EL-34

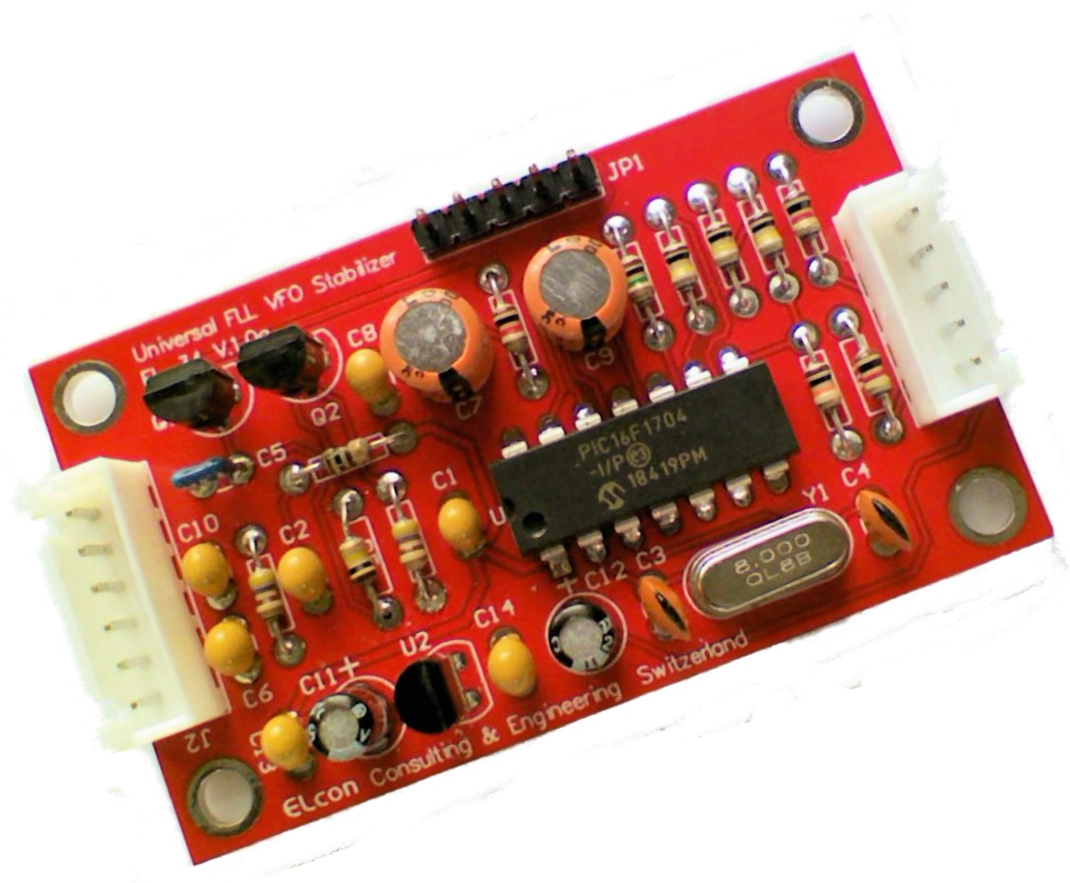## FLL-VFO Stabilizer

for transceivers without PLL or DDS frequency conditioning
e.g. Yaesu FT-101, Heathkit SB-104 etc.

Building and functional description

Version 3.0b, only from firmware V3.0a-20240808

20. July 2025

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Important! Hints or tips for the correct function of the EL-34.

Watch it! Absolutely observe.

1 Introductory remarks

Many radio amateurs still use older radios which do not have a modern frequency synthesizer. Today's digital operating modes, however, require a frequency stability that only modern transceivers can provide.

Usually a free-oscillating oscillator (VFO, Variable Frequency Oscillator) is the reason for the large frequency drift. The reason can be the insufficient voltage stabilization for the VFO, but mostly the fluctuating temperature is the reason for the drift of several 100 Hz.

The EL-34 module has been developed for all radios with free-running VFO and can be built into various transceivers.

2 How it works

The slow running away of the frequency is called frequency drift. With the help of temperature-controlled crystal oscillators (TCXO) or by installing a crystal in thermostats (oven-controlled crystal oscillator, OCXO) it is possible to build extraordinarily long-term stable oscillators.

Unfortunately, the performance of many VFOs of older devices does not match the performance of modern DDS oscillators in today's commercial amateur radios. We cannot redevelop the entire transceiver, but want to make the frequency stability of the VFO crystal stable with a relatively simple additional circuit.

The development of a frequency-stable VFO is difficult, because even an output power of more than 1mW generates so much heat in the transistors that it supports the frequency drift in the long run.

The reasons for the frequency drift are different. The temperature has a particularly strong effect on the capacitance diode, which is used for the "Clarifier" function, and thus on the stability factor of the entire oscillator. A temperature change changes the diode capacitance as well as the bias voltage of these diodes. The junction temperature changes, resulting in drift.

As you will see, this capacitance diode is not only bad, but with our VFO stabilization it changes into a useful component.

2.1 The Frequency Locked Loop (FLL)

A Frequency Locked Loop (FLL) is an electronic control system that generates a signal set to the frequency of an input or reference signal. This circuit compares the frequency of a controlled oscillator with the reference and automatically increases or decreases the frequency of the oscillator until its frequency (but not necessarily its phase) matches that of the reference.

Such circuits are used as frequency doublers, for FM demodulation and for stabilizing RC oscillators.

With this circuit technology we want to stabilize our strongly drifting VFO.

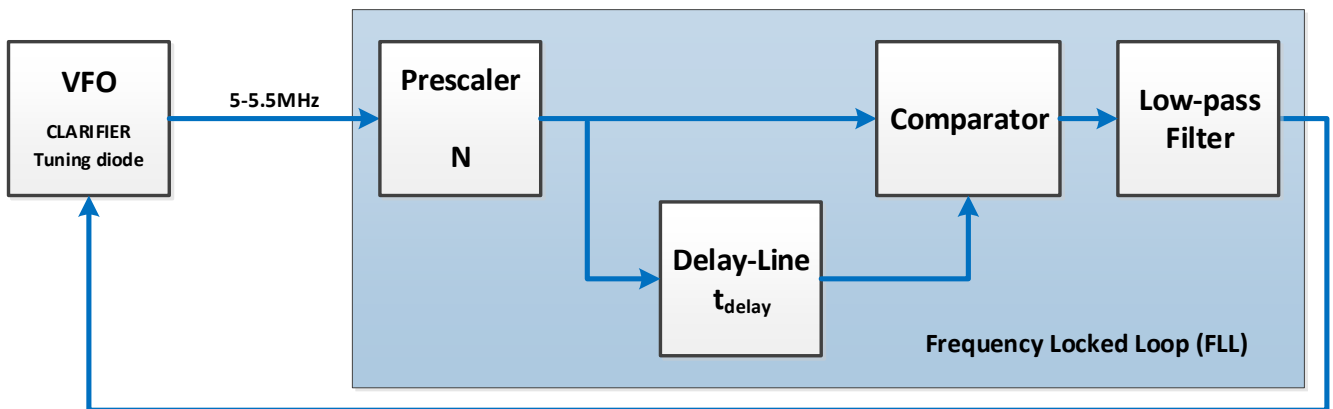The block diagram of the FLL is shown in Figure 1.

Figure 1

The circuit has a negative feedback loop that acts on the VFO. For frequency correction, the capacitance diode built into the VFO (primary for CLARIFIER) is also used.

The input signal of the FLL is the VFO frequency. The prescaler only serves to generate a symmetrical square wave signal that can be processed with a modern microcontroller. This frequency signal is compared with the identical but t_{delay} delayed signal. The comparator generates a correction signal which then controls the frequency of the VFO via a low-pass filter. Since the signals are averaged over complete cycles, the output of the FLL is phase-independent.

The FLL engages with everyone lockup point $= f_{VFO} + n \cdot f_{step}$. This has the advantage that the FLL immediately stabilizes the VFO after the VFO tuning knob is no longer turned.
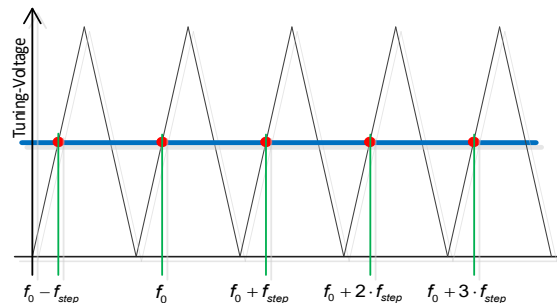
Figure 2

If e.g. and $t_{delay} = 0.2s$ amount $N = 2$, then the FLL step size will $f_{step} = 10Hz$ be. Mathematically derived, the lockup point can be calculated as follows:

$$f_{step} = \frac{N}{t_{delay}}$$

A derivation is left to the reader as an exercise.

