DIY - PC - Interface for Suunto Cobra/Vyper/Mosquito

Summary

This document is the distinct consequence of the Spyder/Stinger interface DIY.

After having many e-mails concerning the application for the above mentioned computers I finally decided to develop a prototype and then a small series of these interfaces.

For the electronics the schematic from the ACW interface could be used. The mechanical concept needed a complete redesign. For the contacts in the plug I wanted to use the proven concept with spring-loaded contact probes because I got absolutely no complaints about the reliability of the data transfer, which is obviously a result of the outstanding performance of these contacts. For the rest of the mechanical design I wanted to have a concept that fits to all of the three computer models.

I think that the design described in this document can easily be rebuilt for people skilled in doing home mechanics and handicrafts in electronics.

The circuit described here has proven to be reliable and safe. A correct assembled device will never harm the dive computer nor the PC it is attached to. However I do not take any responsibility for any kind of damage. If you decide to rebuild this unit, it's on your own risk.

Circuit description
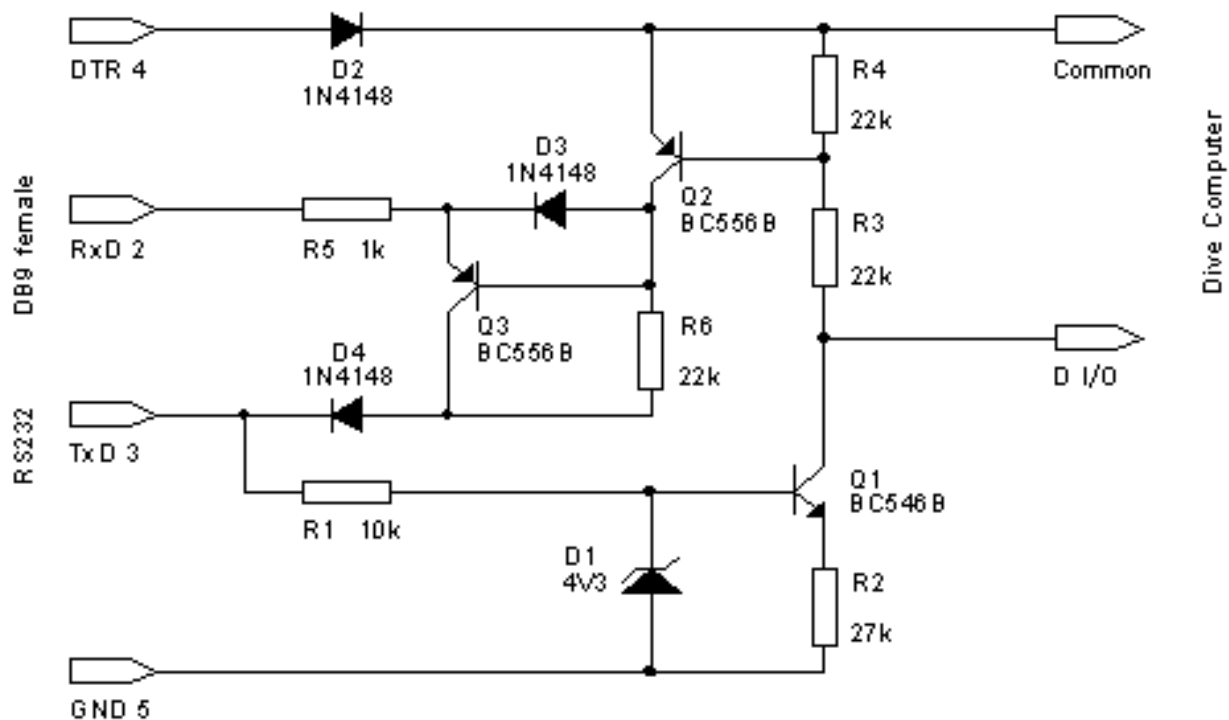
The circuit generally consists of two level shifters.
The power is taken from the output signal lines DTR and TXD. One thing I have noticed a while ago is that the DTR line is forced high during the whole communication process. I decided to use this line for the positive supply. A second fact is that the output RXD has to be low only when the input TXD is low. So I decided to use the TXD line for the negative supply of the RXD level shifter.

R1, R2, D1 and Q1 form a simple controlled current source. The current (about 120 microamps) produces a voltage drop of around 2.6 Volts across R4 when the TXD line is high. The voltage on R3 is limited by the B-E junction of T2 to about 0.6 Volts. The sum corresponds to the logic-high level of -3.2 Volts for the D I/O contact of the dive computer.

