COINCIDENT VIRTUAL-RIBBON MICROPHONE

AND

CONTROL UNIT

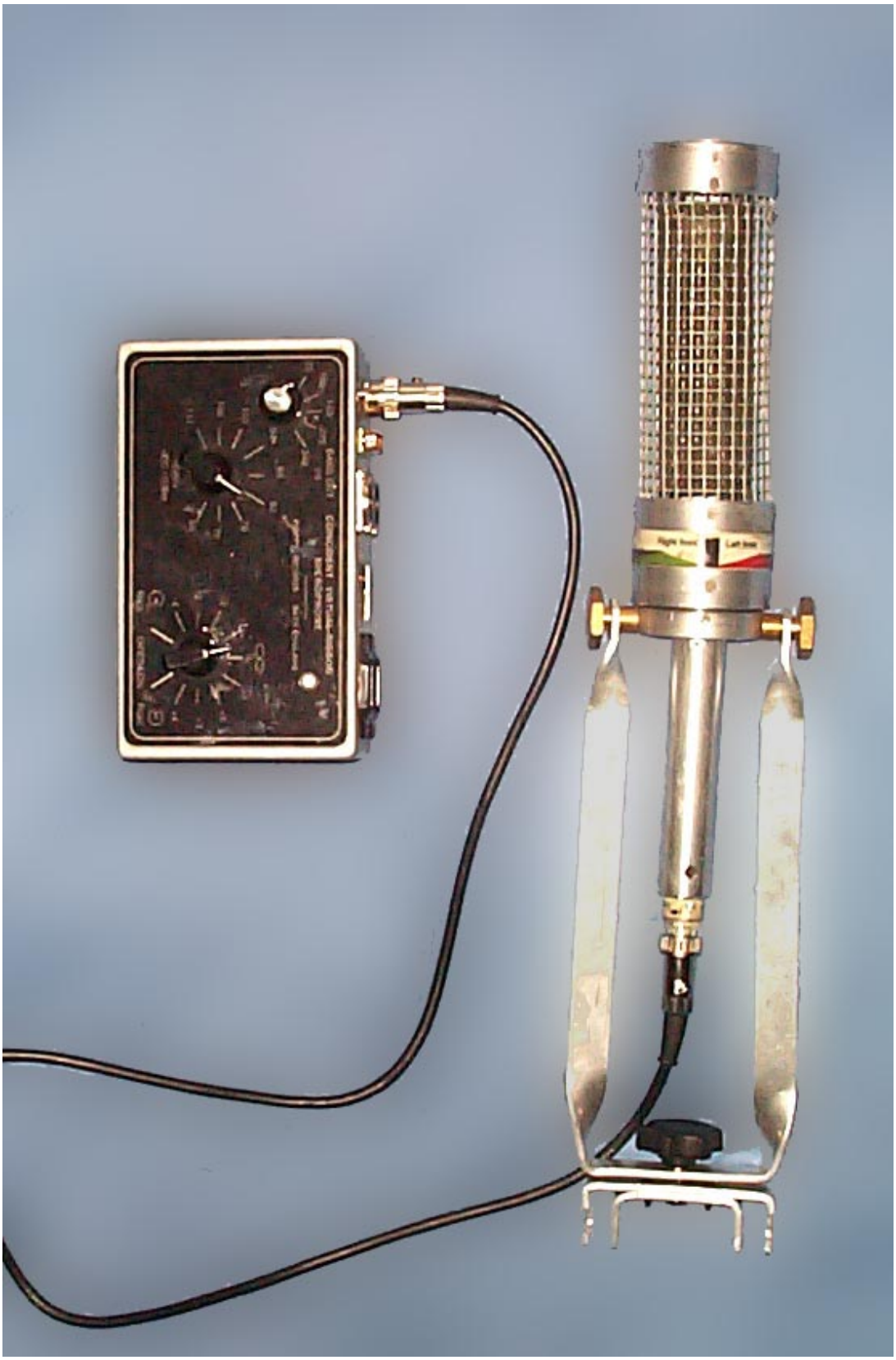
– – –

HANDBOOK

– – –

POPPY RECORDS

BATH ENGLAND



The Control Box, Microphone and Suspension Fork

COINCIDENT VIRTUAL-RIBBON MICROPHONE AND CONTROL UNIT

This is a multi-capsule array microphone, capable of emulating various conventional microphone channels:

Mono Cardioid, ribbon (velocity), omnidirectional (pressure)
Stereo Cardioid pair, hypercardioid pair, crossed ribbons
Surround 4-channel, 5-channel

The 4-channel 5-channel and omnidirectional outputs are always available, independently of the settings of the stereo channels.

A particular property of this microphone, which distinguishes it from other multi-channel microphones, is the accurate phase relationships between the channels which is maintained up to high audio frequencies and gives extremely accurate stereo imaging. For the stereo crossed ribbon response, the channels are phase-coincident over the entire audible range.

The complete apparatus comprises a Microphone Unit, a Control Unit and various connecting cables.

MICROPHONE UNIT

The microphone is cylindrical in construction and would normally be operated with the sound sources in a plane at right angles to the longitudinal axis. It may be mounted with the handle downwards in a microphone stand clip, or suspended with the handle upwards using the adjustable suspension fork provided.

ALL REFERENCES TO 'LEFT' AND 'RIGHT' ASSUME THE HANDLE-DOWNWARDS MOUNTING POSITION. IF THE MICROPHONE IS MOUNTED HANDLE-UPWARDS, 'LEFT' AND 'RIGHT' WILL BE REVERSED.

