Disclaimer

THIS UNIT IS for OFF-ROAD USE ONLY.

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This controller is a prototype unit. It has not been rigorously tested to ensure reliability. I cannot assume responsibility or liability for any injury, property loss or damage that may result from its use. . The user should understand that if the unit should fail, the level of power steering assistance may suddenly vary. The user should not attempt to view the lights on the controller while the vehicle is moving. It is not recommended that the user operate this device while driving on public roads prior to thoroughly testing its function over the range of environmental effects it may encounter during operation. The user installs this unit at their own risk, and is expected to thoroughly test the unit under the range of environmental conditions intended for use prior to operating any vehicle with the unit installed. Always observe safe working practices when installing and testing this unit.

BY INSTALLATION AND USE OF THIS UNIT, THE USER ACKNOWLEDGES THAT THEY UNDERSTAND THE RISKS OF OPERATION OF PROTOTYPE UNIT, AND ASSUME PERSONAL RESPONSIBILITY FOR ANY AND ALL INJURY, PROPERTY LOSS OR DAMAGE WHICH MAY RESULT FROM USE OF OR FAILURE OF THE UNIT.

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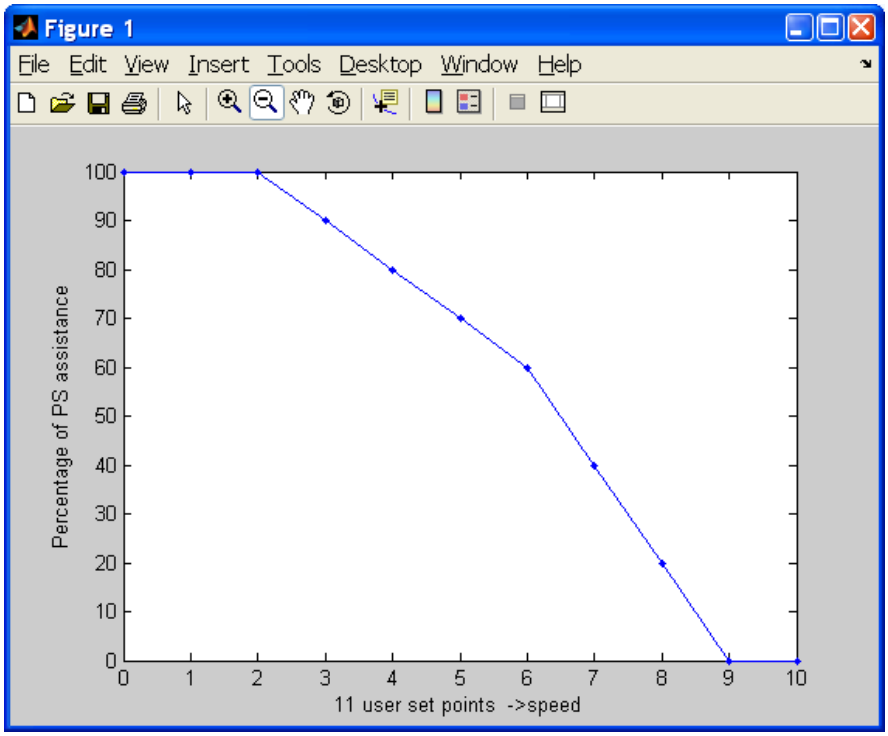
Basic operation

The controller measures how many sensor pulses how passed in ½ a second. Each ½ a second it uses that number of pulses, divided by the number it is programmed with (Nset) to look up in a table how much pump assistance it should send to the PS pump. The table contains 11 user settable points, something like:



The controller linearly interpolates between the points so that the transition is smooth.

So, for the corvette ABS sensor, there are 47 pulses on the reluctor wheel . If you were to set the Nset =47, then the wheel would have to turn around 1 turn in half a second to move from the band 0 point to the band 1 point. The actual formula is:

SpeedStep = D*Nset/Nactual*pi*(2*secs in hour)/(inches in mile)

D=outside diameter of tire in inches (the tire that drives the sensor)

Nset = number of pulses set in the controller

Nactual = number of pulses per wheel revolution on car setup.

