VISA USB

OPTICAL REFLECTOMETER (OTDR)

VISA 1310 USB

VISA 1550 USB

User's Guide

2011

Purpose

VISA 1550 USB is an optical reflectometer (hereinafter OTDR).

The instrument makes it possible:

- to determine the distribution of losses along the fiber-optic communication line (FOCL), to identify defective parts or elements of the communication line,

- to determine the exact location of the breaks or damaged spans of the FOCL,

- to estimate total losses in a fiber-optic communication line by the acceptance of the line and by periodic testing,

- to measure the average losses of optical fiber on spools, the uniformity of losses distribution in the fiber and to detect the presence of local defects in fiber production,

- to measure the losses in mechanical and welded joints,

- to detect gradual or sudden deterioration of fiber quality by comparing its performance with earlier measurements,

- to store the led measurements in *.sor files.

Range of application of the instrument VISA USB - manufacture of optical fiber and cable, construction of a fiber-optic communication lines (FOCL), diagnostics and maintenance of the status of fibers, cables and fiber-optic communication lines.

Environment

- Ambient air temperature from plus 5 °C to plus 50 °C;
- Relative air humidity max. 90 % by 25 °C;
- Atmospheric pressure from 86 to 106,7 kPa.

Delivery Set

	Designation	Amount	Note
1	Instrument VISA 1550 USB	1	Contains only 1550 nm wavelength
2	Optical single-mode connection cable with FC connectors	1	
3	USB interface cable	1	
4	User's Guide	1	
5	CD with software	1	
6	Carrier bag	1	

Note: according to consumer's order the OTDR can be completed with additional adapters for connecting fiber-optic cable with connectors of various types. Number of adapters and their types must be specified when ordering.

Specifications

Generalities	
Power supply	USB
Optical connector type	FC
Fiber type	Single-mode fiber (SM)
Connection with PC	USB
Dimensions, mm	125 x 80 x 40
Weight, kg	0,3
OTDR	

Wavelength of optical radiation at the OTDR output, nm	1310 ± 20 / 1550 ± 20
The values of dynamic range for 1310/1550 nm min., dB [1]	29 / 27 (module **M2**)
The value of deadzone in measuring the attenuation max., m [1]	10 (module **M2**)
The value of deadzone for detecting events max., m [1]	3 (module **M2**)
Ranges of measured distances, km	1.5; 3; 5; 10; 20; 40; 80; 160;
Pulse width, ns	4, 10, 30, 100, 300, 1000, 2000, 5000, 10,000, 20,000
Resolution (dL), m for the range:	
1,5 km	0.4
3,0 km	0.8
5,0 km	1.3
10 km	2.5
20 km	5
40 km	10
80 km	20
160 km	40

Error of measuring distances (ΔL), m

$$\Delta L = \pm (dl + 2*dL + L \times \frac{\Delta n}{n} + 5 \times 10^{-5} \times L),$$

where:

dl=0,3 m, *dL* – resolution, *L* – length of the OF,   *n* – refractive index, *Δn* – accuracy with which the refractive index is known for measured OF.

1) These values are dependant on the optical module type (**M0**, **M1** or **M2**).
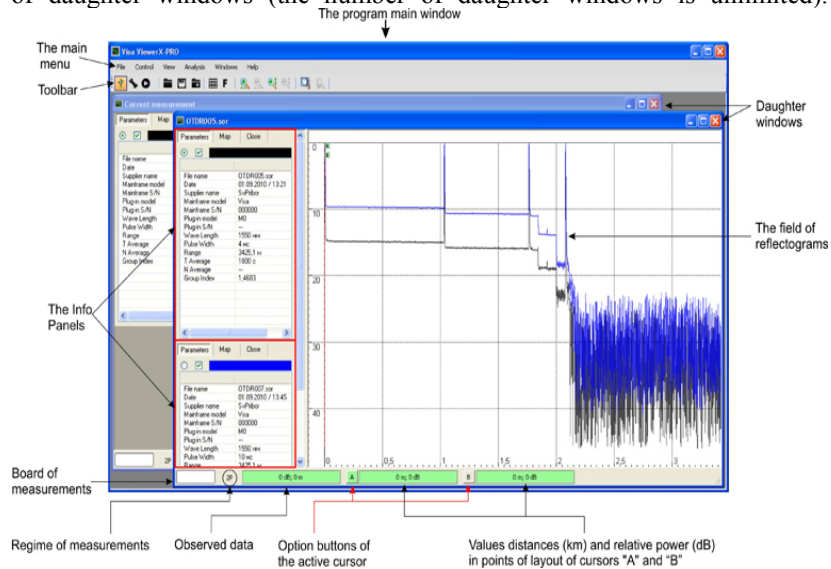
Instrument Design

The device is encase in a shockproof metal housing.

