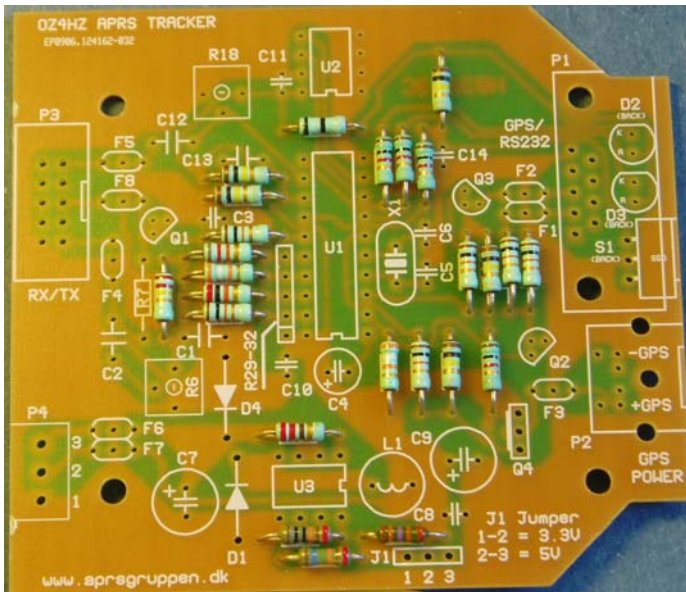


# OZ4HZ tracker assembly instruction.

(version 1.1 pcb H03013C)

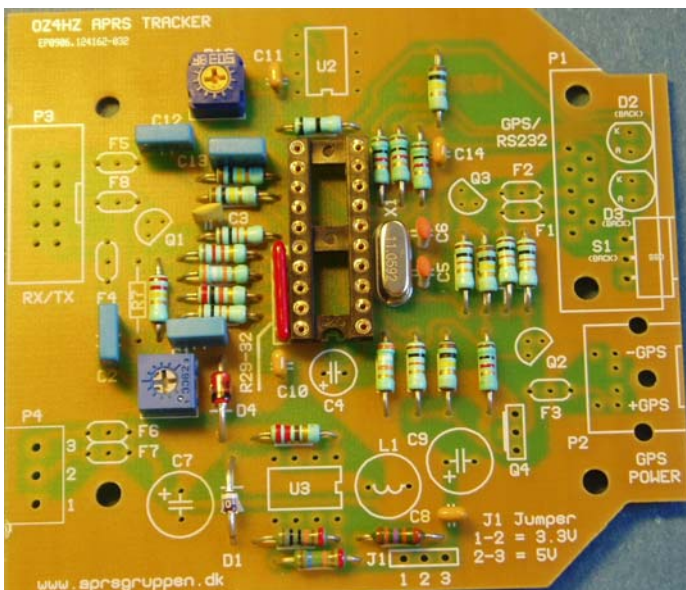
Use the components list to check you got all components for the tracker.



Start installing the following components :

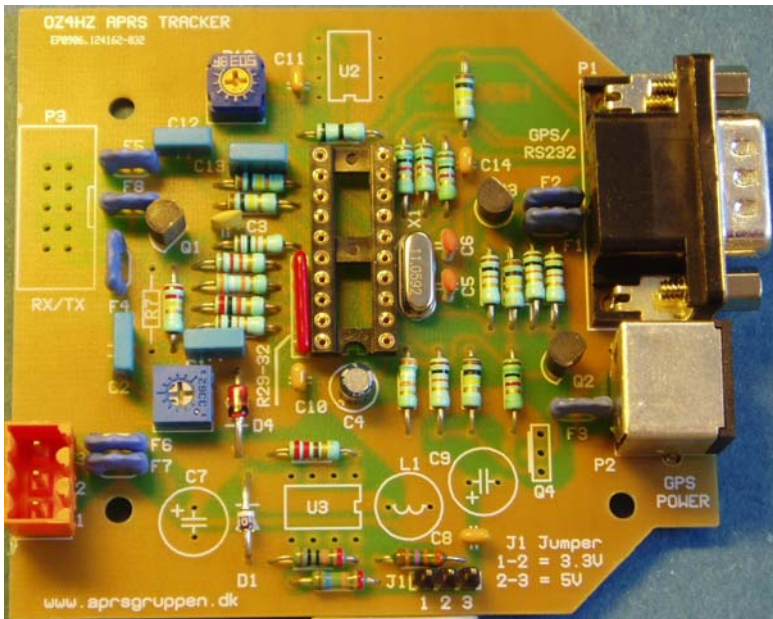
R1	82 Kohm (grey, red, orange, gold)
R2 og R11	39 Kohm (orange, white, orange, gold)
R3	20 Kohm (red, black, orange, gold)
R4,R8,R9, R10,R12,R15	10 Kohm (brown, black, orange, gold)
R5	220 Kohm (red, red, yellow, gold)
R13,R16,R19, R20,R25	100 Kohm (brown, black, yellow, gold)
R14, R21, R22, R24	1 Kohm (brown, black, red, gold)
R17	220 ohm (red, red, brown, gold)
R23	0 ohm (black, black) or just a strap
R26	100 Kohm 1% (brown,black,black,orange,brown (red))
R27	165 Kohm 1% (brown,blue,green,orange,brown,(red))
R28	137 Kohm 1% (brown,orange,violet,orange,(red))

