# User's Manual

# AQ7292A, AQ7293A, AQ7294A, AQ7293F, AQ7293H, AQ7294H OTDR

YOKOGAWA
Yokogawa Test & Measurement Corporation

IM AQ7290-01EN
1st Edition

Thank you for purchasing the AQ7290 OTDR series AQ7292A, AQ7293A, AQ7294A, AQ7293F, AQ7293H, AQ7294H OTDR (Optical Time Domain Reflectometer).
This user's manual explains the features, operating procedures, and handling precautions of the instrument. To ensure correct use, please read this manual thoroughly before beginning operation. Keep this manual in a safe place for quick reference.
The manuals for this instrument are listed on page iii. Please read all manuals.

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 improvements to the product's performance and functionality. Refer to our website to view our latest manuals.
- 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

1st Edition: April 2025

# Manuals

The following manuals, including this one, are provided as manuals for this instrument. Please read all manuals.

## Manuals included with the product

| Manual Title | Manual No. | Description |
|---|---|---|
| AQ7292A, AQ7293A, AQ7294A, AQ7293F, AQ7293H, AQ7294H OTDR Getting Started Guide | IM AQ7290-02EN | Explains the handling precautions, basic operations, and specifications of this instrument. |
| AQ7292A, AQ7293A, AQ7294A, AQ7293F, AQ7293H, AQ7294H OTDR | IM AQ7290-92Z1 | Document for China |
| Model 739883 Battery Pack Handling Precautions | IM 739883-01EN | Explains the handling precautions of the battery pack. |
| 739883 Battery Pack | IM 739883-92Z1 | Document for China |
| Safety Instruction Manual | IM 00C01C01-01Z1 | Safety manual (European languages) |

## Manuals included in the internal memory of this instrument

The following manuals are included in the internal memory of this instrument. Download them to your PC for use. For how to download them, see “How to View the User’s Manual” in the Getting Started Guide (IM AQ7290-02EN). You can also download them from the YOKOGAWA website. Sign in to Customer Portal at the following website.

**https://myportal.yokogawa.com/**

A printed manual can also be purchased separately. Contact your nearest YOKOGAWA dealer.

| Manual Title | Manual No. | Description |
|---|---|---|
| AQ7292A, AQ7293A, AQ7294A, AQ7293F, AQ7293H, AQ7294H OTDR User’s Manual | IM AQ7290-01EN | This document. Explains all the available features, except for the communication interface features, and how to use them. |
| AQ7292A, AQ7293A, AQ7294A, AQ7293F, AQ7293H, AQ7294H OTDR Communication Interface User’s Manual | IM AQ7290-17EN | Explains the communication interface features and instructions on how to use them. |

The “EN and “Z1” in the manual numbers are the language codes.

# Conventions Used in This Manual

## Prefixes k and K

Prefixes k and K used before units are distinguished as follows:

| | |
|---|---|
| k | Denotes 1000. Example: 100 kS/s (sample rate) |
| K | Denotes 1024. Example: 720 KB (file size) |

## Displayed characters

Bold characters in procedural explanations are used to indicate panel keys and soft keys that are used in the procedure and menu items that appear on the screen.

## Notes and cautions

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 cause 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.

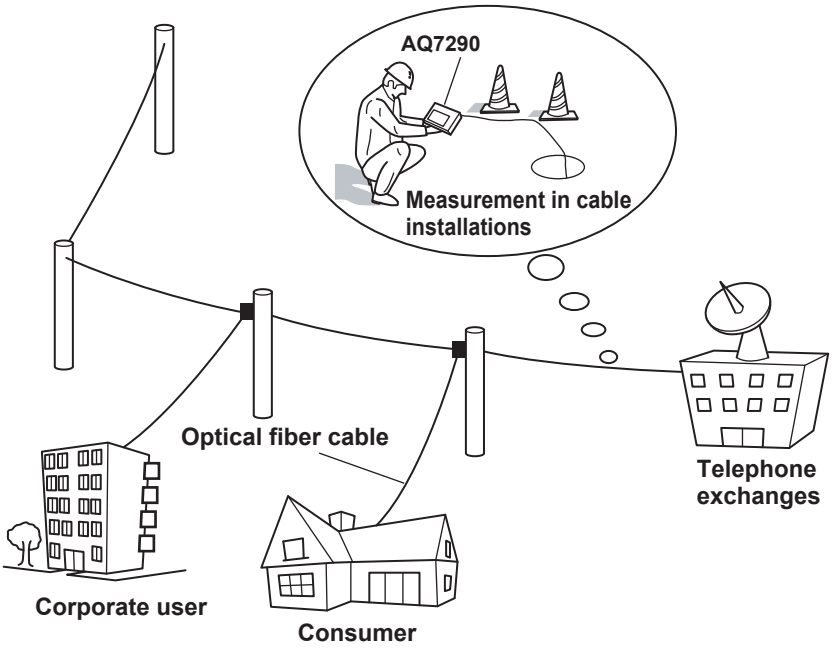
**Explanation**

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 1.

# 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 instrument 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

* SM: Single mode

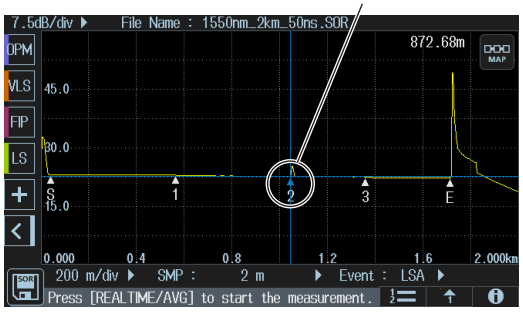
**Optical pulse measurement**

- **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 analysis 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.

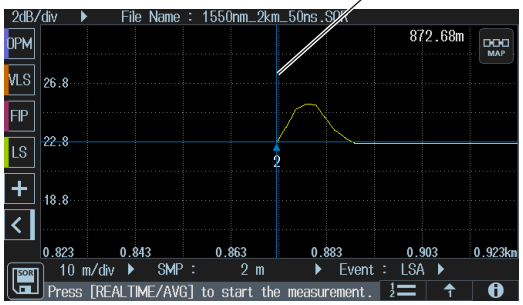
### Optical pulse waveform display (TRACE mode)

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.**



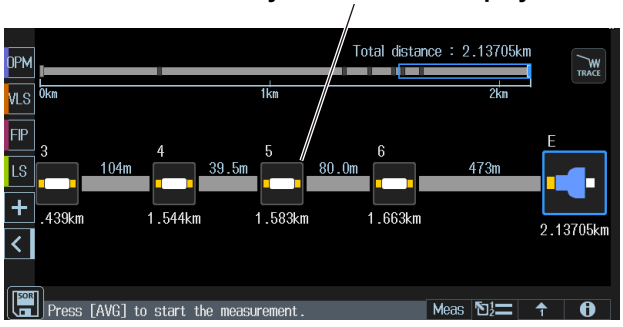

**Zoom the waveform at the cursor position**




### Event icon display (MAP mode)

The instrument 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. 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

- **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.

## USB features

**Connecting USB storage devices, communication dongles, and fiber inspection probes (Type -A)**

USB storage devices complying with USB1.0/1.1/2.0 can be used. Up to two devices can be connected. You can save waveform data and measurement conditions to USB memory devices. By using a communication dongle (LAN, WLAN, LTE), you can remotely control the instrument over a network and transfer measured waveform data to an external server. You can also connect a probe that is used in Fiber Inspec Probe, which is an application of this instrument. For the recommended communication dongles that can be used with this instrument, contact your nearest YOKOGAWA dealer.

**Connecting to a PC (Type-C)**

The instrument 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. You can also connect a PC to the instrument and control it using communication commands. For details, see the communication interface user's manual, IM AQ7290-17EN.

## Ethernet features (/LAN option)

You can connect a PC to the instrument and control it using communication commands. For details, see the communication interface user's manual, IM AQ7290-17EN.

## microSD memory card

You can use microSD memory cards. Only one card can be inserted at any given time. You can save waveform data and measurement conditions to them. Note that microSD memory cards are not included with this instrument. Please use your own microSD memory cards. The instrument supports SDC, SDHC, and SDXC. For information about compatible microSD memory cards, contact your nearest YOKOGAWA dealer.

## Utility features (simultaneous use of multiple functions)

On the OTDR screen, you can call up optical power meter, visible light source, and other features and measure optical power and the like simultaneously with the OTDR measurement. In a measurement that takes a certain time to complete such as in an OTDR averaged measurement, measurement of other fibers can be executed simultaneously to effectively use the measurement wait time and improve work efficiency.

## Light source feature (utility)

**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-fiber optical cables. The VLS port transmits a visible light (CW, CHOP (2 Hz)) with an emission wavelength of 650 nm.

## Fiber in use alarm (utility)

**Power checker (/PC option)**
This feature enables you to check the presence of communication light (fiber in use) within the optical fiber cable under measurement and view its power value.

## Optical power meter feature (utility)

**Standard optical power meter (/SPM option)**
This feature measures the optical power for loss measurement or the optical power of a communication device. This is also used as an optical power meter for the Auto Loss Test, which is an application of this instrument.

**High power optical power meter (/HPM option)**
This feature measures the high power (+27 dBm max.) optical power for loss measurement. This is also used as an optical power meter for the Auto Loss Test, which is an application of this instrument.

## Smart mapper feature (application)

This feature performs multiple measurements automatically with a single operation, combines the measured results, and maps the events that occurred on the optical fiber cable as icons. Because a map display is used in place of a waveform display, complex line configurations can be easily understood even by inexperienced workers. You can also automatically judge measured results by setting thresholds. Furthermore, you can view the multiple measured waveforms which are the bases of the map display.
Events can also be displayed as icons on the map display of the OTDR feature, but the map display of the OTDR feature converts the analysis results of averaged measurements. If multiple measured waveforms, which form the bases, are required, the smart mapper feature is convenient.

## Multi-fiber measurement feature (application)

Multi-fiber measurement takes time and effort. This feature makes it possible to efficiently measure multi-fiber optical cables through a dedicated menu.

**Projects**
Items required to make multi-fiber optical cable measurements such as measurement conditions, analysis conditions, and core information are managed as projects. By creating a project before a measurement, you can measure cores under the same conditions. You can save projects to files. You can load a previously saved project and make measurements under the same conditions. In addition, the AQ7933 Emulation Software can be used to create projects, and the project files can be loaded into this instrument.

**List**

Cores are listed on the screen. You can identify cores that have been measured, cores that have not been measured, and cores that are not to be measured. For each core in the list, you can perform average measurement, real-time measurement, optical power management, and fiber inspection probe operations. This prevents unintended omission in core measurements and allows measurements to be performed efficiently.

**Saving measured results**

Measurement results of each core are automatically saved to a folder that is automatically created in the folder that the project file is saved in. The folder will have the same name as the project file.

## Fiber inspec probe (application)

A YOKOGAWA-specified fiber inspection probe can be used to view stains on the optical fiber cable end face on the instrument screen. Wireless LAN-compatible fiber inspection probes can also be used.

Furthermore, with the /FST option, a pass/fail judgment can also be made on the dirty end face of optical fiber cables.

The fiber inspection probe is not included with the instrument. Please purchase your own fiber inspection probe. For information about compatible fiber inspection probes, contact your nearest YOKOGAWA dealer.

## Auto loss test/multi-fiber loss test (application)

By using two instruments, one as a light source and another as an optical power meter, the optical fiber loss can be measured. In a multi-fiber loss test, the loss of a multi fiber can be measured.

As a light source, the instrument automatically switches between two wavelengths (1310 nm and 1550 nm) and outputs them.

As an optical power meter, the instrument automatically detects the wavelength of the input light, switches its wavelength setting, and measures the optical power.

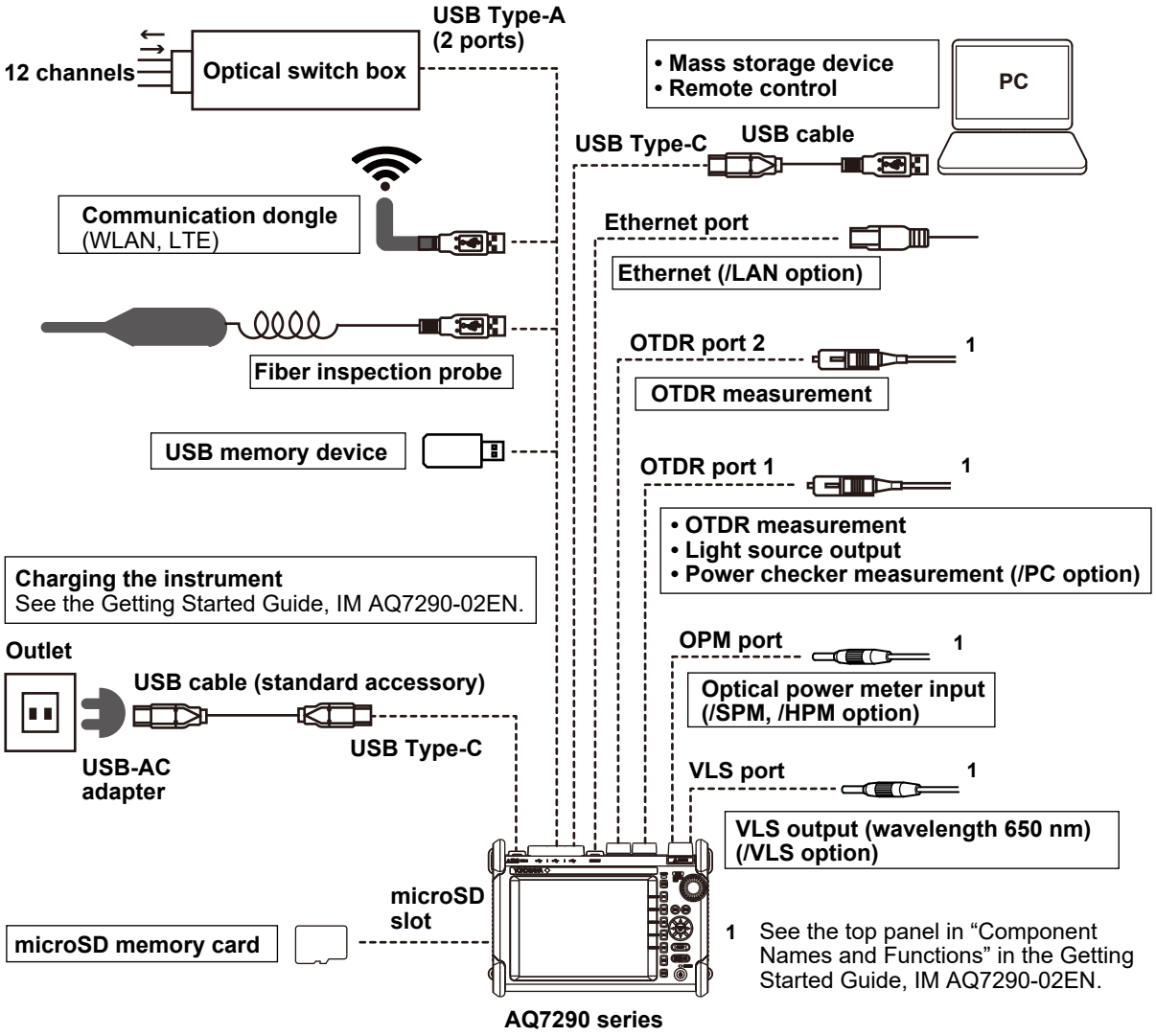
## Optical switch feature

**Optical switch box connection (Type A)**

You can use this feature to change the route of the measurement light during optical pulse measurement. Selecting a test target switch number from the menu on the optical pulse measurement screen causes the route of the measurement light (optical fiber cable under test) to change. During multi-fiber measurement, selecting a route of the measurement light (core under test) causes the target switch number on the optical switch box to change automatically.

During schedule measurement, several measurement light routes can be monitored periodically. Further, by combining the light source feature and optical power meter feature, you can observe the fluctuations in the optical power and loss by switching between multiple measurement light routes (optical fiber cables under test).

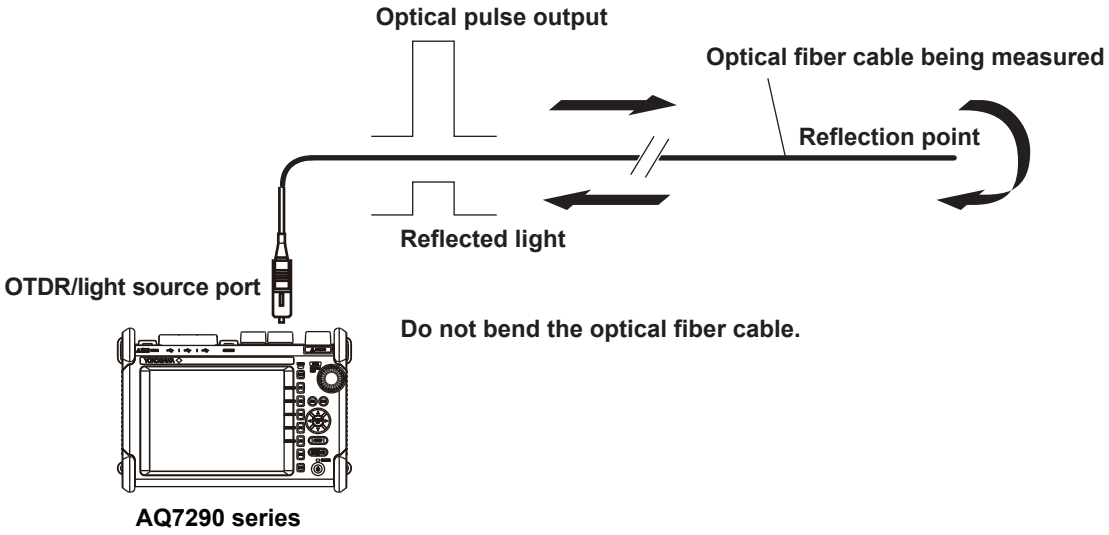
## System configuration




1 See the top panel in “Component Names and Functions” in the Getting Started Guide, IM AQ7290-02EN.

# 1.2 Optical Pulse Measurement (OTDR)

The instrument 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 instrument 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.




## Measurement mode

**Simple mode (simple OTDR)**

In optical pulse measurement, there are measurement conditions related to measurement resolution—such distance range and pulse width—and analysis conditions related to the optical fiber cable—such as index of refraction and backscatter. These conditions must be set according to the item being measured or analyzed. In this mode, an optical pulse measurement is performed immediately before the measurement to calculate the distance, connection loss, and so on. Based on the results, the optimal range can be automatically determined and measured.

**Expert mode (OTDR)**

If the distance to the measurement target or the optical fiber cable characteristics are known or if you want to measure or analyze a specific event in detail, you can set the values individually as necessary. If you set the measurement conditions—such as the distance range and pulse width—to Auto, the instrument will determine the suitable range and perform the measurement like in Simple Mode, described above.

## 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 (the measurement conditions that you can change vary depending on the measurement mode). For details on the measurement conditions, see section 4.2. Real-time measurement is not possible in MAP mode (the mode is automatically switched to TRACE mode before making a measurement).

## 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 instrument 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.

## Auto check before measurement

**Fiber-in-use alarm**

The instrument 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.

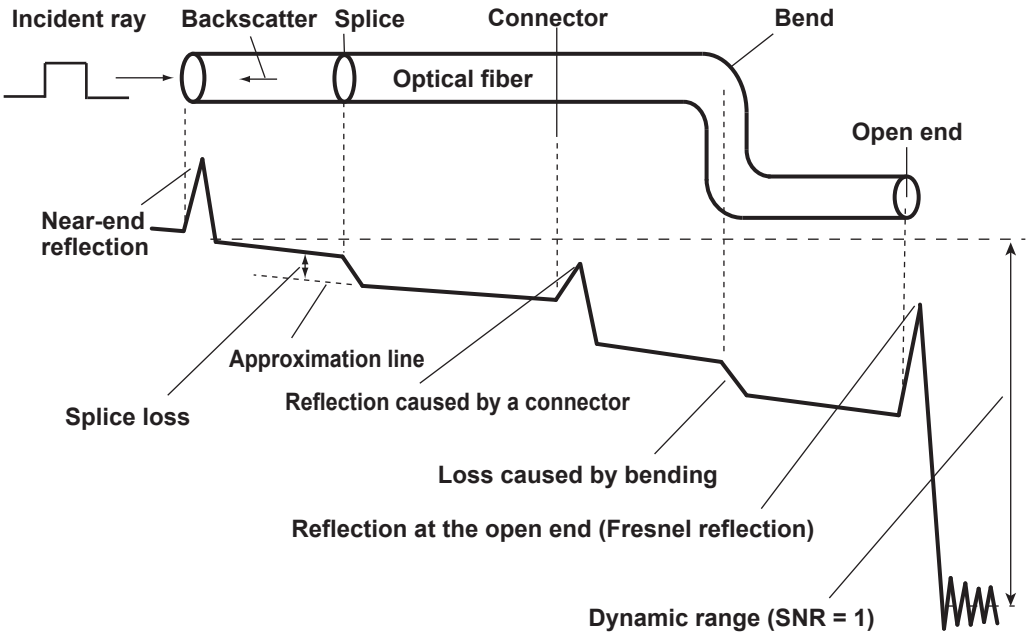
**Connection check**

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

# 1.3 Optical Pulse Waveform Display (OTDR)

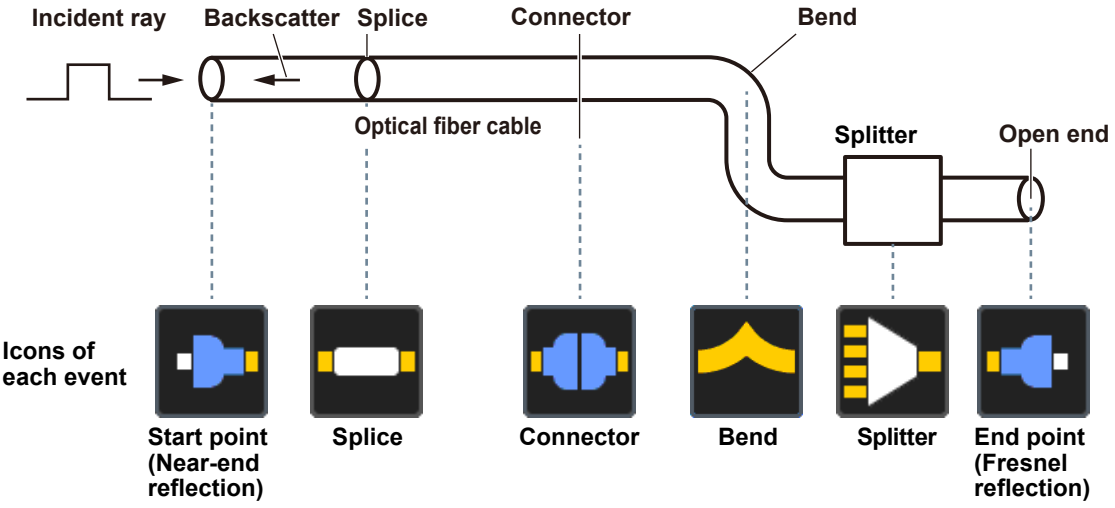
## How to view optical pulse waveforms (TRACE mode)

The optical pulse applied to an 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.

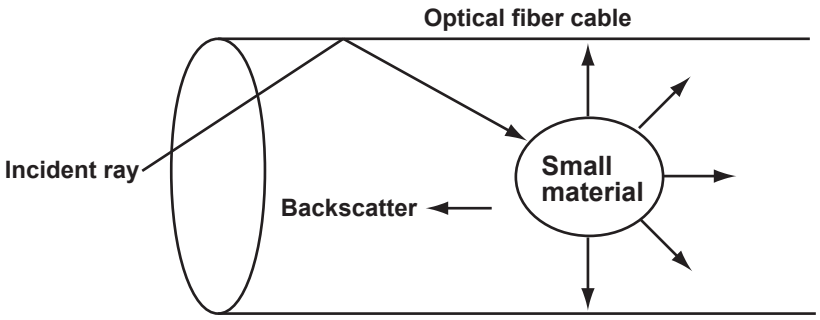


## Near-end reflection

This is the reflection that occurs at the point where the instrument and the optical fiber cable are connected. This also includes the instrument'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.

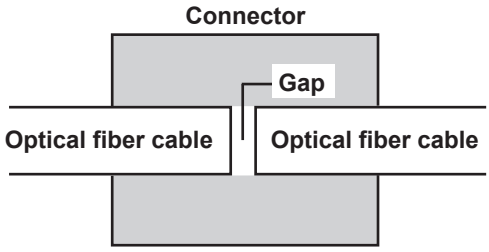



## Splice loss

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.

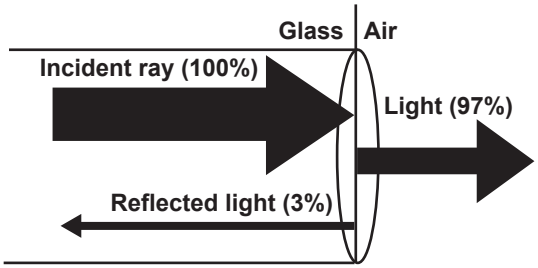
## Reflection at the connection point of connectors

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.



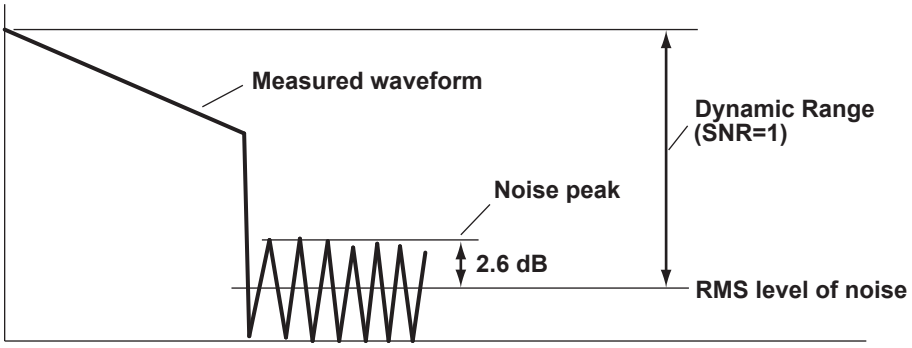
## Fresnel reflection at the open end of the fiber

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 the optical fiber cable. When the end face of the optical fiber cable 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

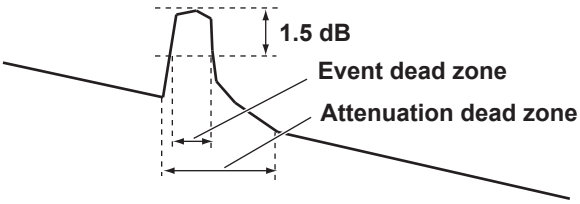
An area where the influence of a large event such as a connector’s connection point makes it impossible to recognize other events that exist in that area is a dead zone. The following types of input modules are available.

**Event dead zone**

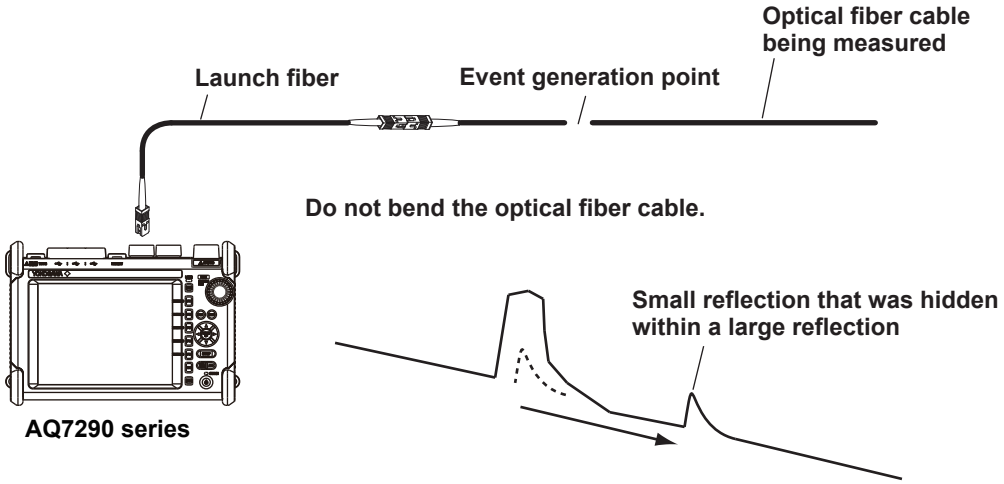
An area where adjacent reflections cannot be separated. This is the area represented by the pulse width between the two points on the waveform at the level that is 1.5 dB below the peak value.

**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.



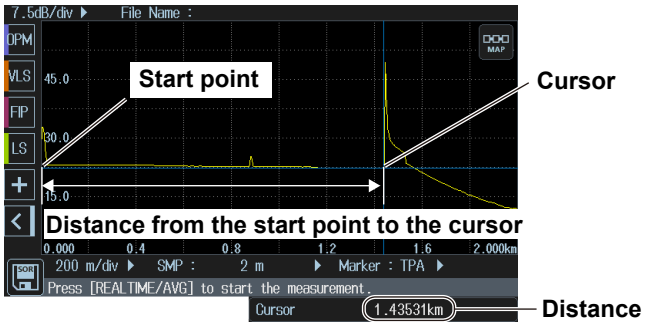
# 1.4 Optical Pulse Analysis (OTDR)

## Marker analysis (TRACE mode)

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

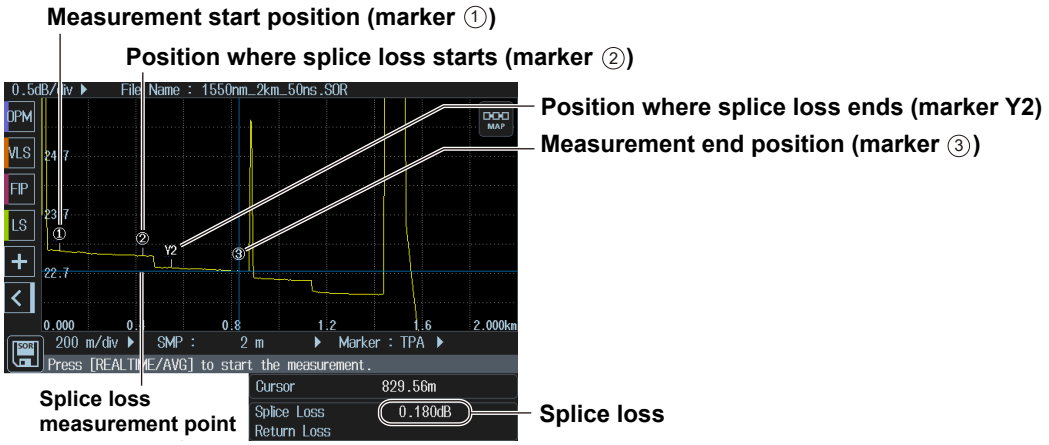
### Distance between two points

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 from the measurement start position to the measurement end position is calculated, and the value is displayed.

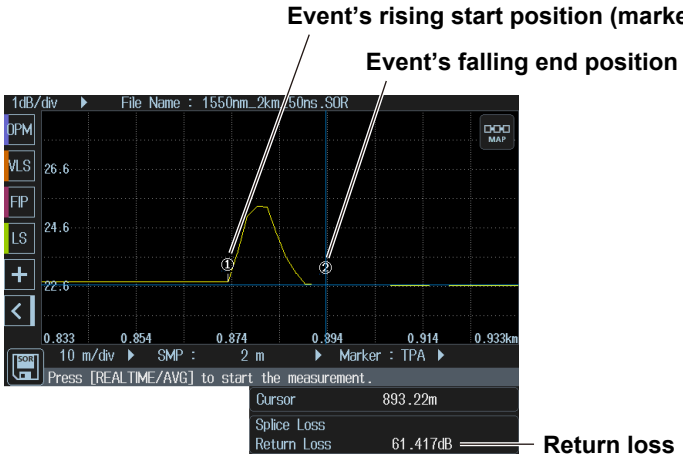



***Note***

In addition to the above method, the splice loss can be measured by using six markers or by using line markers. For details, see section 6.1.

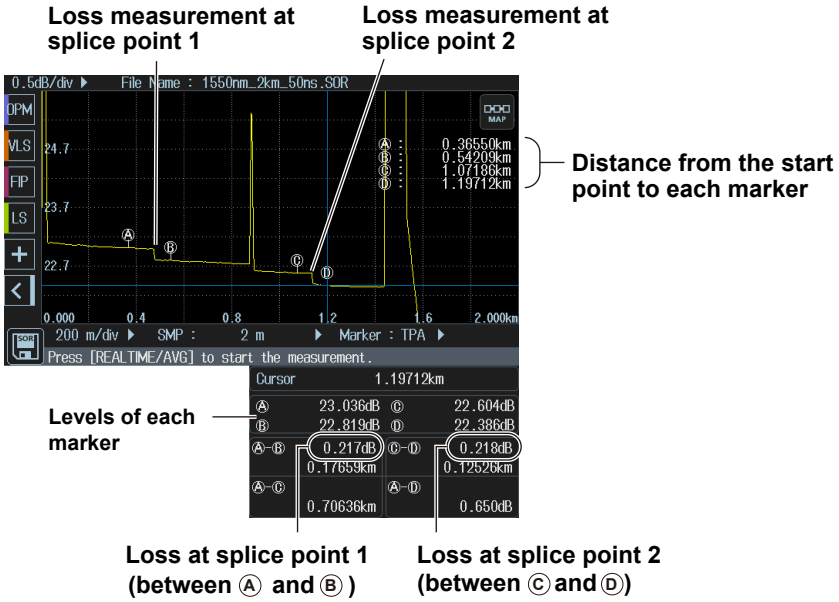
### Return loss

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




### Splice loss at two locations (2-location Marker)

Splice losses at two locations can be measured simultaneously using four markers.



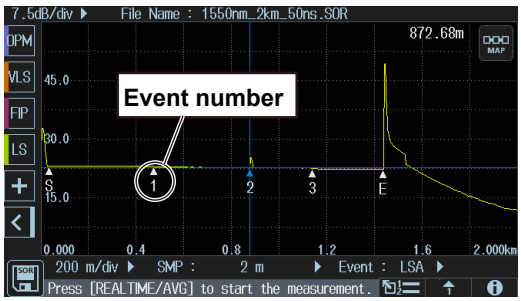
# Event analysis

All events are automatically detected from the waveform of optical pulse measurement, and the types of each event and analysis results (splice loss, return loss, etc.) are displayed on the screen.

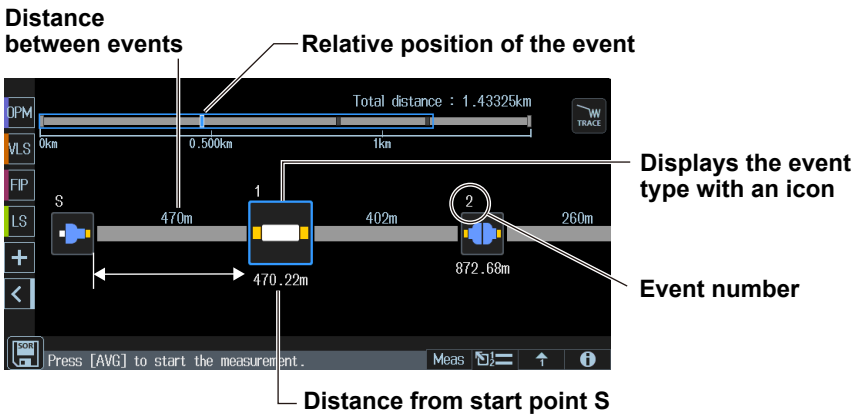
### Event display

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**



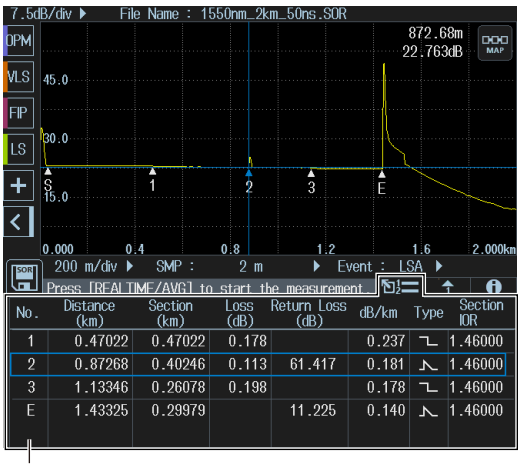

**MAP mode**



### Event information display

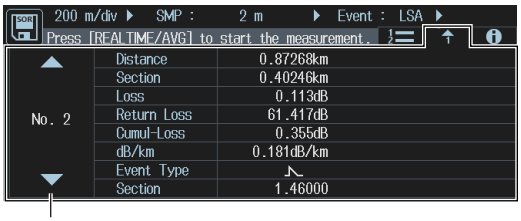
The distance, splice loss, return loss, and the like of each event are displayed. This is a feature common to TRACE mode and MAP mode.

- **List display**
  All detected events are listed.



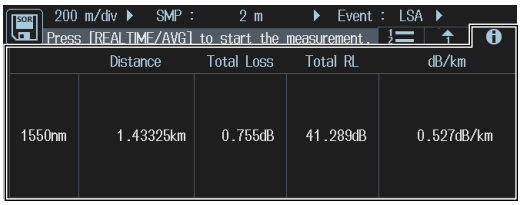

**Event number**

- **Individual event information**
  The analysis data of the selected event number is displayed.




**Event number**

- **Measurement total of events**
  The total values of detected events are displayed.



**Event analysis conditions**

You can set event search conditions.

- **Splice loss (splice/connection)**
  The instrument recognizes that an event has occurred when it detects a measured result that is greater than the specified value.

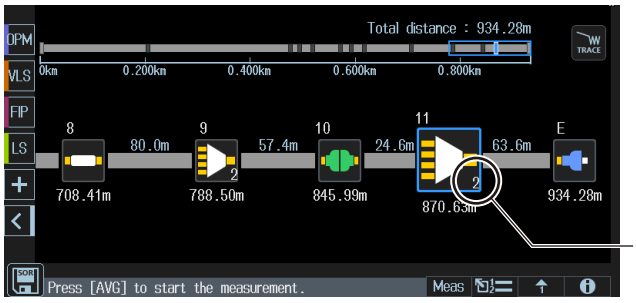
- **Return loss**
  The instrument recognizes that an event has occurred when it detects a measured result that is less than the specified value.

- **End of optical fiber**
  The instrument 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. When detecting bending loss, an event is detected when the difference in the losses of matching events at the two measured wavelengths is greater than the 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 “Dead Zone” in section 1.3.

- **Splitter loss**
  You can set the threshold for each of the number of splitter splits. When a measured result greater than the specified threshold is detected, it is identified as a splitter event and displayed along with the number of splits.




**The number of splitter splits**

# 1.5 Pass/Fail Judgment (OTDR)

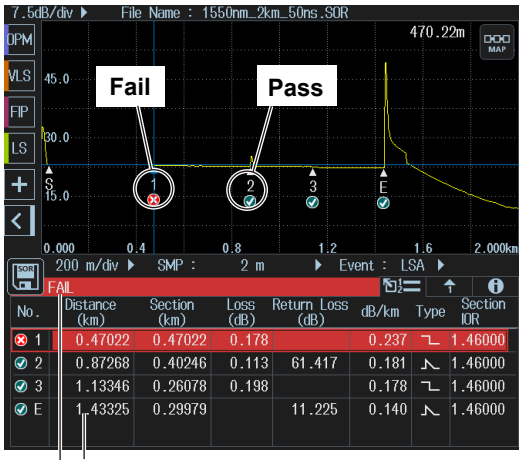
In pass/fail judgment, the instrument automatically determines whether preset conditions are met based on the event analysis data or marker values and displays the results on the screen.

## Judgment conditions

Set a pass/fail judgment threshold on each measurement item (splice loss, return loss, dB/km, total loss). 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 or marker value is indicated as fail.

### Pass/fail judgment of events

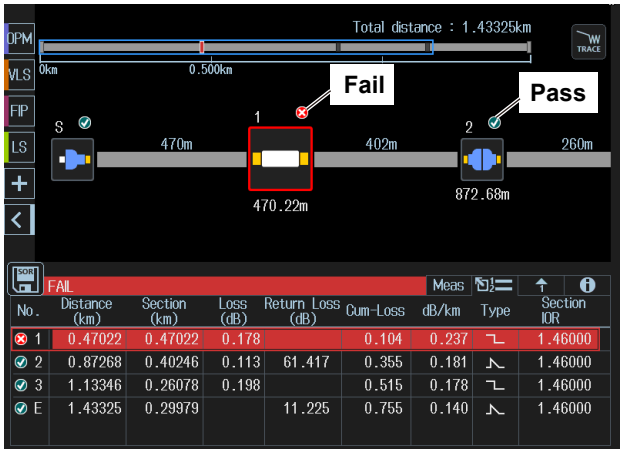
**TRACE mode**




**The pass judgment result and value of each event are displayed.**

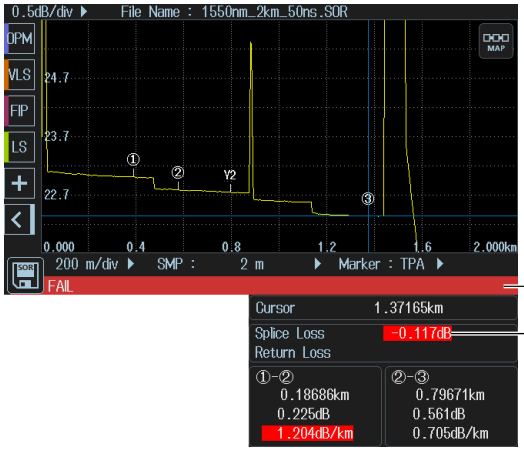
**When all events are judged as Pass, the bar turns green.**

**MAP mode**



## Pass/fail judgment of marker values

### TRACE mode




**When all marker values are judged as Pass, the bar turns green.**

**The pass judgment result and value of each marker value are displayed. When the judgment result is Fail, the indicator turns red.**

# 1.6 Utilities

## Light source

The light source is used to make loss measurements. The following measurement light wavelengths can be generated.

| Model | Measurement light wavelength |
|---|---|
| AQ7292A | 1310 nm, 1550 nm |
| AQ7293A | 1310 nm, 1550 nm |
| AQ7294A | 1310 nm, 1550 nm |
| AQ7293F | 1310 nm, 1550 nm, 1650 nm |
| AQ7293H | 1310 nm, 1550 nm, 1625 nm |
| AQ7294H | 1310 nm, 1550 nm, 1625 nm |

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.
A visible light source can be used for the following purposes.

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

| Model | Measurement light wavelength |
|---|---|
| AQ7292A | 650 nm |
| AQ7293A | |
| AQ7294A | |
| AQ7293F | |
| AQ7293H | |
| AQ7294H | |

## Optical power meter

The optical power meter feature can be applied to models with the /SPM (standard) or /HPM (high power) option. An optical power meter can be used for the following purposes.

- Measure the loss in an optical line that uses optical fibers
- Measure the optical signal power of an optical communication device

The following measurement lights can be measured.

| Model | Measurement wavelength | |
|---|---|---|
| | /SPM option | /HPM option |
| AQ7292A | 800 nm to 1700 nm | 800 nm to 1700 nm |
| AQ7293A | | |
| AQ7294A | | |
| AQ7293F | | |
| AQ7293H | | |
| AQ7294H | | |

### Logging

You can measure short-term optical power stability. The optical power value during logging can be displayed on a graph, and you can calculate the maximum, minimum, and average. In addition, you can use cursors to calculate the optical signal power at a specified location or the maximum, minimum, and average within a specified area. The logging results can be saved to a file in CSV format.

## Power checker (/PC option)

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

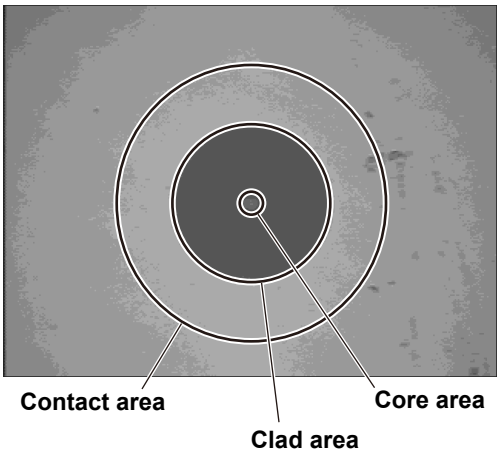
The following measurement lights can be measured.

| Model | Measurement wavelength |
|---|---|
| AQ7292A | 1310 nm, 1490 nm, 1550 nm, 1625 nm, 1650 nm |
| AQ7293A | |
| AQ7294A | |
| AQ7293F | |
| AQ7293H | |
| AQ7294H | |

## Fiber end face inspection (/FST option)

You can use a fiber inspection probe recommended by YOKOGAWA to take a photograph that shows the state of a optical fiber cable end face. You can display this photograph on the instrument screen and save it. You can also perform a pass/fail judgment on the state of the cable end face shown on the photograph.

**Example of an end face image of an optical fiber cable**




Pass/fail judgments can be performed separately on each of the contact areas, clad areas, and core areas.

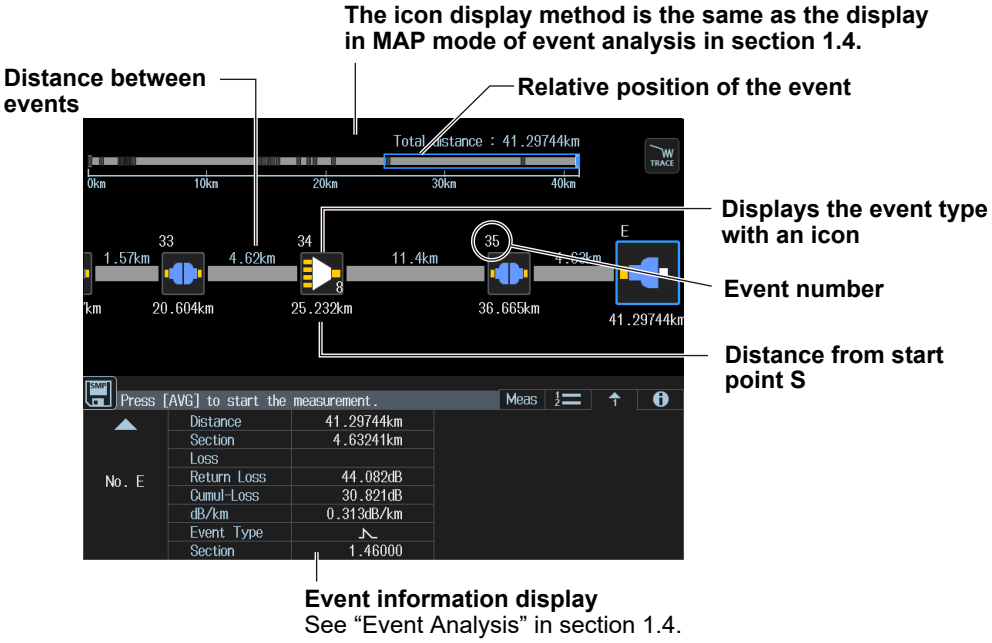
# 1.7 Application

## Smart Mapper

The Smart Mapper feature repeats the averaged measurements of the OTDR feature on the same wavelength using different pulse widths, and then when measurements are completed, automatically executes the event analysis of the OTDR feature.
Like the OTDR feature, when measurements are completed, you can select between MAP mode and TRACE mode.

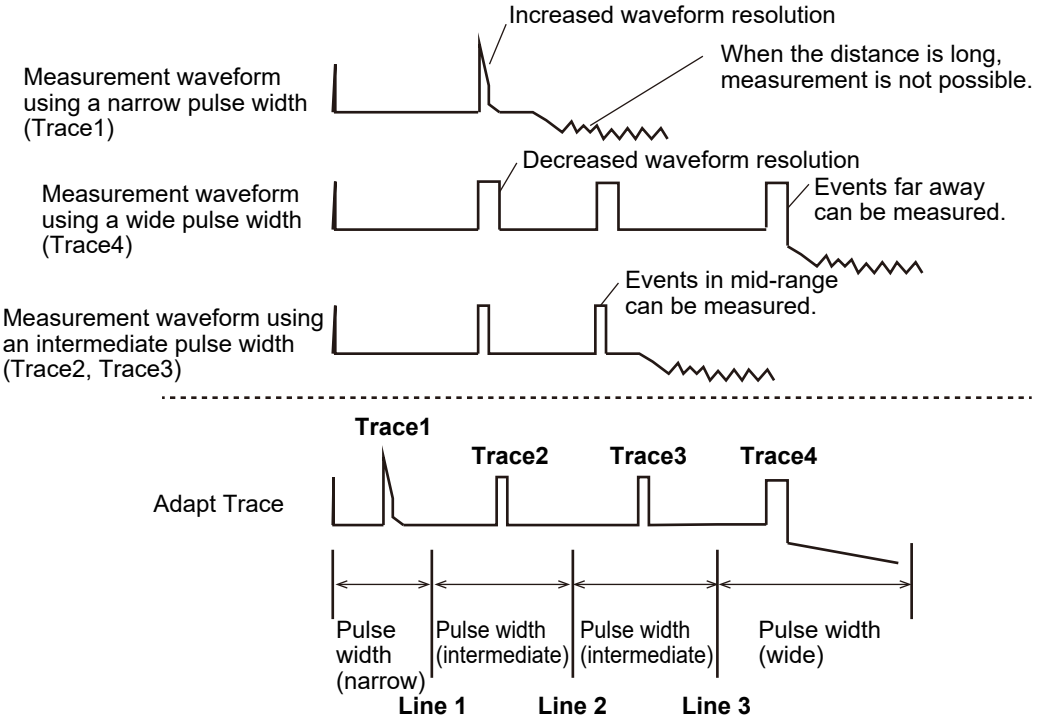
### Event analysis using MAP mode

When you select MAP mode, various events on the optical fiber cable path can be detected and displayed as icons on the screen.



**Adapt trace using trace mode (waveform editing)**

When you select TRACE mode, waveforms measured at different pulse widths can be displayed. In an optical fiber cable measurement, reducing the pulse width of optical pulse measurement increases the measurement resolution of the waveform in the near-end section but causes the optical pulse to attenuate in the far-end section, preventing correct measurement. Conversely, increasing the pulse width of optical pulse measurement allows correct measurement in the far-end section but decreases the measurement resolution of the waveform in the near-end section. The Adapt Trace feature compensates for these measurement accuracy degradations by performing optical pulse measurement using multiple different pulse widths for the same wavelength and combining the multiple waveforms on the screen. The instrument automatically determines the pulse widths depending on the specified distance range and wavelength.




**You can change the effective range of Trace1 to Trace4 by moving the lines marking the sections.**

## Optical pulse measurement of multi-fiber optical cables

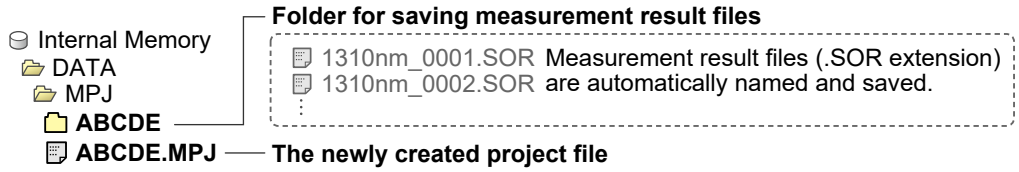
**Projects**

Projects are group of items for measuring multi fibers. The default project name is “NewProject.” In the instrument internal memory, core information, measurement conditions, analysis conditions, measured results, and the like are linked with the project name and saved. You can set up to 15 characters for the project name. For the types of strings and characters that you can use, see section 3.4.

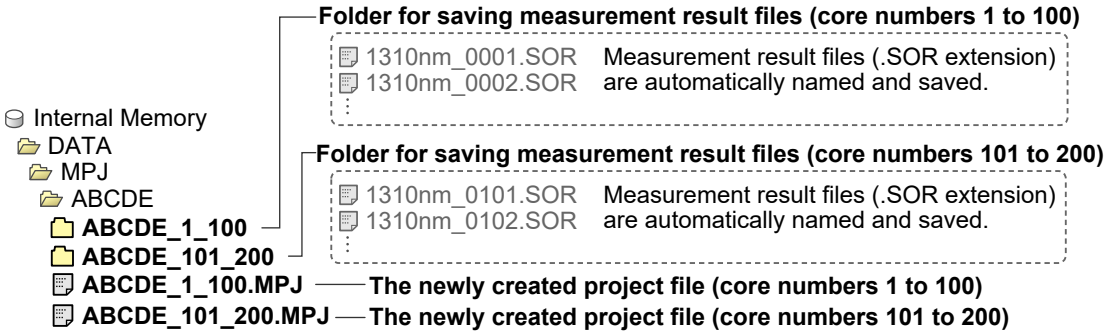
- **Project file structure**

  When you create a new project name, a new project file (.MPJ extension) and a new folder for saving measurement result files (.SOR extension) are created. At this point, you can select whether to inherit the fiber information, measurement conditions, and analysis conditions from an existing project file or reset them to default values.

**Example of when the project file name is "ABCDE"**




If the number of fibers exceeds 100, the folder for saving the project file and that for saving measurement result files will be divided. The folder is automatically divided every 100 fibers. The divided folder names will be the project name followed by the start core number and end number set in the project.

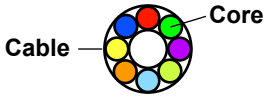



### Number of fibers, number of fibers in each division, tape number

The core number indications and settings vary depending on the type of multi-fiber optical cable.

### Normal core cable (example with eight cores)

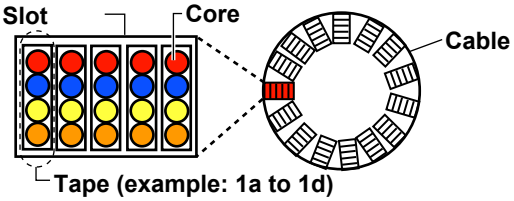
Eight cores are bundled into one.




**Ribbon slotted core cable (example of 300 fiber type 4-fiber ribbon)**

This is an example of a 300 fiber type with 15 slots (20 fibers) containing five 4-fiber tapes.
The following settings need to be entered to set the information of this core cable in a project of this instrument.

- Num of Fibers (per slot): 20
- Tape No.: a-d(4)

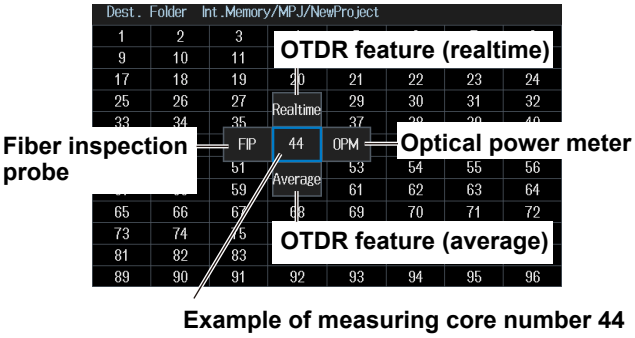


**Multi-fiber measurement**

The following four measurements can be performed in multi-fiber measurement.

- OTDR measurement (Realtime)
- OTDR measurement (Average)
- Optical power measurement
- Fiber Inspec Probe

The four measurement features use the same features as the OTDR feature for measuring a single fiber explained in section 1.1, the optical power meter (excluding the logging feature) explained in section 1.6, and the fiber end face inspection explained in section 1.6. You can run and use these four measuring features from the main view screen of multi-fiber measurement.




**Saving measurement result data**

You can save the results of multi-fiber measurement for each fiber. The data is saved in the folder explained in “Project File Structure” on page 1-24. For details on the data format, see section 9.4.

- **OTDR feature (realtime, average)**
  For each fiber, waveform data is saved in SOR format in a single file.
- **Fiber Inspec Probe**
  For each fiber, screen capture data is saved in BMP format in a single file.
- **Optical power meter**
  For each project, data is saved in tab-separated CSV format in a single file.

## Optical fiber cable monitoring (/MNT option)

This feature performs optical pulse measurement at regular intervals so that you can monitor for errors in the optical fiber cable. Results measured at regular intervals are saved to memory in CSV or SOR format (waveform data). Data and folders saved in memory are automatically assigned names with timestamps. During monitoring (while schedule measurement is in progress), measurement items, such as the loss between two points, of the logged optical pulses are shown on the instrument screen. Because the changes in the measurement items, such as the loss between two points, can be seen on the time axis, if an interruption occurs in the optical pulse input, you can determine when the optical power level fell on the instrument screen. After determining the time, you can view the measured results in the file with the corresponding timestamp. Up to four measurement items can be monitored.

## Auto loss test (combination of light source and optical power meter)

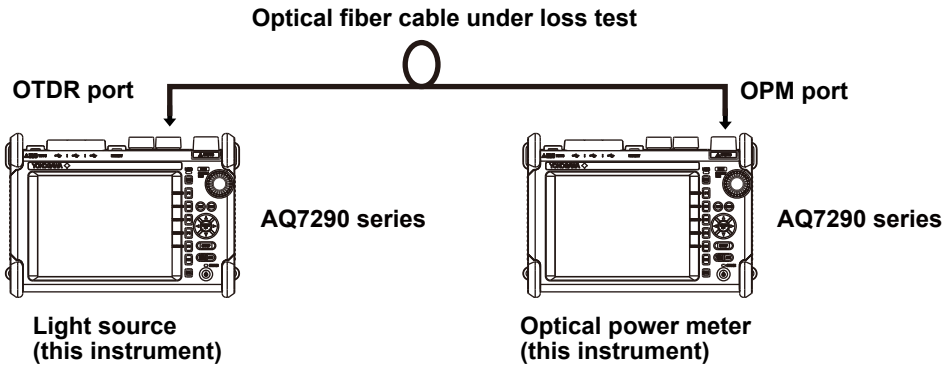
Using the instrument as a light source and optical power meter, you can easily measure optical fiber cable and line optical loss. You can also use an AQ1100A, AQ1100B, AQ1100C, AQ1210A, AQ1215A, AQ1210D, AQ1210E, AQ1215E, or AQ1215F in the multi-field tester series instead of this instrument as the light source or optical power meter.

### Light source feature

You can set up to two measurement light wavelengths and produce them in order. You can produce a constant level of light if you use the optical power adjustment feature.

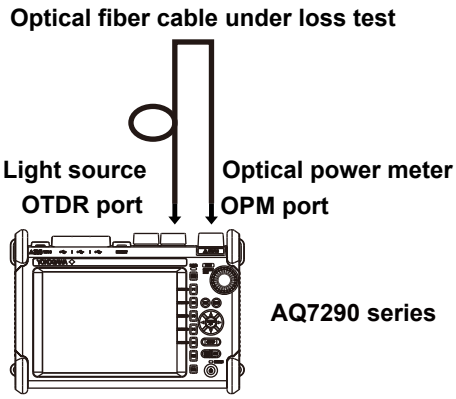
### Optical power meter feature

The instrument automatically identifies the measurement light from the opposing instrument or an AQ1100A, AQ1100B, AQ1100C, AQ1210A, AQ1215A, AQ1210D, AQ1210E, AQ1215E, or AQ1215F that it is connected to and measures the optical power.



**Loopback feature**

You can use the light source and optical power meter features on a single instrument to perform a loop-back loss test on an optical fiber cable or line. To perform loss testing, connect one end of the optical fiber cable that you want to perform loss testing on to the the instrument's OTDR port and the other end to the OPM port on the same instrument.




## Multi-fiber loss test

You can efficiently measure the optical loss of multi-fiber optical cables and optical lines. degradation.

**Projects**

Projects are group of items for measuring multi fibers.

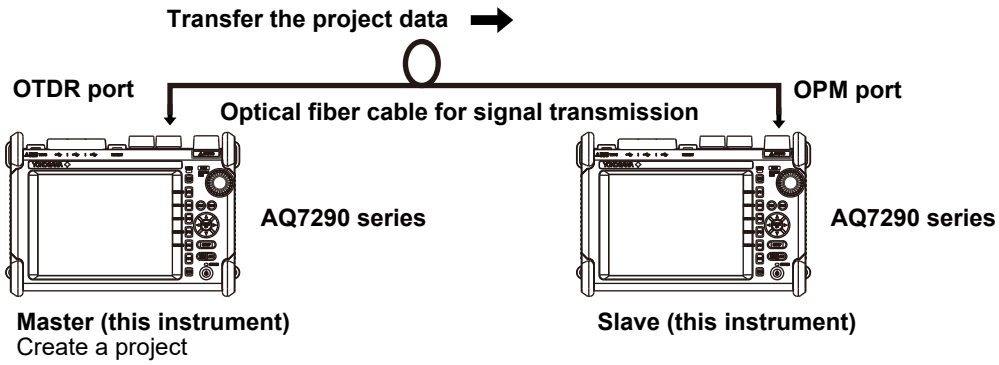
- **Number of fibers, number of fibers in each division, tape number**
  The core number indications and settings vary depending on the type of multi-fiber optical cable. These features are the same as those explained in "Optical Pulse Measurement of Multi-Fiber Optical Cables" on page 1-23.

**Master and slave**

Connect two instruments and specify the optical power meter as the master and the light source as the slave. You can also use an AQ1100A, AQ1100B, AQ1100C, AQ1210A, AQ1215A, AQ1210D, AQ1210E, AQ1215E, or AQ1215F in the multi-field tester series instead of this instrument as the master or slave. The preparation involves the following steps.

- **Connecting an optical fiber cable for signal transmission (step 1)**
  To transmit, between the master and slave, project setup information and information about the fiber under loss test, you must specify a fiber cable from the multi-fiber optical cable to use for the signal transmission. Connect one end of the optical fiber cable for signal transmission to the OTDR port of the instrument specified as the master (optical power meter side) and the other end to the OPM port of the instrument specified as the slave (light source side).

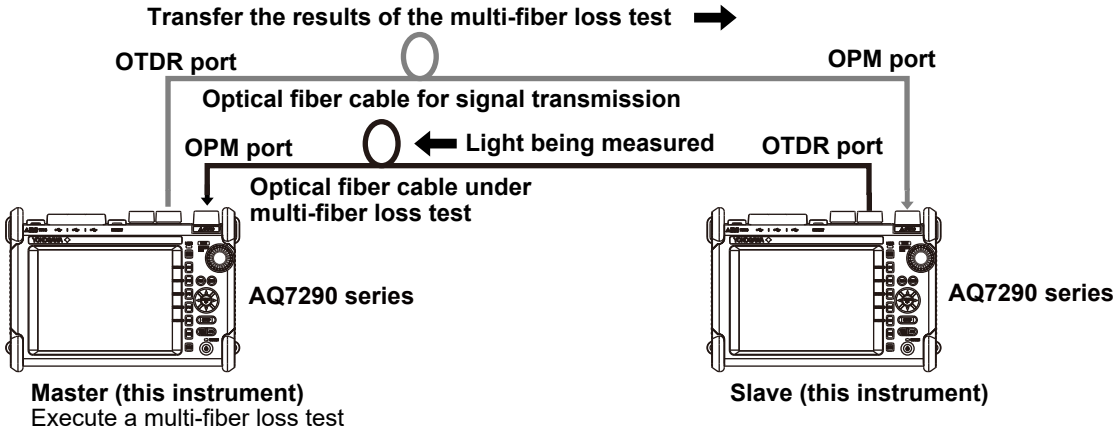
- **Transferring object information from the master to the slave (step 2)**
  On the master instrument, create a project. Transfer the project information to the slave instrument through the optical fiber cable for signal transmission.




- **Connecting the optical fiber cable to perform multi-fiber loss test on (step 3)**
  Multi-fiber loss test is performed on all optical fiber cables other than the optical fiber cable for signal transmission. Connect one end of the optical fiber cable to be tested to the OPM port of the master instrument and the other end to the OTDR port of the slave instrument.

  **Executing the multi-fiber loss test**

  First, start the multi-fiber loss test on the master instrument. The core number information of the cores to be tested is transmitted from the master side through the optical fiber cable for signal transmission. When the core numbers to be measured are received through the OPM port, the slave instrument will be ready to execute a multi-fiber loss test.
  Execute the multi-fiber loss test on the slave side. The light to be measured is output from the OTDR port on the slave side. This light enters the OPM port on the master side, and the loss in the optical fiber cable with the target core number is measured.
  The measurement results are sent from the master to the slave instrument through the optical fiber cable for signal transmission.



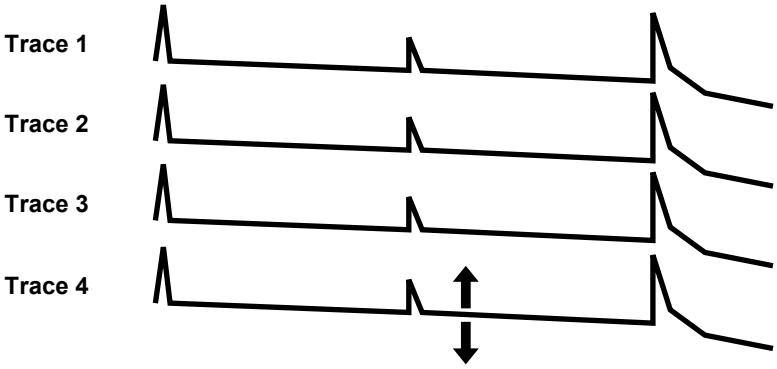

  If you cancel an ongoing multi-fiber loss test, the completed portion of the measurement results are held, so you can resume the test from the optical fiber cable with the next target core number.

# Advanced analysis

### Multi trace analysis

You can load up to four waveforms that have been measured on the instrument and display them simultaneously for comparison. You can adjust the vertical display position of each loaded waveform.

**Displays up to four waveforms simultaneously**

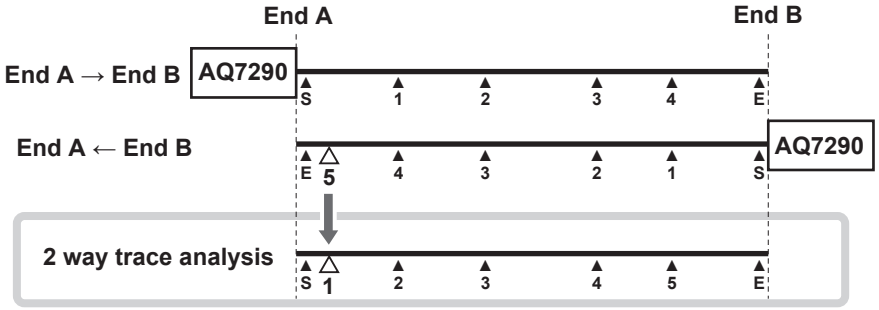



You can move a waveform over another waveform to compare the two.

### 2 way analysis

Waveform events that have been measured from optical fiber cable end A to end B and those measured from end B to end A can be combined. Splice loss between optical fiber cables with different backscatter levels can also be accurately measured.

In the figure below, the event that is in the dead zone of the near-end reflection point (point S) when measured from end A is detected as event number 5 when measured from end B. In the 2 way trace analysis display, it is displayed as event number 1.




An event of the other waveform that exists within 6% of the position of an event of the current trace will be considered part of the current trace event.

If multiple events of the other waveform that exists within 6% of the position of an event of the current trace, the closest event will be considered part of the current trace event.

Waveforms that meet the following conditions can be combined.

- Both have the same wavelength.
- Both have the same pulse width.
- Their end position offset is within 6%.
- Both have event lists.

### Differential trace

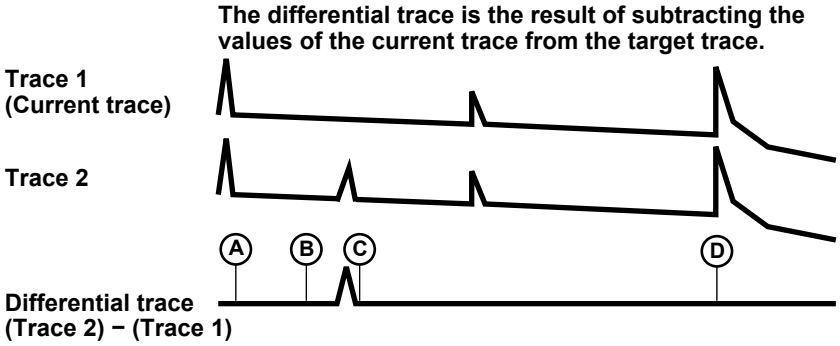
You can load two waveforms that have been measured on the instrument and display their difference as a waveform.

The screen can display the loaded waveforms and the differential trace simultaneously.

The differential trace is the result of subtracting the values of the current trace from those of the other trace.

You can use markers to read the following values of the differential trace.

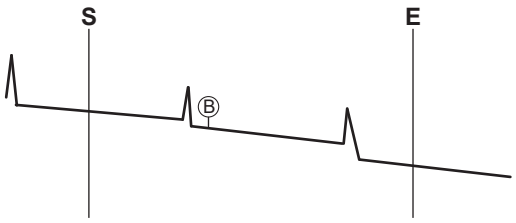
- Loss between markers (dB)
  Loss between Ⓐ and Ⓑ and between Ⓒ and Ⓓ
- Distance to each marker
  Distance between Ⓐ and Ⓑ and between Ⓒ and Ⓓ




**You can perform marker analysis on the differential trace.**

### Section analysis

You can set two markers, start point S and end point E, to measure the return loss and total loss in the section that you have specified. By setting reference point B, you can calculate the return loss using the backscatter level you specify.



# 1.8 Optical Switch Control

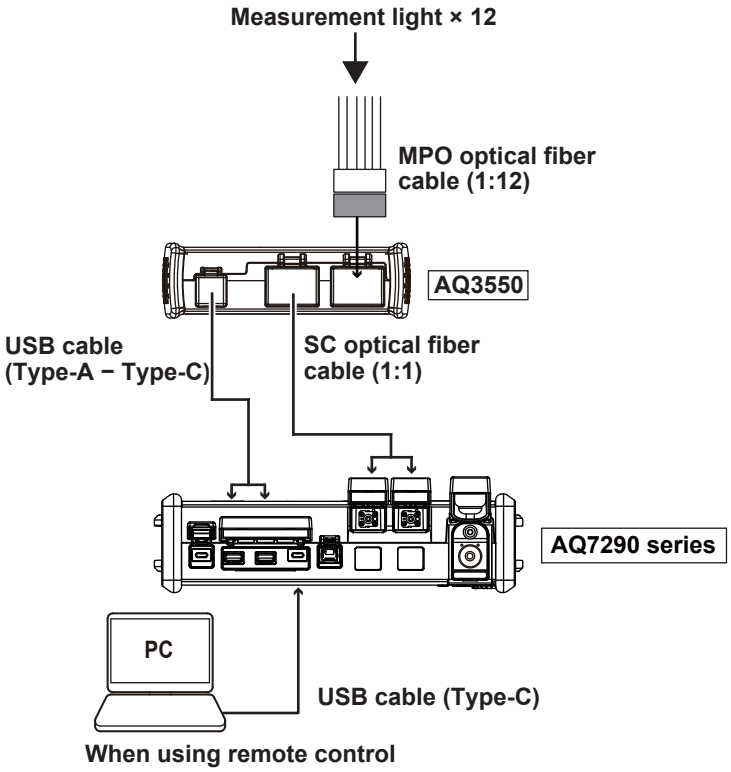
## Optical switch box

You will need an optical switch box that is compatible with this instrument's optical switch control.

| Name | Model | Notes |
|---|---|---|
| Optical switch box | AQ3550 | Port configuration: 1 × 12 |

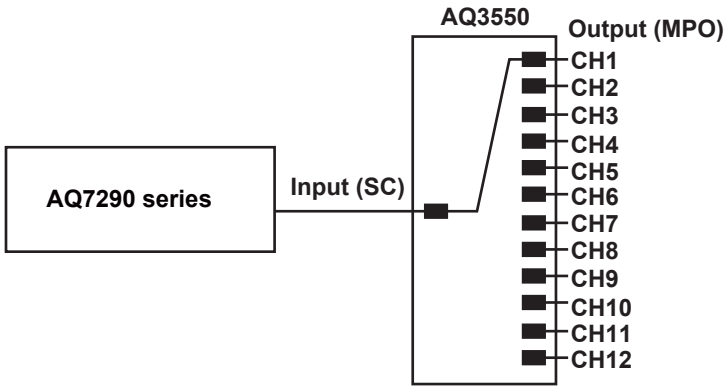
## Instrument connection

The following figure shows how this instrument and an optical switch box can be connected.




## Optical switch structure

The input port (SC) route can be connected to any of the 12 output port (MPO) channels through switching.



# 1.9 File Features

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 or microSD memory card). By saving the measurement/analysis conditions and system setup file for one AQ7290 to external memory, you can efficiently set the same conditions for multiple AQ7290s. In addition, the instrument can save measured waveform data as PDF data in report format.

## Saving and loading files

**File types**

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 instrument, the waveform data is displayed on the instrument 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 perform analysis at a different site.

- **.SET**
  A file for saving the optical pulse measurement and analysis conditions. This file does not include waveform data or event list data. Loading this file into the instrument causes the saved measurement and analysis conditions to be applied to it. It can be used when setting the same measurement/analysis conditions for multiple instruments or when measuring/analyzing under the same conditions as in the past.

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

- **.CFG**
  A file for saving the instrument system settings (device, connection, etc.). It can be used when setting the same system settings for multiple instruments or when using the same system settings as in the past.

- **.CSV**
  A file for saving the results of optical pulse measurement or optical power meter measurement in ASCII format.
  Measurement and analysis conditions are stored at the front of the file, and then data is stored in a comma-separated format.
  This file is useful when you want to analyze the data using a spreadsheet application on the PC.

- **.BMP, JPG**
  A file for saving a screen image of the instrument. 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 instrument.

- **.SOZ**
  A file for saving multiple waveforms measured simultaneously.
- **.SMP**
  A file for saving waveforms measured with a feature equivalent to Smart Mapper.

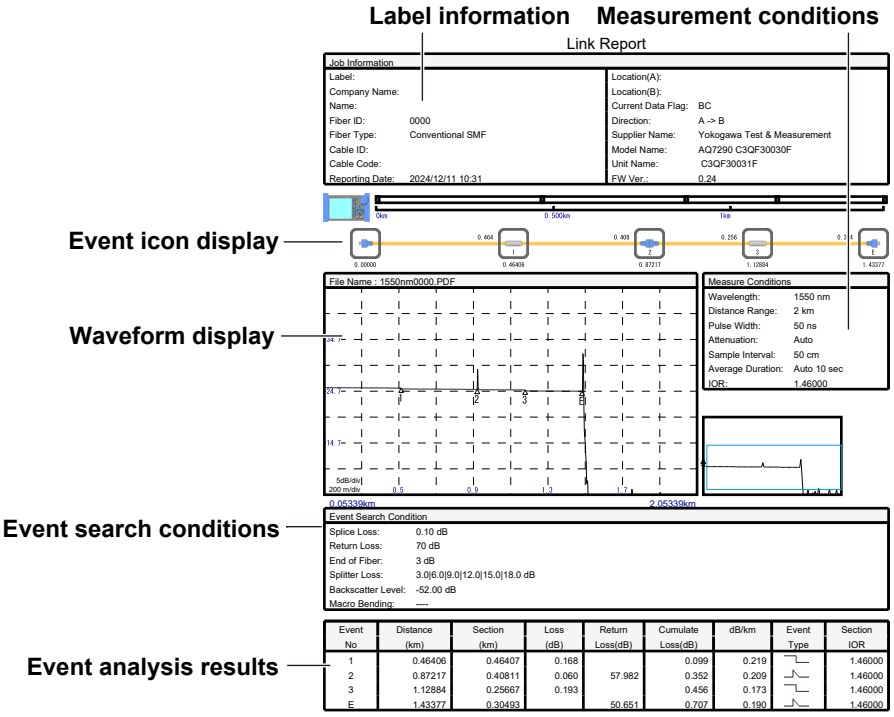
### Selecting Drives

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

- **Internal memory**
  The memory inside the instrument. The size is about 1 GB. It cannot be removed.
- **USB memory**
  USB storage device.
- **microSD memory**
  microSD storage device.

## Creating reports

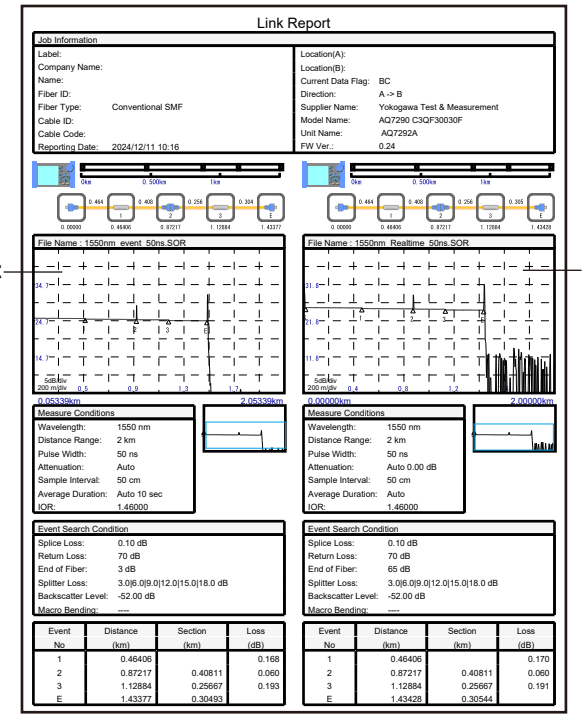
You can save the current optical pulse measurement and analysis conditions, waveforms, and events as a report on a single sheet in a PDF file. You can choose which items to include in the report.




### 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.

- **Example where two waveforms are arranged on a single sheet**




**Report of the first SOR file**

**Report of the second SOR file**

# File operations

### 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 settings for automatically saving measure data explained in section 3.1, 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.

# 1.10 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, such as during outdoor use. You can turn off the display except when viewing the measured data to suppress battery consumption.

**Auto sleep**

If the instrument is turned on and is not accessed for a certain time, the instrument 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 feature setup (chapter 3)
- Utility feature (chapter 7)
- Application feature (chapter 8)
- System settings (chapter 10, except the date and time)

**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.

- **USERS_MANUAL** (contains the user's manuals)

## Configuring network settings

You can use Ethernet or a communication dongle (wireless LAN adapter) to remotely control the instrument from a PC (OTDR Remote Controller) and transfer measured results in the instrument's internal memory to a network server (File Transfer@OTDR Data Transporter).

**User name and password**

Set user names and passwords for authenticating connections from PCs to the instrument.

**Ethernet**

Ethernet can be used on models with the /LAN option.

- **Enabling and disabling network connection**
  Remote control can be disabled. When disabled, a PC cannot connect to the instrument.

- **Timeout period**
  If a communication command is not sent from a PC or measured results are not downloaded within the timeout period, the instrument releases the network connection.

- **TCP/IP**
  Set network address information.

**WLAN application (wireless LAN)**
You can use a communication dongle (wireless LAN adapter) to remotely control the instrument from a PC (OTDR Remote Controller) and transfer measured results and other types of data from the instrument to a network server (OTDR Data Transporter).

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

- **Station mode**
  This is used to connect the instrument to an access point.

**LTE dongle**
You can use an LTE dongle to connect to a PC, smartphone, and other terminals via mobile communication. This is useful when communicating over longer distances than WLAN.

## Other features

**Language selection**
You can change the language used on the instrument screen. The available languages vary depending on the instrument's suffix code.

**Start screen**
You can select the screen that is displayed when the instrument starts.
- Top Menu
  The MENU screen is displayed.
- Start Menu to Last Function
  The screen of the feature that was executed immediately before the power was turned off is displayed.

**Screen color**
You can set the screen color (color 1 or color 2).

**Alarm**
The instrument can generate sound when the rotary knob is turned or when an operation error message is displayed.

**UTIL key selection**

You can assign one of the following features to the UTIL key. You can execute a feature that you use often with a single button.

- Save (see section 9.4)
- Report (see section 9.5)
- Utility menu screen (see section 7.1)
- Power meter (see section 7.4)
- Power checker (see section 7.5)
- Light source (see section 7.2)
- Visible light source (see section 7.3)
- Fiber inspection probe (see section 7.6)
- File name assignment (see section 9.4)

**USB feature (Type-C)**

You can use USB port type C to send communication commands from a PC to the instrument or download measured results and other types of data from the instrument internal memory or microSD memory card to a PC.

**Operation lock**

You can set a PIN to restrict the following operations. This feature prevents settings from being changed or laser light to be emitted by mistake.

- **Laser light output**
  When an operation to emit the following laser light is performed
  Optical pulse (OTDR), light source (measurement light), VLS

**Expiration date**

This feature displays a message at startup or locks the instrument when the specified expiration date arrives. You can display a message that urges you to calibrate the instrument or the like when the recommended calibration period elapses.

**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.

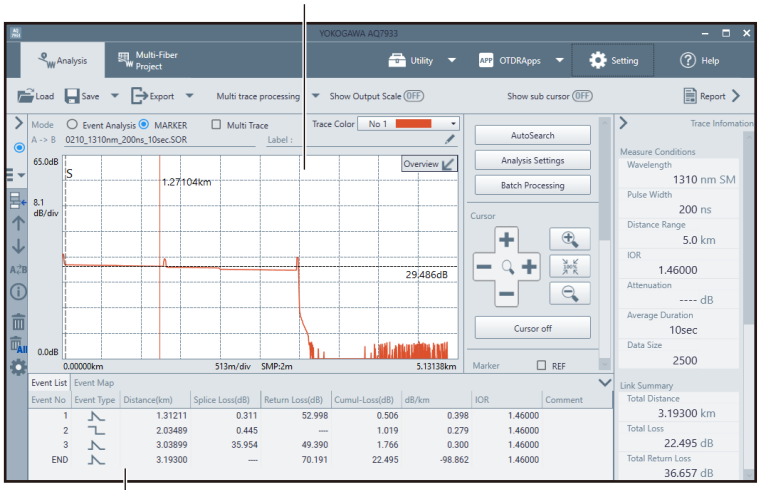
**Installing options**

You can install additional option licenses (sold separately) for the AQ7290.
For details on the available option licenses, see Getting Started Guide, IM AQ7290-02EN.

# 1.11 Analysis Using the Emulation Software

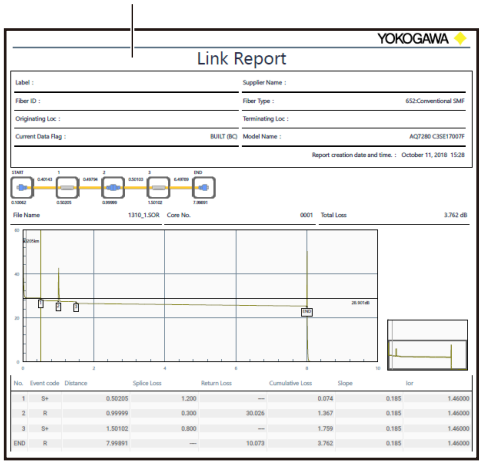
Waveform data measured with the instrument can be analyzed on a PC by using the AQ7933 OTDR Emulation Software. This software also has a PDF report creation feature, which is convenient for creating construction reports.

**Waveform data saved in SOR format using the instrument can be displayed on the PC using the emulation software.**




**Analysis results (displays at list of events)**

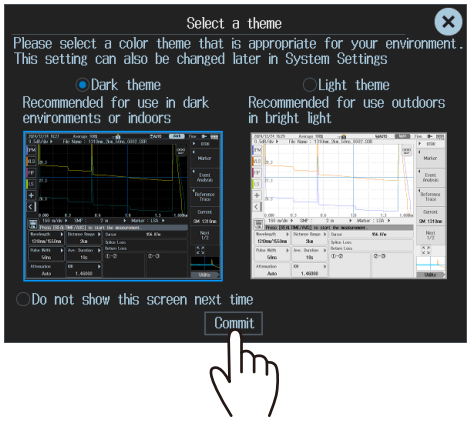
**Create a PDF construction report using the report creation feature of the emulation software.**



# 2.1 Theme Selection Screen, Menu Screen, and Operation Screen

## Theme selection screen

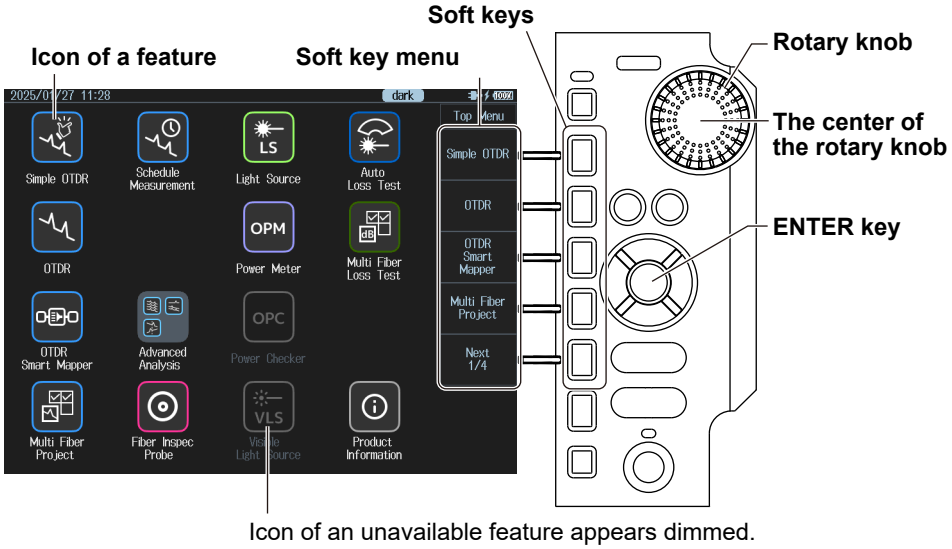
When you turn the instrument on and it starts, the theme selection screen appears.
Set the instrument's screen color to dark or light, and tap **Commit**.
This screen is displayed when the instrument is used for the first time after purchase or when the power is turned on after initializing the settings. This is the same setting as the background color setting in system setup.




