1220S

OPERATORS MANUAL

19350 SW 89th Avenue

TUALATIN, OREGON 97062

A HARTZELL CORPORATION COMPANY

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1. OVERVIEW.

1-1. INTRODUCTION.

The SUNN 1220S integrated mixer/amplifier is a twelve channel 200w stereo console with internal reverb. Requiring only the addition of microphones, speakers and cables, the 1220S constitutes a complete portable sound reinforcement system which may be used for live mixing and home recording.

Each channel of the 1220S features an input gain control to provide maximum headroom and to optimize the signal-to-noise ratio; green and red LED level indicators to indicate pre- and post-EQ signal levels; 4-band active equalization; individual effects/reverb and monitor send controls which may be selected to be pre- or post-EQ and fader via internal jumper connections; and pan controls and level faders for precise control of the mix.

The 1220S contains two independent 200 watt power amplifiers, each of which has a 10-segment "bar graph" LED output indicator and a peak LED to warn of clipping. The console also features two 10-band fully combining graphic equalizers with individual +10 dBV and -20 dBV level indicating LEDs. Under normal conditions the signals fed to the graphics and power amplifiers are controlled by the GEQ/AMP assign switch. In the left "SUB 1/SUB 2" stereo position the equalizers and power amplifiers are driven from the SUBMASTER 1 and 2 output channels, with the SUB 1 and 2 faders acting as the stereo output controls. In the right "MAIN/MON" mono position the equalizers and power amplifiers are driven by the MAIN and MONITOR output channels as in a normal monophonic system. In addition, both the graphic equalizers and the power amplifiers can be separately re-patched to any other part of the system using the input/output jacks on the rear panel of the 1220S.

To reduce the possibility of improper operation, the master mixer section of the 1220S incorporates a unique level warning system- individual +10 dBV indicator LEDs monitor the submaster 1, submaster 2, main, monitor and effects busses and flash when less than 6 dB of headroom is left on any of these busses.

1/4" phone jacks are provided for all buss inputs and outputs, as well as for the EQ and power amplifier patch points. These allow external signal processing devices and other mixers to be patched into the 1220S, and permits each of the sections (mixer, graphic equalizers and power amplifiers) to be used separately. Additional phono (RCA) jack outputs are provided for submasters 1 and 2 and phono jack inputs are provided for AUX 1 and 2 to allow direct connection to most tape recording equipment.

High reliability and long life are insured by the all-steel chassis construction of the mixer portion of the 1220S, and the power amplifier enclosure is constructed of heavy aluminum to minimize heat build-up. This enclosure also isolates the power amps from the sensitive preamp circuitry, minimizing noise and signal interference, and further ensuring long-term reliability and exceptional performance.

The 1220S has been thoughtfully conceived and carefully engineered to satisfy your sound reinforcement needs for many years to come.

1-2-1. PREAMP CHANNEL FEATURES.

* Balanced XLR inputs.
* 1/4" line level inputs.
* Input attenuation control.
* Normal and clip indicators.
* Individual monitor send.
* Effects/reverb send.
* Left/right pan control.
* 4-band active equalization.
* Channel fader control.
* Internal jumpers for selecting pre- or post-EQ and fader operation for monitor and effects busses, factory wired as follows:
* Monitor buss is pre-EQ and pre-fader.
* Effects buss is post-EQ and post-fader.

1-2-2. MASTER SECTION FEATURES.

* Two assignable ten-band graphic equalizers.
* Individual normal and clip indicators for each graphic equalizer.
* Individual peak indicators for main, Sub 1, Sub 2, master monitor and effects.
* Master reverb level and pan controls.
* Two independent auxiliary returns individually pannable to Sub 1 and Sub 2.
* Effects and reverb return to monitor.
* Master effects send and return level controls.
* Individual fader controls for Sub 1, Sub 2, monitor and main.
* Independent graphic EQ inputs and outputs.
* Phono plug outputs for Sub 1 and Sub 2, phono plug inputs for Aux 1 and Aux 2.
* Internal reverb.

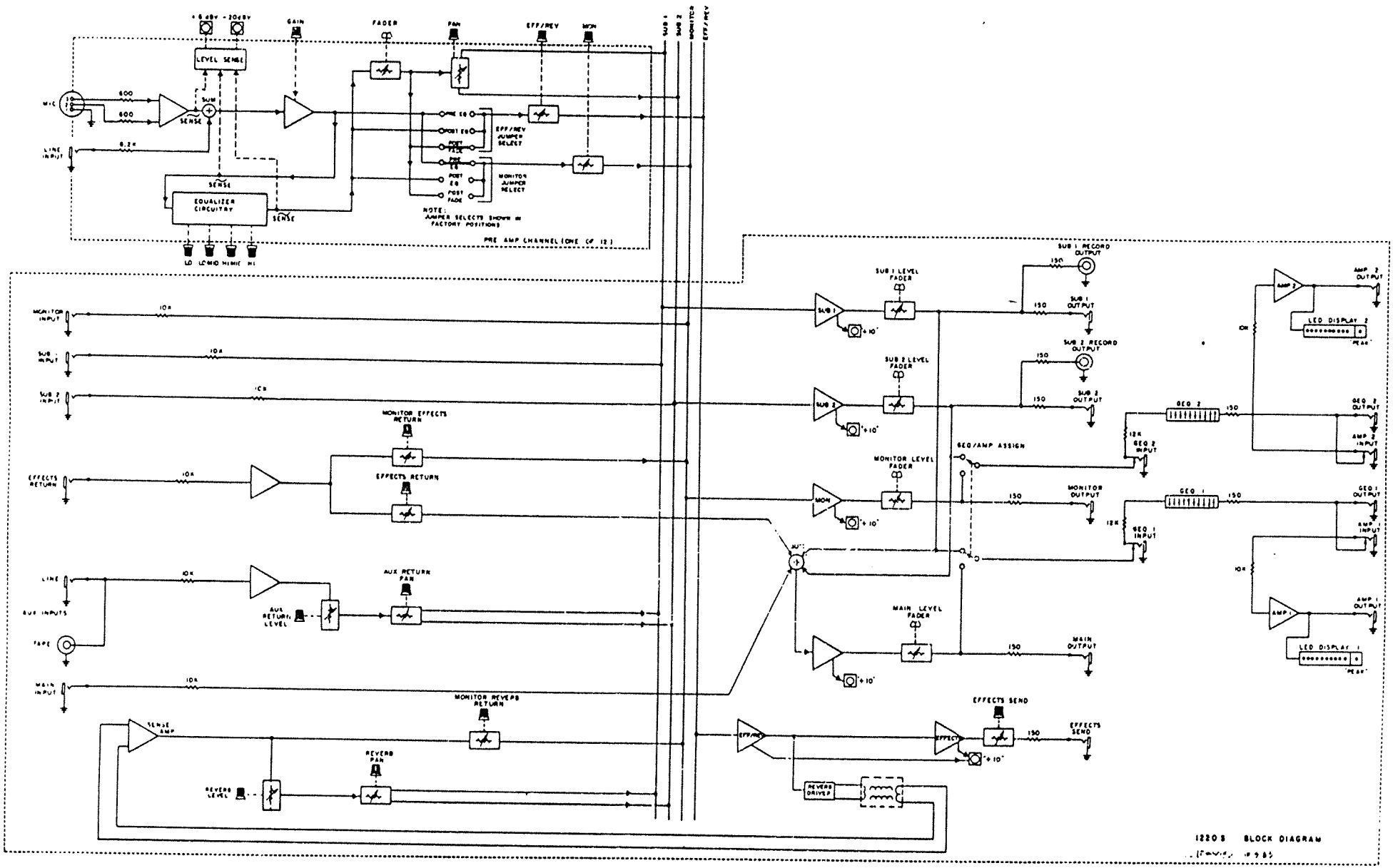
1-2-3. POWER AMPLIFIER FEATURES.

* Dual 200 watt assignable power amplifiers (main/monitor or sub 1/sub 2).
* Dual output level display indicators.
* Independent power amplifier inputs and outputs.

1-3. SYSTEM DESCRIPTION AND BLOCK DIAGRAM.

It is easy to be bewildered by the forest of knobs on a professional mixing console. However, once you understand the path that a signal takes from input to output it all becomes quite simple. You may want to refer to the Block Diagram (Figure 1) during the following description.

The 1220S contains twelve identical preamp channels which are responsible for taking the input signals, tailoring their frequency response, adjusting their levels, controlling the amount of reverb that will be added to them and routing them to the master mixer section. In the master mixer section the signals are mixed (combined) to form the stereo, mono and monitor mixes that are then normally passed on through the graphic equalizers to the power amplifiers that drive the speakers. Auxiliary and effects inputs in the master mixer section allow external signal processing equipment to be used with the console, and their effects to be added to the "dry" signals. An internal reverb system allows reverb to be panned between the two submasters and also added to the monitor mix. The specific operation of each of the sections, controls, inputs and outputs of the 1220S, along with operating hints, will be discussed in the following pages.


+6 dBV -20dBV
GAIN
FADER
PAN
EFF/REV
MON
LEVEL SENSE
MIC
LINE INPUT
600
600
SUM
SENSE
EQUALIZER CIRCUITRY
PRE EQ
POST EQ
POST FADE
EFF/REV JUMPER SELECT
MONITOR JUMPER SELECT
NOTE: JUMPER SELECTS SHOWN IN FACTORY POSITIONS
PRE AMP CHANNEL (ONE OF 12)
LO LO-MID HI-MID HI
SUB 1
SUB 2
MONITOR
EFF/REV
MONITOR INPUT
SUB 1 INPUT
SUB 2 INPUT
EFFECTS RETURN
LINE
AUX INPUTS
TAPE
MAIN INPUT
10K
12K
MONITOR EFFECTS RETURN
EFFECTS RETURN
AUX RETURN PAN
AUX RETURN LEVEL
MONITOR REVERB RETURN
SENSE AMP
REVERB PAN
REVERB LEVEL
SUB 1 LEVEL FADER
SUB 2 LEVEL FADER
MONITOR LEVEL FADER
MAIN LEVEL FADER
AUX
SUB 1
SUB 2
MON
MAIN
+10
SUB 1 RECORD OUTPUT
SUB 1 OUTPUT
SUB 2 RECORD OUTPUT
SUB 2 OUTPUT
MONITOR OUTPUT
MAIN OUTPUT
150
GEQ/AMP ASSIGN
EFFECTS SEND
EFFECT
REVERB DRIVER
GEQ 2
GEQ 2 INPUT
GEQ 2 OUTPUT
GEQ 1
GEQ 1 INPUT
GEQ 1 OUTPUT
AMP 2
AMP 2 INPUT
AMP 2 OUTPUT
AMP 1
AMP 1 INPUT
AMP 1 OUTPUT
LED DISPLAY 2
LED DISPLAY 1
PEAK
1220 S BLOCK DIAGRAM

SPECIFICATIONS
1220S

POWER REQUIREMENTS: 120 VAC - 60 Hz Domestic (US, Canada),
10 amp maximum (1200 watts maximum)
240 VAC - 50/60 Hz Export
5 amp maximum (1200 watts maximum)

DIMENSIONS:

Height X	Width X	Depth
9.5"	28.5"	26.25"
3.7 cm	11.2 cm	10.3 cm

WEIGHT: 63 LBS. 28.6 kg

MIXER SECTION

NOISE:
All specifications are maximums.
All are "A" weighted and referenced
to 0 dBV = 1 VRMS.

