IOWA QRP CLUB Journal

A publication of the IAQRP Club

Presented in TWO SECTIONS, part ONE & part TWO……May 2007 edition

..........IA-QRP at OzarkCon 2007............

NQ5R photo

Four Iowa-QRP members attended OzarkCon 2007. In the front and operating the **K0N** Dummy Load Special Event Station is Tom – N2UHC from the 4 State Group. Across the back from the left is our own 'Forum Presenter,' Builder Session helper, and **K0N** operator Terry-WA0ITP, our IA-QRP Coordinator John-NU0V, Mr. 'I won 2 prize drawings' (note the sympathy arm sling) Jerry-W0PWE, and Walter-K5EST the "Journal" Editor.

A special thanks to all the **4 State QRP Group** for a lifetime of great memories. Great QRP forums, QRO food, great vendors and flea market, great QRP music at night, great QRP conversations and putting faces with familiar call signs.........and not much sleep...**WOW!**

..........Feature Article..........

Build yourself an RF Ammeter

by **Ralph Hartwell - W5JGV** http://w5jgv.com/rfa-2/rfa-2.htm

An Easy way to Monitor RF, AC or DC current with one Instrument

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While I was working on my 166.5 KC transmitter, needed to be able to read the RF drive to the final PA stage. To do this required an RF ammeter that could read down to 100 ma with reasonable accuracy. A search of my Junque Box came up empty, and the great floating Hamfest, eBay, didn't offer any hope either. I decided the time had come to make my own RF ammeter. As it turned out, this was a 30 minute project.First, I needed a suitable meter. My recent search of my Junque Box had uncovered a likely candidate for conversion as seen below.

Well, the meter range is about right - the reading of 100 ma that I need to see is easily readable, and the full scale reading of 1 ampere would make the meter usable for testing with higher powered gear. But, since the DC meter cannot read RF, what to do?

Simple! Just grab an old computer power supply and rob a few parts from that!

What I did was remove four small 1 ampere Schottky rectifier diodes from the computer power supply circuit board and connect them in a full wave bridge rectifier configuration directly on the terminals of the meter. The (+) and (-) terminals of the meter are then connected directly to the (+) and (-) outputs of the bridge rectifier. The other two bridge rectifier connections, (shown as home-made ring terminals in this picture,) are the RF input connections to the bridge rectifier.

Since the meter only reads 1 mA full scale, and I wanted to be able to read 1 A full scale, I placed a non-inductive shunt resistor of 0.1 Ohms resistance directly across the meter (+) and (-) terminals to bypass the other 999 mA of current.

How this works:

The incoming RF current is rectified by the Schottky diodes and is converted to pulsating DC. 999/1000 ths of the DC passes through the meter shunt resistor, and the remaining 1/1000 of the DC passes through the meter. This causes the pointer of the meter to deflect in proportion to the applied RF current. Because the pulsating DC is at a high frequency, there is no visible "bobble" of the meter's pointer during operation.

The Shunt Resistor:

Calculating the shunt resistor value was done by first determining the internal resistance of the meter. In this case, it is 100 Ohms - which just happens to be shown on the front of the meter scale. Next, I determined the voltage that would have to be placed across the meter's resistance of 100 Ohms to cause a full scale deflection (1 mA).

so: E = I * R

or: E = .001 A * 100 Ohms

or: E = 0.1 V

So we need to have a resistor of such a value that when 1 Ampere (actually .999 A) flows through it, there will be 0.1 Volt dropped across the resistor.

Rounding off the current of 0.999 Ampere to 1 Ampere, and again using Ohms Law, we find that:

R = E / I

or: R = 0.1 V / 1 A

so: R = 0.1 Ohm

The power in Watts dissipated as heat across the shunt resistor at full scale current is:

W = I * E, where I is the current through the resistor, and E is the voltage drop across the resistor at that current.

In this case, W = 1 A * 0.1 V

so: W = 0.1 Watt, so a 1 watt resistor would give an excellent heating safety factor.

o - Note that because of the very low resistance of the shunt resistor, the resistor leads mush be short so that the lead resistance does not introduce measurement errors.

