Optical Time Domain Reflectometer

User Manual

PREFACE

Thank you very much for buying and using S2106 series of optical time domain reflectometers. This manual mainly contains the commonly used operating safety instructions, basic operation and specifications, as well as common troubleshooting guidelines and other information. In order to facilitate your use, before operating this instrument, please read the contents of this manual carefully and follow the instructions in the book correctly.

This manual is limited to use in conjunction with this instrument. No unit or individual may alter, copy or disseminate the contents of this manual for commercial purposes without the authorization of the Company.

The contents of this manual are subject to change without prior notice. If you have any questions, please call the supplier. We will do our best to provide you with the best service.

CATALOG

1. Summary

1.1 Unpacking inspection

This instrument is packaged and transported strictly in accordance with GB/T 9174-2008 <General Technical Conditions for Freight Transport Packaging>. When you receive this instrument, please carefully check the product according to the packing list and check the appearance quality of the product, and timely find out the possible damage caused by the product in the process of freight transportation. If packaging damage is found, please notify the freight forwarder immediately while preserving the original packaging materials and contact the supplier of this product to solve it.

In product packaging, with adapter, analysis software and instructions, see the packing list for details. After receiving the instrument, please check the integrity of the instrument packaging at the first time. If you find that the material in the packing box is not complete, please contact your supplier's agent to solve it in time.

1.2 Product Overview

S2106 series optical time domain reflectometers (OTDR) is a new generation of intelligent optical fiber measurement instruments designed for testing optical fiber communication systems. This product is mainly used to measure the length, loss and connection quality of all kinds of optical fibers and cables. It can qucikly

locate the event points and fault points in optical fibre links accurately. It can be widely used in engineering construction, maintenance test and emergency repair of optical fiber communication system, development and production measurement of optical fiber and cable, etc. Installation and construction of optical fiber network construction, or follow-up rapid and efficient maintenance and troubleshooting testing, this product can provide you with the highest performance solutions.

This instrument has a novel appearance; has the simplest interface and intuitive operation; in similar products, the double operation mode of button and touch screen greatly simplifies the user's use; unique one-button analysis, quick access to test results, events are displayed in the main interface in the form of a list, and related information includes: event type, event location, loss, reflection, attenuation between event points, total loss and so on. Intelligent power management mode is adopted for the whole machine. Large capacity lithium batteries make the whole machine work for more than 10 hours, which is very suitable for long-term field use.

This instrument is equipped with OTDR, OPM(optical power meter), LS(light source), VFL(visual fault location) functions, and can also be equipped with event map (iONM), FEI(fiber end inspection), OLT(optical loss test) functions.

1.3 Safety tips

⚠ **External power supply**

The power adapter input meets the following requirements：100V～240V，50/60Hz；@0.5A。

The power adapter output meets the following requirements：12V~19V，1.5A，Polarity：center positive。

Please use AC adapter attached to this instrument and use external power supply strictly in accordance with the specifications; otherwise it may cause equipment damage.

⚠ **Internal battery**

Inside the instrument is a special lithium battery. Only batteries for this instrument can be used. Do not use batteries for other instruments. Only use this instrument to charge batteries. In order to use safely, the internal charging circuit of the instrument sets multiple protection measures such as battery voltage, charging current, charging temperature and so on. The charging temperature of the battery in the machine ranges from 0~50℃. When the ambient temperature is too high, the charging will automatically terminate. When the instrument is not used for a long time, please charge the battery regularly. It is recommended that the battery be charged every 2 to 3 months to ensure the best performance of the battery.

Do not let the battery close to the source of fire or strong heat; do not open or damage the battery; take out

the battery when the instrument is stored for a long time. The temperature range of the battery during long-term storage is -20~45℃.

If the battery leaks or explodes, the electrolyte will damage the clothing or skin it has touched. Electrolyte may cause blindness. If you enter your eyes carelessly, please wash your eyes thoroughly with clean water and go to the hospital immediately.

⚠ **Laser safety**

Laser radiation; do not stare into beam CLASS Ⅱ laser product.

When using this instrument, please pay attention to avoid looking directly at the laser output port, and do not look directly at the end of the optical fiber when testing. When the instrument is finished, please cover the dust cap of the optical output port.

LCD Screen: This series of optical cable census instruments display 5.6 inch color LCD with touch screen. In order to maintain good viewing effect, please keep the LCD screen clean and clean. When cleaning, the LCD screen can be cleaned by wiping with soft fabric.

Tip: Do not press the LCD screen with sharp objects or wipe the LCD screen with organic solvents, otherwise the LCD screen may be damaged.

In the process of using the instrument, without permission, users are strictly forbidden to dismantle the machine without permission, otherwise they will lose the warranty qualification!

1.4 Instrument Maintenance

The whole machine is guaranteed for 24 months, and the consumable parts of battery and optical interface are guaranteed for 6 months. The items given with the products are not covered by this warranty.

If you need to return to the product due to product calibration or other reasons, please contact your supplier in advance, and briefly explain the reasons, so as to provide you with more timely and effective service. And you also can directly send the email to sales@salukitec.com, we will reply to you in 24 hours.

When the product returns, please note that:

The instrument is wrapped with polyethylene and other soft cushions to protect the integrity of the instrument shell.

Please use hard packing box to ensure that at least 3 cm thick soft material is filled around the instrument. Fill in the product after-sales service warranty card correctly, including company name, address, contact person, telephone, problem description and other information.

Delivery in a reliable manner to the agent responsible for your supply.

2. Basic Knowledge of OTDR

OTDR is a precise optical fiber measuring instrument based on the principle of Rayleigh scattering and backscattering generated by Fresnel reflection when laser propagates in optical fibers. By measuring the transmission time of optical pulses from one to the other, the distance L is calculated using the following formula.

$$L=c×t/(2n)$$

L unit is m, C is the propagation speed of light in vacuum $2.99792 ×10^8$m/s, t is the time of light pulse from emission to return (unit is s), n is the group refractive index, designated by the optical fiber manufacturer, divided by 2 in the formula, because the measurement is round-trip time.

OTDR is widely used in the installation, maintenance, emergency repair and monitoring of optical fiber and cable lines. It can measure the length, attenuation, connection quality and fault location of optical fiber cable.

When light propagates in optical fibers, Rayleigh scattering occurs due to the inhomogeneity of the doped components or the defects of the fiber link itself. Some of the optical signals will be scattered back in the opposite direction of the incident pulse, which is called backward Rayleigh scattering. The Rayleigh backscattering light can be observed regularly. With the change of signal intensity, the loss distribution and connection quality of optical fibers and cables can be measured accurately.

According to the theory of optical transmission, Fresnel reflection occurs when light encounters the boundary of two kinds of transmission media with different refractive index (e.g. movable connector, break or end of optical fiber). By receiving the Fresnel reflection signal regularly, the position of discontinuous points along the length of optical fiber can be accurately located. 。 The magnitude of reflection depends on the refractive index difference and the smoothness of the boundary surface.

The event of OTDR test refers to the abnormal point that causes abrupt change of loss or reflection power. Including all kinds of connection points, fusion points and bending, cracks or breaks in optical fiber links, which lead to the loss of transmission signals. The events of OTDR testing are mainly divided into two categories: reflective events and non-reflective events.

2.1 Reflective event

When OTDR transmits laser pulses along the measured optical fibers, reflections will occur due to the sudden change of refractive index when it encounters the active connection points or the end of the optical fibers. Some optical signals will be returned to the instrument along the measured optical fibers. The instrument will detect this reflection event by receiving the
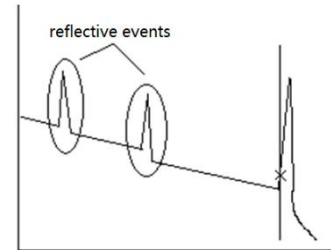
reflected signal. On the OTDR test curve, there is an upward spike signal with a certain width. The width and amplitude of the spike are mainly determined by the pulse width used in the test and the reflected intensity.

2.2 Non-reflective event

When OTDR pulses propagate along the measured optical fibers, such as where there is a partial loss of energy due to fusion or bending, there is no abrupt change in refractive index, so the reflection phenomenon will not occur or can be ignored. OTDR detection can detect the non-reflective event parameters at the OTDR receiver through backscattering. The non-reflective event shows a signal of energy decrease on the OTDR test curve, and its decreasing range indicates power loss.
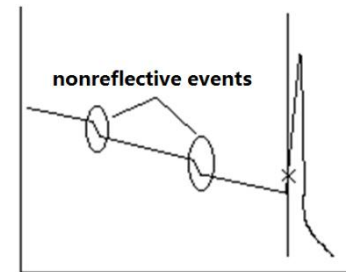
2.3 Dynamic Range

The dynamic range is an important parameter of optical time domain reflectometer, which takes dB as unit. This parameter is expressed as the maximum optical loss that OTDR can analyze when the backscattering level from the output port of the instrument is reduced to a specific noise level. In the actual use of OTDR, this parameter is usually measured by the farthest fiber link distance that OTDR can test under the condition

of the maximum test pulse width provided by the instrument. Therefore, under the same link condition, the larger the dynamic range, the longer the distance of the optical fiber link that the instrument can test.

