User's Manual

AQ1000
OTDR

Thank you for purchasing the AQ1000 OTDR (Optical Time Domain Reflectometer).

This user's manual explains the features, operating procedures, and handling precautions of the AQ1000. To ensure correct use, please read this manual thoroughly before operation. Keep this manual in a safe place for quick reference.

The AQ1000 comes with the following manuals. Please read all manuals.

List of Manuals

Manual Title	Manual No.	Description
AQ1000 OTDR User's Manual	IM AQ1000-01EN	This manual. A PDF file of the manual is contained in the internal memory of the AQ1000. The manual explains all the features and how to use them. For viewing instructions, see page 15 in the Getting Started Guide, IM AQ1000-02EN.
AQ1000 OTDRGetting Started Guide	IM AQ1000-02EN	This guide focuses on the handling precautions, basic operations, and specifications of the AQ1000.
AQ1000 OTDR Compliance with Radio Laws of Various Countries	IM AQ1000-03Z2	This manual explains the compliance with radio laws of various countries (for /WLN option)
AQ1000 OTDR User's Manual	IM AQ1000-92Z1	Document for China.

The "-EN" in the manual number is the language code.

Contact information of Yokogawa offices worldwide is provided on the following sheet.

Document No.	Description
PIM 113-01Z2	List of worldwide contacts.

Notes

- The contents of this manual are subject to change without prior notice as a result of continuing improvements to the instrument's performance and functions. The figures given in this manual may differ from those that actually appear on your screen.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer.
- Copying or reproducing all or any part of the contents of this manual without the permission of YOKOGAWA is strictly prohibited.

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Revisions

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3rd Edition: September 2019

Conventions Used in This Manual

Notes

The notes and cautions in this manual are categorized using the following symbols.

⚠ Improper handling or use can lead to injury to the user or damage to the instrument. This symbol appears on the instrument to indicate that the user must refer to the user's manual for special instructions. The same symbol appears in the corresponding place in the user's manual to identify those instructions. In the manual, the symbol is used in conjunction with the word "WARNING" or "CAUTION."

WARNING Calls attention to actions or conditions that could cause serious or fatal injury to the user, and precautions that can be taken to prevent such occurrences.

CAUTION Calls attention to actions or conditions that could cause light injury to the user or damage to the instrument or user's data, and precautions that can be taken to prevent such occurrences.

French

AVERTISSEMENT Attire l'attention sur des gestes ou des conditions susceptibles de provoquer des blessures graves (voire mortelles), et sur les précautions de sécurité pouvant prévenir de tels accidents.

ATTENTION Attire l'attention sur des gestes ou des conditions susceptibles de provoquer des blessures légères ou d'endommager l'instrument ou les données de l'utilisateur, et sur les précautions de sécurité susceptibles de prévenir de tels accidents.

Note Calls attention to information that is important for proper operation of the instrument.

Symbols and Conventions Used in Procedural Explanations

The contents of the procedural explanations are indicated using the following symbols.

Procedure Carry out the procedure according to the step numbers. All procedures are written under the assumption that you are starting operation at the beginning of the procedure, so you may not need to carry out all the steps in a procedure when you are changing the settings.

Explanation This section describes the setup items and the limitations regarding the procedures. It may not give a detailed explanation of the feature. For a detailed explanation of the feature, see chapter 2.

Character Notations

Panel Key Names and Button Names in Bold Characters
Indicate panel keys that are used in the procedure and buttons and menu items that appear on the screen.

Unit

k	Denotes 1000. Example: 400 km
K	Denotes 1024. Example: 400 KB (file size)

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Contents

1.1　Overview

This instrument is an OTDR (Optical Time Domain Reflectometer) with the features listed below. It is used in the optical fiber and line installation and maintenance servicing of access networks, which link telephone exchanges and service providers with subscribers, and user networks, which enable communication within a corporation or building.
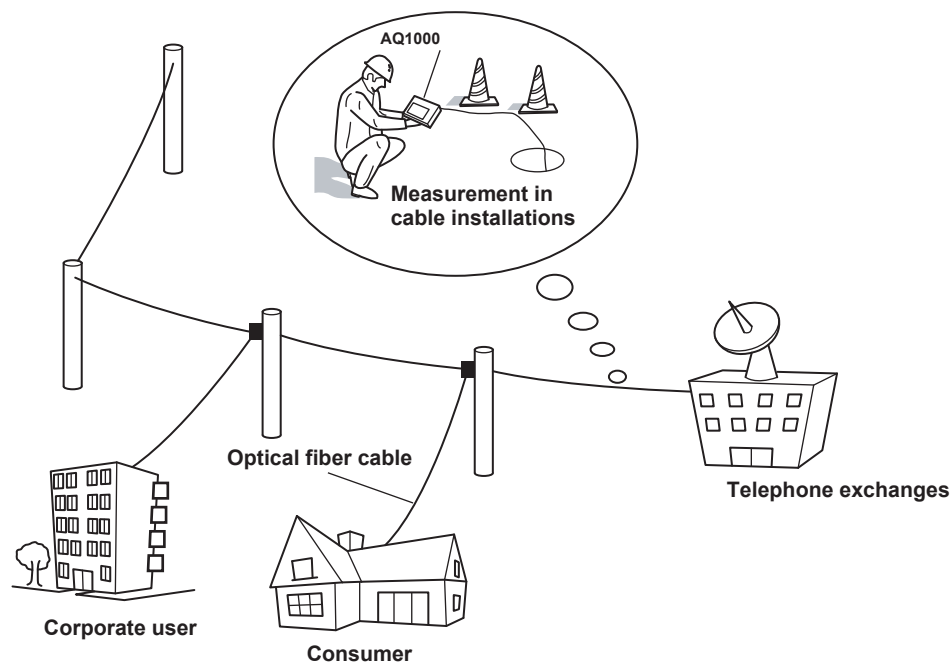
OTDR Features

OTDR stands for optical time domain reflectometer. The AQ1000 displays waveforms (TRACE mode) or icons (MAP mode) that you can use to detect fault locations in optical fiber cables and monitor fault conditions (transmission loss, splice loss, etc.). It is mainly used in the following optical fiber cable installation and maintenance situations.

- Access network connecting telecom carriers and subscribers, including service providers (SM[*] optical fiber cable)
- Network between telecom carriers (segments with relatively short distance)
  * SM: Single mode

Optical Pulse Measurement

- **Averaged Measurement (TRACE mode)**

  A measurement in which measurements are taken several times and the measured values are averaged to display the waveform.

- **Averaged Measurement (MAP mode)**

  After averaged measurement is performed, the OTDR waveform is automatically analyzed, and the results are displayed using icons for each event type.

- **Real-Time Measurement (TRACE mode)**

  While optical pulse measurement is in progress, measured values are updated and displayed as a waveform in real time.

Optical Pulse Waveform Display (TRACE mode)

The results of optical pulse measurement is displayed as a waveform. The displayed waveform can be zoomed and moved.

Analysis results are displayed on the waveform as events.
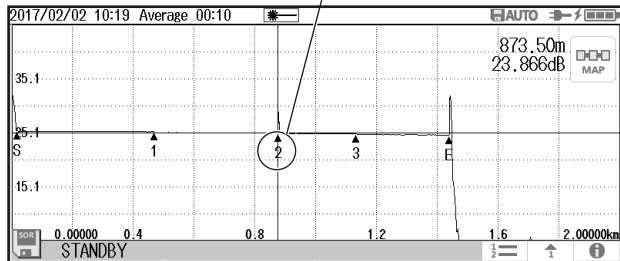
Zoom the waveform at the cursor position
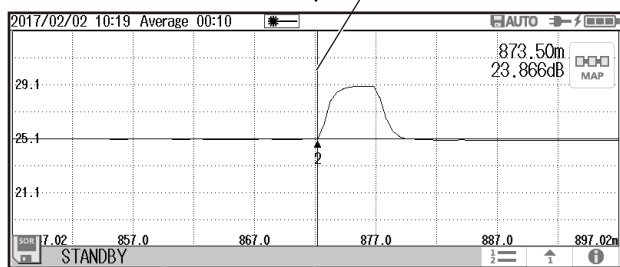
Event Icon Display (MAP mode)

The AQ1000 can perform an averaged measurement and then automatically display the measured result events as icons on the screen. In addition, if pass/fail judgment conditions are specified, judgment results are displayed with icon colors. For details on the pass/fail judgment function, see section 1.5.

Analysis results are displayed as icons.
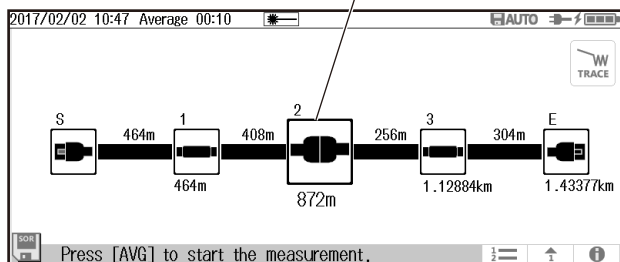
Optical Pulse Analysis

• **Waveform Analysis**

The following events can be analyzed using cursors and markers.
  • Distance
  • Splice loss
  • Return loss
    Return loss between markers can be analyzed.

• **Event Analysis**

Events are automatically detected. In addition, you can edit events. Adjustments can be made when certain events cannot be detected or when noise is detected as events.

1

Features

Light Source Feature

Stabilized Light Source

This is used as a light source for measuring optical loss or as a light source for optical fiber identification. The measurement light (CW, CHOP) is emitted from the OTDR port. The wavelength of the measurement light is the same as that of the optical pulse of the OTDR.

Visible Light Source (/VLS option)

This is used to view the fault locations or check the cores of multi-core optical fiber cables. The VLS port transmits a visible light (CW, CHOP (2Hz)) with an emission wavelength of 650 nm.

Optical Power Meter Feature

Power Checker

The OTDR port enables you to check the presence of communication light (fiber in use) within the optical fiber cable under measurement and view its power value.

USB Feature

USB Storage Medium Connection (Type A)

USB storage media complying with USB1.0/1.1/2.0 can be used. You can save waveform data and measurement conditions to them.

PC Connection (Type B Micro-B)

The AQ1000 can be accessed as a mass storage device from a PC, and the files and folders in the internal memory can be displayed and manipulated.

Wireless LAN Feature (/WLN option)

You can connect a PC to the AQ1000 through wireless LAN and control it remotely. A dedicated software application is necessary for remote control. Moreover, measured data saved in the AQ1000 can be transferred to a server or the like through wireless LAN.

1.2 Optical Pulse Measurement

The AQ1000 applies an incident optical pulse to the connected optical fiber cable and measures the power level of the reflected light from the different sections of the optical fiber cable such as its connections, bent sections, and the open end of the fiber. The AQ1000 uses the measured power level to determine the distance to the different points (splices, breaks, etc.) of the optical fiber cable and the loss and other phenomena that occur at those points. For details on how to view optical pulse waveforms, see section 1.3.

Optical pulse output

Optical fiber cable being measured

Reflection point

Reflected light

**OTDR/
Light source port**

Do not bend the optical fiber cable.
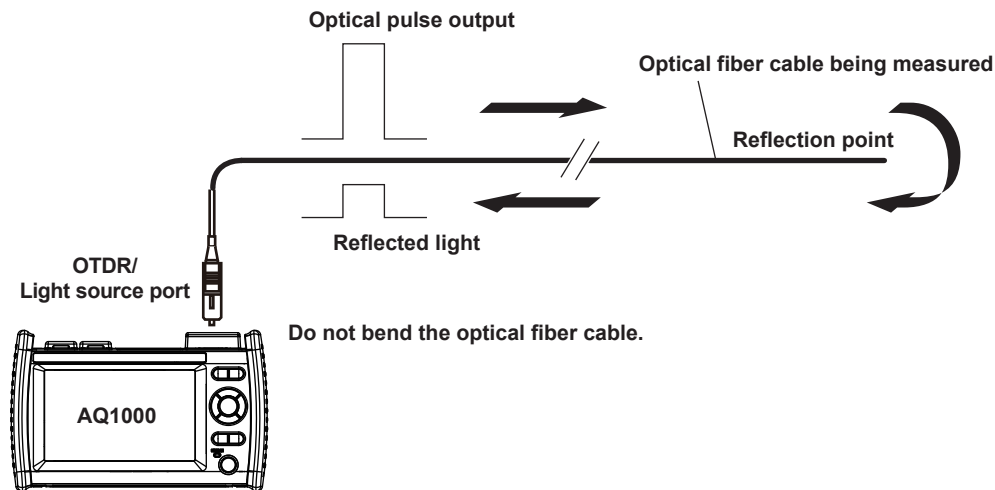
AQ1000

Averaged Measurement

Averaged measurement is effective when you want to detect reflections, splice loss, and other faint events that are generated from connections or splice points but are buried in noise. The AQ1000 derives the measured data by averaging the specified number of optical pulse measurements or by averaging optical pulse measurements over the specified duration. During averaged measurement, you cannot change the measurement conditions. You can stop an averaged measurement before it completes.

• **Multi Wavelength Measurement**
  Two wavelengths, 1310 nm and 1550 nm, can be measured with one measurement operation. When a measurement is started, an averaged measurement is performed at 1310 nm. Then, the wavelength is automatically switched to 1550 nm, and another measurement is made.

Real-time Measurement

Real-time measurement is a feature that measures optical pulses while updating and displaying the measured values. You can monitor in real time events, such as splice loss and return loss, while installing optical fiber cables. You can also view the changes in the waveform as you change the measurement conditions, such as the wavelength, distance range, and pulse width. Real-time measurement is not possible in MAP mode (the mode is automatically switched to TRACE mode before making a measurement).

Auto Check before Measurement

- **Fiber-In-Use Alarm**

  The AQ1000 uses the same wavelength that is used in real communication to measure optical pulses. If communication light is present in the optical fiber cable that you want to measure, the communication will be affected. When this communication light is present, we say that the fiber is in use. The fiber-in-use alarm is a feature that checks if communication light is being transmitted along the optical fiber cable that you are trying to measure. If the fiber is in use, a warning message is displayed asking whether you want to continue the measurement.

- **Connection Check**

  The connection check is a feature that checks the state of the connection between the AQ1000 and an optical fiber cable. When this feature is set to on, you can prevent light from being transmitted from the AQ1000 OTDR port if an optical fiber cable is not connected to the AQ1000 or if the cable is not connected correctly.

1.3 Displaying Measured Data

How to View Optical Pulse Waveforms (TRACE mode)

The optical pulse applied to the optical fiber cable is reflected at different points of the optical fiber such as its connections, bent sections, and the open end of the fiber. These sections generate loss. The measured result is displayed as a waveform that has distance represented in the horizontal direction and loss level represented in the vertical direction. On the waveform, detected losses or reflections are known as events.
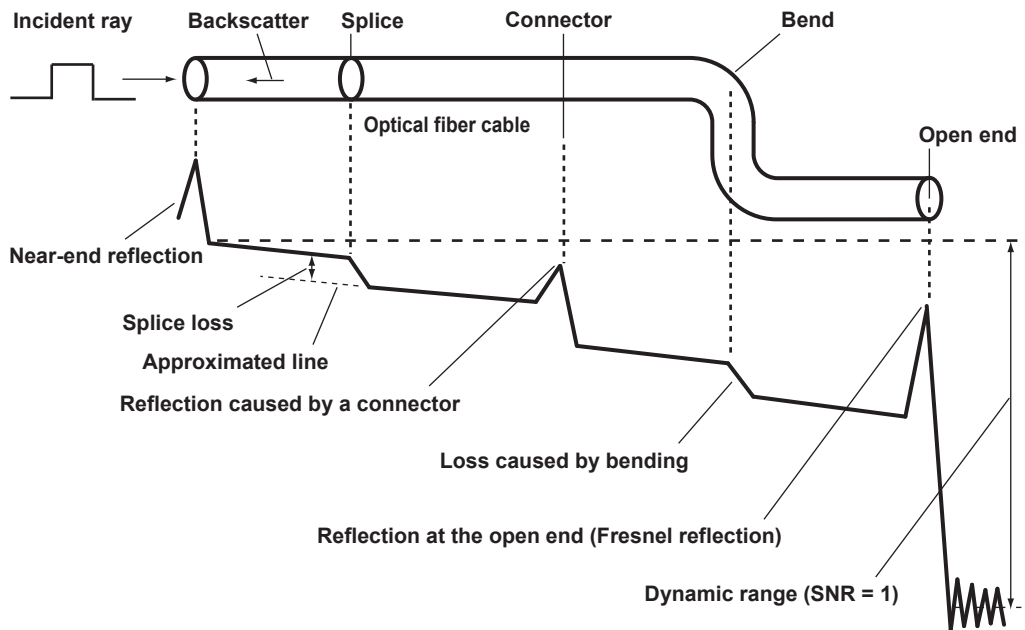
How to View the Icon Display (MAP mode)

Losses and reflections that occur at connections, bent sections, and open ends are displayed using icons. Events in the section from the measurement start point to the open end are displayed in order from the start point.

Each event is displayed as an icon.
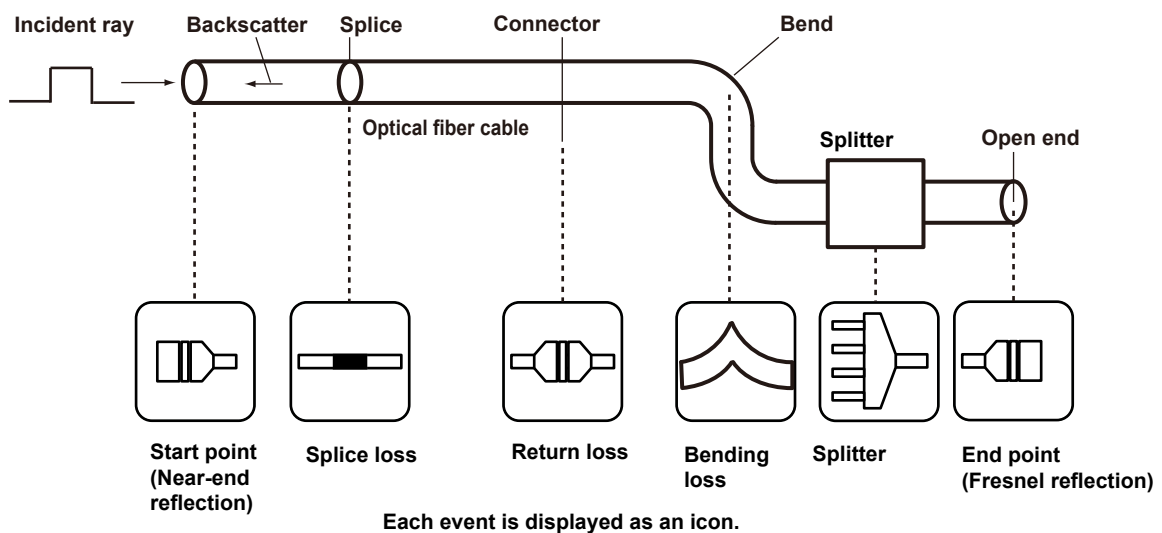
1.4   Analyzing Measured Data

Marker Analysis (TRACE mode)

You can use cursors and markers to measure values such as the distance, splice loss, and return loss between two points.

Distance between Two Points

The distance from the start point to the cursor position is displayed.

Splice loss

When you place four markers as shown in the following figure, the splice loss is calculated, and the value is displayed.

Return Loss

When you place two markers as shown in the following figure, the return loss is calculated, and the value is displayed.

Event's rising start position (① marker)

Event's falling end position (② marker)

Return loss
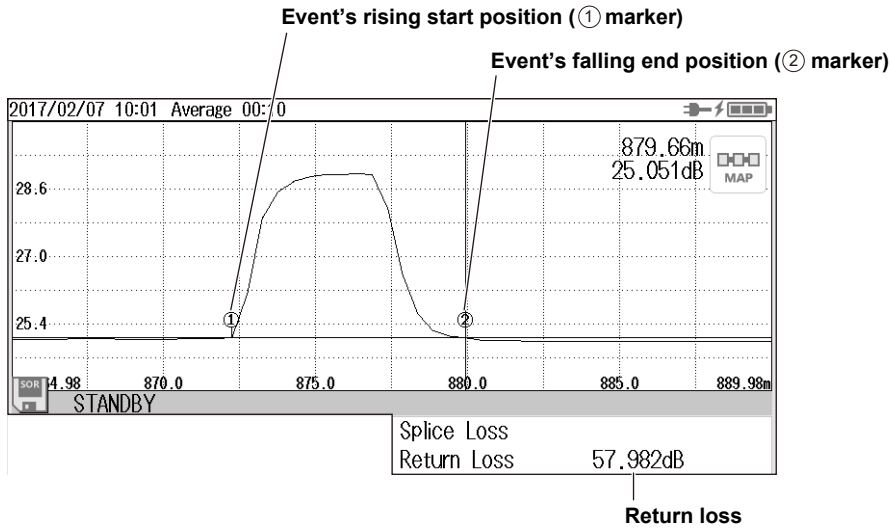
Event Analysis

Events are automatically detected from the waveform of optical pulse measurements and displayed on the screen.

Event Display

In TRACE mode, detected events are displayed on the measured waveform. In MAP mode, the types of events are displayed using icons along with the distances of each from the measurement start position.

TRACE mode

Event number

MAP mode

Displays the event type with an icon

Distance between events

Event number
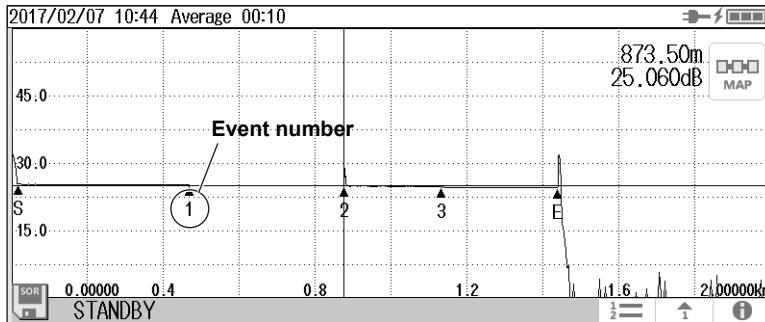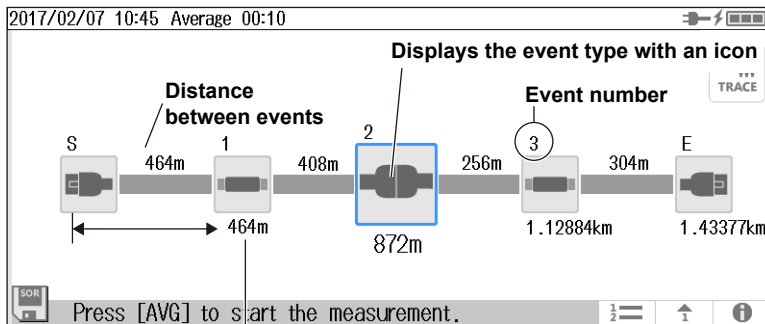
Distance from start point S

Event Information Display

The distance, splice loss, return loss, and the like of each event are displayed. This is a feature common to TRACE mode and MAP mode.

• **List Display**

All detected events are listed.
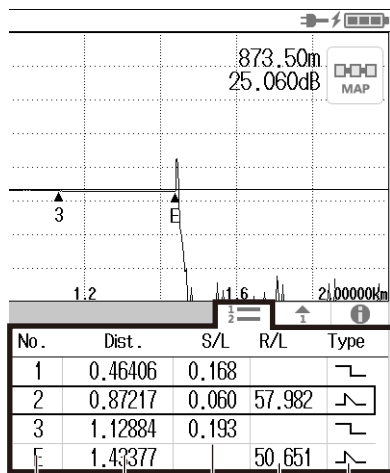
873.50m
25.060dB
MAP

3   E

1.2   1.6   2.00000Km

No.	Dist.	S/L	R/L	Type
1	0.46406	0.168		⌐
2	0.87217	0.060	57.982	⋀
3	1.12884	0.193		⌐
E	1.43377		50.651	⋀

Event type

Return loss or dB/km
Switches each time you tap   : **Positive splice loss**

: **Negative splice loss**

Splice loss   : **Reflection**

Distance from the measurement start point (S)   : **Bending loss (macro bending)**

Event number   : **Splitter insertion loss**

• **Individual Event Information**

The measured data of the selected event number is displayed.

873.50m
25.060dB
MAP

3   E

1.2   1.6   2.00000Km

No.2	⋀	0.209dB/km
Distance		0.87217km
Splice Loss		0.060dB
Return Loss		57.982dB
Cumm. Loss		0.352dB
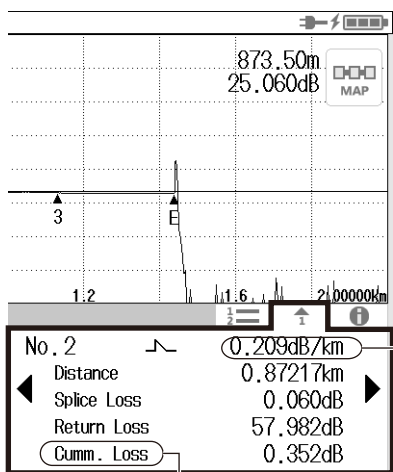
Loss per kilometer between events

Cumulate loss from the measurement start point (S)

- **Measurement Total of Events**

  The total values of detected events are displayed.

Wavelength	1310nm
Distance	3.95274km
Total Loss	2.139dB
Total RL	35.494dB
dB/km	0.541dB/km

Distance from the measurement start point (S) to the measurement end point (E)

Total loss (cumulate loss)

Total return loss

Loss per kilometer between events
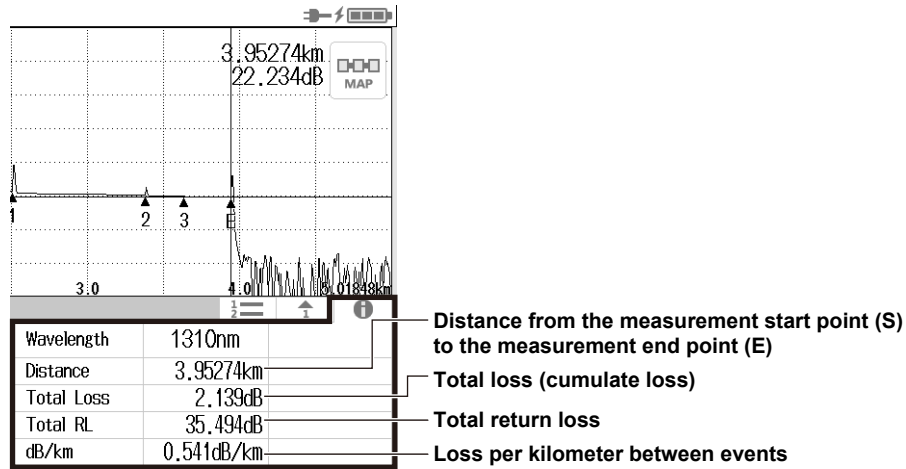
Event Analysis Conditions

You can set event search conditions.

- **Splice Loss (splice/connection)**

  The AQ1000 recognizes that an event has occurred when it detects a measured result that is greater than the specified value.

- **Return Loss**

  The AQ1000 recognizes that an event has occurred when it detects a measured result that is less than the specified value.

- **End of Optical Fiber**

  The AQ1000 recognizes that an end-of-fiber (E) event has occurred when it detects a measured result that is greater than the specified value.

- **Bending Loss**

  You can select whether to detect bending losses. If you select to detect them, the AQ1000 recognizes that an event has occurred when it detects a measured result that is greater than the specified threshold.

- **Near-end Dead Zone Prevention (Launch Fiber Setting)**

  To prevent near-end reflections, if a launch fiber is connected to the measurement start point, the length of the launch fiber is automatically corrected in the calculations.
  For details on near-end dead zone prevention, see the appendix.

1.5   Pass/Fail Judgment

In pass/fail judgment, the AQ1000 automatically determines whether preset conditions are met based on the event analysis data and displays the results on the screen.

Judgment Conditions

You can set a pass/fail judgment threshold on each measurement item. When the measurement value does not exceed the threshold, the corresponding event is indicated as pass. When the measurement value is greater than the threshold, the corresponding event is indicated as fail.

TRACE mode
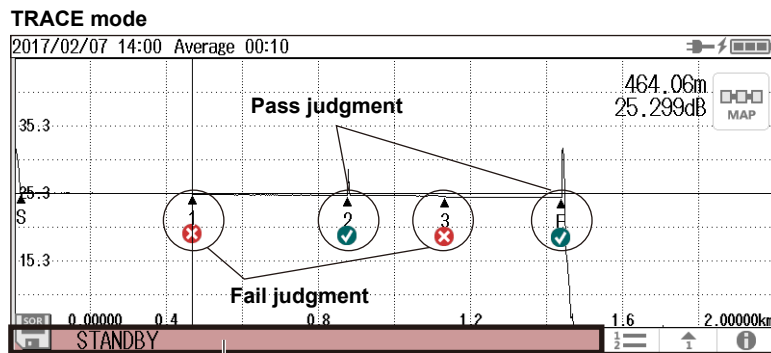
When all events are judged as Pass, the bar turns green.

MAP mode
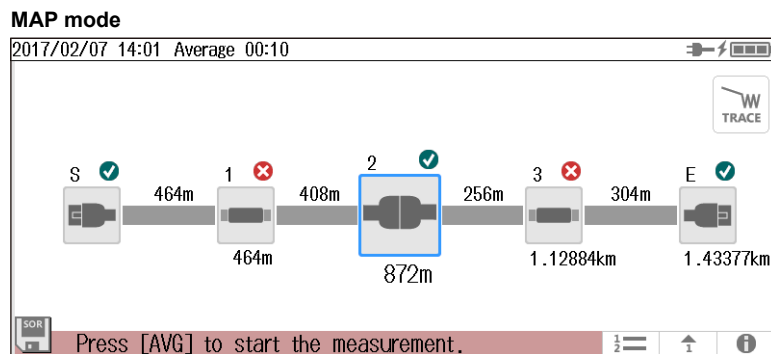
- **Judgment Items**
  Connector loss
  Splice loss
  Return loss
  Loss per kilometer between events (dB/km)
  Total loss

1.6 Light Source and Power Checker

Loss-Measurement Light Source

The following measurement light wavelengths can be generated.

Model	Measurement Light Wavelength
AQ1000	1310nm, 1550nm

You can produce continuous light or light that has been modulated at the selected frequency (modulation mode).

Visible Light Source

The features listed for the visible light source are available on models with the /VLS option.

Visible light can be used for the following purposes.

• Determine visually breaks in the optical fiber cable under test
• Check the cores of multi-core optical fiber cables

Model	Measurement Light Wavelength
AQ1000	650 nm

Power Checker

The power checker feature is used to check the power of the loss-measurement light source in a simplified manner.

The following measurement lights can be measured.

Model	Measurement Wavelength
AQ1000	1310nm, 1490nm, 1550nm, 1625nm, 1650nm

1.7   File Features

File Operation

Measured results (waveform data), measurement and analysis conditions, system settings, and the like can be saved as files to internal memory or external memory (USB memory). You can efficiently configure multiple AQ1000s to the same conditions by loading a file containing measurement and analysis conditions, system settings, and the like. In addition, the AQ1000 can save measured waveform data as PDF data in report format.

Saving and Loading Files

The following types of files can be saved.

- **.SOR**

  A file for saving optical pulse measurement results. Measurement and analysis conditions, waveform data, event list data (when event analysis is executed) are stored in this file. When an SOR file is loaded, the measurement and analysis data is loaded into the AQ1000, the waveform data is displayed on the AQ1000 screen. If event list data is stored, event analysis results are also displayed. This file is useful when you want to save an SOR file at a site where optical fiber cables are being installed and load the file into another AQ1000 at a different site.

  SOR files saved on other instruments cannot be loaded into the AQ1000.

- **.PDF**

  A file for saving the current waveform displayed on the AQ1000 screen or waveform data of an already saved file in a PDF report format.

- **.CFG**

  A file for saving the AQ1000 system settings (device, connection, etc.). This file is useful when you want to apply the same system settings to several AQ1000s.

- **.BMP, JPG**

  A file for saving a screen image of the AQ1000. This file is useful when you want to view the screen content on the PC screen. BMP and JPG files cannot be loaded into the AQ1000.

- **.SOZ**

  A file for saving multiple waveforms measured simultaneously.

Copying and Deleting Files

You can copy or delete all the files and folders in the internal memory or external memory. You can also copy or delete selected files or folders.

Renaming Files

You can rename existing files and folders.

Creating Folders

You can create a folder with a name of your choice in which optical pulse measurement results are saved automatically. In the OTDR settings explained in section 8.1, you can set the name of the folder in which to save the results automatically. When you select a folder that you created with a name of your choice, measurement results can be saved automatically to this folder.

Creating Reports

You can save the current optical pulse measurement and analysis conditions, waveforms, and events as a report on a single sheet in a PDF file. You can choose which items to include in the report.

File Reporting

You can specify several saved SOR files and save the content of the files one at a time as a report on a single sheet in a PDF file. You can choose which items to include in the report.

Selecting Drives

You can set the save destination to the following internal and external memories.

- **Internal memory**

  The memory inside the AQ1000. The size is about 480 MB. It cannot be removed.

- **USB memory**

  USB storage media.

1.8 System Features

Power-Save Mode

To suppress battery consumption, you can set the screen brightness and a screen saver. You can set different screen brightness levels for battery operation and USB-AC adapter operation.

LCD Brightness

You can select from four brightness levels (including OFF). You can choose the appropriate level depending on the ambient light during outdoor use. You can turn off the display except when viewing the measured data to suppress battery consumption.

Auto Sleep

If the AQ1000 is turned on and is not accessed for a certain time, the AQ1000 automatically switches to sleep mode to suppress battery consumption.

Factory Default Settings

Setup

The following setup conditions are reset to their factory defaults. Note that files in the internal memory are not deleted.
* OTDR settings (section 8.1)
* File settings (section 8.2)
* System settings (section 8.3, except the date and time)
* Power checker, light source, and visible light source settings (chapter 6)

All

All the above setup conditions are reset to their factory defaults. All the files in the USER folder of the internal memory are also deleted. The files in the following folders are not deleted.
* **BACKUP** (contains system files)
  The files in this folder are deleted once, and factory default files are created again.
* **USERS_MANUAL** (contains the user's manuals)
  These files are not delete.

Network Settings (/WLN option)

You can use wireless LAN to remotely control the AQ1000 from a PC (OTDR Remote Controller) and transfer measured results in the AQ1000 internal memory to a network server (OTDR Data Transporter).

Application Setup

You can set user names and passwords for authenticating connections from PCs to the AQ1000.

Access Point Mode Setup

You can set network information for running the AQ1000 as an access point. This is used to connect the AQ1000 and terminals directly without connecting a wireless router or other network device.

Other Features

Language Selection

You can change the language used on the AQ1000 screen.

Start Menu

You can select the screen that is displayed when the AQ1000 starts.
*   Trace
    When the AQ1000 starts, a screen with the data display area set to waveform display appears.
*   Map
    When the AQ1000 starts, a screen with the data display area set to icon display appears.
*   Setup Info.
    When the AQ1000 starts, the OTDR setup menu appears.

Screen Color

You can set the screen color (color or black and white).

Alarm

The AQ1000 can generate sound when an operation error message is displayed.

Version Update

You can update the firmware by storing a new firmware in a USB memory device and connecting it to USB port type A.

2.1   Measuring in TRACE Mode

⚠️

WARNING

During measurement, light is transmitted from the light source ports. Do not disconnect the connected optical fiber cables. Visual impairment may occur if the light enters the eye.

French

⚠️

AVERTISSEMENT

Lorsque l'AQ1000 génère de la lumière, la lumière est émise à travers les ports de source lumineuse. Ne pas débrancher les câbles de fibre optique connectés. Des lésions oculaires peuvent être causées si le faisceau lumineux pénètre l'œil.

Procedure

Averaged Measurement Screen (TRACE mode)

Switches the display between TRACE mode and MAP mode

Averaged measurement in progress indication

Data display screen   Laser on indication

Save data directly. See section 2.4.

Set the wavelength. (SM 1310nm, SM 1550nm, 1310nm/1550nm)

Set the distance range. See section 8.1.

Change the measurement conditions. (See section 8.1.)

Set the pulse width. See section 8.1.

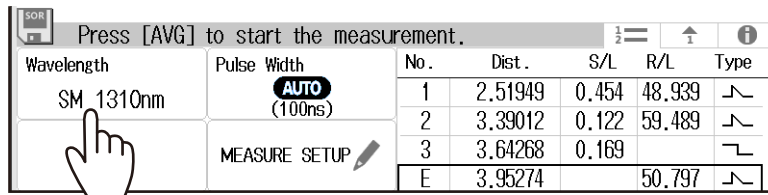Event analysis results See section 4.1.

