

MOT-940

Mini OTDR series

USER MANUAL
(PLEASE READ IT BEFORE USE)



Revision 1.02



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Contents

1	Description of MOT-940	4
2	Technical parameters.....	5
2.1	Parameters and characteristics of light sources.....	5
2.2	Parameter and characteristics of power meter	5
2.3	Parameters and characteristics of the OTDR module	6
2.4	General specifications of the device	7
3	Safety precautions.....	8
3.1	General.....	8
3.2	Optical interface connection:.....	8
3.3	Laser classification	9
4	Starting operation.....	11
4.1	operation modes.....	11
4.2	OTDR design	11
4.3	Power supply.....	13
4.4	Switch ON and OFF the device	13
4.5	Main menu	14
4.6	Cleaning and connection of optical connectors.....	15
5	OTDR Mode	16
5.1	Description	16
5.2	Measuring parameters setting	16
5.3	Events analysis setting	18
5.4	Starting measurement.....	19
5.5	Viewing of the trace	21
5.6	Measurement of trace parameters	23
5.7	Automatical event search.....	24
5.8	Trace saving.....	25
6	Tester Mode.....	27
6.1	Description	27
6.2	Using the power meter	28
6.3	Operation in a light source mode.....	31
6.4	Using the Visual Fault Locator.	33
6.5	Saving of Power meter measurements	33
7	Memory operation	35
7.1	Saving traces.....	35
7.2	Saving power meter reading	35
7.3	Viewing the stored traces	35
7.4	Copy measurement data to an external medium.	36
7.5	Download traces to a computer.....	36
8	Setup of the devices	38
8.1	Setting the date and time.	38
8.2	Language Selection	39
8.3	Switch ON / OFF sound button signal.....	39
9	MAINTENANCE.....	40
9.1	Cleaning the connectors	40
9.2	Charging the battery	40
9.3	The change of the optical power meter adapter.....	41
9.4	FW upgrade	42
10	CALIBRATION of device	43
11	Contacts:	44

1 Description of MOT-940

The MOT-940 Mini optical reflectometer series comes in a compact metal housing with all functions as a full OTDR and with optical light source. The reflectometer determines the distance to reflecting and non-reflecting events and measures insertion loss of optical line and attenuation loss. In addition, the MOT-940 is fitted with an optical power meter and a visible light source. Power supplying is ensured with inbuilt rechargeable Li-Ion battery, which provides long term working time.

The MOT-940 is designed for testing single mode and multimode optical fiber parameters in the process of installation, operation and maintenance, respectively the fault location:

- Backbone and local networks
- FTTx networks, PON
- Access networks

The MOT-940 OTDR is available in several models of devices with different parameters and functionality. The list of possible models of optical OTDR tester, available for order, is presented in Table 1.

Table 1

OTDR module ¹	940-01		940-02	940-03	940-04		940-05	
Fiber Type	MM	SM	SM	SM	SM		SM	
Wavelength (nm)	850/1300	1310/1550	1310/1550	1310/1490/1550	1310/1550	1625	1310/1490/1550	1625
Dynamic range ² (dB)	28/30	40/39	41/40	41/40/39	41/40	39	41/39/38	39

Note: 1) For complete details of all available configuration refer to Ordering code
 one port module: 940-02, 940-03
 two ports module: 940-01, 940-04, 940-05

Optical reflectometers are used for:

- installation and maintenance of fiber-optic communication lines
- troubleshooting
- testing the quality of splice joints and detachable fiber optic lines.

The following measurements can be performed using the device:

- measurement the reflectogram of optical lines
- measurement of nominal insertion loss (dB / km)
- measuring of insertion loss (dB)m
- measurement of the length of the line
- measurement of the distance to the event in the line
- measurement of the average transmitter power (dBm, W);

2 Technical parameters

2.1 Parameters and characteristics of light sources

Table 2

Parameter	Value
Working wavelength, nm	See Table 1
Wavelength offset	± 30
Spectral width at the 0.5 level, nm	≤ 9
The level of continuous optical power, dBm	≥ -4
average power of the pulse modulated optical signal, dBm	≥ -6
Frequency modulation of an optical signal, Hz	270.0 ± 5.4 2048 ± 40
Slope of the modulated pulses optical signal	1.8 to 2.2
Stability of power level continuous optical signal (temperature change ± 2 °C)	0.15 dB (for 15 minutes) 0.25 dB (for 4 hours)

2.2 Parameter and characteristics of power meter

The optical power meter measures the average power of continuous and pulse-modulated optical signal in the operating wavelengths range 800 - 900 nm and 1210 - 1650 nm in single mode and multimode fibers. Specifications of optical power meter are presented in Table 3.

Table 3

Parameter	Value
Dynamic range	-50 to + 20 dBm (from 10^{-8} to 10^{-1} W)
Working wavelengths, nm	650, 800-900, 1060, 1210 -1650
Wavelength setting step, nm	1
Max. uncertainty at 1310/1550 nm	0.3 dB (7%), (-40 to 10 dBm) 0.4 dB (9%), (-50 to + 20 dBm)
Max. uncertainty at 850 nm	0.4 dB (9%), (-40 to 10 dBm) 0.5 dB (11.5%), (-50 to + 20 dBm)
Max. uncertainty in range 1210-1650 nm	0.4 dB (9%), (-40 to 10 dBm) 0.5 dB (11.5%), (-50 to + 20 dBm)

Max. uncertainty in range 800-900 nm	0.6 dB (13%), (-40 to 10 dBm) 0.7 dB (15%), (-50 to + 20 dBm)
Max. uncertainty during relative power measurement	0.2 dB (4.5%), (-40 to 10 dBm) 0.3 dB (7%), (-50 to + 20 dBm)
Measurement of the mean power pulsed modulated optical signal, if the modulation frequency is below 270 Hz	Up to +20 dBm
Display resolution	0.01 dB
Linear scale units	mW, μ W, pW

2.3 Parameters and characteristics of the OTDR module

Specifications reflectometers are presented in Table 4

Table 4

Parameter	Value
Working wavelengths	See Table 1
Distance range	0.25 - 250 km
Pulse width, ns	5, 10, 20, 50, 100, 300, 500, 1000, 3000, 10000
Max. distance measurement error	$L = \pm (dl + dL + L * \Delta n / n + L * 5 * 5.10)$, where: dl = 0,7 m L - length of the measured line n* Δn - refractive index error
Dynamic range on the level of 98% of the maximum noise at 3 minutes averaging time and pulse 10 μ m	40 ± 2 dB
Attenuation measurement error	$0.05 \pm 0,05 \times A$ where: A – measured attenuation, dB
Event dead zone (for min pulse width)	0.8 m
Attenuation dead zone (for min. pulse width)	≤ 4.5 m

* The value n is set in the range of 1.4000 to 1.6000 with 0.0001 step

** For working conditions may decrease the dynamic range by 3 dB

2.4 General specifications of the device

General Specifications of the device are presented in Table 5.

Table 5

Parameter	Value
Optical interface*	FC/UPC, FC/APC, SC/UPC, SC/APC
Power supply	1. In-built Li-Ion battery, 6000 mAh 2. AC/DC adapter 220 V/5 V, 2 A
Operation time on battery**	Not less than 8 hours
Dimensions, mm	110×55×235
Weight	1 kg

* Other type on request

** Under normal conditions and after the battery is fully charged. Mode of operation: real-time (continuous measurements), the pulse width 1 μ m, the line length of 16 km.

3 Safety precautions

3.1 General

To ensure a high level of operator safety during operating and maintenance of the equipment, as well as ensuring that the equipment remains undamaged, it is necessary to consider the following general warnings.



Operation and service are only allowed to be carried out by an authorised person:

Only a person trained in the safety of fiber optical systems can handle and operate the equipment

The test equipment is intended for / to be used (safe extra low voltage) in this environment only.

Use only standard or optional accessories supplied by your distributor

Use only the equivalent connector types to those built into the instrument in order to avoid damage to the instrument components.

During storage and operation the equipment must be kept clean

3.2 Optical interface connection:

Take note of the safety rules for lasers class 1M for OTDR module and 3R for VFL module

Use only the relevant optical connectors

Optical connectors must be clean

Visual check of optical connectors using a 400x magnification microscope must be performed before connection

In case the connectors are not perfectly clean – please clean them according to the procedure described in the technical specification for the relevant connectors

3.3 Laser classification

A laser is a light source that can be dangerous to the people exposed to it. Even low power lasers can be hazardous to eyesight. A person exposed to laser radiation (especially invisible radiation) may be unaware that damage is occurring. Some lasers are so powerful that even the diffuse reflection from a surface can be hazardous to the eye. Laser radiation predominantly causes eye injury via thermal effects on the retina. A transient increase of only 10 °C can destroy retinal photoreceptors

Lasers have been classified by wavelength and maximum output power into four classes and a few subclasses since the early 1970s. The classifications categorize lasers according to their ability to produce damage in exposed people, from class 1 (no hazard during normal use) to class 4 (severe hazard for eyes and skin). There are two classification systems, the "old system" used before 2002, and the "revised system" being phased in since 2002. The latter reflects the greater knowledge of lasers that has been accumulated since the original classification system was devised, and permits certain types of lasers to be recognized as having a lower hazard than was implied by their placement in the original classification system. The revised system is part of the revised IEC 60825 standard. From 2007, the revised system is also incorporated into the US-oriented ANSI Laser Safety Standard (ANSI Z136.1). Since 2007, labeling according to the revised system is accepted by the FDA on laser products imported into the US. The old and revised systems can be distinguished by the 1M, 2M and 3R classes used only in the revised system and the 2A and 3A classes used only in the old system. Class numbers were designated using Roman numerals (I–IV) in the US under the old system and Arabic numerals (1–4) in the EU. The revised system uses Arabic numerals (1–4) in all jurisdictions.

The classification of a laser is based on the concept of accessible emission limits (AEL) that are defined for each laser class. This is usually a maximum power (in W) or energy (in J) that can be emitted in a specified wavelength range and exposure time. For infrared wavelengths above 4 µm, it is specified as a maximum power density (in W/m²). It is the responsibility of the manufacturer to provide the correct classification of a laser, and to equip the laser with appropriate warning labels and safety measures as prescribed by the regulations. Safety measures used with the more powerful lasers include key-controlled operation, warning lights to indicate laser light emission, a beam stop or attenuator, and an electrical contact that the user can connect to an emergency stop or interlock

Below, the main characteristics and requirements for the classification system from 2002 are listed, along with typical required warning labels. Additionally, classes 2 and higher must have the triangular warning label shown here and other labels are required in specific cases indicating laser emission, laser apertures, skin hazards, and invisible wavelengths

Class 1

A class 1 laser is safe under all conditions of normal use. This means the maximum permissible exposure (MPE) cannot be exceeded. This class includes high-power lasers within an enclosure that prevents exposure to the radiation and that cannot be opened without shutting down the laser. For example, a continuous laser at 600 nm can emit up to 0.39 mW, but for shorter wavelengths, the maximum emission is lower because of the potential of those wavelengths to generate photochemical damage. The maximum emission is also related to the pulse duration in the case of pulsed lasers and the degree of spatial coherence.

Class 1M

A Class 1M laser is safe for all conditions of use except when passed through magnifying optics such as microscopes and telescopes. Class 1M lasers produce large-diameter beams, or beams that are divergent. The MPE for a Class 1M laser cannot normally be exceeded unless focusing or imaging optics are used to narrow the beam. If the beam is refocused, the hazard of Class 1M lasers may be increased and the product class may be changed. A laser can be classified as Class 1M if the total output power is below class 3B but the power that can pass through the pupil of the eye is within Class 1.

Class 2

A Class 2 laser is safe because the blink reflex will limit the exposure to no more than 0.25 seconds. It only applies to visible-light lasers (400–700 nm). Class-2 lasers are limited to 1 mW continuous wave, or more if the emission time is less than 0.25 seconds or if the light is not spatially coherent. Intentional suppression of the blink reflex could lead to eye injury. Many laser pointers are class 2.

