Technicalities

In last month's column, we showed the way to a better IF system. We built it and can report that the performance is outstanding. We hope to have achieved the same with this design for a low noise, all band VFO. By Frank Ogden G4JST. Editor Ham Radio Today

The theme for the column this month is 'successful RF design', the art of designing and making things which not only work but hopefully outperform the generally available commercial equivalents.

I started the series last month with a design example for a high performance CW IF strip. I am going to continue the theme with an all-band synthesised VFO suitably complementing last month's strip. The two together form the basis for a really first rate CW transceiver. We anticipate that the complete transceiver could take on something like a TS930 and win. Eventually the whole project will be offered as a constructional project in Ham Radio Today complete with PCB designs produced by Tony Bailey G3WPO. I must emphasise though that, like the IF strip described last month, the circuits given here are original, have been computed from first principles, but have yet to be tried. There will almost certainly be bugs in them but hopefully not too many!

What to look for in a VFO

The VFO, along with the mixer circuit, is probably the most important and critical area of any HF transceiver design. As can be seen from **Fig. 1**, it is central to the equipment for both transmit and receive. Since the transmit signal, derived by mixing the IF signal with the VFO output, will not pass through any narrow band filters, it is essential that the VFO signal has very low noise sidebands. Noisy circuits can cause substantial interference to other users. Likewise, the receive path requires the purest of signals otherwise adjacent, powerful stations will interfere with reception of weak ones regardless of how good the main crystal filter may be.

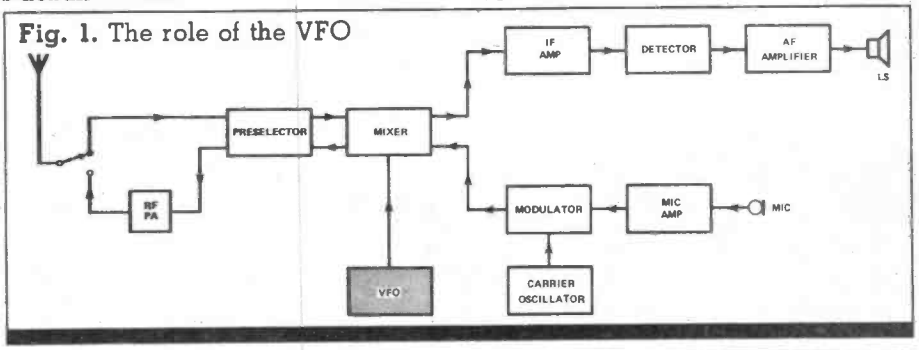
Digitally synthesised LO/VFO circuits offer absolute stability but are virtually all a step backwards when it comes to sideband noise. I cannot think of a single piece of synthesised HF amateur gear, including my own homebrew design described in the January and following issues of HRT, which comes near the purity of free running VFO equipment. Furthermore, most black box synthesised HF gear is so convoluted in design that the equipment displays all sorts of image responses as well as high levels of sideband noise.

Simply put a VFO should produce a pure, single frequency signal with a stability of Hertz/minute. The single band arrangements of **Fig. 2** (circuitry of VFO shown in **Fig. 3**) come very close to this. The disadvantage of course is that the VFO output will only act as an LO signal on one or perhaps two bands only, unless it is mixed with fixed frequency crystal oscillators. However, anyone who has ever listened to any directly coupled gear of this kind will testify to the 'clean' sound of the resulting signal.

Complex VFO systems

The system shown in **Fig. 4** is typical of much of the equipment

Fig. 1. The role of the VFO



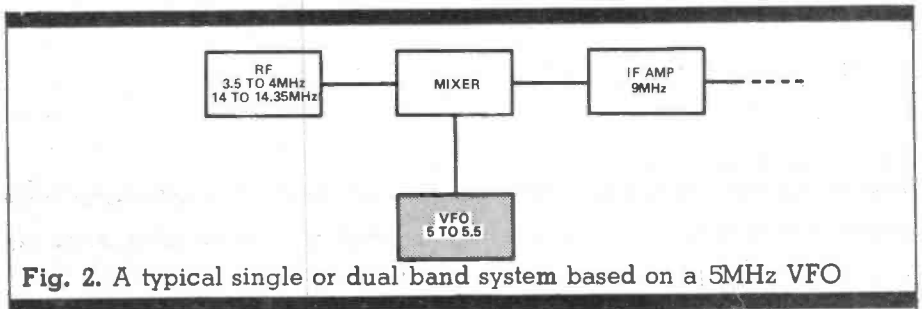


Fig. 2. A typical single or dual band system based on a 5MHz VFO

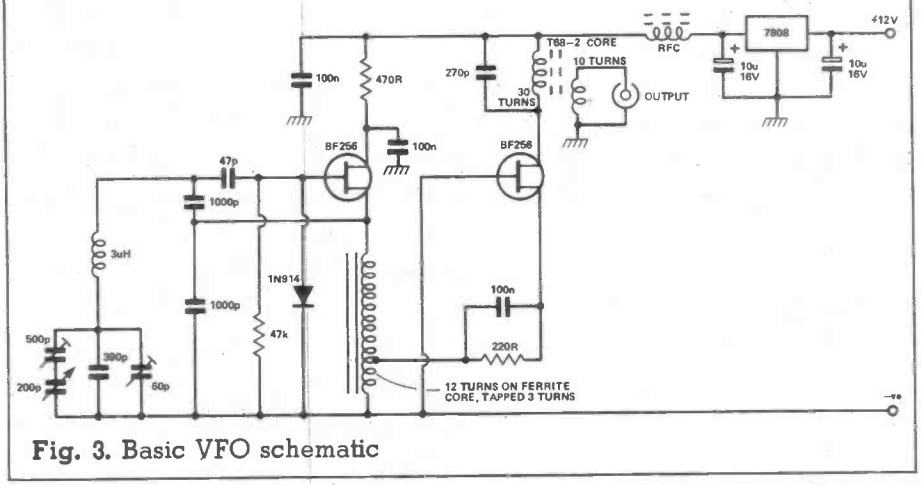


Fig. 3. Basic VFO schematic