Hot Iron

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Contents

Editorial

Many of you will know that my normal daytime work is farming - both my wife and I have been much touched by the expressions of sympathy and good wishes that many of you have sent over recent weeks following the foot and mouth outbreak. Apart from our arable crops we do have a beef finishing herd (and a few sheep) so have been very concerned that we should not find ourselves affected by this most devastating disease. Although Somerset has had a few cases, the major worry has been the scale of the outbreak in Devon and the chance that it might get transmitted our way. We continue to keep up our precautions and keep all fingers and toes crossed. It has been a nuisance for us, with much extra paperwork and lower sale values, but nothing compared to those who have lost their livestock. Even more badly affected are those mainly rural businesses whose customers have just dried up - there are many of them and there is practically nothing available in the way of help despite what Government says! These are the ones who are really suffering. Although many paths are being opened again, those crossing fields with livestock are quite likely to remain officially closed. Thank you very much for your kind wishes and please still keep your fingers crossed!

Kit Developments

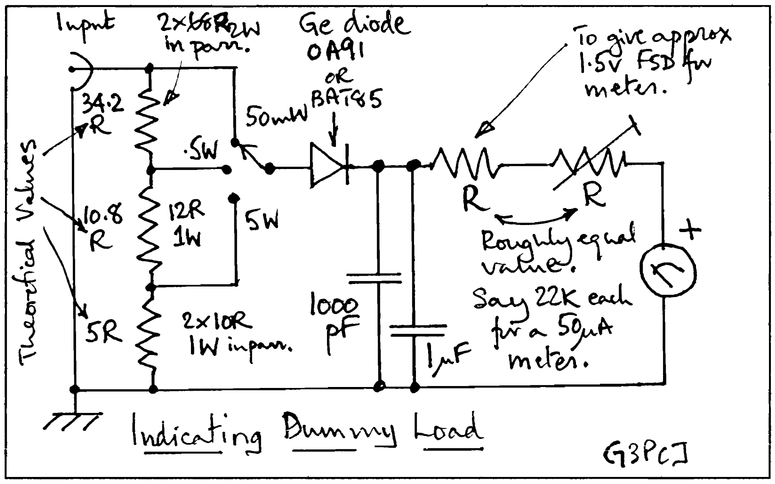
Pressure of semi-normal daytime work has kept me away from the electronics 'laboratory' but I have been mentally working up a new simple 80m 5 Watt CW DC rig - the **Highbridge**. I am just about to lay out the PCB. It will have a strong commutating mixer as product detector with a Polyvaricon tuned ceramic resonator covering most of the CW section of 80m. It will be in the small upright format and should sell for £39 complete. The TX stages will be digital (like the Chinnock - see last time) and supply voltage will be 9 volts upwards to help keen /P operators. The design should allow operation on other higher frequency bands but it will then have to be crystal controlled as higher frequency ceramic resonators are too prone to temperature induced drift. This is a much improved version of the Wedmore with some features from the Sparkford. The expected price is still lower than it was for the Wedmore! Give me a call if you would like to try an early model.

Many of you will have recently seen that Jackson Brothers had a news item in Radcom; they are now owned by Mainline Electronics who have most of the original products available. Always on the lookout for alternatives to varactor diodes to improve frequency stability, I asked about prices for new 150 pF bush mounting ceramic insulated variable C802 style capacitors; they were even worse than I expected at well over £15 + VAT for 100 off! The search for alternatives continues and you should definitely buy any in reasonable condition that you come across at rallies etc.. Sadly I cannot depend on that approach as a source for kit production. Tim Walford. G3PCJ

