

# Soundcraft

## 500

# MONITOR

# USER MANUAL

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## SERIES 500 MONITOR

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1.00 Serial no. and console specification

Model No. .... Frame size.....

Serial No. .... PSU Serial No. ....  
(as used in final test)

Original Customer..... Works Order No. .....

PROGRESS	NAME	DATE	SUPERVISORS INSPECTION
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Frame Fitted by.....

Assembled/Wired by.....

First Test by.....

Final Test by.....

Despatch Inspection by.....

EQUIPPED WITH	TYPE	QUANTITY ISSUE
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Input Modules.....

Output Modules.....

Master Module.....

P.S.U. .....

OPTIONS - SPECIFY

ALTERATIONS TO SPEC.

SPECIAL INSTRUCTIONS

DESPATCH KIT REQUIRED

## 2.00 CONSOLE DESCRIPTION

The Soundcraft Series 500 monitor console is designed to cater for public address applications. The frame of the console is designed to withstand the wear and tear of being on the road.

Key features on the desk include 12 group outputs, Phones output and a mono monitor output. All balanced inputs and outputs use an electronic, transformerless design to ensure low inherent noise.

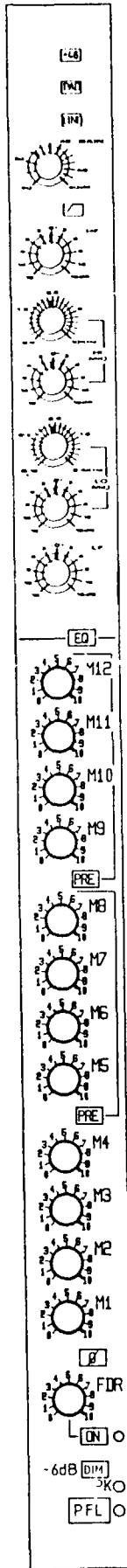
The use of electronic balancing reduces the degradation of signal quality which is introduced by more conventional transformer coupled designs, ensuring superior transient response, minimal phase shift and excellent common mode rejection even at high frequencies

On the Series 500 VU meters are provided for the 12 group outputs. Separate meters are provided for the PFL signal and the Monitor level signal.

Being Modular in construction the Soundcraft Series 500 is easy to dismantle making any necessary maintenance extremely straight-forward.

The Series 500 console operates at +4dBu although the internal operating level, (including the insert points), is at -2dBu allowing for greater internal headroom.

The power supply is a 19" rack mounted unit supplying the console with 17 volts positive and negative rails, +24 volt for the LED display, and a +48 volt rail for phantom power of microphones.



## 2.01 MONITOR INPUT MODULE

### 1) Channel input section

Each channel is individually switchable between the Microphone Input and the Line Input by pressing the LINE switch.

Both Microphone and Line inputs are electronically balanced, using a transformerless design, configured for optimum low noise operation.

The balanced Microphone Input impedance is normally 2kOhms, increasing to 4kOhms when the 20dB Pad is inserted, thus ensuring correct matching for all normally used microphones.

The balanced Line Input has an input impedance of greater than 10kOhm, which is high enough to interface to any normal professional peripheral equipment, without causing undue loading of the source.

#### a) +48

Pressing the +48 button enables capacitor microphones to be powered by the console's internal 48Volt Phantom Power supply. CAUTION: It is not advisable to use a Direct Injection box when the Phantom Power is on.

#### b) PAD

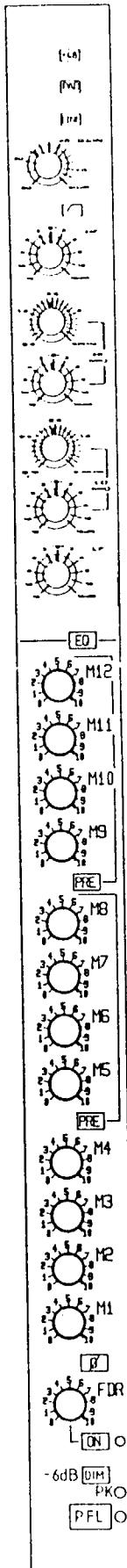
The PAD button inserts a 20dB attenuator into the input of the microphone amplifier, and allows extremely high level input signals to be catered for, without overloading the input stage.

#### c) LINE

Line Input may be selected by pressing the LINE button.

#### d) GAIN

The Microphone and Line inputs can be varied between 20dB and 60dB of gain using the GAIN trim control. When used in conjunction with the 20dB PAD, a 60dB control range is available on the Microphone input.



