JUNE 1990
ISSUE No.26

# LO-KEY

## THE JOURNAL OF THE CW OPERATORS QRP CLUB

Promoting the Use of Low Power
CW Mode Communication
and Homebrewing
in the Amateur Radio Service

CONTENTS





900627 A5COV Z69A/B3

*<< CU on 40m on Scramble Night Thursday 2 August 1990 >>*

# POSITIONS

## *EXECUTIVE COMMITTEE*

- Administers Club policy for the benefit of members.

**ORGANISER**
Max Brunger VK5OS (2) 3 Durham Ave. LOCKLEYS SA 5032 Australia
Please send to Max membership enquiries, suggestions and comments and other mail concerning club business, except as specified otherwise on this page.

**TREASURER**
Kevin Zietz VK5AKZ (43) 41 Tobruk Ave. ST MARYS SA 5042 Australia
Please send to Kevin membership applications and subscriptions, other payments (except for kit-sets), requests for Club logo stickers, past issues of Lo-Key, other financial correspondence, changes of details such as address or call-sign.

**EDITOR OF LO-KEY**
Don Callow VK5AIL (75) 5 Joyce St. GLENGOWRIE SA 5044 Australia
Please send to Don contributions for Lo-Key and suggestions about this journal.

## *OTHER KEY POSITIONS*

**PUBLIC RELATIONS OFFICER**
**AWARDS AND CONTESTS MANAGER**
Ian Godsil VK3DID (112) 9/492 Barkers Rd. EAST HAWTHORN Vic. 3123 Australia
Ian handles the promotion of the Club, general liaison and communications with other Clubs and with editors of radio/electronics magazines.
Also, please send award claims, scoreboard entries and Scramble logs to Ian.

**STATE CO-ORDINATORS**
VK7: Rai Taylor VK7VV (3) Lot 2 Daniels Rd. MAGRA Tasmania 7140
VK2: Garry Cottle VK2AGC (121) 22 Johnston Rd. BASS HILL NSW 2197

**INFORMATION NET CONTROLLER**
Max Brunger VK5OS (2). Identification is VK5OS. QRO SSB is used.
CW stations may call BK de (call-sign) to have their presence acknowledged.
You hear information about the Club and can take part in technical discussions.
**MEMBERS AND VISITORS WILL BE WARMLY WELCOMED.**
**FRIDAY NIGHTS FROM 1030UTC NEAR 3620KHZ.**

**CW NET CONTROLLER**
Ted Daniels VK2CWH/QRP (89). Call is **CQ CW OPS/QRP de VK2CWH/QRP k**
QRP power is used i.e. no more than 5 Watts to ur antenna. Ted adjusts speed to suit the slowest operator in the Net and uses only simple abbreviations.
**ALL WELCOME, PARTICULARLY THE INEXPERIENCED AND NOVICES.**
**WEDNESDAY NIGHTS FROM 0945UTC AT 3529KHZ** or lower if QRM.

**CLUB STATION VK5BCW**
Based at the RICHMOND South Australia QTH of Len O'Donnell VK5ZF (1).

**KIT-SET ACTIVITY CO-ORDINATOR**
Don Callow VK5AIL (75) 5 Joyce St. GLENGOWRIE SA 5044 Australia
Send to Don orders (with payment) for kit-sets, technical queries & suggestions.

**PROJECTS OFFICER**
Rod Green VK6KRG (28) 4 Rothsay St. FORRESTFIELD WA 6058 Australia
Radio projects for Lo-Key and kit-sets.

**THE BOOKSHOP**
Norm Lee VK5GI (139) 25 Ralston St. NORTH ADELAIDE SA 5006 Australia
Magazine and book reviews, circulation of circuits and useful information about home-brewing.

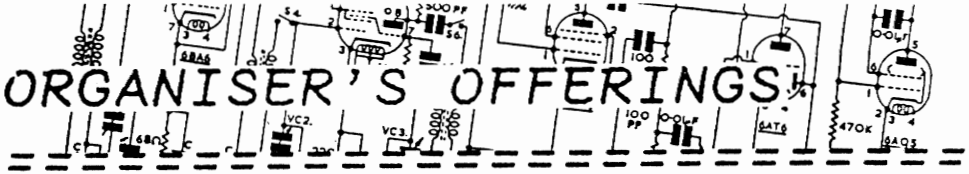
## *GENERAL INFORMATION*

**QRP CALLING FREQUENCIES**
1815kHz....3530kHz....7030kHz....10106kHz....14060kHz....21060kHz....28060kHz

**CLUB MEMBERSHIP SUBSCRIPTION**
Due each January.....Australia $A10.....New Zealand $A12.....DX $A14

**LO-KEY - THE CLUB JOURNAL**
Published quarterly - March.....June.....September.....December.
QRP & CW home-brewing, operating, SWLing etc. **ARTICLES ALWAYS WELCOME.**
The Editor reserves the right to edit all material including letters sent for publication and to refuse acceptance of material without specifying a reason.

900304 P2 Z69A/C3




Since assuming the responsibility of "organiser", I have been aware that in deference to our Novice Members, (and partly to encourage more of them to join our ranks) the main thrust of the Club effort has been towards 80 metre activities.

Now it seems opportune to give attention to other bands and types of Amateur activity (and perhaps to increase the number of Scrambles as suggested by our Contest Manager) Ian VK3DID (112).

But we cannot leave it to the lonely editorial staff to supply articles: we must play our part and send in articles, written (or typed) for presentation: (sketches can be tidied up). Don't be discouraged if publication does not come immediately you send a copy in: the Editor has to balance the material in each issue, no mean feat, but one which has been handled with success, judging by the laudatory comments which come my way.

For my part, I am going to hand in articles on a function generator, a G.D.O. (when I find a source of coils which members can obtain) how to tune a co-ax switch (did you know that has to be done ?) and an infallible source of 1Mhz signal to check your counter to as many decimals at it can carry; plus a battery regenerator.

Brave words? - well, as a member of the C.W. Operators Q.R.P. Club I have to support the Committee, so I will put my pen where my mouth is!

73 MAX VK5OS

p.s. More on Scrambles

Ian suggests we should have more frequent Scrambles and mix up the frequencies. So next issue will contain a list of times, dates and bands for a contest to run approximately three months, from September.

Logs to be forwarded to Ian; only one certificate to be issued to the top scorer, irrespective of frequencies used.

# CLUBTIVITIES

By Don VK5AIL (75) 900610 BODY Z69A/C6


## WELCOME TO NEW MEMBERS !

It's very pleasing to welcome new Members again this quarter. We hope you find that membership increases your enjoyment of out hobby.
*So, greetings to the new Members listed !*

Please tell others about the Club - about *Lo-Key* and our other activities. Pop into the Club Info. Net (see p.2) or write and ask Max VK5OS (2) to send out a complimentary copy of *Lo-Key* to a prospective member you may know of. We also have a promotional brochure and will send you a supply on request, for posting or for handing out at places where Amateurs gather. Quite a few have been sent out already.

| | | | | | |
|---|---|---|---|---|---|
| 197 | K9PNG | James Jones | Palatine | Illinois | U.S.A. |
| 198 | WF9J | Richard Tidberg | Winnebago | Illinois | U.S.A. |
| 199 | VK3CTH | Tony Morris | Blackburn | Victoria | |
| 200 | | Qwintin Foster | Beaumaris | Victoria | |
| 201 | K5VOL | Red Reynolds | Lake Zurich | Illinois | U.S.A. |
| 202 | VK2NBC | Doug Chaffey | Chesterhill | New South Wales | |
| 203 | VK4LA | Glyn Gibbings-Johns | Biloela | Queensland | |
| 204 | VK3AVH | Harold Tribe | Sorrento | Victoria | |

It seems we have made an Illinois connection - Welcome Aboard to the new DX Members. And 'last but not least' - Welcome back Glyn VK4LA (203).

## KEVIN'S KOMMENTS By Kevin VK5AKZ (43), Treasurer

**New QTH ?** If you are shifting QTH please let me know before you move, with the approximate date. We have had one or two instances of things going astray when notice was given at or after the move. Incidentally, it's amazing how many changes of address we have - is everyone trying to get a better spot for propogation ?

**Thanks for Quoting Membership Numbers** This is working well and having the number quoted on letters certainly makes my recording task easier.

**Copies of Past Issues of Lo-Key** There was a rush after the index appeared in *Lo-Key* #25, along with the snippets from past articles. If you order several at a time it is quite cheap. See the Club Sales Price List: $1.80 each plus $2.00 per order for postage and packaging. To order, write to me or to Don VK5AIL (75) - addresses on p.2.

**More Thanks** to those Members out there who promote our Club. Sometimes the new Members tell us WHO introduced them - it's nice to hear about this.

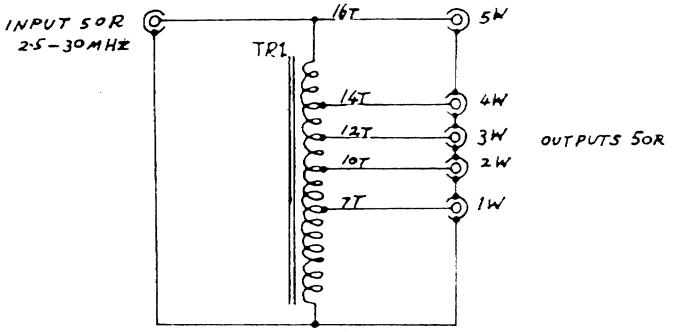
**Gil VK3CQ (4)** is quite active in this field - his call sign stamp appears on the foot of new membership forms he has sent out.

**Merv VK3ADX (85)** probably doesn't know it but he helps clear out the spare prin-run copies of *Lo-Key* by distributing some to 'interested parties'. This is one of best ways of keeping the Club strong and copies are easy to obtain - just contact a member of the Executive (see top of p 2).

*73 Kevin VK5AKZ*

# VK6KRG 2.5 - 30MHZ QRP POWER DIVIDER

By Rod VK6KRG (28) 900616 PWRDIV Z70A/A7




## CONSTRUCTION

TR1 - 16 turns of No.26 B&S enamelled wire on TV balun core, F14 material. Dick Smith Part No. L-1340. Use the larger of the two cores supplied. The wnding must be tapped at 7, 10, 12 and 14 turns. The taps should be made by twisting the wire to a length of about 2.5cm at each of the turns where a tap is required. The taps should be tinned along their entire length, then sleeved using hookup wire covering. You can use a different colour for each tap if you want. For my QRP gear, all sockets are RCA type, and I mounted the device in a small can, and mounted the sockets in a square except for the input and 5 Watt ones, which are mounted symmetrically on either side of the square mentioned above.

## OPERATION

This is best shown by example. Supposing I have a 5 Watt QRP transmitter, I may need 1 Watt only for an experiment. The other 4 Watts must be used up somewhere. Simply connect the 1 Watt output to your required load, and terminate the 4 Watt output into a dummy load. If you need 2 Watts, connect the 2 Watt output to your required load and terminate the 3 Watt output into a dummy load. Just remember that the sum of the two powers must match your Tx output power. All loads must be 50R so you can put an SWR meter on the line (any of the used lines) if you want. Use at any input power - JUST divide it into 5 equal units.

