Fitting a Cumbria Designs X-Lock to the Yaesu FT102

By David Lisney G0FVT

Introduction

The FT102 is a Yaesu hybrid HF transceiver using 3x6146Bs in the PA section. It is a high performance radio with a low distortion high power output on transmit and a high performance receiver. The examples of these radios I have handled lately have all suffered from VFO drift, so I did a search around the net for an aftermarket “Huff and Puff” stabiliser. A Google search for “PA0KSB” and “Hans Summers” will reveal some background information on the principles of “Huff and Puff” stabilisers and their origins.

I decided to use the X-Lock kit from Cumbria Designs. The X-Lock uses a PIC micro-controller and includes a tri-colour LED that indicates loop status. The kit was quick to assemble, the documentation clearly described assembly instructions as well circuit operation.

Preparation

My aim was to not dismantle or modify the FT102’s VFO in anyway so I applied the X-Lock correction signal via the clarifier connection to the VFO.

On examining the circuit diagram for the “Local Unit” of the FT102, I found that the clarifier or RIT relay, selects either an internal potentiometer or the external one depending on whether TX (XIT) or RX (RIT) is selected and depending on whether the radio is on transmit or receive. The external potentiometer is the same value as the internal one (5k) but the resistors that set their ranges are different, the internal potentiometer has more range than the external one. This actually makes little sense as the internal pot is merely used to adjust the centre position of the external control.

Circuit Changes

I decided to replace the resistors R163, R164, R165 and R166. These are now all 10k. The original plus or minus 3kHz of RIT range is still retained. The resistors are circled in figure. 1 (right). Whilst the local board was out I also connected an extra wire to a pad on the moving contact of the relay RL01. This track also connects to R167 and to the clarifier pin of J03.

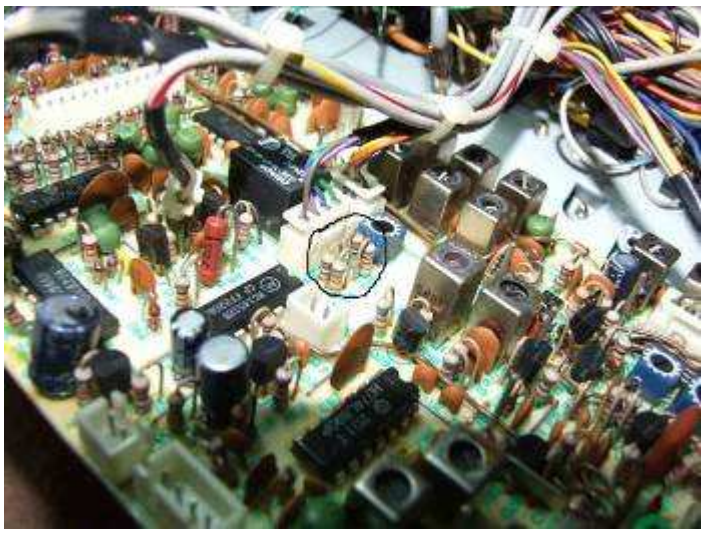

Fig. 1 Resistors to be changed

Note. This is also a good time to change the relay if your FT102 has been jumping about in frequency!

The resistors that are changed in this modification can be seen in the circuit diagram in figure 2. I felt that with the original values the “control range” of the X-Lock would vary significantly with adjustment of VR07 and the external clarifier control.