Q2, Q3, D3, R5 and R6 form a level shifter from the dive computer logic levels to RS232 levels. When the voltage drop across R3, R4 is more than about 1.5 Volts the RXD line is pulled high by Q2. With no voltage drop across R3, R4 and if the TXD is low the RXD line is pulled low by Q3. D3 is to protect the B-E junction of Q3 from being reverse biased and R5 serves to protect the circuit from damage due to shorting or miswiring RXD.

A few words about D2 and D4: Sometimes, especially before the PC software takes control over the RS323 port and after terminating the communication the DTR line can be low. D2 is to protect the circuit (and also the dive computer) from this condition. D4 is to ensure a defined function of the RXD level shifter even when the TXD signal level is higher than the DTR level. Otherwise the C-B junction of Q3 gets forward biased and the RXD output is defined via Q3 instead of Q2.

Remark: To achieve perfect function even with signal voltages down to ±2.5V (below RS232 specs but often used on PDA's) simply replace all diodes (including D1) with BAT48 Shottky and use R2 = 6.2kΩ and R6 = 10kΩ. Then add a LM385-1.2 bandgap voltage reference IC in parallel to D1 (see the spare traces on the PCB layout).

PCB Artwork
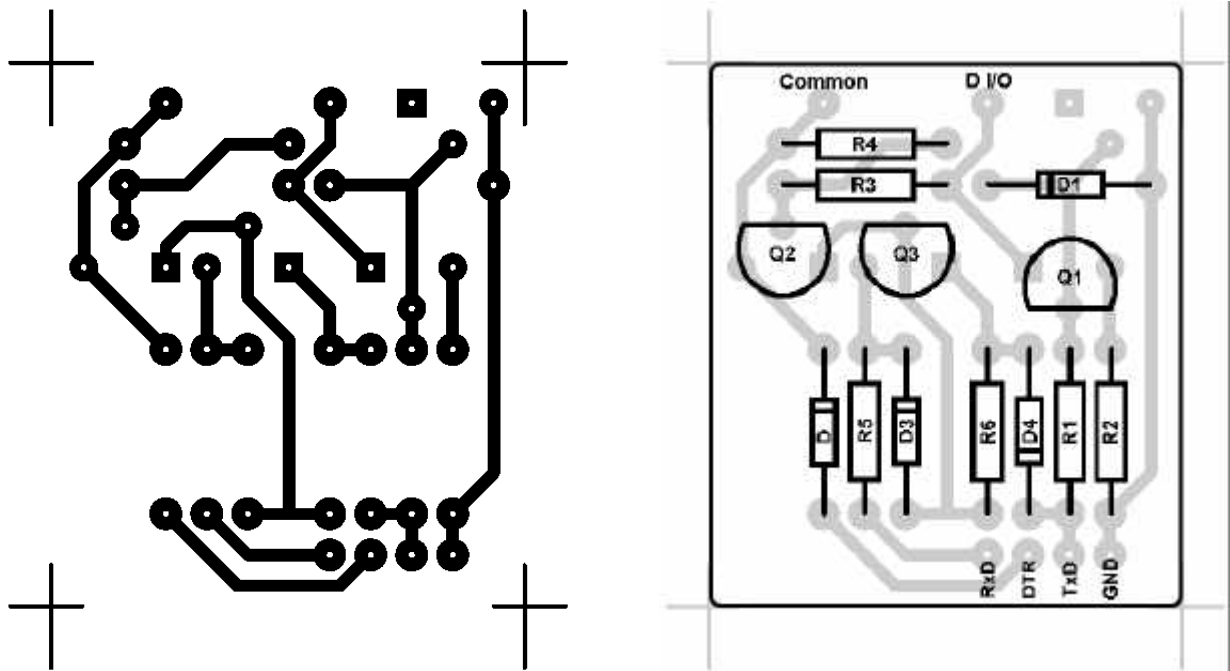
Layout and placement of the components (both top view) and in 2 : 1 scale.

The size of the PCB shown here fits into the housing specified in the parts list.

It should be no problem to reproduce the PCB since it is only single sided and the trace width as well as the spacings are comfortable. If you want to use the above layout for reproduction don't forget to shrink it by 50%.

Carefully note the orientation of the transistors on the layout which may be unconventional for the TO92 package. The square pad is the pin # 1 (left when seen from the front).

