AUDIONICS 106A SQ QUADRAPHONIC DECODER

Introduction and operational instructions

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SQ QUADRAPHONIC SOUND

The Columbia Records SQ System is the re-creation of sound from four different source points-permitting 360 degrees of sound perception. With four-channel sound, space itself has become a new parameter of musical adventure and excitement, a new medium for artists and composers to work with and be inspired by. With the depth and motion that four channels of sound provide, we can not only recreate the concert hall but transcend it; for though we can now reproduce sounds exactly as you hear them in real life, the sounds you hear, the musical spaces you experience may be real or unreal, as creativity dictates. Artists, producers and engineers are beginning to discover and explore the artistic potentials of this last significant sonic dimension, Quadraphonic Sound.

A professional SQ Encoder in the recording studio takes four programs, (pre-recorded on amaster tape), and translates them into an "encoded" stereo format on the SQ record. Two of the tracks appear as they would in normal stereo, with lateral modulation; the other two tracks are modulated, one track in a clockwise direction and the other in a counter-clockwise direction. This type of modulation produces what appears to be a "double helical" pattern encoded onto the SQ record.

The modulation pattern on the record requires nothing more than your Decoder module to translate the code to the original four channel format. The SQ System reproduction is virtually identical to that of the master tape.

The SQ disc is fully compatible with all existing home, broadcast, or studio equipment. An SQ record will play like a regular 2-channel stereo record on any standard stereo system. To play it in 4-channel stereo, you will require an SQ decoding circuit, such as your 106A, and four channels of amplification, plus four speakers. No special player or cartridge is required although maximum potential will be achieved with high quality magnetic cartridges and equally matched arms and turntables. SQ records can also be played over the air on FM stereo in the same manner as standard stereo and received through conventional FM stereo receivers where they can be decoded by your module.

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GENERAL DESCRIPTION OF THE 106A DECODER

The 106A is a fully transistorised module which will enable you to reproduce 4-channel sound from SQ sources such as records or FM broadcasts of SQ records. It performs the CBS SQ matrix decoding function on all SQ encoded program material. The module is extremely versatile, accepting a wide range of signal amplitudes without distortion. It can be introduced into a hi-fi system at several points. By choosing one of the installation systems described on the following pages, (or devising a scheme of your own) you can build a four-channel system as complex or simple as your requirements.

The flexibility of the 106A allows the following functions to be provided:

Four channel decoding from SQ program sources.

Enhancement of conventional two channel program material by synthesizing four channels (Ambience Enhancement).

Conventional stereo reproduction.

2-channel and 4-channel tape recording and playback

INSTALLATION -- General

This section describes the installation of the module at two different points in the amplifying chain. If desired the module can be installed at other points in the chain as long as the signal levels at the point of insertion are neither too large nor too small. The optimum signal level is 250mV to $1\frac{1}{2}$ volts. The module provides a signal to noise ratio of 80dB with a 250mV input. Signal levels below 25mV are not recommended because the signal to noise ratio would thereby be reduced to 60db-- a barely acceptable minimum for true high fidelity.

Operation at levels above 250mV will cause a slight increase in distortion. At 250mV rms for example, the distortion is 0.025% or less, while operation at 1V rms will increase the the level to 0.08%; still a very satisfactory figure. Clipping occurs at 2.5V rms. The module is therefore suitable for operation at the input of virtually any high fidelity power amplifier.

Trouble free installation and operation of the module is assured by the high input impedances (40K ohms) and low output impedance (less than 300 ohms). These impedances permit the 106A to be driven from fairly high impedances (up to 10K ohms) and to drive impedances as low as 2K ohms without any degradation of performance. Normal audio amplifier precautions should be observed when installing the module and any unduly long connections should be made with shielded audio cable-- especially at low signal levels.

For correct operation, the 106A must be provided with a correctly balanced signal at its input. If tone controls are used in front of the module, they must cause less than 1dB gain difference between the two channels. This is because the phase relationship between the two encoded signals must be maintained for accurate decoding of the four channels. The phasing of all the signals throughout the system must be correct.

