The original USB PC-interface uses a Prolific PL2303X USB-to-serial converter chip, which is also found in many USB-to-serial converters. An extra EEPROM (non-volatile memory) is added to set a custom VID (Vendor-ID) / PID (Product-ID) to prevent the OS to detect it as a standard USB-to-serial cable.

To save components, the EEPROM is almost never included in standard USB-to-serial converters. However, on many of these converters, space is reserved on the PCB to mount the EEPROM.

The communication from and to the dive-computer is basically a simple pull-down 2-wire interface, but is slightly different from (for instance) the Suunto computers.

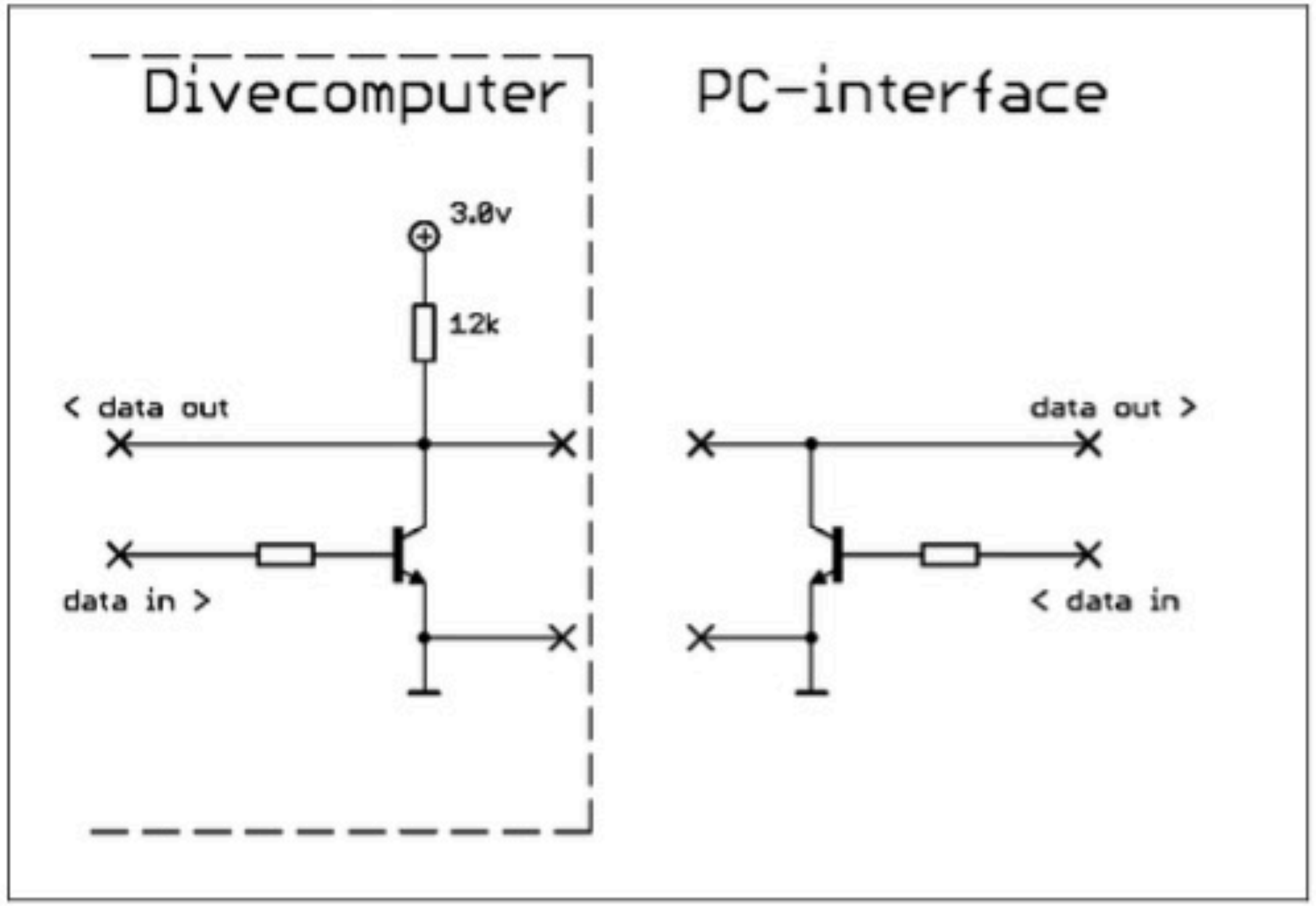


Figure A1: Internal and external data I/O

Both the interface as well as the dive computer can pull-down the data line low. Unlike the Suunto dive-computers, the Seiko dive-computers have an internal pull-up resistor of about 12k, which is connected to the internal supply of 3.0 volts. A zero is represented by a 3 volts, while a one is represented by 0 volts. This is another dissimilarity with the Suunto dive-computers, where the data is not inverted.