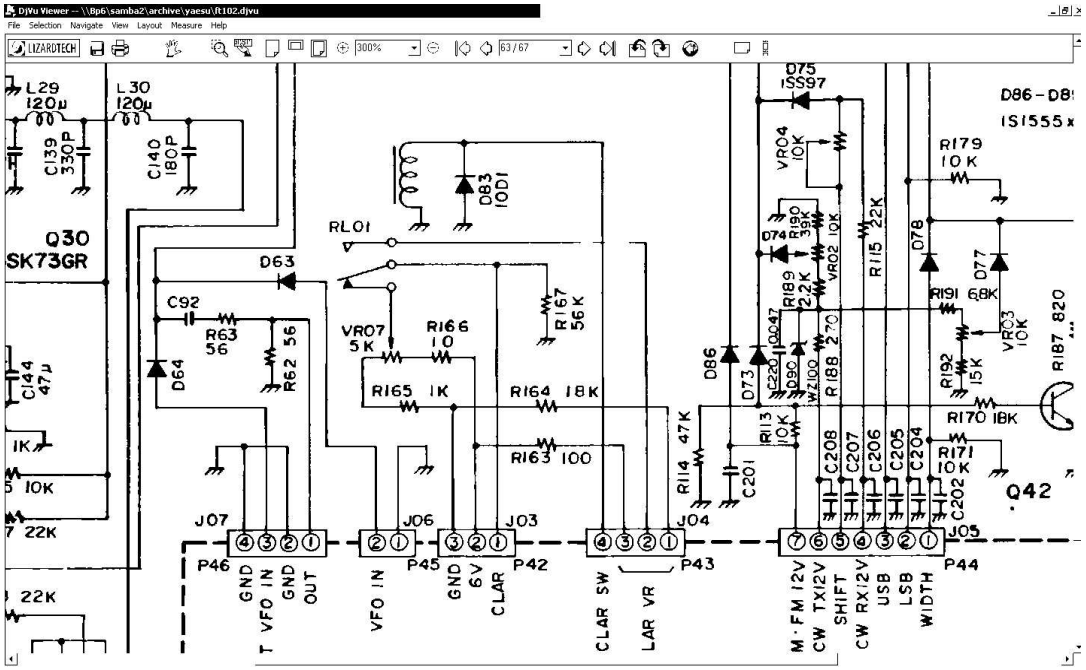

Fig. 2 Circuit detail of resistor changes

The underside of the Local Unit is shown in figure 3. The yellow wire vanishing from the bottom of the picture is routed up to the X-Lock. (Note. The flux marks indicate where I changed the resistors and the relay). Route this wire through the loom to the region of the display board but do not connect it at this stage. Refit and reconnect the local unit and check for loose wire cuttings. Connect a speaker and switch the radio on with the marker on (rear panel switch), centre the external clarifier control and tune to the marker to produce a clear beat note. Referring to the above picture, adjust VR07 so that the

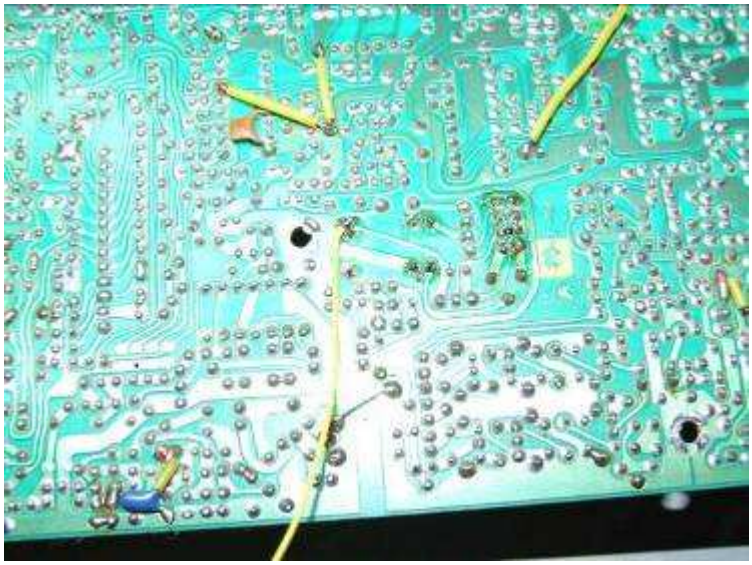

Fig. 3 Underside of the Local Unit

marker produces the same beat note whether RX RIT is depressed or not. Once this stage is complete the bottom cover of the transceiver can be replaced.

Installing the X-Lock Unit

I will leave it to the reader to decide how to mount their X-Lock, mine is still a breadboard so is temporarily attached with double sided pads to the top of the frequency counter chip on the counter board. I think it is best to remain in roughly that area of the radio as it is well away from the receiver and IF stages. Also it means the signal paths associated with the X-Lock are kept very short. Another bonus is that the LED can be observed whilst adjusting the radio with the lid off.

The layout of the Counter Unit is shown in Fig. 4. The various signals and power needed by the X-Lock are available on this board.

