

# Optical Time Domain Reflectometer

## KomShine QX45/QX35

### Preface

All the brands and names mentioned in this document are properties of us. This document is subject to change without prior notice. We disclaims any liability for occasional or secondary damages caused by errors in this document or by the use of this document or version.

### Safety Precautions

When using the product, take the following safety measures. Failure to adopt safe operation methods or failure to observe warnings in this document may cause violation of the safety standards for design, production, and use of the product. We disclaims any liability for any consequence caused by violation of the preceding requirements.

- **Operating environment**

The maximum relative humidity is 95%.

- **Before powering on the product**

Ensure that the voltage of the power supply meets the product requirement, an appropriate fuse is installed, and all necessary safety measures have been taken.

- **DO NOT use the product in an explosive environment.**

DO NOT use this product in an environment with flammable gas or fume.

- **DO NOT remove the protective case from the product.**

Operators are prohibited to remove the protective case of the product, or replace the internal components. To remove protective case of the product, or replace the internal components, please contact maintenance engineers of us.

### Safety Symbols

This Warning symbol indicates the existence of a danger. It reminds users to pay attention to a process, an operation method, or a similar case. Failure to operate properly or observe related rules may cause physical injuries. Before fully understanding and meeting the conditions indicated by this symbol, do not proceed with the next step.

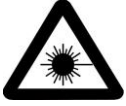


This Caution symbol indicates the existence of a danger. It reminds users to pay attention to a process, an operation method, or a similar case. Failure to operate properly or observe related rules may cause partial or full damages to the product. Before fully understand and meet the conditions indicated by this symbol, do not proceed with the next step.



This Indication symbol provides useful information for using or maintaining the product.

## Warning



- The OTDR is a laser device. Users should always avoid direct eye contact with the laser output. Users are strictly prohibited from using a microscope or magnifier to observe the optical source output. The laser beam may cause permanent damages to eyes when the energy of the laser beam is converged on the retina.
- When the OTDR is used to test an optical fiber, the working light cannot exist on the optical fiber under test. Otherwise, the test result is inaccurate. Even worse, the OTDR may be permanently damaged.

## Precautions



**Battery:** The battery used by the OTDR is a rechargeable Li-ion battery. If the OTDR has not been used for a long time, charge the battery before using the OTDR again. If the OTDR has not been used for more than two months, charge the battery in time to ensure that the battery power is full. DO NOT charge the battery for more than 8 hours. It is prohibited to remove the battery unless otherwise authorized. Keep the battery away from the fire or strong heat. DO NOT open or damage the battery. DO NOT touch the electrolyte of the battery; otherwise, the electrolyte may damage your eyes, skin, or clothes.

**External power supply:** The OTDR supports the external power supply, which should be DC15V/1.0A.

**Laser radiation:** When measuring an optical fiber system, prevent direct eye contact with the open-circuit optical fiber, optical connector, splices, or other optical sources. Otherwise, direct contact of the eyes with the transmitting laser will damage your eyes.

- DO NOT look at the laser output port with naked eyes when the OTDR is working.
- After the OTDR stops working, cover the optical port with a dust-proof cap.
- DO NOT look at the unconnected end of the fiber that is being tested with naked eyes. If possible, point the unconnected end of the fiber to an object that cannot reflect light.

# Contents

<b>1 Overview</b>	<b>4</b>
1.1 About this Manual	4
1.2 Unpacking Inspection	4
1.3 Product Introduction	4
<b>2 Basic Operations</b>	<b>6</b>
2.1 Foreword	6
2.2 Connectors on the OTDR	6
2.3 Use of the Rechargeable Battery	7
2.4 Description of Function Keys	7
<b>3 Basic Knowledge about OTDR</b>	<b>9</b>
3.1 Working Principles of OTDR	9
3.2 Basic Definition and Classification of Events	9
3.2.1 Events	9
3.2.2 Reflection Event	9
3.2.3 Non-Reflection Event	10
3.2.4 Test Event	10
3.3 Measurement Functions of the OTDR	10
3.3.1 Measurement Contents of the OTDR	10
3.3.2 Trace Analysis of the OTDR	10
3.4 Trace Window of the OTDR	错误!未定义书签。
3.4.1 Trace Pane of the OTDR	11
3.4.2 Information Pane of the OTDR	12
3.4.2.1 Trace Measurement Parameters	12
3.4.2.2 Event List	12
3.4.2.3 Information about the A/B Marker	13
3.4.2.4 Information about the Optical fiber Link	14
3.4.3 Tool Bar of the OTDR	14
3.4.3.1 Icons on the Tool Bar	14
3.4.3.2 Parameter Setup Operations	15
3.5 Battery Charging Status	22
<b>4 Obtaining the Trace and Existing Trace Operations</b>	<b>23</b>
4.1 Description of the Home Page	23
4.2 Obtaining the Trace	23
4.2.1 Obtaining the Trace—Connecting an Optical Fiber	24
4.2.2 Obtaining the Trace—Setting Parameters	24

4.2.3 Obtaining the Trace—Automatic Measurement .....	24
4.2.4 Obtaining the Trace—Manual Measurement.....	25
4.2.5 Obtaining the Trace—Measurement Failure Causes .....	25
4.3 Viewing the Information Pane.....	26
4.3.1 Switching Contents in the Information Pane .....	26
4.3.2 Viewing the Event List .....	26
4.3.3 Viewing the A/B Marker Information .....	26
4.4 Zooming in a Trace Horizontally.....	26
4.5 Zooming out a Trace Horizontally.....	27
4.6 Zooming in a Trace Vertically .....	27
4.7 Zooming out a Trace Vertically .....	27
4.8 Displaying the Full Trace .....	27
4.9 Saving a Trace .....	27
4.10 Viewing an Existing Trace .....	28
4.11 Uploading a Stored Trace .....	28
<b>Appendix A Maintenance and Calibration .....</b>	<b>30</b>
Battery Maintenance and Replacement .....	30
Cleaning of Optical Connectors.....	30
Calibration Requirements.....	31
<b>Appendix B Technical Specifications .....</b>	<b>32</b>
<b>Appendix C Warranty Information.....</b>	<b>33</b>

# 1 Overview

## 1.1 About this Manual

Thank you for using the Optical Time Domain Reflectometer (OTDR) product of us. Before using the OTDR, please read this manual carefully, especially warnings and precautions, to prevent unnecessary physical or product damages caused by incorrect operations. This manual covers information that is often used to operate or maintain the OTDR, troubleshooting guide, and information for obtaining technical supports. The product has undergone strict test and quality control processes before delivery.

## 1.2 Unpacking Inspection

The product is transported in compliance with the standard assembly and shipping procedures. On receiving the OTDR, please check the product list carefully against the packing list, and the appearance and quality of the product to find out possible physical damages that may be caused during transportation. If the package is found damaged, please keep the original packing materials properly and meanwhile notify the freight carrier and the agent that supplies the product to properly resolve the problem. The product package should contain an OTDR, an SD card, a power adapter, and an installation disk of the PC analysis software. If any item is missing in the package, please contact the agent that supplies the product to properly resolve the problem.

When necessary, you can contact us:

<http://www.komshine.com>;

KOMSHINE TECHNOLOGIES LIMITED.

## 1.3 Product Introduction

The OTDR launched by us is a reliable instrument used to characterize an optical fiber. It features the compact size and simple operations, and adopts the ergonomic industrial design and touch LCD screen. The OTDR supports the data storage function. The data can be analyzed by using the PC software to obtain the transmission quality of an optical fiber. In addition, the measurement results can be post-processed, archived, and printed. With the data and images measured by the OTDR, you can evaluate characteristics of the entire optical link. In particular, the loss feature and event distribution of the fiber under test are visually displayed. You can use the OTDR to periodically check whether a link meets the specification requirements. To record the transmission quality of an optical fiber, you need to measure the optical path, total loss, and losses of all connectors. By checking event points of optical fibers, engineers who install and maintain optical fibers can point out faults of optical fibers, locate event points, and measure the attenuation between event points, incurred losses, and uniformity of attenuation. In a word, the OTDR is an indispensable tool for manufacturing, installing, or maintaining optical fibers or cables.

**The OTDR has the following characteristics:**

### Basic functions:

- a) Measure the length of an optical fiber or cable.
- b) Measure the distance between two points on an optical fiber or cable.
- c) Determine the location of faults or breaks on an optical fiber or cable.
- d) Describe the loss distribution trace of an optical fiber or cable.
- e) Measure the attenuation coefficient of an optical fiber or cable.
- f) Measure the loss between two points on an optical fiber or cable.

- g) Measure the insertion loss of a connector on an optical fiber or cable.
- h) Measure the reflection of a reflection event on an optical fiber or cable.

**For a specific event (changes in optical transmission characterizes due to splicing, connector, or bending on an optical link), the OTDR can measure the following items:**

- a) Measure the distance, loss, and reflection of an event.
- b) Measure the length and loss (dB or dB/km) of an optical section.
- c) Measure the length and loss (dB) of the entire optical link.

