






Part #:	<b>NCD5700x</b>	   
Description:	High-current single channel IGBT drivers with 5 kV galvanic isolation designed for high system efficiency and reliability in high power applications	 <a href="#">Download Datasheet</a>

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Topic: [#3300] Wavetek 7000, the hidden gemstone. (Read 3912 times)

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**[#3300] Wavetek 7000, the hidden gemstone.**

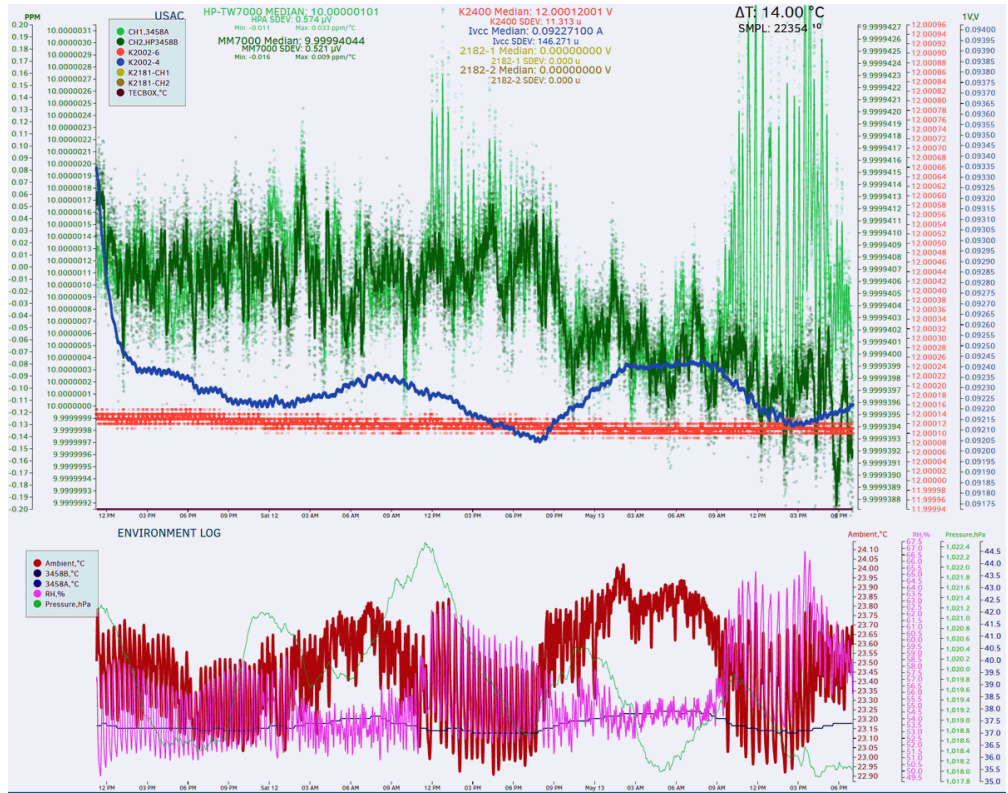
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« on: May 14, 2018, 05:04:11 am »

Yay, post 3300...

As some already know, MM Labs got greedy hands on (not cheap at all) Wavetek 7000 cells, sold recently on ebay.

While I'm working on the article and study of design, here's glimpse on data over last few days:



Two W7000 cells are measured.  
 Cell 1 TW7000 measured by calibrated 3458A in differential to calibrated Fluke 732B (9.99992738 V).  
 Cell 2 MM7000 measured by calibrated K2002 in differential to same Fluke 732B.  
 Environment suboptimal due to ambient temperature oscillation from aircon, but even then output is within +/-0.2 ppm window 🤖.

More to come..

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The following users thanked this post: quarks, edavid, Andreas, cellularmitosis, kj7e

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kj7e  
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Damon Stewart

### Re: [#3300] Wavetek 7000, the hidden gemstone.

« Reply #1 on: May 14, 2018, 06:01:05 am »

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cool!

I think the resolution of the y-axis (voltage) is too small to read. HP3458A hates air condition... for sure. at least mine does. 🤖

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### Re: [#3300] Wavetek 7000, the hidden gemstone.

