 9-way female D-type connector carries a standard RS232 interface via which advanced configuration options may be set and many functions may be remotely controlled. The pin assignations are as follows:

| Pin No. | Function |
|---|---|
| 1 | Unused |
| 6 | Unused |
| 2 | Data transmit (TX) |
| 7 | Unused |
| 3 | Data receive (RX) |
| 8 | Unused |
| 4 | Unused |
| 9 | Unused |
| 5 | Ground |

The RB-VHDMA8 will interface directly with personal computer serial ports at standard RS232 signal levels using a straight-through cable. The default format is 19200 baud with 8 data bits, even parity and 1 stop bit. Sonifex SCi software, when installed on a suitable PC, provides straightforward graphical access to all remote control and configuration options via both RS232 and Ethernet interfaces. Alternatively, commands may be issued from any text-based terminal program (e.g. Hyperterminal) or custom software may be developed for specific requirements.

**Ethernet**

The Ethernet port is connected using a standard RJ-45 connector on the rear of the panel. It is a 10/100Mbps link. The unit is shipped with DHCP enabled to allow the unit to be plug and play if the users local area network has a DHCP server. If one is not available on the network and the unit cannot retrieve a valid IP address after 45 seconds it will default to a static address. This static address is set to 192.168.0.100 by default but can be altered through SCi using the serial port connection. If DHCP is not required then this can also be disabled through SCi using the serial port connection.

The Network connectors pin assignations are as follows:

| Network Connector (RJ-45) | |
|---|---|
| **Pin No.** | **Function** |
| 1 | Transmit Data (Positive) |
| 2 | Transmit Data (Negative) |
| 3 | Receive Data (Positive) |
| 4 | No connection |
| 5 | No connection |
| 6 | Receive Data (Negative) |
| 7 | No connection |
| 8 | No connection |

**SDI Input**

The SDI input is connected using a single female BNC and has a 75Ω input impedance. It is a triple rate SDI receiver with automatic input rate detection and equalisation. It supports the full range of 3G, SD and HD standards from NTSC and PAL up to 1080p 60Hz. The status of the input is displayed on the status LEDs on the front panel. When the SDI input rate and format has been detected, the SDI lock indicator will be lit.

**SDI Outputs**

The two SDI outputs are connected using the two female BNC connectors on the rear panel. They have a 75 Ω output impedance in accordance with the SMPTE standard and are both re-clocked and independently buffered. Each output can be configured separately for group deletion settings.

## Audio Connections

**Analogue Audio Outputs**

The RB-VHDMA8 has eight analogue outputs which are separated into two banks of four channels. These can be connected using balanced connections through the D-type connectors or unbalanced connections through BNC connectors, all are available on the rear panel. The balanced analogue

outputs can be wired unbalanced by connecting non-phase (-) pin to the ground pin for that output, and then connecting the audio signal to the phase (+) pin.

The two output types are connected internally, so please ensure that only one type of connection is used per output.

***Full Scale Setting***

The analogue output full-scale settings, which determine the full-scale 0dBFS level for the digital audio, are set internally via jumpers. They are factory set to +18dBu by default.

| Full-scale Settings | Jumper | |
|---|---|---|
| | JP1 | JP2 |
| +12dBu | Not fitted | Not fitted |
| +18dBu | Fitted | Not fitted |
| +24dBu | Fitted | Fitted |

**Audio Output Gain Adjustment**

The default audio output gain is unity. However, to accommodate lower or higher level sources it is possible to introduce gain or attenuation on a per channel basis. Each audio channel has an adjustable gain range from -24dBu to +24dBu in 0.5dB increments. This is set using the remote Control ports. Once set, this value is stored and reloaded each time the unit is powered on.

**RB-VHDMA8 D-type Pin-out**

| Pin No. | Function De-Embed Bank 1 | Function De-Embed Bank 2 |
|---|---|---|
| 1 | Channel 1+ | Channel 1+ |
| 14 | Channel 1- | Channel 1- |
| 2 | Channel 1 Ground | Channel 1 Ground |
| 15 | Channel 2+ | Channel 2+ |
| 3 | Channel 2- | Channel 2- |
| 16 | Channel 2 Ground | Channel 2 Ground |
| 4 | Channel 3+ | Channel 3+ |
| 17 | Channel 3- | Channel 3- |
| 5 | Channel 3 Ground | Channel 3 Ground |
| 18 | Channel 4+ | Channel 4+ |
| 6 | Channel 4- | Channel 4- |
| 19 | Channel 4 Ground | Channel 4 Ground |
| 7 to 13 | Do not connect | Do not connect |
| 20 to 25 | Do not connect | Do not connect |

## Control Modes

There are two modes available to control the de-embedding channel routing process. These are the BANK mode and the CHANNEL mode.

**Bank Mode**

In Bank mode, audio is routed on a per bank basis, so when controlling de-embedding a group of audio is selected to be sent to a bank.

**Channel Mode**

In Channel mode, audio is routed on a per channel basis, this allows for maximum flexibility when de-embedding, allowing any channel within any group be sent to any channel of any of the available audio output banks.

**Changing Control Mode**

To switch between Bank and Channel control modes, simultaneously press and hold the GROUP CHANNEL and BANK CHANNEL buttons for 5 seconds. The mode will switch after this time and the button can be released. Bank mode is in use when both the BANK CHANNEL and GROUP CHANNEL button LEDs are not lit. Conversely, when Channel mode is in use these two LEDs are lit.

When switching from Channel to Bank mode, all channel mappings are reset to default. When switching from Bank to Channel mode, the channel mappings are retained to allow for further modification.

## De-Embedding

The unit is always de-embedding, automatically reading all the audio data contained in the video signal as it appears to the de-embedding block. Using the front panel controls the user can control which of these channels or groups within the video input are routed to the analogue outputs.

If an SD video signal is being received and extended audio data is detected, then the unit will automatically use this to reproduce full 24-bit audio data and no user intervention is required.

**Bank Mode**

In bank mode, de-embedding is controlled on a per group basis. So whole groups are selected to be output on a particular bank.

1. To de-embed a group of audio to a specific bank.
2. Select the output bank number, using the BANK button.
3. Select the group to de-embed using the GROUP button.

The BANK button LED will show whether the bank is enabled. To enable de-embedding to this bank, press and hold the BANK button for two seconds, until the button turns green. This indicates that de-embedding is enabled to this bank. To turn off de-embedding, then hold the BANK button down until the button turns red. The bank number indicator will blink to show that the change has been applied.

In this mode, the channels of the group are mapped directly to the bank channels. For example channel 1 in the selected group is de-embedded to channel 1 of the selected bank. Channel 2 in the selected group is de-embedded to channel 2 of the selected
bank etc.

Cycling through the banks using the BANK button, allows the user to determine which banks are currently enabled for de-embedding and will also show the source group for that bank.

**Channel Mode**

In channel mode, de-embedding is controlled on a per channel basis. So individual channels within a group are selected to be output on a particular channel within a bank.

To de-embed a group channel of audio to a specific bank channel.

1. Select the output bank number using the BANK button.
2. Select the output bank channel using the BANK CHANNEL button.
3. Select the group to de-embed using the GROUP button.
4. Select the group channel to de-embed using the GROUP CHANNEL button.

To enable de-embedding to this channel, both the BANK and BANK CHANNEL must be enabled. This is indicated by the button LED being lit green. If either are red, then simply enable them by holding down the relevant button for two seconds.

Cycling through the banks and bank channels using the BANK and BANK CHANNEL buttons respectively, allows the user to determine which bank channels are currently enabled for de-embedding and will also show the source for that bank channel.

### Deleting Audio Groups

If the SDI video signal contains audio groups which require deleting, then these can be deleted on a per output basis. For example if the video input contained all four audio groups then it is possible to delete all groups on output 1 and only groups 1 and 2 on output 2.

The unit will also delete any ancillary packets marked for deletion and realign the packets to make maximum use of the available ancillary space.

To delete audio groups the unit is put into a special group deletion mode. To enter this mode press and hold the STATUS button for 5 seconds. The front panel button indicators will change so that only the GROUP, GROUP CHANNEL and STATUS buttons are available. The GROUP button and indicators are used to select the group number, the GROUP CHANNEL button is used to enable or disable deletion on this group and the STATUS button is used to select the output. Once the desired settings have been set, then using the same method to enter the group deletion mode will exit it. The new settings will be applied as soon as the unit returns to its normal operating mode.

## Technical Specification For RB-VHDMA8

| Front Panel Controls & Indicators | |
|---|---|
| De-embed Bank Select: | Bank 1 or 2 |
| Bank Channel Select: | Channels 1, 2, 3 or 4 |
| Group Select: | Groups 1, 2, 3 or 4 |
| Group Channel Select: | Group channels 1,2,3 or 4 |
| Status: | 1 x SDI input status LED<br>2 x SDI output LEDs<br>4 x Audio group status LEDs |

| Audio Specifications | |
|---|---|
| Max. Output Level: | +24dBu (balanced) |
| Output Impedance: | <50Ω (balanced) |
| Full Scale Settings: | 12dBu, 18dBu or 24dBu ref FSD (jumper selectable) |
| Signal to Noise: | Better than -106dB (RMS A-weighted at 24-bit, balanced) |
| Distortion and Noise: | Better than -85dB THD+N at 1kHz (balanced) |
| De-embed Delay: | 3G/HD/SD: 1.1 ms |

| Connections | |
|---|---|
| Analogue Audio Outputs: | 8 output channels via BNC (unbalanced)<br>or D-type socket (balanced) |
| Analogue Audio Connectors: | 8 x BNC 2 x 25-way D-type |
| Power Supply: | Universal filtered IEC, continuously rated<br>85-264VAC @47-63Hz, fused, max 14W |

| SDI Specification | |
|---|---|
| SDI Input: | 1 x BNC, 3G/HD/SD-SDI |
| SDI Outputs: | 2 x BNC, 3G/HD/SD-SDI, Re-clocked |
| Impedance: | 75Ω |

| | |
|---|---|
| Output Alignment Jitter: | <0.2UI (3G <0.3UI) |
| Output Level: | 800mV +/- 10% |
| Return Loss: | <15dB at 1500MHz |
| SDI Supported Standards: | 270Mbps, SMPTE-259M-C (SD)<br>1.485 or 1.4835Gbps, SMPTE-292M (HD)<br>2.97 or 2.967Gbps, SMPTE-424M (3G), SMPTE 425M-A |
| Supported Video Formats: | 525/59.94 (SMPTE-125M)<br>625/50 (ITU-R BT.656)<br>720p/23.98, 24, 25, 29.97, 30, 50, 59.94, 60 (SMPTE-296M)<br>1035i/59.94, 60 (SMPTE-260M)<br>1080i/50, 59.94, 60 (SMPTE-274M)<br>1080p/23.98, 24, 25, 50, 59.94, 60 (SMPTE 274M)<br>1080pSF/23.98, 24, 25, 29.97, 30 (RP-211)<br>1080i/50 (SMPTE-295M)<br>1080p/50 (SMPTE-295M) |
| Video Delay: | SD: 290 pixels / 22 us<br>HD: 570 pixels / 8 us<br>3G: 570 pixels / 4 us |

| Video Delay Control: | | |
|---|---|---|
| | 525/59.94 | 0 to 55 frames |
| | 625/50 | 0 to 46 frames |
| | 1080p/50 | 0 to 8 frames |
| | 1080p/59.94,60 | 0 to 10 frames |
| | 720p/23.98, 24, 25<br>1080i/50 | |
| | 1080p/23.98,24,25<br>720p/29.97, 30<br>1035i/59.94, 60<br>1080i/59.94, 60 | 0 to 16 frames |
| | 1080p/29.97,30 | 0 to 20 frames |
| | 720p/50 | 0 to 33 frames |
| | 720p/59.94, 60 | 0 to 40 frames |

| | |
|---|---|
| Embedded Audio: | 24-bit, 48kHz synchronous<br>SMPTE-272M-C<br>SMPTE-299M |
| Serial Port: | RS232, 9 way D-type |
| Ethernet Port: | 10/100Mbps, RJ-45 |
| Fuse Rating: | Anti-surge fuse 2A 20 x 5mm |

| Equipment Type | | |
|---|---|---|
| RB-VHDMA8 | RK3 | 3G/HD/SD-SDI De-embedder, 8 channel analogue outputs |

| Physical Specifications | |
|---|---|
| Dimensions (Raw): | 48cm (W) x 10.8cm (D*) x 4.2cm (H) (1U)<br>19” (W) x 4.3” (D*) x 1.7” (H) (1U) |
| Dimensions (Boxed): | 59cm (W) x 27.5cm (D) x 11cm (H)<br>23.2” (W) x 10.8” (D) x 4.3” (H) |
| Weight: | Nett: 1.8kg Gross: 2.3kg<br>Nett: 4.0lb Gross: 5.1lb |

* Note that this product is deeper than standard Redboxes

## Remote Interface Commands & Responses Protocol

Sonifex SCi remote control software handles all communication with the unit via a convenient graphical user interface. However, this protocol is provided for those users who wish to develop their own remote control applications or communicate with the unit using a text-based terminal program.

### Command Format

Commands are case-insensitive and should be terminated in a carriage return character, a line feed character may be sent but it will be ignored. Further commands sent before the first command is acknowledged will be ignored. Responses will be CR & LF terminated.

## Remote Control Commands

| Command | Description | Response |
|---|---|---|
| COM:b,d,p,s | Serial Port Settings<br>b is the baud rate (9600, 19200, 38400, 57600 and 115200)<br>d is the data bits (7 or 8)<br>p is the parity (N, O, E)<br>s is the stop bits (1 or 2) | ACK: |
| CTM:m | Control Mode<br>m is the mode<br>0 = bank<br>1 = channel | ACK: |
| DEL:o,g,e | Delete Audio Group<br>o is the output (0 or 1)<br>g is the group (0 to 3)<br>e is the option0 = don't delete<br>1 = delete | ACK: |
| DWN: | Initiates a Firmware Update | |
| DMC:b,c,e | De-Embed Bank Channel Enable<br>This is only used when operating in advanced mode<br>b is the bank (0 to 3)<br>c is the channel (0 to 3)<br>e is the option<br>0 = off<br>1 = on | ACK: |
| DMB:b,e | De-Embed Bank Enable<br>b is the group (0 to 3)<br>e is the option<br>0 = off<br>1 = on | ACK: |
| DMR:b[,bc],g[,gc] | De-Embed Route Control<br>b is the bank (0 to 3)<br>bc is the bank channel (0 to 3) – only in channel mode<br>g is the group (0 to 3)<br>gc is the group channel (0 to 3) – only in channel mode | ACK: |
| FPL:e | Front Panel Lock<br>e is the enable option<br>0 = off<br>1 = on | ACK: |
| MAC: | MAC Address<br>Returns the MAC address of the unit in 12 hex characters. | MAC:<br>XXXXXXXXXXXX |
| NET:<br>x.x.x.x,y.y.y.y,z.z.z.z | Network Address Settings<br>x.x.x.x is a valid IP address<br>y.y.y.y is a valid subnet mask<br>z.z.z.z is a valid gateway address | ACK: |
| NOP:o,v | Network Options<br>o is the option number<br>0 = DHCP<br>v is the option value<br>0 = off<br>1 = on | ACK: |
| OPG:b,c,g | Output Gain<br>b is the bank number (0 or 1)<br>c is the channel (0-3)<br>g is the gain value 0 to 96<br>0 = -24dBu and 96 = +24dBu | ACK: |
| SRQ: | Status Request | |
| UID: | Unit ID | UID:RB-VHEMA8 |
| VER: | Version information<br>M1.m1.b1 is the Firmware version<br>M2.m2.b2 is the FPGA version | VER:M1.m1.b1,<br>M2.m2.b2 |

## SCi For RB-VHDMA8

### System Page

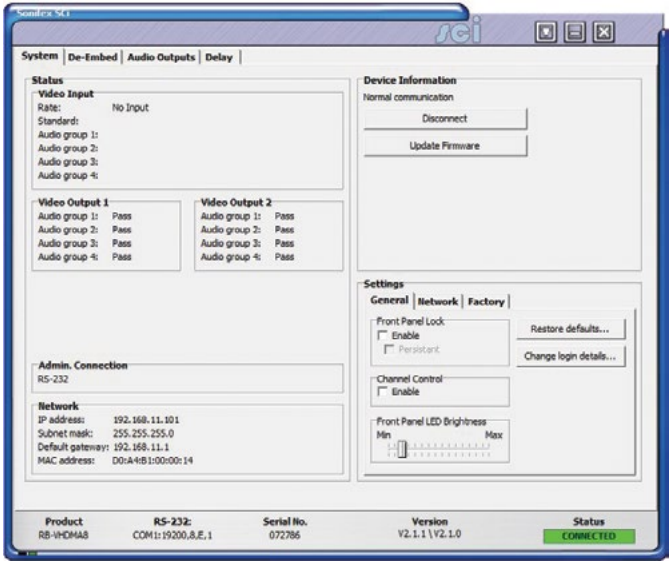


*Fig 4-4: SCi System Screen*

This page is used for the connecting and disconnecting SCi to the unit, updating the firmware in the units, displaying the current status of the unit and controlling various settings.

**Status**

**Video Input**

Shows the current SDI input rate, video format and the audio groups status. When an audio group is detected in the incoming stream the status is set to PRESENT, and MISSING when that group is not detected.

**Video Output 1 & 2**

The two video output status boxes show the audio group status for each output. There are three states per output and these are described below.

**PASS** : This audio group is being passed through on this output.
**EMBED** : This audio group is being embedded on this output.
**DELETE** : This audio group is being deleted on this output.

**Admin Connection**

This displays any connection which has “Administrator” rights to the unit.

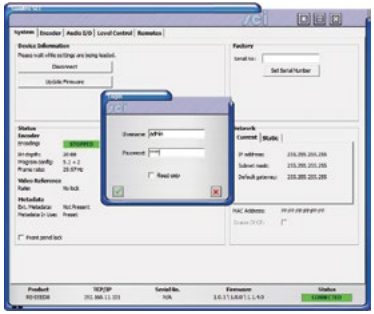

*Fig 4-5: SCi Admin Screen*

**Network Status**

This displays the current network settings assigned to the unit.

**Settings**

**General**

**Front Panel Lock**

When selected, this control disables the front panel and prohibits any changes to be made via the front panel. This control is automatically disabled when the unit is powered on.

**Channel Control**

Enables/Disables the channel control mode.

#### Front Panel LED Brightness

Increases or decreases the LED intensity on the front panel.

#### Restore Defaults

Pressing this button will cause the unit to restore all settings to their factory defaults. All previous settings will be lost. **Note:** The login details are not reset and are unaffected by this process.

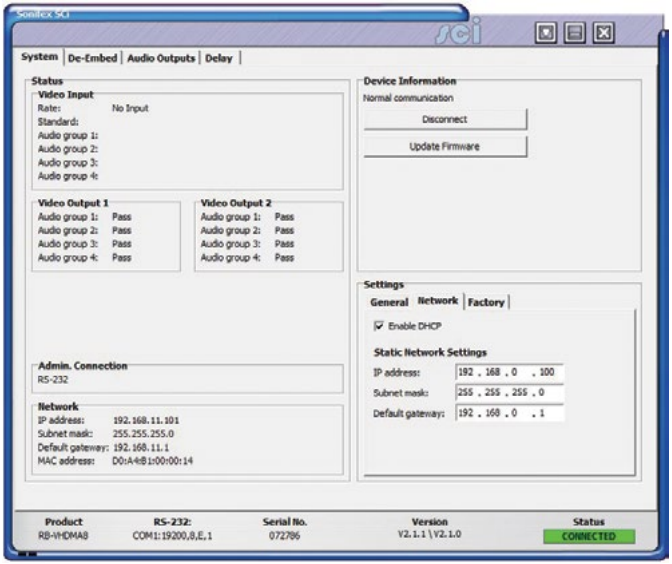


*Fig 4-6: Network Settings*

**Network**

**Enable DHCP**

This enables the unit to receive it's IP address, subnet mask and gateway settings from a DHCP server. If one is not available then this should be disabled through the serial port and a valid static address be entered.

