

Introduction

The LaserDisc medium, which has always been at the forefront of consumer audio/video playback quality has recently added a new (and, to date, unique) ability to its list of features: playback of Dolby AC-3 sound. I do not intend to go into great detail regarding AC-3 sound here, especially as it is comprehensively covered at Dolby's own site. Very briefly, AC-3 is a new way of digitally encoding and compressing 5 discrete, full bandwidth audio channels and 1 subwoofer effects channel into a very small space compared to the requirements for 5.1 uncompressed audio channels. In NTSC laserdiscs, the carrier for the right analog channel is substituted by the carrier for a digital Dolby AC-3 encoded bitstream using Quadrature Phase Shift Keying (QPSK) modulation. The AC-3/RF signal occupies a bandwidth of only 250 kHz, which is approximately the same space as the old carrier for one analog audio channel (200 kHz). It is very important to realize that AC-3 completely replaces the right analog audio signal waveform - it does not simply recode the right analog audio to carry the AC-3 data. Thus you cannot use the LD player's existing right audio output to feed an external AC-3 decoder, but must instead extract the AC-3 signal before it reaches the player's audio processing stages, and use this signal for external decoding.

Most new LD players incorporate an AC-3 output connector for connection to an external AC-3 demodulator/decoder, but owners of older players either have to pay a fortune to get their equipment professionally modified, or buy a new player. Fortunately, if you have a modicum of skill with electronic construction there is a third option: modify the player for AC-3 output yourself.

History of this AC-3 LDP Upgrade Circuit

The construction details and circuit diagram were initially part of an article by Espen Braathen and were published in the August/September 1995 issue of Audio/Video Magazine (Norway). The circuit design was based on the AC-3 output of a Pioneer CLD704 player and from a description

obtained from Pioneer Japan through Dolby Labs. The original article, which included details on assembling the circuit on multiprint board and installing it in a Pioneer CLD2950 is available from Nordisk Fagpresse, Norway, (telephone: 22 59 77 00). The circuit diagram was digitized and the text translated to English by R Larsson who subsequently posted it to alt.binaries.pictures in late September, 1995. Technical questions may be sent to Espen Braathen (home cinema editor, Audio/Video magazine).

Since people on alt.video.laserdisc are still posting requests for this information, and it has long since expired from a.b.p, I decided to make this information permanently available via the WWW. Obviously, any modifications that you may decide to make to your LDP will invalidate the warranty and are completely at your own risk, and I take no responsibility if anything goes wrong. Having said that, hopefully, others with access to AC-3 decoding equipment will give the modification a try and will let me know how they get on. I already know of at least two people who have successfully used this circuit to upgrade their players (a Pioneer LX-1000U and a Pioneer CLD-2950) to AC-3 output and am keen to learn of others who are successful so I can compile a list of players for which the circuit is known to work. I would also like people to tell me their player model number and where on the circuit board they tapped the various signals in order that I can produce a database for others with the same model LD player.

Colin Hunter
November 16th, 1995

Acknowledgements

Thanks to Roger Dressler at Dolby Labs (technical details), Bill Cruce (basic circuit diagram) and Greg Rogers (technical support) from "THE PERFECT VISION", and Kevin Nakano (Pioneer 704 AC-3/RF output diagram) for help during development of the original Audio/Video article.

Location of the AFM (Analog Audio) Signal:

Find the place where the AFM-signal splits into two channels. Tap the signal before it splits. (If you find the chip for the "Audio Demodulator & CX", follow the signal back to the band pass filters (possibly marked BPF) of 2.3MHz (ch 1) and 2.8MHz (ch 2). Follow it further back before the signals split, and hook the wire up there. NB: the wire should be as short as possible - maximum approximately 25cm/10 inches).

Location of the Mute Signal:

To find the mute-signal locate the Audio-Out section, and look around there. Alternatively, if your player has a "Sub Code Out" jack on the back, the mute-signal is on it, or find the "Mechanism Control" chip where the mute-signal originates.

