SoundField DSF-3
Digital Surround Processor

User Guide

Version 1.0

CONTENTS:

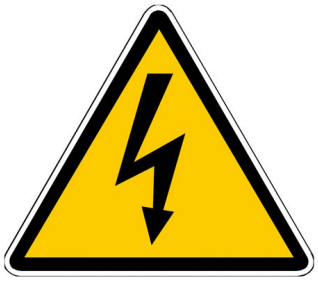
SAFETY INFORMATION

- This equipment must be EARTHED.
- Only suitably trained personnel should service this equipment.
- Please read and take note of all warning and informative labels.
- Before starting any servicing operation, this equipment must be isolated from the AC supply (mains) by removing the incoming IEC mains connector.
- Fuses should only be replaced with ones of the same type and rating as that indicated.
- Operate only in a clean, dry and pollutant-free environment.
- Do not operate in an explosive atmosphere.
- Do not allow any liquid or solid objects to enter the equipment. Should this accidentally occur then immediately switch off the unit and contact your service agent.
- Do not allow ventilation slots to be blocked.

Cleaning

For cleaning the front panels of the equipment we recommend anti-static screen cleaner sprayed onto a soft cloth to dampen it only.

Explanation of Warning Symbols



The lightening flash with arrow head symbol within an equilateral triangle is intended to alert the user to the presence of dangerous voltages and energy levels within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock or injury.

The exclamation mark within an equilateral triangle is intended to prompt the user to refer to important operating or maintenance (servicing) instructions in the documentation supplied with the product.

INTRODUCTION

The DSF-3: What Is It?

The SoundField DSF-3 is a fully digital B-Format to 5.1 decoder and when used in conjunction with the SoundField DSF-2 microphone system provides a complete, accurate, and easy to use surround sound microphone system.

The DSF-3 utilises the SoundField B-Format signals generated by the DSF-2 microphone system to simultaneously deliver phase accurate digital 5.1 surround sound and stereo. Unlike other surround-sound microphone systems, the conversion between surround, stereo and mono formats incurs no phase error because the DSF-3 utilises the four B-Format component signals from the DSF-2 microphone - which are referenced to a single point in space - to generate a five cardioid array - three facing forward (L, C, R) and two facing the rear (SL, SR). The resulting soundfield can be adjusted and customised at any stage in a project, either live during the performance or after in post production if the four B-Format signals have been recorded. Five of the DSF-3's main output channels provide an extremely high quality, full bandwidth audio signal. A sixth output, incorporating a low-pass filter crossover point of 120Hz, provides the sub-bass (LFE) channel for a subwoofer. Each of the six outputs may be independently adjusted in level and are individually metered. An additional stereo output section is provided with independent polar pattern and width controls. A switchable M/S mode can be engaged to convert the Left/Right outputs to Mid and Side.

History of The SoundField Microphone System

In 1933, British scientist Alan Blumlein was issued a patent that stands today as a landmark in the development of stereophonic recording and reproduction. Among its numerous declarations, it defined the basis for all coincident microphone techniques, including the Mid/Side and crossed bidirectional configurations. (The latter, in fact, is commonly referred to as a "Blumlein Stereo" pair.)

In the 1970s, British mathematicians Michael Gerzon, Peter Craven and colleagues expanded upon the stereo concepts pioneered by Blumlein to develop the concept of a microphone system that could reproduce a full three-dimensional soundfield. Both Blumlein and Gerzon realised that only when a soundwave is captured at a single point in space can it be reproduced faithfully and without the phase distortion anomalies inherent in spaced microphone techniques.

Early SoundField prototype models were developed using Gerzon's theory in conjunction with the National Research Development Corporation of Great Britain and Calrec Audio. Chief Designer at Calrec, Ken Farrar, and colleagues played a leading role in turning Gerzon's theory into a real product and his work was later recognised by his appointment as a Fellow of the Institution of Electrical Engineers (F.I.E.E.). In 1993, the company SoundField Ltd. was formed specifically to manufacture and further develop the range of products and their application in both stereo and multi-channel audio environments. SoundField Ltd. is the owner of all trademarks, patent and intellectual property rights relating to SoundField Technology.

