

# ILER MK2

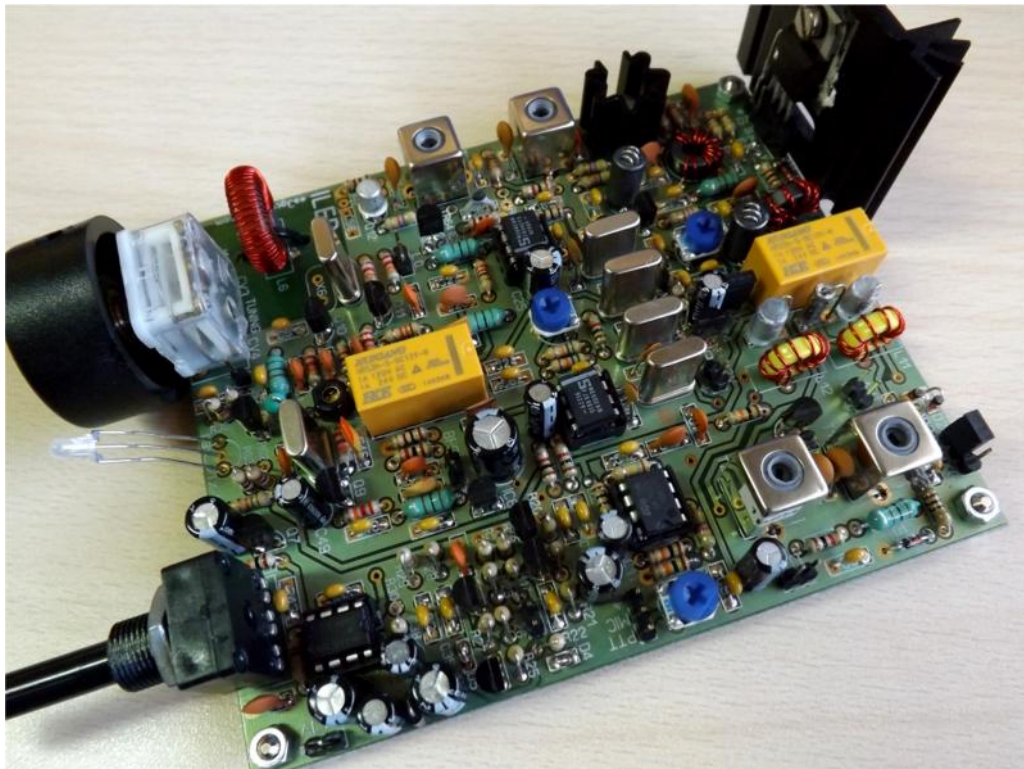
QRP SSB Transceiver in Kit Form

# Appendices

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## APPENDIX 1: TX Final Output Amplifier Transistor Q14

The 2SC1969 or 2SC2078 transistor that is supplied with kit is a good HF/CB final output transistor and has been selected for the ILER kits.

If necessary, a substitute can be used. Other transistors used for CB's such as 2SC2166, 2SC1945, etc., can be adapted and offer similar results. However, they may have a different pinout, and the idle current adjustment also varies. The value of R58 can be changed so that the adjustment range of P5 for the idle current "Bias" is correct.

The combination of jumpers "E-x-C-y" allows for the use of different types of transistors for Q14.

Notes:

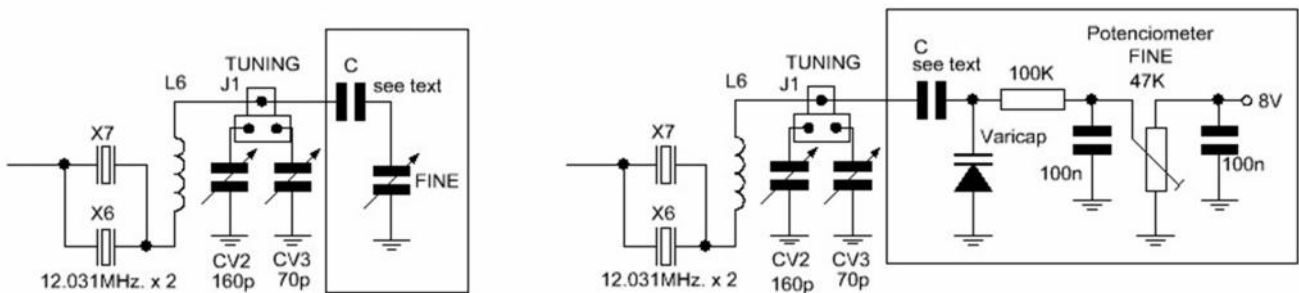
- Some transistors have more gain, and depending on the manufacturer, can be more inclined to produce feedback.

