Live mixing techniques

Mixing a live band involves a multitude of variables, and the sound engineer is expected to deal with them all. A knowledge of PAs, microphones, instruments and musicians is essential. In the first of an occasional series, Konrad Skirlis delves into some of the factors related to setting up a PA.

The acoustic space

The aim of live acoustics is to project the sound of the stage performance to the whole audience simultaneously, with the same frequency characteristics and intensity. This ideal, though, is difficult to achieve. In a live band situation we are listening to a number of musical and vocal sources at the same time, reaching the listener in different ways. Along with direct stage sound, music will reach the listener by reflecting off surfaces such as ceilings, walls and floors. Reflections around the stage area will also affect the overall sound, for example a brick wall behind the stage will cause unwanted reflections, but a backdrop draped over it will reduce these problems.

One side effect of hard boundary surfaces is the formation of standing waves. In short, a standing wave will be formed if a half wavelength of the sound ‘fits’ the distance between the walls. Where wave crests (points of maximum pressure) coincide, they combine and reinforce one another. Their position in space depends on the frequency of the sound, i.e. air-pressure zones are spaced at distances of half the wavelength.

To combat standing waves a well designed venue has non-symmetrical walls, sloping ceilings, absorbent rear walls, and convex surfaces throughout. Unfortunately though, most playing areas haven’t been designed with acoustics in mind. Most venues are acoustically ‘live’, with parallel walls and resonant characteristics. A sound engineer needs to make decisions based upon the acoustics of a room in which the band and PA is set up.

Eliminating feedback

Feedback is one of the most common problems associated with playing live – the source of which usually originates from stage monitors. Microphones are placed closer to monitor wedges than the front of house (FOH, the sound system addressing the audience), so their placement, relative to the vocal microphones, is crucial for controlling feedback. Figure 1 shows a monitor positioned in front of a performer (and hence the back of the performer’s microphone). In this case, a mic with a cardioid polar response is the best choice, because the monitor will be placed at the ‘null’ point of the mic – the spot where the cardioid pattern rejects sound. Often though, two monitors are required for extra volume (Figure 2). A hyper or super cardioid mic is best suited to this monitor placement because its pick-up pattern rejects sound more efficiently from the sides where the monitors are situated. The monitors are placed towards the singer’s ears but are moved slightly to the side of the mic stand. Because a hypercardioid mic has a pickup ‘lobe’ at the rear, it is not suitable to use with a monitor placed directly behind it (as in Figure 1). If you can afford it, removing floor monitors and using an in-ear alternative can eliminate feedback problems altogether.

Equalisation

Equalisation shapes the overall sound of a live performance and is used to eliminate any anomalies in FOH and stage sound. One of the sound engineer’s most valuable tools is a graphic EQ that controls frequencies at 1/3-octave intervals. Third-octave equalisation corresponds well with the critical bandwidth of the ear. Third-octave equalisers are usually found in the guise of 19-inch rack mounting units and are the most widely used means of correcting sound and controlling feedback. Conversely, desk EQ should be seen as enhancing each channel of sound, rather than for any corrective purposes. In order to have such control, a 1/3-octave equaliser should be placed between the desk sends and amplifiers. For example, a stereo PA (left and right master desk outputs), will need a stereo 1/3-octave EQ for optimum tone control. This will allow
equalisation changes to be made on each side of the FOH (and therefore each side of the room). For example, a venue fitted with glass doors down one side for the length of the room will need corrective equalisation (particularly on the speakers facing that side). Glass tends to reflect high frequencies, so by systematically boosting the higher frequencies on the FOH equaliser, the offending frequencies will become clearly audible and can be isolated and cut to suit. Comparison of left and right FOH EQ should then yield a balanced sounding room.