## MENU screen

When you turn on the instrument or press MENU, the menu screen appears.
First select a feature from the menu screen, and then configure the feature or carry out the measurement that corresponds to the feature you have selected.
Select it in the following manner.

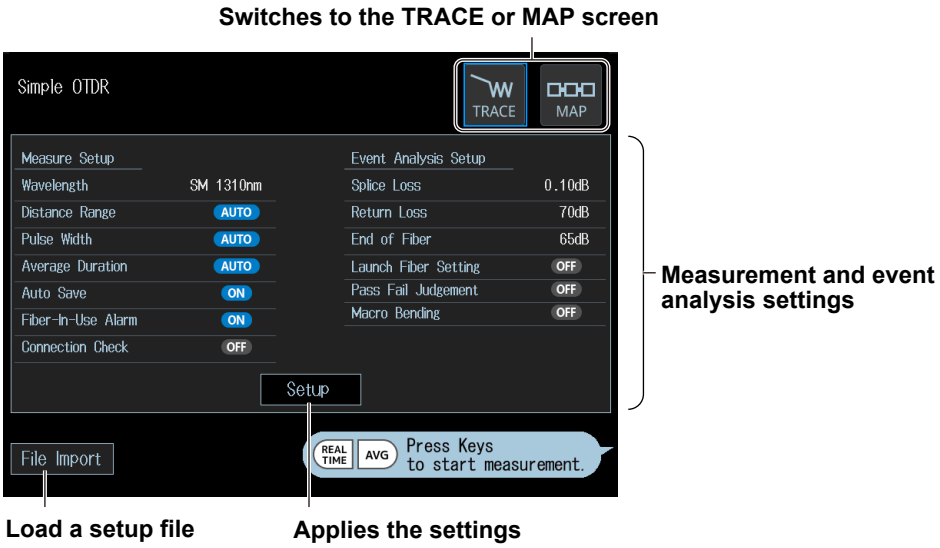
- Select an icon with arrow keys or rotary knob, and press ENTER.
- Select a feature with the soft keys.
- Tap an icon on the screen.



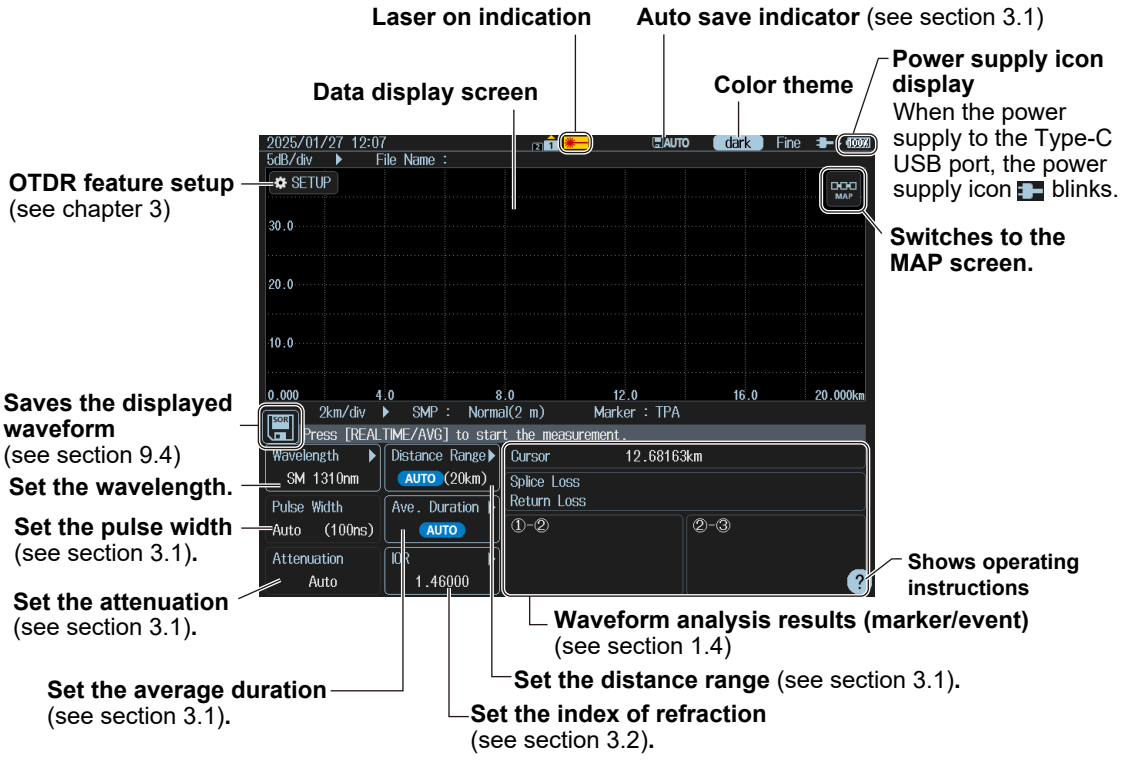
# Simple mode operation screen

This section explains the Simple OTDR operation screen.

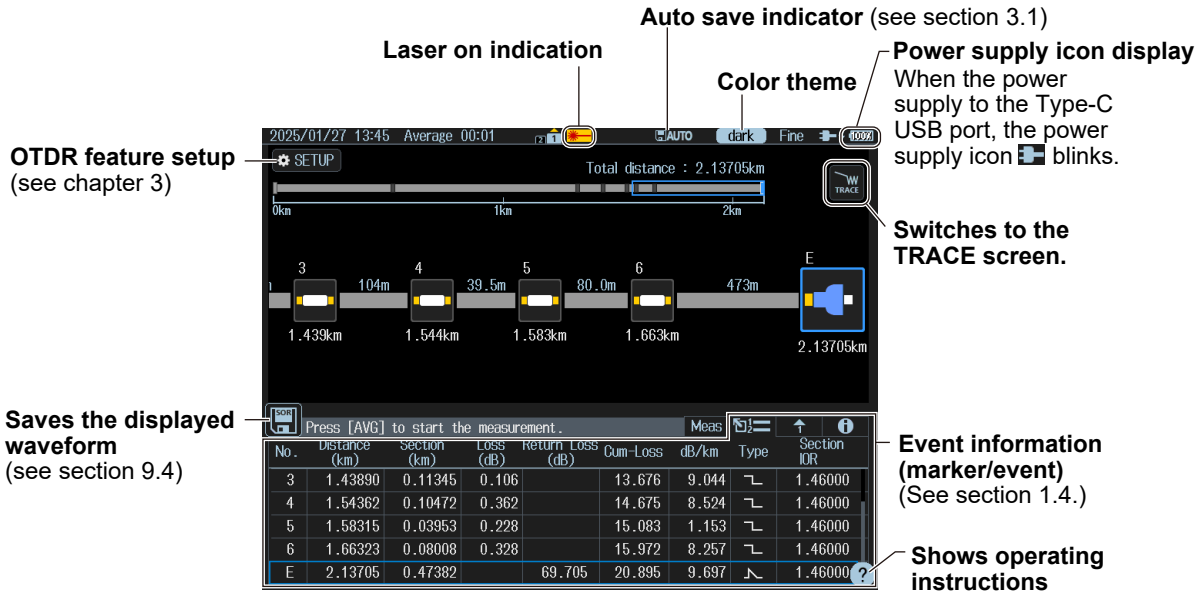
## Simple OTDR setting list




## TRACE screen



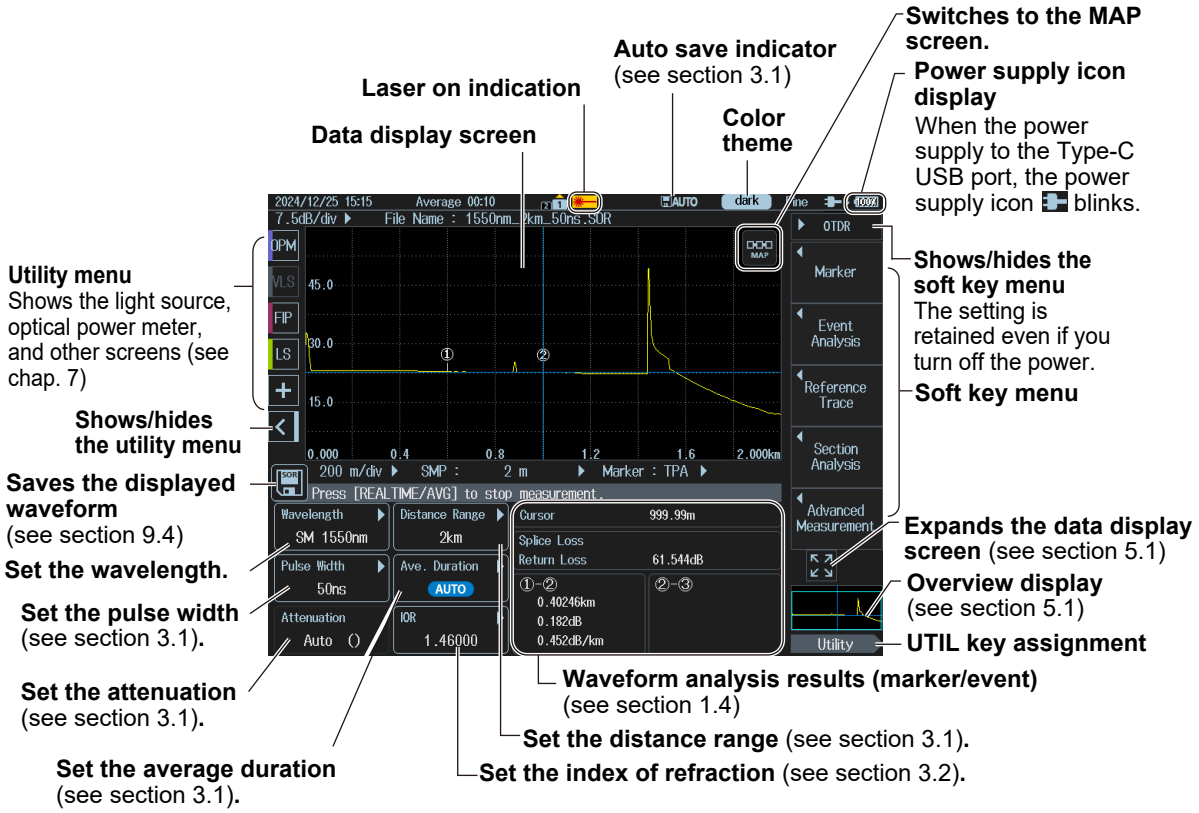
### MAP screen




## Expert mode operation screen

This section explains the Expert OTDR operation screen.

### TRACE screen



## Soft key menu

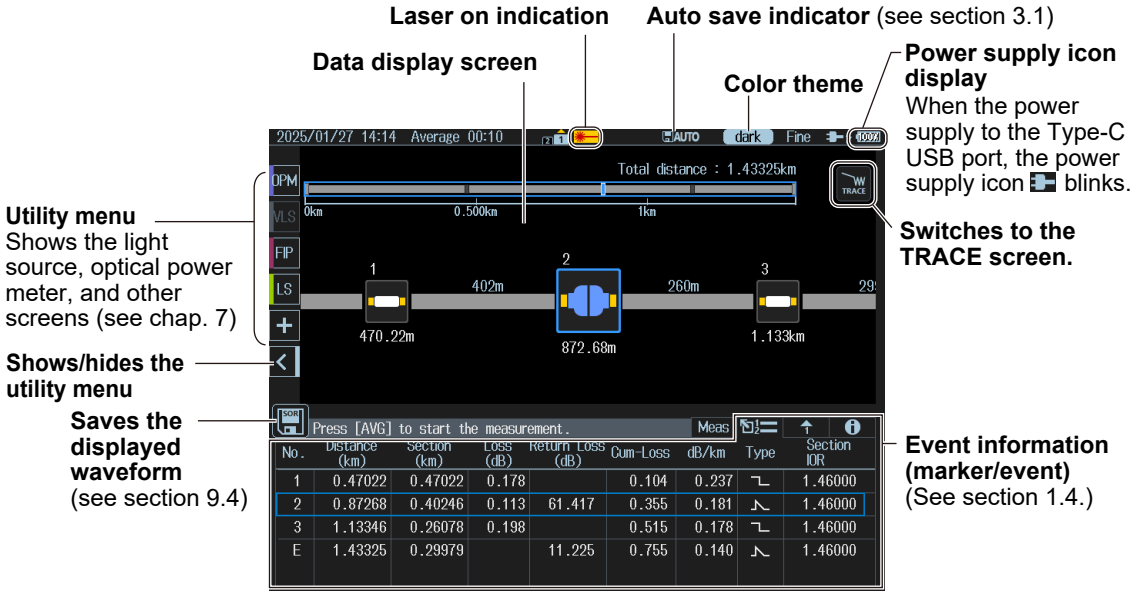
There are three types of soft key menus depending on the function.


Pressing a soft key confirms the selected item or executes its corresponding action.

Pressing a soft key of a menu item with a ◀ mark displays a setup menu.

Pressing a soft key of a menu item with options switches the selected option.

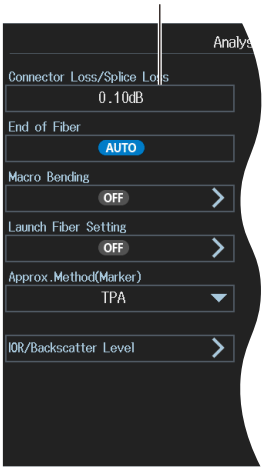
## MAP screen



# 2.2 Using the Rotary Knob and Arrow Keys

We will use the dialog box that appears when you press the OPM Setup soft key as an example to explain the rotary knob and arrow key operations.

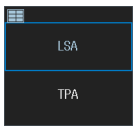
**Move the cursor to the item that you want to set using the arrow keys or the rotary knob.**




**The following setup operation patterns are available depending on the display button shape.**

**Press Enter to display following setup item.**

**Items set from a list of options**




- **Move the cursor to the item that you want to select using the arrow keys or the rotary knob.**
- **Press ENTER to confirm the selected item.**

**Items that require a value to be entered**

**0.10dB** ➡


A numeric keypad appears. Press ENTER to confirm the entered value.

**OFF** ➡ **Items toggle between on and off**
Each time you press the key, the setting toggles between ON and OFF.

➡ **Press Enter to display the detailed setup screen.**

➡ **Press Enter to confirm the selected item or execute its corresponding action.**

# 2.3 Using the Touch Panel

## Touch panel operations

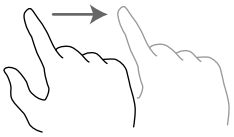
The basic touch panel operations are described below.

### Tap

Tap refers to the act of gently hitting the screen with your finger.
Tapping is used on the instrument screen to select areas with a mark, close a setup menu, and so on.

### Drag

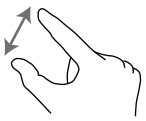
Drag refers to the act of pressing your finger against the screen and sliding your finger.
Dragging is used to display the setup menu, change the ratio of the waveform display area to the measurement condition display area, and so on.



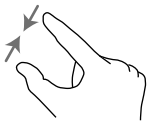
### Pinch out and pinch in

Pinch out refers to the act of pressing two fingers against the screen and spreading them apart. Pinch in refers to the act of pressing two fingers against the screen and drawing them together.
On a screen displaying waveforms, you can pinch out to zoom in and pinch in to zoom out.

**Pinch out**

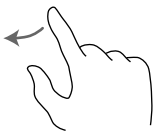


**Pinch in**



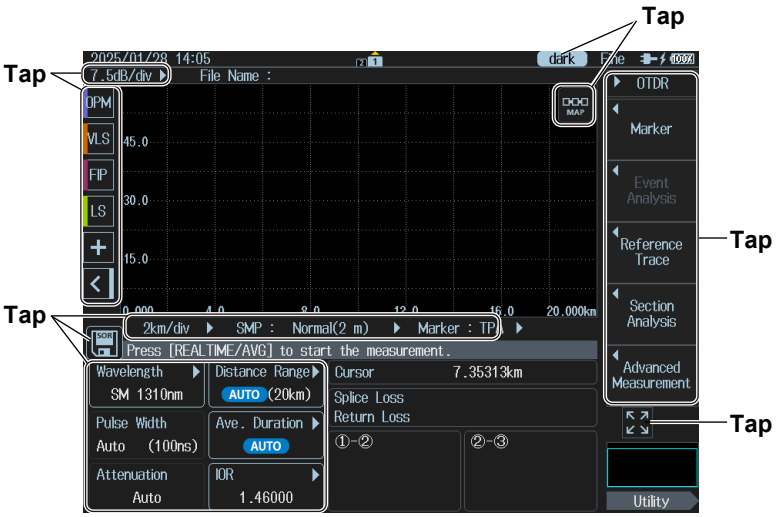
### Flick

Flick refers to the act of pressing your finger against the screen and moving your finger abruptly.
This is used to scroll on a menu display and the like.



## Areas that you can use the touch panel to operate

Touch panel operations can be used in the following areas.



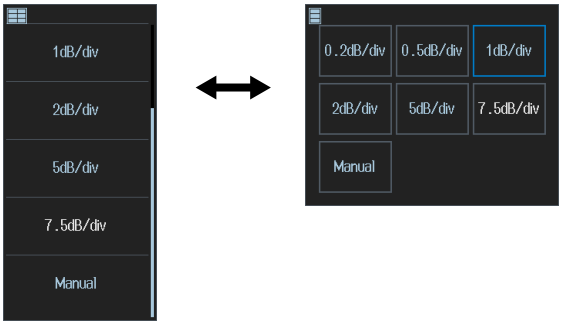

## Switching the menu display

You can switch the menu display format as follows.

: The menu is displayed in a tabular form.

: The menu is displayed in a scrollable form.

**Scrollable form** **Tabular form**

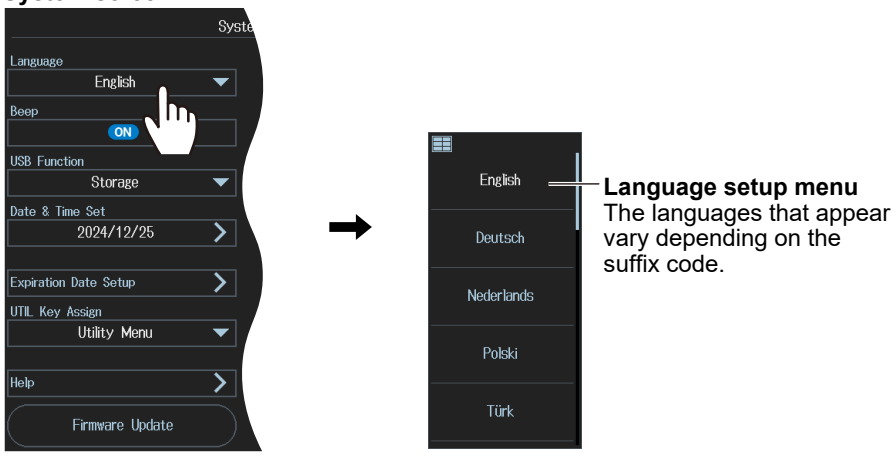


# 2.4 Setting the Date and Time

## Selecting the language to display

1. Press **MENU**. A MENU screen appears.
2. Press **SETUP**. The system setup screen appears.
3. Tap **Language**. A language setting menu appears.

**System screen**

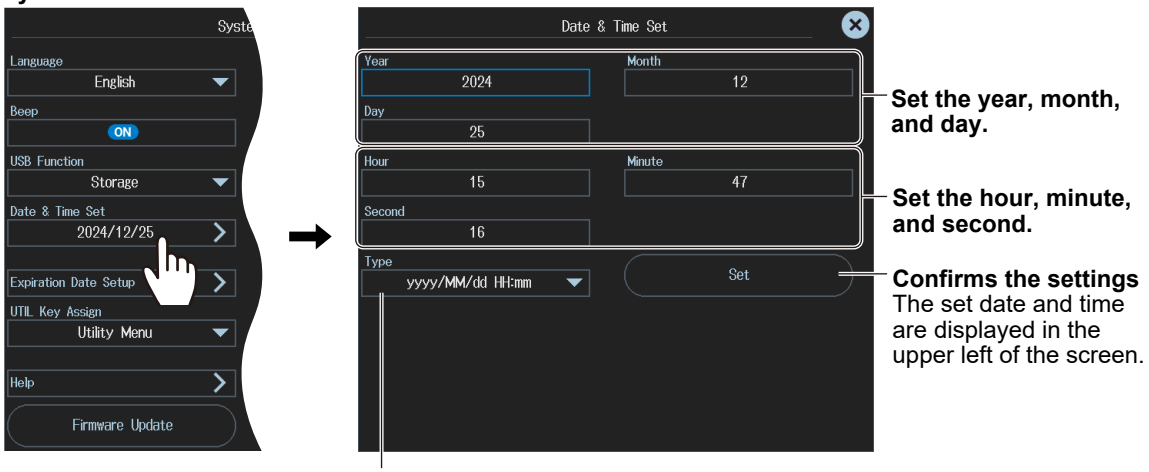



**Language setup menu**
The languages that appear vary depending on the suffix code.

## Selecting the date and time to display

1. Press **MENU**. A MENU screen appears.
2. Press **SETUP**. The system setup screen appears.
3. Tap **Date & Time Set**. The following screen appears.

**System screen**




**Set the year, month, and day.**

**Set the hour, minute, and second.**

**Confirms the settings**
The set date and time are displayed in the upper left of the screen.

**Set the date and time display format (Off, Year/Month/Day Time, Day/Month/Year Time, Year, Month (name), Day Time).**

### Year, Month, and Date

The year is displayed in Western calendar year. The instrument supports leap years.

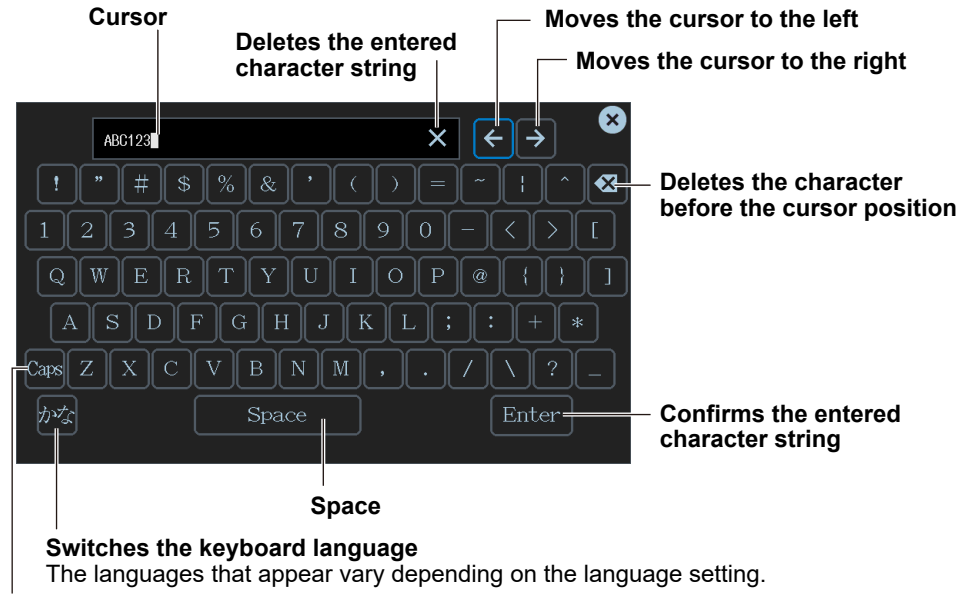
### Hour, Minute, and Second

The hour can be set to a value from 0 to 23.

# 2.5 Entering Text

When you select a setting, a character input dialog box appears if necessary. This section explains the operation after a character input dialog box is displayed.

**Entering alphanumeric characters**



# 3.1 Setting Measurement Conditions (Measure)

## Procedure

### Setting simple mode (Simple OTDR)

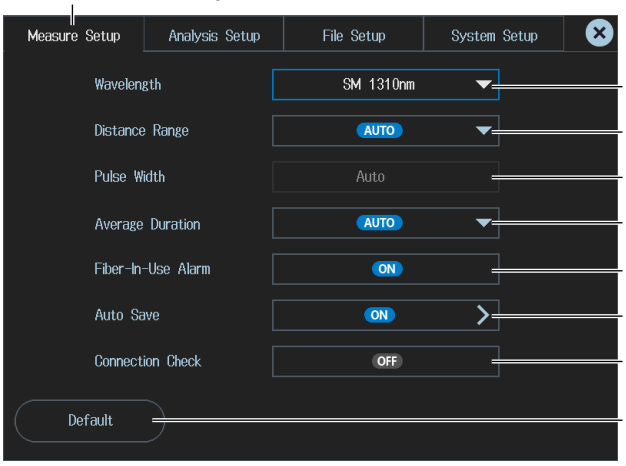
1. Press **MENU**. A MENU screen appears.
2. Tap the **Simple OTDR** icon. A simple OTDR setting list appears.


**Simple OTDR setting list**


3. Tap **Setup**, or press **SETUP**. A setup screen appears.

*4.* Tap the **Measure Setup** tab. The following screen appears.

**Measurement setup tab**




**Set the wavelength.**

**Set the distance range.**

**Set the pulse width.**

**Set the average duration.**

**Turns the fiber-in-use alarm on or off**

**Set auto save.**

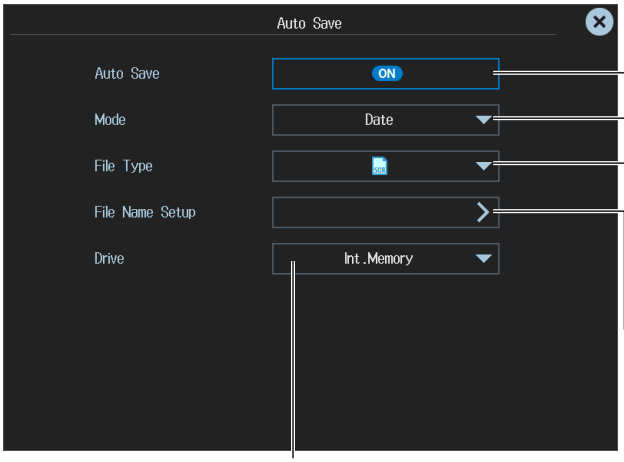
**Turns connection check on or off**

**Executes initialization**
Press to reset the settings to their factory defaults.

## Configuring Auto Save (when averaged measurement is complete)

Tap **Auto Save**. An auto save screen appears.

**When the mode is set to Date**




**Turns auto saving on or off**

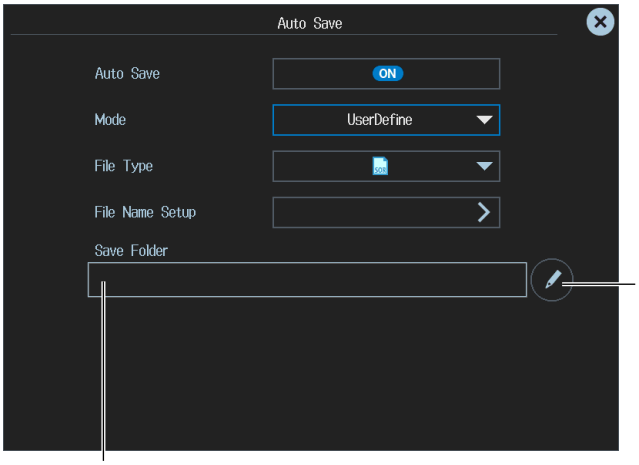
**Set the mode (Date, UserDefine).**
Select how to specify the save destination folder. You can set this when auto save is ON.

**Set the file type.**
**(SOR, SOR + PDF, SOR + BMP, SOR + JPG)**

**Set the file name.**
See section 3.4.

**Set the save destination drive (Int.Memory, SD Card, USB Memory 1, USB Memory 2).**
This is displayed when the mode is set to Date, in which case you can set it.

**When the mode is set to UserDefine**




**Displays the file list of the folder displayed in the current file path.**
For details on file operations, see section 9.6.

**Save destination folder**
The current file path is displayed. This is displayed when the mode is set to UserDefine.

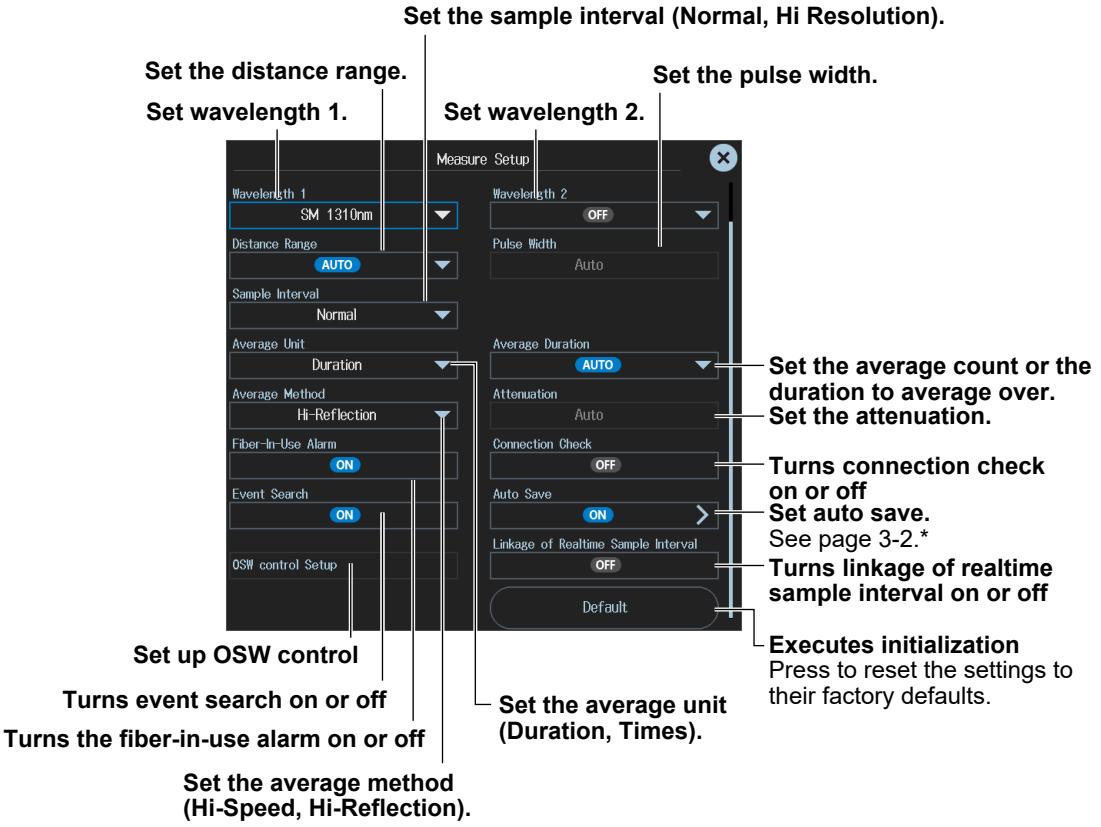
## Setting expert mode (OTDR)

1. Press **MENU**. A MENU screen appears.
2. Tap the **OTDR** icon. A TRACE screen appears.


3. Press **SETUP**. A setup menu appears.


**Measurement setup**

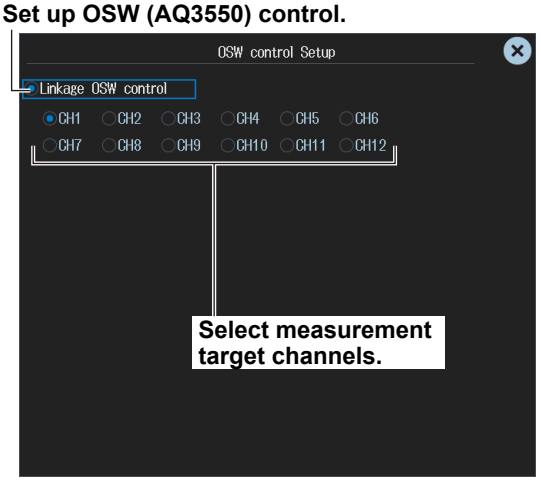
***4.*** Press the **Measure Setup** soft key. The following screen appears.




* The screen displays slightly differently in expert mode and simple mode, but the items that can be operated are the same. See the simple mode instructions.

## Setting up OSW control

Tap **OSW control setup**. An OSW control screen appears.



# Explanation

## Wavelength

You can enter the following wavelengths.

| Model | Optical Pulse Wavelength |
|---|---|
| AQ7292A | 1310 nm, 1550 nm, 1310 nm/1550 nm (multi wavelength measurement) |
| AQ7293A | 1310 nm, 1550 nm, 1310 nm/1550 nm (multi wavelength measurement) |
| AQ7294A | 1310 nm, 1550 nm, 1310 nm/1550 nm (multi wavelength measurement) |
| AQ7293F | 1310 nm, 1550 nm, 1650 nm, 1310 nm/1550 nm (multi wavelength measurement) |
| AQ7293H | 1310 nm, 1550 nm, 1625 nm, 1310 nm/1550 nm/1625 nm (multi wavelength measurement) |
| AQ7294H | 1310 nm, 1550 nm, 1625 nm, 1310 nm/1550 nm/1625 nm (multi wavelength measurement) |

**Multi Wavelength Measurement**

Once the measurement is started, averaged measurement is taken at 1310 nm and 1550 nm or 1310 nm and 1550 nm and 1625 nm one wavelength at a time. The available wavelengths vary depending on the model. The order in which the wavelengths are measured can be changed.

## 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 instrument 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 | 300 km |
| 240 km to 320 km | 400 km |
| 320 km to 400 km | 512 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 pulse widths that you can select vary depending on the distance range, as shown in the following table.

| Distance Range | Selectable Pulse Widths |
|---|---|
| 100 m to 500 m | 3 ns, 10 ns, 20 ns, 30 ns |
| 1 km to 5 km | 3 ns, 10 ns, 20 ns 30 ns, 50 ns, 100 ns, 200 ns, 300 ns, 500 ns |
| 10 km to 50 km | 50 ns, 100 ns, 200 ns, 300 ns, 500 ns, 1 µs, 2 µs, 5 µs |
| 100 km to 512 km | 50 ns, 100 ns, 200 ns, 300 ns, 500 ns, 1 µs, 2 µs, 5 µs, 10 µs, 20 µs |

## Sample interval

The maximum number of sample data points is 256000. The sample interval is determined by the distance range.

Normal: The instrument uses the optimum sample interval for the measurement conditions to perform measurements.

Hi Resolution: The instrument uses a sample interval that would result in the greatest number of data points.

If you use a short sample interval, you can measure for finer changes. However, the data size of the measured result becomes large.

## Attenuation

If large reflections are caused by connectors or by breaks in the optical fiber cable, the waveform may be saturated. Specify attenuation to prevent the waveform from being saturated. The attenuations that you can select vary depending on the pulse width, as shown in the following table.

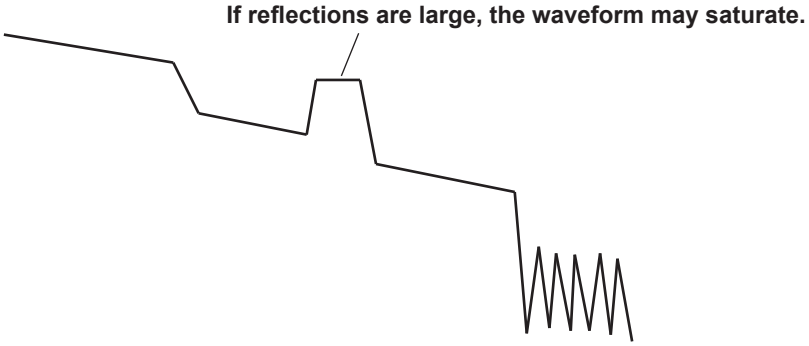
| Pulse Width (Example) | Selectable Attenuations |
|---|---|
| 3 ns to 30 ns | 0.00 dB, 2.50 dB, 5.00 dB, 7.50 dB, 10.00 dB, 12.50 dB |
| 50 ns to 500 ns | 0.00 dB, 2.50 dB, 5.00 dB, 7.50 dB, 10.00 dB, 12.50 dB, 15.00 dB, 17.50 dB, 20.00 dB |
| 1 µs to 5 µs | 0.00 dB, 2.50 dB, 5.00 dB, 7.50 dB, 10.00 dB, 12.50 dB, 15.00 dB, 17.50 dB, 20.00 dB, 22.50 dB |
| 10 µs to 20 µs | 0.00 dB, 2.50 dB, 5.00 dB, 7.50 dB, 10.00 dB, 12.50 dB, 15.00 dB, 17.50 dB, 20.00 dB, 22.50 dB, 25.00 dB, 27.50 dB, 30.00 dB |

The attenuation is fixed to AUTO when the average method is Hi-Reflection.

## Average method

**Hi-Speed**

In Hi-Speed mode, all sections are measured according to the specified attenuation. If the specified attenuation value is not appropriate and a large reflection occurs, the waveform for that section may be saturated.




**Hi-Reflection**

In Hi-Reflection mode, the instrument 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 Hi-Reflection mode, the instrument sets the optimum attenuation according to the backscatter level for each section, and performs the measurement. Therefore, the measurement time is longer than in Hi-Speed mode.

The partitioning of the optical fiber into sections and the specifying of the optimum attenuation are done automatically.

***Note***

Except when the optical fiber cable is short and there are no reflections, we recommend that you measure with the average method be set to Hi-Reflection.

## Average unit

Time: Measurements are performed only over the specified duration. If you specify a short duration, depending on the measurement conditions, measurements may not have finished when the specified time elapses.

Count: Measurements are performed only the specified number of times.

## Average times/average duration

You can select the following values.

Duration: 5s, 10s, 20s, 30s, 1 min, 3 min, 5 min, 10 min, 20 min, 30 min

S is seconds, and min is minutes.

Times: 2^10 (1024 times), 2^11 (2048 times), 2^12 (4096 times), 2^13 (8192 times), 2^14 (16384 times), 2^15 (32768 times), 2^16 (65536 times), 2^17 (131072 times), 2^18 (262144 times), 2^19 (524288 times), 2^20 (1048576 times)

2^10 is 2 to the power of 10 (1024 times).

- The maximum average count is 2^20. If you specify a duration to average over that causes this number of times to be exceeded, the measurement will finish before the duration to average over elapses.
- 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 for the number of times or the duration, you can perform highly precise measurements, but the measurement time becomes longer. Keep the instrument's dynamic range and the loss of the optical fiber cable under measurement in mind when you specify these values.
- The display of the duration or the number of times is determined by the specified average unit.
- If AUTO is selected, one of the options above is used.

## Event search

Event search is a feature that automatically searches for losses and reflections in the data that is acquired during averaged measurements. Losses and reflections detected in waveform data are known as events. See chapter 6 for the analysis of the detected events.

ON: After averaged measurements complete, events are automatically searched for and listed, and the event screen and event analysis menu are displayed.

OFF: After averaged measurements complete, the waveform is displayed, but events are not searched for.

## Fiber-in-use alarm

The instrument 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 instrument and an optical fiber cable. When this feature is set to on, you can prevent light from being transmitted from the instrument OTDR port or light source port if an optical fiber cable is not connected to the instrument 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 location folder.

**Save location folder**

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

**File type**

Set the extension according to the type of data to be automatically 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. |
| SOR+PDF | Waveform data is saved as waveforms and as a report file simultaneously. |
| SOR+BMP | Both SOR and BMP files are saved. |
| SOR+JPG | Both SOR and JPG files are saved. |

## Linkage of realtime sample interval

This function links the sampling of averaged measurement and real-time measurement to measure pulses at the same sample interval. This function links the sampling of averaging measurement and real-time measurement to measure pulses at the same sampling interval. When this function is turned on, the same sample interval is used for averaged and real-time measurements, so the references of the measurement waveforms are aligned.

OFF: Sample intervals may differ between averaged and real-time measurements.

ON: Sample intervals for averaged and real-time measurements are aligned. The sample interval setting of the measurement conditions is applied.

During averaged measurement, pulse measurement is performed based on the sample interval (page “Sample interval” on page 3-6) setting of the measurement conditions. On the other hand, during real-time measurement, pulses are measured at the sample interval optimized in the instrument.

As such, if you perform a provisional pulse measurement using real-time measurement, check the waveform, and then perform a regular pulse measurement using averaged measurement, the measurement waveform reference may be different between the two.

Enabling this feature causes pulse measurements to be performed at the same sample interval, allowing the measurement waveform reference to be aligned.

## Selecting measurement target channels

When “Linkage OSW control” is set to ON, the measurement of the next selected channel begins when the averaged measurement of the current channel is completed.

To use the Linkage OSW control feature, set Auto Save to ON. If Auto Save is set to OFF, waveforms cannot be saved because the display showing the measured waveforms is cleared when the target channel is changed.

# 3.2 Setting the Analysis Conditions (Analysis)

## Procedure

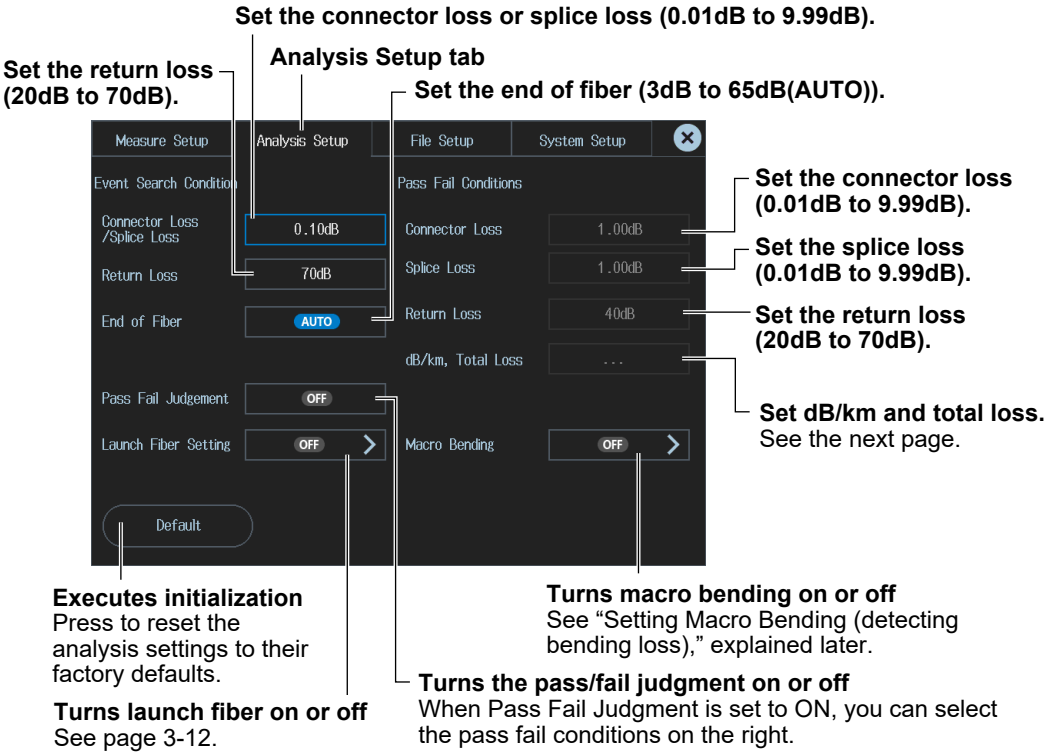
### Setting simple mode (Simple OTDR)

1. Press **MENU**. A MENU screen appears.
2. Tap the **Simple OTDR** icon. A simple OTDR setting list appears.


**Simple OTDR setting list**

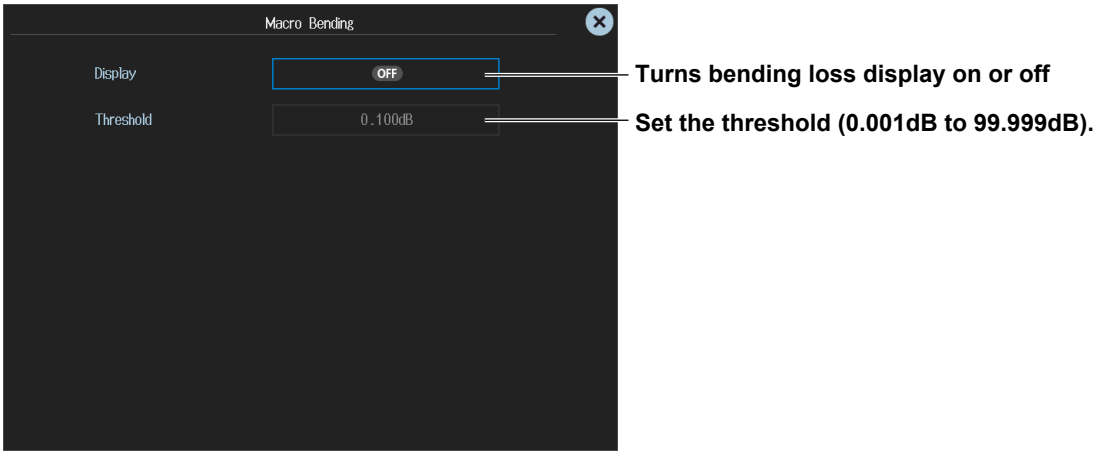
*3.* Tap **Setup**, or press **SETUP**. A setup screen appears.

*4.* Tap the **Analysis Setup** tab. The following screen appears.



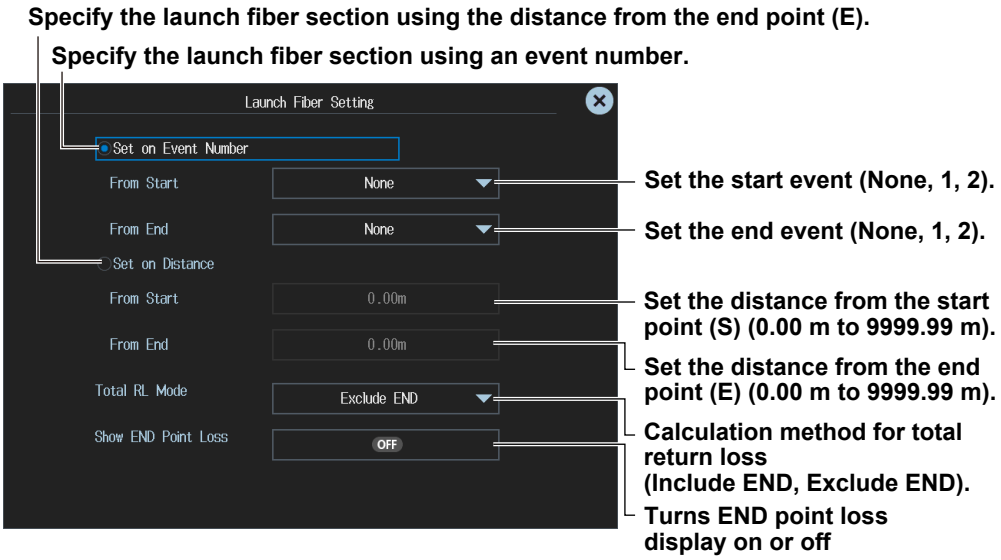

### Setting Macro Bending (detecting bending loss)

*5.* Tap **Macro Bending**. A Macro Bending screen appears.



### Setting a launch fiber

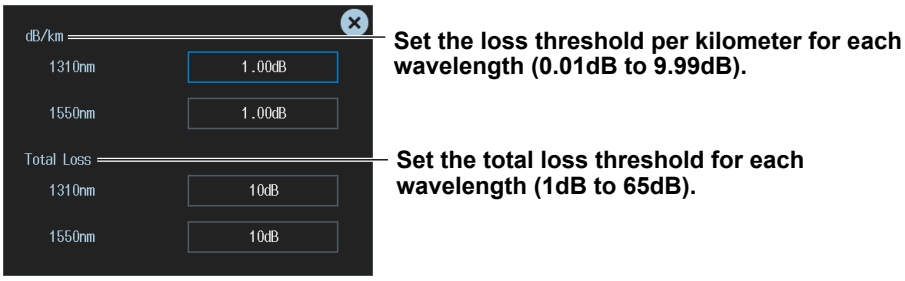
**5.** Tap the **Launch Fiber Setting** tab. A Launch Fiber Setting screen appears.




### Setting pass/fail judgments

**5.** Tap **Pass Fail Judgment**.

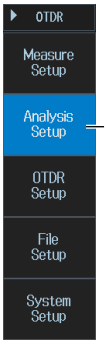
**6.** Tap **dB/km, Total Loss**. The following screen appears.



## Setting expert mode (OTDR)

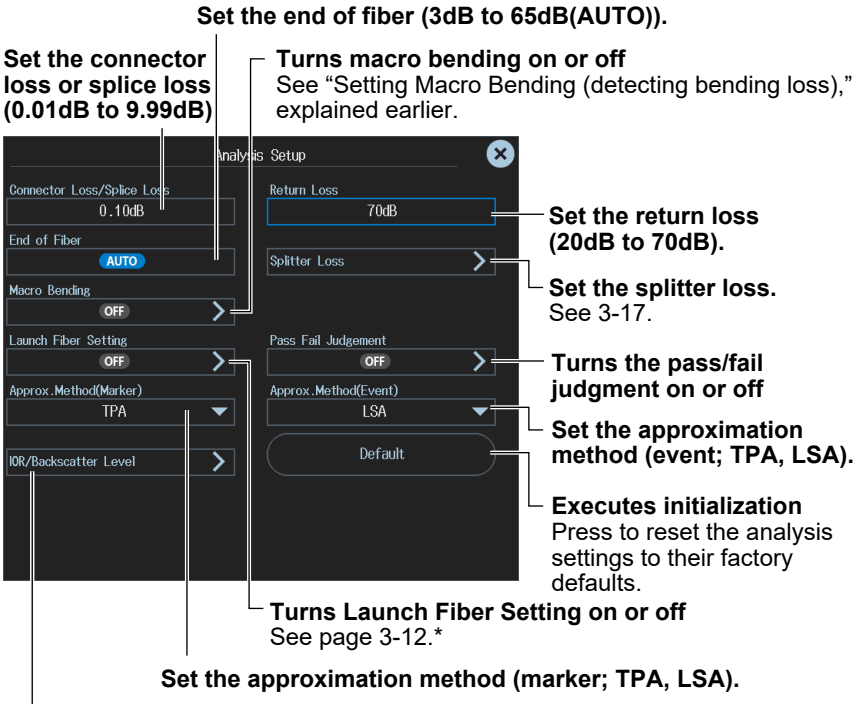
1. Press **MENU**. A MENU screen appears.
2. Tap the **OTDR** icon. A TRACE screen appears.


3. Press **SETUP**. A setup menu appears.




**Analysis Setup**

***4.*** Press the **Analysis Setup** soft key. The following screen appears.

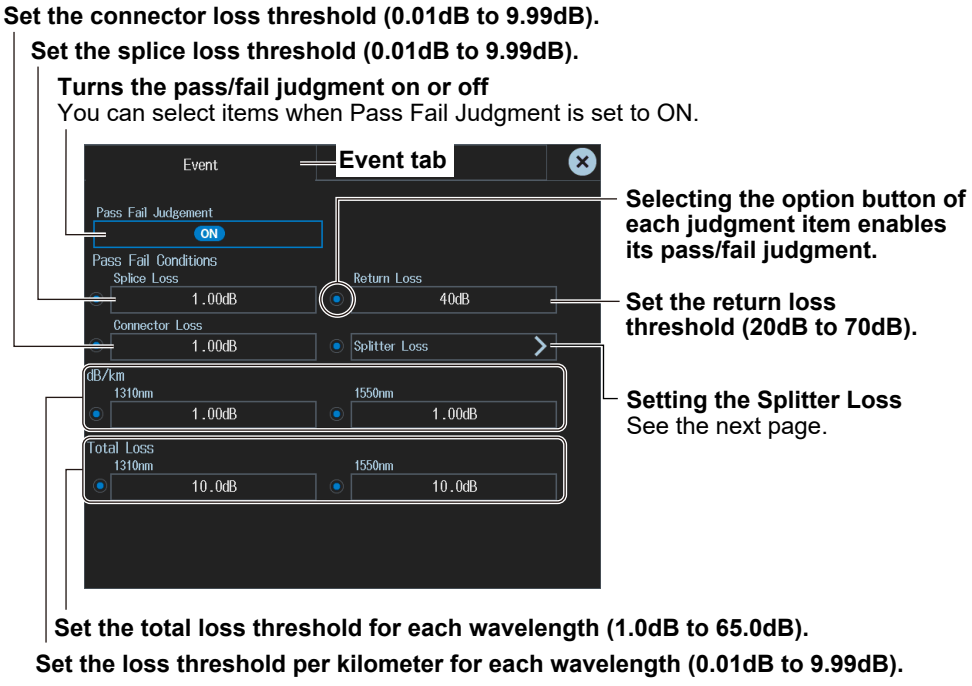



* The screen displays slightly differently in expert mode and simple mode, but the items that can be operated are the same. See the simple mode instructions.

### Setting pass/fail judgments

***5.*** Tap **Pass Fail Judgment**. A Pass Fail Judgment screen appears.

***6.*** Tap the **Event** tab. The following screen appears.

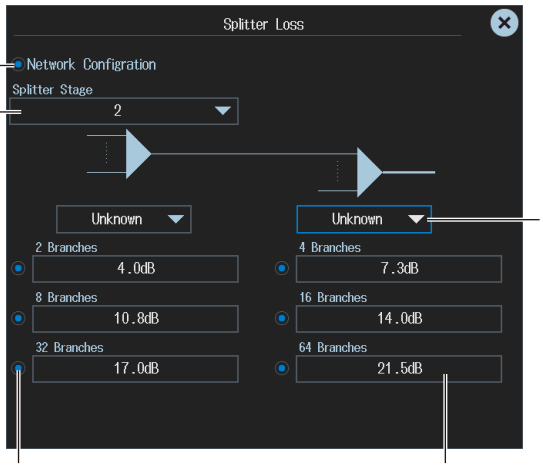


- **Setting the splitter loss**

***7.*** Tap **Splitter Loss**. A Splitter Loss screen appears.

**Set the number of splitter stages (None, 1, 2).**

**Includes the number of splitter stages in the judgment conditions**




**Set the number of splits (Unknown, 2 Branches, 4 Branches, 8 Branches, 16 Branches, 32 Branches, 64 Branches).**

**Includes the selected split in the judgment conditions.**

**Set the splitter loss threshold of each split (1.0 dB to 30.0 dB).**

### Splitter loss judgment conditions

When either of the following conditions is met, it is recognized as a splitter event and displayed along with the number of splits.

- When the number of detected splitter splits is different from the setting
- When the detected splitter loss is greater than the splitter loss threshold of each split

### Setting marker pass/fail judgments

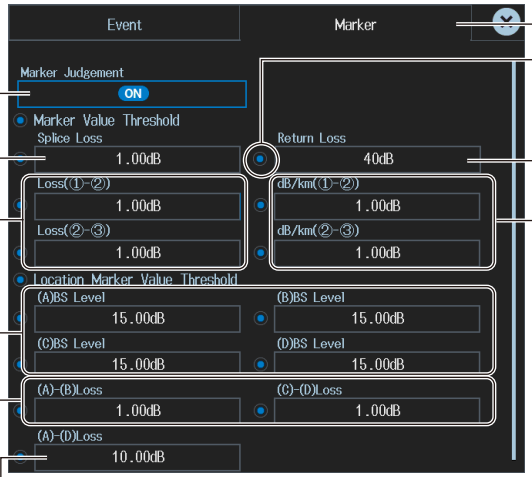
***5.*** Tap **Pass Fail Judgment**. A Pass Fail Judgment screen appears.

***6.*** Tap the **Marker** tab. The following screen appears.

**Set the loss threshold between markers (①-②, ②-③) (0.01 dB to 9.99 dB).**

**Set the splice loss threshold (0.01dB to 9.99dB).**

**Turns the marker judgment on or off**
You can select items when marker judgment is set to ON.




**Marker tab**

**Selecting the option button of each judgment item enables its pass/fail judgment.**

**Set the return loss threshold (20dB to 70dB).**

**Set the threshold for the loss between markers (Ⓐ-Ⓓ) (0.10dB to 65.00dB).**

**Set the threshold for the loss between markers (Ⓐ- Ⓑ, Ⓒ-Ⓓ) (0.01dB to 9.99dB).**

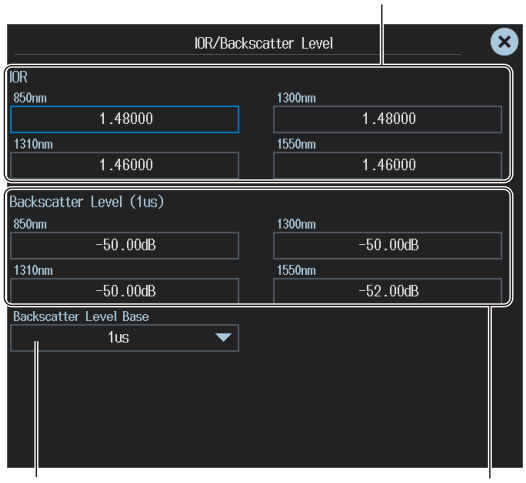
**Set the level threshold for waveform heights between markers (Ⓐ, Ⓑ, Ⓒ, Ⓓ) (0.01 dB to 50.00 dB).**

**Set the dB/km threshold between markers (①, ②, ③) (0.01 dB to 9.99 dB).**

### Setting the IOR/backscatter level

***5.*** Tap **IOR/Backscatter Level**. An IOR/Backscatter Level screen appears.

**Set the IOR each wavelength (1.30000 to 1.79990).**

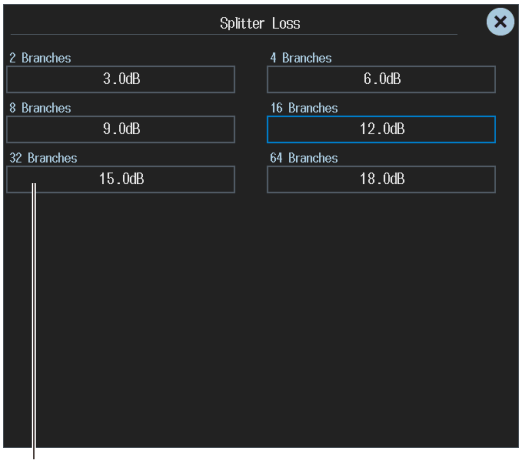



**Set the backscatter level base (1µs, 1ns).**

**Set the backscatter level for each wavelength.**
1 µs pulse width*: −10.00 dB to −64.99 dB
1 ns pulse width*: −40.00 dB to −94.99 dB
* Pulse width used as a base for the backscatter level

**Setting the splitter loss**

***5.*** Tap **Splitter Loss**. A Splitter Loss screen appears.




**Loss threshold for each number of splitter splits**
The loss threshold varies from 1.0 dB to 20.0 dB depending on the loss setting of the number of adjacent splitter splits.
**Example of 4 branches:**
If the adjacent “2 branches” is 3.0 dB and the other adjacent “8 branches” is 9.0 dB, the setting range of the loss threshold for the “4 branches” is 3.0 dB to 9.0 dB.

# Explanation

## 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(AUTO).

## Splitter loss

Events whose loss exceeds this value are assumed to be optical splitters according to the number splits.
The range is 1 dB to 20 dB.

## Macro bending (bending loss)

When an optical pulse measurement is performed in multi wavelength measurement (when wavelength setting is 1310 nm/1550 nm or 1310 nm/1550 nm/1625 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.

**Extension**

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**

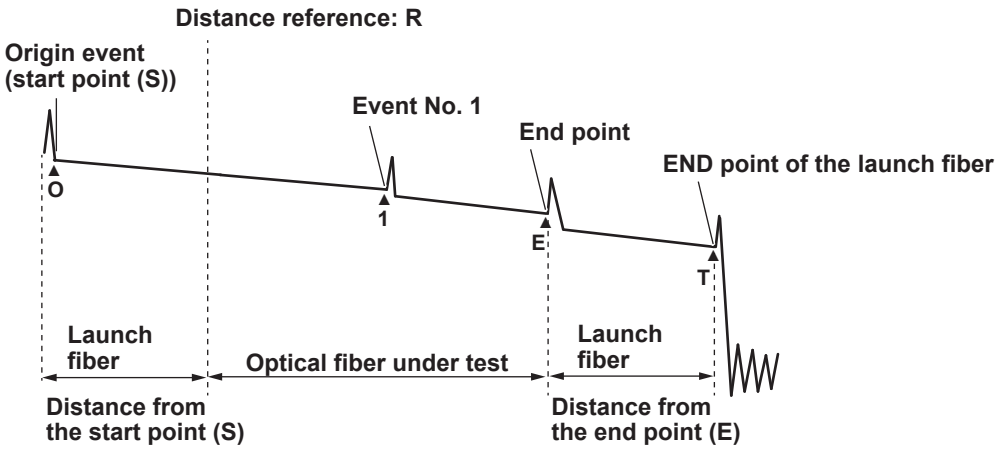
This is the threshold of the difference between the splice losses of each wavelength when optical pulses are measured.

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.

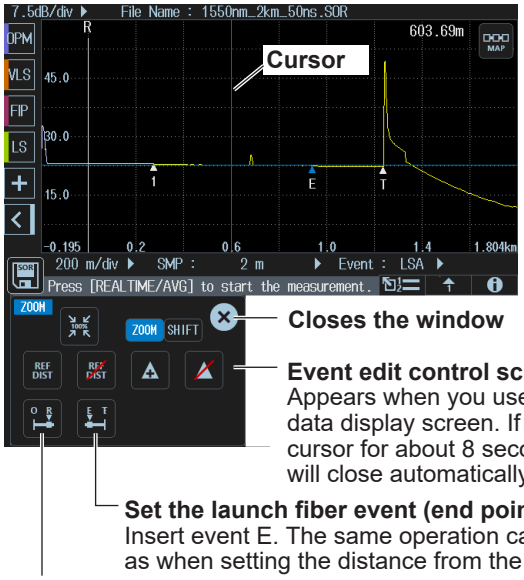
The range is 0.001 dB to 99.999 dB.

## 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) or start position so that the event information in the launch fiber section is excluded from the analysis conditions.



The same operations can be performed from the following screen while the event analysis screen is being displayed.




## 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 an asterisk 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 an asterisk attached to them.

## Marker pass fail judgment

A judgment is performed on the marker values detected in the target waveform, and those that exceed the specified threshold are indicated as Fail on the marker analysis screen.

ON: Pass/fail judgment is set to ON, and Fail is indicated for marker values that have exceeded their thresholds (see section 1.5).

OFF: Pass/fail judgment is set to OFF. Fail is not indicted even if marker values have exceeded their thresholds.

## Approximation method

When the instrument calculates splice loss, it extrapolates straight lines. These straight lines are known as approximation lines.

There are the following two kinds of approximation lines.

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

**LSA**

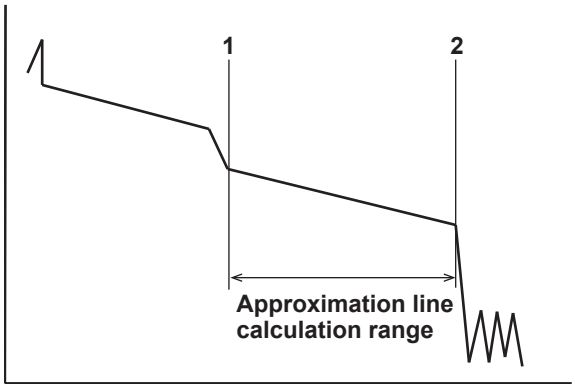
The instrument calculates the loss between two points by using the least squares method on all the data between the two points (between 1 and 2).

This method has the following characteristics.

Advantage: 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.

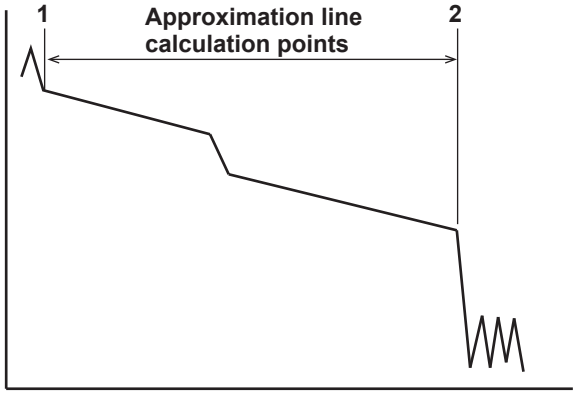
Disadvantage: If a large reflection or splice loss is present in the section whose loss is being calculated, those values are also included in the calculation, so large errors result.

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 instrument 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.



## 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 instrument 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 instrument, you can select the reference pulse width for the backscatter level (see section 3.2). The selectable range of backscatter levels vary depending on the reference pulse width.

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

The instrument 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 |
| 1625 nm | –53 dB | –83 dB |
| 1650 nm | –53 dB | –83 dB |

## IOR

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

| Wavelength | IOR |
|---|---|
| 1310 nm | 1.46000 |
| 1550 nm | 1.46000 |
| 1625 nm | 1.48000 |
| 1650 nm | 1.48000 |

The range is 1.30000 to 1.79999.

## Splitter loss

If splitters are inserted, you can select whether to detect the losses caused by them.
If you set a threshold for each number of splitter splits, the number of splitter splits can be determined automatically from the measured loss. The loss threshold varies from 1.0 dB to 20.0 dB depending on the loss setting of the number of adjacent splitter splits.

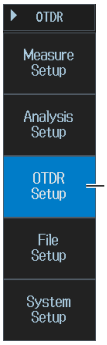
# 3.3 Setting Display Conditions (OTDR)

## Procedure

### Setting expert mode (OTDR)

1. Press **MENU**. A MENU screen appears.
2. Tap the **OTDR** icon. A TRACE screen appears.


3. Press **SETUP**. A setup menu appears.




**OTDR Setting**

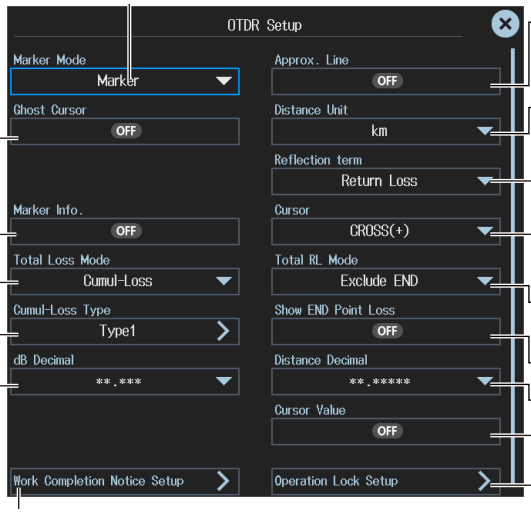
***4.*** Press the **OTDR Setup** soft key. The following screen appears.

**Set the total loss calculation method (Cumul-Loss, Loss between S and E).**
Cumulate: Integrated value of events
Between two points: Loss between S and E

**Turns marker information display on or off**
Displays on the screen the distance and loss value at the marker position.

**Turns ghost cursor display on or off**
This is for checking secondary reflections.

**Set the marker mode (Marker, Line).**




**Turns approximated line display on or off**
Displays an approximated line for waveform events.

**Select the measurement distance unit.**
This menu is not available on -HJ suffix code.

**Select the reflection display (Return Loss, Reflection Level).**

**Set the cursor display method (CROSS(+), Line(┆)).**

**Calculation method for total return loss (Include END, Exclude END).**

**Turns END point loss display on or off**

**Distance decimal places (**.*, **.**, **.***)**

**Turns the cursor dB display on or off**

**Locks screen operations**
Screen operations can be locked after a given time elapses.

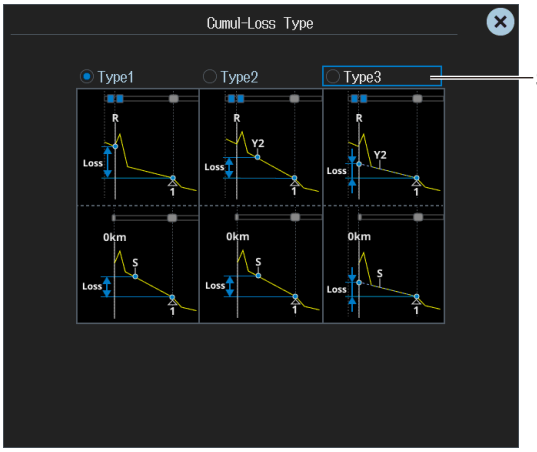
**Configure the work completion notification.**
Configure settings that indicate that the optical fiber cable being installed has reached the destination with an alarm or the like.

**dB decimal places (**.*, **.**, **.***)**

**Set the cumulative loss type (Type1, Type2, Type3).**
Select the cumulate loss calculation method.

### Setting the cumulative loss type

*5.* Tap **Cumul-Loss Type**. A Cumul-Loss Type screen appears.




**Select type 1, 2, or 3.**

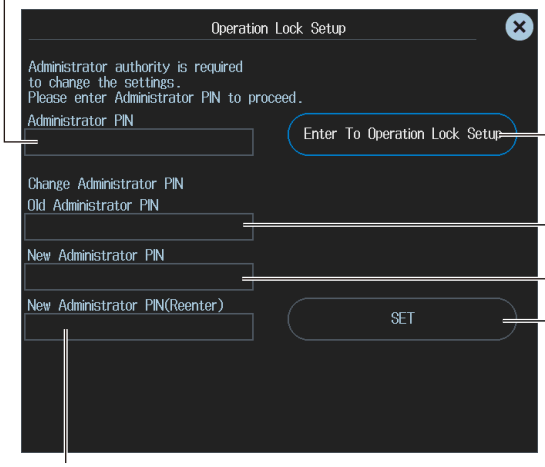
#### Cumulate loss type

With Type1, loss is measured from the measurement start point to the measurement point.
With Type2, loss is measured from the event marker (Y2) to the measurement point.
With Type3, loss is measured from the approximation line of the event marker (Y2) to the measurement point.
For each type, the loss measurement range varies depending on whether the distance reference is set (top illustration in the screen) or not set (bottom illustration in the screen). For details, see “Explanation” in this section.

### Setting operation lock

*5.* Tap **Operation Lock Setup**. An Operation Lock Setup screen appears.

**Enter the administrator PIN (the default value is 0000).**




**Operation Lock Setup**

**Enter the old administrator PIN (the default value is 0000).**

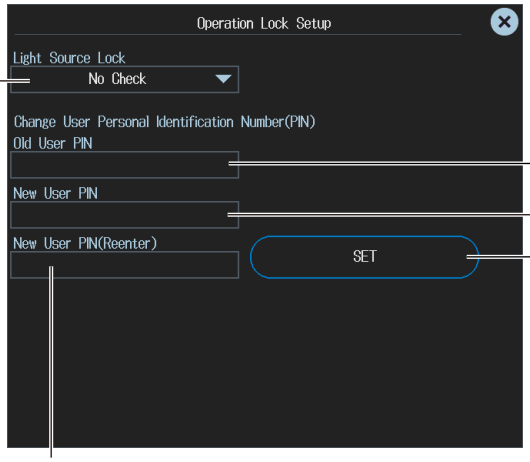
**Enter the new administrator PIN.**

**Confirms the input**

**Enter the new administrator PIN again for confirmation.**

**6.** Tap **Operation Lock Setup**. The following screen appears.

**Select the restriction mode.**
- No Check: Operation possible without entering the PIN.
- Check only once: Enter the PIN only for the first operation.
- Check everytime: Enter the PIN for every operation.




**Enter the old user PIN (the default value is 0000).**

**Enter the new user PIN.**

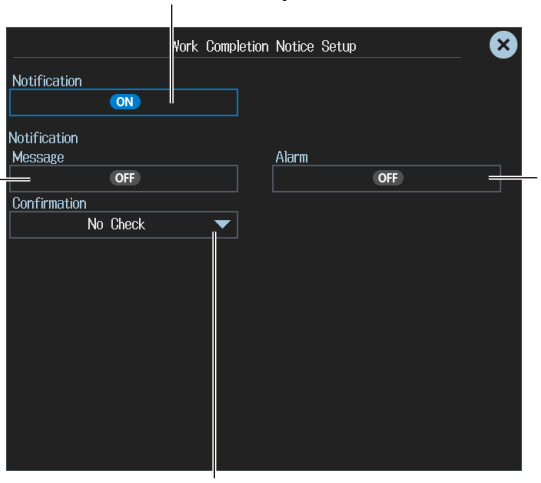
**Confirms the input**

**Enter the new user PIN again for confirmation.**

**Configure the work completion notification.**

**5.** Tap **Work Completion Notice Setup**. A Work Completion Notice Setup screen appears.

**Turns completion notification on or off**




**Turns the alarm sound after work completion on or off**

**Set the confirmation message.**
Set how to display the message confirming whether you have moved the cursor to the work completion point.

**Turns the message display after work completion on or off**

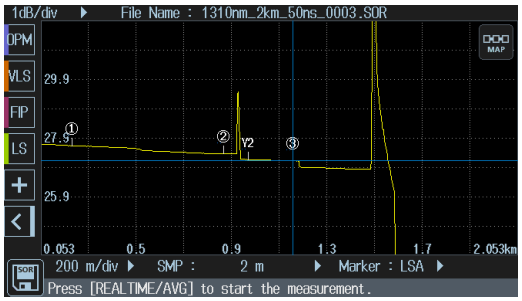
# Explanation

## Marker mode

### Markers

Move the cursor to the location that you want to measure, and set a marker. When you are measuring return loss and splice loss, they are calculated automatically when you set all the markers that are necessary for the measurement method that you are using. For instructions on how to use markers, see section 6.1.

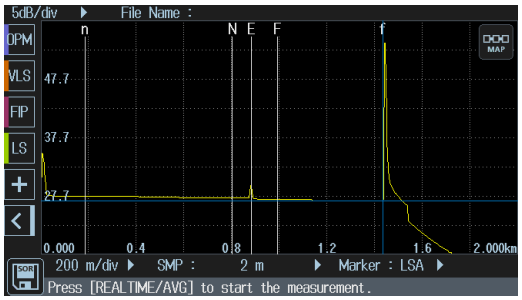
**Example of 4 Point Markers: Marker ① ② Y2 ③**




### Line

After you select the line marker that you want to operate from a set of multiple line markers, move the selected line marker directly. The value of the line marker's section is calculated, and the return loss and splice loss are measured. Each value is calculated in real time as you move the line marker. For instructions on how to use line markers, see section 6.1.

**Example of 5 Point Markers: Line n N E F f**




***Note***

Line is often used outside of Japan. Marker is often used within Japan. It is used on existing YOKOGAWA models.

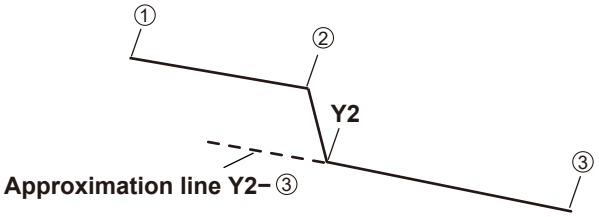
## Displaying approximation lines

In the 4 Point (marker mode set to Marker) or 5 Point (marker mode set to Line) marker modes, you can display the approximation lines that are used to calculate splice loss or return loss.

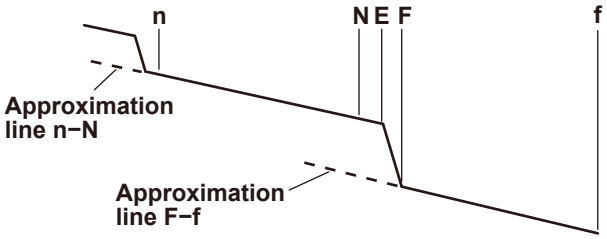
OFF: Approximation lines are not displayed.

ON: Approximation lines are displayed.

**Example of 4 Point Markers: Marker ① ② Y2 ③**

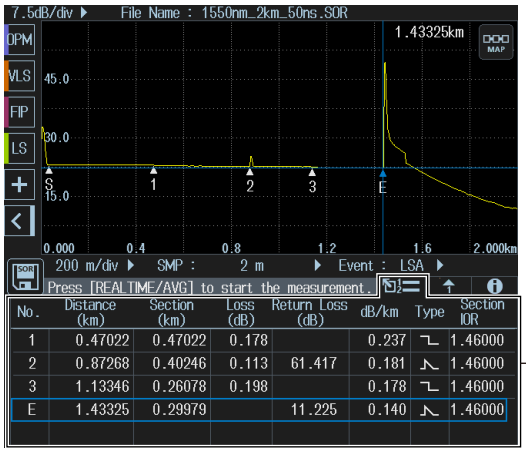



**Example of 5 Point Markers: Line n N E F f**




## Event list display

You can select the items to show in the event list.

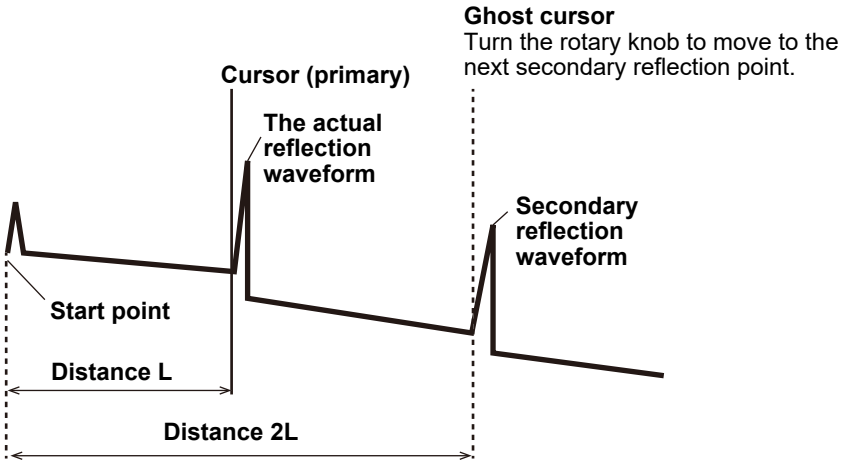


## Ghost cursor

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.




**How secondary reflections are generated**

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

↓

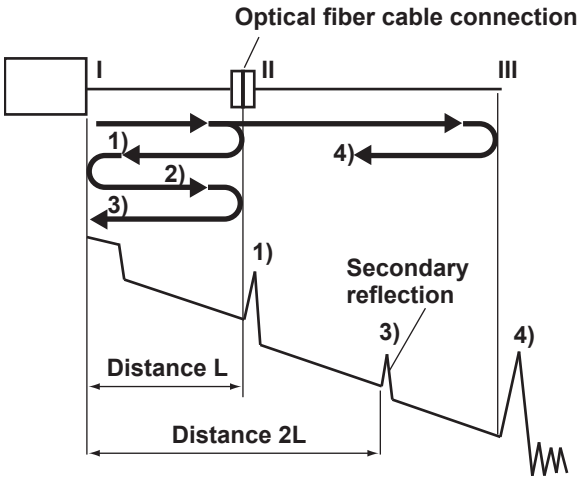
Light ray A that is reflected at connection II in the figure is reflected again at connection I and propagates in the direction of II as light ray B.

At this point, the instrument detects A as an event.

↓

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

Because the instrument 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.



## Distance unit

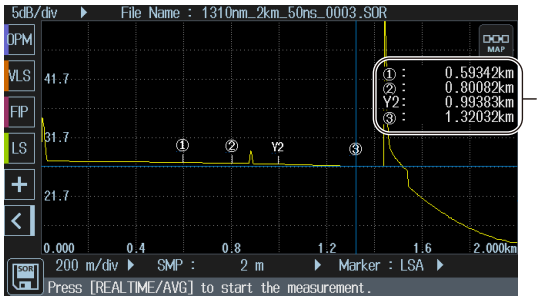
Set the unit of distance to show in the screen. The default setting is km.

## Marker information

You can display the distance from the measurement reference point to each marker on the waveform display area.

OFF: Marker information is not displayed.

ON: Marker information is displayed.



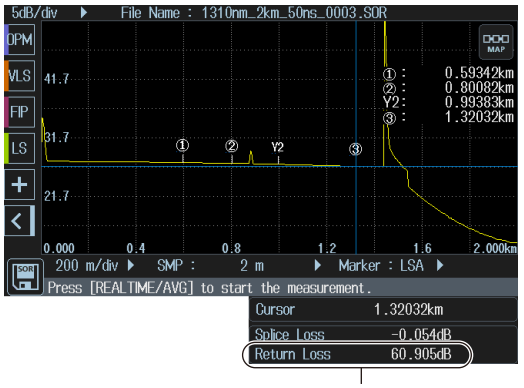

**Marker information**

## Reflection display (when the suffix code is -HJ)

You can set the reflection display at the calculation result display area of measurement data to either of the following settings.

Return loss: The ratio of the incident optical power level and the reflected optical power level is displayed.

Reflection level: The reflected optical power level is displayed.




**Reflection display**

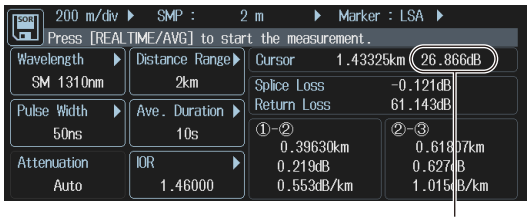
## Cursor dB value

You can display not only the distance at the cursor position, but also the dB value.

OFF: Only the distance at the cursor position is displayed.

ON: The distance and the dB value at the cursor position are displayed.

**Marker mode**




**dB value at the cursor position**

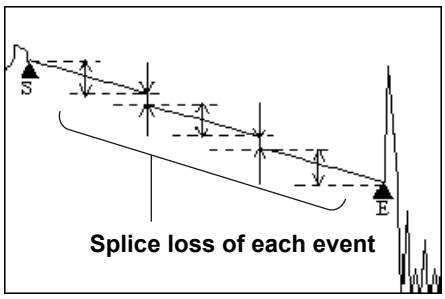
**Event analysis**


**dB value at the cursor position**

## Calculation method for total loss

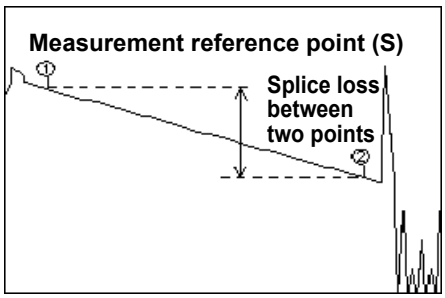
### Cumulate loss

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




### Loss between S and E

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




### *Note*

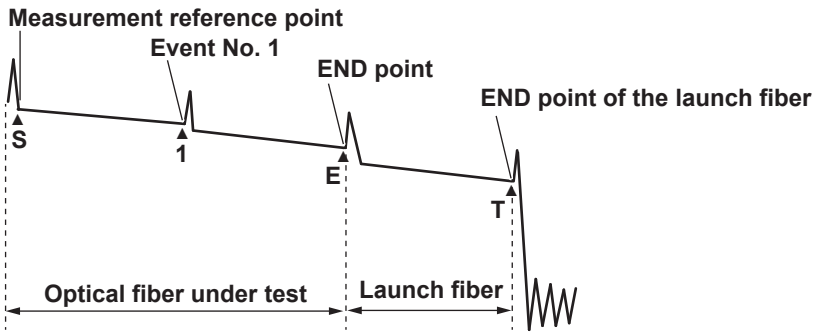
If Loss between S and E is selected, markers ① and ② are placed automatically at the measurement reference point (S) and the END point (E) when event analysis is executed.

## Calculation method for total return loss

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

Include END: The value at END point is included in the total return loss. This is mainly used when a launch fiber is connected to the far end of the optical fiber cable under measurement and end event T is set in the launch fiber settings. The END point and launch fiber connection are also included in the calculation of the total return loss.