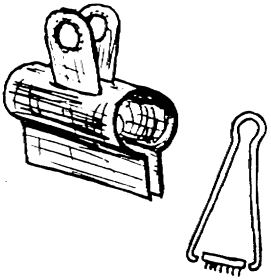
# CIRCUITS AND SHORTCUITS

Edited by Don VK5AIL (75)

At last there is room to include some of these contributions from Members:

## HOMEBREW HANDLING OF IC'S

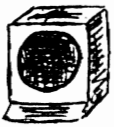
**Bill VK4MUQ (113)** has an answer to the high cost of IC inserters and extractors. For an inserter try one of the older type of bulldog paper clips insulated on both sides. If you get the right set-up you will find it easy to straighten out the IC pins at the same time.



To lift out ICs use a 1/8" (3mm) diameter split pin bent at the ends. Set it so that it is open just clear of the ends of the IC. It will have enough spring in it to close under the IC body, then open clear when released. Insulate the length of the pin.

(continued over page)

## QRP SPEAKERS



**Merv VK3ADX (85)** suggests the use of a Walkman type stereo speaker housing in your QRP receiver. These can often be obtained at very cheap prices. They come in pairs (the same as ears - *hi !*) and some look like miniature hi fi boxes. If the performance turns out to be inadequate you may decide to replace the speaker itself with a better quality minitiature speaker.

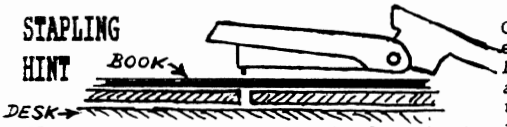
## ETCH RESIST

**Peter VK6BWI (66)** has written to say that correcting fluid (liquid paper) works as a resist for PCBs. Very handy for alterations and for intricate work e.g. IC pins.

Remember to remove the solidified fluid to expose the copper after etching, so that it can be soldered. Some types are better than others. There are two main types: (1) trichlorethane spirit based, which dissolves in thinners; (2) water based, a more recent, safer version.

Of course you can also try the recently introduced pen variety to see if it is easier to use than the brush that comes with the small bottles.

## STAPLING HINT




If you ever need to staple a book which, like *Lo-Key* is too wide to fit in the normal size of stapler there is an easy way to do it. Find a stapler which will open out flat, then position the book over a gap between two pieces of plywood, masonite, glass or other material about 6mm (1/4") thick. Mark the spot on the outside of the book, line up the stapler directly above the gap, which should be about 3mm (1/8"), and then do th stapling. The staples can be bent over with a small screwdriver after both are in.

## STORING RESISTORS SO THAT VALUES CAN EASILY BE FOUND

Do you know of any better way to sort and store loose resistors than these. I use them all ! If you have the answer please let me know.
[ ] indicates wording on typical labels.

Method #1

Keep them in containers with a specific range marked on each e.g.
[1k - 5k]
[>5k to <10k] [10k]

Method #2

Same as #1, except use decade ranges

e.g. [-> 1R] [-> 10R] [-> 100R] [-> 1k] [-> 10k] [-> 100k] [-> 1M]

where -> indicates a range up to the value given.

Method #3

Use colour codes e.g. [RED] for all resistors with the first band coloured red.
If you have a large number of resistors with the same first band e.g. brown, then divide them up into separate containers according to the colour of the second band.

e.g. [BROWN - BROWN & BLACK]
[BROWN - RED to GREEN]
[BROWN - BLUE to WHITE]

Method #4

One value in each bin - just like the electronics stores do. *(If you believe that the components are always the same as on the label in these stores then you will believe anything !)*

Method #5

Just put them all in a box or paper bag and use a magnifying glass and ohmmeter to help with the search ! [RESISTORS]

IF YOU HAVE ANY BRIGHT IDEAS ON THIS SUBJECT, PLEASE LET US KNOW.

# EAR GEAR FOR BETTER HEADPHONE COPY

By David VK3ANP (125)

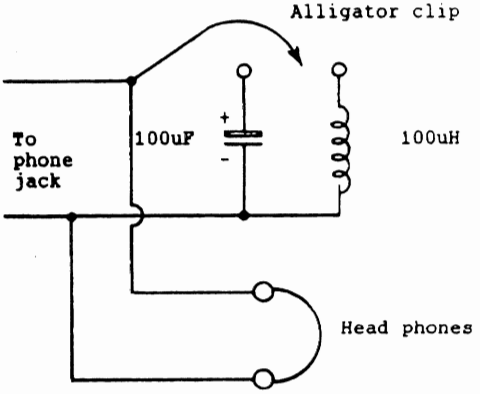
900429 CW CPI IC9A:C4

*Just a small technical aid to help those using earphones for CW copy:*

I am not sure where I got the idea from, probably from *Amateur Radio* magazine sometime in the past. So I don't claim any originality for the design.

The purpose of the circuit is to reduce the level of QRN from static crashes. The circuit consists of a capacitor and an inductor alternatively connected across the headphones, depending on whether you are receiving CW or SSB.

Although the circuit is simple it is quite effective. The components are connected with their common leads together on one side of the phone jack, while the free ends are connected via a wire to the other side of the jack with a small alligator clip. It is only necessary to clip to the inductor or the capacitor for correct operation. If there is no QRN leave the clip lead free.




*73, David VK3ANP*

Circuits and Shortcuits (continued)

## HOME COOKING WITH GAS FETS ?

**Peter VK6BWI (66)** writes: To remove ICs, IF transformers, etc from an old PCB, I have found that the job is made easy by heating the underside of the board with a moderate gas flame The smell produced is noxious and the board can be damaged but the method is very quick

*Editor's True Story:* Well, I had read of similar ideas before (although not suggesting use of the kitchen stove) so after checking that the XYL was asleep I took one of many salvaged commercial PCBs and trod (lightly) to the kitchen. As a precaution I first cut off 10 red LEDs with long leads and removed 5 ICs from their sockets. Past experience warned me it would be a *disaster* but no way could I resist trying. What happened ? Yes, the smell was certainly obnoxious, in fact BAD. Very easy to burn fingers, especially if you change sides on the PCB. Oops, it's not going to workwith this one - it's double-sided and most *leads are soldered both sides* of the PCB. Discovered that PCBs can burn. End result: The ICs and LEDs into storage and PCB back to the 'junkbox'. This is definitely not a method for the faint hearted.

**A Hard Case ?** (The kitchen's already in a mess) **Ian VK8CW (91)** advise: For those making their own cases: try using heat-proof spray paint as used on motor car exhaust systems. Once the paint is dry bake the case in the oven for 30 minutes or so at 250$^{0}$ and you will get a baked enamel finish.

Be careful with fumes and don't cook the roast in with it !!

# AWARDS AND CONTESTS

By Ian VK3DID (112) 900620 AWARDS.9006 Z69A/B2

## *** COMING CONTESTS FOR CW'ERS ***

Recent issues of *Amateur Radio* magazine have mentioned several contests which may interest you, including:-

7 July 1990 - Australasian Sprints CW and Phone July 1990, CW section.
See *AR* May 1990 p.27.

14 July 1990 - Sunshine State Jack Files Memorial Contest 1990.
Tx HF CW or Tx all band CW sections.
See *AR* June 1990 p.30.

14/15 July 1990 (tentative dates) - IARU HF World Championship.
See *AR* May 1990 P.26.

21 July 1990 (CW contest date) - SEAnet World Wide DX Contest 1990.
See *AR* June 1990 p.31.

## *** 40m SCRAMBLE 40m SCRAMBLE 40m ***

**CLUB CW SCRAMBLE #12** is to be held on **40m** on **THURSDAY 2 AUGUST 1990** between 7000kHz - 7040kHz (preferred range).

We hope to have the Club Station VK5BCW operating with Len VK5ZF (1) at the key. As usual, the aim is enjoy yourself making as many contacts as possible - it's not run like a 'serious' contest. Use homebrew Tx & Rx if possible. *SPECIAL WELCOME TO DX MEMBERS*

## RULES

**OBJECT:** To score maximum points by working as many stations as possible on the 7MHz band.

**DURATION:** 2 hours, from 1030Z to 1230Z.

**MODE:** CW only. Club Members to use QRP (maximum 5 Watts output to antenna).

**CALL:** No Control Station to check in to, JUST COME UP AND START CALLING. The call to use is CQ QRP TEST and Members should use the /QRP suffix. There is no need to exchange QSO serial numbers.

**SCORING:**

| CW STATION WORKED | POINTS SCORED |
|---|---|
| QRO VK | 1 |
| QRO DX | 5 |
| QRP VK | 5 |
| QRP DX | 15 |
| CLUB STATION VK5BCW | 15 |

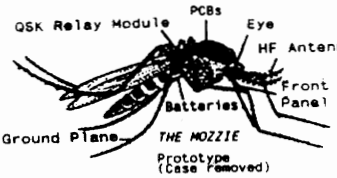
**ENTRIES:** Send log extracts to me *without delay* please. Just show time of contact in UTC, call sign of station QSO'd with and /QRP if it was a QRP station, name of operator (if you know it), signal reports given and received, and points claimed. Some info. about your rig etc. would be of interest.

**RESULTS:** Results including certificate winners will be in September *Lo-Key*.

*73, Ian Godsil* VK3DID (112)
Awards and Contests Manager,
9/492 Barkers Rd.
EAST HAWTHORN Vic 3123

## HARMONIC for Graeme VK3EII (55) and XYL Marisa

Graeme came into the Net during May and told us he had just become a proud father. Congrats to Marisa and OM Graeme on the arrival of your new little boy, Andrew. We hope Graeme can still find some time for amateur radio. We all know how much time you can spend on harmonics.
(p.s. Maybe this should have gone into the Clubtivities page ??)




## THE BOOKSHOP BY NORM VK5GI

Like the man said, "Plus ca change....." and all that. I thought that just for a change, I'd look at two articles - revolutionary in their own right - separated by over 22 years. The first in QST of November 1968, and the other in the May 1990 edition of Silicon Chip.

Way back in 1961 (remember 1961? The Beatles hadn't even been heard of, except by the dozen or so of us that actually worked at the Cavern in Liverpool, remember Viking Galaxies? Or the Swan 350?) a ham called White - no other details available - wrote an article entitled "Balanced Detector in a TRF Receiver" and had it published in QST in May 1961. He thought that by putting diodes into a bridge formation, 'direct conversion' would lead to front end improvement. Well, Mr. White's receiver used tubes and was more complex than any superhet. His article was forgotten.....until our friend Wes Haywood rediscovered it, and wrote for the November 1968 QST "Direct Conversion - A Neglected Technique". Using transistors of the period and Schottky (hot carrier) diodes, Haywood devised the circuit that we know and love to hate today! Anyone wanting to try this circuit can contact me (large SASE please) , but I recommend late 20th century NPNs in place of the probably noisy and certainly unavailable RCA 40233 used in the 1968 circuit. The Schottky diodes are available from Dick Smith. Lets know how you go.

