B&W PRODUCTIONS · CREW TRAINING · MODULE 1

# Microphones for Event Crew

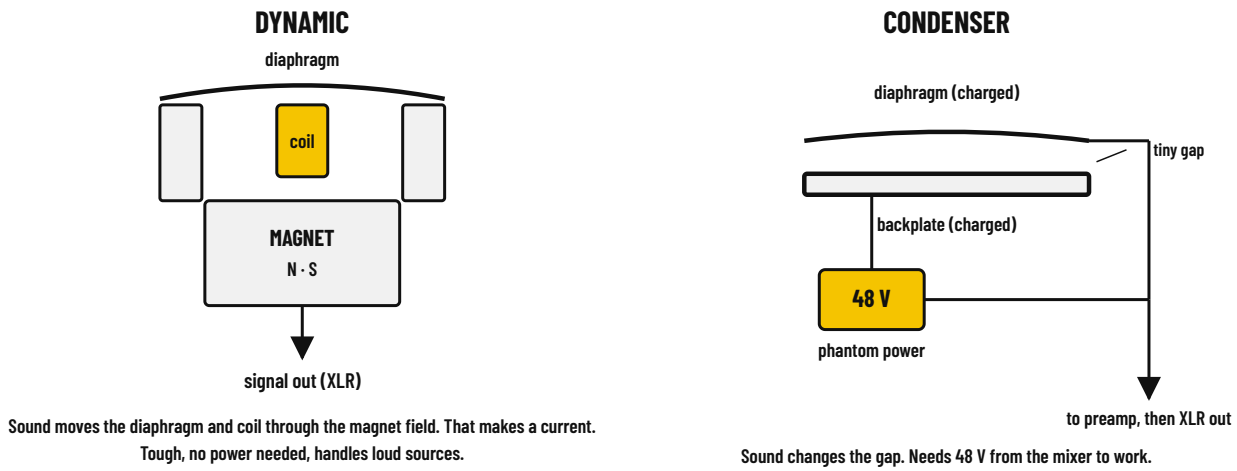
How microphones work, which one to put on what, and how to wire, place, gain and mix them so every word is clear. Covers dynamic and condenser mics, polar patterns, cables, wireless, feedback and a fault-finding table. Written for beginners. Read it, try the tool, then pass the quiz.

**B&W Productions** · Proper Planning, Prevents Poor Performance



## 01 How a mic works

A microphone turns air movement into a tiny electrical signal. Two designs do almost all the work at events: dynamic and condenser. They behave differently, they need different care, and picking the wrong one is how a good job sounds bad.




Left: dynamic. A coil on the diaphragm moves through a magnet. Right: condenser. The diaphragm and a fixed backplate form two plates; sound changes the gap between them. The charge comes from phantom power.

## Dynamic or condenser: which one?

| | DYNAMIC | CONDENSER |
|---|---|---|
| **Power** | None | 48 V phantom (or a battery inside) |
| **Toughness** | Survives drops and sweaty hands | Delicate. Keep it dry, keep it capped. |
| **Sound** | Solid, less detail on top | Detailed, bright, picks up quiet sources |
| **Feedback** | Easier. Hears less of the room. | Harder. Hears more of everything. |
| **Use it for** | Vocals, speech, drums, amps, anything loud | Acoustic guitar, overheads, choirs, quiet sources |

## Phantom power (+48 V)

Phantom power is 48 volts sent down the same XLR cable that carries the audio. It sits on pins 2 and 3 against pin 1, so the audio is not affected. Condenser mics need it. Dynamic mics ignore it and are normally safe on it, but there is no reason to leave it on when you don't need it.

> **PHANTOM RULE**
> Phantom off. Plug the mic in. Fader down. Then switch phantom on. Reverse it when you pack up. Switching it on with a cable half plugged in makes a loud bang through the speakers.

