SPRAT

THE JOURNAL OF THE G-QRP CLUB

DEVOTED TO LOW POWER COMMUNICATION

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Contents

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EDITORIAL

The first GI-QRP Convention took place in June and was enjoyed by all who attended. There is a report from one of the attendees later in this *SPRAT* so I will not steal his thunder, other than to thank all of the team in GI who did a grand job and made us all very welcome.

I will also take this opportunity to thank the GI members who activated the Club callsign as GI5LOW for the very first time in the 10 days leading up to the Convention. The team made over 200 QSOs in the end on bands from 80m to 70cm; a mighty fine effort indeed.

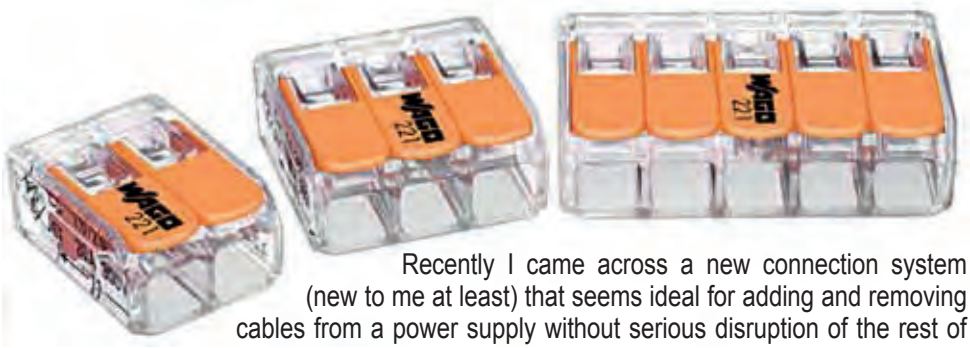
As I write this editorial, we are in the final preparation stages for the Club's annual Convention in Telford and that looks like being a cracker. Thanks to Paul at Kanga UK for providing a nice EFHW ATU as a special Convention price, and to the Telford Hamfest team for making all the site arrangements for the event.

Elsewhere in *SPRAT* you will see an advert for a new QSL Manager. **Dave, GM3VTO**, has been doing the job for many years but he has decided that it is time for a younger member to take over. Three cheers for Dave's hard work with the QSL cards!

Steve Hartley G0FUW
Chairman GQRP Club *g0fuw@gqrp.co.uk*

Versatile DC Connections - WAGO

Mike, GK8NXD, gk8nxd@gmail.com



Recently I came across a new connection system (new to me at least) that seems ideal for adding and removing cables from a power supply without serious disruption of the rest of the shack wiring. It is a modern replacement for the old 'Choc Block' bodge that is the usual NXD connector of choice.

This system is called the WAGO-221 series connector, It was designed for 240V AC at up to 32A. It's readily available in both the UK and EU, and is accepted practice in house wiring to the latest IEE regulations. It consists of a number of lever clamp terminals in a parallel connector. The options that I know of are one-way, two-way, three-way and five-way but I'm sure there are more options from other manufacturers. The connector copes well with wire from 0.1 to 4mm diameter wires, with both stranded and solid core are equally securely held.

A google search for ***WAGO221*** will produce quite a few hits on the connector and its applications.

And for a video introduction: ***https://youtu.be/n8gLG6c-iKc***

WANTED: CLUB QSL MANAGER

Steve, G0FUW email: g0fuw@tiscali.co.uk

Dave GM3VTH, has given notice that he would like to retire from the position of Club QSL Manager. We thank Dave for his long service and wish him well in his retirement.

So, we need a replacement; could it be you?

With the advent of on-line QSLing, Logbook of the World, etc, there are not so many QSL cards being sent via the Club bureau. However, there are still some who prefer to exchange physical cards, and requests for cards for the Club callsign are quite common.

It is a volunteer post, so no pay, but the Club does cover the costs of postage, etc.; you will not be out of pocket!

If you are interested, please drop me an e-mail, or by all means contact Dave to get a feel for what is involved, you can access our contact details from the Who's Who page on the Club website www.gqrp.com

Steve, G0FUW Chairman G-QRP Club

2023 Subscriptions & Sprat-on-a-stick

Graham G3MFJ g3mfj@gqrp.co.uk

As promised in the last issue, the normal subscription will remain at £6 for UK members for 2023, as will the EU rate of £12.

However, the DX rate will have to increase to £15, purely because of the huge increase in postal rates. I'm sorry about this. But it is out of my hands.

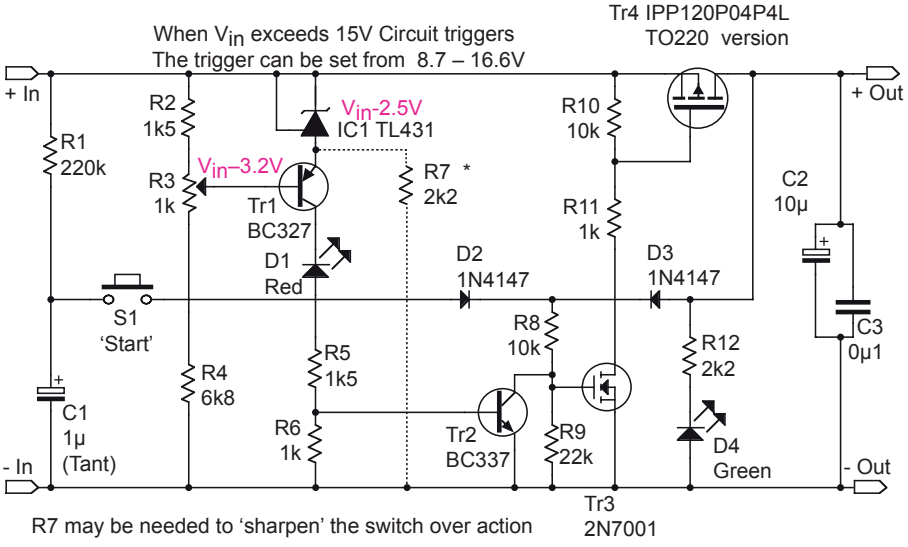
On a more positive note, there will be an updated Sprat-on-a-stick. At the time of writing, it is ordered but as I want to put this issue (192) on it, I won't have it until after Sprat 192 is ready. **There will NOT be a DVD this time**, I still have a lot of the last issue in stock, the new stick is selling so well that we won't have a DVD any more. There is more information about the new stick within the advert pages.

The price is the same, £5 plus postage (see the back page), however those who have bought the last version, since 1st June 2022, they can have a new Sprat-on-a-stick for only £3.80, plus postage. I have good records so contact me and see if you qualify.

Overvoltage Protection Circuit

Idea Corner

Here's an idea for an overvoltage protection circuit, with manual start button. The series pass MOSFET may need a heatsink for heavier currents. The LED D1, is an 'unsafe' indication, and D2 is the 'Power-safe' indicator.



At the moment of power being applied to the input, Tr4's gate 'should' remain at the same voltage level as its source, as Tr3's gate is clamped to it's source voltage level through R9. this should offer only a minute initial current through Tr3, that shouldn't false trigger a start situation.

Due to the slow(ish) rampup of voltage across C1, the trigger voltage available to drive Tr3 gate positive should remain inadequate to bring Tr3 into anything like full conduction. If under this circumstance the input voltage is high, then Tr1 will be conducting, bringing on Tr2 as a minimum of several mA will be driven into its base causing complete saturation and clamping Tr3's gate to within a few mV of 0V.

I agree that if the supply voltage is within the 'Safe range' then there is a minute chance of a false start, due to a leakage current via R1, D2 and R8 to Tr3's Gate, if the start button is pressed at this point too. This state might be sufficient to activate the hold-on line through D3. The thoughts were that this is unlikely to happen, as it would require a safe voltage supply, and S1 to be pressed at the time of connection.

The use of a momentary switch for a startup should remove any false trigger in the event of an over voltage being applied. The short delay before the ability to start the circuit, would allow the over voltage clamp circuit to be in operation, so not allowing a start condition to be initiated in this case.

However, if the supply is in an over-voltage state when these two steps are taken, then the reference voltage is immediately(?) active at the nominal 2.5V level below the positive supply, meaning that the voltage on Tr1's base will also bring it into almost instantaneous conduction, and illuminate D1 the red LED, and cause Tr2 to clamp Tr3's gate to 0V again, so shutting off the maintaining voltage for Tr4's gate.

To make sure that the emitter of Tr1 is kept at a point above the 'Knee' voltage of the reference IC, both immediately and at all times of operation, R7 was added after contemplating the indeterminate nature of voltage in the few micro or milliseconds after power is applied.

With a dynamic working impedance of under an ohm, the reference, IC2 is a device with a very sharply defined action(±2%), varying only a few mV over a decade and more range of current, above the minimum current. So, should be in a known fixed state almost immediately power is applied. I have estimated that the forward voltage of Tr1 at 0.7V rather than a more theoretical 0.6V, so with the base around 3.2V below the positive supply line, Tr1 should trigger the shut off of the output.

So, using an over voltage trigger point of 3.2V below positive sup-ply, and depending on the preferred safe voltage trigger point, a combination of ±1% resistors could be inserted in place of R2, 3 and 4, My estimate are that to 'swamp' any differences of current gain of Tr1, it would be preferable to have at least 1.5–2mA in this chain at the point of minimum trigger level voltage. Using ±5% resistors would be an option, but could lead to operation being allowed at supply voltage levels approaching the point of damage to some equipment being supplied.

I admit that if the input voltage rises slowly, that there may be a little uncertainty as to the exact point at which the shut-off will occur, but in general terms, supply failure are mostly catastrophic rises, and so supply ramp timing is now less important. But with additional components, a degree of positive feedback to the conduction of Tr1 would become far more definitive in terms of timing and voltage levels.

But would that be a case of "gilding the lilly"?

A £15 3D printed 13.8V 50 Amp PSU Case

David Holland, G4LDT email: g4ldt@outlook.com

I must have been thinking about the two articles in *SPRAT* 188 by Wes KN4NPH and M0PNN about 3D printing and power supplies when I bought my "Ender 3" 3D printer. This is the cheapest new 3D printer on the market and sells for about £130. I have to say that I am delighted with it and for amateur radio use it is great. There are thousands of radio related "STL" files out there. You will be amazed.

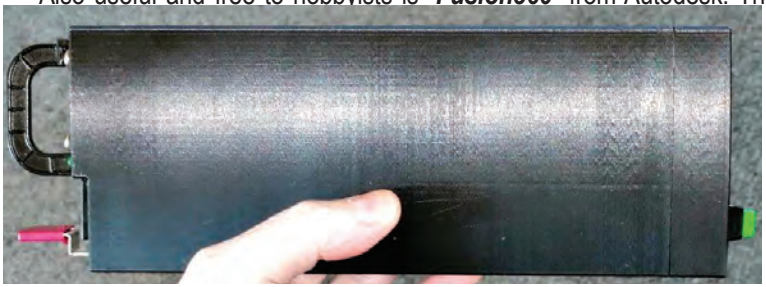
After getting the printer I thought, what now then? Wes Effner mentioned "***Thingiverse***" in his article so I went onto that site and typed "Amateur Radio" into the search bar. I was staggered at the number of projects available. One took my eye immediately. It was a case for a HP HSTNS-PL18 750 Watt Server PSU. Now I have modified a number of these in the past but the problem was that they are rather an awkward shape etc. This case seemed to solve the problem perfectly.

I must state that I claim no originality for this project. I simply got it from the "Amateur Radio" section of "***Thingiverse***".

Before starting I have to state the obvious, you either have to own or have access to a 3D printer in order to complete this project as it is! No doubt other methods of boxing (wood) will be used by some.

I use the free program "***Cura***" to manipulate the files and to convert them to ***.stl*** files that are used by the printer. This is an excellent program and quickly becomes very easy to use. I also use the free program "***Slic3r***" for splitting objects that are too big for my little entry level printer.

Also useful and free to hobbyists is "***Fusion360***" from Autodesk. This is a bit advanced though. At any rate all you will need for this project is "***Cura***". I have included some screen grabs of the two files as they appear in "***Cura***".



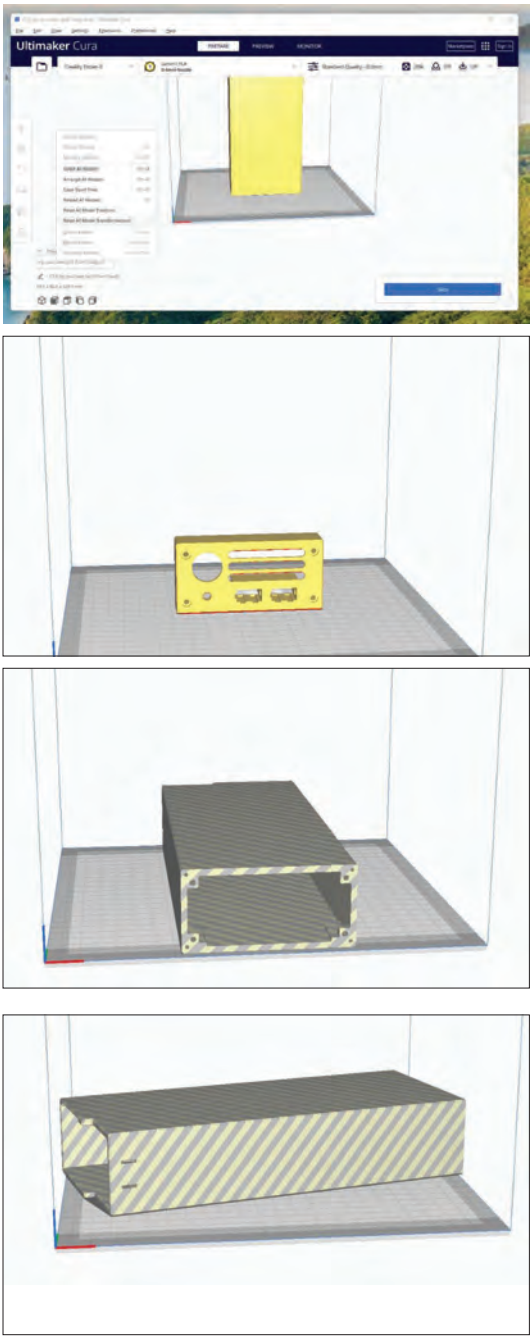
I don't profess to be an authority on 3D printing by any means but if anyone attempts this project and gets stuck feel free to email me and I will try to help.

