

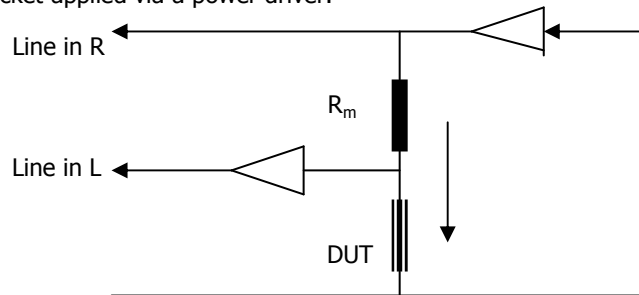
Build a Curve Tracer using a PC and sound card

ZS6KR

A recent QEX/QST publication* - or rather the author's name - caught my eye as he was well known to me since 1980 when he started publishing electronic projects in various magazines. This publication described a curve tracer to characterise components such as diodes and various linear and non-linear devices using a PC sound card and software to emulate a CRT display. The Device Under Test (DUT) is connected in series with an accurately known resistor $R_m = 100\Omega$ and a $\pm 10V$ p-p sinusoidal wave packet applied via a power driver.

The current through the DUT is monitored by the resistor and the voltage across it fed to the sound card L and R inputs. This information is then processed by software to produce a record of swept voltage across - and current through - the DUT.

The oscilloscope display then produces a graphic representation of the voltage and current which we analogue humans can understand.



There is however an important requirement that measuring system must conform to before we can believe what we see. The effects of large capacitor AC coupling in the sound card must be reversed with a software digital filter to get a flat step response. This is achieved as a once-off preparatory procedure by applying an accurately known DC step and using on-screen compensation control to shape the scope trace for amplitude and flatness. L and R channel balance control can also be adjusted to perfection. Once done, the system is ready for use.

It is suggested that the more inquisitive reader consult the original article for a more detailed technical explanation.

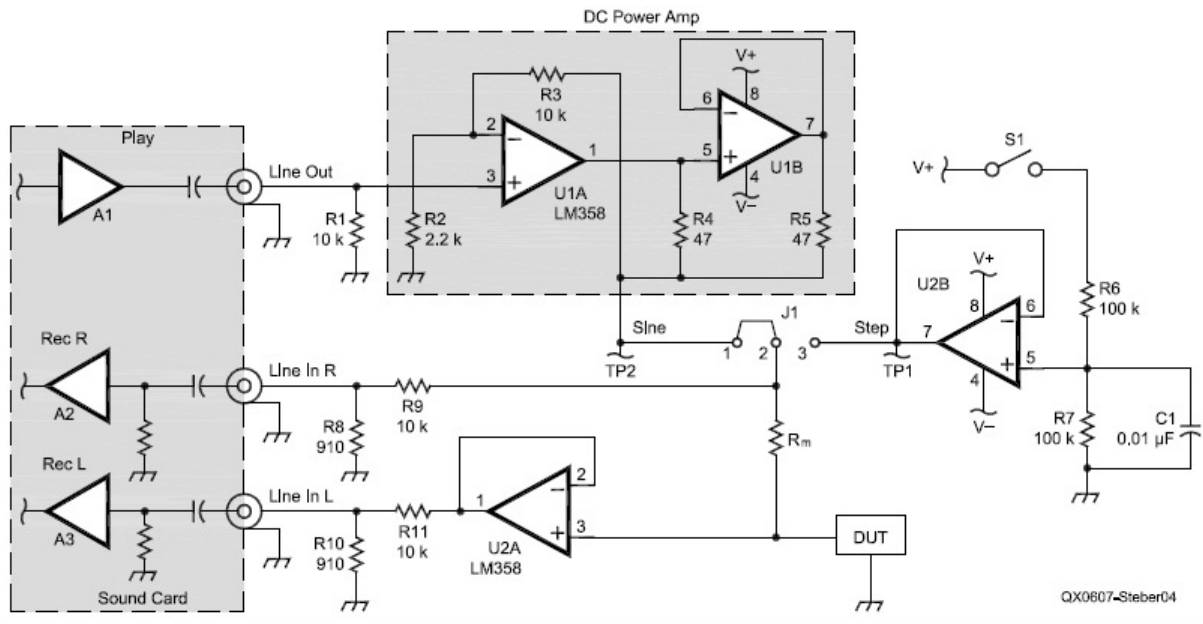


Figure 4 — Curve tracer circuit and the interface to the PC sound card.

