



# Sound Check

✝ Church Audio ✝

## PRE-START

When you work 'Live' you need to be prepared:



A supply of spare batteries (for Radio-microphones, Effect Pedals, etc) ... and not just for you... musicians with flat batteries suddenly become your problem too. A small (discrete light) torch to see the mixer controls when they dim the lights, and to see connections inside cabinets, etc. Always include a wide tape (Duct Tape) (Gaffer Tape) for troublesome microphone stands, and to tape cables to the stage or carpet for safety from tripping. Masking tape (Painters have tape that doesn't leave adhesive when you peel it off) and a thick pen for writing words on mixer channels, equipment and cables. A set of headphones that completely covers your ears (isolates you from surrounding noise) so you can hear soloed channels on the mixer when you press PFL. Music for checking that the loudspeakers and floor monitors are working before the musicians arrive, and for playing background music later during Intervals.



**Spare Adaptor-Jacks (Crossovers).** *You never know what combinations will be needed, people always show up at the last minute with unexpected requests.*

*XLR to Phone and XLR to RCA (although a DI Box is preferred) to connect balanced and non-balanced systems.*

*XLR plug-to-plug and XLR socket-to-socket adaptors allow you to invert XLR cables. Needed for inverting a snake cable direction when you need to send a signal from the mixer to the stage.*

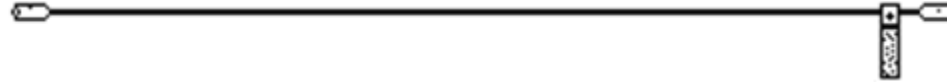
*A Phone socket-to-socket adaptor allows you to join two (guitar-type) cables into one longer one.*

If you can solder (easy to learn electronic soldering) then carry a soldering iron, audio cable and various connectors. That way you can create a crossover cable in an instant or fix a connector that decides to break off the cable at the most inconvenient moment. A Multi-meter (Tester) comes in handy for checking cables.

A little more expensive Cable Tester makes it easy to go through all your cables fairly quickly, or to quickly test a cable when the signal isn't arriving.

If you are working predominantly with radio microphones, keep an emergency microphone "on a cable" nearby. If the meeting is underway, and your radio system suddenly starts having a bad-hair day, quickly run out your emergency cable microphone, and thrust it in someone's hand.

### Preparing Cables For 'Live' Work:

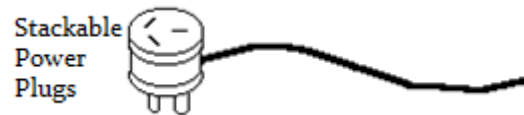


If you are always connecting and disconnecting Sound Systems, then consider permanently fixing Velcro strips to the end of each cable (opposite end to microphone) to act as cable ties. You can buy them at music shops or make them. That way you can put 20 cables on top of each other without tangling them.

Purchasing different coloured microphone cables help you identify which singer is using which microphone.



**Stage-Boxes (Snakes):** Cables tangle easily in transport, so if you are always connecting and disconnecting Sound Systems you should keep rubber rings around groups of 4 or 8 cables. Slide each ring up to hold each bunch before transporting, to stop tangles, and roll the rings back to connect to the mixer etc. Some choose to 'engrave' the numbers on the XLR connectors so that the numbers can't be lost (their number stickers eventually fall off). *Some live technicians choose not to use the conventional multi-core stage box, instead they use long cables in 'bunches'. The argument is that they find boxes unreliable (especially when they are used a lot) and stage-boxes are very difficult to repair on-location.*



**Power Plugs:** As we have many devices that need power, and often not enough power sockets, it can be helpful to cut off some of the normal power connectors and attach the kind that has another set of holes on the back, so you can stack them. *Don't stack unless it's absolutely necessary.*

### Outdoors:

What if it rains? Have you got Mixer, Loudspeaker and Amplifier Covers?

Will you need foam wind-socks on microphones to stop wind roar on the grills?

If you are using a Power Generator take personal interest in the diesel /petrol tank, oil and water (trust no-one, look and see for yourself that they are full!)

Try not to share a Power Generator with Food-Vendors using refrigerator units as they "click" on-off continually and you hear the clicks in your Sound System.

## LINE CHECK

If you are in a theatre-type venue, and you use industrial 3-phase power, try your best to be on a different phase to any 'Lighting' mixers or equipment. This is because when they turn up everything, they draw many amps, and your volume could drop until they lower some of their lights... which doesn't make you look good.