Figure 1 shows the connections to the module..All the signal inputs and outputs, and the power input are available on the right hand edge of the card to allow a socket to be used. Alternative signal inputs are provided on the left hand edge of the card and may be used if desired.

POWER REQUIREMENTS

The module requires 24vdc at a current of 11mA. The ripple on the supply should be less than 20mV peak to peak to insure adequately low hum.

Two suitable power supplies are shown in figure 2 and figure 3. A 470-500 ohm resistor should be fitted on the right hand side of the module if the supply voltage is between 25-30 vdc. A slightly higher value should be used if the voltage exceeds 30 vdc. Ignore the screening on the module marked 21v +Ve; the 106A is actually the same circuit as the 106B and the heart of the circuit has been 'lifted' from the B board. If desired, the supply voltage may be introduced on the left hand side of the board provided the previously mentioned resistor is inserted in series with the supply source.

SYSTEMS

In addition to your decoder module you will of course require a second stereo amplifier plus an additional pair of speakers to achieve quadraphonic reproduction. This second amplifier/speaker combination need not be as elaborate as the one you presently own, however for optimum results, the loudspeakers should have similiar response characteristics. The complexity of the second amplifier will depend upon the set-up required.

DECODER INSTALLATION BEFORE THE MAIN AMPLIFIERS

Figure 4 shows the block diagram of a typical hi-fi amplifier and Figure 5 shows the same amplifier with the decoder incorporated along with an additional Main amplifier and two loudspeakers. Elaborations on the basic system are shown dotted or in the inset. These can be incorporated as desired.

This system will not affect the operation of a tape recorder connected to the Tape Monitor Socket of a normal stereo amplifier (with Tape Monitor access between the Pre-Amp and Tone Controls).

The signal points to be broken (A to C and B to D) for insertion of the 106A module will probably not be provided for access by the manufacturer of the amplifier and the constructor must locate the correct points for himself. Having located the relevant points, the decoder is installed as shown in figure 5. The Left and Right outputs of the Pre-Amp are taken to the Left and Right main inputs of the module respectively. The module performs the SQ decoding function on these two signal sources and provides the four decoded outputs as shown. The Right Front and Left Front pins are takenvia 2 poles of a 4 pole 2 throw switch S2, to the Front Main amplifier.

The Right Back and Left Back (rear channels) pins are also taken via S2 to the Rear Main amplifier. S2 allows the decoder to be by-passed if desired when 2-channel material is being reproduced. It is worth experimenting with the decoder in-circuit with a 2-channel program source because unusual and interesting results can be obtained. The success of this technique will depend largely on the integrity of the program source.

Three options are shown on Figure 5. (1) Independent Volume Controls can be inserted in the lines to the Rear channels to act as effective level and balance controls, so that the system can be set up initially with the correct volume at each of the four speakers. During normal operation of the system with preamp controls, adjust all four channels

During normal operation of the system the preamp controls will adjust all four channels simultaneously and will therefore be the system "Master Controls".

Option 2-- A single pole, double-throw switch S1, when connected as shown adds an "Ambient" or "hall effect" character to ordinary 2-channel stereo sources. The effect is an enhancement of conventional two-channel program material. Sound will come from all four speakers. NB "Ambient" should only be switched in with S2 in the "Stereo" (as drawn) position.

Option 3--A Quadraphonic Tape Playback Unit can easily be switched into the system as shown with a four pole, double throw switch S3. A quadraphonic ganged volume control could also be inserted after S3 to control tape playback volume if this facility is omitted on the Tape unit. Note: If a suitable ganged switch is available, S2 may be combined with the AC on/off switch to the power supply.

DECODER INSTALLED VIA THE TAPE MONITOR SOCKETS

Figure 6 shows a typical stereo amplifier with switched Tape Monitor access. Figure 7 shows the sample amplifier with the decoder installed. Access to the decoder is via the Tape Monitor inputs/output and this overcomes the problem of access to internal amplifier points which might prove difficult for a constructor attempting to use the previously described system. The Rear system need not be as complex as the Front, though ideally it should have tone controls as those of the old system now function only on the front channels. The signal level at the Decoder must be sufficient to drive the Rear amplifier.