**Characteristics:**

- 3.5' touch screen, which facilitates operations
- Compact size and light weight
- Graphical display of the trace data and simple operations
- Storage of the trace data
- USB port
- PC analysis software, which is delivered with the product and can be used to back up and archive the measurement data
- AC or DC power supply
- When fully charged, the battery supports more than 10 hours' continuous working of the OTDR.

## 2 Basic Operations

### 2.1 Foreword

This chapter describes the basic methods for operating the OTDR, including the keys and frequently-used connectors. The touch screen operations have the same functions as keypad operations. This manual provides only a brief description about the touch screen operations. If you meet any problem when using the OTDR, please contact the technical support engineers of us or the local agent.

### 2.2 Connectors on the OTDR

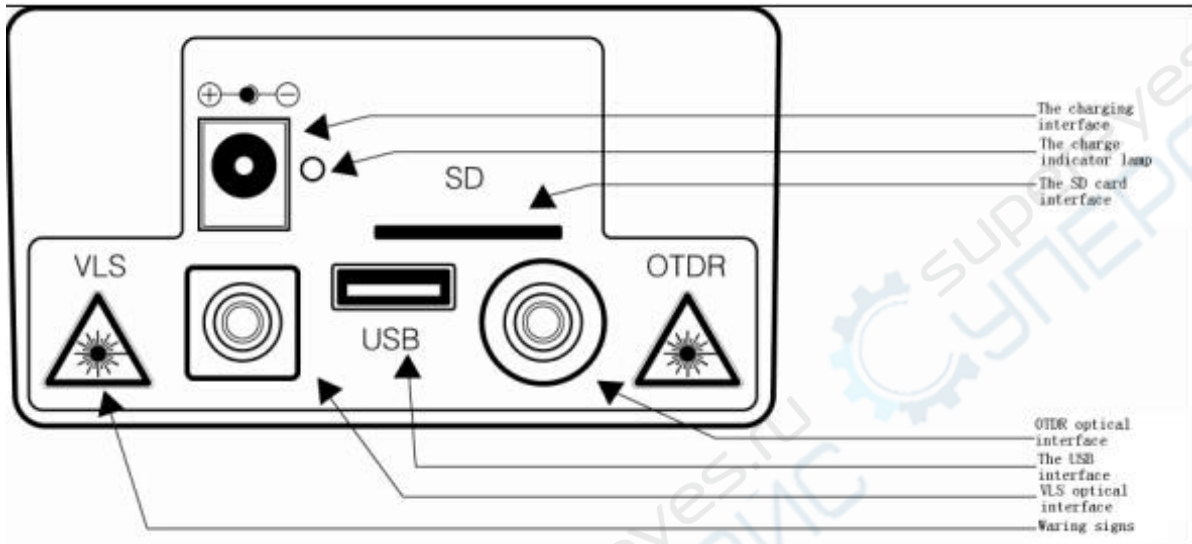


Figure 2-1 Top view of the OTDR

- **Optical connector**

All optical connectors on the OTDR are FC/UPC connectors, which are interchangeable with SC/ST connectors.

- **Power connector**

Requirements for the power connector: 15V DC 1.0A

- **Data connector**

USB connector: A USB flash drive can be used to import the data to the PC data analysis software that is delivered with the OTDR for subsequent analysis.

SD card connector: It is the data storage connector, to which an SD card is inserted.

- **POWER indicator**

When the OTDR is powered on or being charged, the POWER indicator is on. The color of the indicator changes with the amount of battery power. When the battery is fully charged in the OTDR power-off state, the indicator is off.

- **OTDR/VLS**

They are the optical connectors of the OTDR and VLS. All optical connectors are FC/UPC connectors, which are interchangeable with SC/ST connectors.



#### **Invisible laser radiation**

DO NOT look at optical connectors or directly use an optical device to view the optical connectors with naked eyes.

## 2.3 Use of the Rechargeable Battery

The OTDR uses an embedded Li-ion battery.

- Precautions when using the OTDR
  - a) If the battery power is low when the OTDR is working, a low battery icon is displayed on the LCD screen and the OTDR is automatically powered off.
  - b) The battery power may be low because the OTDR has not been used for a long time. In such a case, if you attempt to power on the OTDR, the OTDR will be on for a few seconds and then off to prevent excessive discharging of the battery. At this time, you need to use the power adapter to charge the embedded battery immediately.
- Charging the battery
  - a) Fast-charge the battery until the voltage reaches the preset value, and then trickle charge the battery. The fast charging temperature of the battery ranges from 5°C to 45°C, whereas the trickle charging temperature ranges from 0°C to 55°C. The battery is suitable for indoor use. When the charging temperature is out of the temperature range, the battery cannot be fully charged or the battery may be damaged, which affects the service life of the battery.
  - b) Fast-charge the battery for 3 hours.
  - c) DO NOT charge the battery for more than 8 hours.

## 2.4 Description of Function Keys

### [Enter]

- On the home page, press this key to implement the function corresponding to the key. During the menu operation, press this key so that the current operation takes effect.
- Press [Enter] together with [Shift/↵] to switch between markers A and B.

### [▲] or [▼]

#### Major functions of these keys are as following:

- Move the menu bar up or down during the menu operation.
- Select an icon for operation.
- Adjust parameter values during parameter setup.
- Press [▲] or [▼] together with [Shift/↵] to zoom in or out the comparison traces vertically.

### [◀] or [▶]

#### Major functions of these keys are as following:

- Select the parameter to be modified during parameter setup or menu operation.
- Move the marker left or right during the trace operation.
- Page up or down the help information.
- Press [◀] or [▶] together with [Shift/↵] to zoom in or out the comparison traces horizontally.

### [ESC]





## Major functions of these keys are as following:

- Cancel the current operation.
- Exit from parameter setup.
- Switch contents displayed in the information window.
- Press [ESC] together with [Shift/⌘] to go to the next event point.

### [Shift/⌘]

This key is used together with other keys to implement related functions.



Power on or off the OTDR.

### [Run/Stop]

On the home page, press this key to start a measurement. During a measurement process, press this key to stop the measurement.

On the measurement page, press [Run/Stop] together with [Shift/⌘] to implement a real-time measurement.

### [VFL]

Press and hold [VFL] for 2 seconds, and the optical connector VLS emits the continuous red light. Press [VFL] again, and the optical connector VLS emits the pulse red light. Press [VFL] again, and the optical connector VLS stops emitting the red light.

## **3 Basic Knowledge about OTDR**

### **3.1 Working Principles of OTDR**

Optical Time Domain Reflectometer is the full name of OTDR. OTDR is accurate optoelectronic integrated instrument made according to back scattering that generated from Rayleigh scattering and Fresnel reflection when lights are transmitted in the optical fiber. It is widely used in the maintenance, construction and monitoring of cable line. It can measure the optical fiber length, transmission attenuation of optical fiber, attenuation of splice, and failure location, etc.

When the pulse being transmitted downwards along with the optical fiber, and some small changes (such as changes of refractivity and discontinuity) in the material make the lights scatter to different directions, Rayleigh scattering occurs. Partial lights are scattered back along with the direction that opposite to pulse, therefore, it is called Rayleigh back scattering. Back scattering light shows attenuation details that related to the length. Information related to length is gained through time (i. e. : origin of domain of Optical Time Domain Reflectometer). These back scattering signal indicates the attenuation (loss/distance) degree caused by optical fiber. The curve formed is a downwards curve, which reflects the transmission characteristics of the optical fiber.

When lights transmitted downwards along with the optical fiber encountering sudden change of material density, Fresnel reflection occurs. Material density change may occur at the connection or fracture parts where air gap existed. This phenomenon is used by OTDR to accurately confirm the position of discontinuity point along with the length of optical fiber. Compared to Rayleigh scattering, Fresnel reflection will reflect quite a lot of lights. The power of Fresnel reflection is tens of thousands times of that of back scattering. The reflection strength is ascertained according to the change degree of refractivity.

### **3.2 Basic Definition and Classification of Events**

#### **3.2.1 Events**

Events on optical fiber indicate these abnormal points that brought loss or sudden change of reflection power beyond normal scattering of optical fiber material, including various kinds of connection and bending, loss of flaw or fracture on the optical fiber link.

Event points displayed on the screen is the abnormal points in the optical fiber that led to deviation of trace, which are classified with special symbols on the trace.

Events include “reflection event” and “non-reflection event” .

#### **3.2.2 Reflection Event**

When optical pulse energy is reflected (such as on the connector), reflection event occurs. On the trace, reflection event is shown as peak signal, as shown in Fig.3-1.

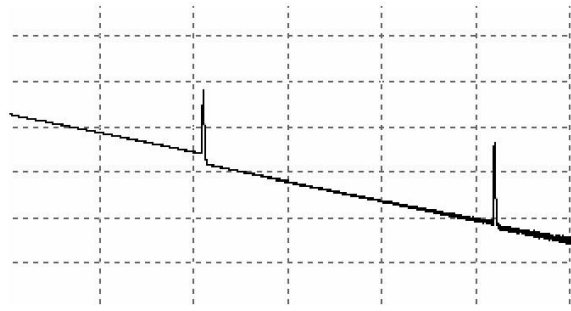


Fig. 3-1 Reflection Event

### 3.2.3 Non-Reflection Event

Non-reflection event brings loss on the whole transmission link of optical fiber, but no light reflection. On the curve, non-reflection event is shown as drop of optical power, as shown in Fig. 3-2.

