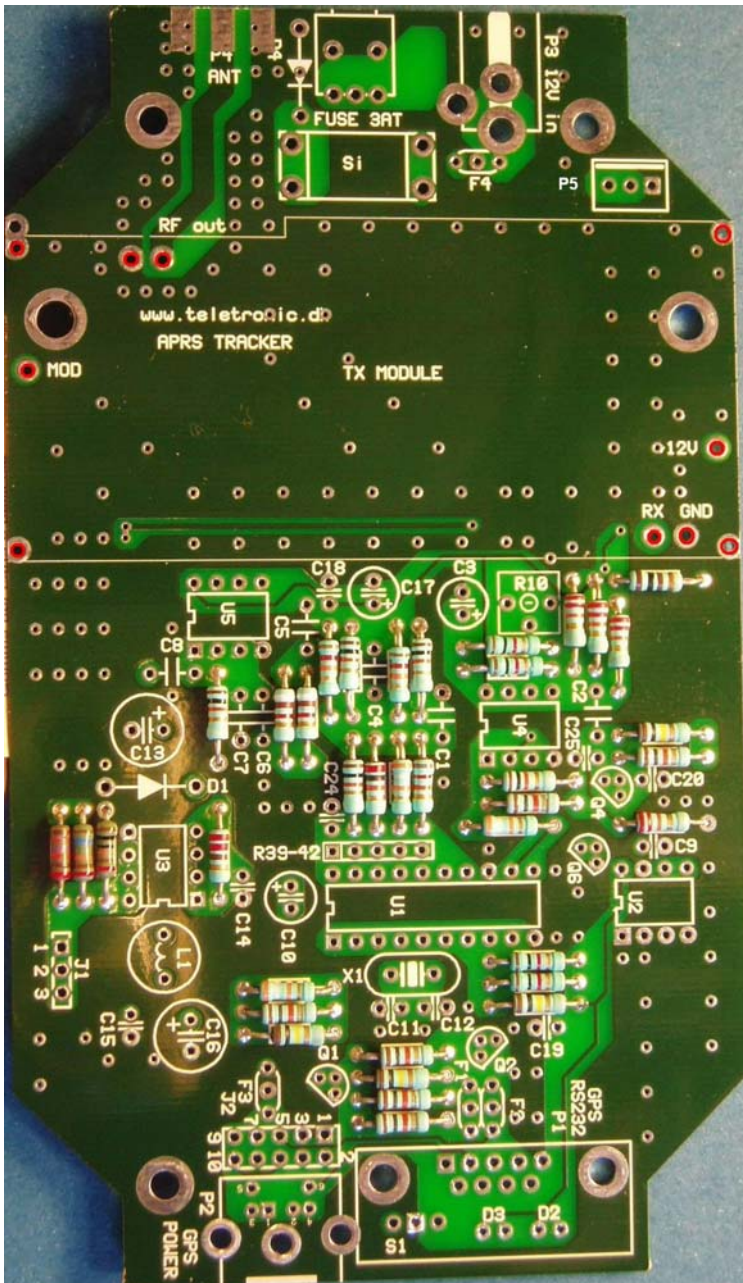


OZ4HZ TXtracker Assembly Instruction.

(version 1.0 pcb H04016C)

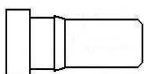
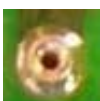
The Mainboard part of the TXtracker uses mostly leaded components so assembly is fairly easy. You will need a pencil-type soldering iron with a small tip, some thin solder (0.5mm), a pair of diagonal cutters and a pair of tweezers. I recommend you follow the list of assembly below.



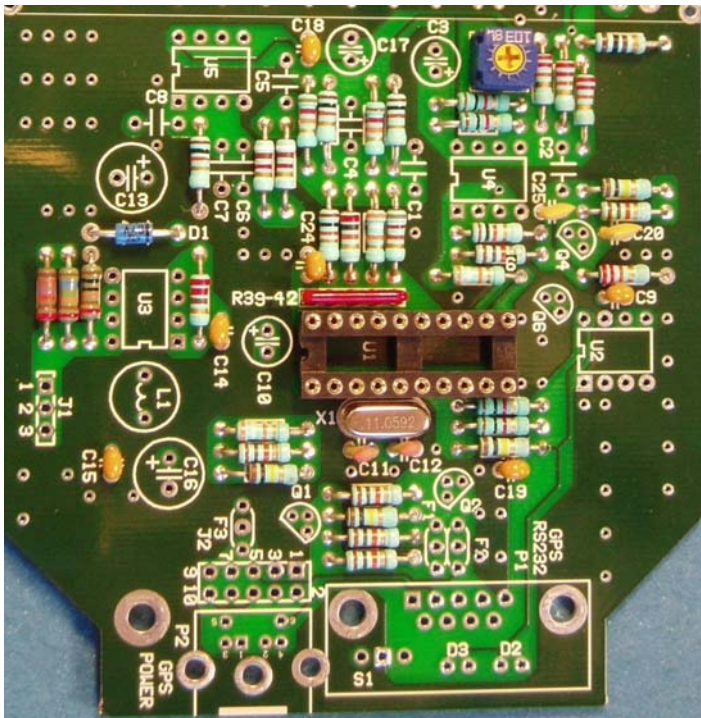
Start installing the following components :

10 pcs	AP102 socket for TXmodule Marked with red circle Solder on bottom layer.
R1	82 Kohm (grey, red, orange, gold)
R2, R33, R38	39 Kohm (orange, white, orange, gold)
R3	20 Kohm (red, black, orange, gold)
R4, R5, R11, R14, R17, R19, R20, R27, R31, R32, R35	10 Kohm (brown, black, orange, gold)
R6, R7, R36, R37	22Kohm (red, red, orange, gold)
R8, R9, R29, R30	1Kohm (brown, black, red, gold)
R12, R13	12Kohm (brown, red, orange, gold)
R15, R16	9.1Kohm (white, brown, red, gold)
R18	100 ohm (brown, black, brown, gold)
R21, R26, R28, R34	100Kohm Kohm (brown, black, yellow, gold)
R22	220 ohm (red, red, brown, gold)
R23	100Kohm1% (brown, black, black, orange, brown (red))
R24	165 Kohm 1% (brown, blue, green, orange, brown, (red))
R25	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)

