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## E20/20 Step TDR

Version 1.0

### Quick Start Guide

This is a generalized Quick Start Guide and is applicable to all versions of the E20/20 TDR.

The E20/20 TDR is a "Step" Time Domain Reflectometer. "Pulse" type TDRs send out single pulses on the cable and listen for reflections from each pulse. A step TDR sends a continuous wave in sweeps. The advantages are no "dead zone" on any range, impedance data, faults in actual Ohms, loop resistance, and an overall clearer trace of faults and the cable's electrical end.

#### Before Starting

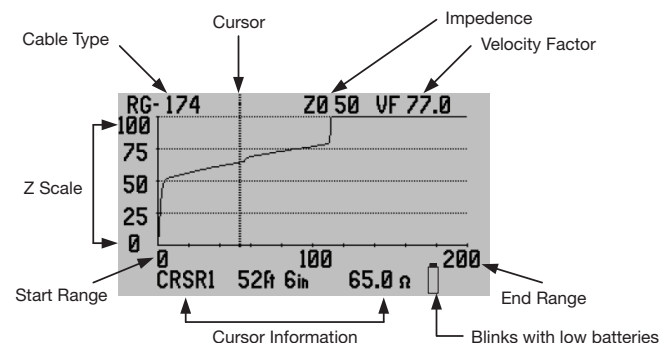
1. Charge the TDR using the AC wall adapter provided. If not charged, the E20/20 can operate from the AC wall adapter, the DC Vehicle adapter, or using AA alkaline cells.
2. Check the cable's specifications for Impedance and Velocity Factor (VF) (aka: VP, VoP, or NVP).
3. Select the cable type from the "PICK/EDIT LIST" under the **Cables** Key or edit a cable type (**Bcksp**) close to cable type to be tested and add the new cable to the "PICK/EDIT LIST."
4. If you need help setting up the TDR for testing press the **Help** key, then **▶** at "SETUP WIZARD" and follow the instructions.

#### Menu Navigation Guide

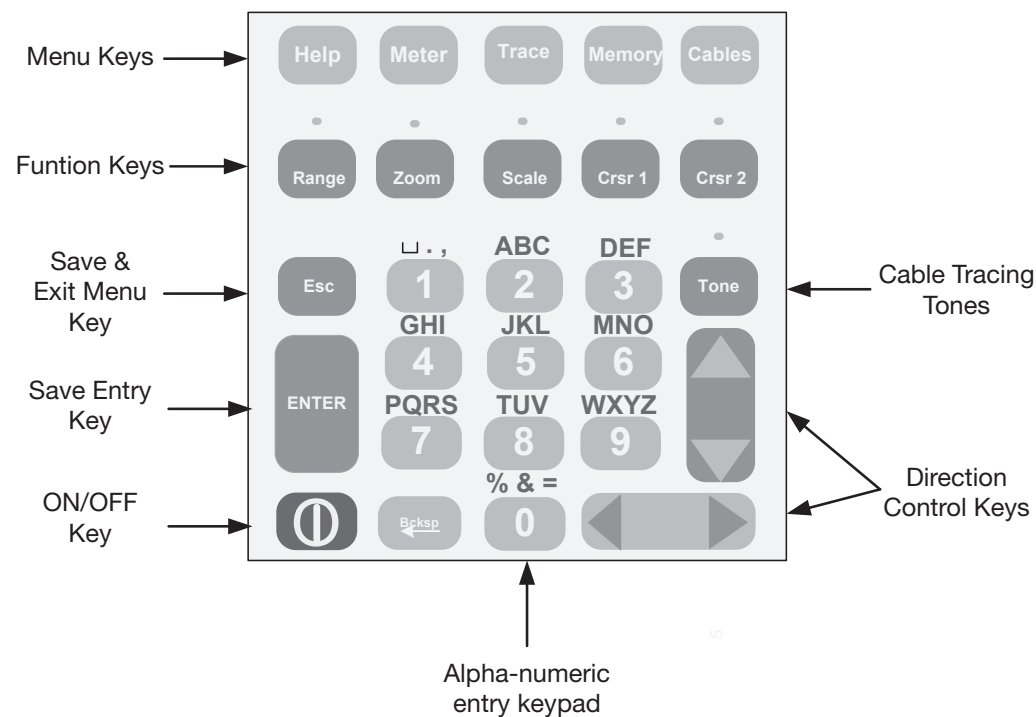
- - Menu Cursor moves vertically with **▼ ▲** keys
- ▶ - Enters/activates menu items marked by →
- ◀ ▶ - Move through horizontal menu selections
- 0-9 - Used for alpha-numeric entries when required
- ENTER** - Use to accept a name or numeric entry
- Bcksp** - Use to delete a character or enter cable edit
- ESC** - Saves selections and exits to Measurement Screen or exits back one menu level

**AEA Technology, Inc.**  
 5933 Sea Lion Pl, Ste 112  
 Carlsbad, CA 92010  
 1-800-258-7805 or +1-760-931-8979  
 www.aeatechnology.com

## E20/20 TDR Measurement Screen



## E20/20 Keypad



## Function Keys

Function keys activate when pressed, have a green LED lit when active, and de-activate when pressed again. Some keys automatically de-activate others to make the **▲ ▼** & **◀ ▶** keys exclusive for their actions.

