CGBC SOUND MANUAL

February 2020

Sound Manual

'All these men were under the supervision of their father for the music of the temple of the Lord, with cymbals, lyres and harps, for the ministry at the house of God. Asaph, Jeduthun and Heman were under the supervision of the king. Along with their relatives—all of them trained and skilled in music for the Lord—they numbered 288.'
1 Chronicles 25: 6-7 NIV

We don't have quite such a large worship team at Croxley Green but it is important that we share the same commitment to training, learning and developing skills as we work together as worship leaders, musicians, singers and technical team to enhance and enrich our worship life as a church.

In a large room with lots of bodies absorbing sound, some amplification is essential.   This is what the PA system is for – to **reinforce** the sound so that it can be clearly heard by all.   Some of our congregation are elderly and others have hearing difficulties; if the service is too quiet, they cannot fully participate.   On the other hand, tinnitus sufferers may find their condition aggravated by excessively loud, unpleasant sounds; we want to avoid both extremes so that the services can be enjoyed by all.

This sound manual is written with the intention that a new person could find out all they need to know to operate the PA system in the main church sanctuary. Of course, any attempt at a definitive sound manual will only represent one person's viewpoint. This is both a strength and a weakness. It is a strength in that some consistency of approach is helpful, but a weakness if it smacks of arrogance and isn't open to newer, better suggestions. Please feel free to make suggestions to improve this guide so that we can make operating the PA system as simple and transparent as possible, to achieve the best results we can so that the technology never gets in the way of the worship.

This manual is formatted in 'landscape' A4 to allow easy reading on a computer screen as a PDF. Thanks for taking the time to read this.

Alan Kerry

# Contents

Glossary

PA	'Public Address' system, the whole setup, mics, mixer, amplifier and speakers.
Signal	One of the sounds that you are using the PA to reinforce
Mix	A combination of signals, a pleasing mixture of vocals, instruments and effects (usually reverb)
Channel	The route that a signal follows through the mixer, allowing processing along the way
Processing	Changing the signal in some way (gain, EQ, effects)
Gain	The amount of amplification added to the signal to make it louder ('volume' if you like)
EQ	Equalisation – 'tone controls' for adjusting the level of certain frequencies within a sound ('bass', 'middle' and 'treble' for instance)
Reverb	Reverberation; an artificial 'echo' effect added to a sound (usually a singer) to make it sound nicer!
DI Box	Direct Injection box, used for plugging instruments into the PA at microphone level
Phantom Power	Low level DC voltage needed by some microphones or DI boxes if they contain active circuitry
Bus	A destination for an audio signal, to allow it to be combined with others ('mixed')
Pan	A control to 'shift' the signal from one bus to another, e.g. from left to right.
Aux	An auxillary bus for creating 'auxilllary' (i.e. additional or different) mixes to the main output mix
Send	Routes a channel to an auxillary bus for 'sending' it out of the mixer (or to internal effects).
Return	Brings an external signal back into the mixer (e.g. after external effects have been added).

Audio Connections

Inputs

The church building has a large number of built in audio inputs and outputs to allow flexibility and to reduce the number of long wires trailing all over the floor.

