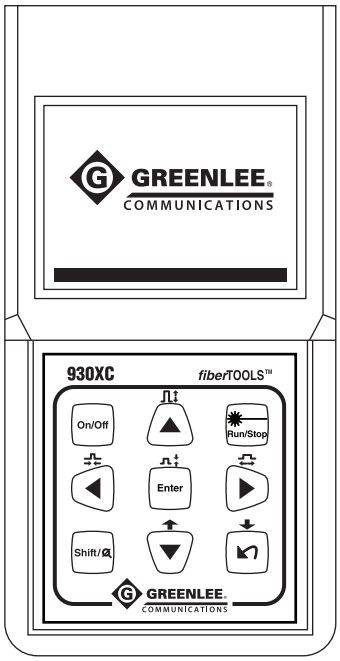
INSTRUCTION MANUAL

GREENLEE®
COMMUNICATIONS
A Textron Company



CE

FC

930XC-20C • 930XC-20M
930XC-30F • 930XC-30P
Handheld OTDRs

Read and **understand** all of the instructions and safety information in this manual before operating or servicing this tool.

Register this product at www.greenlee.com

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Preface

Description

The Greenlee Communications fiberTOOLS™ 930XC instruments are handheld Optical Time Domain Reflectometers (OTDRs) for measuring the specifications of single-mode or multi-mode optical fiber.

- The 930XC-20C measures optical fiber at 1310 nm and 1550 nm.
- The 930XC-20M measures optical fiber at 850 nm and 1300 nm.
- The 930XC-30F measures optical fiber at 1310 nm, 1550 nm, and 1625 nm.
- The 930XC-30P measures optical fiber at 1310 nm, 1490 nm, and 1550 nm.

Included with the 930XC instruments are the following:

- USB and serial data transfer cables
- Power adapter
- Vehicle adapter power cord
- Trace Viewer software installation disk
- Instruction manual
- Soft carrying case

Safety

Safety is essential in the use and maintenance of Greenlee tools and equipment. This instruction manual and any markings on the tool provide information for avoiding hazards and unsafe practices related to the use of this tool. Observe all of the safety information provided.

Purpose of This Manual

This instruction manual is intended to familiarize all personnel with the safe operation and maintenance procedures for the Greenlee Communications 930XC handheld OTDRs.

Keep this manual available to all personnel. Replacement manuals are available upon request at no charge.

Warranty

Greenlee Textron Inc. warrants to the original purchaser of these goods for use that these products will be free from defects in workmanship and material for one year. This warranty is subject to the same terms and conditions contained in Greenlee Textron Inc.'s standard one-year limited warranty.

For all Test Instrument repairs, contact Customer Service at 800-642-2155 or 760-598-8900 and request a Return Authorization.

For items not covered under warranty (such as items dropped, abused, etc.), a repair cost quote is available upon request.

Note: Prior to returning any test instrument, please check replaceable batteries or make sure the battery is at full charge.

All specifications are nominal and may change as design improvements occur.
Greenlee Textron Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

fiberTOOLS is a trademark of Textron Innovations Inc.

Important Safety Information

SAFETY ALERT SYMBOL

This symbol is used to call your attention to hazards or unsafe practices which could result in an injury or property damage. The signal word, defined below, indicates the severity of the hazard. The message after the signal word provides information for preventing or avoiding the hazard.

⚠DANGER

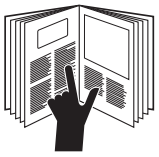
Immediate hazards which, if not avoided, WILL result in severe injury or death.

⚠WARNING

Hazards which, if not avoided, COULD result in severe injury or death.

⚠CAUTION

Hazards or unsafe practices which, if not avoided, MAY result in injury or property damage.



⚠WARNING

Read and understand this material before operating or servicing this equipment. Failure to understand how to safely operate this tool could result in an accident causing serious injury or death.

⚠WARNING

Electric shock hazard:

Contact with live circuits could result in severe injury or death.

CE **Class 3 appliance**

Important Safety Information

⚠WARNING

Electric shock hazard:

- Do not operate in an explosive atmosphere such as in the presence of flammable gases or fumes.
- Before applying power, verify that the unit is set to match the available line voltage.

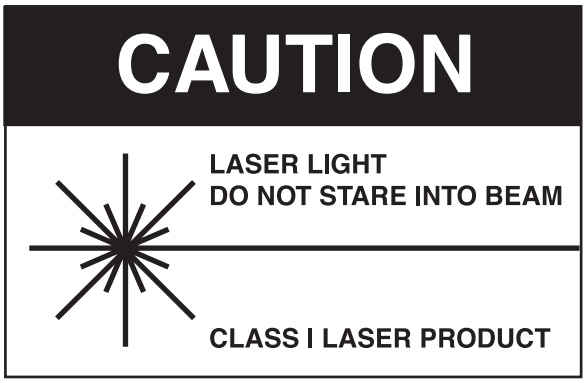
Failure to observe this warning could result in severe injury or death.

⚠WARNING

Electric shock hazard:

- Fuse replacement should be performed by Greenlee qualified personnel.
- Do not use repaired fuses or short-circuited fuse holders.

Failure to observe these warnings could result in severe injury or death.



The 930XC instruments are laser devices conforming to the requirements of CDRH, CFR 1040, Subchapter J. While there is no potential for eye damage due to unaided direct exposure, users should always avoid looking directly into the output port. The use of optical viewing instruments, such as microscopes, magnifiers, etc., should always be avoided. The use of such devices around active fibers can focus an intense beam of light energy onto the retina of the eye, which can result in permanent damage.

⚠CAUTION

Laser hazard:

- When performing measurements on fiber optic systems, avoid eye exposure to any open-ended fibers, optical connectors, optical interfaces, or other sources because they may be connected to active laser transmitters.
- Do not look into the optical port when a source is turned on.
- Avoid looking at the free end of a test fiber, i.e., the end not connected to the instrument. If possible, direct the free end toward a non-reflective surface.

Failure to observe these precautions may result in injury.

Important Safety Information

⚠CAUTION

Electric shock hazard:

- 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 damage to eyes or skin.
- Do not open the case of the unit for any reason. It contains no user-serviceable parts.
- Use this unit for the manufacturer's intended purpose only, as described in this manual. Any other use can impair the protection provided by the unit.

Failure to observe these precautions may result in injury and may damage the unit.

⚠CAUTION

Instrument damage hazard:

- Make sure that the optical fiber or cable is not in use and there is no laser beam in the fiber before testing with this unit.
- Do not leave the unit in direct sunlight or near direct sources of heat.
- Protect the unit from strong impacts or shock.
- Do not immerse the unit in water or store in areas with high humidity.
- When necessary, clean the case, front panel, and rubber cover with a damp cloth. Do not use abrasives, harsh chemicals, or solvents.
- Replace the protective dust cap when the unit is not in use.
- Store the unit and interface adapters in a cool, dry, and clean place.

Failure to observe these precautions may result in injury and may damage the unit.

⚠CAUTION

Electric shock hazard:

- Do not expose the unit to extremes in temperature or high humidity. Refer to "Specifications."
- Turn the unit off, disconnect from power, and make sure the laser source is off before cleaning.

Failure to observe these precautions may result in injury and may damage the unit.

Section 1. Introduction

Greenlee's 930XC handheld OTDRs can make an assessment of one single optical fiber or a whole optical fiber chain. In addition, the user can directly observe loss and events distribution of an optical fiber chain.

The 930XC tools check the transmission quality of optical fiber through the measurement of backscatter. Standard organizations like the International Telecom Union (ITU) define backscatter as an effective analysis means to measure optical fiber loss. Backscattering is also the only effective way of connector inspection, which can be applied to measure the length of optical fiber.

The 930XC OTDRs operate by reviewing events in optical fiber (for example, irregularities and connectors). These tools can help identify irregularities in optical fiber, locate them, and measure their attenuation, relevant loss, and homogeneity.

These tools are easy-to-use, small, and compact with large LCD displays and graphical interfaces. They can save and transfer the measurement curves data to a PC by using the provided Trace Viewer software for further analyzing, reporting, and printing.

Basic applications:

- Measure the length of optical fiber and cable.
- Measure the distance between two points on optical fiber and cable.
- Locate faults and ruptures of optical fiber and cable.
- Display distribution curve of optical fiber and cable loss.
- Measure attenuation coefficient of optical fiber and cable.
- Measure loss between two points on optical fiber and cable.
- Measure loss of tie-ins.
- Measure reflection of reflection events of optical fiber and cable.
- The 930XC-30F can measure live optical fibers at 1625 nm.

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

- For each event: Distance, loss, and reflection.
- For each section of optical fiber: Length and loss of dB or dB/unit length.
- For the whole optical fiber chain: Length and loss of dB.

Additional features:

- Large LCD display with auto or manual adjustment of contrast.
- Backlight LCD display supports night operation.
- Easy operation with trace graphic display.
- Trace storage function.
- RS-232 and USB data upload ports.
- Trace Viewer software for analyzing and reporting previously stored data.
- Auto off function to conserve battery life.
- DC/AC power supply.

Section 2. Basic Operation

This section describes the basic operation of the 930XC instruments. Specific operations are explained in detail in Section 3 of this manual.

Instrument Interface Description

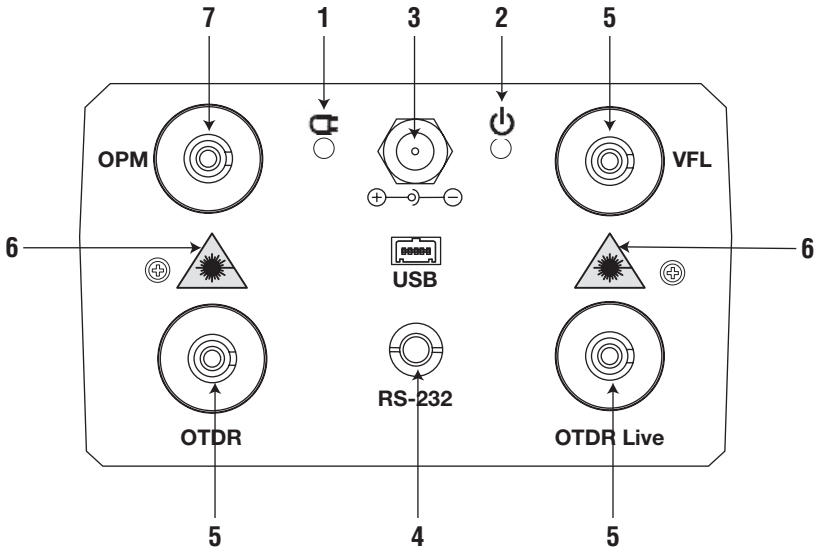


Figure 2-1. Interface Panel

1. **Charge Indicator:** When lit, measurement power is charging.
2. **Power Indicator:** When lit, measurement power is on.
3. **AC Power Jack:** Power adapter jack requirements are 13.8 VDC at 1.2 A.
4. **Data Transfer Ports:** USB and RS-232 interfaces to transfer saved traces in the instrument to a PC for further analysis with Trace Viewer software (provided).
5. **Fiber Optic Output for OTDR or 1625 nm live fiber, and VFL (visual fault locator):** Connector is used for the OTDR interface.
6. **Invisible Laser Caution:** Do not look directly at the optical output or stare at the laser beam.
7. **OPM Optical Power Meter**

Use of Batteries

The 930XC tools use a NiMH battery.

Auto Off Mode

- The instrument will enter auto off mode when there is insufficient power during operation. The low power icon will be displayed on the LCD.
- If unused for a long time, causing insufficient power, the instrument will enter auto off mode several seconds after powering on in order to protect the batteries in case of excessive discharging. The internal battery should be recharged immediately through the adapter.

Recharging

- Perform a quick charge first, and then switch to trickle charge after the voltage reaches a predefined figure. Quick charge temperature is 5 °C to 45 °C (41 °F to 113 °F), and trickle charge temperature is 0 °F to 55 °C (32 °F to 131 °F). Battery will not be fully charged or may be damaged if the charging temperature is beyond the above range, which may shorten battery life.
- A quick charge takes 3 hours.

Keypad Functions

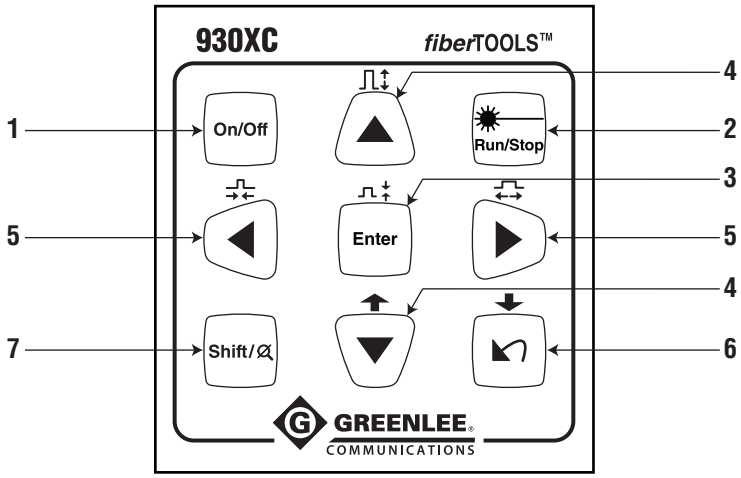


Figure 2-2. 930XC Keypad

1. **On/Off:** Press to turn power on or off to the instrument.
2. **Run/Stop:**
   - Under GUI, press to start measurement.
   - While testing, press to stop measurement.
3. **Enter:**
   - Under GUI, press to confirm the current operation.
   - Use with the **Shift** key to zoom out trace vertically.
4. ▲▼ (up and down) arrows:
   - Move menu bar in menu operation.
   - Highlight the icon to be selected.
   - Adjust parameter in parameter configuration.
   - Use ▼ with the **Shift** key to browse up the events list.
   - Use ▲ with the **Shift** key to zoom in trace vertically.
5. ◀ ▶ (left and right) arrows:
   - Select parameter to be adjusted in parameter configuration.
   - Move marker left or right in trace operation.
   - Turn page while in Help submenu.
   - Use with the **Shift** key to zoom out or zoom in trace horizontally.
6. ↶ arrow:
   - Read Help menu when power on.
   - Cancel the current operation.
   - Exit menu configuration.
   - Switch between information windows.
   - Use with the **Shift** key to browse down the events list.
7. **Shift:**
   - Under GUI, press to return a trace to original size without any zoom.
   - Activate the integration function by pressing this key together with other keys.

Section 3. Basic OTDR Information

Principle of OTDRs

An OTDR (Optical Time Domain Reflectometer) is a measurement instrument for identifying optical fiber transmission features. The OTDR is used to measure the overall attenuation of a fiber optic link and to provide details relating to the position of each event in that link. Events include splices, connectors, bends, and optical components. Its non-destructive, single-ended connection and rapid measurement have made the OTDR an indispensable tool for manufacturing, construction, and maintenance of optical fiber links.

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

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

An OTDR sends out a light pulse into the optical fiber and receives reflections of events and backscattering power of the pulse in time. Locations will be displayed on the LCD. The y-axis is the dB value of backscattering power, and the x-axis is the distance.

Basic Definition and Classification of Events

Events refer to any abnormal points causing attenuation or sudden change of scattering power besides the normal scattering of optical fiber, which include losses such as bending, connections, and ruptures.

Event points displayed on the LCD are abnormal points that cause traces to deviate from a straight line.

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

Reflection Events

When some pulse energy is scattered, reflection events occur. When reflection events occur, a peak is displayed on the trace (Figure 3-1).

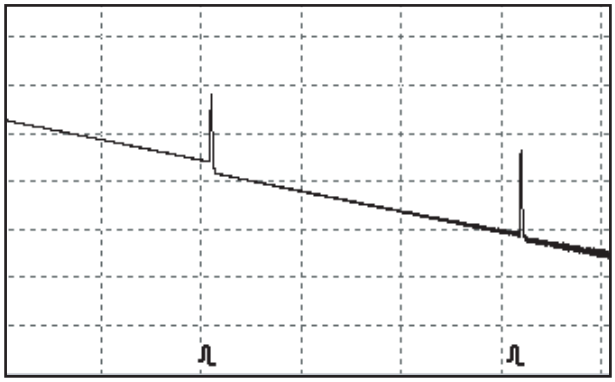


Figure 3-1. Reflection Event

Non-reflection Events

Non-reflection events occur at certain points where there is some optic loss but no light scattering. When non-reflection events occur, a power drop shows on the trace (Figure 3-2).