« Reply #2 on: May 14, 2018, 03:57:27 pm »

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When I was a kid, I would read the old HP catalogs cover to cover. I remember seeing in the 1969 catalog how they kept the Cal Lab room held to + or - .03deg C, IIRC they used water pipes in the walls and floor to regulate temp. Think I was 9 when I first saw that, it amazed me then and still does now.



The DC Room in HP's Palo Alto Standards Laboratory has temperature controlled within  $\pm 0.03^{\circ}\text{C}$ .

Screen Shot 2018-05-14 at 8.48.39 AM.png (962.55 kB, 1846x814 - viewed 674 times.)

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**quarks**

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**Re: [#3300] Wavetek 7000, the hidden gemstone.**

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« Reply #3 on: May 14, 2018, 05:24:17 pm »

looking forward for more to come

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**Pipelie**

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**Re: [#3300] Wavetek 7000, the hidden gemstone.**

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« Reply #4 on: May 16, 2018, 06:00:21 am »

Quote from: kj7e on May 14, 2018, 03:57:27 pm

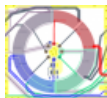
When I was a kid, I would read the old HP catalogs cover to cover. I remember seeing in the 1969 catalog how they kept the Cal Lab room held to + or - .03deg C, IIRC they used water pipes in the walls and floor to regulate temp. Think I was 9 when I first saw that, it amazed me then and still does now.

I think that's how we do in the north of China in winter. 😊

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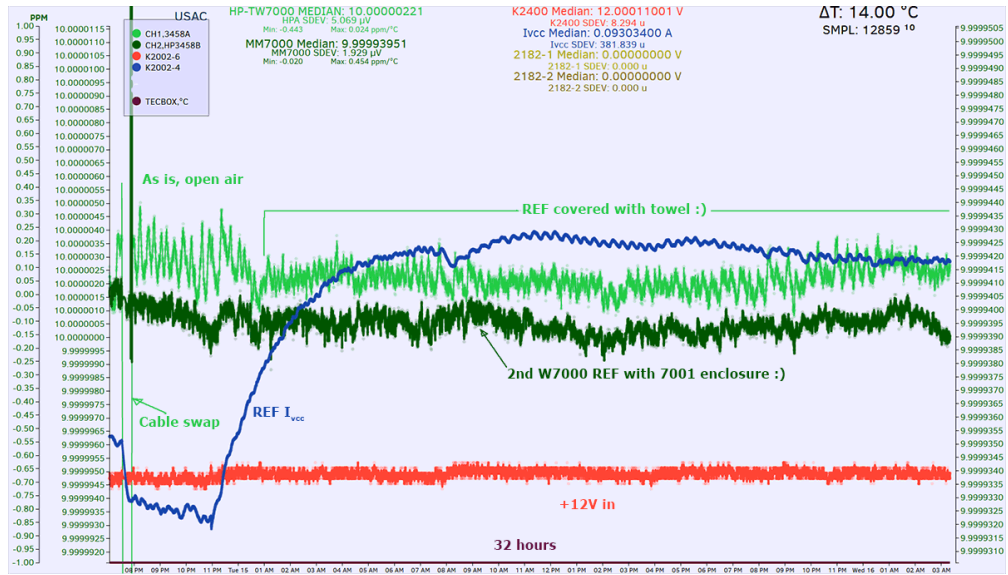


