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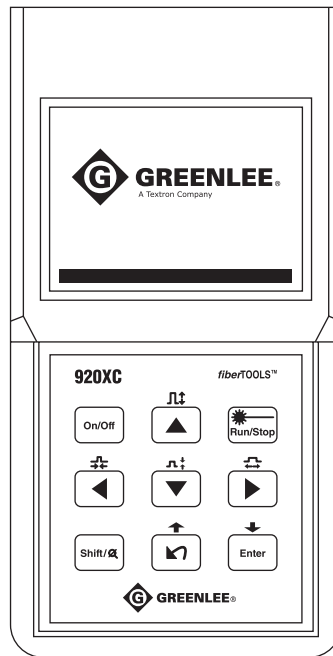
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INSTRUCTION MANUAL



920XC-20C • 920XC-20M 920XC-30F • 920XC-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

Table of Contents

Preface	5
Description	5
Safety	5
Purpose of This Manual	5
Warranty	5
Important Safety Information	6
Section 1. Introduction	9
Section 2. Basic Operation	11
Instrument Interface Description	11
Use of Batteries	12
Auto Off Mode	12
Recharging	12
Keypad Functions	13
Section 3. Basic OTDR Information	15
Principle of OTDRs	15
Basic Definition and Classification of Events	15
Reflection Events	15
Non-reflection Events	16
Inspection of Events	16
Measurement Application	16
Measurement Contents	16
Trace Analysis	16
Trace Display Screen	17
Trace Display Window	17
Information Window	18
Measurement Trace Parameters	18
Events List	18
Marker A/B Information	19
Fiber Information	19
Menu Bar and Icons	20
Parameter Configuration	20
Definitions of Measurement Parameters	21
Range Configuration	21
Pulse Width Configuration	22
Average Time Configuration	22
Wavelength Configuration	23
Measurement Mode Configuration	24
VFL Configuration (920XC-20C only)	24
Length Units	25
Index of Refraction (IOR) Configuration	25
Scatter Coefficient Configuration	26
Non-reflection Threshold Configuration	26

Reflection Threshold Configuration	27
End Threshold Configuration	27
Delete File	28
Time Configuration	28
Auto Off Configuration	29
Language Configuration	29
Contrast Adjustment of LCD.....	30
Color Mode Setting	30
Default Setting.....	31
Help	31
Battery Recharge Status	32
Section 4. Trace Measurement and Processing of Existing Traces	33
Graphical User Interface (GUI) Instructions	33
Trace Measurement	34
Setup.....	34
Auto Trace Measurement	34
Manual Trace Measurement	35
Live Traffic Warning	35
Reasons for Trace Measurement Failures	35
Information Window	36
Switching between Information Window Items.....	36
Reviewing Events List	36
Reviewing Marker A/B Information	36
Switching between Marker A/B	36
Information between Marker A/B	36
Zoom a Trace	36
Zoom out Trace Horizontally	36
Zoom in Trace Horizontally	36
Zoom out Trace Vertically.....	37
Zoom in Trace Vertically.....	37
Zooming Shortcuts.....	37
Re-analyze a Trace	37
Save a Trace	37
Browse Saved Traces	38
Upload Saved Traces.....	39
Alter Measurements in Realtime Testing.....	40
Section 5. Calibration and Maintenance	41
Calibration Requirements	41
Maintenance and Replacement of Batteries.....	41
Cleaning	42
Before Cleaning	42
Cleaning Interfaces and Connectors.....	42
Tools for Cleaning Interfaces and Connectors	42
Procedure for Cleaning Interfaces and Connectors	42

