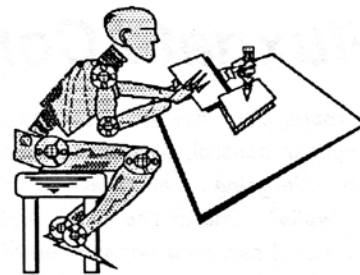


# DPRG

DALLAS  
PERSONAL  
ROBOTICS  
GROUP



Sept 1993

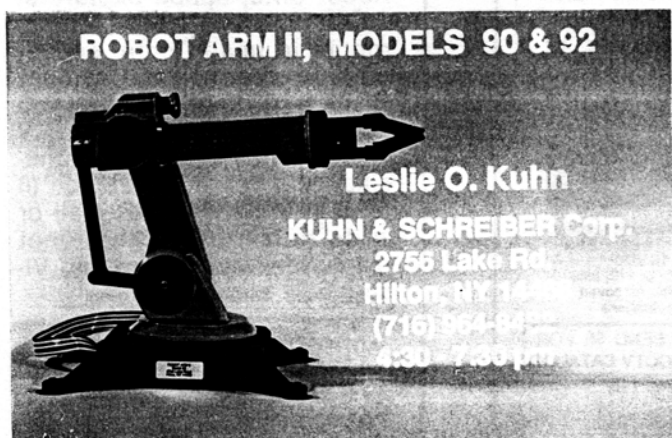
A Newsletter for Personal Robot Enthusiasts

## Personal Robot News

Recently the DPRG has been listed in Nuts & Volts magazine and in MIDNIGHT ENGINEERING. Since becoming more visible, we've been receiving some interesting information in the P.O. box. The Science Center of Connecticut is having robot contest which requires the robot to move through a maze and extinguish a candle. The contest will be held on April 17, 1994 and has a grand prize of \$1,000.00. You can contact Jake Mendelssohn at 203-231-2824 for more information or contact Roger Arrick at DPRG. We also received some info from ProBoard Circuits in Galveston. They offer an impressive line single board computers, accessories and software at prices that will make a robot builder's sonar sensor perk up. Contact them at (409) 762-3414 or ask Roger for their info package.

## Robot Arm

Kuhn & Schreiber is now offering the SVI2000 joystick operated robot to hobbyists and educators. For \$95, including shipping, you get a complete 5-axis robot arm capable of running on 4 "D" cells and able to lift 4 oz. Total robot weight is only 2.6 pounds. Also being offered are the models M90, M92 and M94 robot arms which can be connected to Apple II, IBM or Macintosh computers and include software. These computer-controlled units range in price from \$339 to \$479. This unit may be the perfect alternative to building a custom arm for your mobile platform.



## September Meeting Contest Trial Runs

We'll do the normal idea swapping, new product discussion and data book distribution in the September meeting, but we'll also allow trial runs for the November DPRG robot contest. This will allow builders to test their ideas and make final adjustments. Many members are expected to have contestants along with some out-of-state units also. A complete contest rule sheet is included in this newsletter along with information on how to participate.

We still have a load of data books that will be made available free to members. They include: Motorola microcontroller data book, Phillips 8051 data book, LCD data book, stepper motor data books, and some parts catalogs.

Stop by the meeting and see robots, lots of interesting technical stuff, and maybe even some humans.

## President's Note

Happy fall. For those of you in Texas, this means temperatures under 100 degrees! This makes the garage workshop much more bare-able for activities such as hack-sawing aluminum angle or for drilling large holes in your robotic platform for weight reduction.

This month you'll notice a few new things about the newsletter. #1 - The type size has been reduced to 10 point. This allows us to pack in even more great ideas but may require the use of a small magnifying glass. We've also received several articles from club members and we need the space to print them. (keep those articles coming) #2 - More pictures. This makes the whole publication more enjoyable and informative. And #3 - More product information. New sensors, controllers, motors, etc., are constantly be introduced. We'll find them and show you.

The September meeting will also be used for trial runs for the DPRG robot contest which takes place in November. So bring your creation and tool box to do some tweaking.

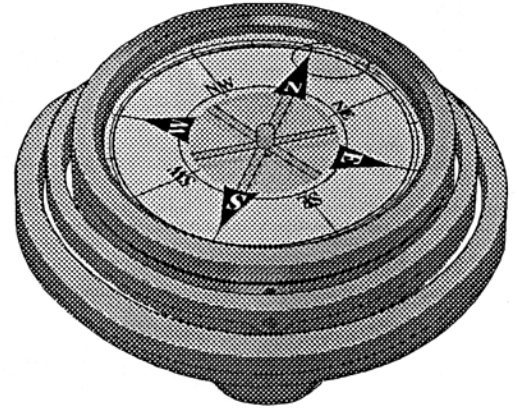
Hope to see you at the meeting.

