

Radio Homebrew and Experimenter's Group

An official function of the
Amateur Radio New South Wales
109 Wigram St Parramatta Ph. 9689 2417
Email: yk2wi@ozemail.com.au

Newsletter Issue 06

December 2005

Group Co-Ordinator	Peter O'Connell VK2EMU	yk2emu@wia.org.au
Honorary Engineer	Mark Blackmore VK2XOF	
Honorary Parts Person	Seppo Ahlstedt VK2SMA	
Newsletter Editor	Brian Keegan VK2TOX	yk2tox@wia.org.au

The Radio Homebrew and Experimenter's Group workshop meetings are free to Amateur Radio NSW (WIA NSW) members. A \$5 cover charge **may** apply to non-members. Meetings are currently held at Amateur Radio House in Parramatta on the first Tuesday night of each month around 6:30pm to 9pm (doors locked by 9:30pm) **and** on the last Sunday of each ODD numbered month around 12:30pm to 4:30pm (that is after the Trash-n-Treasure). The Technical Book Shop and Technical Library are also usually open at these times for those who can't get in during the week. Cold drinks (leave your money in the fridge) and tea/coffee making facilities (FREE) are also available. Plenty of shops just up the road if you would like to grab something to eat in the hour or so break between the T&T and the Homebrew Meeting. Only a short walk from either Harris Park or Parramatta Stations and usually plenty of on-street parking for these meetings. The Sunday afternoon meeting is usually first a show-n-tell for any works-in-progress or completed projects members are working on and followed by a Technical discussion or demonstration. The Tuesday nights are an informal Technical meeting where people bring in works-in-progress to get help or ideas from the rest of those attending. These workshop meetings are informal get-togethers of amateurs interested in building, or repairing their own radio equipment. Some people bring their latest piece of equipment along to work on or to receive advice, while others offer their experience and advice in helping others.

The group has some pieces of test equipment at Parramatta, while others are brought in for the occasion. If you think that you may need some equipment, then **please contact Peter O'Connell VK2EMU by email or leave a message for him at the Parramatta office** and he will endeavor to have the appropriate piece of equipment available.

This Month

- Radio Homebrew and Experimenter's Group News
- Editors Comments – Gosh !! look at all the stuff we have this month
 - Don't forget that Amateur Radio NSW (VK2WI) Web has new web address
- Technical – Re-cycling older PC Power Supplies
- Project – Wein Bridge Audio Signal Generator (in AT PSU Case)
- Project – Easily constructed Metal Bender (Stephen VK2BLQ)
- Tech and Practical Hints – Holes in soft Panels /mobile benches/fans for HD boxes
- Project – LV PSU Tester Circuits
- Project – HV MOSFET PSU (in AT PSU Case)
- Project – LV PSU based on Miniature PSU in AR Jul 2005 (in AT PSU Case)

Best wishes and hope you enjoy the Festive Season ahead

This Newsletter is online at Amateur Radio NSW <http://arnsw.org.au/>

The contents of this publication are © 2005 by Radio Homebrew and Experimenters Group whose meetings are an official function of Amateur Radio New South Wales. All rights reserved. Enquiries should be directed to:
Group Co-Ordinator, Radio Homebrew and Experimenter's Group,
Amateur Radio House, 109 Wigram St Parramatta NSW 2150

Non-copyright material appearing in this publication may be reprinted in similar interest newsletters and non-profit publications if accompanied by the following notice:

"Reprinted from the Radio Homebrew and Experimenters Group Newsletter, this group is an official function of Amateur Radio New South Wales"
Note: The views expressed within this publication are not necessarily those of Amateur Radio NSW or its officers

Radio Homebrew and Experimenter's Group News

Sunday 25th Sept 2005 – a very well attended meeting with Peter VK2EMU having organized a “Safety in the Workshop” demo in the use of various power tools. Some guest speakers expanded on various workshop techniques and safety. We had this in the parking area under the Parramatta office and although the weather was not too good we were all under cover and enjoyed ourselves. Peter brought along one of his mobile benches mentioned in Tech and Practical Hints section of this Newsletter.

Tuesday 4th October 2005 – a quiet and informal meeting, still well attended with discussions on everyone's current projects.

Tuesday 1st November 2005 – again a quiet informal meeting, darned if I can remember what we did, the evening goes so fast and good to meet friends.

Sunday 27th November 2005 – The Trash and Treasure event was held at Dural site this time, unfortunately the weather was terrible. However between showers we did manage to rat the old shed up there. Judging by the smiles there were some happy Homebrewers clomping through the rain and mud back to their cars with little treasures. I understand successful bidders for the deceased Estate items also picked up and paid for there stuff at this event. Unfortunately due to the weather Peter VK2EMU did not get to do his antennae demo, even though he and I were up till late the previous day getting it all ready. It was to be a demo on assembly of a small tower (dismountable sections) and the mounting of a rotator and beam on top of it. Maybe next time.

Westlakes Field Day (14th Nov 2005)

Along with annual Wyong Field Day this would have to be one of my favorite events. I have been going to this event for a few years now and the guys up at Teralba always put on a good day.

The day started well with a bunch of sellers tables and a big table with club stuff for sale, good stuff and prices quite reasonable. Lee Andrews and staff were there with a table, although well guarded after his experience a couple of years ago at Wyong, good to see him back at meetings. A large table of stuff for auction by the Club.



As you can see by the pictures taken by Mike Bell (sorry mate I don't have your call sign) we had a good time, I am not the only one to fill my boot, Mike helped clear the paddock as well!. Thats me with next load to go to the car, some PC PSUs, Audio Equalizer and some bits and pieces. Over there is the boot of my long suffering little car, nearly full !.

It's a fair drive to Teralba so I usually don't stay for the Auction at around mid-day, but after a good steak sandwich and a sit down I decided I would this year. Glad I did as we had great fun. Prices were very reasonable and we all got some good stuff. I wonder if the guy who bought the big section of aluminum tube with a camera lens in it has figured out what it is yet !.