The last ring of colour (red) is not show on all 1% resistors  
It shows the temperature coefficient (red = 50 ppm)



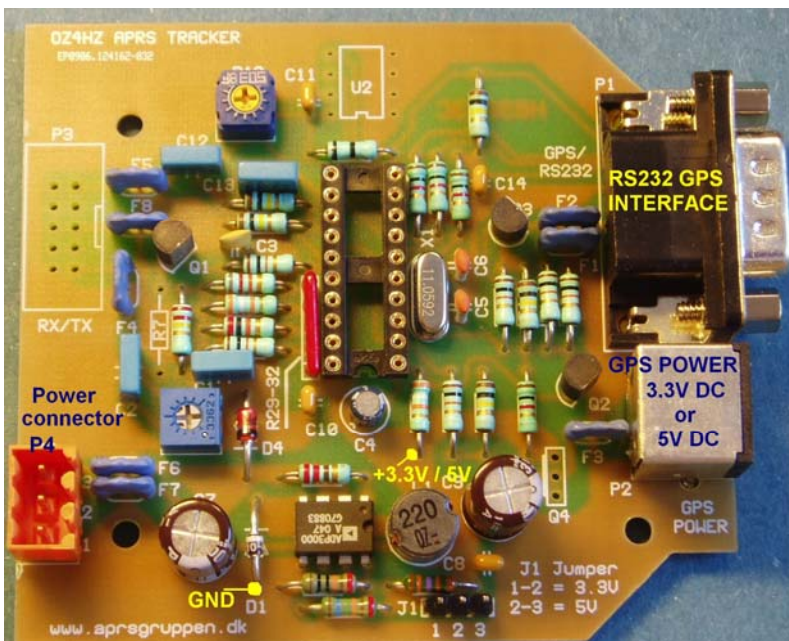
Continue with the following components :

R29-32	1Kohm SIL resistor network pay attention to polarity dot at pin 1
R6	10 Kohm variable resistor marked (103)
R18	50 Kohm variable resistor marked (503)
C8,C10,C11, C14	100 nF capacitor marked (104)
C5, C6	33pF capacitor marked (33p) (orange or black top)
C3	10nF capacitor marked (10n)
D1	BYV 10-40 diode marked (V10-40) pay attention to polarity (black ring at cathode)
D4	BZV85C16 zenerdiode marked (C16) pay attention to polarity (black ring at cathode)
U1	20 pole DIL socket for U1 pay attention to polarity A slight asymmetry is mark for polarity in the socket and in the symbol on the PCB
X1	Crystal 11.0592 MHz
C1	2.2 nF capacitor marked (2.2n)
C2,C12, C13	100 nF capacitor marked (100 n or u1)



Continue with the following components :

C4	1uF capacitor pay attention to polarity
F1 ,F2,F4 ,F5	1 nF T-Filter marked (102)
F3 ,F6, F7, F8	10nF T-Filter marked (103)
Q1, Q2	BC547, BC548 or BC549 NPN transistor
Q3	BC557, BC558 or BC559 PNP transistor
J1	3*2.54mm PCB header + jumper
P1	9 pole DSUB MALE for PCB
P2	6 pole miniDIN for PCB
P4	3 pole Male connector for PCB (orange) pay attention to polarity



Continue with the following components :

L1	22 uH coil marked (220)
C7,C9	100 uF/35V Capacitor (100uF) pay attention to polarity
U3	ADP 3000 AN pay attention to polarity

Now check your work until now – make a visual inspection of the PCB for solder bridges and other errors. Then its time to test the switching power supply part of the tracker with U3 (ADP3000) For this test use either a power supply (output voltage of 8 – 14V) or 4 pcs. batteries in series (6V) At J1 put a jumper between pin 2 and 3 if you want a supply voltage of 3.3V for the circuit

Test using a power supply :

Connect the power supply (Set the voltage to 12V ) between pin 3 (positive) and pin 1 (negative) on P4 power connector (see picture above). Current consumption should be a few mA.