Parts List

(The remarks in brackets are for easier finding equivalents)

| Electronics:			Others:		
Q1	1	BC546 (NPN, 100mA)	Cable	1	4-core, 1-2 meters
Q2, Q3	2	BC556 (PNP, 100mA)	Connector	1	DB9 female
D1	1	BZX55C4V3 (zener 4.3V 0.5W)	Contacts	2	Feinmetall part-#
D2...D4	3	1N4148 (100mA silicon diode)			F620.115.120.N.075
R1	1	10kΩ	Plug part	1	see below
R2	1	27kΩ	PCB	1	see above
R3, R4, R6	3	22kΩ	Housing	1	Conrad part-# 52 20 74
R5	1	1kΩ	Rubber band	1	
all resistors > 0.25W					

The Plug

The plug consists of a support part to hold the spring contact probes and the contact probes themselves. Refer to the drawing below for the dimensions of the support piece.
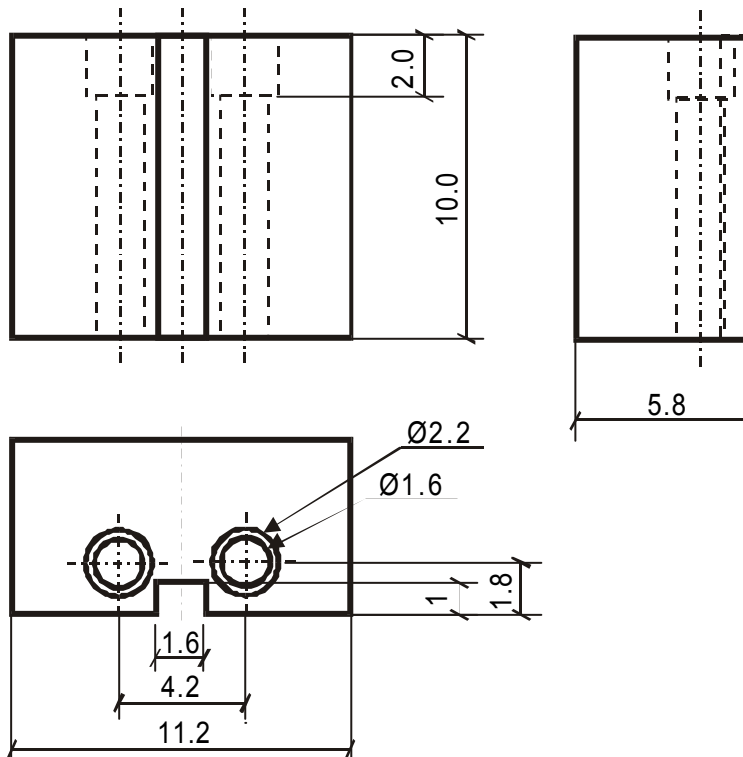
The Assembly
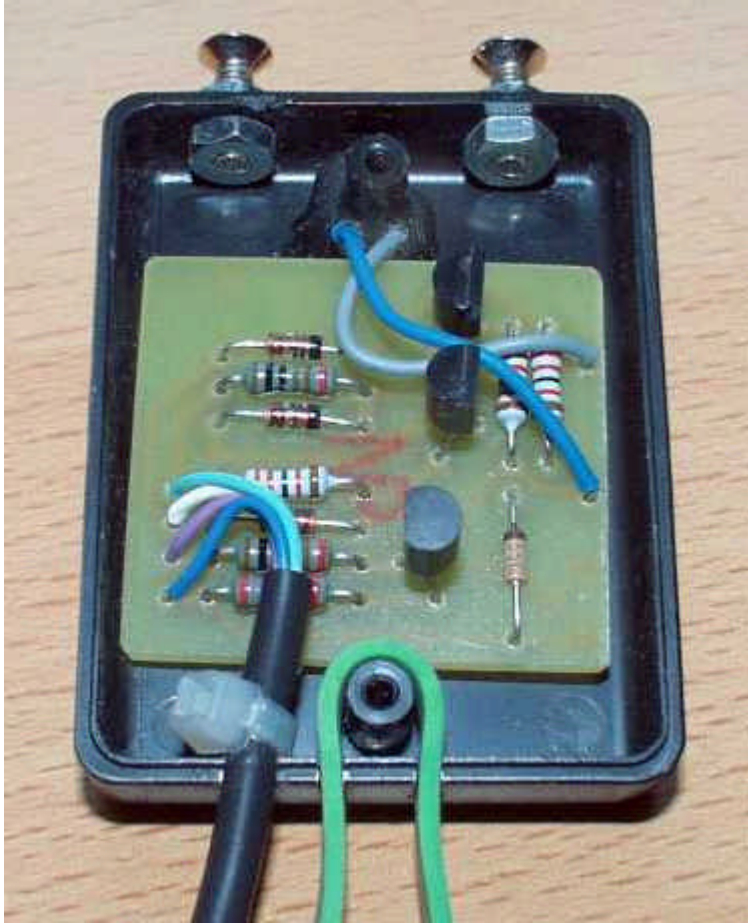
The above picture shows the PCB placed inside the housing. The solder ends of the spring contact probes extending from the plug are glued into two holes in the housing with epoxy resin. The PCB is held inside the housing with another drop of epoxy resin. I use two screws with nuts to wrap the rubber band around. You can see the openings in the other end of the housing for the cable and for the rubber band.
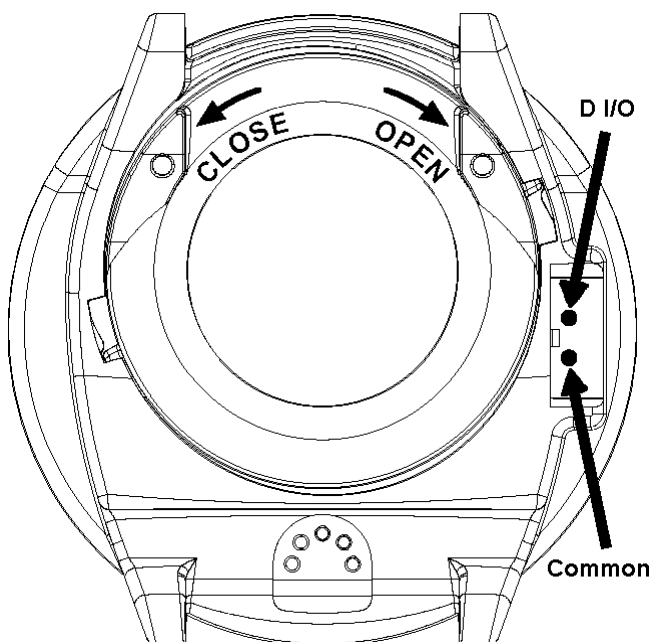
This picture shows the arrangement of the contacts on the back of the dive computer.