Class 2M

A Class 2M laser is safe because of the blink reflex if not viewed through optical instruments. As with class 1M, this applies to laser beams with a large diameter or large divergence, for which the amount of light passing through the pupil cannot exceed the limits for class 2.

Class 3R

A Class 3R laser is considered safe if handled carefully, with restricted beam viewing. With a class 3R laser, the MPE can be exceeded, but with a low risk of injury. Visible continuous lasers in Class 3R are limited to 5 mW. For other wavelengths and for pulsed lasers, other limits apply.

Class 3B

A Class 3B laser is hazardous if the eye is exposed directly, but diffuse reflections such as from paper or other matte surfaces are not harmful. Continuous lasers in the wavelength range from 315 nm to far infrared are limited to 0.5 W. For pulsed lasers between 400 and 700 nm, the limit is 30 mJ. Other limits apply to other wavelengths and to ultrashort pulsed lasers. Protective eyewear is typically required where direct viewing of a class 3B laser beam may occur. Class-3B lasers must be equipped with a key switch and a safety interlock.

Class 4

Class 4 lasers include all lasers with beam power greater than class 3B. In addition to posing significant eye hazards, with potentially devastating and permanent eye damage as a result of direct beam viewing, diffuse reflections are also harmful to the eyes within the distance called the Nominal Hazard Zone. Class 4 lasers are also able to cut or burn skin. In addition, these lasers may ignite combustible materials, and thus represent a fire risk, in some cases. Class 4 lasers must be equipped with a key switch and a safety interlock.

4 Starting operation

4.1 operation modes

The OTDR is equipped with additional power meter and visual fault locator. The choice of device functions performed by switching its operation mode in the main menu (see chapter 6.5).

4.2 OTDR design

Design of the device is presented in Figure 1, Figure 2 and Figure 3.

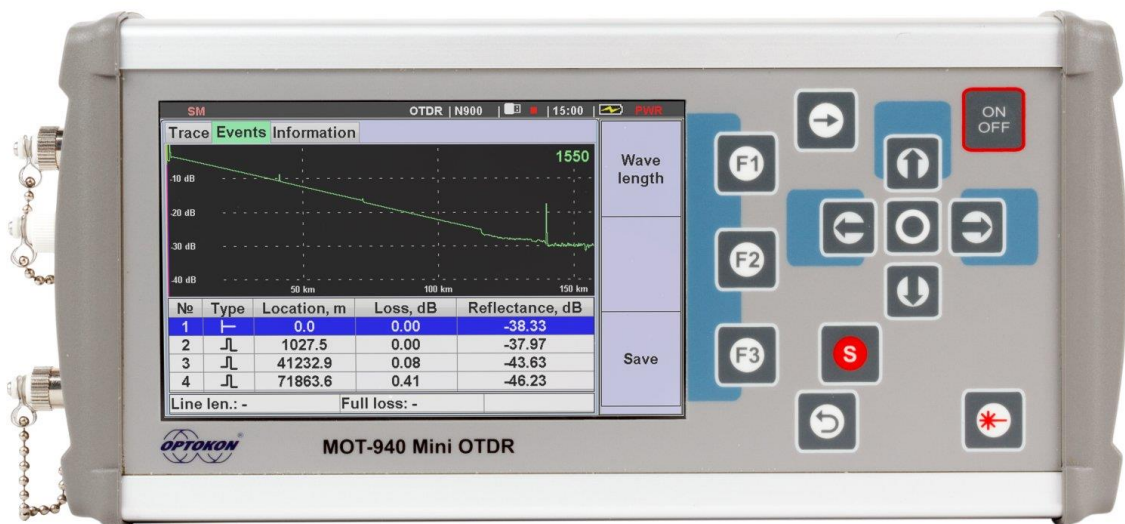


Fig. 1. The design of the device (front)

Control buttons

▲ ▼ Cursor keys



⊙ - Enter

F1, F2, F3 - key functions indicated on the display

↶ - ESC

S - Start measurement

* - The visual fault locator (VFL) - Activate / deactivate the VFL.

⇄ - TAB - toggle between the displayed bookmarks



Figure 2. Side view (electrical connectors)

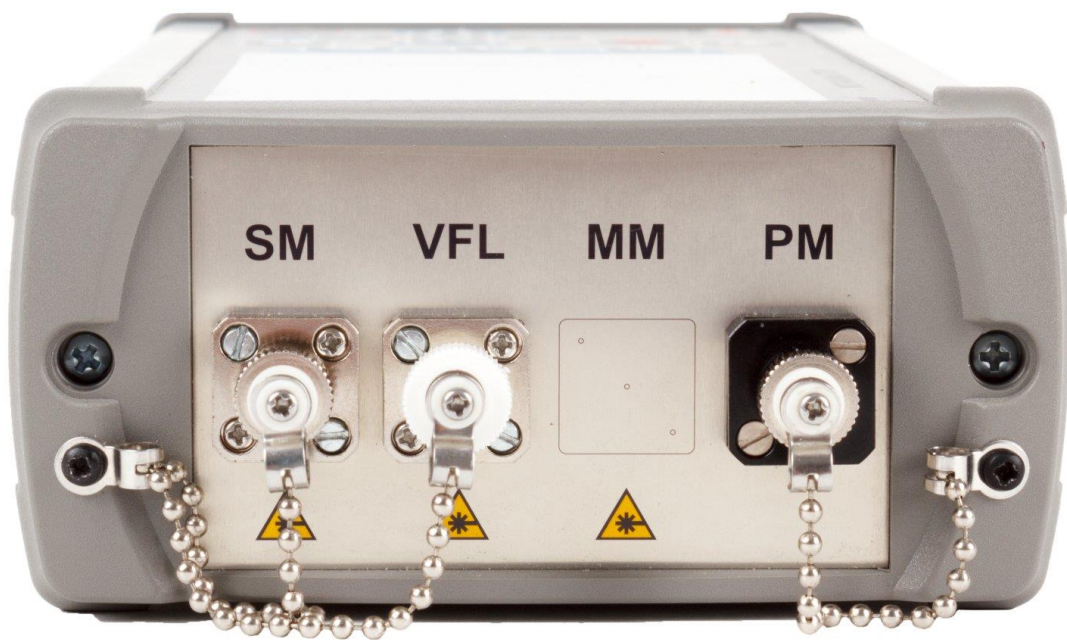



Figure 3. Side view (optical connectors)


4.3 Power supply

The device is powered from the following sources:


- Built-in Li-Ion battery;
- External power supply 220 V;

	CAUTION
	<p>The device is not switched off automatically. When the battery charging level is lower of acceptable, the device switches to power-saving mode. Further operation is impossible. Charge the device or connect an external power supply!</p>

4.4 Switch ON and OFF the device

	IMPORTANT
	<p>Prior to the measurements necessary to ensure the cleanliness of the optical connectors.</p>

Switch ON:

	CAUTION
	<p>Connect the OTDR to the line, make sure the signal line is not in the line. A high power signal in the line can lead to device malfunction.</p>

To switch the unit ON, press and hold the button "ON. / OFF." until audio signal. After a short beep on the screen for a few seconds the information is displayed about the part number of the device model, serial number and version of FW (Figure 4), then the unit will switch to the main menu (Figure 4).

Switch OFF:

To switch the unit OFF, press and hold the " ON / OFF" until the moment when the device display goes off.

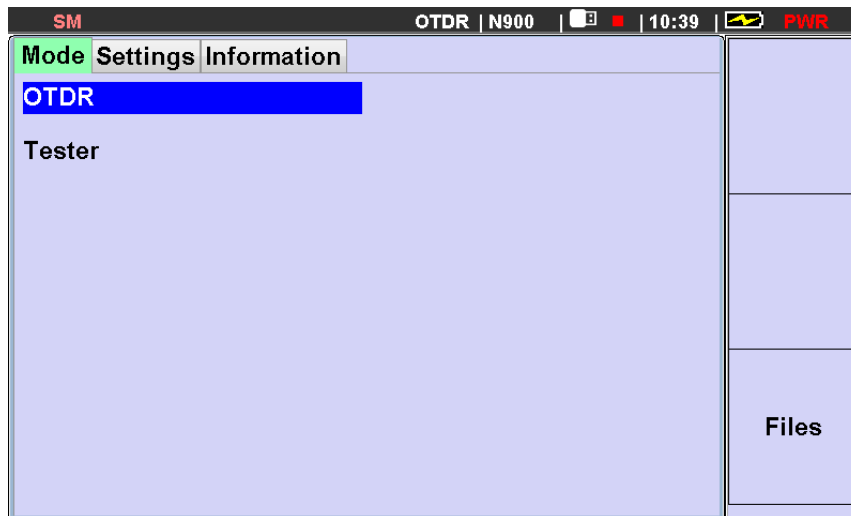






Fig. 4. Display of the main menu.

The top panel of the display is used to show the device status. In this panel, in the operation process, it is displayed the current time, battery charging, connection of an external USB drive, the active OTDR connector, etc.

4.5 Main menu

Main Window menu contains three bookmarks: "Mode", "Settings" and "Information". Switching between them is made by pressing the button "Table." on the ring left to right. Navigating through the menu on the tab is made using the keys  and . For selection the item you need to click . To return to the main menu, use the button "Back" .

Tab "Mode" in main menu is used to select the operation mode of the device (Figure 4): OTDR or tester. In the tab "Settings" the date and time values are set, the choice of language and on / off beep signal accompanying pressing of buttons.

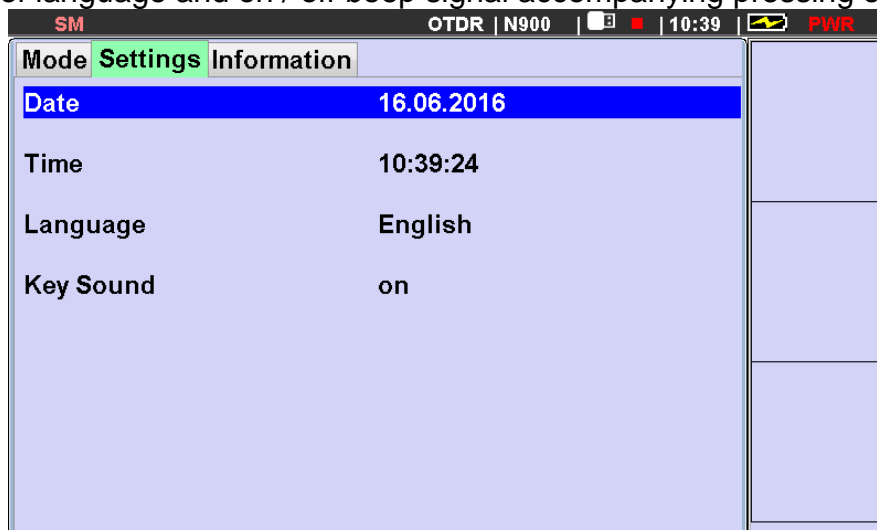


Fig. 5 Main Menu. Settings

The "Information" item displays the information about the manufacturer and the part number of the model, serial number and version of FW of the device. The information about optical module is also displayed. The information on this tab is for reference and can not be changed using the buttons of the device.

