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Topic: **Agilent 34970A dataloggers!** (Read 2910 times)

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**nfmax**  
Frequent Contributor



Posts: 824  
Country:



**Agilent 34970A dataloggers!**  
« on: May 18, 2017, 09:48:04 pm »

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I wobbled not one but *two* faulty 34970A's from the great closing down scragpage at work. The first was labelled 'do not use - turns itself off (20/6/16)'. When I tried it it wouldn't turn on at all. I checked the PSU and the floating +/-18V supplies were appearing correctly whenever mains was applied. Maybe the power-on logic signal wasn't getting through from the front panel? I removed the DVM module and re-seated the front panel ribbon cable connector on the main PWA - and it worked! It looks like that's all that was amiss. There was a bit of case damage to the rear panel moulding, so it may have taken a knock at some time that dislodged the connector slightly. It just barely seemed to move when I pressed it home. It seems OK now, but it remains to be seen how reliable it will be in practice.

The battery is almost dead & must be replaced, however I temporarily reassembled everything, ran the full set of self-tests which all passed, and made a quick DCV check against my 34401A. The two differ by at most a few counts in the 6th digit, which is very encouraging. Date of last calibration was 2010 - which is odd as all these dataloggers should have been kept in current calibration (the place was full of them).

The second unit also has a dead battery, is marked 'not reading 4 wire RTDs', and when the full self test is run gives errors 608, 609, 611, 614, 618, 620, & 623. This sounds like it might be the issue with dodgy ribbon cable connections described in service note 14C <http://literature.cdn.keysight.com/litweb/pdf/34970A-14C.pdf>, as the serial number is in the affected range. I removed the DVM, but couldn't see anything amiss with the cable. The unit now passes self-test without the DVM installed.

I'll investigate this one further when I get the time. But one out of two isn't bad!

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**HighVoltage**

Super Contributor



Posts: 4230

Country:



**Re: Agilent 34970A dataloggers!**

« Reply #1 on: May 18, 2017, 11:45:29 pm »

Say Thanks Reply Quote

Welcome to the club of 34970A owners.  
You should replace the batteries as soon as possible, since they like to leak badly, when they get empty.

Report to moderator

There are 3 kinds of people in this world, those who can count and those who can not.

**nfmax**

Frequent Contributor



Posts: 824

Country:



**Re: Agilent 34970A dataloggers!**

« Reply #2 on: May 19, 2017, 07:46:05 am »

Say Thanks Reply Quote

**Quote from: HighVoltage on May 18, 2017, 11:45:29 pm**

Welcome to the club of 34970A owners.  
You should replace the batteries as soon as possible, since they like to leak badly, when they get empty.

Actually I'm already a member! These are units numbers 2 and 3.  
Farnell is showing the batteries on back order until the end of August, but I'll hunt around for other supplies. I also rescued a 34901A to check over and add to the stock of modules.

Report to moderator

**HighVoltage**

Super Contributor



Posts: 4230

Country:



**Re: Agilent 34970A dataloggers!**

« Reply #3 on: May 19, 2017, 12:21:03 pm »

Say Thanks Reply Quote

You should be able to source the battery in other places.

I just got a new addition to the lab, the 34972A  
The battery problem has finally been solved.

These are great dataloggers and from my point of view far underrated.  
I am always astonished for how little money they go away on ebay.

Report to moderator

There are 3 kinds of people in this world, those who can count and those who can not.

**nfmax**

Frequent Contributor



Posts: 824

Country:



**Re: Agilent 34970A dataloggers!**

« Reply #4 on: May 22, 2017, 09:30:17 pm »

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I found a stock of the 1.2 Ah 1/2AA batteries with wire leads instead of tags: these also fit the PWA and can easily be secured in place with a dab of PVA adhesive goo. The first unit now has its battery installed and seems to be working OK. The DMM relay counts are around 100K, and the relay counts on the low-numbered channels of the 34901A card are between 1 & 2 million. This card spent all its working life logging thermocouples (and still has the leads fitted) so the relays are *probably* still OK, but I'll measure the contact resistance sometime to check. As usual, the high-numbered channels have hardly been used at all.

Hopefully I'll get time to look at the second unit tomorrow.

Report to moderator

**nfmax**

Frequent Contributor



Posts: 824

Country:



**Re: Agilent 34970A dataloggers!**

« Reply #5 on: May 23, 2017, 10:17:31 am »

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Progress on the second unit...

Given a full self-test, it returns error 608, and then a variety of other errors indicating all sorts of dire things. However, error 608 is 'serial configuration read back failure', so it is possible the other errors are arising simply because the configuration is not being applied properly. Furthermore, when I run the self-test on a known good unit, I hear the DMM relays clicking away: on this unit, I do not. Looking at the circuit diagram, the relays are controlled by U150, which is some sort of ASIC. 🙄

However, U150 is the third device in the serial chain, being preceded by U309 & U311, both 74HCT4094's. So I scoped the serial input pin of the first device, U309, and observed likely-looking activity at power-on, and when the self-test is run. This did not appear at the serial input of the next device, U311. The serial clock & strobe pulses seem OK. I suspect U309 may be the culprit. I'll order one and try it.

