Sun Sensors Update

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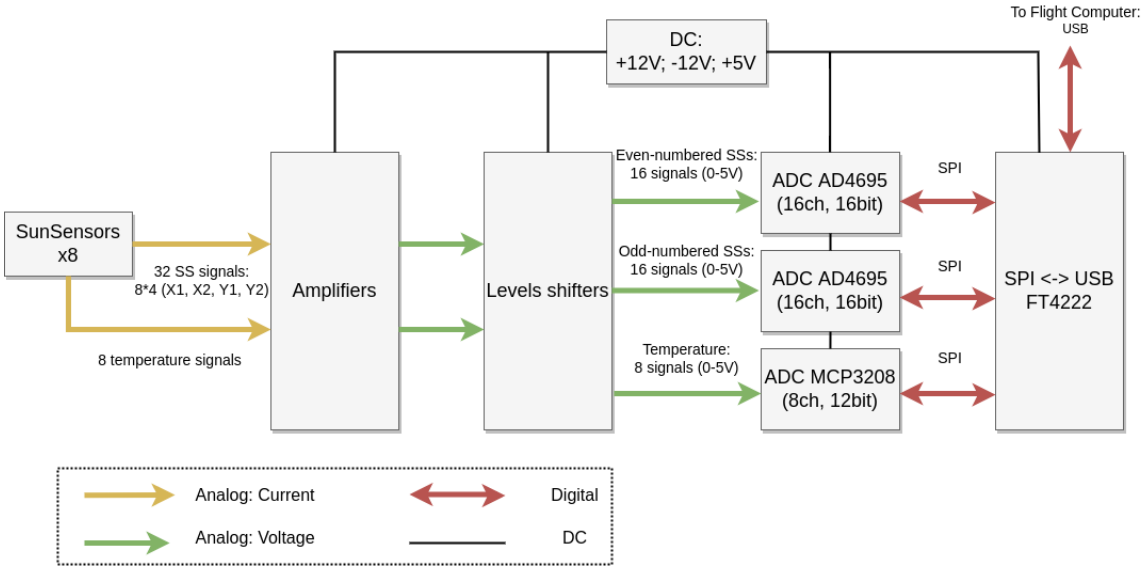
Outline

Reminder: Sun Sensors Electronics Rev. 1.0



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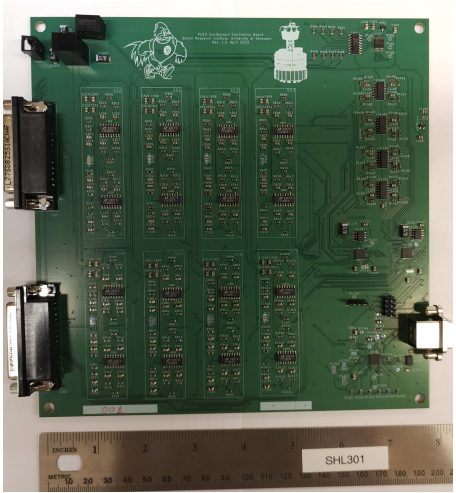


- Inputs/Outputs:
  - DB-25 (x2): SS(x32) + temperature(x8);
  - +12V 2 pin header (2.54 mm);
  - USB type B with locking screws;
  - USB 4 pin header (2.54 mm);
  - SPI 8 pin header (2.54 mm).
- Temperature sensors on both AD4695 (corrections can be made).

Schematics/Layout: https://pueo.uchicago.edu/DocDB/cgi-bin/ShowDocument?docid=213

Sun Sensors Electronics Rev. 1.0: Tests Results

- The Electronics and all 8 Sun Sensors (SS) work nominally:
  - There are a couple of bugs in the electronics which are easy to fix;
  - TV-tests with LED light sources were successful – everything (SS + Electronics) is stable.
- However the TV-tests of the Sun Sensors **connected to the electronics via A4 cables and filter pins** revealed major problems:
  - The readings are off and not stable with time/temperature;
  - The noise is significantly higher.
- Detailed studies of the filter pins and cables were initiated.

