

Basic Guide

E20/20 TDR & Avionics TDR

Step Time Domain Reflectometers



E20/20TDR and Avionics TDR all models



Testing Made Simple!

AEA Technology, Inc.



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WARNING

DC Port and A/C Adapter.

Power requirement 12-18 VDC, 1.2ADC Max.

Operating Precautions

Failure to carefully observe the following procedures and precautions can result in leakage of battery fluid (electrolyte), heat generation, bursting, fire and serious personal injury.

The TDRs are designed for recharging NiMH AA cells only. Do NOT install and attempt to charge lithium batteries of any type as overheating or fire may result.

Alkaline cells may be used safely in the TDR, but when installed go to the Battery Menu and change the Battery Type to ALKALINE or NONE to turn off the charger. Attempting to charge alkaline or carbon cells may result in the cells outgassing. The resulting damage is not covered under warranty.

- Never dispose of Ni-MH batteries in a fire or heat them. Doing so may cause them to burst.
- Do not connect the + (positive) and - (negative) terminals of Ni-MH batteries together with electrically conductive materials, observe polarity.
- Keep Ni-MH batteries or the equipment out of the reach of infants and small children.
- Do not use old and new batteries, or batteries at different charge levels. Do not use Ni-MH batteries mixed together with a dry cell or other battery of a different capacity, type, or brand name.
- After they have been removed from equipment, store Ni-MH batteries in a dry place and within the recommended storage temperature range.
- After long term storage, there is a possibility that a battery cannot be fully charged. In order to fully charge it, charge and discharge the battery a few times.



CAUTION

The E20/20 TDR and Avionics TDR are free of any internal ignition sources. However, the following ignition sources are a potential spark hazard and appropriate precautions apply:

DC Charging Port and A/C Adapter

Charging the E20/20 TDR or Avionics TDR or operating while using the A/C or D/C adapters can create external sparks. Connecting or use of these power sources

in an explosive atmosphere is dangerous and should never be attempted. Always charge the TDRs away from any explosive atmosphere. Use ONLY internal battery power if the presence of explosive fumes is a potential hazard.

Coax and RJ-45 Test Ports

The presence of any voltage, from an applied source or static build-up on cables, can cause an ignition spark when the cable is connected to the TDR. Caution should be taken to ensure cables are free of any voltages or static charge prior to connecting the TDR in a potentially explosive atmosphere.

Electrostatic Discharge (ESD) Precautions

The TDR was constructed in an ESD protected environment. This is because most of the semiconductor devices used in this instrument are susceptible to damage by static discharge. To prevent instrument damage, practice industry accepted techniques for handling static sensitive devices when using the TDR. Very often, coaxial cables and antennas also build up a static charge, which, if allowed to discharge by connecting to the TDR, may damage the instrument input circuitry. To avoid such damage, it is recommended to dissipate any static charges by temporarily attaching a short to the cable or antenna prior to attaching to the instrument.

BE ADVISED: Both the E20/20 and Avionics TDRs are designed to test INACTIVE circuits. Attempted testing of live circuits containing RF signals not originating from the tester itself may yield indeterminate or incorrect results.

The TDR has input voltage protection and a high voltage detection system which will warn if connected to more than 50VDC or 1 VAC pk-to-pk. Use caution with the cable if this detection warning appears in the display as the actual voltage will be unknown.

The TDR is splash resistant and designed to work for relatively long periods in rain depending on intensity. It is not designed to be immersed in water.

The TDR is designed to be safely operated in normal testing environments. Instrument is not to be used in critical applications where failure of the instrument or inaccuracies in data might cause personal injury or property damage. Use in such applications is not recommended.

If you have any questions concerning the use of the TDR or other AEA Technology, Inc. instruments please contact us at:

Tel: 1-800-258-7805 or +1-760-931-8979 or Email: techsupport@aeatechnology.com

Section 1 Getting Started

The E20/20 Step TDRs and Avionics TDR have three operational guidance documents:

Quick Start Guide – Laminated tri-fold guide designed to be carried in the belt case and provide quick reminders on how to navigate the menus and operate functions on the TDR.

Basic Guide – This printed booklet with basic information for setting up and using the TDR. This booklet contains more information and step-by-step guidance than the Quick Start Guide, but is not as complete and detailed as the Operating Manual.

Operating Manual – This book is available on the CD included with the TDR or at www.aeatechnology.com. It contains complete operating instructions, testing examples, full specifications, troubleshooting guides, warranty information, and cleaning instructions. It's a PDF document formatted for local printing.

Warning and Operating Precautions

If you have not already done so, please read the Explosive Atmosphere Warning and other operating precautions on page III right after the Table of Contents.

Basic and Advanced Training for the E20/20 TDR's and Avionics TDR is available in Microsoft Power Point® Format on the CD included with the TDR and our web site at www.aeatechnology.com. Customers are also welcome to call or email us at techsupport@aeatechnology.com to get assistance with getting started, ask operational questions, or questions about test results.

Group training via web conference is also available upon request.

Both the E20/20 TDRs and Avionics TDR operate essentially the same. Differences between these TDRs will be pointed out in all the documents where appropriate. Most differences are identified in the Appendices.

Keypad and Display (same for both E20/20 TDRs and Avionics TDR)

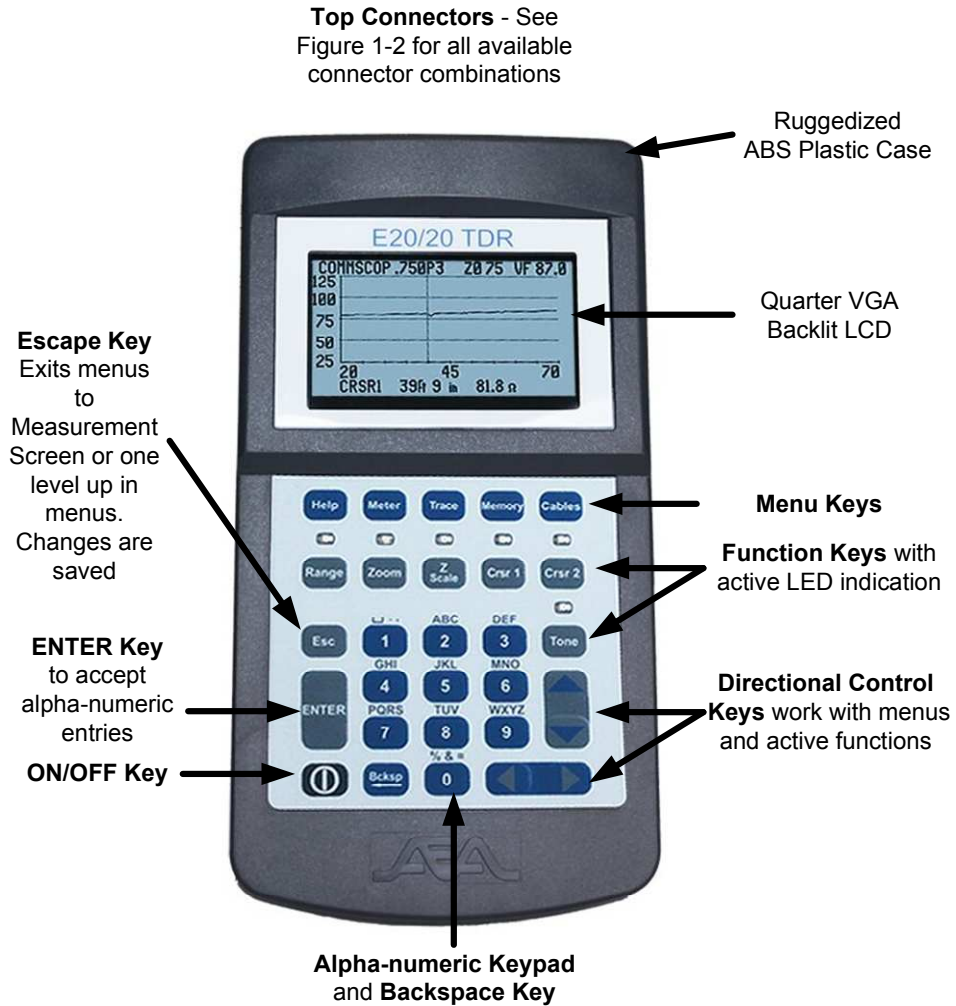


Figure 1-1

Top End Connector Configurations

E20/20N TDR

Part Number 6021-5000 – Broadcast Cable List and N-to-BNC adapter included.



E20/20F Network (F and RJ-45 Connectors)

Part Number 6021-5041 – CATV Cable List

Part Number 6021-5042 – Telco Cable List



E20/20B Network (BNC and RJ-45 Connectors)

Part Number 6021-5053 – VDV/RF Cable List

Avionics TDR

Part Number 6021-5054 – TDR with Avionics Cable List

Part Number 6021-5154 – TDR Kit with Avionics Cable List



Figure 1-2

Measurement Screen

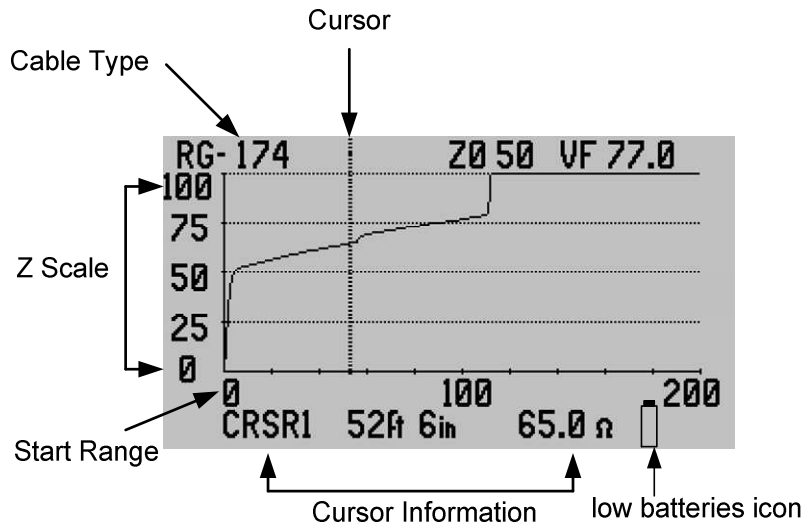


Figure 1-3

Keypad



ON/OFF key – Press once to turn the TDR on. This will restore all the previous settings from the last time it was turned off. Press once to turn the TDR off.

