

Further investigation of the 25Hz fan control issue on the HQ2250XCM4P unit (Multiplus II 48/5000/70-50 230V) purchased in August 2023.

Thanks to the message here in community from Matthijs Vader, the CEO of Victron Energy, I have received the retrofit kit SPR00090 from my distributor. Thank you Panda Solar as well.

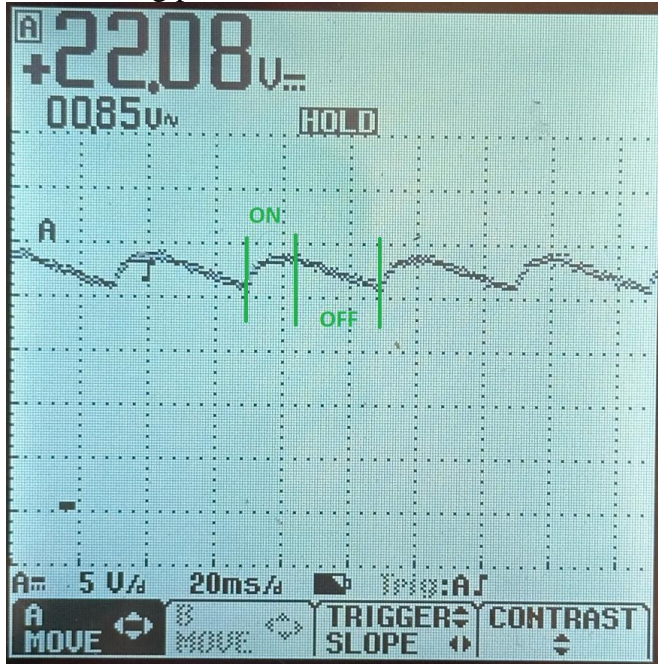
As the beginning of the story, in August 2023 I have purchased two units, those serial numbers start with HQ2250 (production date end of 2022). The cooling fan in one unit runs smooth at low RPM as it should (left picture), but in the other unit the fan runs terrible at low RPM thanks to the 25Hz PMW control unsolved (right picture). Both voltage traces are measured directly across the fan connector:



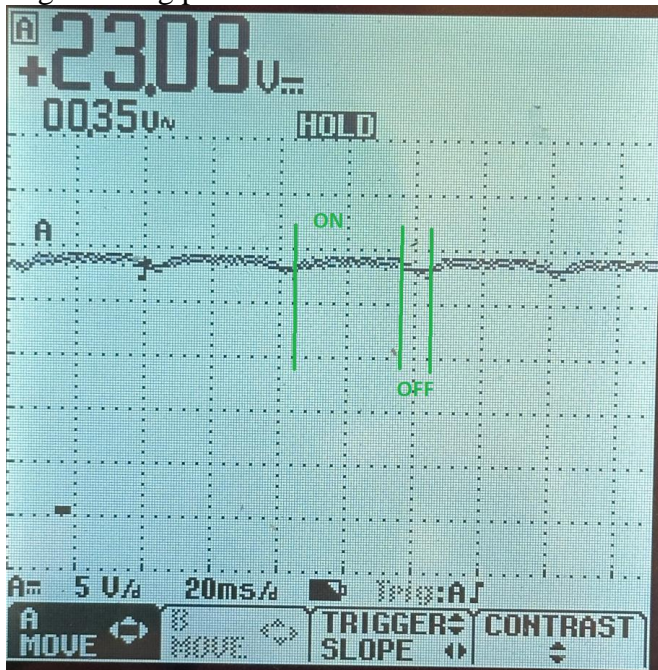
Unfortunately, connecting the original retrofit kit between the control PCB and the cooling fan did not solve the issue, but has made it even worse. Below are the answers why.