The snap-in step frequency is independent of the FLL input frequency and therefore constant over the entire VFO range.

The FLL is very fast compared to a PLL circuit (Phase Locked Loop), because not the phase but the frequency is corrected.

FT-301D (VFO Drift measurement)

Figure 3

As an example, you can see the effect of the FLL-VFO Stabilizer in figure 3, measured over a period of approx. 2h (525 x 15s) from switching on a FT-301D. Without stabilization the VFO drifts about 425Hz. Such a strong drift is extreme annoying in CW or SSB mode, and digital modes are unthinkable.

3 Assembly of the module

For the assembly you need the following tools and additional material:
- Pin soldering iron 50 to 80W
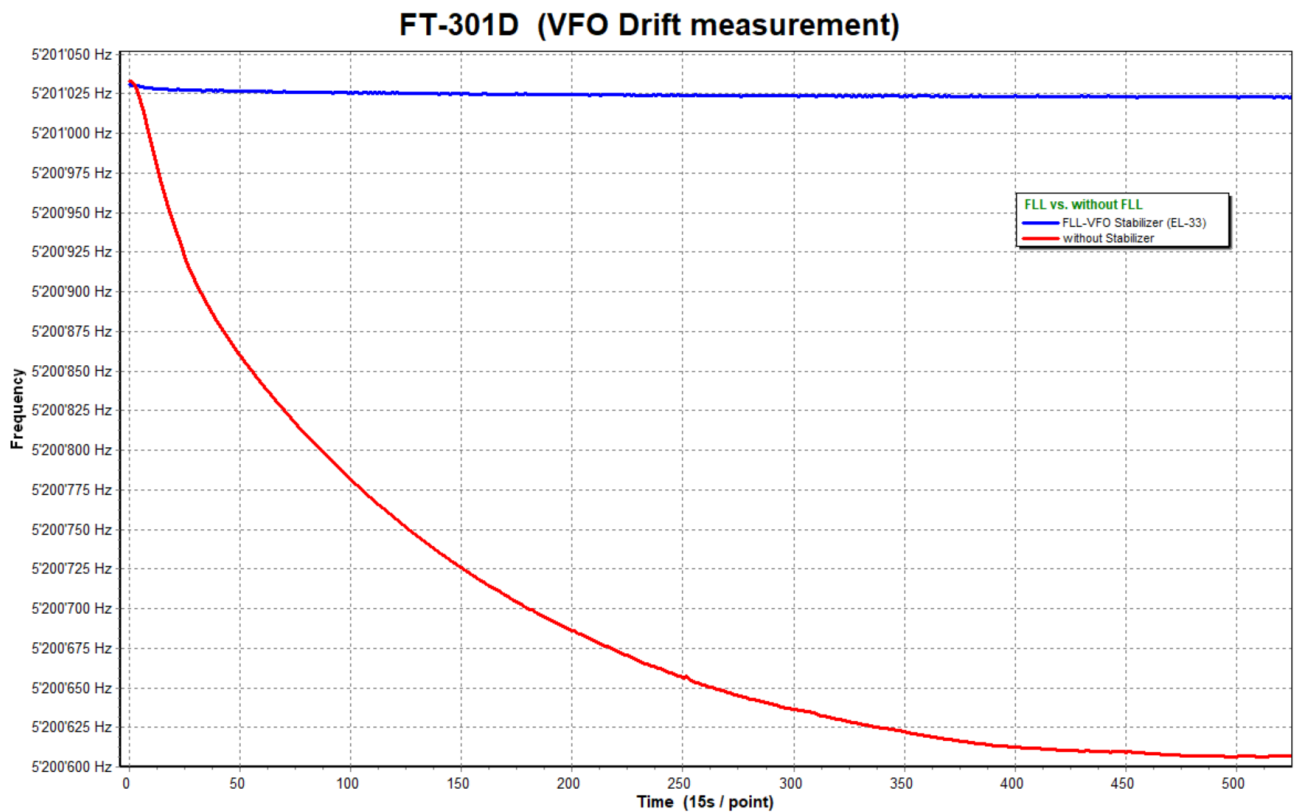- tin solder Ø 0.5mm with flux core
- small needle-nose pliers
- fine side cutter

It is advisable to study and print this documentation carefully because it is a safe reference when you assemble the module and allows you to control every step taken.

Make sure that the workstation is free of static charges so that the microcontroller already soldered in and programmed is not damaged. It is helpful to wear an antistatic bracelet. The illustrations of the individual components on page 7 should help you to identify the various elements by shape and color.

⚠️ Soldering is one of the most important tasks when setting up this device. Even with a carefully assembled kit, a bad solder joint can make it impossible for the device to function and spoil all the fun.

It is easy to create a good solder joint if the following rules are followed:

1. Use a temperature-controlled pin soldering iron with approx. 50 to 80 Watt. A 1 to 2mm wide chisel or pyramid point is best.
2. Set the temperature to a maximum of 320°C for lead-free tin and 360°C for leaded tin. Too high temperatures damage the circuit board.
3. The soldering tip must always be clean and well tinned. Wipe the tip often on stainless steel wool (you can buy it in every supermarket in the cleaning department), never on a wet sponge, because then the soldering iron tip cools down unnecessarily and the heat is missing afterwards on the soldering point.
4. Do not use aggressive solder pastes, but high-quality solder wire with a flux core.
5. Hold the tip of the soldering iron only once, but long enough (approx. 2 to 5s) at the place to be soldered so that the solder can flow well. During this time, apply very little solder between the solder joint and the solder tip.
6. Never touch the circuit boards with your fingers on the solder surfaces, otherwise a good solder joint is no longer possible. Should this happen anyway, clean the circuit board with a lint-free cloth moistened with household petrol.

⚠️ When soldering, always make sure that you do not inadvertently touch already assembled elements with the soldering iron and melt them.

The resistors in the component list also include the respective color coding (see also Table 1). If you are not sure how to handle color coding, it is better to measure the resistance value with an ohmmeter before soldering.

Color coding of resistors with 4 rings				
Color	**Resistance value in Ω**			**tolerance**
	1st ring (1st digit)	**2nd ring (2nd digit)**	**3rd ring (multiplier)**	**4th ring**
none	-	-	-	±20%
silver	-	-	$10^{-2} = 0.01$	±10%
gold	-	-	$10^{-1} = 0.1$	±5%
black	-	0	$10^0 = 1$	-
brown	1	1	$10^1 = 10$	±1%
red	2	2	$10^2 = 100$	±2%
orange	3	3	$10^3 = 1'000$	-
yellow	4	4	$10^4 = 10'000$	-
green	5	5	$10^5 = 100'000$	±0.5%
blue	6	6	$10^6 = 1'000'000$	±0.25%
violet	7	7	$10^7 = 10'000'000$	±0.1%
grey	8	8	$10^8 = 100'000'000$	-
white	9	9	$10^9 = 1'000'000'000$	-

Table 1

Observe the mounting direction for all polarized components (diodes, electrolytic capacitors, etc.).