Great fun when I got home to sort through the stuff, got enough bits to keep me going at least until Wyong and some stuff to swap for bits I don't have.



ST George ARS Auction Day (Sat 19th Nov 2005)

Another fun day down at Kyle Bay Scout Hall with three or four tables full of “stuff”. Some disappointment when Mr. President cancelled the “Auction” format of the day and made it just a market. Lot of club members hopefully clearing out their garages/shacks of much loved items. Golly!! If I had the bench space I would have snapped up that precision signal generator but still got some useful stuff.

The previous week at Teralba, Mike Bell was having a good natured dig at me regarding the full boot of stuff, BUT!! guess who was sighted tip toeing through the trees with not one but a crate full of VHF transceivers, caught you Mike !!. Someone, whose name shall not be mentioned, had accepted the offer of a 19” rack assembly, but when he

got back to his trailer he found he had inherited not one but THREE of the things, much to his concern, along with an old VCR and various bits and pieces. Little voices were heard to say "wasn't that the trailer going to the tip ??"

Peter VK2EMU had the barby up and running with snags and onions along with nice cold drinks, very hot day so he did good trade for the club. When everyone's appetites both food and homebrew were satisfied we all got stuck into clearing up. Not much stuff went back home with the sellers and all had a good day.

Next Meetings :

Tuesday 6th Dec 2005 – Wigram St Parramatta – 6:30pm start

Tuesday 3rd Jan 2006 – **Check with office or email Peter EMU or Brian TOX**

Sunday 29th Jan 2006 – Wigram St Parramatta - Trash and Treasure Sale 11.30am and Homebrew Meeting afterwards at 1pm (Details to be announced)

Tuesday 7th Feb 2006 – Wigram St Parramatta – 6:30pm start

Tuesday 7th Mar 2006 – Wigram St Parramatta – 6:30pm start

Sunday 26 Mar 2006 – Wigram St Parramatta - Trash and Treasure Sale 11.30am and Homebrew Meeting afterwards at 1pm (Details to be announced)

Editors Comments – This months items and those for future Newsletters

This month we have a good selection of articles and projects for you, some from new contributors, thanks guys. Also in the pipeline are articles from other members covering a wide range of subjects, again thanks and keep them coming.

The beaut valve 80m receiver and HF transceiver I mentioned a couple of issues ago were built by Stephen VK2BLQ, in next issue are some details and pictures of these projects, in fact he has given me a CD with details of a number of his past and ongoing projects which we will cover in forthcoming issues.

From Mark VK2HMC is the suggestion of an IRLP or Echolink interface between a PC and a Transceiver as a Group Project. Not sure if he has built one up or is suggesting it as a project, so have emailed him for details. Who is interested ?. Over a period of time I know a few of you guys have built up various interface boxes for a particular mode such as SSTV or Packet. Peter VK2EMU had a little kit a while ago for one of the graphics modes, maybe this could be modified. Anyway will wait to hear from Mark for his ideas.

Some of the projects presents this month are not complete as I am still resolving some hardware issues, mainly heat-sinking. The general idea is to fit the gear into re-cycled PC PSU cases so some compromises are required to get it all into the box. Am developing what I call my "heat-paks", these are compact fan and heatsink assemblies to fit these boxes and dissipate the required heat. In following Newsletters the completed items will be presented.

However chasing up parts and development time has delayed a few of our continuing series of articles:

HV Power Supplies – This series will continue in the next issue with regulated and variable supplies using semiconductors and valves. Mark VK2XOF is also preparing an article on inverters to generate various high voltages.

Re-Cycle old PC PSUs – Continuing series on use of and mods to these very handy units. First we will cover minor mods to make the unit more useful around the shack.

Transistor Tester – This handy project will be expanded to test Diodes, FETs and SCRs. A small HV generator will be included in the final project so as to test Zeners, Diode PIV and various other semiconductor parameters

Signal Tracer – In the next issue various probes will be covered to extend its use and also a signal injector to accompany it.

Make your own PCBs – This series will continue with making of simple PCBs

10GHz Transceiver – This series will continue with the wiring of the control panel and description of the controls PCB



Time and availability of parts has delayed the start of a couple of new projects :

XYZ Table (Stepper Motors) – Still scavenging and testing various stepper motors to get a set of suitable units for this project. We have roughed up a couple of variations of the actual XYZ platforms.

HF Amplifier (Valve) – Well under way with this project but not to the extent that it could be presented yet. Still battling with various problems concerning parts available and bands to be covered. Following some advice I am seriously considering 160 to 20M for the initial unit and then 10 to 6m for a subsequent project. Components and construction for the higher bands definatly seem to favor VHF techniques, whereas the lower bands favor parts

more readily available (ratted from old gear !). I would like the projects to be reasonably compact (not your typical boat anchor size), also built out of fairly ordinary and available parts. A serious limitation is the lack of high voltage rotary

switches to cover the bands. While a relay based switching unit for the input circuit is quite practical, such an assembly for the tank circuit is not so because of the voltages concerned. In case you don't need a multi-band unit the project will actually be presented in a way that you can build a mono-band version of the unit for yourself, in fact the tank circuit will actually be developed as a series of mono-band configurations so that appropriate coils can be wound for the bands you require.

Recently I acquired an old Swan transceiver PSU which badly needs rebuilding, main components are OK but age and heat have seriously compromised the wiring and solder joints. I have built a couple of matching cases, one for the PSU and one for the amplifier (160-20M). Like the original Swan gear the PSU will have its outputs available via Jones Plug so that it can be used on various equipment. These two pieces of gear will possibly be built in parallel so that hardware problems can be sorted out along the way and then followed by a 10 to 6M unit as well.

Got to laugh here !, when I mentioned to a mate that I had built the cases and intended shoe-horning the gear into them, he said to me " I suppose you're the kind of guy who finds a couple of wheels and then goes looking for a car to fit them !". What can I say but, "you gotta start somewhere" and I like the challenge. Shown above is the case I have built up, one each for the PSU and Amplifier.

