SOUNDFIELD

ST450 MKII Portable
Microphone System

User Guide
Version 1.0

System comprises:

• ST450 Microphone • ST450 MKII Control Unit
• HW3010 Shockmount • 5 Metre 12 pin Lemo Mic Cable (Mic to Controller)
• B-Format & Stereo Output Cables • External DC Power Supply

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.

<u>CONTENTS</u>

SOUNDFIELD HISTORY

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 Ken Farrar's contribution 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 patent and intellectual property rights relating to SoundField Technology.

Today, the SoundField range enjoys a reputation as the ultimate microphones for recording both stereo and the new developing multi-channel surround formats. These unique microphones employ a patented tetrahedral array of closely spaced subcardioid capsules to capture the complete three-dimensional soundfield at a single point in space. This single point source pick-up principle avoids all of the time - or phase-related anomalies generated by spaced microphone arrays. 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 are unable to be reduced without introducing significant phase errors unless some of the microphone signals are discarded, which consequently results in loss of essential audio information.

INTRODUCTION

The ST450 MKII Portable Microphone System has been specifically developed for location recording and in the design process both the microphone and control unit have been considerably 'downsized' in comparison to all other previously available SoundField models. The ST450 simultaneously provides both surround and stereo soundscapes and its big advantage over alternative methods is that the multi-channel audio it generates from a 'single point' source is completely phase coherent. This enables the recordist to collapse the surround to stereo or mono without loss of information, frequency imbalance or any of the other phase problems associated with spaced microphones or multi capsule 'dummy head' arrangements.

The ST450 can be powered by either battery or mains power and the microphone can be used at close quarters on a hand held boom or alternatively situated up to 200 metres from the control unit on the relevant SoundField mic extension cables (see accessories on pages 25-26). The ability to adjust all microphone parameters remotely from such a long distance is invaluable in situations where the microphone is placed in an area which is difficult to access.

The ST450 is connected to the control unit by a single lightweight multiway cable which delivers the four individual capsule signals to the control unit and carries the necessary power back to the microphone. A small heating element is located in the microphone head to keep the capsules condensation-free under normal operating conditions. The ST450 control unit outputs stereo Left/Right, M/S and four channels of SoundField B-Format called W, X, Y and Z which is the surround information. All outputs are at balanced line level.

The ST450 is designed to function as either a variable pattern single (mono) microphone, a variable pattern, variable width, coincident stereo microphone array or to generate full surround from the four B-Format outputs which will then be decoded into 5.1 by the Surround Zone post-production software, DSF-3 Digital Surround Processor or analogue SP451 Surround Processor. This is achieved using four sub-cardioid capsules set in a regular tetrahedron, and by adding or subtracting the outputs from these four capsules in different proportions, it is possible to derive all possible polar patterns from omni, through cardioids to figure-of-eights.

For surround sound recording the recordist should use the four B-Format output signals. These contain the three dimensional information (Height, Width, Depth) required for all current and future surround sound formats. The B-Format signals can be de-coded into surround by the Surround Zone post-production software, which outputs discrete surround. The Surround Zone software also provides full surround and stereo re-mixing enabling adjustment of Polar Patterns, End-Fire or Side Address pick-up, Width, Rotate, Tilt, Zoom and all other microphone parameters. The B-Format signals can also be decoded into surround with the hardware digital DSF-3 1U processor and the analogue SP451 1U processor.

Please note: To maintain a high quality audio performance the ST450 microphone employs studio grade condensor capsules - in environments of high moisture and humidity (or other extreme weather conditions) their performance may be temporarily affected.

HOW DOES IT WORK?