3.1 Parts list

EL-34 Board

Number	Component No.	Description of the
1	R2	100Ω 1/8 W (brown-black-black) [Component 1]
2	R4, 11	470Ω 1/8 W (yellow-violet-brown) [Component 1]
3	R1, 3, 6	1kΩ 1/8 W (red-black-red) [Component 1
1	R7	10kΩ 1/8 W (brown-black-orange) [Component 1]
4	R5, 9, 10, 12	100kΩ 1/8 W (brown-black-yellow) [Component 1
1	R8	1MΩ 1/8 W (brown-black-green) [Component 1]
2	C3, 4	15pF Ceramic marked with 150 [Component 3]
1	C5	1nF Ceramic marked with 102 [Component 5] or [Component 2]
7	C1, 2, 6, 8, 10, 13, 14	0.1uF Ceramic marked with 104 [Component 2]
2	C11, 12	10uF/16V electrolytic capacitor [Component 4], observe polarity
2	C7, 9	100uF/10V electrolytic capacitor [Component 6], observe polarity. Attention: Do not touch the terminals with your fingers as these are special "low leakage" capacitors.
2	J1, 2	JST Male connector B5B-XH-Aund B6B-XH-A [Component 14]
1	JP1	1x5 Male connector [Component 11]
2	Q1, 2	NPN Transistor 2N3904 [Component 10]
1	U1	Microcontroller PIC16F1705 I/P [Component 8] programmed
1	U2	5V LDO Voltage Regulator MCP1702-5002E/TO-ND [Component 9]
1	Y1	8MHz Crystal HC-49U [Component 7]
1		Board EL-34 [Component 17]
2		JST Connector housing XHP-5 und XHP-6 [Component 13]

11	JST Socket contact SXH-001T-P0.6 [Component 12]
1	Varactor diode BB910 [Component 15]
1	100kΩ 1/8 W (brown-black-yellow) [Component 1]
1	15pF Ceramic marked with 150 [Component 3]
1	22pF Ceramic marked with 220 [Component 3]
1	0.1uF Ceramic marked with 104 [Component 2]
1	LED green / red LTL1BEKVJNN [Component 16]

Table 2

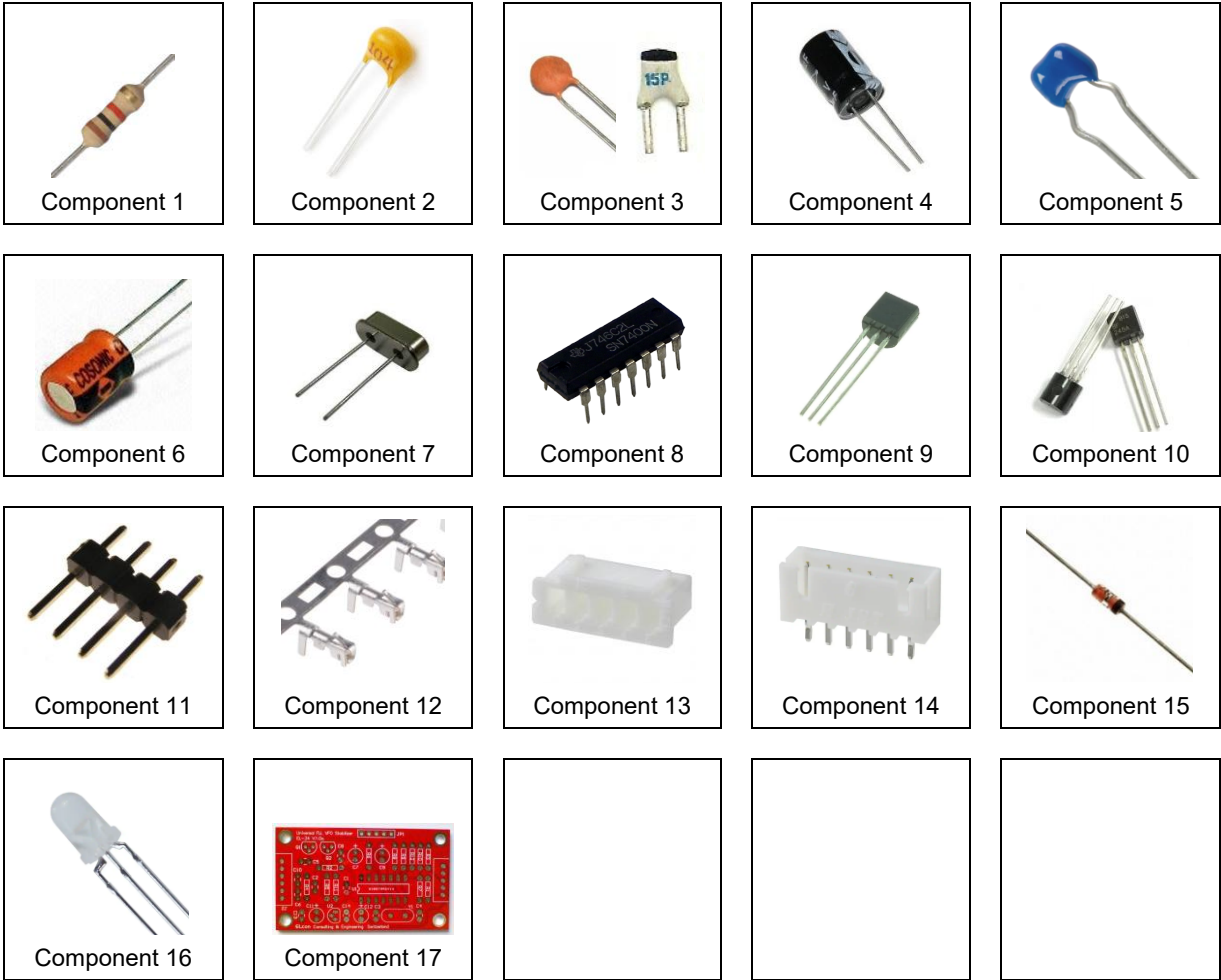|				
Component 1	Component 2	Component 3	Component 4	Component 5
Component 6	Component 7	Component 8	Component 9	Component 10
Component 11	Component 12	Component 13	Component 14	Component 15
Component 16	Component 17			

Table 3

3.2 Mounting the circuit board

The assembly diagrams of the small circuit board can be found in chapter 9.6 (see Figure 30). Assemble the following components using the parts list (Table 2):

☐ R1 to R12, resistors

☐ Y1, Crystal 8MHz →The crystal is soldered in with a small distance to the board.

⚠️ Cut a paper or plastic strip 4mm x 30mm (thickness approx. 0.2mm) and place it on the component side between the two crystal connectors. After soldering, remove the strip again.

☐ Q1, 2, 2N3904 NPN Transistor →Observe installation direction!

☐ U1, IC PIC16F1705 Microcontroller (is programmed) →Observe installation direction!

☐ U2, IC MCP1702 LDO Voltage regulator → Observe installation direction!

☐ C1 to C6, C8, C10, C13, C14 Capacitors

☐ C7, C9, C11, C12 Electrolytic capacitors → pay attention to the polarity!
(white line = minus, see chapter 9.6, Figure 30)

☐ J1, J2 male Socket connector 1x5 pin and 1x6 pin

⚠️ The Socket connector must lie flat on the PCB and be vertical.

☐ JP1, 5 Pin header

☐ Check all solder joints very carefully!

⚠️ Use a magnifying glass if necessary, because even the smallest, unwanted solder bridges can have fatal effects.
Especially with the transistors Q1 and Q2 and the voltage regulator U2 the greatest attention is given.

4 Function test of the board

If all elements are fitted, a first electrical test can be performed.

🛑 Note: Keep your workspace clean so that the pcb is not laying on cut pieces of wires which can lead to short circuits.
For the following tests you need the status LED.

For the functional test of the FLL VFO Stabilizer you need the following measuring instruments:

♦ Digital voltmeter for the range DC 0 to 20V (resolution ≤10mV)

♦ Power supply unit, adjustable between1.5V to 15V DC, current approx. 30mA

♦ RF-signal generator in the frequency range 3 to 20MHz, where the output signal can be adjusted to about approx. 200 to 500mV.

☐ Connect the two-color LED to the circuit via pin header J1 (pin 5 is anode LED red, pin 3 is anode LED green and pin 4 is cathode LED red/green).
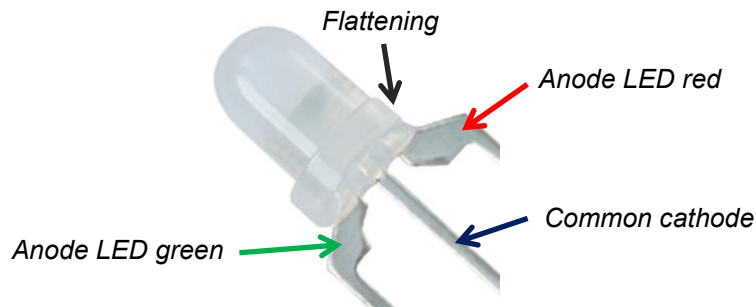For LED connections see Figure 4.

Flattening

Anode LED red

Common cathode

Anode LED green

Figure 4

4.1 Power up test

☐ Plug in a 12V-power supply to the connector J1 (pin 1 is +pole, pin 2 is -pole).

⚠️ If you have a power supply with current limitation, set it to a maximum current of about 30mA.

☐ Switch on the supply voltage.
The status LED lights up briefly in the order red, orange and green.
Afterwards, the red LED flashes because there is no signal at the HF input of the module.

