CEDAR

DNS1500
dialogue noise suppressor

OWNER'S MANUAL

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Serial number DNS-5-00370 onwards

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INTRODUCTION

In 2000, CEDAR Audio launched the DNS1000 dynamic noise suppressor. This was a stand-alone, desktop-format unit designed specifically for film production, dubbing, outside broadcast (remote) and studio noise suppression. It was ideal for replacing analogue units that had been in use for many years, and for use in situations where rapid setup and processing was required 'on the fly'.

The DNS1500 is a further development of the concepts embodied in its predecessor, offering improved 2-channel performance and increased sample rates of up to 100kHz. It is also fully RoHS compliant.

Quality, speed and simplicity are paramount considerations in the DNS1500 design, and its features include the following:

■ **Near zero latency**

The DNS1500 has a group delay of less than 10 samples (typically less than 1/200th of a frame) so there is no loss of lip-sync when using it.

■ **Flexibility**

The DNS1500 will handle a wide range of noise suppression requirements.

■ **Speed and ease of use**

The DNS1500 offers a carefully designed user-interface that maximises speed of use.

■ **Audio interfaces**

The DNS1500 incorporates a 24-bit digital audio interface conforming to both AES/EBU and SPDIF standards.

■ **Universal power supply**

Its universal power supply means that a DNS1500 will work anywhere in the world.

■ **Powerful processor**

A 40-bit floating point DSP processor capable of delivering up to 1.2GFLOPS ensures that the DNS1500 can handle the most complex processing requirements.

SAFETY INSTRUCTIONS

Read these instructions, and follow them.

■ **Water and moisture**

The DNS1500 must not be exposed to rain or moisture. Furthermore, if it is brought directly from a cold environment into a warm one, moisture may condense inside it. This, in itself, will not cause damage, but may cause electrical shorting. This could damage the unit, and even cause danger to life. Always allow the DNS1500 to reach ambient temperatures naturally before connecting the mains power.

■ **Mounting and ventilation**

You should place the DNS1500 on a flat, stable surface. Do not subject it to strong sunlight, excessive dust, mechanical vibration or periodic shocks. The unit is not susceptible to excessive heat build-up, but should be installed away from heat sources such as radiators and audio devices that produce large amounts of heat.

■ **Power sources**

The DNS1500 features a universal power supply that will work safely on any mains supply in the range 85V to 260V, 50Hz or 60Hz AC only. The unit should always be grounded (earthed), and you should route power cables so that they will not be walked on or pinched.

■ **Connections**

Turn off the power to all equipment before making any connections.

■ **Cleaning**

Clean the DNS1500 only with a dry cloth. Never use abrasive pads or liquid cleaners such as alcohol or benzene.

■ **Damage requiring service**

The DNS1500 contains no user-serviceable parts and should on no account be opened or dismantled by unauthorised personnel.

It should be returned to qualified service agents when it has been exposed to liquids, when it fails to function correctly, when it has been dropped, or when the case is damaged.

SETTING UP THE DNS1500

UNPACKING

Unpack the DNS1500 carefully. Save the carton and all packing materials since you may need them to transport the unit in the future. In addition to this manual, the DNS1500 and its packaging, the box should contain the following:

- mains connection lead
- warranty registration card.

INSTALLATION SITE

To maintain reliability and prolong operating life, observe the following environmental considerations:

- the temperature should be maintained between 5 and 30 Celsius
- relative humidity should be in the range 30% to 80% non-condensing
- strong magnetic fields should not exist nearby.

SETUP MODE

In SETUP mode you can adjust the brightness of the DNS1500 front panel to suit local lighting conditions. You can also recalibrate the front panel faders, but this is necessary only after a firmware upgrade, or after replacement of a damaged fader.

To enter SETUP mode, shut down and switch off the DNS1500, and switch it back on while holding the LOW, MID and HIGH buttons simultaneously.

Adjusting Panel Brightness

- Enter SETUP mode as described above.
- Adjust the overall brightness level with the LEVEL fader.
- Adjust the relative levels of the bright and dim buttons using the first two GAIN faders.
- When you have set the brightness as required, shut down the DNS1500 by pressing and holding the BYPASS button.