Watch this space...

[Report to moderator](#)  Logged**HighVoltage**

Super Contributor



Posts: 4230

Country:  **Re: Agilent 34970A dataloggers!**« **Reply #6 on:** May 23, 2017, 10:46:08 am »[Say Thanks](#)[Reply](#)[Quote](#)

It is always good to have a second working instrument - as you have - and you can compare the serial data of the good instrument on U309 to U311. We can also be lucky to have schematics for these great dataloggers.

Keep us posted with the details of your repair. Someone else might need this in the future.

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There are 3 kinds of people in this world, those who can count and those who can not.

**nfxmax**

Frequent Contributor



Posts: 824

Country:  **Re: Agilent 34970A dataloggers!**« **Reply #7 on:** May 28, 2017, 01:05:32 pm »[Say Thanks](#)[Reply](#)[Quote](#)


More progress to report:

Unfortunately replacing U309 made no difference. However, when I started checking around some of the output pins I realised the locally-filtered +5A supply was only around 1.3V, so it wasn't surprising the 74HCT4094 wasn't outputting anything. This supply is derived from the main +5V supply through a 215 ohm resistor, so something is taking about 17mA too much. +5A feeds various chips in the AC signal path: apart from the two 74HCT4094's U309 & U311, these are the CMOS DAC U302, and the two CMOS analogue switches U304 & U306. Total load should be about 2mA at most. I found U304's VL supply pin was about 1mV less than the others, so I lifted it. That gave me about 2.4V on +5A, so some of the excess current drain but not all was being removed.

I then put a scope on +5A and watched what happened at power-on. The +5A supply (ch 1) rose to over 4.5V before dropping back to 2.4V, and the drop happened coincident with the first serial strobe pulse (ch 4). This made U311 output pin 13 (ch 2) try to go high, but succeeded only in taking it up to about 1V - looks like a failed input on U304.

I removed U304, and now I get 4.9V on +5A; the relays click away happily when I run the full self-test; and the only error I get is 621 - AC RMS full scale fail, which sounds about right. I did a quick check and I can now measure DC voltage and resistance successfully. I've ordered a couple of DG411DY's from RS Components - should be here Thursday or Friday (as tomorrow is a holiday)




 scope\_0.png (32.9 kB, 800x503 - viewed 137 times.)

[Report to moderator](#)  Logged**nfxmax**

Frequent Contributor



Posts: 824

Country:  **Re: Agilent 34970A dataloggers!**« **Reply #8 on:** June 04, 2017, 08:41:51 pm »[Say Thanks](#)[Reply](#)[Quote](#)

Well things didn't turn out quite as expected. Replacing U304 caused the original fault to re-appear - very low voltage +5A, no clicking relays on self test, and the return of the set of failure codes associated with error 608. I started checking some of the other supply rails, and I found that +15A was at about -0.6V. This is weird, because U304 is shown as powered by +15B, which was OK. But I found the schematic in the service manual was wrong, and U304 is indeed powered from +15A.

Both these rails are derived from the +18V rail by means of 3.3V zener droppers. CR305, which generates +15A, had failed open circuit. Bridging across it with five 1N4148's in series (since I didn't have a zener handy) caused the +15A supply to rise to about 3V, and the diodes to get very hot. Since so few components are connected to this rail, I relied on inspired guesswork and unsoldered C322 (basically because it was the easiest place to start). This is marked as a 22uF 25V tantalum capacitor - but it measured 29 ohms! I temporarily replaced it with a (through hole) 22uF aluminium electrolytic, and using the diodes bodge I now get 15.3V on +15A. The self test still fails, but this time only on test 620, which is AC RMS zero. Since there are various wires soldered to different parts of the board, and it is not mounted on its screening plate, I'm prepared to assume it's just picking up mains hum from somewhere. I hope.

I suspect that the original failure was C322, which then caused CR305 to fail, and then eventually U304 died. I think my replacement U304 is still OK, as it only saw the bad supply rail for a couple of

minutes. I've ordered replacements for C322 & CR305: when they arrive I'll put it all back together, and if it passes the self tests and performance check I'll soak test it for a few days. I have another DG411 in case U304 has actually been damaged.

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### HighVoltage

Super Contributor



HIGH  
VOLTAGE

Posts: 4230

Country: 



#### Re: Agilent 34970A dataloggers!

« Reply #9 on: June 05, 2017, 06:15:23 pm »

[Say Thanks](#) [Reply](#) [Quote](#)

Did you check for other failed tantalum capacitor? This is a well known problem on older HP and Agilent gear and I had plenty failed tantalums before.

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There are 3 kinds of people in this world, those who can count and those who can not.