A disadvantage of this system is that extra switching (see below) is required to incorporate a Tape Recorder--the Front amplifier's Tape Monitor sockets are now being occupied by the decoder.

As before a 4pole/2 throw switch S2 switches the decoder into circuit and could be ganged with the power supply if desired. Additional options are shown in Figure 7.

1. S1 switches in the "ambient" effect.

2. Since the two channels have independent volume controls, or perhaps the rear channel has no control at all, a Master Volume control could be placed at the input to the decoder as shown. This need only be a normal 2 gang stereo pot. (Remember that if you choose later to incorporate a Quadraphonic Tape Playback unit, you will no longer have a Master Volume Control)

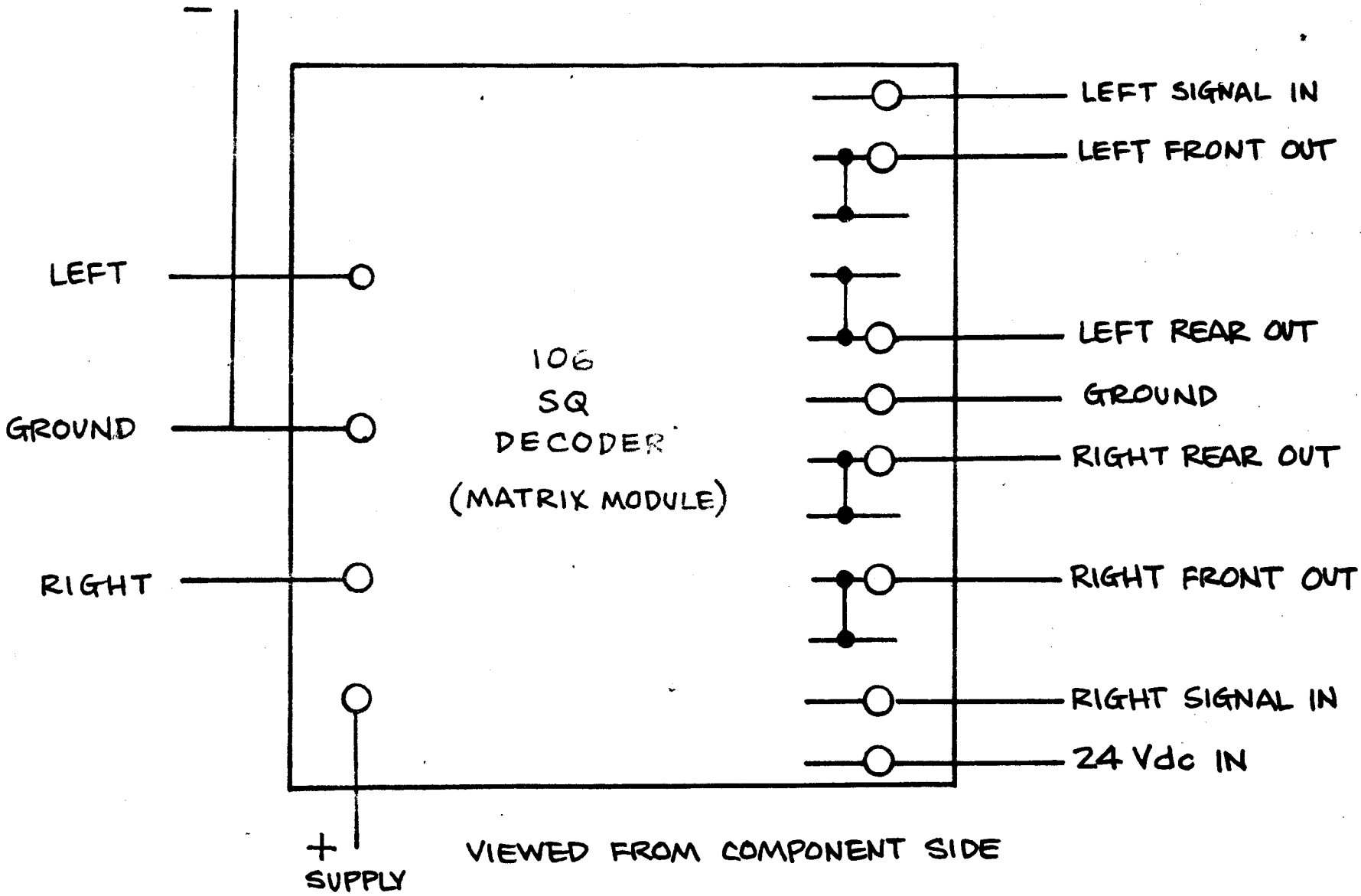
3. A tape recorder can still be used with this system: 2 pairs of sockets must be provided for replacement Tape Monitor sockets and also a replacement Tape Monitor switch S3 (2 pole/2 throw). The Front system amplifier is switched to Tape Monitor "on" to use this system.

