Polarsonde Launching notes – 2013 version

Modifications since 2012

1) The connection to the radiosonde via the RSA921 ozone sonde interface has changed.
2) The battery configuration has changed.

Precautions

1) Be careful not to touch the output surface of the LED lens or the photodiodes. Fingerprints will compromise the polarizing properties of these surfaces. Fingerprints can be cleaned off with alcohol, but do not use acetone, which will attack the polariser.
2) Be aware that the time in the polarsonde output data file starts from when the preparation of the radiosonde starts. However the time in the EDT file starts (re-zeros actually) when the actual launch takes place. It is often necessary to manually note the time from beginning of the preparation to the launch so as to apply this re-zeroing to the polarsonde time data.
3) Be careful that the LED lens does not become loose in the metal ring. If this happens, do not launch – the realignment is not possible in the field.
4) The power input to the board is via regulator IC's that were an afterthought. Check that the leads of these regulators (wrapped in blue and white heatshrink) have not broken. This is a field repair if you feel up to it!

Bits needed

1 x polarsonde

1 x RSA921 ozonesonde interface

3 x 9 V batteries

Duct tape ca 1.5 m

Terminal strip with two connectors

Tools needed

Multimeter

Screwdriver with blade small enough to adjust the trimpots

Larger screwdriver for terminal block

Black foam block with recess for covering photodetectors

Preparing the batteries.

Connect two 9V batteries in series to make one 18V battery. Note Duracell batteries do not seem to like this treatment! Use the Energizer brand for this. The terminals can have wires soldered to them as shown in the picture of the foam box. It is easiest if the batteries are taped together as shown. (Five pairs of batteries with wires soldered appropriately have been left behind. Connect red to red and green to black.)

The unconnected leads on the battery will go to the red and black unconnected leads on the polarsonde, using a piece of terminal strip. This terminal strip doubles as a switch, so don't finish this connection until power is needed on the polarsonde! This battery combination is good for several hours. The battery powering the LED is good only for about 90 min.
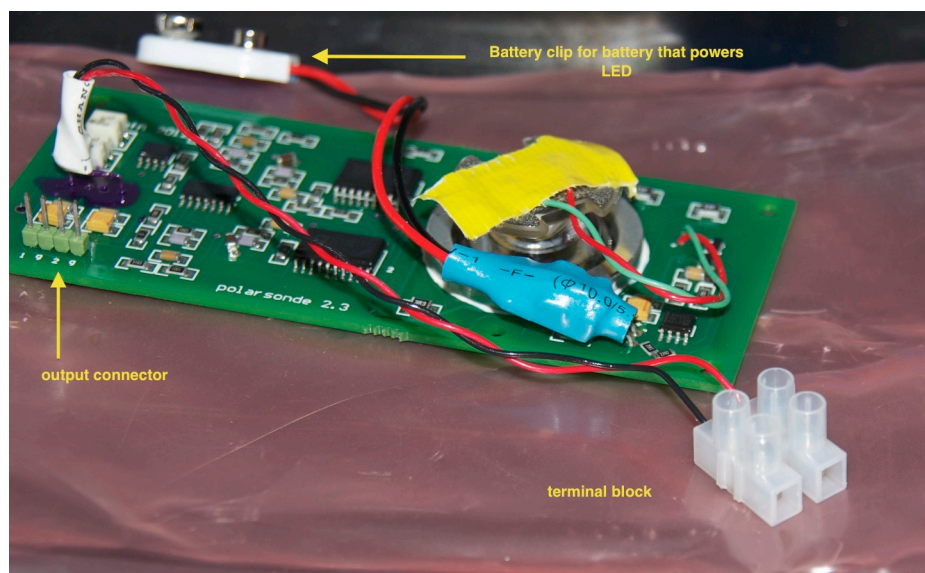
No special preparation is needed for the 9V battery that powers the LED. However do not connect this battery until it is needed. It is good for only about 90 min of operation.

