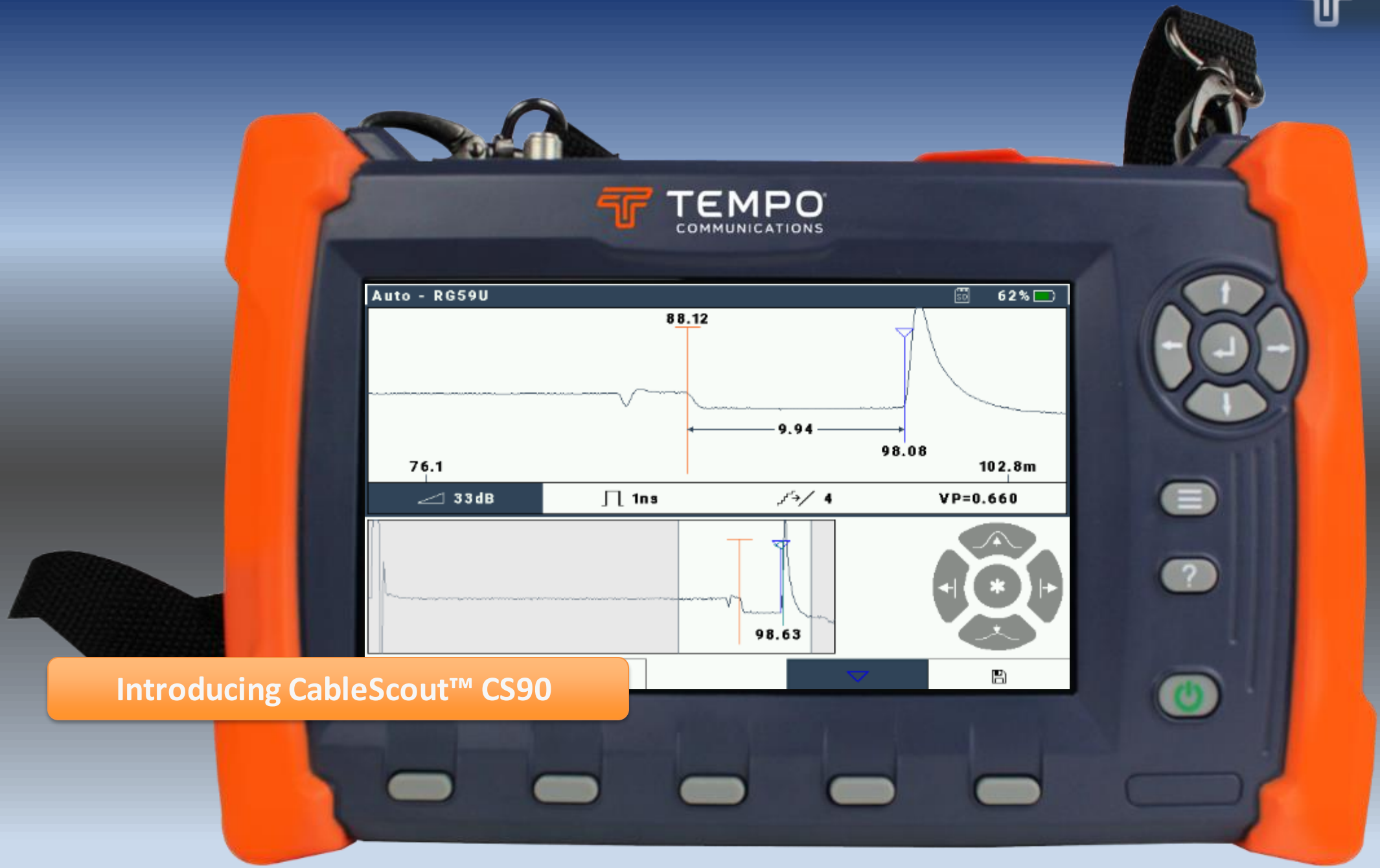


Introducing CableScout™ CS90

Features

- Large, Color, ***HiRes*** Super Backlit Display
  - ❖ **Readable in Bright Sunlight Conditions**
- Splash, Dust and Shock-Resistant Packaging
- Zero Dead Zone
- 1, 5 and 25 ns pulse withs are standard
- ***FastFind™*** event/cable-end detector
- Protected 75Ω F Connector
- Intermittent Fault Locator Feature
- User Selectable Language Menus
- Context- Sensitive
  - ❖ **Help Screens Available for all Functions**
- Small Portable, Lightweight Package
- Library of Cable Types for Fast, Accurate Testing
- Rechargeable Lithium Ion Battery for 8+ hrs of use
- Overiew Window Shows Entire Cable, speeds navigation
- Narrow Pulse Width Enables Near-End Fault ID

Benefits

- Locate Damage in Drops & Defective Passive Devices
- Find Impedance Mismatches
  - ❖ **Corrosion, Water Ingress or Cable Type Changes**
- 1 ns Pulse Width for Precision
- Determine Length of Cable

TEMPO COMMUNICATIONS

Output Pulse
- *Shape: ½ Sinusoid*
- *Widths: 1, 5 or 25 ns*
- *Impedance: 75 Ω*
- *Voltage: >4V peak*

Connection
- *F-connector; male bulkhead with female barrel adaptor for protection*
- *Surge protection: ±400V peak*

Performance
- *Input filtering: 1, 2, 4, 8, 16 or 32 averages*
- *Horizontal resolution: 204 ps (approx. 3” or 75 mm)*
- *Maximum range: 2.9 km (9.5 kft) @ Vp = 0.93*
- *Display resolution: 800 x 480 full colour*
- *Display size: 180 mm (7”) diagonal*
- *Backlight brightness: up to 1000 nits (sunlight viewable)*

General
- *Result Storage: SD Card (included) or USB drive*
- *Battery type: Lithium Polymer*
- *Battery Capacity: 30 Wh (>8 hrs use @ typical brightness)*
- *Battery management system ensures maximum lifetime*

Physical
- *Size: 262 x 162 x 55 mm (10.3 x 6.4 x 2.2 inches)*
- *Weight: 900 g (2.0 lb)*
- *Operating Temperature: -20 to +50 C (-4 to +120 F)*
- *Battery charge temperature: 0 to +30 C (32 to 86 F)*
- *Storage temperature: -30 to +60 C (-22 to +140 F)*
- *Standard & Base kits are supplied in a “shoulder bag” with sufficient space for all accessories.*
- *Individual kits are normally supplied in a corrugated card box, approximately 34 x 24 x 28 cm, weight 2.9 kg.*

Why CableScout™ CS90?

Designed specifically for Cable TV and other 75Ω coaxial cable applications, the CS90 applies the newest technology to provide both ease of use and coaxial cable testing performance not found in any other TDR.

- Simply select the cable type to be tested and the CS90 does the rest.
- Pulse width, Vp, gain, and vertical position are automatically selected and adjusted
- As you scan the cable. Move the cursor to the fault and use the one-button zoom function to pinpoint its location.
- The CS90 uses a 1ns pulse width for close-in resolution.
- Faults as near as 3 feet from the test point are located with ease.
- Optimized pulsing and sampling, coupled with advanced filtering and signal-processing techniques provide a clean waveform for easy event identification.
- Works perfectly on twisted pair and 50Ω cables (allow for a little loss at the launch).

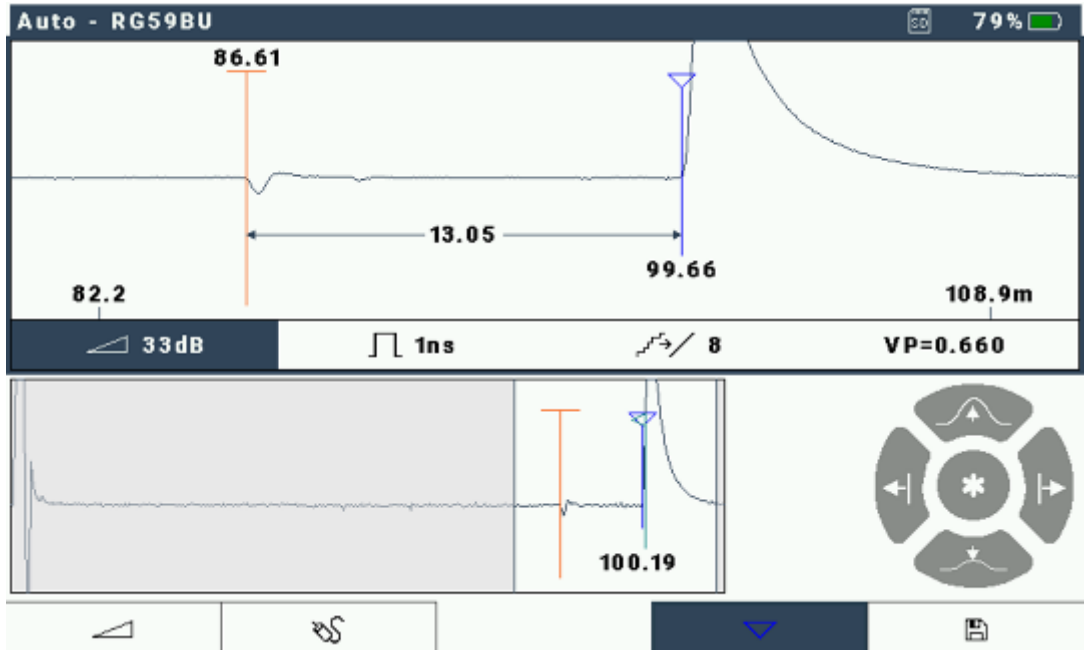
Applications

- Find location of damage in drops
- Find impedance mismatches
- Locate bad passive devices
- Determine length of cable
- Poorly Terminated Connectors


Weather resistant cover
12V DC power
SD Card Slot
USB A for flash-drive

CS90 Front Panel Controls

- **Power:** This button turns the instrument on and off. Settings are retained with power off.
- **Help:** Press ? to display detailed information on the current display and the operation of the controls. Press HELP a second time to remove the help display.
- **Menu:** Press the ≡ button to setup options:-
  - Display backlight brightness
  - Auto/manual mode
  - Live or Intermittent mode
  - Backlight timout
  - Auto power off timeout
  - Units (ft, m, ns)
  - Vp units
  - Language



CS90 Front Panel Softkeys & Connector

- **Five Softkeys:** Located across the bottom of the LCD.
  - These are called softkeys because their labels are displayed on the LCD.
  - Their functions vary according to the instrument function.
- **Softkeys let you:**
  - 1) change functions or modes,
  - 2) select a menu item, and
  - 3) turn functions on and off.
- **Left, right, up, and down arrow buttons** serve the functions of moving the cursor or active window left and right across the displayed waveform, changing values and raising or lowering gain, or scrolling through a menu.
- The “c-enter” key is used to switch between the “overview” and “detail” windows and select highlighted options
- **F-Connector:** This connector consists of an F-connector adapter for connecting to the cable under test. Always use a “sacrificial” barrel coupler here to ensure long life for the built-in connector.

CS90 Front Panel Softkeys & Connector

- **About Device (within settings)**
  - **Hardware model**
  - **Serial Number**
  - **Firmware and FPGA version**
  - **Hardware revision**
  - **Battery Status**
    - **Battery Status**
    - **Current temperature**
    - **Estimated run time (at current use rate)**
    - **Number of charge-discharge cycles**
    - **Measured capacity**
    - **Current load or charge rate**
  - **Time (and date)**
    - **Date**
    - **Time**

CS90 Main Display Screen

Press the Power button to turn on the instrument and reach the Main Display.

CS90 Main Display

The instrument powers up with the same settings in place as when it was last powered off.

The CS90 is already testing and the FastFind™ function of the overview window should automatically show the extent of the cable within a few seconds.