The microphone incorporates an internal wind-shield and resilient suspension which should be adequate for most normal conditions of indoor use. If it is to be used outdoors or for very close speech, additional wind shielding may be necessary. In conditions of high vibration, the mounting may need additional resilient suspension arrangements.

The microphone is supplied with a 5-metre cable to connect it to the control unit. An additional 25-metre drum of cable is supplied for use when required. Should the cables become mislaid or damaged, the microphone can be plugged directly into the control unit without an intervening cable.

It is important to keep cables and other objects away from the body of the microphone where their presence might distort the sound field.

A little time spent becoming familiar with the operation of the locking "Preh" connectors will be amply repaid when they later have to be operated under the stress of studio working conditions.

CONTROL UNIT

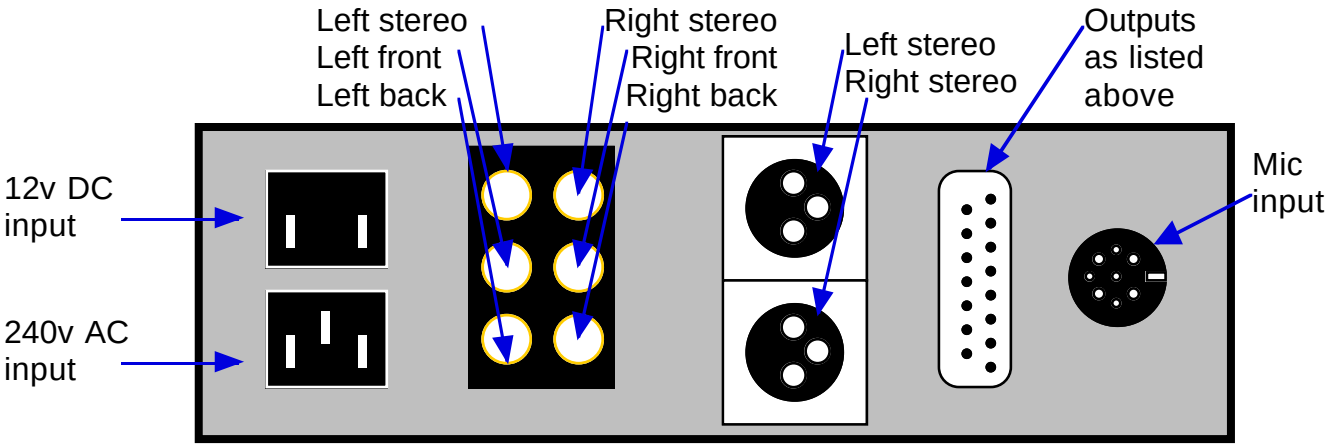
The control unit is rectangular and of robust metal construction. All connectors are grouped on one face of the unit for convenience. The unit may be mounted in any orientation, provided the controls remain accessible.

Connections:

Mains (240v AC) input (IEC connector)
Low voltage (12v DC) input (special connector)
"Preh" locking DIN microphone input connector
P.O. 'B' jack outputs (stereo and 4-channel)
XLR stereo outputs (stereo only)
'D' connector (5-channels + stereo + omnidirectional):

1) Signal earth	9) Right (stereo)
2) Signal earth	10) Left (stereo)
3) Omnidirectional	11) Centre front
4) Signal earth	12) Right back
5) Signal earth	13) Right front
6) Signal earth	14) Left back
7) Signal earth	15) Left front
8) Chassis earth	

All outputs unbalanced 600ohm source impedance



Controls

Calibrated Gain control, 6dB steps
Calibrated bass-correction, 25c/s to 340c/s
Variable Direction control for stereo outputs

POWER SUPPLIES

If mains power from 200v to 250v AC is available, it can be supplied to the Control Unit through a 3-core mains cable equipped with a standard I.E.C. connector. Under these conditions, there must be an earthing connection in the supply wiring.

Alternatively the unit can be operated from a 12v DC supply, such as a car battery, using the special connector supplied. Protection is incorporated against reversed polarity and the metal casing is isolated from the 12v supply. Earthing of this supply is not necessary. At least one of the output connectors should be arranged to give a chassis connection for screening purposes.

SIGNAL LEVELS

The Gain control operates in steps of 6dB and is calibrated in units of dBC/0dBm. The logic and convenience of this arrangement will become apparent when the microphone is put into use.

1) Smoothly variable control of signal levels is the artistic job of the sound mixer, not of the microphone channel. The microphone channel is provided with a range of gain steps which are accurately repeatable in the event of a retake becoming necessary at a later stage. (For this reason, the settings should be noted on the studio log for each session or individual take).

2) For most professional purposes, a nominal output level of 0dBm is required (equivalent to 1mW into 600ohms). The gain setting is usually chosen to achieve this.

3) Most experienced sound engineers can estimate the probable loudness of the performance in 'Decibels' (An inaccurate description, the actual units are "dBC' – decibels relative to the threshold of hearing weighted for frequency on the 'C' scale).
If the sound engineer knows that, for instance, a single performer at 1 metre from the microphone is unlikely to exceed 88 dBC, the switch can be preset to that level and should be left at that setting for the entire performance.

The calibration of the Gain control is only approximate and should not be relied upon for sound level measurements. Sensitivity will vary, depending on the directional response selected and the position and nature of the sound source.

The microphone amplifiers can generate output signals up to +18dBm without overloading. This allows signals up to 18dB higher than the estimated levels to be passed on without distortion; to be attenuated, if necessary, by subsequent equipment in the signal chain.