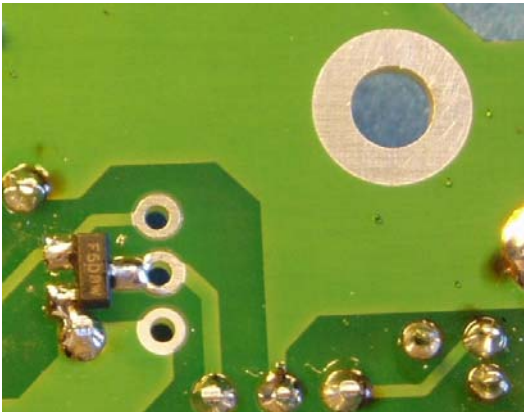
Test using batteries :

Connect the batteries (4 pcs 1.5V = 6V ) between pin 3 (positive) and pin 2 (negative) on P4 power connector (see picture above) and **remark battery negative is NOT GND.**

Current consumption should be a few mA.

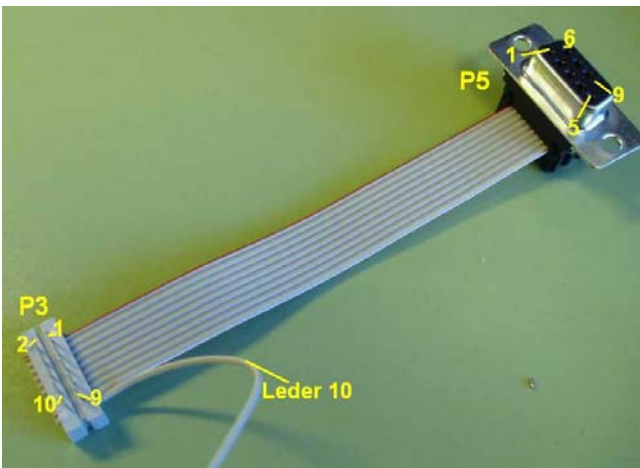
Check the voltage between GND and +3.3V / 5V (see picture above) – The voltage should be either 3.3V (jumper at position 1-2) or 5V .

If this test is OK disconnect the power supply or the batteries and continue installing the last parts :

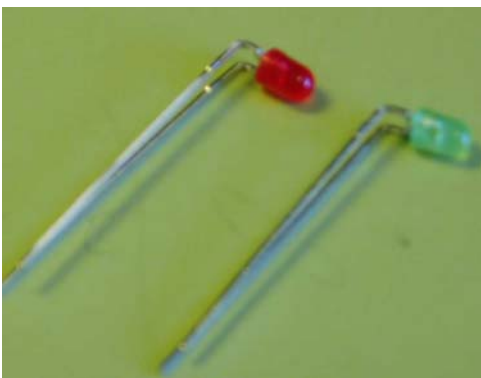


U2                    AT24C02 (256 bytes EEPROM)  
pay attention to polarity

On the copper side of the PCB solder the SMD transistor :  
Q4                    IRLML6401 (P MOS transistor)



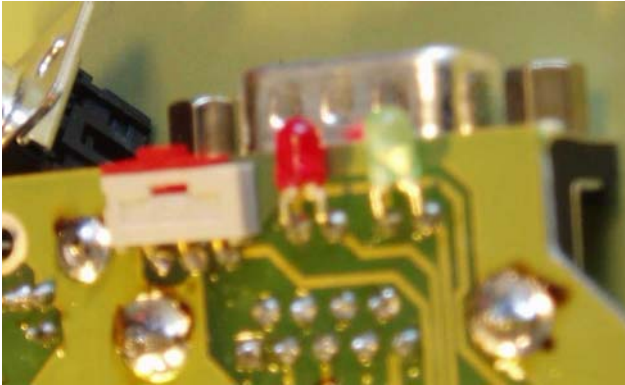
P3                    10 pole IDC connector for PCB  
P5                    9 pole DSUB female connector for ribbon cable  
  
Assemble the ribbon cable with the connectors as shown on the picture left and remark : all 10 conductors used in the IDC connector and only 9 are used in the DSUB ("Leder 10" = conductor no 10)



D2                    green LED  
D3                    red LED  
  
Bent the pins on the LEDs as shown on the picture (short pin = cathode ) at the top.  
  
