SDR-Kits – PA0KLT Si570 VFO Synthesizer Kit for SECOND ISSUE PCB

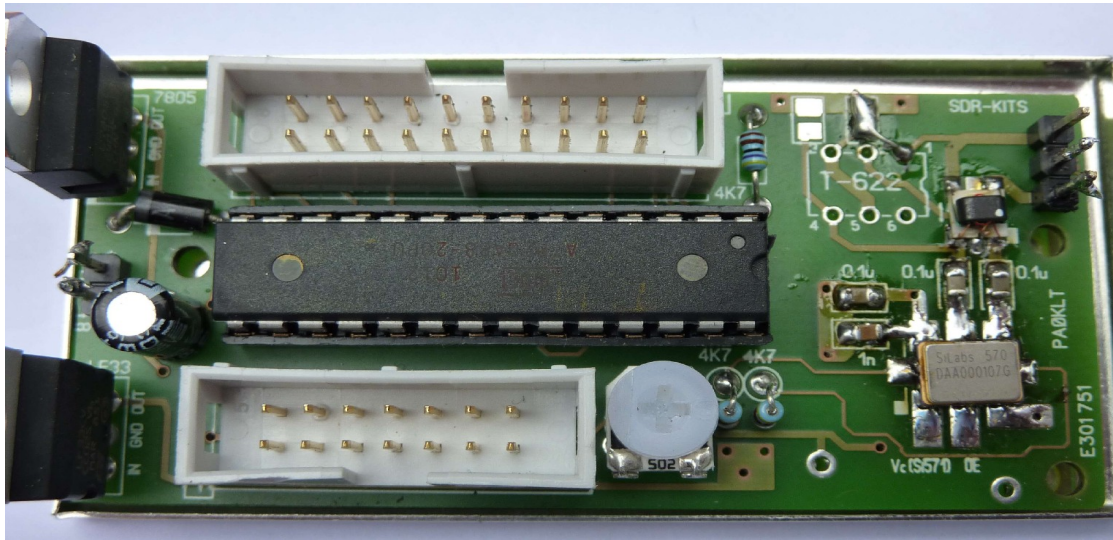**IMPORTANT** - This Manual is for Kits supplied from **1 June 2010** for PCB marking **E30175 or higher**

Fig 1: PAOKLT PCB Second Issue with Coilcraft WBC4-1 transformer fitted

1. Introduction:

The "standalone" PAOKLT VFO Synthesizer kit uses the Silicon Labs Si570 XO Low noise Synthesizer chip controlled by a Atmel Mega 8 or Atmel Mega 88 Controller with connections to an external 16 or 20 character x 2 lines LCD Display and a 96 step rotary encoder for tuning.

Frequency coverage is from 3.5 MHz up to 1417 MHz, depending on the type of Si570 device fitted. The minimum tuning step is selectable from 1 Hz, 10Hz, 100 Hz, 1kHz upwards.

The design offers a Smooth Tuning like in a high quality Analogue VFO – There is no interference when the frequency of the Si570 is tuned within +/- 3500 ppm from last Coarse Frequency command executed. Tuning speed is 96 steps for each turn of the tuning control knob.

Up to **32 frequencies** may be stored in **Memory** in two banks (Memory A and Memory B)

This kit is the latest version of the "Universal Si570 project" by Ton PA0KLT, which was first published in Dutch in "Nieuwsbrief" the club journal of BQC, the Belgium and Dutch QP in 2008 and 2009 (http://home.wanadoo.nl/bqc/)

2. Brief Specifcation:

- Standalone Low Noise VFO Synthesizer suitable as Signal Generator, Local Oscillator or VFO etc with good frequency stability for many (Amateur) Radio Projects.

- Si570 "Smooth Tuning" Algorithm - No interuption of rf output when Si570 is tuned within +/- 3500 ppm of last Coarse Frequency command. 96 steps/rotation by firmware.

- 32 Frequencies may be stored in Memory in two Memory Banks

- Frequency coverage options depending on Si570/Si571 type fitted:
  - Si570CAC **CMOS: 3.5MHz - 160 MHz** at 3V pkpk Square wave CMOS Output **(280 MHz possible but not guaranteed)**
  - Si570BBC LVDS: **3.5 MHz - 280 MHz** at 0.7V pkpk LVDS level
  - Si570BBB LVDS: **3.5 MHz - 810 MHz** at 0.7V pkpk LVDS level **(Max 945 MHz possible but not guaranteed)**
  - Si570DBA CML: **3.5 MHz - 945 MHz, 970 MHz - 1134 MHz and 1213 MHz - 1417.5 MHz** at typically 1.5V pkpk CML level. (**In PA0KLT Kit typically 3.5 MHz - 1417 MHz continuous coverage is obtained in practice but not guaranteed**)
  - Si571CFC CMOS: 3.5 MHz - 160 MHz with FM Modulation input. (**typically 3.5 MHz up to 210MHz is possible but not guaranteed**) See fig 5. note 5.

- Mode Offset applied: AM = 0 kHz, USB/LSB = +/- 1.5 kHz and CWU/CWL = +/- 750 Hz

- Power Supply voltage: 8-12V or from single +5V supply with modification
- Current consumption 125mA (20mA drawn by LCB backlight)

- Provision of RF output transformer options on PCB
  - Homebrew BN43-2402 4:1 transformer up to 200 MHz (BN61-2402 core to 300 Mhz)
  - Minicircuits T-622 4:1 up to 200 MHz
  - Coilcraft WBC4-1WLB up to 800 MHz (fits on PCB)

  A Minicircuits ADT4-1WT 4:1 transformer 2 - 775 MHz may also be used by cutting tracks on the PCB.

- Support industry standard LCD display 2 x16 to 2x20 characters
- LCD module supplied has built-in backlight - size 73mm x 36mm
- PCB size: 70mm x 34mm - Tin plated screen box available.
- Firmware written in Assembler and supports following features:
  - Programmable IF Offset, minimum and maximum frequency and SI570 I2C address
  - Si570 Frequency calibration
  - Programmable multiplier x1. x2 x4 or x8
- IF Offset is removed when "LOCK" is applied (TX Mode). See Table 3 and Table 4.
- Kit suitable for constructors with some previous kit assembly experience. Some components like capacitors (0805mm) and Si570 are Surface Mount Devices. Ability to understand circuit diagrams is required if the kit is to fit your specific requirements.
- Si571 chip is support from V4.19 Firmware onwards. (see fig 5 - notes)

3. Bill of Materials

The following parts are supplied in the basic kit.
Parts marked in blue are options as ordered by you.