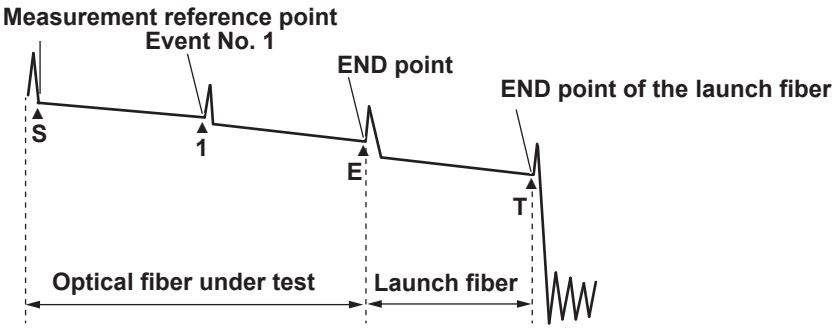
Exclude END: The value at END point is not included in the total return loss.




## Display of the END point loss

ON: The END point splice loss is shown in addition to return loss. This is mainly used when a launch fiber is connected to the far end of the optical fiber cable under measurement and end event T is set in the launch fiber settings. The splice loss at the END point is calculated, and the value is displayed. Consequently, the splice loss at the connection point of the optical fiber under measurement and launch fiber will also be displayed correctly.

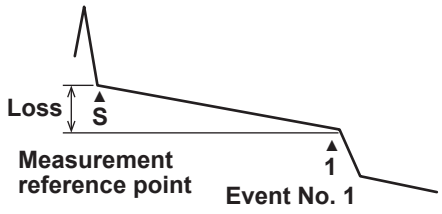
OFF: The splice loss at the END point is not displayed.



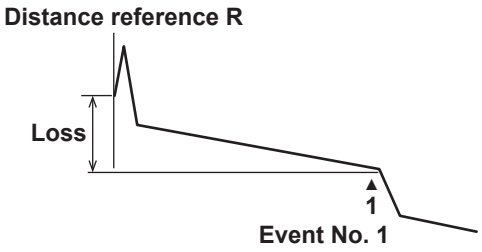
## Cumulate loss type

You can select the cumulative loss measurement method from the following three types in the event analysis settings.

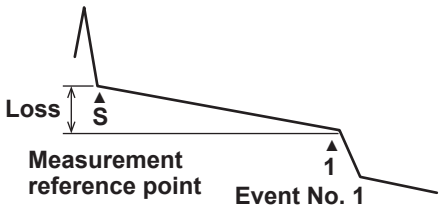
**Type 1 (without distance reference)**
This method does not include the near-end reflection in the cumulate loss value. The loss from measurement start point S to the start point of event No. 1 is measured.



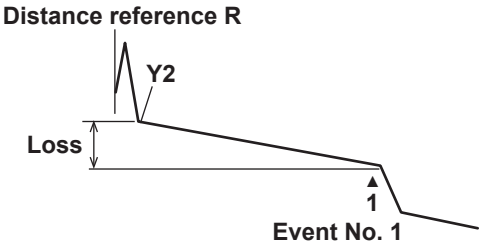

**Type 1 (with distance reference)**
This method includes the near-end reflection in the cumulate loss value. The distance reference is set to the start point of the near-end reflection. The loss from distance reference R to the start point of event No. 1 is measured.



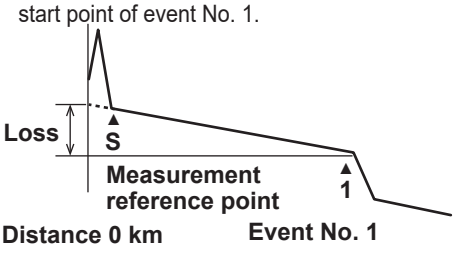

**Type 2 (without distance reference)**
This method does not include the near-end reflection in the cumulate loss value. The loss is measured using the same method as type 1 (without distance reference).



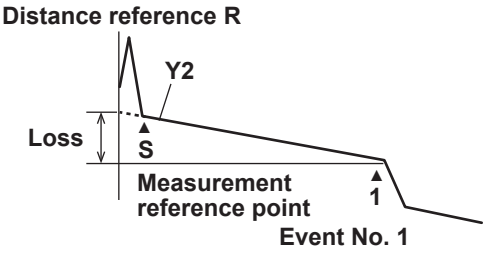

**Type 2 (with distance reference)**
This method does not include the near-end reflection in the cumulate loss value. The distance reference is set to the start point of the near-end reflection. The loss from near-end reflection end point Y2 to the start point of event No. 1 is measured.




**Type 3 (without distance reference)**
This method includes the near-end reflection in the cumulate loss value. The loss is measured from where the approximation line between measurement start point S and event No. 1 intersects distance 0 km to the start point of event No. 1.




**Type 3 (with distance reference)**
This method includes the near-end reflection in the cumulate loss value. The distance reference is set to the start point of the near-end reflection. The loss is measured from where the approximation line between end point Y2 of the near-end reflection and event No. 1 intersects distance 0 km to the start point of event No. 1.




## dB Decimal

You can select the number of decimal places of the dB display.

**.*: 1 decimal place

**.**: 2 decimal places

**.***: 3 decimal places

## Distance decimal

You can select the number of decimal places of the distance display.

**.***: 3 decimal places

**.****: 4 decimal places

**.*****: 5 decimal places

## Operation lock

You can lock the following operations using a PIN (password).

**Operations that can be locked**

- This instrument's emission of light
- The REAL TIME and AVG keys of the OTDR function
- The visible light source ON soft key when an light source option (/VLS) is installed
- The light source ON soft key
- The LS Power Adjust soft key in an auto loss test (LS, loopback test)
- The LS Power Adjust soft key in a multi-fiber loss test (LS, loopback test)
- The Loss Test START soft key for executing the LS or loopback test of the auto loss test
- The Loss Test START soft key for executing the multi-fiber loss test

**PIN**

The following two PINs are available.

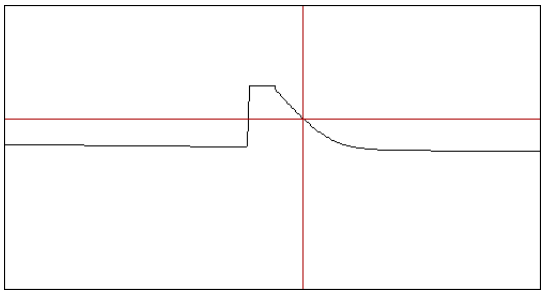
- **User PIN**
  A PIN required to perform the above operations. The default value is 0000.
- **Administrator PIN**
  A PIN required to set the user PIN and restrict the above operations.
  The default value is 0000.

## Cursor display format

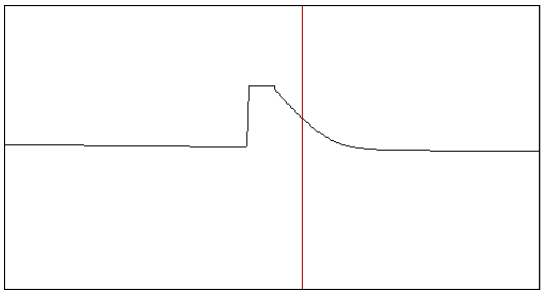
You can select the cursor display format from the following.

CROSS(+): The position on the waveform is displayed with vertical and horizontal cursors that intersect.

LINE(|): The position on the waveform is displayed with a vertical cursor.



**Crosshair display**



**Line display**

## Work completion notice

See section 4.2.

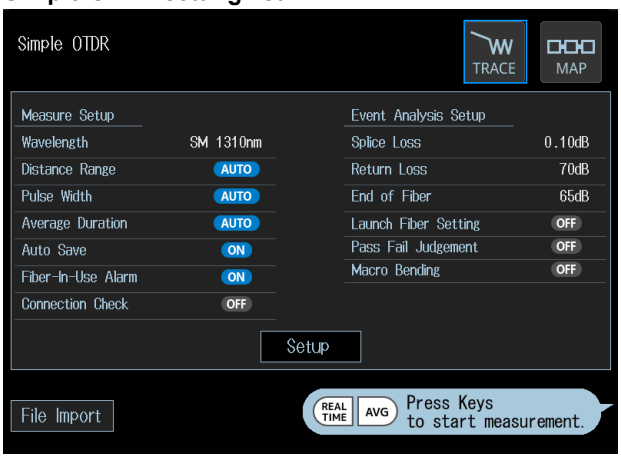
# 3.4 Setting File Conditions (File)

## Procedure

### Setting simple mode (Simple OTDR)

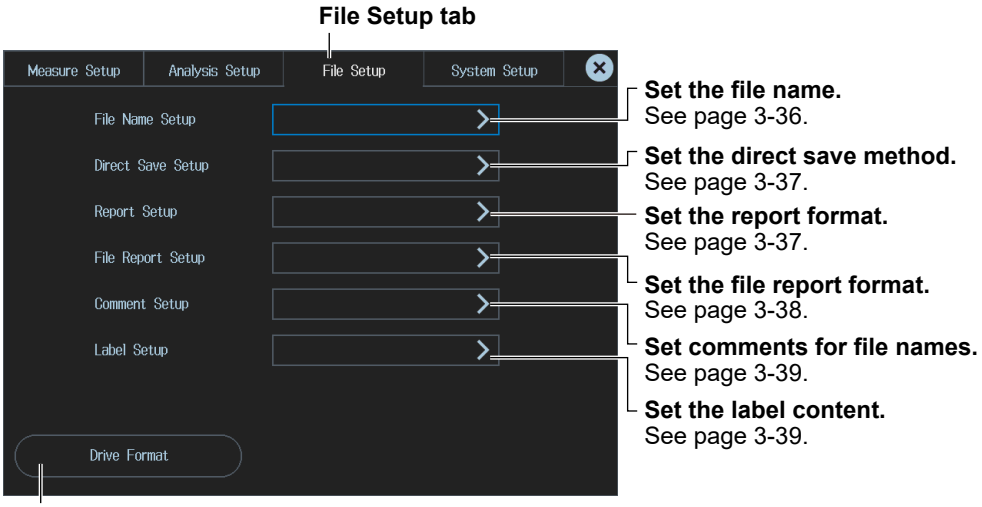
1. Press **MENU**. A MENU screen appears.
2. Tap the **Simple OTDR** icon. A simple OTDR setting list appears.


**Simple OTDR setting list**



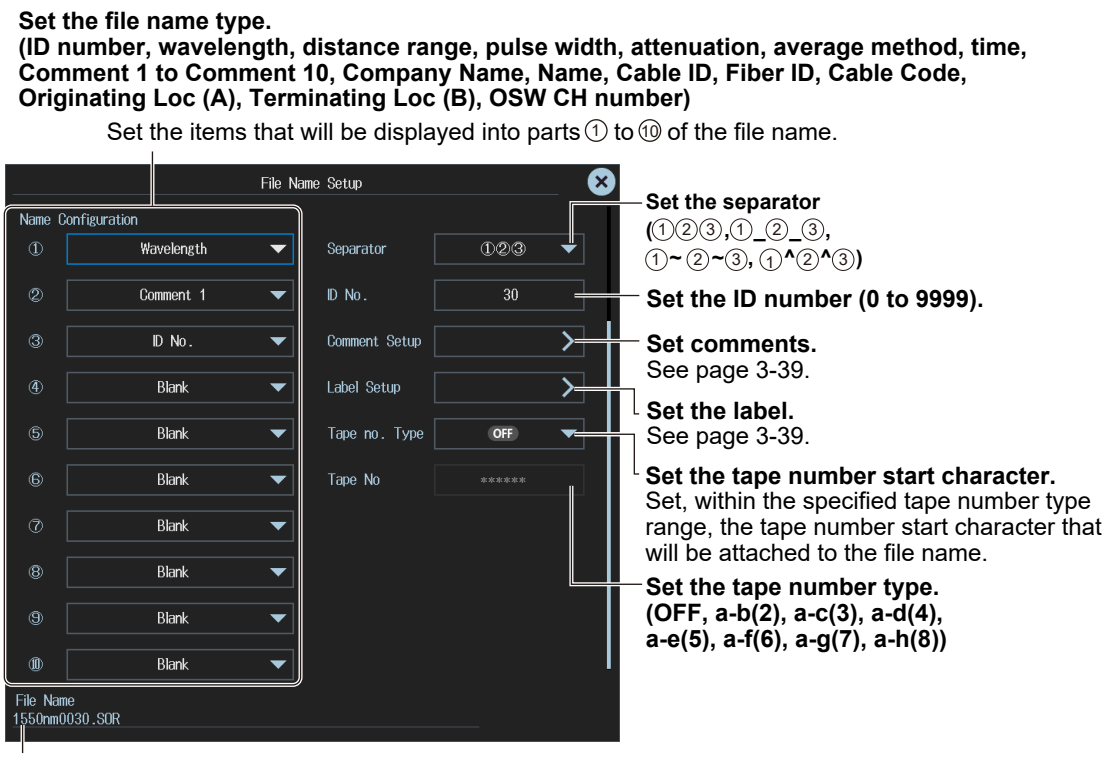
*3.* Tap **Setup**, or press **SETUP**.

*4.* Tap the **File Setup** tab. The following screen appears.



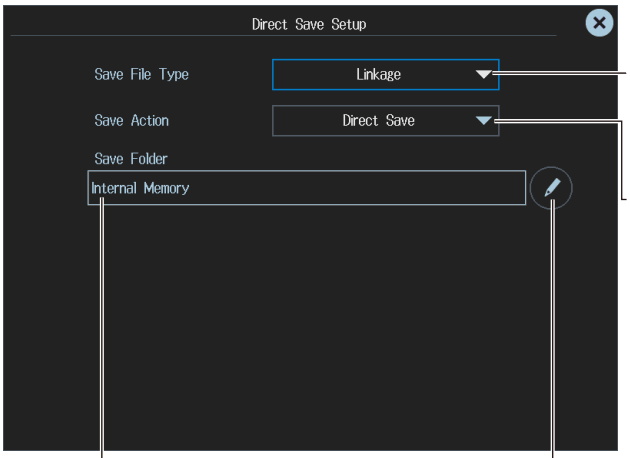

## Setting the file name

*5.* Tap **File Name Setup**. A file name setup screen appears.



## Setting the direct save method

**5.** Tap **Direct Save Setup**. A Direct Save Setup screen appears.




**Set the file type.**
**(SOR, PDF, SOR+PDF, SOR+BMP, SOR+JPG, BMP, JPG, Linkage)**

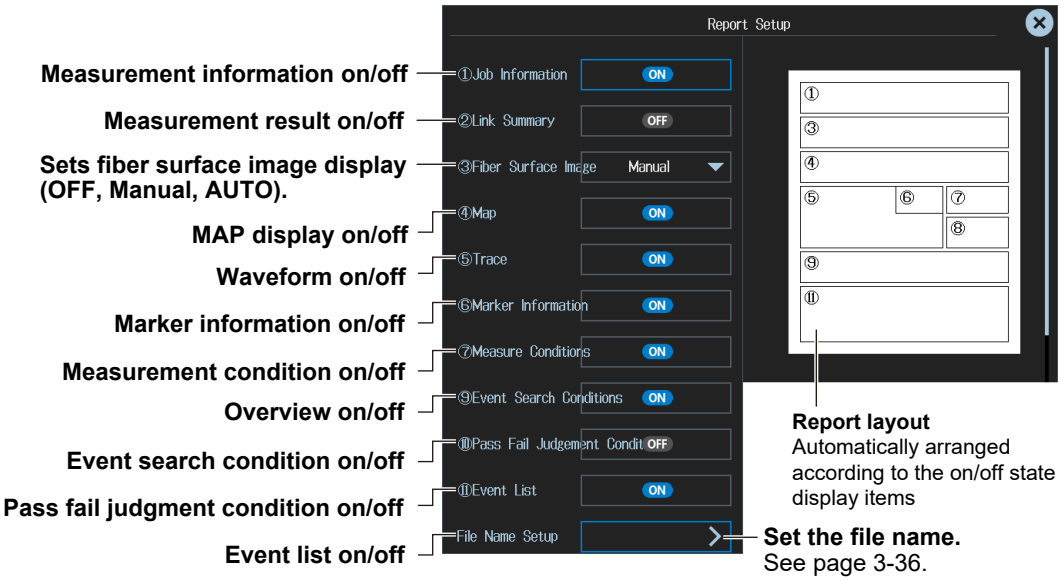
**Set the save action (Direct Save, Select ID).**
Set the action to be taken when you tap the save icon of the displayed waveform on the measurement screen.

**The selected save destination is displayed.**

**Displays the file list of the folder shown in Save Folder.**
For details on file operations, see section 9.6.

## Setting the report format

**5.** Tap **Report Setup**. A Report Setup screen appears.




**Measurement information on/off**

**Measurement result on/off**

**Sets fiber surface image display (OFF, Manual, AUTO).**

**MAP display on/off**

**Waveform on/off**

**Marker information on/off**

**Measurement condition on/off**

**Overview on/off**

**Event search condition on/off**

**Pass fail judgment condition on/off**

**Event list on/off**

**Report layout**
Automatically arranged according to the on/off state of display items

**Set the file name.**
See page 3-36.

### *Note*

For details on the items, see “Explanation” in this section.

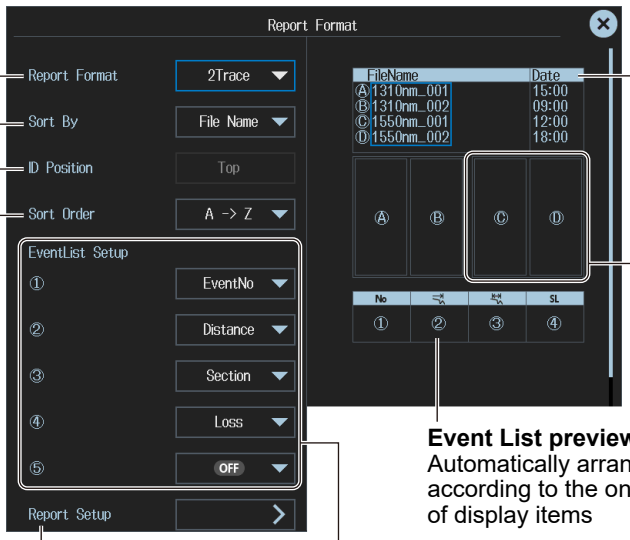
# Setting the file report format

**5.** Tap **File Report Setup**. A File Report Setup screen appears.

**ID Position (Top, Bottom)**
Set the ID position of the file name. You can select this when the order is set to ID.

**Order (File Name, Date, ID)**
Select the file export order (by file name, by date, by ID).

**Number waveforms to display (1Trace, 2Trace)**
Select the number of waveforms to show in a single page.
You can select the following items only when 2Trace is selected.




**Preview of the order in which files will be exported.**

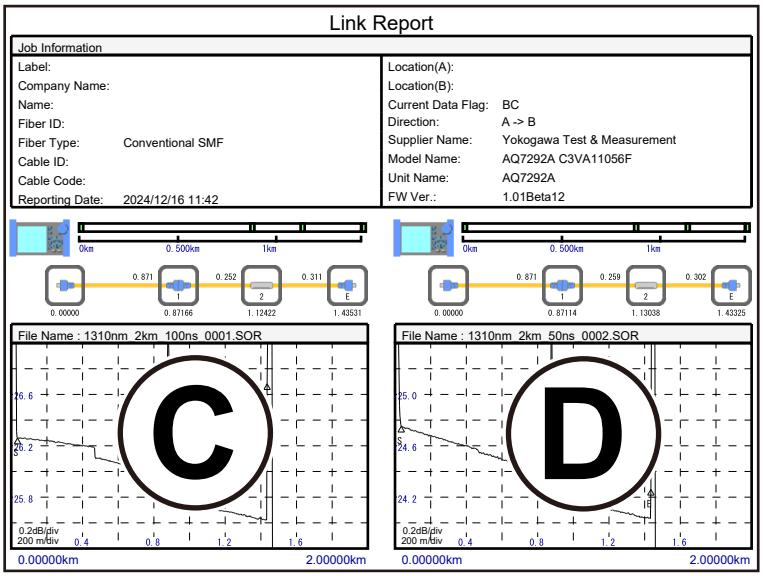
**Sort Order (A -> Z, Z -> A)**
Selects the output sort order.

**Event List preview**
Automatically arranged according to the on/off state of display items

**Event list display items ON/OFF**
Set the items you want to display to ON.
Up to 5 items can be set to ON.

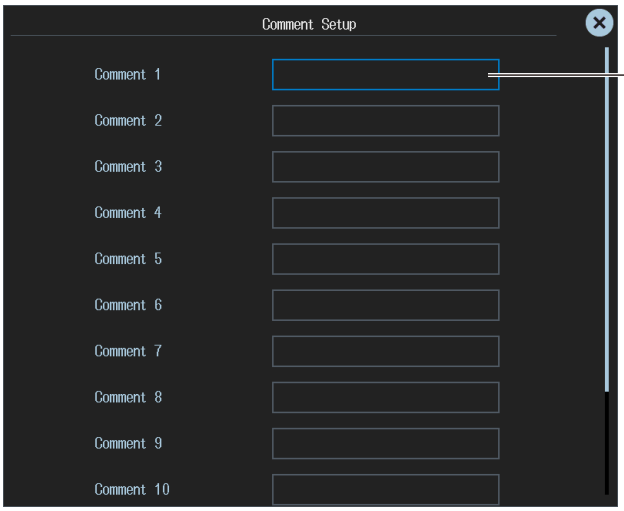
**Report format setup**
See the previous page.

**Format example (when the report format is 2Trace)**
The report of file C is shown on the left and that of file D on the right.



## Setting comments

***5.*** Tap **Comment Setup**. A Comment Setup screen appears.



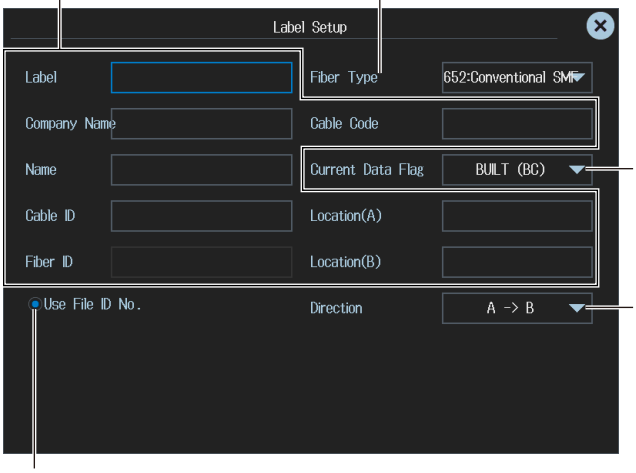

**Set a comment (up to 30 characters).**
Enter a comment by following the procedure in section 2.5.

## Setting a label

***5.*** Tap **Label Setup**. A Label Setup screen appears.

**Label, Company Name, Name, Cable ID, Fiber ID, Cable Code, Originating Loc (A), Terminating Loc (B)**
Enter each item by following the procedure in section 2.5. You can enter up to 36 characters.

**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)**




**Set the current data flag (BUILT (BC), REPAIRED (RC), OTHER (OT), and 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.

**Select the check box to use the file ID (ID number) as the fiber ID.**
**For details on ID numbers, see “Setting the File Name” on page 3-36.**

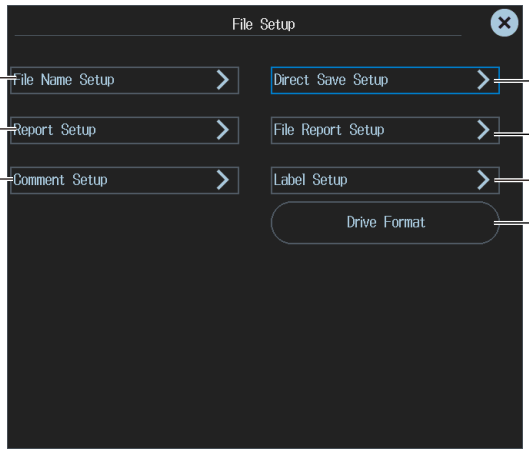
## Setting expert mode (OTDR)

1. Press **MENU**. A MENU screen appears.
2. Tap the **OTDR** icon. A TRACE screen appears.


3. Press **SETUP**. A setup menu appears.


**File Setup**

4. Press the **File Setup** soft key. The following screen appears.




**Set the direct save method.**
See page 3-37.*

**Set the file report format.**
See page 3-38.*

**Set the label content.**
See page 3-39.*

**Initializes the instrument's internal memory (inside the internal memory).**

**Set the file name comment.**
See page 3-39.*

**Report format setup**
See page 3-37.*

**Set the file name.**
See page 3-36.*

* The screen displays slightly differently in expert mode and simple mode, but the items that can be operated are the same. See the simple mode instructions.

# Explanation

## File names and comments

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<br>The setting 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)<br>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.<br>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: 1310 nm) |
| 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 | You can select some of the label items. For details, see the table under “Label” later in this section. |
| Name | |
| Cable ID | |
| Fiber ID | |
| Cable Code | |
| Originating Loc (A) | |
| Terminating Loc (B) | |

- 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.

## 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
SOR+PDF: Both waveform data and report format are saved simultaneously.
SOR+BMP: Both waveform data and BMP data are saved simultaneously.
SOR+JPG: Both waveform data and JPG data are saved simultaneously.
BMP: Saved as BMP data
JPG: Saved as JPG data
Linkage: Saved with the same file type selected in the file list.

### Setting the save action

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.

## Report format

### Measure conditions (Job Information)

The following information is included.

| | |
|---|---|
| Label | Originating Loc (A) |
| Company Name | Terminating Loc (B) |
| Name | Current Data Flag |
| Fiber ID | Direction |
| Fiber Type | Supplier Name[1] |
| Cable ID | Model Name[1] |
| Cable Code | Unit Name[1] |
| Report creation date and time[1] | FW Ver.[1, 2] |
| | Calibration Date |

1 Automatically included by the instrument
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 return loss
- Number of events
- Fault events
- Pass/fail judgments
- Measured date

**Fiber surface image**

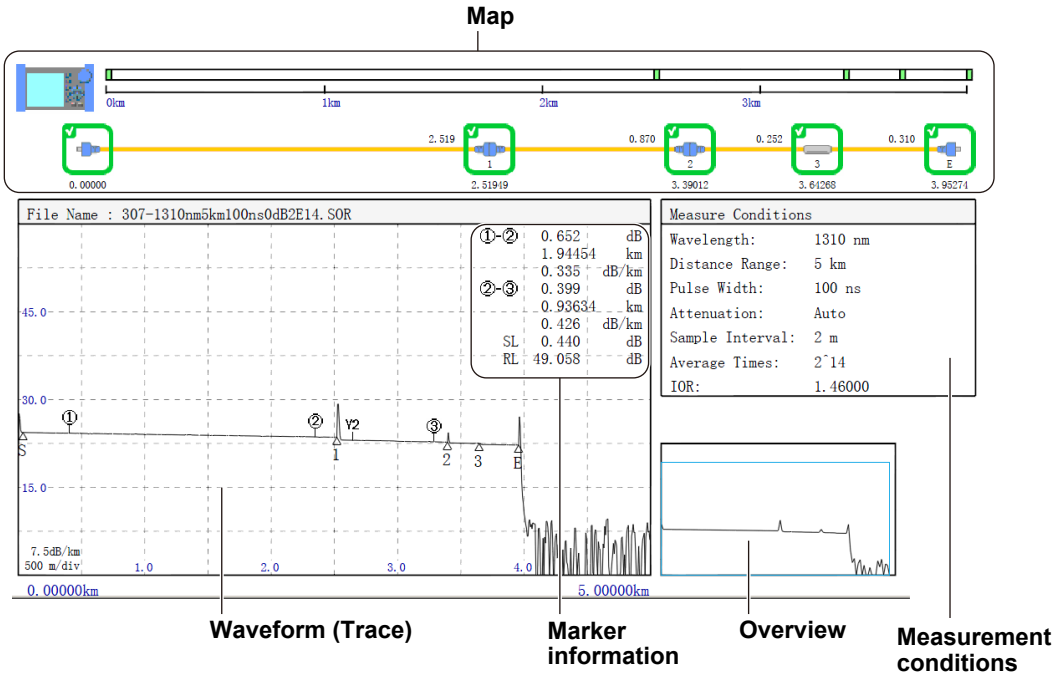
OFF: The fiber end face image is not included in reports.

Manual: The fiber end face image is included in reports. The end face image is selected manually.

AUTO: The fiber end face image is included in reports. The end face image with the same number as the serial number of the report is retrieved and automatically included in the report. If the number is not available, select the end face image manually as in Manual.

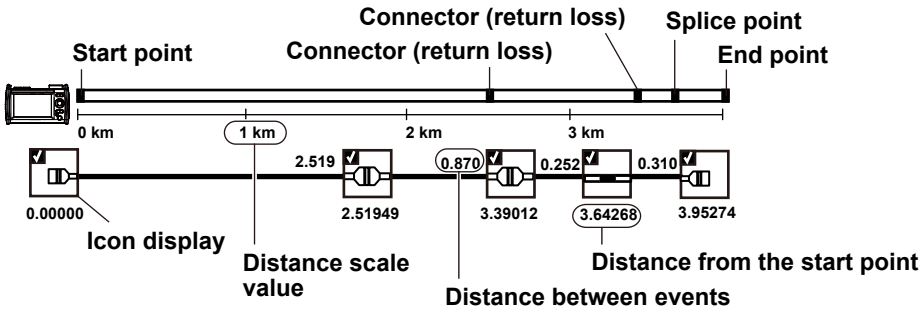
**Map, Waveform, Marker Information, Measurement Conditions, and Overview**

These are included as shown below.




- **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

**Event list setup**

The following information is included.

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

## Report format

If the file action is set to File Report, you can select the number of waveforms to display in a page.

If you select 2Trace, you can select the export order, sort order, and event list items.

**Number of waveforms to display (report format)**

1Trace: The waveform information of a single file is included in a single page.

2Trace: The waveform information of two files is included in a single page.

**Sort by**

Select the file export order when exporting multiple selected files to PDF.

| | |
|---|---|
| File name: | Files are exported to PDF in order by the file name string. |
| Date: | Files are exported to PDF in order by date. |
| ID: | Files are exported to PDF in order by ID number. |

**ID position**

Set where in the file name the ID (ID number) of the selected file is located.* Files with ID numbers set to positions other than top or bottom cannot be exported to PDF in the correct order.

* For file name format, see page 3-36.

Top: The four digit number in the beginning of the file name is identified as the ID number.

Bottom: The four digit number in the end of the file name is identified as the ID number.

**Sort order**

A -> Z: In the case of numbers, the order is 0 to 9. In the case of alphabet characters, the order is a to z.

Z -> A: In the case of numbers, the order is 9 to 0. In the case of alphabet characters, the order is z to a.

**Event list setup**

Set the items to show in the event list. If the number waveforms the display (report format) is 2Trace, up to five items can be displayed in the event list. If five items are specified, other items cannot be specified.

OFF: Events are not displayed in the event list.

Items other than OFF: Selected items are displayed in the event list.

## Setting labels

You can set 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.<br>BUILT (BC), REPAIRED (RC), OTHER (OT), and CURRENT (CC) | |

# 4.1 Performing Averaged Measurements

In averaged measurements, the data that is acquired from each pulse is averaged and displayed. In simple mode, analysis results are displayed in MAP mode. In expert mode, analysis results are displayed in TRACE or MAP mode.

**WARNING**

- During measurement, light is transmitted from the instrument's light source ports. Do not disconnect the connected optical fiber cables. Visual impairment may occur if the light enters the eye.
- Close the covers of any light source ports that do not have optical fiber cables connected to them. Visual impairment may occur if light that is mistakenly emitted from these ports enters the eye.

**French**

**AVERTISSEMENT**

- Lorsque instrument 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'oeil.
- Couvrir les caches des ports de source lumineuse libres. Sur les modèles dotés de deux ports de source lumineuse ou plus, protéger les yeux contre l'émission accidentelle de lumière depuis le mauvais port.

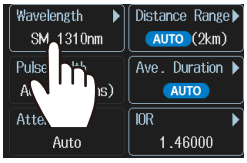
## Procedure

### Setting simple mode (Simple OTDR)

In this mode, the absolute minimum amount of measurement conditions are set. You only have to set the wavelength. Conditions such as distance range, pulse width, and event search are set automatically at the start of the measurement.

1. Press **MENU**. A MENU screen appears.
2. Tap the **Simple OTDR** icon. A simple OTDR setting list appears.
3. Tap **TRACE**. A TRACE screen appears.

***4.*** Tap **Wavelength** to set the wavelength.

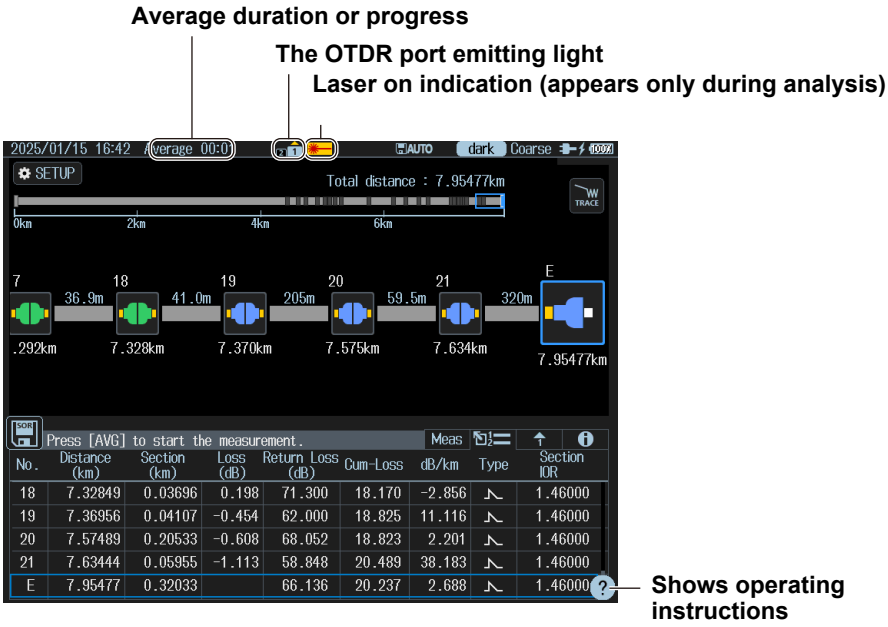



## Executing an averaged measurement

***5.*** Press **AVG**. The measurement starts, and the analysis results are displayed.

During averaged measurement, the duration to average over or the progress 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.

### Analysis results (MAP screen)



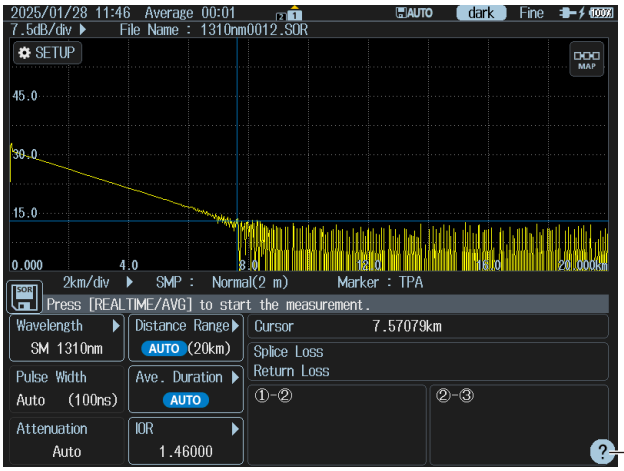

### Average duration or progress

If the average duration is set to AUTO, the duration to average over is displayed in the top area of the screen.

If set to any other value, the progress is displayed. When the measurement completes successfully, 100% is displayed. The time it takes to complete a measurement varies depending on settings such as the distance range and the average count.

6. Tap **TRACE**. Analysis results are displayed in TRACE mode.


### Analysis results (TRACE screen)



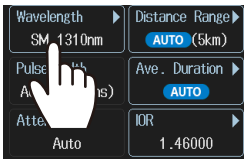

**Shows operating instructions**

### *Note*

If distance range and pulse width are set to auto, the instrument automatically selects the optimal values internally immediately before starting a measurement. Change these values if necessary. For details, see section 3.1.

## Setting expert mode (OTDR)

1. Press **MENU**. A MENU screen appears.
2. Tap the **OTDR** icon. A TRACE screen appears.
3. Tap **Wavelength** to set the wavelength.

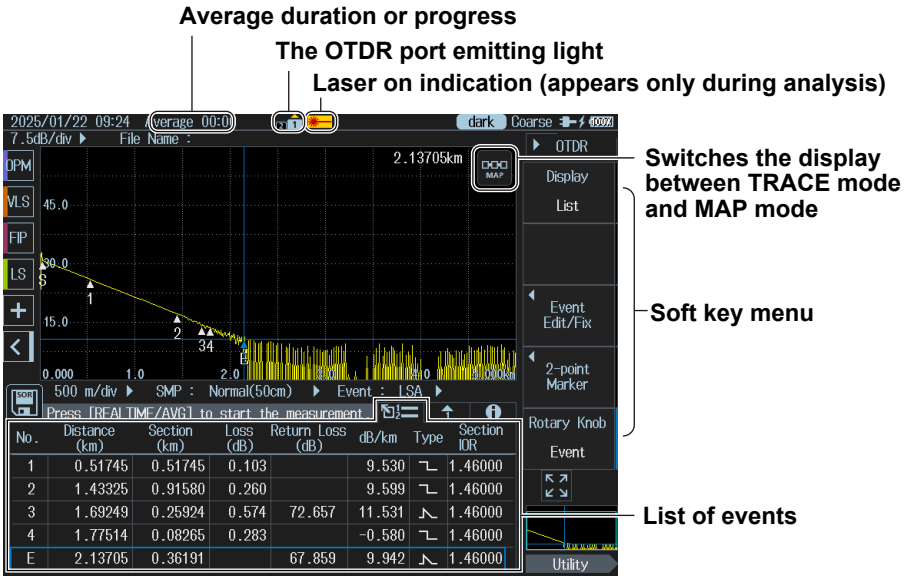


## Executing an averaged measurement

***4.*** Press **AVG**. The measurement starts, and the analysis results are displayed.

During averaged measurement, the duration to average over or the progress is displayed in the top area of the screen. If the average duration is set to AUTO, the duration to average over is displayed in the top area of the screen. If set to any other value, the progress is displayed. When the measurement completes successfully, 100% is displayed. 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.

### Analysis results (TRACE screen)




The menu that can be used during averaged measurement or the menu that can be used after averaged measurement is displayed automatically depending on the usage condition.

#### Menu during averaged measurement


**Marker operation**
See section 6.1.

**Set comments.**
See section 3.4.

**Set labels.**
See section 3.4.

### Menu after averaged measurement

The event analysis menu appears.


**Switches the event analysis result display (Summary, List, Detail)**
This is the same function as switching the analysis result display.

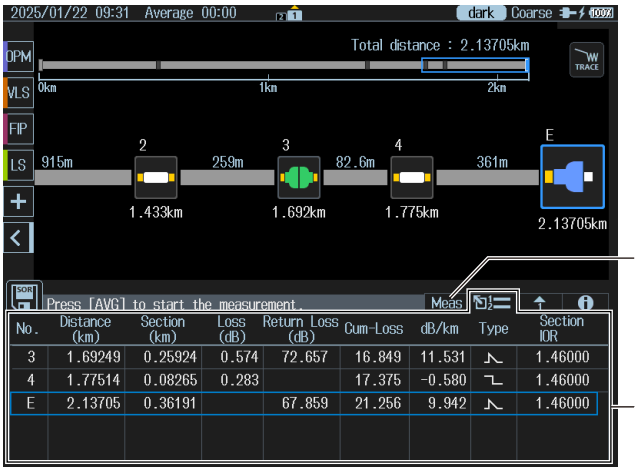
**Edit or fix events.**

**2 Point Markers**
See section 6.1.

**Selects the rotary knob function (Cursor, Event)**
The setting is retained even if you turn off the power.

*5.* Tap **MAP**. Analysis results are displayed in MAP mode.


## Analysis results (MAP screen)




**Shows the setup screen**

**List of events**

Press the Meas tab to set the wavelength. Press the AVG key to start averaged measurement while maintaining MAP mode.

### *Note*

If distance range and pulse width are set to auto, the instrument automatically selects the optimal values internally immediately before starting a measurement. Change these values if necessary. For details, see section 3.1.

# Explanation

## Averaged measurement (AVG)

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

## Distance range

With the auto setting, the instrument 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 3.1.

## 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 3.1.

## Average count and average duration

With the auto setting, the average method is selected according to the distance range and the loss in the optical fiber cable being measured.

## Attenuation

With the auto setting, an attenuation value is selected according to the distance range and the loss in the optical fiber cable being measured. If you want to set the attenuation value manually, select a value appropriate for the pulse width. For details on the attenuation value appropriate for the pulse width, see section 3.1.

## 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 mode: 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**

**Connector (PC connector)**

**Connector (APC connector)**

**Bend**

**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

# 4.2 Performing Real-time Measurement

In real-time measurement, the waveform display is updated in real time. This feature is used to monitor the waveforms. Real-time measurement is not possible in MAP mode (the mode is automatically switched to TRACE mode before making a measurement).

**WARNING**

- During measurement, light is transmitted from the instrument's light source ports. Do not disconnect the connected optical fiber cables. Visual impairment may occur if the light enters the eye.
- Close the covers of any light source ports that do not have optical fiber cables connected to them. Visual impairment may occur if light that is mistakenly emitted from these ports enters the eye.

**French**

**AVERTISSEMENT**

- Lorsque instrument 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'oeil.
- Couvrir les caches des ports de source lumineuse libres. Sur les modèles dotés de deux ports de source lumineuse ou plus, protéger les yeux contre l'émission accidentelle de lumière depuis le mauvais port.

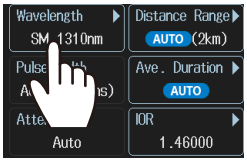
## Procedure

### Setting simple mode (Simple OTDR)

In this mode, the absolute minimum amount of measurement conditions are set. You only have to set the wavelength. Conditions such as distance range and pulse width are set automatically at the start of the measurement.

1. Press **MENU**. A MENU screen appears.
2. Tap the **Simple OTDR** icon. A simple OTDR setting list appears.
3. Tap **TRACE**. A TRACE screen appears.

**4.** Tap **Wavelength** to set the wavelength.

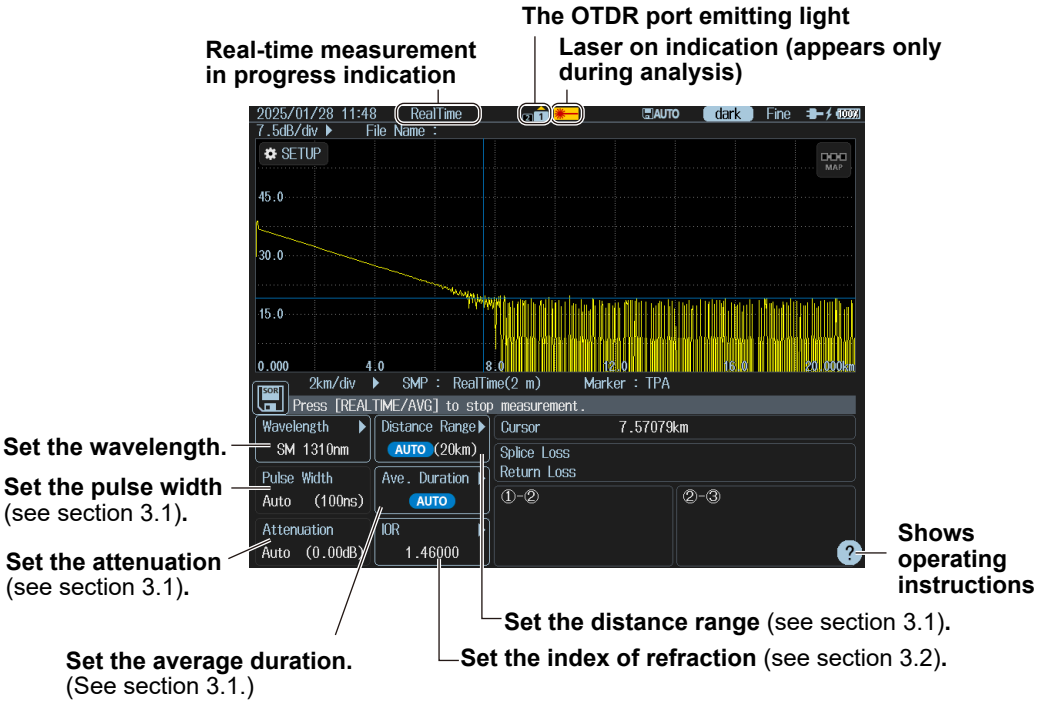



## Executing a real-time measurement

**5.** Press **REAL TIME**. A real-time measurement will begin.

During measurement, a mark appears at the top of the display to indicate that the laser light is on. The words “Check Point” appears at the cursor on the screen. Pressing REAL TIME again stops the measurement.

### Analysis results (TRACE screen)

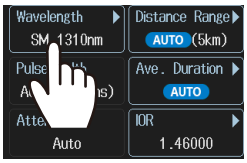



### *Note*

If distance range and pulse width are set to auto, the instrument automatically selects the optimal values internally immediately before starting a real-time measurement. Change these values if necessary. For details, see section 3.1.

## Setting expert mode (OTDR)

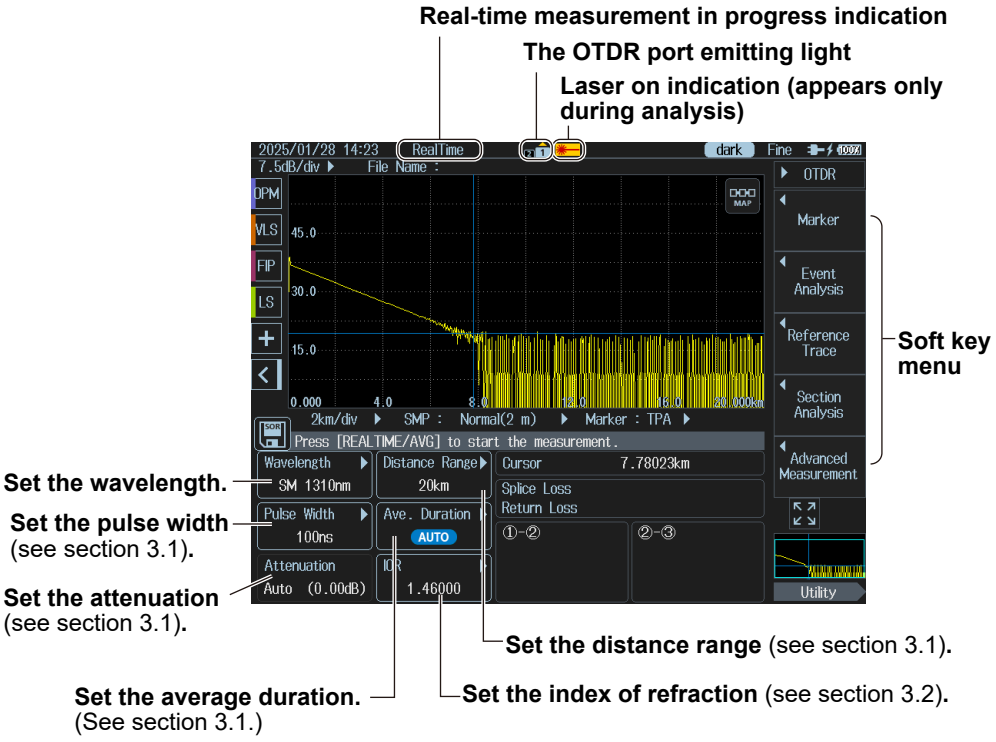
1. Press **MENU**. A MENU screen appears.
2. Tap the **OTDR** icon. A TRACE screen appears.
3. Tap **Wavelength** to set the wavelength.




## Executing a real-time measurement

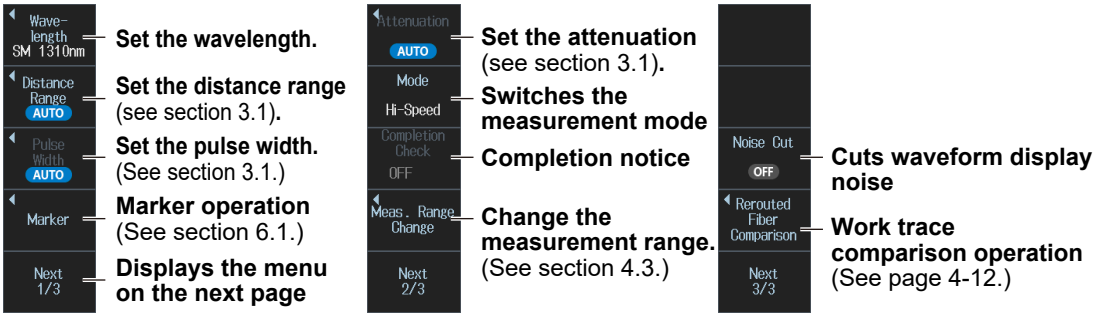
4. Press **REAL TIME**. A real-time measurement will begin.
   During measurement, a mark appears at the top of the display to indicate that the laser light is on. Pressing REAL TIME again stops the measurement.

### Analysis results (TRACE screen)

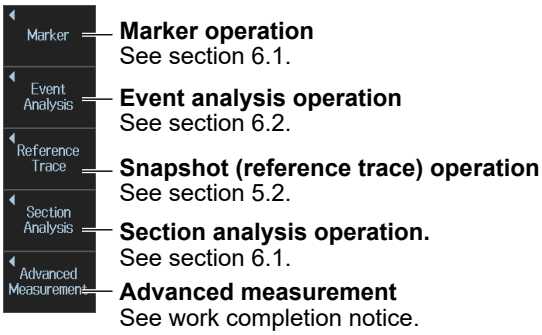



The menu that can be used during real-time measurement or the menu that can be used after real-time measurement is displayed automatically depending on the usage condition.

### Menu during real-time measurement




### Menu after real-time measurement

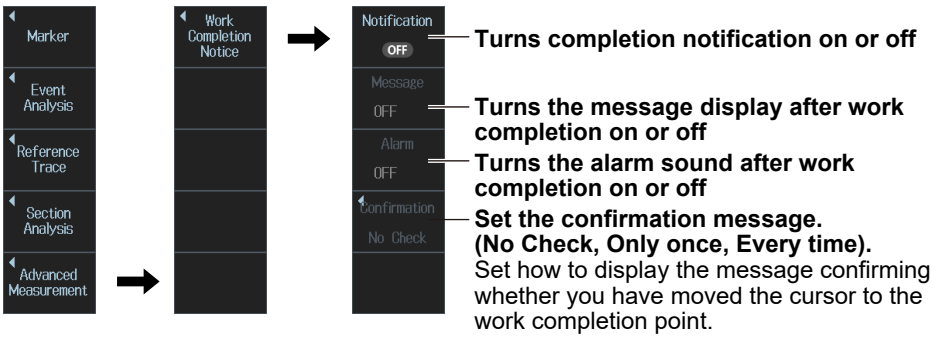



***Note***

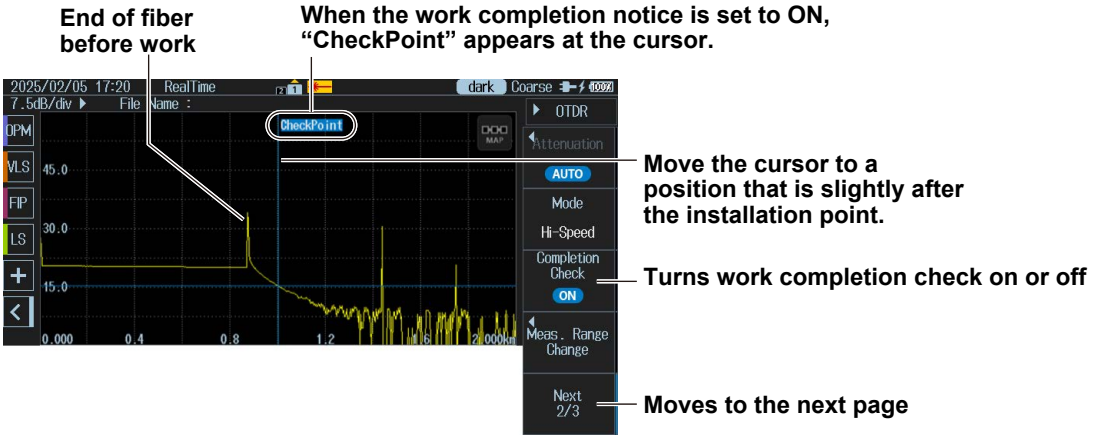
If distance range and pulse width are set to auto, the instrument automatically selects the optimal values internally immediately before starting a real-time measurement. Change these values if necessary. For details, see section 3.1.

## Work completion notice

1. Press **MENU**. A MENU screen appears.
2. Tap the **OTDR** icon. A TRACE screen appears.
3. Tap the **Advanced Measurement** soft key and then the **Work Completion Notice** soft key. The following screen appears.



4. Press **REAL TIME**. A real-time measurement will begin.
   During measurement, a mark appears at the top of the display to indicate that the laser light is on.
5. Tap the waveform display screen. A cursor appears at the tapped position.
   If Notification is set to ON, the word “CheckPoint” appears at the top area of the cursor.
6. Press the **Next** soft key and then the **Completion Check** soft key to select ON.
   When the measurement to the Check Point distance is complete, you are notified with a message or an alarm sound. The alarm sound turns off when you turn off the work completion check.




***Note***

You can perform measurements efficiently by moving the cursor to a position slightly after the installation point (depending on how fast the optical fiber cable will be installed). This is because the instrument notifies you of the work completion, which is your sign to measure the connection loss at that point (splice, connection, etc.). This setting is the same as the work completion notice in section 3.3.

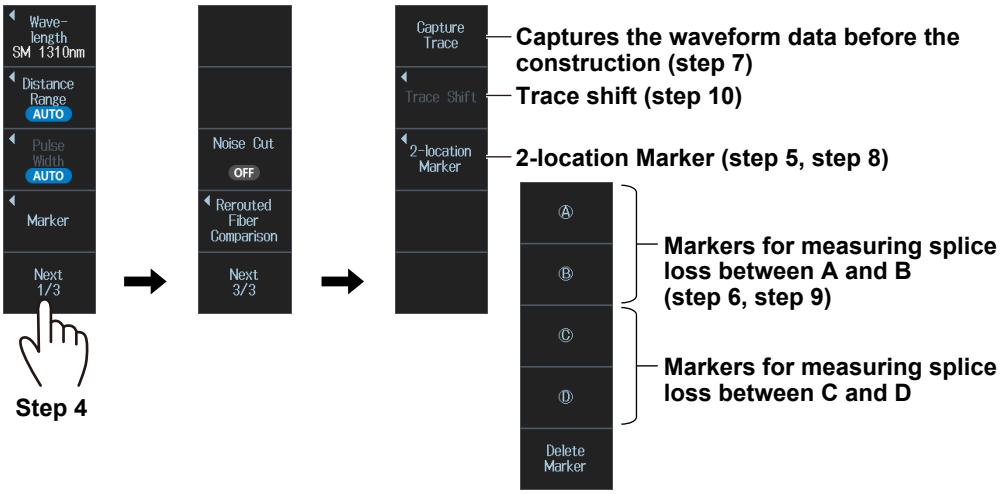
## Rerouting work

When installed optical fiber cables are moved because of road construction or other external factors (rerouting work), using this feature enables you to compare the event waveform before the construction to that after the construction. This makes it easy to check the presence of obstacles caused as a result of the rerouting work.

1. Press **MENU**. A MENU screen appears.
2. Tap the **OTDR** icon. A TRACE screen appears.
3. Press **REAL TIME**. A real-time measurement will begin.
   During measurement, a mark appears at the top of the display to indicate that the laser light is on. The words “Check Point” appears at the cursor on the screen.

**4.** Press the **Next** soft key and then the **Rerouted Fiber Comparison** soft key.

**During real-time measurement**



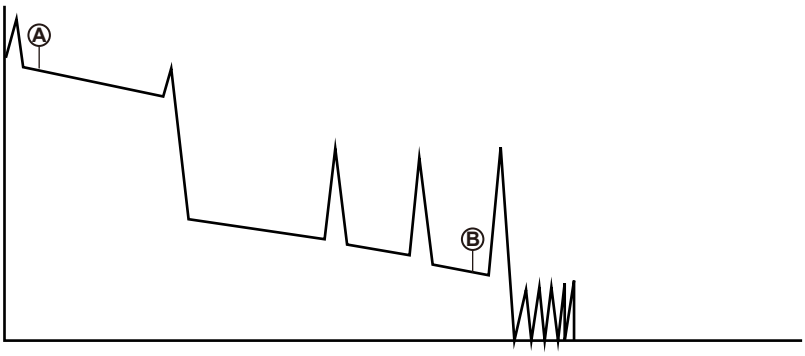

Step 4 to step 10 are the steps for the rerouting work explained in this section.

### Measuring the Connection Loss between the Measurement Start Point and Measurement Endpoint before the Construction

**5.** Press the **2-location Marker** soft key. A marker soft key menu appears for monitoring loss values.

**6.** Place the Ⓐ marker at the measurement start point and the Ⓑ marker at the measurement end point.

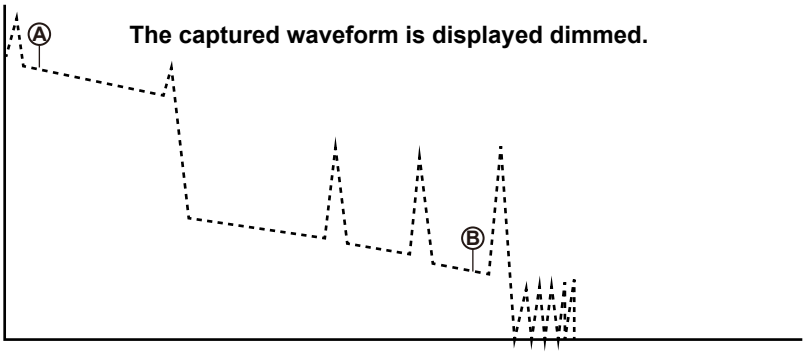
The connection loss between A and B is measured.



**Capture the waveform data before the construction**

***7.*** Press the **Capture Trace** soft key.

The waveforms displayed on the current screen are captured. Because markers are not captured, separately record the connection loss value between A and B before the construction.

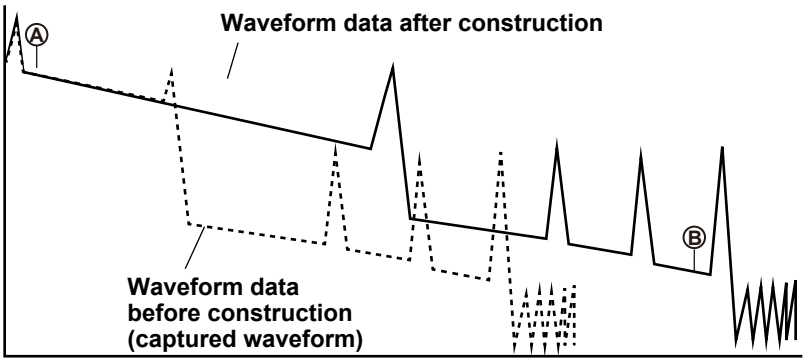



**Measuring the connection loss between the measurement start point and measurement end point after the construction**

***8.*** Press the **2-location Marker** soft key. A marker soft key menu appears for monitoring loss values (see the previous page).

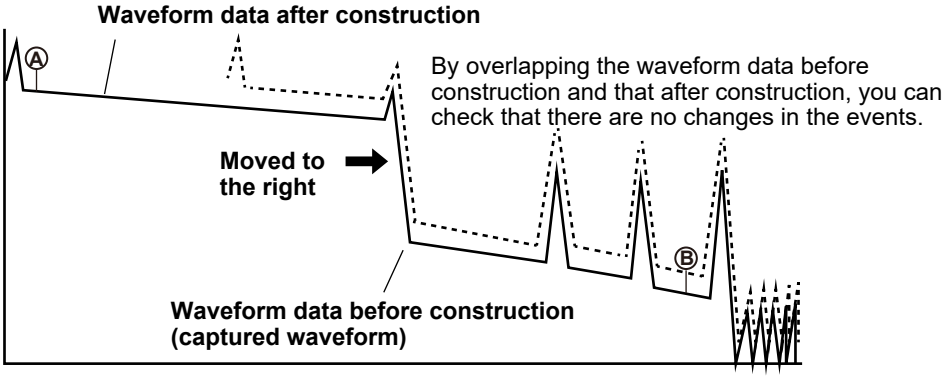
***9.*** Place the Ⓐ marker at the measurement start point and the Ⓑ marker at the measurement end point.

The connection loss between A and B is measured. Check that there are no problems in the connection loss value before the construction and the connection loss value after the construction.



**Comparing waveform data before the construction and after the construction**

***10.*** Press the **Trace Shift** soft key and then the **Trace Shift Right** soft key. The waveform data (captured waveform) before the construction moves to the right side of the screen. Use **Trace Shift Right** or **Trace Shift Left** depending on the differences in the start points before the construction and after the construction. In this example, because the distance between the start point and the end point after the construction is long, the waveform data before the construction is moved to the right side.




# 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 sections 3.2 and 6.1. For marker operation, see section 6.1.

## Distance range

With the auto setting, the instrument 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 3.1.

## 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 3.1.

## Attenuation

With the auto setting, an attenuation value is selected according to the distance range and the loss in the optical fiber cable being measured. If you want to set the attenuation value manually, select a value appropriate for the pulse width. For details on the attenuation value appropriate for the pulse width, see section 3.1.

## Switching the measurement mode

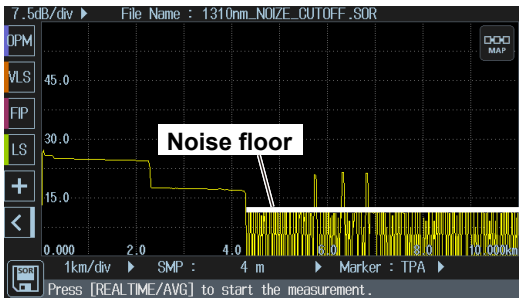
The real-time measurement waveform display updates the displayed waveform each time an optical fiber cable is measured. This update rate can be changed according to your application.

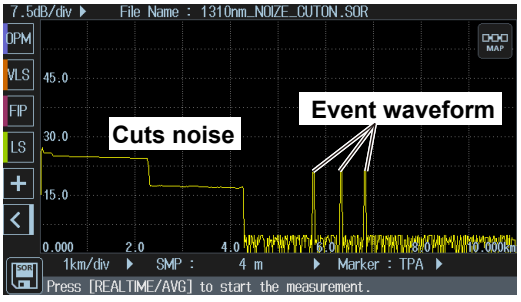
Hi-Speed: The quality of the displayed waveforms decreases slightly, but the waveform display is updated quickly. Reflections on the displayed waveform may saturate or may be buried in noise.

Hi-Reflection: The quality of the display waveforms is prioritized. Waveforms are displayed and updated with high precision.

## Cutting the waveform display noise

This feature removes noise at the far-end point.




## 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.

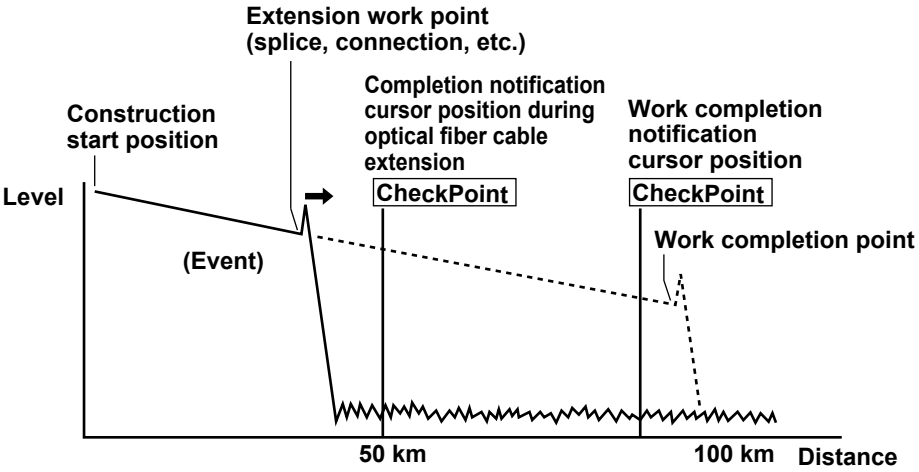
## Saving waveforms during real-time measurement

After real-time measurement, 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.

## Work completion notice

Before you check whether the work is complete, move the cursor slightly after the extension work point or before the work completion point on the optical fiber cable, and turn on the work completion notification.

When the fiber end detection position (the event) during real-time measurement is the same as the cursor position (CheckPoint), the instrument gives a notification (message indication and alarm sound) that the work is complete.




**Notification**

Turns on or off the work completion notice feature.

OFF: The work completion notice feature is disabled.

ON: The work completion notice feature is enabled.

**Notification (Message)**

OFF: Work completion is not notified with a message.

ON: Work completion is notified with a message.

**Notification (Alarm)**

OFF: Work completion is not notified with an alarm sound.

ON: Work completion is notified with an alarm sound.

**Confirmation**

No Check: A confirmation message is not displayed on the screen even if you press the Completion Check soft key.

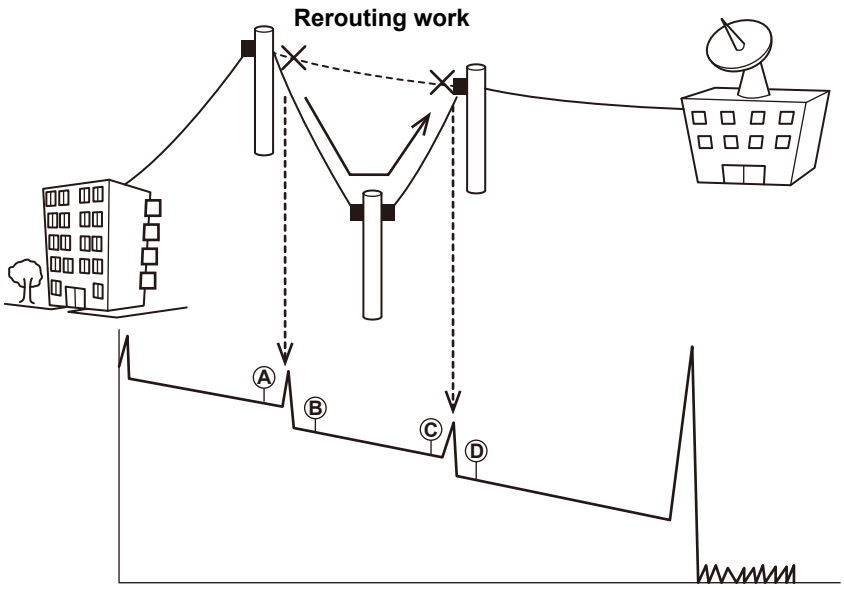
Check only once: A confirmation message is displayed on the screen the first time you press the Completion Check soft key.

Check everytime: A confirmation message is displayed on the screen every time you press the Completion Check soft key.

## Rerouting work

When installed optical fiber cables are moved because of road construction or other external factors (rerouting work), using this feature enables you to compare the event waveform before the construction to that after the construction. This makes it easy to check the presence of obstacles caused as a result of the rerouting work.

The markers of 2-location Marker are used to measure two sections as loss measurements for when the optical fiber cable is switched. The measurement of the two sections is performed the marker pairs Ⓐ and Ⓑ and the marker pairs Ⓒ and Ⓓ.



# 4.3 Performing High Resolution Measurement

When analyzing waveforms in real-time measurement, you can limit the range to be analyzed and measure at high resolution to obtain detailed measurements.

**WARNING**

- During measurement, light is transmitted from the instrument's light source ports. Do not disconnect the connected optical fiber cables. Visual impairment may occur if the light enters the eye.
- Close the covers of any light source ports that do not have optical fiber cables connected to them. Visual impairment may occur if light that is mistakenly emitted from these ports enters the eye.

**French**

**AVERTISSEMENT**

- Lorsque instrument 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'oeil.
- Couvrir les caches des ports de source lumineuse libres. Sur les modèles dotés de deux ports de source lumineuse ou plus, protéger les yeux contre l'émission accidentelle de lumière depuis le mauvais port.

## Procedure

### Executing a measurement

1. On the MENU screen, select **OTDR**.
2. Press **REAL TIME**.

   Measurement will start. The screen shows the measurement waveform, and the RealTime menu appears. A mark appears in the top area of the screen to indicate that the laser light is on.

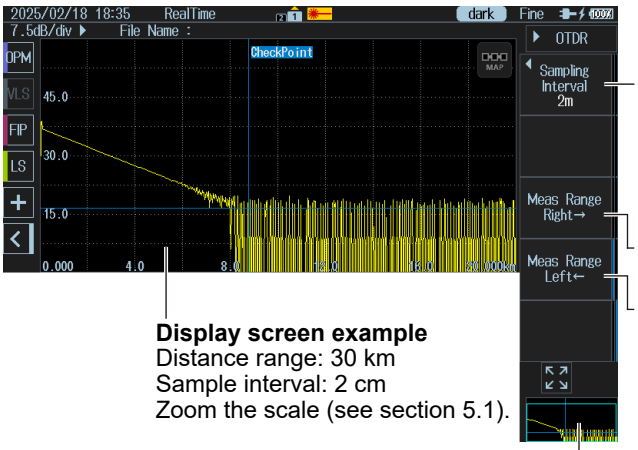
### Specifying the range

3. Press the **Next** soft key and then the **Meas.Range Change** soft key.
4. Turn the **rotary knob** to move the cursor to the center of the range you want to analyze.

## Setting the sampling interval

**5.** Press the **Sampling Interval** soft key to set the sampling interval.

The waveform measured at the specified sampling interval is displayed.




**Set the sample interval (Normal, High Reso., 2cm, 5cm, 10cm, 20cm, 50 cm, 1m, 2m, 4m, 8m, 16m, 32m)**

**Moves the current measurement scope to the right**

**Moves the current measurement scope to the left**

**Display screen example**
Distance range: 30 km
Sample interval: 2 cm
Zoom the scale (see section 5.1).

**Overview screen**
Shows the range displayed on the screen relative to the entire distance range.
White frame: Shows the range that can be displayed at the specified sampling interval
Blue frame: Shows the display range of the zoomed waveform display

### *Note*

The amount of measurement scope movement varies depending on the amount of cursor movement (see section 6.1).

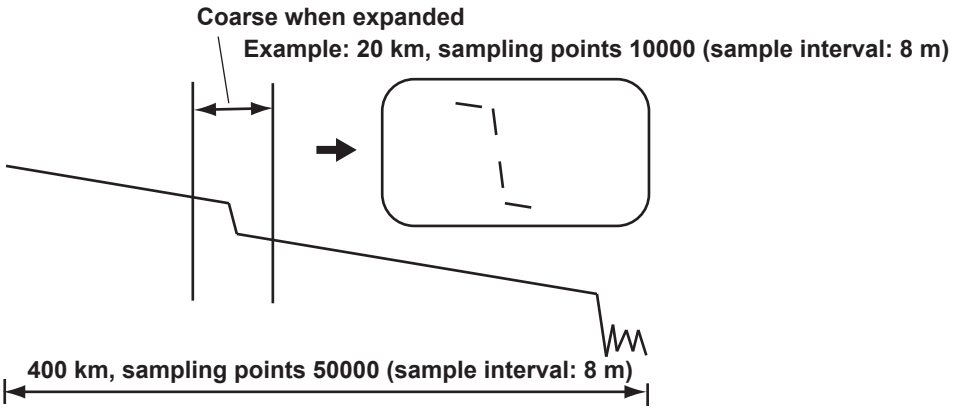
## Averaged measurement with Hi Resolution setting

If the sample interval is set to High Reso. in real-time measurement, averaged measurement can be performed with those conditions.

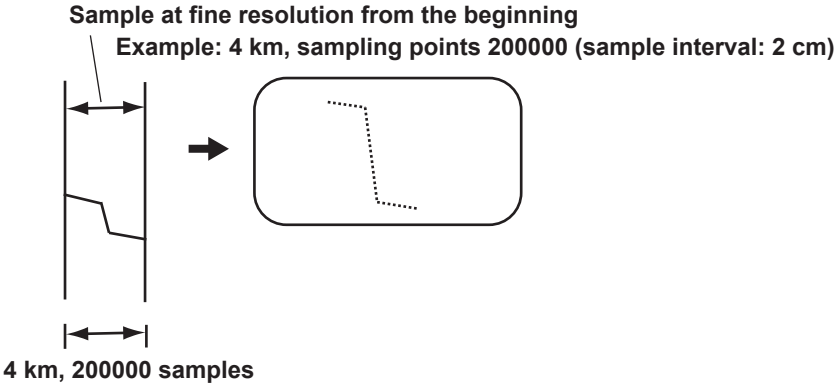
**6.** Press **AVG** to perform averaged measurement while maintaining the high-resolution conditions.

## Explanation

In normal measurement, the sampling interval is set so that data can be sampled at all distances according to the specified distance range. The maximum number of data sampled by this instrument is 256000 (when the distance range is 512 km).
Therefore, if the distance range is large (e.g., 400 km), the sampling interval becomes long, and events occurring between samples cannot be analyzed in detail. Waveform zooming explained in section 5.1 simply expands the measured results at the sampling resolution set for each distance range; it does not increase the resolution.




In high resolution measurement, you move the cursor to the location where you want to analyze in detail and set the sampling resolution. The sampling resolution that you can select here is all intervals regardless of the distance range. The measurement scope is determined by the selected sampling resolution with the cursor at the center. If there is no cursor, the left edge of the present measurement scope becomes the reference.



# 5.1 Zooming and Moving Displayed Waveforms

## Procedure

### Setting simple mode (Simple OTDR)

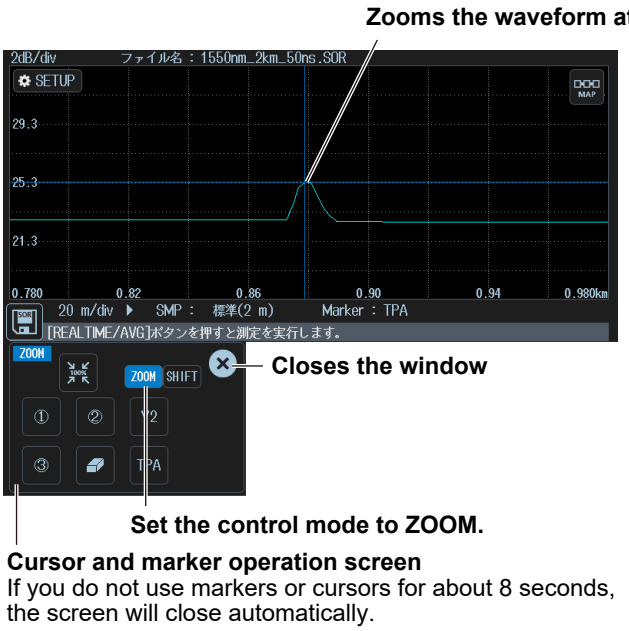
1. Press **MENU**. A MENU screen appears.
2. Tap the **Simple OTDR** icon. A simple OTDR setting list appears.
3. Tap the **TRACE/MAP** button to set the data display screen to TRACE mode.


4. 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 instrument.

### Zooming the displayed waveform

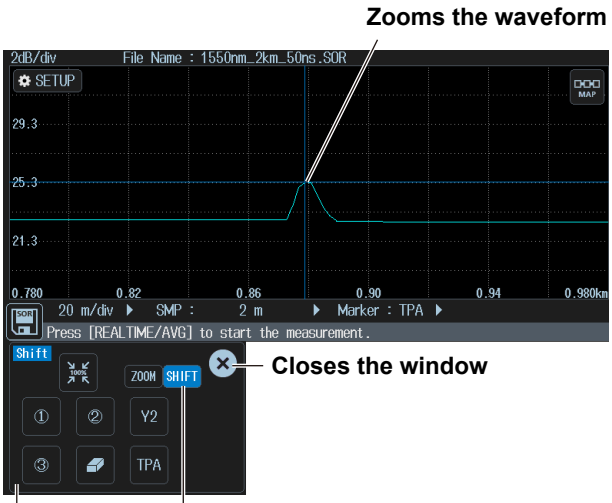
5. Display a cursor at the waveform position you want to zoom. An marker and cursor control screen appears. For the cursor operation procedure, see section 6.1.




6. Set the control mode to ZOOM, and press the **arrow keys**. The displayed waveform expands or contracts.

## Moving the displayed waveform

***5.*** Display a cursor at the waveform position you want to move. An marker and cursor control screen appears. For the cursor operation procedure, see section 6.1.




***6.*** Set the control mode to SHIFT, and press the **arrow keys**. The displayed waveform will move.

### *Note*

You can move zoom waveforms by dragging on the data display screen. Drag an area besides the waveform or cursor display area.

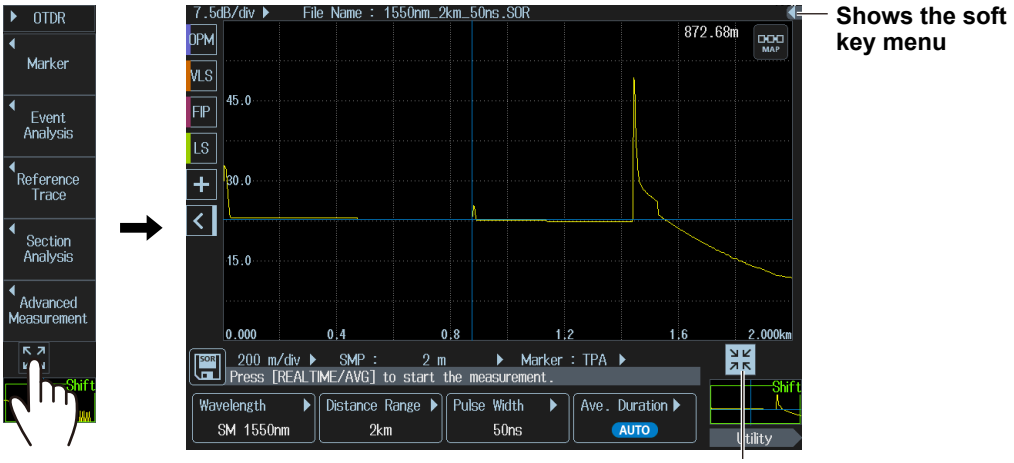
## Setting expert mode (OTDR)

1. Press **MENU**. A MENU screen appears.
2. Tap the **OTDR** icon. A TRACE screen appears.
3. 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 instrument.

## Expanding the data screen

4. Tap the data display screen expand button. The area for displaying the waveform data is expanded.

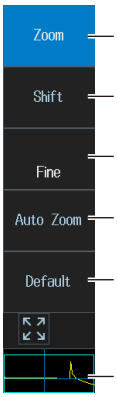



### *Note*

You can zoom waveforms without expanding the data display screen. Expand the data display screen if necessary.

## Zooming the displayed waveform

4. Press **SCALE**. A scale menu appears.




**Zoom in or out**
Pressing this soft key enables you to zoom in and out using the arrow keys.

**Move vertically or horizontally**
Pressing this soft key enables you to move using the arrow keys.

**Set the cursor movement resolution (Fine, Coarse).**
Set whether to move the cursor in fine steps or coarse steps.

**Auto zoom**
Automatically zooms in on the waveform at the cursor position.

**Initializes the display scale and position**

**Overview screen**
This indicates where in the entire waveform display area the currently displayed waveform area is.

5. Press the **Zoom** soft key.
6. Press the **arrow keys**. The displayed waveform expands or contracts.

## Moving the displayed waveform

5. Press the **Shift** soft key.
6. Press the **arrow keys**. The displayed waveform will move.

***Note***

You can move zoom waveforms by dragging on the data display screen. Drag an area besides the waveform or cursor display area.

# Explanation

## Zooming in and out

You can press the arrow keys to zoom the displayed waveform in or out.

When the cursor is displayed, the waveform is zoomed at the cursor position.

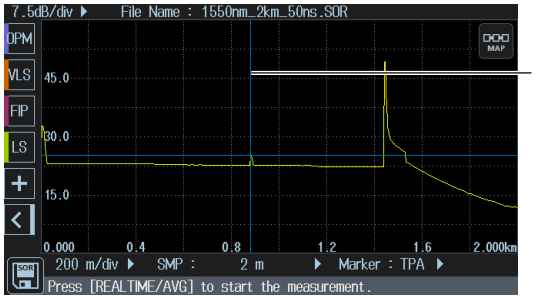
When the cursor is not displayed, the waveform is zoomed at the left edge of the display.

Down arrow key: Zoom in vertically on the waveform.

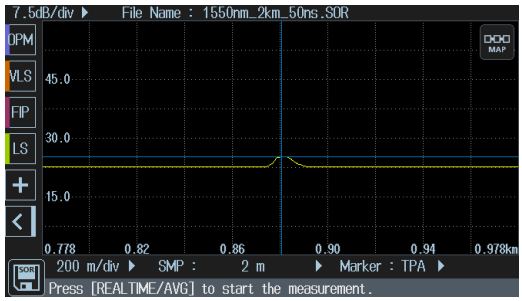
Up arrow key: Zoom out vertically of the waveform.

Left arrow key: Zoom in horizontally on the waveform.

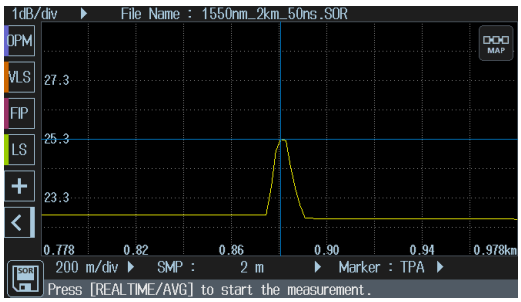
Right arrow key: Zoom out horizontally of the waveform.




**Cursor position**




**Press the left arrow key to zoom the displayed waveform horizontally.**




**Press the down arrow key to zoom the displayed waveform vertically.**

## Shifting the horizontal and vertical axes

You can move the screen by pressing the arrow keys.

Down arrow key: The screen moves down.

Up arrow key: The screen moves up.

Left arrow key: The screen moves left.

Right arrow key: The screen moves right.

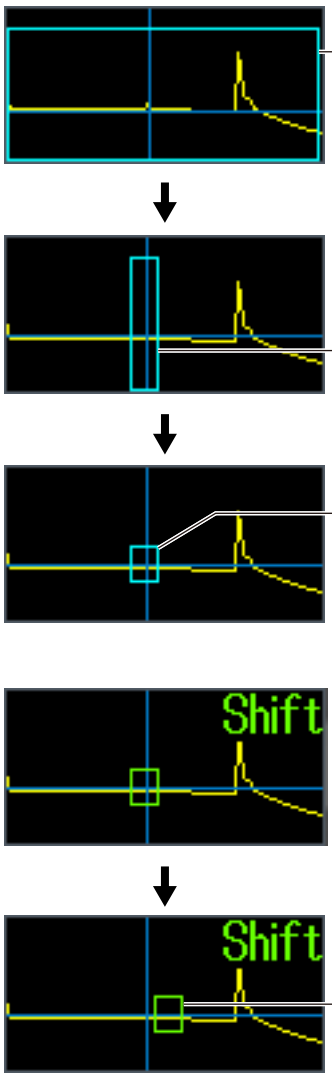
## Auto zoom

The auto zoom feature contains the following two types of zoomed displays.

- Zoom the waveform at the cursor position
  The cursor on the waveform display screen is shown in the center of the zoomed display.
- Zoom the waveform at event positions
  When the instrument has detected events during event analysis, the selected event is zoomed and displayed.

## Overview display

The overview display is linked to the zoomed waveform display. The blue box indicates where in the entire waveform display area the zoomed waveform display is showing.



**When the entire waveform is being displayed**
Everything within the box is displayed.

**When the display is zoomed horizontally**
The area shown within the box is zoomed and displayed in the waveform display area.

**When the display is then zoomed vertically**
The area shown within the box is zoomed and displayed in the waveform display area.




**When vertical or horizontal shift is selected**
“Shift” appears on the screen. The frame color turns green.

When you move the screen, the box that represents the display area also moves.

# 5.2 Displaying a Reference Trace

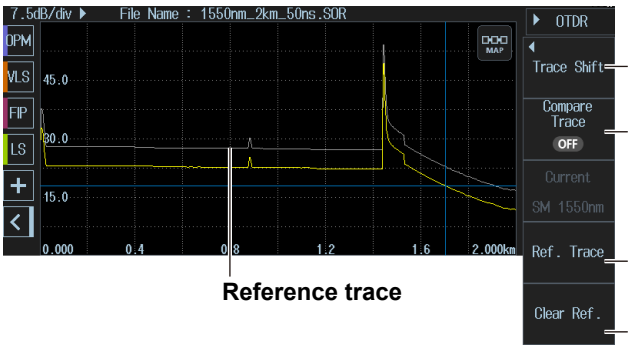
## Procedure

### Setting expert mode (OTDR)

1. Press **MENU**. A MENU screen appears.
2. Tap the **OTDR** icon. A TRACE screen appears.

### Reference trace screen

3. Display the waveform on the screen. Press the **Ref. Trace** soft key and then the Set Reference Trace soft key. The reference trace is displayed in white.