SoundField B-Format

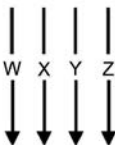**The SoundField Four Capsule Array**

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 ST450 processor into four components known as SoundField B-Format. These convey all of the information of the entire sound field, and are the three directional vectors - Left/Right, Front/Rear and Up/Down - and absolute pressure.
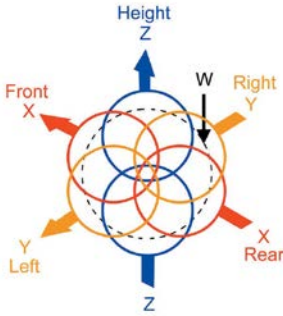
The signals from the four capsules are fed to the ST450 processor where it is converted into four channels of SoundField B-Format, known as W, X, Y and Z.

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

ST450 B-Format Outputs

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 pickup, 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 the ST450 controller 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

PLAN VIEW   ELEVATION VIEW   PERSPECTIVE VIEW
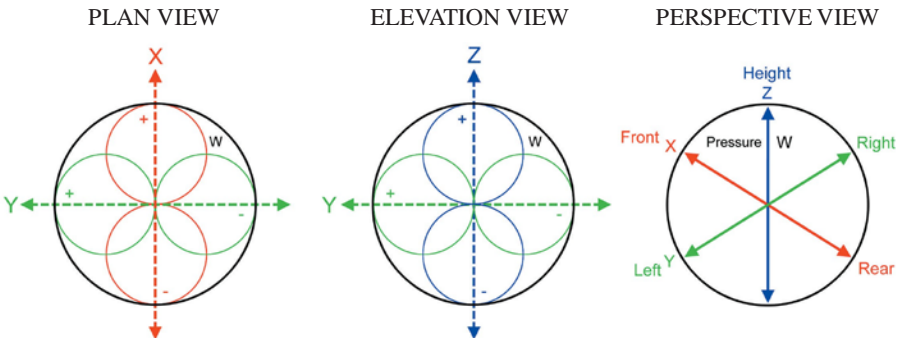
X: HORIZONTAL VECTOR: FRONT/REAR PRESSURE-GRADIENT COMPONENT

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

Z: VERTICAL VECTOR: HEIGHT PRESSURE-GRADIENT COMPONENT

W: PRESSURE (OMNIDIRECTIONAL) COMPONENT

CONTROLS

1. LED Bargraph

8 segment LED bargraph meter displays the mic level over a range of -30dB to +12dB and has a peak hold function.

2. Gain

A switched gain control adds further gain to the microphone in 3dB steps. There are 14 steps with a total of 42dB available. A switch has been selected in preference to a potentiometer to provide excellent level matching of the four capsule signals.

3. End Fire

The End Fire mode should be selected when the microphone is horizontally pointed at the sound source (▆▆ ▦ ◄──── sound source) as you would with a flashlight. Selecting End Fire maintains the correct three-dimensional perspective in both surround and stereo when the mic is used in the horizontal position.

If you do not select this mode when the microphone is horizontal it will result in the Front/Back depth and Up/Down height information being reversed. When making B-Format recordings for later surround or stereo post production with the Surround Zone software or hardware digital DSF-3/analogue SP451 processors, it is important to document the status of the End Fire switch. This mode is particularly necessary when the microphone is mounted in a Rycote or on a fishpole and pointed directly at the sound source.

4. 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 reversed. It is important to document the status of the Invert switch when making B-Format recordings for later post production.

5. Hi-Pass

100Hz hi-pass filter is available to attenuate unwanted low frequency rumble or wind noise. PLEASE NOTE: THE HI-PASS FILTER IS ACTIVE ACROSS BOTH THE STEREO AND B-FORMAT OUTPUTS.

6. Pattern

The Polar Pattern control is continuously variable ranging from Omni through Sub-Cardioid, Cardioid, Hyper-Cardioid to Figure-of-eight and sets the polar patterns used for the stereo pair.

7. Mid Side

When the Mid/Side switch is engaged 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.

8. Width

Offers continuous adjustment of the stereo width from mono ('0') through to wide angle stereo ('10').

