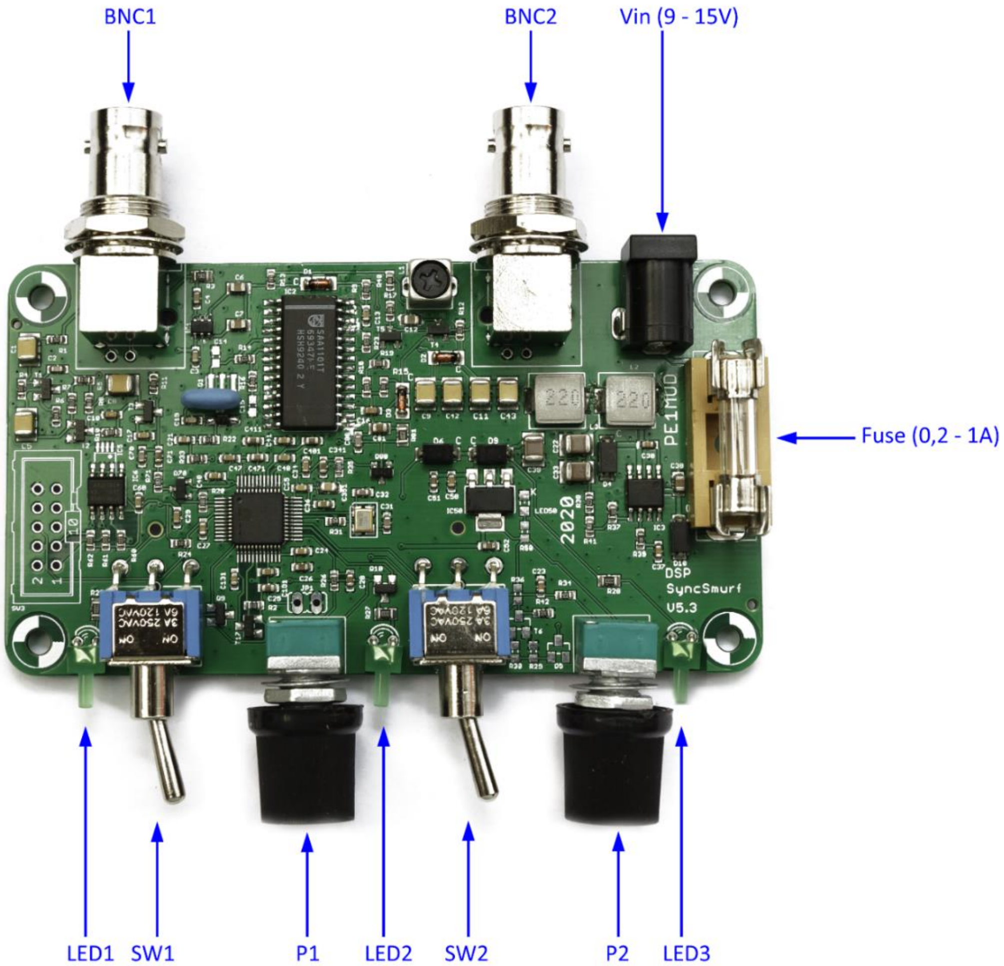
User Manual DSP-SyncSmurf 5.x



BNC1	Video input
BNC2	Video output
Vin	Power Supply, 9 to 15V max, 90mA max, center pin is +
Fuse	Fuse for safety reasons only (not to protect the board in case of a short). Value from 0.2 - 1A
LED1	Sync-led
SW1	Switch to select between direct video (bypass) or DSP-SyncSmurf corrected video.
P1	Fine tuning of horizontal position of the video.
LED2	Led indicating automatic (LED on) or manual sync
SW2	Switch to select 624/625 lines (try the other setting if the image bounces or rolls slowly vertically)
P2	CCW: automatic, otherwise manual sync control
LED3	Power on

Manual or Automatic (P2 en LED2)

Potentiometer P2 is used to select between automatic or manual synchronization. With the potentiometer turned fully counter clockwise the DSP-SyncSmurf is in automatic mode and LED2 is lit to indicate automatic mode and the DSP continuously searches for synchronization pulses from the incoming video signal. When synchronization pulses are found, the DSP-SyncSmurf will lock to this signal and stabilize the video. This is especially useful when waiting for a video signal to appear.