Croxley Green Baptist Church
PA and Audio planner
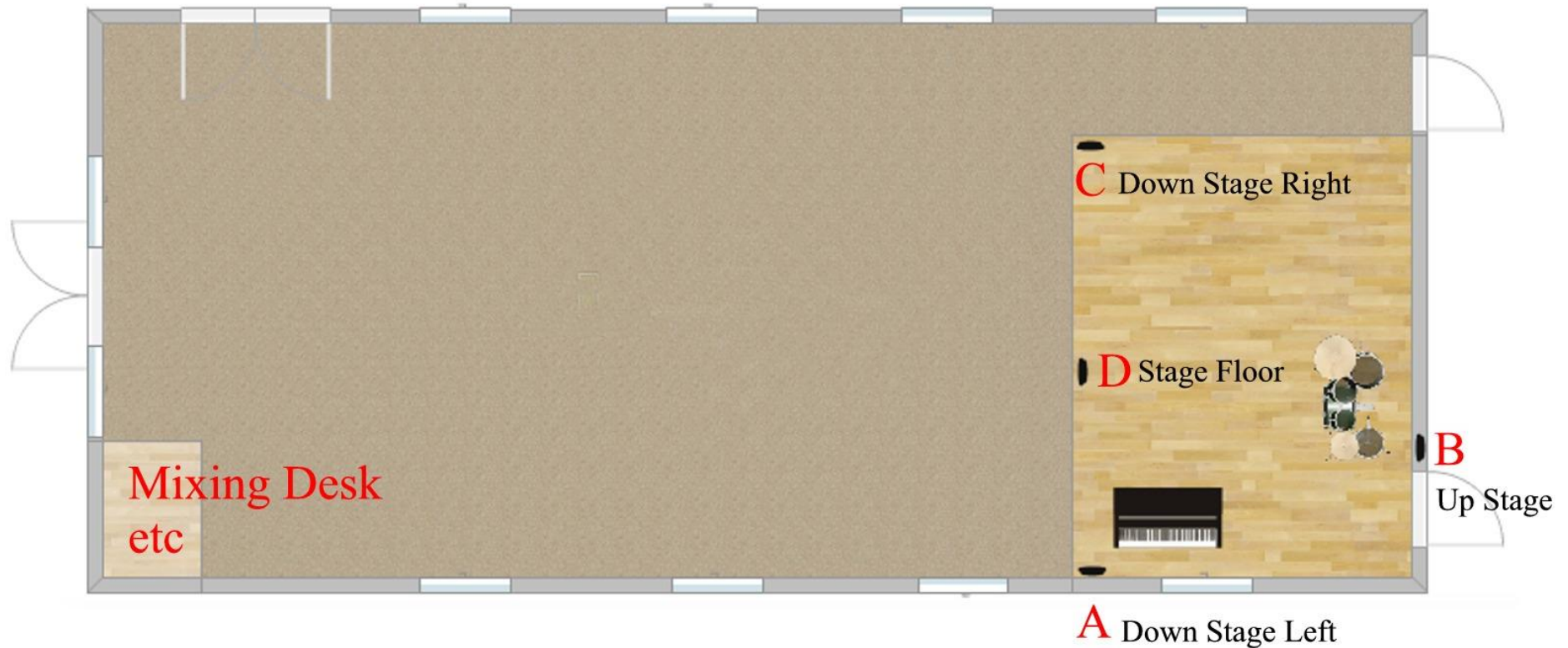
The connections at the following locations are usually:

A = DSL (Down stage left)

    1 = Yellow microphone

    2 = Blue mic

    3 = Green mic

    4 = Red Mic

    5 = (Spare input)

    6 = DI box from Piano

    7 = (Spare input)

    8 = Output for singers foldback

> When the system was installed the leads were labelled with the conventions of 'upstage', 'downstage', 'stage left' and 'stage right' **as viewed from the 'performer'**, hence they say DSL1 or US7. I have stuck with this convention and relabelled some of the wires that were missing tags, but also labelled the stage boxes A-D for simplicity as shown here.

B = US (Upstage)

    1 = Guitar 1 (usually taken from DI box to allow DI box to send 'link' to a guitar amp on stage)

    2 = Guitar 2 (as above – maybe bass guitar?)

    3,4,5,6 = spare

    7 = Output for drums foldback

    8 = Output for foldback 3 (not usually used)

C = DSR (Down stage right)

    1 & 2 = Inputs from Audiobox – USB sound box for plugging in a laptop at the front for laptop sound out.

    3 – 8 = (Spare inputs)

D = SF (Stage Floor box)

    The Lectern mic and optional Baptistry mics are connected here and appear at the desk as SF1 and SF2

The Mixing Desk

The new digital mixing desk is a Behringer X32 which has 40 input channels and 25 mix buses, with 22 outputs and 8 internal effects available. It's easily the best-selling digital mixer of all time and has proven to be very popular in churches of all sizes.