- Don't forget that Amateur Radio NSW (VK2WI) Web has new web address

Technical – Re-cycling older PC Power Supplies

At the rate with which computers are developing a typical machine is only a couple of years old (if that) before it is superseded. As a result for the careful buyer there are a lot of "pre-loved" PCs and ancillary gear available. One of the most disposable parts of a PC would appear to be the Power Supply which either dies as an individual continues to add hardware to their machine or simple lack of maintenance (PSU and or fan blocked up with dust and fibers from the floor).

Faulty or dead PSU units are usually available for free at repairers and markets, whilst early model units can be purchased for \$10 to \$20, sometimes even with a guarantee.

As Hams and Homebrewers our interest in these PSU units is twofold. Firstly as a cheap and compact source of DC voltages for projects and secondly for the box and parts.

WARNING !! Do not attempt any repairs or modifications to these PC PSU units unless you have the knowledge, ability, isolation equipment and test equipment to work on 240Vac mains SMPS power supplies. In fact don't even open up the case !!. At least half of the PCB and components inside the case are connected directly to the 240Vac mains. The DC filters caps on the PCB charge to nearly 400Volts and hold their charge for days after the mains is disconnected. If you have a doubts as to your abilities then get a more knowledgeable friend to test or re-cycle the units for you. Even if a unit has not been connected to the mains for some time be extremely careful when dismantling it, make sure the mains caps are discharged (and stay that way). Hide the mains cord so there is no temptation to plug the unit in whilst out of the case.

Having said this most of the old PC PSUs you will come across will fall into four basic categories :

1. Early XT style PCs – Big often chromed box fitted in the back of the machine sometimes with a mains switch extended off to one side or a length of mains cable running away to a front panel mains switch. Their usual rating is only 50 to 80 watt and unless functional are really only suitable for parts. OK, so if you really need +5V or +12V and don't mind the huge size use it. Repairs are a nightmare as wide variation in the circuit configuration and components. Carefully test any components scavenged from these units as they will be quite old and be affected by heat.

2. AT Style PCs – used in the older sub-Pentium type of PCs. They are usually more compact than the XT style, the box size is reasonably standardized and so are the internal circuits and external connectors. These are still readily available either free (dead ones) or for \$10 to \$20 at the markets. Functional ones certainly have useful output voltages and currents. They compare very favorably both in physical size and cost with linear supplies. Typically they are rated between 100 and 200Watt and can provide +5Vdc at 20A and +12Vdc at 8A along with a couple of negative voltages. Try buying or building a 12V 8A linear PSU and find out what it costs you.

Only problem is that usually only the +5V supply that is actually regulated so the +12V is not much use as it stands. The internal regulator needs to be rewired and configured to monitor the +12V supply, in fact not too much trouble to bring the output up to a nominal 13.8Vdc. Next issue of this newsletter we will cover basic mods to these PSUs to do this.

Dead ones are a useful source of parts for all sorts of projects as they will be fairly modern parts, quite often readily available from parts shops. The boxes are good for projects because of their standard and quite useful size.

3. ATX Style PCs – The newer Pentium 4 PC need much more power so units rated from 250W to 500W are readily available. Like the AT style PSUs they have a fairly standard size box. New they cost between \$40 for a standard

250W unit up to \$120 dollars for a 500W unit with a 120mm fan, dead ones are usually free. A new Pentium4 machines usually come with a 250 to 300W PSU as standard but as the new owner adds various drives, cards, memory upgrades and USB devices, the rating of the PSU is quite quickly exceeded. So !! plenty of dead ones.

For the Homebrewer a mixed bag ! because the ATX PSU has usually more safety circuits (things that shut it down) and requires external inputs (things that stop it starting) and unfortunately at this time a wide range of circuit configurations, they are usually much more difficult to modify. But if you do, a very satisfying +12 at 12A or if you rewind the output transformer to combine the power available from both the original +5 and +12 we can get a 13.8V 300W supply (25Amps) but more of that in a later article.

4. ALL the others !! – Various proprietary makes of PCs build their PSUs into all sorts of boxes, some not even in boxes. So unless you can use them as is, some of them are very useful, I would rat them for parts. Boxes all shapes and sizes but still good for a little project especially as most boxes are extensively ventilated. Saw some at the markets this morning for \$5 each, ex equipment but in good condition.

Sort the good from the bad – If the box is nice and clean and all looks ok then undo the screws and remove the top to have a look inside. NO FINGERS just look !. If all looks ok, no burnt holes in the PCB, no blown up transistors (trust me they actually blow up) and it doesn't smell like a BBQ inside, you just may have a working one. By the way somewhere up near where the mains goes onto the PCB look for a small fuse, if found, is it blown?. This often the reason a PSU is ditched, replacing it with the appropriate rating will often result in a working PSU. Are the DC connecting cables all intact ?. If all this is good then replace the top cover, now !.

Good one ? -

XT and AT style PSUs - Some of the earlier PC PSUs needed an external load on the PSU before the SMPS would start reliably. I always load both the +5 and +12 volt lines when testing as an open circuit voltage does not tell you a great deal. I would suggest somewhere around an amp of current be drawn from each supply, so you will need around 5R at 10W and 12R at 20W to test both these supplies. I actually have a connector from an old floppy drive wired up to a ventilated box which contains a bunch of power resistors which make up the specified value. Also in the box and connected across each supply is a LED and dropping resistor to give a quick indication that those supplies are working.

ATX style PSUs – as mentioned they are more complex circuits which usually require at least a “GO” signal. In its most basic form you will need to short together pin 14 and one of the Ground pins of the motherboard power connector (look up any P4 manual and it will show you which ones). Again in conjunction with the tester mentioned above I have scavenged a motherboard connector to which I have wired a toggle switch to simulate this function and also a LED to monitor the Power Good signal.

