

Basic Guide

E20/20 TDR

Step Time Domain Reflectometer



E20/20 Step TDR all models

AEA Technology, Inc.



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Section 1 Getting Started

The E20/20 Step TDR has 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 – Printed booklet with basic information for setting up and using the E20/20 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 E20/20 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.

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

Operating Precautions

1. The E20/20 TDR is designed for recharging NiMH or NiCd AA cells only. Do NOT install and attempt to charge Li-ion cells as overheating or fire may result.
2. Alkaline cells may be used safely in the E20/20 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 outgassing. The resulting damage is not covered under warranty.
3. The E20/20 TDR has input voltage protection and a high voltage detection system which will warn if connected to more than 100VDC or 0.5VAC. Use caution with the cable if this detection warning appears in the display.
4. The E20/20 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.

If you have any questions concerning the operation, application, or environment use please contact AEA Technology, Inc. at 1-800-258-7805 or +1-760-931-8979 or at www.aeatechnology.com.

Keypad and Display

Top Connectors - See Figure 1-2 for all available connector combinations

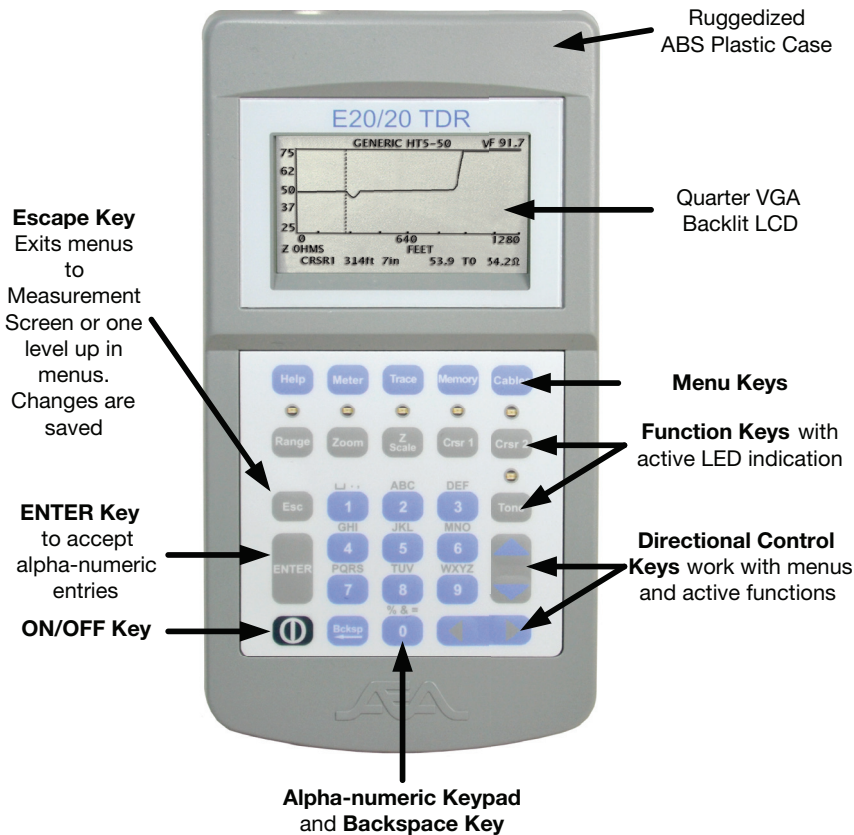


Figure 1-1

Top End Connector Configurations



E20/20N TDR (Single N Connector)

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

Part Number 6021-5154 – Avionics Cable List

Figure 1-2

Measurement Screen

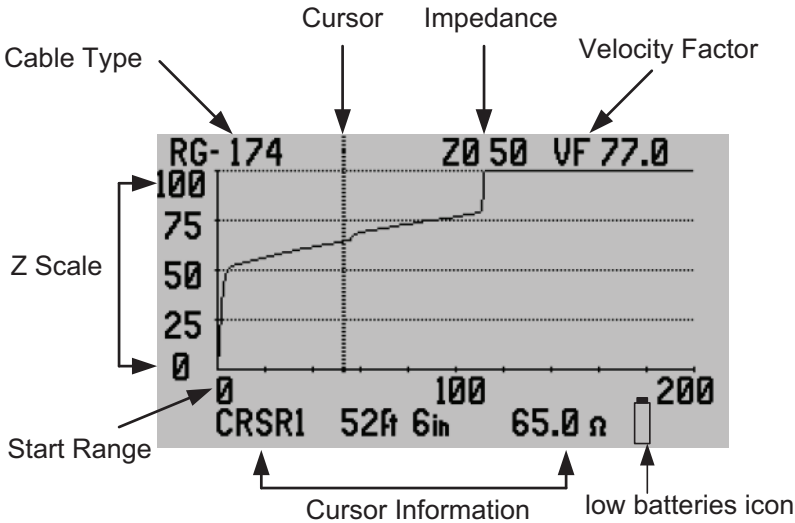


Figure 1-3

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 use the following steps:

