



**DNS1000**  
**dynamic noise suppressor**

OWNER'S MANUAL

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# INTRODUCTION

Thank you for purchasing this CEDAR DNS1000 Dynamic Noise Suppressor.

Quality, speed and simplicity are paramount considerations in the DNS1000 design, and its features include the following:

- **Near zero latency**

The DNS1000 has a group delay of less than 10 samples (typically less than 1/200<sup>th</sup> of a frame) so there is no loss of lip-sync caused by its use.

- **Flexibility**

The DNS1000 will handle a wide range of noise suppression requirements.

- **Speed and ease of use**

The DNS1000 offers a carefully designed control surface that maximises operator comfort and speed of use.

- **Audio interfaces**

The DNS1000 incorporates a 24-bit digital audio interface conforming to both AES/EBU and SPDIF standards.

- **Power requirements**

Its universal power supply means that a DNS1000 will work anywhere in the world.

- **Dual processors**

A pair of 40-bit floating point DSP processors deliver 120MFlops so that the DNS1000 will handle the most complex processing requirements.

# SAFETY INSTRUCTIONS

Read these instructions, and follow them.

## ■ **Water and moisture**

The unit must not be exposed to rain or moisture. Furthermore, if the unit 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 DNS1000 to reach ambient temperatures naturally before connecting the mains power.

## ■ **Mounting and ventilation**

You should place the DNS1000 on a flat, stable surface. Do not subject it to strong sunlight, excessive dust, mechanical vibration or periodic shocks. The DNS1000 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 DNS1000 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 unit only with a dry cloth. Never use abrasive pads or liquid cleaners such as alcohol or benzene.

## ■ **Damage requiring service**

The DNS1000 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.

# SETUP

## Unpacking

Unpack the DNS1000 carefully. Save the carton and all packing materials since you may need them to transport the unit in the future. In addition to the DNS1000 and the packaging, the carton should contain the following:

- mains connection lead
- this manual
- a 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.

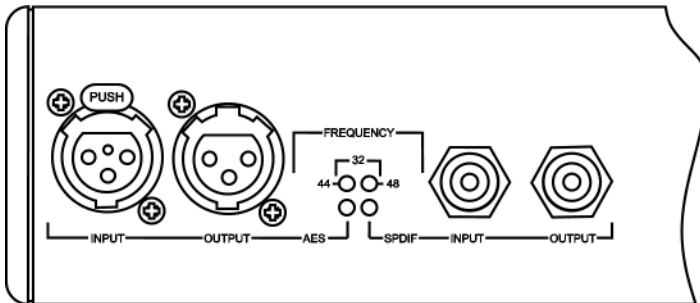
## Brightness control

You can adjust the brightness of the front panel indicators (buttons and Activity LEDs) to suit local lighting conditions:

- with power OFF press and hold Bypass
- continue to hold Bypass and turn the power ON
- adjust the brightness using the Level control
- release Bypass.

This setting is stored in non-volatile memory and will be recalled when you next use the DNS1000

# AUDIO CONNECTIONS AND INDICATORS



## Connections

The DNS1000 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 DNS1000 is not affected by channel status data. It will echo any such data directly to the outputs.

## Indicators

The DNS1000 rear panel offers two pairs of LED indicators. The upper pair display information relating to audio signal sample frequencies. The lower pair show which input is in use.

### ■ Frequency LEDs

If the "44" LED is lit, the input sample rate is 44.1kHz. If the "48" LED is lit, the input sample rate is 48kHz. If both LEDs are lit, the input sample rate is 32kHz.