- **Switching the Display between TRACE mode and MAP mode**

1. Tap the **TRACE/MAP** button to set the data display screen to TRACE mode.

When the data display screen is in TRACE mode, the button is MAP.

- **Setting the Wavelength**

  2. Tap the **Wavelength** button to set the wavelength.

		No.	Dist.	S/L	R/L	Type
Wavelength	Pulse Width	1	2.51949	0.454	48.939	⌐
SM 1310nm	**AUTO** (100ns)	2	3.39012	0.122	59.489	⌐
	MEASURE SETUP ✏	3	3.64268	0.169		⌐
		E	3.95274		50.797	⌐

Press [AVG] to start the measurement.

3. Press **AVG**. The measurement begins, and the data display screen shows the waveform.

During averaged measurement, the duration to average over is displayed in the top area of the screen. Also, during measurement, a mark appears at the top of the display to indicate that the laser light is on. When averaged measurements are completed, measurement is stopped automatically, event analysis is executed, and the analysis results are displayed on the screen. If you press AVG again during averaged measurement, measurement is stopped.

Note

- You can select the initial screen that appears when the AQ1000 starts in system settings. For the procedure, see "Setting the Start Screen" in section 8.3.
- If distance range and pulse width are set to auto, the AQ1000 automatically selects the optimal values internally immediately before starting a measurement. Change these values if necessary. For details, see section 8.1.

Explanation

Averaged Measurement (AVG)

In averaged measurements, the data that is acquired from each pulse is averaged and displayed as a waveform. Averaged measurements improve the signal-to-noise (S/N) ratio. This is effective when you want to detect faint events that are buried in noise.

Distance Range

With the auto setting, the AQ1000 detects the open end (end point) at the start of an averaged measurement and automatically calculates the length of the optical fiber cable. When setting the distance range manually, set a distance range appropriate for the length of the optical fiber cable to be measured. For details on the appropriate distance range, see section 8.1.

Pulse Width

With the auto setting, when the distance range is set to auto, the minimum pulse width that can measure the distance to the open end (end point) is selected. When setting the pulse width manually, set a pulse width appropriate for the distance range. For details on the appropriate pulse width, see section 8.1.

Changing the Measurement Conditions

You can set the following conditions.
- OTDR measurement conditions (wavelength, distance range, pulse width, average duration)

  See section 8.1.
- Fiber-in-use alarm   See section 8.1.
- Connection check   See section 8.1.
- Auto save   See section 2.4.

Switching the Display between TRACE mode and MAP mode

You can switch the data display screen.

TRACE mode: The data display screen shows the waveform of optical pulse measurement.

MAP: The data display screen shows the events detected through event analysis and displays them with icons.

2.2   Measuring in MAP Mode

⚠️

WARNING

During measurement, light is transmitted from the light source ports. Do not disconnect the connected optical fiber cables. Visual impairment may occur if the light enters the eye.

French

⚠️

AVERTISSEMENT

Lorsque l'AQ1000 génère de la lumière, la lumière est émise à travers les ports de source lumineuse. Ne pas débrancher les câbles de fibre optique connectés. Des lésions oculaires peuvent être causées si le faisceau lumineux pénètre l'œil.

Procedure

Averaged Measurement Screen (MAP mode)

Switches the display between TRACE mode and MAP mode

Averaged measurement in progress indication

Data display screen   Laser on indication

Save data directly.
See section 2.4.

Set the wavelength.
(SM 1310nm, SM 1550nm,
1310nm/1550nm)

Set the distance
range.
See section 8.1.

Change the
measurement
conditions.
(See section 8.1.)

Set the pulse
width.
See section 8.1.

Event analysis results
See section 4.1.

- **Switching the Display between TRACE mode and MAP mode**

1. Tap the **TRACE**/**MAP** button to set the data display screen to MAP mode.
    When the data display screen is in MAP mode, the button is TRACE.

• **Setting the Wavelength**

2. Tap the **Wavelength** button to set the wavelength.

3. Press **AVG**. The measurement begins, and the data display screen shows the icons of the detected events.

During averaged measurement, the duration to average over is displayed in the top area of the screen. Also, during measurement, a mark appears at the top of the display to indicate that the laser light is on. When averaged measurements are completed, measurement is stopped automatically, event analysis is executed, and the analysis results are displayed on the screen. If you press AVG again during averaged measurement, measurement is stopped.

Note

• You can select the initial screen that appears when the AQ1000 starts in system settings. For the procedure, see "Setting the Start Screen" in section 8.3.
• If distance range and pulse width are set to auto, the AQ1000 automatically selects the optimal values internally immediately before starting a measurement. Change these values if necessary. For details, see section 8.1.

Explanation

Averaged Measurement (AVG)

In averaged measurements, the data that is acquired from each pulse is averaged, and then event analysis is performed. Averaged measurements improve the signal-to-noise (S/N) ratio. This is effective when you want to detect faint events that are buried in noise.

Distance Range

With the auto setting, the AQ1000 detects the open end (end point) at the start of an averaged measurement and automatically calculates the length of the optical fiber cable. When setting the distance range manually, set a distance range appropriate for the length of the optical fiber cable to be measured. For details on the appropriate distance range, see section 8.1.

Pulse Width

With the auto setting, when the distance range is set to auto, the minimum pulse width that can measure the distance to the open end (end point) is selected. When setting the pulse width manually, set a pulse width appropriate for the distance range. For details on the appropriate pulse width, see section 8.1.

Changing the Measurement Conditions

You can set the following conditions.
*   OTDR measurement conditions (wavelength, distance range, pulse width, average duration)
                                                                See section 8.1.
*   Fiber-in-use alarm   See section 8.1.
*   Connection check   See section 8.1.
*   Auto save   See section 2.4.

Switching the Display between TRACE mode and MAP mode

You can switch the data display screen.
   TRACE mode: The data display screen shows the waveform of optical pulse measurement.
   MAP: The data display screen shows the events detected through event analysis and displays them with icons.

*   **Event Icon Display**

    The following events are displayed using icons.

    | Start point (Near-end reflection) | Splice loss | Return loss | Bending loss | Splitter | End point (Fresnel reflection) |
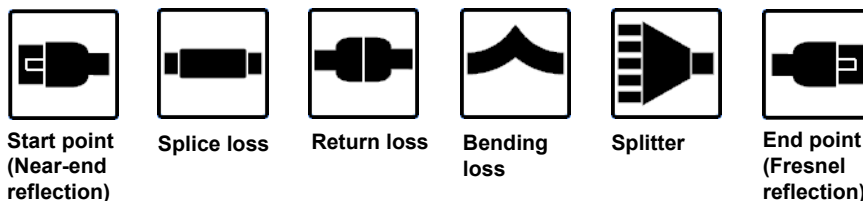
Note

When the data display screen is in MAP mode, the following features cannot be used.
*   Operating the cursors
*   Performing marker analysis
*   Zooming in on or out of waveforms

2.3 Performing Pass/Fail Judgments on Measured Results

Procedure

1. Press **MENU** to display the MENU screen.

2. Tap the **OTDR Setup** button. The Setup Info. Menu appears.
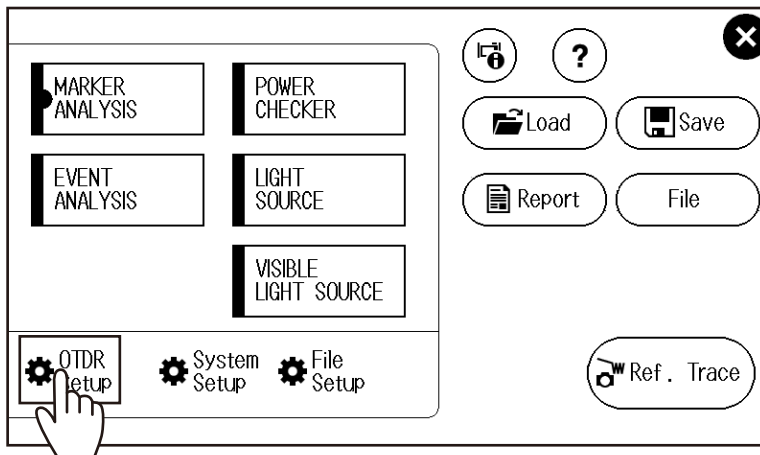
MENU screen

3. Tap the **EVENT ANALYSIS** display area. The EVENT ANALYSIS SETUP screen appears.

Setup Info. Menu screen
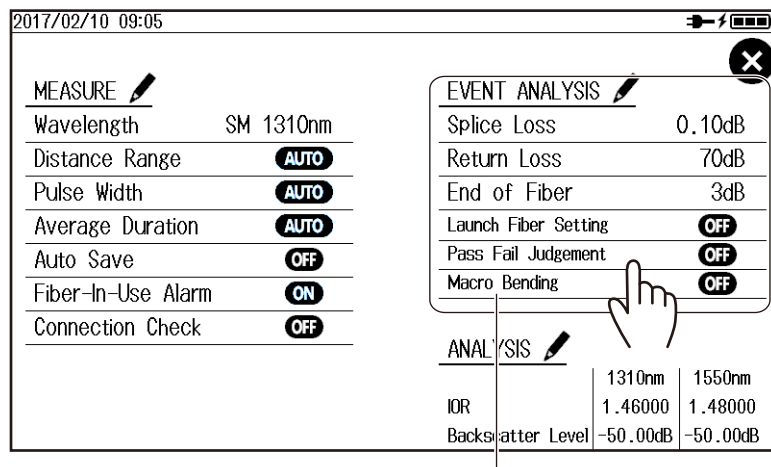
EVENT ANALYSIS display area

4. Tap the **Pass Fail Judgement** button. Pass/fail judgment is set to on.
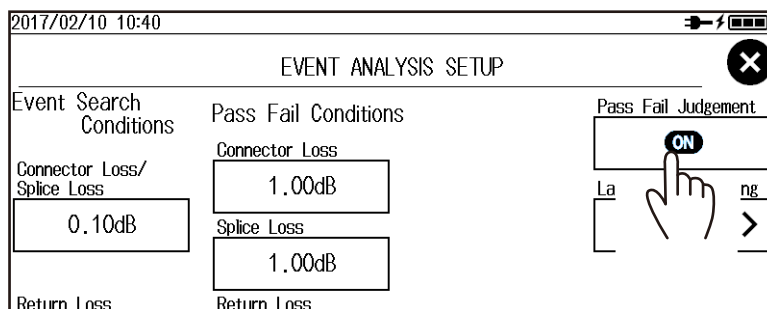
Explanation

When averaged measurements are completed, event analysis is executed automatically, and judgment results based on whether the specified pass/fail judgment conditions are met are displayed. For details on the pass/fail judgment conditions, see section 8.1.

Pass/fail judgment display in TRACE mode
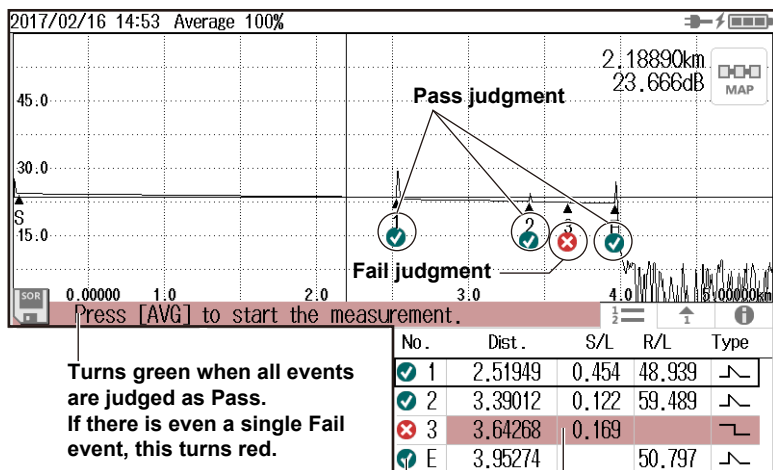
Turns green when all events are judged as Pass.
If there is even a single Fail event, this turns red.

The judgment results are also displayed in the event list.

In the list, rows showing Fail events are in red.

Pass/fail judgment display in MAP mode
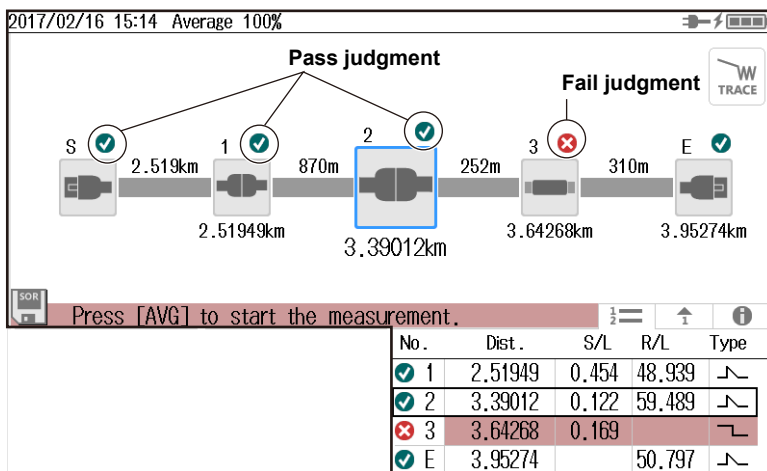
2.4 Saving Measured Data

Procedure

Saving Measured Data Directly

You can save measured waveforms and event analysis data by tapping an icon on the data display screen.

To change the save destination folder or file name, see section 8.2, "Changing the File Settings."

  1. Tap the floppy disk icon. The measured data is saved.
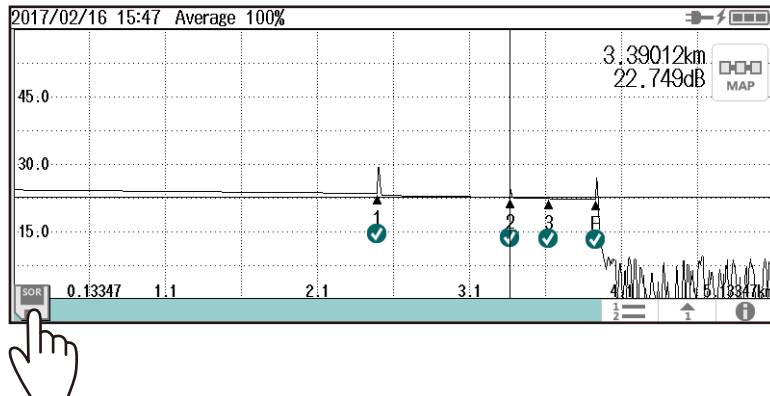
Configuring the Auto Saving of Measured Data

Measured waveforms and event analysis data can be saved automatically when averaged measurements are completed.

To change the save destination folder or file name, see section 8.1, "Changing the OTDR Settings."

  1. Press **MENU** to display the MENU screen.

  2. Tap the **OTDR Setup** button. The Setup Info. Menu appears.

MENU screen

3. Tap the **MEASURE** display area. The MEASURE SETUP screen appears.

Setup Info. Menu screen

```
2017/02/10 09:05                                    ⊡-⚡▭

  MEASURE ✎                         EVENT ANALYSIS ✎          ⊗
  Wavelength        SM 1310nm       Splice Loss       0.10dB
  Distance Range      AUTO          Return Loss        70dB
  Pulse Width         AUTO          End of Fiber        3dB
  Average Duration    AUTO          Launch Fiber Setting  OFF
  Auto Save           OFF           Pass Fail Judgement   OFF
  Fiber-In-Use Alarm  ON            Macro Bending         OFF
  Connection Check    OFF
                                    ANALYSIS ✎
                                              1310nm  1550nm
                                    IOR       1.46000 1.48000
                                    Backscatter Level -50.00dB -50.00dB
```
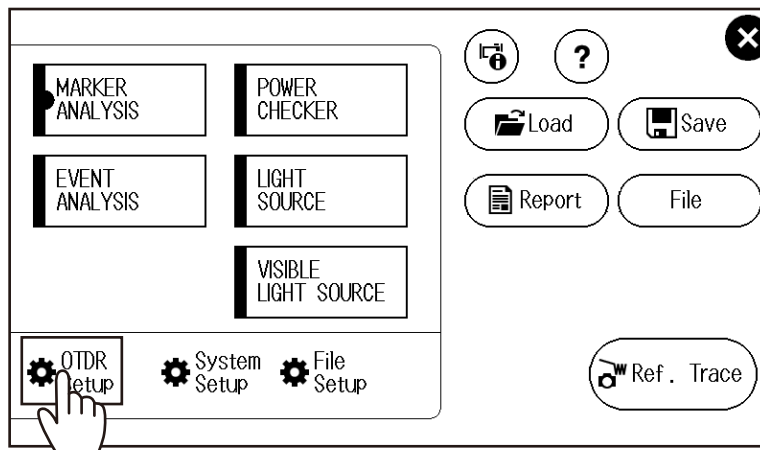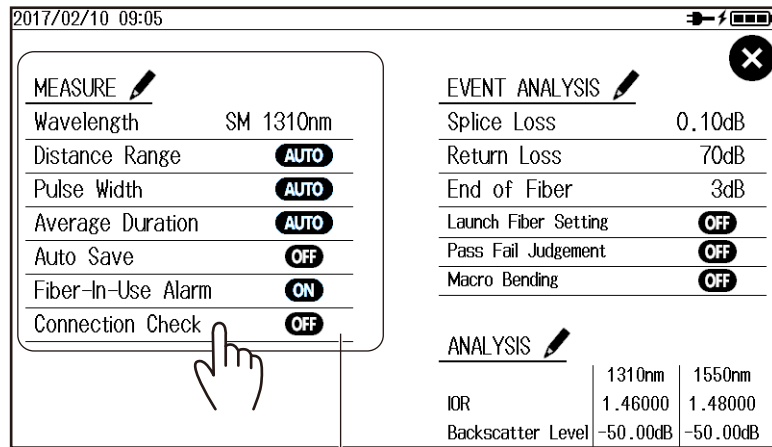
MEASURE display area

4. Tap the **Auto Save** button. The Auto Save screen appears.

MEASURE SETUP screen

```
2017/02/10 09:27                                    ⊡-⚡▭

              MEASURE SETUP                    ⊗
  Wavelength                    Fiber-In-Use Alarm
   SM 1310nm  ▼                     ON

  Distance Range                Connection Check
    AUTO     ▼                      OFF

  Pulse Width                   Auto Save
    AUTO                            OFF  ❯
```
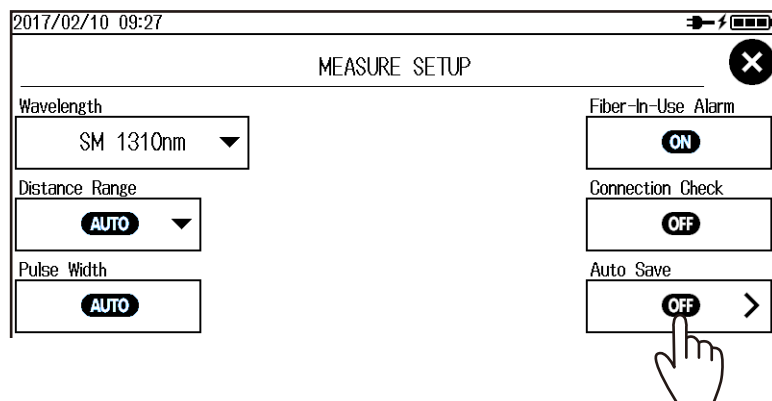
5. Tap the **Auto Save** button.

AUTO SAVE screen

```
2017/02/10 09:48                                    ⊡-⚡▭

              Auto Save                        ⊗
  Auto Save
     OFF

  M        Drive        File Type
          Int.Memory    *.SOR      File Name Setup
```
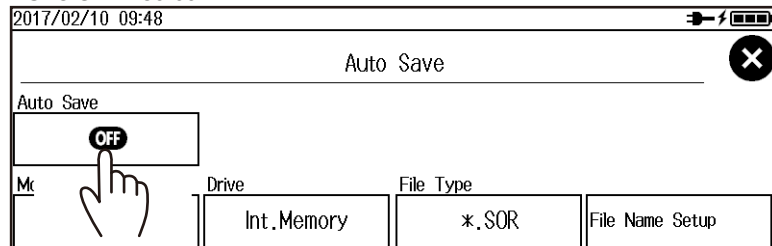
Auto saving is set to on.

Auto saving on indication

```
2017/02/16 16:25  Average 100%          ⊟AUTO ⊡-⚡▭
              Auto Save                        ⊗
  Auto Save
     ON
```
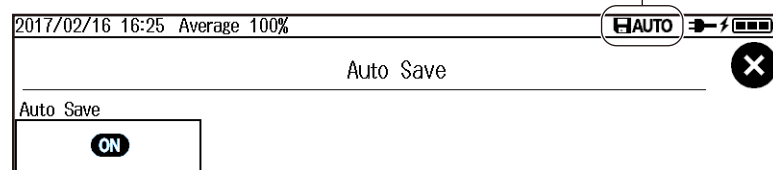
Explanation

Saving Directly

When you tap the floppy disk icon, measured data is saved. The file save format is shown on the floppy disk icon.

SOR

When the icon displays SOR
Measured data is saved as waveforms.

PDF
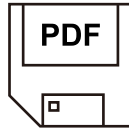
When the icon displays PDF
Measured data is saved as a report file in PDF format.

SOR PDF

When the icon displays SOR+PDF
Waveform data is saved as waveforms and as a report file simultaneously.

Saving Waveforms during Averaged Measurement

You cannot save waveforms during averaged measurement. Save measured data after averaged measurements have been completed. When measured data is saved, MAP display data is also saved in memory.
If you set the auto save feature to on, waveforms and MAP display data are saved in memory when averaged measurements are completed.

Saving Waveforms during Real-Time Measurement

If you save waveforms during real-time measurement, waveform data at that point is saved in memory. If real-time measurement has been completed, waveforms shown on the data display screen are saved in memory. If event analysis is performed on real-time measurement waveforms, MAP display data is also saved in memory.

3.1   Performing Real-time Measurement

⚠️

WARNING

During measurement, light is transmitted from the light source ports. Do not disconnect the connected optical fiber cables. Visual impairment may occur if the light enters the eye.

French

⚠️

AVERTISSEMENT

Lorsque l'AQ1000 génère de la lumière, la lumière est émise à travers les ports de source lumineuse. Ne pas débrancher les câbles de fibre optique connectés. Des lésions oculaires peuvent être causées si le faisceau lumineux pénètre l'œil.

Procedure

Real-time Measurement Screen

Switches the display between TRACE mode and MAP mode
Real-time measurement in progress indication
Data display screen   Laser on indication

Save data directly.
See section 2.4.

Set the wavelength.
(SM 1310nm, SM 1550nm,
1310nm/1550nm)

Set the distance
range.
See section 8.1.

Change the
measurement
conditions.
(See section 8.1.)

Set the pulse width.
See section 8.1.

- **Setting the Wavelength**

1.   Tap the **Wavelength** button to set the wavelength.

2. Press **REAL TIME** to start real-time measurement.

During measurement, a mark appears at the top of the display to indicate that the laser light is on. Pressing REAL TIME again stops the measurement.

Note

• You can select the initial screen that appears when the AQ1000 starts in system settings. For the procedure, see "Setting the Start Screen" in section 8.3.
• If distance range and pulse width are set to auto, the AQ1000 automatically selects the optimal values internally immediately before starting a real-time measurement. Change these values if necessary. For details, see section 8.1.

Explanation

Real-time Measurement

In real-time measurement, the waveform display is updated in real time. This feature is used to monitor the waveforms. Because averaged measurement requires a certain amount of measurement time, checking (monitoring) whether waveforms can be displayed correctly on the data display screen before starting averaged measurement can save time. In addition, you can operate markers and cursors during measurement. For cursor operation, see section 3.2. For marker operation, see section 5.1.

Distance Range

With the auto setting, the AQ1000 detects the open end (end point) at the start of a real-time measurement and automatically calculates the length of the optical fiber cable. When setting the distance range manually, set a distance range appropriate for the length of the optical fiber cable to be measured. For details on the appropriate distance range, see section 8.1.

Pulse Width

With the auto setting, when the distance range is set to auto, the minimum pulse width that can measure the distance to the open end (end point) is selected. When setting the pulse width manually, set a pulse width appropriate for the distance range. For details on the appropriate pulse width, see section 8.1.

Changing the Measurement Conditions

You can set the following conditions.

• OTDR measurement conditions (wavelength, distance range, pulse width, average duration)
    See section 8.1.
• Fiber-in-use alarm   See section 8.1.
• Connection check   See section 8.1.

Switching the Display between TRACE mode and MAP mode

When you start a real-time measurement, the data display screen automatically switches to TRACE mode.

Saving Waveforms during Real-Time Measurement

If you save waveforms during real-time measurement, waveform data at that point is saved in memory. If real-time measurement has been completed, waveforms shown on the data display screen are saved in memory. If event analysis is performed on real-time measurement waveforms, MAP display data is also saved in memory.

3.2 Operating the cursors

Procedure

Displaying the Cursors

1. Tap the waveform display screen. A cursor appears at the tapped position.
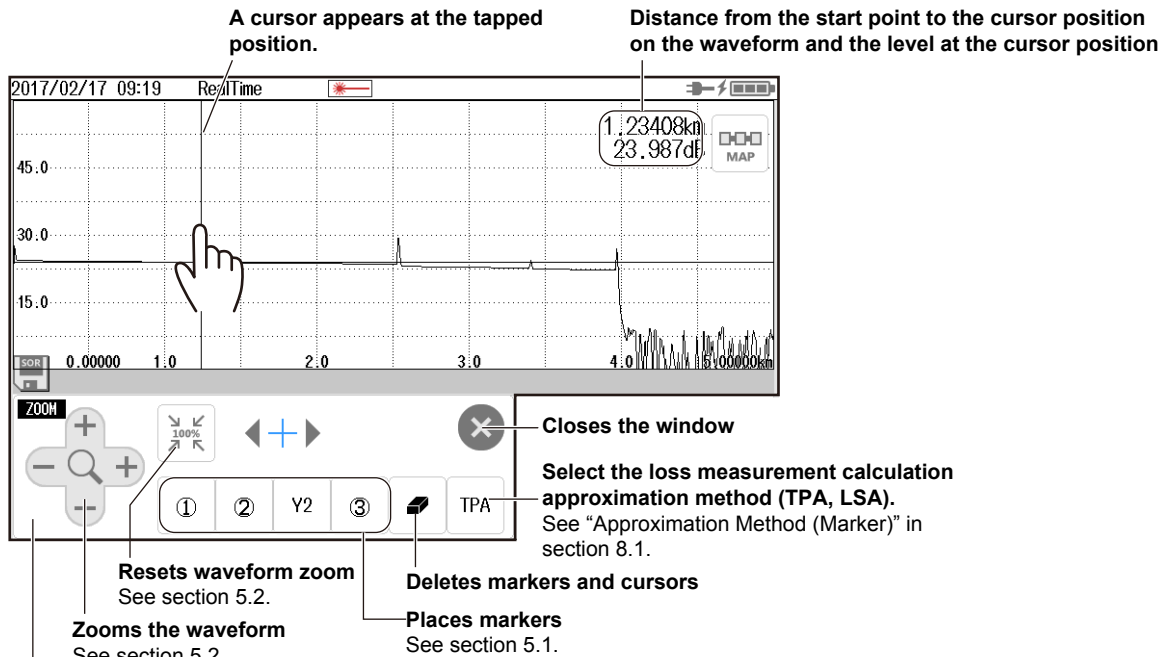
A cursor appears at the tapped position.

Distance from the start point to the cursor position on the waveform and the level at the cursor position

2017/02/17 09:19 RealTime

1.23408km
23.987dB
MAP

45.0

30.0

15.0

SOR 0.00000 1.0 2.0 3.0 4.0 5.00000km

ZOOM

+
100%
− +
−

◀ + ▶

① ② Y2 ③ TPA

Closes the window

Select the loss measurement calculation approximation method (TPA, LSA).
See "Approximation Method (Marker)" in section 8.1.

Resets waveform zoom
See section 5.2.

Deletes markers and cursors

Zooms the waveform
See section 5.2.

Places markers
See section 5.1.

Cursor and marker operation screen
If you do not use markers or cursors for about 8 seconds, the screen will close automatically.

Moving a Cursor

2. Tap the position on the waveform display screen that you want to move the cursor to. The cursor moves to the position that you tapped. You can also drag the cursor on the waveform display screen.

The cursor moves to the position that you tap.

2017/02/17 09:19 RealTime

3.24228km
22.786dB
MAP

45.0

30.0

Drag

15.0

SOR 0.00000 1.0 2.0 3.0 4.0 5.00000km

CURSOR

+
100%
− +
−

◀ + ▶

① ② Y2 ③ TPA

Fine movement of cursors

Displays CURSOR mode or ZOOM mode
Each time you press the ZOOM/CURSOR key, the mode toggles.
In CURSOR mode, you can also use the left and right arrow keys to move cursors in fine increments.
　　CURSOR: Cursors can be moved using the arrow keys.
　　ZOOM: Waveforms can be zoomed using the arrow keys.
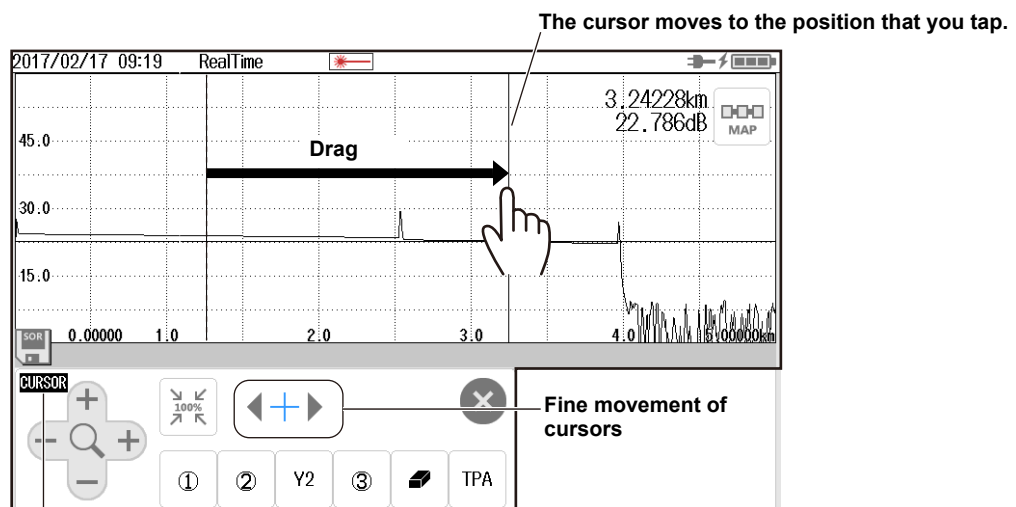
4.1 Analyzing in TRACE Mode

Procedure

Executing an Event Analysis

1. Press **MENU** to display the MENU screen.

2. Tap the **EVENT ANALYSIS** button to execute an event analysis.

MENU screen

Note

When an averaged measurement is executed, event analysis is performed automatically after the measurement. As such, you do not need to manually execute an event analysis. Execute an event analysis if necessary when you execute a real-time measurement or when an SOR file containing data measured in real time with the AQ1000 is loaded.

• **Switching the Display between TRACE mode and MAP mode**

Tap the **TRACE**/**MAP** button to set the data display screen to TRACE mode.
When the data display screen is in TRACE mode, the button is MAP.

Displaying Event Analysis Results

Event detected as the end of the optical fiber cable: E

Measurement reference point: S

Event number

List of events
Displayed by tapping the List tab.

No.	Dist.	S/L	R/L	Type
1	2.51949	0.454	48.939	⌐
2	3.39012	0.122	59.489	⌐
3	3.64268	0.169		⌐
E	3.95274		50.797	⌐

Tab display

Event type   **List Separate All**

Display of separate events
Displayed by tapping the Separate tab.

No.3	⌐	0.356dB/km
Distance		3.64268km
Splice Loss		0.169dB
Return Loss		
Cumm. Loss		1.862dB

Display the adjacent events

Cumulative display of events
Displayed by tapping the All tab.

Wavelength	1310nm	1550nm
Distance	3.95274km	3.95274km
Total Loss	2.139dB	2.039dB
Total RL	35.494dB	30.494dB
dB/km	0.541dB/km	0.341dB/km

Note

The event list can display up to 100 events.

Editing Events

3. Tap the data display area. A cursor appears at the tapped position, and an event edit screen appears.

The event edit screen closes automatically after about 8 seconds of no user activity.
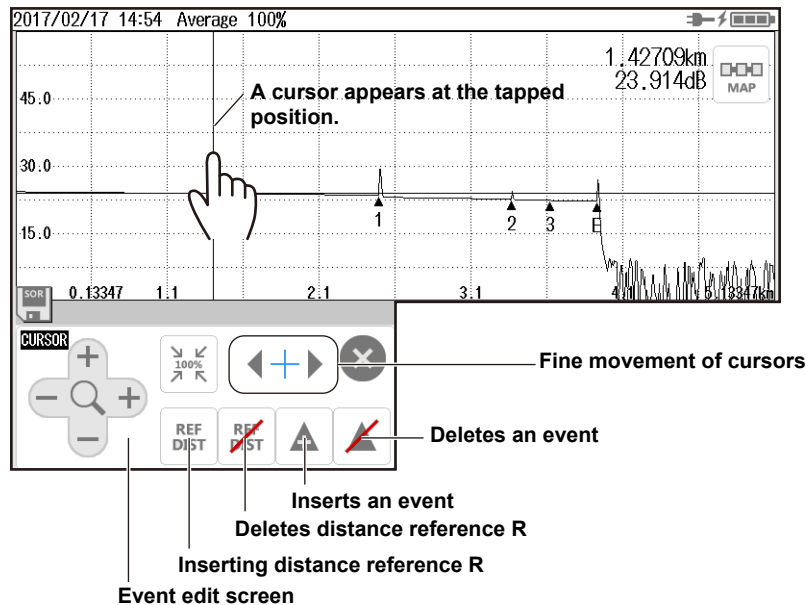
- **Inserting an Event**

4. Move the cursor to the position where you want to insert an event.

5. Tap the insert event button. An event is inserted at the cursor position, and the total event number is updated.

- **Deleting an Event**

4. Move the cursor to the ▲ mark of the event that you want to delete.

5. Tap the delete event button. The event is deleted, and the total event number is updated.

- **Inserting or Deleting Distance Reference R**

4. Tap the insert or delete distance reference R button. Distance reference R is inserted or deleted.

Note

- If you insert an event between two events that are displayed, the new event takes on the number that follows the event on the left, and all subsequent event numbers are increased by one. You cannot insert events to the left of measurement reference point S.
- You cannot insert events to the left of distance reference R.
- If you insert an event to the right of event No. E, the inserted event becomes event No. E, and a new number is assigned to the former No. E event.
- If the only displayed events are measurement reference point S and event No. E, you cannot delete any events.
- If you delete an event, the subsequent event numbers will all be reduced by one.
- You cannot delete measurement reference point S.
- If you insert distance reference R, measurement reference point S will disappear from the screen. In this situation, the measurement reference point is distance reference R. If you delete distance reference R, measurement reference point S reappears at its original position.
- If you delete event No. E, the event that has the largest number becomes event No. E.

4

Analyzing Events

Displaying Event Analysis Results

Event Numbers

A number is displayed on the waveform next to the event. The numbers are in ascending order from the left of the display.

Distance

The distance from the measurement reference point to each event is displayed. If you move distance reference R, which is the measurement reference point, the distance from distance reference R to each event is displayed. Distance reference R can be set when you edit events. Distance reference R also moves automatically according to the distance when a launch fiber is set. For details on setting a launch fiber, see section 8.1. For details on launch fiber use, see appendix 1.

Splice Loss

The splice loss for each event is displayed.

Return Loss

The return loss for each event is displayed.

Cumulate Loss

The loss from the measurement reference point is displayed. If distance reference R is specified, R is the measurement reference point. If distance reference R is not specified, measurement reference point S is the measurement reference.

Event Types

The type of each event is displayed with the following symbols.

⌐_____ : Positive splice loss
⌐_____ : Negative splice loss
__\ : Reflection
_O_ : Bending loss (macro bending)
≡▷ : Splitter insertion loss

• **Total Loss**

Displayed in the following manner depending on the total loss calculation method. For the setup procedure, see section 8.3.

Cumulate loss: The integrated value of the splice losses at each event from measurement reference point S is displayed.

Loss between S and E: The loss between measurement reference point S and end of fiber E is displayed.

- **Total RL**
  The integrated value of the return losses of each event.

Editing Events

There may be cases where, because the backscattering light level is too small at a reflection point in an optical fiber cable, the reflection cannot be detected as an event, or there may be cases where noise is detected as an event. In such cases, you can adjust the events by editing them as follows:

- Inserting an Event
- Deleting an Event

In addition, to prevent near-end dead zones, you can insert a distance reference at the position corresponding to the length of the launch fiber cable.