SETTING UP YOUR LISTENING ROOM

Having assemled your decoder and connected it into your hi-fi system it is necessary to position the loudspeakers for optimum results. Individual requirements may preclude exact setting-up for optimum results. Normally the front speakers are placed eight to ten feet apart. The spacing between the rear speakers may be greater. In practice, both locating the rear speakers either slightly behind or in front of the listener will produce acceptable results. Most classical program material will provide more of an ambience effect rather than the more pinpointed sources of popular material.

Experimentation will quickly determine the most effective location for your listening requirements.

FIG. 1 SQ 106A


LEFT
GROUND
RIGHT
106
SQ
DECODER
(MATRIX MODULE)
LEFT SIGNAL IN
LEFT FRONT OUT
LEFT REAR OUT
GROUND
RIGHT REAR OUT
RIGHT FRONT OUT
RIGHT SIGNAL IN
24 Vdc IN
+
SUPPLY
VIEWED FROM COMPONENT SIDE

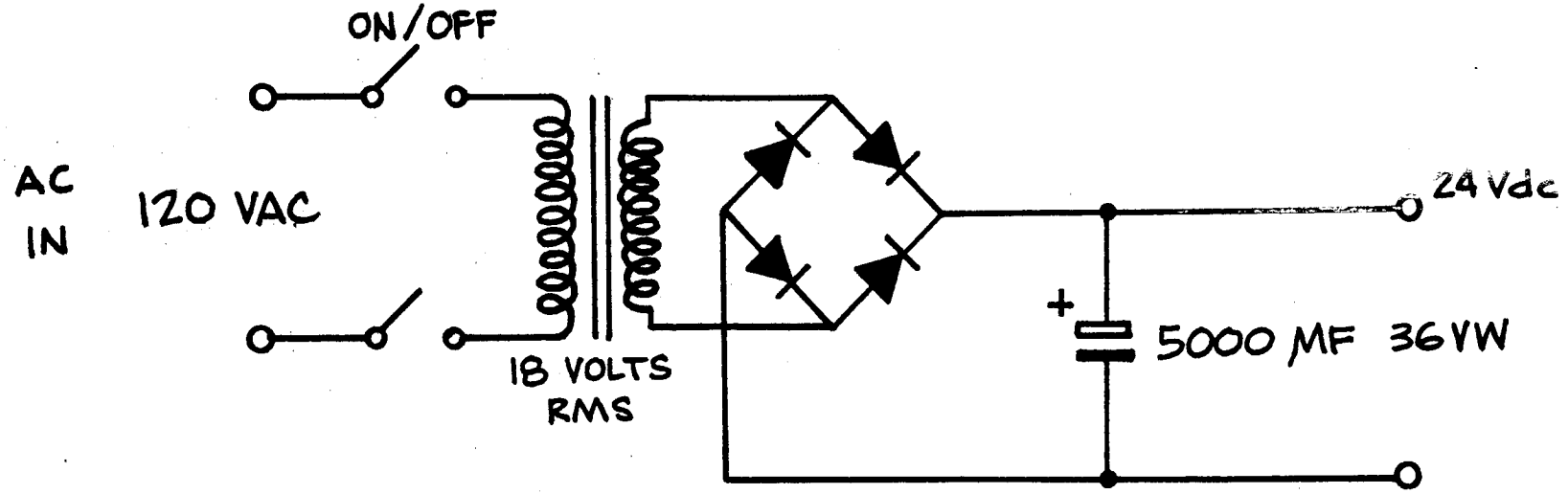

ON/OFF
AC
IN
120 VAC
18 VOLTS
RMS
24 Vdc
+
5000 MF 36VW

FIG. 2

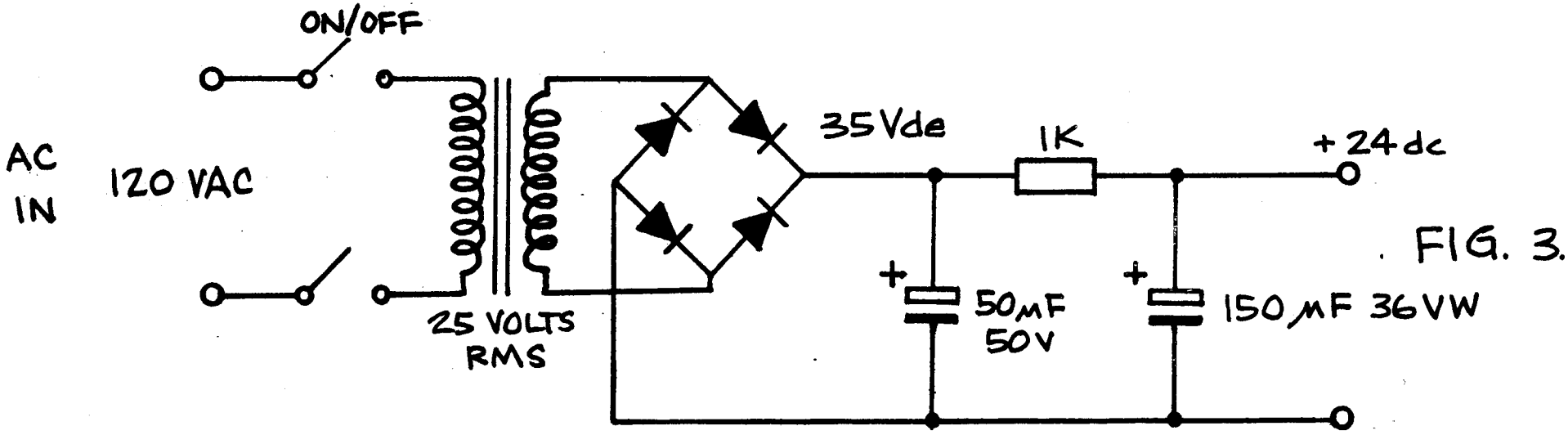

ON/OFF
AC
IN
120 VAC
25 VOLTS
RMS
35Vde
1K
+24dc
+
50MF
50V
+
150 MF 36VW

FIG. 3.