MICROPHONE PREAMP EQUIVALENT INPUT NOISE:
Source resistance = 150 ohms -122 dBV

MASTER MIXER SECTION OUTPUT NOISE:
Channel faders down, all
others at maximum

Submasters	-78 dB
Main	-70 dB
Monitor	-80 dB

NOISE UNDER ACTUAL OPERATING CONDITIONS
All channel GAIN controls
at -10 dB, equalization and
PAN controls at center, faders
at maximum, SUB 1, SUB 2 and
MAIN faders at -10 dB

Submasters	-72 dB
Main	-72 dB

GEQ/AMP assign switch in
MAIN/MONITOR position,
GEQ sliders in "0 dB" position

AMP 1 OUTPUT (Main)	-45 dB
AMP 2 OUTPUT (Mon)	-45 dB

SIGNAL TO NOISE RATIO:
Referenced to maximum output
of 10 VRMS. MAIN OUTPUT +92 dB

Referenced to full output of
200 watts into 4 ohms.

AMP 1 OUTPUT (Main) +73 dB

SPECIFICATIONS (continued)

DISTORTION:
Measured from 20 Hz to 20 kHz, levels and load conditions as stated. IMD measured according to SMPTE standard.

	THD	IMD
Preamp input to MAIN, MONITOR, SUBMASTER or EFFECTS OUTPUT, 7 VRMS, 2 K ohm load	.04%	.04%
Preamp input to EQ 1 or EQ 2 OUTPUT, 7 VRMS, 2 K ohm load	.05%	.05%
Preamp input to AMP 1 or AMP 2 OUTPUT, 200 watts, 4 ohm load	0.1%	.05%

INPUT IMPEDANCES:

All unbalanced inputs	10 K ohms
All balanced inputs	1.2 K ohms

LINE LEVEL OUTPUT IMPEDANCES: 150 ohms

MAXIMUM INPUT LEVELS

Microphone Inputs	0.8 VRMS
Line Inputs	10 VRMS
Aux, Effects Inputs	8 VRMS
Direct Buss Input	10 VRMS

SLEW RATE:

Main Output	6 volts per microsecond

FREQUENCY RESPONSE
From any mixer section input to any mixer section output: +0/-.25 dB, 10 Hz to 40 kHz

GRAPHIC EQUALIZER SECTION

EQ FILTER FREQUENCIES: 32, 63, 125, 250, 500, 1K, 2K, 4K, 8K, 16K

Note: The 32 Hz filter is a low pass shelving filter, the 16 kHz filter is a high pass shelving filter, and all others are bandpass filters.

FILTER RANGE: 15 dB boost or cut

FREQUENCY RESPONSE:
All sliders in "0 dB" position: +0/-3 dB, 5 Hz to 55 kHz

SIGNAL TO NOISE RATIO:
"A" weighted, referenced to full output: +107 dB

DISTORTION:
THD measured from 20 Hz to 20 kHz
IMD measured according to SMPTE standard

THD	IMD
.05%	.03%

POWER AMPLIFIER SECTION

DISTORTION: Measured from AMP 1 INPUT to AMP 1 OUTPUT and from AMP 2 INPUT to AMP 2 OUTPUT, levels and load conditions as stated. THD measured from 50 Hz to 20 kHz, IMD measured according to SMPTE standard	THD	IMD
200 watts, 4 ohm load	.05%	.05%
140 watts, 8 ohm load	.05%	.05%
FREQUENCY RESPONSE:	+0/-0.25 dB, 20 Hz - 20 kHz +0/-3 dB, 2 Hz - 200 kHz	
SLEW RATE:	30V per microsecond	
DAMPING FACTOR: 20 Hz to 1 kHz, 8 ohm load	Greater than 300	
INPUT SENSITIVITY:	1.0 VRMS	
INPUT IMPEDANCE:	10 K ohms	
MINIMUM OUTPUT POWER	200 watts into 4 ohms, 140 watts into 8 ohms	

2. PREAMP CHANNELS.

2-1. CHANNEL INPUTS.

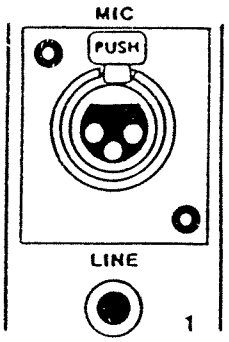


FIGURE 2

2-1-1. MIC INPUTS. The 3-pin audio connectors (often called "XLR" or "Cannon" connectors) on the back panel of the 1220S, directly behind the preamp channels, are intended for low level balanced input signals from low impedance microphones. Signal levels at the MIC INPUTS should not exceed 0.8 VRMS; otherwise, clipping will occur, as indicated by continuous lighting of the +8 dBV LED indicators (see Section 2-2-1). Balanced line level signals may also be patched into the MIC INPUTS provided that the signal level does not exceed 0.8 VRMS; for higher signal levels, an input pad should be used (see Section 9-2).

2-1-2. LINE INPUTS. The 1/4" phone jacks directly below the MIC INPUTS are intended for use with unbalanced high impedance microphones and with devices whose outputs are at line level, such as keyboard mixers and synthesizers. A minimum input signal level of 80 mVRMS at the LINE INPUT is required to achieve +8 dBV output from the channel, and the maximum permissable LINE INPUT level is 10 VRMS.

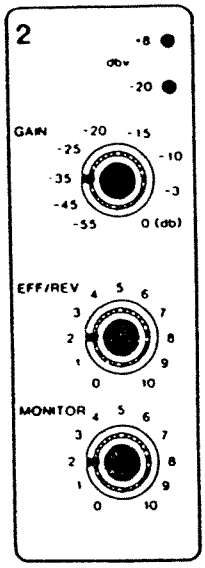
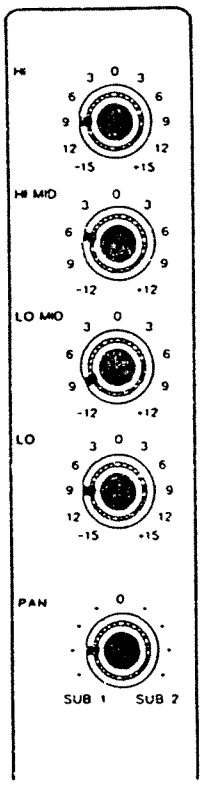
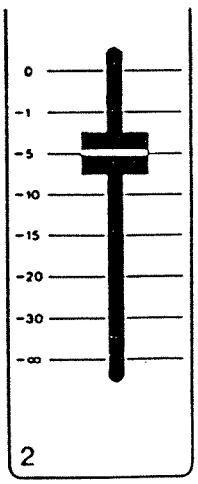


FIGURE 3





2-2. PREAMP CHANNEL CONTROLS. The figure on the left shows the location of the preamp channel controls. These controls are discussed in the paragraphs below.

2-2-1. LED LEVEL INDICATORS. These two LEDs are used in conjunction with the GAIN control to achieve the proper operating level in the preamp channel. The green LED will light at an input signal level of -20 dBV or greater. The red LED will light whenever the input signal exceeds +8 dBV. When the red LED first lights, 10 dBV of headroom remains before the +18 dBV clip level is reached in the channel.

2-2-2. GAIN. The GAIN control adjusts the gain over a range of 35 dB. This control, when used with the two LED indicators, allows the channel to accept any signal source and achieve the maximum signal-to-noise ratio. The GAIN control should be adjusted so that when the channel is operating, the green LED is on and the red LED flashes occasionally during signal peaks. This adjustment will vary with the type of input signal; allow more headroom for transient-related signals such as drums than for more constant-level signals like guitars. If the red LED is on continuously even when the gain control is in its minimum position (-55 dB), the input signal level probably exceeds .8 VRMS. In such cases, the signal should be reduced at the source by turning down the level or by inserting signal attenuation pad between the signal source and the MIC INPUT.

2-2-3. EFF/REV. This control adjusts the level of the signal delivered from the channel to the eff/rev buss. All signals present on the eff/rev buss are combined in the master mixer section (see Section 3) and sent both to the EFFECTS SEND output jack and to the internal reverb. The EFFECTS SEND output may be used to drive external effects devices such as flangers, echo units, digital delays and the like. The EFF/REV control has been factory pre-wired post-EQ/post-fader via internal jumpers; thus, the eff/rev signal will be affected by the settings of the GAIN control, the channel equalization controls and the channel fader. However, it may be rewired to be either pre-EQ/pre-fader or post-EQ/pre-fader (see Section 11).

2-2-4. MONITOR. The MONITOR control adjusts the level of the signal sent from the channel to the monitor buss. This allows a separate mix to be created for stage monitoring. This control has been factory pre-wired to be pre-EQ/pre-fader; however, by changing the location of internal jumpers the MONITOR control can be re-wired to be either post-EQ/pre-fader or post-EQ/post-fader (see Section 11).

2-2-5. CHANNEL EQUALIZATION. The HI, HI MID, LO MID and LO controls allow the soundman to modify the spectral (frequency) content of the input signal as needed.

HI. The HI EQ is a high pass shelving filter with a low-end roll-off at 8 kHz. It has an adjustment range of 15 dB cut or boost.

HI MID. The HI MID EQ is a bandpass filter with a center frequency of 2 kHz, and a control range of 12 dB cut or boost.

LO MID. The LO MID EQ is a bandpass filter with a center frequency of 500 Hz and a control range of 12 dB cut or boost.

LO. The LO EQ is a low pass filter with a high end roll-off at 125 Hz. It has a control range of 15 dB cut or boost.

2-2-6. PAN. The PAN control allows the signal from the channel to be assigned to either or both of the submaster busses, SUB 1 and SUB 2. With the control in its center position (0), the signal is routed equally to the two submaster busses. Rotating the control to the left (counter-clockwise) causes more of the signal to be sent to the SUB 1 buss and less to the SUB 2 buss; with the control FULLY counter-clockwise, the entire signal is sent to SUB 1 and none to SUB 2. Likewise, rotating the control to the right sends more signal to SUB 2 and less to SUB 1; with the control in its rightmost position the signal is sent entirely to the SUB 2 buss.