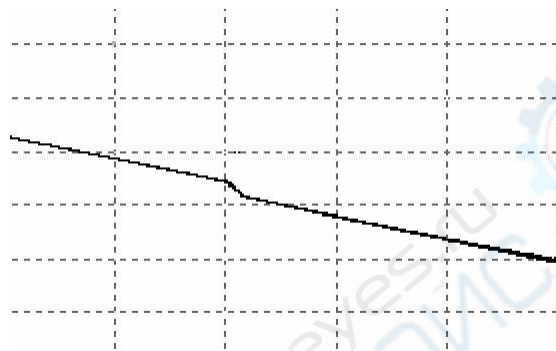


Fig. 3-2 Non-reflection Event

### 3.2.4 Test Event

OTDR sends optical pulse into the optical fiber that waited for inspection, then, begins to accept the returned optical signal immediately, and calculate the distance of “event” in the optical fiber. The further the event is, the longer the time for returning back to otdr will be. The distance can be calculated according to the time when receiving the event.

Through inspecting the curve of the reflected signal, the optical transmission characteristics of optical fiber, connector and joint can be confirmed.

## 3.3 Measurement Functions of the OTDR

OTDR displays the power of the returned signal related to distance. The information can be used to confirm the transmission quality of a fiber optic link.

### 3.3.1 Measurement Contents of the OTDR

- Position (distance) of event, result or fractured position of fiber optic link;
- Attenuation coefficient of optical fiber in the optical fiber link;
- Loss of a single event (for example, a optical connector or bending), or total losses from end to end on the fiber optic link;
- Reflection amplitude (or reflection level) of an event, such as connector.

### 3.3.2 Trace Analysis of the OTDR

OTDR analyzes the curve automatically. Location of the curve:

- Reflection event generated from connection and mechanical connector;
- Non-reflection event (usually be fusion splice);
- Optical fiber bundling: through scanning the first loss event that larger than the

bundling threshold, OTDR detects the bundling of optical fiber;

- Events list: Category of events, loss, reflection, and distance are listed through calculation.

### 3.4 Home Page

The OTDR provides six functional modules: OTDR, VFL, Settings, File management, Open, Help, and so on. Icon become Red when be chosed, and blue means the non current state.



Figure 3-3 Home Page.

### 3.5 OTDR Trace Pane



Figure 3-4 Trace Pane

#### 3.5.1 Trace Pane of the OTDR

The trace pane shows the last trace that is measured by the OTDR.

After the OTDR completes a measurement, the reflection power is displayed as the function of the distance. The diagram in which the power varies with the distance is defined as a trace.

The measurement result of the OTDR is displayed as a graphic on the screen. The vertical axis represents the power, whereas the horizontal axis represents the distance, as shown in Figure 3-5.

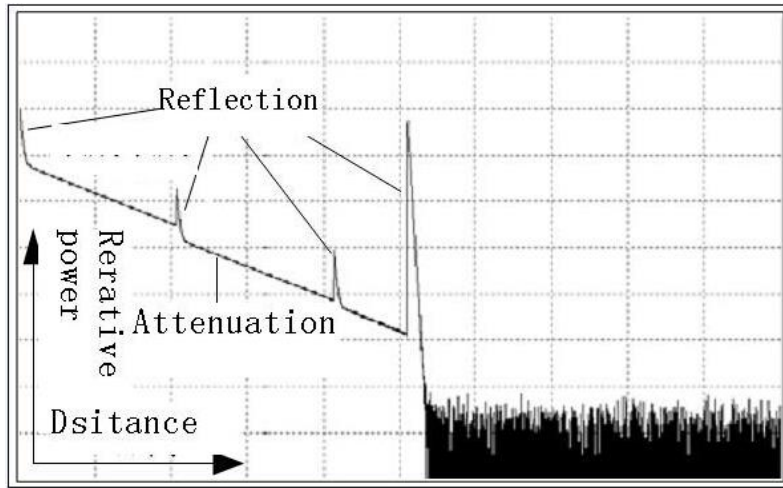


Figure 3-5 Trace and coordinates

### 3.5.2 Information Pane of the OTDR

The information pane shows the measured parameter, event lists, A/B marker, and analyzed parameters.

#### 3.5.2.1 Trace Measurement Parameters

The most important measurement parameters and analysis parameters of the trace are always displayed in the information pane, as shown in Figure 3-6.

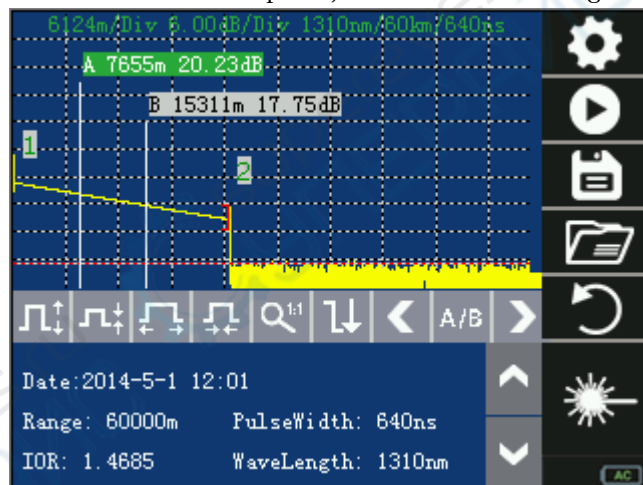


Figure 3-6 Trace measurement parameters

As shown in Figure 3-6, measurement parameters of the trace include the link attenuation, link length, link loss, measurement duration, measurement date, distance range, pulse width, reflection rate, and laser wavelength. For definition and settings of these parameters, see section 3.4.3.2 "Parameter Setup Operations." To view these

parameters, press [ESC] or tap  or  on the touch screen to page up or down the data in the information pane.

#### 3.5.2.2 Event List

The event list indicates the positions of events under test. Non-reflection events (such as splices) and reflection events (such as connectors and any defined landmarks) will be displayed on the event list. All the event points are marked with red icons, as shown in Figure 3-7.

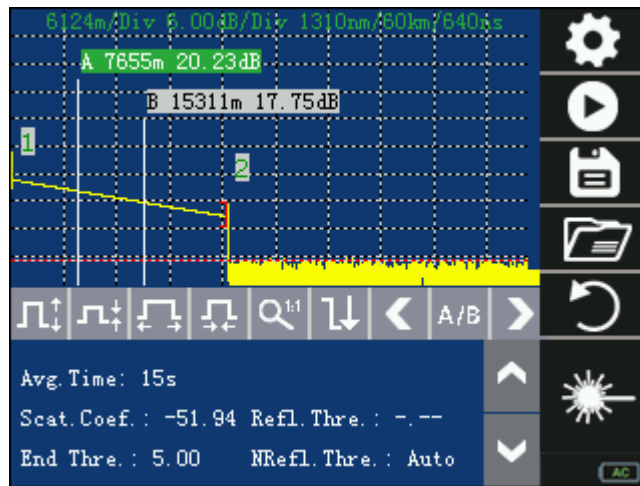


Figure 3-7 Event list

Serial number: "2/2" indicates that there are a total of two events on the trace, and the information about the second event is currently displayed.

Position: It indicates the distance from the start point of the optical fiber to the event.

Reflection: It indicates the reflection strength of the reflection event.

Insertion loss: It indicates the size of insertion loss of the event.

Attenuation coefficient: It indicates the attenuation characteristics of the fiber section between the previous event point and the current event point.

Accumulative loss: It indicates the loss of the optical fiber from the start point of the optical fiber to the event point.

### 3.5.2.3 Information about the A/B Marker

A marker is used to identify and analyze a single event, trace section, and distance. The marker information includes the distance, loss between two markers, and attenuation coefficient between two markers, as shown in Figure 3-8.



Figure 3-8 Information about the A/B marker

The following parameters are measured between markers A and B. When any marker is changed, the recorded values will change accordingly.

- A-B: It indicates the distance between markers A and B.
- A-B loss: It indicates the loss between markers A and B and identifies the power difference in the vertical direction of markers A and B.
- A-B attenuation: It is the attenuation coefficient of the optical fiber between markers A and B.

### 3.5.2.4 Information about the Optical fiber Link

Information about the optical fiber link includes the link attenuation, link length, and link loss of the optical link under test, as shown in Figure 3-9.

