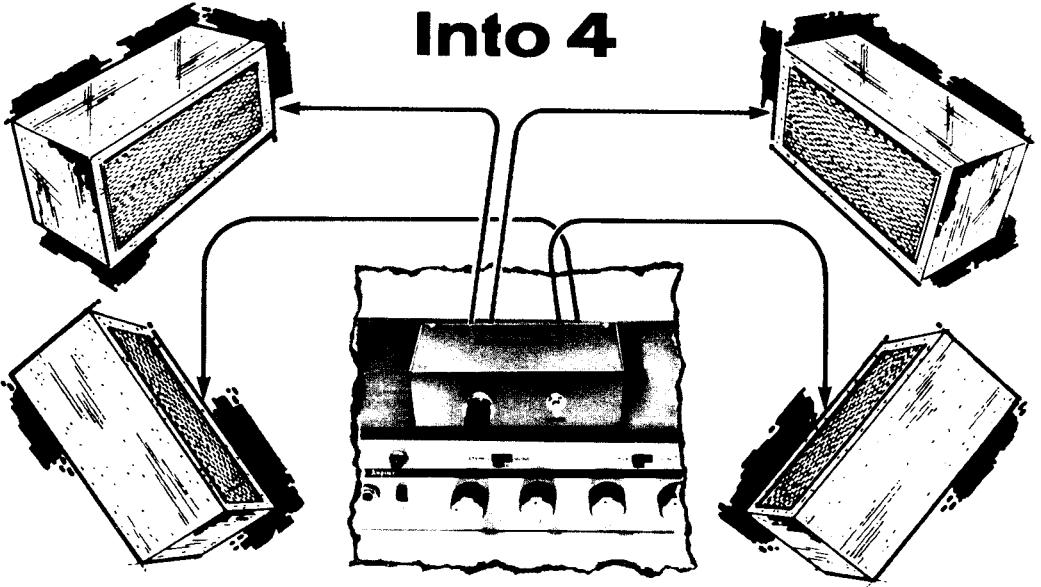


# Easy Way to Turn 2 Hi-Fi Channels Into 4



**MAGIC BOX**—Our easily-built 4-channel synthesizer sits on amplifier, as here, drives front speakers (black) plus two new speakers in rear (color).

**H**OTTEST thing on the hi-fi scene today is four-channel equipment—quadrasound. It's an attempt to get music played from a record in your living room to sound as much as possible like music from an orchestra in a music hall.

Two stereo speakers did it better than mono and now four do it better than two. In a hall, of course, you get the effect of speakers all around—the orchestra up front, echoes from the walls and the coughs, grunts, ughs and whispers of the audience. The echoes and grunts are referred to as *ambient sounds*.

Different four-channel systems do it in different ways. One type (discrete) actually records and plays back four channels, two for orchestra in front, two for ambience in rear, sometimes including grunts. Type No. 2 (matrix) records four channels of sound on two tracks

and, on replay, restores the four. Lastly, system No. 3 (derived) uses the regular two channels of stereo from which to derive two additional channels (rear speakers). It's not the music hall, of course, but few living rooms are.

Our four-channel synthesizer simplifies the procedure even more, though it is in general type No. 3. Stereo sound, from records or tape, piped into our magic box come out as two normal left-right outputs for the front speakers. But now there are two additional outputs for moderate-quality rear speakers. The rear-channel sound is derived from the front channels and gives the illusion of music-hall ambience. A potentiometer (R2) controls rear-speaker volume. Total sound volume still is determined by the amplifier's volume controls.