The maximum test distance of OTDR is different in different applications, because the loss of the link under test is different. Connectors, fuses and spectrometers are also factors that reduce OTDR test length.
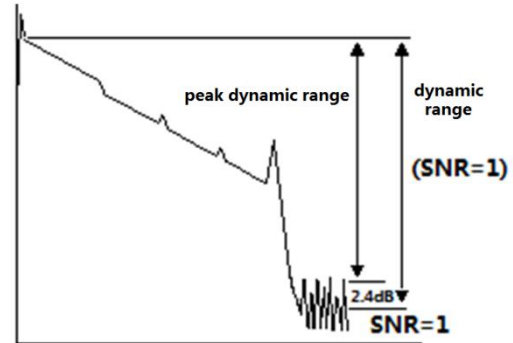
2.4 Event Blind Zone and Attenuation Blind Zone

Due to the influence of connection points or connectors, some parts of the link cannot be measured. OTDR blind area is divided into event blind area and attenuation blind area, which are generated by Fresnel reflection and expressed by the distance (m) which varies with the reflection power.

Event Blind Zone: The shortest distance between the detection of Fresnel reflection signal and the recognition of the next Fresnel reflection signal by OTDR is defined by the pulse width less than 1.5dB of the peak value.

Attenuation Blind Zone: The shortest distance that OTDR goes through from detecting Fresnel reflection signal to normal testing backward Rayleigh scattering signal, that is, the phase cannot measure fusion loss due to adjacent large reflection.

2.5 Splice Loss

OTDR tests distance and loss between specified points. This series of OTDR mainly use four-point marking method:

Measurements are performed at four points: starting point A, starting point B, ending point C and ending point D. The weld loss is calculated by the level difference of the mark B of the approximate line between B-A and C-D. Please set mark B in the correct position. The weld loss depends largely on the location of B. The measured loss between tags depends on the approximation method specified.
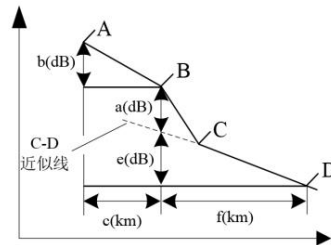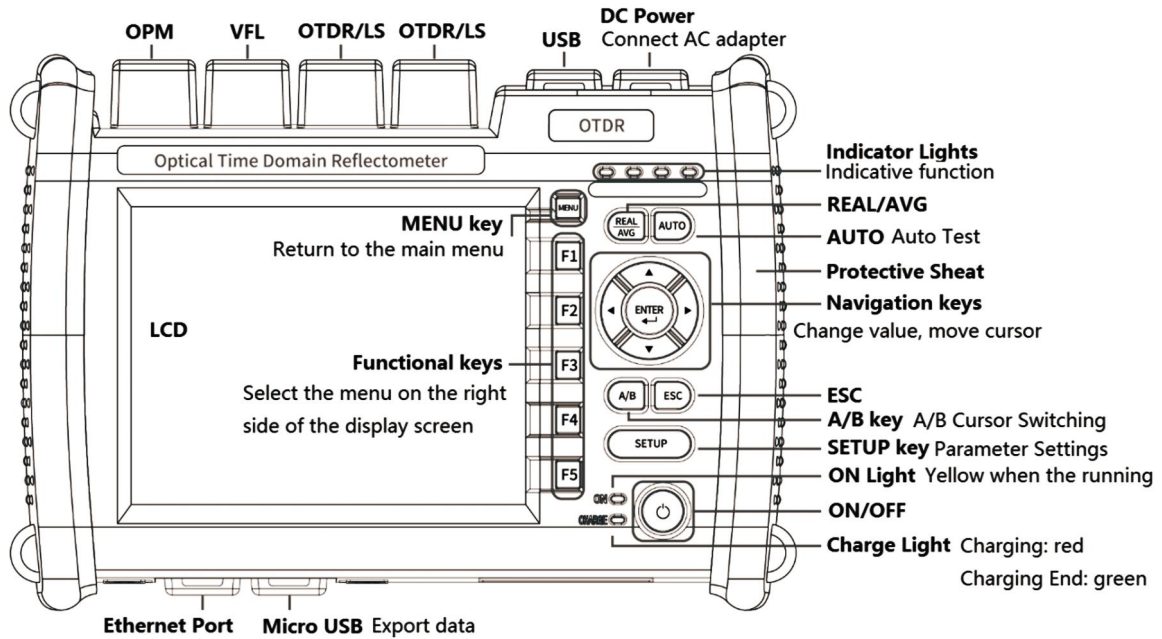

2.6 Return Loss (RL)

RL is the ratio of reflected light Pr to incident light Pi in dB. Using the formula RL=-10log (Pr/Pi), the greater the echo loss, the smaller the reflected light energy, indicating that the better the measured light path.

3. Basic operation and usage of OTDR series

This series of OTDR adopts a unique Nine-palace scheme in the main operation interface, which is novel in design. The optimized operation mode is more in line with users'daily use habits. At the same time, the unique button plus touch screen full-function operation mode in similar products in the industry makes the operation more convenient, and eliminates the cumbersome process of users frequently moving cursors.
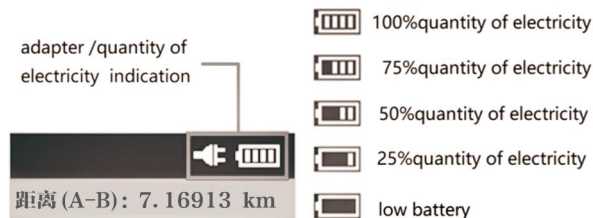
3.1 Front panel, top panel and bottom panel

OPM VFL OTDR/LS OTDR/LS USB **DC Power** Connect AC adapter

OTDR

Optical Time Domain Reflectometer

Indicator Lights Indicative function

MENU key Return to the main menu

REAL/AVG

AUTO Auto Test

Protective Sheat

Navigation keys Change value, move cursor

LCD

Functional keys Select the menu on the right side of the display screen

ESC

A/B key A/B Cursor Switching

SETUP key Parameter Settings

ON Light Yellow when the running

ON/OFF

Charge Light Charging: red

Charging End: green

Ethernet Port **Micro USB** Export data

3.2 ON/OFF

Press the power switch on the front panel of the instrument for more than 3 seconds. If the instrument starts normally, ON indicator lights up and displays the main screen. If an external adapter is connected and the battery is charged, the CHARGE LED will turn on the red light. When the battery is full, the CHARGE LED will turn on the green light.

adapter /quantity of electricity indication

距离(A-B)：7.16913 km

100%quantity of electricity
75%quantity of electricity
50%quantity of electricity
25%quantity of electricity
low battery

Battery power will be displayed at the top of the screen. When the power is too low, a warning message will appear. Please connect the instrument to the power socket with a random adapter and charge it in time.

3.3 Connect Optical Cable
⚠ **Warning**
- **Light is emitted from the light source port of the instrument. Do not unplug the connected optical cable. If light enters the eyes, it may hurt the eyes.**
- **If the light source port is not connected to the optical cable, please cover the cover of the light source**

port. When using an instrument with more than two light source ports, if light from another port enters the eye, it may harm eyes.
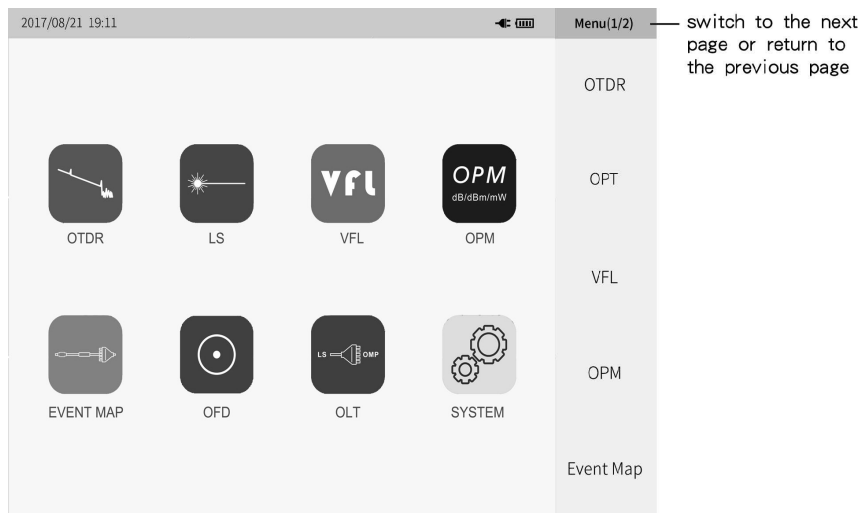
Attention：

● Before connecting the cable connector, make sure that the type of connector matches and the connector is clean. The wrong type of joint or contaminated joint will not only lead to inaccurate measurement, but also may damage the optical interface of the instrument. The correct way to clean the end face is to clean the jumper with absolute alcohol before inserting the optical fiber connector (jumper), especially the end face, and then connect with the instrument after the alcohol evaporates.