From this historic first, let us move up to May 1990 Silicon Chip. Clive Chamberlain's article on his cw transceiver "The Mozzie" is, as far as I know, also a first. This little rig uses only 5 integrated circuits - Look Mom, NO FINALS - and the "finals" or whatever you want to call them are contained in the National Semiconductor chip 75451. Two NAND gates in the chip are connected as inverters and each drive in push-pull a transformer and tank circuit. What a nifty idea! The balanced mixer of the 1968 rig is replaced by a Signetics NE602 chip, containing the mixer and oscillator, the whole kit and kaboodle on IC3 of the circuit! This little rig is single channel only, using a US color tv intercarrier crystal on 3.579545 MHz which is easily obtainable from Tandy or Trickies. Jeepers, the mods for this rig come flooding in - a varactor diode VFO for starters, Tx/Rx relay, perhaps a 2SC1969 to boost the output up beyond 1 watt, a little meter with switch for output power and battery state, the filter is probably too narrow as it stands for speech, but a little jiggery-pokery with the 10k resistor should.....!

Seriously, I can see this little rig being the first of many designs using no discrete transistors at all, and could create quite a cult following! If only National would bring back their famous superhet SSB/CW/FM receiver on a chip of a few years back, I can see QRP rigs of extreme sophistication being built into matchboxes. Lets know if you can come up with something like the Mozzie. Publish and be damned, we've come a fair way since 1961, or 1968 for that matter. Ain't this a great time to be alive?

73's

Norm VK5GI

## BOOMERANG CIRCUIT BOOK

900530 BOOKSHOP Z69A/A2

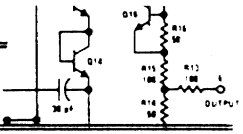
By the time you read this almost everyone on the circulation list should have seen the Boomerang Circuit Book (BCB). If you are on the list, but have missed out, please contact Norm VK5GI (139) or one of the Executive Committee Members or, better still, come up on the Friday evening Info. Net (details on page 2) and let us know.

We will send the BCB around again if a sufficient number of other Members register interest with Norm.

Several people have mentioned that a sheet showing the circuit diagram of the *Ugly Weekender* was missing when they saw the BCB. If you need to see this, please let Norm know and he will `fix things' for you.

# METER AMPLIFIER USING LM4250

By Don VK5AIL (75) 900621 MTR.AMP Z69A/B4



We need a meter amplifier where the maximum current being measured will only give a small fraction of the full scale deflection (fsd) of the available meter. This situation is opposite to the more common one where we shunt a meter with a calculated value of low resistance to allow it to read currents much higher than its own fsd.

With meter prices now approaching $A20 it makes sense to use a 500uA or 1mA meter that you may already have, to avoid buying a 50uA especially for your new project. For other references to meter amplifiers see VK5ZF (1) Len's notes on page 5 of *Lo-Key* #19 Sep. 1988 and a brief mention on p.17 of #20 Dec. 1988.

I have managed to successfully use a Kyoritsu EW-40 edge meter with the VK3XU (49) Drew Diamond Sensitive SWR Meter circuit. This meter, which is on our Club Sales List, is of better quality than the usual edge meters available at retail outlets and is quite suitable for the task, except the fsd is 500uA. Above about 3 Watts power the forward readings are satisfactory - roughly 100uA per Watt. However, below about 3W power the amount of needle movement on the Forward reading is very small (e.g 1/5th of fsd), so the Reverse reading is far too small for a reasonably accurate calculation of VSWR.

I tried several transistor meter amplifier circuits, but could not get satisfactory results when the reverse readings were low, which is of course what we are aiming for. But then I found a winner in *LINEAR APPLICATIONS HANDBOOK Volume 1* published by National Semiconductor. Application Note AN-71 by Vander Kooi and Cleveland describes a meter amplifier based on the LM4250 programmable op amp. They give instructions on setting up circuits for a whole range of different target fsd's, from 100nA (yes, 0.1uA) to 10A. Of course the use of this LM4250 meter amplifier circuit in an SWR meter is only one example of its use.

The good news is that it worked fine. Some might say it would have been better to try to find a 50uA meter in the first place. As an experimenter I KNOW which is better, so my 50uA meters can stay in their boxes for a while yet.

Here are the steps I followed, firstly to set up the basic meter amplifier, then to apply it to a typical situation, the SWR meter mentioned earlier:

A. TO SET UP THE METER AMPLIFIER FOR DC CURRENT MEASUREMENTS

1. Decide on fsd required. The circuit shown opposite is the one I used for 50uA. The Application Note gives a number of different values and circuit variations e.g. for 100uA fsd use the same circuit, but with Rf = 3k.

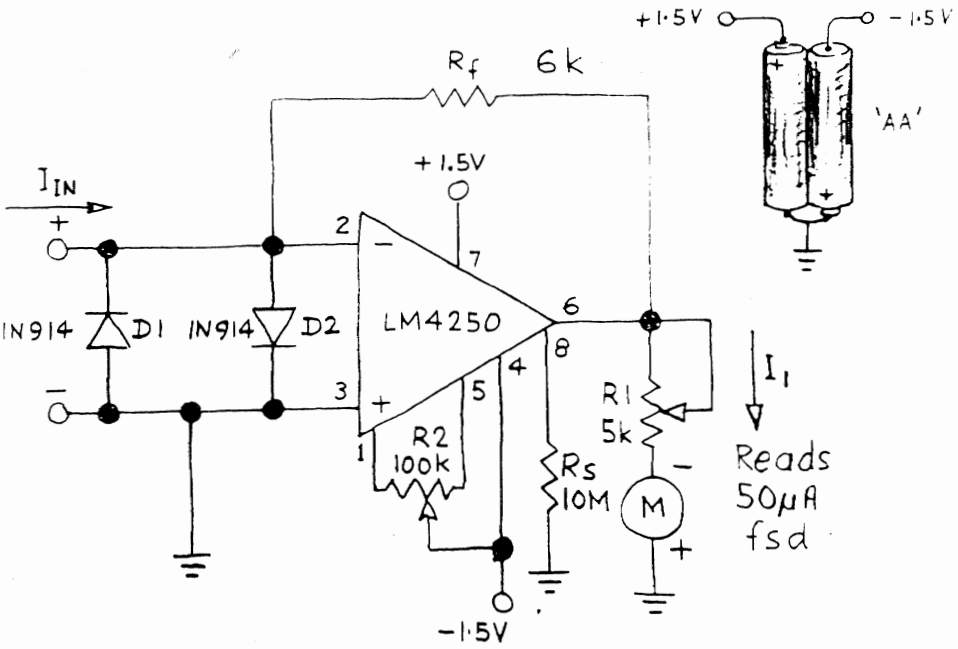
2. Build the amplifier. Best to use an IC socket. Pots can be wire-wound, as the circuit is only passing DC currents.

The circuit requires both + and - voltage sources, so try two 1.5V AA batteries, which are quite compact. Apparently the current drawn from the batteries is very low, but you could arrange to switch them out if this concerns you. Use a dual holder, then slip in a thin piece of brass or copper with a lead to Common. The + and - can be taken off using a battery snap designed for 9V batteries, as used in transistor radios. Ni-Cad batteries are best avoided here because of their gradual loss of charge. See sketch opposite.

3. Test what you have done and calibrate the amplifier and meter combination, as follows:

Run 50uA through the amplifier/meter arranged in series with a multimeter which gives a reasonably precise reading around 50uA. I used a 270 kilohm resistor and a psu set on about 13.8V to give about 50uA. If your psu output voltage is adjustable, you can get 50uA exactly. Then use R1 to set your meter reading to match that of your multimeter. If the maxmum reading obtained is 500uA (fsd on 500uA meter) this is now indicating an actual flow of 50uA.

To experiment with different fsd's try replacing Rf with a 2.7k resistor and 5k pot in series. You could set up for 50 uA fsd, then measure and record actual resistance, then do the same for 100uA. Ordinary resistors could be substituted after the experiment is finished and, if both




ranges are needed, a switch could be used.

Of course, before first using the meter you will have adjusted the needle's zero position. Now try to get a nil reading when no current flows. The trimpot R2 marked "zero set" should achieve this. I did not notice any effect in my experiment - the needle stayed slightly 'negative'. Repeat the fsd calibration.

B. TO APPLY THE METER AMPLIFIER TO THE 'SENSITIVE SWR METER' DESCRIBED BY DREW VK3XU (49)

1. The easiest way to connect to the SWR meter circuit shown in *Lo-Key* #19 page 4 is simply to connect the + terminal of the meter amplifier to the wiper of the SWR meter's pot R3. Note that the ammeter's + terminal is connected to Common when used with this meter amplifier i.e. it is reversed in comparison with the original SWR circuit.

2. You could experiment by feeding the current direct into the meter amp (without any R3) and using R1 5k, or maybe 10k, as the front panel sensitivity adjustment.

It is probably best to use this set up ONLY for QRP power levels. However if you do use it for higher powers, please let me know the result as it may interest others.

For higher powers revert to the method in 1 above. Replace R1 with a 5k trimpot and use the 10k pot as R3 on the original SWR meter circuit.

*In conclusion*, this meter amplifier circuit is most useful and it can be varied for different situations. Even if you have a 50uA meter already, it's an intersting project to use a 'larger' meter with the amplifier.

The LM4250 has been added to the list of parts available from the Club, in case you can't obtain them. See C038, also C001 edge meter.

# CW NET NEWS By Ted VK2CWH (89)

900621 TEDNET Z69A/B7

After a disastrous summer/autumn, the Net is back in effective business, but the heavy toll taken by the QRN in the warmer months set me thinking

On quite a few occasions the QRN was pretty localised - the storms just seemed to head for Wombat country every Wednesday night - and there were possibly quite a few potential starters out there enjoying reasonably good conditions.

Also, to try to keep the Net moving I circulate the overs around all people on the Net at the time and give a CQ when it gets back to me. At times this could mean a long wait for someone wishing to join in, so it is possible they could get frustrated and move to greener pastures !

So it occurred to me: why not encourage people in any of these categories to QSY and see if they can start a QRP net. On noisy nights this could mean two or three local nets are running, instead of none.

Likewise, when the VK2CWH net is busy, the long suffering hopefuls waiting for an opportunity to check in need not miss out, either.

*So, if conditions are bad and you can't hear VK2CWH, or if the Net is taking too long to get to you, why don't you take the initiative and QSY to a nearby frequency and call "CQ CW OPS/QRP DE (ur call)/QRP" and see if you can get one or two replies.*

Since conditions finally got out of summer mode , there have been pretty consistently 5 or 6 people on the Net, and it is good to hear **Matt ZL1ATW (34)** getting through once again. Also it's great to hear from new Members: **Basil VK2AW (180), Brian VK5PAS (145) Wes VK2MIR (162).**

I have found that rarely are there any starters before 0945 U.T.C., so have been starting at that time. This time now appears on page 2 of *Lo-Key* with the rest of the CW Net details.