## 2) The Equalisation Section

The equaliser on the Series 500 monitor console is a flexible device allowing five areas of control to be exercised. All amplitude pots are centre detented for easy zeroing. The equaliser may be switched in or out of circuit, independently of the high pass filter.

### a) THE HIGH PASS FILTER

The High Pass Filter operates at 100Hz with an ultimate slope of 12dB/octave. This will effectively remove low frequency stage rumble, and other extraneous signals.

### b) HF (High Frequency)

15dB of boost or cut is available at 8 KHz, with a "shelving" characteristic, ie. the slope of the EQ curve does not keep rising with frequency, but having reached the desired amount, flattens out or "shelves" from that frequency on.

### c) HI MID

The Hi Mid Frequency is continuously variable between 600Hz and 10kHz, with 15dB of boost or cut available. The response is of the "bell" type, ie. having reached maximum amplitude (or minimum in the case of cut) at the selected frequency, the amplitude response returns to zero on either side of that frequency. The "Q" (a measure of the bandwidth) of the network is 1.5.

### d) LO MID

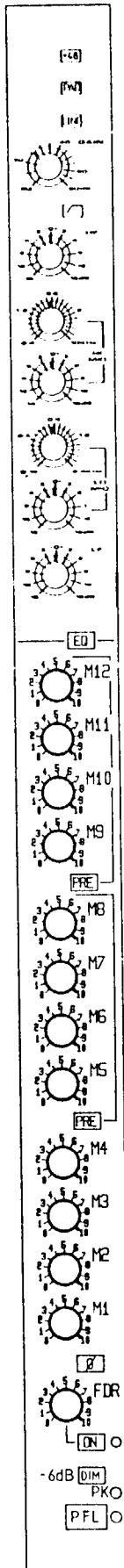
The Low Mid section is identical to the Hi Mid section with the exception that the frequency is variable between 150Hz and 2.4kHz.

### e) LF (Low Frequency)

15dB of boost or cut is available at 70 Hz, with a "shelving" characteristic.

### f) EQ BUTTON

The equaliser circuitry can be switched in or out of the signal path, independent of the High Pass filter.



### 3) Monitor send controls

Twelve individual monitor sends are available, each with their own level control. They are permanently routed to the twelve monitor group outputs.

#### a) SENDS 9 TO 12

These are normally post fade signals but can be switched pre-fade by pressing the associated button marked PRE.

#### b) SENDS 5 TO 8

These are normally post fade signals but can be switched pre-fade by pressing the associated button marked PRE.

#### c) SENDS 1 TO 4

These can be pre/post fade and pre/post EQ depending on jumper selection.

Pre fade and pre EQ

Place jumpers J2 and J3 ON.

Pre fade and post EQ

Place jumpers J1 and J3 ON.

Post fade and post EQ

Place jumpers J1 and J4 ON.

### 4) Channel status section

#### a) PHASE

Pressing the phase button corrects for miswired microphones etc. and can be useful for cancelling feedback in on-stage monitoring.

#### b) CHANNEL FADER

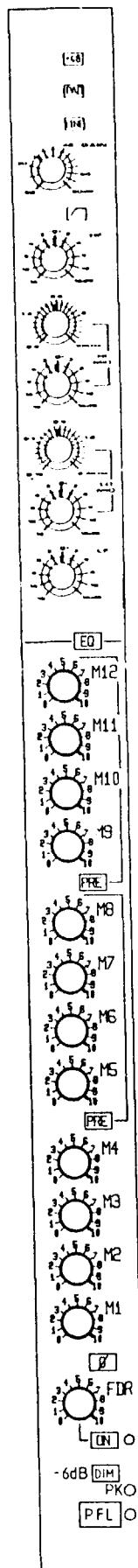
The channel fader is a rotary control calibrated 0 to 10 and provides overall level control for the channel.

#### c) ON

Pressing the ON button enables the monitor sends.

#### d) DIM

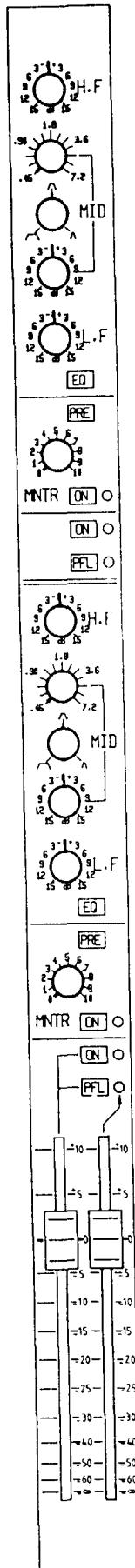
Pressing the DIM control attenuates the signal in the channel by -6dB. This is particularly useful if sudden feedback occurs.



e) PFL

Pressing PFL solos the pre-Fade signal, independently of the ON switch.  
Operation is indicated by a red LED.

