

The Soundfield MKV Microphone

User Guide

527 - 027



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Introduction

The SoundField MKV Microphone System is a unique product offering a previously unobtainable degree of accuracy in the generation of coincident stereo and mono microphone patterns. The user is able to steer and move the generated microphones both in real and post-production time. A fully three dimensional output signal suitable for encoding to any surround system and, in particular, to the UHJ family of Ambisonic Surround Sound systems is available.

The system comprises:

- The MKV Soundfield Microphone in presentation box
- The MKV Soundfield Control Unit
- Shock Mount Assembly
- 20 metre microphone cable
- Mains lead
- Foam windshield

Optional Accessories

- 100 metre microphone lead/extension cable on drum (NN 2886), 5m cable (NN 2882), 10m cable (NN 2883), 20m cable (NN 2884) and 50m cable (NN2885).
- Two splitter cables type NN2877 and NN2878 allow the microphone to control unit connection to be made via 5 separate studio 3 pin XLR tie lines thus placing the control unit in the listening room (both cables are required).
- Rycote Kit comprising of:
 - 1 x Rycote suspension with pistol grip (430-385)
 - 1 x Rycote 140mm Windshield (430-384)
 - 1 x Rycote Mounting Kit (440-182)
- Rycote Windjammer (430-398)
(to fit Rycote Windshield 430-384)

Power Requirements

The SoundField MK V Control Unit may be operated from 200/250 or 100/120 volts AC Mains. The Control Unit incorporates a mains filter and must therefore have mains earth connected.

Getting Started

Plugging-up

- Control unit with the microphone in the studio: connect the microphone to the control unit using the multi-way cable.
- Control unit in the control room and the microphone in the studio: use the 5 x 3 pin female XLR 's to Tuchel Male Plug splitter lead (NN2877) to connect the control unit in the control room to the microphone lines to the studio. Use the 5 x 3 pin male XLR's to Tuchel Female Socket lead (NN2878) to connect the microphone to the studio microphone lines which lead to the control unit in the control room.

DO NOT CONNECT OR DISCONNECT THE MICROPHONE TO THE CONTROL UNIT WHEN THE UNIT IS POWERED.

TAKE CARE TO PLUG THE CORRESPONDING 3 PIN XLR's TO THE SAME MICROPHONE LINE OR DAMAGE COULD RESULT. THE STUDIO TIE LINES SHOULD NOT HAVE PHANTOM POWER ON THEM.

Positioning the Microphone

The front of the microphone is marked by the SoundField logo.

Setting a Stereo Microphone Output

The left and right XLR-3 outputs from the control box are at **line level** and need to be plugged into the line inputs of your recorder or desk and **not** into your mic inputs. Plug in and switch on the SoundField Control Unit.

Ensure that the SoundField *solos* and *osc test* are off (red LEDs flash if they or the oscillator are on).

Ensure that the *dub*, *tape* and SoundField buttons are out.

Put the fine *gain* at the detente and adjust the microphone *gain* to give just enough level to modulate the bargraph meters around '0'.

The stereo outputs are now providing an output of a stereo or mono microphone with a polar response pattern set by the left knob under the stereo microphone section and at a capsule angle set by the right hand knob. For a crossed pair, set the pattern to cardioid (at 12 o'clock) and select 90° on the capsule angle.

Now listen to your stereo SoundField Microphone.

Moving the Microphone Remotely

Set all the SoundField controls to '0'.

Switch the SoundField controls into circuit with the *SF in* button.

Pan the microphone left or right with the *azimuth* knob. You will find that the sound moves left as you pan right.

Tilt the microphone 45° up or down with the elevation knob.

Zoom the microphone in closer to the sound with the dominance knob. You can effectively halve the distance between the microphone and the sound source with this control. You can zoom in on a vocalist without vocal pops, or adjust the balance between the sound of plucked strings and the instrument itself using this *dominance* control.

It should, however, be noticed that the dominance control will not produce any effects that could not be produced by adjusting the pattern, angle and gain controls.

Zoom the microphone out further and listen to the studio acoustics, and let the myriad of reflections mingle with the direct signal.

Application Suggestions

Lead Vocals

Select a mono (0° angle) or stereo (90° or wider) cardioid, forward facing (azimuth 0°), start with half forward dominance and if you have time, tune this for best effect. Why not use the microphone in the control room? The accurate polar pattern will allow the dead sides to be faced to the monitors - try reversing the phase of the microphone or the vocal track.

Backing Vocals

As above but usually stereo sub-cardioid and the dominance at '0' or slightly anti-clockwise for more ambience. If the microphone is positioned above the backing vocalist, then correct its placement with the *elevation* control.

Drum Microphone

Select mono cardioid. Because the pattern is accurate at all audio frequencies, there will be no spill from other drums. If you want the microphone away from the drum skin and out of harm, use full frontal *dominance*. No matter how loud the bass drum is, it won't distort this microphone.

Piano

Use as any stereo microphone but tune the sound using all the controls to get it just right - at least you don't need to keep running into the studio to do this! Remember you cannot reduce reflections from the lid meeting the microphone front side on, even with a SoundField.

Ambience

Again use as any stereo microphone, select figure-of-eight pattern at 90° or crossed cardioids, and if the microphone is high use the *elevation* control to bring the sound on axis. If the microphone is positioned upside down then press the *invert* button and left and right will be switched over.

The Controls - *in more detail*

- 1 **Input Gain** - controls the sensitivity of the microphone over a 30dB range in 10dB steps.
- 2 **Fine Gain** - should normally be operated as near to the zero mark as possible but allows a +10dB to - 10dB fine trim. It is accurately calibrated at the detente and the two ends.
- 3 **Solos** - (*LB - LF+ RF- RB+*) Soloing a capsule means that only that particular capsule is being heard. If two buttons are pressed then both are heard.

