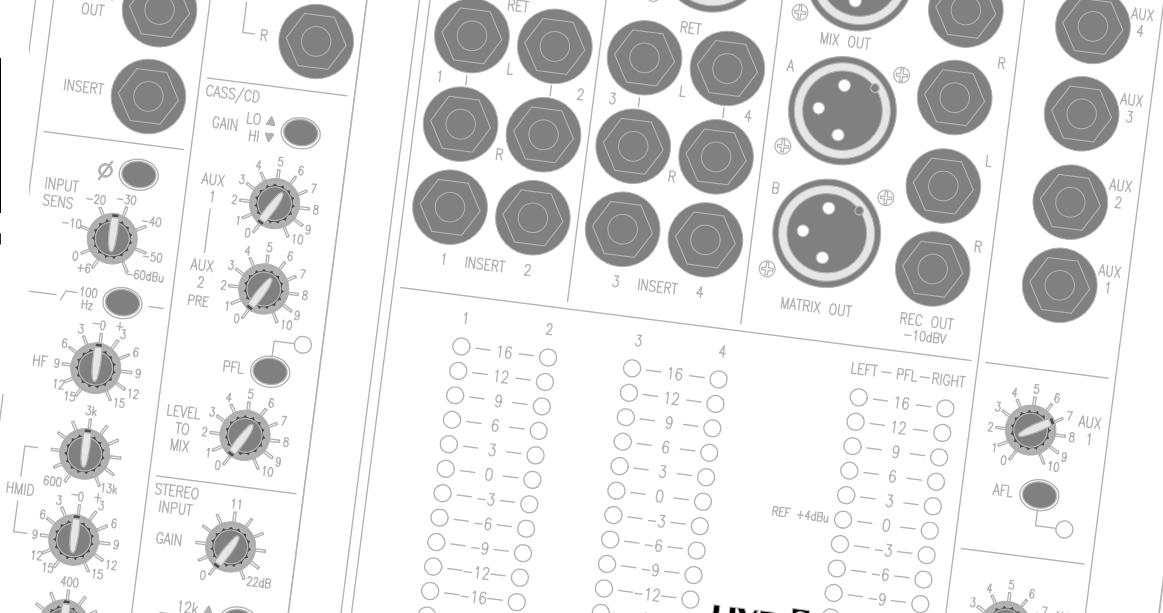


SPIRIT

By Soundcraft



CONTENTS

Introduction	1
Basic Principles of PA Mixing	2
Installation & Safety Precautions	4
Connecting It Up	5
Wiring It Up	6
Getting to Know Your Console	10
Mono Inputs	10
Stereo Inputs	13
Group Section	15
Master Section	16
Using Your Spirit Live 4 ² Console	18
Applications	20
Care Of Your Mixer	26
Glossary	26
Typical Specifications	28
Dimensions	29
Expander Installation Instructions	30
System Block Diagram	32
Panel Layout	Inside rear cover

LIVE4²
24

POWER ON +48V
17V

AUX 1-2
AUX 3-4

TB MIC
MIX
GRP
LEVEL

MATRIX MASTER A

MATRIX MASTER B

MATRIX SENDS
L
R

PFL/AFL ON
PHONES

MONO CHECK

M1
M2
M3
M4

MUTES
PHONES

SPIRIT LIVE 4²

USERS GUIDE

24

25

26

1 GRP 2

3 GRP 4

INTRODUCTION

Congratulations on your purchase of a SPIRIT LIVE 4² mixer. Owning a Soundcraft console brings you the expertise and support of one of the industry's leading manufacturers and the results of over 22 years experience supporting some of the biggest names in the business.

Designed by engineers who understand the individual needs of musicians, SPIRIT LIVE 4² has been built to the highest standards using quality components and employing automated assembly techniques beyond the reach of most manufacturers of compact mixers.

A rugged steel chassis is combined with moulded side trims to give protection and distinctive appearance. Custom moulded controls, designed for the best 'feel' and visual clarity complement the styling, resulting in a truly professional product which is ideal for both touring and fixed PA installations.

SPIRIT LIVE 4² is available in 12, 16, 24 & 32 channel frame sizes, and the 12 and 16 channel sizes may be extended by adding an 8 channel Extender. All frame sizes incorporate removeable side cheeks to enable the console to be fitted compactly in a flight case.

SPIRIT LIVE 4² incorporates circuit technology identical to that used on some of the most sophisticated Soundcraft consoles. The input channels are able to accept a wide range of Microphone and Line level signals from separate input sockets. Every channel features the new UltraMic+™ input with wide range gain control, Phase switch, 4-band Equalisation with swept Hi and Lo Mid ranges, plus a Hi-Pass Filter, 6 Auxiliary Sends (2 pre-fade, 2 pre or post and 2 post-fade), PFL(Pre Fade Listen), Peak LED, Panning to a Stereo Bus and routing in pairs to four Output Groups. Each channel has a separate Direct Output and is controlled by a high-quality long throw fader. All input channels may be assigned to a choice of four Mute Groups..

All frame sizes are provided as standard with dedicated stereo inputs. 1 stereo input is included on the 12 channel frame and 2 stereo inputs on all other frame sizes. Each stereo input comprises two separate input sections, one provided with comparable facilities to the mono inputs, and one more basic input for a cassette or CD player which routes to the stereo mix and two of the Aux outputs only.

The four Output Groups provide submixing to the Mix L/R, either as stereo pairs or as mono sends to L & R. The Group outputs are available on separate connectors to feed external equipment directly. Each Group section incorporates matrix sends, PFL monitoring & bargraph metering. Four external Stereo Return inputs are provided for effects or submixing from external sources and these route to Mix or to a pair of Groups.

Two Matrix outputs receive sends from each Group or Mix L & R as required.

The Master section provides master level control for the Left, Right, Matrix and Auxiliary Send buses, with separate AFL monitoring on each Matrix and Auxiliary output.

The Mix L/R and Group outputs all have insert points for the connection of external signal processing or graphic equalisation.

Comprehensive Talkback facilities are provided, which allow a talkback microphone to be routed to Mix L/R, Groups and Auxes 1-2 or 3-4. Six 12-segment, 3-colour peak reading LED bargraph meters provide clear display of Mix L/R, Group and PFL signals. Pressing any PFL or AFL switch puts the selected signal onto both sides of the headphones output and the L & R bargraph meters in place of the Mix signal. Two LEDs monitor the status of the console power supply.

SPIRIT LIVE 4² is designed to be as user-friendly as possible, but a few minutes spent reading through this manual will help you become familiar with the product away from the pressure of a live session, and allow you to gain full benefit from the superb performance offered by your new mixer.

BASIC PRINCIPLES OF PA MIXING

There was a time when the P.A. system and the operator existed only to increase the overall volume of the performers, so that they could be heard in a large room or above high ambient noise levels. This just isn't true any more. The sound system and the sound engineer have become an integral part of the performance, and the artists are heavily dependent on the operator's skill and the quality of the equipment.

The following introduction to the basics of mixing are included for the benefit of those users who may not have any significant familiarity with sound equipment, and who are baffled by the endless jargon used by engineers and artists alike.

THE MIXER

As one would expect, the main purpose of the mixer is to combine sounds, but under precise control. This is why long-throw faders are essential on any professional mixer, to give a responsive and smooth feel to the operator. The faders provide you with clear and instinctive control of the final sound balance and like an artist playing an instrument you should listen to the effect of your fader movements, not look at your hands.

Your SPIRIT LIVE 42 mixer accepts a wide range of input signals via the UltraMic+™ microphone input, for very low level signals, or a line input, for higher level signals from, for instance, tape machines, effects processors, etc.

The mixer is split into two sections. The **Inputs** receive, match and process individual source signals, and distribute them at precise mix levels to either a stereo **Mix** output or to one of the **Groups**. The **Master** section allows overall level control of all outputs, and provides monitoring of the audio signal at many points in the mixer, either on headphones or meters.

The **Equaliser** controls are the most flexible and potentially destructive feature of the mixer. They have a similar effect on the frequency response of the input channel as the tone controls on a hi-fi system, but with much greater precision, and allow particular characteristics of the input signal to be emphasised or reduced. It is very important that you become familiar with the effect each control has on the sound and this is best achieved by spending time listening to the effect of each control on a well-known track played through the mixer.

The **Auxiliary Sends** provide a way of routing the input signals to a number of secondary outputs, for artists foldback, echo units or additional speaker outputs.

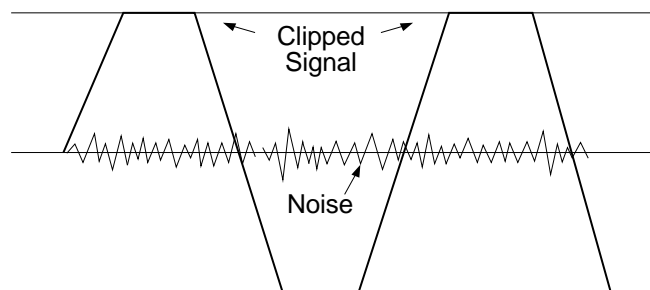
The **Pan** control adjusts the position of the input signal within the stereo mix, and can be swept from full left, through to full right. This allows particular artists to retain their correct spatial position within the mix, and can be valuable for live effects.

Pre-Fade-Listen(**PFL**) allows you to monitor the signal at many points in the mixer. Pressing any PFL switch places the signal at that particular point onto the headphones and the right meter, to check the quality of the signal or to pin-point problems. Using PFL will not affect the signals on the outputs from the desk.

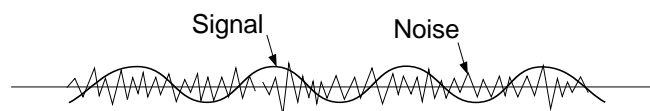
Each mono input channel and the Mix and Group outputs have an **Insert** 'A' gauge jack socket, which is a break point in the signal path. It allows the signal to be taken out of the mixer, through an external piece of equipment and then back into the mixer directly after its original exit point. The Insert point is normally bypassed by the 'A' gauge jack socket contacts, and is only brought into operation when a plug is inserted. Typical uses would include Effects Processors, Limiters, additional Equalisers or Delay units. In addition, each channel has a **Direct output** which may also be used to feed external equipment such as multitrack tape machines or effects devices.

The terms **PRE** and **POST** are often used in the context of Inserts, Equalisers and Auxiliary Sends, and describe whether that facility is placed before (Pre) or after (Post) another particular section. This is explained further in the Glossary.

A mixer is often judged, amongst other factors, by the amount of **Headroom** available. This is a measure of the reserve available to cope with sudden peaks in the input signal, without distortion caused by **Clipping**, when the signal becomes so high that it would exceed the power supply rail voltages and is as a result limited. This commonly occurs where gain settings are incorrectly set or where sources are improperly matched to the mixer input. If the source signal is too high, clipping and distortion results. If the signal is too low it becomes masked by the background noise which is present to some degree in all mixers. The diagram below illustrates this point.



If the signal level is too high, clipping distortion may occur.



If the signal level is too low it may be masked by the noise.

INSTALLATION AND SAFETY PRECAUTIONS

INSTALLING THE MIXER

Correct connection and positioning of your mixer is important for successful and trouble-free operation. The following sections are intended to give guidance with cabling, connections and configuration of your mixer.

- Choose the mains supply for the sound system with care, and do not share sockets or earthing with lighting dimmers.
- Position the mixer where the sound can be heard clearly, preferably within the audience.
- Run audio cables separately from dimmer wiring, using balanced lines wherever possible. If necessary, cross audio and lighting cables at right angles to minimise the possibility of interference. Keep unbalanced cabling as short as possible.
- Check your cables regularly and label each end for easy identification.

SAFETY PRECAUTIONS

For your own safety and to avoid invalidation of the warranty please read this section carefully.

The LIVE 4² mixer must only be connected through the Power Supply supplied.

The wires in the mains lead are coloured in accordance with the following code:

Earth:	Green and Yellow	(Green/Yellow - US)
Neutral:	Blue	(White - US)
Live:	Brown	(Black - US)

As the colours of the wires in the mains lead may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:

The wire which is coloured Green and Yellow must be connected to the terminal in the plug which is marked with the letter E or by the earth symbol.

