N.E.W.S. LETTER

The Publication of the North East Weak Signal Group

NOV 2005 | VOLUME FOURTEEN | ISSUE FIVE

NEXT MEETING
SATURDAY NOV 19TH AT THE RADISSON HOTEL IN ENFIELD, CT
POSSIBLE MICROWAVE UPDATE RUN DOWN
DUCT TAPE AUCTION

IN THIS ISSUE

DON'T FORGET

THE NORTH EAST WEAK SIGNAL GROUP
2 METER VHF AND ABOVE NET
EVERY THURSDAY NIGHT AT 8:30 p.m. LOCAL
144.250
W1COT, WZ1V, OR K1PXE NET CONTROL

MEMBERSHIP in the N.E.W.S. Group is $15 per year. Apply to Bill Conner K5GMX, K5GMX@arrl.net. You may download an application from our web page http://www.newsvhf.com

PREZ SEZ
DE KA1OJ

On behalf of the club I would like to thank Tom WA1MBA and Stan WA1ECF for hanging in there over the last two+ years as Prez and Vice-Prez.

On a sad note, Ted Simmington, W1JOT is now a silent key.

Now is time to plan those winter projects. My Plan is to finish a few of those many many half done projects that live in my cellar.

Tee-shirts I have a few ideas that I would like to run by the members.

Hopefully we can have several of our more ambitious members that went to Microwave Update (MUD) 2005 in California give us a run-down, at the Nov meeting, of what they saw and heard.

There will be yet another duct tape auction at the Nov 19th meeting.

The Radisson Hotel is now in the Crowne Plaza Hotel chain.

Look forward to seeing you on Nov 19th in Enfield.

73
KA1OJ

BOARD MEETING MINUTES
27 AUGUST 2005

Called to order at 11:45 By Tom WA1MBA.

Tom will not be able to be at the General meeting and Mike N1JEZ (VP) will moderator.

NEW BUSINESS
1.Election of president.
2. Come up with new meeting dates for coming year.
Possible dates: Jan 7, March 17, Conference July 15 +/- (picnic) Aug 26, Nov 11

OLD BUSINESS
1. Second meeting vote to amend the By-Laws of the club Constitution, Article 7 on dues
Meeting adjourned at 11:57

Respectfully submitted,
By Don Twombly W1FKF

NEWS MEETING MINUTES
27 AUGUST 2005

Meeting called to order at 13:10

Second meeting vote to amend the By-Laws of the club Constitution, Article 7 changing the words:
A regular annual assessment of $10.00 per member is hereby assessed in accordance..."
read:
A regular annual assessment of $15.00 per member is hereby assessed with a renewal on the date of the annual picnic meeting in accordance..."

The amendment was passed with one nay!

The proposed meeting dates were discussed: Jan 7, March 17, Conference July 15 +/- (picnic) Aug 26, Nov 11

There were no obvious conflicts

Mike asked if any one would like to be president?
There were no volunteers.
W1FKF nominated Mark KA1OJ for President.
He would except for a one-year term.
It was moved and seconded and passed

Treasures Report: Bill K5GMX
We have over $3300 Dollars in the treasury
Due to all the renewals, This meeting 3 new members.

NEW BUSINESS
Asked about if the club had any more T-Shirts
And who had bought the ones in the past. (Paul W1GHZ?)
A raise of hand indicated about a dozen people interested in the room
Asked in news letter if others would be interested.

Mike as everyone in the room to introduce themselves and tell what there currently working on!
Meeting adjourned at 14:15

Duct tape auction.

PROGRAM: Don, W1FKF showed his GPS based portable microwave marker system that covers 2304 - 47088 and his 78 GHz System.

Mike N1JEZ showed VE1ALQ update Reflock 1
board. Darrell has redesigned the CT1DMK board to overcome the problems with the initial Reflock. Demonstrate how to program and adjust the lock range.

Respectfully submitted,
By Don Twombly W1FKF

A QUIET FAN CONTROLLER SPEED VARIES WITH TEMPERATURE

PAUL WADE W1GHZ ©2005

w1ghz@arrl.net

Many modern radios and other electronic devices rely on muffin fans for cooling. These can be loud and annoying. Some run continuously, while others cycle on and off, either when needed or just on transmit. In some radios, the fan cycling results in a small frequency shift as the oscillator is heated and cooled.