Under no circumstances should recording take place with any solo button depressed.

The main use of the solos is for checking continuity when the head lead has been split-out into existing tie lines using the SFS 1 and SFS 2 splitter leads. It is good SoundField practice, though, to check before every recording, as head leads do get damaged, and, while under normal circumstances it would be obvious from the monitored output that all was not well, under difficult monitoring conditions on headphones a discontinuity could go un-noticed.

- 4 **Osc.test** - the test oscillator produces a 0dBm/1kHz tone at the B-Format record outputs which should be used to align the multi-track tape machine record circuits. The tone is coded for later identification of the recorded tracks and the following track plan is recommended as a standard for professional use:

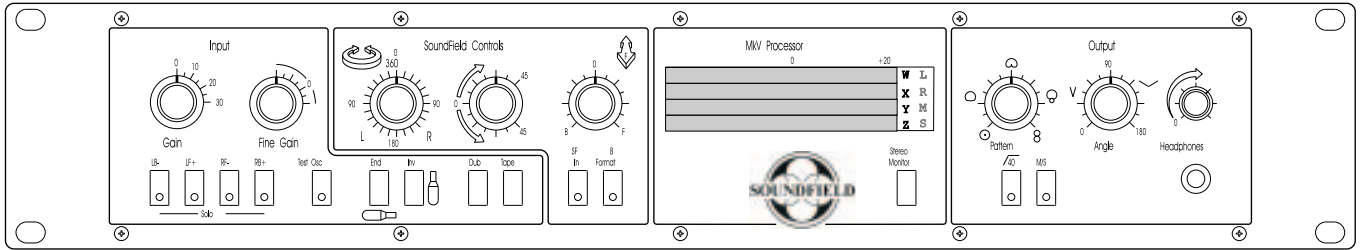
Tape track	B-Format signal	Oscillator coding approx. seconds	
		ON	OFF
1	W	Continuous	--
2	X	1	1
3	Y	2	2
4	Z	4	4

The Y tone sequence is twice as long as the X sequence and the Z is twice as long as the Y.

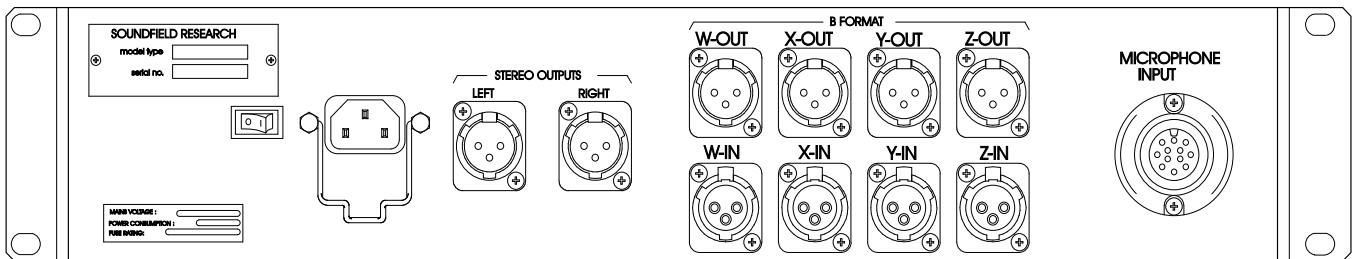
It is imperative that test tones be recorded at the beginning of each session and preferably on each reel of tape.

If a noise reduction system is used, the SoundField test tones should be after those of the noise reduction system. The recorded tones may then be used to align the tape replay section and to check for correct connections of tracks.

The absolute level of the replayed test tone is not important but it is vital to adjust each track to the same relative level.



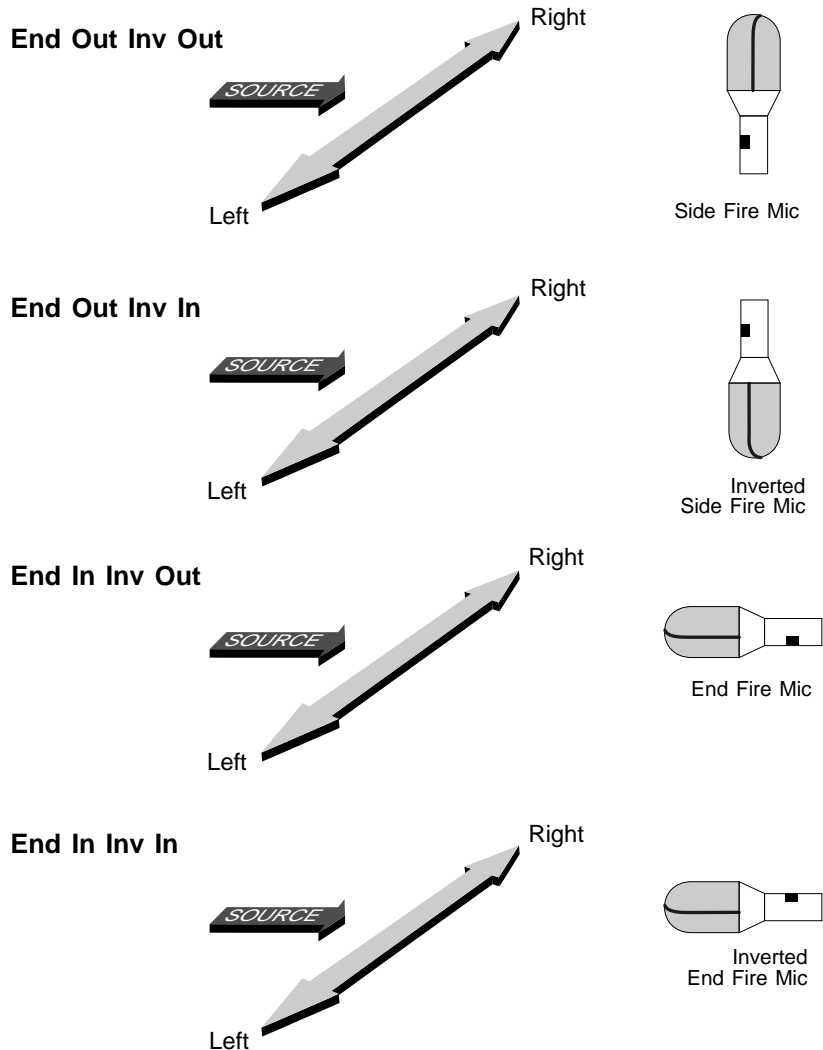
Front Panel



Rear Panel

5 *Red LEDs* - flash with each solo button and when the oscillator is in operation.