In a mono system (with the GEQ/AMP assign switch in the MAIN/MONITOR position) the PAN controls are generally used to create submixes which allow similar types of signals (vocals for example) to be turned up and down in the main mix without disturbing their relative balance. In a stereo system (with the GEQ/AMP assign switch in the SUB 1/SUB 2 position) the PAN controls are used to create a stereo "image," or "panorama" (hence, the term "pan"), spreading the sound spatially from left to right.

2-2-7. CHANNEL FADER. The CHANNEL FADER controls the level of the signal sent to the submaster busses. This control is accurately marked in dB for easy reference in comparing channel settings. A recommended starting position for a channel fader is between -5 and -10 dB. This will provide a good signal-to-noise ratio while maintaining enough range for boosting the output level of a channel when required.

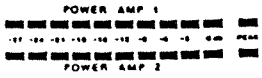
3. MASTER MIXER CONTROLS. Refer to Figure 4 for the locations of each control in the master mixer section; the operation of these controls is described in the following paragraphs.

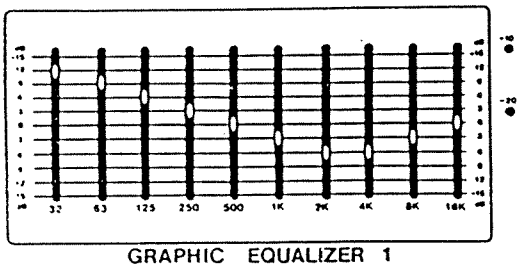
3-1. GRAPHIC EQUALIZERS.

3-1-1. DESCRIPTION. The 1220S contains two ten-band graphic equalizers, each consisting of ten active filters spaced at octave intervals. The lowest frequency filter is a low pass shelving filter with a high end roll-off at 32 Hz; the highest frequency filter is a high pass shelving filter with a low end roll-off at 16 kHz; and all others are bandpass filters centered on the frequencies indicated below their sliders. Moving the sliders up or down boosts or cuts (respectively) the gain at the indicated frequencies. This allows the sound engineer to suppress feedback by compensating for room resonances in live sound reinforcement applications, and to create unusual tonal textures in recording applications. The EQ controls are accurately scaled in dB to indicate the amount of cut or boost applied at each frequency.

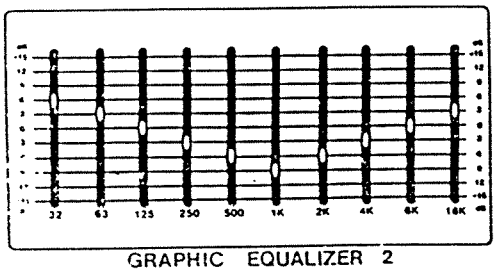
3-1-2. -20 dBV and +10 dBV LEDs. Level-sensing circuits monitor the outputs of the Graphic Equalizers and provide a visual indication of signal levels present at those outputs. Under normal operating conditions the green -20 dBV LED will be lit and the red +10 dBV LED will be off. (Note: -20 dBV corresponds to a signal level of 0.1 VRMS and +10 dBV corresponds to 3.163 VRMS.) The power amplifiers in the 1220S reach their full output when their input signal levels reach 1.0 VRMS; therefore, if the outputs of the equalizers are driving the inputs of these amplifiers (as they do under normal conditions) and the red +10 dBV LEDs light, the power amps are being driven into clipping. This can cause speaker damage and should be avoided.

Although the equalizers are prepatched to the submaster outputs or the main and monitor outputs (depending upon the setting of the GEQ/AMP assign switch) and to the two internal power amplifiers, back panel jacks allow the equalizers to be disconnected from their normal signal source and destination (see Sections 3-1-3 and 10) and used separately with external equipment. In such cases it may be permissable for signal levels to cause the red LED to light occasionally (for example, when driving power amplifiers that have their input sensitivity controls turned down). However, the level at which this LED comes on is only 6 dB below the clipping threshold of the equalizer, and does warn of low headroom and potential distortion within the equalizer itself.

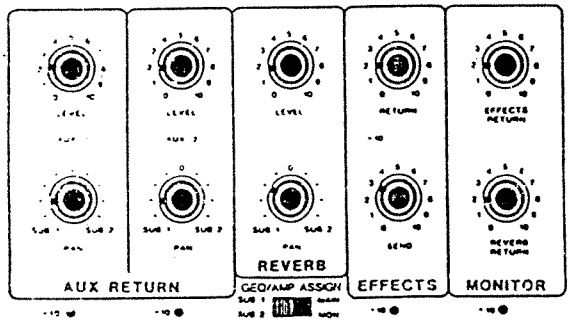


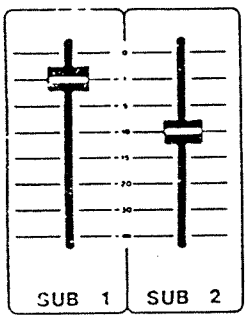


GRAPHIC EQUALIZER 1



GRAPHIC EQUALIZER 2





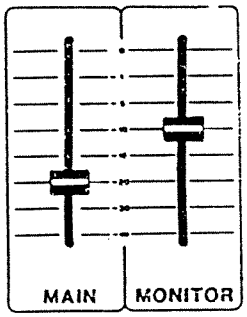


FIGURE 4

3-1-3. NORMAL ASSIGNMENT OF EQUALIZERS. Unless overridden by the use of the EQUALIZER IN back panel jacks (see Section 10), the two equalizers receive their input signals directly from the master mixer section of the 1220S, and deliver their output signals directly to the internal power amps. The GEQ/AMP ASSIGN switch determines whether the EQ input signals come from the submasters or from the main and monitor sections of the board, as follows:

GEQ ASSIGN SWITCH POSITION	SIGNAL SOURCE EQUALIZER 1	EQUALIZER 2
Left (SUB1/SUB2)	SUB 1	SUB 2
Right (MAIN/MON)	MAIN	MONITOR

The outputs of Graphic Equalizers 1 and 2 are normally assigned to Power Amps 1 and 2, respectively; however, the normal patch may be overridden through the use of the POWER AMP IN jacks on the back panel of the 1220S (see Section 10).

3-2. AUX RETURN LEVEL CONTROLS 1 and 2. These controls adjust the overall level of the signals sent to the submaster busses from the AUX INPUT jacks (see Section 4-2).

3-3. AUX PAN CONTROLS 1 and 2. AUX INPUT signals may be assigned to the two submaster busses in varying degrees, depending upon the setting of these controls. With an AUX PAN control all of the way to the left, its entire signal will go to the submaster 1 buss, and with the control in its rightmost position the signal is assigned entirely to the submaster 2 buss; between these two extremes, the signal may be assigned in any proportion to both submaster busses. With the AUX PAN control in its center position (0), the signal will appear equally on both busses.

3-4. REVERB LEVEL. This control determines how much of the signal from the reverb system is added to the submaster busses.

3-5. REVERB PAN. This control determines the proportion of reverb signal reaching each of the two submaster busses. With the control all of the way to the left, the entire reverb signal will go to the submaster 1 buss, and with the control all of the way to the right the signal is assigned entirely to the submaster 2 buss; between these two extremes, the signal may be assigned in any proportion to both submaster busses. With the REVERB PAN control in its center position (0), the signal will appear equally on both busses.

3-6. EFFECTS RETURN. This control determines how much of the signal from the EFFECTS RETURN jack is sent to the mono main buss.

3-7. EFFECTS SEND and +10 dBV LED. The EFFECTS SEND control adjusts the level of the signal sent from the effects buss to the EFFECTS SEND jack on the back panel. The red +10 dBV LED indicates when signal levels approach the clipping threshold of the effects send amplifier; when the LED first lights, 6 dB of headroom remains before clipping distortion occurs.

If the +10 dBV LED comes on even when the EFFECTS SEND control has been turned down, then the effects buss buffer, which has a fixed gain, is being overloaded. This occurs when too many EFF/REV controls on the preamp channels are turned up at once. To correct the problem, turn down each of the EFF/REV controls by an equal amount and turn up the EFFECTS SEND control; this will produce the same mix and the same overall signal level on the effects buss, but will eliminate the overload condition.

3-8. MONITOR EFFECTS RETURN. This control determines how much of the signal from the EFFECTS RETURN jack is added to the monitor buss. This control is independent of the EFFECTS RETURN control; that is, adjusting the EFFECTS RETURN control will not alter the level of the effects return signal being sent to the monitor buss.

3-9. MONITOR REVERB RETURN. This control determines how much of the signal from the reverb system is added to the monitor buss. This control is independent of the REVERB LEVEL control; that is, adjusting the REVERB LEVEL control will not affect the amount of reverb signal being added to the monitor buss.

3-10. GEQ/AMP ASSIGN SWITCH. The position of this slide switch determines whether the 1220S will be used as a stereo or a mono board. With the switch in the SUB 1/SUB 2 (left) position, the board operates as a stereo console; the signals from the SUBS 1 and 2 go to Graphic Equalizers 1 and 2 and from there to Power Amplifiers 1 and 2; the SUB 1 and SUB 2 faders then become the main stereo output faders. With the switch in the MAIN/MON (right) position, the signal from the mono main output channel is routed through Graphic Equalizer 1 to Power Amp 1, and the output from the monitor output channel is routed through Graphic Equalizer 2 to Power Amp 2; the MAIN fader then becomes the master level control for the main mix and the MONITOR fader is the master level control for the monitor mix.

3-11. SUB 1 and SUB 2 LEVEL FADERS and +10 dBV LEDs. The SUB 1 and SUB 2 faders are the master faders for the submaster 1 and submaster 2 mixes. These faders control the signal levels present at the SUB 1 and SUB 2 BUSS OUTPUTS and the SUB 1 and SUB 2 RECORD OUTPUTS. They also determine the relative balance between the sub 1 and sub 2 signals in the final mono main mix. If the GEQ/AMP ASSIGN switch is in the SUB 1/SUB 2 position, the two submasters are patched to the inputs of Graphic Equalizers 1 and 2, and become the left and right master level controls of the stereo sound reinforcement system. They are also the left and right master level controls when the board is used in stereo recording applications.

The red +10 dBV LEDs associated with the SUB 1 and SUB 2 faders indicate when signal levels approach the clipping threshold of the submaster summing amplifiers; when the LED first lights, 6 dB of headroom remains before clipping distortion occurs. Continuous lighting of the LED generally indicates that clipping is taking place within the submaster amplifier itself. Clipping degrades the quality of the sound and may result in loudspeaker damage.

3-12. MAIN LEVEL FADER and +10 dBV LED. This is the master level control for the mono main mix on the 1220S. It determines the level of the signal present at the MAIN OUTPUT jack, and when the GEQ/AMP ASSIGN switch is in the MAIN/MON position, the MAIN fader also controls the signal level sent to Graphic Equalizer 1 and Power Amp 1.

The red +10 dBV LED associated with the MAIN level fader indicates when the mono main signal is within 6 dB of the clipping threshold of the main output stage; when this LED remains on continuously, it is probable that clipping distortion is occuring in the main output stage.