● When connecting optical cable connectors, the optical ports should be inserted vertically and slowly. If left, right or too hard, the optical connectors or optical ports will be damaged

● If the port is not connected to the optical cable, the dust cover should be immediately covered to prevent dust or other dirt from attaching to the optical output port of the instrument.
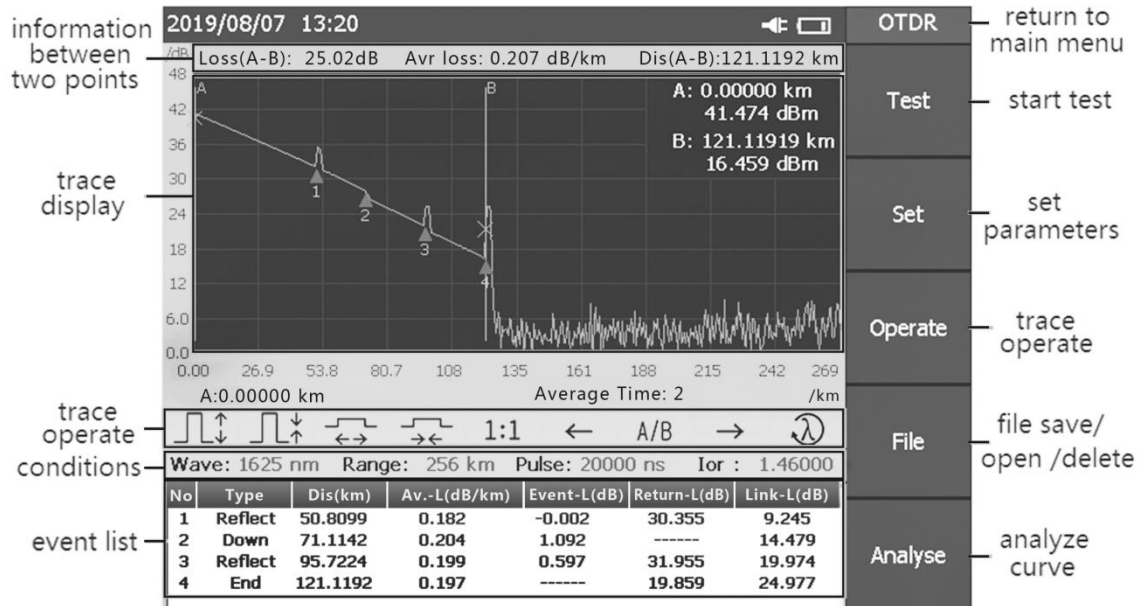
3.4 Main Menu

After opening the instrument, the main screen is displayed first. When using various functions, first select functions from the home screen, and then set up or measure them.

Press each function icon to enter the corresponding function, or select a function with the soft key (F1 ~ F5) on the right side. The " Menu (1/2)" key in the upper right corner of the home screen can switch the main menu to the next page or return to the previous page.
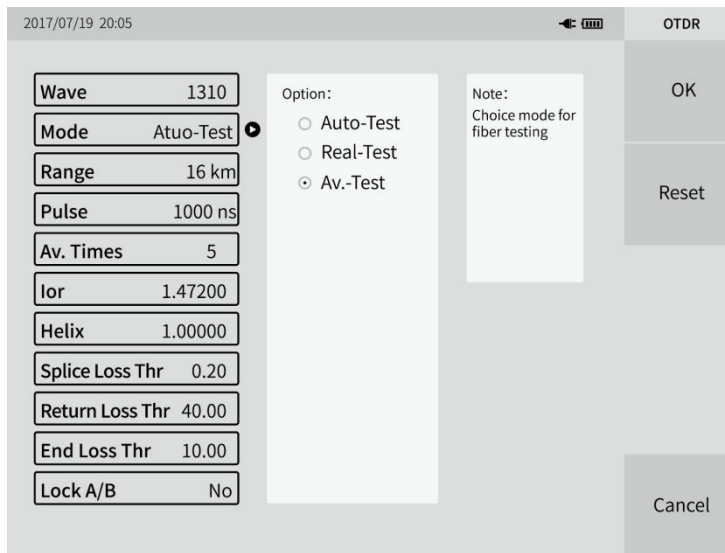
2017/08/21 19:11

Menu(1/2) —— switch to the next page or return to the previous page

OTDR

OPT

VFL

OPM

Event Map

OTDR   LS   VFL   OPM

EVENT MAP   OFD   OLT   SYSTEM

15

3.5 OTDR Main Interface

information between two points —

| 2019/08/07 13:20 | | | OTDR | — return to main menu |

| Loss(A-B): 25.02dB | Avr loss: 0.207 dB/km | Dis(A-B):121.1192 km |

A: 0.00000 km
41.474 dBm
B: 121.11919 km
16.459 dBm

trace display —

Test — start test

Set — set parameters

Operate — trace operate

File — file save/ open /delete

Analyse — analyze curve

A:0.00000 km

Average Time: 2   /km

trace operate —

1:1   ←   A/B   →

conditions — Wave: 1625 nm   Range: 256 km   Pulse: 20000 ns   Ior :   1.46000

event list —

No	Type	Dis(km)	Av.-L(dB/km)	Event-L(dB)	Return-L(dB)	Link-L(dB)
1	Reflect	50.8099	0.182	-0.002	30.355	9.245
2	Down	71.1142	0.204	1.092	------	14.479
3	Reflect	95.7224	0.199	0.597	31.955	19.974
4	End	121.1192	0.197	------	19.859	24.977

3.6 Introduction and Setting Method of Parameters

It is necessary for accurate measurement to set the parameters of the instrument correctly. Therefore, before using the instrument, the parameters must be set according to the requirements

Press [SETUP] key or "Set" menu to enter the parameter setting interface, press the corresponding menu, you can check the corresponding functions.

2017/07/19 20:05		OTDR

Wave	1310
Mode	Atuo-Test
Range	16 km
Pulse	1000 ns
Av. Times	5
Ior	1.47200
Helix	1.00000
Splice Loss Thr	0.20
Return Loss Thr	40.00
End Loss Thr	10.00
Lock A/B	No

Option:
○ Auto-Test
○ Real-Test
⊙ Av.-Test

Note:
Choice mode for fiber testing

OK

Reset

Cancel

■ **Measuring wavelength（nm）：**Set the test wavelength of OTDR.
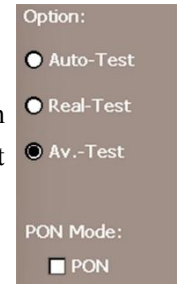
Setting method: Under the parameter setting interface, the corresponding wavelength can be selected by pressing [Wave], [1310 nm], [1550 nm] or [1310/1550 nm].

■ **Measurement mode ：**The method used to select OTDR scanning events includes "Auto-Test", "Real-Test" , "Av.-Test" and "PON Mode".

Auto-Test：Intelligent test method. In this way, the instrument will automatically match the test conditions according to the measured links, without the need for users to set parameters manually.

Real-Test：Real-time scanning of the measured link and displaying the test results each time can realize dynamic monitoring of the link and the state before and after continuation.

Av.-Test：In order to further improve the quality and accuracy of the test curve, the scanning results are accumulated and averaged.

PON Mode：Test optical links with splitters.

Setting method: Under the parameter setting interface, press [Mode], that is, [Auto-Test],[Real-Test] ,[Av.-Test], and [PON], and select the appropriate test mode.

■ **Measurement range（km）**：Setting Scanning Track Range.

Range setting is based on the actual length of the optical fiber to select the corresponding predefined range, must be greater than the length of the measured optical fiber, usually required to be set to about twice the length of the measured optical fiber. The longer the distance, the longer the test time.

Setting method: Under the parameter setting interface, press the [Range], that is, 500m ~ 256km option, press to select the corresponding range.

■ **Pulse Width（ns）：** Setting the width of laser pulse emitted by the instrument.
Pulse width settings vary with distance settings. This series of OTDR has simplified the test pulse width according to the range of different lengths, which greatly facilitates the operator's selection process. In practice, it is recommended to use the upper limit pulse width of the optional range.

Narrow pulse width： Similar time (reflections and losses) can be measured, but long distances cannot be measured.

Wide pulse width: Long distance can be tested, but multiple adjacent events can be identified as a single event.
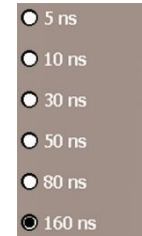
Setting method: Under the parameter setting interface, press the menu of Pulse, that is, the option of 5ns~20000ns appears, and press to select the corresponding pulse width.