(Note: polarsonde numbers 18 and 19 have a little circuit board on one of the power inputs – the leads from the 18V battery are attached to the flying leads from this small board.)

Preparing the foam box.

The batteries fit into polyurethane foam box sideways as shown.
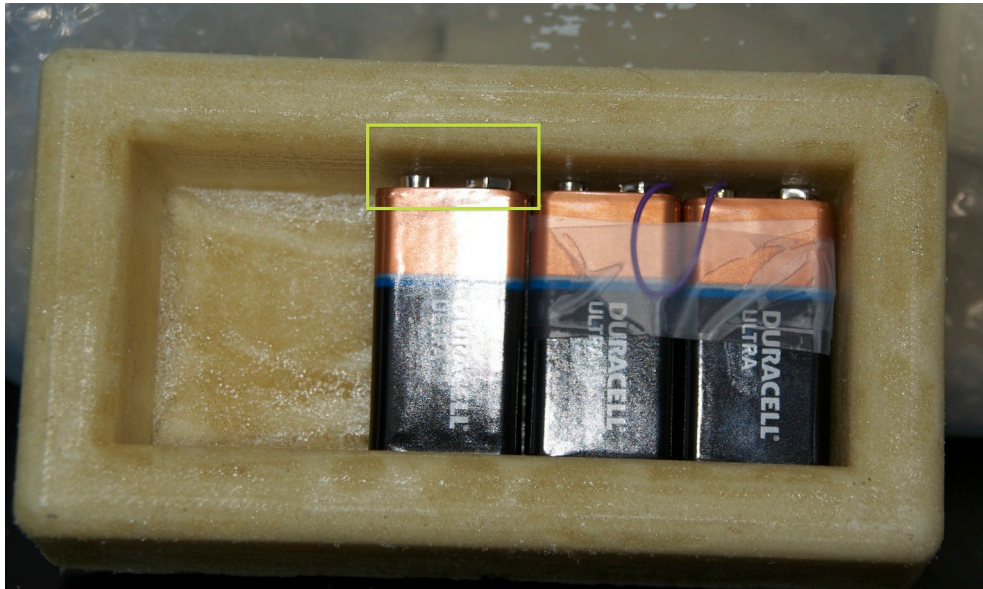
Batteries packed into foam box. The two joined by the purple wire should be Energizer brand, not Duracell!! The green rectangle shows where the clip on the left battery (powering the LED) needs to be accommodated. The space to the left of the batteries accommodates the RSA921 interface.

The clip for the battery that powers the LED does not fit in to the box until the inside wall of the box has a little rebate pushed or cut into it. With the rigid white clips, this can be done simply by pushing the battery with the clip attached down into the box with a small degree of violence. Chiseling a small recess out with a screwdriver is more elegant!

(The greasiness of the boxes is just a residue of Vaseline used as a release agent for the polyurethane.)

Preparing the RS92 SGP radiosonde

This preparation is mostly the same as preparing for an ordinary radiosonde flight, but there is a couple of extra points.

1) the RSA921 needs to be connected to the RS92 while it is being prepared (and must remain attached?). The polarsonde need not be attached at this stage. (The RSA921 derives its power from the radiosonde.) The ground check station must detect the presence of the RSA921, in order for the four data channels from the RSA921 to be included in the data recording.
2) The option Ozone-OIF92 must be selected.

Associated with this option is a number of inputs that need to be added by the operator; for flow rate enter "1". Any of the options for sensor type can be chosen. The RSA921 serial number needs to be entered.

3) When an input for the sensor current is required, enter any number that the software will accept.

These inputs associated with ozone measurements are demanded by the software, because the software is calculating ozone concentrations, or at least thinks it is. This is irrelevant for the polarsonde.

Balloon filling.
Using a 500 g balloon, filling until it lifts 200 g plus the mass normally used for a 350 g balloon will give an initial ascent rate of about 6 m/s. It would be better if this additional mass were about 150 g, rather than 200 g.