9. Headphone Monitoring

Front panel headphone monitoring is provided with a continuously variable volume control. The headphone section monitors the Left/Right stereo output. Connection is via a stereo 1/4 inch jack socket (TRS) and is for use with headphones having an impedance of 100 ohms or greater.

SIDE PANEL INPUT/OUTPUT CONNECTORS
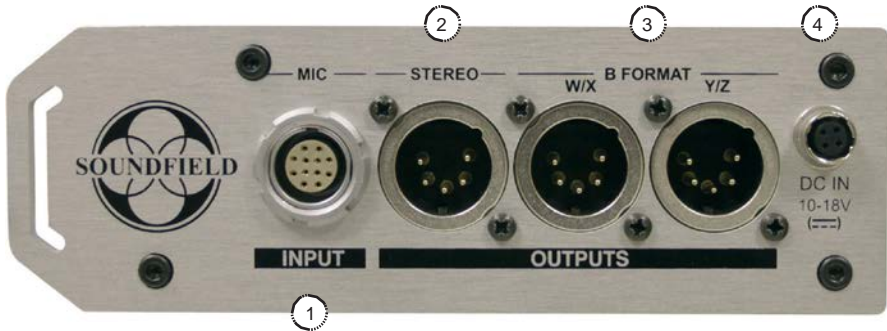
1. MIC INPUT

Lemo 12 pin female panel mount connector.

2. STEREO OUTPUT

Left/Right stereo analogue balanced line outputs on a single 5-pin XLR connector. (Pin 1 = ground, Pin 2 = + (positive) and Pin3 = - (negative). A 5-pin to 2 x 3-pin XLR breakout cable is provided (part NN3104).

3. B-FORMAT OUTPUTS

W, X, Y & Z analogue balanced line level outputs on two 5-pin XLR connectors (see page 22 for wiring details). Two 5-pin to 2 x 3-pin XLR breakout cables are provided (part NN3102 W & X, part NN3103 Y & Z).

4. DC IN

The DC input can range between 10 and 18V DC and requires 7W of power consumption. Power is supplied by a 4-pin connector (part no. 410-320 - see page 22 for wiring details).

ST450 SHOCKMOUNT

The ST450 shockmount is supplied as standard (part HW3010) and is ideally suited for vibration isolation in indoor environments.

RECORDING B-FORMAT FOR SURROUND POST-PRODUCTION

ST450 B-Format Outputs

W X Y Z
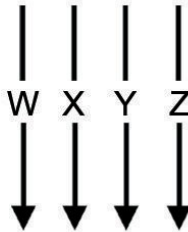
Line Level Inputs of Portable Recorder

The ST450 shares many of the features of the other SoundField systems, but is unique in that it can record full surround without mains power. The ST450 will run from any DC source between 10V and 18V capable of providing 7W. For example, a 14.4V, 2.4Ah battery will provide approximately 3 hours of operation.

The portable recorders then output the B-Format signals at line level which are then decoded into full surround by either the Surround Zone software or hardware DSF-3 / SP451 processors.

The advantage of recording an acoustic event in B-Format is that it can be decoded into any current or future surround format and is therefore ideal for 'surround archiving'.

SURROUND POST-PRODUCTION PART ONE:
THE SOUNDFIELD SURROUNDZONE2 SOFTWARE
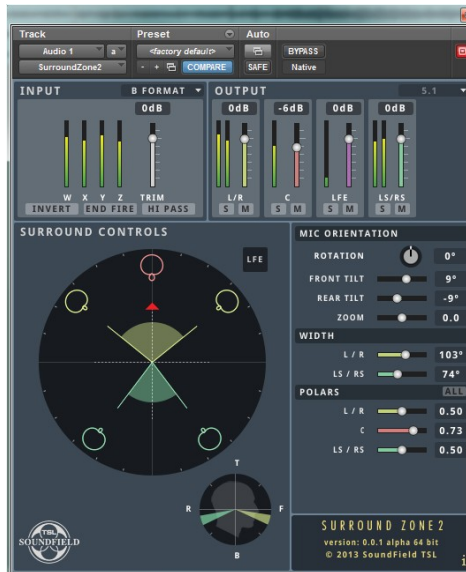
The SoundField SurroundZone2 software brings all the benefits of SoundField Technology to the post-production domain. The plug-in is designed to accept the four B-Format signals (W, X, Y & Z) generated by the ST450 and will then decode it to Stereo or a wide range of Surround Formats.