*Best regards to all, Ted VK2CWH*

Ted Daniels VK2CWH Wombat Hole Bylong Road Rylstone NSW 2849

****** *** ** * CW NET - NEW STARTING TIME 0945 UTC WEDNESDAYS * ** *** ******

# FROM THE EDITOR'S DESK

By Don VK5AIL (75) 900623 EDTOR Z69A/B6

*Well, it's back to normal after the special 25th Issue of Lo-Key.*

*All the articles and associated notes received lately are in the running for the Award for Best Technical Article which was announced in the March issue. Keep 'em coming !*

*I now have an IBM compatible PC sitting alongside the Apple ][ Plus so can now handle most MS-DOS (4.0 or 3.3 etc.) computer files if you feel like sending your input on diskette (any size is O.K.). ASCII/text files are the "safest', but the major commercial word processor outputs can be handled/translated. It is easier for the Editor if the input is on disk - but, as mentioned before, a note on the back of a used envelope is still 100% acceptable.*

## NET OUT OF CONTROL

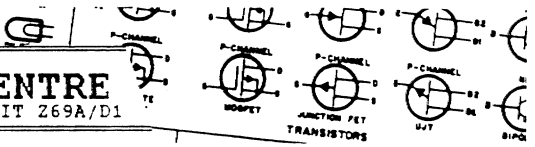
**Max VK5OS (2)** *sends a Stop Press message that he will be unavailable for the Club Info. Net (ssb) on Friday 10 August - but we'll all be there anyhow ! CU ON 3620kHz at 1030UIC.*

*Here is my twist of an old saying:*

***He who laughs most, lasts longest***

# KIT-SET ACTIVITY CENTRE

By Don VK5AIL (75) 900623 KIT Z69A/D1




## ** Thankyou to the Helpers **

who keep the Kit-Set Activity going at top pace:

**Rod VK6KRG (28)**
develops designs for kit-set projects
**Jack VK5FZ (118)**
assists with the setting up of kits for clients
**Max VK5OS (2)**
makes PCBs for Club Communicator kits
and now **Ian VK8CW (91)**
has joined the group by helping with the building & testing of prototypes using kit-set parts. Without all this assistance kit-set activity would be somewhat restricted.

Now, some *** New Items ***
(our Price List ID numbers are shown in brackets)

The **Driver board**
for the **Forrestfield**
is featured in this issue of *Lo-Key*. Don't forget that most of the Forrestfield and Club Communicator modules are valuable in other rigs, so think about it if you are planning a project. (K015)

Another item mentioned elsewhere in this issue is the NatSemi
**LM4250 op amp**
which is extremely versatile, giving the user the ability to externally set the bias current by varying the value of a resistor. (C038)

Yet another IC, but rather different in function is the Motorola
**MC4044 phase frequency detector**
which is hard to beat as the basis for a PLL circuit. (C040)

If you can't obtain
**RG-174 mini coax**
for RF wiring in QRP rigs, or
**screening beads** to stop RF, we can help. You need look no further than C039 & C041 on the list !

Next, ** Two One-Off Specials **


## G-Club Circuit Handbook

The Rev. George Dobbs G3RJV (96) has again assisted us by approving the reproduction of the G-Club Circuit Handbook for Members. We will accept orders for a batch of this top class publication which we plan to produce in August 1990.
See C098 on the Club Sales List.

## Ets. Velleman (Belgium) laborator power supply and digital panel meter kits.

Velleman is a supplier of top quality kits - the PCBs are most impressive. This equipment could be used for powering QRP rigs in the shack, as well as for experimenting with circuits using CMOS and TTL ICs etc.

Output is up to 3 Amps of power, variable, dual tracking voltage 0 to 24V (+ and -) and +5V. You must supply case and transformers (30 or 32V centre tapped, 4A and a 7 or 8V, 250mA. Retail price labels show total $156.90 - Price to Members is $70.00, or $50 for psu without meter. Both include postage and packaging. Only four are available so be quick. **There will be no more - this is it !**

## ** Kit-Sets ** These include:

**Club Communicator**
CW QRP 3.5MHz (80m) VFO-tuned transmitter by Rod VK6KRG (28). Kits are also available for individual modules - drop us a line if you are interested.

The **Forrestfield**
CW QRP 21MHz (15m) transmitter by Rod VK6KRG (28). Kits for individual modules of the VFO, VCO, PLL (phase-locked loop), KDB (buffer) and DVR 1W driver are available so far, from the current series of *Lo-Key* articles.

**Sensitive SWR Meter**
by Drew VK3XU (49). Includes a 5W dummy load.

The **Flexi-Sudden**
direct conversion receiver is a variation on the *Sudden* design by the Rev. George Dobbs G3RJV (91). Our version uses plug-in boards which can be made for any of the Amateur HF and HF bands. (continued over)

Prices are as shown in the ***Club Sales - Price List*** section. Now for some more details on the SWR meter:-

## SENSITIVE SWR METER & QRP DUMMY LOAD

An ideal first project for a beginner

To assist Members who are setting up stations for QRP operation we offer a short-form kit-set for building a sensitive SWR meter, which can also be calibrated to give QRP power readings, plus the parts for a very compact 5W dummy load.

The design and construction of this SWR meter was the subject of an article in *Lo-Key* No. 19 September 1988. The original article by Drew Diamond VK3XU (49) appeared in the Wireless Institute of Australia journal *AMATEUR RADIO* in April 1983, having originally appeared in the *VK CW QRPp Club Bulletin*.

The meter is particularly sensitive, unlike many meters designed for higher power, which hardly move the needle when QRP powers are used. It can be left in-line during QSO's - normally set so that the reverse reading can be monitored. It has a sensitivity control for use when higher power causes the needle to exceed full scale deflection.

Parts are also supplied for building a 5W dummy load in a PL259 coaxial plug, similar to that described in the *ARRL HANDBOOK* (chapter on Test Equipment).

An instruction manual is included. The only significant items not supplied in this short-form kit-set are the main case and the 50uA meter. As an option you could use the meter amplifier featured in this issue with a different meter, such as C001 on our List.

## ** Supply of Components **

We also have available for purchase by Club Members a range of components, particularly items hard to get from normal sources. If you are having difficulty finding parts we may be able to help, so please come up on the Club Info. Net or write to me.

The items are brand new except where stated otherwise. We cannot guarantee availability and may have to limit quantities sold to individuals. The items listed are only a small fraction of those available.

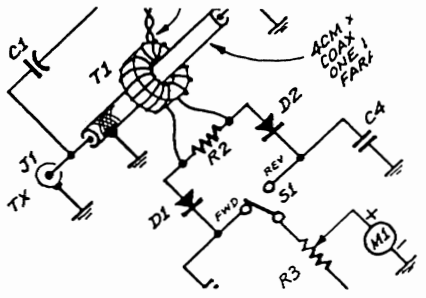
You must take the responsibility for any results of using replacement transistors, diodes etc. suggested in the list. We can give no more than the normal commercial warranty applicable to each item.

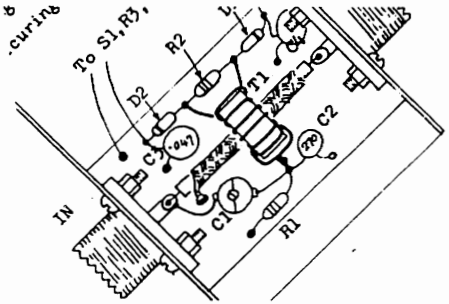
## ** Ordering Kits & Components **

Orders and payment should be sent to Don VK5AIL (75), or to Treasurer Kevin VK5AKZ (43) if you apply for membership at same time. Addresses are shown on page 2.

Please make out the cheque to CW OPERATORS QRP CLUB. For small money amounts up to $A 10.00 it is alright to send the equivalent value of postage stamps (as long as they are unused Australian stamps valued at $1 or less !). The receipt will be enclosed with your next copy of *Lo-Key*. If you don't receive a packet within a reasonable time please contact me on the Club Info. Net or write - things may have gone astray.

(continued opposite)



# CLUB SALES - PRICE LIST

*We give more for less*

The prices listed below are per pack. The list shows how many of each you get in one pack. Prices may change at any time without notice. PSE ADD $2.00 TO THE TOTAL VALUE OF YOUR ORDER, TO COVER POSTAGE/PACKING ETC.
'K' in number indicates a kit-set, usually short-form.
'N' means it is a new item on the list.
'D' means that a simple data sheet will be provided with each order.
'H' means that a set of insulated mounting hardware is included.
The items are for Member's personal use ONLY. You must take the responsibility for all results of using replacements suggested in the list.