Adjustment of output offset voltages
Connect the batteries to the polarsonde.

Check the output levels with no light getting to the photodetectors. This is important as the output voltage offset must not be negative because the RSA921 interface cannot accept negative voltage inputs. The batteries do need to be connected at this point. Cover the photodiodes with the recess in the black foam block as shown. Be careful that the foam does not cover or intrude over the LED output window. Monitor each of the output pins with a multimeter, and adjust the corresponding trimpot so that the output voltage is 200 mV. This setting is arbitrary – anything between 100 mV and 500 mV is appropriate, but it needs to be the same for both channels, and it needs to be recorded.

Then connect the polarsonde to the RSA921
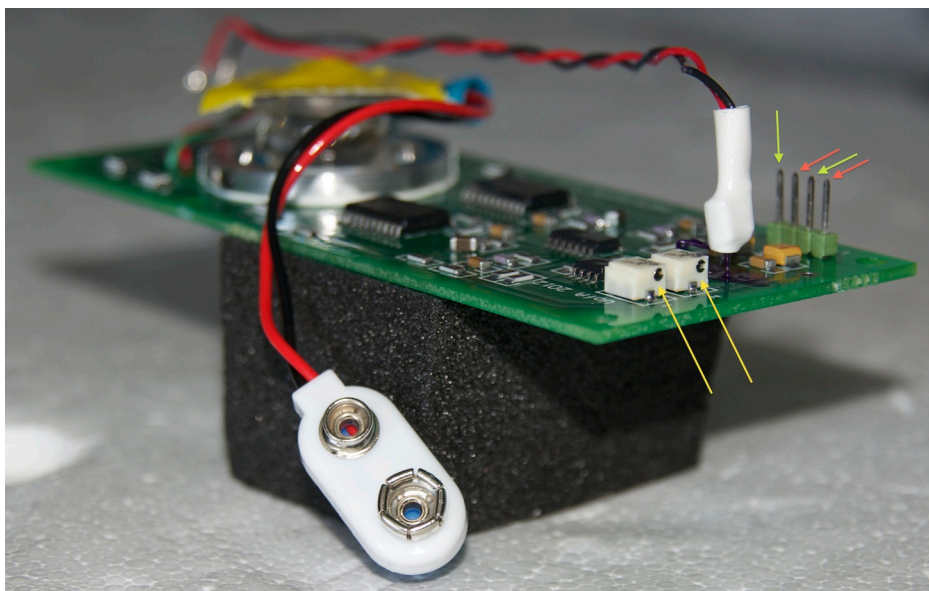
The polarsonde, with the foam covering the photodetectors but not the LED. The trimpots are shown with the yellow arrows. The output pins are shown with the red arrows, and their corresponding grounds with the green arrows.