Since the dive-computer already has a pull-up resistor, a relatively large pull-up resistor in the pc-interface can be used, since this resistor is only needed to keep the data line in a defined state (high) when the dive-computer is not yet connected.

The communication is pretty slow with 1200 baud, 8 bits, 1 stop bit and no parity.

1. Circuit Description

The actual schematics and PCB layout can be found at the end of this document. Below you will find the description of this circuit.

Input circuitry (pc to divecomputer)
The input circuitry consists of only one transistor. Transistor T1 is the pull-down transistor that pulls the data-line to ground. Resistor R7 limits the current to the resistor, while diode D7 protects the transistor from any negative base voltage, when the TXD-line is low (which is between –5 and -12 volts). T1 also inverts the data, since a zero is represented by a negative voltage, while a one is represented by a positive voltage on the TXD-line.

Output circuitry (divecomputer to pc)
Transistor T2 amplifies and inverts the data coming from the dive-computer. R5 limits the current to the base of T2. Transistor T3, diode D9 and R6 form an active pull-up. This is done to save current, while maintaining switching speed. R4 keeps the data line high when no dive-computer is connected. This makes sure that the data-line is in a defined state (zero).
R3 and zener-diode D8 limit the supply voltage to this stage to 4.7 volts. Since the voltage on the base of T2 is about 0.7 volts, the voltage between the divecomputer pins is about $(4.7 – 0.7) * (100k / (100k + 100k)) + 0.7 = 2.7$ volts, which is sufficient and not dangerous for the divecomputer. D8 also makes sure no negative supply voltage reaches the positive divecomputer pin.
It should be noted that the output swings from 0v to +5…+12 (depending on input voltage). Although this is not completely within the specs of a serial port, almost all serial ports correctly detect such voltages.

Power supply
The power supply serves two purposes. The first is to protect the dive computer from any negative voltage on its inputs. The second is to derive a positive supply voltage if only negative supply voltages are available on the serial port outputs. This is needed since the software does not pull any of the outputs high anymore, when the altered USB-to-serial cable is used.
D1, D2, D3, D4, C1 and C2 form a rectifier circuit to rectify the incoming supply voltages. D1, D2 and C1 rectify the positive supply voltage, while D3 and D4 and C2 rectify the negative supply voltage.
The power conversion is done by a switched capacitor charge pump. IC1 (a very common 555 timer IC), R1, R2 and C4 form an oscillator with a push-pull output stage. This output stage can deliver up to 200(mA) and is therefore ideal for our application. Combined with C3, D5 and D6, a voltage doubler is formed. C5 is added to suppress any spikes on the supply voltage, since the peak currents can be relatively high.
Although a 'real' voltage doubler (such as the MAX860) would probably perform better, availability is certainly an issue with these IC's. Also, the output does not have to be regulated as well, since the voltage on the dive-computer output stage is already limited by D8 and R3 to about 4.7 volts.

Connector X1 (a female SUBD-9 connector; not shown in schematic) is connected through a 4-wire cable to the interface. Pins 1, 4 and 6 and pins 7 and 8 should be interconnected. This is done to ensure that in the case when hardware-handshaking is enabled, the data is still available and no timeouts occur.

Special care has to be taken when the diodes are placed. Every diode has a ring that marks the cathode. The diode should be placed exactly as drawn on the component side of the PCB. Also the capacitors and the IC have a marking that should correspond to the drawing on the component side of the PCB. Note that D1 to D7 can be any low-power diodes, preferably Schottky ones, which have a lower voltage drop across them. Do not use 1N4001…1N4004 diodes. These diodes are used in mains rectifiers and are too slow for this application. They also don't fit very well on the PCB.
D8 is a Zener-diode of 4.7 volts. A normal diode will certainly not work here and might possibly damage your divecomputer. D9 must be a 1N4148, or at least a 'normal' diode, which has a voltage drop of about 0.7 volts, otherwise the output circuit won't work.