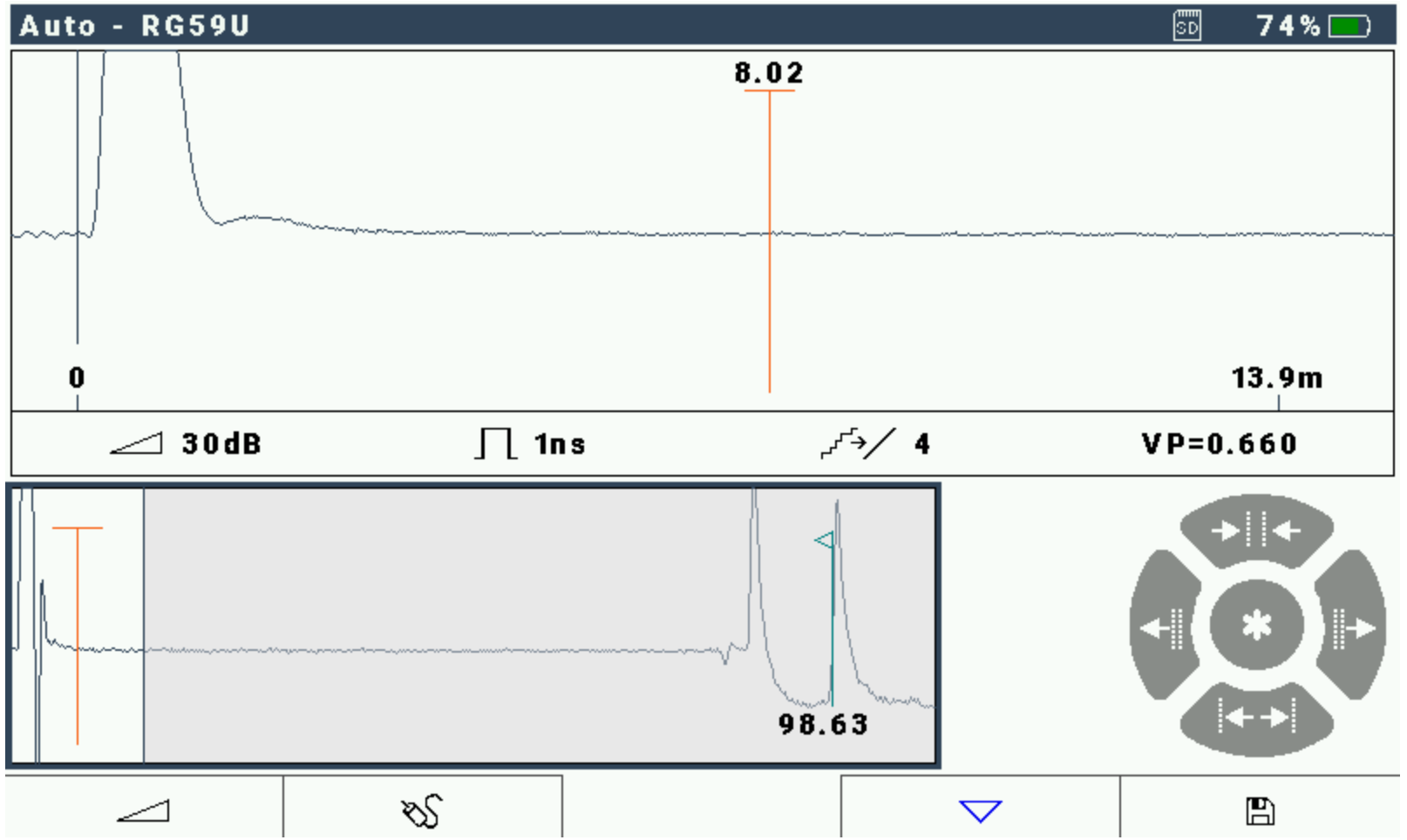
- Press  to select the cable type:
  - The cable type defines the velocity of propagation (Vp) and cable loss per unit length values for the test cable. The latter figure is important for the FastFind feature to work well.
  - Use the up 🡅 and down 🡇 arrows to highlight the cable type to be used
  - Press ✓ to select the cable type and return to the test screen

Testing a Cable

In Auto mode:

Pulse width, gain, and vertical position are automatically adjusted as you scan the cable.

The overview window in the lower half of the display is active, allowing you to quickly move the window of interest to any event along the cable. Starting from the near end



Here the lower overview window is still active and the ← → keys were used to “move” to the area of interest.

More detail can now be seen in the upper “detail” window within that highlighted area.

To zoom in use ↑ to zoom out use ↓

Press ↵ to switch windows

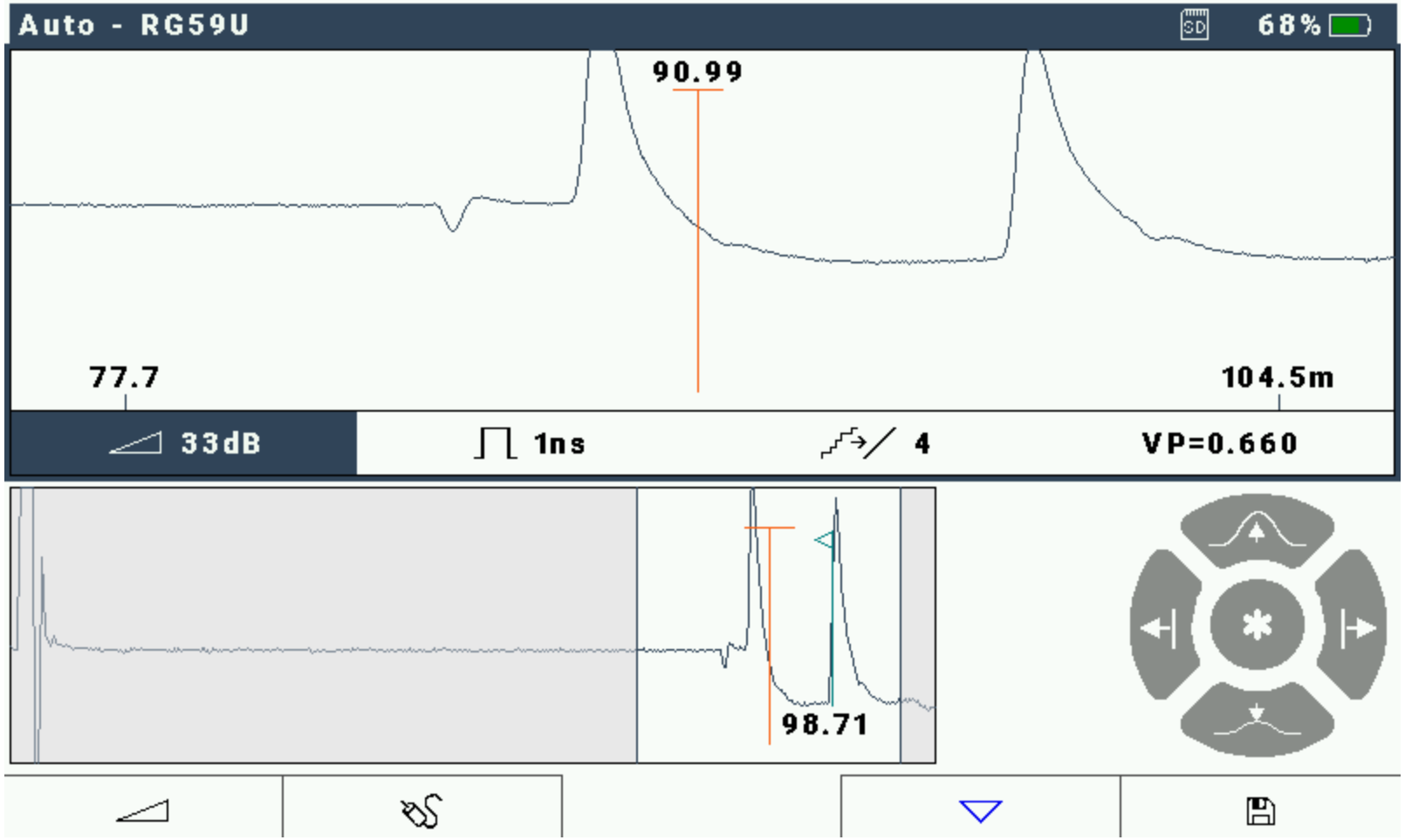
Now the upper “detail” window is highlighted.

As the unit is in “Auto” mode, don’t worry about gain or pulse width.

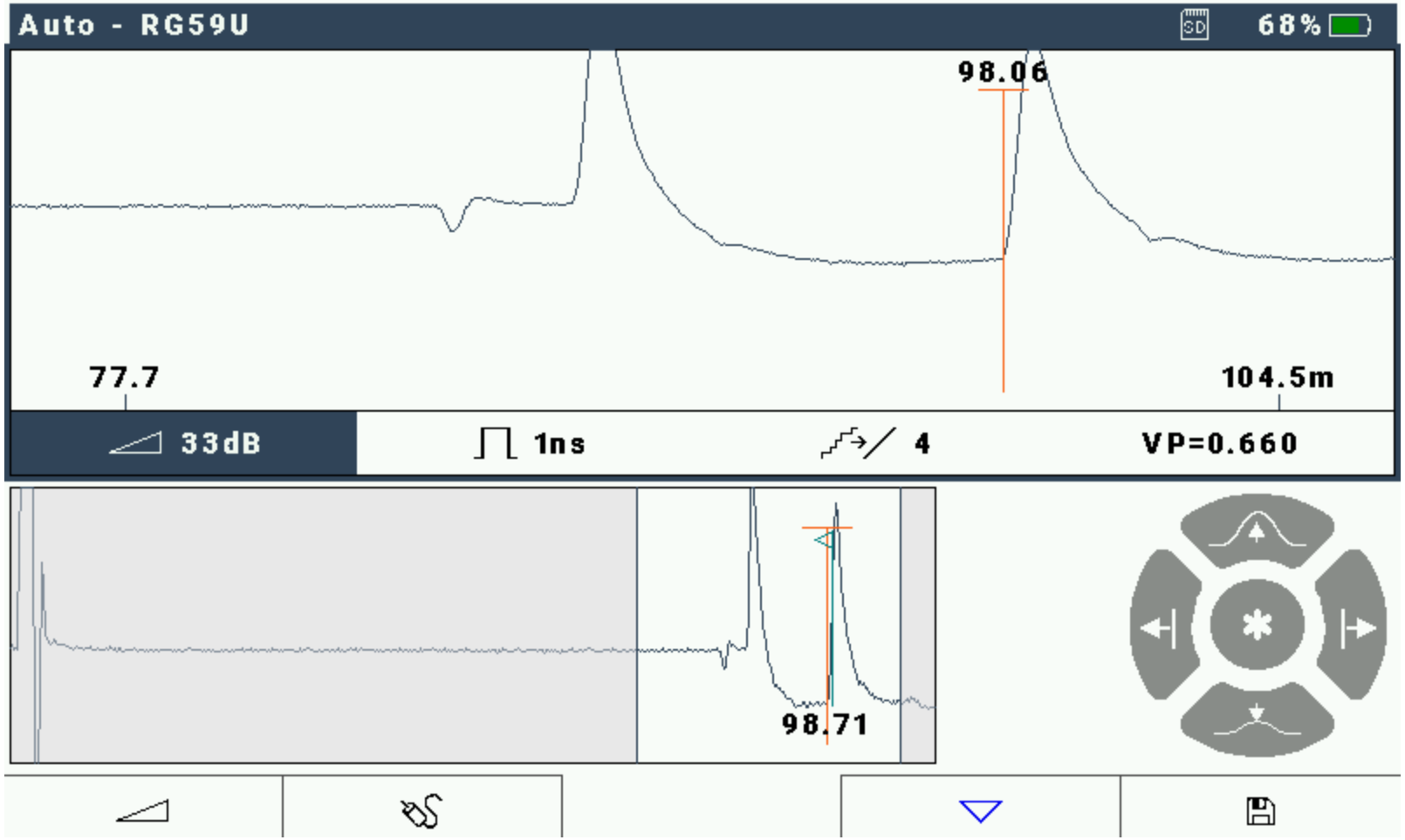
Use the ← → keys to “move” to the cursor to a point of interest.

Remember it is the start of an event that is important.

