

Lightspeed Volume Control - (B) Comments

(2/11/08)

The above post lists are re-organised here more usefully – again, any suggestions are ...

The Standard Lightspeed Mk II uses a [Silonex NSL-32SR2 LDR](#), one in series and another in parallel. The old Mk I version uses a series resistor & shunt LDR and altho' simpler, sounds inferior.

The Circuit ([#1,424](#)) and the layout ([#24,97](#)) are clearly seen in practice on Arne's photo ([#151](#)). How it works ([#117](#)) and "Audio Characteristics" - link ([#483](#)) are essential reading (plus [#35,184](#)) Differences between Mk I & II, RS2, RS3 ([#189,244,1475](#)) and distortion info is on ([#849,50](#)) The range of attenuation is ([#822](#)) and Noiseless operation on ([#147](#)). [The list is not complete!]

Practical Info – Operating Conditions ([#25](#)), Tips to building L/S ([#90,103](#)), "How the Pots work" ([#275,306](#)), Diode limiting resistors ([#358](#)), "Input & Output Impedance = 7kR" ([#141](#)), a tip using the 8pin DIL IC socket ([#365](#)) and a reminder to "use h.sink clips on the LDR legs when soldering" ([#90,198](#)). Power consumption is 50ma @ 5 volts both channels, plus indicator led.

Pots – The standard L/S uses a Dual 100kR log pot - the [RS3 LDRs](#) requires a higher value. The single pot seems to develop faults. The stepper isn't really necessary here (see [#306](#)) but they work well. The log pot "comes on" slower and normal levels are about 12 o'clock. A switched pot saves the diode life but the L/S takes some time to warm up – can leave on continuously IF the Vol Pot remains in mid position when idle. (so diodes don't cook)
A cap was bypassed across the Vol Pot ([#1086](#)) – result? And a link to Dantimax remote control, Alps and other motor pots ([#1256](#)) Some VCCS remote controls are developing.

Diode, Caps and "PhotoResistor" (ph/Res) – Tom's (Gootee) sim work on adding parallel resistors to the ph/Res ([#1062,65..96](#)) – did anybody try it out on the normal L/S?
Adding a 100uf cap directly across the diodes seems to give improved results ([#581,90](#))

The Diode Control is becoming more complex - the more complicated diode Current Control systems appears give better results and with the V- CCS approach, it's looking easier to get remote control, volume, balance, and the LDR type Input Selector may also become a reasonable possibility - very promising.

The CCS - Pietjers constant current source circuits and discussion are on ([#990,1001,17,1118](#))
NOTE: there are some cheap dual stepped pots available on eBay, if not happy with the ordinary dual pot or one of the Voltage Controlled substitute?

The VCCS designs include Barry's AD460 dac idea, see ([#994,1013](#)), Tolu DAC control, see ([#1448,95,1510,12,17](#)), and Pauls (Maximus) remote control design and pcb, see ([#121728,1387,1438,40,1511](#)). The "audiofaidante" project is progressing?

Nelson's circuits - They use the RS3 with the ldr & ldr system but are designed to function a bit differently – only 35dB attenuation and 10kR Zin, etc. Also, the opto-resistors have a 1MR parallel bypass - the buffers are quite straightforward.

For device measurements see ([#1328 – 36,50,..](#)) For circuits see ([#1338,9,40,61](#)) and for the 2 channels ([#1362,3](#)) For circuits operation, see ([#1338,50,67,84](#))

How to measure the LDRs.

Before you jump into action, It is essential that you read the "AudioOhm Optocouplers: Audio Characteristics" on the Silonex website (make a "shortcut, you'll find it very useful!)

Cathode has the DOT on the short wire side – this is the 0volt connection. Flimsy short bits of wire – use a DIL socket, small pointed pliers and be careful (and/or use a ZIF socket).

Note, also, that they will only take 2.5 volts directly across the diode and a max current of 25mA (which is why there is a 100R resistor in series with it.)