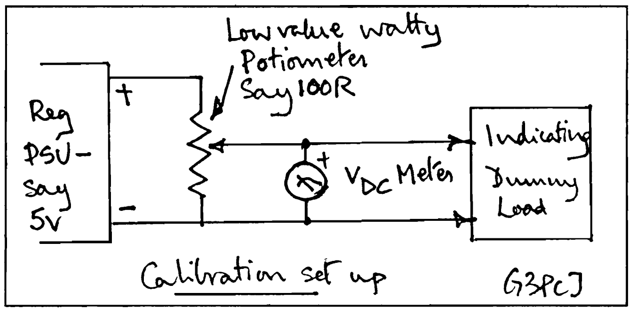
Hot Iron is a quarterly newsletter for radio amateurs interested in building equipment. It is published by Tim Walford G3PCJ for members of the **Construction Club**. Articles on simple theory, construction, testing, updates on kits, questions and suggested topics are always wanted. Please send correspondence and membership inquiries to Upton Bridge Farm, Long Sutton, Langport, Somerset, TA10 9NJ. Tel 01458 241224 or e mail walfor@globalnet.co.uk The Walford Electronics website can be seen at www.users.globalnet.co.uk/~walfor Subscriptions are £6 per year for the UK (£8 overseas) from Sept 1st in each year.

Indicating RF Dummy Load

I make no apology to those of you who have seen this circuit before - its so useful and simple that its worth repeating every few years for newer Members! It is prompted by a Member recalling how he set up CB rigs years ago! It combines the functions of a 5 Watt 50 Ohm dummy load with an output indicator. It has three power ranges, to 50 milliWatts, 0.5 Watts and 5 Watts RMS. The dummy load resistor chain is divided into three so that with the RF voltmeter part of the circuit tapped down the resistor chain, it gives the higher power ranges. Apart from the slightly unusual resistor values, this aspect only needs a three position slide switch! It works from hundreds of KHz to VHF if the layout is good! Since the RF voltmeter is working from a low source impedance it does not require a very sensitive meter, any full scale current up to about 0.5 milliAmp is fine. (The meter series resistor is chosen to give a full scale voltage of about 1.5 volts.) Another advantage is that it can be calibrated with DC from a stable adjustable supply using an accurate DC voltmeter. The meter circuit is simple and can be built on a small tagstrip mounted near the input connector, dummy load resistors and range switch. These latter components should be close together for best high frequency performance - perhaps on the inside of the front panel of a small diecast box together with the meter and RF voltmeter tagstrip.



Having built the circuit, calibrate it as follows. This is dependent on the RF voltmeter actually being a peak reading circuit which will show the same meter reading on DC as the peak of any applied AC voltage - the calibration relies on the applied AC voltage being sinusoidal - if it is not and has harmonics, the indicator may show a higher value corresponding to the tips of the waveform's actual (spiky?) shape. Connect your the dummy load to an adjustable DC supply - perhaps with a low value potentiometer as shown right.

