

XRef-PLL

Icom IC-756ProIII Installation Notes (Draft)

1. Overview

Most modern Amateur transceivers now generate their operating frequency from a single internal Reference Oscillator. In many cases, this Reference Oscillator is voltage-controlled, allowing front panel adjustment of the Reference frequency.

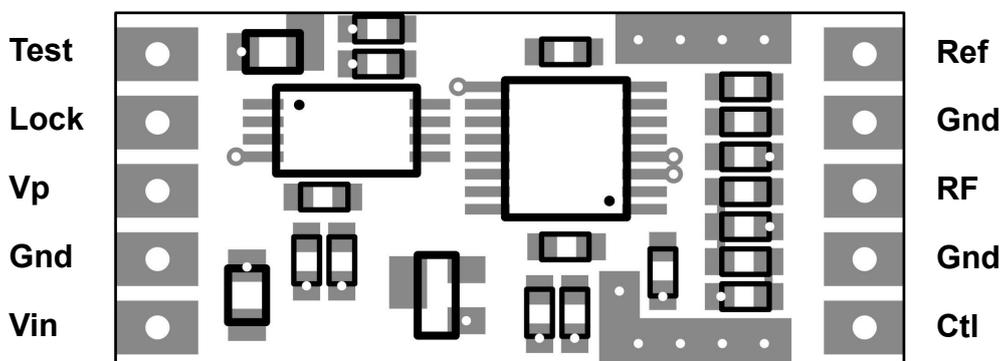
The XRef-PLL locks the radio's Reference Oscillator to an external 10 MHz reference signal from a GPS reference or other high-accuracy source. It intended to be installed internally within the radio. When no 10 MHz reference is connected, the XRef-PLL completely disconnects from the radio, allowing it to operate as from the factory.

In the case of the Icom IC-756ProIII, the Reference frequency is 32.0 MHz.

A Word of Caution: The installation requires a small amount of soldering to very small and fragile SMD components. If you do not have experience with SMD techniques, please seek the assistance of someone who does. We are happy to provide any advice needed, but we cannot take responsibility for any damage to your radio.

2. Technical Specifications

Connections to the board are shown below:



Connection	Description	Specifications
Test	Do Not Connect	
Lock	PLL Lock Indicator	+3.3V 20mA max
Vp	Do Not Connect	
Gnd	Power Ground	
Vin	Supply for XRef	5 to 16 V @ 20 mA
Ref	10 MHz Reference Input	0 to +15 dBm (0.5V to 3.6V p-p)
RF	Reference frequency from Radio.	Radio dependent
Ctl	Control output to Reference VCXO	0 to +3.3V

3. Circuit Modifications

No modifications are required to the standard circuit. The XRef is simply connected to several points on the PLL board. An extract from the circuit diagram in Figure 1 shows where connections are to be made.