Wouldn't it be preferable to have a fan with a variable speed, responding to cooling needs? I've thought so for a long time, but never got around to doing something about it. Recently, I decided it was time. I figured this was an obviously useful thing, so there would be lots of circuits available on the web. NOPE! The only things I could find were microprocessor circuits, many of them relying on fancy fans with internal tachometers – none of those in my junkbox. Also, the microprocessor controls the speed by turning the fan on and off rapidly; some of the notes suggested that the results are audible.

Most muffin fans use DC brushless motors, so the speed is easily controlled by varying the motor voltage. 12-volt fans are convenient and readily available. Also, there are a number of inexpensive temperature-sensing ICs available. What we need is a simple circuit to vary the fan voltage in proportion to temperature – basically, an amplifier. A couple of opamps should do the job.

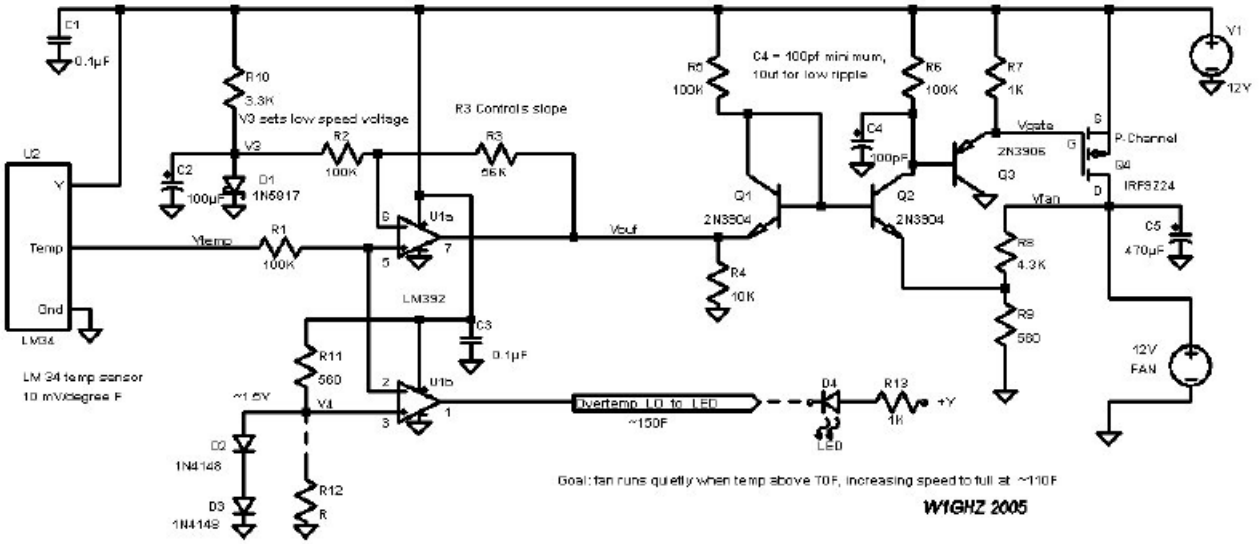
I sketched out some circuits and simulated them with the free SwitcherCAD III software from www.linear.com. None of them worked satisfactorily, so I called the opamp guru, Byron, N1EKV. He agreed that it sounded simple and would look into it. He soon called back to say it wasn't as simple as it sounded, because of some choices I had made: to keep one end of the temperature sensor and one end of the fan grounded, and to drive it with a power FET for minimum voltage drop at full speed. The result is that the sensor is referenced to ground, but the FET is referenced to the positive voltage. The final complication is that there is a huge gain in the circuit due to the transconductance of the FET, about 2.5 Siemens (in tube terms, this is 2,500,000 ìmhos – a typical tube is 5000) or more. To make things worse, the FET is operating in a non-linear region, and having non-linear elements inside a feedback loop is never a good idea.

I went back to engineering basics: find a circuit to steal. One of the microprocessor fan controls1 used an interesting circuit to drive a FET and shift the reference from ground to high side. The circuit, in the area of Q1 and Q2 in the schematic, looks like the Widlar current mirror used in many integrated circuits. I added this circuit plus the PNP emitter follower, Q3, and fiddled with the resistances to get it going. Then I consulted Byron again and added capacitors C4 and C5 to stabilize things.

