

Yaesu FT-221R Frequency-counter



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Yaesu FT-221R frequency-counter

The old VHF- Transceiver **Yaesu FT-22R** has an analog frequency scale, making the precise frequency determination difficult.

A little microcontroller circuit provides a digital frequency readout which can be added to the set without any modifications.

The circuit consists of an ATmega8 microcontroller, a frequency divider U813 and a 5 Volt stabilization circuit. . The LCD can be a small 2x8 character module and can be fitted in front of the analog scale.

A small piece of plastic covers everything from the unused part of the scale and may look almost "original".

In my case, I had 2x16 mini LCD with ribbon cables, although somewhat small, but as good as ready for installation. The ribbon can be placed between the glass window and the front panel and is directly soldered to the motherboard. Individual wires can be used also.

The control signal comes from the PLL unit PB-1455 at Pin2 (VCO) via a coaxial cable RG174 and goes to the frequency divider U813. This divides the signal by 64, generating an output frequency of approximately 2 - 2,3 MHz. Transistor T1 increases the level to 5 Volt and supplies the signal to the Counter Port PD5.

A gate time of 0.5 sec provides a good compromise between indication speed and accuracy.. The microcontroller finally adds the intermediate frequency (IF) of 10.7 MHz and this will be the indicated frequency on the LCD.

The 2 buttons are used to fine tune the crystal frequency, the overall accuracy depends on this setting! Set the signal generator to 133,850 MHz and apply this signal to the HF input of the circuit. The LCD should read 144,550 and can be adjusted by using the pushbuttons (up or down).

This value is then stored in the EEPROM, and remains there even without supply voltage. Depressing the UP-button during power-on, generates a **reset** and selects the default value, if this should become necessary.

The intermediate frequency of 10,7 MHz may be changed by simultaneously pressing the up and down pushbutton during power-on. Select the desired IF by using the buttons and finally store the new frequency by pressing both buttons again. This allows the operation of the counter with radios of different intermediate frequencies.

The resistor R3 is selected for this specific 2x16 LC display and supplies 4.2 V/20mA at 5V. Different LCDs require different resistors and please note, that the 5 Volt regulator can supply a maximum current of 100 milli-Amperes. If more power is needed, re-calculate the resistor, connect it directly to the 12 Volt power supply and break the trace on the PCB.