☐ The power-up test is now complete. The power supply unit can be switched off.

4.2 RF test

☐ Connect the board via pin header J1 (pin 1 is +pole, pin 2 is -pole) to a DC power supply.

⚠️ If you have a power supply with current limitation, set it to a maximum current of about 30mA.

☐ Connect the RF input of the stabilizer to the signal generator via pin header J2 (pin 6 is RF, pin 5 is ground).

☐ Set the signal generator to a frequency of approx. 5MHz at a level of about 200mV.

☐ Switch on the 12V power supply.
The status LEDs light up briefly in the order red, orange and green.

Afterwards the red LED lights up for 2s, then the status LED changes to green because a frequency-stable signal is present at the HF input of the module.

☐ Change the frequency on the signal generator (min. ±200Hz) and observe the status LED.

When the frequency is changed, the status LED lights up red for 2s and then changes back to green.

☐ The RF test is now complete. The power supply unit can be switched off.

If all above tests were successful, the FLL VFO Stabilizer Module EL-34 is ready for installation into the transceiver.

5 Installations

5.1 Connector Assembly

All connector housings and contacts are supplied for easy connection of power supply and signals. Use only high quality, colored stranded wire. The colors of the wires should be chosen to match the function, e.g. red +7-20V supply, blue or black for ground (Gnd) and other colors for the signals Control Voltage Out (VAR) and Clarifier In CLAR etc.

The connectors consist of two components; the connector housing and the contacts. To connect a wire, strip the wire for about 2 mm, twist and tin it. Insert the tinned end of the wire into the contact so that the wire is inside the inner and the insulation is inside the outer pair of tabs.
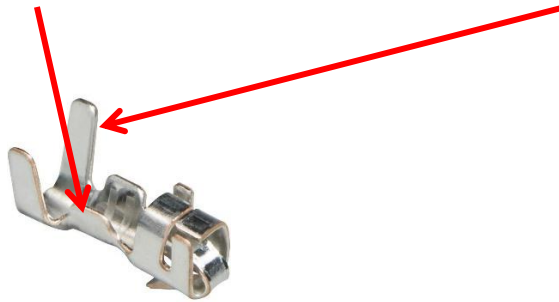

Figure 5

Using small pointed pliers, gently press the outer tabs around the wire insulation to hold the wire in place. Repeat this with the inner tabs to hold the wire in place. Solder the wire to the inner tabs, taking care not to allow solder to flow into the contact.

Now insert the contact into the connector housing, with the small locking tab on the front of the housing. Push the contact inwards until the locking tab snaps into place. If you need to remove a contact, press carefully on the locking tab with a small screwdriver or the end of a pair of pointed pliers. The contact is released and can be pulled out of the housing.
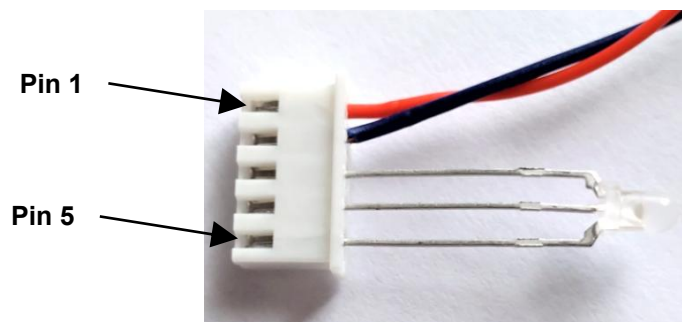

Figure 6

5.2 RF Signal from Transceiver VFO

The RF input signal for the FLL VFO Stabilizer must be taken from the output of the VFO buffer stage to avoid loading the VFO. There should be a RF signal of 200mV p-p or more. Use a small coaxial cable, e.g. RG316 or RG178, as short as possible.
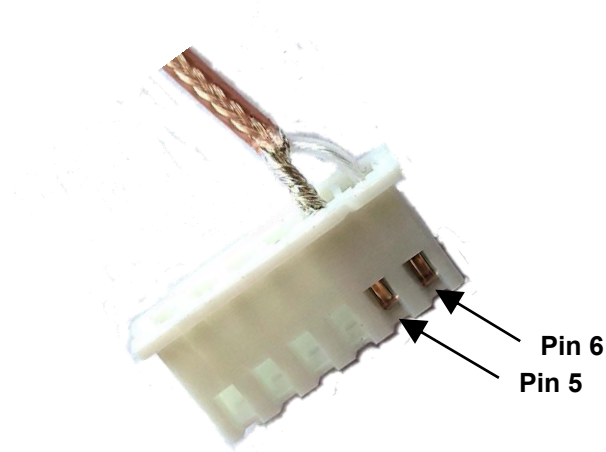

Pin 6
Pin 5

Figure 7

5.3 VFO tuning circuit

The control voltage output (VAR) is used to drive a varactor diode in the VFO tuning circuit. All necessary components, varactor diode, resistor and capacitors are included in the kit to build up the tuning circuit.

With the two ceramic capacitors, 22pF and 15pF, the 4 values for C_x, 37pF (parallel), 22pF, 15pF or 9pF (serial), can be created. These values are suitable for many transceivers. It may be necessary to reduce this value significantly, especially at high VFO frequencies or when the capacitor is connected directly to the VFO tuning circuit. In these cases, the frequency control range can become excessively large, causing the circuit to malfunction.

It is also possible to produce capacitors with low capacitance values from one piece of coaxial cable yourself.

Here are some capacity values:

Cable type	Capacity pF/cm	Capacity pF/inch
RG316	0.95	2.41
RG 178	0.93	2-36
RG 174	1.01	2.57

⚠️ For best results, it is recommended to select the value of the coupling capacitor C_x so that a change in the control voltage by 2V, from 1.5 V to 3.5 V, causes a frequency change of about 6 to 8 kHz. Test the varactor diode frequency range <u>without EL-34</u> by applying a variable voltage (+ at connector VAR).

It may also be possible to find a connection point in the VFO circuit where C_x gives a satisfactory tuning range. This could be an existing tap on the inductor or via the lower feedback capacitor in the case of a Colpitts oscillator.
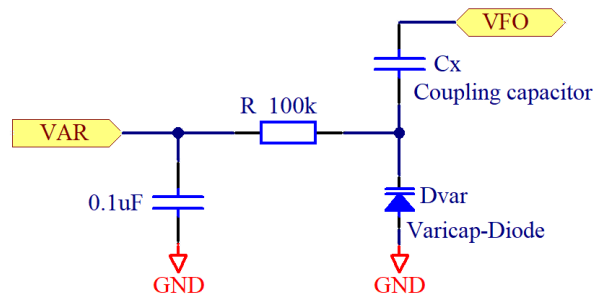

Figure 8

The tuning circuit is shown in Figure 8. The connections of the components C_x and D_{var} on the VFO side must be as short as possible. Make sure that the voltage at the connection point in the VFO is not higher than 100 V DC, otherwise a coupling capacitor C_x with a higher voltage rating must be used. The RF signal level must not be higher than 5V p-p.

With a tube VFO, the signal level is so high that the oscillator signal is rectified in the tuning diode. To avoid this, it is recommended to use two capacitance diodes as shown in Figure 9.
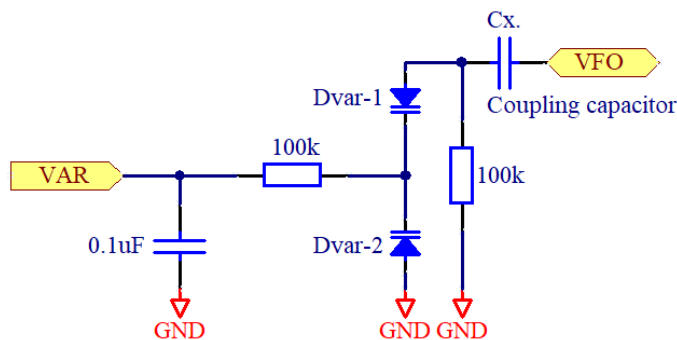

Figure 9

5.4 Using the CLARIFIER circuit

If the transceiver is already equipped with CLARIFIER (RIT), this circuit can be used for the EL-34. The universal FLL VFO stabilization is prepared for the use of a CLARIFIER circuit[1]. The VFO stabilization superimposes its control voltage on the CLARIFIER voltage. However, this negates the voltage, which results in a reversal of the direction of rotation of the "CLARIFIER" potentiometer. This shortcoming can be corrected relatively easily with a modification (reversal of the direction of rotation of the CLARIFIER potentiometer).