End notes:

o - Schottky diodes are required because standard diodes are not fast enough to prevent reverse conduction losses at RF frequencies.

o - This instrument introduces a fixed voltage drop of about 0.4 volts across the combination of the meter and the diodes. This voltage drop is fairly constant for current values from about 0.01 to 1.0 A.

o - Because of the low forward voltage drop of the Schottky diodes, the meter reading is accurate down to about 0.02 Amperes, as long as the circuit under test can accept a voltage drop of about 0.4 volts. Using the Schottky diodes eliminates the need to linearize the meter readings or to draw a new scale for the RF ammeter. The same scale will apply to DC, AC, and RF readings.

o - The voltage rating of the diodes is not critical, because they will never see a large reverse voltage. The DC meter and shunt resistor appear as a virtual short circuit across the DC output from the bridge rectifier.

o - If a higher full scale value is required, the shunt resistor and / or the meter movement may be adjusted as needed. It will also be necessary to use Schottky diodes that are rated for the higher current.

o- Although it is not shown in the photograph, it is a good idea to place an RF bypass capacitor directly across the meter's DC terminals. This is suggested because as the RF frequency increases, the coil of the meter movement will exhibit a rising impedance to the rectified RF pulses, and will cause a drop in the apparent meter reading at higher frequencies. I found that a value between 0.01 and 0.2 uF works well. Use a low inductance capacitor, such as a Polypropylene capacitor, or any good RF rated capacitor.

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73, Ralph W5JGV

You can contact Ralph at w5jgv@w5jgv.com **No problem with answering Q's, just put something Ham related in the subject line so my spam filter does not eat the message**

Thanks, Ralph, for permission to use this wonderful project............k5est

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.........Bonus Feature Article.........

Evolution of a Finger Tapper

By: Terry, WAØITP

Blame it all on Steve Miller, NØSM! During a monthly meeting of our local club, WAØDX, he mentioned a schematic that had been lanquishing in a desk drawer for some time. It was a touch paddle that he thought would make a good mobile accessory for those high speed dashes into town to the convenience store. Little did he know how far the concept would be taken.

What follows is the story of two intrepid experimenters, pursuing that golden grail of hamdom, the perfect paddle. It's important to note here that good CW skills were not a prerequisite to the hunt, hi.

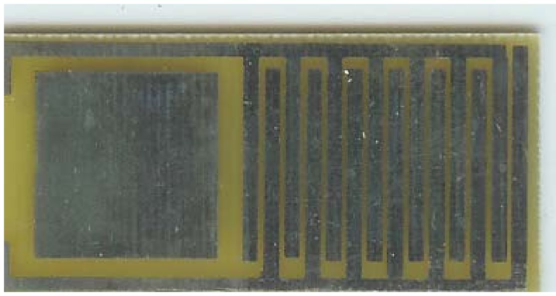
The First Attempt

Our first paddle was the WB4TED Iambic Sensor Keyer [1] This was the dusty schematic mentioned above. Tony used two 2N2222a's in a Darlington configuration for pressure free switching. The idea intrigued WAØMWW, Ron White and myself. Using Microsoft Paint, Ron forged ahead and developed the printed circuit board layout illustrated in the article.

We were building this thing from scratch, etching the board and all, and it looked like a piece of cake, yeah right!, The first hurdle was printing a transparency for exposing the positive resist. The PnP Blue process was investigated, but we wanted to go with something a little more familiar. The thought was to print out the pattern on paper then use a copier transfer it onto a transparency. The resulting inkjet print copied onto a transparency wasn't adequate. The lines were too fuzzy. Reasoning that a laser printer might be better, Ron suggested we try the printer at the local library. This time we printed directly onto the transparency and it worked well. He wound up using a multiple pass printout which is detailed more on his web site
http://showcase.netins.net/web/rmw/pcbs.html

After some experimenting with exposure times, temperatures, and submersion times, the boards became a reality. This process was not without it's challenges, however. If you've ever seen a dense bluish-greenish cloud while the resist is developing, you know what I mean. We discovered that the temperature of the solutions is very important.

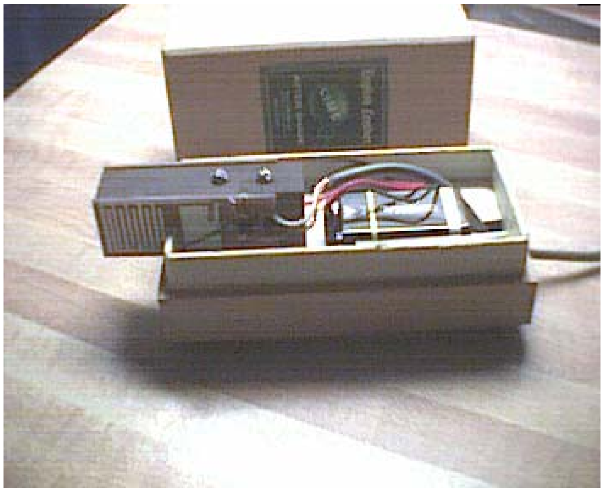
Later on we rediscovered that same principle. Additionally, Ron decided to use a product called Tinit which deposits a layer of tin onto the copper traces. Warm it up, dunk the boards, and an instant attractive, conductive, and protective coating appeared like magic. This is the first iteration of the board.