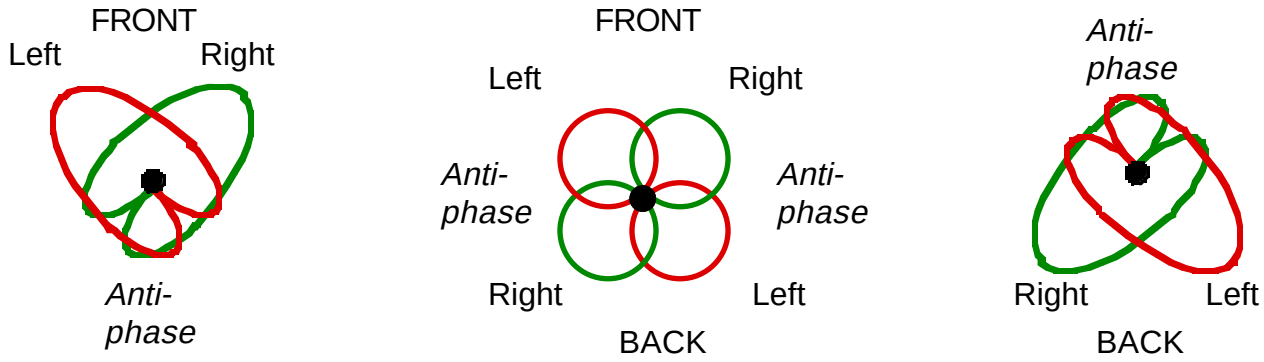
Note: Whilst professional equipment is designed for nominal input levels of 0dBm and can accept signals up to +20 dBm before overloading, there is a large amount of domestic equipment in semi-professional use, which cannot tolerate these levels. If domestic equipment is to be used, the Gain switch should be set two steps anticlockwise (-12dB) from the settings which would otherwise have been used with professional equipment. Alternatively a -13dB attenuator should be inserted in the output signal path.

STEREOPHONIC OPERATION

The front of the microphone is marked with a vertical black bar.

By means of the Direction Control, the polar diagram of the microphone can be altered smoothly from a 90° front-facing coincident cardioid pair through crossed ribbons (double figure-of-eight) to a 90° back-facing coincident cardioid pair.

Direction Control setting



The setting of the control may be altered during the performance if this is artistically justified. It will be found particularly useful for balancing the ratio of direct to reverberant sound. More information on the correct use of coincident stereo ribbon and other types of microphone will be found in "The Technique of the Sound Studio" by Alec Nisbett (Focal Press)

> "In particular, for two reasons, the double figure-of-eight is rarely used. The most important is the poor compatibility with mono: there are bound to be some listeners to a stereo broadcast or disc who will hear it in mono, and if the A — B signal is very large they lose a significant part of the information. What happens in fact is that they lose far too much of the reverberation, which is very strongly represented in the A — B component of a double figure-of-eight. The second problem is that the reverberation is picked up on both back and front of the microphone in roughly equal proportions, so that at low frequencies there is a phase-cancellation effect that takes some of the body out of the stereo reverberation, making it thin and harsh. This is noticeable in a concert hall and very marked in the more reverberant surroundings of, say, a cathedral. Switching the polar diagram even a quarter of the way towards cardioid reduces the effect significantly."

From this it can be seen that the crossed ribbons (double figure-of-eight) response will be particularly useful for achieving clarity in excessively reverberant and boomy acoustics. Because the response is symmetrical, the artistes can be arranged both sides of the microphone if this is convenient. Alternatively an acoustic screen can be used to remove the back response in very 'live' surroundings.