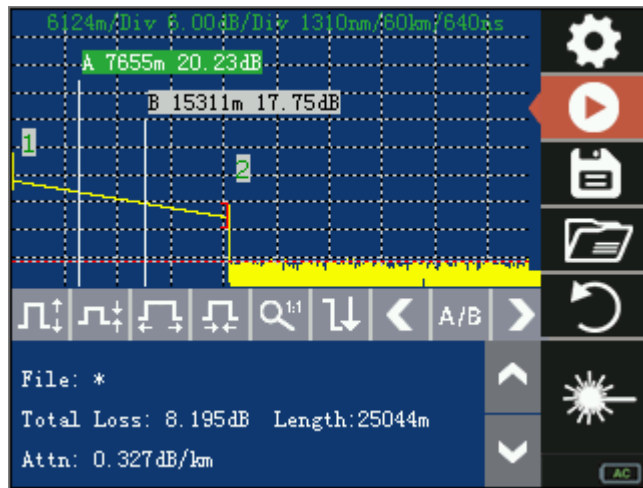






Figure 3-9 Information about the optical fiber link

### 3.5.3 Tool Bar of the OTDR

#### 3.5.3.1 Icons on the Tool Bar

SN.	Tool Icon	Description
1		Set parameters.
2		Start or stop the test.
3		Save a file.
4		Open a file.
5		Return to the HOME page.
6		Zoom in the trace vertically.
7		Zoom out the trace in vertically.
8		Zoom in the trace horizontally.
9		Zoom out the trace in horizontally.
10		Switch between the zoom-in diagram and the original scale.
11		Jump to the next event point.
12		Move the marker to the left.

SN.	Tool Icon	Description
13		Switch between markers A and B.
14		Move the marker to the right.
15		Page up the event list.
16		Page down the event list.

### 3.5.3.2 Parameter Setup Operations

Accurate parameters settings are mandatory for accurate measurement of an optical fiber. Therefore, before using the OTDR, you need to set parameters as required. The following describes how to set parameters in details.

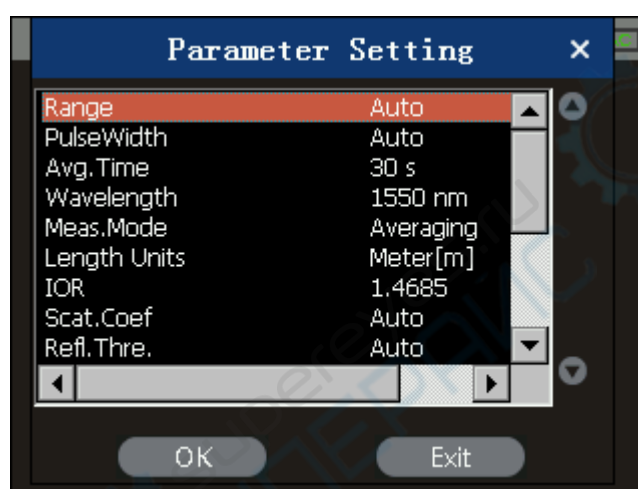


Figure 3-10 Parameter setup page

You can set parameters by using keys on the keypad or by tapping the touch screen.

You can press [▲] or [▼] to select the parameter setup icon, and press [Enter] to enter or [ESC] to exit from the parameter setup page.

Alternatively, you can tap the corresponding items on the touch screen to set parameters. The setup operations on the touch screen have the same effects as keypad operations.

Figure 3-10 shows the parameter setup page.

### Definitions of Measurement Parameters

SN.	Parameter	Definition
1	Distance range	Optical fiber length corresponding to the entire trace



SN.	Parameter	Definition
2	Pulse width	Width of the laser pulse that is transmitted from the OTDR to the optical fiber
3	Measurement duration	Select appropriate test time.
4	Laser wavelength	Select a test laser wavelength.
5	Monitoring mode	Select a measurement mode.
6	Length unit	Select an appropriate length unit.
7	Reflection rate	It is the reflection rate of an optical fiber, which affects the transmission speed of the light on the optical fiber.
8	Scatter coefficient	It affects the back scatter power of the light on the optical fiber.
9	Non-reflection threshold	Any event with the insertion loss higher than this threshold is displayed in the event list.
10	Reflection threshold	Any event with the reflection strength equal to or higher than this threshold is displayed in the event list.
11	End threshold	The first event with the insertion loss equal to or higher than this threshold is regarded as the end of the optical fiber, and all subsequent events will be ignored.
12	Time	Set the current system time.
13	Auto Poweroff	Set whether the OTDR is automatically powered off when no screen or keypad operation is performed within five minutes.
14	Language	Select the language that is displayed on the screen.
15	Default	Default settings of parameters
16	Help	Display the help information.

### Setting the Distance Range

Generally, the distance range is set based on the actual length of the optical fiber. In this way, the measurement accuracy can be ensured.

On the parameter setup page, press [▲] or [▼] to select Distance range. Press [Enter] to enter or [ESC] to exit from the distance range setup page.

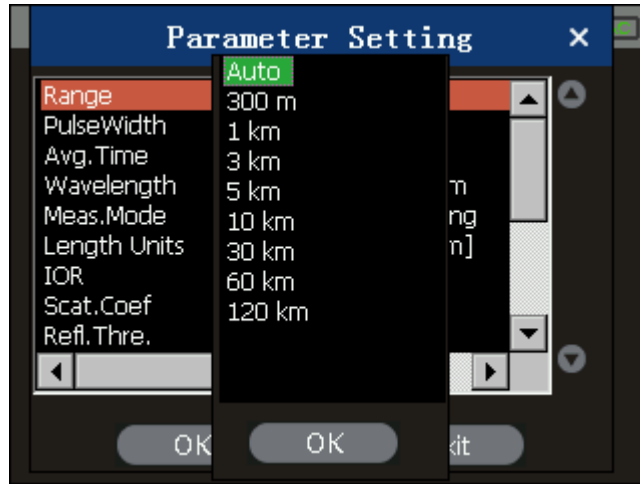


Figure 3-11 Setting the distance range

Press [▲] or [▼] to select an appropriate distance range, and press [Enter] to make the setting effective.



- **Auto** is the automatic measurement mode of the OTDR. If this option is selected, the OTDR will select an appropriate measurement range for the optical fiber under test in an intelligent manner, and automatically select an appropriate pulse width for measurement. The entire measurement process requires no participation of users.
- The default value of **Distance range** is **Auto**.

### Setting the Pulse Width

Selection of a pulse width affects the dynamic range and resolution of the test trace. If the narrow pulse width test is selected, a higher distance resolution and a smaller dead zone can be achieved, but the dynamic range decreases. In contrast, if the broad width test is selected, a longer distance of optical fiber can be tested, but the distance resolution is lower and the dead zone is larger. Therefore, users need to balance between the dynamic range and the dead zone.

Different pulse width options are provided as reference, depending on the selected distance range.

On the parameter setup page, press [▲] or [▼] to select Pulse width. Press [Enter] to enter or [ESC] to exit from the pulse width setup page, as shown in Figure 3-12.

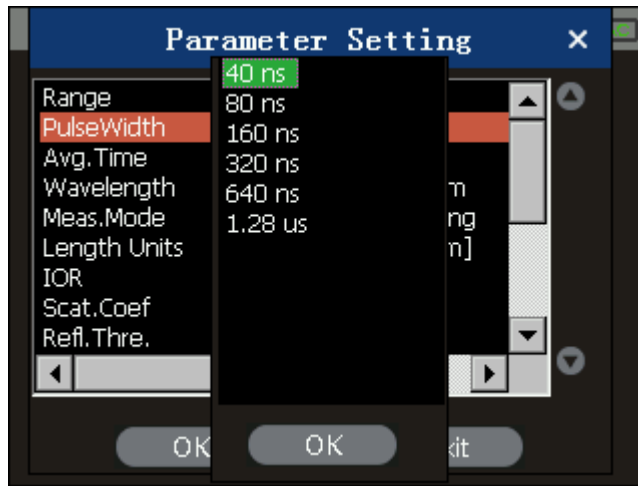


Figure 3-12 Setting the pulse width

Press [▲] or [▼] to select a pulse width as required, and press [Enter] to make the setting effective.



- The default value of **Pulse width** is **Auto**.
- If **Distance range** is set to **Auto**, **Pulse width** is also set to **Auto**. You do not need to set the pulse width by yourself.

### Setting the Measurement Avg.Time

The measurement Avg. Time directly affects the signal to noise ratio (SNR) of the trace. If a measurement Avg. Time is longer, the SNR becomes higher and a larger dynamic range can be achieved. Therefore, when measuring a long-distance optical fiber or viewing remote-end events, select a longer measurement Avg. Time whenever possible.

On the parameter setup page, press [▲] or [▼] to select Measurement Avg. Time. Press [Enter] to enter or [ESC] to exit from the measurement Avg. Time setup page, as shown in Figure 3-13.