Fader Calibration

- Enter SETUP mode as described above.
- Move all the faders to their lowest positions and press the LOW button.
- Move all the faders to their highest positions and press the HIGH button.
- Move the LEVEL fader to -20dB, move the six GAIN faders to 0dB, and then press the MID button.
- Set the panel brightness as required, as described above.
- Store the calibration and panel brightness by pressing and holding BYPASS until the DNS1500 shuts down.

AUDIO CONNECTION

CONNECTIONS

The DNS1500 offers two audio connection standards. It passes its signal to both outputs irrespective of the input used. The standards are:

- Digital SPDIF format
- Digital AES/EBU format

The DNS1500 is not affected by channel status data. It will echo any such data directly to the outputs.

LOCKING AND LOCK INDICATOR

The DNS1500 will by default lock to any AES/EBU signal presented to the rear panel AES/EBU input. If you wish to use the SPDIF input, you must disconnect the AES/EBU input cable, or make sure that no AES/EBU signal is present.(It is not necessary for audio to be passing for the AES/EBU connection to be recognised.)

The unit will lock automatically to any sample rate presented up to 100kHz. If the input signal lies outside the industry tolerances for any of the standard sample rates, the filter table for the nearest standard will be used and scaled accordingly.

If no lock is possible or there is some other form of I/O error, the Bypass button will flash slowly.

INDICATORS AND CONTROLS
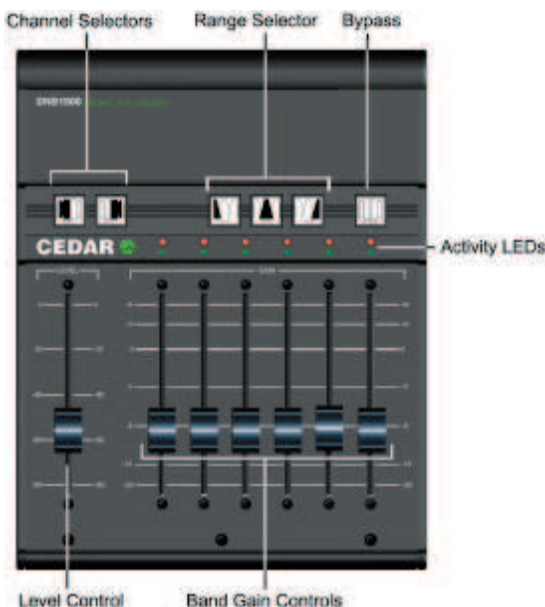
■   Channel Selectors

You can use the DNS1500 to process channel 1, channel 2, or both channels presented to the active input.

■   Range Selector

The Range Selector concentrates the unit's activity into the desired part of the audio spectrum.

■   Level control

The Level control tells the DNS1500 how much noise is present in the input.

■   Band Gain controls

The Band Gain controls determine the maximum amount of processing that the DNS1500 will apply in each band.

■   Activity LEDs

These offer a visual indication of the activity in each of the Bands.

■   Bypass

Allows you to monitor the processed or unprocessed signals. This button is also operates as a "soft" power button; hold it for three seconds to shut down the DNS1500, and press it again to restart.

OPERATING THE DNS1500

Introduction

The DNS1500 divides a signal into a large number of well defined bands. Sophisticated digital filters analyse each of these bands and suppress the noise independently in each. The innovative design of this filter bank allows you to control the DNS1500 using relatively few front panel controls.

Bypass

You can route the input directly to the output by pressing the Bypass button. This allows you to audition the signal before and after processing. The signal latency is not affected by the Bypass state.

Channel Selector

Your first job will be to identify the channel(s) that include(s) the unwanted noise. Press the CHAN 1 button if you wish to process channel 1 only. Press the CHAN 2 button if you wish to process channel 2 only. Press both if you wish to process both channels.

When processing both channels, the DNS1500 uses the same parameter values for each (as determined by the current settings of the front panel controls) but responds to the audio in each channel independent of the audio in the other.

Range Selector

Next, you should identify the frequency range or ranges in which the noise lies. You can press each of the Range Selector buttons individually, or combine them to choose any one of six possible processing ranges:

Low	20Hz	-	400Hz
Mid	200Hz	-	6kHz
High	4kHz	-	18kHz
Low + Mid	20Hz	-	6kHz
Mid + High	200Hz	-	18kHz
Full Range	20Hz	-	18kHz

To select Low + Mid or Mid + High, press the appropriate two buttons simultaneously, or in quick succession while the first is flashing. To select Full Range, press the Low and High buttons simultaneously or in quick succession.