**Re: [#3300] Wavetek 7000, the hidden gemstone.**

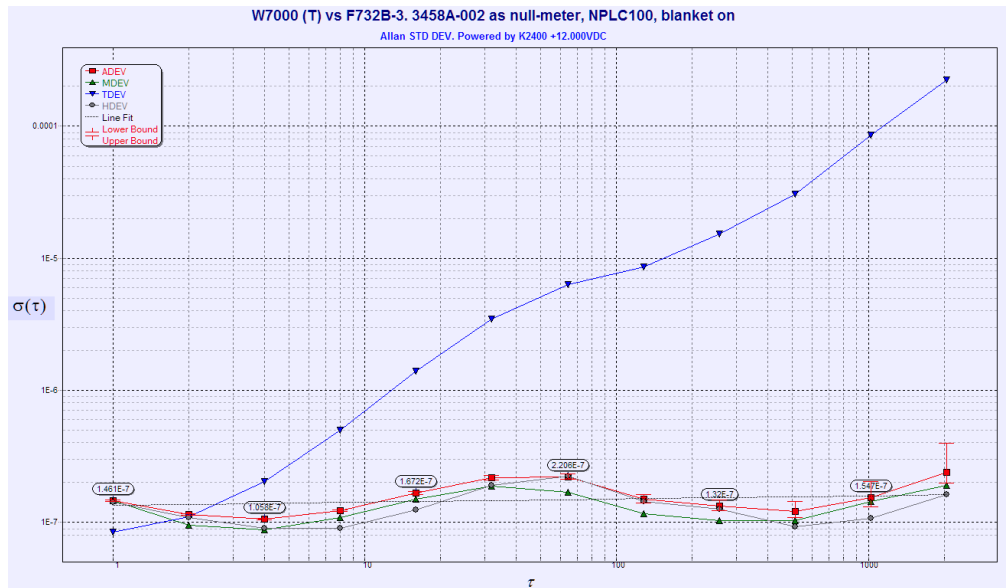
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« Reply #5 on: May 16, 2018, 09:45:14 am »

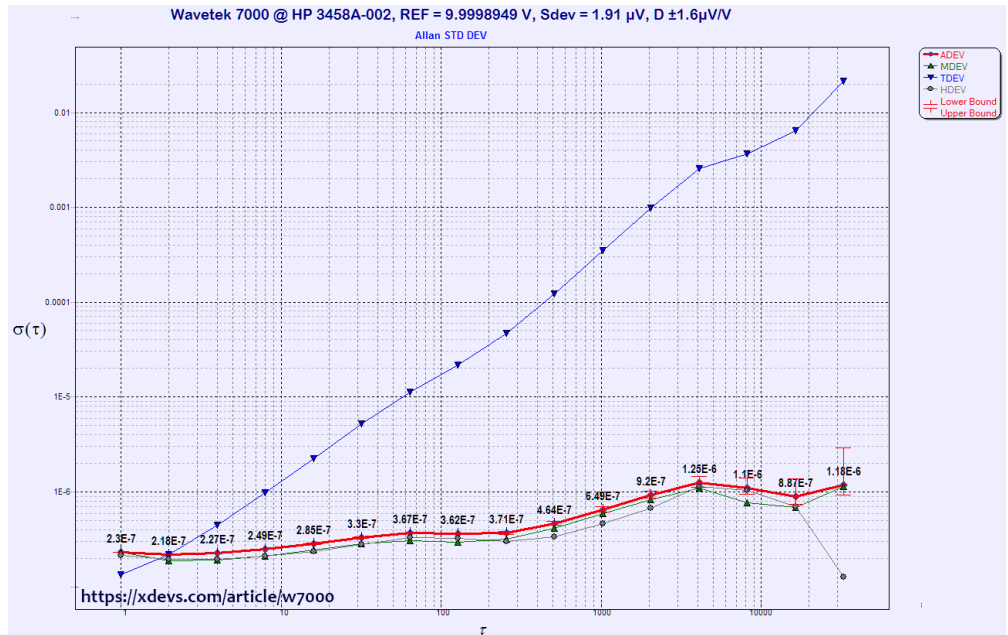
More ppm hunting committed.



Allan deviation plot on data also shows that at short observation time  $\tau$ , the ADEV is higher due to reference and meter noise. At longer  $\tau$ , instability slightly decrease because the noise averages out. At still longer  $\tau$ , the ADEV creep up again, suggesting that the meter stability is gradually drifting over time and impact from other factors.



Here was result with ADEV of same 3458-002 measuring reference directly on 10V range.



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### Re: [#3300] Wavetek 7000, the hidden gemstone.

