"JOURNAL OF THE CONSTRUCTORS CLUB"

Hot Iron

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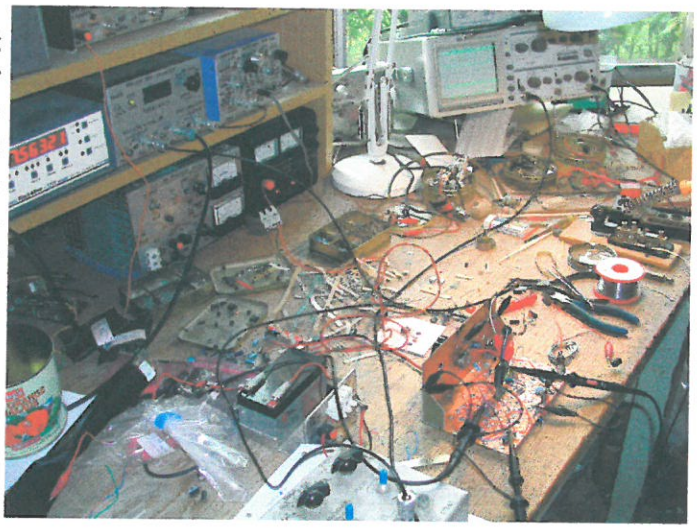
Contents

The Walford Electronics web-site is also at www.walfordelectronics.co.uk

Editorial



Here we are at the start of another Construction Club year, and for once this year, the sun is out and we have a settled spell of good weather which has enabled us to catch up a bit on the farm - thank heavens - many activities are two months behind normal! Hence time for a little electronics work on Hot Iron! Time for a different picture - can you identify what rig I am working on at the bench? The photo was taken a little time back and I suspect was associated with development of a phase lock VFO that never got past this stage! I would love to have some other Member's photos for you all to enjoy - be glad to give them an airing if you care to send them down the wire! Tim G3PCJ

Kit Developments

The **Upton** is now available but is not really a single kit since it is made up of several standard kits allowing potential builders to pick and choose what they need. It is about to appear in PW. Several **Knole** DC Rx's have now been built - this is intended to be a better receiver to replace the Kilve and has several aspects that will improve out of (amateur) band BCI. The K series transmitters can be used with it. I have also just got the first **Brendon** working - this is a development of the Brean; it is a DSB phone TCVR but with a more robust IRF510 RF output stage, LS drive and a PCB front panel to allow a more spaced out layout suitable for novice constructors. See later.

After completing this issue of Hot Iron I shall be writing up the **Knapp** which is a single band regen TRF RX. It is small at only 50 x 80 mm! It uses essentially the same circuits as the Catcott but without the multi-band aspects. Then I *will (!)* be starting on the **Minster** unless I get distracted by a revision of my counter designs. At present I am dithering over how to lay out the Minster - whether as a base single band (20 to 80m) TCVR on the main PCB, with another PCB for any two extra bands with other optional extras like AGC etc; or to go for a RX PCB and separate TX PCB - both having spaces for the extra bands. Any views are very welcome! Tim G3PCJ

Hot Iron is a quarterly subscription newsletter for members of the Construction Club. Membership costs £7 per year with the first issue for each year appearing in September. Those people joining later in the year will be sent the earlier issues for that year. Membership is open to all and articles or questions or comments or notes about any aspect of electronics—principally on amateur radio related topics– is very welcome. Notes on member's experience building their own gear, from kits or otherwise is most interesting to other constructors. To keep it interesting, your thoughts and ideas are required please! For membership, I only need your name and address and subscription. Send it or any other suggestions to Tim Walford, Walford Electronics, Upton Bridge Farm, Long Sutton, Langport, Somerset TA10 9NJ © G3PCJ