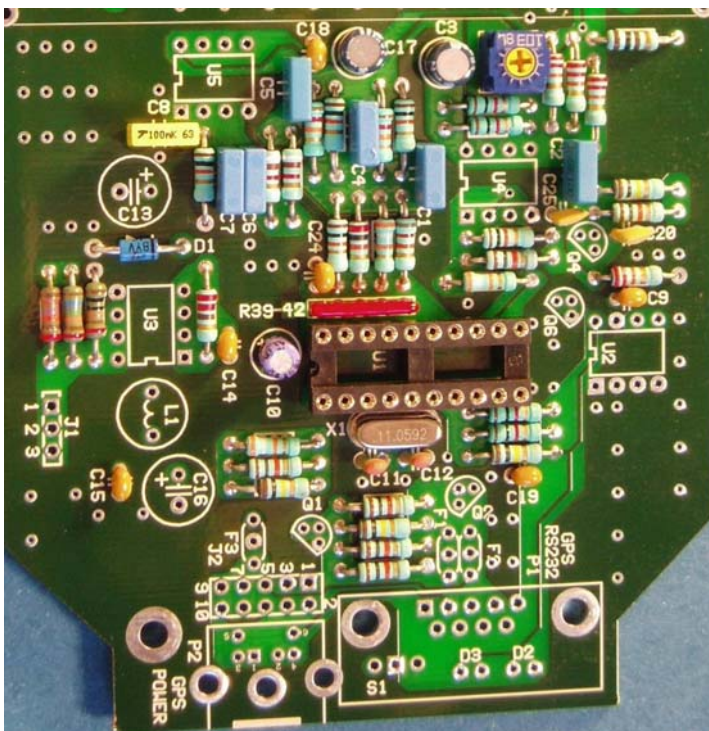


Close view of AP102 socket for interconnection to TXmodule



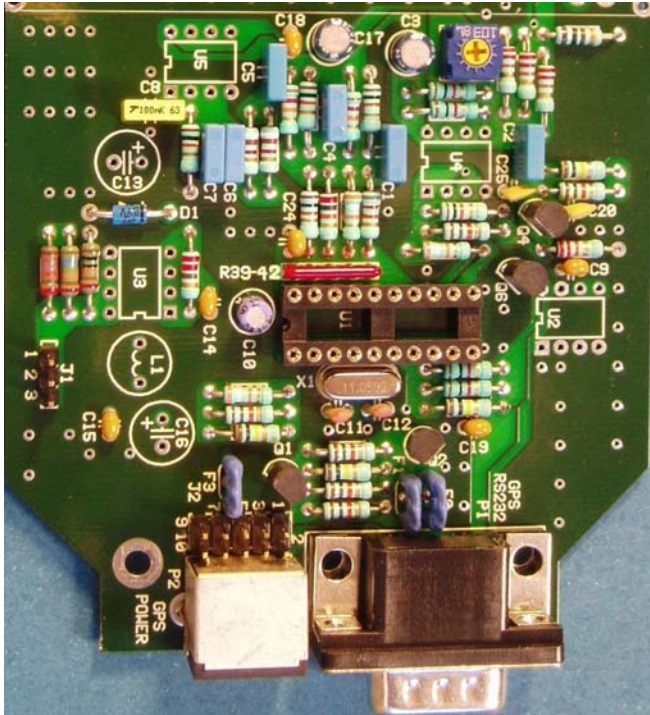
Continue with the following components :

- R39-43 1Kohm SIL resistor network
pay attention to polarity dot at pin 1
- R10 10 Kohm variable resistor marked (103)
- D1 BYV 10-40 diode marked (V10-40)
pay attention to polarity
(black ring at cathode)
- C9,C14,C15,
C18,C19,C24 100 nF capacitor marked (104)
- C11, C12 33pF capacitor marked (33p)
(orange or black top)
- C20,C25 10nF capacitor marked (10n)
- 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



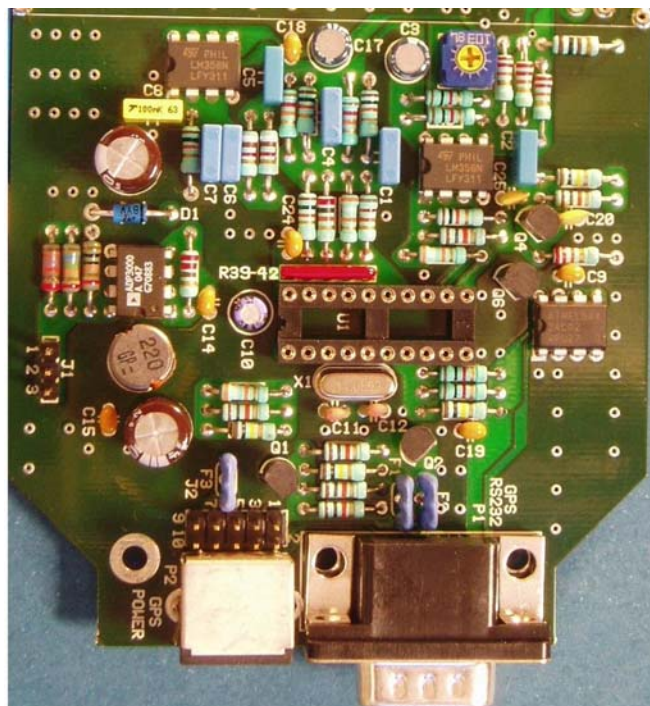
Continue with the following components :

- C1,C2,C5 1.5 nF capacitor marked (1.5n)
- C4 10 nF capacitor marked (10n)
- C3,C17 22uF capacitor
pay attention to polarity
- C6,C7 4.7 nF capacitor marked (4.7n)
- C8 100nF capacitor marked (100n)
- C10 1uF capacitor
pay attention to polarity



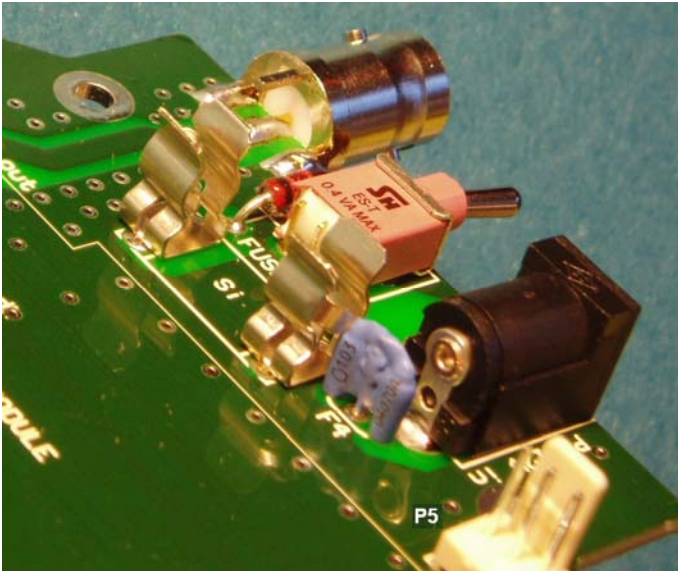
Continue with the following components :