Outputs
Obviously, we are using the mixer to balance the sound for the main PA speakers so the congregation can hear clearly, but there are other outputs as follows:

- Foldback outputs to Singers foldback (front of stage), Drums foldback (rear of stage) and third foldback (not currently used) (Bus Sends 1 to 3 respectively)
- Hearing Loop (via Bus Send 4 to 'Matrix' mix)
- Welcome Area (also via Bus Send 4 to 'Matrix' mix)
- Audio-Video link to Creche (Prayer Room, also via Bus Send 4 to 'Matrix' mix)
- Link to Rear Hall (seldom used, also via Bus Send 4 to 'Matrix' mix)

As you see, the 'Matrix' (Bus 4) feeds the hearing loop, welcome area, Creche and Rear Hall with the same submix (determined by Bus 4 send levels on individual channels).

On a digital mixer there is one set of controls rather than the hundreds of knobs on an analogue desk. Press the 'select' button on the channel you are adjusting (it will light up green) and these controls are available.

Gain – sets the input level, aim for -6 to -9dB
48V – switches on phantom power, necessary for 'condenser' microphones and DI boxes only
Ø – Phase invert button (not needed)
Low Cut button and frequency adjust – cuts all low frequencies below the selected frequency, to reduce unwanted rumble and thumps. Useful for everything except Bass Guitar or Kick Drum.
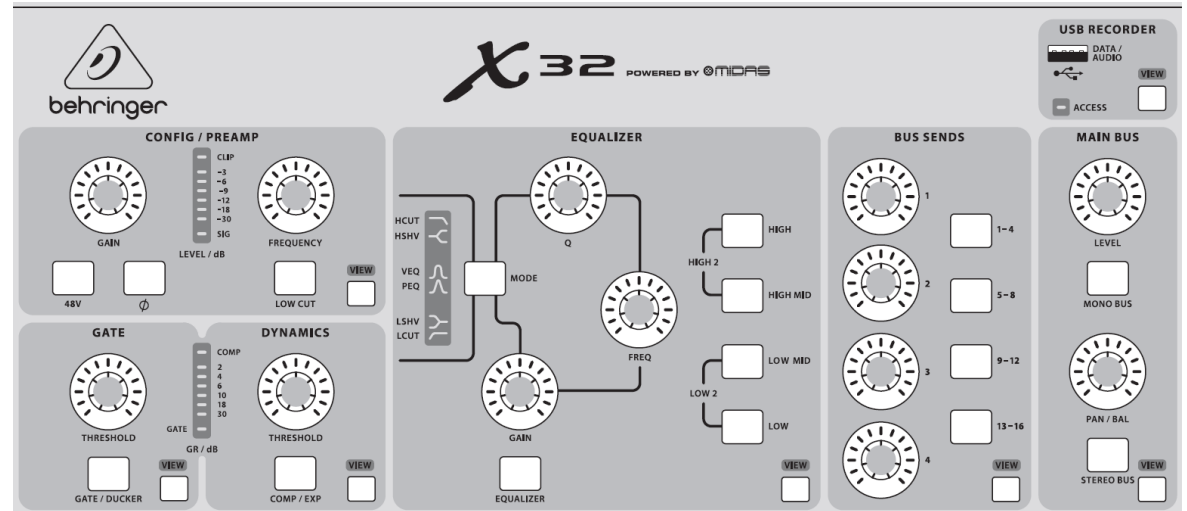
Gate – think of this as an 'automatic mute' that silences the channel if the sound drops below the threshold set. Sound louder than the threshold will be amplified (the gate 'opens'). If used, then setting the threshold is important. If there is no sound then it may be that the threshold is set too high
Dynamics – compression works at the top end of volume to 'compress' very loud sounds. This evens out the volume but may increase risk of feedback
Equalizer section – there are four bands available (five if we count the 'low cut filter' previously mentioned). Use the buttons on the right to select the band from low, low-mid, high-mid or high. Then fine tune the frequency using 'freq' control and cut using 'gain' control (we seldom 'boost' EQ in live sound). The Q control adjusts the width of the filter from a very broad sweeping cut to a more surgical cut for targeting just the troublesome frequency and leaving the rest of the sound unaffected. Use the 'View' button to see a graphical display of the sound frequency spectrum, as well as a real time display of the sound coming through the selected channel. This makes identifying troublesome 'feedback' frequencies much easier to find and control.
Bus Sends – there are 16 buses that you can send the signal to (in addition the main LR mix which all channels are routed to). We are only using 8 as follows:

Bus 1 – Singers Foldback (note that the overall foldback level can be adjusted using the output fader, this knob will tweak the amount of the selected channel that is sent to that foldback bus.