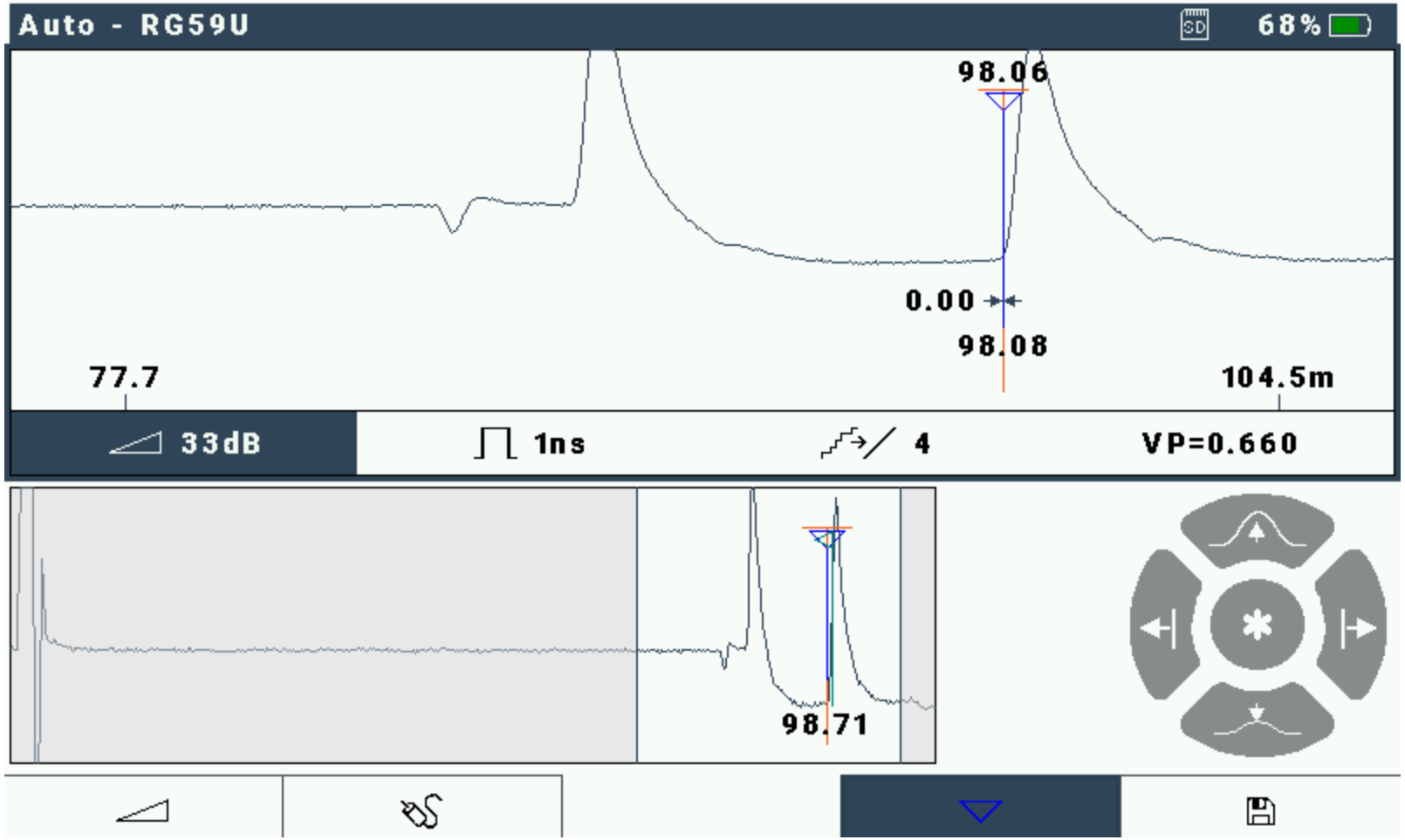
Use ↑ and ↓ to adjust gain (vertical size)



Here we've used the ←→ keys to place the cursor at the end of the cable.

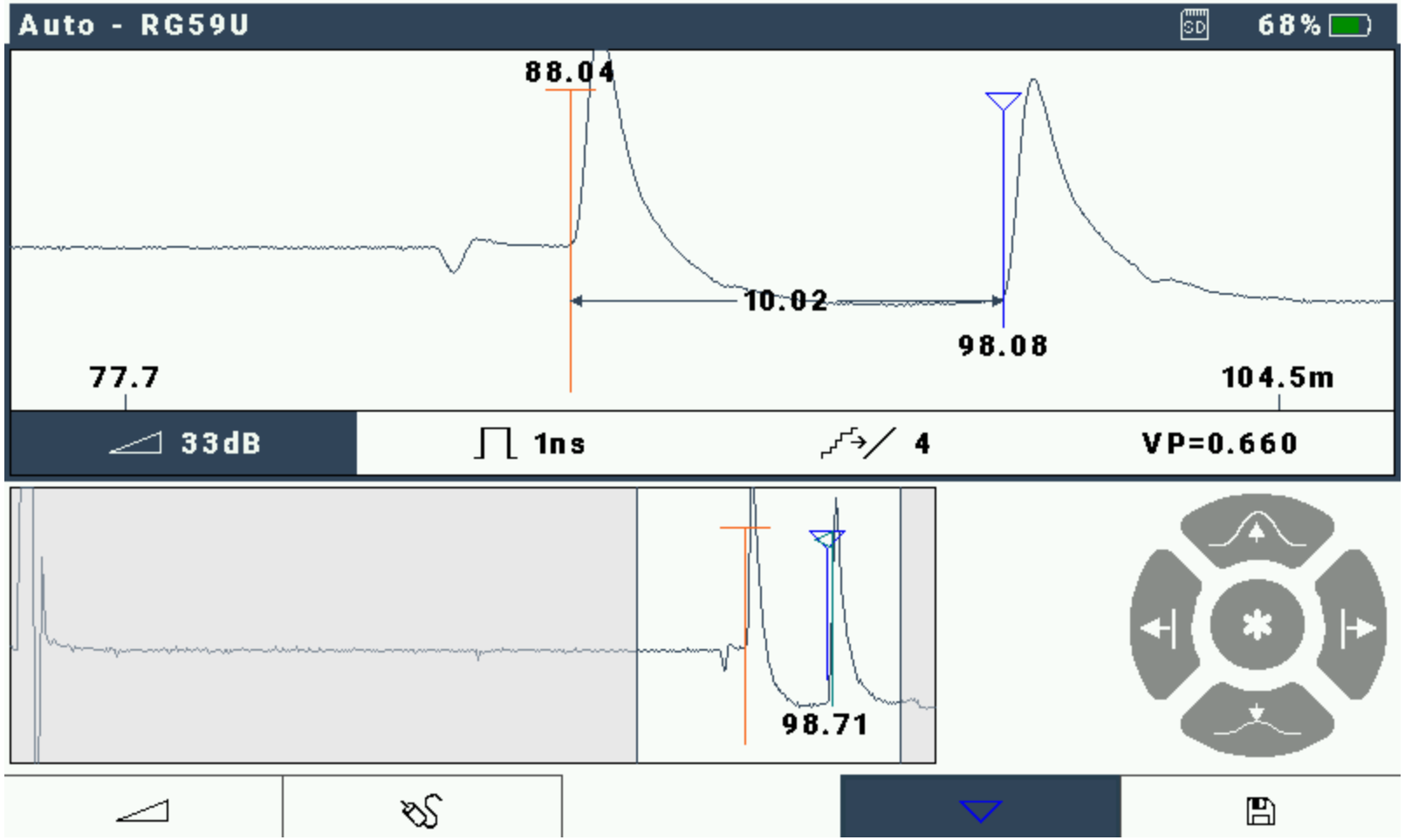


Now we have pressed the ▼ key to place the reference marker at the current cursor position.



Then use the ←→ keys move the cursor to another point of interest. Here I've placed it at the last splitter.

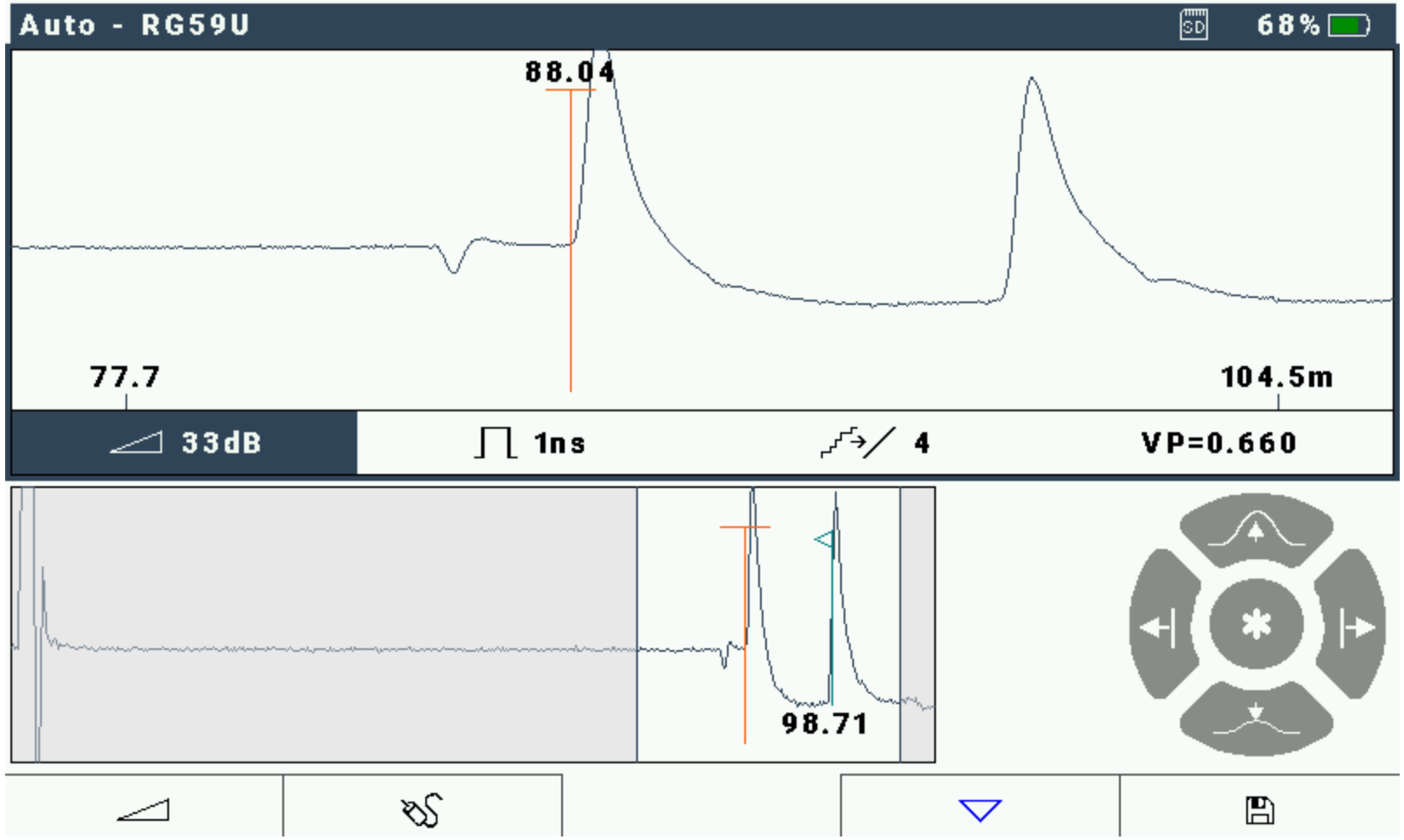
You can see that the distance between the marker and cursor is clearly shown on the dimension line between the markers in the currently chosen units (here that is metres).