Army Signals Cadets in the 50s - by David Proctor G0UTF

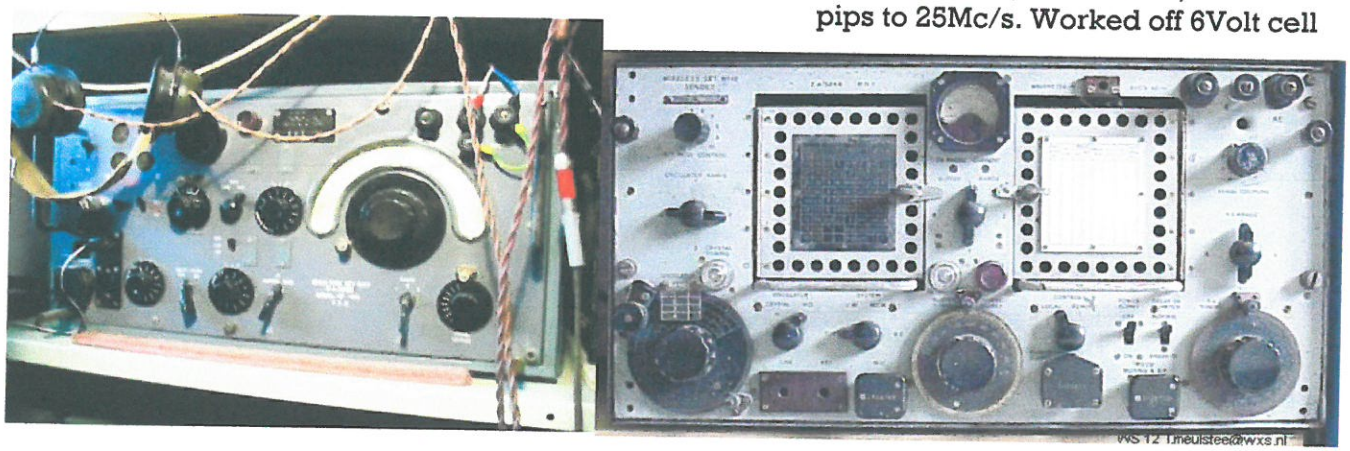
I still have a memo from the Ministry of Labour telling me that I would not be called up for service in H.M. forces after June 1960. I left university in 1961 so I avoided my two years in National Service: however, whilst at school I did join the Combined Cadet Force – because they had a signals section! The corporal in charge was not to my liking, but when he left, I got the job of running the section. I think that some Construction Club members may also have been in the Army Cadets – so let me remind you of the gear we used (as I remember).

The base station was cubicle, about 6 x 5 feet crammed into a prefabricated army store. The RX was an army **R107** and the TX was a **"12 set"**. Frequency checks were by a **"type D"** wave-meter. I ran the aerial via a large army issue copper knife switch (to earth it) via a flag pole on the parade ground to a higher building. The wire was VIR covered multi strand copper and one steel (for strength). With 25 Watts of double sideband AM from the **"12 set"** transmitter, there was a national network on three single frequency allocations (between 4 & 6Mc/s) and I managed to work other cadet stations across the UK during the daytime. Of course, we had less attractive manoeuvres in the field, staggering through wet fields with **18 sets** which were worn on the back like a rucksack and another cadet was needed to operate it. A much lighter rig was the **38 set** which was held by a strap over the shoulder. Both these rigs were valved (IO types) and so the batteries needed for HT and heaters were quite heavy.

If you remember, they looked like this:-

18 set – RX at top & TX below **38 set** - transceiver - 5 valves 4 x ARP12 1 x ATP4 (PA) Po 0.2W. Whip ant to 12 feet. 7.4 – 9.2MHz

Type D Wavemeter spot frequencies 1.9 - 8.0Mc/s in two ranges. The gaps filled by VFO (centre knob) with 1 MHz pips to 25Mc/s. Worked off 6Volt cell