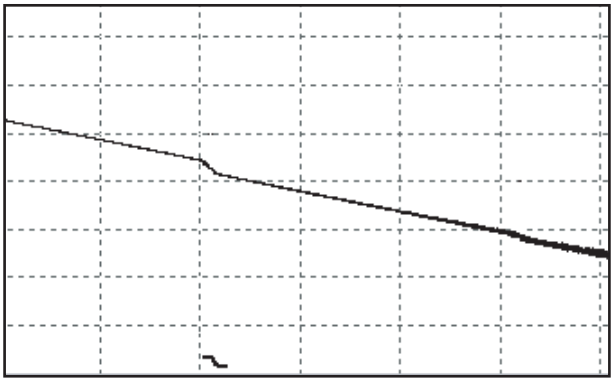


Figure 3-2. Non-reflection Event

Inspection of Events

The 930XC OTDR sends a light pulse into the optical fiber to be inspected, receives returning light signals, and starts calculating the event distance. The farther the distance is, the longer the time needed for scattered light to be received by the instrument. Event distance can be calculated according to the time of receiving events signals.

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

Measurement Application

The 930XC instruments display power relating to the distance of returning signals. This information can be used to identify the main properties of an optical fiber chain.

Measurement Contents

- Event location (distance), end, or rupture of optical 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.

Trace Analysis

The trace analysis of the 930XC OTDR is fully automatic. The trace locates:

- Reflection events of connections and mechanical tie-ins.
- Non-reflection events.
- End of optical fiber.
- Through scanning the first loss event that is larger than the end threshold, identifies the end of optical fiber.
- Events list: Event type, loss, reflection, and distance.

Trace Display Screen

The trace displays on the 930XC screen (Figure 3-3).

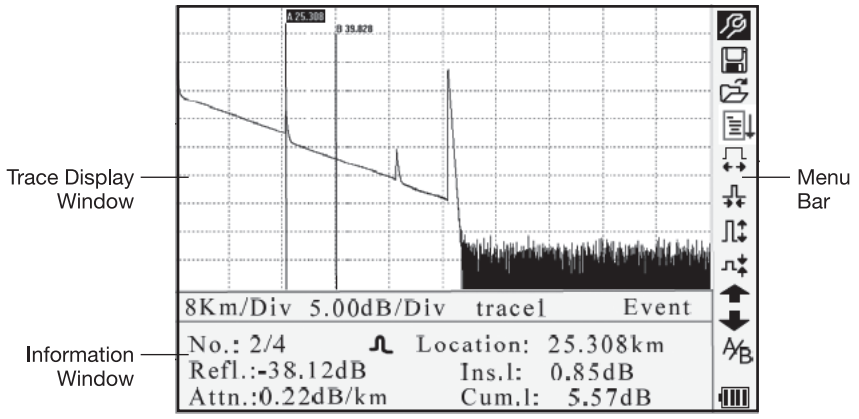


Figure 3-3. Trace Display Screen

Trace Display Window

This window displays the trace after one measurement.

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

The trace of the 930XC displays measurement results in a graphic form. The y-axis represents the power while the x-axis represents the distance (Figure 3-4).

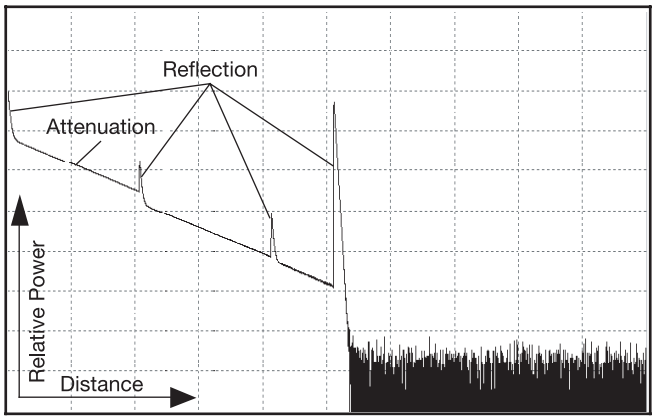


Figure 3-4. Traces and Coordinates

Information Window

The contents of this window are measurement parameters, events list, marker A/B, and analysis parameters.

Measurement Trace Parameters

Important measurement and analysis parameters are displayed in the information window (Figures 3-5a and 3-5b).

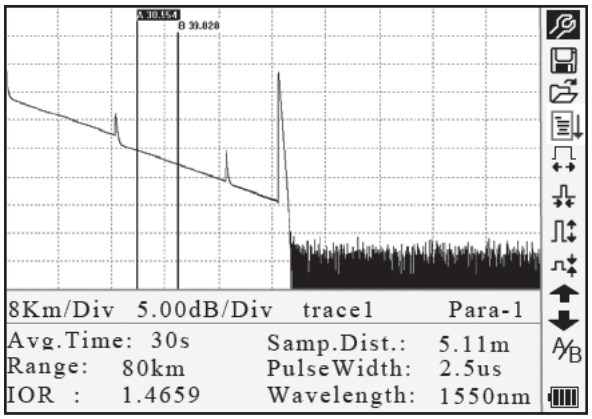


Figure 3-5a. Measurement Trace Parameters

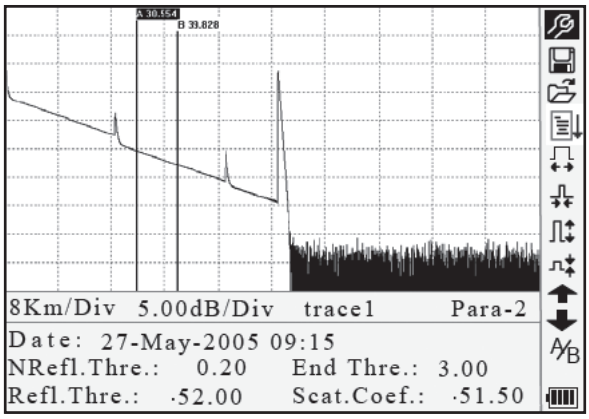


Figure 3-5b. Analysis Trace Parameters

For definitions and configurations of items in Figure 3-5a (average time, sample distance, range, IOR, wavelength, and pulse width) as well as definitions of items in Figure 3-5b (date, reflection threshold, non-reflection threshold, end threshold, and scattering coefficient), refer to "Parameter Configuration" in this section of the manual.

Events List

The events list indicates the location of events inspected. Any defined posts will be displayed in the events list (for example, a non-reflection event such as a fusion splice or a reflection event such as a connector) (Figure 3-6).

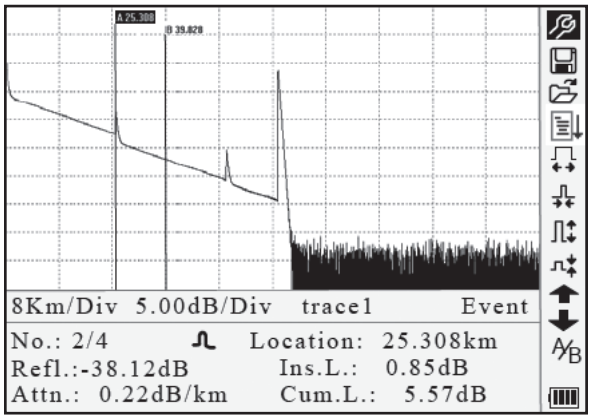


Figure 3-6. Events List

- **No.:** Event sequence number.
- **Four types of events:** ⊢ begin end; ⎍ reflection event; ⊣ fiber end; ⎾⏌ attentuation event.
- **Location:** Distance from beginning point to event.
- **Refl.:** Magnitude of reflection.
- **Ins.L.:** Loss of inserted event.
- **Attn.:** Attenuation characteristic from one event point to the current event.
- **Cum.L.:** Cumulative loss, calculating from beginning point to the current event.

Marker A/B Information

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

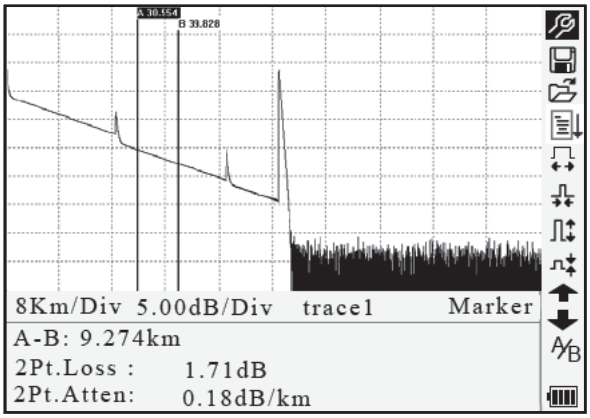


Figure 3-7. Marker A/B Information

The following parameters are measured between marker A and B. Changing either marker will change the record accordingly.

- **A-B:** Distance between two markers.
- **2Pt. Loss:** Loss between two markers; power difference between two markers.
- **2Pt. Atten:** 2 points loss of unit length.

The specific operations of the above items are explained in more detail later in this manual.

Fiber Information

Fiber information includes total attenuation, length, and loss of the tested fiber (Figure 3-8)

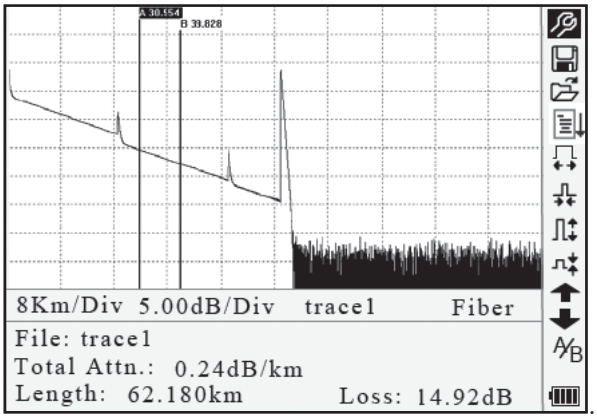


Figure 3-8. Fiber Information

Menu Bar and Icons

No.	Icons	Description
1		Parameter configuration
2		Save file
3		Open file
4		Re-analyze the trace
5		Zoom out trace horizontally
6		Zoom in trace horizontally
7		Zoom out trace vertically
8		Zoom in trace vertically
9	A/B	Switch between markers
10		Review events list upward
11		Review events list downward
12		Battery power indicator

Notes:

- Under the Help menu, only numbers 1 and 3 are operational.
- In the process of measurement, all functions on the menu bar will be disabled.
- Numbers 3, 4, 5, 6, 7, 8, and 9 are tools for trace analysis. Numbers 10 and 11 are tools for reviewing events list.
- Number 1 is explained in the next section, "Parameter Configuration."

Parameter Configuration

Correct parameter configuration is necessary for accurate measurements.

Use ▲ and ▼ to highlight (i.e., parameter configuration on the menu bar), and then press **Enter** (Figure 3-9). Press to exit.

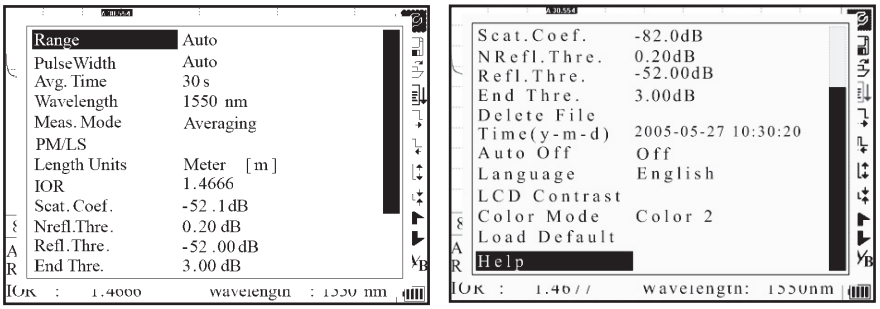


Figure 3-9. Parameter Configuration

Definitions of Measurement Parameters

Parameter	Definition
Range	Length of optical fiber relevant to the trace
Pulse Width	Width of laser pulse sent out from OTDR to optical fiber
Average Time	Select suitable testing time
Wavelength	Select laser wavelength for measurement
Measurement Mode	Select mode for measurement
PM/LS	Optical power meter, stabilized laser source, and VFL
Length Units	Select units of measurement
IOR	IOR of optical fiber which affects the transmission speed of laser
Scatter Coefficient	Affects backscatter power of laser in fiber
Non-reflection Threshold	Events whose insertion loss is ≥ the threshold displayed here
Reflection Threshold	Reflection events ≥ the threshold displayed here
End Threshold	First event with insertion loss ≥ the threshold is considered the end of fiber, and all following events will be ignored
Delete File	Delete stored trace data in the instrument
Time	Show current system time
Auto Off	Enable or disable auto off function
Lang./ 语 言	Choose language
LCD Contrast	Adjust contrast of LCD
Color Mode	Select suitable color setting for display
Load Default	Set all parameters to factory setting
Help	Show Help files (quick reference)

Range Configuration

Generally, the range is set according to the actual length of optical fiber in order to insure the accuracy of the measurement.

Under the parameter configuration menu use ▲ and ▼ to highlight “Range.” Press **Enter** to select a range (Figure 3-10). Press ↩ to exit.

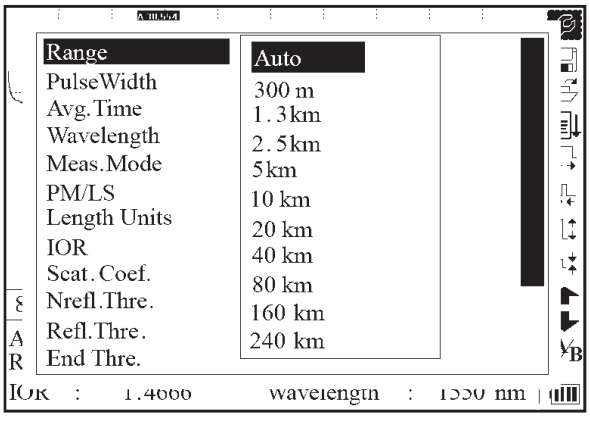


Figure 3-10. Range Configuration

Use ▲ and ▼ to select an adequate range. Press **Enter** to confirm.

Notes:

- "Auto" means automatic measurement. When this function is selected, the instrument automatically selects an adequate range and pulse width for the measurement. The process of measurement does not require any intervention by the user.
- "Auto" is the default setting.

Pulse Width Configuration

The selection of pulse width affects the dynamic range and resolution of the measurement. With a narrow pulse width there will be higher resolution and smaller deadzone; however, the dynamic range will be decreased. A wide pulse width will bring higher dynamic range and measure comparatively longer distance, but resolution and deadzone will be increased. Therefore, users should make the choice between dynamic range and deadzone.

The options for pulse width will change according to the distance range selected.

Under the parameter configuration menu use ▲ and ▼ to highlight "PulseWidth." Press **Enter** to select a value (Figure 3-11). Press ↩ to exit.

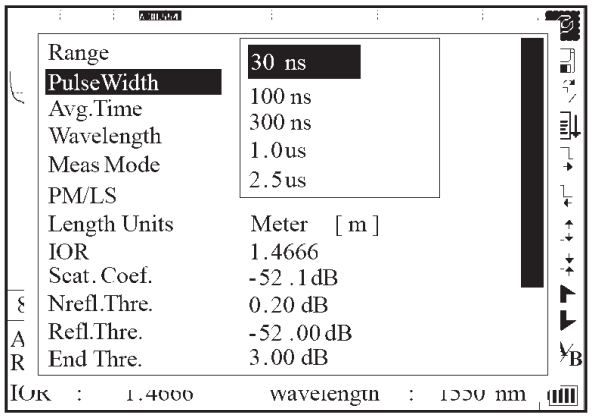


Figure 3-11. Pulse Width Configuration

Use ▲ and ▼ to highlight the pulse width. Press **Enter** to confirm.

Notes:

- "Auto" is the default setting.
- When the range is set to "Auto," the pulse width automatically is set to "Auto."

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, when measuring long-distance optical fiber, a long average time should be selected in order to review events at the long-distance end.

Under the parameter configuration menu use ▲ and ▼ to highlight "Avg. Time." Press **Enter** to confirm (Figure 3-12). Press ↩ to exit.