**Note**: This setting cannot be changed while connected to the unit over Ethernet.

**IP Address**: Displays the current IP address of the unit. If DHCP is enabled then this will normally be the IP address supplied by the DHCP server.

**Subnet Mask**: Displays the current subnet mask for the unit.

**Default gateway**: Displays the current default gateway for the unit.

**Note:** The units are discovered using broadcast packets. If your PC has two network cards, then there is a limitation in windows that requires the two addresses to be on different subnet addresses.

**Updating The Firmware**

The firmware will occasionally be updated to add new features or correct any possible issues that may arise. Check for updates at: https://www.sonifex.co.uk/technical/software

To update the firmware click on the button labelled "Update Firmware" and then select the downloaded firmware file. Firmware files will always have an ".dwn or dw2" extension. A progress bar will appear in SCi, indicating how much of the file has been uploaded to the unit.

When the unit switches to update mode, the unit will continue to operate as normal but the front panel will become locked. The progress of the update will be displayed on screen and once complete the unit will return to it's previous state and operate as normal. To complete the update the unit must be restarted. Only then will the update be complete.

## De-Embed Page

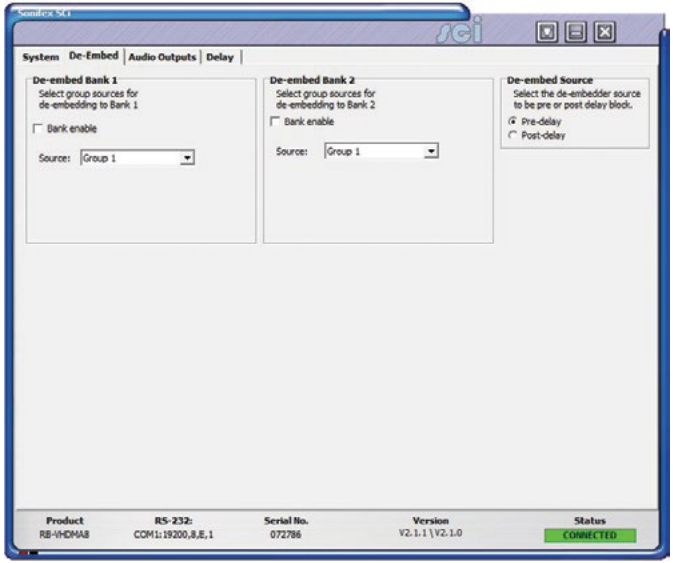


*Fig 4-7: SCi De-Embed Screen*

This page allows you to configure the group sources for each of the available De-Embed banks on the unit.

When in bank control mode, only the top group selection box is available for each bank. This selects the group to de-embed to all the channels in that bank.

When in channel control mode, all of the selection boxes become available, allowing you to individually select a group and channel for each output.

**Bank Enable**: This control enables the bank for De-Embedding.
**Group/Channel**: Selects the group and/or channel for De-Embedding to the bank.
**Enable**: Individually enables each channel within the bank. Only used in channel control mode.

**De-embed Source**
This selection allows you to select whether the video source for the de-embedder block comes before or after the video delay block. If the source is selected to be pre-delay block then de-embedded audio will not be delayed, if the source is selected to be post-delay block then the de-embedded audio will be delayed by the same amount as the video.

## Audio Outputs Page

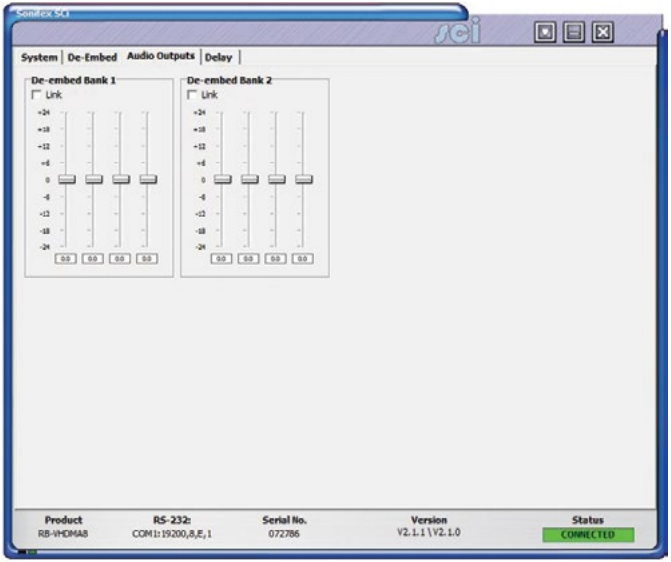


*Fig 4-8: SCi Audio Outputs Screen*

This page allows you to configure the audio outputs for the available De-Embed banks.

**Gain Slide Bars**: Controls the output gain or attenuation for each output channel. Can be set from -24 dB to +24 dB in 0.5 dB steps. Double clicking the gain value label at the bottom of the slide bar will set the gain to 0 dB.
**Link**: If selected, the gain slide bars are linked together so that changing one will change the others in that bank.
**Termination**: Only available on the the RB-VHCMD16, these controls select the output termination from between 75 and 110Ω.

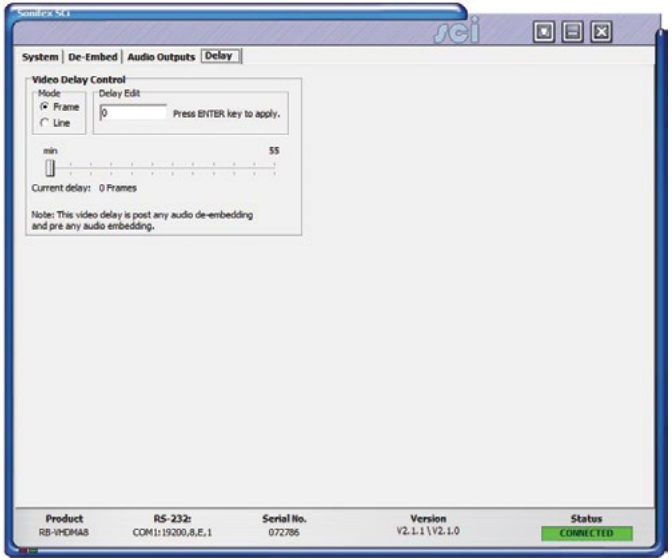


*Fig 4-9: SCi Delay Screen*

This page allows control over the video delay through the unit. This control is only available in the newer units running firmware V2.X.X or greater.

The amount of delay through the unit can be expressed in either lines or frames. The maximum number of which is determined by the current video format being received by the unit. When the input rate changes the maximum delay value is updated.

**Mode**: Selects between Line or Frame delay mode.
**Delay Edit**: This is where the actual delay valued can be entered. This value is represented on the slide bar below, which can also be altered to configure the delay value.
**Current Delay**: This label displays the current delay value active in the unit.

# 5 RB-VHEMA8 3G/HD/SD-SDI Embedder, 8 Channel Analogue Inputs

## Introduction

The RB-VHEMA8 is an 8 channel analogue embedder contained in a single 19-inch rack unit. The unit can selectively embed up to 8 analogue channels onto either of the two output video paths which are sent to the re-clocked SDI outputs. It also has the capability to allow audio groups to be deleted or passed through on each of the two video paths prior to the embedding process.

The embedding channel routing is controlled via the front panel buttons and indicators. There is also LED indication for SDI input status and audio group presence.

The unit can be remote controlled via Ethernet or serial port connections using the Sonifex SCi software.

It has a triple rate SDI receiver with automatic input rate detection and equalisation along with two re-clocked and individually buffered SDI outputs. It supports the full range of 3G, SD and HD standards from NTSC and PAL up to 1080p 60Hz.

There is independent level control for each analogue input channel, which can be adjusted from -24dB through to +24dB in 0.5dB steps.

The analogue inputs have three full-scale gain settings which can be set via jumpers situated inside the unit. Allowable settings are +12dBu, +18dBu and +24dBu for FSD. The balanced and unbalanced input connections are paralleled, allowing one type to be used per input.

## System Block Diagram

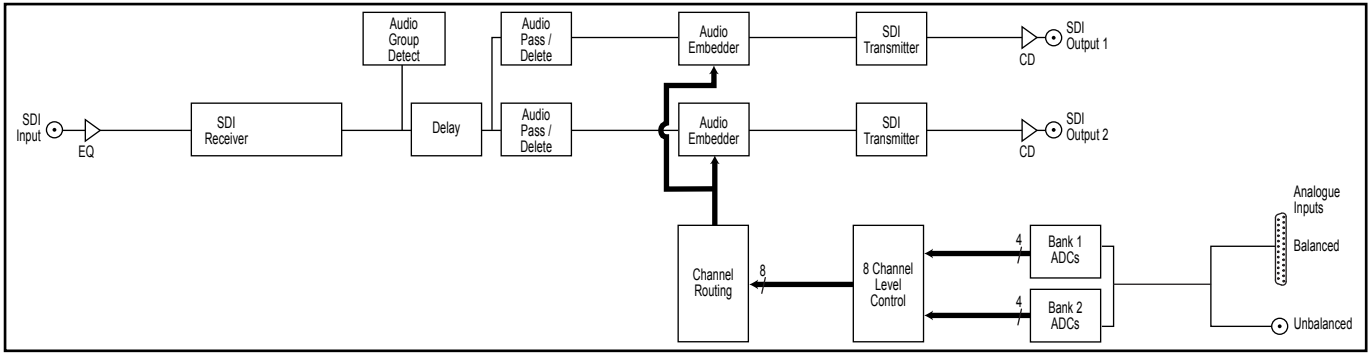


*Fig 5-1: RB-VHEMA8 Block Diagram*

## Front Panel Indicators & Controls

*Fig 5-2: RB-VHEMA8 Front Panel*

**Power LED**
The POWER LED illuminates whilst internal power is present within the unit. If this indicator is not on, the most likely reason is simply the absence of mains power, but under fault conditions it may also indicate a ruptured mains fuse or a problem with the internal power supply module.

**Reset Button**
In the unlikely event that the unit fails to respond, press the reset button to reboot the unit.

**Bank**
The BANK button and its indicators are used to select the audio input bank when controlling the embedding channel routing.

**Bank Channel**
The BANK CHANNEL button and its indicators are only used when the unit is operating in Channel mode and are used to select the audio input bank channel when controlling the embedding channel routing.

**Group**
The GROUP button and its indicators are used to select the group number with which to embed the analogue input channels to. The button LED is used show whether embedding is enabled to the currently selected group. To enable or disable the embedding to a group, press and hold the GROUP button for two seconds until the group number indicator blinks. When lit green it is enabled and when it is lit red it is disabled. When the group is disabled, no embedding is done to that group number.

**Group Channel**
The GROUP CHANNEL and its indicators are used to select the channel within the currently selected group with which to embed the analogue input channel to. This button is only used when operating in Channel mode. The button LED is used show whether the channel is enabled for embedding. To enable or disable the channel, press and hold the GROUP CHANNEL button for two seconds until the channel number indicator blinks. When lit green it is enabled and when it is lit red it is disabled. When the channel is disabled, no audio is embedded to that channel. The channel will also not be embedded if the group is not enabled for embedding, even if the channel is enabled.

**Status**
This button is used to select the output number when controlling the embedding routing. It is also used to enter and exit the group deletion mode.

**Audio Group Detection**
The four audio group indicators associated with the STATUS button display the audio groups present in the SDI input. If an audio group is present,

its relevant indicator will be lit. This is useful to determine which groups require deleting or which groups are available for embedding.

**Lock Indicator**

The lock indicator is lit when the the SDI receiver has detected and locked to the incoming video format. If the input is disconnected or is intermittent then the lock indicator will stay unlit.

**Output Indicators**

These two indicators are used to indicate which one of the two outputs are selected when configuring the embedding routing or when configuring audio packets for deletion.

## Rear Panel Connections

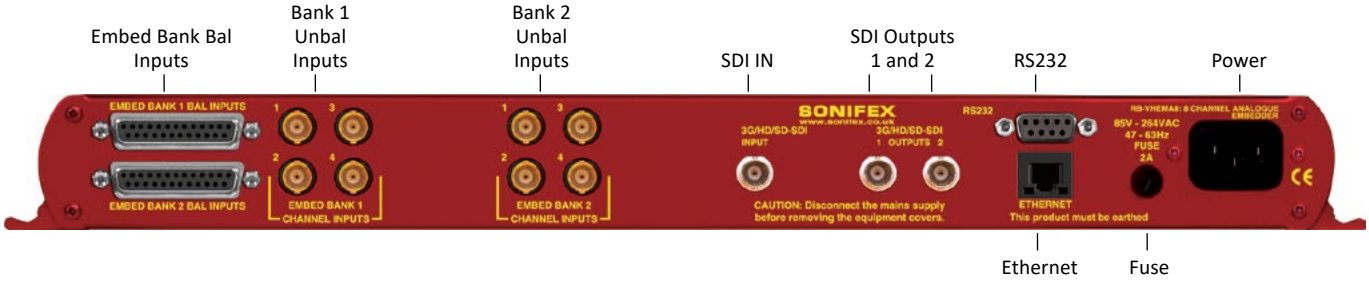


*Fig 5-3: RB-VHEMA8 Rear Panel*

**Mains Power**

Power is applied via a standard three-pin IEC male socket. Mains voltages between 85V and264V AC and frequencies between 47 and 63Hz are accepted without adjustment. A 2A, 5 x 20mm SB fuse is used. The Earth pin MUST be connected to ensure safety.

## Remote Control

The unit can be controlled remotely either by serial RS-232 or Ethernet using the Sonifex SCi software. Using remote control allows the user to monitor the status of the unit and also set various options and settings not available via the front panel.

**RS232 Remote Control**

A 9-way female D-type connector carries a standard RS232 interface via which advanced configuration options may be set and many functions may be remotely controlled. The pin assignations are as follows:

| Pin No. | Function |
|---|---|
| 1 | Unused |
| 6 | Unused |
| 2 | Data transmit (TX) |
| 7 | Unused |
| 3 | Data receive (RX) |
| 8 | Unused |
| 4 | Unused |
| 9 | Unused |
| 5 | Ground |

The RB-VHEMA8 will interface directly with personal computer serial ports at standard RS232 signal levels using a straight-through cable. The default format is 19200 baud with 8 data bits, even parity and 1 stop bit. Sonifex SCi software, when installed on a suitable PC, provides straightforward graphical access to all remote control and configuration options via both RS232 and Ethernet interfaces. Alternatively, commands may be issued from any text-based terminal program (e.g. Hyperterminal) or custom software may be developed for specific requirements.

**Ethernet**

The Ethernet port is connected using a standard RJ-45 connector on the rear of the panel. It is a 10/100Mbps link. The unit is shipped with DHCP enabled to allow the unit to be plug and play if the users local area network has a DHCP server. If one is not available on the network and the unit cannot retrieve a valid IP address after 45 seconds it will default to a static address. This static address is set to 192.168.0.100 by default but can be altered through SCi using the serial port connection. If DHCP is not required then this can also be disabled through SCi using the serial port connection.

The Network connectors pin assignations are as follows:

| Network Connector (RJ-45) | |
|---|---|
| **Pin No.** | **Function** |
| 1 | Transmit Data (Positive) |
| 2 | Transmit Data (Negative) |
| 3 | Receive Data (Positive) |
| 4 | No connection |
| 5 | No connection |
| 6 | Receive Data (Negative) |
| 7 | No connection |
| 8 | No connection |

**SDI Input**

The SDI input is connected using a single female BNC and has a 75Ω input impedance. It is a triple rate SDI receiver with automatic input rate detection and equalisation. It supports the full range of 3G, SD and HD standards from NTSC and PAL up to 1080p 60Hz. The status of the input is displayed on the status LEDs on the front panel. When the SDI input rate and format has been detected, the SDI lock indicator will be lit.

**SDI Outputs**

The two SDI outputs are connected using the two female BNC connectors on the rear panel. They have a 75Ω output impedance in accordance with the SMPTE standard and are both re-clocked and independently buffered. Each output can be configured separately for embedding and group deletion settings.

## Audio Connections

**Analogue Audio Inputs**

The RB-VHEMA8 has eight analogue input channels which are separated into two banks of four channels. The analogue audio inputs are converted to digital audio using high performance, low noise stereo 24-bit ADCs. They are connected using balanced connections through the D-type connectors

or unbalanced connections through BNC connectors, all are available on the rear panel. The balanced analogue inputs can be wired unbalanced by connecting non-phase (-) pin to the ground pin for that input, and then connecting the audio signal to the phase (+) pin.

The two input types are connected internally, so ensure that only one type of connection is used per input.

*Full Scale Setting*

The analogue input full-scale settings, which determine the full-scale 0dBFS level for the digital audio, are set internally via jumpers. They are factory set to +18dBu by default.

| Full-scale Settings | Jumper | |
|---|---|---|
| | JP1 | JP2 |
| +12dBu | Not fitted | Not fitted |
| +18dBu | Fitted | Not fitted |
| +24dBu | Not fitted | Fitted |

**Audio Input Gain Adjustment**

The default audio input gain is unity. However, to accommodate lower or higher level sources it is possible to introduce gain or attenuation on a per channel basis. Each audio input has an adjustable gain range from -24dBu to +24dBu in 0.5dB increments. This is set using the remote Control ports. Once set, this value is stored and reloaded each time the unit is powered on.

**RB-VHEMA8 D-type Pin-out**

| Pin No. | Function Embed Bank 1 | Function Embed Bank 2 |
|---|---|---|
| 1 | Channel 1+ | Channel 1+ |
| 14 | Channel 1- | Channel 1- |
| 2 | Channel 1 Ground | Channel 1 Ground |
| 15 | Channel 2+ | Channel 2+ |
| 3 | Channel 2- | Channel 2- |
| 16 | Channel 2 Ground | Channel 2 Ground |
| 4 | Channel 3+ | Channel 3+ |
| 17 | Channel 3- | Channel 3- |
| 5 | Channel 3 Ground | Channel 3 Ground |
| 18 | Channel 4+ | Channel 4+ |
| 6 | Channel 4- | Channel 4- |
| 19 | Channel 4 Ground | Channel 4 Ground |
| 7 to 13 | Do not connect | Do not connect |
| 20 to 25 | Do not connect | Do not connect |

## Control Modes

There are two modes available to control the embedding channel routing process. These are the BANK mode and the CHANNEL mode.

**Bank Mode**

In Bank mode, audio is routed on a per bank basis, so when controlling embedding, a bank of audio is selected to be embedded into a group.

**Channel Mode**

In Channel mode, audio is routed on a per channel basis. This allows for maximum flexibility when embedding, allowing any audio input channel to be embedded to any channel within any group.