Soft Reset

To perform a Soft Reset see the following instructions:

1. With TDR off, press and hold the ENTER Key through step 3
2. Press the ON/OFF Key for 1 second
3. Wait 2 seconds and release the ENTER Key

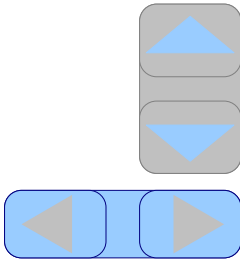
Look for the words “Default Settings” in the splash screens and note the Measurement Screen opens Z Scale = 1KΩ, and “MY CABLE” cable type. This indicate a successful Soft Reset. This action will perform firmware housekeeping and reset the TDR to factory default settings. To see more about when to use the Soft Reset refer to the ENTER key instructions or consult the Operating Manual.

Note: If the TDR’s menu cursors stop responding or the measurement screen does not open correctly the TDR’s firmware may need to be reset. The Soft Reset (similar to rebooting a PC) function performs several housekeeping functions and restores the TDR to factory default values. It will NOT erase saved traces or changes to the Cable List. However, the battery menu’s remaining operating time will be reset. This will need 2-3 re-charges for the smart charger to recalculate the battery’s operating time. The low battery icon’s operation is not affected. It will still appear and blink to warn about a low battery condition. See figure 1-3.

Hard Power Down

If the firmware hangs up during operation the TDR may not power down with a 1 second press of the ON/KEY. In this case press and hold the key for at least 10 seconds. When released, the TDR should power down. Power up using the Soft Reset instructions.

Arrow, Escape and Enter Keys



Arrow Keys – In the menus the up/down arrow keys control the cursor arrow and the left/right arrow keys control the selected item's options or ranges. In the Measurement Screen the up/down arrow keys activate for the function selected. The left/right arrow keys control the Range, Zoom, Cursor 1, and Cursor 2 when those functions are active. The up/down keys control the Scale or Tones selection. The ◀▶▲▼ Indicators in the menus, Help Menu, this guide, the Operating Manual indicate when to use the appropriate arrow keys.



Escape Key – This key is used to exit the menus and either return to the Measurement Screen or back up one menu level. Any changes made in the menus will be saved and applied to the measurements or instrument operation when Esc is pressed.



ENTER key – This key is used to accept alpha-numeric changes in the menus. Example: Save function requests a name for the saved trace. After the name is complete using the alpha-numeric keypad, press ENTER to store the trace. The ENTER key is also used to perform a soft reset of the instrument's firmware. See "Soft Reset" instructions on previous page.

Menu Keys

General – Menus are designed to make TDR setups simple and cable selection easy as possible. When making selections in different menus pressing the next desired menu key will jump directly from the current menu to the new menu. It is not necessary to escape back to the Measurement Screen after work in each menu to save the changes and select another menu. When selections are done in one or more menus press the “Esc” key to save the changes and exit to the Measurement Screen.

Help

Help Key has two functions: 1. If no keypad functions are active (all LED's unlit) and the TDR is not in another menu, the Help key will open its own menu shown in Figure 1-4.

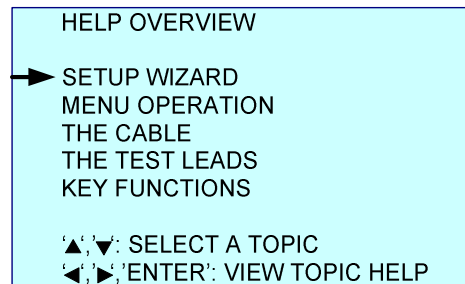


Figure 1-4

If a function key is active or any other menu is open pressing the Help key will provide context sensitive help about the subject function or the menu item pointed at by the menu's cursor.

Meter

Meter Key opens a menu for making changes in the instrument's settings. The Meter's menu is shown in Figure 1-5.

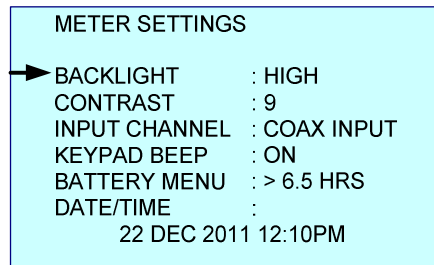


Figure 1-5

NOTE: The E20/20N TDR model has only one input port so no INPUT CHANNEL selection appears on that model's Meter menu.

Both the BATTERY MENU and DATE/TIME are sub-menus selected by pressing the right arrow key when the cursor is next to that item. The BATTERY MENU permits setting BATTERY SAVER ON/OFF, BATTERY TYPE, and BATTERY MA-HR. The DATE/TIME menu is for setting the current date and time. See the Operating Manual for full details on both sub-menus.

Trace

Trace Key opens a menu for viewing and making changes in the display plot settings, turning on MICRO FAULT detection, eliminating the test leads distance, and activating a noise filter. The Trace key's menu is shown in Figure 1-6.

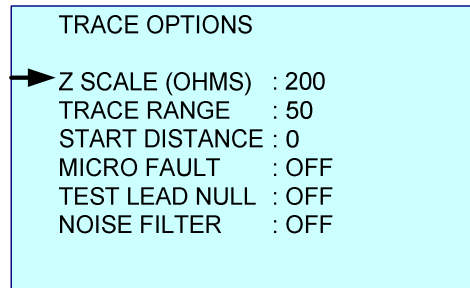


Figure 1-6

Memory

Memory key opens a menu for saving and recalling traces. Saving a trace opens a sub-menu for entering the trace name and automatically saves the date/time with the trace data. Recalling a trace resets the instrument to the recalled trace's settings. This makes all stored traces a stored instrument set up as well. After recalling one or more traces, selecting PRIOR SETTINGS will restore the TDR to original settings before the recalls. The Memory key's menu is shown in Figure 1-7.

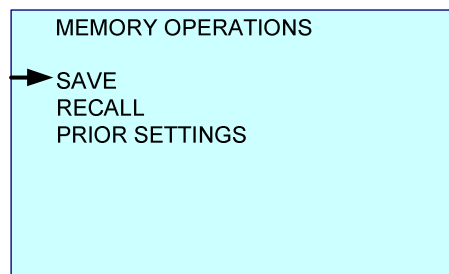


Figure 1-7

Cables

Cables key opens a menu for selecting cable types from a list, editing the list, manually creating a new cable, searching a displayed cable trace for correct velocity, sampling a cable to find its velocity, or changing distance unit2 between feet or meters. The Cables key's menu is shown in Figure 1-8.

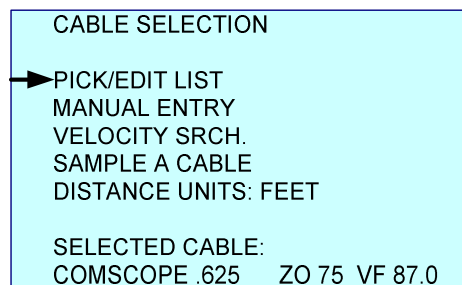


Figure 1-8

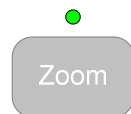
Function Keys

General - All the function keys activate and de-active with one press. When active the green LED will light. Some function keys can not be operating simultaneously and will automatically deactivate other function keys when selected.

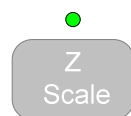


Range Key – When active, this key uses the ◀▶ arrow keys to control the display ranges. Available ranges are:

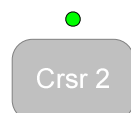
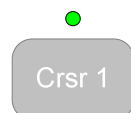
Feet	Meters
10	2
20	5
50	10
100	20
200	50
500	100
1,000	200
2,000	500
5,000	1,000
10,000	2,000
20,000	5,000



Zoom Key – When active, this key will zoom on Cursor 1 or Cursor 2. If both cursors are on-screen, Zoom will center on the last CRSR key pressed (the active Cursor) . When Zoom is active use the left/right arrow keys to control the zoom span. Pressing the ◀ key will reduce the range either side of the cursor until minimum range is reached, pressing the ▶ key will expand the range either side of the cursor until original range setting is reached. To disable the Zoom function, press the Zoom key again. The LED will extinguish and the Measurement Screen will return to the full range originally selected.



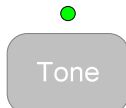
Z Scale Key – When active, this key permits control of the Z (impedance) scale on the left side of the plot. Use the ▲▼ keys to increase or decrease the impedance scale as required. When the impedance is reduced the TDR will keep the selected cable's impedance centered in the display. Example: For a 75 Ohm coax cable if the impedance is reduced to 20 Ohms the display scale will read 65 Ohms to 85 Ohms.



Cursor 1 & Cursor 2 Keys – These keys control the use of the cursors, one or both at the same time as follows:

Cursor 1 only – Single cursor in the display and a single CRSR1 data line below the plot.
 Cursor 2 only – Single cursor in the display and a single CRSR 2 data line below the plot.
 Cursor 1 & 2 active – Dual cursors in the display and two data lines below the plot. Top data line will indicate the last cursor key pressed (active cursor), display that cursor's data, and is under control of the ◀▶ keys. The second data line will be the difference in distance and impedance from the opposite cursor. Both LED's will be lit. To change cursor control press the cursor key desired to be active.

NOTE: When the differential reading from the active cursor is from the left to the right the differential readings will be positive. When the differential reading from the active cursor is right to left, the differential readings will be negative.



Tone Key – This key activates tones for either coax or twisted pair cables based on INPUT CHANNEL selection in the METER menu. Use standard twisted pair or coaxial cable inductive amplifiers (probes) to detect the tones on the cable.

NOTE: Toning works ONLY when operating on batteries. When the AC adapter is connected some AC is induced with the tones and tones are weakened making them unusable.

TONE GENERATOR
 ▲,▼: SELECT A DIFFERENT TONE
 'BCKSP': VIEW THE LIST OF TONES
 'TONE': EXIT TO TDR MODE

 INJECTING A WARBLE TONE ONTO:
 RJ45 CH A

 WARBLE
 PRESENT VALUE: 900/1100HZ

Figure 1-9

Alpha-Numeric Keypad and Backspace Key

General – The alpha-numeric keypad shown in figure 1-10 is for entering values and names. The keys work similar to cell phone pads. Repeated pressing of the same key will cycle from the number to the next alphabetic character. First character above the “1” key is the “space.” The “Bcksp” key (Backspace) will delete the last character entered or character just left of the name entry cursor. Refer to specific menu screen directions for using arrow keys to delete entire entries.