Our synthesizer won't fool you into thinking you're in Philharmonic Hall but it can do quite a bit to enhance the

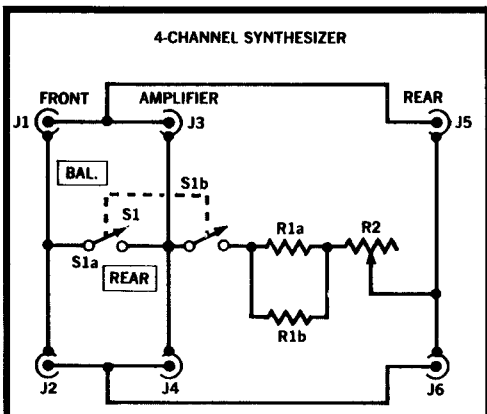


FIG. 1

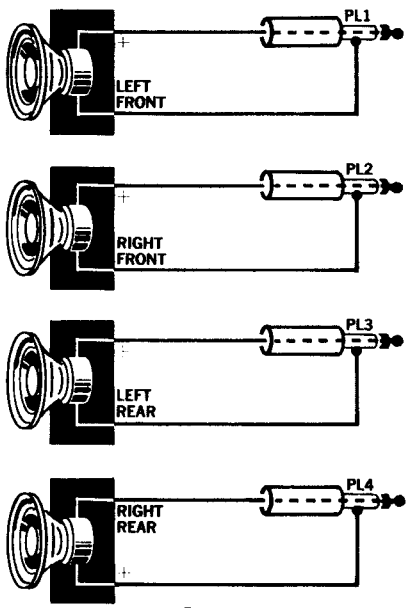
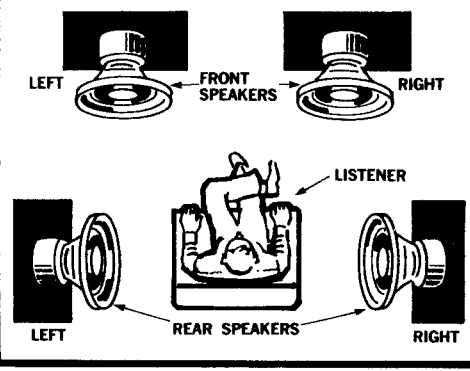


FIG. 2

SUGGESTED SPEAKER ARRANGEMENT FOR QUADRASOUND



listening pleasure in your living room.

Our synthesizer is extremely easy to build and is simplified to the point of having neither transistors nor power supply. Nothing about the parts layout is critical and you can use any plastic (but not metal) cabinet. Our model is built in a Radio Shack cabinet measuring 5x1½x2½ in. There is some heating of R1 and R2 so a ¼-in. ventilation hole should be drilled between each pair of jacks.

To keep the package small, R1 consists of two parallel-wired 22-ohm, 5-watt resistors. If your amplifier is rated for 20 watts per channel volume control R2 should be rated at 5 watts. If your amplifier is rated higher than 20 watts use a larger cabinet and change R2 to at least 10 watts. To take advantage of low-cost surplus components the 10-watt wirewound control used for R2 can be anywhere between 50 and 100 ohms.

Take extra care when wiring switch S1. Note that the grounded or common speaker wire circuits are lifted from the amplifier ground connection when S1 is in the BAL. (balance) position with switch contacts open.

For proper sound the speakers must be correctly phased. As with all stereo equipment, the front speakers must be phase-matched. If the terminal on one speaker indicated with a painted dot or + symbol is connected to the amplifier output terminal indicated with a + symbol, the other speaker must be similarly connected.