- Inserting distance reference R

4.2 Analyzing in MAP Mode

Executing an Event Analysis

1. Press **MENU** to display the MENU screen.

2. Tap the **EVENT ANALYSIS** button to execute an event analysis.

MENU screen

Note

When an averaged measurement is executed, event analysis is performed automatically after the measurement. As such, you do not need to manually execute an event analysis. Execute an event analysis if necessary when you execute a real-time measurement or when an SOR file containing data measured in real time with the AQ1000 is loaded.

• **Switching the Display between TRACE mode and MAP mode**

Tap the **TRACE/MAP** button to set the data display screen to MAP mode.

When the data display screen is in MAP mode, the button is TRACE.

Displaying Event Analysis Results

Event detected as the end of the optical fiber cable: E

Event number

Distance between events

Measurement reference point: S

2017/02/17 15:58 Average 100%

S   1   2   3   E

2.519km   870m   252m   310m

2.51949km   3.64268km   3.95274km

3.39012km **Distance from the measurement reference point**

Press [AVG] to start the measurement.

No.	Dist.	S/L	R/L	Type
1	2.51949	0.454	48.939	⌐⌐
2	3.39012	0.122	59.489	⌐⌐
3	3.64268	0.169		⌐
E	3.95274		50.797	⌐⌐

List of events
Displayed by tapping the List tab.

Tab display

Event type   **List Separate All**

Display of separate events
Displayed by tapping the Separate tab.

No.3   0.356dB/km
Distance   3.64268km
Splice Loss   0.169dB
Return Loss
Cumm. Loss   1.862dB

Display the adjacent events

Wavelength	1310nm	1550nm
Distance	3.95274km	3.95274km
Total Loss	2.139dB	2.039dB
Total RL	35.494dB	30.494dB
dB/km	0.541dB/km	0.341dB/km

Cumulative display of events
Displayed by tapping the All tab.

Note

The event list can display up to 100 events.

4

Analyzing Events

Editing Events

3. Tap an icon in the data display area. The icon is displayed in the center position.

4. Tap the icon displayed in the center position. An event type edit screen appears.

5. Select the event type you want to change to.
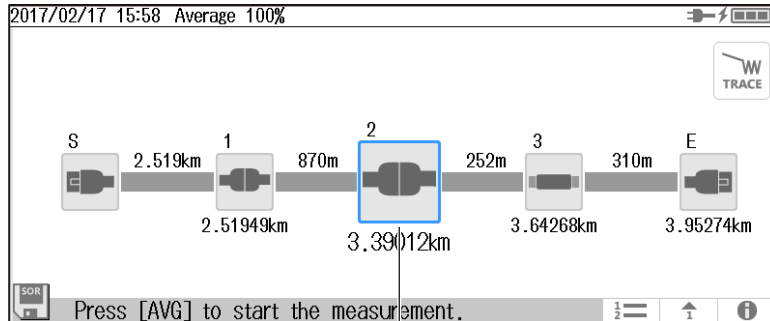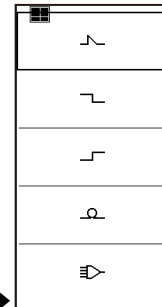
Event Icon Display
The event selected in the event analysis result display is shown at the center.
Tapping the icon of another event on the screen will show that event at the center.
You can move the icon horizontally by dragging the icon.
You can change the event type by tapping the icon shown at the center.

Change the event type.

Explanation

Displaying Event Analysis Results

Event Numbers

A number is displayed on the waveform next to the event. The numbers are in ascending order from the left of the display.

Distance

The distance from the measurement reference point to each event is displayed. If a launch fiber is set, the distance is automatically calculated according to the setup conditions. For details on setting a launch fiber, see section 8.1. For details on launch fiber use, see appendix 1.

Splice Loss

The splice loss for each event is displayed.

Return Loss

The return loss for each event is displayed.

Cumulate Loss

The loss from the measurement reference point is displayed. If distance reference R is specified, R is the measurement reference point. If distance reference R is not specified, measurement reference point S is the measurement reference.

Event Types

The type of each event is displayed with the following symbols.

    : Positive splice loss
    : Negative splice loss
    : Reflection
    : Bending loss (macro bending)
    : Splitter insertion loss

• **Total Loss**

Displayed in the following manner depending on the total loss calculation method. For the setup procedure, see section 8.3.

Cumulate loss:
The integrated value of the splice losses at each event from measurement reference point S is displayed.
Loss between S and E:
The loss between measurement reference point S and end of fiber E is displayed.

• **Total RL**

The integrated value of the return losses of each event.

4

Analyzing Events

<div style="border-left: 8px solid black; padding-left: 10px;">

5.1   Operating Cursors and Markers

</div>

Procedure

Switching the Display between TRACE mode and MAP mode

1. Tap the **TRACE/MAP** button to set the data display screen to TRACE mode.

When the data display screen is in TRACE mode, the button is MAP.
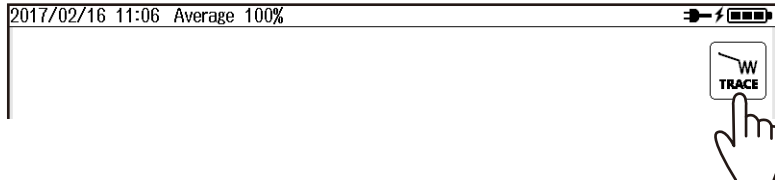
Note

You can operate cursors and markers only in TRACE mode.

Displaying the Cursors

2. Tap the waveform display screen. A cursor appears at the tapped position.

**Distance from the start point
to the cursor position on the
waveform and the level at the
cursor position**

A cursor appears at the tapped position.

**Switches the
display between
TRACE mode
and MAP mode**

Closes the window

Cursor and marker operation screen
If you do not use markers or cursors for about 8 seconds, the screen will close automatically.
An event edit screen appears during event analysis, but the method of using the cursors is the
same. For details on the event edit screen, see section 4.1.

Moving a Cursor

3. Tap the position on the waveform display screen that you want to move the cursor to. The cursor moves to the position that you tapped. You can also drag the cursor on the waveform display screen.

The cursor moves to the position that you tap.
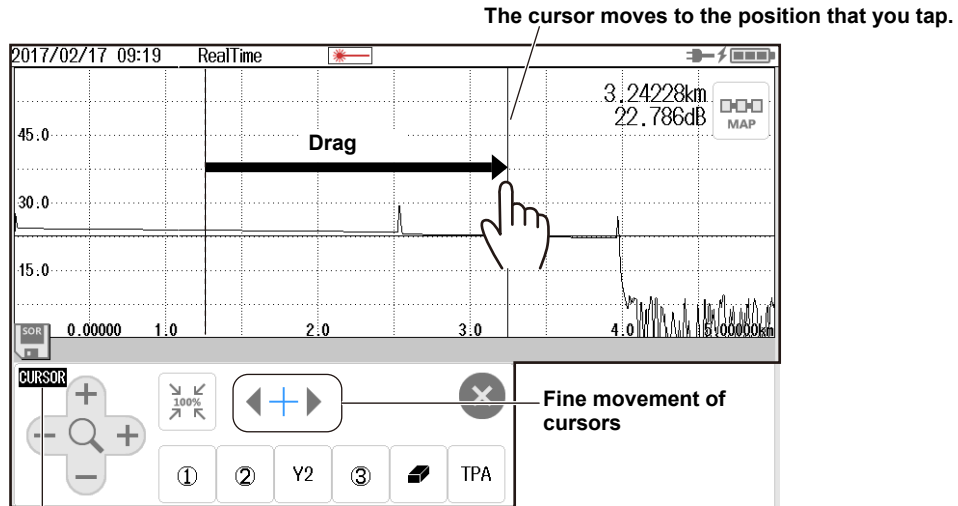
Displays CURSOR mode or ZOOM mode
Each time you press the CURSOR/ZOOM key, the mode toggles.
In CURSOR mode, you can also use the left and right arrow keys to move cursors in fine increments.
    CURSOR: Cursors can be moved using the arrow keys.
    ZOOM: Waveforms can be zoomed using the arrow keys.

For details on the operation of the arrow keys, see "Screen Operations" in the Getting Started Guide, IM AQ1000-02EN.

Operating Markers

4. Press **MENU** to display the MENU screen.

5. Tap the **MARKER ANALYSIS** button to display the marker and cursor operation screen.

MENU screen
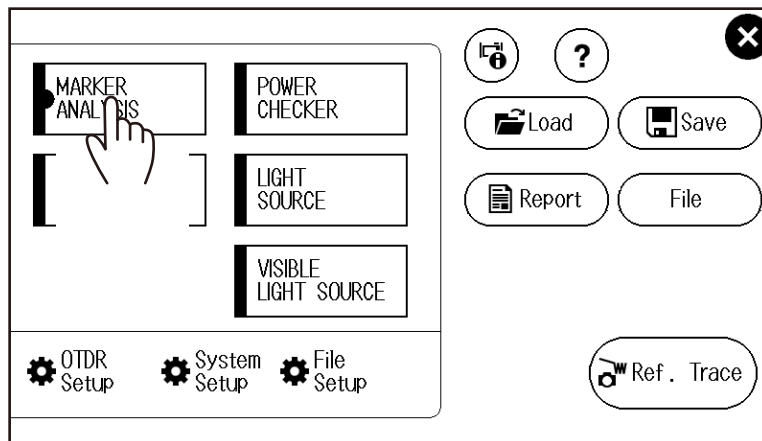
Note

You can operate cursors also on the event edit screen but not markers. When an averaged measurement is executed, event analysis is performed automatically. As such, an event edit screen appears when you operate cursors. Display the marker and cursor operation screen by performing steps 4 and 5 above.

Setting Markers on a Waveform

Set four markers in order starting from the position closest to measurement reference point S.

Place marker ①.
Place a marker near measurement start point S.

Place marker ②.
Place a marker in front of the waveform to be analyzed.

Place marker Y2.
Place a marker immediately after the waveform to be analyzed.

Place marker ③.
Place a marker where analysis is to end.

Closes the window

Place each marker at the cursor positions.

Select the loss measurement calculation approximation method (TPA, LSA).

Deletes markers and cursors

Cursor and marker operation screen
If you do not use markers or cursors for about 8 seconds, the screen will close automatically.

Note

- When you set the markers, set them so that the ① marker is on the measurement start point S side.
- The measured loss value differs depending on the specified approximation method.
- Set the correct position for ②. The splice loss changes greatly depending on the position of ②.
- For details on the approximation method, see "Approximation Method (Markers)" in section 8.1.

Marker Analysis Results

Splice loss and return loss values are displayed on the screen as marker analysis results.
For the analysis procedure of splice loss and return loss, see section 1.4.

5

Analyzing Waveforms

5.2 Zooming in on or out of waveforms

Switching the Display between TRACE mode and MAP mode

1. Tap the **TRACE/MAP** button to set the data display screen to TRACE mode.

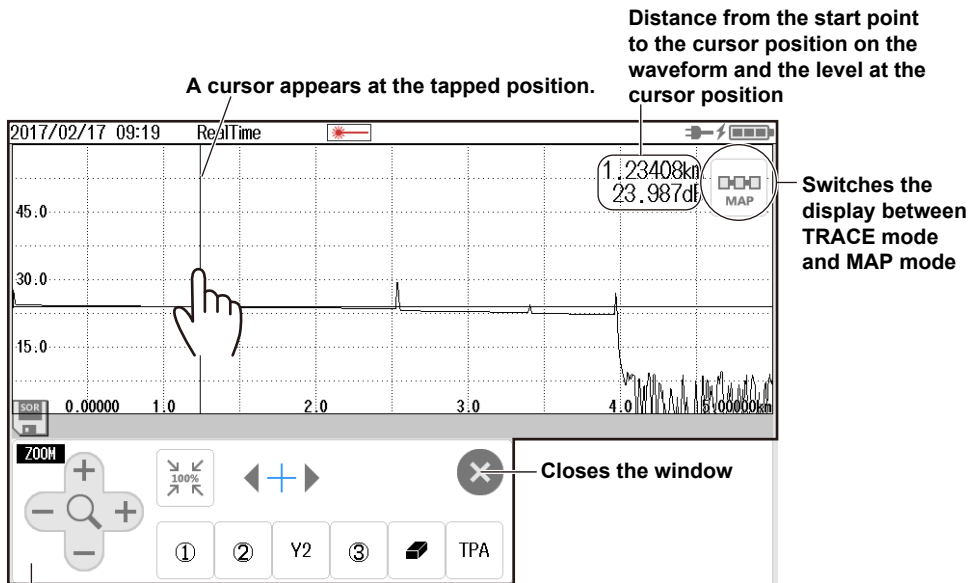   When the data display screen is in TRACE mode, the button is MAP.

Zooming Waveforms

2. Display a cursor at the waveform position you want to zoom. A marker and cursor operation screen or an event edit screen appears.

   For the cursor operation procedure, see section 5.1.
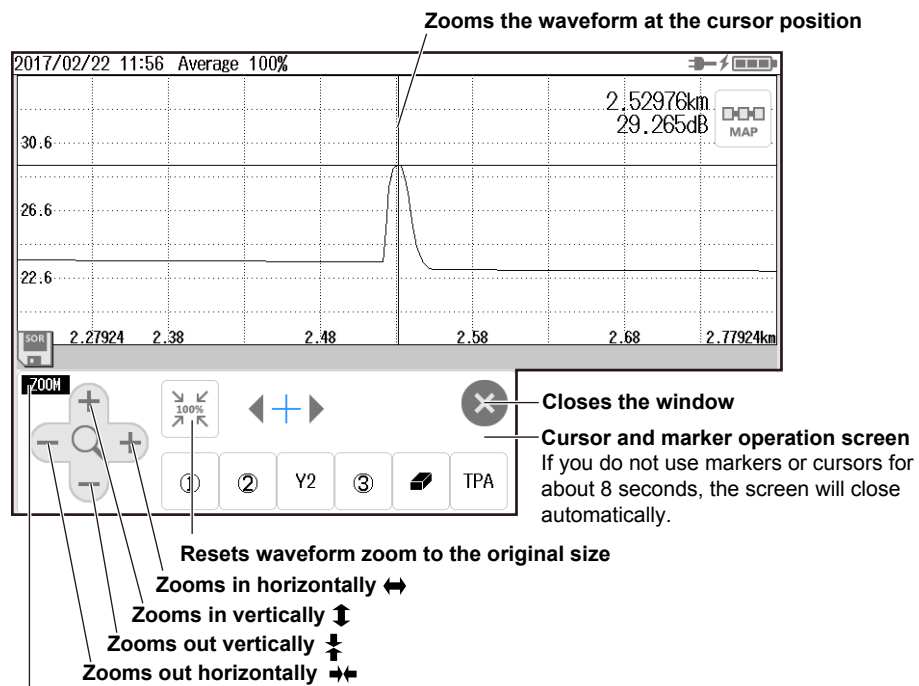
Zooms the waveform at the cursor position

Closes the window

Cursor and marker operation screen
If you do not use markers or cursors for about 8 seconds, the screen will close automatically.

Resets waveform zoom to the original size
Zooms in horizontally ↔
Zooms in vertically ↕
Zooms out vertically ↧
Zooms out horizontally ↦↤

Displays CURSOR mode or ZOOM mode
Each time you press the CURSOR/ZOOM key, the mode toggles.
In ZOOM mode, you can use the up, down, left, and right arrow keys to zoom the waveform.
   CURSOR: Cursors can be moved using the arrow keys.
   ZOOM: Waveforms can be zoomed using the arrow keys. The behavior of the arrow keys is reversed depending on the zoom direction setting.
      For the setup procedure, see section 8.3.

For details on the operation of the arrow keys, see "Screen Operations" in the Getting Started Guide, IM AQ1000-02EN.

5.3 Displaying a Reference Trace

Procedure

Switching the Display between TRACE mode and MAP mode

1. Tap the **TRACE/MAP** button to set the data display screen to TRACE mode.

   When the data display screen is in TRACE mode, the button is MAP.
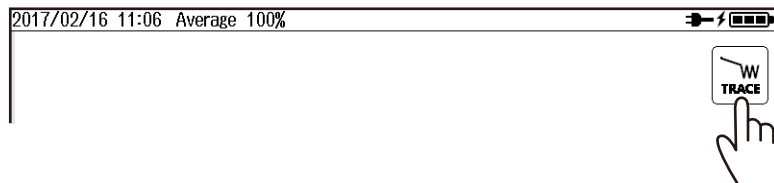
Displaying the Reference Source Waveform

2. Perform a measurement or load a file to display a waveform on the screen.

   When performing an averaged measurement, wait for the measurement to complete. When loading a waveform data file, use an SOR file that has been measured and saved with the AQ1000.

3. Press **MENU** to display the MENU screen.

4. Tap the **Ref. Trace** button. The waveform currently displayed on the screen is displayed as a reference trace.

   If the screen color is set to Color1, the color of the reference trace is white.

   MENU screen

Analyzing Waveforms

Displaying a Reference Trace

Reference trace (white: when Screen Color is set to Color1)

Superimposed on the waveform currently being measured
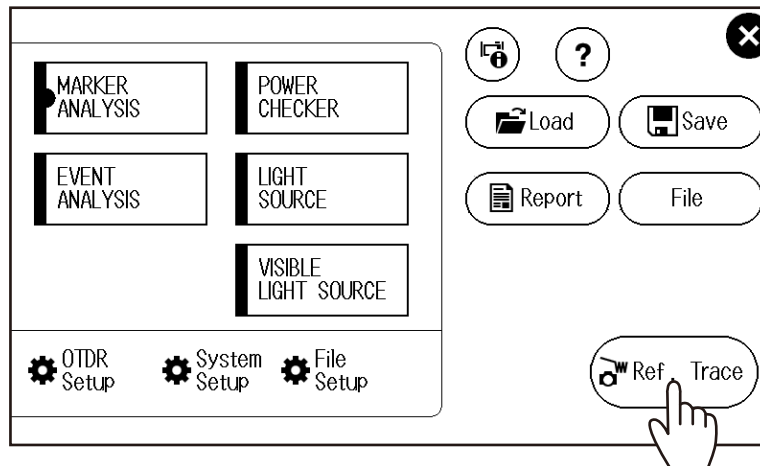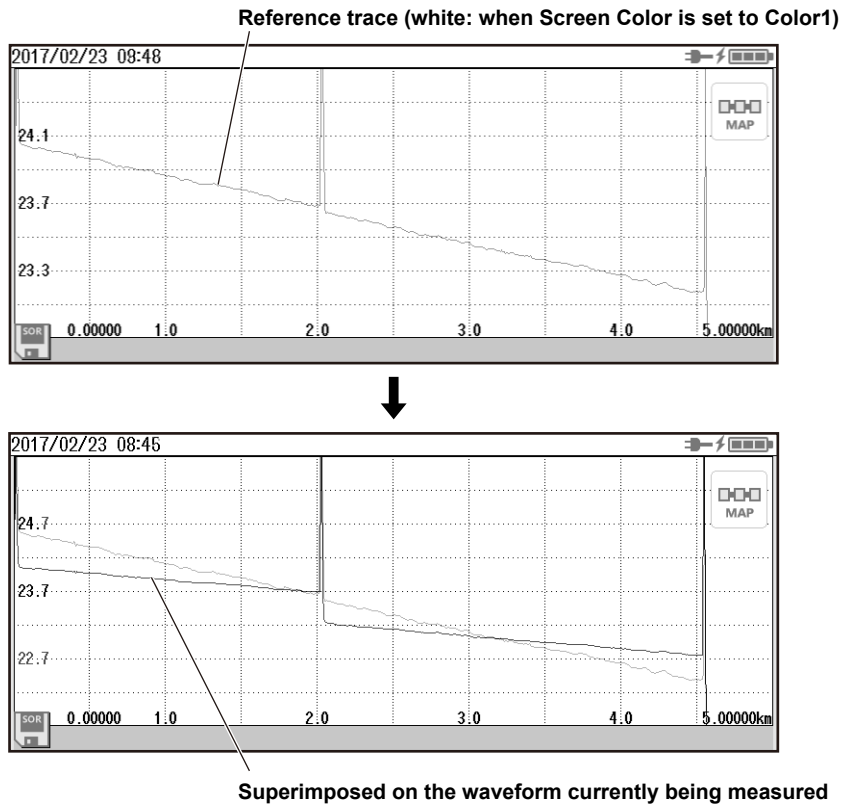
Explanation

You can perform averaged measurements or real-time measurements while retaining the previous waveform on the screen (reference trace). You can display the waveform being measured and the reference waveform at the same time to compare them. Waveform data loaded from a file can also be used as a reference trace.

Note

- You cannot perform waveform analysis or event analysis on a reference trace.
- When you load waveform data from a file, the existing reference trace is cleared.

6.1   Using the Power Checker

Procedure

Displaying the Power Checker Screen

1. Press **MENU** to display the MENU screen.

2. Tap the POWER CHECKER button to display the POWER CHECKER screen.

MENU screen
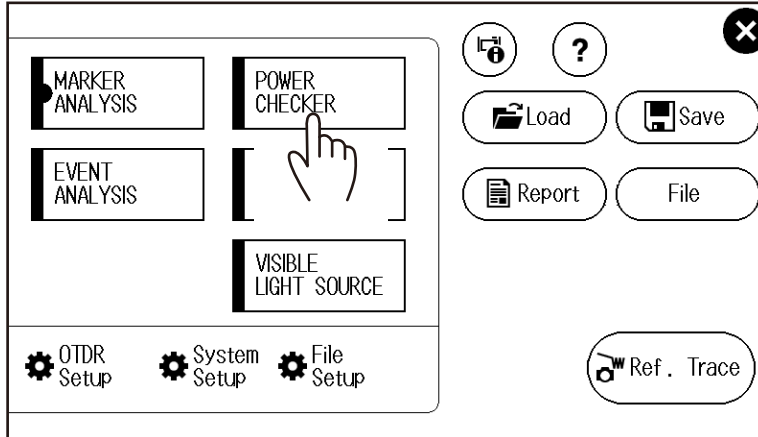
POWER CHECKER Screen

Alarm indication when the threshold is exceeded.

Set the lower threshold (–80 dBm to 40dBm).

Performs zero set

Measured value

Set the unit (dB, dBm, W).
If you set the reference value (DREF), the unit automatically changes to dB.

Sets the reference to the currently displayed measured value

Reference value
Displayed when you set the reference value.

Set the upper threshold (–80 dBm to 40 dBm).

Upper threshold line

Lower threshold line

Set the wavelength (1310nm, 1490nm, 1550nm, 1625nm, 1650nm).

6

Using the Utility Feature

Making Preparations for Measurements

Remove the optical fiber cables from the AQ1000, close the optical connector covers, and then start the power checker zero-set procedure.

3. Tap the **ZERO SET** button to execute a zero-set.

Note

- Perform a zero-set whenever necessary, such as after you have turned on the power or when the ambient temperature changes. Performing a zero-set adjusts the internal deviation of the power checker section and enables you to obtain more accurate absolute optical power values.
- You cannot save measured data to a file.

Explanation

Setting the Wavelength

Measurement light with the following wavelengths can be measured.
1310nm, 1490nm, 1550nm, 1625nm, 1650nm

Unit

Set the optical power display unit from the following.
dBm (absolute value), W (absolute value)

- Unit W is preceded by a prefix m (10^{-3}), μ (10^{-6}), n (10^{-9}), or p (10^{-12}).
- The following relation holds between the absolute display unit dBm and W.
  $P_{dBm} = 10 \times \log(P_w \times 10^{-3})$
  P_{dBm}: Optical power (unit dBm), P_w: Optical power (unit W)

Reference

You can set a reference value and display the relative measured values (the differences from the reference value).

- When you press the DREF button, the displayed measured value becomes the reference value. From this point, relative values will be displayed. The unit changes to dB.
- When you press the DREF button or set the unit to dB, the Reference box appears on the power meter screen.
- You can set the reference value in the Reference box. The range is –80 to 40 dBm.
- When you set the unit to dBm or W, the Reference box disappears, and the absolute measured values will be displayed.

Bar Graph and Threshold Display

The upper and lower threshold values specified on the optical power meter setup screen are displayed with markers. While the bar is within the threshold boundaries, it is displayed in green. Otherwise, it is displayed in red.

6.2 Using the Light Source

⚠️

WARNING

During measurement, light is transmitted from the light source ports. Do not disconnect the connected optical fiber cable. Visual impairment may occur if the light enters the eye.

French

⚠️

AVERTISSEMENT

Lorsque l'AQ1000 génère de la lumière, la lumière est émise à travers les ports de source lumineuse. Ne pas débrancher les câbles de fibre optique connectés. Des lésions oculaires peuvent être causées si le faisceau lumineux pénètre l'œil.

Procedure

Displaying the Light Source Screen

1. Press **MENU** to display the MENU screen.

2. Tap the **LIGHT SOURCE** button to display the LIGHT SOURCE screen.
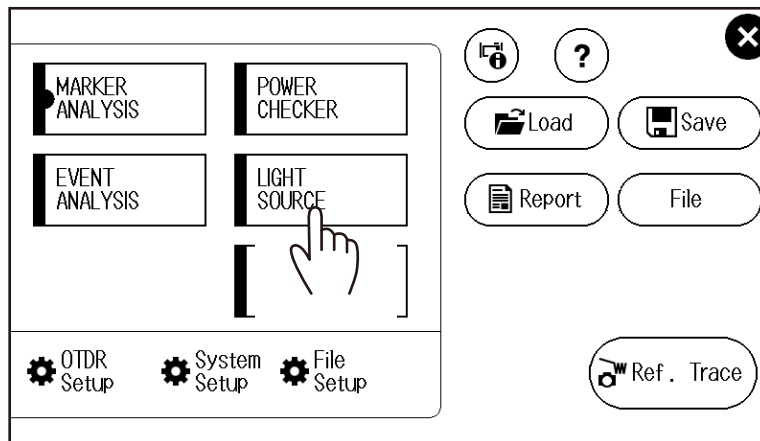
MENU screen

LIGHT SOURCE Screen

Turns the optical output on and off
When you tap the ON button, the measurement light turns on. The button changes to OFF, and a mark appears on the AQ1000 display to indicate that the light is on. When you tap the OFF button, the measurement light turns off.

Laser on indication
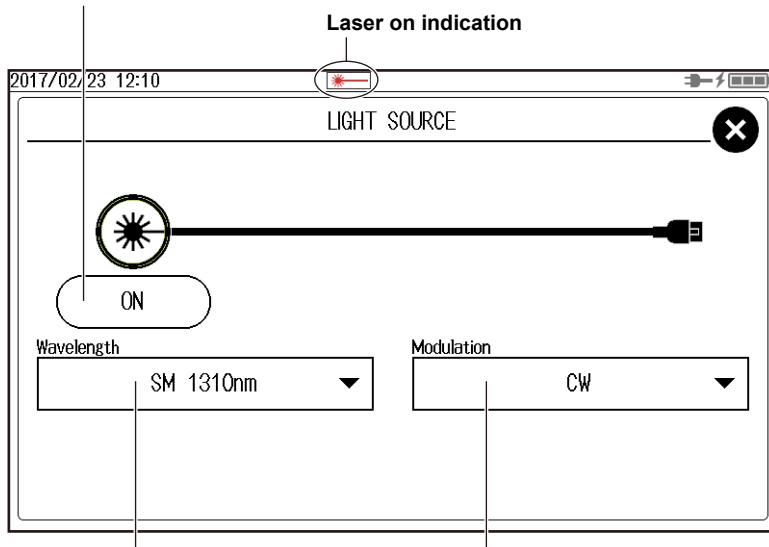
Set the wavelength (1310nm, 1550nm). Set the modulation mode (CW, 270Hz, 1kHz, 2kHz).

Note

Check the wavelength and modulation mode settings before turning on the light source.

6.3 Using the Visible Light Source (/VLS option)

⚠️

WARNING

During measurement, light is transmitted from the VLS port. Do not disconnect the connected optical fiber cable. Visual impairment may occur if the light enters the eye.

French

⚠️

AVERTISSEMENT

Pendant la mesure, la lumière est transmise depuis les ports sources de lumière visible. Ne pas déconnecter les câbles à fibres optiques connectés. Une déficience visuelle peut se produire si la lumière pénètre dans l'œil.

Procedure

Displaying the Visible Light Source Screen

1. Press **MENU** to display the MENU screen.
2. Tap the **VISIBLE LIGHT SOURCE** button to display the VISIBLE LIGHT SOURCE screen.
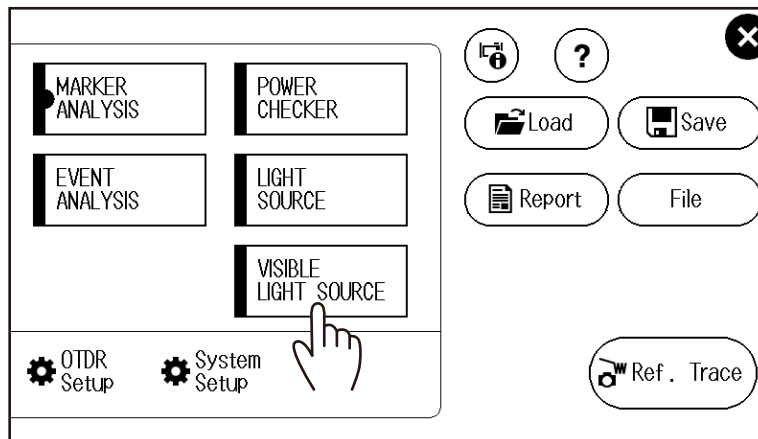
MENU screen

VISIBLE LIGHT SOURCE Screen

Turns the optical output on and off
When you tap the ON button, the measurement light turns on. The button changes to OFF, and a mark appears on the AQ1000 display to indicate that the light is on. When you tap the OFF button, the measurement light turns off.

Laser on indication
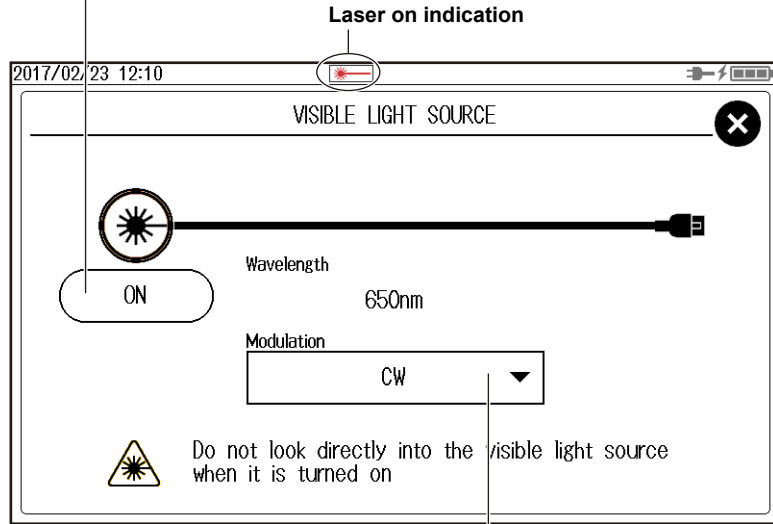
Set the modulation mode (CW, 2Hz).

Note

Connect an optical fiber cable to the VLS port (/VLS option).

7.1   Connecting USB Storage Media to the USB Ports

CAUTION

Do not remove a USB memory device or turn off the power when the USB memory access indicator is blinking or when data is being saved or loaded from internal memory. Doing so may damage the storage medium (USB memory or internal memory) or corrupt its data.

French

ATTENTION

N'enlevez pas un dispositif de mémoire USB et ne coupez pas l'alimentation électrique lorsque l'indicateur d'accès à la mémoire USB clignote ou lorsque les données sont en train d'être enregistrées ou chargées à partir d'une mémoire interne. Vous risqueriez d'endommager le support de stockage (mémoire USB ou mémoire interne) ou les données qu'il contient.

Use a portable USB memory device for the USB storage media. Connect it directly to a type A USB port of the AQ1000.

Hot-plugging is supported: you can connect or disconnect the USB device at any time, regardless of whether the AQ1000 is on or off.

When the power is on, the AQ1000 automatically detects the USB memory device after it is connected.

Note

- Use a portable USB memory device for the USB storage media. Do not connect incompatible USB memory devices.
- Connect USB memory devices directly to the AQ1000, not through a USB hub.
- You cannot use protected USB memory devices (such as those that contain encrypted content).
- Do not remove and connect a USB memory device at short intervals. Provide at least a 10-second interval between removal and connection.
- Do not connect or remove a USB memory device from the time when the AQ1000 is turned on until key operation becomes available.
- USB memory devices complying with USB 1.0/1.1/2.0 can be used.

7

Managing Data

7.2 Using the AQ1000 as a Mass Storage Device

The AQ1000 can be connected to and accessed as a mass storage device from a PC, and the files and folders in the internal memory can be displayed and manipulated.

Procedure

1. Turn on the instrument.

2. Connect the type B (Micro-B) USB port on the top panel of the instrument to the type A USB port of the PC with the supplied USB cable.

For a description of the top panel, see "Component Names and Functions" in the Getting Started Guide, IM AQ1000-02EN. If the instrument is connected to the PC for the first time as a mass storage device, a USB driver is automatically installed in the PC.
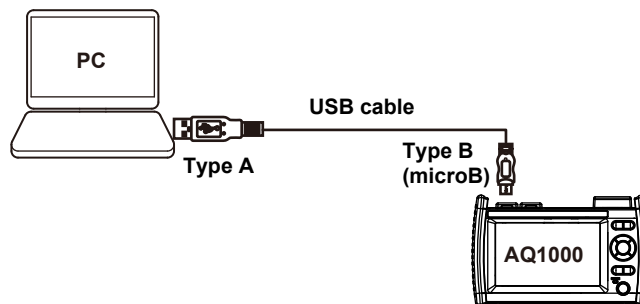
3. On your PC, start Explorer or other browser.
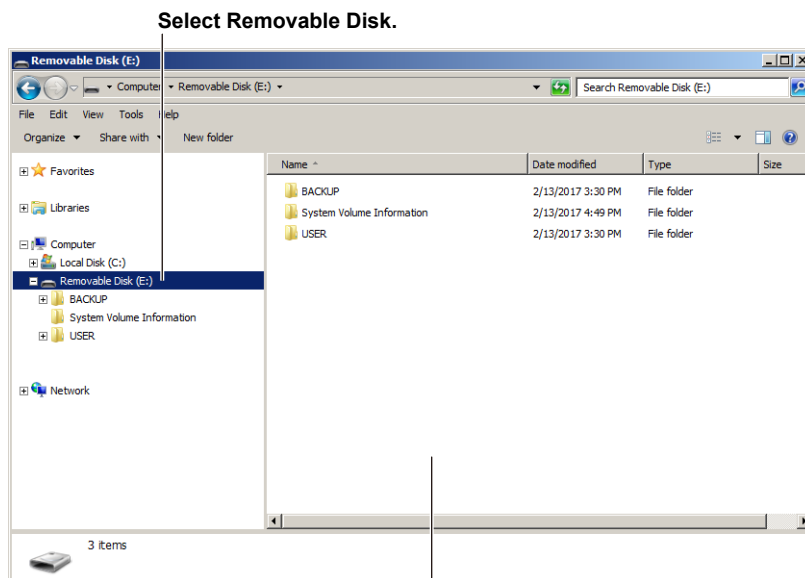
AQ1000 internal memory

Note

- The BACKUP folder is an AQ1000 system folder. Do not change or delete this folder. If you change or delete it by mistake, restart the AQ1000. The folder will be created automatically when it restarts.
- Waveform data and report files of measured results are saved in the USER folder. The necessary folders are created automatically for each file operation. You can view the contents of the USER folder through file operations on the AQ1000.
- Do not save files in the root folder (same folder level as BACKUP and USER). Doing so can reduce the processing capability of the AQ1000. Files saved in the root folder are automatically deleted the next time the AQ1000 is started.

7.3 Saving and Loading Waveform Data

CAUTION

Do not remove a USB memory device or turn off the power when the USB memory access indicator is blinking or when data is being saved or loaded from internal memory. Doing so may damage the storage medium (USB memory or internal memory) or corrupt its data.

French

ATTENTION

N'enlevez pas un dispositif de mémoire USB et ne coupez pas l'alimentation électrique lorsque l'indicateur d'accès à la mémoire USB clignote ou lorsque les données sont en train d'être enregistrées ou chargées à partir d'une mémoire interne. Vous risqueriez d'endommager le support de stockage (mémoire USB ou mémoire interne) ou les données qu'il contient.

Procedure

Saving Waveform Data

1. Press **MENU** to display the MENU screen.

2. Tap the **Save** button. A file list screen for saving data appears.

MENU screen

7

Managing Data

File List Screen for Saving Data

Set the file list display method (list, detail).