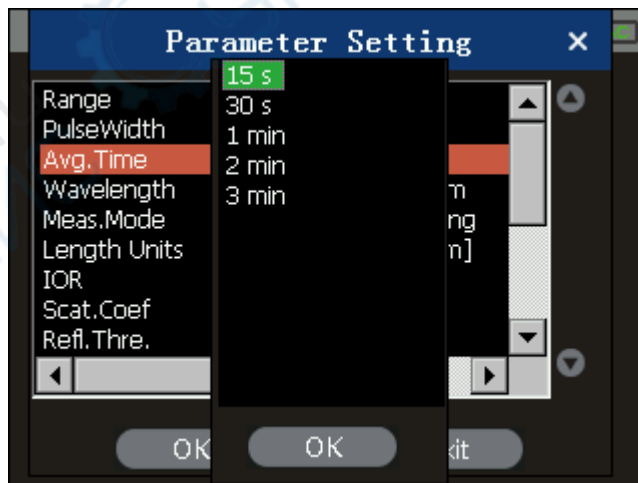


Figure 3-13 Setting the measurement Avg. Time

Press [▲] or [▼] to select a Avg. Time as required, and press [Enter] to make the setting effective.



- Predefined options of the measurement Avg. Time include 15s, 30s, 1min, 2min, and 3min.
- The default value of Measurement Avg. Time is **30s**.

### Setting the Laser Wavelength

On the parameter setup page, press [▲] or [▼] to select Laser wavelength. Press [Enter] to enter or [ESC] to exit from the laser wavelength setup page, as shown in Figure 3-143.

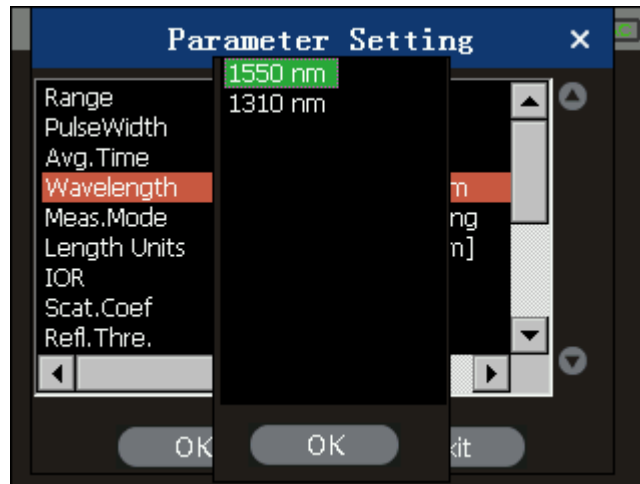


Figure 3-14 Setting the laser wavelength

### Setting the Measurement Mode

Two measurement modes are available: real-time and average.

In real-time mode, the OTDR tests the connection status of the external optical fiber in real time and update the test trace in time. In real-time mode, the measurement stops only when you press [Run/Stop]; otherwise, the measurement goes on an on. In average mode, the OTDR accumulates and averages the measurement data based on the selected measurement duration. When the measurement time is equal to or longer than the measurement duration set by the user, the current measurement stops and the measurement result is displayed. Generally, you can select the average mode for measurement.

On the parameter setup page, press [▲] or [▼] to select Measurement mode. Press [Enter] to enter or [ESC] to exit from the measurement mode setup page, as shown in Figure 3-15.

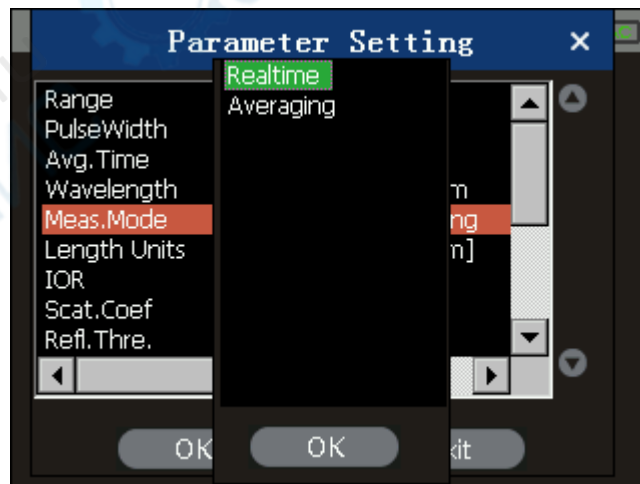


Figure 3-15 Setting the measurement mode

### Setting the Length unit

On the parameter setup page, the length unit is set to m by default.

### Setting the Reflection Rate

The reflection rate of an optical fiber affects the transmission speed of the light on the optical fiber. Therefore, setting of the reflection rate directly affects the accuracy of measured distance. Generally, the reflection rate of an optical fiber is provided by the manufacturer of the optical fiber. It can be set to any value between 1.0 and 2.0. The value has a precision of four decimal places.

On the parameter setup page, press [▲] or [▼] to select Reflection rate. Press [Enter] to enter or [ESC] to exit from the reflection rate setup page, as shown in Figure 3-16.

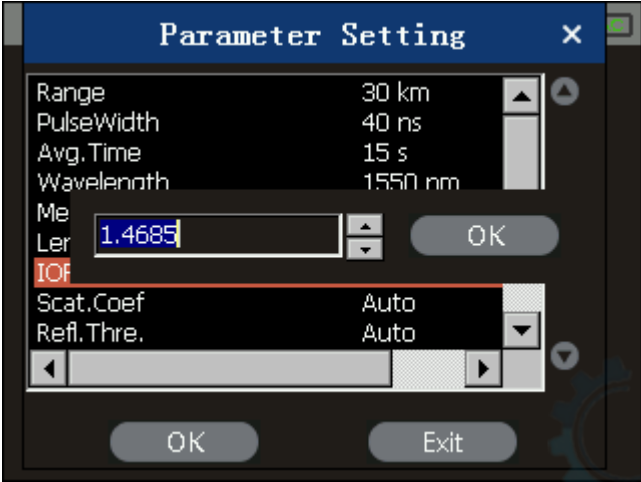


Figure 3-16 Setting the reflection rate

Press [◀] or [▶] to select the digit to be modified, and press [▲] or [▼] to modify the value of the selected digit. After modification is completed, press [Enter] to make the setting effective and press [ESC] from the setup page.

### Setting the End Threshold

This threshold is the fiber end threshold. If the end threshold is set to 3.0 dB, the first event with the insertion loss equal to or higher than 3.0 dB on the test trace is regarded as the end of the optical fiber.

On the parameter setup page, press [▲] or [▼] to select End threshold. Press [Enter] to enter the end threshold setup page, as shown in Figure 3-17.



Figure 3-17 Setting the end threshold

Press [◀] or [▶] to select the digit to be modified, and press [▲] or [▼] to modify the value of the selected digit. After modification is completed, press [Enter] to make the setting effective and press [ESC] to exit from the setup page.



- The default value of **End threshold** is **5.00 dB**.

### Setting the Time

The time setup menu is used to modify the system time of the OTDR.

On the parameter setup page, press [▲] or [▼] to select Time. Press [Enter] to enter or [ESC] to exit from the time setup page, as shown in Figure 3-18.

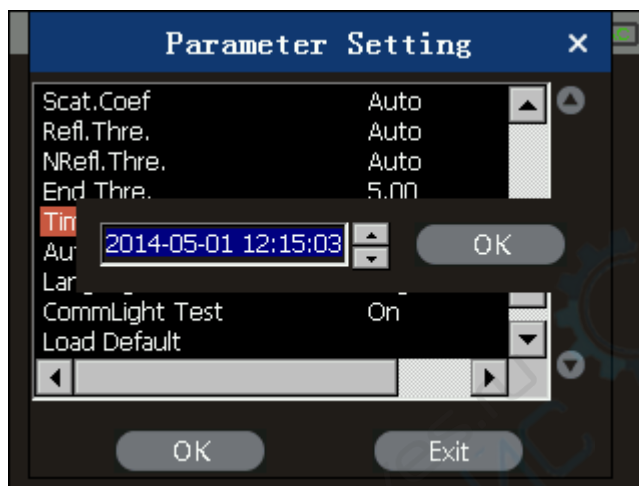


Figure 3-18 Setting the time

Press [◀] or [▶] to select the digit to be modified, and press [▲] or [▼] to modify the value of the selected digit. After modification is completed, press [Enter] to make the setting effective.

### Recovering the Default Settings

You can recover the factory settings of some parameters on the OTDR. These parameters include Distance range, Pulse width, Measurement duration, Reflection rate, and End threshold. On the parameter setup page, press [▲] or [▼] to select Default. Press [Enter] to enter or [ESC] to exit from the page for recovering default settings, as shown in Figure 3-19.

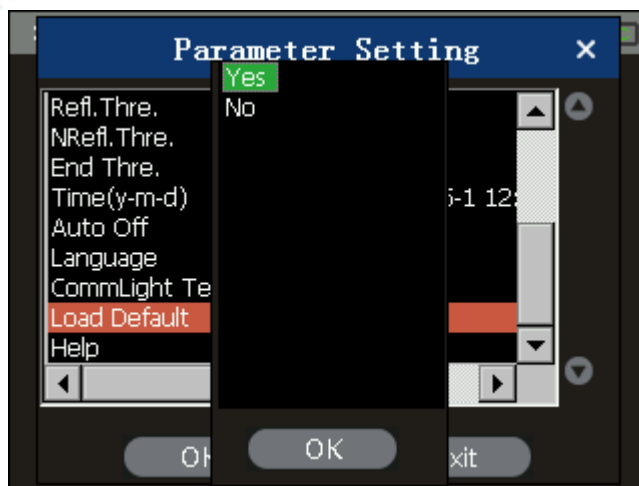


Figure 3-19 Recovering the default settings

Press [▲] or [▼] to select Yes or No, and press [Enter] to make the setting effective.