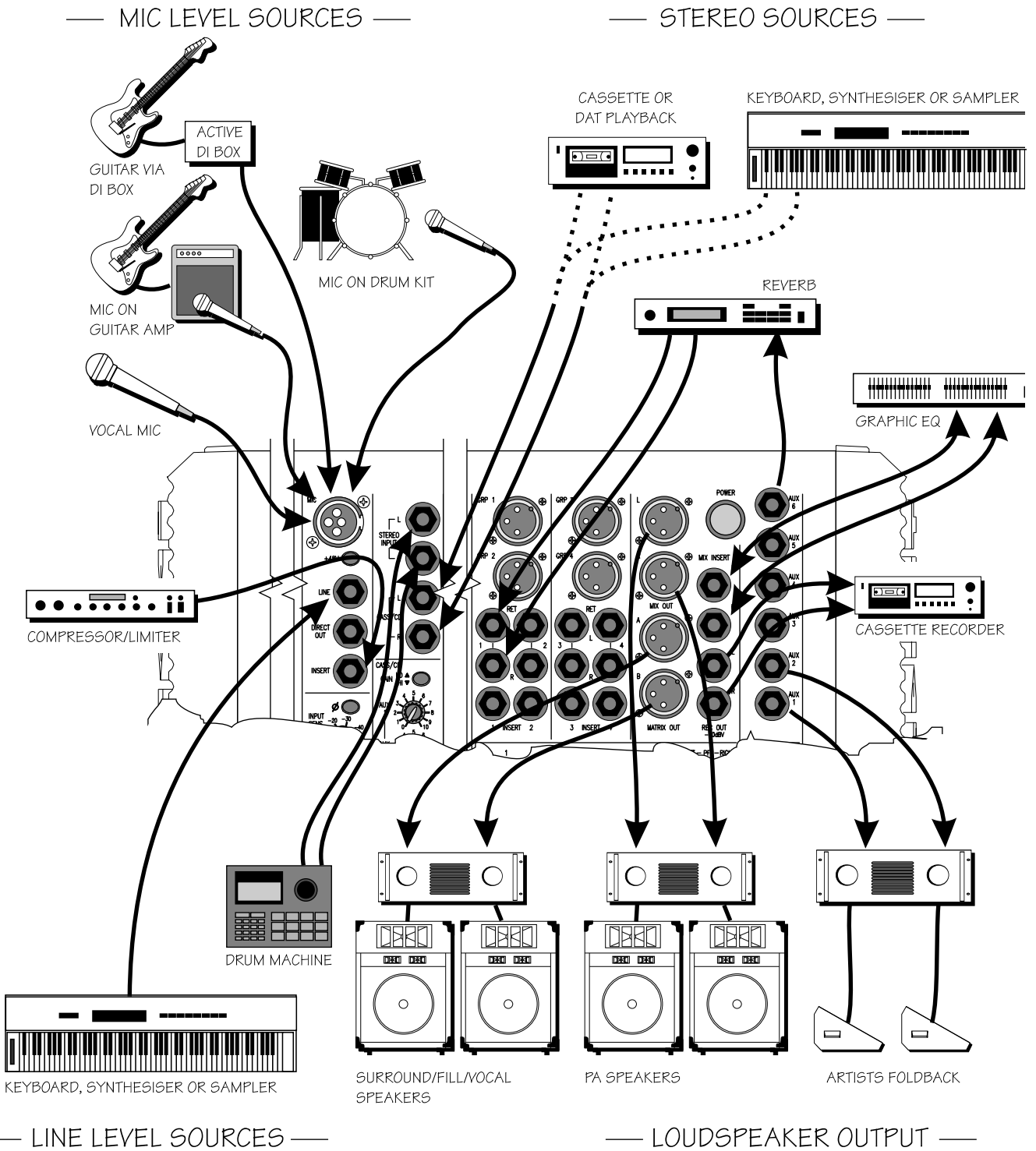
The wire which is coloured Blue must be connected to the terminal in the plug which is marked with the letter N.

The wire which is coloured Brown must be connected to the terminal in the plug which is marked with the letter L.

Ensure that these colour codings are followed carefully in the event of the plug being changed.

To avoid the risk of fire, replace the mains fuse only with the correct value fuse, as indicated on the power supply.

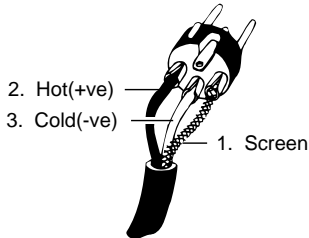
CONNECTING IT UP



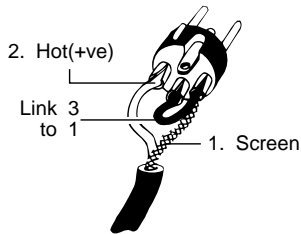
WIRING IT UP

INPUTS

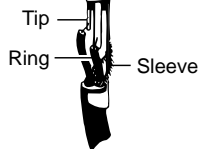
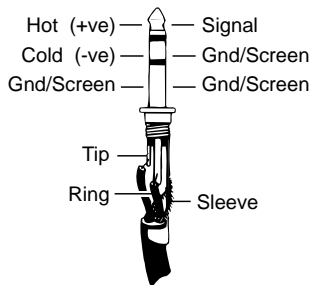
Balanced Mic XLR



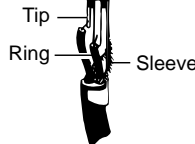
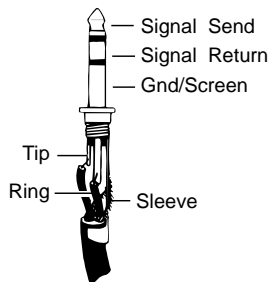
Unbalanced Mic XLR



Balanced 3 pole Jack Unbalanced 3 pole Jack



Inserts



MIC INPUT

The mic input accepts XLR-type connectors and is designed to suit a wide range of **BALANCED** or **UNBALANCED** low-level signals, whether from delicate vocals requiring the best low-noise performance or close-miked drum kits needing maximum headroom. Professional dynamic, condenser or ribbon mics are best because these will be **LOW IMPEDANCE**. While you can use low-cost **HIGH IMPEDANCE** mics, you do not get the same degree of immunity to interference on the microphone cable and as a result the level of background noise may be higher. If you turn the **PHANTOM POWER** on, the socket provides a suitable powering voltage for professional condenser mics.

DO NOT use unbalanced sources with the phantom power switched on. The voltage on pins 2 & 3 of the XLR connector may cause serious damage.

The input level is set using the **INPUT SENS** knob.

The **LINE** input offers the same gain range as the **MIC** input, but at a higher input impedance. This is suitable for most line level sources, and provides the gain needed for lower level keyboards and high impedance microphones.

WARNING - Start with the **INPUT SENS** knob at the '0' position when plugging high level sources into the **LINE** input to avoid overloading the input channel or giving you a very loud surprise!

LINE INPUT

Accepts 3-pole 'A' gauge jacks, or 2-pole mono jacks which will automatically ground the 'cold' input. Use this input for sources other than mics, such as keyboards, drum machines, synths, tape machines or guitars. The input is **BALANCED** for low noise and immunity from interference, but you can use **UNBALANCED** sources by wiring up the jacks as shown, although you should then keep cable lengths as short as possible to minimise interference pick-up on the cable. Refer to the section 'How to Prevent Interference' later in this manual. Note that the ring must be grounded if the source is unbalanced. Set the input level using the **INPUT SENS** knob, starting with the knob turned fully anticlockwise. Plugging into the **LINE** input automatically cuts off the **MIC** input.

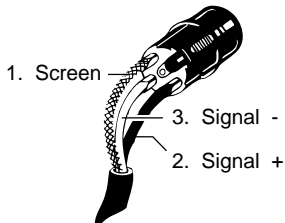
INSERT POINT

The unbalanced, pre-EQ insert point is a break in the channel signal path, allowing limiters, compressors, special EQ or other signal processing units to be added in the signal path. The Insert is a 3-pole 'A' gauge jack socket which is normally bypassed. When a jack is inserted, the signal path is broken, just before the EQ section.

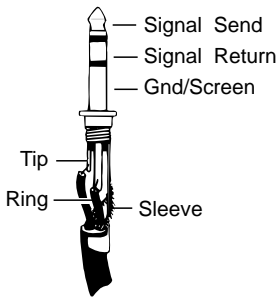
The signal from the channel appears on the **TIP** of the plug and is returned on the **RING**, with the sleeve as a common ground.

OUTPUTS

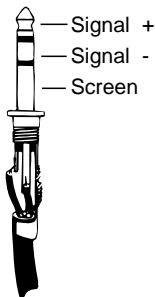
Mix Outputs
Group Outputs
Matrix Outputs



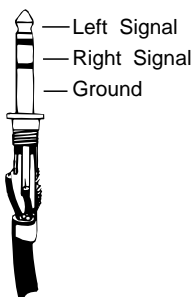
Mix & Group Inserts



Aux Outputs
Rec Outputs
Direct Outputs



Headphones



STEREO INPUTS, CASS/CD INPUTS

Accept 3-pole 'A' gauge jacks, or 2-pole mono jacks which will automatically ground the 'cold' input. Use these inputs for sources such as keyboards, drum machines, synths, tape machines or as returns from processing units. The input is **BALANCED** for low noise and immunity from interference, but you can use **UNBALANCED** sources by wiring up the jacks as shown, although you should then keep cable lengths as short as possible to minimise interference pick-up on the cable. Note that the ring must be grounded if the source is unbalanced. Mono sources can be fed to both paths by plugging into the Left jack only.

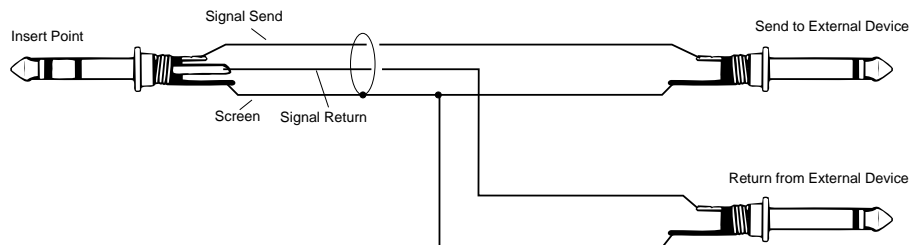
STEREO RETURNS

Similar to the Stereo Inputs. Input gain is sufficient to allow the connection of +4dBu professional or -10dBV semi-professional equipment.

MIX INSERTS, GROUP INSERTS

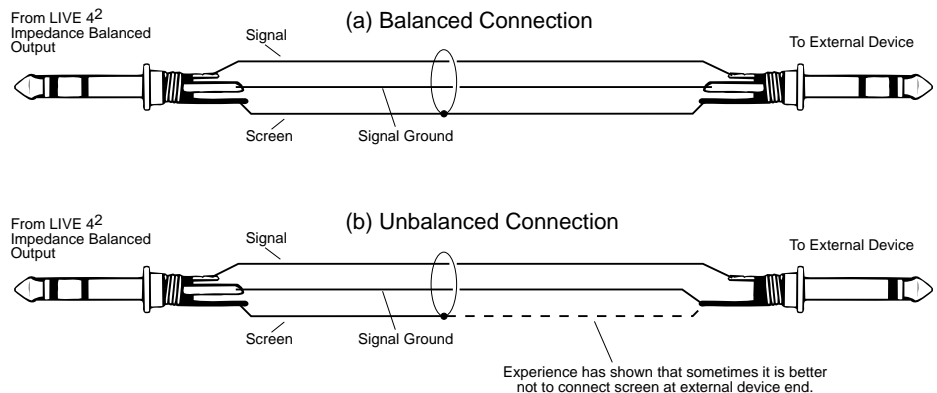
The unbalanced, pre-fade Mix insert point is a break in the output signal path to allow the connection of, for example, a compressor/limiter or graphic equaliser. The Insert is a 3-pole 'A' gauge jack socket which is normally bypassed. When a jack is inserted, the signal path is broken, just before the mix fader.

The mix signal appears on the **TIP** of the plug and is returned on the **RING**. A 'Y' lead may be required to connect to equipment with separate send and return jacks as shown below:



MIX, GROUP & MATRIX

The Mix, Group and Matrix outputs are on 3-pole XLR sockets, wired as shown on the left and below, and incorporate impedance balancing, allowing long cable runs to balanced amplifiers and other equipment.



