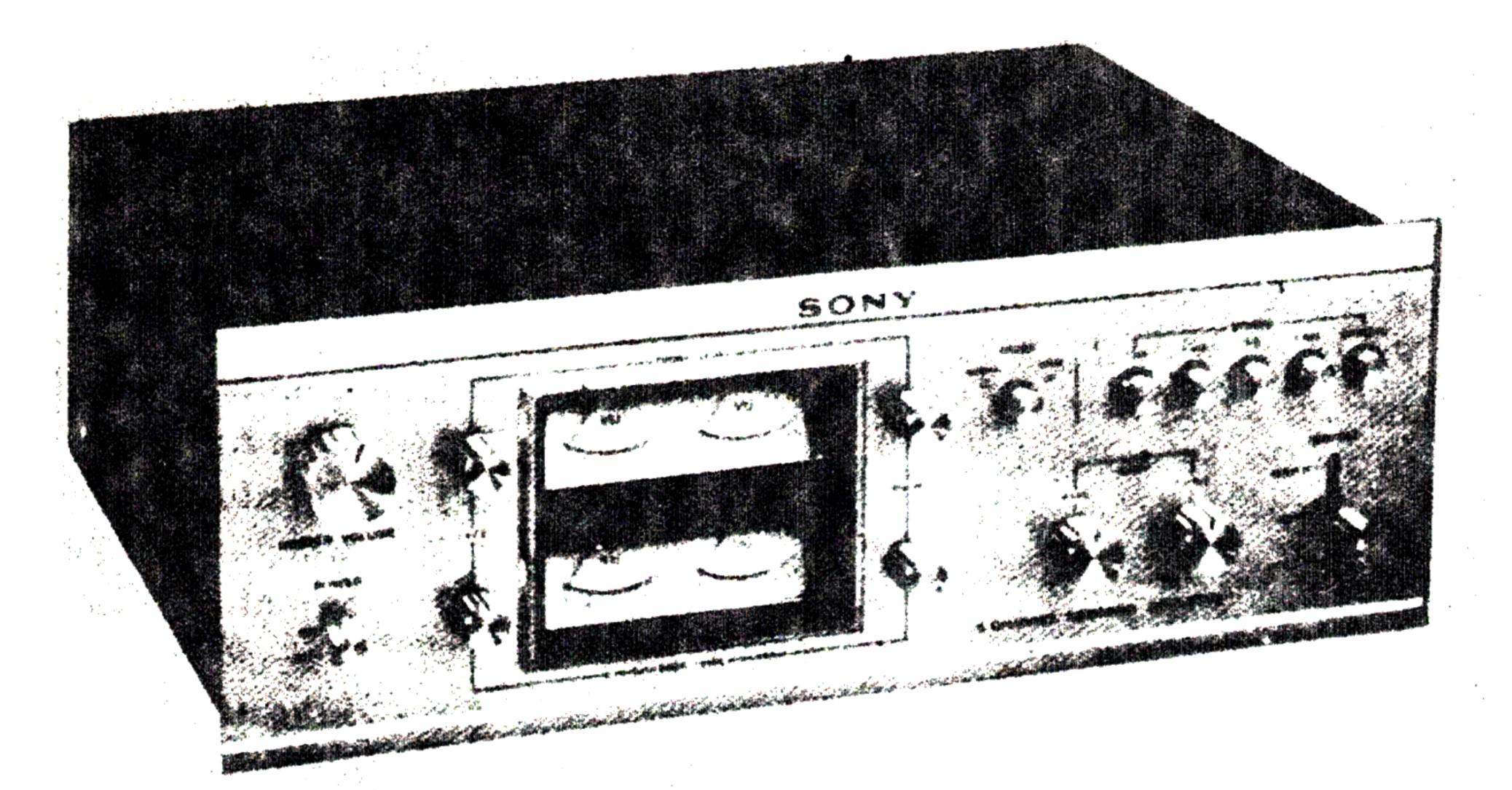
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## SQD-2010 Decoder

## New Circuit Operation

The SQD-2010 contains the latest in SQ decoder circuits, and is our best effort in terms of integration and performance.

SQ has been around a couple of years now, and few people really understand it. SONY has helped with the ensuing service problem recently by using ICs. With ICs you don't have to know everything that's going on because the things that make the system operate are beyond your control - in the IC. So, this product description and your troubleshooting routines should be based on the Signal-Processing Block concept. This means: learn the signal path, know what each IC does to the signal and what the input and output signals should be. Therefore, you trouble-shoot by signal tracing a standard test signal, and seeing where things go wrong. Once you've got the fault down to a particular stage, check the outboard components, and if they are OK, replace the IC.