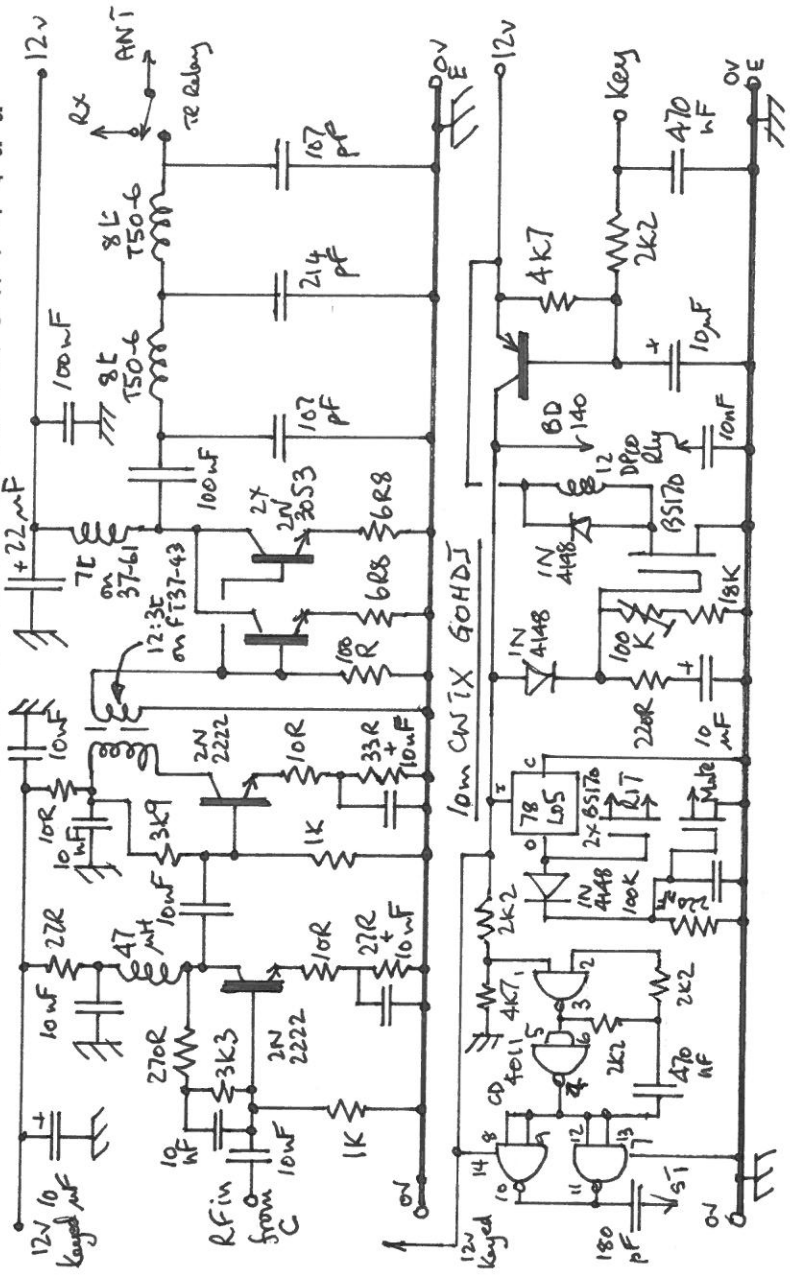
R107 (left above) in steel case and cast iron knobs (very tough) single conversion superhet with 1 RF and 2 IF stages: range 1.2 – 17.4 Mc/s in three bands.

12 set (right above) – built in steel cabinet – front panel perforated to see a pair of glowing PA bottles! It produces 25Watts of double side band AM from 1.2 – 17.5 MHz. Hand held carbon microphones were used – they were rugged.

G0HDJ's Sutton CW TX for 10m

Craig decided that he would build his own 10m CW TX to go with his Sutton and has used a mix of circuits from NB6M's homebrew page of suggestions and mine from earlier rigs. He built it physically with a mix of isolated 6mm square pads stuck down onto sheet copper clad PCB for the RF parts, and Vero board for the control circuits. The resulting assembly was attached to the back of his Sutton RX. At the time of writing in June, it was producing a comfortable 2 W without chirp and he was just waiting for the band to open! Craig's circuit is shown right.

For those unfamiliar with the Sutton design, it was a simple form of multi-band DC rig. The basic rig had ceramic resonators for 80m, with the mixing resonant circuits for other bands on a plug-in card that interfaced with a VFO mixer on the main PCB. This mixer used the 80m VFO input and a specific crystal for each plugged in band - in this case for 10m, the crystal is 24.5 MHz. This scheme avoids the problem of chirp and provides a stable adequately large coverage of each band. For those who would like to explore the arrangement, I have plenty of crystals for the higher bands - 10.5, 17.5 and 24.5 MHz. The Sutton VFO mixer circuit fed into the rig's product detector so that a buffered output for driving a transmitter was available from its point C, which forms the RF input to this circuit. G3PCJ



More Snippets!

High power chips I recently spotted that Freescale Semiconductor claims to have the highest power laterally diffused metal oxide semiconductor (LDMOS) RF power transistor. These are relatives of my trusty BS170 and IRF510 FETs!! It gives a pulsed peak output of 1 kW at 130 MHz with 65% drain efficiency. I wonder if that could be made to open your local 2m repeater?!

Narrow band TV Dave Buddery Snr G3OEP reports that he is a member of the Narrow Band TV Association and they are looking at Baird's work. He suggests the BBC were unwise to drop his experiments as their best members are now achieving good three colour moving images needing only 9 KHz of bandwidth! Dave asserts that a single high powered medium wave transmitter could cover the whole of the UK! I must admit that I don't understand how the many so called digital TV signals (with their digital sharp modulation edges - which imply 'wide' bandwidth) can be more spectrum efficient than the existing FM modulated analogue signals - perhaps a reader can explain!