6 *Microphone Orientation*



7 *Tape and Dub* - The normal condition is the B-Format output of the microphone input stage to be routed direct to the stereo output via the SoundField controls if selected. *Tape* substitutes the microphone signal with the off tape input to the B-Format replay socket and would normally be used for 'tape check' during recording. *Dub* disconnects the microphone completely and routes the B-Format replay input to the fine gain and also to the B-Format record output and the stereo output. This action reverses the roles of the B-Format inputs and outputs and **should never be used during recording**. The facility allows B-Format to B-Format and/or B-Format to stereo dubbing with fine gain control and SoundField control if required. The polar pattern and capsule angle controls are always available in the stereo output.

8 *Azimuth* - complete electronic rotation of the microphone.

9 *Elevation* - allows plus or minus 45° of continuous variation on the vertical alignment of the actual microphone.

10 Dominance - in effect, this is a form of zoom control allowing the generated microphone to be moved closer to or further away from the original sound source than the actual microphone. The effect in stereo is not exactly the same as moving the microphone because the stereo image does not widen as would be expected, in fact it narrows slightly, but this effect can be corrected with the 'Capsule angle' control. In surround sound the apparent movement is even more realistic.

11 SoundField In Button - routes the B-Format signal through the SoundField control section. If no SoundField correction is to be made the section should be switched out of circuit to avoid accidental adjustment.

12 SoundField Rec Button - In normal or dub operation the SoundField controls are inserted into the B-Format signal after the B-Format record outputs and only affect the stereo output. *Rec* allows their insertion into the B-Format record outputs, enabling corrections to be made onto 4 track tape as well as the stereo output.

13 Metering - the 4 bargraph LED meters show the signal levels of the 4 components of the B-Format signal W, X, Y and Z as they appear either at the B-Format output or off tape at the B-Format input. In either case they show the effect on signal level of any SoundField adjustments **and directly represent the signal level at the B-Format outputs**. When used directly as a stereo microphone or on subsequent mixdown of a B-Format signal to stereo they only show the energy being fed to the stereo output circuits and do not show the energy level of the stereo output.

The bar-graphs are calibrated to illuminate 13 green segments at 0dBu line-up tone, and the panel is marked at this position. The calibration is such that the alignment tone only just illuminates segment 13 so that if a tape machine is being aligned prior to recording, the recorder replay gain should be set so that segment 13 just turns on.

Segments 14 - 23 are red representing 0 - 20dB in intervals of -2dB.

The indicators have very approximate 'Peak programme meter' attack and decay times and are not intended as a serious replacement for superior programme metering.

14 Stereo Microphone controls - the polar pattern control is graduated from omni-directional (0) at the anti-clockwise end through cardioid at '12 o'clock' to figure-of-eight at the clockwise end and smoothly adjusts the polar pattern of the generated microphone(s) through all the intermediate sub-cardioid and hyper-cardioid positions. The capsule angle control is graduated from 0° to 180° and smoothly adjusts the angle of the generated microphones between the two extremes. With the control set to 0° the two outputs would be of two microphones pointing in exactly the same direction from exactly the same point in space and would therefore be identical mono signals.

5 Monitor. - controls the signal level of the stereo output to the headphone socket.

16 High pass filter - on the stereo outputs at 40Hz, 18dB per octave. Used to remove 'rumble' and wind noise. Affects the stereo and M/S outputs only.

17 M/S - switches the microphone into M and S mode outputs. The Left socket becomes M and the Right socket becomes S.

Checks and Alignments

The SoundField System produces near perfect figure-of-eight patterns making it possible to substantially check the microphone using speech tests only, preferably using headphones.

Set the microphone on a stand or boom at a comfortable height to walk around but low enough to get your head over the top. Set the controls as follows:

1	Solos	normal (off)
2	Osc	off
3	Invert/End	to suit microphone position
4	Gain	to give comfortable listening level
5	Azimuth	0
6	Elevation	0
7	Dominance	0
8	In	de-selected
9	Rec	de-selected
10	Tape	de-selected
11	Stereo pattern	figure-of-eight
12	Stereo angle	0°

First solo each capsule and listen to one at a time to check the continuity of the microphone lead. If a speech check is conducted at this point it should be possible to ascertain the direction of each individual capsule in the horizontal and, if the test room is not too reverberant, the vertical.

- LB - = left back down
- LF+ = left front up
- RF - = right front down
- RB+ = right back up

Left and right are defined as being the left and right hand side of the stereo picture ie they will be reversed if you face the front of the microphone.

This test is optional provided that a roughly equal signal is received from each capsule. (Bearing in mind that two face forwards and two face backwards and that two face upwards and two face downwards).

De-select all the solo buttons and select the SoundField *in* button.

The unit is now set to produce a forwards facing mono figure-of-eight.