### nfmax

Frequent Contributor



Posts: 824

Country: 



#### Re: Agilent 34970A dataloggers!

« Reply #10 on: June 05, 2017, 07:36:43 pm »

[Say Thanks](#) [Reply](#) [Quote](#)

I haven't found any other problems so far - not wanting to keep the power on for long periods until I've got this issue sorted out. I didn't mention it, but I've used my thermal imager to check for hot components as part of the debugging process, and there were a couple of OPAMPs in the AC amplifier getting hot, seemingly because the configuration of the DG411 switches connected the two outputs together (with no feedback round either), and their offset voltages were of different signs. But that should not harm the devices permanently. I will check again once the new parts arrive.

Oddly enough, this is the newest of the 3 dataloggers that I have, and much newer than my 34401A (which uses the same DVM circuit almost exactly), and the only one to fail so far.

Edit to add: there was no visible sign of failure of the tantalum capacitor. It seems to have died quietly.

« Last Edit: June 05, 2017, 09:40:40 pm by nfmax »

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### nfmax

Frequent Contributor



Posts: 824

Country: 



#### Re: Agilent 34970A dataloggers!

« Reply #11 on: June 06, 2017, 04:22:50 pm »

[Say Thanks](#) [Reply](#) [Quote](#)

Success! I replaced the failed tantalum capacitor & zener diode, and everything seems to work happily. All self-tests pass, and a quick check on DCV, ohms, ACV, and frequency gave results closely matching my 34401A. All the supply rails measure within limits. The factory calibration date is 1 Apr 2005. The last calibration was in 2013. The GPIB interface works.

I'll run the performance verification tests as far as I am able to, and especially have a look at the high frequency AC correction. The service manual says this must be recalibrated if the DVM shield was moved during service - as of course it was. I'll see what Keysight quote me for a calibration as well, since their current 50% off calibration offer is valid in the UK.

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### HighVoltage

Super Contributor



HIGH  
VOLTAGE

Posts: 4230

Country: 



#### Re: Agilent 34970A dataloggers!

« Reply #12 on: June 06, 2017, 06:21:12 pm »

[Say Thanks](#) [Reply](#) [Quote](#)

Congratulations !

Yes, bad tantalum capacitors are horrible and most often a reason for failure in an older Agilent / HP instrument. I have seen many of them fail over the years.

In my experience, removing the cover will not change calibration values at all. But may be it is a good idea to have it calibrated.

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### nfmax

Frequent Contributor



Posts: 824

Country: 



#### Re: Agilent 34970A dataloggers!

« Reply #13 on: July 03, 2017, 08:17:33 pm »

[Say Thanks](#) [Reply](#) [Quote](#)

The 34907A which had the failed capacitor has just come back from Keysight calibration. As received, it passed the calibration tests, but for the 100V 1kHz AC voltage test, the indicated value of 100.0932 V was within the measurement uncertainty of the pass limit, so it could not be guaranteed within specification to 95% confidence level. Everything else was OK. Not bad for a unit that had been taken apart & repaired, 4 years after its last calibration. Now everything is adjusted to be in specification.



I took advantage of the Keysight 50% off calibration promotion, so I got a free 12 month warranty on the instrument as well!

Since the offer is good for two instruments per user, I sent my 34401A DMM in as well. I've no idea when that was last calibrated - probably 10 years or more ago. As received, it was well out on most AC volts, DC current, and ohms ranges, though it passed DC voltage. After adjustment, everything is nicely centred & OK. Again, I got a free 12 month warranty.

« Last Edit: July 03, 2017, 09:55:11 pm by nfmaz »

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**HighVoltage**

Super Contributor



Posts: 4230

Country:



**Re: Agilent 34970A dataloggers!**

« Reply #14 on: July 04, 2017, 03:03:16 pm »

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Did you get a full calibration report that you could share here?  
I was also thinking to get my 34972A and one 34901A MuxCard calibrated.  
How much did you pay at the end for the calibration?

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There are 3 kinds of people in this world, those who can count and those who can not.

**nfmaz**

Frequent Contributor



Posts: 824

Country:



**Re: Agilent 34970A dataloggers!**

« Reply #15 on: July 04, 2017, 06:34:53 pm »

Say Thanks Reply Quote

I've got a PDF calibration certificate, with full test results & measurement uncertainties (both before & after adjustment) but as it includes my contact details I'd rather not share it with everyone. It cost me £66.50 + VAT, which is half the standard charge - the 34401A was exactly the same price. Keysight used their own 34901A - I did ask & they would 'calibrate' one if I supplied it (relay contact resistance & temperature sensors only, I think) but at additional charge. Makes sense, as wiring up the module to the calibrators is probably the most labour-intensive part of the process.

« Last Edit: July 05, 2017, 11:01:02 am by nfmaz »

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**nfmaz**

Frequent Contributor



Posts: 824

Country:



**Re: Agilent 34970A dataloggers!**

« Reply #16 on: July 05, 2017, 09:51:38 am »

Say Thanks Reply Quote

I've now 'sanitised' the calibration certificate to remove my contact information (thanks to Libre Office). Attached FYI

1-8987540682-1\_Calibration Report (sanitised).pdf (198.93 kB - downloaded 111 times.)

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