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

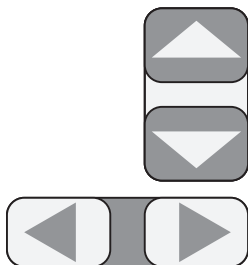
Look for the word “Default Settings” in the splash screen and note the Measurement Screen opens to Z Scale = 0-1K Ω , and “MY CABLE” cable type. This indicates a successful Soft Reset. This action will perform firmware housekeeping and reset the TDR to the factory default settings. To see more about 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. 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/OFF KEY. In this case press and hold the key for at least 10 seconds. When released, the TDR should power down.

Arrow, Escape and Enter Keys



Arrow Keys – In the menus, the up/down arrow keys control the menu cursor (arrow) and the left/right arrow keys control the selected item's options or ranges. In the Measurement Screen the 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 ◀▶▲▼ symbols indicator in the menus, Help Menu, this guide and 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 select a cable type, select a saved trace to recall, or 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 using the following steps:

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

Look for the word "Default Settings" in the splash screen and note the Measurement Screen opens to Z Scale = 0-1K Ω , and "MY CABLE" cable type. This indicates a successful Soft Reset.

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.

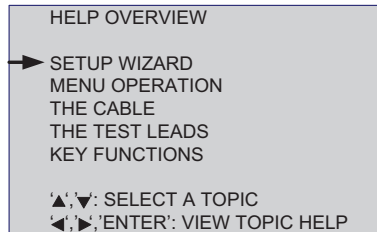


Figure 1-4

If a function key is active or any other menu is open pressing the Help key will provide context sensitive help about that specific 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.

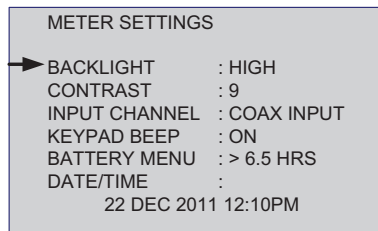


Figure 1-5

NOTE: 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 this guide's section 2 or 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.

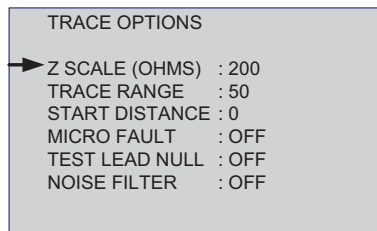


Figure 1-6

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.

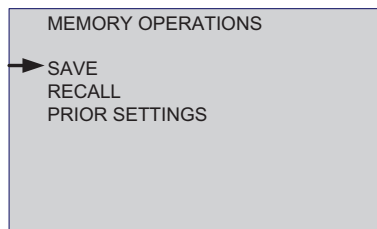


Figure 1-7

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 units between feet or meters. The Cables key's menu is shown in Figure 1-8.

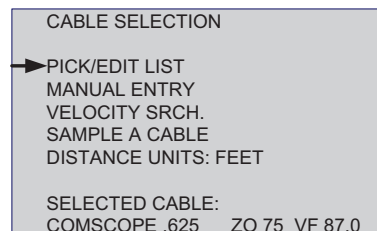


Figure 1-8

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 de-activate other function keys when selected.



Range

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

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

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.

Crshr 1

Crshr 2

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 CRSR 1 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

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. Use the ▲▼ keys to select tone from the list.

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” (Backspace) key will delete the last number entered in a number entry screen, or the character marked by the cursor in an alpha-numeric entry screen. The latter will also back the cursor one position to the left. 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 TDR 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 E20/20 TDR or also 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 that type TDR to clearly see longer cables and faults further away.

Step TDR's, like the E20/20 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.

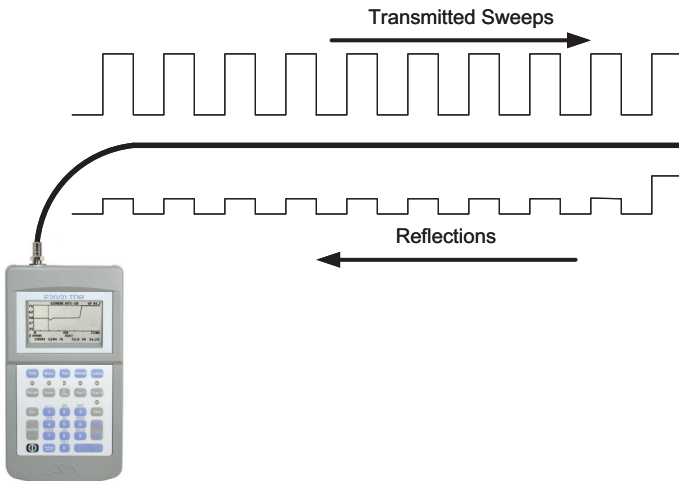


Figure 2-1

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

The impedance measured along the length of a good cable is known as the characteristic impedance (Z_0) and is designed in at the time of manufacture. When measuring with a TDR, the readings displayed are the actual impedance (Z) at each data point along the cable. When a cable is good, you will see impedance readings that are near or equal to Z_0 . When a fault occurs the impedance deviates from Z_0 . 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.