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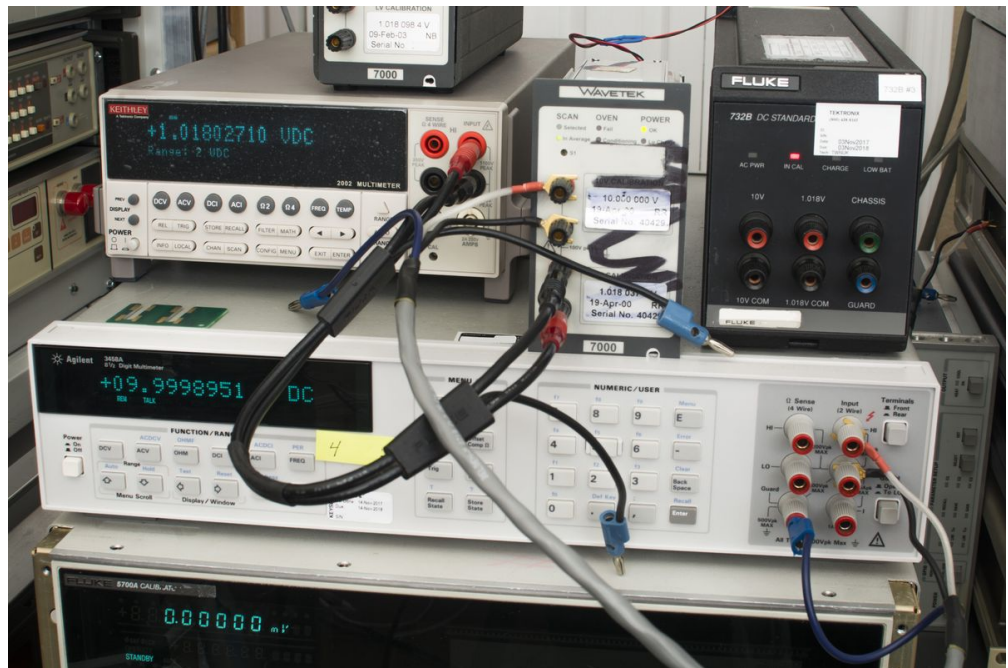
« Reply #6 on: June 25, 2018, 03:56:44 pm »

Completing expensive inner-circle USA cal club round for 2018, box with my Wavetek 7000 is on the way to me, yay 😄<sup>z2z</sup>

Before thing arrives, I can share the following photos taken during the calibration in May 2018.

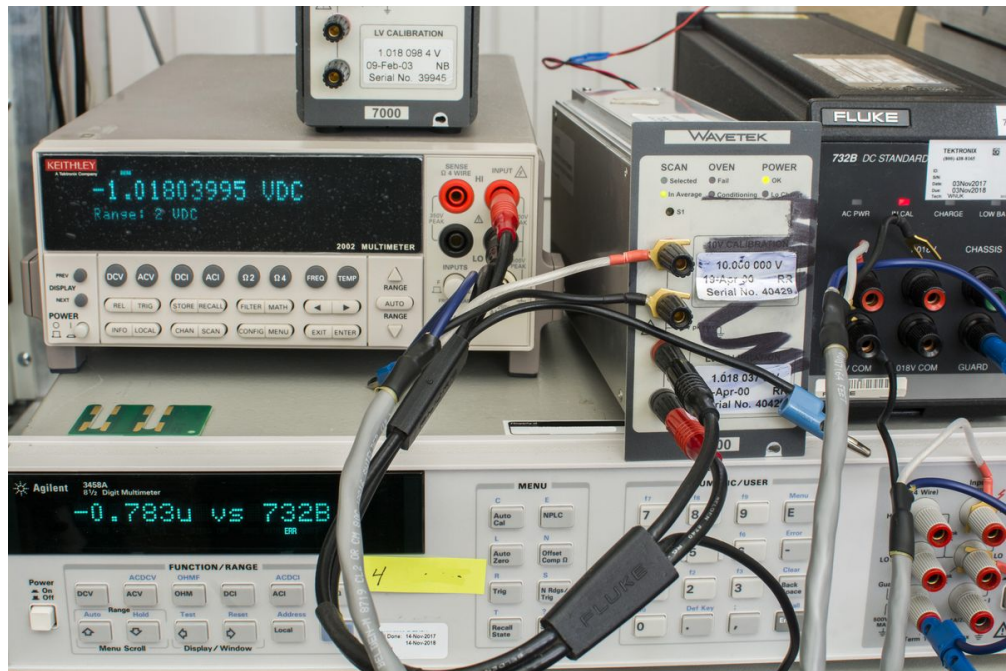
Since 7000 has no history or calibration certificate, decision to adjust it was made.

Prior to adjustment value was measured on direct DCV range, with in-cal 3458A/002 (KS Loveland annual service).