**Changing Control Mode**

To switch between Bank and Channel control modes, simultaneously press and hold the GROUP CHANNEL and BANK CHANNEL buttons for 5 seconds. The mode will switch after this time and the button can be released. Bank mode is in use when both the BANK CHANNEL and GROUP CHANNEL button LEDs are not lit. Conversely, when Channel mode is in use these two LEDs are lit.

When switching from Channel to Bank mode, all channel mappings are reset and no groups are selected for embedding. When switching from Bank to Channel mode, the channel mappings are retained to allow for further modification.

## Embedding

The analogue audio inputs can be embedded into any of the four available groups in the two SDI outputs. They can be embedded on a per bank basis in the Bank control mode, or a per channel basis in the Channel control mode. If you embed to a group which is already present in the SDI video input, then this group is automatically deleted from the video input prior to the embedding block.

**Bank Mode**

To embed a bank of audio to a specific group.

1. Select the SDI Output, using the STATUS button.
2. Select the bank of audio, using the BANK button.
3. Select the group to embed to, using the GROUP button.

The GROUP button LED will indicate whether embedding is enabled to this group. To enable embedding to this group, press and hold the GROUP button for two seconds, until the button turns green. The group number LED will blink to indicate that the change has been applied. This indicates that embedding is enabled to this group. To disable embedding to this group, then hold the GROUP button down until the button turns red.

In this mode, the channels of the bank are mapped directly to the group channels. For example channel 1 in the selected bank is embedded to channel 1 of the selected group. Channel 2 in the selected bank is embedded to channel 2 of the selected group etc.

Cycling through the groups using the GROUP button, allows the user to determine which groups are currently enabled for embedding and will also show the source for that group.

### Channel Mode

To embed a channel of audio to a specific channel within a group.

1. Select the SDI Output, using the STATUS button.
2. Select the bank of audio, using the BANK button.
3. Select the bank channel using the the BANK CHANNEL button.
4. Select the group to embed to using the GROUP button.
5. Select the group channel to embed to using the GROUP CHANNEL button.

To enable embedding to this group and channel, both the GROUP and GROUP CHANNEL must be enabled. This is indicated by the button LED being lit green. If either are red, then simply enable them by holding down the relevant button for two seconds. Embedding will only take place if the GROUP is enabled. If the GROUP CHANNEL is enabled and the GROUP is not, then no embedding will occur.

Cycling through the groups and group channels using the GROUP and GROUP CHANNEL buttons respectively, allows the user to determine which groups are currently enabled for embedding and their sources.

**Insert Option**

While operating in Channel mode, if the Embed insert option is selected through the SCi software, a channel that is not enabled for embedding will contain the original group channel audio. In this mode it enables you to selectively insert channels alongside existing group channels in the incoming SDI stream. For example, if you wish to embed a stereo pair only into group 1 pair 1, then enabling only the first two channels in this group will retain the original group audio in channels 3 and 4, as shown in the diagram below. Note that this option is settable for each SDI output.

| | | ENABLED |
|---|---|---|
| Group 1 | CH1 – New | Y |
| | CH2 – New | Y |
| | CH3 – Original | N |
| | CH4 – Original | N |

**SD & 24-bit Audio**

The Redbox embedders provide full support for 24-bit audio embedding in SD by making use of the extended data packets as per SMPTE-272M. By default the unit embeds 20-bit audio. To enable the full 24-bit embedding, this must be set through the remote control port.

Before enabling this option, ensure that any receiving equipment is capable of handling the extended data packets.

### Deleting Audio Groups

If the SDI video signal contains audio groups which require deleting, then these can be deleted on a per output basis. For example if the video input contained all four audio groups then it is possible to delete all groups on output 1 and only groups 1 and 2 on output 2.

The unit will also delete any ancillary packets marked for deletion and realign the packets to make maximum use of the available ancillary space.

To delete audio groups the unit is put into a special group deletion mode. To enter this mode press and hold the STATUS button for 5 seconds. The front panel button indicators will change so that only the GROUP, GROUP CHANNEL and STATUS buttons are available. The GROUP button and indicators are used to select the group number, the GROUP CHANNEL button is used to enable or disable deletion on this group and the STATUS button is used to select the output. Once the desired settings have been set, then using the same method to enter the group deletion mode will exit it. The new settings will be applied as soon as the unit returns to its normal operating mode.

## Technical Specification For RB-VHEMA8

| Front Panel Controls & Indicators | |
|---|---|
| Embed Bank Select: | Bank 1 or 2 |
| Bank Channel Select: | Channels 1, 2, 3 or 4 |
| Group Select: | Groups 1, 2, 3 or 4 |
| Group Channel Select: | Group channels 1,2,3 or 4 |
| Status: | 1 x SDI input status LED<br>2 x SDI output LEDs<br>4 x Audio group status LEDs |

| Audio Specifications | |
|---|---|
| Maximum Input Level: | +27dBu (balanced) |
| Input Impedance: | >10kΩ bridging (balanced) |
| Input Levels: | +12dBu, +18dBu or +24dBu for FSD (jumper selectable) |
| Signal to Noise: | Better than -113dBFS (RMS A-weighted at 24-bit, balanced) |
| Distortion and Noise: | Better than -100dB THD+N at 1kHz (balanced) |
| Embed Delay: | SD: 600 us<br>3G/HD: 300 us |

| Connections | |
|---|---|
| Analogue Audio Inputs: | 8 input channels via BNC (unbalanced) or D-type socket (balanced) |
| Analogue Audio Connectors: | 8 x BNC<br>2 x 25-way D-type |
| Power Supply: | Universal filtered IEC, continuously rated 85-264VAC @47-63Hz, fused, max 18W |

| SDI Specification | |
|---|---|
| SDI Input: | 1 x BNC, 3G/HD/SD-SDI |
| SDI Outputs: | 2 x BNC, 3G/HD/SD-SDI, Re-clocked |
| Impedance: | 75Ω |

| | |
|---|---|
| Output Alignment Jitter: | <0.2UI (3G <0.3UI) |
| Output Level: | 800mV +/- 10% |
| Return Loss: | <15dB at 1500MHz |
| SDI Supported Standards: | 270Mbps, SMPTE-259M-C (SD)<br>1.485 or 1.4835Gbps, SMPTE-292M (HD)<br>2.97 or 2.967Gbps, SMPTE-424M (3G), SMPTE 425M-A |
| Supported Video Formats: | 525/59.94 (SMPTE-125M)<br>625/50 (ITU-R BT.656)<br>720p/23.98, 24, 25, 29.97, 30, 50, 59.94, 60 (SMPTE-296M)<br>1035i/59.94, 60 (SMPTE-260M)<br>1080i/50, 59.94, 60 (SMPTE-274M)<br>1080p/23.98, 24, 25, 50, 59.94, 60 (SMPTE 274M)<br>1080pSF/23.98, 24, 25, 29.97, 30 (RP-211)<br>1080i/50 (SMPTE-295M)<br>1080p/50 (SMPTE-295M) |
| Video Delay: | SD: 290 pixels / 22 us<br>HD: 570 pixels / 8 us<br>3G: 570 pixels / 4 us |

| Video Delay Control: | | |
|---|---|---|
| | 525/59.94 | 0 to 55 frames |
| | 625/50 | 0 to 46 frames |
| | 1080p/50 | 0 to 8 frames |
| | 1080p/59.94,60 | 0 to 10 frames |
| | 720p/23.98, 24, 25<br>1080i/50 | |
| | 1080p/23.98,24,25<br>720p/29.97, 30<br>1035i/59.94, 60<br>1080i/59.94, 60 | 0 to 16 frames |
| | 1080p/29.97,30 | 0 to 20 frames |
| | 720p/50 | 0 to 33 frames |
| | 720p/59.94, 60 | 0 to 40 frames |

| | |
|---|---|
| Embedded Audio: | 24-bit, 48kHz synchronous<br>SMPTE-272M-C<br>SMPTE-299M |
| Serial Port: | RS232, 9 way D-type |
| Ethernet Port: | 10/100Mbps, RJ-45 |
| Fuse Rating: | Anti-surge fuse 2A 20 x 5mm |

| **Equipment Type** | |
|---|---|
| RB-VHEMA8 | 3G/HD/SD-SDI embedder, 8 channel analogue inputs |

| **Physical Specifications** | |
|---|---|
| Dimensions (Raw): | 48cm (W) x 10.8cm (D*) x 4.2cm (H) (1U)<br>19” (W) x 4.3” (D*) x 1.7” (H) (1U) |
| Dimensions (Boxed): | 59cm (W) x 27.5cm (D) x 11cm (H)<br>23.2” (W) x 10.8” (D) x 4.3” (H) |
| Weight: | Nett: 1.8kg Gross: 2.3kg<br>Nett: 4.0lb Gross: 5.1lb |

* Note that this product is deeper than standard Redboxes

## Remote Interface Commands & Responses Protocol

Sonifex SCi remote control software handles all communication with the unit via a convenient graphical user interface. However, this protocol is provided for those users who wish to develop their own remote control applications or communicate with the unit using a text-based terminal program.

### Command Format

Commands are case-insensitive and should be terminated in a carriage return character, a line feed character may be sent but it will be ignored. Further commands sent before the first command is acknowledged will be ignored. Responses will be CR & LF terminated.

## Remote Control Commands

| Command | Description | Response |
|---|---|---|
| COM:b,d,p,s | Serial Port Settings<br>b is the baud rate (9600, 19200, 38400, 57600 and 115200)<br>d is the data bits (7 or 8)<br>p is the parity (N, O, E)<br>s is the stop bits (1 or 2) | ACK: |
| CTM:m | Control Mode<br>m is the mode<br>0 = bank<br>1 = channel | ACK: |
| DEL:o,g,e | Delete Audio Group<br>o is the output (0 or 1)<br>g is the group (0 to 3)<br>e is the option<br>0 = don't delete<br>1 = delete | ACK: |
| DWN: | Initiates a Firmware Update | |
| EMC:o,g,c,e | Embed Group Channel Enable<br>This is only used when operating in channel mode<br>o is the output (0 or 1)<br>g is the group (0 to 3)<br>c is the channel (0 to 3)<br>e is the option<br>0 = off<br>1 = on | ACK: |
| EMG:o,g,e | Embed Group Enable<br>o is the output (0 or 1)<br>g is the group (0 to 3)<br>e is the option<br>0 = off<br>1 = on | ACK: |
| EMR:o,g[,gc],b[,bc] | Embed Route Control<br>o is the output (0 or 1)<br>g is the group (0 to 3)<br>gc is the group channel (0 to 3) – only in channel mode<br>b is the bank (0 or 1)<br>bc is the bank (0 to 3) – only in channel mode | ACK: |
| FPL:e | Front Panel Lock<br>e is the enable option<br>0 = off<br>1 = on | ACK: |
| IPG:b,c,g | Input Gain<br>b is the bank number (0 or 1)<br>c is the channel (0-3)<br>g is the gain value 0 to 96<br>0 = -24dBu and 96 = +24dBu | ACK: |
| MAC: | MAC Address<br>Returns the MAC address of the unit in 12 hex characters. | MAC: XXXXXXXXXXXX |
| NET: x.x.x.x,y.y.y.y,z.z.z.z | Network Address Settings<br>x.x.x.x is a valid IP address<br>y.y.y.y is a valid subnet mask<br>z.z.z.z is a valid gateway address | ACK: |
| NOP:o,v | Network Options<br>o is the option number<br>0 = DHCP<br>v is the option value<br>0 = off<br>1 = on | ACK: |
| SDB:o,e | SD Audio Sample Width<br>o is the output (0 or 1)<br>e is enable<br>0 = 20-bit<br>1 = 24-bit | ACK: |
| SRQ: | Status Request | |
| UID: | Unit ID | UID:RB-VHEMA8 |
| VER: | Version information<br>M1.m1.b1 is the Firmware version<br>M2.m2.b2 is the FPGA version | VER:M1.m1.b1, M2.m2.b2 |

## SCi For RB-VHEMA8

### System Page

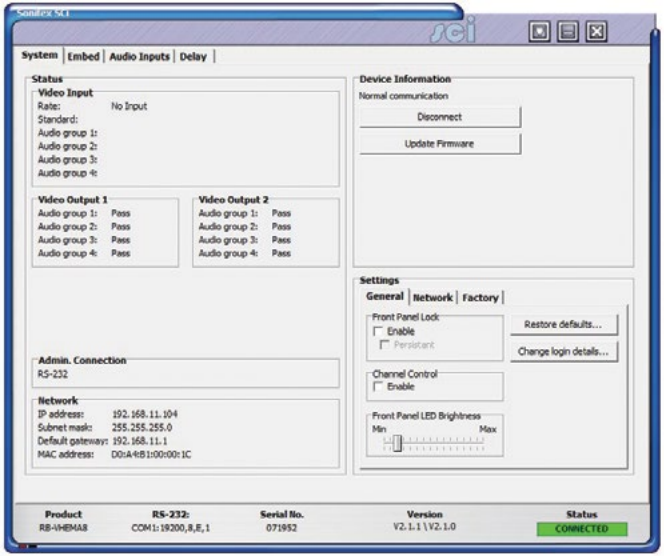


*Fig 5-4: SCi System Screen*

This page is used for the connecting and disconnecting SCi to the unit, updating the firmware in the units, displaying the current status of the unit and controlling various settings.

**Status**

**Video Input**

Shows the current SDI input rate, video format and the audio groups status. When an audio group is detected in the incoming stream the status is set to PRESENT, and MISSING when that group is not detected.

**Video Output 1 & 2**

The two video output status boxes show the audio group status for each output. There are three states per output and these are described below.

**PASS** : This audio group is being passed through on this output.
**EMBED** : This audio group is being embedded on this output.
**DELETE** : This audio group is being deleted on this output.

**Admin Connection**

This displays any connection which has “Administrator” rights to the unit.

**Network Status**

This displays the current network settings assigned to the unit.

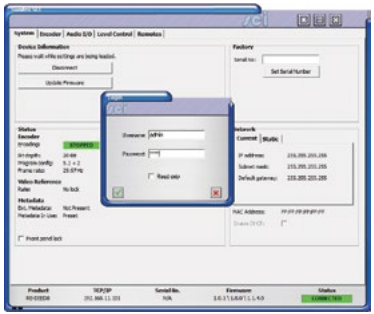

*Fig 5-5: SCi Admin Screen*

**Settings**

**General**

**Front Panel Lock**

When selected, this control disables the front panel and prohibits any changes to be made via the front panel. This control is automatically disabled when the unit is powered on.

**Channel Control**

Enables/Disables the channel control mode.

### Front Panel LED Brightness

Increases or decreases the LED intensity on the front panel.

### Restore Defaults

Pressing this button will cause the unit to restore all settings to their factory defaults. All previous settings will be lost. **Note:** The login details are not reset and are unaffected by this process.

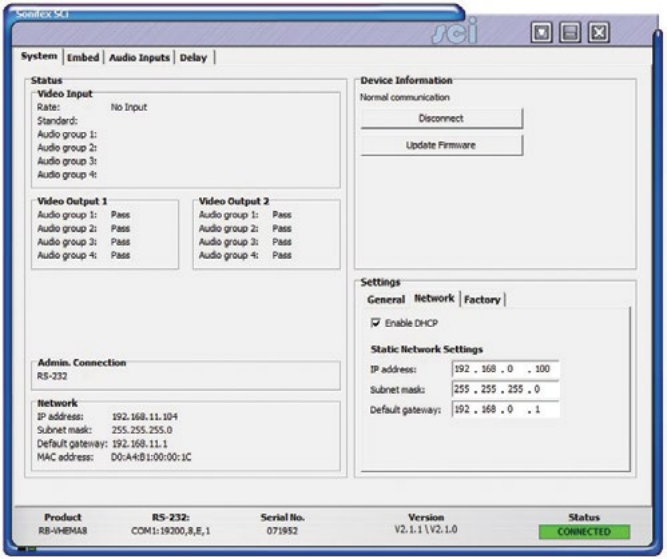


*Fig 5-6: Network Settings*

**Network**

**Enable DHCP**

This enables the unit to receive it's IP address, subnet mask and gateway settings from a DHCP server. If one is not available then this should be disabled through the serial port and a valid static address be entered.

**Note**: This setting cannot be changed while connected to the unit over Ethernet.

**IP Address**: Displays the current IP address of the unit. If DHCP is enabled then this will normally be the IP address supplied by the DHCP server.

**Subnet Mask**: Displays the current subnet mask for the unit.

**Default gateway**: Displays the current default gateway for the unit.

**Note:** The units are discovered using broadcast packets. If your PC has two network cards, then there is a limitation in windows that requires the two addresses to be on different subnet addresses.

**Updating The Firmware**

The firmware will occasionally be updated to add new features or correct any possible issues that may arise. Check for updates at: https://www.sonifex.co.uk/technical/software

To update the firmware click on the button labelled "Update Firmware" and then select the downloaded firmware file. Firmware files will always have an ".dwn or dw2" extension. A progress bar will appear in SCi, indicating how much of the file has been uploaded to the unit.

When the unit switches to update mode, the unit will continue to operate as normal but the front panel will become locked. The progress of the update will be displayed on screen and once complete the unit will return to it's previous state and operate as normal. To complete the update the unit must be restarted. Only then will the update be complete.

## Embed Page

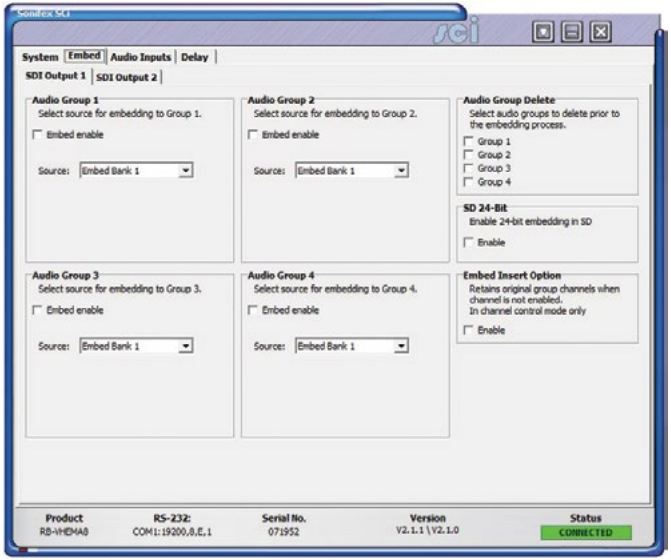


*Fig 5-7: SCi Embed Screen*

The two Embed pages allow you to control embedding for each SDI output.

When in bank control mode, only the top bank selection box is available for each group. This selects the bank to embed to all the channels in that group and then channel assignments are shown in the channel selection boxes.

When in channel control mode, all of the bank and channel selection boxes become available, allowing you to individually select a bank and channel to embed to each group channel.

**Embed Enable**: This control enables embedding for the selected group.
**Bank/Channel**: Selects the Embed bank and/or channel to embed to the group.
**Enable**: Individually enables each channel within the group. Only used in channel control mode.

**Audio Group Delete**
Allows the deletion of audio groups on a per output basis. Simply select the group to enable deletion.

**SD 24-Bit Enable**: This enables 24-bit embedding in SD. This is selectable on a per output basis. Before enabling this option, ensure that any receiving equipment is capable of handling the extended data packets.

**Embed Insert Option**
Enables or disables the Embed Insert option for the selected SDI output. This option is only valid when the unit is operating in Channel control mode.