- **Average times:** in the "average test" and "automatic test" mode, used to set the average processing test time. This option is not supported in Real-time Testing mode. It ranges from 1 to 3000.

Setting method: Under the parameter setting interface, press [AV. Times], pop up the average times input interface, after the average times input, press [OK].

Please input average times

2   The value in [1, 3000]

1	2	3	4	5	6
7	8	9	0	.	Del
<	>	BackSpace	OK	Cancel

- **Index of refractive (Ior):** The refractive index of the fiber affects the transmission speed of the laser in the optical fiber, so whether its value is set accurately or not directly affects the distance accuracy of the measurement. It is provided by optical fiber manufacturers, which range from 1.0 to 2.0, and the default value is 1.468.

Setting method: Under the parameter setting interface, press [IOR], pop up the refractive index input interface, input the refractive index of the

Please input value of Ior

1.46800   The value in [1.0, 2.0]

1	2	3	4	5	6
7	8	9	0	.	Del
<	>	BackSpace	OK	Cancel

measured optical fiber, press [OK] exit window.

- **Helix:** The placement of the correction factor takes into account the change between the length of the optical fiber and the length of the optical cable after the cable is formed. This parameter can be obtained from the cable manufacturer, ranging from 0.5 to 1.0, and is usually set to 1 by default.

Setting method: Under the parameter setting interface, press [Helix], pop up the cable correction input interface, input the correction coefficient of the measured optical fiber, press [OK].

- **Event Loss Thre.:** It is used to set the loss thresholds of connection points, fusion points or macro bends in links that OTDR can test, ranging from 0.01 to 30, usually defaulting to 0.1. When analyzing the measured link, events larger than event threshold will be listed in the event table, and those smaller than event threshold will be ignored.

Setting method: Under the parameter setting interface, press [Event Loss Thre.], pop up the event loss

threshold input interface, input the threshold value, press to determine the exit window.

- **Return loss Thre.：** Used to set the loss threshold of link reflection events that OTDR can test, ranging from 10 to 60, usually defaulting to 40**.**

Setting method: Under the parameter setting interface, press the [Return Loss Thre.], pop up input interface, input the threshold value, press [OK].

- **End Loss Thre.：** It is used to set the loss threshold at the end of the link that OTDR can test, ranging from 1 to 30, usually defaulting to 10.

Setting method: Under the parameter setting interface, press the end loss threshold, pop up the end loss threshold input interface, input the threshold value, press to determine the exit window.

- **Lock the A/B cursor：** Used to set whether to lock A and B cursors in trajectory analysis. Select and move the cursors A and B at the same time.

Setting method: Under the parameter setting interface, press and select [lock A/B].

Note: Refractive index, cable correction, event loss threshold, reflection loss threshold and end loss threshold need not be changed. If the default value needs to be restored after the change, in the parameter setting interface, press [Restore Settings].

3.7 Start test

Automatic test: Set up [Wave], [Mode] - [Auto-Test], and press [OK]. Press [Test] to start test. Or set [Wave] and press the "AUTO" button directly after confirming. No other settings are needed.

Real-time testing: Press the "REAL/AVG" button directly to start real-time testing or average testing. (Test conditions are those set for the last test)

Average test: set [Wave], [Mode] - [AV.-Test], [Range], [Pulse], [AV.Times] and press [test] after confirming.

3.8 View event analysis results

After OTDR test is completed, the measured loss distribution traces of optical fiber links are obtained, and event points are

No	Type	Dis(km)	Av.-L(dB/km)	Event-L(dB)	Return-L(dB)	Link-L(dB)
1	Reflect	50.8099	0.405	-0.002	31.755	20.576
2	Down	71.3935	0.450	1.090	------	30.929
3	Reflect	95.7224	0.397	0.597	33.355	40.746
4	End	121.1192	0.418	------	21.259	51.362

screened and located according to the set event thresholds. The length, loss and average loss of optical fiber links are obtained. At the same time, the event point information is displayed in the event list column of the OTDR operation window.

At this point, by pressing the event list, or by pressing ▲ or ▼ keys in the navigation key, you can view the information of all event points in the event list one by one.

In the event list window:

Event type: the event type of the current event point;

（1）Falling event: indicates that this event point is a non-reflective event point in the middle of the optical fiber link, usually caused by fusion point, bending or extrusion of the optical fiber, etc.;

（2）Rising event: indicates that this event point is a non-reflective event point in the middle of the optical fiber link, usually for testing events generated by different types of optical fibers;

（3）Reflective Event: Indicates that this event point is a reflection event point, usually caused by an active connector in an optical fiber link;

（4）Divider: Indicates that this event is an optical fiber divider;

（5）Fiber End: Indicates that the event point is the end of the fiber.

Dis(km)： Distance for the current event point;

Av.-L(dB/km)：Average loss of distance in linear zone;

Event-L(dB)：Loss from fusion points in optical fiber links;

Return-L(dB)：Return Loss at current event point;

Link-L(dB)：The total loss of the link between the starting point and the current event point in the link.

3.9 Trace Operation

3.9.1 Moving and Switching cursors

The currently activated cursor can be moved to the left and right by the navigation key, ◄ 、 ► key or press ← 、 → . When the ◄ 、 ► key is pressed continuously, the moving cursor will move quickly after moving 10 data points continuously, moving 10 data points at a time. Open the ◄ 、 ► key, the active cursor will stop moving. Or you can press the touch screen directly, and the currently activated cursor stops at the position of the corresponding touch point. The switch between cursors can be achieved by pressing the key in the navigation key【A/B】or pressing the menu A/B .

3.9.2 Trace zooming

After the OTDR test of this series, press the icon ⊓↕ 、⊓↕ of the track operation bar, or press the menu key 【Operate】-【V-Z In】and【V-Z Out】. At this time, just press the ◄ 、 ► key directly to realize the function

of vertical enlargement and reduction of the test curve centering on the position of the currently activated cursor. Press ⬚、⬚ icon or press menu key【Operate】-【H-Z In】,【H-Z Out】. At this time, just press the ◄、► key directly to realize the horizontal enlargement and reduction of the test curve centered on the current activated cursor position; press 1:1 icon or press menu key【Operate】-【Init】, Trace Recovery Primitive Proportion Display

3.10 File Operation

3.10.1 File Save

The OTDR test track storage format of this series is based on the SR-4731 standard clause of Bell Communications Research Center, and the file is extended to. SOR.

Under the main interface of OTDR, select the File -【Save】menu, pop up the Save Interface shown in the right figure, enter the corresponding file name and path, and finally press the Save menu.

There are two types of test trace storage: Fast Save and Auto Save.

Fast Save - By Time: Store according to the end time of the test, such as the track of the test at 8:8:59 seconds on September 9, 2019, whose name is 201909080859.SOR.

Fast Save - By Name: Name the trace by the last name + 1. For example, the name of the previous track

storage is "Qingdao-Jinan 1", and the name of this storage is "Qingdao-Jinan 2", followed by + 1.

Auto Save - By Auto Test: Name the automatic test trace according to the end time of the test or the last name + 1.

Auto Save - By All Test: Name the automatic test and the average test trace according to the end time of the test or the last name + 1.

In trace storage information:

Cable ID, Fiber ID, Cable Code: Cable ID and Cable Code set at the initial laying of line.

Data Flag: BC - Create a test for newly laid optical fiber lines;

RC - Maintenance is the completion of line laying and later maintenance testing;

OT - Others are tested according to the actual situation.

O.Location: Link Starting Point Position.

T.Location: Link Endpoint Location.

Operator: Name of tester.

User offset: The initial offset set by the user.

Fiber Type: Choose the type of fiber optic cable under test. The types of optical fibers are: 651 multi-mode fibers, 652 general single-mode fibers, 653 dispersion-shifted fibers and 655 non-zero dispersion-shifted single-mode fibers.

Comment: Fill in the test conclusion and judgment of the tested optical fiber cable.

If the above information is not clear, do not fill in.

3.10.2 File Open

Under the main interface of OTDR, press【File】-【Open】and enter the File Open Interface. Select the path where the file is located, select the file, press the【Read】menu to open the selected file.

3.10.3 File delete

Under the main interface of OTDR, press【File】-【Delete】to enter the File Delete Interface. Select the path where the file is located, select the file, and press the Delete menu to delete the selected file. Press the Delete All menu to delete all data under the current file path.

Tip: Please use cautiously all deletion functions, data cannot be recovered after deletion!

3.10.4 File Copy

Under the main interface of OTDR, press【File】-【Copy】to enter the File Copy Interface.

From memory to U disk: Double-click the file name in the memory file or press【Mark/Sub】to select the file you want to copy, press the copy menu or ⌐»⌐ copy the file in memory to the U disk.

From U disk to memory: Double-click the name of the file in the U disk or press the 【Mark/Sub】 menu to select the file you want to copy, press the "copy" menu or ⌐«⌐copy the file from the U disk to memory.

Click on the full selection menu and select all files in memory or on the U disk.