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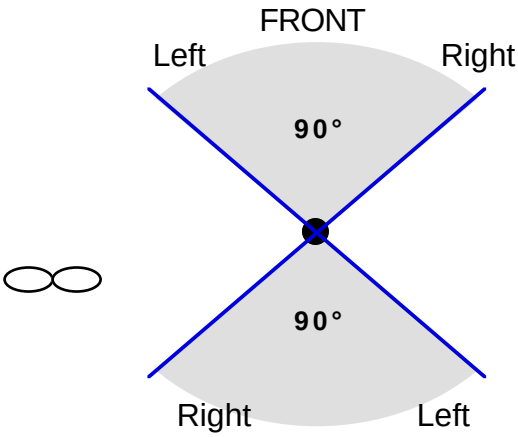
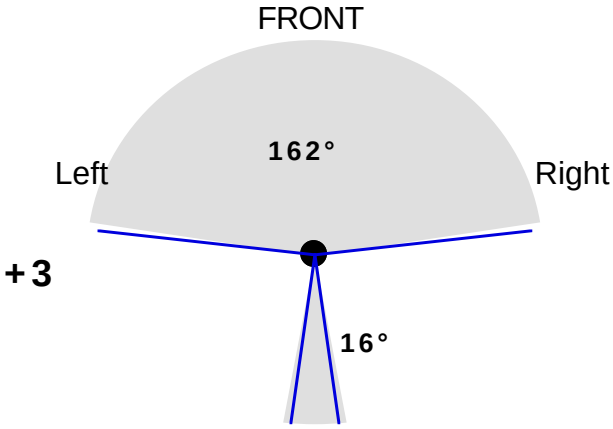
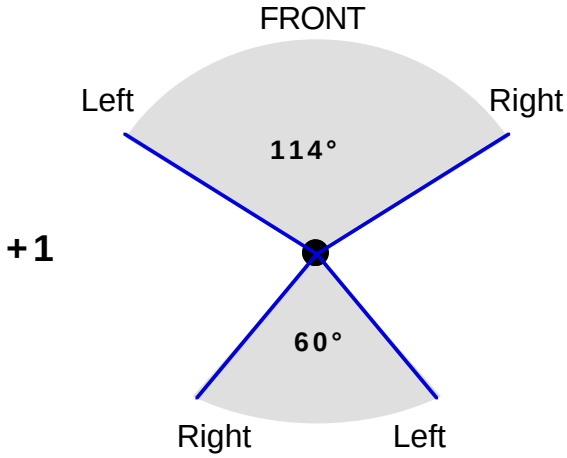
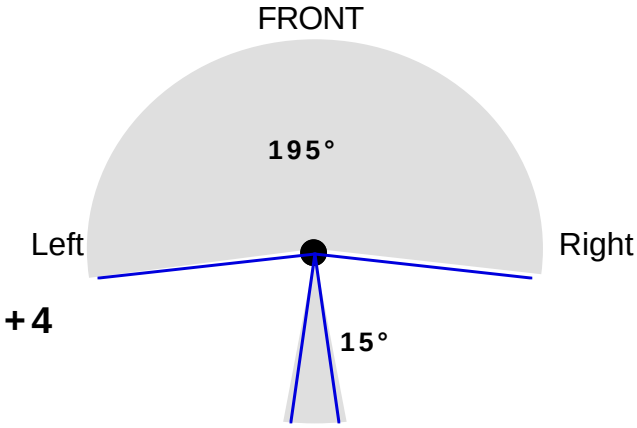
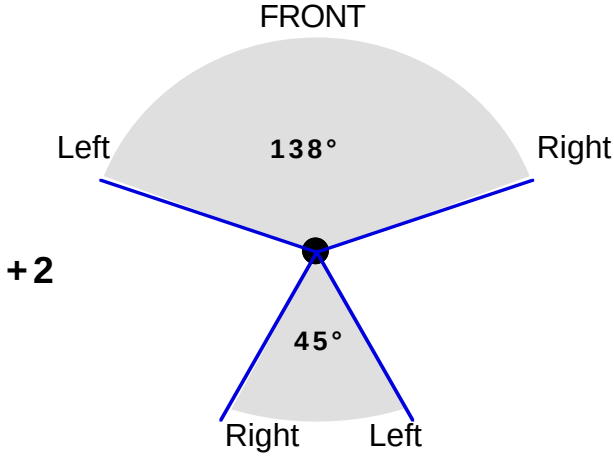
The effect of the Direction Control settings on the stereo field
Area of conventional stereo response shown shaded.

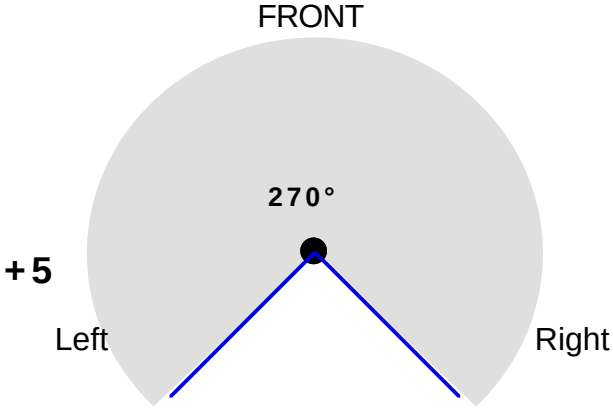






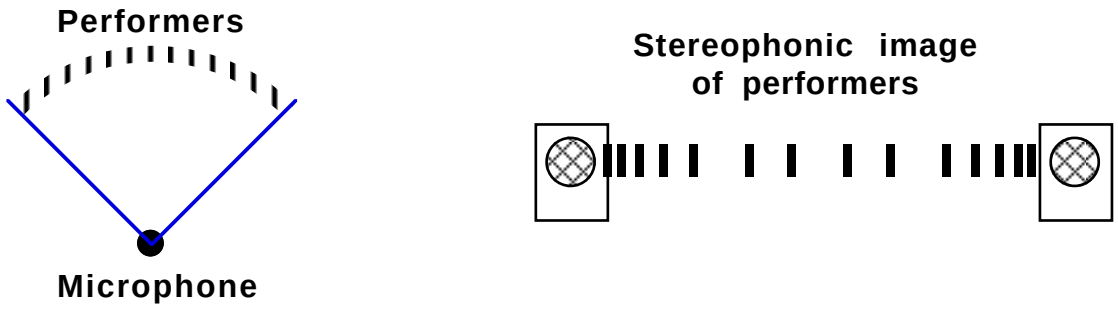






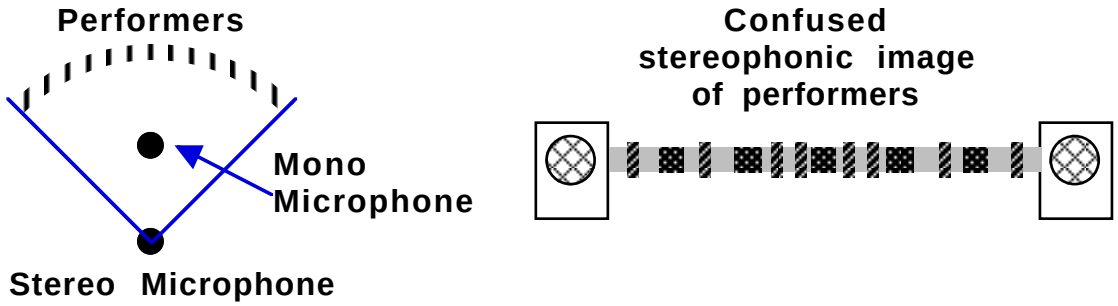
The effect of the studio layout on the reproduced stereo field

If the performers are spaced at equal angles to the microphone, they will appear unequally spaced when the sound is reproduced through a pair of conventional stereophonic loudspeakers.

