

Calibration Made Easy

One of the major issues with reference frequencies in test and measurement applications is their constant need for calibration which is costly and time consuming. It usually also requires that the equipment is out of use for some time especially if the calibration organization isn't just around the corner.

RF-SUISSE frequency reference modules with GPS guidance are the ideal solution to this problem. With a special firmware they can be implemented in a way which allows the user to calibrate the reference with a GPS receiver with 1PPS output traceable to NIST on a regular basis. The solution shown here is intended for applications where it is impossible or undesirable to permanently connect a GPS signal to the frequency reference.

It depends on the required calibration accuracy which module has to be selected. As the crystal oscillators have a temperature drift the required stability has to be determined for each application. If ± 2.5 ppm is sufficient the RS-GGO10-T2P is the correct part. The RS-GGO10-T3P will provide ± 0.1 ppm stability and the RS-GGO10-O2P is at ± 0.05 ppm over the entire specified operating temperature range.

The standard firmware will indicate whether there are GPS pulses (LED amber) or whether the unit is fully locked (LED green) and store required correction values to compensate the ageing of the oscillator every 24h.

The modified firmware for the usage case discussed here implements a different storage behaviour and indicator scheme. Without a GPS connected the LED will be red as it is for the standard firmware. When a 1PPS signal is applied the LED will turn amber and remain there until the frequency is within the specified accuracy and sufficient correction information is collected. Then the new correction value, if different, will be stored and the LED turns green. The equipment can now be disconnected from the GPS and will continue to operate calibrated to the last stored value. For the TCXO based models RS-GGO10-T2P and RS-GGO10-T3P this is even valid when the power is cycled. OCXO's by their nature will normally not fully return to their calibrated frequency at the exact same tuning voltage which means that after every power off and on the system should be connected to a 1PPS GPS signal for calibration.

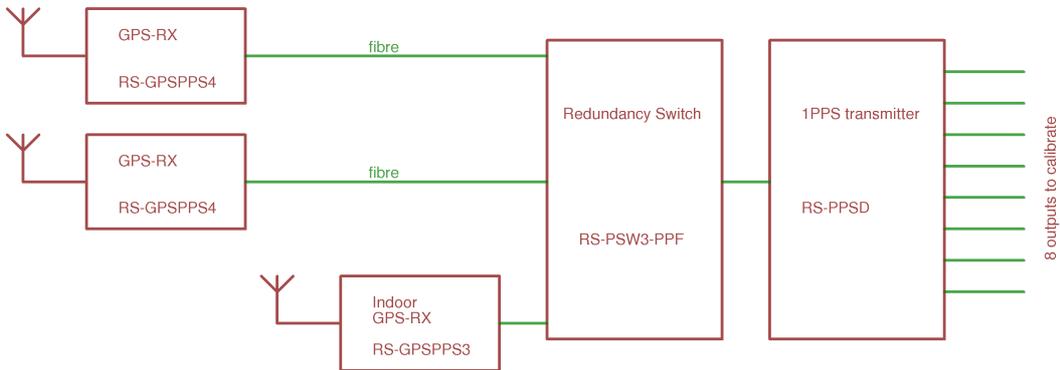
This type of storing the calibration value makes it a valuable relaxation for calibration needs. Especially for hand-held and mobile equipment and product to be used indoors without the possibility of GPS reception it enables the user to calibrate as frequent as desired to be sure to always have the specified accuracy of the reference oscillator without additional ageing drifts. To order the special firmware just add "-SC" to the desired part number (only available for RS-GGO10-T2P, RS-GGO10-T3P and RS-GGO10-O2P).

For implementation into environments with multiple equipment it is not required to have a GPS receiver for every system. RF-SUISSE provides solutions where one calibration system can supply the pulses to multiple frequency references for calibration.

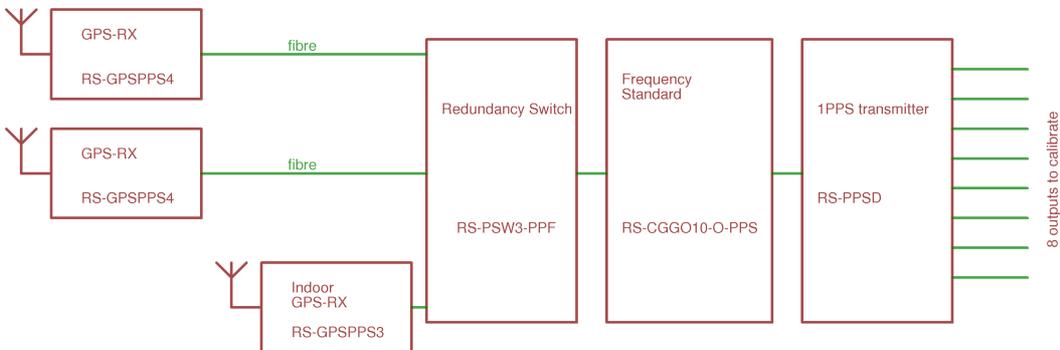
The simplest system will just use one of the RF-SUISSE GPS receivers (RS-GPSPPSx) and an RS-PPSD 1PPS distribution unit if more than 4 outputs are required.

As lightning and availability is always a concern RF-SUISSE recommends an even improved system with complete galvanic isolation of the outdoor and indoor units by means of an optical 1PPS transmission and redundancy with the RS-PSW3 unit. A typical set-up is shown below.

One possible implementation of this system is that the equipment to be calibrated is connected to the 1PPS source if not in use. Another possible implementation would be to have regular intervals, i.e. once a month, where the equipment will be connected to the 1PPS system.



An even better solution is to integrate a real frequency reference into the path which cleans up the jitter inherent in GPS signals:



The initial investment for such a low cost calibration system is naturally higher but the initial investment should be returned by the lack of required full calibration in no time.

Datasheets for all the product discussed here and other frequency reference solution can be found at the RF-SUISSE website <http://www.rf-suisse.ch>. The RF-SUISSE distributors will also help you to tailor a system exactly to your specific needs in close cooperation with the factory.

All RF-SUISSE product is manufactured in Switzerland in our own assembly line.