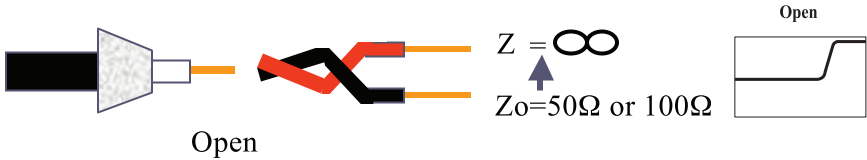


Figure 2-2

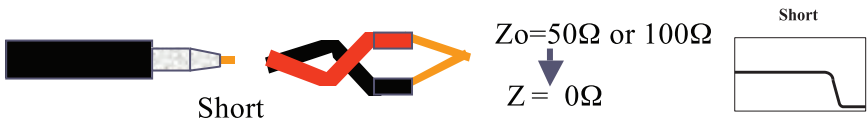


Figure 2-3

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.

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

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 E20/20 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.

A small, rounded rectangular button with a grey gradient and the text "Esc" in white.

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 without saving changes

A small, rounded rectangular button with a grey gradient and the text "ENTER" in white.

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

A small, rounded rectangular button with a grey gradient and the text "Help" in white.

Setup Wizard is located in the E20/20 TDR's menu. It's a step-by-step guided setup procedure for preparing the E20/20 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
- Set the Z scale (Impedance scale)
- 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 Null. Press the "Bcksp" key to back up one screen in the Setup Wizard procedures.

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 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).

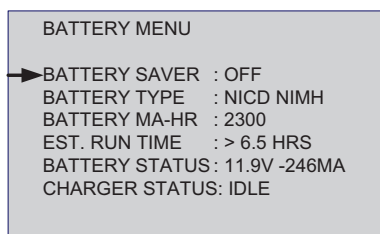


Figure 2-4

BATTERY SAVER

Use ► to turn BATTERY SAVER on and ◀ to turn BATTERY SAVER off. When on, the E20/20 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: NICH-NIMH, Alkaline, None. The battery charge will only operate when in NICH-NIMH. If alkaline cells or other than NICH 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 Li-ion 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, 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 E20/20 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 CHRГ	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 selections. Press the  to save and return to the “Meter” menu.

 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 Ohms 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  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.

MICROFAULT – This feature provides two modes of locating small faults 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 removed to maintain a flat trace at Z_0 . By eliminating the dribble up and reducing the Z Scale small faults of any kind can be more easily identified. See figure 2-6B

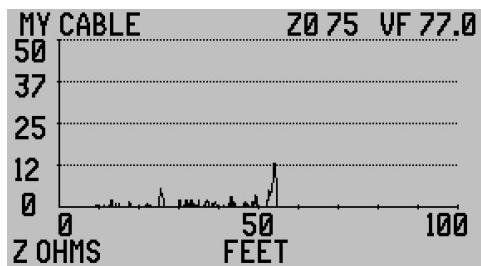


Figure 2-6A

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.

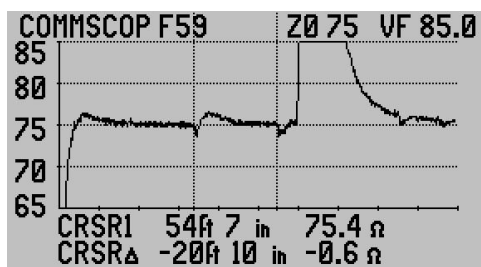




Figure 2-6B

In figure 2-6B there are two small faults. The first fault is marked by Cursor 2 at about 34ft is a worn barrel connector and the second marked by Cursor 1 is a kink in the cable. Both could be service affecting at higher frequencies.

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

TEST LEAD NULL – With the cursor arrow at TEST LEAD NULL press  to measure a test lead and store it's length. Connect the desired test lead and follow the on-screen instructions which will direct marking the end of the test lead and press ENTER again to store that length and return to the Measurement Screen.

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.
2. By Manually entering a cable's description, impedance and velocity then storing it on the list.

