

Typhoon H – GPS „Acquiring“-problem

In the last few months in several drone forums Typhoon H users claim that they cannot start motors anymore. The GPS status remains in „Acquiring“ all the time. Change of GPS module did not help, change of flight controller (MCU board) seems to be the only solution. Often users reported that the problem occurred when they didn't use the drone for a month. But there are also cases where the problem appears during normal use.

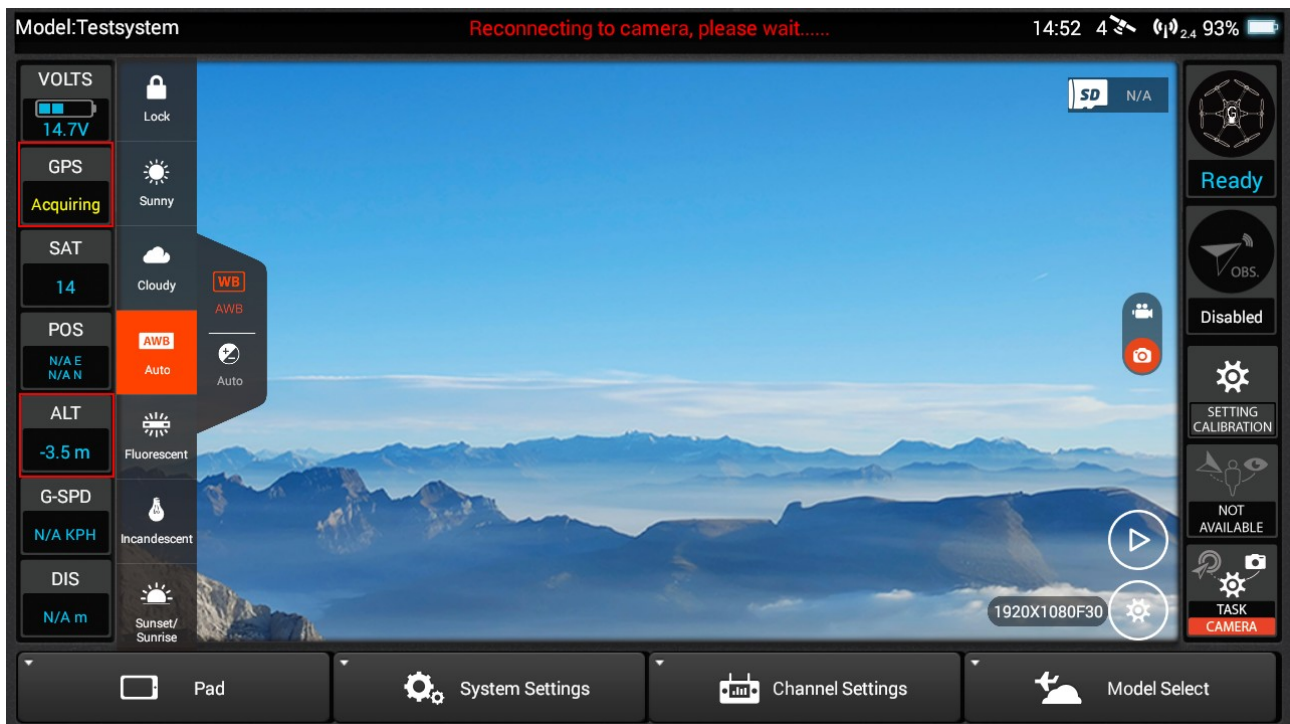
In this case there are strong indications that the problem starts with a behavior that the drone resists to land and could not be brought down. This is also a known fault that was reported lately.

I followed some of those fault reports in the forums, checked flight log data and at last got some MCU boards from generous donors. I could reproduce the „Acquiring“-problem.

The four main symptoms are:

1. GPS status stuck in „Acquiring“. The drone cannot be armed anymore.
2. Motors will also not start when GPS was switched off. This unusual behavior can be used as a quick test to identify the fault.
3. Altitude on ST16 shows some meters below zero and did not initialize. The pressure sensor's height estimate is OK, near zero at this time.
4. The „Yaw“ output in the GUI is slowly rotating while sensor values from accelerometer and gyroscope are also plausible and do not change constantly in one direction as Yaw is doing.