AUX OUTPUTS, DIRECT OUTPUTS

The Aux and Channel Direct outputs are on 3-pole 'A' gauge jack sockets, wired as shown on the left, and incorporate impedance balancing, allowing long cable runs to balanced amplifiers and other equipment.

HEADPHONES

The PHONES output is a 3-pole 'A' gauge jack, wired as a stereo output as shown, suitable for headphones of 200 Ω or greater. 8 Ω headphones are not recommended.

POLARITY

You will probably be familiar with the concept of polarity in electrical signals and this is of particular importance to balanced audio signals. Just as a balanced signal is highly effective at cancelling out unwanted interference, so two microphones picking up the same signal can cancel out, or cause serious degradation of the signal if one of the cables has the +ve and -ve wires reversed. This phase reversal can be a real problem when microphones are close together and you should therefore take care always to connect pins correctly when wiring audio cables. The mono inputs are provided with a Phase (ϕ) switch to reverse the polarity of a selected input if a phasing problem is suspected.

GROUNDING AND SHIELDING

For optimum performance it is vital that all signals are referenced to a solid, noise-free earthing point and that all signal cables have their screens connected to ground. To avoid earth 'loops', use balanced connections where possible and ensure that all cable screens and other signal earths are connected to ground only at their source and not at both ends.

If the use of unbalanced connections is unavoidable, you can minimise noise by following these wiring guidelines:

- On INPUTS, unbalance at the source and use a twin, screened cable as though it were balanced.
- On OUTPUTS, connect the signal to the +ve output pin, and the ground of the output device to -ve. If a twin screened cable is used, connect the screen only at the mixer end.
- Avoid running audio cables or placing audio equipment, close to thyristor dimmer units or power cables.
- Noise immunity is improved significantly by the use of low impedance sources, such as good quality professional microphones or the outputs from most modern audio equipment. Avoid cheaper high impedance microphones, which may suffer from interference over long cable runs, even with well-made cables.

FAULT FINDING GUIDE

Repairing a sound mixing console requires specialist skills, but basic Fault Finding is within the scope of any user if a few basic rules are followed.

- Get to know the Block Diagram of your console (see page 32). It is just like following a road map.
- Get to know what each component in the system is supposed to do.
- Learn where to look for common trouble spots.

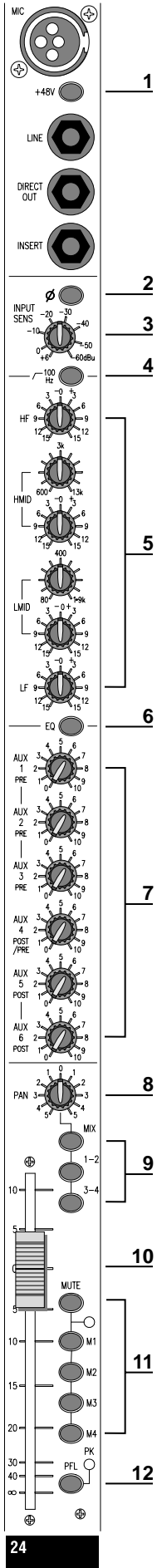
The Block Diagram (see page 32) is a representative sketch of all the components of the console, showing how they connect together and how the signal flows through the system. Once you have become familiar with the various component blocks you will find the Block Diagram quite easy to follow and you will have gained a valuable understanding of the internal structure of the console.

Each Component has a specific function and only by getting to know what each part is supposed to do will you be able to tell if there is a genuine fault! Many 'faults' are the result of incorrect connection or control settings which may have been overlooked.

Basic Troubleshooting is a process of applying logical thought to the signal path through the console and tracking down the problem by elimination.

- Swap input connections to check that the source is really present. Check both Mic and Line inputs.
- Eliminate sections of the channel by using the insert point to re-route the signal to other inputs that are known to be working.
- Route channels to different outputs or to auxiliary sends to identify problems on the Master section.
- Compare a suspect channel with an adjacent channel which has been set up identically. Use PFL and AFL to monitor the signal in each section.

GETTING TO KNOW YOUR CONSOLE



MONO INPUT CHANNEL

Two inputs are available to the mono input channel, via XLR connector (normally for microphone sources) or 3-pole 1/4" 'A' gauge jack socket for higher level signals such as keyboards, drum machines, synths or tape machines. Both input sockets are permanently active, and may be used simply by plugging the source into the required input. You do not need to unplug anything in the MIC socket if you want to use the LINE input. The new UltraMic+™ input provides very wide gain control without the need for a pad, high CMRR and +28dBu input capability.

An impedance balanced DIRECT output is provided, fed from the output of the fader buffer, which is therefore unaffected by the position of the ROUTING switches or PAN control. This provides an ideal source for external processing units, the output of which may be brought back to the console through the STEREO INPUTS or STEREO RETURNS, or to directly send to the tracks of a tape machine for multitrack recording. This provides as many Tape Sends as there are mixer channels, without using the group or mix outputs.

An unbalanced INSERT is provided which is a break point in the input channel signal path. It allows the signal to be taken out of the mixer, through an external piece of equipment and then back into the mixer to continue through to the final output. The Insert is a 3-pole 1/4" 'A' gauge Jack Socket, which is normally by-passed. When a jack plug is inserted, the signal path is broken at a point just after the Hi-Pass Filter, but before the EQ section. The signal from the channel appears on the TIP of the plug and is returned on the RING. The insert point allows limiters, compressors and other signal processing units to be added as required to particular input channels and because it is located PRE EQ, noise generated by the external equipment may be reduced by a small amount of H.F. cut in the Equaliser.

1 +48V

The +48V switch applies phantom powering to the MIC input socket for condenser microphones. Transformer-coupled dynamic microphones may be used without causing damage, even when the +48V power is connected, but care must be taken when using unbalanced sources, because of the voltage present on pins 2 and 3 of the XLR connector.

NOTE: Phantom powered mics should not be plugged in with the +48V switched on. Also you should be aware that some microphones draw an unusually large current which may overload the power supply, resulting in distortion. Consult your microphone supplier for guidance if necessary.

2 PHASE SWITCH

The Phase switch reverses the polarity of the input signal to compensate for phase differences due to microphone placement or incorrect wiring of input cables. This switch should be released for normal operation.

3 INPUT SENSITIVITY

This knob sets how much of the source signal is sent to the rest of the mixer. Too high and the signal will distort as it overloads the channel (shown by illumination of the PEAK LED), and causes clipping. Too low, and the level of any background hiss will be more noticeable and you may not be able to get enough signal level to the output of the mixer. Set the knob fully anticlockwise as a preliminary position for LINE level sources.

4 HI-PASS FILTER

Pressing this switch inserts a 18dB per octave 100Hz Hi-Pass Filter in the signal path, immediately after the input amplifier. This is particularly useful in live PA situations to reduce stage rumble or 'popping', and its use is strongly recommended, even on male vocals. It can also be used for filtering out low frequency hum.

5 EQUALISER

The Equaliser(EQ) comprises four sections. The upper control provides H.F.(treble) boost and cut of +/-15dB and the lower control provides L.F. (bass) boost and cut of +/-15dB.

The centre two pairs of knobs are arranged as HI and LO MID frequency sections, with a cut/boost control (lower knob) of +/- 15dB, and a SWEEP(frequency) control which determines at which frequency the boost/cut action will be centered. These MID sections, with a combined frequency range from 80Hz to 13kHz are particularly versatile for vocals, enabling particular characteristics of the singer to be lifted or suppressed very precisely.

Set the cut/boost control of each section to the centre-detented position when not required.

6 EQ SWITCH

The EQ switch bypasses the Equalisation section when released. Alternately pressing and releasing the switch provides an easy way of comparing the equalised and unequalised signals.

7 AUXILIARY SENDS

These controls route the input channel signal to any one or more Auxiliary buses. These are separate from the main outputs and can therefore provide additional outputs for foldback, echo units or extra loudspeaker 'fills'.

AUX 1, 2 & 3 are derived *before* the channel fader (PRE-FADE), and are therefore unaffected by the fader position. This makes them particularly suitable for foldback or monitor feeds, which need to be controlled separately from the main P.A. mix. Aux 3 may be selected internally to be post-fade if required.

AUX 5 and 6 are derived *after* channel fader (POST-FADE), and therefore follow any changes in fader level. They are normally used to drive effects processing units which are fed back into the mixer and which must fade out with the input channel.

AUX 4 is normally POST-FADE, but may be altered globally to be PRE-FADE by pressing the AUX 4 PRE switch on the Master section.

All pre-fade sends are normally POST-EQ, but may be selected to PRE-EQ by changing internal jumpers. Note that the sends are not affected by the position of the EQ switch

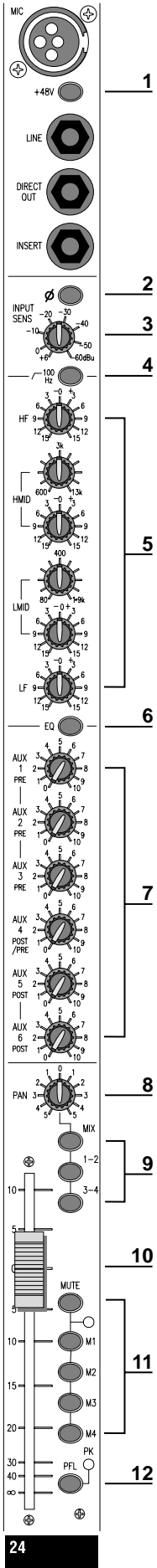
All of the Aux Sends are muted when the MUTE switch is pressed.

8 PAN

The PAN control determines the position of the signal within the stereo mix image or may be used to route the channel signal to particular output GROUPS as selected by the ROUTING SWITCHES (see below). Rotation fully anticlockwise feeds the signal solely to the Left mix buss or Groups 1 and 3, while rotation clockwise sweeps the image to the Right buss or Groups 2 and 4.

9 ROUTING SWITCHES

The input channel signal may be routed to the main Stereo MIX (L-R) or pairs of GROUP busses (1-2, 3-4), by pressing the respective switches. These may be used in conjunction with the PAN control (8 above) to route the channel signal proportionately to any of the selected busses.



10 FADER

This 100mm long-throw fader determines the proportion of the channel in the mix and provides a clear visual indication of channel level. Normal operating position is at the '0' mark, providing 10dB of gain above that point if required.

11 MUTING

All post-fade outputs from the channel may be muted by pressing the MUTE switch, and the associated LED illuminates to show that the channel is OFF.

Alternatively the channel may be selected to any one or more MUTE BUSES to provide grouped muting under the control of the MUTE masters on the far right-hand side of the console. In either case the mute status is shown by the LED.

12 PFL/PEAK

When the PFL switch is pressed, the Pre-Fade signal is fed to the headphones and L & R meters, where it replaces the normal Mix L/R signal. The PFL/AFL ON LED on the master section illuminates to warn that the headphones and the meters are now responding to the PFL/AFL selection and the PFL LED on the input channel lights to identify the active channel. This is a useful way of listening to any required input signal without interrupting the main mix, for making adjustments or tracing problems.

When the PFL switch is released the LED on the channel serves as a PEAK indicator, to warn when an excessively high signal level is present in the channel. The signal is sampled at three points in the channel, immediately after the Hi-Pass Filter (Pre Insert), post Mid EQ and pre HF EQ, and POST EQ. The Peak LED will illuminate approximately 4dB before clipping and therefore give warning of a possible overload even if the peaks are removed by external equipment plugged into the Insert.

STEREO INPUTS

Each Stereo Input section comprises two independent pairs of inputs. The Stereo Input (upper pair of jacks) feeds a full-facility input channel, very similar to the mono input. The lower pair of jacks are intended for a cassette or CD source, typically to provide background music before a performance and are fed to the stereo mix only and Aux 1 & 2.

CASS/CD INPUT SECTION

13 GAIN

The GAIN switch provides two input sensitivities. The LO setting (switch released) should be selected for -10dBV semi-professional equipment such as CD players or cassette, and the HI setting (switch pressed) should be selected for -20dBV Hi-Fi equipment. Start with the LO setting if the source level is unknown.

14 AUXILIARY SENDS

These controls route a mono sum of the input channel signal to Auxiliary busses 1 & 2. These are separate from the main outputs and can therefore provide additional outputs for foldback, echo units or extra loudspeaker 'fills'.