Cut the pins as shown and solder the LEDs on the copper side of the PCB as shown on the picture on next page







S1                      Switch for PCB

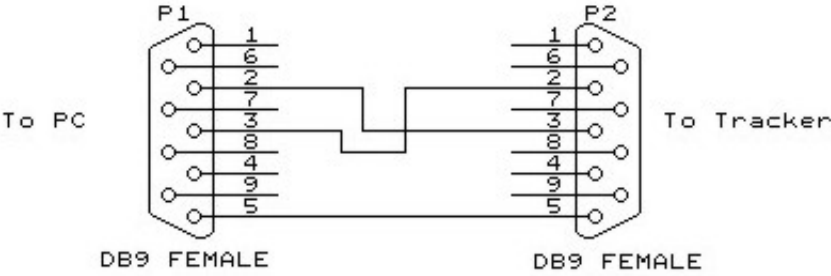
Solder the switch on the copper side on the PCB as shown on the picture after shorting the pins by approx. 1mm

If you want to use the tracker with a handheld transceiver where the transmitter is activated when the microphone input is grounded (Most handheld radios ICOM or YAESU) mount resistor R7 on the PCB  
 R7     2.2 Kohm (red, red, red, gold)

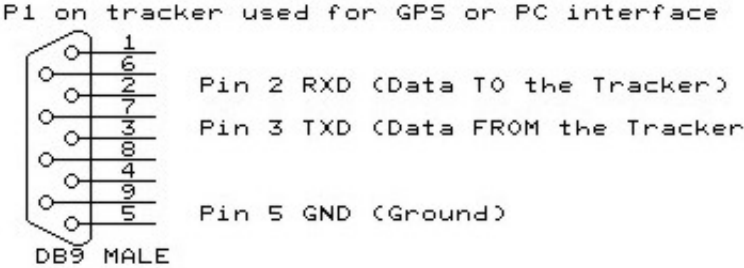
Now its time to test the fully assembled tracker but first insert a programmed CPU (U1 AT89C4051) in the socket for U1 and pay attention to polarity. Again connect a power supply as mentioned on page 2

When the tracker is powered up the green and red LED flashes a few times. Depending on the switch S1 (sets configuration 1 or 2) the green or red LED will stay lit a few seconds.  
 If the green LED is on configuration 1 is used. If the red LED is on configuration 2 is used.

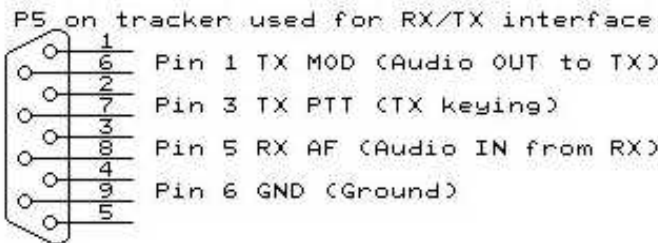
Connect the tracker to a PC with a serial cable (exchange pin 2 and 3 see drawing below)



Connections between serial port on PC and tracker

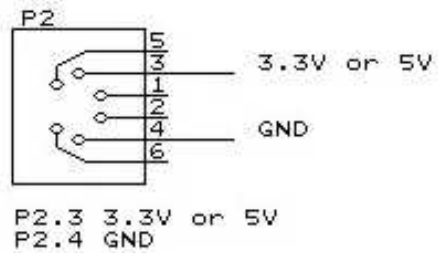


Connections at P1 (GPS/RS232) on tracker.



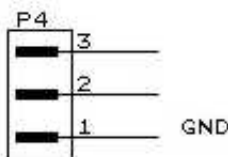
Connections on P5 (RX TX interface)

POWER TO GPS



Connections on P2 (GPS power interface)

POWER INPUT



J1 set to 3.3V :  
 Both battery (4\*AA cells = 6V) and 12V operation  
 P4.3 Positive (+) input  
 P4.1 Negative (-) and GND input

