

Update your quadraphonic system with this—

# Full Logic SQ Decoder

In the three odd years since we developed the Playmaster 140 quadraphonic amplifier, a great deal of research has gone into the development of more ambitious decoding circuitry. This article describes a full logic SQ decoder built up by a New Zealand reader for his own 140 amplifier, using techniques and integrated circuits developed by CBS in collaboration with Motorola.

Like many other E.A. readers I have thoroughly enjoyed the fine sound from discs provided by the simple SQ decoder described in Part 4 of the Playmaster 140 amplifier (EA March 1974). However, from my reading of overseas listeners with quadraphonic discs played through commercial SQ decoding systems I concluded that I was still missing something and got the itch to try out the full SQ logic system.

Playing stereo and quadraphonic discs through the simple SQ decoder resulted, to my ears, in an impressive form of stereo sound but it was not quadraphonic sound, as intended. The trouble at my place of domicile was that I had nowhere to turn to find out what this was, so I decided to be a guinea pig.

My aim therefore was to hook up the three integrated circuits prescribed by

the inventors of the SQ system in order to get the best results from SQ encoded discs. A subsidiary objective was to produce a printed circuit so that other home constructors would have an easy shot at this quad business.

But why SQ?

Well, the situation has not changed since that mentioned by Mr Williams in his article referred to above: namely SQ discs are relatively prolific whereas other systems software is less readily accessible. More potently, the possessor of the Playmaster 140 or a like amplifier is three-quarters on the way to a full logic system; the preamplifier and the power amplifiers remain as before and the logic system will not object to one more volt (the Playmaster 140 provides 21 volts).

As for the end result, the electronic reconstruction of encoded four channel

by HUGH McSHERRE

sound is very much an art. Although the logic P.C. Board (to coin a phrase) subjected to tests, the audiophile will wonder what it sounded like. But, on no common ground where tests are concerned, I can only give my own impressions:

The results were exactly what I hoped for, that is, they were as experienced by United Kingdom listeners.

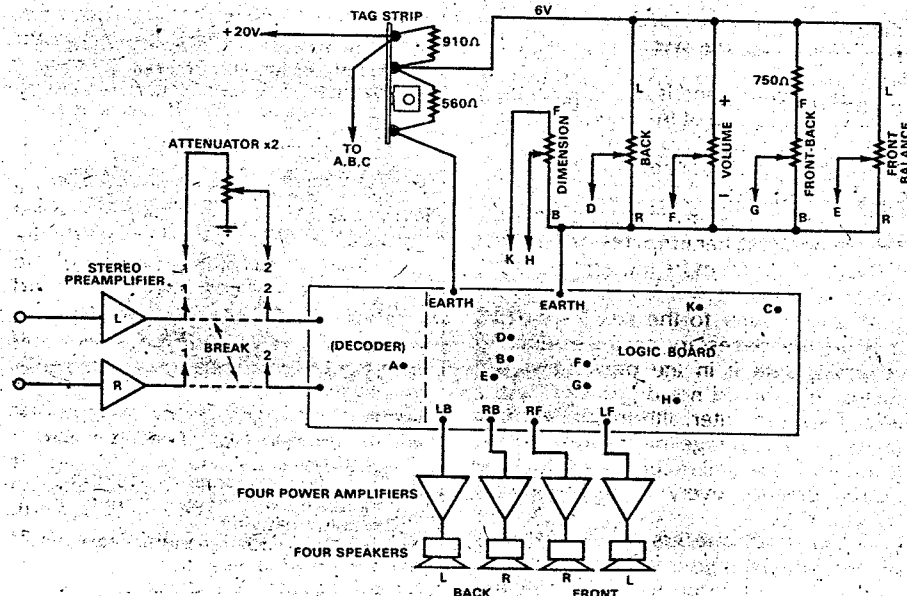
With quadraphonic discs, Robert Layton, "the sound is liberated from its speaker areas and moves through the room while the timbre of the sound itself is enriched". Remarkable realistic separation of orchestral instruments.

As for recent stereo discs, when ambient mode is chosen between a quad disc and a stereo disc, the sound is more natural. My thought on this is that stereo discs have an appreciable amount of ambient sound trapped in the recording.