Ultra capacitors I am fascinated by this technology as it wont be long (I hope) before we can stick these in our electric vehicles and forget about lead acid or Lithium battery technologies! I see that Maxwell Technologies have developed a unit that can deliver over 58 kW of power! Although individual cells operate at about 2.5 volts, higher voltage 'stacks' can be obtained to over 1100 volts. The continuous discharge current can be up to 150 Amps! No mention of price so don't order them from Walford Electronics just yet! G3PCJ

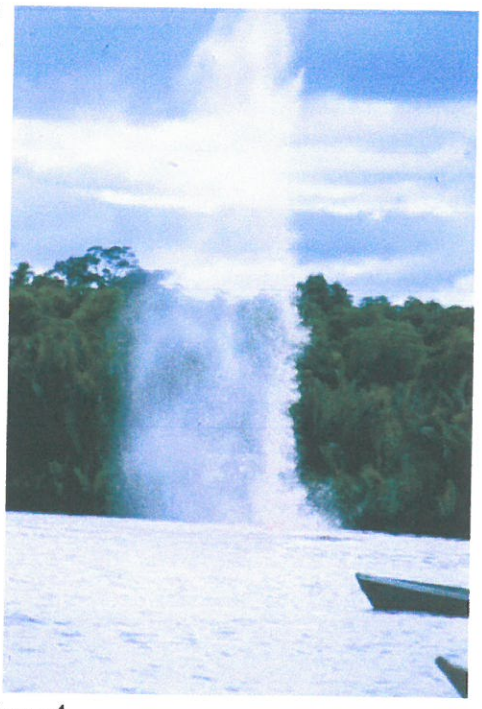
HF Radio experiences in the oil industry – - HF Radio in the bush

The area where I was working in West Africa was a hive of activity in the early 70's. One of the problems we had was "conflicting operations" whereby things one crew did would interfere with the operations of another crew and vice-versa. All the crews had a common HF channel no matter who you worked for and we made arrangements to make radio contact if we thought "conflict" was going to happen or if we found it happening unexpectedly (a very common state of affairs). It got so bad at one time, that we held a meeting in town at which we talked about our areas of operation, their extent and duration etc. and we thought of ways of "deconflicting". Eventually all the interested parties admitted they had a spare transceiver and we decided to take one to the bush every day with the operation, rig up a dipole, make contact and conduct our affairs in a manner such that the conflict ceased to be a problem. This worked like a charm. I very much admired the performance of a dipole slung amongst the trees in the jungle as a result! Needless to say, management and our clients were very happy with this state of affairs.

Later on during this first trip to West Africa, my operation found itself having to let off moderate size explosive charges in the big rivers where we worked. The rule was that if the river crossing in the line of progress (not the actual river width) exceeded 600 metres, we had to make these "water shots". There was one shot for every 50 metres of the river crossing. Each shot used 15 to 20 pounds of explosive and on a good day we might make 2 sets of river crossings. It could amount to about 100 shots a day or a bit more, so around a ton of explosives might be used, quite an undertaking (dangerous too – NB for the environmentalists, these practices are a thing of the past, there are better and safer methods used today). Inevitably, at the time we killed a lot of fish.

The shot firing was carried out by radio and so was the shot positioning (charge supported beneath heavy duty plastic bag, towed behind dinghy, yours truly driving). This was before the days of modern, mass produced VHF transceivers (by only a few years) and we used 3 sets of hybrid AM Motorola taxi radios, with some valves used on the transmitter side but with a solid state receiver. They ran on a frequency around 58 MHz if I recall, just HF of "6 metres" (why?? – I never found out – I was too fly too ask!). The valves in the RF side of the TX meant that these beasts ate batteries, you needed 2 good 12 volt car batteries per set – one for the heater and one for the HT (rotary converter if I remember), if you wanted a reliable day's work to be carried out. The gear came with a set of antennas – a whip for the dinghy from which the shot firing was carried out and a couple of others for the two fixed stations. The whip bases were pretty hopeless for work in the mangrove bush plus the unbalanced RF got into all the other gear and so I rigged up dipoles for the two fixed units and hung them in the mangrove. They worked fine.

My crew carried out several of these operations and a few times I heard music on the channel and once or twice weak voices speaking in what I thought might be Italian or Spanish (neither of which I spoke at the time). One day, in the late afternoon, the music was stronger than normal and so was one of these voices. I noticed a kind of interrogative tone to the voice from time to time after we had been transmitting and words like 'Que?' being used. I thought we had a listener, so I said, "This is Crew XYZ working in (West Africa), who is calling?" I think I repeated it a few times. There was a silence and finally a voice came back "This Taxi in Buenos Aires". I had a rather poor chat with the guy who spoke just a little English and he said, "I hear you before, today you very loud, what you do?" I can't really remember much of what I said, but I know told him not to worry because we would soon be gone!! I reported it "off the record" to our management and they laughed. I think Ham Radio and in particular NFD experiences helped to get me through those operations, perhaps when it came to making sure all the batteries were ready and the antennas. It was certainly useful in explaining to those not familiar with radio operations in what to do to reduce consumption from the HT supply battery by taking one of the croc clips off between times when we were not actively using the gear etc. I often wonder if I would have got through all that without amateur radio.