Make sure you don't overheat your components when soldering them. To prevent the IC from overheating, you might want to place it in a DIL8-socket. If all the components are placed, check again if they are placed in the correct way.

Do not forget to mount the 4 wire-bridges near the SUBD-9 (DB9) connector. If correctly built, your interface should look like this:

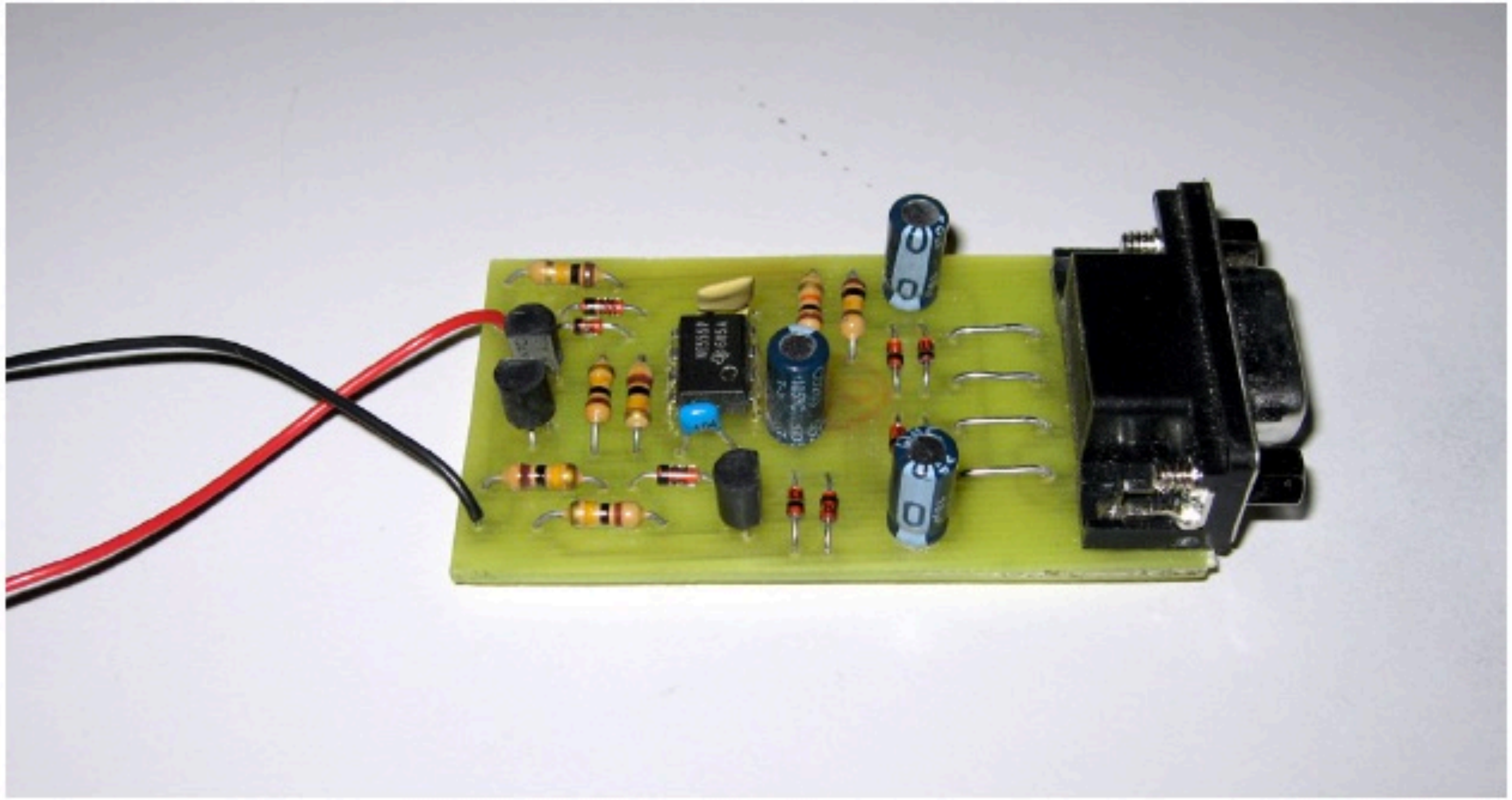


Figure 2: Assembled PC-interface

It is also possible to cut the board as pictured below and mount the SUBD-9 connector via a 4-wire cable to the PCB. This may be handy if you want to place the connector outside the case and connect it through a cable.

