The 2017 FDIM buildathon kit designed by Rex Harper (W1REX) is a self contained, fully integrated crystal test set capable of testing unmarked or questionable crystals and quartz crystal blanks. The kit is a crystal testset/workstation comprised of an on board frequency counter, a test oscillator, and a unique and convenient feature for testing quartz crystal blanks that simplifies and accelerates the process of DIY crystal grinding.

Layout features, allocated on the PCB, enable experimenters to enhance measurement accuracy with easy to implement upgrades to the microcontroller clock reference; as an on board TCXO; or via an external high accuracy reference standard. An input is also provided for testing external crystal oscillators, along with a jumper for the temporary disabling of the on board test oscillator.

While the kit was optimized for its mission as a crystal grinding workstation; the frequency counter operates from a few Hz to 60 MHz, which expands the utility of the kit. A few simple modifications that improve the sensitivity of the couner will optimize its performance over the entire 60 MHz range.

The straight forward modifications, confined to the signal conditioning region of the kit's PCB, can be completed in less than half an hour.

Begin by carefully removing the MPF102 JFET; and wick away the solder from it's mounting holes. Take care to avoid damage to the JFET solder pads during this operation.

Install an NPN GP transistor (2N3904 or equivalent) at the MPF102 JFET location; observing the lead orientation as labeled (CEB) in blue on the following expanded view (Fig. 1) of the topside of the X-Checker PCB:

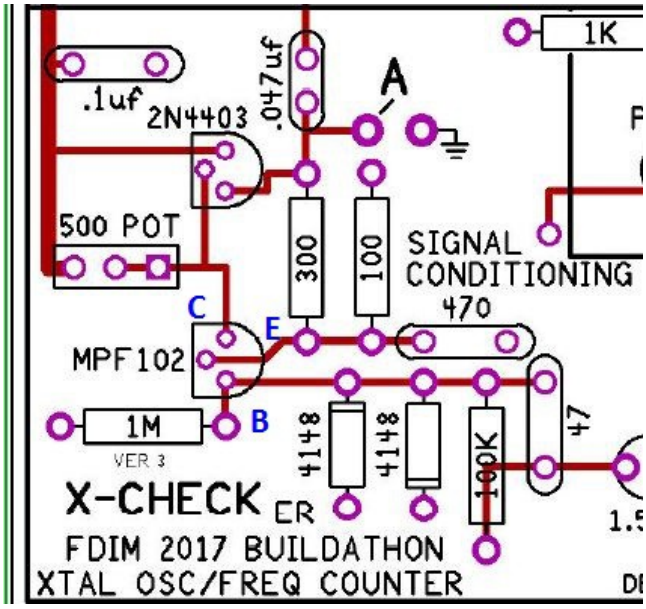

Fig. 1 - Expanded View of the MPF102 JFET locatdion on the X-Checker PCB

Next remove the 2N4403 PNP transistor, the 300 Ohm resistor, and the forward biased 1N4148 diode (the rightmost diode closest to the 100 Kohm resistor). You can simply clip the leads of those components. Leaving the component lead remnants intact will not adversely impact the modifications.

The location of the 4 removed components are shown for reference and marked with a black X in Fig. 2 below:

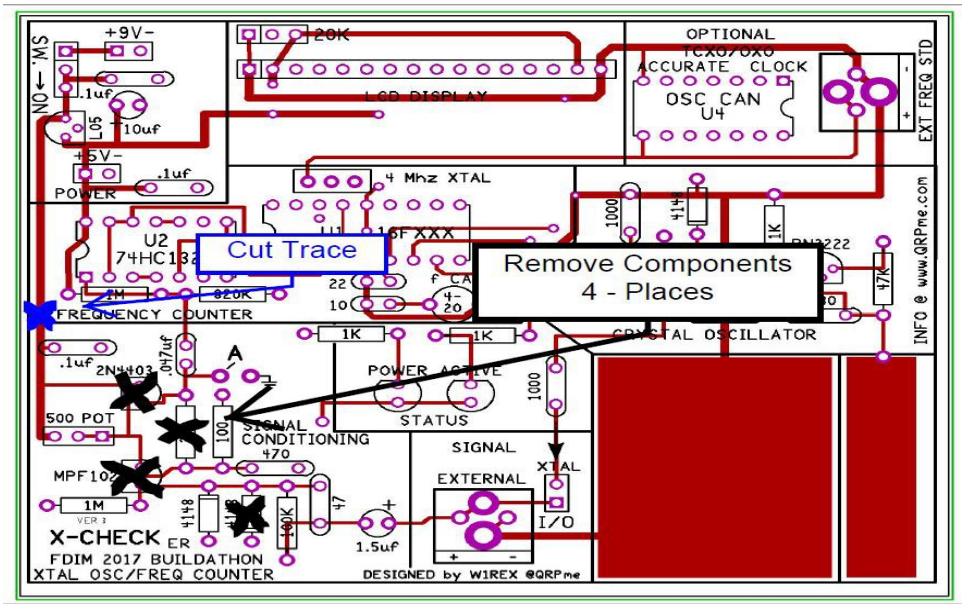

Fig. 2 - X-Checker PCB Component Side (Top) View.

Cut the trace on the left hand edge of the board in Fig. 2, just above the 0.1 uF capacitor as shown at the location marked with a blue X. This cut disables the 9V supply from the Signal Conditioner, and the status LEDs.