## Audio Inputs Page

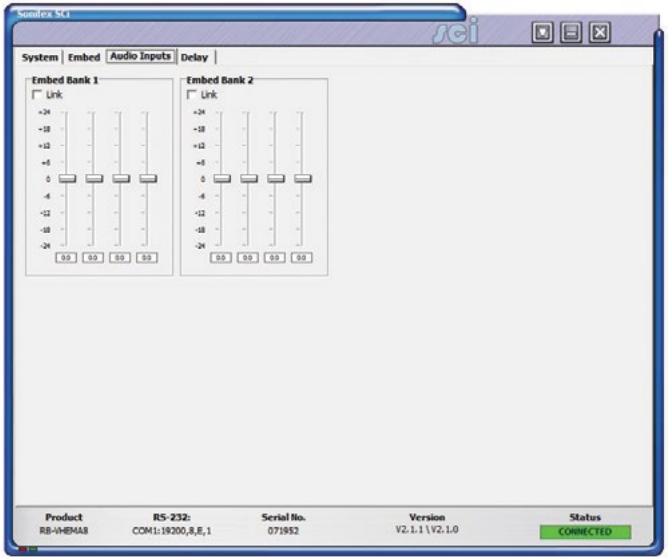


*Fig 5-8: SCi Audio Inputs Screen*

This page allows you to configure the audio inputs for the available Embed banks.

**Gain Slide Bars**: Controls the input gain or attenuation for each input channel. Can be set from -24 dB to +24 dB in 0.5 dB steps. Double clicking the gain value label at the bottom of the slide bar will set the gain to 0 dB.
**Link**: If selected, the gain slide bars are linked together so that changing one will change the others in that bank.
**SRC Disable**: Only available on the RB-VHCMD16, these controls allow you to disable sample rate conversion on each input.

**Termination**: Only available on the the RB-VHCMD16, these controls select the input termination from between 75 and 110Ω.

## Delay Page

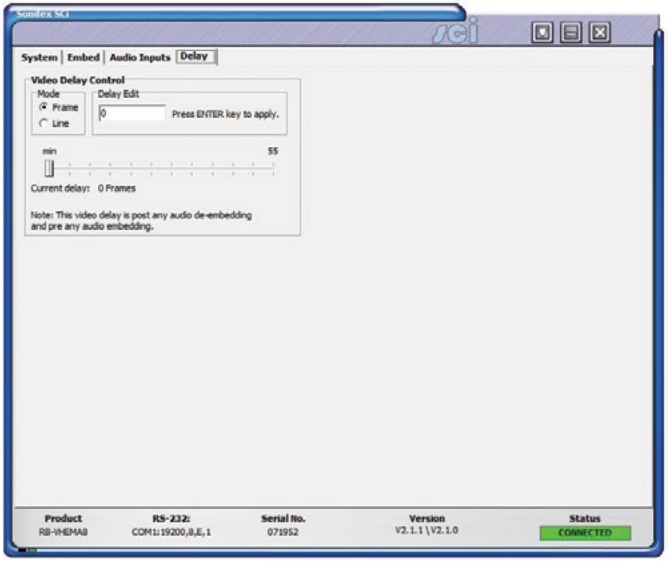


*Fig 5-9: SCi Delay Screen*

This page allows control over the video delay through the unit. This control is only available in the newer units running firmware V2.X.X or greater.

The amount of delay through the unit can be expressed in either lines or frames. The maximum number of which is determined by the current video format being received by the unit. When the input rate changes the maximum delay value is updated.

**Mode**: Selects between Line or Frame delay mode.
**Delay Edit**: This is where the actual delay valued can be entered. This value is represented on the slide bar below, which can also be altered to configure the delay value.
**Current Delay**: This label displays the current delay value active in the unit.

# 6 RB-VHCMA4 3G/HD/SD-SDI Embedder & De-Embedder 4 Channel Analogue I/O

## Introduction

The RB-VHCMA4 is a 4 channel analogue de-embedder and a 4 channel analogue embedder combined into a single 19-inch rack unit. The unit can selectively de-embed up to 4 channels within any audio group of an SDI video signal, to any of the analogue outputs. After which, the video becomes two independent paths where the audio groups can be selectively deleted or passed through. The unit then embeds any of the 4 analogue input channels to available groups within each of the two video paths, which are then sent to the re-clocked SDI outputs.

The de-embedding and embedding channel routing is controlled via the front panel buttons and indicators. There is also LED indication for SDI input status and audio group presence.

The unit can be remote controlled via Ethernet or serial port connections using the Sonifex SCi software.

It has a triple rate SDI receiver with automatic input rate detection and equalisation along with two re-clocked and individually buffered SDI outputs. It supports the full range of 3G, SD and HD standards from NTSC and PAL up to 1080p 60Hz.

There is independent level control for each analogue input and output channel, which can be adjusted from -24dB through to +24dB in 0.5dB steps.

The analogue outputs have three full-scale gain settings which can be set via jumpers situated inside the unit. Allowable settings are +12dBu, +18dBu and +24dBu reference FSD Similarly, the analogue inputs full-scale gain settings can be set via jumpers inside the unit. Allowable settings are +12dBu, +18dBu and +24dBu for FSD. The balanced and unbalanced connections are paralleled, allowing one type to be used per input or output.

## System Block Diagram

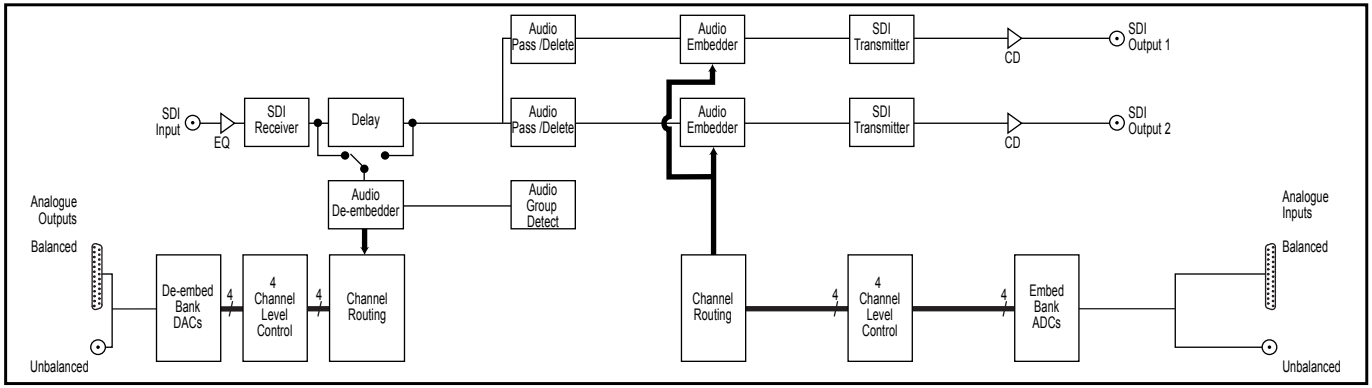


*Fig 6-1: RB-VHCMA4 System Block Diagram*

## Front Panel Indicators & Controls

*Fig 6-2: RB-VHCMA4 Front Panel*

**Power LED**

The POWER LED illuminates whilst internal power is present within the unit. If this indicator is not on, the most likely reason is simply the absence of mains power, but under fault conditions it may also indicate a ruptured mains fuse or a problem with the internal power supply module.

**Reset Button**

In the unlikely event that the unit fails to respond, press the reset button to reboot the unit.

**Bank**

The BANK button is used to select between the embed and de-embed bank. The selection determines the function of the other front panel buttons.

When the de-embed bank is selected, the front panel buttons will control de-embedding to this bank. The button LED is used show whether the bank is enabled. To enable or disable the bank, press and hold the BANK button for two seconds until the bank number indicator blinks. When lit green it is enabled and when lit red it is disabled. When the bank is disabled, all audio outputs on this bank are muted.

When the embed bank is selected, the front panel buttons will control embedding from this bank.

**Bank Channel**

***Embed***

The BANK CHANNEL button and its indicators are only used when the unit is operating in Channel mode and are used to select the audio input bank channel when controlling the embedding channel routing.

**De-Embed**

The BANK CHANNEL button and its indicators are only used when the unit is operating in Channel mode and are used to select the audio output bank channel when controlling the de-embedding channel routing. The button LED is used to show whether the channel is enabled. To enable or disable the channel, press and hold the BANK CHANNEL button for two seconds until the channel number indicator blinks. When lit green it is enabled and when it is lit red it is disabled. When the channel is disabled, the audio output is muted. The channel will also be muted if the bank is disabled, even if the channel is enabled.

**Group**

***Embed***

The GROUP button and its indicators are used to select the group number with which to embed the analogue input channels to. The button LED is used show whether embedding is enabled to the currently selected group.

To enable or disable the embedding to a group, press and hold the GROUP button for two seconds until the group number indicator blinks. When lit green it is enabled and when it is lit red it is disabled. When the group is disabled, no embedding is done to that group number.

**De-Embed**

The GROUP button and its indicators are used to select the group audio number within the video signal to de-embed and send to analogue outputs in the currently selected bank.

**Group Channel**

***Embed***

The GROUP CHANNEL and its indicators are used to select the channel within the currently selected group with which to embed the analogue input channel to. This button is only used when operating in Channel mode. The button LED is used show whether the channel is enabled for embedding. To enable or disable the channel, press and hold the GROUP CHANNEL button for two seconds until the channel number indicator blinks. When lit green it is enabled and when it is lit red it is disabled. When the channel is disabled, no audio is embedded to that channel. The channel will also not be embedded if the group is not enabled for embedding, even if the channel is enabled.

***De-Embed***

The GROUP CHANNEL button and its indicators are used to select the channel number within the currently selected group to de-embed and send to the analogue output in the currently selected bank and bank channel. This button is only used when operating in Channel mode.

**Status**

This button is used to select the output number when controlling the embedding routing. It is also used to enter and exit the group deletion mode.

**Audio Group Detection**

The four audio group indicators associated with the STATUS button display the audio groups present in the SDI input. If an audio group is present, its relevant indicator will be lit. This is useful to determine which groups require deleting or which groups are available for embedding.

**Lock Indicator**

The lock indicator is lit when the the SDI receiver has detected and locked to the incoming video format. If the input is disconnected or is intermittent then the lock indicator will stay unlit.

**Output Indicators**

These two indicators are used to indicate which one of the two outputs are selected when configuring the embedding routing or when configuring audio packets for deletion.

## Rear Panel Connections

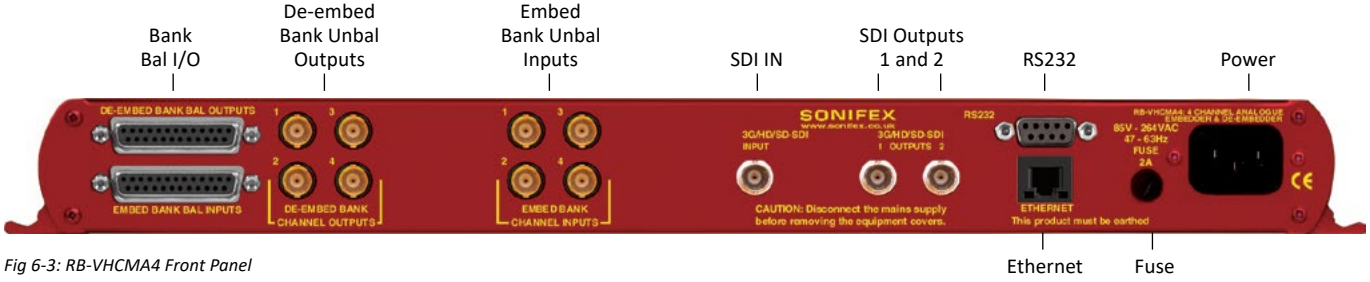


*Fig 6-3: RB-VHCMA4 Front Panel*

**Mains Power**

Power is applied via a standard three-pin IEC male socket. Mains voltages between 85V and264V AC and frequencies between 47 and 63Hz are accepted without adjustment. A 2A, 5 x 20mm SB fuse is used. The Earth pin MUST be connected to ensure safety.

## Remote Control

The unit can be controlled remotely either by serial RS-232 or Ethernet using the Sonifex SCi software. Using remote control allows the user to monitor the status of the unit and also set various options and settings not available via the front panel.

**RS232 Remote Control**

A 9-way female D-type connector carries a standard RS232 interface via which advanced configuration options may be set and many functions may be remotely controlled. The pin assignations are as follows:

| Pin No. | Function |
|---|---|
| 1 | Unused |
| 6 | Unused |
| 2 | Data transmit (TX) |
| 7 | Unused |
| 3 | Data receive (RX) |
| 8 | Unused |
| 4 | Unused |
| 9 | Unused |
| 5 | Ground |

The RB-VHCMA4 will interface directly with personal computer serial ports at standard RS232 signal levels using a straight-through cable. The default format is 19200 baud with 8 data bits, even parity and 1 stop bit. Sonifex SCi software, when installed on a suitable PC, provides straightforward graphical access to all remote control and configuration options via both RS232 and Ethernet interfaces. Alternatively, commands may be issued from any text-based terminal program (e.g. Hyperterminal) or custom software may be developed for specific requirements.

**Ethernet**

The Ethernet port is connected using a standard RJ-45 connector on the rear of the panel. It is a 10/100Mbps link. The unit is shipped with DHCP enabled to allow the unit to be plug and play if the users local area network has a DHCP server. If one is not available on the network and the unit cannot retrieve a valid IP address after 45 seconds it will default to a static address. This static address is set to 192.168.0.100 by default but can be altered through SCi using the serial port connection. If DHCP is not required then this can also be disabled through SCi using the serial port connection.

The Network connectors pin assignations are as follows:

| Network Connector (RJ-45) | |
|---|---|
| **Pin No.** | **Function** |
| 1 | Transmit Data (Positive) |
| 2 | Transmit Data (Negative) |
| 3 | Receive Data (Positive) |
| 4 | No connection |
| 5 | No connection |
| 6 | Receive Data (Negative) |
| 7 | No connection |
| 8 | No connection |

**SDI Input**

The SDI input is connected using a single female BNC and has a 75Ω input impedance. It is a triple rate SDI receiver with automatic input rate detection and equalisation. It supports the full range of 3G, SD and HD standards from NTSC and PAL up to 1080p 60Hz. The status of the input is displayed on the status LEDs on the front panel. When the SDI input rate and format has been detected, the SDI lock indicator will be lit.

**SDI Outputs**

The two SDI outputs are connected using the two female BNC connectors on the rear panel. They have a 75Ω output impedance in accordance with the SMPTE standard and are both re-clocked and independently buffered. Each output can be configured separately for embedding and group deletion settings.

## Audio Connections

**Analogue Audio Inputs**

The RB-VHCMA4 has four analogue inputs grouped into a single embed bank. The analogue inputs are converted to digital audio using high performance, low noise stereo 24-bit ADC's. They are connected using balanced connections through the D-type connectors or unbalanced connections through BNC connectors, all are available on the rear panel. The balanced analogue inputs can be wired unbalanced by connecting non-phase (-) pin to the ground pin for that input, and then connecting the audio signal to the phase (+) pin.

The two input types are connected internally, so please ensure that only one type of connection is used per input.

***Full Scale Setting***

The analogue input full-scale settings, which determine the full-scale 0dBFS level for the digital audio, are set internally via jumpers. They are factory set to +18dBu by default.

| Full-scale Settings | Jumper | |
|---|---|---|
| | JP1 | JP2 |
| +12dBu | Not fitted | Not fitted |
| +18dBu | Fitted | Not fitted |
| +24dBu | Not fitted | Fitted |

**Analogue Audio Outputs**

The RB-VHCMA4 has four analogue outputs grouped into a single de-embed bank. These can be connected using balanced connections through the D-type connectors or unbalanced connections through BNC connectors, all are available on the rear panel. The balanced analogue outputs can be wired unbalanced by connecting non-phase (-) pin to the ground pin for that output, and then connecting the audio signal to the phase (+) pin.

The two output types are connected internally, so please ensure that only one type of connection is used per output.

***Full Scale Setting***

The analogue output full-scale settings, which determine the full-scale 0dBFS level for the digital audio, are set internally via jumpers. They are factory set to +18dBu by default.

| Full-scale Settings | Jumper | |
|---|---|---|
| | JP1 | JP2 |
| +12dBu | Not fitted | Not fitted |
| +18dBu | Fitted | Not fitted |
| +24dBu | Fitted | Fitted |

**Audio Input and Output Gain Adjustment**

The default audio channel gain is unity. However, to accommodate lower or higher level sources it is possible to introduce gain or attenuation on a per channel basis. Each audio channel has an adjustable gain range from -24dBu to +24dBu in 0.5dB increments. This is set using the remote Control ports. Once set, this value is stored and reloaded each time the unit is powered on.

**RB-VHCMA4 D-type Pin-out**

| Pin No. | Function De-Embed Bank | Function Embed Bank |
|---|---|---|
| 1 | Channel 1+ | Channel 1+ |
| 14 | Channel 1- | Channel 1- |
| 2 | Channel 1 Ground | Channel 1 Ground |
| 15 | Channel 2+ | Channel 2+ |
| 3 | Channel 2- | Channel 2- |
| 16 | Channel 2 Ground | Channel 2 Ground |
| 4 | Channel 3+ | Channel 3+ |
| 17 | Channel 3- | Channel 3- |
| 5 | Channel 3 Ground | Channel 3 Ground |
| 18 | Channel 4+ | Channel 4+ |
| 6 | Channel 4- | Channel 4- |
| 19 | Channel 4 Ground | Channel 4 Ground |
| 7 to 13 | Do not connect | Do not connect |
| 20 to 25 | Do not connect | Do not connect |

## Control Modes

There are two modes available to control the embedding and de-embedding channel routing process. These are the BANK mode and the CHANNEL mode.

**Bank Mode**

In Bank mode, audio is routed on a per bank basis, so when controlling embedding, a bank of audio is selected to be embedded into a group and when de-embedding a group of audio is selected to be sent to a bank.

**Channel Mode**

In Channel mode, audio is routed on a per channel basis, this allows for maximum flexibility when embedding and de-embedding allowing any audio input channel to be embedded to any channel within any group. And conversely, when de-embedding, any channel within any group can be sent to any channel of any of the available audio output banks.

**Changing Control Mode**

To switch between Bank and Channel control modes, simultaneously press and hold the GROUP CHANNEL and BANK CHANNEL buttons for 5 seconds. The mode will switch after this time and the button can be released. Bank mode is in use when both the BANK CHANNEL and GROUP CHANNEL button LEDs are not lit. Conversely, when Channel mode is in use these two LEDs are lit.

When switching from Channel to Bank mode, all channel mappings are reset and no groups are selected for embedding. When switching from Bank to Channel mode, the channel mappings are retained to allow for further modification.

## Embedding

The analogue audio inputs can be embedded into any of the four available groups in the two SDI outputs. They can be embedded on a per bank basis in the Bank control mode, or a per channel basis in the Channel control mode. If you embed to a group which is already present in the SDI video input, then this group is automatically deleted from the video input prior to the embedding block.

**Bank Mode**

To embed a bank of audio to a specific group.

1. Select the Embed bank, using the BANK button.
2. Select the SDI Output, using the STATUS button.
3. Select the group to embed to, using the GROUP button.

The GROUP button LED will indicate whether embedding is enabled to this group. To enable embedding to this group, press and hold the GROUP button for two seconds, until the button turns green. The group number LED will blink to indicate that the change has been applied. This indicates that embedding is enabled to this group. To disable embedding to this group, then hold the GROUP button down until the button turns red.

