User's Manual

AQ7270 Series OTDR Operation Guide

YOKOGAWA
Yokogawa Electric Corporation

IM 735020-02E
2nd Edition

Foreword

Thank you for purchasing the AQ7270 Series (AQ7270/AQ7275) OTDR (Optical Time Domain Reflectometer). The purpose of this operation guide is to familiarize the first-time user with the basic operations of the AQ7270 Series.
There are two additional user's manuals for the AQ7270. One is the user's manual (IM735020-01E, CD-ROM) which explains all the functions. The other is the communication interface user's manual (IM735020-17E, CD-ROM) which details the communication functions. Read these manuals along with this operation guide.

Notes

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- 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.

2nd Edition : December 2007 (YK)

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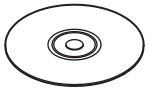
Revisions

1st Edition: January 2007
2nd Edition: December 2007

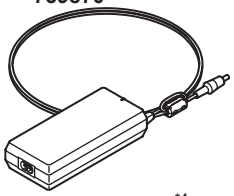
Standard Accessories

The standard accessories below are supplied with the instrument.

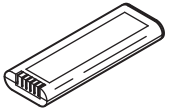
AQ7270 Series OTDR User's Manual B8070TH



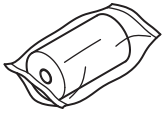
AC adapter 739870



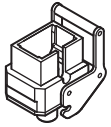
Battery pack B8070TL



Printer roll paper A9010ZP[*1]

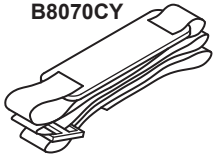


Universal connector (SC) SU2005A-SCC[*2]

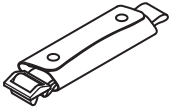


Universal connector (FC) SU2005A-FCC[*3]

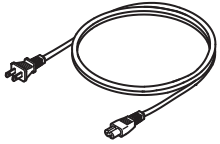
Shoulder belt[*4] B8070CY



Hand belt B8070CX

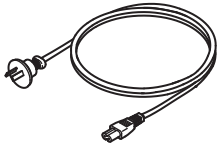


Power cord UL/CSA St'd A1068WD

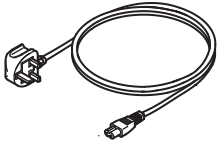


Power cord VDE St'd A1071WD

Power cord AS St'd A1070WD



Power cord BS St'd A1069WD



Power cord GB St'd A1069WD

***1 Included if the suffix code is /PL.**
***2 Included if the suffix code is -USC.**
***3 Included if the suffix code is -UFC.**
***4 Included if the suffix code is /SB.**

Optional Accessories

The optional accessories below are available for purchase separately.

Name	Part Number	Notes	
Soft carrying case	739860	Soft case	
Emulation software	735070	Waveform analysis application	
Printer roll paper	A9010ZP	80 mm width × 25 m roll: 10 rolls per unit	
Battery pack (spare)	739880		
AC adapter (spare)	739870-D	UL/CSA standard	
		739870-F	VDE standard
		739870-R	AS standard
		739870-Q	BS standard
		739870-H	GB standard, Complied with CCC

CD-ROM

The AQ7270 OTDR User's Manual CD-ROM contains PDF files.

English	IM 735020-01E	AQ7270 Series OTDR User's Manual
	IM 735020-17E	AQ7270 Series OTDR Communication Interface User's Manual
Japanese	IM 735020-01	AQ7270 Series OTDR User's Manual
	IM 735020-17	AQ7270 Series OTDR Communication Interface User's Manual

Adobe Reader by Adobe Systems is required to open PDF files. You can download Adobe Reader from the following page.
http://www.adobe.co.jp/products/acrobat/readstep2.html

Notes

- The contents of CD-ROM are subject to change without prior notice as a result of continuing improvements to the instrument's performance and functions.
- Every effort has been made in the preparation of the CD-ROM to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer.
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Precautions

To use the instrument safely and effectively, be sure to observe the precautions given in the user's manual. Not complying might result in injury or death.