- Test 1** To speech check, start at the front of the microphone at about 150mm (6 inches) range and progress clockwise around horizontally, noting the signal peaks at 0° and 180° and the nulls at 90° and 270°. Similar nulls should also be found immediately over the top and underneath the microphone (see Figure 1 - Page 12)
- Test 2** Aim the microphone 90° to the right by rotating the azimuth control 90° clockwise - (see Figure 2 - Page 12)The signal peaks and null will have moved round 90° relative to the label.
- Test 3** Repeat the test with 90° rotation anti-clockwise and results should be as Test 2.
- Test 4** Repeat the test with 180° rotation and results should be as Test 1.
- Test 5** Return the controls to forward facing, as in Test 1 and select 45° clockwise on the *azimuth* control. The peaks and nulls will now have moved 45° to the right of microphone front (ie halfway between Figures 1 and 2).
- Test 6** Repeat Test 5 with the *azimuth* control selected to 45° anticlockwise. The peaks and nulls will now be 45° to the left of microphone front. (Again, halfway between figures 1 and 2 but at 90° to Test 5).
- Test 7** Return the *azimuth* to 0° and turn *elevation* to +45°. The peaks should now be at +45° relative to microphone front and -45° relative to microphone back as in Figure 3.
- Test 8** Repeat Test 7 at -45° and note that the peaks move to this position relative to microphone front and 45° relative to microphone back as in Figure 4.
- Test 9** Return the *elevation* control to 0° and whilst speaking at the microphone front, note that increasing *dominance* increases the microphone sensitivity and reducing *dominance* reduces the sensitivity.
- Test 10** Return the *dominance* control to 0° Move the *polar pattern* control and observe that the microphone works as a single cardioid with a null at 180° (microphone back) in *cardioid* position and all around equally in *omni* position.
- Test 11** With the microphone set as a *cardioid* check that the *dominance* has a similar effect as Test 10. Return the *dominance* control to 0° and de-select *SF IN*.
- Test 12** Set the *stereo* controls to *cardioid* and 90° and observe that the left signal peaks when speaking at 45° microphone left (to your right) and the right one at 45° microphone right (to your left) with corresponding opposite nulls.

Conclusions

If all the above tests have produced the results described, then the system can be assumed to be working correctly.