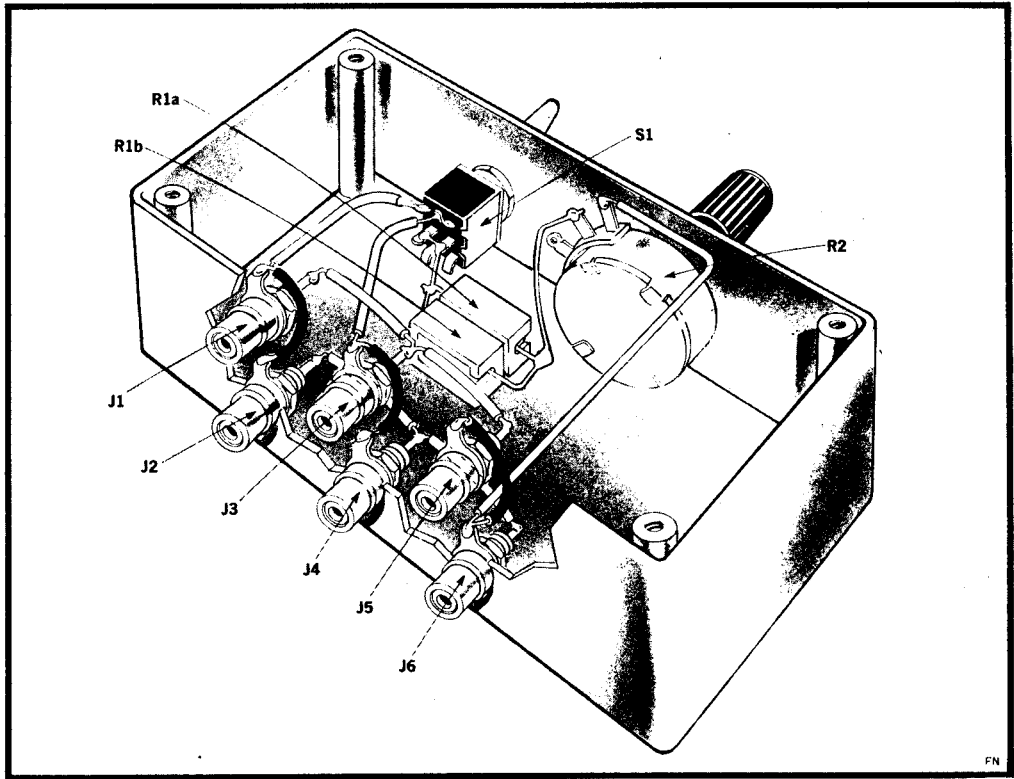
The rear speakers, however, must be reverse-phased. If one speaker (either one) has its + terminal connected to the amplifier's + output terminal the other rear speaker must have the oppo-

PARTS LIST

- R1a,R1b—Parallel-wired 22 ohms/5 watts or 10 ohms/10 watts (see text)
- R2—50 ohms/5 watts wirewound potentiometer or 50-100 ohms/10 watts (see text)
- S1—DPST switch (any type)
- J1 thru J6—Phono jack
- PL1 thru PL4—Phono plug
- Cabinet—Any plastic type

DIAGRAMS at left show simple circuit, the hookup for speakers plus location chart.

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**LAYOUT** of synthesizer can be anything you want. Our arrangement makes for neat project, however. Ventilation holes are needed between jacks.

site or nonmarked terminal connected to matching amplifier + terminal.

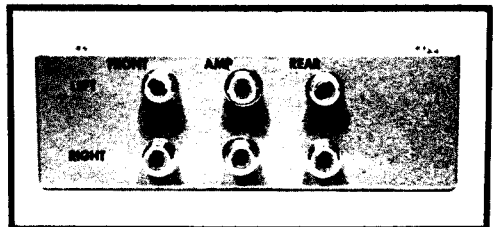
For proper operation, the stereo amplifier must be set to precise balance. If the left-to-right speaker volume is unbalanced there will be considerable front signal appearing in the rear speakers, decreasing ambient sound.

To balance the system, set switch S1 to the BAL position. Set the amplifier to mono and play a stereo record. If your amplifier does not have a mono-stereo switch play a mono record or tape. Keep the total volume moderately low and adjust the amplifier's balance control for minimum sound at the speakers. Then set S1 to rear (contacts closed) and restore the amplifier to stereo.

If your amplifier has two friction-clutch volume controls—one for each channel—and no balance control, simply

juggle the setting of both controls until you obtain minimum sound from the speakers with S1 in the BAL position.