F1 ,F2	1 nF T-Filter marked (102)
F3	10nF T-Filter marked (103)
Q1, Q4,Q6	BC547, BC548 or BC549 NPN transistor
Q2	BC557, BC558 or BC559 PNP transistor
J1	3 2.54mm PCB header + jumper
J2	3*2 2.54mm PCB header + jumpers
P1	9 pole DSUB MALE for PCB
P2	6 pole miniDIN for PCB



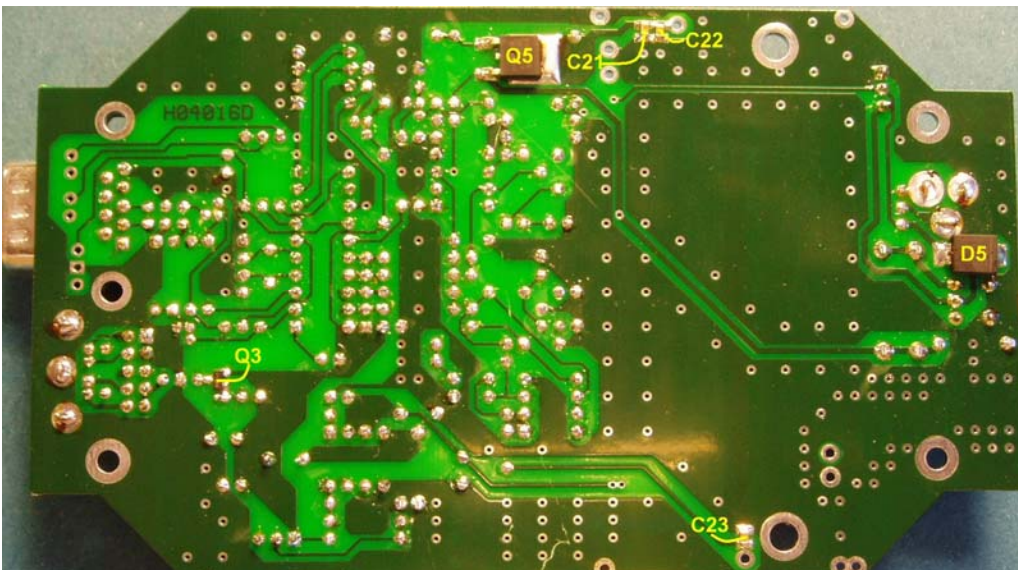
Continue with the following components :

L1	22 uH coil marked (220)
C13,C16	100 uF/35V Capacitor (100uF) pay attention to polarity
U2	AT24C02 (256 bytes EEPROM) pay attention to polarity
U3	ADP 3000 AN pay attention to polarity
U4,U5	LM358N IC pay attention to polarity



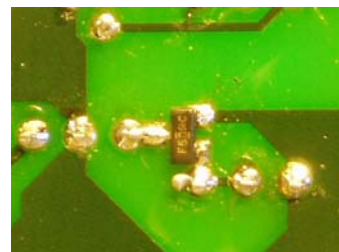
Continue with the following components

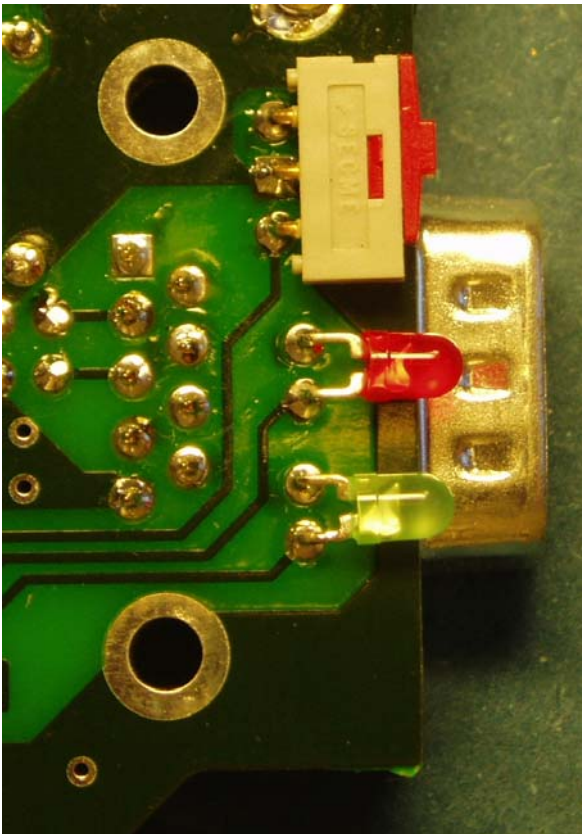
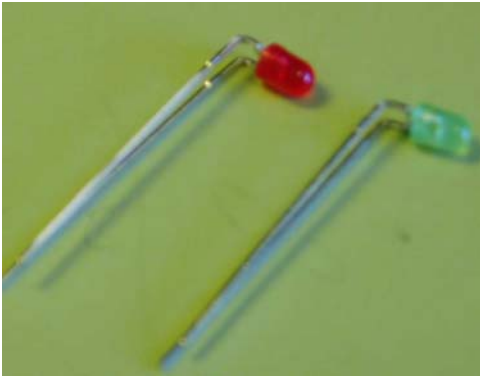
D4	BZV85C16 zenerdiode marked (C16) pay attention to polarity (black ring at cathode)
F4	10nF T-Filter marked (103)
P3	DC connector
Si	Fuseholder – 2 parts+ 3AT Fuse
P5	3 pole male connector
S2	Toggle switch
P4	BNC connector for PCB



Continue with the SMD components on the bottom layer

C21	100nF capacitor size 805 or 603
C22, C23	1nF capacitor size 805 or 603
D5	30BQ040 Diode pay attention to polarity (white mark = cathode)
Q3	IRLML6401PBF P MOS transistor
Q5	IRFR9024NPBF P MOS transistor





D2 green LED

D3 red LED

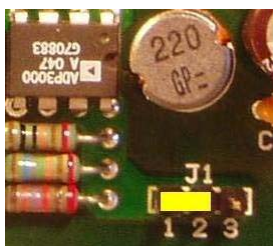
Bent the pins on the LEDs as shown on the picture above
(short pin = cathode) at the top.