So you have some Good Ones ! – Well the important thing to remember is that unless you just bought it, it was originally thrown away for some reason. So old ones get tested again but more thoroughly before use or it means that most of the parts are worth scavenging !. Real Good Ones can be very useful, see upcoming articles.

So what do we do with the dead ones ? – First see above cautions about charged capacitors !! and you need at few small containers for all the screws and fittings. (AT style PSUs used in following discussion)

Boxes - Well firstly the boxes are usually quite robust and fitted with at least an IEC mains inlet and an 80MM 12Vdc fan, a very good start for any project. Some of the ATX style boxes also have a mains ON/OFF switch above the IEC mains input, very useful. The often fitted IEC mains outlet is not much use except if you are sending the mains out again, as in a drill speed or heating controller. Assuming the IEC mains inlet and fan are considered the back of the box, there is usually venting holes or slots punched into a few of the sides, front or top of the box. More about this later. Boxes are usually a standard size so get a few together and have a nice day dismantling them. If the box is dirty inside then suggest you take all hardware out of it and clean the box, even re-spray it.

Fan – as mentioned the fan fitted is usually an 80mm 12Vdc fan although some of the newer ATX have a very nice 120mm fan. In older units the fan may be a little noisy, but hey what!, it's free. Stiff ones will usually respond to a squirt of WD40® or some such, if no good then toss it as nothing worse than an intermittent component. Good thing is that if they work they are usually good blowers up the higher end of the wattage range for that sized fan. If you just must have a new fan then WES Components at Ashfield have a beaut range of Ceramic Magnet Fans at very reasonable prices, very quiet.

DC Leads from the box – When you have the case open chop these leads off close to the PCB. Firstly the connector ends of the leads make excellent extenders or adapters when building up or expanding a PC. Secondly the multi-colored wire on the motherboard connector makes good hookup wire for your projects (although some of it does not solder well as the insulation melts very easily).

PSU Motherboard – This is a goldmine of parts from Torroid filters, mains rated components (400V Caps for your next HV PSU), high current switching diodes (TO220 paks), HV switching transistors, 10 to 20V caps (+5 and +12 filters). TL494 SMPS regulator chip (or a generic type), OP-Amp packages, Heatsinks and lots of hardware. At a Homebrew

meeting Owen and Mark tested some of the torroids scavenged from some PC PSUs and found them functional in oscillator circuits well up into HF. In fact for any mains powered project you are building you should grab the mains filter components from the motherboard and use them in your new project, remember they work both ways, stop mains junk getting out of and into your project.

Comment on using the boxes for projects



The boxes can be used lying down, ie the fan/IEC connector at the “back” and the opposite face being the “front” of the case. With a little planning it is surprising what you can fit into one of these cases. Only problem with this configuration is that most cases have ventilation slots punched into what is now the front of the case. Simple fix is to make up a dummy front of aluminum sheet (or PCB) and use components to secure it to the box. If you have a lot of controls or terminals the ventilation slots can make drilling very difficult so I usually cut and drill the dummy panel then using tin snips remove most of the front panel of the box, leaving enough to secure the dummy panel to (usually with some nice chrome handles).

The boxes can also be used standing up so that the fan/IEC connector is facing down or to one side and thus what was the bottom now becomes the “front” of the case.. In this configuration the boxes provide a much larger surface area for controls, speakers and meters. In fact I am currently building an Audio Test Set into just such a box with a set of speakers and VU/Power meters on the front panel. Only a small PSU is required for this so it will have the fan on the bottom of the case (slowed down) with some nice big rubber feet to space the base of the bench. Then block off where the IEC connectors were and fit the IEC connector to what was the lid (so that the mains comes in the back).

A label for the front panel is made up in your favorite Drawing program, cut out and used a drilling layout, then a new one printed out covered with an oversized piece of clear adhesive sheet, the sheet being wrapped around the edges of the panel. The panel is then fitted to the box and with a sharp knife cut out the holes for the controls and fit them. Careful

not to tighten up the nuts too much or you will scrunch the panel label. Shown are a bunch of boxes with nice new front panels and also a box with its front cut out in readiness for a new front panel with switches and meters.

Project – Audio Signal Generator (in AT PSU Case)

Recently in our T&T stuff we came across a small box of Wien Bridge Audio Oscillator units. They were in fact incomplete as we only received the Front Panel, controls and assembled PCB. Mark VK2XOF offered to look at them in view of making up a kit for members. He subsequently came back with a circuit diagram and the information that although a good basic unit they used germanium transistors, so he had converted the circuit to silicon transistors and in the process optimized a few of the components to suit the new transistors. I then offered to look at fitting one of the modules into a PC PSU case as a functional instrument.