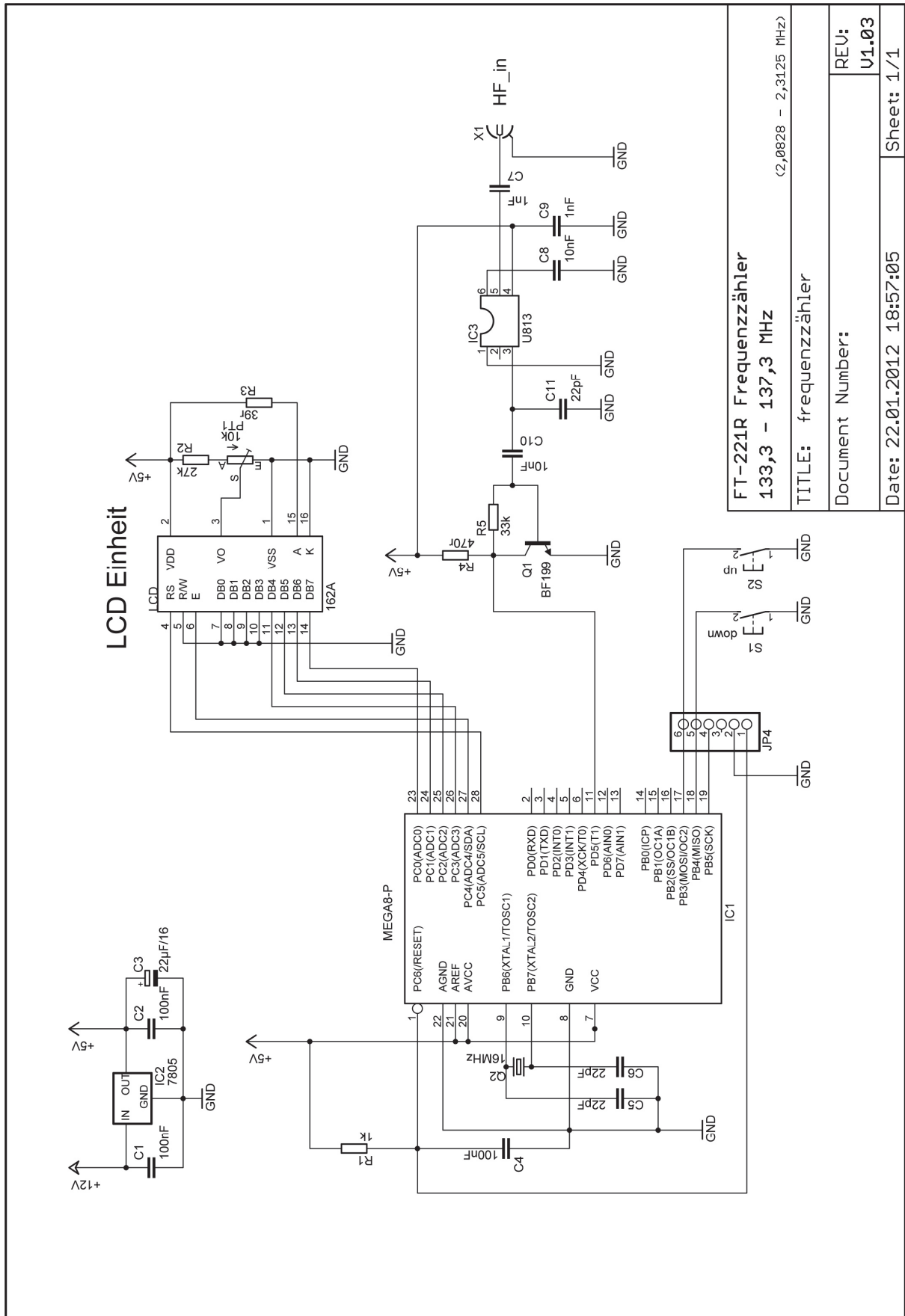
Only if the indication of the display is not correct, C11 should be added to the circuit

According to the schematic and the component location drawing it should be no problem to build the little unit. Parts can be ordered by "Reichelt Electronics" or simply send me an e-mail.

The software I send free-of-charge via e-mail, programmed controllers I can supply at self-cost-price.

73 de Oliver, DG7XO

Schematic diagram



FT-221R Frequenzzähler 133,3 - 137,3 MHz TITLE: frequenzzähler	
(2,0828 - 2,3125 MHz)	
Document Number:	REVU: V1.03
Date: 22.01.2012 18:57:05	Sheet: 1/1