Cut the pins as shown and solder the LEDs on the the bottom layer of the PCB as shown on the picture.

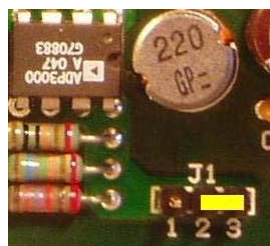
S1 Switch for PCB

Solder the switch on the bottom layer of the PCB as shown on the picture after shorting the pins by approx. 1mm

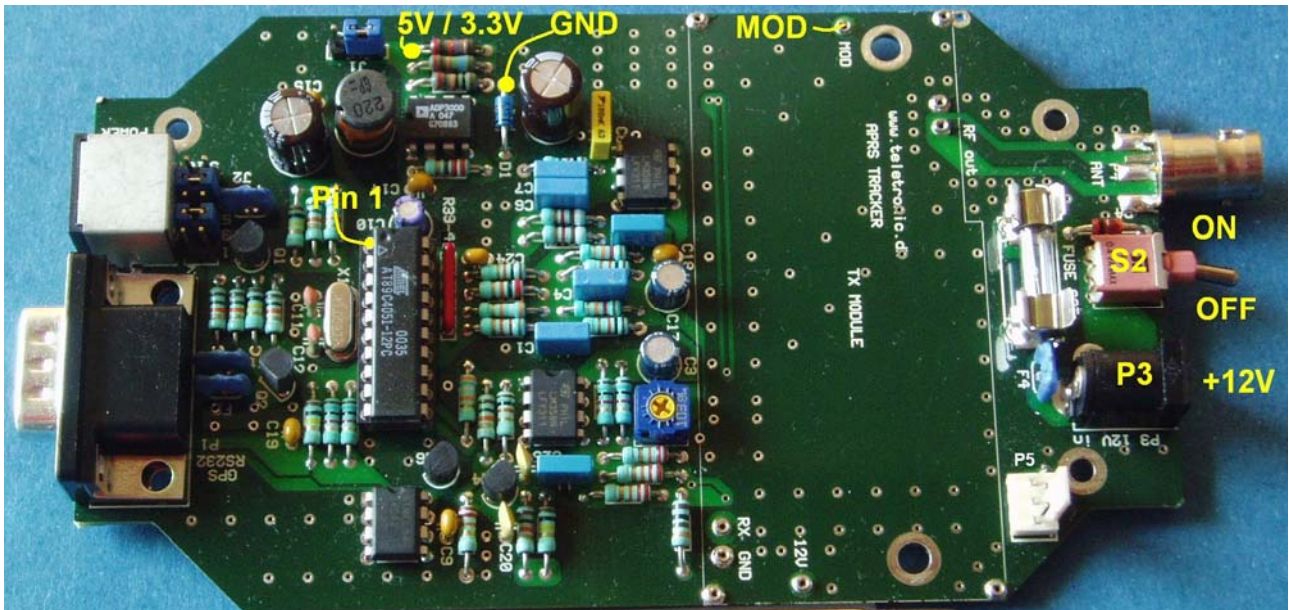
Now check your work until now – make a visual inspection of the PCB for solder bridges and other errors. At J1 put a jumper between pin 1 and 2 if you want a supply voltage of 3.3V for the circuit or between pin 2 and 3 for 5V operation. Put a 3 AT fuse in the fuseholder – **but don't install the CPU (U1) now**



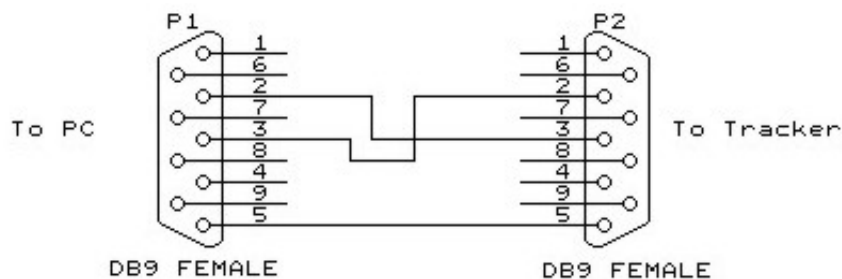
J1 setting for 3.3V operation



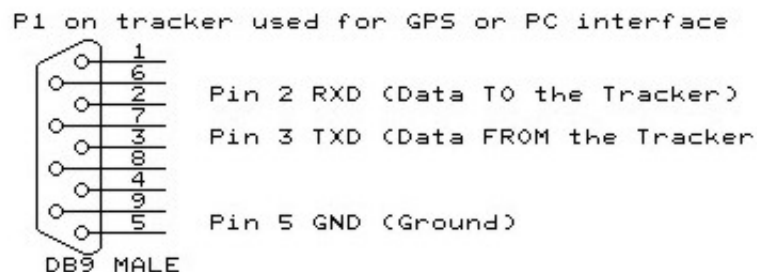
J1 setting for 5V operation



Then its time to test the switching power supply part of the tracker with U3 (ADP3000)
 Connect a power supply with output voltage set to 12V to connector P3 (+ on centre pin) and switch S2 on.
 Check the voltage between GND and +3.3V / 5V (se picture above) – The voltage should be either 3.3V
 (jumper at position 1-2) or 5V (jumper at position 2-3).If OK switch S2 off.
 Insert a programmed CPU (U1 AT89C4051) in the socket for U1 and pay attention to polarity. The HEX code
 (and the source code) for the CPU can be downloaded from my website. Connect the TXtracker to a PC
 with a serial cable (exchange pin 2 and 3 see drawing below)



Connections between serial port on PC and tracker



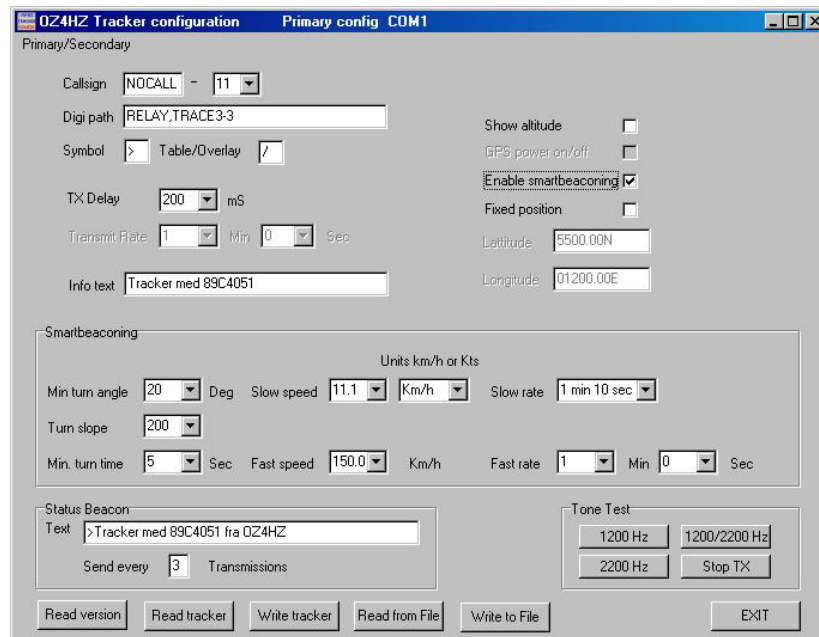
Connections at P1 (GPS/RS232) on tracker.