First you print the two parts; this will take a whole 24 hours! After this task, then insert the Anderson Power poles, LED and switch into the front panel. I opted for the powerpole front but a Banana/ binding post option is available. The hole for the switch was sized by the writer of the file to fit an anti-vandal type. These cost a fortune so I just bodged in a switch I had cannibalised from something. Insert the PSU into the case.

You will get a lovely click as the spring loaded locating spigots slip into the slots in the case side. Next you will need to wire the start switch. This is connected between tabs 33 and 36 on the edge connector – see photo. Then solder all the front panel connections and screw the front panel to the main body with 3mm screws and that's it!

You will need to source form eBay or similar a HP HSTNS-PL18 750 Watt Server PSU. These are ex-equipment and very high quality. In my experience they produce no noise at all. Which is more than be said for the switched mode PSUs sold for amateur radio use! They are readily available and cost between £9 and £12 postage paid!

The problem is that the output is at 12 Volts, not 13.8. This is easy to solve however. Simply unscrew the lid and hinge it off. Lift up the insulating paper and on the side of the PSU you will see the main circuit board. See photos. You need to wire a 20k or thereabouts resistor between the fourth pin from the right (earth) to the left hand side of the tiny potentiometer at the top. This can be a bit fiddly but use a small bit and you will be OK. If someone of my advanced



Screengrabs of the print files with the Cura 3D printing program

The On/Off switch is made between these two lands on the PCB

years and shaky hands can do then you can!. Then it is simply a matter of adjusting the tiny pot with a trim tool or similar until the voltage is 13.8 – Job done! Of course you will have to de-rate the PSU from its 60 Amps original state to a max of about 50 Amps!

.A very nice looking, dare I say, professional looking and very usable unit. I run my IC7300 from it and I have had no problems at all.

The original article is at:-

https://www.thingiverse.com/thing:3831797

If anyone is interested send me an email and I will send the two “STL” files for the printer.

g4ldt@outlook.com

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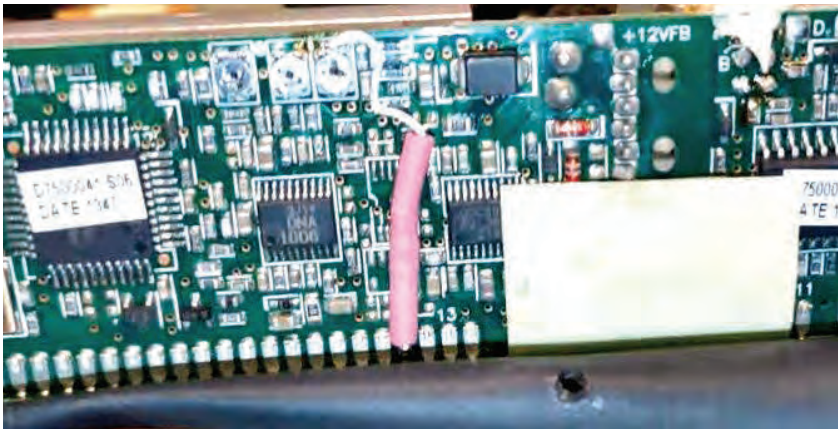
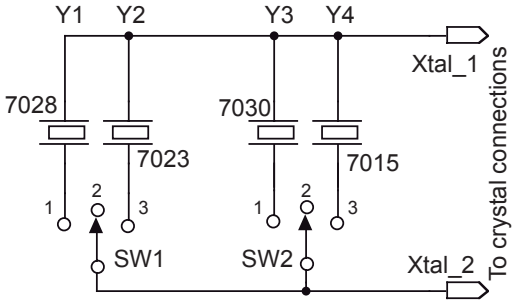


Mixing crystals for more fixed frequencies

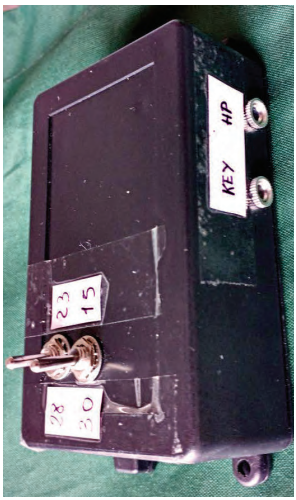
Enzo M0KTZ email: m0ktz@katolaz.net

Here is a simple and relatively inexpensive way to give even more freedom to a single-xtal rockbound transmitter like the Pixie, getting the same stability of single xtals. I built a 4-crystal switcher by connecting 4 xtals to two two-way-center-off switches, as shown in the schematic. When only one of the four xtals is in circuit (the switch of the other pair is in the center-off position), you get that frequency.



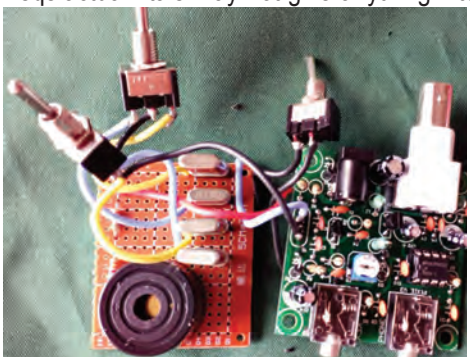
But if you put one xtal from each pair in circuit at the same time, then you might get one of the linear combinations of the two frequencies as a result, or sort of. If you are smart/lucky at choosing the four xtals, you can actually end up with more than four frequencies at your disposal.

This way of mixing xtals is something I have not seen around much, except maybe in *SPRAT* 95 by G4ESP for an 80m VFO, and not with xtals for the same band, anyway.



I have a working example with a Pixie and four xtals for 40m (7015, 7023, 7028 and 7030kHz) arranged as in the schematic. Each of them can work alone, by putting the other switch in the center-off position, but then I also get 7032kHz by concurrently using 7028+7030, 7014kHz with 7015+7023, and around 7036kHz with 7030+7023. So 7 freqs with 4 xtals, all stable, all spotted on RBN, QSOs made with two of them (7030 and 7032kHz, thanks to Marco IU8OJT).

The presence of extra stray capacitance and inductance in the circuit gives room for nice surprises: 7036 could not come from 7030+7023 alone!. Conversely, some combinations of freqs/actual xtals may not give anything interesting, except for a small pull away of one of the two mixed frequencies (in my case, 7015+7028 gives nothing new).



The finished prototype is shown in the picture, where I have added also a small buzzer for the sidetone (the third switch enables the sidetone). Everything fits in a box about twice as wide as the Pixie PCB.

I find it cool. but Your Frequencies may vary!

Tracking down RFI

Andy Eustace, M0RON, Cheltenham, aeustace@sky.com

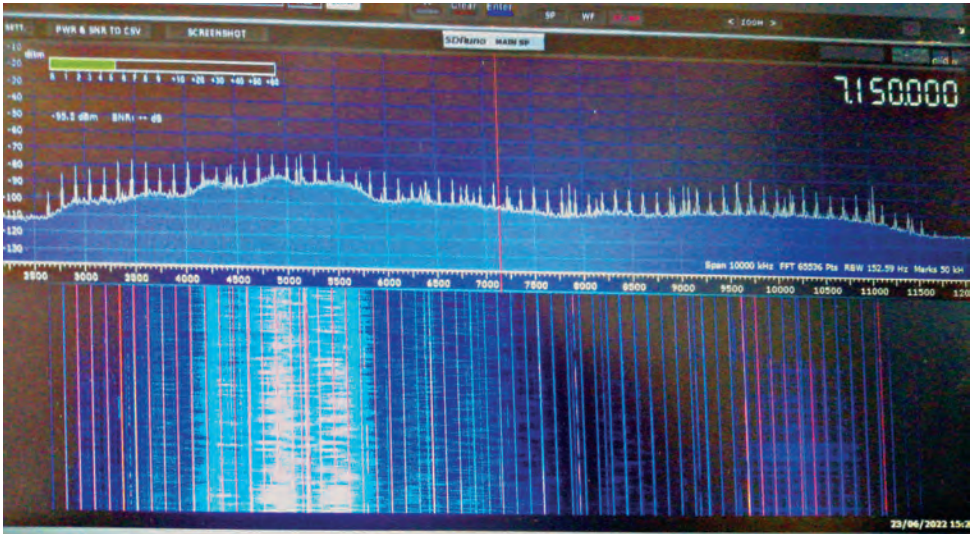
June 17th was world QRP day and the first day of the GQRP's Summer Sizzler. Intending to take part I set up a radio and switched on to be greeted by a solid wall of noise, a few minutes later I turned off the radio and packed everything away. Noise has been a problem for me for a couple of years now but never as bad as this. I tracked it coming from a solar panel's invertor, approximately 8m to my right. The rest of the usual noise comes from the large secondary school 50m to my left. That noise is ever present due to the lighting and PCs left running 24/7, their electric bill must be enormous.

A couple of days later I decided to have a look at the spectrum using my SDRPlay Duo and a PA0RDT active mini whip. As the SDRplay can view up to 10MHz of spectrum in one go so, I set it up accordingly and pressed play, Looking at the screen I couldn't see a single signal, what I did see was regularly spaced spikes all the way from DC to 18MHz and above. The picture shows a portion of spectrum, note the 60m band in particular. Zooming in shows a spacing of 125KHz and each spike has sidebands.

The noise was tracked down to the invertor but as the homeowner sees no issue to himself will not help resolve the problem, I must add that this is a recent addition to my home noise floor and is worse when it is sunny. The reason for this submission is to hopefully help others with noise problems. The *sdruno* software, bundled with any SDRplay receiver is excellent for this type of work as not only can it see up to 10MHz of spectrum in one go it can also have virtual receivers, up to 7 I believe, although there are limitations as to their use. The Duo has 2 receivers and by using 2 antennas each tuner can show a large chunk of spectrum and by choosing the ranges carefully it is possible to see more than the 10MHz of just one tuner.

Hopefully this may be of help to someone.

Andy



AVO 8 Mk8 15V Battery Modification

By Gwil Jones GW6PVK

The AVO Model 8 Mk5 to Mk8, started to use the 15V battery to measure higher resistance ranges. Ever Ready produced the 15V battery that was slightly smaller than a standard PP3 9V battery. The batteries were type B121, BLR121, B154. Varta manufactured the round BLR154 version until recently, now production of these batteries has come to an end with final production of the AVO 8 Mk7 in 2008.

AVO produced an up converter powered from the D cell to eliminate the 15V battery, but they are difficult to come across. The 15V batteries available on eBay between range from five to ten pounds in square or round versions. The core of the new batteries are made up of small 3V button cells, the round pack are shrink wrapped together to produce the 15V. The square battery are made the same way but are kept central with two pieces of polystyrene with caps either end and a plastic outer cover.

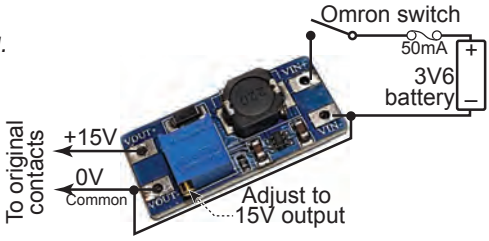
I found the life span of these new batteries varies and start to run down after a while even after periods of non-use. So, there must be a way of eliminating the 15V battery for something a bit more reliable.

I had some DC-to-DC MT3608 converters. This device inputs a voltage between 2V and 24V. the output can be adjusted from 5 to 28 Vdc. Unfortunately, I didn't come across any dc-to-dc converters that would operate lower than 2Vdc input to make them operate as I could have used the 1.5V D cell used for the lower resistance ranges. My test on the MT3608 did not produce any output with a 1.5V input.

Experimenting with the MT3608 converter, I started with a 9V PP3 battery and adjusting the on-board trimmer pot I got a steady 15V on the output. Lowering the input voltage to 3V I readjusted the multi-turn trimmer only slightly to get the 15V.

A little more about the MT3608.