PICK/EDIT LIST – **PICK** – The list contained in the E20/20 TDR will be either pre-loaded at the factory depending on model type or loaded from one of the lists stored in ETDR PC Vision software. The Cable List contains 64 cable types with their impedance (Z_0) and velocity factor (VF). Use the ▲▼ arrows to move the bold highlight to the desired cable type and press



to select, then



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 key. Then follow the on-screen instructions to enter new description, impedance (Z_0), 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_0) 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 to save and exit back to the Cables menu. Press



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 jacket 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

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

will be the cable's 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 open and mark the end with the cursor. Pressing

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

 will calculate and display the velocity factor to accept or decline for use.

DISTANCE UNITS - Use the ◀▶ keys to switch between FEET or METERS.

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

SELECTED CABLE - Displays the selected cable for final review prior to Pressing  to exit to the Measurement Screen. The E20/20 TDR will re-calibrate to the new cable type's impedance (Z_0) and Velocity Factor (VF) prior to measuring.

Measurement Screen and Controls

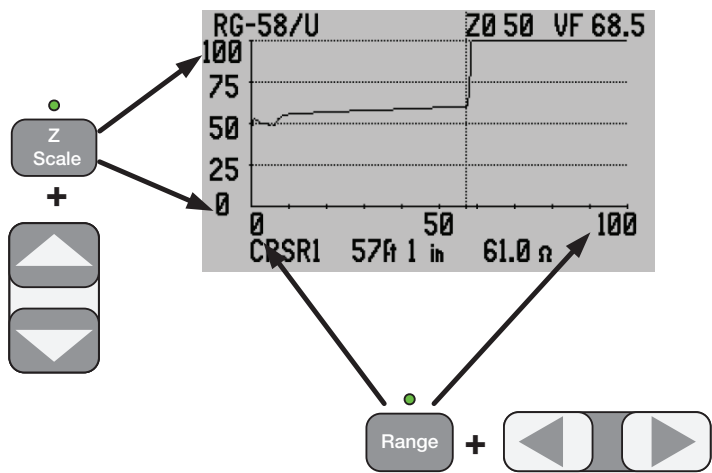


Figure 2-7

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.

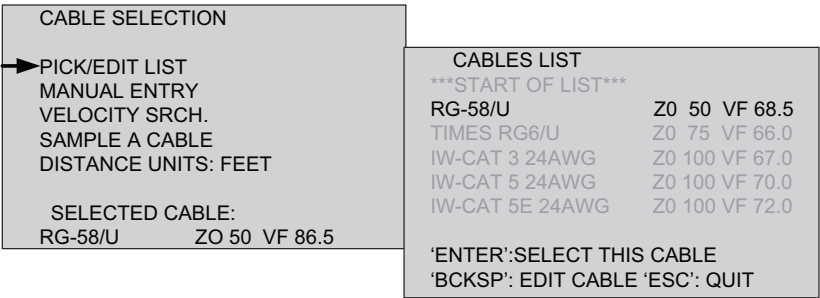


Figure 2-8

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 2-9.

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.

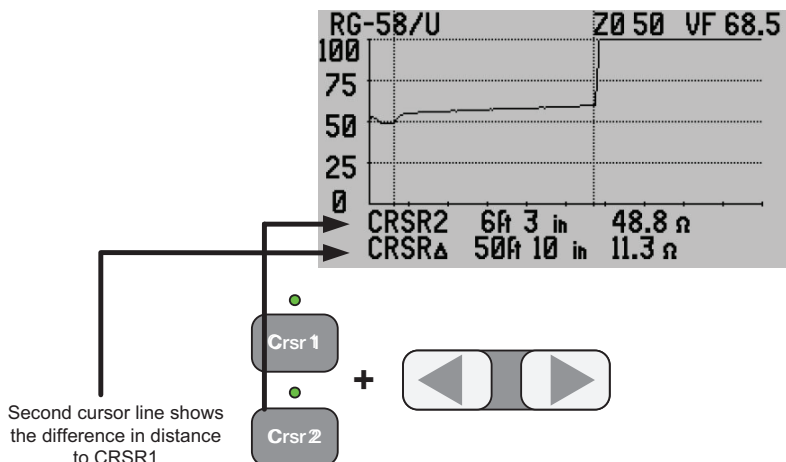
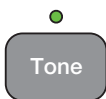


Figure 2-9

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 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.



The **Tone** 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 \blacktriangle \blacktriangledown keys to select the desired tone from the list of available frequencies and modulation combinations. Items with a frequency shown will cause the E20/20 TDR to generate that frequency on the cable. Standard inductive amplifiers (Probes) will pick up the tone to ID the cable or cable pair.

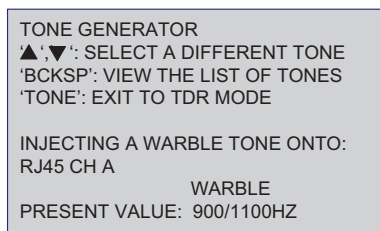


Figure 2-10

- 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 or twisted pair, 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 (18.3m) 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.