▪▪ : List   **Displays the contents of the next higher level folder**

▬▬ : Detail   **File path**

2019/07/09 15:01

Internal Memory

4 items, 0 selected   Space :

1310nm0003 30.2KB 2019/07/09 15:00	1310nm0002 30.2KB 2019/07/09 15:00
1310nm0001 30.2KB 2019/07/09 15:00	1310nm0000 30.2KB 2019/07/09 14:59

List of files and folders

1310nm0004.SOR

Saves data

Name of the file to be saved

Data save format (SOR, SOZ, SOR+JPG)
See "Setting the File Name" in section 8.2.

Saving the Data of Multi Wavelength Measurement (1310 nm/1550 nm) (SOZ format)

You can save the two waveforms of multi wavelength measurement as a single data file in SOZ format. When the data is saved in SOR format, the current waveform is saved. To save the two wavelengths separately, save each file by switching the current waveform display. The wavelength indication in the file name is automatically set to the wavelength of the current waveform.

Files in SOZ format can only be loaded into this instrument. To perform analysis on a PC using the AQ7933 OTDR emulation software, save each wavelength in SOR format.

Loading Waveform Data

1. Press **MENU** to display the MENU screen.

2. Tap the **Load** button. A file list screen for loading data appears.

MENU screen

MARKER ANALYSIS   POWER CHECKER

EVENT ANALYSIS   LIGHT SOURCE

VISIBLE LIGHT SOURCE

Load   Save

File

⚙ OTDR Setup   ⚙ System Setup   ⚙ File Setup

Ref. Trace

File List Screen for Loading Data

Set the file list display method (list, detail).

▤▤ : List   Displays the contents of the next higher level folder

▬▬ : Detail   File path

```
2017/02/23 16:37                                    ▣━⚡▭▭
  ⤵                  ┌──────────────────────────────┐    ✕
                     │ Internal Memory              │
                     └──────────────────────────────┘
                              4 items, 0 selected   Space :
  📄 1310nm0000                      📄 1310nm0000
  [JPG]   69.2KB  2017/02/23 15:30   [SOR]   40.1KB  2017/02/23 15:30
  📄 1310nm0001                      📄 1310nm0000
  [SOR]   6.06KB  2017/02/15 14:44   [PDF]   22.4KB  2017/02/14 10:24




                                                            📂
```

List of files and folders

Loads data

Note

The AQ1000 can load SOR files (waveform data) and CFG files (configuration data). JPG and PDF files cannot be loaded.

Explanation

Saving Data

The following types of files can be saved.

Extension	Description
*.SOR	Waveform data measured from an optical pulse (including the measurement conditions) is saved in an SOR file format that conforms to Telcordia SR-4731.
*.JPG	Screen image of the waveform data is saved to a JPEG file.
*.SOZ	Optical pulse waveform data (including the measurement conditions) for two wavelengths measured with the multi wavelength measurement feature is saved in an SOZ file.

Loading Data

The following types of files can be loaded.

Extension	Description
*.SOR	Waveform data measured from an optical pulse (including the measurement conditions) is saved in an SOR file format that conforms to Telcordia SR-4731.
*.CFG	System settings are saved to a file in CFG format.
*.SOZ	Optical pulse waveform data (including the measurement conditions) for two wavelengths measured with the multi wavelength measurement feature. This file can only be loaded into this instrument.

You can save CFG data on the System Setup screen. For the operating procedure, see section 8.3.

7

Managing Data

7.4 Creating Report Files

CAUTION

Do not remove a USB memory device or turn off the power when the USB memory access indicator is blinking or when data is being saved or loaded from internal memory. Doing so may damage the storage medium (USB memory or internal memory) or corrupt its data.
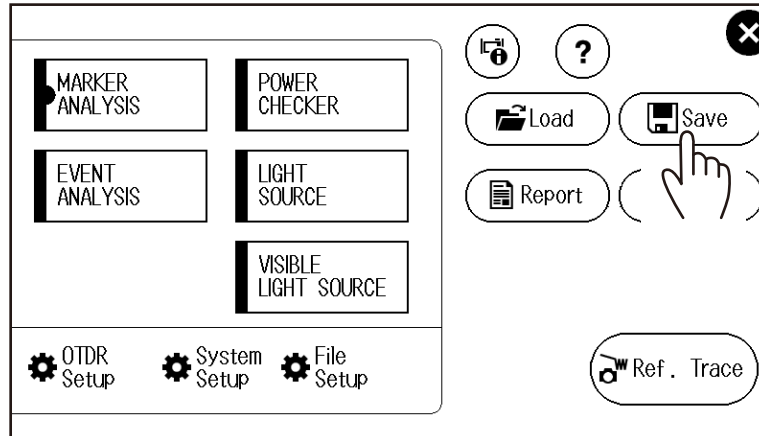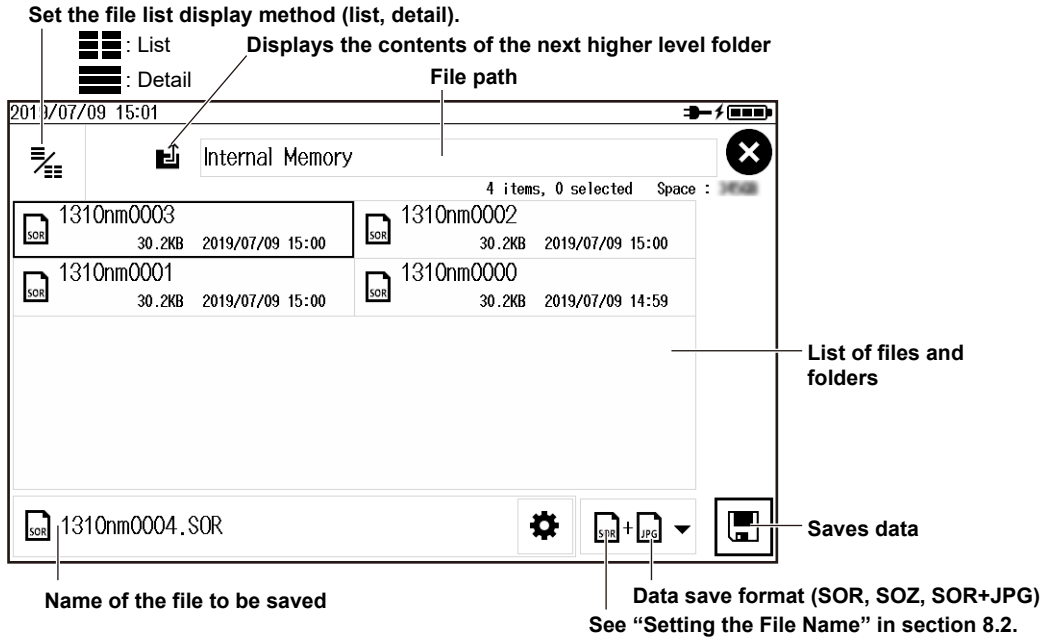

French

ATTENTION

N'enlevez pas un dispositif de mémoire USB et ne coupez pas l'alimentation électrique lorsque l'indicateur d'accès à la mémoire USB clignote ou lorsque les données sont en train d'être enregistrées ou chargées à partir d'une mémoire interne. Vous risqueriez d'endommager le support de stockage (mémoire USB ou mémoire interne) ou les données qu'il contient.

Procedure

Exporting Saved Waveform Data to PDF (Report File)

1. Press **MENU** to display the MENU screen.

2. Tap the **Report** button. A file list screen for creating reports appears.
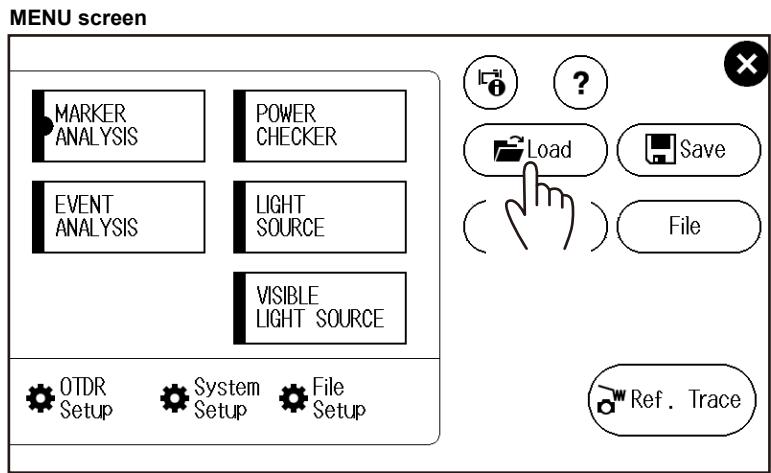
MENU screen

File List Screen for Creating Reports

Set the file list display method (list, detail).

▦ : List   **Displays the contents of the next higher level folder**

▬ : Detail   **File path**

2017/02/23 16:37

Internal Memory

4 items, 0 selected   Space : ▓

📄 1310nm0000
JPG   69.2KB   2017/02/23 15:30

📄 1310nm0000
SOR   40.1KB   2017/02/23 15:30

📄 1310nm0001
SOR   6.06KB   2017/02/15 14:44

📄 1310nm0000
PDF   22.4KB   2017/02/14 10:24

List of files and folders

Creates a report file

Exporting File List Data to Report Files

1. Press **MENU** to display the MENU screen.

2. Tap the **File** button. A file list screen for manipulating files appears.

3. Tap the ☑ icon. A screen for selecting files and folders to be manipulated appears.

4. Select the files or folders you want to manipulate.

2019/08/01 09:17

Internal Memory

4 items, 0 selected   Space : ▓

📁 sample
2019/08/01 09:15

📄 1310nm0001
SOR   30.2KB   2019/08/01 09:16

📄 1310nm0000
SOR   30.2KB   2019/08/01 09:16

📄 1310nm0000
JPG   59.3KB   2019/08/01 09:16

LOAD
RENAME
COPY
DELETE
REPORT

Select all the files you want to export to a report file.

Tap REPORT. (Proceeds to the next step)

7 Managing Data

5. Tap the export report icon. A report file will be created.

Exports a report file

Note

- Report files can only be saved in SOR format (waveform data).
- To view PDF report files, you need Adobe Reader 5.0 or later.

Setting the Report File Format

See "Setting the Report Format" in section 8.2.

Explanation

This section explains how to export waveform data saved according to the procedure in section 7.3 as a report file in PDF format. To directly export the current waveform shown on the data display screen as a report file in PDF format, see the following sections.

Auto save: In "Setting Auto Save" in section 8.1, set the file type to *.pdf. When averaged measurements are completed, a report file is automatically created.

Direct save: In "Setting Direct Save" in section 8.2, set the file type to *.pdf. When you carry out the procedure in "Saving Measured Data Directly" of section 2.4, a report file is created.

7.5 Performing File Operations

CAUTION

Do not remove a USB memory device or turn off the power when the USB memory access indicator is blinking or when data is being saved or loaded from internal memory. Doing so may damage the storage medium (USB memory or internal memory) or corrupt its data.
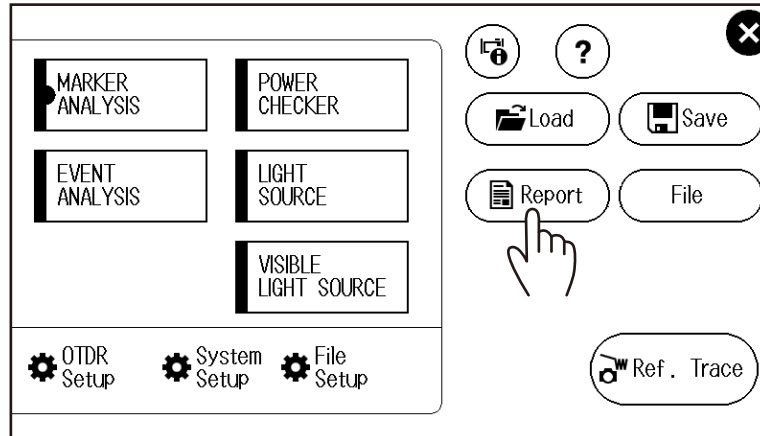

French

ATTENTION

N'enlevez pas un dispositif de mémoire USB et ne coupez pas l'alimentation électrique lorsque l'indicateur d'accès à la mémoire USB clignote ou lorsque les données sont en train d'être enregistrées ou chargées à partir d'une mémoire interne. Vous risqueriez d'endommager le support de stockage (mémoire USB ou mémoire interne) ou les données qu'il contient.
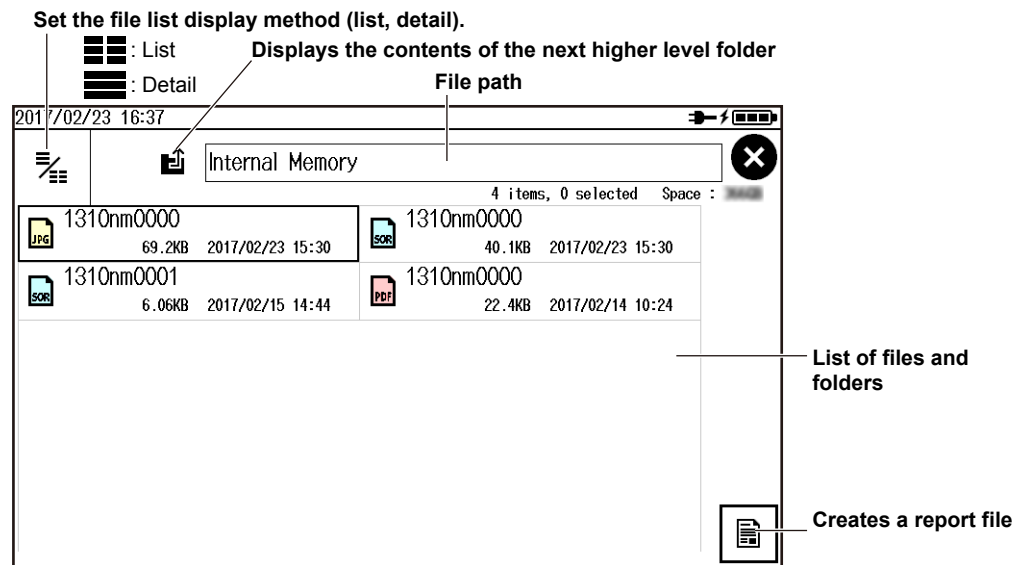

Procedure

Manipulating Files and Folders

1. Press **MENU** to display the MENU screen.

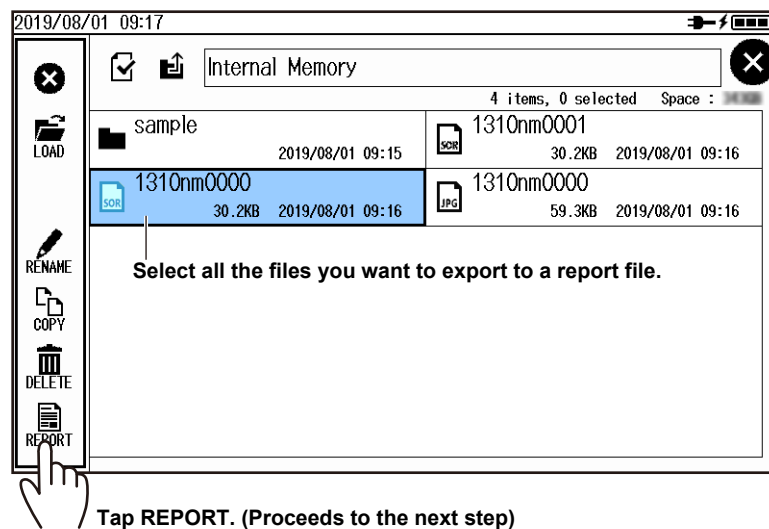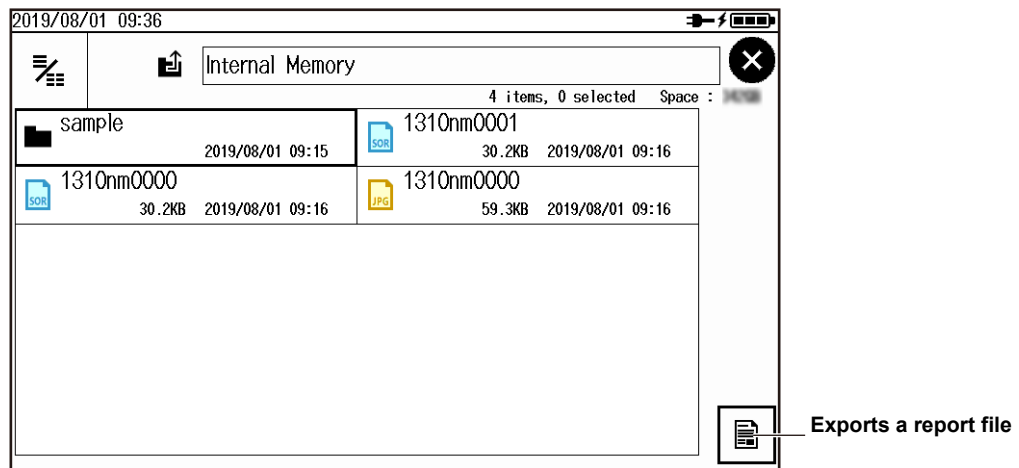2. Tap the **File** button. A file list screen for manipulating files appears.

MENU screen
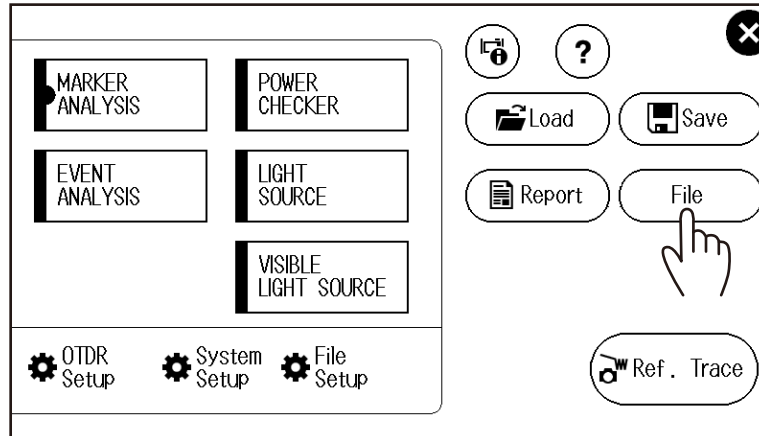
7

Managing Data

File List Screen for Manipulating Files

Displays a screen for selecting files and folders to be manipulated (rename, copy, delete files and folders)

Displays the contents of the next higher level folder

File path

Set the file list display method (list, detail).

⬛⬛ : List

▬▬ : Detail

Creates a folder
A character input screen appears. A new folder is created after you enter the characters.
For instructions on how to input characters, see the Getting Started Guide, IM AQ1000-02EN.

```
2017/02/24 13:35                                    ⊟-ϟ ▇▇▇
  ⧩      ☑  ⬆   Internal Memory                        ✕
  ▦                              4 items, 0 selected   Space :
  ⊞       📁 Sample                      📄 1310nm0000
 NEW                2017/02/24 11:57    JPG      69.2KB  2017/02/23 15:30
          📄 1310nm0000                 📄 1310nm0001
         SOR      40.1KB  2017/02/23 15:30  SOR      6.06KB  2017/02/15 14:44
```

List of files and folders

Renaming, Copying, and Deleting Files and Folders

3. Tap the file or folder you want to manipulate. A screen with file operation icons appears.

4. Tap the file operation you want to execute.

A screen with file operation icons

Returns to the previous screen

Opens a folder
Appears when you select a folder.

Renames a folder or file
A character input screen appears. For instructions on how to input characters, see the Getting Started Guide, IM AQ1000-02EN.

Deletes a file or folder
The selected file or folder is deleted.

```
2017/02/24 13:35                                    ⊟-ϟ ▇▇▇
  ✕       ☑  ⬆   Internal Memory                        ✕
  📂                             4 items, 0 selected   Space :
 OPEN     📁 Sample                      📄 1310nm0000
                   2017/02/24 11:57    JPG      69.2KB  2017/02/23 15:30
          📄 1310nm0000                 📄 1310nm0001
  ✏       SOR      40.1KB  2017/02/23 15:30  SOR      6.06KB  2017/02/15 14:44
RENAME
  📋       Copying Files and Folders
 COPY      A screen for copying files and
  🗑        folders appears.
DELETE
```

Copying Files and Folders
A screen for copying files and folders appears.

- **Copying Files and Folders**

5. Tap the 📋 icon. A file list screen of the copy destination folder appears. Change the folder as necessary.
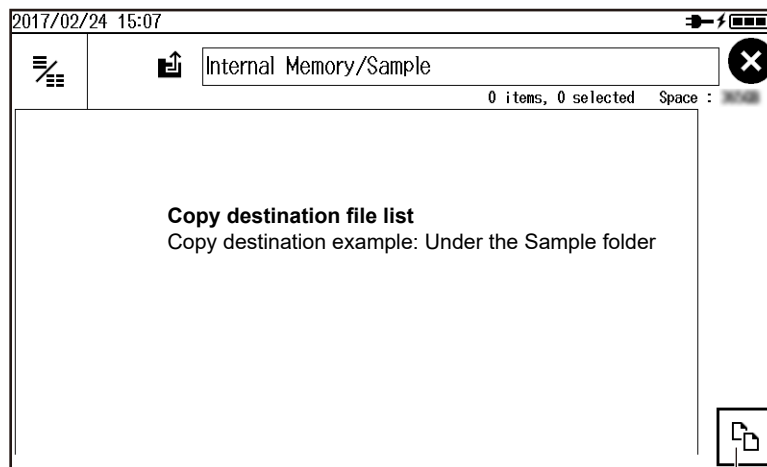
Starts copying
The file or folder is copied in the displayed file list.

Selecting Multiple Files and Folders

3. Tap the ☑ icon. A screen for selecting files and folders to be manipulated appears.

4. Select the files or folders you want to manipulate.

Selects all files and folders
Unselects all files and folders

Selects the file
A check mark appears when the file is selected.
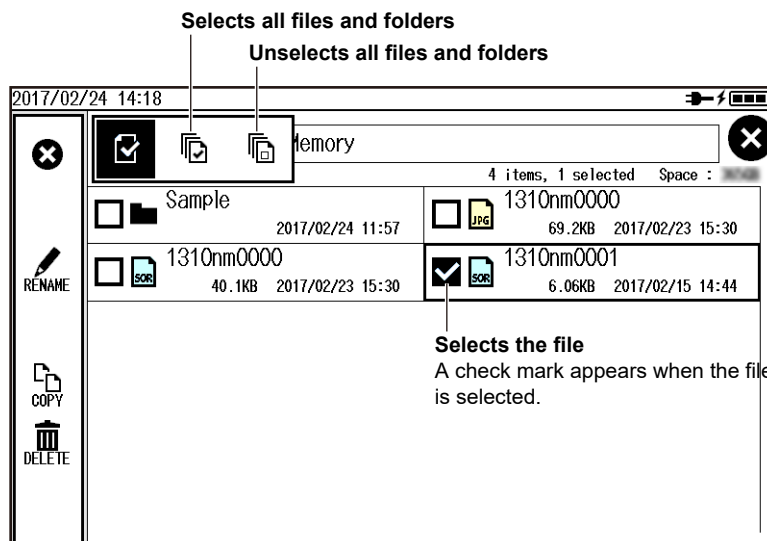
Loading Files (SOR Format, CFG Format)

3. Select the file you want to load. A screen with file operation icons shows a load file icon.

A screen with file
operation icons

Returns to the
previous screen

Loads a file
The selected file will be loaded.

2017/02/24 15:46

Internal Memory

4 items, 0 selected   Space :

☑ ⬆

⊗

📂
LOAD

✏
RENAME

🗐
COPY

🗑
DELETE

📁 Sample
2017/02/24 11:57

[SOR] 1310nm0000
40.1KB   2017/02/23 15:30

[JPG] 1310nm0000
69.2KB   2017/02/23 15:30

[SOR] 1310nm0001
6.06KB   2017/02/15 14:44

Selects the file
The background color changes
when selected.

Note

Files can also be loaded using the procedure explained in section 7.3.

8.1   Changing the OTDR Settings

Procedure

1.   Press **MENU** to display the MENU screen.

2.   Tap the **OTDR Setup** button. The Setup Info. Menu appears.
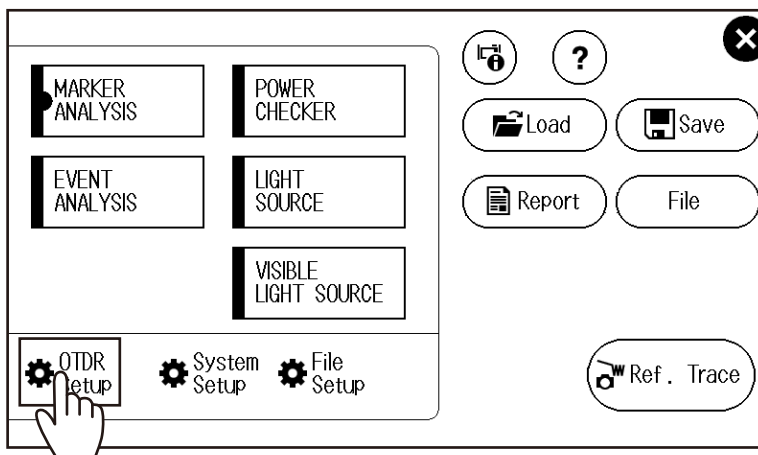
MENU screen

Setting Measurement Conditions (MEASURE)

3.   Tap the **MEASURE** display area. The MEASURE SETUP screen appears.

You can carry out the same operations as when the start screen at power-on is set to Setup Info. Menu.

Setup Info. Menu screen

MEASURE display area

8

Changing the Settings

MEASURE SETUP Screen

Set the wavelength (1310nm, 1550nm, 1310nm/1550nm).

Set the distance range (AUTO, 200m, 500m, 1km, 2km, 5km, 10km, 20km, 30km, 50km, 100km, 200km, 256km).

```
2017/02/10 09:27                                    ⊕─⚡▮▮▮
                         MEASURE SETUP              ⊗

Wavelength                          Fiber-In-Use Alarm
  SM 1310nm      ▼                        ON            Set the fiber-in-use
                                                        alarm (OFF, ON).
Distance Range                      Connection Check
  AUTO          ▼                        OFF            Set the connection
                                                        check (OFF, ON).
Pulse Width                         Auto Save
  AUTO                                   OFF    ❯        Set auto save
                                                        (OFF, ON).
Average Duration
  AUTO          ▼                                       Executes initialization
                                                        Press to reset the
                                  Default               measurement settings to
                                                        their factory defaults.
                                                        See appendix 2.
```

Set the pulse width (AUTO, 3ns, 10ns, 20ns, 30ns, 50ns, 100ns, 200ns, 300ns, 500ns, 1 µs, 2µs, 5µs, 10µs, 20µs).
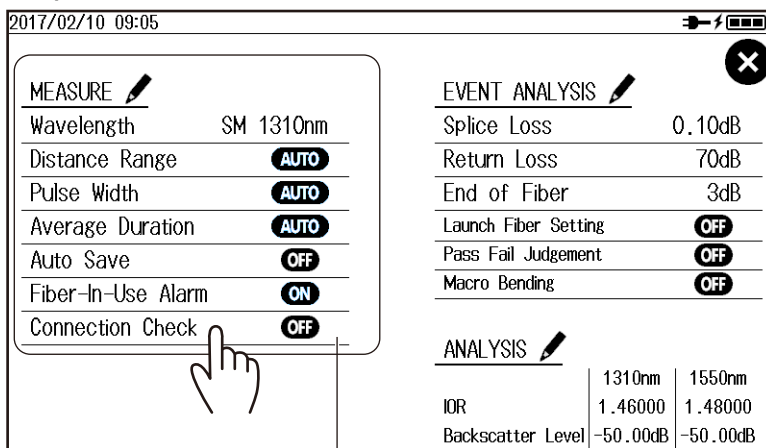
Set the average duration (AUTO, 5sec, 10sec, 20sec, 30sec, 1min, 3min, 5min, 10min, 20min, 30min).

- **Setting Auto Save**

  Tap the **Auto Save** button. The Auto Save screen appears.

  Set auto save (OFF, ON).

  Set the mode (Date, User Define).
  Select how to specify the save destination folder. You can set this when auto save is ON.

  Set the file type (*.SOR, *.SOR+*.PDF).
  Select the data save format.

```
2017/02/10 09:48                                    ⊕─⚡▮▮▮
                         Auto Save                  ⊗

Auto Save
  OFF

Mode              File Type
  Date              SOR        File Name Setup        Set the file name
                                                      (see section 8.2).
Drive
  Int.Memory   ▼
```

Select the save destination drive (Int. Memory, USB Memory).
This is displayed when the mode is set to Date, in which case you can set it.

```
Save Folder

  INTERNAL_AQ1000/DATA                         ✎
```
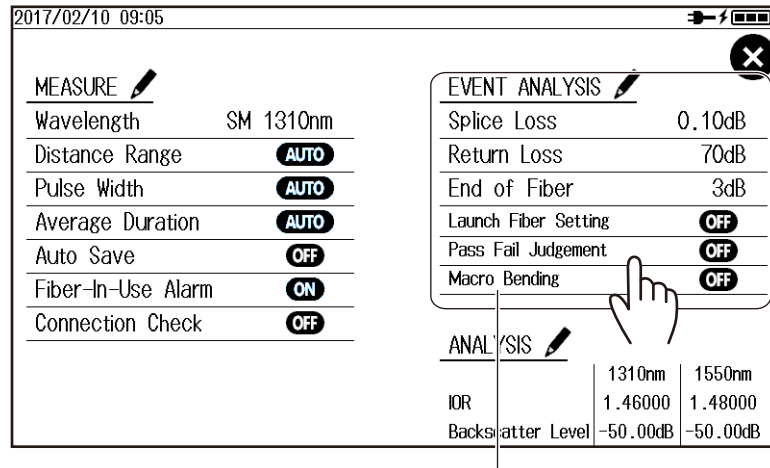
Save destination folder
The current file path is displayed.
This is displayed when the mode is set to User Define.

Displays the file list of the folder displayed in the current file path.
For details on file operations, see section 7.5.
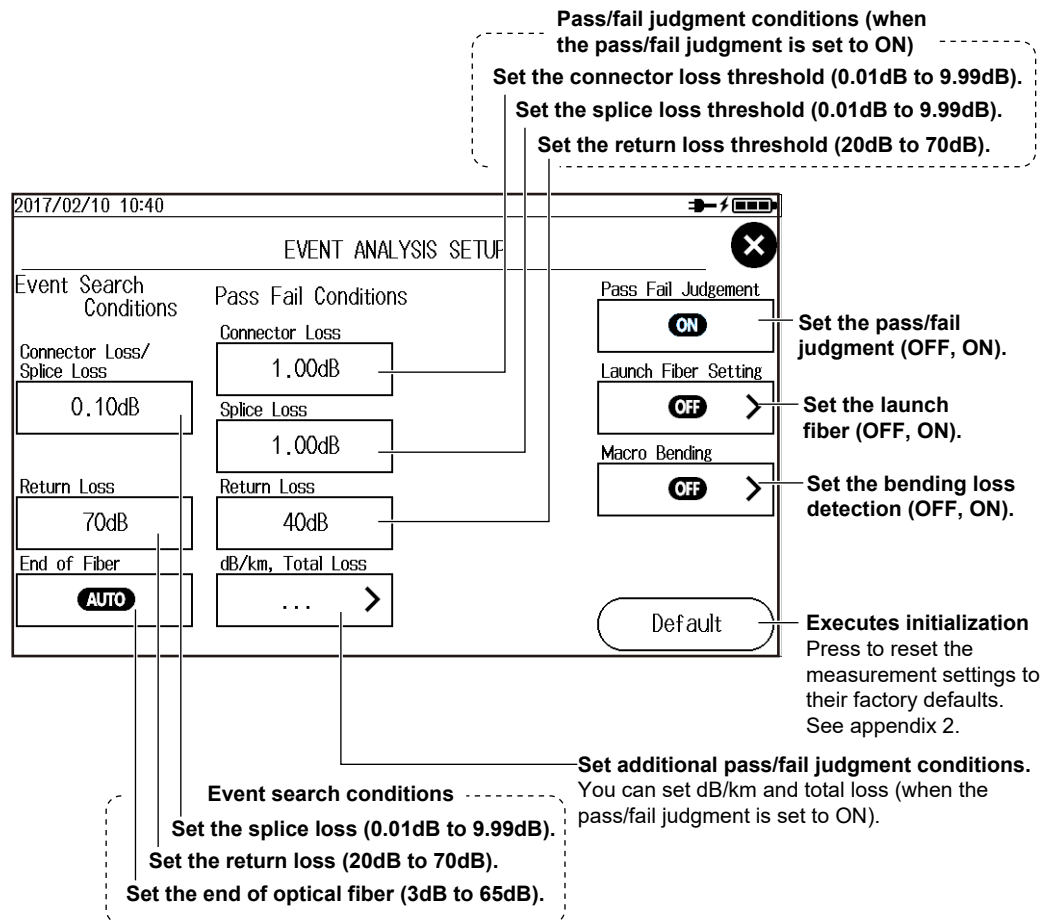
Setting Event Analysis Conditions (EVENT ANALYSIS)

3. Tap the **EVENT ANALYSIS** display area. The EVENT ANALYSIS SETUP screen appears.

You can carry out the same operations as when the start screen at power-on is set to Setup Info. Menu.

Setup Info. Menu screen

EVENT ANALYSIS display area

EVENT ANALYSIS SETUP Screen

Pass/fail judgment conditions (when the pass/fail judgment is set to ON)
Set the connector loss threshold (0.01dB to 9.99dB).
Set the splice loss threshold (0.01dB to 9.99dB).
Set the return loss threshold (20dB to 70dB).

Set the pass/fail judgment (OFF, ON).

Set the launch fiber (OFF, ON).

Set the bending loss detection (OFF, ON).

Executes initialization Press to reset the measurement settings to their factory defaults. See appendix 2.

Set additional pass/fail judgment conditions. You can set dB/km and total loss (when the pass/fail judgment is set to ON).

Event search conditions
Set the splice loss (0.01dB to 9.99dB).
Set the return loss (20dB to 70dB).
Set the end of optical fiber (3dB to 65dB).

8

Changing the Settings

- **Setting dB/km and Total Loss**

    Tap the **More** button. A screen for setting dB/km and total loss appears.

    Set the dB/km loss (1310 nm) threshold (0.01dB to 9.99dB).

    Set the dB/km loss (1550 nm) threshold (0.01dB to 9.99dB).

    dB/km
    1310nm   1550nm

    1.00dB   -----

    Total Loss
    1310nm   1550nm

    10dB   -----

    Set the total loss (1550 nm) threshold (1dB to 65dB).

    Set the total loss (1310 nm) threshold (1dB to 65dB).

Note

These can be set only on wavelengths selected on the MEASURE SETUP screen.

- **Setting a Launch Fiber**

    Tap the **Launch Fiber Setting** button. The Launch Fiber Setting screen appears.

    Specify the launch fiber section using the distance from the end point (E).
    Specify the launch fiber section using an event number.

    2019/08/01 11:31

    Launch Fiber Setting

    Set on Event Number
    From Start   From End

    None   None

    Set on Distance
    From Start   From End

    0.00m   0.00m

    Set the end event (None, 1, 2).

    Set the start event (None, 1, 2).

    Set the distance from the end point (E) (0.00m to 9999.99m).

    Set the distance from the start point (S) (0.00m to 9999.99m).

Note

When you set the launch fiber section, Launch Fiber Setting is set to on.

- **Setting Bending Loss Detection**

    Tap the **Macro Bending** button. The Macro Bending screen appears.

    Turns the display on and off

    2017/02/10 14:41

    Macro Bending

    Display

    OFF

    Threshold

    0.100dB

    Set the threshold (0.001dB to 99.999dB).

Setting Analysis Conditions (ANALYSIS)

3. Tap the **ANALYSIS** display area. The ANALYSIS SETUP screen appears.

You can carry out the same operations as when the start screen at power-on is set to Setup Info. Menu.