**Moves the reference trace**

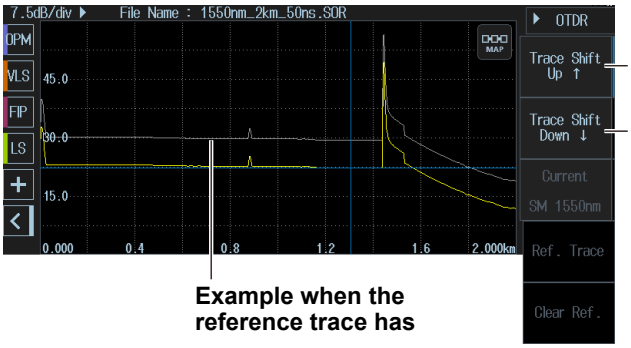
**Turns the trace on or off**

**Executes reference trace**

**Clears the reference trace**

### Moving the reference trace

1. Press the **Trace Shift** soft key.
2. Press the **Trace Shift Up** or **Trace Shift Down** soft key. The reference trace will move.




**Moves the reference trace up**

**Moves the reference trace down**

# Explanation

## Reference trace

You can also create a reference trace from waveforms that you load from files. By creating a reference trace before work, you will be able to check the work progress. For details on loading waveforms, see section 9.5.

## Comparing traces

The instrument displays the differential trace of the current waveform and reference trace.

# 6.1 Analyzing Waveforms

## Procedure

### Setting simple mode (Simple OTDR)

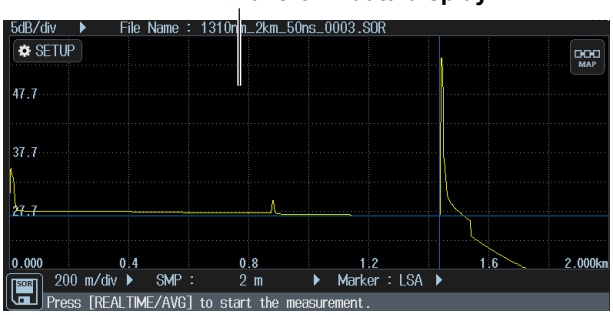
1. Press **MENU**. A MENU screen appears.
2. Tap the **Simple OTDR** icon. A simple OTDR setting list appears.
3. Tap **TRACE**. A TRACE screen appears.


**Note**

You can operate cursors and markers only in TRACE mode.

4. Press **REAL TIME**. A real-time measurement begins, and the data display screen shows the waveform.

**Waveform data display**

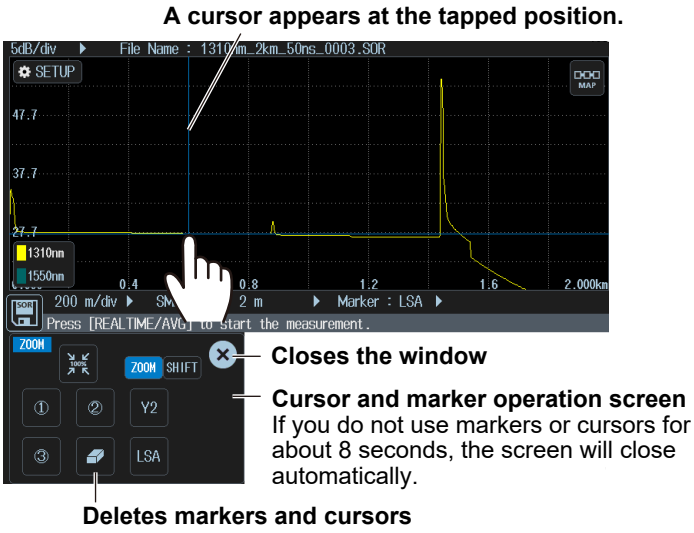



**Note**

- For instructions on how to use real-time measurement, see section 4.2.
- You can use cursors and markers also when you load waveform data from a USB memory device, microSD memory card, or internal memory. For instructions on how to load waveform data, see section 9.4.

## Displaying the cursor

***5.*** Turn the rotary knob, or tap the data display screen. A cursor appears.

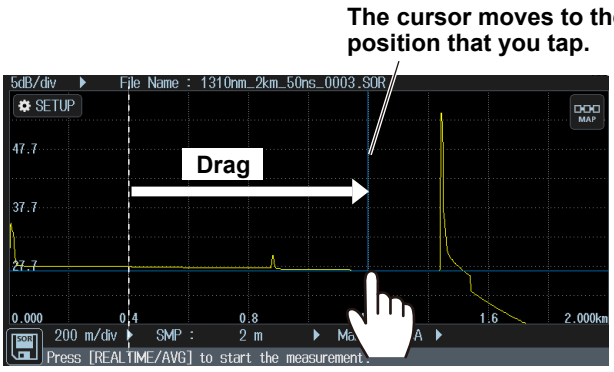



### *Note*

When you turn the rotary knob to the right, a cursor appears at the left edge of the data display screen.

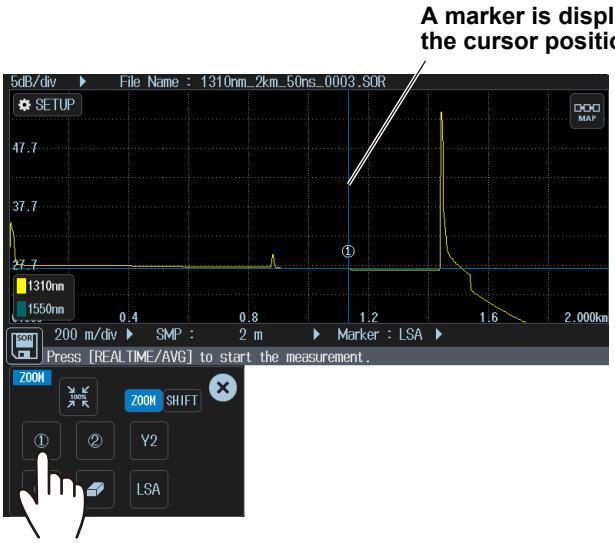
## Moving the cursor

***6.*** Tap the position on the data display screen that you want to move the cursor to. The cursor moves to the position that you tapped. You can also move the cursor by dragging the cursor on the data display screen or by turning the rotary knob. By pressing the rotary knob, you can set the amount the cursor moves when the rotary knob is turned. For details, see “Explanation” in this section.



# Marker operation (4 Point Markers)

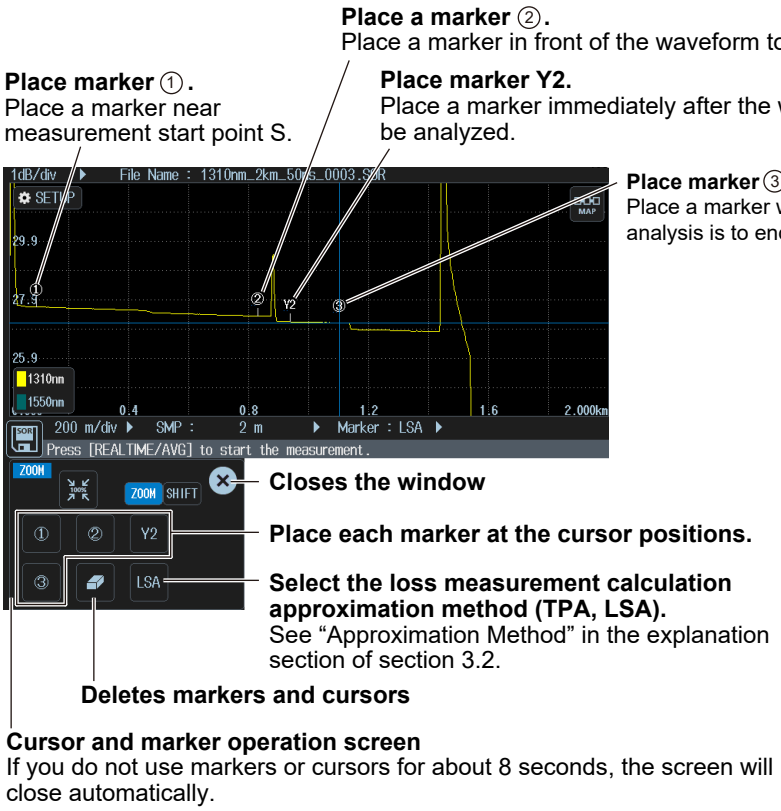
***7.*** Tap a marker button. The selected marker is displayed at the cursor position.




## Setting markers on a waveform

Set four markers in order starting from the position closest to measurement reference point S (example of 4 point markers).

For details on how to perform waveform analysis using markers, see the explanation.



### 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 ② marker to the correct position. The splice loss changes greatly depending on the position of ②.
- For details on the approximation method, see “Approximation Method” in section 3.2.

### Marker analysis results

Splice loss and return loss values are displayed on the screen as marker analysis results. (The reflection level is displayed if Reflection term is set to Reflection level (see section 3.3).)

For the analysis procedure of splice loss and return loss, see the explanation.

## Setting expert mode (OTDR)

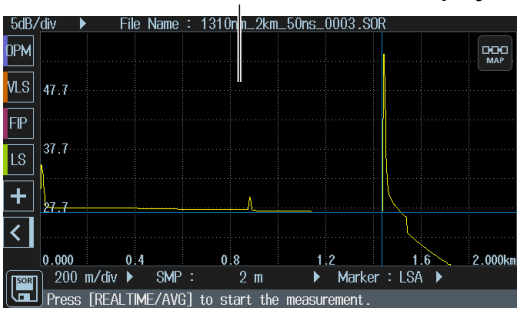
1. Press **MENU**. A MENU screen appears.
2. Tap the **OTDR** icon. A TRACE screen appears.

### Note

You can operate cursors and markers only in TRACE mode.

3. Press **REAL TIME**. A real-time measurement begins, and the data display screen shows the waveform.

**Waveform data display**

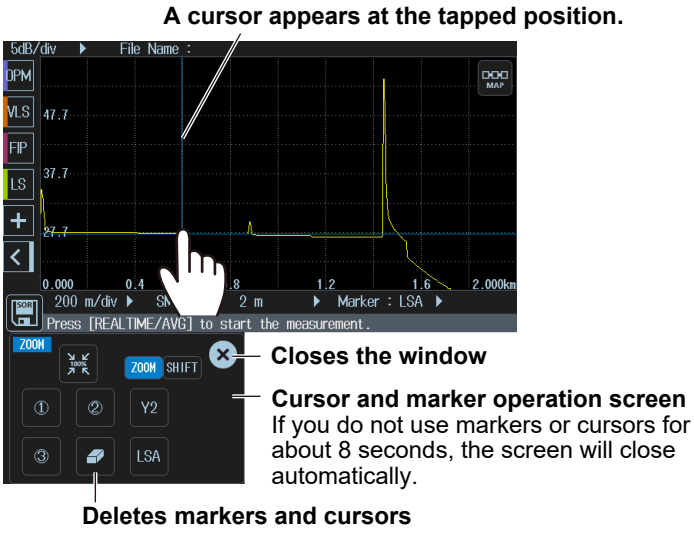



### Note

- For instructions on how to use real-time measurement, see section 4.2.
- You can use cursors and markers also when you load waveform data from a USB memory device, microSD memory card, or internal memory. For instructions on how to load waveform data, see section 9.4.

## Displaying the cursors

***4.*** Turn the rotary knob, or tap the data display screen. A cursor appears.

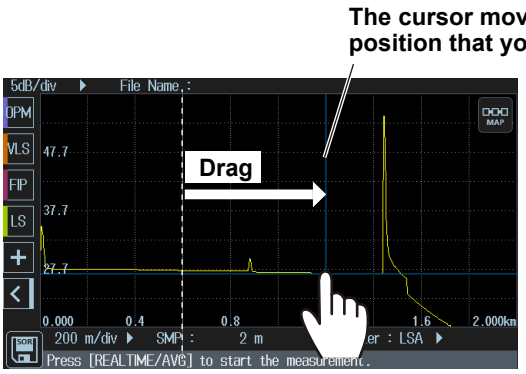



### *Note*

When you turn the rotary knob to the right, a cursor appears at the left edge of the data display screen.

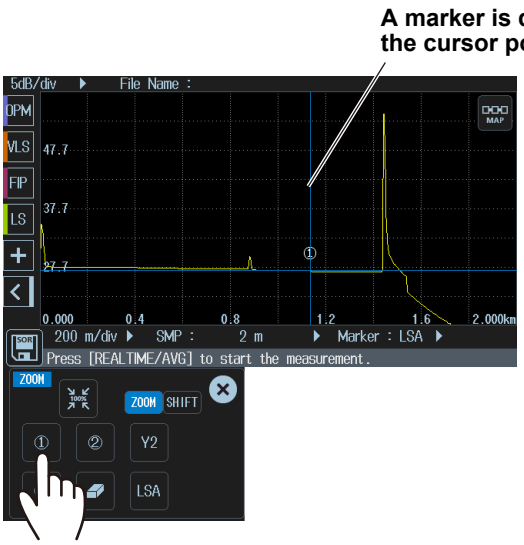
## Moving the cursor

***5.*** Tap the position on the data display screen that you want to move the cursor to. The cursor moves to the position that you tapped. You can also move the cursor by dragging the cursor on the data display screen or by turning the rotary knob. By pressing the rotary knob, you can set the amount the cursor moves when the rotary knob is turned. For details, see “Explanation” in this section.



# Marker operation (4 Point Markers)

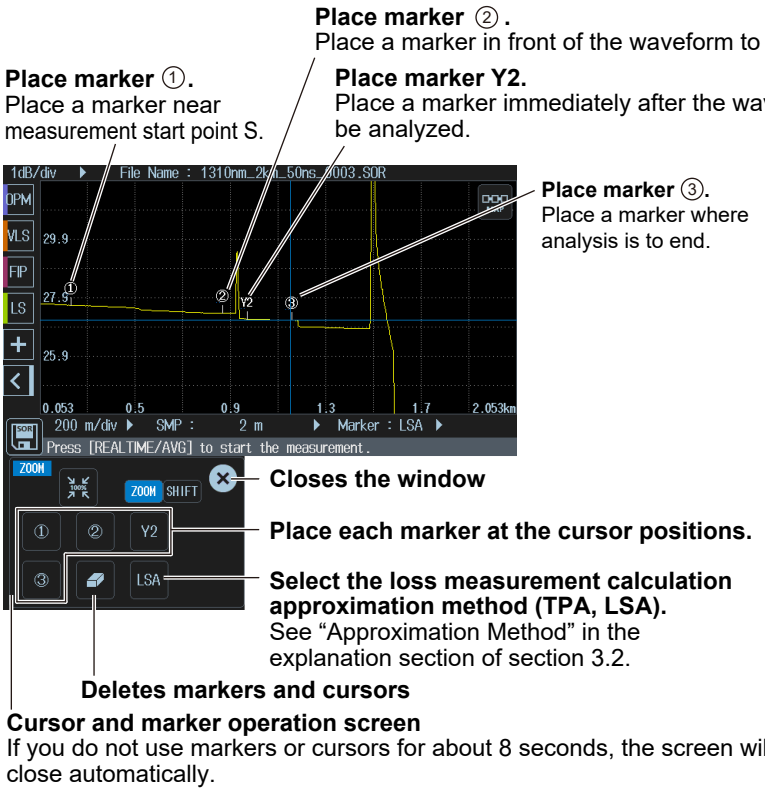
***6.*** Tap a marker button. The selected marker is displayed at the cursor position.




## Setting markers on a waveform

Set four markers in order starting from the position closest to measurement reference point S (example of 4 point markers).

For details on how to perform waveform analysis using markers, see the explanation.



## 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 ② marker to the correct position. The splice loss changes greatly depending on the position of ②.
- For details on the approximation method, see “Approximation Method” in section 3.2.
- For details on how to use 2 Point Markers, 5 Point Markers, 6 Point Markers, see “Soft Key Menu (Markers).”

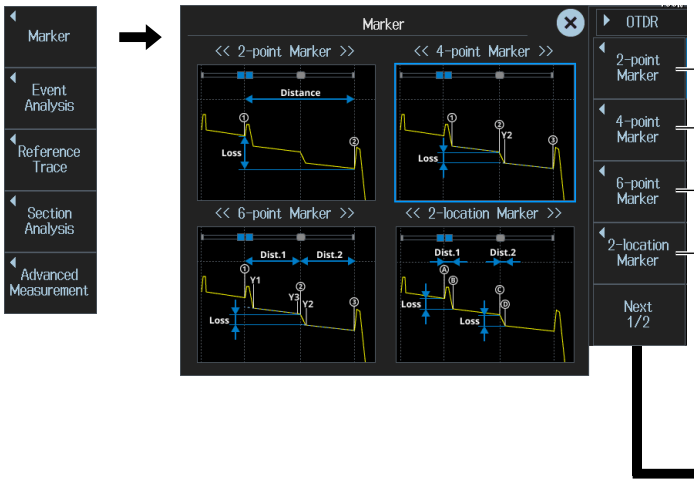
### Marker analysis results

Splice loss and return loss values are displayed on the screen as marker analysis results. (The reflection level is displayed if Reflection term is set to Reflection level (see section 3.3).)

For the analysis procedure of splice loss and return loss, see the explanation.

***7.*** Press the **Marker** soft key. A marker soft key menu appears.

**When marker mode is set to Marker (see section 3.3)**




**2 Point Markers**
Switches to the screen for measuring with 2 Point markers. For details, see the explanation.

**4 Point Markers**
Switches to the screen for measuring with 4 Point markers. For details, see the explanation.

**6 Point Markers**
Switches to the screen for measuring with 6 Point markers. For details, see the explanation.

**2-location Marker**
Place markers on the waveform data and monitor the loss between S and E and analysis values of up to two events. See page 6-11.

**Preset markers**
Register markers that you set in advance, and apply them on waveforms during measurement when necessary.

**Auxiliary function**
Displays a menu used to set and clear the distance reference and clear markers and cursors. See page 6-8.

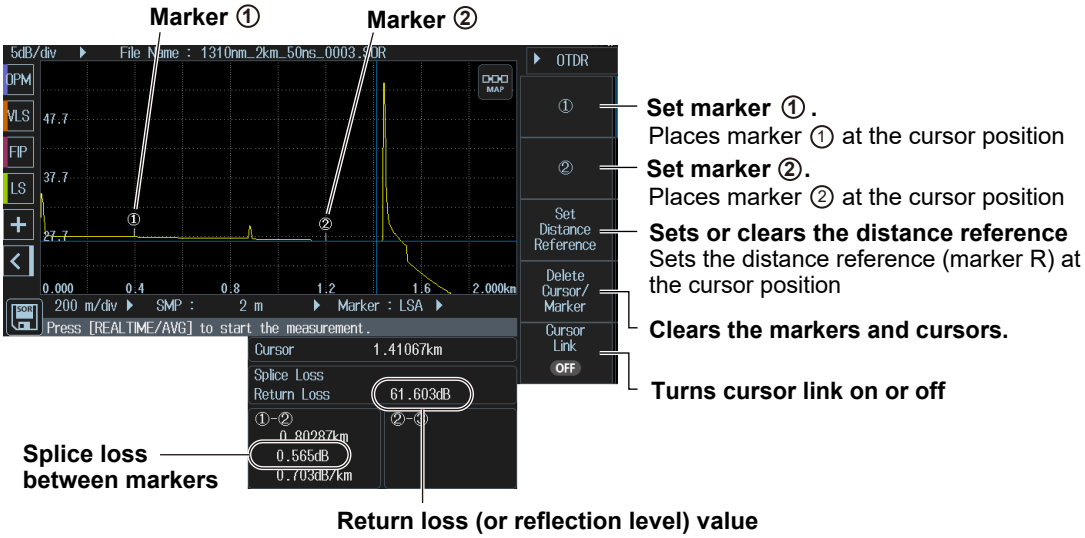
**When marker mode is set to Line (see section 3.3)**


**2 Point Markers**
Switches to the screen for measuring with 2 Point markers. For details, see the explanation.

**5 Point Markers**
Switches to the screen for measuring with 5 Point markers. For details, see the explanation.

### 2 Point Markers (when the marker mode is Marker)

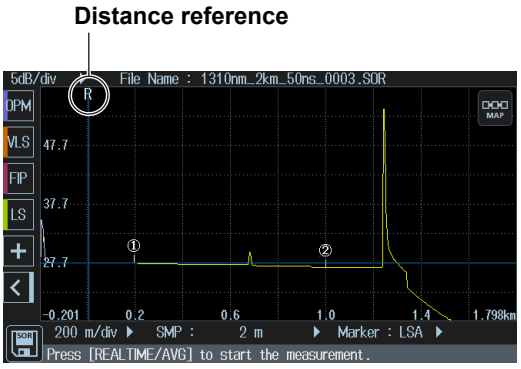
*8.* Press the **2 Point Markers** soft key. A soft key menu for the 2 markers method appears.




## *Note*

- When you set the markers, set them so that the ① marker is on the measurement start point (distance reference) side.
- The measured loss value differs depending on the specified approximation method.

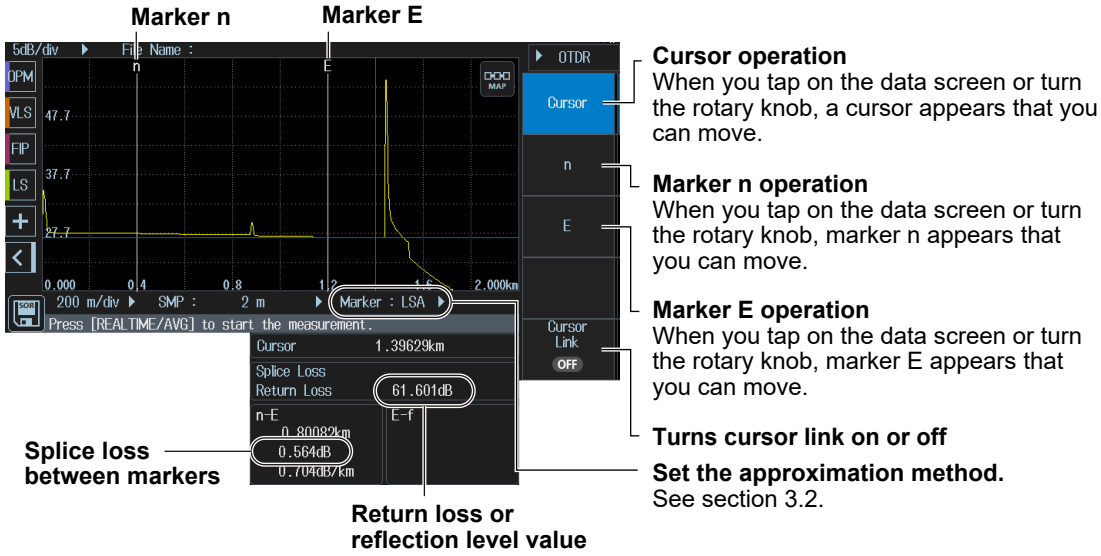
- **Distance reference**
  Normally, the location where the instrument and the optical fiber cable are connected is the measurement reference point. This reference point is the distance reference. It is used to calculate the distance to the cursor and markers. If you are using a launch fiber to perform measurements, move the distance reference the length of the launch fiber before performing measurements.




- **Cursor link (Moving all markers together)**
  You can move all markers while maintaining the distance between them.

### 2 Point Markers (when the marker mode is Line)

***8.*** Press the **2 Point Markers** soft key. A soft key menu for the 2 markers method appears.

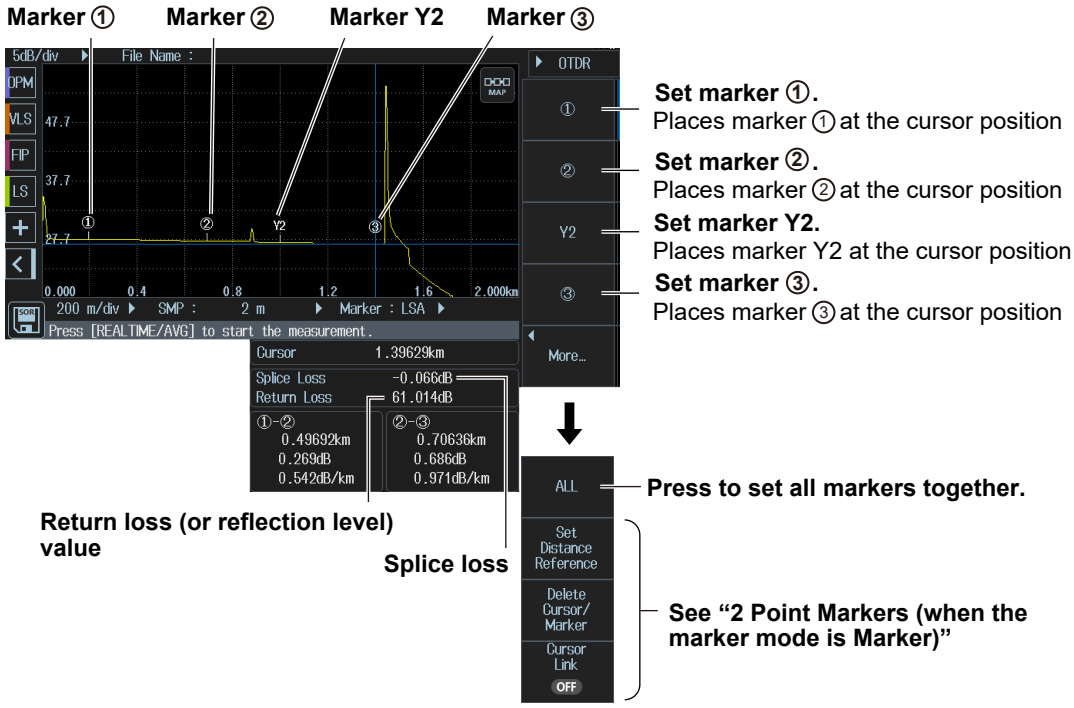



## *Note*

- When you set the markers, set them so that the n marker is on the measurement start point (distance reference) side.
- The measured loss value differs depending on the specified approximation method.

### 4 Point Markers (when the marker mode is Marker)

***8.*** Press the **4 Point Markers** soft key. A soft key menu for the 4 markers method appears.

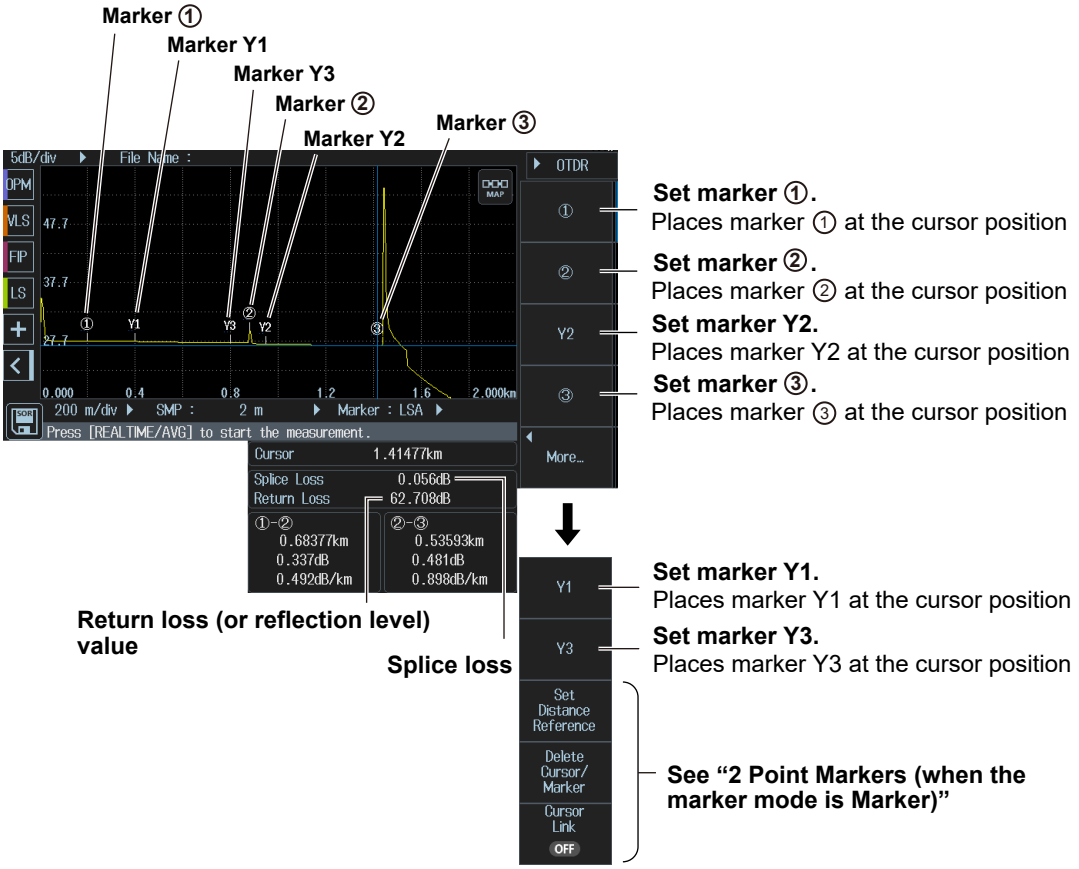


## Note

- Set the markers in the order shown above, starting with the measurement start point (the distance reference).
- The measured loss value differs depending on the specified approximation method.
- Set the ② marker to the correct position. The splice loss changes greatly depending on the position of ② .

### 6 Point Markers (when the marker mode is Marker)

***8.*** Press the **6 Point Markers** soft key. A soft key menu for the 6 markers method appears.

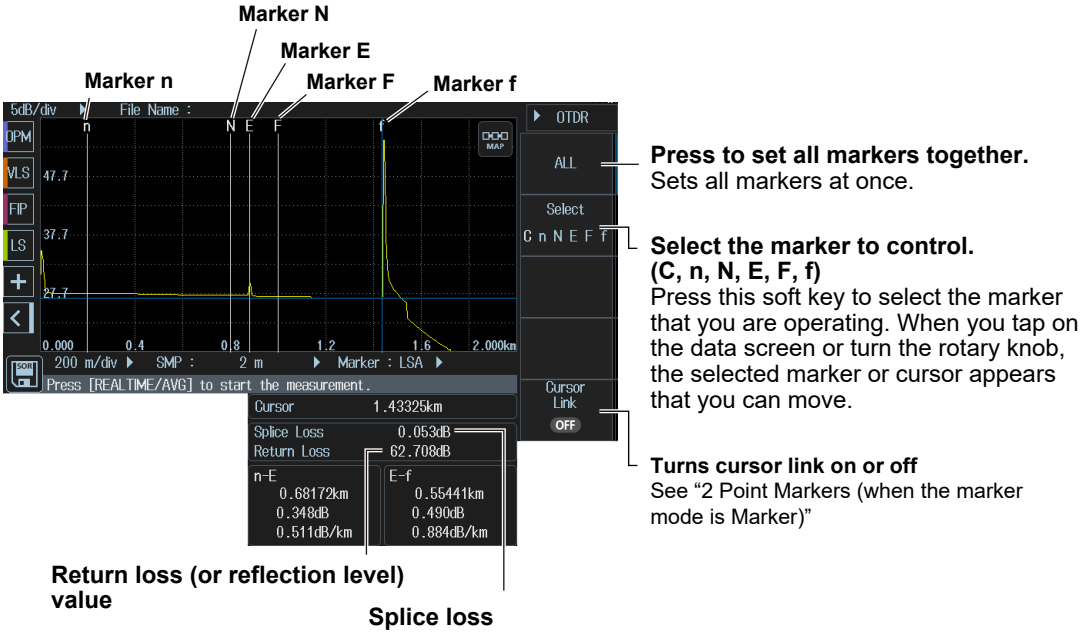



## Note

- Set the markers in the order shown above, starting with the measurement start point (the distance reference).
- The measured loss value differs depending on the specified approximation method.
- Set the ② marker to the correct position. The splice loss changes greatly depending on the position of ② .

### 5 Point Markers (when the marker mode is Line)

*8.* Press the **5 Point Markers** soft key. A soft key menu for the 5 markers method appears.

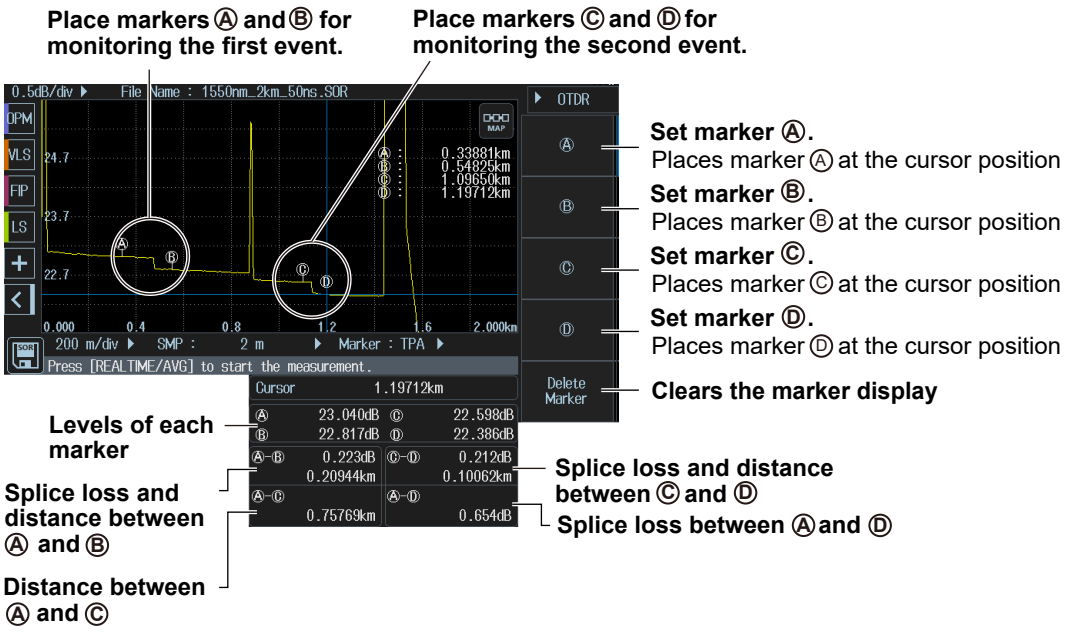



## *Note*

- Set the markers in the order shown above, starting with the measurement start point (the distance reference).
- The measured loss value differs depending on the specified approximation method.
- Set marker E to the correct position. The splice loss changes greatly depending on the position of E.

### 2-location Marker (splice loss at two locations) (when the marker mode is Line)

*8.* Press the **2-location Marker** soft key. A 2-location Marker soft key menu appears.



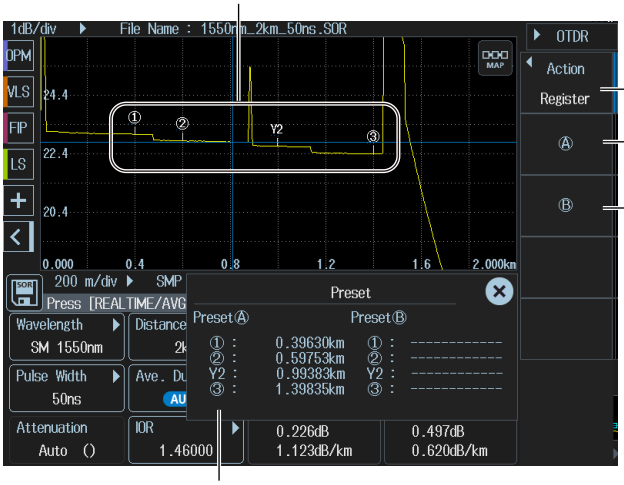
### Presetting markers

***7.*** Using 2 Point Markers, 4 Point Markers, or 6 Point Markers, place markers on the waveform data.

***8.*** Press the **Preset** soft key. A preset soft key menu appears.

**Select the action (Register, Delete, SetMarker)**
Select the action to perform when you tap the Ⓐ or Ⓑ soft key.
Register: Registers the markers on the current waveform data to preset A or preset B.
Delete: Deletes the markers registered in preset A or preset B.
SetMarker: Displays the markers registered in preset A or preset B on the waveform.

**Registers the markers (e.g., 4 Point Markers) on the current waveform data.**




**Executes the action on preset A**

**Executes the action on preset B**

**Displays the information of the markers registered in the preset.**

- **Registering markers**

***9.*** Press the **Action** soft key to select **Register**.

***10.*** Press the Ⓐ or Ⓑ soft key. The markers applied to the waveform are registered, and the marker information is displayed on the preset information display screen.

- **Setting the markers registered in preset A or preset B**

***11.*** Display the measurement target waveform data on the data display screen.

***12.*** Press the **Action** soft key to select **SetMarker**.

***13.*** Press the Ⓐ or Ⓑ soft key. The markers registered in preset A or preset B are displayed on the waveform data.

***Note***

Preset markers exceeding the distance range of the waveform display cannot be applied.

- **Deleting the markers registered in preset A or preset B**

***9.*** Press the **Action** soft key to select **Delete**.

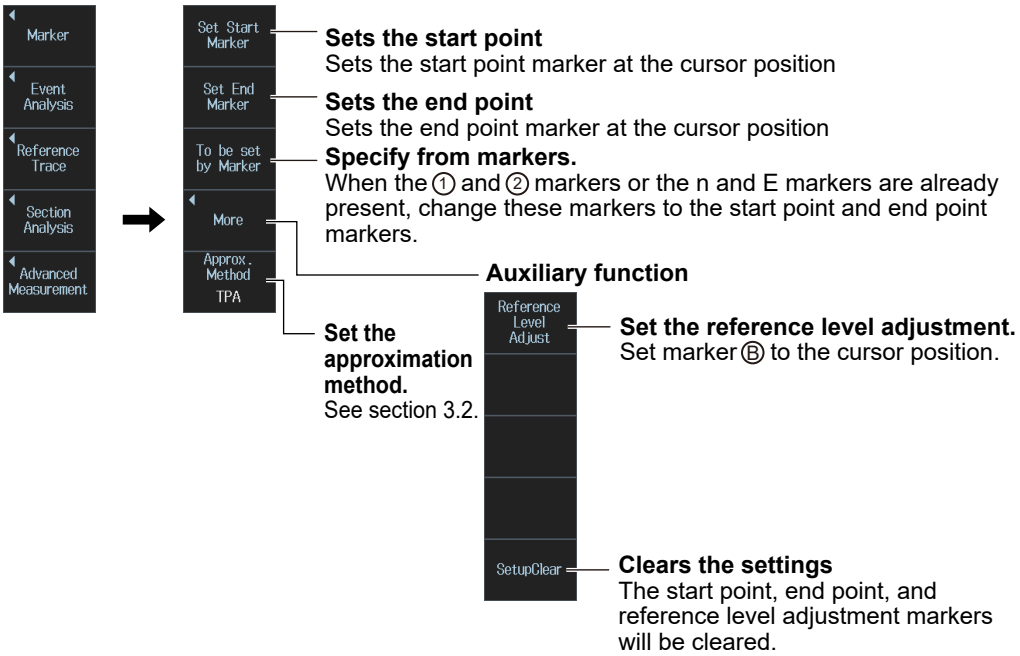
***10.*** Press the Ⓐ or Ⓑ soft key. The markers registered in preset A or preset B are deleted.

***Note***

A marker applied to the waveform is not cleared. To delete markers set on the waveform, press the Delete Cursor/Marker soft key. See page 6-8.

## Analyzing sections

***4.*** Press the **Section Analysis** soft key. A section analysis soft key menu appears.



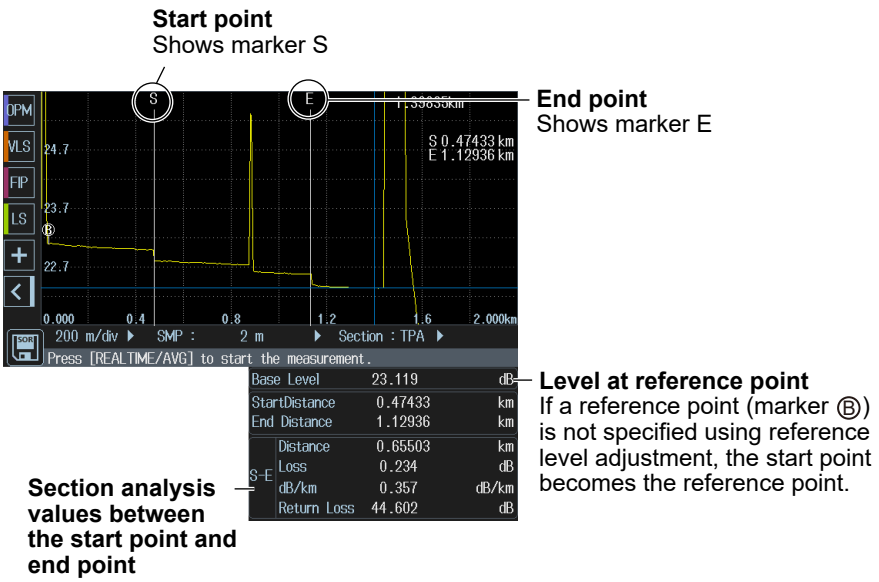

### Setting the start and end points

***5.*** Move the cursor to the start point position. For the cursor operation procedure, see section 6.1.

***6.*** Press the **Set Start Marker** soft key. Shows marker S.

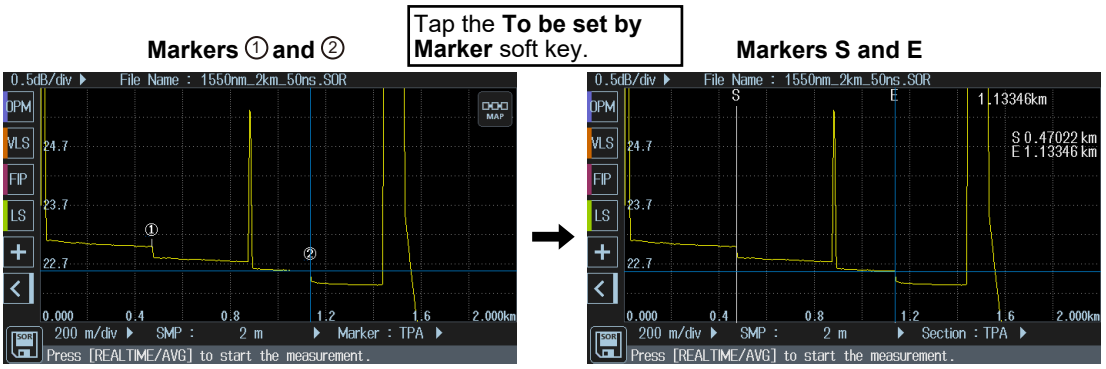
***7.*** Move the cursor to the end point position.

***8.*** Press the **Set End Marker** soft key. Shows marker E



### Setting the Start or End Point to a Set Marker (①, ②, n, or E)

***5.*** Press the **To be set by Marker** soft key. The position of marker ① or n already set on the waveform data changes to a start point and the position of marker ② or E changes to an end point.

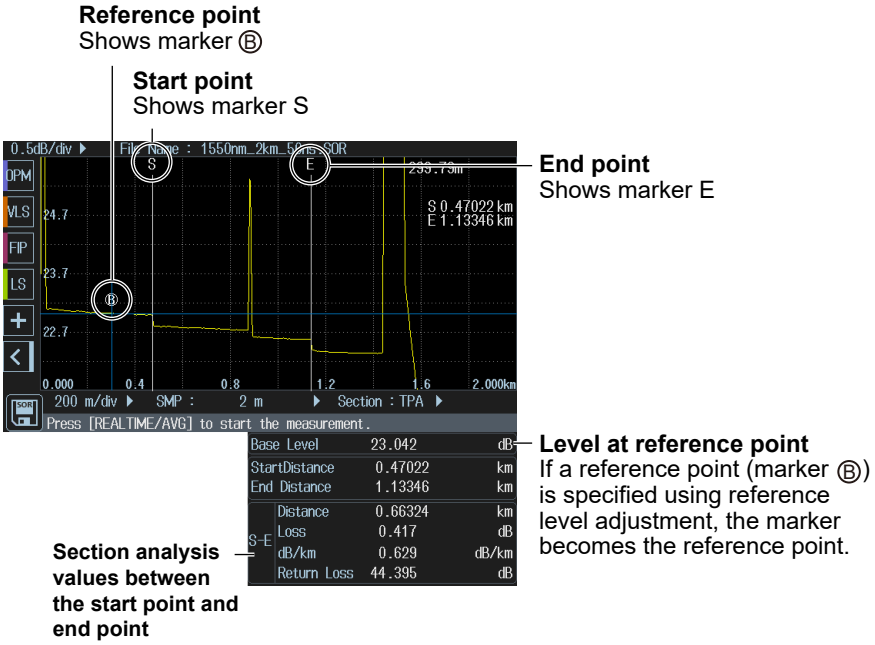



## *Note*

For details on how to set markers ①, ②, n, and E, see section 6.1.

### Adjusting the reference level

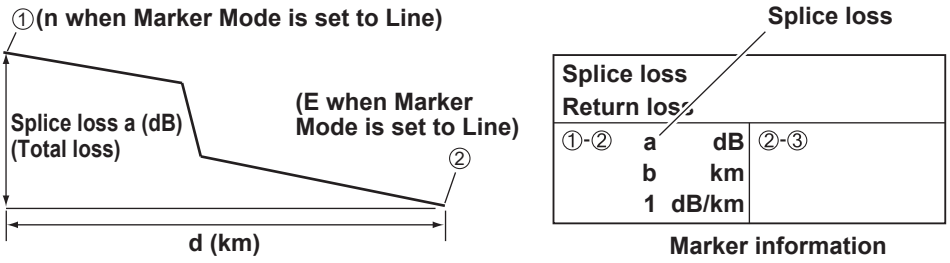
***9.*** Press the **Auxiliary Function** soft key and then the **Reference Level Adjust** soft key. Marker Ⓑ appears.



# Explanation

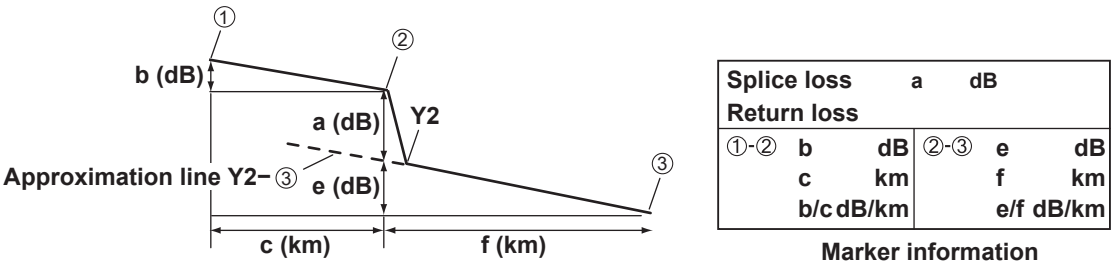
## 2 Point Markers

The instrument measures the distance and the loss between two points. If reflection is detected between the two points, the return loss is also measured. The splice loss value changes depending on the approximation method that you have specified. This can be used when Marker Mode is set to Marker or Line.



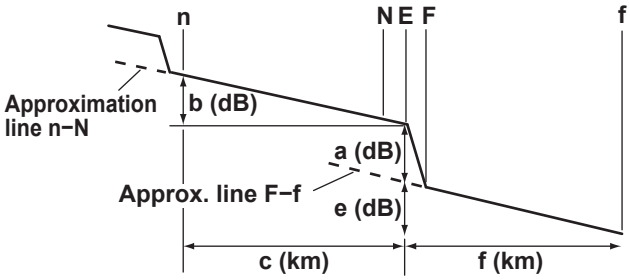

## 4 Point Markers (when the marker mode is Marker)

The instrument 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 approximation line ②−① and the approximation 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.



## 5 Point Markers (when the marker mode is Line)

The instrument uses the following five points to perform the measurement: the near-end point (n), a point (N) that is used to calculate the near-end side's approximation line, a point (E) where splice loss is detected, a point (F) that is used to calculate the far-end side's approximation line, and the far-end point (f). At position E, the level difference between the approximation line n−N and the approximation line F−f is calculated as the splice loss. The splice loss changes greatly depending on the position of E. Set the correct position for E. 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 Line.

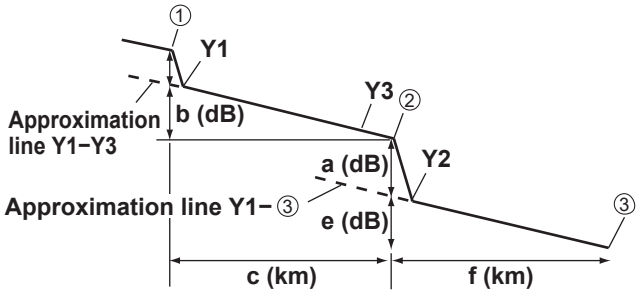



| Splice loss | a | dB | | | |
|---|---|---|---|---|---|
| Return loss | | | | | |
| n-E | b | dB | E-f | e | dB |
| | c | km | | f | km |
| | b/c | dB/km | | e/f | dB/km |

Marker information

## 6 Point Markers (when the marker mode is Marker)

The instrument measures using the 6-point method when there are two adjacent splice loss events. The instrument uses the following six points to perform the measurement: the first splice loss start point ①, start point Y1 used to calculate the approximation line, end point Y3 used to calculate the approximation line, the second splice loss start point ②, the second splice loss end point Y2, and the measurement end point ③. At the position of marker ②, the level difference between the approximation line Y1−Y3 and the approximation line Y2−③ is calculated as the splice loss.




| 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

## Setting the amount that the cursor moves

Press the rotary knob to set whether to move the cursor in coarse steps or fine steps. Tap the screen to set the cursor to move in fine steps.

COARSE: The cursor moves a large amount.

FINE: The cursor moves a small amount.

The amount that the cursor is set to move is displayed in the upper right of the screen.

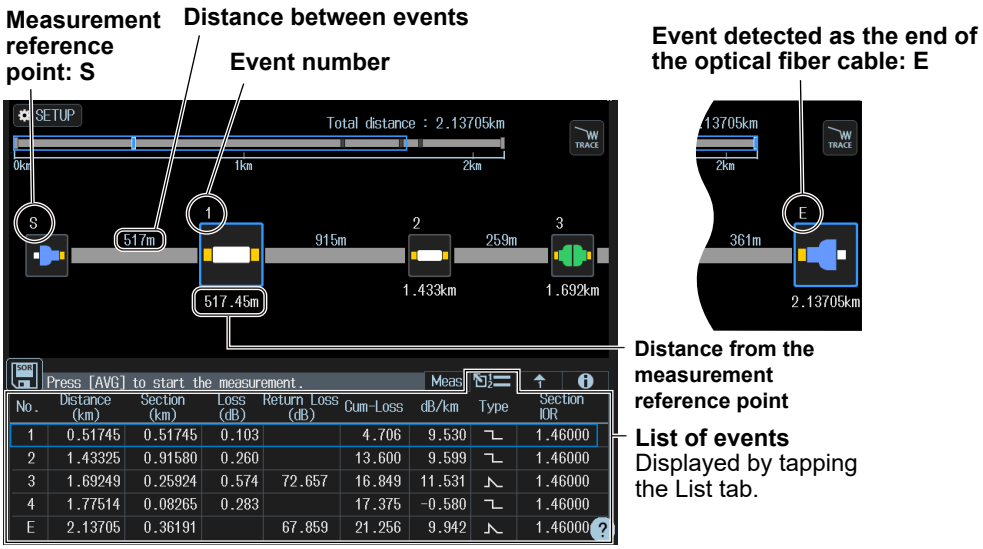
**Amount of cursor movement**

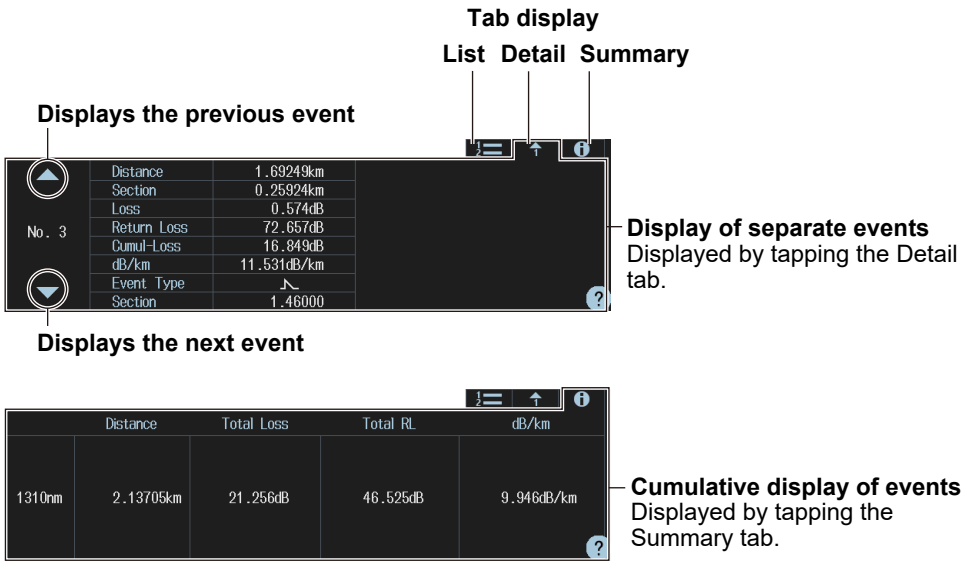
# 6.2 Analyzing Events

## Procedure

### Setting simple mode (Simple OTDR)

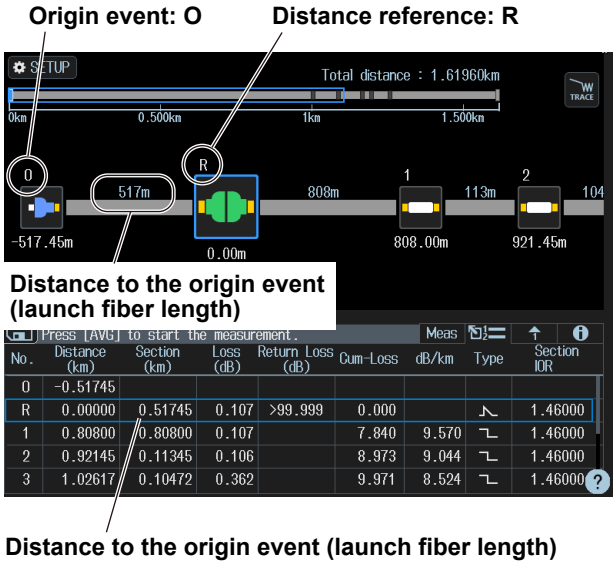
1. Press **MENU**. A MENU screen appears.
2. Tap the **Simple OTDR** icon. A simple OTDR setting list appears.
3. Tap **Setup**, or press **SETUP**. A setup screen appears.
4. Tap the **Analysis Setup** tab. You can set event search conditions.
   For event search conditions, see section 3.2.
5. Press **AVG**. The measurement begins, and the data display screen shows the waveform.
   When averaged measurement is completed, event analysis is automatically executed, and the event analysis results are shown on the data display screen. For details on averaged measurement, see section 4.1.



### When the Launch Fiber Setting is ON

When a launch fiber is connected and measured waveform data is displayed, analysis can be performed by assuming the start point of the launch fiber to be the origin event (O). The length of the launch fiber from the origin (O) to the distance reference (R) is displayed.

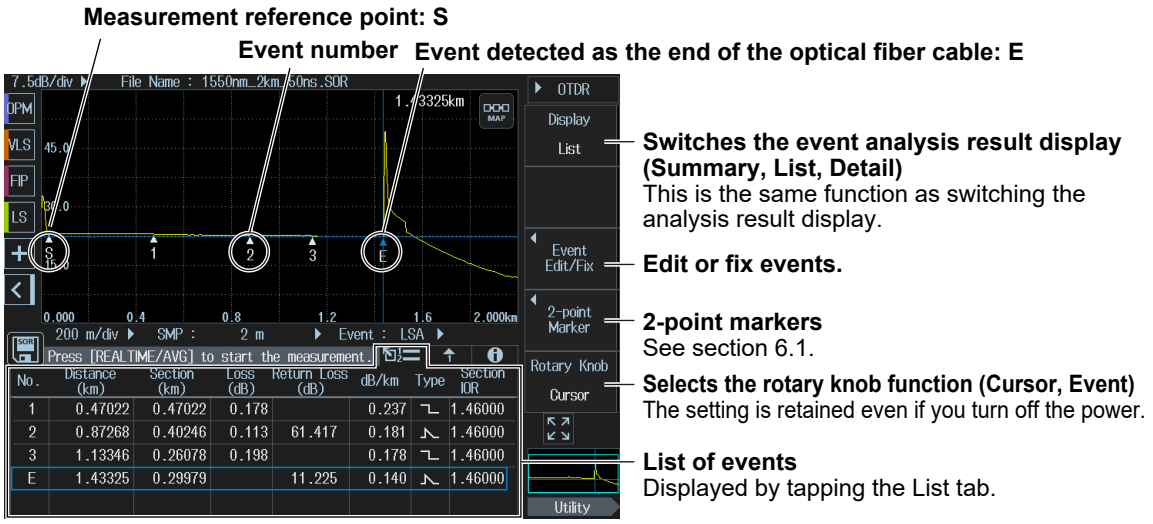


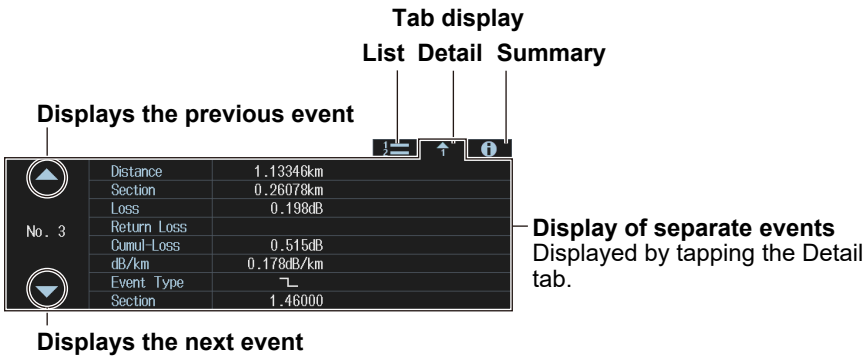
## Setting expert mode (OTDR)

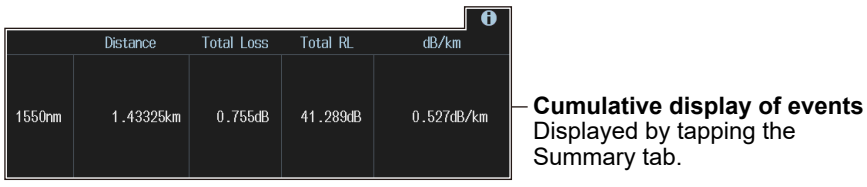
1. Press **MENU**. A MENU screen appears.
2. Tap the **OTDR** icon. A TRACE screen appears.

## Displaying event analysis results (TRACE mode)

3. Press **AVG**. The measurement begins, and the data display screen shows the waveform.
   When averaged measurement is completed, event analysis is automatically executed, and the event analysis results are shown on the data display screen. For details on averaged measurement, see section 4.1.

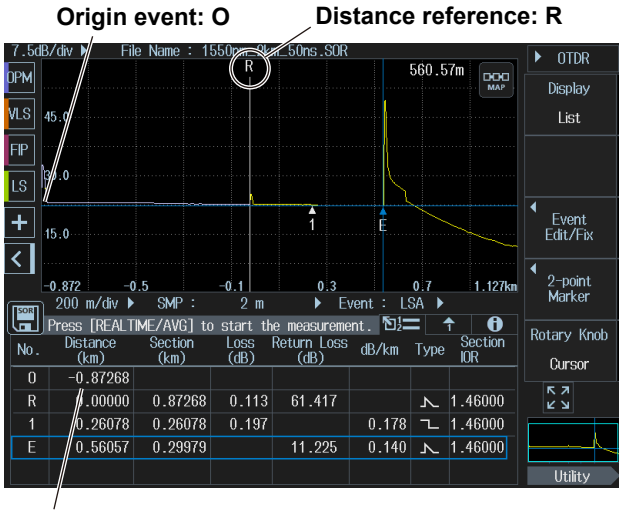


**When the launch fiber setting is on**

When a launch fiber is connected and measured waveform data is displayed, analysis can be performed by assuming the start point of the launch fiber to be the origin event (O). The length of the launch fiber from the origin (O) to the distance reference (R) is displayed.




## Executing an event analysis

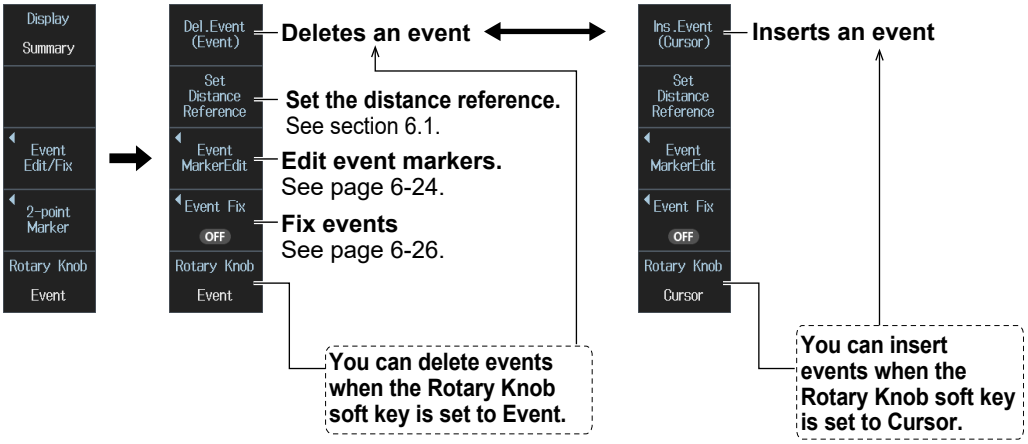
4. Press **ESC**.
5. Press the **Event Analysis** soft key. Event analysis is performed, and the event results are displayed on the waveform data. For details on the event analysis results, see “Displaying Event Analysis Results (TRACE mode)” on page 6-19.

## Editing or fixing 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:

- Insert events
- Delete events
- Edit event markers
- Fix event positions

**6.** Press the **Event Edit/Fix** soft key. An event edit soft key menu appears.

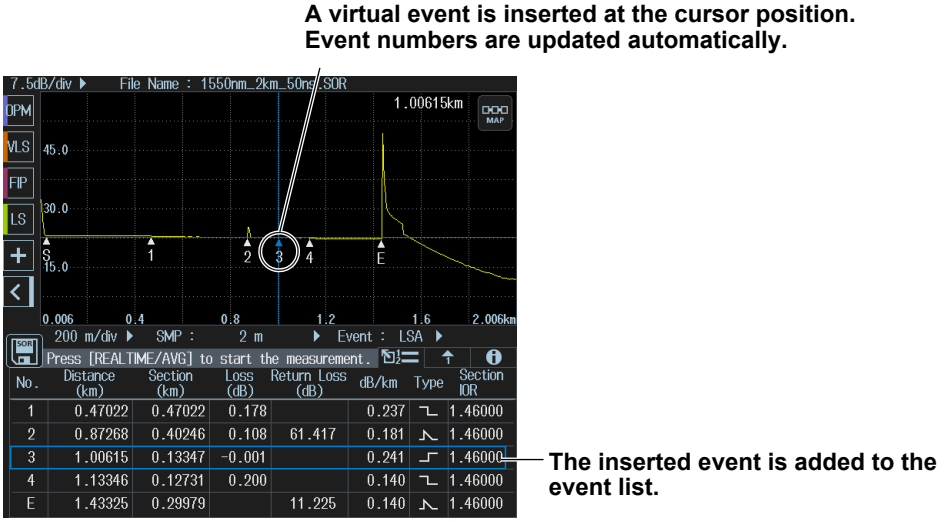



### Insert events

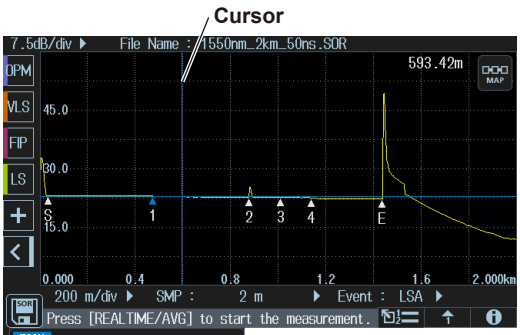
**7.** Press the **Rotary Knob** soft key to select Cursor.

**8.** Turn the rotary knob to move the cursor to the position where you want to insert an event.

**9.** Press the **Ins. Event (Cursor)** soft key. An event is inserted at the cursor position.




The same operations can be performed from the following screen while the event analysis screen is being displayed.




**Closes the window**

**Event edit control screen**
Appears when you use the cursor on the data display screen. If you do not use the cursor for about 8 seconds, the screen will close automatically.

**Inserts an event**
The same operation as step 9 can be performed.

**Deletes the distance reference**
See page 6-8.

**Inserts a distance reference**
See page 6-8.

## *Note*

- The event list can display up to 100 events.
- 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 the S point.
- You cannot insert events to the left of the distance reference. You can use the Set Distance Reference soft key to move the distance reference. For details about the distance reference, see page 6-8.
- If you insert an event to the right of the E event, the inserted event becomes the E event, and a new number is assigned to the former E event.

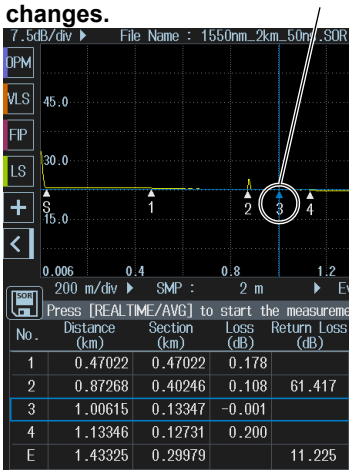
### Delete events

***7.*** Press the **Rotary Knob** soft key to select Event.

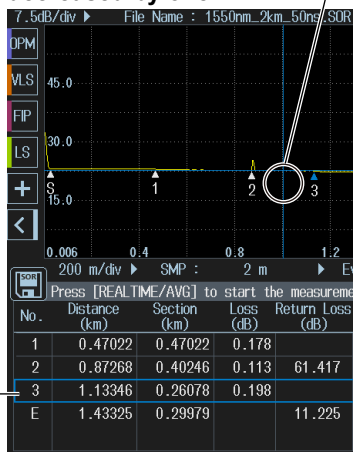
***8.*** Turn the rotary knob to select the event you want to delete.

***9.*** Press the **Del.Event (Event)** soft key. The selected event is deleted.

**The color of the selected event changes.**

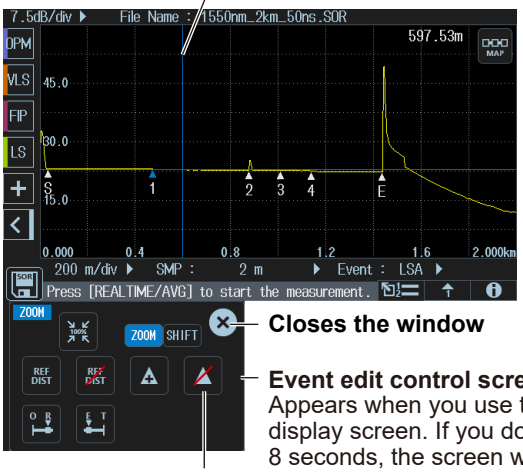



**The selected event is deleted. The subsequent event numbers are each decreased by one.**




**The deleted event is deleted from the event list.**

The same operations can be performed from the following screen while the event analysis screen is being displayed.




## *Note*

- If only the S point and the E event are displayed, you cannot delete any events.
- If you delete an event, the subsequent event numbers will all be reduced by one.
- You cannot delete the S point.

### Edit event markers

You can move an event marker to recalculate return loss and splice loss.

***7.*** Press the **Event MarkerEdit** soft key. An event marker edit soft key menu appears.

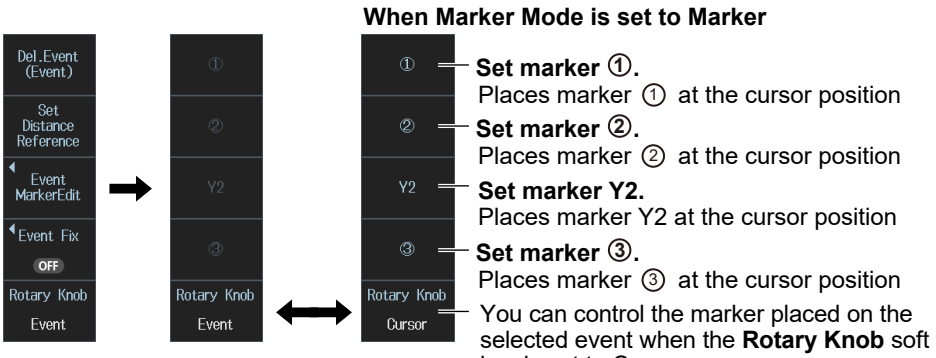
***8.*** Press the **Rotary Knob** soft key to select Event.

***9.*** Turn the rotary knob to select the event you want to edit.

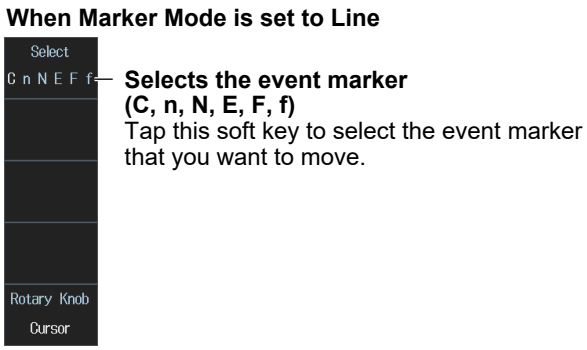
The color of the selected event changes.

***10.*** Press the **Rotary Knob** soft key to select Cursor.

You can now use the marker menu.



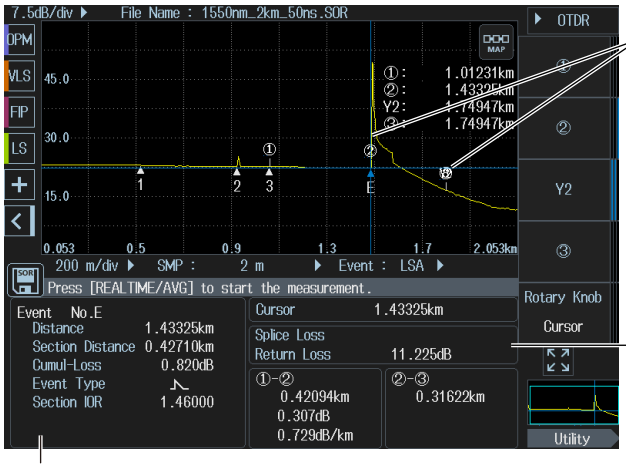

You can select an event to edit when the **Rotary Knob** soft key is set to Event.




## *Note*

For details on how to set markers, see “4 Point Markers” on page 6-9 (marker mode is Marker).
For details on how to set line markers, see “5 Point Markers” on page 6-11 (marker mode is Line).

### Example when marker mode is set to Marker

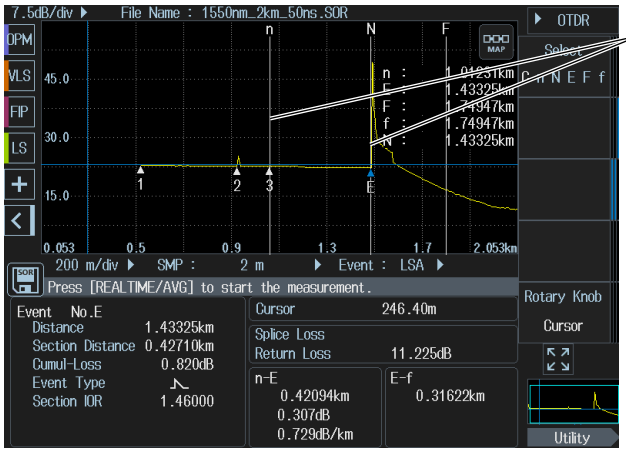



**Shows the current marker placed when event analysis was executed**

**Splice loss and return loss (or reflection level) of the selected event**
You can edit the splice loss and return loss (or reflection level) values by moving the marker position.

**Detailed information about the selected event**

### Example when marker mode is set to Line

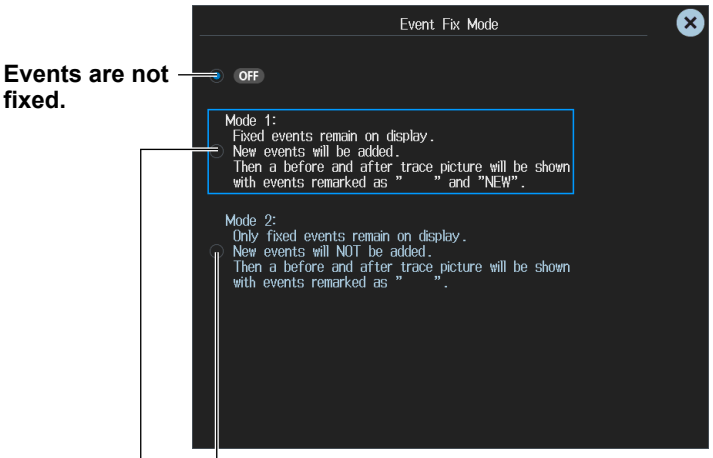



**Shows the current line marker placed when event analysis was executed**

### Fixing events

Event positions can be fixed. Fixed events are handled as master events. You can configure the instrument so that in subsequent event analysis only master events are handled.

***7.*** Press the **Event Fix** soft key. An Event Fix Mode screen appears.




**Master mode**
Registers the current placed event as the master.
New events are not detected even when the waveform data is updated.
Only the master event is displayed on the updated waveform data.

**Add mode**
Registers the current placed event as the master.
New events are detected when the waveform data is updated. Both the master event and the new detected events are displayed on the updated waveform data.

### Changing the event type

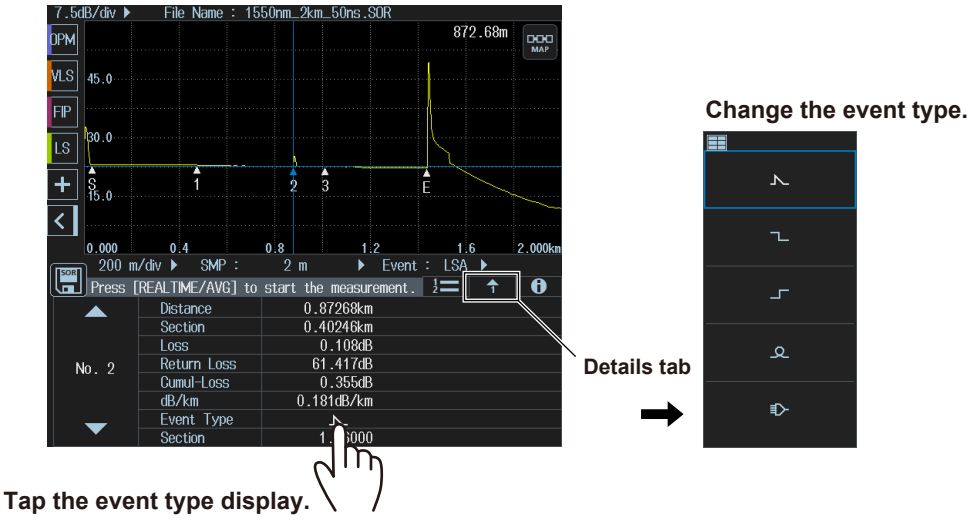
***7.*** Press the **Rotary Knob** soft key to select Event.

***8.*** Turn the rotary knob to select the event you want to change.

***9.*** Tap the Details tab.

***10.*** Tap the event type display. An event type selection screen appears.

***11.*** Select the event type you want to change.



***Note***

You can also change the event type of distance reference R.

## 2-point markers

The section distance and section loss between two markers are measured.

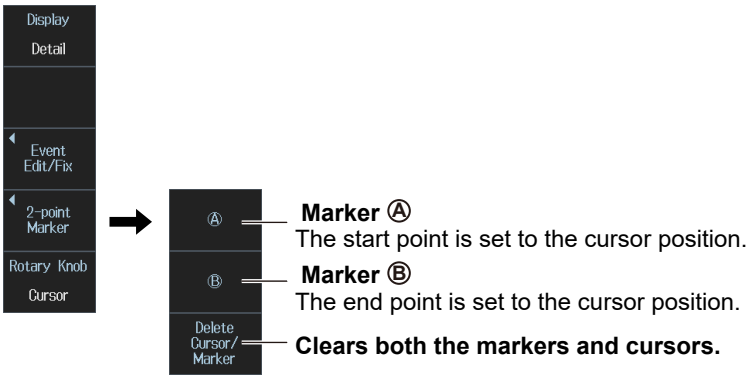
***6.*** Press the **2 Point Markers** soft key. A soft key menu for the 2 markers method appears.

***7.*** Turn the rotary knob to move the cursor to the analysis start position.

***8.*** Press the Ⓐ soft key. Marker Ⓐ is displayed at the cursor position.

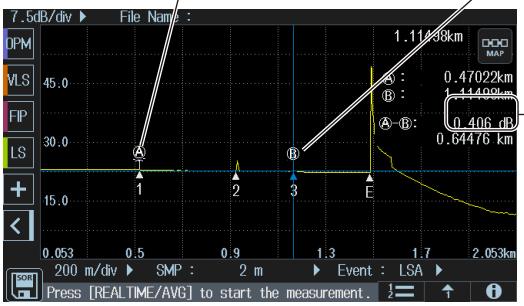
***9.*** Turn the rotary knob to move the cursor to the analysis end position.

***10.*** Press the Ⓑ soft key. Marker Ⓑ is displayed at the cursor position.




**Analysis start position**
Places marker Ⓐ.

**Analysis end position**
Places marker Ⓑ.




Displays the section loss (top row) and the section distance (bottom row) between two markers.

## Displaying event analysis results (MAP mode)

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

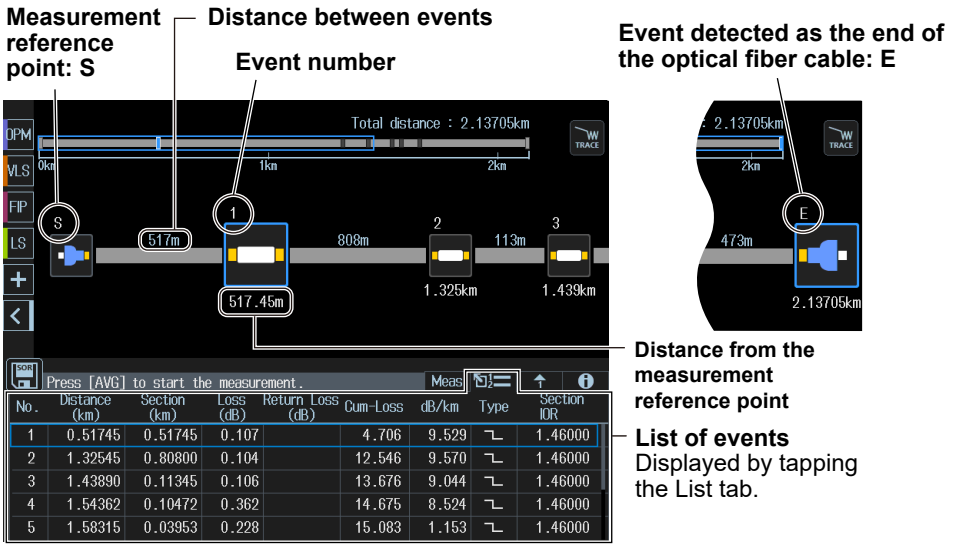
When the data display screen is in MAP mode, the button is TRACE.

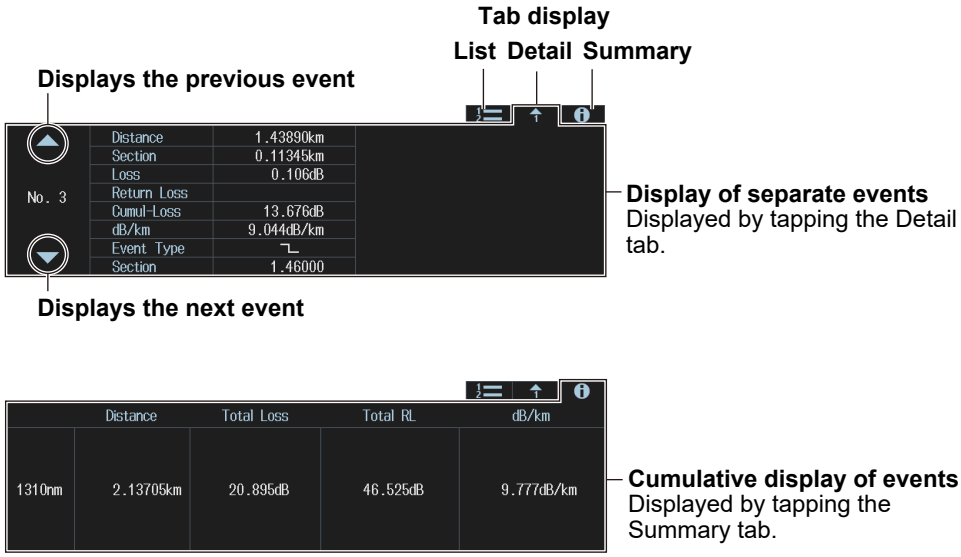

### *Note*

If you switch the data display screen to MAP mode, event analysis is automatically performed. The results of event analysis are displayed with icons.

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

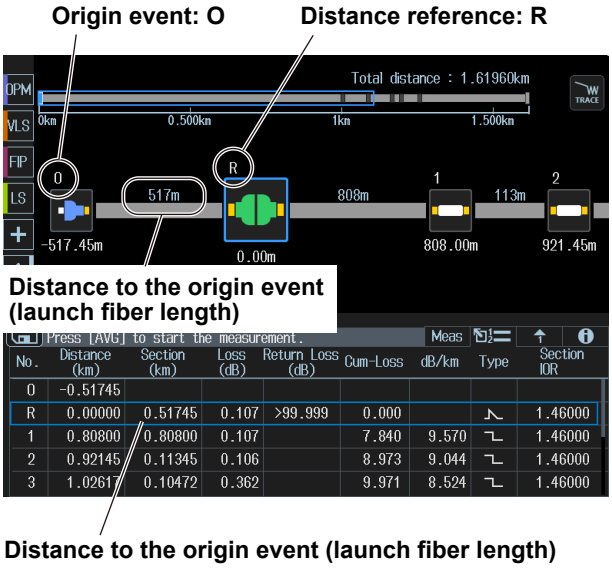
When averaged measurement is completed, event analysis is automatically executed, and the event analysis results are shown on the data display screen. For details on averaged measurement, see section 4.1.



### When the Launch Fiber Setting Is ON

When a launch fiber is connected and measured waveform data is displayed, analysis can be performed by assuming the start point of the launch fiber to be the origin event (O). The length of the launch fiber from the origin (O) to the distance reference (R) is displayed.



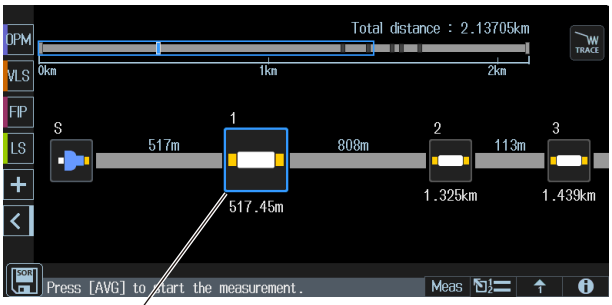

## *Note*

If you display waveform data using the following methods, you need to manually execute event analysis. See “Soft Key Menu (during event analysis)” explained later.

- When a real-time measurement is performed
- When waveform data (without event analysis information) is loaded from a USB memory device, internal memory, or microSD memory card. Event analysis information is not included in waveform data of real-time measurement or waveform data of averaged measurement that is aborted in the middle of a measurement.

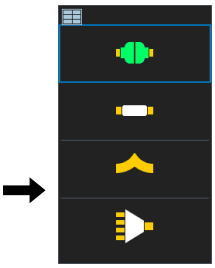
## Editing events

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.




**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.
Tap the icon in the center to display the event types that can be changed.

**Change the event type.**



# Explanation

## Event analysis results

**Event number**

A number is displayed on the waveform next to the event. The measurement reference point is displayed as S and the fiber end point as E. In the section between S to E, 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 the distance reference, which is the measurement reference point, the distance from the distance reference to each event is displayed. For details about the distance reference, see page 6-8.

**Splice loss**

The splice loss for each event is displayed.

**Return loss**

The return loss for each event is displayed.
In TRACE mode, the following is displayed.
When the return loss of distance reference R exceeds 99.999 dB, “> 99.999” is displayed.
When the return loss of an event other than the distance reference exceeds 99.999 dB, “----” is displayed.