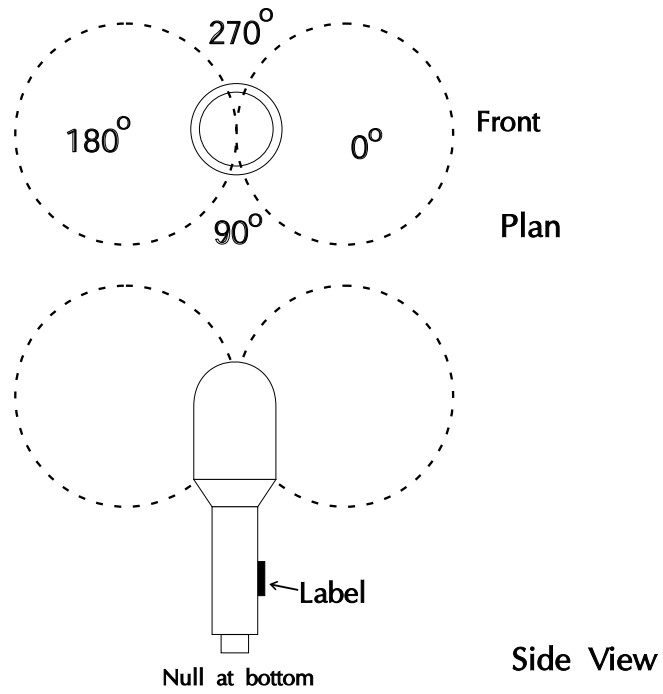


Figure 1: Figure of Eight: Angle, Azimuth, Elevation: 0°

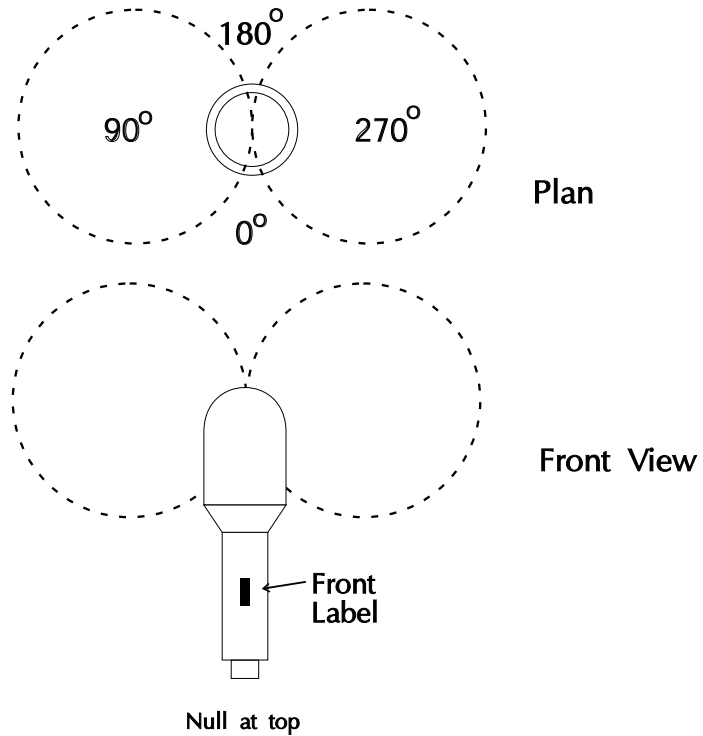


Figure 2: Figure of Eight: Angle = 180°, Azimuth, Elevation: 0°

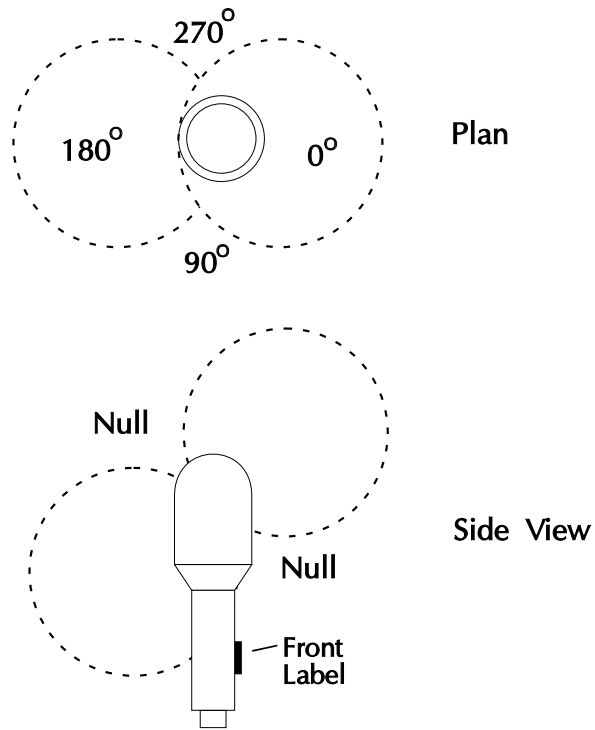


Figure 3: Figure of Eight: Angle, Azimuth
Elevation: $+45^{\circ}$

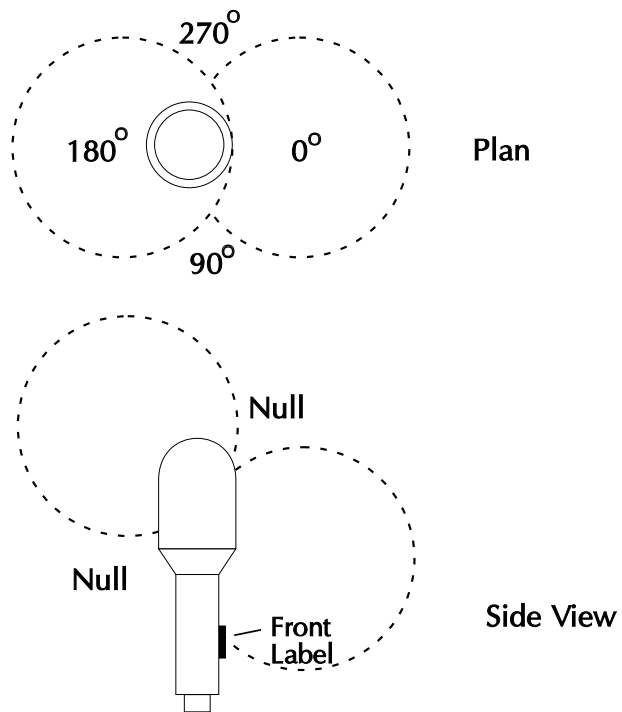


Figure 4: Figure of Eight: Angle, Azimuth
Elevation: -45°

Warranty

Limited Liability

SoundField Research 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 Research 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 Research Ltd. or their Authorised Representative.

Shipping Information

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 Research 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 Research Ltd. or their Certified Representative. Final claims and negotiations with the carrier must be completed by the customer.

Applications problems

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

SoundField Research Ltd.
Charlotte Street Business Centre
Charlotte Street
Wakefield
West Yorkshire
WF1 1UH
ENGLAND

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 below or alternatively inform one of our world wide network of distributors who will be able to assist with any of your queries.

SoundField Research Ltd.
Charlotte Street Business Centre
Charlotte Street
Wakefield
West Yorkshire
WF1 1UH
ENGLAND

All SoundField products are sold subject to our 'General Conditions of Sale' and the purchaser should note 'that the equipment is not being sold to him to meet his individual requirements and it is therefore the buyer's responsibility to ensure that the purposes and functions of the equipment meet his requirements prior to purchase.' However, we would non-the-less be grateful to receive any constructive criticism or ideas for additional features which you feel might enhance the usefulness of our product in the studio environment. At SoundField Research Ltd., we have an 'advanced module replacement policy' so that following telephone/fax diagnosis of your problem, equipment can be despatched as quickly as possible to reduce the product's 'down time' and ensure complete customer satisfaction with as little fuss as possible.

All we ask is that you return the defective module within one month to assist our investigations and help minimize the likelihood of the problem re-occurring. Any charges levied for service is dependent on the warranty period of the product and the prompt return of modules affected.

SoundField Research Ltd.
Charlotte Street Business Centre
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Wakefield
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APPENDIX A Theory of Operation

SoundField Controls

Azimuth, *Elevation* and *Dominance* are effected by adding or subtracting appropriate other B-Format components to each basic B-Format signal either in-phase or inverted to achieve a desired result.

For example if it is required to effectively move the front of the microphone 45° to the left then the 'new X' or X', must now consist of equal components of X and Y but so that the amplitude of X' is identical to that of X, the X and Y constituents must each be reduced by a factor of $\frac{1}{\sqrt{2}}$ or -3dB (See Figure 1 - Page 18).

Similarly 45° to the right requires the same component of X ie $\frac{X}{\sqrt{2}}$
but now the added Y component requires to be $\frac{Y}{\sqrt{2}}$

Thus the *azimuth* control in the front sector merely reduces X by 3dB at each end relative to centre, the signals remaining in-phase, whereas the added component, $\frac{Y}{\sqrt{2}}$ (-3dB) at left, disappears at centre and re-appears as $-\frac{Y}{\sqrt{2}}$ (-3dB) at right ie inverted.

This is the key to understanding and testing all SoundField circuits.

The basic signal component is varied in amplitude from its 0dB neutral position whilst remaining in-phase (it actually increases in the *Dominance* circuit) whilst the added signal component appears in opposite phase on either hand from a zero value at neutral. The maximum value of the added signal at the ends of the controls is always $\frac{1}{\sqrt{2}}$ or -3dB.