WARNING

- **Use the Correct Power Supply**
  Before connecting the power cord, ensure that the source voltage matches the rated supply voltage of the AC adapter and that it is within the maximum rated voltage of the provided power cord.
- **Use the Power Cord and AC Adapter Correctly**
  Use only the power cord or AC adapter that comes with the instrument. Do not use it for other devices.
- **Use Only the Designated Battery**
  Use only the battery specified for the instrument. Do not use it for other devices. Use only this instrument or a charger specified by YOKOGAWA to charge the battery. If the charging of the battery does not complete within a specified time, stop charging the battery immediately. Because the electrolyte solution inside the battery is alkaline, harm can be done to the clothes or skin, if the battery leaks or explodes and the solution comes in contact. If the electrolyte solution enters the eye, it can cause blindness. If this happens, rinse thoroughly with water and immediately consult your eye doctor. To prevent the possibility of electric shock and accidents, always turn OFF the power switch and remove the AC adapter power supply from the instrument when replacing the battery. Do not throw the battery into fire or apply heat to it. This can cause dangerous explosions or spraying of the electrolytes.
- **Do Not Look at the Laser Light**
  Do not look at the laser's direct ray, reflected ray from a mirror, or indirect ray without the proper protective eyewear. In addition, avoid being exposed to the laser light. It can cause blindness or damage to the eye. Attach the cover on unused optical connectors.
- **Do Not Operate in an Explosive Atmosphere**
  Do not use the thermocouple in a location where any flammable or explosive gas/vapor is present. Operation in such an environment constitutes a safety hazard.

See below for operating environment limitations.

Causion

This product is a Class A (for industrial environments) product. Operation of this product in a residential area may cause radio interference in which case the user will be required to correct the interference.

Description of Symbols

The following symbols are used on this instrument.

Warning: handle with care. Refer to the user's manual or service manual. This symbol appears on dangerous locations on the instrument which require special instructions for proper handling or use. The same symbol appears in the corresponding place in the manual to identify those instructions.

Direct current

Standby

Recycle

Ni-MH

Equipment protected throughout by double insulation or reinforced insulation

Directive 2002/96/EC
This product complies with the WEEE Directive (2002/96/EC) marking requirement.

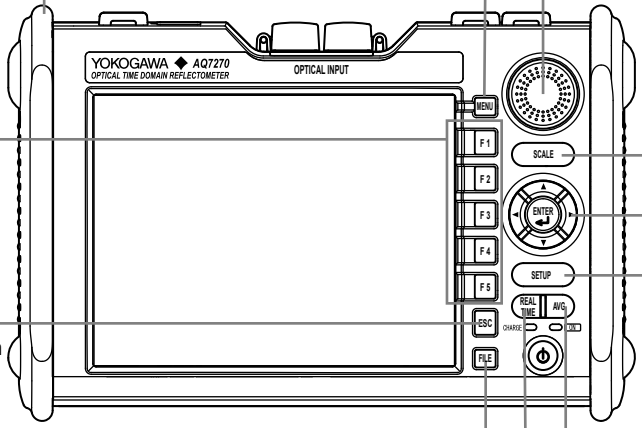
For details on each item, see the respective chapter or section in the user's manual indicated by the ● ● ● ▶ mark.

Contents

Names and Functions of Parts

Front Panel

Section 1.1, "Front Panel" in the user's manual



Protector
Protects the AQ7270 from external shock.

MENU key
Moves to the main menu.

Rotary knob
Moves the cursor or changes the setup conditions.
Press the knob to switch between fine and coarse cursor movement.

Soft keys
Selects the functions that are assigned to the soft keys displayed at the right edge of the display.

SCALE key
Expands, reduces, and moves the waveform display.

Arrow keys and ENTER key
Selects or sets items while setting conditions. Changes the scale while displaying waveforms.

ESC key
Cancels a setup operation or closes the menu.

SETUP key
Sets measurement conditions and system configuration.