The inverter Q3 is only needed if the MUTE signal is active "LOW" (i.e. has a positive voltage (+5V during play, as it is in the Pioneer CLD-2950 PAL/NTSC player for which this circuit was originally designed). If the mute signal is active "HIGH", Q3 must be deleted from the circuit. (This can be measured with a volt meter). Typically, for many NTSC-only players, there is no need for Q3.

(Strictly speaking, you don't need the mute-signal at all - you can just drop transistors Q2 and Q3, and wire resistor R2 to +5V. I believe all that happens is you will get some unwanted sounds when the player is not in "PLAY".)

Mounting of the RCA Jack:

The jack should not be in direct contact with the chassis. The ground-connection comes through the shielding of the 75 ohm coaxial cable.

C2 is connected to the chassis (Rear panel GND.)

Testing:

A simple test of the function is to measure the AC-3 output with a voltmeter. It should be 3.6V in "PLAY", 0V in "PAUSE".

Parts List:

R1 680 ohm, 1/4 watt
R2 10K ohm, 1/4 watt
R3 100K ohm, 1/4 watt
R4 75 ohm, 1/4 watt
C1,C2 100nF, ceramic
Q1 2SC1740 or MPS3904, Transistor NPN
Q2 DTC124ES, Digital transistor NPN, 22K+22K
Q3 DTA124ES, Digital transistor PNP, 22K+22K
RCA jack for mounting on the back, not in direct contact with the chassis
75 ohm impedance coaxial-cable

(Transistors DTC124ES and DTA124ES can be replaced respectively with type numbers MPS2222A and MPS2907, with 22K resistors at the base and across the base/emitter junctions as shown in the circuit diagram)

Last Word:

This information was originally published in the Norwegian magazine, AudioVideo. I have made only small changes to the circuit-diagram and to the above description. If your player explodes in a bolt of green flame, well, that's too bad, but you did it at your own risk. :-)
R Larsson

Pioneer CLD-2950

The following instructions come courtesy of R Larsson. The Pioneer CLD-2950 is a dual-standard (NTSC/PAL) player for the European market, very popular and probably the best of its kind available.

Remove the top cover by loosening seven screws (two on each side and three on the back).

With the front of the player pointing towards you, remove the large board on the right side of the player by unscrewing four screws, and thereby "folding" the board out to the right, and placing it in the three slots designed to hold the board during service.

The narrow board you now see is the AFMB board (Analog FM sound board).

The big chip on it is the "FM-demodulator and CX-decoding" HA12127ANT. Four of the five taps are done on this board, and you have to remove it completely from the player. Loosen two screws and one clip, then pull out the four jacks. You can now take the board out.

Now place the AFMB-board so you have three jacks on the right side, and one on the left side. You can install the home made AC-3/RF-board.

Solder the wire for +5V to jumper W187 on the left side of the AFMB-board. At the same place you'll find a marking for C175 which is not mounted. Place the wire for -5V in the hole for C175's negative pin (marked with a square), and solder it on the print side of the board. Similarly, solder the wire for GND to C175's positive pin. The wire for the AFM RF-signal (as short as possible!) is soldered to jumper W355, on the right side of the board.