Setup Info. Menu screen
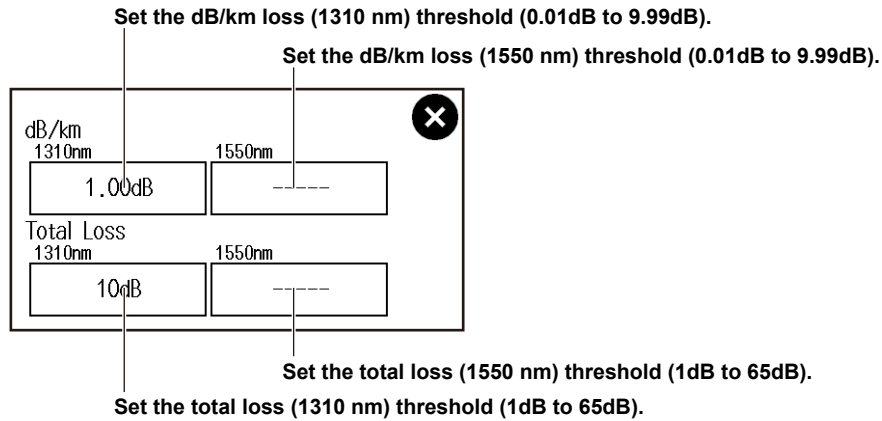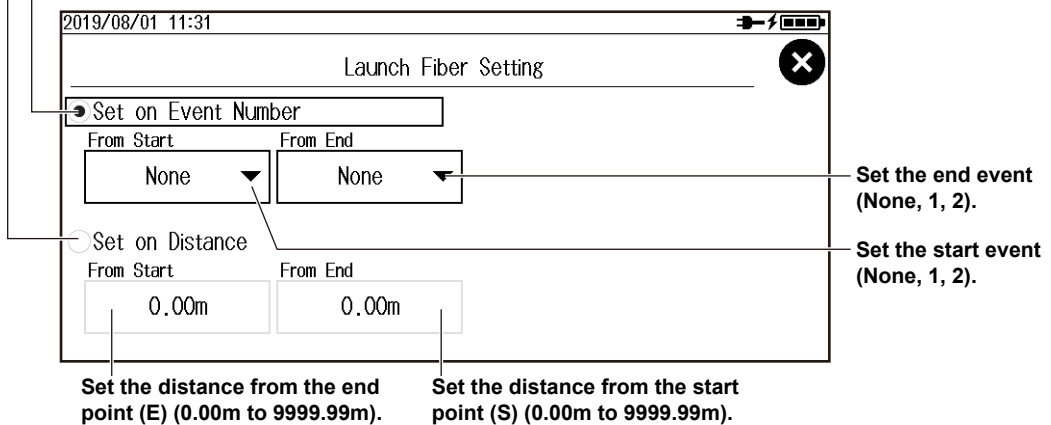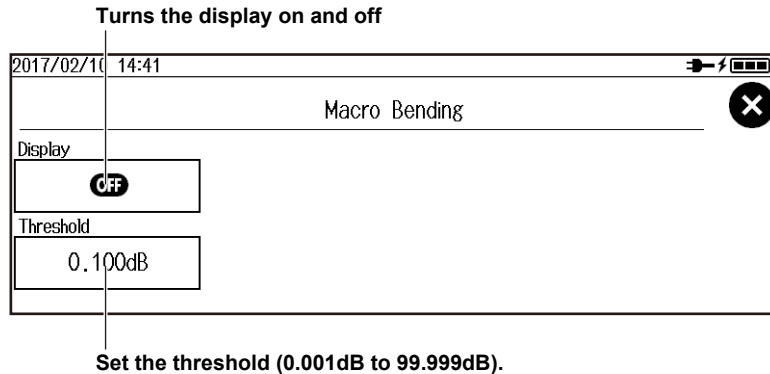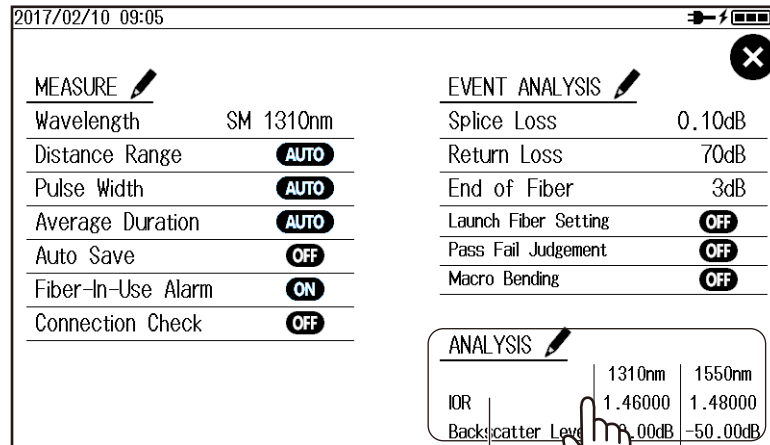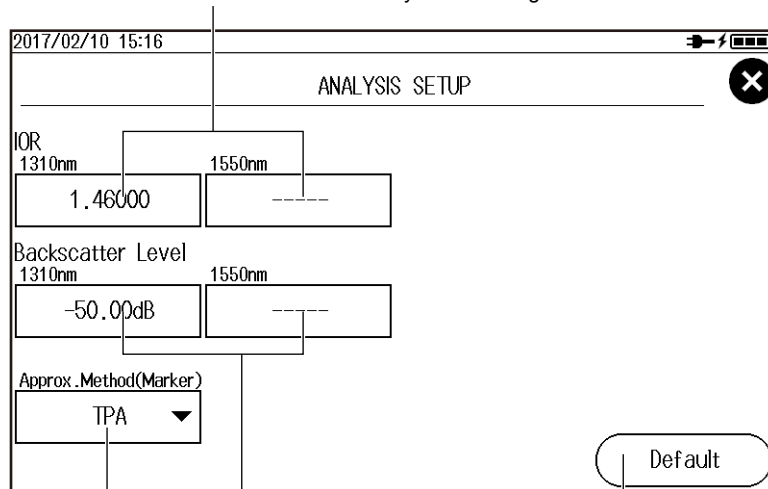

ANALYSIS display area

ANALYSIS SETUP Screen

Set the index of refraction (1.30000 to 1.7999).
These can be set only on wavelengths selected on the MEASURE SETUP screen.

Executes initialization
Press to reset the measurement settings to their factory defaults. See appendix 2.

Set the backscatter level.
For a pulse width of 1 µs: –10.000 dB to –64.99 dB
For a pulse width of 1 ns: –40.00 dB to –94.99 dB
These can be set only on wavelengths selected on the MEASURE SETUP screen.
For details on the pulse width setting, see "Setting the Backscatter Level Base" in section 8.3.

Set the approximation method (marker; LSA, TPA).

Explanation

Setting Measurement Conditions (MEASURE)

Wavelength

You can enter the following wavelengths.

Model	Optical Pulse Wavelength
AQ1000	1310 nm, 1550 nm, 1310 nm/1550 nm (multi wavelength measurement)

1310 nm/1550 nm (multi wavelength measurement)

In a single measurement, 1310 nm and 1550 nm are measured one at a time.
If 1310 nm/1550 nm is selected, the wavelength of optical pulse being measured is displayed on the screen.

Distance Range

Set the distance range according to the length of the optical fiber cable. The distance range that you can select varies depending on the wavelength. Specify a distance range value that is greater than the length of the optical fiber cable that you will measure. If you specify a shorter value, the AQ1000 will not be able to perform measurements properly. The longer the distance that you specify, the more time measurements will take. When you specify the distance range, the optimum pulse width and attenuation values are set automatically.

Cable Length	Distance Range
Unknown	Auto
0 m to 160 m	200 m
160 m to 400 m	500 m
400 m to 800 m	1 km
800 m to 1.6 km	2 km
1.6 km to 4 km	5 km
4 km to 8 km	10 km
8 km to 16 km	20 km
16 km to 24 km	30 km
24 km to 40 km	50 km
40 km to 80 km	100 km
80 km to 160 km	200 km
160 km to 240 km	256 km

Pulse Width

The pulse width has the following characteristics.
• A short pulse width enables you to measure with a high resolution, but you cannot measure long distances.
• A long pulse width enables you to measure long distances, but you cannot measure with a high resolution. Also, dead zones are larger with long pulse widths.

The selectable pulse width is 3 ns to 20 μs. The selectable pulse width varies depending on the distance range. The AQ1000 automatically selects the optimal value and displays the selectable pulse widths.

Average Duration

You can select from the following values.

10 sec, 20 sec, 30 sec, 1 min, 3 min, 5 min, 10 min, 20 min, 30 min

Sec is seconds, and min is minutes.

In averaged measurement mode, the AQ1000 can perform measurements correctly even if large reflections (excluding extremely large reflections caused by sections of the fiber such as the open end of the fiber) occur. In averaged measurement, the AQ1000 sets the optimum attenuation according to the backscatter level for each section, and performs the measurement. The partitioning of the optical fiber into sections and the specifying of the optimum attenuation are done automatically.

*   Due to the influence of other measurement conditions, a measurement may take less time than the duration you have specified or it may not complete when the specified duration elapses.
*   If you specify a large value, you can perform highly precise measurements, but the measurement time becomes longer. Keep the AQ1000's dynamic range and the loss of the optical fiber cable under measurement in mind when you specify these values.
*   If AUTO is selected, one of the options above is used.

Fiber-in-Use Alarm

The AQ1000 uses the same wavelength that is used in real communication to measure optical pulses. If communication light is present in the optical fiber cable that you want to measure, the communication will be affected. When this communication light is present, we say that the fiber is in use. The fiber-in-use alarm is a feature that checks if communication light is being transmitted along the optical fiber cable that you are trying to measure. If the fiber is in use, a warning message is displayed asking whether you want to continue the measurement.

OFF: Fiber in use is not checked.

ON: Fiber in use is checked.

Connection Check

The connection check is a feature that checks the state of the connection between the AQ1000 and an optical fiber cable. When this feature is set to on, you can prevent light from being transmitted from the AQ1000 OTDR port if an optical fiber cable is not connected to the AQ1000 or if the cable is not connected correctly.

OFF: Connections are not checked.

ON: Connections are checked.

Auto Save

After an averaged measurement of the optical pulse is complete, the measurement waveform is automatically saved.

*   **Set the mode.**

    Select how to specify the save destination folder.

    Date: Folders that are named with dates are automatically created in the selected drive.

    UserDefine: Specify the save destination folder.

*   **Destination Folder**

    Create a folder of your choice in advance in the selected drive, and select this folder as the save destination folder.

8

Changing the Settings

Setting Event Analysis Conditions (EVENT ANALYSIS)

Splice loss

If a splice loss that exceeds the specified threshold occurs, it is detected as an event.
The range is 0.01 dB to 9.99 dB.

Return Loss

If a return loss that is less than or equal to the specified threshold occurs, it is detected as an event.
The larger the reflection, the smaller the return loss, so events (reflections) are detected when the return loss is less than or equal to the threshold.
The range is 20 dB to 70 dB.

End of Fiber

If a reflection that exceeds the specified threshold occurs, it is detected as the end of the optical fiber cable (Fresnel reflection).
The range is 3 dB to 65 dB. If the threshold is specified to 10 dB, the threshold value displayed on the End of Fiber box becomes AUTO.

Pass/Fail Judgment

A judgment is performed on the events detected in the target waveform, and those that exceed the specified threshold are displayed as fault events on the event screen.

ON: Pass/fail judgment is set to ON, and events that have exceeded their thresholds are displayed with a mark attached to them (see section 1.5).

OFF: Pass/fail judgment is set to OFF, and events that have exceeded their thresholds are not displayed with a mark attached to them.

Connector Loss, Splice Loss, Return Loss, dB/km, Total Loss

Set the pass/fail judgment threshold for each item.

• **Connector Loss**

Values greater than the threshold value are judged as fail. The range is 0.01 dB to 9.99 dB.

• **Splice loss**

Values greater than the threshold value are judged as fail. The range is 0.01 dB to 9.99 dB.

• **Return Loss**

Values less than the threshold value are judged as fail. The range is 20 dB to 70 dB.

• **dB/km(1310nm, 1550nm)**

Values greater than the threshold value are judged as fail. The range is 0.01 dB to 9.99 dB.

• **Total Loss (1310 nm, 1550 nm)**

Values greater than the threshold value are judged as fail. The range is 1 dB to 65 dB.

Because the end of fibers is handled as either a splice loss or a reflection, there is no fault event just for the end of fibers.

Launch Fiber Setting

When you connect a launch fiber cable to avoid near-end dead zones, you can set the launch fiber cable events (start point and end point), start position or end position so that the event information in the launch fiber section is excluded from the analysis conditions.

Macro Bending (Bending Loss)

When an optical pulse measurement is performed in multi wavelength measurement (when wavelength setting is 1310 nm/1550 nm), you can compare the splice losses at each wavelength and display on the screen bending loss events that are caused by bends in the optical fiber cable.

Display

This function displays the detected bending losses in the event list on the event screen when optical pulses are measured.

OFF: The bending losses are not displayed in the event list.
ON: The bending losses are displayed in the event list.

Threshold

This is the threshold of the difference between the splice losses of each wavelength when optical pulses are measured.

When the difference between the splice losses of each wavelength for the same event is larger than this value, the event is detected as a bending loss.

The range is 0.001 dB to 99.999 dB.

Setting Analysis Conditions (ANALYSIS)

Index of Refraction (IOR)

The AQ1000 uses the index of refraction to calculate the distance. If you do not set the index of refraction correctly, the distance measurement will be incorrect. The index of refraction varies depending on the connected optical fiber cable. Enter the value recommended by the manufacture of the cable.

The AQ1000 has the following preset indices of refraction that correspond to each wavelength.

Wavelength	Index of Refraction (IOR)
1310 nm	1.46000
1550 nm	1.46000

You can specify a value from 1.30000 to 1.79999.

Backscatter Level

Light that travels through an optical fiber cable displays a phenomenon known as Rayleigh scattering. Due to this phenomenon, light is sent backwards, in the direction opposite to the direction of propagation. This phenomenon is known as backscattering. The backscatter level setting is used when the AQ1000 calculates the return loss and total return loss.

If you do not set the correct backscatter level, the return loss and total return loss measurements will be incorrect. On the AQ1000, you can select the reference pulse width for the backscatter level (see section 8.3). The selectable range of backscatter levels vary depending on the reference pulse width.

1 μs: The range is –10.00 to –64.99.
1 ns: The range is –40.00 to –94.99.

The AQ1000 has the following preset backscatter levels that correspond to each wavelength.

Wavelength	1 μs Pulse Width	1 ns Pulse Width
1310 nm	–50 dB	–80 dB
1550 nm	–52 dB	–82 dB

8

Changing the Settings

Approximation Method (Marker)

When the AQ1000 calculates splice loss, it extrapolates straight lines. These straight lines are known as approximated lines.

There are the following two kinds of approximated lines.

• Least squares approximation (LSA)
• Two point approximation (TPA)

• **LSA**

The AQ1000 calculates the loss between two points by using the least squares method on all the data between the two points (between 1 and 2).

This method has the following characteristics.

    Merits: Because all the data between the two points is used, errors in the calculated value are small. Fluctuations in the calculated values are reduced, and highly reproducible values can be obtained.

    Demerit: If a large reflection or splice loss is present in the section whose loss is being calculated, those values are also included in the calculation, so large errors result.

If no events such as reflections and splice losses are present in the section being calculated, the LSA provides a value that has a smaller degree of error than the TPA.
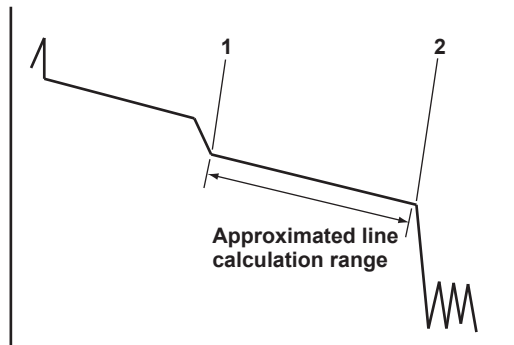
• **TPA**

The AQ1000 uses the difference between the levels of the two specified points to calculate the loss. The level of fluctuation and reproducibility in the calculated value may vary greatly. If events such as reflections and splice losses are present in the section being calculated, the TPA provides a value that has a smaller degree of error than the LSA.
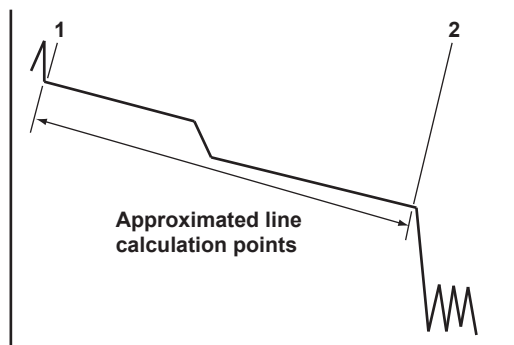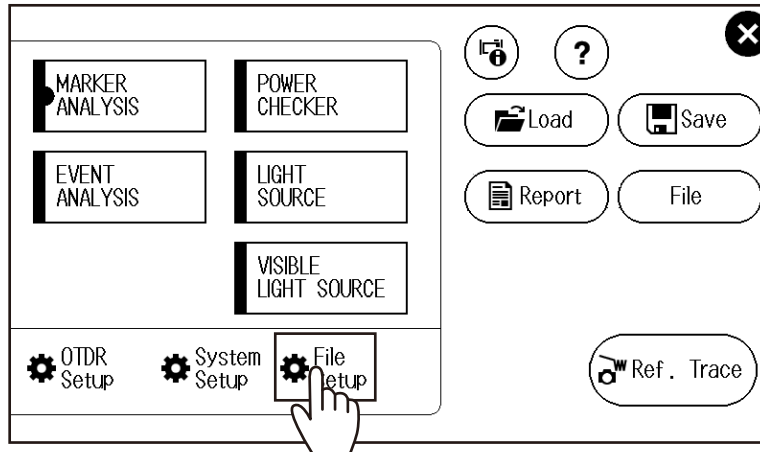
8.2   Changing the File Settings

Procedure

1. Press **MENU** to display the MENU screen.
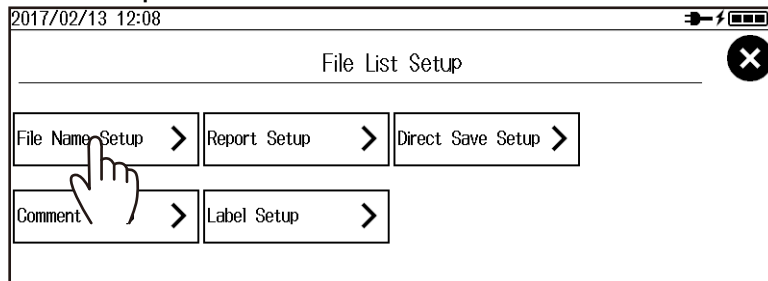2. Tap the **File Setup** button to display the File List Setup screen.

MENU screen

Setting the File Name

3. Tap the **File Name Setup** button to display the File Name Setup screen.

File List Setup screen

File Name Setup Screen

Set the file name format (Wavelength, Comment1 to 10, Company Name, Name, Cable ID, Fiber ID, Cable Code, Originating Loc(A) to (B), Distance Range, Pulse Width, Duration, Blank).
Set the items that will be entered into parts ① to ⑩ of the file name.

```
2017/03/14 16:42   Average 100%                    ⚡▯▮▮▮

                        File Name Setup              ✕

Name Configuration
  ①                  ②                  ③                  ④
  │ Wavelength ▼ │  │ Comment 1 ▼ │  │ ID No.    ▼ │  │ Blank     ▼ │
  ⑤                  ⑥                  ⑦                  ⑧
  │ Blank      ▼ │  │ Blank     ▼ │  │ Blank     ▼ │  │ Blank     ▼ │
  ⑨                  ⑩                                  Tape no. Type
  │ Blank      ▼ │  │ Blank     ▼ │                   │  OFF      ▼ │

  Separator          ID No.                          Tape No
  │ ①②③     ▼ │  │  0        ▼ │  Comment Setup ❯  │ ✳✳✳✳✳✳       │

File Name
  1310nm0000.SOR
```

Set the ID number (0 to 9999).

Set the separator
(①②③,①_②_③, ①˜②˜③, ①ˋ②ˋ③).

Set comments.

Set the tape number start character.
Set, within the specified tape number type range, the tape number start character that will be attached to the file name.

Set the tape number type.
(Off, a-b(2), a-c(3), a-d(4), a-e(5), a-f(6), a-g(7), a-h(8))
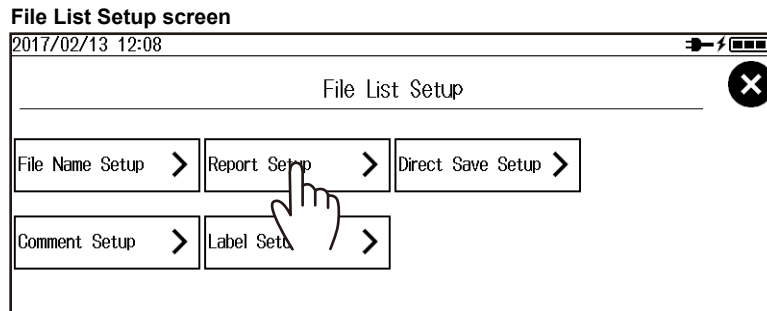
• **Setting Comments**

   Tap the **Comment Setup** button to display the Comment Setup screen.

Set a comment (up to 30 characters).
Enter a comment by following the procedure provided in "Entering Text" in the Getting Started Guide, IM AQ1000-02EN.

```
2017/02/13 14:39                                   ⚡▯▮▮▮

                        Comment Setup                ✕

Comment 1                        Comment 6
│                      │         │                      │

Comment 2                        Comment 7
│                      │         │                      │

Comment 3                        Comment 8
│                      │         │                      │

Comment 4                        Comment 9
│                      │         │                      │

Comment 5                        Comment 10
│                      │         │                      │
```
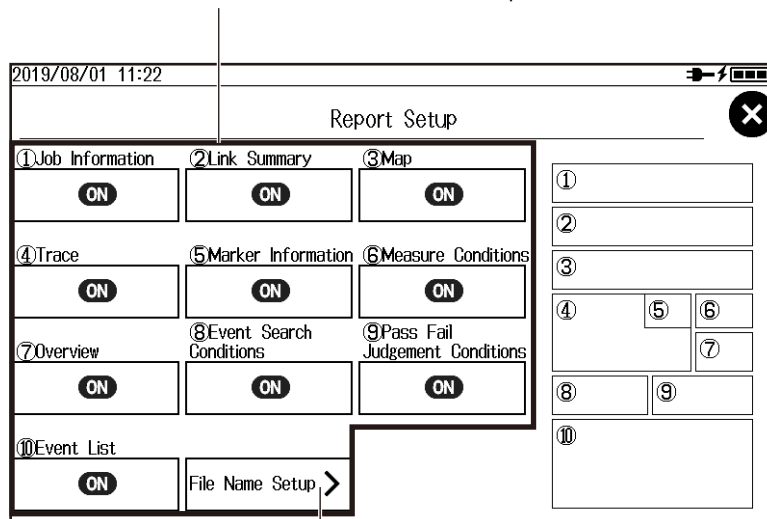
Setting the Report Format (Creating Reports)

3. Tap the **Report Setup** button to display the Report Setup screen.

File List Setup screen

Report Setup Screen

Select the items to include in the report.
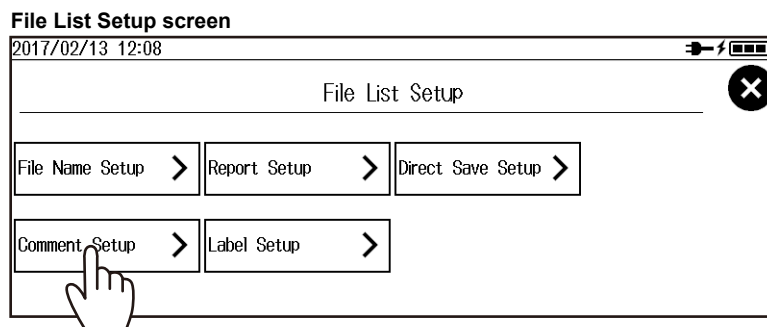For details on the items, see "Explanation" in this section.

Set the file name.
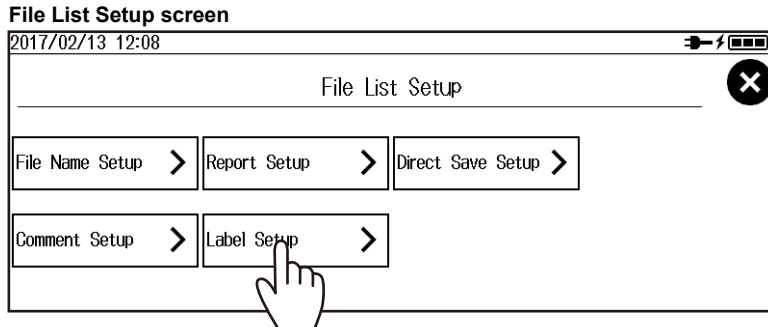See "Setting the File Name" on the previous page.

Setting Comments

3. Tap the **Comment Setup** button to display the Comment Setup screen.

For the procedure, see "Setting Comments" on the previous page.

File List Setup screen

8

Changing the Settings

Setting Labels

3. Tap the **Label Setup** button to display the Label Setup screen.

File List Setup screen

2017/02/13 12:08

File List Setup ✕

| File Name Setup ❯ | Report Setup ❯ | Direct Save Setup ❯ |

| Comment Setup ❯ | Label Setup ❯ |

Label Setup Screen

Set the label.*

Set the company name.*

Set the name.*

Set the fiber type
(652:Conventional SMF, 653:Dispersion Shifted SMF,
654:Cut-Off Shifted SMF, 655:Non-Zero Dispersion Shifted SMF,
656:NZDSF for Wideband Transport, 657:Bend Optimized SMF,
651:Multi-Mode Fiber)

2019/08/01 09:53

Label Setup ✕

Label		Fiber Type
Company Name		652: Conventional SMF ▼
Name		Cable Code
Cable ID		Current Data Flag
Fiber ID		BUILT (BC) ▼
		Location(A)
		Location(B)
		Direction
		A -> B ▼

Set the cable
code.*

Set the start
position.*

Set the end
position.*

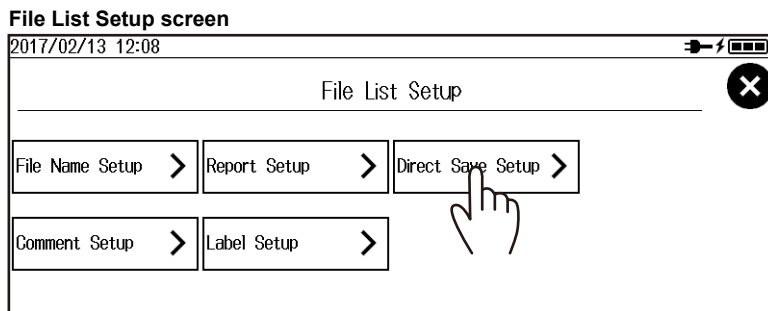Set the cable ID.*
Set the fiber ID.*

Set the current data flag
(BUILT(BC), REPAIRED(RC),
OTHER(OT), CURRENT(CC)).

Direction (A -> B, B -> A)
Shows from which side the optical fiber cable connecting the
start position (A) and stop position (B) was measured.

* Enter the label by following the procedure provided in "Entering Text" in the Getting Started
  Guide, IM AQ1000-02EN.

Setting Direct Save

3. Tap the **Direct Save Setup** button to display the Direct Save Setup screen.

File List Setup screen

2017/02/13 12:08

File List Setup ✕

| File Name Setup ❯ | Report Setup ❯ | Direct Save Setup ❯ |

| Comment Setup ❯ | Label Setup ❯ |

Direct Save Setup Screen

Set the file type (*.SOR, *pdf).

Set the save action (Direct Save, Select ID).
Set the action to be taken when you tap the save icon of the displayed
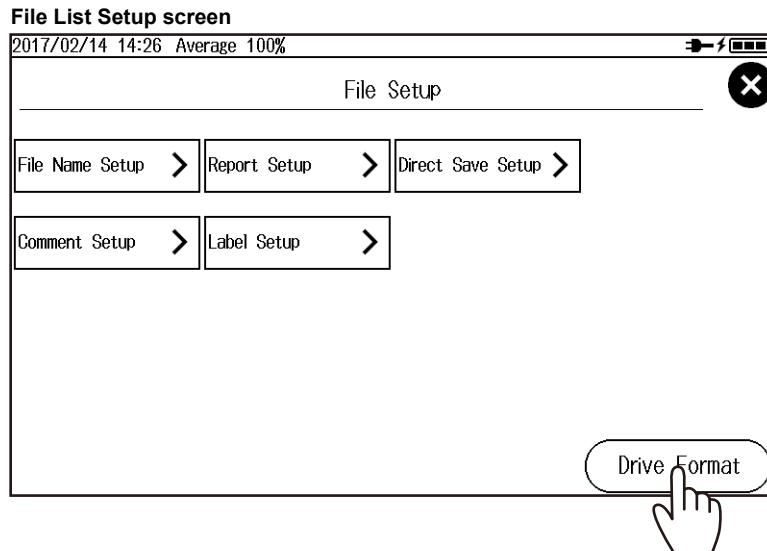waveform on the measurement screen.
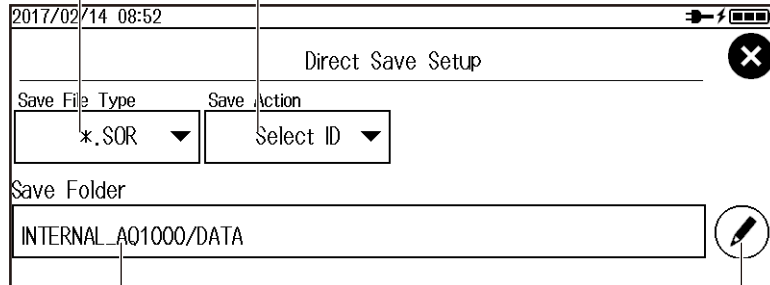
Current file path

**Displays the file list of the folder
displayed in the current file path.**
For details on file operations, see
section 7.5.

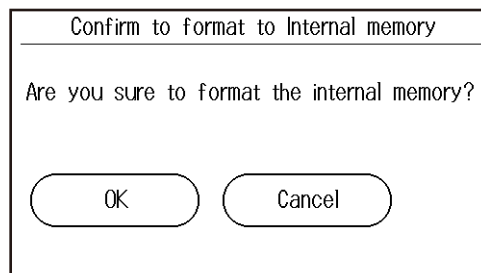## Initializing the Internal Memory

3.   Tap the **Drive Format** button. A screen for confirming the internal memory initialization appears.

File List Setup screen

4.   Tap the **OK** button. The internal memory will be initialized.

The area that will be initialized is the USER/DATA folder.

Drive Format execution confirmation screen

8

Changing the Settings

Explanation

Setting the File Name and Comment

You can select up to 10 items to be used for file names. The items specified for fields ① to ⑩ under Name Type are displayed in order as a file name. The longest file name is 60 characters.

Item	Description
ID No.	Four digit number
	The range is 0 to 9999. Four characters are assigned for the file name. For example, if you set the number to "1," "0001" will be used in the file name.
	One character (tape number)
	If you select to use the ID number for the file name, when Tape Number Type is set to anything other than Off, the tape number is automatically appended to the ID number. Example: If you have a combination of ID No. "0" and Tape Number Type "a to c (3)," the file names will be set as follows: 0000a → 0000b → 0000c → 0001a → 0001b → 0001c.
Wavelength	Six characters containing the wavelength number and unit (Example: 1310nm)
Comment	Up to 30 characters. However, because the entire file name must be within 60 characters, you may not be able to set 30 characters.
Company name	
Name	
Cable ID	
Fiber ID	You can select some of the label items. For details, see the table under "Label" later in this section.
Cable code	
Start position	
End position	

- If the whole file name is longer than 60 characters, the excessive characters will be deleted.
- Blank cannot be specified for field ① under Name Type.
- You cannot set duplicate items for Name Type.

Types of Characters and Strings Allowed in File and Folder Names

The following restrictions apply to the types of characters and strings allowed in file and folder names.

- The following exact strings cannot be used due to MS-DOS limitations:
  AUX, CON, PRN, NUL, CLOCK, CLOCK$, LPT0, LPT1, LPT2, LPT3, LPT4, LPT5, LPT6, LPT7, LPT8, LPT9, COM0, COM1, COM2, COM3, COM4, COM5, COM6, COM7, COM8, COM9
- Of those characters on the keyboard that appears on the screen, the characters that can be used are 0-9, A-Z, a-z, _, –, =, (,), {, }, [,], #, $, &, ~, !, `, and @.
  @ cannot be entered consecutively.
- Keep the full path name (absolute path from the root folder) within 200 characters.
  If this is exceeded, an error will occur when you perform file operations (save, copy, rename, create folder, etc.).
  Full path name: When you are operating a folder, it is the path up to the folder name.
  When you are operating a file, it is the path up to the file name.

Setting the Report Format (Creating Reports)

Measure Conditions (Job Information)

The following information is included.

Label	Originating Loc
Company Name	Terminating Loc
Name	Current Data Flag
Fiber ID	Supplier Name[1]
Fiber Type	Model Name[1]
Cable ID	Unit Name[1]
Cable Code	FW Ver.[1,2]
Report creation date and time[1]	

1 Automatically included by the AQ1000
2 Firmware version

Information such as label and company name can be specified on the Label Setup screen explained in "Setting Labels." Set these if necessary.
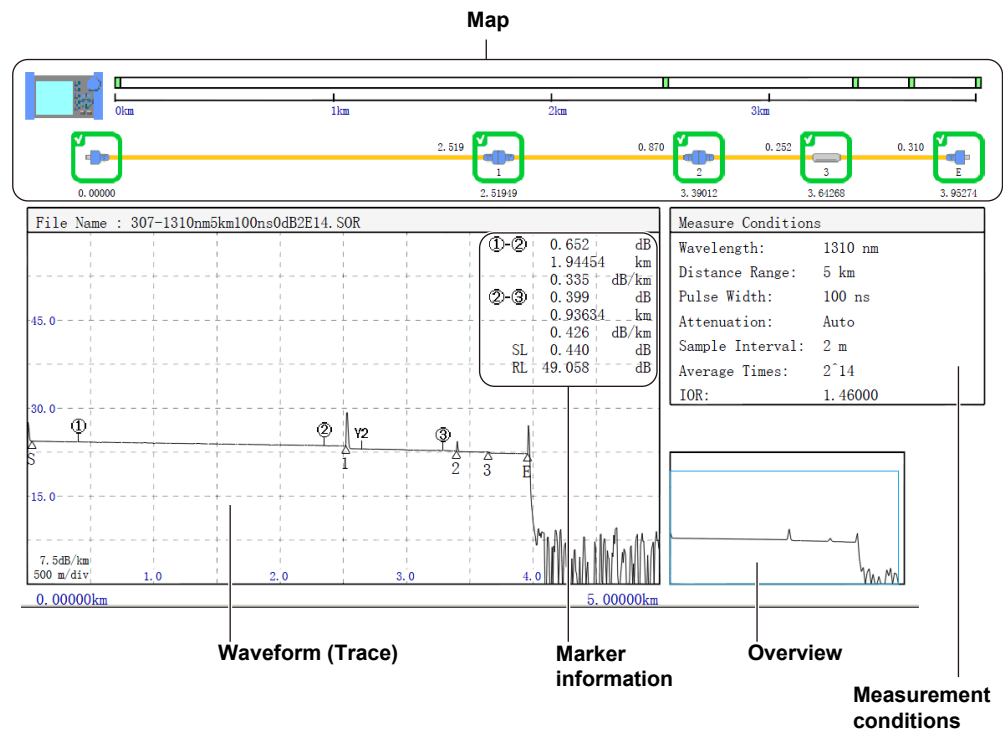
Measured Results (Link Summary)

The following information is included.

- Total distance
- Total loss
- Total RL
- Number of events
- Fault events
- Pass/fail judgments
- Measured date

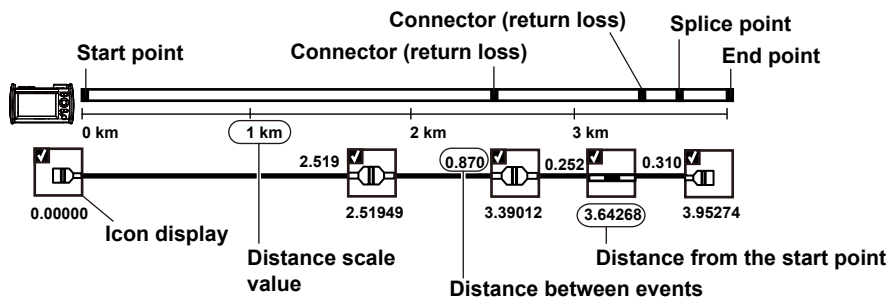### Map, Waveform, Marker Information, Measurement Conditions, and Overview

These are included as shown below.

Map

Waveform (Trace)

Marker information

Overview

Measurement conditions

8

Changing the Settings

• Map

The events in the event list are mapped as icons. Up to 100 events can be mapped. For a description of icons, see section 1.3.

Event Search Conditions

The following information is included.

- Splice loss
- Return loss
- End of fiber
- Splitter loss
- Backscatter level
- Macro bending

Pass/fail Judgment Conditions

The following information is included.

- Connector loss
- Splice loss
- Return loss
- Splitter loss
- dB/km
- Total loss

EventList Setup

The following information is included.

- Event number
- Distance
- Section
- Splice loss
- Return loss
- Cumulate loss
- dB/km
- Event type
- Section group index

Setting Labels

You can specify the following items. If you save waveform data measured from an optical pulse to a file in SOR format, the following label information is also saved.