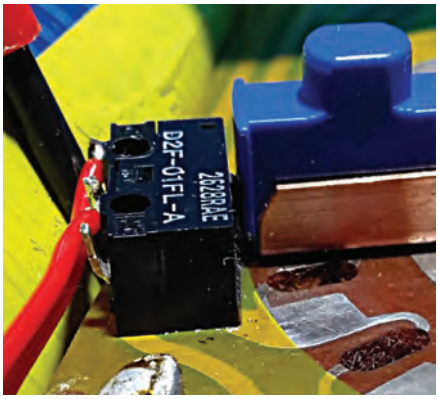
1) *Input voltage 2 to 24V.*
2) *MOSFET and Schottky diode switching.*
3) *2 Amp current rating.*
4) *Low current consumption.*
5) *1.2MHz switching with highly efficient inductor.*
6) *Overcurrent sensing.*
7) *The board measures 36x17x14mm.*



The standby current was measured at 1.7mA, while 80uA was used by the standard AVO 15V battery, no noticeable current change was seen when either a resistor was measured or the AVO test leads were shorted together. Leaving the MT3608 permanently connected would start to drain the battery which would defeat the object. The MT3608 would need to be switched

The switch would be actuated using the AVO 10kΩ range to turn on the supply voltage to the MT3608. The micro switch would have to be small enough to be fixed using two-part

glue under the body of the micro switch or using hot glue. Positioning of the switch is also important and the gap between the rotating arm and the micro switch. I found that a 1mm gap seemed to be reliable, a reduced gap could damage the switch, pull it off the board or damage the actuator.



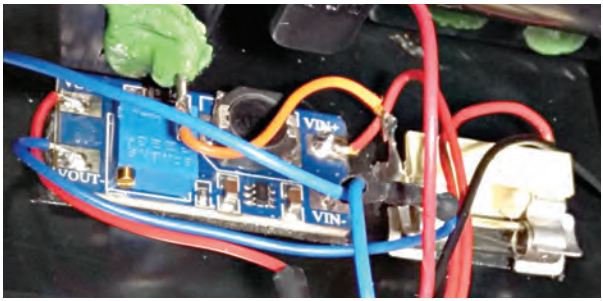
The micro switch is an Omron D2F-01 (or similar) these are available from RS or Farnell. Connect wires to the common and open contacts of the switch to a buzzer or ohmmeter adjust the micro switch until the switch activates and adjust to suit by rotating the 10kΩ range switch to find its final position and the actuation is smooth.

The type of battery to power the device is limited due to the size of the original BLR121 holder on the Avo. I adopted to use a 3.6V wire ended battery which claims to have a shelf life of 15 years available from RS. The battery has a 1% discharge rate when in constant use, my AVO wouldn't get enough use to drain the battery, so the battery could possibly out-live the AVO.

What to do

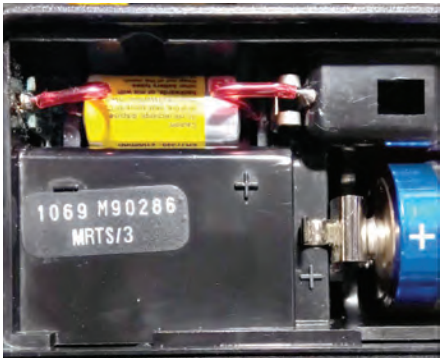
- Fix down the micro switch (as described) and allow the glue to set (don't forget to leave the switching gap).
- Set the voltage to 15V on the output of the MT3608 using the battery you are going to use before you fix it in the Avo.
- Remove the original +V wiring from the AVO battery terminal and connect it to the +V output of the MT3608.
- Run two connected wires from the micro switch up to the rear case of the AVO and secure the cables to the AVO loom using small cable ties.
- Connect one wire of the switch to the AVO +V battery terminal and the other wire to a resettable or normal fuse, this should be rated at 50ma
- Connect a wire from the resettable fuse to the +V input of the MT3608
- Connect a wire link from the 0V battery terminal to the 0V of the MT3608 as this has a common ground, leave the other 0V wire on the battery connector in place.
- The MT3608 board can now be attached to the inside rear of the AVO case using double sided foam tape (shown below)
- Rotate arm several times to ensure it activates the microswitch reliably.

If you want to check the current drawn by the MT3608 place an ammeter in line with the +V supply of the battery and the +V AVO connection and a reading of around 1.7 to 1.8mA should be seen.



Carefully put back the rear panel onto the front of the meter,

solder the +v and the -v of the battery to the battery terminals, observe the polarity markings either side of the battery compartment. Secure the 4 screws and the tamper proof caps (if fitted). Refit the battery cover and the meter on to the 10kΩ range, short the meter leads together and adjust the 10K trimmer pot on the front of the meter to show zero. Check meter with a known resistor value and read the position of the needle and should read the correct resistance.



The cost of parts (at the time of writing):
MT3608 £0.80 ea (Amazon pack of 6)
Microswitch D2F-01 £1.33 (Farnell)
Battery £5.13 (RS) 183-5718
Standard or Resettable fuse – 50ma (RS/Farnell)

Overall cost around £8 which is in line with the 15V batteries on eBay at the time of writing, the overall cost is lower over a long period of time with the expecting 15-year lifespan of the battery. After several months of use, the modification has proved reliable, no adjustment of the internal trimmer has been required and the 15V has been constant throughout and my second Avometer has also been converted this way.

Alternative AVO 8 battery (inexpensive)

Tony Fishpool, G4WIF

The BLR154 15V battery in an AVO 8 lasts an awful long time but mine eventually died and a new one seemed a little expensive.

A trip to a pound shop got me a card of “hearing aid” type batteries 10 of which were joined by using the yellow heat shrink sleeve as shown in the attached picture”. The old BLR154 is shown on the right in my picture.

As the sleeve shrinks it seems to pull the button cells tighter together and they make good (enough) contact with each other.

More WSPR magic!

Paul Taylor, VK3HN, prt459@gmail.com

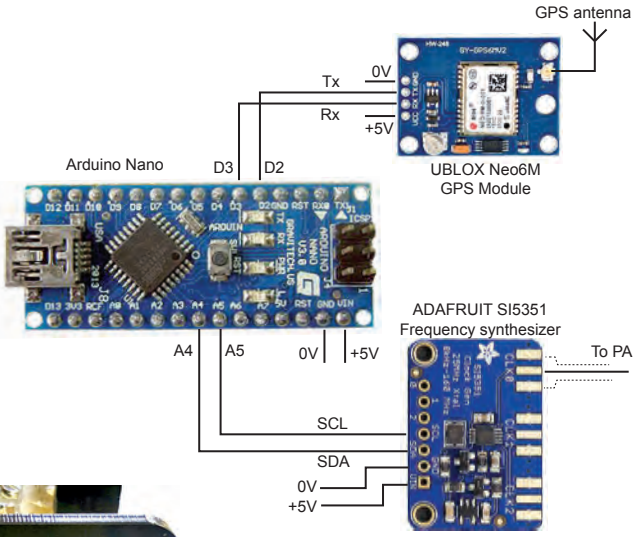
20m, 200mW & 12,000 miles:

I'm late to the WSPR party. I've wanted to try a beacon project for a few years. A while back, I took a copy of the ZachTeck script ‡ and experimented with it and a Ublox GPS, but after getting the NMEA strings decoded from the GPS unit at roughly one second intervals, the rest of my code was over-engineered and bloated, and did not fit into the small memory constraints of the Arduino Nano. I put is aside.

Recently, I did a much needed upgrade to my Arduino IDE and libraries. The thought occurred to me that improvements to both IDE and libraries may give me a fighting chance of getting that old WSPR script fitting. When I opened it up, and started to work through it, I saw some obvious ways of reducing memory usage. I had too many String objects (memory-hungry). And my code was written to parse each NMEA message string and tokenise it.

This allowed me to get to discrete data fields a long way down the messages, like the number of detected satellites. In a simple WSPR beacon, all you need is the UTC timestamp at the very start of most NMEA messages. I ditched the superfluous stuff and got it uploading, and more to the point, not hanging!

The schematic is simple and modular. The Ublox-6M GPS connects to Arduino D2 and D3 for serial data transfer. The



si5351 breakout board uses I2C using Arduino A4 (SDA) and A5 (SCK). Connect the si5351's CLK0 to whatever low power HF amp you like.

Mine is from Experimental Methods in RF Design (EMRFD), Fig 12.32, but I could have chosen any number of similar two-transistor stages.

WSPR works on truly tiny power levels. If you connect the bare si5351 clock output

to an antenna, you will get decodes! (You should add a Low Pass Filter if this is anything more than a quick test).

So use a single 2N3904, or anything with gain, up to a full 5W QRP PA with an IRF510 or Mitsubishi RF FET, which is a 'big gun' in the WSPR world.

Mine uses a 2N3904 and 2N4427 in common emitter feedback configuration, (shown below) delivering around 10 volts peak to peak into 50Ω (250mW), followed by a W3NQN Low Pass Filter for the band of interest.

The beacon should simply run when powered on. It will take a few minutes to find overhead satellites, then, when the UTC time is found, it will automatically transmit on a randomised frequency within the WSPR band. Look at the top of the script to change the band center frequency, your callsign, power level and grid square.

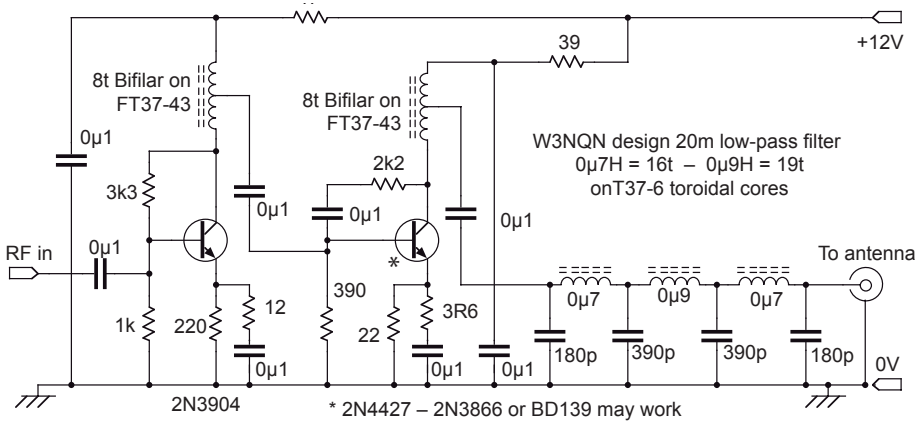
If you have any problems with this project please email me and I am happy to help out.

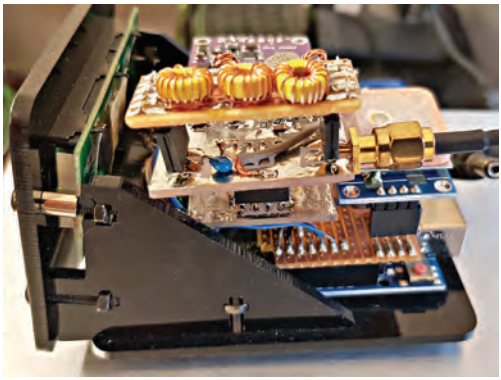
Thanks to **Harry** from **ZachTek** for making his code open source.

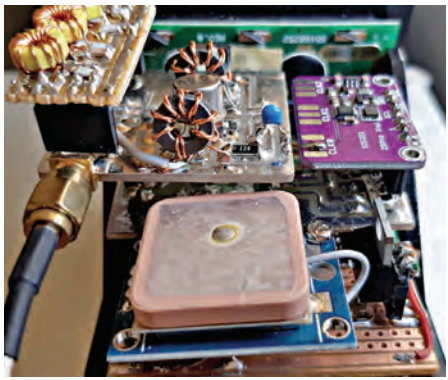
And to **Jason Milldrum NT7S** for his si5351 and JTEncode libraries.

My script's available from here: ***https://github.com/prt459/WSPR_GPS_Beacon***

A video is on my YouTube channel here: ***https://youtu.be/YbmRH2Yyb24***







The GI-QRP Convention

Michael Na bPiob, MI0HOZ

The very first GI-QRP convention was held on 25th June 2022. Being a member I was excited to attend and wasn't really sure what to expect. There were a few trade/club stands and the event was streamed live on Zoom.

Proceedings started with an introduction from Philip, MI0MSO and **Steve, G0FUW**. We then had our first presentation from Dick, GØBPS on the history of QRP. We heard how Rev George Dobbs G3RJV wrote the early *SPRAT* newsletters using a Spirit Duplicator.

Next up was **Michael, MI5MTC**, who gave a great lecture on the writings of the Rev George Dobbs, G3RJV, which were extensive. Michael also showed off some of the kits that were either built by or designed by George.

Following this we were treated to a lecture on low cost transmitters and receivers by **Les, GI1BZT.** He showed us how to build a transmitter for as low as £3, the now famous Pixie transmitter. We were informed that it doesn't cost the world to start building transmitters.

Les also demonstrated CW reception with his pixie and there were at least half a dozen stations heard, all at the same time. He then inserted an audio filter which cut that down to just one signal which was very easy to decode. Les also showed us the now famous 'Molar morse key' made out of a toothbrush.

Then we broke up for lunch and I had some very tasty food. I made a new friend who ate with me and we had a great chat about QRP and how we were both enjoying the convention very much.

Tony, EI5EM started the afternoon session with his lecture on home brewing QRP equipment. Tony showed off his many kits and his 'Rig In A Box'. He explained his process of building kits and etching his own circuit boards. Tony ignited a spark in me to build more home brew kits and QRP operating as well.

Albert, EI6KO then gave a talk on SOTA. He admitted taking a 100W rig up a mountain including batteries but found it wasn't worth it. When you are up that great of a height you are going to get a good signal out, even with 5 or 10 watts. He also explained how to install a dipole using a fishing road type pole. SOTA is very popular in Ireland with activations nearly if not every weekend with awards for both chasers and activators.

The final presentation was by **Nathan, MiØNPR**, who is a Raspberry Pi expert. He told us the history of Raspberry Pi. The current version is powerful enough to be the main shack PC and at about €40, cheap enough. All sorts of radio software runs on the Raspberry Pi from logging software to satellite prediction software and everything in between.