## 2.02 MONITOR OUTPUT MODULE



Each monitor output module contains two outputs per module. Controls for even numbered outputs are located at the top of the module and controls for odd numbered groups at the bottom.

### 1) Equaliser section

Each output has a three band equaliser with a parametric mid-range.

#### a) HF

The high frequency is of a shelving type and provides 15dB of boost or cut at 10kHz.

#### b) MID

The parametric mid frequency control is of the 'bell' type and provides 15dB of boost or cut over a frequency range of 450Hz to 7.2kHz. The Q of the filter can be varied to give narrow or broad-band control.

#### c) LF

The low frequency control is of a shelving type and provides 15dB of boost or cut at 100Hz.

### 2) Monitor level

The rotary monitor level control contributes to the mono mix available via the SUB level control on the Master module. This can be either pre/post insert point or pre/post fader depending on jumper selections.

#### a) PRE

Pressing the PRE button takes the signal for the monitor send from either before the insert point or before the fader depending on jumper selection.

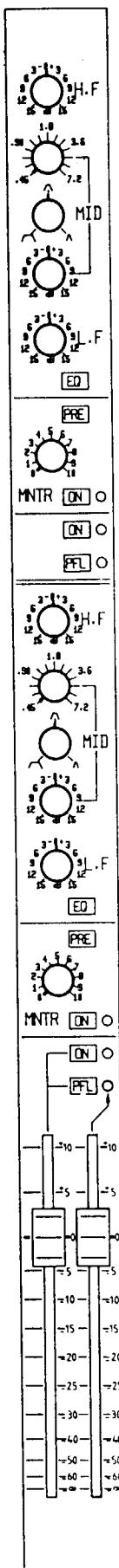
##### i Pre insert point

Install jumper J13 for odd numbered groups and J15 for even numbered groups.

##### ii Pre fader

Install jumper J14 for odd numbered groups and J16 for even numbered groups.

Note: each jumper has two possible positions.



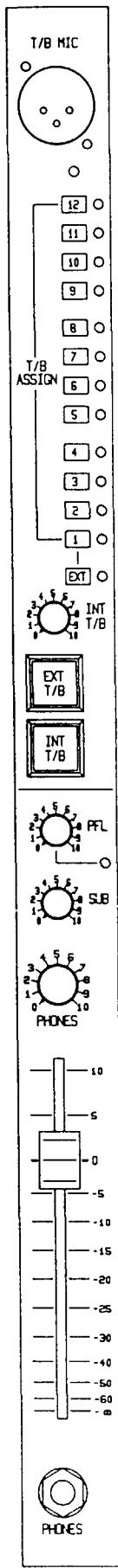
b) ON  
Pressing the ON button enables that particular monitor output.

3) Group fader section

a) ON  
The ON button enables the module.

b) PFL  
Pressing PFL soloes the pre-Fade signal.

c) GROUP FADER  
The two group faders control the overall group output level. Odd numbered groups are controlled by the lefthand fader and even numbered groups by the righthand fader.



### 2.03 Master module

The Series 500 monitor master contains the mono monitor output, the talkback output and the phones output.

#### 1. Talkback section

An electronically balanced XLR input is available with a gain range of 20dB to 60dB for the talkback microphone, phantom power is not provided.

##### a) MIC LEVEL

Adjusts the level of the talkback signal.

##### b) ROUTING

The talkback signal can be routed to any of the twelve monitor output groups. The talkback source is determined by the small EXT button. When this is pressed the talkback signal is an incoming external signal.

When talkback is in operation the signals from the PFL and SUB buses are dimmed by 20dB.

Pressing the large INT button turns on local talkback and feeds a small amount of signal to the headphones circuit.

Pressing the large EXT button routes the local talkback to the T/B out socket on the rear connector panel and sends a small amount of signal to the headphones circuit.

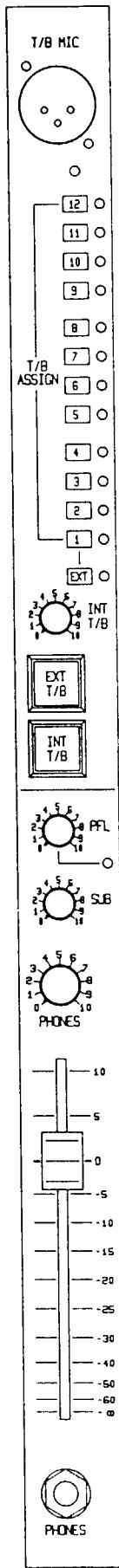
This is designed to interface with the Soundcraft Series 8000 talkback system.

