



Instructions for building an OpenVario DS2

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Many thanks to Daniel Smolka for developing the OpenVario DS2, for providing pictures and the many helpful tips on building the OpenVario DS2. These notes have all been incorporated into the instructions here!

I. General

When we talk about the classic OpenVario, we have to distinguish the variant that is available opensource and the variant that Stefan sells in his shop. They differ mainly in the connections, and here especially with the ttyS0 to ttyS3. When the classic OpenVario is mentioned here, it refers to the opensource variant.

The OpenVario DS2 differs from the classic OpenVario in the following:

- it has 7 USB slots:
 - a USB slot is directly connected to a USB port on the Cubieboard. The other 6 are connected to the second USB port via a hub.
- all 4 RJ45 places can be used: with the classic OpenVario only 3
- the RJ45 places are correctly arranged, i.e. ttyS1.... ttyS4
- A slide switch can be used to decide for each Rj45 place whether it is supplied with 5 or 12V
- every RJ45 place is occupied with RS232 and TTL signals
- the voltage converter is neatly integrated in the board
- the amplifier is no longer on the sensor board but on the adapter board
- the sensor board no longer has a sensor for AHRS, which has not worked anyway. However, it has a slot for a suitable module if the function should be implemented in the future
- The connector board is no longer needed, it is integrated in the adapter board
- The tire block is made of aluminum and has two ring grooves for sealing rings

In addition, a completely new, very complex sensor board is being developed. This differs from the previous one in:

- an attached ESP32, which should allow a more reliable timing of the sensors. So far, that was the problem why the temperature sensor did not work. The main processor is also relieved in this way.
- AHRS is implemented via a three-axis accelerometer / gyro combination IC and a three-axis magnetometer IC as well as GPS
- You can choose from three different differential pressure sensors

This sensor board is not yet part of this manual. Due to its complexity, however, it is more likely to be obtained completely soldered. An exchange then becomes easy.