Computer simulations are only as good as the models, and don't always fully model reality, so I built up a breadboard on a piece of perfboard. It actually works – and it definitely oscillates without C4!

Now it felt safe to make a printed-circuit board, to make it reproducible and robust enough for portable equipment – perfboard wonders seem to fall apart bouncing around in the back of the truck. Since opamps come in pairs and quads, I tried to think of something to do with the other half. The best use I could come up with is an overtemperature alert, but that really requires a comparator rather than an opamp. But there is

Temperature-proportional Fan Speed Controller



one IC available with one of each, the LM392.

The comparator uses the output of the same temperature sensor to provide an alert at some higher temperature. The output goes low at the desired temperature to turn on whatever: an LED, a sound, a relay to shut down the amplifier, or a jolt to the operator's chair. The noisemaker from a defunct smoke alarm might be interesting, but a blinking LED seems adequate to remind me not to talk so much.

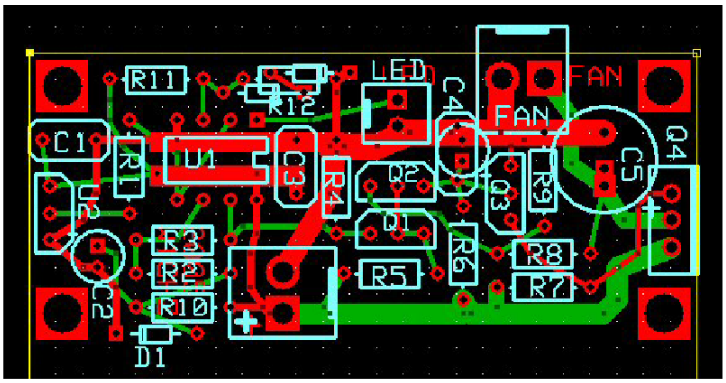


Figure 2

I used the free software from ExpressPCB (www.expresspcb.com) to layout the board shown in Figure 2 and placed a Miniboard order: three boards in four days for $59. Four days later, the boards arrived, I put one together and sparked it up. After I added one resistor that somehow was left out of the layout (Figure 2 includes the correction), it works fine. The fan purrs away at room temperature and speeds up as the temperature sensor is heated up. Figure 3 is a photo of the completed controller, with the LM34 temperature sensor at the left edge of the board, not yet attached to a heat source. It could also be soldered to the other side of the board, if the intent were to mount this board on the heat sink.

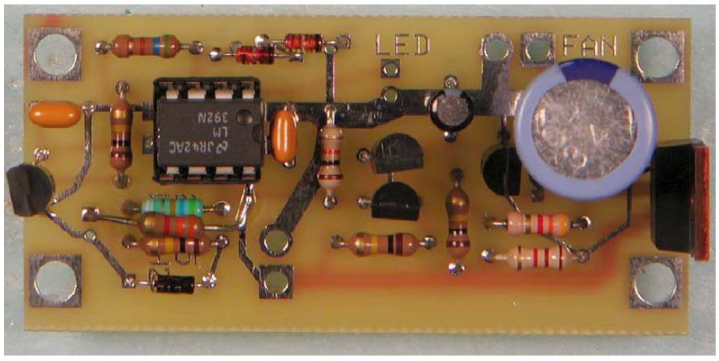


Figure 3

With the resistor values in the schematic, the fan gets about 9.5 volts at room temperature and gets up to full speed with full voltage at about 105°F. We will use Fahrenheit since the LM34 temperature sensor output is in Fahrenheit: 10mV per degree F, so the output at 70°F is 700 mV and at 105°F is 1.05 Volts. The slow speed is set by voltage V3, controlled by resistor R10; decreasing R10 increases the current through Schottky diode D1, which increases the voltage drop of the diode and increases V3. The temperature at which the fan reaches full speed is controlled by resistor R3; increasing R3 makes the fan reach full speed at a lower temperature. Note that we can monitor the temperature directly by measuring voltage Vtemp at the LM34 output, as 10mV per degree F.