Today, the new SoundField digital systems enjoy a reputation as the preferred method to capture 5.1 surround at large scale events to be broadcast in High Definition. These microphones employ a unique array of closely spaced capsules to capture the complete three-dimensional soundfield at

a single point in space. This single point source pickup principle avoids all of the time - or phase-related anomalies generated by spaced microphone arrays and spaced capsule ‘dummy heads’. Thus, surround recordings made with SoundField microphones can be collapsed to stereo - or stereo recordings to mono - without the phase problems that result in “comb-filtering” (phase cancellation) distortions. Furthermore, a single point source system is the only one that allows a truly phase coherent sub-channel to be derived. Spaced microphone arrays and spaced capsule ‘dummy heads’ are unable to be folded down to stereo and mono without introducing significant phase errors unless some of the microphone signals are discarded, which consequently results in loss of essential audio information.

HOW DOES IT WORK?

SoundField B-Format:

The SoundField Four Capsule Array

The capsules are placed tightly together to eliminate the phase problems associated with 'spaced' multi-microphone set-ups.

From a single point source sound is received from all directions, reproducing a realistic listening experience.

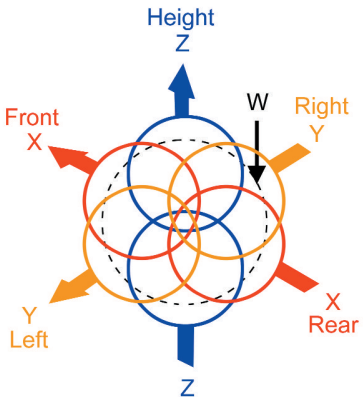
The four outputs from the capsules of SoundField microphones (called SoundField A-Format) are converted by the DSF-2 processor into four components known as SoundField B-Format. These convey all of the information of the entire soundfield, and are the three directional vectors - front/rear, left/right, up/down - and absolute pressure.

The signals from the four capsules are fed to the microphone's control unit where it is converted into four channels of SoundField B-Format, entitled W, X, Y and Z.

Mono, Stereo, Mid-Side, 5.1 and all future surround formats can be derived from this information.

DSF-2 Digital B-Format Outputs (BNC)

W X Y Z



B-Format Illustration

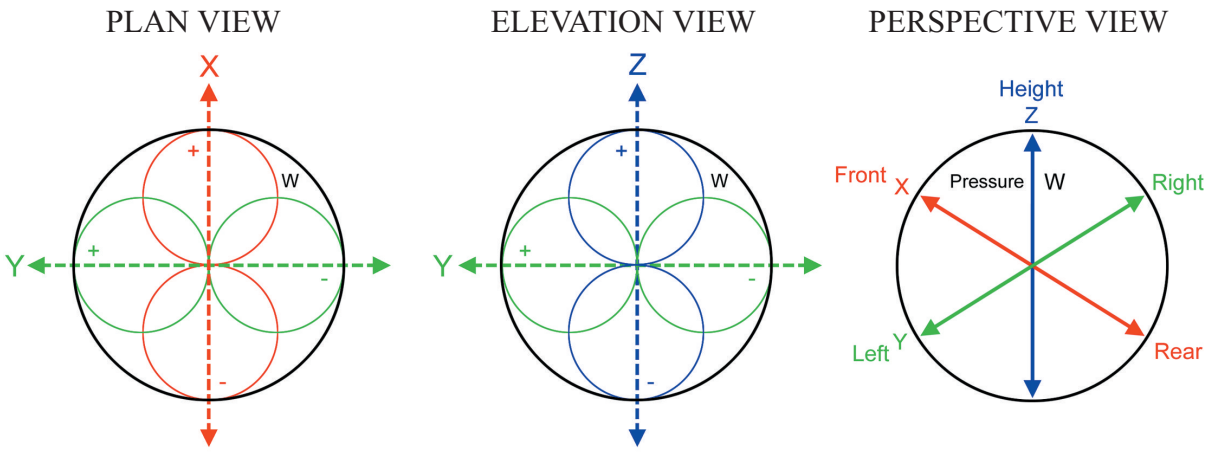
B-Format is three dimensional acoustical information and consists of three figure of eight polar patterns called X, Y and Z plus one omni called W.