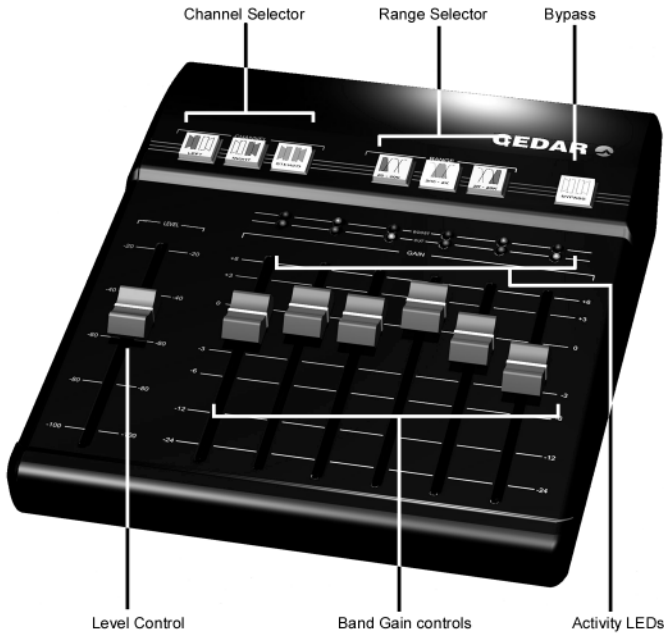
If one or both LEDs are flashing, the DNS1000 is receiving a signal that is close to, but outside the industry tolerances for that sample rate. The unit will operate correctly, but with the filterbank frequencies scaled by a corresponding amount.

### ■ Input LEDs

If the AES LED is lit, the DNS1000 is receiving data through its AES/EBU input. If the SPDIF LED is lit, the unit is receiving data through its SPDIF input. If data is presented to both inputs simultaneously, the input that was first locked to audio will retain priority.

If both LEDs are flashing alternately, the DNS1000 is unable to detect a valid signal and can not lock to either input.

# FRONT-PANEL INDICATORS AND CONTROLS



- **Channel Selector**  
You can use the DNS1000 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 DNS1000 how much noise is present in the input.
- **Band Gain controls**  
The Band Gain controls determine the maximum amount of processing that the DNS1000 will apply in each band.
- **Activity LEDs**  
These offer a visual indication of the activity in each of the Bands.
- **Bypass**  
This control allows you to monitor the processed or unprocessed signals.



# OPERATING THE DNS1000

## Introduction

The DNS1000 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 DNS1000 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 the STEREO button if you wish to process both channels.

*In Stereo mode, the DNS1000 processes both channels equally according to the positions of the front panel controls.*

## 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 to 400Hz	
Mid	200Hz to 6kHz	
High	4kHz to 18kHz	(to 12kHz at 32kHz sample rate)
Low + Mid	20Hz to 6kHz	
Mid + High	200Hz to 18kHz	(to 12kHz at 32kHz sample rate)
Full Range	20Hz to 18kHz	(to 12kHz at 32kHz sample rate)

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 DNS1000'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 DNS1000'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 $\pm 0.5$ dB activity
Green LED dim:	Between 0.5dB and 3dB attenuation
Green LED bright:	Greater than 3dB attenuation
Red LED dim:	Between 0.5dB and 3dB boost
Red LED bright:	Greater than 3dB boost

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 DNS1000. You can apply the DNS1000 equally to recorded signals and to 'live' signals at the point of recording or transmission.

## 1. Suppressing traffic noise and other ambient sound

The DNS1000 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 DNS1000 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.

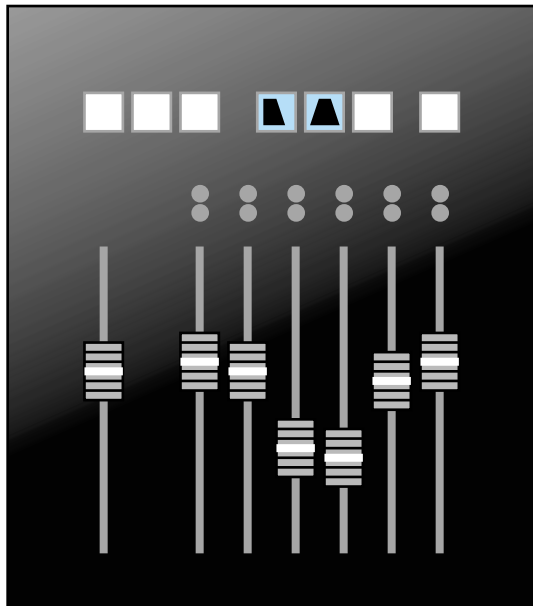
*The DNS1000 takes a short period to “settle” after moving the Level control (especially in the lower ranges) so you should not adjust it rapidly.*