Once this principle is understood, the required phase of the added signal to achieve a desired result can easily be determined by reference to the B-Format signal vectors (See Figure 2). For example, if the microphone requires to be tilted up, (elevation control) X' must now contain some +Z and Z' some -X, or tilted down, X' must contain some -Z and Z' some +X and so on (See Figure 3). Each of the 3 B-Format directional signals has a 'positive hemi-sphere' in which its vector lies, and an opposite 'negative hemi-sphere'.

Dominance is slightly more complicated (but only slightly). This control breaks the basic symmetry of the SoundField sphere and causes it to 'bulge' forwards or backwards. This is achieved by adding or subtracting some X to the W component to make it into a front or back facing sub-cardioid* and at the same time adding or subtracting W to the X component to form a front or back facing hyper-cardioid*.

*It must be remembered that equal quantities of W (pressure, omni-directional) and X (pressure-gradient, figure-of-eight) components form a front facing cardioid. If X is subtracted (inverted), this is a back facing cardioid. If W is greater than X then the polar pattern is said to be a sub-cardioid; if X is greater than W, a hyper-cardioid. There is a range of sub and hyper-cardioids but only one cardioid. A fuller explanation of this is given in the next section.

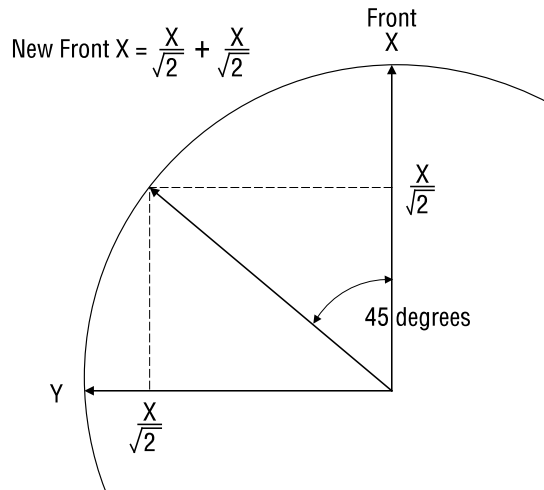
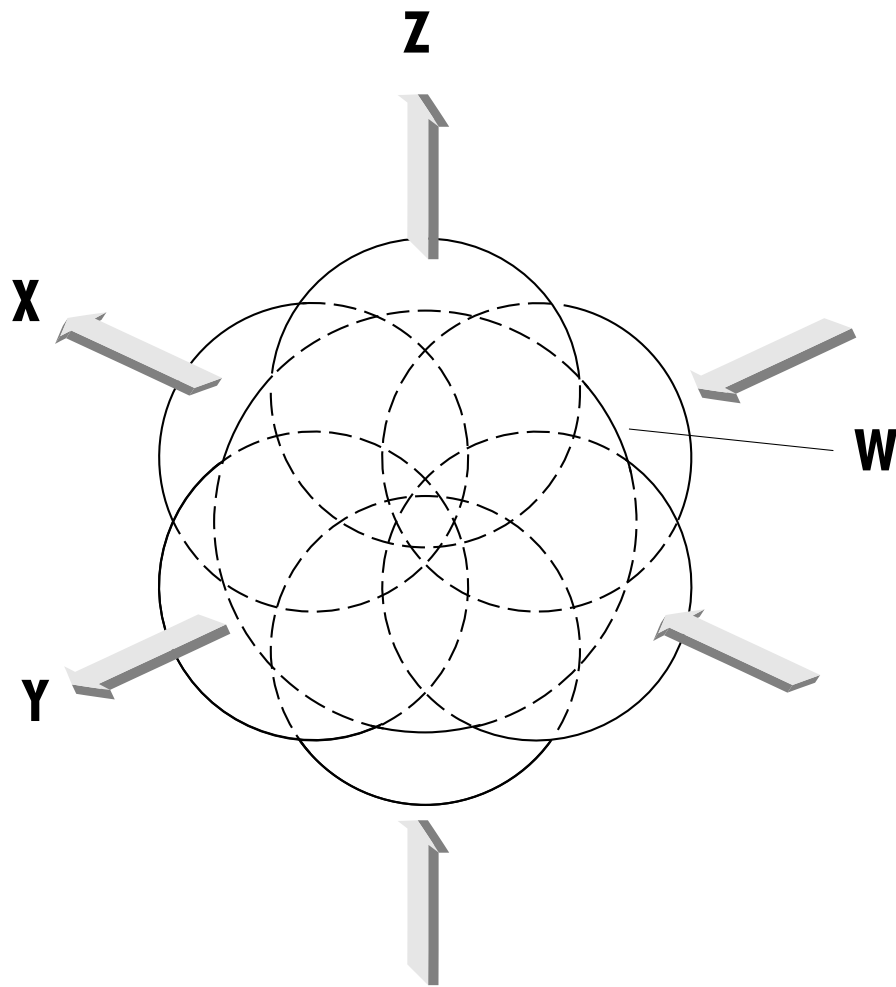


Figure 1 - Azimuth Control



Components of B Format

Stereo Outputs

There are 2 stereo outputs from the control unit:

1 The main stereo output (left and right) from 2 x XLR 3 pin male sockets on the rear panel. These signals are not subject to the monitor gain control.

2 A stereo jack socket on the front panel.

The stereo output circuits are fed with B-Format signals W, X and Y from the record amplifiers (and hence the microphone) in the normal mode (Z, the height component, is not used in stereo except in the SoundField circuits to effect elevation when required). If *tape* is pressed the circuits are switched to the B-Format signals from the tape recorder via the B-Format play socket. On *dub* the record level control may be introduced.

The main stereo output levels are approximately 0dBu programme level for 0dBu B-Format programme inputs. Level adjustment is available in the dub mode. The monitor jack outputs may be adjusted from off to +10dB relative to the main levels.