**Cumulate loss**

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

**dB/km**

The loss per kilometer between events is displayed.

**Event type**

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

 : Superimposed reflections

**Total loss**

Displayed in the following manner depending on the total loss calculation method. For the setup procedure, see section 3.3.

| | |
|---|---|
| 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 the measurement reference point (S) and the end of fiber (E) is displayed. |

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

The following is a description of the TRACE mode.

## Rotary knob feature

You can select the operation that occurs when you turn the rotary knob from the following.
Cursor: The cursor moves continuously.
Event: The cursor moves directly between detected events.

## Inserting an event

- The event list can display up to 100 events.
- 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 the S point.
- You cannot insert events to the left of the distance reference. For details about the distance reference, see page 6-8.
- If you insert an event to the right of the E event, the inserted event becomes the E event, and a new number is assigned to the former E event.

## Delete events

- If only the S point and the E event are displayed, you cannot delete any events.
- If you delete an event, the subsequent event numbers will all be reduced by one.
- You cannot delete the S point.
- If you set a distance reference (R point), the S point disappears from the screen. In this situation, the measurement reference point is the distance reference. If you delete the distance reference, the S point is displayed again at its original position.
- If you delete the E event, the event that has the largest number becomes the E event.

## Edit event markers

Event markers are used to calculate the splices losses and reflection losses at event positions. Normally, event markers are automatically assigned, but when event markers are assigned to noise and other undesirable waveforms, correct values cannot be calculated. In such cases, you can obtain correct values by moving event markers.

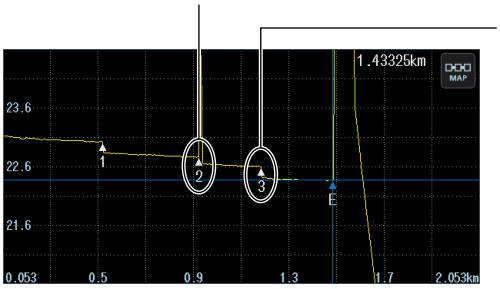
## Event fix mode

Event positions can be fixed. Fixed events are handled as master events. You can configure the instrument so that in subsequent event analysis only master events are handled.
How the events that are detected at positions other than the master event positions are displayed varies depending on the Event Fix Mode as follows:

**When event fix mode is set to append mode**

Events detected at positions other than the master event positions are also displayed in the event list.

**Events other than fixed events are also detected.**

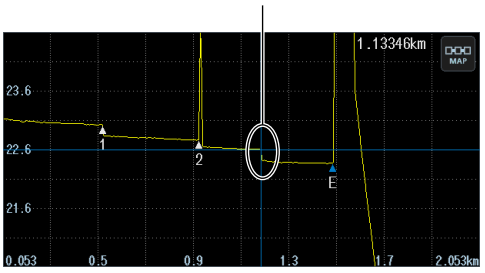



**An earlier event is detected, so the number of this fixed event is updated (changes from 2 to 3).**

**When event fix mode is set to master mode**

Only the events that are detected at the master event positions are displayed in the event list.

**Not detected even when an event exists.**




## Section analysis

In section 6.1, each item was measured with the distance reference as the reference point, but in section analysis, each item is measured with the location that is specified as the start point within the specified section as the reference point.

The distance, return loss, total loss, and loss per division (dB/km) between the S and E markers are displayed on the screen.

## Marker auto setting (set from markers)

You can automatically set marker ① or marker n as the start point and marker ② or marker E as the end point. You can use this feature to automatically set markers on waveform data in which marker ① and ② or n and E are already set.

## Adjusting the reference level

If you set marker Ⓑ, which represents the reference point, the return loss is measured with this location as the reference. The instrument uses the backscattering light level of the reference point to calculate the return loss. If you do not set the reference point, the start point is used as the reference point.

# 7.1 Using the Utility Menu

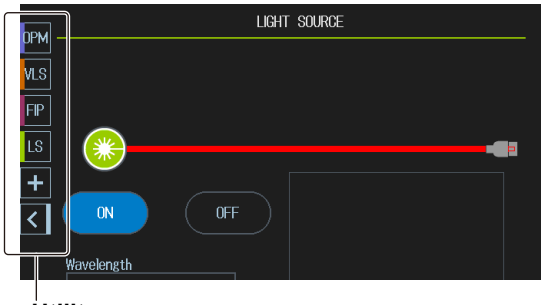
## Procedure

1. Press **MENU**. A MENU screen appears.
2. Tap the **OTDR**, **Light Source**, **Power Meter**, **Power Checker**, or **Visible Light Source** icon. The corresponding control screen appears.

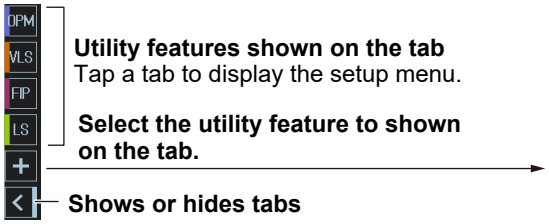
   A Utility menu is displayed at the left edge of the control screen.

**MENU screen**


**Example of light source screen**




**Utility menu**

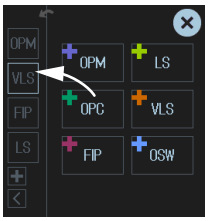



**Utility features shown on the tab**
Tap a tab to display the setup menu.

**Select the utility feature to shown on the tab.**

**Shows or hides tabs**

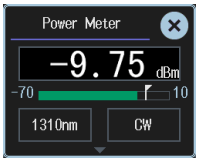
**Utility feature selection screen**



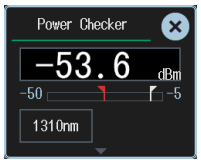

**Drag on to the tab the utility feature to show on the tab**

*3.* On the Utility menu, tap the tab of the function you want to configure. A setup screen appears. For details on each setting, see the respective sections.

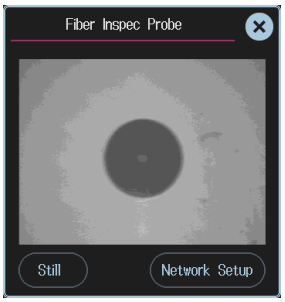
**Power meter (OPM) (See section 7.4.)**



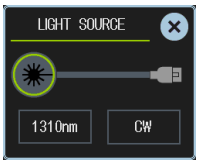

**Power checker (OPC) (See section 7.5.)**



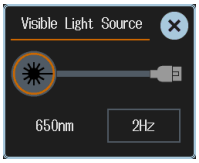

**Fiber inspection probe (FIP) (See section 7.6.)**




**Light source (LS) (See section 7.2.)**




**Visible light source (VLS) (See section 7.3.)**




**Optical switch box (OSW) (See section 7.7.)**


The setup screen is also displayed by tapping the icon for each function on the utility function selection screen displayed by tapping +.

***Note***

You can run multiple utility features simultaneously.

## Explanation

The Utility menu allows you to change relevant settings without having to switch setup screens. The following six features can be displayed on the Utility menu.

- Light source (LS)
- Visible light source (VLS)
- Optical power meter (OPM)
- Optical power checker (OPC)
- Fiber inspection probe (FIP)
- Optical switch box (OSW)

Of the above features, four can be displayed in tabs.

# 7.2 Using the Light Source

**WARNING**

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

**French**

**AVERTISSEMENT**

Lorsque instrument 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'oeil.

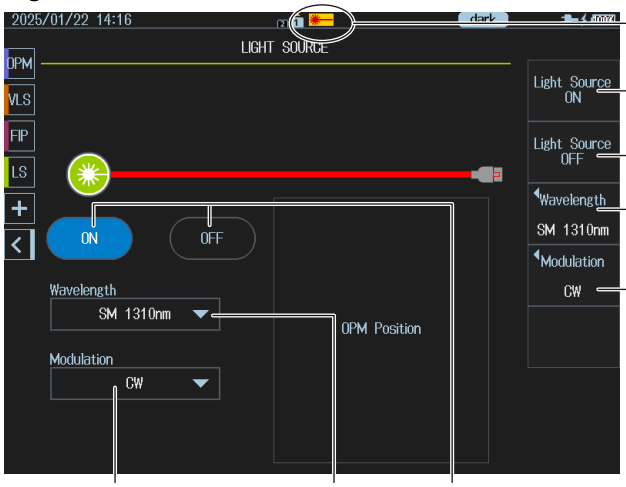
## Procedure

1. Press **MENU**. A MENU screen appears.

**2.** Tap the **Light Source** icon. A light source screen appears.

**MENU screen**


**Light source screen**




**Light mark**

**Turns the optical output on**

**Turns the optical output off**

**Set the wavelength.**

**Set the modulation mode.**

**Set the modulation mode.**

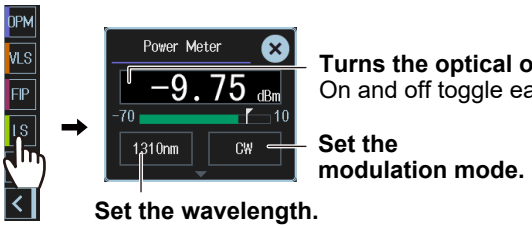
**Set the wavelength.**

**Turns the optical output on and off**
When you tap ON, the measurement light turns on. When turned on, a mark appears on the instrument display to indicate that the light is on. When you tap OFF, the measurement light turns off.

You can edit the settings in the screen or using the soft key menu.

### Setup using the Utility menu

On the OTDR, power meter, power checker, or visible light source setup screen, tap **LS** (light source) on the Utility menu. A light source setup screen appears.




The features shown on the Utility menu and their display positions vary depending on the settings. For details, see section 7.1.

***Note***

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

## Explanation

The following measurement light wavelengths can be generated.

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

| Model | Measurement light wavelength | Modulation mode |
|---|---|---|
| AQ7292A | 1310 nm, 1550 nm | CW, 270 Hz, 1 kHz, 2 kHz |
| AQ7293A | 1310 nm, 1550 nm | CW, 270 Hz, 1 kHz, 2 kHz |
| AQ7294A | 1310 nm, 1550 nm | CW, 270 Hz, 1 kHz, 2 kHz |
| AQ7293F | 1310 nm, 1550 nm, 1650 nm | CW, 270 Hz, 1 kHz, 2 kHz |
| AQ7293H | 1310 nm, 1550 nm, 1625 nm | CW, 270 Hz, 1 kHz, 2 kHz |
| AQ7294H | 1310 nm, 1550 nm, 1625 nm | CW, 270 Hz, 1 kHz, 2 kHz |

# 7.3 Using the Visible Light Source (/VLS option)

**WARNING**

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

**French**

**AVERTISSEMENT**

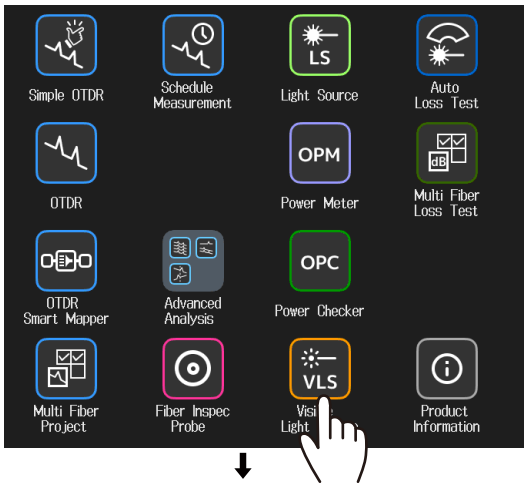
Lorsque instrument génère de la lumière, la lumière est émise à travers le port VLS. Ne pas débrancher les câbles de fibre optique connectés. Des lésions oculaires peuvent être causées si le faisceau lumineux pénètre l'oeil.

## Procedure

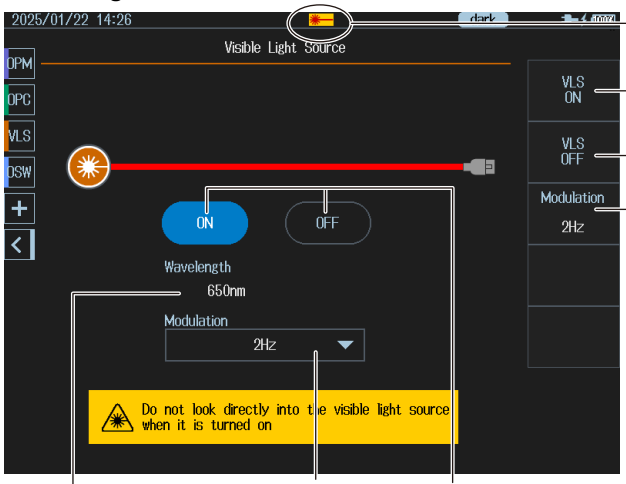
*1.* Press **MENU**. A MENU screen appears.

**2.** Tap the **Visible Light Source** icon. A visible light source screen appears.

**MENU screen**




**Visible Light Source Screen**




**Light mark**

**Turns the optical output on**

**Turns the optical output off**

**Set the modulation mode.**

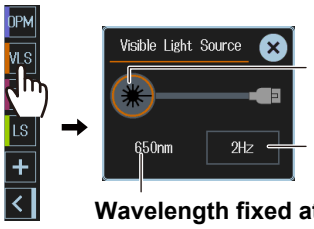
**Set the modulation mode.**

**Wavelength fixed at 650 nm**

**Turns the optical output on and off**
When you tap ON, the measurement light turns on. When turned on, a mark appears on the instrument display to indicate that the light is on. When you tap OFF, the measurement light turns off.

### Setup using the Utility menu

On the OTDR, power meter, power checker, or light source setup screen, tap **VLS** (visible light source) on the Utility menu. A visible light source setup screen appears.




**Turns the optical output on and off**
On and off toggle each time you tap.

**Set the modulation mode.**

**Wavelength fixed at 650 nm**

The features shown on the Utility menu and their display positions vary depending on the settings. For details, see section 7.1.

***Note***

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

## Explanation

A visible light can be emitted as a measurement light.
The wavelength is 650 nm.
Set the modulation mode to CW or 2 Hz.

# 7.4 Using the Optical Power Meter (/SPM, /HPM option)

## Procedure

1. Press **MENU**. A MENU screen appears.
2. Tap the **Power Meter** icon. A power meter screen appears.

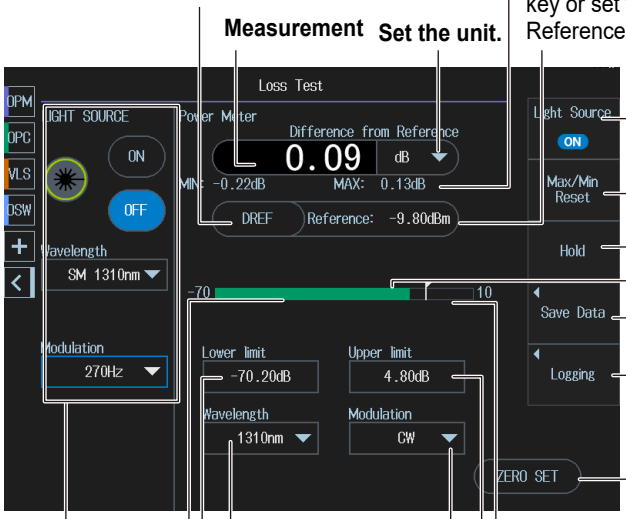
**MENU screen**


**Optical power meter screen**

**Sets the reference value to the current measured value (−80 to 40dBm).**
The reference value appears if you press the DREF soft key or set the unit to dB.

**MAX (maximum), MIN (minimum)**
Turns the display on or off (see the next page)

**Enter a value and assign it to the reference value (−80 to 40dBm)**
The reference value appears if you press the DREF soft key or set the unit to dB. Tapping the value or the word Reference displays a number input screen.




**Measurement**

**Set the unit.**

**Turns the light source setup screen display on or off**

**Reset MAX, MIN**
Resets the MAX and MIN values. Appears when MAX, MIN display is turned on (see the next page)

**Holds the measured values**

**Bar graph of the measured value**
Within the threshold: green
Outside the threshold: red

**Data storage settings**

**Set logging.**

**Executes zero-set**

**Light source setup screen**

**Set the wavelength.**
Varies depending on the wavelength mode described on the next page.

**Upper threshold limit mark**

**Upper threshold**

**Set the modulation mode.**

**Lower threshold**

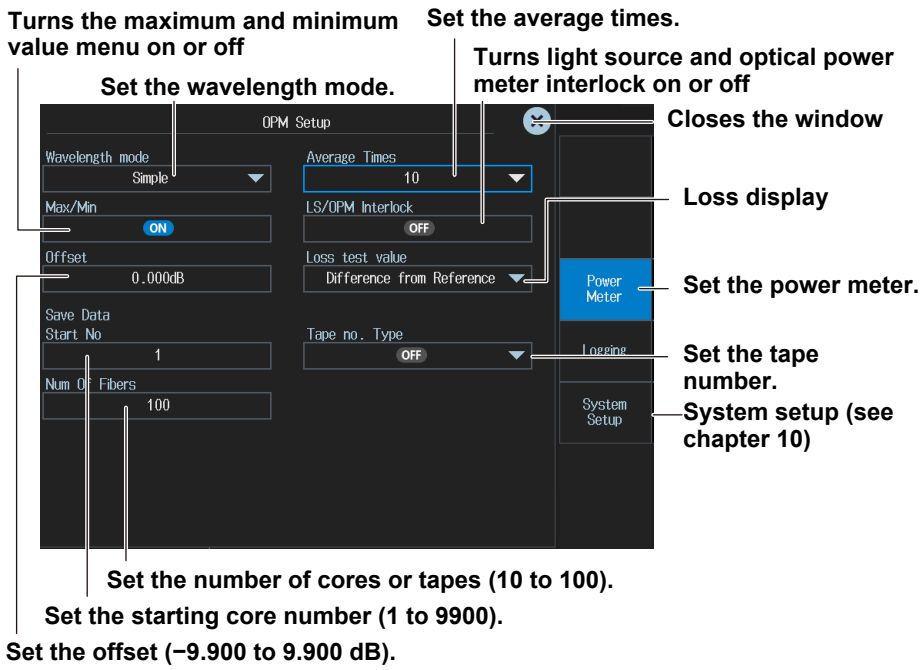
**Lower threshold limit mark**

## Performing setup

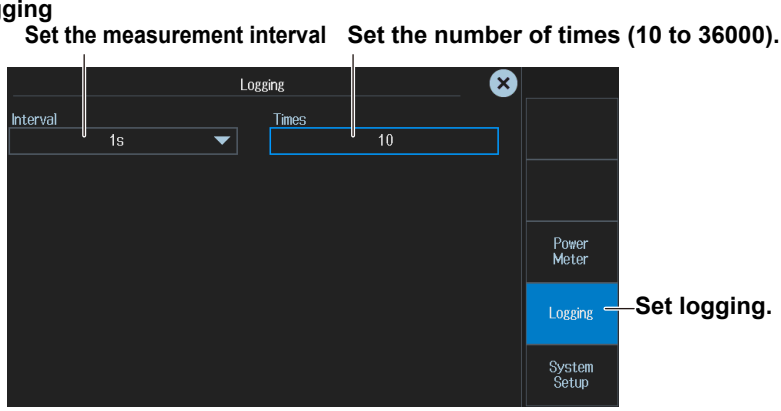
***3.*** Press **SETUP**.

***4.*** Tap **Power Meter** or **Logging**. The following screen appears.

**Power meter**



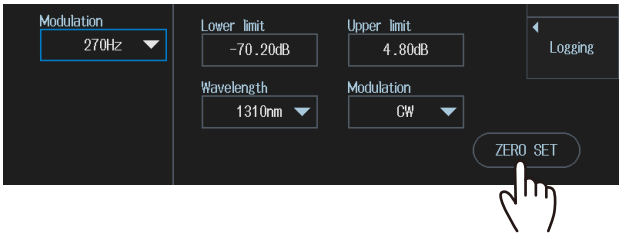

**Logging**




## Executing the zero set

***5.*** After step 4, close the optical power meter screen. The screen returns to the power meter screen.

***6.*** Remove the optical fiber cables from the instrument and close the OPM port cover, or make sure that the power meter section is not receiving any light, and then tap **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 optical power measurement section and enables you to obtain more accurate absolute optical power values.

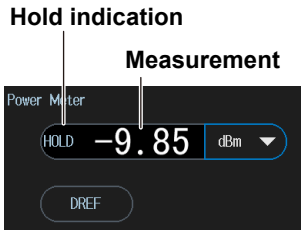
## Measuring the optical power

***7.*** Connect an optical fiber cable to the OPM port. The measured value is displayed on the power meter screen. For the position of the OPM port, see “Component Names and Functions” in the Getting Started Guide, IM AQ7290-02EN.

### Holding the measurement display

***8.*** Press the **HOLD** soft key. The measured value at that point remains displayed.

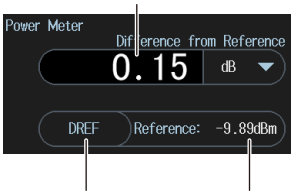
When you press the HOLD soft key again, the hold mode will be cleared.




### Setting the reference value to the currently displayed measured value

***8.*** Tap **DREF**. The reference value is set to the current measured value, and the measurement display changes to dB units. The measurement display indicates a value relative to the reference value.

**Measurement**
The display changes to show values relative to the reference value (dB). If the absolute measurement value (dBm) after executing DREF is the same as a reference value, 0 dB is displayed.




**DREF**

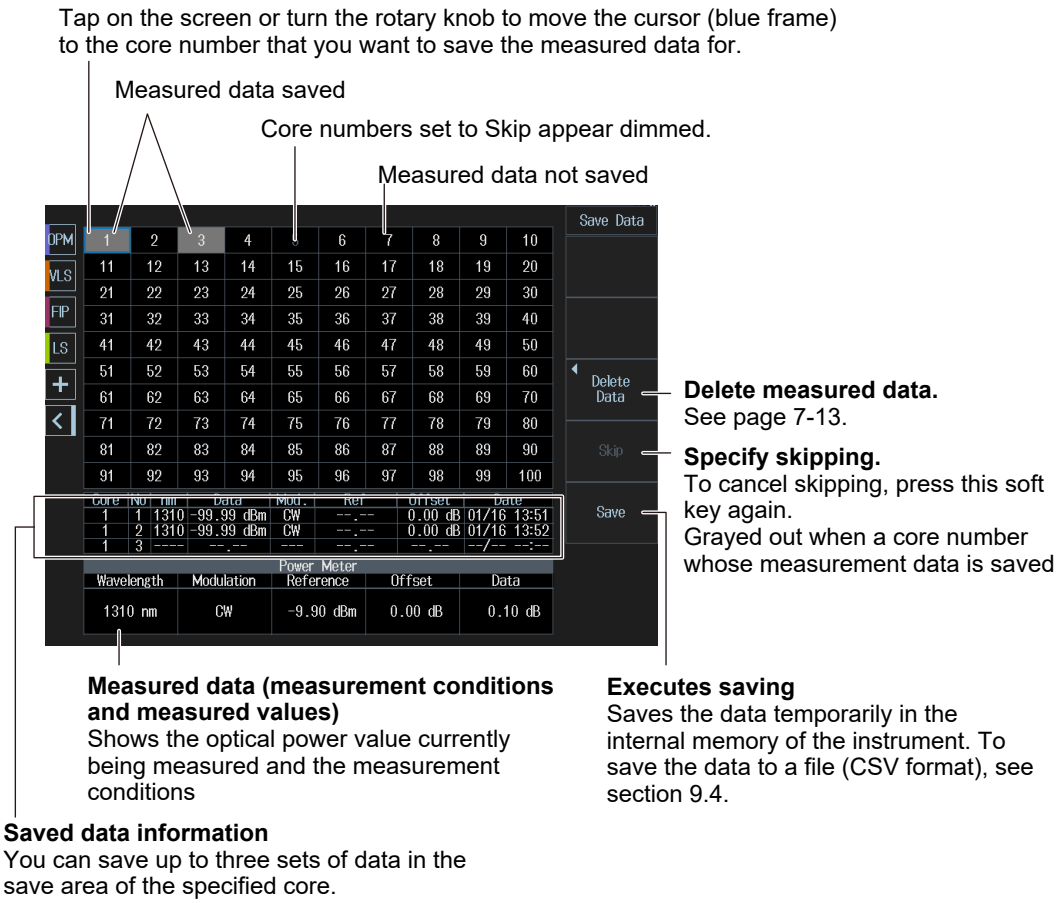
The measurement value after executing DREF (e.g., –9.69 dBm) becomes the reference value.

### Setting the Light Source Feature for Loss Tests

***8.*** Tap **Wavelength** or **Modulation** to set the wavelength or modulation. Tap ON on the light source on the screen to output light for loss testing.

### Saving the results of optical power measurements for multi-fiber cables (saving data)

***8.*** Press the **Save Data** soft key. A screen appears for saving the results of optical power measurements for multi-fiber cables.



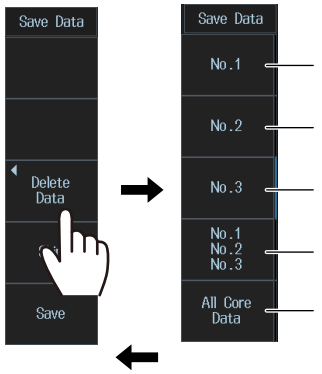

## *Note*

You can save the optical power meter measurement results by following the procedure explained in section 9.4. The “Save Data” feature explained in this action is for saving multiple measurement results (such as the measurement of a multi-fiber cable) in a single file. Even if data is saved in this section, the CSV file is not saved. To save the data in CSV format, follow the instructions in section 9.4.

If you save the data according to the procedure explained in section 9.4 without using the “Save Data” feature explained in this section, the optical power measurement of a single fiber is saved to a file in CSV format. Each time you save the data according to the procedure explained in section 9.4, a CSV file with a new name is saved.

- **Deleting measured data**

***9.*** Press the **Delete Data** soft key. A data delete soft key menu appears.




**Deletes the measurement data of No. 1 from the saved data information of the selected core number**

**Deletes the measurement data of No. 2 from the saved data information of the selected core number**

**Deletes the measurement data of No. 3 from the saved data information of the selected core number**

**Deletes collectively the measurement data of No. 1 to No. 3 from the saved data information of the selected core number**

**Deletes collectively the measurement data of all core numbers**

When you delete data, the screen returns to the Save Data menu after the data is deleted.

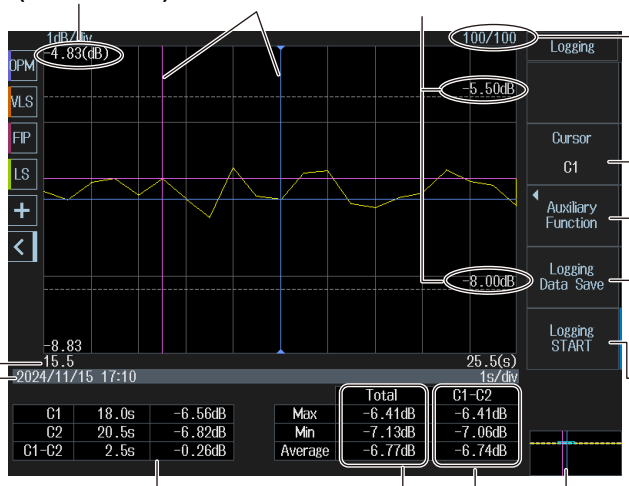
### Logging measurement of optical power values (logging)

***8.*** Press the **Logging** soft key. A logging measurement screen appears.

**Optical power value (vertical axis)**

**Cursors C1 and C2**

**Thresholds**
Appears when the threshold display of the auxiliary function is on




**Measurement count**
The number of times that logging has currently been executed and the total number of times to execute logging

**Select the cursor (C1, C2).**

**Auxiliary function**
See page 7-14.

**Saves log data**
A screen for setting the file save destination and the file name appears.

**Starts logging**
Logging will start. After the specified number of entries are recorded, a screen for saving the logging results appears (see the File Save screen described below).

**Optical power at the cursor position**

**Date and time that logging was executed**

**Logging time (horizontal axis)**

**Entire graph**
The section that is displayed in the display area is indicated by a box (overview).

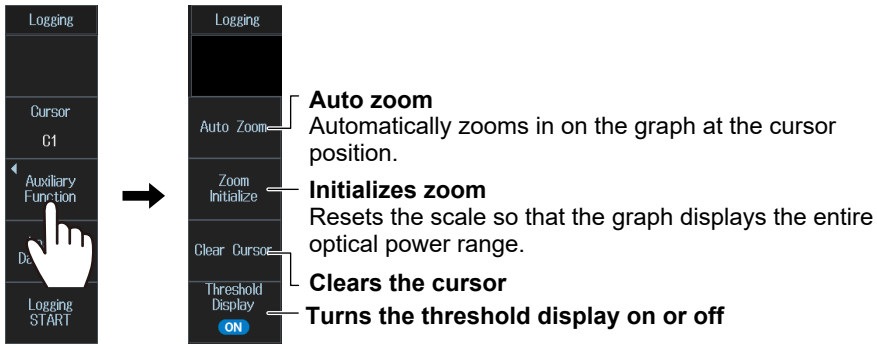
**Maximum, minimum, and average of the logging data within the area specified by the cursor**

**Maximum, minimum, and average of all the logging data**

You can also use the up, down, left, and right arrow keys to zoom in and out on the waveform.

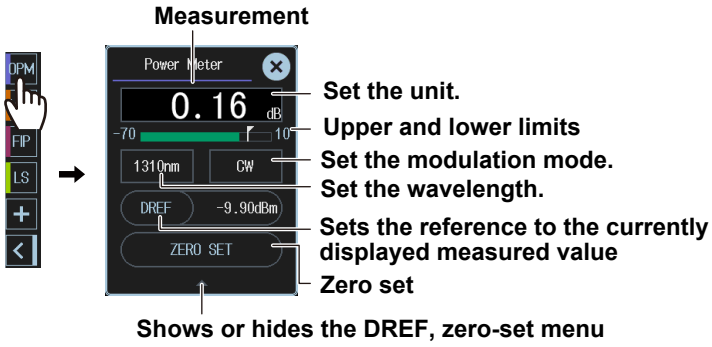
- **Setting the auxiliary function**

***9.*** Tap the **Auxiliary Function** soft key. A soft key menu appears for the auxiliary function of the logging screen.




## Setup using the Utility menu

On the OTDR, light source, power checker, or visible light source setup screen, tap **OPM** (power meter) on the Utility menu. A power meter setup screen appears.




The features shown on the Utility menu and their display positions vary depending on the settings. For details, see section 7.1.

# Explanation

## Wavelength

The photodetector in the optical power measurement area has wavelength sensitivity characteristics. The photodetector corrects the sensitivity according to the set wavelength and measures optical power more accurately. The wavelength setting range and setting step very depending on the wavelength mode set in the detailed setup screen. Set the wavelength in the following range.

### /SPM or /HPM option

| Wavelength mode | Setting range and setting step |
|---|---|
| Simple | 850 nm, 1300 nm, 1310 nm, 1490 nm, 1550 nm, 1625 nm, 1650 nm |
| Detail | Set the wavelength to a value from 800 nm to 1700 nm in 1 nm steps. |
| CWDM | Select from 1270 nm to 1610 nm wavelengths subdivided in 20 nm steps. |

## Modulation mode

You can select the modulation mode of the light to be measured from the following:
CW (continuous light), 270 Hz, 1 kHz, 2 kHz

## Unit

Set the optical power display unit from the following.
dB (absolute value), 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), Pw: optical power (unit W)

## Reference value

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

- When you tap DREF, the displayed measured value becomes the reference value. From this point, relative values will be displayed. The unit changes to dB.
- When you tap DREF 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 dBm to 40 dBm.
- When you set the unit to dBm or W, the Reference box disappears, and the absolute measured values will be displayed.

## Wavelength mode

You can select the wavelength mode of the light to be measured from the following:
Simple, Detail, CWDM
Like the “wavelength” item described earlier, the setting range and setting step vary depending on the mode.

## Average times

The average value is displayed as the measured value. Select the average count from the following.
1, 10, 50, 100

## Turning light source and optical power meter interlock on and off

When an optical fiber is connected from the light source port of this instrument to the optical power measurement port of the same instrument to measure optical power, the wavelength and modulation mode settings of the light source can be reflected in the power meter settings.

| | |
|---|---|
| ON | The light source settings are reflected on the optical power meter side from the time it is turned ON. |
| OFF | The settings are not reflected. |

## Loss display

Set how to display the measured values for loss tests (when the light source is on).

| | |
|---|---|
| Difference from the reference value | The value obtained by subtracting the reference value from the measured value is displayed (a negative value is displayed). |
| Loss value | The value obtained by subtracting the reference value from the measured value is displayed as a loss (a positive value is displayed). |

## Turning the maximum and minimum value menu on and off

A menu can be displayed in the soft key menu for updating the maximum and minimum measured values.

| | |
|---|---|
| ON | The menu is displayed. The minimum and maximum values are also displayed. |
| OFF | The menu is not displayed. The maximum and minimum values are also not displayed. |

The maximum and minimum values can be updated to the latest data from the menu.

## Offset

You can add a specified value (the offset value) to measured input optical power values and display the results as measured values.
The range is –9.900 dB to 9.900 dB.

## Threshold

You can set upper and lower threshold values and determine whether or not the measured values fall within them.

- The range for upper and lower threshold values is −80 dBm to 40 dBm. The upper limit must be greater than the lower limit.
- If the measured values are less than or equal to the upper limit and greater than or equal to the lower limit, the corresponding bar graph is displayed in green.
- If the measured values exceeds the upper limit or fall below the lower limit, the corresponding bar graph is displayed in red.

## Holds the measured value display

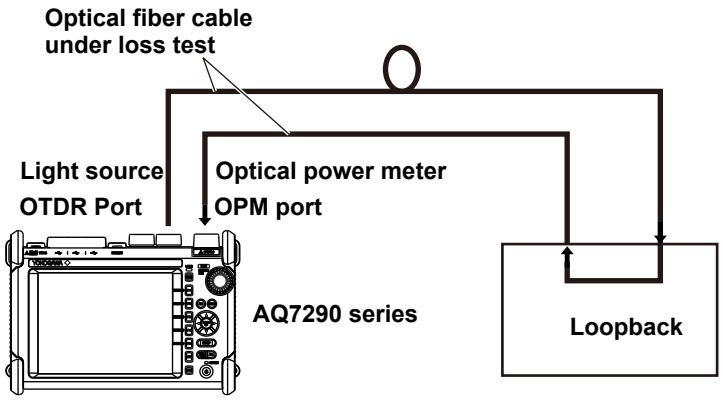
When you press the HOLD soft key, the measured values, bar graph, maximum value, minimum value, and the on/off state of the maximum and minimum value display are no longer updated. The value at the time that you pressed the HOLD soft key remains displayed. To release the hold, press the HOLD soft key again.

## Zero set

Perform a zero-set whenever necessary, such as after you have turned on the power or when the ambient temperature changes.
Performing zero set adjusts the internal deviation of the optical power measurement section and enables you to obtain more accurate absolute optical power values.

## Loss test

The loss test loops back the other end of the optical fiber cable being measured to measure the optical power emitted by the light source of this instrument with the optical power meter of this instrument. This allows you to check the level of loss that occurs relative to the optical output power value of the light source.




## Saving the results of optical power measurements for multi-fiber cables

### Skip

When Skip is selected, the corresponding core is not measured. By specifying Skip on cores that do not need to be measured, you can save time.

### Saving data

When you execute a save operation, up to three sets of data can be saved temporarily in the save area of the specified core number.

For details on saving data to files, see section 9.4.

### Deleting data

You can delete data from the save areas for each core number individually or all cores at once.

### Starting core number

Set the starting core number in the following range.

1 to 9900

### Tape number type

By setting the tape number type, you can the tape number accordingly.

The core number display will be as follows.

OFF: 1, 2, 3, ...

a-d(4): 1a, 1b, 1c, 1d, 2a, 2b, 2c, 2d, 3a, 3b, 3c, 3d, ...

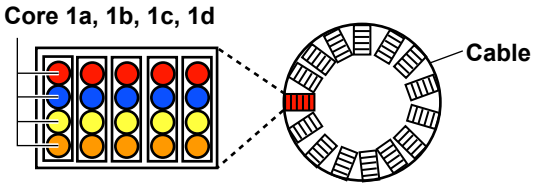



**Illustration of how tape No. a-d(4) are used**

### Number of cores or tapes

Set the number of cores or tapes in the following range.

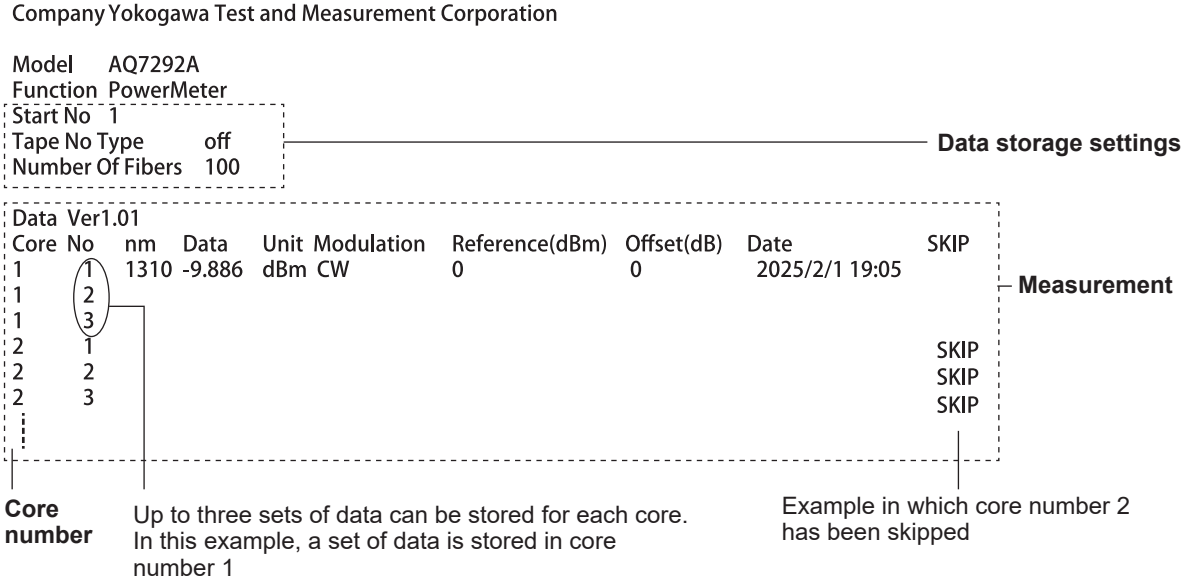
| Tape number type | Number of cores or tapes |
|---|---|
| Off | 10 to 100 cores (in steps of 10) |
| a-b(2) | Number of tapes: 1 to 50 |
| a-c(3) | Number of tapes: 1 to 33 |
| a-d(4) | Number of tapes: 1 to 25 |
| a-e(5) | Number of tapes: 1 to 20 |
| a-f(6) | Number of tapes: 1 to 16 |
| a-g(7) | Number of tapes: 1 to 14 |
| a-h(8) | Number of tapes: 1 to 12 |

***Note***

The data saved in the save area of the core number list can be consolidated and saved in a single CSV file. The data that you save can be edited in a spreadsheet application. The file can also be loaded into the instrument.

### Save data format

Measured results are saved in the following CSV format.




## Logging measurement of optical power values

### Executing logging and saving

While the optical power meter screen is displayed, the instrument is constantly measuring the optical power. To save the measured values, execute logging.

- Press the Logging START soft key to start logging. While logging, the Logging START soft key on the menu changes to Logging STOP.
- When the specified number of entries have been logged or when you press the Logging STOP soft key, logging stops. The Logging STOP soft key on the menu changes to Logging START, and the file save screen appears.
- The logging results can be saved in csv format.

**Interval**

Set the interval for logging the measured values from the following.
500 ms, 1 s, 2 s, 5 s, 10 s

**Times**

Set the number of times to log in the following range.
10 to 36000

**Graph display of logging data**

Set Display to Logging to display the measured values on a graph in real time during logging.
Logging results that have been saved in CSV format cannot be displayed on a graph.

- **Selecting the cursor**
  You can switch between the two cursors (C1 and C2) that are displayed on the screen. If the selected cursor is outside of the display area, the display position is automatically changed so that the cursor is in the center of the screen. If the cursor is at the left or right edge of the screen, because the sections that are outside of the measurement range cannot be displayed, even if you switch to the other cursor, the selected cursor will not be displayed in the center of the screen.

- **Auto zoom**
  The vertical zoom factor is set automatically so that all the logging data is displayed.
  The median value between the maximum and minimum of the logging data is the center position on the screen.
  If there is no logging data, auto zoom is not performed.

- **Zoom initialization**
  Zoom initialization returns the vertical and horizontal zoom factors to ×1.

- **Zooming in and out**
  You can press the arrow keys to zoom the displayed graph in or out. The graph is zoomed at the cursor position.

  | | |
  |---|---|
  | Up and down arrow keys: | Zooms in or out vertically. (The up arrow key zooms in; the down arrow key zooms out.)<br>Zoom factors are ×1, ×2, ×5, ×10, ×20, and ×50. |
  | Left and right arrow keys: | Zooms in or out horizontally. (The right arrow key zooms in; the left arrow key zooms out.)<br>Zoom factors are ×1, ×2, ×5, ×10, ×20, and ×50.<br>You cannot zoom in on the graph so much that there are less than 11 logging data points on the screen. |

***Note***

The logging results are saved in a CSV file, so you can open it with a spreadsheet application. However, CSV files cannot be loaded in to this instrument.

### Saving logging data

Logging results are saved in the following CSV format.

```
Company Yokogawa Test and Measurement Corporation
Model   AQ7292A
Function  Logging
Start Date   Mon Dec 23 09:34:26 2024
```

**Measurement start date and time**

```
Wavelength              1550
Modulation              CW
Offset                  0
Unit                    dB
Interval(ms)            1000
Measurement Number      10
Logging Count           10
Reference               10000
```

**Measurement conditions**

```
-6553
-6584
-6973
-6713
      . . . . . .
```

**Measurement result (When the unit is dB or dBm, 1000 times the actual measurement value is recorded. Example: actual measured value of –6553 is –6.553 dB)**

# 7.5 Using the Power Checker (/PC option)

## Procedure

### Displaying the power checker screen

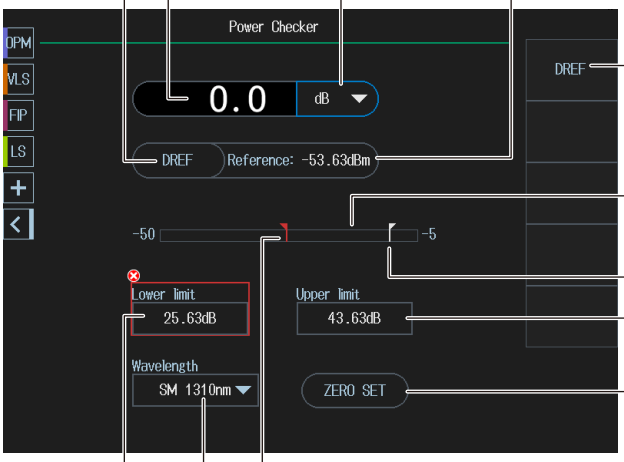
1. Press **MENU**. A MENU screen appears.
2. Tap the **Power Checker** icon. A power checker screen appears.

**MENU screen**


**Power Checker Screen**

**Sets the reference value to the current measured value (−80 to 40dBm).**
The reference value appears if you press the DREF soft key or set the unit to dB.

**Enter a value and assign it to the reference value (−80 to 40dBm)**
The reference value appears if you press the DREF soft key or set the unit to dB. Tapping the value or the word Reference displays a number input screen.




**Measurement**

**Set the unit.**

**Sets the reference value to the current measured value (−80 to 40dBm).**

**Bar graph of the measured value**
Within the threshold: green
Outside the threshold: red

**Upper threshold limit mark**

**Upper threshold**

**Executes zero-set**

**Lower threshold**

**Lower threshold limit mark**

**Set the wavelength.**

## Executing a zero set

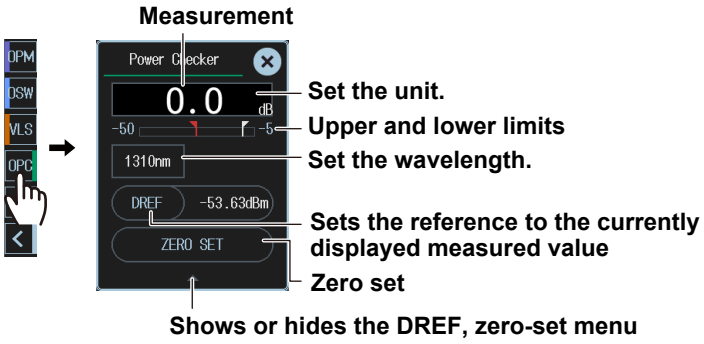
3. Remove the optical fiber cables from the instrument and close the OPM port cover, or make sure that the power meter section is not receiving any light, and then tap **ZERO SET**.

## Measuring the optical power

4. Set the wavelength.
5. Connect an optical fiber cable to the OTDR port (Port1). The measured value is displayed on the power checker screen. For the position of the OTDR port, see “Component Names and Functions” in the Getting Started Guide, IM AQ7290-02EN.

## Setup using the utility menu

On the OTDR, light source, power meter, or visible light source setup screen, tap **OPC** (power checker) on the Utility menu. A power checker setup screen appears.




The features shown on the Utility menu and their display positions vary depending on the settings. For details, see section 7.1.

# Explanation

## Wavelength

The photodetector of the optical power checker has wavelength sensitivity characteristics. The photodetector corrects the sensitivity according to the set wavelength and measures optical power more accurately. Select the wavelength from the following:
1310 nm, 1490 nm, 1550 nm, 1625 nm, 1650 nm

## Unit

Set the optical power display unit from the following.
dB (absolute value), 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), Pw: optical power (unit W)

## Reference value

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

- When you press the DREF soft key, 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 soft key 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 dBm to 40 dBm.
- When you set the unit to dBm or W, the Reference box disappears, and the absolute measured values will be displayed.

## Threshold

You can set upper and lower threshold values and determine whether or not the measured values fall within them.

- The range for upper and lower threshold values is −80 dBm to 40 dBm (when the unit is dBm). The upper limit must be greater than the lower limit.
- If the measured values are less than or equal to the upper limit and greater than or equal to the lower limit, the corresponding bar graph is displayed in green.
- If the measured values exceeds the upper limit or fall below the lower limit, the corresponding bar graph is displayed in red.

## Zero set

Perform a zero-set whenever necessary, such as after you have turned on the power or when the ambient temperature changes.
Performing zero set adjusts the internal deviation of the optical power measurement section and enables you to obtain more accurate absolute optical power values.

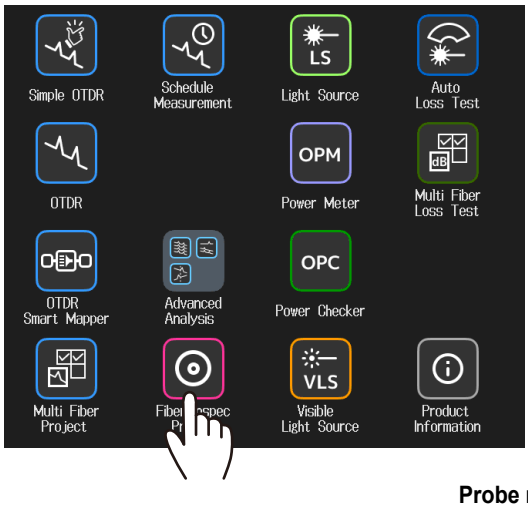
# 7.6 Using the Fiber Inspection Probe

## Procedure

### Displaying the fiber inspection probe screen

1. Press **MENU**. A MENU screen appears.
2. Tap the **Fiber Inspec Probe** icon. A fiber inspection probe screen appears.

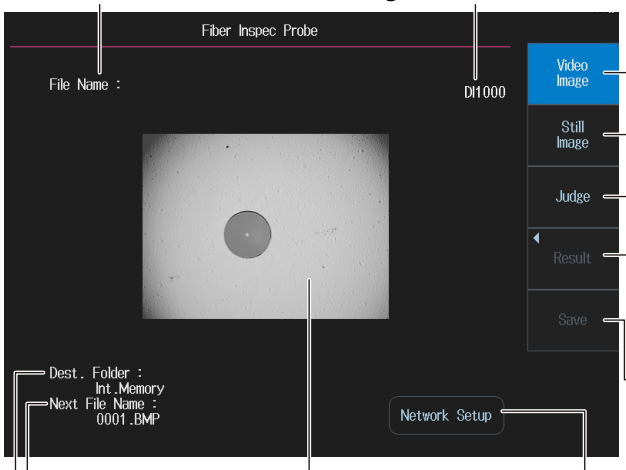
**MENU screen**




**Fiber inspection probe screen**

**File name of the saved still image**

**Probe model**
When a probe is automatically recognized by the instrument, the model name of the probe is displayed on the screen. If the probe is not recognized, “Unknown” is displayed. If “Unknown” is displayed, pass/fail judgment is not possible.




**Displays the image in real time**

**Holds the image display**

**Executes pass/fail judgment**
A pass/fail judgment is performed, and the result (summary) is displayed.

**Displays results**
Displays the judgment results (detail). This is available when a pass/fail judgment is executed.

**Executes saving**
Still image is saved to a BMP file. This available for still images. For the file save destination, see section 9.4. For the procedure to set the file name, see section 3.4.

**File name of the next still image to be saved**

**Fiber surface image**

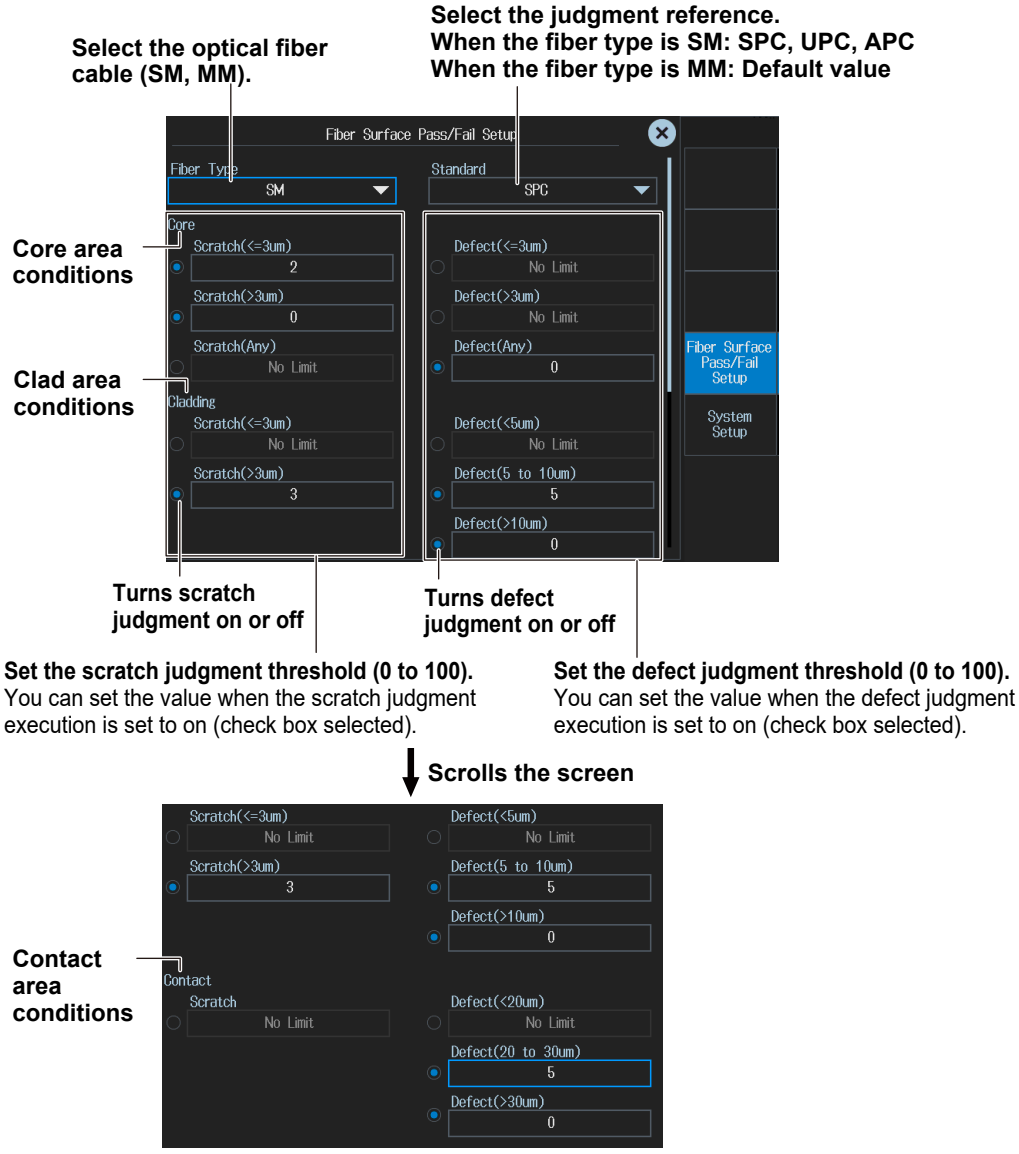
**Data save location folder**

**Set the network (station mode).**
Set this when using a wireless LAN fiber inspection probe for inspection. (See page 7-26.)

## Performing setup

*3.* Press **SETUP**.

*4.* Tap **Fiber Surface Pass/Fail Setup**. A Fiber Surface Pass/Fail Setup screen appears.




### *Note*

If you change threshold setting after setting the judgment reference, “User” is displayed for the judgment reference setting to indicate that the reference is user defined.

## Connecting the fiber inspection probe

3. Connect the fiber inspection probe to the USB port (Type-A) of this instrument.
4. Connect the probe of the fiber inspection probe to the end face of the optical fiber cable.

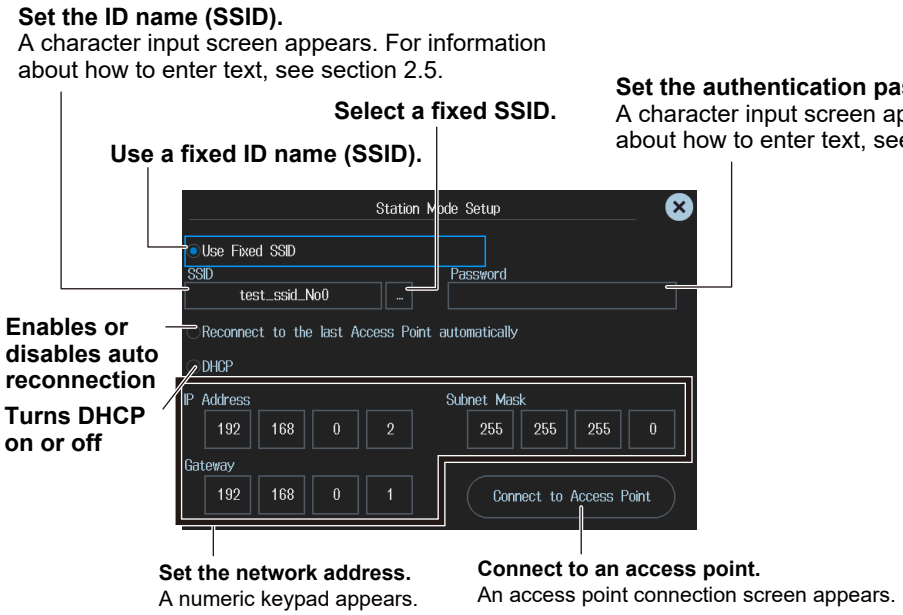
***Note***

For instructions on how to use the fiber inspection probe, see the user's manual for the probe.

## Connecting a wireless LAN-compatible fiber inspection probes

3. On the fiber inspection probe screen of step 2, tap **Network Setup**.

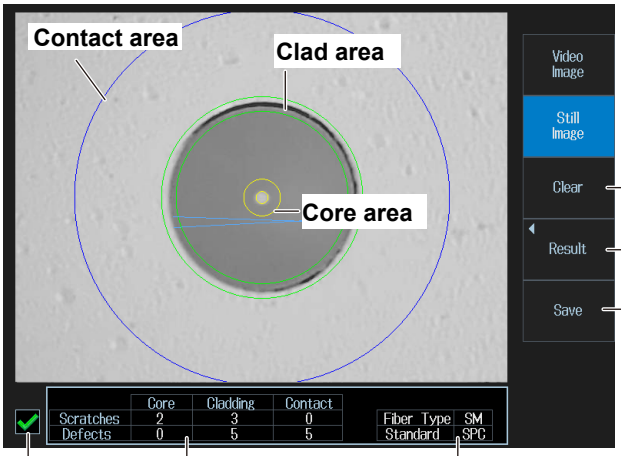
   A network setup screen for station mode appears. These are the same settings as the network settings in system setup. For details, see section 10.5.




4. Tap **Connect to Access Point** to connect to the fiber inspection probe.

## Executing pass/fail judgment

5. Press the **Still Image** soft key.
6. Press the **Judge** soft key. A judgment is performed, and the result (summary) is displayed. Before executing pass/fail judgment, adjust the fiber inspection probe knob to focus on the image.




**Clear**
Clears the judgment results

**Displays results**
Displays the judgment results (detail).

**Executes saving**
Press this soft key to save a still image and a judgment result file. For the procedure to set the file save destination, file type, and file name, see section 9.4.

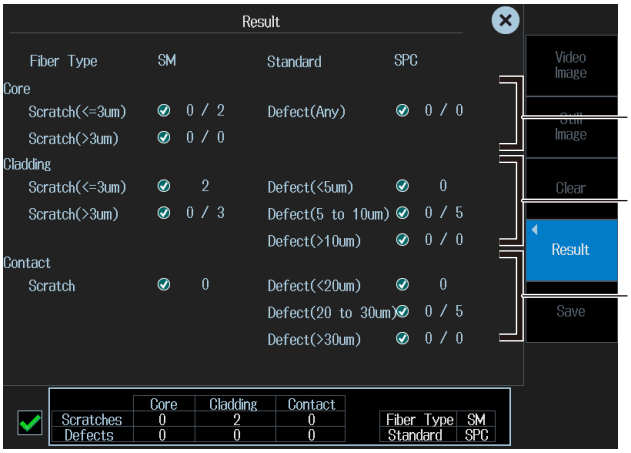
**Judgment results (summary)**
Appears when pass/fail judgment is performed.

**Optical fiber cable type**
Appears at all times for still images.

**Pass/fail result (mark)**

### Displaying judgment results (Details)

7. Press the **Result** soft key. The inspection results are displayed.




**Results in the core area**

**Results in the cladding area (excluding the core area)**

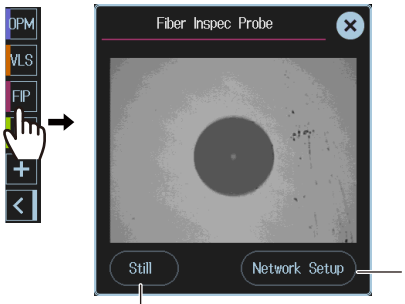
**Results in the contact area (excluding the core and cladding area)**

### *Note*

Pass/fail judgment complies with IEC 61300-3-35.

## Using the fiber inspection probe from the Utility menu

On the OTDR, light source, power meter, or visible light source setup screen, tap **FIP** (fiber inspection probe) on the Utility menu. A fiber inspection probe screen appears.



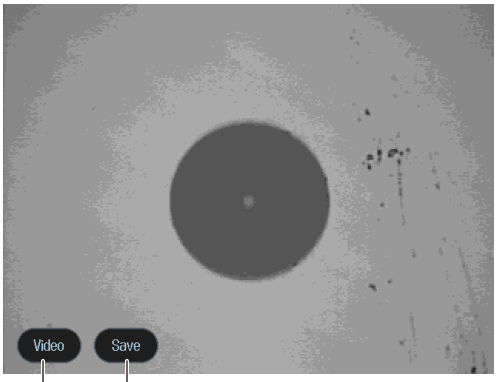

**Fiber inspection probe screen**
This is a video screen.

**Set the network (station mode).**
Set this when using a wireless LAN fiber inspection probe for inspection.
(See page 7-26.)

**Displays the still image**
Displays the still image over the entire data display screen

### Displaying the still image

Tap **Still Image**. A still image display screen appears.




**Saves the still image to a BMP file**

**Returns to the video display**

The features shown on the Utility menu and their display positions vary depending on the settings. For details, see section 7.1.

# Explanation

## Connecting a fiber inspection probe

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

If you connect the USB fiber inspection probe while the instrument is on, the instrument will automatically recognize the probe.

For cautions regarding connecting the probe, see Note in section 9.1.

For information about compatible fiber inspection probes, contact your nearest YOKOGAWA dealer.

**Connecting a wireless LAN-compatible fiber inspection probes**

When connecting a wireless LAN fiber inspection probe to this instrument, use the station mode of the instrument's WLAN settings. Connect the fiber inspection probe to the instrument using the SSID and password set in station mode.

## Holding the image display

The still image size is VGA for both the USB2.0 and USB1.1 fiber inspection probes.

***Note***

If a USB2.0 fiber inspection probe is connected, it will take some time to display the still image.

## Saving data

You can save the still image. Video cannot be saved.

## Pass/fail judgment (/FST option)

**Configure the pass/fail judgment.**

- **Selecting the optical fiber cable**
  Select the type of optical fiber cable to be judged.
  SM: Single mode
  MM: Multi mode

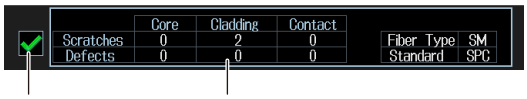
- **Selecting the judgment reference**
  Select the ferrule's polished surface of optical fiber cable to be judged. The judgment reference varies depending on the polished surface.
  UPC, SPC: For spherical surface polishing
  APC: For angled spherical surface polishing
  User: When judgment execution and threshold are set manually (when any of the settings is changed, the judgment reference is automatically set to User (UPC User, SPS User, or APC User for SM)). When you select the polished surface, the judgment execution on/off and scratch or defect judgment threshold values explained below are set automatically.

- **Turning judgment execution on or off**
  Judgment of scratches and defects are executed separately by size. The size value is fixed. Clearing the check box turns off the judgment execution. Pass/fail judgment is not performed on scratches or defects whose check box has been cleared.

- **Setting the scratch or defect judgment threshold values**
  Set the number of scratches and defects that will be judged as fail. The setting range is 0 to 100. If the judgment execution check box explained above is cleared, No Limit is displayed.

**Judgment results (Summary)**

Displays the judgment results and the number of detected scratches (Scratch) and detects (Defect). The detection count is displayed separately for the core, cladding, and contact areas. The judgment will be fail if there is even only a single fail (×) judgment.




**Judgment result**
**Pass: ✓ (green)**
**Fail: × (red)**

**Number of detected scratches and defects**

**Judgment results (Details)**

For each of the core, cladding, and contact areas, the threshold (Setting) and detection count (Result) are displayed.
If the detection count (Result) exceeds the threshold (Setting), the judgment will be fail (×).
Scratches and defects are detected separately by size.

Example
Scratch(<=3um): Scratches that are 3 µm or less
Scratch(>3um): Scratches that exceed 3 µm
Defect(2 to 5um): Defects from 2 µm to 5 µm

**Saving data**

The judgment result image and a judgment result file (including judgment settings) in CSV format are saved with the same file name (excluding the extension). Video cannot be saved.

## Judgment result syntax (csv file)

| | | |
|---|---|---|
| BMP File | 0000.BMP | : File name |
| Result | PASS | : Judgment result |
| Fiber Type | SM | : Optical fiber cable type |
| Standard | SPC | : Judgment reference type |

| Area | Kind | Condition | Setting | Result (Detections) | Judge | |
|---|---|---|---|---|---|---|
| Core | Scratch1 | <=3um | 2 | 1 | Pass | Judgment of scratches that are 3 µm or less in length in the core area |
| Core | Scratch2 | >3um | 0 | 2 | Fail | Judgment of scratches that exceed 3 µm in length in the core area |
| Core | Defect1 | Any | 0 | 3 | Fail | Defect judgment in the core area |
| Core | Defect2 | --- | NoLimit | 4 | | |
| Cladding | Scratch1 | <=3um | NoLimit | 5 | Pass | Judgment of scratches that are 3 µm or less in length in the clad area |
| Cladding | Scratch2 | >3um | 3 | 6 | Fail | Judgment of scratches that exceed 3 µm in length in the clad area |
| Cladding | Defect1 | <5um | NoLimit | 7 | Pass | Judgment of defects that are 5 µm or less in length in the clad area |
| Cladding | Defect2 | 5 to 10um | 5 | 8 | Fail | Judgment of defects that are 5 µm to 10 µm in length in the clad area |
| Cladding | Defect3 | >10um | 0 | 9 | Fail | Judgment of defects that exceed 10 µm in length in the clad area |
| Contact | Scratch | Any | NoLimit | 10 | Pass | Scratch judgment in the contact area |
| Contact | Defect1 | <20um | NoLimit | 11 | Pass | Judgment of defects that are 20 µm or less in length in the contact area |
| Contact | Defect2 | 20 to 30um | 5 | 12 | Fail | Judgment of defects that are 20 µm to 30 µm in length in the contact area |
| Contact | Defect3 | >30um | 0 | 13 | Fail | Judgment of defects that exceed 30 µm in length in the contact area |

# 7.7 Controlling the Optical Switch Box

**WARNING**

- During measurement, light is transmitted from the instrument's light source ports. Do not disconnect the connected optical fiber cables from this instrument or from the optical switch. Visual impairment may occur if the light enters the eye.
- Close the covers of any light source ports that do not have optical fiber cables connected to them. Visual impairment may occur if light that is mistakenly emitted from these ports enters the eye.

**French**

**AVERTISSEMENT**

- Lorsque instrument 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'oeil.
- Couvrir les caches des ports de source lumineuse libres. Sur les modèles dotés de deux ports de source lumineuse ou plus, protéger les yeux contre l'émission accidentelle de lumière depuis le mauvais port.

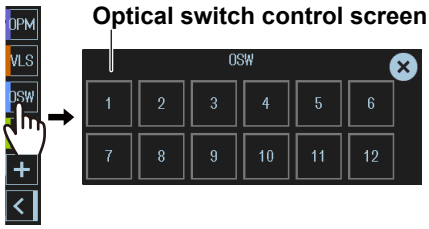
## Procedure

### Displaying the optical switch screen

The optical switch screen is opened from the Utility menu.

**Displaying the OTDR screen**

1. On the OTDR, light source, power meter, or visible light source setup screen, tap **OSW** (optical switch) on the Utility menu. An optical switch setup screen appears.




The features shown on the Utility menu and their display positions vary depending on the settings. For details, see section 7.1.

2. Tap the number of the control screen. The optical switch changes to the optical port corresponding to the number you tapped.

## Controlling the optical switch during multi-fiber measurement (OTDR)

Setting “Linkage OSW control” to ON in the multi-fiber measurement project settings causes the optical switch to change automatically when you select a measurement target core number and execute a measurement. The optical switch control screen does not appear. For details, see section 8.2.

# 8.1 Displaying a Map of the Line Configuration and Events (OTDR Smart Mapper)

**WARNING**

- During measurement, light is transmitted from the instrument's light source ports. Do not disconnect the connected optical fiber cables. Visual impairment may occur if the light enters the eye.
- Close the covers of any light source ports that do not have optical fiber cables connected to them. Visual impairment may occur if light that is mistakenly emitted from these ports enters the eye.

**French**

**AVERTISSEMENT**

- Lorsque instrument 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'oeil.
- Couvrir les caches des ports de source lumineuse libres. Sur les modèles dotés de deux ports de source lumineuse ou plus, protéger les yeux contre l'émission accidentelle de lumière depuis le mauvais por

## Procedure

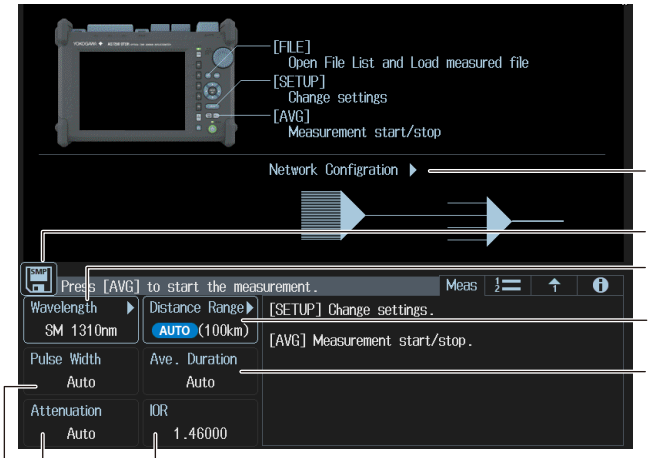
### Displaying the OTDR Smart Mapper screen

*1.* Press **MENU**. A MENU screen appears.

**2.** Tap the **OTDR Smart Mapper** icon. An OTDR Smart Mapper screen appears.

**MENU screen**


**OTDR Smart Mapper screen**




**Set the number of splitter stages and the number of branches** (see the next page).

**Save data directly.**

**Set the wavelength** (see section 3.1).

**Set the distance range** (see section 3.1).

**Set the averaging conditions** (see section 3.1).

**Set the index of refraction** (see section 3.1).

**Set the attenuation** (see section 3.1).

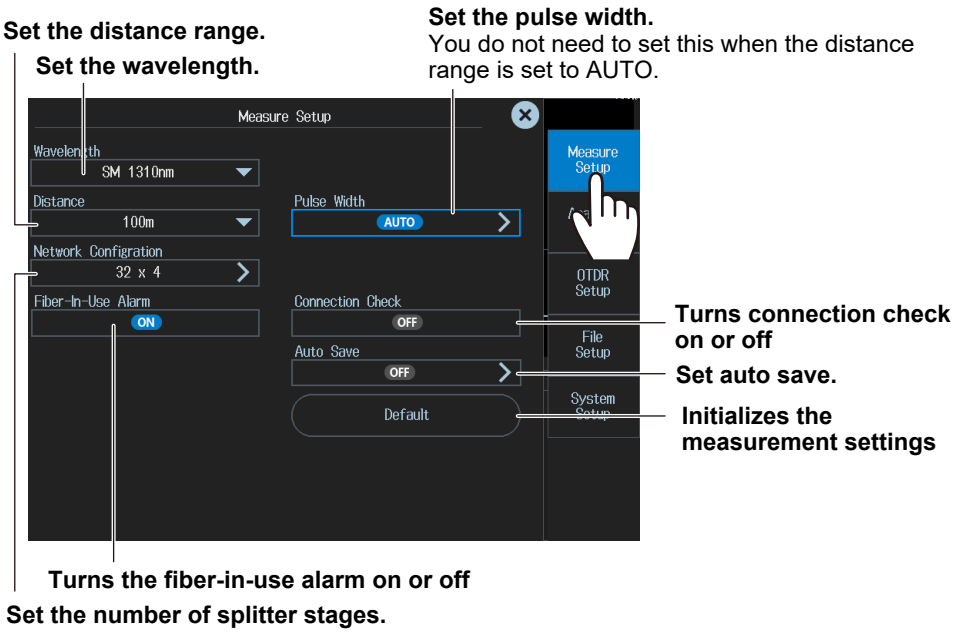
**Set the pulse width** (see section 3.1).

## Performing setup

*3.* Press **SETUP**.

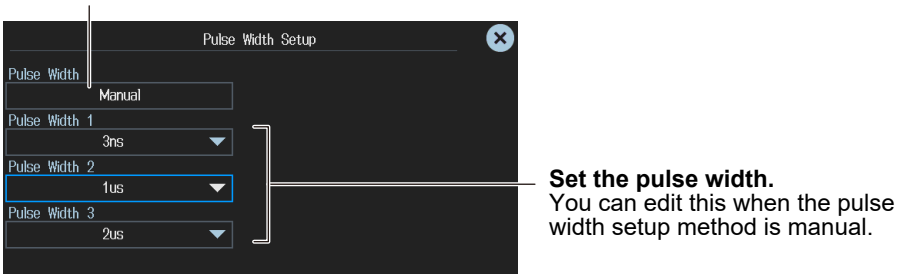
### Measurement conditions

*4.* Press the **Measure Setup** soft key. The Meas Setup screen appears.




- **Setting the pulse width**

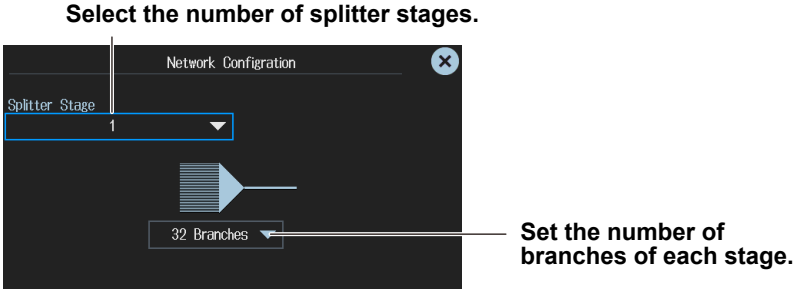
*5.* Tap **Pulse Width**. A pulse width setup screen appears.




- **Setting the network configuration**

  Set the number of splitter stages and the number of branches.

*6.* Tap **Network Configuration**. A Network Configuration screen appears.



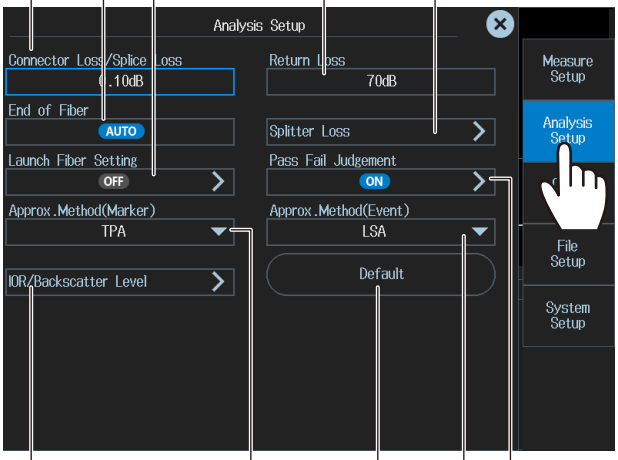
## Note

- Pulse width setup is a feature for individually setting the three pulse width values explained in “Viewing and editing waveforms in trace mode” on page 8-7. For the pulse width feature used in Adapt Trace, see “Smart Mapper” in section 1.7.
- For details on the setup screen that appears when you select a setting and the descriptions of the settings other than those of pulse width and network configuration, see section 3.1.

### Analysis conditions

***4.*** Press the **Analysis Setup** soft key. The Analysis Setup screen appears.

**Set the splice loss (0.01dB to 9.99dB).**
**Set the end of fiber (AUTO, 3dB to 64dB).**
**Set the launch fiber.** (See section 3.2.)
**Set the return loss (20dB to 70dB).**
**Set the splitter loss.** (See section 3.2.)




**Set pass/fail judgment.**
(See section 3.2.)
**Set the approximation method.**
**Executes initialization**
Press to reset the analysis settings to their factory defaults.
**Set the approximation method (marker).**
**Set the backscatter level.**

## Note

For details on the setup screen that appears when you select a setting and the descriptions of the settings, see section 3.2.

### OTDR setup (display setup)

***4.*** Press the **OTDR Setup** soft key. A OTDR setting window appears.

**Set the total loss calculation method (Cumul-Loss, Loss between S and E).**
Cumulate: Integrated value of events
Between two points: Loss between S and E

**Turns marker information display on or off**
Displays on the screen the distance and loss value at the marker position.

**Turns ghost cursor display on or off**
This is for checking secondary reflections.

**Set the cursor display method.**

**Set the marker type.**

**Select the reflection display.**


**Turns approximated line display on or off**
Displays an approximated line for waveform events.

**Distance decimal places**

**Turns the cursor dB display on or off**

**Locks screen operations**
Screen operations can be locked after a given time elapses.

**Turns END point loss display on or off**

**dB decimal places**

**Calculation method for total return loss**

**Set the cumulative loss type.**
Select the cumulate loss calculation method.

## *Note*

For details on the setup screen that appears when you select a setting and the descriptions of the settings, see section 3.3.

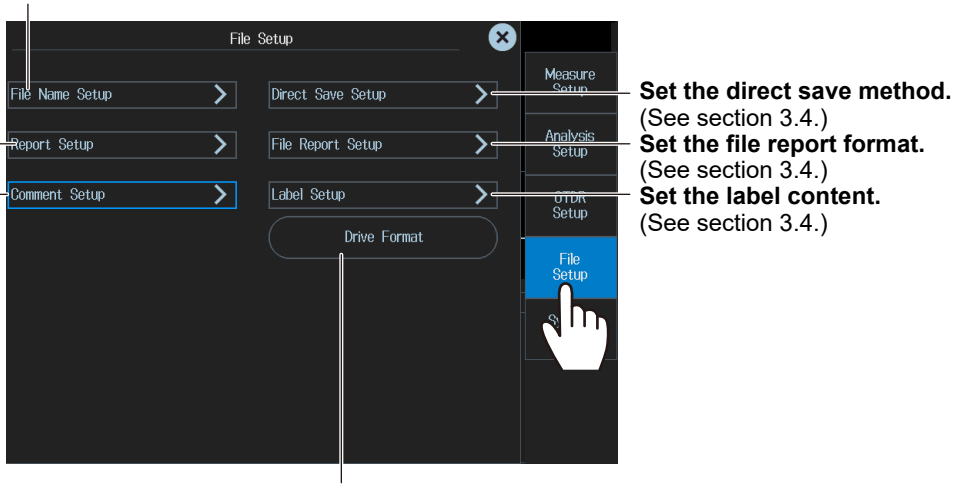
### File conditions

***4.*** Press the **File Setup** soft key. A file setup screen appears.

**Set the report format.** (See section 3.4.)

**Set comments for file names.** (See section 3.4.)

**Set the file name.** (See section 3.4.)




**Set the direct save method.** (See section 3.4.)

**Set the file report format.** (See section 3.4.)

**Set the label content.** (See section 3.4.)

**Initializes the instrument's internal memory (inside the internal memory).**

***Note***

For details on the setup screen that appears when you select a setting and the descriptions of the settings, see section 3.4.

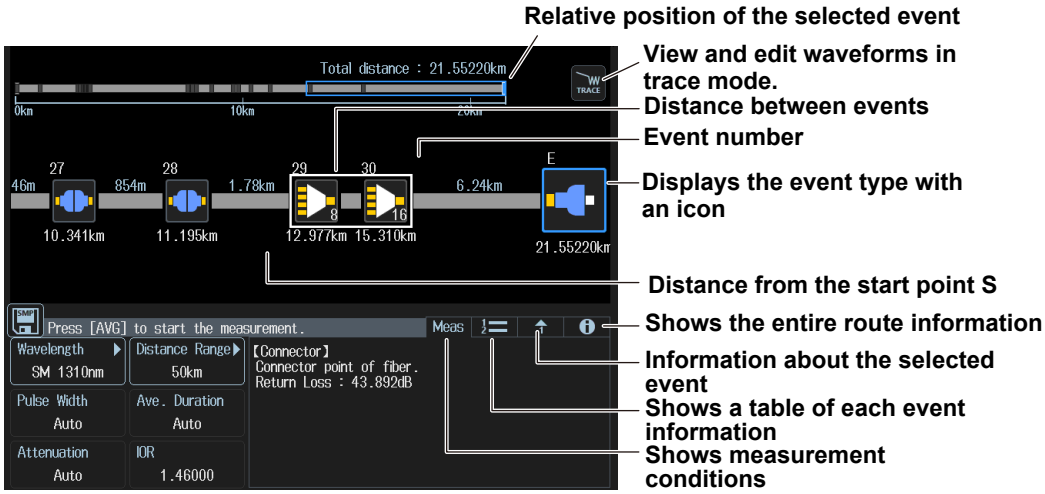
## Executing an averaged measurement

***5.*** Press **AVG**. A measurement will begin.

Measurements are performed four times using the set averaging conditions. A wait screen is displayed while the measurement is in progress.

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 using icons on the screen. If you press AVG again during averaged measurement, the measurement is aborted. When you abort the measurement, the measurement results are not displayed.

### Map display of the measurement results



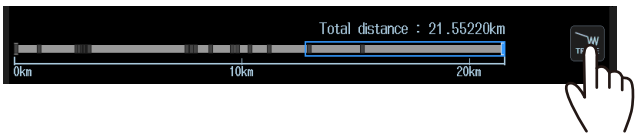

## Note

- The icon display method is the same as the display in MAP mode of event analysis in section 1.4.
- For details on event information display, see “Event analysis” in section 4.1.

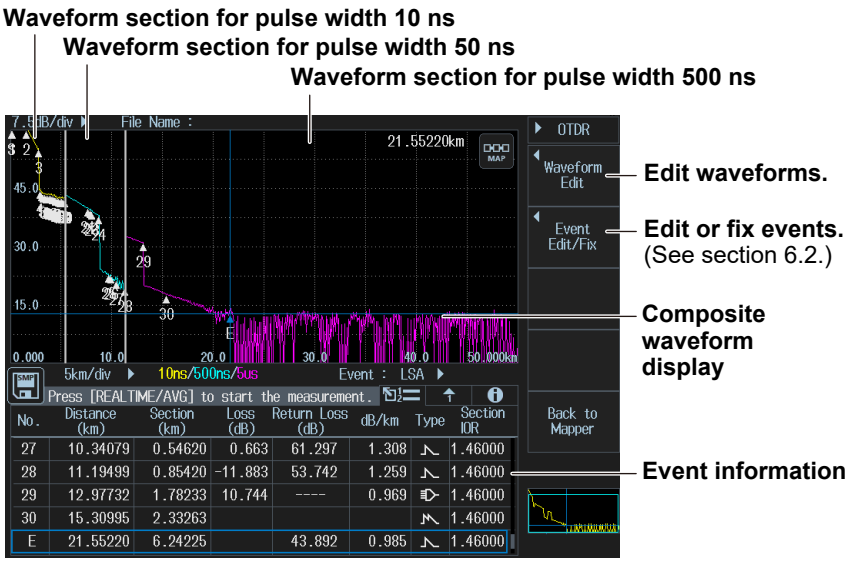
# Viewing and editing waveforms in trace mode

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

A waveform view/edit screen appears.




### Waveform view/edit screen

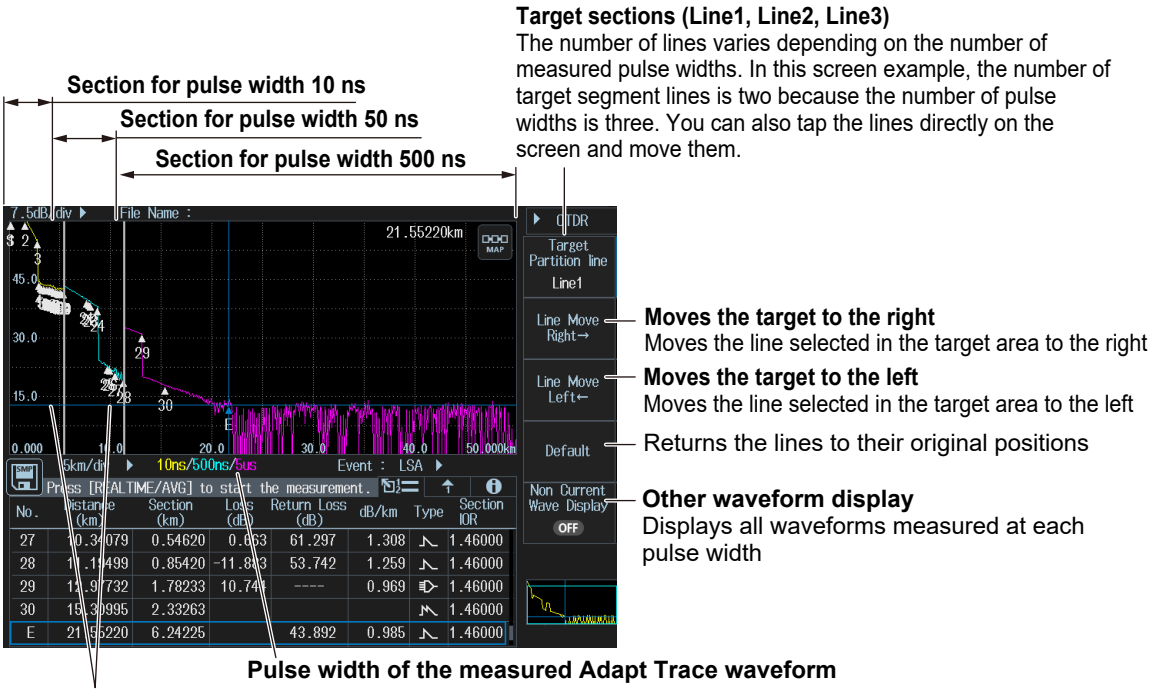



## Note

For details on event information display, see “Event analysis” in section 1.4.

