

# THE EVOLUTION OF FOUR-CHANNEL EQUIPMENT

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The 4-channel era is less than four years old and we have already witnessed at least four generations of equipment suitable for home reproduction of surround sound. There seems to be a frenetic endeavor on the part of component high fidelity manufacturers to be "first" with innovative products, and it is this very desire to reach the marketplace ahead of all competition that has given rise to a sometimes confusing array of add-ons, conversion components, interim components and finally, "universal" products which purport to solve all four-channel needs—now and in the future.

The transition from monophonic to stereophonic sound which, from the audiophile's point of view, took place some ten or twelve years ago had fewer "false starts," viewed in retrospect. Few stereo converts ever bothered to add a second amplifier component equipped with any sort of "combining" controls. Typically, the consumer who wanted stereo sound simply went out and bought a two-channel receiver or a two-channel integrated amplifier as the "first phase" of his transition. Later, when stereo FM broadcasting began, he either added a multiplex adapter (these devices were popular for only two or three years) or, if he was fortunate enough to have separate amplifier and tuner facilities, he disposed of his single-channel tuner and purchased a stereo tuner. The age of solid-state equipment arrived at a very

opportune moment in terms of home stereo systems, since anyone who owned a mono tube-type receiver was provided with additional incentive to buy an all-in-one solid-state stereophonic receiver. He thereby acquired state-of-the-art electronics and stereo reproduction with one new investment.

From the time stereo conversion was completed, a measure of stability descended upon the industry. Equipment up-dating from the mid-sixties to the present was largely confined to improved performance rather than change of basic formats.

## Four-Channel—Phase One

The first, hesitant entry into four-channel equipment on the part of the buying public is best characterized by the block diagram of Fig. 1—a diagram which appeared in literally dozens of tutorial articles and on countless manufacturers' brochures. Users were advised to buy a second stereo amplifier (its power output capability was the subject of much debate), a second pair of speakers (their similarity to the first pair is *still* a subject of debate) and some form of matrix decoder with which to tie the whole thing together. At just about the same time, two additional alternatives were offered. There were the early quadraphonic amplifiers, which were simply four amplifier channels mounted on a single chassis with *no* matrix decoding facilities. There were also a group of decoder/amplifier products which offered one or more

matrix decoder circuits *plus* a pair of amplifying channels and a master volume control which controlled the level of all four channels simultaneously. Some of the early decoder add-ons recognized the importance of this control and included it in their products as well. The four-channel amplifiers sans decoding facilities have just about vanished from the scene, since they are neither fish nor fowl. Owners of stereo systems would find no need for them, and newcomers desiring four-channel sound at the outset certainly had no desire to have to add a separate decoder after making a heavy investment in a four-channel integrated amplifier. Decoders and decoder/amplifiers still abound, but their character and complexity have been altered considerably since those first, simple matrix "black boxes" were first offered to the public.

## Four-Channel—Phase Two

Early auditioners of four-channel sound were subjected to two kinds of public demonstrations. There was, of course, discrete four-channel programming on open-reel tape. RCA adopted a position that any four-channel programming offered by them would have to be discrete (as opposed to "matrix"), with "full separation." Since the viable discrete disc was still a development of the future, RCA introduced Q-8 cartridges, similar in form to the popular 8-track cartridges which had gained popularity in automobile and home use. Despite their limited signal-to-noise and frequency response, the Q-8 format taught the four-channel listener that "discrete" channel separation was audibly superior to the rather minimal separation achieved by most simple matrix systems.

There then began a race on the part of many manufacturers to introduce "second generation" matrix decoders which included "logic circuitry." Logic, or gain-riding circuitry, simply senses which channel is instantaneously dominant and either increases the gain in that channel or reduces the gain in non-dominant channels (or performs some of each gain change at once). The result is improved apparent separation for most musical situations. The most popular matrix method is that proposed by CBS and called SQ. Another matrix system vying for consideration is QS—proposed by Sansui Corporation of