First, look on these two pictures (low cooling power and high cooling power), showing the voltage traces at the input connector of the retrofit kit, when it is installed:

Low cooling power:



High cooling power:

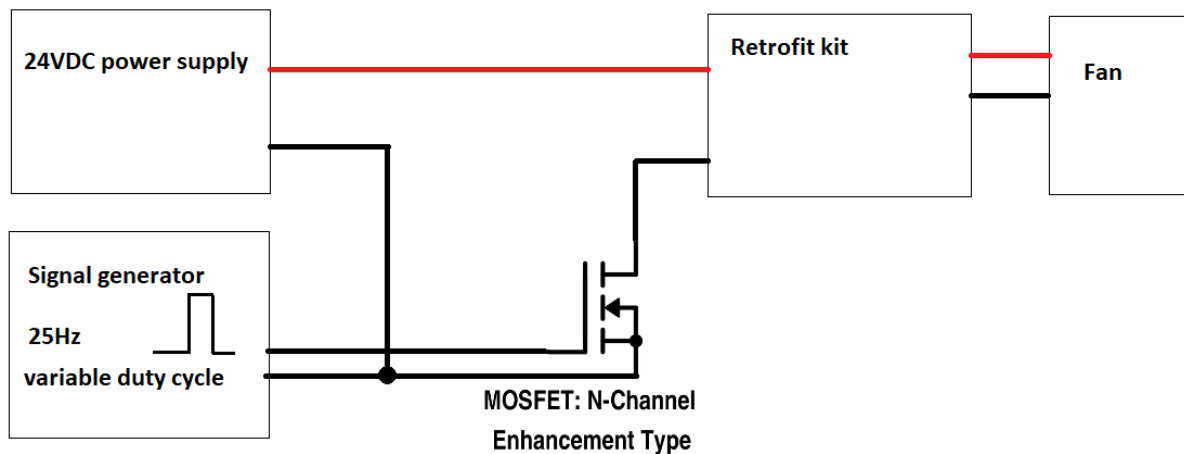


It is clear that the information about the PWM duty cycle is lost, and retrofit kit cannot “see the difference”.

As the result, the fan starts from zero to full speed, the “low RPM mode” is not possible at all. The voltage at the output connector of the retrofit kit is close to the maximum in both cases.

May be it is something wrong with the retrofit kit?
How it is designed to work?

