

Sound for Scout Shows



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Introduction

This is the first edition of support to Producers and Stage Directors on the subject of sound reinforcement and amplification. Further editions will be produced in the light of experience from this edition. The publication of further editions will be notified in Scouting Magazine, Talking Points and the Activities Newsletter.

How to use this guide

This guide contains three levels of information. The bold type is intended for those who require an overview of the subject and each bold paragraph can be read in isolation. The conventional type contains more detail and will be of use by the sound engineer or technician. Further technical detail is included in *Italics* for anyone who is sufficiently interested.

Microphones

As with most things in life, you get what you pay for. Microphones come in many shapes and sizes. The specification which is usually provided in the equipment catalogue will describe the performance in detail.

The first part of the specification to look at is its polar response. This is a description of the shape of the area around the microphone, which is sensitive to sound. The diagrams in *fig 1* show the most common types, omnidirectional, cardioid (uni-directional) and hypercardioid (shotgun).

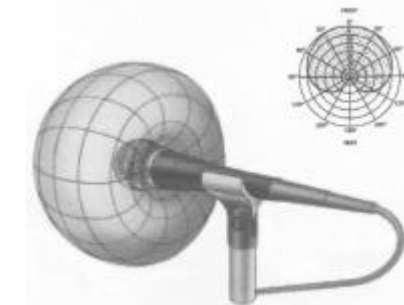
The next part of the specification to study is the impedance. The lower the figure, the less susceptible the microphone will be to interference

on the cable. It also means that the signals from the microphone will be smaller and this can

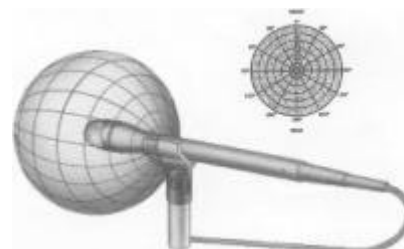
Fig 1



Hypercardioid



Cardioid



Omnidirectional

sometimes cause other problems. However, most modern microphones for professional and semi-professional use are between 200 and 600 ohms impedance.

Some types of microphone i.e. capacitor or condenser specify phantom powering. This is usually about 48 volts d.c. and is used to polarise the plates of the microphone capsule and power a small amplifier circuit inside the microphone.

Most good quality microphone mixers have this facility.

Positioning

For use on the front of the stage, hypercardioid microphones are the most useful as they have a high gain characteristic in front of the microphone and little to the sides and rear. Often, these type of microphones are physically long as they obtain their directional properties from a pattern of holes cut in the tube in front of the mic capsule. These are called shotgun or short shotgun mics. However, there are some hypercardioid mics which, like the Beyer M201 or AKG D95, are housed in 'conventional' housings.

One of the myths of sound reinforcement is that the more microphones that you use the better they pick up of the performers. This is not necessarily true. Not only does the large number give the sound technician a headache when balancing the mics but each microphone added requires that the overall level of all other mics is reduced with no net gain apart from possibly some pick up in an area not covered.

The front of the stage should be covered with a row of microphones spaced 2 metres apart and directed towards the rear wall of the stage, at about head height to the performers. For a typical review type show such as most Scout performances the producer can have more influence on the overall quality of the sound than any amount of planning and work by the sound crew. If the producer can be persuaded to 'set' or 'block' weak or solo performers on the front of the stage by the microphones both the quality and the quantity of sound will be as good as it can be. It is also essential that performers are instructed to face the audience when they are speaking or singing. A microphone on the front of the stage cannot pick up sound that is not there.

Radio Microphones

Radio microphones transmit their signal by radio waves and have no need to be connected to the amplifier with wires. These allow performers to be personally miked and give the best coverage whether or not the performer is at the front or back of the stage. The performer has almost total freedom to move around the stage.

Lapel or tie clip radio microphones are tiny microphones connected to a 'belt pack' transmitter. As the microphone is so small, it can easily be concealed in clothing or in the performer's hair or by the side of their face, and will give a constant output wherever the performer is on stage. Performers can also use headset microphones.