3-13. MONITOR LEVEL FADER and +10 dBV LED. The MONITOR level fader is the master level control for the monitor mix on the 1220S. It determines the level of the signal present at the MONITOR OUTPUT jack, and when the GEQ/AMP ASSIGN switch is in the MAIN/MON position, the MONITOR fader also controls the signal level sent to Graphic Equalizer 2 and Power Amp 2.

The red +10 dBV LED associated with the MONITOR level fader indicates when the monitor signal is within 6 dB of the clipping threshold of the monitor output stage; when this LED lights continuously, clipping distortion is probably occuring in the monitor output stage.

4. MASTER MIXER SECTION INPUTS AND OUTPUTS. The rear panel of the 1220S contains a group of jacks which permit access to all signal busses, graphic equalizer inputs and outputs and power amp inputs. These jacks allow any of the basic sections of the 1220S to be used individually, or to be repatched into the 1220S in different ways, greatly increasing the flexibility of the mixing console. The following paragraphs describe the function of each of these jacks. For more information on patching, see Section 10.

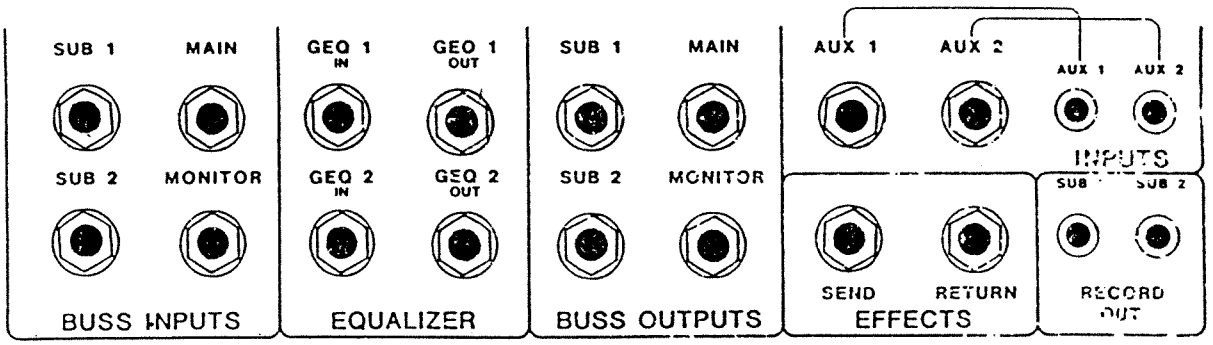


FIGURE 5

NOTE: Unless otherwise noted, all master mixer section input and output jacks are 1/4" phone jacks. All inputs have a 10 K ohm impedance and all outputs have a 150 ohm impedance.

4-1. DIRECT BUSS ACCESS.

4-1-1. SUB 1 and SUB 2 INPUTS. These line level inputs provide direct access to the SUB 1 and SUB 2 audio busses. Signals patched into the SUB 1 and SUB 2 INPUTS mix with other signals present on the submaster 1 and submaster 2 busses in the subs 1 and 2 mixing amplifiers. The SUB 1 and SUB 2 INPUTS are generally used to patch another mixer into the 1220S.

4-1-2. MAIN INPUT. This line level input provides direct access to the mono main output channel. Any signal patched into this jack is mixed with the outputs of SUBS 1 and 2 and the effects return signal to form a final mono mix. The MAIN INPUT is generally used for patching another mixer into the 1220S.

4-1-3. MONITOR INPUT. This line level input provides direct access to the monitor buss. Signals present on this buss are combined in the monitor output channel to form the final monitor mix. The MONITOR INPUT is generally used for patching another mixer into the 1220S.

4-2. AUX 1 and AUX 2 INPUTS. The line level AUX 1 and AUX 2 INPUTS each consist of a 1/4" phone jack and an RCA phono jack wired in parallel. The 1/4" and RCA jacks are interchangeable in function, and ordinarily only one of them would be used at a time. Any signal present at either of these jacks is sent to the AUX 1 (AUX 2) return amplifier and from there to the SUB 1 and SUB 2 busses by way of the AUX 1 (AUX 2) level control and the AUX 1 (AUX 2) pan control. The AUX 1 and AUX 2 INPUTS may be used as effects returns, or as tape recorder inputs for providing background music during breaks in the performance. They may also be used as independent input channels for line level signals, although of course the auxiliary input channels lack the equalization, level sensing and monitor, reverb and auxiliary sends available on the preamp channels.

It is possible to connect equipment to both the RCA and 1/4" jacks at the same time, provided that the output impedances of the two pieces of equipment are low (150 ohms or lower- see the owner's manuals for information on the output impedances of equipment used in this way) and that only one piece of equipment is used at any one time. Thus, you may use the 1/4" jack as an effects return during the performance, and the RCA jack as a tape input during breaks, without disconnecting either unit. You will, however, experience some attenuation of the signal levels from the two pieces of equipment when doing this.

4-3. EFFECTS SEND AND RETURN.

4-3-1. EFFECTS SEND. Signals present on the effects buss are mixed in the effects/reverb summing amplifier, and this mix is sent both to the reverb driver and to the effects output amplifier. Thus the mix created by the settings of the EFF/REV level controls on each of the preamp channels is present at the EFFECTS SEND jack. The overall level at this output is determined by the master mixer section EFFECTS LEVEL control. This output may be used to drive external effects (echo units, phase shifters, flangers, digital delays, etc.). The return signal from the effect may be routed either to an EFFECTS RETURN, AUX RETURN, or to a preamp channel LINE INPUT. Use of a preamp channel as a return gives you the ability to shape the frequency response of the signal; however, care must be taken to insure that the EFF/REV control on that channel is turned all the way down- otherwise a feedback loop will exist which could cause oscillation and possible damage to speakers.

4-3-2. EFFECTS RETURN. As its name implies, this input is generally used as a return from an external signal processing device (flanger, phase shifter, etc.). Signals present at this input are routed to the mono main buss by way of the EFFECTS RETURN level control, and to the monitor buss by way of the MONITOR EFFECTS RETURN level control. The two level controls operate independently. In emergencies, it is possible to use the EFFECTS RETURN as a line level preamp channel, although it lacks the equalization, submaster and effects sends available on the preamp channels.

4-4. BUSS OUTPUTS.

4-4-1. SUB 1 AND SUB 2 OUTPUTS. Signals present on the submaster 1 buss are mixed in the sub 1 amplifier and routed to the SUB 1 OUTPUT. Similarly, signals present on the submaster 2 buss are mixed in the sub 2 amplifier and routed to the SUB 2 OUTPUT. The signal levels at the SUB 1 and SUB 2 OUTPUTS are determined by the positions of the SUB 1 and SUB 2 faders, respectively.

4-4-2. MAIN OUTPUT. The submaster 1 and 2 mixes are combined with the effects return signal and any signal present at the MAIN INPUT jack to form a final composite mono mix. The balance of the sub 1, sub 2 and effects return signals in the final mix is determined by the settings of the SUB 1 and SUB 2 faders and the EFFECTS RETURN level control, respectively. The overall level of the mix is controlled by the MAIN fader.

4-4-3. MONITOR OUTPUT. Signals present on the monitor buss are combined in the monitor amplifier and sent to the MONITOR OUTPUT jack. The signal level present at this output is determined by the MONITOR LEVEL control.

4-5. SUBS 1 and 2 RECORD OUTPUTS. The same signals present at the SUBS 1 and 2 OUTPUTS are also present at the SUBS 1 and 2 RECORD OUTPUTS (see paragraph 4-4-1). Most tape decks use RCA jacks; for this reason the RECORD OUTPUTS of the 1220S are also RCA style jacks. If your tape deck has a "LINE INPUT," it should be used, since the SUBS 1 and 2 RECORD OUTPUTS are at line level.

The SUBS 1 and 2 OUTPUTS may be used at the same time as the SUBS 1 and 2 RECORD OUTPUTS.

4-6. GRAPHIC EQUALIZER INPUTS AND OUTPUTS.

4-6-1. GEQ 1 and GEQ 2 INPUTS. The two graphic equalizers on the 1220S are prepatched, as explained in Section 3-1-3. However, the GEQ 1 and 2 INPUTS allow this "normalized" patch to be defeated; inserting a 1/4" phone plug into the GEQ 1 (or GEQ 2) INPUT disconnects the equalizer from the signal selected by the GEQ/AMP assign switch, and instead connects it to any signal carried by the phone plug. This allows the equalizer to be patched to other 1220S outputs or to other pieces of audio equipment.

4-6-2. GEQ 1 and GEQ 2 OUTPUTS. The output of Graphic Equalizer 1 is present at the GEQ 1 OUTPUT jack, and the output of Graphic Equalizer 2 is present at the GEQ 2 OUTPUT jack. Inserting a plug into these jacks does not interrupt the normal signal path. These jacks are useful for patching more power amplifiers into the system, for post-equalizer recording, and for inserting signal processing equipment (limiters, parametric equalizers and the like) between the equalizers and the power amplifiers (see the section on patching, Section 10).

5. POWER AMPLIFIERS.

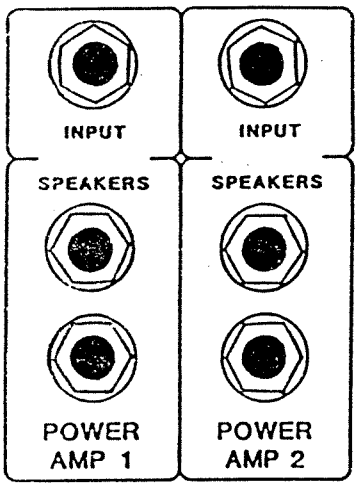


FIGURE 6

5-1. AMP 1 and AMP 2 INPUTS. Under normal circumstances, Power Amp 1 receives its input from Graphic Equalizer 1 and Power Amp 2 receives its input from Graphic Equalizer 2. However, by inserting a 1/4" phone plug into the AMP 1 or AMP 2 INPUT jack, the normal signal path is broken and any signal carried by the phone plug becomes the power amplifier's input. This allows the power amplifier to be used independently from the rest of the 1220S. Possible uses of this feature include using both power amps for the main PA, and using an auxiliary amplifier for the monitors; using both power amps on the monitor system; or using AMPS 1 and 2 as the two power amplifiers in a biamped system (which would require the addition of an external crossover). These possibilities are detailed in Section 10.

5-2. AMP 1 and AMP 2 OUTPUTS. These are the speaker outputs for Power Amps 1 and 2. Each power amp is capable of providing 200 watts into a 4 ohm load. Do not connect loads with impedances lower than 4 ohms to either AMP 1 or AMP 2 OUTPUT, as this may result in amplifier overheating. (See Section 9-5-2 for information on computing load impedances). In addition, be sure that the speaker cable you use is of adequate gauge; otherwise, power will be lost in the wire instead of being delivered to the speaker, and the damping factor will be impaired (see Section 9-5-2).