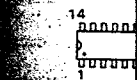
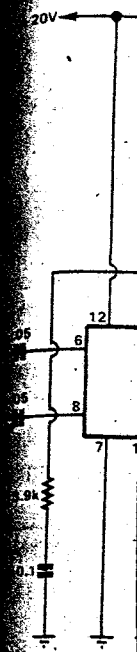
But I must say that, when the speakers are roughly equalised, I was enthralled by the Variations of the Petrushka ballet. I was able to locate a SQ test disc, I had to hand the CBS disc with his four mikes right in the New York Philharmonic's Concerto for Orchestra. With the instrument placement provided with the disc, I find that all was well. No string basses rear right and rear left!

For those who like it, it can be a fun thing; for example, a stereo disc of Sir Geraint and the Enchanted Sword by Mozart arias and had him out of each of the four speakers. I have noticed that an advantage of this new outfit is that one can play the room with no apparent sound source i.e., the sound

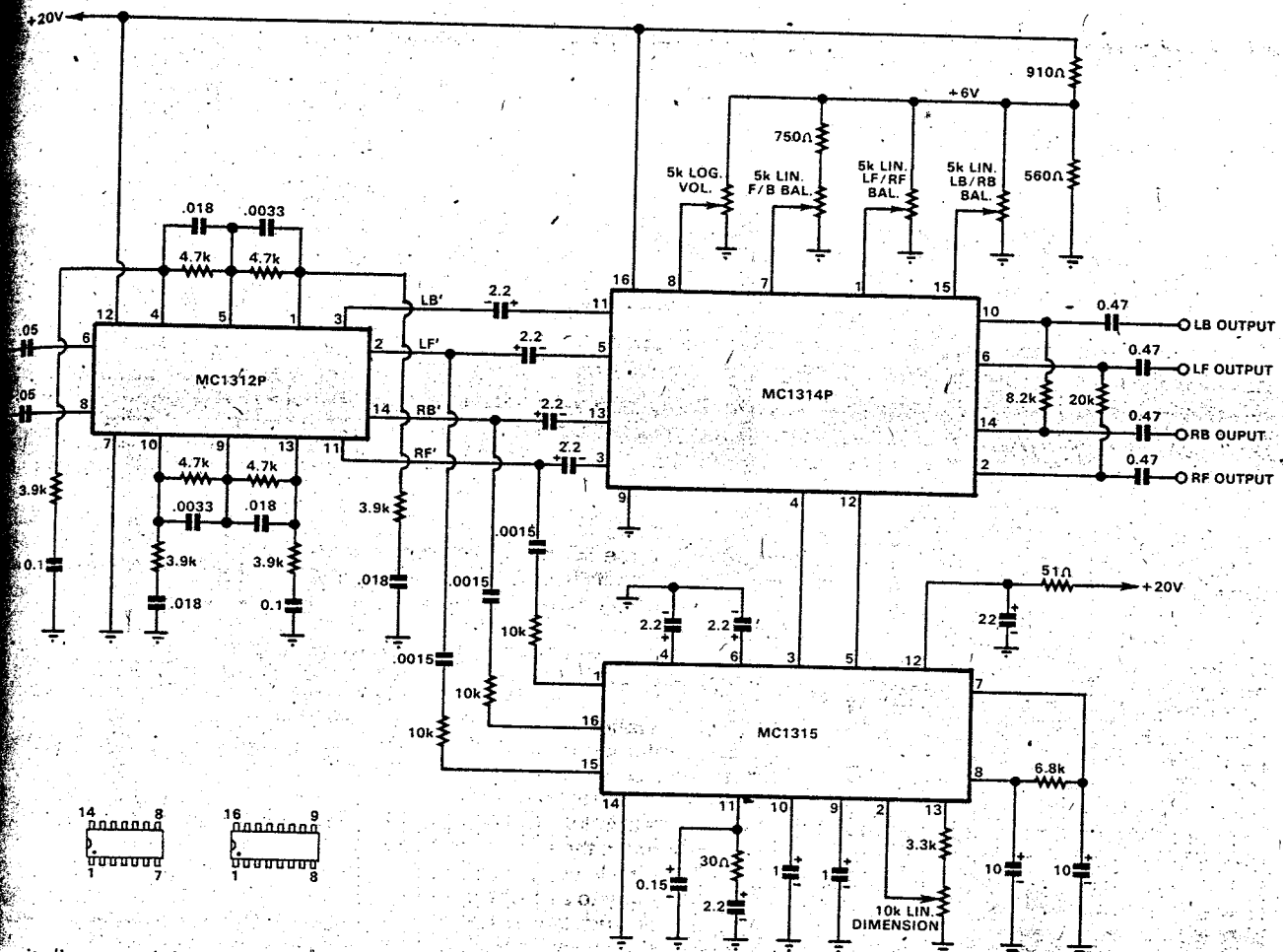
\*Dept of Physics, Victoria University, Wellington, N.Z.