Pcs/kit	Part	Value	Remarks
1	C1	10uF Electrolytic	Radial
5	C2, C3, C4, C5	1uF Ceramic	0805 SMD Blue stripe
8	C6, C7, C8, C9, C10, C11	100nF Ceramic	0805 SMD - No marking
2	C12	1nF Ceramic	0805 SMD - Black Stripe
3	R1, R3	4k7 0.25W	yellow violet red gold
1	RV1	4k7	adjustable
1	R4	47 ohm 0.6W - LCD Backlight	Yellow violet black gold brown
1	D1	1N4001	
1	U3	LF33ABV	3.3V LDO Regulator TO220
1	U4	7805	5V Regulator TO220
1	U1	ATMega8-16 or Mega88-20PU	PAOKLT Firmware marked
1	IC Socket	28 pin DIL for U1	28 pin
1	P1	2 pin header plug (+8 - +12V)	0.1" male
1	P2	3 pin header plug (HF Out)	0.1" male
1	P3	LCD Header	14 pin IDC Male
1	P4	Aux Conn Header	20 pin IDC Male
1	J1	LCD Connector	14 pin IDC female
1	J2	Aux Connector	20 pin IDC female
1	PCB	PA0KLT	SDR-Kits - marked E301751 (see fig 1)
2		mini push switch	Red (Mem and ESC)
2		mini push switch	Black (< and >)
0.3	Ribbon cable	16 way	
1	Encoder	Encoder	24 step contact
1		LCD Display with backlight	16 character by 2 lines
1	U2 option 1	Si570CAC000141DG	3.5-160 MHz - max 210 MHz - CMOS output
1	U2 Option 2	Si570BBC000141DG	3.5-280 MHz - LVDS output
1	U2 Option 3	Si570BBB000141DG	3.5-810 MHz - Max 940 MHz - LVDS output
1	T1 Option 1	43 BN-2402 kit	with 32AWG = 0.23mm enamelled wire
1	T1 Option 2	Coilcraft ADT4–1WT 4:1	wound transformer

<u>Caution -</u> This Manual is applicable to Kits supplied up to May 31st 2010 with PCB marking E301751 or higher batch numbers

If the PCB supplied has V238031 printed on the track side then you have a FIRST ISSUE PCB and this manual is NOT applicable Please download PAOKLT Assembly and Operations MANUAL for FIRST ISSUE PCB.

4. PCB Assembly instructions

Assembly of the PCB should be quite straight forward. Observe antistatic precautions especially when handling Semiconductors - Si570 and the programmed AVR. The Kit assembly sequence is as follows:

- Assemble the PCB and check voltages on regulators
- Wire up LCD Display unit and Aux Connections to 4 push buttons
- Install AVR in socket
- Apply Power and check AVR and LCD functionality
- Solder in Si570 XO Synthesizer chip and test RF output

Use a 15-40W Solder station or a 15W - 25W soldering iron and 0.5mm solder. SMD soldering is not difficult - Apply a little tin to one of the pads, place the SMD capacitor over the pads and apply heat to make the bo.d. Once the SMD part has been soldered to one of the pads continue by soldering the second pad and finish off by reflowing the tin on the first pad, applying a little more tin if necessary. Use a magnifiying glass to inspect any joints.

Caution: Do NOT solder U2 = Si570 until instructed to do so.

( )   Start by fitting the 1uf Ceramic 0805 capacitors C2, C3, C4 and C5 (blue stripe)
          as shown in fig 2. (there is no polarity indication as capacitors are bipolar)

( )   Solder 100nF 0805 capacitors (no markings) C6, C7, C8, C9, C10 and C11

( )   Solder C12 = 1nF - black stripe

( )   Solder R1, R2 and R3 = 4k7 resistors (yellow violet red gold)

( )   Fit and solder RV1 4k7 Preset

( )   Fit diode D1 1N4001 - observe white band and solder

( )   Fit C1 10uF - observe correct polarity. White stripe is negative -   lead.

( )   Fit 28 pin DIL socket - Observe notch and align as shown on PCB.
          Ensure that the socket is mounted flush to the board solder pin one and pin 28 then
          check for a snug fit to the board. If it is not apply a slight pressure to the DIL
          socket and re-solder the pins. Once it is flush solder the remaining pins

( )   Fit connectors P1 (location 8-12V) and P2 (location HF Out) making
          sure that the short pins are the ones you solder to the board.

( )   Refer to fig. and fit connectors P3 (14 pin LCD header) and P4 (20 pin AUX
          Connector).
          Caution - ensure that the notch of the connector is located shown in Fig 1
          Ensure that the connectors are fitted flush with the board. Use the same
          procedure as you did with the 28 pin DIL socket to ensure that the
          connectors are fitted flush with the board.

( )   Fit TO220 Regulators U3 (LF33) and U4 (7805) and check position against PCB
          before soldering.

Inital PCB testing

At this stage all components except the AVR and SI570 are fitted on the PCB.

( )   Connect +8V - 12V DC Power to P1 on the PCB - observe polarity. Current
          consumption should be no more than 20mA at this stage. Switch of and investigate
          if current is too high or if any components are getting hot or any of the voltages are
          not within +/- 5% of the expected valued.

( )   Use a DC voltmeter to check whether +5V is present on the "IN" of U3 LF33.
          and +3.3V is present on the output pin of U3 - LF33 regulator before proceeding.

( )   Switch off Power and remove leads from P1.

Final Assembly

          **CAUTION: In the following step ensure the 14 Way cable is connected
          correctly so pin 1 of LCD is connected to GND and Pin 2 to +5V otherwise the
          LCD display will be destroyed.**

( )   **LCD Connector J1:** In this step the wiring to the LCD display.
          Before cutting to length you will wish to consider how long the cable needs to be to
          fit in the enclosure you are going to use.
          Cut a length of 16 way ribbon cable required to connect between PCB and LCD
          module. Peel off two of the cores at the opposite end to the red cores to reduce the
          cable to 14 wires. Fit the cable at right angle into the IDC connector **so the red
          coloured wire connects to P3 Pin 1** (See fig 2). Clamp into a small vice. Turn the
          vice until the ribbon cable is solidly pressed into the connector.
          Caution: Over-tightening may damage the connector.

( )   Remove a 2mm insulation from the end of each of the wires. Refer to Fig 6. and
          Solder the 14 wires to the LCD module. Observe connections as shown in fig 5. (J1
          pin 1 connects to LCD pin 1, J2 pin 2 to LCD pin 2 etc)

( )   **LCD Backlight connections J1:** Caution - the following instructions are only
          valid for LCD modules supplied by SDR-Kits: Use the two wires removed
          previously and solder one wire from LCD Pin 1 to LCD Pin 16. Solder one end of
          the 47 Ohm resistor to LCD module pin 15 and the other end of the resistor to Pin 2
          of the LCD module. (This is shown in fig 6.)