5-3. POWER OUTPUT DISPLAYS.

5-3-1. BARGRAPH LED DISPLAYS. The two ten-segment "bargraph" LED displays in the upper right corner of the 1220S indicate the signal level present at the output jacks of the two amplifiers. They are accurately calibrated in dB in 3 dB steps; lighting of the "0 dB" LED indicates full power output at 4 ohms (200 watts), and every decrease of 6 dB on the displays corresponds to a halving of output power.

5-3-2. PEAK LEDs. The PEAK LEDs are driven by circuitry which senses distortion in the power amplifiers. If all of the LEDs on a bargraph display are lit and its PEAK LED comes on, the power amp is being driven into clipping. Clipping causes the sound to be distorted and excessive clipping can damage loudspeakers; to avoid clipping, reduce the signal level to the power amp.

If the bargraph LEDs are not on, but the PEAK LED is lit, there is a problem with the load connected to the output of the power amp- most likely the speaker cord or the speaker is shorted- repair or replace defective cords and speakers.

6. POWER SWITCH AND CIRCUIT BREAKER.

6-1. POWER SWITCH. AC POWER to the 1220S is turned on and off by a lighted rocker switch located on the power amp enclosure on the rear of the chassis. If you have any external signal processing devices patched to the 1220S, turn them on first to avoid pops in the loudspeakers. Also, when you turn on the 1220S, make sure that the main faders are down- this eliminates the risk of the system immediately feeding back when it is turned on, and also minimizes turn-on pops.

6-2. CIRCUIT BREAKER. The circuit breaker is located immediately below the POWER switch. If the circuit breaker opens once, push it in to restore power. However, if it quickly opens again, check all inputs and outputs to make certain that they are correctly connected before resetting the breaker. If it continues to blow, refer the problem to authorized service personnel.

7. LIVE PA SETUP. Figure 6 illustrates a typical setup of the 1220S for monophonic live sound reinforcement; for an illustration of a typical stereo setup, see Figure 7.

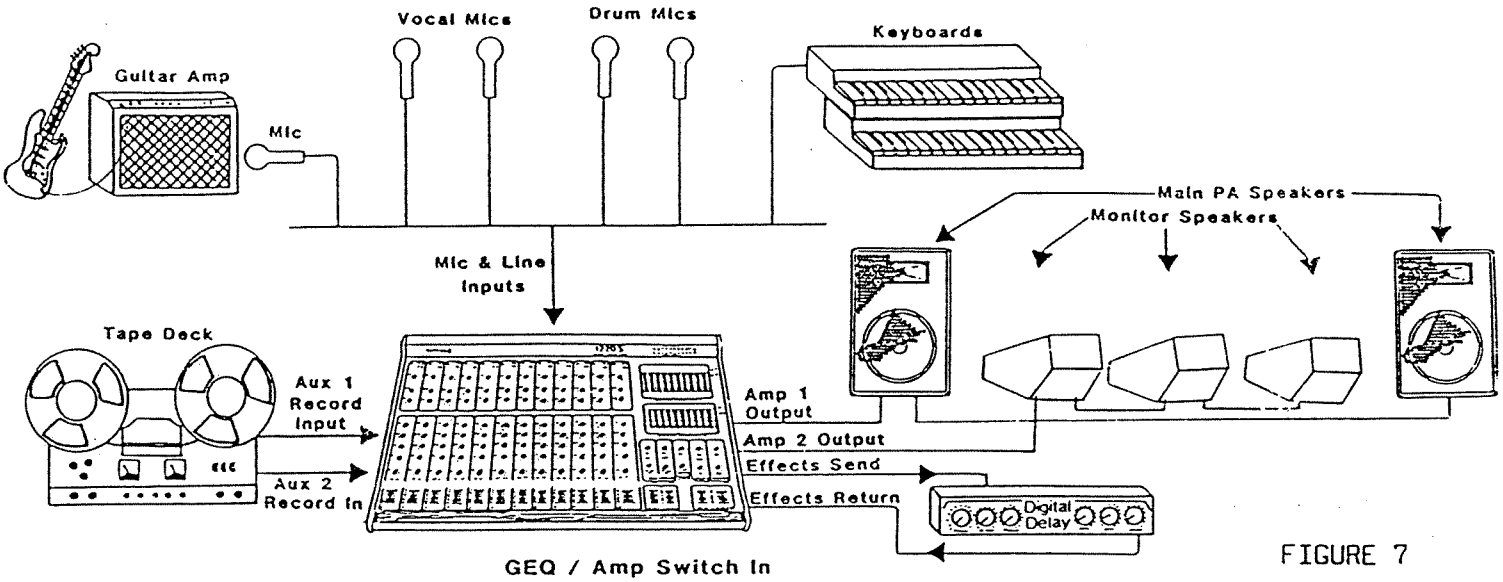


FIGURE 7

7-1. MONO PA. To use the 1220S in mono, place the GEQ/AMP assign switch in the MAIN/MON (right) position, connect the main PA loudspeakers to the two POWER AMP 1 output jacks, and the monitor speakers to the POWER AMP 2 output jacks. Other inputs and outputs are connected as described in the following paragraphs.

7-1-1. CHANNEL INPUTS. Connect all low impedance microphones to the MIC INPUTS. LINE inputs may be used with high impedance microphones and line level signals. If the mixer is more than 25 feet from the stage, only low impedance balanced microphones should be used- this helps to prevent noise from external sources from entering the sound system through the microphone cables. The use of an audio snake is recommended when the mixing board is operated away from the stage.

7-1-2. MAIN PA SOUND SYSTEM. The main PA system is responsible for producing the sound heard by the audience. In this example, the main PA is monophonic; the main output channel is internally patched to Graphic Equalizer 1 and Power Amp 1, and the main PA loudspeakers are connected to the AMP 1 output. The channel faders adjust the signal level sent from the channels to the submaster busses. Typically, one submaster (SUB 1 for example) is dedicated to the vocal mix and the other (SUB 2) is dedicated to the instrument mix. The two submaster faders control the balance of the two submixesin the main mix, and the MAIN fader adjusts the overall level of the main sound system. Graphic Equalizer 1 is used to tailor the sound of the system to the room and to control acoustic feedback (see Section 9-3).

7-1-3. MONITOR SYSTEM. The MONITOR system provides the the performers with a separate mix which allows them to hear themselves properly. With the GEQ/AMP ASSIGN switch in the MAIN/MON position the monitor output channel is internally patched to Graphic Equalizer 2 and Power Amp 2. The output of the power amplifier is then connected to the monitor speakers. The total impedance of the monitor speakers should not be lower than 4 ohms (see Sections 5-2 and 9-5-2). The monitor mix is determined by the settings of the channel MONITOR controls, and the MONITOR fader in the master mixer section controls the overall monitor level. Graphic Equalizer 2 is used to prevent acoustic feedback and to create the clearest possible monitor sound on stage.

7-1-4. TAPE RECORDER INPUT PATCHING USING THE AUX INPUTS. The AUX RECORD INPUT jacks 1 & 2 provide input access to the submaster 1 and 2 busses. In many performances a band will play program music from a tape recorder through the MAIN PA system during breaks. The AUX RECORD INPUT jacks in this example are used as tape recorder inputs. These are RCA jacks- the same style used on most recording equipment. Set the AUX 1 PAN control to the far left (wihch assigns that input to Sub 1) and the AUX 2 PAN control to the far right (Sub 2); this allows the SUB 1 and 2 faders to act as balance controls for the tape recorder output. Use the AUX RETURN LEVEL controls and tape output level controls to achieve the desired sound level.

7-1-5. ACCESSORY PATCHING USING THE EFFECTS SEND & EFFECTS RETURN. The mix created by teh settings of the channel EFF/REV controls appears at the EFFECTS SEND output jack; this same mix is also sent to the reverb system. By patching from this output to the input of an external effects device (for example, a flanger, phase shifter, echo unit or digital delay), and returning the output of the effect to the EFFECTS RETURN jack, external effects may be added both to the monitor mix and to the main mix. The EFFECTS SEND control adjusts the level of the signal sent to the effect, and the EFFECTS RETURN knob controls how much of the effect is added to the main mix. The MONITOR EFFECTS RETURN control determines the level of the effect in the monitor mix.

The same mix present at the EFFECTS SEND jack also drives the internal reverb of the 1220S. Thus, both the external effect and the reverb may be used simultaneously, and their return levels controlled independently.

7-2. STEREO PA. With the GEQ/AMP ASSIGN switch in the SUB 1/SUB 2 (left) position, the 1220S may be used as a stereo PA system. Connect the main PA speakers to the POWER AMP 1 and 2 output jacks, as illustrated in Figure 7.