This block diagram indicates how the SQ decoder/logic module might be integrated into a 4-channel system. The writer chose to make all controls accessible but, for simplicity, all but Volume and Front/Back Balance could probably be made internal presets. One option seemingly open to Playmaster 140 owners would be to make all the controls miniature presets, attached to the board, so that it substitutes electrically for the simple SQ decoder, accepting the stereo input and delivering pre-adjusted outputs to the existing front and back volume controls. In this way, the double stereo facility and the Stereo-24 decoder would be retained.



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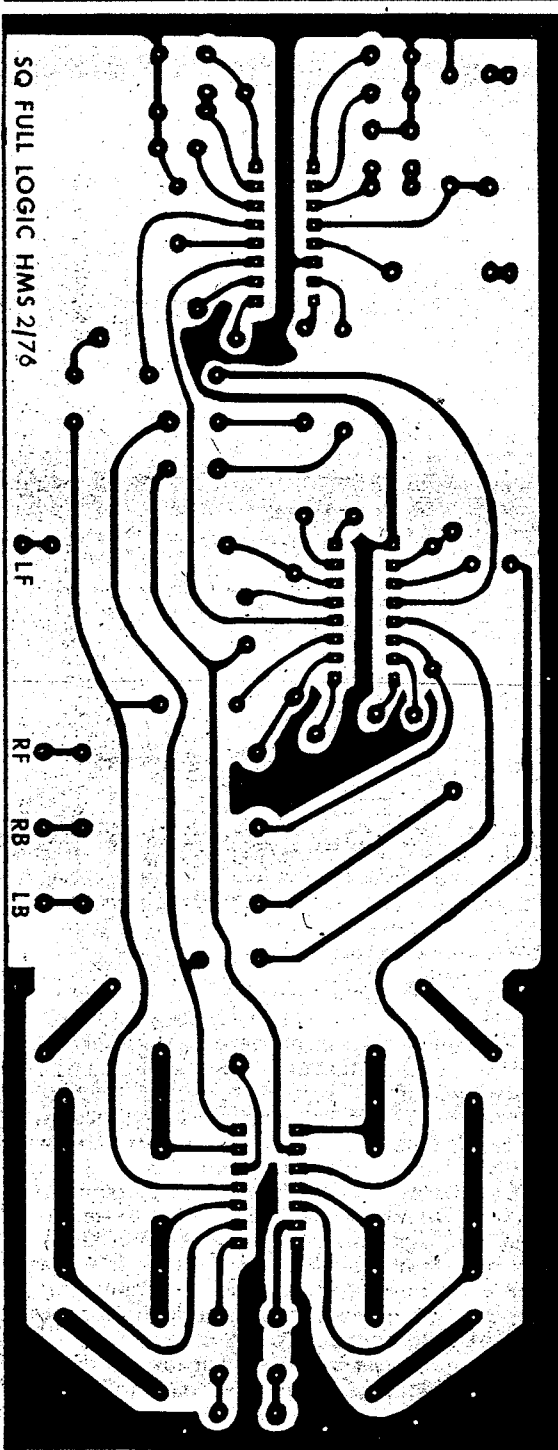
Circuit diagram of the basic decoder/logic system, issued by Motorola Semiconductor Products Inc, who manufacture these under licence to CBS, owners of the SQ trademark. Stocks of the ICs are held in Australia by Motorola

and their distributors, sufficient for likely home-constructor needs. As explained in our March, 1974 issue, a royalty fee is payable to CBS by users of the particular ICs but suppliers should be able to meet the demand now, as then.