X gives Front to Rear depth information, Y gives Left to Right horizontal information and Z gives vertical height information. From the omni W sub-bass (LFE) is extracted.

SoundField are the only microphones in the world that generate B-Format.

The four channels of the B-Format signal are represented by three bidirectional and one omnidirectional pickups, all centred at a single point in space, and are labelled W (pressure), X (front/rear), Y (left/right), and Z (up/down). These signals contain all of the information required to describe a soundwave and are the essential elements needed to create any conventional mono, stereo, or surround format where the microphone positions and polar patterns can be fully variable. By recording the four B-Format outputs from a DSF-2 these components can be preserved for subsequent production and processing of current and all future surround formats.

THE FOUR PRIME COMPONENTS GENERATED BY SOUNDFIELD MICROPHONES



X: HORIZONTAL VECTOR: FRONT/REAR PRESSURE-GRADIENT COMPONENT

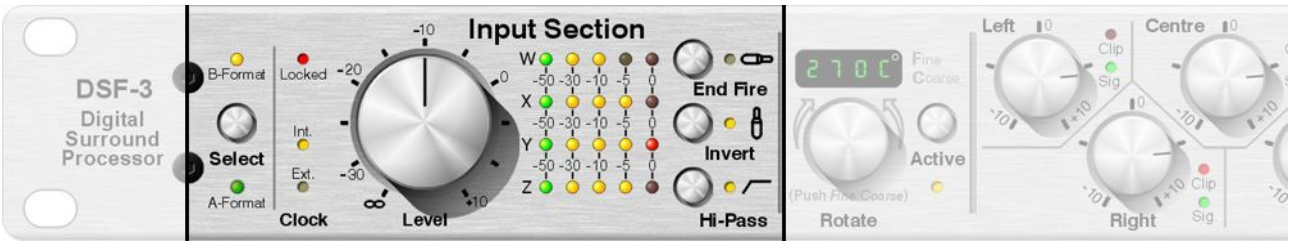
Y: HORIZONTAL VECTOR: LEFT/RIGHT PRESSURE-GRADIENT COMPONENT

Z: VERTICAL VECTOR: HEIGHT PRESSURE-GRADIENT COMPONENT

W: PRESSURE (OMNIDIRECTIONAL) COMPONENT

CONTROLS

Input Section



B-Format / A-Format Input Select

The DSF-3 Surround Processor supports both B-Format inputs (as generated by the SoundField DSF-2 microphone system) and A-Format inputs (as generated by the SoundField SPS200 microphone). The relevant input mode can be selected using the A-Format/B-Format input select button.

NOTE: As this is a control used only for initial setup purposes the select button has a built-in time lag feature to avoid accidental pushes. To switch input status keep the select button depressed for 5 seconds until the status LED changes.

Word Clock INT/EXT

The DSF-3 can be either internally or externally clocked. The on-board sample rate converters will synchronise the incoming AES-3 streams to either the internal clock or an external word clock when available. The external wordclock input accepts a 48kHz clock signal only.

Without a valid external wordclock present the unit will be clocked internally, in this case the amber INT LED will be illuminated. When a valid 48kHz external clock is present this will be automatically detected and the unit will switch over to the external clock, illuminating the amber EXT LED.

Locked Status LED

The Locked LED shows the status of the two digital AES-3 inputs. When both inputs are locked and functioning correctly - the LED is green, when one of the two inputs is unlocked the the LED will blink, when neither input is locked the LED will not be illuminated. The digital inputs will accept and lock to any incoming sample rate in the range of 32kHz to 192kHz.

Gain

This control adjusts the input level of all four A-Format or B-Format channels simultaneously and is variable from full attenuation to a gain of +10dB. Normally this control should be used at or close to its 0dB position. Four 5-segment bargraph level meters are provided to monitor the levels of the A-Format or B-Format signals.