#### 2. PFL

The PFL level control allows adjustment of the amount of PFL signal present in the monitor and headphone outputs.

#### 3. SUB

The SUB level control allows adjustment of the amount of Monitor signal, provided by the monitor level controls on the Group outputs, in the Monitor and headphone outputs.



#### 4. Phones

The phones level control allows the level in the headphone output to be adjusted independently of the Master fader.

#### 5. Insert point

An unbalanced insert point is available immediately before the Monitor output fader.

#### 6. Monitor output fader

The Master fader control the amount of signal present on the mono output.

#### 7. Metering

Fourteen VU meters are provided, one for each of the group outputs, a PFL meter and a Monitor output meter.

## 2.04 INPUT CONNECTOR PANEL

### 1) Line Inputs

These stereo standard jacks carry the electronically balanced Line Inputs. They are wired as follows:-

Tip: HOT (In phase signal)  
Ring: COLD (Out of phase signal)  
Sleeve: GROUND

### 2) Mic Inputs

These carry the electronically balanced Microphone Inputs and are wired as follows:-

Pin 1: GROUND  
Pin 2: HOT (In phase signal)  
Pin 3: COLD (Out of phase signal)

The Microphone Inputs can be fed with a +48v Phantom Power for Capacitor microphones. This is controlled by the Phantom Power switch on the individual Input Channels.

### 3) Channel Inserts

The Channel Inserts are standard, unbalanced, stereo jacks used to carry both insert send and insert return signals. Nominal level at the insert point is -2dBu.

Under normal conditions with nothing inserted the signal is normalled through the jack socket and thus inserting a jack will automatically break the link. Channel inserts are wired as follows:-

Tip: Insert return - unbalanced  
Ring: Insert send - unbalanced  
Sleeve: Common Ground

### 4) Line Outputs

The Line Outputs are standard, unbalanced, stereo jacks used for sending signals to peripheral equipment. Minimum loading is 5kOhm. They are wired as follows:-

Tip: HOT (In phase signal)- unbalanced  
Ring: Signal Common  
Sleeve: Signal Common

## 2.05 OUTPUT CONNECTOR PANEL

### 1) Monitor Group Inserts

These carry the insert sends and returns. The insert send is normalled to the insert return. Inserting a jack into the return socket breaks the normalising. The insert send is unbalance and the insert return is balanced. They are wired as follow:-

SEND	RETURN
Tip: HOT (In phase signal)	Tip: HOT (In phase signal)
Ring: Common ground	Ring: COLD (Out of phase)
Sleeve: Common ground	Sleeve: Ground

### 2) Monitor Group outputs

Fed from the twelve individual monitor groups these are electronically balanced and are wired as follows:-

Pin1:	GROUND
Pin2:	HOT (In phase signal)
Pin3:	COLD (Out of phase signal)

### 3) Talkback Input

The Talkback input allows an external signal to access the talkback routing matrix. It is wired as follows:-

Pin1:	GROUND
Pin2:	HOT (In phase signal)
Pin3:	COLD (Out of phase signal)

### 4) Talkback output

The Talkback output enables the local talkback signal to be sent out from the console. It is wired as follows:-

Pin1:	GROUND
Pin2:	HOT (In phase signal)
Pin3:	COLD (Out of phase signal)

### 5) Monitor Output

This is the mono Monitor output point. It is wired as follows:-

Pin1:	GROUND
Pin2:	HOT (In phase signal)
Pin3:	COLD (Out of phase signal)

## 4. Main Mix Insert

The mix insert allows access to the main mono output immediately before the fader. The insert send is normalled to the insert return. Inserting a jack into the return socket breaks the normalising. Like the Group inserts the send is unbalanced and the return is balanced. They are wired the same as the Group inserts.

## 3.00 INSTALLATION

### 3.01 Applying Power

Before switching on the Series 500 console check that the mains voltage selector on the power unit is set at the correct mains voltage for your area, and that the fuse is of the correct rating.

For operation on voltages between 220 and 240V ac the fuse should be rated at - 3.15A, 20mm, anti-surge.

For operation on voltages between 100 and 120V ac the fuse should be rated at - 6.30A, 20mm, anti-surge.

### 3.02 Connector Conventions

All XLR type connections are normally wired to the following standard:-

Pin 1 GROUND  
Pin 2 HOT (In phase signal)  
Pin 3 COLD (Out of phase signal)

All inputs and outputs are electronically balanced except for Monitor Channel Insert and Line Out.