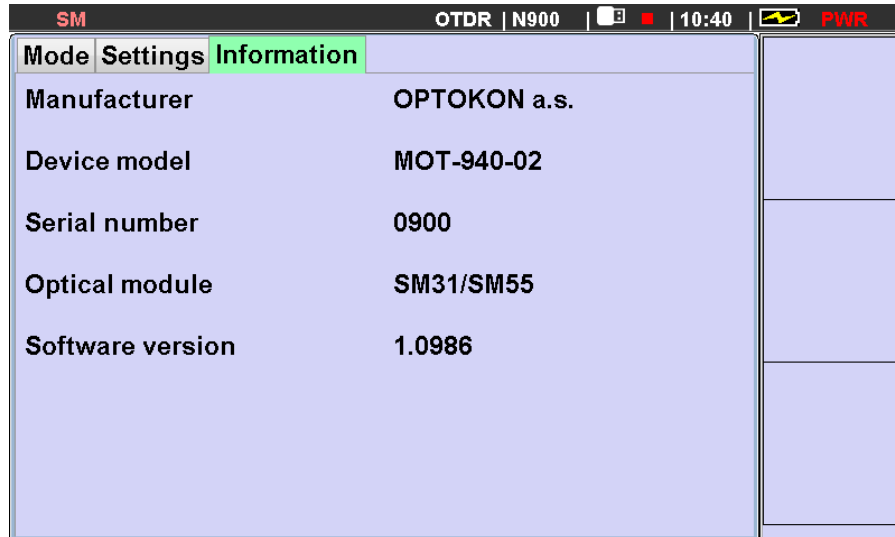


Fig. 6. Main Menu. Information

4.6 Cleaning and connection of optical connectors



IMPORTANT	
! ●	<p>In order to avoid errors during the measurement:</p> <ol style="list-style-type: none"> 1. Before connecting the optical connector to the adapter of the device it is always necessary to clean it, as described below. The manufacturer can not be held liability for damages or errors caused by incorrect handling optical connectors, or poor cleaning. 2. Make sure that your cable has a corresponding type of connector. The attempt to connect distinct types of connectors may damage them.

5 OTDR Mode

5.1 Description

Mode is designed for recording trace fiber optic line, determining distances to reflective and non-reflective inhomogeneity measurement line attenuation, the quality of splicing and optical connectors.

5.2 Measuring parameters setting

To set the measurement parameters of the trace log in the OTDR mode (See. pic. 4.5). In the Install Options tab "Measure" table appears with current settings (Figure 7 and Figure 8). Moving the points made buttons vertical arrows  and . To change the setting of the selected item should be press "Enter" to select the desired value by the arrows in the drop-down list and another just press the "Enter" key.

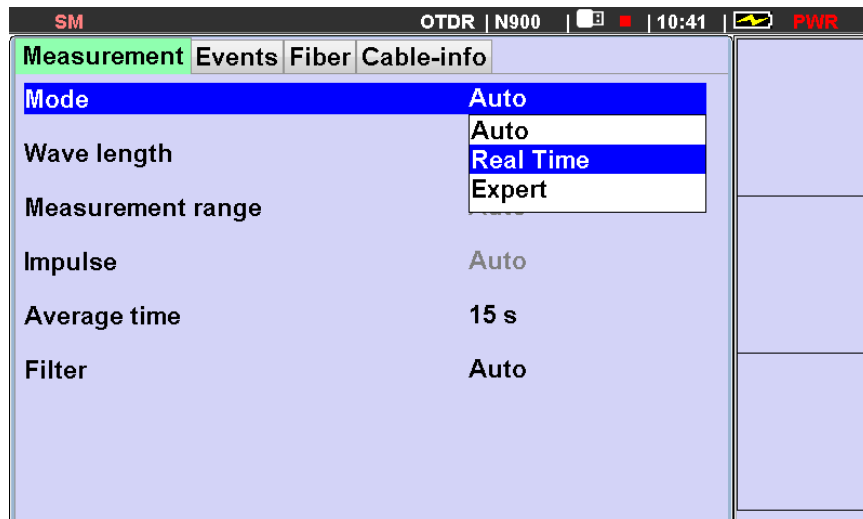


Fig. 7. Setting the measurement mode OTDR

The top row is selected OTDR mode: "Auto", "Overview" or "Expert".

In "Expert" mode, the operator has the ability to set all parameters measurement. This mode is for highly skilled users.

In the "Auto" user sets the wavelength and the averaging time, other parameters appliance chooses automatically.

In the "Overview" mode makes continuous scanning of the traces with a periodic displays them. This mode is useful for troubleshooting and monitoring splicing process.

Let to check more detailed process of the parameter setting in the "Expert" mode:

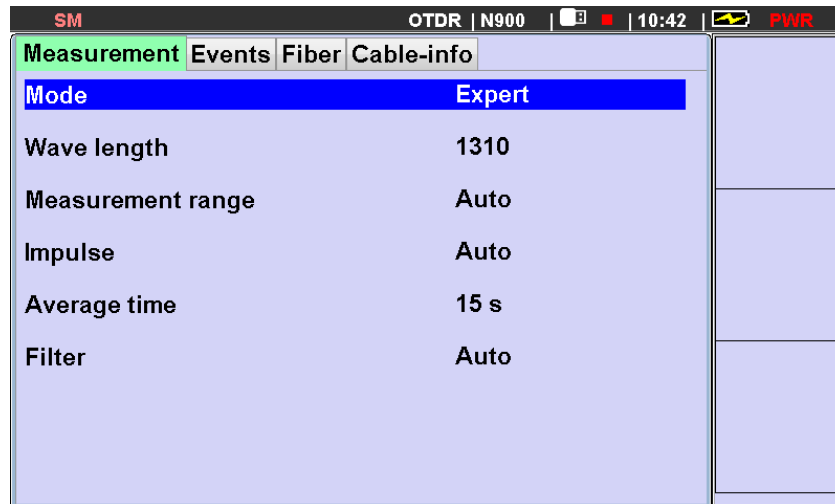


Fig. 8 Setting the measurement parameters in expert mode

Select "wavelength" on which you want to measure. Can select 1, 2 or 3 of the wavelengths in the instrument, at which will be performed measurement for one cycle. The results of these measurements are displayed on the display in different colors.

The "line length" is recommended to install 30% more expected line length. If the length of the line is not known, set to "auto". In this mode the instrument itself determine the length of the line, and shall set the optimum duration of the pulse.

The duration of the pulse is set at "Impulse" line.

The large value of "Time averaging" reduces the noise level, but at the same time increases measurement time.

The "Filter" in the ON state also reduces the noise level on the trace (smooth curve), but due to the post-processing of the measured data.

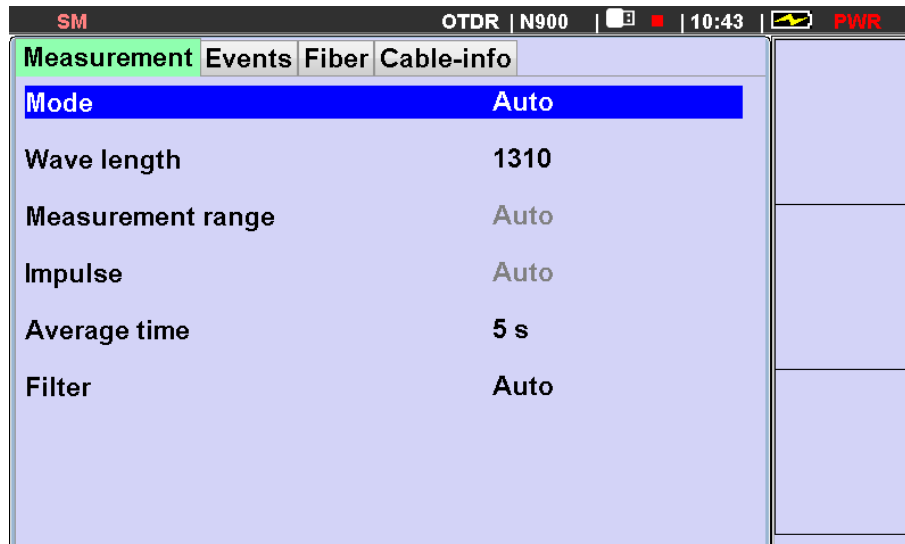


Fig. 9 Setting the measurement parameters. Mode "Auto"

5.3 Events analysis setting

To go to the "Events" tab to set the event search options.

Measurement	Events	Fiber	Cable-info
Events	On		
Thresholds	User		
End of line	5.0	dB	
Reflectance	-60	dB	
Loss	2.40	dB	

Fig. 10. Setup tab event search options

In the first line the events search process is switched ON.

Measurement	Events	Fiber	Cable-info
Events	On		
Thresholds	On		
	Off		
End of line	5.0	dB	
Reflectance	-70	dB	
Loss	1.00	dB	

Fig. 11. Set ON of automatic event search

When the line "Events" is set to "On." in the future at the end of the measurement process, the device automatically searches for events. The value "OFF" cancels automatic search for events.

The next line is set a method of selecting thresholds event parameters to be used in the search and display events.

If you select "Default" will be used typical values. When set to "User" in the device the operator has an opportunity to choose the threshold event search.

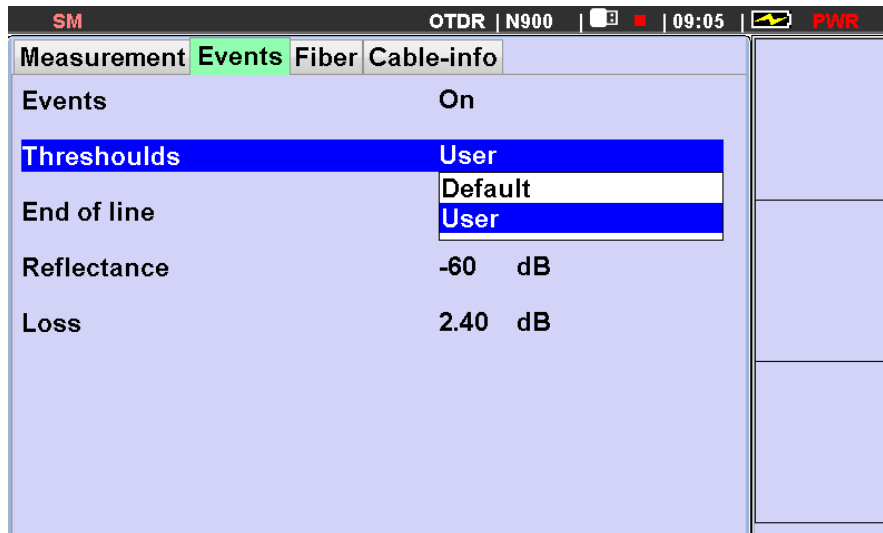


Fig. 12. Select the type of events search options

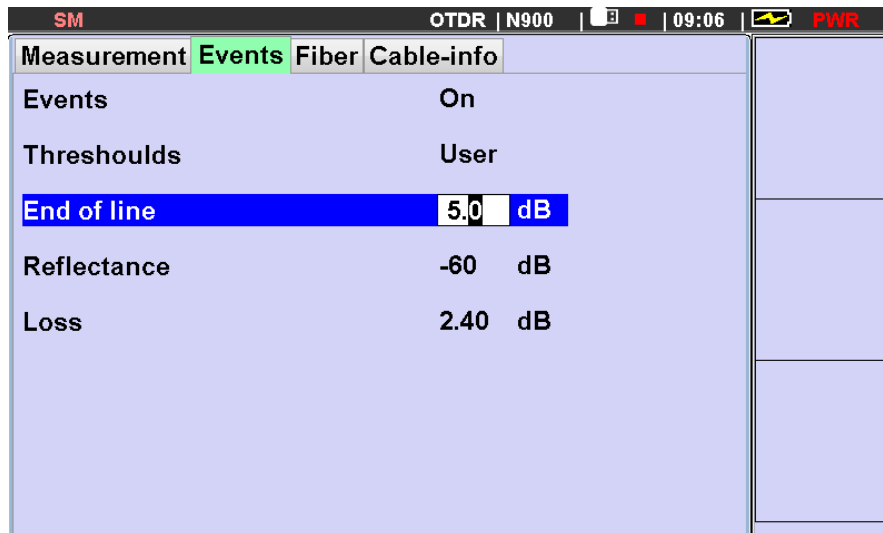




Fig. 13. Set custom event search options

5.4 Starting measurement

	<p>IMPORTANT</p>
	<p style="text-align: center;">Connecting the OTDR to the line, make sure the signal is not in the line. A strong signal in the line can lead to device malfunction.</p>

Starting the measurement process can be performed in the setup window or in the trace preview window. To start, press the button.  Time measuring approximately equal to the set averaging time. Before the beginning measuring instrument checks the quality of the input connector on the reflection level from it and measured in the presence of the signal in measured fiber. The screen displays relevant message (Figure 14).

