- Users Guide -

(USU Soil Physics Group)

A Windows based program used to measure the volumetric water content and electrical conductivity of soils by controlling the Tektronix 150xB/C Cable Time Domain Reflectometry (TDR) Cable Tester.

WinTDR Version 6.1 – Fall 2004

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Introduction

The WinTDR program was written by the Soil Physics Group at Utah State University. This program was developed to measure volumetric water content using the Tektronix 150X B/C series Metallic TDR Cable Tester Device. Since it's conception in 1993, modifications have been made to allow the program to analyze electrical conductivity (Ec) and give the user an enhanced ability to interact with the system.

The intent of the program has been to create an easy to use Windows interface with accurate and efficient analysis under a variety of conditions. The program is currently being used here at Utah State University and at selected other locations in a variety of research and management applications.

The basic principles used by WinTDR for analysis to determine the bulk dielectric from a TDR waveform is illustrated in figure (1). First, the reflected distance an electromagnetic wave travels from the TDR device, through cables of fixed dielectric properties to the head of the probe and back again, is fairly constant, with the exception of small variations due to temperature. We call this the first reflection or first peak. It is set (determined) in an initial calibration phase by the user, then given room to move during consecutive analysis phases. Next, the travel distance (time), back and forth, along the length of the probe is determined by finding the point of the second reflection, which follows the first peak, and subtracting the first peak from the point of the second reflection. Finally, the length, of the probes prongs, is a known fixed constant. The travel distance along the probe length determines the bulk dielectric, which is then converted into the volumetric water content by applying Topp's (1980) equation.

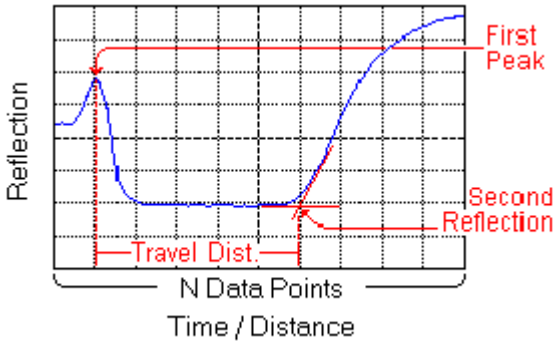

Figure 1: Basic principles used by WinTDR for analysis of a waveform.

About WinTDR 6.1:

Older versions of WinTDR were written for Windows 3.11, but with the newer Windows versions out today a re-engineered version of WinTDR needed to be produced. While missing a few features included in older versions of WinTDR, Version 6.1 is fully compatible with any Windows version available today (9x, Me, NT, 2000, and XP) and will soon incorporate all of the old features plus some new ones.

Currently WinTDR 6.1 is able to take readings from the Tektronix 150xB/C TDR units with:

- Self-calibration methods to increase accuracy.
- An open interface to make important data visible to the user.
- Multiple Waveform Viewing (Waveform capture feature).
- The ability to quickly and easily alter the information being analyzed.
- Dynamic file format for saving waveforms, where the data from the analysis, and the waveform data, can be saved to disk as files specified by the user, then can be viewed again in WinTDR or easily exported to Excel or other programs by the User.
- Ability to change the third order polynomials coefficients of Topp's (1980) equation with other coefficients.
- Calculation of waveform values to Reflection Coefficient values (Rho).
- Option of calculating the Dielectric Constant from the temperature of water.
- Ability to use multiplexers.
- New method for calculating Probe Impedance and EC
- Automated Readings

Future plans of WinTDR 6.1 and 7.0:

- Analysis using Frequency Domain Analysis (FDA).
- Connectivity to both Tektronix and Campbell TDR devices.

This manual was written in an attempt to explain the concepts, and the functionality of the WinTDR application. Because it is eternally changing, and because the manual is only updated at intervals, items contained in this text may become inaccurate. If something is not contained within this text, or is radically different, check our web site for information, or email us your questions. We will answer any questions as able. We hope this application turns out to be a benefit.

The authors would like to thank and acknowledge those involved in WinTDR version 6.1:

Dani Or	Project Director
Scott Jones	Assistant Project Director

Current WinTDR Staff:

Jeffrey R. VanShaar	– Lead Programmer, Website, and Manual Editor
Seth Humphries	– Analysis Algorithm Development
Louis Koberstein	– Manual Editor

And all the faculty and students, come and gone, who have given input into the program, also to the other people who have sent in email with their suggestions and other ideas that have influenced our program. Again we hope this product serves you well.

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