Figure 1-10

Section 2 Setup and Measuring Cables

General Information

The following pages provide some basic information concerning cable construction and how a step TDR works. This information is designed to help users set up their TDRs and better understand what a step TDR can show about a particular cable type. For more detailed information please refer to the Operating Manual found on the CD included with the TDR or available on our web site at www.aeatechnology.com.

Step TDR Operation

TDR's are divided into two basic types: Pulse and Step. A pulse TDR sends out just one pulse at a time and waits until no more reflection can be received from that pulse to send another pulse. This requires adjusting the pulse width and/or gain control on those TDR's to clearly see longer cables and faults further away.

Step TDR's, like the TDR, transmit continuous wave sweeps on the cable and interpret the reflections to provide more detailed information on the condition of the cable. A Step TDR can not only provide accurate distance to the end of the cable or faults. It can also provide the cable's impedance over length, loop resistance and more detailed reflective information to determine fault type and amplitude.

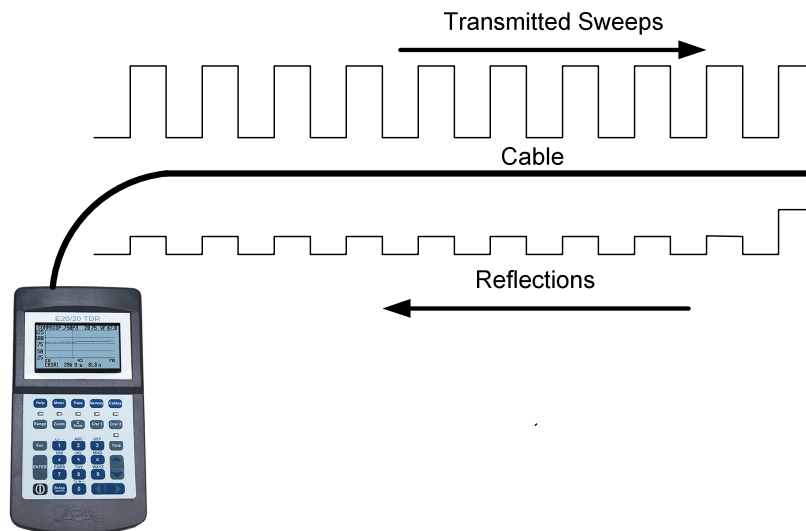


Figure 2-1

Figure 2-1 is a representation of the sweep sent by a Step TDR. The wave is uniform at any range setting and the TDR calibrates to the range selected by the user and the cable's velocity factor used. The result is accurate measurements both in distance and fault amplitude. In a Step TDR a 10 Ohm fault detected 10 feet (3 meters) from the TDR will still show up as a 10 Ohm fault if the cable is reversed and it is now seen at 100 feet (33 meters) from the TDR.

Impedance Effects

Impedance (Z) is simply defined as the resistance a conductor offers to AC frequencies and measured in Ohms. Also known as characteristic impedance it is designed in at the time of manufacture. Figures 2-2 and 2-3 show the effect of an open or short has on the cable's impedance. A Step TDR's trace will react per the display on the right. The reading will change from the horizontal normal impedance reading to either the maximum Ohms for an open or down to 0 Ohms for a short.

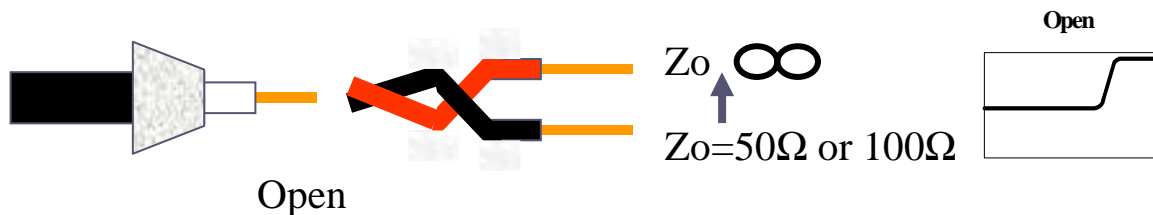


Figure 2-2

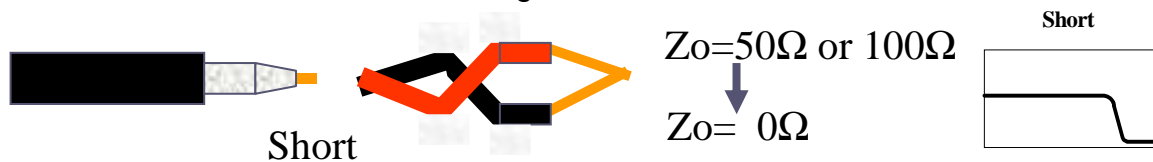


Figure 2-3

Velocity Factor

A cable's velocity factor (VF) is also designed in at the time of manufacture. VF is expressed as a fraction of the speed of light in a vacuum [c]. A VF of 0.677c indicates that a transmitted wave will travel along that cable at 67.7% the speed of light in a vacuum.

TDR's measure the delay time of the reflected signals. The time is divided in two because it is always a round trip, then multiplied by the cable's VF in feet or meters per second to obtain the distance to a particular reflection.

$$\frac{\text{Time} \times \text{Velocity}}{2} = \text{Distance}$$

Loop Resistance

Along with measuring the impedance of a cable, a Step TDR also measures a cable's loop resistance. The result is a slight upward slope over distance of the cable as the loop resistance is added to the impedance reading. This phenomenon is referred to as "Dribble Up."

More detailed information about impedance, velocity factor and loop resistance are contained in the TDR Operating Manual and AEA Technology's TDR application notes found on the CD shipped with the TDR and at www.aeatechnology.com.

Menu Navigation

When working in the menus here are some basic navigation rules:

- ▼▲ Use the up/down arrow keys to move the menu cursor [→] to the desired feature/function.
- ◀▶ Use the right arrow key to enter a feature or function and make selections. Many features have a hidden horizontal menu of options. Use the left/right arrows to reveal and select the option desired.

Esc

Use the Escape key to

1. Save changes and exit the menu to the Measurement Screen.
2. Exit back up one menu level
3. Exit a completed step in Setup Wizard and go on to the next step
4. Exit Cable Table without changing selection
5. Exit Sample Cable or VF Search with saving changes

ENTER

Use the ENTER key where indicated to make a value or name change (entry is made from the alpha-numeric pad). This will set the new value or name and exit back to the menu item or features list.

Setup Wizard

Help

Setup Wizard is located in the TDR's menu. It's a step-by-step guided setup procedure for preparing the TDR for measuring any cable type. The guided process includes:

- Selecting a cable type from a pre-stored list in the TDR or manually entering data
- Choose units of measurement – feet or meters
- Set the display range
- Set the start distance from the end of the TDR
- Select the input channel – Coax or RJ-45 channel A, B, C, or D (pair selection)
- Test Lead Null. This removes the test lead's length from the measurement

Press the “Esc” key after each selection to move to the next screen and to return to the Measurement Screen after Test Lead Calibration.

NOTE: Test Lead Null can be a handy way to remove the test lead from measurements, but a word of caution about this feature. If you have test lead Null ON for a 6 ft (2m) test lead for example and you do NOT use that test lead when connecting a cable to the TDR, you will be blind about the cable attached directly to the TDR for 6ft (2m) and any measurements will be off by that distance. Test Lead Null ON is indicated by “(NULL)” in the Measurement Screen

Trace

or can easily be checked in the menu and turned OFF when not required.

Manual Setups

Help

In addition to the Setup Wizard, the Help key has Help text on the following subjects: Menu Operation, The Cable, The Test Leads and Key Functions. To enter any of these subjects be sure no Function Key is active (no LEDs lit) and no other menu open. Then press the Help key, select the subject using the cursor and press the ► key to read the information.

The Help key also provides context sensitive help for:

1. The menu item pointed to by the menu cursor.
2. Any active action key – as denoted by the keypad LED.

Press the Help key whenever assistance or more detailed information is required with making selections or using the action keys.

Meter

Use this menu to select the backlight intensity, contrast level, turn on/off keypad beep, or to make settings in the BATTERY MENU (figure 2-4) or DATE/TIME menu (figure 2-5).

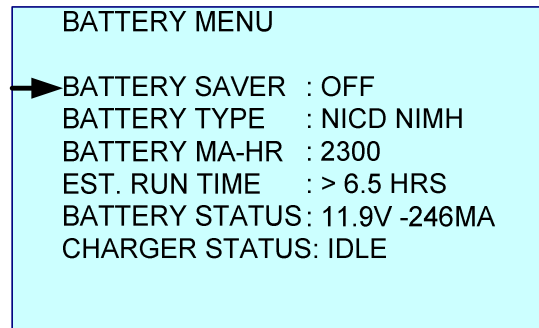


Figure 2-4

BATTERY SAVER

Use ► to turn BATTERY SAVER on and ◀ to turn BATTERY SAVER off. When on, the TDR will automatically power down if no key is pressed in 5 minutes. This is a normal power down that will save all settings and re-store them on the next power up.

BATTERY TYPE

There are three battery types: NICD-NIMH, Alkaline, None. The battery charge will only operate when in NICD-NIMH. If alkaline cells or other than NICD or NIMH cells are used this menu selection should be in alkaline or none to prevent attempting to charge the cells.

CAUTION – The E20/20's smart charger is not designed for charging LiON cells. Attempting to do so may result in damaged cells, damage the instrument and potentially cause a fire. This type of damage is not covered under warranty.

BATTERY MA-HR

Use this feature to change the mAhrs setting to the re-chargeable cell rating installed. This will adjust the charging and compute the correct time remaining per the cell's rating.

The remaining items in the BATTERY MENU are status only and not user adjustable.

EST. RUN TIME

This time is based on the cell rating (mA), charge status, and cell age. New NiMH cells rated at 2300mA and in good condition will provide about 5.5 hours continuous operation.

As the cells age this run time will reduce even with a maximum charge.

Run time = 0 hrs – Normally the result of installing new cells, performing a soft reset, or selecting a battery type of alkaline or none. The charger will need one complete charge/discharge period to compute the cell's run time.

Run time = N/A – Normal indication when the TDR is on external power.

BATTERY STATUS

Displays the cells current voltage level (normally 11.5 to 8.6V) and mA of charge or discharge.