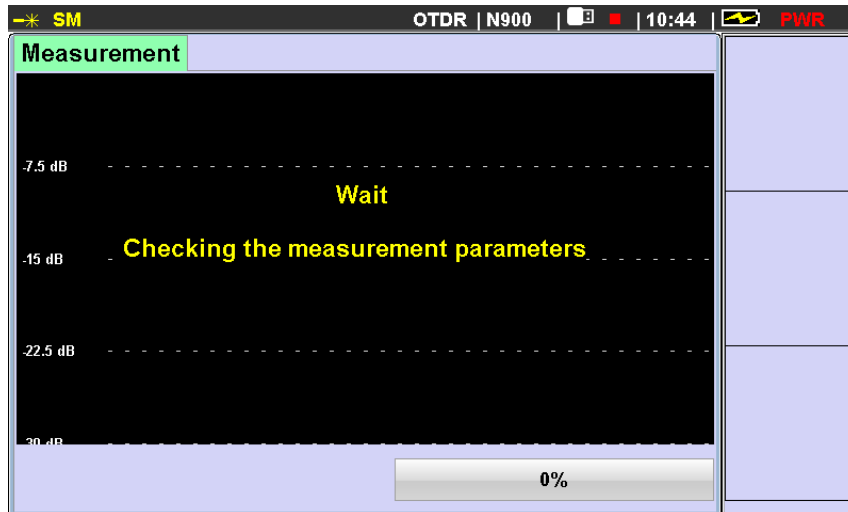



Fig. 14. Preparation for the measurement

The device provides protection against low of signal at the device input. But if the signal is strong, it will cause the device to malfunction. If there optical signal is detected, the measurement process is stopped and the display message appears. Make sure that is no signal at the line and repeat the measurement.

If the device detects a defective input connector in the near end (up to 20 m), on the display a message appears. Make sure that the input connector and cable connectors are clean (see. p. 9.1 and p. 4.6) and repeat the measurement.

NOTE	
	<p>To check the quality of the input connectors of the test line it is recommended to use a launch cable, which is connected between the output port of the OTDR and line input connector</p>

During the measurement the screen will be displayed intermediate results and at the bottom line the percentage of measurement completion (Figure 15).

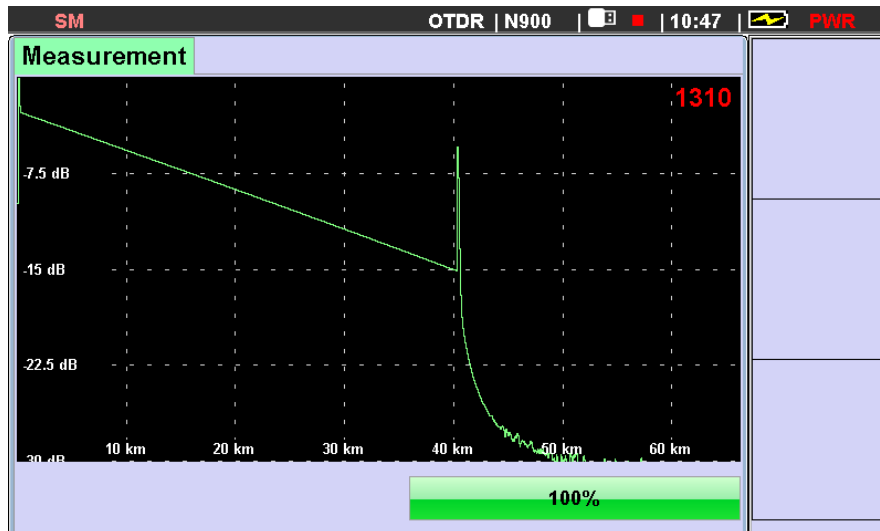



Fig. 15. The measurement process

After measurement, the instrument will go into view mode of measured trace with the resolution and the position of the cursor at which the measurement is started.

Abort the measurement process can be a new push of a button . After interruption the device displays that had measured.

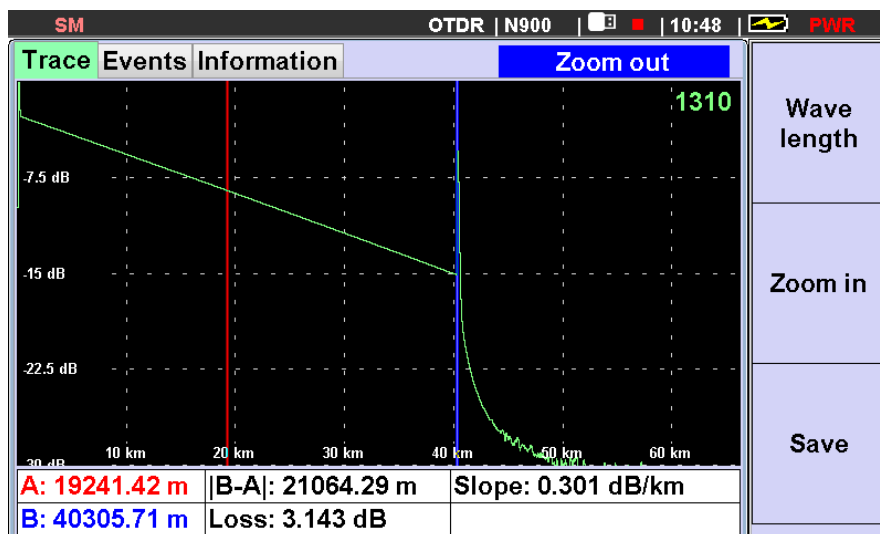


Fig. 16. Viewing the results of measurement

5.5 Viewing of the trace

In view mode of the trace on the instrument screen displays two tabs. In the "Trace" is displayed reflectogram, markers and information line at the bottom part of the window (Figure 16). The information line corresponding to the left and right colors (red and blue) displays the markers coordinates: x axis - the distance from the line and the y axis - relative attenuation peaks the initial probe pulse. In the middle of the bottom line shows the distance between the cursors and attenuation in the area between them.

One marker is active. Its position can be changed with the horizontal arrows. Switch the active marker by pressing the "Enter" button.

Zooming the image of the trace graph is as follows: Move the active marker to the desired location and press longer time the button «F2»

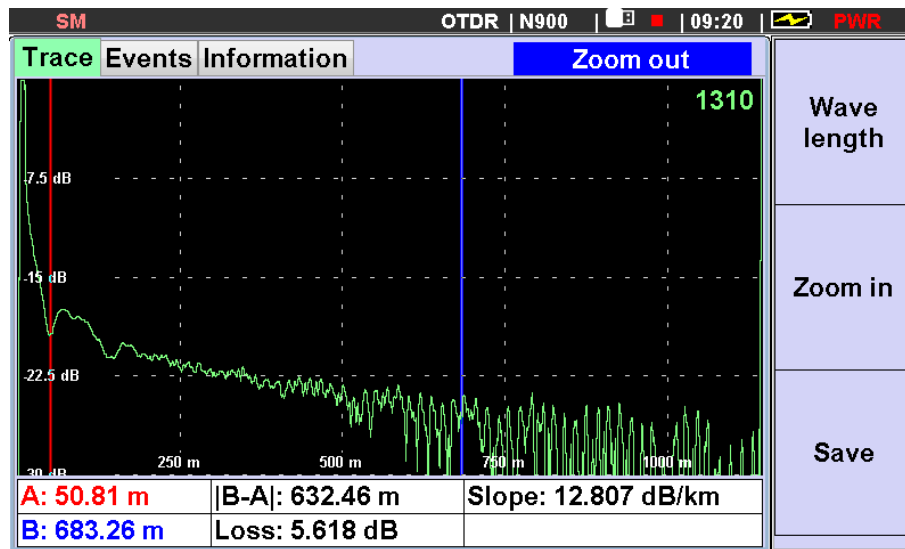


Fig. 17 Setting the trace display scale.

until the message at the right side of the top line of the window appears "Setup Scale ". After this using the horizontal and vertical arrows you can set the desired zoom horizontally and vertically, respectively. To exit scale setting mode, briefly press «F2». Further short pressing «F2» it will be possible to switch the display of the graph from the view mode to zooming and vice versa. Therefore, to analyse more interesting section of graph in view mode set on it the active marker, and then by briefly pressing the «F2» to zoom the section of the image in the marker area.

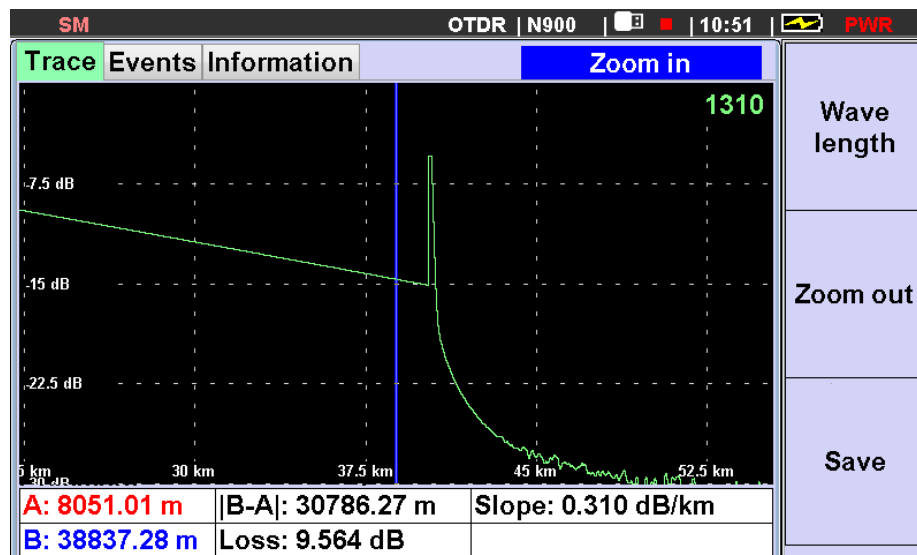


Fig. 18 Display the trace section in zoom mode

In the "Information" tab displays the parameters at which were made measurement.

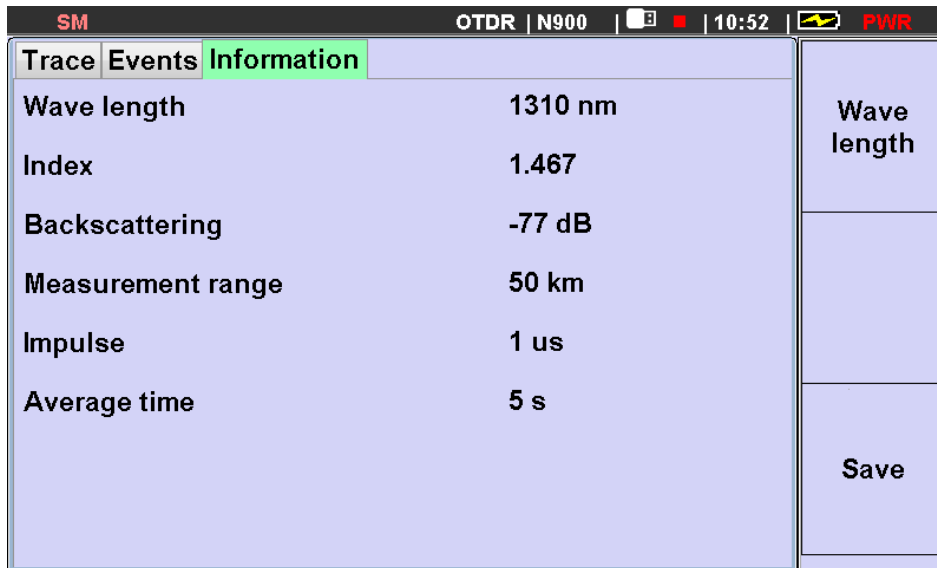


Fig. 19 Display of measurement parameters

5.6 Measurement of trace parameters

The device allows to measure the insertion loss and attenuation in trace events, as well as the distance between the events with the help of two markers. Using the zoom you can increase the accuracy of positioning the cursor to evaluate the value of event insertion loss or the distance to the event (see. Figure 20).