There are two further controls for when the unit is being used as a stereo microphone, or when dubbing from the B-Format to Stereo, or (experimentally) when monitoring a B-Format recording in stereo. These are polar patterns and angle, the latter allowing adjustment of the 'angle of point' of the synthesised stereo pair of microphones.

Note 1

In standard B-Format the pressure-gradient signals X, Y (Z) are enhanced 3dB.

Examples of the inter-play of these controls and general polar pattern theory may be seen in Figure 5

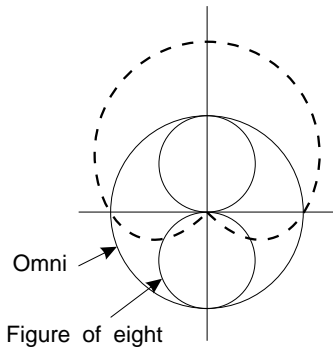
Note 2

The stereo output signals are in phase with the acoustic signals. That is, a pressure increase is reproduced as a positive going omnidirectional component at the stereo outputs.

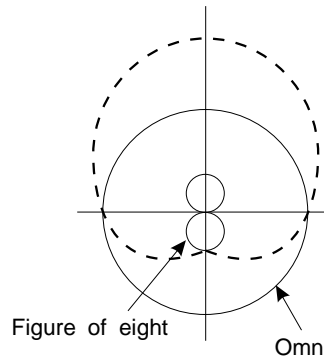
The B-Format signals are inverted. This has been done to retain compatibility with previous SoundField microphones. This will only affect you if you wish to manipulate the B-Format signals independently at the SoundField control unit.

Fig 5a Mono polar patterns

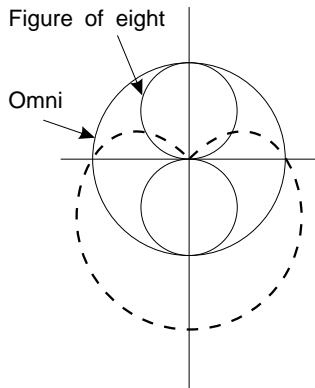
Front Cardioid
Omni and Figure of eight



Sub-Cardioid ($2+\cos \phi$)
Omni greater than the Figure of eight



Back Cardioid
Omni minus Figure of eight



Hyper-Cardioid ($0.5+\cos \phi$)
Omni less than the Figure of eight

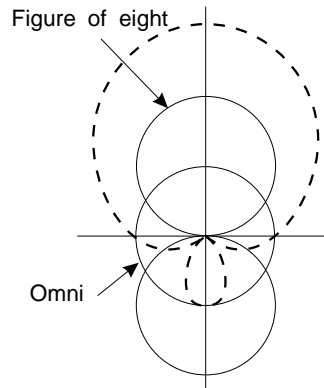
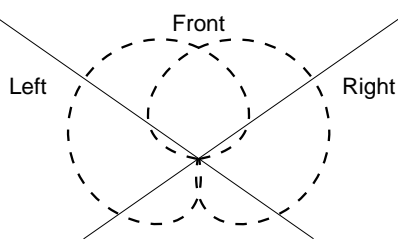
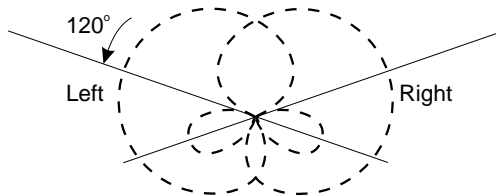