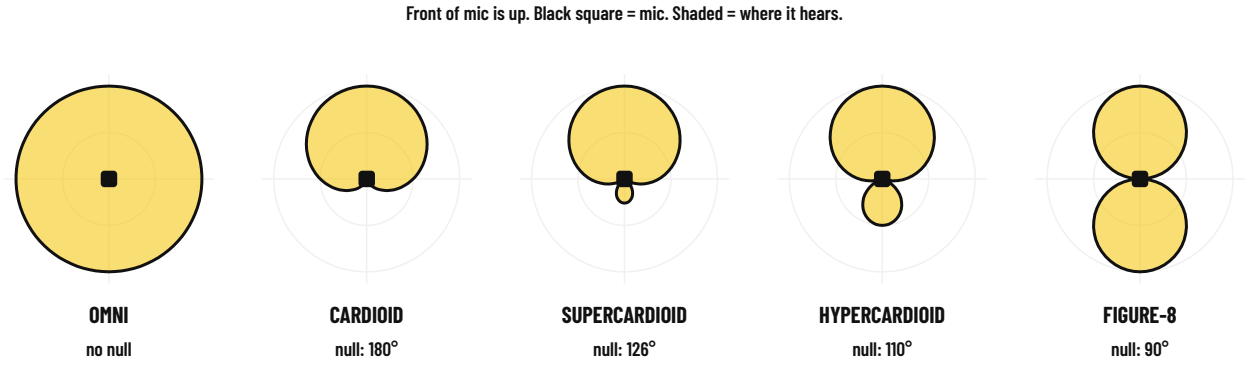
> **RULE OF THUMB**
> Dynamic by default. Reach for a condenser only when the source is quiet or needs detail, and the room is under control.

# 02 Polar patterns



A cardioid mic's dead spot is straight behind it. Point that at the wedge and you can run the monitor louder before it rings.

A polar pattern is the map of where a mic listens and where it is deaf. The deaf spots are called nulls. Knowing them tells you where to put the monitor wedge and which way to point the mic.




Where each pattern is deaf. Cardioid is deaf directly behind. Super and hyper cardioid have two nulls at the rear sides, but also a small lobe straight behind.

## OMNI

Hears everything equally. No nulls, so no safe place for a wedge. Lapels and some headsets are omni. Use in-ear monitors or no monitor.

## CARDIOID

Hears the front, rejects the rear. The standard handheld and instrument pattern. **Wedge directly behind the mic**, pointing back at the singer, centred.

### SUPERCARDIOID

Tighter front, nulls about 126° off-axis. **Wedge off to the side of centre**, roughly 50° either side of straight behind. Has a small rear lobe.

### HYPERCARDIOID

Tightest. Nulls about 110° off-axis, with a bigger rear lobe. **Wedge well off to the sides**. Never dead centre behind it.

### FIGURE-8

Hears front and back equally, deaf to the sides. Rare at events. A wedge goes at the **side**, 90° off the mic.

> **FIELD RULE**
> Point the null at the wedge. Aim the back of the mic at the monitor, not the other way round. Don't stand a vocalist with their mic pointed down at the wedge on the floor: that is the loudest, worst spot for it.

# 03 The workhorse mics



Condenser on a quiet, detailed source. It needs 48 V phantom from the desk; switch it on before you raise the fader.

You will meet the same half dozen mics on almost every job. Know what each is for, and you can answer "what do I put on this?" without asking.

### SHURE SM58

Cardioid dynamic. The standard handheld vocal and speech mic. Built-in pop filter ball, takes a beating, rejects the stage well.
In the B&W kit: Shure SM58s on stands and as wireless handhelds.

### SHURE SM57

Cardioid dynamic with a flat grille. Made for instruments: snare, guitar amps, brass. Close to an SM58 in build, tuned for instruments rather than voice.

### SHURE BETA 58A

Supercardioid dynamic. A tighter, brighter vocal mic. Better when the stage is loud or there are wedges close by, because it rejects more from the sides.

### SHURE BETA 52A

Supercardioid dynamic made for kick drum and bass cabinets. Handles very low frequencies and high levels without distorting.

### SM81 OR SIMILAR SMALL CONDENSER

Small-diaphragm condenser, cardioid, needs 48 V. For drum overheads, acoustic guitar and anything quiet that needs detail. Keep it dry.

### LAPEL AND HEADSET

Tiny omni-type capsules worn on the body, hands-free. The usual choice for presenters and MCs. Always wireless, so see Lesson 5.
In the B&W kit: wireless lapel mics for presenters, alongside the wireless handhelds.

### QUICK PICK

Voice: SM58. Instrument or amp: SM57. Kick: Beta 52A. Quiet or detailed: small condenser. Presenter walking about: lapel or headset.