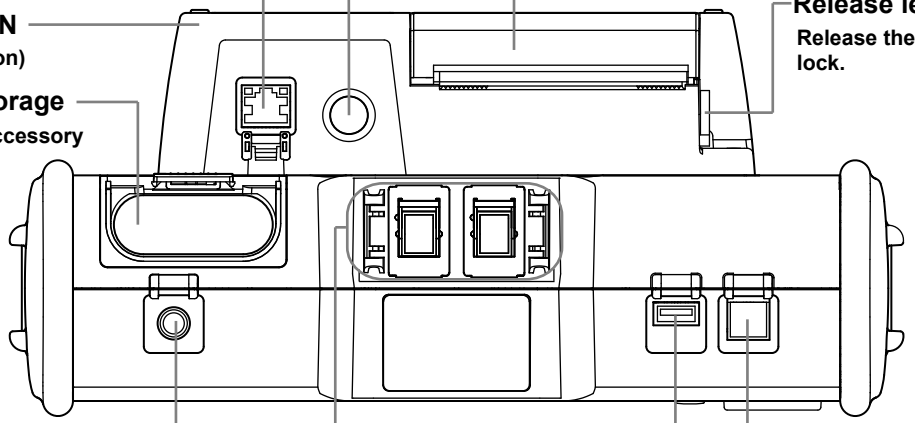
FILE key
Displays the file menu.
Saves, loads, or prints the waveform.

REAL TIME key
Starts or stops the realtime measurement.

AVERAGE key
Starts or stops the averaging measurement.

Top Panel

Section 1.3, “Side Panel” in the user’s manual



Printer paper feed button

Ethernet connector
Used for remote control.

Printer/LAN
(factory option)

Battery storage
Stores the accessory battery pack.

Internal printer
Prints waveforms and event lists.

Release lever
Release the front cover lock.

DC power connector
Connects the accessory AC adapter.

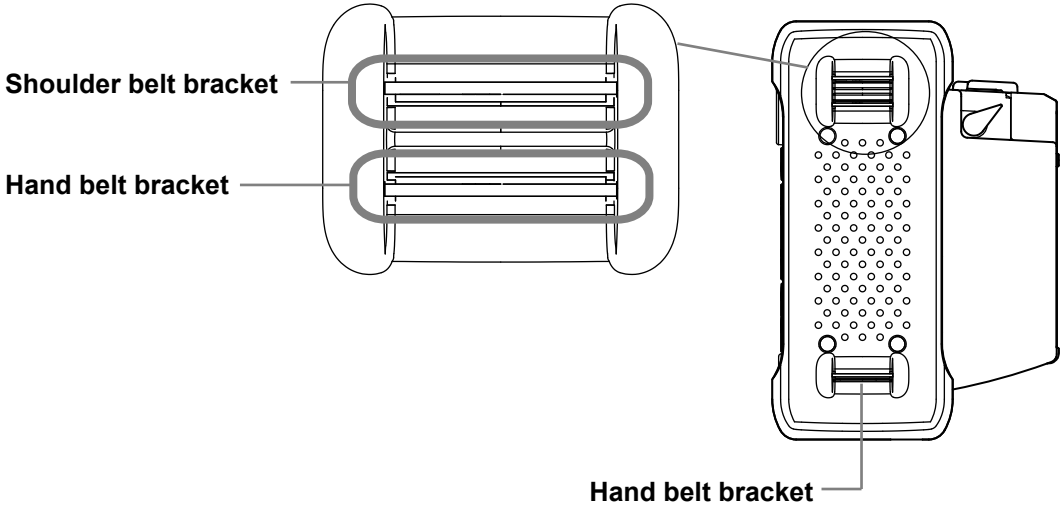
Measurement port
Outputs an optical signal during the optical pulse test (OTDR).
Receives an optical signal when operating as a power monitor.

USB (Type B)
Connects an external memory or printer.

USB (Type B)
Connects to a PC for remote control and reading/writing to the internal memory.