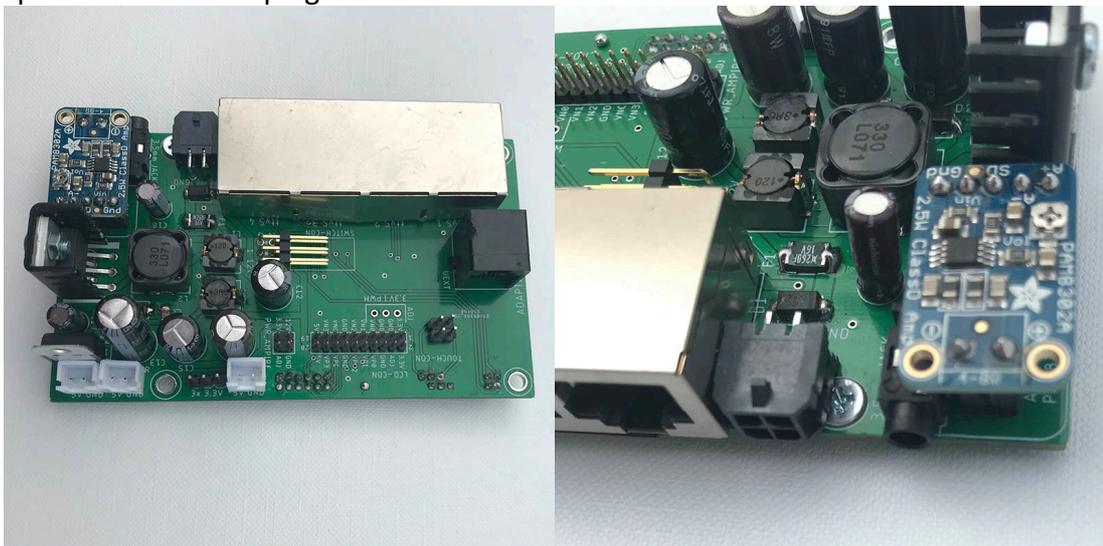
II. Parts List

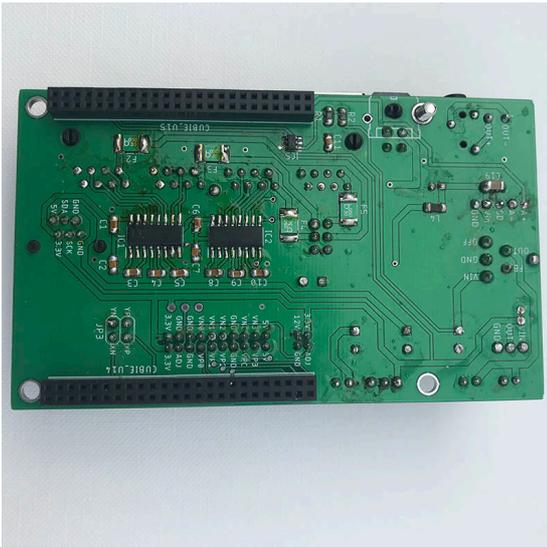
- PCBs and components for sensor, adapter and switch boards according to BOM
- USB hub (Aliexpress "1 to 7 ports USB expansion board 7")
- RJ12 connection cable for adapter and sensor board
- Connector for USB hub and Cubieboard (1x JST B4B-XH-A, 1x JST XHP-4, 4x BXH-001T-P0.6)
- Pneu-Block
- 5x hose nozzles (M5, Ebay)
- Approx. 0.2m silicone hose suitable for your hose nozzle

- Casing
- Front frame for your display
- Display (Texim 7 "(CH070OLDL-002-CHEF), Texim 5.7" (CH057DLCL-002-CHEF), Ampire 7 "(AM-1280800P3TZQW-00H-AMPI or the less bright variant AM-1280800P3TZQW-10H-AMPI))
- Display cable:
for Texim Display: Aliexpress "20Pin DF14 20-20 Signal 8-Bit LCD". Often these cables are not fully occupied. Then buy two and take the missing cables from one.
for Ampire Display: Aliexpress "DF19KR-20P-1H"
- possibly touch panel (Aliexpress "7.1 inch touch screen for AT070TN83" or "127mm * 99mm touch screen panel digitizer")

III. Equipping the adapter board

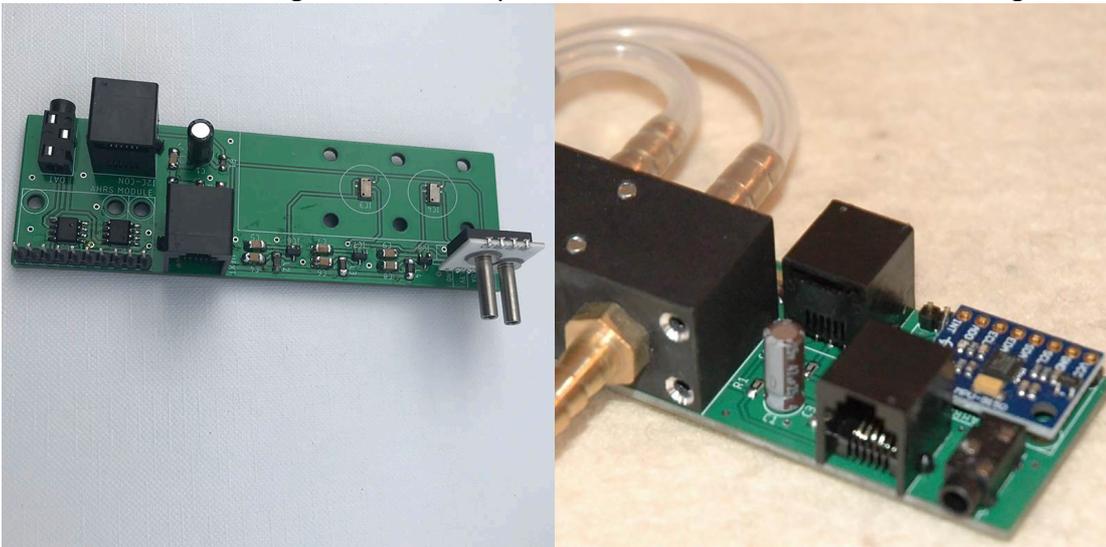
1. Countersink the mounting hole, which is slightly overlapped by the 4-pin connector (see second photo), with a 90 ° countersink until the M3x6 countersunk head screw is flush with the board surface.
2. Solder the adapter board according to the BOM and shown on the pictures. Make sure that the M3x6 screw is inserted before the connector is soldered on.
3. The front of the plug of the audio board is 3.5mm. Separates two single sockets from a socket strip and solder them into the adapter board. Do the same with the pens for the audio board. Uses socket headers with a height of 8mm so that there is enough space for the audio plug.