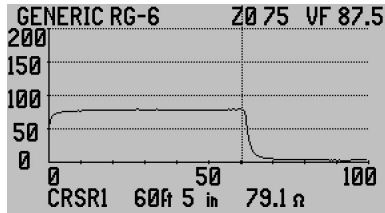


Figure 2-11

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.

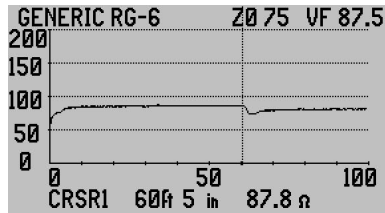


Figure 2-12

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 (5.2m).

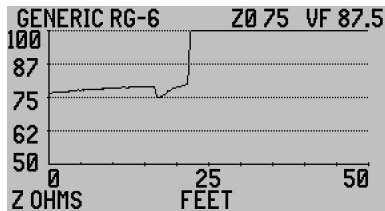


Figure 2-13

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.

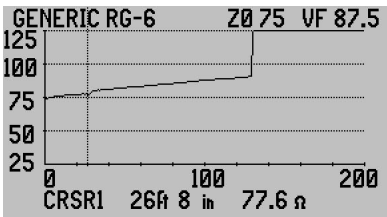


Figure 2-14

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.

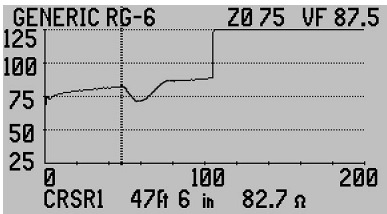


Figure 2-15

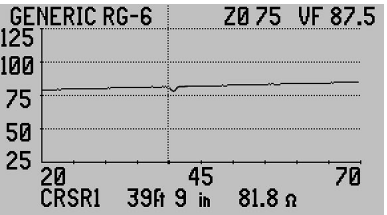


Figure 2-16

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.

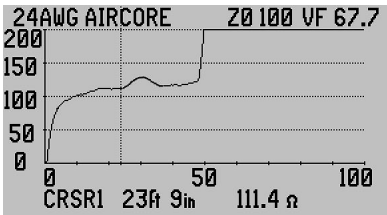


Figure 2-17

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 568C or TIA's 570 building wiring standards which use "home run" or "star" wiring configurations.

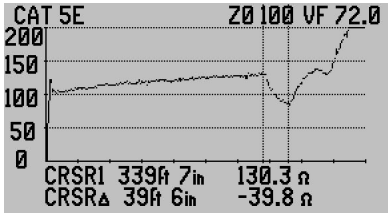


Figure 2-18

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.

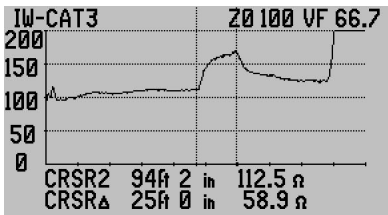


Figure 2-19

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.

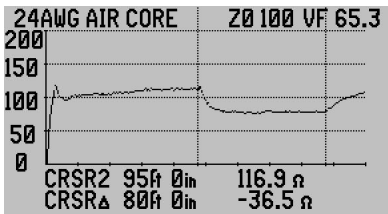


Figure 2-20

For more example traces and more detailed explanations of the impedance and velocity affects refer to the Operation Manual on the E20/20 TDR's CD or download the Operation Manual from our web site at www.aeatechnology.com.

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

Saving and Recalling Traces

General

Traces saved in the E20/20 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

Esc

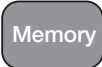
once to exit the recalled trace and start a new measurement using the recalled trace's setups.

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, etc. 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

Memory

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

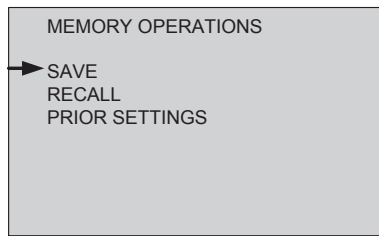


Figure 3-1

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.

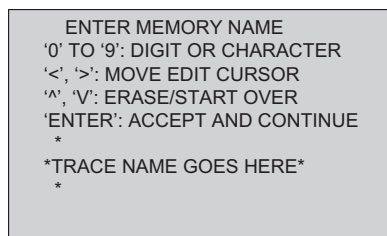


Figure 3-2

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 the character position cursor will auto advance one digit position to the right. Repeat character entries until completed. The ◀▶ keys can be used to reposition the character cursor at any time. 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. See ETDR PC Vision software instructions for deleting traces.

Recall Traces

Memory

Press the **Memory** key to access the memory functions shown in Figure 3-1. 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.