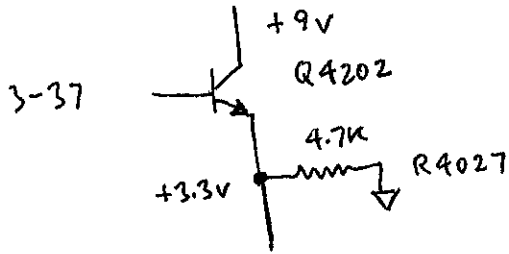
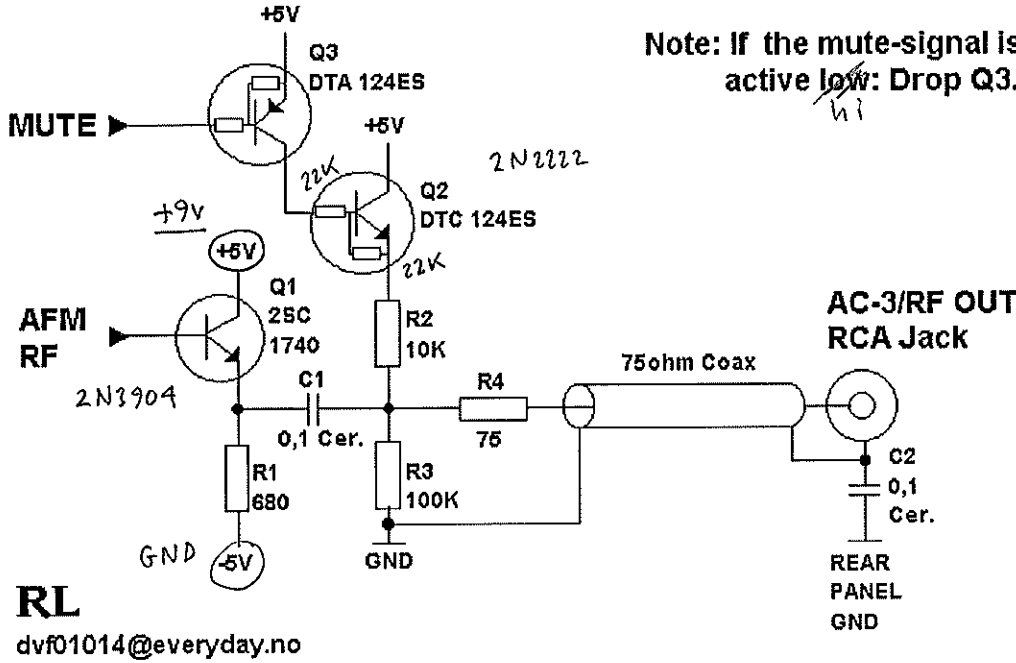
Fasten your home made board to the AFMB-board some way (double-sided sticky tabs should suffice).

Location of the Mute-signal

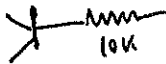
On the edge of the main board (the one at the bottom of the player), above IC201, marked PULSEFLOW (D/A converter) you'll find a jumper marked W206 and MUTE. You'll need to solder the mute-signal wire to this jumper, but be careful not to touch any other wires with your iron during this operation.

Finally, mount the RCA jack, the coax, C2, and after putting the boards back in place you're ready to test your glorious new creation.