During the talks, younger people made a morse tutor kit in a build-a-thon and after the talks it was the turn of the adults. It was a really easy project but I still was happy that it worked first time; an excellent circuit for an absolute beginner. The micro-tutor was by Kanga Products and they sell a range of other kits. Thanks to Paul at Kanga for all of is support, and to the RCF for their sponsorship.

GI5LOW was available to G-QRP members to activate in the run up to the Convention. I activated it on Friday 24th June for two hours and had great fun. It wasn't the normal rubber stamp QSOs but each QSO was a great rag chew. I didn't make many contacts, about 13 in total, but they were from all over Europe and Asia. All with only 5 watts.

When I got home, I decided to let the linear sleep for a while as the QRP bug had bitten me. Overall it was a great day and I think we all enjoyed it. It was well organised and went ahead without any major hiccups. I hope the event returns next year as it was a great success.

Thanks should be given to the Mid Ulster ARC, Philip Hosey, MI0MSO, and the G-QRP Club for organising it.

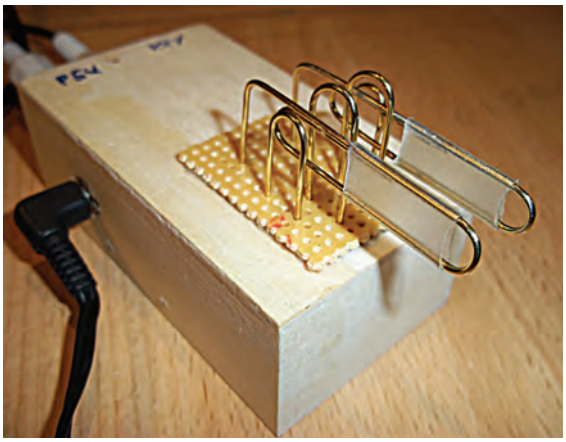
Post Convention Note from Steve, G0FUW:

Thanks to Michael for a great report. The Club were very happy to support this event and it was great to see people 'in the flesh' once again. It was also good to see so many members from USA and across Europe join on the live stream. As with all such events, the Team effort was great to see and we owe a debt of thanks to all concerned.

It was my first visit to Northern Ireland but it will not be my last!

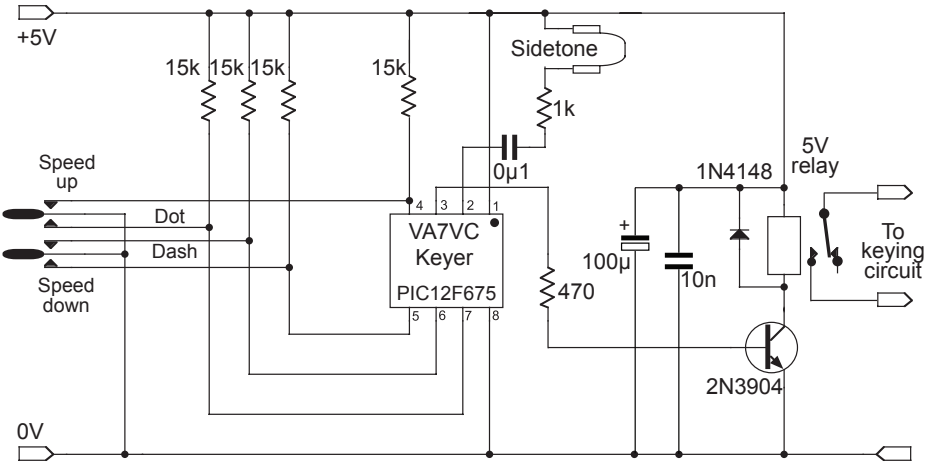
The Paperclip Keyer

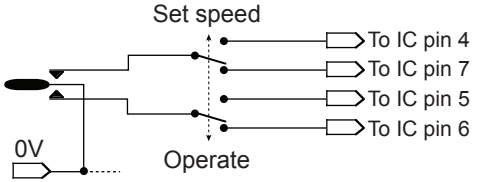
Peter Howard G4UMB email: pahowd@gmail.com



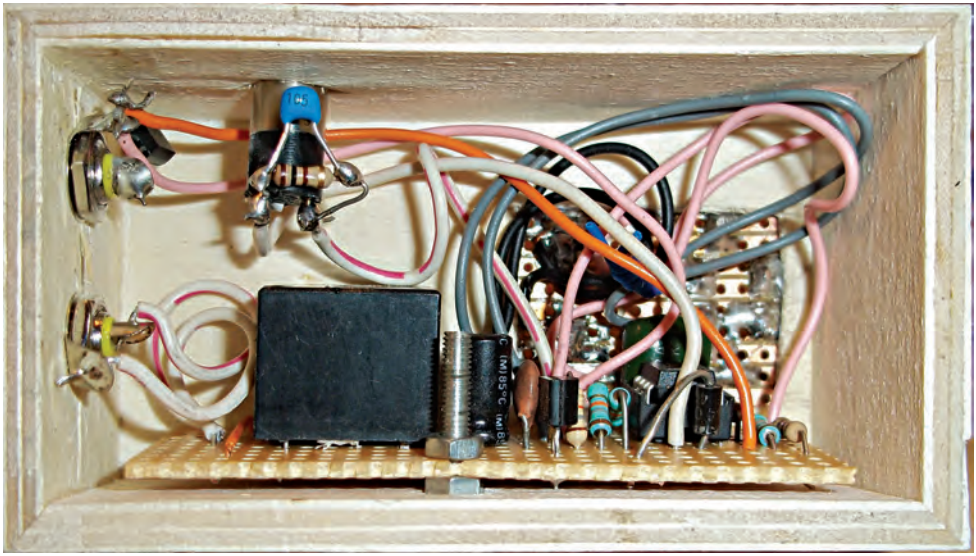
This is a keyer based on the simple circuit created by Fred Kwok Yin Lam VA7VC, that can be found on the internet. He has provided this free of charge including the HEX Code to program the chip.

Fred's original circuit used a rotary encoder to change the keying speed, but as I did not having one, or for that matter really understanding how they work, I decided to innovate instead. So, I made a special paddle key from large paper clips soldered into stripboard which, in addition to having both the usual Dot and Dash contacts, has extra contacts for Speed Up & Speed Down.





The keyer itself is Iambic, the paddles form in effect a 2–pole 2–way switch with a centre off position. If you feel the paper clip paddles are crude and would prefer to use your proper keyer then the circuit can still be used with a 2–pole 2–way switch wired as shown in the inset drawing. So, that in one position the keyer will act as a regular Dot/Dash and in the other the paddles will alter the speed.



When changing speeds and, when first turned on, the keyer sends a message which tells you how fast it is going. To get to the speed you want you have to hold the paddle against the contact until that speed is reached and then the keyer will remember it. The wooden Craft Box I used is from "The Works" shop.

It's good to talk

Bryan Page, M0IHY, email: bryanpage1@btinternet.com


QRP For the Mic-Shy

I read with interest the "*QRP For the Mic-Shy*" article that appeared on pages 12&13 of *Sprat* issue 191.

In the "Conclusion" section Chris went on to say "Additionally I understand that FT8 is more readable (-24dB) in QRM conditions, than CW", is this his reason for not learning Morse?

If you're "Mic-Shy", you could always try *JS8Call* (a derivative of *FT8*), I've had many *JS8Call* QSOs with some very interesting people, you could also try PSK, RTTY, Olivia and a whole host of other keyboard-to-keyboard modes, you should try it, you might even surprise yourself!

As Beattie in the old (1980's) BT advert on TV said "it's good to talk".

Repurposing the Sudden VFO

Daimon Tilley, G4USI

A few months ago I noticed that a new set of Sudden VFO PCBs had been stocked by the club. I had built a couple of VFOs for experimentation, and had built a nice transmitter from one. The Sudden VFO appealed though, for a couple of reasons. First it has a nice readable colour display, and second, it has an inbuilt CW keyer. Additional features, like twin VFOs were a bonus, although I was not likely to use them.

I decided to order and build one, but at this stage did not plan to use the Sudden TX or RX boards, deciding instead to "go it alone" in this respect. Initially I planned to describe the full transceiver build in this article, but for reasons of competing priorities I will leave that for another article.

What I was clear of though, was my desire to use the VFO as the heart of a true multiband transceiver for all ten bands from 160 – 10m. But the sketch by the designer, Kevin Wheatley, does not allow for this. It was time to hack Kevin's code!

To cut a long story short, I have now successfully made the following changes and improvements (in my view, at least!) to the original code:

- Multiple band selection is now available. The VFO tuning step buttons now have two functions. A short press continues to change tuning step, whilst a longer press (>0.5s) allows increment / decrement of band from 160-10m.
- When a band is selected, or VFOs swapped, the Teensy now outputs a LOGIC HIGH to pins 24-33 inclusive, ensuring only one (the correct one for the band) is selected at any time. Fixed the issue where the x10MHz digit is not removed when moving to a frequency below 10MHz
- Cursor for VFO step can now be placed under the x 1MHz position - useful for general coverage RX or 28MHz band
- Unit display changed from Hz to MHz as the proper unit to match the decimal display
- Allow a different default frequency and band for each VFO
- RIT display simplified. I found the full frequency display cluttered. Now RIT is displayed merely as a ± offset from main frequency and displayed in Hz.

Filter arrangements

When a band is selected, or when swapping when over VFOs, the Teensy outputs a LOGIC HIGH to pins 24-33 inclusive. (shown in the table here). This ensures that only one (the correct one for the band and active VFO) is selected at any time. These pins are accessed by

solder pads on the UNDERSIDE of the Teensy, so fitting the Teensy direct to the board must be avoided and header sockets used instead.

My intent is to use the pins to drive transistors, operating relays on a QRPLabs LPF / BPF board. The outputs could be used in parallel to switch both LPF and BPF boards at the same time. They could also be used to activate any antenna changeover relay for different bands.

Filters for 160 – 30m bands are on the QRP Labs Ulitimate LPF Relay board, but because they feed a SECOND board of five filters, this board MUST be configured as BPF switching arrangement, to allow each filter DIRECT access to the next board, without having to pass through Relay 1 on the board.

Filters for the bands from 20 – 10m, follow the normal arrangement of LPF on the other board, i.e. the 10m filter, number 1 on the board is ALWAYS in circuit. These 10 LPF's will be switched alongside 10 BPF's, again using QRPLabs boards and filters, so that each band has a set of discrete filters. The BPFs will feed the QRPLabs Receiver module and Polyphase kit, giving a DC receiver with just one audible sideband. A SOTABEAMS CW Laser filter will provide enhanced CW filtering.

Band	Code	Pin
160	0	24
80	1	25
60	2	26
40	3	27
30	4	28
20	5	29
17	6	30
15	7	31
12	8	32
10	9	33

I hope that others will find these ideas and amendments helpful, and that the new multiband facility will encourage a new raft of VFO builds. The amended code can be found at my GitHub repository and Steve Hartley will add the link to the VFO instructions in due course.

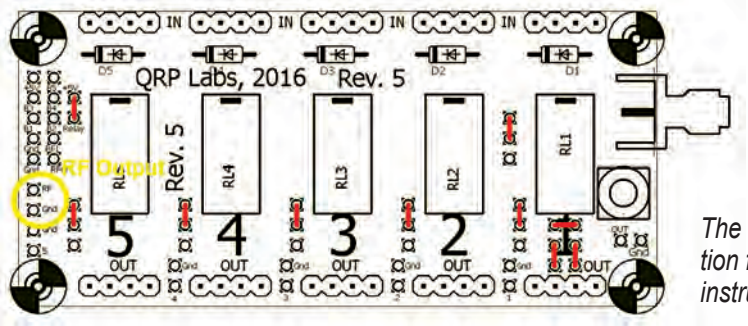
And I will soon also add the Gerber files for a Relay switching PCB I have designed, allowing the 3.3v Teensy micro-controller to switch the 5v relays of the QRPLabs Relay boards, as well as a further relay for TX/RX switching, or other needs as appropriate.

As a final note, please be aware that recently it has become impossible to obtain the Teensy 3 series of micro-controllers due to the worldwide chip shortage. It is not anticipated that new 3.2's used by the Club VFO will become available again until Spring next year.

https://github.com/BrendonHills/SuddenVFOv1.2/blob/main/README.md

Also at this location you can find CAD drawings of the PCB fascia to aid in cutting a fascia of your own for the board to sit behind.

My thanks to both Kevin and Steve for their support.



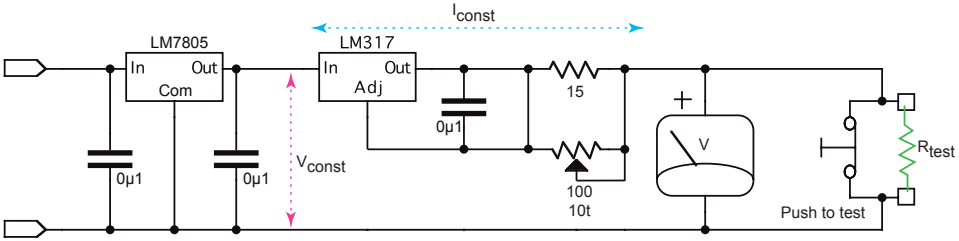
The configuration illustration from the QRPLabs instruction sheets

The Low Ohms Meter Revisited

Frank J Lotito K3DZ

I had a number of very enlightening trans-Atlantic emails with 'Tex' Swann (G1TEX)[1] and Peter Howard (G4UMB) regarding Peter's article on a low ohms meter in SPRAT[2]. In one of the e-mails Peter sent me a brilliant one-page idea for a different design low value ohmmeter. As the old saying goes, "There's more than one way to skin a cat![3]" I immediately picked up on Peter's idea and via the miracle of my various junk boxes containing 60+ year's worth of stuff, I cobbled together a low ohms meter that gets around the most of the contact resistance problem in Peter's original design. What it does not solve is the analog or digital equivalent of "bang" upscale when the voltmeter is presented with a voltage greater than its maximum range. Parts requirements are minimal and non-critical.