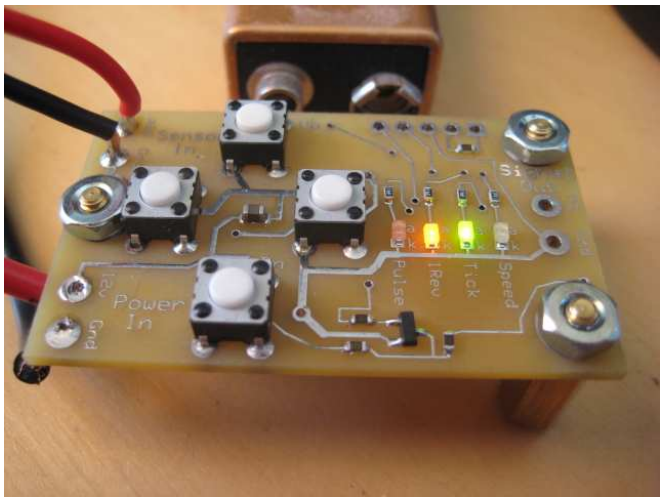
Speedstep = D*0.357*Nset/Nactual

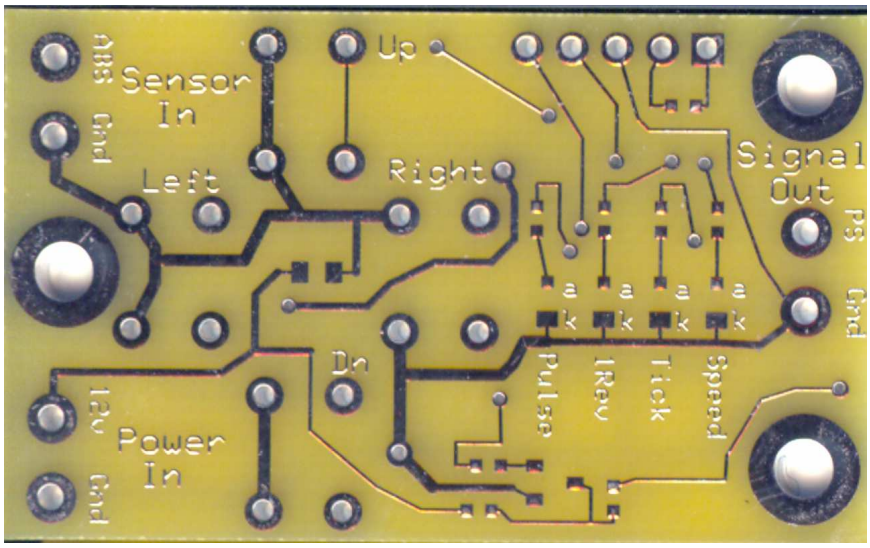
There are 11 bands, 0 to 10, so the top band is 10*Speedstep.

So for the corvette ABS with Nset=47, the speed step is about 8mph (assuming 24” tire).

So for the corvette ABS with Nset=17, the speed step is about 3mph.

User Interface





There are four user buttons on the controller: “up”, “ down”, “right” & “left”.

There are 4 lights on the controller: “pulse”, “1Rev”, “Tick” and “Speed”.

The lights and buttons have different meaning in the three modes:

Normal Mode

This is the mode that the unit defaults to on power up, and is the normal operational mode.

The “pulse” light flashes every time the unit sees a pulse from the sensor. This can be used to verify that the controller is connected to the sensor/pcm signal ok.

The “1Rev” light toggles every time the unit sees “Nset” pulses, so if Nset=Nactual, then the light should flash on once per revolution of the wheel.

The “tick” light flashes on about once per second, it tells the user that the unit is running. Every time the light toggles, the unit makes a measurement and updates the PS assistance.

The “speed” light indicates the current band that the unit is measuring, by counting the number of flashes, the user can determine the speed band used.

Nset Adjust Mode

To get in and out of this mode, hold down the” left” and “right” buttons for 2 secs.

In this mode the “1Rev” and “speed” lights have the same meaning.

The “Pulse” and “tick” lights are used to indicate Nset.

The “pulse” light flashes to indicate the 10’s and the “tick” light indicates the 1’s.