The sends are derived *before* the LEVEL TO MIX control (Pre-fade) and are therefore not affected by the position of that control. This makes them particularly suitable for foldback or monitor feeds, which need to be controlled separately from the main P.A. mix. These sends are not affected by the mute switching.

15 PFL

When the PFL switch is pressed, a mono sum of the pre-fade signal is fed to the headphones and L & R meters, where it replaces the normal Mix L/R signal. The PFL/AFL ON LED on the master section illuminates to warn that the headphones and the meters are now responding to the PFL/AFL selection and the PFL LED on the input section lights to identify the active channel. This is a useful way of listening to any required input signal without interrupting the main mix, for making adjustments or tracing problems.

16 LEVEL TO MIX

This control sets the level of the stereo signal to the stereo MIX. The knob should be left fully anticlockwise when not required.

STEREO INPUT SECTION

17 GAIN

This knob allows you to match the input level to suit a wide variety of professional, semi-professional and hi-fi sources. Start with a low setting, especially for professional equipment, and increase it if you cannot reach an adequate signal level with the fader at maximum.

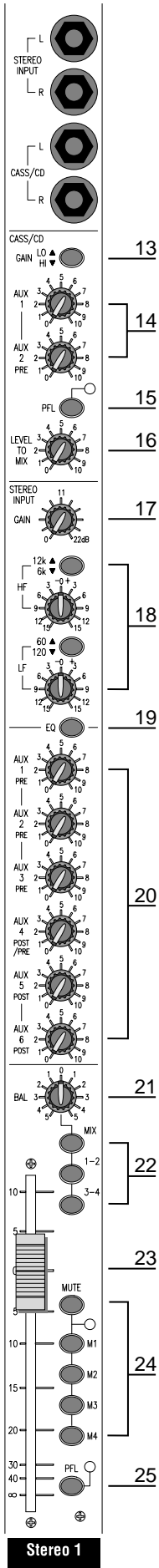
18 EQUALISER

The Equaliser section has HF and LF shelving controls, each with a range switch to provide two centre frequencies for each control.

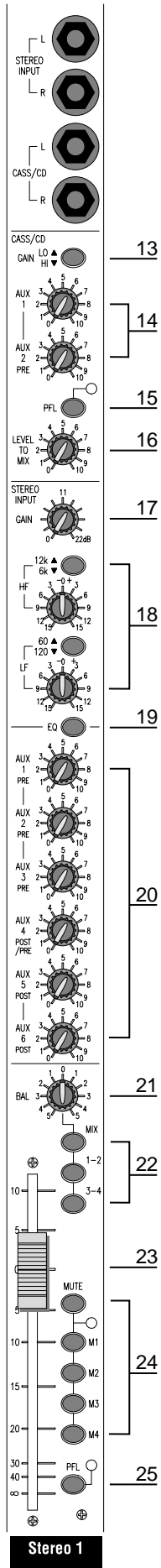
Turn the HF knob to the right to boost high (treble) frequencies by up to 15dB at a choice of 6kHz or 12kHz centre frequencies, adding crispness to percussion from drum machines, synths and electronic instruments. Turn to the left to cut these frequencies, reducing hiss or excessive brilliance.

Turn the LF knob to the right to boost low (bass) frequencies by up to 15dB at a choice of 60Hz or 120Hz centre frequencies, adding extra punch to synths, guitars and drums. Turn to the left to reduce hum, boominess or improve a mushy sound.

Set both knobs in the centre-detented position when not required.



Stereo 1



19 EQ SWITCH

The EQ switch bypasses the Equalisation section when released. Alternately pressing and releasing the switch provides an easy way of comparing the equalised and unequalised signals.

20 AUXILIARY SENDS

These controls route a mono sum of the input channel signal to any one or more Auxiliary buses. These are separate from the main outputs and can therefore provide additional outputs for foldback, echo units or extra loudspeaker 'fills'.

AUX 1, 2 & 3 are derived *after* the EQ section and *before* the channel fader (PRE FADE, POST EQ), and are therefore unaffected by the fader position and mute status. This makes them particularly suitable for foldback or monitor feeds, which need to be controlled separately from the main P.A. mix. Aux 3 may be selected internally to be post-fade.

AUX 4, 5 and 6 are derived *after* the EQ and channel fader (POST FADE, POST EQ), and therefore follow any changes in fader level. They are normally used to drive effects processing units which are fed back into the mixer and which must fade out with the input channel.

AUX 4 may be altered globally to be PRE FADE by pressing the AUX 4 PRE switch on the Master section.

All of the post-fade Aux Sends are muted when the MUTE switch is pressed.

21 BALANCE

The BALANCE control sets the amount of the channel signal feeding the Left and Right Mix outputs, allowing you to balance the source in the stereo image. When the control is turned fully left or right you feed only that side of the signal to the mix.

22 ROUTING SWITCHES

The input channel signal may be routed in stereo to the main Stereo MIX (L-R) or pairs of GROUP busses (1-2, 3-4), by pressing the respective switches. The Left side of the channel feeds Groups 1 & 3, and the Right side feeds Groups 2 & 4, subject to the position of the BALANCE control (21).

23 FADER

This long-throw fader determines the proportion of the channel in the mix and provides a clear visual indication of channel level. Normal operating position is at the '0' mark, providing 10dB of gain above that point if required.

24 MUTING

All post-fade outputs from the channel may be muted by pressing the MUTE switch, and the associated LED illuminates to show that the channel is OFF.

Alternatively the channel may be selected to any one or more MUTE BUSES to provide grouped muting under the control of the MUTE masters on the far right-hand side of the console. In either case the mute status is shown by the LED.

25 PFL

When the PFL switch is pressed, a mono sum of the pre-fade signal is fed to the headphones and L & R meters, where it replaces the normal Mix L/R signal. The PFL/AFL ON LED on the master section illuminates to warn that the headphones and the meters are now responding to the PFL/AFL selection and the PFL LED on the input channel lights to identify the active channel. This is a useful way of listening to any required input signal without interrupting the main mix, for making adjustments or tracing problems.

GROUP SECTION

The Group outputs are available on XLR connectors, and a pre-fade insert point is also provided on 3-pole 1/4" jacks. The Groups may also feed the stereo Mix (see 27, below) or the Matrix outputs (see 28, below).

26 GROUP FADERS

These 100mm long-throw fader determine the level of the Group signal. Normal operating position is at the '0' mark, providing 10dB of gain above that point if required.

27 GROUPS TO MIX, STEREO/MONO

Pressing the GROUPS TO MIX switch feeds the post-fade Group signals in stereo to both sides of the stereo Mix. Groups 1 and 3 feed Mix Left, and Groups 2 & 4 feed Mix Right.

Alternatively pairs of Groups may be used as mono subgroups feeding both sides of the Mix, by pressing the STEREO/MONO switch.

28 MATRIX SENDS (GROUPS)

The console is provided with two independent Matrix outputs A & B. These may receive feeds from each Group or Mix Left and Right to create additional mixes for extra speaker outputs (e.g. side fills or delays) without affecting the main mix. The MATRIX SENDS control the level of the Group signal sent to Matrix A & B buses. They should be turned fully anticlockwise when not required.

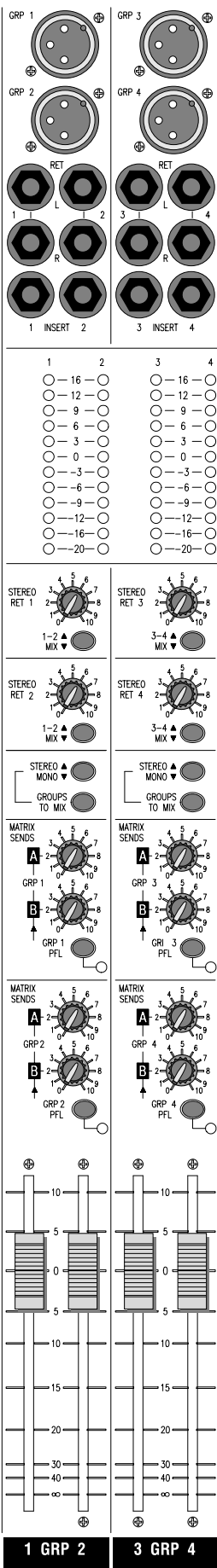
If required the Matrix outputs may be used to create an additional stereo output from the console, and in this case the Groups may be fed as stereo pairs, for instance with Groups 1 & 3 feeding Matrix A and Groups 2 & 4 feeding Matrix B.

29 PFL

When the PFL switch is pressed, the pre-fade signal of the relevant Group is fed to the headphones and L & R meters, where it replaces the normal Mix L/R signal. The PFL/AFL ON LED on the master section illuminates to warn that the headphones and the meters are now responding to the PFL/AFL selection and the associated PFL LED lights to identify the active Group. This is a useful way of listening to any required Group signal without interrupting the main mix, for making adjustments or tracing problems.

30 STEREO RETURNS

Four STEREO RETURNS are provided which feed either to the stereo Mix or the local pair of Groups, as selected by the 1-2(3-4)/Mix switches. These are an ideal way of mixing in the output of a reverb or effects unit, additional keyboards or the output of other consoles used as sub-mixers. The knobs should be turned fully anticlockwise when not required.



31

30

27

28

29

26

MASTER SECTION

31 BARGRAPH METERS

Six 12-segment, three colour bargraph meters provide visual monitoring of the levels of the Mix Left and Right, and Group outputs. All the meters are peak reading.

Normally the Left and Right meters show the level of the Mix Left and Right outputs. If any PFL or AFL switch is activated the meters are switched to display the level of the selected PFL or AFL signal.

32 MIX FADERS

The MIX FADERS set the final level of the Mix outputs. The faders should normally be set close to the '0' mark if the input channel levels have been set correctly.

Pre-fade INSERTS are provided for connection of external processing equipment (e.g. Graphic EQ) if required.

33 MATRIX SENDS

The console is provided with two independent Matrix outputs A & B, which may receive feeds from each Group or Mix Left and Right to create additional mixes for extra speaker outputs (e.g. side fills or delays) without affecting the main mix. These knobs control the level of the Mix signal sent to Matrix A & B buses. They should be turned fully anticlockwise when not required.

Normally the Matrix Sends are derived from a mono sum of Mix L & R. Pressing the STEREO switch routes Mix L to Matrix A and Mix R to Matrix B to allow the Matrix outputs to be used as a separate stereo output from the console.

34 MATRIX MASTERS

Each Matrix section has a MASTER control which sets the final output level.

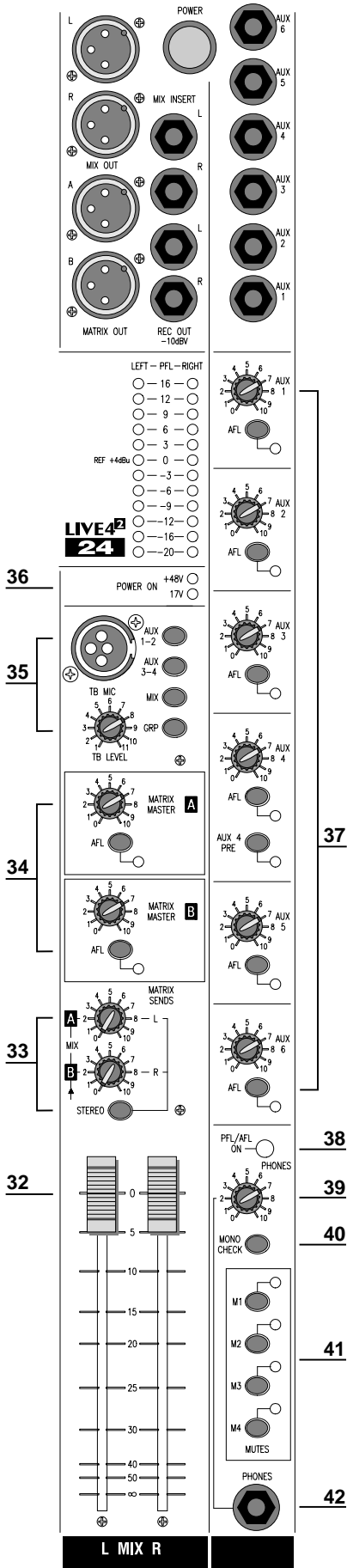
When the AFL switch is pressed, the post-fade signal is fed to the headphones and L & R meters, where it replaces the normal Mix L/R signal. The PFL/AFL ON LED on the master section illuminates to warn that the headphones and the meters are now responding to the PFL/AFL selection and the PFL LED on the input channel lights to identify the active Matrix output. This is a useful way of listening to any required output signal without interrupting the main mix, for making adjustments or tracing problems.