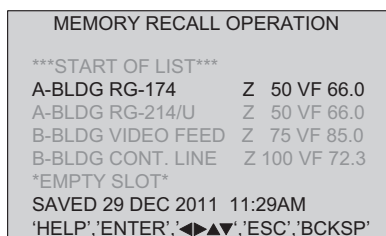


Figure 3-3

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

ENTER

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

Delete Traces


To delete a highlighted trace press the [Bcksp] key.

CAUTION: There is no “UNDELETE” function. All deletions are final and permanent. Ensure the trace has been uploaded and saved using ETDR PC Vision prior to deleting or is absolutely not required.

Traces can also be deleted using ETDR PC Vision's “Stored Traces” tab.


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

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, at the Measurement Screen. 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.

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.

ETDR PC Vision™ Software

Operating Systems

The ETDR PC Vision software included with the E20/20 TDR is designed to operate on most PC's with the following operating systems:

Windows XP – Home Office and Professional®

Windows 7®

Windows Vista®

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

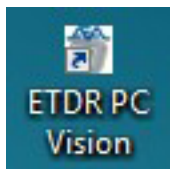
E20/20 TDR use only ETDR PC Vision

20/20 TDR 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 E20/20 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.

Run ETDR PC Vision

Work with E20/20 TDR Connected

For: Uploading traces to PC
 Deleting traces in the TDR
 Uploading or downloading Cable Lists
 Downloading settings to the TDR

First, ensure the E20/20 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.

NOTE: The first connection between ETDR PC Vision and the E20/20 TDR will require using the "COM Port Utilities" tab to establish connection. ETDR PC Vision to TDR communications also requires FTDI Drivers be installed. These drivers are located on the enclosed CD or available from www.ftdichip.com/Drivers/VCP.htm. See the Operator Manual Section 5 for complete instructions for different Windows operating systems.

Work without E20/20 TDR Connected

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



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, the Com Port Utilities tab will appear as shown in Figure 3-5. It is normal for this to occur on the first connection attempt after installing the application.

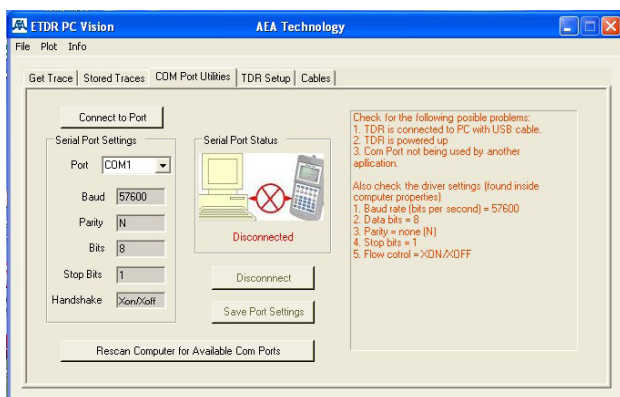


Figure 3-5

Check List to Establish Communications:

1. Ensure E20/20 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.

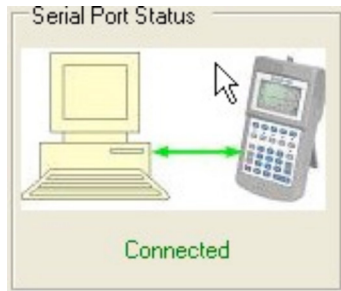


Figure 3-6

Get Trace Tab

Refer to figure 3-4. With communications established between the PC and the TDR a trace upload or deletion can be accomplished by one of the following:

“Plot Current Trace” – Press to upload the current trace in the E20/20 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 or communications is optional with this action).

Stored Traces Tab

The Stored Traces tab is designed to work with the traces stored in the E20/20 TDR’s memory. Use this tab’s features to upload the TDR’s memory list, archive traces to the PC directly, copy a list of saved traces to clipboard, open saved traces into graphs and delete traces from the TDR’s memory. See option buttons in figure 3-7

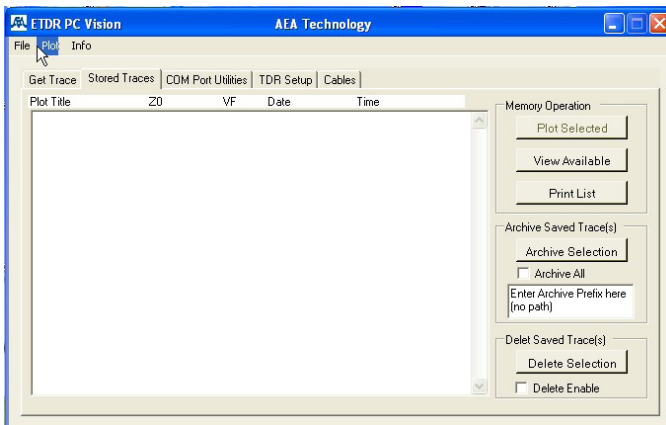


Figure 3-7

“Plot Selected” – After uploading the E20/20 TDR’s memory list, use the mouse to move the blue highlight to a selected trace and press this button to upload and graphically plot that trace.