End Fire

The END FIRE mode maintains the correct three-dimensional perspective in both surround and stereo when the mic is used in the horizontal position pointing at the sound source ‘like a flash-light’. Not selecting this mode when the microphone is horizontally pointed will result in the Up/Down height information and the Front/Back depth information being reversed.

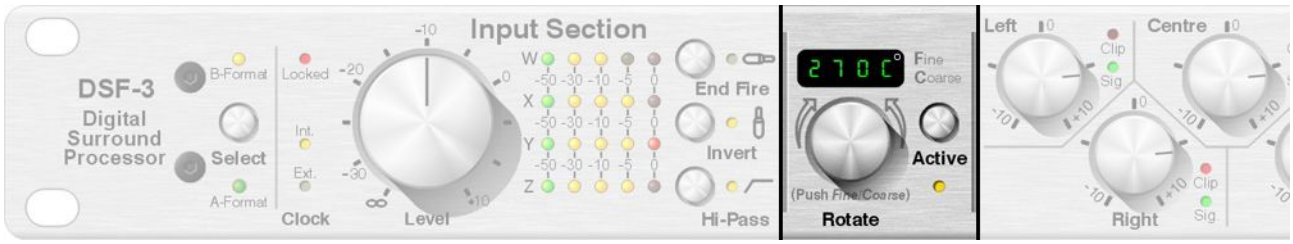
Invert

The INVERT mode maintains the correct three-dimensional perspective in both surround and stereo when the microphone is suspended upside down above the sound source. Not selecting this mode with the mic suspended will result in the Left/Right width information and Up/Down height information being inverted

Hi-Pass

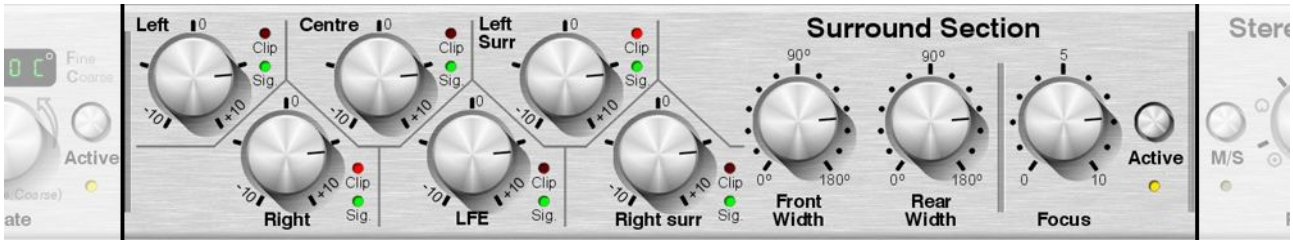
A switchable 80Hz high pass filter is available to attenuate unwanted low frequency rumble or wind noise.

Rotate



Rotates the microphone’s pick up through a full horizontal 360º and redefines the front centre of the stereo and surround image. A four character display shows the degree of rotation and a ‘Course’ or ‘Fine’ mode may be selected by pushing the Rotate control. In the Course mode rotation is in 10º steps and in Fine mode the rotation is in 1º steps for more precise pin-pointing of sound sources. The ‘Active’ button switches the Rotate control in or out of the signal path. An amber status LED is permanently illuminated when Rotate is activated.

5.1 Surround Output Section



Independent trim controls are provided for each of the 5.1 output channels and are fully variable from -10dB to +10dB. A separate green ‘signal present’ and red Clip LED are also included on each channel.

Front Width

A fully variable Front Width control adjusts the angle of the front soundstage (L, R). Normal operation for this control is at the 90º position with the ability to narrow or widen the front angle depending on application.

Rear Width

A fully variable Rear Width control adjusts the angle of the rear soundstage (SL, SR). Normal operation for this control is at the 90º position with the ability to narrow or widen the rear angle depending on application.

Focus

The Focus control is used to vary the patterns of Surround Left and Surround Right from cardioid through to figure of eight. This degree of control can be very useful for adding additional spatial information to the rear surround channels, especially in ambient or free-field environments. A status LED indicates when active.