IV. Equipping the sensor board

1. Solder the sensor board according to the BOM and shown in the picture.
2. I recommend soldering the two small pressure sensors with a hot air soldering iron.



V. Equipping the switch board

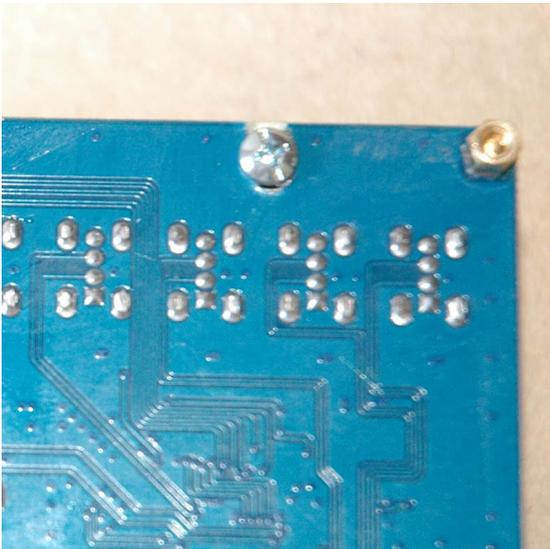
1. Solder the switchboard according to the BOM and shown in the picture.
2. I recommend you to put M3 polyamide washers under the fastening screws and nuts on both sides. The screws can damage the coating of the board and cause a short circuit.
3. Use two of the M3x6 standoffs and two of the M3 self-locking nuts.

4. The soldered joints of the slide switches are wider on some models on the switch housing. So that the slide switches sit flush on the circuit board, I filed that away.