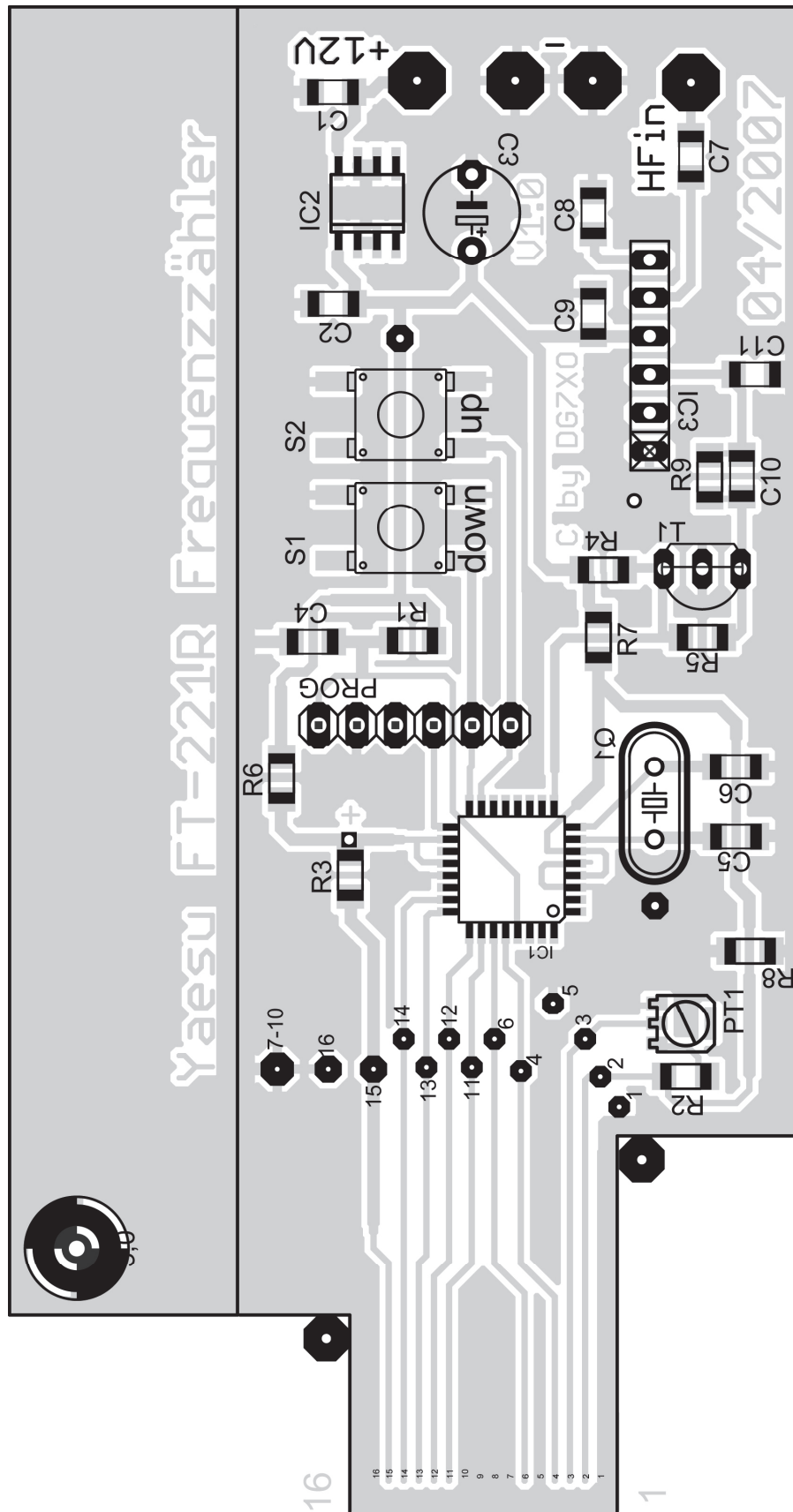
Assembling list

Part	Value	Case
C1	100nF	1206
C2	100nF	1206
C3	22µF	RM5
C4	100nF	1206
C5	22pF	1206
C6	22pF	1206
C7	1nF	1206
C8	10nF	1206
C9	1nF	1206
C10	10nF	1206
C11	22pF (see text !!)	1206
R1	1k	1206
R2	100k	1206
R3	39r	1206
R4	470r	1206
R5	33k	1206
R6	0r	1206
R7	0r	1206
R8	0r	1206
R9	entfällt	1206
PT1	10k	SMD
IC1	ATMega8-16 SMD	SMD
IC2	µA7805	SMD
IC3	U813	6SIL
T1	BF199	TO92
Q2	16 MHz	HC49
LCD	2x16 chr DIP	
2x Pinleiste	Pinboard 2,54mm	
	2x groper SMD	
	30cm Coax RG-174	