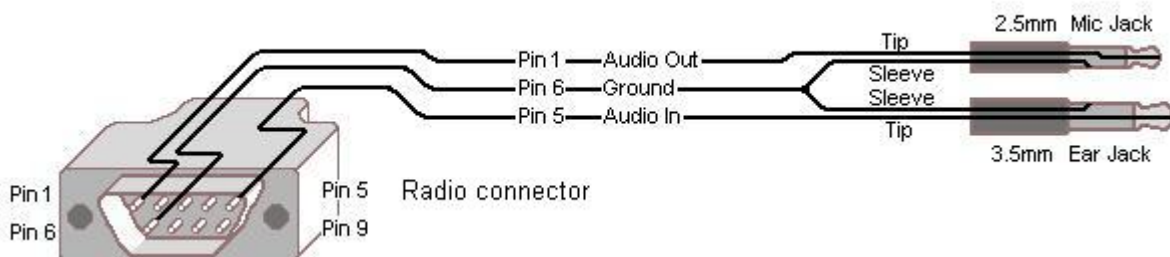
J1 set to 5V :  
 Battery (4\*AA cells = 6V)  
 P4.3 Positive (+) input  
 P4.2 Negative (-) input AND THIS IS NOT GND

12V Operation  
 P4.3 Positive (+) input  
 P4.1 Negative (-) and GND input

Connections at P4 ( Batteries (4 pcs AA cells) or 12V )

### Radio interface.

If you plan to use the tracker with a ICOM or YAESU handheld transceiver an example for the connection cable is shown below – and remember R7 (2.2Kohm) should be mounted.



For other transceivers use the connections :

- P5.1** TX AF (modulation)
- P5.3** TX Tst (transistor Q1 max. current approx. 50mA)
- P5.5** RX AF (connected to the receiver's squelched audio out)
- P5.6** GND

and remark R7 is not used.

Some example radio interface diagrams are available at:

<http://www.cqham.ru/trad.htm> and <http://www.packetradio.com/tnc2rad.htm>

To set user options such as callsigns and path etc use the Windows program aprstrak.exe available from the website :

[www.aargang64.dk/aprs](http://www.aargang64.dk/aprs)

Read the manual for the setup program (in pdf format)..

At power up of the tracker the green and red LED flashes a few times and one of the LEDs stays on for some seconds (depending on the switch S1) . Now its possible to read an write the tracker.

## GPS interface.

The GPS unit is connected to P1 (serial data RS232) and P2 (Power supply). If you use an BR304 GPS the connectors fits directly and you can also put jumper J1 in position for 3.3V operation. BR304 works very well at this voltage (the manufacturer gives his OK)- and you will save power



Picture of GPS unit BR304 with connector for RS232 (DSUB) and power (MiniDIN)

## Adjustments.

There are only a few adjustments First the transmit audio level should be adjusted at R6. Use the panel with Tone Test in the configuration program. Click on one of the buttons (1200Hz, 2200Hz or 1200/1200Hz) to let the tracker transmit the tone while adjusting. The red LED is on during transmission. Adjust R6 to a suitable level .If the audio level is to low with R6 set to maximum replace resistor R5 with a 100Kohm resistor.

The next adjustment is R18 used to adjust the receivers squelched audio "carrier detect" level. The green LED shows the activity of the carrier detect function.

Adjust R18 such that the green LED is usually off, but turns on when the transceiver opens squelch. If this function is not used adjust R18 counter clockwise to stop. (Green LED off).

## LED function.

During power up the green and red LED will be flashing. The last LED lit shows the configuration used.