- **CAUTION! Currently, many transistors of this type that are offered at a low price are FAKES and work very poorly or not at all.**

## APPENDIX 2: Adding fine tuning to the VXO

The VXO tuning polyvaricon has a range of travel of ½ turn. When the tuning range is more of 40-50Khz., the tuning becomes touchy even when using a large diameter knob. The ILER MK2 was designed to work around the QRP frequency of the SSB segment of the band. By modifying the VXO coil (L6), you can achieve coverage of nearly 100Khz (with less stability), but you will also need to add fine tuning.

This can be done by means of mechanic reduction using a Vernier Dial or by means of a second polyvaricon or varactor diode ("varicap") (see the following drawings).



The value of capacitor "C" limits the action of the polyvaricon or varactor diode that is used. Begin with a small value of 10-15pF and increase proportionally until obtaining the desired "fine tuning" range. Everything depends on the value of capacitance of the variable capacitor or of the varactor diode that is used. This involves "cut and try" experimentation.

Keep in mind that the effect of the fine tuning will be remarkably different from one extreme to the other of the main tuning polyvaricon. This is due to the fact that when the polyvaricon is at its position of maximum capacitance, external capacitance added has less effect; on the other hand, when its position is at minimum capacitance, the external capacitance has more significant effect.

Note: Remember that to use extended leads for the VXO wiring, you should use stiff wires, making them as short as possible, and close to the circuit board. Any movement or vibration will affect the tuning.

**IMPORTANT:** If you are going to experiment with fine tuning, we strongly recommended that you first verify the operation of the VXO as it is provided.

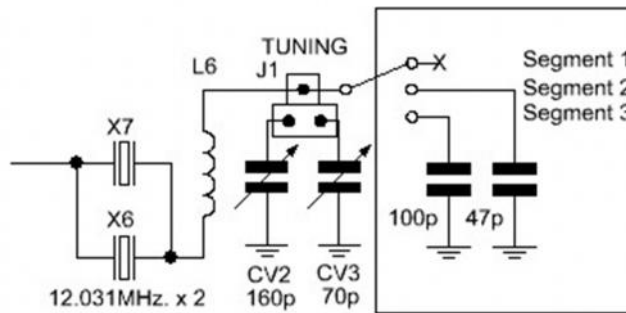
### APPENDIX 3: Adding segments to the VXO

Probably the most basic and economical way of widening the VXO coverage while maintaining easy tunability is to add a fixed capacitor in parallel with the tuning polyvaricon.

To do this, we must configure and adjust the VXO for a more moderate coverage (40KHz or less). Once the VXO is working correctly, we just have to add a capacitor in parallel with the polyvaricon and select it with a switch, as shown in the schematic (the capacitance values are illustrative).

When adding capacitance to the main variable “polyvaricon”, the frequency is lowered, and the coverage range is reduced significantly. This happens because as we add more external fixed capacitance, the polyvaricon has less effect. In this case I recommend adding just one or, at most, two segments in addition to the normal one. See in the following table what happens in an illustrative example:

|                   | segment | From      | To        | Range | Band                |
|-------------------|---------|-----------|-----------|-------|---------------------|
| Polyvaricon       | 1       | 18.140MHz | 18.170MHz | 45KHz | 18.125 to 18.170MHz |
| Polyvaricon + 39p | 2       | 10.993MHz | 11.010MHz | 20KHz | 18.100 to 18.130MHz |
| Polyvaricon + 82p | 3       | 10.985MHz | 10.996MHz | 15KHz | 18.088 to 18.103MHz |



The capacitors must be of good quality, of type “NPO”, “styroflex” or similar, to avoid harming the stability of the VXO.