Selecting a range concentrates all of the filters within the DNS1500's filter bank across that part of the audio spectrum.

Level control

Your next job will be to identify the noise level of the audio.

With the appropriate channel(s) and range(s) selected, pull all six Band Gain controls and the Level control down fully. Now increase the Level slowly. At first, you will hear very little happen but, at some point determined by the noise content of the recording, you will hear the noise disappear. You should attempt to find the point at which this occurs.

When you place the Band Gain controls in this position, maximum processing will occur as you increase the Level control, thus making identification of the noise easier.

Band Gain controls

Once you have chosen the range(s) and determined the Level, you control the action of the DNS1500's filter bank using the Band Gain controls.

The six faders represent six frequency bands distributed from lower frequencies (left) to higher frequencies (right) across the selected range.

You will use the Band Gain controls to control the amount of noise attenuation performed in each band, adjusting them to suppress as much noise as possible without introducing unwanted artefacts into the desired signal.

Noise suppression occurs in a given band when the fader is below the 0dB line. However, there are occasions when you might wish to boost the signal in a given band, and you can do this by moving the appropriate fader above the 0dB line.

Activity LEDs

The twelve Activity LEDs offer a visual indication of the activity in each of the six bands controlled by the Band Gain controls.

Both LEDs off:	Less than ±0.5dB activity
Green LED lit:	The signal is being attenuated
Red LED lit:	The signal is being boosted

The brightness of an LED offers an indication of the amount of attenuation or boost being applied.

Note that each band controls numerous filters. Therefore, the Activity LEDs in a given band display the overall activity in that band, and are not necessarily indicative of the action of any single filter at that moment.

CASE STUDIES

The following case studies describe just three of the ways in which you can use the DNS1500. You can apply the DNS1500 equally to recorded signals and to 'live' signals at the point of recording or transmission.

1.   SUPPRESSING TRAFFIC NOISE

The DNS1500 can suppress background noises such as road traffic, aircraft, air conditioning, wind, rain, and many other common soundstage, location, and OB problems that contaminate audio. If your signal exhibits any of these problems, you can suppress them as follows.

First, identify the frequency range(s) in which the noise lies.

You should be able to do this by listening to the problem. However, if this proves difficult, you can use the following method.

It is not important that you find the perfect settings at the first attempt. In particular, you will be able to refine your Level and Band Gain settings once you have found the correct range.

Begin as follows:

> Select the correct channel(s)
> Ensure that the DNS1500 is not in Bypass
> Select Full Range
- Set all six Band Gain controls to -24dB
- Raise the Level control until the noise disappears

At this point you have determined an approximate setting for the Level. This is necessary for determining the range but it is likely that you will refine this later in the procedure.

When the Level is close to the ideal setting, you should see the Activity LEDs flicker in response to the signal content.

Now continue as follows:

- Raise the Band Gain controls to 0dB (no processing occurs)
- Adjust the Band Gain controls to suppress the noise

You should always attempt to suppress the noise with the minimum of damage to the desired signal.

In all likelihood, you will find that the leftmost Band Gain controls are pulled down significantly, whereas the central and rightmost are close to 0dB. This tells you that the problem does not lie in the upper frequencies, so you should use the Range Selector to select Low+Mid. Then repeat the steps marked "▪".

If you now find that you are using all six faders in similar fashion, it is likely that the noise is distributed across the entire Low+Mid range. However, if the suppression is still heavily biased towards the left hand faders, you should now select the Low range alone and repeat the procedure.

If you select Low alone and cannot suppress the noise, it is probable that there is considerable noise energy in the Mid band, so you should return to using Low+Mid ranges.

For many problems such as traffic noise, the noise will lie primarily in the range 50Hz - 1.5kHz. In this case, Low+Mid will be the correct choice.

Second, optimise the Level control.

Listening carefully to the audio, refine the Level setting so that the noise is correctly identified without introducing audible artefacts. If this proves difficult, you can return the Band Gain controls to -24dB for this stage.

The DNS1500 takes a short period to "settle" after moving the Level control (especially in the lower ranges) so you should not adjust it rapidly.

Third, refine the Band Gain controls for optimum suppression.

Set all six Band Gain controls to 0dB. Now increase and decrease the Gain in each band separately while listening to the effect that each has on the noise. This will identify the bands that contain the majority of the noise. (Do not be alarmed if all six bands contain significant noise. This is not unusual.)