( )   **AUX Connector J2:** Fit the required length of 16 way ribbon cable on the 20 Way
          connector J2 similarly to how you prepared the cable for the LCD module. Caution

the red coloured wire should connect to pin 1 of P4, **Note:** the correct orientation of the pins for J2 is shown in Fig 2.   Pin 17-Pin 20 are reserved for future use.

The table below shows the essential connections required to support the four pushbuttons (< > ESC and MEM) and the Rotary Encoder for Tuning.

Wiring Aux Connector – J2 (mates with P4)		
Pin	**Description**	**Remark**
1	Band Select Output A	Optional use
2	Band Select Output B	Optional use
3	Band Select Output C	Optional use
4	Band Select Output D	Optional use
5	< cursor pushbutton	essential connection
6	> cursor pushbutton	essential connection
7	Rotary Control "A"	essential connection
8	Rotary Control "B"	essential connection
9	AM Mode Select input	Optional use
10	+5V output	Optional use
11	GND	essential connection
12	**ESC** pushbutton	essential connection
13	**MEM** pushbutton	essential connection
14	SSB/CW Select input	Optional use
15	LSB/USB Select input	Optional use
16	LOCK input	Optional use
17	PB2 – D4	Future Use
18	PB3 – D5	Future Use
19	PB4 – D6	Future Use
20	PB5 – D7	Future Use

Table 1: Aux Connector J2

( )   **Rotary Encoder:** The 24 step encoder (enhance to 96 steps due software) comes standard with a "click mechanism" which can be easily disabled. This is preferred by most users. Please see Appendix 1 for modification instructions.

( )   Viewed from the back of the encoder and with the pins facing down, solder wire from pin 11 (GND) to Left pin of the encoder.
The wire from Pin 7 (Rotary control A) is soldered to the Right lug.and the wire from Pin 8 (Rotary Control "B") to the middle lug. See Appendix 1. fig 2.

( )   **AVR Chip installation**
Caution observe ESD precautions by grounding yourself with a ESD strap or frequently touching the stations EARTH connection.

( )   Install the programmed AVR (AT Mega8 or AT Mega88) into the 28pin socket. It may be necessary to gently bend all the pins slightly first before the AVR will fit

into the IC socket. Check that the notch of the AVR points towards the location where the Si570 will be mounted later. (See photo on page 1).

Initial Functionality test

At this stage the kit is fully assembled with exception of the SI570.

( )   Adjust Preset Resistor RV1 to full **Anti clockwise** position

( )   Connect +8V - 12V DC Power to P1 on the PCB - observe polarity. Current consumption should be no more than 30mA at this stage.

( )   The LCD Screen should display the Welcome Message as shown in Fig 6. after Power up and the Frequency should change when turning the Tuning Control.

( )   Adjust Preset Resistor RV1 for "best contrast" on the LCD Screen.

( )   Switch off Power and remove leads from P1.

Si570 Installation

In this final step the Si570 chips will be installed. **Caution** observe ESD precautions by grounding yourself with a ESD strap or frequently touching GND connection.

( )   Refer to fig 2. and coat PCB pads marked 1 and 4 for the Si570 with a small amount of solder.   Locate Si570 pin 1 indicated by a dot on the case and align with pad 1 shown in fig 2 below. Place Si570 over the pads and solder pin 1 to the pads secure the chip to the PCB. Check alignment. Next solder all remaining pads to the PCB. Make sure there is a small bow of solder connecting the side pad of the Si570 to the PCB pad. Check all connections, especially if pad 7 and 8 are properly soldered to the PCB pads. (Common reason why AVR does not talk with the Si570 chip). **Note:** recently supplied Si570 chips have two tiny pads on each side of of pad 7 and pad 8. These are for Factory use only and should **NOT** be connected.

Final Functionality test

( )   Connect +8V - 12V DC Power to P1 on the PCB - observe polarity. Current consumption should be no more than 100-150mA depending on Si570 type. The LCD Screen should display the Welcome Message after Power up and the Frequency should change when turning the Tuning Control.