ed. This was with a solo violin  
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 (the subject of channel balance,  
 no yardstick to rely on (I delibera-  
 refrained from voltage meas-  
 (ents) I adopted an American  
 sition: A mono disc, preferably a  
 speaking voice, is played and each  
 er adjusted for equal volume—as  
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 types of SQ discs.  
 sense, the decoder was double-  
 ed in that I actually built up two  
 ns. The first was the larger of the  
 rendered so because I could not  
 at the time, small 5% tolerance  
 s to use around the MC1312  
 2. Instead, I had to settle for the rather  
 Philips 1% type. The second board,  
 I completed later with smaller  
 s, is the one which will find  
 general application and is therefore  
 e depicted here.  
 resistors can be ¼-watt types, 5%,  
 smaller ½-watt types still capable  
 ng the board. As for capacitors, the  
 2 and 10uF units were 35V bead  
 antalums, while the 20 or 22uF  
 pigtail type. Because no 0.15uF  
 r was available, I used a 0.22 and  
 series. All the rest were 25V (or  
 ) polyester (or mylar which I

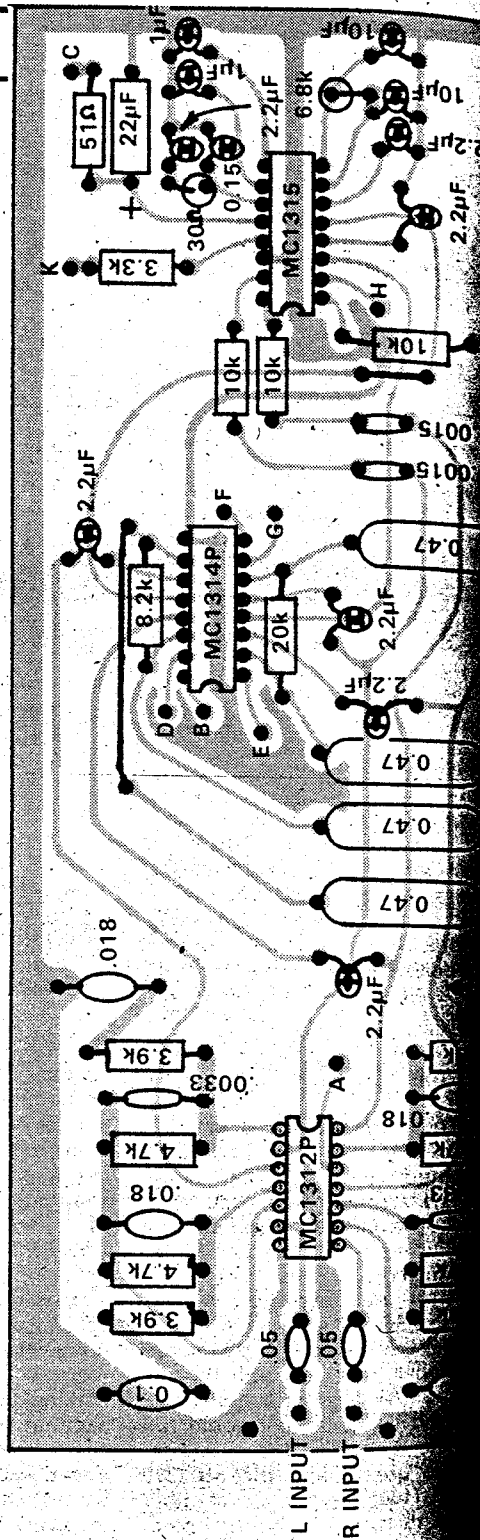
prefer) with the precaution that those  
 around the decoder were checked to be  
 within 5%.  
 With the wiring and layout diagrams to  
 assist, construction of the actual decoder  
 should not present too great a problem  
 to anyone with reasonable do-it-yourself  
 experience.  
 Planning the board into a Playmaster  
 140, or into another amplifier set-up will  
 call for somewhat more thought and skill,  
 however, since it will involve marrying  
 the new circuitry to the old, as well as  
 making the necessary arrangements to  
 accommodate it in the physical sense.  
 Again, this should not deter the experi-  
 enced experimenter, although I certainly  
 would not encourage the beginner to get  
 involved who still needs step-by-step  
 instructions for every component and  
 wire.  
 The potentiometers may present a  
 slight problem if your existing amplifier  
 has little panel room to spare. For the  
 purpose of the SQ logic I rehashed my  
 amplifier to use slider pots. They do take  
 up an awful lot of room but they have  
 the virtue that one can see at a glance  
 "the state of play".  
 There are two other options: (i) use  
 rotary pots which occupy much less  
 space (ii) use preset pots—preferably the