At the PC you need the setup software for the TXtracker (aprstrak.exe) .You can download the software from :

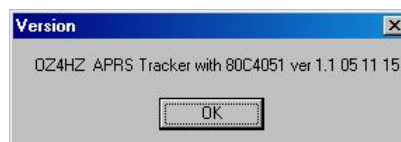
www.aargang64.dk/aprs/docs/config.html

Read the manual for the setup program (pdf file). Run the program aprstrak.exe

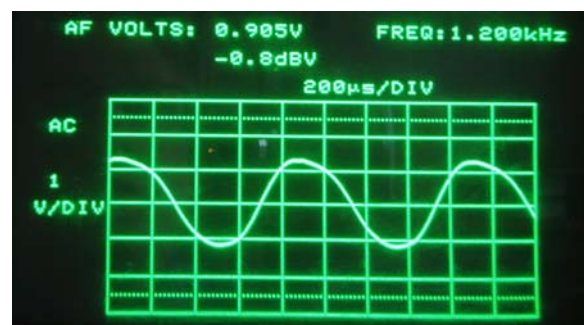
Now switch S2 on again and the green and red LED flashes a few times. Depending on the switch S1 (sets configuration 1 or 2) the green or red LED will stay on for a few seconds. If the green LED is on configuration 1 is used. If the red LED is on configuration 2 is used. Now its possible to read and write the tracker. Below is shown the screen of the configuration program use it to set user options such as callsigns and path etc.



First test the connection to the TXtracker .Click on the 'Read version' button and you should see a dialog box



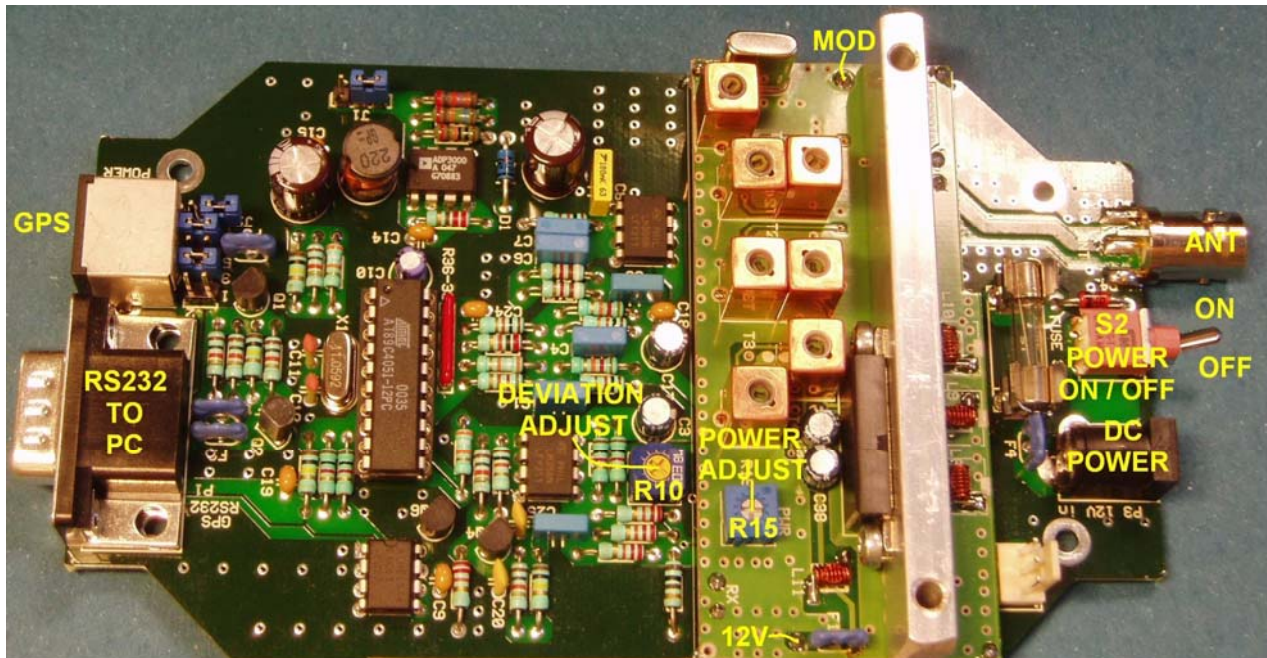
like the one above. (In the box you can see the software version of the tracker).



Now click the '2200Hz' button and connect a oscilloscope between MOD and GND. Adjust R10 for 4 Vp-p (1.35 Vrms) as shown above. Level is adjustable from 0.6 Vp-p (220 mVrms) to 4.7 Vp-p (1.65 Vrms). Now click the '1200Hz' button and check the voltage on the oscilloscope is approx. 2.3 Vp-p (0.8 Vrms).

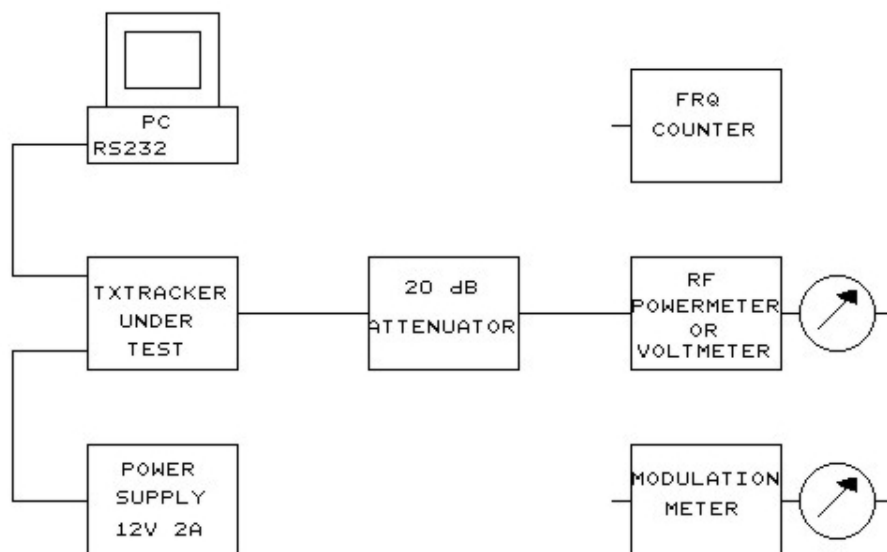
The difference in signals at 1200Hz and 2200Hz is due to pre-emphasis of the signal because the TX is Frequency Modulated (this means deviation is independent of modulation frequency) but we want deviation to increase with modulation frequency (as with Phase Modulation) because it gives an increase in S/N of the received signal. (if of course the receiver uses de-emphasis –). Now switch S2 off and we are ready for :