Wrong GPS status and Altitude value:

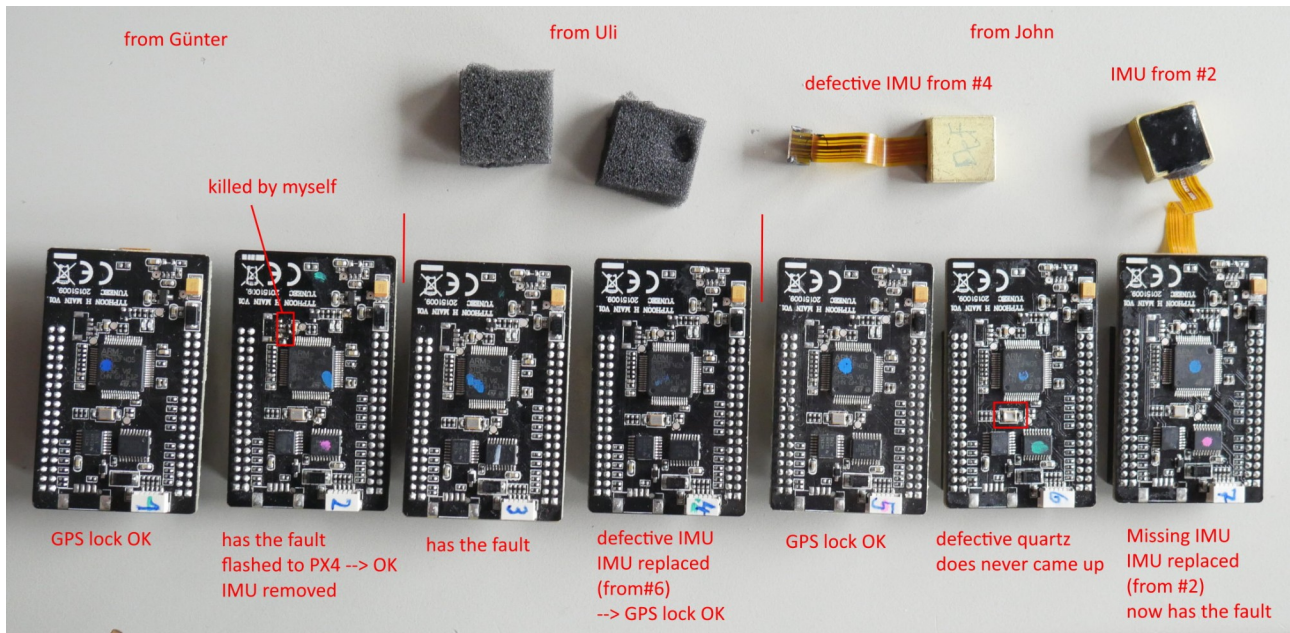


Yaw rotation:

https://1drv.ms/v/s!AtiK_DeOGL5sir0A2Rbx7y7Zq4-SHg?e=UTRLzF

In some cases the problem could be overcome by downgrading the flight controller firmware to an old version. For the MCU-boards where I could reproduce the fault this didn't work.

I investigated all seven MCU-boards that I got.



No 1 was fine and got GPS lock soon. It was used to compare with a good one.

No 2 had the fault with all four symptoms mentioned above. Flashing firmware back and forth did not help. Put it into the freezer and brought it down to -10°C . Now the Altitude shown on the ST16 was -15m . It came up to -4m while the board warmed up but never reached zero.

Now the board was flashed with customized PX4 autopilot (Thunderbird firmware from Toni Rosendahl). It comes up, could be connected to QGroundControl. After proper calibration it could be armed and all looks plausible. Due to poor test system not flight test was possible. But during soldering on the board I have destroyed a pull-up resistor. So, this board is crap now.

No 3 had the fault with all four symptoms mentioned above and has it still. Used for further experiments.

No 4 came with a defective IMU. Fault was reported by sound and red LED.

No 5 got GPS lock and looks OK so far.

No 6 came with mechanical destroyed quartz oscillator, does never came up.

No 7 came without IMU but came up and showed the same error indication as No 4.

At this point I decided to exchange IMU modules. MCU board No 4 got the IMU from dead board No 6. As result it came up and got GPS lock. This board looks good now.

