



# **Precision Rated Optics**

*Work with a PRO!*

## **OFL-301B**

Optical Fault Locator



## ***Operation Guide***

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**Warranty**

The material contained in this document is subject to change without notice. We make no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. We shall not be liable for errors contained herein or for incidental or consequential damages in connection with furnishing, performance, or use of this material.

The battery is a consumable part and is not subject to the OTDR warranty.

**ISO9001 Certification**

Produced to ISO9001 International Quality System Standard.

**Safety Instructions**

During each stage of operation of this instrument, please always observe the following safety instructions. Not taking any safety precautions or following the instructions will violate the safety standards of design, manufacturing and application of these instruments. In no case shall we bear the responsibilities for consequences incurred by violation of the following instructions.

**General**

This product is a Safety Class 1 instrument. The protective features of this product may be impaired if it is used in a manner not specified in the operation instrument.

**Environmental conditions**

It is designed to operate at a maximum relative humidity of 95% and at altitudes of up to 2000 meters. Refer to the specifications tables.

**Before applying power**

Verify that the product is set to match the available line voltage, the correct fuse is installed, and all safety precautions are taken. Note the instrument's external markings described under Symbols.

Do not operate in an explosive atmosphere

Do not operate the instrument in the presence of flammable gases or fumes.

Do not remove the instrument cover.

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made only by qualified service personnel.

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

**Safety Terms Used in This Manual**

The **WARNING** sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a **WARNING** sign until the indicated conditions are fully understood and met.

The **CAUTION** sign denotes a hazard. It calls attention to an operating procedure, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or the entire product. Do not proceed beyond a **CAUTION** sign until the indicated conditions are fully understood and met.

The **NOTE** sign information that may be beneficial during the use and maintenance of the instrument.

- OTDR is a laser instrument. Users should avoid looking directly into the optic output. And the use of microscope or magnifier should also be avoided, for the use of such devices can focus a highly intense beam onto the retina, which may result in permanent eye damage
- Make sure that the optical fiber or cable is not in use and there is no laser beam in the fiber before testing via OTDR. Otherwise, it may result in imprecise test trace, even permanent damage for the OTDR

**Battery:**

Battery for this instrument is rechargeable NiMH battery. If unused for a long time, battery should be recharged before being used. If the instrument is left idle for more than two months, it should be recharged to maintain adequate battery volume. Do not recharge batteries for more than 8 hours. Do not take batteries out without technical staff's help. Do not expose batteries to fire or intense heat. Do not open or mutilate batteries. Avoid touching the electrolyte in the batteries, which is corrosive and may cause injuries to eyes, skin or damage to clothes.

**External Power:**

OTDR supports external power. Power requirements: DC 13.8V/1.2A.

**Laser Radiation:**

To avoid serious eye injury, never look directly into the optical outputs of fiber optic network equipment, test equipment, patch cords, or test jumpers.

- Always avoid looking directly into the optical output port, when the instrument is working
- Always replace protective dust cap on the detector port when the instrument is not being used
- Always avoid looking directly at unconnected end of optic fiber in testing and make the unconnected end pointing at a non-reflective object, if possible

## 1. General Information

### 1.1 Scope of this Manual

Thank you for purchasing OTDR. Please read this manual carefully before using any of our fiber-optic instruments. Always observe the warnings and cautions appearing throughout this manual.

This manual contains the information necessary for proper operation and maintenance of OTDR, troubleshooting instructions as well as information regarding obtaining services.

All our OTDR are carefully assembled and undergo a rigorous mechanical, electrical, and optical inspection prior to shipment. Beside the instrument, the package should also include a data transfer cable, a power adapter, a PC Analysis software installation disk and this users' manual etc. For detailed information, refer to the packing list.

Upon receiving the instrument, please check for any obvious signs of physical damage that may have occurred during shipment. Report any damage to the shipping agent or the representative of us immediately. Retain the original packing materials in case reshipment becomes necessary.

### 1.2 Unpacking and Inspection

This instrument has been carefully packed in accordance with standard shipping procedures. Examine the instrument for damage that may have occurred during shipment. If you find any damage or the instrument is not working, or if any of the following items are not included, please contact us.

### 1.3 Introduction

OTDR's are the preferred choice for the measurement of optical fiber's systems. With an OTDR, you can make assessment of one single optical fiber or a whole optical fiber chain. You can directly observe loss and events of the optical fiber chain.

OTDR's check the transmission quality of optic fiber through measurement of backward scattered lights. Standard organizations like International Telecom Union (ITU) define backward scattered lights as effective analysis means of measurement of optical fiber loss. Backward scattering is also the only effective way of connector inspection, which can be applied to measure the length of optical fiber, . Therefore, the OTDR is a useful tool for optical fiber manufacturing, installation and maintenance.

OTDR's work through reviewing "events" in optical fiber (for example, irregularities and connectors), which is quite helpful for quality control for those who are in charge of optical fiber manufacturing, installation and maintenance. OTDR's can help identify the irregularities in optical fiber, locate them, and measure their attenuation, relevant loss and their homogeneity.

OTDR's are more helpful for field operation. They can help to check the qualification of the optical fiber chain circuit on a regular basis. They can be used for future maintenance, transmission quality and condition of the optical fiber that need to be recorded and stored. This includes the measurement of optical path, total loss, and loss of all tie-ins and connectors.

OTDR's are easy to use, small and compact. They are designed to fully embody the user's convenience with its large LCD display and graphical interface. They can save and transfer the measurement curves data to a PC by the provided software for further analyzing, reporting and printing.

**OTDR features by:**

Basic applications:

- 1) Measure the length of optical fiber and cable
- 2) Measure the distance between two points on optical fiber and cable
- 3) Locate faults and ruptures of optical fiber and cable
- 4) Display distribution curve of optical fiber and cable loss
- 5) Measure attenuation and coefficient of optical fiber and cable
- 6) Measure loss between two points on optical fiber and cable
- 7) Measure loss of tie-ins
- 8) Measure reflection of reflective events of optical fiber and cable

For a specific event (Transmission quality changed due to faults caused by splicing, connector, bending etc.), the following measurements can be carried out with an OTDR:

For each event: distance, loss and reflection

For each section of optical fiber: length and loss of dB or dB/Km

For the whole optical fiber chain: length and loss of dB

- Large Colorful LCD display with auto or manual adjustment of contrast
- Backlight LCD display supports night operation
- Easy operation with trace graphic display
- Trace storage function
- RS232/USB Data upload port
- PC analysis software for analyzing and reporting previously stored data
- Auto off function conserving battery life
- DC/AC power supply
- Auto recharging, over 8 hours operation for one charge.

## 2. Basic Operation

### 2.1 Foreword

This part introduces the basic operation on the OTDR. Specific operations of each type instrument are elaborated in Chapter 3 of this manual. Please read this manual carefully for optimal operation. Should you encounter any problems during operation, you are welcome to contact the technical staff of our company or representatives.

### 2.2 Instrument Interfaces Instructions

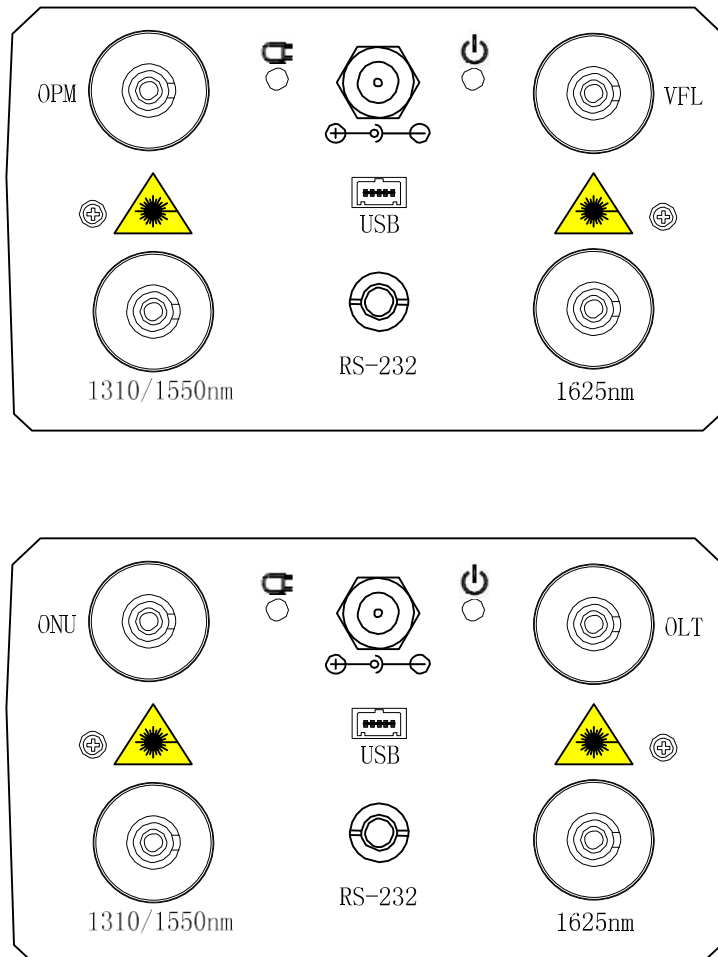


Figure 2-1. Typical Port Layout of the OTDR

(Port Layout of the OTDR's may vary according to different models and configurations)



**OTDR/VFL**

(VFL maybe not be available on some models, please contact us for configuration) Fiber optic output for OTDR and VFL, a FC/PC (interchangeable SC, ST) connector is used for optic interface.

**ONU/OLT**

(Only available for limited models) Fiber optic ports of PON Power Meter module.

**AC Power Jack**

Power adapter jack requirements: 13.8V DC@1.2A.

**Data Transfer Port**

For all types, there are USB interface and RS232 interface. This interface is used to transfer saved traces in the instrument to a PC for further analysis by associated trace manager.

**Power/Charge Indicator**

When measurement power on or charging, the relevant indicator will be lightened.

**Caution**

**Invisible laser radiation!** Please always avoid looking directly at the optical output or stare at laser beam.

**2.3 Use of Batteries**

Battery for the OTDR is NiMH battery.

**Cautions During Operation:**

The following may bring auto power off of the instrument:

- The instrument will be auto powered off when there is insufficient power during operation and low power will be shown on the LCD.
- If unused for a long time and which may cause insufficient power, the instrument will be powered off several seconds after powering on so as to protect the batteries in case of excessive discharging. The inside batteries should be recharged immediately through adapter.
- Please charge only when battery remaining capacity is low. Irregular charging operation may seriously shorten battery life.

**Cautions in Recharge:**

- Quick charge is needed first and then switch to trickle charge after the voltage reaches a predefined value. Quick charge temperature is +5~+45°C, and trickle charge temperature is 0~+55°C, suitable for indoors. Battery will not be full or be damaged if the charging temperature is beyond the above range, which may shorten battery life.
- 3 hours for quick charge
- Do not charge for over 8 hours

## 2.4 Keypad Functions

### [On/Off]

Power on or off



Under GUI, Press to start measurement While testing, press this key to stop measurement

### [Enter]

- Under GUI, press this key to confirm the current operation
- Together with [Shift/↵], can browse the event list downwards

### [▲][▼]

- Move menu bar in menu operation
- Highlight the icon to be operated
- Adjust parameter in parameter configuration
- Together with [Shift/↵], can zoom out or zoom in trace vertically



- Select parameter to be adjusted in parameter configuration
- Move marker leftwards or rightwards in Trace operation
- Turn page while in Help sub-menu
- Together with [Shift/↵], can zoom out or zoom in trace horizontally



- Read help when power on
- Cancel the current operation
- Exit menu configuration
- Switch between information Windows
- Together with [Shift/↵], can review the event list upwards

### [Shift/↵]

This is the hot key to active the integration function by being pressed together with other keys. Besides, by pressing this key singly under the GUI of displaying trace, the trace can be resumed to the original size without any zoom.