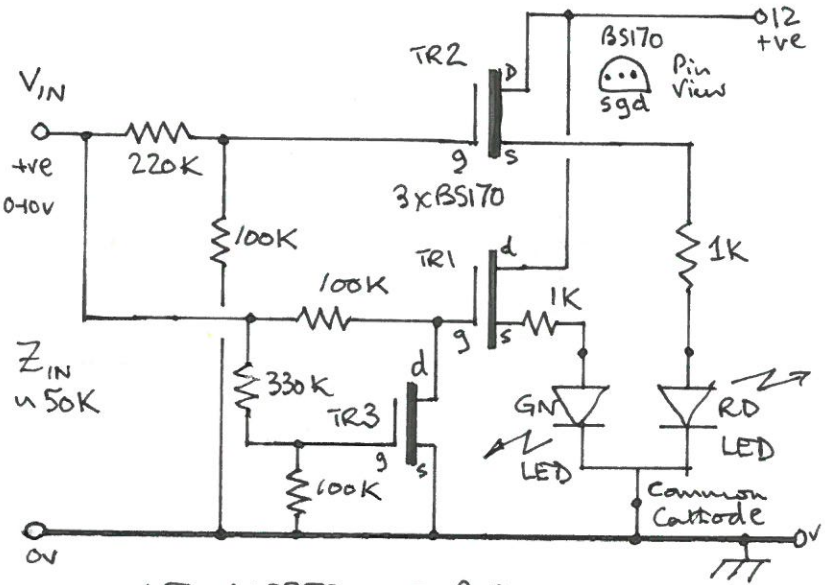


Copyright D Buddery Jnr G3SEP

Meter Miscellany and CD4066s!

Andy Howgate tells me that he had fitted a LED 'meter' to Eric (G3GC's) partially finished Taunton. When clearing Eric's shack I found this rig and Andy expressed an interest in completing it - which he now has, but not without considerable difficulties. Although a retired design now, it is worth recounting the difficulties in case any members have had similar problems (and not told me!). The symptoms were that it would work for a while and then blow one of the CD4066 switching chips, which it did repeatedly! This was not doing the PCB, or Andy's temper, any good whatever! Andy eventually did find the problem himself and this then prompted my memory to confirm that there had been a design problem which had led to a PCB modification on later models. The problem was an unused section in one of the CMOS mixer switches, where the recommendation is to tie the unused or unconnected inputs to a supply rail. Owing to the complex track pattern, it was much more convenient to tie the inputs to the 8 volt supply than to 0 volts, and this was eventually causing the chip to blow. The modification was to connect the unused inputs to 0 volts; so I am now pleased to report that this Taunton is now working properly! Andy fitted two LEDs instead of a normal edge meter (see right) which set me thinking about tri-colour LEDs as an alternative to expensive moving coil meters.