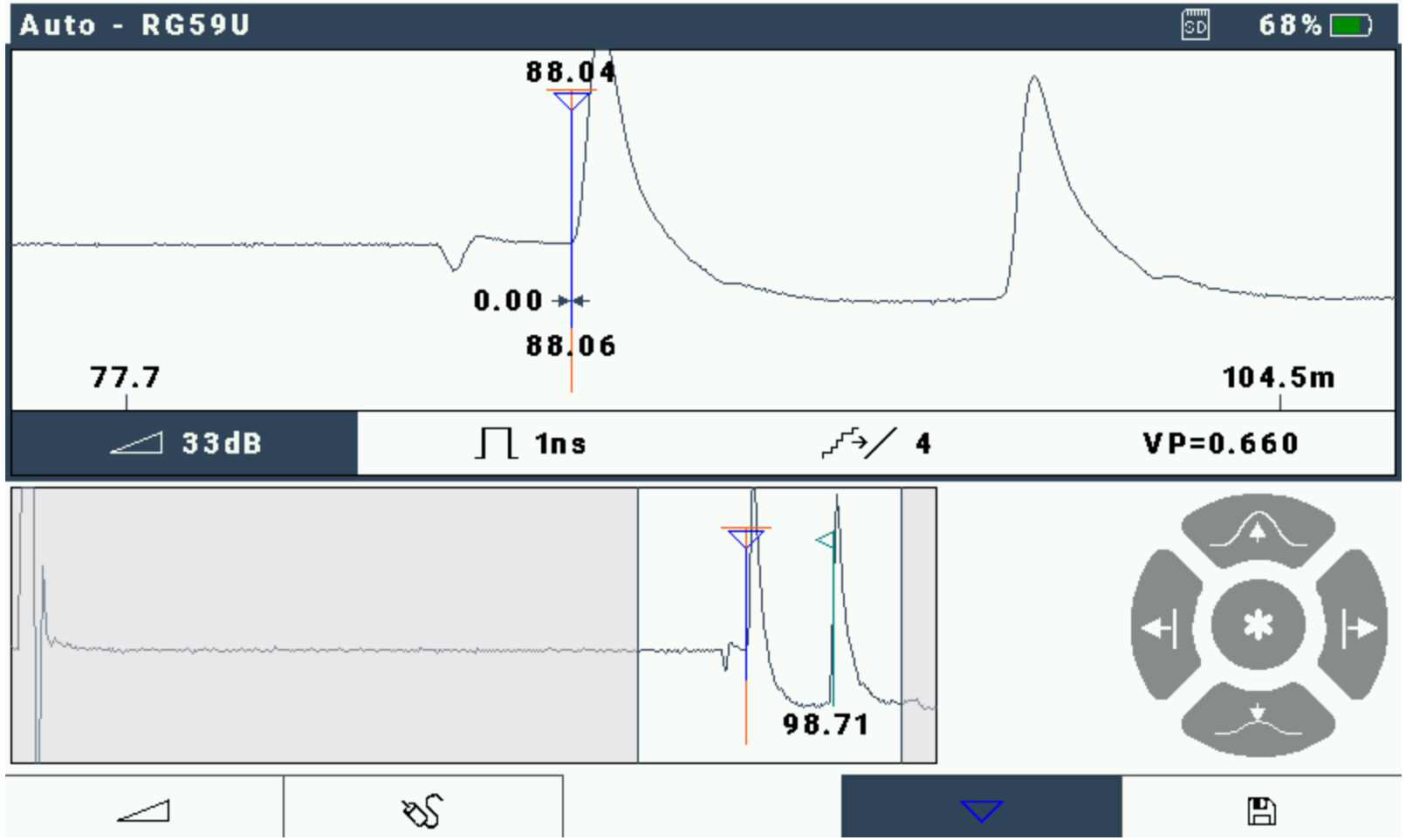
To clear the marker and all the measurements from the screen simply press ▼ again.

Now only the cursor remains on the screen at the same position. This can then be used to set a new reference to try to locate that “dip”.

Press ▼ again…



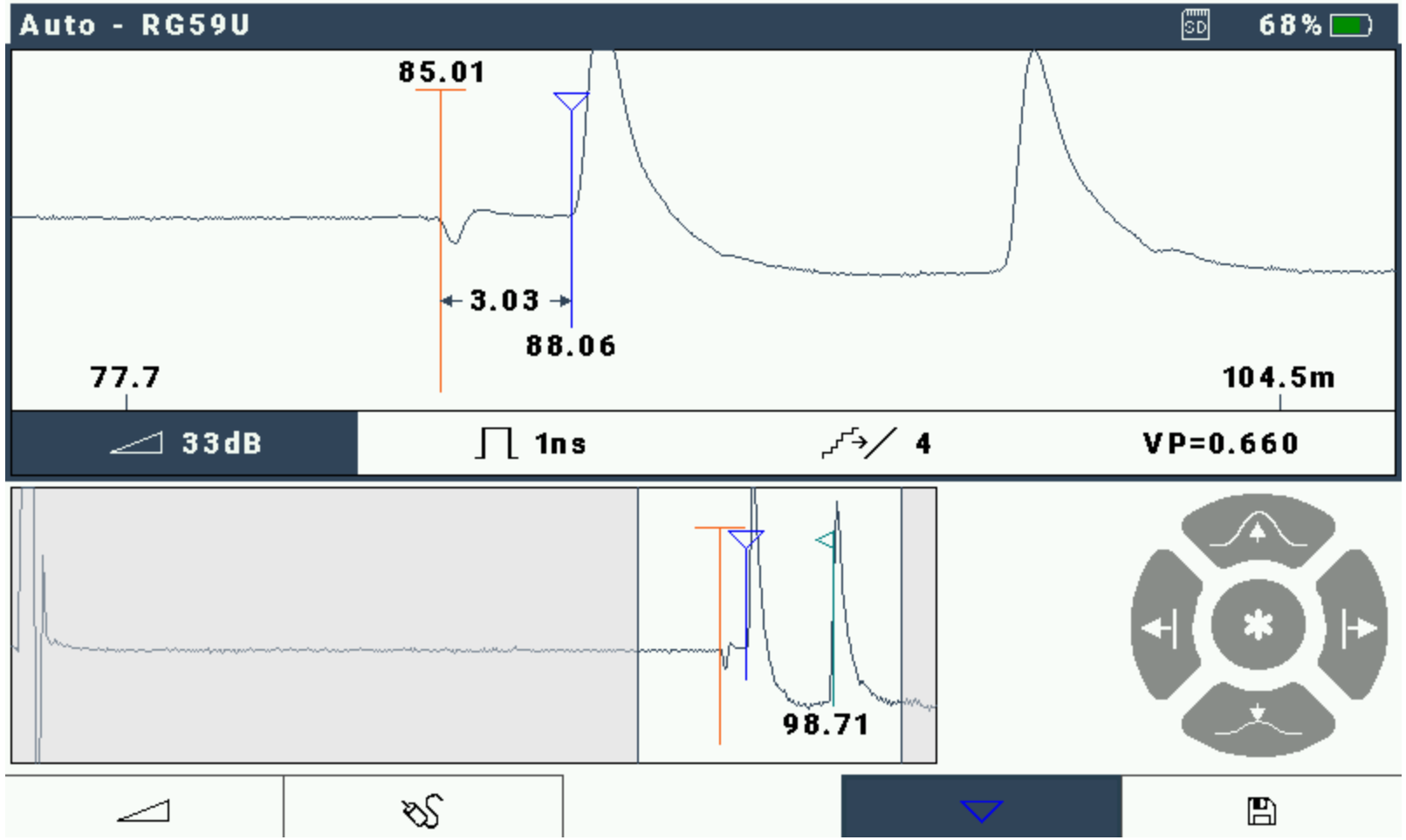
Now the “marker” is set at the new cursor position…



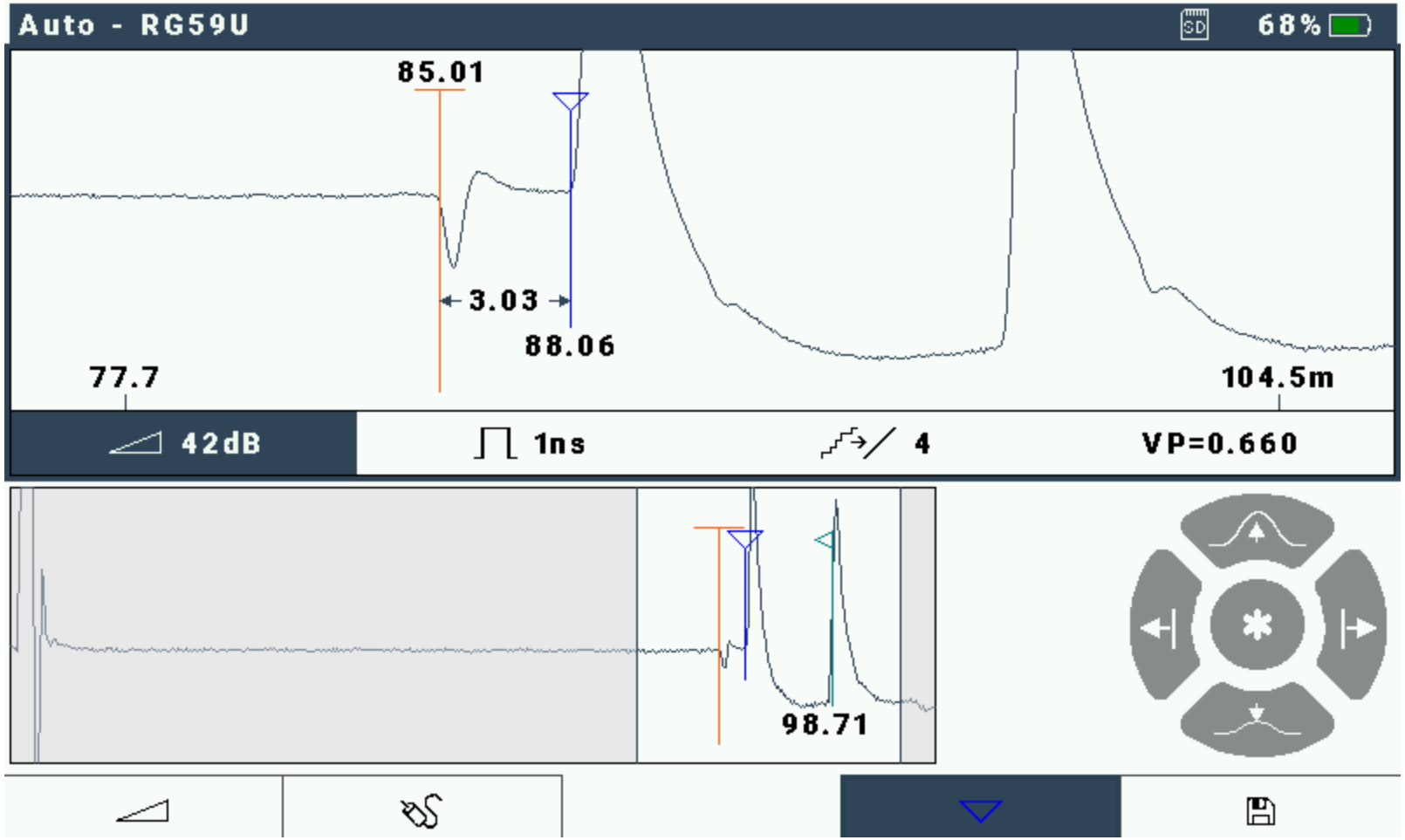
Move the cursor using the ←→ keys and read off the distance to the “dip”.