Side Panel

Section 1.3, “Side Panel” in the user’s manual

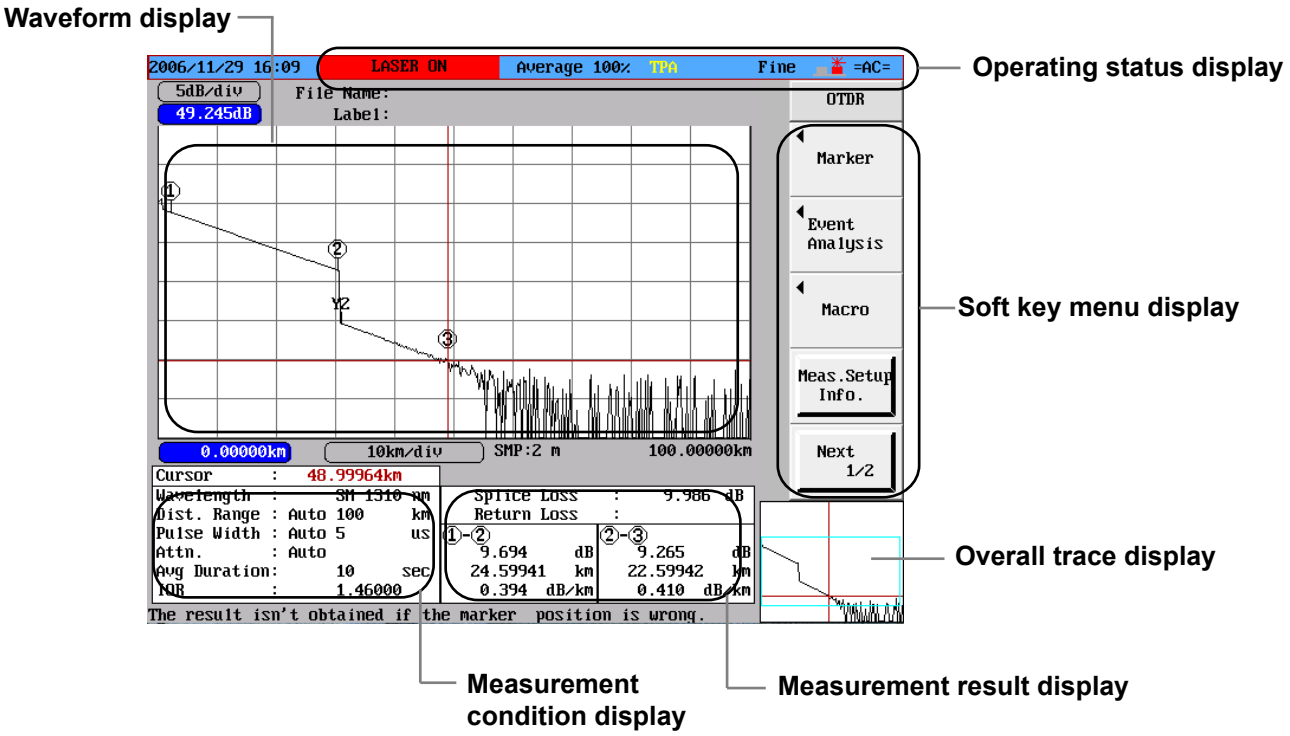


Note

- For the procedure to attach the belt, see page 12.

Display (OTDR)

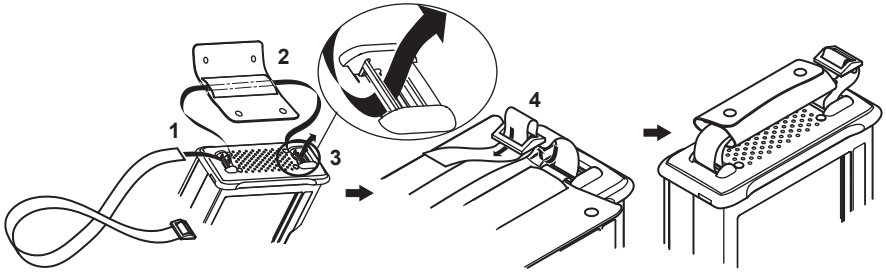
Section 1.4, “Display” in the user’s manual



Preparation

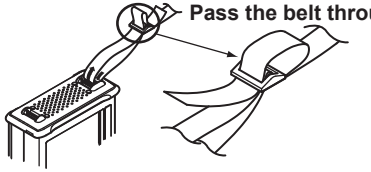
Attaching the Belt

Attaching the Hand Belt



1. Pass the hand belt through the lower hand belt bracket on the side of the instrument.
2. Pass the hand belt through the hand belt cover.
3. Pass the hand belt through the upper hand belt bracket (the second attachment section from the top) on the side of the instrument.
4. Pass the hand belt through the buckle and fasten the button.