Note: The center voltage of the CLARIFIER should be 2.5V±0.4V.
If this is not the case with your device, the following modification may be helpful.

5.4.1 Clarifier Resistor R_x and V_{Ref}

If the voltage at the clarifier potentiometer at center position differs from 2.5V±0.4V, or the voltage variation Δ-V_{clar} from 1.75V, the following adjustments to the circuit or parameters are necessary:

- Inserting a resistor R_x to restrict the voltage variation Δ-V_{clar}
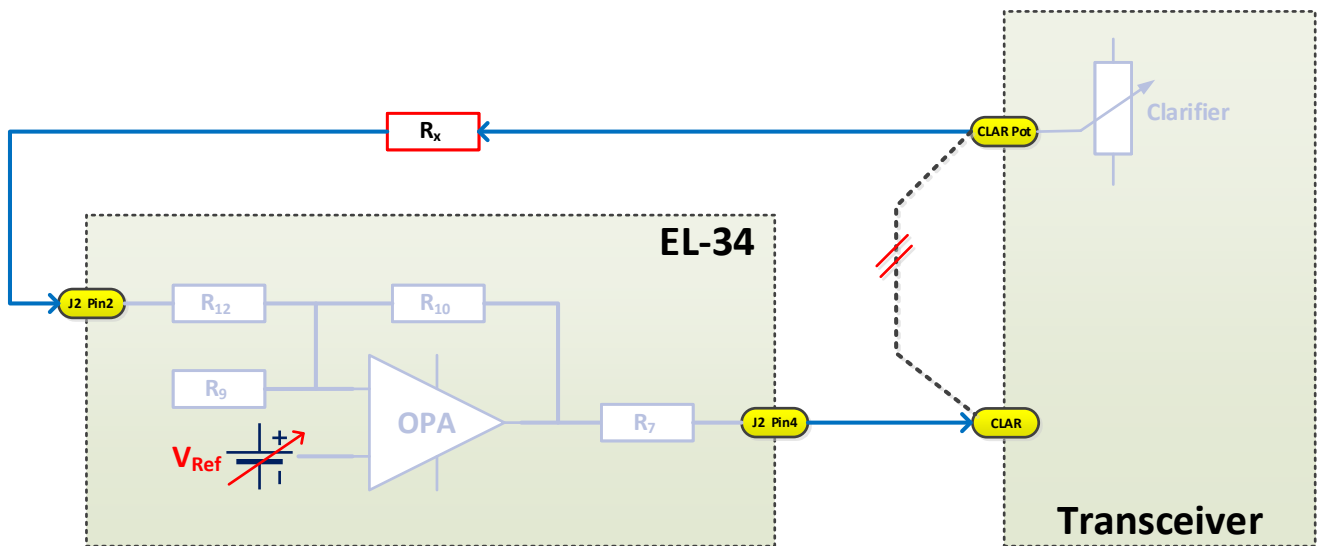 (see Table 4).

Figure 10

- Adjusting the reference voltage V_{Ref} to compensate the clarifier offset voltage
  (see Chapter 7.3.6).

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[1] The offset voltage can be adjusted see chapter 7.3.6. This function has not yet been tested for all transceivers.

Table 4 lists some devices with the corresponding values for Rx and V_{Ref}. The resistance values for R_x can be replaced by values of the E12 resistor series.

| Clarifier	FT-301D	FR-101	FT-101EE	FT-101ZD	FT-102	FT-902DM	TS-120	TS-520S	TS-830S
V_{clar} max.	3.38V	5.27V	5.18V	5.11V	5.97V	5.11V	8.91V	9.00V	9.00V
V_{clar} center	2.51V	3.64V	3.66V	3.57V	4.57V	3.57V	7.10V	5.46V	6.69V
V_{clar} min.	1.64V	2.30V	2.13V	2.03V	3.45V	2.03V	5.76V	3.94V	5.18V
Δ-V_{clar} (max-min)	1.74V	2.97V	3.05V	3.08V	2.52V	3.08V	3.15V	5.06V	3.82V
EL-34	FT-301D	FR-101	FT-101EE	FT-101ZD	FT-102	FT-902DM	TS-120	TS-520S	TS-830S
R_x (R_{CLAR})	0kΩ	71kΩ	75kΩ	77kΩ	45kΩ	77kΩ	81kΩ	191kΩ	120kΩ
V_{REF} Voltage	2.50V	2.8V	2.8V	2.7V	3.0V	2.7V	3.5V	2.9V	3.3V

Table 4
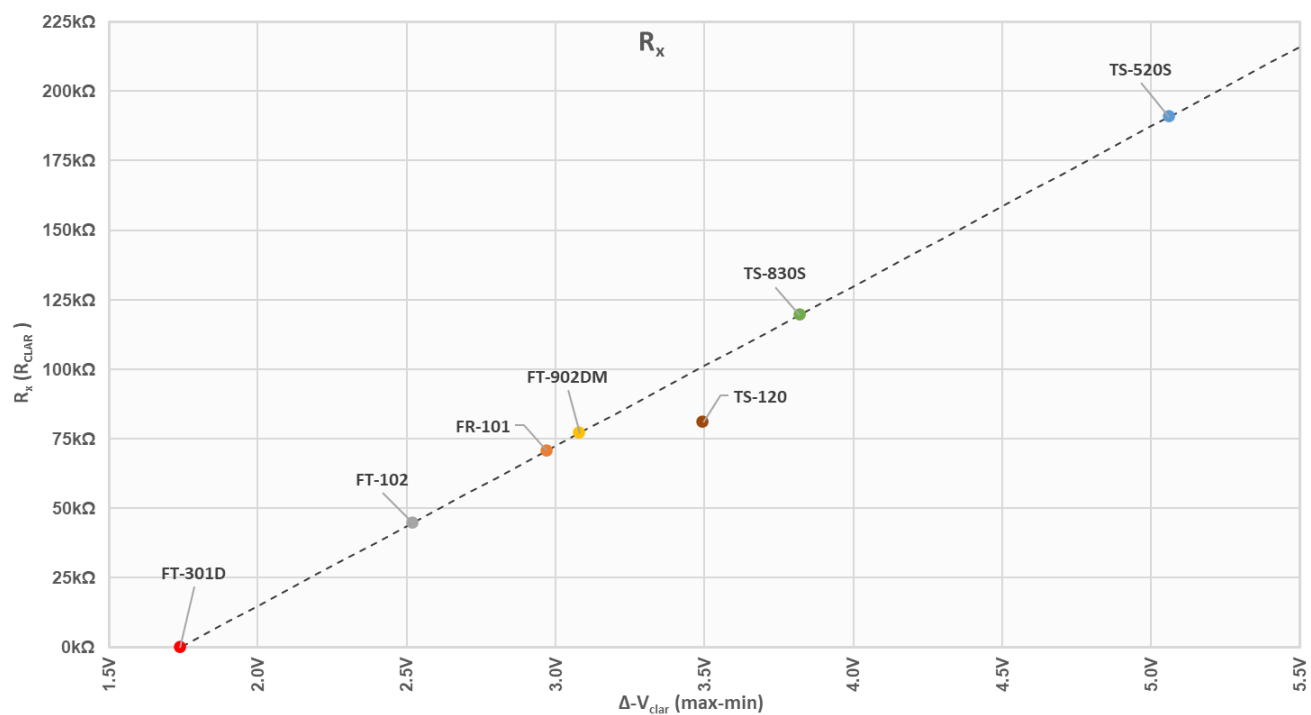
Figure 11
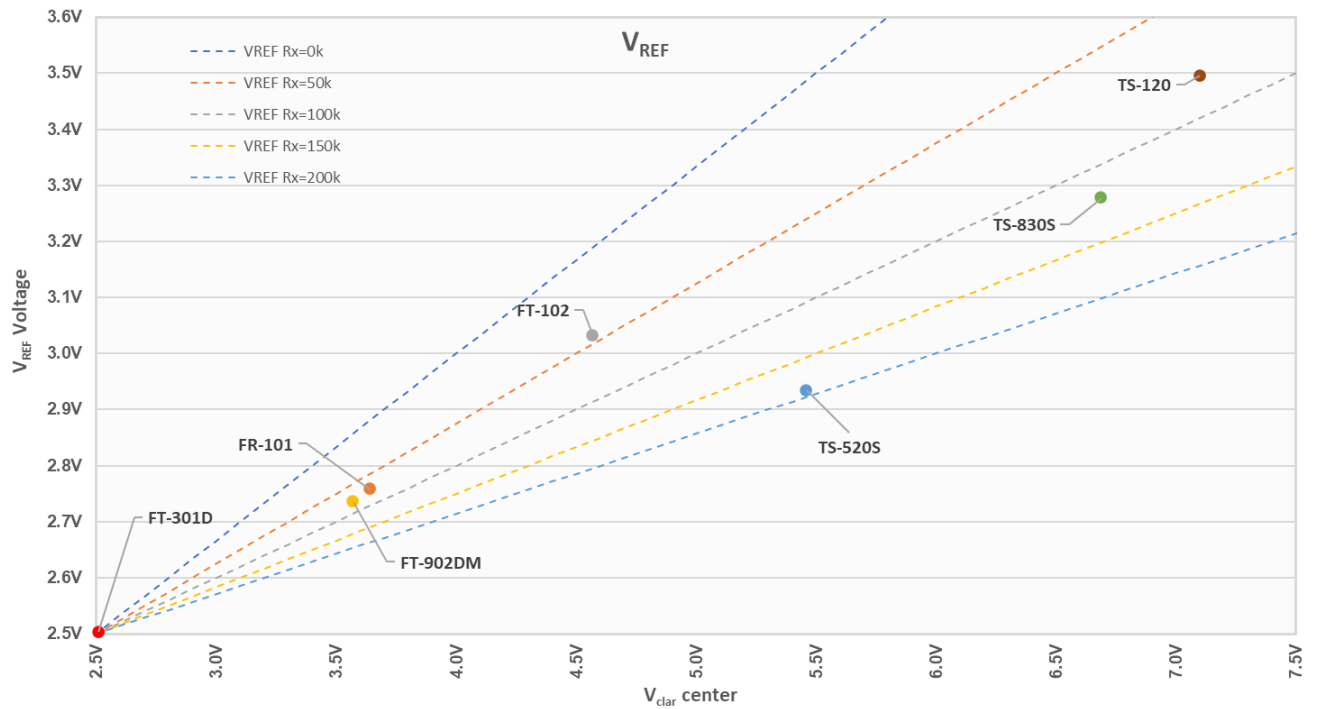
Figure 12