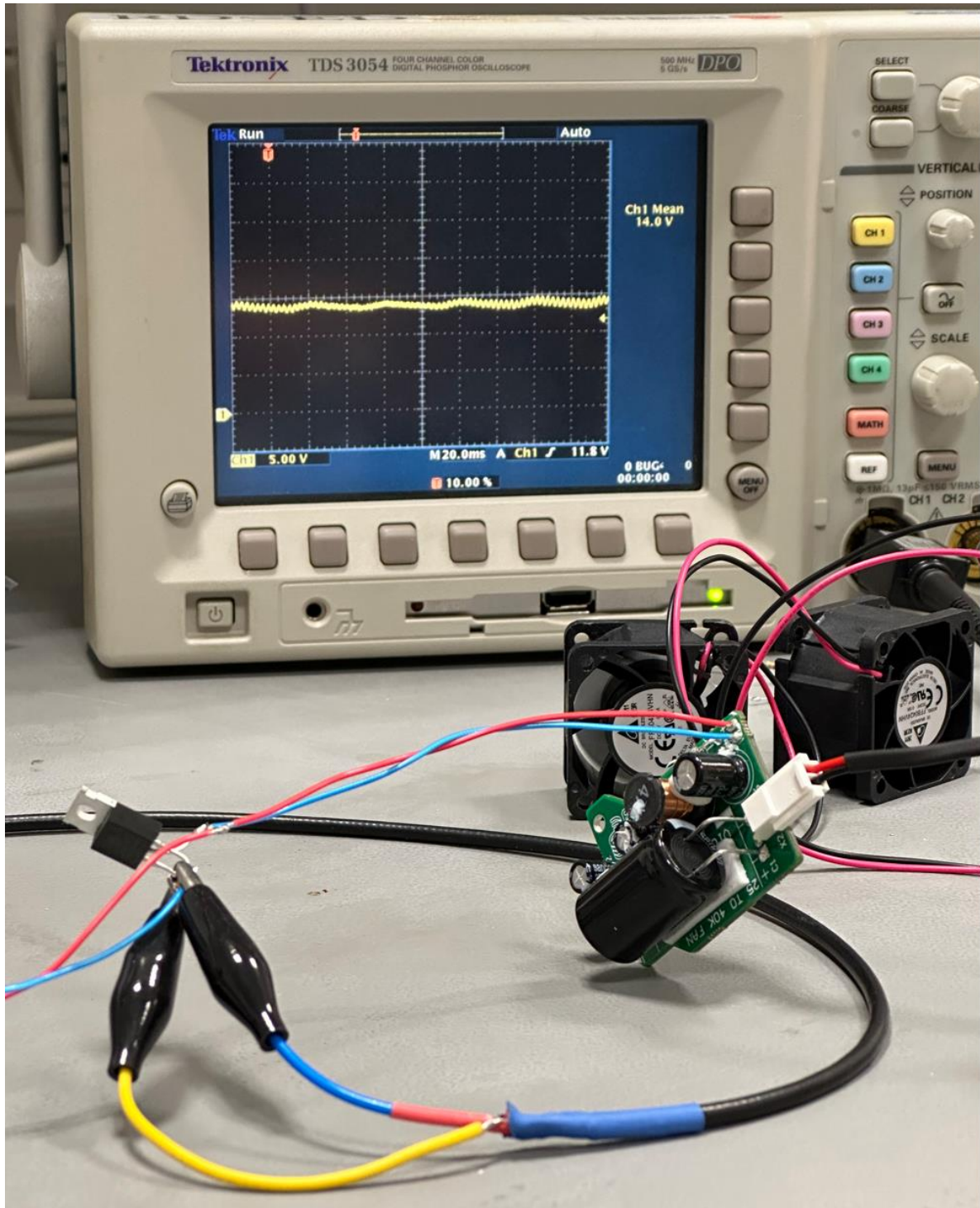
To answer this question I have built a simple test setup in my lab:



I do not have a Multiplus device build before HQ2224, and I have assumed that its output stage, controlling the fan, should consist of a simple top-side or bottom-side Mosfet.

So, I have replicated it as you can see on the schematic above.

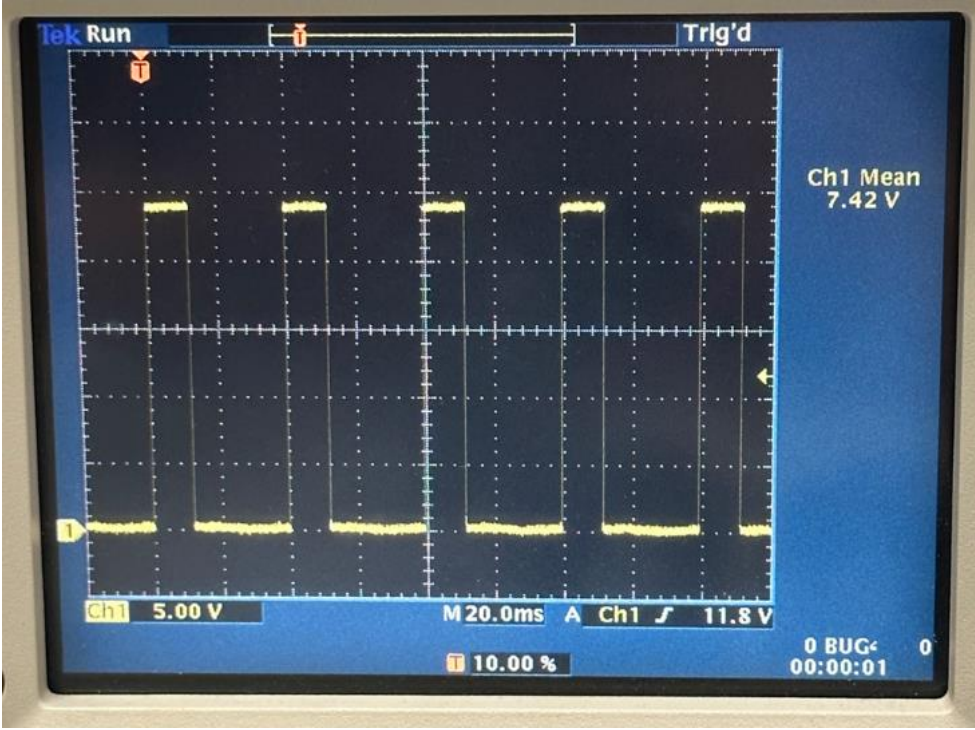
As a load, I have connected two small fans 24V 0.15A each, their total consumption is very close to what the original Jamicon fan has:



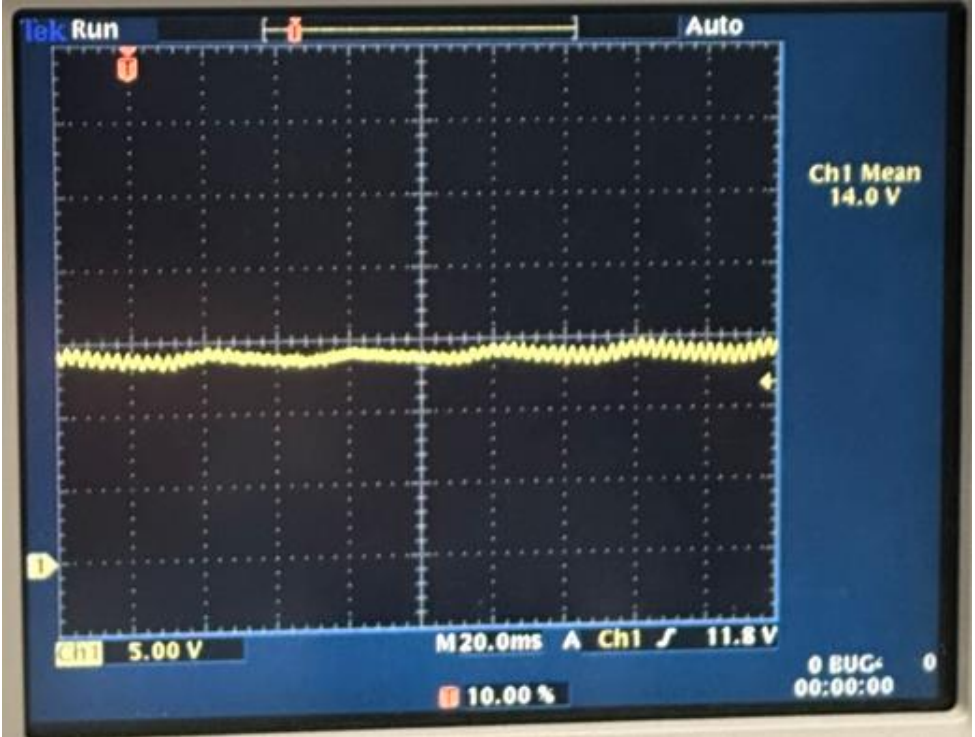
By changing the duty cycle of my signal generator, I can simulate the behavior of the PWM output stage at 25Hz and different requested cooling capacities.