### 3.03 General Wiring Procedures

To take full advantage of the excellent signal to noise ratio and low distortion of Soundcraft consoles care must be taken to ensure that incorrect installation and wiring does not degrade the performance of the desk. Hum, buzz, instability and Radio Frequency Interference can usually be traced to earth loops and inferior earthing systems. In some areas, especially heavy industrial areas, the incoming mains earth will not be adequate, and a separate technical earth for all the audio equipment must be supplied. However, check with your local electricity supply company to ensure that safety regulations are not infringed or negated.

The successful, hum free, installation of a system requires forethought, and the establishment of a set of ground rules, which must be consistently adhered to at all stages of installation.

## 1) Initial Wiring Considerations.

- a) For optimum performance, it is essential for the earthing system to be clean and noise free, as all signals are referenced to this earth. A central point should be decided on for the main earth point system, and all earths should be "star fed" from this point. It is common electrical practice to "daisy chain" the earths to all electrical outlets but this method is unsuitable for audio installations. The preferred method is to run an individual earth wire from each outlet, back to the system star point to provide a safety earth of screen reference for each piece of equipment.

A separate earth wire should also be run from each equipment rack and area, to the star point. This may or may not be used depending on circumstances, but it is easier to install in the first place, than later when problems arise.

The location of the star point should be a convenient, easily accessible place preferably at the rear of the console, or in the main equipment rack.
- b) Install separate "clean" and "dirty" mains outlets, wired individually back to the incoming mains distribution box. Use the "clean" supply for all audio equipment and the "dirty" supply for all lighting, vending machines etc. Never mix the two systems.
- c) If necessary, to provide sufficient isolation from mains borne interference, install an isolating transformer for the "clean" supply. The isolation transformer should be provided with a Faraday Shield which must be connected to earth.
- d) Never locate the incoming mains distribution box near audio equipment, especially tape recorders, which are very sensitive to electro-magnetic fields.
- e) Ensure that all equipment racks are connected to earth, via a separate wire back to the star point.
- f) Equipment which has unbalanced inputs and outputs may need to be isolated from the rack to prevent earth loops.

## 2) Audio Wiring

Having provided all equipment with power and earthing connections, consideration must be given to the method of providing audio interconnection, and adequate screening of those interconnections. This must be done in a logical sequence to avoid problems, and assist in the localisation of problem equipment.

- a) Connect Control Room Monitor system to the console, and check for any hum, buzz, or RFI. Only when you are satisfied with the quietness of the console and the monitor system should you proceed with the next step.
- b) Connect multitrack tape recorder, via noise reduction system if applicable, and again check that the system is still clean.
- c) Connect stereo tape recorders, studio monitors, echo and foldback sends one at a time, checking and isolating any connection which degrades performance.
- d) Connect all peripheral devices.
- e) Connect all microphone lines.

By following this sequence much time and future trouble will be saved, and the result will be a quiet, stable system.

## 3) Shielding

Audio equipment is supplied with a variety of input and output configurations, which must be taken into consideration when deciding where the screen connections should be made. There are three sources of unwanted signal being impressed on the screen, which are as follows:-

- i Extraneous electrostatic or electromagnetic fields.
- ii Noise and interference on the earth line.
- iii Capacitive coupling between the screen and signal wires.

To minimise the adverse affects of the unwanted coupling to the signal wires, it is important that the screen is connected at one end only, i.e. the screen must not carry any signal current. Any signal on the wires within the screen will be capacitively coupled to the screen, and this current will ultimately be returned to the source of the signal, either directly, if the screen is connected at the signal source end, or indirectly via the earthing system, if the signal is connected at the signal destination end. The indirect connection will cause an increase in high frequency cross-talk, and should be avoided wherever possible. Therefore, in general, always connect the shield only at the signal source end. In high RF areas, the screen can also be connected to earth via a 0.01 micro Farad capacitor. This will present a short circuit at RF frequencies, thus lowering the effective shield impedance to ground. However, at low audio frequencies the reactance of the capacitor will be sufficiently high not to cause an earth loop problem.

Combinations of unbalanced, balanced and electronically balanced, (differential), systems mean that there are nine interconnection permutations. The optimum of the screen in each case is shown in Table 1.

TABLE 1

	OUTPUT	INPUT	SCREEN
1	Unbalanced	Unbalanced	Source
2	Unbalanced	Balanced	Source
3	Unbalanced	Differential	Source
4	Balanced (Note 1)	Unbalanced	Destination
5	Balanced	Balanced	Source
6	Balanced (Note 2)	Differential	Destination
7	Differential (Note 3)	Unbalanced	Source
8	Differential	Balanced	Source
9	Differential	Differential	Source

Note 1 - The shield is connected to the destination earth point, which is opposite to normal practice, because the signal wires being shielded are referenced to the input earth, not the output earth.