Roger Arrick

# Fluxgate Compass for OW

By Dutch Uselton

My robot OW, has been coming along pretty well. I have the drive motors under computer control, digital encoders feed back wheel position to give some idea of where it's going. I also have an ultrasonic range finder on a rotating pod so it can "see walls". One of the tough problems in navigation is knowing where you are. For instance, I can do a sonar scan of a room and find out the dimensions and location from the nearest two walls. In a rectangular room, you still do not know where you are though. When Roger Arrick told me he had one of the obsolete Digi-Compass' from Radio Shack, I thought it would be a good addition to OW. With it I got a copy of the Nov. 1989 issue of Radio Electronics which has an article on building a computer interface for the Digi-Compass. I built the interface and downloaded the software from the Radio Electronics BBS.



The interface seems pretty bizarre to an ME like me. The compass circuitry puts out two sinusoidal voltage signals which are out of phase. The levels are about 3.7 volts plus-and-minus 3 volts. If you measure the voltages on the two analog data channels, you can use trigonometry to back out the compass heading. This is the part made by Radio-Shack and is very straight forward. The interface uses a serial Analog to Digital converter chip (TLC548 hard to find) to convert each signal to a digital bit stream. The A to D is multiplexed between the two signals. The output from the chip is fed into the computer through the parallel port. Software drives the port to select which signal to look at and interpret the serial bit stream coming in. I built it and it almost worked! It gave good compass readings around west-north-west and south. But at the other headings it gave erroneous readings. I got exasperated and pitched the interface. I'm pretty sure there was some problem with the software.

I had to go to England on business for 5 weeks. While I was away, I realized I was, as my grandfather used to say, "standing in my own light". I have a nice data acquisition board on OW already. It has analog channels for reading voltages and I have already developed my own software to access it through the serial port. The sonar ranging system distance information uses this same interface. When I got back home, I made a small voltage divider board to drop the two analog voltage levels to the right range and wired up the Digi-Compass. Next, I had to get the signals interpreted properly, so I brushed up on Trig. You must use the arctangent of the absolute value of the two voltages to get an angle between 0 and 90 degrees and then you figure out which quadrant this angle is in by looking at the polarity of the two incoming signals. I added a segment of code written in QuickBasic to my main mobility program for OW. The darn thing works pretty good. I was afraid that all the metal and EMI would give the sensor a problem but, so far, it looks pretty good. Now, when I get a range map of a room I have the added clue of which general direction OW is pointed in. This will help to establish an absolute position. I have not experimented yet with the viability of driving to maintain a constant magnetic heading. If the headings are accurate and reliable enough, that could be a powerful navigation technique.

Dutch is a member of the DPRG and has attended meetings regularly over the past year. His wheel chair-based robot always draws a crowd.

The following ads were seen in the September issue of NUTS & VOLTS magazine along with an article on neurons and robotics. You can contact NUTS & VOLTS at 1-800-783-4624, Annual subscription cost is about \$17.

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# Vibration, Robots at Risk!

By Roger Arrick, R.D.

If you've read the newspapers lately, everyone is either 'AT RISK!' or 'IN A STATE OF CRISIS!'. If robots were people, they may have their own publications screaming about the latest calamity to befall their fellow machines. One of these looming catastrophes would certainly be VIBRATION. We'll just refer to it as the 'V' word.

Every robot is at risk. At any moment, V could cause a nut to loosen, falling on to the sensor board, transmitting false information to the main control computer, and whamo - you guessed it - a dented coffee table and tire tracks leading to a very flat kitten. When you open up your bot, you may not only find the innocent little zinc-plated, 10-32 hex nut rolling around between the IC's and the electrolytic capacitors, you may also discover the effect of arc welding around sensitive A-D converter chips. Unlike human publications which would probably suggest an 'Anti Loose-Nut Law' or 'Equal Rights for Screws and Washers', we're going to actually find a way to fix the problem. No, not by filling the entire cavity of the robot with silicon rubber, but by using very common products found in most hardware stores.