3.03m

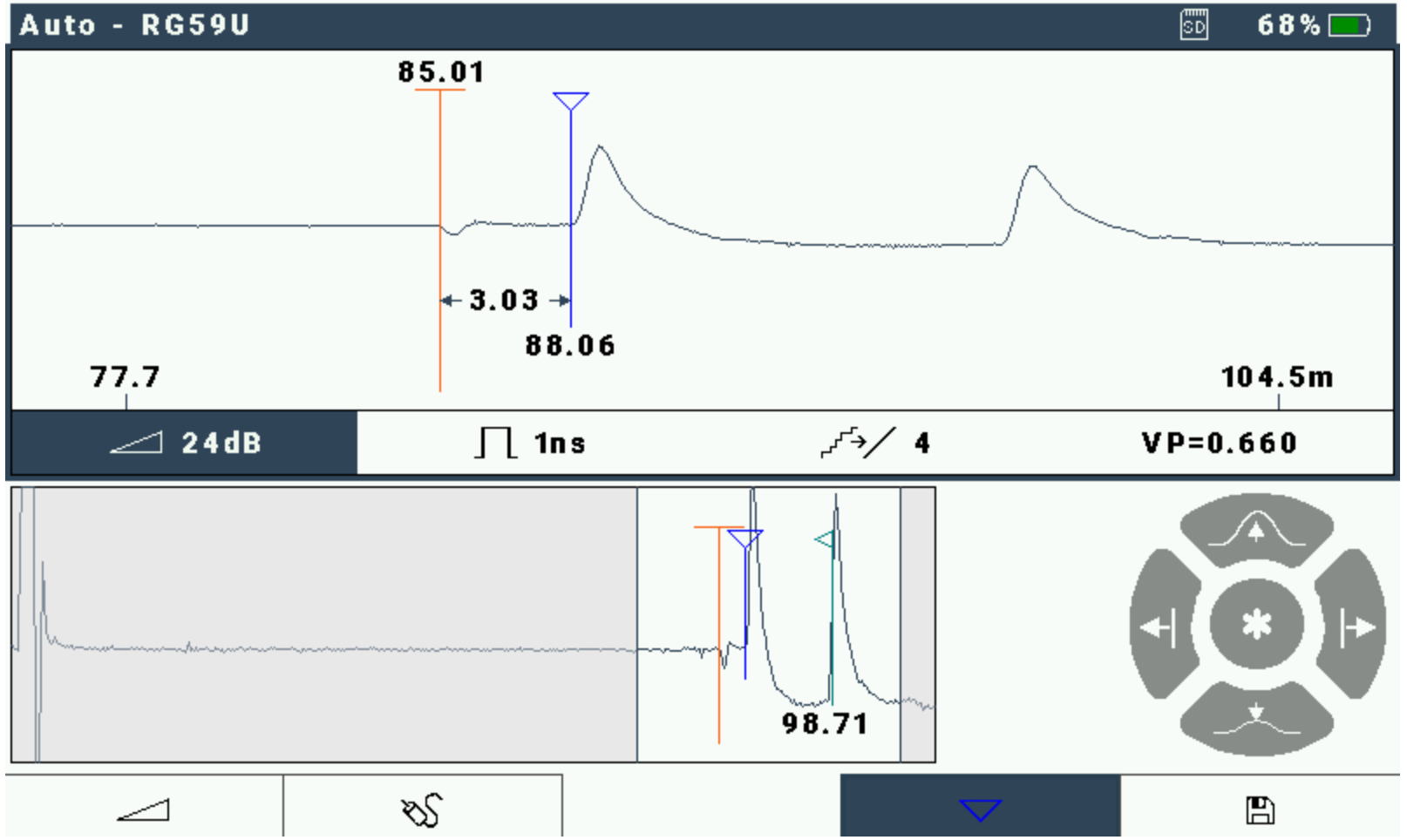
It takes far longer to explain than to do.



If you suspect that “auto” mode is not showing something, you can use the ↑ key to increase gain.



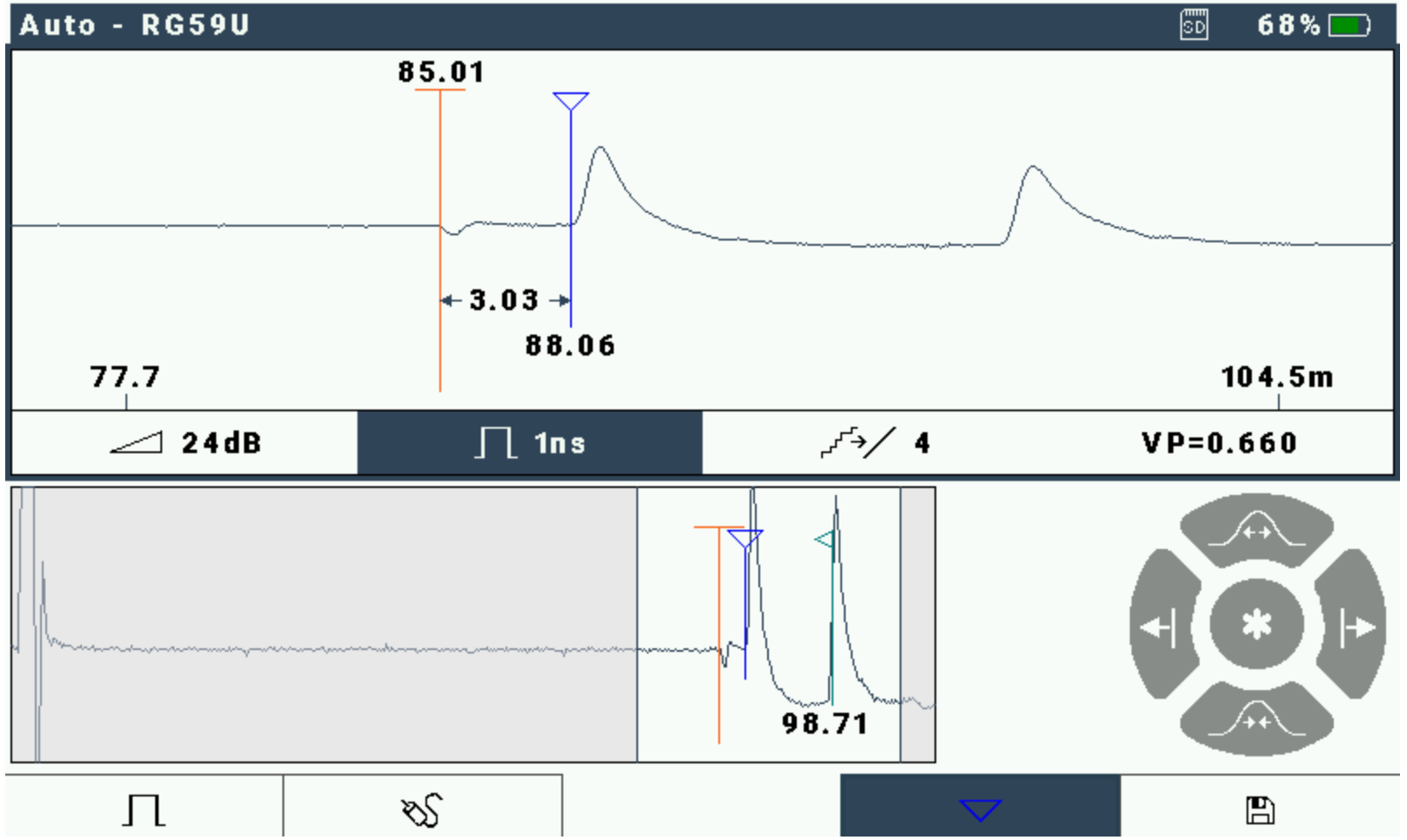
Or use 🡻 to reduce gain if something is saturating.



Press the left-most smart button, shown as the wedge here.

That will move the “manual adjustment” to “pulse width”, you can then use the ↑ and ↓ keys to widen or narrow the pulse being used.

The third option is for filtering. The last option for tuning the VoP.



Screen-shots

First ensure that a correctly formatted (FAT32) SD Card or USB drive is inserted.

With the trace showing the are of interest simply press the “c-enter” key ↵ and the leftmost “smart button” below the screen.

The file will automatically be named according to the current date and time.

Saving Complete Traces

First ensure that a correctly formatted (FAT32) SD Card or USB drive is inserted.

With the trace showing the area of interest simply press the right-most “smart button” below the screen with the floppy disk icon.

Then press “save” (or load to recover an earlier trace)

Choose the destination; SD Card or USB flash drive. Whether to save the current trace or a complete scan of the cable. Enter a suitable filename and any notes that are relevant.

Press “Save” (right-most smart-button).

Other Applications:

CS90 is targeted at 75Ω CATV COAX cable testing BUT can be used for:

- 75Ω satellite LNB downlink cables
- 50Ω COAX, e.g. antenna feed cables
- Twisted Pair (e.g. telephone or structured cabling, industrial control)
- Piezoelectric detection cables
- Underfloor heating cables
- Even use it to check lengths of cable on drums

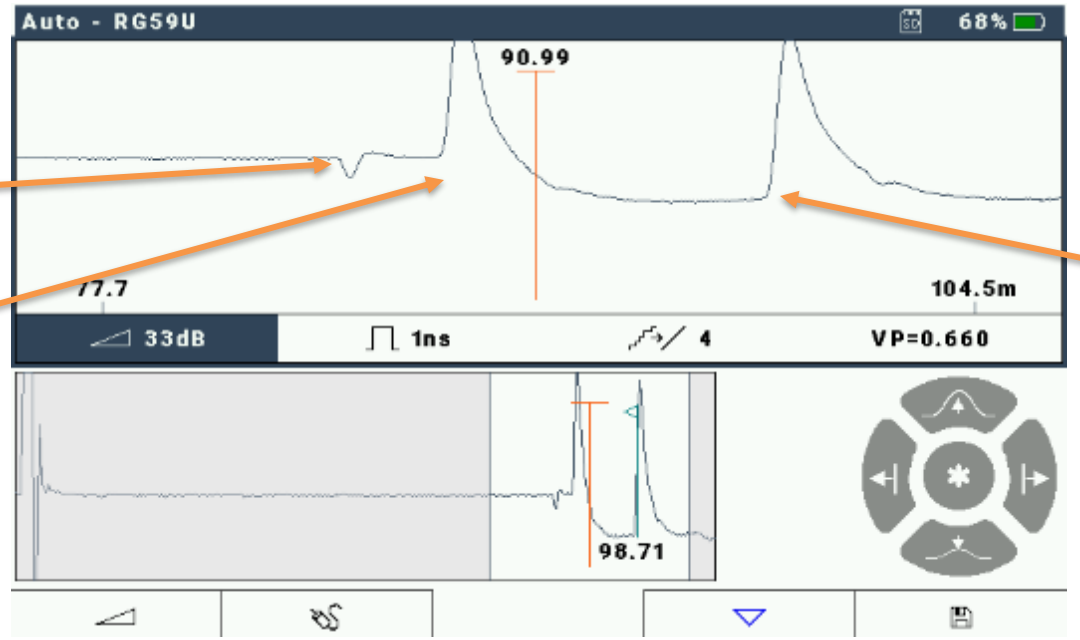
The fact that the CS90 has a 75 ohm output impedance means that when connected to other cable types there will be a small reflection (insertion loss) of signal. For example when connecting to a 50 ohm antenna feed the insertion loss will be just 0.2 dB showing as an event with return loss of around 14 dB. Please keep things in perspective. Cable matching is important for avoiding noise due to reflections but not critical when testing, provided you're expecting it.

General TDR Training

➢ Time-Domain Reflectometer Principles

- A Time-Domain Reflectometer (TDR) is a device using a principle like radar to measure time and distance over a length of cable.
- A TDR sends out a pulse of energy into the cable and records the reflected energy coming back from “events” along the length of the cable.
- The TDR measures the time taken for the reflections to return and can also convert this into distance along the cable.
- The results are shown as a trace of amplitude vs time/distance on the screen.
- The events that a TDR can detect are normal occurrences such as Taps, Splitters, Couplers, Loop Extenders, etc., as well as accurately pinpointing trouble such as Shorts and Opens.
- A TDR can provide the exact location of the start of the flooded section and a rough estimate of the total amount of cable that is wet.

Time Domain Reflectometer Principles



Low impedance event

Unterminated splitter high impedance event

Open end of cable High impedance event

- The TDR displays a graph of the tested cable with distance (time to reflection) on the horizontal axis.
- The on-screen cursor helps by displaying feet or meters to a point on the cable.
- The vertical axis on the TDR display shows the type and severity of fault.

Time Domain Reflectometer Concepts

Velocity of Propagation (Vp)

A cable's velocity of propagation (VoP or Vp) specification is simply a measure of how fast a signal travels in the cable. It is typically expressed as a percentage of the speed of light.

For example, a cable with a Vp value of 0.85 indicates that the signal is traveling down the cable at 85% of the speed of light. Since a time-domain reflectometer (TDR) is really making measurements in the time domain, the distance accuracy of the TDR is dependent upon having the correct Vp value.

- Pulses travel at different velocities on different cables just as an object travels at different speeds through different fluids.
- Vp varies between cable types, sizes, and manufacturers, and is mostly influenced by the type of insulation material and how it is constructed.
- Identifying the correct Vp for the cable being tested is imperative to have accurate distance measurements.

