The tracER - A dual range tester for semiconductors and other components.

Introduction

The Electro resales tracER is a modern implementation of a testing device developed originally to assist service professionals who had access to an oscilloscope with identification of component types and possible non-working conditions of these same components. The circuit origin is thought to have been from the US Military, but this is not certain. Original implementations involved cross connecting the scope inputs to a low voltage AC source, via current limit resistors, this led to its name as 'The Octopus' tester, due to the tangle of wires this created.

This implementation tidies all these wires into a PC layout and minimizes the clutter. Two levels of current limit are available via an on board switch the use of which is described herein.

What do I need to start using this tracER?

Your purchase should include the following items:

1. The Dual Range tester box (Known in this guide as the 'DRT')

You will also need the following:

1. An AC power supply that has an output of 9 – 18 VAC (DC power supplies do not work) the plug is a 2.1mm barrel jack. Several suitable types are available from Amazon.
2. Two BNC to BNC cables ~ Approx. 18 – 24 Inches long
3. Test leads with banana plug terminations.

A note about Oscilloscopes

1. The DRT is best used with an analog scope (one with a CRT), it will also work with a digital scope, the DRT has not been tested with any of the USB 'scopes or other 'scope types such as those based on Arduino/PIC technology or those that require a computer to function.
2. The oscilloscope to be used in conjunction with the tester needs to be a 2 channel unit with settings that allow it to be configured to work in XY mode.
3. Most 2 channel scopes can be used, the higher the frequency response of the 'scope, the more versatile the testing, but a 5MHz unit is as good as a 100MHz unit.

Initial Setup

The following steps allow the easy first use of the DRT.

1. Connect the two BNC – BNC cables to the DRT and then connect the one marked X to CH 1 or X on your oscilloscope, and the one marked Y to CH 2 or Y on the 'scope.
2. Connect the power pack barrel jack to the matching socket on the DRT. Ensure the DRT on/off switch is in the off position and then plug in the power pack to a suitable 110 Volt wall socket.
3. Connect the test lead set to the corresponding banana jacks on the DRT. While polarity does not matter, connecting red to red and black to black just seems right.
4. Connect your oscilloscope in XY mode. Please refer to your user manual for the correct settings for your 'scope.
    a. **We are unable to provide advice on the settings your specific oscilloscope requires.**
5. With the range switch set to either the High or Low position; switch on the DRT by moving the on/off switch to the 'on' position. A horizontal straight line trace should appear on the 'scope. Adjust the 'scope controls to achieve the correct intensity and position of the line, which is best centered on screen. Adjust the Scopes' Volts/Div. control to make the line about 4 grid units wide
    a. **If the line appears vertical, swap the X Y BNC cables.**
6. With the unit setup and power applied, test initial operation by shorting the red and black test leads together, the horizontal line on the scope should become a vertical line, and revert back to a horizontal line when the leads are no longer shorted.

This concludes the initial set up.

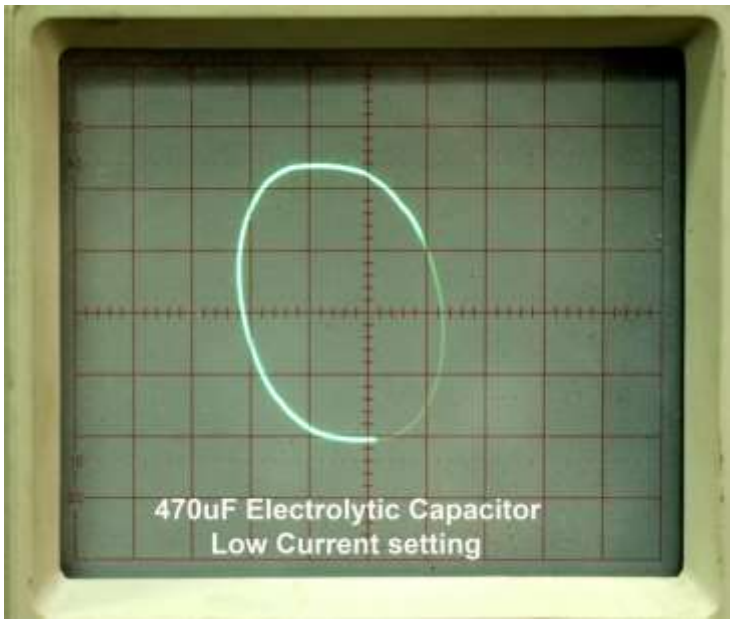
Basic Operation

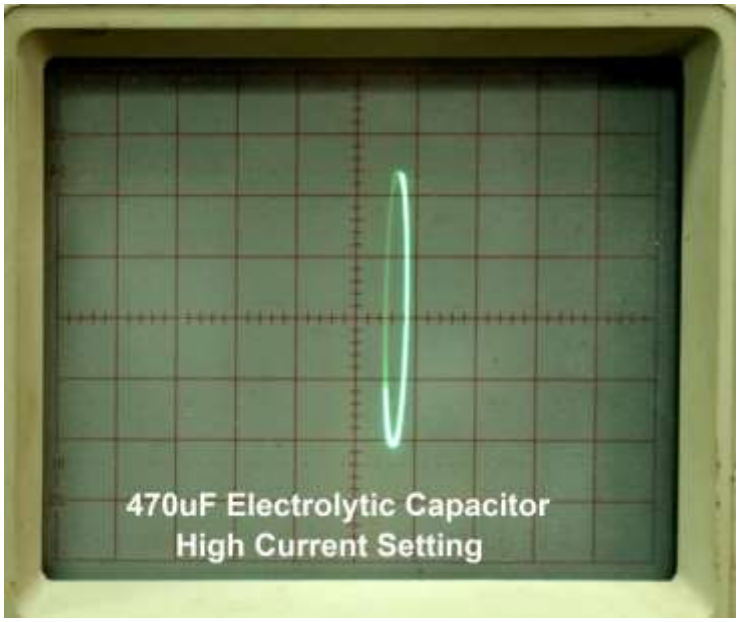
After setup the DRT can be put to work. Components to be tested are connected to the test leads and the display on the scope will change to reveal various patterns that indicate operation, these patterns will become well known after using the DRT for a little while. Some patterns are standard across devices and some vary even within the same device.