5.5 Assembling the module into the transceiver

⚠️ Install the module as close as possible to the VFO. All signal wires should be as short as possible to minimize interference.

The board can be mounted to the transceiver chassis with four M3 or self-tapping screws and spacers. The dimensions of the board are 53mm x 60mm and hole spacing 28mm x 53mm, see Figure 13.
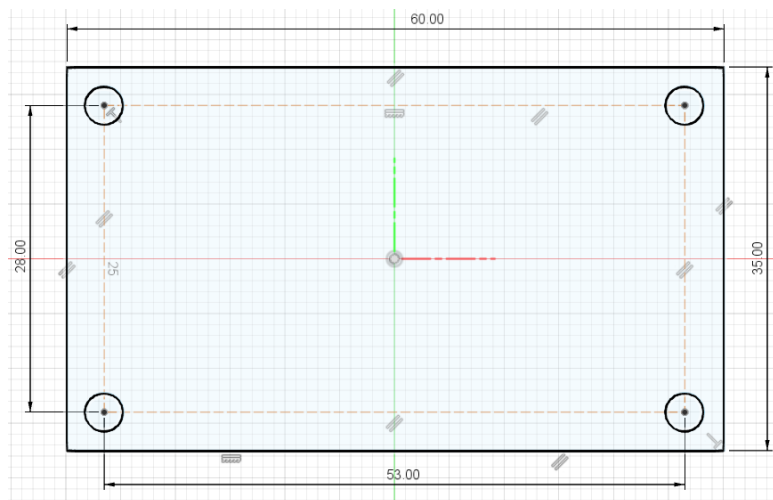

Figure 13

The power supply of the module must be from a regulated DC voltage of 7V to max. 30V.

☐ Plug the prepared connectors into the pin headers J1 or J2

 For the following steps, shorten the stranded wires and the coaxial cable to the appropriate lengths.

☐ Connect the power supply (red / blue) to a regulated DC voltage of the transceiver.

☐ Connect the coaxial cable to the buffered VFO RF output.

☐ Connect the tuning line VAR to the tuning circuit in the VFO, or to the clarifier tuning circuit if this meets the conditions for the EL-34.

6 Operation

For the operation of the FLL-VFO Stabilizer Module EL-34 no special settings are required. You can use the transceiver as usual. The big advantage is that the VFO is crystal stable and the drift is compensated.

6.1 Delay after tuning

During VFO tuning, frequency correction is suspended and the control voltage VAR is kept at the current value. The status LED lights red during this process, indicating that the unit is unlocked.

As soon as tuning stops, the FLL VFO Stabilizer is waiting a delay of 2s before reactivating frequency correction. This gives you enough time for slow manual tuning without the stabilization trying to correct a drift.

 The delay time can be programmed to your needs → Chapter 7.3.3

6.2 Status display

With a dual LED (red / green) the status of the FLL VFO Stabilizer Module can be indicated. The status indication is not mandatory for the operation of the EL-34 module and can be omitted.

The status LED has the following meaning:

Section	LED display	Status
Power up	lights red, orange and green	FLL VFO stabilizer is initialized
Stabilisation	lights constantly red	Frequency change, stabilization stopped Unlock frequency tolerance incorrectly set
	glows constantly green	VFO frequency is stabilized
RF signal	flashes red	RF signal missing or RF level is too low.

7 Programming via USB to Serial Adapter

7.1 Connection to FLL VFO Stabilizer

The EL-34 FLL VFO stabilizer has a serial interface (5.0V TTL, <u>no RS-232 levels</u>). With a "USB to Serial adapter" (e.g. TTL-232R-5V0 or TTL-232R-5V0-PCB from FTDI) the EL-34 module can be connected to a PC or laptop.

The connection is made via the programming connector of JP1, the 5-pin male connector (see Figure 14).
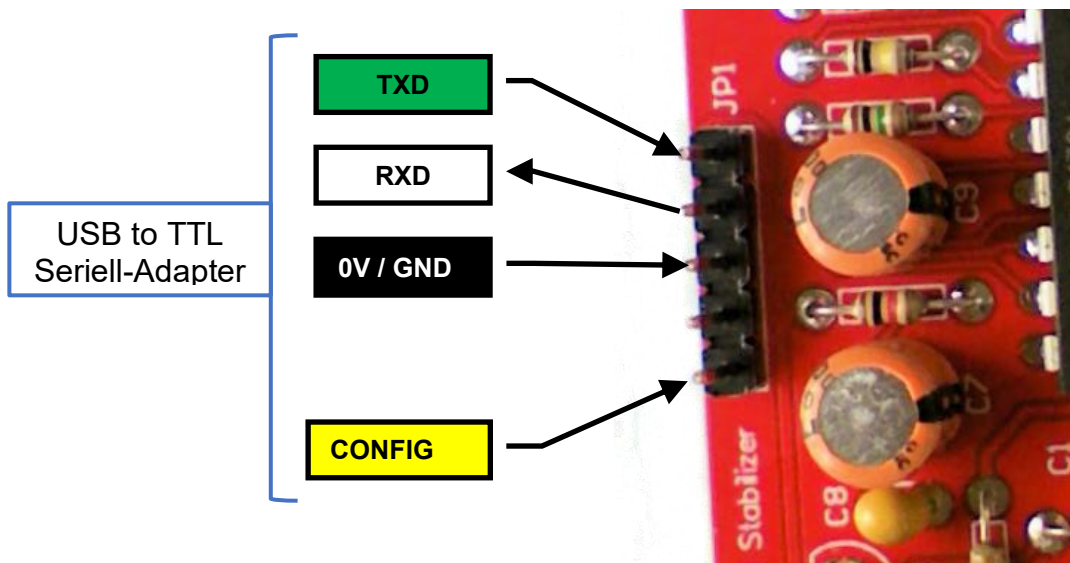

Figure 14

The <u>power is supplied via transceiver</u>, so that no further power supply is necessary.

Proceed as follows:

1. Plug the "USB-to-TTL" adapter into the PC. Power is supplied via transceiver.

    The 5V voltage of the adapter must not be connected to the EL-34.