Time Domain Reflectometer Concepts

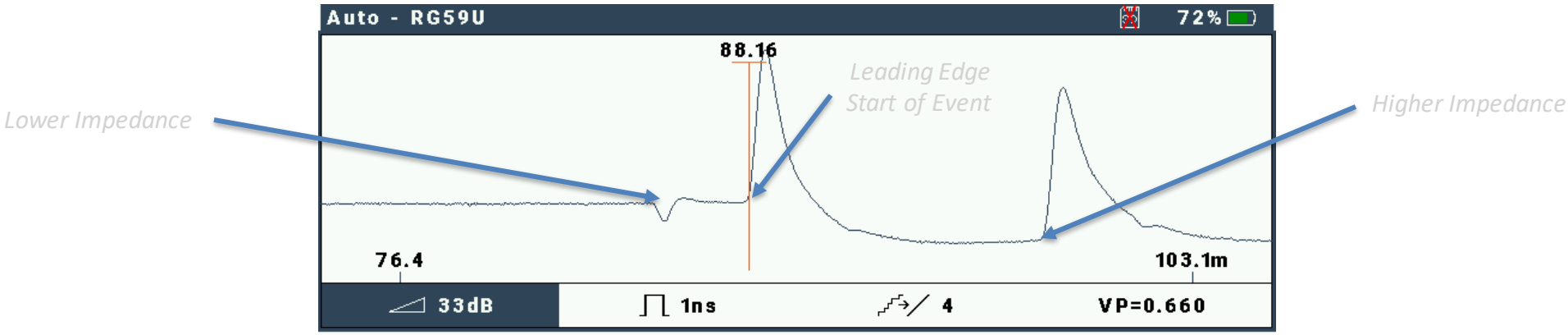
Cable Impedance

- Cable impedance is made up of resistance, inductance, and capacitance inherent in a cable. Reflected pulses are caused by impedance changes.
- TDRs can measure reflections caused by series impedances from several hundred ohms down to a few ohms.
- TDRs can also measure reflections caused by shunt impedances up to several hundred ohms.

Proper Cable Termination

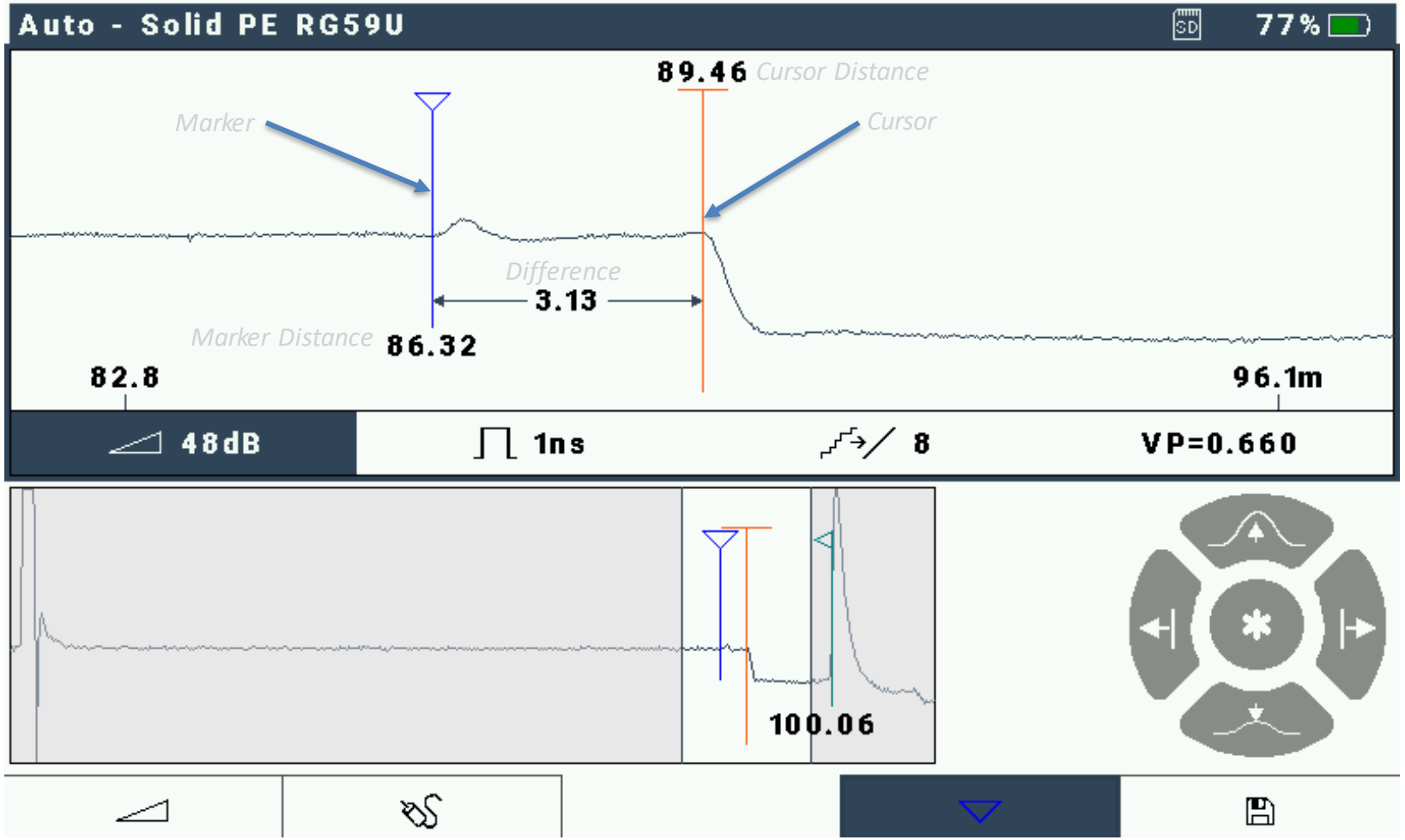
- Cable TV standardizes on 75-ohm termination on all cable ends, taps, and terminations.
- When all ports are correctly terminated, the ability to distinguish faults in a cable is greatly enhanced.
- The 75-ohm termination absorbs the TDR pulse reflection normally caused by an open cable and there should be zero reflection.

Time Domain Reflectometer Concepts (cont'd): Interpreting Waveforms

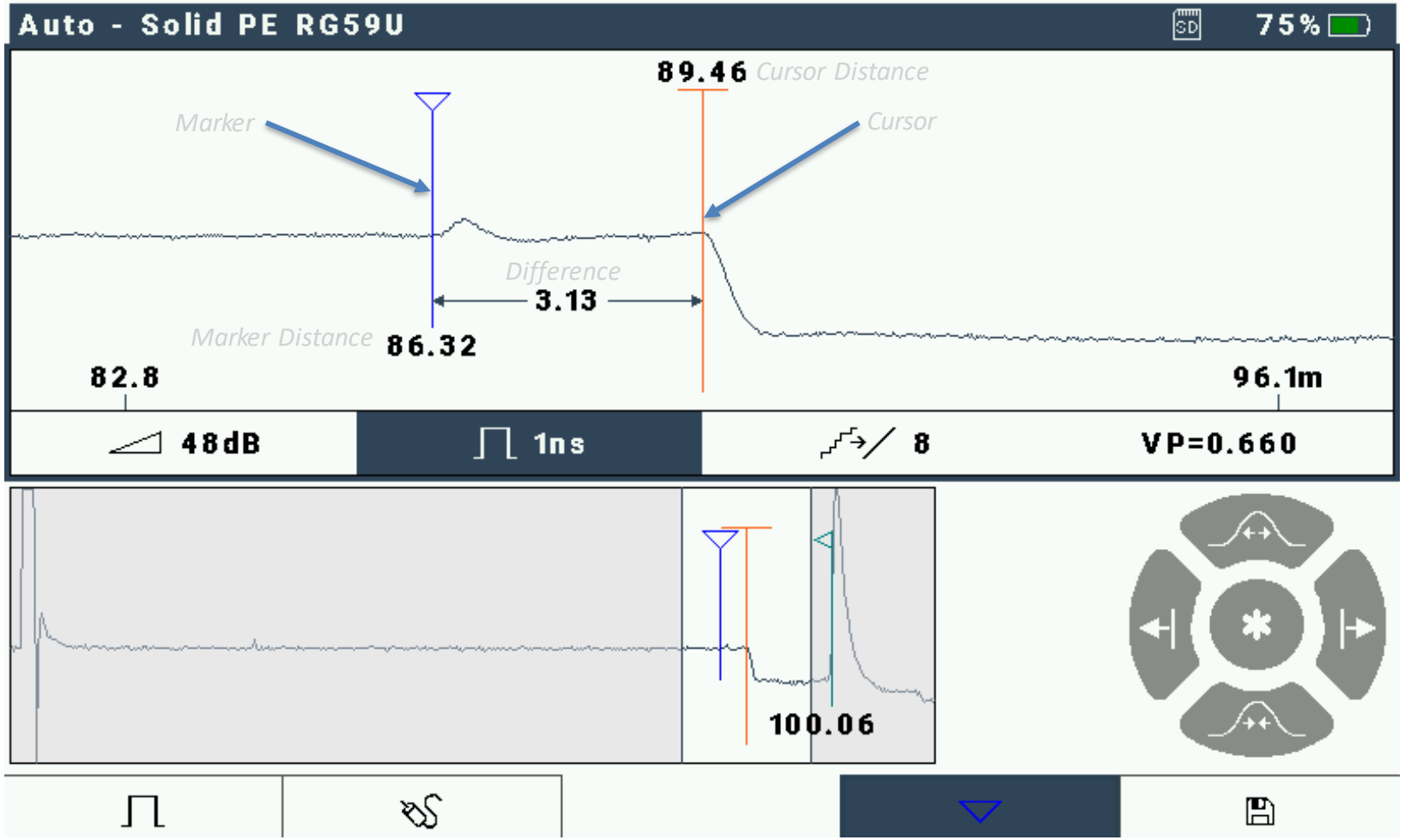


- **Higher impedance**: Will cause a peak to display above the mean position of the pulse reference line.
- **Lower impedance**: Will cause the waveform to dip below the average level of the line.
- **LEADING EDGE**: Indicates where the event is located. The left edge is the precise point where the waveform breaks the plane above or below the pulse reference line. Such as shown by the red cursor line above.
- **MARKER**: A Cursor or Marker can be set at the Leading Edge of the pulse break so that distances can be read on the TDR. Markers may be moved anywhere on the screen to mark distance from the left-hand zero reference point.
- **GAIN**: Acts like an amplifier control. Adjusts the vertical amplitude (height) of the waveform displayed. However, amplitudes that are too high may produce distorted waveforms.

- **MARKER**: A Cursor or Marker can be set at the Leading Edge of the pulse break so that distances can be read on the TDR. Markers may be moved anywhere on the screen to mark distance from the left-hand zero reference point.
- **GAIN**: Input amplifier control. Adjusts the gain of the received signal increasing the “height” of features on the displayed waveform. Beware amplitudes that are too high; they may produce distorted waveforms.