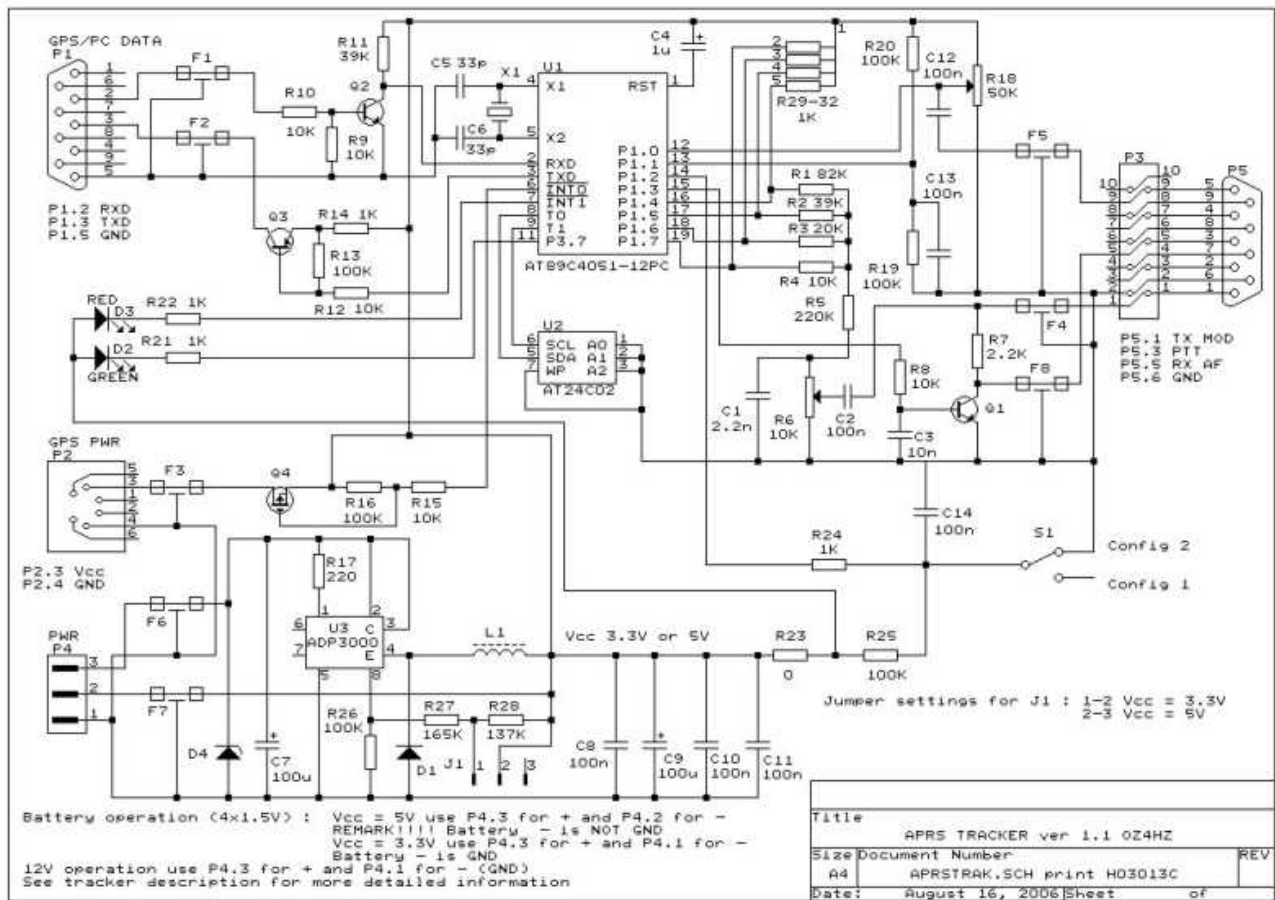
Green LED : configuration 1

Red LED : configuration 2

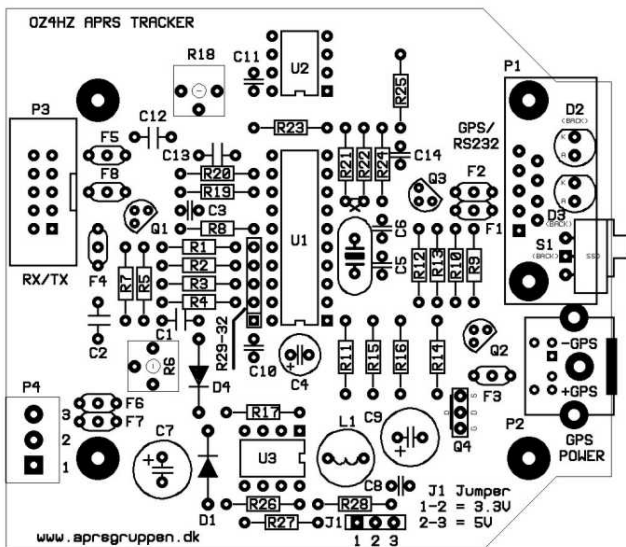
Normal operation :

Red LED : TX keyed

Green LED : Dimly lit with activated carrier detect. On when TX keyed and data from GPS is OK.



Schematic of the OZ4HZ APRS tracker



Component side OZ4HZ APRS tracker



Picture of the completed APRS tracker in enclosure with adjustments points marked

Assembly instruction 15-08-2006

OZ4HZ APRS TRACKER PCB H03013C Bill of material (Correction date 14 AUG 2006)