The design uses a LM317 voltage regulator as a constant current source to feed a four-terminal measurement circuit, ***Fig 1***. The 4-terminal circuit gets around most of the contact resistance problems we frequently experience when we use our standard meter leads to measure resistance on a the lowest measurement range. This is typically 0-199Ω as on a Harbor Freight "freebie" (at one time) digital VOM (90899,) or classic era Triplett 630 VOM on its x1 ohms range.



It is still incumbent that the user to make sure the terminals, or wires on the resistor being measured are clean of oxide, solder flux, rust and other insulating materials. This includes the 5-way binding posts and test meter clip leads. The purpose of the LM7805 is to absorb, if you will, most of the supply voltage instead of the LM317 current regulator. Additionally, the upscale "bang" is minimized since the max open circuit voltage is a little less than 5VDC.

The 7805 regulator circuit can be eliminated and 4 alkaline or rechargeable AA or D-cells in series used in its place. Remember to include an on/off switch to keep from unnecessarily draining the batteries. **Note:** The LM317 requires at a minimum 2.5V drop to work. Thus, for a 20Ω meter using 100mA as the constant current, the minimum battery voltage should be 4.5 volts. A three-cell design is iffy as it could reach this level before the batteries are even part used.

For my design, I chose a 0-20Ω full scale measuring capability and a 100mA as the constant current. There is no reason to not use a higher or lower current[4]. Be mindful though, as the current flows through the LM7805 and LM317 things get warm. Heat sinking is definitely recommended to minimize heat related damage and regulator drift.

If the design is limited to 20Ω full scale that means the resistor being tested may have to dissipate up to 200mW. Not a problem as long as you're not testing 1/8th watt low ohms resistors.

If you use say 250 mA as the constant current, a 20Ω resistor will have to dissipate around 1.3 watts! Additionally, if a 12 VDC source was used to power the circuit, the LM7805 will have to dissipate 1.75 watts. It's 'do-able', but to be definitely safe, heat sinking is required!
If 100mA is chosen as the test current, a 0-2VDC digital meter or 0-20 graduated analog meter makes the meter reading almost direct reading. If you use a Harbor Freight DVM, there is a 0-2000 millivolt DC range. Thus 1500 on the meter means 15Ω resistance. If you use a 0-50μA meter as I did, the 15Ω resistor would indicate 37.5 μA[5]. (You can easily change the meter engraving on many types of analog meters. Be careful though!) I made a new meter scale indicating 20Ω for a 50μA current, 10Ω for a 25μA current, etc. Be mindful that repurposing an analog meter means the meter with its series multiplying resistor is in parallel with the resistor under test. I'd recommend using an analog meter movement rated no more than a 1mA full scale.

I calibrated my low-ohms meter by connecting a trusted VOM on a range that displayed 100mA on the best range, to the 5-way binding posts. With 12V DC applied and the push button depressed, I adjusted the 100Ω - 10 turn trim pot for the test meter to display 100 mA. I next connected a 0.5W 18Ω resistor at the binding posts and paralleled a trusted volt meter that best displays 2 volts across the resistor. To mimimize contact resistance with the 5-way binding posts I placed this meter's leads close to the body of the resistor. I connected the low ohms meter's meter movement plus its multiplier resistor in parallel with the test volt meter. With the push button depressed I adjusted the low ohms voltmeter's trim pot for the same reading as indicated by the test volt meter. For my 50μA meter buildup the multiplier resistor consisted of a 33K fixed resistor in series with a 10 turn 10k potentiometer.

The upscale "bang" is still present should you push the normally closed momentary open push button with too high of a resistance to test, or no resistance mounted between the 5-way terminals. My educated guess is most digital and analog meter movements will be able to survive unscathed. Remember to put the voltmeter clip leads between the resistor to be tested and 5-way binding posts if you want to minimize the effect of contact resistance between the resistor and terminals of the constant current source. There are low voltage zener diodes that might minimize the bang by clamping the constant current open circuit voltage to something a tad over 2 VDC. I have not tried them yet. Maybe you have experience with how well 2 to 3 volt zeners work.

Footnotes:

1 – Tex Swann is the editor of *SPRAT*, the quarterly magazine of the UK-based GQRP club founded in 1974 by **Rev George Dobbs G3RJV** (sk). Membership is international.

2 – *SPRAT* issue #191, Summer 2022, page 27.

3 - I do love cats. For the last 57 years of my almost 4-score years I've had cats, both indoor only and feral.

4 – Power dissipated = current squared times resistance, I^2R, or
voltage drop squared divided by resistance, E^2/R, or
voltage drop times current, EI

5 –Note, unlike the more common constant voltage ohm meter design, the constant current ohm meter design gives you a meter indication that varies linearly with resistance, not inversely with resistance.

A note to the "antique radio aficionados," The LM317 goes back to 1976, some 46 years ago! The LM78XX series a little prior to that.

Minimalist Receiving and audio

Philip, G4HOJ email: G4HOJ@yahoo.co.uk

The background to this short article is that most minimalist receivers have ranged from 'gain-less' or passive-detector-with-VFO designs (in fact signal attenuating because of conversion loss in diodes), through to one or two valves or semiconductor devices.

With the passive designs, using a full-size transmit 80m antenna and only reasonable-sensitivity headphones (and, of course, when the band is open!), I can hear CW signals that are the equivalent of 200 to 300µV in 50Ω. A signal at around the 5mV level (equiv. to S9+15dB) is very comfortable copy. So, on a properly calibrated 'S' meter, S9+60dB (even with passive detector losses) is double the power needed for comfortable headphone copy.

To bring, let's say, an S5 equivalent signal (around your noise on 80m?) up to a similar level as my passive receiver comfortable copy, some 45 to 55dB or so of gain is all that is required. But, of course, with that amount of gain, signals of S9 equivalent and above might even seem too loud?

What the Experts Say

The World Health Organisation and other experts say: "Sounds at or below 70dBA are generally considered safe. Any sound at or above 85dBA is more likely to damage your hearing over time. Researchers have found that people, exposed over long periods of time to noise levels at 85 dBA or higher, are at a much greater risk for hearing loss" (the "A" in dBA shows that the level is adjusted to account for frequency sensitivity. BUT it seems that the adjustment may under-estimate of the impact of lower frequency sounds below 700 to 800Hz!).

Headphones

Can we understand a little more about the headphones we use? Well, the sensitivity, or "efficiency", quoted in headphone specifications tells us how much sound ouput (pressure) they should provide for a given input power. Let's say that you have earbuds or headphones where the sensitivity is quoted as 100dB/mW. That means that 100dB sound pressure level is produced if 1mW is applied. These are good sensitivity 'phones but certainly not the highest efficiency ones available (I have seen as high as 120dB/mW).

I have several headphones and 'earbuds' to try on my receivers. For example, I have some old Racal inserts which are sensitive and provide good communication quality, some 2000Ω magnetic headphones which can work well with valve sets without a transformer and I commonly use some 32Ω earbuds, which I often utilise through an LT700 miniature transformer.

If we calculate for the earbuds, their 100dB sensitivity means that they require only 10mV at under 0.2mA

(RMS audio signal) to produce 70dB output. This is only 0.002mW (2μW)!....and that 85dB danger level quoted by WHO for longer-term listening? Well, that's just 0.03mW (30μW) provides a sound output of 85dB!

Using some of the older "sound-powered" headphones, or indeed some of the more efficient modern varieties, an audio output of only 50 picowatts (equivalent to S9) can be heard with typical/normal hearing. In fact, using very high-sensitivity headphones some measurements suggest that good ears can produce a minimum discernible signal down to 10 picowatts…less than S8 equivalent!

And, finally

I know, some of you are pleased that this wasn't another receiver article!!...but I hope this is of some interest and that it provides a little more understanding around a minimalist approach to hearing signals.

Finally, please do be careful with your common LM386 and similar output audio stages if/when using good efficiency headphones. They can output way more power than is safe for your ears! …..the switch-on click or crackling gain control, etc., let alone long-term high-level signals. Have fun but be safe!

Membership Secretary News

Daphne G7ENA (g7ena@gqrp.co.uk)

Like in previous years we have decided not to put a standing order form in this issue of Sprat. As we have 4000+ members who already pay by various methods, to have it to take up 2 valuable pages of Sprat seems unnecessary.

If you wish to set up a standing order then please do it online if possible, the info you will need is: GQRP Club account, 01-07-44, 04109546.

You MUST include your membership number as the reference, and our preferred date is 15th January. If you do need the form, then I can email it to you, or, if you send an SAE to me, I will send you a copy.

A standing order authorises your bank to make automatic annual subscription payments for you. It is not a direct debit, I cannot make alterations to the payment and I cannot even cancel it. It remains under your full control. This means that if the membership rate rises, you have to alter the payment amount.

Full information about renewals will be, as usual, in the next issue of Sprat. I will be accepting renewals for 2023 from 31st October.

DX Members, please see Graham's message about the increase in postage costs.

Valve QRP Reports July 16th/17th 2022

Colin Turner G3VTT email: g3vtt@aol.com

It was certainly hot over the last VQRP event and a number of 'Filamenteers' commented they had stayed out of the shack in the day or only operated in the hopefully cooler evenings. Derek **G3NKS** writes he had a busy weekend with not much time for radio. He made just six QSOs, one on 60m and the rest on 80m mostly on the Sunday evening. All were valve to valve contacts with shack temperatures reaching 33°C! This was a sterling effort indeed in the heat.

G3MCK was active with his infamous 5 watts co/pa transmitter along with a homemade superhet receiver and an inverted vee antenna. His activities were also limited by heat in the shack and noise on the bands. He worked five stations in two evening stints all QRP. I've personally tried Gerald's receiver and it's a cracker with outstanding performance both quiet and good filtering with a high dynamic range.

Another sufferer in the heat was Ian **G4GIR** with his 807 co/pa and an AR88 receiver. Ian made four contacts on 80m and one on 160m and thanks those he contacted. Chris **G3XIZ** was active making contacts with twenty stations using his homemade eight valve transceiver. He was assisted by Gordon **G4FGJ** who made three consecutive contacts with him on 160m, 80m and 60m to check out signal purity. Chris also suffered with the heat and was unable get into his loft shack to make some planned improvements to the transceiver but hopes the have them completed by the time of the November session which is on the weekend of November 5/6th this year by the way.

A relative newcomer is Paddy **G4MAD** pictured here who joined us from rural Warwickshire. Paddy used a Trio 9R-59DS and a borrowed transmitter from **G0GGA** and a manual change over system. The transmitter was based on a design from *PW* from February 1994 and if my memory serves me right uses a co/ba/pa design and grid block keying. I made one similar many years ago myself and the keying was outstanding with two EF80's and a 6BW6 valve as PA.

Talking of keying I recently made the Kanga Kits Universal Keyer which has a substantial keying relay and keys both my cathode and grid block transmitters with ease. I actually like the noise of keying relays, not to mention the odd flashing light, as it looks and sounds like real radio! Check out the Kanga website for their Universal Keyer ‡.

Steve **G4ALG** recently acquired

an FL50/FR50B combination which is a vintage transmitter/receiver combination that is VFO controlled by the receiver VFO. It was designed to satisfy the Japanese Novice licence requirements and the few that were imported here were very popular. I used one at a friends home many years ago and worked a VE7 on 21MHz with 25 watts to a poor low dipole which was bit of a shock. Steve did some initial refurbishment and although he had the T/R relay stick on transmit he was able to jolt it back to receive by operating the mode switch to 'phone' and back to 'CW'. Sounds like the relay needs cleaning or a resistor has gone high in value?

Steve likes the British Army WT8 key you can see in the picture although his German T1 key is to be preferred. I personally like the WT8 key which was made by many companies in the 1940's and 50's and mine has a skirt disc around the knob. Steve worked 27 contacts 19 of which were two way QRP in 11 different countries. Steve's set up is shown above.

Another sufferer in the heat was Mike **G4AQS** who braved the heat to make a couple of contacts with 'valvies' as he calls them. He says the hot weather was a deterrent but he worked **G4ALG** and **G4BLI** the latter using an 807 and valve VFO. Mike was using his 6BW6 VXO transmitter on 40m and a 6V6 VXO on 80m. The receiver was a KW77. Mike suggests we have an activity weekend for a group using designs by Frank Rayer G3OGR who was a prolific designer and experimenter from the 1960's and 70's. Any thoughts? Finally Dave **G4FKI** was active with a Codar AT5 and a Drake R4C but found activity sparse on 80m certainly in the daytime. He worked seven stations in two countries.

My thanks to all of you who wrote in and please write again if you are active in November. Just a few anecdotes or technical notes will do and total numbers of stations worked. Some of you kindly send me complex charts of activity, equipment and antennas which I do read but space in Sprat is too limited for them to be reproduced. Hopefully things will cool down by November and shack operation will become more bearable then. See you on the 5th and 6th.