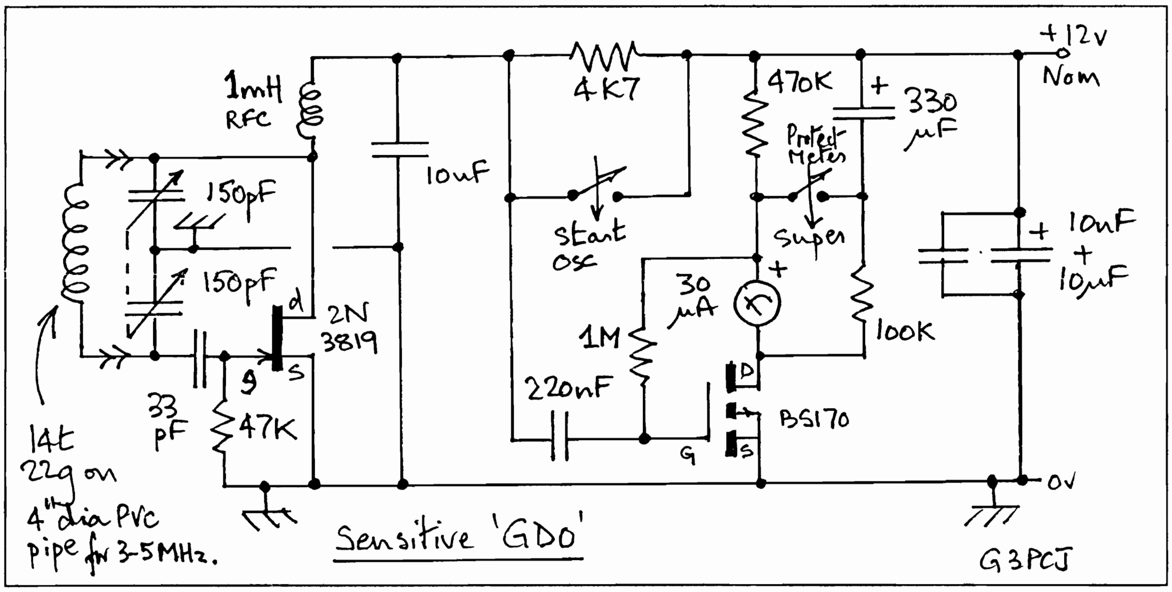


Slowly increase the DC voltage to the dummy load to 2.24 volts and adjust the meter preset for full scale deflection with the slide switch set to the 50 mW range. Mark the scale FSD position 50 mW and or 17 dBm. Then reduce the DC input voltage to the dummy load and make markings on the meter scale as room permits using the lower values in this table. The other ranges will be automatically correct. The dBm figures are the RMS power (being dissipated) relative to 1 mW (0 dBm) into 50 Ohms. The higher ranges each increase power by a factor of 10 which corresponds to a 10 dB increase giving FSDs of 27 & 37 dBm or 0.5 & 5 Watts. The maths behind the calibration is V_{DC} = sq.root(2RP), where R=50 Ohms & P = power in watts. Tim G3PCJ

Input DC volts	milliWatts	dBm	Input DC volts	milliWatts	dBm
0.316	1	0.0	1.00	10	10
0.447	2	3.0	1.41	20	13
0.547	3	4.8	1.73	30	14.8
0.707	5	7.0	2.00	40	16
0.836	7	8.5	2.24	50	17

More on Grid Dip Oscillators!

Last time I mentioned the QRP Convention Challenge which was to build the most sensitive GDO. It was won by Peter G3OFX who achieved a distance of 21 cms against the test circuit set to near 4 MHz. For various reasons I felt I should not enter my own offering but it did prove to be pretty sensitive and readers might light to see the circuit. It hardly qualifies as a normal GDO since it has only a limited tuning range but that could be altered with plug-in coils. The starting point is a large oscillator coil for best coupling to the test circuit - I know 4" inch PVC pipe is not very practical but the bigger the better! Thereafter one should also use the oscillator transistor as a DC amplifier; often the meter in a GDO is associated with the gate of the FET (or grid for valves) but measuring the change in standing current through the device will also utilise its DC gain. In this case it is done across the 4K7 drain DC load resistor. (As this resistor is quite large, the device may not burst into oscillation without first shorting this out, hence the start button - alternatively use a lower drain resistor or higher supply.) As the device current often changes appreciably across the oscillator frequency range, the 'indicator' should be AC coupled so that it only shows the sudden change in current as the oscillator frequency sweeps through that of the test circuit. (This requires a slightly different technique of use where the tuning is swept at a constant rate - the indicator will not give a 'dip' if left stationary at the test circuit's frequency.) I tried all of the oscillator circuits mentioned in Hot Iron 31 but this proved the most sensitive and it should have a wide frequency range with suitable coils. The Challenge allowed a second device so I used a BS170 MOSFET as a further amplifier for the low frequency current changes. (The second switch prevents meter damage due to switch on transients.) G3PCJ