Order list Fa. Reichelt.de

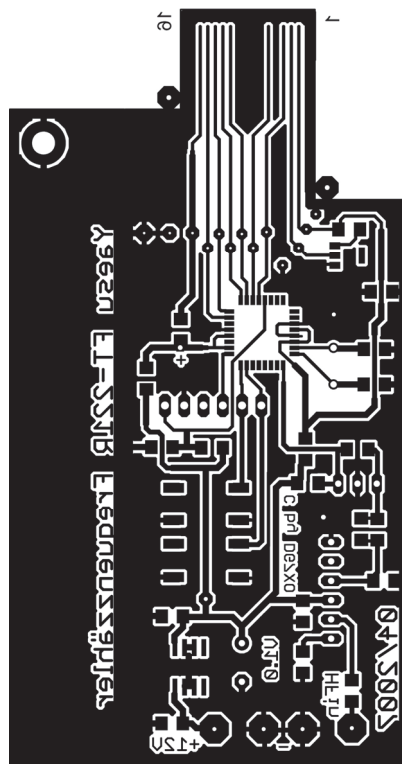
Teilnehmer	Anzahl Gesamt	Anzahl Stück	Artikel-Nr.	Preis / St.	Preis / Ges.	Preis / Ges 1 Stück	ohne LCD	Bemerkungen
1	0					0,00 €	0,00 €	
1	3	3	X7R-G1206 100N	0,09 €		0,27 €	0,27 €	G1206
1	2	2	X7R-G1206 10N	0,06 €		0,12 €	0,12 €	G1206
1	2	2	NPO-G1206 1,0N	0,06 €		0,12 €	0,12 €	G1206
1	3	3	NPO-G1206 22P	0,05 €		0,15 €	0,15 €	G1206
1	1	1	RAD 220/35	0,10 €		0,10 €	0,10 €	RM5
1	3	3	SMD 1/4W 0,0	0,10 €		0,30 €	0,30 €	G1206
1	1	1	SMD 1/4W 39	0,10 €		0,10 €	0,10 €	siehe Text !!
1	1	1	SMD 1/4W 470	0,10 €		0,10 €	0,10 €	G1206
1	1	1	SMD 1/4W 1,0k	0,10 €		0,10 €	0,10 €	G1206
1	1	1	SMD 1/4W 100k	0,10 €		0,10 €	0,10 €	G1206
1	1	1	SMD 1/4W 33k	0,10 €		0,10 €	0,10 €	G1206
1	0	0	SMD 1/4W 1,0M					entfällt
1	1	1	SMD PC25 10k	0,39 €		0,39 €	0,39 €	SMD PC25
1	1	1	ATMega 8-16 TQ	1,70 €		1,70 €	1,70 €	SMD
1	1	1	µA 78L05 SMD	0,12 €		0,12 €	0,12 €	8-SOP
1	1	1	U 813 BS SI	0,86 €		0,86 €	0,86 €	6SIP
1	1	1	16,0000-HC49U-S	0,24 €		0,24 €	0,24 €	HC49
1	1	1	BF 199	0,09 €		0,09 €	0,09 €	TO92
1	2	2	Taster 9313	0,24 €		0,48 €	0,48 €	SMD Taster
1	1	1	SPL 20	0,27 €		0,27 €	0,27 €	Buchsenleiste RM2,54
1	1	1	LCD 082 DIP	15,75 €		15,75 €		siehe Text, R3 beachten
1	0					0,00 €	0,00 €	
1	0					0,00 €	0,00 €	
			Summen:			21,56 €	5,81 €	
						Model I	Model II	
			<u>Preise:</u> Stand: 26.04.2007			Anzahl Teilnehmer:	1	
			Gesamt Model I: 21,56 €					
			Model I: LCD 2x8 Zeichen, R3 beachten, von 12V aus berechnen					
			Model II: ohne LCD					
			Fett = Kostentreiber :-)					