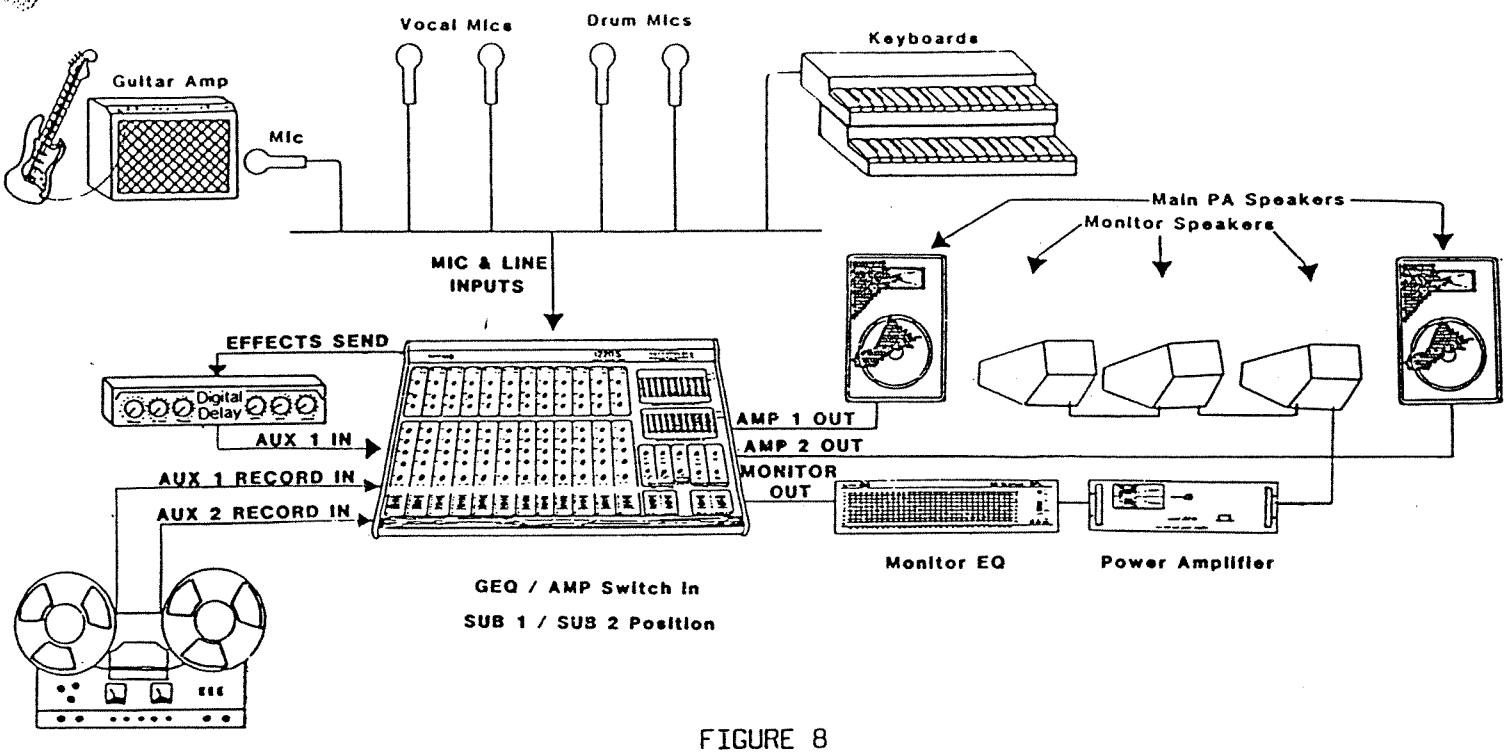


FIGURE 8

7-2-1. CHANNEL INPUTS. Channel inputs are used in the same manner regardless of whether the 1220S is used in mono or in stereo; see Section 7-1-1.

7-2-2. MAIN PA SOUND SYSTEM. With the board in its stereo configuration, the Submaster 1 and 2 output channels are internally patched to Graphic Equalizers 1 and 2 and Power Amplifiers 1 and 2. The output of Power Amp 1 then becomes the left main output to the speakers and the output of Power Amp 2 becomes the right main speaker output. The preamp channel PAN controls determine the proportion of each channel's output appearing on the two submaster busses, thus determining where in the room the sounds seem to be originating. (It is generally best to make the "panned" locations correspond to the actual locations of the performers.) The channel faders control the total signal level sent from the channel to the two submaster busses, and the SUB 1 and SUB 2 faders determine the overall volume of the main PA system. Use the two graphic equalizers to obtain the clearest possible sound from the system and to control acoustic feedback (see Section 9-3 for tips on using the equalizers).

7-2-3. MONITOR SYSTEM. Since both of the graphic EQs and both of the power amplifiers in the 1220S are used for the main outputs when the console is in the stereo mode, the monitor system must employ a separate equalizer (not absolutely necessary, but very highly recommended) and power amp. An excellent choice would be a SUNN SGA 107 or SGA 310 Graphic Amplifier which contains both an equalizer and a power amp in a single package. Another possibility would be a SUNN 4120 Dual 10-band Graphic Equalizer and an SA 10, 11, 20 or 21 Power Amplifier. Using unbalanced shielded cables with 1/4" plugs, patch from the MONITOR BUSS OUTPUT to the input of the external equalizer, and from the output of that equalizer to the input of the power amplifier. The output of the amp is then connected to the monitor speakers. The MONITOR fader then controls the overall volume of the stage monitors.

7-2-4. TAPE RECORDER INPUTS. The AUX RECORD INPUT jacks 1 and 2 (the RCA jacks) may be used in the stereo PA mode in the same way as in the mono setup (see Paragraph D of Section 7-1-1).

7-2-5. ACCESSORY PATCHING USING THE EFFECTS SEND AND AUX 1 AND 2 INPUTS. As described in Section 7-1-5, the EFFECTS SEND jack provides a convenient output to drive external effects devices. In that (mono) setup, the EFFECTS RETURN jack was recommended as the pathway for mixing the processed signal back into the 1220S. However, the EFFECTS RETURN only routes the signal to the monitor buss and to the mono main buss; in the stereo mode the signal must be returned to the submaster busses. This is most easily done using the AUX 1 and 2 inputs; the AUX RETURN LEVEL control then adjusts the overall level of the effect returned to the submaster busses and the AUX RETURN PAN control determines the proportion of the signal returned to each of the submaster busses. If you have used the RCA AUX 1 and 2 INPUTS as your tape deck input, the AUX RETURN LEVEL and PAN controls will affect the level and stereo image of both the tape deck and the effect. Since the two should not be used simultaneously, this should not be a problem (see Section 4-2).

If you have any unused preamp channels, these may be used as effects returns or as tape deck inputs, eliminating any potential conflicts. However, whenever a preamp channel is used as an effects return, BE SURE TO AVOID ACCIDENTAL FEEDBACK LOOPS (see Section 10-2).

8. RECORDING WITH THE 1220S. The SUNN 1220S consoles were designed primarily for live sound reinforcement applications. However, many of the features of the 1220S that make it excellent for PA also aid in making stereo recordings. How you set up the 1220S for recording depends upon whether you are doing a "recording session" and using the 1220S solely as the recording console, or you are using the 1220S for your PA system and recording the live performance.

8-1. USING THE 1220S AS A RECORDING CONSOLE. To use your 1220S as a dedicated recording console, connect microphones, direct sends from keyboards, etc., to the preamp channel inputs as you ordinarily would; put the GEQ/AMP assign switch in the left (SUB 1/SUB 2) position; and connect a pair of shielded cables from the GEQ 1 and GEQ 2 output jacks on the back of the 1220S to the LINE IN jacks on any standard tape deck (you will probably need a phone-to-RCA adapter as most tape decks use RCA (phono) jacks). In this configuration, the graphic equalizer can be used to equalize the tape recording. If you do not wish to use the equalizers in the recording, patch from the RCA (phono) SUB 1 and SUB 2 RECORD OUT jacks to the tape deck LINE INPUTS. By connecting loudspeakers to the POWER AMP 1 and POWER AMP 2 outputs you can monitor the signals that are being recorded. The SUB 1 and SUB 2 faders control the level of signal being sent to the tape deck- further adjustment is usually available via the tape deck's level controls.

For playback, two options are available: patch from the LINE OUTPUT of the tape deck either to the RCA-style AUX 1 and AUX 2 INPUT jacks or to the LINE input jacks of two unused preamp channels. In both cases a loop will exist between the output of the tape deck and its input, since the tape deck output will appear on the Submaster 1 and 2 busses, which are in turn patched to the input of the deck; this will create an echo effect on the recording unless you turn down the AUX RETURN LEVEL controls (if you are using the AUX 1 and 2 INPUTS for the tape deck return) or the appropriate channel faders (when you employ a preamp channel for the tape deck return) when you are actually recording.

8-2. RECORDING DURING A LIVE PERFORMANCE. Many groups wish to make recordings of their live performances through their sound system. In such cases, the graphic equalizers would be dedicated to tuning the system to the room; since most rooms are far from ideal, recordings made from the equalizer outputs are likely to sound unnatural. In addition, if the GEQ/AMP assign switch is in the MAIN/MON position, the

equalizers will be connected to the mono main and monitor outputs, and will thus not be suitable for stereo recording. For these reasons, the signals routed to the tape deck should be taken prior to the graphic equalizers. To do this, run shielded cables from the RCA-style (phono) SUB 1 and SUB 2 RECORD OUTPUT jacks on the back of the 1220S to the LINE IN jacks on any standard tape deck. Adjust the level controls on the tape deck to provide adequate headroom and minimum noise on the recording.

9. OPERATING HINTS.

9-1. INITIAL SETUP RECOMMENDATIONS. When you first set up the sound system, initial settings are critical for arriving at a satisfactory mix quickly. Often, to the distress of many soundmen, the show must begin without a preliminary sound check at all. The following recommendations should help to alleviate some of the soundman's headaches.

9-1-1. GAIN CONTROLS. Try GAIN settings at approximately -20 dB (straight up). On some drum mics, guitar amp mics and other high level signal sources, start with the GAIN control set 15 to 25 dB lower than this (-35 dB to -45 dB on the dial). Be ready to adjust the GAINS quickly, since without proper gain adjustment the rest of the mix cannot correct for the error. Also, start with relatively low GAIN settings, since any boosting of the EQ section of the preamp channels will tend to boost the channel toward clipping.

9-1-2. MONITOR CONTROLS. Most groups like to hear their voices in the monitors; some also like to hear certain instruments as well (bass drum, bass guitar, and so forth). A good initial MONITOR control setting is 5, or again, straight up. Assuming you have already properly adjusted each channel's GAIN controls, the levels appearing in the monitor mix should be fairly well matched. Further adjustments can be made as needed.

9-1-3. CHANNEL EQUALIZATION. For starters, most vocal, keyboard and other full-range signals are best left flat (controls at 0, or straight up). For signals having a great deal of low frequency content, such as drums and bass guitars, the LO and LO MID controls should initially be backed off slightly (rotated to the left) from the 0 position to reduce boominess. Naturally, all of the equalization settings should be set to achieve the most pleasing sounds, but the settings listed above should help in achieving good results quickly. In general, it is best to avoid extreme settings, as such settings tend to cause the sound to be unnatural.

9-1-4. CHANNEL FADERS. A good nominal channel fader setting is around -5 dB, or about two-thirds of the way up; this allows the channel output to be boosted if necessary, and provides a good signal-to-noise ratio in the system. Adjust the input gain control so that the channel fader may be run at this setting.

9-1-5. GRAPHIC EQUALIZERS. Start out with the equalizers set "flat" (0 dB); the slide controls have a center detent that makes them easy to set in this position. The 32 Hz and 64 Hz controls may be set initially 3 to 6 dB below the center position, since excessive low frequencies rob power from the rest of the system and low-end feedback can damage loudspeakers. Section 9-3 gives hints on making further adjustments to the equalizers.

9-1-6. MASTER MIXER FADERS. The SUB 1, SUB 2, MAIN and MONITOR faders should initially be all of the way down. The MAIN fader should then be moved up slightly (to -30 dB, for example) and the SUB 1 and SUB 2 faders moved up until the +10 dB LEDs above the SUB 1 and 2 faders begin to flash occasionally on signal peaks. The MAIN fader may then be adjusted to bring the volume of the system up to the desired level. Readjust the faders as necessary to achieve the SUB 1/SUB 2 balance and overall level required.

The MONITOR fader should be moved up CAUTIOUSLY until the stage monitor volume is at a satisfactory level- be very sensitive to possible acoustic feedback.