All plug-in features can be utilised either retrospectively in the studio after the recording has taken place or 'live' and provides the user with the most powerful stereo and surround sound recording/post-production package available.

Once the SoundField B-Format is in the Surround Zone environment the plug-in enables the user, either live or in post-production, to generate various surround mic-arrays with variable polar patterns. The plug-in also provides additional control over the sound, such as *Rotate* - 360 degree horizontal rotation, *Snap Tilt* - individual rear and front tilt - and *Zoom* - zoom in on sound sources.

For more information about the SurroundZone2 visit: www.soundfield.com

SURROUND POST-PRODUCTION: PART TWO
THE SOUNDFIELD SP451 SURROUND PROCESSOR

B-Format playback from Portable Recorder
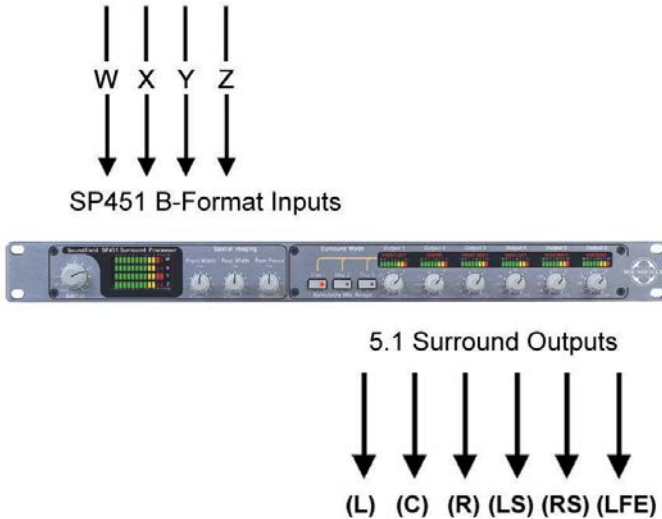
In this configuration the ST450/SP451 combination will deliver six discrete channels of 5.1 surround sound.

The SP451 offers a rugged 1U rackmount hardware alternative to the Surround Zone software. It is favoured by those wishing to bypass DAW's and commit up to eight tracks of surround sound directly to digital recorders 'live' as the performance takes place. It can also be used 'stand alone' in post-production where from pre-recorded B-Format material it will output a 5.1 surround mix and stereo mix simultaneously. It generates up to three surround mic arrays with differing polar pattern combinations for instant comparison. Front panel controls include individual 5.1 channel levels and metering with variable Front Width, Rear Width and Rear Pattern for each mic array. The SP451 has B-Format inputs (W, X, Y & Z) and up to eight surround outputs. Input/outputs are balanced XLR at line level.

RECHARGEABLE BATTERY PROCEDURE FOR ST450

(See Accessories on pages 25-26, part no. ST450/BATT-KIT)

CHARGING INSTRUCTIONS

1. Place the battery in the correct direction and make sure that the battery is fitted tightly into the charger and the metal points.

2. Connect the charger with the supplied power supply.

3. The indicator shows "Red" when the battery is charging and "Green" when the battery is fully charged.

4. Unplug the charger before taking out the battery.

BATTERY LIFE
A fully charged battery *(part no. 800-002)* will provide approximately 3 hours of operation under normal operating conditions.

