# DIY - PC - Interface for Suunto Spyder/Stinger ACW

**Summary**

This document is intended to be read after the "DIY-PC-Interface for Suunto Spyder ACW" from September 2000. However, it can also be read separately.

After having built more than 20 interface boxes with the old schematic I thought it was time to spend some time thinking about simplification of the design. The previous schematic was a straight forward approach without knowing much about the data format and handshaking of the transfer protocol. The new schematic discussed in this document is more sophisticated and therefore also reduced in versatility, meaning that only the use of the Suunto Dive Manager / ACW Dive Log programs with Spyder, Stinger, Cobra, Vyper/Vytec, Mosquito and D3 can be assured. The main advantage of the new schematic is that the component count of the old design is cut in half. The dive computer models Cobra, Vyper/Vytec, Mosquito and D3 need a different mechanical design. There is a separate document available for these models.

I have been thinking about a new housing but the old design was very successful and reliable. So I decided to rely on the proven concept.

I have also included the PCB artwork in the document, that will allow the reproduction of reliable units.


Note: 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
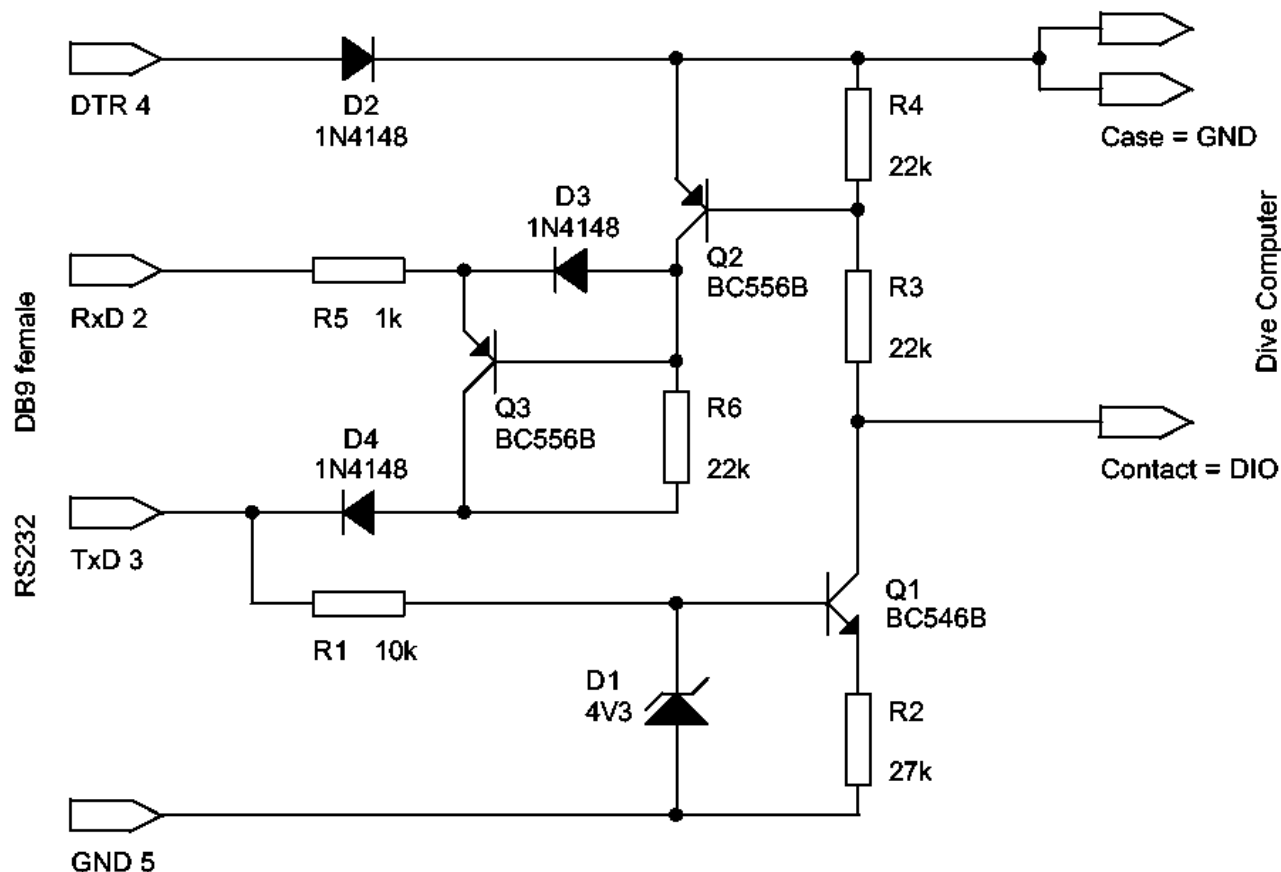