## 3.1 Principle of OTDR

OTDR (Optical Time Domain Reflectometer) is a measurement instrument for identifying optic fiber transmission features. The instrument is mainly used to measure attenuation of a whole optic fiber chain and provide attenuation details relating to length, namely detect, locate and measure any event in the optic fiber chain (events refer to faults caused by splicing, connectors, and bending whose transmission change can be measured). Its non-destructive, one-end connection and rapid measurement have made the OTDR an indispensable tool for manufacture, construction, and maintenance of optic fiber.

The faults and heterogeneity of optic fiber itself cause Rayleigh scattering of light pulse transmitted in optic fiber. Part of light pulse is scattered in the reverse direction, and this is called Rayleigh backward scattering, which actually provides attenuation details relating to length.

Information relating to distance is obtained through time information (that's the reason why there is "Time Domain" in the name of OTDR). Fresnel reflection occurs at the boundary between two media of different IOR (for example, connections of faults, connectors, or optic fiber end). This reflection is used to locate the discontinuous points on the optic fiber. The magnitude of reflection depends on the difference between IOR and the smoothness of boundary.

The OTDR sends out a light pulse into the connected optic fiber, and receives reflections of events and backward scattering power of pulse in time. Results will be displayed on the LCD. The y-axis is dB value of backward scattering power, and the x-axis is the distance.

## 3.2 Basic Definition and Classification of Events

### 3.2.1 Events

Events refer to any abnormal points causing attenuation or sudden change of scattering power besides the normal scattering of optic fiber, which include all kinds of losses like bending, connections and ruptures.

Events points displayed on LCD are abnormal points that cause traces to deviate from straight line.

Events can be classified as reflection events and non-reflection events.

### 3.2.1.1 Reflection Events

When some pulse energy is scattered, reflection events happen. When reflection event occurs, peak shows on trace, as shown in Figure 3-1.

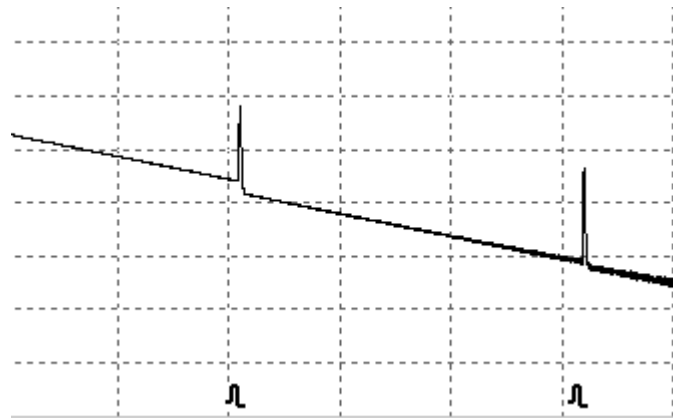


Figure 3-1. Reflection Event

### 3.2.1.2 Non-reflection Events

Non-reflection events happen at certain points where there is some optic loss but no light scattering. When non-reflection event occurs, a power decline shows on trace, as in Figure 3-2.

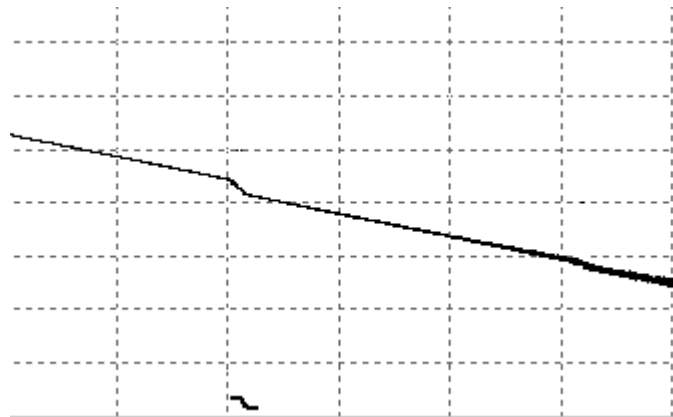


Figure 3-2. Non-reflection Event

### 3.2.1.3 Inspection Events

The OTDR sends off a light pulse into the optic fiber to be inspected, and then receive returning light signals, and starts calculating the “event” distance. The farther the distance is, the longer time needed for scattered light to be received by the instrument. Event distance can be calculated according to the time of receiving event signals.

Through inspection of scattered signals, properties of optic fiber, connectors, tie-ins can be identified.

### 3.3 Measurement Application of OTDR

The OTDR displays power relating to distance of returning signals. This information can be used to identify the main properties of an optic fiber chain.

#### 3.3.1 Measurement Contents of OTDR

- Event location (distance), end or rupture of optic fiber chain
- Attenuation coefficient of fiber
- Loss of a single event (for example, one optic tie-in), or total loss from upper end to end
- Range of a single event like reflection of connectors (or grade of reflection)
- Auto measurement of cumulative loss of a single event

#### 3.3.2 Trace Analysis of OTDR

The trace analysis of OTDR is fully automatic. The trace locates:

- Reflection events of connections and mechanic tie-ins
- Non-reflection events (usually at welding tie-ins)
- End of optic fiber. Through scanning the first loss event that is larger than end threshold, end of optic fiber can be identified.
- Events list: event type, loss, reflection and distance.

### 3.4 Trace Display Screen of OTDR

Trace displays on OTDR screen, as in Figure 3-3.

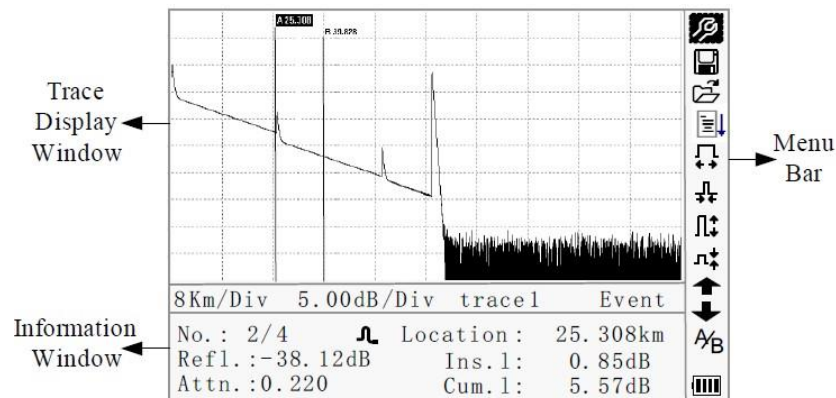


Figure 3-3. Trace Display Screen

### 3.4.1 Trace Display of OTDR

This window displays the trace after one measurement.

Definition of Trace: After one measurement, reflection power diagram will be displayed as distance function. This diagram is referred to as a trace.

Trace of an OTDR displays measurement result in a graphic form. The y-axis stands for power, and the x-axis stands for distance, as shown in Figure 3-4.

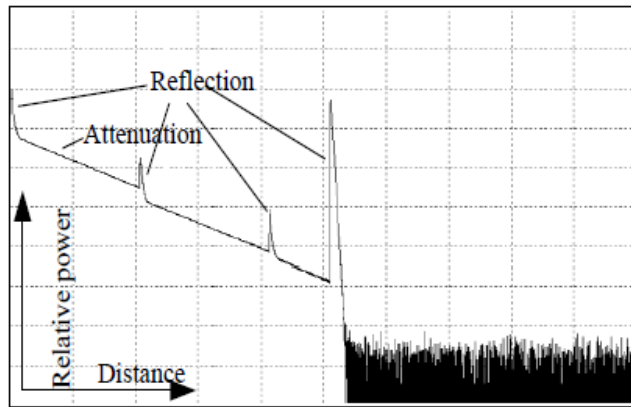


Figure 3-4. Traces and Coordinates

### 3.4.2 Information Window of OTDR

Contents of this window: measurement parameters, events list, marker A/B and analysis parameters.

#### 3.4.2.1 Measurement Trace Parameters

Important measurement and analysis parameters always display in the information window. As shown in Figure 3-5.(a), (b):

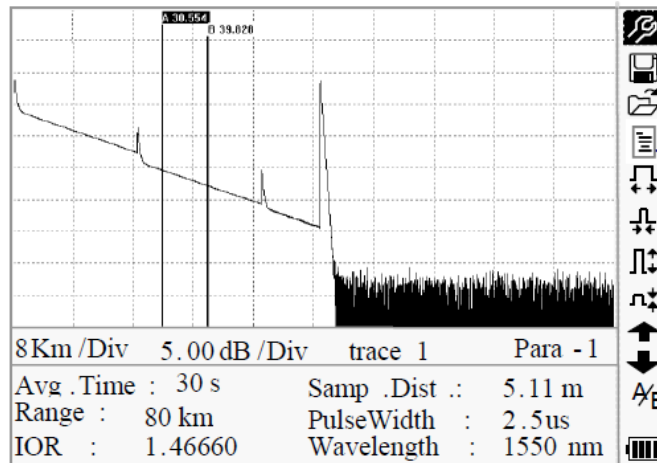


Figure 3-5.(a) Measurement Trace Parameters

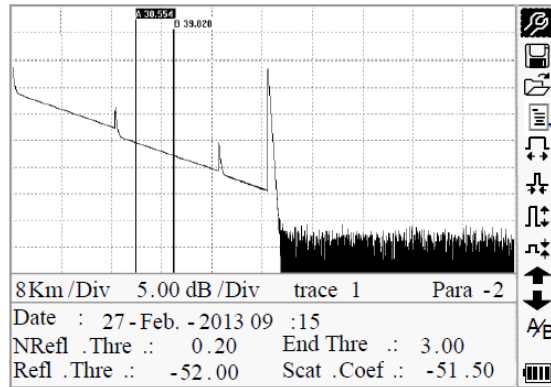


Figure 3-5.(b) Analysis Trace Parameters

For definitions and configurations of items in Figure 3-5. (a) (Avg. time, sample distance, Range, IOR, wave length and pulse width) showed in the interface, please refer to parameter configuration.

For definitions of items in Figure 3-5.(b) (date, reflection threshold, non-reflection threshold, end threshold, scattering coefficient), please refer to parameter configuration.

### 3.4.2.2 Events List

To indicate the location of events inspected. Any defined posts will be displayed in event list, for example, non-reflection event like welding points and reflection event like connectors, as shown in Figure 3-6.

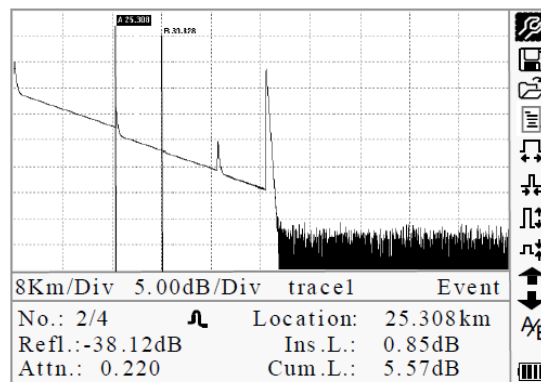






Figure 3-6. Events List

No: Event sequence Number

Four types of events:  Begin end,  Reflection event,  Fiber end,  Attenuation event

Loc.: Distance from beginning point to event

Refl.: Magnitude of reflection

Insl.: Loss of Inserted event

Attn.: Attenuation characteristic from one event point to the current event

Cuml.: Cumulative loss, calculating from beginning point to the current event

**3.4.2.3 Information of Marker A/B**

Marker is used to mark and analyze a single event, trace section and distance. Distance, attenuation, loss at marker or between markers will be displayed in information of markers, as shown in Figure 3-7.