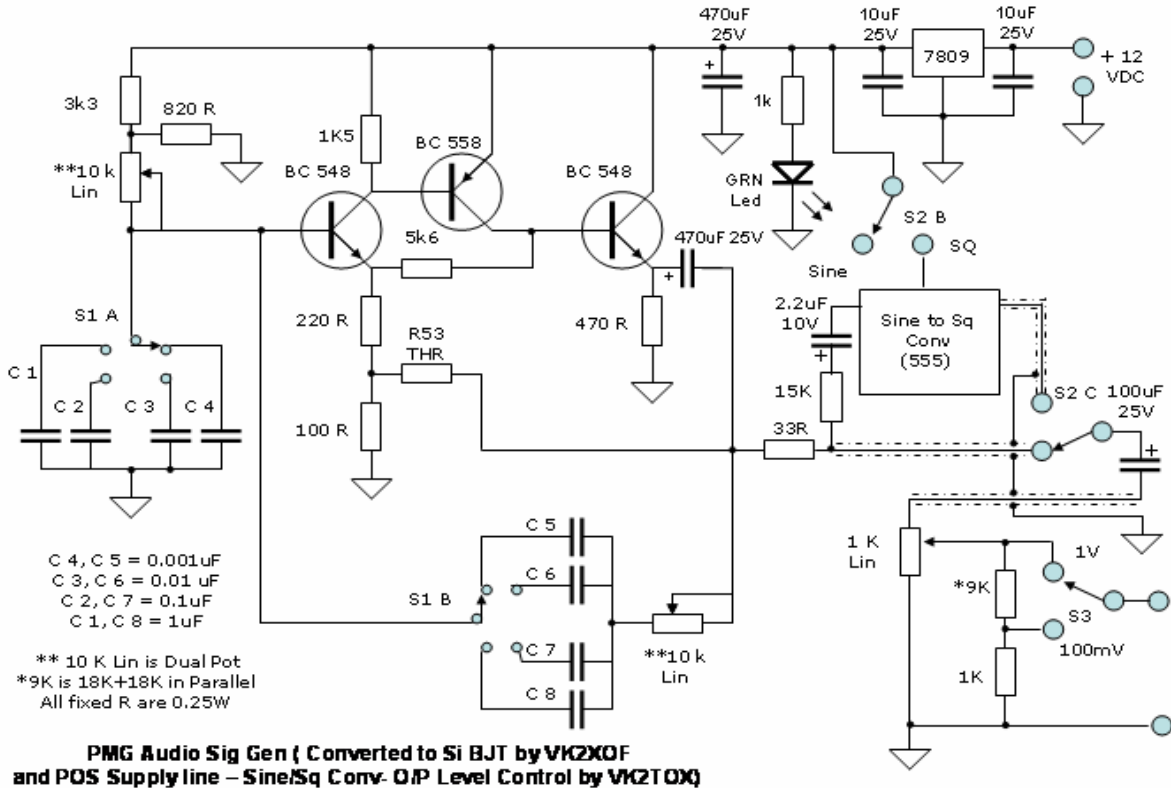
Firstly although converted to Si devices the PCB still utilized a Negative supply rail as do most germanium circuits, so I inverted Marks’ device selection to allow a Positive supply rail. With a few resistors and a capacitor changed to suit Marks’ conversion (and electro caps reversed to suit positive supply rail) the circuit works well providing an acceptable sine wave from 15Hz out to about 200KHz of around 1V. It utilizes a good basic circuit of three transistors and a R53 thermister for stabilization. Its controls include a double gang pot for frequency control a four position switch to select a range multiplier along with a switched pot controlling the output and switching the unit on or off. Looks like it was originally intended to be battery powered.

While doing this work I noticed that some of the soldered joints were a bit rough, which leads me to believe that the PCBs may actually have been assembled by students in a Radio or Electronics course. So with some solder braid and a solder sucker I reworked all joints fixing a number of dry and cooked joints in the process.

The original front panel is very similar in dimensions to the “front” panel of a PC PSU box, only difference being that the original panel is mounted upright ie portrait instead of landscape fashion as the PSU box is. The three controls are mounted through holes in the PCB and have long shafts. The range switch and output pot are mounted too far apart to easily mount the PCB behind the PSU front panel. I carefully elongated the two holes to bring these controls closer together such they are now 35mm apart. The PCB now fits well behind the PSU box front panel.

My version of this conversion will be mains powered so I have bypassed the switch section on the output pot and will be fitting a separate mains ON/OFF switch and a LED pilot light run from the supply to the PCB. Also to be fitted is a 555 based sine to square wave converter which can be switched in or out as required.

PMG Audio Sig Gen [Si + Pos Supply] Cct



I will mounting the PCB back off the front panel so that the mains switch, power LED and the Sine/Sq Wave selector switch can be mounted. Also as no cooling fan is required I will be blocking off the fan outlet in the back panel. The power transformer and PSU components are scavenged from a surplus PCB, the whole PSU section simply cut away from the old board and mounted on some pillars.

Sorry have run out of space in this issue so will cover circuit description, sine/square wave converter and construction in next issue.

Project – Easily constructed Metal Bender (Stephen VK2BLQ)

How many times have you needed to build up a small box or make some brackets for a project. Do you find a square edge on your bench or a big vice and bash away at a piece of metal, well not Stephen VK2BLQ.

I'll let the pictures explain his use of material easily available from your local hardware store and mounted on a fold-up saw horse. Including the saw horse I seem to recall the total cost for the bender was \$40 using new materials.



Some old bed iron from the council cleanup would make this even cheaper.

As you can see it consists of two lengths of say 25mm steel angle joined together by a couple of steel gate hinges, in fact as you can see the screws used to locate one side of the hinge on the stationary angle are also used to secure the whole thing to the saw-horse wooden top. The pieces of angle are butted up together and the hinges installed with the pin upwards as shown. The swing of the hinges actually provides a good clearance for the thickness of metal being bent as the movable section swings up. A couple of operating arms are then fitted to the movable section, these could be anything from wood to 10 or 15mm steel angle, but need to be long enough to provide the bending force as you approach the 90 deg mark.

The sheet to be bent is clamped to the stationary section by another length of say 25mm angle and a

couple of “G” clamps as shown. This section can vary in length in fact short bits would fit into a box with turned up edges as in a “pan-brake” bender.

So simply clamp the piece of sheet metal to be bent between the stationary angle and the top piece and “G” clamps, line up the marks for your bend with the mating edges of the stationary and movable angle sections. Before tightening down the clamps move the top piece of angle back from your bending line by the thickness of the sheet metal, clamp down tight and operate the handles to bend the sheet. Although the top piece of angle is stronger as shown in the picture, after the initial bend you may need to re-position it around the other way so that you can slightly over-bend the angle and thus end up with the angle at 90 deg. Usually when a piece of sheet metal is bent up to a 90 deg surface it springs back to less than 90 deg when released, hence the need to slightly over-bend it.

Thanks Stephen, an excellent project, with care very nice boxes and panels could be fabricated with this bender. Aluminum sheet is readily available (look in the Yellow Pages®) and don't overlook thin Galvanized sheets available from your local hardware store, easy to cut, bend and solder into great boxes, panels and shielded enclosures.