### **Before the Musicians arrive:**

Connect all audio devices (Stage-Box, Loudspeakers, Floor Monitors, Microphones, Keyboard, DI, Laptop).

Audio equipment generally gives a sharp 'bang' sound when being switched on, and sometimes quite violently when being switched off. This sudden impact can damage Power Amplifiers and will definitely damage Loud-speakers. Switch on all equipment and then, lastly, switch on the Power Amplifiers and any Loudspeakers with Amplifiers inside them. This stops the electrical bursts arriving at the Loudspeakers. When shutting-down turn off anything with Power Amplifiers first to avoid the impulses... **LOFO** (last on and first off).

You shouldn't hear buzzing or humming in the Loudspeakers, except if you place your ear up really close to the cones. If you have background noise that is at the point of being disturbing, then search for the guilty device using the process of elimination. Lower each channel fader or physically disconnect each device, one at a time, to find the moment the disturbance goes away. If the problem is an earthing (grounding) problem it may not go away just by lowering the particular channel fader, it may need to be physically disconnected. Once you have identified the background noise maker try swapping cables to it because it may actually be the cable that is faulty. You can also try connecting it to a different input channel because, unfortunately, input channels can get damaged.

Check for things that need Phantom Power... Microphones... Active DI Boxes. Lower the main Left/Right faders before you switch on the 48V phantom power as it sends an electrical bang to the Loudspeakers.

If you are connecting a portable computer or cellphone-type device to a mixer, make sure the volume is set high on the computer side. A loud audio playing from the device means the signal is furthest away from the background noise (which computers have). We call this signal-to-noise ratio. If there is a hum when you make the connection it will be because computers/phones are not earthed (grounded) to audio standards, and you will need to connect via a DI Box.

A good sound technician will play music through the loudspeakers and floor monitors to confirm that the signal flow is good. Then raise the microphone faders slightly and simply say "testing" through each microphone, checking that they are going. Walk around with radio microphones checking for radio dead-spots. Musicians should not have to wait while you muck around trying to sort out basic things like signal flow... it is **your** responsibility to do a Line check.

The perfect sound technician would send pink noise through the Front-of-House loudspeakers and equalise the ambient, in this way double checking also that all the loudspeakers cones are going. The perfect sound technician would bleed the Floor monitors and Front-of-House loudspeakers to remove squeal frequencies, reducing the ability of the sound system to squeal. No-one is perfect.

**Once you know what the musician line-up will finally be:**

set up the mixer, assign input channels to the stereo master or sub-groups, assign floor monitors, label everything clearly with masking tape if need be.

*If you wrote it all down, it might look something like this:*

INPUT CHANNEL		SOURCE	requires	ASSIGN TO	INSERT
1	<b>Billy</b> (Lead Vocal)	Handheld Radio microphone	Battery inside mic	Main L/R	Compressor 4:1
2	<b>Sally</b> (Backing vocal #1)	Dynamic microphone		Subgroup 1 (Backing Vox)	
3	<b>Linda</b> (Backing vocal #2)	Dynamic microphone		Subgroup 1 (Backing Vox)	
4	<b>Vox Gtr</b> (Backing vocal guitarist)	Dynamic microphone		Subgroup 1 (Backing Vox)	
5	<b>Gtr</b> (Electric Guitar)	Direct connection	D.I.Box (needs Phantom)	Main L/R	
6	<b>Bass</b> (Electric Bass)	Dynamic Bass microphone		Subgroup 2 (Music)	
7	<b>Kbd</b> (Keyboard)	Direct connection	D.I. Box (Passive)	Subgroup 2 (Music)	
8	<b>Kick</b> (drum)	Dynamic microphone		Subgroup 2 (Music)	
9	<b>O.H.</b> (Drums overhead)	Condenser microphone	Phantom	Subgroup 2 (Music)	
10	<b>Ac Gtr</b> (Acoustic Guitar)	Pickup		Subgroup 2 (Music)	
11					
12	<b>Guest</b> (Visiting Speaker)	Lapel microphone	Battery transmitter pack	Main L/R	Compressor 2:1
25.26	<b>Rvb</b> (External Reverb Return)	External Reverb Unit		Main L/R	

<b>Aux Send 1</b>	Floor Monitor 1	Lead Vocal
<b>Aux Send 2</b>	Floor Monitor 2	Backing vocals
<b>Aux Send 3</b>	Floor Monitor 3	Gtr. Bass. Kbd.
<b>Aux Send 4</b>	Floor Monitor 4	Drums
<b>Aux Send 5</b>	Reverb	External Effect Unit



This mixer has got the channel gains (at the top) turned approximately half way around, and all faders up around their zero mark (unity gain). This will mean that, from an electronic point of view, the mixer will be operating correctly. The sign of this will be a healthy electrical level on the output volume meters (the mixer manufacturer assumed you know all of this, and calibrated the mixer accordingly).