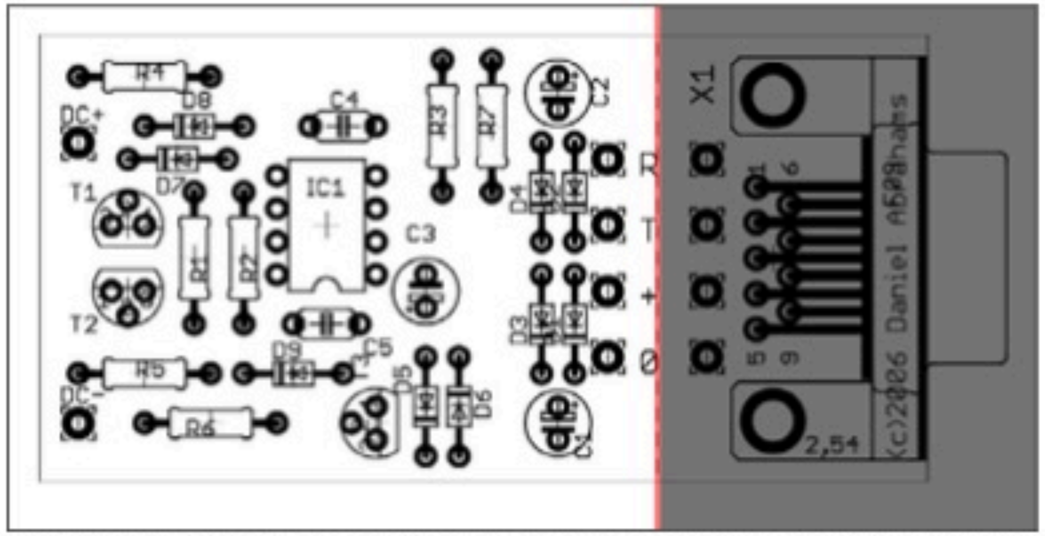


Figure 3: If you don't want to mount the SUBD-9 connector directly to the board, Cut the board on the red line as shown in the picture above

Make sure not to damage any of the wires on the PCB.

On the SUBD-9 (DB9) connector (female), pins 2, 3 and 5 should have a separate wire. Pins 1, 4 and 6 are interconnected. Together they share another wire. Finally, connect pins 7 and 8 to each other. Now, solder the other end of the cable to your divecomputer interface. The wire connected to pin 2 should be connected to 'R', the wire to pin 3 to 'T', the wire to pin 5 to '0' and the wire to pins 1, 4 and 6 to '+'.

A schematic of these connections can be found in the figure below:

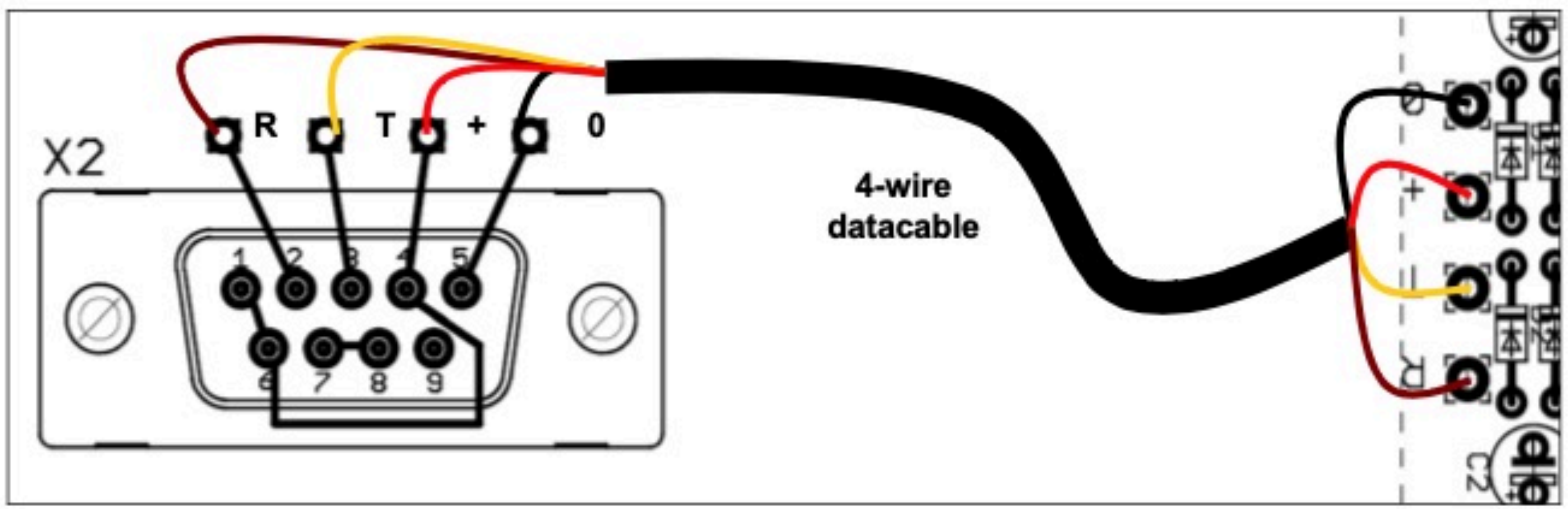


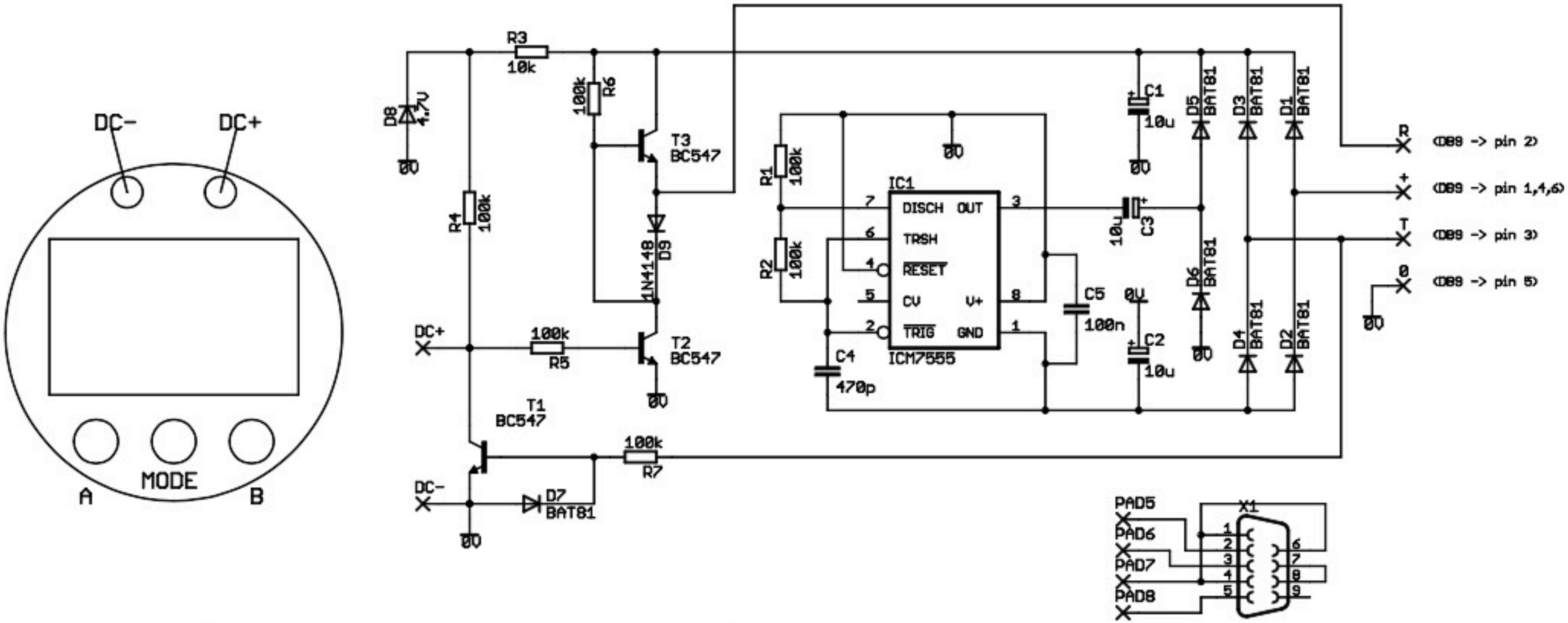
Figure 3: Back (solder) side of the SUBD-9 female connector and the connection to the divecomputer interface.