PRICE LIST
From 15 June 1990

| Code No. | Nbr in pck | $ Price per pack | | Description |
|---|---|---|---|---|
| K001 | 1 | 79.00 | | Club Communicator Full Kit-Set 3.5MHz CW QRP Tx complete with 52 page manual C010. See *Lo-Key* #14 Jun '87. |
| K006 | 1 | 25.00 | | Sensitive SWR meter. Short-form kit. Plus 5W dummy load. Manual included. See *Lo-Key* #19 Sep 1988 & *AR* Apl 1983. |
| K007 | 1 | 28.00 | | VFO for Forrestfield 21MHz CW QRP Tx. Short-form kit. Instructions in *Lo-Key* #22 Jun 1989. |
| K010 | 1 | 20.00 | | VCO Voltage Controlled Oscillator for Forrestfield 21 MHz CW QRP Tx Short-form kit Inst'ns in *Lo-Key* #23 & 24. |
| K011 | 1 | 40.00 | | *Flexi*-Sudden receiver. Any band - choose one. Based on design by George G3RJV (96). Short-form kit with manual. Extra modules available for other bands. See K014. |
| K012 | 1 | 31.00 | | PLL Phase-Locked Loop for Forrestfield 21 MHz CW QRP Tx. Short-form kit. Inst'ns in *Lo-Key* #24 Dec 1989. |
| K013 | 1 | 18.00 | | KDB Key Delay, Buffer for Forrestfield. Instructions in *Lo-Key* #24 Dec 1989. |
| K014 | 2 | 18.00 | | Pair of extra BPF and VBFO modules for the Flexi-Sudden. You nominate band. See *Lo-Key* #25 Mar 1990. |
| K015 | 1 | 25.00 | N | DVR driver board for Forrestfield. Instructions in *Lo-Key* #26 Jun 1990. |
| C001 | 1 | 5.00 | | Ammeter edge type 500uA f.s.d. (DC) Kyoritsu EW-40. Needs a 14mm x 42mm cut-out in your panel. |
| C002 | 2 | 4.00 | DH | IRF510 transistor N-channel MOSFET (Replaces IRF511). Used in some of VK3XU (49) Drew's projects. |
| C004 | 4 | 2.30 | | BAT85 Schottky (hot carrier) diode. Voltage drop is 0.2 - 0.3V. High sensitivity - can replace germanium types. |
| C007 | 2 | 3.00 | D | BS170 transistor VMOS N-channel FET. |
| C008 | 2 | 5.00 | DH | VN88AF transistor. |
| C013 | 2 | 1.10 | | Toroidal core 9mm od x 6mm id x 3mm ht. Philips 4322 020 97170 material 4C6 ferrite (violet) |
| C014 | 2 | 1.40 | | Toroidal core 14mm od x 9mm id x 5mm ht. Philips 4322 020 97180 material 4C6 ferrite (violet) |
| C015 | 4 | 1.70 | | BA102 equivalent: 1S2688 varicap (varactor) diode. |
| C018 | 2 | 0.60 | | Toroidal core 6mm od x 3mm id x 2mm ht. Philips 4322 020 97160 material 4C6 ferrite (violet) |
| C022 | 10m | 0.20 | | Enamelled copper wire 0.17mm diam. approx. 34B&S 37SWG |
| C025 | 1m | 0.70 | | Enamelled copper wire 1.25mm diam. approx. 16B&S 18SWG |
| C026 | 5 | 7.50 | | TIP31C trans'r VCEO = 100V (TIP31,31A,31B = 40,60,80V) |
| C031 | 1 | Free | | Crystal (for experimenting) Large Y3 10X W type ex RAAF. You nominate frequency 6561.111, 7810 or 8036.25kHz. Postage and Packaging charge only. |
| C032 | 1 | 3.50 | D | NE602 double balanced mixer & HF oscillator for Sudden Rx. |
| C034 | 2 | 3.00 | D | IRFD1Z0 FET (Replaces IRFD1Z3) For GEMAL transceiver. |
| C035 | 2 | 2.40 | | Toroid - Neosid 4327R/2/F25 ferrite, as in K006 SWR meter. |
| C036 | 2 | 2.00 | D | BF981 Si N-channel dual gate MOSFET SOT103 case. (Similar to 40673, MPF121 and MFE131, but case different). |
| C037 | 2 | 4.10 | D | LM386 audio power amplifier. |
| C038 | 2 | 3.00 | ND | LM4250 programmable amp IC. See *Lo-Key* #26 Jun 1990. |
| C039 | 1m | 0.70 | N | RG-174 mini coaxial cable 50 Ohms 2.5mm diam. |
| C040 | 1 | 7.00 | ND | MC4044 phase frequency detector |
| C041 | 10 | 1.00 | N | Screening beads - ferrite FX1115 or similar |
| C098 | 1 | 10.00 | N | G-QRP Club Circuit Handbook - Approved copy Taking orders for a production batch *UNTIL 31 JULY 1990* |
| C099 | 1 | 1.80 | | Past issue of *Lo-Key*. You nominate month/year or issue number. #1 and #2 count as one. |

# Test Reports - Howes Kits

By Brenton VK5AQ (172)

REPORT THE C.W.HOWES 80 METRE CW MORSE TRANSMITTER

Having an AMATEUR LICENCE for only a short time I decided to construct something in the field of this hobby and decided on one of these "HOWES KITS" Not having constructed kit form projects for quite a number of years in radio,The only one I can remember was the "AWA MARCONI AM RADIO KIT" back in 1952 which I constructed,still goes as well as the day it was built.So I decided to have a go at constructing one of these"HOWES KITS"which was purchased from a Dick Smith Store.On arriving home I decided to check that all components were there this did not create a problem as the easy to follow list supplied with the instructions was very good.All the parts were there,so the next thing was to read the instructions through and understand the procedure.Then the task was to solder all the components to the pcb and in their correct position this took approx. an hour.Then the tuning coil and toroids were wound and I used candle wax to hold the wire on these in place,these were placed on pcb and wiring soldered.Next external wiring was soldered to the various outlets on the board and letter labels used to identify wire function.Well it was hooked to an external dummy load,power meter,key and power supply 13.8 volts then switched on and key pressed,there was no smoke signals all was ok.Output was 4 watts and tone good,which came through the Realistic DX302 receiver,then it was connected to an 80 metre antenna,the key was operated,into Adelaide on CW,RST was 5x9 +

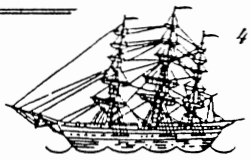
SUMMARY I found that the instructions supplied were excellent,and any person with limited knowledge should have no trouble at all with construction.Components were of good quality.Could not find any bad points with the kit it functioned first time up.It is a cheap transmitter for an amateur to use if he or she does not have funds to get on air,also it does give the constructor the knowledge of a simple transmitter.Possibly 1 more crystal could be placed in the kit to give another frequency,on 3.5

REPORT C.W.HOWES DIRECT CONVERSION 80 METRE RECEIVER

Well having built the transmitter I decided it was the next best thing to put a receiver along side it.Using the same construction technique as in the 80 metre transmitter. The instructions supplied with the kit were excellent to follow from start to finish.All components were in the packet to construct the receiver.Extra to purchase was the tuning capacitors 50pf (2),but other values can be used successfully,plus I used switches and extra connectors.The tuning coil and toroids were pre-wound making construction simpler.The performance of this receiver I found when connected to my 80 metre antenna,which is used on the TS 130,its audio and its ability to select frequencies is excellent,with a narrow filter fitted it would possibly be as good as a more expensive unit.It took 2 hours to construct and test on air.For an amateur with limited funds these 2 units would give him or her countless hours of enjoyment.Also an excelllent kit to learn the fundamentals of a receiver.Both circuit boards were fitted and wired in an aluminum box 26cm x 18cm x 50cm and a relay used to switch over from transmitter to receiver as required,top cover was drilled and perforated in centre to take a small speaker which was fitted,2 leds were fitted to front panel to signify which circuit was in operation,also a headphone jack.

# RIC'S REGEN Rx

By Ric WBØNQM (106) 900627 REGEN Z70A/B6





(Editor's Note: Ric sent this little circuit with the transceiver we published in *Lo-Key* #24 December 1989. It was very pleasing to see the tcvr reprinted in SPRAT along with a couple of other extracts from *Lo-Key*).

Now down to the important business, the little regen receiver is as goof proof as possible. The coil was wound on a toroid and the toroid is a T50-2. The formulas for the little receiver will be at the bottom of this letter, since my typewriter can't make all those strange symbols. The primary of the coil is 1/10 the total number of turns on the taped secondary. This was done to provide a low impedance for the antenna and to mimize stray radiation. The secondary is tapped up from the cold (ground) end approx. 25 to 30 percent of the total number of turns on the secondary. Don't let the toroid worry you because you can use any type of coil form or a air coil. The tap percentage and the number of turns in the primary are the same on any coil. At this point I would like to give the builders of this little receiver a WARNING: Do Not Open The Source Leg of The FET With Power On. The output of the receiver can be (Drain Leg) fed into any type of audio transformer including Radio Shack isolation transformer which is 1:1. The isolation transformer works well if you are going to use an seperate audio stage. The audio stage I designed for the transceiver in this issue of Lo-Key will work fine with this little receiver.

T50-2 $N = 100\sqrt{\frac{L}{50}}$

N = Number of turns
L = Inductance in µh

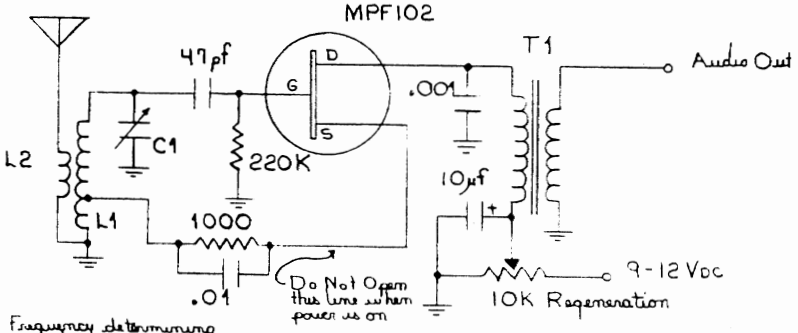
73's

Rick

$f = \frac{10^6}{2\pi\sqrt{LC}}$ $L = \frac{10^6}{39.5 \times f^2 C}$ $C = \frac{10^6}{39.5 \times f^2 L}$

f = Frequency in Mhz
L = Inductance in µh
C = Capacitance in pf

Receiver




L1:C1 = Frequency determining circuit

Use Formula $f = \frac{10^6}{2\pi\sqrt{LC}}$

Tap 25% from cold end

L2 = 3 turns around L1

T1 = Any audio transformer as long a primary is greater than 1KΩ

Coil form can be anything even T50-2 toriod

# BACK TO BASICS: BATTERY WILL GET YOU NOWHERE - WITHOUT THIS LED WARNING LIGHT

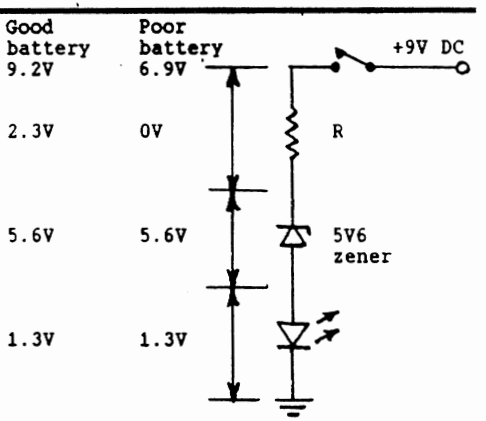
By Don VK5AIL (75) 900317 BTB 16HA/D4

If you are thinking about installing a LED ON/OFF indicator on battery powered gear, why not go further and make it into a warning light for battery low voltage, as well ? The aim is to make the LED turn off (or be very dim) when the battery voltage drops below a figure you choose. The gear will still operate, but you know you will soon need to replace or recharge the battery. All it takes is a zener diode. See the sketch opposite.

I used this method after a 'fault' appeared in my *Sudden* receiver. It turned out to be low battery voltage, as I had left it switched on overnight once or twice. But it did fool me into making a start with troubleshooting. Here is one answer to this sort of problem. I will work through my calculations and you can substitute your figures if the voltage or other details are different.

Suppose our supply voltage is 9V (nominal). The maximum actual voltage might be about 9.2V and we will choose 20mA current through the LED for a nice bright display when the battery is fully charged. *Yes, I know this will gradually flatten the battery, but I use rechargeables !* The *Sudden* circuit certainly has problems when the battery gets into the 6 to 7V range, so let's aim to switch the LED off at 7V. In fact there will be a tiny current flow below this voltage, because LEDs are not perfect diodes.

We know the voltage drop across a LED is around 1.2V to 1.4V. Suppose it measured on the diode tester at 1.3V. So we need a zener voltage of 7V - 1.3V = 5.7V for the LED to switch off at 7V supply voltage. The nearest standard value is a 5V6 zener, which gives a total voltage drop across zener and LED of 6.9V, which is very close to the target.




Now work out the value of the resistance. At 9.2V from the battery, the voltage drop across the resistor is 9.2 - 6.9V = 2.3V. From Ohm's Law: R = 2.3/(0.020) = 115 Ohms. The 0.020 is the 20mA current. The nearest standard value is 120 Ohms, which gives a current of 19mA. From P = I x V we get a maxim um power dissipation of 0.019 x 2.3 = 44mW, which is well within the capability of a 1/4W resistor.