For instance silicon diodes and small signal diodes tend to all have a similar pattern shape, with some variation occurring from device to device in the length of the waveform shape arms. When connecting the DRT to a transformer though the patterns achieved can vary depending on the winding tested, or the portion of the winding. This is when use of the low or high current switch becomes an important tool.

Another example is illustrated below, where different pattern shapes is achieved with the same component depending on the setting of the High/Low switch.

In this example a low voltage (35VDC) 470uF electrolytic capacitor is connected to the test leads and the pattern achieved is markedly different depending on the switch setting. See the photos of actual screen shots;

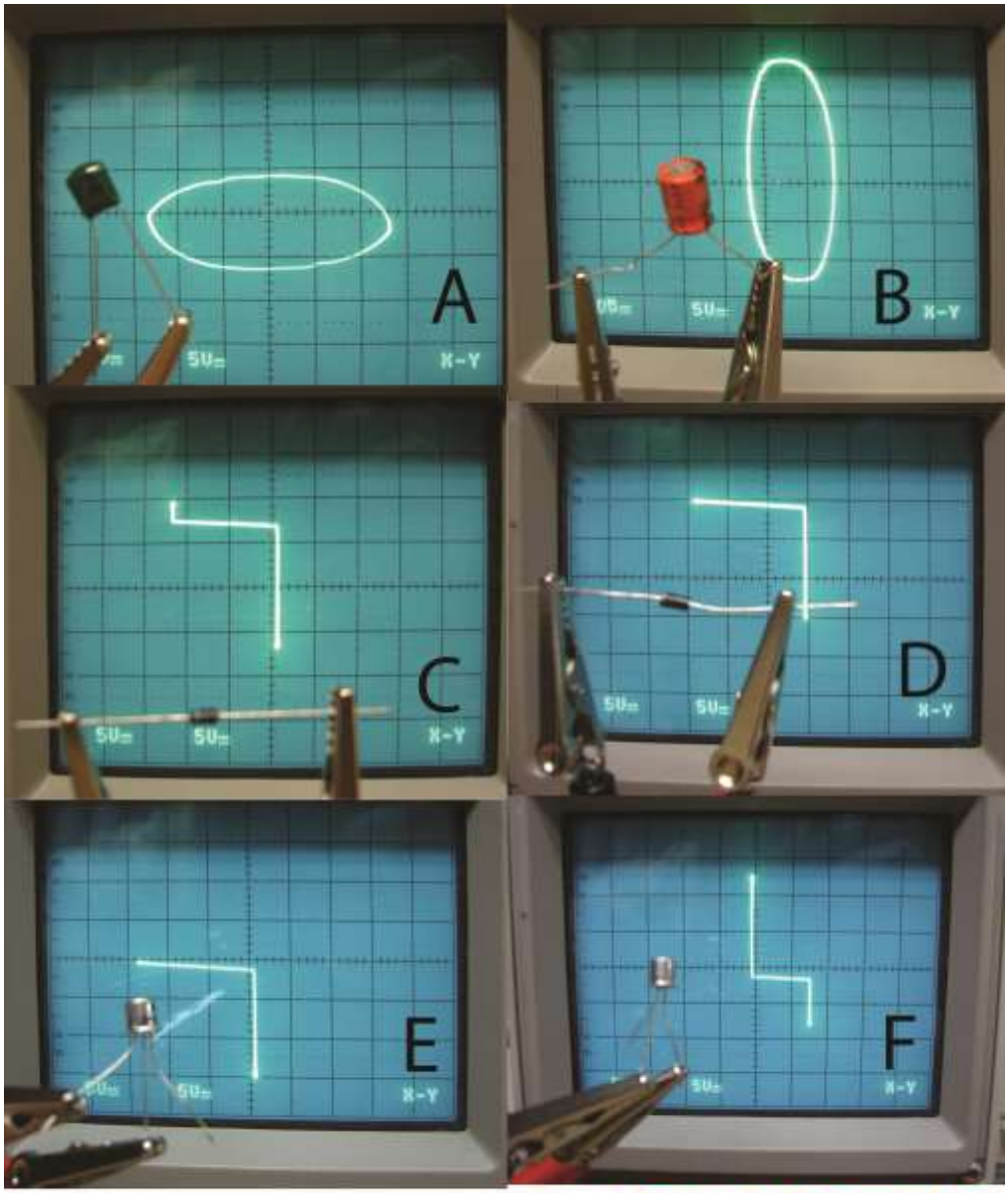




At times the oscilloscope controls may need altering to get the desired pattern shape and size, but often use of the High Low switch will negate this need to alter the ‘scope settings.

A good practice to adopt is to start all measurements with the DRT set to the low current setting, observe the waveform pattern achieved and then briefly move the switch to the high setting to determine if a better representation is possible.

On the next page a number of representative waveforms are shown to guide initial testing. Over time and with use of the DRT you will quickly build up knowledge of what trace is created for what component, keeping a note/drawing of this will aid future determinations and troubleshooting.



Curve Tracer Examples

A=20pF Capacitor
B= 47uF Electrolytic
C= 12 volt Zener
D= Silicon Rectifier
E=Base to collector, 2N2222A F= Base to Emitter, 2N2222A

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