Handle every mic as if it costs more than your phone. Hold it by the body, not the grille. Never tap it, blow into it or throw it. Put it back in its clip or case after use. The capsule is the expensive bit.

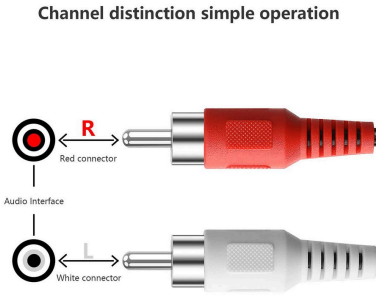
# 04 Cables and wiring



XLR, 3-pin (mic lead)



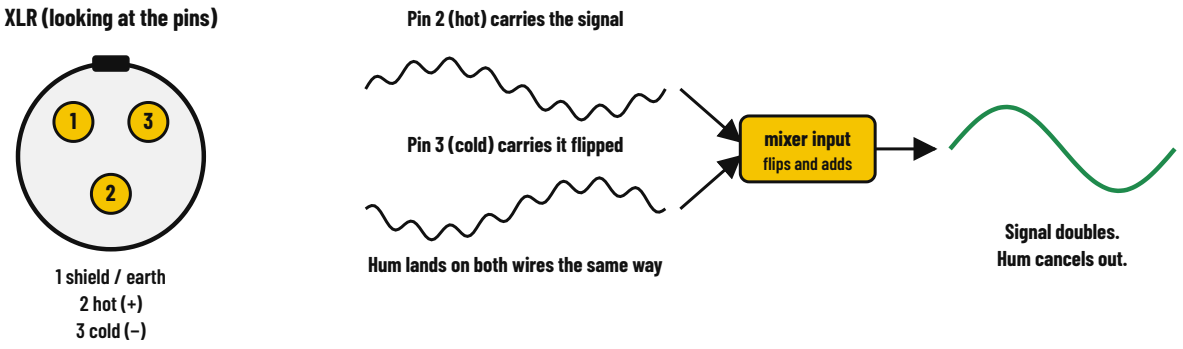
6.35 mm TRS jack (balanced line)




RCA / phono (unbalanced, consumer)

The three signal plugs you will handle most. XLR and TRS carry balanced signal and can run long; RCA is unbalanced, keep it short.

Most mic faults are cable faults. A balanced XLR cable is the reason a mic can run 50 m across a venue with no hum. Here is why, and how to look after the cable.




Both wires carry the signal, one flipped. Noise lands on both the same way. The mixer flips one back and adds them: the signal adds up, the noise cancels.

## Balanced vs unbalanced

**Balanced** means two signal wires plus a shield: XLR, or a TRS jack (tip, ring, sleeve).
**Unbalanced** means one signal wire plus a shield: a guitar lead, an RCA or a mono jack.
Unbalanced cables pick up hum and radio buzz and should stay short, under about 5 m.
Mics always use balanced XLR.

## Test and look after your cables

1. **Test every cable before the job** with a cable tester. Plug both ends in. Pins 1, 2 and 3 must light in turn, with no crossing. Wiggle the plug while testing: a flickering light is a broken joint.

2. **Coil over-under.** Alternate the loop direction so the cable lies flat and unwinds without twists. Never wrap it round your elbow, and never pull from the cable. Pull the plug.
3. **Tag faulty cables** with red tape and take them out of use. Don't put a bad cable back in the bag.
4. **Repair basics.** Re-soldering a plug is a workshop job. A broken XLR gets tagged and handed to the person who repairs them. At the venue, swap it.

> **NEVER**
>
> Never run mic cables alongside power cables if you can avoid it. Cross them at 90°. Never leave cables where guests walk without a cable ramp or gaffer tape.

# 05 Wireless microphones

Wireless frees the presenter, but you are now sharing the air with every other radio user. Most wireless trouble comes from three things: a flat battery, a bad antenna position, or two systems on the same frequency.

### HANDHELD

A mic with the transmitter built into the body. Easy for guests to use. Good for MCs, Q&A and singers.

### LAPEL (LAVALIER)

A tiny mic clipped to the chest, cable to a bodypack on the belt. Hands-free. Place it about 15 to 20 cm below the chin, centred on the breastbone.