Somerset Homebrew Contest

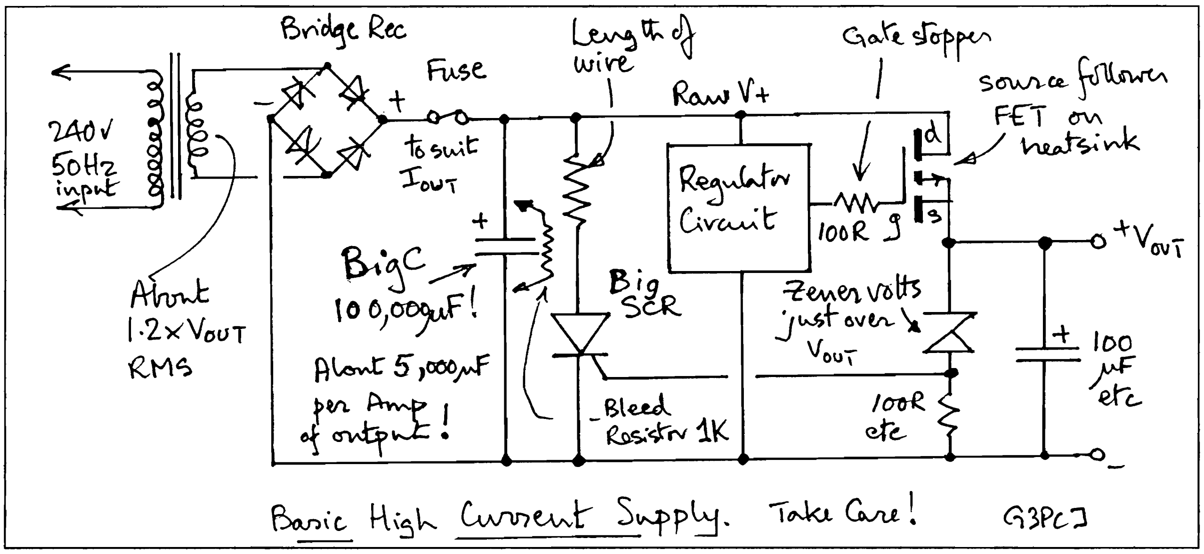
This event was kindly organised by Peter Barville G3XDS of the GQRP Club on March 25th. Entrants had to use either a homebrew RX or TX (or both) for 3 hours on 40 or 80m. I pleased to report that Alan Burgess G4GLV won the first prize £50 Walford Electronics voucher using his Bruton TCVR. There were also several other 'brands' of rigs - both kits and completely home designed. Well done Alan and watch out for it again next year. Details will be in Hot Iron and Sprat.

Bristol Frequency Stability

Generally, builders have reported very good frequency stability especially on receive after a few minutes warm up. However, one or two builders have noticed a slow frequency drift after going to transmit. I have searched for a possible cause for this and eliminated all potential culprits except thermal effects! Actual frequency is highly dependent on the varactor tuning supply voltage from the LM317L regulator, these have excellent load and line voltage regulation - much better than the common 78L0X fixed regulators - but output voltage is prone to temperature influences. The 317 regulator is located near the output stage heatsink so is slightly warmed up after going to transmit. I wondered if heat might also be altering the main regulated 9 volt line to the RIT circuit but this is insignificant. The solution is to keep the 317 cool, either with polystyrene insulation between heatsink and regulator as suggested in the Manual, or a fan blowing the heat away from the 317. G3PCJ

High Current Power Supplies

In correspondence with Joseph Bell, G3DII, he mentions the care that should be taken with over voltage protection circuits for high output supplies. His own design had a 100,000 µF reservoir capacitor feeding the regulator stage. This normally holds a lot of energy! (Don't drop your screwdriver across it!) It needs to be discharged quickly in a controlled manner in the event of regulator failure or other causes of excess output voltage. The usual solution is an SCR crowbar circuit across the big capacitor and triggered by an over voltage detector at the output which also blows a protective fuse to prevent things melting. You need to be careful that the when the SCR fires, which you never want to happen anyway, that it does not destroy itself before blowing the fuse! The suggestion is that you should use some thickish wire in series with the SCR's anode to act as a low value resistor. I have sketched the main parts of a simplified supply below.



Joseph also mentioned strange heating effects in his main output device which happened to be a large FET operating as a source follower. It was getting hot when passing a very low output current! FETs have a well known tendency to oscillate (often at UHF) when used as source followers with a capacitive load. (An FET source follower fed from a long time constant used to be used in many computer supply 'reset' circuits until someone twigged this point! I have also spent hours chasing finger sensitive audio filters using source followers for the same reason!) In a power supply situation there is often 10 to 100 µf across the output to provide low output impedance for high frequency load currents which are too fast for the regulator circuit - so everything is there for an oscillator! The cure is simple - add a 100R gate stopper resistor! Older style regulators using bipolar transistor pass devices such as 2N3055s do not suffer from this problem!

