AN201
Step vs. Pulse TDR Technology

Written by Paul DeWinter and Bill Ashley for

AEA Technology Inc.

www.aeatechnology.com

Abstract

Time Domain Reflectometers are divided into two distinct technologies or types of operation; "Step" and "Pulse" TDRs. The following information describes the difference between these types of TDRs and the advantages of the Step over the Pulse type TDR when trying to find a fault on a cable.

General

Pulse

Pulse technology is similar to AM Radar, where a short burst of a sine wave is transmitted. The transmitter emits a single pulse then shuts off. The TDR then enables the receiver to listen for reflections. The longer the transmitted pulse, the longer the distance before the receiver can start looking for reflections. This is called the "Dead Zone" or "blind spot", and can be quite long in less expensive units. Pulse technology can only measure the time between reflections and cannot interpret information between reflections such as gradual cable losses. In pulse TDRs, the width of the pulse needs to be set by the operator. Using a shorter pulse width will reduce the Dead Zone, but it also limits the TDR's range. The longer pulse widths have good range, but a correspondingly larger Dead Zone. The pulse TDR, when compared to a step TDR, has less signal energy which results in a plot that has a lower signal to noise ratio and a less clear picture of the cable.

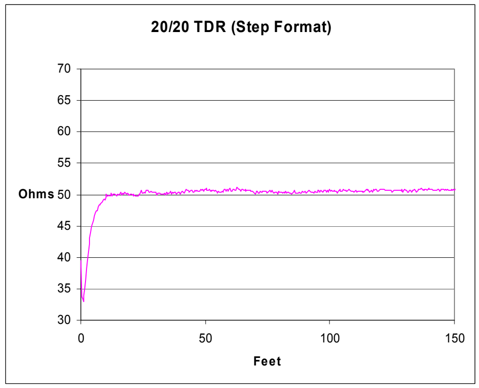
Step

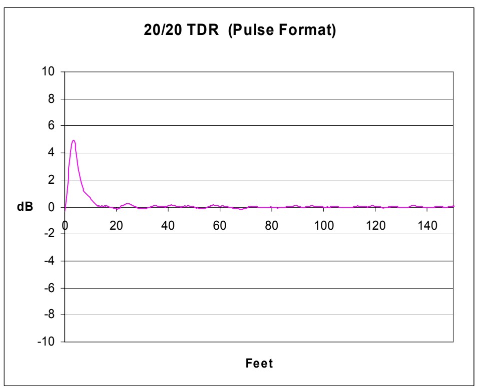
Step Technology is more like a Doppler radar, where the transmitter always emits energy while the receiver simultaneously listens for returned signals. This eliminates the "Dead Zone" pitfall of pulse technology, and allows the receiver to "see" right from the TDR's connector. Since the receiver looks at a constant signal, it accurately detects information that the pulse types cannot such as the cable's impedance along its length. Due to the higher energy in a step signal TDR, the signal to noise ratio is improved. Couple this with the addition of noise filters and you can effectively reduce or eliminate outside interfering noise with less degradation of the received signal.

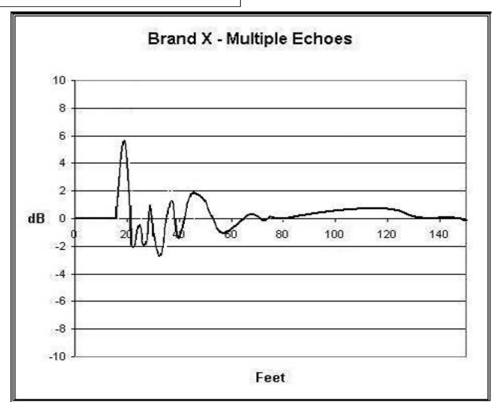
5933 Sea Lion Pl Suite 112, Carlsbad, CA 92010 ◦ Tel: 1-800-258-7805 or +1-760-931-8979 ◦ Fax: +1-760-931-8969
www.aeatechnology.com

Dead Zone and Plot Clarity

Often, pulse TDR units will echo many times between the fault and the TDR, causing distortion that is difficult to interpret. An example of this phenomenon compared to the 20/20 TDR's clear trace is shown in the following figures. Notice the dead zone on the pulse TDR is about 15 feet long.







Event Appearances:

In a pulse TDR, event appearance, or fault appearance, on the display is relative to the range at which it was detected, the pulse width setting, and the gain control setting used. These setting can be done in automatic by the TDR or in manual control by the operator. Hence, the amplitude of reflections is as much a matter of the control settings and operator's skill rather as it is the actual fault's effect on the cable. A step TDR calibrates itself for any change in range setting and velocity to present faults' amplitudes in Ohms as they affect the characteristic impedance of the cable. In short, a 10 Ohm fault detected at 1 foot from the step TDR and looked at again at 1,000 feet away will still read as a 10 Ohm fault. Operator's can't intervene to make a good splice look like a bad splice or vice versa.

5933 Sea Lion Pl Suite 112, Carlsbad, CA 92010 ◦ Tel: 1-800-258-7805 or +1-760-931-8979 ◦ Fax: +1-760-931-8969
www.aeatechnology.com

Loop Resistance:

Loop resistance and series resistive faults are important to factors in a cable's attenuation factor. Pulse TDR can't read the impedance, loop resistance or display the Ohms of a series resistive fault. A step TDR will show these to the operator and let the operator measure the loop resistance over distance to compute it back to manufacturer's specifications.

Conclusion

Step TDR technology presents clearer and easier to interpret cable plots compared to pulse TDR units.

5933 Sea Lion Pl Suite 112, Carlsbad, CA 92010 ◦ Tel: 1-800-258-7805 or +1-760-931-8979 ◦ Fax: +1-760-931-8969
www.aeatechnology.com