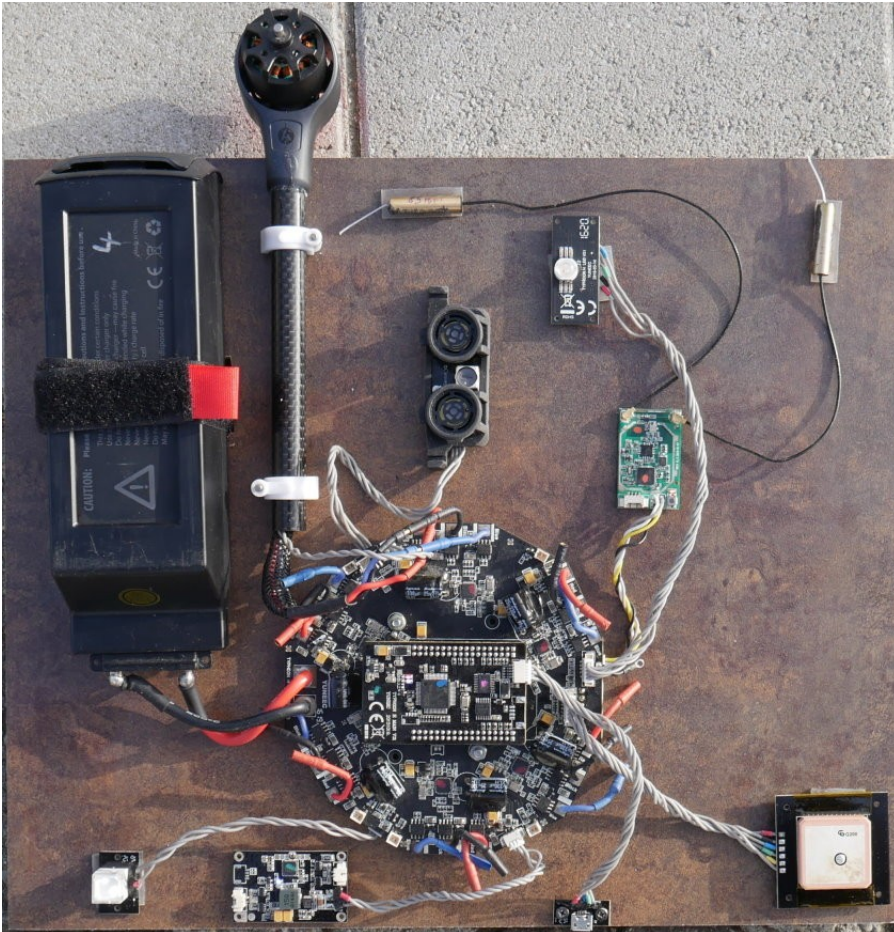
Then I replaced the IMU on MCU No7 with the one from No2. Now the fault with all four typically symptoms was moved to this MCU board. It looks like the problems travels with the IMU module. To verify this I have exchanged the IMU with the one from No 4. Now it got GPS lock and works. Change back brings the fault back.

I'm pretty sure that **the IMU is the reason for the faulty behavior**. I think there is a charge of IMU modules that aging and run out of some threshold in the firmware. As result the EKF output for altitude and NED orientation is implausible and the pre-flight check fails.

This assumption is supported by some observations I did during my tests. When IMU was changed it appears that accelerometer calibration could not level horizon. Also massive compass warnings occur. This could be solved by firmware downgrade and stay solved after upgrade to latest version. Same was reported by some user that could get GPS lock after downgrade firmware. For the faulty modules downgrade did not help.

Final status: Two destroyed MCU-boards, two to reproduce the fault and three that seem to be good.

The “good-ones” are only checked in the test system.



I never did a compass calibration with the board except the Thunderbird. Flight test are still pending to make sure it could be used in a drone.

Conclusion: Fault is probably caused by aged IMU module.

Solution:

- In rare cases GPS lock came after very long time (~4h) and faster at next try.
- Sometimes it helps to downgrade the flight controller firmware. Not in all cases an upgrade to latest firmware is successful after that, but sometimes this is possible.
- **The ultimate solution is to replace the flight controller module (MCU-board).**

Proper accelerometer and compass calibration is always needed before and during trouble shooting.