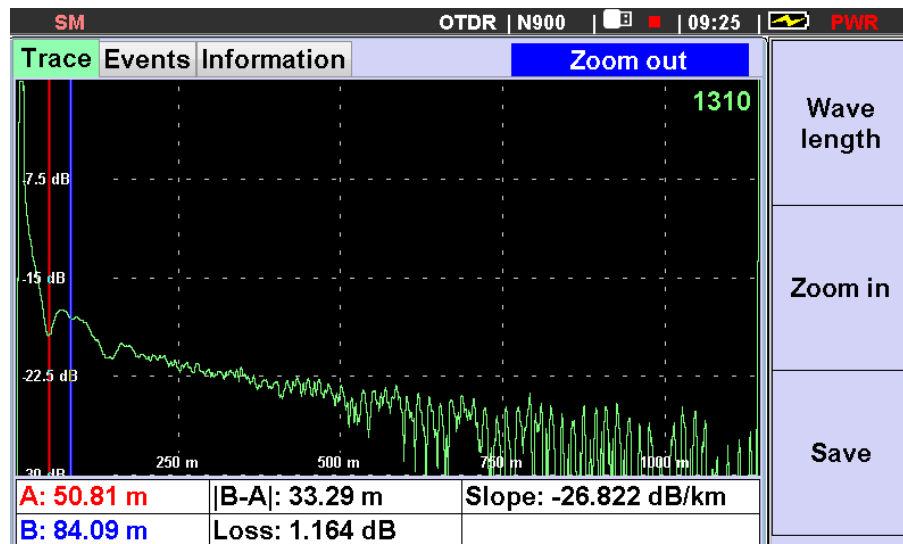


Fig. 20 Evaluation of attenuation on the connector with the two markers

In the lower part of the display on the tab. "Trace" the distance from the beginning of line to markers A and B is displayed, the distance between the markers and the loss rate on the section between the markers, the slope (attenuation per unit length) in the area between the cursors. To evaluate the nominal attenuation of the optical fiber should be chosen without events (for example, see. Fig. 16). Note that the error of the nominal attenuation by the two

markers on the line section less than 1 km can be high because of insufficient averaging the noise component of the measured data.

5.7 Automatical event search

If you set the "Events" tab in the measurement parameter setting ". Events - ON" (.. See Figure 11), the device at the end of the measurement cycle will search for events. List of events and their parameters are displayed in the tab "Events" window "Measurement" (see. Fig. 21).

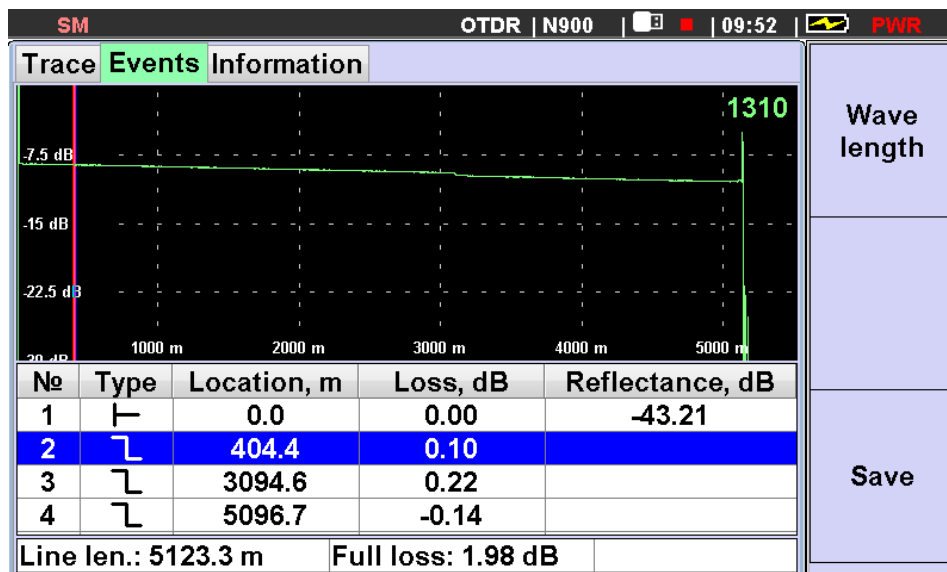


Fig. 21 Display of results of automatically search for events.

At the bottom of the window displays a table of events. Each event is assigned to a stroke, which specifies: number of the event; event type (in the form of icon); distance to the event; insertion loss; reflectance (for reflective events). The bottom line displays the length of the line, and the total losses.

Use the button "Wavelength» (F1) switch to the search of traces, measured at different wavelengths. Use the "Save» (F3) you can start the process of saving the measurement results in the internal or external memory.

Choice of Event line is made with vertical arrow buttons. The markers on the trace graph occupy the position corresponding to the selected event.

Check more detailed the selected event on the trace graph, you can click "Enter" button. In this case the device will switch to the tab "Trace" and the markers will still point to the selected event. Further scaling is possible to use a function Zoom, (see. Fig. 22 and 23).

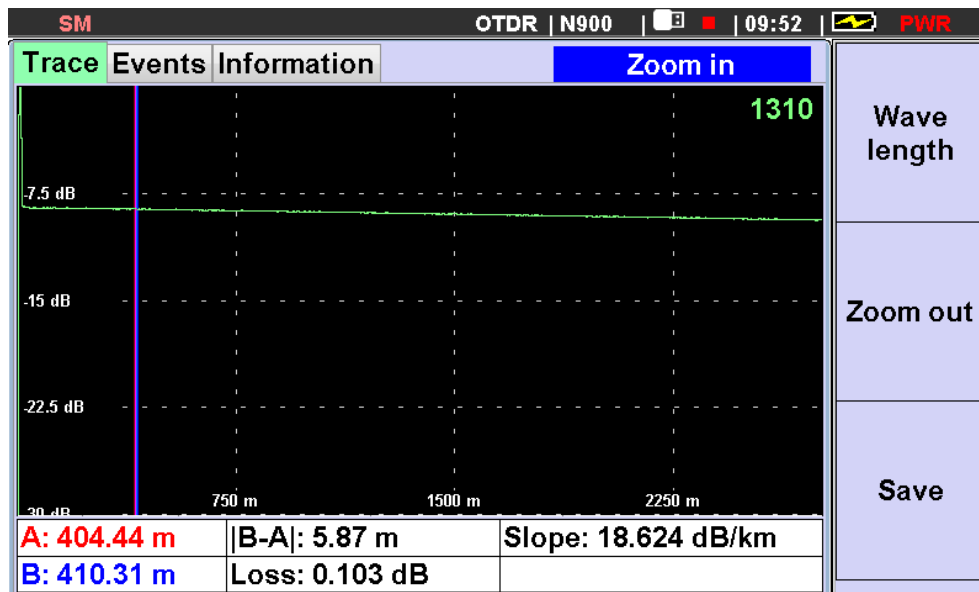


Fig. 22 The position of the selected event on the "Trace" tab

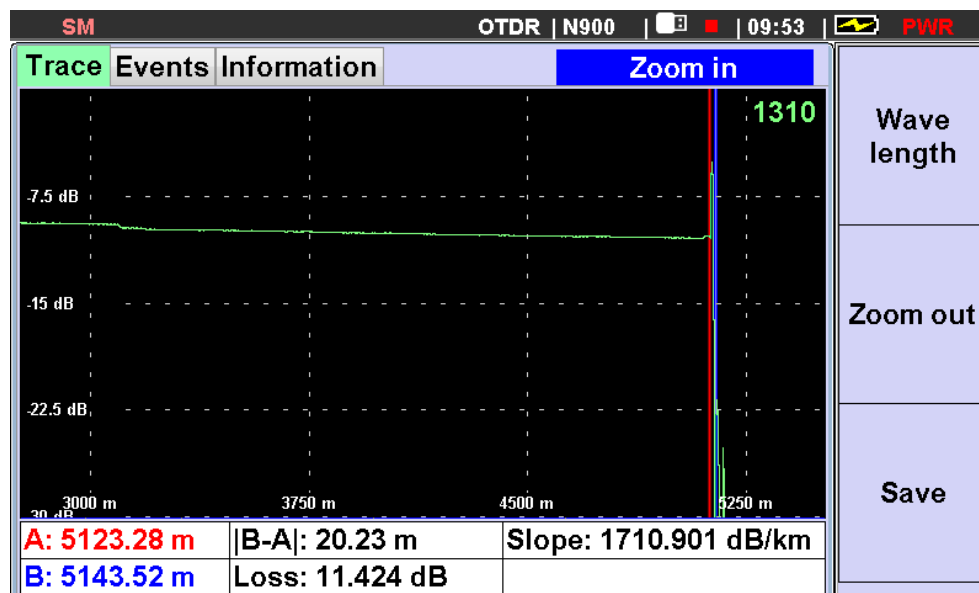


Fig. 23 Zoom of the selected event

5.8 Trace saving

The device allows you to store more than 1,000 traces in internal memory or on the an external USB-drive. Press «F3» to save the trace. The window will appear at the display, where you can select the drive and directory to save the file, enter prefix the file name, number of fibers, comment line, indicate the beginning and end of the trace, the type of trace and the name of the operator (Figure 24). The file name is formed automatically from a prefix, trace type, number of fiber, and the measurement wavelength. Part these parameters can be edited using the keyboard, the other part, such as the wavelength is specified when set measuring parameters.



Fig. 24 Trace saving window

To save trace press «F3», for not saving - "Escape" button. After saving or cancel the tester will return to the window view of measurement results. Trace stored in memory in the Bellcore / Telcordia format.

To view the saved traces the files management mode is needed to use. Entry to this mode is possible in the window of the Main Menu by pressing the «F3» key (see.Figure 4).

6 Tester Mode

6.1 Description

Tester mode is selected in the main menu window. Appearance Mode window shows in Figure 25. The window has two tabs "Power meter" and "Light Source". Switching between tabs by pressing the "Tab" button. In the active tab, the operator can change parameters corresponding type of the tester (e.g., power meter). The other side of the window indicates the current state of another part of the tester (e.g., light source).

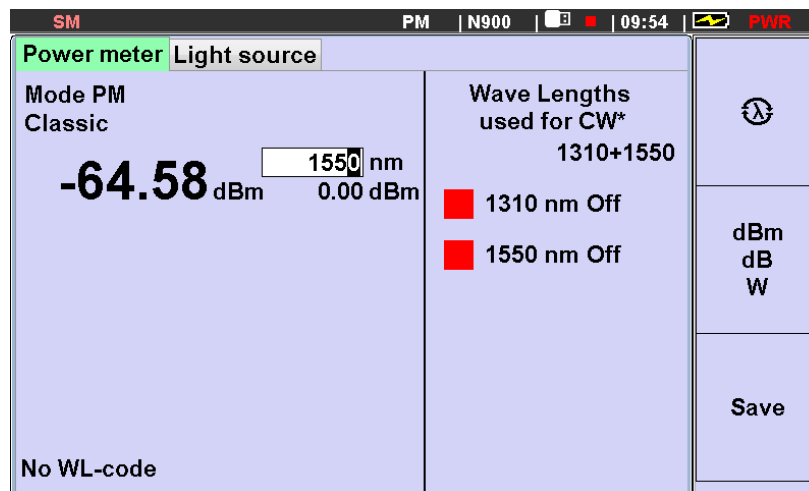


Fig. 25 Tester mode window.

Buttons F1, F2, F3 have the following functionalities:

F1 - «Power Meter Wavelength» Pressing of button leads to switching sequence of wavelengths value, which the power meter is calibrated: 850, 1300, 1310, 1490, 1550, 1625 nm

F2 - «dBm / dB / W».

- **A short press** switches step by step the unit, which displays the measured value of the optical power at the meter input. Showing in dBm and watts used in the measurement of the absolute power level of the optical signal. Display in dB - the measurement of loss (attenuation), reading is the difference between the measured and reference power level, so the loss is displayed with the sign "-".

- **Long press** (> 2 seconds) leads to storing of the input signal as a reference level (reference) and the switch meter display mode measurement of differences between input and reference signals. For each calibration wavelength values stored its reference value (reference) power level

F3 - «Save». Pressing leads to the appearance of the windows settings of the saved file and select the path to save it.