**Range** - **◀ ▶** Controls display range in set increments 10ft (2m) minimum to 20Kft (5Km) maximum.

**Zoom** - **◀ ▶** Controls zoom in/out range on the active cursor. Each **◀** press doubles the zoom on the cursor position until minimum range is reached. Each **▶** press restores the range one level until the original range setting is reached.

**Z Scale** - **▲ ▼** Controls the impedance scale in set values. Minimum is ±10 Ohms on Zo, maximum is 1KOhms. At lower values the Zo setting will be kept vertically centered in display.

**Crsr 1 & Crsr 2** - **◀ ▶** Control each cursor's position in the display. Either cursor or both cursors can be used at the same time. The last cursor key pressed is the active cursor. The active cursor has its data and the differential data for the other cursor position displayed.

**Tone** - Activates a menu screen to select the desired tone frequency (warble, steady, or pulsed). Use standard inductive amplifiers (probes) to detect tones.

#### Control & Alpha-Numeric Keys

**ENTER** - Saves and exits after name, number, or user action entries.

**ESC** - Saves menu changes and exits to the Measurement Screen or up one menu level.

**Alpha-Numeric Keys** - First press enters the number, repeated presses cycles through the characters shown above the number. The "0" key cycles to more characters than are shown.

**Bcksp** - Erases the character to the left of the character cursor position. When viewing a table of items (Cables, Tones, etc) The Bcksp key initiates the editor.

## User Tips

### Setup for Measuring a Cable-Guided Setup

Press **Help** key then **▶** to enter "SETUP WIZARD" and follow the on-screen guidance. Use **ESC** to accept current settings shown and move to next selection. Selections are:

#### Cable Selection

- PICK/EDIT LIST - choose a cable from the list directly or choose a cable and edit to desired cable type
- MANUAL ENTRY - create a cable (no list add)
- VELOCITY SRCH - determine Velocity factor based on known distance to an event or end of cable.
- SAMPLE A CABLE - sample a cable to determine its velocity factor

#### Units (of Measurement)

Feet or Meters

#### Range

10 to 20,000 feet (2 to 5,000m)

#### Start Distance

0 = TDR's connector. Enter value shifts plot's range setting.

#### Input Channel

Coax or RJ-45 pair desired (RJ-45 models only)

**Test Lead Null** - ON subtracts nulled lead length from measurement. OFF starts measurement at Start Distance.

Use **ENTER** to measure a test lead and store for use when ON. Next press of **ESC** returns to the Measurement Screen

### Setup for Measuring a Cable - Un-Guided Setup

All steps listed below are not generally required. Use only the required menu keys and features needed. Menu keys can jump directly between menus and ESC saves the settings and returns to the Measurement Screen.

**Select a Cable** - Press Cable key and choose selection method per list shown in Setup Wizard above.

**Measurement Settings** - Press Trace key:

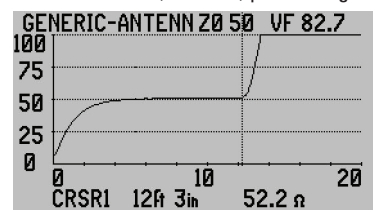
- Z SCALE - Use **▲ ▼** to set 20 to 1,000 Ohms
- TRACE RANGE - Use **◀ ▶** to set 10 to 20,000 ft (2 to 5,000 m)
- START DISTANCE - Use **▶** then numeric pad to enter distance. 0 = TDR's connector
- DISTANCE UNITS - Use **◀ ▶** to select Feet or Meters
- TEST LEAD NULL - **◀ ▶** ON subtracts nulled lead length from measurement. OFF starts measurement at Start Distance. "(NULL)" in Measurement Screen and Start Distance indicates function is ON. ENTER - Measures the test lead and stores for use when ON.

**Input Channel Setting** - Press Meter key:

- INPUT CHANNEL - Use **◀ ▶** to select COAX or RJ-45 pair (RJ-45 models only). See table on the far right panel for RJ-45 CHAN to pair guide.

## Operational Tips

Position cursor at left edge of any impedance change for the most accurate distance to faults or end of cable. See figure below and CRSR1 (cursor 1) positioning.