Bus 2 – Drums Foldback

Bus 3 – Third Foldback (not currently used)

Bus 4 – 'Matrix' bus. This is a combination bus that feeds ALL of the following, Welcome Area, Hearing Loop, Creche video feed, Rear hall (if needed). As these all require the same 'mix' it is convenient to combine them for individual channels, but you can control the level of each destination using the output faders (see below)

Bus 5-8 and 9-12 are not currently used

Bus 13-16 sends to the internal effects, 13 is a 'large reverb' good for slow songs, 14 is an ambience reverb, good for quicker songs, 15 is a chorus effect sometimes useful for acoustic guitar and 16 is a 'tap-delay' effect which adds a tempo based repeat for special effects.

Channel IN	Source	Notes
1	Yellow mic, DSL1 (down stage left) = A1	Some of the vocal mics have their own on-off switches, check these are 'on' if there is no level. These 'dynamic' mics do **not** require phantom power (thought it doesn't harm them if accidentally switched on).
2	Blue mic, DSL2 = A2	
3	Green mic, DSL3 = A3	
4	Red mic, DSL4= A4	
5	DSL5 = A5	Spare
6	DSL6 = A6 = Piano via DI box	Needs phantom power
7	SF1 = Lectern mic (condenser mic)	Needs phantom power
8	Lapel radio mic 1	Check batteries every time
9	Lapel radio mic 2	Check batteries every time
10	Handheld radio mic 1	Check batteries every time
11	Handheld radio mic 2	Check batteries every time
12	Guitar 1, US1 (upstage)= B1	If these are taken from a DI box then phantom power is required
13	Guitar 2, US2 = B2	
14	SF2 = 'Baptistry'	A condenser mic would be best for this (phantom power required)
15	Front Laptop SF1 = C1	From the blue external USB soundcard on the stage.
16	Front Laptop SF2 = C2	
17 - 20	US3,4,5 and 6	Spare at present
21 - 24	DSF3,4,5 and 6	Spare
25-26	Main PC via USB connection	Use this digital connection or Aux 5&6 as below to get sound from AV desk PC
27-32	Empty	Spare
AUX ins		
Aux 1&2	Minijack L&R	For playing music from a phone etc.
Aux 3&4	CD Player L&R	
Aux 5&6	Main PC L&R from audio output at rear of PC	Analogue connection

Outputs	Feeds	Notes
Internal BUS sends		
Bus 1	Singer Foldback level	
Bus 2	Drums Foldback level	
Bus 3	Third (not used) Foldback level	
Bus 4	Matrix Mix	This same mix feeds the Hearing loop, Creche video, Welcome Area and Recording
Bus 5-12	Unused	
Bus 13	Internal effect 1 – Long Reverb	Large reverberation effect
Bus 14	Internal effect 2 – Short Reverb	Small reverberation effect
Bus 15	Internal effect 3 – Chorus	Chorus effect, mainly useful for guitar
Bus 16	Internal effect 4 – Delay	'Tap' delay effect – discrete 'echos', speed according to tap
Physical Outputs		
AUX1	Hearing Loop Amplifier	Fed from 'Matrix'
AUX2	Welcome Area Amplifier	Fed from 'Matrix' post-fade, Driven by Australian Monitor AMIS120P amp
AUX3	Singers Foldback 1 (front), DSL7 = A7	Pre-fade
AUX4	Drums Foldback 2 (rear), US7 = B7	Pre-fade
AUX5	Video Link	Fed from 'Matrix' post-fade
AUX6	Foldback 3 if needed, US8 = B8	
Main Outs		
1 & 3-14	Unused	
2	Rear Hall	For feeding sound to the large rear hall.
15	Main out Left = Front speaker	Driven by QSC USA400 amplifier
16	Main our Right = Rear speaker	Driven by QSC USA400 amplifier

Assignable Knobs and Buttons

At the front-right part of the mixer the 'Assign' section has 4 knobs and 8 buttons. These can be programmed to allow quick access to certain commonly used functions, and there are three sets for each, A, B and C.