We'll start with the problem of V on fasteners. Screws and nuts are particularly susceptible to V and will eventually fall off if you don't take precautions. For this reason, aircraft have pins that prevent nuts from coming off. There are a couple of simpler ways to keep nuts on bolts and threaded rod. One is to use a star washer which is like a normal flat washer with small teeth that are bent at angles. These teeth dig into the nut during tightening. Star washers come in two flavors: internal and external. I normally use the internal star washers since their teeth are on the inside hole and allow more penetration of the nut. A lock washer is also a very common, inexpensive method of keeping nuts attached to screws. It's simply a flat washer that has been cut and bent resulting in spring-like characteristics. When the nut is tightened, the washer compresses and digs into the nut. My favorite piece of common hardware made to resist vibration is the lock nut. A lock nut looks like a normal hex nut with one, very important difference. Down inside the opening, next to the threads is a small ring of nylon or other plastic. This ring is smaller than the inside diameter of the threads which results in a lot of friction between the nut and the screw. Last but not least, especially not in cost, is Lock-tite. Lock-tite comes in little red bottles costing about \$10-\$30 depending on size and type. One kind is used by placing a drop on the fastener threads before attaching and is called permanent, meaning its not meant to ever come off. Another kind is also placed on before screwing on the nut but can be removed with moderate effort - called, strangely enough, removable. My favorite type is the penetrating, removable type. Just place a very expensive drop on the nut AFTER it's attached and it penetrates into the threads. It can then be removed with a little effort. Be careful when using lock-tite, some plastics will deteriorate after a couple of days of being in contact with it. Lock-tite is expensive (about \$10 for a very small bottle) but one bottle will last for a very, very long time. If you're exceptionally paranoid, or are making a robot that carries precious cargo, you may want to use all of these ideas together. But don't go overboard, your machine may need to be taken apart someday.



LOCK NUT



STAR WASHER



LOCK WASHER



LOCK-TITE

V has another main side effect: it creates noise. This noise is not caused by pieces that are tightly attached together, but by pieces that are loosely attached such as hinges and parts that must slide or rotate. To minimize noise at these places, a rubber grommet may be just the answer your looking for. Grommets are small circular pieces of rubber with a hole through the center and a channel around the outside. This channel allows the grommet to be placed inside of a hole without falling out. A normal fastener like a bolt or threaded rod can be placed through the center hole and then a flat washer and lock-nut can be placed on each side. You'll be amazed at how well this dampens rattles.

Roger Arrick is a licensed, registered, authorized and scrutinized robotic doctor (R.D.) who can often be found following closely behind his robot with a hot soldering iron and EPROM programmer.

## CHECK THIS OUT

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ALL ELECTRONICS  
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### ULTRASONIC PROXIMITY DETECTOR

The ED-100 was designed for use as an auto/RV/truck back-up alarm. It consists of two computer controlled, 40 kHz ultrasonic modules that attach to the back of a vehicle and warn the driver when the rear of the vehicle is within 14 feet of another object. A digital display that clips onto the rear-view mirror continually monitors the distance to the object. As the vehicle gets closer to the object, an audible signal beeps inside the car at increasingly closer intervals. There is also a visual indicator. The ultrasonic modules measure 5.81" long X 1.9" wide X 2.05" high and have swivel mounting brackets. Operates on 12 or 24 Vdc. Includes instructions for installation. The units are all new, in original display cartons and as far as we know, in working condition. The company that originally marketed this device is no longer in business, and no manufacturer's guarantee is in effect. We offer these ultrasonic detectors on an experimental basis only, and in no way wish to promote their usefulness as an aid to driving a motor vehicle. This unit originally sold for over \$100.00.



CAT# ED-100 \$24.95 per set

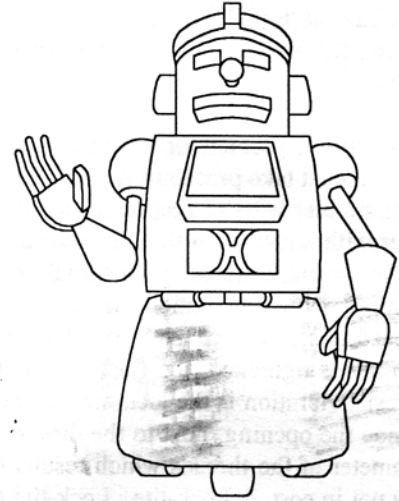


*September 1993*  
**NEWSLETTER**

**September Meeting:**  
Saturday the 18th, 1:30 PM  
At the Dallas INFOMART

***Inside -***

- September Meeting Information***
- Fluxgate Compass for OW***
- Vibration, Robots at Risk!***
- Robot Contest Rules***



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