

The long HP1980B repair story...

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- *From:* Robert Obermayer <robert_ng@xxxxxxxxxxxxxxxxxxxxxx>
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Hi,

Just finished repairing it. Quite interesting problem, and real easy to fix once one knows which of several hundred ICs is faulty...

First of all, what is a "HP 1980B"?

Its one of the most advanced analog scopes made, being fully digitally controlled either via GPIB or locally by piezo buttons and a rotary encoder. It has a well-working autoset function and with a option (which i have installed) can also provide digital waveform storage.

It looks like that:

http://www.amplifier.cd/Test_Equipment/Hewlett_Packard/HP_other/1980B.htm

So, first of all, what was broken at all?

The text display didnt work, being compressed to vertical lines where a whole line of text should be.

This happened one day after 2-3mins of running and stayed since then.

All other functions were ok, indicating that the controller should be okay.

Part1:

The first step was looking for a service manual, which proved to be near impossible. None of the usual manual dealers had one, just with one having a printed edition for about 4 times the price i paid for the whole instrument. Oh well.

All i could find was the operating manual, containing zero repair information.

Looking around inside this really complex instrument showed no obvious problems like blown tantalum capacitors or what else. Randomly probing around the horizontal output stage didnt really show useful results. Probing around at the z-axis amplifier showed a lot of pulses when text display was on, so whatever generates the text display at least produces Y and Z signals, with the X signal being dead.

More random probing and testing didnt help, and led to the [false] conclusion that the hybrid DAC probably produces the ramp signal and is faulty, which would be a problem.

Since the scope was more or less useable i didnt do anymore and started looking for a replacement.

Part2:

While searching around for possible info on how the waveform storage works (turned out it uses progressive sampling and a rather slow ADC) i came across a document listing a lot of test eq. manuals, and a email adress where to order. It included the 1980B service manual (with all 612 pages)!

Quickly i asked for the price (15euro shipped!) and bought it.

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Now i had 612 pages full of schematics, descriptions and other information.
Much time was spent gluing together the printed schematic pages to something that is readable.

Finally, it turned out that the text display X and Y ramps are generated by simple integrators with a reset and enable signal coming from the video controller.

A good time probing around showed the enable signals were okay, as were the enable circuits.

Some time later, i was working on the X ramp generator, having looked for every component with no results, scoping the enable signal at the base of the transistor, which looked like a square wave. I didn't pay attention to the amplitude.

A good time later, i came back to this part again, this time looking at the amplitude.

It measured 0.3v on the transistor base. Not much.

I unsoldered the transistor to see if it's shorted but tested okay.

Since i had no 2N4904 i substituted a BC547 for testing, no success.

Measuring around the base transistor showed a 0.3v signal both sides, so now it was clear the transistor couldn't turn on!

Soldered it back in and looked where the signal came from, which happened to be the video controller, oops no, a 74LS373 octal latch after the controller.

Scoping at the video controller shows a 5v signal, perfect.

After the latch, it was reduced to 0.3v.

Measuring (with power off!) from the latch output to GND it had 50 Ohms of resistance. With the chip removed, it was much higher.

So what caused the latch output to resistively short to GND?

Bridging the input and output with a 1k resistor (so chances are lower to fry the video controller) brought a perfect display!

Of course the latch had to be replaced since whatever caused it to short would now damage the hp-custom video controller if it came back.

3 Days later, i had some LS373 in the mail.

Quickly put one in, works perfectly!

Having it running now for a longer time, it still works so i think i can announce success finally!

Part3:

What happened?

What causes a LSTTL Output to resistively short to GND?

Can the condition reappear?

Can this happen to other parts too?

Regards,

Robert

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