## Help

You can obtain the online help from the Help menu. On the parameter setup page, press [▲] or [▼] to select Help. Press [Enter] to enter or [ESC] to exit from the help page, and press [◀] or [▶] to page up or down, as shown in Figure 3-20.

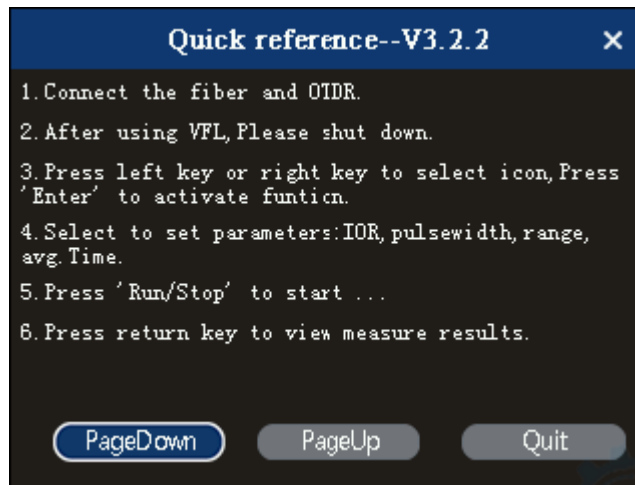








Figure 3-20 Help information

## 3.6 Battery Charging Status

When the OTDR is powered off and is charged by using the AC/DC adapter, the indicator on the top cover of the OTDR is on in red, indicating that the OTDR is being charged. After the OTDR is fully charged, the indicator is automatically off. When the OTDR is powered on and is charged by using the AC/DC adapter, the embedded battery of the OTDR is automatically charged.

The battery icon on the screen is described as follows:

-  : The battery is exhausted.
-  : The battery power is low.
-  : Half of the battery power is used.
-  : More than half of the battery power is left.
-  : The battery power is full.
-  : The battery is being charged.

## 4 Obtaining the Trace and Existing Trace Operations

### 4.1 Description of the Home Page

After the OTDR is powered on, the logo page and the home page is displayed, as shown in Figure 4-1/2.



Figure 4-1 logo page



Figure 4-2 Home page

Six icons are displayed on the home page, including OTDR Mode, Visible Light Source, Parameter Setup, File Management, Open File, and Help.

You can press [◀] or [▶] to select an icon and press [Enter] to execute the corresponding function. Alternatively, you can tap an icon as required on the touch screen to execute the corresponding function.

### 4.2 Obtaining the Trace

The OTDR can start a measurement process to obtain a complete trace or open a trace file that is stored earlier.



- Before measurement, familiarize yourself with precautions of the OTDR to ensure personal safety.
- When the OTDR is used to test an optical fiber, the working light cannot exist on the optical fiber under test. Otherwise, the test result is inaccurate. Even worse, the OTDR may be permanently damaged.



### 4.2.1 Obtaining the Trace—Connecting an Optical Fiber

Connect the optical fiber to the optical output port on the OTDR without using any tool.



- Clear the connector. For details about how to clear optical connectors, see Appendix A.
- Clear the optical connector on the OTDR and check whether the optical interface is an FC/UPC connector.
- Connect the optical fiber to the OTDR.

### 4.2.2 Obtaining the Trace—Setting Parameters

Set parameters. For details, see section 3.5.3.2 "Parameter Setup." If parameters of the optical fiber are not clear, directly use the default values of the OTDR. This, however, may increase errors of measurement results.




- In automatic measurement mode, the parameter **Distance range** is set to **Auto**.

### 4.2.3 Obtaining the Trace—Automatic Measurement

If the length of the optical fiber is not known, you can use the automatic measurement function. The OTDR will automatically select an appropriate distance range for the optical fiber under test.

**The automatic measurement procedure is as follows:**

1. Set parameters. For details, see section 3.5.3.2 "Parameter Setup." Set **Distance range** to **Auto**.
2. Start the measurement by pressing [Run/Stop] or tapping  on the touch screen. The OTDR displays a page, as shown in Figure 4-3 (a) and Figure 4-3 (b).

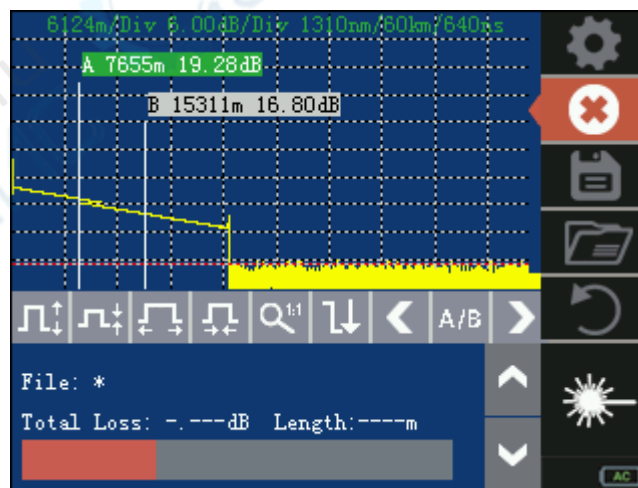


Figure 4-3(a) Measuring page of OTDR

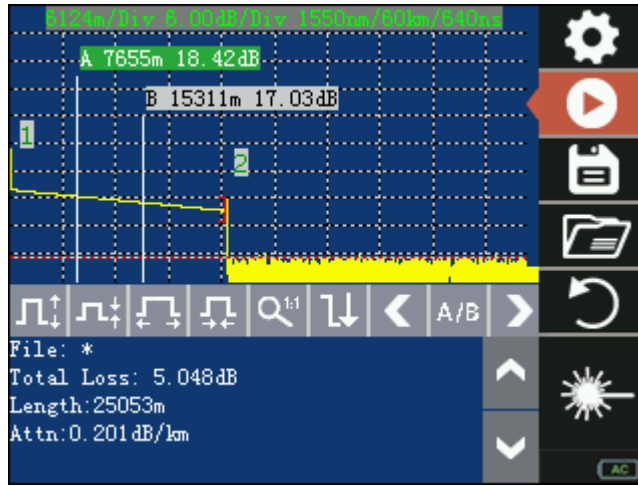


Figure 4-3(b) Trace analysis page of the OTDR

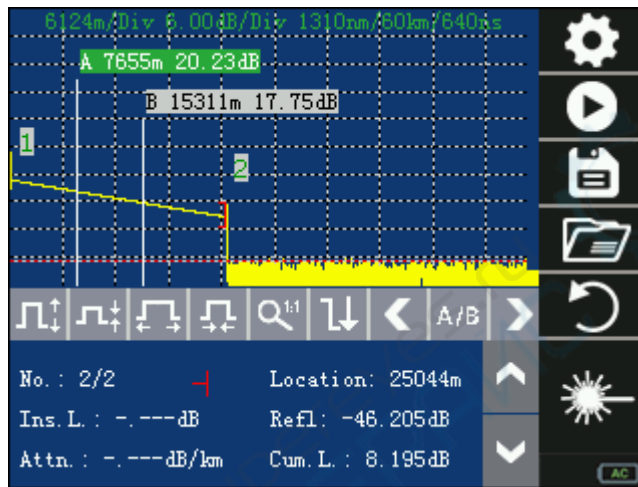


Figure 4-4 OTDR Trace




- During the measurement process, the intermediate result of the measurement is displayed on the screen. The trace is refreshed regularly to display the entire measurement process to users. After the measurement duration expires, the trace is the final trace, as shown in Figure 4-4.

#### 4.2.4 Obtaining the Trace—Manual Measurement

If the optical fiber under test is known, you can set parameter accurately to obtain a satisfying measurement result.

The manual measurement procedure is as follows:

1. Change the measurement distance by selecting a preset distance range according to 3.5.3.2 "Parameter Setup."
2. Start the measurement by pressing [Run/Stop] or tapping  on the touch screen. The measurement process is the same as step 2 in an automatic measurement process.

#### 4.2.5 Obtaining the Trace—Measurement Failure Causes

If expected events are not displayed, the failure may be caused by one of the following reasons:

- Two events are too close to each other.  
Reduce the pulse width and try again. If events are still not detected, measure the other end of the optical fiber.
- The SNR is too low.

Select the broad pulse or increase the average time (measurement duration), and try again.

- The user settings are incorrect.



Check the user settings (such as the reflection rate), and try again.

### 4.3 Viewing the Information Pane



The information pane displays the measurement parameters, analysis parameters, event information, and A/B marker information.


For details about the information displayed in the information pane, see section 3.4.2 "Information Pane."

#### 4.3.1 Switching Contents in the Information Pane

On the page as shown in Figure 4-4, press [ESC] or tap  or  on the touch screen to display measurement parameters, analysis parameters, event information, and A/B marker information cyclically.