Stereo Output Section

M/S

When the Mid/Side button is enabled the stereo outputs will be M/S encoded. The Left output channel provides the Mid signal and the Right output channel provides the Side signal.

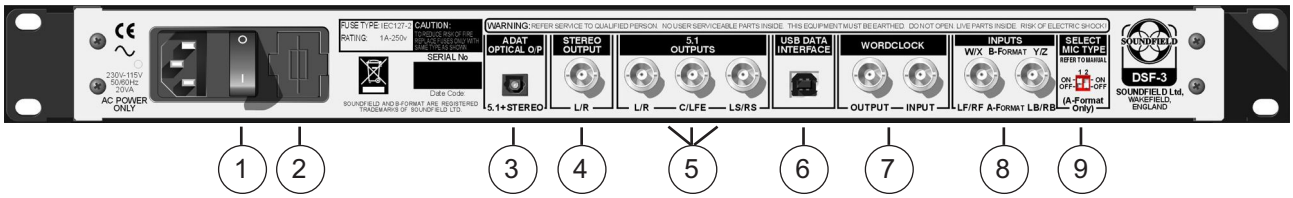
Pattern

The Polar Pattern control only affects the stereo output and is continuously variable ranging from Omni through Sub-Cardioid, Cardioid, Hyper-Cardioid to Figure-of-eight. This control dictates the pattern for both mono and stereo usage depending on whether the Width control is utilised.

Width

This control varies the stereo image from 0º (mono) through 90º (standard stereo coincident pair) to an extra wide stereo 180º.

REAR PANEL



1. MAINS POWER - ON/OFF mains power switch / IEC mains power inlet

2. FUSE HOLDER - Fuse type IEC127-2 (1A - 250V anti-surge)

3. ADAT OPTICAL DIGITAL OUTPUT - 5.1 (L, R, C, LFE, LS, RS) and Stereo

4. DIGITAL STEREO OUTPUT - 75Ω Coax (AES3id) - BNC connector

5. DIGITAL 5.1 SURROUND OUTPUTS - 75Ω Coax (AES3id) - BNC connectors

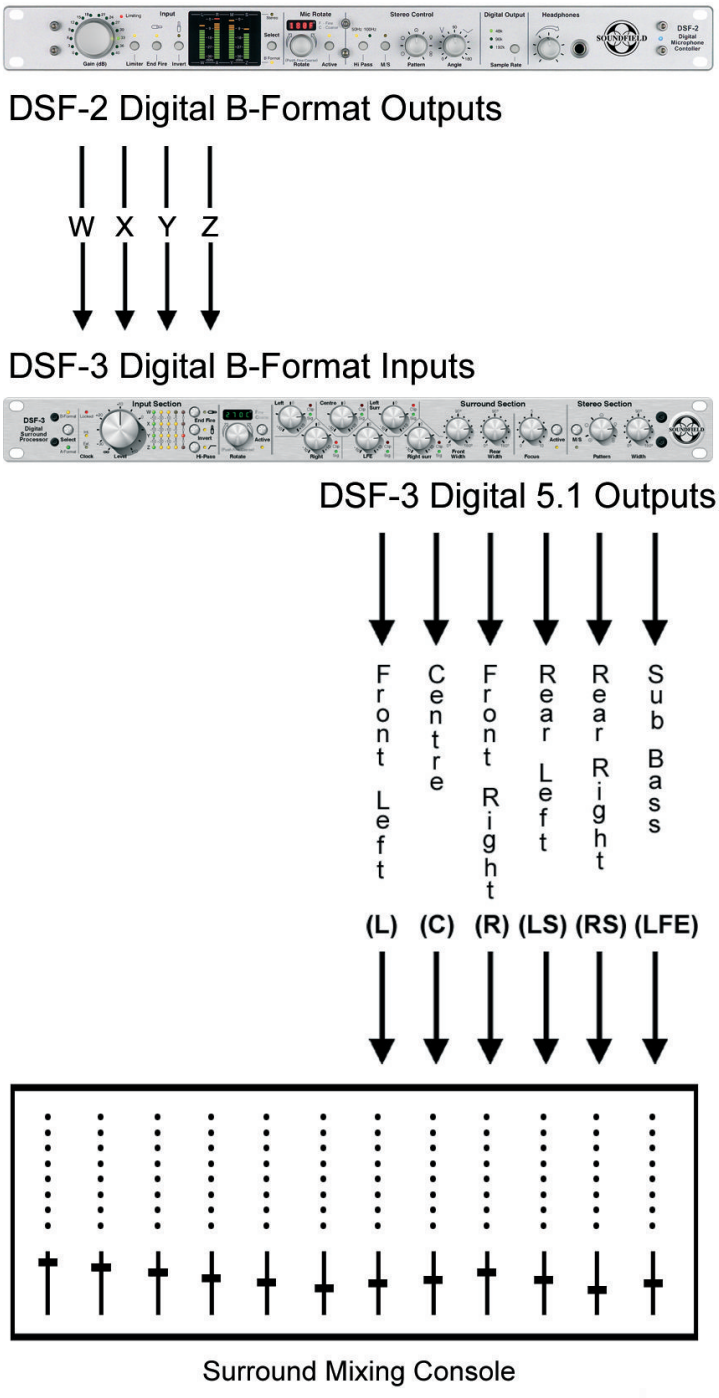
6. USB INTERFACE - A USB interface is provided for future software upgrades