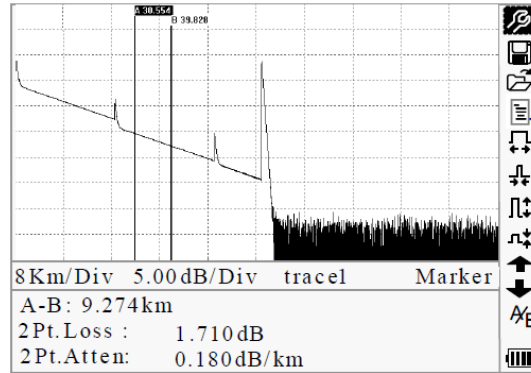


Figure 3-7. Information of Marker A/B

The following parameters are measured between marker A and B. When you change either marker, record will change accordingly.

- “A-B”: Distance between two markers
- “2 points loss”: Loss between two markers; power difference between two markers
- “2 points attenuation”: 2 points loss of unit length

The specific operations of the above are to be elaborated afterwards.

**3.4.2.4 Information of Fiber**

Information of fiber includes total attenuation, length and loss of the tested fiber. As shown in figure 3-8.

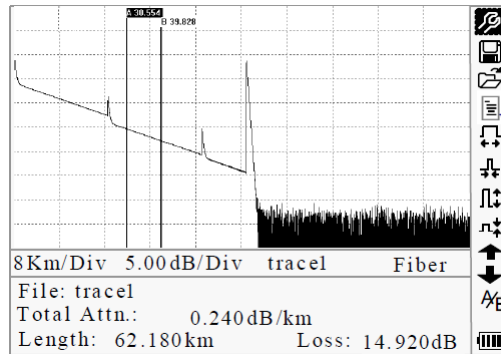














Figure 3-8. Information of Fiber



### 3.4.3 Menu Bar and Window of OTDR


#### 3.4.3.1 Menu Bar and Icons of OTDR

No.	Icons	Meanings
1		Parameter configuration
2		Save file
3		Open file
4		Re-analyze the trace
5		Zoom in trace horizontally
6		Zoom out trace horizontally
7		Zoom in trace vertically
8		Zoom out trace vertically
9		Switching between markers
10		Review events list upwards
11		Review events list downwards
12		Battery power indicator

- Under Help Menu, only No.1 and 3 are operational
- In the process of measurement, all function on menu bar will be disabled
- No.3, 4, 5, 6, 7, 8 and 9 are tools for trace analysis; No.10 and 11 are tools for reviewing events list
- No.1 is elaborated in Figure 3.4.3.2

**3.4.3.2 Parameter Configuration on OTDR Menu Bar**

Correct parameter configuration is a necessity for accurate measurement; therefore, necessary configuration must be performed before using the instrument.

Use [▲] and [▼] to highlight , i.e. parameter configuration, then press [Enter], as shown in Figure 3-9; Press [↵] to exit.

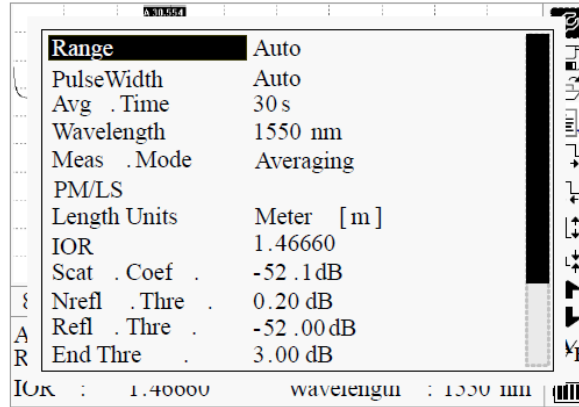


Figure 3-9. (a) Parameter Configuration

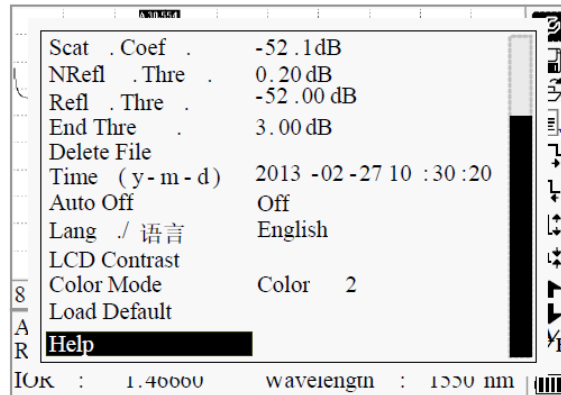


Figure 3-9. (b) Parameter Configuration

### 3.4.3.2.1 Definitions of Measurement Parameters

Parameter	Definition of Parameter
Range	Length of optic fiber relevant to the trace
Pulse Width	Width of laser pulse sending out from OTDR to optic fiber
Average Time	To select suitable testing time.
Wavelength	To select laser wavelength for measurement
Measurement Mode	To select mode for measurement
VFL	Power on or off visible laser
Length Units	To select length units
IOR	IOR of optic fiber which affects the transmission speed of laser
Scatter Coefficient	Which affects backward scatter power of laser in fiber
Non-reflection Threshold	Events whose insertion loss is greater than the threshold displays here
Reflection Threshold	Reflection events GE the threshold will be displayed.
End Threshold	The first event with insertion loss GE the threshold is considered the end of fiber, and all following events will be ignored
Delete Files	Delete stored trace data in the instrument
Time	Show current system time
Auto Off	On or off of Auto off function
Lang./语言	Choose the language
LCD Contrast	Adjust the contrast of LCD to select
Color Mode Setting	Select suitable displaying color setting
Load Default	Set all parameters to factory setting
Help	Show help files (Quick Reference)

### 3.4.3.2.2 Range Configuration

Generally, range will be set according to actual length of optic fiber, so as to insure the accuracy of measurement.

Under the menu of parameter configuration, use [▲] and [▼] to highlight “Range”; Press [Enter] to enter, as shown in Figure 3-10; press [↵] to exit.

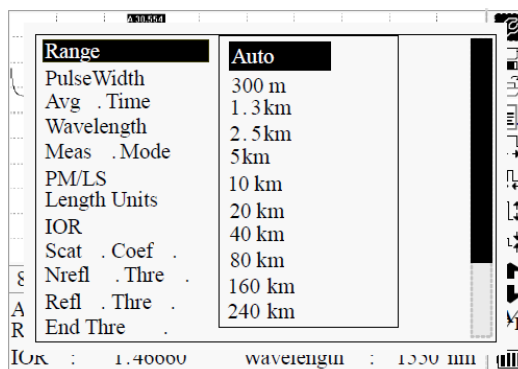


Figure 3-10. Set Range

Use [▲] and [▼] to select adequate range; Press [Enter] to confirm.

**Note**

- “Auto” means the automatic measurement. When this function is selected, the instrument will automatically make an intelligent selection of adequate range and pulse width for measurement. The whole process of measurement does not need any intervention of the operator
- “Auto” means the default setting

**3.4.3.2.3 Pulse Width Configuration**

The selection of pulse width affects the dynamic range and resolution of measurement trace. With narrow pulse width, there will be higher resolution and smaller dead zone; however, the dynamic range will be decreased. On the contrary, wide pulse width can bring higher dynamic range and measure comparatively long distance, but resolution and dead zone will be affected. Therefore, users should make choice between dynamic range and dead zone.

There will be different pulse width options for reference according to different range of distance being chosen.

Under menu of parameter configuration, use [▲] and [▼] to highlight “Pulse Width”; Press [Enter] to select as shown in Figure 3-11. Press [Esc] to exit.

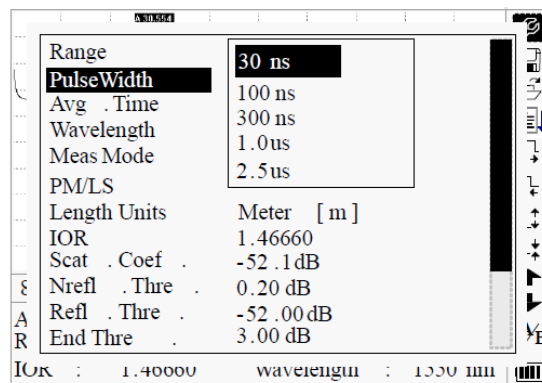


Figure 3-11. Pulse Width Configuration

Use [▲] and [▼] to highlight pulse width; Press [Enter] to confirm.

**Note**

- “Auto” means the default setting
- When Range is set to “Auto”, pulse width will automatically become “Auto”

#### 3.4.3.2.4 Average Time Configuration

Average time will affect the SNR directly. The longer the average time is, the higher SNR is, as well as dynamic range. Therefore, in case of measurement of long-distance optic fiber, long average time should be selected in order to review events at long-distance end.

Under parameter configuration, use [▲] and [▼] to highlight “Average time”; press [Enter] to confirm, as shown in Figure 3-12. Press [Esc] to exit.

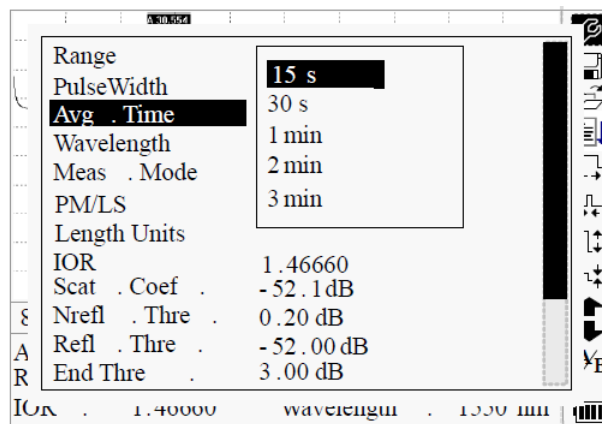


Figure 3-12. Average Time Configuration

Use [▲] and [▼] to highlight the desired time; and press [Enter] to confirm.

#### Note

- There are 5 levels of predefined average time: 15s, 30s, 1min, 2min and 3min
- The default setting is 30s

#### 3.4.3.2.5 Wavelength Configuration

Under parameter configuration, use [▲] and [▼] to highlight “wavelength”; press [Enter] to change wavelength, as shown in Figure 3-13.

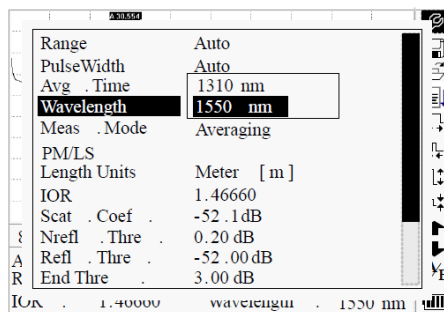


Figure 3-13. Wavelength Configuration

**3.4.3.2.6 Measurement Mode Configuration**

There are two kinds of measurement mode: Averaging and Real time mode. Under Real time Mode, OTDR will undertake real-time measurement for the connector of exterior fiber and refurbish the measure trace. While under Real time Mode, press key “Run/Stop” to stop, otherwise it will measure all along. Under Averaging Mode, OTDR will average the data within the measure time which is set by user. While exceeding the set time, it will stop automatically and display the result. Generally, we suggest Averaging Mode.

Under menu of parameter configuration, use [▲] and [▼] to highlight “Measurement Mode”; Press [Enter] to choose Averaging mode or Real-time mode, as shown in Figure

3-14. Press [↵] to exit.

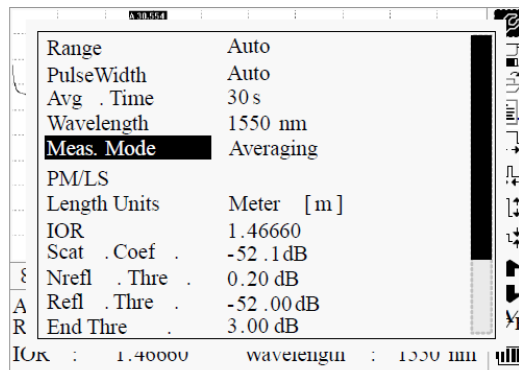


Figure 3-14. Measurement Mode Configuration

**3.4.3.2.7 Power Meter and Laser Source Configuration (Optional only)**

Under parameter configuration, use [▲] and [▼] to highlight “PM/LS” and press [Enter] to enter PM/LS interface as shown in Figure 3-15a/b/c (Depending configurations). Please refer to 4.13 for details.