( )   Connect a RF Counter, Oscilloscope to the Si570 output to check RF output is obtained. Alternatively hold the antenna lead of a communications receiver near the Si570 output terminal and check whether the Si570 RF signal is audible.
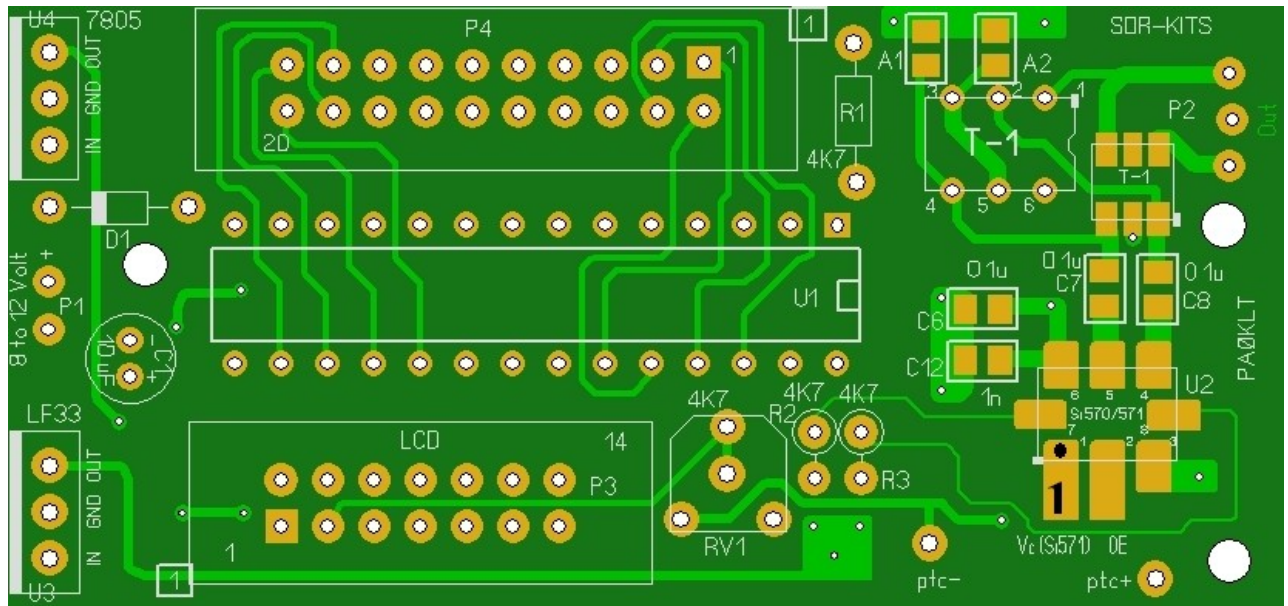
fig 2: Top Component placement view PA0KLT PCB - Note location Pin 1 of P3 and P4
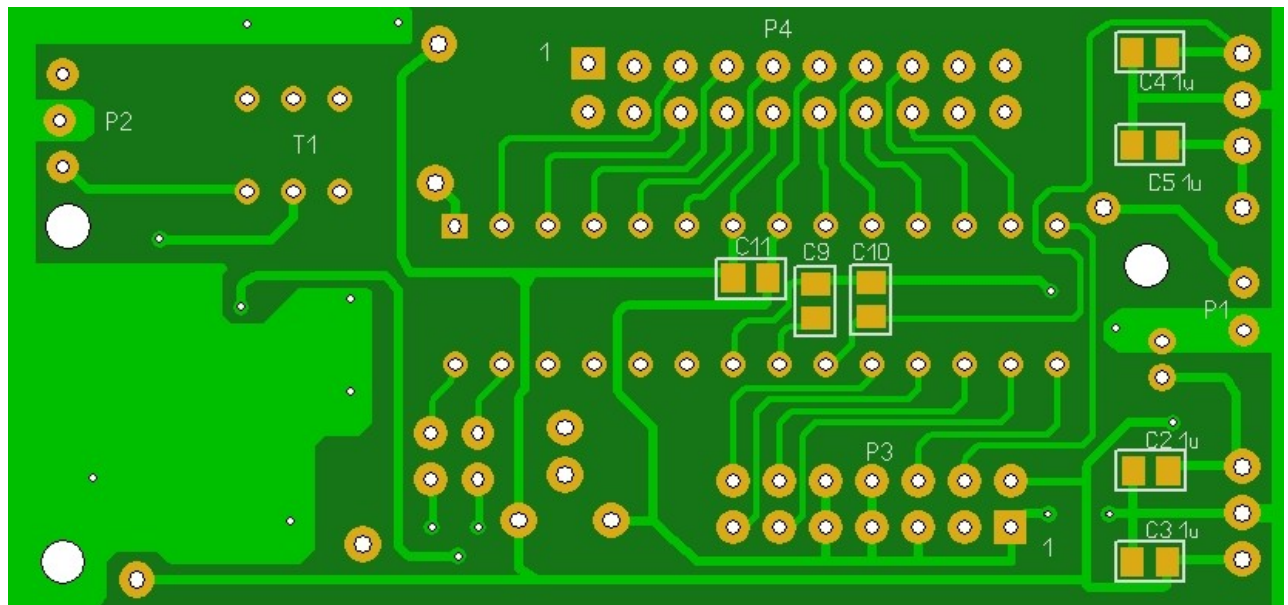

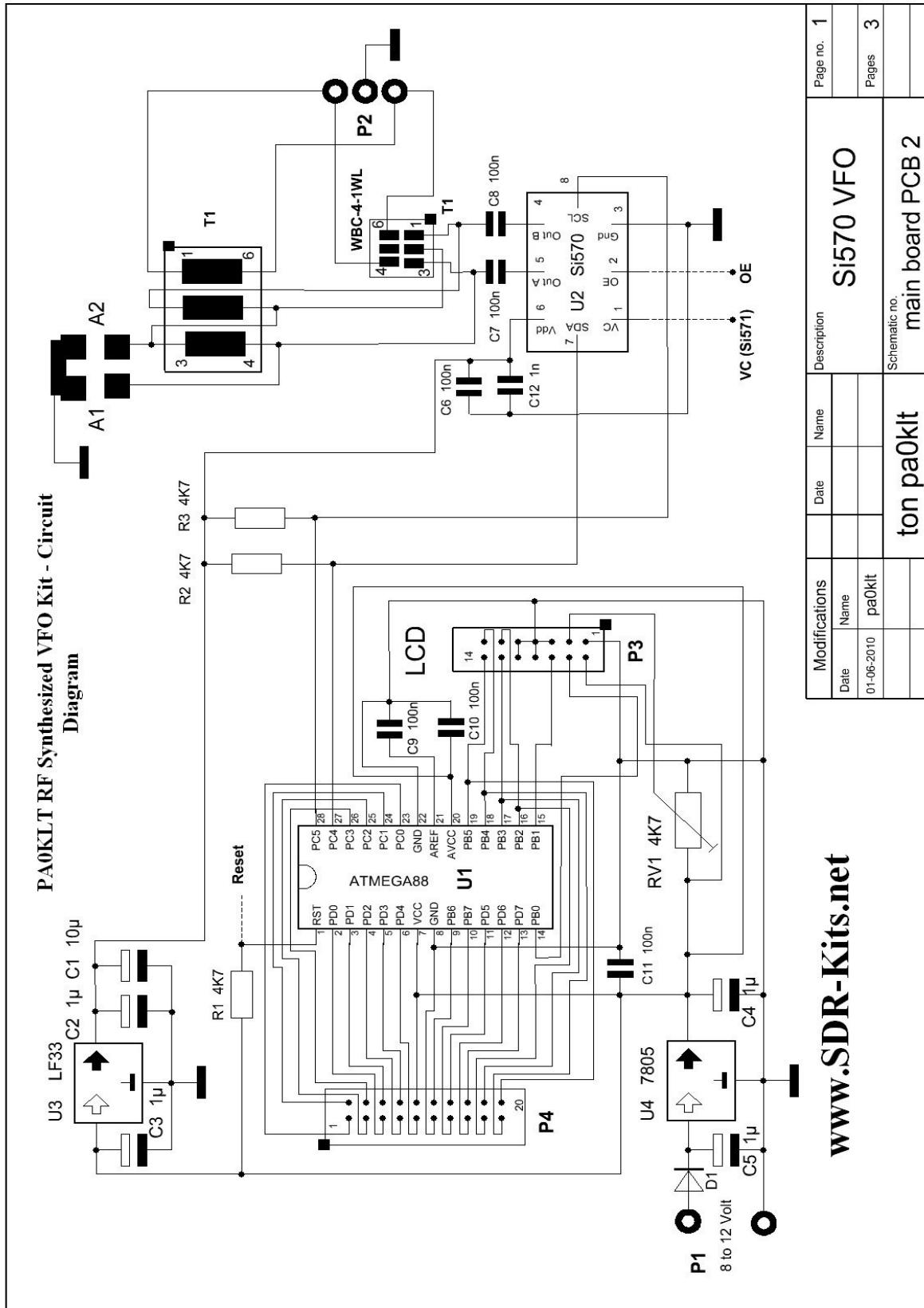Fig 3: Bottom Component Placement view PA0KLT PCB - Note location Pin 1 of P3 and P4