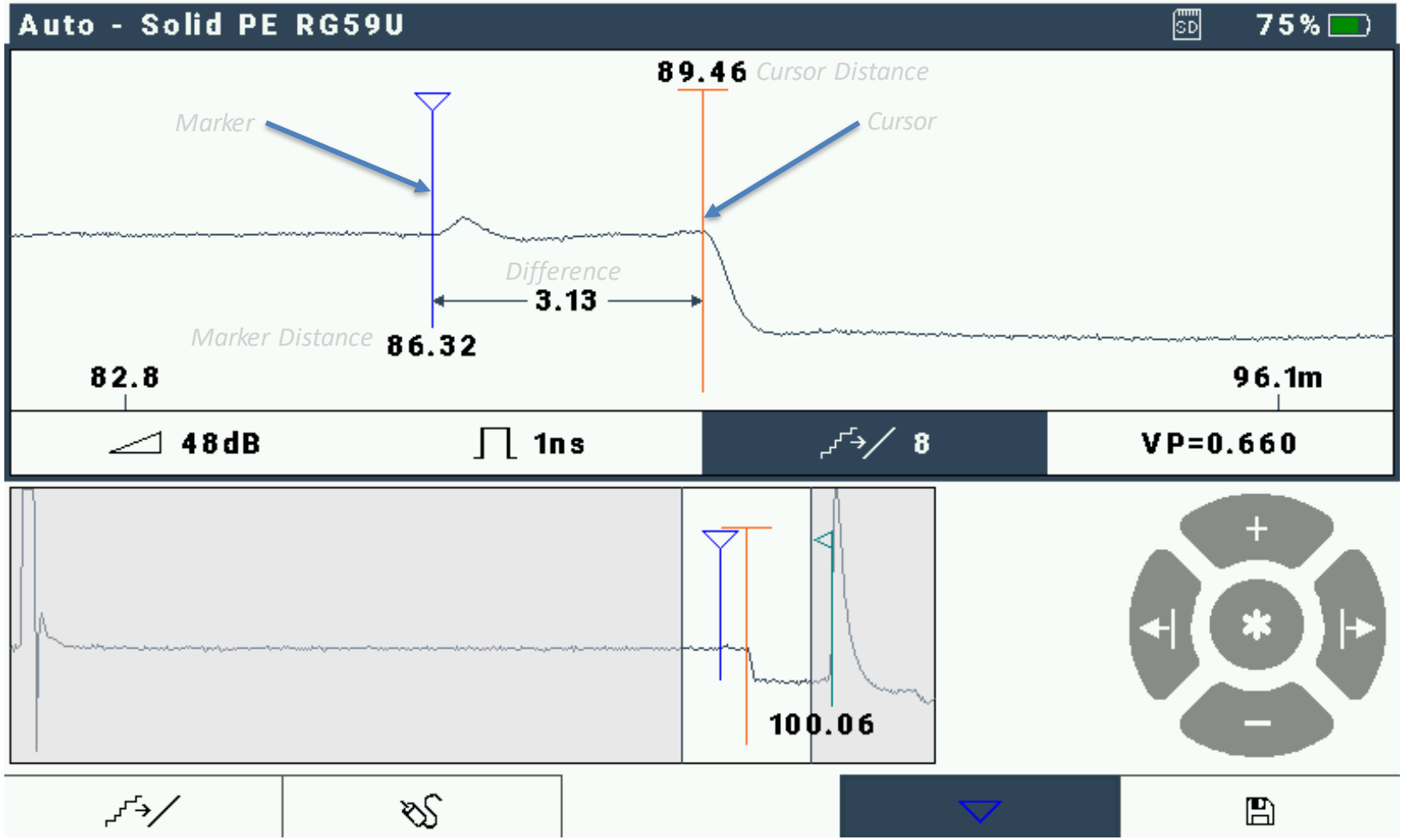


- **FUNCTIONS**: Press the "Select Function" button repeatedly to select which parameter you want to change. Use ↑ and ↓ to adjust:
- Here we've moved from Gain to pulse width.
- The available options are:
  - 1 ns
  - 5 ns
  - 25 ns

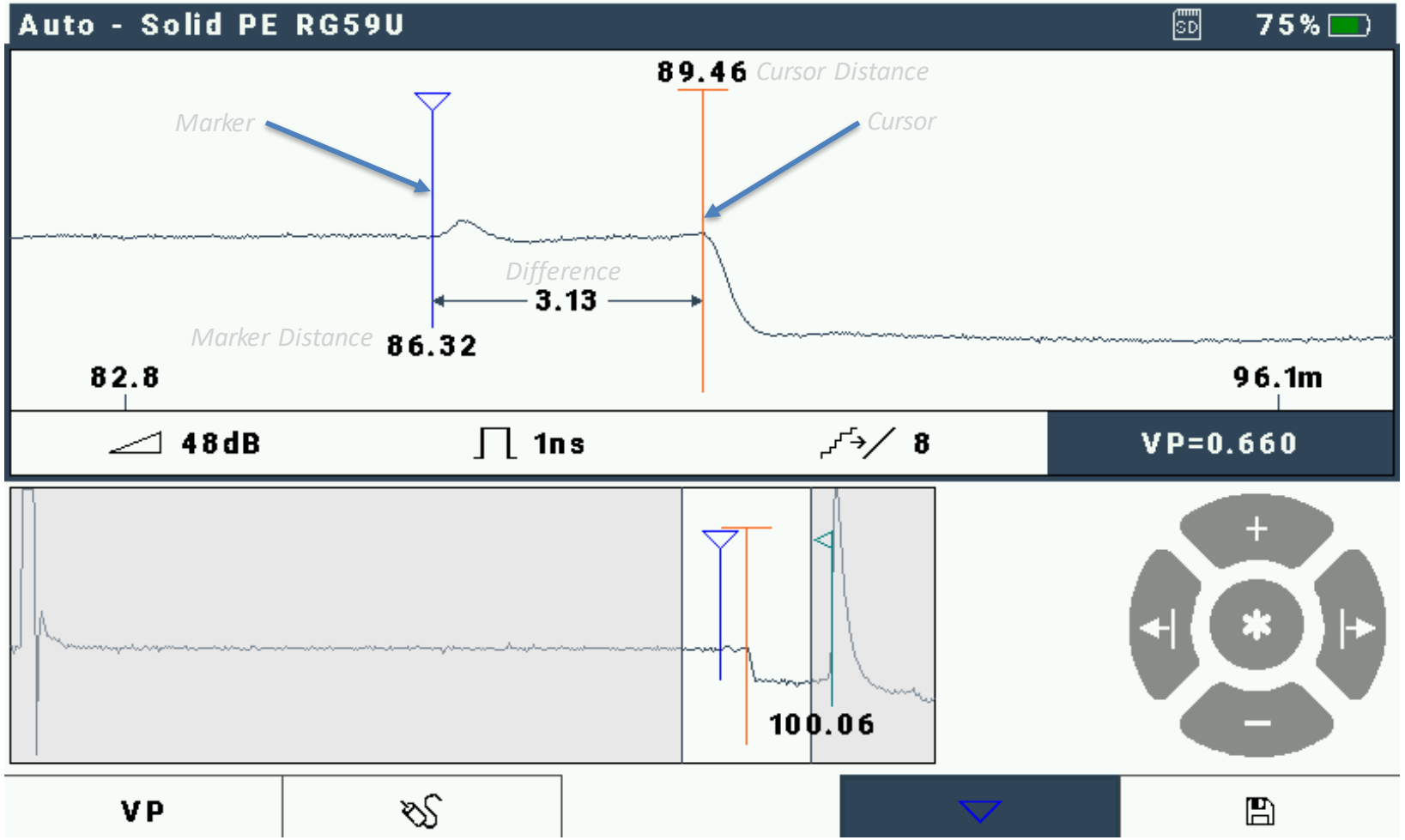


- **FUNCTIONS**: Press the "Select Function" button repeatedly to select which parameter you want to change. Use ↑ and ↓ to adjust:
- Here we've moved from pulse width to Filter.
- The available options are:
  - 1 (no averaging)
  - 2
  - 4
  - 8
  - 16
  - 32

  The larger the number the "smoother" the trace, removing noise, but slower response to intermittent faults.



- **FUNCTIONS**: Press the "Select Function" button repeatedly to select which parameter you want to change. Use ↑ and ↓ to adjust:
- Here we've moved from Filter to Velocity of Propagation (Vp).
- You can adjust the Vp to suit the actual cable being tested for maximum precision of measurement.
  - 0.300 to 1.000
  - This is expressed as a factor of the speed of light in a vacuum.
  - From the settings menu you can choose different ways of expressing this.



Tempo Report Writer
TRW

Interpreting and Reporting on Saved Traces

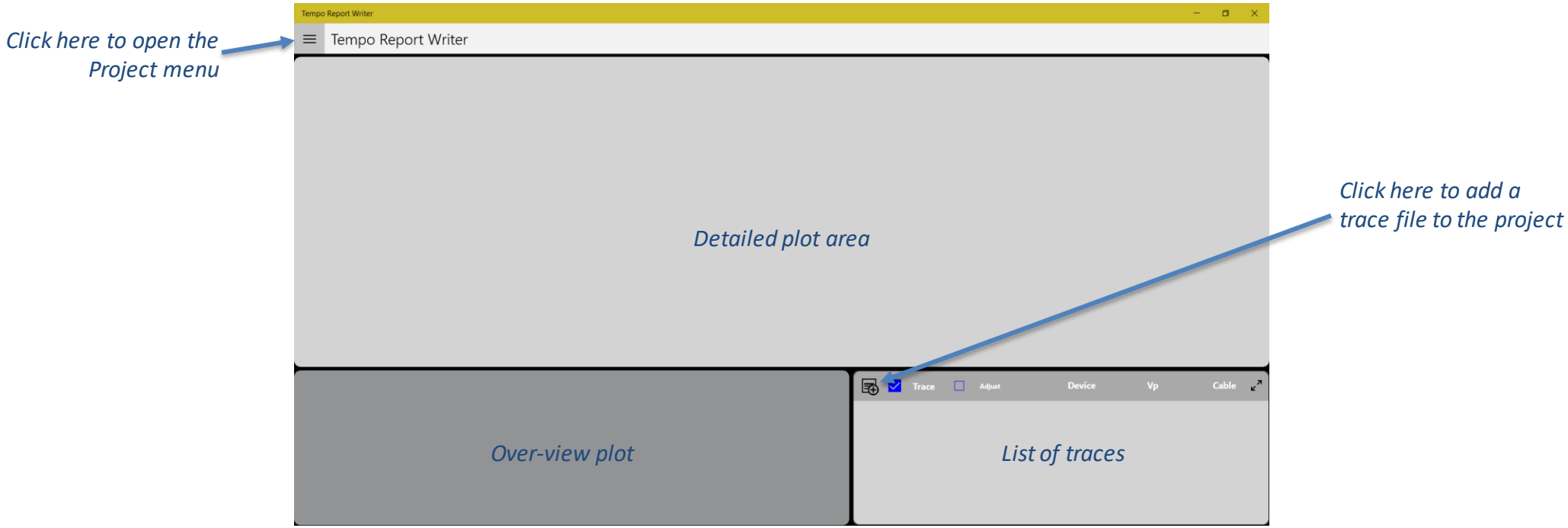
As you saw earlier you can save traces to the SD Card or USB drive. These can be just the section shown “live” on the display window or can be a “full” trace captured throughout the available range of the CS90 from zero to almost 3 km (10 kft) at typical Vp.

If you visit the Microsoft Store you can find “Tempo Report Writer” by searching or following this link:

https://www.microsoft.com/store/productId/9P8NMJ1VZMRK

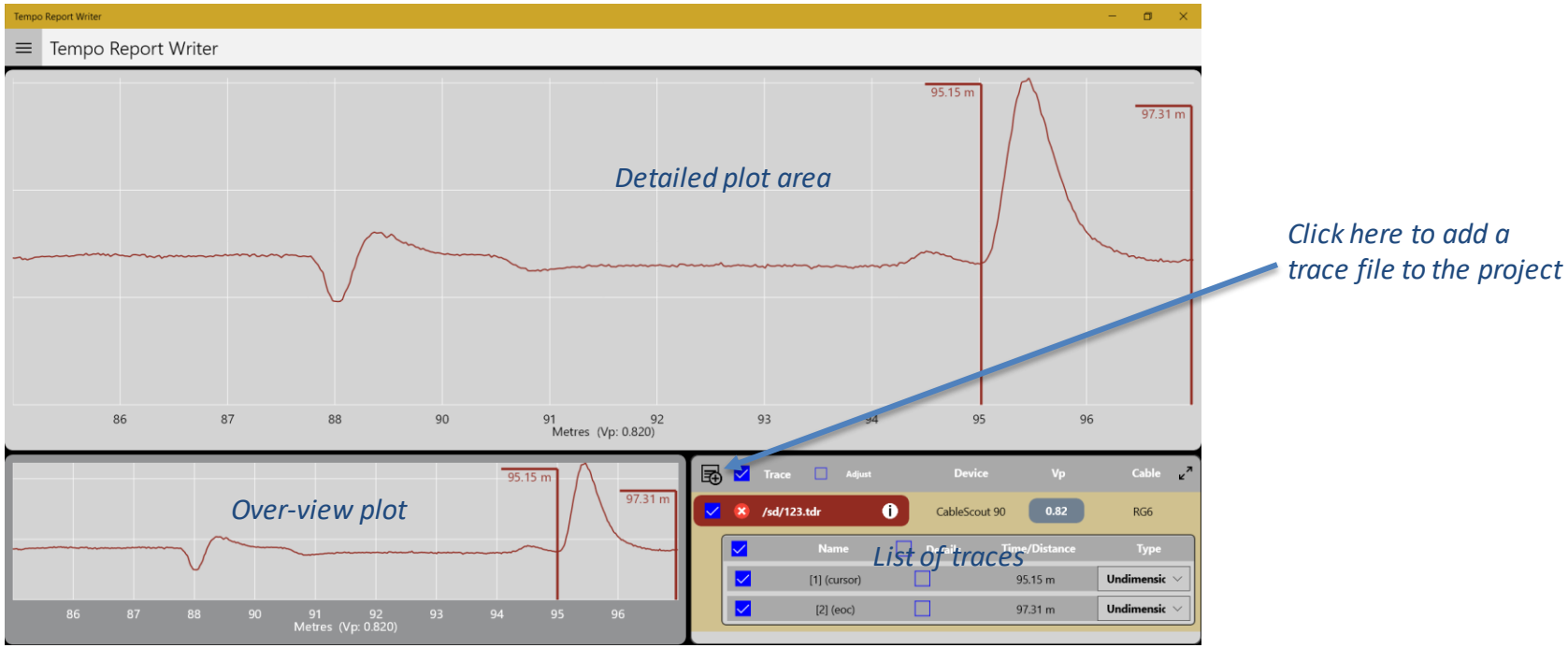
Familiarity – we've tried to keep the user interface familiar…

When you first open the Tempo Report Writer (TRW), you will see that this adopts the now familiar layout of an "overview" trace in a lower window and a more detailed, zoomed in, trace above. The list of loaded trace files is shown in the lower right window.