The circuit generally consists of two level shifters.
The power is taken from the output signal lines DTR and TXD. One thing I have noticed a while ago is that the DTR line is forced high during the whole communication process. I decided to use this line for the positive supply. A second fact is that 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 R3 when the TXD line is high. The voltage on R4 is limited by the B-E junction of Q2 to about 0.6 Volts. The sum corresponds to the logic-high level of -3.2 Volts for the "water sensor" contact of the ACW.

Q2, Q3, D3, R5 and R6 form a level shifter from the ACW 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.

Notice: The metal case of the dive computer is not on the same potential as the GND of the RS232 connector (difference to the "old" schematic).

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).

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**PCB Artwork**
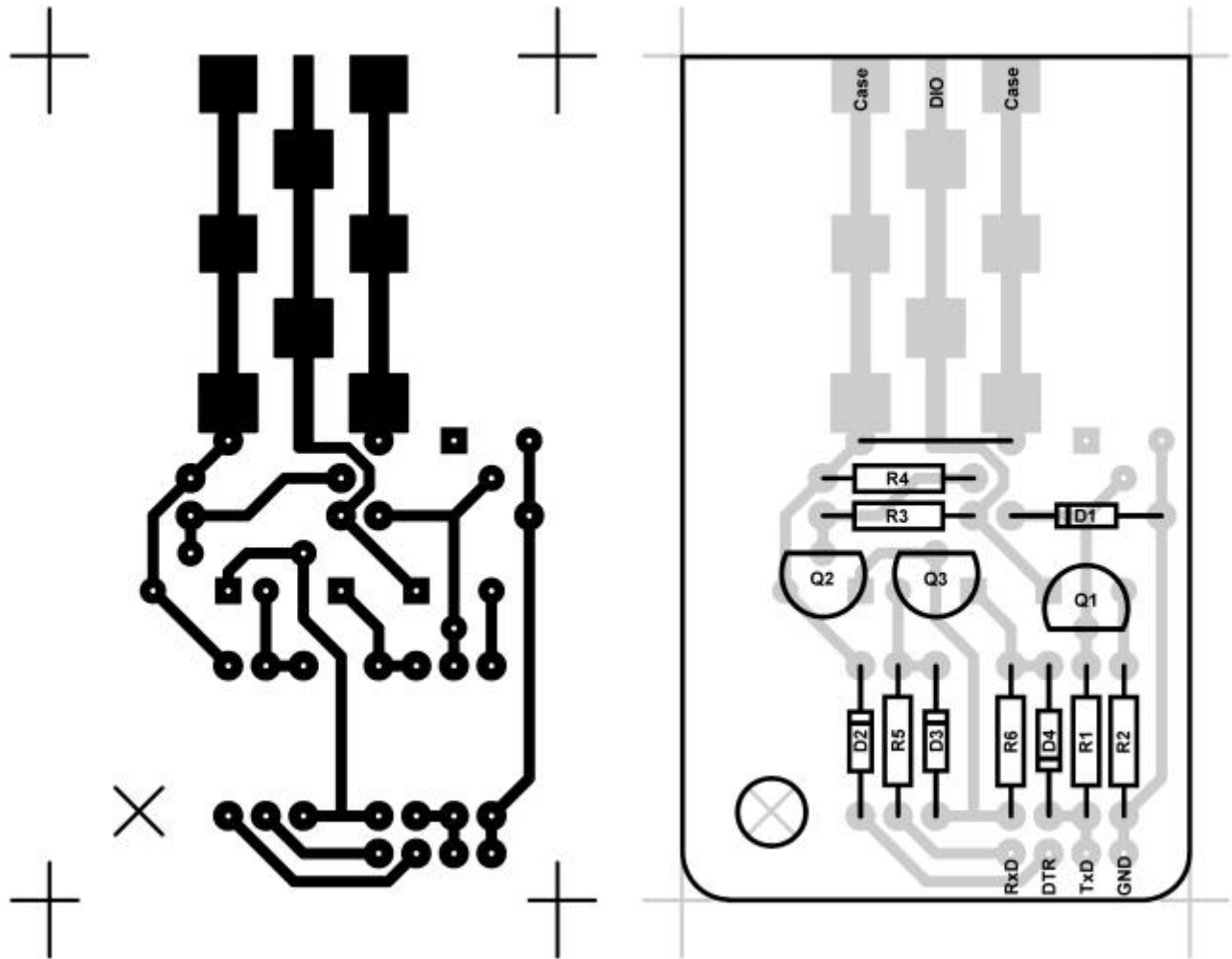