Similarly, a 1/3-octave EQ can be utilised for each of the stage monitor sends, e.g. outside wedges, centre wedges, side fillis and drum fill. A widely used method of reducing feedback is equalising the monitors to attenuate the frequencies where feedback occurs or is likely to occur. The engineer will need to ‘ring out’ each monitor send to remove offending frequencies. This is done by carefully raising the vocal mic gain feeding a stage monitor, so the monitor engineer can hear the offending frequencies slowly creeping up. The engineer will then drop the mic gain (to avoid feedback howl), isolate the nasty frequency on the corresponding equaliser and attenuate that frequency band – thus reducing the possibility of feedback. Constantly speaking into the mic between EQ adjustments will optimise gain before feedback and ensure that each adjustment is improving the foldback sound. Remember to give yourself extra headroom with stage monitor levels – chances are you’ll need it once the band lets rip.

Using the same brand of vocal microphones and monitors night in night out will help make the stage monitors easier to EQ and the likelihood of feedback will be reduced. Choosing microphones that have a high gain before feedback, e.g. an ElectroVoice N/D 957, will help achieve a louder signal without increasing the risk of feedback occurring. ‘Ringing out’ the system is best done before the band and their fans reach the venue. This not only gives their ears a rest but also reduces the possibility of band personnel speaking into an open mic while equalisation is taking place.

Having a good sounding system ready to go also gives you more time to organise the band and concentrate on a good sound check.

Another method of room equalisation is by using a real-time analyser (RTA). This may be the most sophisticated (and expensive) piece of equipment in any sound person’s tool kit. RTAs are used to obtain an instantaneous display of a sound system’s frequency response. By placing the RTA’s measurement microphone at the critical listening distance (about 1-2 metres away from the speakers), reverberation does not become a factor and a more accurate measurement takes place. Applying a pink noise source to the main system (before EQ) and bringing up the system volume to a comfortable measuring level allows you to use the system equaliser to make adjustments for a flat frequency response. Finally, play recordings that you are familiar with and fine tune the system equalisation to taste.

**Phase Check**

Phase is an important element in live sound and can impact on your overall sound in a number of different ways. Phase essentially describes the relationship between two or more waves and how they affect each other. One crucial element in any sound system is making sure the physical alignment of the speaker boxes is okay. The positioning of the PA itself is crucial to attaining good live sound – a few inches out can make all the difference, especially in an outdoor concert. Positioning the speakers so they provide coverage of the audience (rather than the walls or ceiling) will help control the sound fed into a room. Poor positioning may result in dead spots (where phase cancellation occurs between the conflicting output of two or more speaker cabinets) and uneven dispersion.

Phase also refers to proper electrical wiring – non-standard wiring in your gear can give you phase cancellation problems. Start out by checking that outboard effects, including equalisers, are wired according to spec – not all manufacturers keep to a standard! Packing a multi-meter will help check correct wiring. Also, phase reversal leads are an important part of every engineer’s sound kit, they provide an easy way of correcting phase without rewiring. Out of phase signals end up sounding thin and weak.

Paradoxically, having a mic out of phase may actually help reduce feedback! If you are having problems with feedback on a certain microphone, try hitting the phase reversal switch on the console – it can work wonders.

**Tuning the system**

With the EQ flat (or bypassed), and using the lead singer’s microphone, talk into the mic, panning left and right to make sure each side is working equally (assuming the PA is running in stereo). By adjusting the crossover, you should be able to get a good balance of highs, mids and lows. This forms the basis for equalising the system. While riding the channel fader, with sub-groups and master fader set at zero (unity gain), you’ll be bringing up the mic preamp to where it’s needed. Using PFL metering ensures that the vocal channel is not being overloaded. This method reduces the risk of distortion and gives you a more open desk sound. Using a high pass filter on vocals (usually around 100Hz on the desk) filters out unwanted low frequency rumble. If you know the sound of your own voice well enough, you should be able to attenuate frequencies that are problematic in the room. For example, if the room is emphasising everything around 800Hz, use your FOH equaliser to cut back at 800Hz to keep things under control. With the FOH tuned to optimise vocals, you can then use desk EQ to sweeten the sound of individual instruments. Running a CD of your favourite music is another good method of checking that the PA is sounding good.

![Fig 2](image)

**Fig 2** Using a hypercardioid mic, the least sensitive area is around 45° away from the rear axis of the mic. To minimise feedback, the monitor should be offset to make the most of this.