Hand held radio microphones are like large conventional microphones and contain both the microphone capsule and the transmitter in the microphone housing. They are very useful when one mic is being used by several performers as they can be easily passed from performer to performer. They are, however, not discrete and can only be used where it does not matter if the microphone is seen by the audience.

Only one microphone can be used on each channel at any time and the Radiocommunication licensing agency has made provision for five radio channels to be made available for low power radiomicrophone use. These are available to the amateur theatre without the need for a licence. However, it is not possible to use all five channels simultaneously as some of the frequencies might mix and cause interference to each other. If you are planning to use several radio microphones, avoid the frequencies of 174.8MHz with 174.1MHz.

Further frequencies in the VHF and UHF band are available but a licence is required from the Radiocommunications Agency before they can be used.

Loudspeaker

There are as many types and models of loudspeaker as there are venues in which to perform. Many Scout shows will be performed in small halls and small theatres, almost all of which are rectangular in shape with 'hard' walls, acoustically, the worst design possible.

When considering speaker position this type of hall leaves little flexibility, but remember one fact, the design of the human head with one ear on each side allows the brain to distinguish between sounds from the sides but it is unable to identify which sounds originate from above or below the performer. Often extra gain can be achieved from a sound system by raising the speakers to the height of the top of the proscenium arch. This effect is seldom noticeable to the audience.

Many people reading this will not own equipment and will beg, borrow or hire the equipment for their show. It is often tempting to select the cheapest option and accept Johnny's dad's speakers "cause they can handle 500 watts and he used them when he played in a band". More often than not, they will be totally unsuitable and will cause more problems than they are worth.

Modern loudspeakers designed for sound reinforcement are often quite small and many hire companies use Bose 802s or similar. They are very rugged and can safely and easily be mounted on a portable tripod. A good speaker to hire, but not to buy as they will cost the entire budget of a small show. If you are planning to buy speakers there are better options at considerably lower cost.

Many commercial loudspeaker manufacturers supply speakers suitable for use in the theatre. As with microphones "you get what you pay for" but excellent products can be obtained from JBL, Bose and Fostex.

Speakers should be positioned in front of the mic's to reduce feedback.

Control and Amplification

When you have selected suitable microphone and speaker positions you must select a

suitable mixing desk and amplifier. The mixer is designed to allow the operator to control all of the input signals and adjust the level of each to provide the required level of each signal to the power amplifier at the right time.

Mixers vary in size and capability but all have basically the same features. Fig 2 (pg2), over, shows the features of a typical 12 channel mixer. Looking at the left hand side there are 12 identical sets of controls, each column provides control for one input channel. From the top we see a rotary gain control. This sets the gain of the channel allowing it to be used with very low signals as well as with high level signals like tape recorders. Next are 4 equaliser controls. These are tone controls just like the bass and treble controls on your home stereo but there are four to allow finer control of the frequency spectrum. Some modern mixers have parametric equalisers - see the glossary for a description. The next four controls are called auxiliary outputs but may be called foldback outputs. These allow a variable amount of each channel to be fed to another amplifier and speakers and may be used to allow the performers to hear the band or to drive an off stage monitor or calling system. These outputs could also be used to feed effects units to give reverb or echo to create special effects. Foldbacks may be described as pre-fader or post-fader. Pre-fader means that the signal to the aux output is derived from before the fader. Post fader is where the output is in proportion to the position of the fader. Post-fade outputs would be used for relaying the show to the dressing rooms and calling systems so that the output will be exactly the same as the audience will be hearing.

The last rotary control is a pan-pot. This allows for a proportion of each channel to be fed to the two master channels of i/p's a stereo and speakers in different proportions making it appear that each microphone is positioned in a different place in the stereo image. Finally, the channel fader. Once the mixer has been properly installed and set up and levels set, this is usually the only control, which needs adjustment.

The other items on the diagram are switches and are usually push buttons. The button near the top allows the equaliser section to be switched out and the set of three buttons near the master fader allow the output of the channel to be fed to each pair of group outputs (1+2 or 3+4) or directly to the left and right (L+R) main outputs.