### HEADSET

A mic on a boom beside the mouth. Constant distance, so a steady level and the best feedback resistance of the wireless options. Best for people who move a lot.

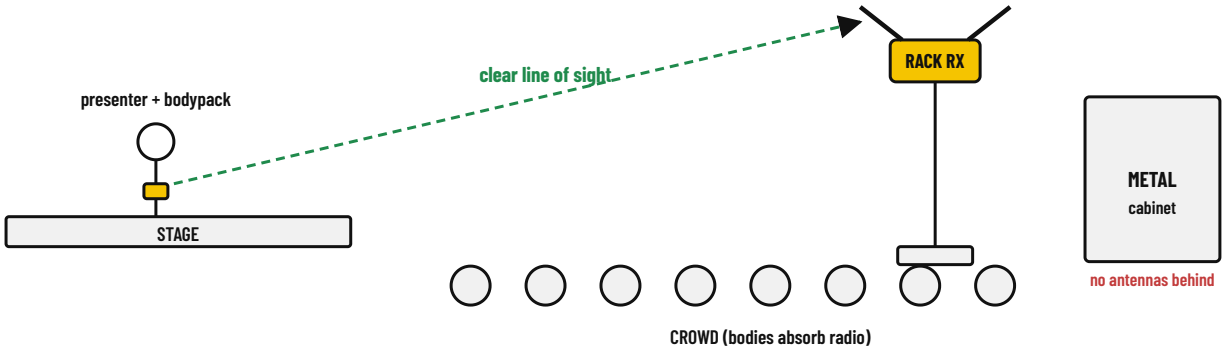
In the B&W kit: wireless handhelds and lapels, each with its own numbered receiver.

## Frequency and the law

In South Africa, ICASA regulates radio spectrum. Wireless mics mostly work in the UHF band, and the 470 to 694 MHz range is shared with TV broadcasting. Some bands need a licence and some do not, and the rules change. **Check the current ICASA rules before you buy or hire for a new job type.** Systems on 2.4 GHz are licence-free but share the air with Wi-Fi and Bluetooth, so they get crowded in venues full of phones and routers.

## Scan, then set

1. Switch on every receiver and transmitter in the room that you can, including other crews' gear.
2. Run the receiver's **scan** to find clear frequencies. Pick the ones it reports as quiet.
3. Set each receiver to a different frequency, then match each transmitter to its receiver.
4. Walk the whole area with each mic switched on. Listen for dropouts.




Put the antennas where they can see the transmitter: high, on a stand, in the open, near the stage. Not behind metal, not under the stage, not on the floor behind the crowd.

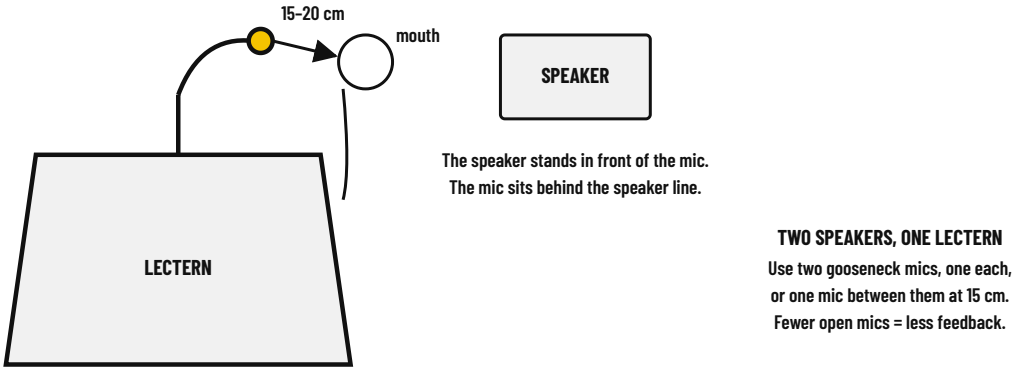
## Antenna placement and show-day rules

- **Line of sight.** Antennas should see the transmitter. Bodies absorb radio, so go above the crowd.
- **Not behind metal.** Racks, truss, lighting cabinets and LED walls block and reflect signal.
- **Close to the stage** beats far. Use remote antennas on a stand rather than the rear of the rack.
- **Fresh batteries every show.** Put in new alkalines for the day, or charge rechargeables fully. Don't gamble on a half-used set. Carry spares in a labelled bag.
- **Squelch** mutes the receiver when the signal is too weak, so you get silence rather than hiss. Set it just above the noise. Too high and the mic cuts out at a distance.
- **Mute before you change batteries or swap a mic.** The thump goes straight to the speakers.