“View Available” – Press this button upload and view a list of traces stored in the TDR’s memory.

“Copy to Clipboard” – Highlight one or more save traces on the list to copy them to Clipboard. From clipboard they can be pasted into Notebook, Word, or other documents and printed. This feature copies and pastes only the list item as shown, not the saved trace.

“Archive Selection” – Press this button to store one, a group, or all the traces stored in the TDR’s memory without plotting them first. Check the “Archive All” box to upload and store all the traces.

“Enter Archive Prefix Here” – Choose a prefix for the traces to be archived on the PC. This prefix, the trace name, and a unique ID will make up the archived trace’s full file name as shown in brackets below:

[prefix_trace name_ID].aea

“Delete Saved Traces” – This button will delete the highlighted trace(s) on the list from the TDR’s memory. As a safety feature the “Delete Enable” box must be checked before each deletion. CAUTION – There is no undelete. Traces deleted in the TDR’s memory are permanently deleted.

Open Trace Plot

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

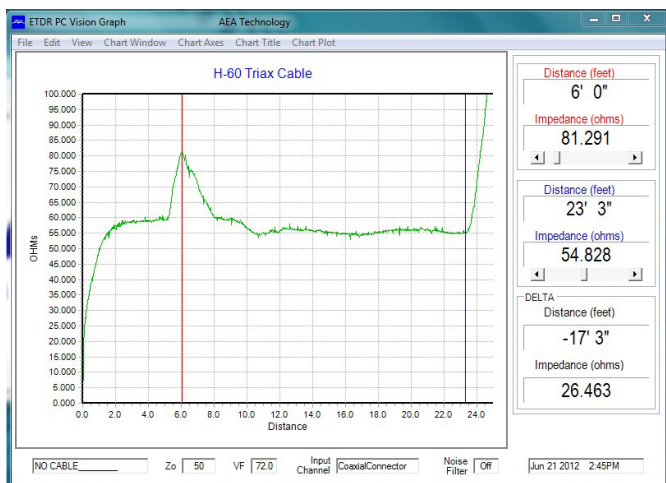


Figure 3-8

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 – Add “Kinks Only” and/or “All Faults” traces to impedance trace, select colors for different traces, 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 E20/20 TDR's Operating Manual for more detailed information about managing ETDR trace graphs. The Operating Manual can be found on the CD that came with the E20/20 TDR 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 Setup 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 or creating custom Cable Lists.

Refer to the E20/20 TDR's Operating Manual for more detailed information about both these tabs. The Operating Manual can be found on the CD enclosed with the E20/20 TDR or downloaded from www.aeatechnology.com.