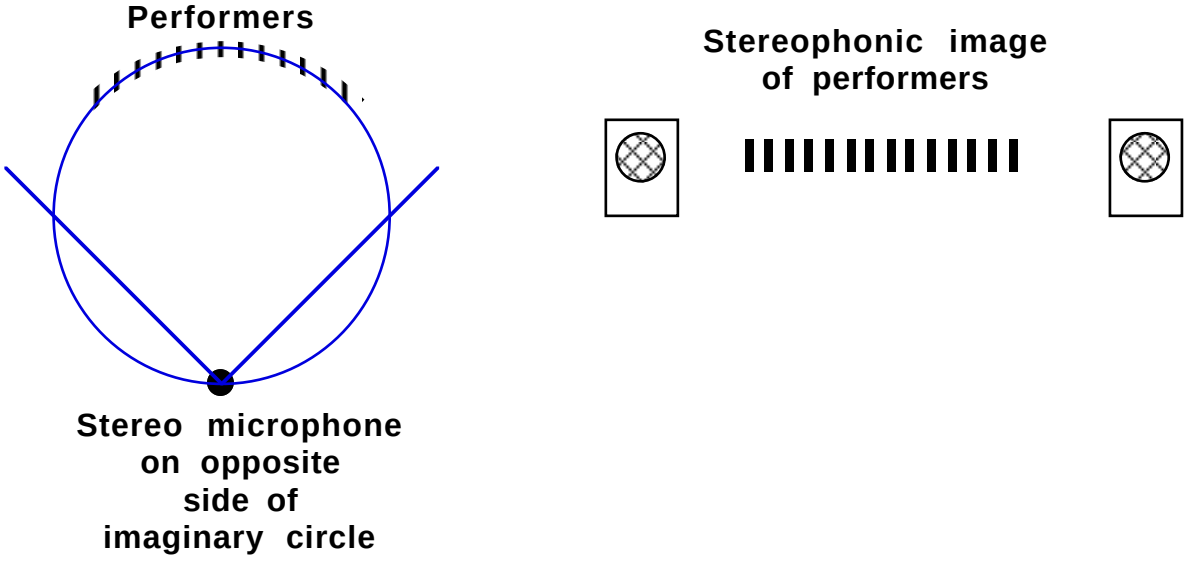


The effect is caused by the directional properties of the loudspeakers, but the recording engineer may wish to compensate for it during recording. It can be overcome in several different ways.:

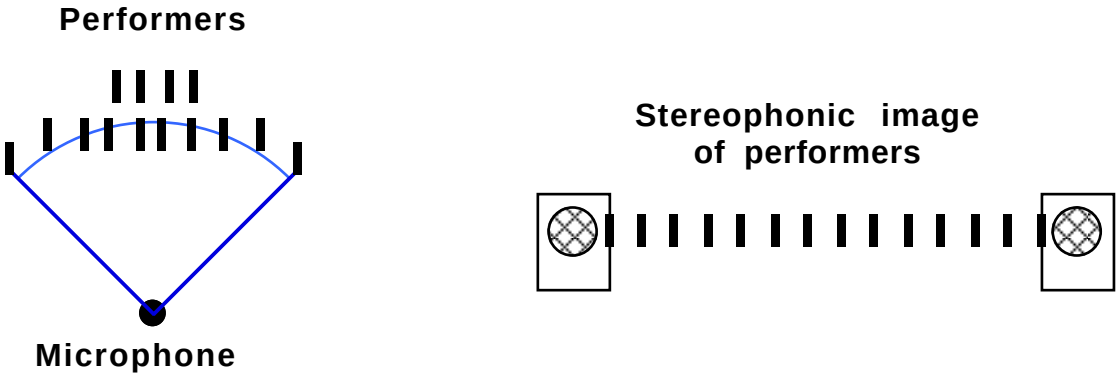
1) The output of an additional monophonic microphone is added in equal proportions to the two stereophonic channels. This fills up the 'hole in the middle' but gives an indistinct stereo image.



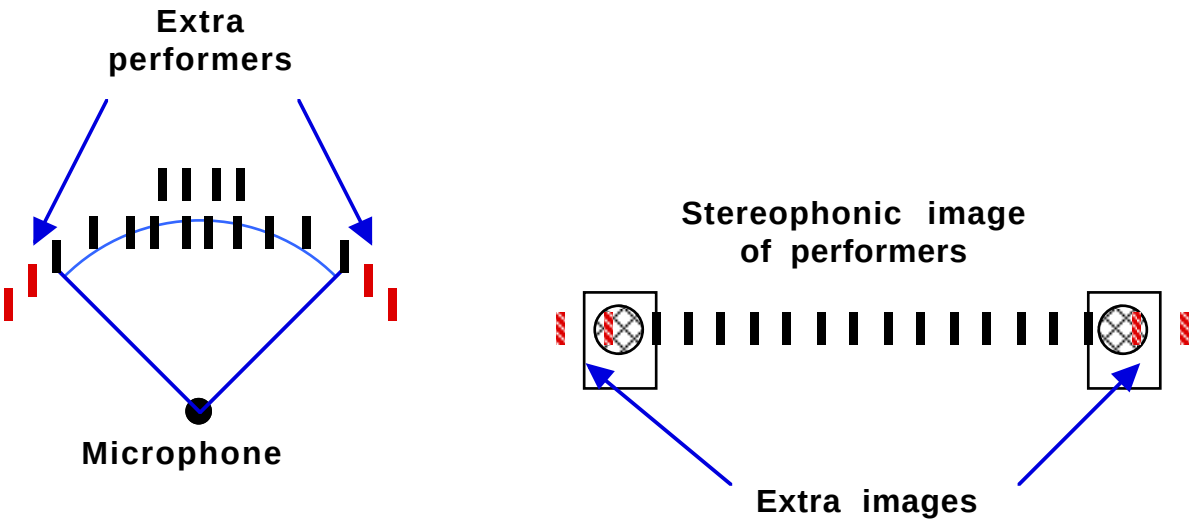
2) The stereophonic microphone is placed further away from the performers. This has the disadvantage that the sound field does not completely fill the width of the space between the loudspeakers and the ratio of reverberant to direct sound may be.excessive.