### **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 DNS1000 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.**

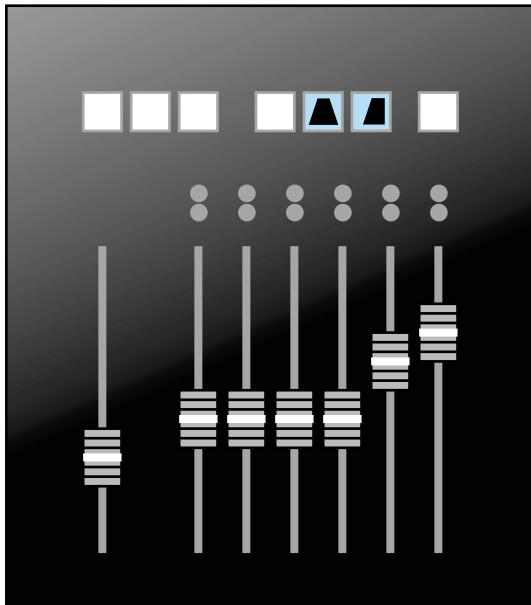
To determine the correct Level, you should again follow the procedure described in case 1.

### **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 DNS1000 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.**

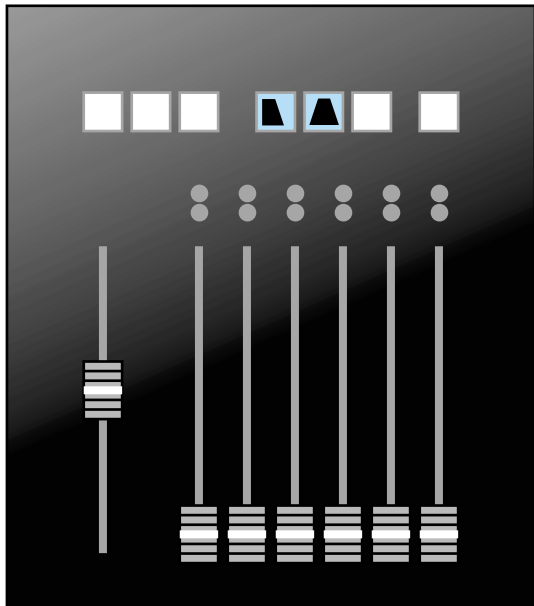
You should set all six Band Gain controls to -24dB. This will ensure that (provided the other controls are set correctly) the DNS1000 processes the “tails” of the sound without adversely affecting the desired signal.

#### **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  
Overall dimensions: 70 x 230 x 285 mm

Power consumption: 20W  
Weight: 2.1kg (net); 3kg (gross)

## Audio

I/O type: Digital PCM  
I/O resolution: 24 bits  
Data formats: SPDIF or AES/EBU  
Latency: <10 samples

Sample rates: 32, 44.1, 48 kHz  
Varispeed: approx.  $\pm 4\%$   
Processor power: 120 Mflops  
Process resolution: 40 bits

# EMC REGULATIONS

In order to comply with EMC regulations, you must connect the DNS1000 using metal-shelled connectors and good quality shielded cable suitable for digital audio.

## Declaration of conformity

Date of issue	1 October 2000
Equipment	CEDAR DNS1000
Manufacturer	CEDAR Audio Ltd
Address	20 Home End, Fulbourn, Cambridge CB1 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.

# LICENCE 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 CB1 5BS, UK;
- 'the System' means an instance of the sound-reprocessing system comprising hardware and software held on EPROM ('firmware') developed by the Company;
- 'this Document' means this Licence 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.
- 2.2 The Company hereby grants to the Licensee and the Licensee agrees to accept a non-exclusive right to use the System.

## 3. PROPERTY AND CONFIDENTIALITY

- 3.1 The System contains confidential information of the Company and all copyright, trade marks, trade names, styles and logos and other intellectual property rights in the System including all documentation and manuals relating thereto are the exclusive property of the Company. The Licensee acknowledges that all such rights are the property of the Company and shall not question or dispute the ownership of any such rights nor use or adopt any trading name or style similar to that of the Company.
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- 3.3 The Licensee shall take all reasonable steps to protect the confidential information and intellectual property rights of the Company.