> **RULE**
> No two systems on the same frequency, ever. Label every transmitter and receiver with the same number, and tape it on.

# 06 Mic placement and technique

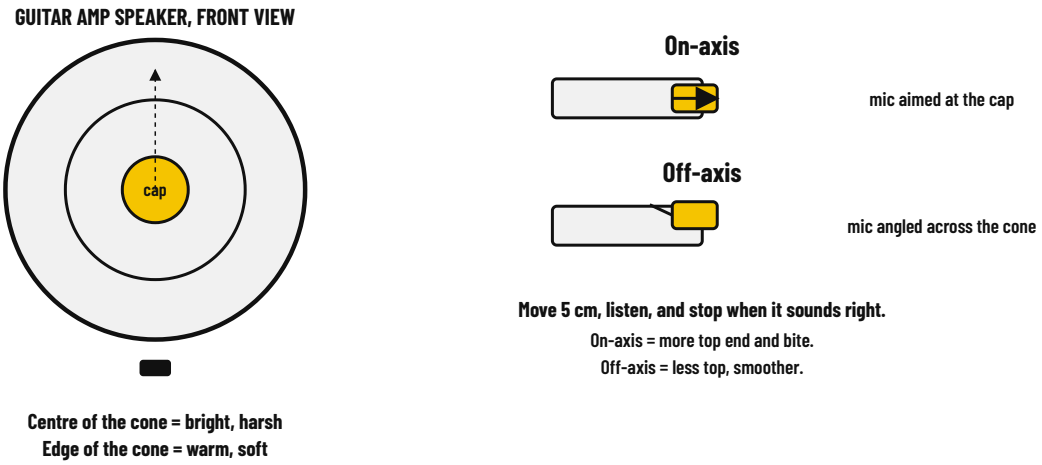
Where the mic sits matters more than which mic you pick. Move the mic 5 cm and the sound changes more than any EQ. Use these starting points and adjust by ear.



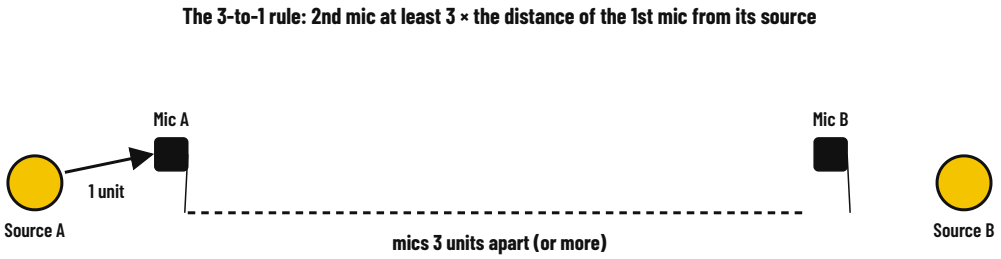

Lectern: 15 to 20 cm from the mouth, slightly off-axis to dodge breath pops, and behind the speakers. Two speakers sharing one mic need a mic that is close to both, or one mic each.

## Starting points

| SOURCE | MIC | STARTING POSITION |
|---|---|---|
| **Handheld vocal** | SM58 | Lips 2 to 5 cm from the grille. Closer = louder and bassier (proximity effect). Hold below the mouth, not wrapped over the grille. |
| **Kick drum** | Beta 52A | Inside the shell through the port, or just outside it, aimed at the beater. Move for punch vs boom. |
| **Snare** | SM57 | 3 to 5 cm above the rim, angled at the centre. Aim away from the hi-hat. |
| **Guitar amp** | SM57 | Touching or within 2 to 3 cm of the grille. See below. |
| **Acoustic guitar** | Small condenser | 20 to 30 cm from where the neck meets the body, aimed between the sound hole and the 12th fret. Not straight at the hole: that goes boomy. |
| **Speaker at a lectern** | Gooseneck or lapel | 15 to 20 cm. Slightly to the side of the mouth. |




The same mic sounds different in each spot. Centre of the cone is bright. Edge of the cone is warmer. Angling the mic off-axis rolls off the top.



