Modular Tester user guide: short seeker

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Revision 1/11/2024

Allows audio-visual tracing of shorts in PCB's.

The principle is based on a milliohm meter, Ohm value is converted into a tone, an increasing value results in a decreasing tone frequency, decreasing value in an increasing tone frequency. IOW the closer you get to a short the lower the resistance and the higher the pitch of the sound.

The system can be reset to use the current value as mid-range tone, this can be done manually or automatically when the measurement gets out of the defined window.

The measurement range can be set, the system is not auto-range. The Ohm measurement is not super precise and not intended as a replacement for a high end meter but rather an indicator to find a short.

The sensitivity can be set, this determines the operating window, increased sensitivity means the tone will change faster on varying measurements so smaller changes can be detected easier.

A LED bar provides a visual indicator of the changes and the position within the window.

A 4 wire kelvin probe is used, construction tips are at the bottom of this document.

After power on the module shows the splash screen and goes to sleep.

Press the right rotary encoder and hold until the splash screen appears.

Turn the right rotary encoder to select the audio level, lowest level mutes the audio.

Press the left rotary encoder to toggle between Range and Sensitivity adjustment.

Turn the left rotary encoder to select the measurement range or adjust the sensitivity level.

Short circuit the probes and press the left rotary encoder long to set the offset to 0 Ohm.

In manual mode, press the right rotary encoder to set the current measurement as mid-range and reset the tone.

In automatic mode, press the right rotary encoder to set the current measurement as mid-range in case there is a valid active measurement (same as manual mode) or to start the calibration process in case of an open probe (measurement out of range), it will wait and set the mid-range when a valid measurement is found and stable during 1 second.

If in automatic mode the measurement is out of the measurement window (but still in range) during 1 second the automatic calibration function will restart.

Press right encoder long for the menu, turn to select, press to select or toggle setting:

Return: return to main screen.

Automatic mode / Manual mode:

LED bar / Single LED: toggle LED bar appearance.

Go to sleep: put the module to sleep.

Calibration

Calibration of the measurement amplifier gain should be done without power connected!

Measure the resistance over R12 and adjust RV5 to 18KOhm.

Measure the resistance over R10 and adjust RV4 to 38KOhm.

Sound level, set volume to maximum and adjust RV6 for an acceptable level.

Select 20 ohm range, connect current meter to Signal plugs, adjust RV3 to 1mA.

Select 2 ohm range, connect current meter to Signal plugs, adjust RV2 to 5mA.

Select 0.2 ohm range, connect current meter to Signal plugs, adjust RV1 to 50mA.

Select 200 ohm range, connect voltage meter to Signal plugs, adjust RV7 to 0.3V.

Kelvin probe construction

In a measurement setup for resistance a constant current is applied to the test subject and the voltage across is measured, This voltage is proportional to the resistance.

However this method generates a voltage drop over the probe wires since current to the test subject passes through it hence the result is off for small resistance values and high measurement current.

A better method is to use separate wires to supply the current and to measure the voltage so the current does not travel through the measurement wires, this is the principle of the kelvin probe.

I used thin flexible 50 ohm coax, at one end 2 Hirschmann banana plugs, one connected to the shield, one to the inner conductor.

The other end shield and inner conductor soldered together at the tip of a probe.

The plugs with the inner conductors are plugged in the Sense terminals of the module, the other in the Signal terminals. So one wire set is connected to the black terminals and the other wire set to the red terminals, don't cross connect.