At present we are only using Bank A presets which I have set up as follows for now:

Bank	Controller	Function
A	Knob 1	Master L / R pan[1]
A	Knob 2	Not assigned
A	Knob 3	Not assigned
A	Knob 4	Not assigned
A	Button 5	USB record home
A	Button 6	USB stop
A	Button 7	USB start record
A	Button 8	Lamp
A	Button 9	9:15 scene[3] recall
A	Button 10	Library[2] page
A	Button 11	11:00 scene[3] recall
A	Button 12	Scene page (to save new scenes if required)

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[1] This pans between the front (left) and rear (right) speakers.   It is best to leave it slightly towards the rear, this allows for higher overall sound level before feedback occurs (assuming the mics are at the front of the church).

[2] The library stores presets for individual channels – e.g. Dave lectern mic or Lisa lapel mic etc.

[3] Scenes are global settings for ALL channels, the whole desk setup is saved.   Use this to load the appropriate Master Preset at the start of each service.

AUDIO-VISUAL QUICK CHECKLIST

SUMMARY:

1.   *Turn up*

2.   *Open A-V desk – **Power On** (automated sequence, turn the key only),*

3.   *Determine **What is Required** for this particular service (Mics, backline amplification, video? laptop? other sound sources).*

4.   ***Load X32 Master Preset** (button 11 or 9)*

5.   *Pull up **Main Fader** to an appropriate overall level*

6.   *Adjust level for individual channels or subgroups as required*

7.   *Perhaps Fine Tune channel strip for clarity and warmth (EQ etc)?*

8.   *Set up Video and other Media Sources **Check they work OK** sound and vision.*

9.   ***Record the Sermon** to USB stick*

10. *Keep active during the service – Mute unwanted groups during sermon or singing, adjust levels as required*

11. *Pack away equipment used and **Power Down** at end of service (don't forget foldback speakers)*

AUDIO-VISUAL CHECKLIST IN MORE DETAIL

For each service you should aim to:

1. ***TURN UP*** – nice and early (9:00am for 9:15am service, 10:30am for 11:00am service)
2. ***OPEN AV CUPBOARD (keys in photocopying office – number 4) – POWER ON –*** The Furman PS-PRO II Power conditioner / sequencer takes care of powering everything up in sequence, while avoiding power surges. Therefore, all other switches should be left ON all the time, and the Furman used to switch everything else on and off with the key.   Separately turn on the computer, projector and power switches on foldback speakers at the front of the church (if required).
3. ***DETERMINE WHAT IS REQUIRED FOR THIS PARTICULAR SERVICE*** (Mics, stands, instruments via DI boxes, backline amplification, video, laptop etc). Radio mics are stored in the drawer – check battery level on the transmitter by powering on. There are two lapel mics and two handheld radio mics. The lapel mics can be swapped for headset mics.
4. ***LOAD X32 MASTER PRESET –*** The desk will boot up to the last used configuration. To load the preset for the whole desk select assignable button 9 or 11 (these are essentially identical but 9 mutes the singers mics and effects channels) then confirm.
5. Pull up ***MAIN FADER*** to an appropriate overall level. The presets are saved with main fader pulled down to avoid unexpected noises.   Fade it up towards (usually) 0dB level for a healthy volume overall.
6. ***ADJUST LEVEL FOR EACH CHANNEL or SUBGROUP IF NECESSARY*** – The main gain and EQ for each channel are automatically loaded with the master preset. So the sound should be pretty close to OK. To adjust the sound simply tweak the fader for an individual channel or, even simpler, use the group level control (DCA) on the right-hand side to adjust **Speech mics**, **Singers mics**, **Instruments**, **A-V inputs** and **FX level**.   The mutes for these groups are also very useful during the service to quickly switch from a spoken section to a song.
7. Perhaps ***FINE TUNE THE CHANNEL STRIP*** for clarity and warmth.   Again, the master preset should have taken care of this. But sometimes it helps to tweak the sound by adjusting the EQ. Cutting problem frequencies always sounds better than
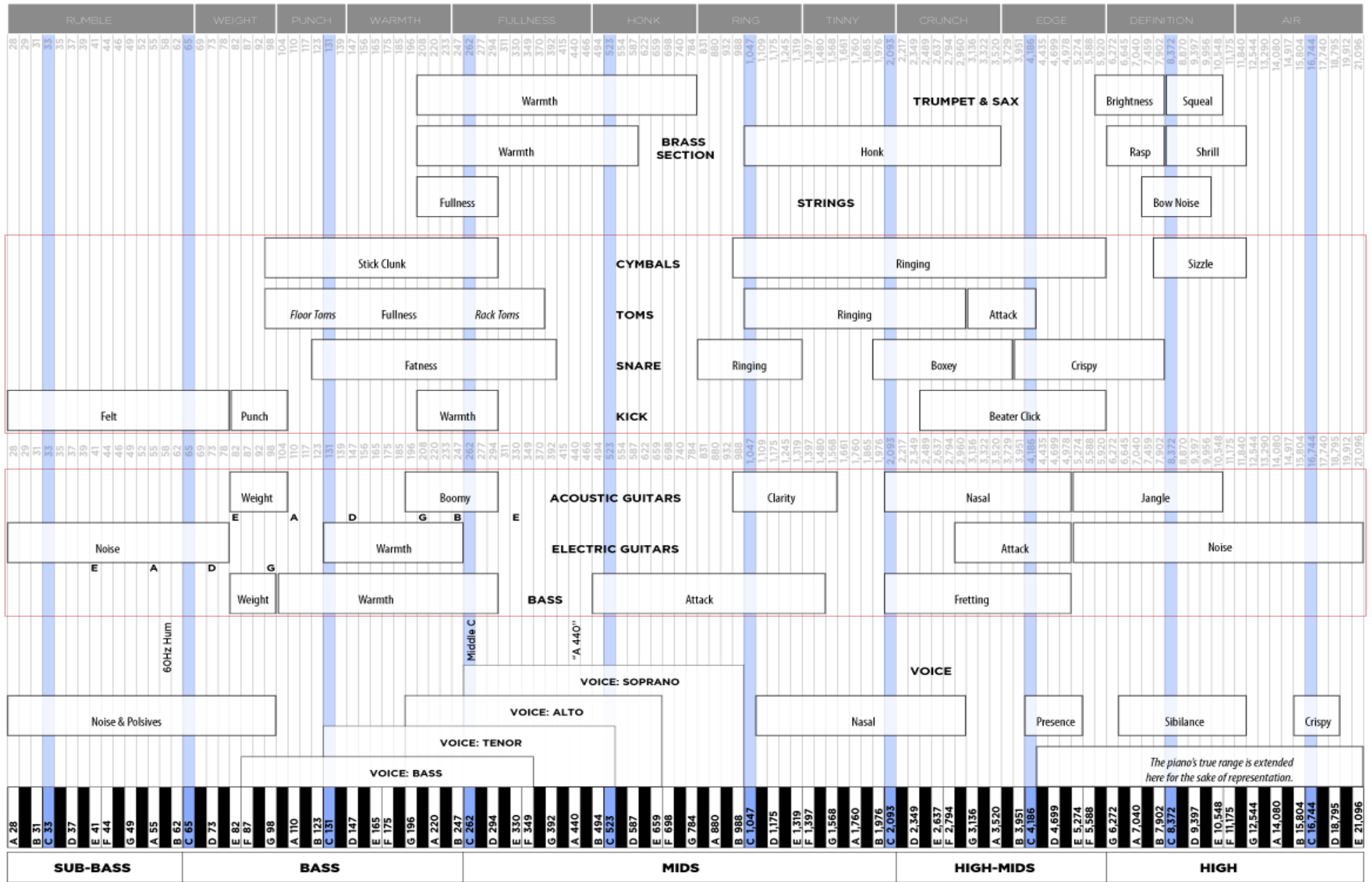
boosting frequencies. The feedback range is often around 500Hz, boxiness around 700Hz, harshness 1-2kHz. Use the 'view' button on EQ section to see the frequency spectrum for the selected channel. This may help identify problem areas.