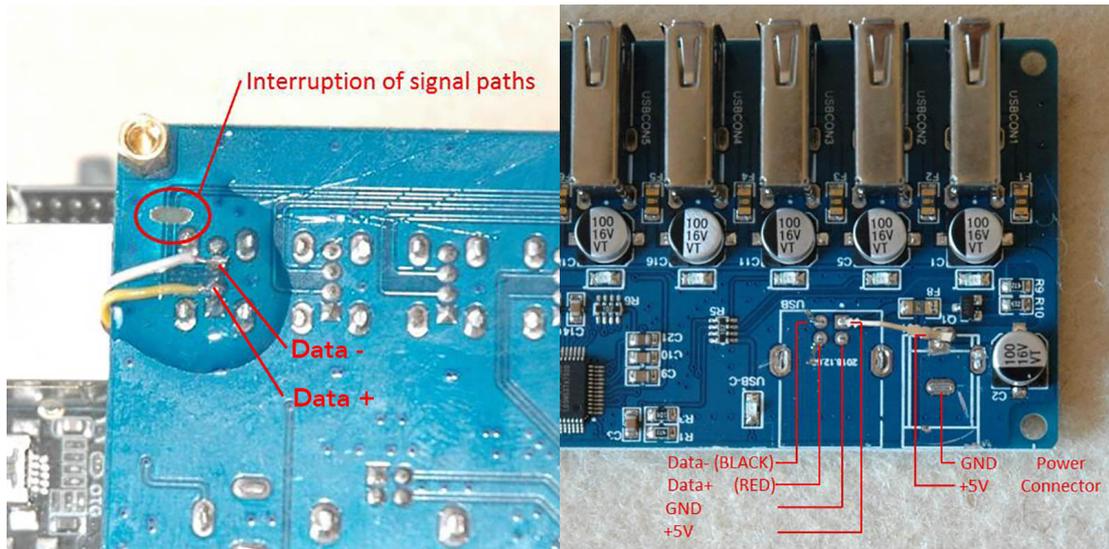


VI. Changes to the USB hub

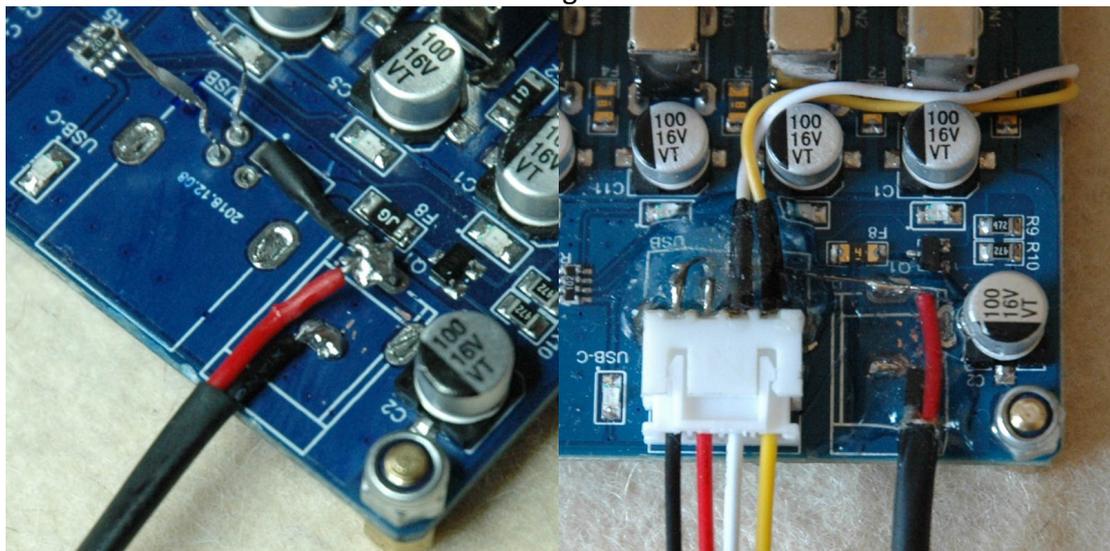
1. Remove the USB plug and the plug for the power supply from the USB hub.
2. Make a 4-5mm wide slot between the 5th and 6th USB connector so that the hub can later be screwed to the Cubieboard.



3. Scratch the signal lines at the first USB connector on the underside of the board.
4. Instead, solder two thin cables to the pins of the USB connector.
5. Solder a bridge made of an insulated, thin cable between the 5V pin of the power supply and the 5V pin of the USB connection (see picture).

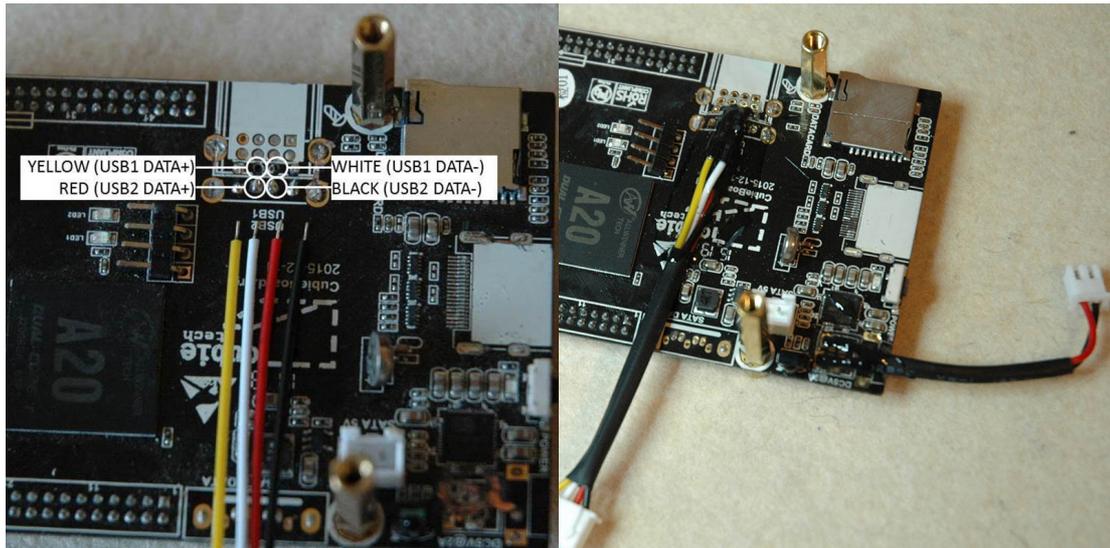


6. Solder the connection cable to the adapter board to the power supply of the USB hub.
7. Connects two PINS of the 4-pin connector to the cables that are soldered to the modified USB connector and two PINS to the data PINS of the USB connection.
8. Fix the connector to the USB hub with hot glue.