If you have turned any Gain knob more than  $\frac{3}{4}$  of its turn then keep an eye on that channel. A device turned up that much can start sounding hissy (you are amplifying the background noise too much). Such a high gain will make a microphone very sensitive, and will easily cause feedback (squealing) later. If necessary, move the microphone closer or change it for a more sensitive one so you need less gain.

We normally push the **HPF** EQ button on all microphones to cut the very low bass frequencies (with the exception of any Bass Amp and Kick Drums). The reason for this is that there are no frequencies that low that are desirable. Microphone stands generate rumble (picked up from the stage). Anyone holding a microphone with a cable will cause cable rubbing which generates low frequency rumble. Humans create low frequency rumble with their voices (especially plosive consonants like the letter 'P'). A High Pass Filter (HPF) will remove all the low frequency rumble we don't want in a microphone channel.

## **SOUND CHECK** **(while musicians rehearse)**

Once the musicians have arrived (and settled down a bit) ask them, kindly, to stop for an “individual” sound check. One-by-One each musician needs to play (*they ‘must’ perform at a level and intention similar to how they will perform live*) while the other musicians stay absolutely quiet... no twinkling. Tell them it will happen a lot faster if the others don’t disturb. Ensure you are getting a natural sound, with a good electrical level, from each musician, that’s enough. Equalize any unbalanced sounds. Thank them, and wait till they start rehearsing so you can sort out the levels in their Floor Monitors. Remember... any time they want any changes made to their floor monitors they ‘must’ perform at a level and intention similar to how they will perform Live, while you adjust them (not just twinkle the instrument or say *testing testing* into the microphone).

### **Mixing Floor Monitors for Performers:**

Check that the Aux Send Master knobs are turned up to their zero (unity) mark. Now balance all your floor monitors from this beginning. If things start to squeal later during the performance, you only need to reach up quickly and turn down the Aux Send Masters to stop the squealing. Once the squeal has been sorted it is easy to restore all floor monitors to their previous states by returning the Aux Sends to unity again.

While the musicians are messing around (they love to) and rehearse (a fraction of the time) balance their levels and equalize any unbalanced sounds. Get the Floor Monitors to a standard that each performer can hear themselves adequately. It’ll probably never be as loud as they would like... we can’t continually raise a Floor Monitor, it will risk squealing. At high volume it causes unnecessary off-stage noise, which interferes with the Front-of-House sound (not acceptable!).

Be prudent... the more instruments you send to a Floor Monitor, the more confused the sound will be, so try and minimize what you send to each. Musicians don’t commonly need to hear everything in their monitor.

Bad monitor mixes are one of the first reasons for performers not being able to give a good performance! You need to do all you can to help them hear enough to perform well. It’s not easy. Mixing floor monitors is far more difficult than mixing front-of-house, yet strangely it is always the ‘assistant’ sound technician’s role.

Because the auditorium will usually be empty of people, some sound technicians just leave the main Front-of-House (FOH) speaker volumes turned down during the sound check. If you don’t have the FOH volume up somewhat, you will inevitably make the Floor Monitor levels too loud, which will cause excess offstage noise later when you add the FOH volume, and feedback squealing will be more likely.

If you mix the Floor monitors with the FOH quiet, then later when you raise the FOH mix, the balance in the musicians Floor monitors will seem (to them) to have changed because now the musicians are hearing some of the FOH as well, and they will want major adjustments again.

Momentarily listen to the rehearsals with the FOH volume turned down so you can check for ‘unnecessarily’ loud off-stage noise. Then raise FOH again.

***One typical complaint made by performers is that the floor monitors sounded good during the sound-check, but it was all different at the moment of performance. The sound technician swears that everything is exactly the same, no-one touched anything! They disagree... strongly! What happened?***

The musicians heard their floor monitors in an empty church. Now that the public have arrived the offstage spillage (stage-wash) and the room reverberation are absorbed noticeably by the human bodies. Yes, the sound is quite different now... no-one’s fault!

