

# Sweeperino



The Sweeperino a very useful Arduino based test instrument. It is the following:

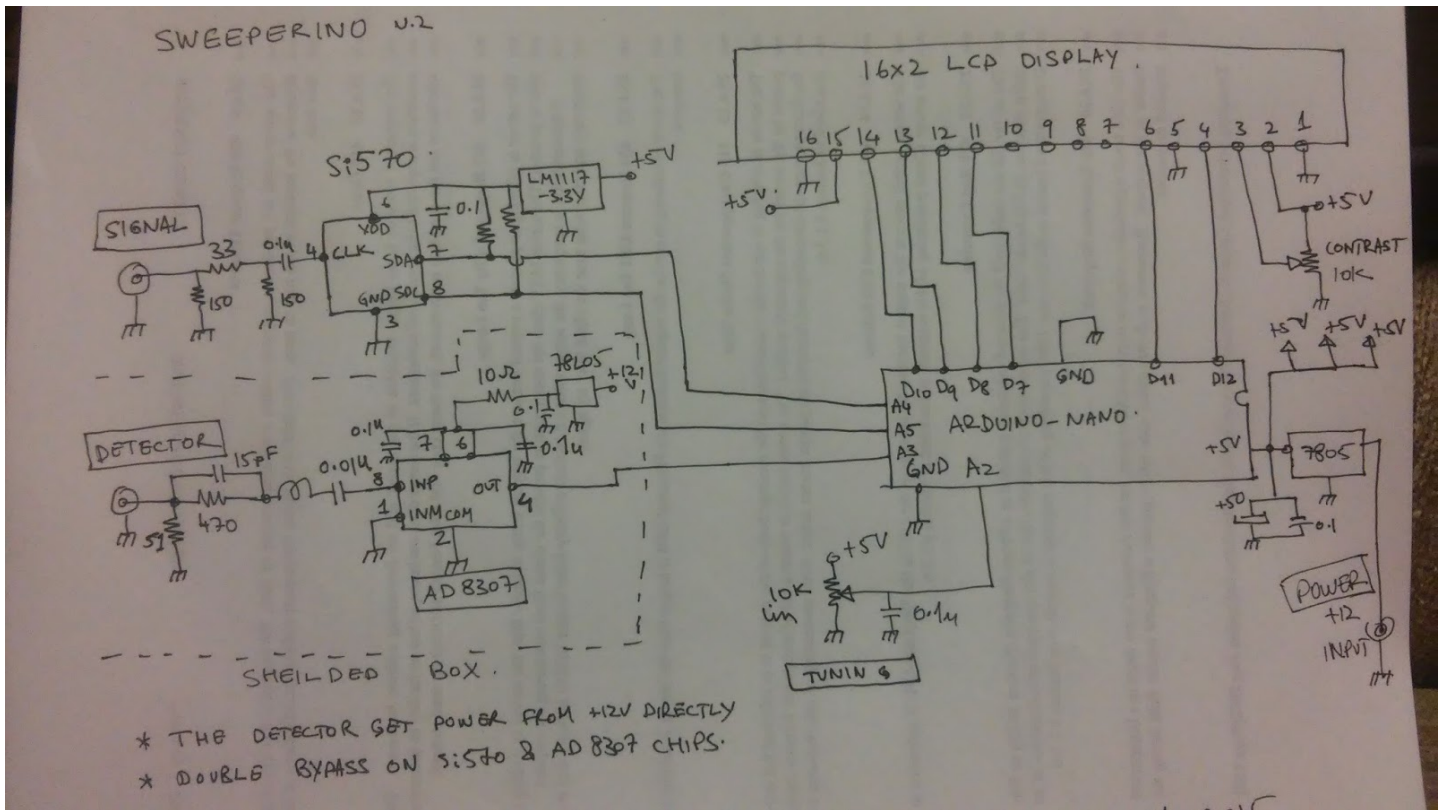
- A very stable, low noise signal generator from 4 MHz to 160 MHz without any spurs
- A high precision power meter with 90 db with 0.2db resolution
- A sweeper that can be your antenna analyzer, plot your crystal or band pass filter through the PC
- It fits in your jacket
- It can be assembled in an evening.
- Costs about \$50 in new parts.