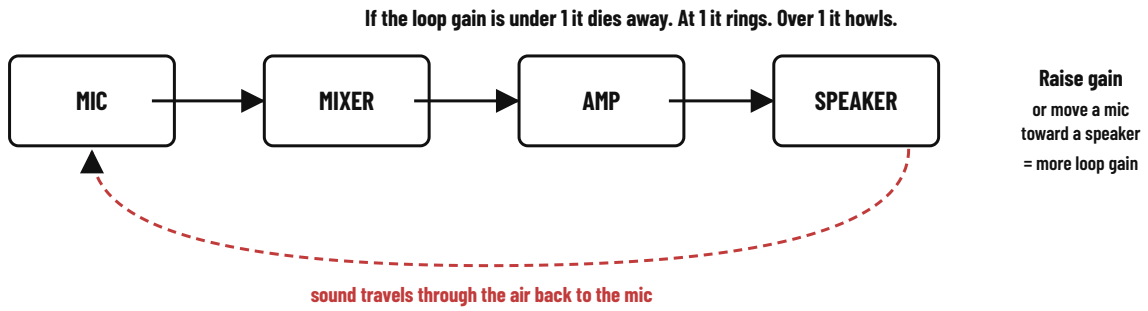

Each mic is close to its own source. The other mic is three times further away, so it hears it about 10 dB quieter, and phase smearing stays under control. This keeps the sound clean.

### 3-TO-1

If two mics are open on nearby sources, put them at least three times as far from each other as each is from its own source. Mics 10 cm from their sources should be 30 cm apart or more. Breaking this makes the sound thin and hollow.

# 07 Gain and feedback

Feedback is the howl you get when the speaker is heard by the mic and amplified again. It is a loop, and a loop only runs away when it has more than enough gain. Your job is to give the system just enough gain, and no more.




Break the loop with geometry first: mics behind the speakers, aimed away from them. Then with gain and EQ.

## Set the gain properly

1. Fader at 0 dB (the marked "U" or 0), master down, channel on **PFL** (pre-fader listen).
2. Get the person to speak at their normal loud level.
3. Turn the gain knob up until the meter peaks around −12 to −6 dBFS on digital mixers, or in the green with an occasional flicker of yellow on analogue ones. Never red.
4. Switch PFL off and bring the fader up for level.

> **PFL**
> PFL lets you listen to and meter one channel before its fader, without sending it to the room. Use it to set gain. Gain is not volume: it matches the mic's signal to the mixer.

## Cut the lows, ring it out

Switch on the **high-pass filter (HPF)** on every vocal at 80 to 120 Hz. Voices have nothing useful down there, only rumble, stand knocks and wind.

Then **ring out** the system, with the speakers on and the room empty:

1. Open the mics you will use and raise the master slowly until one just starts to ring.
2. Find that frequency with a narrow EQ boost, sweeping until the ring jumps out. Pull it down by 3 to 6 dB.
3. Raise the level again until the next ring starts. Cut that one.
4. Repeat three or four times, then stop. Any more and you strip the sound out of the system.
5. Back the level off a little below the last ring. That margin is your safety.

Fewer open mics means less feedback. Each time you double the number of open mics, you lose about 3 dB of gain before feedback. **Mute every mic that is not being used**, and tell speakers to keep the mic at the same distance.

### TRY IT: MIC DISTANCE AND FEEDBACK

Good working range for a vocal. Bass is full but controlled. Closer mic, more gain before feedback.