So, if Nset=47, the ”pulse” light will flash 4 times and the “tick” light will flash 7 times.

To adjust the Nset, use the “up” and “down” buttons. The “1rev” light can be used to see how the adjustments are making a change to the speed step by spinning the car’s wheel (jacked up).

(I do not recommend running the car’s engine while the car is jacked up).

Once the Nset is adjusted as required, the user needs to save the settings in the controller's permanent memory (flash). This done by holding down the "up" and "right" keys for two secs. Once flashed, the unit light will scroll a few times to indicate the flashing has occurred, then the unit will reboot.

Table Adjust Mode

To get in and out of this mode, hold down the "up" and "down" buttons for 2 secs

In this mode all of the lights operate as in normal mode, except that the speed mode now indicates the point of the table that is being edited. When you 1st enter the mode, the speed being adjusted is the middle point, i.e. It will flash 5 times. Use the "left " and "right" buttons to select the table speed entry. Don't forget there is a "zero" setting. To change the level of assistance for each band, use the "up" and "down" keys. You should be able to hear the PS motor speed vary, and you can move the car's steering wheel to get a feel of how much assistance is being applied at each speed band setting. Once you have set all the bands, you need to store setting in the flash, again press and hold the "up" and "down" buttons for 2 secs until the lights scroll, then the unit restarts.

Factory Reset

By holding down all 4 keys for 12 secs, the unit goes back to "factory presets", which are:

Nset=47

Bands = 100%,90%,80%,70%,60%,50%,40%,30%,20%,10%,0%

The unit stores these setting in the flash. After this all 4 light will flash on and off for a few secs and the unit will restart.

Hooking it up to an MR2 Spyder PS Pump

Connect Gnd to the bottom left connection marked “Power in, GND”.

Connect ignition 12v to the “12v” connection in the lower left of the board.

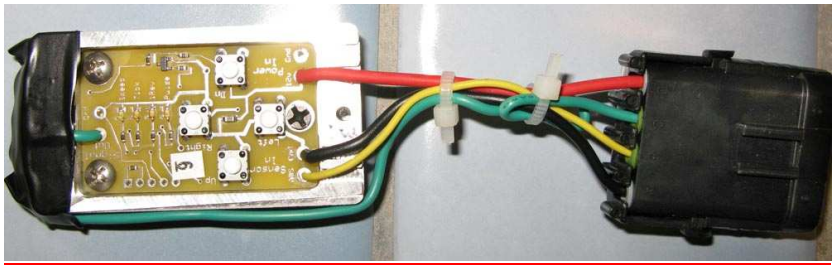
For a reluctance type sensor with two wires, hook up the wires to the “Sensor in” connections in the upper left of the board. The order does not matter as long as neither is connected to the vehicle’s Gnd. (if one is of the sensor wires is grounded, make sure that one goes to “Gnd” on the board)

If you wish to use the speed pulse output from the PCM, just hook up that signal to the “sensor in abs” connection. The Gnd is not needed.

The output “signal out PS” is connected to the MR2 spyder’s pump speed pin. The “signal out gnd” is connected to the Gnd on the MR2 spyder’s pump connector.

All three GND signals need not be connected, as long as one is connected.

e.g.



The Enclosure

The board should be housed in a water tight box, and the wire entry points sealed with silicone etc. The large holes in the board are for mounting using m3 screws or similar. If the enclosure is metal, make sure that the back of the board is not touching the case. A clear font would be nice so that the leds can be seen.

Something like this would work, but you it would be best to seal the lid with caulk:

http://hammondmfg.com/dwg2c.htm

Helpful Pics:

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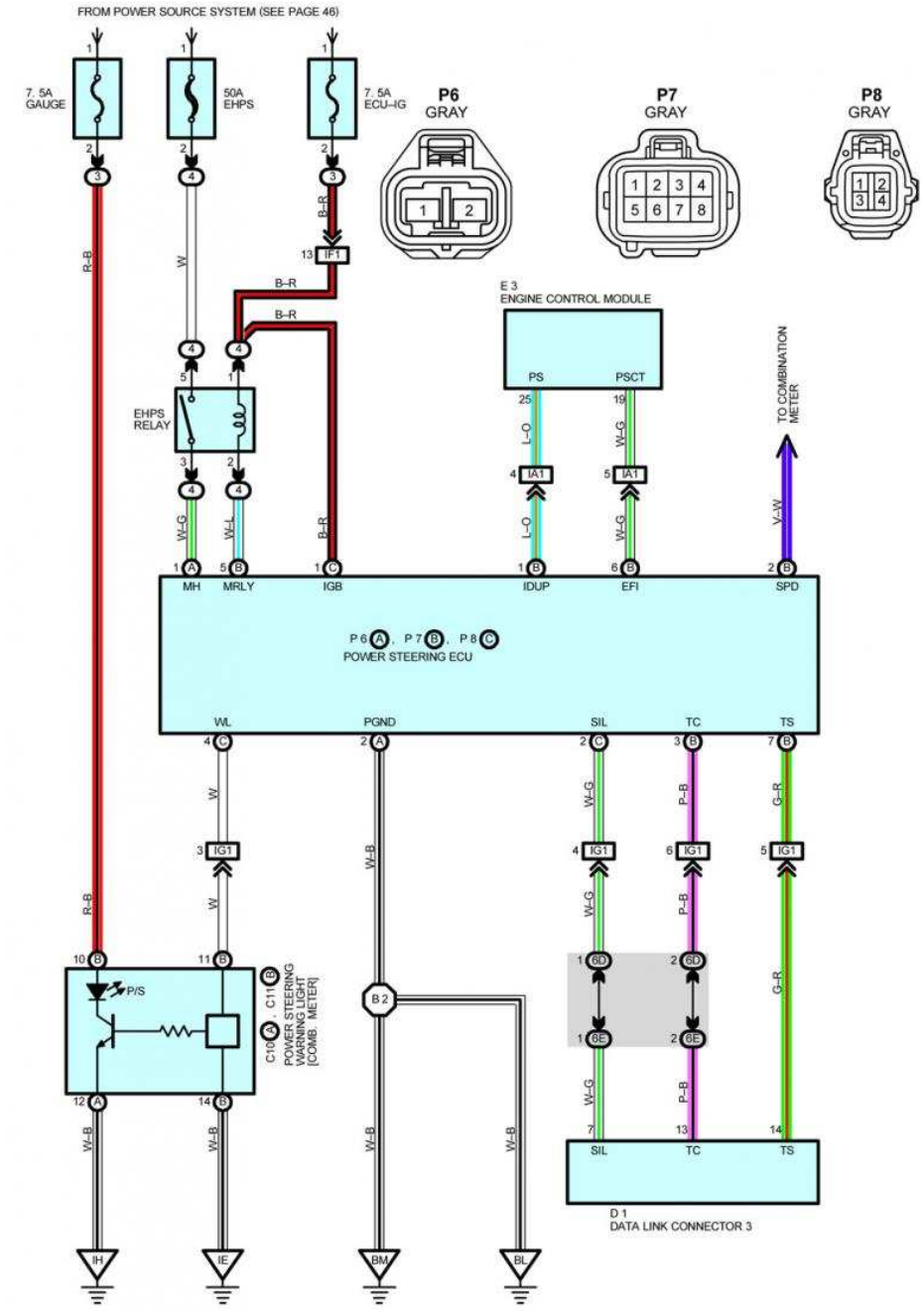
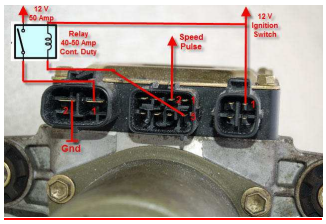

FROM POWER SOURCE SYSTEM (SEE PAGE 46)
7. 5A GAUGE
50A EHPS
7. 5A ECU-IG
P6 GRAY
P7 GRAY
P8 GRAY
E 3 ENGINE CONTROL MODULE
PS
PSCT
TO COMBINATION METER
EHPS RELAY
MH
MRLY
IGB
IDUP
EFI
SPD
P6 A , P7 B , P8 C
POWER STEERING ECU
WL
PGND
SIL
TC
TS
P/S
POWER STEERING WARNING LIGHT [COMBI. METER]
B 2
D 1 DATA LINK CONNECTOR 3
IH
IE
BM
BL