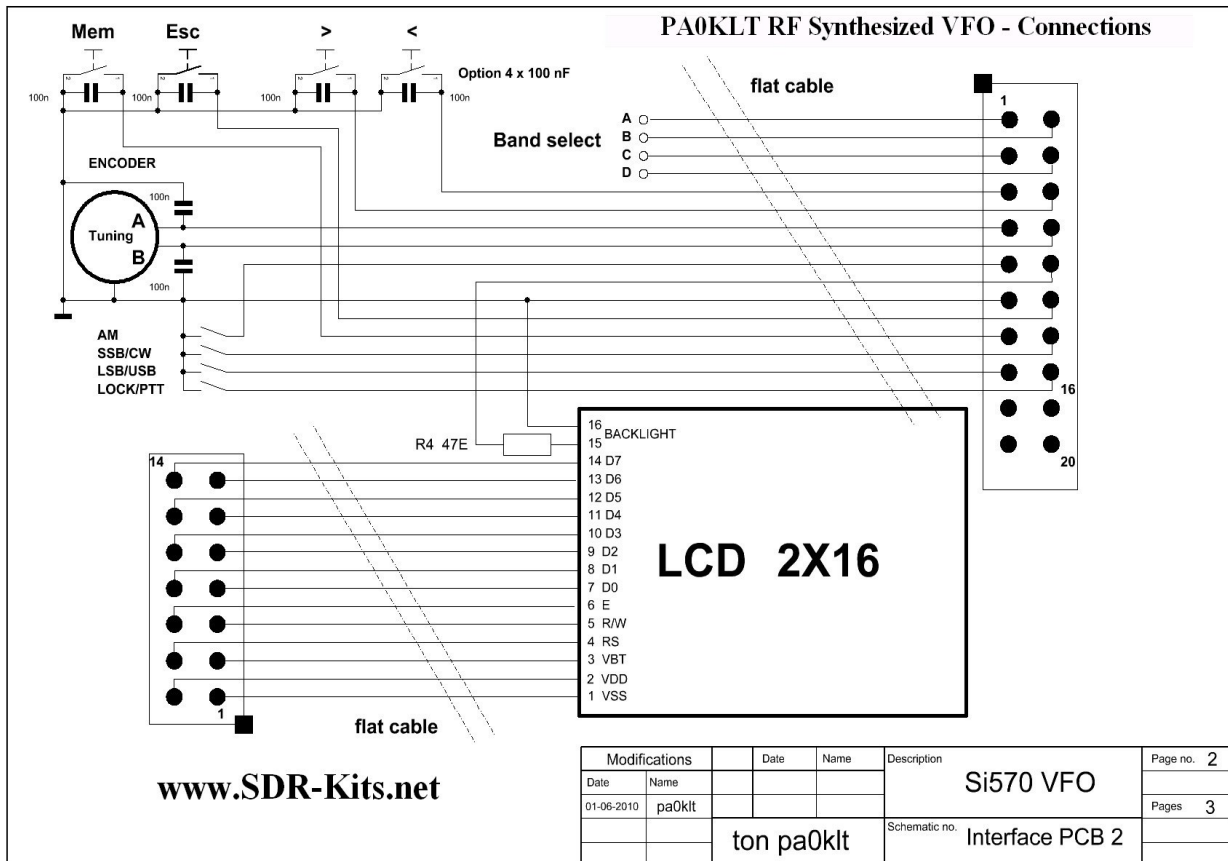Fig 4: Circuit Diagram of PA0KLT Synthesizer (Only for 2nd issue PCB)

Fig 5: Interfacing the PA0KLT Synthesizer

Notes:

1. LCD Display supplied by SDR-Kits - backlight connections: Connect pin 16 to pin 1 (GND) and Pin 15 via a 47 Ohm resistor to pin 2 (+5V)
2. C1 10uF electrolytic is required to stop oscillation on 3.3V supply. C2 is 1uF capacitor in parallel
3. Rotary encoder: Viewed from rear with pins facing down: GND = Left, B = Middle and A = Right
4. Capacitor colour coding: 1uF 0805 = blue,   1nF 0805 = black,   100nF 0805 = no colour/no stripe

5. Si571 Chip Support is provided from Firmware version V4.19 onwards. This allows FM Modulation of the RF Carrier. Pin 1 (VC) of Si571 should be set to 1.65V DC and the Modulating Audio applied via a Capacitor of 0.1uf - 1uF. 1.65V DC can be obtained by soldering a 4k7 resistor from pin 1 to GND and another 4k7 resistor from pin 1 to 3.3V supply rail.   See figure to the right
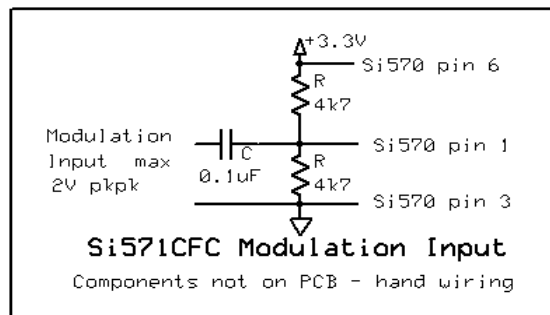
Si571 AF modulation Input modification

Band Select Output		
	Band Output	**Frequency MHz**
0	0000	0.1357 – 0.1378
1	0001	1.8 – 2.0
2	0010	3.5 – 4.0
3	0011	7.0 – 7.3
4	0100	10.1 – 10.15
5	0101	14.0 – 14.35
6	0110	18.068 – 18.168
7	0111	21.0 – 21.45
8	1000	24.89 – 24.99
9	1001	28.0 – 29.7
10	1010	50.0 – 54.0
11	1011	144.0 – 148.0
12	1100	430.0 – 440.0
13	1101	0 – 30.0 *
14	1110	30.001 – 180.0 *
15	1111	180.001 – 800.0 *
* = Frequency selected outside Amateurband		