TXtracker Final Adjustment.



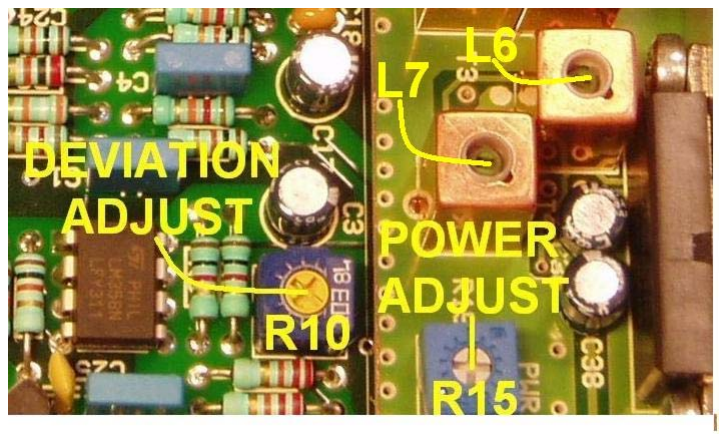
Install the TX part into the main board as shown on the picture. The following test equipment are required:

- DC power supply 12V ,min 2 A
- RF power meter or
- RF voltmeter ,Spectrum analyzer or just a diode detector + a 20 dB attenuator with 10W rating
- Modulation meter
- Frequency counter capable to measure at least 150 MHz.
- PC with setup software for the tracker.



Connect the RF power meter or RF voltmeter and a 20dB attenuator as shown on the drawing to the BNC antenna connector of the TXtracker.

RF Power Adjustment.



Turn R15 fully counter clockwise (TX pcb) for max. RF power. Start the setup program and switch power on (S2 to ON) .At power up the green and red LED on the TXtracker flashes a few times and one of the LEDs stays on for some seconds (depending on the switch S1) .Now it is possible to read and write the TXtracker from the PC program. Click on one of the buttons (1200Hz, 2200Hz or 1200/1200Hz) to key the transmitter while adjusting. The red LED is on during transmission. Due to the small heatsink limit the transmitter on time to max. 2 min.

Adjust coil L6 and L7 for max. RF power (or voltage)

Adjust R15 (on TX pcb) for 5 W RF output.

RF measurements with a 20 dB attenuator and RF power = 5 W :

RF power meter : 50 mW (17 dBm) (with 20 dB attenuation this means RF output of 5 W)

or

RF voltmeter (RMS reading) : 1.6 V (with 20 dB attenuation this means RF voltage of 15- 17 V)

or

Diode detector (p-p reading) : 4.0 V (remember this is p-p reading)

Frequency and Deviation Adjustment.

Now exchange the the power meter with a frequency counter and adjust L1 (on TX pcb) to 144.800 MHz.

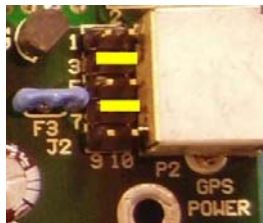
Then exchange the counter with a modulation meter. Click on the button for 2200Hz. The transmitter will now be modulated with a 2200Hz tone. Adjust R10 for a frequency deviation of 4.5 KHz on the modulation meter. Now click the 1200Hz button and the deviation meter should have a reading of approx. 2.5 KHz.



If you don't have access to a modulation meter you can make a provisional adjustment using a oscilloscope. When modulated with a 2200 Hz tone adjust R10 for a reading of 4 V p-p at pin MOD (see picture). Click on the 1200 Hz button and the reading should be approx. 2.3 V p-p and **REMEMBER** to check the frequency deviation when you have access to a modulation meter!!

GPS Interface.

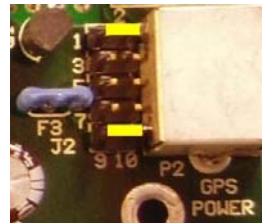
The GPS unit can be connected to P1 (serial data RS232) and P2 (Power for GPS). If you use an BR355 GPS the MINIDIN connector on the GPS can be connected directly to the TXtracker connector P2 without need for the conversion cable. At J2 put jumpers between pin 3 – 4 and pin 7 – 8. If using the older type BR304 (or BR355 with conversion cable) put jumpers between pin 1 – 2 and pin 9 – 10 for GPS power and use P1 for RS232 data from the GPS unit.



P2 pinout

Pin 1 : Vcc to GPS
Pin 2 : GND
Pin 3 : Data to GPS
Pin 4 : NC
Pin 5 : NC
Pin 6 : Data from GPS