‡ Kanga's website: ***www.kanga-products.co.uk***

72 Colin **G3VTT**
182 Station Road Rainham Kent ME8 7PR

Mixing Arduino I²C & Vcc devices

Steve Bennett 2E0XRL

Objective

To investigate how to interface 3V3 I²C peripherals to 5V microcontrollers without violating any electrical specifications.

Software

On Arduino boards using the 5V series of ATmega microcontrollers (MCUs), such as the UNO and NANO, the I²C communication between the MCU and the various peripherals is normally handled by the WIRE library. This is to be normally found at:

C:\Program Files (x86)\Arduino\hardware\arduino\avr\libraries\Wire

The WIRE library consists of two scripts, *Wire.h* and *Wire.cpp*. The latter includes *twi.h* located with *twi.c* at:

C:\Program Files(x86)\Arduino\hardware\arduino\avr\libraries\Wire\src\utility

The I²C interface uses an 'open drain' (or 'open collector') outputs, allowing multiple devices to share the bus. Open drain outputs can pull the bus lines to a logical low voltage, but require pull-up resistors so the bus lines reach a logical high voltage when not being actively driven low. The I²C interface is different from the SPI one, which is the other bus commonly used by microcontrollers, in that SPI data line are actively driven both high and low by conventional 'totem-pole' outputs. So that they do not require pull-up or pull-down resistors unless bus floating is undesirable during an inactive 'tri-state' bus periods.

The I²C bus pull-up resistors should be of sufficiently low value to achieve acceptable voltage rise times with the distributed capacitance of the bus at the various I²C operating frequencies. These frequencies can range from 100kbit/s up to 3.4Mbit/s‡1.

The code in *twi.c* uses the following to activate the internal pull-ups to 5V Vcc with the coding lines 87-89:

```
// activate internal pullups for twi.
  digitalWrite(SDA, 1);
  digitalWrite(SCL, 1);
```

The internal pull-ups of the MCUs , when used, are in the region of 20-50kΩ, which is really too high a value to allow reliable I²C operation at higher bus frequencies. The following replacement code, referenced above, will disable the internal pull-ups allowing their effect on bus voltages to be examined:

```
// deactivate internal pullups for twi.
  digitalWrite(SDA, 0);
  digitalWrite(SCL, 0);
```

Pull-up Resistors

The recommended value for external pull-ups is between 4k7–10kΩ, depending on the bus capacitance. The minimum value will be determined by the lowest value of *Iol* (output low current) of any device on the I^{2}C bus. The ATmega328P microcontroller is able to sink 20mA with an output voltage of 0V9**‡3** . A minimal pull-up resistor could be as low as 5V5/20mA or 275Ω. Many I^{2}C peripheral devices, such as LCD and OLED display modules, incorporate 4k7Ω pull-up resistors on the bus lines, labelled SDA and SCL. Even with 10 such peripheral devices the combined pull-up would only be 4k7/10 = 470Ω.

The *Iol* specification for peripheral devices is rather more complicated, varying from only 3mA 'sink' for 'Fast' and 'Standard-mode' operation and 20mA for Fast-mode Plus. Clearly the specification of devices connected to an I^{2}C bus, the speed of operation and the bus capacitance all have to be considered when calculating the correct value of pull-up resistors; full guidance is contained in the I2C-bus specification and user manual**‡1**.

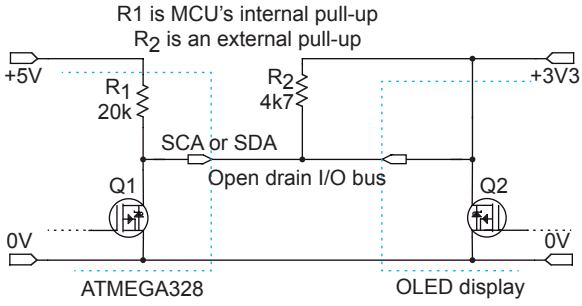
Interface Voltages

The maximum *Vin* for 3V3 Vdd chips such as the SSD1306 used for OLED displays is VDD+0.3 or 3V6. Now the minimum *Vih* (high) for 5V ATmega MCUs is: **Vcc * 0.6** or 3V with Vcc at 5V or 3V3 with Vcc at the 5V5 maximum supply level.

The ideal solution for MCUs operating with Vcc = 5V5 is to provide a 3V6 supply to power any 3V3 I^{2}C peripheral devices. Devices with no on-board Low-dropout (LDO) 3V3 regulator will tolerate 3V6 as the absolute maximum supply voltage is usually 4V0 and those with a 3V3 LDO regulator will operate with a 5V supply.

If the MCU Vcc is known to be 5V0 or less then *Vih* minimum will be <= 3V0 so can be driven by 3V3 peripherals as their *Voh* will be their Vdd i.e. 3V3.

A peripheral device with pull-ups to its Vdd of 3V3 will be marginal when driving an MCU operating at 5V5 and therefore having its *Vih* of 3V3. One solution is to add additional pull-up resistors to 5V5, or better to use the internal pull-ups enabled, by default, when using the Arduino Wire library.



The logical high voltage on the SDA and SCK pins will be from 3V49 to 3V62 giving a safety margin of 160-290mV:

Vout = (4k7/{20k + 4k7))*(5V5 – 3V3) + 3V3 = 3.62 Volts

Vout = (4k7/{50k + 4k7})*(5V5 – 3V3) + 3V3 = 3.49 Volts

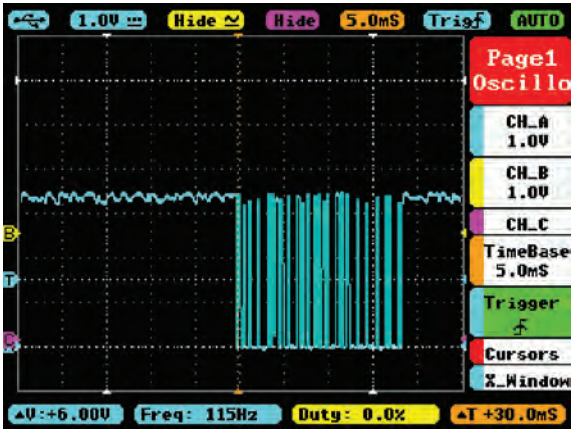
So the effective bus voltage is compatible with *Vih* max for a 3V3 OLED display and will not cause any input protection diodes to conduct. Image below, shows the high level bus voltage to be approximately 3V3

Even if 4k7Ω pull-ups to 3V3 were not present then the current injected into an OLED display data pin would be approximately (5V5 – 3V3)/20kΩ = 110 µA which probably would

not be sufficient to trigger any SCR latch up‡2 in the I/O structure of the MCU (2). However just using the internal 20K pull-up is usually not sufficient for I2C to operate at its rated speed of 100 Kbit/s up to 3.4 Mbit/s.

Conclusion

Connecting 3V3 peripheral devices, such as OLED displays, to a 5V0 MCU such as an Arduino UNO or NANO will operate reliably and within safe voltage specifications providing that the MCU internal pull-ups are enabled and that 4k7 pull-ups are used, either integrated within the display modules, or as separate components.



References

‡1: https://www.nxp.com/docs/en/user-guide/UM10204.pdf

‡2: https://en.wikipedia.org/wiki/Latch-up

‡3:https://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-7810-Automotive-Microcontrollers-ATmega328P_Datasheet.pdf

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Update in WSPR Tones Box (Sprat 191)

Paolo IK1ZYW email: Paolo paolo.cravero@gmail.com

While reading through *SPRAT 191* I came across a mention, by Hugh GM8FXD, in the *WSPR Audio Tones Box article*, of a previous article of mine.

I would like to issue a warning for the RTC modules as some models included components to charge a LIR2032 coin cell. If a non-rechargeable CR2032 was used, it would be subject to a charging voltage leading to battery damage. I have documented on my blog how to identify the extra components and a couple of ways to (permanently) disable the charging feature.

I do not own the exact module shown in full colour in SPRAT, but you all know how to find out with a voltmeter if a voltage is applied to the battery when the module is powered with 5V

.Stay safe and good DX!

Paolo IK1ZYW

Reference:

MP3 WSPR: ***https://ik1zyw.blogspot.com/2009/04****/mp3-wspr.html*

Think – before throwing away!

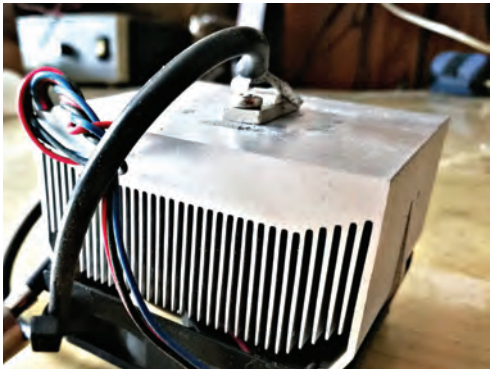
Paul Debono 9H1FQ

I don't throw away any electronics and electrical appliance stuff, before having a look inside...Many components, some, expensive, can be salvaged from printers, audio amplifiers, old TV sets, computers, transistor radios, etc, even washing machines and microwaves!

From transistor radios: Ferrite rods and beads to make baluns, mains filters, varicon capacitors, mains transformers, audio transformers to make audio filters, loudspeakers, pots, jacks, sockets, rechargeable batteries, and switches.

From printers: Power supplies, often around 24 volts @ 5 amps or more. Stepper motors for remote atu, LCD screens, keypads, gears, springs, relays, mains rfi filters.

From DVD, or Cassette recorders: Switch mode power supplies, display units, ferrite filters and beads, motors, stepper motors, motor mechanism., and switches.



From Computers: very large aluminum heatsinks, with fan, switch mode power supply, ferrite and mains rfi filters, ribbon cables, cooling fans, buzzers.

From Floppy Disk Drives: motors and mechanism

From old TV sets: lots of enamel winding wire from the tube scan coils, mains filter, ferrite, ferrite and wire, from the eht transformer. Tuner enclosures, good for screening, very large wattage mains dropper resistor.

From Washing Machines: conservative rating mains rfi filter, high voltage capacitors, high current connectors.

If you have the patience and time, lots of other goodies can be claimed, like strange value resistors, or high wattage ones, all kinds of capacitors, coils, IFT, connectors, cables, regulators, varistors, thermistors, transistors, crystals, valve bases and mains leads.

I wonder if even the cavity magnetron of a microwave can be of use!

ON-AIR ACTIVITY MANAGER

Peter Barville G3XJS email: g3xjs@gqrp.co.uk

CONVENTION ON-AIR ACTIVITY PERIOD.

This will coincide with the Convention weekend and take place on Saturday 3rd and Sunday 4th September. There are streamed talks/lectures from the Convention planned between 11:00 and 15:00 on the Sunday and so the activity period will pause between those times in order to avoid any clash of interests. Otherwise, the event will run very much in the well-known style of Winter Sports, requiring no points scoring etc … just a social meet-up on the air with QRP. Logs/reports to me please as soon as possible.

INTERNATIONAL QRP DAY

was on June 17th (as every year) and this time was incorporated into our Summer Sizzler event. **Enzo M0KTZ** only made 4 QSOs during the day but had "great fun". **Charles G4JQX** was inspired to venture out into the heat (which reached over 30degs C) and operate /P using a 20m inverted vee with his QRP rig. In all he made 10 QSOs, of which 7 were QRP/QRP. The Club's call **GI5LOW** was aired for the first time from Northern Island, making 19 QSOs with 8 different DXCC entities using a mixture of SSB, FM and CW.

The operators were **MI0MSO, 2I0FVX** and **GI4SJQ**. Our congratulations and thanks to them for their fine combined effort in both the International QRP Day and Summer Sizzler (see below). As is often the case, **Valery RW3AI** submitted the highest scoring log having had 27 QSOs with 25 different DXCC entities on the various bands, using his G90 at 5W output into a vertical ECO and long wire.

The 2022 **Suffolk Trophy** will therefore be making its way to Valery in due course for him to add to his collection! *(**Note from the Chairman:** The Committee do not in any way support the Russian invasion of Ukraine, but we have decided not to exclude long-standing members from Club competitions or awards programmes.)*

SUMMER SIZZLER,

which started on June 17th, and continued until 23rd June, potentially provided us with 7 days of QRP FUN. Unfortunately, propagation did us no favours (where have we heard that before!) and I'm sure many folk were taking the opportunity to be out and about in the summer weather.

The Sizzler was a disaster for **Andy M0RON** as he switched on only to find a new horrendous local noise across most of the HF spectrum, making QSOs almost impossible. It was so bad he took down his HF aerial 2 days later in despair. Another member who these days suffers with an almost impossible high local noise level is **Chris G3XIZ** who tries to put out CQ calls every day but is aware that stations may be calling which he is unable to hear under the noise.

Gerald G3MCK was less active than usual but enjoyed using his homebrew VXO/PA running 5W on 80m. The teamwork by the **GI5LOW** operators continued on from their efforts during International QRP Day resulting in them bagging 142 QSOs, 6 of which were QRP/QRP, with 21 DXCC entities across 9 bands using a total of 4 modes. 7 operators

contributed to the excellent log (but only one at any given time) with **Davy MI0IRZ, Andy GI0VGV, Roger MI0WWB** and **Ian GI0AZB** joining forces with the 4 ops named under their International QRP Day entry above. Normally such a good and extensive log might be expected to scoop 1st place but in view of the fact that it represented the combined efforts of 7 operators the Club has decided to award **Enzo M0KTZ** with the honour of finishing in top spot. He made 42 QSOs throughout the event using his TR-5 tcvr (by WA3RNC) into his Norcal doublet in the loft fed via a homebrew Z match. Enzo's best Dx included N3AD in PA and R90SOK near Chita. You may remember that Enzo had a very successful Winter Sports and has continued that success and enthusiasm for QRP through into Summer Sizzler. Our congratulations and thanks go to him on his fine efforts, along with my thanks to all who contributed to both events.