Note 2 - If the output transformer is centre tapped to earth, the screen should be connected at the source.

Note 3 - When an active differential output is operated in unbalanced mode, it is very important that the output current returns to earth via the shortest, least reactive route. Check for instability at the output.

N.B.

- a) In all cases, use good quality twin screened audio cable. Check for instability at the output.
- b) Always connect both conductors at both ends, and ensure that the screen is only connected at one end.
- c) Do not disconnect the mains earth from each piece of equipment. This is needed to provide both safety and screen returns to the system star point.
- d) Equipment which has balanced inputs and outputs may need to be electrically isolated from the equipment rack and/or other equipment, to avoid earth loops.

It is important to remember that all equipment which is connected to the mains is a potential source of hum and interference, and may radiate both electrostatic or electromagnetic radiation. In addition, the mains will also act as a carrier for many forms of RF interference generated by electric motors, air-conditioning units, thyristor light dimmers etc. Unless the earth system is clean, all attempts to improve hum noise levels will be futile. In extreme cases there will be no alternative but to provide a completely separate and independent "technical earth" to replace the incoming "noisy earth". However, always consult your local electricity supply authority to ensure that safety regulations are not being infringed.

## 4.00 MAINTENANCE

Every console that leaves Soundcraft undergoes a thorough testing at all stages of manufacture. These tests include individual testing of every function on all the PCB's, a thorough testing of all the functions of the completed mixer, a soak test of 48 hours before the final test, which consists of listening, measuring and mechanical function checks prior to packaging and shipment. In this way we try to ensure that any faulty components or manufacture show up long before the console leaves the company. Thus a long and trouble-free life can be expected.

Although all Soundcraft Consoles have been designed with long term reliability in mind, it is inevitable that occasional maintenance will be required. However, due to the amount of attention given to the problems of maintenance during the design stages of this console, and the modular construction, servicing tends to be extremely simple to carry out, with the minimum of test equipment needed to isolate and rectify faults.

### 4.01 General Fault Finding

With the exception of the electronically balanced microphone amplifier, and the hybrid discrete/op amp summing amps, all signal electronics are configured around high slew rate, low noise integrated circuits. The microphone amplifier is a proprietary design, utilizing a discrete transistor, noise cancelling front end, differentially summed via a low noise integrated circuit.

The use of integrated circuits means that the majority of audio faults can be repaired by simply replacing the I.C., having first isolated the fault to a particular stage in the signal chain. The isolation can often be done without even having to remove the module from the console, by judicious use of insert points, and/or switching the module to various modes. As with all servicing a good knowledge of the basic signal flow is necessary for best results. Each module should be viewed as a number of signal blocks, through which the signal must flow. If the signal appears at the input to a block, but not at the output, then the fault lies within that block. By dividing a module into individual sections, what at first appears to be an extremely complicated piece of equipment can be simplified into a series of sequential stages. This is the basic first move in all types of fault finding, and usually requires no more than a certain amount of logical thought. Servicing a console is more a matter of clear thinking and having an understanding of what should be happening, than having a highly developed technical knowledge.

To illustrate the method of logical fault finding, let us assume that we have a non-functioning input module, in both microphone and line modes.

The first step is to ensure that a fault really does exist! Check that the module is in the correct mode of operation, and that no jacks are inserted in the insert points, which may be interrupting the signal flow.

If in doubt about the module operation, set up an adjacent module in exactly the same way, which will allow a direct comparison between a working and possible non-working module.

Route the channel directly to MIX, so that the channel may be monitored in the normal way. Using an oscillator set it to approximately 1kHz and patch the oscillator signal into the channel Line Input. If all is well, an undistorted signal should now be heard. More likely, because of the fault it won't.

Large sections of the module circuitry can be by-passed by switching out the Hi-pass filter and the Equalizer.

If switching out a section causes the signal to re-appear, then the fault is located in that section, which can then be traced at component level, by removing the module from the console frame, and reconnecting it via extender cables.

With the module installed on extender cables, access is now available to all parts of the module, and the signal may be traced through the various stages, using an oscilloscope, millivoltmeter, or even high impedance headphones. Refer to the Block Schematic which shows the signal flow through the modules. When a point is reached where the signal is not present, or is distorted, the probable faulty components can be checked out and if necessary replaced. Integrated circuits, due to their internal complexity, are the most likely cause of problems, followed by mechanical components such as switches and faders, which are susceptible to physical contamination from oxidisation, dust and liquids.