The over-temperature setting for the comparator is similarly set by voltage V4, the voltage drop through silicon diodes D2 and D3. Decreasing resistor R11 increases the current through the diodes, increasing the voltage drop and thus raising the temperature setting. With the value shown for R11, V4 is about 1.50 volts, so the over-temperature alarm is at about 150°F. If a much different temperature setting is desired, R12 could be used instead of the diodes, but the temperature setting would vary with the supply voltage.

The temperature sensor U2, the LM34, should be in contact with the heat sink or surface being cooled by the fan. Either attach the flat side of U2 directly to the heat sink with Super Glue (cyanoacrylate), or use a dab of heat sink compound and clamp it on. A heat sink takes some time to heat and cool, so the fan will not change speed instantaneously, but will speed up as the heat sink heats. More important, it will continue running at higher speed until it brings the heat sink temperature down, gracefully slowing down as things cool. U2 need not be mounted on the printed circuit board, but may be mounted remotely, on the heat sink; twist the wires together, and consider adding ferrite beads if there is a lot of RF floating around.

Of course, controlling fan speed won't do much good if there isn't adequate cooling with the fan running at full speed. If you are adding a fan, size, placement, and airflow are important. For cooling a heat sink, impingement cooling, with the air blasting directly into the fins (like a Pentium cooling fan), is much more effective than ordinary convection cooling, where the airflow is just passing through the fins. If you are just cooling a cabinet or enclosure, sucking may be more effective than blowing. But any airflow is better than none at all.

1. ADM1028 data sheet, www.analog.com

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3DFIX
BY TOMMY SULLIVAN
W1AUV

I enjoyed and was intrigued by the paper "A Simple GPS Stabilized Oscillator" by N1JEZ, Mike Sequin, published in the Proceedings of the 31st Eastern VHF/UHF Conference. At the conference in April 2005 I picked up a PLL board and an oscillator from Paul Wade, W1GHZ. Soon after the conference, I ordered parts and got ready to assemble one of my own.

The following is from Mike's write-up:

One problem with the Jupiter engine is that from the moment it's powered, it outputs 10 kHz and 1 PPS. Until I had a valid 3D GPS fix (I recommend at least 4 satellites) the output was not accurate. I needed some way to be able to verify that I had a valid 3D GPS fix before I could trust the 10 MHz output. The GPS engine does not provide any type of output such as a line that might go high/low to indicate lock, so I had to think of another solution.

By the time the parts arrived I had decided build what Mike said the GPS lacked: a small microcontroller to generate a lock indication by monitoring the NMEA serial stream. As suggested in the article, I keyed my software on the GPGSA sentence. The sentence looks something like this:

$GPGSA,A,3,01,20,19,13,,,,,,,,,40.4,24.4,32.2*0A

After the second delimiter (comma) in the sentence there is a three. A three in this position means that a 3D position has been established.

The microcontroller I chose for this application is a Microchip PIC. I have experience with a wide range of microcontrollers and microprocessor but, I chose the PIC because of its popularity in ham applications. The firmware development tools, for assembly language at least, are inexpensive as are chip programmers.

The PIC16F688 is a Flash based microcontroller that has a built-in UART. A smaller controller could be used with a bit-banging serial routine. I've done this before but I prefer the hardware approach. The hardware UART helps save code space and CPU cycles for enhancements and updates.

The 16F688 is available in a 14 pin DIP package which makes it ideal for hand assembly and prototype boards. The 100 mil spacing of the pins is easier on my eyes too.

The software is straight forward. The PIC just monitors the serial data looking for our target string. If the three is found in the right spot a pin goes high on the PIC and this drives an LED. If the field in the GPS string doesn't have a 3 then the LED goes out as the pin goes low in response.

It is possible to reverse the LED so that it is on until a 3D fix is acquired, then off. This will save a little power. Every little bit of power counts: especially in battery powered applications. The overall power required for the PLL and GPS is so much higher that it swamps out the small amount of power for the LED. I mention this option though because it is basically free.