7. WORD CLOCK INPUT/OUTPUT - BNC 75Ω, 48kHz only

8. DIGITAL A-FORMAT/B-FORMAT INPUTS - 75Ω Coax (AES3id) - BNC connector

9. MIC TYPE DIP SWITCH (ONLY APPLICABLE TO A-FORMAT INPUTS)
These DIP switches are provided to accommodate future models of SoundField A-Format microphones. Refer to the SoundField website (www.soundfield.com) for new product announcements.

INTERFACING THE DSF-3 WITH THE DSF-2 DIGITAL BROADCAST MICROPHONE SYSTEM FOR LIVE SURROUND BROADCAST



In this configuration the DSF-2/DSF-3 combination will deliver six discrete channels of digital 5.1 surround for High Definition broadcast. The DSF-3 can also output simultaneous digital stereo for Standard Definition and radio.

AUDIO SPECIFICATION

Digital Inputs	75Ω Coax (AES3id)
Supported Input Sample Rates	32kHz - 192kHz
Supported Input Bit Rates	16 & 24 bit
Sample Rate Converter	AD1896 (128dB SNR)
Digital Outputs	75Ω Coax (AES3id)
Output Sample Rate	48kHz
Output Bit Rate	24 bit
Bandwidth	20Hz - 24kHz
THD+N (-1dBfs, 1kHz)	<0.00005% on <-130dB

MAINS REQUIREMENTS

AC Input	100V - 240V AC 50/60Hz
Power Consumption	<20W
Fuse Rating	IEC127-2 (1A - 250V anti-surge)
Case Size	482mm (w) x 44mm (h) x 295mm (d)
Weight	2.5 KGS