Table 2: Band Select Output on AUX Connector J2 pin 1, 2, 3 and 4 (A, B, C, D)
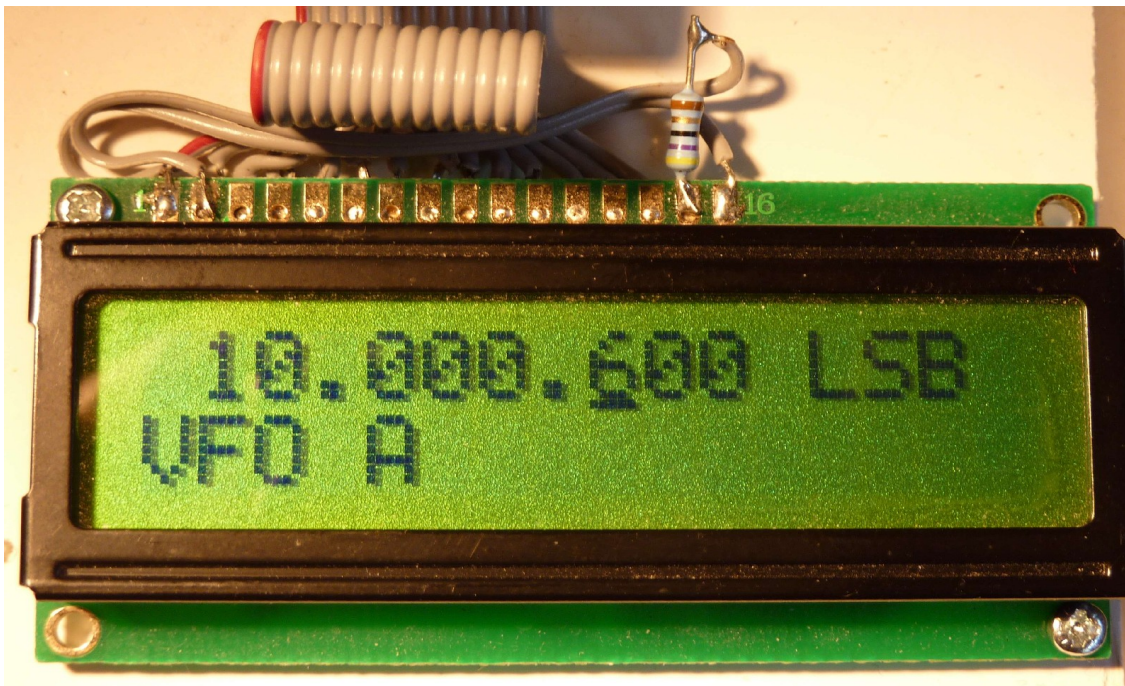

*Fig 6: LCD Connections and 47 Ohm Resistor soldered to pin 15 with link
to pin 2 (+5V).   Pin 16 is linked to pin 1 (GND)*

5. Kit Configuration Options:

A number of options are available depending on the type of Si570 chip ordered
and typical applications are shown in fig 7. Reasons for using a transformer are:

- Matching the Si570 CMOS device which has approx 200 Ohm output impedance to a 50
  Ohm load by using a 4:1 transformer. Up to +12dBm output over 50 Ohms may be
  obtained this way. Please note the Si570 CMOS only has one RF output.

- Si570 LVDS and CML devices have two (push-pull) complimentary outputs. Using a 4:1
  transformer with a centre tap on the primary allows combining the two outputs and
  matching into 100 Ohms. An MMIC amplifier (MAV11 or equivalent) will provide 12dB
  gain...

- The secondary of the transformer should be grounded at one end to obtain single ended
  output required when using coax cable to connect to other circuitry.

- Si570 CML device has two (push-pull) complimentary outputs. Each RF output may be
  interfaced directly into a 50 Ohm Load or feed a MMIC Amplifier stage (ie MAV11)

The following transformers have been used:

- homebrew transformer. This consists 5 turns 0.2mm wound trifiliar on a BN43-2402 core
  up to 200 MHz. alternatively use a BN61-2402 core with 6 turns 0.2mm trifiliar for up to
  300 Mhz.

- You can also use a Minicircuits T-622 4:1 up to 200 MHz - This drops into the PCB.

- A Coilcraft WBC4-1WTB 4:1 is supplied with PA0KLT Kit C and is specified up to 800
  MHz and usable up to 945 MHz. This is a SMD transformer which may be soldered direct
  on pads on the 2nd ISSUE PCB as shown in fig 1.   This transfomer may also be
  configured as a 4:1 transformer for Si570 CMOS chip.
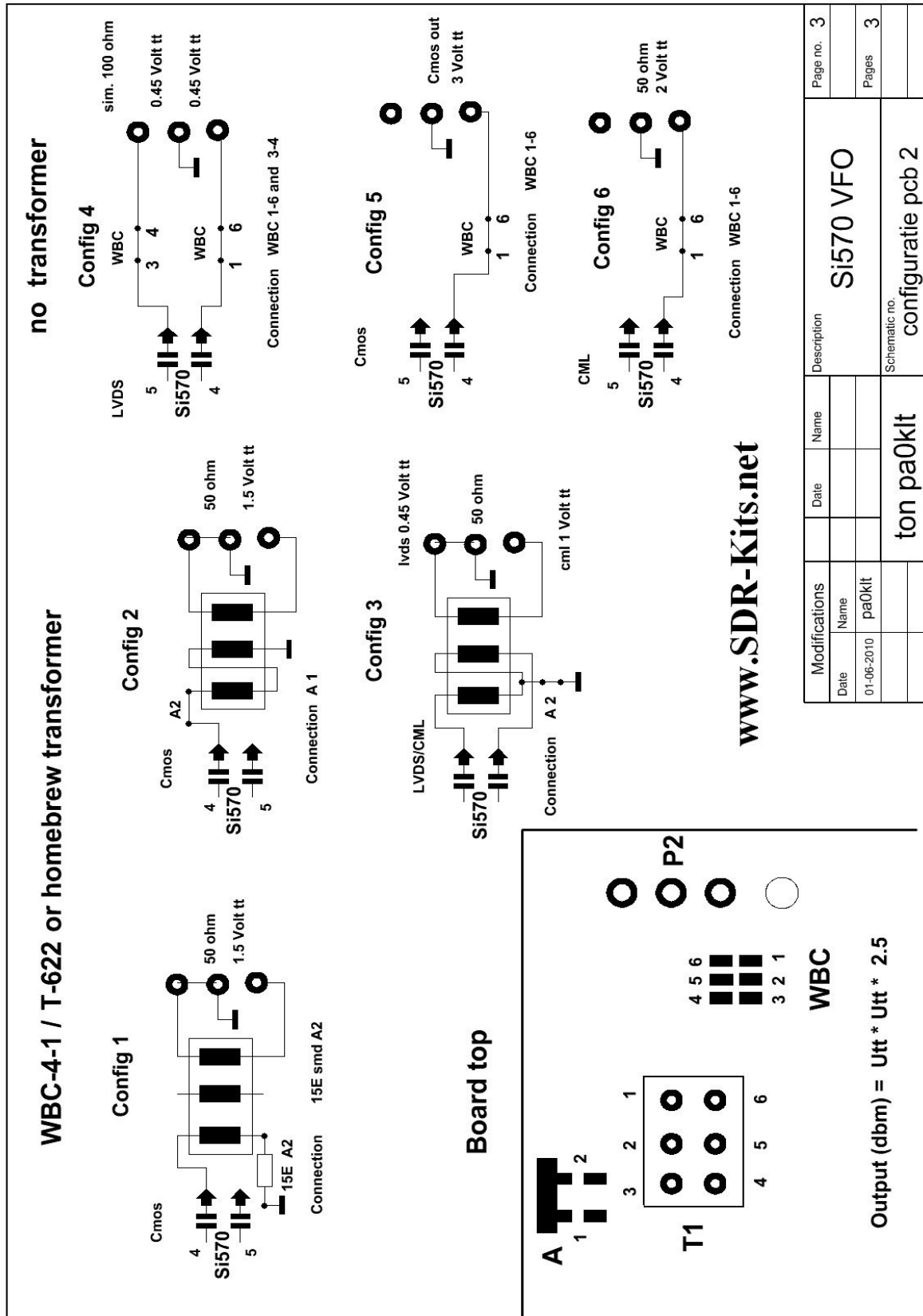
Fig 7: RF Output configuration options for 2nd Edition PCB