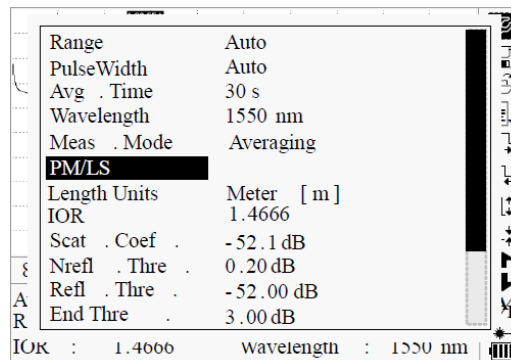


Figure 3-15a. PM/LS Option



Figure 3-15b. PM/LS Interface

1310nm	PASS
-3.15 dBm	
1490nm	WRNG
-20.76 dBm	
1550nm	PASS
-3.29 dBm	
0.beijing	Save

Figure 3-15c. PPM Interface

### 3.4.3.2.8 Length Units Configuration

Under the parameter configuration menu use [▲] and [▼] to highlight “Length Units”; press [Enter] to select the desired units of measurement, as in Figure 3-16. Press [↵] to exit.

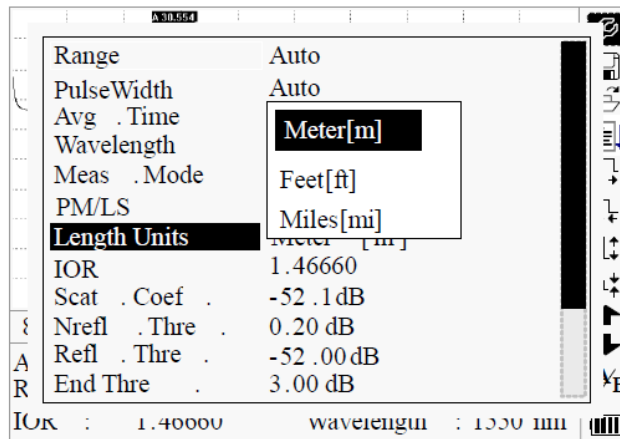


Figure 3-16. Length Units Configuration

### 3.4.3.2.9 Index Of Refraction Configuration (IOR)

IOR is a key factor to affect the speed of laser transmission in optic fiber; and in this case, IOR configuration has direct impact on the accuracy of measurement. Generally speaking, the IOR parameter is provided by optic fiber manufacturer, and it can be set to the accuracy of four digits after decimal point between 1.00000-2.00000.

Under parameter configuration, use [▲] and [▼] to highlight “IOR”; and press [Enter] to enter, as in Figure 3-17. Press [↵] to exit.

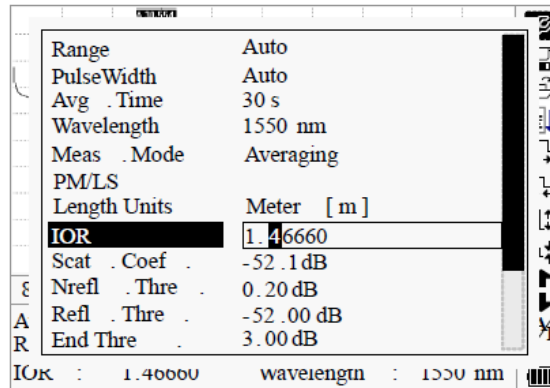


Figure 3-17. IOR Configuration

Use [◀] and [▶] to adjust the position of highlights; use [▲] and [▼] to change the digits. After setting, press [Enter] to confirm.

### 3.4.3.2.10 Scatter Coefficient Configuration

Scatter coefficient determines the value of backward scatter power. The configuration affects the calculation of reflection value.

Under parameter configuration, use [▲] and [▼] to highlight “Scatter coefficient”; press [Enter] to enter, as shown in Figure 3-18. Press [↵] to exit.

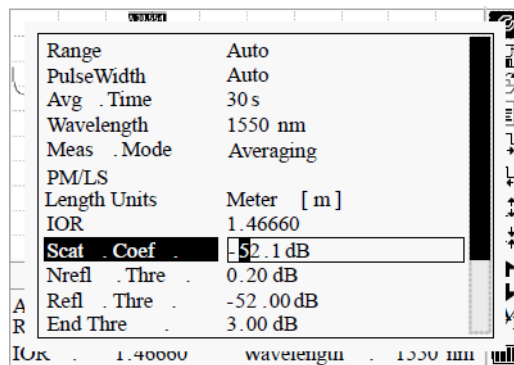


Figure 3-18. Scatter Coefficient Configuration

Use [◀] and [▶] to adjust the position of highlights; use [▲] and [▼] to change the digits. After setting, press [Enter] to confirm.



### 3.4.3.2.11 Non Reflection Threshold Configuration

This configuration has direct impact on the listing of insertion loss events. Only events GE this threshold will be listed.

Under parameter configuration, use [▲] and [▼] to highlight “Non reflection threshold”; press [Enter] to enter, as shown in Figure 3-19. Press [↵] to exit.

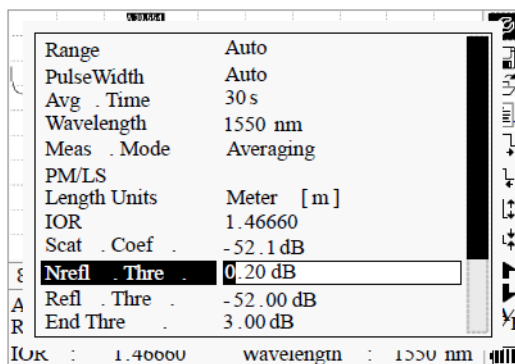


Figure 3-19. Non Reflection Threshold Configuration

Use [◀] and [▶] to adjust the position of highlights; use [▲] and [▼] to change the digits. After setting, press [Enter] to confirm.

The default setting is 0.2dB

### 3.4.3.2.12 Reflection Threshold Configuration

This configuration has direct impact on reflection events listing. Only reflection events GE this threshold will be displayed in events list.

Under parameter configuration, use [▲] and [▼] to highlight “reflection threshold”; press [Enter] to enter, as shown in Figure 3-20. Press [↵] to exit.

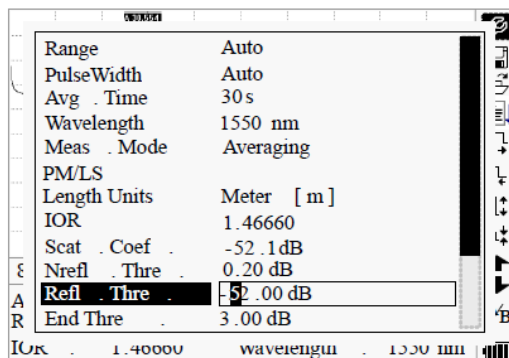


Figure 3-20. Reflection Threshold Configuration

Use [◀] and [▶] to adjust the position of highlights; use [▲] and [▼] to change the digits. After setting, press [Enter] to confirm.

The default setting is -52.00dB

### 3.4.3.2.13 End Threshold Configuration

This threshold is the end threshold of optic fiber. If the end threshold equals 3.0dB, then the first event with insertion loss higher than 3dB will be considered as the end of the optic fiber. If the value is set to 0dB, there will be no end threshold.

Under parameter configuration, use [▲] and [▼] to highlight “End threshold”; press [Enter] to enter, as shown in Figure 3-21. Press [↵] to exit.

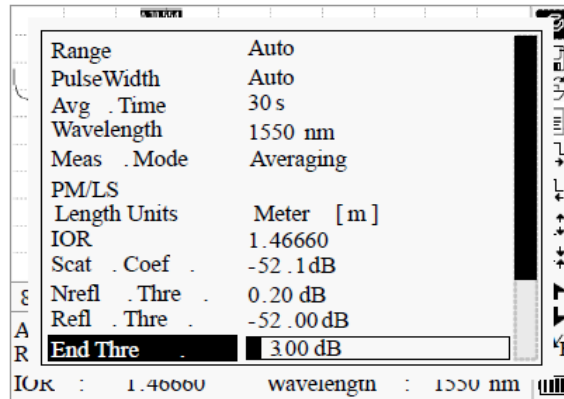


Figure 3-21. End Threshold Configuration

Use [◀] and [▶] to adjust the position of highlights; use [▲] and [▼] to change the digits. After setting, press [Enter] to confirm.

The default setting is 3.00dB

### 3.4.3.2.14 Delete File

This function is designed to delete saved traces.

Under parameter configuration, use [▲] and [▼] to highlight “Delete file”; press [Enter], to enter, as shown in Figure 3-22. Press [↵] to exit.

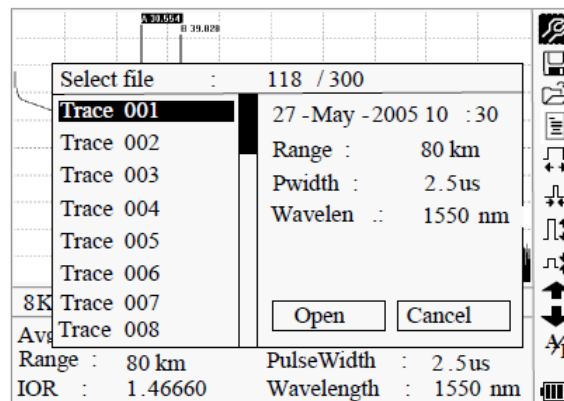


Figure 3-22. Delete File

Press [▲] and [▼] to choose the files to be deleted, and then press [Enter] to confirm.

Users can delete one or several files by one time. Press [◀] and [▶] to choose [Delete]. Press [Enter], according to the instruction, choose “Yes” to delete; choose “No” to not delete. If choose [Cancel], it will exit the file delete menu.

#### 3.4.3.2.15 Time Configuration

Time configuration is used to change system time.

Under parameter configuration, use [▲] and [▼] to highlight “Time”; press [Enter] to change, as shown in Figure 3-23. Press [↵] to exit.

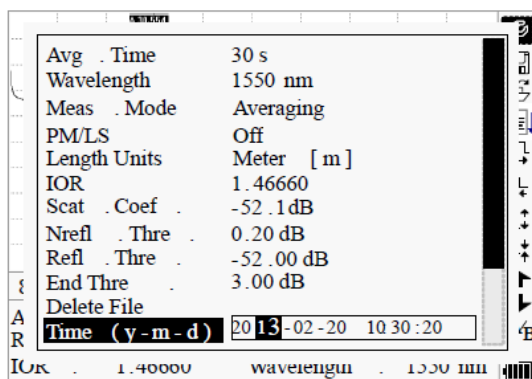


Figure 3-23. Time Configuration

Use [◀] and [▶] to adjust the position of highlights; use [▲] and [▼] to change the digits. After setting, press [Enter] to confirm.

#### 3.4.3.2.16 Auto off Configuration

This function is designed for conserving battery power. If auto off is on, the instrument will auto power off within 5 minutes of idleness.

Under parameter configuration, use [▲] and [▼] to highlight “Auto off”; press [Enter] to switch, as shown in Figure 3-24. Press [↵] to exit.