8. ***SET UP VIDEO AND OTHER SOUND SOURCES –*** Check that any video used during the service actually plays (also CD, smartphone or other source) BEFORE the service begins please.

9. ***RECORD THE SERMON –*** This is simplicity itself on the X32, so long as a USB Memory stick is plugged in (and it should live with the desk). Press assignable button 5 to see a graphical representation of an old-school tape recorder, button 7 starts recording and button 6 stops the recording.   **Please remember to stop the recording before switching off the power.** The USB stick can then be removed (while power is still on) and the file copied to a computer to edit and convert to MP3 for posting on the website for the podcast.

10. ***KEEP ACTIVE DURING THE SERVICE –*** Maybe mute unwanted subgroups for different sections (singing -vs- sermon for example) Walk around – if possible, move away from the A-V desk during a song and get the sound 'first hand' as the congregation are hearing it from the centre of the room. Avoid the temptation to mix using just the headphones, these are useful for troubleshooting (e.g. why can't I hear the guitar?) but should NOT be used to shape the sound. What sounds good on headphones might sound terrible through the PA and vice versa.

11. ***PACK AWAY IN REVERSE ORDER AT END OF SERVICE and POWER DOWN*** – When powering down the PA, simply use the key on the Furman unit to switch everything off in sequence and to avoid power surges. Finally, don't forget to switch off foldback speakers, projector and computer.
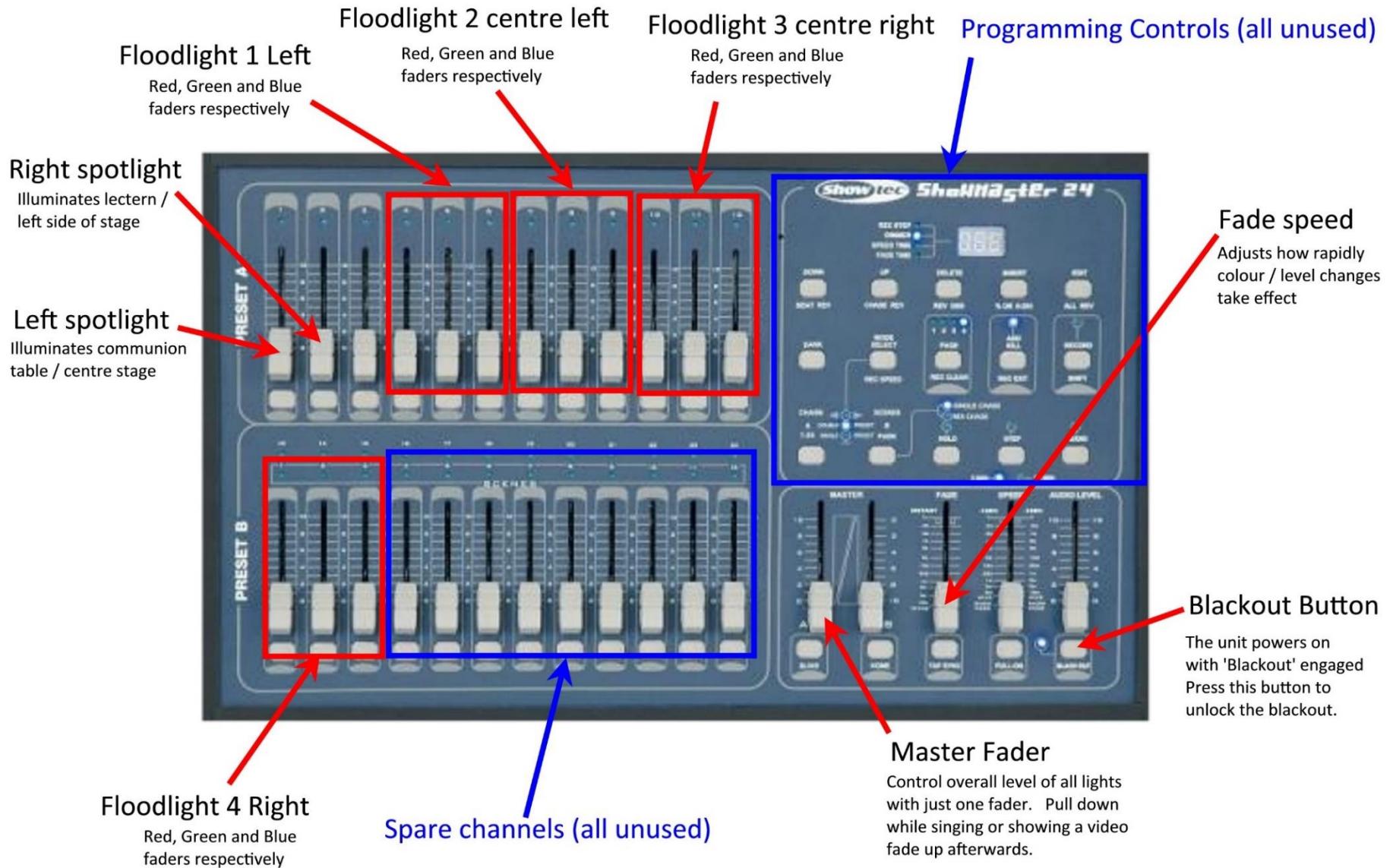
Appendix A - Other Equipment