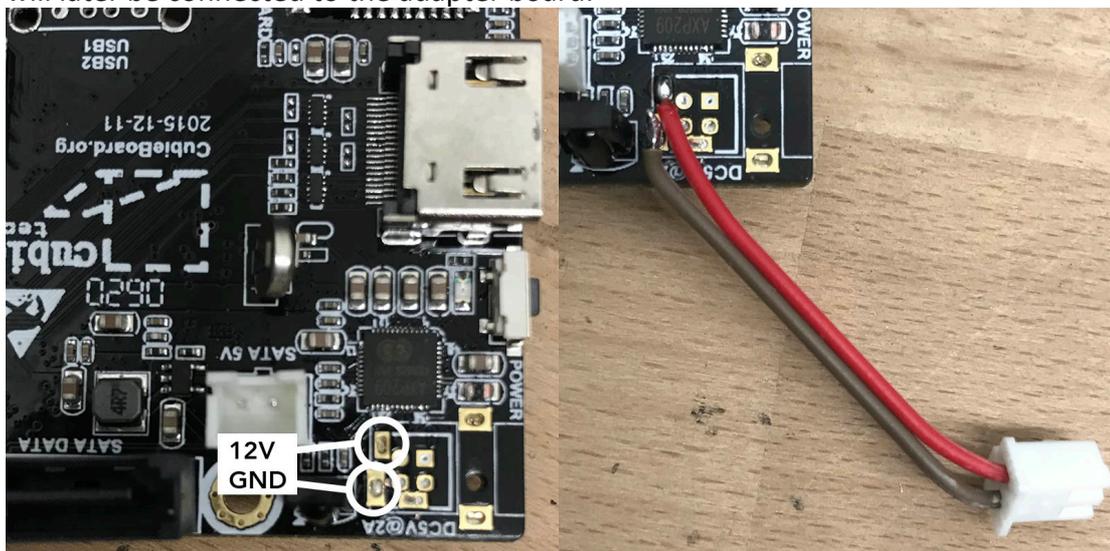


VII. Changes to the Cubieboard

1. Also remove the USB plug and the plug for the power supply from the Cubieboard.
2. The Cubieboard is extremely sensitive. Try not to unsolder the connectors, you will almost certainly bring too much heat into the board. Pinch off the pins with sharp, small pliers and leave the rest in the soldering pads.
3. Solder the 4-pin cable for the USB hub according to your PIN assignment to the 4 PINS marked in the picture.



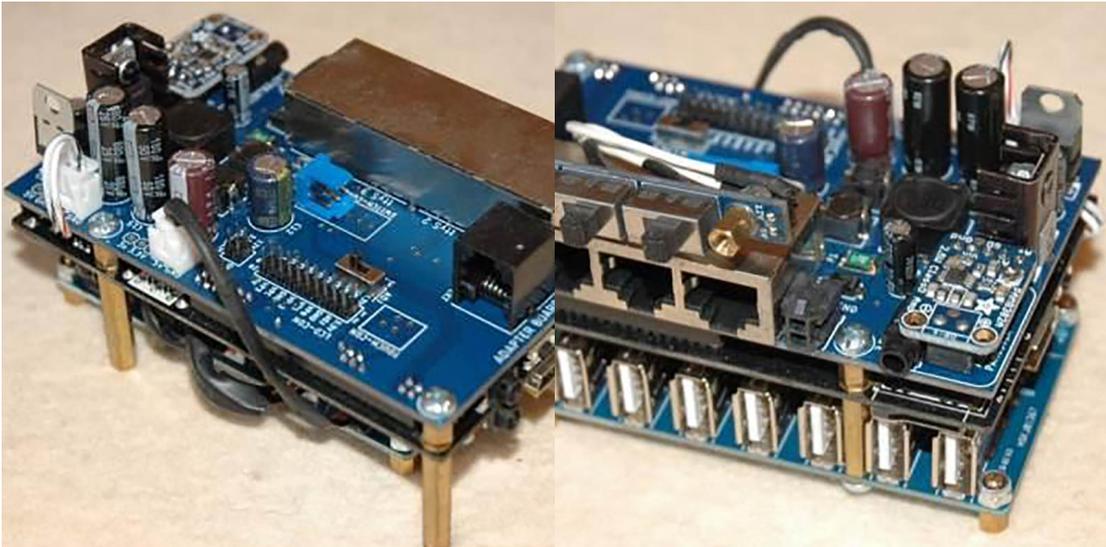
4. Solder a cable for the power supply where the connector was previously attached. This will later be connected to the adapter board.