Let's assume that the greatest improvement occurs when you reduce the Gain in bands 3 and 4. This suggests that the noise is concentrated in an approximate range of 200Hz to 1kHz. You should now find the optimum positions for all six faders. The greatest cuts will lie in bands 3 and 4, whereas bands 1, 2, 5 and 6 should remain as close to 0dB as possible to ensure that minimal signal damage occurs in the bands that do not contain much noise.

The final configuration may look like this:
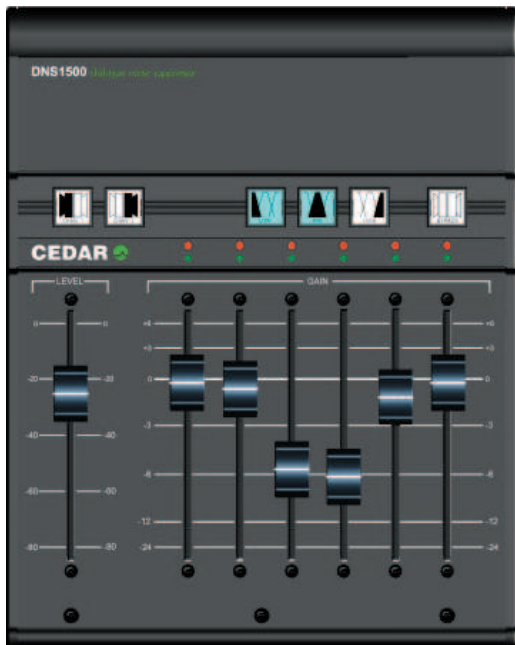
2.   SUPPRESSING TAPE HISS

The DNS1500 can suppress the tape hiss that mars many older recordings. It will also improve the signal/noise ratio of dialogue tapes that have been poorly copied as well as those that are many generations old.

First, identify the frequency range(s) in which the noise lies.

You should follow the procedure laid down in case 1 to determine the range(s) in which the problem lies. For most instances of tape hiss, you will find that the Mid+High ranges are most appropriate. In a few cases you may find that the High range alone is most suitable. It is not as common to require suppression in the Low range because hiss is usually less prominent at lower frequencies, and it may also be masked by the genuine audio in the range.

Second, optimise the Level control.

To determine the correct Level, you should again follow the procedure described in case 1.

Third, refine the Band Gain controls for optimum suppression.

As in case 1, you should start with all six Band Gain controls at 0dB. You should then increase and decrease each control individually to find the bands that contribute most hiss to the signal. Because tape hiss often exhibits a "white" profile at Mid and High frequencies, you may find that satisfactory results are achieved with the Band Gain controls set in a horizontal line.

However, hiss is generally less annoying at very high audio frequencies. Consequently, you may be able to reduce the amount of processing in the uppermost bands. This will help to ensure that any low amplitude signal components lying at high frequencies (which provide much of the "air", "ambience" or "life" in a signal) are passed with little or no attenuation.

The final configuration may look like this:

3.   SUPPRESSING EXCESSIVE REVERBERATION

In many situations, the DNS1500 can suppress excessive reverberation. This can be useful in TV production when you need to match the audio from a large recording studio or soundstage to visual images set in a small room or other enclosed space. Suppressing reverberation can also be beneficial in increasing the intelligibility of poor dialogue recordings.

The method used to suppress reverberation is quite different from that applied in cases 1 and 2, and is as follows:

First, set the range in which the reverberation lies.

In general, reverberant spaces include soft materials that absorb high frequencies more rapidly than middle and lower frequencies. Even bare rooms with hard walls include these materials: they are the actors.

Consequently, you will find that Low+Mid is almost always the most appropriate combination of ranges for suppressing reverberation.

Second, set the Band Gain controls.

You should set all six Band Gain controls to -24dB. This will ensure that (provided the other controls are set correctly) the DNS1500 processes the "tails" of the sound without adversely affecting the desired signal.

Third, optimise the Level control.

Starting at its minimum position (-80dB) increase the Level control slowly. At some point before full noise suppression becomes apparent, you will hear the tails of louder sounds become truncated.

You can adjust the amount of truncation of the reverb using the Level control rather than the Band Gain controls.