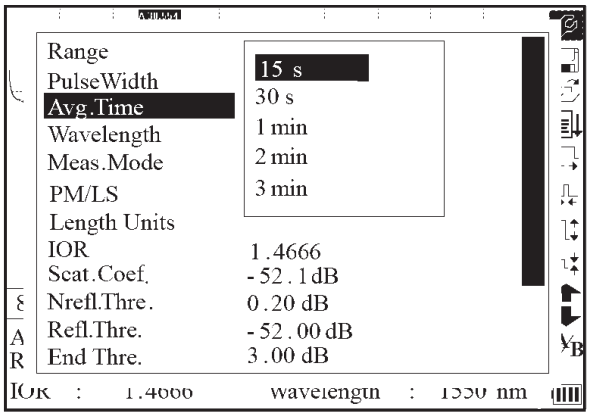


Figure 3-12. Average Time Configuration

Use ▲ and ▼ to highlight the desired time. Press **Enter** to confirm.

Notes:

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

Wavelength Configuration

Under the parameter configuration menu use ▲ and ▼ to highlight “Wavelength.” Press **Enter** to change the wavelength (Figure 3-13).

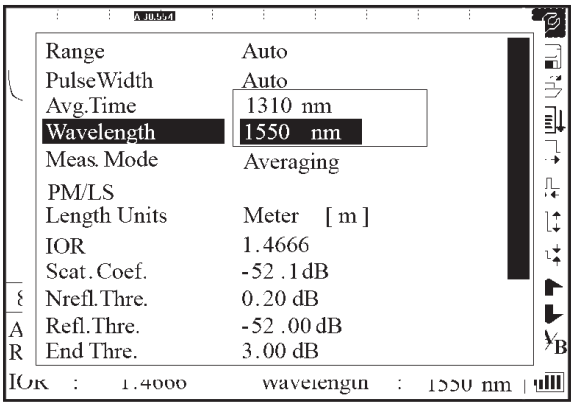


Figure 3-13. Wavelength Configuration

Measurement Mode Configuration

There are two kinds of measurement mode: averaging and realtime. Under realtime mode the 930XC will undertake realtime measurement for the connector of exterior fiber and refurbish the measured trace. While under realtime mode, press **Run/Stop** to stop; otherwise it will measure continuously. Under Averaging mode the tool will average the data within the measure time, which is set by the user. When exceeding the set time, it will stop automatically and display the result. In general, averaging is the preferred mode.

Under the parameter configuration menu use ▲ and ▼ to highlight “Meas. Mode.” Press **Enter** to select “Averaging” or “Realtime” mode (Figure 3-14). Press ↩ to exit.

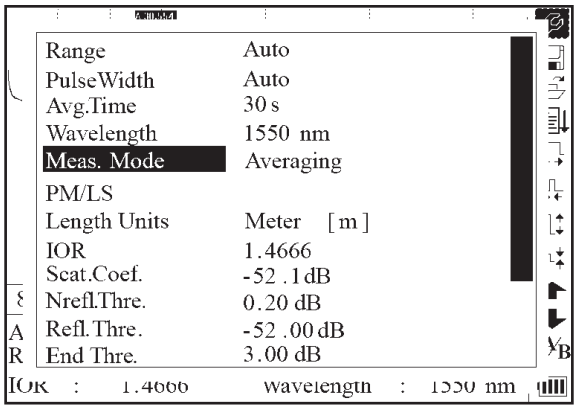


Figure 3-14. Measurement Mode Configuration

Power Meter, Laser Source, and VFL Configuration

Under the parameter configuration use ▲ and ▼ to highlight "PM/LS" and press **Enter** to enter PM/LS interface (Figure 3-15). Refer to "Power Meter, Laser Source, and VFL Settings" in Section 4 for details.

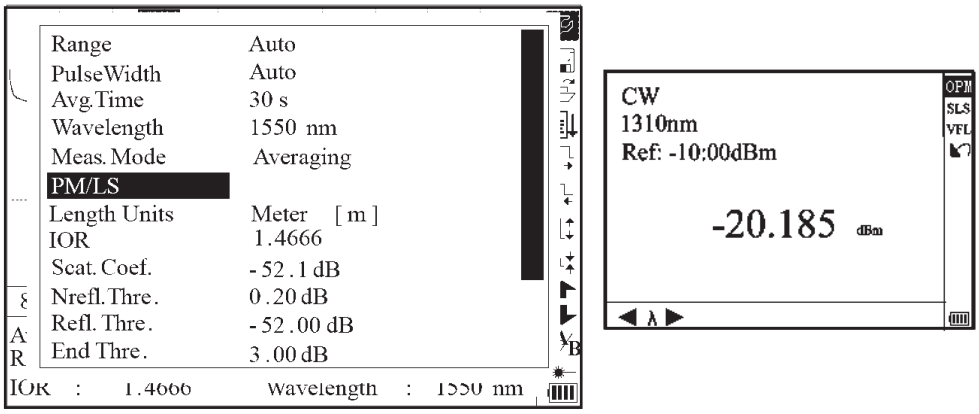


Figure 3-15. Power Meter and Laser Source Configuration

Length Units

Under the parameter configuration menu use ▲ and ▼ to highlight "Length Units." Press **Enter** to select the desired units of measurement (Figure 3-16). Press ↶ to exit.

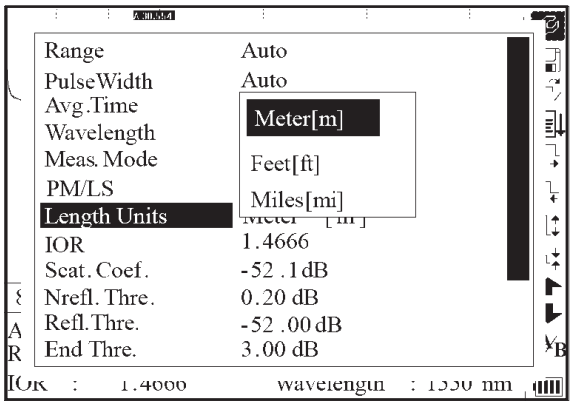


Figure 3-16. Length Units

Index of Refraction (IOR) Configuration

Because IOR is a key factor affecting the speed of laser transmission in optical fiber, the IOR configuration has a direct impact on the accuracy of measurement. In general, the IOR parameter is provided by the optical fiber manufacturer, and it can be set to the accuracy of four digits after the decimal point between 1.0 and 2.0.

Under the parameter configuration menu use ▲ and ▼ to highlight "IOR." Press **Enter** to enter a value (Figure 3-17). Press ↩ to exit.

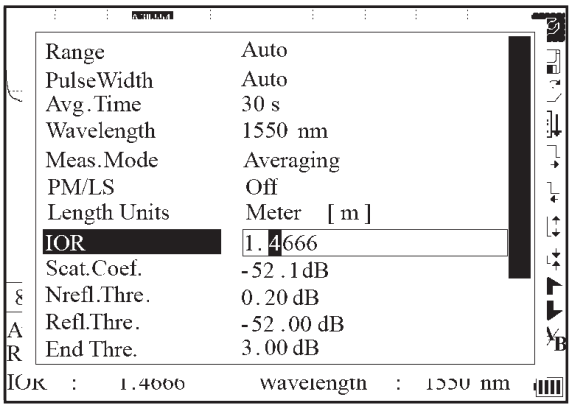


Figure 3-17. IOR Configuration

Use ◀ and ▶ to adjust the position of the highlighted area. Use ▲ and ▼ to change the digits. After setting, press **Enter** to confirm.

Scatter Coefficient Configuration

Scatter coefficient determines the value of backscatter power. This configuration affects the calculation of reflection value.

Under the parameter configuration menu use ▲ and ▼ to highlight "Scat. Coef." Press **Enter** to enter a value (Figure 3-18). Press ↩ to exit.

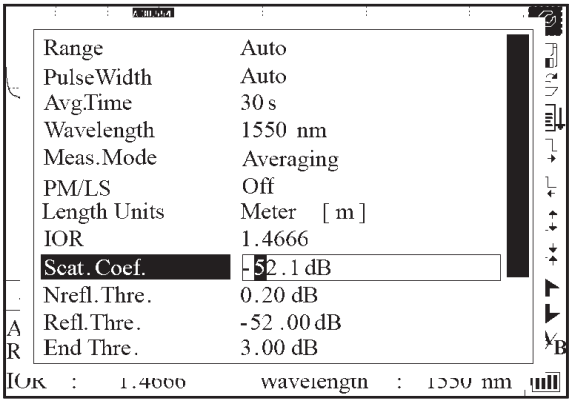


Figure 3-18. Scatter Coefficient Configuration

Use ◀ and ▶ to adjust the position of the highlighted area. Use ▲ and ▼ to change the digits. After setting, press **Enter** to confirm.

Non-reflection Threshold Configuration

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

Under the parameter configuration menu use ▲ and ▼ to highlight "Nrefl. Thre." Press **Enter** to enter a value (Figure 3-19). Press ↶ to exit.

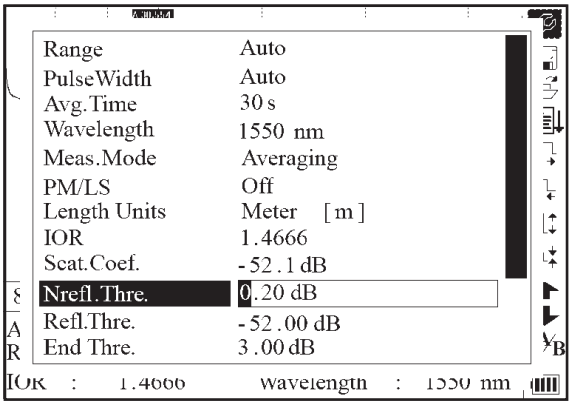


Figure 3-19. Non-reflection Threshold Configuration

Use ◀ and ▶ to adjust the position of the highlighted area. Use ▲ and ▼ to change the digits. After setting, press **Enter** to confirm.

Note: The default setting is "0.20 dB."

Reflection Threshold Configuration

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

Under the parameter configuration menu use ▲ and ▼ to highlight "Refl. Thre." Press **Enter** to enter a value (Figure 3-20). Press ↶ to exit.

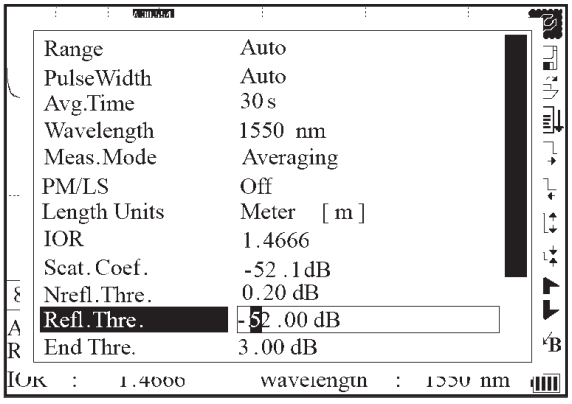


Figure 3-20. Reflection Threshold Configuration

Use ◀ and ▶ to adjust the position of the highlighted area. Use ▲ and ▼ to change the digits. After setting, press **Enter** to confirm.

Note: The default setting is "–52.00 dB."

End Threshold Configuration

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

Under the parameter configuration menu use ▲ and ▼ to highlight "End Thre." Press **Enter** to enter a value (Figure 3-21). Press ↶ to exit.

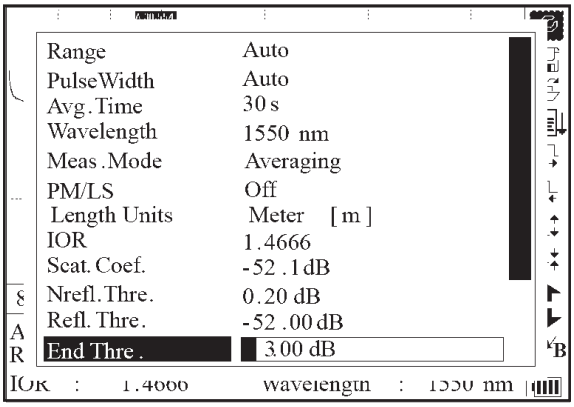


Figure 3-21. End Threshold Configuration

Use ◀ and ▶ to adjust the position of the highlighted area. Use ▲ and ▼ to change the digits. After setting, press **Enter** to confirm.

Note: The default setting is "03.00 dB."

Delete File

This function deletes saved traces.

Under the parameter configuration menu use ▲ and ▼ to highlight "Delete File." Press **Enter** to enter (Figure 3-22). Press ↶ to exit.

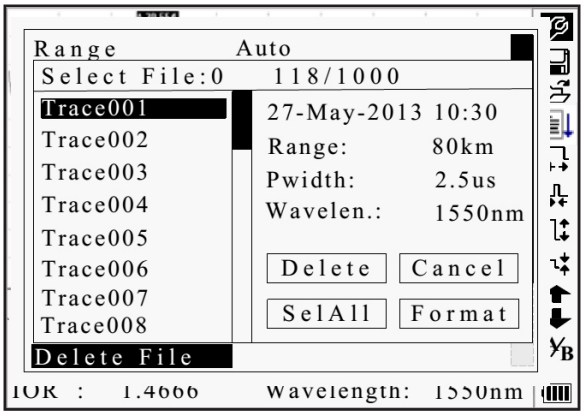


Figure 3-22. Delete File

Use ▲ and ▼ to choose the files to delete, and press **Enter** to confirm. Or use the arrow keys to choose "SelAll," and press **Enter** to select all files.

One or several files can be deleted at a time. Use the arrow keys to select "Delete." Press **Enter,** and choose "Yes" to delete or "No" to not delete. Choosing "Cancel" will exit the Delete menu.

Format Memory

Press **format memory** to format the internal memory.

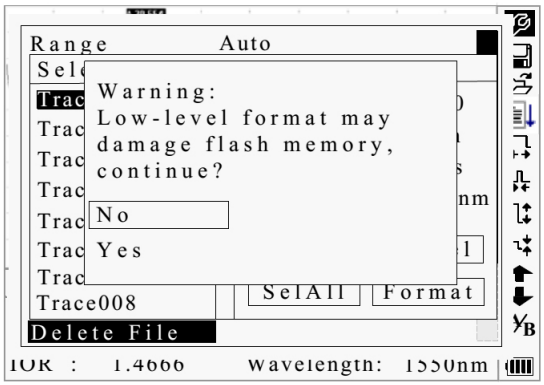


Figure 3-22a. Format Memory

Time Configuration

Time configuration is used to change system time.

Under the parameter configuration menu use ▲ and ▼ to highlight "Time (y-m-d)." Press **Enter** to change (Figure 3-23). Press ↩ to exit.

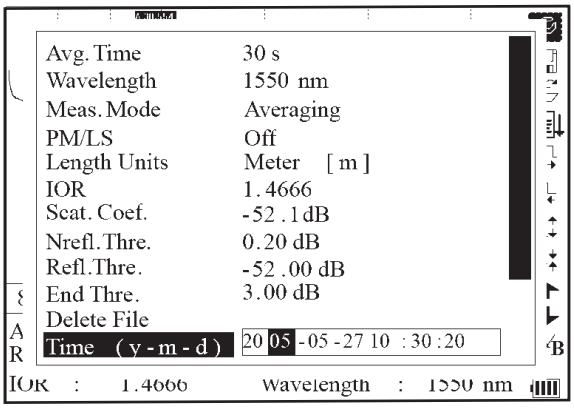


Figure 3-23. Time Configuration

Use ◀ and ▶ to adjust the position of the highlighted area. Use ▲ and ▼ to change the digits. After setting, press **Enter** to confirm.

Auto Off Configuration

This function conserves battery power. When auto off is enabled, the instrument will automatically power off when idle for 5 minutes.

Under the parameter configuration menu use ▲ and ▼ to highlight "Auto Off." Press **Enter** to switch between "Off" and "On" (Figure 3-24). Press ↩ to exit.

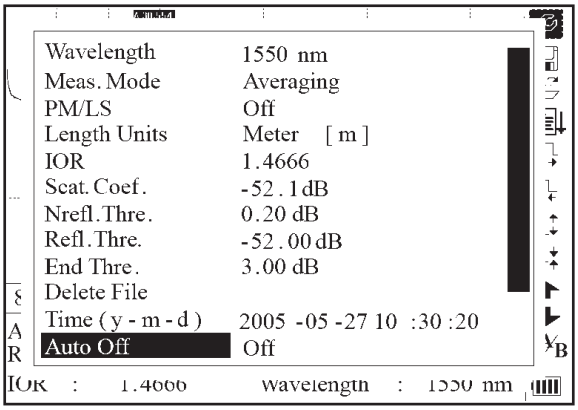


Figure 3-24. Auto Off Configuration

Note: The default setting is "On."