Referring to Fig. 3 below; install jumpers on the solder side of the PCB, at the three locations shown as red wire markups. I found it easiest to simply solder bridge the center jumper (shown closest to the red arrow). This jumper shorts the base and collector pads of the 2N4403 PNP transistor previously removed.

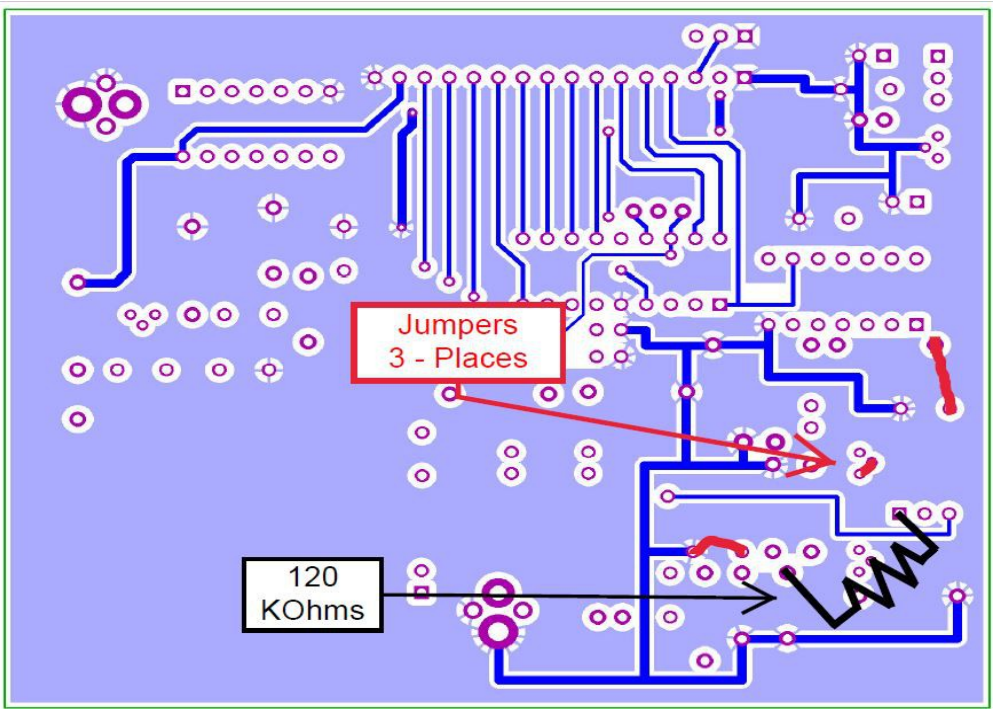

Fig. 3 - X-Checker PCB Solder Side (Bottom) View.

Finally; Install a 120 kOhm resistor shown sketched in black in the lower right hand corner of Fig. 3.

The use of small gauge wire, and minimal solder will help assure that no unwanted shorts or solder bridges are created while performing these modifications.

Adjust the 500 Ohm potentiometer to maximum to complete the moifications.

These modifications are documented in the following schematic (Fig. 4):

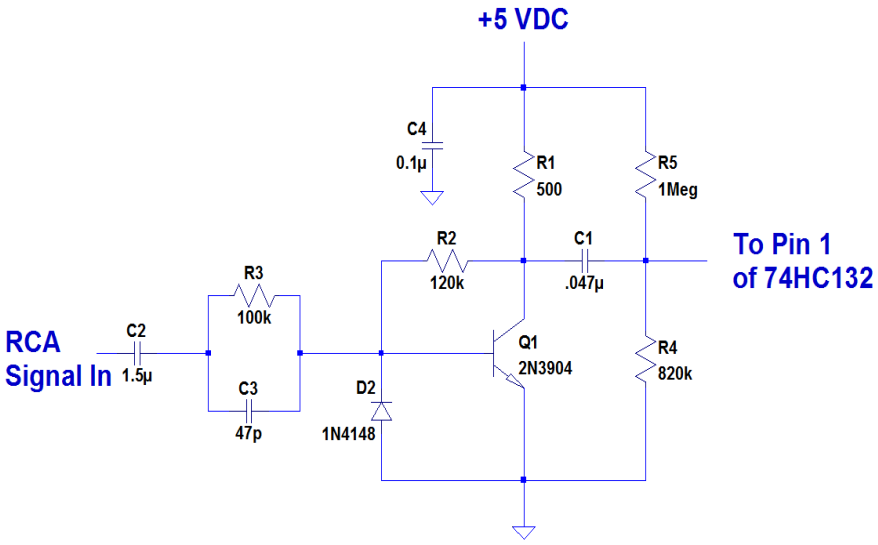

Fig. 4 - X-Checker Signal Conditioner Schematic (After Modifications)

This document should be retained with the original X-checker Kit documentation for future reference.

As part of this modificatdion, a power supply change was made from the 9V unregulated to 5V regulated. This change limits and maintains the maximum signal output excursions of the signal conditioner circuit to within the input signal level constraints of the 74HC132 Schmidt trigger IC. The power dissipation and brightness of the status LEDs is reduced slightly to a more favorable level as well.

The forward biased input clipping diode used with the MPF-102 N-channel JFET in the original circuit, is redundant and not required with grounded emitter bipolar transistors such as the 2N3904 (or equivalent NPN) used in this modification.