2. On the PC a connection with the EL-34 FLL VFO stabilizer is opened with any terminal program (e.g. PuTTY) (Baud rate: 9600, Flow control: none, Terminal Options: Implicit CR in every LF). Check with the device manager which virtual COM port number the adapter has received.
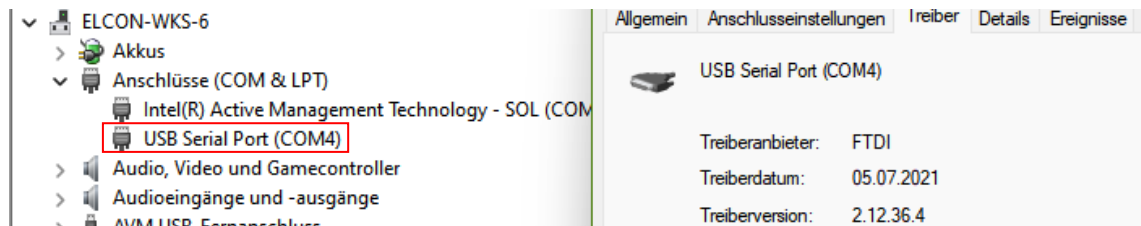

Figure 15

3. Connect the CONFIG line at EL-34 (Pin 1, JP1) via a 10kΩ resistor to GND (0V).

4. Turn on the transceiver. The LED will light up red and green simultaneously in programming mode. Programming is possible only if the EL-34 is active! The following message is displayed on the terminal (press the Enter key if necessary).
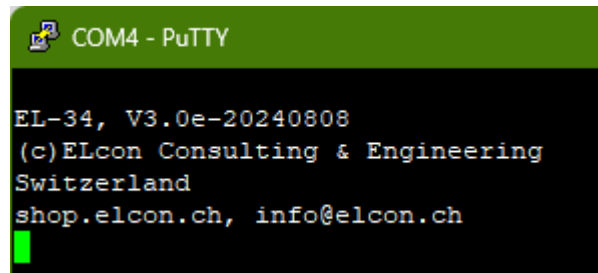

Figure 16

5. Press the Enter key and you will receive a confirmation. This ensures that communication with the module is functioning correctly.
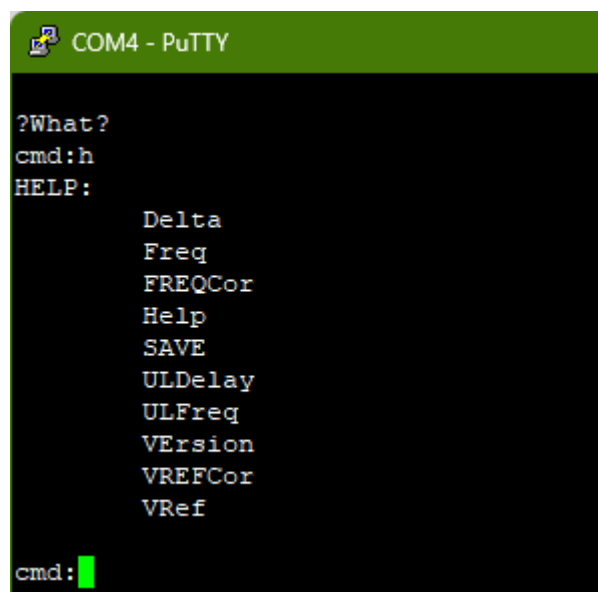A command overview is obtained by entering "h" or "H" after the prompt "cmd:"

Figure 17

7.2 Entering commands

English words or abbreviations are used to change parameter values and give instructions to the EL-34. Upper and lower case is not relevant for all terminal inputs.

The following commands are possible for input:

> **Delta**
> **Freq**
> **FREQCor**
> **Help**
> **SAVE**
> **ULDelay**
> **ULFreq**
> **VErsion**
> **VREFCor**
> **VRef**

Some commands do not require the complete command word to be entered.

For example, for frequency measurement, at least "F" must be entered, but "FR", "FRE" or "FREQ" are also valid entries.

```
cmd:F
FREQ = 5499940Hz
cmd:FR
FREQ = 5499940Hz
cmd:FREQ
FREQ = 5499940Hz
cmd:
```

Figure 18

In the help output, the commands are displayed in such a way that capital letters represent the minimum required entries for the respective command.

If the input is incorrect or cannot be interpreted, **?What?** is returned.

```
cmd:abc
?What?
cmd:
```

Figure 19

Some commands use parameters that are entered after the command, separated by at least one space.

Command entries without parameters output the current parameter value.

```
cmd:vref
VREF 25
cmd:vref 15

VREF was 25
VREF now 15
cmd:
```

Figure 20

⚠ Only change the parameters if you know exactly what they do. Incorrectly set parameters could put the FLL VFO Stabilizer out of service.

7.3 Commands

7.3.1 H   Help

Enter the command "H" in command mode to read the online help file in abbreviated form.

7.3.2 SAVE   SAVE

Saves the changed parameters. The next time the transceiver is switched on, the parameters are loaded into RAM.

7.3.3 ULD   ULDELAY "n"

Default: 2 (2s)
Parameter: "n"   1 bis 10

"Unlock Delay" defines the delay time, which is waited after an Unlock, before the FLL VFO Stabilizer changes back into Lock Mode.

7.3.4 ULF   ULFREQ "n"

Default: 40 (40Hz)
Parameter: "n"   20 bis 100

The "Unlock Frequency" defines the unlock frequency tolerance. If the measured frequency shift of the VFO is larger than the frequency tolerance, the unit switches to Unlock status (Lock to Unlock, LED red). A too small value (20Hz) can lead to sporadic unlock cycles.

7.3.5 VE   VERSION

With the command "VE" the firmware version is displayed. For example

```
cmd:VE
VERSION EL-34, V3.0e-20240808
cmd:
```

Figure 21

7.3.6 VR   VREF"n"

Default: 25 (2.5V)
Parameter: "n"   10 bis 40

⚠️ If VREFCOR is **OFF** (see chapter 7.3.7), the VREF command can be used to set the voltage at the output on J2 pin 4 "Control Voltage Out" (VAR) in 0.1V steps from 1 to 4V.

Together with the frequency measurement "FREQ" the varactor diode frequency range can be measured, this in contrast to chapter 5.3 also with built-in FLL VFO stabilizer.
Example:

```
cmd:vrefc

VREFCOR OFF
cmd:delta on

DELTA was OFF
DELTA now ON
cmd:f
FREQ = 5499940Hz, DELTA = 00Hz
cmd:vr 15

VREF was 25
VREF now 15
cmd:f
FREQ = 5492720Hz, DELTA = -7220Hz
cmd:vr 35

VREF was 15
VREF now 35
cmd:f
FREQ = 5503050Hz, DELTA = 3110Hz
cmd:
```

Figure 22

⚠️
* IMPORTANT: Check that VREFCOR is OFF.
* Frequency measurement **FREQ = 5499940Hz, DELTA = 00Hz**
* Set the voltage at the varactor diode to 1.5V.
* Frequency measurement **FREQ = 5492720Hz, DELTA = -7220Hz**
* Set the voltage at the varactor diode to 3.5V.
* Frequency measurement **FREQ = 5503050Hz, DELTA = 3110Hz**

This was used to determine the varactor diode frequency variation in a voltage range from 1.5V to 3.5V at 10.34kHz. The tuning circuit is therefore suitable for use with the FLL VFO Stabilizer.

The following section is only relevant for equipment with a clarifier function and if the Clarifier tuning voltage is routed via EL-34.

If VREFCOR is **ON** (see chapter 7.3.7), the offset voltage at the input "Clarifier In" (CLAR) can be compensated with the command VREF.

⚠ WARNING: Incorrectly set values can affect the function of the FLL-VFO stabilizer or even make it impossible.

The center voltage at the tuning circuit in the VFO should be around 2.5V±0.4V.
The voltage is measured with a multimeter at J2 pin 4 (Control Voltage Out).

If the transceiver's Clarifier (CLAR) circuitry is delivering a voltage outside of this range, the drift of the VFO frequency may not be compensated by the FLL VFO stabilization.
The voltage is measured with a multimeter at J2 pin 2 Clarifier In (CLAR).

Proceed as follows:

1. Turn off the clarifier on the transceiver. Switch the transceiver on.

2. Measure the voltage with a multimeter at J2 pin 2, if the voltage is in the range of 2.5V±0.4V you can skip this chapter, if not continue at point 3.

3. Connect the multimeter to J2 pin 4 (Control Voltage Out) so that you can check the voltage easily while you are entering data via the terminal.