## Editing waveforms

***3.*** Press the **Waveform Edit** soft key. A soft key menu appears for operating the composite waveform display.




# Explanation

## Measurement conditions

For details on the measurement conditions, see section 3.1.

### Wavelength

The wavelengths that you can specify vary depending on the model.

| Model | Wavelength |
|---|---|
| AQ7292A | 1310 nm, 1550 nm |
| AQ7293A | 1310 nm, 1550 nm |
| AQ7294A | 1310 nm, 1550 nm |
| AQ7293F | 1310 nm, 1550 nm, 1650 nm |
| AQ7293H | 1310 nm, 1550 nm, 1625 nm |
| AQ7294H | 1310 nm, 1550 nm, 1625 nm |

### Distance range

Select a distance range from the following options.

AUTO, 100 m, 200 m, 500 m, 1 km, 2 km, 5 km, 10 km, 20 km, 30 km, 50 km, 100 km

### Network configuration

Set the number of splitter stages and the number of branches of each stage.

Select the number of splitter stages from Unknown, 1, and 2.

Select the number of branches from Unknown, 2 Branches, 4 Branches, 8 Branches, 16 Branches, 32 Branches, and 64 Branches.

## Analysis

For details on analysis, see section 3.2.

**Approximation method**

The following two types of approximation methods are available.

LSA: The instrument calculates the loss between two points by using the least squares method on all the data between the two points.

TPA: The instrument uses the difference between the levels of the two specified points to calculate the loss.

## OTDR setup

**Marker mode**

Select whether to display markers or lines on the waveform screen.

**Cumulate loss type**

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

**dB decimal**

Set the number of decimal places to display.

**.*: 1 decimal place

**.**: 2 decimal places

**.***: 3 decimal places

**Reflection display**

Select the value to display in the calculation result display area of the waveform display screen.

Return loss: The ratio of the incident optical power level and the reflected optical power level is displayed.

Reflection level: The reflected optical power level is displayed.

**Cursor**

Set the cursor display to crosshair or line.

**Total return loss**

Select whether to include the return loss value at the 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.

**Distance decimal**

Set the number of decimal places to display.

**.***: 3 decimal places

**.****: 4 decimal places

**.*****: 5 decimal places

## Event icon display

The following events are displayed using icons.

**Start point (Near-end reflection)**

**Splice**

**Connector (PC connector)**

**Connector (APC connector)**

**Bend**

**Splitter**

**End point (Fresnel reflection)**

# 8.2 Measuring a Multi-Fiber Optical Cable (Multi-Fiber Project)

**WARNING**

- During measurement, light is transmitted from the instrument's light source ports. Do not disconnect the connected optical fiber cables. Visual impairment may occur if the light enters the eye.
- Close the covers of any light source ports that do not have optical fiber cables connected to them. Visual impairment may occur if light that is mistakenly emitted from these ports enters the eye.

**French**

**AVERTISSEMENT**

- Lorsque instrument 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'oeil.
- Couvrir les caches des ports de source lumineuse libres. Sur les modèles dotés de deux ports de source lumineuse ou plus, protéger les yeux contre l'émission accidentelle de lumière depuis le mauvais por

## Procedure

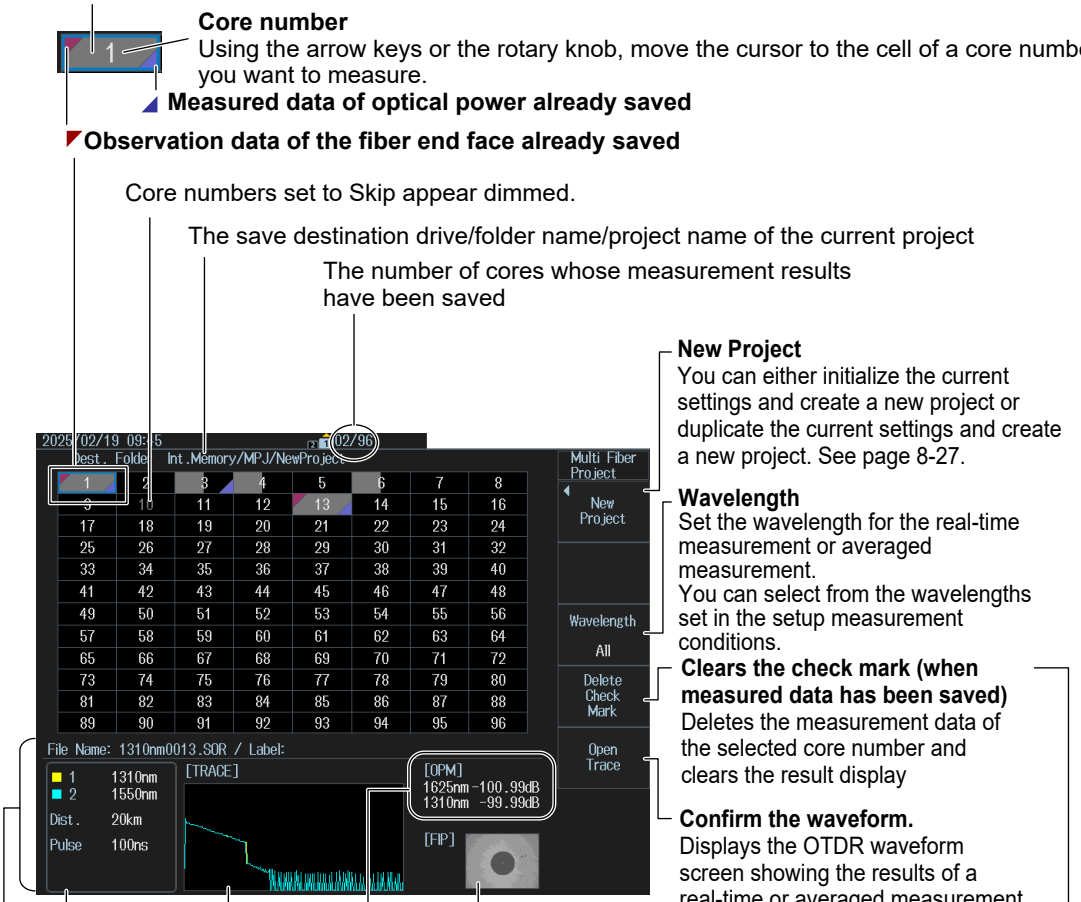
### Displaying the multi-fiber measurement screen

1. Press **MENU**. A MENU screen appears.
2. Tap the **Multi Fiber Project** icon. A multi-fiber measurement screen appears.

**MENU screen**

## Multi-fiber measurement screen

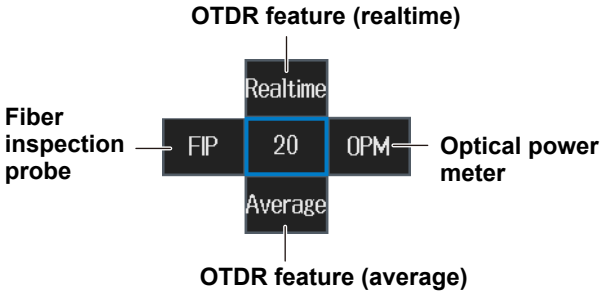
The background color of the cell indicates the storage status of the measurement data and the pass/fail judgment result.
If only the measurement results of either wavelength are stored during multi wavelength measurement, only half of the cell background color is displayed. If the measurement results of both wavelengths are stored, the background color of the cell is displayed in its entirety.
Gray: Measured data saved
Green: Measured data saved, pass judgment
Red: Measured data saved, pass judgment



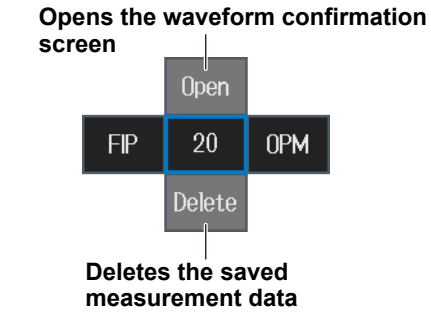
### Menu for executing measurements

When you tap a core number on the multi-fiber measurement screen, a menu appears for executing measurements. The displayed content of the menu varies depending on whether there is measurement data that has been saved.

**When measured data is not saved**




**When measured data is saved**



# Performing setup

***3.*** Press **SETUP**.

### Project setup

***4.*** Press the **Project Setup** soft key. A project setup screen appears.

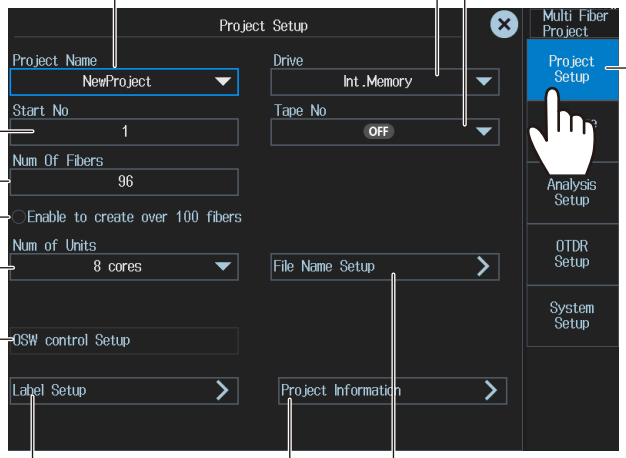
**Set the number of cores or tapes (1 to 2000).**
If you select the Enable to create over 100 fibers check box, you can set the number of fibers to 100 or more.
Selected: The selectable range of number of cores is 100 to 2000.
Not selected: The selectable range of number of cores is 1 to 100 (the setting resolution varies depending on the number of units).

**Set the starting core number (1 to 9900).**

**Set the project name.**
A character input dialog box will open.

**Select the drive.**
Selectable when auto save is ON.

**Set the tape number.**




**Project Setup**

**Set the label.**
The same label can be entered for all cores (see section 3.4).

**Set the file name type.**
See the next page.

**Project information**
You can view the project settings and measurement settings in a table (see the next page).

**Set OSW control.**
The optical switch can be changed automatically when you select the numbers of the cores to be measured and execute a measurement (see page 8-29).

**Set the number of cores in each division.**
You can set this when the tape number is set to OFF (see page 8-29).

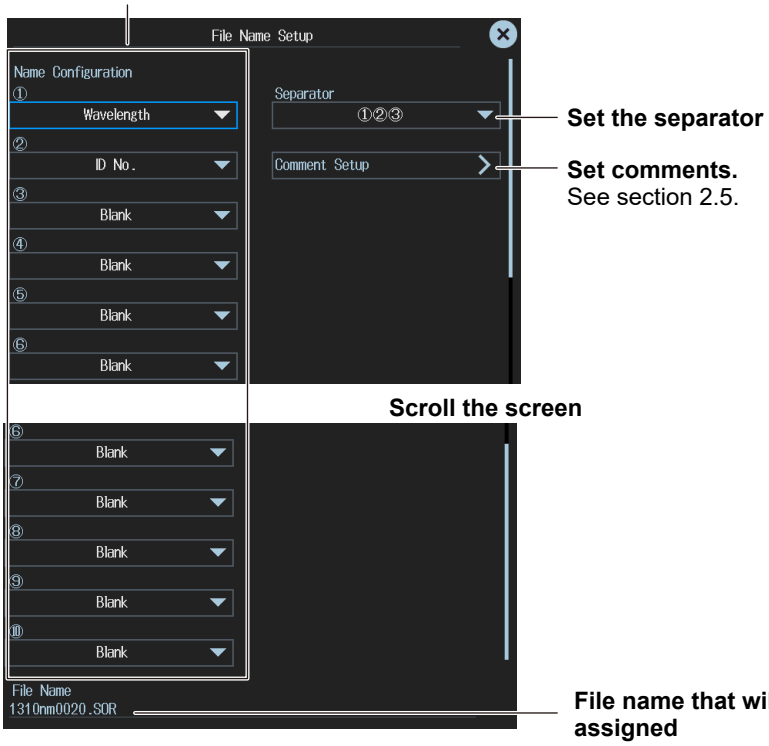
## *Note*

When you change the measurement core information, all the previous core measurements are discarded.

- **Setting the file name type**

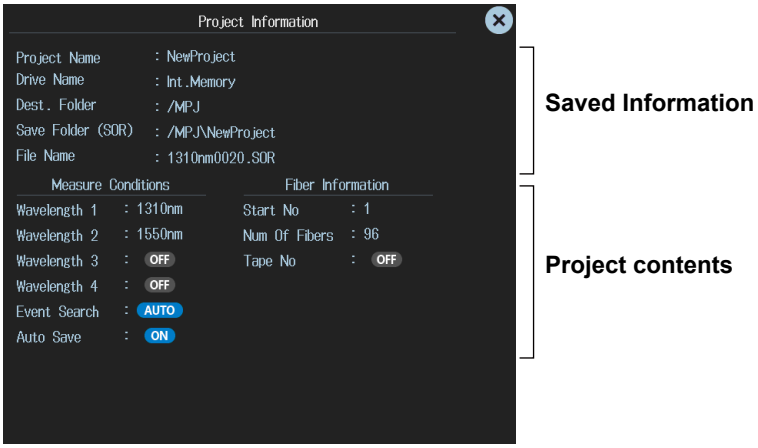
***5.*** Tap **File Name Setup**. A file name setup screen appears.

**Set the file name type.**
**(Project Name, ID No., Wavelength, Distance Range, Pulse Width, Attenuation, Average Method, Comment 1 to Comment 10, Company Name, Name, Cable ID, Fiber ID, Cable Code, Originating Loc (A), Terminating Loc (B), OSW CH number)**
Set the items that will be displayed into parts ① to ⑩ of the file name.



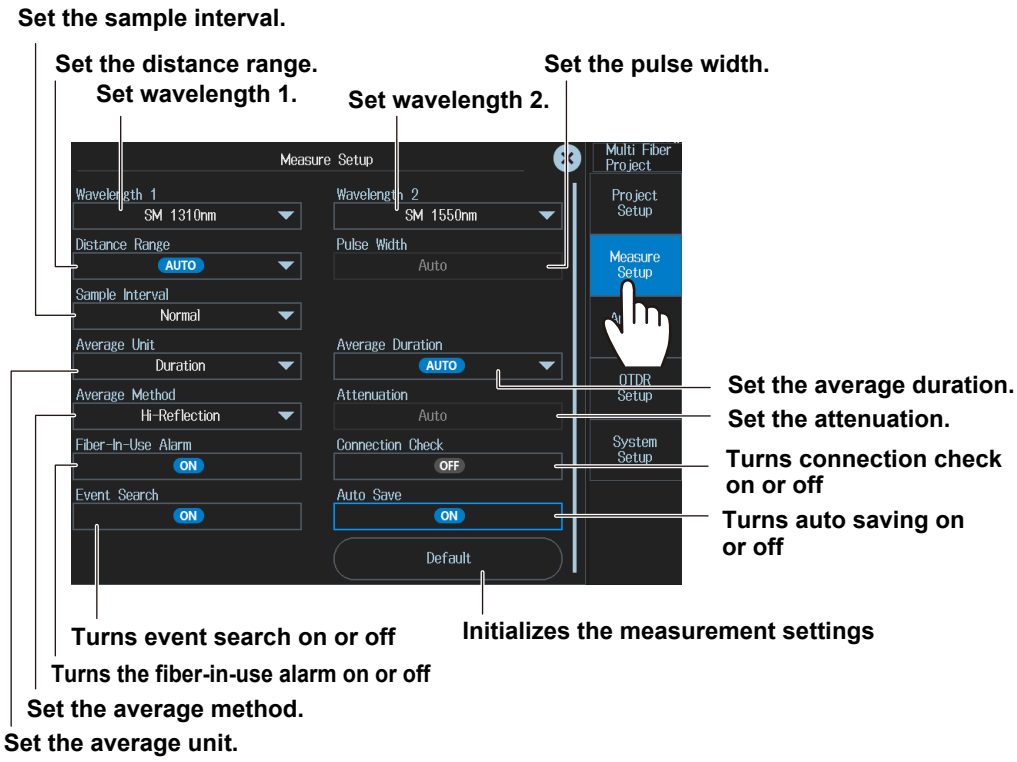

- **Displaying project information**

***5.*** Tap **Project Information**. The contents of the current project are displayed.



### Measurement conditions

***4.*** Press the **Measure Setup** soft key. The Meas Setup screen appears.

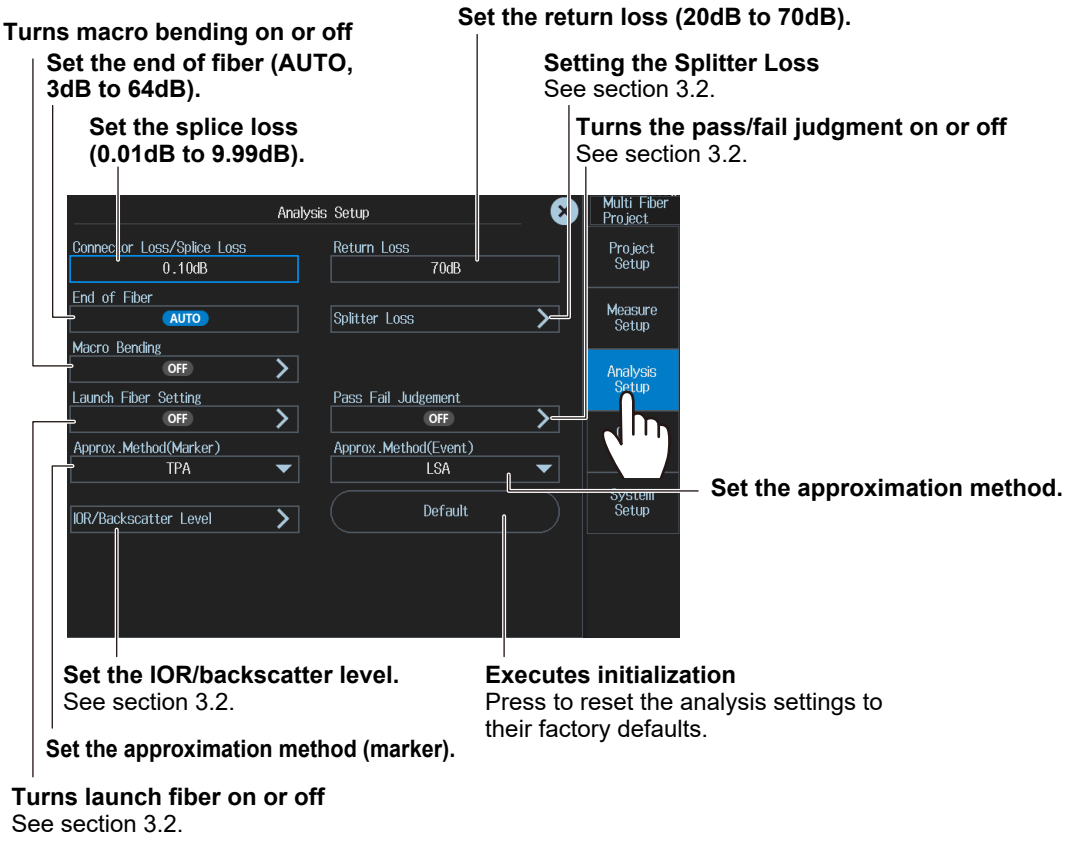



## *Note*

For details on the setup screen that appears when you select a setting and the descriptions of the settings, see section 3.1.

### Analysis conditions

***4.*** Press the **Analysis Setup** soft key. The following screen appears.




## *Note*

For details on the setup screen that appears when you select a setting and the descriptions of the settings, see section 3.2.

### OTDR setup (display setup)

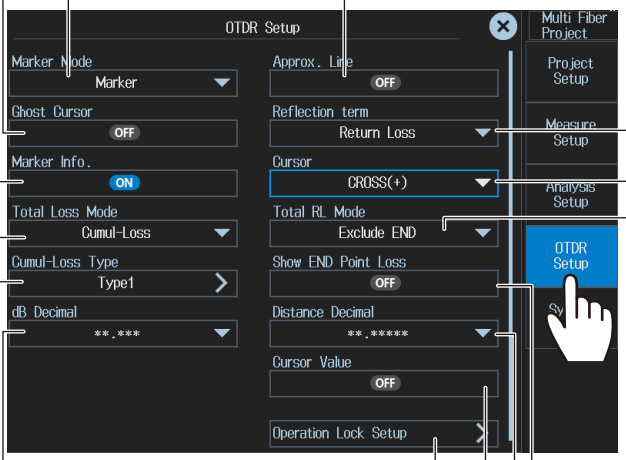
***4.*** Press the **OTDR Setup** soft key. The following screen appears.

**Turns marker information on or off**
Displays on the screen the distance and loss value at the marker position.

**Turns ghost cursor on or off**
Checks secondary reflections.

**Turns approximated line display on or off**
Displays an approximated line for waveform events.

**Set the marker type.**




**Select the reflection display.**

**Set the cursor display method.**

**Calculation method for total return loss**

**dB decimal places**

**Turns END point loss on or off**

**Set the cumulative loss type.**
Select the cumulate loss calculation method.

**Distance decimal places**

**Turns the cursor dB on or off**

**Set the calculation method for total loss**

**Operation Lock Setup**
Locks screen operation.

## *Note*

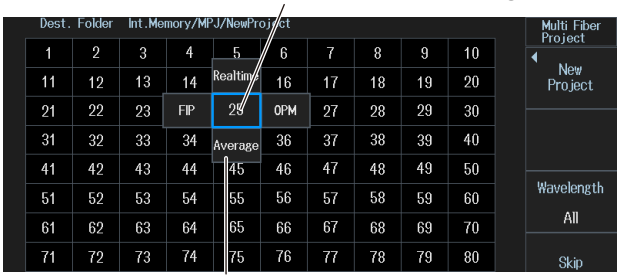
For details on the setup screen that appears when you select a setting and the descriptions of the settings, see section 3.3.

## Performing averaged measurements

After setting the SETUP menu, close the setup screen, and return to the multi-fiber measurement screen in step 2.

**5.** Tap the core number you want to perform an averaged measurement on. A menu appears for executing a measurement.

**Example of measuring core number 25**




**OTDR feature (average)**

**6.** Tap the **Average** menu. Averaged measurement begins.

The measured waveform is displayed on the screen, and while the measurement is in progress, a laser emitting mark is displayed at the top of the screen.

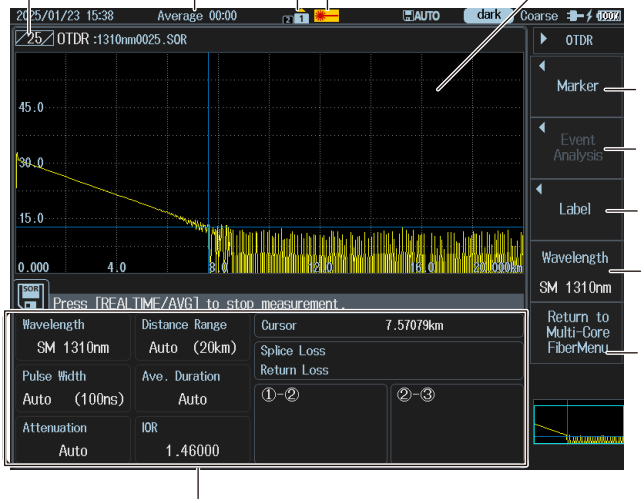
**Core number being measured**

**Averaged measurement in progress indication**

**The OTDR port emitting light**

**Laser on indication**

**OTDR waveform screen**




**Marker operation**
See section 6.1.

**Event analysis**
Cannot be selected during measurement.

**Set labels.**
See section 2.5.

**Wavelength***
Displays the wavelength currently being measured

**Returns to the list***
Returns to the multi-fiber measurement screen (core selection screen)

Cannot be controlled on the OTDR waveform screen of multi-fiber measurement. When event search is set to on in the setup measurement conditions, the analysis results are displayed when the measurement is complete.

* This setting is valid when auto save is on.

### *Note*

- If Wavelength on the multi-fiber measurement screen is set to “All,” measurement is executed using multiple wavelengths for each core.
- If you enter the label characters in the label setting of the project setup screen, the same label characters can be entered at once for all cores.
- You can also execute an averaged measurement using the AVG key.

**When Auto Save is set to ON in the measurement (Measure) conditions of setup**

When measurement is complete, the measured results are automatically saved. The screen returns automatically to the multi-fiber measurement screen, and pass/fail judgment indications appear in the core number cells whose measurement results have been saved.

**When Auto Save is set to OFF in the measurement (Measure) conditions of setup**

When measurement is complete, the measured results are not automatically saved. The OTDR waveform screen will be displayed. To return to the multi-fiber measurement screen, press the Return to Multi-Core FiberMenu soft key. When returning to the multi-fiber measurement screen, a message appears for confirming the saving of the measured results. If necessary, save the measured results.

Soft key menu when auto save is OFF and averaged measurement is complete


**Display**
Switches the event analysis result display (see section 6.2)

**Current trace**
Switches the wavelength of the current trace (when measuring multiple wavelengths)

**Edit or fix events.**
See section 6.2.

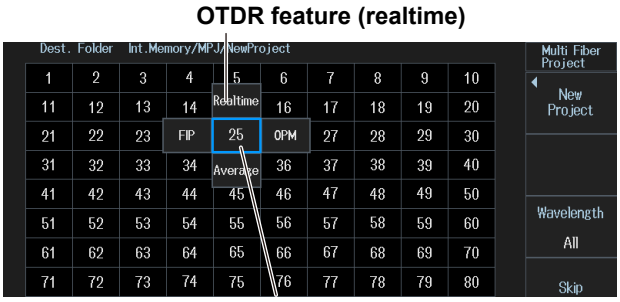
**2-point markers**
Set the 2-point marker of event analysis (see section 6.2).

**Returns to the list**
Returns to the multi-fiber measurement screen (core selection screen)

## Performing real-time measurement

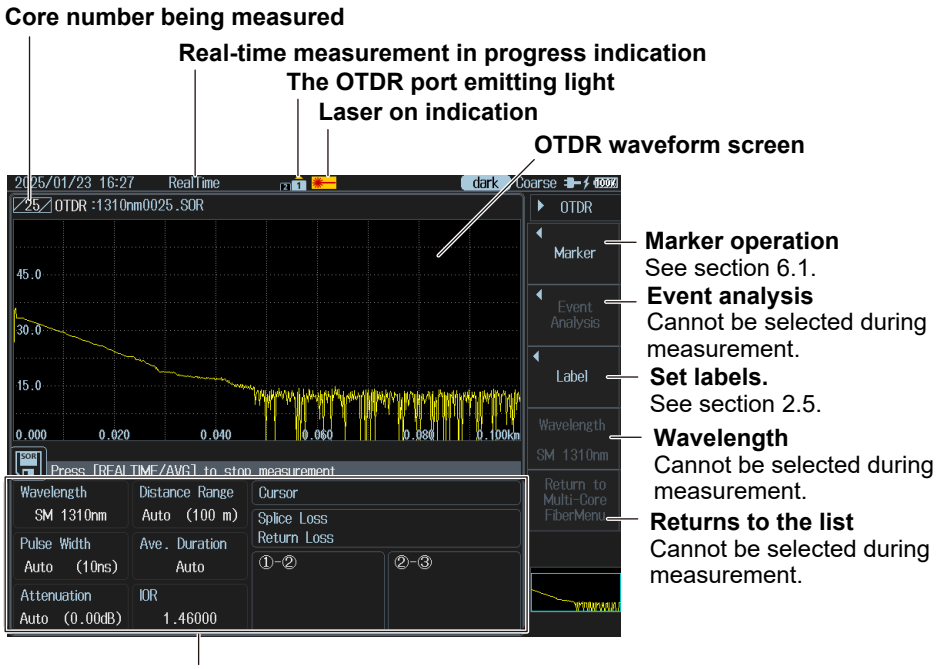
After setting the SETUP menu, close the setup screen, and return to the multi-fiber measurement screen in step 2.

***5.*** Tap the core number you want to perform a real-time measurement on. A menu appears for executing a measurement.




***6.*** Tap the **Realtime** menu. A real-time measurement will begin.

The measured waveform is displayed on the screen, and while the measurement is in progress, a laser emitting mark is displayed at the top of the screen.




Cannot be controlled on the OTDR waveform screen of multi-fiber measurement. When you press Event Analysis on the soft Key menu after measurement, the analysis result display appears.

***7.*** Press **REAL TIME**. Real-time measurement will stop.

To return to the multi-fiber measurement screen, display the soft key menu, and press the Return to Multi-Core FiberMenu soft key. When returning to the multi-fiber measurement screen, a message appears for confirming the saving of the measured results. If necessary, save the measured results.

### Soft key menu after real-time measurement completion


**Marker**
See section 6.1.

**Event analysis**
See section 6.2.

**Section analysis**
See section 6.1.

**Set the wavelength.**
Switches the wavelength to perform real-time measurement

**Returns to the list**
Returns to the multi-fiber measurement screen (core selection screen)

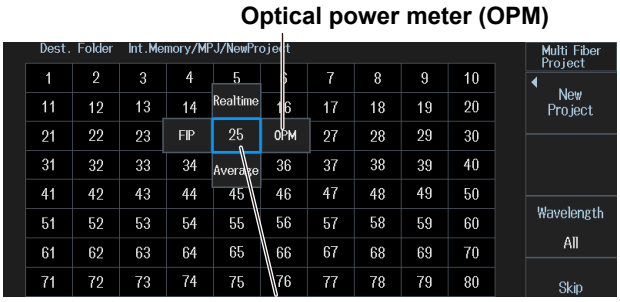
## *Note*

- In real-time measurement, measured results are not automatically saved.
- If Wavelength on the multi-fiber measurement screen is set to “All,” measurement of “Waveform 1” is executed. To measure “Wavelength 2” and later, save the measured results of “Waveform 1,” and then press the Wavelength soft key in the soft key menu to switch the wavelength.
- If you enter the label characters in the label setting of the project setup screen, the same label characters can be entered at once for all cores.

## Measuring the optical power

After setting the SETUP menu, close the setup screen, and return to the multi-fiber measurement screen in step 2.

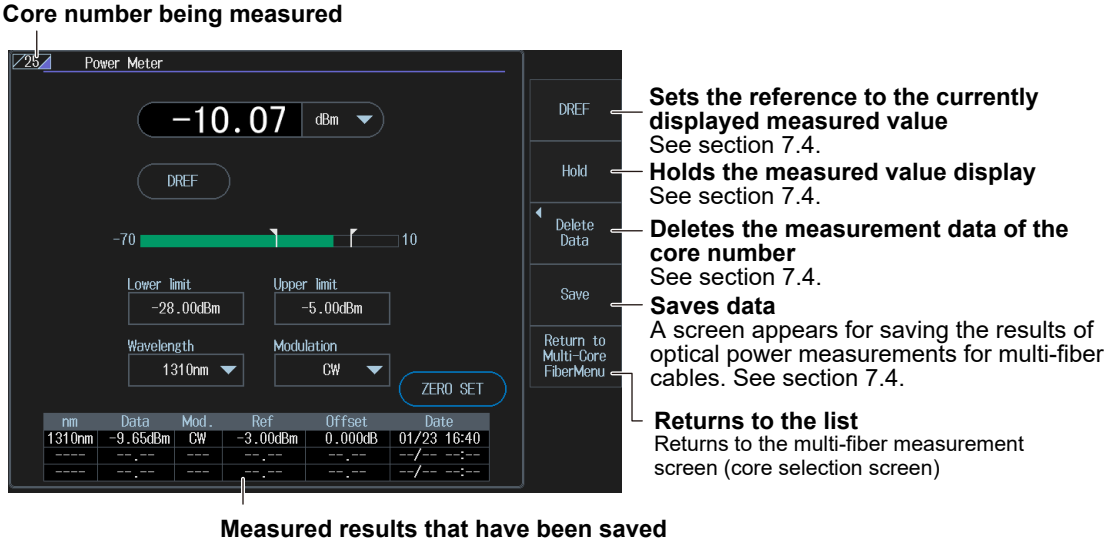
**5.** Tap the core number you want to measure the optical power of. A menu appears for executing a measurement.




**6.** Tap the **OPM** menu. A power meter screen appears.

For details on how to operate the optical power meter, see section 7.4.

To return to the previous screen, tap Return to Multi-Core FiberMenu on the soft key menu.




### Performing setup

**7.** Press **SETUP**. An optical power meter setup screen appears.

**8.** Tap the **Power Meter** tab. A power meter screen appears.

For details on how to set up the optical power meter, see section 7.4.

### Executing a zero set

***9.*** After step 8, close the optical power meter screen. The screen returns to the power meter screen.

***10.*** Remove the optical fiber cables from the instrument and close the OPM port cover, or make sure that the power meter section is not receiving any light, and then tap **ZERO SET**.

For details on how to perform zero set on the optical power meter, see section 7.4.

### Measuring the optical power

***11.*** Set the wavelength.

***12.*** Connect an optical fiber cable to the OPM port. The measured value is displayed on the power meter screen. For the position of the OPM port, see “Component Names and Functions” in the Getting Started Guide, IM AQ7290-02EN.

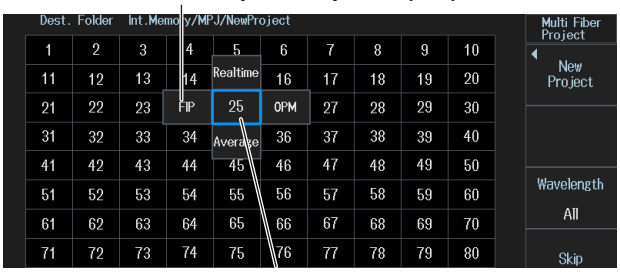
## Using the fiber inspection probe

After setting the SETUP menu, close the setup screen, and return to the multi-fiber measurement screen in step 2.

***5.*** Connect the fiber inspection probe to the core of the optical fiber cable you want to inspect.

***6.*** Tap the core number that you are connecting the fiber inspection probe to. A menu appears for executing a measurement.

**Fiber inspection probe (FIP)**



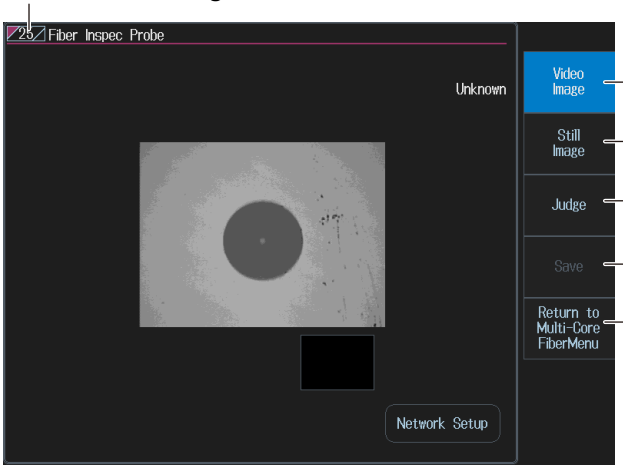

**Example of measuring core number 25**

***7.*** Tap the **FIP** menu. A fiber inspection probe screen appears.

For details on how to use the fiber inspection probe, see section 7.6.

To return to the previous screen, tap Return to Multi-Core FiberMenu on the soft key menu.

**Core number being measured**




**Displays the image in real time**
See section 7.6.

**Holds the image display**
See section 7.6.

**Executes pass/fail judgment**
See section 7.6.

**Executes saving**
Press the soft key to save the still image to a BMP file. For the file save destination, see section 9.4. For the procedure to set the file name, see section 3.4.

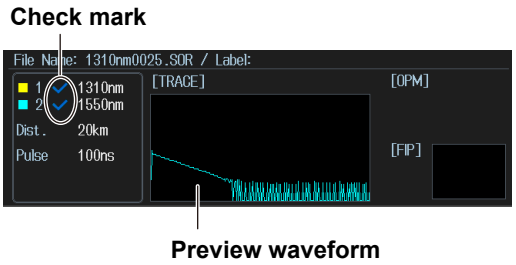
**Returns to the list**
Returns to the multi-fiber measurement screen (core selection screen)

## Previewing measured results

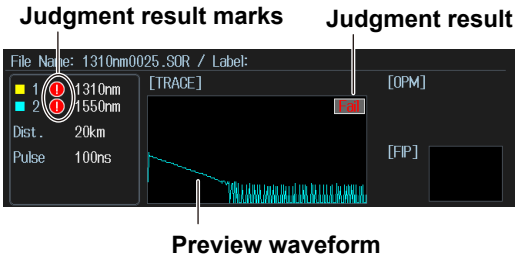
Using the arrow keys or the rotary knob, move the cursor to the core number cell of the multi-fiber measurement screen. The preview area at the bottom of the screen displays the measurement conditions, measurement date, and the measurement result waveform of the selected core number. For details on pass/fail judgment, see section 3.2.

### Real-time/averaged measurement preview

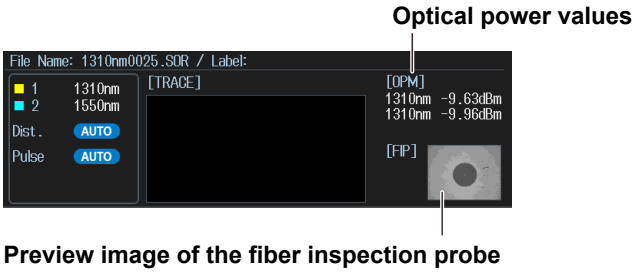
- **When pass/fail judgment is set to OFF**
  Check marks appear next to the wavelengths for which measured data is saved.




- **When pass/fail judgment is set to ON (/FST option)**
  Judgment result marks appear next to the wavelengths for which measured data is saved.



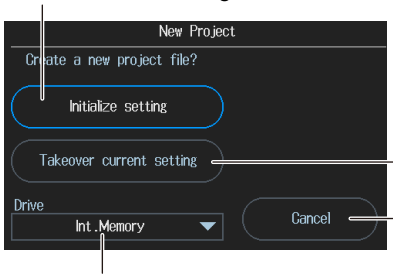

- **Optical power measurement results and fiber inspection probe observation results**
  The optical power of the measured wavelength is displayed. An image data is displayed for the fiber inspection probe observation results.



## Creating a new project

3. Continuing from step 2 on 8-11, click the **New Project** soft key. A character input dialog box will open.
4. Enter the project name by following the procedure in section 2.5.
5. Tap **Enter** in the character input dialog box displays the following screen.

**Initialize setting**
Initializes the settings of the current project and creates a new project




**Creates without changing the settings**
Duplicates the settings of the current project to create a new project

**Cancel**
Cancels the creation of a new project.

**Set the project save destination.**
**(Int.Memory, SD Card, USB Memory 1, USB Memory 2)**

6. Tap **Initialize setting** or **Takeover current setting**. A new project is created, and a multi-fiber measurement screen appears.

To change the project settings, see “Project setup” on page 8-14.

The contents of the current project can be viewed in project information on page 8-15.

# Explanation

## Project setup

### Saving the project

The project file and measurement result files of each core can be compressed in MPZ format and saved. For information on how to save files in MPZ format, see section 9.4.
The created project information is saved in CSV format in the MPJ folder of the specified destination media.

### *Note*

**Decompressing MPZ files**

On the AQ7933 OTDR emulation software (sold separately), run Utility > MPZ Converter. Select the source file (MPZ file) and the conversion destination. An MPJ file and SOR files will be extracted.
AQ7933 is a PC software application for analyzing and creating reports of waveform data measured by the instrument.

### Loading a project

An MPJ file created using the “multi-fiber project” feature included in the AQ7933 OTDR Emulation Software can be loaded into the instrument.

### *Note*

- On the instrument, you can only create projects whose measurement conditions of all cores are the same. “Multi-Fiber Project” can be used to create projects whose measurement conditions are different for each core.
- To load a past project into the instrument, you need an MPJ file and an SOR file (data saved with the project).

**NoJudge display**

If an MPJ file of an older version is loaded, the file may contain core information whose event analysis has not been executed even when pass/fail judgment is set to ON. If this occurs, you can turn off the display of pass/fail judgment setting once and then turn it back on so that pass/fail judgment is executed again on the measured data and pass or fail is indicated.

### Number of cores or tapes

Set the number of cores or tapes in the following range.

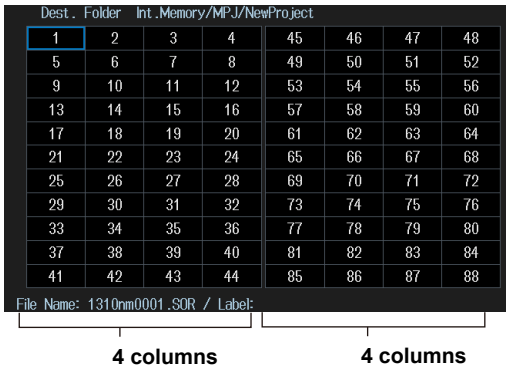
| Tape number | Number of cores or tapes | | | |
|---|---|---|---|---|
| OFF | Cores 4 to 96 (4 cores) | Cores 8 to 96 (8 cores) | Cores 10 to 100 (10 cores) | Cores 12 to 96 (12 cores) |
| a-b(2) | Tapes 1 to 50 | Tapes 1 to 50 | Tapes 1 to 50 | Tapes 1 to 50 |
| a-c(3) | Tapes 1 to 33 | Tapes 1 to 33 | Tapes 1 to 33 | Tapes 1 to 33 |
| a-d(4) | Tapes 1 to 25 | Tapes 1 to 25 | Tapes 1 to 25 | Tapes 1 to 25 |
| a-e(5) | Tapes 1 to 20 | Tapes 1 to 20 | Tapes 1 to 20 | Tapes 1 to 20 |
| a-f(6) | Tapes 1 to 16 | Tapes 1 to 16 | Tapes 1 to 16 | Tapes 1 to 16 |
| a-g(7) | Tapes 1 to 14 | Tapes 1 to 14 | Tapes 1 to 14 | Tapes 1 to 14 |
| a-h(8) | Tapes 1 to 12 | Tapes 1 to 12 | Tapes 1 to 12 | Tapes 1 to 12 |

You can set the number of cores in steps of 8 when the number of cores in each division is set to “8 cores” and in steps of 10 when the number of cores in each division is set to “10 cores.”
Example: When the number of cores in each division is set to “8 cores,” even if you set the number of cores to 12, it will be set to 16.

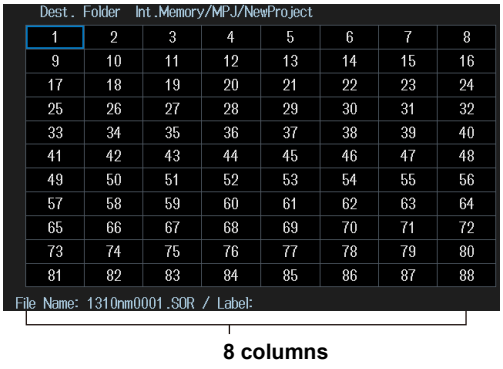
### Number of cores in each division

When Tape No is set to OFF, you can set the number of columns shown on the main view screen. If you will set the number of cores to 97 or higher, first set Num of Units to 10 cores.

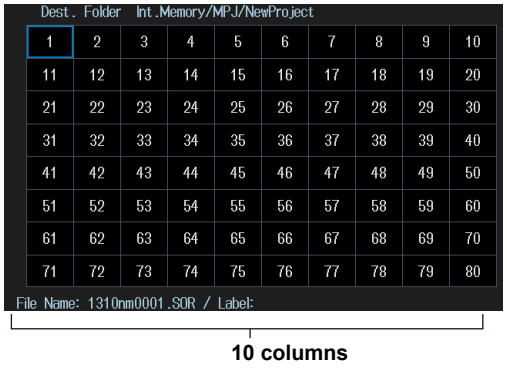
**4 cores**



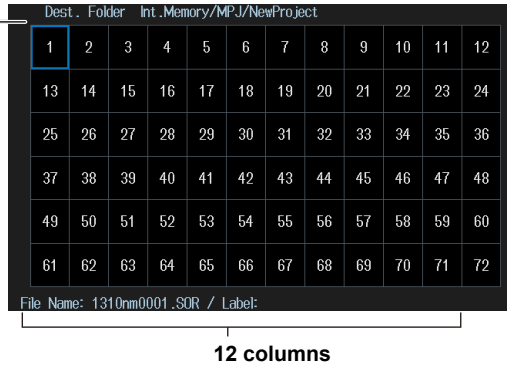

**8 cores**




**10 cores**




**12**




**In the project settings, setting "Linkage OSW control" to ON causes optical switch port numbers to appear. When you select the numbers of the cores to be measured and execute a measurement, the optical switch changes automatically.**
**When "Measure all channels" is set to ON, after the averaged measurement of the selected core is completed, the channel is switched to measure the next core, and the averaged measurement continues.**

## Measurement setup

Same settings as OTDR. For details, see section 3.1.

### Wavelength

You can set Wavelength 1, Wavelength 2, and Wavelength 3. Depending on the setting of Wavelength 1, only OFF may be set for Wavelength 2. Wavelength 3 can be set to AQ7293H or AQ7294H.

| Model | Wavelength 1 | Wavelength 2 | Wavelength 3 |
|---|---|---|---|
| AQ7292A | 1310 nm, 1550 nm | OFF, 1310 nm, 1550 nm | — |
| AQ7293A | 1310 nm, 1550 nm | OFF, 1310 nm, 1550 nm | — |
| AQ7294A | 1310 nm, 1550 nm | OFF, 1310 nm, 1550 nm | — |
| AQ7293F | 1310 nm, 1550 nm, 1650 nm | OFF, 1310 nm, 1550 nm | — |
| AQ7293H | 1310 nm, 1550 nm, 1625 nm | OFF, 1310 nm, 1550 nm, 1625 nm | OFF, 1310 nm, 1550 nm, 1625 nm |
| AQ7294H | 1310 nm, 1550 nm, 1625 nm | OFF, 1310 nm, 1550 nm, 1625 nm | OFF, 1310 nm, 1550 nm, 1625 nm |

**Distance range**

Set the distance range according to the length of the optical fiber cable. Specify a distance range value that is greater than the length of the optical fiber cable that you will measure.

The distance range can be set to any of the following values.

AUTO, 100 m, 200 m, 500 m, 1 km, 2 km, 5 km, 10 km, 20 km, 30 km, 50 km, 100 km, 200 km, 300 km, 400 km, 512 km

**Sample interval**

The maximum number of sample data points is 256000. The shortest sample interval is determined by the distance range.

Normal: The sampling interval is matched to the measurement update interval and pulse width. For real-time measurement, the sampling interval is such that an update interval of 5 times per second can be ensured.

High resolution: The instrument uses a sample interval that would result in the greatest number of data points. If you use a short sample interval, you can measure for finer changes, but the data size of the measured result becomes large.

**Pulse width**

The selectable pulse width varies depending on the distance range and type.

| Distance range | Pulse width |
|---|---|
| 100 m to 500 m | 3 ns, 10 ns, 20 ns, 30 ns |
| 1 km to 5 km | 3 ns, 10 ns, 20 ns, 30 ns, 50 ns, 100 ns, 200 ns, 300 ns, 500 ns |
| 10 km to 50 km | 50 ns, 100 ns, 200 ns, 300 ns, 500 ns, 1 µs, 2 µs, 5 µs |
| 100 km to 512 km | 50 ns, 100 ns, 200 ns, 300 ns, 500 ns, 1 µs, 2 µs, 5 µs, 10 µs, 20 µs |

**Average unit**

Set whether to perform averaging using measurement duration or measurement time.

Duration: Averages over the set measurement duration.

Time: Averages over the set measurement count.

**Average duration**

Set this when the average unit is set to Time.

Select the average duration from the following:

AUTO, 5 s, 10 s, 20 s, 30 s, 1 min, 3 min, 5 min, 10 min

When set to AUTO, measurement continues until the noise floor level reaches a certain level.

**Average times**

Set this when the average unit is set to Time.

Select the average duration from the following:

AUTO, 2^10 (1024 times), 2^11 (2048 times), 2^12 (4096 times), 2^13 (8192 times), 2^14 (16384 times), 2^15 (32768 times), 2^16 (65536 times), 2^17 (131072 times), 2^18 (262144 times), 2^19 (524288 times), 2^20 (1048576 times)

2^10 is 2 to the power of 10 (1024 times).

When set to AUTO, measurement continues until the noise floor level reaches a certain level.

**Average method**

There are two methods: Hi-Speed and Hi-Reflection.

Hi-Speed: All sections are measured according to the specified attenuation.

Hi-Reflection: Measurements are made with optimum attenuation according to the backscattered light level of each section.

## Analysis setup

Same settings as OTDR. For details, see section 3.2.

**Connector loss and splice loss**
If a splice loss that exceeds the specified threshold occurs, it is detected as an event.

**Return loss**
If a return loss that is less than or equal to the specified threshold occurs, it is detected as an event.

**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).

**Splitter loss**
Events whose loss exceeds this value are assumed to be optical splitters according to the number splits.

**Macro bending (bending loss)**
When an optical pulse measurement is made with multi-wavelength measurement, the connection loss of each wavelength is compared and detected as an event when the bending loss generated by the bending of the optical fiber cable exceeds a set threshold value.

**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) or start position so that the event information in the launch fiber section is excluded from the analysis conditions.

**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.

**Approximation method**
LSA: The instrument calculates the loss between two points by using the least squares method on all the data between the two points. The loss can be calculated with smaller error than TPA when there are no events such as reflections or connection losses within the interval to be calculated.
TPA: The instrument uses the difference between the levels of the two specified points to calculate the loss. The loss can be calculated with smaller error than LSA when there are events such as reflections or connection losses within the interval to be calculated.

**Backscatter level**
The backscatter level setting is used when the instrument 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.

**Index of refraction (IOR)**
The instrument 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.

## OTDR setup

Same settings as OTDR. For details, see section 3.3.

**Marker mode**

Select whether to display markers or lines on the waveform screen.

**Reflection display**

Select the value to display in the calculation result display area of the waveform display screen.

Return loss: The ratio of the incident optical power level and the reflected optical power level is displayed.

Reflection level: The reflected optical power level is displayed.

**Cursor**

Set the cursor display to crosshair or line.

**Total loss**

Select the calculation method for the displayed loss.

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

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

**Total return loss**

Select whether to include the return loss value at the 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.

**dB decimal**

Set the number of decimal places to display.

**.*: 1 decimal place

**.**: 2 decimal places

**.***: 3 decimal places

**Distance decimal**

Set the number of decimal places to display.

**.***: 3 decimal places

**.****: 4 decimal places

**.*****: 5 decimal places

## Saving measurement data

Measurement data for real-time measurement, averaged measurement, OPM, and FIP are stored in the following folder.

Save destination device > MPJ > Project name folder

Real-time measurement and averaged measurement data are in SOR format. OPM data is in CSV format. FIP data is in BMP format.

# 8.3 Monitoring Optical Fiber Cables (Schedule Measurement, /MNT option)

**WARNING**

- During measurement, light is transmitted from the instrument's light source ports. Do not disconnect the connected optical fiber cables. Visual impairment may occur if the light enters the eye.
- Close the covers of any light source ports that do not have optical fiber cables connected to them. Visual impairment may occur if light that is mistakenly emitted from these ports enters the eye.

**French**

**AVERTISSEMENT**

- Lorsque instrument 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'oeil.
- Couvrir les caches des ports de source lumineuse libres. Sur les modèles dotés de deux ports de source lumineuse ou plus, protéger les yeux contre l'émission accidentelle de lumière depuis le mauvais por

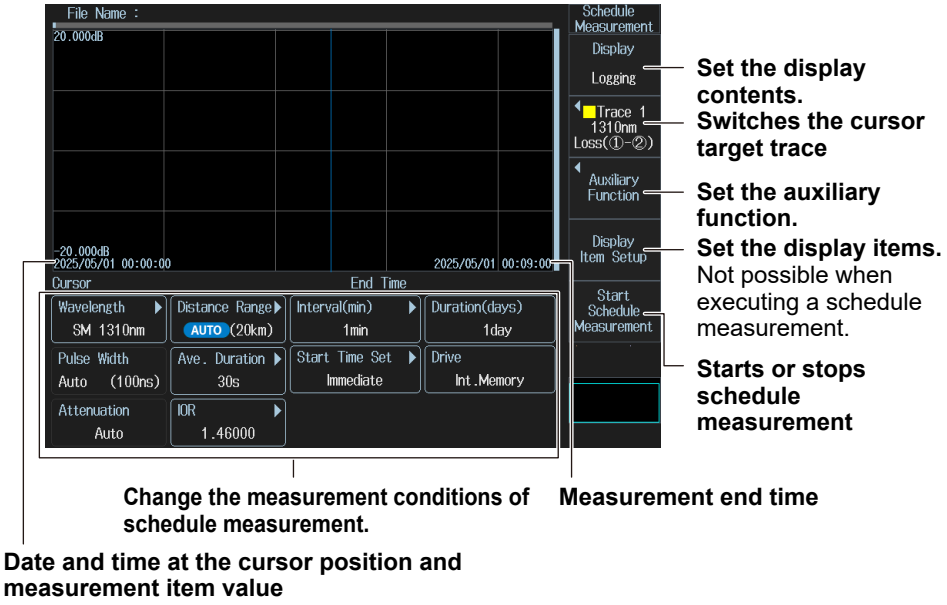
## Procedure

### Displaying the schedule measurement screen

1. Press **MENU**. A MENU screen appears.
2. Tap the **Schedule Measurement** icon. A Schedule Measurement screen appears.

**MENU screen**

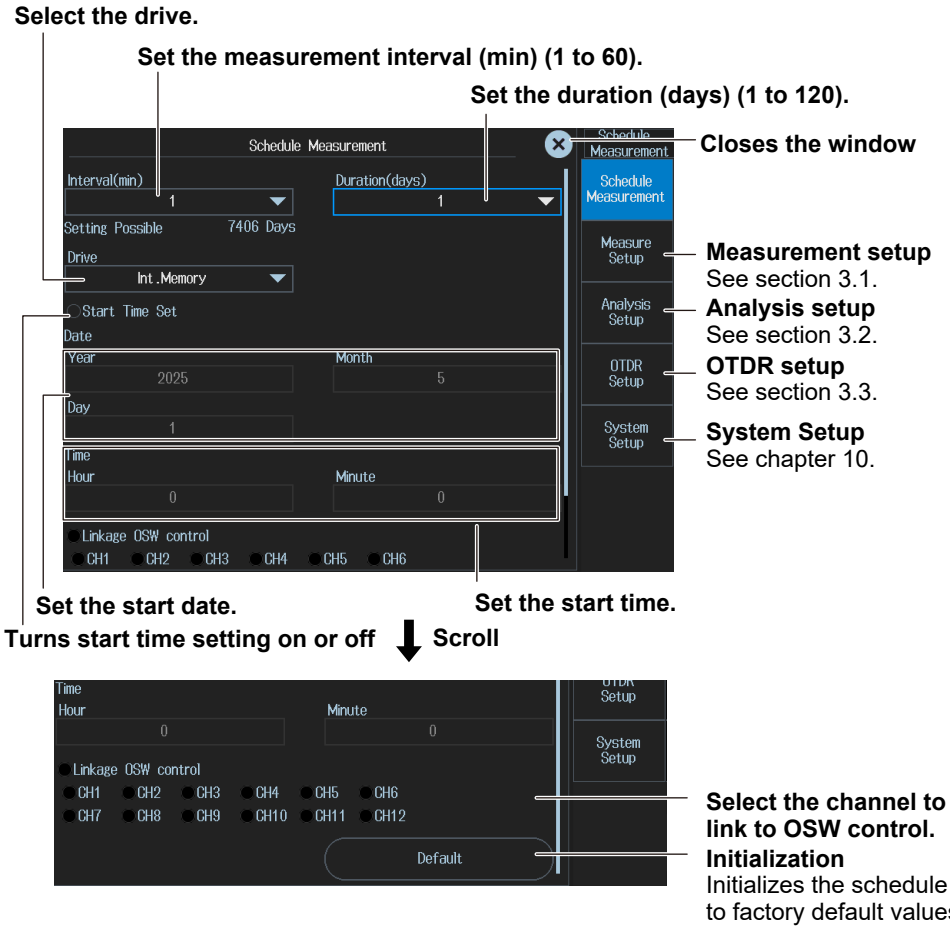
### Schedule Measurement screen




## Performing setup

***3.*** Press **SETUP**.

***4.*** Press the **Schedule Measurement** soft key. The following screen appears.



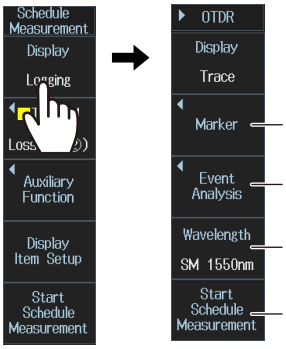

***5.*** After completing the schedule measurement, measurement settings, analysis settings, and OTDR settings, close the setup screen and return to the screen shown in step 2.

### Note

- When a schedule measurement is being performed, you cannot change the schedule.
- When a schedule measurement is being performed, you cannot perform marker analysis or event analysis. When a schedule measurement is stopped, you can perform marker analysis or event analysis on the measurement waveform data. But, you cannot save the analysis results.
- If you do not set “Linkage OSW control” to ON and select the channel to be linked, you will not be able to set the optical switch channel in the display items of the display content settings.

## Setting the display contents

**6.** Press the **Display** soft key. The waveform display screen (OTDR) appears.




**Marker analysis**
See section 6.1.

**Event analysis**
See section 6.2.

**Select the displayed waveform.**
The waveform is displayed for the selected wavelength.

**Starts or stops schedule measurement**

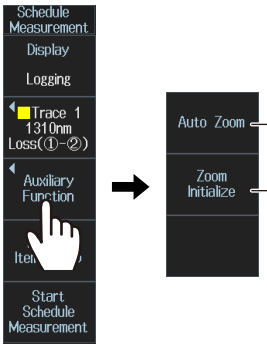
### Note

The following operations cannot be performed when optical pulse measurement is in progress.

- Moving the cursor
- Switching the display (between waveform and logging)
- Auxiliary function

## Setting the auxiliary function

**6.** Press the **Auxiliary Function** soft key. The waveform display screen (OTDR) appears.



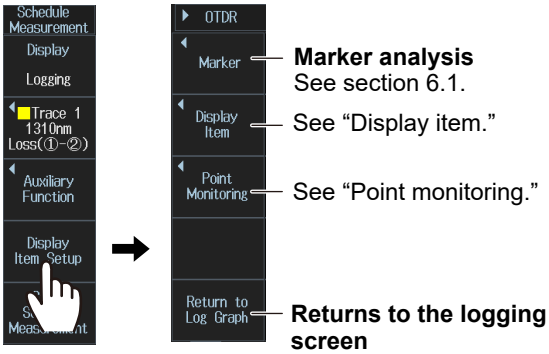

**Auto zoom**
Automatically zooms the logging data scale

**Zoom initialization**
Initializes the scale

## Setting the display items

**6.** Press the **Display Item Setup** soft key. A display item setup message appears.

**7.** Tap **OK**. A display item setup menu appears.




**Marker analysis**
See section 6.1.

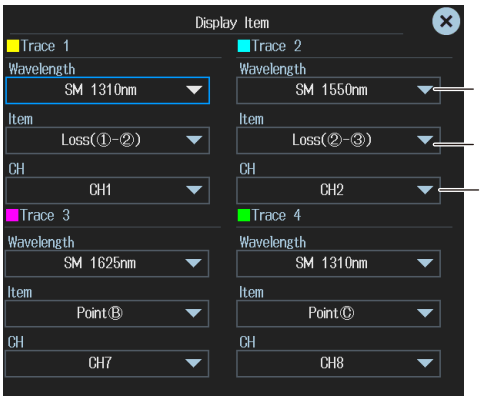
See “Display item.”

See “Point monitoring.”

**Returns to the logging screen**

### Display item

**8.** Press the **Display Item** soft key. A display item setup screen appears.




**Set the wavelength.**

**Set monitored items.**

**Set the optical switch.**
Select from the channels whose check boxes are selected when Linkage OSW control is on (see step 4).

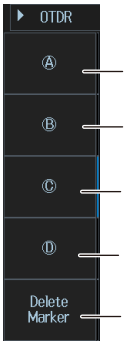
For each trace, set the wavelength, monitored items, and optical switch channel (when Linkage OSW control is on).

### *Note*

- If markers are not set, after the first measurement, marker 1 is set automatically to the near end of the waveform data and marker 2 to the far end.
- When a schedule measurement is being performed, you cannot set the display items.
- When a schedule measurement is being performed, you cannot perform marker or event analysis even if you switch to waveform display.

**Point monitoring**

*8.* Press the **Point Monitoring** soft key. A point monitoring setup screen appears.




**Sets point Ⓐ**
Sets point Ⓐ at the cursor position.

**Sets point Ⓑ**
Sets point Ⓑ at the cursor position.

**Sets point Ⓒ**
Sets point Ⓒ at the cursor position.

**Sets point Ⓓ**
Sets point Ⓓ at the cursor position.

Clears the point display

## Starting a schedule measurement

*9.* Press the **Start Schedule Measurement** soft key. Measurement will start according to the start time setting.

To stop an ongoing schedule measurement, press the **Stop Schedule Measurement** soft key.

# Explanation

## Schedule setup

**Interval (min)**
Set the interval to measure optical pulses.
The range is 1 to 60 minutes (in 1 minute steps).

**Duration (days)**
Set the duration to measure optical pulses.
The range is 1 to 120 days (in 1 day steps).

**Setting Possible**
The number of days is automatically calculated from the measurement interval and the size of the memory in which measured data will be saved. The result is displayed here. Select the drive according to the required duration. Note that even if a number greater than 120 is displayed, the maximum duration (days) that you can set is 120.

**Selecting the drive**
Select the drive where you want to save the measurement data.
Int. Memory: The internal memory of this instrument.
SD Memory: microSD memory card.
USB Memory 1: The first USB memory device detected.
USB Memory 2: The second USB memory device detected.

**Start time**
Measurement starts from the specified time.
OFF: Measurement starts immediately.
ON: Measurement starts at the specified date and time.

**Selecting measurement target channels**

Select the channels for schedule measurement. When “Linkage OSW control” is set to ON, the optical switch for the target channel in schedule measurement switches automatically in sync with the measurements.

## Setting the display contents

Select Logging or Trace.

**logging**

The measured optical pulse power values are logged on the time axis. You can view the places where the optical power is changing. Also, you can view the date and time and the power value at the cursor position.

**Trace**

You can display the waveform data at the cursor position. While waveform data is being displayed, the menu changes.

## Switching the cursor target trace

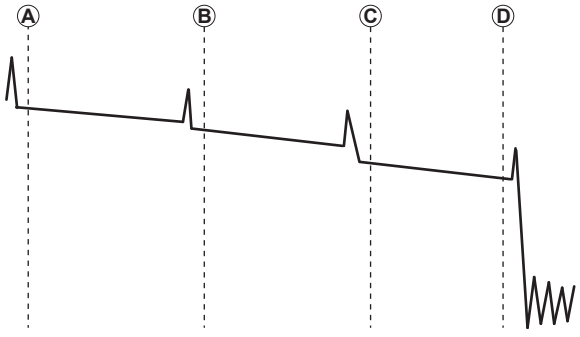
Switches the logging data to display on the screen. Trace for which the monitoring item is set to OFF in “Setting the display items” described later will not be displayed.

## Setting the display items

**Monitor items**

- **Monitoring measured values between markers (splice loss, return loss, loss(1−2), dB/km(1−2), loss(2−3), dB/km(2−3))**
  To display monitor items, you need to set markers. Averaged measurement and real-time measurement can be performed while the schedule measurement screen is displayed. Connect the optical fiber cable to be monitored and execute an optical pulse measurement. Then set the markers necessary for item display (events). For details on how to set markers, see section 6.1. For details on the items, see “Splice Loss” in section 1.4.

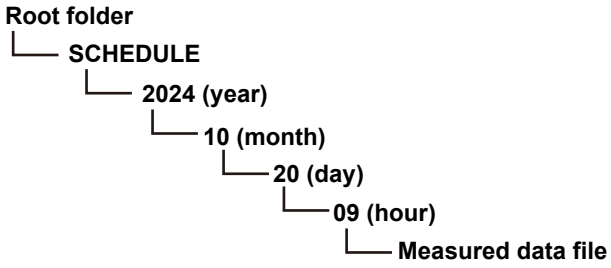
- **Monitoring measured values at fixed points (Point A, Point B, Point C, Point D)**
  Monitors the variation in the measured values at the specified points. You can set up to four points.



# Saving measurement data

### Save destination and file name

Schedule measurement data excluding schedule data (CSV format) is saved to the following path.




The above example shows the destination of a file saved on October 20, 2024 at 9:00 a.m.
The file name is wavelength_minute.SOR.
The name of the file for 1310 nm and 9:20 is
1310_20.SOR

### Schedule data (logging graph data)

When a schedule measurement finishes, logging graph data in CSV format is automatically saved in root folder/SCHEDULE. The time when a scheduled measurement begins is used for the file name.
Example: 202410200901.CSV if it begins on October 20, 2024 at 9:01 a.m.

- **Schedule data format**

| | |
|---|---|
| Company | Yokogawa Test and Measurement Corporation |
| Model | AQ7292A |
| Function | Schedule Measurement |
| Start Date | 2024/12/4 13:13 |
| Start TimeT | 1733317980 |
| Data | Ver1.02 |
| Wavelength1 | 1550 |
| Wavelength2 | 1310 |
| Wavelength3 | |
| Wavelength4 | |
| Trace1(Wavelength) | 1310 |
| Trace1(Item) | 3 |
| Trace1(CH) | 1 |
| Trace2(Wavelength) | 1310 |
| Trace2(Item) | 4 |
| Trace2(CH) | 2 |
| Trace3(Wavelength) | 1550 |
| Trace3(Item) | 7 |
| Trace3(CH) | 4 |
| Trace4(Wavelength) | 1550 |
| Trace4(Item) | 8 |
| Trace4(CH) | 6 |
| Interval(min) | 5 |
| Duration(days) | 1 |
| MeasureCount | 2 |
| MonitoringPointA | 599 |
| MonitoringPointB | 1067 |
| MonitoringPointC | 1340 |
| MonitoringPointD | -1 |
| LinkageOswControl | 0 |

| Trace1 | Trace2 | Trace3 | Trace4 |
|---|---|---|---|
| 36964 | 149391 | 16293 | 10997 |
| 41772 | 168823 | 16324 | 11166 |
| | ・・・・・・・ | | |

**Measurement start date and time**

**Set the measured wavelength.**

**Set the display items.**

**Monitor items (Item)**

**1: splice loss**
**2: total return loss**
**3: loss ( ① - ② )**
**4: dB/km( ① - ② )**
**5: loss ( ② - ③ )**
**6: dB/km ( ② - ③ )**
**7: point**
**8: point**
**9: point**
**10: point**
**0: OFF**

**Optical switch number (CH)**

Ⓐ **-1 : Not use** **6 : CH7**
Ⓑ **0 : CH1** **7 : CH8**
Ⓒ **1 : CH2** **8 : CH9**
Ⓓ **2 : CH3** **9 : CH10**
**3 : CH4** **10 : CH11**
**4 : CH5** **11 : CH12**
**5 : CH6**
**6 : CH7**

**Schedule measurement settings**

**Number of times measurements have been completed**

**Fixed point measurement settings (Example : 599 → 599 m, -1 is not set)**

**Optical switch linkage (0: no, 1: yes)**

**Schedule measurement results (When the unit is dB or dBm, 1000 times the actual measurement value is recorded. Example: 36964→36.964 dB)**

### Loading schedule data

If the CSV file and the SOR waveform data for the schedule period have the same configuration as described in “Save destination and file name,” the graph and waveform can be analyzed again after the CSV file is loaded into this instrument.

# 8.4 Performing an Auto Loss Test (Auto Loss Test)

**WARNING**

- During measurement, light is transmitted from the instrument's light source ports. Do not disconnect the connected optical fiber cables. Visual impairment may occur if the light enters the eye.
- Close the covers of any light source ports that do not have optical fiber cables connected to them. Visual impairment may occur if light that is mistakenly emitted from these ports enters the eye.

**French**

**AVERTISSEMENT**

- Lorsque instrument 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'oeil.
- Couvrir les caches des ports de source lumineuse libres. Sur les modèles dotés de deux ports de source lumineuse ou plus, protéger les yeux contre l'émission accidentelle de lumière depuis le mauvais por

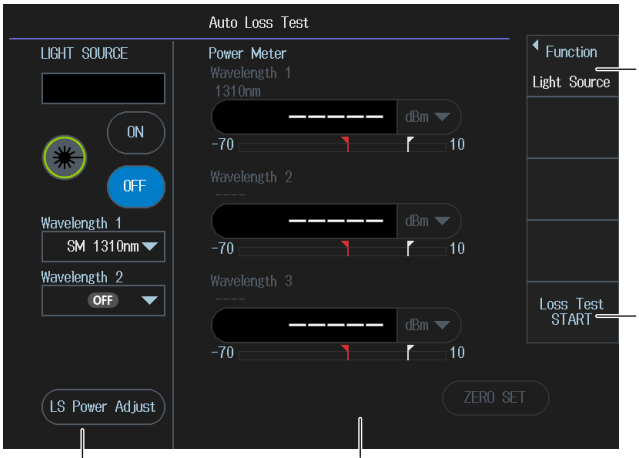
## Procedure

### Displaying the Auto Loss Test Screen

1. Press **MENU**. A MENU screen appears.
2. Tap the **Auto Loss Test** icon. An auto loss test screen appears.

**MENU screen**

### Schedule Measurement screen




**Select the function.**

**Executes a loss test**

**Optical power meter display screen**

**Light source display screen**
(Wavelength 3 is displayed for AQ7293H and AQ7294H.)

## Performing setup

***3.*** Press **SETUP**.

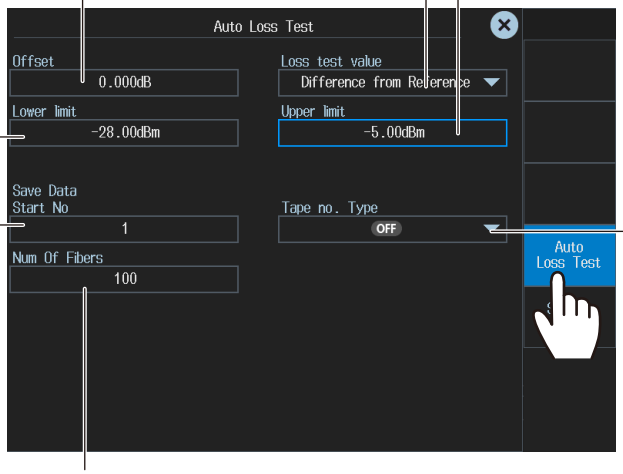
***4.*** Press the **Auto Loss Test** soft key. The following screen appears.

**Lower threshold (see section 7.4)**

**Loss display (based on the reference value, loss)**

**Set the offset (−9.900 to 9.900 dB).**

**Upper threshold (see section 7.4)**




**Set the tape number type.**

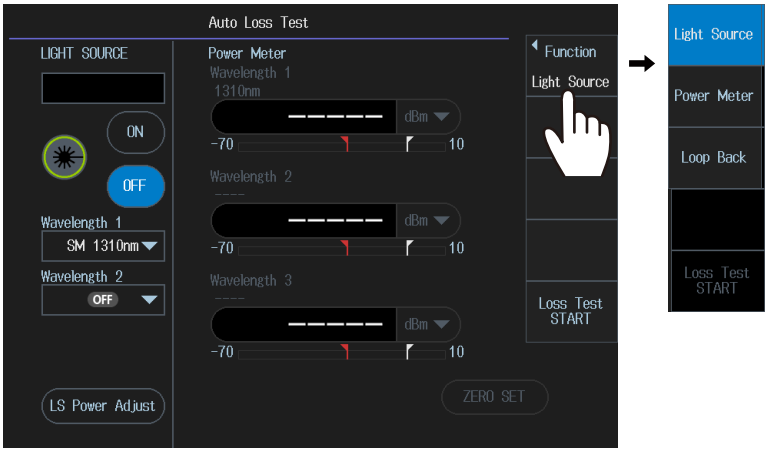
**Set the number of cores or tapes.**
**When tape number type is off: number of fibers**
**When tape number type is not off: number of tapes**

**Set the starting core number (1 to 9900).**

## Selecting the function

***5.*** Press the **Function** soft key. A function selection menu appears.

**Function selection menu**




- **When the function is set to Light Source**
  Configure the light source display screen.


**Executes a loss test**
The light source generates the specified wavelengths of measurement light in order. The optical power meter measures the optical power of the light that it receives.

- **When the function is set to Power Meter**
  Configure the power meter display screen.


**Sets the reference to the currently displayed measured value**
See section 7.4.

**Holds the measured value display**
See section 7.4.

**Saves data**
A screen appears for saving the results of optical power measurements for multi-fiber cables. See section 7.4.

- **When the function is set to Loopback**
  Configure the loopback display screen.

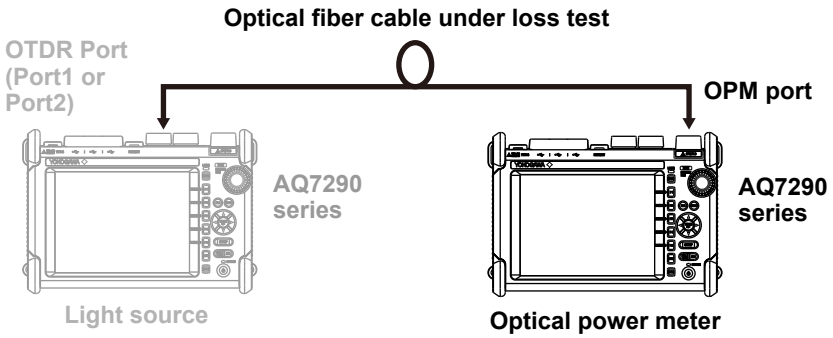

**Sets the reference to the currently displayed measured value**
See section 7.4.

**Holds the measured value display**
See section 7.4.

**Saves data**
A screen appears for saving the results of optical power measurements for multi-fiber cables. See section 7.4.

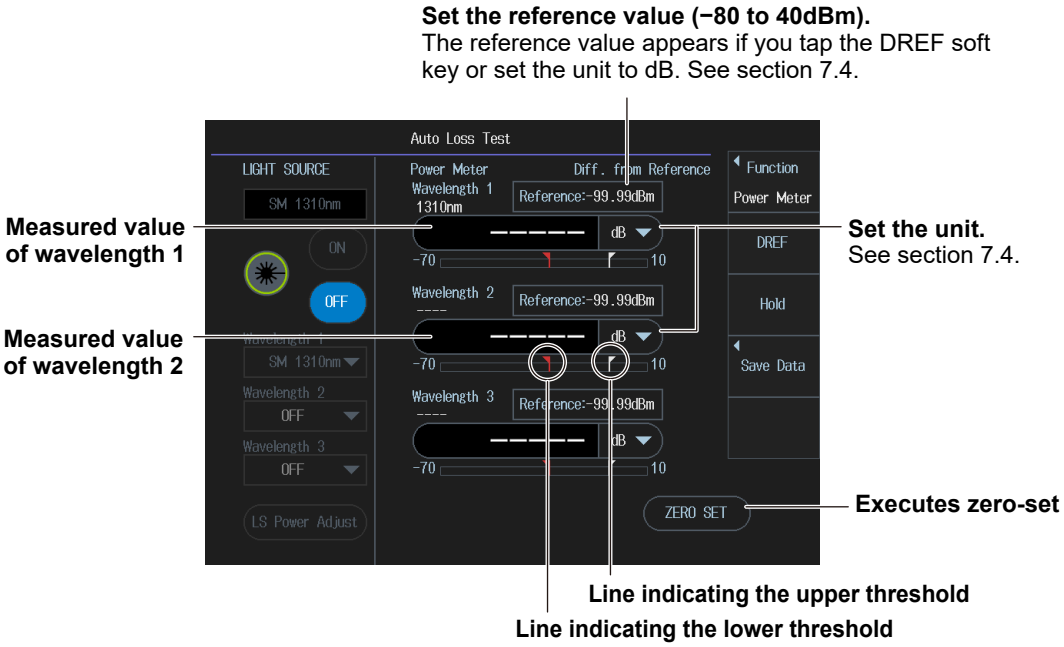
**Executes a loss test**
The light source generates the specified wavelengths of measurement light in order. The optical power meter measures the optical power of the light that it receives.

## Operation on the optical power meter side




### Optical power meter display screen

**6.** Press the **Function** soft key to select **Power Meter**. You can now operate the optical power meter display screen.



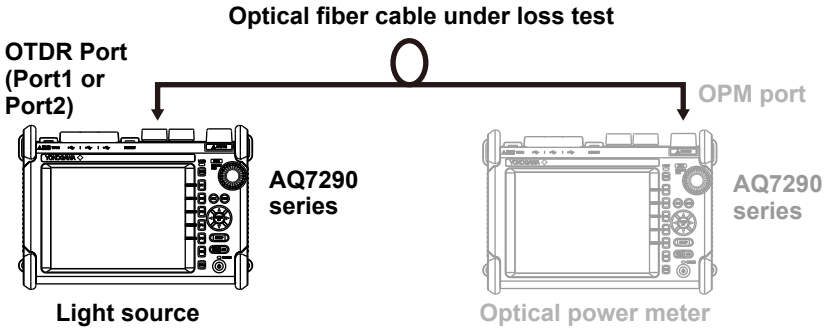

### Executing a zero set

**7.** Remove the optical fiber cables from the instrument and close the OPM port cover, or make sure that the power meter section is not receiving any light, and then tap **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 optical power measurement section and enables you to obtain more accurate absolute optical power values.

## Operation on the light source side

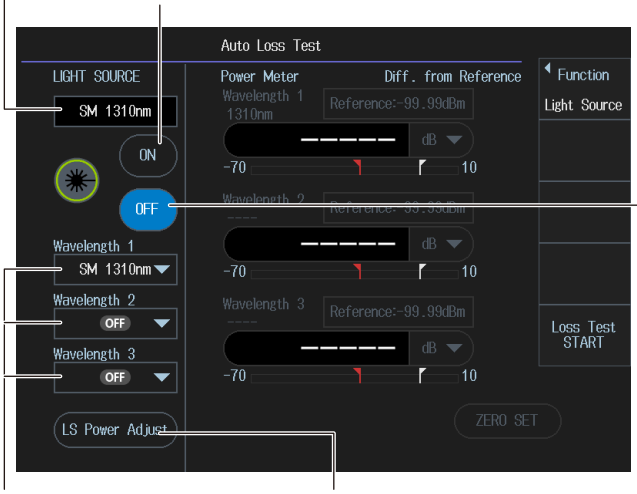



### Light source display screen

**6.** Press the **Function** soft key and select **Light Source**. A light source soft key menu appears, and you will be able to operate the light source display screen.

**Output wavelength**
When you start a loss test, the instrument generates the specified wavelengths in order. The current wavelength appears here.

**Starts a loss test (ON)**
Starts a loss test During a loss test, wavelength 1 and wavelength 2 switch alternately. This is the same function as the Loss Test START on the soft key Menu.



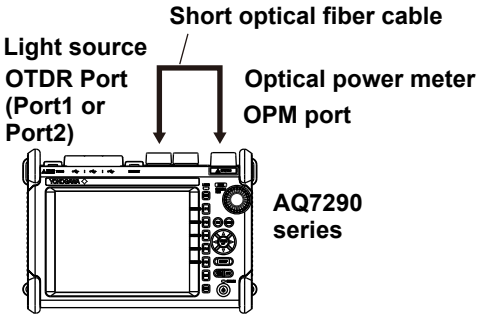

**Stops the loss test (OFF)**
Stops the loss test This is the same function as the Loss Test STOP on the soft key Menu.

**Set the wavelength.**
(Wavelength 3 is displayed for AQ7293H and AQ7294H.)

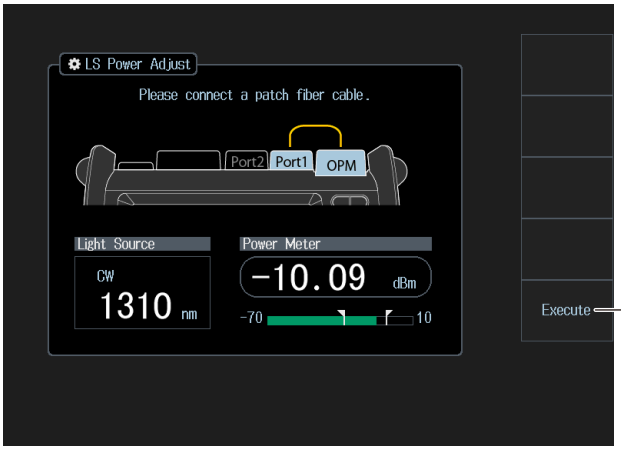
**Optical power adjustment**
Before a loss test, you can adjust the amplitude of the optical output of the light source.

### Adjusting the optical power

***7.*** Before starting the loss test, directly connect the OTDR port of the instrument (light source side) to the OPM port with a short optical fiber cable.



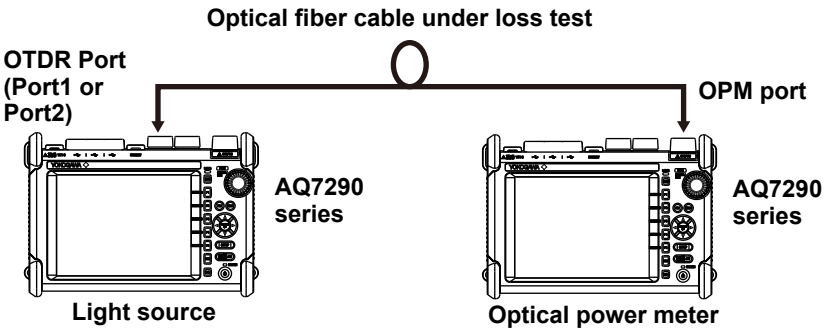

***8.*** Tap **LS Power Adjust**. The following screen appears.




**Starts optical power adjustment**
The measurement light turns on.
When adjustment ends normally, the instrument returns to the previous screen.

### Executing a loss test

***9.*** Connect the OTDR port of the instrument (light source side) to the OPM port of the instrument (optical power meter side) with an optical fiber cable.



***10.*** On the light source side of the instrument, press the **Loss Test START** soft key. The loss test starts, and the soft key display changes to Loss Test STOP. Then, on the power meter side of the instrument, the optical power value of the wavelength is displayed on the screen.

On the light source side of the instrument, press the Loss Test STOP soft key to end the loss test.

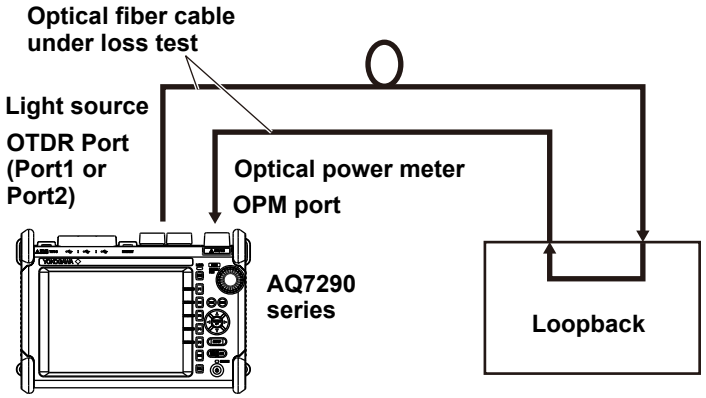
***Note***

When you start a loss test, the optical power values of wavelength 1 and wavelength 2 (if the wavelength is set) are measured once. Then, the soft key display changes to Loss Test STOP, which you can use to end the loss test. You can also end the loss test by tapping OFF on the light source display screen.

**Saving data**

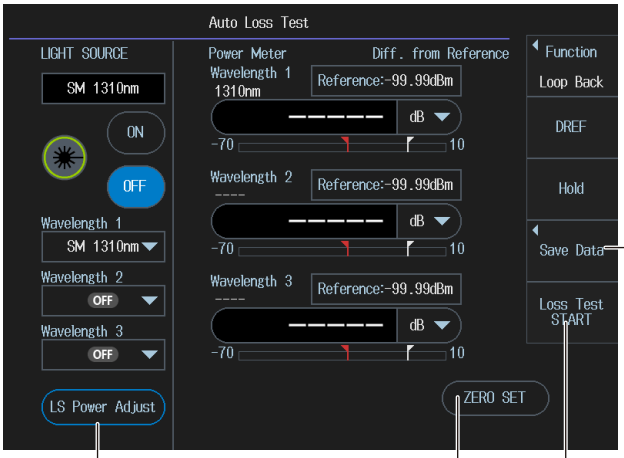
***11.*** On the optical power meter side of the instrument, press the Save Data soft key. A screen appears for saving the results of optical power measurements for multi-fiber cables. For details, “Saving the Results of Optical Power Measurements for Multi-Fiber Cables” in section 7.4.

