High Performance 2007 CD-4 Demodulator

By
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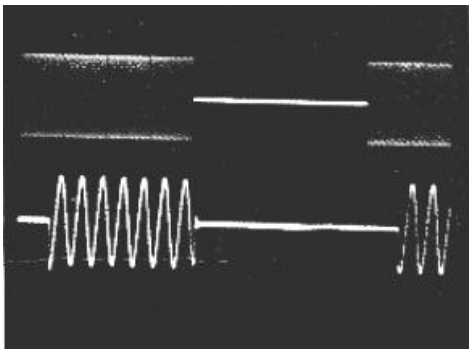
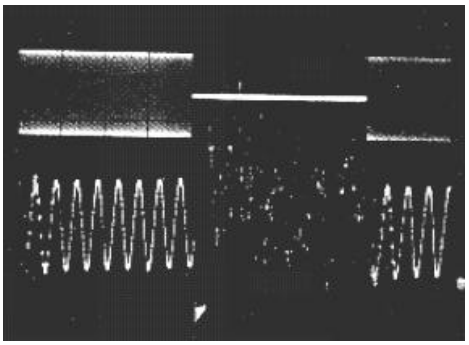
Installment V

The last sub-system in the sub-channel is the carrier Received Signal Strength Indication (RSSI) dropout compensate and mute system. This system identifies the carrier signal level and prevents the output of no signal demodulation noise when there is a carrier loss or the carrier gets below the demodulation threshold. Figure 43 is a dual trace oscilloscope photo of the carrier dropout system of the QSI5022 when driven by a generated test signal. The top waveform is a modulated 30KHz carrier with a 1KHz audio signal, that is then purposely turned off for about 5 milliseconds and then turned back on. The bottom trace is the demodulated output from the mute system. In the mute system there is a 18 millisecond hysteresis (delay) after reacquisition of carrier before the system unmutes. This insures that there is a good demodulated signal before the sub-carrier audio chain is re-enabled.



CARRIER OFF 5 MSEC **Figure 43**

Figure 44 shows the result of carrier dropout to high impulse noise. In both pictures, the chopped viewing mode was used on the oscilloscope, which is the reason for the dots in the modulation waveform.



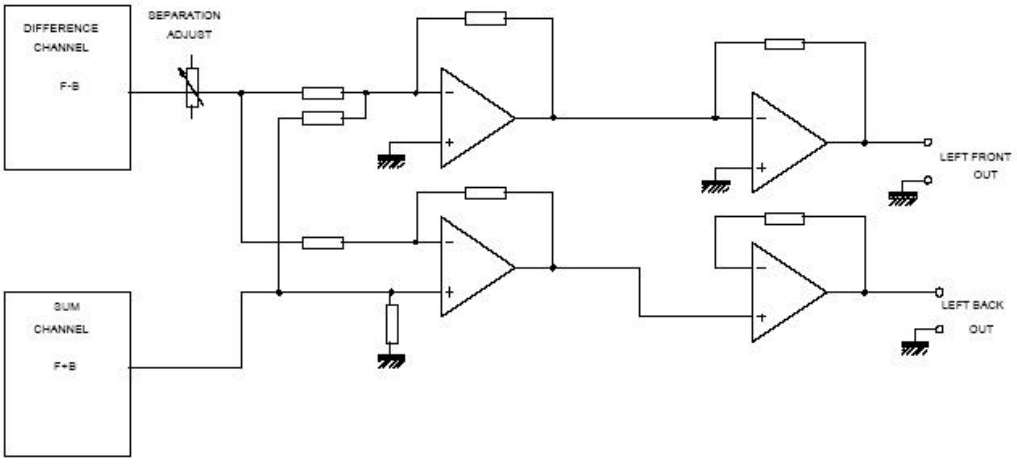
CARRIER OFF TO IMPULSE NOISE 5 MSEC **Figure 44**

The new high performance CD-4 demodulator will function in the same manner. It will, however, have a wider dynamic range carrier monitor system then did the QSI5022. The mute circuit is also much faster which will prevent very small carrier losses from getting through the system to the output.

Now that we have two complete signal chains, the sum channel F+B and the difference channel F-B, we need an algebraic network to process these signals into the final Front and Back signals. This network called a matrix. You are all saying "wait a minute". "I thought that the CD-4 system was a discrete Quadraphonic system and not a matrix"! Well, have no fear, it is discrete. The term matrix is really misused when applied to the 4-2-4 systems. The 4-2-4 system does in fact have a matrix network in its circuits. The problem is that this matrix is not fed by algebraically different signals so it cannot perform real algebraic sum and difference processing. The CD-4 system does have the proper signals (F+B) and (F-B) feeding its matrix network. The CD-4 algebraic equations are:

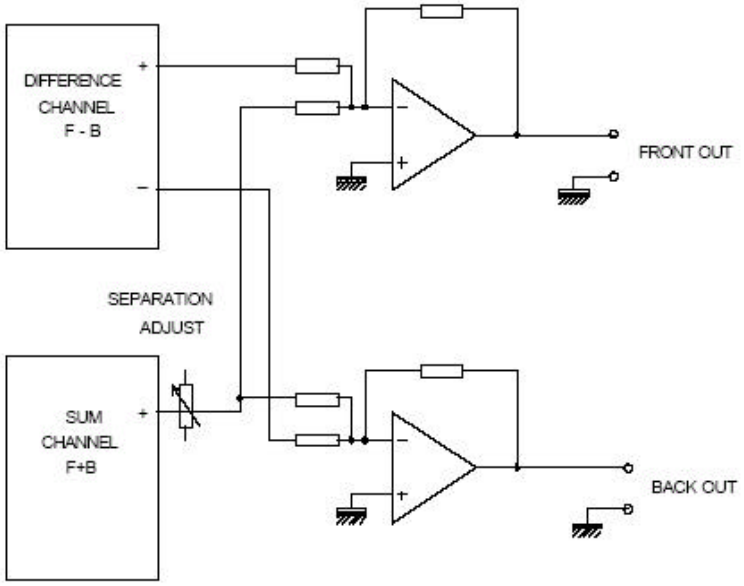
For the Left side: (LF+LB) + (LF-LB) = 2LF or Left Front
(LF+LB) - (LF-LB) = 2LB or Left Back
For the Right Side: (RF+RB) + (RF-RB) = 2RF or Right Front
(RF+RB) - (RF-RB) = 2RB or Right Back

Figure 45 is a simplified schematic diagram of the new CD-4 matrix network. The matrix is made from



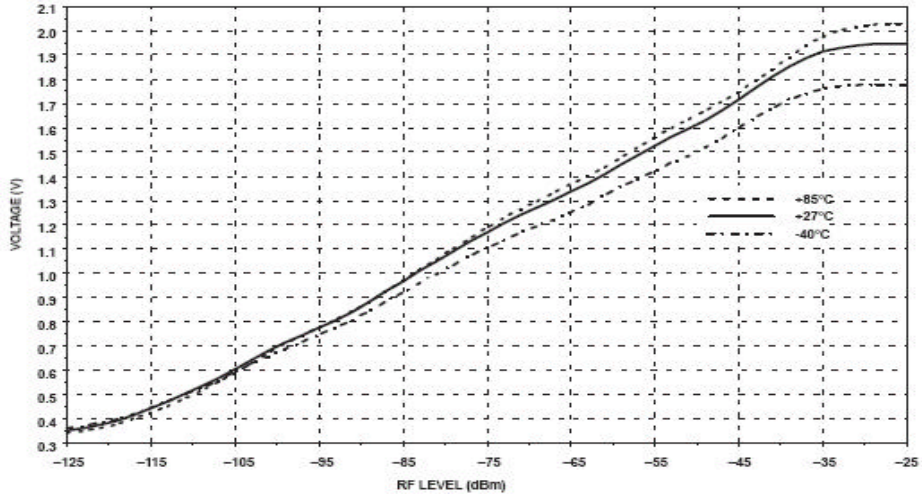
SIMPLIFIED SCHEMATIC NEW CD-4 DEMODULATOR MATRIX NETWORK **Figure 45**

four ultra low noise, low distortion operational amplifiers and six precision matched resistors. There are several ways to implement the matrix. This configuration was chosen because it can use single ended inputs and a minimum of components that affect the optimum separation. Single ended outputs from most sub-systems such as the sub-carrier detector or the sum channel filter are much easier to obtain. Differential outputs can make the actual matrix simpler, but it becomes more difficult to get the matched level accuracy from both outputs. This can lead to separation imbalance between the Front and Back channels. What this means is that when you adjust the separation control, you would find one optimum separation control position for Front to Back separation and another optimum position for Back to Front separation. With the single ended drive from the sub-systems, separation precision is maintained in the matrix circuitry. The simplified schematic for the differential version is shown in Figure 46.



DIFFERENTIAL CD-4 DEMODULATOR MATRIX NETWORK **Figure 46**

I would like to add one more thought about the RSSI system. The version in the new CD-4 demodulator is much improved over the QSI5022. The new CD-4 RSSI signal dynamic range is 90 dB, which is 40 dB greater then the QSI5022. This should provide much greater sub-carrier detection range as well as better sub-carrier drop out control. Figure 47 shows the RSSI dynamic range curve of the new demodulator.



NEW CD-4 DEMODULATOR RSSI DYNAMIC RANGE **Figure 47**

Well CD-4 Fans, there you have it, a new CD-4 demodulator design for 2007-2008. The first working bench prototype should be operational soon. Please post any questions you may have.

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