Loading your first trace…

Click on the add trace button in the top left of the traces list window. Choose a file from your traces' directory (copied using Windows file manager from the SD Card or USB drive).



Setting up the project…

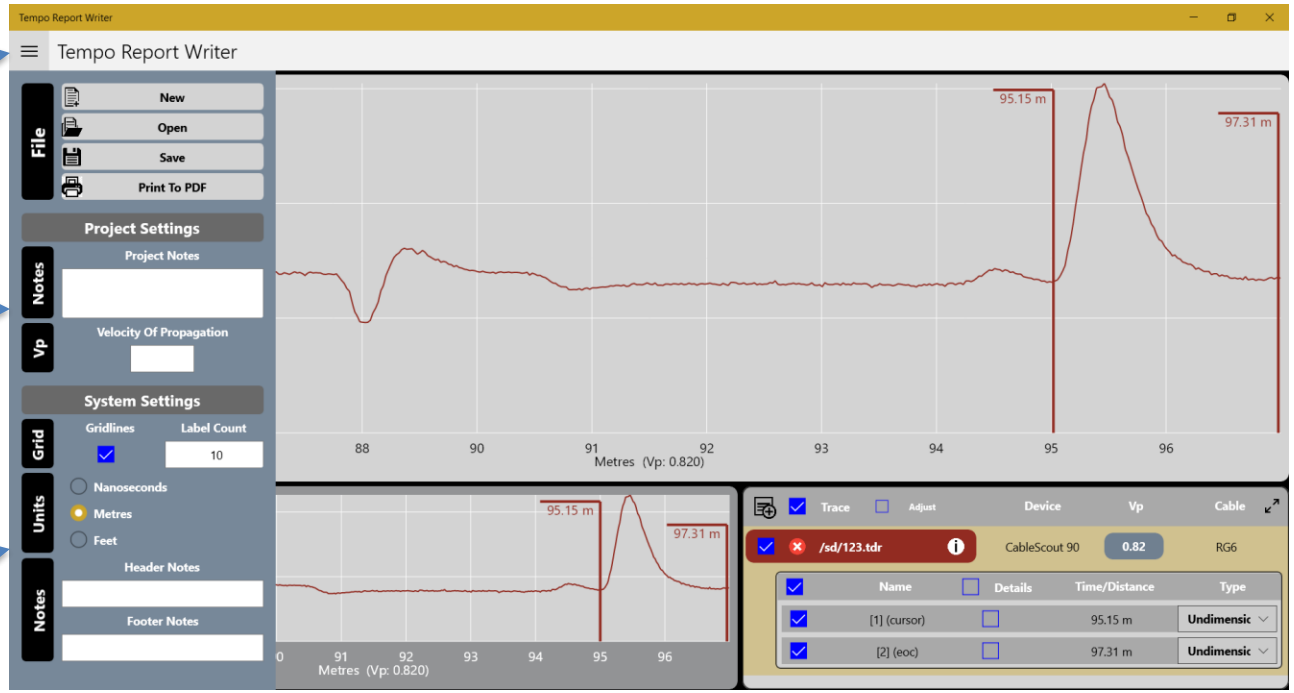
Click on the “Project Menu” button in the top left. From the menu, you can start a new project, open a previously saved one, save the current one or create a PDF report of the current project.

Cursors and markers that were present on the CS90 when saved are automatically shown.

Click here to open the Project menu

Here you can add a block Of notes for the project And adjust the overall Vp

In this section, set common Headers and footers for your Reports, the units you use and Whether gridlines are shown etc.



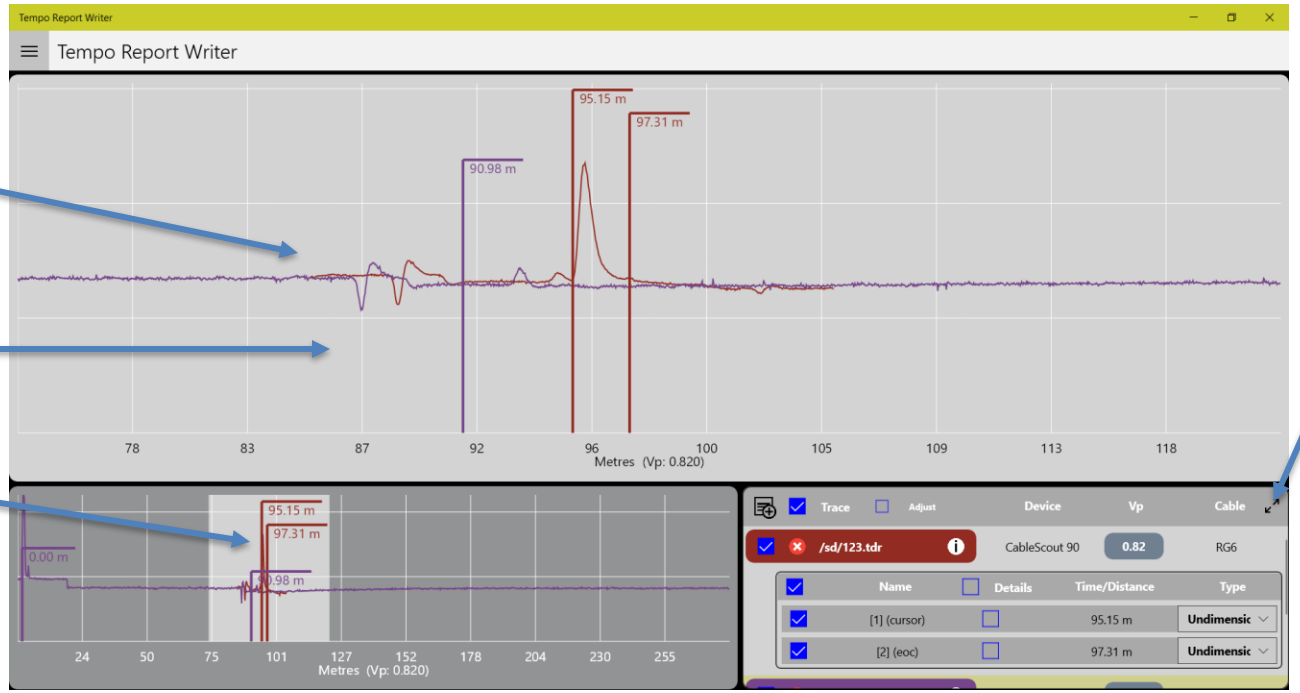
Compare multiple traces…

Whether you want to document “before” and “after”, show some new detail about a cable or otherwise compare traces, provided traces have the same Vp, they can be loaded into one report. Here we have a “full” trace loaded with the detailed trace previously loaded…

Purple line is the “full” trace
And the brown line is the original one

Hover over the trace and
Use the scroll wheel to zoom

Click and drag to move
The “detail window”
Along the “overview” trace



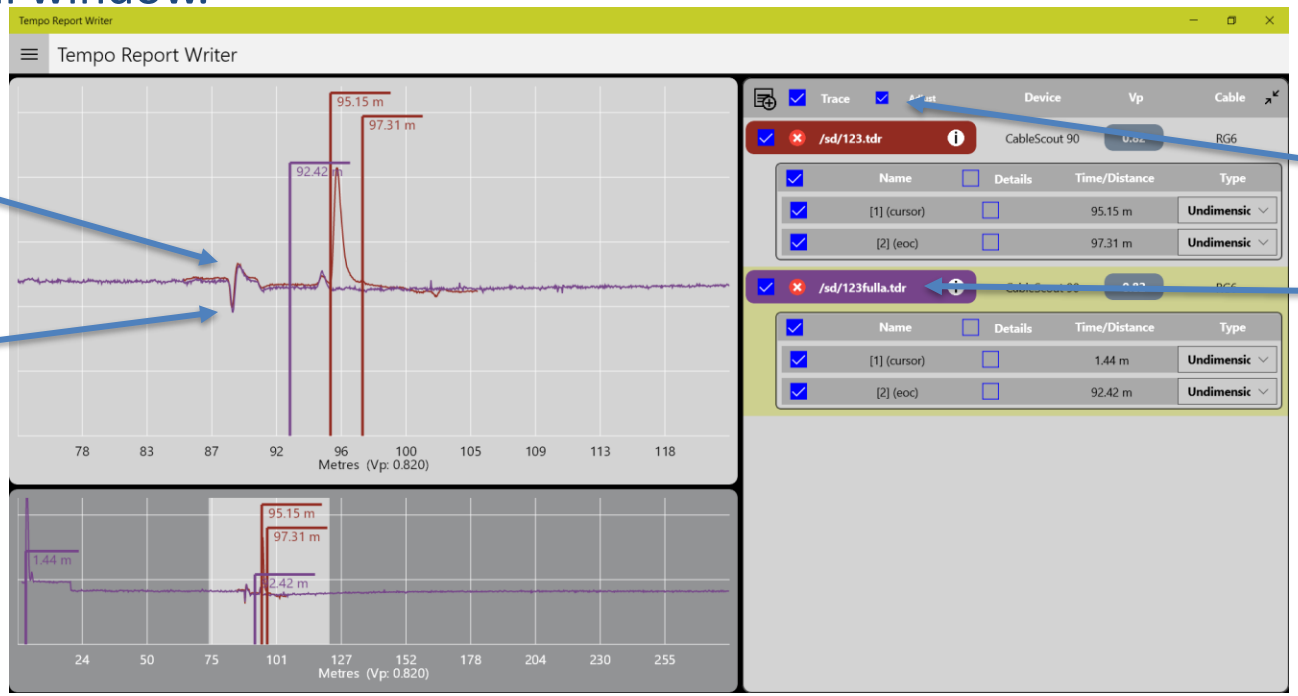
Click here to expand the traces list…

Adjust the time offset of traces…

When traces are taken at different times or with different units, the “zero” point of each trace could have a slightly different calibration value. To re-align the displayed traces, highlight by clicking on the trace to be adjusted, select “adjust” then drag the trace a few nanoseconds left or right in the detail window.

Drag the selected trace to Align some key point as a Reference to the “master”

Right-click (long press) to Add a new marker…



Click here to allow adjustment

Click to select the trace to be adjusted

Add and hide cursors; add relative measurements…

To add a new cursor to a trace, first click on the title of the trace to select it. Then right click on the trace in the window to add a marker (long press on a touch-screen).

To measure the distance between markers, drop down the “Undimensioned” and change to “Dimensioned” on at least two cursors.

Right-click (long press)
To add a new marker.
Markers can be adjusted
By left-clicking and dragging

Click to select the trace to have a new marker added

Click and choose “Dimensioned”

Click to hid a merker.
Click the red X to delete

Questions & Contact Details

CableScout™ CS90
The TDR for Digital Cable Broadband

And MANY other Uses!

Tempo Communications Technical Support

Tempo Communications Inc.

www.tempocom.com/contact-us

Technical Support: techsupport@tempocom.com


TEMPO
COMMUNICATIONS