Incidentally, recent EU regulations effectively prohibit such simple commercially made supply circuits because they introduce very nasty current spikes in the supply mains on each cycle as the big capacitor charges. Switch mode supplies are designed to avoid this - but they radiate instead! G3PCJ

Contributions!

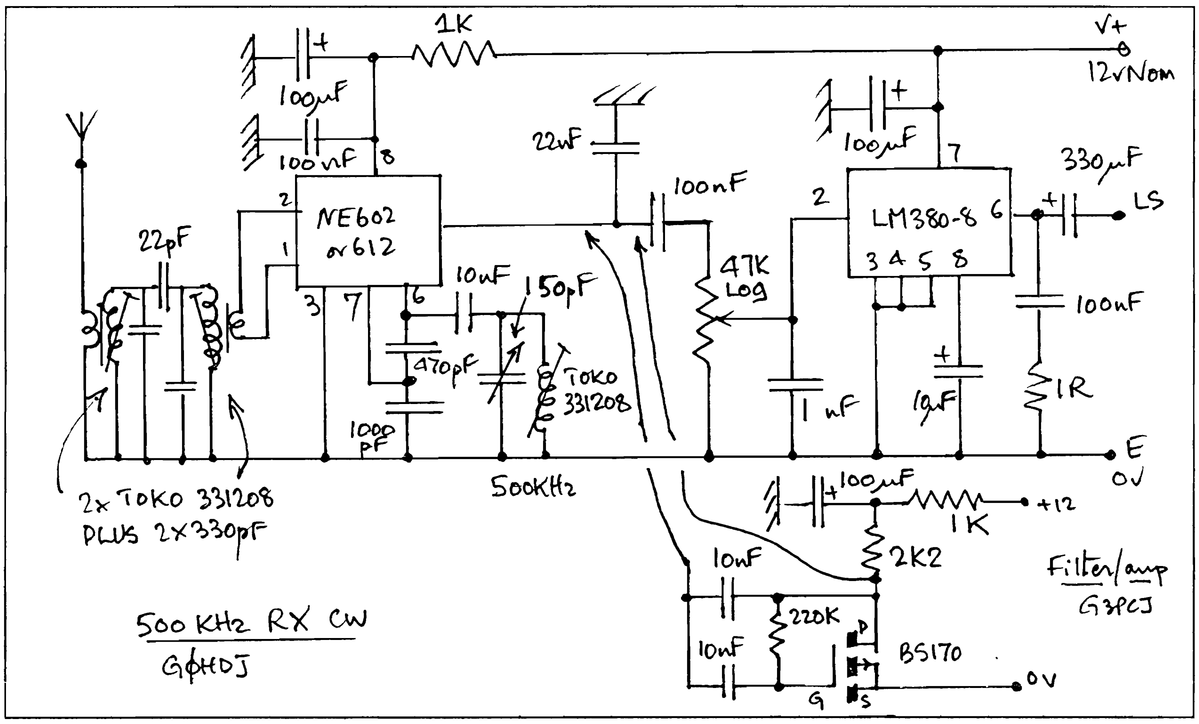
You can have hardly failed to notice that most of this issue is my prose with a few ideas suggested by others! I know you will get tired of this so please get writing! I know many of you do write quite happily because you correspond with me and others who I see occasionally in print elsewhere. Even if you feel unable to do all of an article, I am always pleased to have suggestions or questions because I have great difficulty thinking up new and interesting things!

PME and Radio!

Recently I completed the mains wiring of some barns needing new incoming single phase supplies. I had installed the distribution units with current operated earth leakage trips, known as RCDs; when Western Power came to install the meters etc. the man asked why I was not using PME - protective multiple earthing? I explained that I did not like being dependent on their neutral wire for safety earthing especially if there was any chance of touching mains earth and real earth at the same time. He agreed with my caution - it is especially relevant to radio shacks. Radio and PME don't mix!