Keep in mind that when switching from one segment to another of higher frequency, the tuning jumps suddenly and, for example, if we were in the high end of a segment, we will be in the high end of the segment that we switch to; therefore, to continue tuning from where we left off, we would have to move the tuning to the extreme low end and continue from there.

If you have graphical ability, you can draw a dial on the front panel with a frequency scale to serve as a guide.

Note: Once again, it is necessary to stress that to wire the switch and capacitors, you should use stiff wires, making them as short as possible, and close to the circuit board. For example, solder the capacitors directly to the circuit board trace and the other end to the switch, and from the switch connect to the polyvaricon with a short, stiff wire (a miniature toggle switch is satisfactory).

Any movement or vibration will affect the tuning.

**IMPORTANT:** If you are going to experiment with fine tuning, we strongly recommend that you first verify the operation of the VXO as it is provided originally.

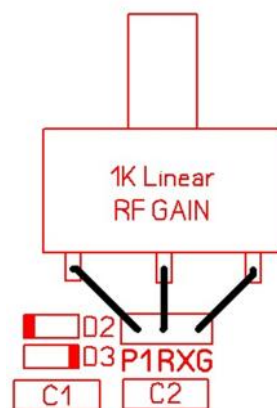
## APPENDIX 4: Connecting a potentiometer to terminals “P1RXG”

The switch at terminals ATT activates a fixed level of attenuation that in some situations is not suitable for the band conditions.

If you frequently use the ILER at different hours of the day and night, it might prove useful to add a potentiometer for “RF Gain”, with which you can adjust the attenuation level at the RX input according to what is most appropriate for each situation. This will help you to reduce the undesired effects of saturation due to broadcast stations near the band of use.

Connect a 1K linear potentiometer to the terminals “P1RXG” as indicated in the following drawing. Try to place the potentiometer as close to the circuit board as possible and use short wires. If there is distance between the circuit board and the potentiometer, then use a thin coaxial cable. You may place the potentiometer in the rear panel of the box.

The fixed attenuator switched at terminals ATT will still be available.

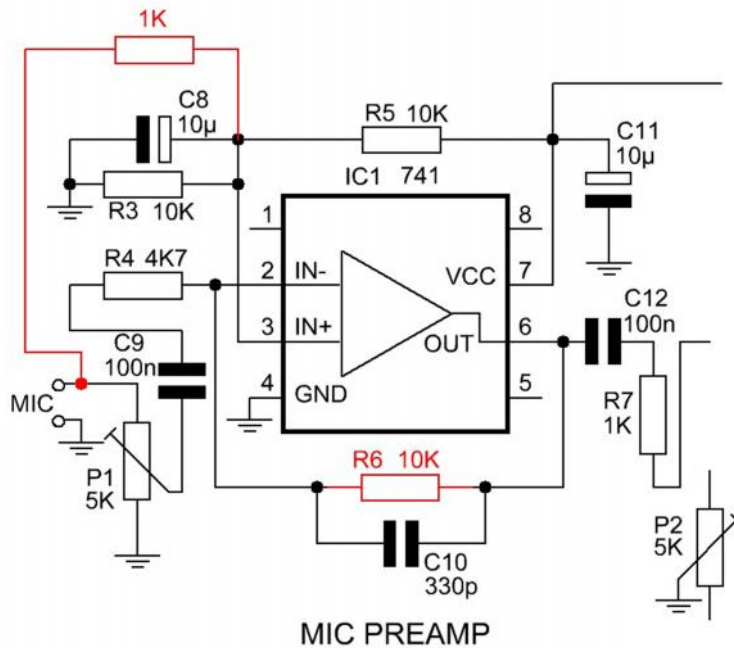


## APPENDIX 5: Using an “electret” microphone

Electret condenser microphone elements are now common and very low priced. If you wish to use this type of microphone, you just need to carry out a couple of simple modifications to reduce the gain of preamplifier IC1 and to feed the electret element.