Language Configuration

There are two language options: English and Chinese.

Under the parameter configuration menu use ▲ and ▼ to highlight "Lang./ 语 言." Press **Enter** to switch the language (Figure 3-25). Press ↩ to exit.

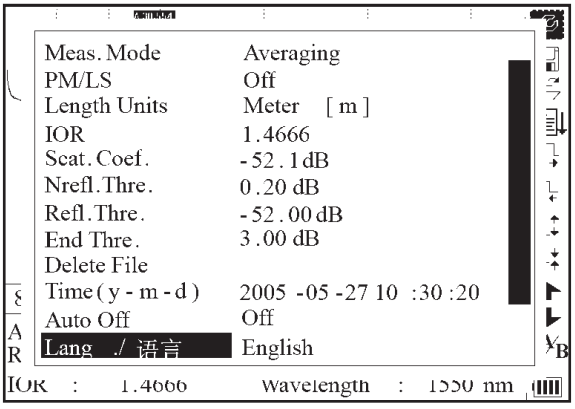


Figure 3-25. Language Configuration

Contrast Adjustment of LCD

The contrast of the LCD can be adjusted.

Under the parameter configuration menu use ▲ and ▼ to highlight “LCD Contrast.” Press **Enter** to adjust (Figure 3-26). Press ↩ to exit.

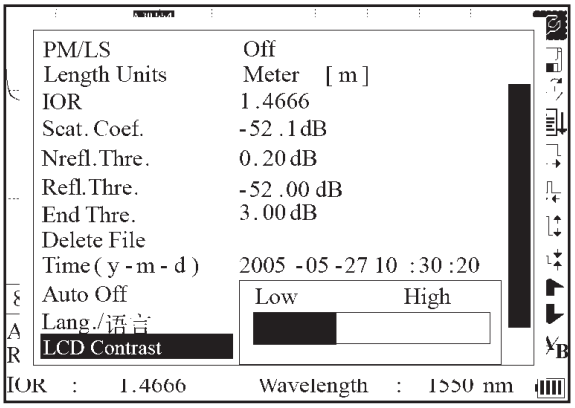


Figure 3-26. Contrast Adjustment of LCD

Use ◀ and ▶ to adjust the contrast. After adjusting, press **Enter** to confirm.

Color Mode Setting

This setting changes the color scheme of the display.

Under the parameter configuration menu use ▲ and ▼ to highlight “Color Mode.” Press **Enter** to choose a different mode (Figure 3-27). Press ↩ to exit.

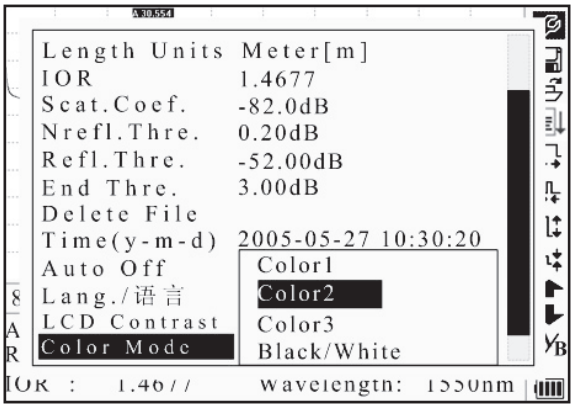


Figure 3-27. Color Mode Setting

Use ▲ and ▼ to highlight the desired color mode setting. Press **Enter** to confirm the selection.

Default Setting

This function is used to set the OTDR parameters to factory settings. These parameters include: range, pulse width, average time, IOR, non-reflection threshold, reflection threshold, end threshold, and scatter coefficient.

Under the parameter configuration menu use ▲ and ▼ to highlight "Load Default." Press **Enter** to enter (Figure 3-28). Press ↶ to exit.

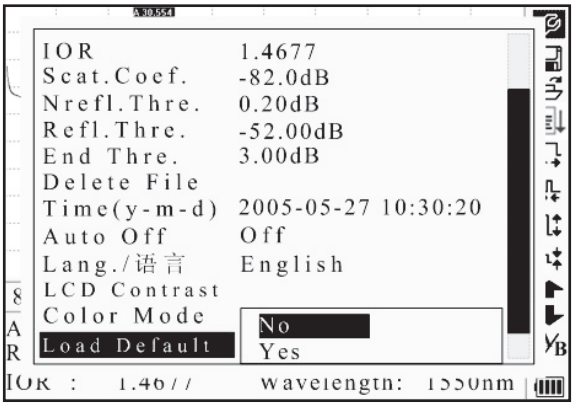


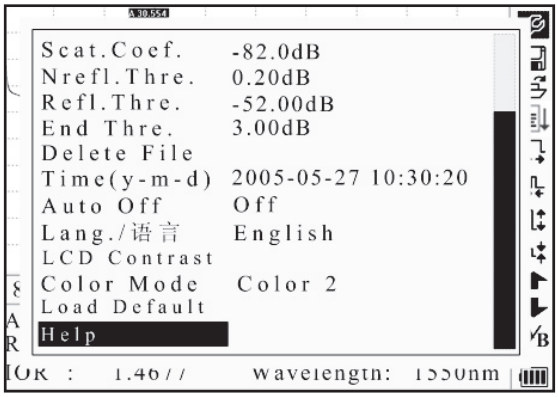
Figure 3-28. Default Setting

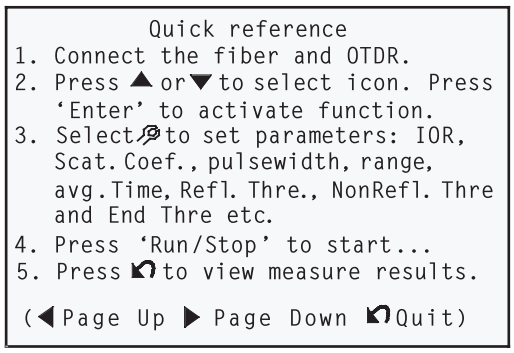
Use ▲ and ▼ to highlight "Yes" or "No." Press **Enter** to confirm.

Help

The Help function provides access to the quick reference screen.

Under the parameter configuration menu use ▲ and ▼ to highlight "Help." Press **Enter** to display the quick reference screen (Figure 3-29). Press ↶ to exit.





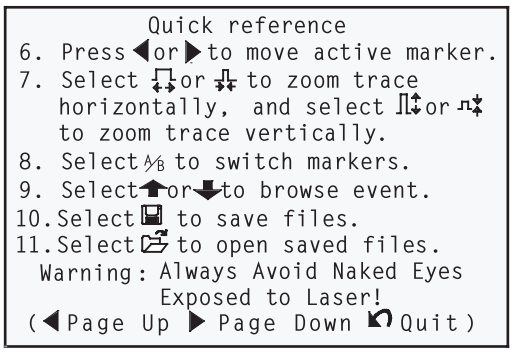


Figure 3-29. Help

Battery Recharge Status

When the 930XC is powered off and powered through the AC/DC adapter, the “CHARGE” indicator on the interface panel (Figure 2-1) will be lit. When the battery is fully recharged, the indicator will turn off.

When the instrument is powered on and powered through the AC/DC adapter, the internal battery is automatically recharged. The icons mean the following:

 Battery is being recharged

 Battery is fully charged

When the 930XC is powered by the internal rechargeable battery, the power level of the battery is shown on the LCD:

 No power

 Low power

 Half power

 More than half power

 Full power

Section 4. Trace Measurement and Processing of Existing Traces

Graphical User Interface (GUI) Instructions

When the 930XC is first turned on, an introductory screen appears on the LCD (Figure 4-1).

Figure 4-1. Power On Screen

Three seconds after the instrument is turned on, a quick reference screen appears (Figure 4-2).

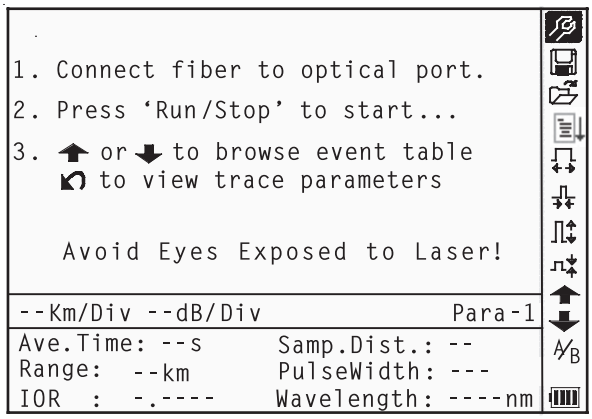


Figure 4-2. Quick Reference Screen

Trace Measurement

One complete trace can be obtained for each measurement. The 930XC can also load a saved trace.

⚠CAUTION

Instrument damage hazard:

Make sure that the optical fiber or cable is not in use and there is no laser beam in the fiber before testing with this unit.

Failure to observe this precaution may result in injury and may damage the unit.

Setup

Connect the optical fiber directly to the 930XC optic output. No tools are required.

- Clean the connectors. Refer to Section 5 of this manual for details.
- Clean the tie-ins, making sure they are compatible (APC or UPC).
- Connect optical fiber to the 930XC.

For details relating to parameter configuration, refer to "Parameter Configuration" in Section 3. If the parameters are unclear, use the default parameters of the instrument.

Note: Range is set to "Auto" when auto measurement is on.

Auto Trace Measurement

Auto measurement can be used if the length of optical fiber is unknown. The 930XC will select an adequate range for measurement.

For auto measurement follow these steps:

1. Set the range to "Auto." Refer to "Parameter Configuration" in Section 3.
2. Press **Run/Stop** to start the measurement (Figure 4-3).

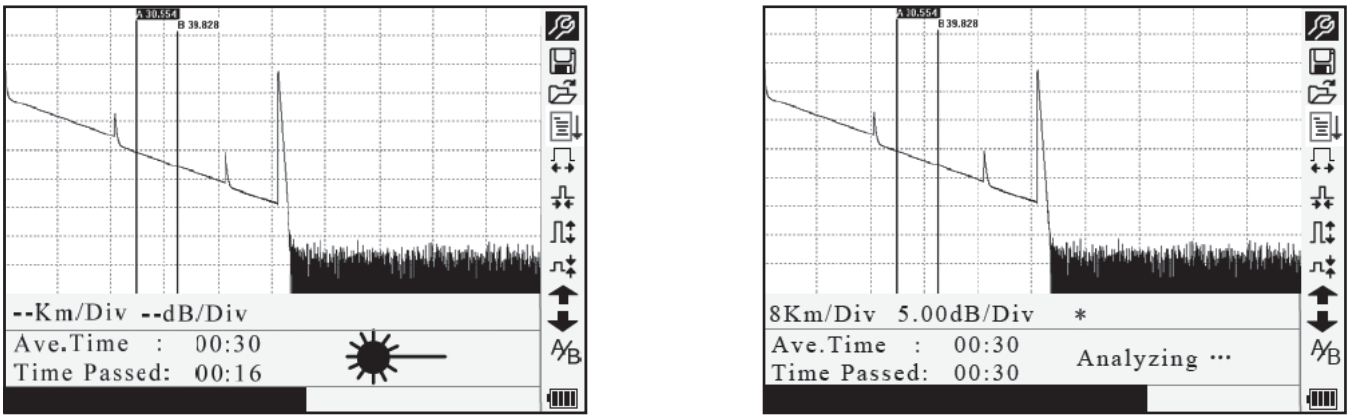


Figure 4-3. Measuring

3. Interface:
   - **Ave. Time: 00:30:** Measure time, which is set by user, is 30 seconds.
   - **Time Elapsed: 00:16:** Total measurement time has passed 16 seconds.
   - ✷—: Blinking of this icon 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 in realtime. But at the end of measurement the trace will be complete, as shown in Figure 4-4.

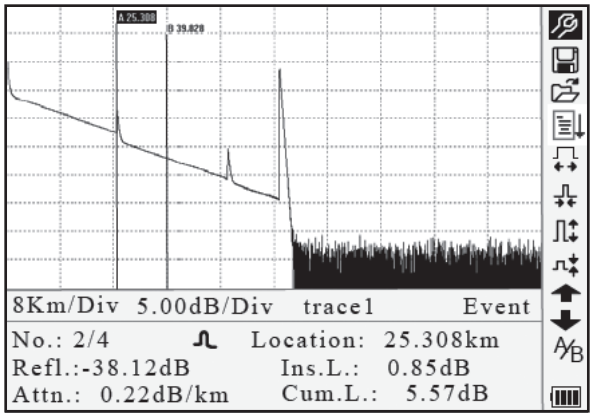


Figure 4-4. Trace Measurement

Manual Trace Measurement

To achieve optimal measurement results, set the parameters manually.

1. Set the range. Refer to "Range Configuration" in Section 3.
2. Press **Run/Stop** to start the measurement. The process is the same as with auto measurement.

Live Traffic Warning

If the 930XC is connected to a fiber with live traffic, the warning of "Traffic Signal Detected!" will be displayed after **Run/Stop** is activated. Disconnect the fiber under test and quit the measurement. To avoid damage to the 930XC, ensure that live traffic is removed from the test fiber before reconnecting to the 930XC.

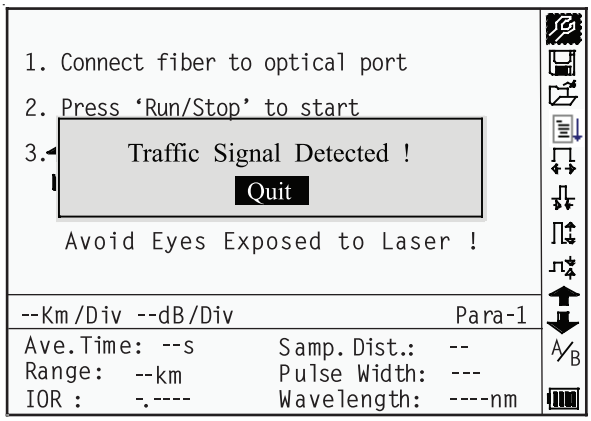


Figure 4-5. Live Traffic Warning

Reasons for Trace Measurement Failures

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

- Events may be too close to each other: Shorten the pulse width and try again. If failure still occurs, try measuring at the other end of the optical fiber.
- Low SNR: Use a wider pulse or increase average time and try again.
- Incorrect parameter configuration: Check the parameter configuration and try again.

Information Window

The information window displays the following items: measurement parameters, analysis parameters, and information regarding marker A/B.

For details regarding the information window, refer to “Information Window” in Section 3.

Switching between Information Window Items

Under GUI (Figure 4-4) press ↩ and the items in the information window will display in this order: measurement parameters → analysis information → events list → marker A/B information → fiber information → measurement parameters.

Reviewing Events List

Under GUI (Figure 4-4) press ↩ until the events list information appears in the information window.

Use ▲ and ▼ to highlight ↑ or ↓, and then press **Enter** to review the events list. Use ↑ to browse upward, and ↓ to browse downward. To browse up and down the events list using the keypad, press **Shift** + ↩ and **Shift** + **Enter**.

Reviewing Marker A/B Information

Switching between Marker A/B

Under GUI (Figure 4-4) use ▲ and ▼ to highlight A/B, and then press **Enter** to switch betweeen marker A/B.

Use ◀ and ▶ to move marker A or B.

Information between Marker A/B

Under GUI (Figure 4-4) press ↩ to switch the information window to marker A/B information.

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

Zoom a Trace

Zoom out Trace Horizontally

To review the details of an event more closely, follow these steps:

1. Under GUI (Figure 4-4) use ▲ and ▼ to highlight ⇳, and then press **Enter** to zoom out the trace horizontally.
2. Use ◀ or ▶ to move the marker to the event point being reviewed.
3. Refer to “Switching between Marker A/B” above for more information.

Zoom in Trace Horizontally

Under GUI (Figure 4-4) use ▲ and ▼ to highlight ⇵, and then press **Enter** to zoom in the trace horizontally.