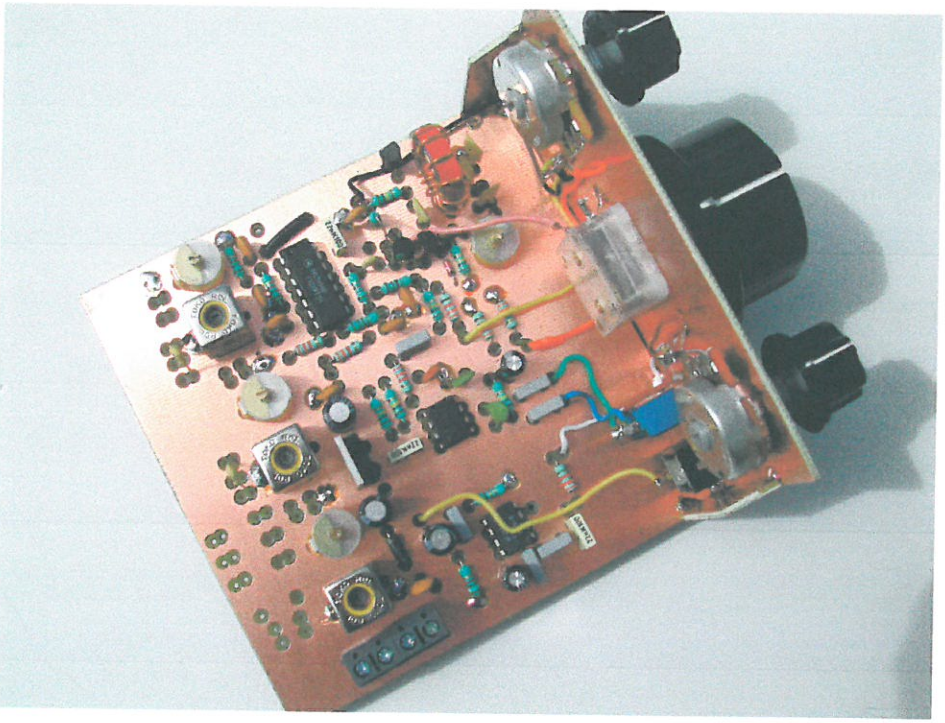
Tri colour LEDs are cheap and easily fitted devices - they are usually just a pair of red and green diodes in one package with three leads, the central one being their common cathode. The driving circuit is intended to simulate a nominal 0 to 10 volt FSD voltmeter; it relies on the BS170 needing just over two volts between gate and source to make it conduct. Because the gate is like a capacitor, you can use resistive potential dividers on their inputs to select the threshold at which they will begin to conduct. TR1 and 2 are arranged to come on with voltages above 3 (brings on the green LED) and above 6 which also brings on the red LED for a combined orange colour. TR3 then comes on at about 8 volts, acting as a switch across the input to TR1 so that only the red LED is left on! I have to admit that I have not tried this out but I am reasonably confident it will work - maybe with some resistor value alterations!



LED METER - G3PCJ

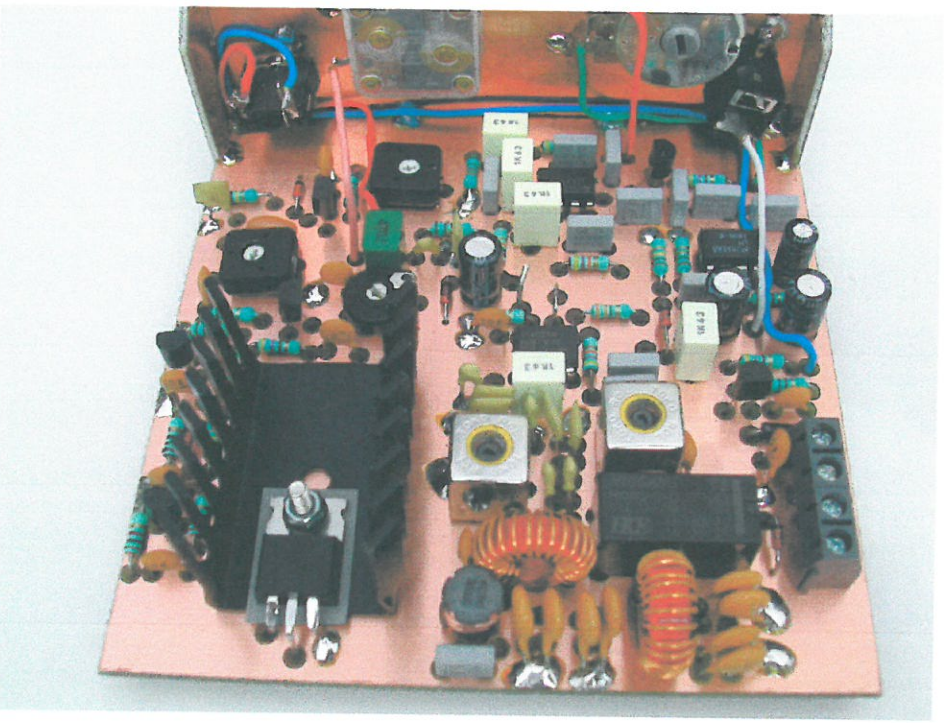
For those who like to stick with **conventional** meters, I recently purchased a quantity of good quality 50 micro-amp moving coil brand new boxed meters with 6 x 7 cm faces. **I can offer these to members at the very low price (one third of (not off!) normal) of three meters for £10, plus £3 for P & P.** Tim