Appendix C Partlist

Resistors	
R1, R2, R4…R7	100kΩ
R3	10kΩ
Capacitors	
C1, C2, C3	10uF (electrolytic, 25Volts or higher)
C4	470pF
C5	100nF
Semiconductors	
D1…D7	BAT81, BAT85 or any other low-drop equivalent
D8	Low-power zener diode 4.7V
D9	1N4148
T1…T3	BC547
IC1	NE555 or any other equivalent
Other materials	
1x	9 pin SUBD female connector (PCB mounted or wire-mounted; see chapter 3 for more details)
1x	4-wire (data) cable (optional; see chapter 3 for more details)

PC INTERFACE

For Cressi-sub Archimede I/II, Apeks Quantum, TUSA IQ-700, Dive Rite Nitek Duo



READ THIS FIRST!

The use of this schematic might possibly damage your PC or your divecomputer

The author cannot be held responsible for any damage occured by using this schematic

USE THIS SCHEMATIC AT YOUR OWN RISK

Before connecting your divecomputer:

Check the polarity of DC+ and DC- and if the voltage between DC+ and DC- does not exceed 3.0v

D1...D7	BAT81 or any equivalent
D8	Low-power zener diode 4.7 volts
D9	Must be 1N4148

SEIKO COMPUTER INTERFACE

TITLE: seiko-interface-ser-v12

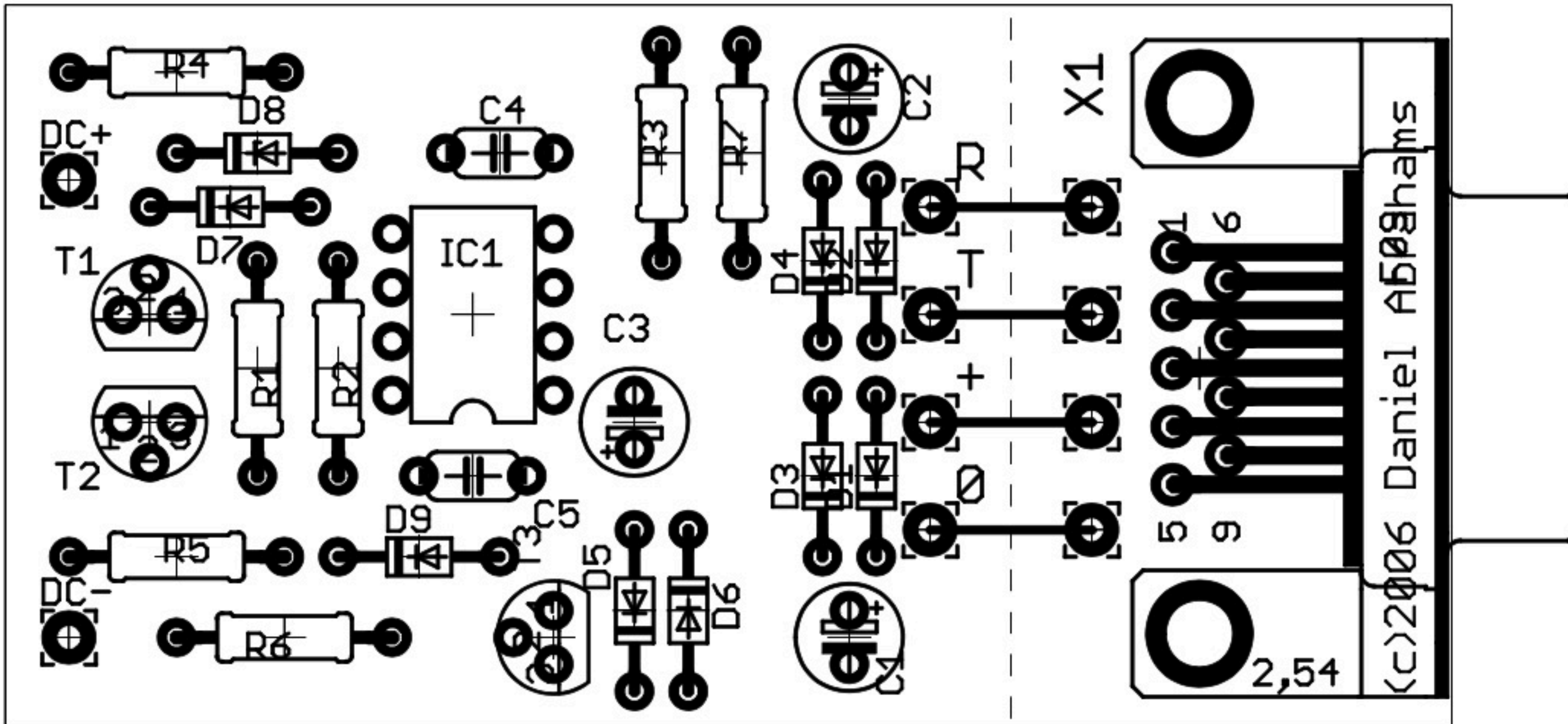
Document Number:

REV: 1.1

Date: 04-09-2006 16:27:39

Sheet: 1/1

COMPONENT SIDE



Appendix B How to connect an external supply

Some USB-to-serial cables are not capable to deliver enough current to supply this interface. In that case, the interface will not work. To make it work, disconnect pin 1,4 and 6 or cut the '+' wire-bridge. Then, connect a 9v battery between '+' and '0', as shown below:

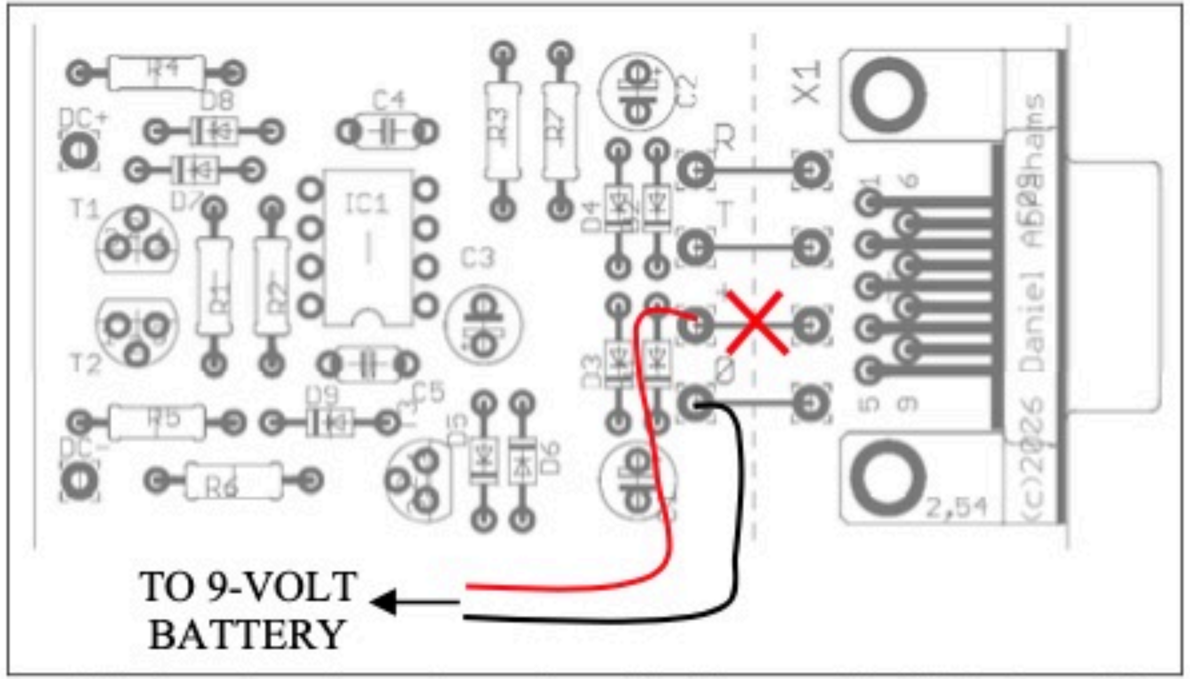


Figure B1: An external supply can be added in case the USB-to-serial cable cannot deliver enough current to supply the interface.

In the above picture, the red wire is connected to the '+' of the 9volt-battery, the black wire is connected to the '-' of the 9volt-battery. Make sure to connect the battery through an on/off switch, to prevent the battery to be drained by the interface when it is not used.

SOLDER SIDE