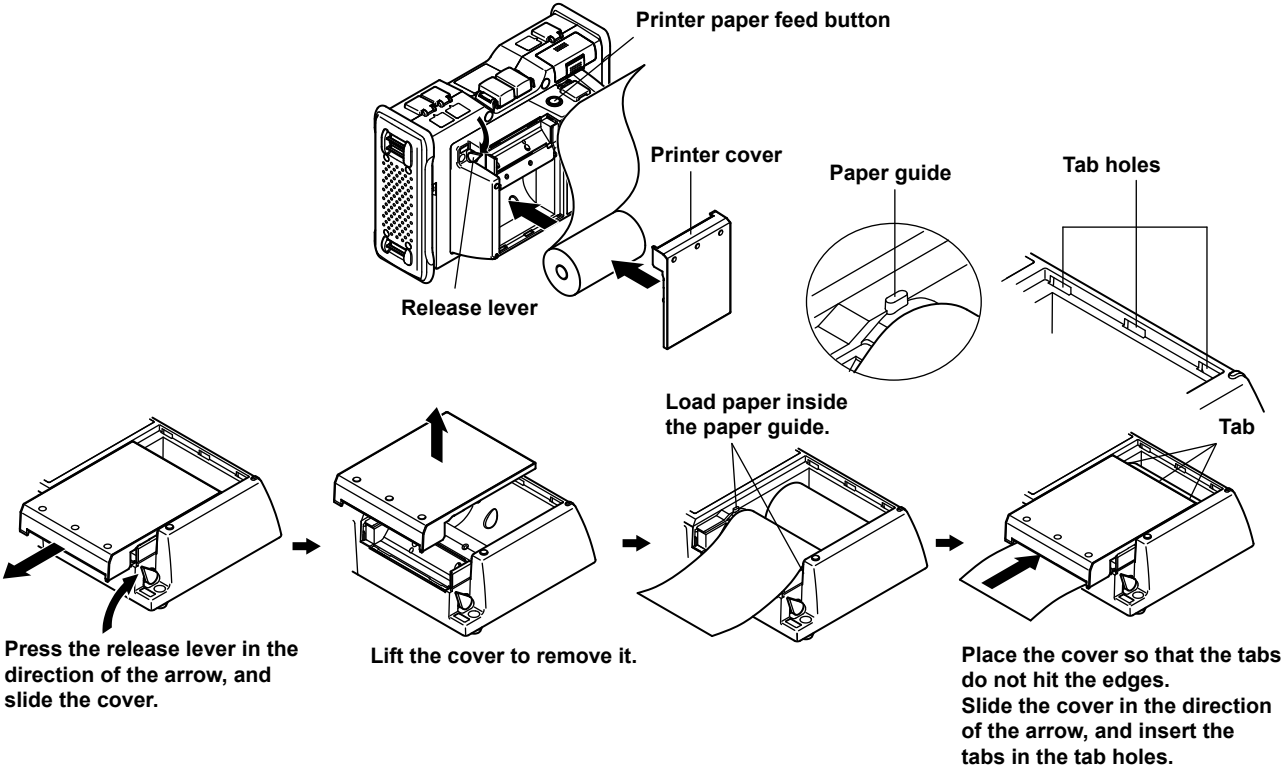
Attaching the Shoulder Belt



Pass the belt through the buckle again so that it does not come loose.

Attach the shoulder belt to the shoulder belt bracket on the left and right sides of the AQ7270. There are two shoulder belt brackets at the upper section of the side of the instrument. As shown in the figure, securely attach the shoulder belt by passing the belt through the top belt bracket on each side of the instrument and then pass it through the buckle.