6.2 Using the power meter

The power meter has three modes: "Classic", "Auto-wavelength" "Full Auto. Mode selection is made in the line "Mode PM "(Figure 26)

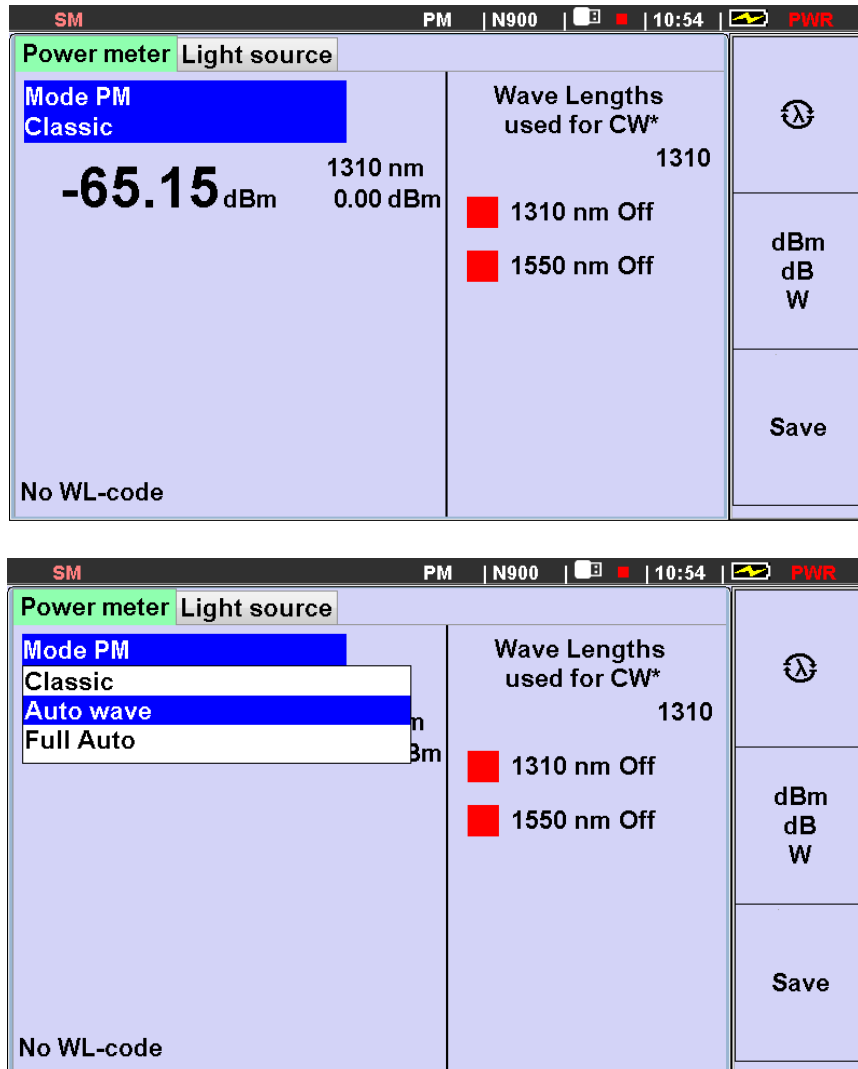


Fig. 26 Power meter mode selection.

The "**Classic**" mode measures the average power of continuous and pulse modulated optical signal at the device input (input power meter). The display of instrument shows the measured value in the linear (mW, μ W, nW, pW), or logarithmic (dBm) units, or the ratio of the measured value to the reference value of the average power, previously established. The ratio of the measured and reference the values displayed in logarithmic units (dB). This can be used to determine the attenuation of the fiber optic line.

Appearance of power meter display type in "Classic" mode is presented in Figure 27.

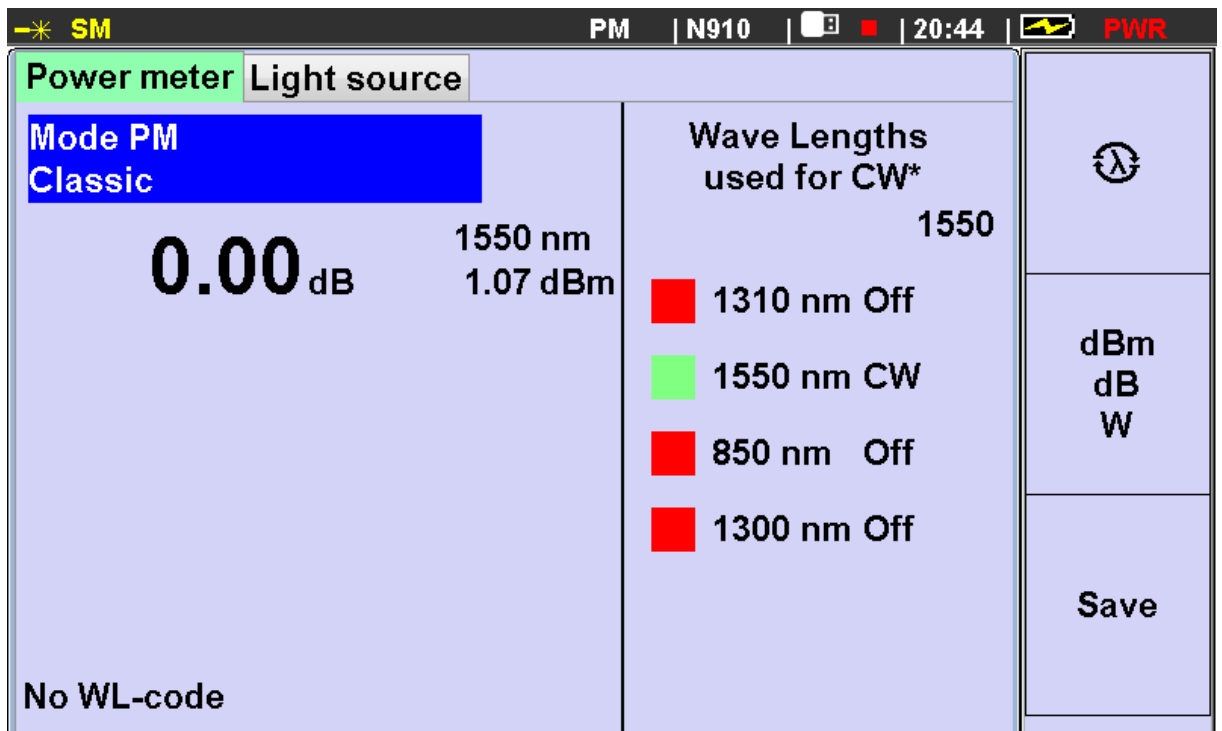


Fig. 27 The power meter readings in "Classic" mode (automatic detection of the measured signal wavelength)

In the "**Classic**" mode, information about the **wavelength** of measured signal can be defined in two ways:

- Contained in the measured signal in the form of a special code, which is periodically transmitted by a source (in this case in the lower left corner of the display value of the wavelength transmitted by the source);

- Set by the operator from a number of working wavelengths (850, 1300, 1310, 1490, 1550, 1625 nm) by pressing «F1» button. Changing the wavelength values by 1 nm step is made of horizontal arrow buttons. The value set by the operator of the wavelength used for the calculation of the measured signal. In the bottom left line of the display the message: "There is no wavelength code."

Setting of units of measurement result is made by sequential pressing «F2» button. Short press «F2» sequentially switches the unit in which the measured value is displayed on the power meter input port. Display in dBm and watts used in the measurement of the absolute power level of the optical signal. Display in dB - in measuring the loss (attenuation); reading is the difference (in dB) of the measured and reference power level, so the loss is displayed with the sign "-".

Setting a reference level by long pressing (> 2 seconds) «F2» key.

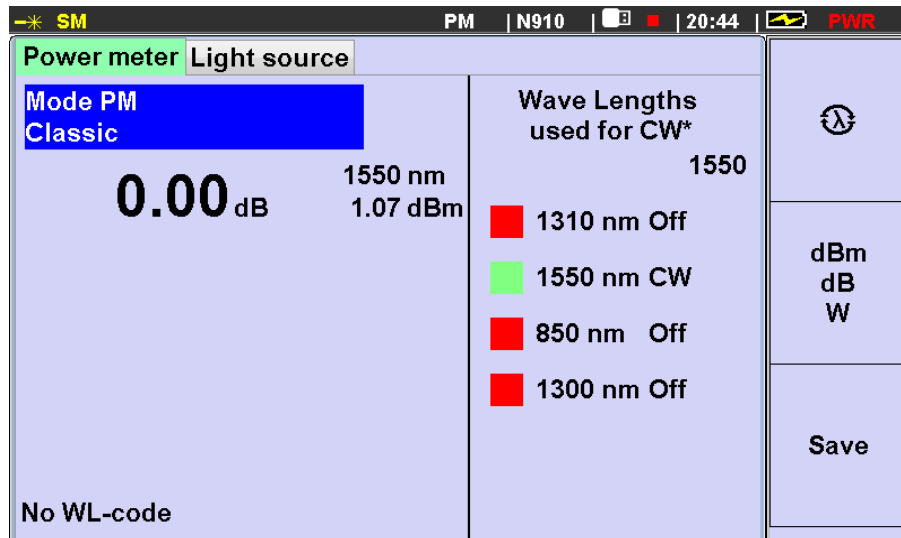


Fig. 28 Setting the reference level of the power meter

The measured value of power in the PM input signal is stored as a reference (displayed below the current value of the wavelength), the display mode switches to "dB", the meter readings are set to "0.00 dB".

For each calibration wavelength values it is stored its reference value of power level.

Saving the measurement result by pressing «F3» button (more ref. to chapter 6.5).

"Auto wavelength" and "Full Auto" are designed to measure the insertion loss of a fiber optic cable and optical components.

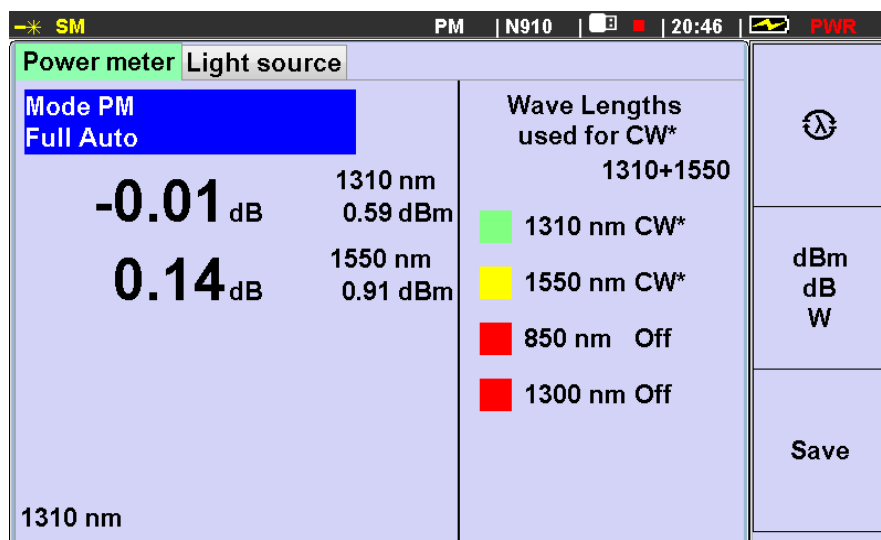


Fig. 29 The power meter in the "auto-lambda" mode

In these modes attenuation is measured at 4 wavelengths in one measuring cycle. For this the compatible optical light source is required for two, three or four wavelengths. The results of attenuation measuring in "dB" will be displayed at the current wavelengths of the source. The source sequentially changes the

wavelength and sends appropriate code, with a periodicity of 3 seconds. The difference between these modes is that in the "Auto-lambda" mode the attenuation value is calculated with the reference value stored in a power meter, and mode "Full Auto with a remote reference" uses reference level sent by code from the source with optical signal.