The next four columns are the group outputs and, provided the push button switches on each input channel have been pressed to select the group output, the main amplifier could be connected to a pair of group outputs and all would be well. Four groups and two main outputs can be used to allow you to drive more than one set of speakers and to be able to vary the amount of each input being passed to each set. For example, it may be useful to feed the signals from the band to a more robust set of speakers in the orchestra pit. The group output could also allow you to provide another feed which could be used for a recording output. The rotary controls on the group inputs are auxiliary outputs which are intended to be used as the return from an effects unit which has been supplied with a signal from one of the rows of auxiliary outputs or foldbacks. The correct amount of "return" can then be mixed with the main output.

The main outputs are usually to drive the main PA amplifier.

Amplifier

There are many myths about the size and power needed for a PA or sound reinforcement system for use in a theatre. Enormous amounts of power are not necessary. Enough power to allow the chosen loudspeakers to handle the loudest parts of the performance without distorting is required and this is often quite a small amount

Sound reinforcement systems should not be obvious. Ideally the system should reinforce the performer and the audience should believe that it is the performer's voice that is being heard. An over loud system becomes a public address system and the audience only hears sound emanating from the loudspeakers. Some shows

require this type of amplification but it should be used only as and when required.

In general select an amplifier suitable for the loudspeakers and also suitable for the show. Usually 100 Watts per channel is adequate for a small hall and modern speakers.

Connecting the System together

To design the system, start with the loudspeakers, identify the best location to suit your requirements and fit them temporarily. Secondly decide on the sound engineer's operating position. This needs to be in the body of the hall or auditorium and should ideally be 2/3 the length of the hall back in a central position. Safety is paramount and cables draped across the floor can be a real hazard. Cables must be gathered and laid neatly and fixed to the floor. Check venue for Health and Safety guidelines.

The microphones are normally connected to the mixer using a multicore cable which allows one thick cable containing many individual microphone signal cables to be laid in one operation.

Operating the System

If a sound reinforcement system in a theatre is working well, the audience should not be aware that it is in use. This seems a rash statement but usually it is only when something goes wrong like the leading lady cannot be heard or a critical part of the dialogue is drowned out by the howl of feedback that the sound operator is noticed.

The most important thing to remember when operating is to be sympathetic to the performance. Don't suddenly turn the gain of microphones up and down, creep them up to preset limits. Know the system, be aware how far a mic channel can be turned up before the system becomes unstable and feedback occurs. Remember one mic on its own can be turned up further than five all at once.

Next design the sound plot, know the show and ensure that you have a copy of the script and mark it with relevant notes to remind you which mics soloists use and which parts are the quietest and which are the loudest.

Sound effects should be used with care and the script marked with notes to ensure that the effect can be heard and does not blow the audience out of their seats.

Amplifying the Band

For small shows it is usually better, and certainly far easier, to allow the band or orchestra to sort out their own sound balance using their own equipment. The musical director knows precisely what sound they require and is best placed to control that themselves. It is, however, worth developing a rapport with them as bands do have a tendency to get carried away and as the show week progresses the volume increases in proportion to the band's confidence. If they are aware of your problems and accept that you are in an ideal position to assess the overall sound balance, they will accept your requests for more or less volume to achieve the correct sound 'picture' for the show.

If it is necessary to amplify the band, the equipment which you will require will need to be capable of handling considerably more peak power than that described earlier. Sound levels during loud passages from electronic instruments are very high and have a high harmonic content, the surest way to wreck a pair of loudspeakers.

Ideally, a separate system will be used to allow the band loudspeakers to be located nearer the performing area so that the sound appears to originate from the band rather than from speakers at the side or in the roof.

Most electronic musical instruments have separate amplifiers and speakers designed for the instrument and it is best to allow the performer to retain this unit so that he can hear himself. Connection to the main system is made via a direct injection box (DI box) which is connected between the instrument and the amplifier and takes a proportion of the signal and feeds it to the mixer of the main system. Other acoustic instruments will require a conventional microphone and there are several commendable

texts describing the location and type of microphones to use for particular instruments.