The Knole



This is a DC RX for any single band 20, 40 or 80m. It can do other bands but the single set of normal parts covers those common bands. You can see the set of three inductors and trimmers on the left hand side which are the RF input bandpass filter. The use of three resonators gives extra rejection to out of amateur band broadcast stations. A further feature to improve its BCI rejecting performance, is the use of an MC1496 Gilbert cell mixer (middle top left) - this is like the SA602 but is 'stronger' and hence better able to deal with overload problems caused by BCI. The VFO uses a powdered iron toroid for better stability on the higher bands than could be obtained from TOKO inductors. I am afraid you do have to wind the toroid yourself! Main tuning is by the PolyVaricon with Fine tuning by potentiometer; the latter can be converted to RIT when used with a CW transmitter. The MC1496 feeds an audio pre-amp (in middle of the PCB) having a bandwidth suited to speech reception; the other half of this chip is a low pass filter for CW. Their output, selected by a front panel switch, feeds the AFG pot and the LM380-8 output stage (bottom middle right) which can drive a LS or phones. There is also provision for mounting a TR relay when used with either the Kilton CW, or the Kilmot DSB phone transmitters. Plenty of space! **£44 + £3 P & P.**

The Brendon



This is 'builder friendly' DSB phone TCVR producing 1.5W of RF on nom 12 volt supplies. It is laid out with a lot more space than the earlier Brean and includes a front panel etc! The audio output stage has been changed to an LM380-8 so it can now drive phones or LS. The low level RX and speech amp audio stages now use a TL072 dual op-amp. The RF output stage now uses a more robust IFR510 and heatsink instead of three BS170s! The VFO remains a 2N3819 using a ceramic resonator for 80m. For other bands (up to 20m), you can use a crystal - this avoids the drift associated with higher frequency ceramic resonators but has the drawback of very limited tuning range. This is solved by using a crystal mixed VFO with the Mini Mix kit. **The Brendon is normally £49, but is reduced to £44 + £3 P and P for Construction Club members.**

A guide to Bi-polar Transistor selection - by Gerald Stancey G3MCK

How many times do you read in a constructional article the phrase 'a 2NXXX or anything similar will do'? This is fine if you know which transistors are similar or have a book which lists them, but what can the normal amateur do? The following notes are intended as a guide and if you have followed them but the project does NOT work, at least you will know where to start to find the problem.

Firstly the no-brainers. If a **PNP** type is specified, then a **PNP** it must be. An **NPN** just will not do and vice versa.

The next thing to consider is the order in which the leads come from the transistor. Are they **ecb** or **bce** or whatever? This may or my not matter. If you are using a ready made PCB then unless you can fiddle the connections it will be a show-stopper. On the other hand, if you are using ugly construction or something similar then it probably does not matter.

In a similar vein is the type of package. If the specified transistor is in a TO1 case then trying to substitute something in a TO3 case may not be a good idea.

We now come to the voltage, current and power dissipation figures. By and large, if the proposed substitute equals or exceeds those of the one which was specified then you wont have a problem. Even if it doesn't you may still be alright but in this case you will have to analyse the circuit to see exactly what voltages and currents are involved.

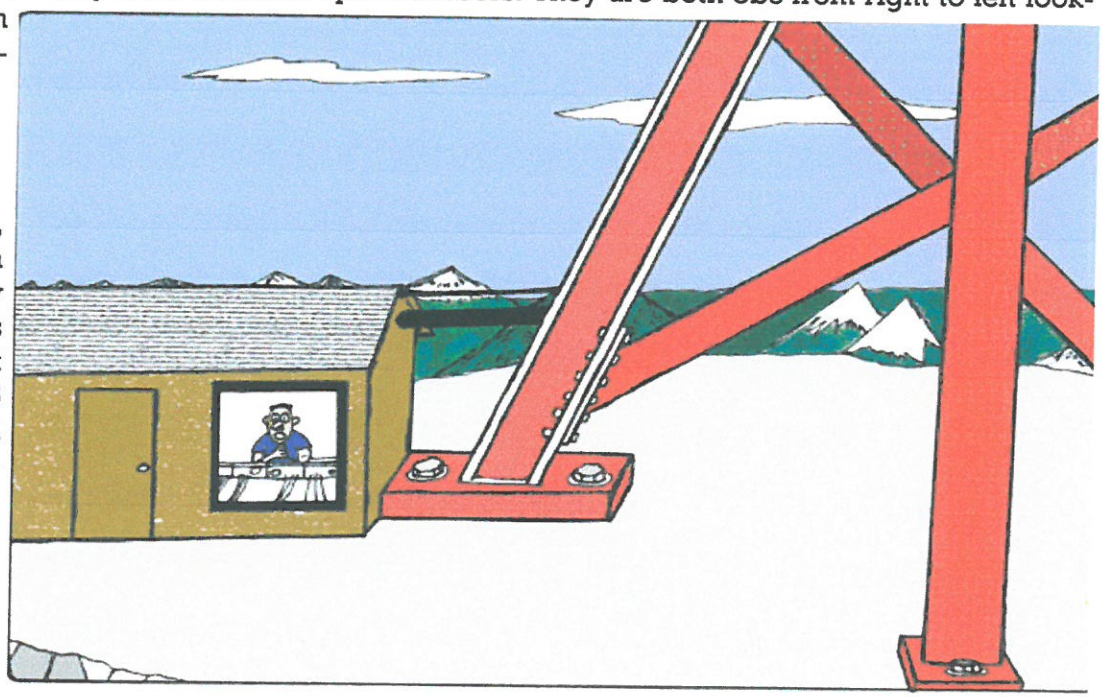
The **Hfe** (current gain - ratio of emitter/collector to base current) and **Ft** (frequency where gain drops to unity) are other parameters that need to be considered but usually they are of little importance provided they are over a certain minimum.