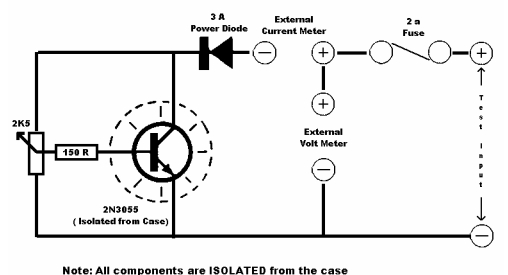
If you would like to built something a bit more rugged then check out Drew Diamonds Project Books for an excellent example of a Metal Bender, needs some welding and a bit of machining. Why not buy a copy anyway, it's up to Vol 3 now, excellent source of ideas and information and support his efforts in Homebrew.

Tech and Practical Hints

Fans for drive boxes – How many of you have those “Mobile Racks” in your PCs, the pluggable drawers with HD in them. Usually on the back of the actual rack there is a small 40mm fan to cool the HD. I have found that these fans don't last very long and get quite noisy. My fix is to go along to WES Components in Ashfield a get some of their Ceramic Magnet Fans 40 x 40 x 10 at a very reasonable price and fit them as a replacement. Have had some in for 18months now and still running fine, in fact so quiet I have to actual occasionally check them to make sure they are still running.

Round holes in aluminum and other soft materials – Drilling and reaming out various sized holes for project controls can be quite a chore. Some of the guys at the meetings were talking about a hole cutter/drill they had purchased so I decided to take the plunge. I got mine from Jaycar, not cheap at around \$30 each for the two sizes. But gosh ! do they drill holes well, although I must say it is easier and I think safer to do it using a bench drill. Turn the panel over and run down to the next size to de-burr the hole, they look like they have been punched.

Mobile tables for power tools – Unless you have a huge garage or work space I bet most of your power tools live in their boxes or under the bench. To use them you have to get them out find a place to use them safely and then do the job, then clean up and put the tools away again. Well Peter VK2EMU has got a fix for that, he has built up a couple of small movable benches with tops about 400mm square. The legs are fitted with nice big casters (one side has wheel locks) and a low down shelf makes for a very sturdy work table. On one he has a small bench drill and a drop saw mounted, on the other a vice and a bench grinder. He uses them, a quick brush away of any swarf, unlock the wheels and push them away into an unused corner of his workshop, ready to be pulled out for the next job. An extra benefit is that he can take the setup tools anywhere ready to use on their own bench. Magic idea Peter.

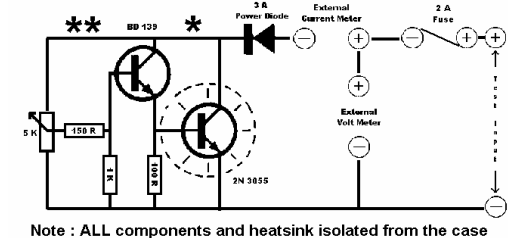


Project – LV PSU Tester Circuits

When you are designing or building a power supply, either as part of a piece of equipment or as a piece of test gear, how do you test it ?? Most people fiddle around with banks of globes or power resistors. This is OK for initial testing but when it comes to optimizing components, soak testing or setting current/voltage limits you usually need some way to set the current drawn fairly accurately. For some tests you need to cycle the load to dynamically test various parameters.

This is where an “Active Load” comes in. They are available commercially but are quite expensive. Basically you need some way of sinking current from a supply under test, it needs to be readily adjustable, stable and capable of being switched on/off for dynamic testing.

In it's simplest form a small power transistor with a adjustable bias supply will suffice, but depending on what you need to do it may have a number of drawbacks.



However even this simple circuit can be very useful and depending on the range of current and the applied voltage the transistor can be anything from a BC108 through to one of the TIP series in a TO220 pak or even the ubiquitous 2N3055. I mention the BC108 as it usually has a metal can which can be press fitted into a small piece of aluminum to heatsink it. One of the limitations of a simple circuit is

Some magazine articles use the above circuit configurations but with power resistors in the emitter circuit of higher values so that they become an integral part of the load. This is fine, except you now have to cool the resistors as well as the power transistor and the maximum current is now limited by the resistors instead of the power transistor. Having said this, a number of commercial active loads use switched resistor banks and a semiconductor load in parallel to trim the load to required value.



An active load to test power supplies is fine, however if you build the control circuit into a box and run the power transistor elements out on flexible leads you then attach these transistors as “heating elements” to a heatsink and test its parameters. Especially comparison of convection and forced draught cooling. This is how I am testing my “heat paks” for my projects.



Future articles will cover practical PSU loads and heatsink testing. On the side here are some happy snaps of a couple of versions of my “heat paks”, one uses a couple of small heatsinks (HH-8518) from Jaycar and the other uses a section of clip together heatsink sections (HH-8530) designed to bolt to an 80mm fan, also from Jaycar.