In this mode, the channels of the bank are mapped directly to the group channels. For example channel 1 in the selected bank is embedded to channel 1 of the selected group. Channel 2 in the selected bank is embedded to channel 2 of the selected group etc.

Cycling through the groups using the GROUP button, allows the user to determine which groups are currently enabled for embedding and will also show the source for that group.

**Channel Mode**

To embed a channel of audio to a specific channel within a group.

1. Select the Embed bank, using the BANK button.
2. Select the SDI Output, using the STATUS button.
3. Select the bank channel using the the BANK CHANNEL button.
4. Select the group to embed to using the GROUP button.
5. Select the group channel to embed to using the GROUP CHANNEL button.

To enable embedding to this group and channel, both the GROUP and GROUP CHANNEL must be enabled. This is indicated by the button LED being lit green. If either are red, then simply enable them by holding down the relevant button for two seconds. Embedding will only take place if the GROUP is enabled. If the GROUP CHANNEL is enabled and the GROUP is not, then no embedding will occur.

Cycling through the groups and group channels using the GROUP and GROUP CHANNEL buttons respectively, allows the user to determine which groups are currently enabled for embedding and their sources.

**SD & 24-bit Audio**

The Redbox embedders provide full support for 24-bit audio embedding in SD by making use of the extended data packets as per SMPTE-272M. By default the unit embeds 20-bit audio. To enable the full 24-bit embedding, this must be set through the remote control port.

Before enabling this option, ensure that any receiving equipment is capable of handling the extended data packets.

## De-Embedding

The unit is always de-embedding, automatically reading all the audio data contained in the video signal as it appears to the de-embedding block. Using the front panel controls the user can control which of these channels or groups within the video input are routed to the analogue outputs.

If an SD video signal is being received and extended audio data is detected, then the unit will automatically use this to reproduce full 24-bit audio data and no user intervention is required.

**Bank Mode**

In bank mode de-embedding is controlled on a per group basis. So groups are selected to be output on a particular bank.

To de-embed a group of audio to a specific bank.

1. Select the De-Embed bank, using the BANK button.
2. Select the group to de-embed using the GROUP button.

The BANK button LED will show whether the bank is enabled. To enable de-embedding to this bank, press and hold the BANK button for two seconds, until the button turns green. This indicates that de-embedding is enabled to this bank. To turn off de-embedding, then hold the BANK button down until the button turns red. The bank number indicator will blink to show that the change has been applied.

In this mode, the channels of the group are mapped directly to the bank channels. For example channel 1 in the selected group is de-embedded to channel 1 of the selected bank. Channel 2 in the selected group is de-embedded to channel 2 of the selected
bank etc.

Cycling through the banks using the BANK button, allows the user to determine which banks are currently enabled for de-embedding and will also show the source group for that bank.

**Channel Mode**

In channel mode, de-embedding is controlled on a per channel basis. So channels within a group are selected to be output on a particular channel within a bank.

To de-embed a group channel of audio to a specific bank channel.

1. Select the De-Embed bank using the BANK button.
2. Select the output bank channel using the BANK CHANNEL button.
3. Select the group to de-embed using the GROUP button.
4. Select the group channel to de-embed using the GROUP CHANNEL button.

To enable de-embedding to this channel, both the BANK and BANK CHANNEL must be enabled. This is indicated by the button LED being lit green. If either are red, then simply enable them by holding down the relevant button for two seconds.

Cycling through the banks and bank channels using the BANK and BANK CHANNEL buttons respectively, allows the user to determine which bank channels are currently enabled for de-embedding and will also show the source for that bank channel.

## Deleting Audio Groups

If the SDI video signal contains audio groups which require deleting, then these can be deleted on a per output basis. For example if the video input contained all four audio groups then it is possible to delete all groups on output 1 and only groups 1 and 2 on output 2.

The unit will also delete any ancillary packets marked for deletion and realign the packets to make maximum use of the available ancillary space.

To delete audio groups the unit is put into a special group deletion mode. To enter this mode press and hold the STATUS button for 5 seconds. The front panel button indicators will change so that only the GROUP, GROUP CHANNEL and STATUS buttons are available. The GROUP button and indicators are used to select the group number, the GROUP CHANNEL button is used to enable or disable deletion on this group and the STATUS button is used to select the output. Once the desired settings have been set, then using the same method to enter the group deletion mode will exit it. The new settings will be applied as soon as the unit returns to its normal operating mode.

## Technical Specification For RB-VHCMA4

| **Front Panel Controls & Indicators** | |
|---|---|
| Bank Select: | De-embed bank or Embed bank |
| Bank Channel Select: | Channels 1, 2, 3 or 4 |
| Group Select: | Groups 1, 2, 3 or 4 |
| Group Channel Select: | Group channels 1,2,3 or 4 |
| Status: | 1 x SDI input status LED<br>2 x SDI output LEDs<br>4 x Audio group status LEDs |

| **Audio Specifications**<br>**Analogue Inputs** | |
|---|---|
| Maximum Input Level: | +27dBu (balanced) |
| Input Impedance: | >10kΩ bridging (balanced) |
| Input Levels: | +12dBu, +18dBu or +24dBu for FSD (jumper selectable) |
| Signal to Noise: | Better than -113dBFS (RMS A-weighted at 24-bit, balanced) |
| Distortion and Impedance: | Better than -100dB THD+N at 1kHz (balanced) |

| **Analogue Outputs** | |
|---|---|
| Max Output Level: | +24dBu (balanced) |

| | |
|---|---|
| Output Impedance: | <50Ω (balanced) |
| Gain Range: | 12dBu, 18dBu or 24dBu ref FSD (jumper selectable) |
| Signal to Noise: | Better than -106dB (RMS A-weighted at 24-bit, balanced) |
| Distortion and Noise: | Better than -85dB THD+N at 1kHz (balanced) |
| De-embed Delay: | 3G/HD/SD: 1.1 ms |
| Embed Delay: | SD: 600 us<br>3G/HD: 300 us |

| **Connections** | |
|---|---|
| Analogue Audio Inputs: | 4 input channels via BNC (unbalanced) or D-type (balanced) |
| Analogue Audio Outputs: | 4 output channels via BNC (unbalanced or D-type (balanced) |
| Analogue Audio Connectors: | 8 x BNC<br>2 x 25-way D-type |
| Power Supply: | Universal filtered IEC, continuously rated 85-264VAC @47-63Hz, fused, max 16W |

| **SDI Specification** | |
|---|---|
| SDI Input: | 1 x BNC, 3G/HD/SD-SDI |
| SDI Outputs: | 2 x BNC, 3G/HD/SD-SDI, Re-clocked |
| Impedance: | 75Ω |
| Output Alignment Jitter: | <0.2UI (3G <0.3UI) |
| Output Level: | 800mV +/- 10% |
| Return Loss: | <15dB at 1500MHz |
| SDI Supported Standards: | 270Mbps, SMPTE-259M-C (SD)<br>1.485 or 1.4835Gbps, SMPTE-292M (HD)<br>2.97 or 2.967Gbps, SMPTE-424M (3G), SMPTE 425M-A |
| Supported Video Formats: | 525/59.94 (SMPTE-125M)<br>625/50 (ITU-R BT.656)<br>720p/23.98, 24, 25, 29.97, 30, 50, 59.94, 60 (SMPTE-296M)<br>1035i/59.94, 60 (SMPTE-260M)<br>1080i/50, 59.94, 60 (SMPTE-274M)<br>1080p/23.98, 24, 25, 50, 59.94, 60 (SMPTE 274M)<br>1080pSF/23.98, 24, 25, 29.97, 30 (RP-211)<br>1080i/50 (SMPTE-295M)<br>1080p/50 (SMPTE-295M) |
| Video Delay: | SD: 290 pixels / 22 us<br>HD: 570 pixels / 8 us<br>3G: 570 pixels / 4 us |

| Video Delay Control: | | |
|---|---|---|
| | 525/59.94 | 0 to 55 frames |
| | 625/50 | 0 to 46 frames |
| | 1080p/50 | 0 to 8 frames |
| | 1080p/59.94,60 | 0 to 10 frames |
| | 720p/23.98, 24, 25 | |
| | 1080i/50 | |
| | 1080p/23.98,24,25 | 0 to 16 frames |
| | 720p/29.97, 30 | |
| | 1035i/59.94, 60 | |
| | 1080i/59.94, 60 | |
| | 1080p/29.97,30 | 0 to 20 frames |
| | 720p/50 | 0 to 33 frames |
| | 720p/59.94, 60 | 0 to 40 frames |

| | |
|---|---|
| Embedded Audio: | 24-bit, 48kHz synchronous<br>SMPTE-272M-C<br>SMPTE-299M |
| Serial Port: | RS232, 9 way D-type |
| Ethernet Port: | 10/100Mbps, RJ-45 |
| Fuse Rating: | Anti-surge fuse 2A 20 x 5mm |

| **Equipment Type** | | |
|---|---|---|
| RB-VHCMA4 | RK3 | 3G/HD/SD-SDI embedder & de- embedder, 4 channel analogue I/O |

| Physical Specifications | |
|---|---|
| Dimensions (Raw): | 48cm (W) x 10.8cm (D*) x 4.2cm (H) (1U)<br>19” (W) x 4.3” (D*) x 1.7” (H) (1U) |
| Dimensions (Boxed): | 59cm (W) x 27.5cm (D) x 11cm (H)<br>23.2” (W) x 10.8” (D) x 4.3” (H) |
| Weight: | Nett: 1.8kg Gross: 2.3kg<br>Nett: 4.0lb Gross: 5.1lb |

* Note that this product is deeper than standard Redboxes

## Remote Interface Commands & Responses Protocol

Sonifex SCi remote control software handles all communication with the unit via a convenient graphical user interface. However, this protocol is provided for those users who wish to develop their own remote control applications or communicate with the unit using a text-based terminal program.

### Command Format

Commands are case-insensitive and should be terminated in a carriage return character, a line feed character may be sent but it will be ignored. Further commands sent before the first command is acknowledged will be ignored. Responses will be CR & LF terminated.

## Remote Control Commands

| Command | Description | Response |
|---|---|---|
| COM:b,d,p,s | Serial Port Settings<br>b is the baud rate (9600, 19200, 38400, 57600 and 115200)<br>d is the data bits (7 or 8)<br>p is the parity (N, O, E)<br>s is the stop bits (1 or 2) | ACK: |
| CTM:m | Control Mode<br>m is the mode<br>0 = bank<br>1 = channel | ACK: |
| DEL:o,g,e | Delete Audio Group<br>o is the output (0 or 1)<br>g is the group (0 to 3)<br>e is the option<br>0 = don’t delete<br>1 = delete | ACK: |
| DWN: | Initiates a Firmware Update | |
| EMC:o,g,c,e | Embed Group Channel Enable<br>This is only used when operating in channel mode<br>o is the output (0 or 1)<br>g is the group (0 to 3)<br>c is the channel (0 to 3)<br>e is the option<br>0 = off<br>1 = on | ACK: |
| EMG:o,g,e | Embed Group Enable<br>o is the output (0 or 1)<br>g is the group (0 to 3)<br>e is the option<br>0 = off<br>1 = on | ACK: |

| | | |
|---|---|---|
| EMR:o,g[,gc],b[,bc] | Embed Route Control<br>o is the output (0 or 1)<br>g is the group (0 to 3)<br>gc is the group channel (0 to 3) – only in channel mode<br>b is the bank (0 or 1)<br>bc is the bank (0 to 3) – only in channel mode | ACK: |
| DMC:b,c,e | De-Embed Bank Channel Enable<br>This is only used when operating in channel mode<br>b is the bank (0 to 3)<br>c is the channel (0 to 3)<br>e is the option<br>0 = off<br>1 = on | ACK: |
| DMB:b,e | De-Embed Bank Enable<br>b is the group (0 to 3)<br>e is the option<br>0 = off<br>1 = on | ACK: |
| DMR:b[,bc],g[,gc] | De-Embed Route Control<br>b is the bank (0 to 3)<br>bc is the bank channel (0 to 3) – only in channel mode<br>g is the group (0 to 3)<br>gc is the group channel (0 to 3) – only in channel mode | ACK: |
| FPL:e | Front Panel Lock<br>e is the enable option<br>0 = off<br>1 = on | ACK: |
| IPG:b,c,g | Input Gain<br>b is the bank number (0 or 1)<br>c is the channel (0-3)<br>g is the gain value 0 to 96<br>0 = -24dBu and 96 = +24dBu | ACK: |
| MAC: | MAC Address<br>Returns the MAC address of the unit in 12 hex characters. | MAC: XXXXXXXXXXXX |
| NET:<br>x.x.x.x,y.y.y.y,z.z.z.z | Network Address Settings<br>x.x.x.x is a valid IP address<br>y.y.y.y is a valid subnet mask<br>z.z.z.z is a valid gateway address | ACK: |
| NOP:o,v | Network Options<br>o is the option number<br>0 = DHCP<br>v is the option value<br>0 = off<br>1 = on | ACK: |
| OPG:b,c,g | Output Gain<br>b is the bank number (0 or 1)<br>c is the channel (0-3)<br>g is the gain value 0 to 96<br>0 = -24dBu and 96 = +24dBu | ACK: |
| SDB:o,e | SD Audio Sample Width<br>o is the output (0 or 1)<br>e is enable<br>0 = 20-bit<br>1 = 24-bit | ACK: |
| SRQ: | Status Request | |
| UID: | Unit ID | UID:RB-VHEMA8 |
| VER: | Version information<br>M1.m1.b1 is the Firmware version<br>M2.m2.b2 is the FPGA version | VER:M1.m1.b1, M2.m2.b2 |

## SCi For RB-VHCMA4

### System Page

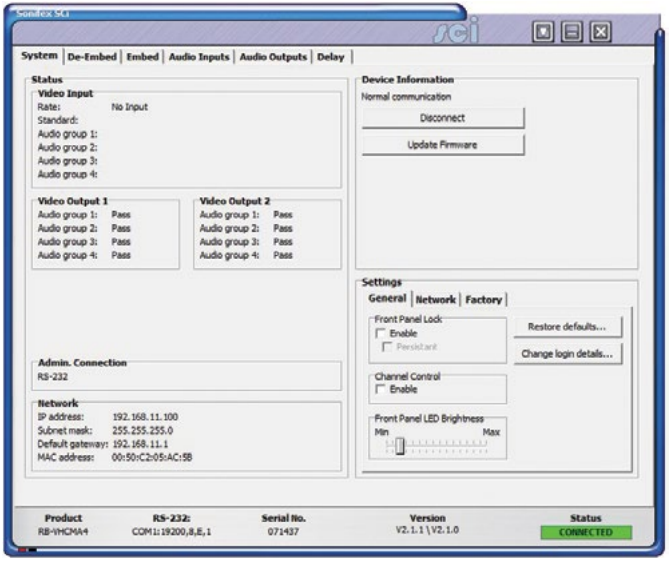


*Fig 6-4: SCi System Screen*

This page is used for the connecting and disconnecting SCi to the unit, updating the firmware in the units, displaying the current status of the unit and controlling various settings.

**Status**

**Video Input**

Shows the current SDI input rate, video format and the audio groups status. When an audio group is detected in the incoming stream the status is set to PRESENT, and MISSING when that group is not detected.

**Video Output 1 & 2**

The two video output status boxes show the audio group status for each output. There are three states per output and these are described below.

**PASS** : This audio group is being passed through on this output.
**EMBED** : This audio group is being embedded on this output.
**DELETE** : This audio group is being deleted on this output.

**Admin Connection**

This displays any connection which has “Administrator” rights to the unit.

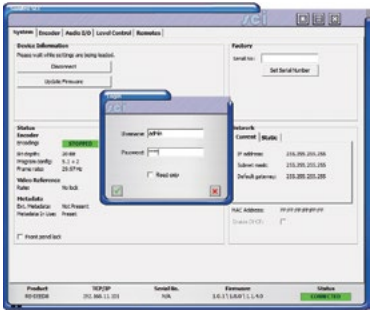

*Fig 6-5: SCi Admin Screen*

**Network Status**

This displays the current network settings assigned to the unit.

**Settings**

**General**

**Front Panel Lock**

When selected, this control disables the front panel and prohibits any changes to be made via the front panel. This control is automatically disabled when the unit is powered on.

**Channel Control**

Enables/Disables the channel control mode.

### Front Panel LED Brightness

Increases or decreases the LED intensity on the front panel.

### Restore Defaults

Pressing this button will cause the unit to restore all settings to their factory defaults. All previous settings will be lost. **Note:** The login details are not reset and are unaffected by this process.

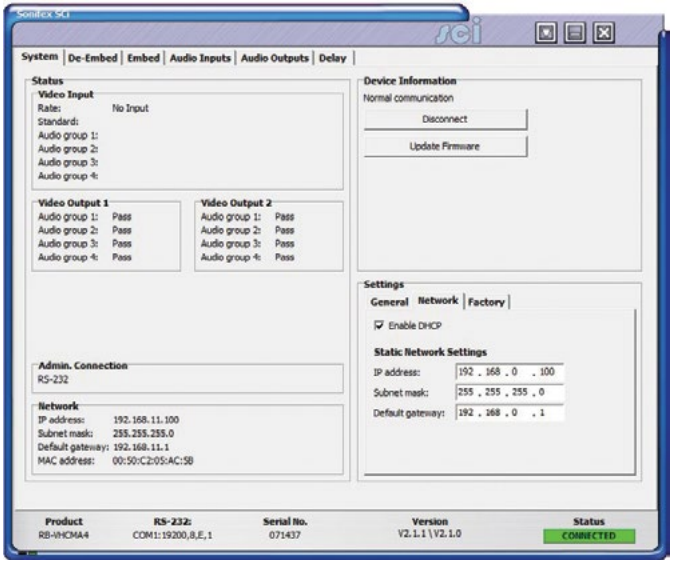


*Fig 6-6: Network Settings*

**Network**

**Enable DHCP**

This enables the unit to receive it's IP address, subnet mask and gateway settings from a DHCP server. If one is not available then this should be disabled through the serial port and a valid static address be entered.

**Note**: This setting cannot be changed while connected to the unit over Ethernet.

**IP Address**: Displays the current IP address of the unit. If DHCP is enabled then this will normally be the IP address supplied by the DHCP server.

**Subnet Mask**: Displays the current subnet mask for the unit.

**Default gateway**: Displays the current default gateway for the unit.

**Note:** The units are discovered using broadcast packets. If your PC has two network cards, then there is a limitation in windows that requires the two addresses to be on different subnet addresses.

**Updating The Firmware**

The firmware will occasionally be updated to add new features or correct any possible issues that may arise. Check for updates at: https://www.sonifex.co.uk/technical/software

To update the firmware click on the button labelled "Update Firmware" and then select the downloaded firmware file. Firmware files will always have an ".dwn or dw2" extension. A progress bar will appear in SCi, indicating how much of the file has been uploaded to the unit.

When the unit switches to update mode, the unit will continue to operate as normal but the front panel will become locked. The progress of the update will be displayed on screen and once complete the unit will return to it's previous state and operate as normal. To complete the update the unit must be restarted. Only then will the update be complete.