### Mixing Front-of-House (FOH) during the Sound-check:

Each time you add a channel to the mix the overall balance and sound will change. Some frequencies will add, some frequencies will subtract. It is a juggling act. Because, obviously, everyone performing needs to be heard; sometimes it is helpful to look directly at each one, can you actually hear them?

Focus on giving them a 'natural sound' just like they sound if you are up close to them. Once you get experience you can be more creative with the Filters.

While you are balancing the channel volumes, keep an eye on the overall electrical level. Watch the Left/Right output Level Meters, they should be operating at a healthy level. For electronic reasons the Mixer circuits function optimally when the electrical levels inside it reach at least a half to two thirds of the output Level Meters. Watch all Peak Lights for any hint of overload. A Peak level that occasionally splashes into the red is Ok but if the Peak Lights continually flash then you will get distortion.

During the Sound Check continually listen for unwanted noises, hums, buzzes. When you hear disturbance... isolate one channel at a time to find the offender. Unplug one at a time, if necessary, until the noise goes away. Has a musician just turned something off or on, causing the disturbance? We find all noises by the process of elimination, there is no other way.

Discuss with the musicians on how to signal you when they want to change something in the floor monitor. There's nothing more annoying than finding yourself in the middle of a performance and some distraught musician is pointing at the floor monitor and giving a whole lot of weird signs and strange lip movements that have no connection with any language you know. An example:

**To change a level...** 1. point at musician or singer. 2. Point to floor monitor concerned. 3. Point up or down (louder, softer).

**To change a floor monitor volume...** 1. Point to floor monitor concerned. 2. Point up or down (louder, softer).



An important tool is the PFL. Use a headphone that has a large diaphragm so that you can hear frequency content properly (small diaphragm headphones have poor frequency response) because you make decisions with the Equalisers based on what you hear. Headphones that are "noise-cancelling" are best suited. Always be listening for the characteristic sound of 'feedback'... it is a bright metallic sound. You can often hear it in the headphones quite easily.



**Using Dynamic Compression:**

A Compressor / Limiter on the FOH outputs gives a much better result. The compressor should be on a light compression, and the limiter just catching any excessive peaks that would damage the power amplifiers and loudspeakers. A Compressor available for the lead singer and main speaking microphone would ensure a more professional result also.

**Using external Equalisers on the Floor Monitors:**

This allows you to bleed out the squeal frequencies and make a sound to suit that particular performer.

**Using Reverb / Echo:**

If there is an Effects Unit (e.g. Reverb) available, then a short fresh reverb can sound very professional on the Lead Singer. It makes them more audible, and helps their level become more stable. If possible let them hear it in the fold-back and they'll feel more confident. When Indoors (especially in a very reverberated church) avoid using a long dark reverb or you'll turn the whole sound to mud, and it will work against you. Keep the reverb short and fresh sounding.

**Finally, Remember!!**

The sound will change once the public arrives:

*people absorb certain frequencies, changing the sound and the levels.*

*people change the air temperature and humidity, changing the sound and the levels.*

*musicians play louder, and differently, in front of a public, changing the sound and the levels.*

... **so**, don't invest all your energy in getting 'absolute perfection' during a Sound check. That is a waste of valuable time. It is better to concentrate on your system working perfectly and cleanly, and everything planned and labelled.

This gives you the power to make quick sound and level corrections when the actual performance starts.

## NOTES:

### **Suggestions to give to people who use microphones:**

Never put the microphone horizontal and in-line with your mouth as this is the cause of the terrible 'P' explosions, and aesthetically the congregation can't see half of your face (not nice). The grill of the microphone should be just below chin-level, a hand-span away from the mouth, pointing up at the mouth.

If the microphone is on a stand then learn to move side to side turning your head as you move so that your mouth is always pointing at the microphone (explain to them that the microphone only hears on the end, and not all around the sides of the wire-grill).

If you are using a hand-held microphone, then lock your arm pointing the microphone up at your mouth so that your arm (and the microphone) follows your mouth wherever you turn.

Never cup your hand around the rear part of the wire-grill of the microphone as this causes the microphone to become omni-directional, and cause squealing.

Control your vocal dynamics so that the electrical signal that reaches the mixer is as constant as possible. Do this by coming closer when you sing quietly and pull away when you shout. A good exercise is to permit each singer to sing a song while watching their own electrical level at the mixer.