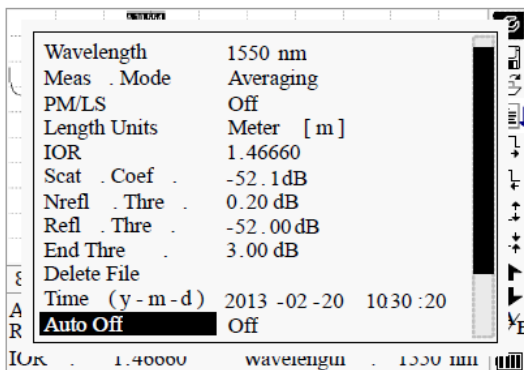


Figure 3-24. Auto Off Configuration

The default setting is “auto off” on

### 3.4.3.2.17 Language Configuration

There are two language options: English and Chinese.

Under parameter configuration, use [▲] and [▼] to highlight “Lang./语言”; press

[Enter] to switch, as shown in Figure 3-25. Press [↵] to exit.

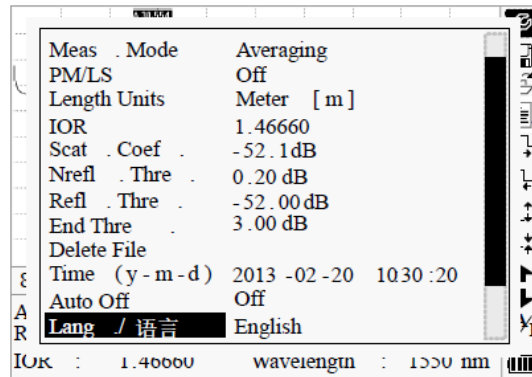


Figure 3-25. Language Configuration

### 3.4.3.2.18 Contrast Adjustment of LCD Display

The contrast of LCD has been adjusted. And users can adjust the contrast according to personal visual habits.

Under parameter configuration, use [▲] and [▼] to highlight “LCD Contrast”; press [Enter] to adjust, as shown in Figure 3-26. Press [↵] to exit.

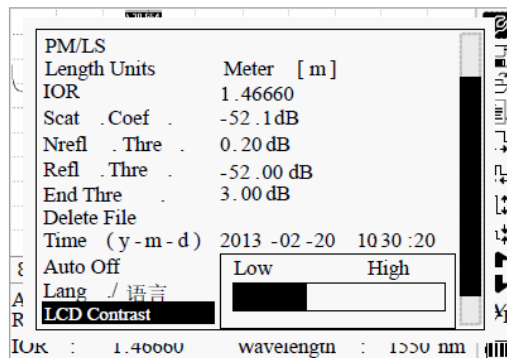


Figure 3-26. Contrast Adjustment of LCD Display

Use [◀] and [▶] to adjust contrast, and press [Enter] to confirm.

### 3.4.3.2.19 Color Mode Setting

Choose the different displaying color scheme according to the user’s fancy.

Under parameter configuration, use [▲] and [▼] to highlight “Color mode”, press [Enter] to choose different mode. Press [↵] to exit, as shown in Figure 3-27.

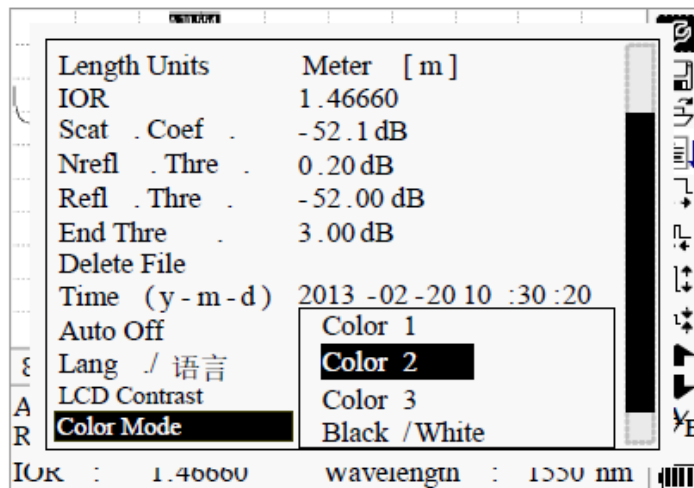


Figure 3-27. Color Mode Setting

Use [▲] and [▼] to highlight suitable color mode setting; press [Enter] to confirm the selection.

#### 3.4.3.2.20 Default Set

This function is used to set OTDR parameters to factory settings. Those parameters include: range, pulse width, average time, IOR, non-reflection threshold, reflection threshold, end threshold, and scatter coefficient. Under parameter configuration, use [▲] and [▼] to highlight “Load default”; press [Enter] to enter, as shown in Figure 3-28. Press [↶] to exit.

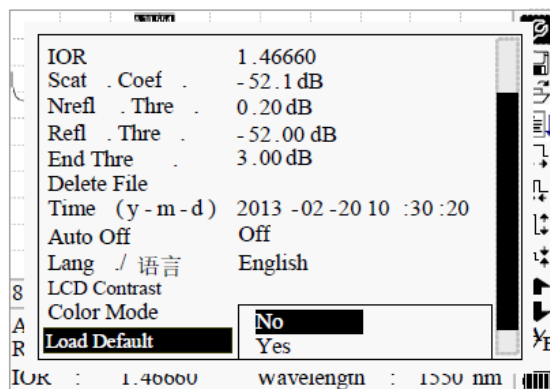


Figure 3-28. Load Default

Use [▲] and [▼] to highlight “yes” or “no”; press [Enter] to confirm.

3.4.3.2.21 Help

Users can get the quick reference via Help menu.

Under parameter configuration, Use [▲] and [▼] to highlight “Help”; Press [Enter] to enter, as shown in 3-29 a/b/c. Press [↵] to exit.

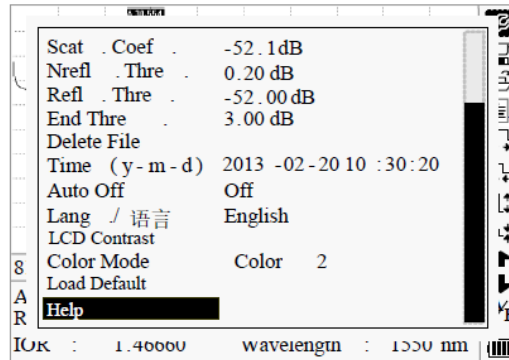


Figure 3-29. (a) Help

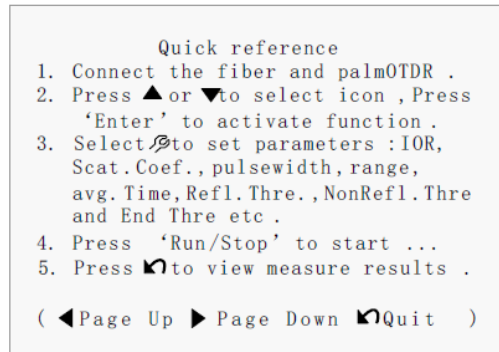


Figure 3-29. (b) Help

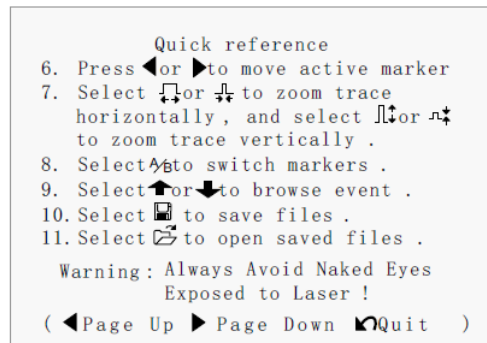


Figure 3-29. (c) Help

### 3.5 Battery Recharge Status

When the instrument is power off and powered through AC/DC adapter, the “CHARGE” indicator (Figure 1.) will turn on. When batteries are fully recharged, the indicator will turn off.

When the instrument is power on and powered through AC/DC adapter, the inside batteries are automatically recharged. The meanings of signals are as follows:

- The batteries are being recharged
- The batteries are fully recharged.

When the instrument is powered by inside rechargeable batteries, power volume of batteries is shown on the LCD:

- No power
- Low power
- Half power
- More than half power
- Full power

## 4. Trace Measurement and Processing of Existing Traces

### 4.1 Instructions on GUI

After power on, power on interface displays on the LCD, as shown in Figure 4-1:



Figure 4-1. Power on Interface

OTDR-XXXX: Model

---Version X.X---: Software Version.

Three seconds after power on, the interface will be automatically directed to quick reference:

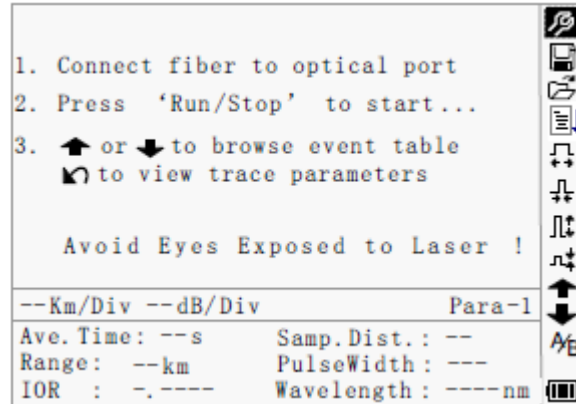


Figure 4-2. Quick Reference

## 4.2 Trace Measurement of OTDR

One complete trace can be obtained for each measurement. Also, OTDR can load a saved trace.

### Note

- Before each measurement, if the operator is not familiar with the cautions, please do follow instructions in this manual for personal safety
- Make sure that the optical fiber or cable is not in use and there is no laser beam in the fiber before testing via OTDR. Otherwise, it may result in imprecise test trace, even permanent damage for the OTDR

### 4.2.1 Trace Measurement- Connect Optical Fiber

Connect optic fiber to OTDR optic output directly, no tools needed.

- Clean connectors, for details please refer to chapter A
- Clean tie-ins and check whether they are FC/PC tie-ins or not
- Connect optic fiber to the instrument

### 4.2.2 Trace Measurement - Parameter Configuration

For details relating to parameter configuration, please refer to 3.4.3.2, Parameter Configuration on OTDR Menu Bar. If the parameters are unclear, please use the default parameters of the instrument, however, this may cause an increase of measurements errors.

### Note

Range is set to “Auto”, when auto measurement is on.



### 4.2.3 Trace Measurement- Auto

Auto measurement can be applied in case that the length of optic fiber is unidentifiable. OTDR auto select adequate range for measurement.

Steps for Auto measurement:

- Parameter configuration: for detailed operations, please refer to 3.4.3.2, Parameter Configuration on the OTDR Menu Bar. Set range to “AUTO”
- Measure: **press [ ]** to start measurement, and the interface is as in Figure 4-3. (a), (b)

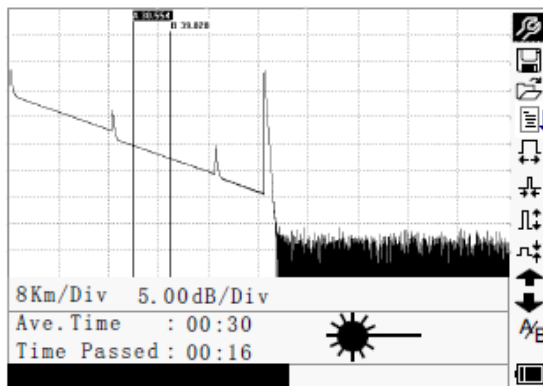


Figure 4-3.(a) Measuring

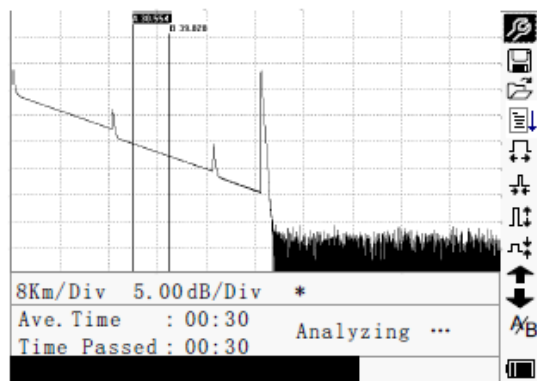


Figure 4-3.(b) Measuring

**Interface:**

- “Total: 00: 30”                      Measure time which is set by user is 30 seconds
- “Passed: 00: 16”                    Total measurement time has passed 16 seconds
- “☀️”                                      Flickering of this sign means laser is active

**Note**

After a certain period of time, the trace displays on the GUI. The trace in the Figure below is a trace during measurement, which will be refreshed for every certain period of time to demonstrate the whole process to users in real time. But at the end of measurement, the trace will be final, as shown in Figure 4-4.