FIG. 4 STEREO SYSTEM BEFORE INCORPORATION OF SQ DECODER

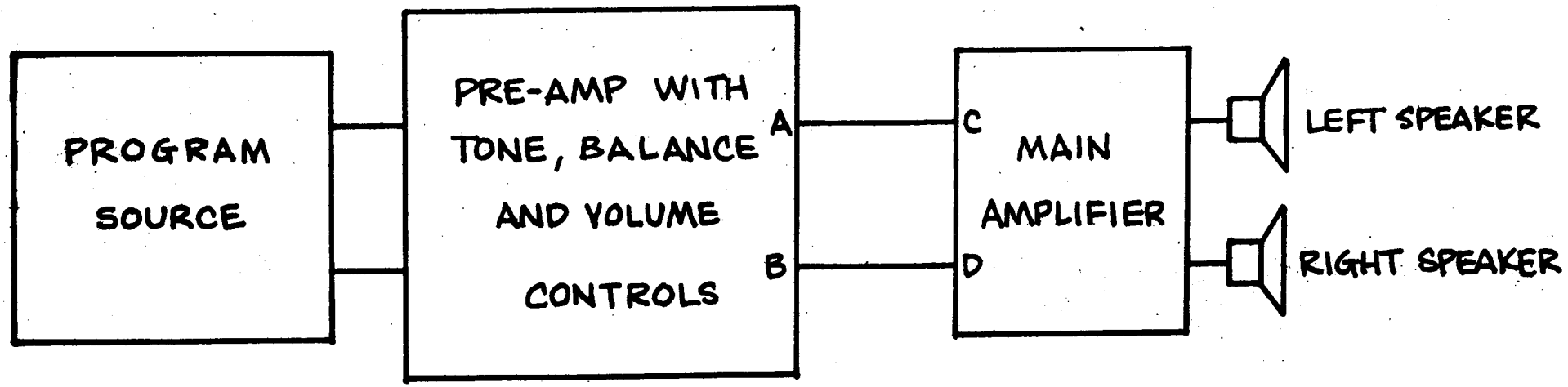


FIG. 5 INCORPORATION OF DECODER BEFORE MAIN AMPLIFIER