Tips: In order to shorten your copy time, when the number of tracks is less than 500, you can directly copy to the U disk; when the number of tracks is more than 500, you can connect to the computer through the data line for copy!

3.11 Optical Power Peter（OPM）

In the main menu interface, press the menu or icon to enter the optical power meter test interface.

The measured light signal is connected to OPM optical interface through optical fiber jumper, and the test wavelength is selected to start power measurement. Absolute power, relative power and linear power are converted as follows:

$P_{Abs.Pow}=10lgP_{Lin.Pow}/1mW,$

$P_{Rel.Pow}=P_{Abs.Pow}-P_{Reference}.$
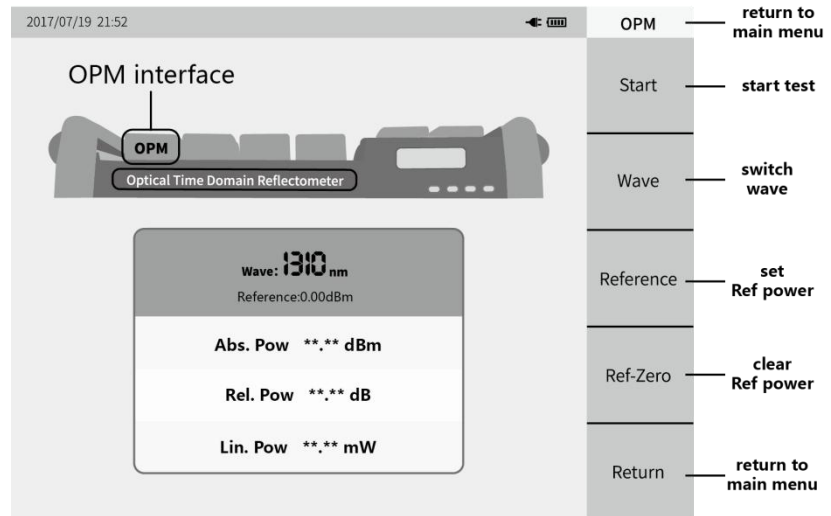
3.12　LS

In the main menu interface, press the menu or icon to enter the light source test interface.

The output light interface and wavelength of the light source function are consistent with OTDR. Press the "OFF" below the corresponding wavelength in the right wavelength menu or status information to open the source of the corresponding wavelength, and then press the "ON" below the corresponding wavelength in the

wavelength menu or status information to turn off the source of the corresponding wavelength.
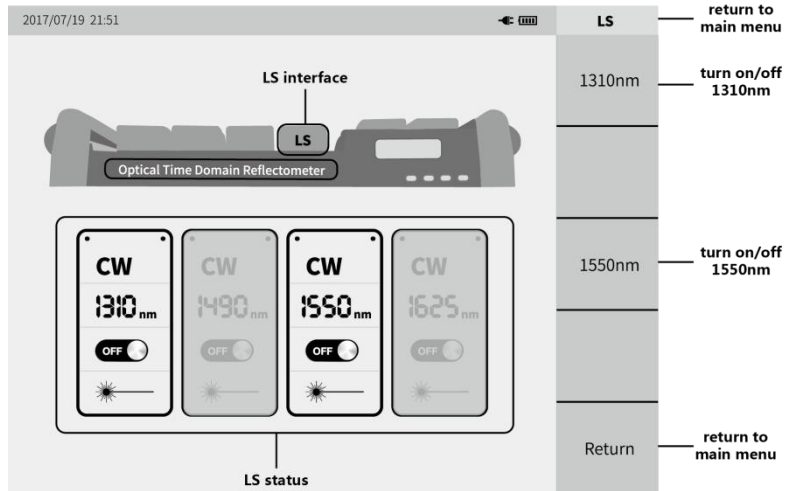
3.13 VFL

In the main menu interface press the menu or 【VFL】 icon to enter the visual fault diagnosis interface.

Press the 【Normal】 menu, turn on the red light and output the continuous light; press 【1Hz】 or 【2Hz】, the red light outputs the modulated light at 1Hz or 2Hz frequencies.

⚠ **Warning:**

Avoid looking directly at the laser output port, the laser will cause damage to the human eyes!
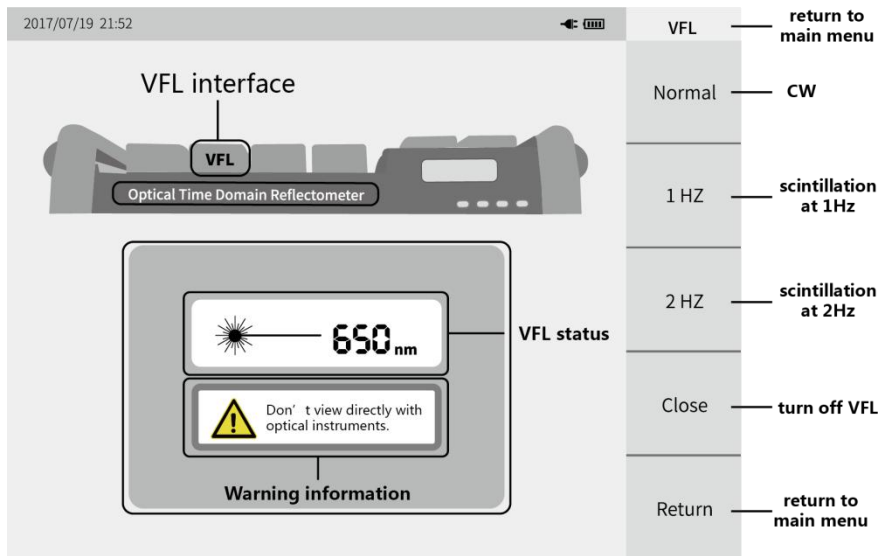
3.14 Event Map (Optional)

In the main menu interface, press the event map menu or icon to enter the event map interface.

Press the menus of【Set】,【File】and【Threshold】to enter the test condition setting interface, waveform File Selection interface and analysis threshold setting interface.

Splice Loss: Click on "+" and "-" can increase or decrease the threshold, each step changes 0.02dB, or click the corresponding position of the threshold.

Connection Loss: Clicking on "+" and "-" can increase or decrease the threshold, changing 0.25dB per step, or clicking on the corresponding position of the threshold.

Bending Loss: clicking on "+" and "-" can increase or decrease the threshold, changing 2dB at each step, or clicking on the corresponding position of the threshold.

After the threshold setting is completed, click "OK" to save the settings and click "Test" to start the average test.

After the test, the link test trace is displayed, and all event information in the link is displayed in the event list. Link information shows test wavelength, fiber link length, total link loss, number of events and number of location events.
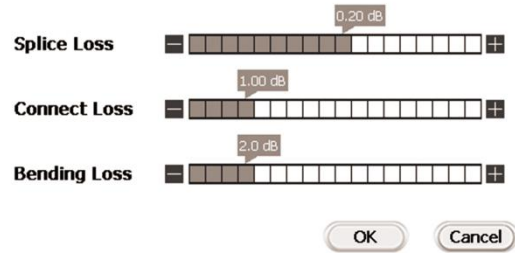
Press the "Switch Trace Display" menu in the lower right corner of the screen, and the whole measured optical fiber link is displayed graphically. The event type of each event point, the distance from the instrument test port, the result of "Pass/Fail" judgment and the distance between two adjacent events are displayed in the event map.
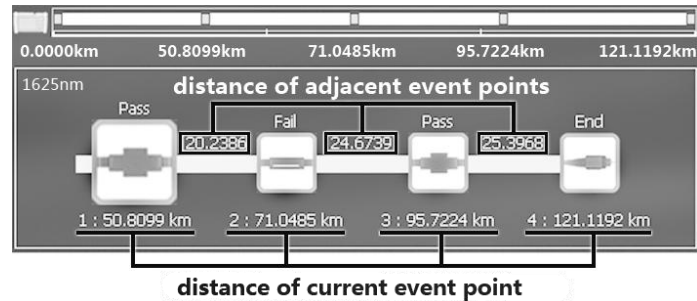
⊟： Connector diagrams, such as square flanges, circular adapters, SC, ST, LC connectors, etc.;

⊟： Optical fiber fusion point diagram;

⊟： Optical fiber end diagram;

▷： Optical fiber splitter diagram;

⌒： Optical fiber Macro-bend diagram.

Tips: According to the threshold of analysis parameters set in the eligible criterion, the green border represents "Pass", the red border represents "Fail", and the gray border represents "Unknown".

3.15 FEI (Optional)

Connect the external end detector to the USB port of the instrument.

In the main menu interface, press the menu or icon to enter the end detection interface.

Press【X2】menu to enlarge the end display interface.

Press【X1】menu to restore the interface proportion of the end display.

Note: This function needs to purchase probe to cooperate with the instrument.

3.16 OLT(Optical)

In the main menu interface, press the menu or icon to enter the optical loss test interface.