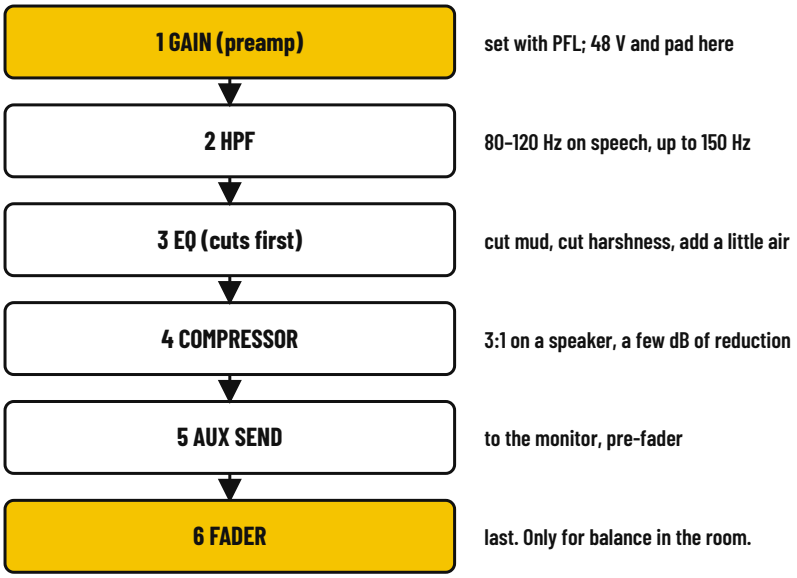
| DISTANCE | LEVEL VS 10 CM | SOUND |
|---|---|---|
| 2 cm | +14 dB | very bassy, risk of pops |
| 5 cm | +6 dB | warm, full |
| 10 cm | 0 dB | natural |
| 20 cm | -6 dB | thinner |
| 30 cm | -10 dB | thin and distant |

### MUTE DISCIPLINE

Mute the channel, not the fader, when a mic isn't in use. Unmute only when someone is about to speak. A wireless handheld left on a table is a feedback source and a thump waiting to happen.

# 08 Mixing a mic at a corporate event

At a corporate event the voice is the product. Every word must be clear in the back row. Follow the same order on every channel and you won't get lost.




Always the same order. Set gain first, filter next, EQ, then compress, send to the monitor, and use the fader last for the balance.

## Speech vs singing

| | SPEECH | SINGING |
|---|---|---|
| HPF | `100–120 Hz` | `80–100 Hz` |
| **Compressor** | 3:1, 3 to 6 dB of reduction, medium attack | 3:1 to 4:1, 4 to 8 dB of reduction, quicker |
| **Priority** | Clarity and being understood | Warmth and presence |
| **Reverb** | None, or a hint | A touch, in the mix |

## A 4-step vocal EQ

1. **Cut mud, 200 to 400 Hz.** A cut of 2 to 4 dB removes the boxy sound.
2. **Cut harshness, 2 to 4 kHz, only if needed.** Small cut, narrow. Don't take away the intelligibility.
3. **Gentle presence, around 5 kHz.** +2 dB. Helps the voice cut through the room.
4. **Air, around 10 kHz.** A small shelf boost for sparkle. Skip it if the mic is already bright.

Cut before you boost. Cutting leaves headroom and removes the sources of feedback.

## Mono, stereo and monitors

- **Speech goes out in mono.** A centred voice reaches every seat equally. Panning one speaker hard left leaves half the room hearing a quiet voice. Send mics to the mono bus, or pan them centre on the main L/R.
- **Stereo is for music.** Playback and bands can be spread. Speakers and MCs stay centred.
- **Aux sends feed the monitors.** Use a **pre-fader** send, so the performer's wedge level doesn't change when you move the main fader. Give each person only what they need: their own voice, a little of the track.

> **RULE**
> Fix it with the mic position, then the EQ, then the fader. Don't push the fader up to hide a bad sound.

# 09 Setup checklist and fault-finding

Run the same list every job. Then, when something fails, work through the chain: mic, cable, input, channel, output.

### BEFORE YOU LEAVE

- Count the mics, clips, stands and windshields
- Test every cable with a tester
- New batteries in every wireless pack, spares in the bag
- Tape and a marker

### SET UP

- Stands and mics in place, cables run and taped
- Phantom off until the mic is plugged in
- Wireless: scan, assign, label, walk-test
- Gain on PFL, HPF on, fader down

### SOUND CHECK

- One mic at a time, at the real position
- Ring out with the mics that will be open
- Walk the room while someone speaks
- Write down settings or save the scene