35 TALKBACK

An XLR connector is provided to accept the input from a local talkback mic or gooseneck mic. Gain is set by the TB LEVEL control and the signal may be routed to a choice of AUX 1-2, AUX 3-4, MIX or GROUP buses using the four adjacent switches.

36 POWER ON LEDS

Two LEDs monitor the status of the console power supply and will be illuminated when power is connected. Check that both LEDs are lit after turning on the console power supply.



37 AUXILIARY MASTERS

Each of the Auxiliary Send busses is provided with a rotary MASTER LEVEL fader and an AFL switch with indicating LED which monitors the final output *after* the fader.

AUX 4 normally receives post-fade sends from the input channels, but may be switched to pre-fade by pressing the AUX 4 PRE switch.

38 PFL/AFL ON

This LED illuminates to show that a PFL or AFL is active on the headphones, and to show that the Left & Right meters will be displaying the PFL/AFL signal.

39 PHONES

This control sets the level of the PHONES output jack.

40 MONO CHECK

Normally the Phones output monitors the Stereo Mix. Pressing the MONO CHECK switch sums the L & R outputs to check for phasing problems. The main outputs are not affected by the position of the switch.

41 MUTE MASTERS

Four MUTE MASTER switches provide muting control of any channels which have been assigned to a mute group using the M1-M4 switches on the input channels. The associated LED illuminates when the MUTE is active.

42 PHONES JACK

The PHONES output appears on a 3-pole 1/4" jack, suitable for headphones with an impedance of 200Ω or higher.

USING YOUR SPIRIT LIVE 4² CONSOLE

The final sound from your P.A. system can only ever be as good as the weakest link in the chain, and especially important is the quality of the source signal because this is the starting point of the chain. Just as you need to become familiar with the control functions of your mixer, so you must recognise the importance of correct choice of inputs, microphone placement and input channel settings. However, no amount of careful setting up can take account of the spontaneity and unpredictability of live performance and the mixer must be set up to provide 'spare' control range to compensate for changing microphone position and the absorption effect of a large audience (different acoustic characteristics from sound check to show).

MICROPHONE PLACEMENT

Careful microphone placement and the choice of a suitable type of microphone for the job is one of the essentials of successful sound reinforcement. The aim should be to place the microphone as close as physically possible to the source, to cut out unwanted surrounding sounds, allow a lower gain setting on the mixer and avoid feedback. Also a well-chosen and well-placed microphone should not need any appreciable equalisation.

There are no exact rules - let your ears be the judge. In the end, the position that gives the desired effect is the correct position!

INITIAL SET UP

Once you have connected up your system (see the sections on connection and wiring earlier in this manual for guidance) you are ready to set initial positions for the controls on your mixer.

The front panel drawing inside the rear cover shows typical initial control positions which may be found a useful guide to setting up the mixer for the first time.

The diagram on page 3 demonstrated how the matching of input gain to the signal source was crucial to avoid distortion at one extreme and excessive noise at the other. Set up individual input channel as follows:

- Connect your sources (microphone, keyboard etc.) to the required inputs.
Note: Phantom powered mics should be connected before the +48V is switched on.
Route the channel to Mix.
- Set Master faders at 0, input faders at 0, and set power amplifier levels to about 70%.
- Provide a typical performance level signal and press the PFL button on the first channel, monitoring the level on the bargraph meters.
- Adjust the input gain until the meter display is in the amber section, with occasional peaks to the first red LED at a typical maximum source level. This allows sufficient headroom to accommodate peaks and establishes the maximum level for normal operation (but see note below).
- Repeat this procedure on other channels as required. As more channels are added to the mix, the meters may move into the red section. Adjust the overall level using the Master Faders if necessary.

- Listen carefully for the characteristic sound of `feedback`. If you cannot achieve satisfactory input level setting without feedback, check microphone and speaker placement and repeat the exercise.

Note: The initial settings should only be regarded as a starting point for your mix. It is important to remember that many factors affect the sound during a live performance, for instance the size of the audience!

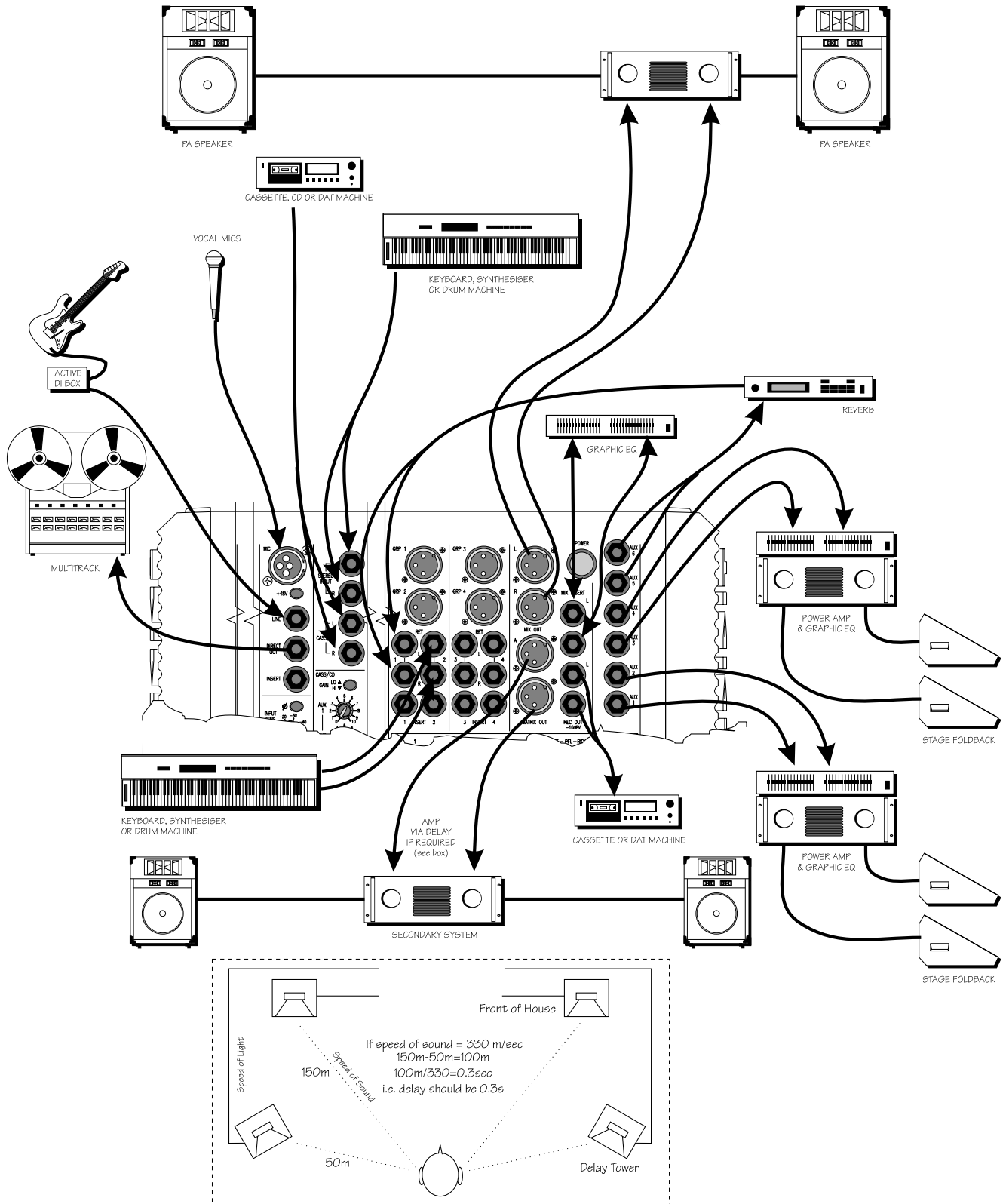
You are now ready to start building the mix and this should be done progressively, listening carefully for each component in the mix and watching the meters for any hint of overload. If this occurs, back off the appropriate Channel Fader slightly until the level is out of the red segments, or adjust the Master Fader.

NOTE:

The level of any source signal in the final output is affected by many factors, principally the Input Sensitivity control, Channel Fader, Group and Output Faders. You should try to use only as much microphone gain as required to achieve a good balance between signals, with the faders set as described above. If the input gain is set too high, the channel fader will need to be pulled down too far in compensation to leave enough travel for successful mixing and there is a greater risk of feedback because small fader movements will have a very significant effect on output level. If the gain is set too low, you will not find enough gain on the faders to bring the signal up to an adequate level.

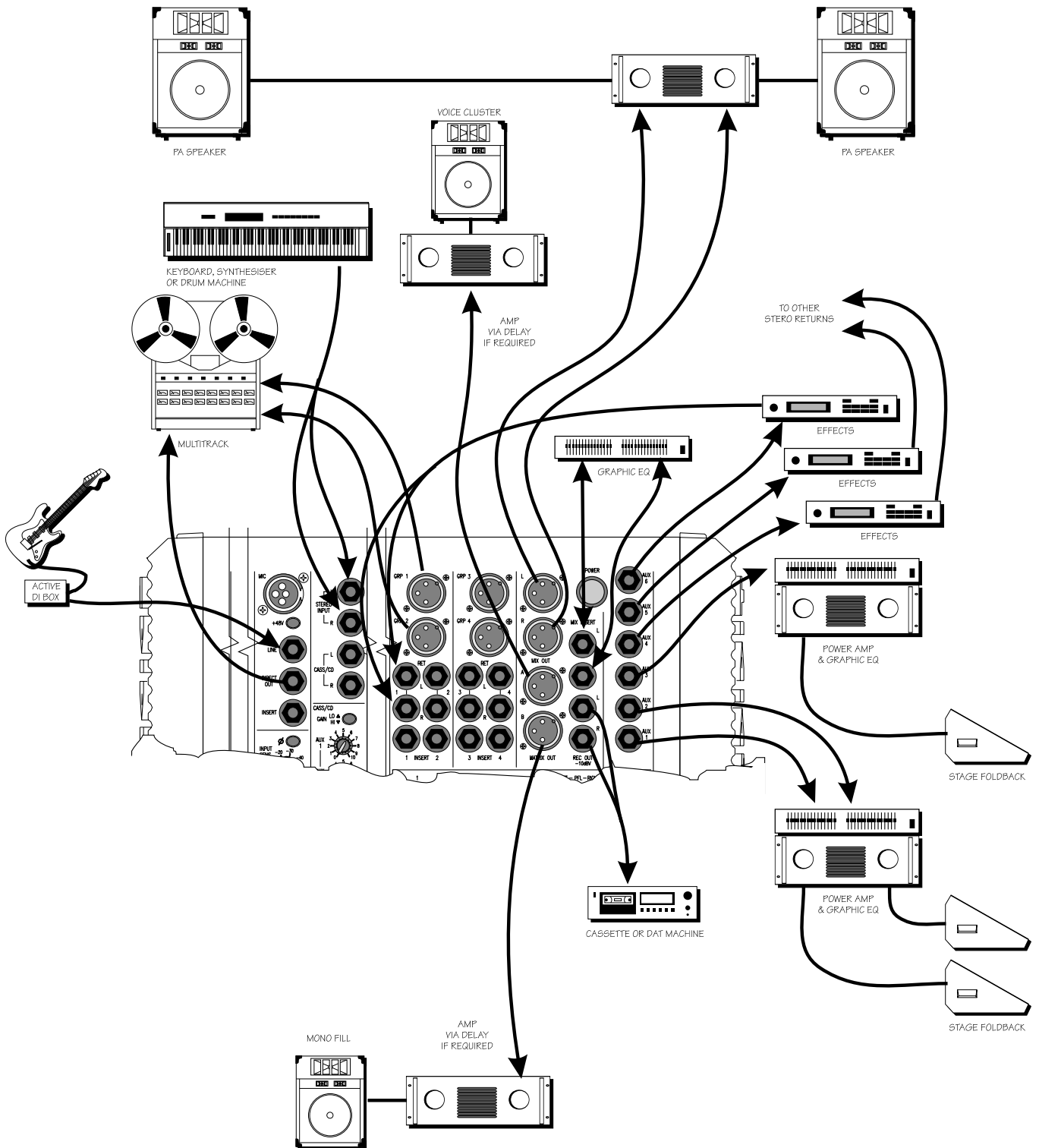
APPLICATION 1 - LIVE SOUND REINFORCEMENT

This drawing shows a typical configuration for sound reinforcement, with the main PA fed from Mix L/R and a secondary system fed from the Matrix outputs. The illustration shows the flexibility of the inputs to the mixer and how the direct outputs are available as sources for a multitrack tape machine. The Aux Sends are used for reverb (Aux 1 & 2 which are pre-fade) and for artists foldback (Aux 4-6).