Section 6. Specifications	43
Section 7. Trace Viewer Software	45
Software Installation	45
Computer System Requirements	45
Installation	45
Software GUI	46
Graphical User Interface (GUI)	46
Menu, Tool Bar, and Status Bar	47
File (F)	47
Edit (E)	47
View (V)	48
Window (W)	48
Help (H)	48
Information Subwindows	49
Trace Display Window	49
Events List Window	49
Parameter Window	50
Fiber Section Information Window	51
Fiber Chain Information Window	51
Software Functions	52
Upload Trace Data	52
Browse Traces	52
Tool Bar	52
Open Trace File	53
Zoom in and out of Trace	53
Review Trace Information	53
Save Trace	55
ASCII Format Output	55
Edit Optical Fiber Information	55
Revise Events List	56
Add Event	56
Revise Event	56
Delete Event	56
Printing	57
Printing Options	57
Printing Setup	57
Printing Preview	58
Printing	59
Batch Edit	59
Batch Print	60
Batch Print Preview	61
Exit Software	62
Appendix A. Quick Reference Guide and Menu Shortcuts	63

Preface

Description

The Greenlee fiberTOOLS™ 920XC instruments are handheld Optical Time Domain Reflectometers (OTDRs) for measuring the specifications of single-mode optical fiber.

- The 920XC-20C measures optical fiber at 1310 nm and 1550 nm.
- The 920XC-20M measures optical fiber at 850 nm and 1300 nm.
- The 920XC-30F measures optical fiber at 1310 nm, 1550 nm, and 1625 nm.
- The 920XC-30P measures optical fiber at 1310 nm, 1490 nm, and 1550 nm.

Included with the 920XC instruments are the following:

- USB and serial data transfer cables
- Power adapter
- 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 920XC 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 Greenlee Textron 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.

 **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.

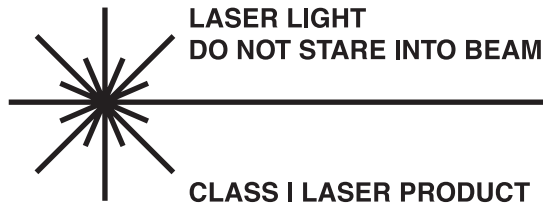
⚠ WARNING

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.

CAUTION



The 920XC 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 920XC 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 920XC 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 920XC 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 920XC-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.
- Auto recharging.



Section 2. Basic Operation

This section describes the basic operation of the 920XC instruments. Specific operations are explained in detail in Section 3 of this manual.

Instrument Interface Description

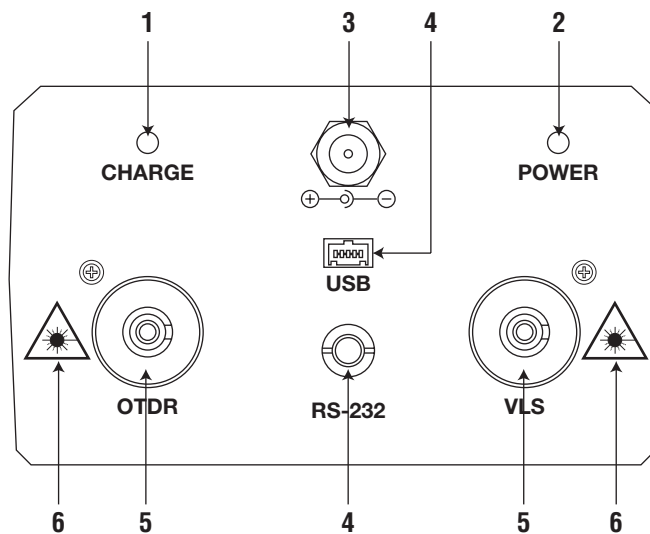


Figure 2-1. Interface Panel

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 and VLS (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.