## De-Embed Page

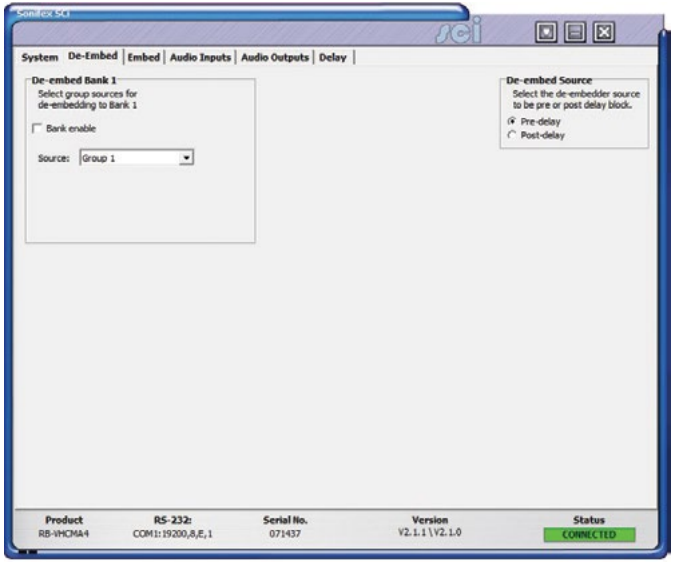


*Fig 6-7: SCi De-Embed Screen*

This page allows you to configure the group sources for each of the available De-Embed banks on the unit.

When in bank control mode, only the top group selection box is available for each bank. This selects the group to de-embed to all the channels in that bank.

When in channel control mode, all of the selection boxes become available, allowing you to individually select a group and channel for each output.

**Bank Enable**: This control enables the bank for De-Embedding.
**Group/Channel**: Selects the group and/or channel for De-Embedding to the bank.
**Enable**: Individually enables each channel within the bank. Only used in channel control mode.

**De-embed Source**

This selection allows you to select whether the video source for the de-embedder block comes before or after the video delay block. If the source is selected to be pre-delay block then de-embedded audio will not be delayed, if the source is selected to be post-delay block then the de-embedded audio will be delayed by the same amount as the video.

## Embed Page

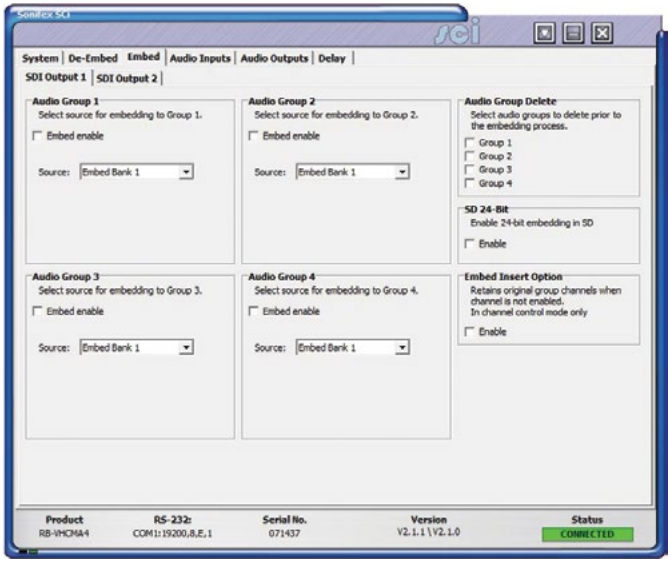


*Fig 6-8: SCi Embed Screen*

The two Embed pages allow you to control embedding for each SDI output.

When in bank control mode, only the top bank selection box is available for each group. This selects the bank to embed to all the channels in that group and then channel assignments are shown in the channel selection boxes.

When in channel control mode, all of the bank and channel selection boxes become available, allowing you to individually select a bank and channel to embed to each group channel.

**Embed Enable**: This control enables embedding for the selected group.
**Bank/Channel**: Selects the Embed bank and/or channel to embed to the group.
**Enable**: Individually enables each channel within the group. Only used in channel control mode.

**Audio Group Delete**
Allows the deletion of audio groups on a per output basis. Simply select the group to enable deletion.

**SD 24-Bit Enable**: This enables 24-bit embedding in SD. This is selectable on a per output basis. Before enabling this option, ensure that any receiving equipment is capable of handling the extended data packets.

**Embed Insert Option**
Enables or disables the Embed Insert option for the selected SDI output. This option is only valid when the unit is operating in Channel control mode.

## Audio Inputs Page

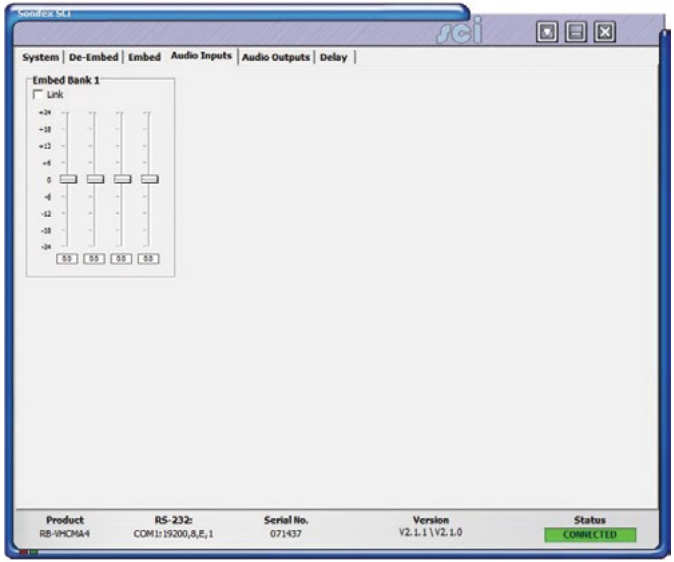


*Fig 6-9: SCi Audio Inputs Screen*

This page allows you to configure the audio inputs for the available Embed banks.

**Gain Slide Bars**: Controls the input gain or attenuation for each input channel. Can be set from -24 dB to +24 dB in 0.5 dB steps. Double clicking the gain value label at the bottom of the slide bar will set the gain to 0 dB.
**Link**: If selected, the gain slide bars are linked together so that changing one will change the others in that bank.

**SRC Disable**: Only available on the RB-VHCMD16, these controls allow you to disable sample rate conversion on each input.
**Termination**: Only available on the the RB-VHCMD16, these controls select the input termination from between 75 and 110Ω.

## Audio Outputs Page

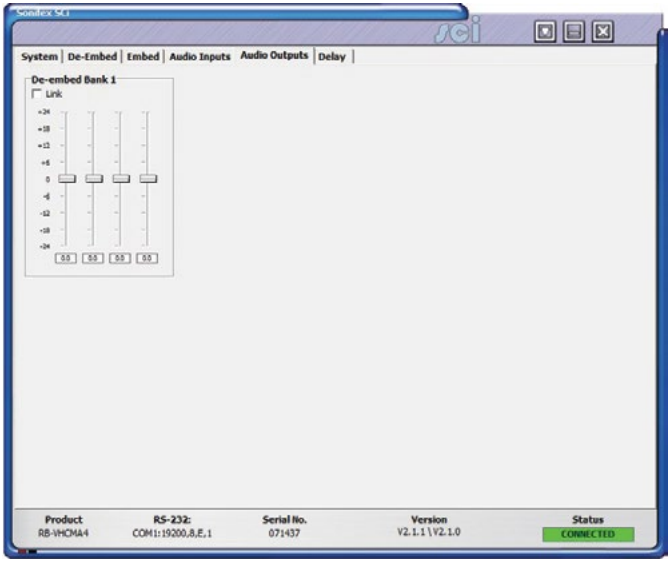


*Fig 6-10: SCi Audio Outputs Screen*

This page allows you to configure the audio outputs for the available De-Embed banks.

**Gain Slide Bars**: Controls the output gain or attenuation for each output channel. Can be set from -24 dB to +24 dB in 0.5 dB steps. Double clicking the gain value label at the bottom of the slide bar will set the gain to 0 dB.
**Link**: If selected, the gain slide bars are linked together so that changing one will change the others in that bank.
**Termination**: Only available on the the RB-VHCMD16, these controls select the output termination from between 75 and 110Ω.

## Delay Page

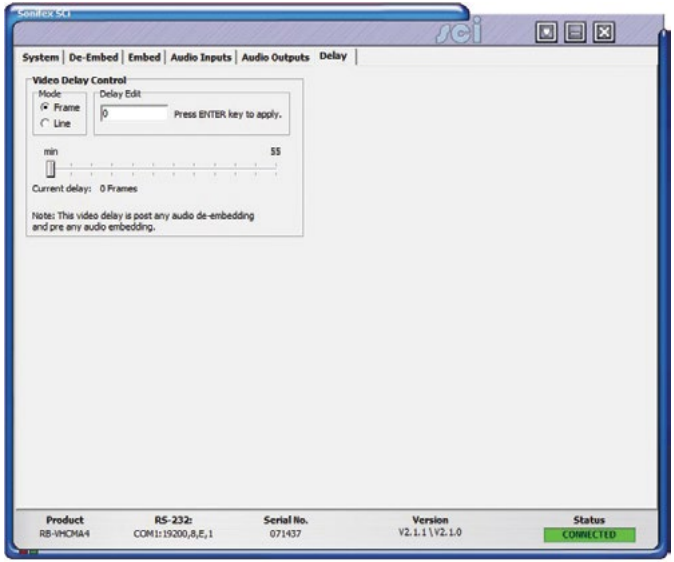


*Fig 6-11: SCi Delay Screen*

This page allows control over the video delay through the unit. This control is only available in the newer units running firmware V2.X.X or greater.

The amount of delay through the unit can be expressed in either lines or frames. The maximum number of which is determined by the current video format being received by the unit. When the input rate changes the maximum delay value is updated.

**Mode**: Selects between Line or Frame delay mode.
**Delay Edit**: This is where the actual delay valued can be entered. This value is represented on the slide bar below, which can also be altered to configure the delay value.

**Current Delay**: This label displays the current delay value active in the unit.

# 7 RB-VHCMD16 3G/HD/SD-SDI Embedder & De-Embedder 16 Channel Digital I/O

## Introduction

*Fig 7-1: RB-VHCMD16 Front Panel*

The RB-VHCMD16 is a 16 channel de-embedder and 16 channel embedder combined into a single 19-inch rack unit. The unit can selectively de-embed any channel within any audio group of an SDI video signal, to any of the digital outputs. After which, the video becomes two independent paths where the audio groups can be selectively deleted or passed through. The unit then embeds any of the digital input channels to available groups within each of the two video paths, which are then sent to the re-clocked SDI outputs.

The de-embedding and embedding channel routing is controlled via the front panel buttons and indicators. There is also LED indication for SDI input status and audio group presence.

The unit can be remote controlled via Ethernet or serial port connections using the Sonifex SCi software.

It has a triple rate SDI receiver with automatic input rate detection and equalisation along with two re-clocked and individually buffered SDI outputs. It supports the full range of 3G, HD and SD standards from NTSC and PAL up to 1080p 60Hz.

Each digital input is normally sample rate converted to 48kHz before embedding, so that it is synchronous to the video input. Though sample rate conversion can be bypassed on a per input basis allowing SMPTE-337M data to be embedded. All digital outputs are output at 48kHz, synchronous to the video input.

There is independent level control for each digital input and output channel, which can be adjusted from -24dB through to +24dB in 0.5dB steps.

The digital audio I/O connections are transformer-coupled balanced line interfaces and can be configured through SCi to be either 75Ω (AES 3ID) or 110Ω (AES 3) impedance through either a BNC or via the D-type connector. These connections are paralleled, allowing one type to be used per input or output.

## System Block Diagram

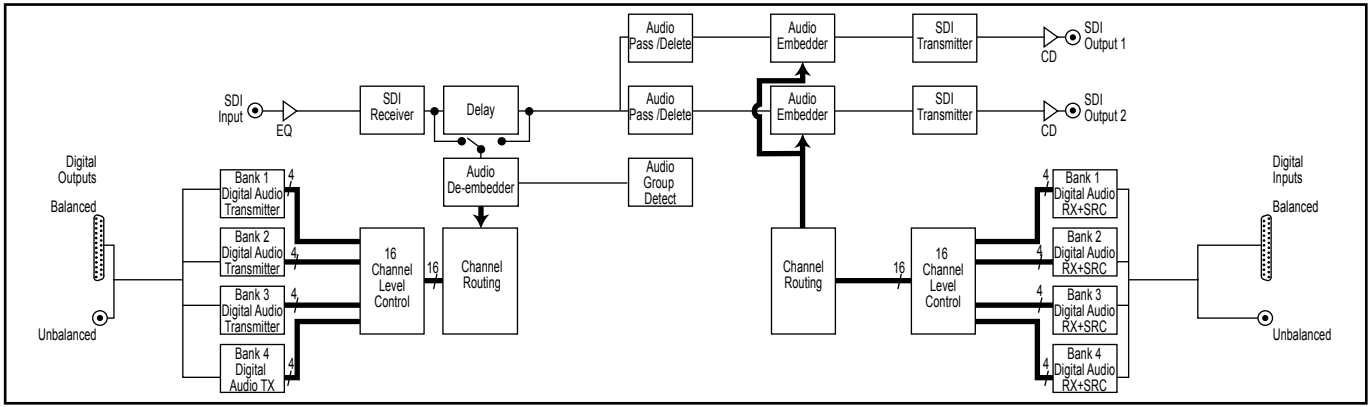


*Fig 7-2: RB-VHCMD16 System Block Diagram*

## Front Panel Indicators & Controls

*Fig 7-3: RB-VHCMD16 Front Panel*

**Power LED**

The POWER LED illuminates whilst internal power is present within the unit. If this indicator is not on, the most likely reason is simply the absence of mains power, but under fault conditions it may also indicate a ruptured mains fuse or a problem with the internal power supply module.

**Reset Button**

In the unlikely event that the unit fails to respond, press the reset button to reboot the unit.

**Bank**

**Embed**

The BANK button and its associated indicators are used to select the audio input bank when controlling the embedding channel routing.

***De-Embed***

The BANK button and its associated indicators are used to select the audio output bank when controlling the de-embedding channel routing. The button LED is used show whether the bank is enabled. To enable or disable the bank, press and hold the BANK button for two seconds until the bank number indicator blinks. When lit green it is enabled and when it is lit red it is disabled. When the bank is disabled, all audio outputs are muted.

**Bank Channel**

**Embed**

The BANK CHANNEL button and its indicators are only used when the unit is operating in Channel mode and are used to select the audio input bank channel when controlling the embedding channel routing.

***De-Embed***

The BANK CHANNEL button and its indicators are only used when the unit is operating in Channel mode and are used to select the audio output bank channel when controlling the de-embedding channel routing. The button LED is used to show whether the channel is enabled. To enable or disable the channel, press and hold the BANK CHANNEL button for two seconds until the channel number indicator blinks. When lit green it is enabled and when it is lit red it is disabled. When the channel is disabled, the audio output is muted. The channel will also be muted if the bank is disabled, even if the channel is enabled.

**Function Button**

This button is used to select between embedding or de-embedding control.

**Group**

***Embed***

The GROUP button and its indicators are used to select the group number with which to embed the analogue input channels to. The button LED is used show whether embedding is enabled to the currently selected group. To enable or disable the embedding to a group, press and hold the GROUP button for two seconds until the group number indicator blinks. When lit green it is enabled and when it is lit red it is disabled. When the group is disabled, no embedding is done to that group number.

***De-Embed***

The GROUP button and its indicators are used to select the group audio number within the video signal to de-embed and send to digital outputs in the currently selected bank.

**Group Channel**

***Embed***

The GROUP CHANNEL and its indicators are used to select the channel within the currently selected group with which to embed the digital input channel to. This button is only used when operating in Channel mode. The button LED is used show whether the channel is enabled for embedding. To enable or disable the channel, press and hold the GROUP CHANNEL button for two seconds until the channel number indicator blinks. When

lit green it is enabled and when it is lit red it is disabled. When the channel is disabled, no audio is embedded to that channel. The channel will also not be embedded if the group is not enabled for embedding, even if the channel is enabled.

***De-Embed***

The GROUP CHANNEL button and its indicators are used to select the channel number within the currently selected group to de-embed and send to the digital output in the currently selected bank and bank channel. This button is only used when operating in Channel mode.

**Status**

This button is used to select the output number when controlling the embedding routing. It is also used to enter and exit the group deletion mode.

**Audio Group Detection**

The four audio group indicators associated with the STATUS button display the audio groups present in the SDI input. If an audio group is present, its relevant indicator will be lit. This is useful to determine which groups require deleting or which groups are available for embedding.

**Lock Indicator**

The lock indicator is lit when the the SDI receiver has detected and locked to the incoming video format. If the input is disconnected or is intermittent then the lock indicator will stay unlit.

**Output Indicators**

These two indicators are used to indicate which one of the two outputs are selected when configuring the embedding routing or when configuring audio packets for deletion.

## Rear Panel Connections

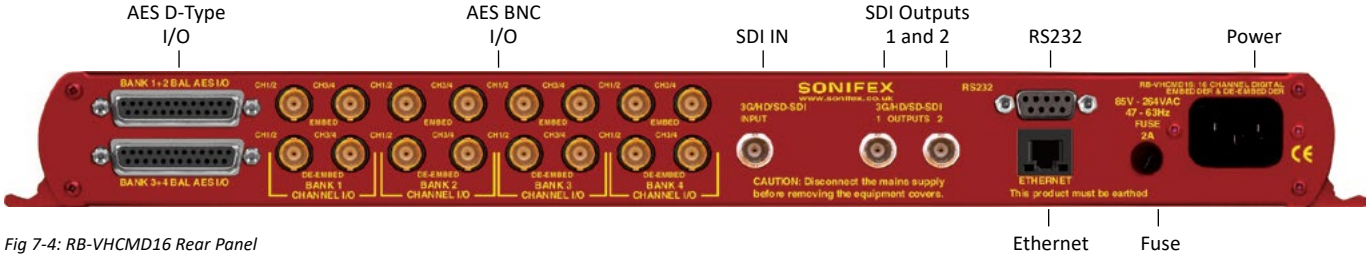


*Fig 7-4: RB-VHCMD16 Rear Panel*

**Mains Power**

Power is applied via a standard three-pin IEC male socket. Mains voltages between 85V and264V AC and frequencies between 47 and 63Hz are accepted without adjustment. A 2A, 5 x 20mm SB fuse is used. The Earth pin MUST be connected to ensure safety.

## Remote Control

The unit can be controlled remotely either by serial RS-232 or Ethernet using the Sonifex SCi software. Using remote control allows the user to monitor the status of the unit and also set various options and settings not available via the front panel.

**RS232 Remote Control**

A 9-way female D-type connector carries a standard RS232 interface via which advanced configuration options may be set and many functions may be remotely controlled. The pin assignations are as follows:

| Pin No. | Function |
|---|---|
| 1 | Unused |
| 6 | Unused |
| 2 | Data transmit (TX) |
| 7 | Unused |
| 3 | Data receive (RX) |
| 8 | Unused |
| 4 | Unused |
| 9 | Unused |
| 5 | Ground |

The RB-VHCMD16 will interface directly with personal computer serial ports at standard RS232 signal levels using a straight-through cable. The default format is 19200 baud with 8 data bits, even parity and 1 stop bit. Sonifex SCi software, when installed on a suitable PC, provides straightforward graphical access to all remote control and configuration options via both RS232 and Ethernet interfaces. Alternatively, commands may be issued from any text-based terminal program (e.g. Hyperterminal) or custom software may be developed for specific requirements.

**Ethernet**

The Ethernet port is connected using a standard RJ-45 connector on the rear of the panel. It is a 10/100Mbps link. The unit is shipped with DHCP enabled to allow the unit to be plug and play if the users local area network has a DHCP server. If one is not available on the network and the unit cannot retrieve a valid IP address after 45 seconds it will default to a static address. This static address is set to 192.168.0.100 by default but can be altered through SCi using the serial port connection. If DHCP is not required then this can also be disabled through SCi using the serial port connection.