Quantity	Reference	Part	
1	C1	2.2nF MKT 10% Capacitor Lead pitch 5 mm (BC 2222 470 series)	(Farnell 568405)
3	C2,C12,C13	100nF MKT 10% Capacitor Lead Pitch 5mm (BC 2222 470 series)	(Farnell 567450)
1	C3	10nF +80/-20% Ceramic Capacitor Lead Pitch 2.54mm	(Farnell 237279)
1	C4	1uF/50V Miniature radial electrolytic capacitor	(Farnell 9452303)
2	C5,C6	33pF 5% Ceramic Capacitor Lead Pitch 2.54mm (NPO or N220)	(Farnell 236986)
2	C7,C9	100uF/35V UPM1V101MPD Low ESR electrolytic Capacitor(Nichicon)	(Farnell 8812543)
4	C8,C10,C11,C14	100nF/50V X7R or Z5U Capacitor Lead pitch 2.54mm (RSonline 2644911 (X7R) or 2644933 (Z5U))	
1	D1	BYV10-40 or SB140	(Farnell 518189)
1	D2	LED green 3mm	
1	D3	LED red 3mm	
1	D4	BZV85C16 1W zenerdiode 16V	(Farnell 9844104)
4	F1,F2,F4,F5	1nF T-FILTER ZJSR5101-102TA (TDK)	( or Murata Farnell 9527362)
4	F3,F6,F7,F8	10nF T-FILTER ZJSR5101-103TA (TDK)	( or Murata Farnell 9527389)
1	L1	22uH Coil ELC08D220E	(Farnell 3227200)
1	P1	9 Pole D-Sub MALE /90 for PCB	(Farnell 4106076)
1	P2	6 pole MINIDIN Connector female for PCB	(Farnell 3300304)
1	P3	IDC 10 Print	(Farnell 7338210)
1	P4	3 Pole Male connector (Weidmuller SL3.5/3/180G and Plug BL3.5/3)	(PCB Farnell 617568) (Plug Farnell 17362)
1	P5	9 pole D-Sub female for IDC Ribbon Cable (cable length = 10cm)	
1	J1	3 pin header (2.54mm) + jumper	
2	Q1,Q2	BC547,BC548,BC549 or similar NPN transistor	
1	Q3	BC557,BC558,BC559 or similar PNP transistor	
1	Q4	IRLML6401PBF (SMD) P MOS transistor	(Farnell 8660093)
1	R1	82Kohm 5% 0.4W Resistor (SFR25)	
2	R2,R11	39Kohm 5% 0.4W Resistor (SFR25)	
1	R3	20Kohm 5% 0.4W Resistor (SFR25)	
6	R4,R8,R9, R10,R12,R15	10Kohm 5% 0.4W Resistor (SFR25)	
1	R5	220Kohm 5% 0.4W Resistor (SFR25)	
1	R6	10Kohm BOURNS TYPE 3362P Variable Resistor	(Farnell 9354301)
1	R7	2.2Kohm 5% 0.4W Resistor (SFR25)	
5	R13,R16,R19, R20,R25	100Kohm 5% 0.4W Resistor (SFR25)	



4 R14,R21,R22,R24 1Kohm 5% 0.4W Resistor (SFR25)

OZ4HZ APRS TRACKER PCB H03013C Bill of material

Quantity	Reference	Part	
1	R17	220ohm 5% 0.4W Resistor (SFR25)	
1	R18	50Kohm BOURNS TYPE 3362P Variable Resistor	(Farnell 9354367)
1	R23	0ohm or short Resistor (SFR25)	
1	R26	100Kohm 1% 0.6W Resistor (MRS25)	(Farnell 9463896)
1	R27	165Kohm 1% 0.6W Resistor (MRS25)	(Farnell 9464786)
1	R28	137Kohm 1% 0.6W Resistor (MRS25)	(Farnell 9464425)
1	R29-R32	1Kohm 5 pin SIL 4 Resistor network	(Farnell 9356053)
1	S1	Switch for PCB (Type EAO 0910290-01)	(RSonline 2047871)
1	U1	AT89C4051-12PC + 20 pin socket	
1	U2	AT24C02-10PU-2.7	(Farnell 1095750)
1	U3	ADP3000 AN	(Farnell 3146443)
1	X1	11.0592MHz HC49/4H	(Farnell 9713115)

The pcb fits into this box :

1 OKW A9408348 (get datasheet from the website) (Farnell 207706)

GPS used for this tracker :

1 BR304 (get datasheet from the website) not available any more (ELFA 7843014)

1 BR355 (get datasheet from the website) (ELFA 1400065)

1 RS232 and power cable for BR355 (ELFA 7843105)

Remark: Most of the datasheets for this tracker can be downloadet from the website

<http://www.aargang64.dk/aprs/docs/datablade.html>

Suppliers web pages :