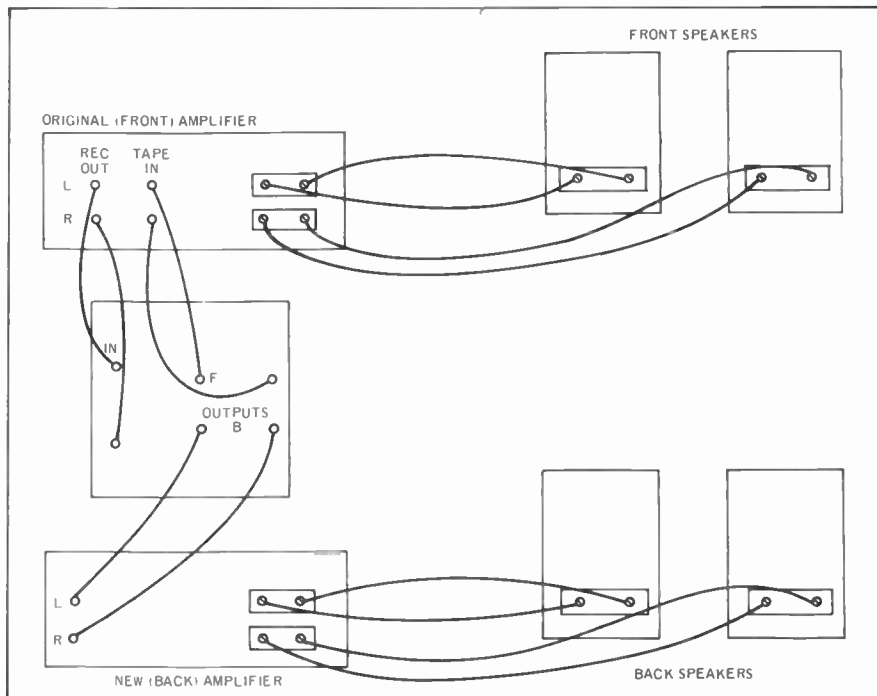


Fig. 1—"Classical connection diagram for connecting matrix decoder via tape monitor jacks of existing amplifier or receiver.

Japan. This latter form of matrix conforms to the so-called "regular matrix" sound field adopted by many other Japanese manufacturers. What the two systems have in common, however, is that they offer an inherent separation limitation of only 3 dB of actual separation. In the case of CBS-SQ, left to right separation is fully maintained, while front-to-back and diagonal separation is limited to 3 dB in their simple matrix system. In the case of Sansui QS matrix discs, diagonal separation is total, while adjacent flanking channels are limited to only 3 dB of separation. CBS's dominance in the software field resulted in the availability of hundreds of SQ discs which, if played on simple SQ decoders, left much to be desired in the way of separation. QS decoders were supplied by Sansui to many radio stations and recording studios as well, so that the preponderance of four-channel program material suffered from "lack of separation" if played on simple decoding equipment.

Sansui offered its "variomatrix," a sophisticated "logic circuit" arrangement designed to offset these limitations in separation, while CBS, through its hardware manufacturing licensees offered first "front-back" enhancement circuits and, finally, "double logic" circuits which accentuated both front-back separation and side-to-side separation when required. Thus, a whole new breed of "matrix decoder" products appeared upon the market and those listeners who had hastily purchased "simple" matrix decoders found that their very recent purchases no longer represented the latest four-channel technology.

During this same "phase two" period, receiver manufacturers quickly designed and developed integrated four-channel receivers which included one or more simple matrix decoders. Most featured at least three-position switches with settings for SQ, Regular Matrix and "Stereo Enhancement" (a matrix similar to the original Electro-Voice proposal which offered greatest front-back separation and was therefore particularly effective in keeping "front-and-center" vocalists up front, where they belong, while permitting out-of-phase random signals of stereo discs to wander around towards the rear to simulate a four-channel effect). Most of these receivers offered moderate power output capabilities—around 10 to 20 watts per channel was typical. Despite the recent flurry of high-powered stereophonic receivers on the market, the lower powered quadrasonic units were

justified by their manufacturers because, after all, with four channels operating simultaneously there was that much more acoustic power being pumped into the listening room. The obvious flaw in this argument occurs if a listener prefers to play some of his program material in two-channel stereo, in which case two of the four amplifying channels simply idled along and did nothing. The wastefulness of this arrangement must have become obvious to manufacturer and user alike very early in the four-channel evolution and undoubtedly accounted for new system purchasers' reluctance to invest in these new receivers. Many listeners felt that the amount of program material then available for four-channel listening was at best limited and wanted to start their systems by purchasing only two speakers. These buyers were in somewhat of a bind, in that they were reluctant to purchase stereo receivers as well, recognizing that it would not be long before they would, indeed want to "switch to four-channel." The idea of then having to add a decoder and a second amplifier did not appeal to such new purchasers. They felt that if they were just starting to assemble a system that they should certainly not have to "add on" and "make do" in just a few months. As a result, the "brute force" and obvious type of four-channel receiver did not enjoy the success its manufacturers had hoped for and the anticipated race towards four-channel slowed down to a veritable crawl!