Use of Batteries

The 920XC 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

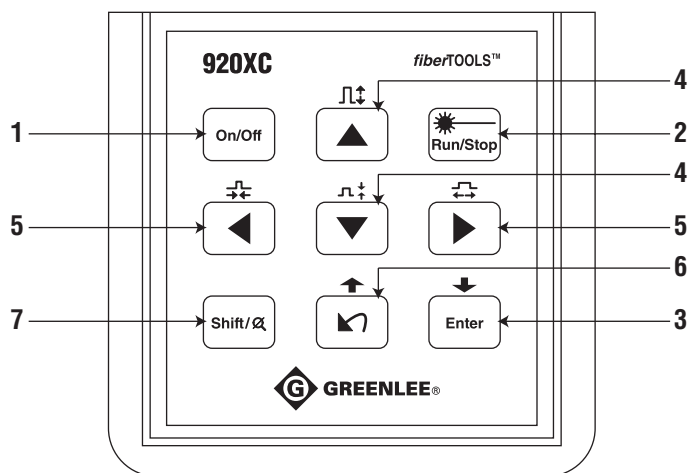


Figure 2-2. 920XC Keypad

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 browse down the events list.
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 zoom out or 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 up 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).

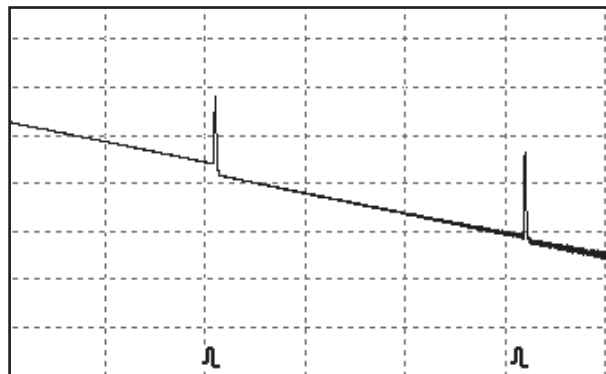


Figure 3-1. Reflection Event

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).

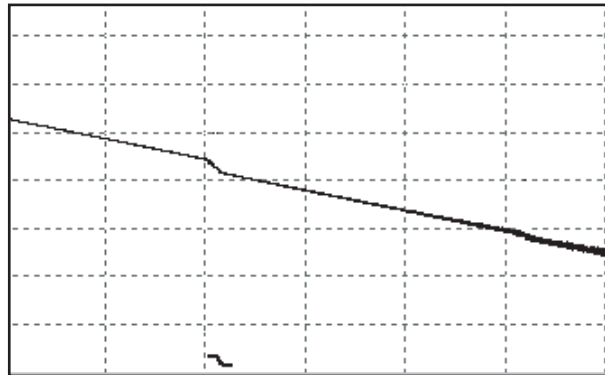


Figure 3-2. Non-reflection Event

Inspection of Events

The 920XC 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 920XC 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 920XC 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 920XC screen (Figure 3-3).

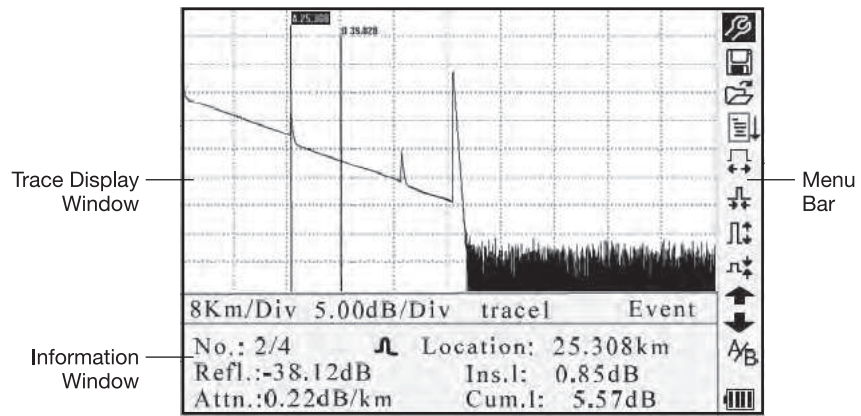


Figure 3-3. Trace Display Screen

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 920XC displays measurement results in a graphic form. The y-axis represents the power while the x-axis represents the distance (Figure 3-4).