## Circuit Description

The circuit consists of three very simple blocks

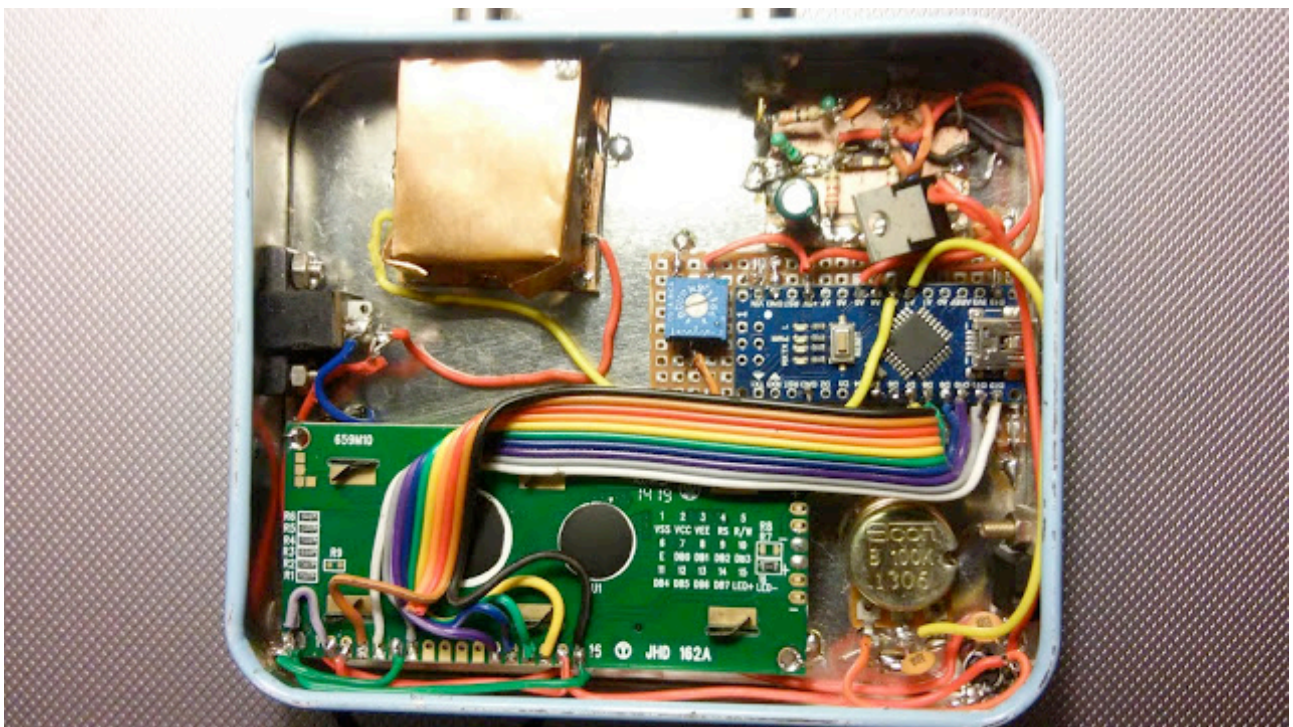
- 1 An Arduino.** I used Arduino Nano board though any Arduino board will do. If you don't know what an Arduino is, look around the Internet. The Arduino is connected to a commonly available 16 characters by 2 line LCD display and a tuning knob to tune the frequency
- 2 The Si570.** The Si570 is a spurs free, low noise programmable IC from Silicon Labs. Though slightly more expensive than the DDS, it is easily soldered by hand. We use the excellent Si570 library written by Thomas Sarlandie from Github (<https://github.com/sarfata/radiono/tree/master/radiono>)
- 3 W7ZOI power meter.** The W7ZOI designed power meter based on AD8307 that is read by the Arduino.

Here is the entire circuit diagram :



The picture below shows how I made it in a small tin-box of in-flight cashew nuts . The box is twice the size of an Altoids box. Note that the power meter circuit is shielded using copper sheeting.

The coil at the input of the detector is just on turn of slightly less than 1/4 inch of a small gauge wire.





## Software

- A. The software to be loaded into Sweeperino. Download it from <https://github.com/afarhan/sweeperino>. Programming the Arduino is very simple. Just follow the instructions on [www.arduino.cc](http://www.arduino.cc) to load it up. It is a good idea to first load the software into Arduino and then add the LCD display, Si570, the tuning pot and the power meter in that order. The software checks that the hardware is working well. If you want high accuracy you will want to tweak the **WB\_POWER\_CALIBERATION** constant in the `sweeperino_lcd.ino` sketch for accurate readings.
- B. `specan.exe` to use to the Sweeperino from the PC. This is a common software that runs on Microsoft Windows as well as under WINE on Linux. You can download the source code or the exe from <https://github.com/afarhan/specan-ui>

## Using the Sweeperino

The Sweeperino can be used independent of a PC. This is very useful for doing on the fly measurements or antenna tuning on the roof and field. The tuning is a little unusual. The tuning knob behaves like a regular tuning control with steps of 100 Hz. However as you tune to the very edge of the tuning range, the frequency starts drifting up or down (depending on which edge of the band you are on). It takes a little patience to get to your frequency but it works very well.

Using the Sweeperino with the PC is very easy, Start the `specan.exe` and choose the correct port. When using the it under WINE, there is a little trick : start `specan.exe` and then exit it. It will create a file **sweeperino.caliberation** in the same folder. Edit this file's line that reads like `port:=COM1` to whatever port the Arduino is connected to . The PC software is self explanatory. From the panle on the right, you can set the center frequency of the sweep and the range. Click on the SWEEP button to start the sweep. Tips:

- When using the mouse, as you move it over the plot it displays the power vs frequency reading under the mouse on the right panel.
- To start a new sweep around a particular frequency, move the mouse to that frequency on the plot, left click and choose a new smaller range.
- To make comparisions (like 6 skirts of a ladder filter), left click and point and choose MARK from the popup menu. Now, in addition to the readings under the mouse, the difference in dbms and the current plot location under mouse are readable.
- Press the PrtScr key to save the plot to the clipboard and paste it into your favourite picture editor.

## Limitations :

The Si570 doesn't work below 4 MHz. The Si570 doesn't have spurs, instead it has odd harmonics. So beware if you see your 15 MHz bandpass filter shows a peak at 5 MHz (It would be the third harmonic of 5 MHz passing through your 15 MHz filter).

The power meter is quite sensitive. Keep your circuits well shielded or it might pick up the local broadcast stations. It can sense up to 500 MHz.