#### Four-Channel—Phase Three

It would be difficult to assign the credit for the first two/four channel "bootstrapped amplifier" receiver to a single high fidelity component manufacturer. So as not to become involved in the argument as to who was first, let's assign the credit to Bell Laboratories who some years ago published a technical paper describing a method of connecting two solid state amplifiers in a bridge-like configuration to obtain more than twice the power output capabilities of each. Whether it was by grapevine communication or industry-wide inspiration, several manufacturers, almost simultaneously, designed and produced a new kind of quadrasonic receiver which offered distinct advantages to the perplexed audiophile.

For the hesitant quadrasonic equipment buyer, the new receivers offer full-powered stereo, with four amplifier channels bridged or combined to provide higher-powered two-channel operation. Thus, the purchaser who wants to begin his home system by purchasing

two speakers is secure in the knowledge that half his power output capability is not being wasted. Then, when he's convinced that four-channel is here and that there's enough happening by way of program material, broadcasts and the like, he can purchase that second pair of speakers, flip a switch and, like biological cells, the two amplifiers divide into four, albeit at somewhat reduced total power. Typically, such a receiver producing about 50 watts per channel in the stereo mode would be expected to deliver about 20 watts per channel when the quadrasonic switch is thrown. Naturally, all of these receivers contain matrix and control facilities similar to their less flexible predecessors, and that brings us to what we hope is the *final* phase in this quadrasonic equipment revolution.

#### Four Channel—Phase Four

While these hectic three phases of equipment development underwent their gestation and production periods, the people who gave immortality to a little dog listening to an acoustic phonograph horn (and have since deserted "little nipper" in favor of a more avant garde corporate image, much to the distress of nostalgia buffs such as myself) have not been idle. Having put their money on the "discrete" four-channel approach, they huffed and they puffed and finally declared that the discrete disc was "ready." It turned out to be none other than the CD-4 disc which had been developed by Japan Victor Company of Japan and which had been briskly selling in the Orient for nearly two years. RCA, however, improved, refined, perfected and renamed the disc—and now we have quadradiscs, plus the need for a new kind of decoder called a demodulator. It appeared for a while that "Phase Four" would consist of the addition of yet another "black box" and the need for six more audio pin-to-pin cables, in order to hook-up for Quadradisc playback, as shown in the block diagram of Fig. 2. Furthermore, RCA grudgingly admitted that in *most* instances a new phono cartridge and stylus would be required if the high frequency content of these new Quadradiscs was to be properly traced. No mention was made of the fact that the new "demodulator" included low-level preamplification circuitry, thereby obsoleting the preamplifier section of one's existing receiver or amplifier, but this is apparent from the connection arrangement shown in Fig. 2. In short, if you were a four-channel pioneer dating back to "phase one," you might have ended up with a total system

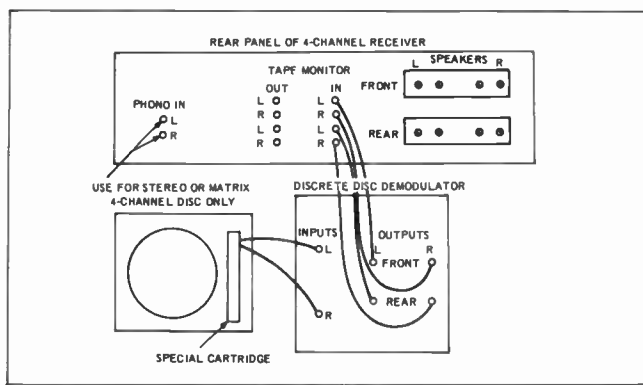


Fig. 2—Most "4-channel receivers" offered to date still require an externally connected Quadradisc demodulator if RCA discs are to be played