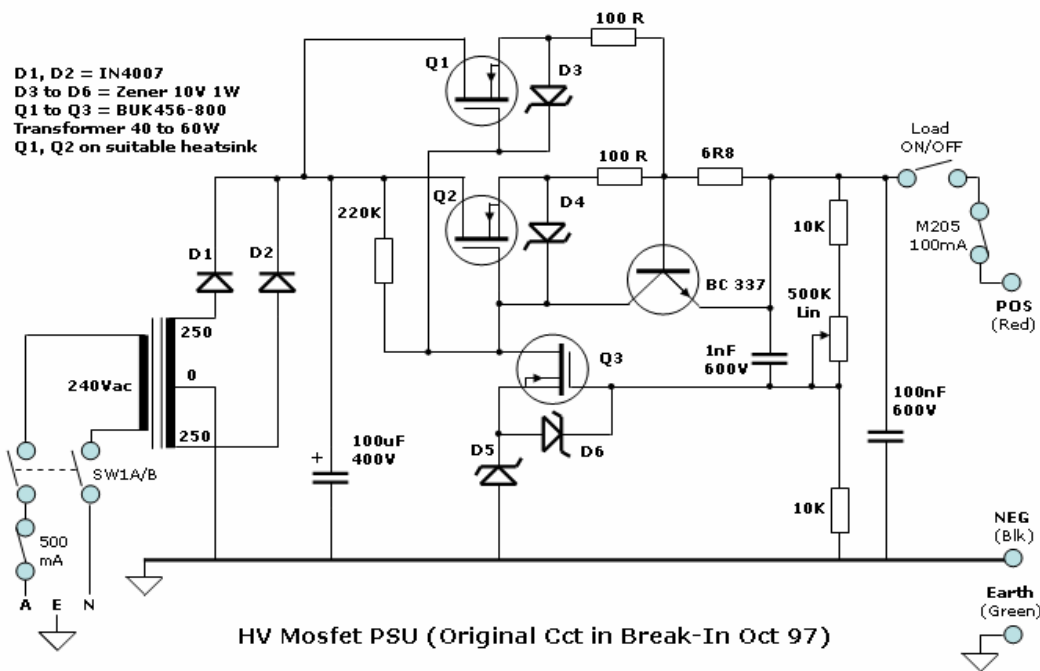
Also shown on the previous page is an AT PSU Box with a large heatsink mounted on top in preparation for building a LV Power Supply Tester. The internally mounted fan will blow air up through holes cut in the lid, under the heatsink and cool it. I am hoping to get a rating of around 200Watts on this unit, will let you know next issue.

Project – HV MOSFET PSU (in AT PSU Case)

For many years I used a variable high voltage supply originally built from an Electronics Australia article in the 70's it worked fine but often the 100 to 300V at around 30mA was just not enough. A much larger supply was built using a couple of pentodes as the series pass element but spent most of its life under the bench because of its size. It disappeared somewhere over the years, probably got ratted for another project and the EA project got dropped last time I moved and was never quite the same again.

So for a while now I have been looking for a replacement and preferably using semiconductors. I found what appeared to be a good one in an old copy of Radio-Electronics which used a LM317 and a high voltage transistor to regulate a supply from 100 to 500V at about 50mA. It was a difficult circuit to follow because the LM317 was fed from an isolated supply and sat on top of the 500Vdc supply. A quick “lash-up” of the circuit did not shed

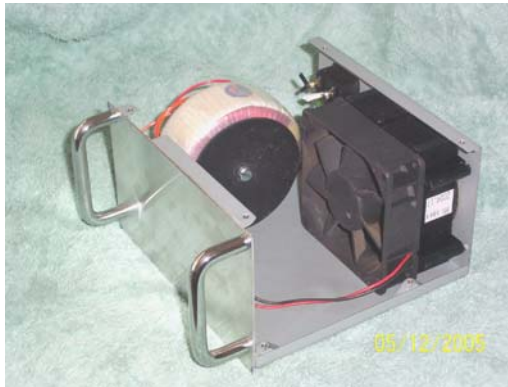
HV Mosfet PSU [Break-In Modified]



any light on its operation for whilst it did not blow up, it did not regulate either !. It was potentially an excellent circuit using quite ordinary parts, so I'll come back to it at a later date.

Meanwhile I found a circuit in a copy of Break-In Oct 97 (NZ Ham Newsletter) using a couple of MOSFETs, this looked good as HV MOSFETs are available at quite a good price. I discussed the circuit with Mark VK2XOF and he was concerned at the amount of power expected to be dissipated in the series pass MOSFET, so as he had a use for a similar circuit he offered to try it out. Sure enough he did and a couple of weeks later turned up with not only a working circuit but a nice compact PCB for it. However he had found that to deliver the expected current it required two MOSFETs in parallel with some minor alterations to the circuit to drive them.

This is our implementation of the Break-In circuit so just a brief description of the circuit. DC supply fed to series pass Q1 and Q2, the 100R resistors are to balance the load in each device. The output voltage is sensed by the 10K + 500K pot +10K and fed back to amplifier Q3 whose source is clamped at 10V by the Zener diodes. When the output voltage tries to fall Q3 turns off and increases the voltage on the gates of Q1 and Q2 causing the output to rise and vice versa. The voltage across the lower 10K resistor is always about 12V so the current in the sensing resistor chain is constant therefore the output voltage is directly proportional to the top 10K and setting of 500K pot. The BC337 and the 6R8 resistor form a current sensing circuit in the output of Q1 and Q2. At around 100mA of output current a voltage drop of 0.7V across this resistor will turn on the BC337 which will start shutting down Q1 and Q2, hence limiting the output current.



With regard to components it would be a good idea to stick with the isolated type of MOSFET, that way you don't have a heatsink sitting at 400 to 500volts. Although it might be interesting to try Drew Diamonds trick of grounding the positive supply as per his new Valve Tester in latest AR magazine. That way the heatsinks would only be a few volts above earth, I guess Ok for a piece of test equipment but not much use to power a conventional piece of HV equipment which of course usually has the negative supply earthed. These are N-Ch Fets, wonder if we could invert the circuit and use P-Ch Fets instead. Who wants to try it ?.

The other issue is the high voltage supply itself, we show a 240Vac to 250-0-250Vac transformer. These are a bit hard to come by these days so if you don't have something like this check out the article in last issue re HV Supplies. With my first project I cheated and purchased a 240Vac to 240Vac mains isolation transformer and voltage doubled the secondary winding which will easily supply 100mA to the regulator. As the rest of the circuit is almost point to point wiring I built mine on a piece of perforated board and saved my PCB for another unit which will utilize a 285-0-285 transformer I have since acquired but which is only 40mA rating so can possibly get away with only one pass MOSFET.

Just some minor mods to my project are switched current limit resistors. The 6R8 resistor shown limits the supply at about 100mA which does not provide much protection to tests on say semiconductors so have added switching to provide limit at 20mA, 50mA and 100mA. Also added is an extra pot to allow vernier adjustment of the output voltage.