- Substitute the current R6 with a 10K resistor.
- Connect a 1K resistor to the SMD type pads provided on the trace side of the circuit board. It is not necessary to use an SMD type resistor; you may use a conventional resistor and prepare the leads for correctly soldering to the pads.
- - Install a 1N4141 diode in parallel with the relay RL2 so that the switching pulses do not cause damage to the internal circuitry of the electret. (The cathode (the stripe) of the diode goes to the + supply of the relay).

Note: Due to their high pick up sensitivity, the common “electret” microphones pick up a lot of ambient noise during speaking intervals and this can also cause a certain amount of voice compression.



## APPENDIX 6: Terminals K1 and K2 (for occasional CW operation)

In basic terms, working CW is accomplished by generating a continuous carrier which is codified into a “CW” Morse transmission, and a slight offset of a few hundreds of Hertz between RX and TX is created. The offset between RX and TX is theoretically the tone at which our QSO contact will hear us.

The K1 terminal activates an unbalancing of the SSB modulator, thus generating a transmitting carrier. The K2 terminal activates a frequency offset of the BFO of a few hundred Hertz. The combination of K1 and K2 allows for generating a transmitting carrier which is offset from the receive frequency, thus providing a way for the ILER to operate in CW.

The activation of terminals K1 and K2 for CW mode functions inversely, meaning:

|              | K1      | K2      |
|--------------|---------|---------|
| <b>RX</b>    | 0 V GND | +12 V   |
| <b>TX CW</b> | +12 V   | 0 V GND |

## Adjustment

*ILER-40 MK2*

**With K2 energized** (to +12V) adjust CV1 (BFO) to hear LSB correctly (approx. 4.913.5)  
When disabling K2, the frequency will increase 500-700Hz.

*ILER-20 MK2 & ILER-17 MK2*

**With K2 energized** (to +12V) adjust CV1 (BFO) to hear USB correctly (approx. 3.276.0).  
When disabling K2, the frequency will increase 500-700Hz.

**Operation:**

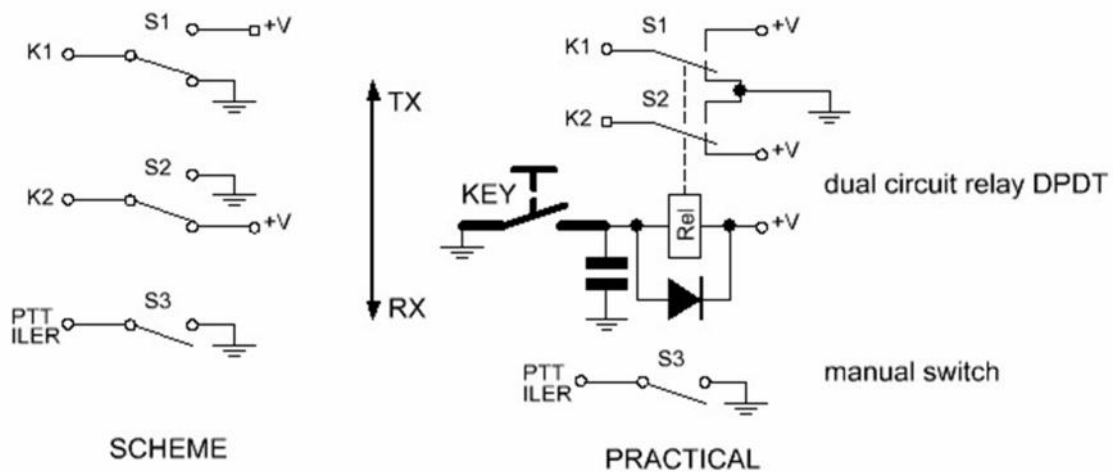
- For SSB, between RX and TX there is no offset, therefore it is necessary to always maintain K2 energized (to 12V).
- For RX in CW, K2 is maintained energized, the same as in SSB (the ILER-40 receives CW in LSB and the ILER-20/17 receives CW in USB).
- For TX in CW K2 is de-energized; K1 is energized to generate carrier and the PTT is enabled. Switching to transmit, carrier is generated and the frequency is offset.