## 4. LIMITED WARRANTY AND POST-WARRANTY OBLIGATIONS

- 4.1 The Company warrants that the System will perform substantially in accordance with the appropriate section of its accompanying product manual for a period of one year from the date of supply to the Company's immediate customers.
- 4.2 The Company will make good at its own expenses by repair or replacement any defect or failure that develops in the System within one year of supply to the Company's immediate customer.
- 4.3 The Company shall have no liability to remedy any defect, failure, error or malfunction that arises as a result of any improper use, operation or neglect of the System, or any attempt to repair or modify the System by any person other than the Company or a person appointed with the Company's prior written consent.
- 4.4 In the case of any defect or failure in the System occurring more than twelve months after its supply to the Company's immediate customer the Company will at its option and for a reasonable fee make good such defect or failure by repair or replacement (at the option of the Company) subject to the faulty equipment having first been returned to the Company. The Company will use reasonable efforts to return repaired or replacement items promptly, all shipping, handling and insurance costs being for the account of the Licensee.
- 4.5 The above undertakings 4.1 to 4.4 are accepted by the Licensee in lieu of any other legal remedy in respect of any defect or failure occurring during the said period and of any other obligations or warranties expressed or implied including but not limited to the implied warranties of saleability and fitness for a specific purpose.
- 4.6 The Licensee hereby acknowledges and accepts that nothing in this Document shall impose upon the Company any obligation to repair or replace any item after a time when it is no longer produced or offered for supply by the Company or which the Company certifies has been superseded by a later version or has become obsolete.

## 5. FORCE MAJEURE

The Company shall not be liable for any breach of its obligations hereunder resulting from causes beyond its reasonable control including, but not limited to, fires, strikes (of its own or other employees),

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insurrection or riots, embargoes, container shortages, wrecks or delays in transportation, inability to obtain supplies and raw materials, or requirements or regulations of any civil or military authority.

## **6. WAIVER**

The waiver by either party of a breach of the provisions hereof by the other shall not be construed as a waiver of any succeeding breach of the same or other provisions, nor shall any delay or omission on the part of either party to exercise any right that it may have under this Licence operate as a waiver of any breach or default by the other party.

## **7. NOTICES**

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.

## **8. ASSIGNMENT AND SUB-LICENSING**

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

## **9. LIMITATION OF LIABILITY**

The Company's maximum liability under any claim including any claim in respect of infringement of the intellectual property rights of any third party shall be, at the option of the Company either:

- (a) return of a sum calculated as the price received for the System by the Company from its immediate customer depreciated on a straight line basis over a one year write-off period; or
- (b) repair or replacement of those components of the System that do not meet the warranties contained within this Document.

The foregoing states the entire liability of the Company to the Licensee.

## **10. CONSEQUENTIAL LOSS**

Even if the Company has been advised of the possibility of such damages, and notwithstanding anything else contained herein the Company shall under no event be liable to the Licensee or to any other persons for loss of profits or contracts or damage (whether direct or consequential) arising in connection with the System or any modification, variation or enhancement thereof and including any documentation or data provided by the Company or for any other indirect or consequential loss.

## **11. ENTIRE AGREEMENT**

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.

## **12. TERMINATION**

This Licence may be terminated forthwith by the Company if the Licensee commits any material breach of any terms of this Licence. Forthwith upon such termination the Company shall have immediate right of access to the System for the purpose of removing it.

## **13. SEVERABILITY**

Notwithstanding that the whole or any part of any provision of this Document may prove to be illegal or unenforceable the other provisions of this Document and the remainder of the provision in question shall remain in full force and effect.

## **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 which cannot be resolved by negotiation shall be determined by arbitration in England in accordance with the Arbitration Act 1950 and 1979.

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# CEDAR DNS1000

Serial number:	
Inspected:	
QC Engineer:	

**Designed and manufactured by**

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Cambridge CB1 5BS  
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