Now for some construction hints, if you call installing a LED plus resistor and zener 'construction' - The Quick Rock-bottom Price method is to drill in the front panel a hole the same size as the LED and glue it in (the LED not the hole). Better still, drill the hole just undersize and use a small rat-tail file to open out and taper the hole to give a push fit. Then slip a piece of heatshrink material over the resistor and zener before soldering them in place between the LED and 'downstream' side of the power switch or other suitable spot.

All this should only take half an hour, but if you are like me you will make it last a whole evening !

*73, Don VK5AIL*

# The FORRESTFIELD 21MHz Tx - Part 5

By Rod VK6KRG (28) and Don VK5AIL (75)

900625 FF#5 Z70A/B5

## THE 1 WATT DRIVER BOARD

**DESCRIPTION**
See Fig. 17 Driver Circuit Diagram

As is the case with several other modules of the *Forrestfield*, remember that the driver is suitable for use in other rigs you may be planning.

This board is divided into two main parts. The first is a low power amplifier capable of delivering about 1/4W or so. This has some features worth mentioning. The first transistor Q1 is equipped with a variable bias supply, which gives a wide control of the gain of the stage. It has worked well with an input RF voltage down to about 0.5V peak. In this transmitter there is enough drive from the KDB board to have the bias wound off altogether. In fact you could leave the 330R resistor, zener and 500R pot out and earth the end of the 820R resistor if desired. However this would limit its versatility, in that you have no way to experiment with bias and output levels versus input levels, a fascinating study in itself. You should learn much from building this stage.

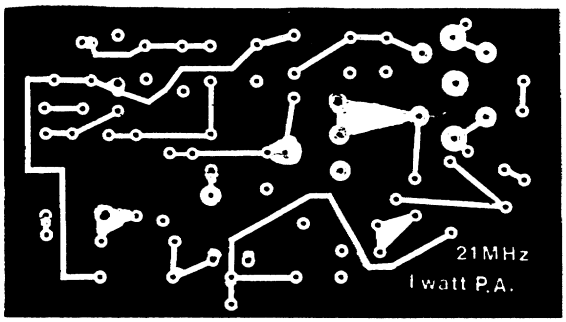
The output coupling L1 (TUNE) and the 100pF capacitor C8 in parallel with C9 LOAD capacitor, form the output L-network for coupling to the next stage. Although it looks like a standard coupling between stages, this is not the case. Transistor Q1's collector is looking into about 350 Ohms for 1/4W output. This must be converted to about 5 to 8 Ohms at the input of the next stage. That is the purpose of the deceptively simple network just mentioned.

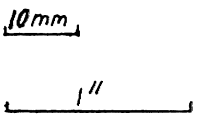
You may be curious about RFC3, as this component is usually used in power amplifiers for CW using bipolar transistors. It is used here because the base-emitter junction of the following transistor Q2 acts like a diode. When Q2 is fed with a large signal it becomes rectified and tries to turn off the transistor, thus reducing available output. The RFC simply shorts the DC component to earth, preventing a DC voltage buildup on the transistor's base.

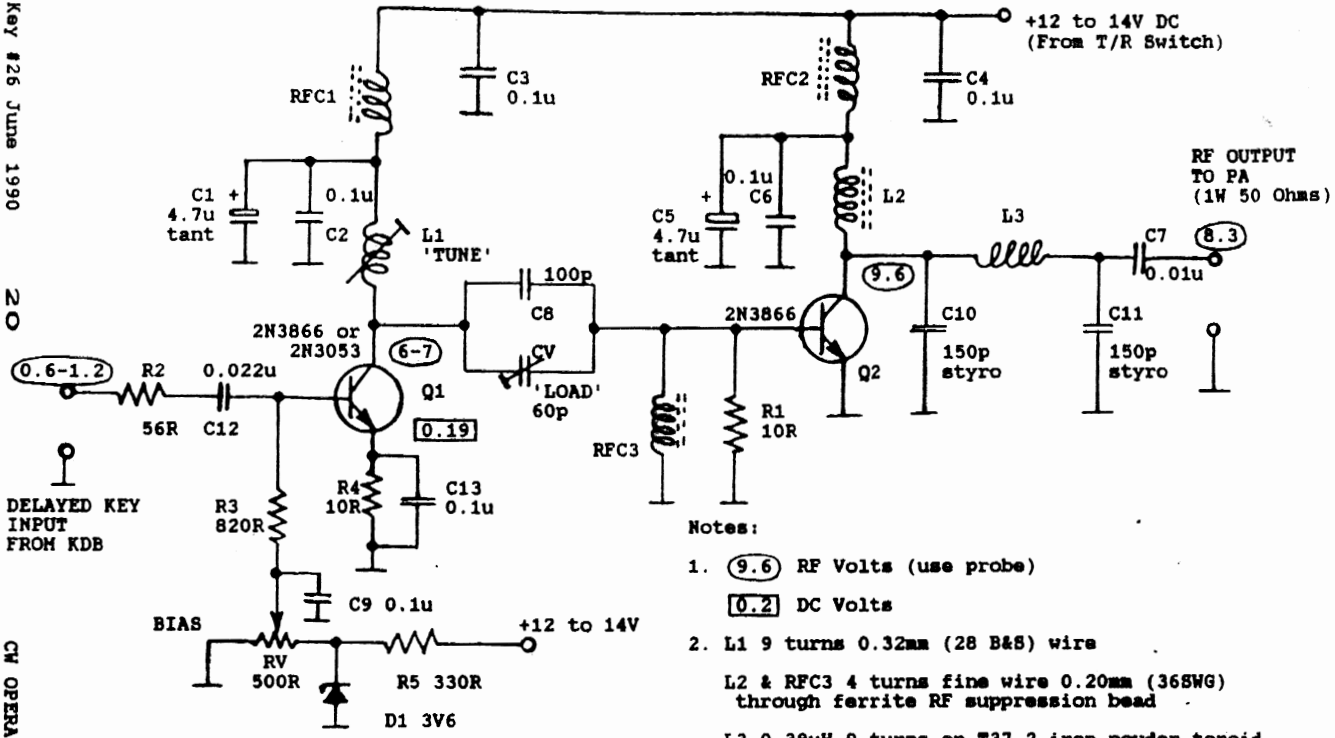
The 10R resistor at the emitter of the first stage has two functions. The first is to limit and regulate collector current flow if bias control is used. The second is to use the voltage drop across the resistor as metering to check tuning during alignment.

The second transistor stage is used to deliver about 1W to the PA board. It has no bias. This is to ensure maximum efficiency of the stage and thus reduce the drain on the power supply. This stage must look into about 90 Ohms to deliver 1 Watt. As a compromise 50 Ohms has been chosen, which has the effect of allowing the amplifier to give about 1.4 Watts. This allows us to use a standard 50 Ohms into and out of the filter (C10 - L3 - C11).

**FIGURE 16 - DRIVER PCB ETCHING PATTERN** Actual size (white = copper)






Notes:

1. (9.6) RF Volts (use probe)

   [0.2] DC Volts

2. L1 9 turns 0.32mm (28 B&S) wire

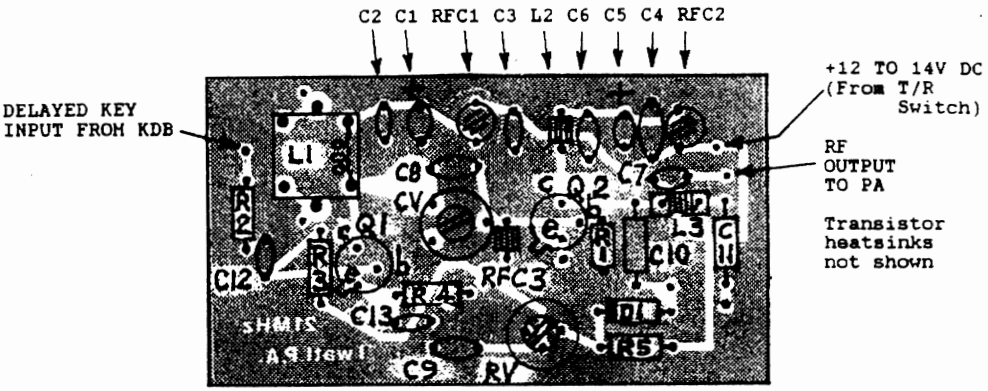
   L2 & RFC3 4 turns fine wire 0.20mm (36SWG) through ferrite RF suppression bead

   L3 0.38uH 9 turns on T37-2 iron powder toroid or 3 turns on Philips 9mm 4C6 (vio) ferrite 0.51mm (24 B&S) wire

   RFC1 & RFC2 fully wound ferrite 6-hole bead

FIGURE 17 - DRIVER CIRCUIT DIAGRAM

**FIGURE 18 - DRIVER PARTS LAYOUT**




**DRIVER PARTS LIST**

Resistors

R1 ..... 10R 1/4W (brn-blk-blk)
R4 ..... 10R 1/2W (brn-blk-blk)
R2 ..... 56R " (grn-blu-blk)
R5 ..... 330R " (org-org-brn)
R3 ..... 820R " (gry-red-brn)
RV ..... 500R trimpot (horizontal)

Capacitors

C8 ..... 100pF ceramic NPO
C10 C11 150pF ceramic NPO or polystyrene
C7 .... 0.01uF ceramic (103)
C12 .. 0.022uF (or 0.02) ceramic
C2 C3 C4 C6
C9 C13 . 0.1uF ceramic (104)
C1 C5 .. 4.7uF tantalum
CV ..... 60pF trimmer

Semiconductors

Q1 Q2 .. 2N3866 (Q1 can be 2N3053 (metal can TO-39)
D1 ..... 3.6V zener diode or BFY51)

Colour codes:

| | | |
|---|---|---|
| blk black | brn brown | red red |
| org orange | yel yellow | grn green |
| blu blue | vio violet | gry grey |
| wht white | sil silver | gld gold |

Miscellaneous

1nbr ..... Driver PCB double-sided
2nbr ..... Stand-off set
2nbr ..... Heatsink TO-5/TO-39 type
RFC1 RFC2 . Ferrite 6-hole bead 0.5mm plain wire
L2 RFC3 ... Ferrite screening bead 0.20mm enamelled wire
L3 ..... Toroid Amidon T37-2 or Philips 9mm 4C6 vio 0.51mm enamelled wire
L1 ..... Neosid former, F25 or F29 slug, base and can 0.32mm enamelled wire

Note: None of the wire sizes are critical

**CONSTRUCTION HINTS**
See Fig. 18 Driver Parts Layout and Fig. 16 Driver PCB Etching Pattern

1. The same comments apply as were given for other double-sided PCBs e.g. PLL. Be careful to solder leads on both sides of the board, where they are to be grounded, otherwise you may have an open circuit at certain points. Not essential at some points.

2. Before any soldering is done make sure that the larger parts fit O.K. Holes may need to be opened out to take special pin sizes.