**Also remember that the microphone should be disconnected.**

**Simple circuit for CW switching**

The following schematic is very simple and is probably the most recommendable way of operating CW on an occasional basis or in cases of emergency. Switching from RX to TX is done manually with a simple switch, and the switching of K1 and K2 is accomplished with a double pole relay circuit activated by the telegraph key.

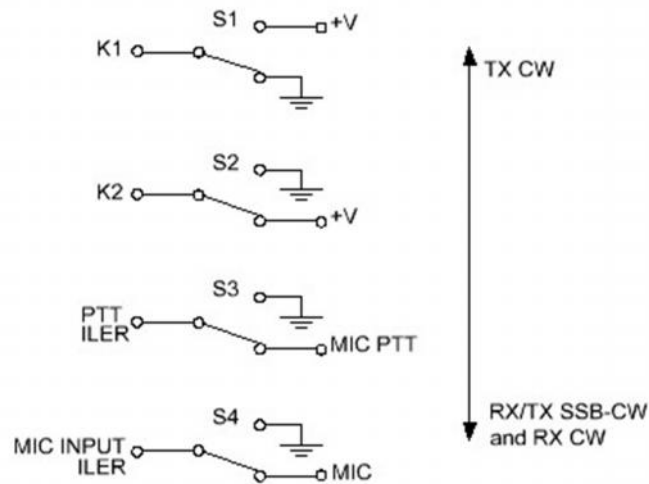
If you wish, you may also activate a “buzzer” as a sidetone.



**MINIMUM CW WIRING**

Recommended for occasional/emergency use  
Remember: unplug the microphone

The following basic schematic shows the switching to operate CW, including the Mic/Ptt switching to be able to work SSB without disconnecting the microphone.



## CW Wiring Mic/Ptt switched for SSB

### Notes:

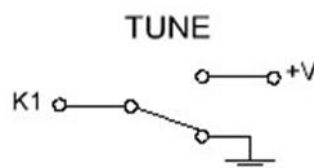
- The operation in CW has been implemented only for testing, occasional operation or emergencies.
- the ILER has not been designed to work CW, therefore, it does not have a side-tone monitor, a narrow bandwidth IF filter, electronic break-in switching and RX/TX delay, or “anti-click” filter, etc.
- The BFO offset is accomplished by raising its frequency so that we approach the center of the IF filter’s frequency passband to allow passage of the signal. Otherwise, if we were to move away from the center frequency of the filter’s passband, we would not achieve power output.
- Obviously all these switches could be made with transistors and could add delays etc. But in that case you should use a more complex circuit.

**IMPORTANT: If you are only going to use the ILER in SSB, then just carry out the adjustments as indicated in the kit manual (K2 is not used).**

### APPENDIX 7. Activation of K1 for “Tune” function

The K1 terminal can be activated (to +12V) to obtain a small amount of power output for adjusting antenna tuners, antennas etc.

Simply connect K1 to a manual switch connected to +12V. It is also recommendable to connect it to GND when it is not activated. See the following drawing.



## APPENDIX 8. Connecting the ILER-DDS

The ILER-DDS kit is an excellent option for equipping all ILER transceivers with a digital frequency control and complete band coverage with very high stability.

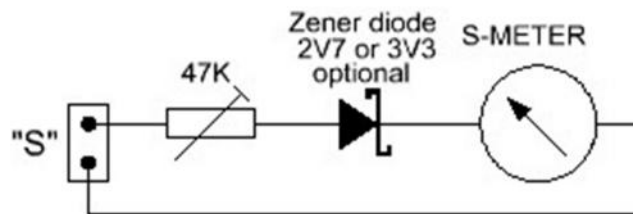
In the ILER-DDS manual you will find all the details for connecting it to the ILER transceivers.

Keep in mind that the VXO should be disabled by disconnecting inductor L7, which feeds the entire VXO.

## APPENDIX 9. Terminals "S". Connecting an "S-Meter"

In the "S" terminals on the quadrant H-9/10 you can connect a "s-meter".

You can use the following connection.



Notes:

The "S" output will show some indication of the relative level between the different stations received.

Although not receive any signal, the s-meter displays a small signal level; this is normal.