AC-3 LaserDisc-player upgrading

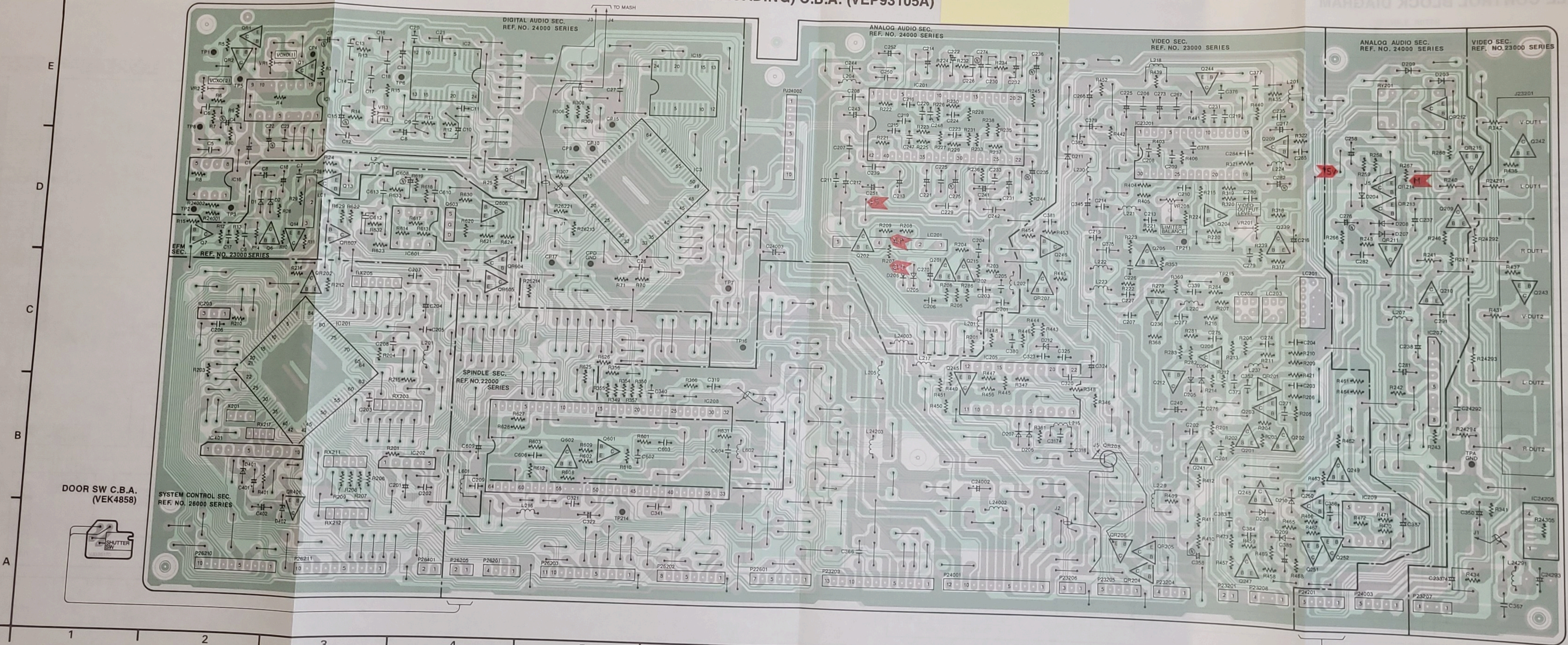


QR4214 4.8v Mute

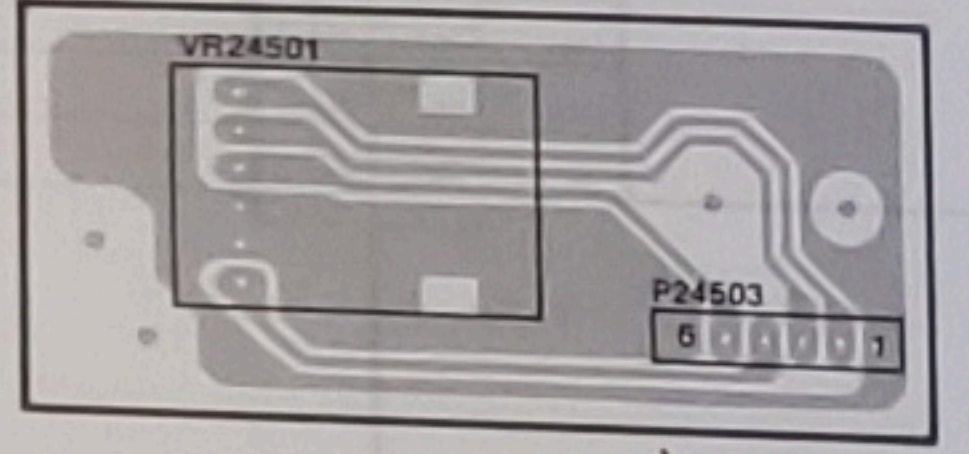


3-8. MAIN (VIDEO/EFM/ANALOG AUDIO/DIGITAL AUDIO/SYSTEM CONTROL/SPINDLE SERVO/LOADING) C.B.A. (VEP93105A)

Board Mod.



HEADPHONE VR C.B.A. (VEK5006)



HEADPHONE JACK C.B.A. (VEP94077A)