The example is for the Vyper but it's the same on Mosquito and Cobra, too.

Test

It's favorable to test the circuit before putting it into operation. All you need is a dual output adjustable power supply (two 9V batteries do the job, either) and a voltmeter.

1) Set DTR and TxD to +9V in respect to GND. The voltage across the dive computer contacts should become around 3V and the voltage at RxD should be around +8V to GND.
2) Change TxD to –9V. The voltage across the dive computer contacts should become zero and the voltage at RxD should be around –8V.

Are these tests successful, you can plug the interface to the PC and see if the Dive Manager software recognizes it by the test routine. Now you can perform your first data transfer.

Pictures

That's it... Inspire yourself with the pictures and improve the design even more. If you e-mail me pictures of your designs, I could add them to this documentation or put them on my web page.

In Case of Problems

First of all there are no known problems with the PC-interface or the Suunto software. In most of the cases the problem with the data transfer is due to dirt on the water sensor contacts, improper COM-port selection or the "COM time delay" value is not suitable for the hardware used. Here are some hints & tips:

When you often get the Transfer Timed Out error message, try the following:

1. Make sure that you have your PC-interface properly connected to your PC following the instructions of the program and the Help utility. Run the TEST utility from the Transfer Menu - PC Interface Setup window which should recognize the COM-port to which the PC-interface is connected to. Now make sure that this COM-port is the one you have selected.

2. You can set the "COM time delay" in the Interface Setup window of the Dive Manager program. The value depends on the hardware used (is it a powerful PC or not, and some other PC settings). It is advisable to experiment with different values and see which one works the best. A value between 10 and 50 should be appropriate for 95% of all computers.

3. The water sensor contacts are sometimes contaminated with dirt or corrosion, which usually causes problems with the data transfer. Carefully clean the PC-interface pins and the water-sensor contacts of your computer with a soft eraser or dry cloth.

4. Attach your interface plug to the dive computer when you are asked to do so by the Dive Manager software, then switch the dive computer to the TR-PC mode . According to the program's Help, you should set your computer in TR-PC mode before attaching the PC-interface. However some users have good experiences when setting the computer in PC-TR mode after the interface is attached.

5. If you had an unsuccessful transmission just leave and re-enter the TR-PC mode (without removing the interface from the computer) to try again.

   Remark: On some dive computer models 4. and 5. don't work because the computer enters the Dive mode (when it is not yet in TR-PC mode) as soon as the interface is attached.

6. Do not move or touch your dive computer and interface while transmitting because any movements may interrupt the transfer and you have to start all over again.