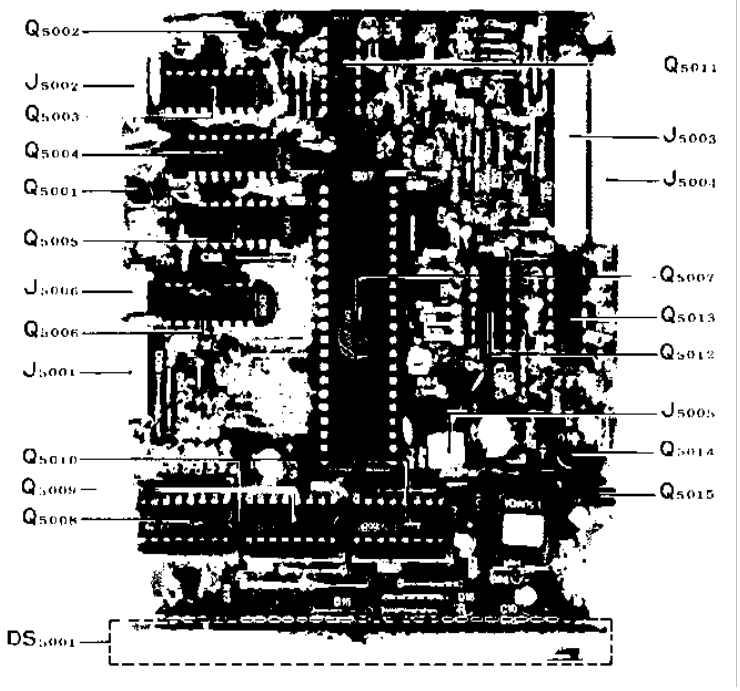

Fig. 4 The Counter Unit

The brown wire to J5005 carries +12v, Gnd is available in a number of places such as the screens of the wires on J5002. An input signal which tunes from 0.5Mhz to 1MHz appears on J5002 however, I found the level here was inadequate to drive the X-Lock so I extracted the signal from Pin 9 of Q5005. Please note that this signal is a mixed product of the VFO and crystal band oscillator, so the correction signal will be applied to the whole Local Oscillator system correcting any drift produced by the mixing oscillators as well as the VFO. As these are all crystal sources drift is minimal but they are included in the correction process.

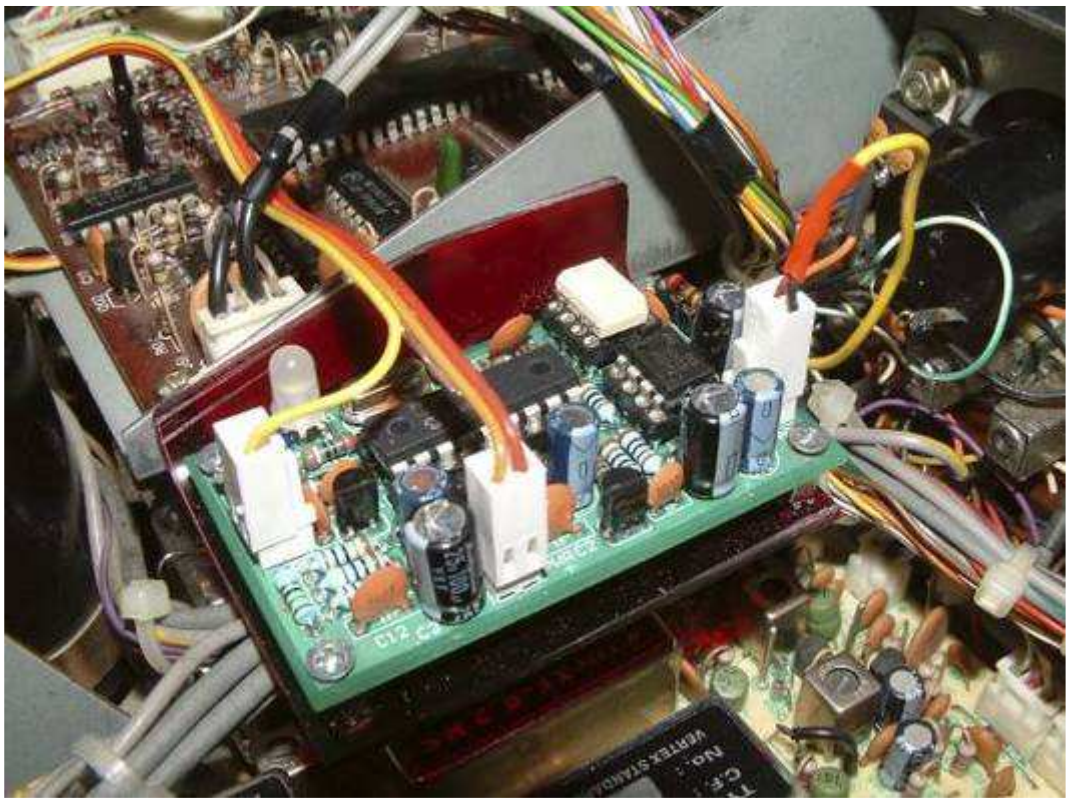

Fig. 5 The installed X-Lock unit

A close up of the installed X-Lock is shown above in figure 5. The kit includes all of the mating connectors for the connectors seen on the board.

Observations

The time constant is relatively “fussy”, the default 390k is fine as a starting value but if the correction introduces a “warbly” sound quality to demodulated audio, it may have to be increased somewhat. Mine currently uses a 1 M Ohm resistor. I have also included a resistor in series with the “VAR” correction output of the X-Lock. In the three FT102s that have been modified so far, we have used a value of 47k for this. This value produces a maximum correction roughly plus or minus 2 kHz. The FT102 drifts less than this but I believe there is scope to having a little overkill. The input adjustment of the X-Lock needs to be turned up until the LED only just goes green. In mine, if I turned it up too high it seems to see one of the clock signals on the display board.

Acknowledgements

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David Lisney G0FVT

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