UPGRADING OF THE TEN TEC 505

Some time ago I bought a Ten Tec 505 transceiver using the antique string-and-pointer mechanism for approximate frequency indication and a calibrated tuning knob skirt giving more accurate indication of the true frequency. The problem is that the skirt had to be calibrated for every band change. This article describes a digital frequency read-out solution to that problem, that can be used with any transceiver using a 9 MHz IF.

FREQUENCY COUNTER BASICS

If your transceiver is generating a signal at say 14.567890 MHz, and you want to determine the frequency, you could count the number of oscillations in a one second period, and you'll end up with 14567890 cycles, i.e. the frequency in Hz. It is, however, inconvenient to wait for a full second every time you need an answer, and one Hertz precision is totally unnecessary. So say you only need 100 Hz precision (Adequate for transceiver frequency calibration.) If you count oscillations for 0.01 second, you'll end up with 145678 of them, and is you juggle the decimal point a bit, this comes to 14.5678 MHz. Only one problem remains - you need a counter that counts at more than 14 MHz in this case, and up to 30 MHz in the case of the 10 meter band. If the signal is first divided by 10, a technique known as prescaling, and then fed to the counter, the counter only sees a maximum of 3 MHz. To get the required precision, however, the gate time has to be increased to 0.1 second.

We now have a counter that determines the frequency of an arbitrary oscillator in the 0-30 MHz range. In a superhet receiver the variable frequency oscillator (VFO) operates on a frequency that differs from the received signal by the IF frequency. Typically the VFO will be operating at 5.5678 MHz to receive the signal at 14.5678 MHz, assuming a 9 MHz IF. This is not really a problem - you already know that the MHz part of the frequency is 14 MHz, so if you only look at the last four digits, you get 567.8 kHz, and this gives the received frequency to the nearest 100 Hz. This method also carries the advantage that a simple counter circuit can be used - only four digits are required.

THE ACTUAL CIRCUIT

A four digit counter is available in a single package, with the number 74C926. This is a complete counter, latch and 7 segment driver, and replaces 12 TTL IC's as used in the traditional counter-latch-driver design. The maximum frequency for this counter, incidentally, is about 3 MHz. The input to this counter is gated to count input pulses for 0.1 second. The count value is latched by an input on the LATCH pin, putting the value on the display, and the counter is then reset to zero by an input on the RESET pin. The actual value displayed is only as accurate as the gate time, which is derived from a crystal at 3.2768 MHz by a series of dividers.

ASSEMBLY AND USE

The frequency counter is built on a fairly cramped printed circuit board, since the counter had to fit inside my Argonaut transceiver. The only cautionary note is to be careful with the CMOS IC's, but I have never had any static electricity problems here near the sea. Also, carefully clean ALL the soldering flux off the PCB - CMOS circuitry doesn't like high-resistance paths anywhere. The frequency counter is connected to the VFO using the smallest value capacitor that gives a stable display. Too large a capacitor will 'pull' the VFO by a small amount, which is annoying if you switch the counter on and off while using the set. In some cases it might be necessary to implement a small buffer amplifier using a FET and a transistor. The circuit for such a buffer amplifier can be found in the Handbook. Power for the counter can be anything from about 8 volts to about 40, but in the latter case the regulator might need a fairly substantial heatsink. The circuit draws between 100 and 200 mA, so that power can be 'stolen' from virtually anywhere. If you get 'hash' on your receiver, it might help to wrap the power leads to the counter around a ferrite bead. There has to be a grounded shielding plate of some type between the counter and the R.F. circuitry of your rig, of course.

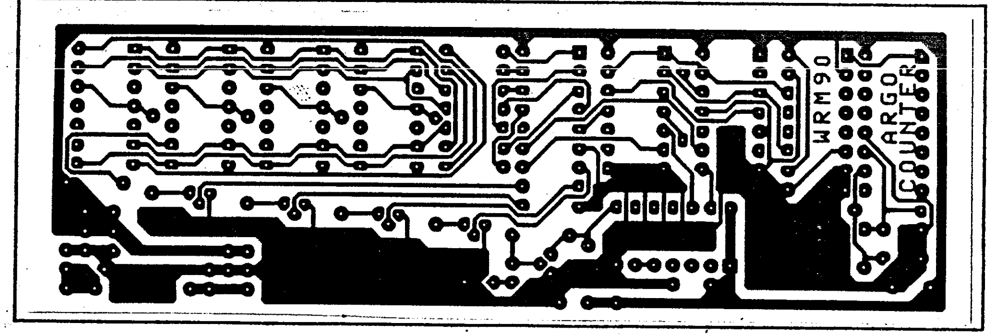
If you have any problems, you can reach me at:

Address: P.O. Box 264 / Stellenbosch 7600

Packet Radio Address : ZS1KE @ ZS1AFB

or try calling me on 2m during Sunday morning Swap Shop.

73 de Wouter, ZS1KE.



Unfortunately there was no component-overlay available when this newsletter went into production. For the experienced home-brewer, however, there should be no problems in placing the components correctly. The positions of the ICs are shown on the scheme to the right. R indicates the position of R4 to R10 (horizontally). The fat lines are wire links. An enlarged circuit diagram and/or a negative for the circuitboard can be obtained from the author or the editor.