In view of the obvious success and enthusiasm shown by the GI5LOW operators during the week, I wonder whether there are other local Clubs or groups who would like to get together and use the Club call sign during any of our activity periods? To enquire about the use of G5LOW please write or email to Steve Hartley, G0FUW.

ACTIVITY SURVEY.

I received a note from **Fred GM3ALZ** telling me that his local club (the Aberdeen Amateur Radio Society) has been experimenting with solar panels for QRP operating – using no batteries. They have been pleased with the results which have encouraged members to take part and enjoy QRP operating. He also comments on the ever-present issue of inconsiderate contest operators 'hogging' the QRP COAs, and wishing organisers could/would deduct points from 'transgressors. I've received no other input from members with regard to the Club's efforts to encourage QRP activity, but there has certainly been wide support for the continuation of the activity periods we currently promote and organise.

WINTER SPORTS.

Is it too early to remind you all about Winter Sports? It's never too early! Commencing on 26th December each year and running for 7 days to include 1st January it is our most popular and well supported event of the year. Propagation is likely to be much improved (compared to what we are experiencing at the moment) and most of us are able to spend at least some time during the festive season sitting in front of the rig. There are no rules or points to worry about, just fill your boots with QRP contacts on the band(s) of your choice. You will find plenty of friends, some new and some not so new, with whom to enjoy a relaxed QSO and thus keep the QRP fun flag flying.

These are the International QRP Calling Frequencies:
CW: 1836, 3560, 5262 (UK Only), 7030, 10116, 14060, 18086, 21060, 24906, 28060
SSB: 3690, 7090, 14285, 21285, 18130, 24950, 28360 kHz
But they are "Centres of Activity" so please spread out if activity levels are high.

72 de QRPeter G3XJS
Felucca, Pinesfield Lane,
Trottiscliffe, West Malling, ME19 5EN

An Audio/Visual Power&SWR 'meter'

Niall M3NGS email: m3ngs@me.com

This project is based on a 'four-port' style of bridge that produces output signals that are representations of the forward and reverse powers over a wide band of frequencies. Such a bridge needs no calibration on changing bands. However, it could be adapted for most SWR bridges over a smaller band of frequencies.

In use, the display shows on the top row, both the forward and reverse powers. Then, from these two values it calculates and shows an SWR figure on the second display row. As long as there is forward power to display, the reverse and SWR figure will be updated and shown. The two inputs are interchangeable as the unit assumes that the higher power figure is the reading that represents the 'Fwd' sensing value, irrespective of which one that is.

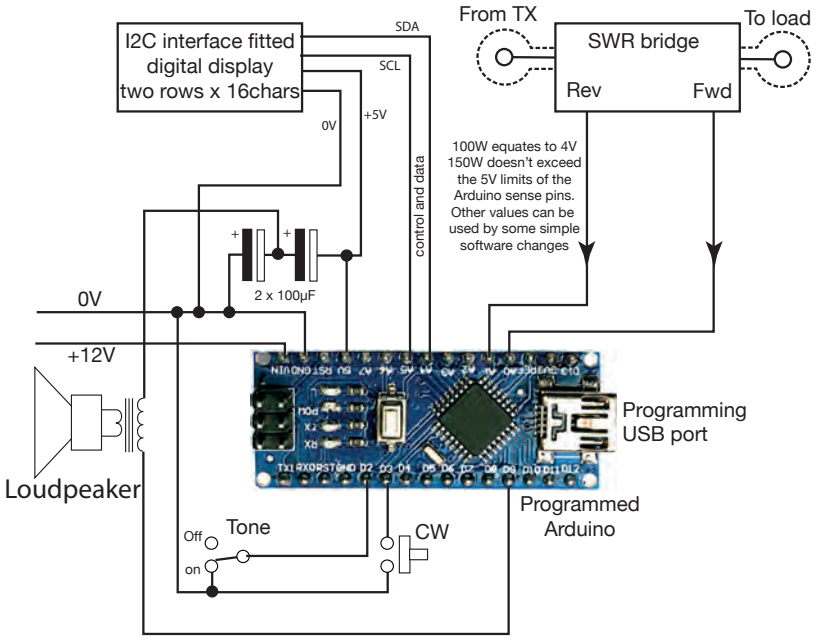
When the 'Tone' switch is in the position shown, a continuous tone is output that simulates the value of the SWR, such that a low frequency tone is a low SWR and a higher one, a higher SWR value.

Pressing the 'CW' button cuts off the continuous tone and then after a pause, sends the value of the forward power, and the value of the SWR figure in Morse characters.

Putting the 'Tone' switch 'up' turns off the continuous tone for normal operation, though pressing the 'CW' button at any time will send out the present forward power and SWR, before becoming silent again.

Copies of the Arduino 'sketch' are available via email, along with help to create your own.

M3NGS



MEMBERS' NEWS

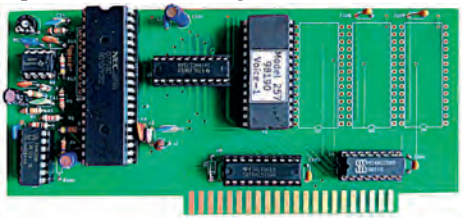
by Chris Page, G4BUE

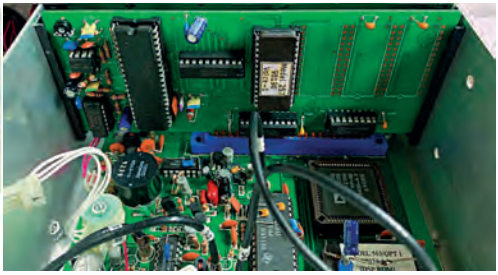
E-mail: chris@g4bue.com
gc4bue@gmail.com

G4NMD and **MØREQ** are planning to launch a new regional hub for makers and home-brewers of radio related projects. The idea being for a group which co-operates with knowledge, experience and test gear to support those who are already building or wishing to build radio related projects. It is initially suggested the group will have a monthly evening meeting, with perhaps a quarterly all day meeting. The possibility of group builds and buildathons are under consideration too. The inaugural meeting is set for the evening of 7 September in Grafham, Surrey; more information from Graham or Eric at <HamRadioBuilders@gmail.com>.

In Worthing, West Sussex, there is a group called the Worthing Radio Events Group (WREG) and although small, **GØJXX** says they, "do quite a lot of stuff from vintage restoration, to satellites and digi-stuff". Mike wanted to encourage more members to improve their CW and build kits as a group, and organised a 'Play Day' after ordering 10 Kanga Micro Tutor kits. He says the build went very well and Paul, from Pheonixkits, where he bought the kits, provided excellent service. He added, "Hopefully it will bring more into the CW fold (and join G-QRP!)". The picture shows (l to r) Nick, **GØPBV**; Peter, **MØPCR**; Mike, **GØJXX**; Martin, **G7RQD**; David, **MØHVD** and Roy, **G4WTV**. They also had a visit from Paul, **G3SXE** and Andy, **G3UEQ** who made the kits later.

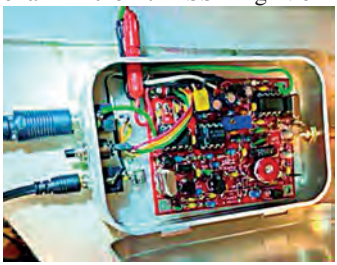
G3XIZ bought a couple of old and u/s millivolt meters, way beyond economical repair, from the Luton Rally for just £5 and stripped them down, getting useful cases, valves, meters and HT transformers. Chris re-used one to build an adjustable electronic load, which works 10-30V and can sink up to 6A, and is using the second to install a similar unit but for HT (valve) work. He has been transmitting WSPR signals on LF using his home-made TX and suggests the term 'QRP' needs redefining for LF work as, although the TX runs 100W of RF, the ERP is a mere 30mW. Using his usual end-fed 40m antenna, he has been getting reports from much of Europe, the best DX being 560 miles.





DJ9IE gave **DF9TS** an Omni VI back in 2017 and since then, Gerd has been searching for a Ten-Tec 257 voice synthesiser board, that announces the TRX frequency on a simple button press, but impossible to buy on the used market. Last month, **DF1DA** loaned Gerd his voice board so he could replicate it. He says, "The PCB was too large for the free version of the Eagle CAD program, so I tried KiCAD and was pleasantly surprised how easy this is to use, <https://www.kicad.org>. The board is working without problems" (pictures above). **MØNTV**'s latest video tackles the

challenge of turning microwatts into milliwatts in the first stages of the transmit amplifier chain in the 17m SSB rig Nick is building, <https://youtu.be/CVgP6SdHPcE>.

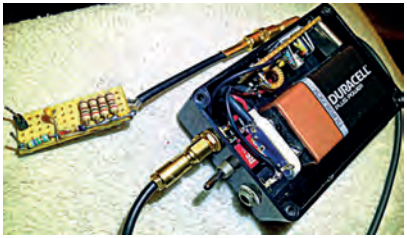


showing spots for DX call: G4FBC — rows to show: 15

search spot by callsign

de	dx	freq	cq/dx	snr	speed	time
W1NT-6	G4FBC	14060.4	CW CQ	7 dB	14 wpm	0417z 10 Jun
SE5E	G4FBC	14060.4	CW CQ	3 dB	15 wpm	0416z 10 Jun
DL1HWS	G4FBC	14060.4	CW CQ	2 dB	14 wpm	0415z 10 Jun
LZ5DB	G4FBC	14060.4	CW CQ	12 dB	14 wpm	0415z 10 Jun
DM6EE	G4FBC	14060.3	CW CQ	6 dB	15 wpm	0414z 10 Jun
DF2CK	G4FBC	14060.4	CW CQ	5 dB	15 wpm	0414z 10 Jun

G4FBC has frequent bouts of insomnia and on 10 June, to fill in the time until breakfast, he went on 20m CW with his 200mW QRPp rig (above) and **W3EDP** antenna. Ron saw on the RBN (above right), that his signal reached USA and is now going to try more QRPp with his other home-brew single transistor TXs (above). **M3KXZ** was QRV /P from Pevensey Level in East Sussex on 27 June activating nature reserves for the WWFF program (GFF-0428) with his 5W QRP rig. In poor conditions, Pete made 35 QSOs in less than two hours, including **KD1CT**, and two with your scribe on 20 and 12m at the great DX distance of 3½ miles from my QTH!

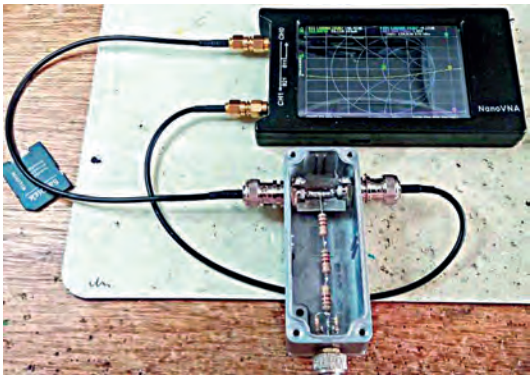


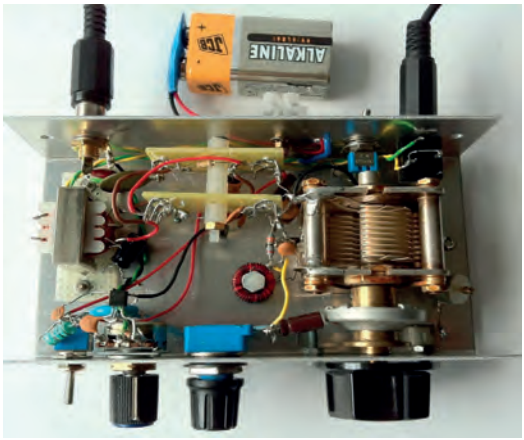
G8GYW's wife evicted him from their small bedroom to make way for their grandson, so Mike built a new shack (right) in the garden that has given him room for a bench and a desk! The main rig (far right) is a TS-850SAT and above is a Yaesu FT-817 which is his QRP and VHF rig. To the right is a Hamclock running on a Raspberry Pi. For some years Rosy and **F5VLF** ran CC as a non-commercial site for the benefit of military and other charities but, sadly, increasing age and infirmity mean they now have to stop. John says Combat Stress and other charities have benefited by a total of more than £10,000 and thanks all those who have helped them. **G4TGJ**'s activity continues to be dominated by SOTA activations which he tries to do weekly. Richard has completed the 10 and 12m RX board for his five-band SOTA TCVR making it seven bands (40-10m), and GP verticals for these bands, and had QSOs from summits with them.