full size ones—inside the amplifier case;  
 the idea being to set up the system for  
 normal use and leave it at that. Of course  
 the master volume pot would need to be  
 at front.  
 This last alternative will appeal least to  
 those who like tinkering. For those who  
 used the published layout of the  
 Playmaster 140, it would be convenient  
 to mount the logic PCB edgewise (in the  
 longitudinal direction) immediately in  
 front of the power amplifiers and  
 likewise mount the preamplifier PCB  
 edgewise between the logic board and  
 the front controls.  
 It will be noted that the SQ decoder  
 pattern on the new board follows that  
 used in the Playmaster 140 (EA March  
 1974 p. 73). As this had been in use for  
 over a year or so and performed well, no  
 useful purpose was seen in changing it.  
 It will be seen that there are three varia-  
 tions, however:  
 (a) for the purpose of the three chip sys-  
 tem it was convenient to bring the  
 inputs to the left hand side of the  
 board.  
 (b) Motorola in a revised version of the  
 circuit surrounding the decoder chip  
 (MC 1312P) changed the capacitors  
 and resistors to the more easily  
 obtained 'preferred' values. The new



The wiring pattern for the full logic SQ decoder, as prepared by the contributor. Shown here full size, it measures 7.5/8in x 2.7/8in, equivalent to 194 x 73mm. He suggests that it could be stood on edge inside a normal Playmaster 140 amplifier although, to do this, the present preamplifier board would have to be mounted in a similar fashion.

Showing the layout of components on the printed circuit board. The left hand end virtually duplicates the original simple decoder so that, with care, the parts could be transferred from it to the new board. Alternatively, the new board could be cut about where indicated on the block diagram and the original board married to it.



values are used in the complete system. I have had in use, singly, for some time both simple decoder boards and have noticed no audible difference. So constructors who wish to retain the Playmaster decoder could do so by chopping the new PCB pattern as indicated by dashed vertical line and drilling and inserting soldering pins as marked. I have not tried this but see no reason to believe that this arrangement will be other than compatible.

(c) However, the Playmaster coupling capacitors and resistors are no longer required and would require to be removed. Also, since separation is taken care of in the logic system, the blend resistors (7K5 and 47K) are no longer required. Jumping wires would be required to take the place of the four 0.47mfd capacitors removed. This done, the connections remain as before.

Whatever arrangement is used it is important to stick to the earthing arrange-

ment set out in the December. The pros and cons of regulation for power amplifiers seem a matter of argument among enthusiasts. I favour (and use) supplies for the power amplifier a regulator for the chips. But to be general agreement the argument propounded by Mr. [the article just quoted] is a loudspeaker (and power earths).

One point should be men-

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100uF decoupling capacitor used in Playmaster 140 for the simple decoder is not adequate for the full logic because of a clearly audible hum. Fixed up with a 2200uF in parallel with 100uF, the series resistor being managed to give the necessary 20V supply decoder. This done, it worked fine. Measured supply voltage of 19.75, current drain of my prototype measured 52.4mA, which compares with Motorola's figure of 60mA (typical).