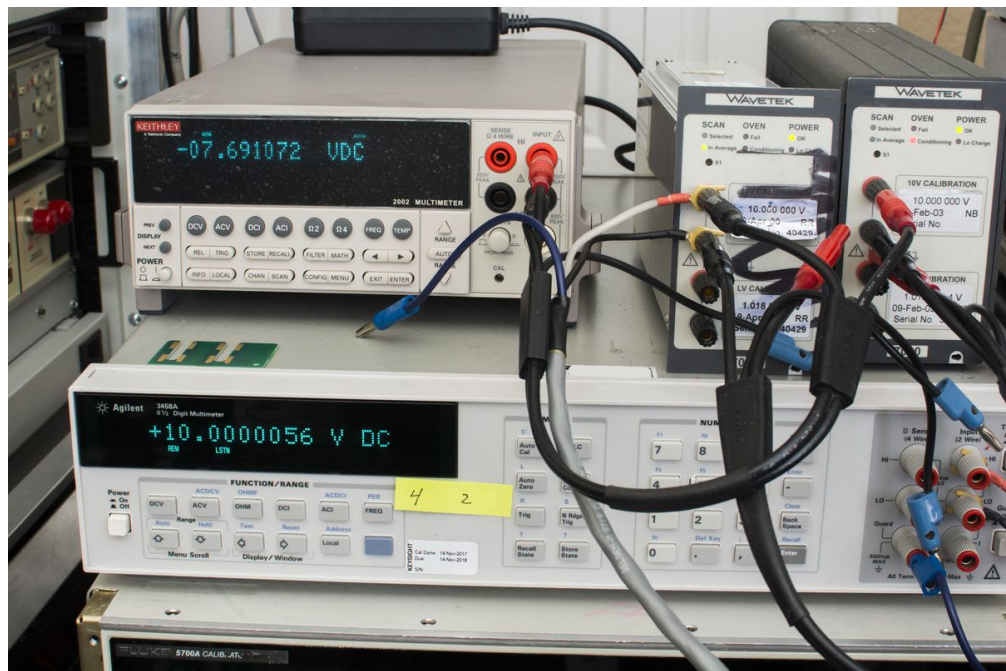
After this, Wavetek 7000 was connected opposite to in-cal Fluke 732B, which has assigned value with uncertainty 0.33ppm and accumulated few calibrations to establish predicted value at the time of W7000 cal.

732B value is expected to be 9.99992738 VDC.



Wavetek 7000 was adjusted 78.3  $\mu$ V higher than 732B, to result new calibrated value **+10.00000568** VDC. (ignore incorrect multiplier on VFD).

Resulting direct measurement: **+10.0000056** VDC, which is spot on.



I plan to calibrate some of my LTZ references , one 3458 and one 2002 to this Wavetek, and then ship same 2002 to calibration, to increase confidence that DC Volt import this year for my lab is good. Once all is confirmed, this will be used as my primary reference, together with my zombie 792X battery-backed LTZ FX 10V-reference box.

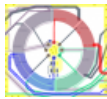
« Last Edit: June 25, 2018, 04:00:30 pm by TiN »

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**Re: [#3300] Wavetek 7000, the hidden gemstone.**

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« Reply #7 on: July 03, 2018, 12:01:57 pm »

Another day, another Doug.

W7000 finally delivered to me today. Now it's going thru it's conditioning thing. Once it finishes conditioning (that takes about 8.5 hours) logging will start in both direct

measurement and differential to my 792X LTZ-box (large scary box on top of 3458As). 🤖



You can see K2400 powering the unit on backstage right. Keep heatsources like SMU far from precision stuff 😊

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doktor pyta

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**Re: [#3300] Wavetek 7000, the hidden gemstone.**

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« Reply #8 on: December 08, 2018, 05:09:17 pm »

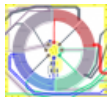
TiN,  
can we expect photos of the PCBs of this rare device?  
Existing ones don't satisfy my curiosity...