Discharge, indicated by a negative mA, indicates the instrument is running on battery power.

Charging, indicated by a positive mA, indicates external power is applied to the batteries. The level of mA will depend on the Charger Status.

CHARGER STATUS

STATUS	MEANING	LED
IDLE	No external power applied, cells are too hot or cold to accept a charge, or BATTERY TYPE is set to Alkaline or None and the charger is off.	Not lit
BATT CHK	External power is applied and charger is checking the cells charge state.	Red blink
PRE CHR	Pre-Charge - Low current charge is being applied to provide initial charge.	Red solid
CHARGING	Full charge power is being applied	Red solid
TRICKLE	Cells are 95% or more charged and being topped off. This state prevents overcharging	Green blink
FULLY CHARGED	Cells are 100% charged	Green Solid

DATE AND TIME MENU

DATE AND TIME ENTRY

→ MONTH : MAR

DAY : 2

YEAR : 2011

HOUR : 2PM

MINUTE : 56

Figure 2-5

Use the ▲ ▼ to select the date or time entry to change and the ◀ ▶ arrows to cycle through the

A grey rectangular button with rounded corners and the text "Esc" in the center.

selections. Press the to save and return to the "Meter" menu.

A blue rounded rectangular button with the text "Trace" in the center.

The "Trace" menu permits viewing or setting all of the following Measurement Screen options:

Z SCALE (OHMS) – Impedance scales: 20, 50, 100, 200, 500, and 1,000 Ohms.
The best starting point is a scale that places the cable's impedance (Z_0) about mid-scale on the display. Then reduce the Z Scale as required to improve vertical resolution for small faults.

TRACE RANGE – Sets the plot width. Ranges in feet are: 10, 20, 50, 100, 200, 500, 1,000, 2,000, 5,000, 10,000, and 20,000.
Ranges in meters are: 2, 5, 10, 20, 50, 100, 200, 500, 1,000, 2,000, and 5,000.

START DISTANCE – Sets the left plot starting point xx ft (m) away from the TDR's connector. Press the ▶ then use the alpha-numeric keypad to enter the start distance desired, then press

A grey rectangular button with rounded corners and the text "ENTER" in the center.

to save and return to the menu.

NOTE: If this item indicates, "NULL" then there is a "Test Lead Null" length added to the feet or meters shown in the start distance on the plot.

MICRO FAULT – This feature provides two modes of locating small faults, mainly on coax cables. Use the ◀ ▶ keys to select one of the following modes:

OFF – TDR presents normal impedance trace on Measurement Screen.

KINKS ONLY – TDR presents an amplified trace of reflections from kinks, crimps, or crushed areas along the cable. The cable's Z_0 is plotted at the bottom of the plot with the faults appearing as upward reflection spikes. See Figure 2-6A.

ALL FAULTS – TDR presents a reduced Z Scale trace with dribble up (loop resistance) removed to maintain a flat trace at Z_0 . By eliminating the dribble up and reducing the scale faults are greatly amplified. See Figure 6B.

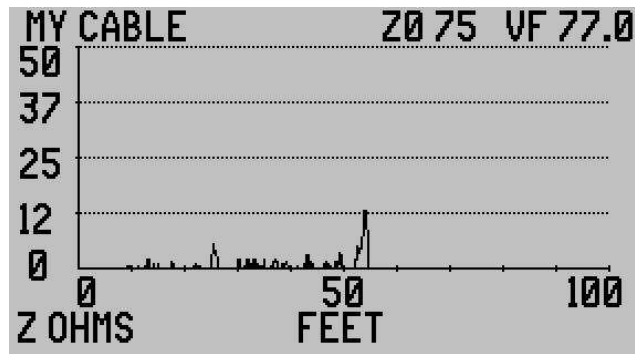


Figure 2-6A

The microfault at about 25 feet (5 Ohms) may not be service affecting. The microfault at 55 feet (12 Ohms) is most likely service affecting. Anything over 15 Ohms is certain to affect service.

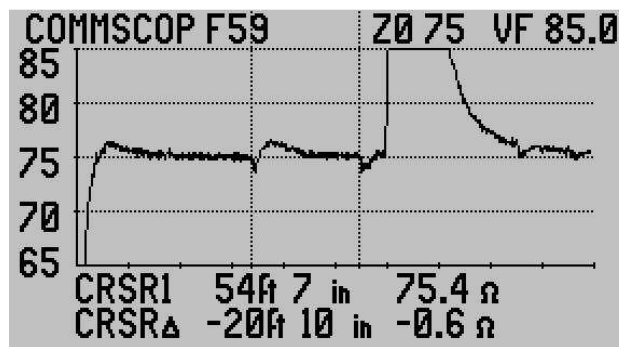




Figure 6B

There are two small faults marked by the cursors at in this coax cable either could be service affecting depending on the frequency employed on the cable. The higher the frequency, the more smaller faults affect performance.

TEST LEAD NULL – Use ◀▶ to turn ON or OFF or press  to store a new test lead's length. When ON the stored test lead's length will be removed from the cable's distance measurements.

STORE – Attach only the test lead to the TDR and follow the only screen

instructions to mark the end of the test lead and press  again to store and use this test lead's length.

NOISE FILTER - Use ◀▶ to turn ON or OFF the filter. When ON this filter reduces unwanted noise signature on the cable's trace.

Cables

This menu provides for two ways to select a cable: 1. From a pre-stored Cable List, and 2. By Manually entering a cable's impedance, velocity and name.

PICK/EDIT LIST – **PICK** – The list contained in the TDR will be either pre-loaded at the factory depending on model type or loaded from one of the lists stored in TDR PC Vision software. The Cable List contains 64 cable types with their impedance (Z) and velocity factor (VF). Use the ▲▼ arrows to move the bold

highlight to the desired cable type and press

ENTER

then

Esc

to return to the Measurement Screen.

PICK/EDIT LIST – **EDIT** – To edit this list select a cable type to replace or

an empty cable list slot and press

Bcksp

←

. Then follow the on-screen instructions to enter new description, impedance (Z), and Velocity Factor (VF).

MANUAL ENTRY – Use for a one time entry not to be saved on the Cable List. Permits entering a cable's name or description, impedance (Z) and velocity factor (VF). Use ▼▲ to select the menu item to change and ▶ to select. Make the desired entry using the

alpha-numeric keypad and press

ENTER


to the Cables menu. Press

Esc

at Cables menu to return to the Measurement Screen.


VELOCITY SRCH. – This feature permits adjusting a cable's Velocity Factor (VF) manually to get the end of the cable or a known event on the cable's trace to match a known measurement or measurement on a cable plat. Follow the on-screen instructions. After the "Preparing" screen use the ◀▶ keys to move the active cursor to a known target length on the cable. When the cursor is in position use the ▲▼ keys to adjust the VF higher or lower until the cable's end or desired event is at the cursor. The resulting VF will be the cable's

A gray rectangular button with rounded corners and the word "ENTER" in white capital letters.

actual VF. Press  to accept and return to the Measurement Screen and use the modified VF.

SAMPLE A CABLE - This feature permits measuring a cable's velocity factor. It requires knowing the cable's length in feet and inches or meters to make that entry valid and obtain an accurate velocity factor. A cable's point-to-point measurement on a cable plat will suffice as long as there are no undocumented maintenance loops in the cable. Use ► to select this feature and follow the on-screen instructions to connect the cable, leave the opposite end


A gray rectangular button with rounded corners and the word "ENTER" in white capital letters.

open and mark the end with the cursor. Pressing  will calculate and display the velocity factor to accept or decline for use.

DISTANCE UNITS – Use the ◀▶ keys to switch between FEET & METERS.

SELECTED CABLE – Displays the selected cable for final review prior to

A gray rectangular button with rounded corners and the word "Esc" in white capital letters.

Pressing  to exit to the Measurement Screen. The TDR will re-calibrate to the new cable type's impedance (Z) and Velocity Factor (VF) prior to measuring.

Measurement Screen and Controls

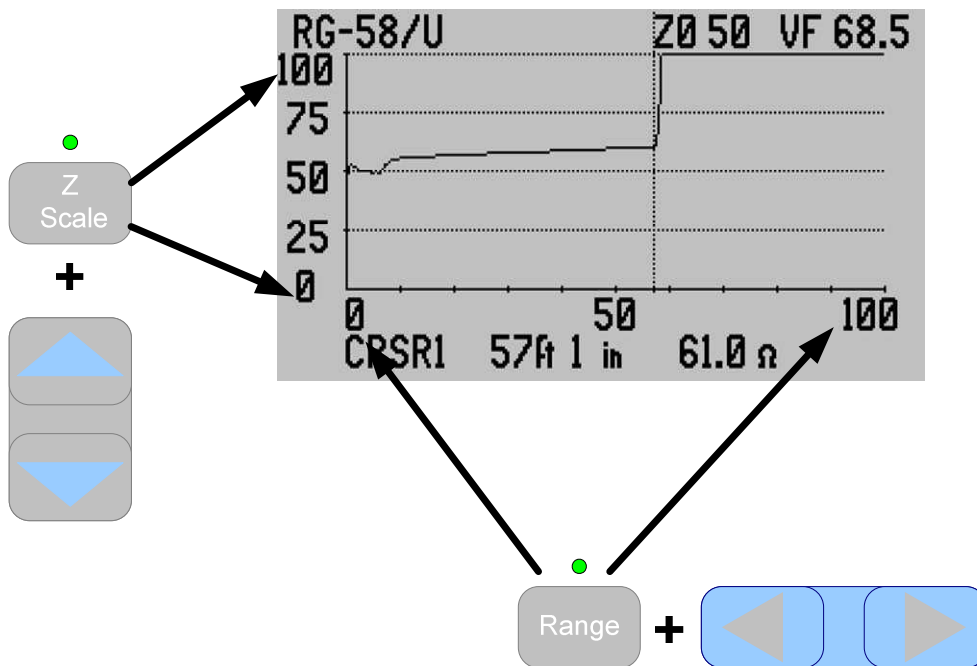


Figure 2-7

Figure 2-7 is an example of the measurement screen. The plot displayed has two axis controls. The “Range” key, when active, used with the left/right arrow keys control the display range. The “Z Scale” key used with the up/down arrow keys control the impedance scale.