**Velocity Factor (VF)** - Published VF can be off by a small percent and VF can change in a cable exposed to abuse, heat, moisture, etc. For the most accurate distances try to measure a sample length 10-50 ft (3-15m) and use the "SAMPLE CABLE" feature in the Cables menu. Use this VF for remaining cable from the same batch for more accurate lengths. Twisted Pair cables will show different lengths for each pair in the same jacket because of different twist ratios and manufacture of the pairs is done on different machines introducing variations of 1-6% in VF.

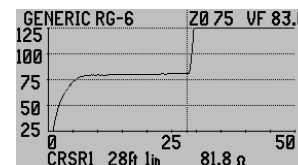
**Velocity Search** - Located in Cables menu. Use this feature to find a cable's correct VF. If measuring an installed cable with known distance to an event or end of the cable. Permits marking the known distance to an event or end of cable with a cursor and adjusting the velocity **▼ ▲** until the trace event or end of cable is at that distance.

**Drizzle Up** - a Step TDR phenomena where the DC loop resistance of a cable (2 wires of a pair or center conductor and shield of coax cable) is added to the impedance measurement over length. The result is an upward slope in the trace depending on the loop resistance. See the Operating Manual for example slopes for different wire gauges, coax types and their typical loop resistance.

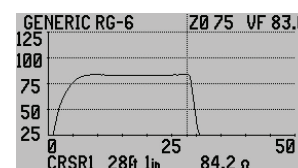
**Zoom** - Zooms on the active cursor. With Zoom active press the **◀** key to zoom down in range on and event. Zoom will stop when the shortest range (10ft or 2m) is reached. Press **▶** key to zoom out in range. Zoom out will continue until the original range setting is reached.

**Saved Test Results are also Saved Test Setups.** When testing or retesting a cable it's not always necessary to perform manual setups. Recalling a saved test with the same cable type will result in resetting the TDR to the same testing parameters. After recalling a test result, press the **ESC** to return to live testing and the instrument will have the Zo, VF, Range, and all other parameters of the selected saved test.

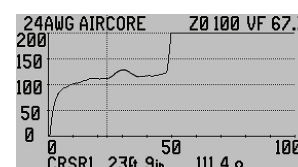
## Example Cable Traces



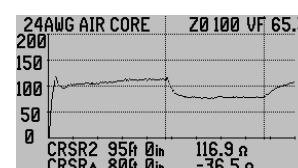
75 Ohm coax with slightly high impedance open end



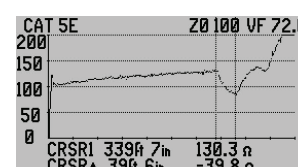
75 Ohm coax with slightly high impedance shorted end



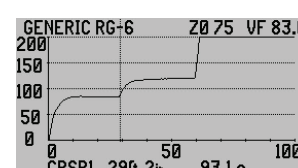
Twisted pair cable with bad splice and open end



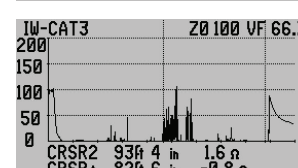
Twisted pair cable wet starting at 95ft (wet coax has similar reduced impedance)



40ft Bridged tap at 339ft



Series resistive fault at 29ft



Intermittent fault or connection (distance undetermined)

## Cable Pairs to TDR Input Table

| Wire Map Scheme    | TDR Input      |
|--------------------|----------------|
|                    | <b>Channel</b> |
| Coax Connector     | COAX           |
| Telco Red/Black*   | CHAN A         |
| Telco Green/Black* | CHAN B         |
|                    |                |
| T568-A Pair 1      | CHAN A         |
| T568-A Pair 2      | CHAN B         |
| T568-A Pair 3      | CHAN C         |
| T568-A Pair 4      | CHAN D         |
|                    |                |
| T568-B Pair 1      | CHAN A         |
| T568-B Pair 2      | CHAN C         |
| T568-B Pair 3      | CHAN B         |
| T568-B Pair 4      | CHAN D         |
|                    |                |
| USOC Pair 1        | CHAN A         |
| USOC Pair 2        | CHAN B         |
|                    |                |
| 10BASE-T Tx        | CHAN C         |
| 10BASE-T Rx        | CHAN B         |

\*AEA Technology Telco Test Leads

See the Operator Manual on the enclosed CD for complete wire maps, color codes, and reference standards.

NOTES: 1. Telco test leads are not required to measure twisted pair wires. Pairs can also be measured via the coax connector and alligator clips test lead. The E20/20 TDR test ports are not impedance matched to specific cable types. They are impedance independent.

2. The coax to alligator clips test lead can also be used to connect to unconnectorized coax. Clip to the center conductor and shield to measure the cable.