Possible source for Toyota connectors for the pump:

P6 connector Part # 90980-12068, list $9.63, source below $7.70

P7 connector Part # 90980-10897, list $9.75, source below $7.80

P8 connector Part # 90980-10942, list $6.34, source below $5.07

Olathe Toyota
685 N. Rawhide, Olathe, KS 66061
(866) 596-1970
parts@olathetoyota.com,
http://www.olathetoyota.com

PWM Mode for Non-MR2 Spyder Power Steering Pumps

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Since most other power steering pumps do not have a built in speed controller, to use them they need to be set up to directly control the motor power supply using Pulse Width Modulation (PWM).

The controller unit may be put into PMW mode by holding down the "left" and "down" keys for 12 secs. (actually it toggles the mode). A full reset (4 keys held) will default to regular MR2 spyder mode.

PWM mode can be identified when the unit powers up, since all 4 LEDs will stay on for 1 sec before starting operation. It is up to the user to provide the power FET transistors to switch the motor current.

Here my thoughts on the subject, though I have not tried to do this, so I cannot be sure it will work:

Non-MR2 pumps: How To

Ref the FETs (transistor) for other pumps:

These should work, $3.85 from Digikey (I'd buy a couple):

http://www.fairchildsemi.com/ds/FD%2FFDP025N06.pdf

http://www.fairchildsemi.com/ds/FD%2FFDP025N06.pdf

You need to screw it to a heatsink/chassis using the hole on the metal tab.
It needs Bare metal contact to conduct the heat away from the transisitor (actually you should use heatsink grease).
Note, I can't see if the metal tab is connected to any of the three pins on the FET. You need to be careful of this. If it is connected to the DRAIN (D) you're ok. If it's any of the other two, you need to use a special insulating mica washer under the transistor, which will still conduct the heat away, but electrically isolate the tab, such as:

http://www.mcmelectronics.com/product/21-1175
digikey probably has them, also.

and there is also a plastic spacer that stops the screw making electric contact.

You can just use a multimeter to see if the metal tab is connected to any of the 3 pins.

To hook up the transistor:

Connect the DRAIN (D) to ground
connect the SOURCE (S) to one side of the motor
connect the other side of the motor to 12v
connect the GATE (G) to 12v to start the pump and 0v to stop the pump.

Keep the wires to the motor short to reduce RF emmision.

Later you may have to add a ferrite bead around the wire to stop radio interference, but just get the basic stuff working 1st ;-).

If can get this working, I can send you a specially programmed controller that will connect to the GATE of tge FET transistor and will then speed control the pump.

Eventually, you need to water proof the circuit. You could buy a metal project box that is at least splash proof and screw the transistor to the inside of that to act as a heat sink. Then mount the box close to the pump on the frame to help pull the heat away.

I don't have access to a stand alone pump, so I can't test this myself, but is someone else could pioneer this and share the details, that would be good.

Oh, I just found the FET insulator kits from Jameco (insulator, washer, bolt and nut) from Jameco:
http://www.jameco.com/Jameco/catalogs/c291/P17.pdf

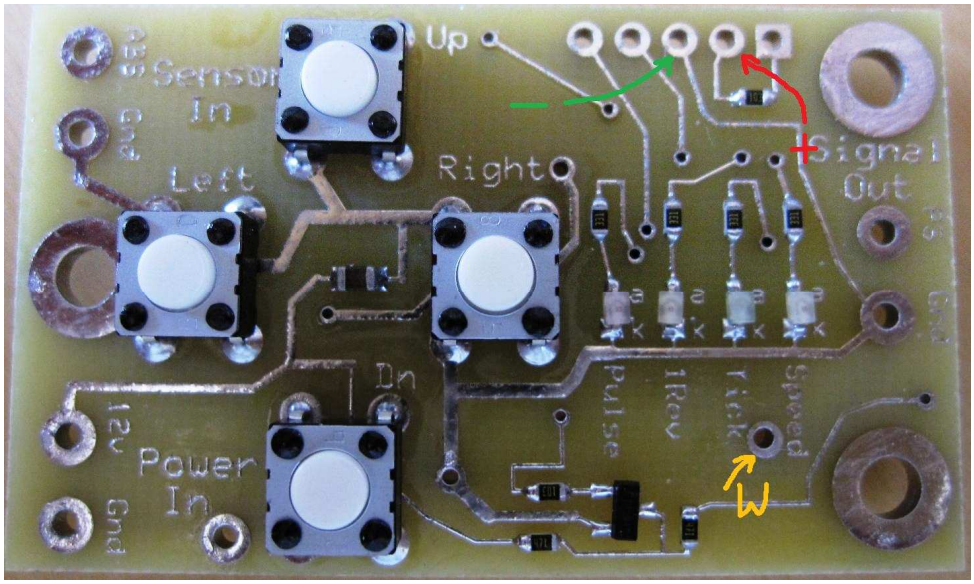
bottom left of the page, part number 34121, $3.95 for 5 sets