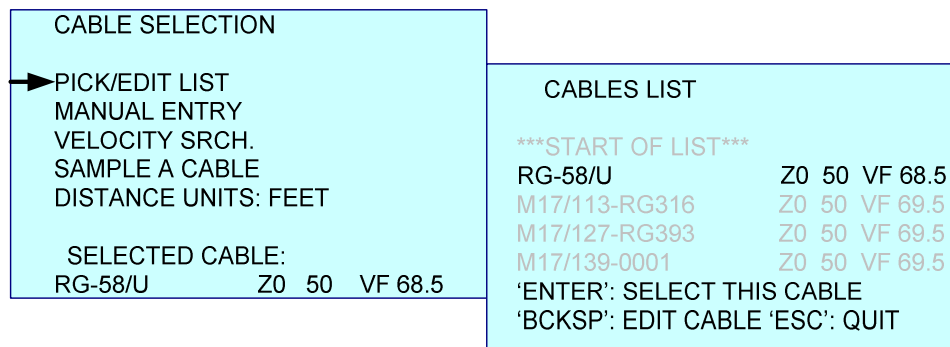


Figure 2-8

Figure 2-8 shows the “Cable” menu which controls the cable type selected. Once selected, it will display at the top of the measurement screen. See Figure 2-7 above.

The “Crsr 1” and/or “Crsr 2” keys used with the left/right arrow keys control the active cursor, which in this screen is Cursor 1 only. If Cursor 2 is activated, both cursors will appear on screen and both cursor LED’s will be green. The last “Crsr” key pressed will have control of the left/right arrow keys. That cursor’s data will appear in the top data line and the difference in the measurement to the other cursor will appear in the bottom data line. See Figure 2-9.

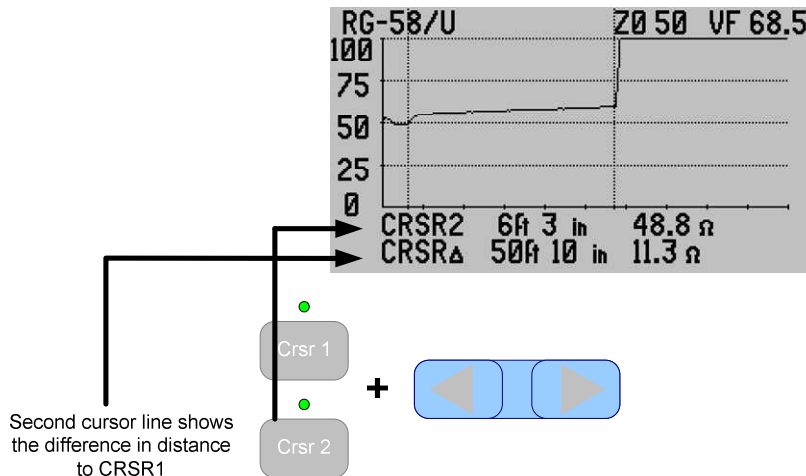
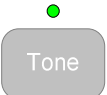


Figure 2-9

In figure 2-9 both cursors are enabled. The top cursor line will show the distance and impedance for CRSR2 as that was the last cursor key pressed or “Active” cursor. The bottom cursor line will show the difference in distance and impedance from CRSR1’s position to CRSR2’s position.

NOTE: When the differential reading from the active cursor is from left-to-right (going away from the TDR) the distance reading will be positive. When the differential reading from the active cursor is from right-to-left (going toward the TDR) the distance reading will be negative. The impedance differential may be positive or negative depending on the absolute readings at the cursors

The  key is activated when pressed and the green LED is lit. A Tone menu will be presented in the LCD as shown in Figure 2-10. Use the ▲▼ keys to select the tone frequency desired and the ◀▶ keys to select having the tone steady or warbled. Items with a frequency shown will cause the TDR to generate that frequency on the cable. Standard inductive amplifiers (Probes) will pick up the tone to ID the cable or cable pair. If “Pocket Toners” are selected the TDR will generate the DC voltage required to turn on their tone attachment at the far end of the cable.

TONE GENERATOR
 ▲, ▼: SELECT A DIFFERENT TONE
 'BCKSP': VIEW THE LIST OF TONES
 'TONE': EXIT TO TDR MODE

 INJECTING A WARBLE TONE ONTO:
 RJ45 CH A

 WARBLE
 PRESENT VALUE: 900/1100HZ

Figure 2-10

- NOTES:**
1. Toner should be used on battery power only. Use with the AC charger connected will cause 50/60Hz interfere with the tone frequencies.
 2. When the Tone feature is active the TDR measurement will not be active.
 3. When the Tone feature is active the Battery Saver time-out will be suspended to prevent automatic turn-off of the TDR.

Example Traces and Faults

Figures 2-7 and 2-9 (shown earlier) are both examples of an open cable. Whether coax, twisted pairs, or single-wires in a harness, the trace will go from the cable's normal impedance straight upward to maximum impedance reading ($>5 \times Z_0$) if one or both conductors are open at the cable's far end.

Figure 2-11 displays the trace for a 75 Ohm coax cable 60ft feet long and shorted at the end. The short is indicated by the trace dropping from the cable's nominal impedance to zero or near zero Ohms. A twisted pair cable will display the same trace drop to zero or near zero if shorted.

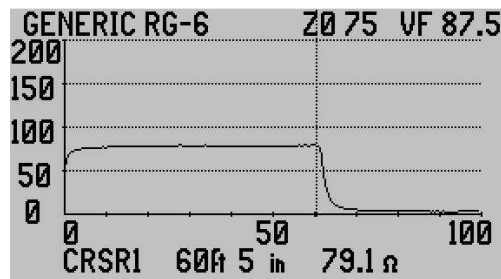


Figure 2-11

Figure 2-12 is an example of a 75 Ohm coax cable with an impedance matched device or equipment connection. The trace will go on with no end in sight due to the lack of a reflection from an open or short.

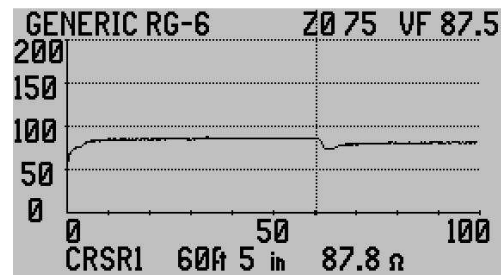


Figure 2-12

Figure 2-13 displays the trace for a 75 Ohm coax cable with an excessive bend or crimp in the cable at about 17 ft.

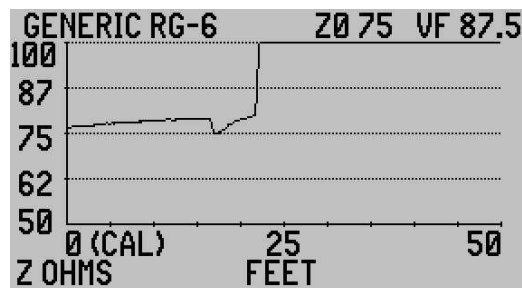


Figure 2-13

Figure 2-14 displays the trace for a 75 Ohm coax cable with a series resistive fault marked by the Cursor 1. This is typical of a poor connection or corroded barrel connector.

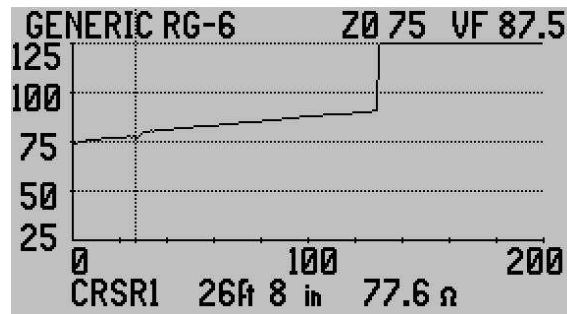


Figure 2-14

Figure 2-15 is an example of water in a 75 Ohm cable and figure 2-16 is an example of a wet tap. Remember TDR distances in and after a wet section are invalid as the velocity slows to an unknown velocity in the wet section.

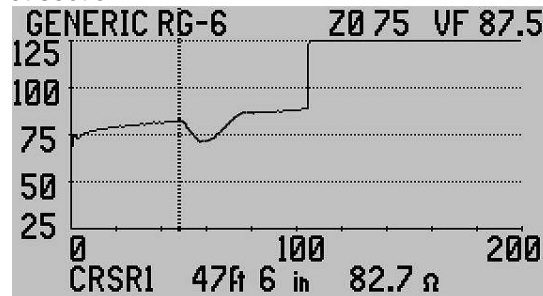


Figure 2-15

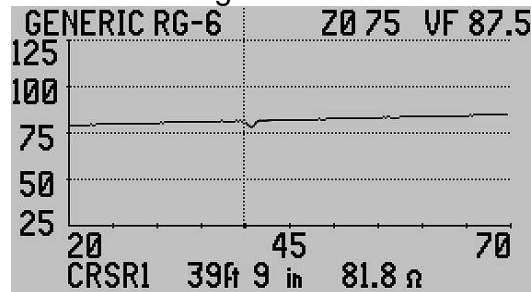


Figure 2-16

Figure 2-17 is an example of a poor splice in a twisted pair cable. A good splice will have a smaller upward appearance, but far less than 15% over the cable's normal impedance. Additionally, the splice is adding resistance indicating a series resistive fault in the splice.

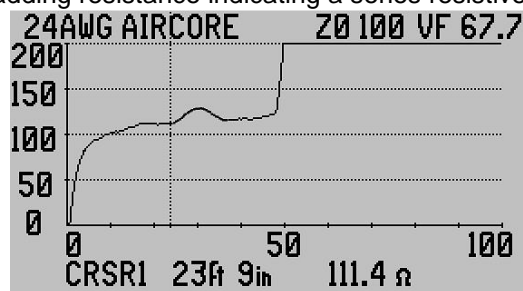


Figure 2-17

Figure 2-18 is an example of a bridged tap on a twisted pair cable. The tap starts at the downward excursion and ends at the point the trace starts upward. Taps can be spliced on the pair or be a drop cord plugged into a wall outlet. Bridge Taps are common on older homes and business wired using the telco loop. Bridge Taps should never appear on a network wired to TIA's 568B or TIA's 570 building wiring standards which use "home run" or "star" wiring configurations.