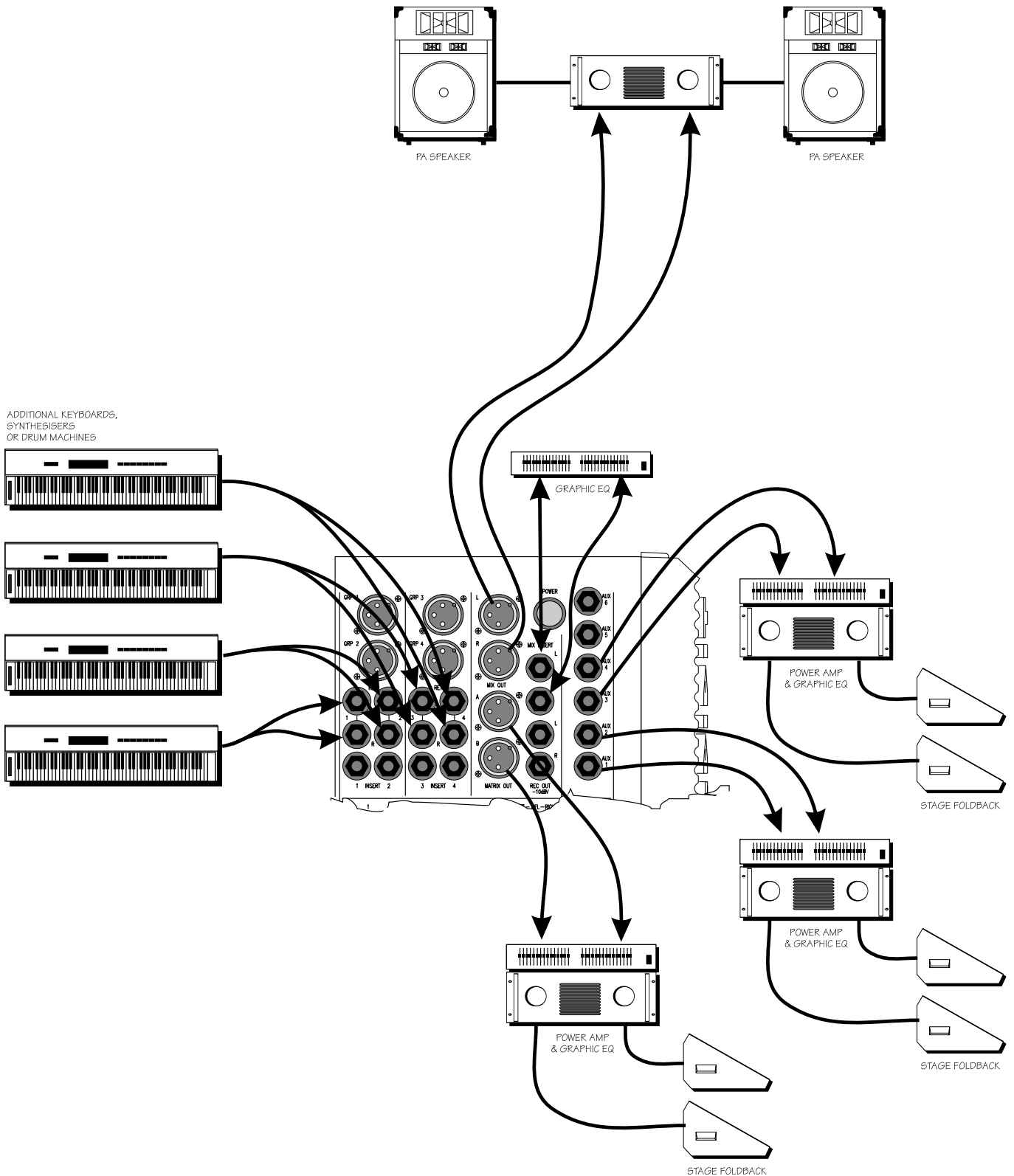
APPLICATION 2 - LIVE SOUND WITH CENTRE CLUSTER

This configuration is similar to application 1, but with the addition of a voice cluster and mono fill, both fed from the Matrix outputs. The source for the Matrix could be the main Mix, or a combination of Mix and Groups. The first three Aux sends are used as mono feeds to Effects Units, brought back to the Mix on the Stereo Returns.



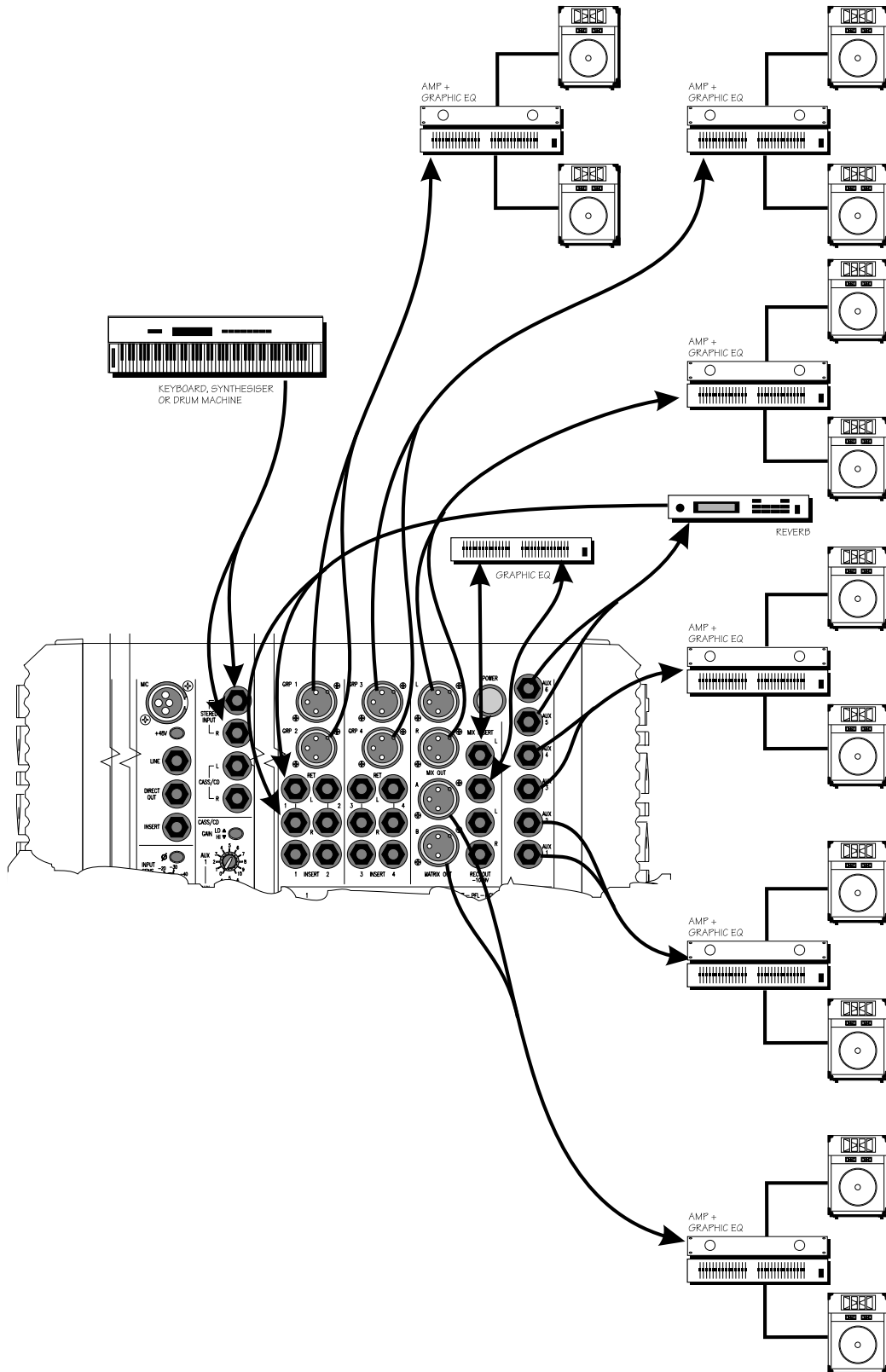
APPLICATION 3 - ADDITIONAL STEREO INPUTS

This illustration shows how the number of Stereo Inputs to the Mix may be expanded by using the Stereo Returns for sources such as keyboards and drum machines, when the normal Stereo input channels are already used. Additional stage foldback is provided by the Matrix outputs in this example.



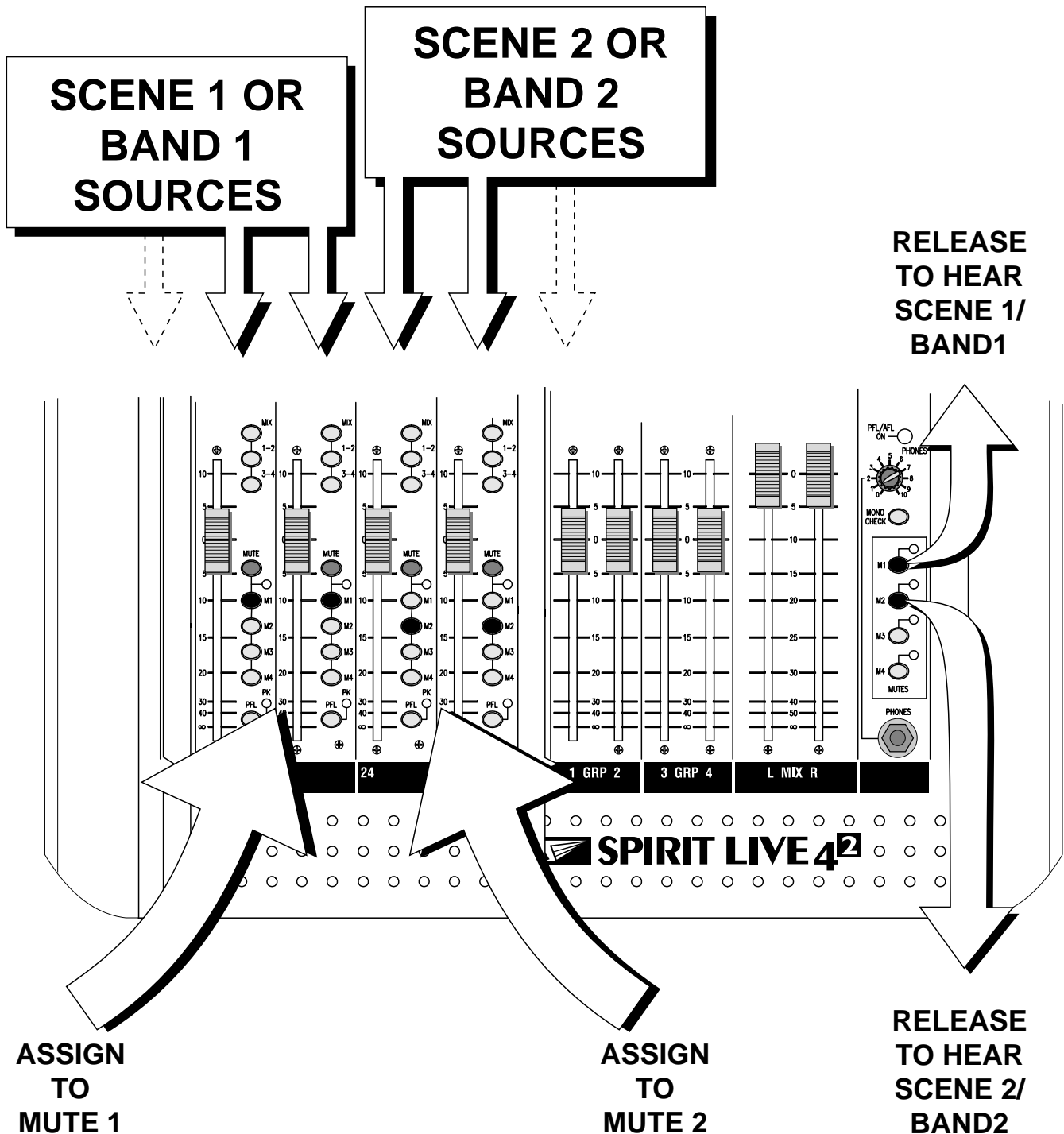
APPLICATION 4 - THEATRE SOUND

In this application the main requirement is to drive a large number of separate loudspeaker outputs for spot sound effects. The Groups, Mix, Aux Sends and Matrix outputs are all used for this purpose. Each could be provided with Graphic EQ or Delay units as required.