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<http://rfscientific.eu/our-measurement-laboratory>

TiN

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**Re: [#3300] Wavetek 7000, the hidden gemstone.**

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« Reply #9 on: December 08, 2018, 06:03:29 pm »

Yes, you can expect photos and schematics. It's just too much distractions here, sorry... Silly equipment from ebay keep coming and coming... 🤖

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**Re: [#3300] Wavetek 7000, the hidden gemstone.**

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« Reply #10 on: May 19, 2019, 03:42:48 pm »

I pretty much appreciate tear down pictures. This unit is really interesting and with the upgraded battery pack with 1700mAh instead of 850mAh and thus 30h instead of previously 16h together with it's low power consumption <1W this is the perfect candidate by now for hot shipping. So Illya, you might want to put the teardown in the upper place of the priority list?  
I'd also like to know more about the recovery methode, especially the details not covered by the



patent or the paper. Would be great. A live stream on that is also welcome 😊

-branadic-

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Fluke 8050A | Prema 5000 | Prema 5017 SC | Advantest R6581D | GenRad 1434-G | Datron 4000A | Tek 2465A | VNWA2.x with TCXO upgrade and access to: Keysight 3458A, Keithley 2002, Prema 5017 SC, 34401A, 34410A, Keithley 2182A, HDO6054, Keysight 53230A and other goodies at work

**TiN**

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**Re: [#3300] Wavetek 7000, the hidden gemstone.**

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« Reply #11 on: May 19, 2019, 06:01:18 pm »

Okay, I'll try to move it up, sorry.

I'm arranging my 732 calibration versus new SI Volt (Happy metrology day everyone!), so I want to close up 7000 as add it into my current 24/7 DC ref bank as 4th reference. So this has to be done earlier than later.

Some of pictures are already taken: [here](#)

« Last Edit: May 19, 2019, 06:07:34 pm by TiN »

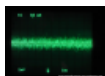
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**branadic**

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**Re: [#3300] Wavetek 7000, the hidden gemstone.**

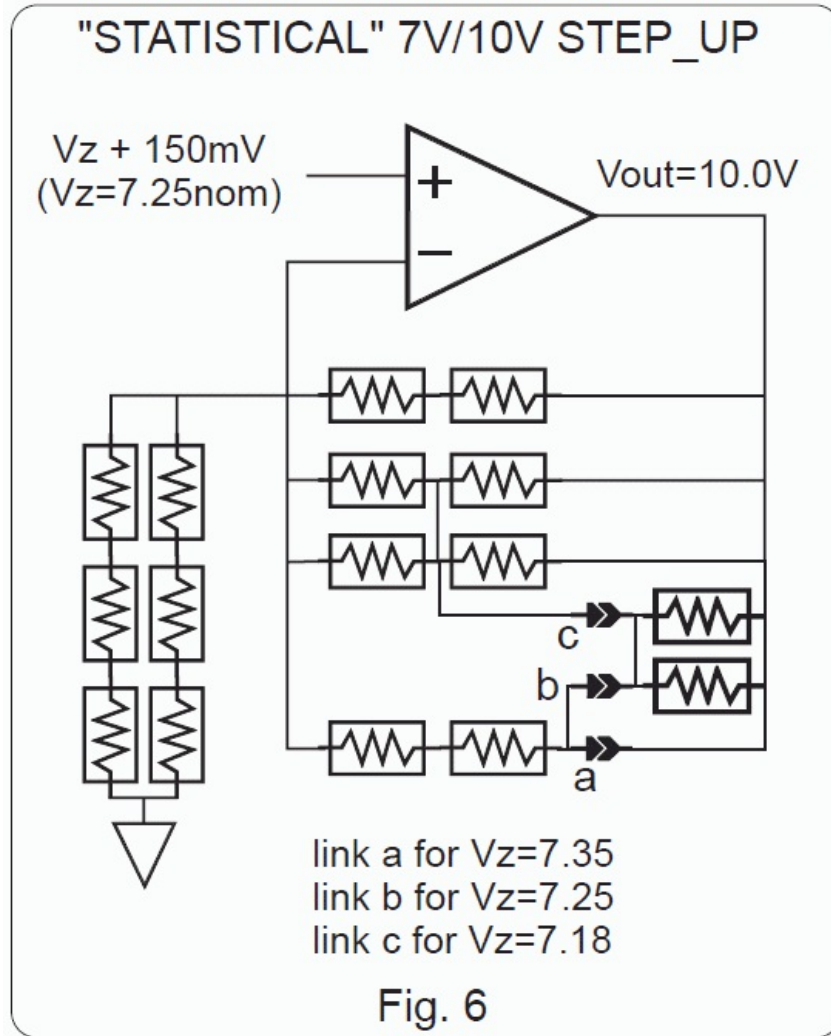
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« Reply #12 on: May 26, 2019, 01:50:15 pm »