The upper connector panel and the bottom panel of the instrument are made of impact-resistant plastic.

.

VISA VIEWER X-PRO

Program Visa Viewer X-Pro represents MDI (multiple document interface) the application for which is typical presence of one principal window-container having common controls (board of the main menu and toolbar), and dynamically created at opening *.sor files or at connecting of the device of daughter windows (the number of daughter windows is unlimited).
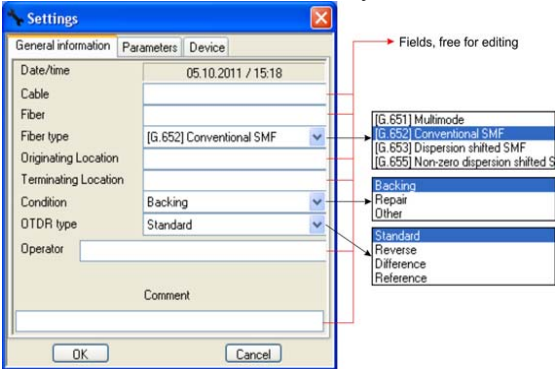

Connecting

  AT THE FIRST CONNECTING OF THE VISA SERIES DEVICE of by means of USB-cable to the PC with operating system Windows® **IT IS RECOMMENDED AT FIRST TO WAIT MESSAGES OF AN OPERATING SYSTEM** on successful adjustment of the new arrangement

and only after that to start operation with application Visa Viewer X-Pro. It is necessary to follow the given sequence of acts for observing only at primary connecting of the device, further the sequence of connecting/activation of the device/program has no value. Procedure of recognition by program Visa Viewer X-Pro of connected unit is completely autonomous, thus in a program parent window there is the daughter window containing the information about device, its possibilities and initial parameters of measurement. If at least one daughter window has been opened, creation of a new window or Info Pane adding to an active daughter window will be offered to the user at possibility.
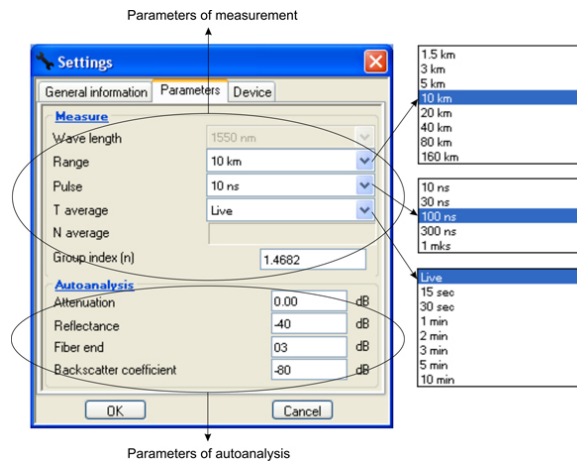
Measurement parameters

Customization" window contains three bookmarks: **"General information", "Parameters", "Device".**

Bookmark **"General information"** includes the fields containing the additional information on type of a cable, color of a filament, a name of the operator which has led measurement, etc. All fields are optional for filling in, but data values of fields are saved in *.sor file and inferred at the report hardcopy. The values saved earlier (in *.sor a file) of the above-stated fields can be edited by the user further if needed.

Bookmark **"Parameters"** contains fields of parameters of measurement and the field of parameters of the autoanalysis. While viewing *.sor file saved earlier the fields of measurement parameters are blocked and the user cannot change their contents (except for the field "the Index of refraction (n)"). The modification of data values of fields becomes accessible if device is connected correctly and recognized by the program.

Parameters of measurement

Parameters of autoanalysis

"Wave length" - sets wave length of 1310 or 1550 nanometers (depending on the instrument version). If device modification includes only one radiation source of certain wave length (for example: "VISA1310") the modifications of the field will be blocked and wave length supported by the device set automatically.

"Band" - sets a peak value on a horizontal axis. It is necessary to remember, that the band also defines the resolution - the minimum distance between reflectogram points: the more band is longer the more is the distance between points. It is recommended to choose a band exceeding a prospective length of the researched line in 1.5 times. For example, for a line of 2 km length it is necessary to choose a band of 3,0 km.