VIII. Assembly

1. Insert a M3x6 spacer sleeve including a washer in each of the 4 mounting holes on the top of the Cubieboard, and screw on from under the M3x25 spacer sleeve.
2. Only at this point where the USB hub will later be attached to the slot previously made is screwed the M3x18 spacer sleeve.
3. Put the adapter board on the Cubieboard and screw it with 3 M4x6 flat head screws and the one already prepared countersunk head screw.
4. Insert one of the M3x5 spacer sleeves into each of the 4 original mounting holes of the USB hub and screw them together with one of the self-locking M3 nuts.

5. Attach the USB hub from below and screw it in with an M3 self-locking nut so that it can still be pushed a little. Make sure to use a M3 polyamide washer for insulation between the spacer sleeve and the USB hub, as well as between the self-locking nut and the USB hub.
6. Connect the power supply for the Cubieboard and the USB hub to the adapter board as shown in the pictures.
7. Connect the 4-pin cable between the Cubieboard and the USB hub.



8. Solder one of the jumper cables to each of the numbered PIN of a slide switch on the switch board.
9. You crimp the contacts of the JST connector on two of the jumper cables and insert them into the connector housing.
10. Connect the jumper cables of the switch board. Pay attention to the PIN assignment of the 6-pin, 90 ° angled pin header.



11. Now everything can be inserted and screwed into the housing.

12. Connects the sensor board to the adapter board with the RJ12 cable.
13. The display cable still has to be modified in accordance with the assignment plan attached here. Make sure that the assignment for the Ampire display is different than for the 2 Texim displays.



14. If you want to use a touch panel, I recommend that you carefully solder four more jumper cables to the contacts of the ribbon cable. Fix the soldering points with hot glue so they don't break off.
15. Sorts them according to the pin assignment of the connector printed on the board and connects the touch panel.
16. Connect your display cable to the display and to the adapter board. Pay attention to the correct alignment on the adapter board. It can easily be swapped here.
17. Close your case.

IX. Attachment

1. Allocation plan display cable Texim

Display		Adapterboard	
PIN	Name	PIN	Name
1	3,3V	1	3,3V
2	3,3V	2	3,3V
3	GND	5	GND
4	GND	6	GND
5	RxIN0-	7	TXO0-
6	RxIN0+	8	TXO0+
7	GND	3	GND
8	RxIN1-	9	TXO1-
9	RxIN1+	10	TXO1+
10	GND	17	don't connect for Texim Display
11	RxIN2-	11	TXO2-
12	RxIN2+	12	TXO2+
13	GND	13	GND
14	CKIN-	15	TXOC-
15	CKIN+	16	TXOC+
16	GND	14	GND
17	5V	19	5V
18	5V	20	5V
19	GND	18	don't connect for Texim Display
20	ADJ	4	ADJ

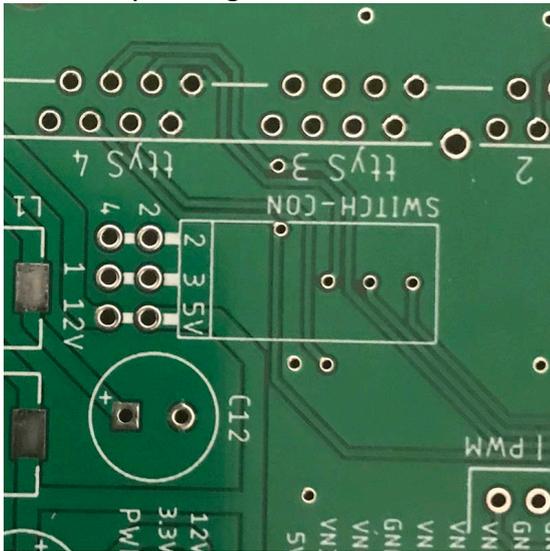
2. Allocation plan display cable Ampire

Display		Adapterboard	
PIN	Name	PIN	Name
1	3,3V	1	3,3V
2	3,3V	2	3,3V
3	GND	5	GND
4	GND	6	GND
5	RxIN0-	7	TXO0-
6	RxIN0+	8	TXO0+
7	GND	3	don't connect for Ampire Display
8	RxIN1-	9	TXO1-
9	RxIN1+	10	TXO1+
10	GND	14	GND
11	RxIN2-	11	TXO2-
12	RxIN2+	12	TXO2+
13	GND	13	GND
14	CKIN-	15	TXOC-
15	CKIN+	16	TXOC+
16	GND	4	don't connect for Ampire Display
17	RxIN3-	17	TXO3-
18	RxIN3+	18	TXO3+
19	GND	19	don't connect for Ampire Display
20	GND	20	don't connect for Ampire Display