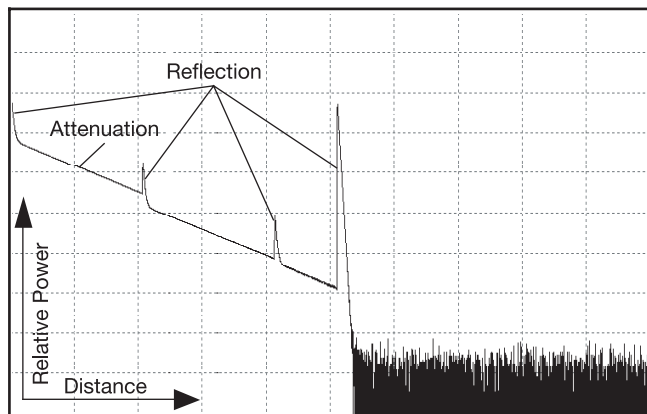


Figure 3-4. Traces and Coordinates

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).

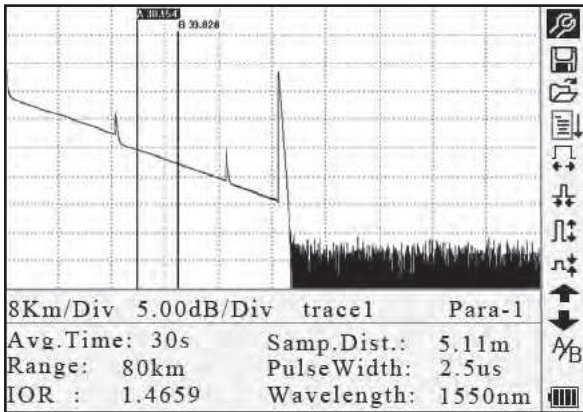


Figure 3-5a. Measurement Trace Parameters

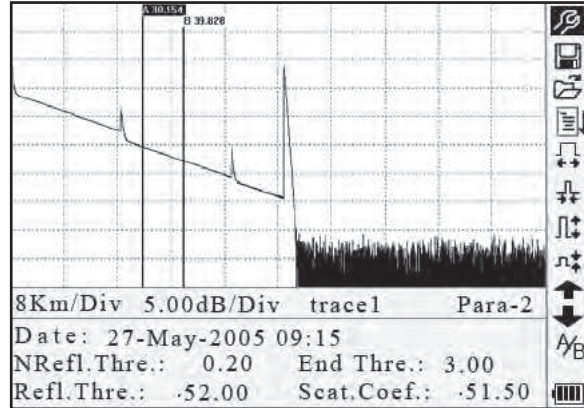


Figure 3-5b. Analysis Trace Parameters

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).

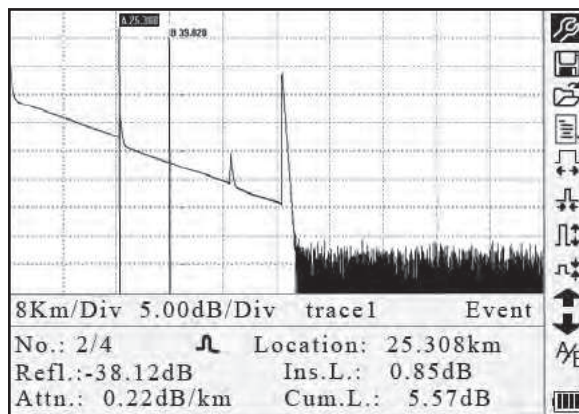


Figure 3-6. Events List

- **No.:** Event sequence number.
- **Four types of events:** ┆ begin end; ┘ reflection event; └ fiber end; ┘ attenuation 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).