The final configuration may look like this:
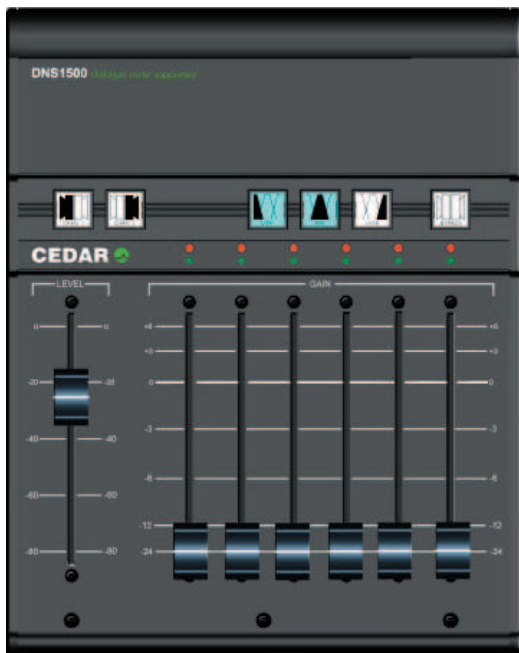
SPECIFICATIONS

General

Power supply: 85–260VAC; 50–60Hz

Power consumption: 20W

Overall dimensions: 70 x 230 x 285 mm

Weight: 2.1kg (net); 3kg (gross)

Audio

I/O type: Digital PCM

Sample rates: 44.1, 48, 88.2, 96kHz

I/O resolution: 24 bits

Varispeed: approx. ±4%

Data formats: SPDIF or AES/EBU

Processor power: 120 Mflops

Latency: <10 samples

Process resolution: 40 bits

EMC REGULATIONS

In order to comply with EMC regulations, you must connect the DNS1500 using metal-shelled connectors and good quality shielded cable suitable for digital audio.

Declaration of conformity

Date of issue   1 October 2007
Equipment   CEDAR DNS1500
Manufacturer   CEDAR Audio Ltd
Address   20 Home End, Fulbourn, Cambridge CB21 5BS, UK

This is to certify that the aforementioned equipment, when used in accordance with the instructions in this manual, fully conforms to the protection requirements of the following EC Council Directives: on the approximation of the laws of the member states relating to:

■   **89/336/EEC Electromagnetic Compatibility**
        Applicable standards: EN 55103-1:1996
                                    EN 55103-2:1996
■   **73/23/EEC Low Voltage Equipment**
        Applicable standard: EN 60065:1998

E&OE.

The Company reserves the right to change specifications without notice.

LICENSE AND LIMITED WARRANTY

1. DEFINITIONS

In this Licence and Limited Warranty the following words and phrases shall bear the following meanings:

'the Company'   is CEDAR Audio Limited of 20 Home End, Fulbourn, Cambridge CB21 5BS, UK;

'the System'   means an instance of the DNS1500 sound-reprocessing system comprising hardware and software held on non-volatile memory ('firmware') developed by the Company;

'this Document'   means this License and Limited Warranty.

2. ISSUE AND USE OF THE SYSTEM

2.1   The terms and conditions of this Document are implicitly accepted by any person or body corporate who shall at any time use or have access to the System, and are effective from the date of supply of the System by CEDAR Audio Limited to its immediate customer.

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Any notices or instruction to be given hereunder shall be delivered or sent by first-class post or telecopier to the other party, and shall be deemed to have been served (if delivered) at the time of delivery or (if sent by post) upon the expiration of seven days after posting or (if sent by telecopier) upon the expiration of twelve hours after transmission.

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The Licensee may at his discretion assign the System and in doing so shall assign this License its rights and obligations to the purchaser who shall without reservation agree to be bound by this License. The original Licensee and any subsequent Licensees shall be bound by the obligations of this License in perpetuity.

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(b)   repair or replacement of those components of the System that do not meet the warranties contained within this Document.

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The Company shall not be liable to the Licensee for any loss arising in connection with any representations, agreements, statements or undertakings made prior to the date of supply of the System to the Licensee.

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14. HEADINGS

The headings to the Clauses are for ease of reference only and shall not affect the interpretation or construction of this Document.

15. LAW

This Document shall be governed by and construed in accordance with English law and all disputes between the parties shall be determined in England in accordance with the Arbitration Act 1950 and 1979.

CEDAR DNS1500

Inspected:	
QC Engineer:	
Serial number:	

Designed and manufactured by

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