#### 4.3.2 Viewing the Event List



On the page as shown in Figure 4-4, press [ESC] or tap  or  on the touch screen to switch to the event list.

You can tap  on the touch screen to page down the event list, or press [Shift/⌘] and [ESC] together to page up or down the event list.



#### 4.3.3 Viewing the A/B Marker Information



##### Switching and Moving the Marker A/B

On the page as shown in Figure 4-4, press [Shift/⌘] and [ESC] together, or tap  on the touch screen to switch between markers A and B.

You can press [◀] or [▶], or tap  or  on the touch screen to move marker A or B.




##### Viewing the A/B Marker Information

On the page as shown in Figure 4-4, press [ESC] or tap  or  on the touch screen to switch to the A/B marker information.

You can press [◀] or [▶], or tap  or  on the touch screen to change the position of marker A or B. Meanwhile, the A/B marker information in the information pane changes accordingly.

### 4.4 Zooming in a Trace Horizontally

This function allows you to view the event details on a trace.

- On the page as shown in Figure 4-4, tap  on the touch screen, or press [Shift/⌘] and [▶] on the keypad together to zoom in the trace horizontally.
- Press [◀] or [▶], or tap  or  on the touch screen to move the marker to the event point to be observed.
- View the information about the event point according to 4.3.3.1 "Switching and Moving the Marker A/B."




## 4.5 Zooming out a Trace Horizontally

This function is used to zoom out a trace horizontally.

- On the page as shown in Figure 4-4, tap  on the touch screen, or press [Shift/⌘] and [◀] on the keypad together to zoom out the trace horizontally.

## 4.6 Zooming in a Trace Vertically

This function allows you to view the event point on a trace closely.

- On the page as shown in Figure 4-4, tap  on the touch screen, or press [Shift/⌘] and [▲] on the keypad together to zoom in the trace vertically.
- Press [◀] or [▶], or tap  or  on the touch screen to move the marker to the event point to be observed.
- View the information about the event point according to 4.3.3.1 "Switching and Moving the Marker A/B."

## 4.7 Zooming out a Trace Vertically

This function is used to zoom out a trace vertically.

- On the page as shown in Figure 4-4, tap  on the touch screen, or press [Shift/⌘] and [▼] on the keypad together to zoom out the trace vertically.



## 4.8 Displaying the Full Trace

This function is used to display the full trace.

- On the page as shown in Figure 4-4, tap  on the touch screen, or press [Shift/⌘] on the keypad to display the full trace.

## 4.9 Saving a Trace

After an automatic or a manual measurement is completed, you can save the current trace. The trace and its related information are saved.

On the page as shown in Figure 4-5, press [▲] or [▼] to select the icon , and press [Enter] to save the trace. Alternatively, directly tap the icon  to save the trace.

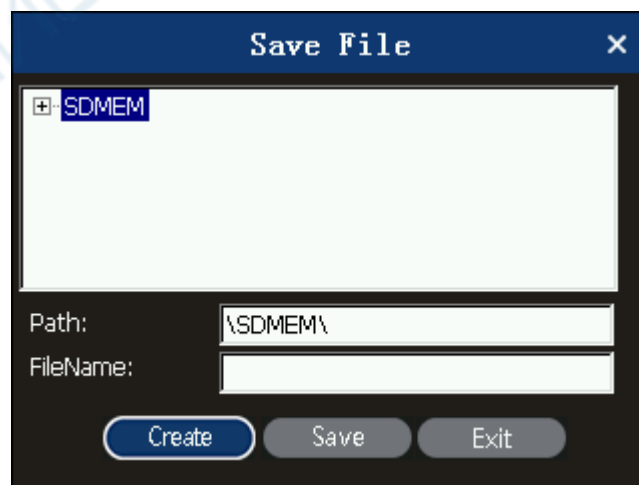




Figure 4-5 Saving a trace

- Enter a file name. Press [▲], [▼], [◀], or [▶] to select a letter from the letter/number list, and press [Enter] to make the current selection effective. Repeat

the same operation to enter the next letter until the complete file name is entered. Alternatively, You can directly tap a letter or number on the touch screen to enter a file name.

- Press [▲], [▼], [◀], or [▶] to select the **Save** button, and press [Enter] to save a file. Alternatively, you can directly tap the **Save** button on the touch screen to save the file.
- Press [▲], [▼], [◀], or [▶] to select the **Cancel** button, and press [Enter] to cancel the save operation. Alternatively, you can directly tap the **Cancel** button on the touch screen to cancel the save operation.
- Delete a letter. Press [▲], [▼], [◀], or [▶] to select the **Delete** button, and press [Enter] to delete the highlighted letter. Alternatively, you can directly tap the **Delete** button on the touch screen to delete a letter.

#### 4.10 Viewing an Existing Trace

On the page as shown in Figure 4-4, press [▲] or [▼] to select the icon , and press [Enter] to access the Open File dialog box, as shown in Figure 4-5. Alternatively, directly tap the icon  to access the Open File dialog box.

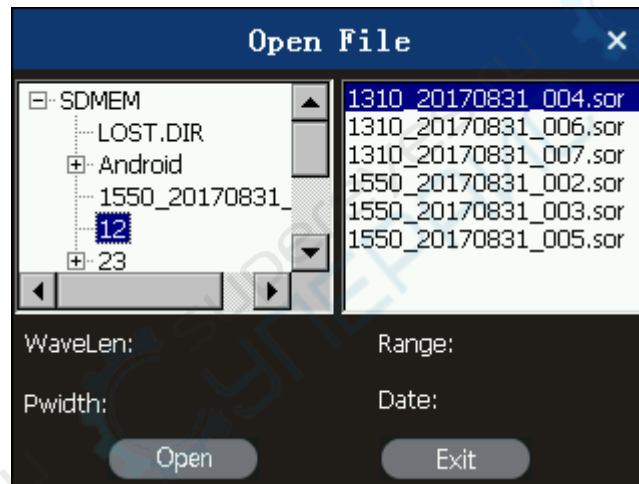


Figure 4-5 Viewing an existing trace

- Press [▲] or [▼] to select a trace file as required, press [◀] or [▶] to select the **Open** button, and finally press [Enter] to open the selected file. Alternatively, tap the **Open** button on the touch screen to open the selected file.

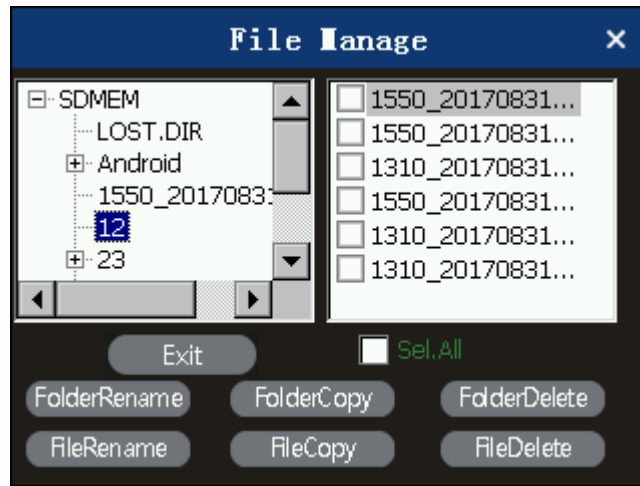
#### 4.11 Uploading a Stored Trace

You can use a USB flash drive or an SD card to upload a stored trace to a PC. On the PC, you can use the analysis software to perform more flexible operations on the trace. If a USB flash drive is used for uploading, the uploading procedure is as follows:

- Insert the USB flash drive to the USB connector.



- On the home page of the OTDR, tap  to access the File Management dialog box.



- Copy the target file to the USB flash drive, and then copy the data on the USB flash drive to the PC.
- If the SD card is used for uploading, directly remove the SD card from the OTDR, and use a card reader to copy the trace data to the PC.



# Appendix A Maintenance and Calibration

## Battery Maintenance and Replacement

The OTDR uses an embedded Li-ion battery.



Pay attention to the following points when maintaining the battery:

- It is recommended that the OTDR (with the embedded battery) be stored at a dry place at room temperature (15°C to 30°C) to achieve the optimum performance.
- If the OTDR has not been used for more than a month, it is recommended that the battery be charged once every month.
- DO NOT charge the battery for more than 8 hours; otherwise, the battery may be permanently damaged.
- To replace the battery, perform the following steps:
  - a) Remove the top cover of the battery compartment.
  - b) Remove the rechargeable battery, and then remove the battery connector from the battery jack.
  - c) Remove the clock battery.

## Cleaning of Optical Connectors

Optical connectors of the OTDR must be kept clean. You need to wipe these connectors regularly using the special alcohol. After the OTDR is used, cover the connector with a dust-proof cap.

In addition, you need to regularly clean the flange connector.

### ● Purpose of Cleaning Connectors

On a transmission link, the diameter of a fiber core is 9  $\mu\text{m}$ . The diameter of the dust or any other particle ranges from 0.1 to 0.01  $\mu\text{m}$ . This means that the dust or any other particle can cover a part of the fiber end, thus deteriorating the system performance.