6. Operating instructions PA0KLT - Si570 VFO v4.0 firmware

Four push Buttons and the Rotary Tuning control are used to operate the VFO:
These are: Cursor "<", Cursor ">",   Escape ESC ,   Memory MEM and TUNING (Rotary tuning Control)

6.1)   There are four modes of Operation: These are:

- VFO A   (VFO A frequency - Manual tuning - Frequency Recal and Store)
- VFO B   (VFO B frequency - Manual tuning - Frequency Recal and Store)
- Memory A   (16 Memory Locations 1 - 16 to Recall or Store Frequencies)
- Memory B   (16 Memory Locations 1 - 16 to Recall or Store Frequencies)

A Short push on "MEM" button switches between these four modes

6.2   VFO Mode A or VFO Mode B

- The Tuning speed - Frequency step is adjusted with < and > CURSOR keys. The mininimum frequency step can be set from 1 Hz, 10 Hz, 100 Hz, 1 kHz etc up to 100 Mhz

- Press ESC sets all the digits right of the curser to zero

- To store the displayed frequency in VFO mode to EEPROM, the MEM key is pressed for 2 seconds until the LCD displays STORED

- Tuning to a frequency and pressing the MEM button for two seconds stores that frequency ready for the next time the unit is switched on. When in VFO use, pressing MEM is only to store the last frequency used in EEPROM. Setting that frequency does not store it in any of the 16 Memory locations.

6.3   Memory Mode

- Use a single quick press of the MEM button selects Memory A or Memory B.

- When in Memory A or Memory B mode, press < > cursor buttons to select the required memory location (1 - 16). The previously stored frequency in the selected memory location is now displayed.

- When in the selected Memory location press the ESC button to turn on Manual memory tuning and tune to the frequency you want to memorise (store)

- When at the desired frequency press the MEM Button for 2 seconds to store that frequency

- Press ESC sets all the digits right of the curser to zero

6.4   Synthesizer Configuration Mode for Firmware Versions V4.0 to V4.16

The desired frequency and mode is configured as follows
Press CURSOR < and > keys together for about 2 seconds until the configuration menu appears.
Release and use CURSOR buttons **< or >** to select Configuration Options 1 to 8 as described below. Store your selection by pressing the MEM key

Intermediate Frequency (IF) Offset Mode:
Press MEM and select the desired (MF Offset =IF Offset). The offset can only be a positive frequeny (Local Osc is higher than IF Signal Frequency). Press MEM to store the offset.   Press ESC to cancel.

Note 1. If an IF-Offset of less than **<100 kHz** is specified then the IF-offset will be removed with a delay of 5mS if the Lock (PTT) is activated by grounding this line to earth.

Note 2. If an IF-Offset of less than **<1 kHz** is specified then the 5 mS delay will not be applied (as is the case for FSK)

Calibration mode:
Press MEM momentarily. The Si570 Crystal frequency is now displayed and may be changed so the SI570 output frequency measured on a counter is exactly as displayed on the LCD display. Once the corrected Crystal frequency has been selected press the MEM for 2 seconds to store the new value.

Multiplier (Si570 output frequency = (Displayed Frequency * Multiplier)
Presss MEM momentarily and select the required multiplier factor: 2^0 for Multiplier 1, 2^1 for Multiplier 2, 2^2 for Multiplier = 4 and 2^3 for Multiplier = 8. Press MEM for 2 seconds to store.

Default Configuration
If the configuration is corrupted for whatever reason the default configuration may be loaded in EEPROM.   Press MEM momentarily. Press MEM for 2 seconds to confirm or ESC to cancel

Set Maximum Frequency for Si570
The maximum frequency which is supported by the Si570 depends on the installed Si570 chip as well as the IF Offset and the Multiplier value selected. For example: Si570BBB max frequency is 945 MHz. If a IF Offset of 40MHz and Multiplier of 4 is selected then the maximum frequency will be (940-40)/4 =225 MHz. Press MEM briefly and set maximum frequency using rotary control and <> buttons. Press MEM for 2 seconds to store or press ESC to cancel. (Max Freq = 945 MHz is supported on V4.15 firmware)

Minimum frequency for Si570
The minimum frequency which is supported by the Si570 and the firmware is 3.50 MHz but IF Offset and Multiplier need to be taken into account. For Example if IF Offset = 40 MHz and multiplier of 4 is selected then the mimimum frequency should be set to: (3.5+40)/4

Configuring I2C adres Si570
In V4.13 firmware: This option allows you to select the correct I2C address for AVR to communicate with the Si570 chip. Si570 chips supplied by SDR-Kits from England or by Tom Hoflich KM5H have address HEX 55.   Si570 supplied by others may use other addresses (for example on German Supplier uses HEX 50).   **For V4.15 firmware:** you may specify any I2C address between Hex 50 and Hex 5F. The default is Hex 55.

END Configuration
Selection of of this option exits the configuration mode and returns to normal tuning mode with the new saved configuration selected.

6.5   Complete Power-up Reset.

On **rare** occassions the EEPROM data may become corrupted which could prevent the VFO from initializing properly. Erasing EEPROM and applying the default Configuration is not possible and a Power-up Reset may be necessary as follows:

Press ESC and MEM buttons at same time and apply DC Power until the LCD Screen shows the normal start-up screen. Release ESC and Mem buttons.
Any configuration information previously applied have been lost and need to be re-applied.