6.3 Operation in a light source mode

The optical light sources are designed for emission of stable continuous optical power for determining of the optical signal loss in single mode and multimode optical fibers.

Device MOT-940 Series can have up to four sources to one output (OTDR connector). At the same time only one source can be active. Wavelengths of optical light sources are displayed on the right side window of the tester. Selection of light source is by using the buttons vertical arrows at the active tab "Source". To switch ON/OFF it is required to set the light source into the operating mode by pressing button "VOD" and then select the desired source mode.

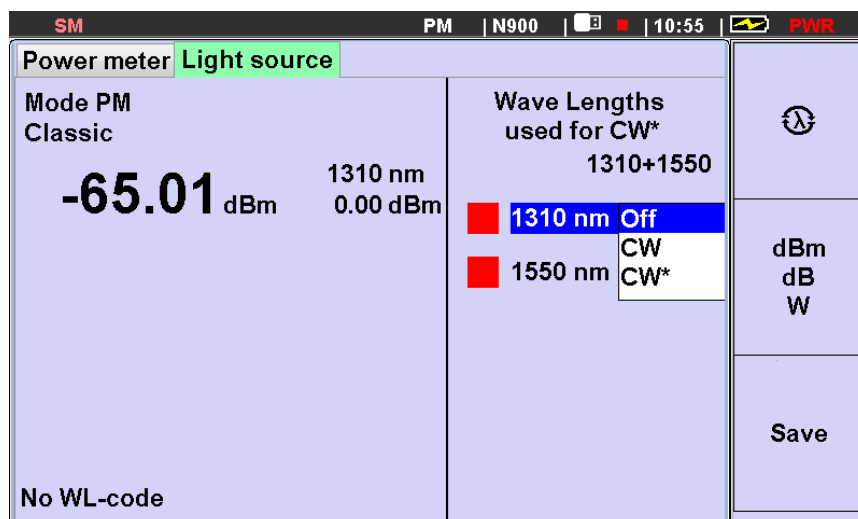


Fig. 30 Light source mode settings

The light source can operate in the following modes:

1. «OFF» - light source is switched OFF.
2. «CW» - constant wavelength mode.
3. «CW *» - light source with periodic wavelength switching. In that mode the device cycles through the wavelength sources and transmits the code of wavelength and optical power level to a compatible power meters.

Menu item - "Wavelength source for CW*" allows setting of list of wavelengths switching in the « CW* » mode. To change the set (list) of wavelengths designed in the line of "wavelength in the CW*" press "Enter" and select required list of the of wavelengths (Fig. 30).

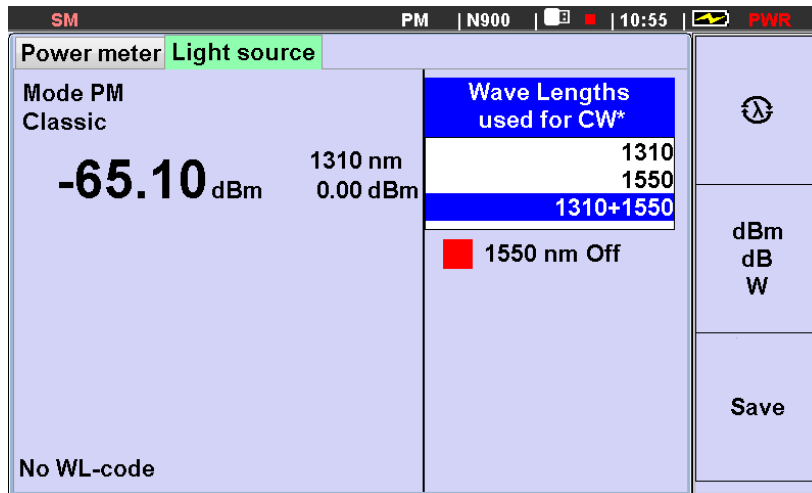


Fig. 31 Wavelength settings in CW* mode

If the OTDR has two optical outputs (light source), such as in models 940-01, 940-04, 940-05, the list of possible wavelength combinations includes all possible sets of wavelengths for relevant port,(see. Table 1).

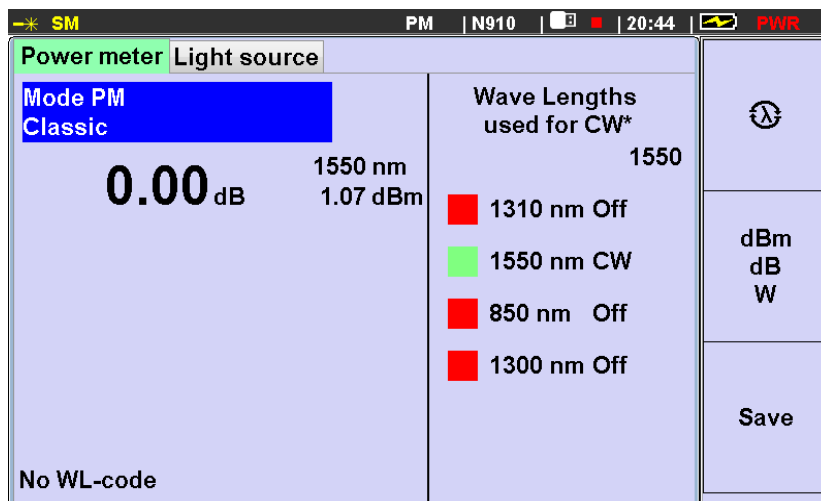


Fig. 32 Operation in CW mode in the display device.

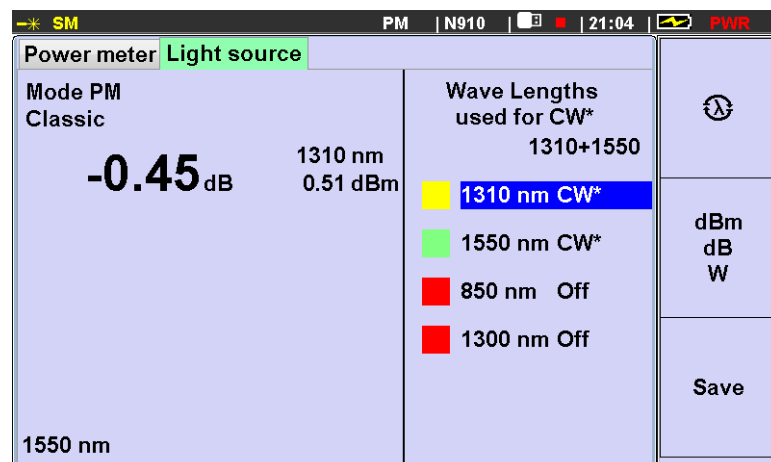


Fig.33 The display device in the CW* light source mode.

In mode CW* the light source sequentially switches the wavelength at its output, and transmits the information about the current wavelength.

6.4 Using the Visual Fault Locator.

Visual Fault Locator (VFL) is used to locate local defects, the continuity of the fiber in OTDR dead zone, as well as fiber identification in an optical cable.

VFL has a separate output (see. Figure 3) and operates in flashing light mode 1 Hz. Switch ON / OFF of VFL light is made with a separate button (See. Figure 1), to switch OFF requires a longer time press. The signal from VFL it is possible to switch ON and OFF even when the power supply of OTDR is switched OFF.

Checking the signal from VFL is done visually by the presence of red light at its output. Connector Protective cap is made of semi-transparent plastic.

6.5 Saving of Power meter measurements

Result of measurement of optical power or insertion loss can be saved into internal or external flash disc by pressing «F3» button. After pressing this button, current power meter readings are fixed (also fixed the date and time), and "Save as" window appears on the device display (see. Fig.34)

This window is similar to the same window in the "OTDR" mode. The main difference between measured data saving is that in "Reflectometer" mode data are stored in a separate file, and in the "tester" mode are added in the form of successive entries in the currently open file extension * .cvs (text file with separators). The file name is displayed on the top line of the window. It consists of a prefix "PM", a string of characters from the "File name" and characters "Operator name" line. The file path is set in the first three rows of the window "Save as". If the file name, file path and name of the operator does not change, the data will be added to the current file. If the next record to change the file name (and / or the path, and / or operator's name), a new file will be opened, and start recording a new data table. File format and one row (record) of measurement data is given in Appendix 1 to this document. In the power meter modes "Auto Wavelength" and "Full Auto" in one recording cycle as many rows are added to the file, as the results of different wavelengths is displayed when you press the "F3" button.

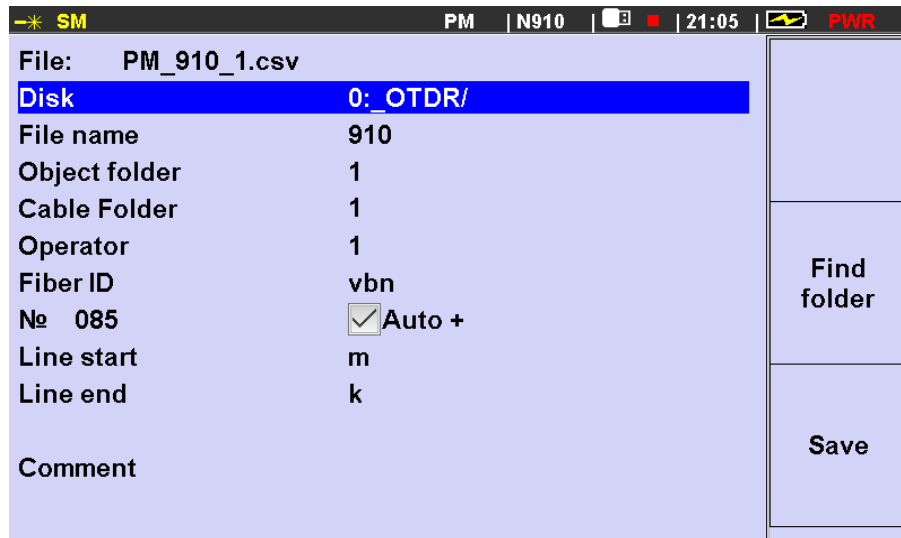


Figure 33 The window "Save as"

"Object folder" corresponds to the field "Project", and "Cable folder" - field "Cable ID" in the file header. "Near End Line", "Far End Line", "Operator Name", "Comment" also apply to the data file header.

"Fiber", "number" - written in the appropriate fields of rows of data written to the file during the save operation. If the recorded number of lines (1 to 4), these data are the same for all lines written in this cycle. The values of date and time fields will be the same for these lines. A record number increases the number of recorded lines.

It should be noted that the preview of measured data file in tester mode is not provided in the device. When you try to open a file with the extension *.cvs using the file manager will receive a message: "File format is not supported". These files can be copied to an external USB-drive and used for preparation of the measurements report on the computer.

7 Memory operation

The device has a built-in SD-card capacity of at least 4GB for the storage of measurements. In addition there is a USB type A for external USB-flash drive. Provided indicator of connection external memory at the top status bar on the display.

7.1 Saving traces

To save a trace in the viewing mode, press «F3» (see chapter 5.8).

7.2 Saving power meter reading

Press «F3» to save the results (see chapter 6.5).

7.3 Viewing the stored traces

Press «F3 (Files)» to view the traces in the main menu screen instrument (see chapter 4.5). The screen displays a folder tree of the selected memory card (Internal or external) (Fig. 21). Selecting the memory card (internal or external) by pressing «F1» button is possible if the connected external drive. Otherwise, it may be used Only the internal memory of the device. When recording on external hard drive data placed in the prospectus «_OTDR». If this directory does not exist, it is created.