4. Enter the command **VREFCOR ON** via terminal. This switches the EL-34 into the offset voltage correction mode. The inputs with **VREF "n"** have a direct effect on the internal reference voltage of the FLL VFO stabilization.

5. Use the **VREF** command (without parameters) to check the currently set value (the default value is 25) and make a note of it just in case.

6. If you measure a voltage lower than 2.5V at J2 pin 4 Control Voltage Out (VAR), the current value must be increased, otherwise vice versa.

   ⚠ Change the value only in steps of 1.

7. Enter the new value with the command **VREF "n"** and check the changes on the multimeter. If the voltage is still not within the range of 2.5V±0.4V, repeat point 7 until you are satisfied with the result.

8. Save the adjusted value with SAVE.

9. Turn the transceiver off and on again and check the voltage value at J2 pin 4 (Control Voltage Out). If the voltage is still outside 2.5 ±0.4V, repeat steps 4 to 9.

7.3.7 VREFC   VREFCOR ON/OFF

Parameter:

Default: OFF

OFF   With the command VREFCOR **OFF** the voltage at the output at J2 pin 4 "Control Voltage Out" (VAR) can be set directly with VREF "n". This function is intended for testing the varactor diode frequency range.

⚠   With the command SAVE a changed "n" value is _not saved_.

ON   With the command VREFCOR **ON** the stabilization-internal reference voltage can be changed with VREF "n". This function can be used to correct offset voltages in clarifier circuits.

⚠   The SAVE command will _save_ a changed "n" value.

7.3.8 D   DELTA ON/OFF

Parameter:

ON   With the DELTA ON command, the frequency difference measurement is switched on for the frequency measurement. The current frequency is saved as an offset.
With "FREQ", the difference frequency is also calculated and displayed in addition to the frequency.

```
cmd:d on

DELTA was ON
DELTA now ON
cmd:f
FREQ = 5498690Hz, DELTA = 00Hz
cmd:f
FREQ = 5502730Hz, DELTA = 4040Hz
cmd:
```

Figure 23

OFF   The frequency difference measurement is switched off with the DELTA OFF command.
When the stabilizer is switched on, DELTA = OFF

8 Software-Update

A new software version for the EL-34 can be downloaded via the Internet. The new data is loaded into the EL-34 using the "Updater_EL-34.exe" program. The connection is made via the programming terminals of P1, the 5-pin connector. This requires a connection cable from the USB to TTL converter to the EL-34, which is wired with a diode and a 100nF capacitor as shown in Figure 24.
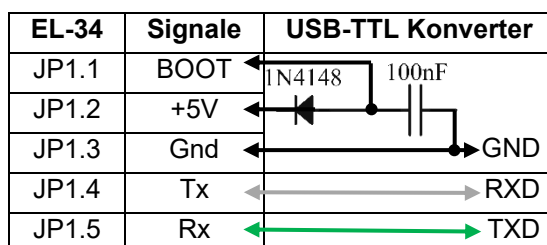
EL-34	Signale	USB-TTL Konverter
JP1.1	BOOT	1N4148 100nF
JP1.2	+5V	
JP1.3	Gnd	GND
JP1.4	Tx	RXD
JP1.5	Rx	TXD

Figure 24

8.1 Installing the software update

Proceed as follows to update the software:

1. Download the latest software update "EL34xxx.ELC" from the website http://shop.el-con.ch .

2. Save the file in the same folder as the "Updater_EL-34.exe" program. There may only be one update file in the folder.

3. Connect the PC and EL-34 with the special serial cable.

4. Start the "UpdaterEL-34.exe" program. The program opens the following "Updater" program window and the new update file "EL34xxx.ELC" must be displayed in the status bar.

Figure 25

5. Switch on the power supply to the EL-34.

6. Click on [Auto Detect...] to search automatically for the COM port or define the correct COM port yourself. The following "Auto Detect Port" window must indicate successful detection of the EL-34 in order to be able to carry out the software update. Confirm this with the [OK] button.
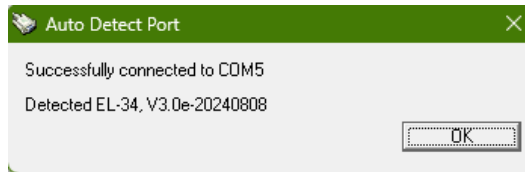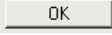
Figure 26

7. The update can now be started by pressing the [OK] button in the updater window. If possible, do not interrupt the loading process.
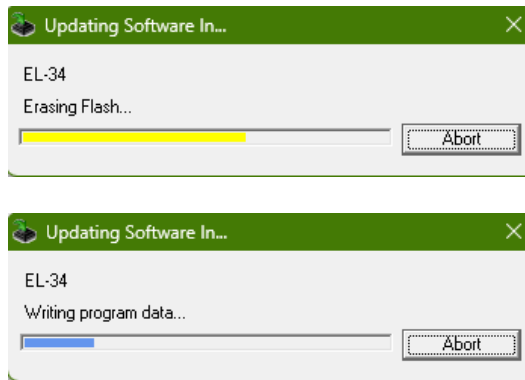

Figure 27

8. The successful software update is confirmed with the following window. Check whether the new software version is correct. The power supply to the EL-34 can now be switched off and the connection to the PC disconnected.
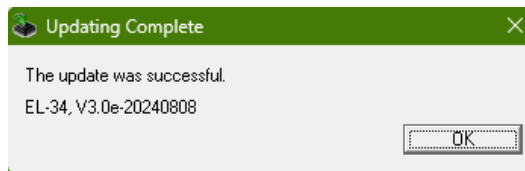

Figure 28

9 Appendix

9.1 Specifications

Frequency: 1 to 30MHz
Input level: > 200mV
Power supply: 7 to 20V / 20mA
Dimensions: 60(L) × 35(W) × 15(H) mm

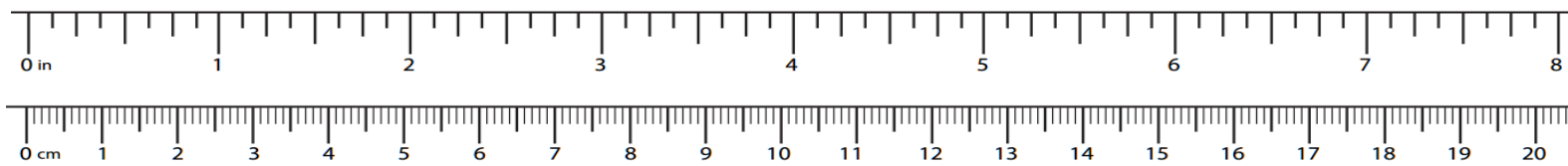All specifications are subject to change without notice or obligation.

Translated into English Roland Elmiger, HB9GAA, and Katharina Sanz Elmiger.
The reference for the content of this document is in German.

There is no guarantee for the accuracy of the translation.

9.2 Ruler

9.3 Repair / Warranty

We have no influence on the correct and proper assembly and can only guarantee the completeness and flawless condition of the components. We guarantee that the components will function in accordance with their characteristic values when not installed and that the technical data of the module will be adhered to when professionally processed in accordance with the installation instructions and commissioned or connected and operated as prescribed. We do not warrant or assume any liability for damages or consequential damages in connection with this product. We reserve the right to repair, rectify, deliver spare parts or refund the purchase price. Further claims are excluded.

The following criteria will not be repaired or are not covered by warranty:

- if acidic solder, solder grease or acidic flux etc. was used for soldering.
- if the kit has been improperly soldered, glued and assembled.
- during modifications and repair attempts on the module.
- in case of unauthorized modification of the module or the circuit.
- in case of improper removal of components not provided for in the design, improper free wiring, etc.
- Use of other components not originally part of the kit.
- in the event of incorrect assembly and wiring, as well as the resulting consequential damage.
- damage caused by non-observance of the operating instructions or the schematic and assembly diagram.
- if the module is connected to an incorrect voltage or type of current or if the polarity is incorrect.
- in the event of faulty operation or damage due to negligent handling or misuse.
- defects caused by bridged fuses or the use of incorrect fuses.

In all cases the transport costs of the kit shall be borne by you.

9.4 Disclaimer of liability

Any actions based on the information contained in this document are taken at the user's own responsibility. Any liability is excluded, both for direct and indirect damages and consequential damages that may arise in connection with the use of the information contained in this document.

9.5 Schematic

Figure 29

9.6 Circuit board assembly

Figure 30