Zoom out Trace Vertically

To review the details of an event more closely, follow these steps:

1. Under GUI (Figure 4-4) use ▲ and ▼ to highlight , and then press **Enter** to zoom out the trace vertically.
2. Use ◀ or ▶ to move the marker to the event point being reviewed.
3. Refer to "Switching between Marker A/B" above for more information.

Zoom in Trace Vertically

Under GUI (Figure 4-4) use ▲ and ▼ to highlight , and then press **Enter** to zoom in the trace vertically.

Zooming Shortcuts

- To zoom in horizontally using the keypad, press **Shift** + ▶.
- To zoom out horizontally using the keypad, press **Shift** + ◀.
- To zoom in vertically using the keypad, press **Shift** + ▲.
- To zoom out vertically using the keypad, press **Shift** + **Enter**.

Re-analyze a Trace

If the test result at a certain threshold is not adequate, it can be re-analyzed using this function to change the threshold. This function can be effective while the OTDR is disconnected from the fiber.

Under the parameter configuration menu edit the threshold value, and then press to exit the parameter configuration menu. Press to re-analyze the trace.

Save a Trace

When auto or manual measurement is finished, the measurement trace can be saved. The contents of a saved trace include the trace curve and related information of the trace.

1. Under GUI (Figure 4-4) use ▲ and ▼ to highlight , and then press **Enter** to enter (Figure 4-6).

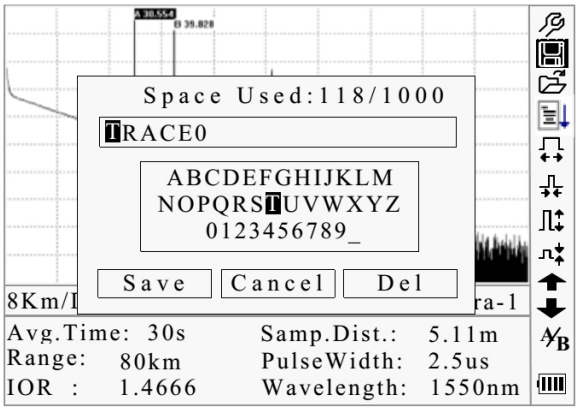


Figure 4-6. Save a Trace

2. Input file name: Use ▲, ▼, ◀, and ▶ to choose the alphanumeric characters one by one, and then press **Enter** to confirm. The filename can be a maximum of eight characters in length.
3. Save file: Use ▲, ▼, ◀, and ▶ to highlight "OK," and then press **Enter** to save.
4. Cancel saving file: Use ▲, ▼, ◀, and ▶ to highlight "Cancel," and then press **Enter** to cancel the save file operation.
5. Delete alphanumeric characters: Use ▲, ▼, ◀, and ▶ to highlight "Delete," and then press **Enter** to delete the characters.
6. Memory space: "118/1000" means that total memory space is 1000 files; 118 files have been saved so far.

Browse Saved Traces

1. Under GUI (Figure 4-4) use ▲ and ▼ to highlight , and then press **Enter** to confirm (Figure 4-7).

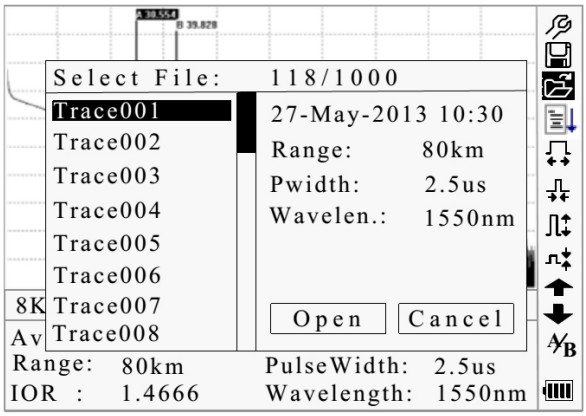


Figure 4-7. Browse Saved Traces

2. Use ▲ and ▼ to highlight the trace, and then use ◀ and ▶ to choose "Open" or "Cancel." Press **Enter** to confirm.
3. Memory space: "118/1000" means that total memory space is 1000 files; 118 files have been saved so far.

Alter Measurements in Realtime Testing

To alter measurements in realtime testing, follow these steps:

1. Use ▲ and ▼ to highlight (i.e., parameter configuration), and then press **Enter**. A parameter box will appear at the bottom of the screen.
2. Use ◀ and ▶ to move to the parameter to be changed (Figure 4-9), and then press **Enter**.
3. Use ▲ and ▼ to change the value. Select “Averaging” to choose Averaging testing.
4. Press “OK” to exit the parameter configuration menu.

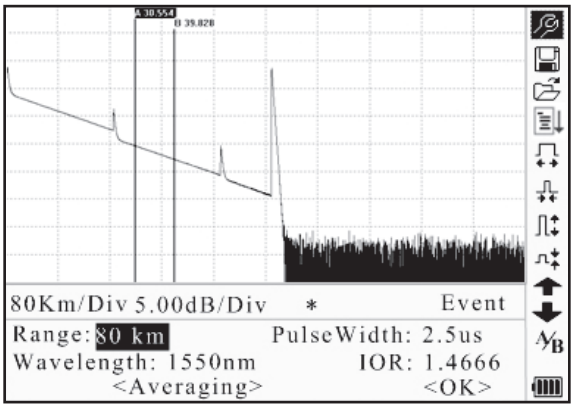


Figure 4-9. Alter Measurements in Realtime Testing

Power Meter, Laser Source, and VFL Settings

Optical Power Meter Settings

1. Enter PM/LS interface as described in "Power Meter, Laser Source, and VFL Configuration" in Section 3. Use ▲ and ▼ to highlight "OPM", and press **Enter** to enter OPM interface (Figure 4-10).

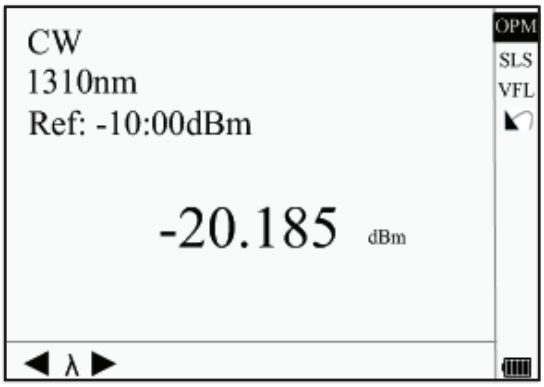


Figure 4-10. Optical Power Meter

2. Use ◀ and ▶ to toggle between calibrated wavelengths. Press **Enter** to enter OPM measurement setting interface (Figure 4-11).

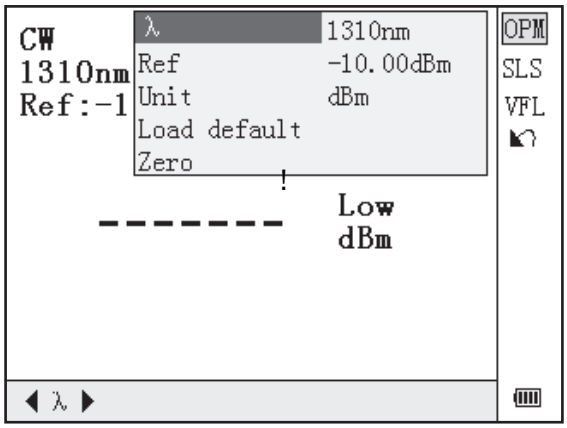


Figure 4-11. OPM Measurement Setting

3. Use ▲ and ▼ to highlight the parameter to be adjusted, and 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 exit setting.

Zeroing the Optical Power Meter

1. Isolate OPM port from outside light input with dust cap tightened securely.
2. Enter "Setup" and find "PM/LS".
3. Enter "PM/LS" and select "OPM".
4. In OPM interface, press **Enter** to find OPM popup menu.
5. Find "Zero", and press **Enter** to zero the OPM.

Stabilized Laser Source Settings

1. Enter PM/LS interface as described in "Power Meter, Laser Source, and VFL Configuration" in Section 3. Use ▲ and ▼ to highlight "SLS", and press **Enter** to enter SLS interface (Figure 4-12).

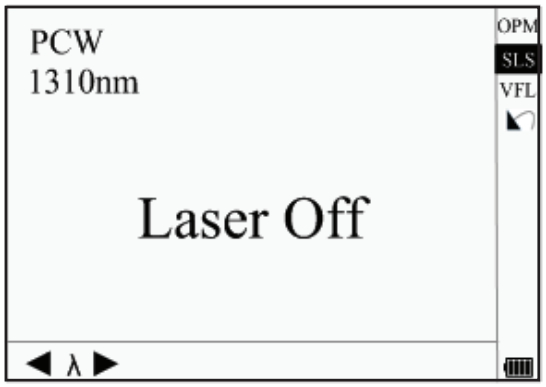


Figure 4-12. Stabilized Laser Source

2. Use ◀ and ▶ to toggle between SLS working wavelengths. Press **Enter** to enter SLS setting interface (Figure 4-13).

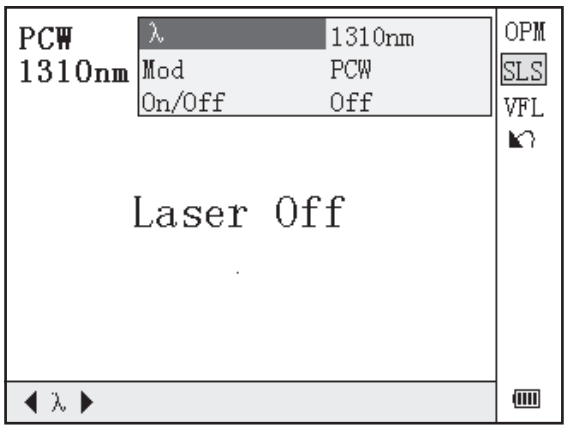


Figure 4-13. Stabilized Laser Source Setting

3. Use ▲ and ▼ to highlight the parameter to be adjusted, press **Enter** to confirm, and press ↶ to exit setting.

Visible Fault Locator Settings

1. Enter PM/LS interface as described in "Power Meter, Laser Source, and VFL Configuration" in Section 3. Use ▲ and ▼ to highlight "VFL", and press **Enter** to enter VFL interface (Figure 4-14).

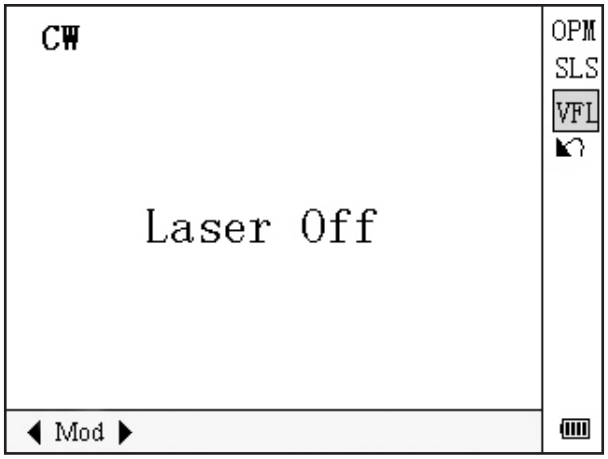


Figure 4-14. Visible Fault Locator

2. Use ◀ and ▶ to toggle between VFL working modes. Press **Enter** to enter VFL setting interface (Figure 4-15).

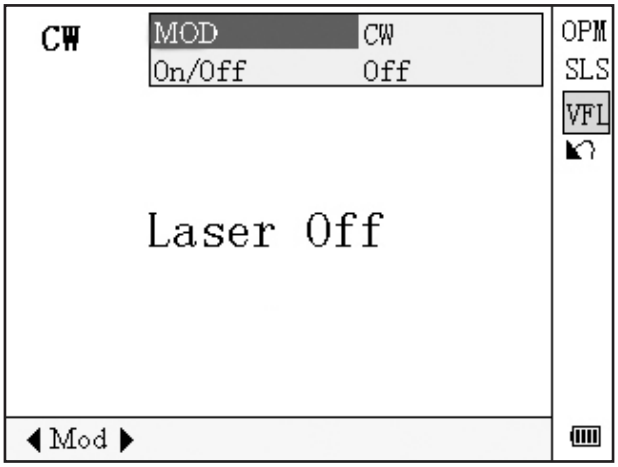


Figure 4-15. Visible Fault Locator Setting

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

Section 5. Calibration and Maintenance

⚠CAUTION

Electric shock hazard:

- Do not expose the unit to extremes in temperature or high humidity. Refer to "Specifications."
- Turn the unit off, disconnect from power, and make sure the laser source is off before cleaning.

Failure to observe these precautions may result in injury and may damage the unit.

Calibration Requirements

Calibration of the instrument is recommended every two years. Contact Greenlee for proper calibration services.

Maintenance and Replacement of Batteries

The 930XC has two batteries: a NiMH battery to power the instrument and a realtime clock (RTC) battery for data retention.

Note: Recharge the battery prior to use if the OTDR has not been used for one month.

To replace the NiMH battery (Figure 5-1):

1. Remove the battery compartment cover.
2. Remove the battery and disconnect the battery connector.
3. Replace the battery with the Greenlee supplied replacement battery.

To replace the RTC battery (Figure 5-1):

1. Remove the NiMH battery as above.
2. Remove the RTC coin cell battery.
3. Replace using a CR1220. Insert the replacement coin cell with the positive side facing up.

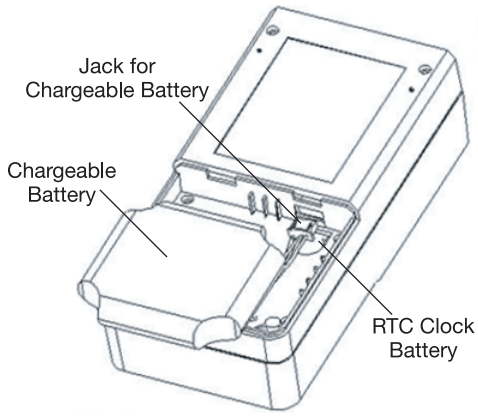


Figure 5-1. Replacing Battery

Cleaning

When necessary, clean the case, front panel, and rubber boot with a damp cloth. Do not use abrasives, harsh chemicals, or solvents.

Before Cleaning

- Make sure the power is off to the instrument.
- Make sure the laser source is off when cleaning any optical connectors.
- Make sure AC power is disconnected.

Cleaning Interfaces and Connectors

Interfaces must be kept clean. Isopropyl alcohol may be used to clean the optical output. Always replace the protective dust caps when the unit is not being used, and keep the protective dust caps clean. In addition, flanges must be cleaned periodically.

Notes:

- The diameter of optic core is 9 um, and the diameter of dust and other particulates ranges from 1/100 to 1/1000 um. Dust and other particulates can cover part of the optical end and therefore degrade the performance of the instrument.
- In addition, power density may burn dust into optical fiber and induce further damage (for example, 0 dBm optic power may produce about 16000000 W/m*m power density in single mode fiber). If this happens, the measurement will be inaccurate and damage will be irreversible.

Tools for Cleaning Interfaces and Connectors

- Optical fiber cleaner (for cleaning optical connectors)
- Optical fiber cleaning rod (for cleaning optical outputs)
- Optical fiber cleaning tissue (for cleaning optical interfaces)
- Isopropyl alcohol
- Paper tissue
- Cleaning brush
- Cleaning swabs
- Condensed air

Procedure for Cleaning Interfaces and Connectors

1. Unscrew the adapter from the bulkhead.
2. Carefully clean the bulkhead and the inside of the adapter.
3. Screw the adapter back onto the bulkhead.