Assembling plan

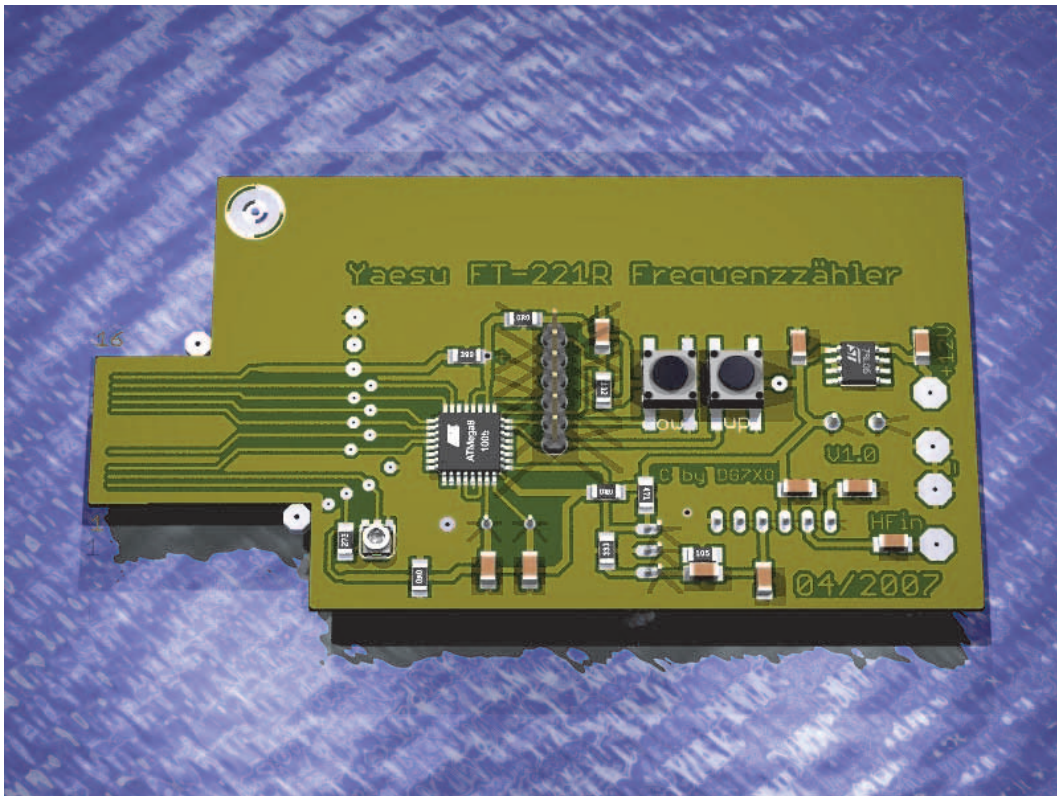


C3, Q1, T1 and IC3 soldering on the ground site

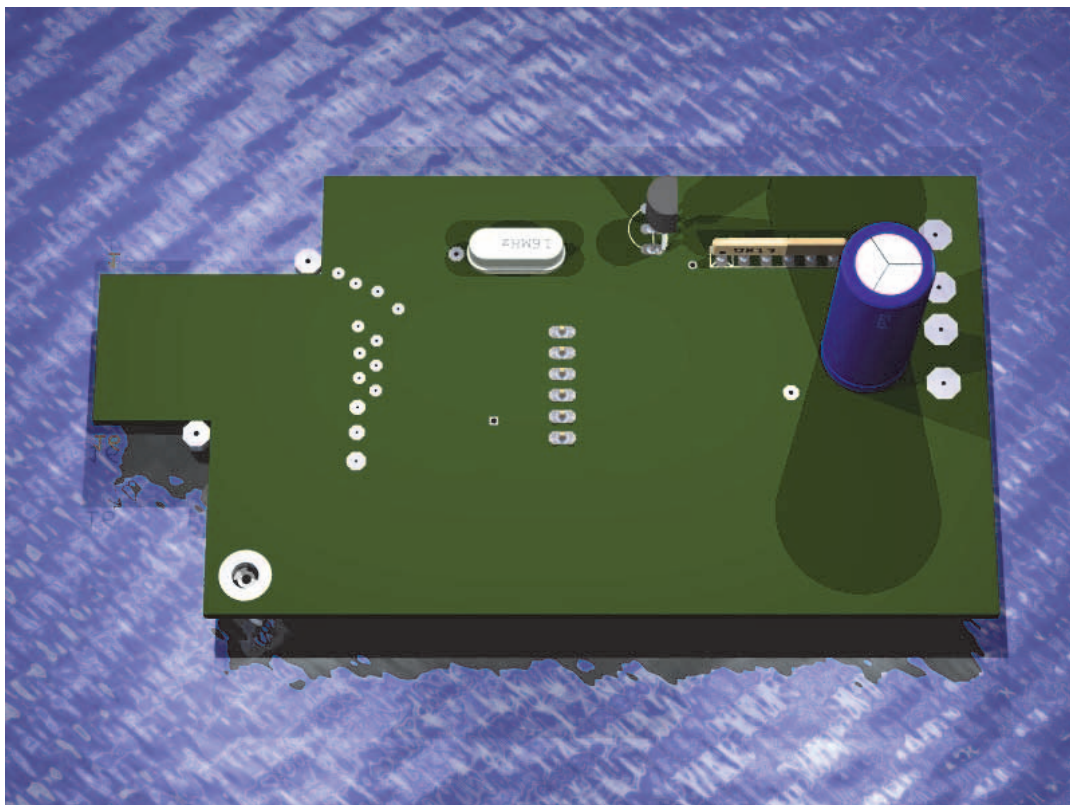
Layout



finished construction SMD-site (TOP)



finished construction ground-site (Bottom)