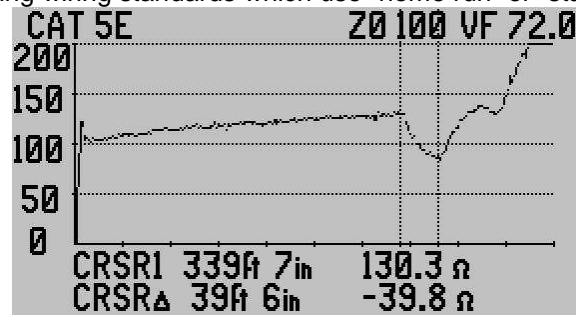


Figure 2-18

Figure 2-19 is an example of a twisted pair cable with a split pair (one wire from one pair crossed with one wire from another pair running in the same cable jacket), and a re-split which corrected the split at the next junction. Split is marked by Cursor 2 at 94 ft and the re-split by Cursor 1. The CRSR Δ indicates the distance and impedance change between Cursor 2 and Cursor 1.

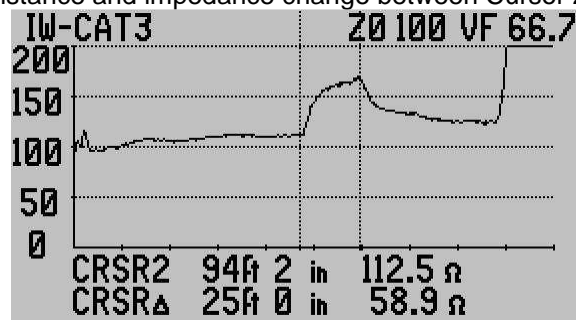


Figure 2-19

Figure 2-20 is an example of a wet twisted pair cable. Remember TDR distances in and after the wet section are shorter than actual length and invalid as the velocity reduces to an unknown. However, a wet section of cable will always have an erratic lower impedance spot in the trace.

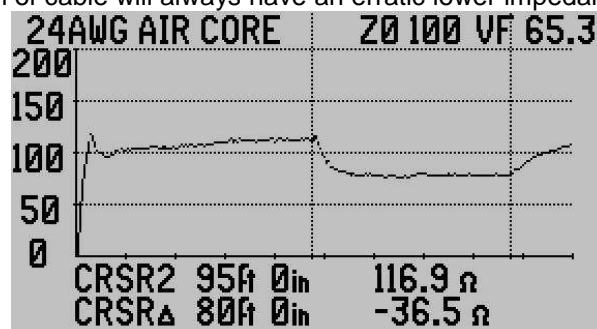


Figure 2-20

For more example traces and more detailed explanations of the impedance and velocity affects, particularly for avionics TDR uses testing single-wires in a harness, refer to the Operation Manual on the TDR's CD or download the Operation Manual from our web site at www.aeatechnology.com.

Section 3 – E20/20 TDR and Avionics TDR Memory and ETDR PC Vision™ Software

Saving and Recalling Traces

General

Traces saved in the TDR's memory can be recalled on the TDR's display or uploaded to a PC using ETDR PC Vision software where they can be archived on the PC or other memory media. When a trace is saved it also saves all the TDR setups for the cable type tested. When any trace is recalled on the TDR it will change the TDR's setups to the ones used when that trace was saved. This brings up two important points:

1. You can use a recalled trace to reset the TDR to that specific cable type and continue testing using all the recalled trace's setups. After the desired trace is recalled, press

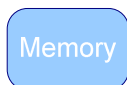


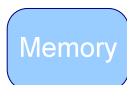
once to exit the recalled trace and start a new measurement using the recalled trace's setups.

2. When you recall a trace or traces, all the current TDR settings are automatically saved. If you wish to restore all the current setups after recalling one or more traces, use the PRIOR SETTINGS function.

NOTE: The memory used to save traces is non-volatile. Loss of battery charge, changing batteries, performing Soft Resets will not cause loss of any saved traces. However, it is prudent to upload traces to a PC as soon as practical to ensure 100% backup.

Saving Traces



Press the  key to access the memory functions shown in figure 3-1.

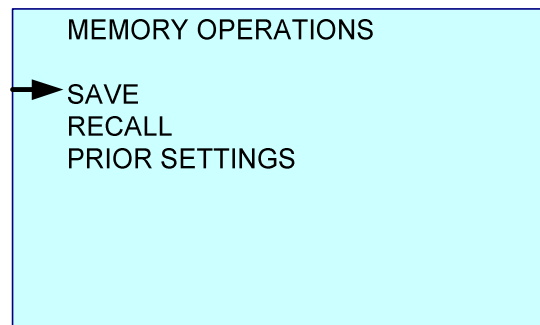


Figure 3-1

To save the current trace press the ► key at "SAVE" and the menus will guide you to enter a name for the trace as shown in figure 3-2.

```

ENTER MEMORY NAME
'0' TO '9': DIGIT OR CHARACTER
'<', '>': MOVE EDIT CURSOR
'X', 'V': ERASE/START OVER
'ENTER': ACCEPT AND CONTINUE
*
*TRACE NAME GOES HERE*
*

```

Figure 3-2


Use the alpha-numeric keypad to enter the trace name. Each key cycles from the number to the next letter of the alphabet shown above the key. When the desired character is entered use the ► key to move the cursor to the next digit position and repeat character entry until completed. When the name is complete (11 characters maximum) press the ENTER key to save the trace with the name. The date and time will be saved automatically along with the cable's impedance, velocity, trace data and all the TDR's current setups.

Maximum traces that can be saved is 32. Saving trace number 33 or more will overwrite the traces with the oldest date/time stamps. To delete a highlighted trace press BCKSP key and follow on-screen directions or use procedures in ETDR PC Vision.

CAUTION: There is no "Undelete." All deletions in the TDR's memory are permanent.

Recall Traces

Memory

Press the  key to access the memory functions shown in Figure 3-1 above. Then use the ▼ key to move the cursor down to the "RECALL" function and press the ► key to recall the memory trace list shown in figure 3-3.

```

MEMORY RECALL OPERATION


***START OF LIST***
A-BLDG RG-174      Z  50 VF 66.0
A-BLDG RG-214/U    Z  50 VF 66.0
B-BLDG VIDEO FEED  Z  75 VF 85.0
B-BLDG CONT. LINE  Z 100 VF 72.3
*EMPTY SLOT*
SAVED 29 DEC 2011  11:29AM
'HELP','ENTER','◀▶','ESC','BCKSP'

```

Figure 3-3


Use the ▲ ▼ keys to move the bold highlight to the desired trace. Use the ◀ ▶ keys to move the

ENTER


list a page at a time. Press  key to recall the highlighted trace. The "SAVED (DATE & TIME)" information at the bottom applies to the bold highlighted trace. Traces are saved in date/time order starting with the oldest at the top of the list.

A recalled trace also recalls all the instrument setups used at the time the trace was saved. This can be a fast way to reset the instrument to the cable type and setups used in the saved trace. First, recall the desired trace. When the Measurement Screen returns with the recalled trace



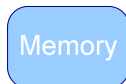
displayed, press the  key to exit the recalled trace and return to a live Measurement Screen. Note the cable type will now be the one used to test the recalled trace and all TDR setups will be the ones used with the recalled trace.

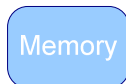


If no trace is being recalled, press  to exit the list and return to the Measurement Screen.

Restore Prior Settings


When a trace is recalled from the memory, the TDR must be restored to the settings used at the time the trace was saved. If you desire to return to the original settings being used before one or



more traces were recalled press the  key to access the memory functions menu shown in Figure 3-1 above. Then use the ▼ key to move the cursor down to “PRIOR SETTINGS” and press the ► key to restore the TDR’s settings and cable type being used before recalling traces from memory.

Delete Traces



To delete a highlighted trace press  key and follow on-screen directions. The ESC key will cancel the delete procedure, any other key pressed will complete the deletion. Traces can also be deleted using procedures in ETDR PC Vision.

CAUTION: There is no “Undelete.” All deletions in the TDR’s memory are permanent.

ETDR PC Vision™ Software

Operating Systems

The ETDR PC Vision software included with the TDR is designed to operate on most PC’s with the following operating systems:

Windows XP® – Home Office and Professional, Windows Vista®
Windows 7®, Windows 8 & 8.1®, Windows 10®

NOTE: TDR PC Vision (for 20/20TDR models) and ETDR PC Vision (for E20/20 TDR and Avionics TDR models) can reside on the same PC. However, they must be used with their respective instrument models.

E20/20 TDRs and Avionics TDR use only ETDR PC Vision
20/20 TDRs use only TDR PC Vision

Installation

NOTE: Before installing a new or upgraded version of ETDR PC Vision software, be sure to use Windows ADD/DELETE feature to remove whichever older version is being replaced.

Using the CD – Use Windows Explorer® to access the removable media disk with the TDR's CD loaded. Open the folder "ETDR PC Vision" and double-click the "Setup" application. Follow the standard Windows installation guide until completed. When finished the ETDR PC Vision icon will appear on the desktop.

Downloading from AEA Technology's web site – Go to www.aeatechnology.com. In the tool bar at the top of the home page, position the mouse point on "Literature and Software" then click on "Software" in the drop down menu. Locate the "ETDR PC Vision" software and click on "Download." Follow your operating system's instructions to save the downloaded file to a desired folder. When the download is complete, unzip the down loaded file and run the "Setup" application. Follow the standard Windows installation guide until completed. When finished the ETDR PC Vision icon will appear on the desktop.

NOTES:

1. The appropriate FTDI Driver must also be installed for ETDR PC Vision to communicate with TDR. The drivers are on the enclosed CD or can be obtained from www.ftdichip.com/Drivers/VCP.htm.
2. For detailed installation and operating instructions consult the Operation Manual on the enclosed CD or download it from www.aeatechnology.com/libraries.

Run ETDR PC Vision

Work with E20/20 TDR or Avionics TDR Connected

For: Uploading traces to PC, from active trace or TDR's memory
 Deleting traces in the TDR
 Uploading or downloading Cable Lists
 Uploading or downloading settings to the TDR

First, ensure the TDR is connected to the PC's USB port via the USB cable provided. The TDR needs to be powered on and at the Measurement Screen to communicate with the PC software. Next double-click the ETDR PC Vision icon on the desktop to open the application. ETDR PC Vision will connect automatically with the TDR and open to the "Get Trace" tab shown in figure 3-4.

Work without E20/20 TDR or Avionics TDR Connected

For: Working with archived traces stored on the PC or other memory media
 Making cable list changes in the software only.



Figure 3-4

Connection Error – If ETDR PC Vision can not locate the TDR or if the TDR can not establish a Com Port connection link, click on the “Com Port Utilities” tab to open the tab shown in Figure 3-5. It is normal for this to happen on the first connection attempt after installing the software.