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 or you need support

In the unlikely event that a fault develops with your product, please contact support as follows:

By email using service@soundfield.com

Claim for damage during transit

All products should be thoroughly inspected immediately upon delivery. If there is any damage to the product a claim should be filed with the carrier immediately. A quotation to repair shipment damage can be obtained from SoundField Ltd. Final claims and negotiations with the carrier are the responsibility of the customer.

Repair process and how to return your goods

In the first instance you should contact support using the contact details above. In the event that your product needs to be returned, a unique return number will be provided which should be used for all further correspondence.
Repairs and returned goods are subject to the following conditions:

• No equipment should be returned without the prior consent of SoundField Ltd.

• Shipping/Insurance costs for returned items are the responsibility of the customer.

• All returned goods must be suitably packaged to avoid damage and preferably in the original purpose built SoundField packaging. If this is not possible, packaging may be available from SoundField.

• In the event of transit damage, you will be advised immediately and the repair of the unit may be subject to additional costs which will be quoted before repair work commences.

• Warranty repairs will be returned free of charge (subject to the limited liability terms detailed elsewhere in this document)

• Non - warranty repairs will be inspected and an estimated cost provided before work starts.

• If after initial inspection we find the product is beyond economic repair (BER) you will be notified and charged for inspection only.

• Non-warranty repairs will be subject to additional return shipping costs.

Application support or help

TSL Products will be happy to answer any applications questions to enhance your use of this equipment. Please contact support using the details provided above.

5-PIN FEMALE TO 2 x 3-PIN MALE XLR WIRING DETAILS
(Stereo and B-Format Output Cables)

5-Pin XLR		3-Pin XLR
Pin 1	-	Ground
Pin 2	-	Pin 2 of W or Y or Left
Pin 3	-	Pin 3 of W or Y or Left
Pin 4	-	Pin 2 of X or Z or Right
Pin 5	-	Pin 3 of X or Z or Right

4-PIN POWER CONNECTOR WIRING DETAILS

Pin 1	-	GND
Pin 2	-	GND
Pin 3	-	+VC
Pin 4	-	+VC

12 PIN CONNECTOR WIRING DETAILS FOR MIC CABLES

12 Pin Male   **12 Pin Female**

Pin 1	-	LB (+)	-	Pin 1
Pin 2	-	LB (-)	-	Pin 2
Pin 3	-	RB (+)	-	Pin 3
Pin 4	-	RB (-)	-	Pin 4
Pin 5	-	RF (+)	-	Pin 5
Pin 6	-	RF (-)	-	Pin 6
Pin 7	-	LF (+)	-	Pin 7
Pin 8	-	LF (-)	-	Pin 8
Pin 9	-	Voltage GND	-	Pin 9
Pin 10	-	-V	-	Pin 10
Pin 11	-	+V	-	Pin 11
Pin 12	-	Signal GND	-	Pin 12

SOUNDFIELD COLOUR CODING

Pin 1	-	White
Pin 2	-	Purple
Pin 3	-	Grey
Pin 4	-	Pink
Pin 5	-	Green
Pin 6	-	Yellow
Pin 7	-	Red
Pin 8	-	Blue
Pin 9	-	Black
Pin 10	-	Brown
Pin 11	-	Orange
Pin 12	-	Screen (plus link to connector chassis)

Important Note: Use colour coding as above as some wires have a different number of strands.

TECHNICAL SPECIFICATION

SPECIFICATIONS (+/- 1dB)

Microphone acoustic line up at 0dB gain	-	-	-	80dB SPL
Maximum input for less than 0.5% THD	-	-	-	135dB SPL
Frequency range -	-	-	-	-	20Hz - 20kHz
Frequency range with 100Hz Hi Pass Filter	-	-	-	100Hz - 20kHz
Equivalent self noise, IEC 179 (cardioid)	-	-	-	13dB - A SPL
Control Unit outputs at line up	-	-	-	0dBu, Balanced
Maximum output levels	-	-	-	+22dBu

Minimum loads:

Stereo and B-Format outputs	-	-	-	600 ohms
Headphones	-	-	-	400 ohms/side

Output impedance -	-	-	-	-	100 ohms balanced
Powering	-	-	-	-	DC9 / 18V (7W)

*All specifications are subject to change without prior notice.