Two subtleties: it is usually unwise to use VHF transistors (having very high Ft) where an HF device has been specified, instability may result; also check to see if the specified transistor has some special characteristic, for example, is it low noise?

Suppliers catalogues (and websites of Farnell and RS) can be used to find the basic data to which I have referred. The above is not an exhaustive list but should be good enough to put the home constructor on the right lines as I said before - if it does NOT work, then you know where to start looking!

As a comment, I (G3PCJ) offer the following quick fix solutions! Use TO92 plastic BC182s for any HF (or lower frequency) NPN task! They are 50 volt, 300 mW, 100 mA (all max) devices with min Hfe of over 100 and typical Ft of 200 MHz. Noise figure is 10 dB. For HF PNP tasks use the complimentary BC212s - they have the same spec numbers! They are both ebc from right to left looking at pins with the flat side pointing down!

Finally, Richard Booth kindly drew my attention to this cartoon! I expect he has about 15 BC182s in parallel for his 160m output stage!



"Yes I really am running just 5 watts QRP...although I suppose I do have an above average antenna system..."

Snippets!

DDS chips - I have the following surface mount sample devices surplus to my needs:- AD9857AST, AD9283BRS, AD9835BRU. They are all direct digital synthesizer chips needing control from a microprocessor. I also have a 50 MHz xtal oscillator to drive them. Free to a deserving home! G3PCJ

Tolerances! Craig Douglas G0HDJ has built the diode tester which Godfrey Manning wrote about in an earlier Hot Iron but he had a spot of bother about the voltage thresholds. Craig eventually contacted Godfrey and the trouble was soon spotted - Craig had used 5% resistors in a critical part of the circuit where 1% ones were actually required. (I hope this vital aspect was not a problem of editing!) If so my apologies - but it does show that occasionally 'tolerancing' does actually matter as parts can be on the edge of their specified value.

Counter ideas! Gerald Stancey G3MCK kindly wrote about his needs following my pleas for suggestions: he would like the readout to 100 Hz. However he knows the band he is on so XXX.X KHz would meet his need but this could be reduced further by accepting a resolution of 1 KHz instead. As a CW man, he also knows that he is in the bottom part of the band and therefore has no need for the hundreds of KHz digit which brings the need back to XX.X or XX KHz. He could live with a set of plain LED indicators - nothing on for first 10 KHz, red for 10 - 20, green for 20 - 30 KHz, etc. In fact his 'essential' needs are met by a display of just XX KHz. As a comment, I had concluded that just two digits are adequate but have found that the extra circuits to make it into a scrolling five digit display using just two actual displays does not need many extra parts or chips. This is what I hope to offer soon. Tim

LCD Voltmeters Craig G0HDJ sent me a note about his recent move into making furniture and the need to measure the moisture content of wood! He tried adapting a soil moisture measuring circuit but lacked the information relating electrical resistance to moisture content for many species of timber. By the time he obtained this, he was given a commercial wood moisture meter as a Christmas present! However he does recommend the ICL7106 chip as a most useful voltage measuring device. It contains an A to D converter, 3 1/2 digit display driver for LCDs, voltage reference, decoders etc all running off a 9 volt battery and consuming just 2 mAmps! They are available from Farnell for about £3.20 and the matching LCD display costs about £6. The A/D input range can be 0 - 2v or 0 - 200 mV FSD.

Finally - a lighter note! Both David M0EZP and his Sutton have been recent visitors here. David kindly sent me this picture that he took while I was contemplating what to do - I did want to delete his call sign from the picture but was unable to make my software do it - sorry David! Note Upton in background. Tim