Inputs		
Radio mics	Two lapel mics (can be switched to headset mics) with clip on belt transmitter units Two hand-held mics, with internal transmitters.	
Singer Vocal mics	Shure SM58s and the like. 'Proximity effect' means bass frequencies are louder when the source is closer to the mic.	Tough as old boots!
Lectern mic	Condenser microphone – more sensitive and does not exhibit the 'proximity effect'	Needs phantom power. Rather more delicate, do not drop.
DI boxes ('direct injection')	Useful for a wide range of inputs, e.g. guitar, keyboard, submixer. The DI boxes need phantom power from the mixer (or a 9V battery but phantom power is better!). They match the impedance of the input to a mic level so that a line level signal can be sent down a much longer lead than would otherwise be possible without signal degradation. The input is via a Jack socket, the link socket allows you to 'split' your input, i.e. one split (the output on the XLR socket) goes to the mixing desk and the other (the link jack socket) can connect to the guitarist's own amplifier. The pad switch attenuates (turns down) the signal by 20 or 40dB – usually for high level keyboard outputs, Ground lift helps to eliminate hum if there's a ground loop.	

APPENDIX B – A rough guide to the sound frequency spectrum – EQ

Top category bands: RUMBLE · WEIGHT · PUNCH · WARMTH · FULLNESS · HONK · RING · TINNY · CRUNCH · EDGE · DEFINITION · AIR

TRUMPET & SAX: Warmth · Brightness · Squeal

BRASS SECTION: Warmth · Honk · Rasp · Shrill

STRINGS: Fullness · Bow Noise

CYMBALS: Stick Clunk · Ringing · Sizzle

TOMS: Floor Toms · Fullness · Rack Toms · Ringing · Attack

SNARE: Fatness · Ringing · Boxey · Crispy

KICK: Felt · Punch · Warmth · Beater Click

ACOUSTIC GUITARS: Weight · Boomy · Clarity · Nasal · Jangle (E · A · D · G · B · E)

ELECTRIC GUITARS: Noise · Warmth · Attack · Noise (E · A · D · G)

BASS: Weight · Warmth · Attack · Fretting

60Hz Hum · Middle C · "A 440"

VOICE: VOICE: SOPRANO · VOICE: ALTO · VOICE: TENOR · VOICE: BASS · Nasal · Presence · Sibilance · Crispy · Noise & Polsives

The piano's true range is extended here for the sake of representation.

Bottom range bands: SUB-BASS · BASS · MIDS · HIGH-MIDS · HIGH

ShowMaster 24 Lighting Controller