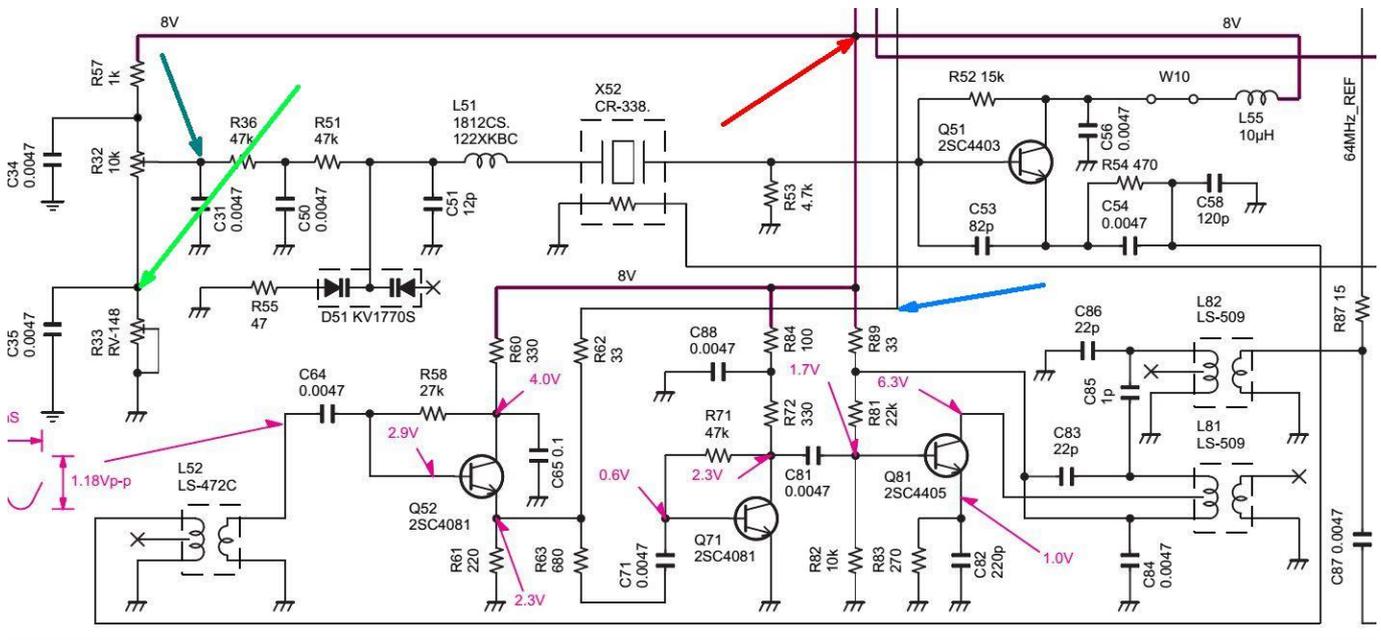


Figure 1. – Icom IC-756ProIII Reference Oscillator Circuit

- The **Blue** arrow indicates where the output of the Reference Oscillator is sampled.
- The **Green** arrows indicate where the control voltage is fed back to the Reference Oscillator.
- The **Red** arrow indicates where +8V is taken to power the XRef.

4. Installation

For this installation, you will need about 300mm of very thin coax - say RG178B or RG316 and a socket to suit. As well, a small signal NPN transistor is needed (e.g. BC547/8/9). You will also need some short lengths of very fine gauge hookup wire and a small piece of double-sided foam adhesive tape.

Remove the bottom cover of the radio.

A photo of the PLL board, taken from the Service Manual, is shown in Figure 2. Locate the Reference Oscillator area in the top right corner of the PLL board.

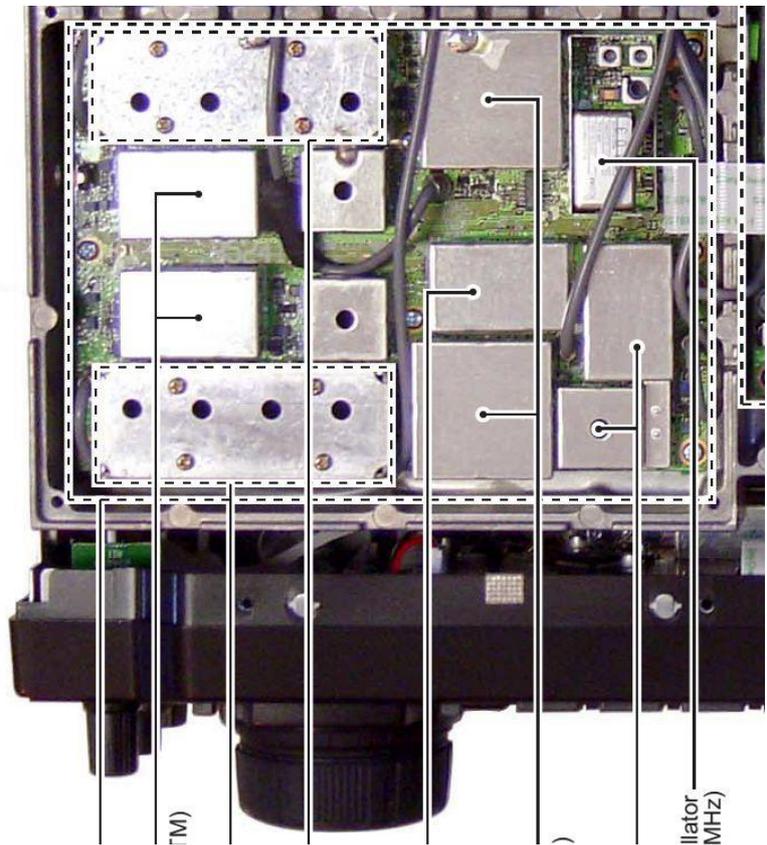


Figure 2. – PLL Board Location

The connection points are shown in Figure 3. The green connections are on the left edge of the PLL board.