Humidity and Condensation

Condensation which is caused by rapid changes in humidity and cold, damp conditions can be a problem to ALL polarised condenser microphones. Moisture from the atmosphere or from the breath, if used close to the mouth, may condense on the capsules resulting in noise and reduced signal. The ST450 microphone includes a heater in the capsule cluster to minimise this effect and normal performance is restored when this moisture has completely evaporated. The heater is operational when powered by both battery and mains electricity. It is therefore advisable when the microphone has been stored in a cold place, such as in a vehicle overnight, to bring the microphone into a warm dry environment prior to use and full performance will be achieved more quickly. For outdoor use it is desirable - and in many cases essential - to use a shockmounted windshield such as Rycote.

ST450 Accessories   **Part No.**

ST450 Compact Rycote Kit   **ST450/RY/C**
Comprising: Pistol Grip with Suspension • Mic Inner Cradle
                     105mm diameter Windshield • Rycote Windjammer
                     Rycote Anti-vibration Mic cable

ST450 Standard Rycote Kit   **ST450/RY/S**
Comprising: Pistol Grip with Suspension • Mic Inner Cradle
                     140mm diameter Windshield • Rycote Anti-vibration Mic cable

ST450 Battery Kit   **ST450/BATT-KIT**
Comprising: Rechargeable Battery • Battery Charger
                     Battery Power connection cable • Power Adapter

Cables
ST450 5 Metre Microphone Cable - Lemo Connectors	**NN3001**
ST450 10 Metre Microphone Cable - Lemo Connectors	**NN3002**
ST450 20 Metre Microphone Cable - Lemo Connectors	**NN3003**
ST450 50 Metre Microphone Cable on Drum - Lemo Connectors	**NN3004**
ST450 100 Metre Microphone Cable on Drum - Lemo Connectors	**NN3005**
SoundField Microphone Cable per Metre	**310-353**
Battery Power Connection Cable (4 pin Hirose to 4 pin Hirose connector)	**NN8185**
Rycote Anti-vibration Mic Cable	**NN9203**

Connectors
12 pin Lemo Male In line Connector	**410-301**
12 pin Lemo Female In line Connector	**410-302**
4 pin Hirose In Line ST450 Power Connector	**410-320**

Shockmount
ST450 Shock Mount System - complete	**HW3010**

Batteries & Chargers
Rechargeable Battery	**800-002**
Battery Charger (for 800-002)	**810-002**
Regulated 12V Power Adapter - 2 x Hirose outputs, on/off switch	**DV-AUX2S**
Battery Power Connection Cable (4 pin Hirose to 4 pin Hirose connector)	**NN8185**

Power Supply
Replacement ST450 Mains Power Supply	**ST450/PSU**

ST450 Accessories   <u>**Part No.**</u>

<u>**Rycote**</u>
Standard Rycote
Pistol Grip with Suspension   **430-385**
ST350 Mic Inner Cradle to fit 430-385   **440-183**
140mm diameter Windshield   **430-384**
Rycote Anti-vibration Mic Cable   **NN9203**
Rycote Windjammer   **430-398**

Optional Accessory:
High Wind Cover   **430-400**

<u>**Rycote**</u>
Compact Rycote
Pistol Grip with Suspension   **420-380**
Mic Inner Cradle to fit 420-380   **440-183**
105mm diameter Windshield   **420-381**
Rycote Anti-vibration Mic cable   **NN9203**
Rycote Windjammer   **430-397**

Optional Accessory:
High Wind Cover   **430-399**