The Network connectors pin assignations are as follows:

| Network Connector (RJ-45) | |
|---|---|
| Pin No. | Function |
| 1 | Transmit Data (Positive) |
| 2 | Transmit Data (Negative) |
| 3 | Receive Data (Positive) |
| 4 | No connection |
| 5 | No connection |
| 6 | Receive Data (Negative) |
| 7 | No connection |
| 8 | No connection |

**SDI Input**

The SDI input is connected using a single female BNC and has a 75Ω input impedance. It is a triple rate SDI receiver with automatic input rate detection and equalisation. It supports the full range of 3G, SD and HD standards from NTSC and PAL up to 1080p 60Hz. The status of the input is displayed on the status LEDs on the front panel. When the SDI input rate and format has been detected, the SDI lock indicator will be lit.

**SDI Outputs**

The two SDI outputs are connected using the two female BNC connectors on the rear panel. They have a 75Ω output impedance in accordance with the SMPTE standard and are both re-clocked and independently buffered. Each output can be configured separately for embedding and group deletion settings.

## Audio Connections

**Digital Audio Inputs & Outputs**

The RB-VHCMD16 has sixteen channels of audio inputs and outputs grouped into four banks each with four input channels of inputs and four output channels.

The digital audio I/O connections are transformer-coupled balanced line interfaces and can be configured through SCi to be either 75Ω (AES 3ID) or 110Ω (AES 3) input or output impedance through either a BNC or via the D-type connector. These connections are paralleled, allowing one type to be used per input or output.

The digital inputs are sample rate converted to 48kHz so that the audio is synchronous to the video input signal. This can be disabled via a remote control option.

The digital outputs are always output at 48kHz and will be synchronous to the video signal. No sample rate conversion is applied to the digital outputs.

**Audio Input and Output Gain Adjustment**

The default audio channel gain is unity. However, to accommodate lower or higher level sources it is possible to introduce gain or attenuation on a per channel basis. Each audio channel has an adjustable gain range from -24dBu to +24dBu in 0.5dB increments. This is set using the remote Control ports. Once set, this value is stored and reloaded each time the unit is powered on.

**Automatic Dolby Detection & SMPTE-337M Support**

Each digital input is sample rate converted by default so that it is synchronous to the incoming video signal. But if a digital audio signal contains non-linear PCM data such as Dolby E or Dolby Digital, then this process will corrupt the data and render it unusable. In addition to this if any gain or attenuation is applied to this channel, the effect will be similar. To provide support for these types of signals and any other non-audio data the units will automatically detect non-audio data and bypass the SRC and gain sections as soon as it is detected. This method relies on the channel status bits being correct, but there is also an option to bypass the SRC on a per input basis regardless of the signal content. The user must ensure that unity gain is applied through the gain section in this case so that the data is passed through unaffected.

Note that for correct embedding of non-audio data, the digital audio input must be synchronous to the video signal prior to the embedder unit.

**RB-VHCMD16 D-type Pin-out**

| Pin No. | Function I/O Bank 1 | Function I/O Bank 2 |
|---|---|---|
| 1 | Digital 1 In+ | Digital 5 In+ |
| 14 | Digital 1 In- | Digital 5 In- |
| 2 | Digital 1 In Ground | Digital 5 In Ground |
| 15 | Digital 1 Out+ | Digital 5 Out+ |
| 3 | Digital 1 Out- | Digital 5 Out- |
| 16 | Digital 1 Out Ground | Digital 5 Out Ground |
| 4 | Digital 2 In+ | Digital 6 In+ |
| 17 | Digital 2 In- | Digital 6 In- |
| 5 | Digital 2 In Ground | Digital 6 In Ground |
| 18 | Digital 2 Out+ | Digital 6 Out+ |
| 6 | Digital 2 Out- | Digital 6 Out- |
| 19 | Digital 2 Out Ground | Digital 6 Out Ground |
| 7 | Digital 3 In+ | Digital 7 In+ |
| 20 | Digital 3 In- | Digital 7 In- |
| 8 | Digital 3 In Ground | Digital 7 In Ground |
| 21 | Digital 3 Out+ | Digital 7 Out+ |
| 9 | Digital 3 Out- | Digital 7 Out- |
| 22 | Digital 3 Out Ground | Digital 7 Out Ground |
| 10 | Digital 4 In+ | Digital 8 In+ |
| 23 | Digital 4 In- | Digital 8 In- |
| 11 | Digital 4 In Ground | Digital 8 In Ground |
| 24 | Digital 4 Out+ | Digital 8 Out+ |
| 12 | Digital 4 Out- | Digital 8 Out- |
| 25 | Digital 4 Out Ground | Digital 8 Out Ground |
| 13 | Do not connect | Do not connect |

## Control Modes

There are two modes available to control the embedding and de-embedding channel routing process. These are the BANK mode and the CHANNEL mode.

**Bank Mode**

In Bank mode, audio is routed on a per bank basis, so when controlling embedding, a bank of audio is selected to be embedded into a group and when de-embedding a group of audio is selected to be sent to a bank.

**Channel Mode**

In Channel mode, audio is routed on a per channel basis, this allows for maximum flexibility when embedding and de-embedding allowing any audio input channel to be embedded to any channel within any group. And conversely, when de-embedding, any channel within any group can be sent to any channel of any of the available audio output banks.

**Changing Control Mode**

To switch between Bank and Channel control modes, simultaneously press and hold the GROUP CHANNEL and BANK CHANNEL buttons for 5 seconds. The mode will switch after this time and the button can be released. Bank mode is in use when both the BANK CHANNEL and GROUP CHANNEL button LEDs are not lit. Conversely, when Channel mode is in use these two LEDs are lit.

When switching from Channel to Bank mode, all channel mappings are reset and no groups are selected for embedding. When switching from Bank to Channel mode, the channel mappings are retained to allow for further modification.

## Embedding

The audio inputs can be embedded into any of the four available groups in the two SDI outputs. They can be embedded on a per bank basis in the Bank control mode, or a per channel basis in the Channel control mode. If you embed to a group which is already present in the SDI video input, then this group is automatically deleted from the video input prior to the embedding block.

**Bank Mode**

To embed a bank of audio to a specific group.

1. Select the Embed function using the FUNCTION button.
2. Select the SDI output using the STATUS button.
3. Select the bank of audio using the BANK button.
4. Select the group to embed to, using the GROUP button.

The GROUP button LED will indicate whether embedding is enabled to this group. To enable embedding to this group, press and hold the GROUP button for two seconds, until the button turns green. The group number LED will blink to indicate that the change has been applied. This indicates that embedding is enabled to this group. To disable embedding to this group, then hold the GROUP button down until the button turns red.

In this mode, the channels of the bank are mapped directly to the group channels. For example channel 1 in the selected bank is embedded to channel 1 of the selected group. Channel 2 in the selected bank is embedded to channel 2 of the selected group etc.

Cycling through the groups using the GROUP button, allows the user to determine which groups are currently enabled for embedding and will also show the source for that group.

**Channel Mode**

To embed a channel of audio to a specific channel within a group.

1. Select the Embed function using the FUNCTION button.
2. Select the SDI Output, using the STATUS button.
3. Select the bank of audio using the BANK button.
4. Select the bank channel using the the BANK CHANNEL button.
5. Select the group to embed to using the GROUP button.
6. Select the group channel to embed to using the GROUP CHANNEL button.

To enable embedding to this group and channel, both the GROUP and GROUP CHANNEL must be enabled. This is indicated by the button LED being lit green. If either are red, then simply enable them by holding down the relevant button for two seconds. Embedding will only take place if the GROUP is enabled. If the GROUP CHANNEL is enabled and the GROUP is not, then no embedding will occur.

Cycling through the groups and group channels using the GROUP and GROUP CHANNEL buttons respectively, allows the user to determine which groups are currently enabled for embedding and their sources.

**Insert Option**

While operating in Channel mode, if the Embed insert option is selected through the SCi software, a channel that is not enabled for embedding will contain the original group channel audio. In this mode it enables you to selectively insert channels alongside existing group channels in the incoming SDI stream. For example, if you wish to embed a stereo pair only into group 1 pair 1, then enabling only the first two channels in this group will retain the original group audio in channels 3 and 4, as shown in the diagram below. Note that this option is settable for each SDI output.

| | | ENABLED |
|---|---|---|
| Group 1 | CH1 – New | Y |
| | CH2 – New | Y |
| | CH3 – Original | N |
| | CH4 – Original | N |

**SD & 24-bit Audio**

The Redbox embedders provide full support for 24-bit audio embedding in SD by making use of the extended data packets as per SMPTE-272M. By default the unit embeds 20-bit audio. To enable the full 24-bit embedding, this must be set through the remote control port.

Before enabling this option, ensure that any receiving equipment is capable of handling the extended data packets.

## De-Embedding

The unit is always de-embedding, automatically reading all the audio data contained in the video signal as it appears to the de-embedding block. Using the front panel controls the user can control which of these channels or groups within the video input are routed to the analogue outputs.

If an SD video signal is being received and extended audio data is detected, then the unit will automatically use this to reproduce full 24-bit audio data and no user intervention is required.

**Bank Mode**

In bank mode de-embedding is controlled on a per group basis. So groups are selected to be output on a particular bank.

To de-embed a group of audio to a specific bank.

1. Select the De-Embed function using the FUNCTION button.
2. Select the audio bank, using the BANK button.
3. Select the group to de-embed using the GROUP button.

The BANK button LED will show whether the bank is enabled. To enable de-embedding to this bank, press and hold the BANK button for two seconds, until the button turns green. This indicates that de-embedding is enabled to this bank. To turn off de-embedding, then hold the BANK button down until the button turns red. The bank number indicator will blink to show that the change has been applied.

In this mode, the channels of the group are mapped directly to the bank channels. For example channel 1 in the selected group is de-embedded to channel 1 of the selected bank. Channel 2 in the selected group is de-embedded to channel 2 of the selected
bank etc.

Cycling through the banks using the BANK button, allows the user to determine which banks are currently enabled for de-embedding and will also show the source group for that bank.

**Channel Mode**

In channel mode, de-embedding is controlled on a per channel basis. So channels within a group are selected to be output on a particular channel within a bank.

To de-embed a group channel of audio to a specific bank channel.

1. Select the De-Embed function using the FUNCTION button.
2. Select the audio bank using the BANK button.
3. Select the output bank channel using the BANK CHANNEL button.
4. Select the group to de-embed using the GROUP button.
5. Select the group channel to de-embed using the GROUP CHANNEL button.

To enable de-embedding to this channel, both the BANK and BANK CHANNEL must be enabled. This is indicated by the button LED being lit green. If either are red, then simply enable them by holding down the relevant button for two seconds.

Cycling through the banks and bank channels using the BANK and BANK CHANNEL buttons respectively, allows the user to determine which bank channels are currently enabled for de-embedding and will also show the source for that bank channel.

## Deleting Audio Groups

If the SDI video signal contains audio groups which require deleting, then these can be deleted on a per output basis. For example if the video input contained all four audio groups then it is possible to delete all groups on output 1 and only groups 1 and 2 on output 2.

The unit will also delete any ancillary packets marked for deletion and realign the packets to make maximum use of the available ancillary space.

To delete audio groups the unit is put into a special group deletion mode. To enter this mode press and hold the STATUS button for 5 seconds. The front panel button indicators will change so that only the GROUP, GROUP CHANNEL and STATUS buttons are available. The GROUP button and indicators are used to select the group number, the GROUP CHANNEL button is used to enable or disable deletion on this group and the STATUS button is used to select the output. Once the desired settings have been set, then using the same method to enter the group deletion mode will exit it. The new settings will be applied as soon as the unit returns to its normal operating mode.

## Technical Specification For RB-VHCMD16

| Front Panel Controls & Indicators | |
|---|---|
| Bank Select: | Bank 1, 2, 3 or 4 |
| Bank Channel Select: | Channels 1, 2, 3 or 4 |
| Function Select: | De-embed or embed |
| Group Select: | Groups 1, 2, 3 or 4 |
| Group Channel Select: | Group channels 1,2,3 or 4 |
| Status: | 1 x SDI input status LED<br>2 x SDI output LEDs<br>4 x Audio group status LEDs |

| Audio Specifications | |
|---|---|
| Output Sample Rate: | 48kHz |
| Input Sample Rates: | 32-192kHz, sample rate converted to 48kHz.<br>SRC can be bypassed. |
| Input & Output Impedance: | 75Ω/110Ω selectable |
| Signal Level (un-terminated): | Unbalanced: 1Vp-p ±20%<br>Balanced: 6.6Vp-p ±20% |
| Dynamic Range: | 138dB |
| Distortion and Noise: | <-137dB THD+N at 997Hz, ref 0dBFS<br>Connections |
| De-embed Delay: | 3G/HD/SD: 330 us |
| SRC Input Delay: | 192 kHz: 1.3 ms<br>96 kHz: 1.83 ms<br>48 kHz: 2.9 ms |
| Embed Delay: | SD: 600 us + SRC Input Delay<br>3G/HD: 300 us + SRC Input Delay |
| Digital Audio Outputs: | 16 outputs via 8 BNCs or D-type (AES3) |
| Digital Audio Inputs: | 16 inputs via 8 BNCs or D-type (AES3 ) |
| Digital Audio Connectors: | 16 x BNC<br>2 x 25-way D-type socket |
| Power Supply: | Universal filtered IEC, continuously rated<br>85-264VAC @47-63Hz, fused, max 13W |

| SDI Specification | |
|---|---|
| SDI Input: | 1 x BNC, 3G/HD/SD-SDI |
| SDI Outputs: | 2 x BNC, 3G/HD/SD-SDI, Re-clocked |
| Impedance: | 75Ω |
| Output Alignment Jitter: | <0.2UI (3G <0.3UI) |
| Output Level: | 800mV +/- 10% |

| | |
|---|---|
| Return Loss: | <15dB at 1500MHz |
| SDI Supported Standards: | 270Mbps, SMPTE-259M-C (SD)<br>1.485 or 1.4835Gbps, SMPTE-292M (HD)<br>2.97 or 2.967Gbps, SMPTE-424M (3G), SMPTE 425M-A |
| Supported Video Formats: | 525/59.94 (SMPTE-125M)<br>625/50 (ITU-R BT.656)<br>720p/23.98, 24, 25, 29.97, 30, 50, 59.94, 60 (SMPTE-296M)<br>1035i/59.94, 60 (SMPTE-260M)<br>1080i/50, 59.94, 60 (SMPTE-274M)<br>1080p/23.98, 24, 25, 50, 59.94, 60 (SMPTE 274M)<br>1080pSF/23.98, 24, 25, 29.97, 30 (RP-211)<br>1080i/50 (SMPTE-295M)<br>1080p/50 (SMPTE-295M) |
| Video Delay: | SD: 290 pixels / 22 us<br>HD: 570 pixels / 8 us<br>3G: 570 pixels / 4 us |
| Video Delay Control: | 525/59.94 0 to 55 frames<br>625/50 0 to 46 frames<br>1080p/50 0 to 8 frames<br>1080p/59.94,60 0 to 10 frames<br>720p/23.98, 24, 25<br>1080i/50<br>1080p/23.98,24,25 0 to 16 frames<br>720p/29.97, 30<br>1035i/59.94, 60<br>1080i/59.94, 60<br>1080p/29.97,30 0 to 20 frames<br>720p/50 0 to 33 frames<br>720p/59.94, 60 0 to 40 frames |
| Embedded Audio: | 24-bit, 48kHz synchronous<br>SMPTE-272M-C<br>SMPTE-299M |

| | |
|---|---|
| Serial Port: | RS232, 9 way D-type |
| Ethernet Port: | 10/100Mbps, RJ-45 |
| Fuse Rating: | Anti-surge fuse 2A 20 x 5mm |

**Equipment Type**

| | |
|---|---|
| RB-VHCMD16 | 3G/HD/SD-SDI embedder & de- embedder<br>16 channel digital I/O |

**Physical Specifications**

| | |
|---|---|
| Dimensions (Raw): | 48cm (W) x 10.8cm (D*) x 4.2cm (H) (1U)<br>19” (W) x 4.3” (D*) x 1.7” (H) (1U) |
| Dimensions (Boxed): | 59cm (W) x 27.5cm (D) x 11cm (H)<br>23.2” (W) x 10.8” (D) x 4.3” (H) |
| Weight: | Nett: 1.8kg Gross: 2.3kg<br>Nett: 4.0lb Gross: 5.1lb |

* Note that this product is deeper than standard Redboxes

## Remote Interface Commands & Responses Protocol

Sonifex SCi remote control software handles all communication with the unit via a convenient graphical user interface. However, this protocol is provided for those users who wish to develop their own remote control applications or communicate with the unit using a text-based terminal program.

**Command Format**

Commands are case-insensitive and should be terminated in a carriage return character, a line feed character may be sent but it will be ignored. Further commands sent before the first command is acknowledged will be ignored. Responses will be CR & LF terminated.