Jumper setting BR355

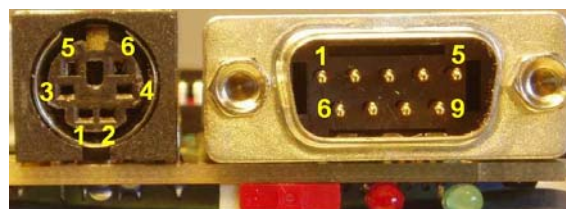
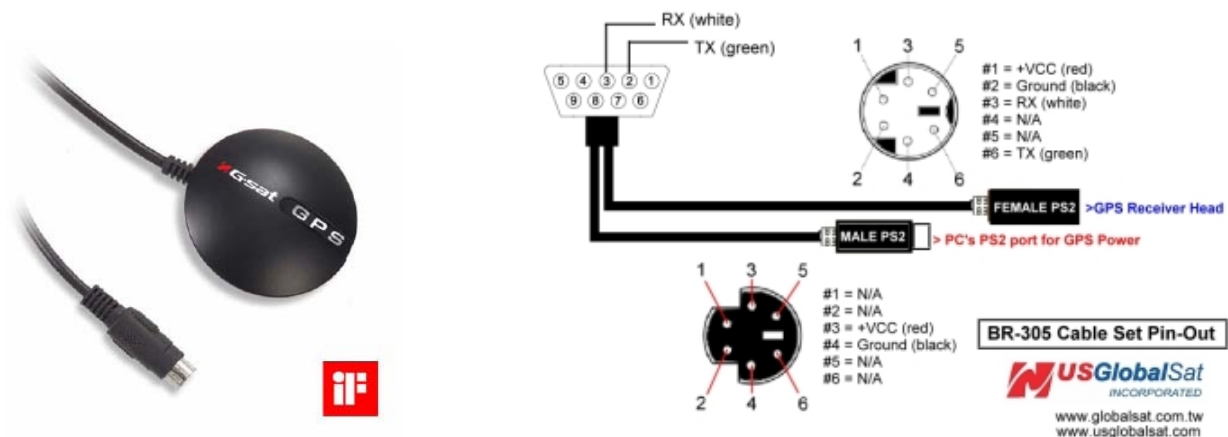


P2 pinout

Pin 1 : NC
Pin 2 : NC
Pin 3 : Vcc to GPS
Pin 4 : GND
Pin 5 : NC
Pin 6 : NC

Jumper setting BR304

If your GPS supports 3.3 V operation put jumper J1 in position for 3.3V operation and you will save power. BR355 and BR304 works well with a supply voltage of 3.3 V.



P2

P1

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

Jumper settings for J1: 1-2 Vcc = 3.3V
2-3 Vcc = 5V

Title	
024MHz APRS TRACKER WITH TX	REV
Size Document Number	
A3	APRSTX.SCH print 00-0016D
0315	JAGUAR TX 2000/05/01

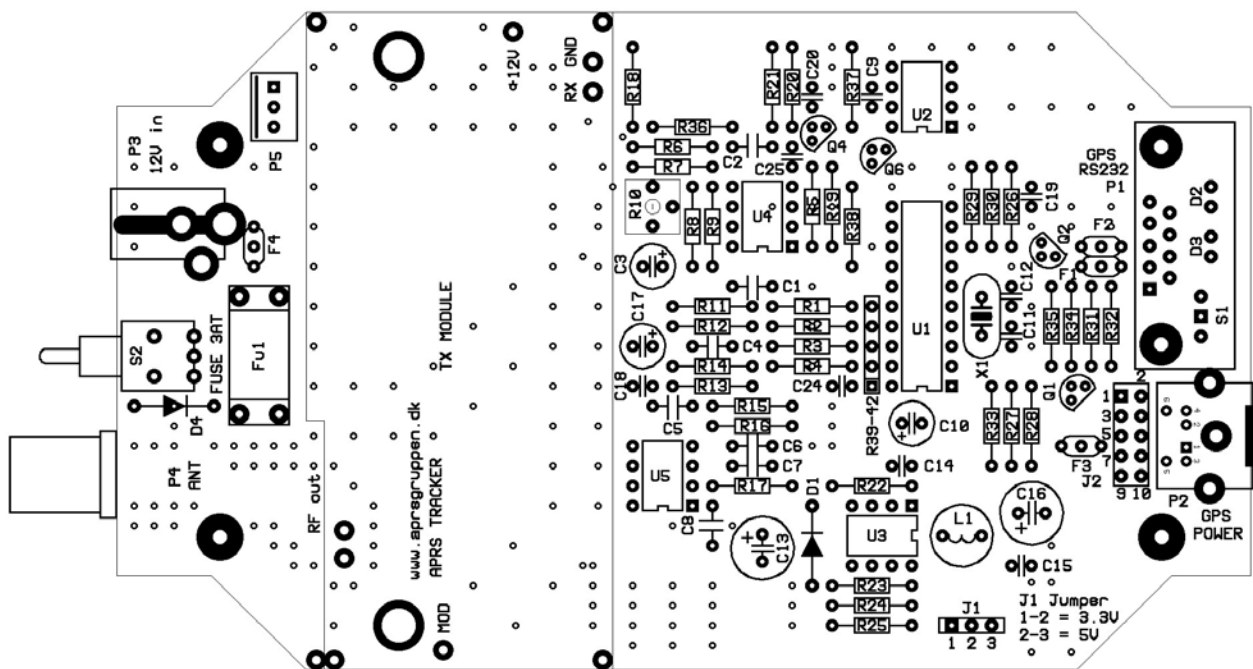
P1 : RS232 connector to PC/GPS

P2 : Powersupply for GPS (and data to-from GPS unit BR355)

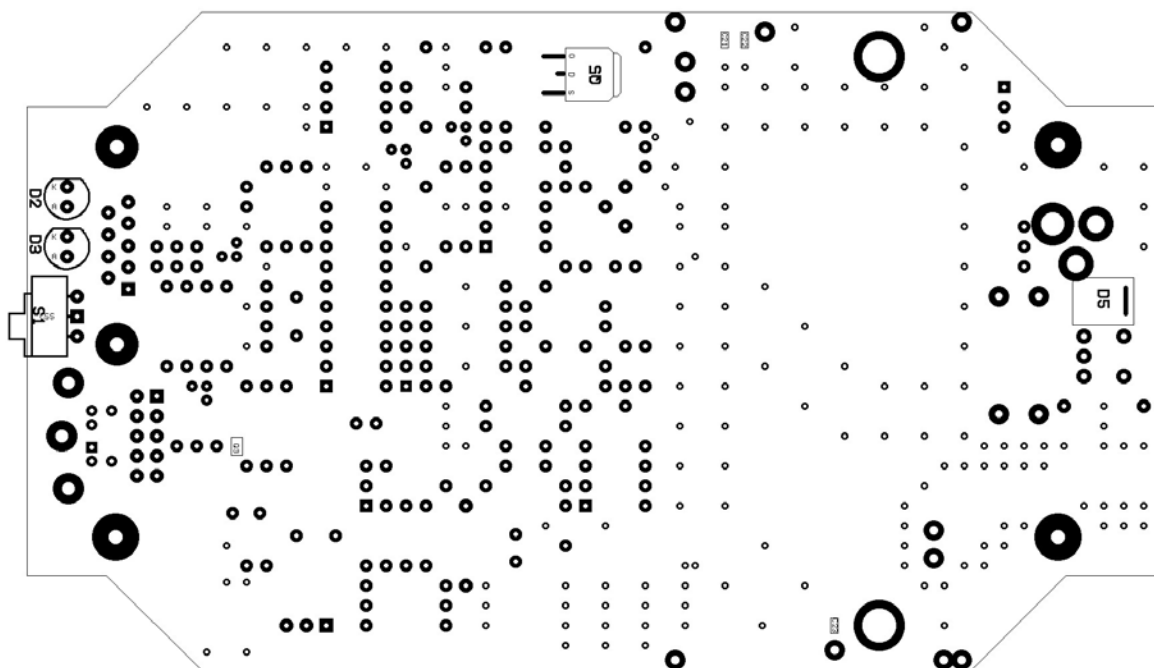
P3 : Powersupply 12 V

P4 : BNC antenna connector

P5 : Connection to a optional batterypack (12V 2400 mAH 10x1.2V NiMH AA batteries)



Top of pcb



Bottom of pcb.