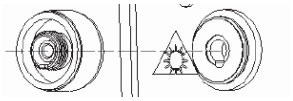


Figure 5-2. Flange

Section 6. Specifications

Optical Specifications[1]	930XC-20C	930XC-20M	930XC-30F	930XC-30P
Dynamic Range (db)[2]	35	21/24	38/37/37	
Wavelength (±20 nm)	1310/1550	850/1300	1310/1550/1625	1310/1490/1550
Display Type	Color			
Fiber Type	Single-mode	Multi-mode	Single-mode	
Selectable Ranges (km)	0.3/1.3/2.5/5/10/20/40/80/160/240	@ 850 nm: 0.1/0.3/0.5/1.3/2.5/5/10; @ 1300 nm: 0.1/0.3/0.5/1.3/2.5/5/10/20/40/80	0.3/1.3/2.5/5/10/20/40/80/160/240	
Pulse Widths (ns)	5/10/30/100/300/1000/2500/10000/20000	@ 850 nm: 12/30/100/275/1 μs; @ 1300 nm: 30/100/275/1 μs/2 μs	5/10/30/100/300/1000/2500/10000/20000	
Average Time (s)	15/30/60/120/180			
Attenuation Deadzone (m)[3]	≤ 14	≤ 12	≤ 14	≤ 14
Event Deadzone (m)[3]	≤ 2.5	≤ 2.5	≤ 2	≤ 2.5
Sampling Range (m)	0.1 to 15	1 to 10	0.1 to 15	
Sampling Points	16000 (maximum)			
Distance Measure Accuracy	± (1 m + 5 x 10^{-5} x Distance (m) + sampling space)			
Attenuation Measure Accuracy	0.05 dB/dB			
Reflection Measure Accuracy	±4 dB			
Measurement Data Storage	1000 test curves			
Connector Type	PC, APC	PC	PC, APC	
Data Transmission	RS-232/USB port			

(1) Specifications describe the instrument's typical performance, measured with FC/PC-type connectors. Uncertainties due to the refractive index of fiber are not considered.
(2) The dynamic range is measured using a 1 μs (850 nm), 2 μs (1300 nm), 20 μs pulse, SNR = 1, and an average time of 3 minutes.
(3) Conditions for deadzone measurement: Reflection intensity is less than –35 dB (-20M), –45 dB (-20C), –55 dB (-30X), and a pulse width of 10 ns.

Other Specifications	930XC-20C	930XC-20M	930XC-30F	930XC-30P
Power Supply	NiMH chargeable battery/AC adapter			
Battery Capacity	Supports over 8 hours operation on one charge or > 20 hours standby			
VFL Power	–3 dBm			
VFL Wavelength	650 nm			
Operating Temperature	–10 °C to 50 °C (14 °F to 122 °F)			
Storage Temperature	–20 °C to 60 °C (–4 °F to 140 °F)			
Relative Humidity	10% to 90% (non-condensing)			
Weight	0.87 kg (1.9 lb)			
Dimensions (H x W x D)	196 mm x 100 mm x 60 mm (7.7 in x 3.9 in x 2.4 in)			

Stabilized Laser Source Module

Specification	930XC-20C	930XC-20M	930XC-30F	930XC-30P
Wavelength	Same as OTDR working wavelength			
Output Power (dBm)	≥ –7			

Optical Power Meter Module

Specification	930XC-20C	930XC-20M	930XC-30F	930XC-30P
Calibrated Wavelength (nm)	850/1300/1310/1490/1550/1625			
Power Range (dBm)	–70 ~ +6 (–60 ~ +6 @ 850 nm)			
Detector Type	InGaAs			
Display Resolution (dB)	0.01			
Accuracy	±5% ±0.01 nW (±0.5 dB @ 850 nm)			
MOD Identification	1 K, 2 K Hz			

Section 7. OTDR Trace Viewer Software

Trace Viewer software is an application developed for the 930XC OTDR. It allows the previously stored measurement records in the instrument to be uploaded to a PC and to be displayed, saved, or printed. This software provides a convenient data management function, which includes: editing, analysis, browsing, saving, backup, printing, and ASCII format output.

Software Installation

Computer System Requirements

Requirements for operating system and hardware:

- PC with Intel Pentium III processor or higher
- Microsoft® Windows 98/2000/XP/Vista/7/8 operating system
- Minimum 64 MB of internal memory
- Minimum 40 MB of available hard disk space
- 8-speed CD-ROM drive
- 9-pin series port or USB port

Installation

Follow these steps to install the 930XC OTDR Trace Viewer software on a PC:

1. Start Microsoft® Windows.
2. Exit all other running applications that Windows is currently running.
3. Insert the installation disk into the CD-ROM drive, and locate the OTDR Trace Viewer folder.
4. Run 930XC OTDR Trace Viewer setup file to install.
5. Follow the step-by-step installation wizard instructions until installation is complete.

Software GUI

Graphical User Interface (GUI)

After installing the 930XC Trace Viewer software, click “run” to view the main GUI (Figure 7-1).

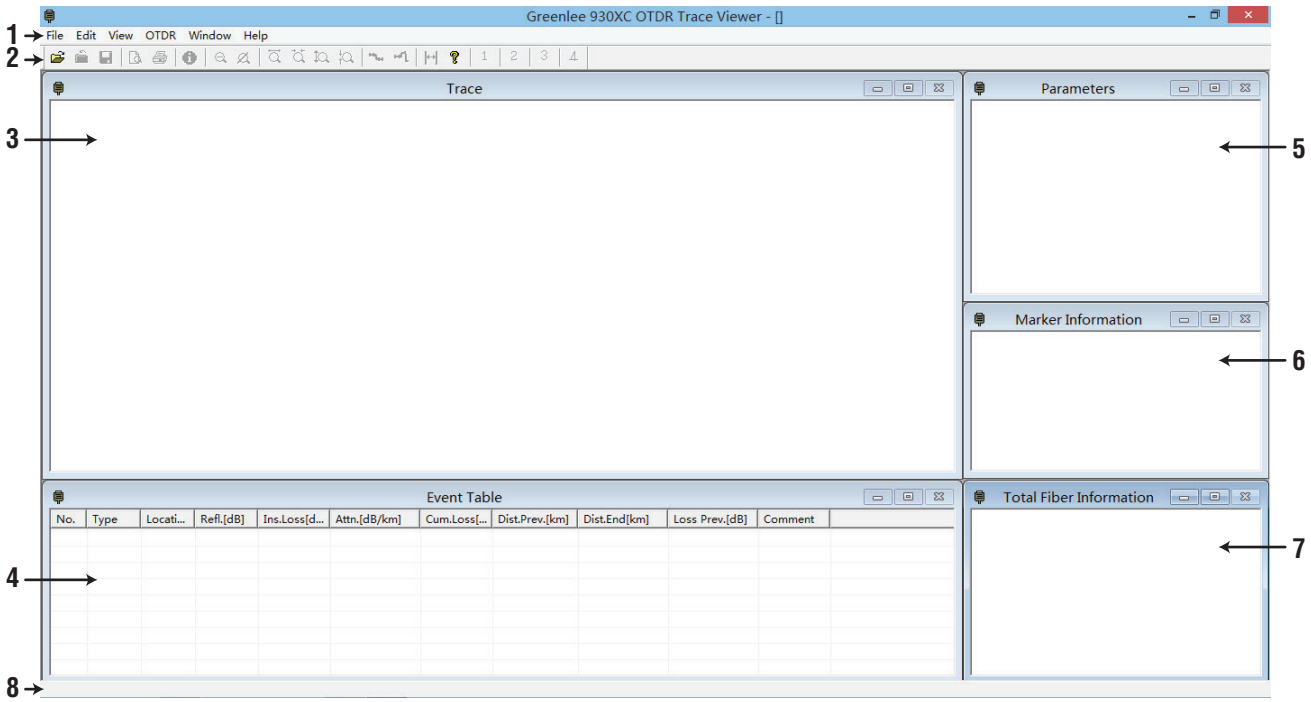


Figure 7-1. GUI

1. Menu
2. Tool bar
3. Trace display window (Spectral line)
4. Events list window (Events Table)
5. Measurement and analysis parameter window (Parameter Sheet)
6. Fiber information window (Fiber section information)
7. Fiber chain information window (Fiber chain information)
8. Status bar

Menu, Tool Bar, and Status Bar

The main GUI of the 930XC OTDR Trace Viewer software is shown in Figure 7-1.

The **menu bar** includes: File, Edit, View, OTDR, Window, and Help.

The **tool bar** is right below the menu bar. Use the mouse pointer to highlight a tool, and the operation reference will pop up. The tool bar display can be turned on or off by clicking "Show Toolbar" under the "View" menu. The tool bar provides shortcut keys to complex operations. All the functions on the tool bar can also be accessed through the menu bar.

The **status bar** is at the very bottom of the GUI. It displays information or reference of the current menu or tool bar application. The status bar is a brief summary of the current menu application or tool bar function.

File (F)

The functions enabled under the "File" menu (Figure 7-2) include: Upload Trace File, Open, Multi-traces (add up to four traces to display) , Save, Save As, ASCII Export, Print Option, Printing Preview, Print, Batch Print Preview, Batch Print, Batch Edit, and Exit.

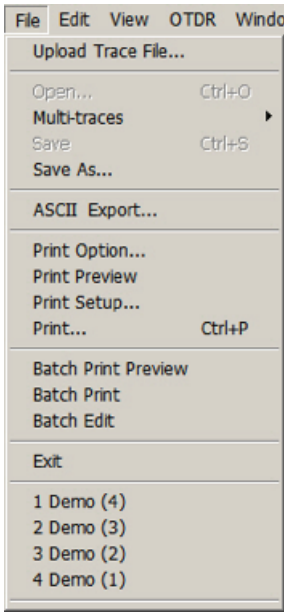


Figure 7-2. File Menu

Edit (E)

Use the "Edit" menu (Figure 7-3) to edit the events list: Add Event, Modify Event, Delete Event and Edit Trace (optical fiber) Information. Optical fiber information is explanatory text relating to the trace file that users type in. For each measurement, users can save the measurement trace with the 930XC. This software provides an interface for text input. For each trace file, users can input related information (No. of cable, No. of fiber, type of fiber, beginning of fiber, end of fiber, manufacturer, and technician. With this information, users can identify the corresponding relations between trace file and fiber chain.

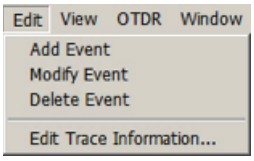


Figure 7-3. Edit Menu

View (V)

The “View” menu (Figure 7-4) controls the display of the tool bar, status bar, marker operation and trace display (zoom in and out horizontally and vertically), and the display style of the trace.

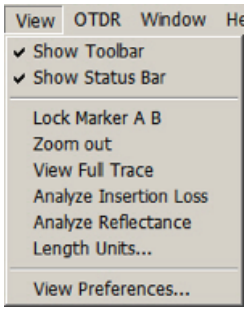


Figure 7-4. View Menu

A trace is composed of many dots. To review the details of a trace, zoom in by drawing square with mouse on selected trace area from upper left to lower right direction and zoom out by drawing square from any other direction.

Lock Marker A and B to fix the distance between them.

Use “Analyze Insertion Loss” function to manually calculate the insertion loss of an event (Figure 7-5).

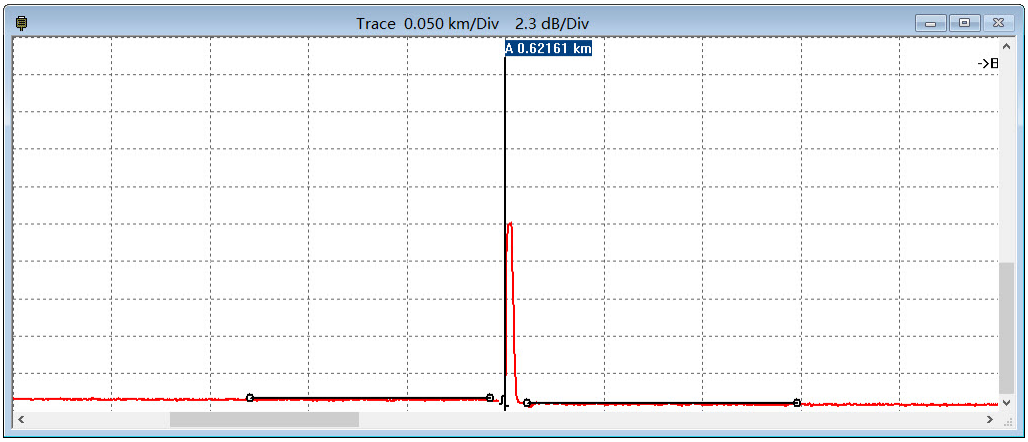


Figure 7-5. Analyze Insertion Loss

Use “Analyze Reflectance” function to manually measure the reflectance of reflection event (Figure 7-6).

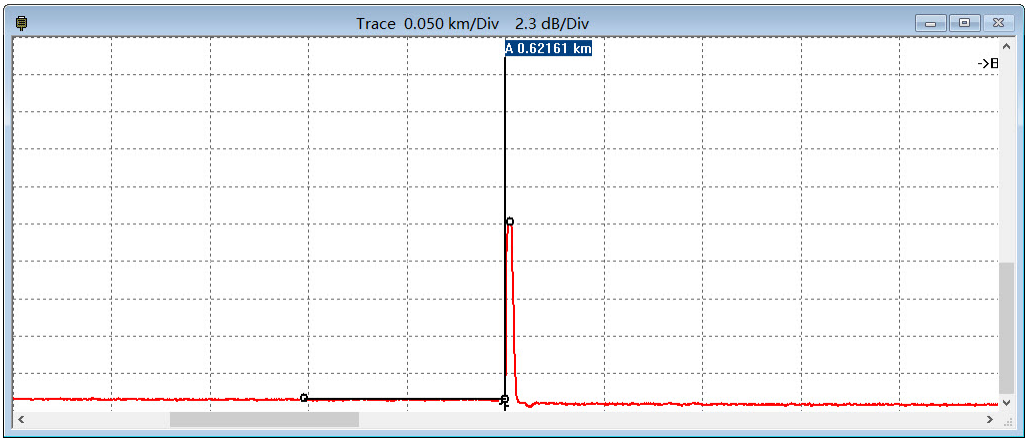


Figure 7-6. Analyze Reflectance

Use the "Length Units" setting to select meters, feet, or miles as the unit of measurement. Note: When the Trace Viewer application is opened, this setting defaults to the last unit of measurement selected.

View Preferences refers to the trace display styles. Trace can be displayed in dots or solid line; dashed line displays or not; selection of the event status bar.

OTDR (O)

The "OTDR" menu (Figures 7-7 and 7-8) provides a reanalysis function for acquired traces. Operator can modify IOR, Scatter Coefficient, and event thresholds (Non-reflection, Reflection, and End) per each wavelength to review correct results.

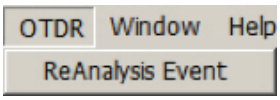


Figure 7-7. OTDR Menu

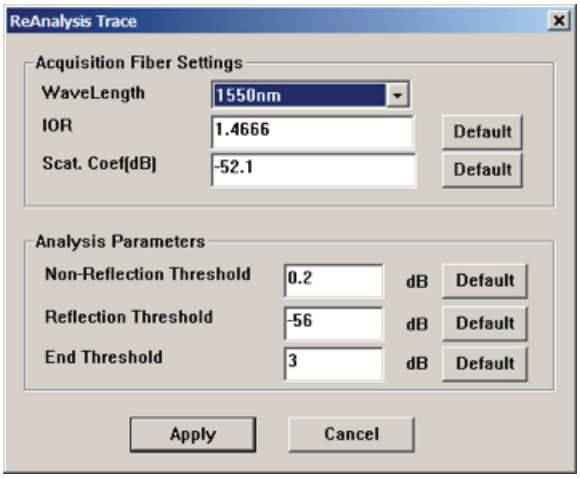


Figure 7-8. Trace Reanalysis

Window (W)

The "Window" menu (Figure 7-9) controls the display of the subwindows: trace window, events table window, parameter window, and fiber chain information. Tile function displays subwindows in a layout similar to Figure 7-1. Other submenus take the selected window as the current active window.

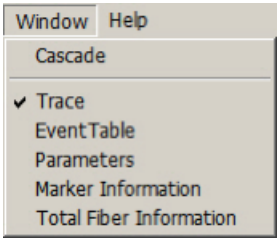


Figure 7-9. Window Menu

Help (H)

The "Help" menu (Figure 7-10) displays the version of the software.

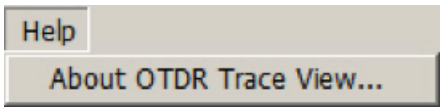


Figure 7-10. Help Menu

Information Subwindows

Trace Display Window

Click “Open…” under the “File” menu to open a trace file, and a trace curve will display in the trace display window (Figure 7-11). The x-axis displays the distance (km); the y-axis represents the backscatter power (dB). There are two markers, A and B; click either one to activate it. To move the marker, click and drag with the mouse pointer; the position information will change accordingly. By moving the marker, the horizontal distance and vertical power can be read manually. Zooming in and out of the trace features depends on the activation of a marker. In Figure 7-11 below, the sloped line represents backscatter from the optical fiber. The peaks are reflective events in the fiber chain. The end of the fiber is shown by the sudden drop in optical power, which is followed by noise. The symbols at the bottom of the window indicate the type of event.