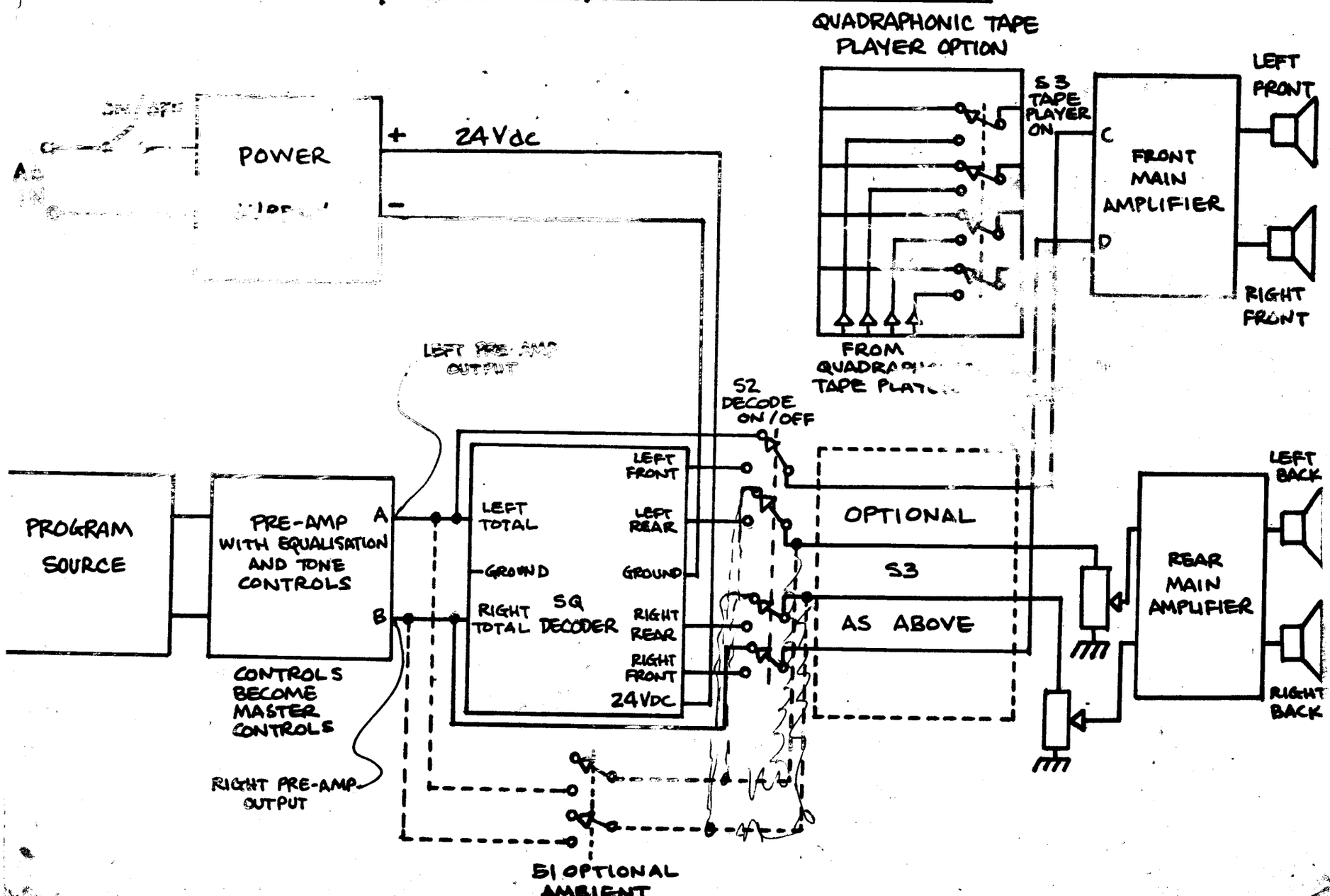


FIG. 6 BASIC STEREO AMPLIFIER WITH TAPE MONITOR

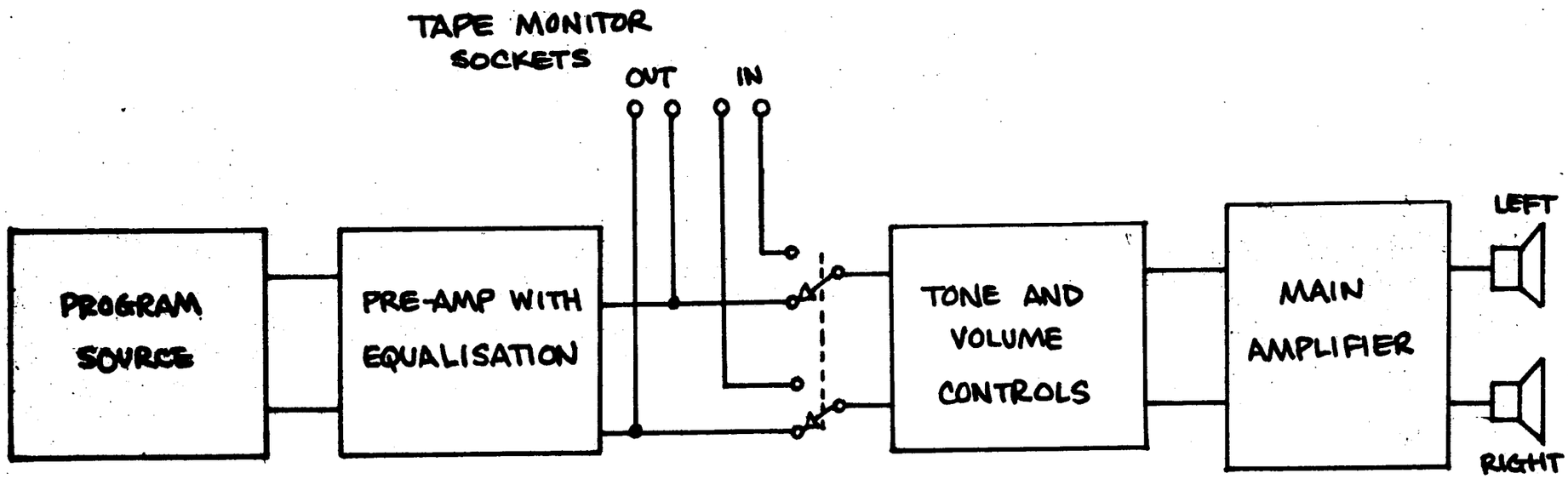


FIG. 7 DECODER USING TAPE MONITOR ACCESS