However, beware, to satisfactorily mic a band or small orchestra requires a considerable amount of equipment. Professional sound engineers regularly use an array of 12 mics on the drum kit alone and consider that 8 is the absolute minimum. The hire cost alone could be enormous. Secondly to achieve the correct sound balance that the MD and the band are happy with can take a considerable amount of time and lashings of patience and diplomacy.

Sound Effects

The use of taped sound effects is often a major requirement for the small show, particularly when the hall is small and the performers have been encouraged to project. Sound effects are available on tape, CD or minidisc.

The critical requirement of sound effects is to be able to cue the effect so that the audience hears the effect at precisely the right moment. This is impossible with cassette tape and can only really be achieved using reel to reel tape which is edited to allow leader tape to be inserted into the tape to identify the start of an effect. Cassette tapes are useful for longer effects such as rain or wind which do not require precise timing.

It is possible to use CDs as these can be cued up accurately at the start of an effect although it is only possible to use effects, which feature on your CDs. Often the required effect is a mix of several different effects.

An increasingly common trend is to use multimedia PCs to both produce and replay sound effects. Some excellent packages exist for this and CD Roms are available containing digitised sounds.

Other Effects

Many commercial units are available to modify the sound, which is emitted from the loudspeakers. Most units are designed to alter the sound of electronic musical instruments. However, one or two are useful

in sound reinforcement systems but they must be used with caution.

Reverberation and Echo

These effects are basically similar and are produced by feeding a small amount of the signal back into the input after a delay. The length of the delay determines whether the effect is called reverberation or echo which requires longer delays. Reverb is most useful to reinforce the sound of a soloist giving a more robust "fuller" sound.

Graphic Equalisers

These are sophisticated tone controls which allow the user to cut or boost selected frequency bands. The most expensive models have three controls in each octave, the cheaper units only one per octave. Graphic equalisers are useful for

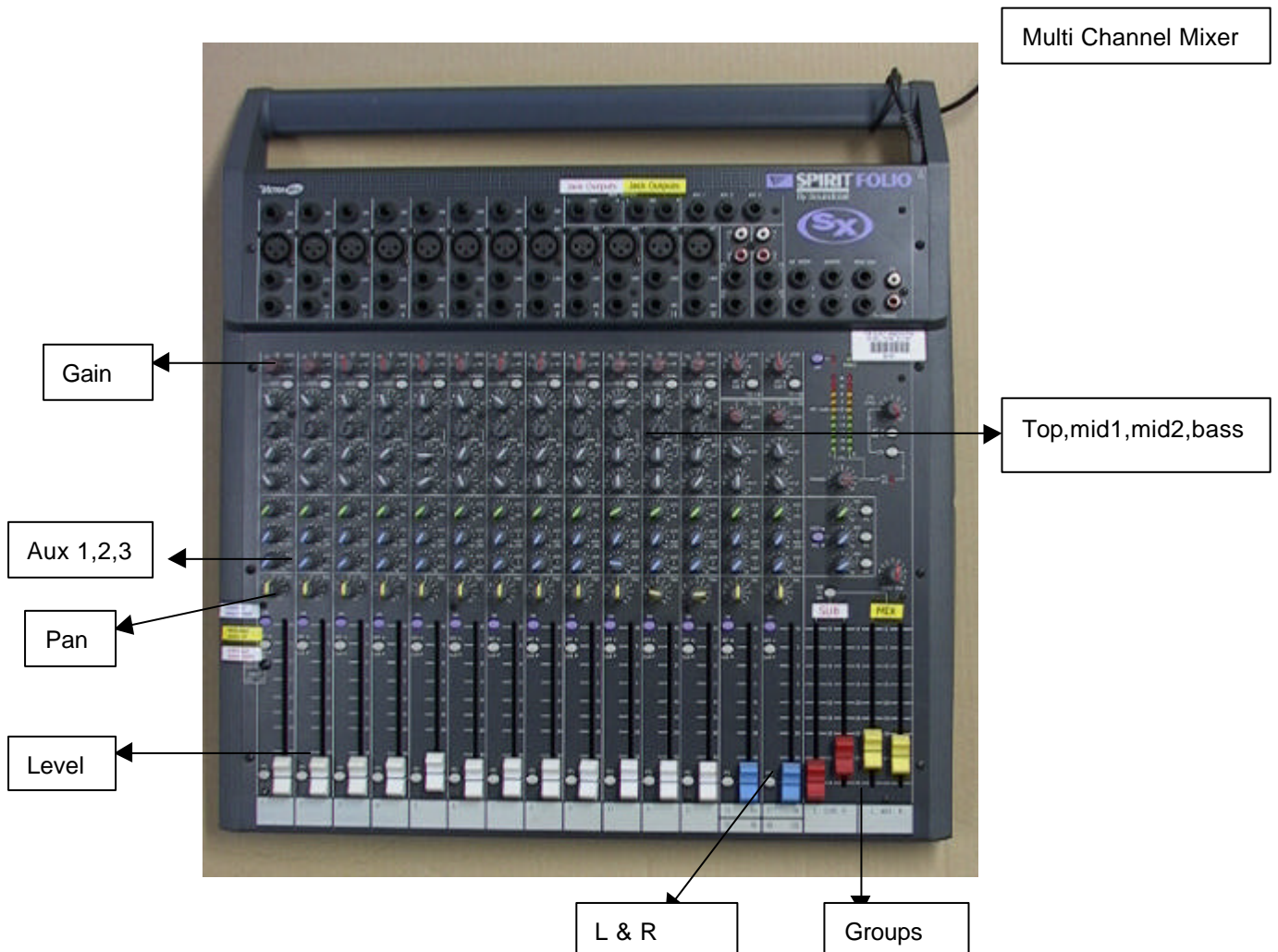
correcting the acoustic performance of a hall to reduce the likelihood of acoustic feedback.