## Loopback operation (operation of the light source and optical power meter)




### Loopback display screen

*6.* Press the **Function** soft key and select **Loop Back**. You can now operate the loopback display screen. On the loopback display screen, you can operate the light source screen and the optical power meter screen. For a description of the display screen, see “Optical power meter display screen” and “Light source display screen.”




**Saves data**
A screen appears for saving the results of optical power measurements for multi-fiber cables. See section 7.4.

**Optical power adjustment**
Before a loss test, you can adjust the amplitude of the optical output of the light source.

**Executes zero-set**

**Starts a loss test**
The light source generates the specified wavelengths of measurement light in order. The optical power meter measures the optical power of the light that it receives.

### Executing a zero set

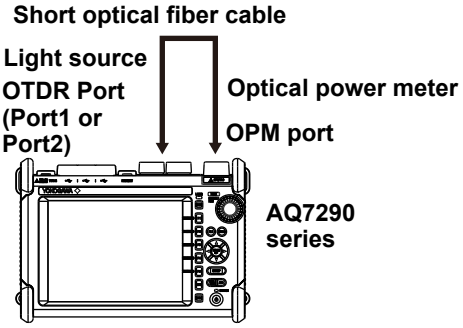
***7.*** Remove the optical fiber cables from the instrument and close the OPM port cover, or make sure that the power meter section is not receiving any light, and then tap **ZERO SET**.

## *Note*

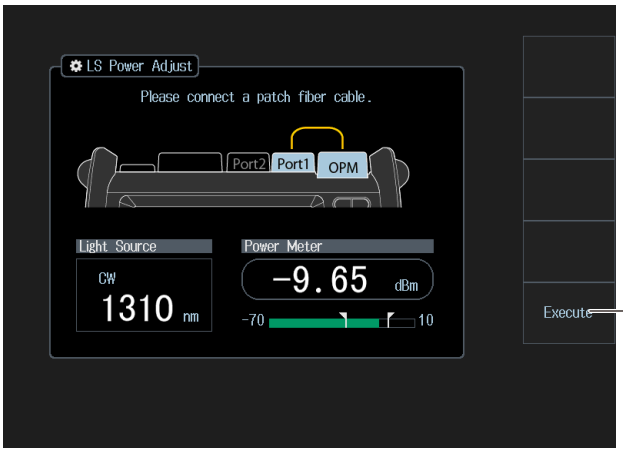
Perform a zero-set whenever necessary, such as after you have turned on the power or when the ambient temperature changes. Performing a zero-set adjusts the internal deviation of the optical power measurement section and enables you to obtain more accurate absolute optical power values.

### Adjusting the optical power

***8.*** Before starting the loss test, directly connect the OTDR port of the instrument (light source side) to the OPM port with a short optical fiber cable.



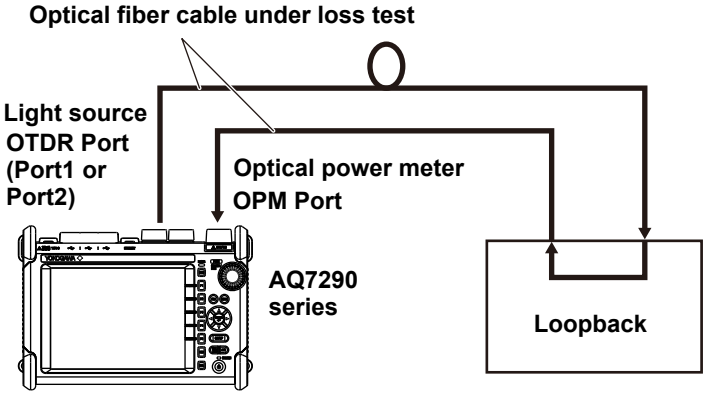

***9.*** Tap **LS Power Adjust**. The following screen appears.




**Starts optical power adjustment**
The measurement light turns on. When adjustment ends normally, the instrument returns to the previous screen.

### Executing a loss test

***10.*** Loop back the optical fiber cable connected to the OTDR port of the instrument at the far end of the cable installation, and connect the other end of the optical fiber cable to the OPM port of the instrument.




***11.*** Press the **Loss Test START** soft key. The loss test starts, and the soft key display changes to Loss Test STOP. Then, the optical power value of the wavelength is displayed on the instrument screen.

Press the Loss Test STOP soft key to end the loss test.

***Note***

When you start a loss test, the optical power values of wavelength 1 and wavelength 2 (if the wavelength is set) are measured once. Then, the soft key display changes to Loss Test STOP, which you can use to end the loss test. You can also end the loss test by tapping OFF on the light source display screen.

### Saving data

***12.*** Press the **Save Data** soft key. A screen appears for saving the results of optical power measurements for multi-fiber cables. For details, “Saving the Results of Optical Power Measurements for Multi-Fiber Cables” in section 7.4.

## Explanation

This feature is available on models with the /SPM or /HPM option.
Models without the above option do not have the Auto Loss Test feature, so combine these models with a light source and the optical power meter feature to perform the loss test. For details, see sections 7.2 and 7.4.

## Zero set

Perform a zero-set whenever necessary, such as after you have turned on the power or when the ambient temperature changes.
Performing zero set adjusts the internal deviation of the optical power measurement section and enables you to obtain more accurate absolute optical power values.

## Optical power adjustment

Adjust the optical power of the light source as necessary. When you execute optical power adjustment, the instrument automatically identifies the optical power level and adjusts itself accordingly. Perform optical power adjustment on the light source side.

- Press the Execute soft key to execute the optical power adjustment. When adjustment ends normally, the instrument returns to the previous screen. While adjusting, the word “Execute” on the menu changes to “Abort.” All soft keys other than Abort will be invalid.
- When you press the Abort soft key, the optical power adjustment will be aborted. The word “Abort” On the menu returns to “Execute.” The adjustment value returns to the previous value before the execution.
- Connect an optical fiber that is no longer than a few meters. Make sure that the fiber is free from dirt, scratches, bends, and other potential causes of optical loss.
- The default adjustment value is set to the factory default value.

## Executing an auto loss test

Configure the optical power meter side and the light source side. Connect the optical fiber or optical circuit to be tested to the optical power measurement port on the optical power meter side and the light source port on the light source side. Then execute the loss test. The optical power of the light passing through the optical fiber or optical circuit to be tested is measured on the optical power meter side.

## Loss display

Set how to display the measured values.

| | |
|---|---|
| Difference from the reference value | The value obtained by subtracting the reference value from the measured value is displayed (a negative value is displayed). |
| Loss | The value obtained by subtracting the reference value from the measured value is displayed as a loss (a positive value is displayed). |

# 8.5 Performing a Multi Fiber Loss Test (Multi Fiber Loss Test)

**WARNING**

- During measurement, light is transmitted from the instrument's light source ports. Do not disconnect the connected optical fiber cables. Visual impairment may occur if the light enters the eye.
- Close the covers of any light source ports that do not have optical fiber cables connected to them. Visual impairment may occur if light that is mistakenly emitted from these ports enters the eye.

**French**

**AVERTISSEMENT**

- Lorsque instrument 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'oeil.
- Couvrir les caches des ports de source lumineuse libres. Sur les modèles dotés de deux ports de source lumineuse ou plus, protéger les yeux contre l'émission accidentelle de lumière depuis le mauvais por

## Procedure

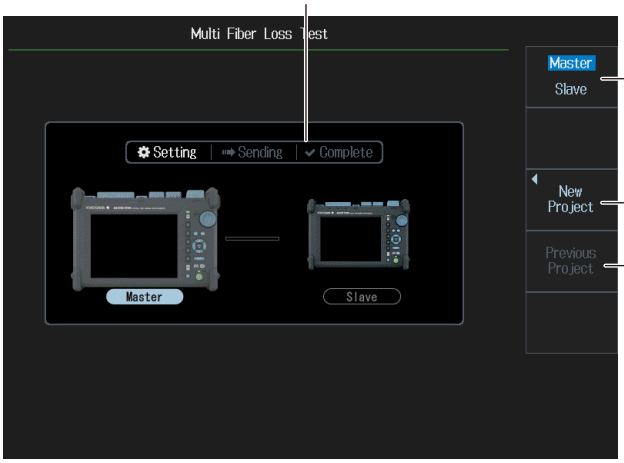
### Displaying the Multi fiber loss test screen

1. Press **MENU**. A MENU screen appears.
2. Tap the **Multi Fiber Loss Test** icon. An auto loss test screen appears.

**MENU screen**

### Multi fiber loss test screen

**Master**

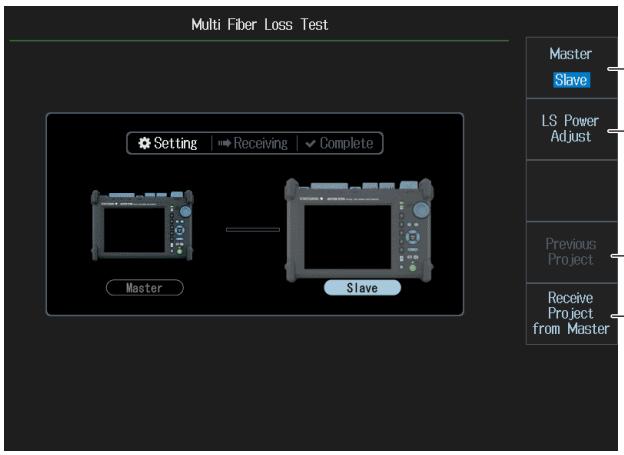



**Switches master and slave**

**Creating new project conditions**

**Loads the previous project**
Loads the previous project To load other project conditions that were created separately, see section 9.4.

**Slave**




**Switches master and slave**

**Optical power adjustment**
Before a loss test, you can adjust the amplitude of the optical output of the light source.

**Loads the previous project**
Loads the previous project To load other project conditions that were created separately, see section 9.4.

**Receives project conditions from the master**
Project conditions created on the master are loaded.

- **Project condition status**
  Before starting a multi-fiber loss test, set the conditions (e.g., number of cores) of the multi-fiber optical cable to be measured. The project conditions are created on the master side and then sent to the slave side.
  On the slave side, the project conditions sent from the master side are received and loaded into the instrument.

  Setting: Indicates that the master and slave are being selected or the project information is being created.

  Sending: Indicates that the project conditions are being sent from the master side to the slave side.

  Receiving: Indicates that the project conditions sent from the master side are being received on the slave side.

  Complete: Indicates that the transmission of the project conditions has been completed between the master side and slave side. After completion, a screen appears for executing multi-fiber loss tests.

# Creating and loading projects

## Creating new project conditions

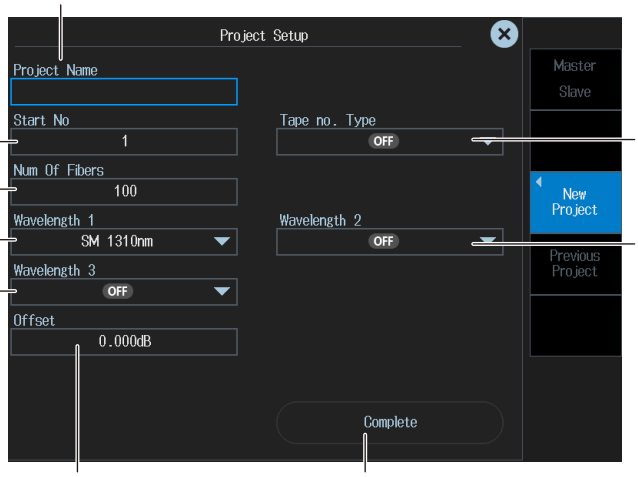
*3.* Press the **Master Slave** soft key to select **Master**.

*4.* Press the **New Project** soft key. A project setup screen appears.

**Set the number of cores or tapes (1 to 2000).**

**Set the starting core number (1 to 9900).**

**Set the project name.**
A character input dialog box will open.




**Set the tape number.**

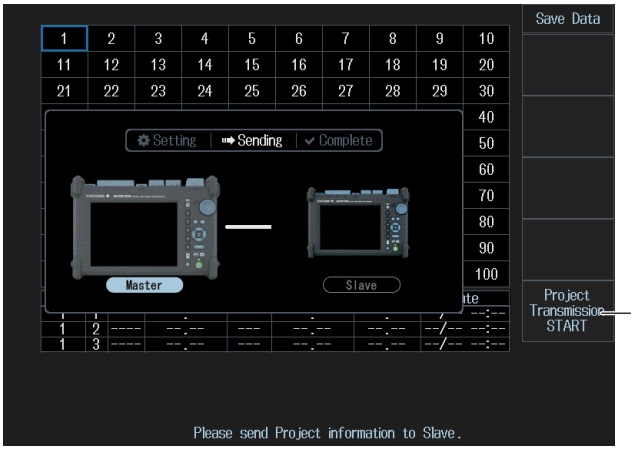
**Set wavelength 2.**

**Set the offset.**
**(−9.900 to 9.900dB)**

**Finishes the setting of the project conditions**
When the setup screen closes, the project condition status changes to “Sending.”

**Set wavelength 3.**

**Set wavelength 1.**

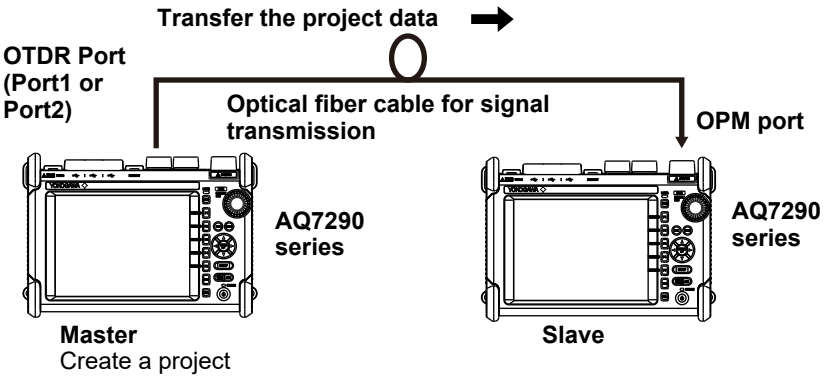



Press to share the project with the slave. For instructions on how to share with the slave, see the next page.

The newly created project can be shared with slaves.

### Sharing the project conditions

***5.*** Connect the OTDR port of the instrument on the master side and the OPM port of the instrument on the slave side with an optical fiber cable.



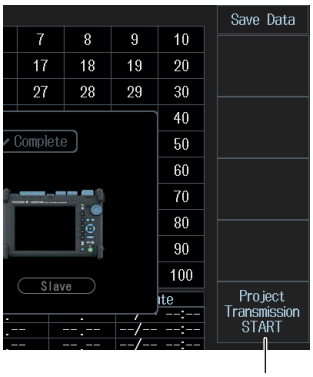

***6.*** On the slave side, press the **Receive Project from Master** soft key. The soft key changes to "Stop."

***7.*** On the master side, press the **Project Transmission START** soft key.

**Slave**


**Receives project conditions from the master**

**Master**




**Sends project conditions to the slave**

### Loading a previous project

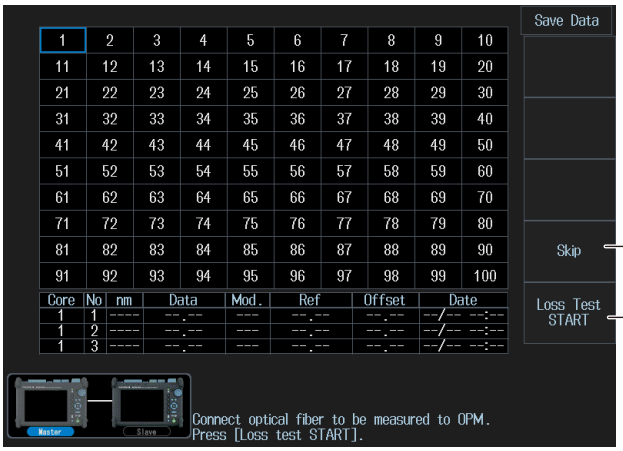
***3.*** On the multi fiber loss test screen of step 2, press the **Previous Project** soft key.

The project is loaded, and a table of core numbers is displayed.

### Screen after a project is loaded

When a project is set or loaded, a table of core numbers is displayed.

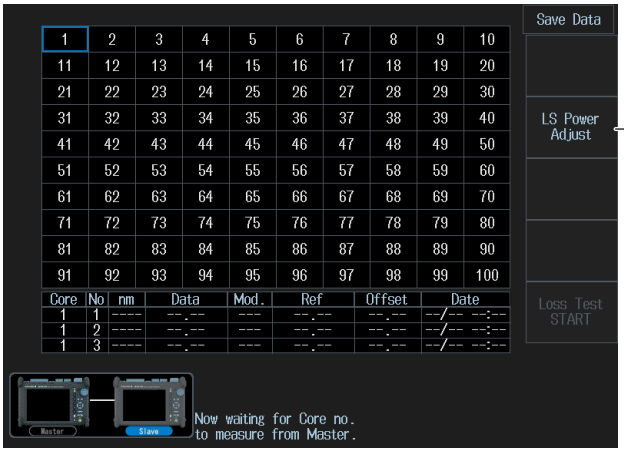
**Master**




**Sets the loss test of the selected core to skip**

**Starts a loss test**

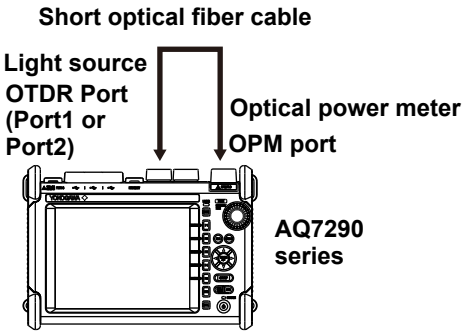
**Slave**



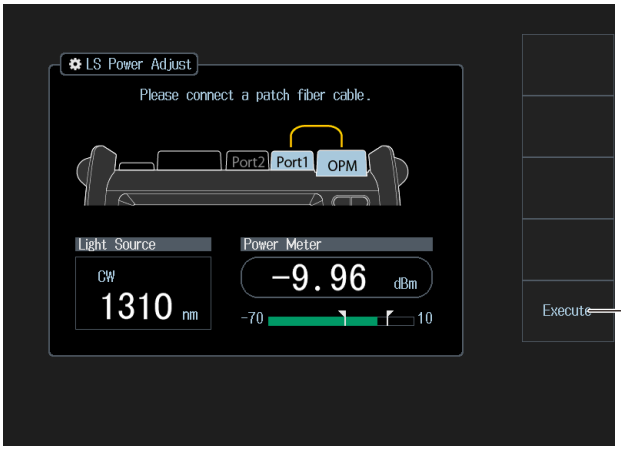

**Optical power adjustment**
Before a loss test, you can adjust the amplitude of the optical output of the light source.

## Adjusting the optical power (slave)

***8.*** Before starting the multi-fiber loss test, directly connect the OTDR port on the slave side of the instrument to the OPM port with a short optical fiber cable.




***9.*** Press the **LS Power Adjust** soft key. A LS Power Adjust screen appears.

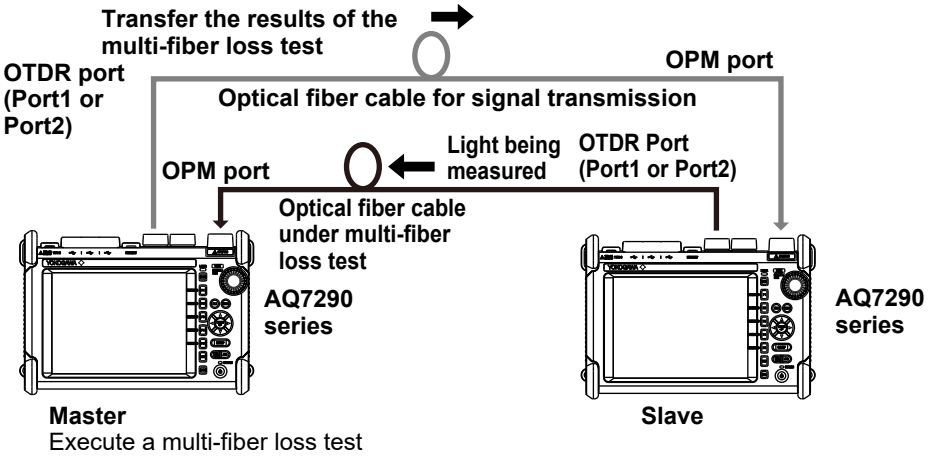



**Starts optical power adjustment**
The measurement light turns on. When adjustment ends normally, the instrument returns to the previous screen.

When the adjustment is complete, the screen returns to the table of core numbers.

## Executing the multi-fiber loss test

***10.*** In addition to the optical fiber connected in step 5, connect the OPM port of the instrument on the master side and the OTDR port of the instrument on the slave side with an optical fiber cable.




***11.*** On the master, tap the core number you want to perform a loss test on.

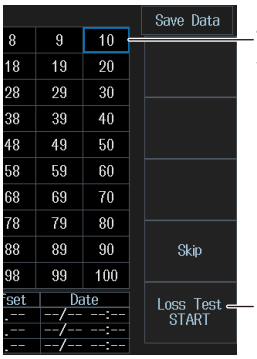
***12.*** On the master, press the **Loss Test START** soft key to start the test. The core number for which a loss test was started on the slave becomes active.

***13.*** On the slave, press the **Loss Test START** soft key to start the test on the slave side. The light to be measured is output from the OTDR port on the slave.

When the measurement is complete, the result is displayed in the measurement data display area of the master.

***14.*** Repeat steps 11 to 13 to test other core numbers.

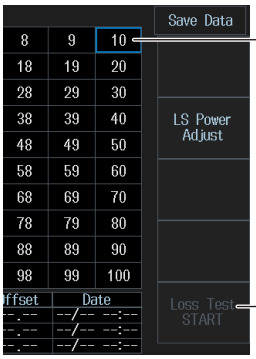
**Master**




Tap the core number you want to perform a loss test on.

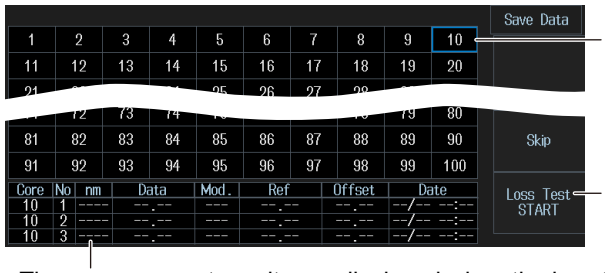
**Starts a loss test**

**Slave**




The core number for which a loss test will be executed becomes active.

**Starts a loss test**




The color changes when the loss test of the target core is completed.

When the lost test of the target cores completed, you can start the loss test of the next core.

The measurement results are displayed when the loss test of the target core is completed.

## Explanation

This feature is available on models with the /SPM or /HPM option.
The same project conditions must be shared between the master and slave. The project conditions can be shared using the following methods.

### Sending the project conditions

Send the project conditions from the master to the slave.
Decide in advance which optical fiber cable to use to transmit the project conditions (signal transmission optical fiber cable) from the master to the slave. Before sending the project conditions, connect one end of the signal transmission optical fiber cable to the OTDR port on the master side and the other end to the OPM port on the slave side.

- On the slave side, prepare to receive the project conditions.
- On the master side, check that the slave is ready to receive the test conditions, and send the conditions.

***Note***

When a project is sent, loss test results and skip information are not transmitted.

### Loading a project file

Load the same project file into the master and the slave. Have the project file stored in the internal memory of the instrument, microSD memory card, or a USB memory device in advance.

### Restarting an interrupted loss test

In a multi-fiber optical cable loss test, you may need to interrupt the test before the loss tests have been completed on all cores. If you want to resume the loss test using the same shared project, the test can be resumed while retaining the data of the completed tests. Data is maintained even when you turn the instrument off.

- The loss test must be performed using the same project.
- If you reload the project file, the data of the loss test up to that point will be deleted and cannot be recovered.

### Optical power adjustment

Adjust the optical power of the light source as necessary. When you execute optical power adjustment, the instrument automatically identifies the optical power level and adjusts itself accordingly. Perform optical power adjustment on the light source side.

- Press the Execute soft key to execute the optical power adjustment. When adjustment ends normally, the instrument returns to the previous screen. While adjusting, the word “Execute” on the menu changes to “Abort.” All soft keys other than Abort will be invalid.
- When you press the Abort soft key, the optical power adjustment will be aborted. The word “Abort” On the menu returns to “Execute.” The adjustment value returns to the previous value before the execution.
- Connect an optical fiber cable that is no longer than a few meters. Make sure that the optical fiber cable is free from dirt, scratches, bends, and other potential causes of optical loss.
- The default adjustment value is set to the factory default value.

# 8.6 Performing Advanced Analysis (Advanced Analysis)

**WARNING**

- During measurement, light is transmitted from the instrument's light source ports. Do not disconnect the connected optical fiber cables. Visual impairment may occur if the light enters the eye.
- Close the covers of any light source ports that do not have optical fiber cables connected to them. Visual impairment may occur if light that is mistakenly emitted from these ports enters the eye.

**French**

**AVERTISSEMENT**

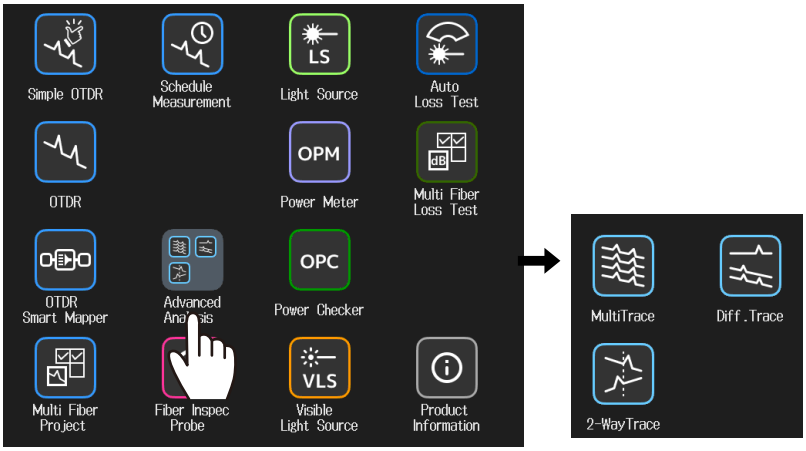
- Lorsque instrument génère de la lumière, la lumière est émise à travers les ports de source lumineuse. Ne pas débrancher les câbles de fibre optique connectés. Des lésions oculaires peuvent être causées si le faisceau lumineux pénètre l'oeil.
- Couvrir les caches des ports de source lumineuse libres. Sur les modèles dotés de deux ports de source lumineuse ou plus, protéger les yeux contre l'émission accidentelle de lumière depuis le mauvais por

## Procedure

### Displaying the Advanced Analysis (Waveform Analysis) screen

1. Press **MENU**. A MENU screen appears.
2. Tap the **Advanced Analysis** icon. A menu appears for selecting the analysis.

**MENU screen**



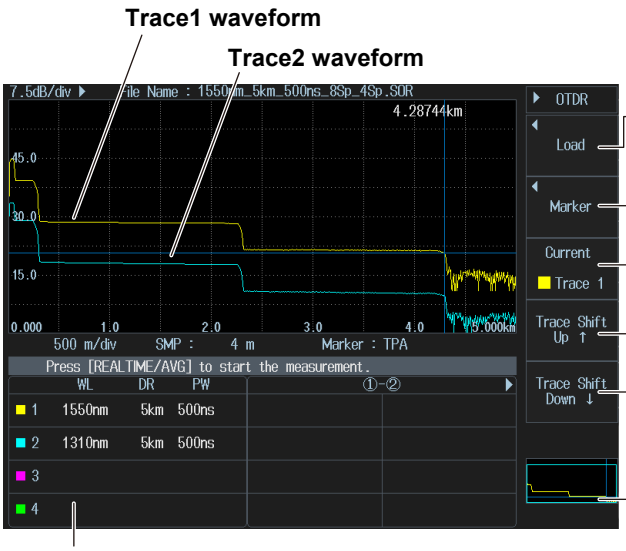

Multi trace analysis: Up to four waveforms can be loaded and compared.

2 way trace analysis:The waveform measured from each end can be combined and compared.

Differential trace: You can display a waveform obtained by subtracting the values of one waveform from those of another waveform selected as the current trace.

## Multi trace analysis

***3.*** Tap the **MultiTrace** icon. A MultiTrace screen appears.




**Load analysis waveforms.**

**Set markers (4 Point Markers).**
See section 6.1.

**Selects the current trace**
Select the waveform to place markers and cursors on or move vertically.

**Moves the trace up**
Moves the display position of the current trace up.

**Moves the trace down**
Moves the display position of the current trace down.

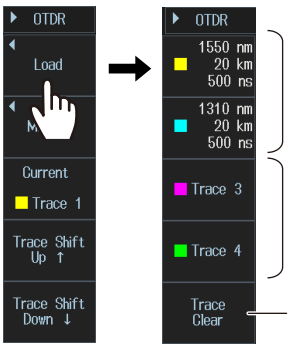
**Overview display**
See section 5.1.

**Displays the waveform information loaded into Trace1 to Trace4 (wavelength (WL), dynamic range (DR), power value (PW))**

### Loading a waveform

***4.*** Press the **Load** soft key. A menu appears for selecting the waveform load destination trace.

***5.*** Press the soft key of the trace number you want to load the waveform into. A file operation window appears.




**When already loaded, the measurement conditions (wavelength, distance range, pulse width) of the loaded waveform are displayed. When tapped, a file operation screen appears, and you can load waveforms. See section 9.4.**

**When tapped, a file operation screen appears, and you can load waveforms. See section 9.4.**

**Clears the waveforms of Trace1 to Trace4**

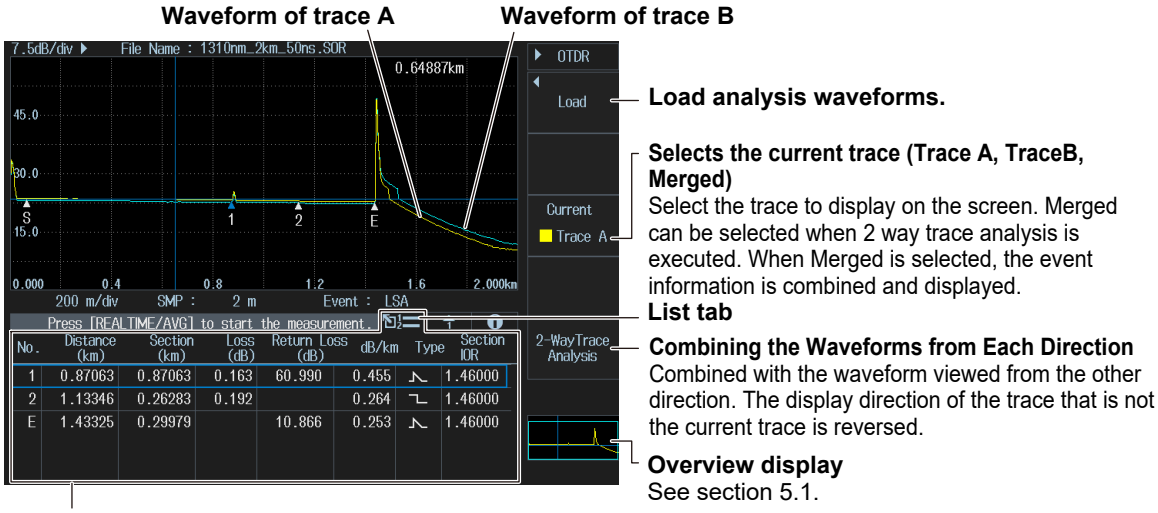
### Waveform display example


## *Note*

- The current waveform display before switching to the multi trace analysis screen is read into the trace that is selected as the current trace.
- Changing the current trace clears the vertical waveform shift.

## 2-Way Trace Analysis

*3.* Tap the **2-WayTrace** icon. A 2 way trace analysis screen appears.




**Load analysis waveforms.**

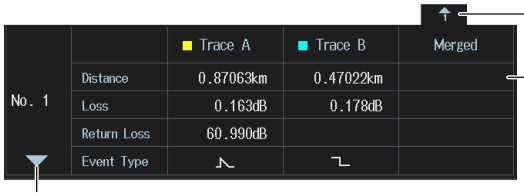
**Selects the current trace (Trace A, TraceB, Merged)**
Select the trace to display on the screen. Merged can be selected when 2 way trace analysis is executed. When Merged is selected, the event information is combined and displayed.

**List tab**

**Combining the Waveforms from Each Direction**
Combined with the waveform viewed from the other direction. The display direction of the trace that is not the current trace is reversed.

**Overview display**
See section 5.1.

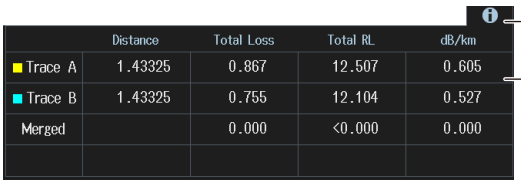
**List of events**
Displayed by tapping the List tab.
For details on events, see the explanation in section 6.2.




**Details tab**

**Display of separate events**
Displayed by tapping the Detail tab.

Displays the next event



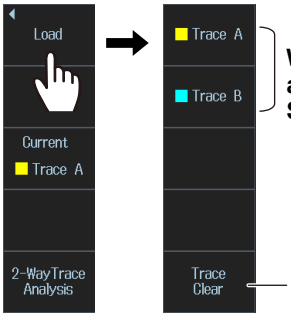

**Summary tab**

**Cumulative display of events**
Displayed by tapping the Summary tab.

### Loading analysis waveforms

*4.* Press the **Load** soft key. A menu appears for selecting the waveform load destination trace.

*5.* Press the soft key of the trace number you want to load the waveform into. A file operation window appears.







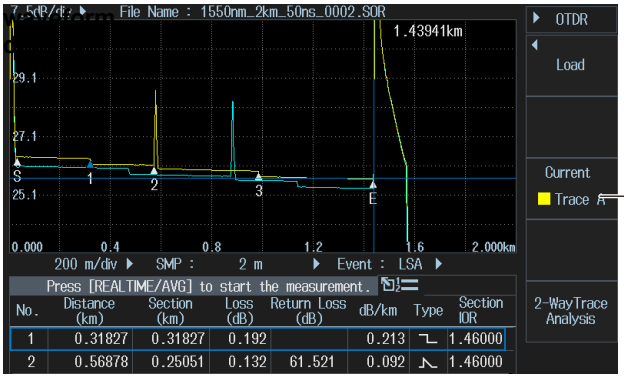
**When tapped, a file operation screen appears, and you can load waveforms. See section 9.4.**

**Clears Trace A and Trace B waveforms.**

### Combines the waveforms of each direction

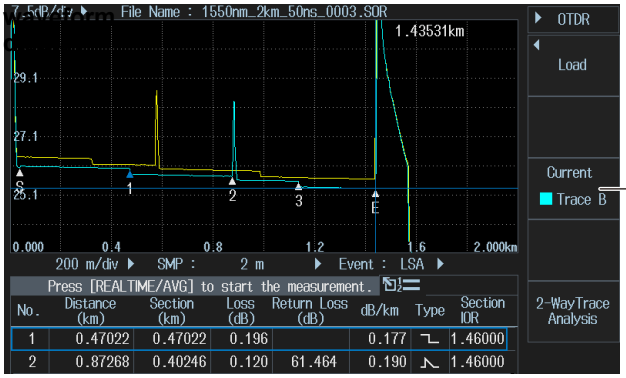
To display the two waveforms obtained by measuring the same section from two directions, one of the waveforms can be reversed and superimposed on the other waveform, which is specified as the current waveform.

**TraceA**



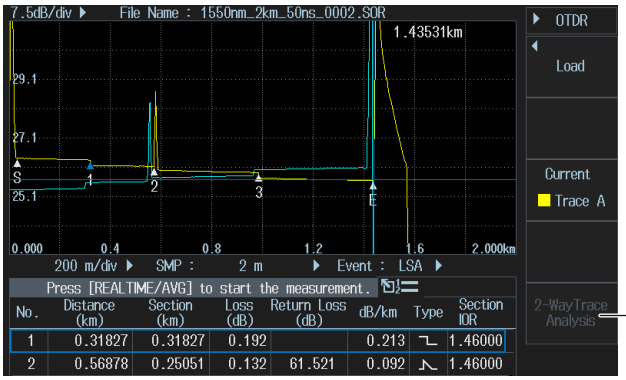

**Displays the waveform viewed from one end**

**TraceB**




**Displays the waveform viewed from the other end**

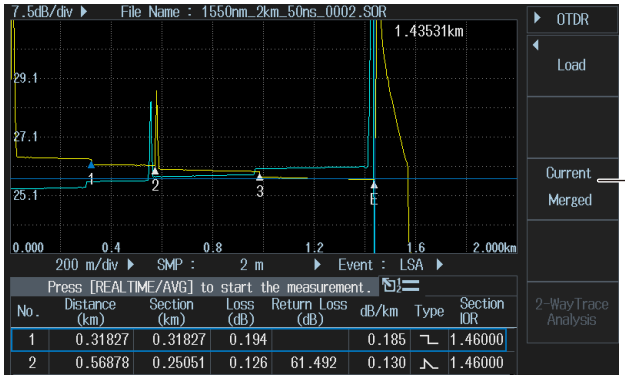
**2 way trace waveform display (displays the event number of TraceA of the current trace)**




Combines the waveform viewed from one end and that viewed from the other end and displays the result

**Executes 2 way trace**

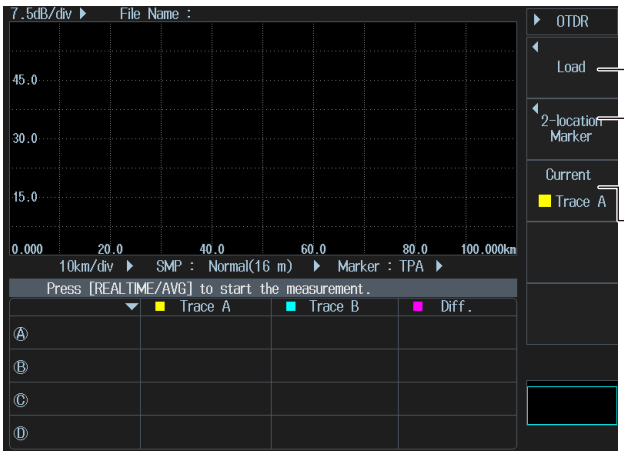
**2 way trace waveform display (Combines and displays the events of TraceA and TraceB)**




**When Merged is selected, the events of TraceA and TraceB are combined.**

## Differential trace

***3.*** Tap the **Diff.Trace** icon. A difference trace analysis screen appears.




**Load analysis waveforms.**

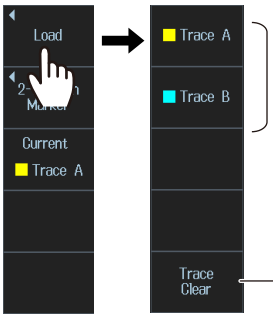
**2-location Marker**
Loss values can be measured for TraceA, TraceB, and differential trace.

**Selects the current trace (Trace A, TraceB, Diff.)**
Select the waveform to place 2-location Marker markers and cursors on. Diff can be selected when a difference analysis is executed.

### Loading analysis waveforms

***4.*** Press the **Load** soft key. A menu appears for selecting the waveform load destination trace.

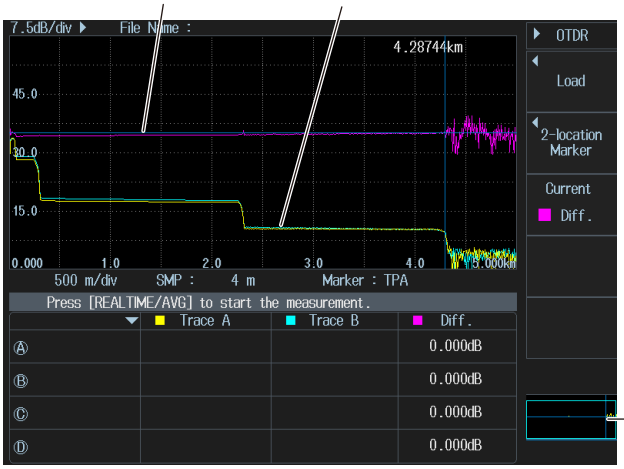
***5.*** Press the soft key of the trace number you want to load the waveform into. A file operation window appears.




**When tapped, a file operation screen appears, and you can load waveforms. See section 9.4.**

**Clears Trace A and Trace B waveforms.**

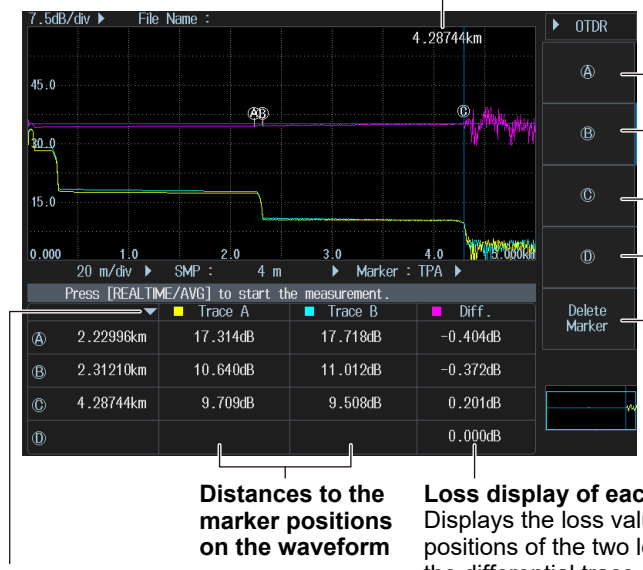
**Differential trace** **Trace A and Trace B waveforms**




**Overview display**
See section 5.1.

### 2-location Marker

This is an example of placing 2-location Marker markers on the differential (Diff.) trace.




**Marker information of the trace waveform specified as the current trace**

**Set marker Ⓐ.**
Places marker Ⓐ at the cursor position

**Set marker Ⓑ.**
Places marker Ⓑ at the cursor position

**Set marker Ⓒ.**
Places marker Ⓒ at the cursor position

**Set marker Ⓓ.**
Places marker Ⓓ at the cursor position

**Clears the marker display**

**Distances to the marker positions on the waveform**

**Loss display of each waveform**
Displays the loss values at the marker positions of the two loaded waveforms and the differential trace of the two

**Switches the loss value display**
**Ⓐ to Ⓓ The values of each marker D**
**Loss between Ⓐ and Ⓑ and between Ⓒ and Ⓓ**

# Explanation

## Multi trace analysis

### Loading waveform data

Up to four traces can be loaded. Loaded traces are displayed on a single screen, so you can compare them. The type of file that you can load is SOR.

Loaded waveforms are displayed at the 0 m position on the horizontal axis or so that their distance references match that of the current trace. Each loaded trace can be shifted vertically as you like.

### Current trace

You can select the current trace from Trace 1 to Trace 4.

When you expand or reduce the current trace, other traces are adjusted accordingly.

Cursors are displayed on the current trace. Distance and splice loss that are displayed in the marker information are those of the current trace.

## 2 way trace analysis

### Loading waveform data

The type of file that you can load is SOR.

Traces that meet the following conditions can be combined.

- Event lists are available.
- The wavelengths and pulse widths of the two traces are the same.
- The distances from the measurement reference (S) to the end event (E) are the same.

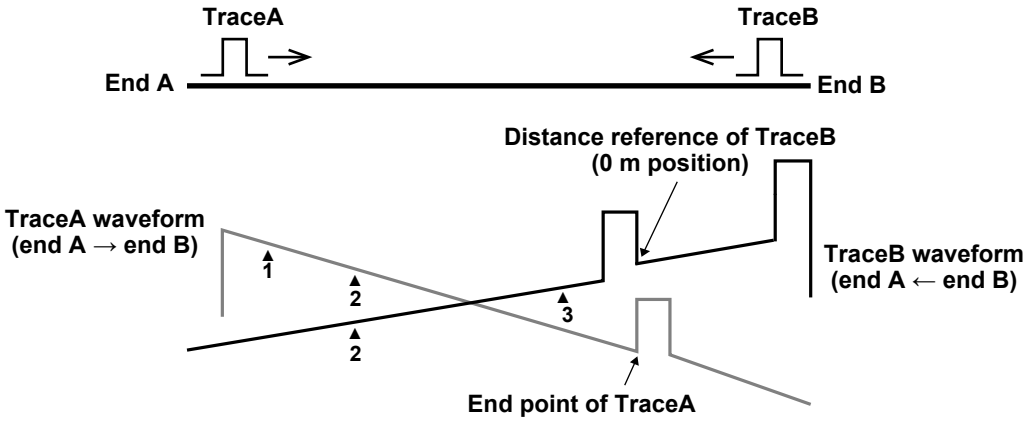
### Current trace

The current trace can be set to one of the combined traces.

Cursors are displayed on the current trace.

### Waveform display of 2 way trace analysis

The horizontal axes of the combined traces are aligned so that the end point of the Trace1 (in the end A to end B direction) match the 0 m position (distance reference) of the Trace2 (in the end B to end A direction).




### *Note*

When optical fibers with different backscattered light levels are connected, the loss can be negative. When optical fibers with different backscattered light levels are connected, the average loss measured from both directions is the correct loss value. The 2 way trace analysis function automatically calculates the correct loss value.

# Differential trace

**Loading waveform data**

The type of file that you can load is SOR.

A differential trace of traces that meet the following conditions can be displayed.

- Sample interval
- Measurement start position

**Current trace**

The current trace can be set to one of the traces that are used for taking the difference.

Cursors are displayed on the current trace. Distance and splice loss that are displayed in the marker information are those of the current trace.

**Differential trace analysis**

The differential trace is the result of subtracting the values of the current trace from those of the other trace.

**Loss value monitor**

You can place cursors and 2-location Marker markers on the current trace or differential trace and monitor the following values.

- Loss (dB)
- Distance (km)

The differential trace cannot be saved.

# 9.1 Connecting USB Storage Devices 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 device (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 device. Connect it directly to a Type-A USB port of the instrument.
Hot-plugging is supported: you can connect or disconnect the USB device at any time, regardless of whether the instrument is on or off.
When the power is on, the instrument automatically detects the USB memory device after it is connected.

***Note***

- Use a portable USB memory device for the USB storage device. Do not connect incompatible USB memory devices.
- Connect USB memory devices directly to the instrument, 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 instrument is turned on until key operation becomes available.
- USB memory devices complying with USB 1.0/1.1/2.0 can be used.
- The destination drive is displayed in the order in which the USB memory devices are connected to the instrument, with the USB port recognized first as USB Memory 1 and the second as USB Memory 2.

# 9.2 Connecting a microSD Memory Card

**CAUTION**

- Before connecting a microSD memory card, turn off the power.
- Do not insert the microSD memory card in the wrong direction. Doing so may damage the microSD memory card and the instrument.

**French**

**ATTENTION**

- Avant de connecter une carte mémoire microSD, mettez l'appareil hors tension.
- N'insérez pas la carte mémoire microSD dans le mauvais sens. Cela pourrait endommager la carte mémoire microSD et l'instrument.

## Compatible microSD memory cards

You can use memory cards that conform to the SDC, SDHC, or SDXC standard with the instrument. For details, contact your nearest YOKOGAWA dealer.

***Note***

When using a microSD memory card with a PC, make sure that the PC is compatible with the memory card. Also, depending on the type of PC, some of the microSD memory cards listed above may not function properly. Check it in advance.

## How to insert a microSD memory card

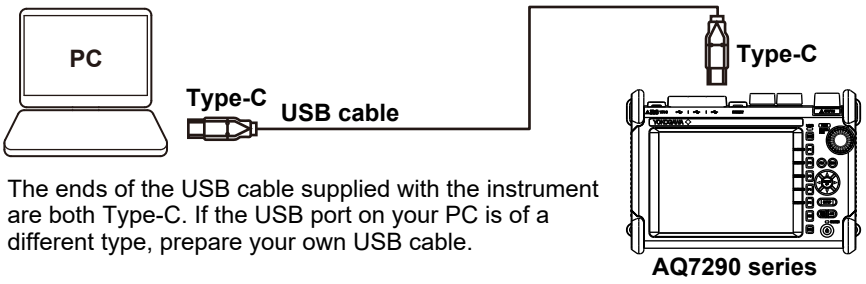
See the Getting Started Guide, IM AQ7290-02EN.

# 9.3 Using the Instrument as a Mass Storage Device

## Procedure

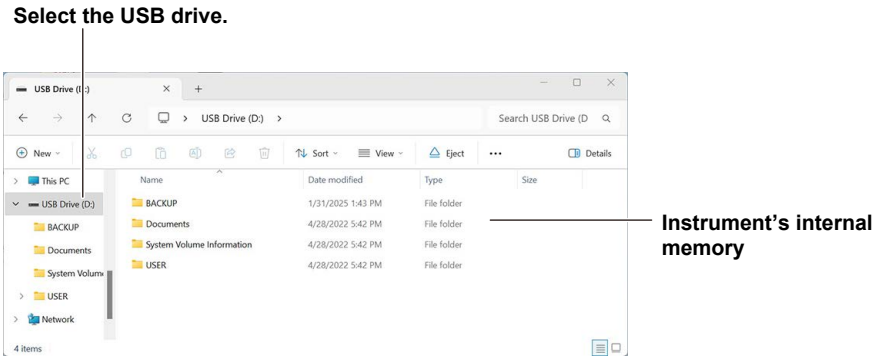
1. Turn on the instrument.
2. Connect the Type-C USB port on the top panel of the instrument to the USB port of the PC with an USB cable.

   For a description of the top panel, see “Component Names and Functions” in the Getting Started Guide, IM AQ7290-02EN. 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.




The ends of the USB cable supplied with the instrument are both Type-C. If the USB port on your PC is of a different type, prepare your own USB cable.

3. Press **SETUP**. The system setup screen appears.
4. Set **USB Function** to Storage. For the procedure, see section 10.1.
5. On your PC, start Explorer or another browser.




### Note

- The ends of the USB cable supplied with the instrument are both Type-C. If the USB port on your PC is of a different type, prepare your own USB cable.
- The BACKUP folder is an instrument system folder. Do not change or delete this folder. If you change or delete it by mistake, restart the instrument. 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 instrument.
- Do not save files in the root folder (same folder level as BACKUP and USER). Doing so can reduce the processing capability of the instrument. Files saved in the root folder are automatically deleted the next time the instrument is started.

# 9.4 Saving and Loading 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 device (USB memory or internal memory) or corrupt its data.

**French**

**ATTENTION**

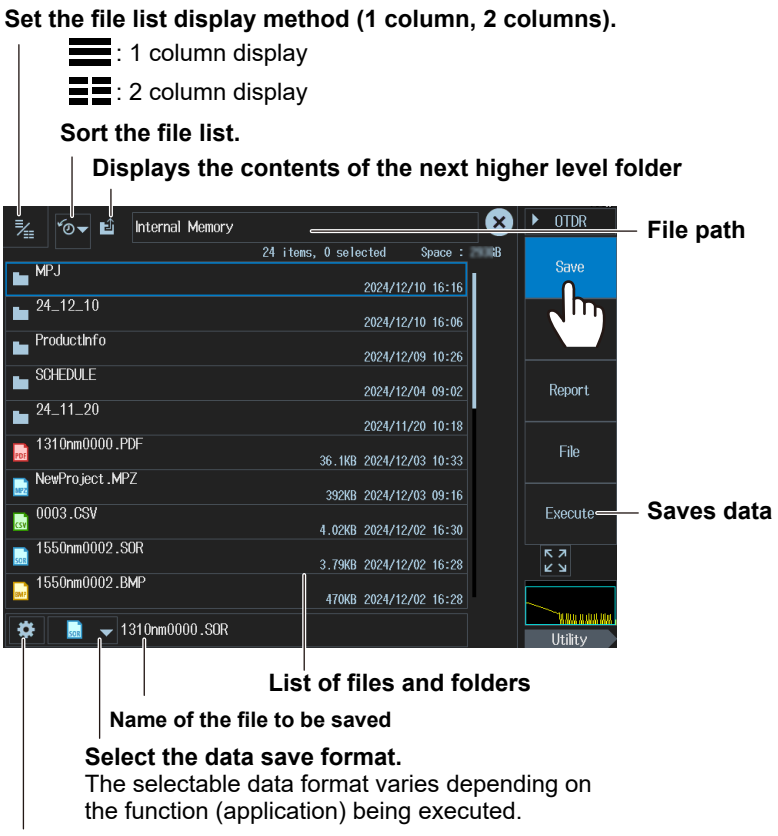
N’enlevez pas un dispositif de mémoire USB et ne coupez pas l’alimentation électrique lorsque l’indicateur d’accès à la mémoire USB clignote ou lorsque les données sont en train d’être enregistrées ou chargées à partir d’une mémoire interne. Vous risqueriez d’endommager le support de stockage (mémoire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

## Procedure

### Saving Data (excluding system settings)

1. With the data you want to save displayed, press **FILE**. A file list screen appears.
2. Press the **Save** soft key.
3. Select the data save format. The data format that can be saved depends on the function being performed.
4. Press the **Execute** soft key. A file is created in the selected save format.

### File list screen for saving data




## Saving the data of multi wavelength measurement (1310 nm/1550 nm) (SOZ format)

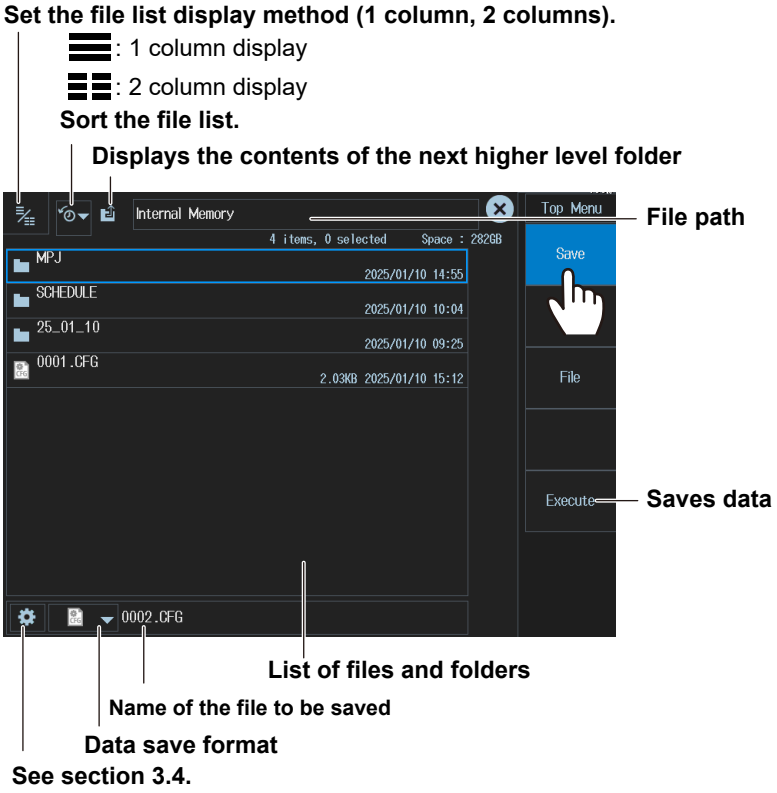
You can save the two waveforms of multi wavelength measurement as a single data file in SOZ format. When the data is saved in SOR format, the current waveform is saved. To save the two wavelengths separately, save each file by switching the current waveform display. The wavelength indication in the file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

### *Note*

- You cannot use this when the power meter logging feature is in use.
- For details on file operation, see section 9.6.

## Saving the system setup data (CFG format)

1. Press **MENU**. A MENU screen appears.
2. Press **FILE**. A file list screen appears.
3. Press the **Save** soft key.
4. Press the **Execute** soft key. A file is created in CFG format.



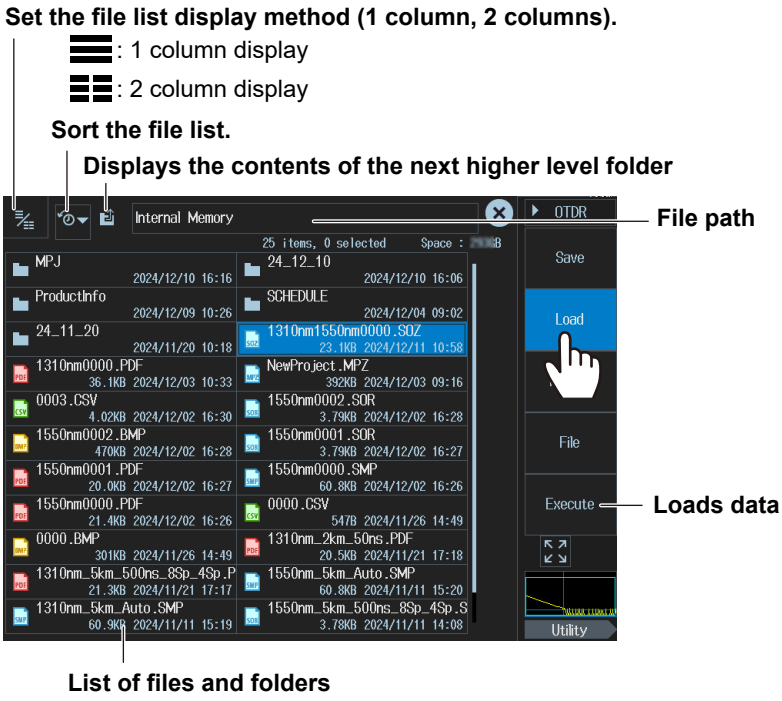

### *Note*

- System setup data can be saved only from the data management button window of the MENU screen.
- For details on file operation, see section 9.6.

## Loading data

1. Press **File**. A file list screen appears.
2. Press the **Load** soft key.
3. Tap the file to load to select it. Files that can be loaded depend on the function being performed.
4. Press the **Execute** soft key. The file is loaded and displayed on the screen.

### File list screen for loading data




## *Note*

- The data that can be loaded by this instrument depends on the function being performed.
- You cannot use this when the power meter logging feature is in use.

# Explanation

## Saving data

The following types of files can be saved.

### System setup

| Extension | Description |
|---|---|
| CFG | System settings are saved to a file in CFG format. |

### OTDR features

| 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. |
| SOZ | Optical pulse waveform data (including the measurement conditions) for two wavelengths measured with the multi wavelength measurement feature is saved. |
| BMP | Screen image of the waveform data is saved to a BMP file. |
| JPG | Screen image of the waveform data is saved to a JPEG file. |
| SOR+BMP | Both SOR and BMP files are saved. |
| SOR+JPG | Both SOR and JPG files are saved. |
| CSV (waveform) | Waveform data measured from an optical pulse is saved to a file in CSV format. |
| CSV (event) | Event data is saved to a file in CSV format. |
| SOR+PDF | Both files, the SOR file and report file, are saved simultaneously. |
| SET | Measurement condition information file is saved. |

The screen image immediately before entering the file operation screen is saved.

- **CSV (waveform) file format**

| | | |
|---|---|---|
| Label | | **Label and date** |
| Date and time | Fri Jan 10 10:04:24 2025 | |
| Wavelength | SM 1310nm | **Measurement conditions** |
| Distance range | 5km | |
| Pulse width | 30ns | |
| Attenuation | | |
| Average duration | Auto | |
| IOR | 1.46 | |
| Data size | 10000 | |
| Sample interval | 50cm | |
| [km] | [dB] | **Measurement** |
| 0 | 14.227 | |
| 0.00051 | 32.466 | |
| 0.00103 | 32.464 | |
| 0.00154 | 32.468 | |
| **Distance** | **Total return loss** | |

- **CSV (event) file format**

| | | |
|---|---|---|
| Label | | **Label and date** |
| Date and time | Fri Jan 10 10:04:24 2025 | |
| Wavelength | SM 1310nm | **Measurement conditions** |
| Distance range | 5km | |
| Pulse width | 30ns | |
| Attenuation | | |
| Average duration | Auto | |
| IOR | 1.46 | |
| Data size | 10000 | |
| Sample interval | 50cm | |
| Approximation method | LSA | **Analysis conditions** |
| Backscatter level | -50.00dB | |
| Splice loss | 0.10dB | |
| Return loss | 70dB | |
| End of fiber | 65dB | |
| Distance | 2.13705km | **Measurement** |
| Total loss | 22.033dB | |
| Total return loss | <46.526dB | |
| Number of events | 3 | |

| Event No | Distance (km) | Section distance (km) | Splice loss (dB) | |
|---|---|---|---|---|
| 1 | 0.51745 | 0.51745 | 0.106 | **Event information** |
| 2 | 1.58315 | 1.0657 | 1.237 | |
| END | 2.13705 | 0.5539 | 68.721 | |

### OTDR Smart Mapper

| Extension | Description |
|---|---|
| BMP | Screen image of the waveform data is saved to a BMP file. |
| JPG | Screen image of the waveform data is saved to a JPEG file. |
| SMP | Adapt Trace data measured from an optical pulse (including the measurement conditions) is saved to a file in SMP format. |
| SMP+PDF | Both files, the SMP file and report file, are saved. |

The screen image immediately before entering the file operation screen is saved.

### Multi-fiber measurement feature

| Extension | Description |
|---|---|
| MPZ | SOR files, MPJ files, and BMP files are compressed and saved to MPZ files. They can be used as storage files. AQ7933 OTDR emulation software is required to extract the files. On the AQ7933 OTDR emulation software, run Utility > MPZ Converter. For details, see the AQ7933 manuals. |
| TXT | Multi-fiber measurement conditions, waveform data summary information, and optical power measurements are saved to a tab separated file. |
| SOR* | Waveform data from measuring Multi fiber (including the measurement conditions) is saved in an SOR file format that conforms to Telcordia SR-4731. |
| BMP* | A BMP file saved with the fiber inspection probe is saved. |
| CSV* | Multi-fiber measurement conditions, waveform data summary information, and optical power measurements are saved to a tab separated file. |

* This cannot be selected as a data save format. It is saved automatically.
SOR and BMP files are saved in a folder with the project name as the folder name in the folder automatically generated with the “MPJ” folder name.
CSV files are saved in the MPJ folder above.

### Schedule measurement

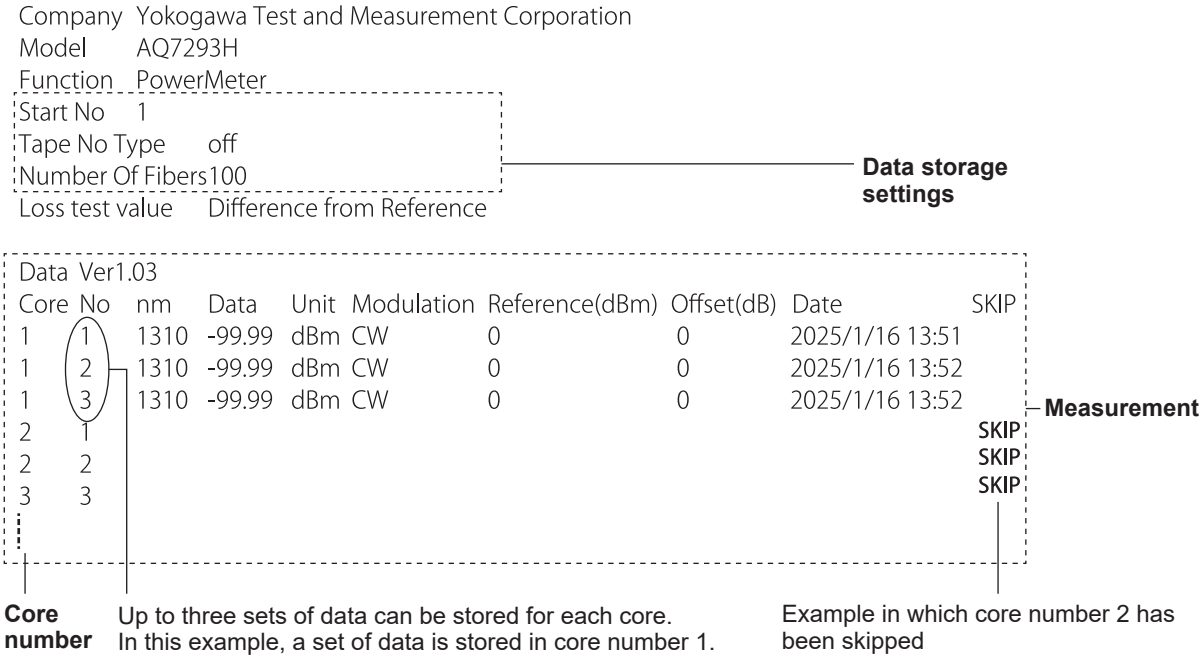
| Extension | Description |
|---|---|
| — | Waveform data measured according to the specified schedule (including the measurement conditions) is saved in an SOR file format that conforms to Telcordia SR-4731. When Action is set to Save or Load, files are not displayed. |
| CSV | Schedule information and measured optical power values (including measurement conditions) are saved to a file in CSV format. |

For file formats, see section 8.3.

### Auto loss testing

| Extension | Description |
|---|---|
| CSV | CSV file that contains measurement data.<br>Measurement data (including measurement conditions such as wavelength and offset) for the specified number of fibers and tape number type is saved. |
| LTS | A file containing the measurement conditions of the optical power meter and the light output conditions is saved. |

- **CSV file format of auto loss test**



### Power meter, multi-fiber loss test

| Extension | Description |
|---|---|
| CSV | CSV file that contains measurement data.<br>Measurement data (including measurement conditions such as wavelength and offset) for the specified number of fibers and tape number type is saved. |

For power meter file formats, see section 7.4.

- **CSV format of multi-fiber loss test**

| | |
|---|---|
| Company | Yokogawa Test and Measurement Corporation |
| Model | AQ7293F |
| Function | Multi Fiber LossTest |
| Project Name | ProjectA |
| Wavelength1 | 1550 |
| Wavelength2 | 1310 |
| Wavelength3 | 65535 |
| Offset | 0 |
| Start No | 101 |
| Tape No Type | off |
| Number Of Fibers | 50 |
| Loss test value | Difference from Reference |

**Measurement conditions**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Data | Ver1.03 | | | | | | | | |
| Core | No | nm | Data | Unit | Modulation | Reference(dBm) | Offset(dB) | Date | SKIP |
| 101 | 1 | 1550 | -2.908 | dBm | CW | 0 | 0 | 2025/1/7 17:58 | |
| 101 | 2 | 1310 | -3.09 | dBm | CW | 0 | 0 | 2025/1/7 17:58 | |
| 101 | 3 | | | | | | | | |
| 102 | 1 | 1550 | -2.908 | dBm | CW | 0 | 0 | 2025/1/7 17:58 | |
| 102 | 2 | 1310 | -2.979 | dBm | CW | 0 | 0 | 2025/1/7 17:58 | |

**Measurement**

# Loading data

The following types of files can be loaded.

### OTDR features

| Extension | Description |
|---|---|
| SOR | File in a format that conforms to Telcordia SR-4731 or Bellcore GR-196-CORE (must be a data file with measurement conditions that can be set on the instrument) |
| SOZ | Optical pulse waveform data (including the measurement conditions) for two wavelengths measured with the instrument's multi wavelength measurement feature. This file can only be loaded into this instrument. |
| SET | Information file that contains the measurement conditions that have been saved using the instrument |

### OTDR Smart Mapper

| Extension | Description |
|---|---|
| SMP | Adapt Trace data measured from an optical pulse (including the measurement conditions). |

### Multi-fiber measurement feature

| Extension | Description |
|---|---|
| MPJ | Project information file for multi-fiber measurement. For details on projects, see section 8.2. |

### Schedule measurement

| Extension | Description |
|---|---|
| *.CSV | Schedule information and measured optical power values (including measurement conditions) are loaded. To load the file, the file and folder configuration of the SOR file measured with the schedule measurement feature must be the same as when the file was saved. |

## Save destination drive

Select the destination drive from the following.

| Extension | Description |
|---|---|
| Internal Memory | Instrument internal memory |
| SD Card | microSD memory card (external memory) inserted into the instrument |
| USB Memory 1 | The first USB storage device (external memory) connected to a type A USB port of the instrument |
| USB Memory 2 | The second USB storage device (external memory) connected to a type A USB port of the instrument |

## File conditions

For details on the file name and comment feature, see section 3.4.

# 9.5 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 device (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.

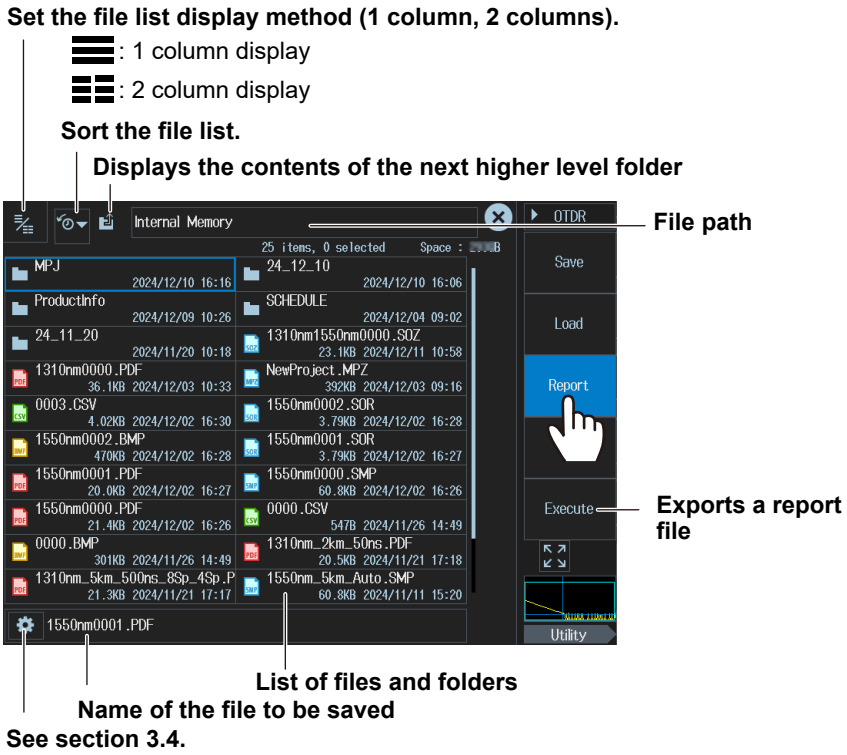
## Procedure

### Exporting the waveforms on the screen to report files

1. Press **FILE**. A file list screen appears.
2. Control the screen, and display the file list of the folder that report files will be saved in.
3. Press the **REPORT** soft key.

***4.*** Press the **Execute** soft key.

A message appears about how to create a report file from a saved SOR file. Tap anywhere or leave it for a while and it will disappear.



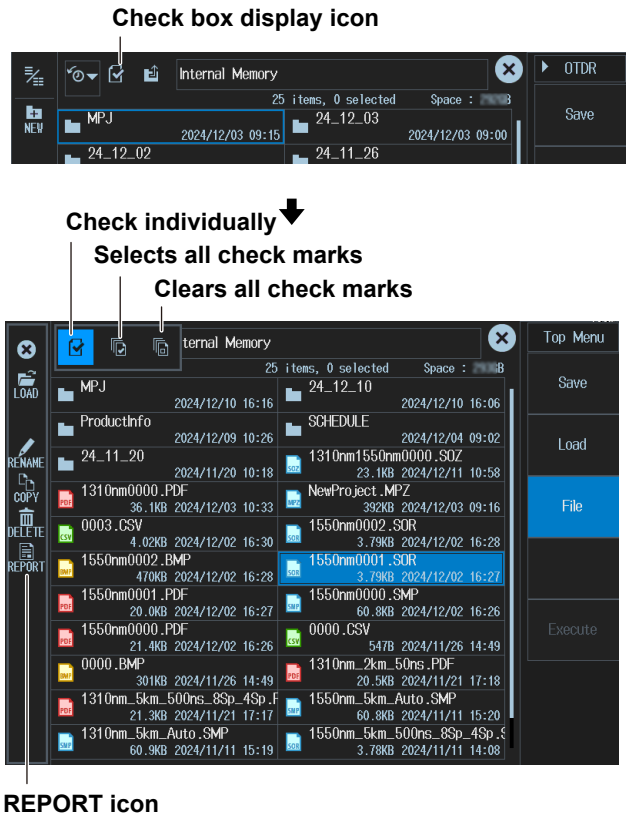

When “Fiber surface image” is set to Manual in the report format settings, or when there is no target image data (image data with the same file name as the serial number of the report file to be created) even if it is set to Auto, the fiber surface image selection screen is displayed. Select the fiber surface image to display in the report.

## *Note*

- The waveform shown on the data display screen is exported to a PDF report file. To select a waveform data file in the file list and export a report file, see “Exporting File List Data to Report Files” below.
- Report files can only be saved in SOR format (waveform data).

## Exporting file list data to report files

1. Press **FILE**. A file list screen appears.
2. Press the **File** soft key. A check box display icon appears at the top of the screen.
3. Tap the check box display icon. A check box is displayed for each file and folder.
4. Tap **REPORT**. A report file will be created.




When “Fiber surface image” is set to Manual in the report format settings, or when there is no target image data (image data with the same file name as the serial number of the report file to be created) even if it is set to Auto, the fiber surface image selection screen is displayed. Select the fiber surface image to display in the report.

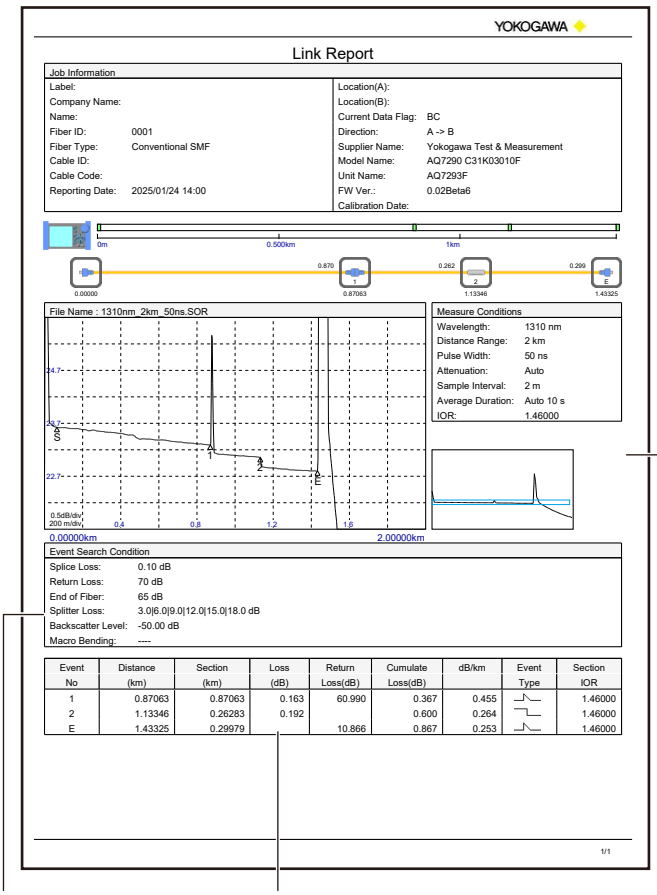
### *Note*

The REPORT icon will not appear if a file that cannot be exported to a report file or a folder is selected.

# Explanation

## Example of a report file

A report file is exported in the following format.




## Files that can be exported to report files

Report files can be exported in SOR, MPZ, and SMP formats.

The report file of the currently displayed waveform can also be exported by selecting PDF as the save format in section 9.4.

# 9.6 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 device (USB memory or internal memory) or corrupt its data.

**French**

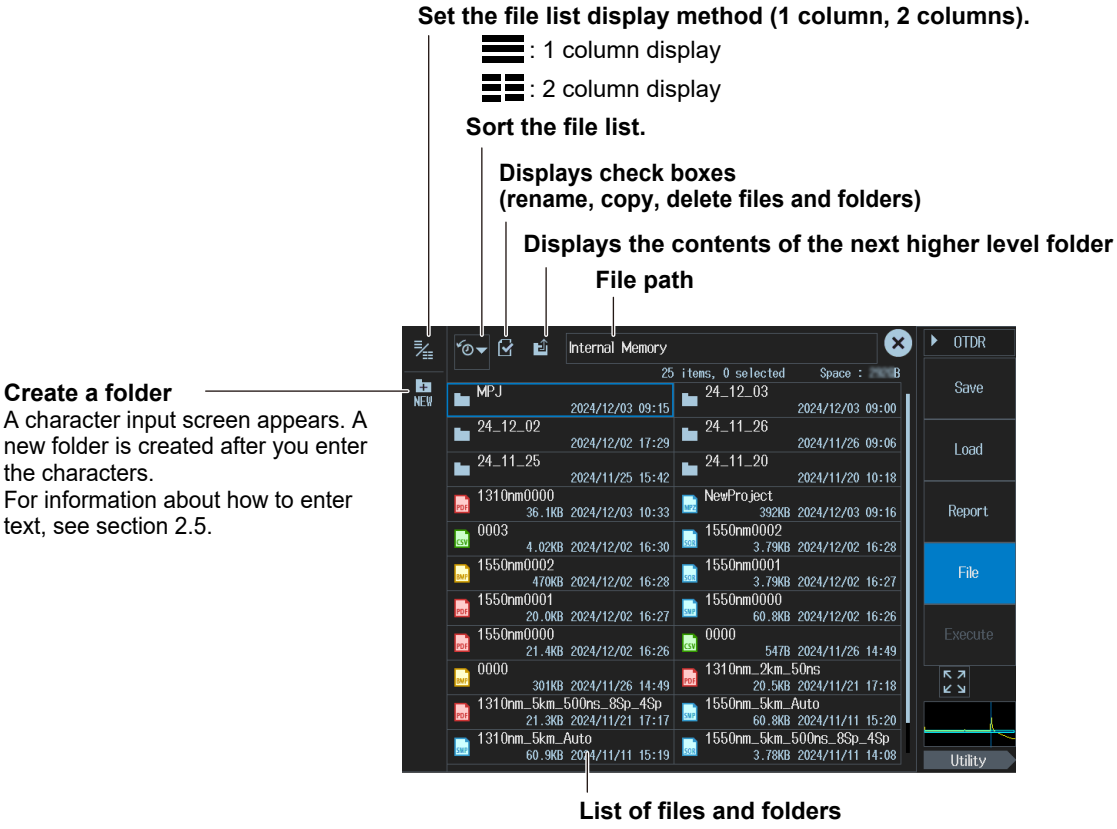
**ATTENTION**

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

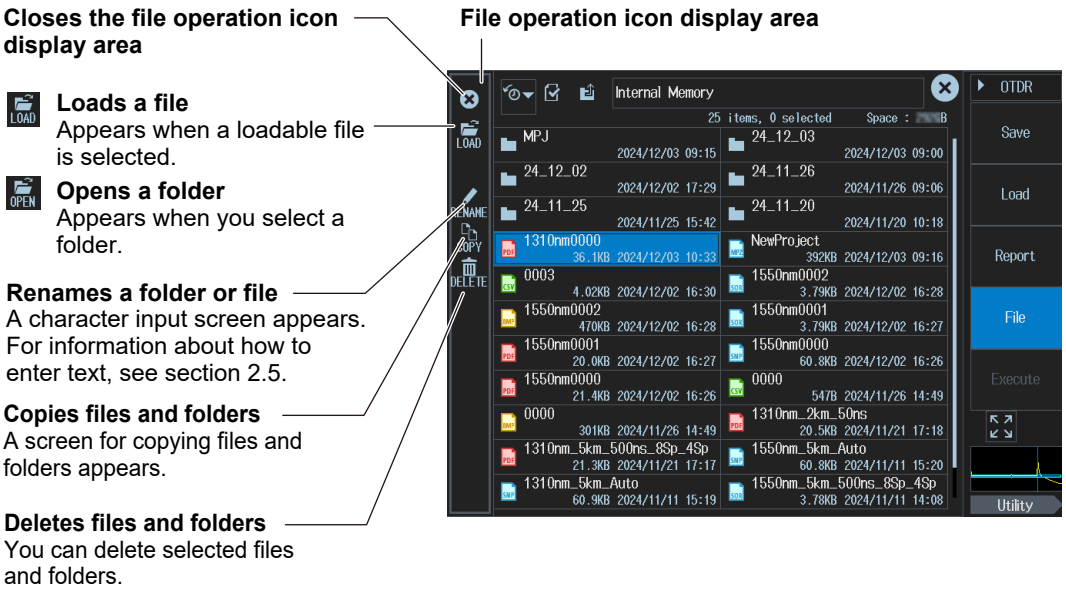
### Manipulating files and folders

1. Press **FILE**. A file list screen for manipulating files appears.
2. Press the File soft key. A list of files to be manipulated is displayed.



## 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.




### Renaming files and folders

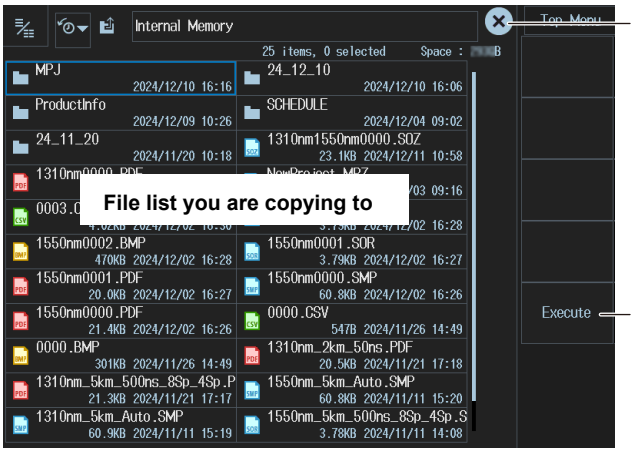
5. Tap the **RENAME** icon. A file name input screen appears.
6. Follow the instructions in section 2.5 to enter a new file or folder name.

### Deleting files and folders

5. Tap the **DELETE** icon. A confirmation message appears.
6. To delete, tap **OK**. To not delete, tap **Cancel**. Deleting a folder will delete all files and folders in the folder.

### Copying files and folders

**5.** Tap the **COPY** icon. A file list screen of the copy destination folder appears. Change the folder as necessary.




**Returns to the previous screen**

**Starts copying**
The file or folder is copied in the displayed file list.

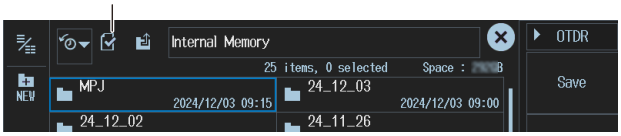
**6.** Tap the copy execute icon. The file or folder is copied.

## Selecting (copying or deleting) multiple files and folders

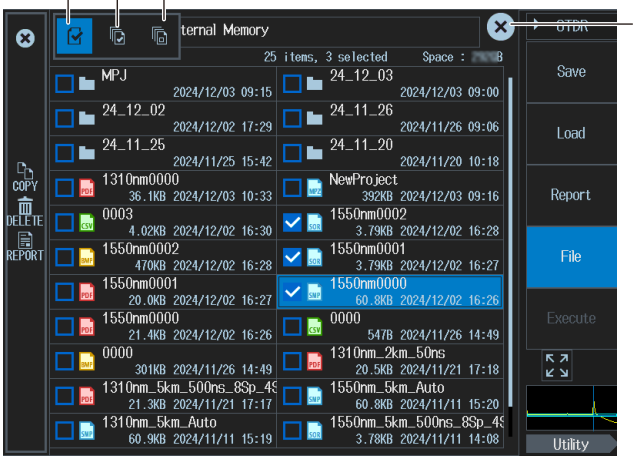
**3.** Tap the check box display icon. A screen for selecting files and folders to be manipulated appears.