"Pulse" - at a band modification which is automatically set an optimal pulse duration. In the given string the user can adjust duration of an outgoing pulse, choosing from the falling out list the necessary value. The list of possible pulse lengths depends on the chosen band.

8

Usage of shorter pulses allows to improve resolution capability, but the ratio signal/noise worsens. Such approach is recommended to be used at the defects in the beginning of a line. Pulse duration magnification boosts a dynamic range, but close defects can be indiscernible. This approaches for defects detection of in the end of range lines or sections with the big signal attenuation more.

"Averaging (T average)" - sets chosen time for a measurement process. The more is average time, the more is value of a dynamic range, accordingly, adjustment of long time of an average facilitates review of events in noisy area of the reflectogram. Possible values of weeding **"Averaging"**: "Live", "15 sec", "30 sec", "1 minute", "2 minutes", "3 minutes", "5 minutes", "10 minutes". Value "Live" matches to a regime with a minimum time of an averaging and automatic upgrading of the shield. It is recommended to be used for a line tentative estimation.

"n" - An optical fiber index of refraction (OF). It defines a velocity of light in fiber. Wrong value of an index of refraction leads to the big measuring error of distance. Set the value of optical fiber measuring recommended by the manufacturer of this fiber. An accessible band of values of an index of refraction is 1,2000 - 1,7000. If index of refraction OF is unknown, use a default value (1,4683).

Autoanalysis parameters:
"Attenuation" - sets a threshold of determination of signal attenuation in interconnection below which event will not be revealed by means of the autoanalysis.
"Reflectance" - a threshold value of a coefficient of reflection (REF). In case REF of going on event less than the given magnitude, event will not be revealed the autoanalysis.
"Fiber end" - a threshold of determination of the end of an optical fiber.
"Backscatter coefficient" - rayleigh backscattering coefficient diffusing which appears in reflectance calculation's formulas and optical return losses. The given magnitude depends on wave length of optical emanation and should be indicated by the manufacturer of optical fiber.

9

Bookmark **"Device"** contains the information on the manufacturer of the device, its name, the serial number, etc. All fields on this bookmark are not edited.

Measurement activation/stop

Activation of measurement's process is initiated by pressing the key Start on control's console or through the main menu: "Control - Start". The outcome of measurement will be represented in the form of the reflectogram (dependence of decimal logarithm of reflected and a dissipated power upon the distance). The Refresh interval of observed data depends on the chosen band and an average time.
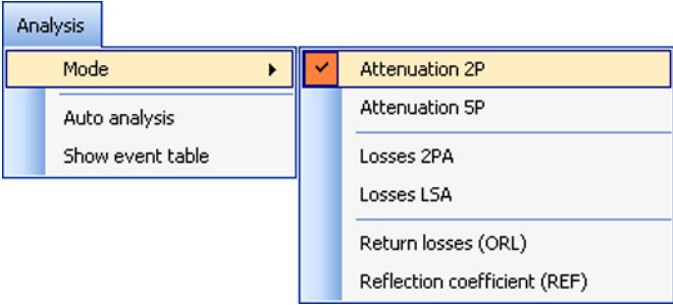
	Attention! Do not connect optical fiber to the instrument, not having convinced in cleanness of a tip. It can lead to a fault of a demountable connector or incorrect outcomes. Be convinced that the key on the adapter hit in a demountable connector slot.

In case of measurement with fixed parameter "Averaging"- "Live" process of measurement is infinitival: the instrument in an infinite loop leads measurement and transfers data to the user computer. At any other values of

weeding "Average" measurement process automatically is completed on the fluxion of a time pointed in an aforementioned floor. It is possible to interrupt measurement's process without dependence from the mounted parameters by pushing a Stop key on director's console, or by choosing the item in the main menu: "Control - Stop".

Reflectogram analisys

The item of the main menu "Analysis" allows to carry out the automatic analysis of the reflectogram and choose a method of an estimation of losses:

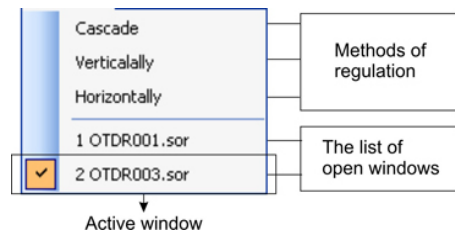| **"2P"**	Difference of levels between cursors (dB).
"2PA"	The linear signal attenuation (dB/km) is counted on a difference of levels between two cursors.
"LSA"	The linear signal attenuation (dB/km) is counted on the inclination of straight line, made by means of a method of the least squares between two cursors.
"5P"	Estimation of losses in event (more exact estimation of losses on a method of 5 cursors) (dB).
"ORL"	Estimation of reflexive losses (dB).
"REF"	Estimation of a coefficient of reflection (dB).