Speak into your microphone listening for freshness (say 'eSSSS'). You should be able to hear some 'S' but not too much.

Speak into your microphone listening for basses (say 'PoPPy'). Is the microphone going to boom when you say 'P'?

If you share a microphone with someone who comes on after you, and the microphone has a switch, don't switch the mic off (the person at the mixer will do that). This saves an ugly moment when the next person who uses the microphone starts without realizing it is switched off.

Don't BANG the microphone to see if it is working, that will damage it, SPEAK into it!

If you move around a lot then coil the cable once (loosely) in your hand to reduce cable noise caused by the dragging across the floor.

### **Why don't live concerts sound like studio recordings?**

Recordings are Stereo. Live is Mono. Mono can't get the space and depth that stereo can.

Recordings has no noticeable spillage mixing in to the sound. Live has off-stage noise that mixes into the Front of House (FOH) sound.

Recordings have their EQ done 'calmly' in Solo mode. Live is too noisy to do advanced EQ work.

Recordings have their DSP (Effects) done 'calmly'. Live you can't hear a lot of DSP subtleties, and don't usually have the time to pursue them.

Recordings stop and restart the song dozens of times until it sounds perfect. Live means no-going-back, there's only one 'take' and correcting something 'later' is not an option.

A Recording is a permanent copy of a great execution of the piece – virtuosity. It is a chance for excellence in performance and sound giving the song a chance to be 'well-dressed'.

A Live Performance doesn't pursue excellence (although we are all doing our best, of course) it is an interactive experience between musicians and audience-human interaction. Here a song is given life which is shared with the public, and develops according to their immediate reactions, and it will never be that way again.

## **Trouble-Shooting:**

### **No Sound?**

If you can't hear anything coming from an input channel (or the whole system is quiet), check your connections and knobs from beginning to end. Trace the cables (if in doubt swap cables as one might be faulty). Check the path of the signal to be sure that you are not cutting it off by inserting something. Did someone stand on a cable and pull it out? Once again: it is by the process of elimination that we fault-find.

### **No Power?**

Is the mains supply (wall-plug) working? Is the mains lead firmly connected? Check the building power fuses... you may have overloaded a circuit breaker (especially if there is Lighting). Check the mixer fuse.

### **Condenser Mic Not Working?**

Is the 48V turned on? Is the mic plugged into the XLR Mic input (phantom needs a 3-pin balanced circuit to work)? Are you sure the mic cable has 3-wires inside (or phantom wont work)?

### **No Mix Output. Meters not showing any signal?**

Do you have something connected to the Master LR Inserts, and is that external device switched on? Are the Meters assigned to L-R?

Are the Master faders raised? Are the Sub-group Faders sending to LR? Are the Input faders sending to LR?

Is the MUTE switch released on all relevant channels? Is there a PFL/AFL pressed accidentally?

Is the sound source connected correctly to the Mixer? Has a cable fallen out?

### **No PFL output?**

Is a headphone jack plugged completely in? Is the Phones volume control set high enough? Is the appropriate monitor select switch pressed, so you send the PFL to the Phones?

### **Headphones Distorting?**

Distortion means somewhere a level is too high.

## CREDITS

*This material is offered freely to the Christian Churches; downloadable at [Pietango.com](http://Pietango.com)*

**Text:** *Original, by the Author, a Christian Recording Engineer.*

**Images:** *Designed by the Author. Some photographs were sourced from the Internet, then re-worked.*

Ever since the creation of the world, God's invisible attributes and divine nature have been evident. They are clearly understood through his workmanship, and all the wonderful things that he has made. Therefore, those who fail to believe and trust in him are without excuse, or defence. **Romans 1:20**

All of us have sinned and fallen short of God's glory, but God treats us much better than we deserve.

Because of Christ Jesus, he freely accepts us and sets us free from our sins. God sent Christ to be our sacrifice. Christ offered his life's blood, so that by faith in him we could come to God. **Romans 3:23**

If you declare with your mouth, "Jesus is lord," and believe in your heart that God raised him from the dead, you will be saved. For it is with your heart that you believe and are justified, and it is with your mouth that you profess your faith and are saved. **Romans 10:9**

For the Scripture (*Isaiah 28:16*) says, "Whoever believes in Him will not be disappointed." **Romans 10:11**

These things have been written so that you may believe that Jesus is the Christ, the son of God; and that by believing, and relying on him, you may have new life in his name. **John 20:31**