Filter Pins and Cables Issue

- Multiple filter pins (FP) and A4 cables were tested:
  - None of the available FPs showed 'acceptable' performance (even in the lab);
  - The best result was achieved with a custom made LC-filter (L = 120 mH, C = 39 pF):
    - No commercially available solutions with reasonable form factor found so far;
  - The longer the cable the worse the result (not only the noise, but the values as well):
    - Calibration needs to be done with the cables;
    - Looking into A4 data to see the correlation between the cables' length and the SS performance.
- Sanity check: A4 electronics (the analog part is almost identical) show similar behaviour;
- The results agree well with 'expected theoretical' performance:

SS is essentially a photodiode with a typical output of $\sim 10\mu A$. General recommendation (from multiple manufactures including On-Trak) for a read-out system (transimpedance amp) is to use a **cable as short as possible**, and if a filter is needed its **capacitance should be as low as possible**

Possible Solutions

1. Use the current version of the electronics and try to find a working FP configuration:
   - There is no guarantee that a good configuration exists with a reasonable form-factor;
   - A good configuration will need to be also verified in TV-chamber;
2. Build new SS analog electronics and put it inside the SS enclosure:
   - A working prototype has been built (see below);
   - Requires new SS cases;
   - **No changes in the hardware from other groups required: cables/enclosures can be reused (the number of available cable lines is a challenge);**
   - **No AC on the sensor sites;**
   - Digital part remains the same (no difference for the communication with FC);
   - Will require verification (possibly better calibration) with the full setup (cables, FPs, etc);
3. Build new SS digital electronics and put it inside the SS enclosure:
   - Requires new SS cases;
   - **No changes in the hardware from other groups required: cables/enclosures can be reused;**
   - **AC on the sensor sites – will require better shielding**;
   - Performance should not depend on FPs, cables etc, everything is digital.

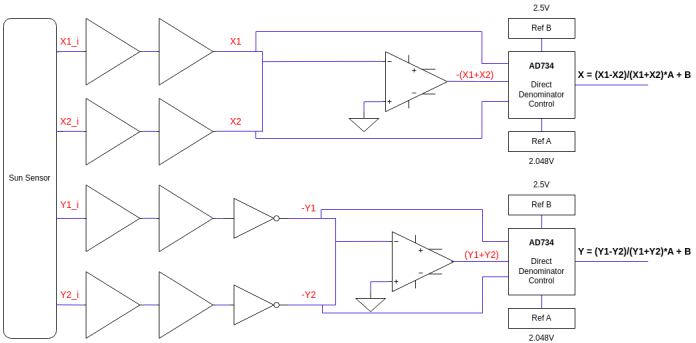
Solution 2: Build New Analog Electronics

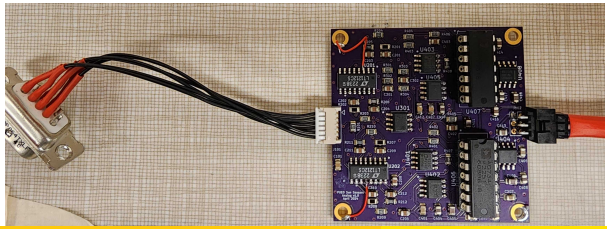
Pins (to the digital board):

1. +12V;
2. -12V;
3. GND;
4. Calculated X;
5. Calculated Y;
6. Temperature.

Key component

AD734 with direct denominator control.





Solution 2: Build New Analog Electronics

- 1st board was built and tested:
  - Works nominally (tested with laser);
  - A couple of minor bugs discovered;
  - More tests to be done.
- New analog board will require changes of the main board, essentially removing the analog part of it:
  - The board will be significantly shorter but the width will be the same – easy to fit inside the ADU5 box;
  - Digital part remains the same – communication with the FC over USB.
  - Software is not affected.

Solution 2: Build New Analog Electronics, SS Enclosure