The current method of an estimation of losses and magnitude are represented in a board of measurements.

11

"To lead the autoanalysis" - the given regime allows to carry out the automatic analysis of the current (active) reflectogram. Automatic searching of discontinuities thus is carried out, signal attenuation or a coefficient of reflection in which exceed the mounted threshold values. At the autoanalysis distances to discontinuities, losses on sections between discontinuities and losses on discontinuities are defined. These data are brought in the table of events and represented in the form of tags and marks on the reflectogram. The table of events can be displayed by means of button or by the appropriate choice in menu - "the Analysis - to Show the table of events". If on the reflectogram opened from memory there are already marks of events at the next activation of process of the automatic analysis these marks are deleted. The analysis is led taking into account new threshold values.
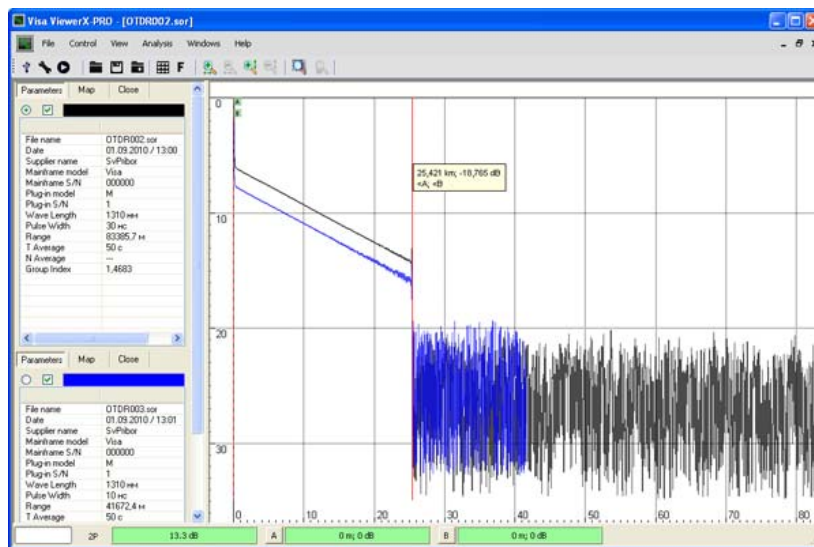
The option filter **F** switches on/switches off an additional filtration of noises.

Saving of measurement's outcomes is carried out in a format *.sor or *.csv by means of button "Save" of a toolbar or at choice sampling "File - Save".

Opening *.sor files is carried out by means of the button "Open" of a toolbar or from the main menu "File - Open". Thus each reflectogram opens in a new daughter window. It is possible to choose earlier open window (to make it active) by means of a pop-up window in the main menu of "Window" from the list in its bottom part. In this menu the user also can arrange all open windows.

To open *.sor a file in already existing daughter window it is possible also by means of button or from the main menu "File-Add". In this case the reflectogram will open in an active daughter window and will be represented together with earlier opened reflectograms.

All acts necessary for the user for the analysis and editing of measurement's parameters are presented in sections relating to the operations with devices of series VISA.

Dynamic range estimation
1.   Set the following measurement parameters:
Wavelength   1310/1550 nm
Range   160 km
Pulse width   20 μs
Averaging   3 min.
Assessment of losses   2 PA

Filter   OFF

n   in accordance with OF mode

2.   Clean the connector and connect the 25 km optical fiber to the OTDR.

3.   Carry out measurements with the specified parameters.

4.   After trace acquisition according to received trace measure the dynamic range. To do this:

Set the left marker just after the end of the probe pulse.