Item	Description	
Company name	Up to 36 characters	
Name	Up to 36 characters	
Cable ID	Up to 36 characters	
Fiber ID	Up to 36 characters	
Fiber type	652:Conventional SMF	General purpose single mode
	653:Dispersion Shifted SMF	Dispersion shifted
	654:Cut-Off Shifted SMF	Cut-off shifted
	655:Non-Zero Dispersion Shifted SMF	Non-zero, dispersion shifted, single mode
	656:NZDSF for Wideband Transport	Wideband non-zero, dispersion shifted, single mode
	657:Bend Optimized SMF	Bend optimized single mode
	651:Multi-Mode Fiber	Multi mode
Cable code	Up to 36 characters	
Originating Loc (A)	Up to 36 characters	
Terminating Loc (B)	Up to 36 characters	
Current data flag	Shows the operation state. BUILT (BC), REPAIRED (RC), OTHER (OT), CURRENT (CC)	

Setting Direct Save

- **Setting the File Type**

    Set whether to make the measurement results to be saved into waveform data or a report.

    *.SOR: Saved as waveform data

    *.PDF: Saved in a report format

- **Setting the Save Operation**

    Set how to save the file when you save data.

    Direct Save: A file name as assigned automatically according to the file name setup conditions, and the file is saved.

    Select ID: A file name as assigned automatically according to the file name setup conditions. Then, you set a 2-digit ID to be appended to the file name. Finally, the file is saved.

8

Changing the Settings

8.3 Changing the System Settings

Procedure

1. Press **MENU** to display the MENU screen.
2. Tap the **System Setup** button to display the System Setup screen.

MENU screen
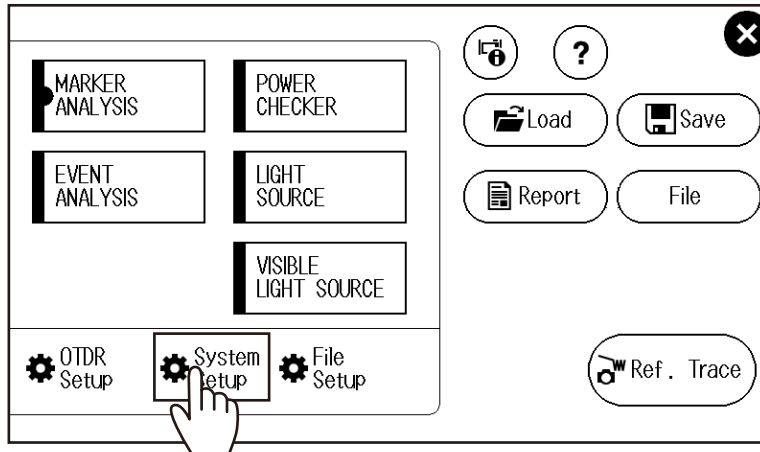
System Setup Screen

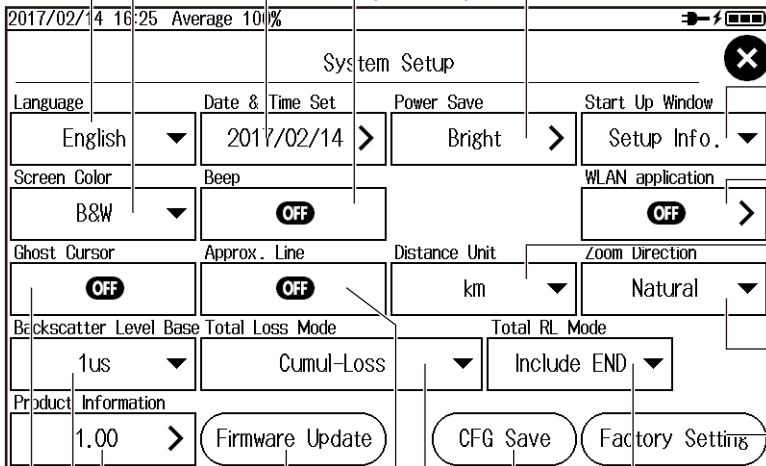Set the language. See "Selecting the Language to Display" in the Getting Started Guide, IM AQ1000-02EN.

Set the screen Color (Color1, Color2, B&W).

Set the date.
See "Selecting the Date and Time to Display" in the Getting Started Guide, IM AQ1000-02EN.

Set the beep sound (OFF, ON).

Set the power save mode.

Setting the Start Screen (Trace, Map, Setup Info.)

Set the wireless LAN. See chapter 9.

Set the distance unit (km, mi(mile), kf (kfeet)).

Setting the Zoom Direction (Natural, Legacy)
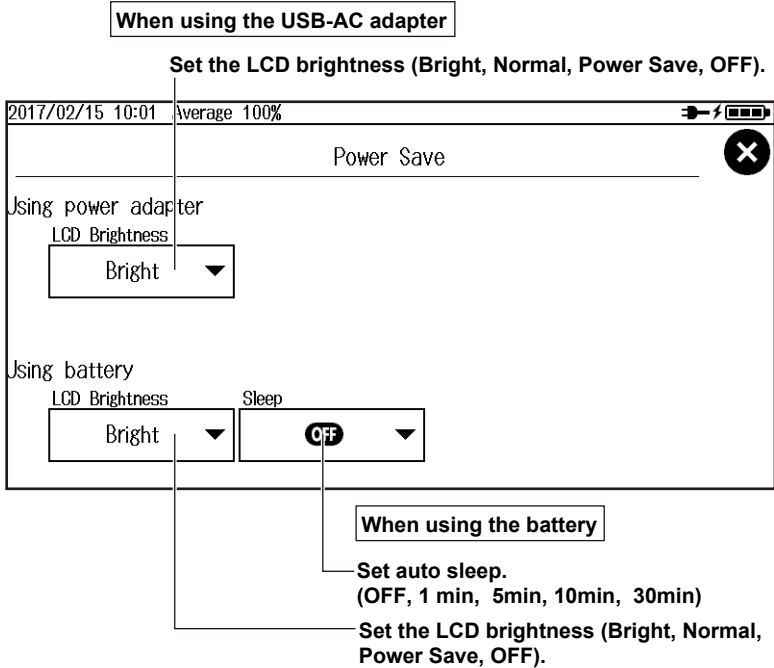
Reset to factory default settings. See appendix 2.

Set the calculation method for total return loss (Include END, Exclude END).

Store settings.

Set the calculation method for total loss (Cumul-Loss, Loss between S and E).

Approximated line display (OFF, ON)

Product information
See section 10.3.

Update the firmware.
See section 10.5.

Set the backscatter level base (1µs, 1ns).

Ghost cursor display (OFF, ON)

- **Setting the Power Save Mode**

  Tap the **Power Save** button to display the Power Save screen.

When using the USB-AC adapter

Set the LCD brightness (Bright, Normal, Power Save, OFF).

```
2017/02/15 10:01  Average 100%                    ⊟⚡▭▭
                        Power Save                    ⊗

Using power adapter
    LCD Brightness
    ┌──────────────┐
    │  Bright    ▼ │
    └──────────────┘


Using battery
    LCD Brightness        Sleep
    ┌──────────────┐      ┌──────────┐
    │  Bright    ▼ │      │ OFF    ▼ │
    └──────────────┘      └──────────┘
```

When using the battery

Set auto sleep.
(OFF, 1 min, 5min, 10min, 30min)

Set the LCD brightness (Bright, Normal, Power Save, OFF).

Explanation

Setting the Power Save Mode

LCD Brightness

You can set the LCD brightness.

Bright	The screen is set bright. Use this setting in a bright environment. This setting uses a lot of power. During battery operation, pay attention to the battery level.
Normal	Normal brightness.
Power Save	Slightly darker the normal brightness. This setting can be used in a dark environment. The battery lasts longer than the Normal setting.
OFF	The LCD backlight is turned off. The battery lasts longer, even longer than the Power Save setting. When you press any key, the backlight turns on for approximately 10 seconds.

Auto Sleep

If the AQ1000 is left standing for a certain period with the power turned on, the power will be automatically switch to sleep mode. If the AQ1000 is left standing for 2 hours in sleep mode, the power automatically turns off. This does not apply during averaged measurement or real-time measurement.

OFF	The power will not be turned off.
1 min	If you do not operate the AQ1000 for 1 minute, the power will be automatically switched to sleep mode.
5 min	If you do not operate the AQ1000 for 5 minutes, the power will be automatically switched to sleep mode.
10 min	If you do not operate the AQ1000 for 10 minutes, the power will be automatically switched to sleep mode.
30 min	If you do not operate the AQ1000 for 30 minutes, the power will be automatically switched to sleep mode.

Setting the Start Screen

Set the first screen that appears when you start the AQ1000.

Setup Info. Menu	The AQ1000 starts with the OTDR setup menu.
Trace	The AQ1000 starts with the data display screen set to waveform display.
Map	The AQ1000 starts with the data display screen set to icon display.

8

Changing the Settings

Setting the Screen Color

Select the screen color from the following:

|	
Color1	Color scheme based on black
Color2	Color scheme based on white
B&W (black and white)	This setting is suitable when you want to print data saved in JPG format in black and white on an external printer.

Setting the Beep Sound

The AQ1000 can generate a sound when an averaged measurement is finished or when an operation error message is displayed.

ON	Beep sound is on.
OFF	Beep sound is off.

Displaying Approximated Lines

In waveform analysis (marker operation), you can display the approximated lines that are used to calculate splice loss or return loss. For details, see "Splice Loss" in appendix 1.

ON	Approximated lines are displayed.
OFF	Approximated lines are not displayed.
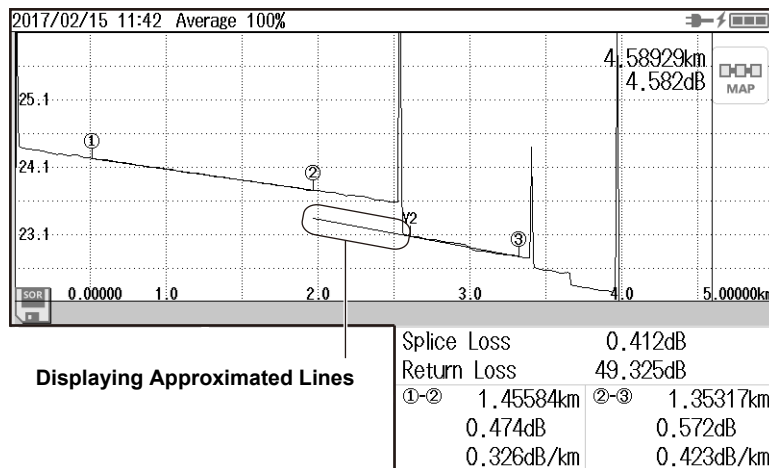
Displaying Approximated Lines

Setting the Distance Unit

Set the distance unit from the following.

km, mi (mile), kf (kfeet)

Setting the Backscatter Level Base

Select the reference pulse width for detecting backscatter. The selectable range of backscatter levels in the analysis conditions vary depending on the reference value.

For details on backscatter, see appendix 1.

For the procedure to set backscatter, see "Setting Analysis Conditions (ANALYSIS)" in section 8.1.

     1μs: The range is –64.99 to –10.00.

     1ns: The range is –94.99 to –40.00.

Displaying the Ghost Cursor

The ghost cursor is used to check for secondary reflections. A secondary reflection is a reflection that is detected in a location where no event actually occurs. The ghost cursor is automatically displayed at twice the distance from where the cursor (primary) is placed. The ghost cursor moves in sync with the cursor (primary).

OFF: The ghost cursor is not displayed.

ON: The ghost cursor is displayed.
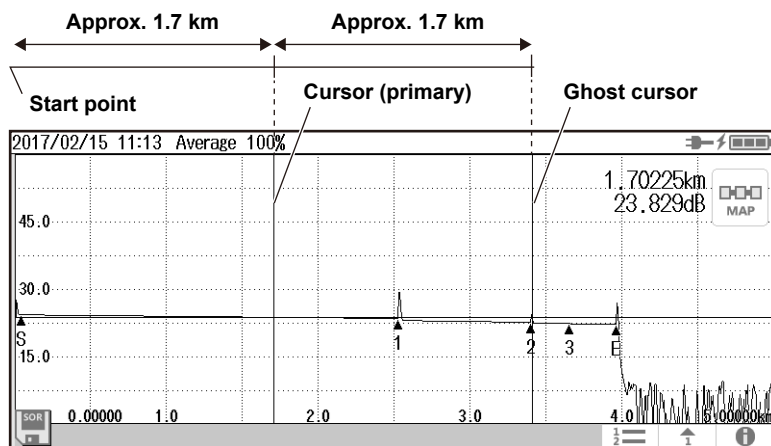
Ghost cursor display example

- **How Secondary Reflections Are Generated**

  The optical pulse that is generated from position I in the following figure propagates in the direction of II.

  ↓

  Light ray A that is reflected at connection II in the figure is reflected again at connection I and propagates in the direction of II as light ray B. At this point, the AQ1000 detects A as an event.

  ↓

  B is again reflected by connection II, and this generates reflected light ray C. At this point, the AQ1000 detects C as an event.

  Because the AQ1000 measures all the reflected light rays, A, C, and D, C is also detected as an event in the same manner that an actually generated reflection is. Therefore, while there is no actual event in this location, it appears as if an event has in fact occurred.

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Changing the Settings
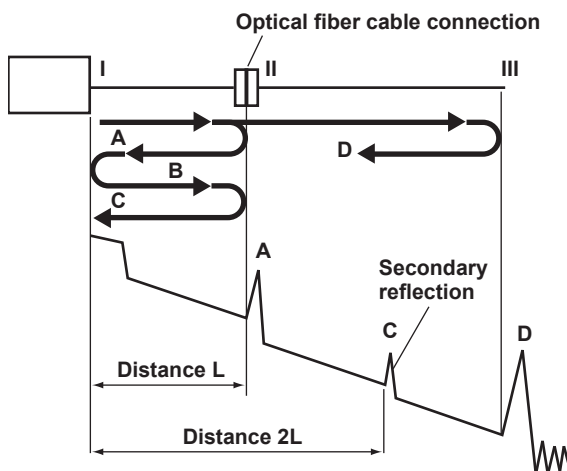
Setting the Calculation Method for Total Loss

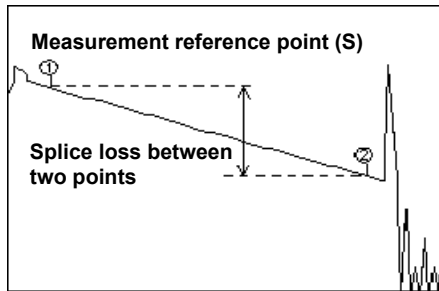**Cumulate Loss (Cumul-Loss)**

The integrated value of the splice losses at each event from the measurement reference point (S) is displayed.

Splice loss of each event
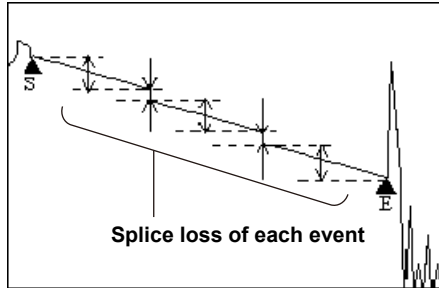
Loss between S and E

The loss (TPA approximation method) between the measurement reference point (S) and end of fiber E is displayed.

Measurement reference point (S)

**Splice loss between two points**

Note

If "Loss between S and E" is selected, markers ① and ② are placed automatically at the measurement reference point (S) and point E when event analysis is executed.

Setting the Calculation Method for Total Return Loss

Select whether to include the return loss value at end of fiber E in the total return loss.

Include END: The value at end of fiber E is included in the total return loss.

Exclude END: The value at end of fiber E is not included in the total return loss.

Measurement reference point

Event No. 1
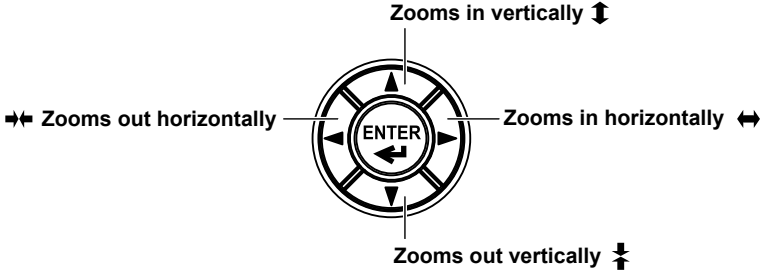
Event No. 2

END point

S

1

2

E
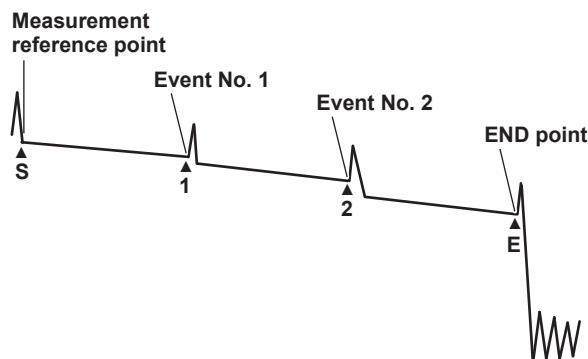
Storing Settings

The system settings are saved. When you save the settings, a file list screen for saving data appears.

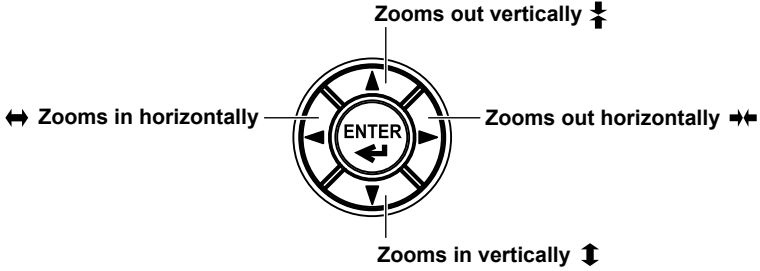For the procedure, see "Saving Waveform Data" in section 7.3. The procedure is the same.

Setting the Zoom Direction

You can select the zoom behavior of the waveform display that is controlled with the arrow keys.

- **Natural**

The waveform is zoomed.

Zooms in vertically ↕

→← Zooms out horizontally ——— Zooms in horizontally ↔

Zooms out vertically ↟

- **Legacy**

The waveform display range is zoomed

For example, if you expand the waveform display range to the entire waveform, the displayed waveform will appear smaller. If you reduce the waveform display range to a portion of the waveform, the displayed waveform will appear larger.
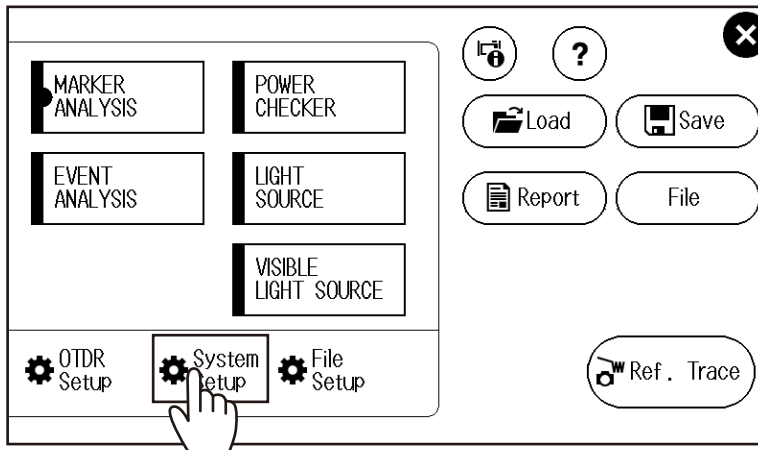
Zooms out vertically ↟

↔ Zooms in horizontally ——— Zooms out horizontally →←

Zooms in vertically ↕

8

Changing the Settings

9.1　　Configuring Wireless Network

Procedure
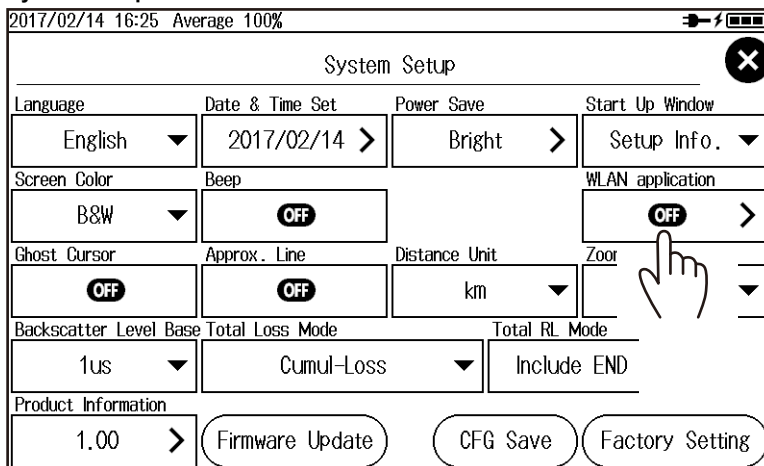
Starting the Wireless LAN Application

1. Press **MENU** to display the MENU screen.

2. Tap the **System Setup** button to display the System Setup screen.
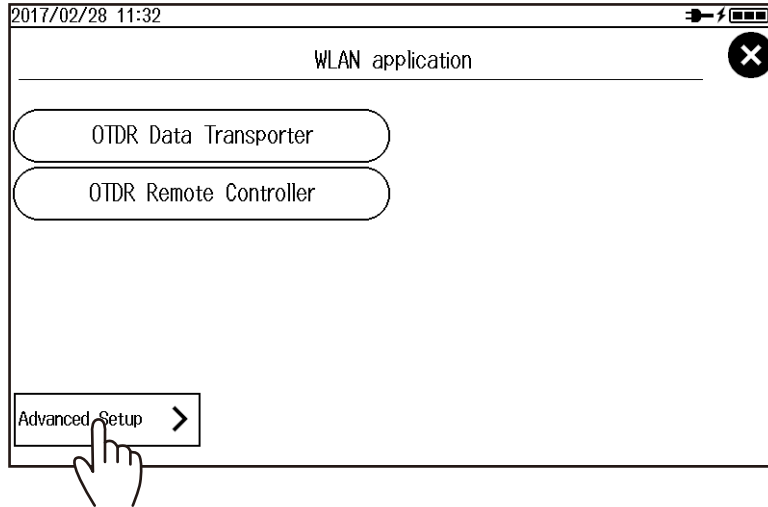
MENU screen

3. Tap the **WLAN application** button to display the WLAN application screen.
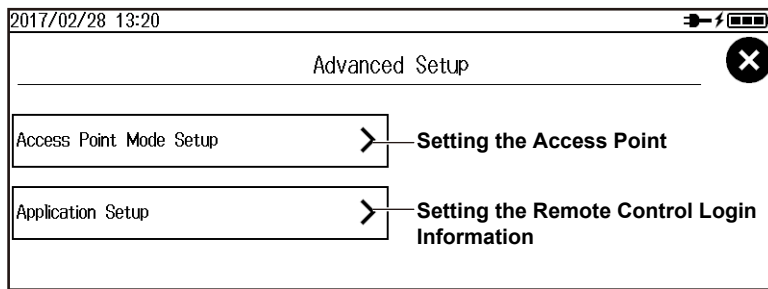
System Setup Screen

4. Tap the **Advanced Setup** button to display the Advanced Setup screen.

WLAN application Screen

```
2017/02/28 11:32                              ⊐━⚡▭▭▭

              WLAN application              ⊗

       ╭─────────────────────────╮
       │   OTDR Data Transporter   │
       ╰─────────────────────────╯
       ╭─────────────────────────╮
       │  OTDR Remote Controller   │
       ╰─────────────────────────╯




   ┌──────────────┐
   │Advanced Setup  ❯│
   └──────────────┘
```

Advanced Setup Screen

```
2017/02/28 13:20                              ⊐━⚡▭▭▭

              Advanced Setup              ⊗
   ──────────────────────────────────

   ┌───────────────────────────┐
   │Access Point Mode Setup      ❯│─── Setting the Access Point
   └───────────────────────────┘

   ┌───────────────────────────┐
   │Application Setup            ❯│─── Setting the Remote Control Login
   └───────────────────────────┘        Information
```

• **Setting the Access Point**

Tap the **Access Point Mode Setup** button to display the Access Point Mode Setup screen.
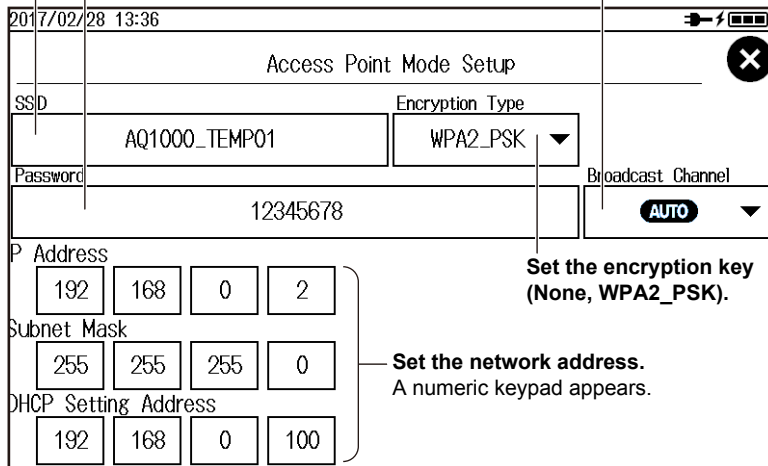
Set the ID name (SSID).
A character input screen appears. For instructions on how to input characters, see the Getting Started Guide, IM AQ1000-02EN.
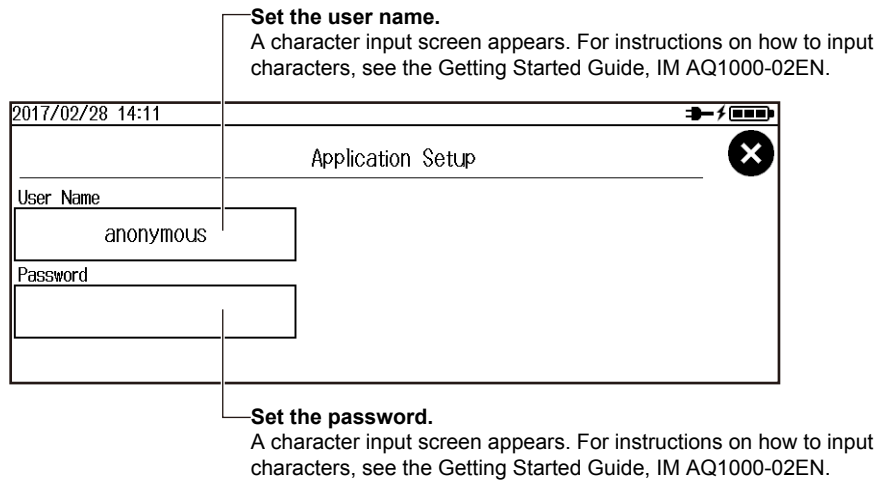
Set the authentication password.
A character input screen appears. For instructions on how to input characters, see the Getting Started Guide, IM AQ1000-02EN.

Set the broadcast (beacon signal) channel to the wireless terminal (AUTO, 1ch, 2ch, 3ch, 4ch, 5ch, 6ch, 7ch, 8ch, 9ch, 10ch, 11ch).

```
2017/02/28 13:36                              ⊐━⚡▭▭▭

              Access Point Mode Setup              ⊗
   ──────────────────────────────────
   SSID                      Encryption Type
   ┌─────────────────┐      ┌──────────────┐
   │  AQ1000_TEMP01    │      │  WPA2_PSK  ▼ │
   └─────────────────┘      └──────────────┘
   Password                  Broadcast Channel
   ┌─────────────────────────┐  ┌──────────┐
   │       12345678          │  │ AUTO   ▼ │
   └─────────────────────────┘  └──────────┘
   IP Address
   ┌────┬────┬───┬───┐
   │192 │168 │ 0 │ 2 │
   └────┴────┴───┴───┘
   Subnet Mask
   ┌────┬────┬────┬───┐
   │255 │255 │255 │ 0 │
   └────┴────┴────┴───┘
   DHCP Setting Address
   ┌────┬────┬───┬────┐
   │192 │168 │ 0 │100 │
   └────┴────┴───┴────┘
```

Set the encryption key (None, WPA2_PSK).

Set the network address.
A numeric keypad appears.

- **Setting the Remote Control Login Information**

  Tap the **Application Setup** button to display the Application Setup screen.

  ┌─**Set the user name.**
  A character input screen appears. For instructions on how to input characters, see the Getting Started Guide, IM AQ1000-02EN.

  2017/02/28 14:11   ⬛⚡▥

  Application Setup   ✖

  User Name

  anonymous

  Password

  └─**Set the password.**
  A character input screen appears. For instructions on how to input characters, see the Getting Started Guide, IM AQ1000-02EN.

Explanation

Setting the Access Point

ID Name (SSID)

This is the name of the access point that is displayed when access points are searched for from a wireless terminal.

Authentication Password

This is the password for connecting to the access point from the wireless terminal.

Encryption Key

This is the encryption key used in the communication with the wireless terminal.

    None: An encryption key is not used.

    WPA2_PSK: A WPA2-PSK encryption key is used.

Broadcast (Beacon Signal) to Wireless Terminals

Specify the channel on which to receive beacon signals when access points are searched for from a wireless terminal.

    AUTO: The channel is selected automatically when sending a broadcast.

    1ch to 11ch: When there are wireless communication interference signals in the surrounding area, manually select a channel to avoid the interference.

Network Address

Set the address for performing a one-to-one communication between the AQ1000 (access point) and the wireless terminal. The address format is IPv4.

- **IP Address**

  Set the IP address to assign to the AQ1000. The IP address is an ID number assigned to each computer connected to a network.

9

Using the Wireless LAN (/WLN option)

- **Subnet Mask**

  Set the mask value for determining the subnet network address from the IP address. Subnet mask is a value that defines how many bits of the IP address is used for network identification.

- **DHCP Setting Address**

  This is the IP address assigned to the wireless terminal that has accessed the access point (AQ1000).
  Addresses are assigned in order from the specified address.

Remote Control Login Information

User Name

You can use up to 15 characters. The default setting is "anonymous."

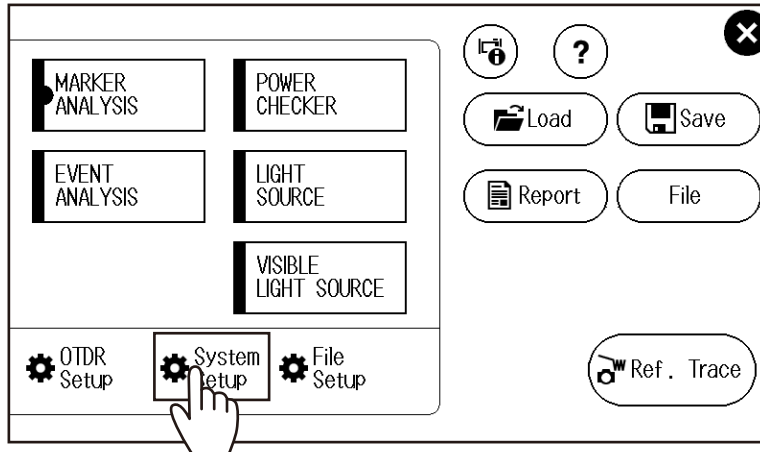### Password

You can use up to 15 characters.

9.2 Transferring the Waveform Data

Procedure

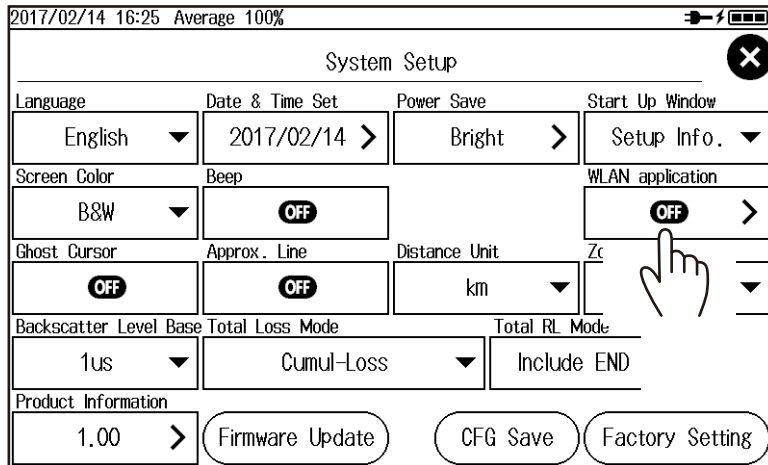### Starting the Wireless LAN Application

1. Press **MENU** to display the MENU screen.

2. Tap the **System Setup** button to display the System Setup screen.
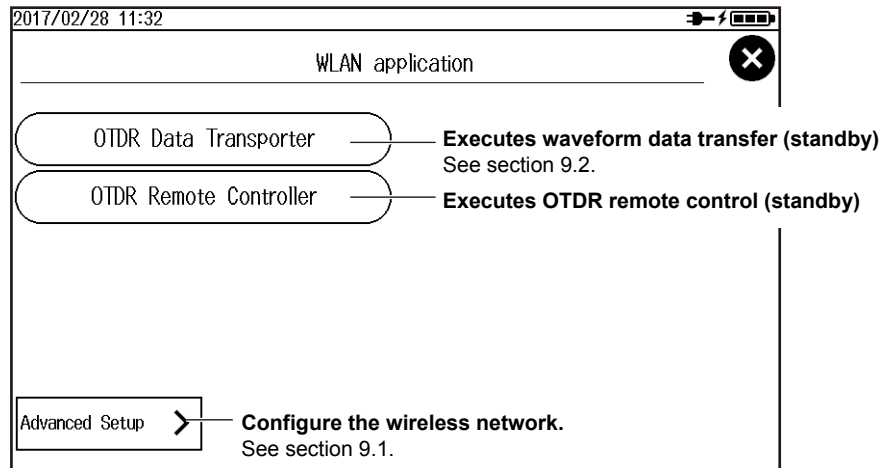
MENU screen

3. Tap the **WLAN application** button to display the WLAN application screen.

System Setup Screen

WLAN application Screen

```
2017/02/28 11:32                              ⊟–⚡▐▐▐▌

              WLAN application                    ✕

      OTDR Data Transporter      ────  Executes waveform data transfer (standby)

      OTDR Remote Controller     ────  Executes OTDR remote control (standby)
                                       See section 9.3.



 Advanced Setup    ❯          ────  Configure the wireless network.
                                     See section 9.1.
```
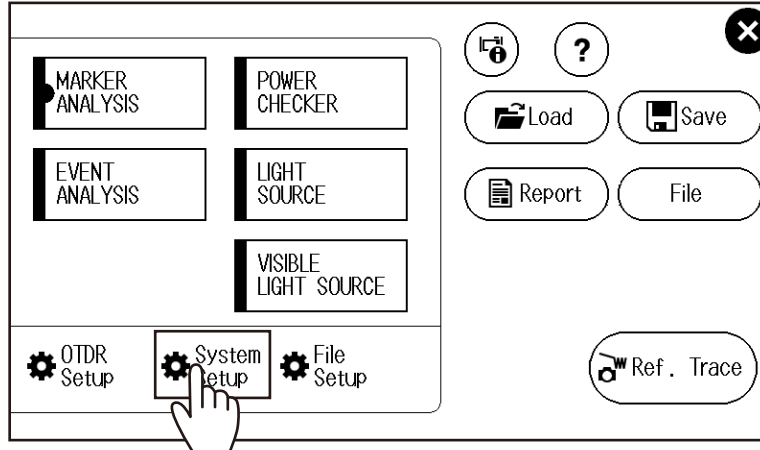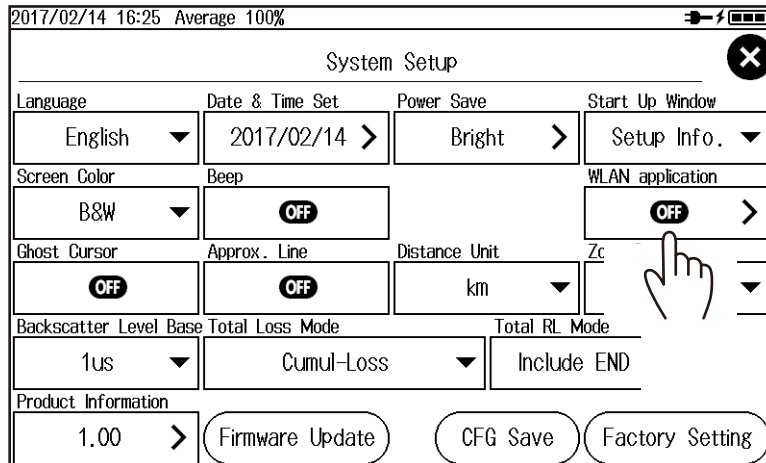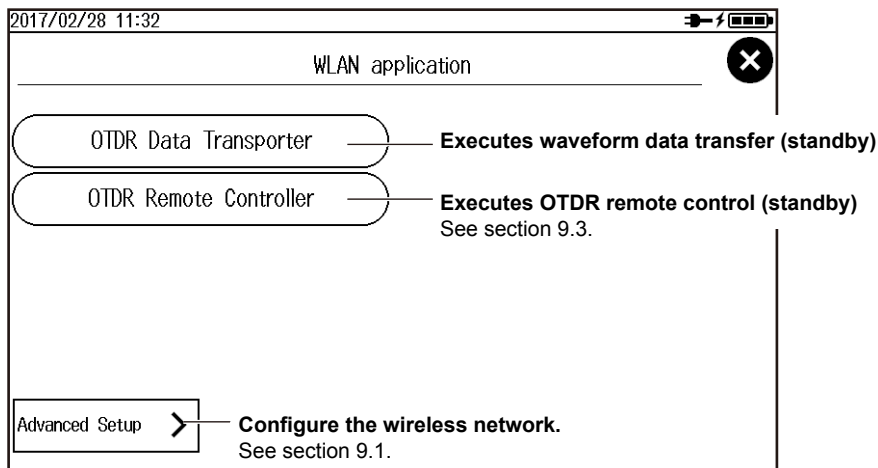
Transferring the Waveform Data

- **Executing a Waveform Data Transfer (Access Point Standby State)**

4. Tap the **OTDR Data Transporter** button. A standby screen for waveform data transfer appears.

```
2017/02/28 16:20                              ⊟–⚡▐▐▐▌

              OTDR Data Transporter               ✕

 Connect to the following
 access point with smartphone.

 SSID        : AQ1000_TEMP01  ──  Access point information
 Password    : 12345678




                              ⏞ Cancel ⏝
```

Cancels waveform
data transfer
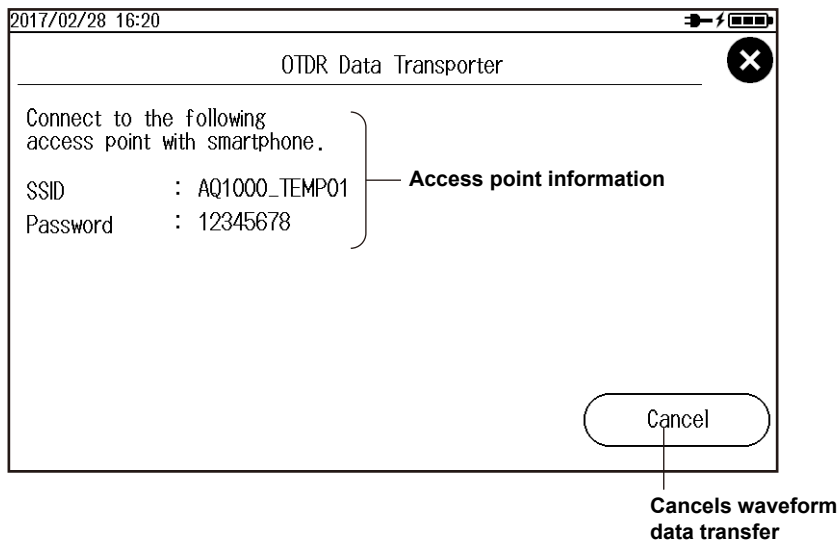
- **Operation on the Wireless Terminal**

5. Search for the access point from the wireless terminal, and connect to the access point.
   Check that the SSID is the same as that of the AQ1000.