If the video signal is really very noisy/poor or has a lot of interfering signals from for instance radar, signals from cellphone towers, adjacent stations or fading, manual mode may provide a more stable image. Turning potentiometer P2 out of the fully CCW position enables manual as indicated by LED2 which will turn off. When carefully adjusting P2 until the video is stable, a very light PLL will assist in keeping the signal locked.

The capture range of the DSP-SyncSmurf is extremely large and will enable a stable lock even to frequencies that are way out of (PAL) spec.

Horizontal position after locking (P1)

As soon as a lock has been established, potentiometer P1 can be used to adjust the horizontal position of the video on the monitor. This can also affect/improve the color reproduction of the image shown on the monitor.

Sync-LED (LED1)

When the DSP-SyncSmurf sees an incoming signal, which may still be to faint to produce an image, LED2 will light. In some cases, this can be useful to optimally align the antenna.

Note: when a signal is strong enough to provide an image, the SYNC LED isn't reliable anymore.

Bypass (SW1)

When an incoming signal is very strong, it's advised to put the DSP-SyncSmurf in bypass mode, using switch SW1. The incoming video is then passed to the output without the addition of sync pulses. With stronger signals this usually provides better video quality.

In bypass mode the DSP-SyncSmurf also needs DC power. Monitors that don't show anything as long as there are no syncpulses "no signal", also won't show anything in bypass mode when no video is present. In this case please switch bypass mode off in order to see the receiver noise.

Power Supply

Supply the DSP-SyncSmurf with a voltage between 9 and 15V DC, using entry 'Vin' at the rear. The current consumption is around 90mA. Don't go over 15VDC, not even momentarily, as DSP-SyncSmurf won't withstand higher voltages.

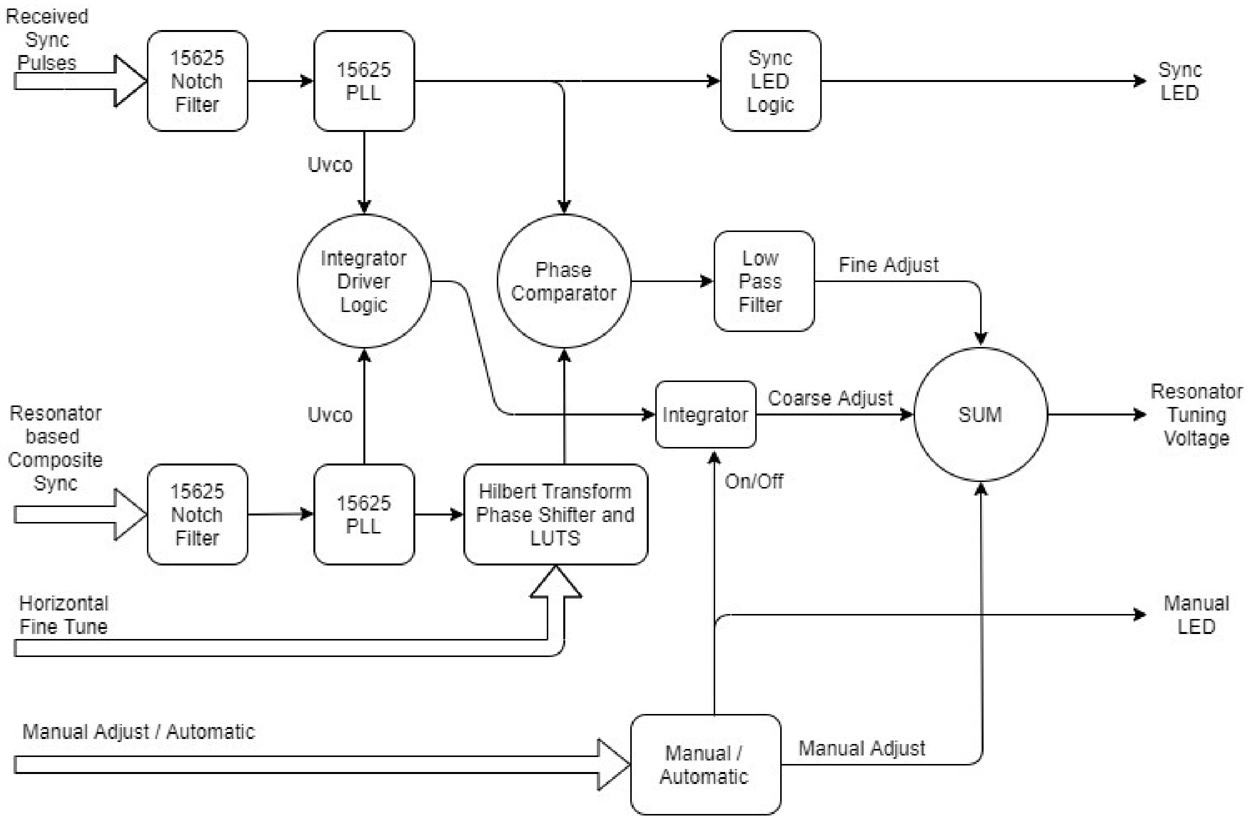
Technical description of the DSP SyncSmurf inner workings