Fig 5b Two of many Stereo configurations from the Soundfield microphone

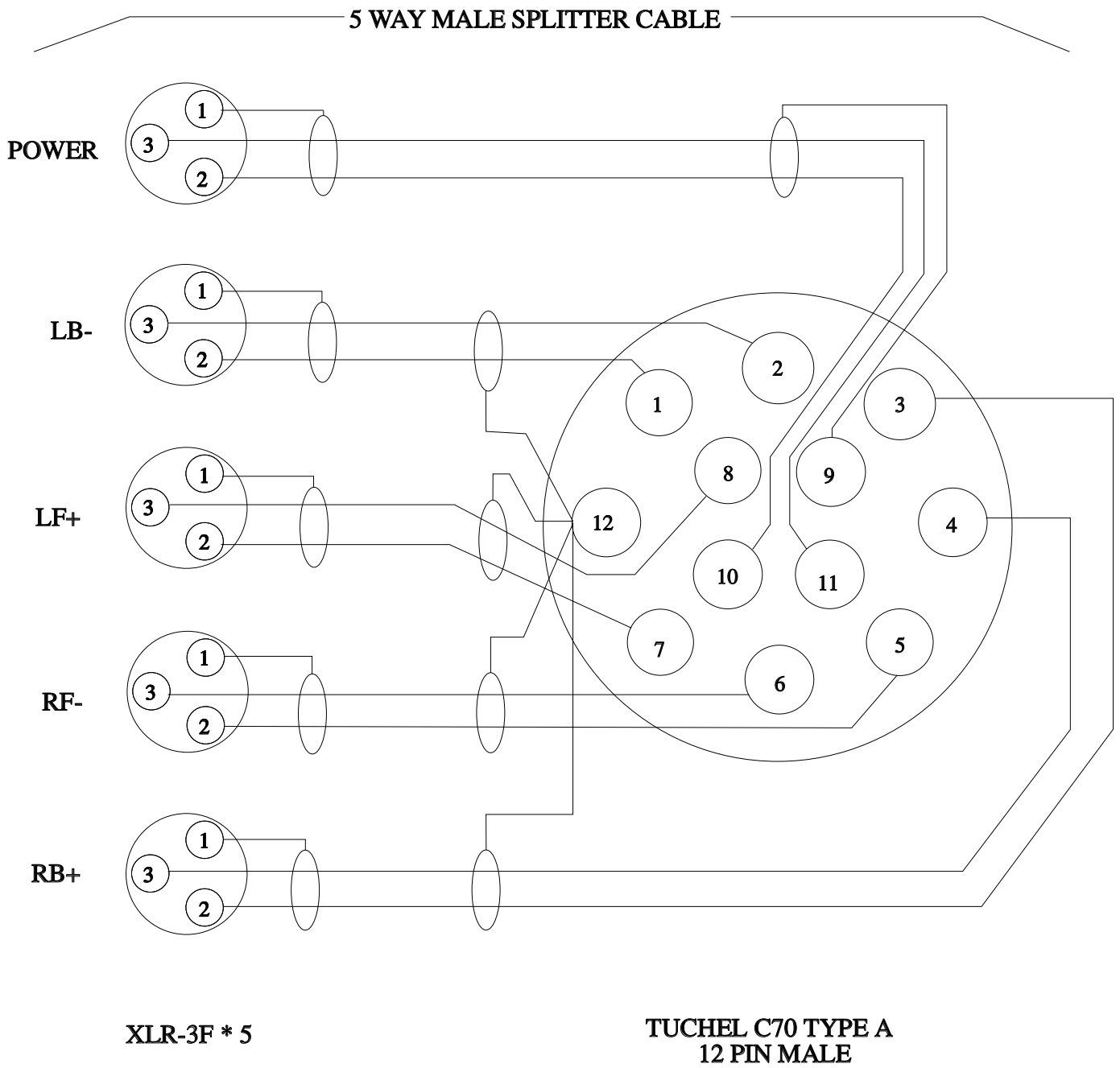


Stereo pair of synthesised cardioid microphones

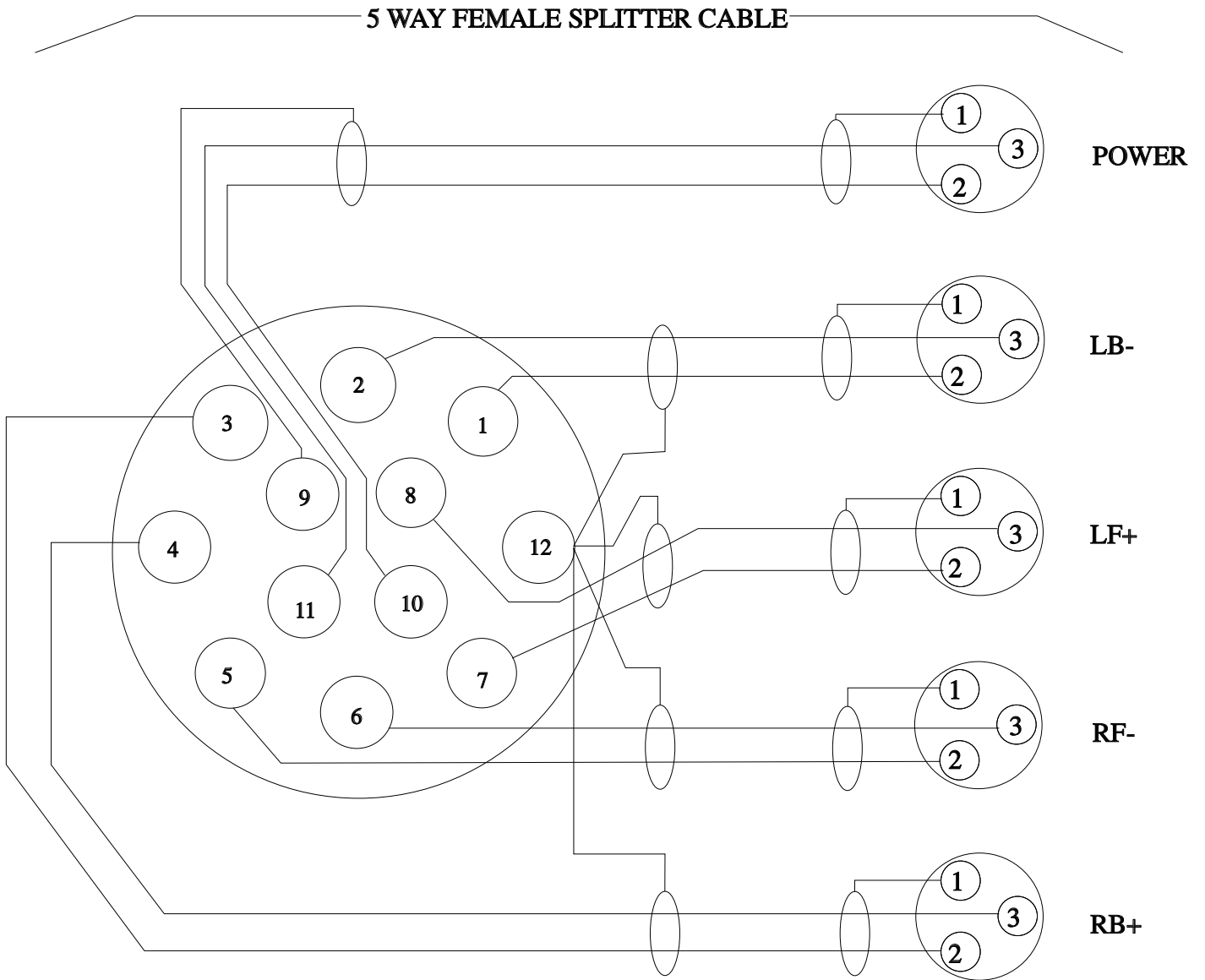


Stereo pair of synthesised hyper-cardioid microphones set at 120° and tilted downwards.

APPENDIX B Cable and Connector Details



ALL CONECTIONS VIEWED FROM REAR



ALL CONECTIONS VIEWED FROM REAR