9-2. CHANNEL OVERLOAD AND INPUT PADS. Each channel of the 1220S has a level sensing circuit that monitors three stages of amplification: the microphone pre-amp, the line amp, and the EQ circuitry. The green -20 dBV LED indicates normal operating level, and the red +8 dBV LED indicates that overload is imminent or actually occurring, resulting in hard clipping in the op-amps. If the red LED flashes frequently, reduce setting of the GAIN control. This cuts the gain of the channel at the input summing stage, which is the most likely overload point. If the red LED still flashes frequently, turn the preamp's EQ controls back to "0". If the red LED still refuses to go away, then the microphone preamp is overloading. Pull the GAIN down to -55, and add a 30 dB pad in series with the MIC input. It's not a bad idea to carry several of these pads around with you. A 30 dB pad can be made by using a Switchcraft connector (part #S3FM) with the resistor network shown in Figure 9.

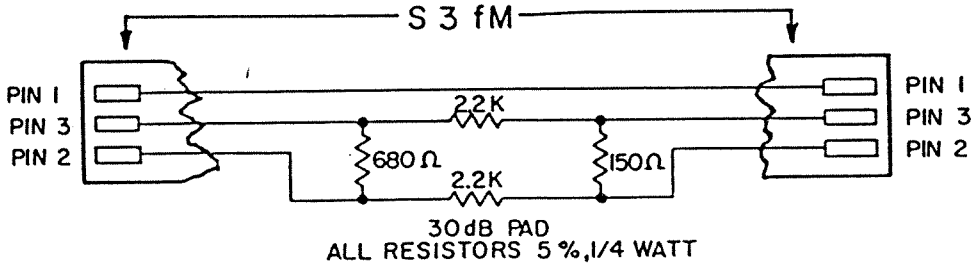


FIGURE 9

9-3. USING THE GRAPHIC EQUALIZERS TO ELIMINATE ACOUSTIC FEEDBACK.

9-3-1. THE CAUSE OF ACOUSTIC FEEDBACK. Acoustic feedback in a sound system is the result of coupling between the speakers and microphones. The microphones will always pick up a certain amount of signal from the speakers; how much they pick up will depend on the room acoustics, the frequency response of the microphones and speakers and the mic and speaker placement. If the received signal is amplified enough (in the mixer and power amplifier) the speakers will continue to produce the signal, and the characteristic howl of acoustic feedback will begin. This feedback will occur at the frequency which receives the largest amount of gain from the sound system (including the room). If the signal can be attenuated at that frequency, more gain can be added to the rest of the signal frequencies before feedback occurs. This is the primary role of an equalizer in a sound system.

9-3-2. TYPICAL PROCEDURE FOR ROOM EQUALIZATION.

1. Set up your entire sound system the way it will be used. Include all auxiliary equipment and adjust it the way you would normally use it. If feedback occurs during set up, reduce the gain of the mixer output controls (if you are in the mono mode, this will be the MAIN and MONITOR level control, and if you are in the stereo mode, the SUBS 1 and 2 controls should be brought down). Follow the procedure outlined in the paragraphs below- first for one output channel, and then for the other.

2. Set the controls on the graphic equalizers to the "flat" position, indicated as "0 dB" on the panel.

3. Slowly increase the output level (using the appropriate fader) until the sound system is on the threshold of feedback- a ringing sound will occur when you tap on the microphones.

4. Slowly attenuate the Equalizer control which has the greatest effect on reducing the ringing. This will take some trial and error- the first ringing usually occurs between 1 kHz and 4 kHz. Continue until the ringing has stopped.

5. Again, slowly increase the output level control until the system is on the verge of feeding back. Adjust the equalizer to remove the potential feedback. Continue this procedure until you have achieved sufficient gain for your application or until the equalizer becomes ineffective at removing the ringing. (It is best to back off the gain once maximum gain before feedback has been established). Avoid extreme settings, or settings which require a large amount of cut in the middle frequency bands, as such settings impair intelligibility.

6. "Fine tune" the equalizer settings as the performance progresses to achieve the best overall sound from the system.

9-4. SUBINSTRUMENT FILTERING. The frequency of the low "E" on a bass guitar is 41.25 Hz; in most cases, this is the lowest frequency your sound system will need to reproduce. Most of the sounds below this frequency are the result of people moving around on stage (stage rumble), hands bumping the strings of electric guitars, wind striking the microphones and so forth. Most such sounds do not add to the music; instead, they rob power from the power amplifiers (reducing power amp headroom) and can cause overexcursion and damage in the loudspeakers. To minimize the level of these "subinstrument" frequencies (frequencies in the range below those produced by the instruments), cut back the 32 Hz slider on the graphic EQs 9 to 12 dB. The 63 Hz control can also be lowered 3 to 9 dB, provided the stage volume of the bass guitar is adequate.

9-5. CORDS AND CABLES.

9-5-1. MICROPHONE CORDS. It is possible to be fooled during set-up by an apparently quiet system; however, when the triac-controlled house lights come on and all the amplifiers are switched on, buzzes and hash will appear. It takes balanced lines to reject the strong EMI fields found in a working environment, although unbalanced lines may be used when the runs are very short (less than 6 feet).

Use balanced two-conductor shielded cable for all long runs. If balanced cable is connected to an unbalanced output (e.g., a keyboard mixer output) or microphone, use a 600 ohm line-matching transformer close to the unbalanced device. This ensures maximum common-mode noise rejection for the entire system.

If you have no choice and must use unbalanced cables, use the shortest cables possible and keep them away from AC power mains, lighting cables and speaker wires. If you want the quietest system possible, you should follow these rules with balanced lines as well.

Balanced input lines connect to the three-pin (Cannon, XLR) MIC jacks on the back of the 1220S. Unbalanced lines connect to the 1/4" (phone) LINE jacks.

9-3-2. SPEAKER CABLES. Use two conductor zip cord to connect the amplifier outputs to your speakers. The gauge of the wire is important; wire that is too light in gauge causes a loss in damping factor (the ability of the amplifier to control the motion of the speaker) and also consumes power (the power from the amplifier heats up the wire instead of driving the speakers). Use Figure 10 to choose the proper gauge of wire for your particular situation. To calculate your speaker impedance, use Figure 11.

Speaker Wire Length	2	4	*8	16 ohms
100' - Up	8	10	12	14
50 - 100'	10	12	14	16
*25 - 50'	12	14	*16	18
10 - 25'	14	16	18	18
0 - 10'	16	18	18	18

Speaker Impedance

FIGURE 10

*Example: The length of speaker wire required is between 25 and 50 feet and the speaker impedance is 8 ohm. The minimum recommended gauge speaker wire is 16 gauge.

CHART A

Parallel Impedance

$$RT = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} \ldots \frac{1}{R_t}}$$

Cabinet B Impedance	Cabinet A Impedance 2	4	8*	16
16	1.8	3.2	5.3	8
8	1.6	2.7	4	5.3
4*	1.3	2	2.7*	3.2
2	1	1.3	1.6	1.8

*Example - Cabinet A is 8 ohms, Cabinet B is 4 ohms. The total impedance when connected in parallel is = $\frac{1}{\frac{1}{8} + \frac{1}{4}}$ = 2.7 ohms.

CHART B

Series Impedance

$$RT = R_1 + R_2 \ldots R_t$$

Cabinet B Impedance	Cabinet A Impedance 2	4*	8	16
16	18	20*	24	32
8	10	12	16	24
4	6	8	12	20
2	4	6	10	18

*Example - Cabinet A is 4 ohms. Cabinet B is 16 ohms. The total impedance when connected in series is = 4 + 16 = 20 ohms.

FIGURE 11

10. PATCHING. Patching to external signal processing devices such as effects units, limiters, crossovers, additional equalizers, power amplifiers and so forth may be accomplished easily with the 1220S. Such patching generally falls into one of three categories: 1) effects patching in line with the input signal before the mixer, 2) patch loops within the 1220S system and 3) patching external devices to 1220S outputs without returning them to the 1220S.

10-1. IN-LINE EFFECTS PATCHING. Effects patching before the mixer is straight-forward; the input signal is patched into the effect and the effect output goes to a preamp channel input.

10-2. PATCH LOOPS WITHIN THE MIXER SECTION OF THE 1220S. Essentially, a "patch loop" is created whenever a signal is taken from one output of the console and returned to one of the console's inputs. Patch loops within the mixer portion of the 1220S generally involve the use of external effects (phase shifters, digital delays, echo units and so on) and may be accomplished in several different ways. Two standard effects loop patches have already been described (in Sections 7-1-5 and 7-2-5); these involved taking an output signal from the EFFECTS SEND and using either the EFFECTS RETURN, the AUX 1 and 2 INPUTS, or an unused preamp channel for the return. In general, an effects loop may be created by patching to an effect from any output of the 1220S and returning the output of the effect to any of the console's inputs. However, IT IS IMPORTANT NOT TO INADVERTANTLY CONNECT THE OUTPUT OF A BUSS BACK TO ITS INPUT. An example of this would be patching from the EFFECTS SEND to a phase shifter and returning the output of the phase shifter to a preamp channel LINE INPUT. In this case, if the EFF/REV control on the preamp channel is turned up, oscillation could well occur, since the Effects Send amplifier output would be patched back into its input, and further, the output of the phase shifter would be patched back into its input. Even if the resulting oscillation could not be heard, it could result in audible distortion and loudspeaker damage. Refer to the block diagram (Figure 1) to determine whether or not a particular patch will work.

10-3. PATCHING IN THE OUTPUT CHAIN. Extensive patching capabilities have been incorporated into the output chain (MAIN and SUB outputs, Graphic Equalizers and Power Amplifiers) of the 1220S; patching in this portion of the console usually involves external signal processing equipment other than effects (e.g. equalizers, limiters and crossovers), additional power amplifiers and mixers; Figure 12 illustrates some of the possibilities.