Display		Adapterboard	
PIN	Name	PIN	Name
1	12V	1	12V
2	GND	2	GND
3	3,3V	3	3,3V
4	ADJ	4	ADJ

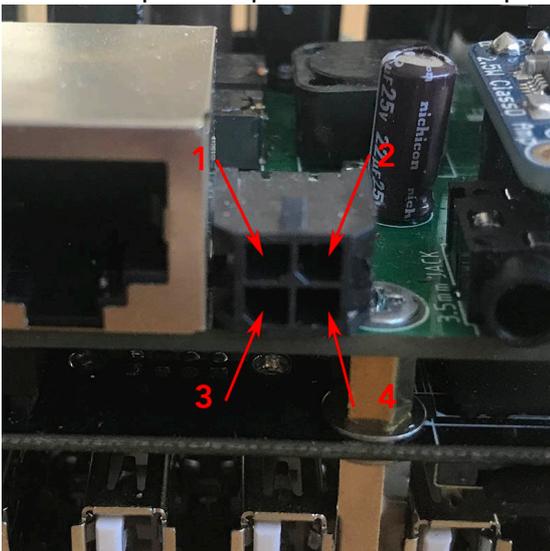
3. Allocation plan for pin header switch board

The PINs of the adapter board are already labeled with the number of the ttyS port to which they belong.



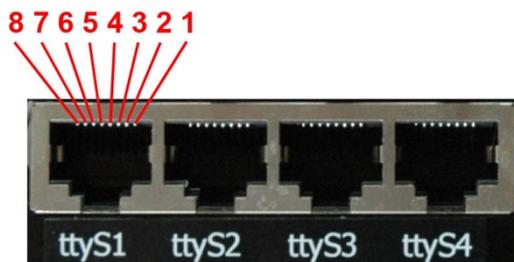
- 1: ttyS4
- 2: ttyS2
- 3: ttyS1
- 4: ttyS3
- 5: 12V
- 6: 5V

4. Allocation plan for power connector OpenVario-DS2



- 1: free
- 2: GND
- 3: +12V OpenVario
- 4: +12V RJ45 connectors

5. Allocation plan for ttyS ports



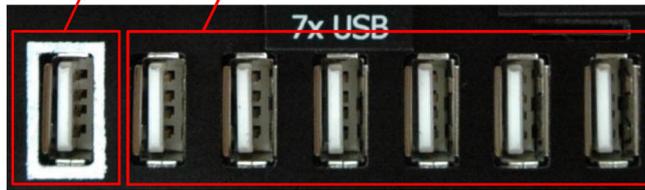
- 1: +5V/+12/, selectable via the slide switch
- 2: +5V/+12/, selectable via the slide switch
- 3: RX, OpenVario receives data, TTL (3,3V)
- 4: TX, OpenVario sends data, TTL (3,3V)
- 5: RX, OpenVario receives data, RS232 (12V)
- 6: TX, OpenVario sends data, RS232 (12V)
- 7: GND
- 8: GND

It is essential to ensure that, for example, PINS 3 and 4 are not connected with the Flarm. Otherwise the data transmission will be disturbed. When connecting, always pay attention to which PINs are really necessary and only use these. The connector is not assigned according to the IGC standard!

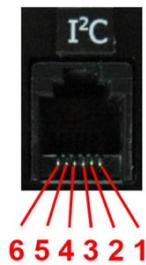
6. Arrangement USB ports

Single USB port connected directly to the Cubieboard

6x USB hubs, all connected to a USB port on the Cubieboard



7. Allocation plan I²C connector



- 1: +5V
- 2: +3,3V
- 3: SDA
- 4: SCK (SCL)
- 5: GND
- 6: GND

8. Allocation plan temperatur sensor



- 1: Signal
- 2: +3,3V
- 3: GND

9. Allocation plan audio connector



- 1: Audio +
- 2: Audio -
- 3: GND