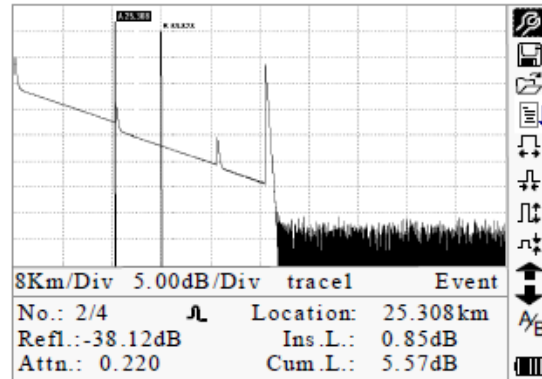



Figure 4-4. Trace Measurement of OTDR

#### 4.2.4 Trace Measurement - Manual

If the operators have full knowledge of measured optic fiber, they can set accurate parameters, and achieve optimal measurement results.

- Change “range”: Refer to 3.4.3.2.2 range configuration to select adequate range
- Measure: Press  [Run/Stop] to start measurement. The process is the same with Auto measurement

#### 4.2.5 Trace Measurement -Reasons of Measurement Failures

If measurement failures occur, reasons may be one of the following:


- Events may be too close to each other.  
Shorten the pulse width, and make another try. If failure still occurs, please try to measure at the other end of the optic fiber
- Low SNR  
Try to use wider pulse or increase average time, and make another try
- Incorrect parameter configuration  
Check parameter configuration, and make another try

### 4.3 Information Window

Items of information window: measurement parameters, analysis parameters, and information regarding marker A/B.










For details regarding information window, please refer to 3.4.2 OTDR information window.

### 4.3.1 Switch between Information Window Items

Under GUI of Figure 4-4., press  and the items of information window will display in circulation: measurement parameter, analysis information, event list, information of marker A/B, fiber, measurement parameter.

### 4.3.2 Review Event List



Under GUI of Figure 4-4, press , items in information window will switch to event list information.

Use  and  too highlight  or , then press [Enter] to review events list,  is to browse upwards and  downwards; or to browse events list upwards and downwards by the combining hot key [Shift/ ]+ and [Shift/ ]+[Enter] in the keyboard


### 4.3.3 Review Marker A/B Information



#### 4.3.3.1 Switching between Marker A/B

Under GUI of Figure 4-4., use  and  to highlight B, and then press [Enter] to switch between marker A/B.

Use  and  to move marker A or B.








#### 4.3.3.2 Information between Marker A/B

Under GUI of Figure 4-4., press  switch information window to marker A/B.

Press  and  to change the position of marker A or B, and information of marker A/B will change accordingly in information window.






## 4.4 Zoom in Trace Horizontally

This function is designed for users to review details of every event more carefully.

- Under GUI of Figure 4-4., use  and  to highlight , then press [Enter] to zoom in trace horizontally; or to zoom in trace horizontally by the combining hot key [Shift/ ]+ in the keyboard
- Press  and  to move marker to the event point to be observed
- To examine information of event point, please according to “4.3.3.1 Switching between Marker A/B”


## 4.5 Zoom out Trace Horizontally

This function is to zoom out trace horizontally.

Under GUI of Figure 4-4., use  and  to highlight , and press [Enter] to zoom out trace. To zoom out trace horizontally by the combining hot key [Shift/ ] +  in the keyboard.


## 4.6 Zoom in Trace Vertically

This function is designed for users to review event points more carefully.

- Under GUI of 4-4, press [▲] and [▼] to highlight , then press [Enter] to zoom in vertically; or to zoom in trace vertically by the combining hot key [Shift/⌘]+[▲] in the keyboard
- Use [◀] and [▶] to move marker to event point to be observed
- For details, please refer to 6.3.3.1 switching between Marker A/B


## 4.7 Zoom out Trace Vertically

This function is designed to zoom out trace vertically.

- Under GUI of Figure 4-4, press [▲] and [▼] to highlight , and then press [Enter] to zoom out trace vertically, or to zoom out trace vertically by the combining hot key [Shift/⌘]+[▼] in the keyboard.


## 4.8 Re-analyze the trace

While the test result at a certain threshold is not good enough, it can be re-analyzed by this function (to change the threshold). Please note that this function can be effective while the OTDR is disconnected from the fiber.

- Under parameter configuration menu, edit the threshold value you want, press [↵] to exit parameter configuration menu, then press  to re-analyze the trace.

## 4.9 Save Trace

When auto or manual measurement is finished, the measurement trace can be saved. Contents of trace saved include: trace curve, related information of trace.

- Under GUI of Figure 4-4., use [▲] and [▼] to highlight , and then press [Enter] to enter, as shown in Figure 4-5.

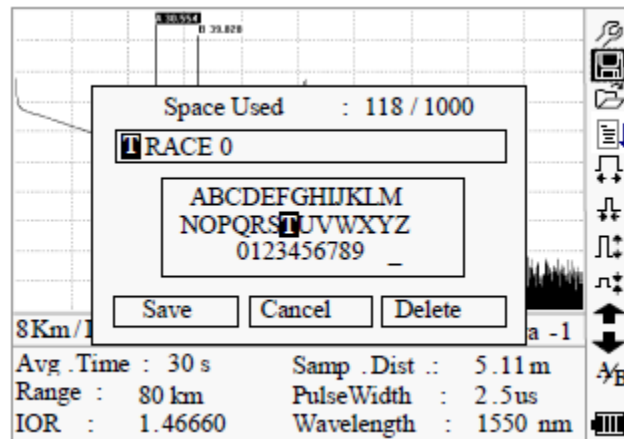


Figure 4-5. Save Trace

- Input filename: use [▲],[▼],[◀] and [▶] to choose the alphabet or Arabic numerals one by one, and press [Enter] to confirm. The length of filename will not exceed 8 characters of alphabet or Arabic numerals
- Save file: use [▲],[▼],[◀] and [▶] to highlight “OK”, press [Enter] to save
- Cancel saving file: use [▲],[▼],[◀] and [▶] to highlight “cancel”, press [Enter] to cancel the operation of “save file”
- Delete alphabet/Arabic numerals: use [▲],[▼],[◀] and [▶] to highlight “Delete”, press [Enter] to delete the alphabet/Arabic numerals
- Memory space: 118/1000 means that total memory space is 1000 files; it has already saved 118 files so far

#### 4.10 Browse Saved Traces

Under GUI of Figure 4-4, use [▲] and [▼] to highlight  , press [Enter] to confirm, as shown in Figure 4-6.

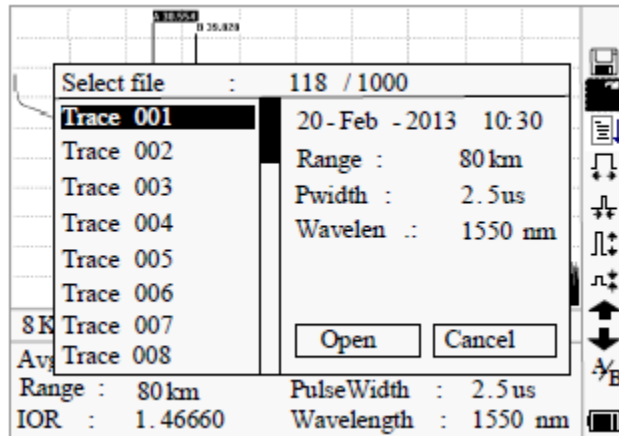


Figure 4-6. Browse Saved Traces

- Use [▲] and [▼] to highlight the certain trace, then use [◀] and [▶] to choose [Open] or [Cancel]; Press [Enter] to confirm
- Memory space: 118/1000 means that total memory space is 1000 files; it has already saved 118 files so far

## 4.11 Upload Saved Traces

Saved traces can be uploaded to PC through the associated software of trace manager or USB interface cable, with which traces can be further processed on PC.

- We suggest at first upload traces through USB interface cable:
  - a. Connect PC and OTDR with USB interface cable;
  - b. Power on OTDR;
  - c. Click “Computer” on PC, find the “removable disk” and click it then enter into the “trace” document folder which saved measurement traces, you can freely copy, paste or delete them.
- Upload with RS232 interface cable:
  - a. Install the software, and run
  - b. Power off OTDR
  - c. Connect OTDR to PC through RS232(or USB) interface cable
  - d. Power on OTDR, and upload data with the software. The whole process is as in Figure 4-7.

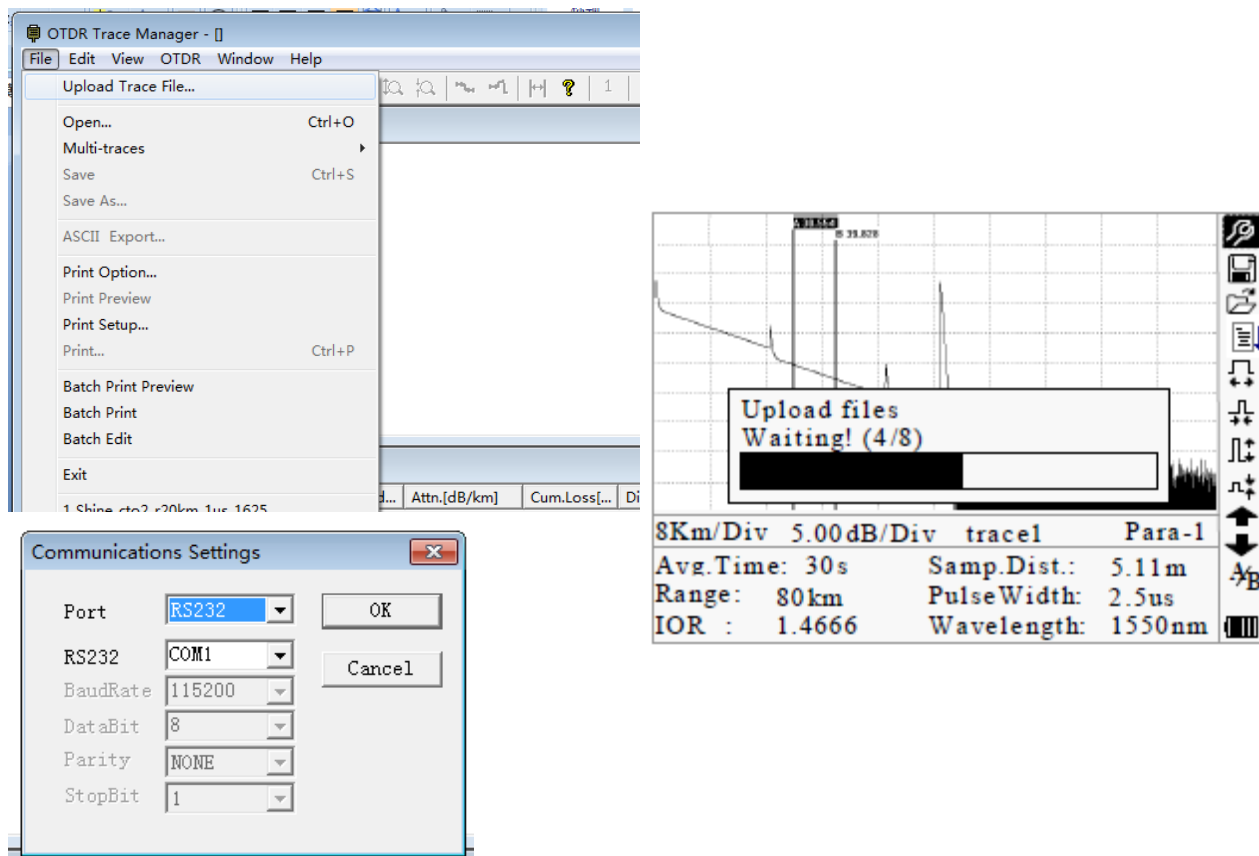



Figure 4-7. Upload Saved Traces

**Note**

- Make sure the instrument is power off when connecting to PC through RS232 (or USB) data cable; Make sure it's fastened, then power off.
- USB sustains the electrification hot plug. However USB operation rules must be obeyed while connecting to PC. To install USB driver correctly is necessary before uploading the data; Make sure USB is pulled out safely. Otherwise it will result in losing data.
- This operation cannot be applied under GUI of parameter configuration, save trace, browse saved traces, and measuring in progress.