So I was looking at the pictures and do wonder a bit. Around LTZ they use TDP16031000 and TDP16031002 resistor network as well as a 30k foil resistor. Can someone explain how they are arranged to set temperature? Is 100R network to form precision 120R resistor? Furthermore they have 3x TDP16031002 to form 7V/10V boost. Fluke shows, that they need 16 resistors to do that, so third network must be wired in a different fashion, but I can't figure out how. Has someone a schematic of Wavetek/Fluke 7000 or an idea?

-branadic-





7000.jpg (89.31 kB, 549x678 - viewed 185 times.)

« Last Edit: May 26, 2019, 02:55:32 pm by branadic »

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**Re: [#3300] Wavetek 7000, the hidden gemstone.**

Say Thanks

Reply

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« Reply #13 on: June 09, 2019, 11:20:58 pm »

Reverse engineered front panel pcb by the pictures available on <https://doc.xdevs.com/docs/Wavetek/7000/> and simplified the resistor network arrangement.

-branadic-



Front PCB.png (112.68 kB, 9202x6262 - viewed 67 times.)

« Last Edit: June 15, 2019, 01:27:00 pm by branadic »

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**Re: [#3300] Wavetek 7000, the hidden gemstone.**

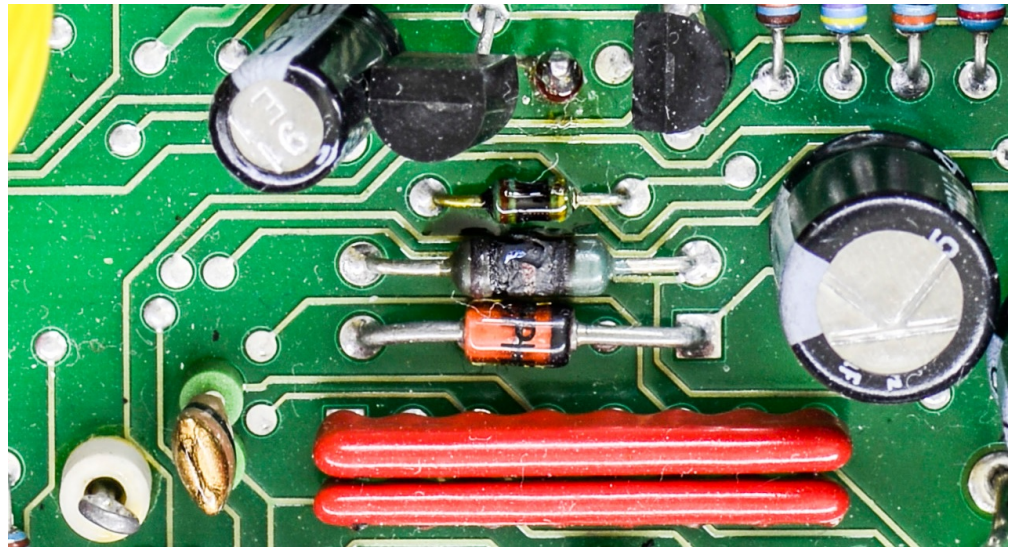
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« Reply #14 on: June 10, 2019, 01:22:30 pm »

Tin, maybe I missed some thread but have You seen this burned resistor (pic) ?



from\_7000\_mtop.jpg (352.21 kB, 1276x693 - viewed 183 times.)

« Last Edit: June 10, 2019, 01:26:59 pm by doktor pyta »

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<http://rfsscientific.eu/our-measurement-laboratory>

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**Re: [#3300] Wavetek 7000, the hidden gemstone.**

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« Reply #15 on: June 10, 2019, 01:47:26 pm »

😊 Yes, already fixed that. Onboard battery pack charger / power supply escaped some smoke.

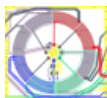
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**Re: [#3300] Wavetek 7000, the hidden gemstone.**

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« Reply #16 on: June 30, 2019, 02:46:40 am »

In case somebody want to dig into reverse-engineering LTZ cell, here's [spaghetti-schematics](#) loosely based on physical placement.

Will need to check all nodes again and redraw it all into human readable shape.

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