Layout and placement of the components (both top view) and in 2 : 1 scale.

The layout shown here is intended for the housing I purchase from Conrad Electronic explained in the following chapter.

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%.

The bulky solder pads and traces are to hold the three sleeves of the spring-loaded contacts in place on the solder side of the board. I use Ingun part-# 112 313 100 R 1502 with their corresponding sleeves. These are certainly expensive parts but give a true reliable contact to the ACW. I never had complaints about it.

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:

| | | |
|---|---|---|
| Q1 | 1 | BC546 (NPN, 100mA) |
| Q2, Q3 | 2 | BC556 (PNP, 100mA) |
| D1 | 1 | BZX55C4V3 (zener 4.3V 0.5W) |
| D2...D4 | 3 | 1N4148 (100mA silicon diode) |
| R1 | 1 | 10kΩ |
| R2 | 1 | 27kΩ |
| R3, R4, R6 | 3 | 22kΩ |
| R5 | 1 | 1kΩ |

all resistors > 0.25W

Others:

| | | |
|---|---|---|
| Cable | 1 | 4-core, 1-2 meters |
| Connector | 1 | DB9 female |
| Contacts | 3 | Ingun part-# 112 313 100 R 1502 don't forget the solder sleeves |
| PCB | 1 | see above |
| Housing | 1 | Conrad part-# 54 12 14 |
| Pillars | 4 | M3 * 20mm |
| Rubber profile 10mm | | |