Assumption has been made that the logic board described here will be of great interest to those who have made Playmaster 140. However a number of veteran do-it-yourselfers, me included, may have other four channel requirements. For them the SQ logic is a piece of cake! It has an input impedance of 2 megs, an output impedance of 2K and unity gain at 100%—so it could go almost anywhere! One point however, it doesn't handle an input voltage of more than 1.9 and from the impression that best results come from the recommended level of 1.5V. Therefore it may be desirable—where necessary—to put pots in the block diagram; 10k log seemed OK.

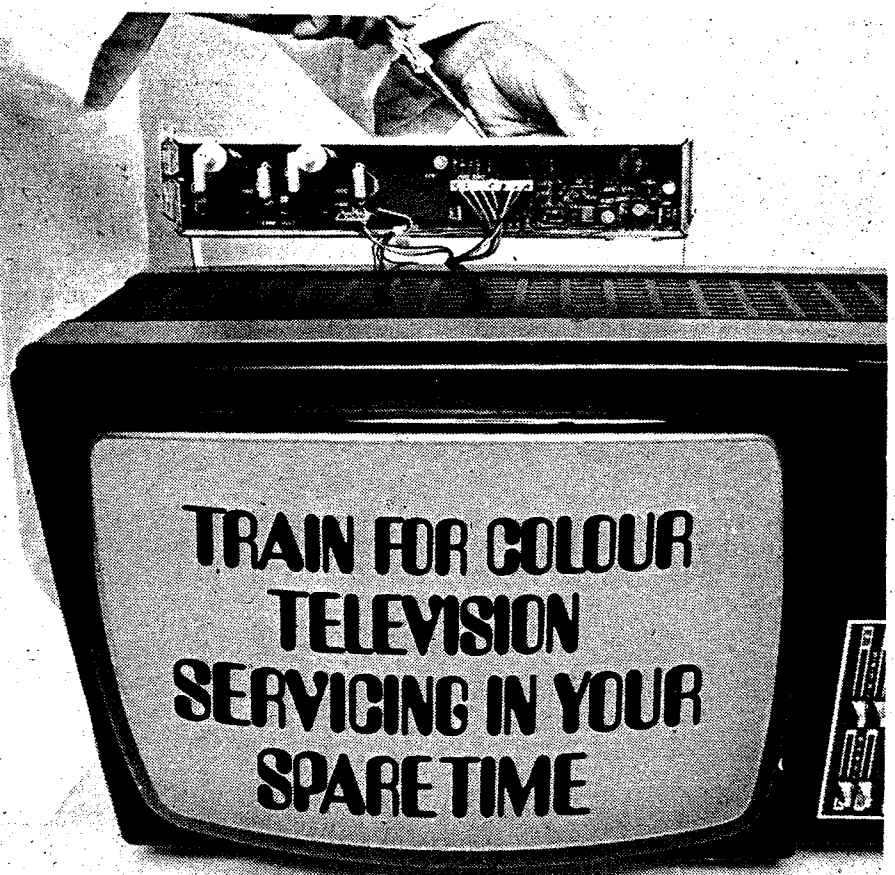
For a simple soul, the question is "How do you work it? As shown in the circuit there are three chips in the decoder; the first one, MC 1312P, was fully described in the March 1974 EA.

The MC1315P (wave matching logic) is Motorola's answer to the criticism of not enough front to back separation. It motivates the dimension control and really want all the sound to come from the back speakers this is the pot in the diagram. Normal use is 50% rotation.

The heart of the job is the MC1314P which is four voltage controlled amplifiers with the four pots giving all the control for the localisation of sound. The circuit will not permit giving all the pots the same rotation but the block diagram will be self-explanatory.

For example, say sound is required from the left back speaker alone. The balance control is set to the required level; Front Balance 50% rotation; Back Balance hard on to Back; the Dimension Control hard on to left and the last control as necessary. In normal use the balance pots are rotated in accordance with the previous diagram on balancing.

Perhaps the most important question is "Is all this effort worthwhile?" I don't know. But my answer you can put in my age group. I am rather old and enjoy clear and smooth sound thru the decoder and an accurate amp. If you want kicks out of your life by all means go ahead. Me? I'm going to get hold of the SQ Gurrelieder after hearing which the London Philharmonic went round in a daze muttering a string of adjectives and obscenities, and I'm up to amazement!



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