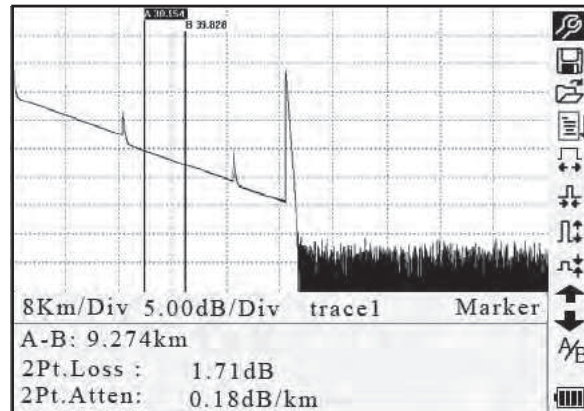


Figure 3-7. Marker A/B Information

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).

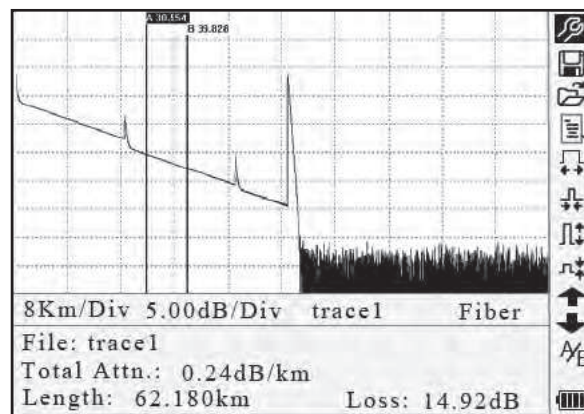














Figure 3-8. Fiber Information

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		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.

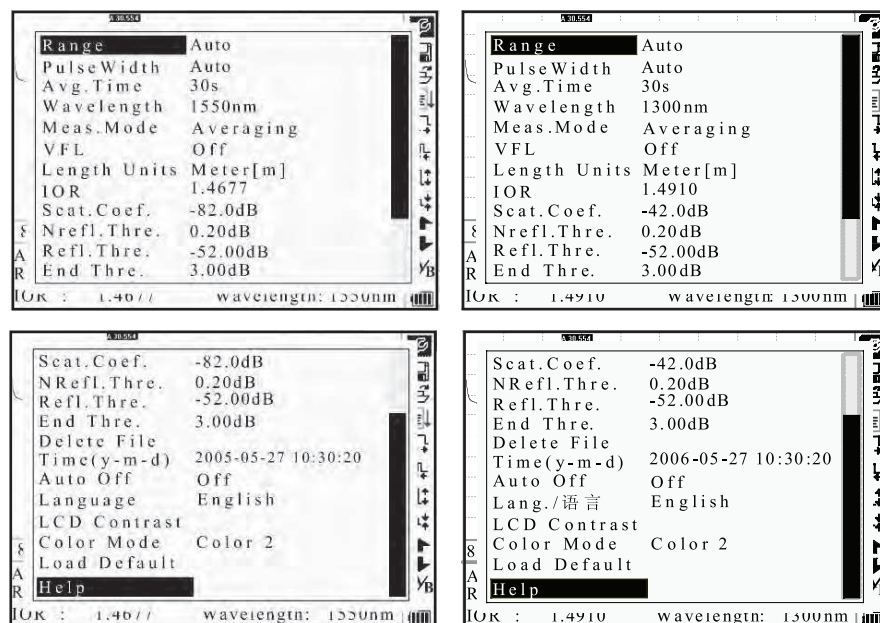


Figure 3-9. Parameter Configuration

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
VFL	Power on or off for visible laser
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 \geq the threshold displayed here
End Threshold	First event with insertion loss \geq 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 \blacktriangle and \blacktriangledown to highlight "Range." Press **Enter** to select a range (Figure 3-10). Press \blacktriangleleft to exit.