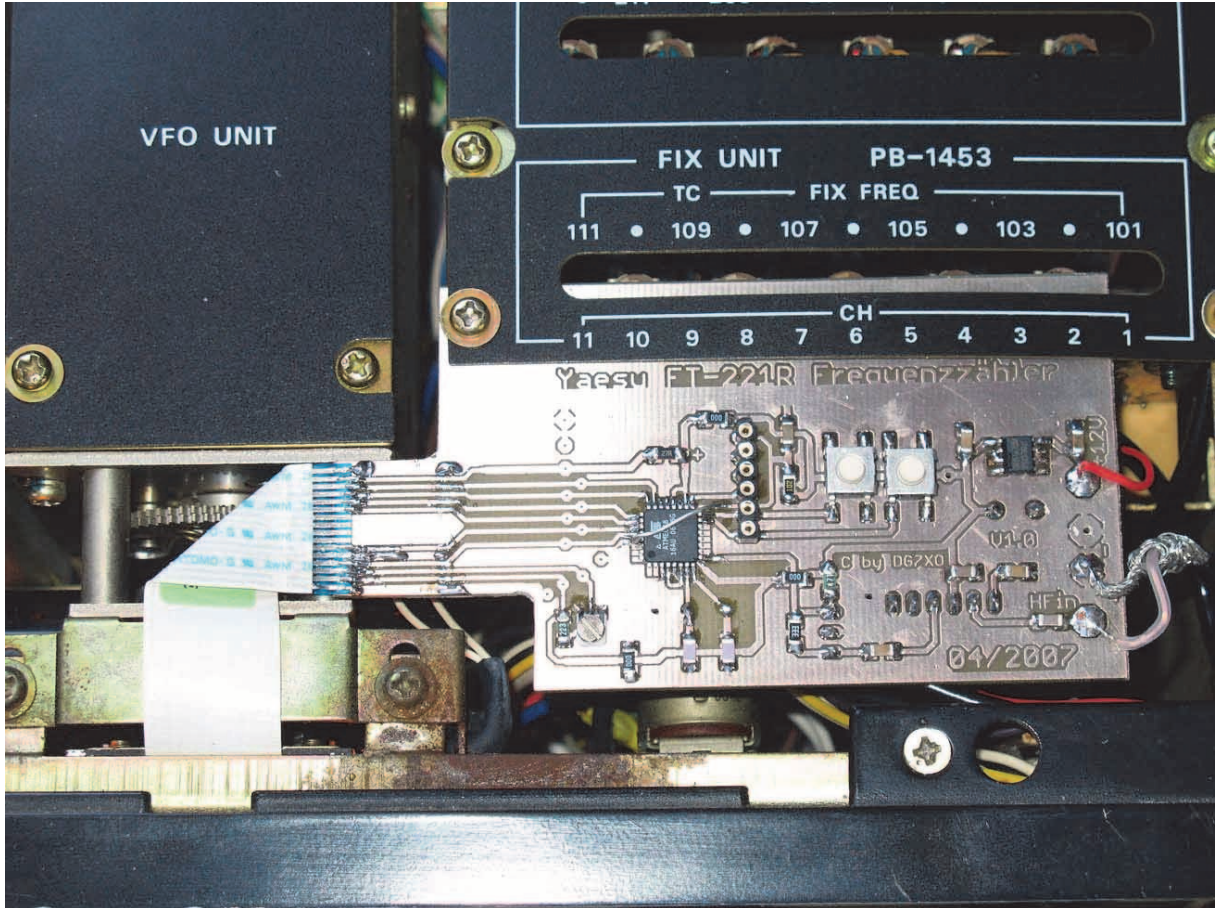
view LCD with aperture



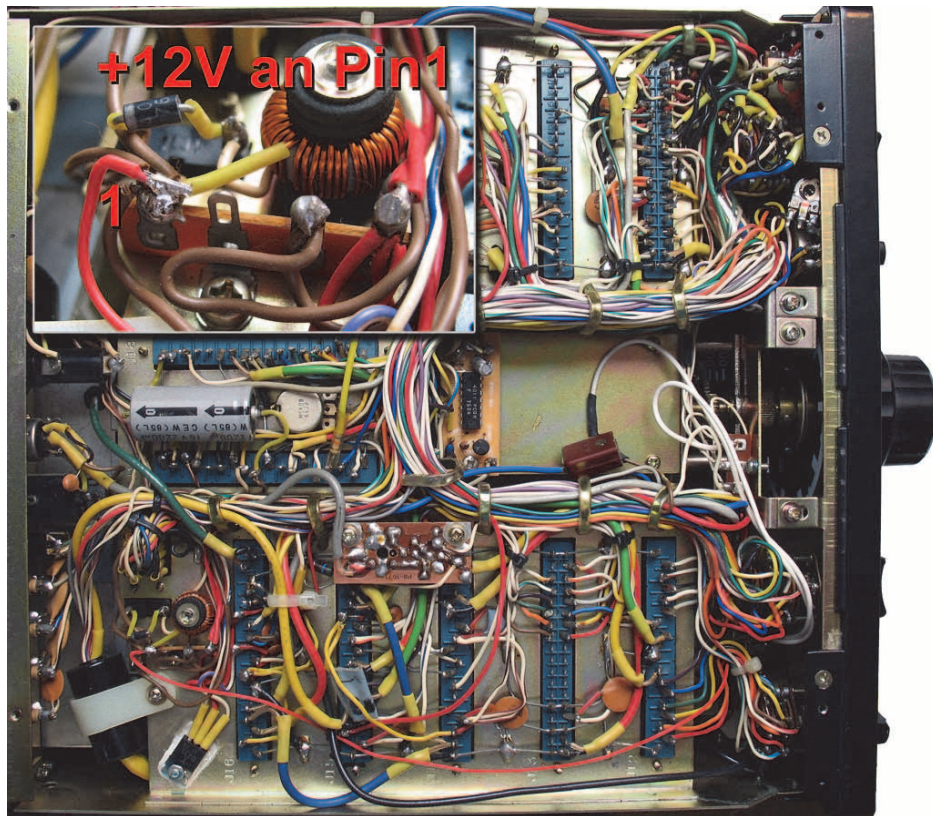
view LCD without aperture



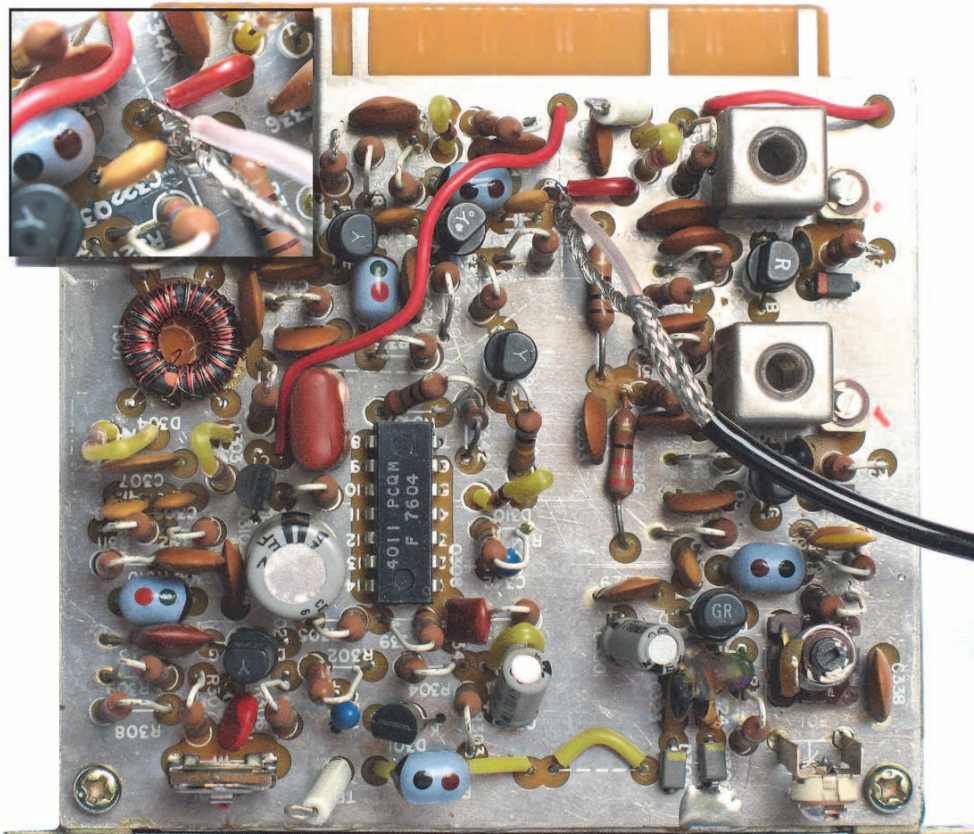
view installed PCB



+12V on Pin1 from solder base (brown)



HF- on the VFO (little red bridge)



general notes

- The accuracy depends heavily on quartz and operating from. Therefore, crystals with min. 30ppm to use and the adjustment should be filed with the temperature prevailing in the device are made. Thus, one after the warm-up time the max. accuracy.
- The board should be on the back of a complete cooper mass, the holes without mass line with drill bit bigger auger.
- The board of bridges or possibly cracks control.
- First solder all SMD parts on the track side solder, until finally the remaining parts on the ground (cooper) side.
- The 78L05 regulator has a flattened edge, this corresponds to the lateral line.
- The +12 V are on the gray wire solder pad, this pin is the switched +12 V line.
- RF is the VFO Pin2 on the PLL-PCB/module. This pin is also the little red jumper on the TOP-Side.
- The capacitor C11 22pF equip only when the frequency display only should jump around wildly, R9 are completely deleted.

Have fun building and installation

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