M5AML found June a good month - working 9A, I, EA, F, HA, OE and OK on 6m and F and DL on 10m. In July, he QSO'd **ST2NH** via QO-100 (3W to a helix fed 60cm dish) who said he spoke to his daughter on HF 18 years ago! This encouraged John to tune around HF late evening and 17m gave him **PY7ZC** and **PV8AL** and 15m **CX7SS**. He says, "Quite good for 10W or less SSB into a bent indoor dipole". **MØKTZ** has been continuing a personal goal of making one CW QRP QSO a day with his Norcal doublet cramped through his loft and a **WA3RNC** TR-35 TCVR assembled from kit. Best QSOs as **MØKTZ/P** on holiday at Polegate,

East Sussex in July, with the TR-35 and a Norcal doublet on a 20ft fibreglass pole, were **IKØNOJ** and **IK2ÚWA** on 30m, whilst at the other extreme, two early-morning QSOs with your scribe on 20 and 30m, 12 miles away at his Bexhill-on-Sea QTH! Best DX as **MØKTZ** was **VK3XU** who answered Enzo's CQ on 30m LP for his first VK QSO. USA stations, including **KU1CW** in WA, were worked mostly early morning on 20m. Since the end of July, Enzo has been QRV as **I/MØKTZ** from Sicily and has QSO'd **M3KXZ/P** among other European stations, mainly on 20 and 30m.

PH2LB now has a TinySA to measure the spectrum output of his homebrew kit rigs, and built a 40dB RF sampler (pictured right) based on **W7ZOI**'s design 'Simple RF-Power Measurement' on pages 38-43 of June 2001 *QST*. Lex says the sampler also works perfectly with his **OZ2CPU** digital RF mW-dBm-mV meter. He built a QRP-Labs QDX kit in three evenings that included, "Some mindful toroid winding". Christmas came early this year when he got his hands on a used Elecraft K2 which needed some work, and he realigned the BPFs with his NanoVNA-H4 instead of following the manual. **N2CQR** has been working on the temperature





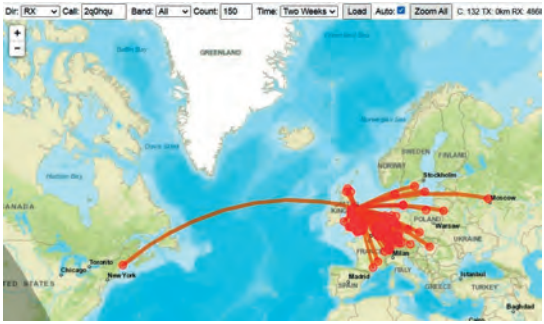
stabilisation of LC VFOs. With help from **KK4DAS**, Bill found the ceramic resonator VFO he used in the DC RX featured in *SPRAT* 173 was drifting, and this has led him into the world of VFO temperature stabilisation. "Stay tuned!", he says.

Encouraged by **VK3YE**'s comments in *SPRAT* 191, **GØUCP** built **G4HOJ**'s Fetler RX (left) and says, "It is the best regen I have ever handled, valve or solid state. Philip has done hard work on the circuit and component values. His caveats on rigid construction, good slow motion dial, and reliably sourced FETs are the key to success. Switching in and out the silver mica padding capacitors, it covers 3.5-3.8 and 5.5-7.5MHz. Mine has volume to spare with an LT700 transformer and low impedance phones. It draws about 4mA so can be left on all day if you forget".

Also inspired by **G4HOJ**'s Fetler RX article, **VE3ALH** decided to build one (left and above). Al says the build was straight forward and he chose to build on a PCB, incorporating an LT700 transformer to match his headphones. He says the RX works well and was a thrill to hear the first signals, "I plan on setting the receiver up with my two valve

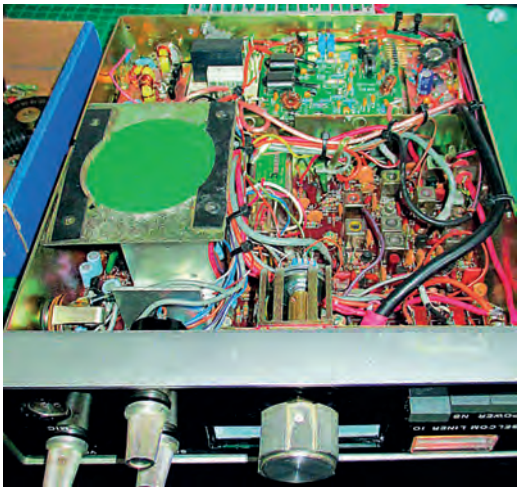
'Novice Special' as a station and have a go at some QSOs", he added. **GØFUW** reminds us there is a complete searchable *SPRAT* index on the Club website <http://www.gqrp.com/spratindex.xls>, but be sure to search the workbook, not the page!

VE3IPS has been doing weekly POTA activity and enjoying his BuddiHex beam (far right) acquired at the Dayton Hamvention. It is portable, covers 20-6m and John can deploy it himself in 30 minutes. He QSO'd some southern USA stations and when a CU3 called, he rotated the beam and brought his 55 signal up to 59. He says, "POTA offers a great QRP experience because when you spot yourself, the 'hunters' jump on you right away, with pile-ups at times". John also built the Buddipole 6m yagi (above) and worked a KP4 running 10W. He got a 5W valve TX with two crystals with a change-over switch built on a ARRL 1960s Handbook design at a rally, and finally completed his Kanga FOXX TCVR after 20 years, and mounted it in an Altoids tin.



Welcome to new member **2EØHQU** (ex-**M7LWR**) who has been licensed for two years and worked as a component design engineer 20 years ago before retraining to teach computing. Lester has been experimenting with Pixie 40m kits and finds them to be, "Quite amazing and capable little receivers". He swapped out the 7.023Mhz crystal with that of both WSPR (7.0386MHz) and FT8 (7.074MHz) and connecting via a simple ATU to a 33ft wire in the loft, found his signals reached around Europe and to the USA (screenshiot above). He says, "Some new members might not realise they could wield a soldering iron and within an hour or so have a super cheap WSPR/FT8 monitoring station setup for well under a tenner! (PC and ATU not included of course)".

G4JXX thought members might be interested in what can be done with an old Belcom Liner 2. Mike ripped out the original 2m section, 'butchered' the case, made a new front panel, fitted a QRP Labs synth and a Minikits 15W PA, and after sweating and swearing a lot, finished up with that shown pictured right and top next page. Having spurious signal issues in his latest 2 IF superhet (*SPRAT* 191), **R2AUK** built a spurious free TCVR (HBR/3B) for the WARC bands



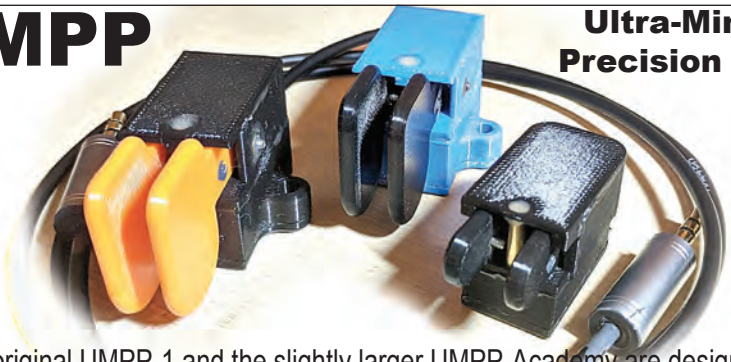
to use with his fan dipole for those bands. Alex discovered the reason for the spurious was a dirty signal from Si5351, which he used for both VFO and BFO. When he replaced the BFO with an analog one, the problem was gone, and checks on all HF bands found only three barely audible (<S1) spurs, two in SSB portions of 80m and 40m and one at the beginning of the 10m CW portion, which could be local QRM. The schematic etc is available on GitHub at <https://github.com/afiskon/hbr-3b>. His best DX so far is **EA1ARW** on 30m. Your scribe QSO'd Alex on 22 August on 17m running 5W QRP.

At the end of May, **DDØVR** and **DE3BWR** toured VE1, 2 and 3 with the /P set-up (right): fully equipped Elecraft KX2 (centre), Key Log Go (right), emergency Miracle whip antenna (below), Bose earbuds, Begali paddle key (below the KX2) and two LiPo 28.8Wh batteries. The main antennas are a vertical dipole by **DL1VU**, (far right and base below) two x 17ft with 300 ohms DX-wire twinlead, SOTA Beams four-bander linked dipole, 38ft high mast, Fuchs antenna 140ft, and a Titanex multi-bander for 40-10m (25½ft vertical on the mast and the same horizontal, fed with 300 ohm twin-lead). They will be QRV 16-23 December from P4, 23 December-5 January from PJ2 and 5-13 January from PJ4, mainly SSB on 7055, 14260 and 18128kHz and CW on 7030, 14060 and 18098kHz, with their KX2/KX3 and antennas they used in Canada this summer.

Thanks to all the contributors. Please tell me how your autumn goes for the Winter 2022 edition of *SPRAT*; what you have been building, who you have been working, and any other information about QRP, by 12 November. Also, interesting pictures please, don't be shy in letting members see what you have been building and/or where you have been operating from, your antennas, who you have been meeting, and even a shack picture to let other members know what you and your equipment look like. Let me know if you intend operating from somewhere other than your home QTH during the winter and spring months, especially during the Winter Sports, so I can let members know to listen out for you.

UMPP

Ultra-Miniature Precision Paddles



The original UMPP-1 and the slightly larger UMPP-Academy are designed and handmade in Scotland by Peter, GM0EUL, a real CW enthusiast. Both paddles benefit from a magnetic action and precision bearings that give a delightfully light and precise keying experience. Prices start from £40 and we ship internationally. UMPP paddles are becoming very popular with portable operators and are ideal for camping trips, activations, field days and lightweight operating of any sort. We also make a range of accessories including mounting brackets and high-quality cables.

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Contact Paul@phoenixkitsonline.co.uk for more information on this as not on the web site yet.

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HC49U (wire) crystals for all **CW** calling freqs – 1.836, 3,560*, 7.015, 7.028, 7.030, 7.040, 7.0475 } plus **postage**
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HC49U crystals- 1.8432, 3.5, 5.262, 5.355, 7.0, 10.006, 10.111, 11.5, 14.0, 22.0, 29.0MHz – **50p each}**

HC49U crystals – 2.00, 3.00, 3.20, 3.579, 3.58, 3.60, 3.6864, 4.0, 4.096, 4.1943, 4.433, 4.5MHz } £1.20p (UK), or
5.00, 6.00, 7.2, 7.6. 8.0, 9.0, 10.0, 10.70, 11.0, 12.0, 13.50, 15.0, 16.0, 18.0, 20.0, 24.0, 25.0MHz} £3.50p (EU) or
26.0, 27.0, 28.0, 28.224, 30.0, 32.0, 33, 40, 48MHz – **all 35p each** (Some of these are low profile) } £4.50 (DX)

Ceramic resonators – 455, 480kHz, 2.0, 3.58, 3.68, 4.00, 10.7, 14.32 & 20.00MHz **– 50p ea.** }

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1SV149 – 25pF @ 8V; 500pF @ 1V - 30p each **(MVAM109 – all gone now)** } with heavier

SA612AN - £2.00 (note – I may supply NE or SA, 602 or 612 as available. (Max of 2 per member) } things

MC1350 - £2.00 (Max of 2 per member) } like binders,

LM386N-1 - 4 to 15v, 300mW, 8pin **DIL - £0.50 10 for £4.75** } toroids,

TDA7052A - 4.5 to 18v, 1W 8pin **DIL** low noise & DC volume control – **£0.60 each** } polyvaricons,

TDA2003 - 10w audio amp – 5 pin **£0.25 each** } or filters

TA-7642 Radio IC – direct equivalent of **MK484** (& ZN414) – **75p each** } Use just

BC109B (metal) (npn) fT - 100MHz, hFE-320 **- 10 for 50p** } that postage

MPSH10 transistors (npn) fT - 650MHz, hFE 60, VCEO 25V **- 10p each, 10 for 80p** } If parts are

2N3904 transistors (npn) fT - 300MHz, hFE-150, VCBO +40V **- 10 for 50p** } ordered

2N3906 transistors (pnp) fT - 250MHz, hFE-150, VCBO -40V **- 10 for 50p** } with books

BC517 Darlington (npn) fT - 200MHz, hFE-30,000, VCBO +40V **- 13p each, 10 for £1.10** } or DVDs

FETs - IRF510 – 50p; 2N3819 - 24p; 2N7000 - 10p; BS170 – 8p - all each } add this

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Magnet Wire – 18SWG – 2 metres – 60p; 20 & 22 SWG – 3 metres - 60p; } do not

24, 25 & 27SWG – 4 metres - 40p; 30, 33 & 35SWG – 5 metres - 30p. } travel well

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Litz wire – double silk covered multi-strand wire 7/.04mm -12p, 14/.04mm. 25p. Both for 3 metres. }

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QRP heatsinks - TO92 – 30p; TO39/TO5 – 40p; TO18/TO72 – 80p (pics in Sprat 148) }

Axial lead inductors (they look like fat ¼W resistors) these are low current }

3.3, 4.7, 6.8, 10, 15, 18, 22, 33, 39, 47, 56, 100, 150, 220, 470 and 1000 - all uH, all 20p each. }

Toroid Cores – **priced per pack of 5 – you may order 2 packs only if you actually need them.**
I will no longer supply packs of everything – order only what you need please.

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T50-1 - £1.00, T50-2 – £1.40, T50-6 – £1.60; T50-7 - £1.20, T50-10 - £1.20; } **for toroids**
T68-2 - £2.20, T68-6 - £2.50, T130-6** - £2.60ea; } **includes**
FT37-43 – 90p, FT50-43 - £1.20, FT37-61 - £1.20, FT50-61 - £2.40; } **postage**
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