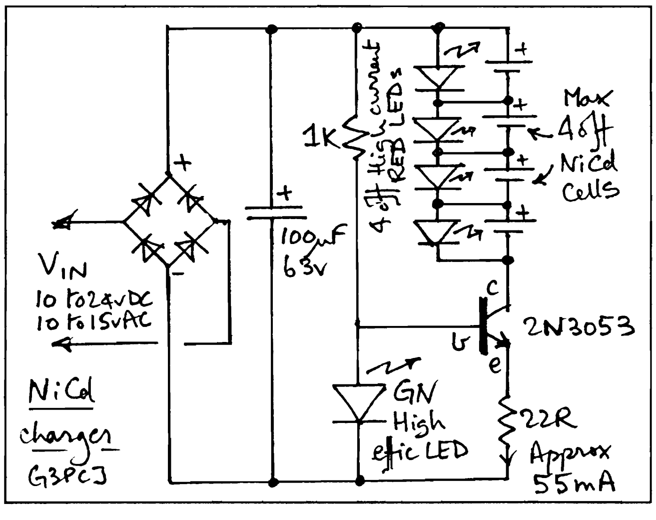
Maritime CW on 500 KHz

Craig Douglas G0HDJ sent me details of a simple receiver for this band based on the Sudden concept. The circuit below is his with a few minor alterations. It is a simple direct conversion receiver using the oscillator section of the NE602/612 mixer chip actually as an oscillator, followed by an audio output power amplifier stage with a voltage gain of 50. So overall it is not a particularly sensitive receiver but with a long wire antenna it should be able to find the maritime beacons and other signals near 500 KHz. If you want more sensitivity, you can add an RF amp or, perhaps more easily, an extra audio stage before the AF gain control as sketched in the corner. This arranged as a CW filter because the RX is also bit short on selectivity!



Nickel Cadmium Cell Charger

The circuit shown right can be used to charge any number of AA sized cells up to four. The green LED shows the supply is on and also acts as a simple zener diode for the constant current source. The red LEDs go out when a flat cell is inserted and tend to glow slightly when the cell is charged or shine fully when a cell is absent. The red LEDs will go out when the cell is inserted either way round so do get the polarity correct! You do not need to short out missing cells. The use of a bridge rectifier plus smoothing capacitor at the input means it can operate off AC or either polarity DC quite safely! I found this circuit invaluable for charging walkman batteries for the kids when doing long car trips abroad! G3PCJ

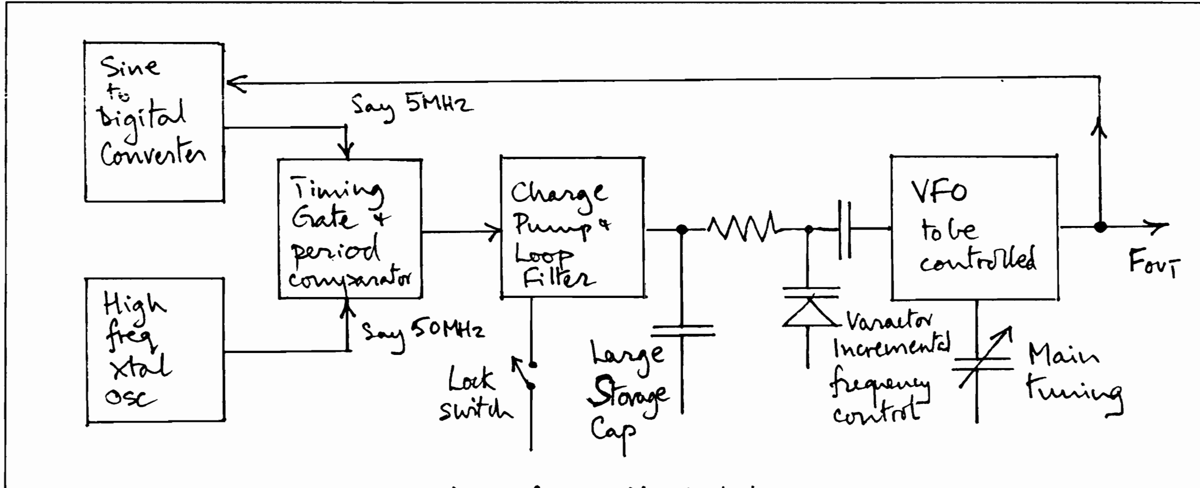


Subscriptions!