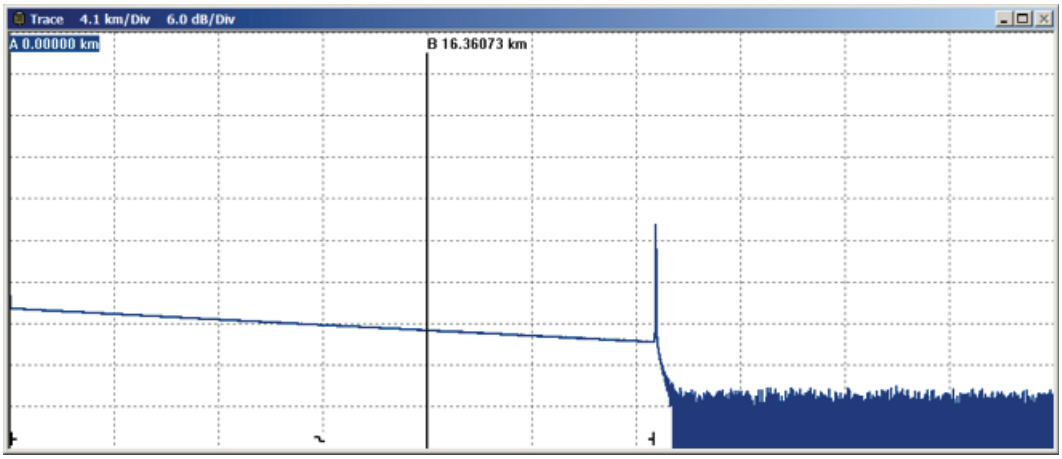


Figure 7-11. Trace Display

Events List Window

Trace data collected by the 930XC will be processed automatically, and analysis results will be displayed in the events list (Figure 7-12).

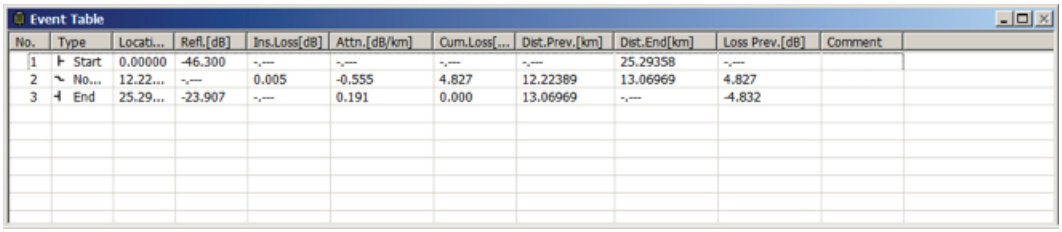


Figure 7-12. Events List

The events list contains the following items:

- **No.:** Sequence of events in optical fiber chain.
- **Type:** Beginning, end, reflection, and non-reflection event.
- **Distance:** Distance from OTDR to event point.
- **Reflection Value:** Value of reflection event.
- **Insertion Loss:** Vertical decline of dB.
- **Attenuation Coefficient:** Value of attenuation per kilometer between current event point and previous event point in optical fiber chain.
- **Cumulative Loss:** dB value of loss from 0 km to current event point.
- **Dist. Prev. (km):** Distance from the previous event.

- **Dist. End. (km):** Distance from the end event.
- **Loss Prev. (dB)**: Loss from 0 km to current event point.
- **Comment:** Notify other details of the event.

Parameter Window

The parameter window (Figure 7-13) displays the default parameters of the currently displayed trace. Measurement parameters include: range, pulse width, average time, and wavelength. Analysis parameters include: IOR, scattering coefficient, end threshold, non-reflection threshold, reflection threshold, and samp. dist. For definitions of these parameters, refer to "Parameter Configuration" in Section 3 of this manual.

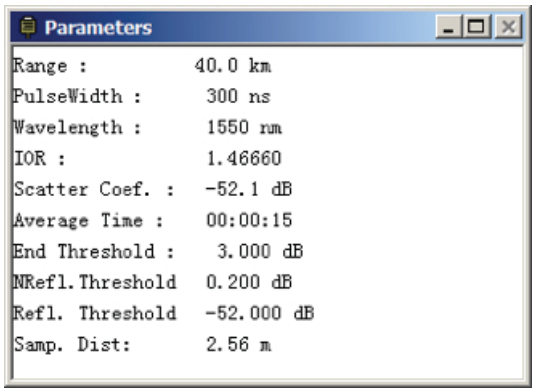


Figure 7-13. Parameters

Fiber Section Information Window

This window (Figure 7-14) displays the distance between marker A and B, attenuation coefficient, and loss information. The two point loss is the difference of vertical power between marker A and B. Two point attenuation is the two point loss of marker A and B divided by the horizontal distance between marker A and B.

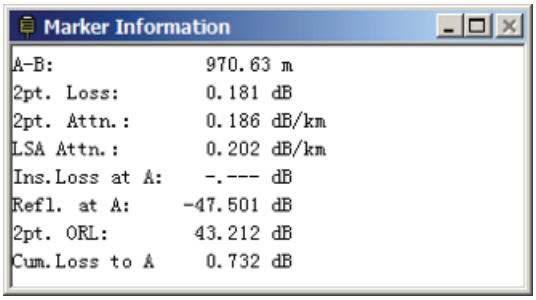


Figure 7-14. Fiber Section Information

Fiber Chain Information Window

The contents displayed in this window (Figure 7-15) are date of measurement, length of fiber chain, loss of fiber, attenuation, ORL, and event number of fiber.

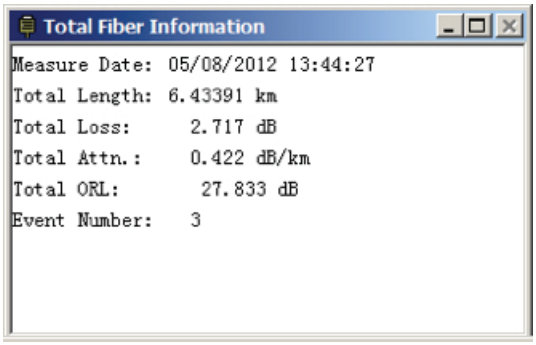


Figure 7-15. Fiber Chain Information

Software Functions

Upload Trace Data

Option 1:

Power off the 930XC, and then connect the 930XC to a PC via USB cable. Turn the 930XC on and wait for PC to recognize 930XC as an USB memory device. Find “trace” folder to copy saved files to PC.

Option 2:

Power off the 930XC, and then connect the 930XC to a PC via serial cable. Turn the 930XC on and run the 930XC OTDR Trace Viewer software. Under the “File” menu, select “Upload trace file…”, and the “Communications Settings” dialog box appears. Choose a communication port (RS-232) and click “OK”. Choose the saved position of traces, and then start uploading data.

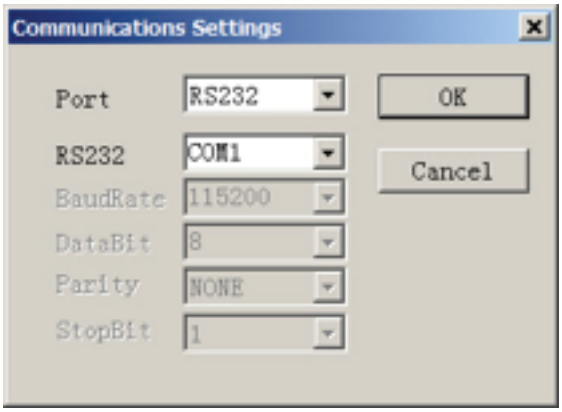


Figure 7-16. Upload Trace Data

Browse Traces

Tool Bar

Move the mouse pointer over the tool bar and an explanation of the buttons will pop up. Their functions are as follows:

 Open file

 Close file

 Save file

 Printing preview

 Printing

 Edit optical fiber information

 Zoom out trace

 Display whole trace

 Zoom in trace horizontally

 Zoom out trace horizontally

 Zoom in trace vertically

 Zoom out trace vertically

 Analyze insertion loss (the five-point measurement to test the insertion loss)

 Analyze reflectance

 Lock marker A and B

 Display version

Trace number (in multi-trace display mode)

Open Trace File

Select “Open trace file…” under the “File” menu, and choose the trace file to be reviewed (Figure 7-17). Select “Tile” under the “Window” menu to automatically rearrange the subwindows as shown in the figure below.

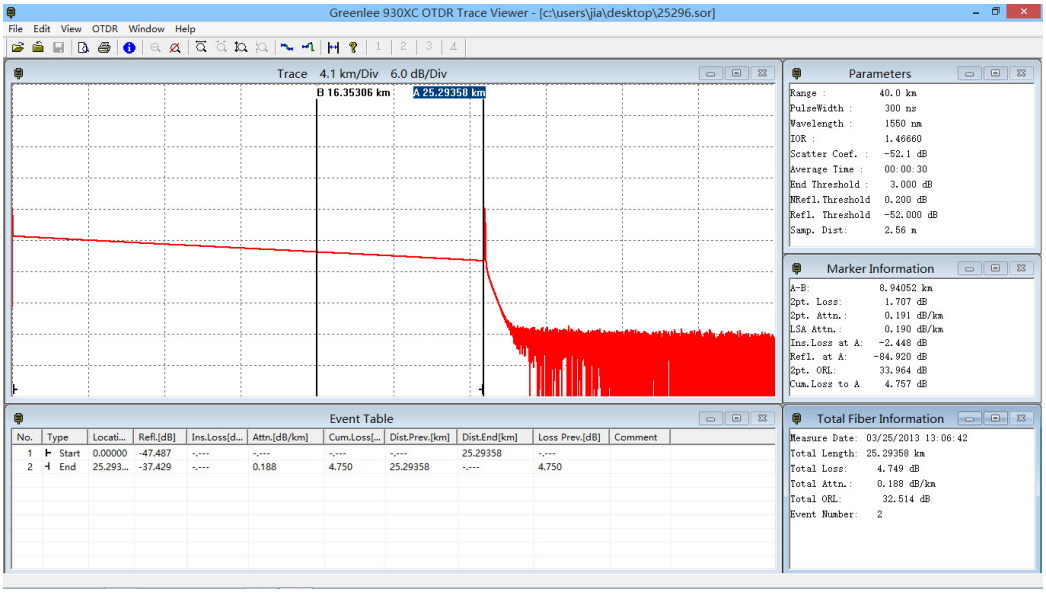


Figure 7-17. Open Trace File

Zoom in and out of Trace

Trace curves are displayed in the trace window (Figure 7-17).

To view in more detail, drag the marker to the trace detail to be reviewed and then:

- **Zoom in trace horizontally:** Click on the tool bar.
- **Zoom out trace horizontally:** Click on the tool bar.
- **Zoom in trace vertically:** Click on the tool bar.
- **Zoom out trace vertically:** Click on the tool bar.
- **Whole trace:** Click on the tool bar.

Or zoom in by drawing square with mouse on selected trace area from upper left to lower right direction, and zoom out by drawing square from any other direction.

Note:

- Zoom in or out is centered on the trace features of the activated marker.
- The software supports floating menu operation. Right click the mouse on the window in order to display the operations that can be performed, including zoom in and out of trace.

Review Trace Information

Trace information includes: trace measurement parameters, analysis parameters, fiber section information, fiber chain information, and the events list.

Trace Parameter

Measurement parameters and analysis parameters display in the parameter window (Figure 7-18).

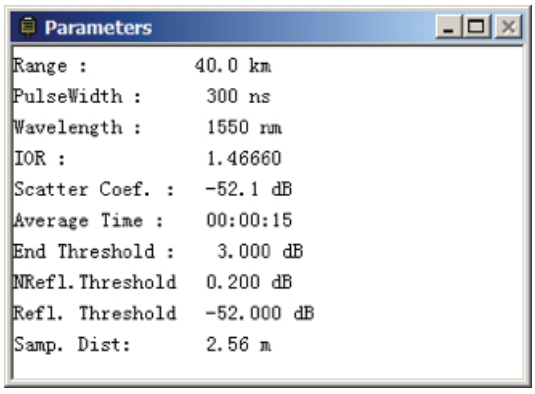


Figure 7-18. Parameters

Fiber Section Information

The distance between marker A and B should be considered as one section of optical fiber (Figure 7-19).

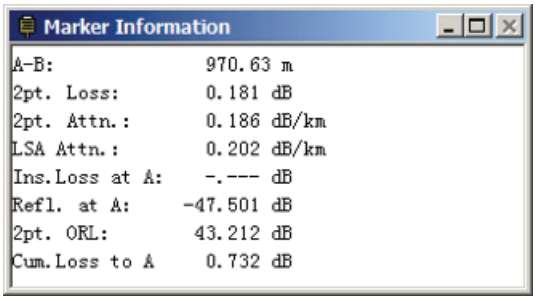


Figure 7-19. Fiber Section Information

Fiber Chain Information

The distance from beginning to end should be considered as a fiber chain (Figure 7-20).

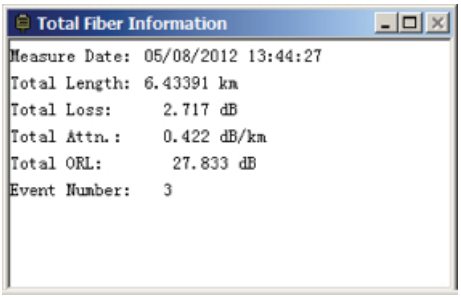


Figure 7-20. Fiber Chain Information

Review Events List

The trace curve decreases at a fixed slope. Any sudden peak or drop should be considered an event. The 930XC acquires measured data automatically and creates the events list (Figure 7-21).

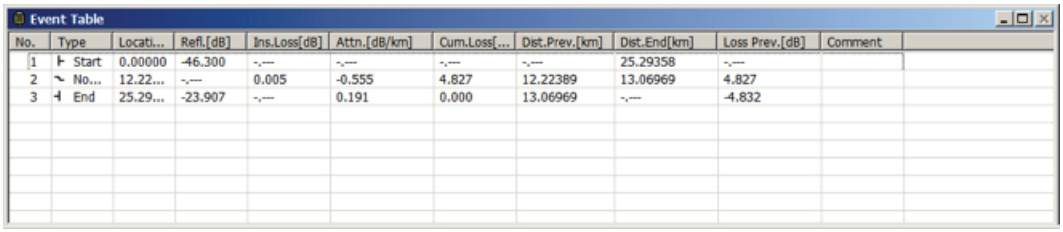


Figure 7-21. Review Events List

For details relating to the events list, refer to "Events List Window" in this section.

Save Trace

Opened trace files can be saved in the same manner as other files. Click "save trace file" under the "File" menu to save a trace with an existing file name. Click "save as trace file" under the "File" menu to save a trace with a new file name.

ASCII Format Output

Trace Viewer software provides a software interface so that data can be exported in ASCII format and then opened and viewed by a third-party application like MS Excel.

Select "ASCII format output" under the "File" menu (Figure 7-22). Select the information and format, and then press **Enter** to choose the path and file name.

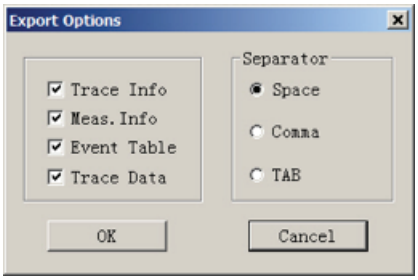


Figure 7-22. ASCII Format

Edit Optical Fiber Information

Select "Edit information of optical fiber" under the "Edit" menu, or click  to start editing optical fiber information (Figure 7-23). Information of optical fiber is a description of measurement trace displayed in the trace window. Users input relevant information for efficient management of measurement files. Upon completion of editing, press **Enter** to confirm.

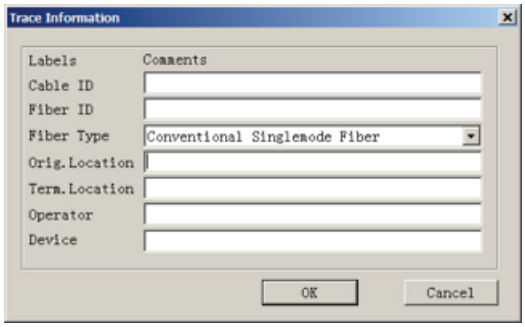


Figure 7-23. Edit Optical Fiber Information

Revise Events List

Because field measurement situations are constantly changing, the 930XC analysis software cannot guarantee that every analysis is correct. The software provides an interface for users to revise the events list: add event, revise event, delete event, and delete events list.