Install L1 first, so that nearby components do not foul it, then wind it when in position.

3. Inductor L1 - Construction and Installation

3.1 Remove the excess middle pins from the base. Only the four pins at the corners are required.

3.2 Make sure the remaining pins fit into the PCB.

3.3 Ensure the bulge in the two pins (under the base) in the coil circuit do not touch the ground plane. Countersink all four pins so the base and former fit squarely on the PCB. Don't solder to ground plane.

3.4 Mount former in base. Best to use a spot of SuperGlue to make it firm.

3.5 Carefully solder the pins to the PCB without filling them with solder.

3.6 Take a 190mm length of enamelled wire and tin 5mm at each end. Insert one end in the pin which is connected to C1 and C2 and position it flush with the end of the pin and solder.

3.7 Wind on 9 turns in an anticlockwise direction (when viewed from top). Insert free end of wire into the pin which is connected to the collector of Q1, ensuring the coil does not unwind, then solder.

3.8 Cut short wires and solder them on both sides of PCB near the can pins, using the holes provided, so that the can is grounded.

3.9 Note that the inductance of L1 should measure about 0.5 to 0.6uH with the slug inserted flush with the top of the can.

4. Now install the other inductors, then resistors including RV, then capacitors.

5. RFC1 and RFC2 Wire length is 85mm. Fit an insulated pad under the bead, to make certain that it cannot short circuit to the ground plane. Pad is essential if wire is not insulated. Note: inductance is about 6 or 7uH with low Q (at 8MHz).

6. L3 Wire length is 60mm. Wind on three turns, close wound i.e. do not spread around the toroid. Each pass of wire through the hole of the toroid counts as one. Note: inductance is about 0.4uH (the aim being 0.38uH). Install the toroid 4mm clear above the PCB surface, thus ensuring its Q is reasonably high, to facilitate tuning.

7. L2 and RFC3 Wire length is 100mm. Ensure loops don't cross over in the centre of the core. Inductance has been measured as high as 10 - 20uH (low Q), which is ample.

8. Trimpot RV Make sure that the pins of RV do not short circuit to the ground plane at the countersunk holes. Jumper lead for earth pin:- a fine wire (one strand of multistrand wire) can be soldered to the ground plane and passed through the earth pin hole. Then the trimpot is installed and the earth lead is soldered only on the underside (circuit side).

9. The same applies to leads of other components, especially where they need to be bent before passing through the PCB. Increase the countersinking if necessary.

10. As mentioned earlier, you can now install the remaining resistors, then the capacitors.

11. Now install Q1, Q2 (for which there are heatsinks) and diode D1. Q1 and Q2 are installed well above the PCB surface, so use 6mm of insulation on each lead. A jumper lead (similar to those used for the case of L1) to connect the emitter of Q2 to the ground plane would make it easier to remove Q1 in the future, if this becomes necessary.

12. Before going any further, check construction against the Parts Layout and List and check ALL ground plane connections. Leads soldered to a lone pad may also need to be soldered to the ground plane, either on that lead or on a separate jumper lead between the pad and ground plane.

**TESTING AND ADJUSTMENT**

Preliminary set up -

1. Remove the 50 Ohm load from the point Delayed Key Output to Driver on the KDB board and connect it across the output of the DVR board. Or use 2 x 1/4W 100 Ohm resistors.

2. Preset trimpot RV fully clockwise, to give zero volts at wiper. Preset trimmer capacitor CV for minimum capacitance.

By using a small forward bias on Q1 the output level and purity are improved.

3. The aim of adjusting L1/CV is to maintain approximate resonance to improve signal purity while obtaining the highest output power from Q2 by providing a good interstage match between Q1 and Q2.

4. Connect power via the T-R switch and connect all other power and connections for the complete transmitter. See *Lo-Key* #25 page 15. The additional connections for the DVR are shown in Fig. 19, the others were in *Lo-Key* #25 Fig.15 on page 15, except that the load is across the Driver's RF output to the final, as mentioned above.

5. Turn on power, then switch the T/R switch to the Tx position. Check that nothing gets hot (too hot to touch). During alignment monitor the temperature of Q1 and Q2. It is safest if alignment is done using a routine of a half-minute-ON then one-minute-OFF.

6. Depress the key or ground the connection to the Key Input on the KDB board. Again check that nothing gets excessively hot. The output transistor may eventually get quite hot, but not such that it will boil a drop of water.

7. Incidentally, if your dummy load is only 1/4W total, then this will eventually get very hot and may even smoke. If this happens, open the key until the resistor cools down a little ( or set up a more robust dummy load, as mentioned earlier).

8. When probing components be careful not to short to ground or to other leads e.g. Q2 heatsink to base. Note: Q1/Q2 case/heatsink is connected to the collector.

Adjustment steps -

1. Connect a DC voltmeter across R4 to measure V-R4, the voltage across R4 i.e. the emitter voltage of Q1.

2. With no RF applied to the DVR board input, adjust RV until V-R4 equals 200mV.

3. Apply RF input and adjust the core of L1 until V-R4 dips indicating resonance. Use the correct tool (not too tight in slot) in the core of L1.

Check and record the RF output voltage across the 50 Ohm load with your diode probe.

4. Increase the capacitance of the trimmer capacitor CV by about 1/10th of a turn. Tune L1 by unscrewing the core slightly, to redip V-R4 for minimum DC Volts, as above. Again check and record the RF output voltage.

5. Keep repeating the previous step, a little at a time, noting any increase in output power.

6. When no further increase in output power can be obtained and V-R4 is dipped (at about 300mV), stop.

7. Using a diode probe measure the voltage on the collector of Q2. If this is higher than the RF voltage across the 50 Ohm dummy load then adjust the turns spacing around the core of L3. Open up the spacing to reduce the inductance.

If the collector voltage is lower than that across the dummy load close the turns of L3 to increase inductance.

Aim for approximately equal RF voltages, indicating correct load matching.

If the spacing becomes extreme (close spaced at one side of the toroid or spaced around the whole 360°) you may need to try adding or subtracting a turn.

8. If you have used a 2N3053 in the first stage you may need to adjust trimpot VR to get maximum output. If you do, simply adjust the trimpot gradually until V-R4 (Q1 emitter voltage) starts to increase. Repeat the Adjustment Steps until maximum RF output is obtained, 6 - 7V or more.

9. Total DVR board current drain should be of the order of 270mA. Switch off and remove the 50 Ohm load, as the Driver board is now complete.

FIG. 19 - DVR TESTING - WIRING

•=•••• until next issue.

Titles of connections are shown on the various Parts Layout drawings.

| FROM | TO |
|---|---|
| DVR - +12 TO 14V DC (From T/R Switch) | Temporary switch wired to the 12V supply |
| DVR - DELAYED KEY INPUT FROM KDB | KDB - DELAYED KEY OUTPUT TO DRIVER |
| RF OUTPUT TO PA | Temporary dummy load: 2 x 100R 1/4W resistor preferred |

# U CAN HELP !

Edited by Don VK5AIL (75)

The notes from **Ian VK8CW (91)** on audio filters and on the cheaper type of solid dielectric variable capacitors would not fit into *Lo-Key* #25, but here they are, as promised:

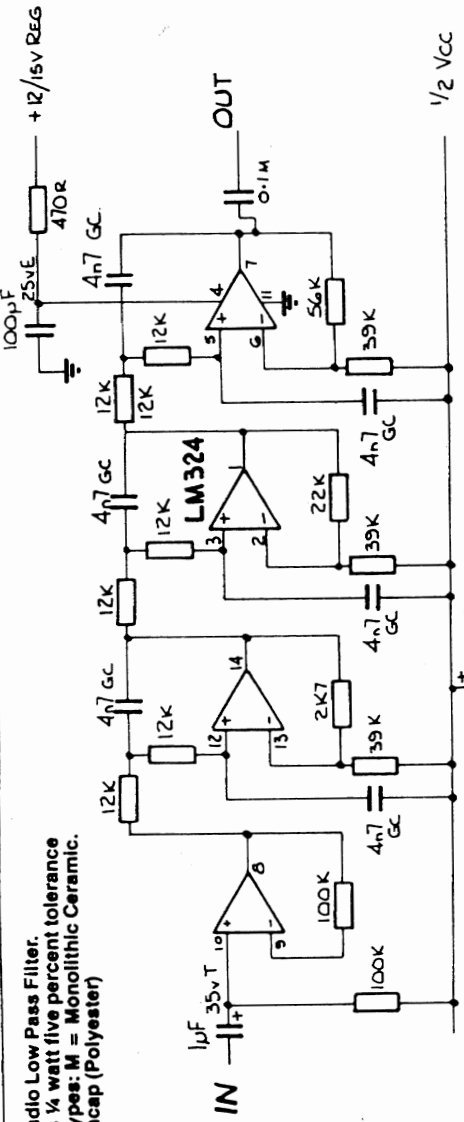



Figure 3: Audio Low Pass Filter.
All resistors ¼ watt five percent tolerance
Capacitor Types: M = Monolithic Ceramic.
GC = Greencap (Polyester)

Audio Filters for Simple Receivers -

Two filters come to mind. A time proven filter is shown on page 11 of *Lo-Key* #7 "Some Filter Ideas". This design was incorporated in the *Tassie Devil/TDM80* with excellent results. As shown the centre frequency is 760kHz, adjustable by changing C2, 3, 4 & 6. Circuit gain is 4, 6dB and the bandwidth is 100Hz. Eight of these have been built, all with instant success. The only change I suggest is the use of TL072 IC - they are pin compatible and give lower noise.

Another excellent filter is shown opposite. This is reproduced with permission from the Editor of the WIA journal *Amateur Radio*, which is much appreciated. See pages 7 & 8 of *AR* June 1987; also, pps 4 & 5 of May. This is a low-pass filter as needed to reduce audio selectivity to a useful value 50 - 2700Hz.

By combining these filters, low-pass followed by band-pass, an excellent audio stage response is produced. SSB and CW can be selected by the use of a 4066 CMOS bi-directional switch.

Small Solid Dielectric Variable Capacitors -
(transistor radio type)

Regarding the use of small solid dielectric variables, over the years I have found these very suitable, especially those capacitors retrieved from radios with FM.

I have found VFOs the most challenging to build, and basically I find that the tuned circuit inductors have a positive temperature coefficient and the capacitors in question have negative coefficients - fortunately ! Hy method of achieving stable operation is to calculate the L and C values, wind the coil and select a near value of

capacitor from the choice available on the variable, pad it out using polystyrene fixed caps, then run the VFO and let it stabilise.

Generally the frequency will settle within 15 minutes if all is well. After this time if the frequency continues to drop then there is too much L, its value is then reduced and the C value increased so as to set the desired frequency. However, if after 15 minutes the frequency continues to increase then the C value is too high - its value needs to be decreed and the L value increased etc. With a little practice and luck good results can be achieved in two or three tries.

The above assumes that good construction techniques are are being used, including good circuit layout and printed cct board.