Yes, I am afraid its that time of year again. Assuming you wish to continue receiving Hot Iron, let me have your cheque for £6 please by Sept. 1st please. If you are like me and inclinded to forget such deadlines, its as well to do it while fresh in the memory - i.e. now! You only need send me the cheque and your name and address. Don't forget to include any questions or articles etc. - preferably by e mail to walfor@globalnet.co.uk Don't worry about polishing up the final version - I can do that!

Huff and Puff Stabilisers

David Proctor G0UTF asks me to explain this concept. What a question - its far too difficult and I am not sure I fully understand it anyway! However - here goes! It is the slang name given to a relatively simple circuit used to stabilise the frequency of a conventional free running VFO. Although it uses the negative feedback principle it is not as complicated as phase locked loops. It was made practical by a Dutch Ham a few years back and has been the subject of several articles in Radcom's Technical Topics series. Our member Derek Alexander G4GVM uses a recent version with his Yeovil's 5 to 5.5 MHz VFO. It is not easy to explain but I think it helps to regard the circuit as being similar to a frequency counter but without the displays! It is a lot simpler too! I don't have a full circuit that I can sensibly include here so I will only describe the general concepts. In a conventional frequency counter, a relatively long period reference timing waveform (often divided down from a crystal) opens a gate for a defined period during which the counter counts up (and then displays) the number of cycles of the unknown signal. For example, a simple 5 digit counter using a gate open period of 1 mS would have a least significant digit showing the KHz of the incoming signal with a maximum of 99.999 MHz. (Beware that often a prescaler is used to increase the upper frequency limit requiring a longer gate period for the same resolution - my 5 digit counter uses a divide by 10 prescaler and a gate period of 10 mS.) For very low frequency signals the process is reversed to measure the period of the unknown (and then calculate the reciprocal to determine the frequency). In such situations, the counter instead measures the number of cycles of the accurate reference which occur during the much longer period of the unknown. For example, the reference might be at 1 KHz so that five digits would give a maximum period of 99999 milliseconds for which the reciprocal gives a frequency (lowest) of 0.01 Hz. It is perfectly feasible to compare the displayed unknown period with a desired value and apply a correction to the VFO being measured - this can be done manually or electronically with a device which compares the measured and desired values and then alters the VFO tuning in the direction to make the values equal. The Huff and Puff stabiliser shown in block diagram form below operates in a similar manner but without the displays.



Outline of huff + puff stabiliser (G3PCJ)

In this arrangement the high frequency crystal reference is used to 'measure' the period of the desired VFO output - however, only the least significant digit of the counter is present - the slower more significant digits of the counter are missing as they are not needed. If the frequency drifts up (say), the output of the single bit comparator will become a logic 1 more often which is arranged to drive the VFO down by means of the long time constant filter connected to the varactor diode. If the frequency goes down, the comparator output will spend more time being a logic 0 so that the control circuit tries to bring the frequency back up. When the frequency is spot on, the comparator spends an equal time at logic 1 and at logic 0 so that the net effect is zero. An actual huff and puff circuit uses at least a crystal oscillator, a couple or more digital chips, a few transistors and an op-amp. The frequency control range of the varactor is usually quite small and the oscillator has to have good short term stability so that they invariably depend on air variable capacitor main tuning. Quite often the circuits need to settle for a minute before they can be turned on with a 'lock' switch. It is also quite difficult to make them change often and suddenly between two defined frequencies such as is required of the LO in generating the 800 Hz offset in a CW transceiver. Injecting a keyed CW tone into a phone rig avoids this problem. Derek - is this about right? Tim G3PCJ