The OLT steps are as follows:

1) Connect LS and OPM optical interface with standard jumper, press 【Start】, after power is stable, press【OPM Ref】;

2) The standard jumper is used to connect the test piece to the optical interface of LS and OPM, and the insertion loss of the test piece can be obtained by pressing【Start】.

3.17 System Information

In the main menu interface, press the menu or icon to enter the system information interface.

Device information: contains the host number and module number.

Use wave: the wave that the host can output.

Version Information: the version information of the whole instrument software and system software.

Alarm Log: Record the times the instrument has been tested with light and the latest test with light.

2019/08/03 11:26	System — return to main menu
System Information...	Information — system informaition
Device Information	
Host Number : 10010001	
Host Module : 2301	Sys-Set — system settings
Use Wave	
1310 nm	
1550 nm	Sys-Help — help informaition
Version Information	
Software Version : 4.00	
System Version : 4.0	T-Adjust — touch screen calibration
About Product	
Phone :	
CopyRight :	Update — system update
Alarm Log	

3.17.1 System Settings

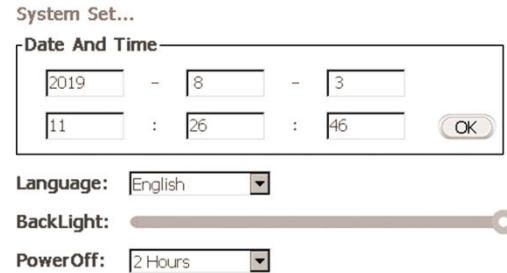In the system information interface, press the [System] menu to enter the system settings.

System time: Click on the input box of year, month, day, hour, minute and second, pop up the up and down adjustment icon on the right side of the input box, adjust the corresponding time by clicking the up and down icon, and then confirm.

Language selection: Chinese or English display is optional.

Backlight brightness: drag left and right to adjust screen brightness.

Automatic shutdown: You can choose the automatic shutdown time, or you cannot use this function. After selection, the instrument will be shut down automatically without any operation in the corresponding time to save electricity.

3.17.2 System Help

In the system information interface, press the 【Sys-Help】menu to enter the system help interface.

The system information includes OTDR test process, test notes, optical power meter, end detection and other functions. Click on the corresponding entry to view the relevant content.

Click ◀ ▶ to switching entries and click 🏠 back to the help information display interface.

3.17.3 Touch Calibration

In the system information interface, press 【 T-Adjust 】 menu and enter the touch screen calibration interface. According to the prompt information on the screen, click on the position of 5 points on the screen and exit the calibration mode.

2019/08/03 11:26

Help File......

◆ 1. How to use otdr?

2. About testing fiber!

3. How to use Optical Power Meter?

4. How to use Fiber End Face Detector?

5. How to manage OTDR files?

6. Using and maintenance of battery!

7. General information and maintenance!

8. Warranty!

System

Information

Sys-Set

Sys-Help

T-Adjust
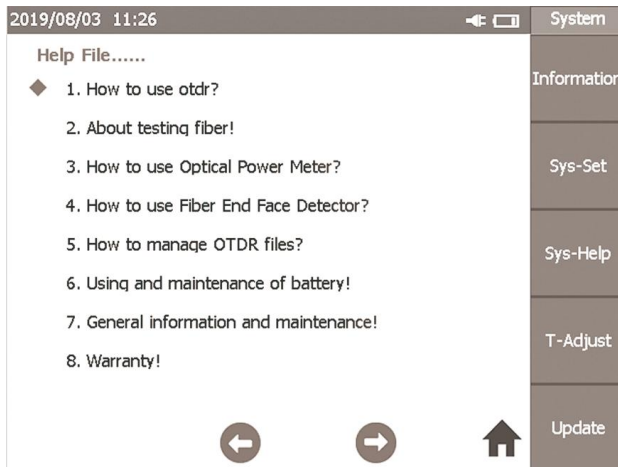
Update

3.17.4 Software Update

Insert the U disk with the update software (create a folder named "OTDR" in the U disk root directory, and put the upgrade file FTX-1000.exe in the "OTDR" folder) into the instrument. After waiting for 10 seconds, press the【Update】menu on the system information interface and enter the system update interface. Instrument prompt whether to update, select【yes】, then enter the update interface, click【update】button, prompt the update completed, restart the instrument.

Note: In the update process, please do not turn off the power or pull out the U disk, otherwise the system will not work properly!
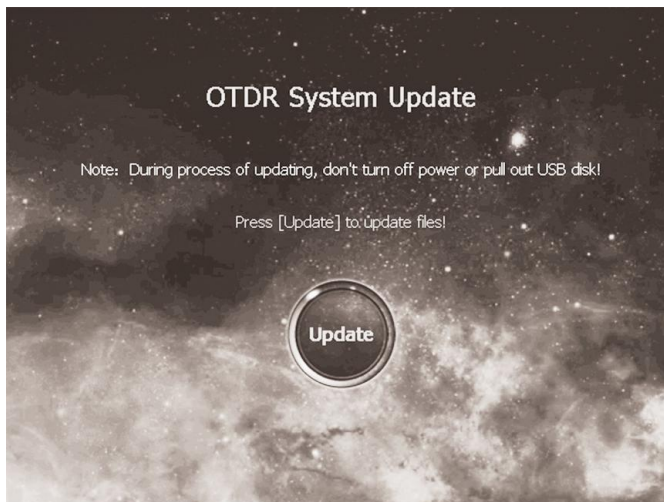
3.18 Analysis Software

The analyse_Otdr software is equipped in the U disk of the instrument. Copy it to the computer. Double-click Open, click【File】-【Open】and select Trace Storage Directory to view all files in the directory.

3.18.1 Trace Analysis

Open the selected file, analyze and operate the trace through the trace operation menu, and the event information is displayed in the event list.

3.18.2 Report Print

Click on File - 【BatPrint】 to select the Trace Storage Directory to view all the files in the directory.

Add the printed file to the printing area, determine the type of printing, and perform the printing operation.

Tip: Traces can be printed preview and batch printing.
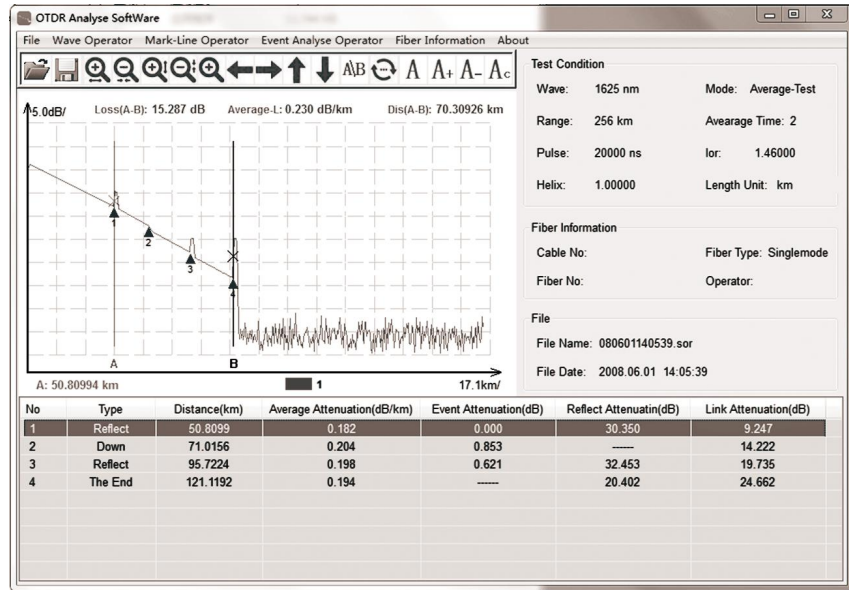
4. Common problems and Solutions

4.1 How to observe the optical pulse waveform?

Pulsed light emitted by OTDR injects into different locations of the measured optical fiber links, which can cause loss, such as connection points, bends and end of the optical fiber. The measurement results will be shown in the trace waveform, in which the horizontal axis represents the test distance, the longitudinal axis represents the loss power, and in the waveform, the measured loss or reflection is expressed in the event. **Near-end reflection:** Reflection
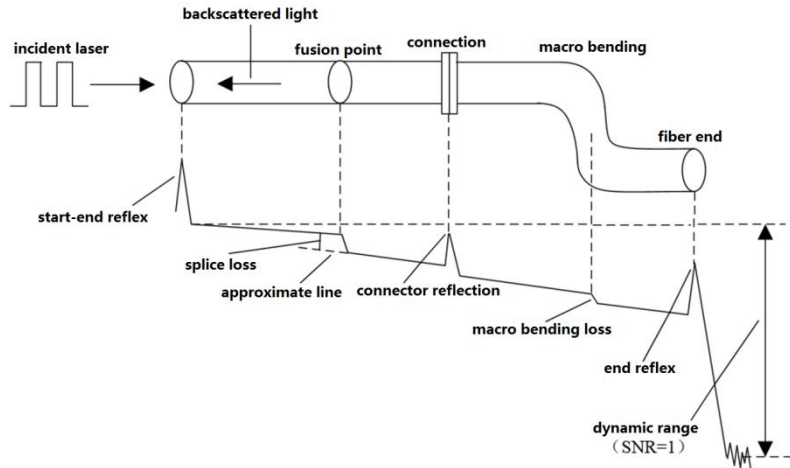
occurring at the junction between OTDR and the connector of the optical cable. This also includes the internal reflection of the instrument, and the loss and reflection between the connecting points cannot be detected in the near-end reflective area.