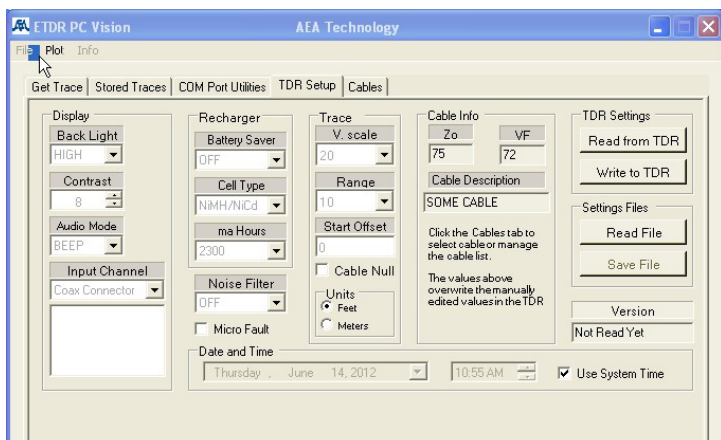


Figure 3-9

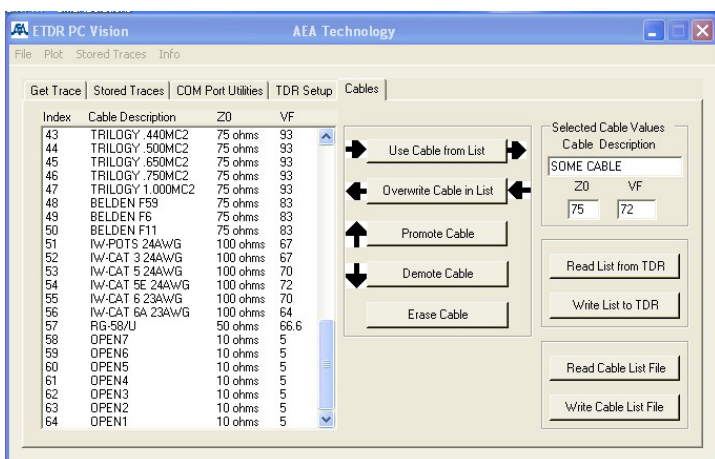


Figure 3-10

4. Maintenance, Service, Warranty and Accessories

Limited Warranty

AEA Technology, Inc., warrants to the original purchaser that the E20/20 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 (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 (Operator Manual, 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	1. Cable Null is on	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 on battery power only to eliminate AC interference
TDR will not turn off	Illegal instrument state	Press and hold the ON/OFF key for about 10 seconds (Hard Power Down), then perform a Soft Reset with power ON (Operator Manual, Section 1)
TDR has steady beep tone and will not respond to any key press	Illegal instrument state	Remove the battery cover and 1 AA cell for about 10 seconds. Replace the cell and power ON using Soft Reset (Operator Manual, Section 1)
ETDR PC Vision software		
TDR and PC show “Disconnected” in “Connection Status”	1. TDR is OFF or not in Measurement Screen.	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 elected. 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	<ol style="list-style-type: none"> 1. Battery Saver mode is ON. 2. By design to protect the cells & TDR from damage by operating at too low voltage 	<ol style="list-style-type: none"> 1. See Battery Menu in the Meter Menu 2. Operate on external power, recharge the cells, or exchange for a fresh set of 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 Specifications

Characteristic	AEA Technology E20/20 TDR
	Specification
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 (1.2 m) cable impedance dependent
Output Impedance	95Ω All Connectors
Pulses	
Amplitude	750mV ±50mV (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
	Specification
Display Plots	
Impedance Scales	Z ₀ ±10, ±25, ±50, ±100, 0-500, 500 and 0-1KOhms
Range Scales: Feet Meters	0-10, 20, 50, 50, 100, 200, 500, 1,000, 2000, 5,000, 10,000, & 20,000 ft 0-2, 5, 10, 20, 50, 100, 200, 500, 1,000, 2,000, and 5,000m
Cursors	2 with independent distance & 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-to-Pk, 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
Trace Export	USB-Serial. AEA supplied PC software and USB Cable included
Characteristic	AEA Technology E20/20 TDR
	Specification
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 will reduce operating time
AC Power	100-240VAC, 50-60 Hz
DC Power	13.2 VDC minimum
Physical	
Size	8.5" (216mm) x 4.3" (109mm) x 2.25" (57mm)
Weight	2.2lbs (1Kg) with batteries & belt case
Environmental	
Operating Temperatures	-18° to 50oC (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 48inches (122cm)

*Refer to the Operators Manual Appendix E for extreme cold weather operations

Refer to the Operating Manual located on the E20/20 TDR CD or download from <http://www.aeatechnology.com/software/manuals>.

E20/20 TDR Accessories

The following is a list of E20/20 TDR replacement an optional accessories available at the time of printing. To see the complete list of accessories, description and pictures visit our web site, position mouse pointer on **the tool bar at “Products” and click on “Accessories” in the drop down menu.** www.aeatechnology.com.

Replacement Accessories

<u>Item</u>	<u>Part Number</u>
Belt Case	5001-1002
Soft Carrying Case	6015-1002
AC Adapter	5001-0202
DC Vehicle Adapter	6025-0250 (all models except Avionics Kit)
8 AA NiMH Cells	0010-0218
USB Cable, A-to-Mini B	0070-1208
Quick Start Guide	6021-3010
Basic Guide	6021-3020
E20/20 TDR CD	6021-1220
Telco Test Leads	6020-0250 (specific models only)
F Test Lead with Quick Connect	0070-1230 (specific models only)
BNC-to-Alligator Clips	0070-1221 (specific models only)
F-to-Alligator Clips	0070-1230 (specific models only)
N-to-BNC Adapter	0070-1190 (E20/20N model only)
BNC Coax Test Lead	0070-1500 (Avionics Kit only)
RJ45-RJ45 Test Lead	0070-1219 (Avionics Kit only)
BNC-to-Pins & Sockets Lead Set	6021-3020 (Avionics Kit only)
Certification of Calibration with data	6000-0403 (Avionics Kit only)

Optional Accessories

<u>Item</u>	<u>Part Number</u>
Hard Carrying Case	6015-1003 (all models except Avionic Kit)
F Test Lead with Quick Connect	0070-1230
BNC Test Lead	0070-1500
RJ45-RJ45 Test Lead	0070-1219
N-to-SMA Kit	6025-0260
N-to-TNC Adapter	0070-1134
N-to-SO-239 (UHF) Adapter	0070-1195
DC Power Extension Cable	0070-1200
USB Extension Cable	0070-1210
Certificate of Calibration with data	6000-0402 (must be ordered with the TDR or the TDR returned for calibration)
Certificate of Calibration with before and after data	6000-0403 (TDR must be returned for calibration)



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