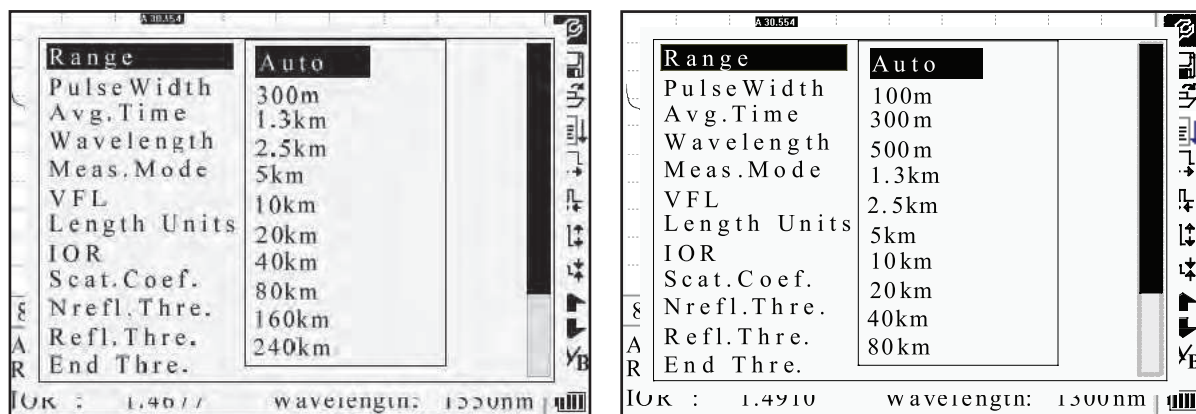


Figure 3-10. Range Configuration

Use \blacktriangle and \blacktriangledown 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.

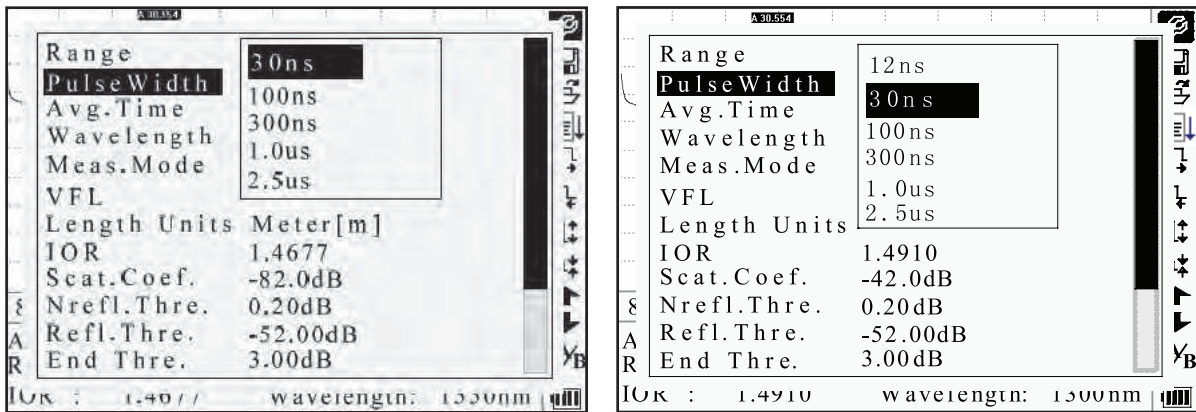


Figure 3-11. Pulse Width Configuration

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.