Splice loss: Due to the uneven density of the welded parts or the change of material quality, the increase of Rayleigh scattering loss results in the welding loss.

Reflection of Connector: There is a small gap in the connecting part of the connector, and the group refractive index of the gap changes, so the reflection occurs and causes loss.
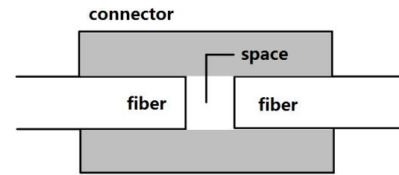
Fresnel reflection at the end of the cable: Fresnel reflection occurs at the breakpoint of the cable or at the position where the group refractive index changes at the end of the cable (glass and air). When the end face of the optical fiber is vertical, the power reflection of the incident light is about 3%(-14.7dB).
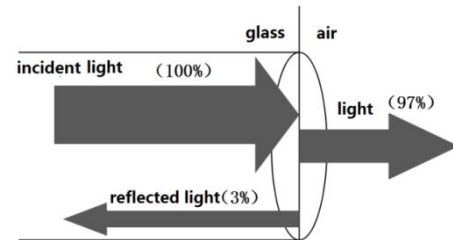
4.1.1 Normal Curve

As shown on the right, how to judge whether the curve is normal or not?

(1) The main slope of the curve is basically the same, and the slope is smaller, which indicates that the attenuation constant of the line is higher than that of the line.

Small, good uniformity of attenuation.

(2) There is no obvious "step", which indicates that the quality of line joints is better.

(3) The tail reflection peak is higher, which indicates that the distal end-forming quality is better.
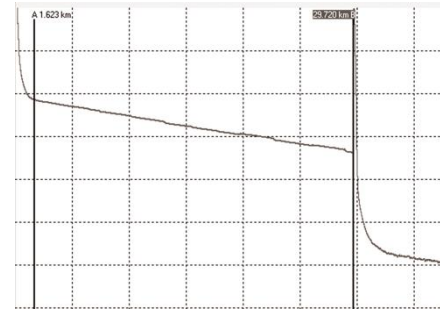
4.1.2 Curves Have Large Steps

If there is an obvious "step" in the lower right figure, if this is the joint, it means that the joint is not qualified or that the bending radius of the optical fiber is too small or squeezed in the fused disc; if this is not the joint, it means that the optical cable is squeezed or sharply bent here.
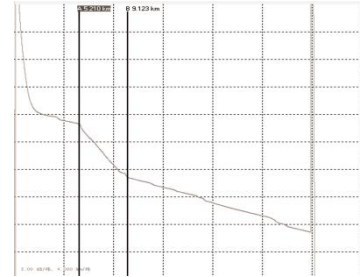
4.1.3 High Slope of Curve

As in the upper right figure, the slope of this section is obviously larger, which indicates that the quality of this section of optical fiber is not good and the loss is large.
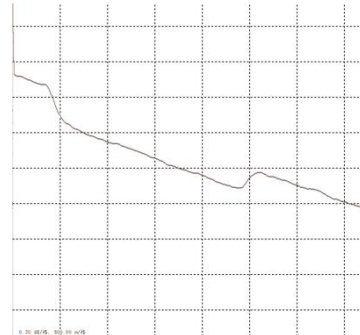
4.1.4 No reflection peak at the far end of the curve

As shown in the lower right figure, there is no reflection peak at the tail of the curve, which indicates that the quality of the distal end of the optical fiber is not good or that the distal end of the optical fiber is broken here.
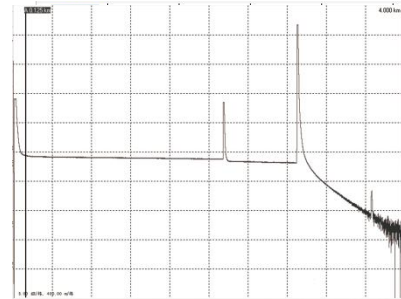
4.1.5 Recognition and Processing of Mirage Peak (Ghost)

Recognition of phantom peaks (ghosts): The ghosts on the curve do not cause obvious loss (such as the upper right figure); the distance between the ghosts and the beginning of the curve is a multiple of the distance between the strong reflection event and the beginning, which is symmetrical (such as the lower right figure).

Eliminate phantom peak (ghost): select short pulse width, increase attenuation in strong reflection front end (such as OTDR output). If the event causing ghost is located at the end of the optical fiber, it can "bend" to attenuate the light reflected back to the beginning.
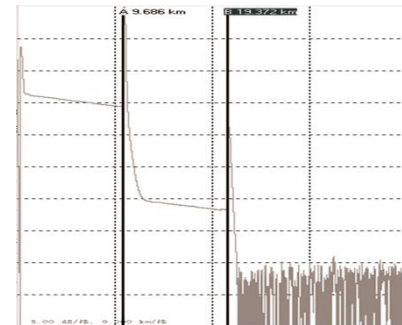
4.1.6 Positive Gain Phenomenon Processing

Positive gain may occur on the OTDR curve, as shown in the right figure. Positive gain is due to more backward astigmatism produced by the fibers after the fusion point than those before the fusion point. In fact, the optical fibers have a loss at this fusion point. It often occurs in the fusion process of optical fibers with different mode field diameters or backscattering coefficients. Therefore, it is necessary to measure the fusion loss in two directions and take the average of the results as the fusion loss.
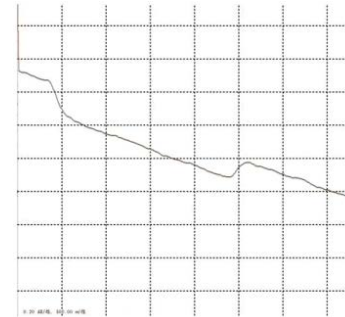
4.2 How to clean the optical output interface of OTDR?

The optical output interface of OTDR series is a replaceable universal interface, which must be kept clean during use. When the instrument is unable to test the normal curve or the test results are inaccurate, the first consideration is to clean the optical interface of the instrument.

Specific cleaning methods: unscrew the output interface, wipe the end face of ceramic core with clean cotton sheets or special paper towels and cotton swabs wetted by alcohol, and then screw the output interface after the end alcohol evaporates.

Tip 1: When cleaning, be sure to proceed under the condition that both OTDR and visual red light fault location function stop!

Tip 2: In the normal use of the instrument, please cover the dust cap after it is finished, and keep the
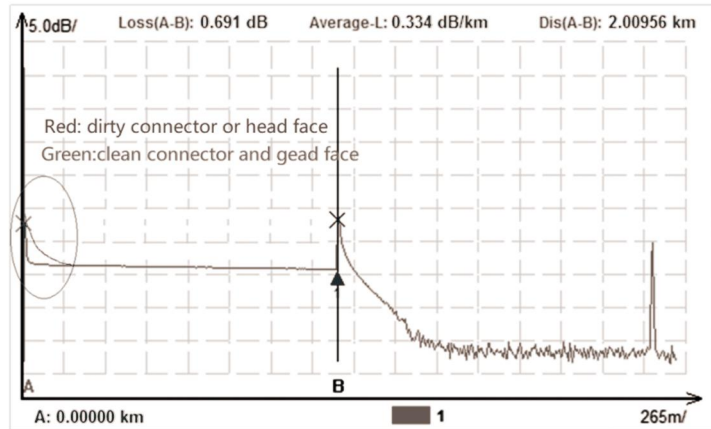
dust cap clean at the same time!

4.3 How to copy the internal documents of the instrument to the U disk or computer?

Copy to the U disk: insert the U disk into the top USB port of the instrument, enter the main interface of OTDR, press【File】-【Copy】, enter the copy interface. Double-click on the file that needs to be copied in the selected memory file, press the Copy menu or copy the file to the U disk.

Tip:【Mark/Sub】is used to select a single file or entire folder,【Select All】is to select all files.

Copy to the computer: Connect to the computer through the Micro USB port at the bottom of the instrument with the data line in the box. Open "My Computer" - "U Disk" on the computer, open the "NSOR" folder, and copy internal files to the computer.

Note: When connecting computers with data lines, the instrument itself cannot save files!

4.4 How to print test trace in batch?

Step 1: Copy the analytical software "Analyse_Otdr" from U disk to the computer.

Step 2: Click on File - [Batch Processing] to select the Storage Directory and view all the files.

Step 3: Add the printed file to the printing area, determine the type of printing, and perform the printing operation.