We placed pads for the Darlington pair circuit on the board, soldered them in place, hooked up a 9 volt battery and tried it out. It worked, the first time, and every time for me. It worked the first time for Ron also, but not quite every time. More about that later.

Now the boards had to be incorporated into a semblance of a paddle. This became an adventure in packaging. I choose to put mine in a Whitman's Sampler tin, er, two tins, sure was fun emptying them. Weight was needed to keep the paddle from walking around on the desk, and for help I turned to Ed Wright, WBØFGB. Ed said he had some lead pipe left over from a housing renovation. Now what do you do with lead in a shape you cant use? That's right, melt it down. So one cool day in October 2003, Ed and I sat on his patio melting the pipe on his barbecue grill. The molten lead was poured into several Whitman's and Altoids tins, and some bars were made by slopping 1 half inch or so into the bottom of some of those small bread pans. You know, like your wife previously made banana bread in? They worked fine and the lead came out easily, but no more of my favorite Banana Nut bread..

Steve had suggested that the boards should be separated by about ½ inch. Ed, thinking that the paddles needed some "sprucing up", donated some nice pieces of walnut to use for the spacers between the dot and dash boards. See the picture below for the final version of the Sensor Keyer paddle.



Four of these were built, one each for Ron and I, one for Steve, and one for Ed. I like to think of them as circuit by WB4TED, boards by Ron, and walnut and lead by Ed! Mine wound up in two Whitman's and Ed installed his in, of all things, an English Leather after shave box. It looks great.

As mentioned above, the paddle didn't work reliably for Ron, and as it turns out not for Ed either. But, they were fine for Steve and I. What was the difference? The dreaded Midwest winter, over 50, dry thumb syndrome. The circuit depends on skin resistance bridging the contacts to provide enough base current to fire the transistors. Dry skin has too much resistance to do the job. I'm able to use mine regularly, however. It's plugged into my old homebrew HB9ABO CMOS keyer, circa 1979, which fires the Yaesu-840 on the low ends of the bands.

New Ideas

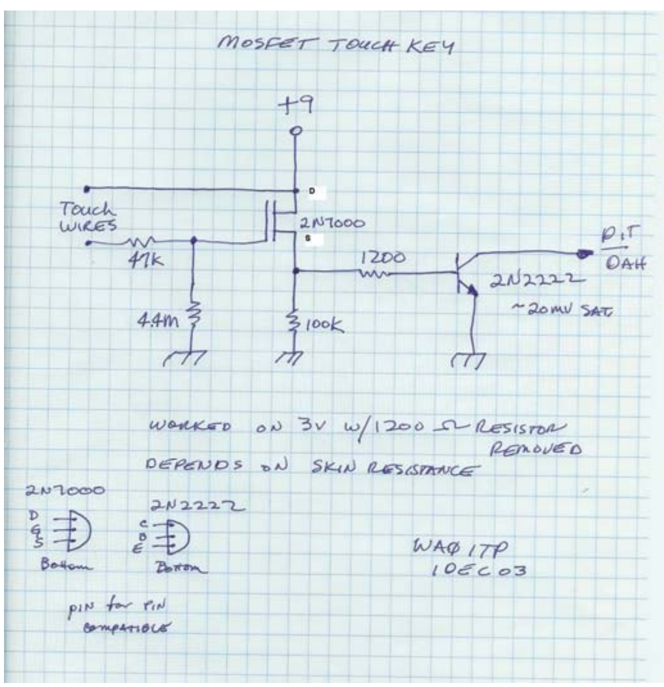
A new idea entered the arena about now. Ron had harbored the mental image of a home brew switch. Later on in the hunt, this was to be the final answer to our original design goals, albeit in a slightly evolved design. He built one using kitchen variety aluminum foil and "scotch" tape. The tape provided the gap between the foil and the previously etched boards. The foil acted like low resistance skin, and it worked very well, surprising me, but not Ron. He knew what he was doing all along.

I had emailed a picture of my version of the keyer to Mark Milburn, KQØI. He suggested a finger tapper model might be useful. Hmmmm….that sounded innovative, and a little challenging, and we already had boards that would work. Homebrewing seems to work that way, one idea generates others, all going the same direction, just a slightly different tangent.

Finger Tappers

Mosfet

The touch circuit idea still intrigued me, so I set about breadboarding one using a 2N7000 mosfet. (schematic below) It still relied on skin resistance but much less current was needed to turn it on. Perfect I thought, and it worked well for me, but again, not so well for those with dry skin. I liked the action and used it for some time while it was still breadboarded (izzat a word?). I used only 2 bare wires for the touch plates, and seemed very reliable, and immune to rf.



.....continued on part TWO.

....end of part ONE....IA-QRP Journal, May 2007.....continue to part TWO

Please be sure to download part TWO of the “Journal”