Add Event

If an event on the measurement trace is not listed in the events list (due to inaccuracies caused by poor SNR or inadequate parameter configuration), use the "add event" function to manually add this event into the events list. Click the events list window, and select "Add event" under the "Editing" menu (Figure 7-24). Choose the type of event from the pull-down menu, enter the event features, and then press **Enter** to add the event to the events list.

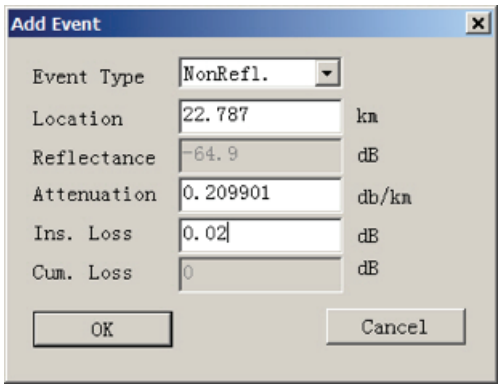


Figure 7-24. Add Event

Revise Event

Use the "revise event" function to manually revise features of an event (due to inaccuracies caused by poor SNR or inadequate parameter configuration). Select the event to be revised in the events list window, and select "Revise event" (Figure 7-25). After modifying the event feature(s), press **Enter** to confirm the changes. The software will automatically refresh the event sequence.

Events can also be revised by clicking on the event to access a pop-up menu.

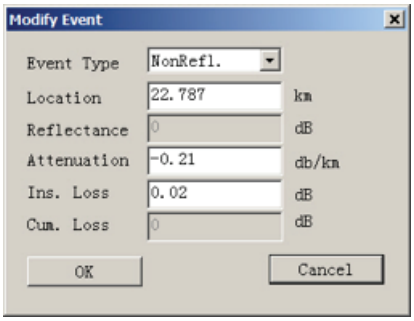


Figure 7-25. Revise Event

Delete Event

Use the "delete event" function to manually delete a trace from the events list when it appears in error (due to inaccuracies caused by poor SNR or inadequate parameter configuration). Highlight the event to be deleted, and then select "Delete event" under the "Editing" menu.

Events can also be deleted by clicking on the event to access a pop-up menu.

Printing

Printing Options

Select “Printing options…” under the “File” menu (Figure 7-26), to select the contents to be printed.

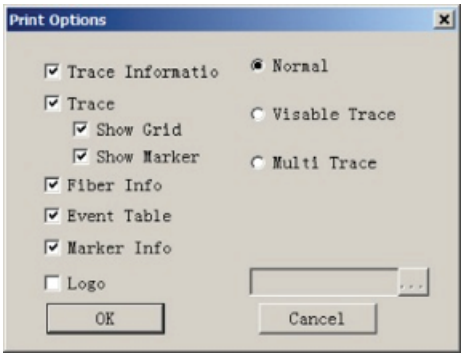


Figure 7-26. Printing Options

Printing Setup

Select “Printing setup” under the “File” menu (Figure 7-27) to select the printer, paper size, and printing orientation.

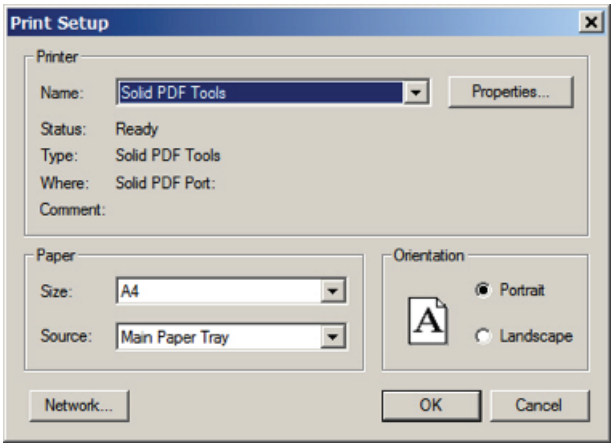


Figure 7-27. Printing Setup

Printing Preview

To preview the page before printing, select “Printing preview” under the “File” menu or click  on the tool bar (Figure 7-28).

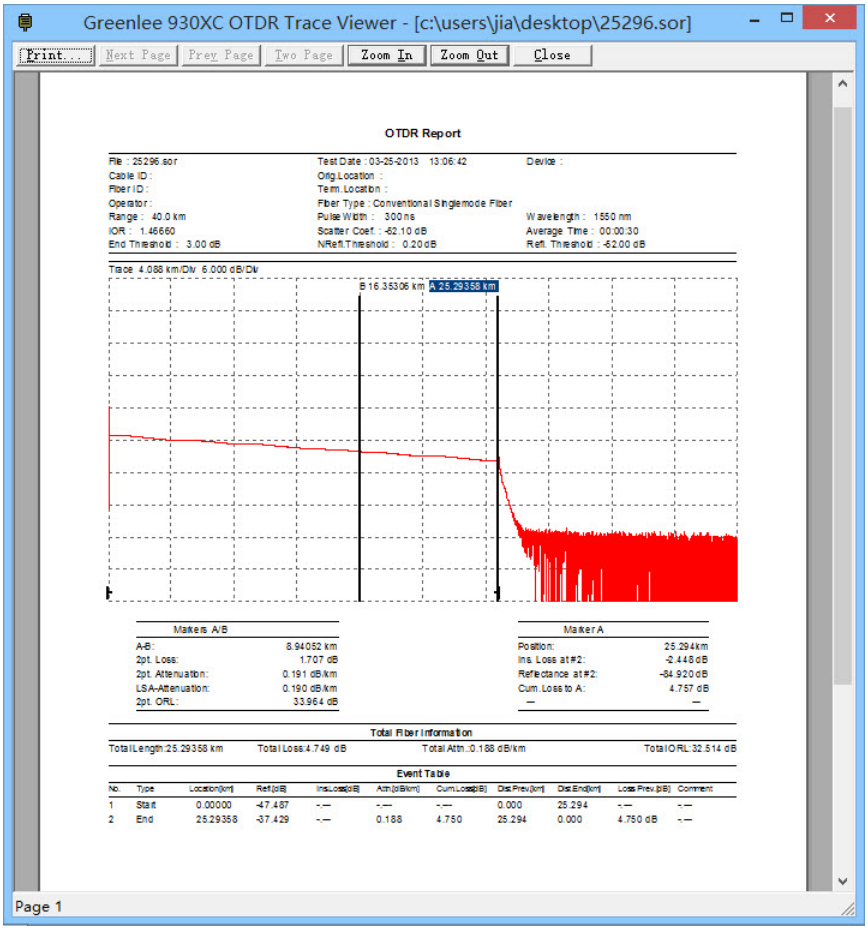


Figure 7-28. Printing Preview

Printing

Select “Printing” under the “File” menu, or click  on the tool bar (Figure 7-29).

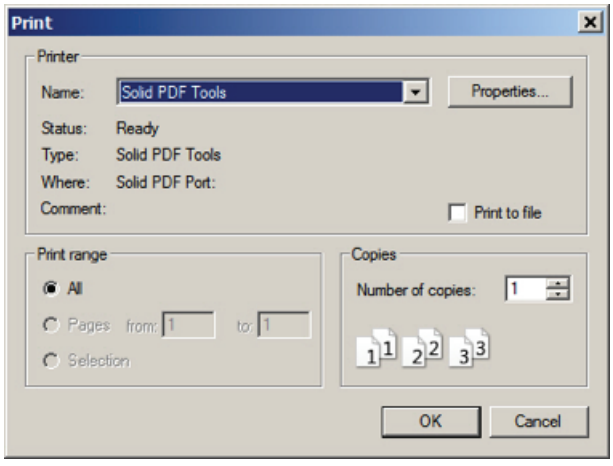


Figure 7-29. Printing

Batch Edit

The 930XC Trace Viewer software has a batch-edit function that allows users to edit the trace information of several trace files in the same folder at one time. Select “Batch Edit” under the “File” menu (Figure 7-30).

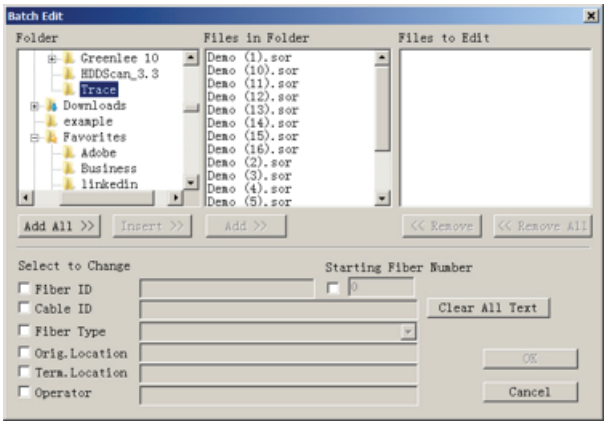


Figure 7-30. Batch Edit

Batch Print

The 930XC Trace Viewer software has a batch-print function that allows users to print several trace files in the same folder at one time. Select “Batch Print” under the “File” menu (Figure 7-31).

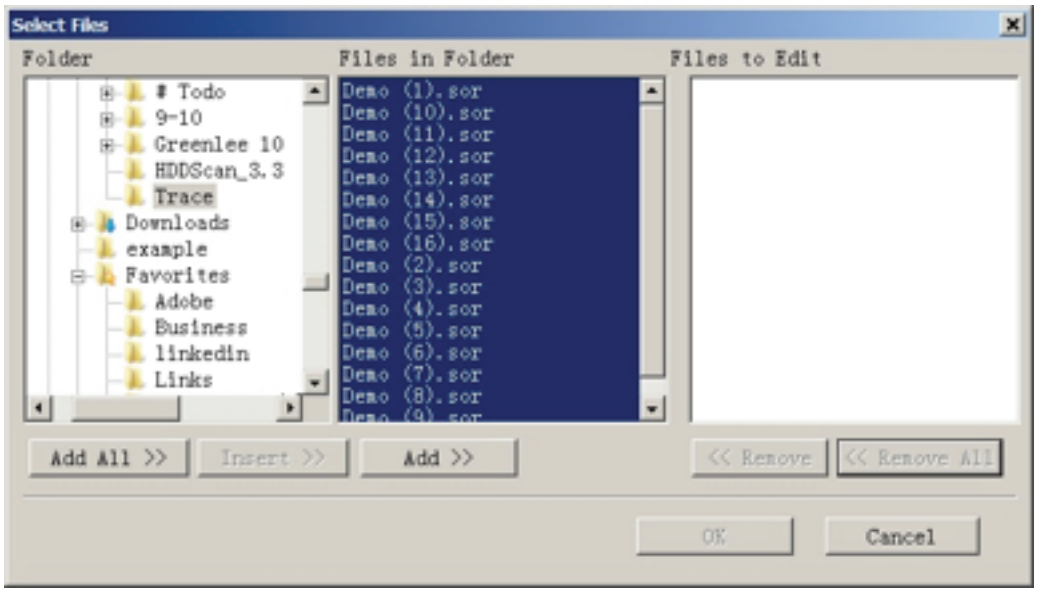


Figure 7-31. Batch Print

Batch Print Preview

To preview before batch printing, select “batch print preview” under the “File” menu (Figure 7-32).

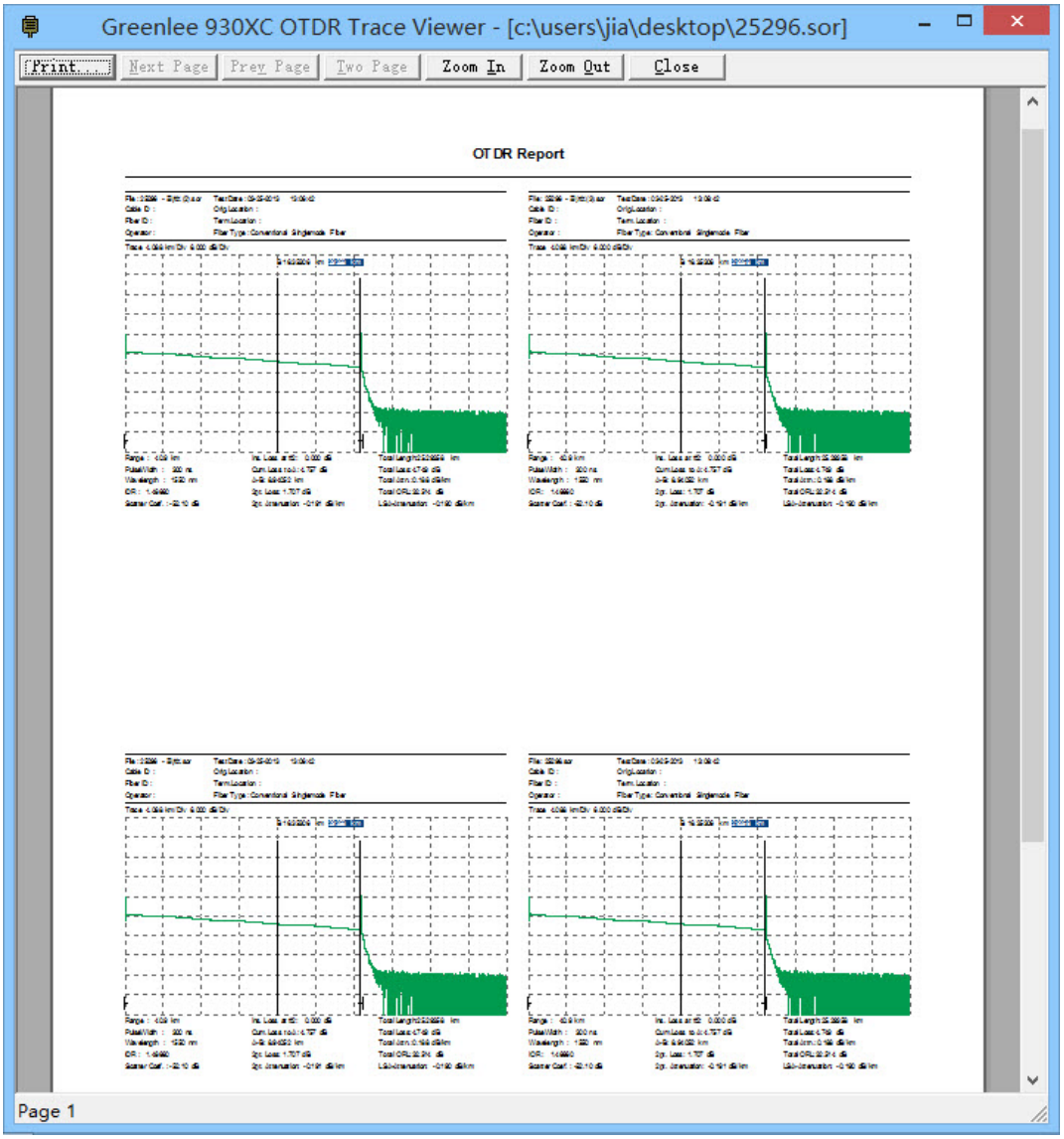


Figure 7-32. Batch Print Preview

Exit Software

Press “Exit” under the “File” menu (Figure 7-33) to exit the Trace Viewer software.

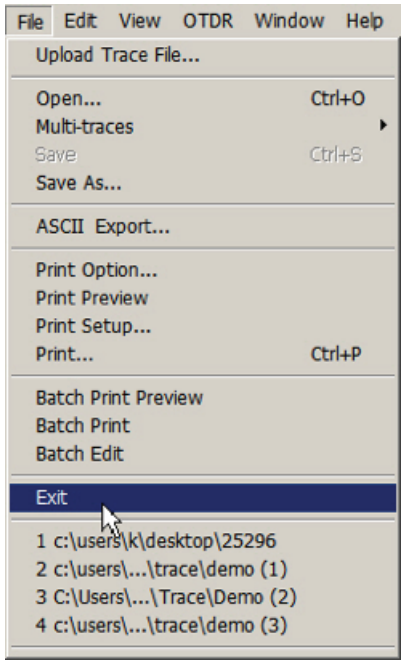


Figure 7-33. Exit Software