* **I-V Curve Tracing With a PC.** Dr George R. Steber PhD.
Software available on the QEX website. Else from this author.

QEX Jul/Aug 2006 5

Concentrating on practical aspects, it can be seen that only a few components are required and I have designed a PCB for the job as shown. (true size 55 x 31,5mm)

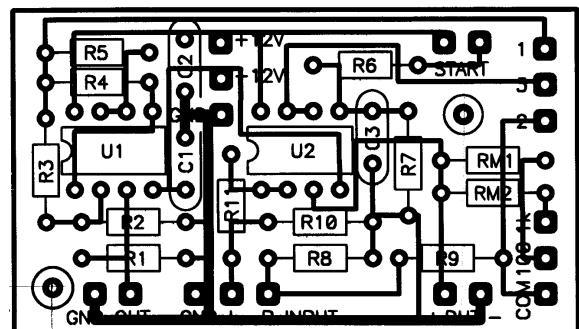
The PC sound controls are recommended to be set as follows:

Play: Enable only WAVE and OUTPUT

Rec: Enable only LINE/MIC IN

All slider controls set to maximum. Maximum is convenient to remember but it may be necessary to adjust the values of R8 and R9 down to honour this rule.

Calibration is done by connecting 2 and 3 of J1, pressing SW1, measuring the voltage at TP1 with an accurate DVM and doing on-screen adjustments for a display as shown.



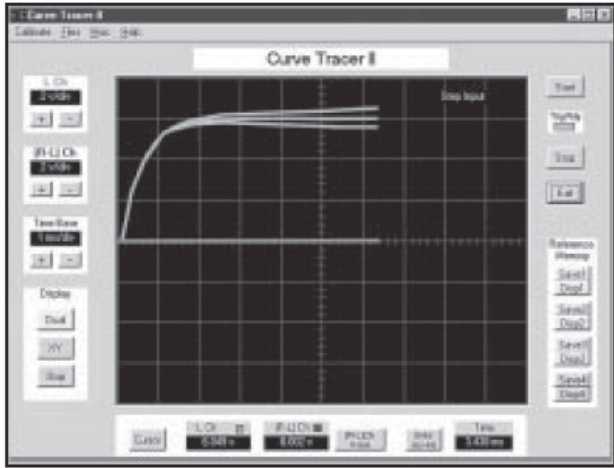


Figure 6 — The main window of the curve tracer program showing step voltage input.

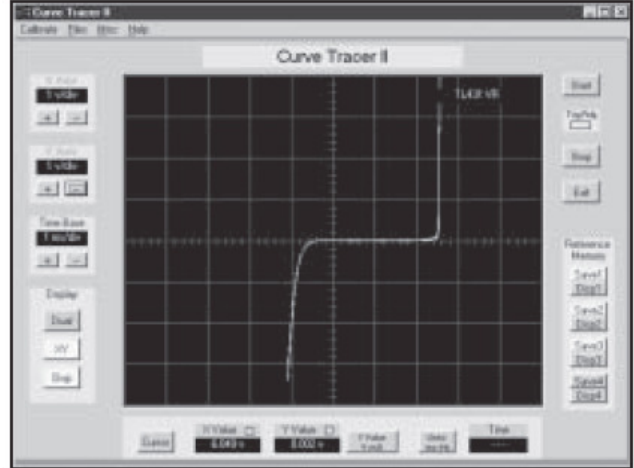
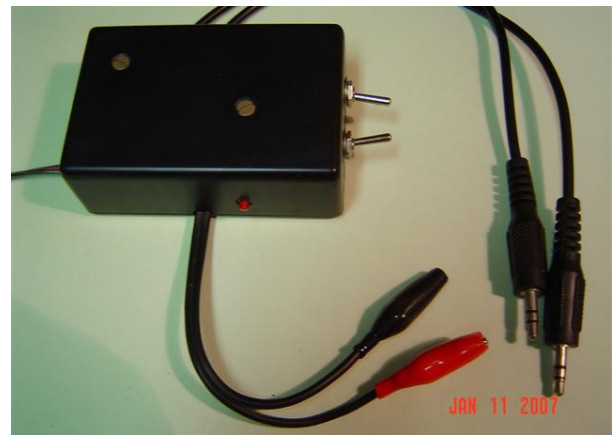