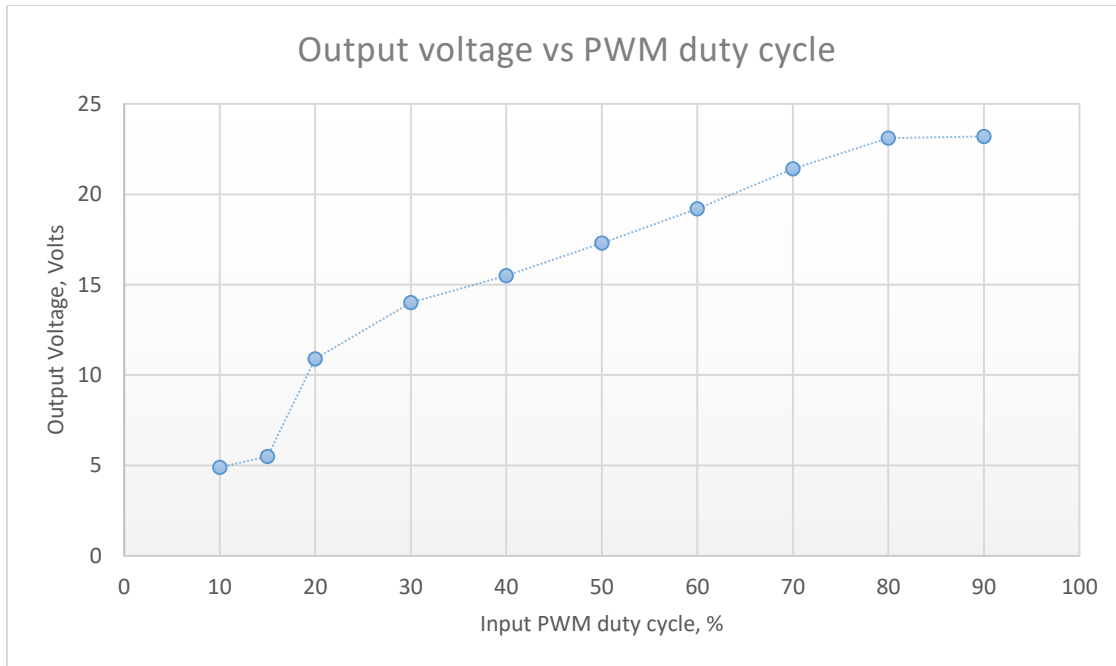
Next pictures show the input and the output of the retrofit kit respectively (30% duty cycle PWM):

Input:



Output:



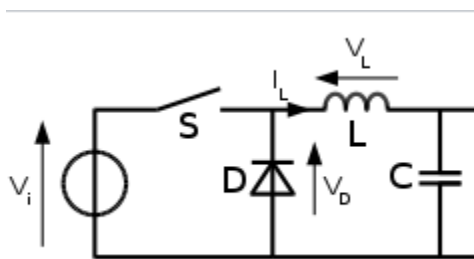


I have measured the output voltage as the function of the input PWM duty cycle, and as you can see **the retrofit kit works as it should work.**

The problem why it does not work in my device is very simple:

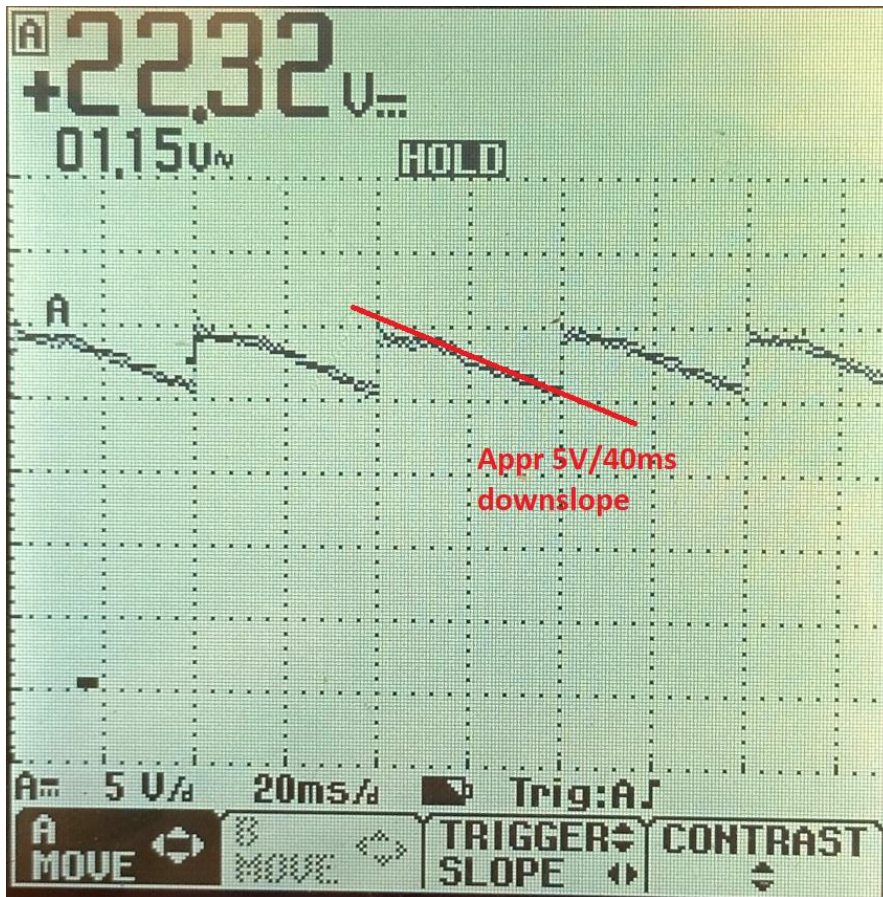
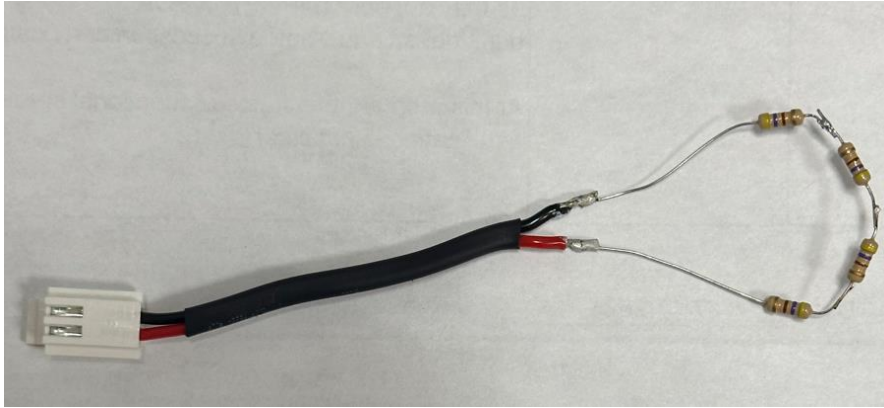
In 2022 Victron has changed the design of the output stage controlling the fan.

I assume it is now something like a high frequency dc/dc buck stage, having a capacitance at the output:



I do not want do disassemble my unit to confirm that, as it runs and it is under warranty. This is just my assumption.

In order to estimate this capacitance I have connected a 1.88K resistor instead of the fan directly to the fan connector inside the Multiplus for a couple of minutes at light load conditions:



A simple formula $dU/dt = I/C$ gives the value of the capacitance about $100\mu\text{F}$. This capacitor at the output of the fan controlling stage makes it impossible for the retrofit kit to work correctly, because the retrofit kit needs to “see” full amplitude of the 25 Hz PWM signal.

Again, I did compare the hardware of both my units and could not find any visible differences in the PCBoards.

This is a short summary of my findings:

There are at least 3 types of the Multiplus devices in regard to the fan control output stage:

1. “Old” units build before HQ2224, having 25Hz PWM output stage, the retrofit kit will help.
2. “New” units build after HQ2224, having high frequency DC/DC buck stage (my personal assumption), they do not require retrofit kit if properly configured at the factory, as you can see on the very first picture dedicated to the HQ2250EY7AN unit.
3. “New” units build after HQ2224, having the same hardware as type 2 (because I do not see any difference in two my units), but the output stage is still controlled by the 25Hz signal, **installing the retrofit kit will make the situation even worse, as the “low RPM mode” will be lost.**

Now the questions to Victron Energy:

How many units of type 3 have been build and sold?

Can you trace them with the serial numbers?

What can you offer to the customers having these type 3 units running in the field in order to solve terrible 25Hz fan noise issue at low RPM?