Adjust the overall sound volume with the normal amplifier controls. Use control R2 only to adjust the degree of rear ambient sound. ●



**HOOKUP** on back of synthesizer. Amplifier plugs in at center, speakers on the outside.

## UTAH STUDIO 4 FOUR-CHANNEL ADAPTER (A Hirsch-Houck Lab Report)

The Utah Electronics "Studio 4" Ambience Regenerator is a passive device designed for extracting "ambience" or reverberant sound from 2-channel stereo recordings and broadcasts, reproducing four channels of sound with an additional pair of speaker systems located at the rear of the listening room. In some ways, the Studio 4 resembles other matrix devices for "decoding" specially processed 4-channel material. However, it is not offered as a 4-channel decoder or synthesizer. Rather, it is advertised as a means for enhancing listening pleasure by reproducing some of the sounds not normally heard through a 2-channel stereo system.

The simplified schematic of the Studio 4 shows how this is accomplished. The Ambience Regenerator is connected to the amplifier's left and right speaker outputs, and cables go from it to four speaker systems, two of which are in the traditional front left and right locations and one each in the rear left and rear right. The only special requirement for the amplifier is that its speaker output grounds be internally tied together, which is no real problem since most amplifiers are so constructed.

The common, or ground, lead from the two front speakers returns to the amplifier's common connection through an 8-ohm L-pad, shown in the schematic diagram as



a simple potentiometer. This potentiometer, identified on the front panel of the Studio 4 as RIGHT REAR, controls the level of a *sum* signal ( $L + R$ ) used to drive the right rear speaker. The left rear speaker, with its level controlled by the LEFT REAR L-pad, is connected across two "hot" amplifier outputs and, thus, receives a *difference* signal ( $L - R$ ).

Off hand, it is not easy to imagine the spatial distribution produced by the Studio 4. The left rear difference signal can be expected to supply ambience sounds, as it does with other matrix systems (including the original system proposed by Dynaco some time ago). But the purpose of the sum signal in the right rear is not quite as clearly understood.

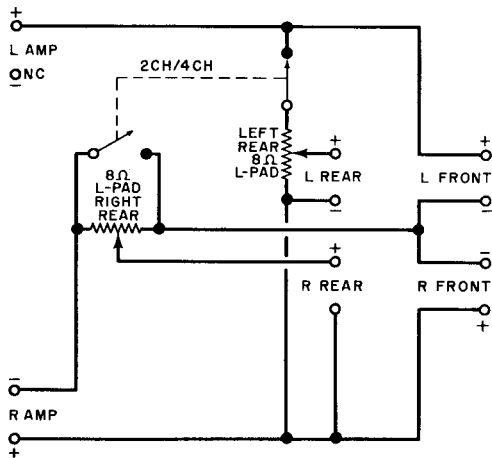
**Listening Tests.** It was a pleasant surprise

to find that the Utah Studio 4 produced a very listenable and pleasant pseudo-4-channel effect with most stereo program material. At most points in the listening room, one senses a distinctly different sound character from each of the four corners of the room. As an Ambience Regenerator, it must be considered a success, quite

comparable in its subjective qualities to the other matrix decoders we have used on ordinary 2-channel stereo programs.

One could hardly expect the Studio 4 to decode records cut for a specific matrix parameter (such as those used by Dyna, Electro-Voice, Sansui and the like) with any faithfulness to the original intent. We played a number of these records through the Studio 4, and although there was at times a vague sense of directionality, it was random and difficult to define. Certainly, it was not equivalent to the results one obtains with the appropriate decoder. However, the records sounded fine, exhibiting a strong sense of spaciousness, even if directionality was lacking.

One mildly annoying side effect of the Studio 4 was the difference in noise level from the two rear speakers. A large percentage of hiss, hum, rumble, and other unwanted sounds on records and on FM broadcasts seems to be out-of-phase information. It appears to emit from the left rear speaker, often at audible levels. On the other hand, little or no noise comes from the right rear speaker system. Fortunately, the rear speaker systems are normally operated at rather low levels,



**Simplified diagram of Utah Ambience Regenerator shows speaker hookup.**