Figure 3-5

Check List to Establish Communications:

1. Ensure TDR is powered on and at the Measurement Screen.
2. Ensure the USB cable is connected between the PC and TDR.
3. If the “Disconnect” button is enabled, press to disconnect port attempt.
4. Press “Rescan Computer for Available Com Ports”
5. Ensure port (normally COM3 or higher) has the following settings:
 - a. Baud = 57600
 - b. Parity = N
 - c. Bits = 8
 - d. Stop Bits = 1
 - e. Handshake = Xon/Xoff
6. If any changes are made, press “Connect Port/Poll TDR” button.

Once communications is established between the TDR and the PC, the “Serial Port Status” block will look like figure 3-6.



Figure 3-6

Get Trace Tab (Figure 3-4)

With communications established between the PC and the TDR a trace upload can be accomplished by one of the following:

“Plot Current Trace” – Press to upload the current trace in the TDR’s Measurement Screen.

“Plot Archived Trace” – This button will open a folder on the PC to select a previously stored trace or move to a folder or PC connected storage media for selecting a previously stored trace (TDR connection is NOT required to use this feature).

Stored Trace Tab (Figure 3-7)

The stored trace tab is designed to work with the traces stored in the TDR’s memory. Use this tab’s features to upload the TDR’s memory list, plot selected traces on the PC, archive traces to the PC’s memory, copy a list of save traces to Clipboard, or delete traces from the TDR’s memory.

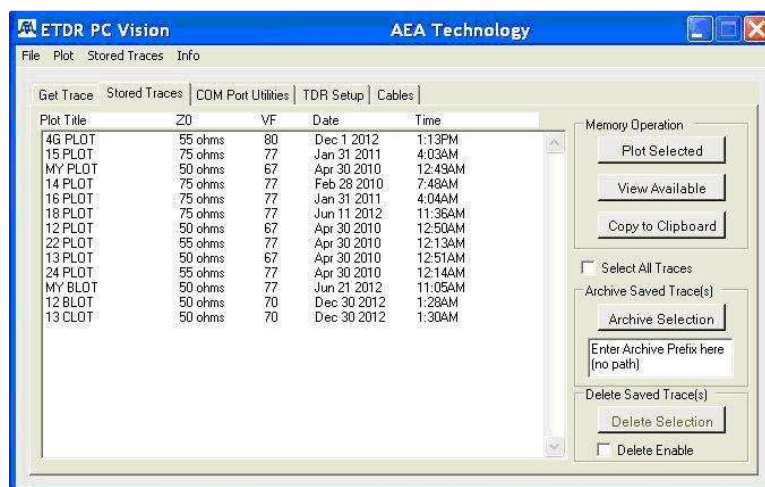


Figure 3-7

“View Available” – To view traces stored in the TDR’s memory press this button first to upload and display the list of traces stored in the list area of this tab.

NOTE: The following actions can apply to one trace, multiple selected traces or all traces shown in the uploaded list of traces. Use the keyboard’s “Shift” or “Ctrl” key with the mouse’s left click to select the desired traces.

“Plot Selected” – This button will upload and display a graphical plot of the highlighted trace shown in the list. To learn more about the graphical plot and available user actions go to the “Open a Trace Plot” sub-section next in this section.

“Copy to Clipboard” – This button will send the uploaded trace list to Clipboard. Using Windows functions this list can then be printed, pasted to a document or saved.

“Archive Selection” – This feature is designed to directly archive traces highlighted on the uploaded list or to archive all the traces in the uploaded list. When a single trace is archived on the PC from the graphical plot, the trace, by default, takes the name of the plot uploaded or edited in the graphical plot. When archiving multiple traces directly from the TDR’s memory, ETDR PC Vision needs the user to input a traces’ group name, the trace’s stored name will be used, and it will automatically assign a numerical designator to each trace to avoid any duplications.

“Delete Selection” – This button will delete the highlighted trace or group of traces from the TDR’s memory. As a precaution against accidental deletions the “Delete Enable” box must be checked first to enable (Black text) this button.

CAUTION: THERE IS NO UN-DELETE FUNCTION. Be sure the trace(s) you plan to delete has/have been successfully uploaded and archived on the PC or other storage media, or is/are definitely not needed or they will be lost forever.

Open Trace Plot

When any trace is opened, it will plot on the screen similar to what is shown in figure 3-8.

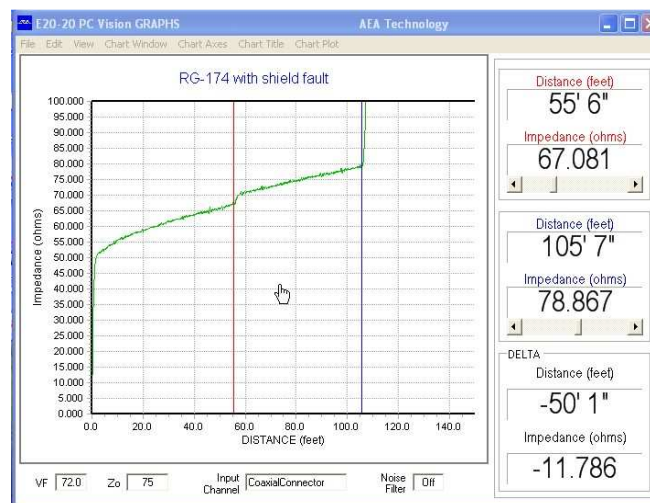


Figure 3-8

Plot Controls

Cursors – The red and blue cursors can be clicked on and dragged, slide bar moved or fine positioned using the control arrows in the data window.

Chart Zoom – To zoom in on any part of the trace position the mouse at the upper left point of interest, click and hold the left mouse button and drag it to the lower right position of interest and release the mouse button. The trace will expand to the box created around the point of interest on the chart. To un-zoom, click in the chart's lower right corner and drag it back to the upper left corner.

Chart Tool Bar

File – Save, Recall, Export and Print the Chart

Edit – Copy the chart to clipboard.

View – Used to enlarge the chart by hiding the cursor data

Chart Window – Control Background Color and Save Setting made in Chart Axes

Chart Axes – Opens a Chart size control sub-window to select/deselect Autscale and/or manually rescale the chart. To maintain a set scale, use manual scale in Save Settings under Chart Window.

Chart Title – Rename the uploaded title and change title color

Chart Plot – Turn on/off plot points and setup mouse pointer to show plot point data (X & Y = distance & impedance) when the mouse pointer is on a plot point.

Refer to the TDR's Operating Manual for more detailed information about managing ETDR trace plots. The Operating Manual can be found on the CD that came with the TDR'S or downloaded from www.aeatechnology.com.

TDR Setup and Cables Tabs

The two remaining tabs are: "TDR Setup" figure 3-9. and "Cables" figure 3-10. TDR Setups is used to build TDR setups which can be uploaded directly to the TDR or stored on the PC for later recall and upload. The Cables Tab permits uploading or downloading Cable Lists from the TDR, creating custom Cable Lists which can be stored on the PC for future download to the TDR as required.

Refer to the TDR's Operating Manual for more detailed information about both these tabs. The Operating Manual can be found on the CD included with the TDR or downloaded from www.aeatechnology.com.

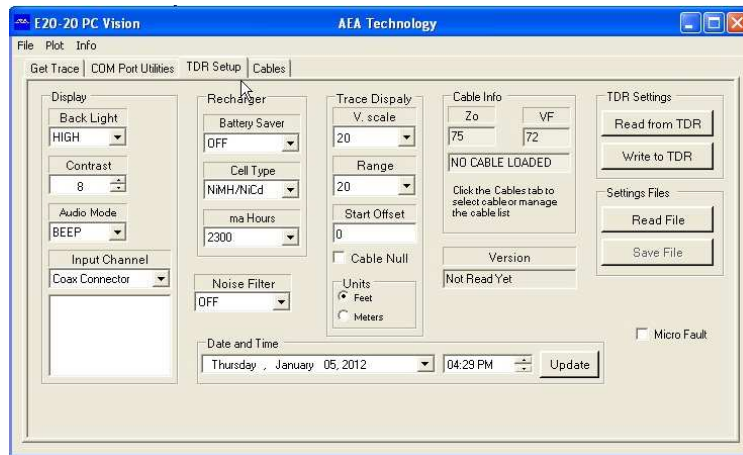


Figure 3-9

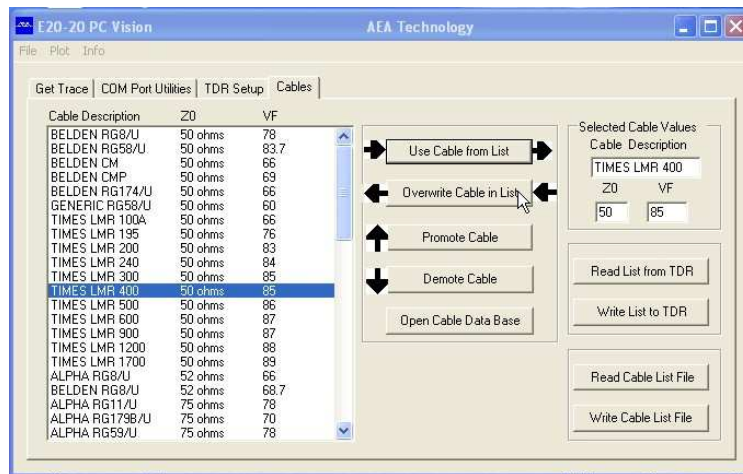


Figure 3-10

Maintenance, Service, Warranty and Accessories

Limited Warranty

AEA Technology, Inc., warrants to the original purchaser that the E20/20 TDR or Avionics TDR shall be free from defects in material or workmanship for a period of one year from the date of shipment. All units returned to the factory, delivery charges prepaid, and deemed defective under this warranty, will be replaced or repaired at this company's option. No other warranties are implied, nor will responsibility for operation of this instrument be assumed by AEA Technology, Inc.

There are no warranties that extend beyond express warranties stated herein. No other warranties are expressed or implied. AEA TECHNOLOGY SPECIFICALLY DISCLAIMS ALL IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. AEA TECHNOLOGY, INC. SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

Remedies for any breach of warranty, either expressed or implied, are limited to repair, replacement, or return of the instrument, at the option of AEA Technology, Inc. Any warranty is valid for the original purchaser only.