APPLICATION 5 - USING THE MUTE BUSES

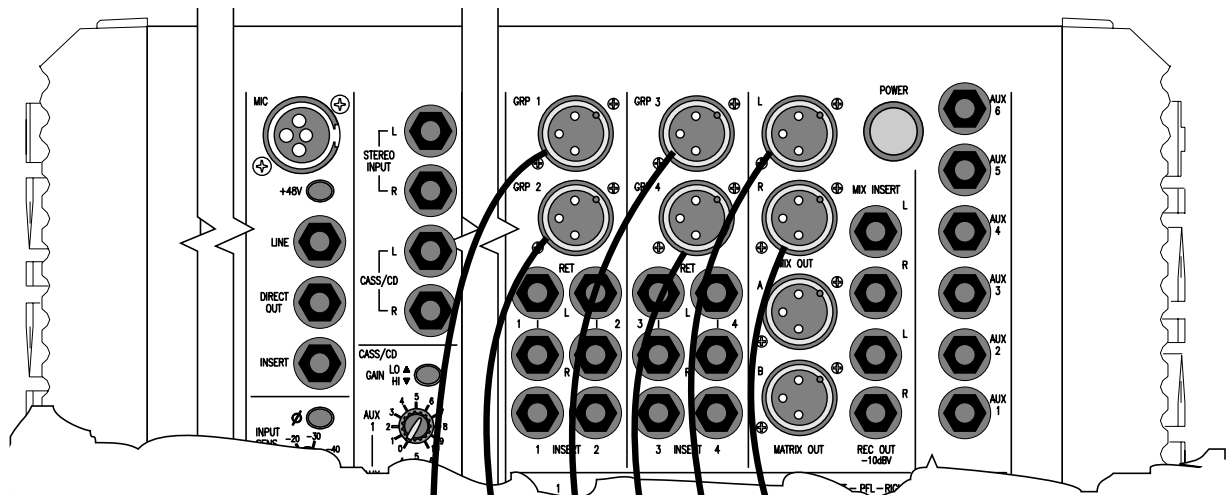
This illustration demonstrates how the Mute buses may be used to control groups of inputs, allowing those sources to be set up in advance, including fader positions, and muted until required. Releasing the respective Master Mute button activates the whole group. Pressing the button mutes the selected channels.



APPLICATION 6 - LINKING TWO LIVE 4² MIXERS

This illustration shows how to link the outputs of one mixer into a second mixer, to control a larger number of input channels, or to accommodate a separate mixer being used as a submixer. Note that the PFL/AFL monitoring and Mute buses remain separate.

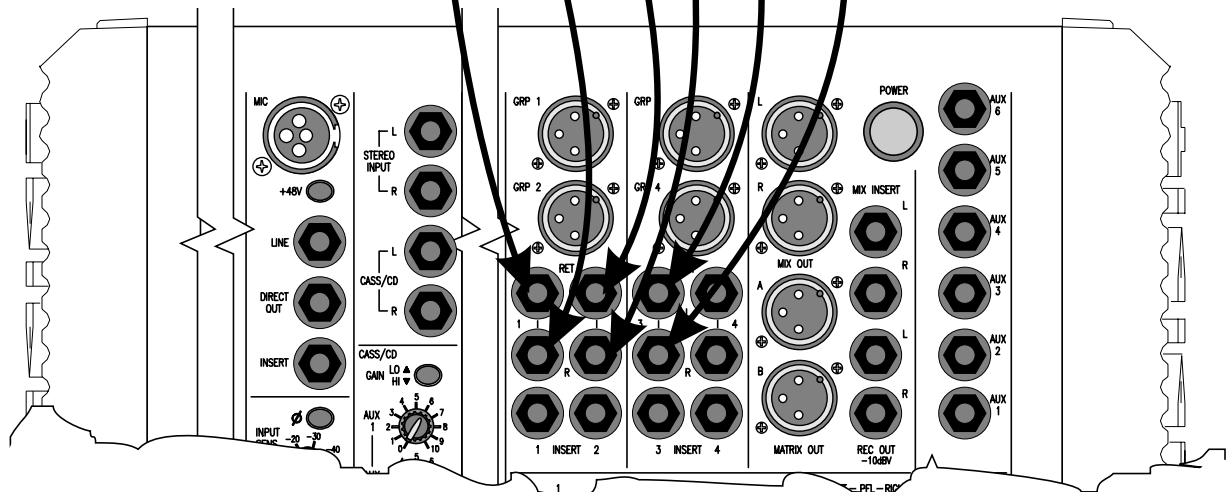
Slave Mixer



Groups 1-4 out

Mix L/R out

Master Mixer



NOTE:

PFL/AFL and Group Muting are SEPARATE for each mixer

CARE OF YOUR MIXER

GENERAL PRECAUTIONS

- Avoid storing or using the mixer in conditions of excessive heat or cold, or in positions where it is likely to be subject to vibration, dust or moisture.
- Keep the mixer clean using a soft dry brush, and an occasional wipe with a damp cloth or ethyl alcohol. Do not use any other solvents which may cause damage to paint or plastic parts.
- Avoid placing drinks or smoking materials on or near the mixer. Sticky drinks and cigarette ash are frequent causes of damage to faders and switches.

Regular care and inspection will be rewarded by a long life and maximum reliability.

GLOSSARY

AFL (After Fade Listen)	a function that allows the operator to monitor the post-fade signal in a channel independently of the main mix.
auxiliary send	an output from the console comprising a mix of signals from channels and groups derived independently of the main stereo/group mixes. Typically the feeds to the mix are implemented on rotary level controls.
balance	the relative levels of the left and right channels of a stereo signal.
balanced	a method of audio connection which 'balances' the signal between two wires and a screen which carries no signal. Any interference is picked up equally by the two wires, but out of phase resulting in cancellation of the interference signal.
clipping	the onset of severe distortion in the signal path, usually caused by the peak signal voltage being limited by the circuit's power supply voltage.
DAT	Digital Audio Tape, a cassette-based digital recording format.
dB (decibel)	a ratio of two voltages or signal levels, expressed by the equation $dB = 20 \log_{10} (V_1/V_2)$. Adding the suffix 'u' denotes the ratio is relative to 0.775V RMS.
DI(direct injection)	the practice of connecting an electric musical instrument directly to the input of the mixing console, rather than to an amplifier and loudspeaker which is covered by a microphone feeding the console.
direct output	a post fade line level output from the input channel, bypassing the summing amplifiers, typically for sending to individual tape tracks during recording.
equaliser	a device that allows the boosting or cutting of selected bands of frequencies in the signal path.
fader	a linear control providing level adjustment
feedback	the 'howling' sound caused by bringing a microphone too close to a loudspeaker driven from its amplified signal.
foldback	a feed sent back to the artistes via loudspeakers or headphones to enable them to monitor the sounds they are producing.
frequency response	the variation in gain of a device with frequency.
gain/input sensitivity	the variation in level of the signal

(sub) group	an output into which a group of signals can be mixed.
headroom	the available signal range above the nominal level before clipping occurs.
highpass filter	a filter that rejects low frequencies.
impedance balancing	a technique used on unbalanced outputs to minimise the effect of hum and interference when connecting to external balanced inputs.
insert	a break point in the signal path to allow the connection of external devices, for instance signal processors or to another mixer. line level signals at a nominal level of -10 to +6dBu, usually coming from a low impedance source.
mute groups	a method of combining the on/off status of a selection of channels under a single control button.
pan (pot)	abbreviation of 'panorama': controls levels sent to left and right outputs.
peaking	an equaliser response curve affecting only a band of frequencies i.e. based on a bandpass response.
PFL (pre-fade listen)	a function that allows the operator to monitor the pre-fade signal in a channel independently of the main mix.
phase	a term used to describe the relationship of two audio signals. In-phase signals reinforce each other, out-of-phase signals result in cancellation.
polarity	a term used to describe the orientation of the positive and negative poles of an audio connection. Normally connections are made with positive to positive, negative to negative and this would correct polarity. If this is reversed, the result will be out-of-phase signals (see 'phase' above).
post-fade	the point in the signal path after the monitor or master fader and therefore affected by fader position.
pre-fade	the point in the signal path before the monitor or master fader position and therefore unaffected by the fader position.
rolloff	a fall in gain at the extremes of the frequency response.
shelving	an equaliser response affecting all frequencies above or below the break frequency i.e. a highpass or lowpass derived response.
spill	acoustic interference from other sources.
stereo return	an input specifically designed to receive the output of effects or other external processing devices
talkback	the operator speaking to the artistes or to tape via the auxiliary or group outputs.
transient	a momentary rise in the signal level.
unbalanced	a method of audio connection which uses a single wire and the cable screen as the signal return. This method does not provide the noise immunity of a <i>balanced</i> input (see above)
+48V	the phantom power supply, available at the channel mic inputs, for condenser microphones and active DI boxes.

TYPICAL SPECIFICATIONS

NOISE

Measured RMS, 22Hz to 22kHz Bandwidth

Line inputs selected at unity gain and terminated 150R

MIX	26 Inputs routed to Mix, faders at unity, muted	-82 dBu
	Mix Faders down	-97 dBu
AUX	26 Inputs routed, output at max., input faders down	-84 dBu
DIRECT OUTPUT	Input to Direct Output @ unity gain	-87 dBu
	Input to Direct Output @ 40dB gain	-77 dBu
MATRIX OUTPUT	Matrix Output at max., sends down	-95 dBu
E.I.N.	Microphone Input, Maximum Gain, terminated 150R	-129 dBu
CROSSTALK	@ 1kHz	
	Typical Channel Fader Attenuation	> 80 dB
	Typical Aux Attenuation	> 80 dB
	Typical Pan Isolation	> 70 dB
	Adjacent Channel Crosstalk	> 85 dB

FREQUENCY RESPONSE

	20Hz to 20kHz	-1dB
T.H.D.	-10dBu Input routed to Mix, +20dBu out @ 1kHz	< 0.006%
C.M.R.R.	Typical at max. gain @ 1 kHz	-85 dB
	Typical at any gain @ 50 Hz	-65 dB

