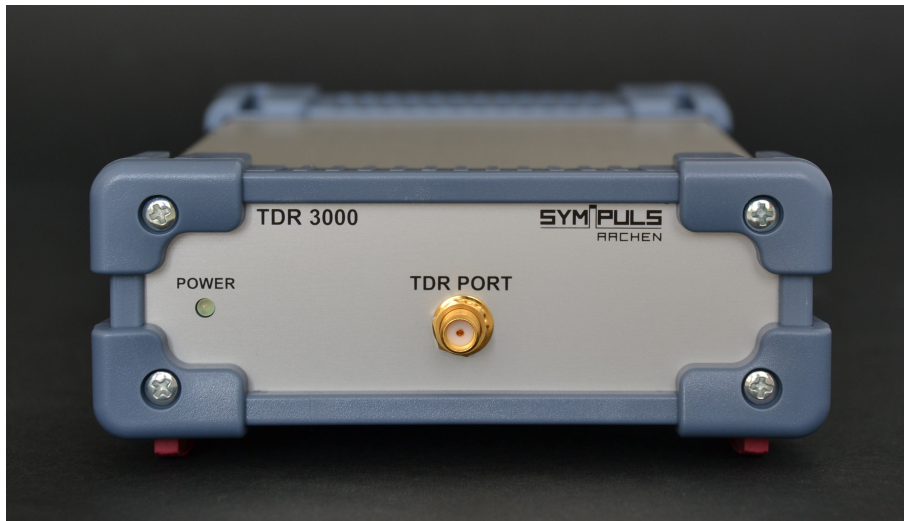# Line Impedance Analyzer TDR 3000

Line Impedance Analyzer TDR 3000

Key Features

- Compact Instrument for TDR Measurement

- Simple Measurement of Line Impedances and Reflections even on Internal Layers of PC-Boards

- Internal Pulse Generator with less than 100 ps Rise Time

- More than 3 GHz System Bandwidth

- Powered by USB-Port

- For General Applications in Workshops and Laboratories and Educational Purposes

- Optionally Available:

    – Pulse Output and Pulse Input for Transmission Measurements

Brief Description

The Line Impedance Analyzer TDR 3000 is used for precise analysis of various lines:

- Transmission lines up to 1000 m length

- Microstrip- and striplines on printed-circuit boards

- Line terminations, line transitions, connectors

TDR analysis (Time Domain Reflectometry) shows directly the line impedance as a function of the propagation time or the distance.

The variation of the impedance as a function of the length of a given line is shown in form of an oscillogram directly on the personal computer. Reflections and transitions are displayed directly and can be analyzed with accuracy to a millimeter.

The combination of a fast pulse generator with a rise time less than 100 ps and a sampling scope of 5 GHz bandwidth leads to a system-bandwidth of more than 3 GHz. Thus measurements of transmission lines with a time resolution in the range of pico-seconds are possible.

The pulse generator and the input of the sampling oscilloscope are connected internally via a special coupler. The device under test can be directly connected to the SMA input on the instrument's front panel. Optionally the TDR 3000 is available with an additional pulse output and pulse input for transmission measurements.

The small-sized instrument is connected via USB to a personal computer (PC). The power is supplied over the USB-port. All instrument settings are changed over the easy-to-use graphical user interface. Measuring results are displayed on the PC-monitor and can be processed directly on the PC. All important characteristics like bandwidth or sensitivity only depend on the TDR 3000, not on the PC.

Adjustable cursors in vertical and horizontal direction allow precise measurements of propagation time or line length and reflection factor or line impedance.

The TDR 3000 can be equipped alternatively with SMA- or BNC-Connectors.

Graphical User Interface
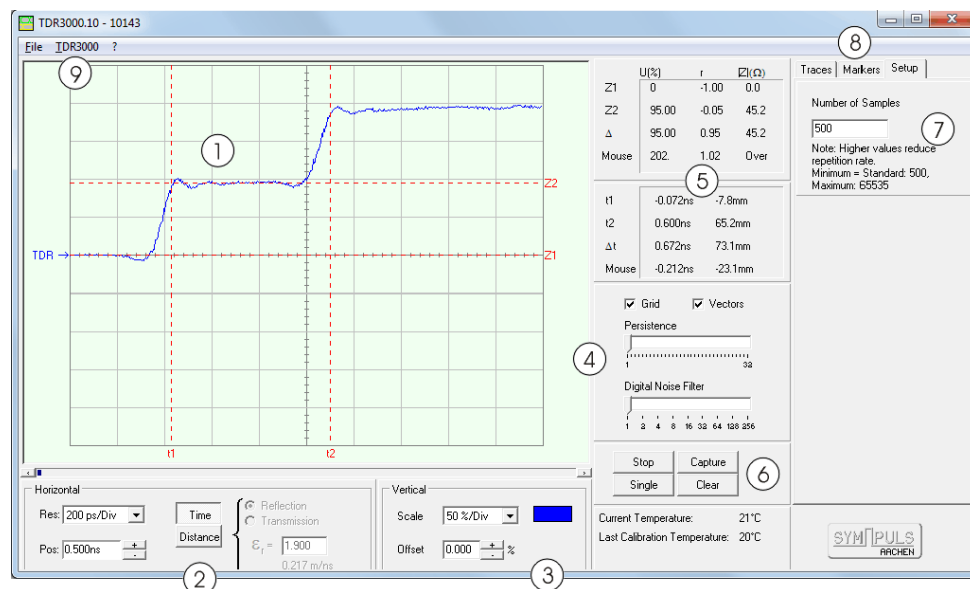
Graphical User Interface of the TDR 3000. The TDR port is open.