4.5 How to print test trace into PDF report?

Open the analysis software, click or 【File】-【Open File】, select the target file, click 【Print】, select PDF print.

4.6 How to replace the instrument battery?

Batteries are installed at the time of shipment and need not be disassembled. If you need to replace the battery, please follow the following steps:

1) Unscrew the two screws on the battery cover (the red circle mark in the right picture) and remove the battery cover.

2) The front panel of the instrument is up, the left hand holds the instrument, and the position of the battery bin is aligned with the palm of the right hand. Remove the battery;

3) Replace the battery, cover the battery cover and screw the removed screw.

4.7 Other common faults and treatment methods

Fault Description	Causes	Solution
The instrument can't start normally.	The battery has run down.	Charge the battery and observe the switch key lamp. If the red light is displayed, continue charging. Otherwise, contact the supplier.
The instrument cannot be charged properly.	The use environment does not meet the charging conditions.	The instrument is charged in the environment of 0℃～50℃.
	Battery contact is poor.	Open the battery bin cover and check whether the battery contacts are off. If they are off, please contact the supplier.
	Battery problems or internal circuit problems.	Replace the battery.
Normal curve cannot be measured	Parameters setting are incorrect.	Reset the correct test parameters.
	The output surface of optical fiber is polluted.	Clean optical output.
	The optical output connector is damaged.	Replacement of output connector.
	Optical output connectors do not match.	Replace the matched connector, the locating pin of jumper joint should be aligned with the

		flange notch and tightened.
The test curve has big burrs, waveform unevenness.	The output interface connection is incorrect.	Reconnect the appropriate output interface.
	Pulse width setting is too small.	Increase the test pulse width.
Saturation (flat top) phenomenon at the front of test curve.	Pulse width setting is too large.	Reduce the test pulse width.
	Fiber coupling is not good.	Clean the instrument with clean cotton chips and the measured optical fiber end face.
The reflection peak at the beginning of the test curve decreases slowly and the tail appears.	The output surface of optical fiber is polluted.	Replacement of output connector.
	The output connector is damaged.	Replace connectors.
	Optical output connectors do not match.	Replace matched connectors.
Reflection peaks at the end of optical fibers cannot be measured	The range setting is too small.	Increase the test range value.
	Pulse width setting is too small.	Increase the test pulse width parameters.
Misreporting in curve analysis	The quality of test curve is poor/the setting of event threshold is small.	Increase the test pulse width parameter/increase the event threshold.
The measurement of optical fiber length is inaccurate	The parameter setting is incorrect.	Reset the appropriate parameters.
	The refractive index setting of optical fibers is inaccurate.	Reset the refractive index of the optical fiber.

	Incorrect setting of correction coefficient for optical cable.	Reset the cable correction factor.
The average loss of optical fibers measured is inaccurate.	The front end of the test curve is too long.	Clean optical output face.
	The cursor position is not set properly.	Reset the cursor position.

The above description is for reference only. Please refer to the instructions for detailed usage. In the process of using the instrument, if you have any questions, you can contact the instrument supplier to solve them.

Technical Specifications

Model	S2106 OTDR									
	S0	S1	S2	S3	S4	T1	T2	F1	M1	SM1
Type	SM								MM	SM/MM
Wavelength	1310/1550nm					1310nm /1490nm /1550nm	1310nm /1550nm /1625nm	1310nm /1490nm /1550nm /1625nm	850nm/ 1300nm	850nm /1300nm /1310nm /1550nm
Max	32/30dB	35/33dB	38/36dB	42/40dB	45/43dB	37/35/35dB	37/35/35dB	37/35/35/35dB	26/28dB	26/28/35/33dB

Dynamic Range[①]										
Event Blind Zone[②]	1m	1m	0.8m	0.8m	0.8m	0.8m	0.8m	0.8m	1m	1m
ATT Blind zone	6m	6m	6m	6m	6m	6m	6m	6m	6m	6m
Test Range	500m/1km/2km/4km/8km/16km/32km/64km/128km/256km									
Pulse Width	3ns/5ns/10ns/30ns/50ns/80ns/160ns/320ns/500ns/800ns/1000ns/3000ns/5000ns/8000ns/10000ns/20000ns									
Ranging accuracy	±（0.75m+ Sample interval +0.005％×Test distance）									
Loss accuracy	±0.05dB/dB									
Sample Points	16k~256k									
Sample Resolution	0.05m~16m									
Reflection Accuracy	±3dB									
File Format	SOR Standard File Format									
Loss Analysis	4-point method /5-point method									
Laser Safety Level	Class Ⅱ									
Refresh Rate	3Hz (Typ.)									
Data Storage	Internal storage：100M（≤3000 curves）；External storage：4G bit									

Output Interface	FC/UPC（Interchangeable SC、ST）				
Data Interface	USB、Mini-USB、10M/100M Ethernet Port				
Model	**S2106P PON OTDR**				
	PD1	**PS1**	**PS2**	**PT1**	**PT2**
Wavelength	1310nm±20nm 1550nm±20nm	1625nm±20nm(Filtered)	1650nm±15nm(Filtered)	1310nm/1550nm±20nm 1625nm±15nm(Filtered)	1310nm/1550nm±20nm 1650nm±15nm(Filtered)
Filter	/	High Pass>1595nm, Isolation>50dB （1270nm~1585nm）	Band pass 1650nm±7nm, Isolation>50dB （1650nm±10nm）	High Pass>1595nm, Isolation>50dB （1270nm~1585nm）	Band pass 1650nm±7nm, Isolation>50dB （1650nm±10nm）
Fiber type	G.652				
Max Dynamic Range[①]	37/35dB	38dB	38dB	38/35/35dB	38/35/35dB
Event Blind Zone[②]	1m	0.8m	0.8m	0.8m	0.8m
ATT Blind zone	6m	6m	6m	6m	6m
PON Blind zone	30m	30m	30m	30m	30m
Test Range	500m/1km/2km/4km/8km/16km/32km/64km/128km/256km				
Pulse Width	3ns/5ns/10ns/30ns/50ns/80ns/160ns/320ns/500ns/800ns/1000ns/3000ns/5000ns/8000ns/10000ns/20000ns				
Range Accuracy	±（0.75m+ Sample interval +0.005％×Test distance）				
Loss Resolution	±0.001dB				

Loss Accuracy	±0.05dB/dB
Sample Points	16k~256k
Sample Resolution	0.05m~16m
Reflection Accuracy	±3dB
File Format	SOR Standard File Format
Loss Measurement Mode	4-point method /5-point method
Laser Safety Level	Class Ⅱ
Refresh Rate	3Hz (Typ.)
Data Storage	Internal storage：100M（≤3000 curves）；External storage：4G bit
Connector	FC/UPC（Interchangeable SC、ST）
Data Interface	USB、Mini-USB、10M/100M Ethernet Port
OPM	
Wavelength range	800nm~1700nm
Connector	Universal FC/SC/ST
Test scope	-50dBm～+26dBm
Uncertainty	±5%
Calibration wavelength	850nm/980nm/1300nm/1310nm/1490nm/1550nm/1625nm/1650nm

LS	
Wavelength	Consistent with OTDR output wavelength
Laser Type	FP-LD
Connector	FC/UPC（Interchangeable SC、ST）
Output power	≥-5dBm
Stability	CW，±0.5dB/15min（Test after 15 minutes of boot-up preheating）
VFL	
Wavelength	650nm±20nm
Standard Output power	≥10mW
Mode	CW/1Hz/2Hz
Connector	FC/UPC（Interchangeable SC、ST）
The Optical Loss Test index refers to the above light source and optical power meter index.	
Others	
Display	5.6 inch color LCD + Touch screen

Power supply	AC/DC adapter：Input：100V～240V，50/60Hz，0.6A；Output：12V~19V，1.5A
	Lithium battery：7.4V，5200mAh
Working temperature	-10℃～+50℃
Storage temperature	-40℃～+70℃
Relative humidity	0～95％，Non Condensing
Weight	≤1.2kg
Size	227mm×160mm×70mm

NOTE：①Test ambient temperature is 25℃±2℃, the maximum pulse width, the average number of times is more than 300.

②Test conditions of event blind zone are minimum range, minimum pulse width, reflection loss of optical fiber end surface (> 45dB), typical value.

Configuration List

NO.	Name	Quantity
1	Host	1
2	AC/DC adapter	1
3	U-disk (including analysis software, instructions)	1
4	Touch pen	1
5	Data line	1
6	OTDR SC adapter	1
7	OPM SC adapter	1
8	Fast Operating Manual	1
9	User's Manual	1
10	Calibration Certificate	1
11	Qualification Certificate/After-sales Service Guarantee Card	1
12	Clean cotton slices	10
13	Cortical handle	1
14	Instrument backpack (with straps)	1

Note: OTDR interface type is designated FC/UPC, and FC/APC type is optional.

Note: Due to the need of design improvement, the above contents are subject to change without notice.