### PACK DOWN

- Mute, phantom off, then unplug
- Remove batteries from the packs
- Coil cables over-under, count everything
- Note faults on the job sheet

| SYMPTOM | CHECK FIRST | THEN |
|---|---|---|
| No sound | Mute, fader, gain, phantom (for a condenser), wireless battery | Swap the cable, then try another mic in the same channel |
| Hum or buzz | Unbalanced cable or a bad cable. Try another XLR. | Move away from power cables; check the DI ground lift |
| Pops and thumps | Plosives (p, b) and a mic too close. Is there a windshield? | HPF on, aim the mic off to one side of the mouth |
| Feedback | Mic in front of a speaker, too many open mics | Mute unused mics, HPF, cut the ringing frequency |
| Wireless dropouts | Battery, antenna position, other systems on the same frequency | Re-scan, move the antennas, raise the squelch margin |
| Distorted | Gain too high (red input), battery low in a wireless pack | Lower gain, press the pad, fresh batteries |

> **REMEMBER**
> Mic, cable, input, channel, output. Swap one thing at a time, and the fault points at itself.

# 10 Check what you learnt

Ten questions. Circle one answer for each. The answer key is on the last page. Pass mark: 8 out of 10.

**1. What does a condenser mic need that a dynamic mic does not?**

- ○ **A** A battery in every show
- ○ **B** 48 V phantom power
- ○ **C** A pop filter
- ○ **D** A balanced jack

**2. Correct order when using phantom power with a condenser?**

- ○ **A** Phantom on, then plug in
- ○ **B** Plug in with the fader down, then switch phantom on
- ○ **C** Fader up, then phantom on
- ○ **D** Order doesn't matter

**3. Where does a wedge go for a cardioid mic?**

- ○ **A** Directly in front of the mic
- ○ **B** Directly behind the mic, pointing back at it
- ○ **C** At the sides, 90° off
- ○ **D** Under the mic

**4. Which mic is the standard for a kick drum?**

- ○ **A** SM58
- ○ **B** SM57
- ○ **C** Beta 52A
- ○ **D** Lapel

5. **On an XLR, which pin is the shield / earth?**

- ○ **A** Pin 1
- ○ **B** Pin 2
- ○ **C** Pin 3
- ○ **D** None

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6. **Why does a balanced cable not pick up hum?**

- ○ **A** It is thicker
- ○ **B** The same noise lands on both signal wires and cancels when one is flipped
- ○ **C** It uses a higher voltage
- ○ **D** The shield is gold plated

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7. **Where should wireless receiver antennas go?**

- ○ **A** Behind the metal rack
- ○ **B** Under the stage
- ○ **C** High, in the open, with line of sight to the transmitter
- ○ **D** On the floor behind the crowd

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8. **Rule for placing two mics on nearby sources (3-to-1)?**

- ○ **A** Mics at least 3 × as far apart as each is from its own source
- ○ **B** Mics 3 cm apart
- ○ **C** Three mics per source
- ○ **D** Mic 3 m from the speaker

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9. **How do you ring out a system?**

- ○ **A** Turn all gain to maximum
- ○ **B** Raise level until it rings, cut that frequency a few dB, repeat 3 to 4 times
- ○ **C** Boost the ringing frequency
- ○ **D** Switch the speakers off

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10. **On a vocal channel, what comes first in the order?**

- ○ **A** Fader
- ○ **B** Compressor
- ○ **C** Gain, then the high-pass filter
- ○ **D** Reverb

## Answer key

1. **B**. Condensers need 48 V phantom power from the mixer (or an internal battery). Dynamics need nothing.
2. **B**. Plug in first, fader down, then phantom on. Switching it on with a cable half plugged in bangs through the speakers.
3. **B**. A cardioid is deaf directly behind. Supercardioid and hypercardioid nulls are off to the sides of the rear.
4. **C**. The Beta 52A is built for kick drums and bass cabinets. The SM57 is the snare and amp mic.
5. **A**. Pin 1 is shield, pin 2 is hot (+), pin 3 is cold (–).
6. **B**. Noise arrives equally on hot and cold. The mixer flips one and adds them: signal adds, noise cancels.
7. **C**. Bodies and metal block radio. Put antennas up and in the open, near the stage.
8. **A**. Keep the second mic three times as far from the first source as the first mic is. It keeps the sound clean.
9. **B**. Slowly raise the level, make a narrow cut of 3 to 6 dB at the ringing frequency, and repeat three or four times.
10. **C**. Set gain first (PFL), then the HPF at 80 to 120 Hz, then EQ cuts, compressor, and the fader last.

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