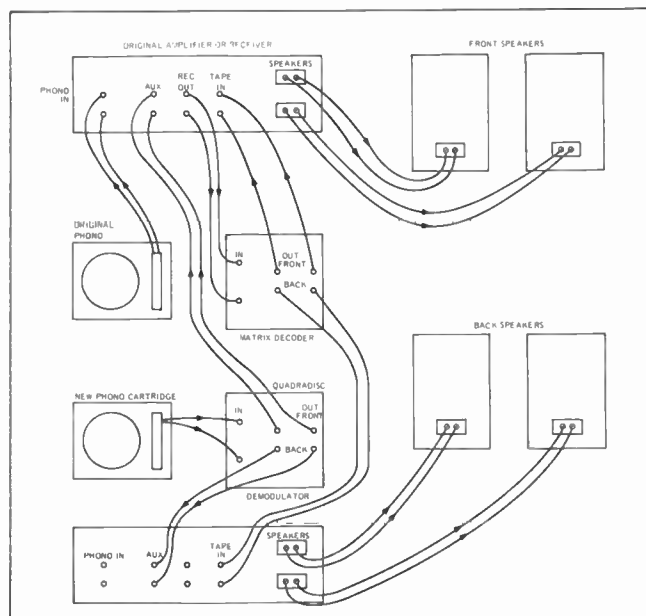


Fig. 3—Anyone keeping pace with 4-channel equipment from "the beginning" would end up with the components shown above.

shown in the block diagram of Fig. 3—heaven help you!

Well, for the moment, the only separate demodulators offered for sale are those made by JVC and Panasonic (who endorses the "discrete" approach along with RCA), and in view of what seems to be happening in "phase four," such separate demodulators are likely to be around for an even shorter period than the "matrix decoders" of "phase one" and "phase two." The new crop of receivers, as you may have guessed, includes (at very least) a *four* position switch for Quadradiscs, SQ-discs, Regular Matrix and, in some cases, 2-channel enhancement. With this arrangement, there is a minimum of circuit redundancy and the electronics of your system settles down to one all-inclusive piece (or, at most two if you prefer a separate tuner) once again.

### Future Phases of Four Channel

Before you breathe a sigh of relief, you had better know that it's not all over just yet. For one thing, there remains the question of "logic circuitry." Some of the new receivers equipped with both matrix and "discrete" demodulator circuits will still lack sophisticated logic circuitry for use in their matrix modes. The use of such receivers is likely to give RCA a much needed boost, because when discrete discs are compared with matrix discs played through simple matrix decoders there's no question about the superiority of the quadradisc (if we confine the comparison to separation or image placement). Some receiver manufacturers, therefore, are going all the way and including both matrix-logic circuitry and quadradisc demodulator circuits

in their latest products and such products (however costly they must be) are sure to become "favorites" in the immediate future. In time, the "strapping" feature will no doubt be dropped, as buyers are increasingly convinced that the only way to listen to music is in four-channel surround sound. Elimination of the "bootstrapping" feature may partly offset the cost of including logic-matrix *plus* quadradisc playback capability.

Lurking behind the scenes, however, is one more technological breakthrough—and that has to do with four-channel FM broadcasting. Obviously, the many stations currently featuring quadraphonic programming are confined to one or another matrix system. Since only two channels (however encoded) need be transmitted for this format, present FCC broadcast rules relating to stereo broadcasting are adequate and need not be modified. If past performance is any guide, the purists among us will not settle for this form of four-channel broadcasting forever and sooner or later there will be an approved method of discrete four-channel FM transmission. Committees are already at work on the problem and some seven proposed systems are currently under consideration. It's likely to take at least several more years before the FCC gives the nod to one of these systems (or to an as yet unproposed system), but when they do, you'll no doubt have to run right out again for still another black box—for which a back-panel jack is already being provided on today's receivers and tuners. You can be sure that the progressive and eager manufacturers in the high fidelity component industry would add the needed circuitry for four-channel discrete reception *right now*—if only they knew which circuits to add. Since that depends upon a government ruling, however, you'll have to be content with the equipment you purchased during the first four phases of the quadraphonic equipment revolution.

Actually, the stages in this evolution are nothing for the dedicated audiophile to grumble over. What sort of a hobby would this be if new and exciting equipment failed to come upon the scene every couple of years? At least model changes in *this* industry result in better sound—rather than in just fancier front panels. . . .

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