3) Rearrange the performers.



It is possible to extend the stereo image slightly beyond the width occupied by the two loudspeakers by placing performers outside the theoretical capture angle of the microphone. This is only effective for extending the sound field by a small proportion of its width and, if carried too far, will result in confused imaging.



This phenomenon can be used to particularly striking effect by arranging for a significant proportion of the distant reverberation to arrive at the microphone from outside the theoretical capture angle for normal stereophonic pickup. This will transfer the reverberation of the recording venue into the listening room in a natural way, which will appear to surround the listener. Care must be taken that the loss of this effect when the sound is reproduced monophonically does not result in a performace which sounds too 'dry'.

A more detailed examination of stereophonic image location will be found in: "Two-Channel Stereophonic Sound Systems" by F.H. Brittain and D.M. Leakey. *Wireless World. Vol 62* (May 1956) pp.206 - 210

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SPATIAL RESPONSE

In the crossed-ribbons mode, the plane of maximum sensitivity is at right angles to the longitudinal axis of the microphone body – the nulls of both channels are in the direction of the long axis. Sounds approaching from an oblique angle between these two directions will suffer partial cancellation which is frequency-dependent, this is because the path-lengths to the capsules of the array will differ and the sound wave will not arrive at all capsules in the same phase.

These effects can offer certain advantages in difficult acoustics, where the majority of unwanted reflected sound from the floor and ceiling will be arriving at oblique angles. Also, by angling the longitudinal axis of the microphone appropriately, it may be possible to considerably attenuate a single troublesome point-source echo or other source of unwanted noise.

If a performer or instrument is producing excessive sibilance, angling the microphone may help to overcome the problem.

The disadvantage is that care must be taken in arranging all the sound sources in the plane of maximum sensitivity if unwanted phasing effects are to be avoided.

BASS CORRECTION

As a sound source approaches a microphone with a 'velocity' response, the amplitude of the lower frequency signals will increase disproportionately, this is known as 'bass tip-up'. The 'ribbon' response is entirely a velocity (pressure-difference) response and exhibits this effect most strongly. The cardioid response also contains a velocity component and is affected, but to a lesser degree. The omnidirectional pressure response is not affected in this way.

To counteract bass tip-up, a 'Bass Cut' control is incorporated in the Control Unit. Its range of operation is approximately as follows:

Setting	**Speaking distance**			
c/s	**Ribbon**		**Cardioid**	
25	> 1.5 m	(4'6")	> 0.75 m	(2'3")
100	1 m	(3')	0.5m	(1'6")
150	0.7m	(2')	0.3m	(1')
225	0.5m	(1'6")	0.25m	(9")
340	0.35m	(1')	0.17m	(6")

These setting are only intended as a guide and the final settings must be judged by ear. There may be artistic reasons for preferring settings higher or lower than those for natural-sounding results, for instance: to increase the apparent distance of a sound source or, conversely, to produce a more intimate sound.

The settings and the artiste's working distance and position should be noted on the studio log for future reference in case a re-take should become necessary. It will be extremely difficult to edit together two performances where these parameters are significantly different; attempts at correction of the response, post-recording, would require very specialised equipment.

GENERAL CONSIDERATIONS

Whilst the microphone is reasonably robust, especially compared with conventional studio ribbon microphones, it is not intended for hard usage and will be damaged by rough handling.

The necessity for allowing an undistorted sound field to reach the capsules, places constraints upon the construction of the microphone housing. The main cylinder is formed from lightweight mesh with a low obstruction factor and is liable to become distorted if subjected to physical pressure or a moderately heavy blow.

The body and handle of the microphone contain electronic circuitry which must be protected from moisture. Should conductive objects or particles of metal find their way into the body or handle, severe damage may result.

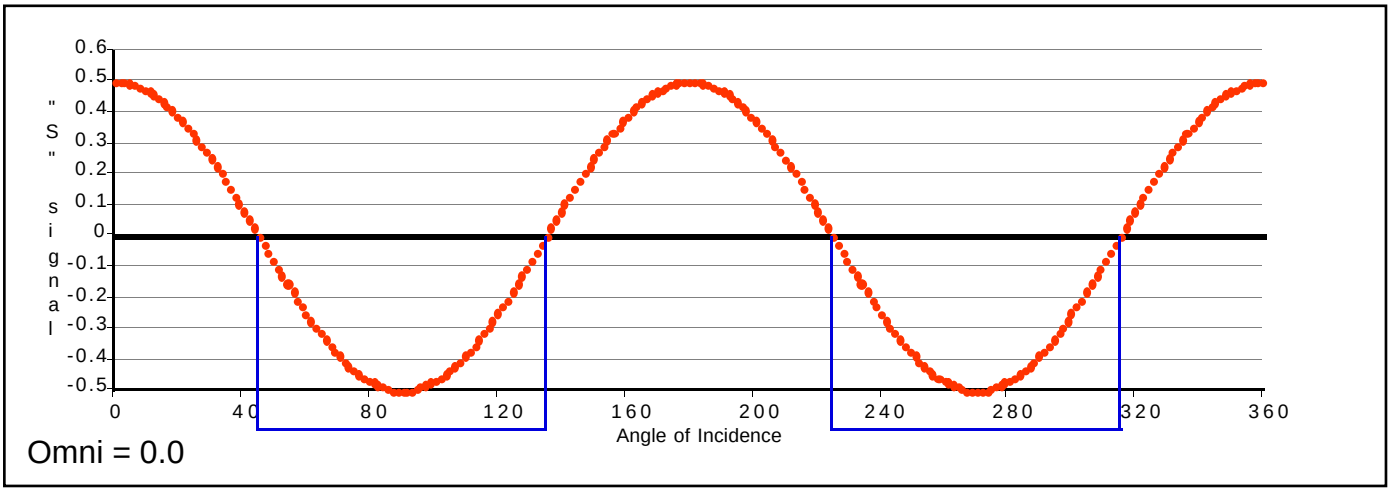
The inside of the microphone should not be allowed to become dirty. If cleaning becomes necessary the microphone will have to be dismantled; this is not a job for the inexperienced or ill-equipped.