All warranties of performance are disclaimed.

AEA Technology assumes no liability for applications assistance or customer product design.

User Troubleshooting Guide

Symptom	Possible Causes	Solutions
On power up, relays may click, but there is no visible display	Display contrast setting is not in line with temperature	Adjust contrast with blank screen - Press "Meter" key, press ▲ 6 times, press ▼ once, press ► repeatedly until text appears. Alternative – Perform a Soft Reset (See Basic Guide. Section 1)
On power up, no relays click & no display appears	Power source or batteries at fault	Try a second power source. If on batteries use AC or DC adapter. If on AC use different outlet. If on DC turn on vehicle. Lastly, install 8 AA fresh batteries.
On power up, display appears, but there is no activity.	Illegal instrument state	Turn off and perform a Soft Reset (See Basic Guide, Section 1).
TDR has large offset distance	Start Distance setting or "Test Lead Null." is ON or both	Press "Trace" key & reset Start Distance to 0 and/or turn OFF Test Lead Null.
TDR distance readings are in error	Wrong cable type or VF selected.	Press "Cables" key to pick matching cable type or "Velocity Srch." or "Sample Cable" to find correct VF
Tone Function has AC noise over tone frequencies	AC adapter power in use	Operate the TDR Tone Function <u>on battery power only</u> to eliminate AC interference
ETDR PC Vision software		
TDR and PC show "Disconnected" in "Connection Status"	1. TDR is OFF or not in Measurement Screen. 2. USB Cable not connected 3. PC setups are incorrect	1. Turn TDR ON to Measurement Screen and try again. 2. Recheck USB cable connections 3. See Basic Guide, Section 3 for more corrective actions.
Get Traces tab only has "Plot Archive Trace" button active	No TDR connected or TDR is not recognized	Normal for working with Archived Traces only, or check items shown above

Power/Battery Charging Troubleshooting Guide

Symptom	Possible Cause(s)	Correction
External power is applied, but Status is always IDLE or stuck in BATT CHK (Some of these symptoms are more likely to occur when a new set of batteries are installed)	<ol style="list-style-type: none"> 1. Battery Type: NONE or ALKALINE previously selected. 2. Batteries may be damaged, defective, missing, improperly installed or have expired shelf life. 3. Contacts may be dirty or corroded. 4. External power may not be properly connected. 5. Non-AEA recommended power pack. 6. Cells may be alkaline or carbon. 7. Deeply depleted cells may take longer to condition. 	<ol style="list-style-type: none"> 1. Set Battery Type and Battery Capacity to match cell type. 2. Replace with new set of batteries or install cells per polarity guides. 3. Clean or replace contacts. 4. Check external power (wall switch off, bad plug, broken cord, etc.). 5. Use correct power pack. 6. Set battery type to ALKALINE. 7. Have patience, recheck status in one hour.
Operational time is getting shorter with each use.	Cells may be at or near mfg limit for number of recharges (nominal 750 times).	Lengthen recharge time, if no improvement replace cells with 8 new AA rechargeable cells
Not very old cells stop recharging	<ol style="list-style-type: none"> 1. Battery Type: NONE or ALKALINE selected. 2. Charging power is not sufficient or not on. 3. Battery Temperature too HOT or COLD. 4. One or more cells is installed with polarity reversed. 5. Batteries are damaged, missing, or have dirty contacts. 	<ol style="list-style-type: none"> 1. Set Battery Type and Battery Capacity to match cell type. 2. Correct AC or DC input to TDR. 3. Recharge at room temperature. 4. Align all cells polarity per battery case Diagram. 5. Examine batteries and contacts correct any issues.
TDR auto powers down when batteries still workable	1. By design to protect the cells & TDR from damage by operating at too low voltage.	1. Operate on external power or change to fresh cells.
Charger goes directly to IDLE or TRICKLE	Cells may already be fully charged	Use battery power only & check Battery Status for full charge (>11v).
Charger Status jumps from BATT CHK to IDLE	<ol style="list-style-type: none"> 1. Cells may be missing, damaged or Defective. 2. One or more cells is installed with polarity Reversed. 	<ol style="list-style-type: none"> 1. Replace with new set of batteries. 2. Align all cells polarity per battery case Diagram.

Contact Us

If the troubleshooting tips do not resolve TDR issues or other questions arise please contact us by phone or email;

Tel: 1-800-258-7805 US & Canada, +1-760-931-8979 all locations. Office hours are 7:00am to 4:30pm Pacific Time Monday – Friday.

Email: techsupport@aeatechnology.com.

E20/20 TDR and Avionics TDR Specifications

Characteristic	AEA Technology E20/20 TDR and Avionics TDR Specifications
Distance	
Range	0-13,250ft (3,300m) @ VF =.660c 0-20,000ft (5,000m) @ VF =.999c
Resolution: TDR in feet = ETDR PC Vision in feet = TDR in meters = ETDR PC Vision in meters =	span/240 or 1/2 in @ 10ft span span/1920 or 1/16 in @ 10ft span span/250 or 8mm @ 2m span Span/2000 or 1mm @ 2m span
Accuracy	<0.2% ± 1 inch (2.54cm) + VF uncertainty
Impedance (Z)	
Full Range	0 to 1K Ohms
Range Scales	20, 50, 100, 200, 500, and 1KOhms
Resolution	0.1 Ohms
Accuracy	<3% of reading may vary over longer lengths
Velocity Factor (VF)	
Range	0.20 - 0.999c
Resolution	0.001c
Dead Zone	None - Soft Z readings ≤2-4 ft (0.6 to 1.2 m) cable impedance dependent
Output Impedance	95Ω All Connectors
Pulses	
Amplitude	640mV ±10% (open circuit)
Width	11.5 μsec Nominal
Repetition Rate	23 μsec Nominal (43KHz)
Pulse Rise Time	<1 nsec
Display	
Type	Qtr VGA LCD, Backlit
Size	287 X 156 pixel, 2.8 X 1.45 inch (67 X 37.5mm)

Characteristic	AEA Technology E20/20 TDR and Avionics TDR Specification
Display Plots	
Impedance Scales	Zo ± 10 , ± 25 , ± 50 , ± 100 , and 0-200, 500, or 999 Ohms
Range Scales: Feet Meters	0-10, 20, 50, 100, 200, 500, 1,000, 2,000, 5,000, 10,000, and 20,000ft 0-2, 5, 10, 20, 50, 100, 200, 500, 1,000, 2,000, and 5,000m
Cursors	2 with independent distance and Impedance, plus delta data
Zoom	Adjustable zoom ranges on active cursor
Noise Filtering	ON/OFF
Input Protection	
Continues Operation	1.0VAC Pk-to-Pk, or 50VDC
High Voltage Warning	Over 1.0VAC Pk-toPk, 50VDC
Protection Limit	250VAC or VDC
Advanced Features	
Micro Fault Detection: Kinks Only – All Faults –	Locates coax crimps or crushes too small for easy detection on impedance trace Enhances any faults on any cable type, removes dribble up (DC loop resistance) for flatter trace
Cable Sampler	Computes VF on sample length
VF Search	User adjust VF to known event or cable end
Test Lead Null	Removes lead from measurement
Start Distance Off Set	Adjust trace's start distance to improve resolution in range scales
Cable Trace Tones (Hz)	900/1100 warble, & 977.5, 850, 577, and Pocket Toner DC voltages All steady or pulse selectable
Setup Wizard	Guides user through set ups
Context Sensitive Help	For any action key or menu item
Smart Charger settings	Use NiMH, NiCD, Alkaline cells, 400-5000mAh rated.
Real Time Clock	Date/time stamps saved traces
Cable List	64 programmed cables, user select, edit and overwrite. ETDR PC Vision can upload or download revised lists.
Memory	32 Display Traces/ Instrument setups with trace name and date time stamp

Characteristic	AEA Technology E20/20 TDR and Avionics TDR Specification
Trace Export	USB-Serial. AEA supplied PC software and USB Cable included
PC Software	"ETDR PC Vision" software included for trace upload, storing, printing & export. Cable List management & download, Memory Catalog management, and setups download
Power	
Batteries	8AA NiMH, NiCd or Alkaline cells. Internal charging. NiMH cells included.
Battery Operating	Alkaline Cells - 7 hrs top brands, NiMH & NiCd ~7.3 hrs on a full charge, Backlight use will reduce operating time
AC Power	100-240VAC, 50-60 Hz
DC Power	12-18 VDC, 1.2ADC Max
Physical	
Size	8.5" (216mm) x 4.3" (109mm) x 2.25" (57mm)
Weight	2.2lbs (1Kg) with batteries & beltcase
Environmental	
Compliance	CE compliant. EMC, Safety, and RoHS
Operating Temperatures	-18° to 50°C (0° to 122°F)*
Non-operating Temperatures	-30° to 70°C (-21° to 158°F)
Relative Humidity	0-95% non-condensating
Weather	rain & dust resistant
Drop Resistance	MilSTD 810G, Procedure IV Transit Drop 48 inches (122cm), 26 drops
*Refer to the Operators Manual Appendix E for extreme cold weather operations	

Characteristic	Avionics TDR Kit's Hard Case
	Specifications
FOD Protection	Custom foam for item securing and lid label for item ID and locating
Transportation	ATA 300, Category 1 rated
Size	18.1 x 13.7 x 6.9 inches (48 x 35 x 18cm)
Weight	11.5lbs (5.2Kg) with TDR and all accessories
Environmental: Ambient Pressure Equalization Waterproof & Dust Tight Impact, UV, Solvents and Fungus Resistance	MilSTD 648C MilSTD C4150J MilSTD 810F for all

E20/20 TDR and Avionics TDR Accessories

With the addition of the Avionics TDR and its large number of specialized accessories this section expanded and is now in the Operating Manual, Appendix C. The Operating Manual can be found on the enclosed CD or by downloading it from www.aeatechnology.com/library

Other useful information in the Operating Manual's Appendices are:

Appendix B – Wiring Guides showing ANSI/TIA Category and ISO Category wiring standards for twisted pair cabling systems, USOC's Teleco standards, and 10Base-T standards. This is useful when selecting which RJ-45 Channel applies to which pair number, pins, and pair color code for each standard.

Appendix D – Resolution Tables for both the TDR's LCD cursor positioning and ETDR PC Vision software's graphic presentation.

Appendix E – Operating tips for using the TDR in extreme cold weather conditions.

User Notes:



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