**4.12 Alter Measurement Parameters in Real-time Testing**

To alter measurement in real-time testing, follow these steps:

- Use [▲] and [▼] to highlight “”, and then press [Enter]. A parameter will appear at the bottom of the screen.
- Use [◀] and [▶] to toggle between the parameters to be changed (Figure 4-8), and then press [Enter].
- Use [▲] and [▼] to change the Ref. value. Select “Averaging” to select averaging testing.
- Press “OK” to exit the parameter configuration menu.

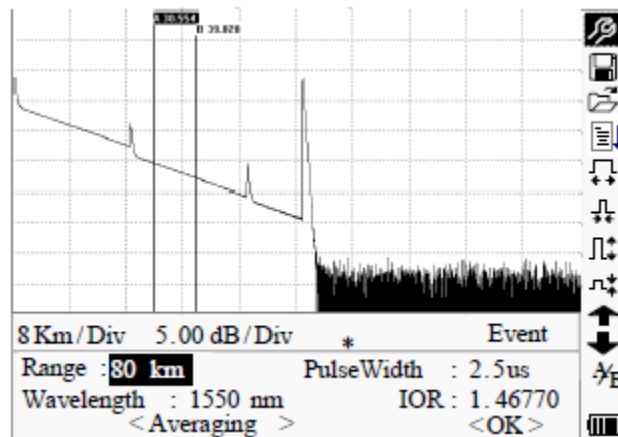


Figure 4-8. Real-time Testing

### 4.13 Power Meter and Laser Source Settings (Optional)

#### 4.13.1 cal Power Meter Settings

Enter PM/LS interface as described in 3.4.3.2.7. Use [▲] and [▼] to highlight OPM, and press [Enter] to enter OPM interface as shown in Figure 4-9.



Figure 4-9. Optical Power Meter

Use [◀] and [▶] to toggle between calibrated wavelengths. Press [Enter] to enter OPM measurement setting interface as shown in Figure 4-10.

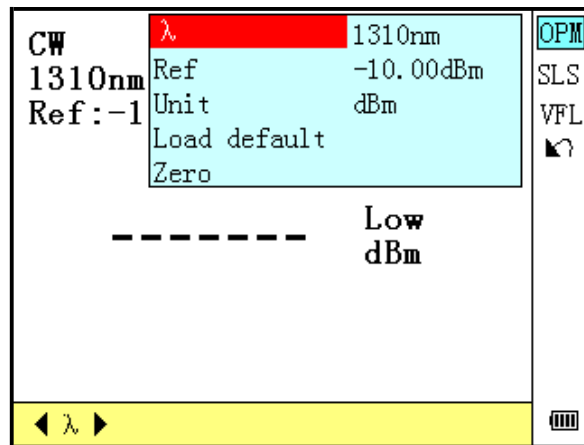


Figure 4-10. OPM Measurement Setting

Use [▲] and [▼] to highlight the parameter to be adjusted, press [Enter] to enable adjustment. Press [◀] and [▶] to adjust digit position and press [▲] and [▼] to adjust the value. Press [Enter] again to confirm and press [↶] to quit setting.



4.13.2 Stabilized Laser Source Settings

Enter PM/LS interface as described in 3.4.3.2.7. Use [▲] and [▼] to highlight SLS, and press [Enter] to enter SLS interface as shown in Figure 4-11.

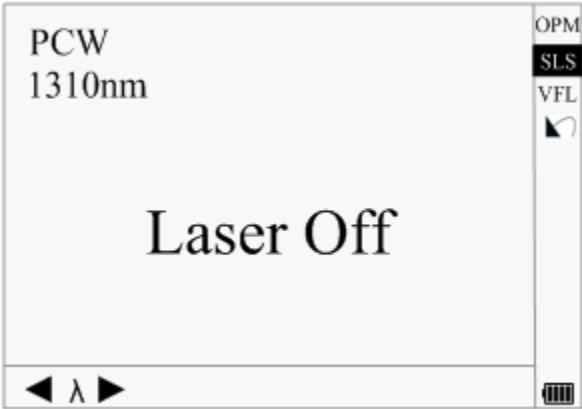


Figure 4-11. Stabilized Laser Source

Use [◀] and [▶] to toggle between SLS working wavelengths. Press [Enter] to enter SLS setting interface as shown in Figure 4-12.

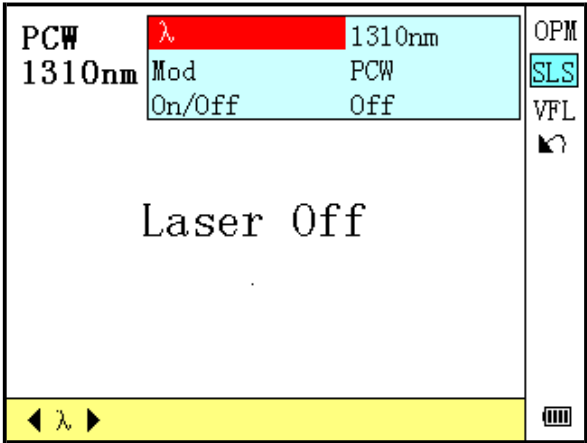


Figure 4-12. Stabilized Laser Source Setting

Use [▲] and [▼] to highlight the parameter to be adjusted, press [Enter] to confirm and press [↵] to quit setting.

**4.13.3 Visible Fault Locator Settings**

Enter PM/LS interface as described in 3.4.3.2.7. Use [▲] and [▼] to highlight VFL, and press [Enter] to enter VFL interface as shown in Figure 4-13.

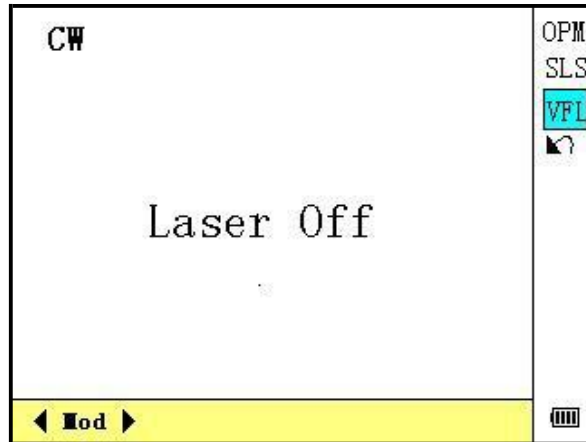


Figure 4-13. Visible Fault Locator

Use [◀] and [▶] to toggle between VFL working modes. Press [Enter] to enter VFL setting interface as shown in Figure 4-14.

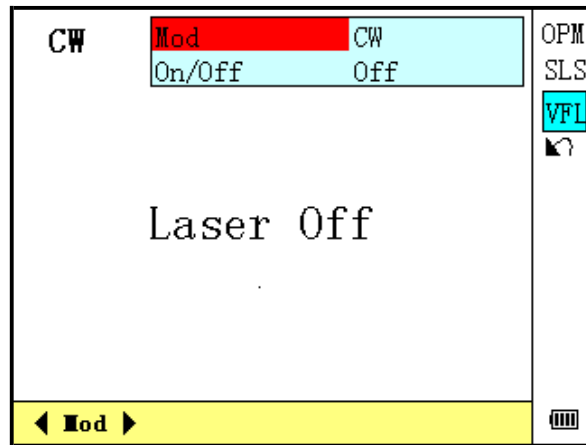


Figure 4-14. Visible Fault Locator Setting

Use [▲] and [▼] to highlight the parameter to be adjusted, press [Enter] to confirm and press [↶] to quit setting.

4.13.4 PON Power Meter Settings

Enter PM/LS interface as described in 3.4.3.2.7. Use [▲] and [▼] to highlight PPM, and press [Enter] to enter PPM interface as shown in Figure 4-15.

1310nm	PASS	PPM
-3.15	dBm	↩
1490nm	WRNG	
-20.76	dBm	
1550nm	PASS	
-3.29	dBm	
0.beijing	Save	⏏

Figure 4-15. PON Power Meter

PPM interface displays the measured signal power values at 1310/1490/1550nm. It displays “Low” or “High” when measured value is beyond measurement range. Press [◀] to enable data saving function and press [↩] to quit PPM interface.

4.13.4.1 Saving Data

The [Save] icon at the bottom right corner of PPM interface will be highlighted when data saving function is enabled, as shown in Figure 4-16.

1310nm	PASS	PPM
-3.15	dBm	↩
1490nm	WRNG	
-20.76	dBm	
1550nm	PASS	
-3.29	dBm	
0.beijing	Save	⏏

Figure 4-16. Data Saving Enabled

Press [Enter] to save measured data which will be filed as “record.csv” in “ppm” folder of OTDR internal memory. User can review test results from “record.csv file in both OTDR and PC.

Press [◀] to enable threshold setting as described below. Press [↶] or [▶] to return to PPM interface.

**4.13.4.2 Threshold Setting**

The threshold name will be highlighted when threshold setting is enabled as shown below:

<b>1310nm</b>	<b>PASS</b>	PPM
<b>-3.15 dBm</b>		↶
<b>1490nm</b>	<b>WRNG</b>	
<b>-20.76 dBm</b>		
<b>1550nm</b>	<b>PASS</b>	
<b>-3.29 dBm</b>		
<b>0.beijing</b>	<b>Save</b>	☐

Figure 4-17. Threshold Setting

OFL-301B supports 60 thresholds. User can save up to 20 measurement results under each threshold set. Threshold setting is saved in “threshold.csv” file in “ppm” folder of OTDR internal memory. Modification to “threshold.csv” file requires system reboot to take effect. If no threshold is set, system will create a threshold set with default settings.

Press [▲] and [▼] to modify threshold.

Press [▶] to enable save function, press [↶] to return to PPM interface.

**4.13.4.3 Main Menu**

In PPM interface, press [Enter] to enter PPM main menu as shown in Figure 4-18.

<b>Menu</b>	PPM
<b>Unit W/dBm</b>	↶
<b>Reference</b>	
<b>Thre. Set</b>	
<b>Thre. View</b>	
<b>View Record</b>	
<b>Clear Record</b>	
<b>Auto Zero</b>	
<b>Default Set</b>	
	▼ ▲ ☐

Figure 4-18. PPM Main Menu

The main menu includes Unit Setting (Unit W/dBm), Reference Setting (Reference), Threshold Setting (Thre. Set), Threshold Review (Thre. View), Record Review (View Record), Delete Record (Clear Record), Auto Zero and Load Default Setting (Default Set) functions. Press [▲] and [▼] to toggle between functions and press [Enter] to select.

4.13.4.3.1 Unit Setting (Unit W/dBm)

User can toggle between different measurement units as shown in Figure 4-19: dB dBm and W, default unit is dBm.