6. Start OTDR Data Transporter on the wireless terminal.
   For the operating procedure of the application, see the application software's help.

Note

Only a single wireless terminal can access the AQ1000 at any given time. (Multiple wireless terminals cannot access the AQ1000 simultaneously.)

Explanation

You can transfer data saved on the AQ1000 to a wireless terminal. To use this feature, you need to install OTDR Data Transporter (a YOKOGAWA software application) in the wireless terminal.
This software application is a freeware. Visit the YOKOGAWA webpage below, and download OTDR Data Transporter.

   http://www.yokogawa.co.jp/tm/F-SOFT/

Waveform data can also be transferred by remotely controlling the AQ1000. See "Downloading Files" in "Controlling the Wireless Terminal (Web Browser)" of section 9.3.

9

Using the Wireless LAN (/WLN option)

9.3 Controlling the OTDR Remotely

Procedure

Starting the Wireless LAN Application

1. Press **MENU** to display the MENU screen.

2. Tap the **System Setup** button to display the System Setup screen.

MENU screen

3. Tap the **WLAN application** button to display the WLAN application screen.

System Setup Screen

WLAN application Screen

2017/02/28 11:32

WLAN application ✕

OTDR Data Transporter ——— **Executes waveform data transfer (standby)**
See section 9.2.

OTDR Remote Controller ——— **Executes OTDR remote control (standby)**

Advanced Setup ❯ ——— **Configure the wireless network.**
See section 9.1.

Controlling the OTDR Remotely

Executing OTDR Remote Control (Access Point Standby State)

4. Tap the **OTDR Remote Controller** button. A standby screen for OTDR remote control appears.
An icon indicating that the wireless LAN is in use appears at the top of the screen.

An icon indicating that the wireless LAN is in use
If you cancel, the wireless LAN operation ends, and the icon disappears.
If you select Back, the wireless operation does not end, and the icon remains displayed.
In addition, even if you stop accessing from the wireless terminal, the wireless LAN
operation does not end, so you can access from the wireless terminal again.
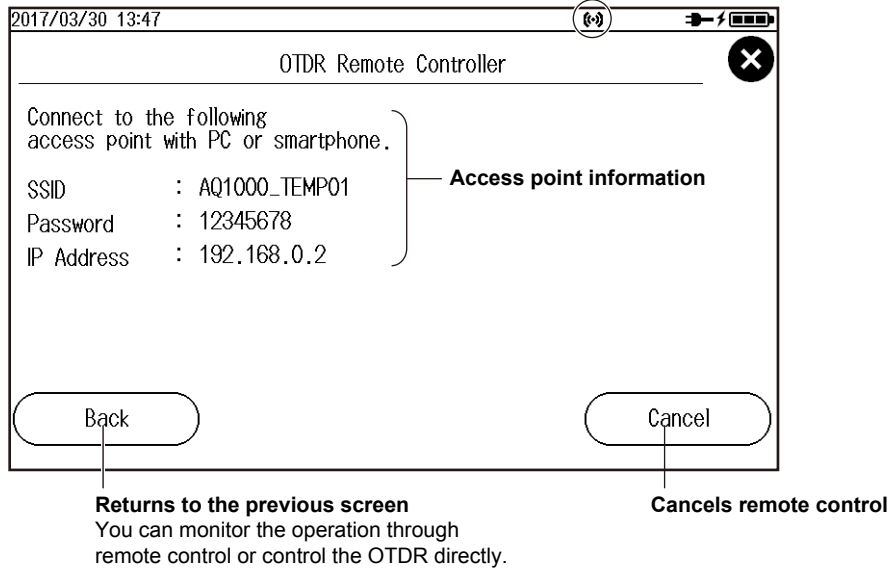
2017/03/30 13:47 (•)

OTDR Remote Controller ✕

Connect to the following
access point with PC or smartphone.

SSID : AQ1000_TEMP01 ——— **Access point information**
Password : 12345678
IP Address : 192.168.0.2

Back Cancel

Returns to the previous screen **Cancels remote control**
You can monitor the operation through
remote control or control the OTDR directly.

9

Using the Wireless LAN (/WLN option)

Operation on the Wireless Terminal (Yokogawa OTDR Remote Controller)

5. Search for the access point from the wireless terminal, and connect to the access point.

Check that the SSID is the same as that of the AQ1000.

6. Start Yokogawa OTDR Remote Controller on the wireless terminal.

For the operating procedure of the application, see the application software's help.

**7.** On the **File** menu, click **Connect**.

This is an example on a PC.
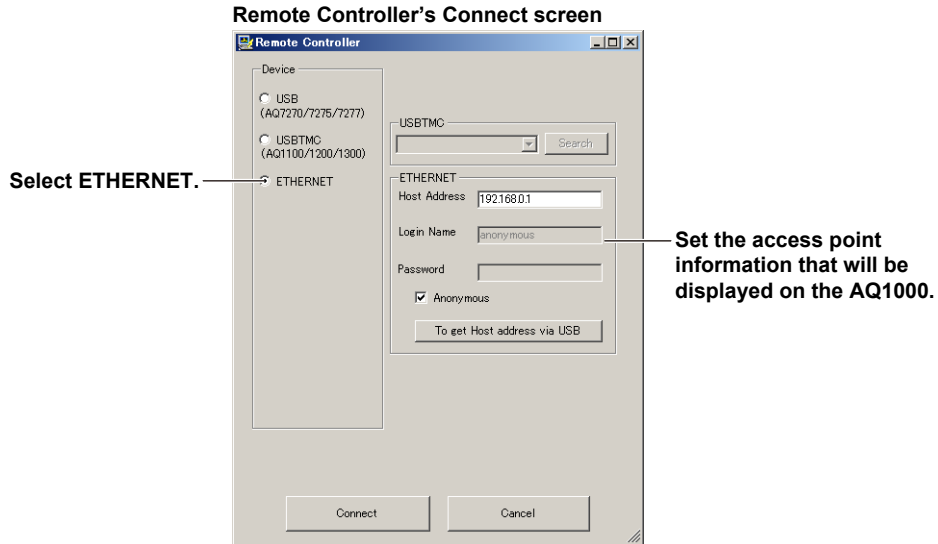
Remote Controller's Connect screen

Select ETHERNET.

Set the access point information that will be displayed on the AQ1000.

Note

Only a single wireless terminal can access the AQ1000 at any given time. (Multiple wireless terminals cannot access the AQ1000 simultaneously.)

Operation on the Wireless Terminal (Web Browser)

5. Search for the access point from the wireless terminal, and connect to the access point.

Check that the SSID is the same as that of the AQ1000.

6. On the wireless terminal, start Internet Explorer or other Web browser.

If you are using Internet Explorer, use version 9.0 or later.

7. In the address box, enter "http://IP address" to connect to the AQ1000. The IP address is that of the access point shown on the AQ1000.

A page for selecting the connection mode appears.

Connection mode selection screen

AQ1000 Login(Control Mode) — Connection Mode (Control mode)

AQ1000 Login(View Mode) — Connection Mode (View mode)
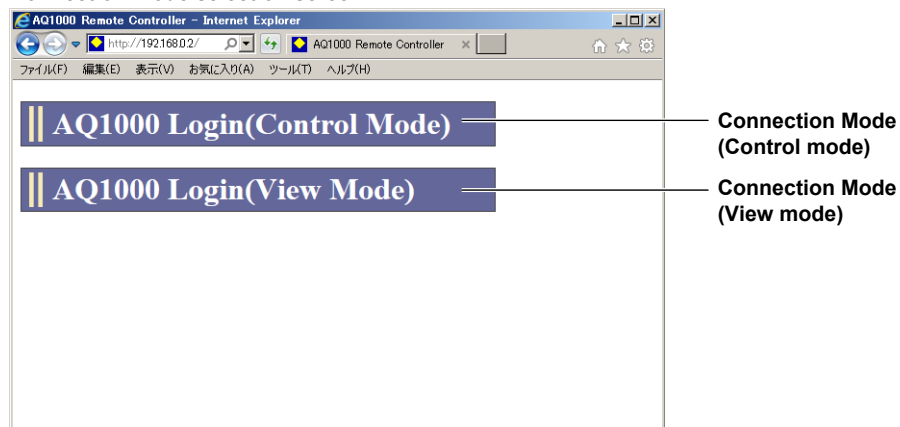
8. Click a connection mode. An authentication dialog box appears.
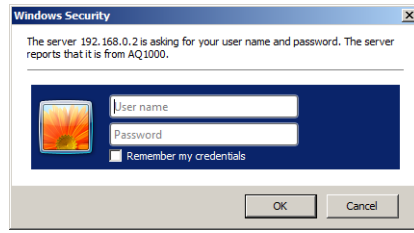
9. To connect in Control Mode, enter the user name and password that you specified in "Remote Control Login Information" in section 9.1, and click OK.

The AQ1000 screen and control panel appear on the wireless terminal screen. You can control the AQ1000 with a mouse or through the touch panel.

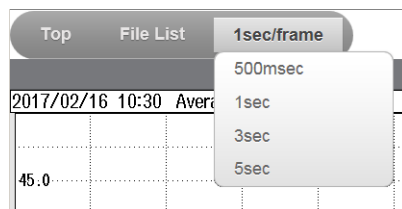**Control screen**

Displays the top menu (connection mode selection)
Displays a file dialog box
Screen refresh interval (shows a setup screen)

Corresponds to the AQ1000 panel keys

You cannot control the power switch.
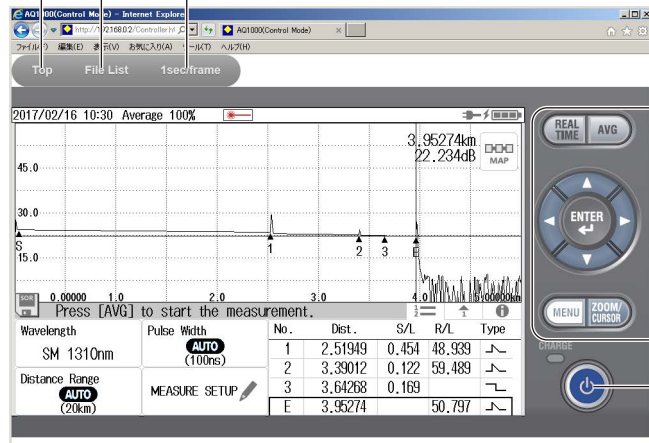
Note

- If you set the user name in the network settings to "anonymous," enter "anonymous" for the user name. You do not have to enter the password.
- To connect in View Mode, enter "guest" for the user name and "yokogawa" for the password.
- User name and password are case-sensitive.

• Set the screen refresh interval.

You can set the interval for refreshing the content displayed on the wireless terminal screen.
Click the refresh interval at the top of the screen. A drop-down list for setting the interval appears.
Click the refresh interval you want to use.

9

Using the Wireless LAN (/WLN option)

- **Displays a file dialog box**
  Click **File List** at the top of the screen. A folder structure of the AQ1000 internal memory and USB memory devices connected to the AQ1000 appears.
  Click **download** to download the corresponding file to the wireless terminal.

— **Click to download files**
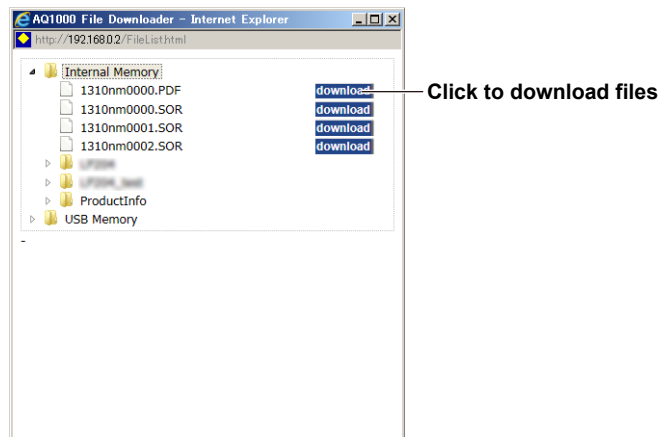
<div style="border:1px solid">Explanation</div>

Operation on the Wireless Terminal (Yokogawa OTDR Remote Controller)

You can install Yokogawa OTDR Remote Controller in the wireless terminal and remotely control the AQ1000 from the software application.

This software application is a freeware. Visit the YOKOGAWA webpage below, and download Yokogawa OTDR Remote Controller.

http://www.yokogawa.co.jp/tm/F-SOFT/

Operation on the Wireless Terminal (Web Browser)

You can remotely control the AQ1000 from a Web browser of your wireless terminal.

Connection Mode

There are two connection modes: Control and View.

Control Mode: The AQ1000 screen is displayed on the wireless terminal screen. You can control the AQ1000 with a mouse or through the touch panel of the wireless terminal. You can also download files from the AQ1000.

View Mode: The AQ1000 screen is displayed on the wireless terminal screen, but you cannot control the AQ1000 from the wireless terminal. You can, however, download files from the AQ1000.

Touch Panel Remote Control

The AQ1000 touch panel remote control only supports tap operations.
You can perform the equivalent of tapping by clicking the mouse.
Dragging and pinching are not possible.

Click to download files

- Only files that are 1400 KB or less in size can be downloaded.
  The download button does not appear for files that cannot be downloaded.
- The download destination varies depending on your browser.
- Multiple files cannot be downloaded at once.

10.1 Troubleshooting

Faults and Corrective Actions

- If a message appears on the screen, see the following pages for reference.
- If servicing is necessary, or if the instrument does not operate properly even after you have attempted to deal with the problem according to the instructions in this section, contact your nearest YOKOGAWA dealer.

Symptom	Corrective Action	Reference
Nothing appears on the screen even when the power is turned on.	If you are using an USB-AC adapter, make sure that the plug is connected firmly to the outlet, the power cord is connected firmly to the USB-AC adapter, and the USB-AC adapter's DC plug is connected firmly to the AQ1000.	—[1]
	Charge the battery, and make sure that the POWER LED is illuminated.	—[1]
	The LCD turns black at high temperatures. At low temperatures, the display slows down. Make sure that the temperature of the area where you are using the AQ1000 is within the operating temperature range.	—[1]
	Holding down the power switch for at least 2 seconds.	—[1]
	The backup file in the AQ1000 may be corrupt due to an improper shutdown execution. Turn the power off, and restart by following the procedure below. 1. While holding down the MENU key, press the power switch. 2. Keep holding down the key until the AQ1000 starts.	—[1]
The display disappears after some time passes.	The AQ1000 turns off automatically when its battery level is low. Check the battery level.	—[1]
	If you have specified a time for the Power Save setting, the AQ1000 will turn off automatically if there is no user activity for the specified time. Check the settings.	8.3
The screen is dark.	The screen will appear dark when the LCD Brightness setting is set to "Power save." Check the settings.	8.3
	The LCD may be worn out. Servicing is required.	8.3
	If the AQ1000 or its battery becomes hot, the LCD brightness is reduced automatically to prevent damage. Make sure that the temperature of the area where you are using the AQ1000 is within the operating temperature range.	—[1]
The power turns off automatically while the AQ1000 is in use.	The AQ1000 turns off automatically when it detects an error. A warning message will appear when this happens. Read the message. Fix the problem indicated in the message, and then turn the AQ1000 back on. If the Auto Power OFF feature is enabled in Power Save mode, the AQ1000 automatically turns off after a certain time elapses.	8.3 10.2[2]
The battery cannot be charged.	The battery may be too cold or too hot. Make sure that the temperature of the area where you are using the AQ1000 is within the operating temperature range. Let the AQ1000 sit for about an hour at room temperature.	—[1]
	The battery may be approaching the end of its service life. Contact your nearest YOKOGAWA dealer.	—
The power turns off automatically while the AQ1000 is starting.	You may have accidentally pressed the power switch twice.	—
Touch panel operations do not work.	Touch operation is not possible with gloves. Touch the screen with bare hands.	—[1]

1 See the Getting Started Guide, IM AQ1000-02JA.
2 When it is likely that the usage limitations of the AQ1000 will be exceeded, the AQ1000 will display a warning message and turn off automatically to prevent damage. For the conditions under which such messages appear, see section 10.2.

10

Maintenance and Inspection

10.2 Error Message Display

Error Messages

Messages may appear on the screen during operation. This section describes the error messages and how to respond to them. Messages are displayed according to the language setting (see "Setting the Language and Date and Time" in the Getting Started Guide IM AQ1000-02EN). If the corrective action states that serving is required, contact your nearest YOKOGAWA dealer.

Error in Execution

Code	Message
28	The measurement may not be completed within the specified duration.
35	The optical plug may not be connected securely.
39	This file cannot be supported by the firmware with this product. This firmware do not support some of new functions. Please update into the latest firmware.
46	A lot of files are saved in the root folder. The file manipulation slows when saved any further. Please make a folder in the root folder, and save files in that.
221	Setting conflict.
223	Data invalid
500	The measurement condition cannot be replicated. Please modify the measurement setup where ****** is shown.
501	Not executable during measurement. Please stop the measurement and execute again.
505	Hardware failed, and needs to be repaired. Please contact Yokogawa's representatives.
506	Hardware failed, and needs to be repaired. Please contact Yokogawa's representatives.
507	Hardware failed, and needs to be repaired. Please contact Yokogawa's representatives.
508	Hardware failed, and needs to be repaired. Please contact Yokogawa's representatives.
510	PLUG CHECK Error. Please check or clean the connector.
512	ZERO SET ERROR
513	ZERO SET ERROR
514	Exceeding limit. It may cause damage of the instrument. Please disconnect the plug.
515	ZERO SET ERROR
516	Fiber In Use Alarm Error 1
517	Fiber In Use Alarm Error 2
521	Operation is stopped outside of operating environmental condisions.
522	Hardware failed, and needs to be repaired. Please contact Yokogawa's representatives.
563	Conditions of the macro bending do not match.
564	When the launch fiber is enable, the distance reference setup cannot be performed.
602	Can not recognize file system. -Internal memory : Contact Yokogawa's representatives. -USB memory : Try the other media or format again with FAT
605	Same file name or folder name exists.
608	Invalid file name or folder name
612	Invalid path name
614	Unknown file or folder
620	Free space is not enough
623	Folder is not empty.
629	Writing to USB memory is not allowed.
636	Failed to delete the folder. The hierarchy below the specified folder is too deep.
641	Failed to copy the folder. The hierarchy below the specified folder is too deep.
645	The path name is too long.
646	USB memory can not be recognized
648	Can not make file or folder in this folder. (Max 550 files/folder)
650	The file or folder cannot be accessed. It can be considered the following causes. -Media is not installed correctly. -Other file or folder is saving, reading or deleting. Please wait a moment and try again.

Code	Message
651	Cannot copy the file or folder. The destination file path or folder path is invalid. It can be considered the following causes. -Media is not installed correctly. -The file path or folder path is too long. Please change file path or folder path.
652	Cannot execute the specified operation. It can be considered the following causes. -The destination file path or folder path is invalid. -The file or folder contains cannot be confirmed. Please check media is correctly installed. When using USB memory: Please try the other media or check the USB memory is formatted with FAT.
653	Same file name or folder name exists. Please change the file name or folder name.
654	Invalid file name or folder name. It can be considered the following causes. -The name is 0 charactor or more than 61 characters. -The file name contains "." or " (SPACE)". etc... Please change the file name or the folter name.
655	Cannot execute direct save. Direct save path is not existed. Please select "Save Folder" in the direct save setting menu and change save destination.
656	Cannot execute auto save. Auto save path is not existed. Please change the save path in the auto save setting menu. -Mode is "Date": Please select "Drive" and change save destination. -Mode is "UserDefine": Please select "Save Folder" and change save path.
657	The file or folder is not existed. The media may be uncorrectly installed. Please check the media is correctly installed.
658	Specified media is not enough free space. Please make enough free space. When using USB memory: Please try other USB memory.
659	The folder could not be deleted. There are files that cannot be deleted in specified folder.
660	Writing to USB memory is not allowed.Please change other USB memory or remove the write-protection of the USB memory.
661	Cannot copy the file or folder. Same media is selected as source and destination. Please change the destination to a different media from the source.
662	The path name is too long. Please change the file path or folder path.
663	USB memory can not be recognized. Please check the USB memory is correctly installed.
664	Cannot copy the file or folder. It can be considered the following causes. -Same path source and destination. -The source folder is upper than the destination folder Please change the destination path.
700	Failed to open the file.
701	Failed to close the file.
702	Failed to read the file.
703	Irregular file format.
704	Failed to write the file.
705	Cannot be saved. No trace data.
708	Cannot be saved. This data is not taken with this instrument.
710	File cannot be retrieved. Invalid wavelength
711	File cannot be retrieved. Invalid distance range
712	File cannot be retrieved. Invalid pulse width
713	File cannot be retrieved. Invalid sampling points
714	File cannot be retrieved. Distance range exceeds 400km.
715	File cannot be retrieved. Sampling intervals exceed 64m.
716	File cannot be retrieved. Actual averaging times or duration is not set.
717	Duplicate file name.
718	File is damaged. Check the file.
719	File name too long. Maximum length is 60 letters.
720	File is now being accessed. Execute after access is released.
721	Cannot load this file. Invalid file format or this firmware version is old.
722	Recall Setup File cannot load the measurement condition which sampling interval has been changed to shorter than the standard sampling interval at Meas. Range Change function.
723	This file cannot be supported by the firmware with this product. Please update into the latest firmware to read this file.

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Maintenance and Inspection

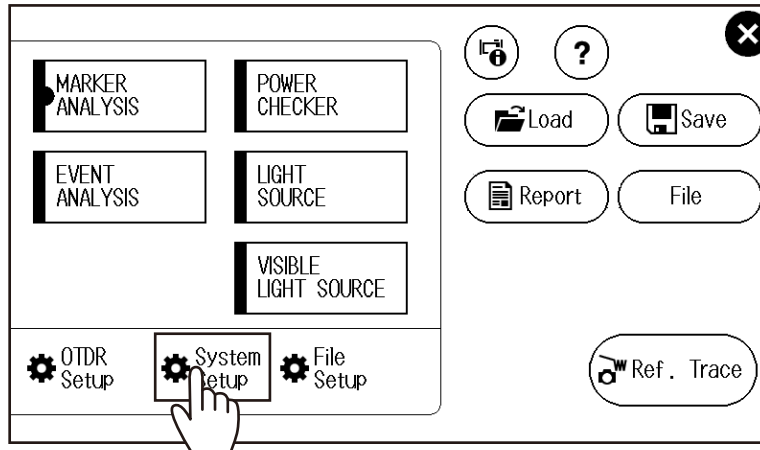## 10.2 Error Message Display

Code	Message
724	The model name of the instrument and model name in the file is different. This file cannot be read with this instrument.
725	Can't use the following characters. \ / : ; * ? " < > | % . ,
726	This file cannot be read with this instrument. This file that tries to be loaded includes the measurement condition that cannot be measured with this instrument.
727	This file cannot be read with this instrument. This file that tries to be loaded includes the measurement condition that cannot be measured with this instrument. - Distance Range
728	This file cannot be read with this instrument. This file that tries to be loaded includes the measurement condition that cannot be measured with this instrument. - Pulse Width
732	ID No. is not selected in File Name. Please include ID No. in File Name if using direct save(Select ID).
733	Cannot read the file. Please check the media is correctly installed.
734	Cannot read the file. The file may be damaged. Check the file.
735	Cannot read the file. Irregular file format. The file format cannot be supported by AQ1000.
736	Cannot save the file. Please check media is correctly installed. When using USB memory: Please try other media or check the media is formatted with FAT.
737	Fail to write the file. Please check destination media is correctly installed.
738	Cannot save the PDF file. Invaild fiber surface image file format. Please check the image file format is ".JPG" or ".BMP".
739	Cannot save the file, It can be considered the following causes. -No trace Data. -Cannot save the file during measurement. Please save the file after measurement.
740	Cannot save the file. No event data. Please save the file after event search.
741	Cannot save the file. No event data. Please save the file after event search.
742	There are unset items in the measurement conditions. Please confirm the measurement conditions.
743	Cannot save the SOR file. This data is not taken with this instrument.
744	Duplicate file name. Please change the file name.
745	Can't use the following characters. \ / : ; * ? " < > | % . , Please change the text.
819	ROM Test Error occurred.
820	RAM Test Error occurred.
821	System File Test Error occurred.
822	Battery Test Error occurred.
823	Temperature Test Error occurred.
824	Power Supply Test Error occurred.
825	WLAN Test Error occurred.
854	In USB Storage mode, all keys are locked. Please disconnect the USB Cable.
902	Battery is low. Please power it off, and charge the battery or replace the battery. Or, please use the power supply.
903	Backup battery is low Please contact Yokogawa's representatives.
906	Battery is low. The instrument will be powered off in 10 sec.
909	The temperature inside the instrument is too high. The instrument may be damaged if used in this condition. The instrument will be powered off in 10 sec. Please turn off power to allow instrument to cool down.
922	Incorrect date and time setting. Set the correct date and time.
925	Please use AC adapter.
933	Setting conflict.
934	Communication not allowed during measurement
937	The temperature inside the instrument is too high. The instrument may be damaged if used in this condition. The instrument will be powered off in 10 sec. Please turn off power to allow instrument to cool down.
938	The temperature inside the instrument is too low. The instrument may be damaged if it is used in this condition. The instrument will be powered off in 10 sec. Please turn off power until internal temperature is increased.
939	Hardware failed, and needs to be repaired. Please contact Yokogawa's representatives.
940	Hardware failed, and needs to be repaired. Please contact Yokogawa's representatives.
941	Hardware failed, and needs to be repaired. Please contact Yokogawa's representatives.
942	Hardware failed, and needs to be repaired. Please contact Yokogawa's representatives.
943	Hardware failed, and needs to be repaired. Please contact Yokogawa's representatives.
944	Hardware failed, and needs to be repaired. Please contact Yokogawa's representatives.
945	Hardware failed, and needs to be repaired. Please contact Yokogawa's representatives.
946	Hardware failed, and needs to be repaired. Please contact Yokogawa's representatives.
947	Battery is low. The light source cannot be turned on.
948	Hardware failed, and needs to be repaired. Please contact Yokogawa's representatives.
950	Failed to control WLAN module.

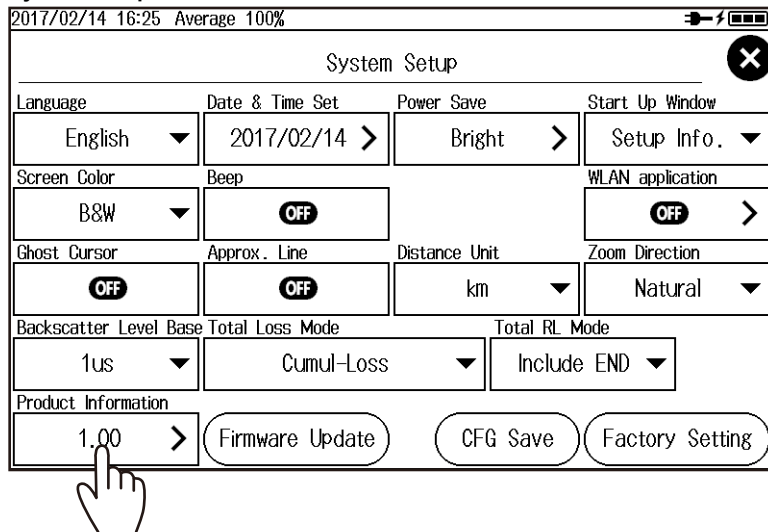# 10.3 Viewing the Product Information

1. Press **MENU** to display the MENU screen.

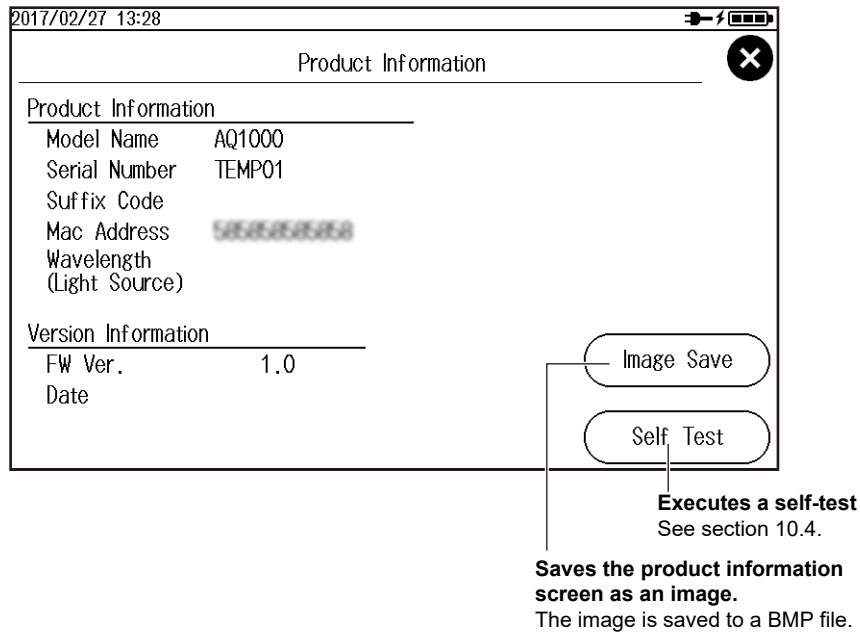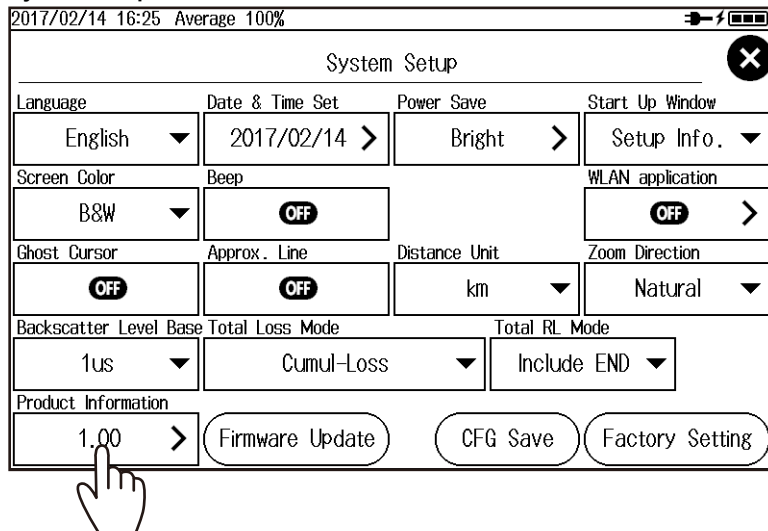2. Tap the **System Setup** button to display the System Setup screen.

MENU screen

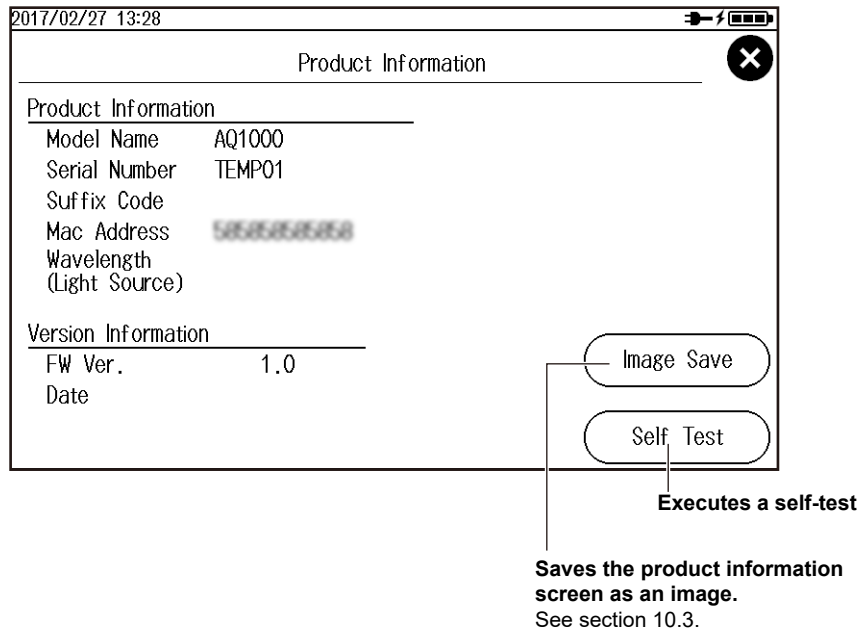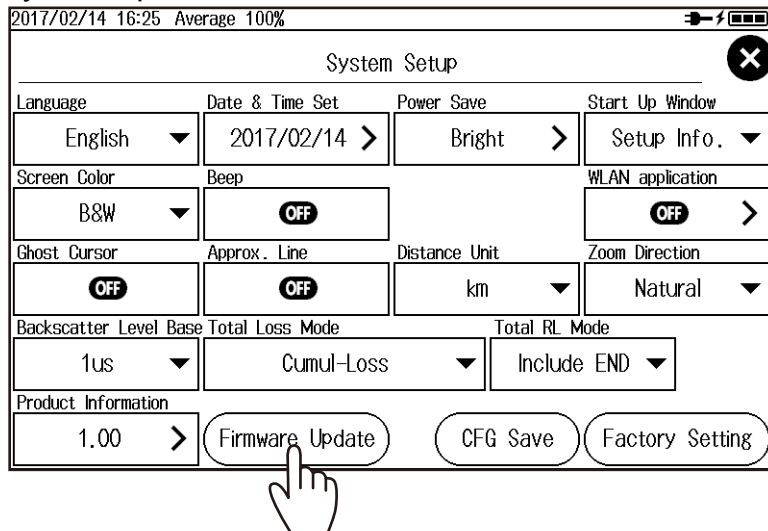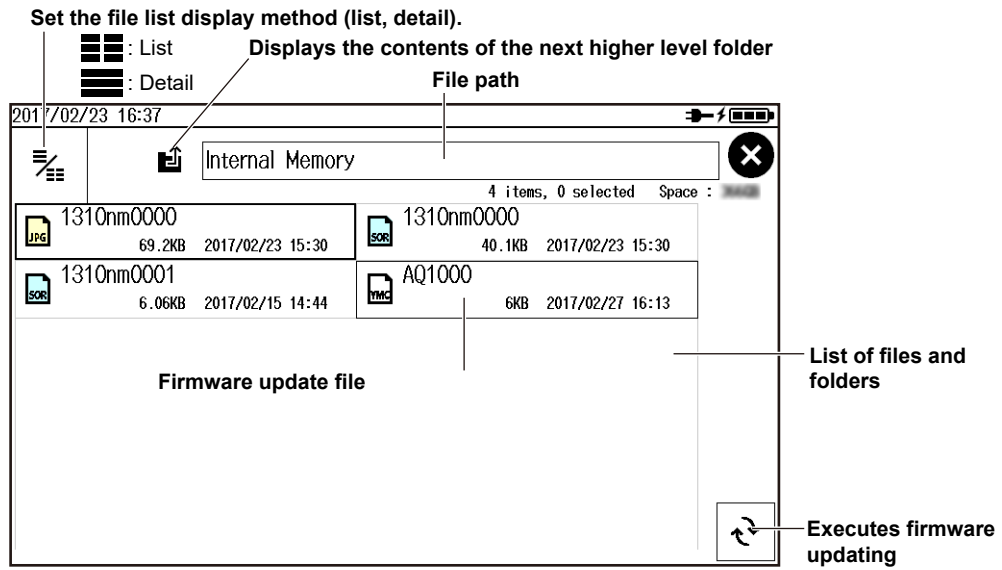3. Tap the **Product Information** button to display the Product Information screen.