#### 4.02 Removing Modules

Remove the 2 module retaining screws, which will allow the module to be carefully withdrawn from the console. The ribbon cable will now be exposed, and may be detached from the module. The module will still have some cables attached, but these are sufficiently long to allow the module to be completely withdrawn from the console. Extender cables can now be plugged into the main ribbon cable, and the module, taking care not to twist the extender cable. Although damage to the module will not be caused by plugging and unplugging the module with the power still switched on, this is not recommended for the inexperienced, as it is possible to bend the connector pins if care is not taken.

#### 4.03 Meter Alignment

The VU meters are attached to drive cards in sets of four on the group outputs, with the two master VU meters being connected together on a separate card. These cards also contain the detection and drive circuitry for the peak LED which is pre-set to indicate a peak level of 8dB above 0VU.

0VU is normally adjusted to indicate a line level of +4dBu, i.e. a level of 1.228volts. However, it can be re-adjusted to indicate a different line level if required by the pre-set potentiometer on the drive card.

Connect a millivoltmeter to the group output. Route the oscillator set to 1kHz to the group outputs 1-4 and adjust the group output levels to read the required level on the millivoltmeter. (Normally this would be +4dBu). Adjust the VU drive pre-set to indicate 0VU on the VU meters and repeat for all other group meters and the Stereo mix meters.

Note that the peak LED will always indicate a level of 8dB above whatever the 0VU level has been set to.

#### 4.04 Lamp Replacement

Illumination of the VU meters is provided by 1 wire ended lamp in each meter. This is a 12 volt lamp. NB: On some early models illumination is provided by 2 wire ended lamps in each meter. These are 9 volt lamps. The lamps in each group of 4 meters are wired in series and powered by the  $\pm$  17 volt audio supply. A series resistor provides turn on surge current limiting to prolong the lamp life.

The stereo mix meters have an additional series resistor to simulate the voltage drop of the missing pairs of meters.

To replace lamps, first remove the eight screws securing the PCB, (on the stereo mix meters there are only 4 screws), and the 6 screws that secure the sub-bracket, (4 on the stereo mix meters), the back of the meter is now accessible, and the lamps may be replaced.

It is recommended that both lamps be replaced even if only one has failed, as the remaining lamp will have been overstressed and its life substantially reduced.

#### 4.05 Medium Power Supply Servicing

The power supply for 24 and 32 channel consoles provides the following regulated supply rails;

- i) +/- 17 volts, Audio
- ii) + 24 volts, (not used)
- iii) + 48 volts, Phantom Power
- iv) +/- 7.5 volts, (not used)

If a power supply fault is suspected, first ensure that it really is the P.S.U. which is at fault, and not a short circuit in the console. This can be checked by disconnecting the P.S.U. from the console, and measuring the voltage at the connector. A load across the supply should be provided, to simulate the normal load conditions imposed by the console.

A 10 Ohm, 20 Watt resistor across each of the audio supply rails and a 20 Ohm, 5 Watt resistor across the +24 volt rail is suitable. The phantom power supply can be loaded with a 2.2kOhm, 1 Watt resistor.

The ripple and noise value of the various supply rails can now be measured, using a millivoltmeter or an oscilloscope, and a value of at least -80dB, (ref 0.775V, DIN audio should be obtained on the audio), on the phantom supply rails.

If a fault is found to exist in the P.S.U., disconnect the mains supply and remove the cover. Check visually for any obvious problems, such as blown fuse, burnt components, etc. If nothing obvious is observed, reconnect the mains and measure the voltages across the various electrolytic smoothing capacitors, which should be as follows;

Audio Supply      C1      = +26volts  
                    C5      = -26volts

+24volt Supply    C9      = +36volts

Phantom Supply    C13,C14 = +59volts

Differences of +10% are acceptable, due to variations in the incoming mains voltage. If satisfactory, the problem lies in the regulator section. If not, however, check the bridge rectifier, smoothing capacitor and transformer for failure.

#### 4.06 LARGE POWER SUPPLY TECHNICAL DESCRIPTION.

The Soundcraft Large Power Supply Unit (PSU) is designed to power not only the TS24, but also any large desk, as it provides a comprehensive set of supply rails. These are as follows:-

+17V at 3 Amps.  
-17V at 3 Amps.  
+48V at 3 Amps.  
+24V at 3 Amps.  
+7.5V at 3 Amps.  
+24V at 3 Amps.  
+7.5V at 3 Amps.

NOTE the last two supplies can be equally well configured to provide -7.5V and -24V, as the actual supplies are floating. The necessary connections are made in the console rather than the supply, so that one PSU is suitable for a wide range of desks with differing power requirements.