**4.** Select the check boxes of the files or folders you want to manipulate.

**Check box display button**




**Check individually**
**Selects all check marks**
**Clears all check marks**




**Returns to the previous screen**

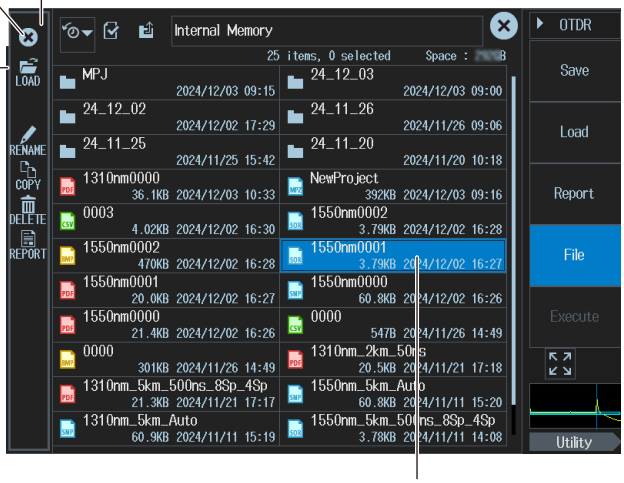
# Loading files

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

**Closes the file operation icon display area**

**File operation icon display area**

**Loads files**
The selected files will be loaded. Appears when a loadable file is selected.




**Selected file**
The background color changes when selected.

## *Note*

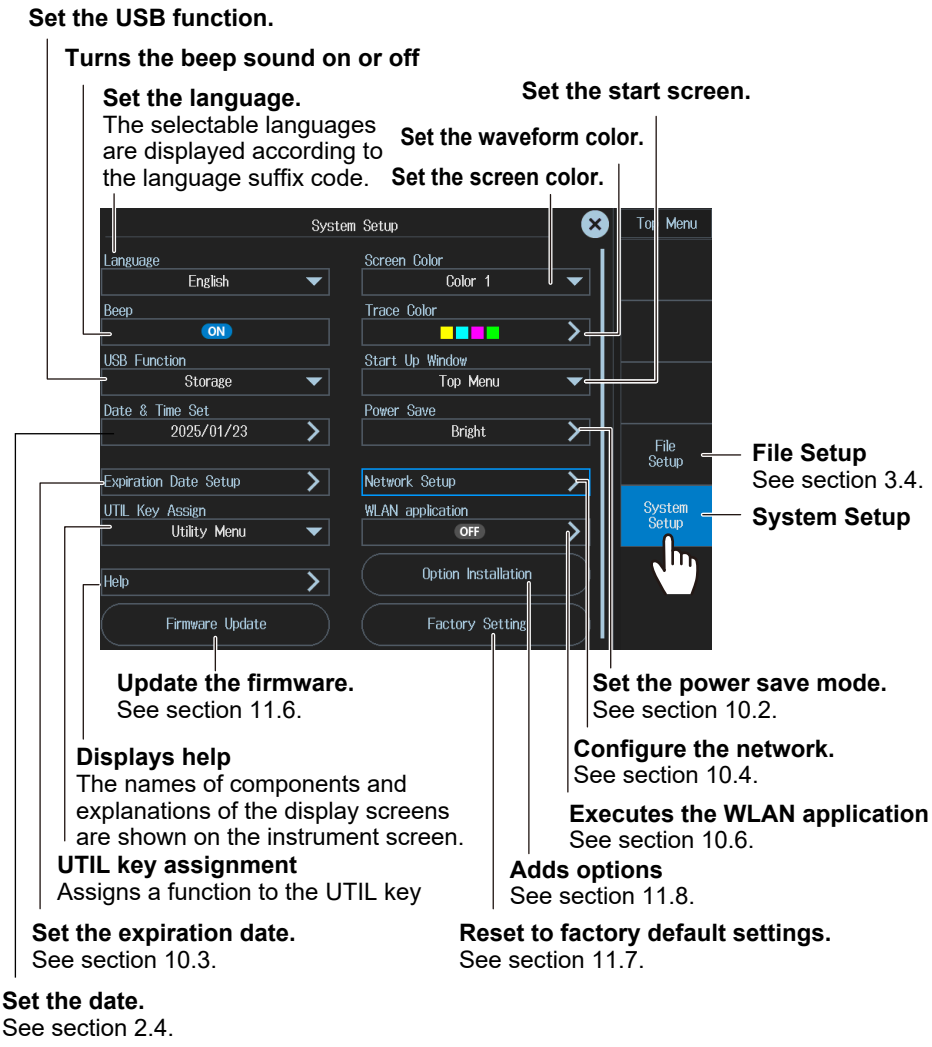
Files can also be loaded using the procedure explained in section 9.4.

# 10.1 Displaying the System Setup Screen

## Procedure

1. Press **MENU**. A MENU screen appears.
2. Press **SETUP**. A SETUP screen appears.
3. Press the **System Setup** soft key. The system setup screen appears.

   You can display the system setup screen by pressing the SETUP key on screens other than the MENU screen, such as those of the OTDR feature and power meter feature. Depending on the feature, you may need to tap the System tab after displaying the setup screen with the SETUP key. The settings are applied globally regardless of which screen system setup is executed from.



# Explanation

## Language

Set the language used on the instrument screen. The options are displayed according to the language suffix code of each product. For details on the language suffix codes, see the Getting Started Guide, IM AQ7290-02EN.

## Screen color

Select the screen color from the following:

| | |
|---|---|
| Color 1 | Color scheme based on black |
| Color 2 | Color scheme based on white |

## Beep

The instrument 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. |

## Trace color

Select the trace color from yellow, cyan, magenta, green, red, blue, black (when the screen color is Color 2), or white (when the screen color is Color 1).

## USB function

Set the function of the Type-C USB port.

| | |
|---|---|
| Storage | You can access the instrument internal memory from an external device, and load and save data. |
| Communication | You can control the instrument remotely from external devices.<br>For instructions on how to use remote control, see the communication interface user's manual, IM AQ7290-17EN. |

## Start up window

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

| | |
|---|---|
| Top Menu | The MENU screen appears. |
| Start Menu to Last Function | The screen of the feature that was executed immediately before the power was turned off appears. |

## UTIL key assignments

You can set how the instrument operates when the UTIL key is pressed.

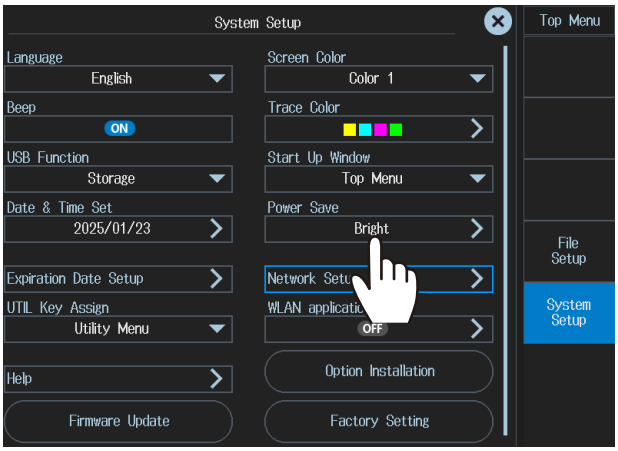
| Function | Description | Reference |
|---|---|---|
| Save | Data is saved. | Section 9.4 |
| Report | The current waveform display is exported to PDF. | Section 9.5 |
| Utility menu | Shows or hides the Utility menu when optical pulse measurement is in progress | Section 7.1 |
| Power meter | An optical power meter is displayed on the optical pulse measurement screen, and measurement is executed. | Sections 7.1 and 7.4 |
| Power checker | An optical power checker is displayed on the optical pulse measurement screen, and measurement is executed. | Sections 7.1 and 7.5 |
| Light source | A light source is displayed on the optical pulse measurement screen, and a measurement light is emitted. | Sections 7.1 and 7.2 |
| V isible light source | A visible light source is displayed on the optical pulse measurement screen, and a visible light is emitted. | Sections 7.1 and 7.3 |
| Fiber inspection probe* | A fiber end face image is displayed on the optical pulse measurement screen. | Sections 7.1 and 7.6 |
| Optical switch** | Opens the optical switch control screen | |
| File name setup | A screen for setting the file name format when saving files is displayed. | Section 3.4 |

* Available when an optical switch is not connected to the instrument
** Available when an optical switch is connected to the instrument

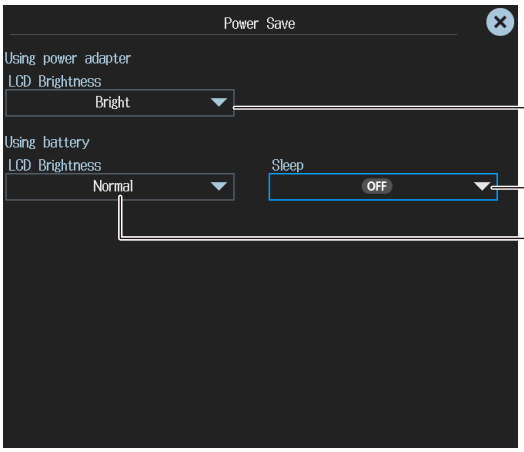
# 10.2 Using the Power Save Mode

## Procedure

1. Press **MENU**. A MENU screen appears.
2. Press **SETUP**. A SETUP screen appears.
3. Press the **System Setup** soft key. The system setup screen appears.
4. Tap **Power Save**. A power save screen appears.




**Power save mode screen**




**Set the LCD brightness for USB-AC adapter operation.**

**Set the sleep mode.**

**Set the LCD brightness for battery operation.**

## Explanation

### 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. |

## Sleep

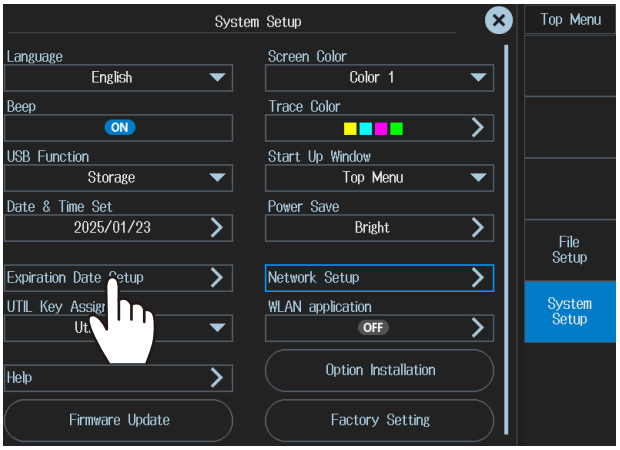
If the instrument is left on for a set period of time without any operation, it will automatically go to sleep. This does not apply during averaged measurement or real-time measurement.
After 2 hours in sleep mode, the power will automatically turn off.

| | |
|---|---|
| OFF | Sleep is disabled. |
| 1 min | If you do not operate the instrument for 1 minute, the power mode is set to sleep. |
| 5 min | If you do not operate the instrument for 5 minute, the power mode is set to sleep. |
| 10 min | If you do not operate the instrument for 10 minute, the power mode is set to sleep. |
| 30 min | If you do not operate the instrument for 30 minute, the power mode is set to sleep. |

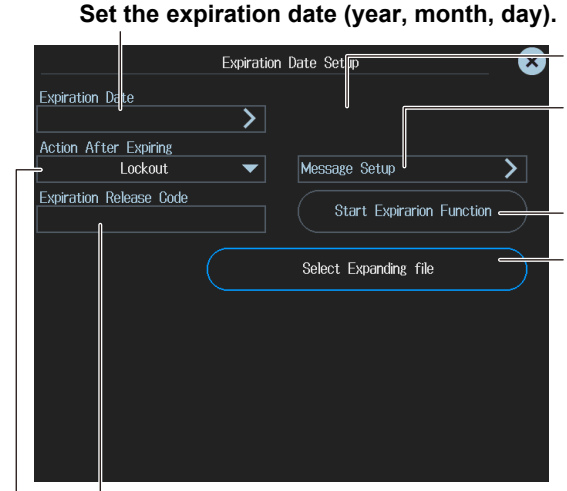
# 10.3 Setting the Expiration Date

## Procedure

1. Press **MENU**. A MENU screen appears.
2. Press **SETUP**. A SETUP screen appears.
3. Press the **System Setup** soft key. The system setup screen appears.
4. Tap **Expiration Date Setup**. An Expiration Date Setup screen appears.




**Expiration date setup screen**




**Set the expiration date (year, month, day).**

**Number of days until expiration date**

**Set the message to be displayed when the action to be taken when the expiration date is reached is alarm.**

**Starts the expiration date setup**

**Select an expiration date extension file.**

**Set the number to release the expiration date.**

**Set the action to be taken when the expiration date is reached.**

## Setting the expiration date

5. Tap **Expiration Date**. An Expiration Date screen appears.
   Set the year, month, and day.

## Setting the message to display on when the expiration date is reached

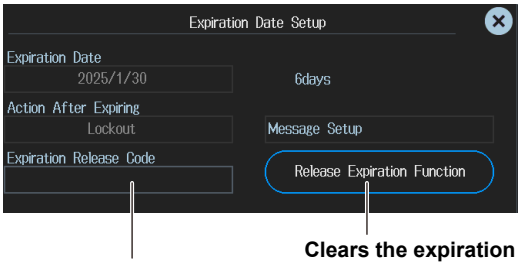
6. Tap **Message Setup**. A Message Setup screen appears.
   Set the message. For information about how to enter text, see section 2.5.
   You can set up to three messages.

## Enabling the expiration date settings

7. Tap **Expiration Release Code**. A numeric input screen appears.
8. Enter a 4-digit release number.
9. Tap **Start Expiration Function**. A screen appears for executing the expiration function.
10. Tap **Execute**. The expiration date setting is enabled. Start Expiration Function changes to Release Expiration Function.

## Releasing the expiration function

11. Continuing from step 3, tap **Expiration Release Code**. A numeric input screen appears.
12. Enter the release number that you entered to set the expiration date.
13. Tap **Release Expiration Function**. The expiration date setting is disabled.



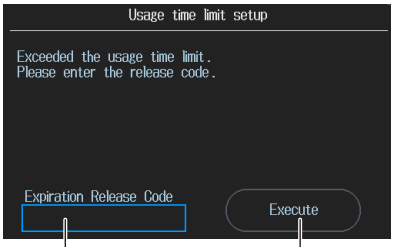

**Clears the expiration date settings**

**Enter the release number (the same number as when you entered the settings).**

## Releasing the locked state

When the expiration date is reached, a screen indicating that the instrument is locked is displayed at startup.

1. Tap **Expiration Release Code**. A numeric input screen appears.
2. Enter the release number that you entered to set the expiration date.
3. Tap **Execute**. The locked state is released.




**Clears the expiration date settings**

**Enter the release number (the same number as when you entered the settings).**

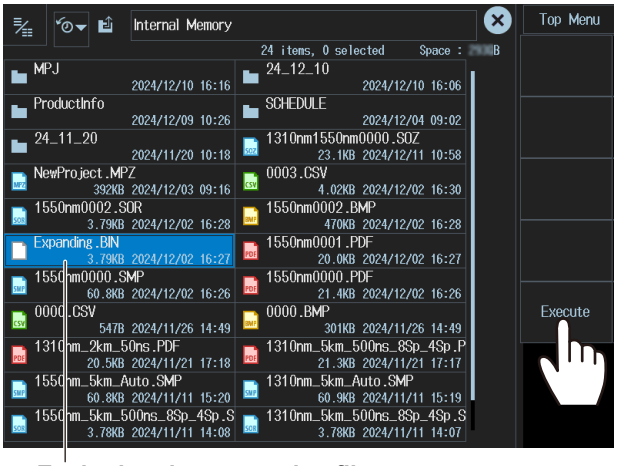
### *Note*

If you forget the release number, you will not be able to release the expiration date settings. The release number cannot be initialized. Be sure to manage the release number carefully. If you forget the release number, contact your nearest YOKOGAWA dealer.

## Extending the expiration date

If you have purchased a product with an expiration date, you can extend the expiration date by loading the expiration date extension file provided by the dealer you purchased the product from. For details on the expiration date extension file, contact your nearest YOKOGAWA dealer.

5. Load the previously obtained expiration date extension file into this instrument or save it to a USB memory device and insert it into this instrument.
6. Tap **Select Expanding File**. A file list appears.
7. Manipulate the files, select the expiration date extension file, and press the **Execute** soft key. The expiration date is extended to the date listed in the expiration date extension file.




**Expiration date extension file**

## Explanation

This function displays a message during instrument startup or locks the instrument when the expiration date expires. You can use it to display a message that urges you to calibrate the instrument or the like when the recommended calibration period elapses.

## Expiration date

Set the expiration date by entering the year, month, and day. The year is displayed in Western calendar year. The instrument supports leap years. When the number of remaining days until expiration reaches 7 days (1 week before expiration), a message that you specified in the message settings is displayed on the screen when the instrument starts.
The maximum expiration date is 180 days after the current date and time.

## Action

Set the action to be taken when the expiration date has passed.

| | |
|---|---|
| Lock | When the expiration date expires, you will need to enter a release number during instrument startup. If you do not enter the correct number, the instrument will not start.<br>If the expiration date is reached while you are using the instrument (startup completed condition), the instrument will not be locked. |
| Alarm | When the expiration date expires, the set message will be displayed during instrument startup. When you close the message screen, the instrument starts normally. While the expiration date setting is enabled, the message is displayed every time the instrument starts. |

## Messages

You can set up to three messages to be displayed when the expiration date expires. Up to 40 alphanumeric characters can be entered.
When the number of remaining days until expiration reaches 7 days (1 week before expiration), the set message is displayed during instrument startup.

## Release number

Set a 4-digit number. This is used to release the expiration date.

## Extending the expiration date

An expiration date extension file is used to extend the expiration date. The expiration date extension file is binary (.bin extension). Check with the instrument provider to see if an expiration date extension file can be provided.

***Note***

If you know the release number, you can set the expiration date without using an expiration date extension file.

# 10.4 Using the Network (LAN)

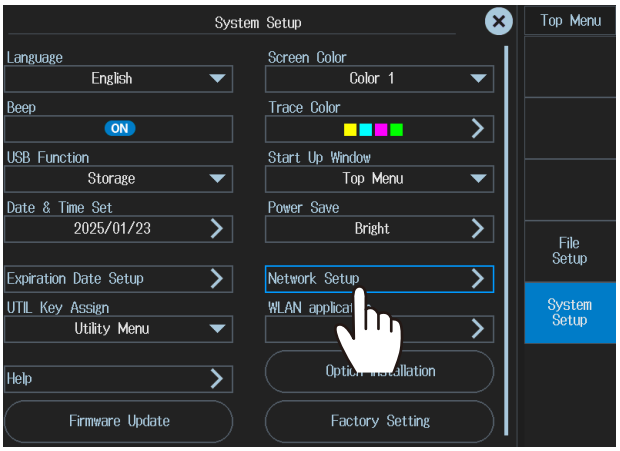
## Procedure

### Connecting to wired LAN

Connect a LAN cable to the Ethernet port on a model with the Ethernet option (/LAN), and connect the instrument to a network.

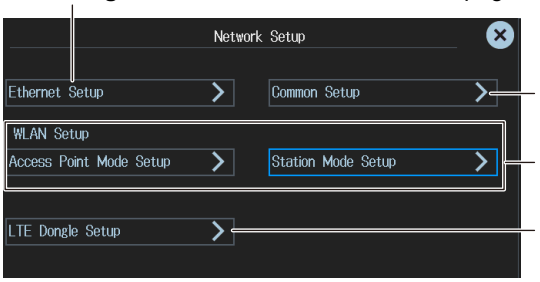
### Network setup screen

1. Press **MENU**. A MENU screen appears.
2. Press **SETUP**. A SETUP screen appears.
3. Press the **System Setup** soft key. The system setup screen appears.
4. Tap **Network Setup**. A Network Setup screen appears.




**Network setup screen**

**Configure the Ethernet.** See the next page.




**Set common parameters (user name, password).** See the next page.

**Configure the WLAN.** See section 10.6.

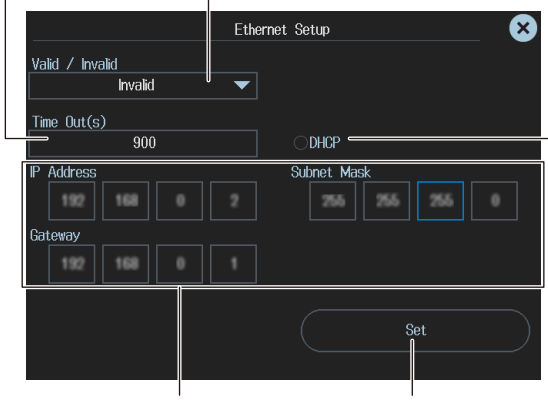
**Set the LTE dongle.** See section 10.7.

## Configuring the Ethernet

**5.** Tap **Ethernet Setup**. An Ethernet Setup screen appears.

**Set the timeout period.**
**(Infinite (0), 1 to 3600)**

**Enable or disable the network feature.**




**Turns DHCP on or off**

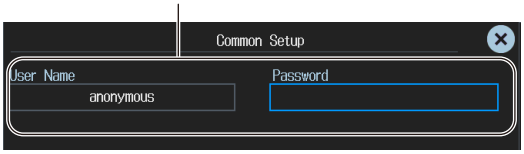
**Set the TCP/IP parameters.**

**Applies the network settings**

## Setting common parameters (user name, password)

**5.** Tap **Common Setup**. A Common Setup screen appears.

**Set the user name and password.**
(For information about how to enter text, see section 2.5.)



## Explanation

Connect a network to the Ethernet port on a model with the Ethernet option (/LAN), and connect the instrument to a network. With a network connection, you can control the instrument using communication commands.
For details on DHCP and TCP/IP, contact your network administrator.

### Enabling and disabling the network feature

Set the user name, password, timeout value, and TCP/IP parameters, and then select Valid. Applying the network settings, you can start communicating over the network. You do not have to restart the instrument.
Valid: Communication is possible using the network feature.
Invalid: Communication is not possible using the network feature.

### Timeout period

If there is no access to the instrument within the specified period, the network connection between the instrument and the PC is automatically disconnected.
Selectable range: Infinite (0), 1 to 3600 s
If you set the value to 0, “Infinite” is displayed, and the timeout value is set to infinity. If the network connection is disconnected because of external factors, not a normal disconnection from the remote device, the instrument will keep the network connected unless the power is turned off. To prevent this from happening, we recommend that you set the timeout value to a finite period.

### DHCP

If there is a DHCP server on the network to which the instrument is connected and you want to use DHCP, set this to ON. Consult your network administrator to verify if DHCP is available.
ON: IP address, netmask, and gateway parameters are assigned automatically.
OFF: IP address, netmask, and gateway parameters must be assigned manually.

### TCP/IP

**IP address**
Set the IP address to assign to the instrument. The IP address is an ID number assigned to each computer connected to the Internet or an intranet network.
Obtain the IP address from your network administrator.
If DHCP is available and you set DHCP above to ON, the IP address is assigned automatically.

**Netmask**
Set the mask value for determining the subnet network address from the IP address. In a network such as the Internet, networks are divided and managed in small subnets. Subnet mask is a value that defines how many bits of the IP address is used for network identification.
Consult your network administrator for the netmask address.
If DHCP is available and you set DHCP above to ON, the IP address is assigned automatically.

**Gateway**

Set the IP address of the default gateway used to communicate with other networks. The default gateway has features for controlling the communication between multiple networks so that data exchange is performed smoothly.

Consult your network administrator for the gateway setting.

If DHCP is available and you set DHCP above to ON, the IP address is assigned automatically.

## User name and password

Set the user authentication user name and password for accessing the instrument from a PC.

**User name**

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

**Password**

You can use up to 15 characters.

***Note***

- If a user authentication error occurs, communication will not possible using the network feature.
- You do not need to enter a password when the user name is set to “anonymous.”

# 10.5 Using the Web Server

## Procedure

### Connecting the AQ7290 to a PC

Connect the AQ7290 to your PC through an Ethernet network.

### Configuring AQ7290 settings

Enable the AQ7290 network function by following the instructions in section 10.4.

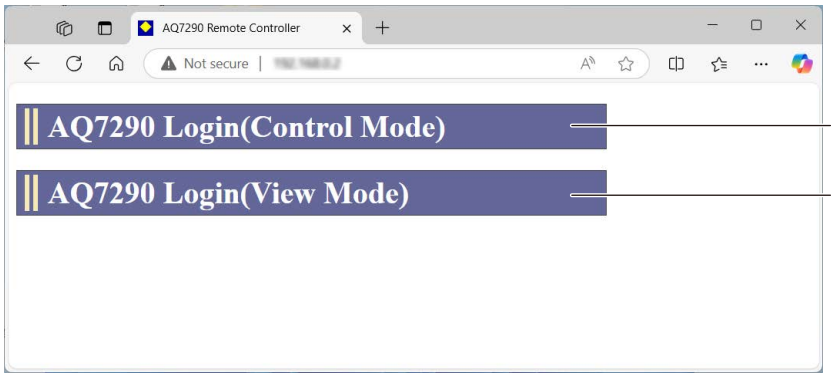
### Connecting to the AQ7290 from Your PC

1. Run a Web browser on your PC.
2. In the address box, enter “http://IP address” to connect to the AQ7290.

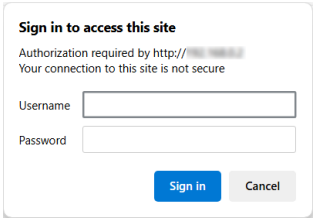
   Use the IP address that you specified on the AQ7290.

   A page for selecting the connection mode appears.

**Connection mode selection screen**




3. Click a connection mode. An authentication dialog box appears.




4. To connect in Control Mode, enter the user name and password that you specified in the AQ7290 network settings, and click OK.

   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, and click OK.

   User name and password are case-sensitive.

   The AQ7290 screen and control panel appear on the PC screen.

# Controlling from a PC

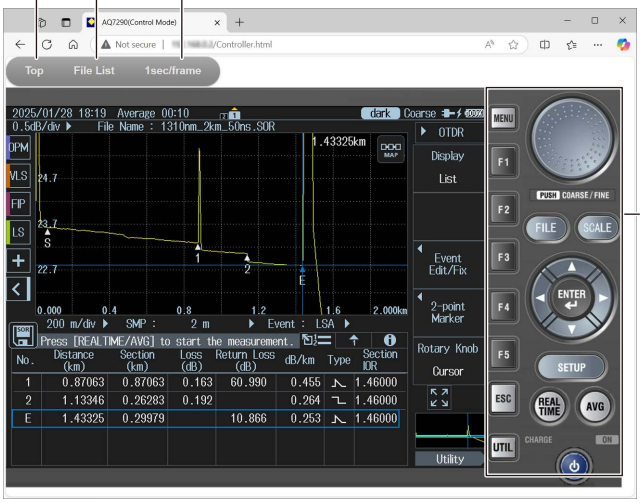
You can control the AQ7290 with a mouse or through the touch panel of your PC.

**Control screen**

**Displays the top menu (connection mode selection)**

**Displays a file dialog box**

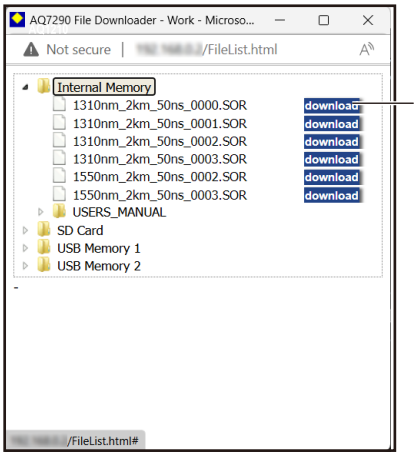
**Screen refresh interval (shows a setup screen)**




### Displaying the file dialog box and downloading Files

Click **File List** at the top of the screen. A directory structure of the AQ7290 internal memory, microSD memory card, and USB memory devices connected to the AQ7290 appears.

Click **download** to download the corresponding file to your PC.

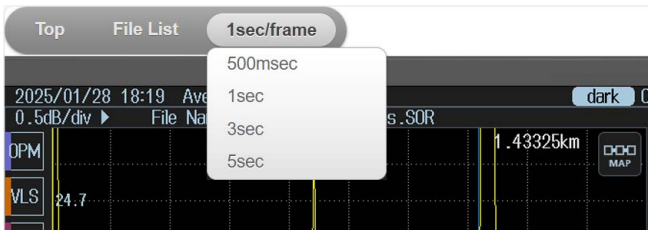



### Setting the refresh interval

You can set the interval for refreshing the content displayed on the PC 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.



## Explanation

You can control an AQ7290 connected to a network from your PC.

## Connection mode

There are two connection modes: Control and View.

Control Mode: The AQ7290 screen is displayed on your PC screen. You can control the AQ7290 with a mouse or through the touch panel of your PC. You can also download files from the AQ7290.

View Mode: The AQ7290 screen is displayed on your PC screen, but you cannot control the AQ7290 from your PC. It is possible, however, to download files from the AQ7290.

## Controlling the AQ7290

If you connect in Control Mode, you can control the AQ7290 from your PC.

**Rotary knob operation**

The operation varies depending on where on the rotary knob you click.

Upper right of the rotary knob: Equivalent to turning the rotary knob to the right by a small amount (1 point).

Lower right of the rotary knob: Equivalent to turning the rotary knob to the right by a large amount (10 points).

Upper left of the rotary knob: Equivalent to turning the rotary knob to the left by a small amount (1 point).

Lower left of the rotary knob: Equivalent to turning the rotary knob to the left by a large amount (10 points).

**AQ7290 touch panel operation**

The AQ7290 touch panel only supports tapping. You can perform the equivalent of tapping by clicking the mouse.

## Downloading files

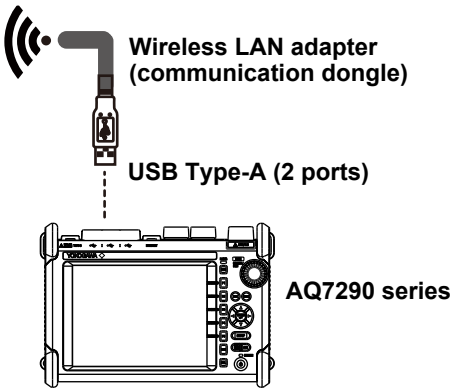
- Only files that are 1400 KB or less in size can be downloaded. The download button does not appear for files that cannot be downloaded.
- The download destination varies depending on your browser.
- Multiple files cannot be downloaded at once.

# 10.6 Using the WLAN Application

## Procedure

### Connecting the Wireless LAN Adapter (communication dongle)

***1.*** Connect a wireless LAN adapter to the Type-A USB port of the instrument.

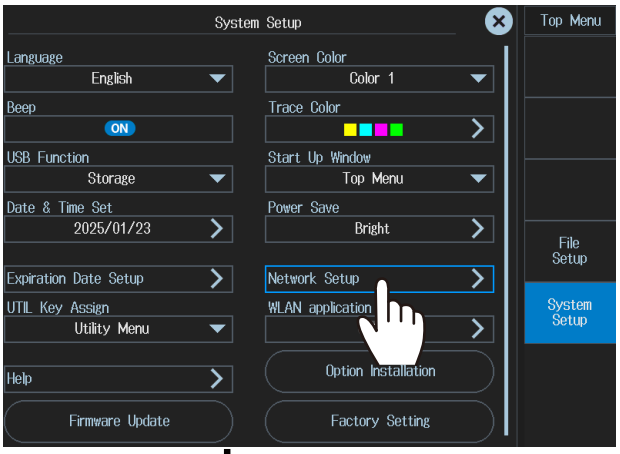



***Note***

Please use your own communication dongle. For the recommended communication dongles that can be used with this instrument, contact your nearest YOKOGAWA dealer.

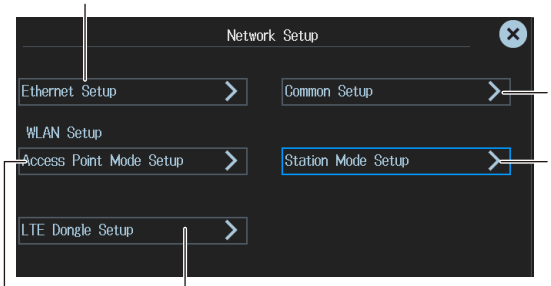
## Network setup screen

1. Press **MENU**. A MENU screen appears.
2. Press **SETUP**. A SETUP screen appears.
3. Press the **System Setup** soft key. The system setup screen appears.
4. Tap **Network Setup**. A Network Setup screen appears.




**Network setup screen**

**Configure the Ethernet.** See section 10.4.




**Set common parameters (user name, password).** See the section 10.4.

**Set the station mode.**
Select this option when using this instrument by connecting to an access point.
See the next page.

**Set the LTE dongle.** See section 10.7.

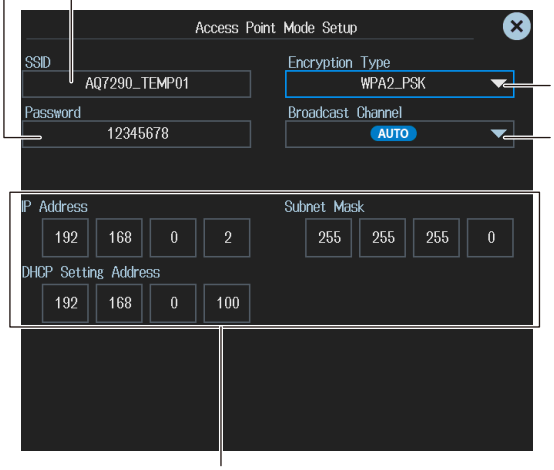
**Set the access point mode.**
Select this option when using this instrument as an access point.
See the next page.

## Setting the access point mode

**5.** Tap **Access Point Mode Setup**. An Access Point Mode Setup screen appears.

**Set the authentication password.**
A character input screen appears. For information about how to enter text, see section 2.5.

**Set the ID name (SSID).**
A character input screen appears. For information about how to enter text, see section 2.5.




**Set the encryption mode.**

**Set the broadcast (beacon signal) channel to the wireless terminal.**

**Set the network address.**
A numeric keypad appears.

## Setting the station mode

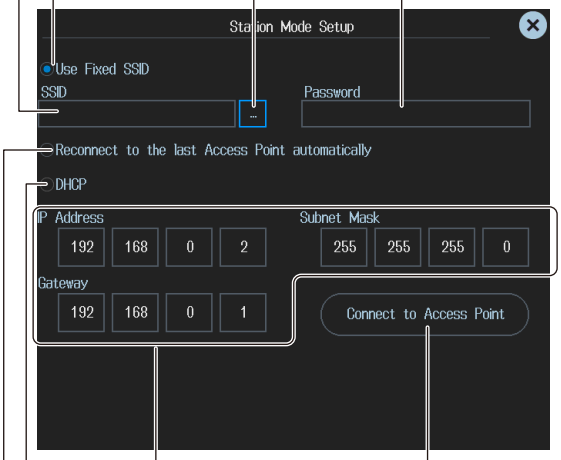
**5.** Tap **Station Mode Setup**. A Station Mode Setup screen appears.

**Set the ID name (SSID).**
A character input screen appears. For information about how to enter text, see section 2.5.

**Select to use a fixed ID name (SSID).**

**Select a fixed SSID.**

**Set the authentication password.**
A character input screen appears. For information about how to enter text, see section 2.5.




**Set the network address.**
A numeric keypad appears.

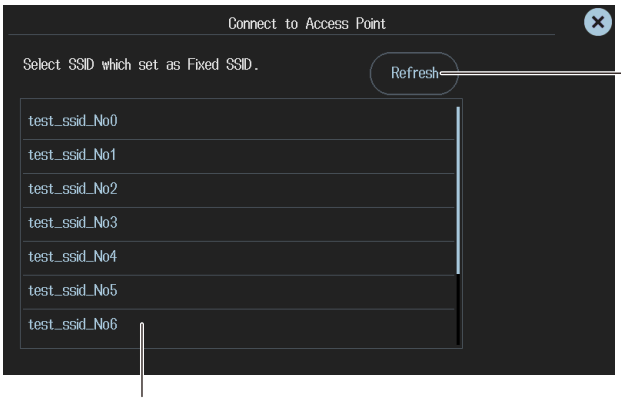
**Connecting to an access point**
An access point connection screen appears.

**Turns DHCP on or off**

**Enables or disables auto reconnection**

### Selecting an SSID from a list of detected SSIDs

**6.** Select an SSID from the list of detected IDs. A screen appears for selecting a fixed SSID from the detected SSIDs.




**Updates the list**

**Select a fixed SSID from the list.**

### Connecting to an access point

**7.** Tap **Connecting to an Access Point**. An access point connection screen appears.

**An icon indicating that the wireless LAN is in use**
If you execute the Stop WLAN function, the wireless LAN operation ends, and the icon disappears.
If you select Back to OTDR, 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.

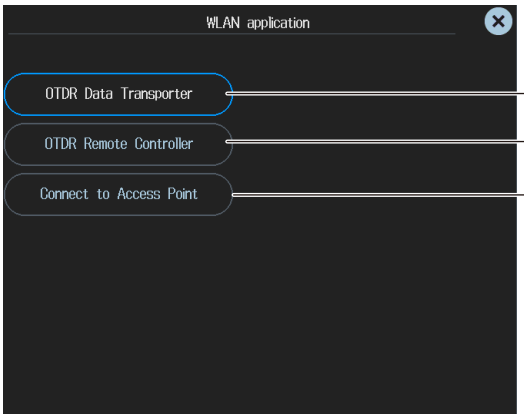

**Returns to the previous screen**

**Cancels wireless LAN connection**

**When a connection is established, the IP address assigned to this instrument is displayed.**

## Starting the wireless LAN application

1. Press **MENU**. A MENU screen appears.
2. Press **SETUP**. A SETUP screen appears.
3. Press the **System Setup** soft key. The system setup screen appears.
4. Tap **WLAN application**. A WLAN application screen appears.




**Executes waveform data transfer (standby)**

**Executes an OTDR remote operation (standby).** See the next page.

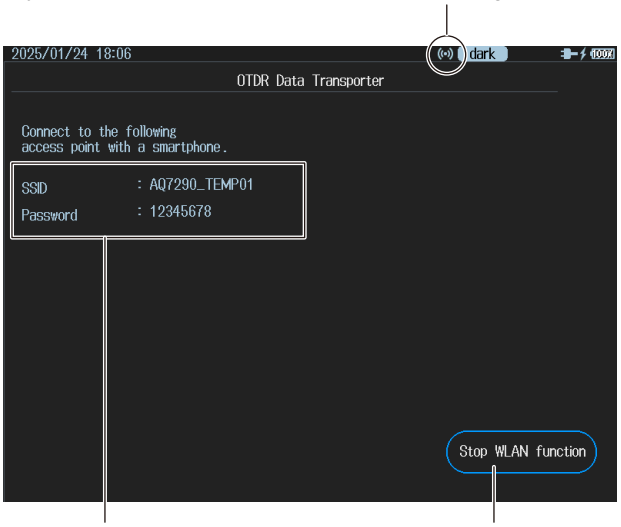
**Connects to an access point.** See the previous page.

## Transferring the waveform data

### Executing a waveform data transfer (access point standby state)

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

**An icon indicating that the wireless LAN is in use**
If you execute the Stop WLAN function, the wireless LAN operation ends, and the icon disappears. 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.




**Access point information**

**Cancels waveform data transfer**

### Operation on the wireless terminal

6. 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 instrument.

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

**Note**

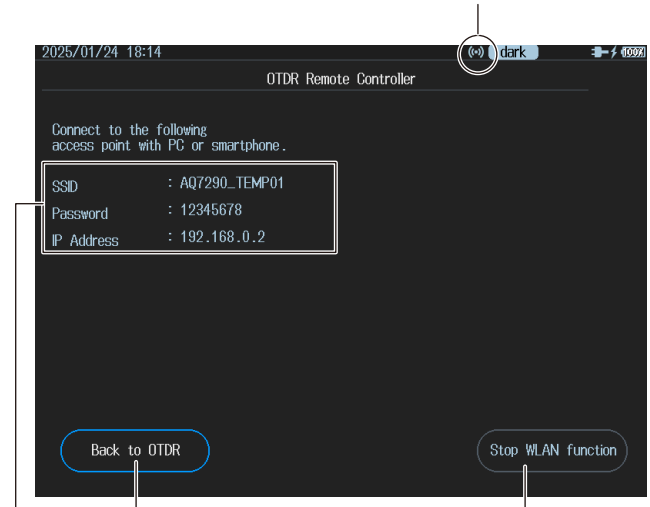
Only a single wireless terminal can access the instrument at any given time. (Multiple wireless terminals cannot access the instrument simultaneously.)

## Controlling the OTDR remotely

### Executing OTDR remote control (access point standby state)

5. Continuing from step 4 on page 10-22, tap **OTDR Remote Controller**. A standby screen appears for OTDR remote control. 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 execute the Stop WLAN function, the wireless LAN operation ends, and the icon disappears. 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.




**Returns to the previous screen**

**Cancels waveform data transfer**

**Access point information**

### Operation on the wireless terminal (PC) (Yokogawa OTDR Remote Controller)

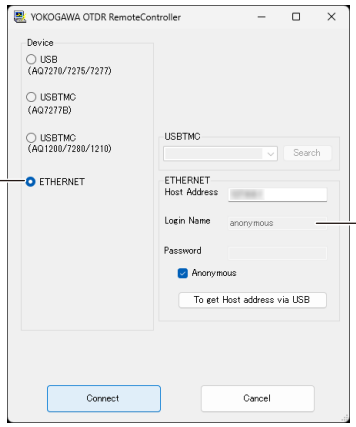
To use this function, our application software OTDR Remote Controller must be installed on the wireless terminal.

6. On the wireless terminal, search for and connect to the same access point as the SSID of this instrument.
7. Start Yokogawa OTDR Remote Controller on the wireless terminal.

   For information on how to operate the OTDR remote controller, see the OTDR remote controller help.
8. From the **File** menu, select **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 instrument.**

***Note***

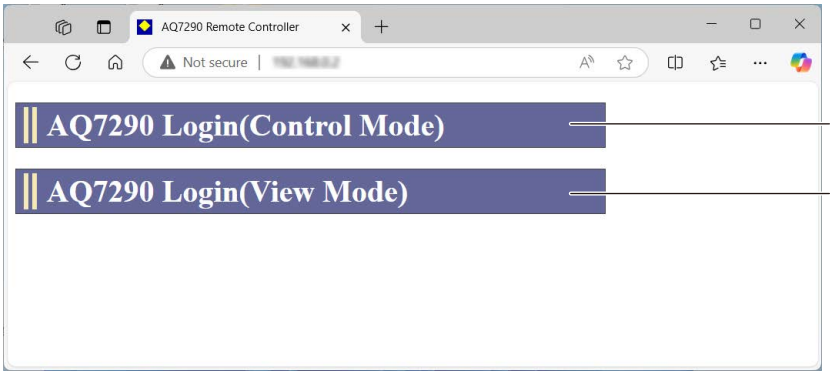
Only a single wireless terminal can access the instrument at any given time. (Multiple wireless terminals cannot access the instrument simultaneously.)

### Operation on the wireless terminal (PC) (Web browser)

6. On the wireless terminal, search for and connect to the same access point as the SSID of this instrument.
7. Run a Web browser on your wireless terminal.
8. In the address box, enter "http://IP address" to connect to the instrument. The IP address is that of the access point shown on the instrument.

   A page for selecting the connection mode appears.

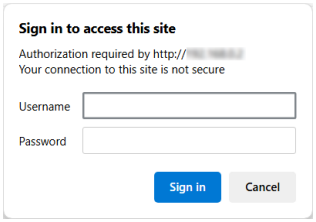
**Connection mode selection screen**




**Connection mode (Control mode)**

**Connection mode (View mode)**

**9.** Click a connection mode. An authentication dialog box appears.




**10.** To connect in Control Mode, enter the user name and password that you specified in “Setting common parameters (user name, password)” in section 10.4, and click OK.

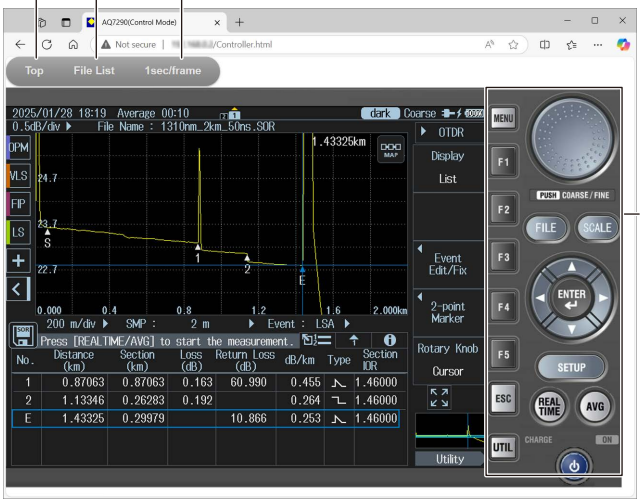
The AQ7290 screen and control panel appear on the wireless terminal screen. You can control the AQ7290 with a mouse or through the touch panel.

**Control screen**

**Displays the top menu (connection mode selection)**

**Displays a file dialog box**

**Screen refresh interval (shows a setup screen)**



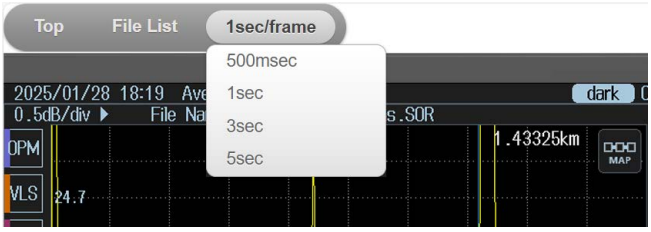

**Corresponds to the AQ7290 panel keys**

## *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.

### Setting the screen refresh interval

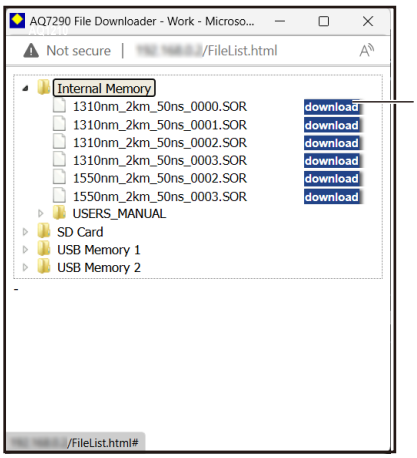
You can set the interval for refreshing the content displayed on the wireless terminal screen. Click the refresh interval at the top of the screen. A drop-down list for setting the interval appears. Click the refresh interval you want to use.



**Displaying the file dialog box**

Click **File List** at the top of the screen. A folder structure of the instrument internal memory and USB memory devices connected to the instrument appears.

Click download to download the corresponding file to the wireless terminal.




# Explanation

## Access point

**SSID (ID name)**

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

**Password**

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

**Encryption mode**

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 channel (beacon signal)**

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.

**TCP/IP settings**

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

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

- **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 (instrument).
  Addresses are assigned in order from the specified address.

## Remote control login information (Application Setup)

**User name**
You can use up to 15 characters. The default setting is “anonymous.”

**Password**
You can use up to 15 characters.

## Transferring waveform data

You can transfer data saved on the instrument 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.

https://tmi.yokogawa.com/library/

Waveform data can also be transferred by remotely controlling the instrument. See “Displaying the file dialog box” on page 10-26.

## Remote controlling the OTDR

**Operation on the wireless terminal (Yokogawa OTDR Remote Controller)**
You can install Yokogawa OTDR Remote Controller in the wireless terminal and remotely control the instrument from the software application.
This software application is a freeware. Visit the YOKOGAWA webpage below, and download Yokogawa OTDR Remote Controller.

https://myportal.yokogawa.com/

**Operation on the Wireless Terminal (Web Browser)**
You can remotely control the instrument from a Web browser of your wireless terminal.

- **Connection mode**
  There are two connection modes: Control and View.
  Control Mode: The instrument screen is displayed on the wireless terminal screen. You can control the instrument with a mouse or through the touch panel of the wireless terminal. You can also download files from the instrument.
  View Mode: The instrument screen is displayed on the wireless terminal screen, but you cannot control the instrument from the wireless terminal. However, you can download files from the instrument.

- **Touch Panel Remote Control**
  - The instrument's 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.

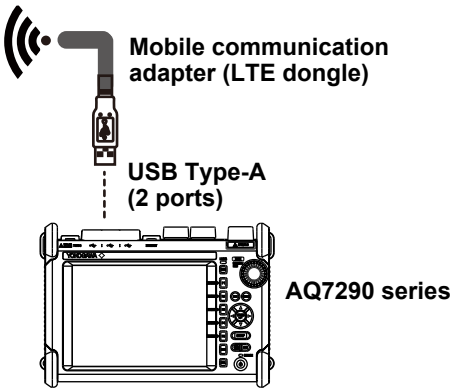
- **Downloading files**
  - Only files that are 1400 KB or less in size can be downloaded.
    The download button does not appear for files that cannot be downloaded.
  - The download destination varies depending on your browser.
  - Multiple files cannot be downloaded at once.

# 10.7 Using the LTE Dongle

## Procedure

### Connecting the mobile communication adapter (LTE dongle)

*1.* Connect a mobile communication adapter to the Type-A USB port of the instrument.

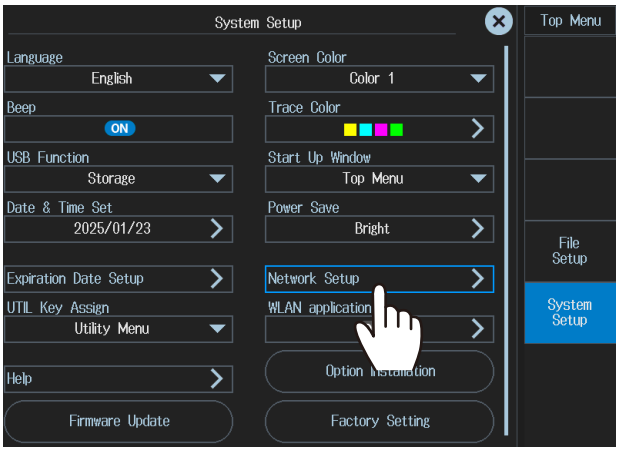



***Note***

Please use your own LTE dongle. For the recommended LTE dongles that can be used with this instrument, contact your nearest YOKOGAWA dealer.

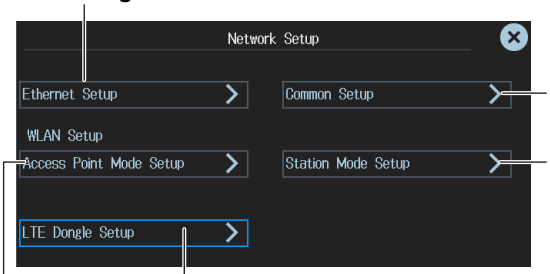
## Network Setup screen

1. Press **MENU**. A MENU screen appears.
2. Press **SETUP**. A SETUP screen appears.
3. Press the **System Setup** soft key. The system setup screen appears.
4. Tap **Network Setup**. A Network Setup screen appears.




**Network setup screen**

**Configure the Ethernet.** See section 10.4.




**Set common parameters (user name, password).** See the section 10.4.

**Set the station mode.**
Select this option when using this instrument by connecting to an access point.
See section 10.6.

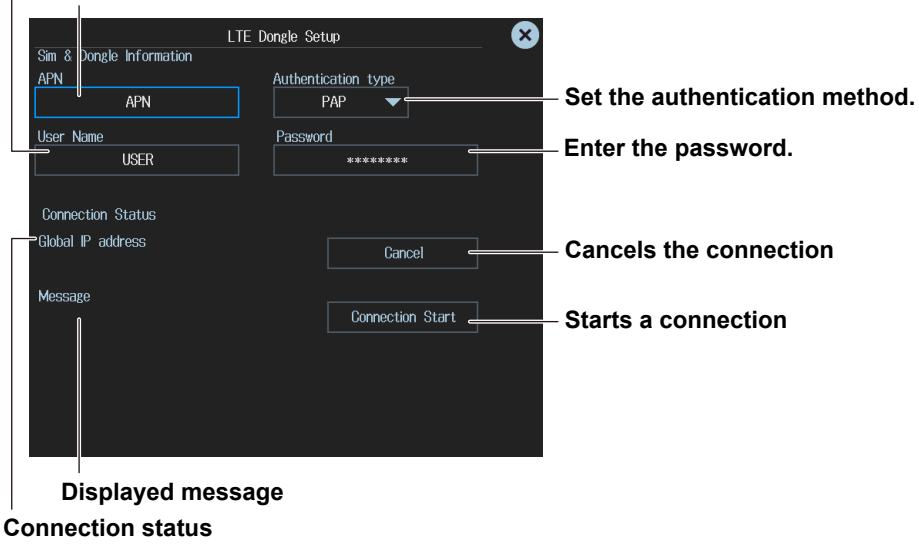
**Set the LTE dongle.** See the next page.

**Set the access point mode.**
Select this option when using this instrument as an access point.
See section 10.6.

*5.* Tap **LTE Dongle Setup**. An LTE Dongle Setup screen appears.

**Enter the user name.**
Enter the destination user name.
A character input screen appears. For information about how to enter text, see section 2.5.

**Set the connection destination name (APN: Access Point Name).**
A character input screen appears. For information about how to enter text, see section 2.5.




## Explanation

You can use an LTE dongle to connect to a PC, smartphone, and other terminals via mobile communication.
If our application software “Yokogawa OTDR Remote Controller” or “OTDR Data Transporter” is installed on the terminal connected to this instrument, you can use these application software to control this instrument.
It can be used for communication over longer distances than WLAN.

### APN

Set the name of the connection destination when connecting from a terminal.

### Authentication type

Set the authentication type.

PAP: Unencrypted passwords are sent to the network.
CHAP: Challenge handshake method. No password is sent to the network.
PAP&CHAP: Both PAP and CHAP are supported, depending on the connected terminal.

### User name

Set a user name of up to 15 characters to access this instrument.

### Password

Set a password of up to 15 characters to access this instrument.

# 11.1 Troubleshooting

## Dealing with problems

- 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 | See |
|---|---|---|
| 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 USB cable is connected firmly to the USB-AC adapter, and the USB-AC adapter's DC plug is connected firmly to the instrument. | —[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 instrument is within the operating temperature range. | —[1] |
| | Holding down the power switch for at least 2 seconds. | —[1] |
| | The backup file in the instrument may be corrupt due to an improper shutdown execution. Turn the power off, and restart by following the procedure below.<br>1. While holding down the MENU key, press the power switch.<br>2. Keep holding down the key until the instrument starts. | —[1] |
| The display disappears after some time passes. | The instrument 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 instrument will turn off automatically if there is no user activity for the specified time. Check the settings. | 10.2 |
| The screen is dark. | The screen will appear dark when the LCD Brightness setting is set to "Power save." Check the settings. | 10.2 |
| | The LCD may be worn out. Servicing is required. | — |
| | If the instrument 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 instrument is within the operating temperature range. | —[1] |
| The power turns off automatically while the instrument is in use. | The instrument 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 instrument back on. If the Auto Power OFF feature is enabled in Power Save mode, the instrument automatically turns off after a certain time elapses. | 10.2<br>11.2[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 instrument is within the operating temperature range. Let the instrument 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 instrument 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. | 2.3 |

1 See the Getting Started Guide, IM AQ7290-02EN.

2 When it is likely that the usage limitations of the instrument will be exceeded, the instrument will display a warning message and turn off automatically to prevent damage. For the conditions under which such messages appear, see section 11.2.

# 11.2 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 section 2.4). If the corrective action states that serving is required, contact your nearest YOKOGAWA dealer.

## Error in execution

| Code | Message |
|---|---|
| 18 | Test succeeded. |
| 19 | Success |
| 27 | The end point is different between acquired data and reference data. Please check the connected fiber cable. |
| 28 | The measurement may not be completed within the specified duration. |
| 35 | The optical plug may not be connected securely. |
| 38 | Shutting down |
| 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. |
| 45 | The warm-up was ended. |
| 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. |
| 48 | Self test executing. Please wait… |
| 49 | MENU : Close the Touch Screen window<br>ENTER : Clear the display |
| 51 | Need the AC power supply to measure for a long time. Please connect the AC adapter. |
| 52 | Expiration function start success. |
| 53 | Expiration function release success. |
| 54 | Please select the fiber surface image. |
| 55 | Auto save setting is required to use this function. Please turn on auto save setting. |
| 70 | The following option was installed. To activate the option, restart the AQ7290. |
| 71 | Cannot save the SOR file correctly with the current file name settings. When you select Multi-wavelength measurement, you have to include ""Wavelength"" in the file name.<br>Please check "File Name Setup". |
| 72 | license registration is complete. |
| 73 | Connecting to the LTE network. It may take up to 60 seconds. |
| 74 | LTE network connection was successful. |
| 75 | Failed to connect to the LTE network. Please check the SIM card settings. Additionally, there might be an incompatible LTE dongle inserted in the device. |
| 76 | Expiration Date updated successfully. |
| 77 | Failed to initialize settings of measurement. Please restart the AQ7290. |
| 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. |
| 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. |
| 509 | 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 |

| Code | Message |
|---|---|
| 521 | Operation is stopped outside of<br>operating environmental condisions. |
| 522 | Hardware error has occurred. |
| 523 | OFFSET_CALIBRATE_ERROR(AMP OFFSET3) |
| 524 | Failure to initialize the option module. |
| 525 | The Interval is too short. Please change the inteval value. |
| 526 | Please set Avg Duration. |
| 527 | Need the AC power supply to measure. Please connect the AC adapter. |
| 528 | Free space is not enough. Please set the interval or the period again. |
| 529 | OFFSET_CALIBRATE_ERROR(AMP OFFSET2) |
| 560 | When the event fix is ON, the distance reference setup cannot be performed. |
| 563 | Conditions of the macro bending do not match. |
| 564 | When the launch fiber is enable, the distance reference setup cannot be performed. |
| 565 | Judgement failure. The surface of fiber is too dirty. |
| 566 | Judgement failure. Too many scratches. |
| 567 | Judgement failure.<br>The radius of fiber is too small. |
| 568 | Judgement failure. Unfocused. |
| 602 | Can not recognize file system.<br>-Internal memory : Contact Yokogawa's representatives.<br>-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 or SD memory card 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. |
| 642 | Failed to copy the folder. The path name is invalid. |
| 645 | The path name is too long. |
| 646 | USB memory or SD memory card can not be recognized |
| 648 | Can not make file or folder in this folder. (Max 550 files/folder) |
| 649 | Failed to copy the file or folder. Same path source and destination. |
| 650 | <HEADER><BODY><br>Please confirm the following.<br>-Media is uncorrectly installed.<br>-Other file or folder is saving, reading or deleting.<br>Please wait a moment and try again. |
| 651 | Cannot copy the file or folder. The destination file path or folder path is invalid. It can be considered the following causes.<br>-Media is uncorrectly installed.<br>-The file path or folder path is too long.<br>Please change file path or folder path. |
| 652 | <HEADER><BODY><br>Please check media is correctly installed.<br>When using USB memory:<br><FOOTER> |
| 653 | <HEADER><br>Same file name or folder name exists. Please change the file name or folder name. |
| 654 | <HEADER><br>Invalid file name or folder name.<br><FOOTER> |
| 655 | Cannot execute direct save. Direct save path is not exisetd. Please select "Save Folder" in the direct save setting menu and change save destination. |
| 656 | Cannot execute auto save. Auto save path is not exisetd. Please change the save path in the auto save setting menu.<br>-Mode is "Date":<br>Please select "Drive"<br>-Mode is "UserDefine":<br>Please select "Save Folder" . |

## 11.2 Error Message Display

| Code | Message |
|---|---|
| 657 | <HEADER><br>The media may be uncorrectly installed.<br><FOOTER> |
| 658 | <HEADER><br>Specified media is not enough free space. Please secure enough free space.<br>When using USB memory:<br>Please try other USB memory. |
| 659 | The folder could not be deleted. There are files that cannot be deleted in specified folder. |
| 660 | <HEADER><br>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 | <HEADER><br>The path name is too long. Please change the file path or folder path. |
| 663 | <HEADER><br>USB memory can not be recognized. Please check the USB memory is correctly installed. |
| 664 | Cannot copy the file or folder.<br><BODY><FOOTER>. |
| 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. |
| 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 |
| 729 | Project file load failed. Create new project file" |
| 730 | This project file has individual settings. Conditions cannot be changed using SETUP. Please create new project file to change setting.<br>Select ""Revise project name"" to create new file. |
| 731 | Checked SOR file does not exist. Please check the SOR files in the folder. |
| 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 installed correctly. |
| 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 AQ7290. |
| 736 | <HEADER><br>Please check media is installed correctly.<br>When using USB memory: Please try other media or check the media is formatted with FAT. |

| Code | Message |
|---|---|
| 737 | <HEADER><br>Fail to write the file. Please check destination media is installed correctly. |
| 738 | Cannot save the PDF file. Invalid fiber surface image file format. Please check the image file format is ""JPG"" or ""BMP"". |
| 739 | <HEADER><BODY><br>Please save the file after measurement. |
| 740 | Cannot save the SOR file. The file contains invalid values." |
| 741 | <HEADER><br>No event data. Please save the file after event search. |
| 742 | <HEADER><br>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 | <HEADER><br>Duplicate file name. Please change the file name. |
| 745 | <HEADER><br>Can't use the following characters. \ / : ; * ? " < > \| % .<br><FOOTER> |
| 746 | <HEADER><br>The current function cannot load the file.<br><FOOTER> |
| 747 | Cannot load the SOR files.<br><BODY><FOOTER>. |
| 748 | Cannot read the file. The measurement result may have been edited after saving on the instrument. |
| 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. |
| 904 | Hardware failed, and needs to be repaired. 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.<br>The instrument will be powered off in 10 sec. Please turn off power to allow instrument to cool down. |
| 919 | Non-standard battery is connected. The instrument may be damaged if it is kept using in this condition. The instrument will be powered off in 10 sec. Please replace the battery. |
| 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 |
| 935 | USB port over current error. |
| 936 | Invalid license key. Option was not installed. |
| 937 | The temperature inside the instrument is too high. The instrument may be damaged if used in this condition.<br>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.<br>The instrument will be powered off in 10 sec. Please turn off power until internal temperature is increased. |
| 939 | The temperature inside the instrument is too high. The instrument may be damaged if used in this condition.<br>The instrument will be powered off in 10 sec. Please turn off power to allow instrument to cool down. |
| 940 | The temperature inside the instrument is too low. The instrument may be damaged if it is used in this condition.<br>The instrument will be powered off in 10 sec. Please turn off power until internal temperature is increased. |
| 941 | The voltage of a module is too low. The instrument may be damaged if it is kept using in this condition.<br>The instrument will be powered off in 10 sec. Please make sure of using the dedicated the power adapter. |
| 942 | The voltage of a module is too high. The instrument may be damaged if it is kept using in this condition.<br>The instrument will be powered off in 10 sec. Please make sure of using the dedicated the power adapter. |
| 943 | The voltage of a module is too low. The instrument may be damaged if it is kept using in this condition.<br>The instrument will be powered off in 10 sec. Please make sure of using the dedicated the power adapter. |
| 944 | The voltage of a module is too high. The instrument may be damaged if it is kept using in this condition.<br>The instrument will be powered off in 10 sec. Please make sure of using the dedicated the power adapter. |
| 945 | The voltage of a module is too low. The instrument may be damaged if it is kept using in this condition.<br>The instrument will be powered off in 10 sec. Please make sure of using the dedicated the power adapter. |

| Code | Message |
|---|---|
| 946 | The voltage of a module is too high. The instrument may be damaged if it is kept using in this condition. The instrument will be powered off in 10 sec. Please make sure of using the dedicated the power adapter. |
| 947 | Battery is low. The light source cannot be turned on. |
| 948 | The operation of the battery is not confirmed normally. After stopping the measurement, turn off the power. Please check the connection of battery. |
| 949 | Hardware failed, and needs to be repaired. Please contact Yokogawa's representatives. |
| 950 | Failed to control WLAN module. |
| 960 | OSW is not correctly connected. Please confirm OSW connection. |
| 961 | Please use a PD adapter with the specified power or higher. |

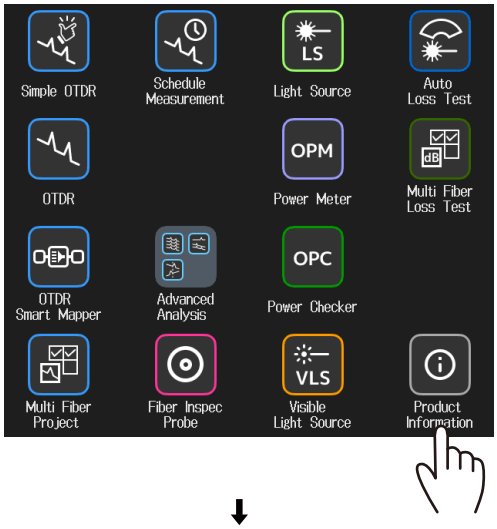
<HEADER>, <BODY>, <FOOTER>: The message displayed will vary depending on the operation performed and the cause of the error.

# 11.3 Viewing the Product Information

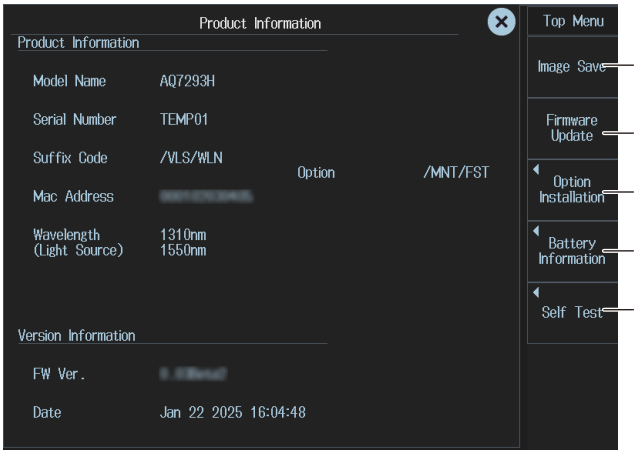
## Procedure

1. Press **MENU**. A MENU screen appears.
2. Tap the **Product Information** icon.A production information screen appears.

**MENU screen**




**Product information screen**




**Saves screen data**

**Update the firmware.**
(See section 11.6.)

**Add options.**
(See section 11.8.)

**Battery information**
(see section 11.4)

**Self test**
(see section 11.5)

# Explanation

## Product information

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

## Version information

The firmware version and update date information are displayed.

## Saving a screen image

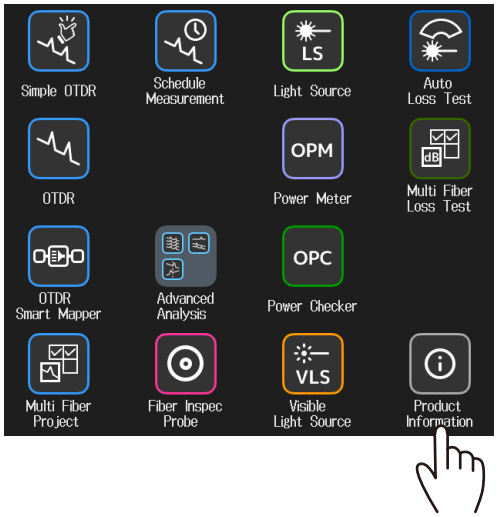
The screen image of the product information can be saved in internal memory.
Folder name: ProductInfo
File name: SystemInfo.BMP

# 11.4 Viewing the Battery Information

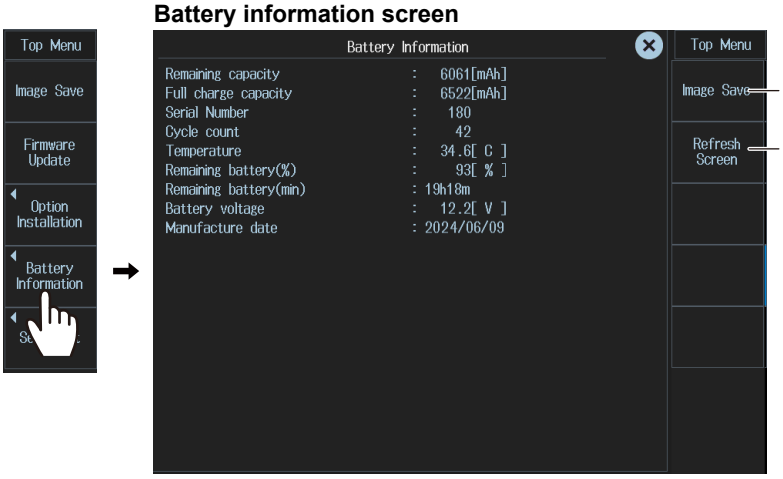
## Procedure

1. Press **MENU**. A MENU screen appears.
2. Tap the **Product Information** icon. A production information screen appears.
3. Press the **Battery Information** soft key. The battery status is displayed.

**MENU screen**




**Battery information screen**




**Saves screen data**

**Refreshes with the latest information**

# Explanation

## Battery information

You can view information such as remaining battery level, approximate time remaining, temperature, and date of manufacture.

## Saving a screen image

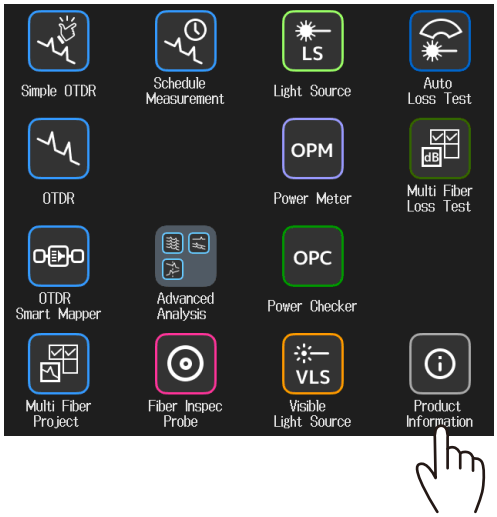
The screen image of the battery information can be saved in internal memory.
Folder: Selected folder
File name: BatteryInfo_year_month_day_hour_minute_second.BMP

# 11.5 Executing a Self-Test

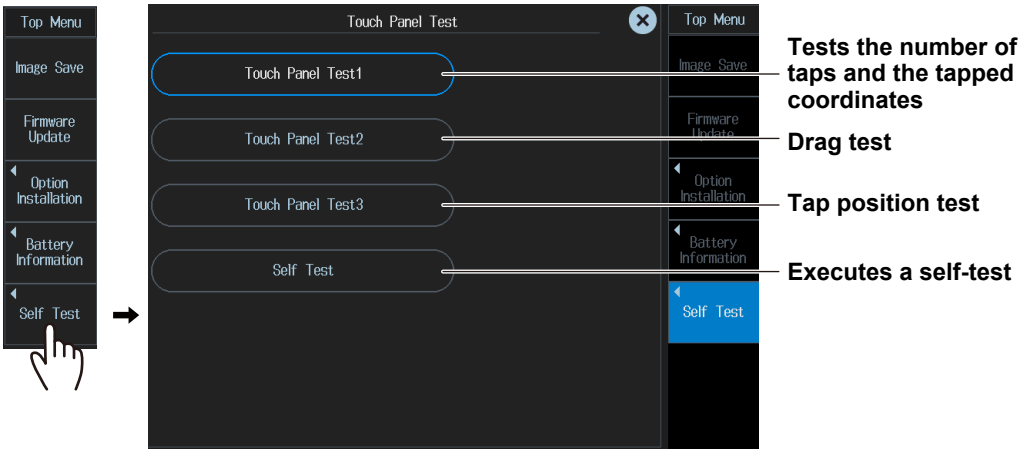
## Procedure

1. Press **MENU**. A MENU screen appears.
2. Tap the **Product Information** icon. A production information screen appears.
3. Press the **Self Test** soft key. A self test screen appears.

**MENU screen**




**Self test screen**




**Tests the number of taps and the tapped coordinates**

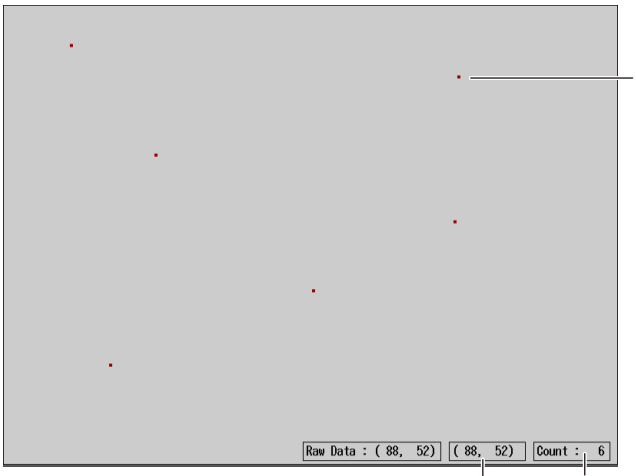
**Drag test**

**Tap position test**

**Executes a self-test**

### Touch Panel Test 1 (coordinate and tap count test)

4. Tap **Touch Panel Test1**. A touch panel test screen appears.
5. Tap anywhere on the screen. The touched position is displayed on the screen as a dot, and the coordinates of the last touched position and the number of touches are displayed in the lower right corner of the screen.



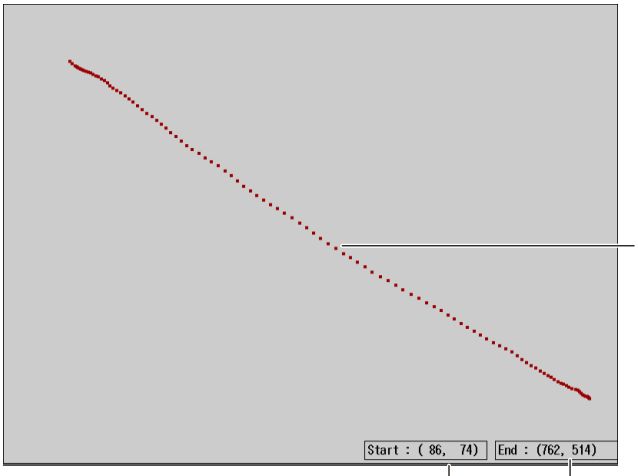

**Tapped position**

**Number of taps**

**Coordinates of the last tapped position**

### Touch Panel Test 2 (straight line test)

4. Tap **Touch Panel Test2**. A touch panel test screen appears.
5. Drag a straight line on the screen. The dragged track is displayed on the screen, and the coordinates of the last touched position and the number of touches are displayed in the lower right corner of the screen.



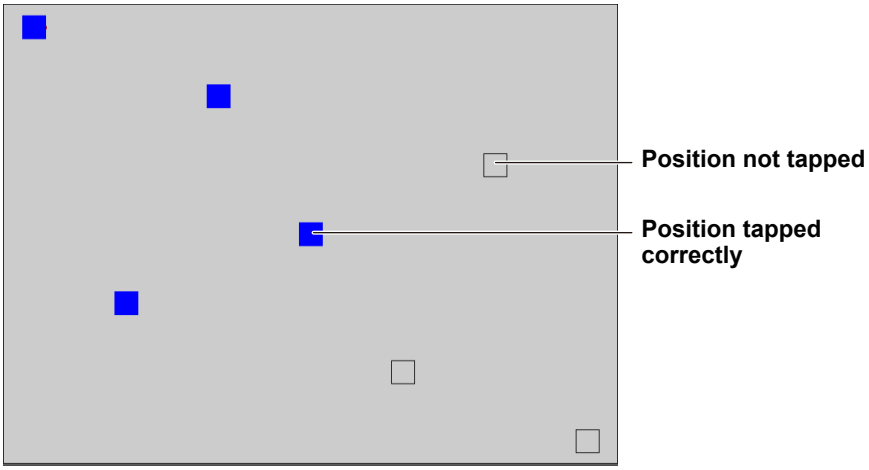

**Dragged track**

**Drag end position**

**Drag start position**

### Touch Panel Test 3 (tap location test)

4. Tap **Touch Panel Test3**. A touch panel test screen appears.
5. Tap the location designated by the square on the screen. The color of the square changes when it is touched correctly.




### Self test

4. Tap **Self Test**. A self test starts, and the test results are displayed.

# Explanation

## Touch panel test 1

Displays the touched position on the screen, the last touched coordinates and the number of touches.
A diagnosis is made on whether the appropriate position is detected by the gap between the touched position and the touch position on the screen, and whether chattering is not caused by the number of touches.

## Touch panel test 2

The dragged track is displayed on the screen.
A diagnosis is made on whether the track of the drag operation is properly detected.

## Touch panel test 3

A diagnosis is made on whether the specified position is detected correctly.

## Self test

The following tests are executed.

- RAM test
- ROM test
- Battery voltage test
- Temperature test (CPU temperature, function board)

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.

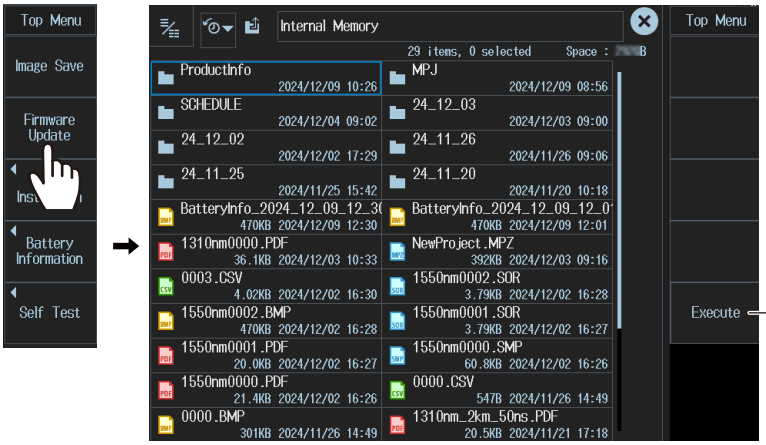
# 11.6 Updating the Firmware

## Procedure

1. Press **MENU**. A MENU screen appears.
2. Tap the **Product Information** icon. A production information screen appears.
3. Press the **Firmware Update** soft key. A file list screen for selecting the firmware file appears.

**MENU screen**


**File List Screen**




**Executes version update**

4. Manipulate the files, select the firmware update file, and press the **Execute** soft key. For instructions on how to use the file list, see chapter 9.

### *Note*

Save the firmware update file in the folder of this instrument beforehand.

## Explanation

Firmware update files are YMC files (e.g., AQ7290.YMC).

When updating the firmware, use a USB-AC adapter and connect to AC power.

When a firmware update completes successfully, the instrument will restart automatically.

If it fails, an error message will appear.

Check the firmware version. For the procedure, see section 11.3.

# 11.7 Initializing the Instrument to Its Factory Default Condition

## Procedure

1. Press **MENU**. A MENU screen appears.
2. Press **SETUP**. The system setup screen appears.

   You can display the system setup screen by pressing the SETUP key on screens other than the MENU screen, such as those of the OTDR feature and power meter feature. The settings are applied globally regardless of which screen system setup is executed from.
3. Press the **Factory Setting** soft key. A Factory Setting screen appears.


**Factory Settings Screen**


**Initializes settings**
The setup data will be initialized.

**Initializes the settings and deletes data**
The setup data will be initialized. Waveform data, image data, and the like in the Internal Memory folder in the instrument 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

### Set

The setup data will be initialized. Data in the Internal Memory folder in the instrument internal memory will not be deleted.

### All

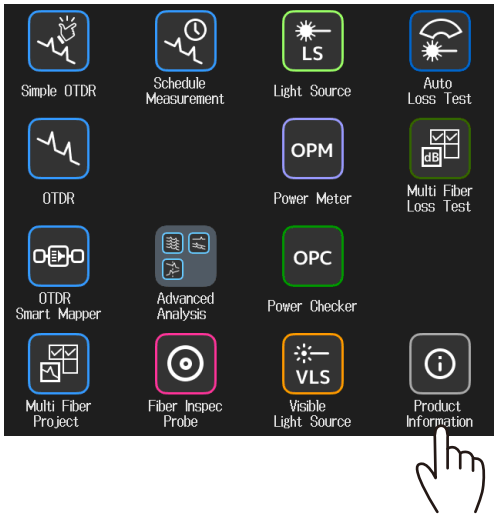
The setup data will be initialized. All data (except the user's manual) in the Internal Memory folder in the instrument internal memory will not be deleted.

# 11.8 Adding Options

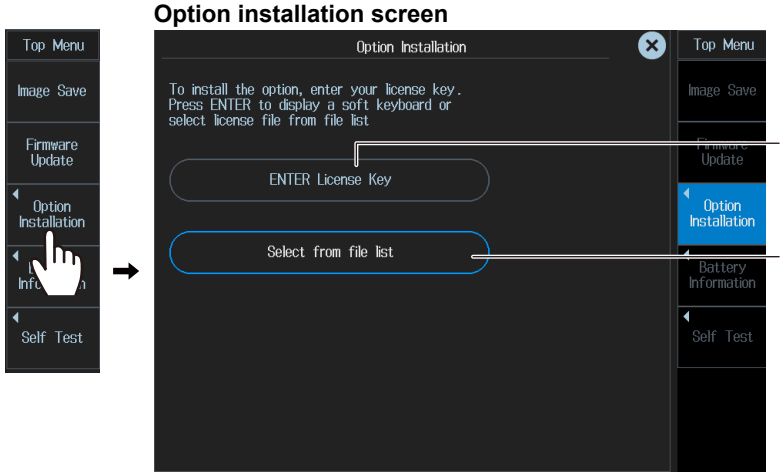
## Procedure

1. Press **MENU**. A MENU screen appears.
2. Tap the **Product Information** icon. A production information screen appears.
3. Press the **Option Installation** soft key. A Option Installation screen appears.

**MENU screen**




**Option installation screen**




**Enter the license key.**
Manually enter the license key. For the input procedure, see section 2.5.

**Select the license file from the list.**

For details, see the manual included with the additional option license you purchased.

## 11.9 Checking the Optical Fiber End Face for Stains

By connecting an off-the-shelf fiber inspection probe (with a USB interface) to an instrument USB port, you can display the image of optical fiber cable end face on the instrument display. This image can be used to check for stains on the optical fiber end face and to determine pass/fail.
For details, see section 7.6.

# 11.10 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 instrument 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 instrument 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 instrument 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 instrument 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 instrument on to start it. Check the following to verify that the instrument is running normally.

- The start screen appears after power-on.
- The screen can be switched using the control keys.
- Touch panel operations work.

# 11.11 Routine Maintenance

## Cleaning the outside of the instrument

To clean the LCD or the outside of the instrument, turn the power off, and remove the USB-AC adapter from the instrument. 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 instrument to prevent the light from accidentally being emitted from the light source port. Cleaning the light emitter with the instrument turned on may cause the emitted light to accidentally enter the eye. This can cause eye damage or vision impairment.

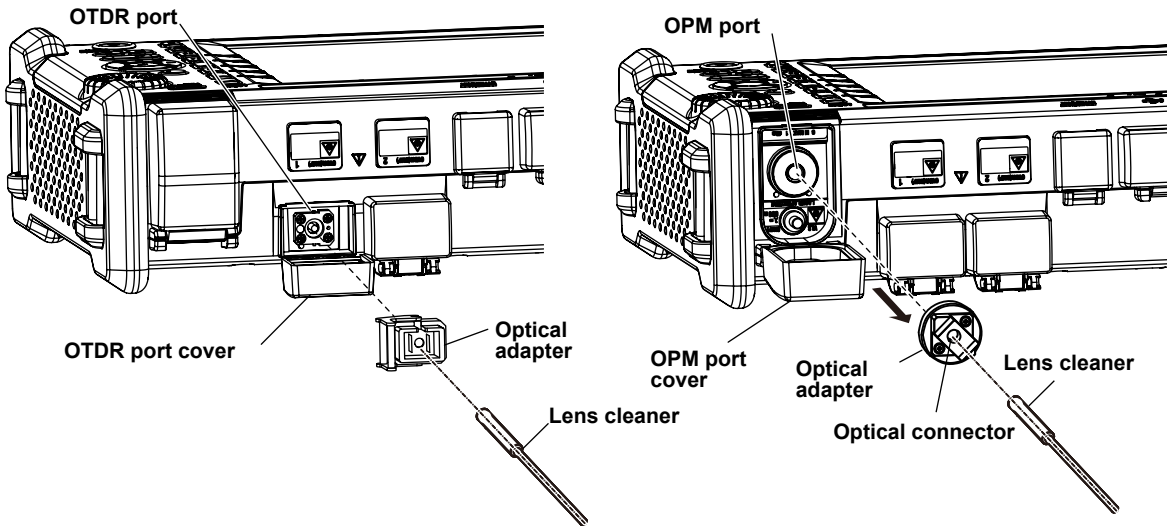
**French**

**AVERTISSEMENT**

Lors du nettoyage de l’émetteur de lumière, mettre instrument hors tension pour empêcher l’émission accidentelle de lumière provenant du port de la source lumineuse. Le nettoyage de l’émetteur de lumière avec instrument 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. Make sure that the instrument is turned off.
2. Open the cover of the OTDR port or light source port (option).
3. Remove the optical adapter.
   For instructions, see “Replacing the Optical Adapter” in the Getting Started Guide, IM AQ7290-02EN.
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 OTDR port or 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.

# 11.12 Storage Precautions

## Before storage

Clean the instrument before storage. For details on cleaning, see section 11.11.

## Storage conditions

Store the instrument 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 instrument for one month or longer, charge the battery, and store the instrument away from direct sunlight in a location that has an ambient temperature of 10 to 30°C.

## Reuse

When using the instrument after long-term storage, check its operation (see section 11.10).

## Packing

Follow the procedure below to pack the instrument.

1. Wrap the instrument in a thick plastic sheet or the like to prevent dust from entering the inside of the instrument.
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 instrument.
4. Place cushioning material at the bottom of the box.
5. Place cushioning material in the gaps between the instrument and the box.
6. Seal the box securely with adhesive tape or the like.

## Transportation

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

# Appendix Using Open Source Software

## Using open source software

This product includes open source software.

For the open source software licenses, see TermsAndConditions_OpenSourceSoftware.pdf in the USER\DATA\USERS_MANUAL folder of this instrument.

For instructions on how to access the USERS_MANUAL folder in the internal memory of this instrument, see “How to View the User’s Manual” in the Getting Started Guide, IM AQ7290-02EN.

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