The 2010 is identical in external appearance to the 2020. Also, with the exception of the actual decoding and logic section, the circuitry is the same. Let's start with a quick analysis of the overall operation and signal flow, using the decoder-section schematic diagram (Fig. 1). Note that two kinds of heavy overlay are used on some signal paths. The solid overlay shows "standard" or forward AC signal flow; one path for IC601 to the individual SQ output terminals, the other path for IC601 to IC801. The broken overlay shows feedback paths; DC feedback from the logic circuit AGC rectifiers to IC701, and the logic control signals from IC801 to IC602

Left and right signals are applied to the inputs of CX-050 IC. This IC requires three external networks to operate. These networks contain resistors and capacitors too large to install in the IC. Of these networks, CP601 and CP602 produce the 90° relative phase shifts required by the SQ system, and CP603 contains the SQ formula, and regular matrix formula, matrixing resistors. This IC and the outboard RC networks do all of the actual decoding. Left total and right total signals go in, and left-back, right-back, left-front, and right-front signals come out. The job of the remainder of the circuitry is to alter the relative strength of the output signals in a way that makes the final output of the 2010 a close copy of the original program material.


The four output signals are applied to the output buffer amplifier through 15 k resistors (R613-R616). These resistors are very important to the operation of the 2010 because of the way they affect the output signal level, in conjunction with IC602. To see why, we'll have to stop and take a look first at the CX-718 IC, shown schematically in Fig. 2.

The CX-718 contains 4 voltage-controlled resistors. These resistors are each actually the drain-source resistance of a P-channel FET. By varying the gate bias on these FETs, the drain source resistances change in value. They can be driven to a few hundred ohms with zero bias, or into the megohn region by bias voltages around cutoff.

The variable resistances inside the CX-718 are connected to the output ends of R613 - R616 and to AC ground, so they form variable voltage dividers with R613 - R616. The AC ground is actually the emitter of Q601 which is a low-impedance bias source for the "cold" ends of the resistance element. This is needed to establish the proper quiescent bias relationship between the control elements and the resistance elements of the CX-718. The control elements of these resistors are connected so that variable voltage dividers for the front channel are controlled by the line from logic mixer Q801, and the control elements for the back channels are controlled by the line for logic mixer Q802. The logic circuitry, and this means everything on the bottom half of this schematic, is set up so that when left-front, right-front, or center-front signals are detected, Q801's source voltage goes positive, and Q802's source voltage goes negative. This action makes the control voltage on the front-channel variable resistors more positive, increasing their drain-source resistance. This adjusts the attenuation of the front-channel voltage dividers in a way that allows nearly the full front-channel signal voltages to appear in the output.

Simultaneously, the control voltage on the back-channel resistors becomes more negative, decreasing the drain-source resistance of the back-channel variable resistors. This adjusts the attenuation of the back-channel voltage dividers in a way that allows very little back-channel signal to reach the output. This alteration of the relative amplitude of the front-channel vs back-channel gain according to the front-back ratio of the input signal (which in physical terms means front-back position), is the method by which the output of this decoder contains accurately positioned or separated signals despite the mere 3 dB separation that is characteristic of the basic SQ matrix.

The CX-049 logic IC performs the decisions regarding the amounts of attenuation required in each set of channels to properly reproduce a particular program source.



At one time full-logic decolers used two large and complex circuits to perform this decision-making process, front-back logic, and wave-matching logic. These systems did essentially the same thing, but did it in different ways. The result was an overall logic system that performed well with any kind of program material. Now both logic systems have been integrated into one chip, and are distinguishable only by the existence of two sets of outputs which end up in the same place, the logic mixers.

Because of the extremely complex interconnection of diodes acting as steering gates, voltage-variable resistances, and limiters, the best bet when confronted with the likelihood of a defect in this portion of the circuit is to start checking junctions with your ohmmeter. Incidentally, use an ohmmeter range with a high-battery voltage, over 4-1/2 volts, to check the SV-06 diodes. Their forward conduction voltage is over 4 volts.

The inputs required by the CX-049 logic IC are the four separate decoded signals themselves; left front, right front, left back, right back. However, for optimum performance, the absolute level of these signals must be held to a relatively narrow range at the logic IC. This is done by inserting an AGC system in the amplifier chain between the decoder IC (CX-050) and the logic IC (CX-049). The AGC system uses another CX-718 (IC701) as a voltage-controlled voltage divider between the decoder IC and the amplifier. The output of each of the four amplifiers is rectified, and the individual DC output voltages are combined via resistors R738 - R741 to produce an average DC control voltage that is applied to all of the control elements of IC701. The result is that the variable voltage dividers formed by the IC701's resistance elements and resistors R705 - R708 have the same attenuation, preserving the relative amplitudes of the four signals, although the average amplitude of the four signals is confined to a narrow range.

Now that the overall operation is out of the way, let's take a close look at the AGC amplifiers themselves. The first stage is simply a CE voltage amplifier. The second transistor is a phase splitter direct-coupled to the collector of the first transistor. This produces two outputs referenced to ground and opposite in phase. Therefore, a pair of diodes connected as shown function as a full-wave rectifier, providing a DC output with fairly low ripple. This eliminates the need for big filter capacitors which would reduce ripple quite well but slow up the response time of the circuit.