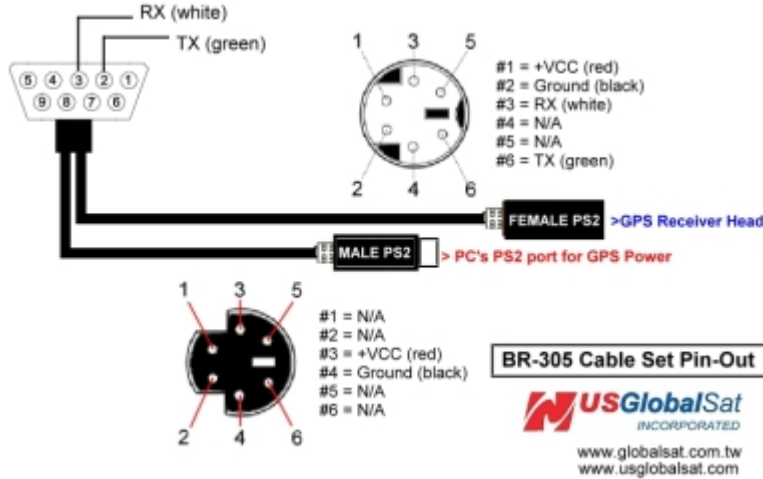
Farnell : [www.farnell.com](http://www.farnell.com)

RSonline : [www.rsonline.dk](http://www.rsonline.dk)

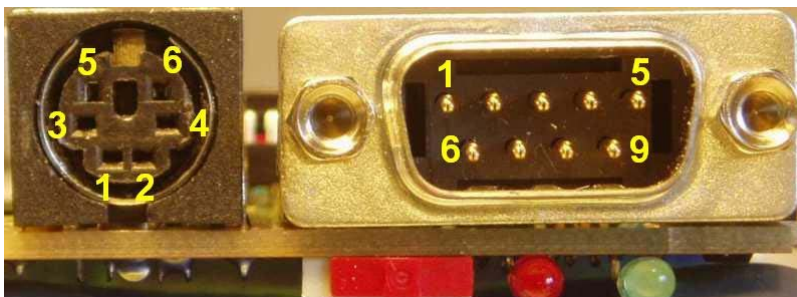
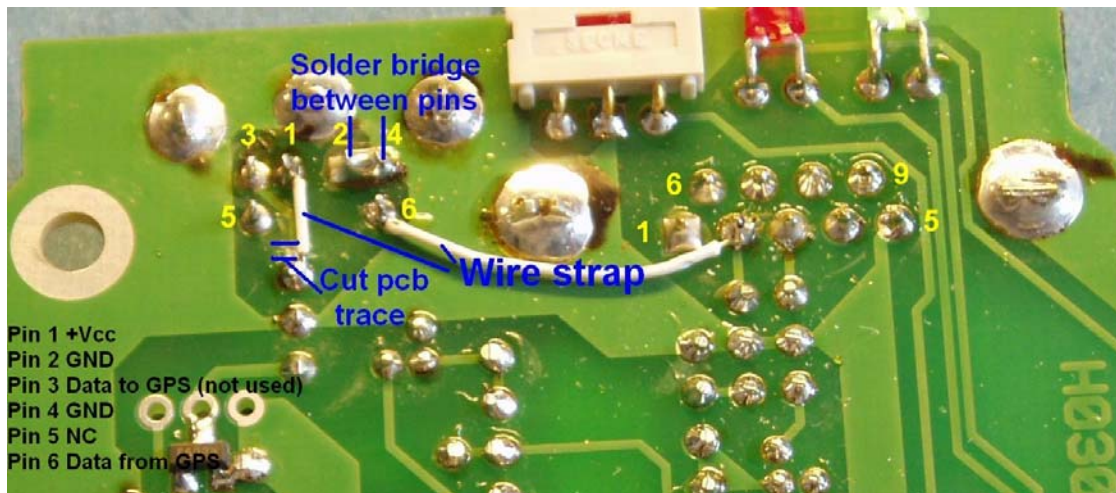
Elfa : [www.elfa.se](http://www.elfa.se)

## Modifications.

The GPS unit BR304 has been replaced by BR355 . This unit has not a normal DSUB connector for RS232 connections but a 6 pole mini DIN connector with both data and power connections. A special conversion cable is available (shown below) to split power and RS232 connections.



If you want to connect the BR355 GPS unit to the tracker without the conversion cable a small modification of the pcb is needed. See below :



BR355 has been tested with the tracker at 3.3V and 5 V (the manufacturer has not yet given his OK for 3.3V operation) and it works fine at both voltages.

**Remark : Pin numbers on P2 (Power to GPS) on the schematic has been changed to follow the pin-out in the drawing of the BR355 GPS unit !!! There are no changes on the pcb.**