In addition, the laser energy may burn the dust into the optical fiber, causing a further damage. For example, 0 dBm optical power on a single-mode optical fiber may generate a power density of about 16000000W/m<sup>2</sup>. If this situation occurs, the measurement will be inaccurate and cannot be duplicated.

### ● Before cleaning optical connectors, observe the following safety rules:

- a) Power off the OTDR.
- b) Failure to observe the stipulated control, adjustment, or operation procedures may cause dangerous radiation damages.
- c) When cleaning any optical connector, ensure that no laser source is used.
- d) When the OTDR is working, do not check the end of the optical device connected to the optical output in any case. Laser radiation is invisible to human eyes, but the laser can seriously damage the eyesight.
- e) Prevent the OTDR against electric shocks. Before cleaning the OTDR, disconnect the OTDR from the AC power, and use a dry or slightly wet soft cloth to clean the exterior of the chassis. DO NOT clean the interior of the chassis.
- f) DO NOT install components on an optical device or adjust the optical device without prior approval.

g) Only qualified or OUR authorized maintenance engineers can perform maintenance operations on the OTDR.

- **Tools for Cleaning Connectors**

- a) Fiber cleaner, used to clean optical connectors
- b) Fiber cleaning rod, used to clean optical connectors
- c) Fiber cleaning cloth, used to clean optical connectors
- d) Isopropanol
- e) Cotton ball
- f) Soft tissue
- g) Pipe cleaning brush
- h) Compressed air

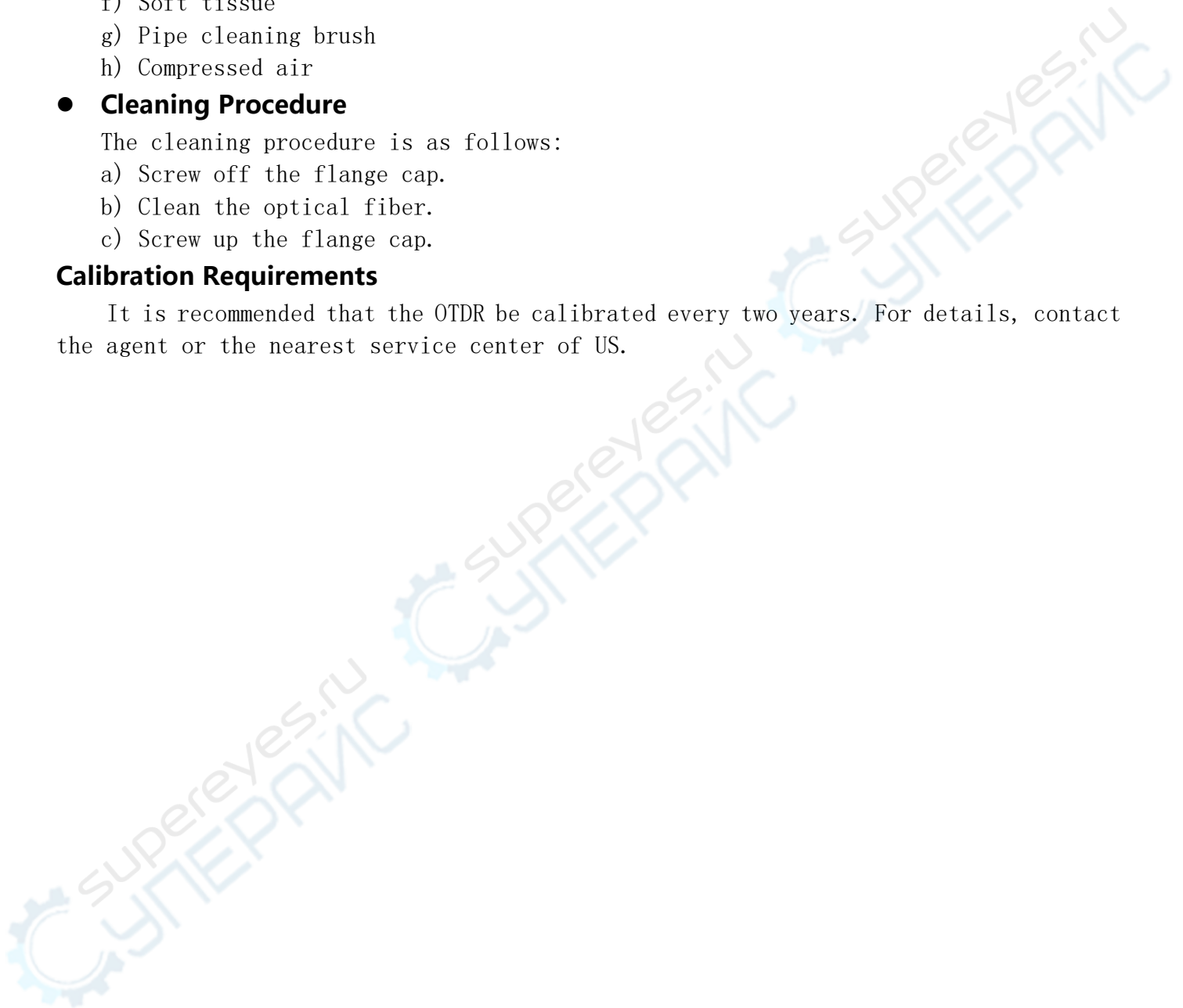
- **Cleaning Procedure**

The cleaning procedure is as follows:

- a) Screw off the flange cap.
- b) Clean the optical fiber.
- c) Screw up the flange cap.

### **Calibration Requirements**

It is recommended that the OTDR be calibrated every two years. For details, contact the agent or the nearest service center of US.





## Appendix B Technical Specifications

Model	QX35	QX45	
Dynamic (1)	30dB	32/30dB	
Wavelength ( $\pm 20$ nm)	1550	1310/1550	
Display	3.5' TFT LCD touch screen		
Light source type	LD		
Optical interface	FC/UPC		
Distance range (km)	0.3、1、3、5、10、30、60、120		
Pulse width (ns)	5、10、20、40、80、160、320、640、1280、2560、5120、10240、20480、Auto		
Measurement duration	15s、30s、1min、2min、3min		
Attenuation dead zone (2)	10m	10m	
Event dead zone	1.6m	1.6m	
Distance measurement precision	$\pm (1 \text{ m} + 5 \times 10^{-5} \times \text{Distance} + \text{Sampling interval})$		
Data storage	> 60000 test traces		
Communication interface	USB		
VFL	Wavelength	-	650nm
	Output power (mw)	-	$\geq 10$
	Test distance (km)	-	10
Optical Communications Test	YES	YES	

Note:

(1) Technical specifications describe the guaranteed performance of the OTDR when a typical UPC connector is used for measurement. The uncertainty caused by the reflection ratio of the optical fiber is not considered. The dynamic range of QX35 is measured when the measuring range is 60 km, the pulse width is 2560 ns, and the average time is 3 min. The dynamic range of QX35 and QX45 is measured when the measuring range is 120 km, the pulse width is 2560 ns, and the average time is 3 min.

(2) Dead zone measurement conditions: The reflection event occurs within 4 km. The reflection strength is smaller than -45 dB. The minimum pulse width is used.

## **Appendix C Warranty Information**

### **Warranty Period**

A warranty period of 1 (one) year is provided for the product from the date of product delivery. Within the warranty period, OUR provides the repair or replacement service free of charge for any defect of the product. In any case, the liability of us is limited to the original cost of the product. The warranty does not cover accessories or optional items provided by us.

### **Exclusions**

The warranty does not apply to the defects caused in the following cases:

- Unauthorized maintenance or adjustment
- Misuse, tampering, or accidents

OUR reserves the right to modify any product manufactured by us at any time, and thereby does not have the obligation to replace or modify products that have been sold.

### **Repair Registration**

A warranty registration card is delivered with the product. After you purchase the product, please complete this card and mail or fax back this card to the local customer service center of us so that the warranty items of the product that you have purchased can be properly confirmed.

### **Return of the Product**

If a product needs to be returned due to annual calibration or other reasons, please contact the local customer service center of us in advance, obtain a Return Material Authorization number (RMA#), and describe the reason of return briefly so that we can provide more effective services to you.

If a product must be returned for repairing, calibration, or other maintenance, note the following points:

- Use soft and thin packaging materials (such as polyethylene) to properly pack the product so that the chassis of the product is intact.
- Please use the original hard packing box. If other packages are used, fill in at least 3cm-thick soft materials around the product.
- Correctly fill in and return the product warranty card, including the company name, address, contact person, telephone number, email address, and problem description.
- Seal the packing box with the dedicated adhesive tape.
- Use a reliable means to send the product to the agent that supplies the product or a branch of us.

### **Contact Information**

Please visit the website of us to obtain the updated information about the product, user manual, and related applications. If you need any technical or sales supports, contact the local customer service center of us.

KOMSHINE TECHNOLOGIES LIMITED.

<http://www.komshine.com>;