Figure 8 — Voltage reference diode I-V curve.

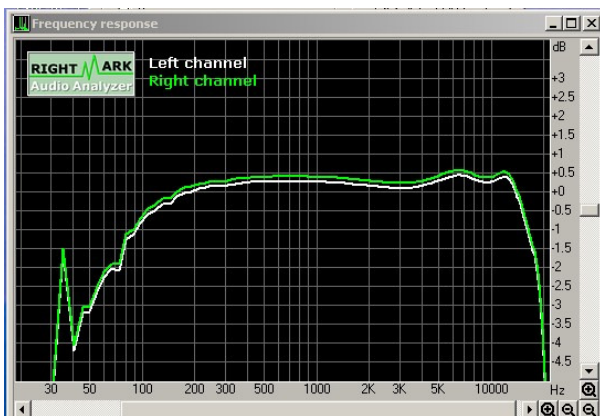
The first screen shows a superposition of slightly over-, under-, and ideal compensation. The top middle trace is what to aim for and the amplitude must be = DVM voltage previously measured. The trace at the screen centre must run perfectly along the zero line indicating perfect L-R stereo balance. The control for this is available via the CALIBRATE button (top left). The trace is initiated by clicking on START, wait for the trigger indicator to go red and pressing the hardware TEST button.

Once done, further operation is simple. Connect a DUT, click START and a trace will appear. X and Y scaling is adjustable and the trace can be stored for further reference. There is also a cursor for precise measurements.

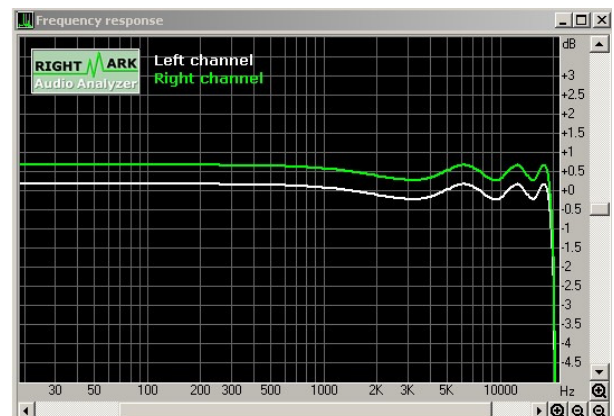
This is it in a nutshell. Below is my version of the unit that I hook to a dual power supply and sound card. I have added an extra switchable R_m of 1k and reduced R2 to 1k8 so that a maximum voltage sweep of just on $\pm 10V$ is available when using a $\pm 12V$ DC supply. Variable sweep is also possible using the Windows Play Control slider.



A further note on sound card performance is in order. A good wide, flat frequency response is desirable. An extremely useful software utility RMAA5.5 is available free from <http://audio.rightmark.org/download.shtml>. All you need to do is to connect line-out to line-in and the software will test some 7 audio parameters:



My laptop soundcard response (not very suitable)



Sound Blaster 24 (balance deliberately offset)