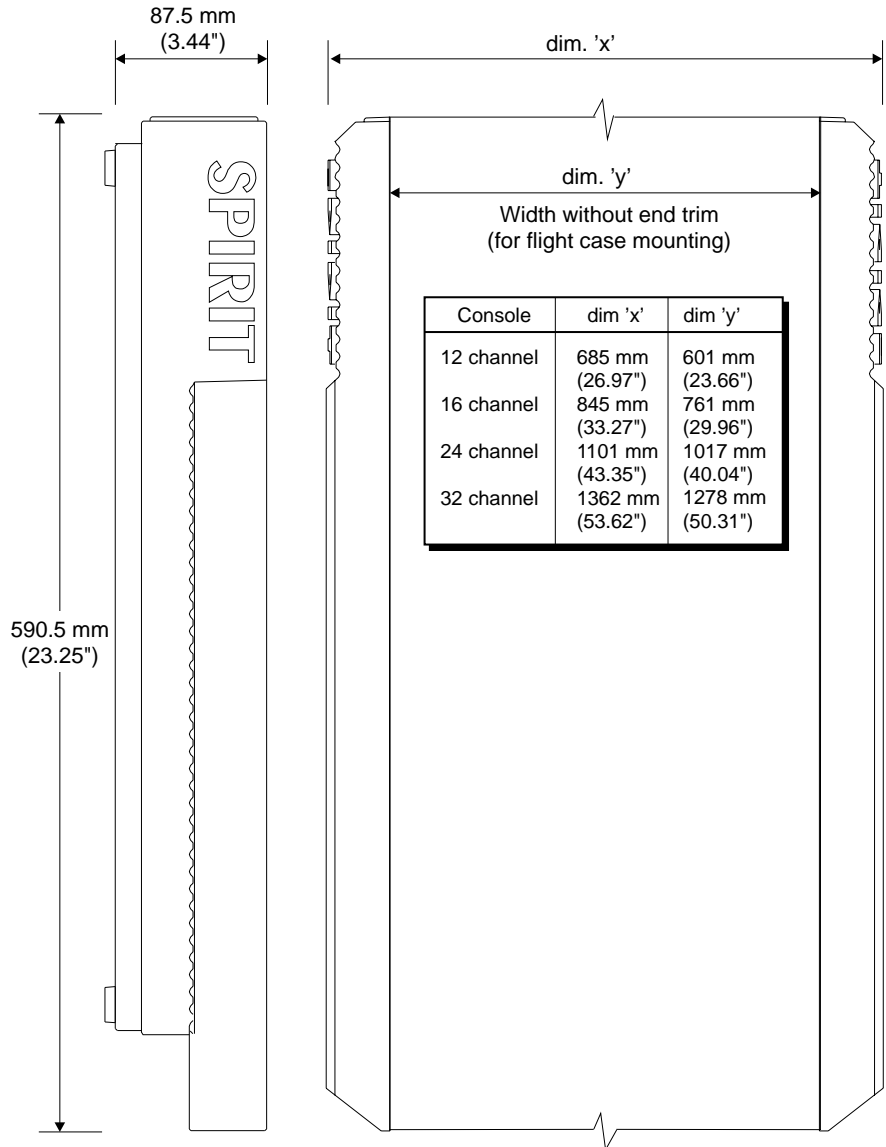
INPUT & OUTPUT IMPEDANCES

Microphone Input	1.8 k Ω
Line Input	10 k Ω
Stereo Input	8.6 k Ω
Cass/CD Input	12.8 k Ω
Stereo Return	19 k Ω

INPUT & OUTPUT LEVELS

Mic/.Line Input Maximum Level	+28 dBu
Stereo Input	+25 dBu
Cass/CD Input	+18 dBu
Stereo Return	+22 dBu
Nominal Input for +4dBu at Mix Output, level at '7'	-10 dBV (LO)
	-20 dBV (HI)
Max. Mic Gain through longest path to Mix	84 dB

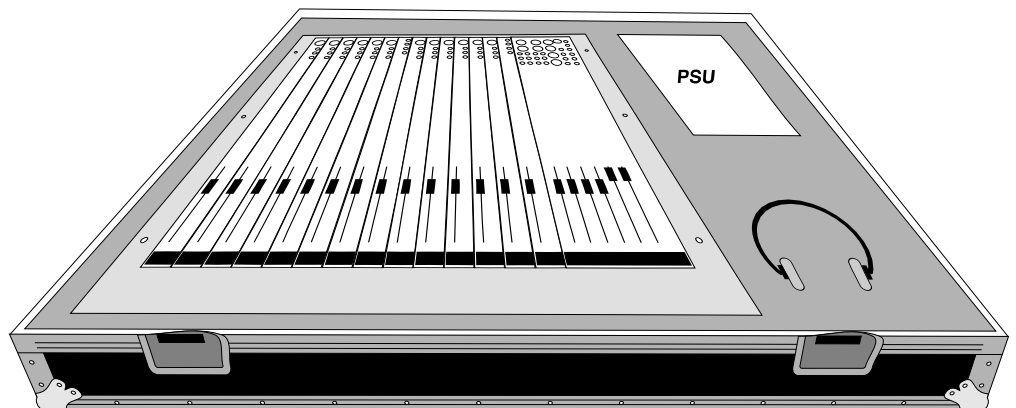
DIMENSIONS



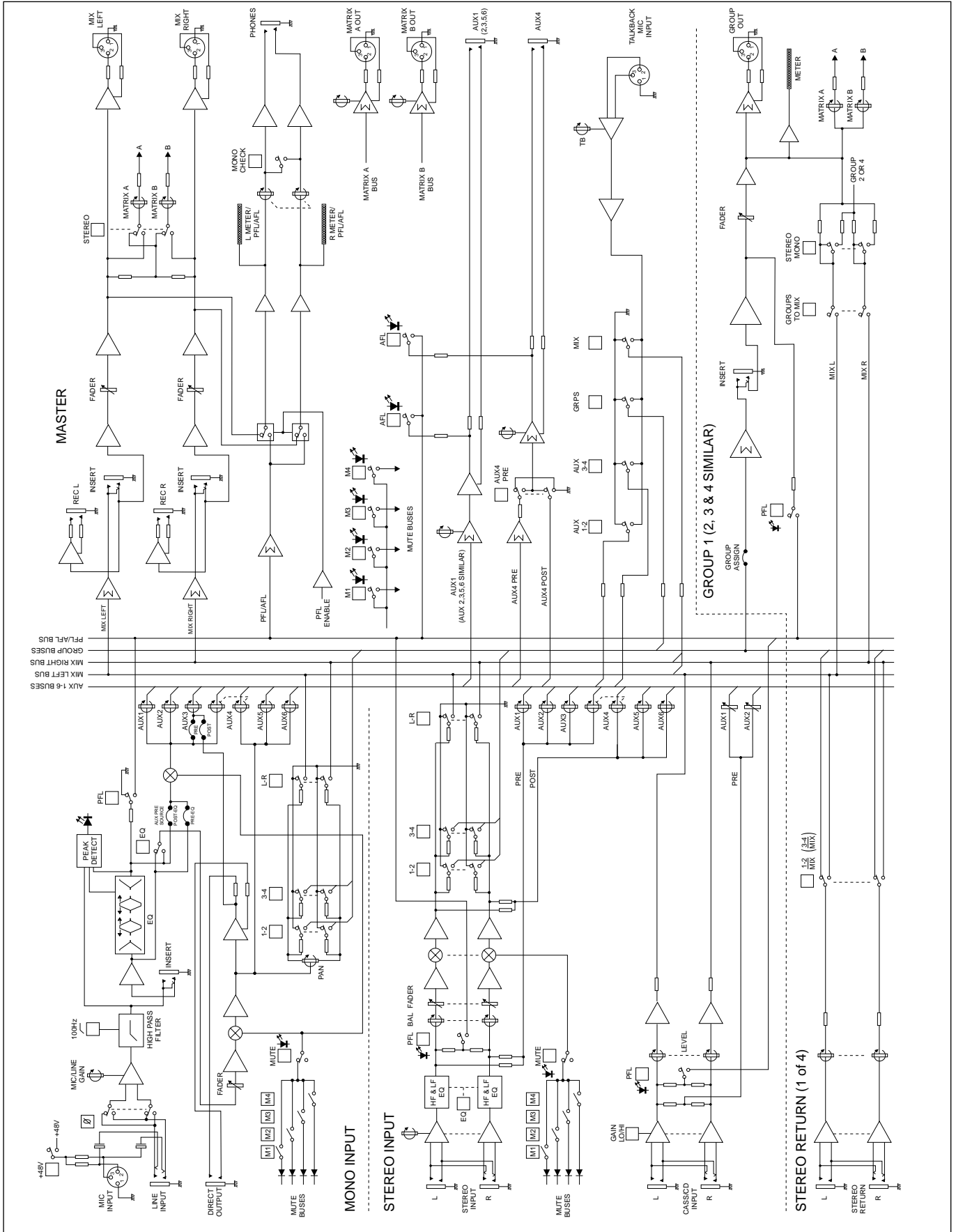
FLIGHT CASE MOUNTING

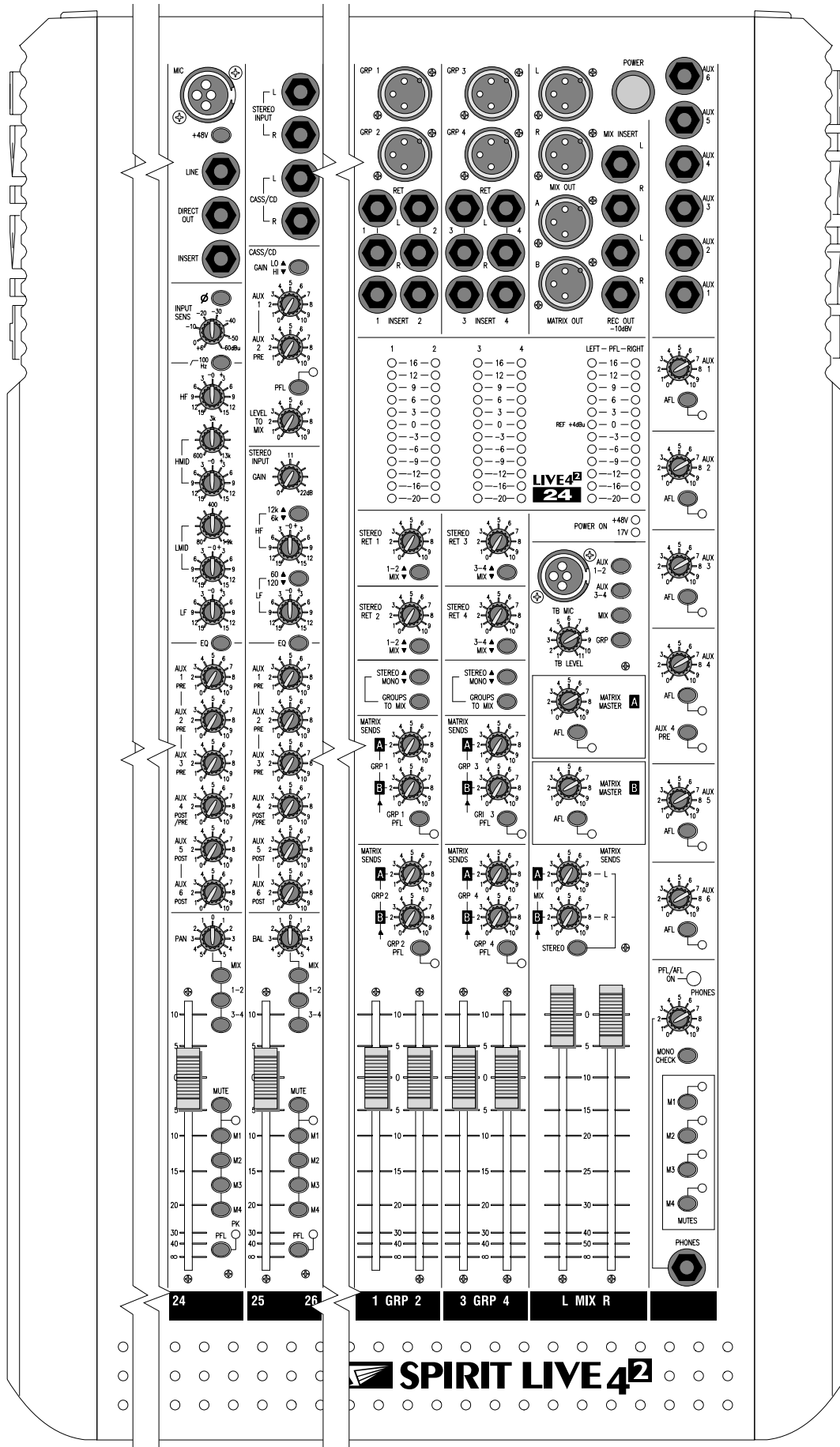
The console is ideal for flight case mounting, with all connectors on the top panel. The end cheeks may be removed to save space in the flight case if required. The example below shows a 12-channel console, flight case mounted together with the power supply and space for headphones or other accessories.

Refer to the Expander Installation Instructions on page 30 for guidance on removing the side cheeks if required.



SYSTEM BLOCK DIAGRAM







Spirit By Soundcraft™
Harman International Industries Ltd., Cranborne House, Cranborne Industrial Estate,
Cranborne Road, Potters Bar, Herts., EN6 7JN U.K.
Tel: +44 (0) 1707 665000 Fax: +44 (0) 1707 665461

H A Harman International Company

Part No: ZM0111