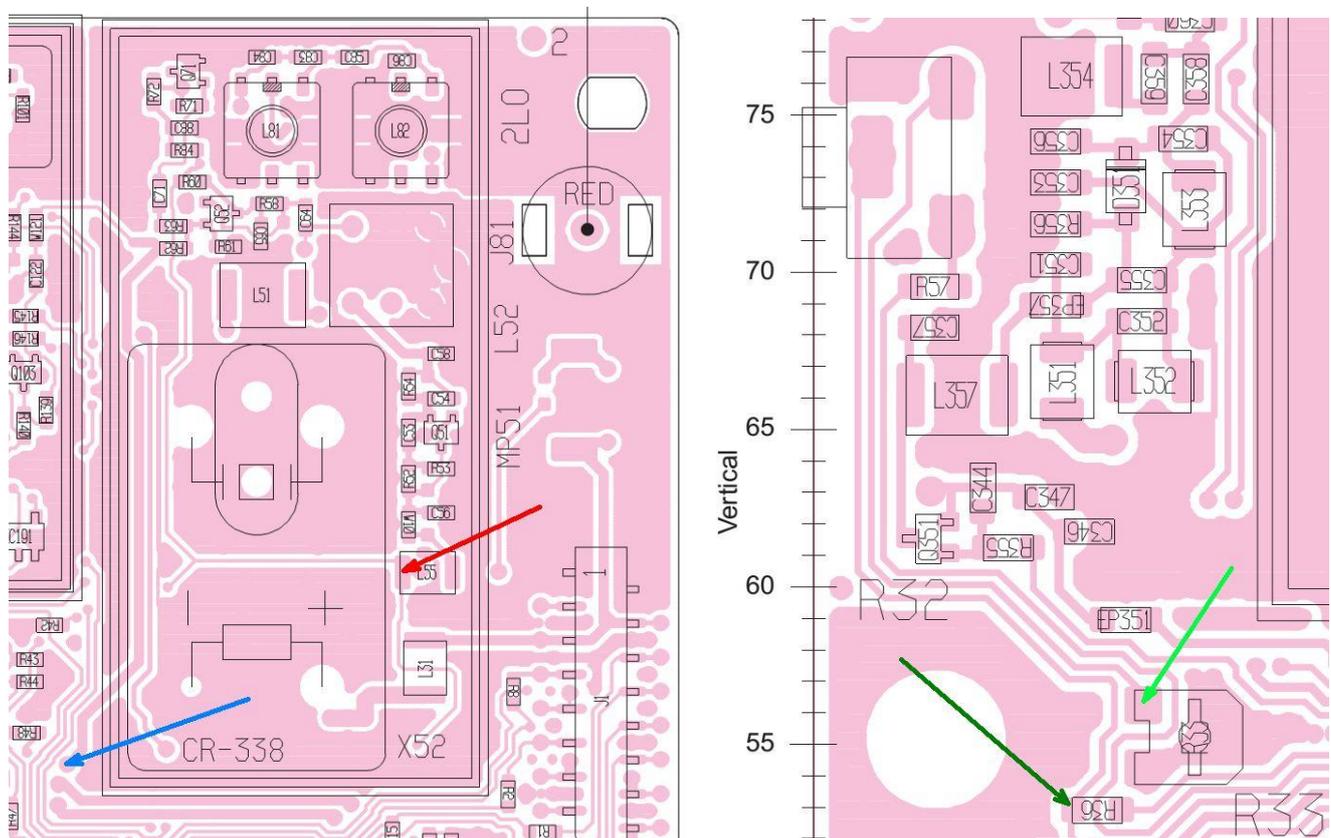


Figure 3. – PLL Board Reference Oscillator Connections

There are two possible points (two green arrows) for controlling the Reference Oscillator. The point with the dark green arrow should be more sensitive. Connect the NPN transistor with Collector to whichever of these points you choose, and Emitter to ground.

Using thick double-sided foam adhesive tape, mount the XRef board either on top of a shielded box or in some other suitable location near the Reference Oscillator.

Mount the board with the Ref/RF/Ctl connections closest to the Reference Oscillator area. The XRef connection pads are double-sided, so check that the underside pads aren't shorting to the shielded box.

The next step involves soldering three short lengths of fine hookup wire to each of the connection points circled in Figure 3. With a very fine tip soldering iron, it is possible to do this with the board in place. Be very careful not to overheat the components as they can be easily damaged. I normally apply a small blob of "normal" (i.e. not lead-free) solder to the connection point first, and then attach the already-tinned wire.

Attach the wires to the XRef as follows:

- **Blue** connection to RF pin.
- The base of the NPN transistor to Ctl pin.
- **Red** connection to Vin pin.

Also connect a wire from the XRef Gnd pin to a nearby earth connection, like the tin shield.

Finally, we need to bring 10 MHz in to the XRef. Mount a suitable connector on the back panel of the radio and run some thin coax to the XRef.

Optionally, an LED can be connected from the XRef Lock pin to ground to indicate when the radio is locked to 10 MHz. The LED could be mounted next to the connector on the back panel.

Before putting everything back together, carry out some basic tests.

- With 10 MHz NOT connected, turn the radio on, select SSB mode and a higher band, and tune to a beacon or carrier.
- Adjust the Ref Freq Adjust control up and down and you should hear the beacon tone change indicating the Reference Frequency is changing.
- With Ref Freq Adjust set to say 75% of its travel, connect 10 MHz and you should hear the beacon tone jump slightly. If there is no jump, try again with a setting of 25%. The radio should now be frequency locked.

Finally, re-assemble the radio in the reverse order and enjoy your new frequency accuracy and stability!

5. Operation

The board continually tests for the presence of the external reference. If 10 MHz is removed, the XRef-PLL will automatically disconnect from the radio, leaving the radio to operate as standard.

If you notice a warble on the signal indicating a marginal PLL lock, try altering the Ref Adjust setting so that there is very little change in the radio's frequency with 10 MHz connected or not.

The 10 MHz source can be a sine or square wave, but it is important that it is clean. The board is, in effect, adjusting the radio's Reference in step with the incoming 10 MHz, including whatever imperfections there may be. The old adage *garbage-in, garbage-out* applies here.

6. Support

If you have any difficulties, you can contact David Smith VK3HZ by email : xref@vk3hz.net