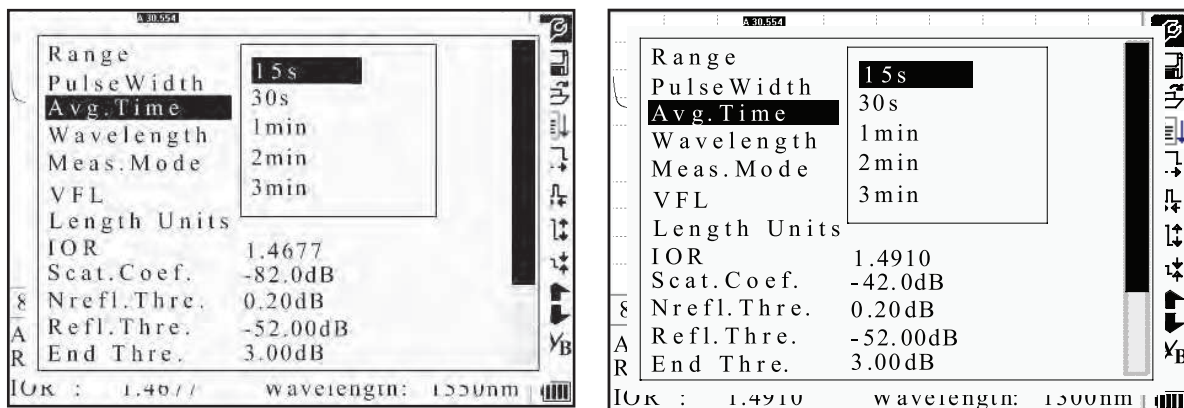


Figure 3-12. Average Time Configuration

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).

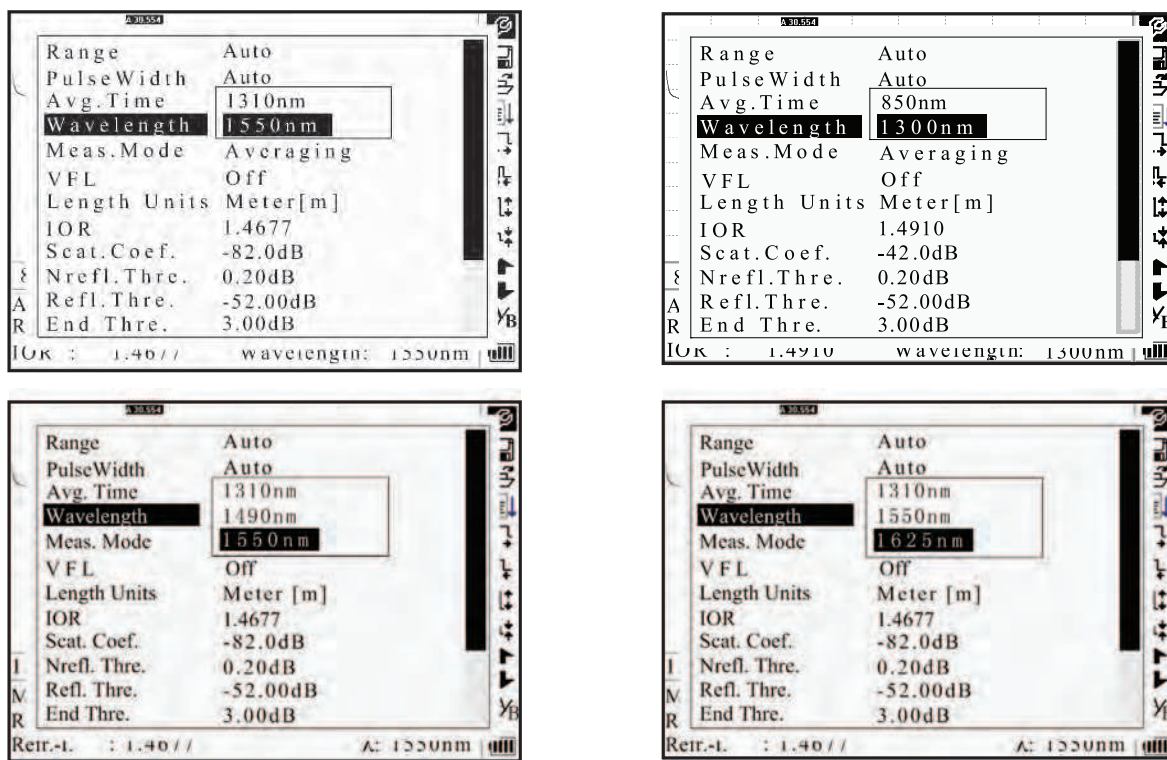


Figure 3-13. Wavelength Configuration

Measurement Mode Configuration

There are two kinds of measurement mode: averaging and realtime. Under realtime mode the 920XC will undertake realtime measurement for the connector of exterior fiber and refurbish the measure 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.