A number of the bits for this project such as the filter cap and the MOSFETs can be scavenged from old PC power supplies

As mentioned am still sorting out the heatsinking for this project so in next issue can show you completed project and give setup and testing information. But shown above is the box being laid out for the major parts.

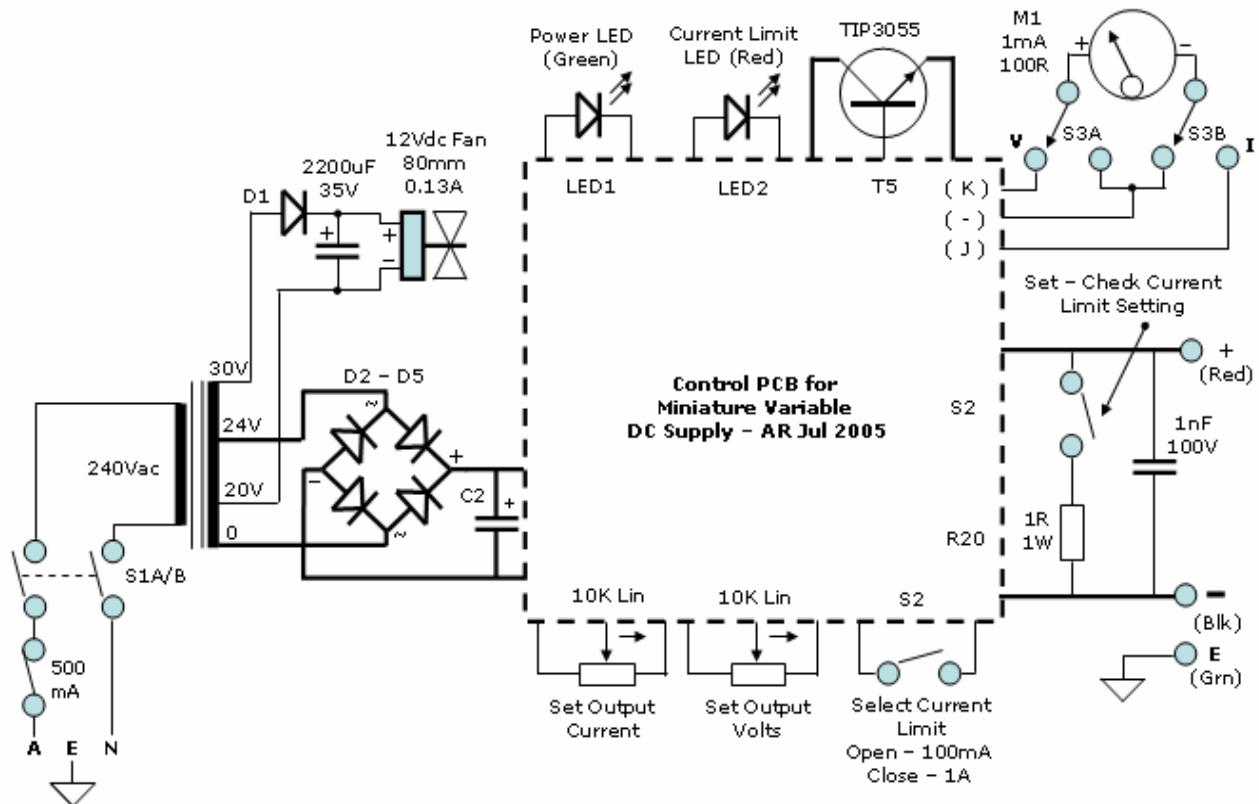
Project – LV PSU based on Miniature PSU in AR Jul 2005

For many years now I have built and used a number of low voltage power supplies based on the control board from the ETI 151 project in the mid 70's. It has been very reliable and this board has been used to control 1A to 25A supplies, it has individual Voltage and Current overload adjustments and importantly LED indication of the mode it is in. But the circuit is reasonably complex and sometimes difficult to fault find when it occasionally plays up. Must admit most problems are usually traced to dud soldering or sub standard components.



Anyway along came the project in AR July 2005 for a "Miniature LV PSU" and to boot fitted into an AT PSU box. A quick breadboard of the control board, hookup some volts and away we go. Definatly a more compact circuit than the ETI project and newer style components. It also seems quite conducive to modification of supply rails, output current and volts etc, so this may become my standard PSU control board, allowing a revamp of my existing test instruments. On the side here is the box being laid out for the major parts.

I won't go into detail on it's workings as this is covered well in the AR article, so below are the external connections to my implementation of this project and covers the components most likely to be changed for various output configurations.



VK2TOX Construction of Miniature Variable DC Supply (Mk 01) – AR Jul 2005 (Output 0-20VDC at FSD of 1A or 100mA [variable])

The initial project was built as per the AR article except for the fan, heatsink components and the panel layout. I am deliberately allowing for higher voltages and currents to be supplied. The idea is to head for a supply with switched 15 to 50V or 0V to 20V output at around 2A, this is actually the configuration of one of my ETI 151 projects and has been very useful. This would involve switching the tapings on the mains transformer to ensure the higher voltages and to minimize series pass power dissipation on the lower voltage range. A nice little circuit from a Silicon Chip PSU to indicate loss of regulation and better control of the cooling fan will be fitted (no point in the fan trashing away on low loads). The switching of the transformer tapings may be manual (front panel voltage range selector) or by an automatic output sensing circuit used in an AEM power supply of a few years ago. The automatic method seems to work quite well in a Jaycar PSU I use.

This Newsletter online at Amateur Radio NSW web page

The Radio Homebrew and Experimenters Group is on the net, just go to www.arnsw.org.au and look for "Homebrew News" for latest news on the group and a "pdf" copy of this newsletter. Let your friends know too. We will shortly have our own email address, meantime just send any email to Peter vk2emu@wia.org.au concerning the Homebrew Group or myself Brian vk2tox@wia.org.au concerning the Newsletter

Thank you.
..END..