#### MAINS INPUT.

Mains input is via a standard IEC type socket. Basic safety fusing is provided by F1. The mains transformer is a toroidal type for high efficiency, low mechanical noise, and a low external magnetic field. Taps are provided allowing the transformer to be configured for inputs of 100, 120, 200, and 240V rms, by the use of two screw-driver operated switches. For power supplies operating on mains voltages 200-240 volts a mains fuse of 6.3 amp rating should be fitted, for 100-120 volts the fuse rating should be 10 amp. PSUs are normally dispatched from Soundcraft with the switch set to 240 volts and a 6.3 amp fuse.

1) The +17V supply is a discrete-component regulator. Raw DC is provided by full-wave rectifier RECT1 and reservoir capacitors C1, C2. The supply regulator itself is in three parts; a reference voltage, an output power stage, and a differential amplifier that compares the actual output voltage with the desired one.

The reference voltage is provided by Zener diode ZD1, powered from the regulated voltage via R7. C16 bypasses any Zener noise to ground. This reference voltage is applied to the emitter of TR6; this is effectively one input of the differential amplifier. The other input is TR6 base, which samples a proportion of the output voltage via R8, R9. Should the output volts tend to rise, TR6 turns on more, and this turns on TR7. This diverts current away from the power output stage TR3, TR4, TR5, and counteracts the tendency of the output to rise. C12, 13 provide high-frequency stability for the feedback loop.

The current required to control the output stage is provided by constant-current source TR1,TR2. The constant-current effect prevents ripple from the unregulated raw DC degrading the output voltage purity. The action of TR1,2 is as follows; Current flows through R1 and turns on TR2. This causes the voltage across R2 to rise until it reaches 0.6V, when TR1 turns on, shunting current away from TR2 to maintain the voltage across R2 constant. This provides a constant current of approx 18mA out of the collector of TR2.

The output stage consists of TR3,TR4,TR5, arranged as a complementary feedback configuration; in effect all three transistors operate as a high-power high-gain emitter follower, the voltage gain between TR3 base and TR5 collector being one. TR4 and TR5 are connected in parallel to give greater output current capability. When TR3 turns on, its collector current is split between TR4 and TR5 base, turning on both of them. The voltage on their collectors then rises until TR3 begins to turn off, the circuit stabilising at a current level which keeps the output voltage the same as the voltage on TR3 base, minus TR3 base-emitter drop (approx 0.6V). C8,C9 are to maintain the stability of this local feedback loop.

The regulator is short-circuit protected. R5,R6 sample the output current, and when it becomes large enough to give a drop across them of 0.6V, TR10 turns on, turning on TR9, and shunting the drive current away from the output stage.

Since the +17 and -17V supplies are always used together, arrangements are made so that if one supply collapses, say due to current limiting, the other of the pair will also close down. Since the two supplies produce equal and opposite voltages, and R10,R22 have equal values, their junction at D5 should be at 0V. If the +17V supply closes down, the cathode of D5 goes negative, and TR18 turns on, closing down the -17V supply also. Likewise, if the -17V supply closes down, the anode of D5 goes positive, turning on TR8 and bringing the +17V supply out in sympathy. The presence of D5 allows a small degree of variation between the two output voltages, due to component tolerances, without initiating a shutdown.

LED1 indicates that both +/-17V supplies are operating when it is illuminated. D2 provides reverse-polarity protection.

- 2) The -17V supply is similar to the +17V, except that all component and voltage polarities are inverted.
- 3) The +48V supply is also a discrete type, operating in much the same way as the +17V supply. It is normally used for phantom powering microphones.

This supply operates in the same way as the +17V PSU described above. TR24,25 make up the differential amplifier stage, TR23 is the output transistor, and TR21,22 make up the constant-current source. R45 samples the output current, and turns on TR26 if it becomes excessive, closing down TR23. When this occurs R43 also feeds current to TR26 base, reducing the current being supplied further. This is often known as foldback current limiting. D10 provides reverse-polarity protection, and LED6 shows that the supply is working. VR5 allows the output voltage to be set to exactly +48V.

- 4) The +24V supply is based on integrated-circuit regulator REG4, its output voltage being set by the network R37,R38,R39,VR4. REG4 maintains a constant 1.5V between its output and common terminals, and therefore varying VR4 varies the regulated output voltage. C36 helps bypass ripple and noise to ground, D9 provides reverse-polarity protection, and LED5 demonstrates that the supply is still working.
- 5) The remaining three IC regulator supplies all work as described under 4) above.