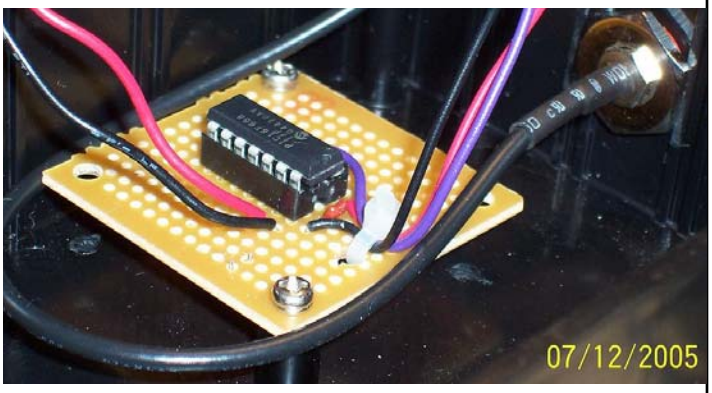

Figure 1
The prototype board version of 3Dfix.

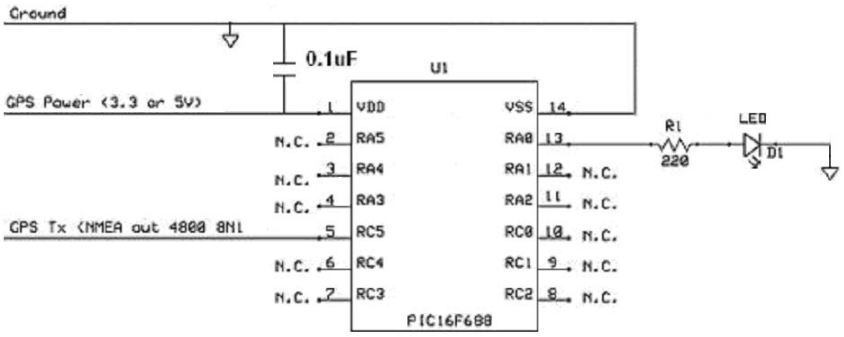

Figure 2
The Schematic

I soldered a prototype together and tested it with the assembled PLL and GPS. It works great. All that is needed is to tap the TX line and power from the GPS. The PIC can run from 3.3 or 5 volt power. This means this design will work with either a 3.3 or a 5 volt GPS.

I use the PIC's internal oscillator to drive the CPU and UART. This oscillator's frequency will vary with temperature. With the addition of a small 32 KHz oscillator the software can be

Figure 3
Front View

changed to compensate for changes in frequency that may cause errors in decoding the serial data. I plan to add this capability to the software in the future.

The source code is available (C or assembly) to anyone who wants it and has the equipment to program the chip themselves. If you want a programmed chip let me know. They cost $3 or less (plus postage). Contact me for details.

tpsully@verizon.net
6/22/2005

ERROR IN THE GPS INTERFACE BOARDS
MIKE, N1JEZ

We've just discovered a minor error in the ground plane of the GPS Interface Boards.

First, this _only_ applies to those that purchased new boards before Oct 15.

The ground plane on these boards was inadvertently extended over two thru-holes on the output of U5 and U7. Essentially this grounds the output of each regulator. (not a good thing). These holes were added as a convenient way to pick off 5 or 3.3 volts to power your GPS engine antenna input or to be used as a pick off point for pull up voltage for alternate GPS engine serial output or soft reset etc.

The fix is easy. Use a 3/16" drill bit as a hand reamer to remove the ground plane from the top (silk screen) side of the board. It only takes 2 or 3 turns by hand.

One hole is located right in between U5 and U7 and the second is located just to the right of U7.

Once again I want to emphasize that the only boards affected are the latest run. You can easily tell if you have one by looking at the edge of the board between J2 and J4. You'll see 3 ground points. You can also just look at the two small holes mentioned above and you'll see the ground plane extends over them.

I really apologize for any inconvenience this may have caused. Please share this note with everyone you know who may have purchased one of these new boards.

I will also post this to my website at:

http://mysite.verizon.net/n1jez/index.html

73,
Mike, N1JEZ
"A closed mouth gathers no feet"

FOR SALE OR SWAP:

PC boards for W1GHZ small projects available.
see http://www.w1ghz.org/small_proj/small_proj.htm

73
paul

Icom 910H All Mode VHF/UHF Transceiver in like new, mint condition. Original non-smoking owner. CR-293 High Stability Oscillator and UT-106 DSP Unit installed. Original Instruction Manual, original Service Manual, HM-12 Hand Mike, power cord and original box. $1300 plus shipping. Photosavailable.

73 de Warren
WM2Z

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