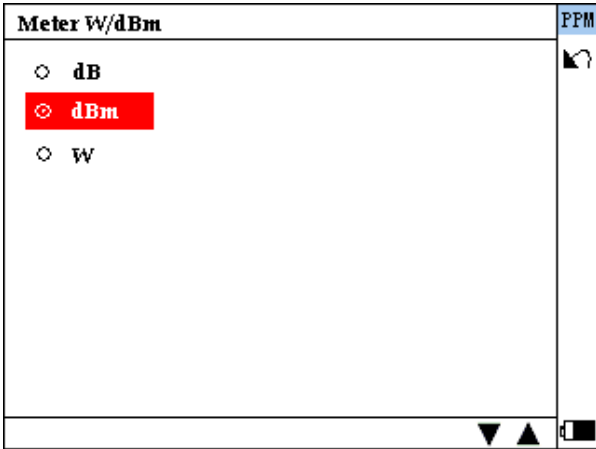


Figure 4-19 Unit Setting (Unit W/dBm)

4.13.4.3.2 Reference Setting (Reference)

User can set reference in below interface:

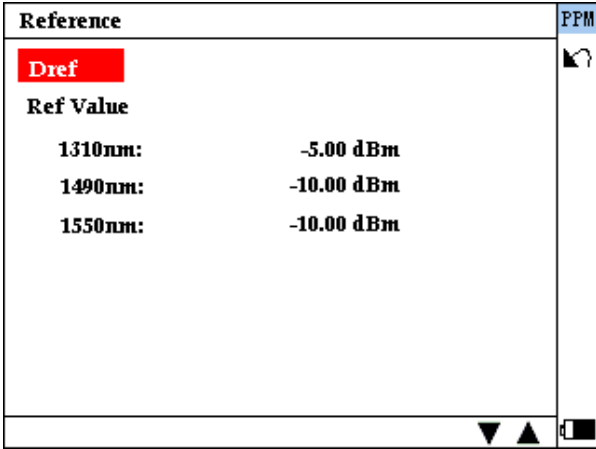


Figure 4-20 Reference Setting (Reference)

Select and run Dref to set current measured values as reference values (The measured values should be within the measurement range, e.g., not “Low” or “High”).

User can also modify the reference value of single wavelength.

The default reference value is shown in Figure 4-20: -5.0dBm@1310nm, -10.0dBm@1490nm, and 1550nm.

Reference value is effective when “dB” is enabled as the measurement unit.

**4.13.4.3.3 Threshold Setting (Thre. Set)**

User can enable/disable threshold function by selecting and running “Thre. Set”. When such function is enabled, PPM will compare measured values with threshold settings and display PASS, FAIL or WRNG (Warning) accordingly. Threshold setting is on by default.

**4.13.4.3.4 Threshold Review (Thre. View)**

User can check threshold settings by selecting and running Thre. View, please select the threshold set (Test Station) to review.

Test Station	PPM
<b>0.Beijing</b>	↩
1.Tianjin	
2.Shanghai	
3.Fuzhou	
4.Hangzhou	
5.Dalian	
6.Wenzhou	
7.Changxing	
8.Huzhou	
9.Jiaxin	

Figure 4-21 Reference Setting (Reference)

Select the threshold set (Test Station) and press [Enter] to review the threshold settings: Switch the wavelength by [▲] and [▼].

0.Beijing	1310nm	PPM
<b>FAIL</b>	-2.50	dBm
<b>PASS</b>	3.00	dBm
<b>WRNG</b>	-1.50	dBm

4.13.4.3.5 Record Review (View Record)

User can check the saved record by selecting and running View Record, please select the test station to review.

0.Beijing		1/4	PFM
1310nm	-2.50	dBm	
1490nm	3.00	dBm	
1550nm	-1.50	dBm	
2011-12-15 16:34:23		▼ ▲	

The saved time is shown at the lower left corner of the interface. Switch the record by [▲] and [▼]. One test station can save 20 records.

4.13.4.3.6 Delete Record (Clear Record)

User can delete the record by selecting and running Clear Record. Please select the test station firstly. Press [shift+enter] to delete all records in this test station. Press [enter] to delete the record separately. The record in the test station is saved by time, as shown in the figure below. Delete the record by selecting and pressing [enter].

Clear		PFM
2011-12-15 12:12:23		
2011-12-15 13:12:43		
2011-12-15 14:13:43		
2011-12-15 15:34:21		
2011-12-15 15:56:03		
2011-12-15 16:23:16		
2011-12-15 16:33:54		
2011-12-15 16:47:36		
2011-12-15 17:32:22		
2011-12-15 18:02:32		
		▼ ▲

4.13.4.3.7 Auto Zero

Auto zero can be done by running this menu.

4.13.4.3.8 Load Default Setting (Default Set)

User can load the default setting by running Default Set.

## 5. Maintenance and Calibration

### Maintenance and Replacing of Batteries

Battery for this instrument is rechargeable NiMH battery.

#### Notes for maintenance of batteries in the instrument:

In order for the OTDR (including the batteries) to meet specifications, the storage temperature should be within

15 °C to 30°C. And the instruments should be stored in low humidity environments.

If the instrument is left unused for a long time (idle for over 2 months), it is recommended to recharge the battery every other month.

As in figure 5-1, procedure of replacing battery is as follows.

- 1) Take off cover of the battery chamber
- 2) Remove the battery and draw out socket from the jack of chargeable battery, then change the battery if necessary
- 3) Remove the RTC clock battery, then change it if necessary

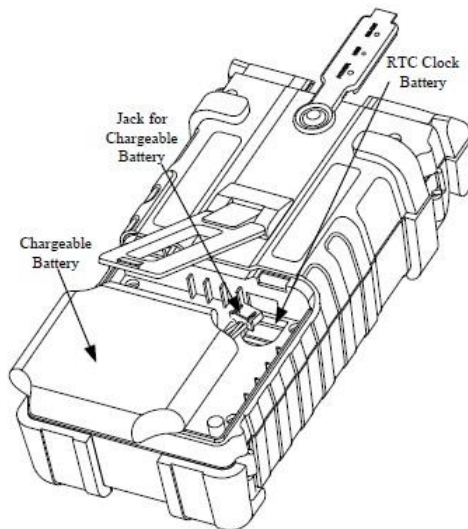


Figure 5-1. Replacing Battery



### **Cleaning of Interfaces**

Interfaces must be kept clean. Special alcohol may be used to clean optic output. Always replace protective dust caps when the unit is not being used, and keep the protective dust caps clean.

In addition, flanges must be kept clean periodically.

### **Effects of Cleaning Interfaces and Connectors**

The diameter of optic core is 9um, and diameter of dust and other particles ranges from 1/100 to 1/1000 um.

Comparatively speaking, the size of dust and other particles can cover part of optic end and therefore degrade the performance of the instrument.

In addition, power density may burn dust into optic fiber and induce further damage (for example, 0dBm optic power may produce about 16000000W/m\*m power density in single mode fiber). In this case, measurement will be inaccurate and irreversible.

### **Safety instructions to be followed before cleaning**

- 1) Make sure the instrument is power off when cleaning
- 2) Any operations contradict to the instructions may result in dangerous laser injuries
- 3) Make sure laser source is off, when clean any optic connectors
- 4) When the instrument is in operation, please always avoid looking directly into optic output. Although laser radiation is invisible, it may do serious injury to eyesight
- 5) Be cautious of electric shock and make sure AC power is disconnected with the instrument before cleaning. Always use dry or moistest soft cloth to clean the outside of the instrument, and never clean the inside
- 6) Please do not add any accessory to optic instrument or adjust the instrument at discretion
- 7) For maintenance, always go to qualified or certified professionals

### **Tools for Cleaning Interfaces and Connectors**

- 1) Optic fiber cleaner (for cleaning of optic connectors)
- 2) Optic fiber cleaning rod (for cleaning of optic outputs)
- 3) Optic fiber cleaning tissue (for cleaning optic interfaces)
- 4) Isopropyl alcohol
- 5) Cotton ball
- 6) Paper tissue
- 7) Cleaning brush
- 8) Condensed air

### Preferred Procedure for Cleaning Interfaces and Connectors

As in Figure 5-2. Preferred Procedure is as follows:

- 1) Screw off the cap of flange
- 2) Clean the laser head carefully
- 3) Screw on the cap of flange

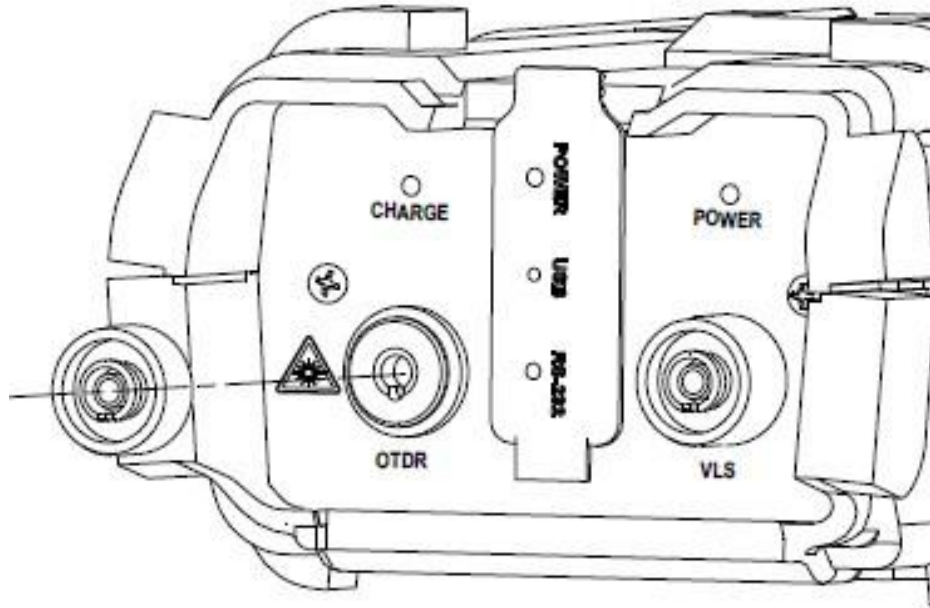


Figure 5-2. Structure of Flange

### Calibration Requirements

Calibration of the instrument is recommended every two years. Please contact our representatives or nearby customer service centers for proper calibration.

## 6. Warranty Information

### Terms of Warranty

All products are warranted against defective material and workmanship for a period of one (1) year from the date of shipment to the original customer. Any product found to be defective within the warranty period will be repaired or replaced by us free of charge.

In no case shall our liabilities exceed the original purchase price of the product.

### Exclusions

The warranty on your equipment shall not apply to defects resulting from the following:

- Unauthorized repair or modification
- Misuse, negligence, or accident

We reserve the right to make changes to any of its products at any time without having to replace or change previously purchased units.

### Warranty Registration

A warranty registration card is included with the original shipment of equipment. Please take a few moments to fill out the card and mail or fax it to the local Customer Service Center of us to ensure proper initiation of your warranty term and scope of your warranty.

### Returning Instruments

To return instrument for reasons of yearly calibration or other, please contact the local Customer Service Center to obtain additional information and a RMA# (Return Materials Authorization number). And describe briefly reasons for the return of the equipment, to allow us offer you more efficient service.

### Note

To return the instrument in the case of repair, calibration or other maintenance, please note the following:

- Be sure to pack the instrument with soft cushion like Polyethylene, so as to protect the shell of the instrument.
- Please use the original hard packing box. If use other packing material, please ensure at least 3 cm soft material around the instrument.
- Be sure to correctly fill out and return the warranty registration card, which should include the following information: company name, postal address, contact, phone number, e-mail address and problem description.
- Be sure to seal the packing box with exclusive tape.
- Be sure to ship to your representative or the agent of the Company in a reliable way.







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