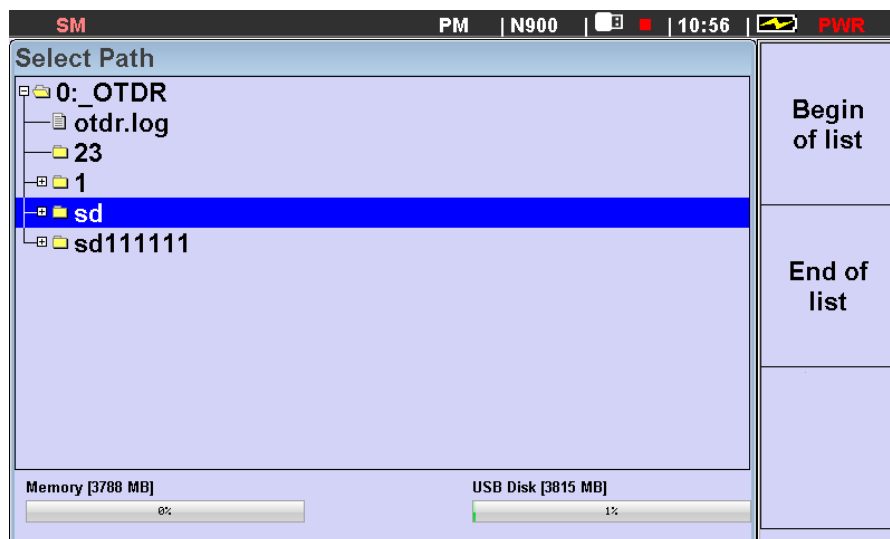


Fig. 34 Selecting a memory device

The device provides two-levels structure of folders for recording OTDR files. Top-level folders are used to store data of the project. Folders of the second level - a file folder traces of fibers of one cable. Selection / creation of the cable folder name can be made in the tab "Cable-Info" window installation of measurement parameters, or in the process of file saving. Selection / creation of the project folder is performed during file saving (see chapter. 5.8)

To find the saved file, you can move through the folder tree using the buttons vertical arrows. Entrance to the selected folder - pressing the "Right" arrow. Log in folder by pressing button F3 "Open". Go up from the folders of tree of File - by pressing arrow "Back".



Fig. 35 Working with memory. Selecting a file.

7.4 Copy measurement data to an external medium.

In the process of viewing the recorded measurement data, they can be copied to external drive. To do this, press the «F2» after selecting you are interested in a file or a folder.

It is possible to remove the selected object (Press «F1») At the bottom of the display a message appears about the successful removal of the specified number of files.

Note: If you try to make a copy of an object (file or folder) in the process of viewing the external memory, the device will display a message on the refusal to perform this operation.

If you select a file with the extension * .sor, you can open it by pressing F3 («Open»). The display track appears in the display of measurement results recorded in the file. Open only sor-files stored in the device.

Viewing the results of measurement file is not supported in the tester mode. You can copy them to external media and downloaded to a computer

7.5 Download traces to a computer.

You can download the reflectogram stored in the memory in your computer for the analysis of results and preparation of reports. It is possible in two ways.

The first way - to copy the measurement data to an external USB drive.

The second way - to measure the trace running "TopOTDRViewer" SW. When you start the measurement of the program, all data are immediately downloaded to the computer.

For measurements under the control of a computer::

1. Connect the device to your computer using the USB cable (supplied with the device set).
2. Run the program «TopOTDRViewer». And act in accordance with instructions in the program menu.

8 Setup of the devices

Use the "Setup" menu (Fig. 36) it is possible to set the current date and time, the display backlight, change the language setting, operating mode OTDR and contrast. Selecting the "Settings" menu, going from the main menu (See chapter. 4.5)

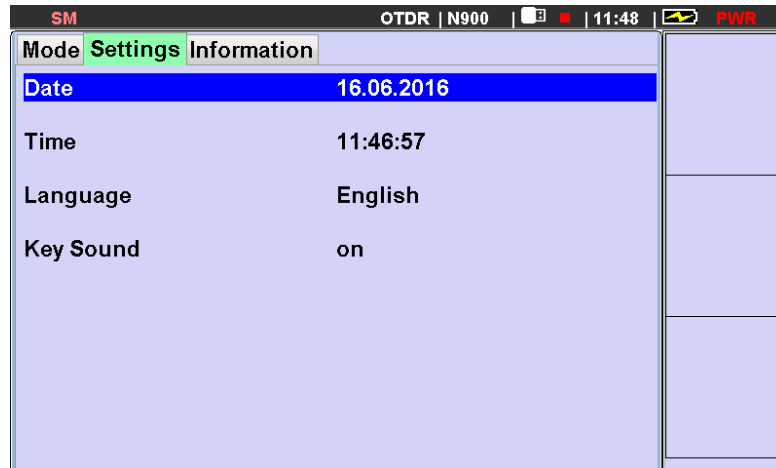









Fig. 36 "Setup" menu

8.1 Setting the date and time.

The device has a built-in clock and calendar, the values of which are used in the formation of the measured trace data file. To change the date, do the following actions:

Select "Date" in the "Setup" menu and press the button . Press "Tab" to select the date, month or year. Press  or  to select a number, the value you want to change. Using the buttons  and  set the desired value. To save changes, click . To return to the main menu, press button .

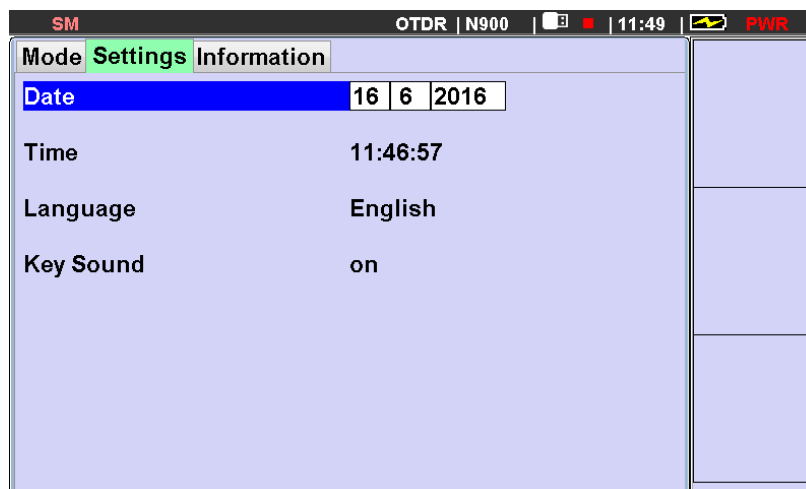



Fig. 37 Setting the date and time

The time is set similarly.

8.2 Language Selection

The device provides the ability to select the interface language. For change interface language, select the menu item «Language» and press "Enter" . At the list that appears, select your language and press the button again.

8.3 Switch ON / OFF sound button signal.

The device provides the ability to support the fact of pressing buttons control beep. This feature can be switch on or off in a panel "Buttons Audio" tab "Settings" menu of the main window. To change the status of this function to select the appropriate menu bar and press "Enter."

9 MAINTENANCE

9.1 Cleaning the connectors

To clean the connector, follow these steps (Fig. 38):

1. Remove the connector cover.
2. Slightly moisten the end of swab with isopropylalcohol (no more than one drop!)
3. Gently insert the connector end of the cleaning.
4. Gently rotate the wand connector.
5. Remove the wand from the socket.
6. Repeat steps 3-5 with a dry swab.
7. Cleaning products should be used only once.

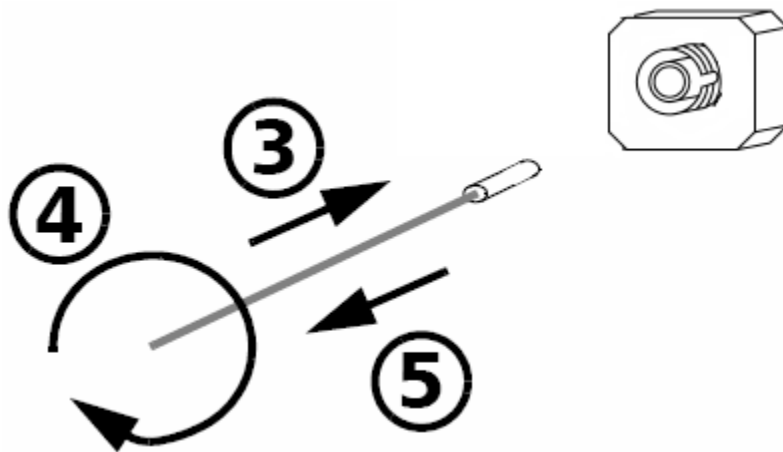


Fig. 38 Cleaning the connectors


IMPORTANT	
!	<p>Excess of isopropylalcohol may leave trails or dirt. Therefore, use a small amount of alcohol - just one drop.</p>

9.2 Charging the battery

The device provides a continuous operation from a fully charged battery normal conditions of use for at least 20 hours.

The device provides the battery level indication: on the right side the top panel of the display (see. Fig. 4) shows the numerical value of the actual voltage at the battery output. The maximum value corresponds to 100% the total charge value of less than 15% indicates a need to charge the device using external power adapter «5 V» or «USB - B» and a USB cable for connecting to a computer. Wherein should be flashing red LED on the side panel device near the connector «5 V» (see. Fig. 2). At the end of the charge process indicator stops flashing.

Standard charging time at the ambient room temperature - 5 hours. When you charge the device through the connector «USB - B» and the USB cable connecting it to the computer USB connector, charge time may increase. The charge is carried out independently on if device is switched ON or OFF.

	IMPORTANT
	<p>Charging the battery it is recommended to perform at environment 20-25°C. At lower temperature, the charge time increases. Not recommended to charge at temperatures below 0°C!</p>

To increase battery life time the instrument provides control of the degree of its discharge. When battery discharge level is to 25% on the display device the message "Battery Low! ". Continue to work with the device, you can press "Enter". If further work it is recommended to connect the device to the power supply, and at the end of the work to put the device to charge the battery batteries.

If the work will continue without connecting the device to an external power supply, the message "Low Battery!" will appear every 5% reduction battery level. Upon reaching a critical low battery level ("0%") device turned off. Continued work will be possible only after the device to connect to external power supply (AC adapter 220 or USB port of a computer).

For long term storage of the device it is recommended to charge battery up to 40-70% of its full capacity. Then we recommend the battery disconnect from the device.

9.3 The change of the optical power meter adapter.

The design of optical power meter connector adapter allows you to connect to it optic cables with connectors of various types. Changing the type of optical connector, it might be done by replacing the outer part of "adapter".

As option it is possible to deliver connector adapters for connection of the following types: FC, SC, ST, LC, and Universal adapter with hole diameter 2.5 mm and 1.25 mm.

To replace the adapter you need a screwdriver with a flat end.

Before replacing the adapter, remove protective cover from the power meter connector, then unscrew its fastening screws.

To install the socket, perform the steps in reverse order. If necessary, replace the protective cover.

9.4 FW upgrade

Manufacturer of the device is permanently working on their improvements: corrected errors and inaccuracies identified in the process of operation, new functionality. The instruments provide the ability to upgrade internal software using a special computer program (see. Top940FWLdr user guide)

To update the software, follow these steps:

- Connect your device to your computer using the USB interface cable from instrument sets.
- Turn off the power.
- Run the program «Top940FWLdr».
- Connect to the device and load the new software.
- After the update the device powered up, in the information tab of the Main Menu window to change the number version of internal software.

10 CALIBRATION of device

Calibration of device is made in accordance with the regulations documents for calibration OTDR, Power meter and Light source.

Recommended Calibration interval - one year.

OPTOKON Calibration Laboratory

The OPTOKON calibration laboratory offers excellent prices and fast turn-around times for all types of fiber optic test equipment.



Established in 1999, the OPTOKON calibration laboratory is an on-site, independent laboratory offering a comprehensive range of metrological services in the field of fiber optic calibration, verification, measurement and consultation. The laboratory helps our customers to comply with the steadily increasing requirements for product and service quality and reliability. Calibration services were accredited by the Czech Accreditation Institute in accordance with ISO 17025 standard (listed as calibration laboratory No. 2315) in 2003. The laboratory also provides a fast and nondestructive screening of materials and products for conformity with EU directives 2202/95/EC (RoHS) and 2002/96/EC (WEEE) and the outsourcing of metrological services.

The OPTOKON calibration laboratory offers:

- calibration of fiber optic test equipment including power meters, OTDR, attenuators, light sources
- verification of fiber optic test equipment including OSA, PDL meters
- measurement of fiber optic components including climatic tests
- all required documentation and certification

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