Add a number to each compartment in a “multibox” so that after measuring each LDR, the written results have the this same identification number – no confusion about your information – sounds silly, but avoids mistakes.

Method A If you have a power supply with a “dial up” voltage display, then just add a current limiting resistor (100 ohms – for max current of 25mA) in series with the diode for a simple 2 component circuit and connect to the supply – be careful that the LDRs DOT wire goes to the 0 volt terminal!

Apply 1.0v, 2.0v, 3.0v, 4.0v or 5.0volts *to the resistor + diode* for 3 minute (that let's the LDR temp to settle down), then measure the *impedance across the opto-resistor* (the long wires) with a DMM and *write it down* – so you have 5 readings for each LDR, okay? 15 minutes each LDR. (see #1262). From the results, choose the 4 LDRs with same measurements – if you can't get a quad matched set, then use a “matched pair” for series and another nearest “matched pair” for shunt. If you drawup the results on a sheet of graph paper, it's an easier comparison. Try for a better than 2% match – 2% per pair is better than a 5% overall spread. See (#719)

Method B If you have equipment that can supply consistently low current levels, use the same procedure (1, 2 and 3) as above but with currents of 0.1mA, 0.5mA, 1.5mA, 5.0mA and 15mA.

Method C If you only have a fixed 5 volt supply (LM7805, etc), the different currents settings thru the diode are “arranged” by altering the diode's 100 ohm current limiting series resistor – as the diode uses 2.5 volts itself, the resistor value is found by dividing the remaining 2.5 volts by the required current settings. (see #67)

So $2.5v/0.1mA = 25k\text{ ohms}$, ... $0.5mA \Rightarrow 5kR$, $1.5mA \Rightarrow 1.67kR$, $5mA = 500R$, $12.5mA \Rightarrow 200R$.

Then the same procedure for measuring the opto-resistor's impedance is used (as above) and this is done for each LDR in turn. [suggest a 5 position switch for the 5 resistors, a 8pin DIL socket, etc]

NOTE: The LDRs are very *temp dependant*, so make sure there's no room draughts, no fan, etc

NOW that you have the LDRs selected, assembled and it's working okay, there is a ***last fine tuning procedure*** and I've found the “Blues” system on (# 515) (P21) to be the simplest one, particularly as there is a diagram to follow. George's production adjustment method is more thorough and more accurate, but not easy! Also, you need good equipment and experience.

Input and Output Impedance?

. Basically, you need the Output Z of your signal Source (CD player, etc) to be less than 100R (series resistance) and the amplifier InputZ to be a higher than 60kR. Buffers are very useful for equipment with low Input Impedances

“How to properly measure the in/output impedances of CD players, preamps and Amplifiers”
[Perhaps someone can explain clearly?]

Parallel resistors to the LDRs Opto-Resistor

Tom's model for the RS2 LDR is quite extensive (#1062,87....) In a nutshell, with parallel resistors across the opto- resistors, the Zin of the LS can be kept constant over it's full volume range Has anybody tried this out in practice and does it sound any better?

System integration (?)

As has been mentioned, when the series LDRs are equal (impedance) to the shunt LDRs (not 12 o'clock position of log pots), then we have the *position of minimum distortion*. If you can organise the o/p signal level from the source, the gain of the amp(s) and the efficiency of the speakers so that the LS Volume pot setting is at this *optimum position* for normal listening, the whole audio system will operate at it's best. (#845,50) Hmmm!

Power supplies - 5volts, 50mA max, both channels (plus indicator!)

Double regs, with chokes, etc, batteries, etc. It appears that the quality does affect the results. I'm using the basic R-C-R-C with the u/fast diodes plus standard Cmultiplier, as usual, but organising a "Toole" reg (as per D1 dac thread) to complete a well finished *buffered* CCS L/S.

Hopefully, this may be of use for those looking for information about this amazing device.

No doubt, some of these OPINIONS will provoke comments – please don't hesitate.

I have written this in "Open Office.org Writer" but converted it to PDF to post it up – could someone create those very convenient links to things?

Thanks. ... Jh