The control unit should be protected from spillage of liquids. If it is suspected that any liquid may have entered the unit, immediately disconnect it from all sources of electrical power and do not attempt to use it again until it has been dismantled, thoroughly checked and, if necessary, repaired and safety tested.

Appendix 1

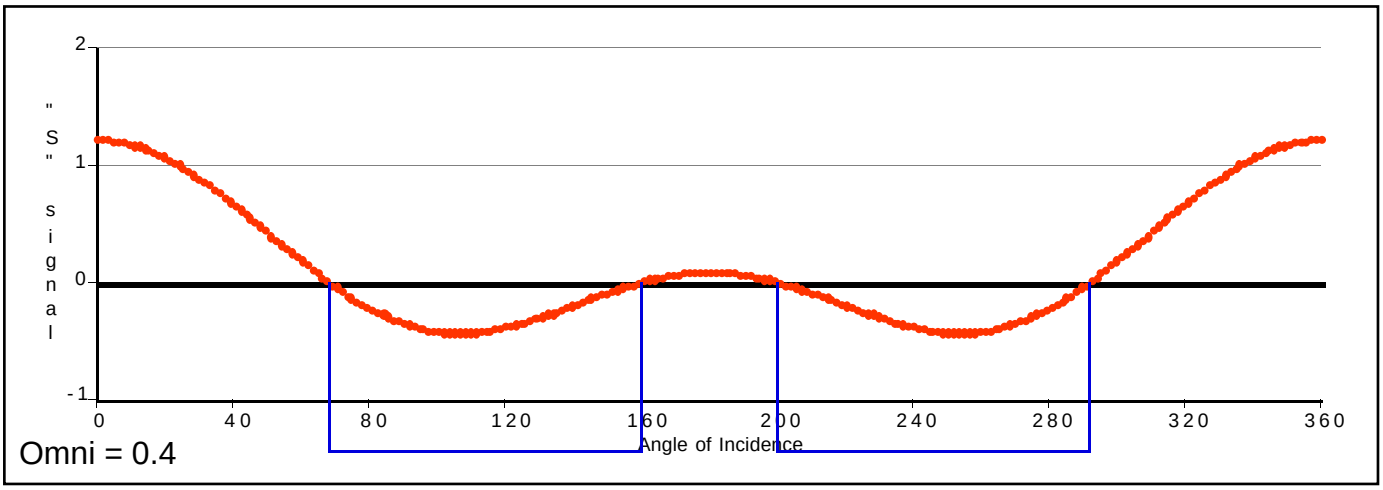
DIRECTIONAL PROPERTIES

The following graphs show the amplitude response of a single channel with respect to incidence angle for a fixed pressure gradient microphone combined with different amounts of omnidirection signal. The blue markings indicate the angle within which an antiphase response occurs.