The basic function of the DSP-SyncSmurf is to separate syncpulses from the applied input signal. This part is an exact copy of the original circuit by Hans PA0JBB (source: VERON Elektron December 2011). The sync insertion is almost the original circuit with the video amplifier replaced by a more modern variant. Also, the sync and black levels have been optimized to suit the new video circuitry.

The power supply has been built around a simple buck converter.

In the original design, a crystal oscilator was tuned by varactors driven by the phase comparator from the SAA1101 composite sync IC. A result of using a crystal was that the tuning range was limited, and was too small in many cases. This has been solved by replacing the crystal by a ceramic resonator. The increased tuning range can't be successfully driven by a phase comparator so a Digital Signal Processor was added to drive the resonator.

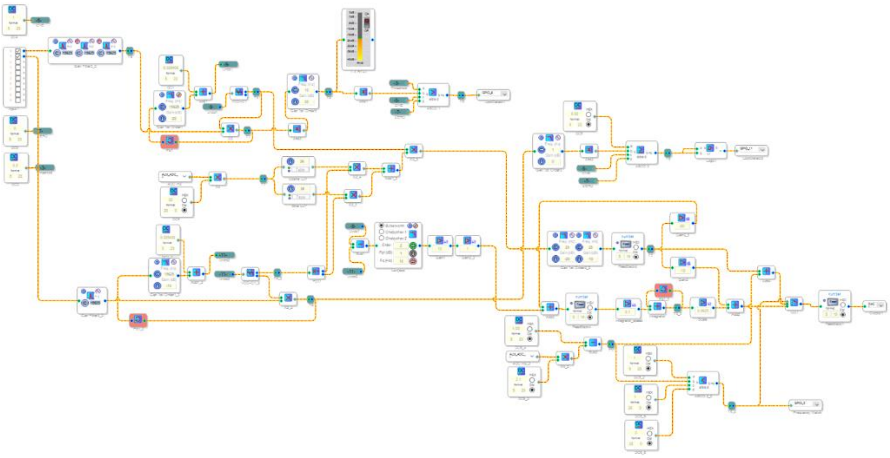
The DSP has the following blockdiagram:



In the automatic mode (P2 fully CCW) the DSP primarily uses an integrator to adjust the resonator frequency such that the SAA1101's sync pulses match the frequency of the recovered syncpules. When the frequencies are almost aligned, the integrator is switched of and a phase comparator makes a final adjustment and maintains a phase lock. The absolute phase can be tuned using P1, allowing the horizontal alignment of the video to be adjusted.

In manual mode, the entire frequency range of the ceramic resonator is available, and the phase comparator will only ever so slightly try to maintain a lock. This allows the system to be used even with signals that have interference from adjacent channels, radar, fading and so on.

To give you an idea of the complexity of the DSP part, its circuit diagram is shown here:



Due to the efforts it took to develop the DSP-SyncSmurf, the circuit has been reduced in size to obfuscate it a little bit.

Technical documentation and references

The most up to date version of the documentation can be found at https://www.pe1rqm.nl. Please use the sites search function and look for the word “syncsmurf”.

Weblink for this version of the DSP-Syncsmurf: https://www.pe1rqm.nl/dspsyncsmurf5/