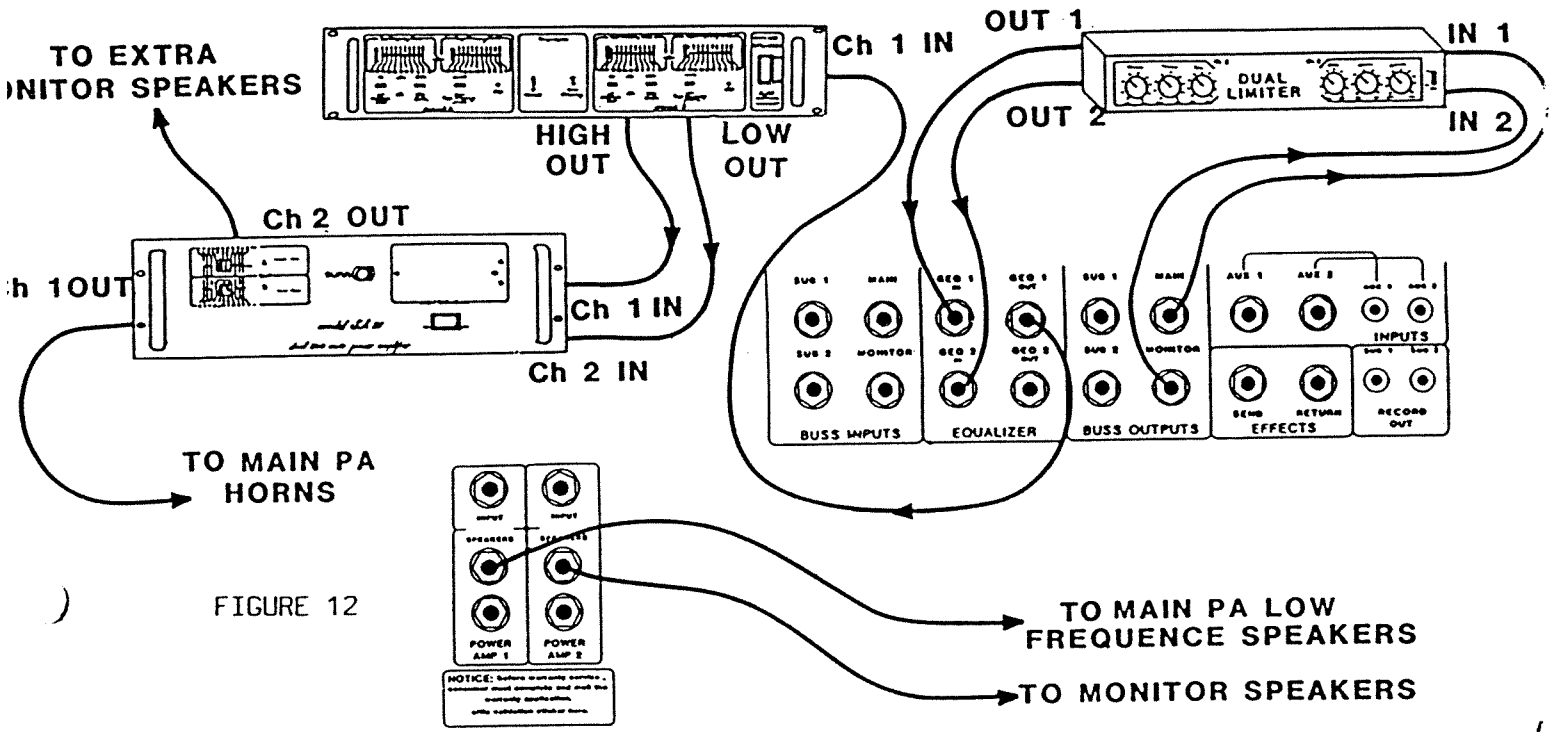


FIGURE 12

In Figure 12 a limiter has been inserted in the signal path between the MAIN BUSS OUTPUT and the GEQ 1 EQUALIZER INPUT. Inserting a 1/4" plug in the GEQ 1 INPUT jack breaks the normal signal path, causing the entire signal from the Main output stage to pass through the limiter before it reaches the equalizer.

Another limiter has been patched into the Monitor Output/Graphic Equalizer chain.

The output of Graphic Equalizer 1 has been patched to the input of a SUNN 4320 electronic crossover so that the main PA system can be bi-amped. The low frequency output of the crossover is patched back to the POWER AMP 1 INPUT to drive the low frequency speakers and the high frequency output of the 4320 goes to another power amplifier (in this case, one channel of a SUNN SA 21) to power the horns.

Another external power amplifier (the other half of the SA 21) is patched to the GEQ 2 OUTPUT so that more monitor speakers may be driven. Use of the GEQ 2 OUTPUT jack does not interrupt the normal signal path between the Graphic Equalizer and Power Amp 2; therefore Power Amp 2 is still available to drive its portion of the monitor speaker system.

The patches illustrated are by no means the only ones possible. As before, consult the block diagram (Figure 1) to see if a particular patch will work.

10-4. PATCHING TWO BOARDS TOGETHER. Two or more boards may easily be patched together. One is defined as the "slave" board, the other as the "master" board. If you are patching two 1220S consoles together, the BUSS OUTPUTS of the slave board are patched to their respective inputs on the master board. This results in a board having more channels. Set the SUB 1, SUB 2, MAIN and MONITOR faders on the slave board so that similar control settings on both boards produce similar levels on the master board outputs. Use the SUB 1, SUB 2, MAIN and MONITOR faders on the master board to control the overall output levels for the system. The graphic equalizers and the power amplifiers on the slave board may be treated as auxiliary equipment to augment the EQs and amps on the master board; or they may be used for other applications.

Other mixing consoles or powered mixers may be patched to the 1220S in a similar manner; however, since other mixers may not have the same buss structure as the 1220S, some of the 1220S BUSS INPUTS may not be needed. Once again, consult the block diagrams of the respective pieces of equipment to determine what is possible.

11. JUMPER OPTIONS. Both the EFF/REV control and the MONITOR control on each of the preamp channels are capable of receiving their signals from three different points in the circuit:

A) pre-EQ/pre-fader
B) post-EQ/pre-fader or
C) post-EQ/post-fader.

The EFF/ REV control is factory-wired post-EQ/post fader and the MON control is factory-wired pre-EQ/pre-fader; however, jumpers on each of the preamp channel printed circuit boards may be moved to reassign these controls to one of the other two points in the circuit.

The component diagram (Figure 13) shows the locations of the jumpers on the individual channel cards. The solid lines represent the factory-wired standard locations; the dotted lines represent optional user-selectable jumper locations.

When jumpers are changed, record the changes for the benefit of others who might use the mixer.

RESETTING INTERNAL JUMPERS

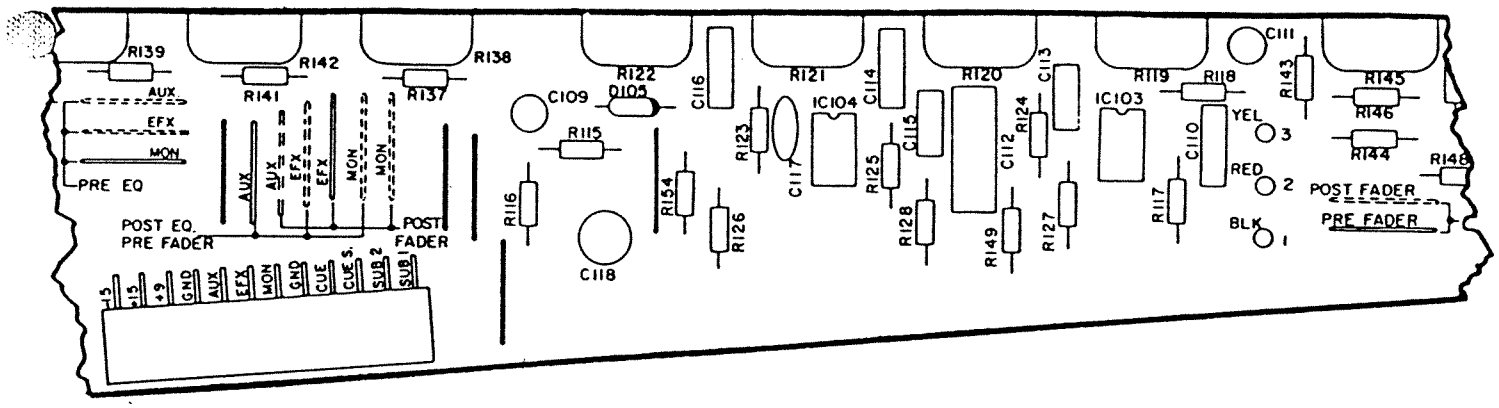


FIGURE 13

SUNN recommends that the changing of jumpers be performed at the nearest qualified SUNN dealer or service center. Costs incurred are the responsibility of the owner of the console. SUNN is not responsible for damage caused by improper modifications.

12. UPKEEP AND SERVICE. The SUNN 1220S has been designed to give you years of trouble-free service. With a few precautions you can help to insure its continued reliable operation:

*Do not obstruct the cooling vents on the bottom, top and back of the 1220S.

*Transport the 1220S with care; SUNN highly recommends that you carry the console in a hard shell ATA case.

*Periodically check the 1220S for loose screws and tighten as necessary, being careful not to overtighten.

*If you leave the 1220S set up when you are not using it, protect it from dust with a soft cover.

*DO NOT SET FOOD OR DRINKS ON THE 1220S- this point can not be overemphasized. Spilling a drink is the quickest way to ruin a potentiometer (fader, level control, EQ control) or switch.

*When using the console outdoors, protect it from moisture (rain, sprinklers, beer, etc.).

*Do not set anything heavy on the front panel of the console, as this may cause the panel to warp and may cause shafts or knobs to break.

*Periodically clean the 1220S by wiping it with a soft cloth and a small amount of furniture polish.

There are no user-serviceable parts in the 1220S. Therefore any service problems should be referred to qualified service personnel; contact your dealer for the location of the nearest Sunn Authorized Service Center.

13. SUNN MUSICAL EQUIPMENT COMPANY'S LIMITED WARRANTY.

SUNN Musical Equipment Company warrants this new product to be free from defective materials and workmanship for one year from date of purchase to the original owner when purchased from an AUTHORIZED SUNN DEALER according to the following conditions:

The purchaser is responsible for completing and mailing to SUNN, within 15 days of purchase, the warranty application enclosed with each product. Upon receipt of the warranty application, SUNN will issue a warranty validation sticker that must be affixed to the product. Where a warranty validation area has not been provided on a few SUNN products, the validation sticker is to be affixed to your original proof of purchase and presented at the time of warranty service. PROOF OF PURCHASE ON UNREGISTERED EQUIPMENT IS NOT SUFFICIENT FOR RECEIVING IN-WARRANTY SERVICE. In the event you do not receive your validation sticker within 60 days of mailing, you are to notify SUNN Musical Equipment Company in writing immediately. The purchaser has the sole responsibility for completing and mailing the warranty application.

Meters, meter light bulbs, vacuum tubes and lighting fixtures carry a 90 day warranty from date of purchase. There is no warranty on gels or lamps used in portable lighting systems.

SUNN products that have been subject to accident, alterations, abuse, rental or defacing of the serial number are not covered by this warranty. Loudspeakers and drivers misuse due to overpowering or improper installation resulting in torn, burned or charred components will not be covered by this warranty.

The normal wear and tear of appearance items such as handles, corners, casters and knobs are not covered under this warranty.

If your SUNN product requires service during the warranty period, SUNN will repair or replace, at its option, defective materials provided you have identified yourself as the owner of the validated product to any SUNN authorized service center or contact SUNN for service assistance. Transportation charges to and from an authorized service center or factory for SUNN products and components to effect repairs shall be the responsibility of the owner. In the event a product is to be returned to SUNN for repairs, a written return authorization from SUNN must be obtained prior to shipping.

SUNN is not liable for any incidental or consequential damages resulting from any defect or failure of this instrument other than the repair of the SUNN product subject to the terms of this warranty. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. This warranty is expressly in lieu of all other agreements and warranties, expressed or implied, except as may be otherwise required by law.

Thank you for choosing SUNN!