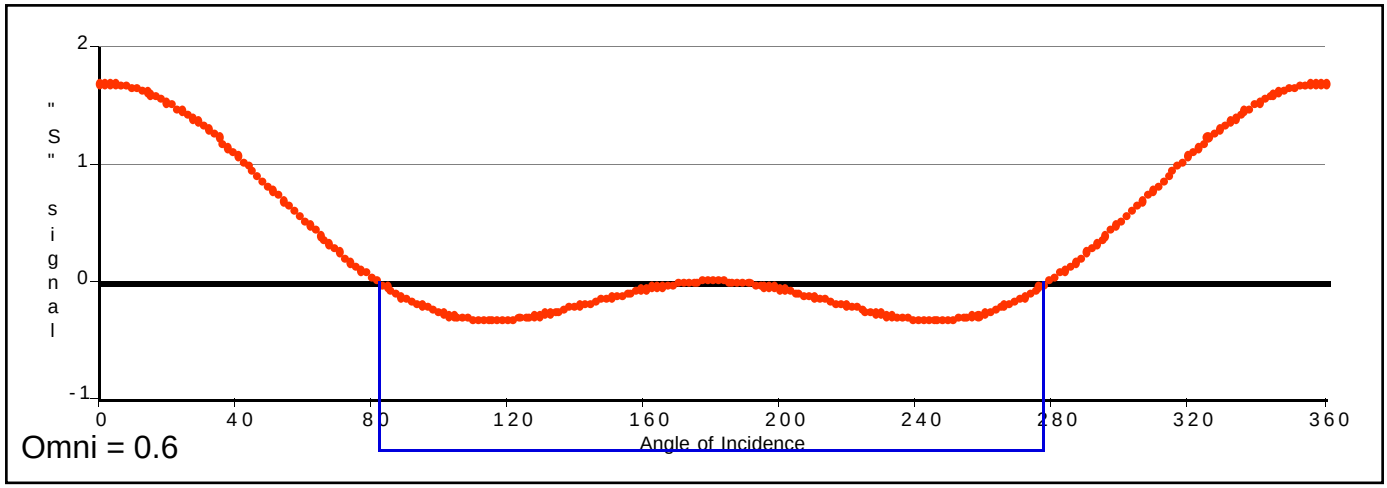


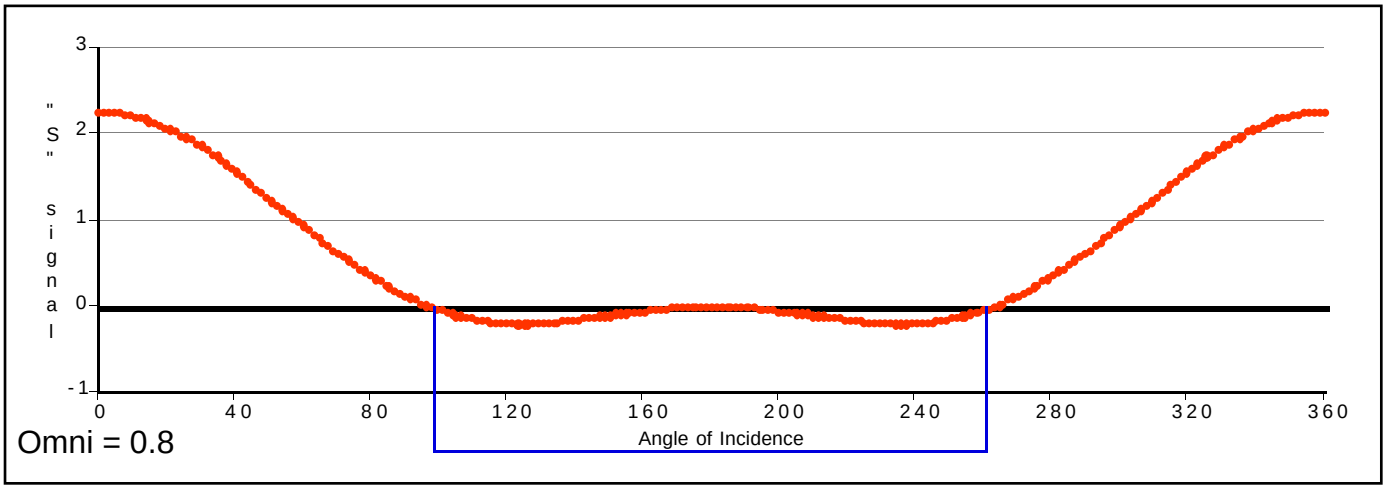
Omni = 0.0

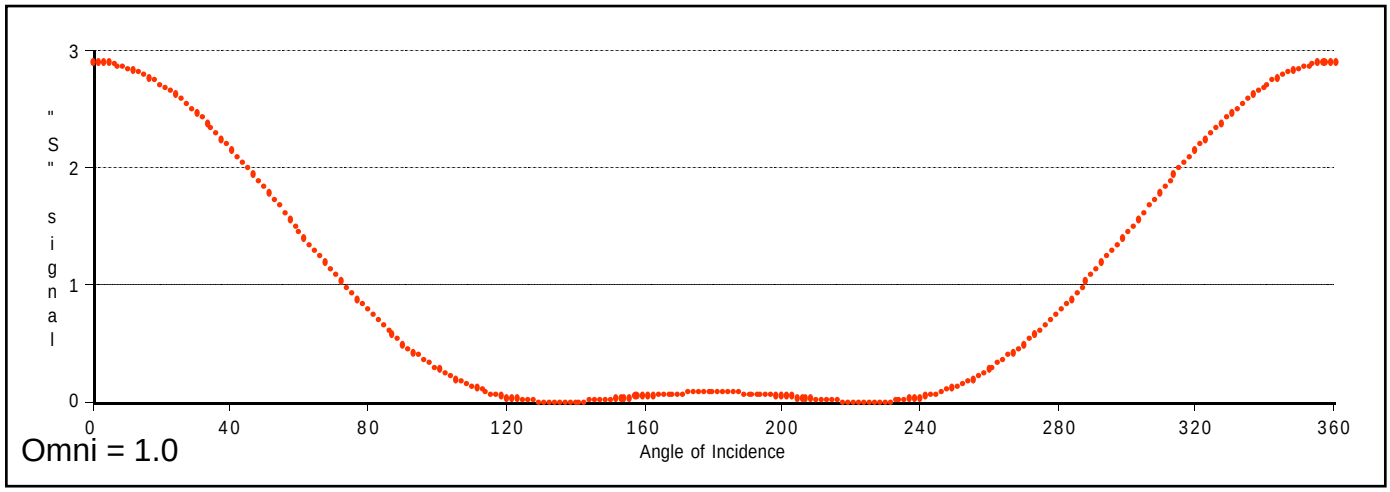
Omni = 0.2



Omni = 0.4


2
1
0
-1
"S" signal
0
40
80
120
160
200
240
280
320
360
Angle of Incidence
Omni = 0.6


3
2
1
0
-1
"S" signal
0
40
80
120
160
200
240
280
320
360
Angle of Incidence
Omni = 0.8


3
2
1
0
"S" signal
0
40
80
120
160
200
240
280
320
360
Angle of Incidence
Omni = 1.0