Assembly of polarsonde package

Tape the thermistor on the RSA921 to one of the batteries. Ensure that the green wire coming from the RSA921 is connected to the "g" on the output of the polarsonde.
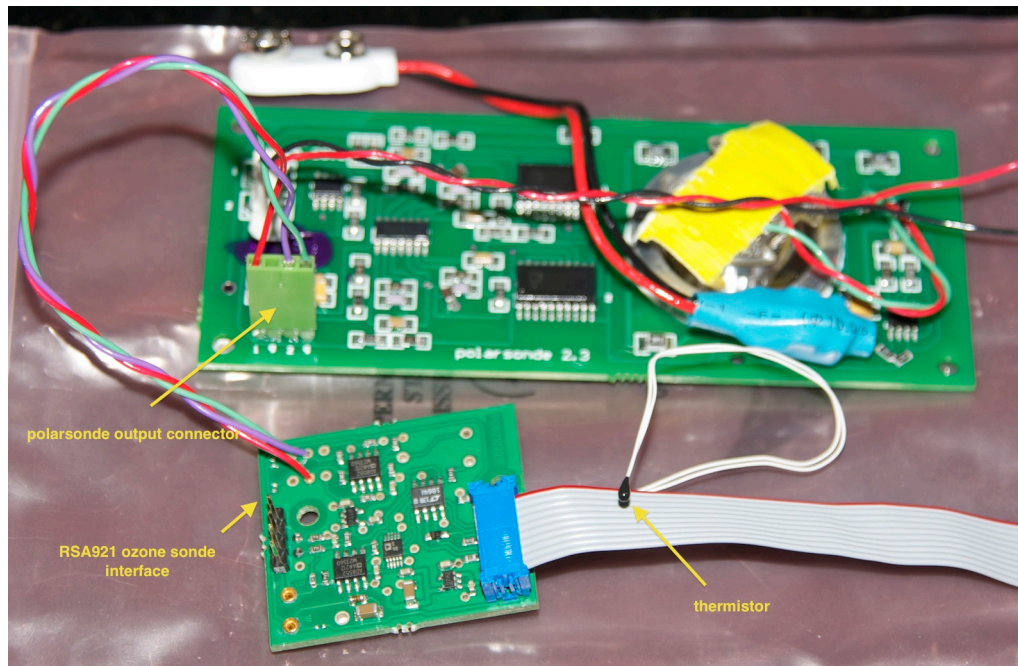
Pack the batteries in a row into the bottom of the foam box (as shown in photo above) with the RSA921 in the bottom at the other end. Cover this with the polarsonde (light shining outward!). Use duct tape to hold this assembly together, being careful not to cover either the photodetectors, or the LED with the tape. Duct tape the polarsonde assembly to the radiosonde, again without blocking any of the optical surfaces. It doesn't matter whether the LED is above or below the photodiodes.

Pic of completed polarsonde/radiosonde assembly.

Extraction of polarsonde data

The Digicora III system records the data to a *.dc3db file. In fact this is a Microsoft Access database, but the data within is stored as binary files. Extracting these with MS Access requires greater skills in Visualbasic that the author possesses!

To extract the data, click on the Archive Manager button on the Digicora GUI interface. A window listing the data files will appear. Select the desired one with a right click of the mouse. A window will appear listing the various possible outputs. Some are already produced as a matter of course , but if these cannot be found, the EDT and RAWPTU should be output (as ASCII). The critical file is the SPECSENSORS.

Outputting SPECSENSORS as a *.tsv file results in a file that gives the data encoded in groups of four hex digits, concatenated together. This is described the the Vaisala Ozone sonde manual. The snippet below illustrates the format.

```
Record name:   Unit:      Data type:      Divisor: Offset:
--------------------------------------------------------------------
   time        sec        float (4)     1      0
   length      ?          byte (1)      1      0
   specdata    ?           binary (40)    1      0

*************************************************************************************
   0.68      10.00     00032902905e0000000000000000000000000000000000000000000000000000000000000000
```

The following snippet of Matlab code shows how this is decoded;

```matlab
f_id = fopen('SPECSENSORSnh.txt');
tline = fgets(f_id);
disp(tline);
[time, remain] = strtok(tline);
t = str2double(time);
[token, remain] = strtok(remain);
[token, remain] = strtok(remain);
a = strread(token,'%4c',5);
a = a(2:5,:);
a = [a(:,3:4) a(:,1:2)];
byte = a(1,1:4);
v1 = hex2dec(byte);                    % O3 channel
byte = a(2,1:4);
v2 = hex2dec(byte);                    % therm channel
byte = a(3,1:4);
v3 = hex2dec(byte)                     % data channel 1
byte = a(4,1:4);
v4 = hex2dec(byte)                     % data channel 2
```

Note that this uses a version of the data file with the header info stripped off. The O3 channel is not used. The thermistor data can be used to monitor the polarsonde battery temperature.

Questions?
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