① Screen: Displays the oscillograms.

② Horizontal (Time Base): Horizontally scales and positions the waveform. Two different scales for time and distance measurements are selctable.

③ Vertical (Scale): Vertically scales and positions the waveform on the screen.

④ Screen Settings: Different Display Modes and Digital Filters are selectable.

⑤ Marker: Markers `t1, t2, Z1` and `Z2` can be activated and positioned. Values and value differences are displayed according to the markers' positions.

⑥ The buttons `Run/Stop` and `Single` allow to stop the acquisition while retaining the displayed curve. `Capture` stores a measured curve for further processing.

⑦ `Number of samples` taken for each measurement.

⑧ The three tabs `Traces`, `Markers` and `Setup` allow to change properties of stored measured curves, generate new markers and change the number of samples.

⑨ Two Pull-down menus provide additional functionality.

Application Examples
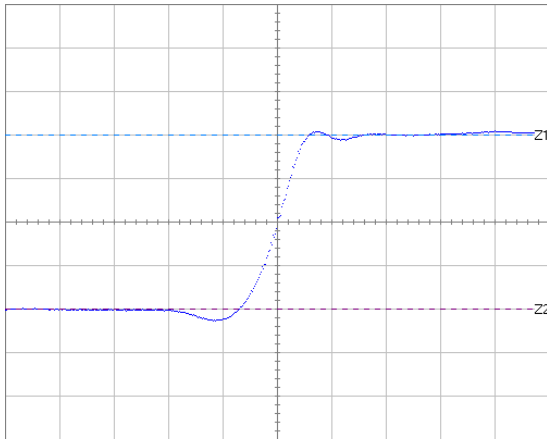
X-Resolution: 100 ps/Div   Position: 592.00 ps
Y-Resolution: 25 %/Div   Offset: -50 %

Z1:   U= 100 %   r= 0.00   Z= 50.0 Ohm
Z2:   U= 0 %   r= -1.00   Z= 0.0 Ohm
Z2 - Z1: U= 100 %

t1:   t= 6.2960 ns   d= 651.24 mm
t2:   t= 6.5360 ns   d= 676.07 mm
t2 - t1: t= 240.00 ps   d= 24.825 mm

Example 1: Rising edge of a test generator pulse
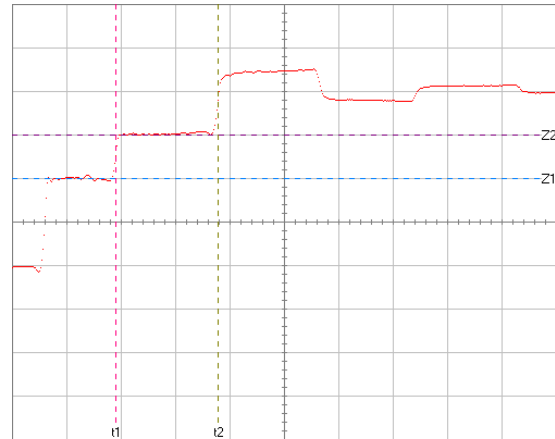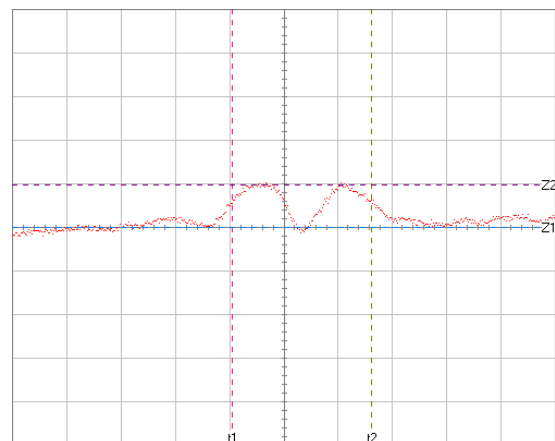

X-Resolution: 1 ns/Div   Position: 5.0000 ns
Y-Resolution: 50 %/Div   Offset: -50 %

Z1:   U= 100 %   r= 0.00   Z= 50.0 Ohm
Z2:   U= 150 %   r= 0.50   Z= 150.0 Ohm
Z2 - Z1: U= -50 %

t1:   t= 1.9000 ns   d= 196.53 mm
t2:   t= 3.7800 ns   d= 390.99 mm
t2 - t1: t= 1.8800 ns   d= 194.46 mm