PAOKLT	Firmware 4.16	Frequency Range 3.45 MHz – 945 MHz	
Required Mode	**Connection J2**	**Output Frequency (Offset)**	**Remarks**
AM	9 to GND	0 Hz (No offset)	Calibration done in this mode
LSB	No connections	Displayed Freq – 1.5 kHz	Default
USB	9 and 15 to GND	Displayed Freq + 1.5 kHz	
CWL	9 and 14 to GND	Displayed Freq – 0.75 kHz	
CWU	14 and 15 GND	Displayed Freq + 0.75 kHz	
LOCK	16 to GND	If IF offset = set to any frequency less than 100 kHz then both IF offsset and Mode offset are removed regardless what mode is selected	
		If IF offset = set to any frequency more than 100 kHz then only Mode Offset is removed	

Table 3: Connections and Offsets for firmware versions up to V4.16

6. 6   Synthesizer Configuration Mode for Firmware Version V4.19.

The desired frequency and mode is configured as follows
Press CURSOR < and > keys together for about 2 seconds until the configuration menu appears.
Release and use CURSOR buttons **< or >** to select Configuration Option as described below. Store your selection by pressing the MEM key
You can leave the Configuration mode by pressing ESC. This will reset the AVR which will use the options which were stored during Configuration Setup.

Intermediate Frequency (IF) Offset Mode:
Press MEM and select the desired (MF Offset =IF Offset). The offset can only be a positive frequeny (Local Osc is higher than IF Signal Frequency). Press MEM to store the offset frequency.   Pressing ESC will exit the Configuration mode.

Note If the Lock (PTT) is activated by grounding this line to earth then the IF Offset specified will be removed.

Calibration mode:
Press MEM momentarily. The Si57x Crystal frequency is now displayed and may be changed so the SI57x output frequency measured on a counter is exactly as displayed on the LCD display. The < > Cursor buttons may be used to select the digit to be changed. Once the new Crystal frequency has been selected using the Tuning Knob, press the MEM for 2 seconds to store the new value. Pressing ESC will abort and exit to the IF Offset Mode.
Note: If displayed Frequency is lower than measured frequency then the Crystal frequency needs to be lowered and visa versa.

Multiplier (Si570 output frequency = (Displayed Frequency * Multiplier)
Presss MEM momentarily and select the required multiplier factor with the <> cursor buttons: 2^0 for Multiplier 1, 2^1 for Multiplier 2, 2^2 for Multiplier = 4 and 2^3 for Multiplier = 8. Press MEM for 2 seconds to store. Pressing ESC will abort and exit to the IF Offset Mode.

Set Maximum Frequency (280 Mhz for C-grade, 945 for B-grade and 1417 A-grade)
The maximum frequency which is supported by the Kit depends on the grade of the installed Si570 chip as well as the IF Offset and the Multiplier value selected. For example: Si570BBB max frequency is 945 MHz. If a IF Offset of 40MHz and Multiplier of 4 is selected then the maximum frequency will be around (940-40)/4 =225 MHz. Press MEM briefly and set maximum frequency using rotary control and <> buttons. Press MEM for 2 seconds to store or press ESC to cancel. (Max Freq = 1417 MHz is only supported from V4.19 firmware with Si57x A-grade chips.

Minimum frequency
The minimum frequency which is supported by the Si57x and the firmware is 3.45 MHz but IF Offset and Multiplier need to be taken into account. For Example if IF Offset = 40 MHz and multiplier of 4 is selected then the mimimum frequency should be set to: (3.5+40)/4

Configuring I2C adres Si57x

This option allows you to select the correct I2C address for AVR to communicate with the Si57x chip. Si57x chips supplied by SDR-Kits from England or by Tom Hoflich KM5H have address HEX 55. Si57x supplied by others may use other addresses (for example on German Supplier uses HEX 50). **Y**ou may specify any I2C address between Hex 50 and Hex 5F. The default is Hex 55.

Si570/Si570 Selection (default settings Kv = 0 for Si570)

Selection of of this option allows entering of a value for Kv. If Si570 is used then Kv should be set to 0 (default setting). If a Si571 chip is fitted then Kv should be set to a starting value of 180 to ensure that the generated Frequency is as close as possible to the frequency displayed on the LCD screen AFTER calibration. If errors are seen then try a different value (170 or 190) for Kv and after performing calibration. then check whether the fequency error the Si571 has been reduced. After Kv value has been set press MEM to store the new value or press ESC to quit this option.

6.5   Complete Power-up Reset.

On **rare** occassions the EEPROM data may become corrupted which could prevent the VFO from initializing properly. Erasing EEPROM and applying the default Configuration is not possible and a Power-up Reset may be necessary as follows:

Press ESC and MEM buttons at same time and apply DC Power until the LCD Screen shows the normal start-up screen. Release ESC and Mem buttons.
Any configuration information previously applied have been lost and need to be re-applied.

PAOKLT	Firmware 4.19	Frequency Range 3.45 MHz - 1417 MHz	
Features since 4.16			
Support for A Grade chip 3.45 MHz to 1417 MHz without gaps (not warranted)			
Support for Si570 and Si571 Chips			
AM mode selected as default – Easier Calibration			
Required Mode	**Connection J2**	**Output Frequency (Offset)**	**Remarks**
AM	No connection	0 Hz (No offset)	Default – calibration
LSB	9 to GND	Displayed Freq – 1.5 kHz	
USB	9 and 15 to GND	Displayed Freq + 1.5 kHz	
CWL	9 and 14 to GND	Displayed Freq – 0.75 kHz	
CWU	9, 14 and 15 to GND	Displayed Freq + 0.75 kHz	
LOCK	16 to GND	Any IF offset and all Mode Offsets are removed regardless what mode is selected	

Table 4: Connections and Offsets for firmware up to V4.19 and higher

Success & 73s
Jan Verduyn G0BBL   Jan.Verduyn@gmail.com
www.SDR-Kits.net - kit production - English Manual - Kit support -

Ton Blokker PA0KLT   Pa0klt@amsat.org
PCB Design and Firmware development

APPENDIX 1 - Removing clickstop from Rotary encoder

Note: The rotary encoder supplied has 24 clickstops, **which is enhanced to 96 steps per resolution through firmware by detecting additional steps between each clickstop**. Removing of the clickstop is essential for the enhancement to resolution of 96 steps per resolution.

( )   Gently bend open the four lugs from (two at each side) of the encoder and remove the rear plate as shown in the picture below.

Appendix 1 - Fig 1 - Adjusting Click Stop Spring

( )   Remove the contact assembly as shown in the photo below and locate the
        contact spring.

        Gently bend the sliding contract spring away to the back so the pressure on the
        rotary disc is reduced.

        Ideally you want to maintain a little pressure - You can test by placing the
        contract assembly back and trying out until you feel it is right for you.

        CAUTION: Do not touch or try to adjust the three sliding contacts below as it may
        damage the encoder and cause erratic operation.

( )   After adjustment fit the rear plate and secure by bending the lugs back in original
        position

Appendix 1 - Fig 2 - Adjusting Click Stop Spring

End of Appendix 1.