System Setup Screen

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Product Information Screen

```
2017/02/27 13:28                                    ⇥⚡▭▭

                    Product Information                  ✕

Product Information
  Model Name        AQ1000
  Serial Number     TEMP01
  Suffix Code
  Mac Address       ▨▨▨▨▨▨▨▨
  Wavelength
  (Light Source)

Version Information
  FW Ver.              1.0              ⎛  Image Save  ⎞
  Date

                                        ⎛   Self Test  ⎞
```

Executes a self-test
See section 10.4.

Saves the product information screen as an image.
The image is saved to a BMP file.

Explanation

Product Information

The Product Information screen displays the information (model, serial number, suffix code) inscribed on the name plate affixed to the AQ1000, MAC address, and measurement light wavelength information.

Version Information

The firmware version and update date information are displayed.

Saving Screen Images

A screen image of the product information can be saved in internal memory.
File name: Systeminfo.BMP

10.4   Executing a Self-Test

Procedure

1. Press **MENU** to display the MENU screen.
2. Tap the **System Setup** button to display the System Setup screen.

MENU screen
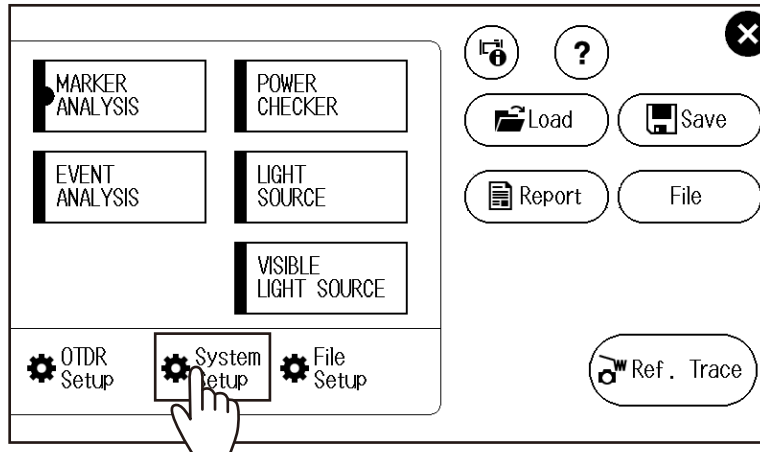
3. Tap the **Product Information** button to display the Product Information screen.

System Setup Screen

Product Information Screen

```
2017/02/27 13:28                                    ⊟⚡▬▬▬

                    Product Information                  ⊗

Product Information
    Model Name      AQ1000
    Serial Number   TEMP01
    Suffix Code
    Mac Address     5858585858
    Wavelength
    (Light Source)

Version Information
    FW Ver.             1.0            ╱⎯  Image Save
    Date

                                          Self Test
```

Executes a self-test

**Saves the product information
screen as an image.**
See section 10.3.

Explanation

Self-Test

The self-test checks the operation of the following items.
- Internal memory
- Battery voltage
- Wireless LAN (/WLN option)

If the self-test result is successful, the message "Test succeeded" will appear.
If there is an error, the message "Test Error occurred" will appear.

If an Error Occurs during a Self-Test

If an error occurs, contact your nearest YOKOGAWA dealer.

10.5 Updating the Firmware

Procedure

1. Press **MENU** to display the MENU screen.

2. Tap the **System Setup** button to display the System Setup screen.

MENU screen
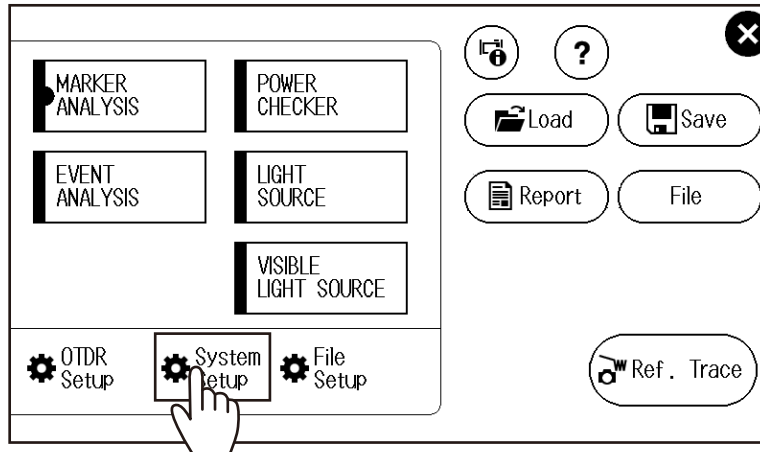
3. Tap the **Firmware Update** button. A file list screen for selecting the firmware file appears.

System Setup Screen

File List Screen for Selecting the Firmware File

Set the file list display method (list, detail).

▦▦ : List   **Displays the contents of the next higher level folder**

▤ : Detail   **File path**

```
2017/02/23 16:37                                          ⊕⚡▮▮▮

 ⩵                   ⬏  Internal Memory                        ✖
                                       4 items, 0 selected   Space : ▨▨

   1310nm0000                    1310nm0000
JPG      69.2KB   2017/02/23 15:30  SOR      40.1KB   2017/02/23 15:30

   1310nm0001                    AQ1000
SOR      6.06KB   2017/02/15 14:44  YMC      6KB     2017/02/27 16:13
```

List of files and folders

Firmware update file

Executes firmware updating

Explanation

- Firmware update files are YMC files (e.g., AQ1000.YMC).
- If necessary, you can change the file name, but on the extension. For details, see section 7.5.
- When updating the firmware, connect the USB-AC adapter to the AQ1000.
- When a firmware update completes successfully, the AQ1000 will restart automatically.
- If it fails, an error message will appear.
  Check the format and version of the firmware update file. For the procedure, see section 10.3.

10.6 Mechanical Inspection and Operation Check

WARNING

Before performing a mechanical inspection, be sure to turn off the power. Inspecting the OTDR port or light source port with the AQ1000 turned on may cause the emitted light to accidentally enter the eye. This can cause eye damage or vision impairment.

CAUTION

- Connectors clogged with foreign objects can cause abnormal operation or malfunction.
- Loose connectors may cause the AQ1000 to operate abnormally.

French

AVERTISSEMENT

Veiller à couper le courant avant d'effectuer une inspection mécanique. L'inspection du port OTDR ou du port de source lumineuse avec l'AQ1000 sous tension peut permettre à la lumière émise de pénétrer accidentellement dans les yeux. Ceci peut provoquer des lésions oculaires ou une déficience visuelle.

ATTENTION

- Si des corps étrangers se retrouvent emprisonnés dans les différents connecteurs, un dysfonctionnement ou un endommagement risque de se produire.
- Si l'ajustement de l'un des différents types de connecteurs n'est pas parfait, l'instrument risque de ne pas fonctionner normalement.

Mechanical Inspection

Make sure that:
- The exterior of the AQ1000 is not damaged or deformed.
- Switches, connectors, and screws are not loose.
- Switches and moving parts work smoothly.

If there are any problems, contact your nearest YOKOGAWA dealer.

Operation Check

Turn the AQ1000 on to start it. Check the following to verify that the AQ1000 is running normally.
- The start screen appears after power-on.
- The screen can be switched using the control keys.
- Touch panel operations work.

10.7 Replacing the Optical Adapter

⚠️

WARNING

When replacing the optical adapter, turn off the AQ1000 to prevent the light from accidentally being emitted from the light source port. Replacing the optical adapter with the AQ1000 turned on may cause the emitted light to accidentally enter the eye. This can cause eye damage or vision impairment.

French

⚠️

AVERTISSEMENT

Lors du nettoyage de l'émetteur de lumière, mettre l'AQ1000 hors tension pour empêcher l'émission accidentelle de lumière provenant du port de la source lumineuse. Le nettoyage de l'émetteur de lumière avec l'AQ1000 sous tension peut permettre à la lumière émise de pénétrer accidentellement dans les yeux. Ceci peut provoquer des lésions oculaires ou une déficience visuelle.

Removal

1. Check that the AQ1000 is turned off.
2. Open the light source port cover.
3. Remove the optical adapter attachment screws (nominal diameter: M2, length: 4 mm) with a Phillips screwdriver.
4. Pull out the optical adapter.

OTDR port

Optical adapter

Attachment screws (nominal diameter: M2, length: 4 mm)

Light source port cover
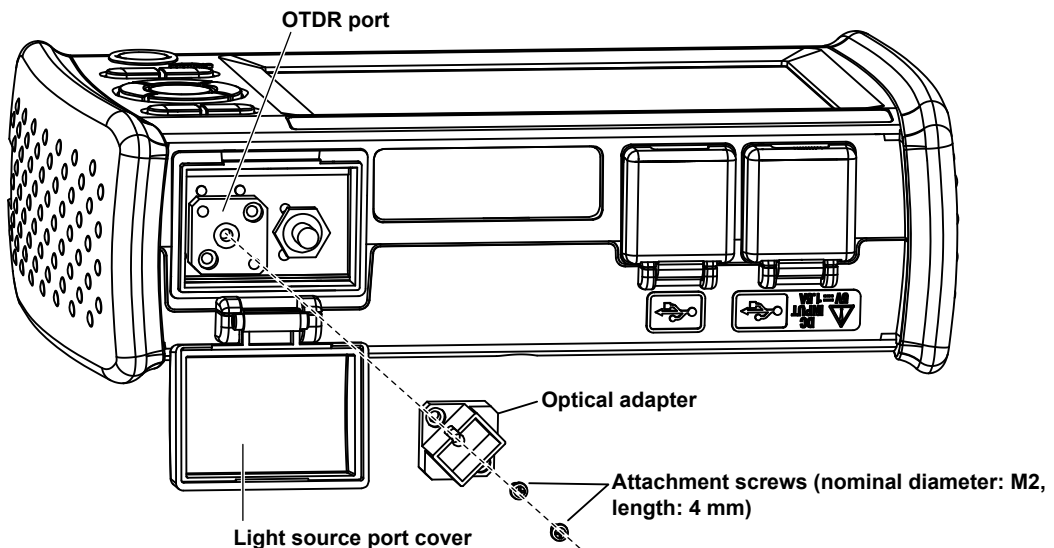
Installation

1. Check that the AQ1000 is turned off.

2. Open the light source port cover.

3. Align the optical adapter attachment screw holes and the OTDR screw holes (two locations), and insert the optical adapter straight into the slot.

4. Tighten the attachment screws (nominal diameter: M2, length: 4 mm) with a Phillips screwdriver. The proper tightening torque is about 0.12 N-m.

Note
If the optical port cover comes off, bend the cover axle with your fingers and reattach it.

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Maintenance and Inspection

10.8 Routine Maintenance

Cleaning the Outside of the AQ1000

To clean the LCD or the outside of the AQ1000, turn the power off, and remove the USB-AC adapter from the AQ1000. Use a damp, well-wrung cloth to clean the outside and then wipe it off with a dry cloth. Do not use chemicals such as thinner, benzene, or alcohol. Doing so may cause deformation and discoloring.

Cleaning the Optical Adapter and Optical Fiber End Faces

⚠️

WARNING

When cleaning the light emitter, turn off the AQ1000 to prevent the light from accidentally being emitted from the light source port. Cleaning the light emitter with the AQ1000 turned on may cause the emitted light to accidentally enter the eye. This can cause eye damage or vision impairment.

French

⚠️

AVERTISSEMENT

Lors du nettoyage de l'émetteur de lumière, mettre l'AQ1000 hors tension pour empêcher l'émission accidentelle de lumière provenant du port de la source lumineuse. Le nettoyage de l'émetteur de lumière avec l'AQ1000 sous tension peut permettre à la lumière émise de pénétrer accidentellement dans les yeux. Ceci peut provoquer des lésions oculaires ou une déficience visuelle.

1. Check that the AQ1000 is turned off.

2. Open the light source port cover.

3. Remove the optical adapter.
   For the procedure, see section 10.7.

4. Use a lens cleaner to clean the optical fiber end face.

5. Insert the lens cleaner slowly into the optical adapter's optical connector and turn the lens cleaner to clean the inner walls.
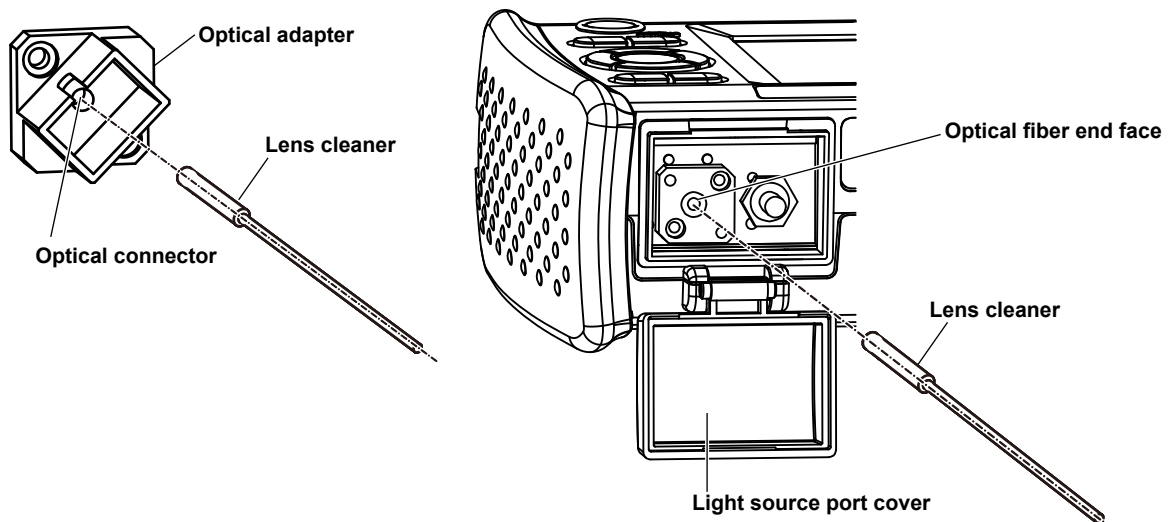
Note

- Use a lens cleaner that does not produce fuzz or residue to clean the optical components.
- The light source port can be cleaned with a stick type lens cleaner with the optical adapter attached, but we recommend that you remove the optical adapter to clean it.

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Maintenance and Inspection

10.9 Storage Precautions

Before Storage

Clean the AQ1000 before storage. For details on cleaning, see section 10.8.

Storage Conditions

Store the AQ1000 under the following conditions.
- In a place where the temperature and humidity are within their allowable ranges.
- In a place where the temperature and humidity do not change greatly over a day
- Out of direct sunlight
- In a place with little dust
- In a place without corrosive gas

Note
To avoid over discharging, if you will not use the AQ1000 for one month or longer, charge the battery, and store the AQ1000 away from direct sunlight in a location that has an ambient temperature of 10 to 30°C.

Reuse

When using the AQ1000 after long-term storage, check its operation (see section 10.6).

Packing

Follow the procedure below to pack the AQ1000.

1. Wrap the AQ1000 in a thick plastic sheet or the like to prevent dust from entering the inside of the AQ1000.

2. Apply cushioning material to the LCD to protect it.

3. Prepare a box with a 10 to 15 cm gap on each side of the AQ1000.

4. Place cushioning material at the bottom of the box.

5. Place cushioning material in the gaps between the AQ1000 and the box.

6. Seal the box securely with adhesive tape or the like.

Transportation

- When transporting the AQ1000, avoid vibration.
- Transport in an environment that meets the storage conditions.
- This instrument contains a battery (lithium-ion cell). For information on transporting the AQ1000 by air, see the requirement for each packing instruction (lithium battery packing instruction UN3480 PI965 Section II) in the latest IATA Dangerous Goods Regulations. For details, contact your airline company in advance.

10.10 Recommended Part Replacement

The following parts are wearable. It is recommended to replace them after the time period indicated below. For replacement of parts, please contact your nearest Yokogawa representative.

Parts with Limited Service Life

Part Name	Service Life	Notes
Battery	500 charges	The actual service life varies depending on the operating environment. You cannot replace the battery. To replace the battery, contact your nearest YOKOGAWA dealer.

Consumable Parts

We recommend replacing them at the following intervals.

Part Name	Recommended Replacement Interval*	Notes
Backup battery (lithium battery)	5 years	Replacement at our factory
LCD	Approx. 30000 hours	Replacement at our factory
Ferrule	1 year	Replacement at our factory
Universal adapter	1 year	New purchase
USB port	1500 times	Replacement at our factory

* The recommended replacement period varies greatly depending on the operating environment and frequency of use. The values in the above table are guidelines.

10.11 Calibration Period

Periodic calibration is an effective means of keeping the instrument performing correctly for a long time and of detecting malfunctions at an early stage. We recommend that you calibrate the AQ1000 once a year.

10.12 Disposing of the Instrument

This instrument uses a battery (lithium-ion cell). Because you cannot remove the battery, for details on disposing of the AQ1000, contact your nearest YOKOGAWA dealer.

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Maintenance and Inspection

Appendix 1   OTDR Terminology

Near-end Reflection

This is the reflection that occurs at the point where the AQ1000 and the optical fiber cable are connected. This also includes the AQ1000's internal reflection. In the section where this near-end reflection is detected, even if there are other connections, the loss and reflections that occur at these points cannot be detected. This section is the near-end dead zone.

When you are measuring a short distance, connect a launch fiber cable to reduce the effect of the near-end reflection.

Backscatter

When light travels through an optical fiber cable, Rayleigh scattering caused by changes in the density of materials that are smaller than the light's wavelength and inconsistencies in the fiber's composition generates loss in the optical fiber itself. The portion of the scattered light that travels in the direction opposite to the direction of propagation is known as backscatter.
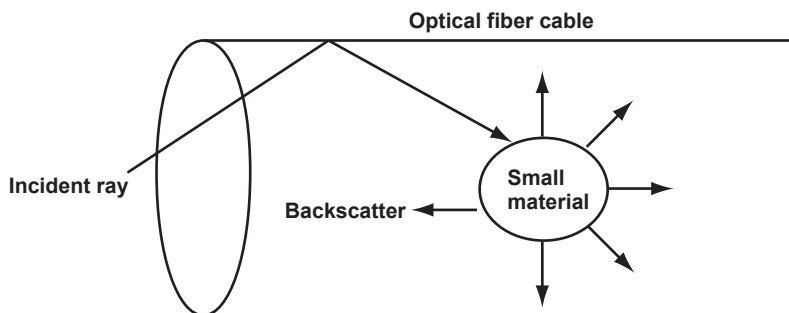
Splice Loss

Because spliced sections of optical fiber cables have a great number of changes in the material's density and inconsistencies in the cable's composition, loss due to Rayleigh scattering becomes large, and splice loss occurs in these sections.

Reflection at the Connection Point of Connectors

Using a connector to connect two optical fibers is different from splicing them together in that a small gap remains between the two fibers. Because this gap has a different index of refraction, reflection occurs.
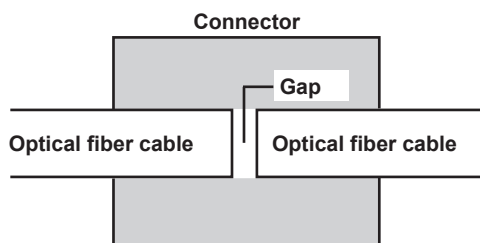
Fresnel Reflection at the Open End of the Fiber

This is the reflection that occurs at locations where the index of refraction changes (glass to air) such as where there are tears in the optical fiber cable or at the end of it. When the optical fiber cable end face is vertical, approximately 3% of the incident optical power (14.7 dB) is reflected.
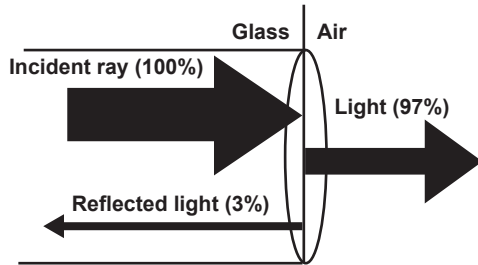
Dynamic Range

Dynamic range refers to the range of optical power levels that can be measured. The larger the dynamic range, the greater the distance that optical pulses can be measured over.
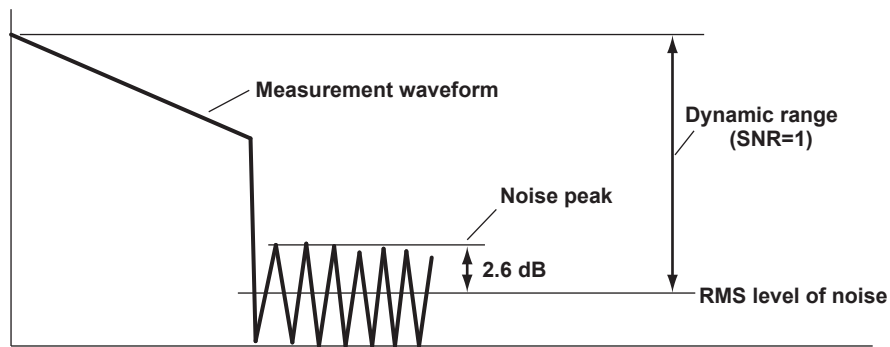
Dead Zone

An area where the influence of a large event such as a connector's connection point makes it impossible to recognize other events that exist in that area is a dead zone. There are the following types of dead zones.

- **Event Dead Zone**

  An area where adjacent reflections cannot be separated. This is the area represented by the pulse width between the two points on the waveform at the level that is 1.5 dB below the peak value.

- **Attenuation Dead Zone**

  An area where, because there is a large reflection, the surrounding splice losses cannot be measured.
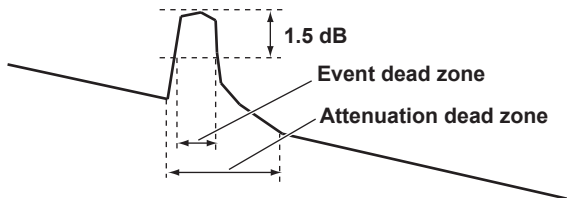
Near-end Dead Zone Prevention

In sections where near-end reflection is detected, loss and reflections that occur at connections cannot be detected. If you are measuring a short distance, connect a launch fiber cable to move events that are hidden in the near-end reflection the distance of the launch fiber cable.

Optical fiber cable being measured

Launch fiber **Event generation point**

Do not bend the optical fiber cable.

OTDR/light source port

AQ1000

Small reflection that was hidden within a large reflection
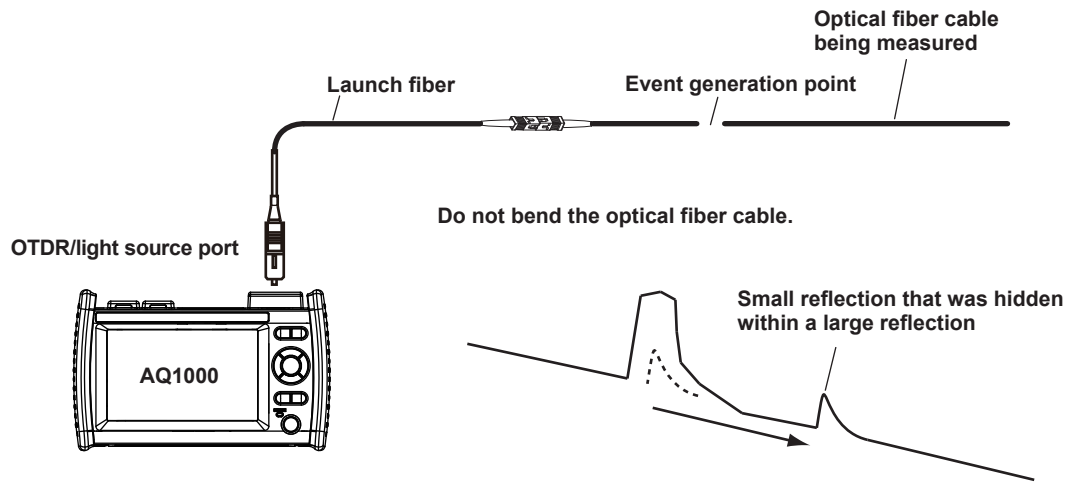
Splice Loss

The AQ1000 measures the distance and the loss between the specified points.
The AQ1000 uses the following four points to perform the measurement: the measurement start point ①, the splice loss start point ②, the splice loss end point Y2, and the measurement end point ③. At position ②, the level difference between the approximated line ②–① and the approximated line Y2–③ is calculated as the splice loss. The splice loss changes greatly depending on the position of ②. Set the correct position for ②. The splice loss value changes depending on the approximation method that you have specified. This can only be used when Marker Mode is set to Marker.

①

②

b (dB)

a (dB) Y2

Approximated line Y2–③ e (dB)

③

c (km) f (km)
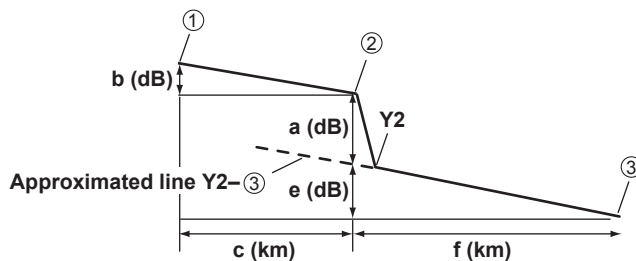
Splice loss		a	dB	
Return loss				
①-②	b	dB	②-③ e	dB
	c	km	f	km
	b/c	dB/km	e/f	dB/km

Marker information

Return Loss

Return loss RL is the ratio, in dB, of the reflected optical power level Pr to the incident optical power level Pi. It is calculated using the following equation. The larger the return loss, the smaller the reflected optical power. This implies that the performance of the measured optical line is good.

$$RL = -10\log(Pr/Pi) \text{ [dB]}$$

App

Appendix

Measuring Distance

The AQ 7280 measures the time that it takes for an incident optical pulse to be reflected and return to the device. It uses this information and the following equation to calculate the distance (L).

L=C×T/(2N) [m]

C : The speed of light in a vacuum $2.99792×10^8$ [m/s]

T : The time measured from when the incident optical pulse was generated to when the reflected light was received [s]

N : Index of refraction

In the above equation, the division by two accounts for the fact that the measured time represents the total time taken by the optical pulse to reach the reflection point and to return from it.

If the correct index of refraction is not specified, there will be errors in the distance measurement.

Index of Refraction (IOR)

The AQ1000 has preset indices of refraction that correspond to each wavelength. Contact the optical fiber manufacturer for the optical fiber cable's correct index of refraction.

Distance Range

You must select a distance range that is longer than the cable length of the optical fiber cable that you want to measure. As the distance becomes greater, the measurement time also increases. For details on the setting range, see section 8.1.

Pulse Width

The following features are available depending on the length of the pulse width. The pulse width that you can select varies depending on the distance range that you have specified. For details on the settings, see section 8.1.

• **Short Pulse Width**

You can separate and measure adjacent events (reflection points and losses). However, you cannot measure long distances.

• **Long Pulse Width**

Long distances can be measured. However, multiple adjacent events may be seen as one single event.
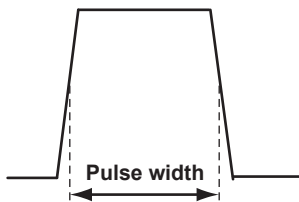
Appendix 2   Factory Default Settings

1. Press **MENU** to display the MENU screen.

2. Tap the **System Setup** button to display the System Setup screen.

MENU screen
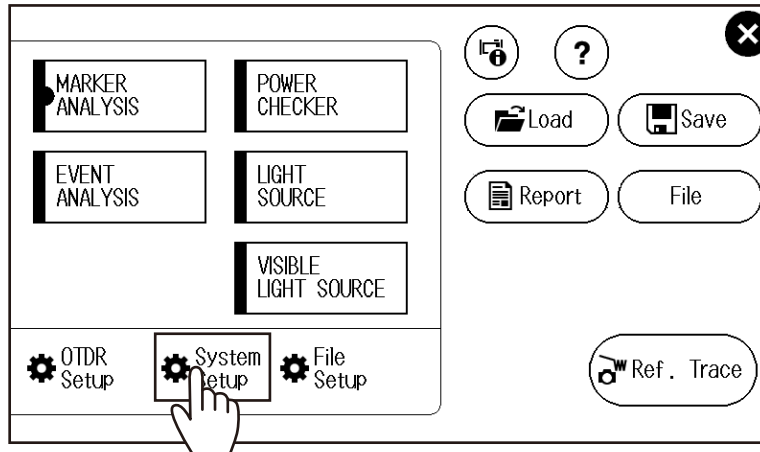
3. Tap the **Factory Setting** button to display the Factory Setting screen.

System Setup Screen

App

Appendix

Factory SettingScreen

2017/03/02 16:06

Factory Setting

Initializes settings
The setup data will be initialized.

Setup

All
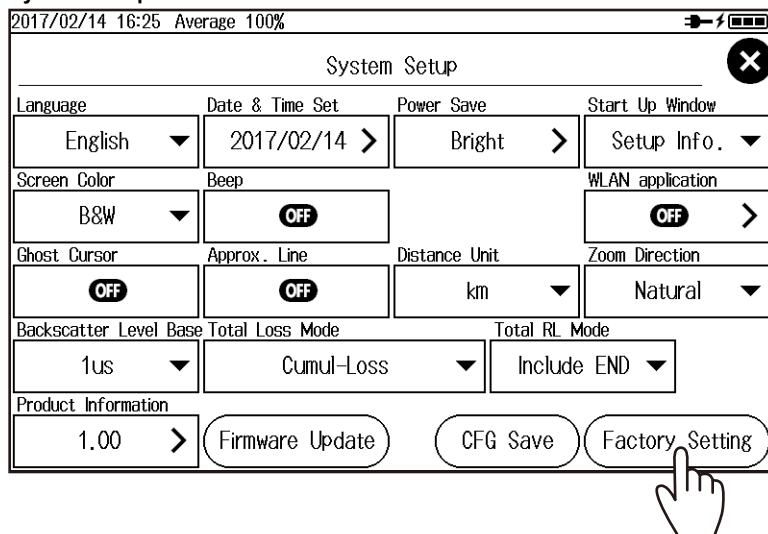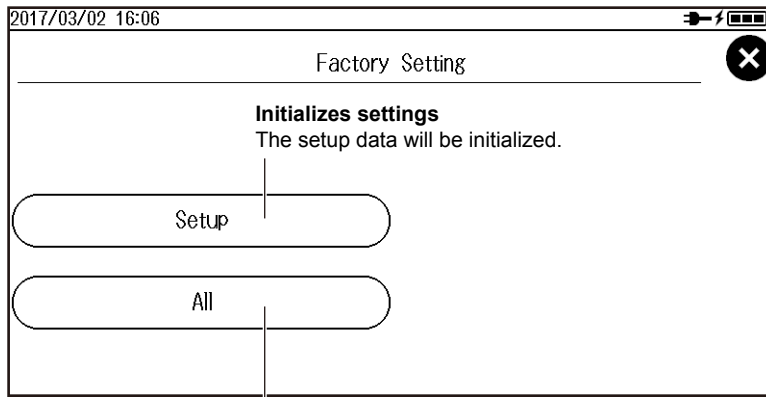
Initializes the settings and deletes data
The setup data will be initialized. Waveform data, image data, and the like in the USER folder in the AQ1000 internal memory will also be deleted.

Note
• The USERS_MANUAL folder in the USER folder and the PDF user's manuals in the USERS_MANUAL folder will not be deleted.
• The time setting will not be initialized.

Explanation

Setup

The setup data is initialized. Data in the USER folder in the AQ1000 internal memory will not be deleted.

All

The setup data is initialized. All data (except the user's manual) in the USER folder in the AQ1000 internal memory will not be deleted.

Factory Default Values

OTDR Setup

MEASURE	
Wavelength	SM 1310nm
Distance Range	Auto
Pulse Width	Auto
Average Duration	Auto
Auto Save	OFF
Fiber-In-Use Alarm	ON
Connection Check	OFF
EVENT ANALYSIS	
Splice Loss	0.10 dB
Return Loss	70 dB
End of Fiber	3 dB
Launch Fiber Setting	OFF
Pass Fail Judgement	OFF
Macro Bending	OFF
ANALYSIS	
IOR(1310nm, 1550nm)	1.46000
Backscatter Level	
1310 nm	–50.00 dB
1550 nm	-52.00 dB

System Setup

Language	English
Power Save	Bright (Using the USB-AC adapter)
	Normal (Using the battery)
Start Up Window	Setup Info.
Screen Color	Color 1
Beep	ON
Ghost Cursor	OFF
Approx. Line	OFF
Distance Unit	km
Backscatter Level Base	1μs
Total Loss Mode	Cumul-Loss
Total RL Mode	Include END
Zoom Direction	Natural
WLAN application	
Access Point Mode Setup	
SSID	AQ1000_TEMP01
Encryption Type	WPA2_PSK
Password	12345678
Broadcast Channel	AUTO
IP Address	192.168.0.2
Subnet Mask	255.255.255.0
DHCP Setting Address	192.168.0.100
Application Setup	
User Name	anonymous

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Appendix

File Setup

File Name Setup	
Name Configuration	
①	Wavelength
②	Comment1
③	ID No.
④	Blank
⑤	Blank
⑥	Blank
⑦	Blank
⑧	Blank
⑨	Blank
⑩	Blank
Tape no. Type	OFF
Separator	③②①
ID No.	0
Tape No	******
Comment Setup	
Comment 1	Blank
Comment 2	Blank
Comment 3	Blank
Comment 4	Blank
Comment 5	Blank
Comment 6	Blank
Comment 7	Blank
Comment 8	Blank
Comment 9	Blank
Comment 10	Blank
Report Setup	
①Job Information	ON
②Link Summary	ON
③Fiber Surface Image	OFF (fixed to OFF)
④Map	ON
⑤Trace	ON
⑥Marker Information	ON
⑦Measure Conditions	ON
⑧Overview	ON
⑨Event Search Conditions	ON
⑩Pass Fail Judgement	OFF
⑪Event List	ON
Label Setup	
Label	Blank
Company Name	Blank
Name	Blank
Cable ID	Blank
Fiber ID	Blank
Fiber Type	652:Conventional SMF
Cable Code	Blank
Originating Loc(A)	Blank
Terminating Loc(B)	Blank
Current Data Flag	BUILT(BC)
Direct Save Setup	
Save File Type	*.SOR
Save Action	Direct Save
Save Folder	Blank

POWER CHECKER

Wavelength	SM 1310nm
Lower Limit	-28.00 dBm
Upper Limit	-10.00 dBm

LIGHT SOURCE

(OFF/ON)	OFF
Wavelength	SM 1310nm
Modulation	CW

VISIBLE LIGHT SOURCE

(OFF/ON)	OFF
Modulation	CW

App

Appendix

Appendix 3　Using Open Source Software

StarterWare

This product uses StarterWare source code. In accordance with the StarterWare license, the original text regarding copyright, distribution terms, and license are provided below.

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