Example 2: Multiple reflections on an open 150 Ω line
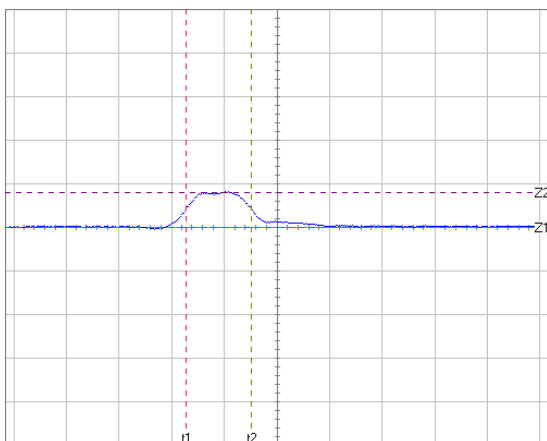
X-Resolution: 2 cm/Div   Position: 686.00 mm
Y-Resolution: 25 %/Div   Offset: -100 %

Z1:   U= 100 %   r= 0.00   Z= 50.0 Ohm
Z2:   U= 120 %   r= 0.20   Z= 75.0 Ohm
Z2 - Z1: U= -20 %

t1:   t= 6.2960 ns   d= 651.24 mm
t2:   t= 6.5360 ns   d= 676.07 mm
t2 - t1: t= 240.00 ps   d= 24.825 mm

Example 3: Reflection of a 75 Ω line inserted into a 50 Ω line

X-Resolution: 2 cm/Div   Position: 779.19 mm
Y-Resolution: 5 %/Div   Offset: -100 %

Z1:   U= 100 %   r= 0.00   Z= 50.0 Ohm
Z2:   U= 104,875 %   r= 0.05   Z= 55.1 Ohm
Z2 - Z1: U= -4,875 %

t1:   t= 7.5900 ns   d= 760.16 mm
t2:   t= 8.1000 ns   d= 811.24 mm
t2 - t1: t= 510.00 ps   d= 51.078 mm

Example 4: BNC-connectors inserted into a 50 Ω coax line (RG58)

Screenshots of Time Domain Reflectometry Measurements using the TDR 3000

Gesellschaft für Pulstechnik und Meßsysteme mbH

Technical Specifications

TDR 3000	
Vertical System	
Input	50 Ω, SMA-Connector
Rise Time (10-90%)	80 ps
Bandwidth (3 dB)	5 GHz
Deflection Factors (/div)	500 %, 250 %, 100 %, 50 %,
	25 %, 10 %, 5 %, 2.5 %
Range of Line Impedance	0 ... 1000 Ω
Offset Range	± 200 %
Reference Value	Test Pulse Amplitude = 100 %
Resolution	0.01 %
Display Resolution	40 dots/div, 400 dots/screen
Horizontal System	
Two Different Scales for Time and Distance Measurements are Selectable	
Time Scale (/div)	100 ps, 200 ps, 500 ps, 1 ns,
	2 ns, 5 ns, 10 ns, 20 ns, 50 ns,
	100 ns, 200 ns, 500 ns, 1 μs
Position (Time)	100 ps/div - 10 ns/div: 125-times
	20 ns/div: 100-times, 50 ns/div: 40-times
	100 ns/div: 20-times, 200 ns/div: 10-times
	500 ns/div: 4-times, 1 μs/div: 2-times
Time Resolution	1 ps
Display Resolution	50 dots/div, 500 dots/screen
Distance Scale (/div)	1 cm, 2 cm, 5 cm ... 100 m
Range of Cable Measurement $(\varepsilon_{reff} = 2)$	0 ... 1000 m
Range of Dielectric Constant	$\varepsilon_{reff} = 1.0 ... 10.0$
Internal Pulse Generator for TDR-Measurement	
Pulse Shape	Rectangular 24.4 kHz, app. 0.5 V into 50 Ω
Rise Time	< 80 ps
PC-Interface	
Interface	USB-port, max. data transfer rate 1 MByte/s
Software	GUI for configuration of instrument settings on PC
	Display oscillograms on PC-monitor
	Export oscillograms as bitmaps to file or clipboard

Miscellaneous	
Power Supply	4.5 V . . . 5.5 V / 0.5 A
	Powered over USB-port
Mechanical Dimensions	Aluminium Case,
	W x H x D = 115 mm x 55 mm x 175 mm
Optionally Available	
Option 1	Pulse Output and Pulse Input for Transmission Measurements

Ordering Information

Included in delivery:

TDR 3000

- Mainframe with SMA-Connectors

- User Manual

- USB Cable Set for PC connection

- CD-ROM with Device Driver and Operating Software

TDR 3000B

- As TDR 3000, but with BNC-Connectors

**The instrument is produced by SYMPULS in Germany.
We offer a reliable service and 24 month warranty.**