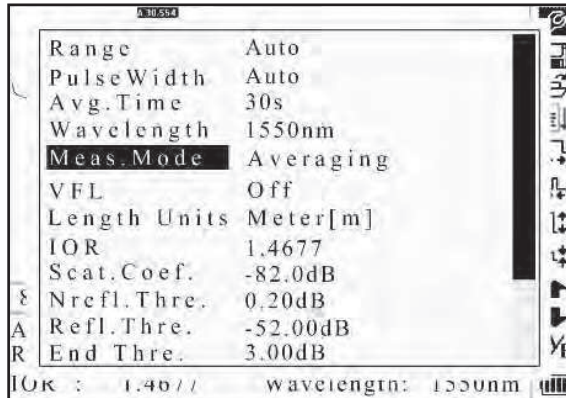


Figure 3-14. Measurement Mode Configuration

VFL Configuration (920XC-20C only)

Under the parameter configuration menu use **▲** and **▼** to highlight “VFL.” Depending on demand, press **Enter** to select “CW,” “1Hz,” or “Off.” Press **↵** to exit. When VFL is on, **☼** will be displayed under the **A/B** icon in the menu bar on the right (Figure 3-15).

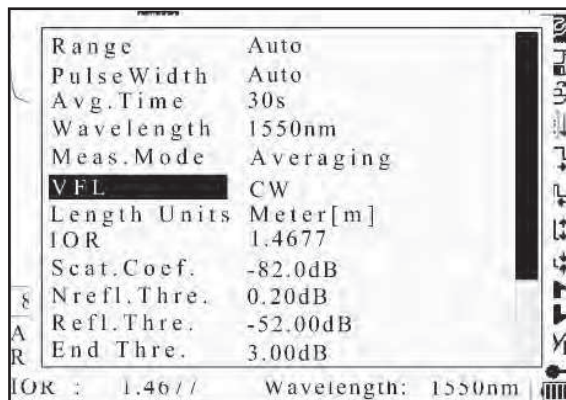


Figure 3-15. VFL Configuration

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.

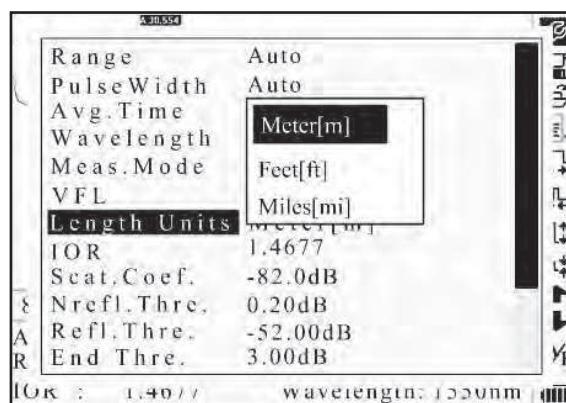


Figure 3-16. Length Units

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.

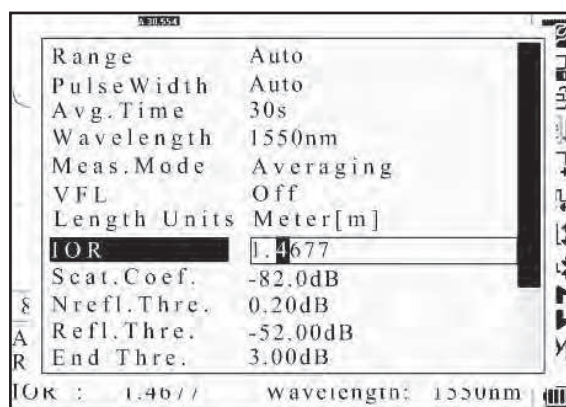


Figure 3-17. IOR Configuration

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