Insurance

It will be usual to have to supply your own equipment for a show held in a school or community hall and to supply extra equipment for some theatres. This will have to be begged, borrowed or hired. Remember, that this is valuable equipment, which will be expensive to repair or replace if it is lost, stolen or damaged. Please ensure that adequate insurance cover is included in your budget and don't forget to actually arrange the necessary cover.

Publications Cross Reference

Radio Microphones – RA16 – Radio Communications Agency



Glossary

Amplifier	Amplifies the electrical signals to power the loudspeakers.
Balanced Line	This is a technique to reduce the interference possible on cables carrying the very low level signals from microphones. It comprises two wires (with an outer screen) into which the electrical signal from the microphone is fed in opposite phases.
Boom	Used to describe the horizontal component of a microphone stand.
Cardioid	Heart shaped microphone pick up pattern which gives good directionality.
Echo	Sound effect produced by delaying the sound and feeding it back into the amplification system after a time delay.
Equaliser	Frequency spectrum modification device which allows the frequency response of an amplification system to be adjusted to compensate for the acoustics of a hall.
Fader	Term used to describe a linear volume control.
Feedback	Acoustic feedback, sometimes called howl round. A loud howl caused by the sound from the speakers being picked up by the microphone and further amplified until it becomes unstable.
Foldback	Term used to describe the technique of feeding amplified sound back to the stage. It is often used to allow the performers to hear the band.
Mixer	A device for amplifying and controlling electrical signals from several sources, microphones, tape players etc.
Parametric equaliser	Type of frequency control device which allows both the centre frequency and the level of boost or cut to be adjusted.
Radio Microphone	Microphones which require no lead to connect them to the amplification system. Two types are commonly available, hand held (which look like a large conventional microphone) and the lapel types which comprise a small battery powered transmitter pack and a miniature microphone. Both types need a receiver to convert the radio signals into electrical signals for feeding into a mixer.
Reverberation	Sound effect which produced the impression of performing in a large empty hall.
Rifle mic	Sometimes called shotgun mics and describe microphone pick up patterns which are highly directional.
PLR	The description of the most common plug and socket type used for connecting audio sources.