Set the right marker to the maximum burst of noise outside the phantom reflection area. Read the attenuation value difference between D max. cursors. For precise positioning of the cursors use zoom function.
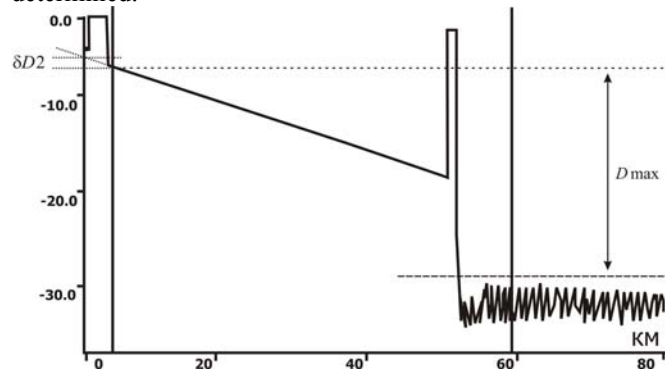
Calculate the dynamic range D by the following formula:

$$D = D\max + \delta D1 + \delta D2$$

$\delta D1$ - the ratio between the peak value of Gaussian noise and signal level equal to the root-mean-square value of this noise (i.e. the level at which SNR = 1),

$\delta D1 = 2{,}4$ dB

$\delta D2$ –attenuation of the OF span between its start and the position of the left marker; for its definition the trace should be mentally extended to the left from the left marker to the beginning of the distance scale and by the vertical scale the magnitude of increase in the level of trace should be determined.

5.   Record results in table.

6.   Carry out similar measurements for a different wavelength.

Deadzone estimation
1.   Set the following measurement parameters:
Wavelength   1310/1550 nm
Range   1,5 km
Pulse width   4 ns
Averaging   3 min.
Assessment of losses   2 PA
Filter   OFF
n   in accordance with OF mode
2.   Clean the connector and connect two series-connected 1 km optical coils to the OTDR.
3.   Carry out measurements with the specified parameters.
4.   After completion of trace acquisition carry out measurements of deadzones by the events and by the attenuation. To this effect:

Measure the attenuation deadzone as the distance from the reflection start to the point at which the signal level does not differ by more than 0.5 dB from the level of backscattering. For precise positioning of the cursors use zoom function.

Measure the event deadzone as the distance between the start of reflection and a point on the trailing edge of the reflection peak with level of 1.5 dB relative to the top. For precise positioning of the cursors use zoom function.

5.   Record results in table.
6.   Carry out similar measurements for a different wavelength.

Estimation of attenuation management inaccuracy
1.   Set the following measurement parameters:
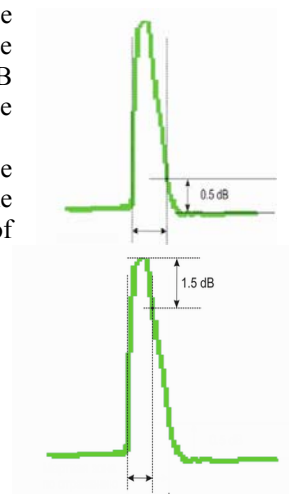Wavelength   1310/1550 nm
Range   40 km
Pulse width   3 μs
Averaging   3 min.
Assessment of losses   LSA
Filter   OFF

n   in accordance with OF mode

2.   Clean the connector and connect the 1 km match throttle to the OTDR, to the end of this throttle connect the 25 km reference fiber.

3.   Carry out measurements with the specified parameters.

4.   After trace acquisition estimate the attenuation management inaccuracy. Position the cursors at the end and at the beginning of the linear span of the trace and compare the measured value of the slope in dB/km with certified value of the used 25 km coil.

5.   Record results in table.

6.   Carry out similar measurements for a different wavelength.

Estimation of distance management inaccuracy

1.   Set the following measurement parameters:

Wavelength   1310/1550 nm

Range   80 km

Pulse width   3 μs

Averaging   3 min.

Filter   OFF

n   in accordance with OF mode

2.   Clean the connector and connect the 1 km match throttle to the instrument. To the end of this throttle connect the 25 km throttle with the calibrated refractive index and length.

3.   Carry out measurements with the specified parameters.

4.   After trace acquisition estimate the distance management inaccuracy. To this effect using zoom position the cursors exactly on the reflecting event of the start and on the reflecting event of the end of the calibrated optical fiber. Compare the derived distance with the certified value. Record results in table.

5.   Carry out similar measurements for a different wavelength. (specifying the refraction index).

Calibration Interval

Calibration of the instrument must be made at least 1 time in 12 months.

MANUFACTURER'S WARRANTY

The manufacturer guarantees the efficiency of the instrument under observance of the terms of use, storage and transportation specified in this technical description.
Warranty period is 1 year from a purchase date.

Instrument VISA 1550 USB serial number _____
meets specifications and is accepted for use.

Release date   _____
Representative of the factory   _____

17