



Ken Eckert <eckertkp@gmail.com>

[TekScopes] PS 5010 troubleshooting (no negative, erratical display)

7 messages

Martin <musaeum@arcor.de>
Reply-To: TekScopes@groups.io
To: TekScopes@groups.io

Mon, Mar 15, 2021 at 12:37 PM

Hi all,

I just started to troubleshoot my PS5010. Symptoms are a missing negative output and an erratic display when I switch on the outputs with the on/off key. The supply starts up fine, 5V and plus supply is working as it should. Negative supply can be dialed in as I wish, the relay is clicking when I increase current limit. But it does not give any output at all.

When I switch on the supplies with the on/off key, more often than not and when it is not selected, all the numbers and LEDs of the positive supply go off, then go back on a little later and randomly alternate with the display of the negative supply. When the supplies are in off-mode the display returns to normal.

If anybody has an idea of what that could mean I would be glad to hear about!

cheers
Martin

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Martin <musaeum@arcor.de>
Reply-To: TekScopes@groups.io
To: TekScopes@groups.io

Mon, Mar 15, 2021 at 12:47 PM

First update: I discovered the switch that allows to select between front and rear panel... it has contact problems. I toggled it many times until the negative supply came up. Now it seems to work as it should, too.

Remains the erratic display...

cheers
Martin

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Martin <musaeum@arcor.de>
Reply-To: TekScopes@groups.io
To: TekScopes@groups.io

Mon, Mar 15, 2021 at 1:20 PM

Second update: after further RTFM it seems - that blanking of the display occurs when "the supply is neither in the constant current or constant voltage mode. This happens when the output is foldback current limited or driven into overload by an external source.

Interesting. I have these blinking displays although there is only a DMM connected to them. The DMM displays the correct voltage (with less than 1% deviation). So no overcurrent and no external source...

TBC - cheers
Martin

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Martin <musaeum@arcor.de>
Reply-To: TekScopes@groups.io
To: TekScopes@groups.io

Wed, Mar 17, 2021 at 7:06 AM

Third update: I made some experiments and found out that, once I let some current flow (200mA), the blinking stops and the display is steady.

Then I tested the module in may "Rack"-TM5006 frame, and to my surprise the display was fine there. Back into the other frame it.... still.... was.... fine!!

I decided to do some alignments and put the module back in the racked frame, this time in the high-power compartment at the right. Well, the display started acting up again, and remained so in both frames! Suspecting the hi-power switch on the module I did the same as I did to the front-back-switch, a lot of actuations. And indeed, that cured the fault.

So my conclusions are:

- the PS5010 is well built and rather precise power supply... :-)
- the linear switches used in many Tek equipments are prone to contact problems that can have all sorts side effects. Actuating all these switches should be the first thing to do when troubleshooting.

I didn't resort to cleaning the switches, just actuating seems to do the job, at least for a good while. If the supply acts up again I know what to do.

cheers
Martin

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ditter2 via groups.io <ditter2@yahoo.com@groups.io>
Reply-To: TekScopes@groups.io
To: TekScopes@groups.io

Wed, Mar 17, 2021 at 10:24 PM

Hello Martin,

I designed the analog circuitry in the PS5010, although that was nearly 45 years ago...

The front/rear switch not only selects the output terminals, but the remote sense inputs for voltage regulation as well. So if the switch is intermittent, you may have one of the sense inputs open, which would explain the lack of regulation.

The power supply goes through voltage and current ramps when the output is cycled to protect the relay from damage in fault conditions. The loop balance monitors are not monitored during this ramp cycle.

I have found those switches commonly used in TM500/5000 and 5100 series remain reliable if operated in a very clean environment, but have problems when there is dust in the air. They are not sealed, and lubricated with grease. Dust will get into the grease and make its way into the contact surface, which causes them to become intermittent. Also, the grease cakes up when it gets dirty, making the switch spring return not operational.

Steve

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Martin <musaeum@arcor.de>
Reply-To: TekScopes@groups.io
To: TekScopes@groups.io

Thu, Mar 18, 2021 at 1:14 AM

Hi Steve,

thanks for your insights. I did understand what you said about the front/rear switch, but I could not altogether follow what you said about the voltage and current ramps. In particular, the error-condition (i.e. erratical blinking of pos and neg supply), when present, was permanent. It only disappeared once I got a certain amount of current flowing. And finally it turned out it was related somehow to the hi/lo switch.

Realigning the supplies was straightforward and easy to do... well designed, as I said. Currently I have two PS5004 precision supplies in the frame. Both turned out OK, so I started the alignment. But theres a weird thing, something I've never seen before: a coarse and fine alignment pot that is realigned several times on later steps! Usually a pot is aligned and you don't touch it anymore. Do you know anything about that module, too?

cheers
Martin

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ditter2 via groups.io <ditter2@yahoo.com@groups.io>
Reply-To: TekScopes@groups.io
To: TekScopes@groups.io

Sat, Mar 20, 2021 at 4:25 PM

Hello Martin,

On the PS5010, my reference to the voltage and current ramping is the programming that takes place in the current and voltage limit DACs on a user request through front panel ON/OFF switch, or through remote control. This action takes place in both ON > OFF and OFF > ON operations. If you are monitoring the DAC outputs with a scope when the Output is toggled, you will see this programming action. It is to protect the output relay. Because the supply will normally go into CC mode during this transition, the software does not monitor the loop status during this time, to prevent reporting of the mode change.

If you need to draw a small amount of current to get regulation, then the minimum load is not sufficient to keep the output regulated. This could be either in the supply itself, or possibly (??) C-E leakage around the pass transistor in the mainframe. That would explain different amounts of the effect in different mainframe slots.

For the PS5004 – I designed all of it. For some fun, get a schematic and quickly try to find the precision 16 bit DAC needed to support the output resolution. If you are looking for a large “brick”, you won't find it. 16 bit DACs were available at the time, but cost about 2.5 times the proposed manufacturing cost target for the entire built and tested instrument. The DAC I designed is a gated charge pump, using simple digital counter logic to set the duty factor of the current gate clock. BTW, Sony independently came up with the same idea for the 16 bit DACs needed in CD players

about the same time.

I believe the part of the cal procedure you are referring to asks you to set output V to max, then back down one count (If my memory is correct – that was designed 40 years ago.) What you are doing is setting the full scale of the fine span of the DAC. Rather than take the full 16 bit resolution in one span, there are two charge pumps, scaled – I believe 200 counts (Each is 8 bits, the fine is 1/200th the coarse. They don't map 1:1 with the digital pot coarse-fine range). Since calibration requires use of the digital knobs to set ranges, and the display is a volt meter measuring the measured output (not the programmed value as in the PS5010), the only way to set known values with the knob is at the extremes. So "0" is easy to set – turn both knobs to the left several turns and you can calibrate out the offsets in the system. Turn either or both knobs to the right several turns and you are at full scale – it is now possible to set the full span gain of the coarse current pump. Turning only the fine control down one "click" reduces the coarse stage DAC count by 1, and sets the fine DAC to is max scale. Now the user can calibrate the full scale of the fine . The order might not be the same as what I wrote in the cal procedure 40 years ago, but the process is the same.

Steve

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