WARRANTY

Limited Liability

SOUNDFIELD LTD., HEREIN AFTER KNOWN AS THE MANUFACTURER, GUARANTEES THIS EQUIPMENT FROM DEFECTS IN MATERIAL AND WORKMANSHIP UNDER NORMAL USE AND SERVICE FOR A PERIOD OF ONE YEAR. THIS GUARANTEE EXTENDS TO THE ORIGINAL PURCHASER ONLY AND DOES NOT APPLY TO FUSES OR ANY PRODUCT OR PARTS SUBJECTED TO MISUSE, NEGLECT, ACCIDENT OR ABNORMAL CONDITIONS OF OPERATION. THE GUARANTEE BEGINS ON THE DATE OF DELIVERY TO THE ACTUAL PURCHASER OR TO HIS AUTHORISED AGENT OR CARRIER. IN THE EVENT OF FAILURE OF A PRODUCT COVERED BY THIS GUARANTEE, THE MANUFACTURER OR THEIR CERTIFIED REPRESENTATIVES WILL REPAIR AND CALIBRATE EQUIPMENT RETURNED PREPAID TO AN AUTHORISED SERVICE FACILITY WITHIN ONE YEAR OF THE ORIGINAL PURCHASE AND PROVIDED THAT THE GUARANTORS EXAMINATION DISCLOSES TO ITS SATISFACTION THAT THE PRODUCT WAS DEFECTIVE, EQUIPMENT UNDER THIS GUARANTEE WILL BE REPAIRED OR REPLACED WITHOUT CHARGE. ANY FAULT THAT HAS BEEN CAUSED BY MISUSE, NEGLECT, ACCIDENT, ACT OF GOD, WAR OR CIVIL INSURRECTION; ALTERATION OR REPAIR BY UNAUTHORISED PERSONAL; OPERATION FROM AN INCORRECT POWER SOURCE OR ABNORMAL CONDITIONS OF OPERATION, WILL NOT FALL UNDER THIS GUARANTEE. HOWEVER, AN ESTIMATE OF THE COST OF THE REPAIR WORK WILL BE SUBMITTED BEFORE WORK IS STARTED. THE MANUFACTURER SHALL NOT BE RESPONSIBLE FOR ANY LOSS OR DAMAGE, DIRECT OR CONSEQUENTIAL, RESULTING FROM MACHINE FAILURE OR THE INABILITY OF THE PRODUCT TO PERFORM. THE MANUFACTURER SHALL NOT BE RESPONSIBLE FOR ANY DAMAGE OR LOSS DURING SHIPMENT TO AND FROM THE FACTORY OR ITS DESIGNATED SERVICE FACILITY. THIS GUARANTEE IS IN LIEU OF ALL OTHER GUARANTEES, EXPRESSED OR IMPLIED, AND OF ANY OTHER LIABILITIES ON THE MANUFACTURERS PART. THE MANUFACTURER DOES NOT AUTHORISE ANYONE TO MAKE ANY GUARANTEE OR ASSUME ANY LIABILITY NOT STRICTLY IN ACCORDANCE WITH THE ABOVE. THE MANUFACTURER RESERVES THE RIGHT TO MAKE CHANGES OR IMPROVEMENT IN THE DESIGN AND CONSTRUCTION OF THIS UNIT WITHOUT OBLIGATION TO MAKE SUCH CHANGES OR IMPROVEMENTS IN THE PURCHASER’S UNIT. ANY DISPUTE ARISING FROM THIS WARRANTY SHALL BE SUBJECT TO THE LAWS OF ENGLAND.

What to do if a fault is found

If a fault develops in the unit, notify SoundField Ltd. or their nearest service facility giving full details of the difficulty. On receipt of this information, service or shipping instructions will be forwarded to you. No equipment should be returned under the warranty without prior consent from SoundField Ltd. or their authorised representative.

SHIPPING AND QUALITY ASSURANCE

Authorised returns should be prepaid and must be insured. All SoundField products are packaged in specially designed containers for the best possible protection. If the unit is returned the original container should be used. If this is not possible, a new container can be obtained from SoundField Ltd.; please specify the model number when requesting a new container. If the specially designed container is not used ensure that a suitable rigid container of adequate size is used, wrap the instrument in paper and surround it with a good thickness of shock absorbing material.

Claim for damage during transit

The instrument should be thoroughly inspected immediately upon delivery to the purchaser. If the instrument is damaged in any way a claim should be filed with the carrier immediately. A quotation to repair shipment damage can be obtained from SoundField Ltd or their certified representative. Final claims and negotiations with the carrier must be completed by the customer.

Applications problems

SoundField Ltd. will be happy to answer any applications questions to enhance your use of this equipment. Please address all correspondence to:

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email: info@soundfield.com
www.soundfield.com

Quality Assurance and Service Policy

Over the years SoundField products have gained an enviable reputation for their quality of design, performance and reliability, however, in the unlikely event that problems are encountered with this unit, please contact SoundField Service at the appropriate address above or alternatively inform one of our world wide network of distributors who will be able to assist with any of your queries.