## Remote Control Commands

| Command | Description | Response |
|---|---|---|
| BOP:b,o,v | Bank Option<br>b is the bank<br>o is the option<br>0 = SRC Disable for input channels 1/2<br>1 = SRC Disable for input channels 3/4<br>2 = Input channels 1/2 Termination<br>3 = Input channels 3/4 Termination<br>4 = Output channels 1/2 Termination<br>5 = Output channels 3/4 Termination<br>v is the option value<br>0 = off<br>1 = on | ACK: |
| COM:b,d,p,s | Serial Port Settings<br>b is the baud rate (9600, 19200, 38400,<br>57600 and 115200)<br>d is the data bits (7 or 8)<br>p is the parity (N, O, E)<br>s is the stop bits (1 or 2) | ACK: |
| CTM:m | Control Mode<br>m is the mode<br>0 = bank<br>1 = channel | ACK: |
| DEL:o,g,e | Delete Audio Group<br>o is the output (0 or 1)<br>g is the group (0 to 3)<br>e is the option<br>0 = don't delete<br>1 = delete | ACK: |
| DWN: | Initiates a Firmware Update | |
| EMC:o,g,c,e | Embed Group Channel Enable<br>This is only used when operating in channel mode<br>o is the output (0 or 1)<br>g is the group (0 to 3)<br>c is the channel (0 to 3)<br>e is the option<br>0 = off<br>1 = on | ACK: |
| EMG:o,g,e | Embed Group Enable<br>o is the output (0 or 1)<br>g is the group (0 to 3)<br>e is the option<br>0 = off<br>1 = on | ACK: |

| | | |
|---|---|---|
| EMR:o,g[,gc],b[,bc] | Embed Route Control<br>o is the output (0 or 1)<br>g is the group (0 to 3)<br>gc is the group channel (0 to 3) – only in channel mode<br>b is the bank (0 or 1)<br>bc is the bank (0 to 3) – only in channel mode | ACK: |
| DMC:b,c,e | De-Embed Bank Channel Enable<br>This is only used when operating in channel mode<br>b is the bank (0 to 3)<br>c is the channel (0 to 3)<br>e is the option<br>0 = off<br>1 = on | ACK: |
| DMB:b,e | De-Embed Bank Enable<br>b is the group (0 to 3)<br>e is the option<br>0 = off<br>1 = on | ACK: |
| DMR:b[,bc],g[,gc] | De-Embed Route Control<br>b is the bank (0 to 3)<br>bc is the bank channel (0 to 3) – only in channel mode<br>g is the group (0 to 3)<br>gc is the group channel (0 to 3) – only in channel mode | ACK: |
| FPL:e | Front Panel Lock<br>e is the enable option<br>0 = off<br>1 = on | ACK: |
| IPG:b,c,g | Input Gain<br>b is the bank number (0 or 1)<br>c is the channel (0-3)<br>g is the gain value 0 to 96<br>0 = -24dBu and 96 = +24dBu | ACK: |
| MAC: | MAC Address<br>Returns the MAC address of the unit in 12 hex characters. | MAC: XXXXXXXXXXX |
| NET: x.x.x.x,y.y.y.y,z.z.z.z | Network Address Settings<br>x.x.x.x is a valid IP address<br>y.y.y.y is a valid subnet mask<br>z.z.z.z is a valid gateway address | ACK: |
| NOP:o,v | Network Options<br>o is the option number<br>0 = DHCP<br>v is the option value<br>0 = off<br>1 = on | ACK: |
| OPG:b,c,g | Output Gain<br>b is the bank number (0 or 1)<br>c is the channel (0-3)<br>g is the gain value 0 to 96<br>0 = -24dBu and 96 = +24dBu | ACK: |
| SDB:o,e | SD Audio Sample Width<br>o is the output (0 or 1)<br>e is enable<br>0 = 20-bit<br>1 = 24-bit | ACK: |
| SRQ: | Status Request | |
| UID: | Unit ID | UID:RB-VHEMA8 |
| VER: | Version information<br>M1.m1.b1 is the Firmware version<br>M2.m2.b2 is the FPGA version | VER:M1.m1.b1, M2.m2.b2 |

## SCi For RB-VHCMD16

### System Page

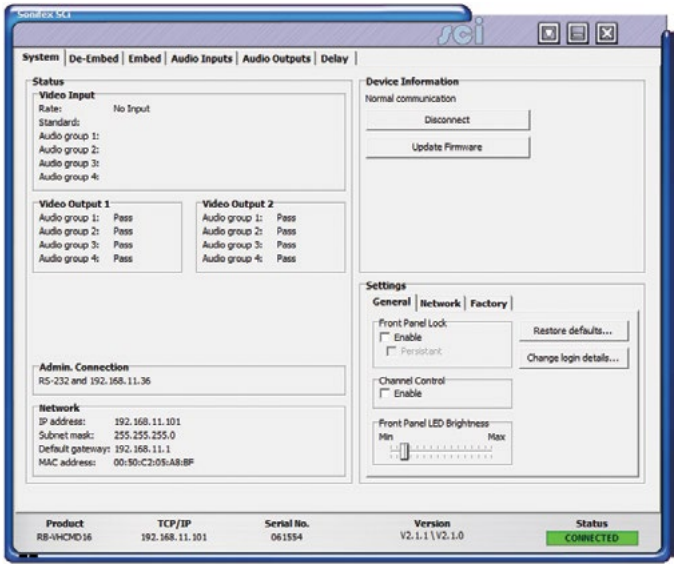


*Fig 7-5: SCi System Screen*

This page is used for the connecting and disconnecting SCi to the unit, updating the firmware in the units, displaying the current status of the unit and controlling various settings.

**Status**

**Video Input**

Shows the current SDI input rate, video format and the audio groups status. When an audio group is detected in the incoming stream the status is set to PRESENT, and MISSING when that group is not detected.

**Video Output 1 & 2**

The two video output status boxes show the audio group status for each output. There are three states per output and these are described below.

**PASS** : This audio group is being passed through on this output.
**EMBED** : This audio group is being embedded on this output.
**DELETE** : This audio group is being deleted on this output.

**Admin Connection**

This displays any connection which has “Administrator” rights to the unit.

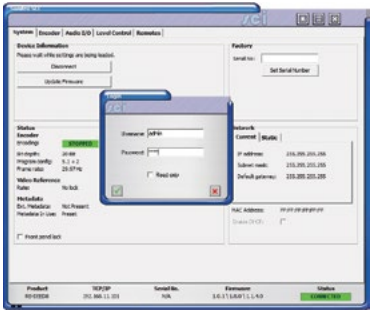

*Fig 7-6: SCi Admin Screen*

**Network Status**

This displays the current network settings assigned to the unit.

**Settings**

**General**

**Front Panel Lock**

When selected, this control disables the front panel and prohibits any changes to be made via the front panel. This control is automatically disabled when the unit is powered on.

**Channel Control**

Enables/Disables the channel control mode.

### Front Panel LED Brightness

Increases or decreases the LED intensity on the front panel.

### Restore Defaults

Pressing this button will cause the unit to restore all settings to their factory defaults. All previous settings will be lost. **Note:** The login details are not reset and are unaffected by this process.

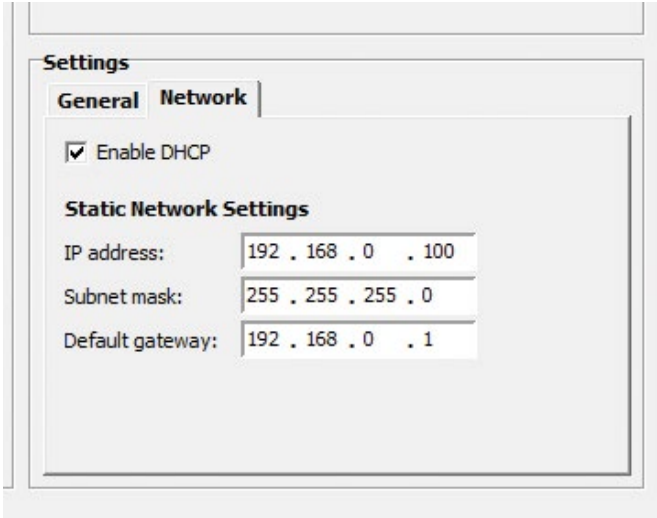


*Fig 7-7: Network Settings*

**Network**

**Enable DHCP**

This enables the unit to receive it's IP address, subnet mask and gateway settings from a DHCP server. If one is not available then this should be disabled through the serial port and a valid static address be entered.

**Note**: This setting cannot be changed while connected to the unit over Ethernet.

**IP Address**: Displays the current IP address of the unit. If DHCP is enabled then this will normally be the IP address supplied by the DHCP server.

**Subnet Mask**: Displays the current subnet mask for the unit.

**Default gateway**: Displays the current default gateway for the unit.

**Note:** The units are discovered using broadcast packets. If your PC has two network cards, then there is a limitation in windows that requires the two addresses to be on different subnet addresses.

**Updating The Firmware**

The firmware will occasionally be updated to add new features or correct any possible issues that may arise. Check for updates at: https://www.sonifex.co.uk/technical/software

To update the firmware click on the button labelled "Update Firmware" and then select the downloaded firmware file. Firmware files will always have an ".dwn or dw2" extension. A progress bar will appear in SCi, indicating how much of the file has been uploaded to the unit.

When the unit switches to update mode, the unit will continue to operate as normal but the front panel will become locked. The progress of the update will be displayed on screen and once complete the unit will return to it's previous state and operate as normal. To complete the update the unit must be restarted. Only then will the update be complete.

## De-Embed Page

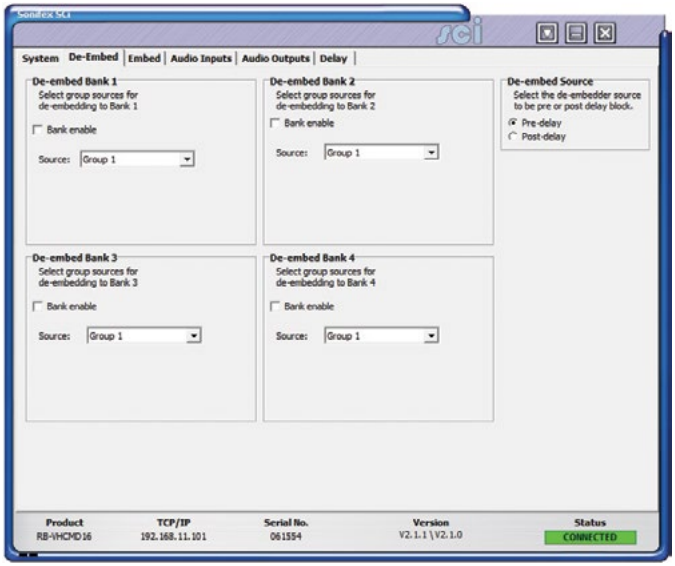


*Fig 7-8: SCi De-Embed Screen*

This page allows you to configure the group sources for each of the available De-Embed banks on the unit.

When in bank control mode, only the top group selection box is available for each bank. This selects the group to de-embed to all the channels in that bank.

When in channel control mode, all of the selection boxes become available, allowing you to individually select a group and channel for each output.

**Bank Enable**: This control enables the bank for De-Embedding.
**Group/Channel**: Selects the group and/or channel for De-Embedding to the bank.
**Enable**: Individually enables each channel within the bank. Only used in channel control mode.

**De-embed Source**
This selection allows you to select whether the video source for the de-embedder block comes before or after the video delay block. If the source is selected to be pre-delay block then de-embedded audio will not be delayed, if the source is selected to be post-delay block then the de-embedded audio will be delayed by the same amount as the video.

## Embed Page

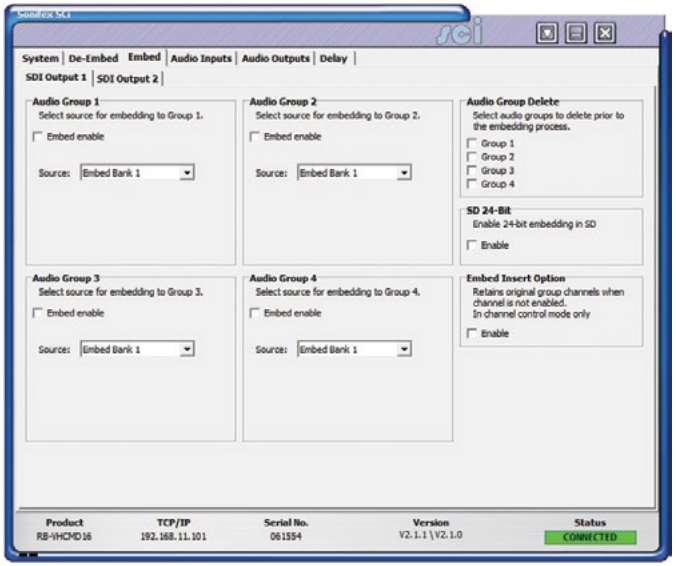


*Fig 7-9: SCi Embed Screen*

The two Embed pages allow you to control embedding for each SDI output.

When in bank control mode, only the top bank selection box is available for each group. This selects the bank to embed to all the channels in that group and then channel assignments are shown in the channel selection boxes.

When in channel control mode, all of the bank and channel selection boxes become available, allowing you to individually select a bank and channel to embed to each group channel.

**Embed Enable**: This control enables embedding for the selected group.
**Bank/Channel**: Selects the Embed bank and/or channel to embed to the group.
**Enable**: Individually enables each channel within the group. Only used in channel control mode.

**Audio Group Delete**
Allows the deletion of audio groups on a per output basis. Simply select the group to enable deletion.

**SD 24-Bit Enable**: This enables 24-bit embedding in SD. This is selectable on a per output basis. Before enabling this option, ensure that any receiving equipment is capable of handling the extended data packets.

**Embed Insert Option**
Enables or disables the Embed Insert option for the selected SDI output. This option is only valid when the unit is operating in Channel control mode.

## Audio Inputs Page

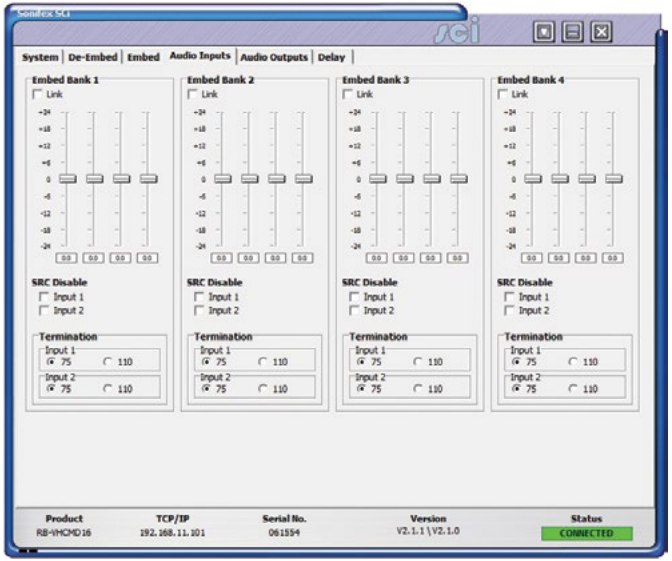


*Fig 7-10: SCi Audio Inputs Screen*

This page allows you to configure the audio inputs for the available Embed banks.

**Gain Slide Bars**: Controls the input gain or attenuation for each input channel. Can be set from -24 dB to +24 dB in 0.5 dB steps. Double clicking the gain value label at the bottom of the slide bar will set the gain to 0 dB.
**Link**: If selected, the gain slide bars are linked together so that changing one will change the others in that bank.
**SRC Disable**: Only available on the RB-VHCMD16, these controls allow you to disable sample rate conversion on each input.
**Termination**: Only available on the the RB-VHCMD16, these controls select the input termination from between 75 and 110Ω.

## Audio Outputs Page

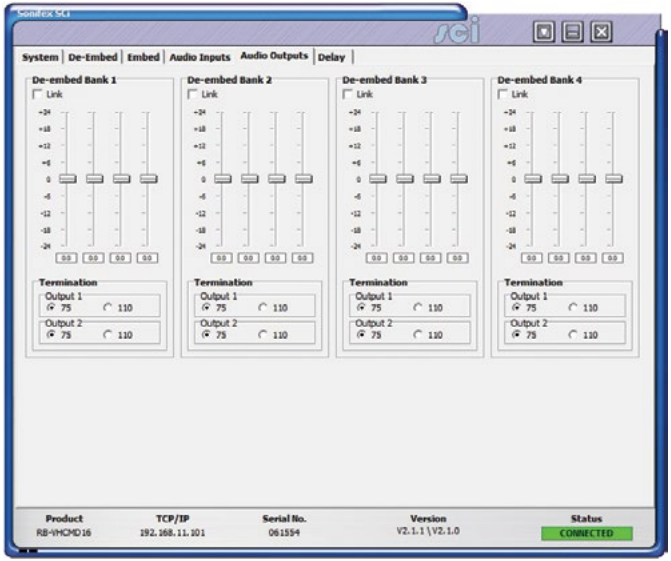


*Fig 7-11: SCi Audio Outputs Screen*

This page allows you to configure the audio outputs for the available De-Embed banks.

**Gain Slide Bars**: Controls the output gain or attenuation for each output channel. Can be set from -24 dB to +24 dB in 0.5 dB steps. Double clicking the gain value label at the bottom of the slide bar will set the gain to 0 dB.
**Link**: If selected, the gain slide bars are linked together so that changing one will change the others in that bank.
**Termination**: Only available on the the RB-VHCMD16, these controls select the output termination from between 75 and 110Ω.

## Delay Page

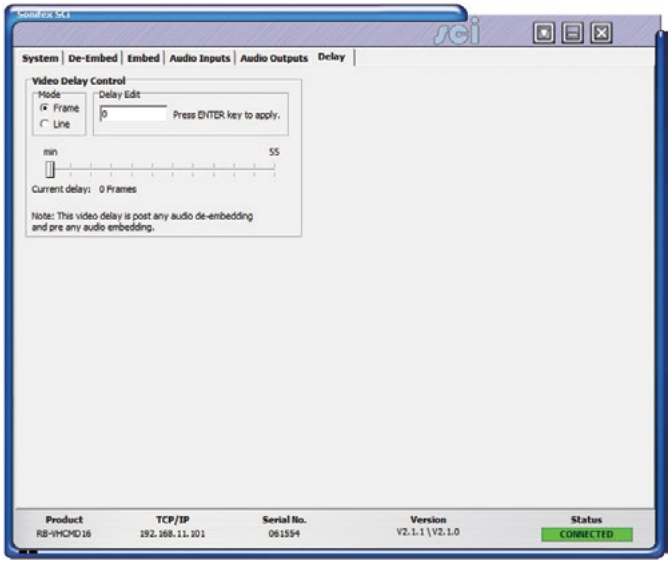


*Fig 7-12: SCi Delay Screen*

This page allows control over the video delay through the unit. This control is only available in the newer units running firmware V2.X.X or greater.

The amount of delay through the unit can be expressed in either lines or frames. The maximum number of which is determined by the current video format being received by the unit. When the input rate changes the maximum delay value is updated.

**Mode**: Selects between Line or Frame delay mode.
**Delay Edit**: This is where the actual delay valued can be entered. This value is represented on the slide bar below, which can also be altered to configure the delay value.
**Current Delay**: This label displays the current delay value active in the unit.

# 8 Glossary

| | |
|---|---|
| AES | Audio Engineering Society. |
| Attenuation | The reduction of a signal level. Attenuation is usually measured in dB. |
| Balanced Audio | A way of sending audio over cable that protects it from induced interference |
| BNC | Bayonet Neill-Concelman connector. |
| Clipping | The onset of severe distortion in the signal path, usually caused by the peak signal voltage being limited. |
| dB (decibel) | A ratio of two voltages or signal levels, expressed by the equation.<br>dB=20LOG(V1/V2).<br>Adding the suffix “u” denotes that the signal is relative to 0.775V RMS. Adding the suffix “v” denotes that the signal is relative to 1V RMS.<br>Adding the suffix “FS” denotes that the signal is relative to the maximum value of a digital signal. |
| DHCP | Dynamic Host Configuration Protocol is a computer networking protocol used to retrieve IP address and other configuration information from a server. |
| EBU | European Broadcast Union |
| FSD | Full Scale Digits - This is the analogue representation of the maximum digital value that the converter in question can see before digital clipping occurs. |
| Gain | The degree of amplification, or attenuation, applied to a signal. |
| IEC | International Elecrotechnical Commission - often used to refer to a mains connectivity standard, i.e. A type of plug/socket similar to that of a kettle, used on most pro-audio equipment. |
| ITU | International Telecommunication Union. |
| kHz | Kilo Hertz (One thousand cycles per second). |
| LAN | Local Area Network - scheme where several computers on the same<br>premises are connected together so that they can exchange data. |
| LED | Light Emitting Diode (small lights e.g. on computers). |
| MHz | Mega-hertz - One million cycles per second. |
| NTSC | National Television System Committee. |
| PAL | Phase Alternating Line. |
| PSU | Power Supply Unit |
| SDI | Serial Digital Interface. A digital video interface standardised by SMPTE. |
| SMPTE | Society of Motion Picture and Television Engineers. |
| SRC | Sample Rate Converter. |
| TCP/IP | Transmission Control Protocol / Internet Protocol. Computer interconnection methodology used on the internet and LANs. |

| | |
|---|---|
| THD | The Total Harmonic Distortion is the percentage presence of signals<br>outside the measured reference frequency. |
| U | A height measurement for rack-mount equipment:<br>1U = 1.75 inches<br>2U = 3.5 inches<br>3U = 5.25 inches<br>4U = 7 inches |
| SD | Standard Definition video. |
| HD | High Definition video |
| 3G | 3Gpbs High Definition video. |

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