## Bill VK2BWW (161)

Last issue was looking for ideas on electronic keyers. Info. has been sent to Bill and we are also seeking approval to reprint an article which Ian VK8CW (91) recommends.

## HERE ARE MORE REQUESTS.

Perhaps **U CAN HELP**, so if you have the answer contact the person direct or, where the answer may be of use to other Members, let the the Editor know and it may appear in *Lo-Key*. See the centre 'lift out' section of December *Lo-Key* for addresses current at that time.

## Basil VK2AW (180)

has suggested that we stock parts, especially the MC3359, for the superhet Rx featured in *Silicon Chip* magazine Dec. 1989 p.92. This looks very interesting and is a different design approach to the use of the NE602 chip in the *Sudden* direct conversion Rx. We know of a number of people who are interested in this and several have actually built it

However, reports on performance have not been good - but maybe you have done O.K. with the MC3359.

If you have succeeded with this circuit or any similar application of the MC3359 e.g. in the *QST* September 1986 Rx article, please let us have some notes , or better still an article, as this could greatly assist other Members.

Basil also asked for some info. on winding various valued of RF chokes and suggested we obtain ferrite beads for Members. We have added beads to the current Club Sales List. Can you help with details of your favourite choke constructions ? If so, write in and we will produce a 'Choke Special' article.

## Norm VK5GI (139)

(25 Ralston St. North Adelaide SA 5006) is looking for an instruction manual (or loan) on the *Dick Smith HF Amateur Transceiver* kit. This is the same as the *Electronics Australia* article in the Nov/Dec 1985 issues.

One possible answer is mentioned on p.3 of *Lo-Key* #25, but perhaps a Member can help.

## Don VK5AIL (75)

(5 Joyce St. Glengowrie SA 5044) wants to transfer ASCII (text) files from an Apple ][ Plus computer to an IBM compatible computer (80386, with DOS4.0 or DOS3.3). Preferably machine-to-machine, as an alternativ to using 5-1/4" floppy disk conversion. A serial (?) interface card which came with an old Apple Silentype (Trendcom) printer is available, along with a more recent *Orange* parallel interface. Kit-Set Activity centre records, letters and *Lo-Key* documents etc. are on the Apple at present, along with 10 years of other work, mainly using *Zardax* word processing.

Do you have any ideas or circuits or plug-in cards (to loan or sell) with appropriate software ? If you do, please make the contact.

# BENCHTOP BENDING JIG

By Graeme VK3EII (55)

(No, it's not meant for bending benchtops)

**Graeme VK3EII (55)** has provided a sketch of the jig he uses for bending sheet metal. Those of us on the Net understood his explanation perfectly (?), but thought he should put it down on paper only because you might find it useful, too ! In Graeme's words:

Vice jaws are not wide enough or deep enough for most bending jobs.

Two 2 x 2 x 1/4" (50 x 50 x 6.5mm) angle irons make a very useful smooth-jaw extension to a vice. See the sketch for the layout.

The length L is not critical but should be long enough to take the biggest bend you ever expect to do. 60cm (2ft.) would be a realistic length, although I have made mine 90cm.

The leg H is also 2 x 2 x 1/4" angle iron and is cut to a length so that the two angle irons L are horizontal i.e. parallel to the floor when clamped in the vice.

All are loosely bolted together at one end with a 1/2" SAE nut and bolt (or nearest equivalent) . Make sure the two angle irons L are lined up evenly before drilling the hole to take leg H. This leg takes the downwards pressure only during the bending process. It is not necessary therefore to do the nut and bolt up very tight, as you must be able to separate the two top angles enough to insert the metal to be bent, before clamping up the vice. Extra pressure at the opposite end to the vice end can be achieved by using a 'G' clamp, if necessary.

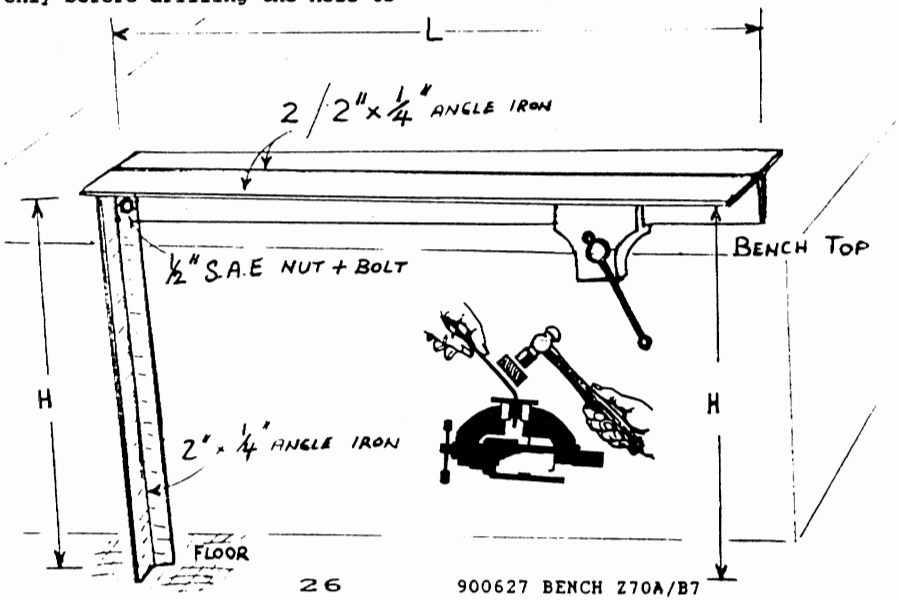
When working with flat metal and when you want an accurate inside measurement, make the bend exactly on your measured line. If you want a specific outside size then add one-half the thickness of the metal to the length of the bend. For thinner than 12 gauge metal add two-fifths the thickness to the length of the bend.

A quick guide to sheet metal thicknesses is:

| | | |
|---|---|---|
| 10G = | 1/8" | (3.2mm) |
| 16G = | 1/16" | (1.6mm) |
| 22G = | 1/32" | (0.8mm) |
| 28G = | 1/64" | (0.4mm) |

In the angle iron vice, set the bending-mark level with the edge and pull towards you. Aim to bend evenly along the full length in the early stages.

Acknowledgement is due to Jeff VK3DZZ who gave me the inspiration for this idea in the first place.



ADVERTISEMENT

# HOMEBREWERS QRP GROUP

Len O'Donnell VK5ZF (1), 33 Lucas St., Richmond,
S.A. 5033, Australia.
Phone 08 - 439194

INFORMATION SHEET

THE AIMS OF THE GROUP

1. To bring together those Amateur Radio Operators, who have a common interest in homebrewing and experimenting with, their station equipment, and a desire to transmit in the Amateur Service, with QRP power output (CW 5watts SSB 10watts).
2. To encourage the group to exchange ideas, information and circuits etc., on the building of such equipment. To this end, the group will publish a quarterly journal, to be known as the "Experimenter".
3. The group's activities will cover ALL legal modes of transmission in the Amateur Service.
4. To become involved with junior and beginners clubs, novices etc., with regard to their teaching programes.
5. To supply members with up to four travelling circuit books each year.

SOME NOTES ON HOW THE GROUP IS OPERATED

1. There are no fees to pay, and membership is for life.
2. The only contact person for all group matters is given above.
3. Believing that a hobby group such as ours, does not need over regulating or administration, we have no secretaries, treasurers, organisers, editors etc. The group is operated with the very minimum of rules regulations, fuss and administration. One rule that is used is the principle of the user pays. For instance if you require an answer to a letter you may write, then you will need to enclose a stamped and addressed envelope for the reply. This includes enquiries about membership to the group.
4. The technical journal "The Experimenter" is published quarterly, in March, June, September and December, and it is optional. That is members do not have to subscribe to it. However if a member requires a copy of a particular issue, then the cost of an issue is $2 per issue, plus the current rate of postage. At present in Australia that postage rate is 41 cents. Only members who have sent the costs of an issue before it is published, will receive that issue.
5. With regard to the technical articles written for the "Experimenter", there will be emphasis placed on experimenting with the circuits supplied and in many cases alternative circuits will be included. In this way members are encouraged to compare and try alternatives, before accepting what they have built, as the best result.
6. There is an on air chat of our members at 1030Z on Monday evenings, using a frequency of 3583khz approx. It is not conducted as a net, more like an informal discussion group. All aspects of homebrewing, experimenting and QRPing are discussed. The mode of transmission used for these on air chats is SSB and QRO power level.
7. SWLs are welcomed as members of the group, and articles written for their needs appear regularly, in the Experimenter.
8. For those members who still like to extract a watt or two from valves, there are circuits and ideas included in each issue of the journal.

BUILD IT AND USE IT

# INTERESTED IN JOINING US ?

***IF YOU ARE A NON-MEMBER, THEN THIS PAGE IS FOR YOU !***

**THIS COMPLIMENTARY COPY OF OUR CLUB JOURNAL** has been sent to give you an appreciation of the scope of activities of the **CW OPERATORS QRP CLUB**.

In each issue of ***Lo-Key*** we include as many technical articles as possible on all types of QRP equipment and we encourage our members to make their own gear. Many articles are written with the inexperienced builder in mind - as are the instructions with the Club's kit-sets.

We promote the use of CW mode to show support for a skill that has been part of Amateur Radio since its inception - and we are proud of it.
Our Club is possibly the only Radio Club in Australia that actively supports CW exclusively.

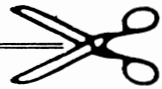
Using low power and homebrewing our own equipment gives QRPers a great feeling of achievement and satisfaction. It certainly gives us a direction and purpose in holding an Amateur Licence and enjoying our hobby.

We are saying to Amateurs that you can enjoy your hobby just as much as at present - in fact more - without having to spend thousands of dollars.

*Would you like to join us in putting the **AMATEUR** back into Amateur Radio ?*
*Would you like to use more of the Amateur skills you have acquired ?*
*Would you like to become enthusiastic about your hobby again ?*

If so, fill in the application form (or a copy of it) and post it to our Treasurer at the address shown on the form.

Cut along this line



## CW OPERATORS QRP CLUB

Promoting the Use of Low Power
CW Mode Communication
and Home-Brewing
in the Amateur Radio Service

Please post this application to:

Kevin Zietz VK5AKZ
41 Tobruk Ave.
ST MARYS SA 5042
Australia

*I would like to apply for Membership of the **CW Operators QRP Club**.*

With this application I enclose $A10 for VK Amateurs or $A12 for ZL Amateurs or $A14 for DX Amateurs, which is the annual membership fee.

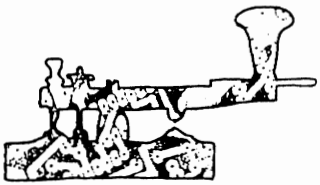
(please print)
FIRST NAME & CALL SIGN .....

INITIALS & SURNAME .....

ADDRESS .....

.....

.....



I agree to the required details being held on the Club's data base.
I DO/DO NOT (strike out one) agree to publishing of my street name and number.

SIGNATURE ..... June 1990 900618 OBCA5 Z69A/D3

A receipt and your membership number will be sent with your next *Lo-Key*.