## The Assembly
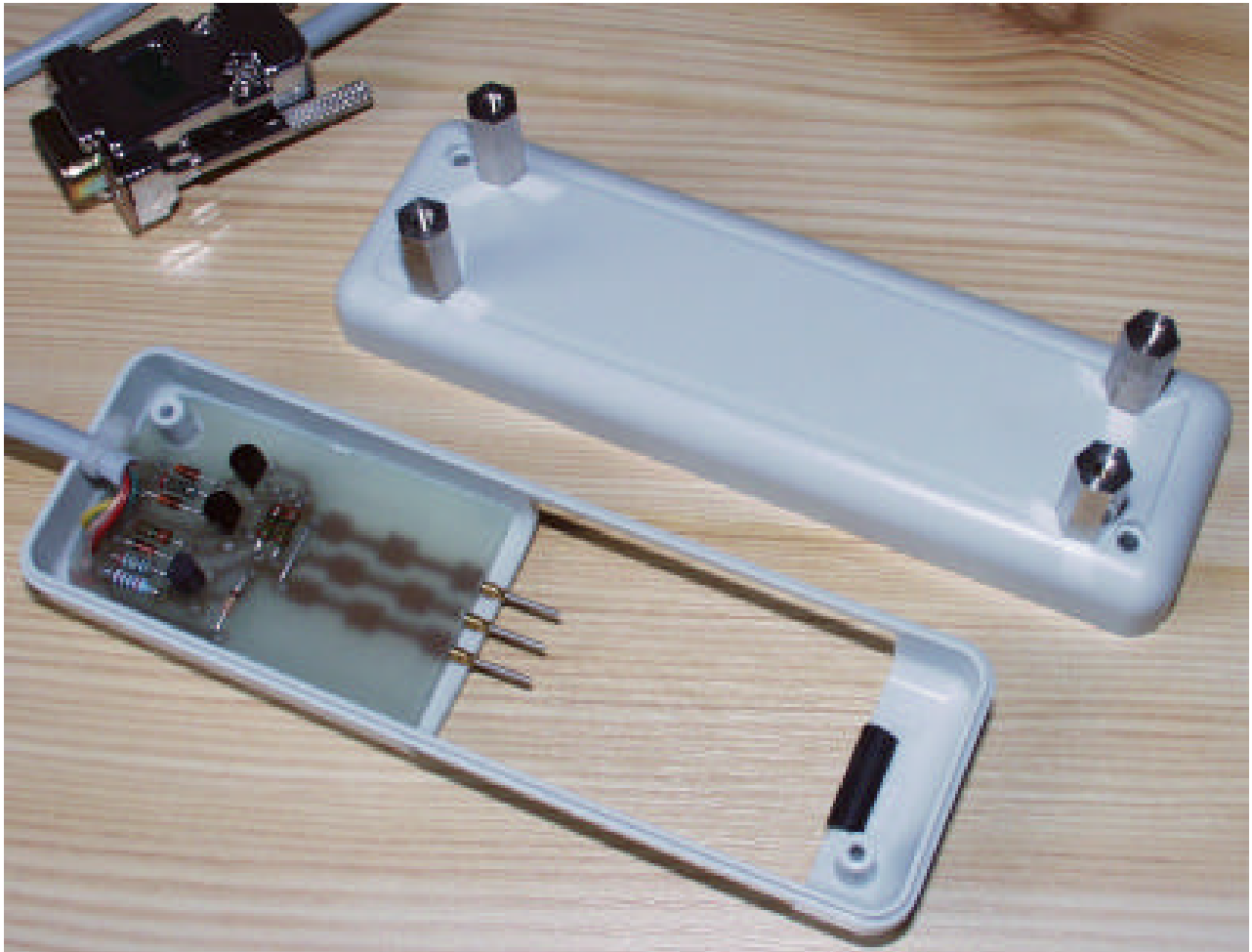


The above picture shows the PCB mounted inside the housing. The sleeves of the spring loaded contacts with rounded tips are soldered directly on the PCB. The position of the PCB inside the housing is chosen such that the ACW fits in respect to the contacts. The PCB is mounted inside the housing with hot-glue... ...I know, I know. But it's simple. And it works!

**Test**

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

1) Set DTR and TXD to +9V referred to GND. The voltage across the dive computer contacts should become around 3V and the voltage at RXD should be around +8V.
2) Change TXD to –9V (keep DTR at +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.

**The Housing**



Some electronics people will have their trouble with the construction of the mechanical parts of the interface. I have found that very nice and handy housing at the German distributor "Conrad" that requires only little machining. See how I machined the housing for inserting the ACW on the pictures.

To keep the ACW secure in place while communicating I added a piece of rubber profile normally used to protect sharp edges.

One disadvantage is that the cradle is too light. It can be compensated for when you add some heavy pillars on the bottom. This lifts it up from the table which is good when you have the ACW with rubber wrist straps.

Some people may find that the size of the cradle is too big. However, with a smaller housing it gets more difficult to put all parts in. Furthermore there is so much memory in the ACW that needs several weeks of intense diving activity to fill.

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 contact, 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 program 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 Log 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 of 10 should be appropriate for 95% of all computers.

3. The spring contact in the middle (out of 3) of the cradle is the most important one. Sometimes this pin does not make a proper contact to the water-sensor of your ACW. Carefully clean the three PC-interface pins and the water-sensor of your ACW with a soft eraser or dry cloth.

4. Insert the ACW into the cradle and carefully twist your ACW just a little bit to ensure a proper contact of the middle pin. Now look at your ACW's display and notice a short 'blink'. This blink tells you that the connection is made correctly and that your ACW is ready to transmit. According to the program's Help, you should set your ACW in TR-PC mode before inserting the unit into the PC-interface. However some users have good experiences when setting the ACW in PC-TR mode after the unit is inserted.

5. If you had an unsuccessful transmission just scroll through MEM - LOG - HIS to TR-PC with the upper left button of the ACW (without removing the ACW from the cradle) to try again. It is also advisable to set the ACW to MEM-mode (upper right button) before inserting into the cradle and after inserting scroll to TR-PC. Now notice the 'blink'.

6. Do not move or touch your ACW and PC-Interface while transmitting because any movements may interrupt the transfer and you have to start all over again.

7. To confirm the proper working of your ACW's TR-PC mode you can also simulate the 'blinking' effect (see 4) by using an open-bent paper-clip. Connect the paper-clip's ends between the water-sensor and the metal chassis of your ACW. Now notice the 'blink'.