OZ4HZ TXTRACKER PCB H04016C Components list (Correction date 19 JAN 2007)			
Quantity	Reference	Part	
3	C1,C2, C5	1.5n MKT 5% Capacitor Lead pitch 5 mm (BC 2222 470 series)	(Farnell 1166064)
1	C4	10n MKT 5% Capacitor Lead pitch 5 mm (BC 2222 470 series)	(Farnell 1166055)
2	C3,C17	22u /16V Miniature radial electrolytic capacitor	(Farnell 9452206)
2	C6,C7	4.7n MKT 5% Capacitor Lead pitch 5 mm (BC 2222 470 series)	(Farnell 1166067)
1	C8	100n MKT 5% Capacitor Lead pitch 5 mm (BC 2222 470 series)	(Farnell 1166036)
6	C9,C14,C15, C18,C19,C24	100nF/50V X7R or Z5U Capacitor Lead pitch 2.54mm (RSONline 2644911 (X7R) or 2644933 (Z5U))	
1	C10	1uF/50V Miniature radial electrolytic capacitor	(Farnell 9452303)
2	C11,C12	33pF 5% Ceramic Capacitor Lead Pitch 2.54mm (NPO or N220)	(Farnell 236986)
2	C13,C16	100uF/35V UPM1V101MPD Low ESR electrolytic Capacitor(Nichicon)	(Farnell 8812543)
2	C20,C25	10nF +80/-20% Ceramic Capacitor Lead Pitch 2.54mm	(Farnell 237279)
1	C21	100nF ceramic capacitor size 0805 or 0603 XR7 10%	(Farnell 3019949)
2	C22,C23	1nF ceramic capacitor size 0805 or 0603 XR7 10%	(Farnell 3019871)
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)
1	D5	30BQ040 Schottky diode	(Farnell 8647879)
2	F1,F2	1nF T-FILTER ZJSR5101-102TA (TDK)	(or Murata Farnell 9527362)
2	F3,F4	10nF T-FILTER ZJSR5101-103TA (TDK)	(or Murata Farnell 9527389)
1	Fu1	Fuseholder (Shurter OG751.0052) + 5*20mm 3A fuse	(ELFA 3315454)
1	J1	3 pin header (2.54mm) + jumper	
1	J2	3*2 pin header (2.54mm) + jumpers	
1	L1	22uH Coil ELC08D220E	(Farnell 3227200)
1	M1	144.800 MHz OZ4HZTX module	
10		Socket for TX module AP102 -BZ (Mfg Assmann)	
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	DC connector K375B with 2.5 mm centre pin	(Cypax 140303051)
1	P4	Female BNC SOCKET for PCB	(Farnell 1020980)
1	P5	3 pin header with lock NSL25-3G	(Cypax 142512503)
3	Q1,Q4,Q6	BC547,BC548,BC549 or similar NPN transistor	
1	Q2	BC557,BC558,BC559 or similar PNP transistor	
1	Q3	IRLML6401PBF (SMD) P MOS transistor	(Farnell 8660093)

OZ4HZ TXTRACKER PCB H04016C Components list

Quantity	Reference	Part	
1	Q5	IRFR9024NPBF (SMD) P MOS transistor	(Farnell 8649863)
1	R1	82Kohm 5% 0.4W Resistor (SFR25)	
3	R2,R33,R38	39Kohm 5% 0.4W Resistor (SFR25)	
1	R3	20Kohm 5% 0.4W Resistor (SFR25)	
11	R4,R5,R11,R14, R17,R19, R20, R27,R31,R32, R35	10Kohm 5% 0.4W Resistor (SFR25)	
4	R6,R7,R36,R37	22Kohm 5% 0.4W Resistor (SFR25)	
4	R8,R9,R29,R30	1Kohm 5% 0.4W Resistor (SFR25)	
1	R10	10Kohm BOURNS TYPE 3362P Variable Resistor	(Farnell 9354301)
2	R12,R13	12Kohm 5% 0.4W Resistor (SFR25)	
2	R15,R16	9.1Kohm 5% 0.4W Resistor (SFR25)	
1	R18	100 ohm 5% 0.4W Resistor (SFR25)	
4	R21,R26, R28,R34	100Kohm 5% 0.4W Resistor (SFR25)	
1	R22	220 ohm 5% 0.4W Resistor (SFR25)	
1	R23	100Kohm 1% 0.6W Resistor (MRS25)	(Farnell 9463895)
1	R24	165Kohm 1% 0.6W Resistor (MRS25)	(Farnell 9464786)
1	R25	137Kohm 1% 0.6W Resistor (MRS25)	(Farnell 9464425)
1	R39-R43	1Kohm 5 pin SIL 4 Resistor network	(Farnell 9356053)
1	S1	Switch for PCB (Type EAO 0910290-01)	(RSOnline 2047871)
1	S2	Switch for PCB ES-6 MINI 90 1pol ON-ON	(Cypax 100061011)
1	U1	AT89C4051-12PC + 20 pin socket	
1	U2	AT24C02-10PU-2.7	(Farnell 1095750)
1	U3	ADP3000 AN	(Farnell 3146443)
2	U4,U5	LM358N	
1	X1	1.0592MHz HC49/4H	(Farnell 9713115)

The pcb fits into this box :

OKW A9408340 (get datasheet from the website) or

OKW A9408440 with room for battery pcb (get datasheet from the website)

GPS used for this tracker :

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

RS232 and power cable for BR355 (ELFA 7843105)

Remark: Most of the datasheets for components used in the TXtracker can be downloaded from the website

www.aargang64.dk/aprs/docs/datablade.html

Suppliers web pages :

Farnell : www.farnell.com

RSonline : www.rsonline.dk

Elfa : www.elfa.se

Cypax : www.cypax.dk