On the same page are nice heatlinks and one transistor may work, IRF3205
but the digikey one is better, as it has less ON resistance (RdsOn) which means that it won't get as hot.

I would buy two FETs and wire them in parallel, then connect the gate to 12v and run the pump for 2mins under load to make sure they don't overheat. BTW, don't run them w/o the heatrsink or they will burn up very quickly.
As a side note, I once had a PC that was flakey and kept crashing, I goit more and more frustrqated with it until one time it crashed I kicked the PC case (not very hard). But hard enough to knock off the heatsink/fan crom the CPU. Those CPU's generate huge amont of heat, the cpu burned up in <5secs .. it just went up in smoke!! Once you let the "magic smoke" out of electronics, they don't work anymore. The magic smoke is what makes them work.

BTW, the MR2 spyder pumps have the FETs built in and use the aluminum motor pump body as the heatsink.

Potentiometer Mode (Pot Mode)



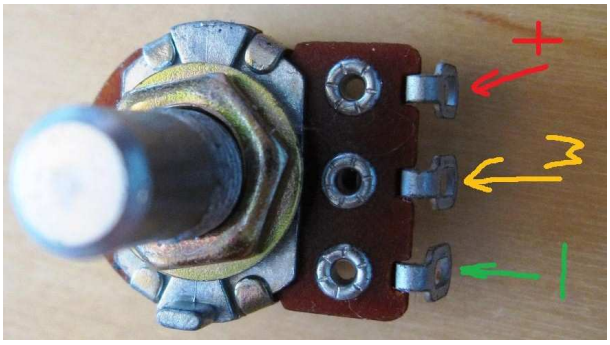
Newer revisions of the pcb have additional capability of "Pot Mode". New revisions can be identified by the hole marked "W" above. Also, the new board used the pic 16f88 microcontroller chip instead of the pic 16f87 chip. In this mode, the position in the table (x-axis) is not controlled by the speed of the vehicle, but it is controlled by the position of a user supplier potentiometer. This potentiometer can be cockpit mounted so that the driver can fine tune the power steering assistance "on the fly", for autocross events etc. To use this mode, connect up the 3 leads of a 10kOhm pot to the three connection points on the pcb shown above:

W is the wiper signal, normally the middle connection of the pot.

+ is the connection to the side of the pot that is connected to the wiper when the pot is turned fully clockwise.

- is the connection to the side of the pot that is connected to the wiper when the pot is turned fully counter clockwise.

A typical pot is shown here:



To toggle "pot mode" on and off, hold down the up, down and left keys for 10 seconds. When the command is accepted, the light will flash in an alternating pattern of 0101 and 1010. When in pot mode, the brightness of the pulse LED is controlled by the potentiometer position. This is a good check to make sure that the pot is hooked up correctly, and serves as a visual indicator that the board is currently set in pot mode.

Pot mode still uses the user defined 11 point table, but the board keeps its own copy of the table for this mode, so that as the user switches back and forth between pot mode and normal mode, the table doesn't have to be edited each time. On reset (all keys pressed) the pot mode table is set to:

0%, 4%, 8%, 12%, 16%, 20%, 24%, 28%, 32%, 36%, 100%

This is because the MR2 Spyder pump does not respond linearly with frequency applied. This is a good 1st approximation for the pot mode, but the user can edit the table if desired.