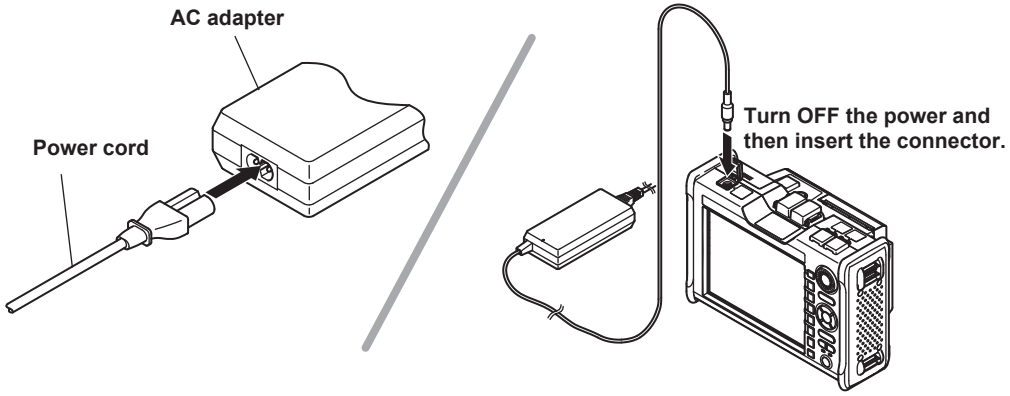
Loading the Printer Roll Paper



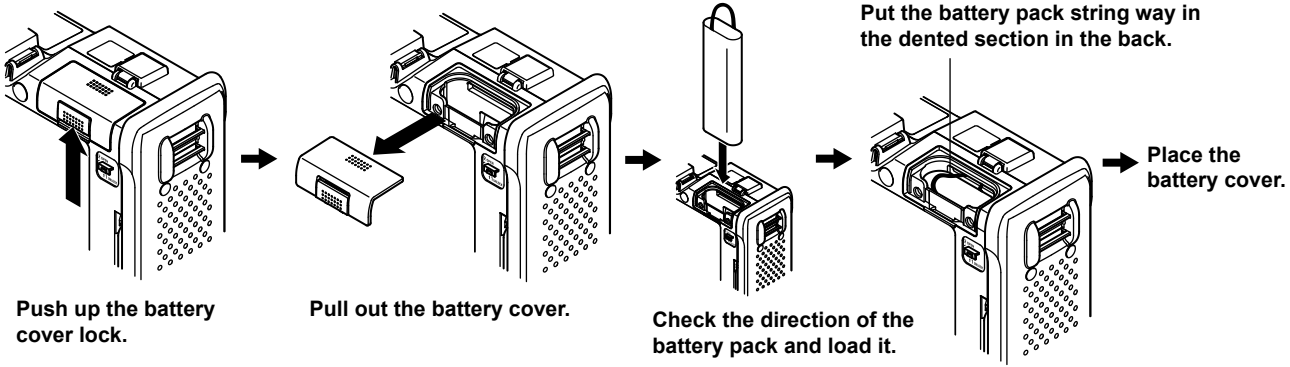
Connecting the Power Supply

To use the AQ7270 in a safe manner, read the warnings given in section 3.1, "Connecting the Power Supply" in the user's manual before connecting the power supply.

Using the AC Adapter

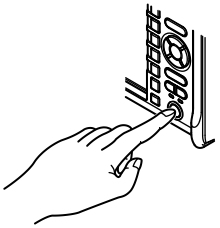


Loading the Battery Pack



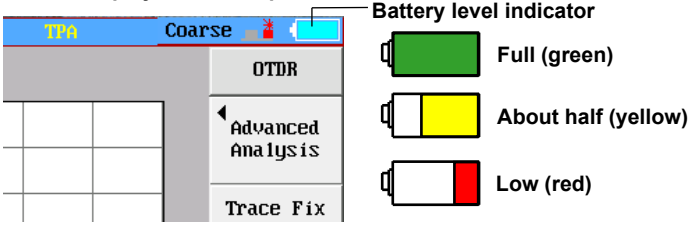
Turning the Power ON

A warning message appears when the battery level is low.
If you see the message, charge the battery pack. The battery level is displayed at the top section of the screen.



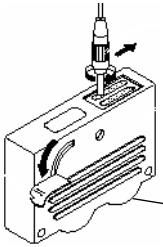
POWER lamp
Green: Running
Red: Low battery level

CHARGE lamp
Green: Charging
Green (blinking): Charging not started



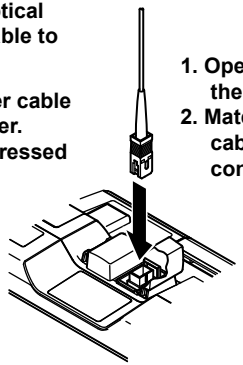
Connecting the Optical Fiber Cable

Clean the connector end face of the optical fiber cable under measurement before connecting it to the AQ7270.
If dust is adhered to the connector end face, it may damage the optical connector of the AQ7270. If this happens, the AQ7270 will not be able to make correct measurements.



1. **Press the connector end face of the optical fiber cable firmly against the cleaning surface of the cleaner.**
2. **Turn the cable around once with the end face pressed against the cleaner.**
3. **Rub the end face against the cleaner.**
4. **Repeat steps 1 to 3.**

You can purchase an optical fiber connector cleaner from NTT-ME Corporation.



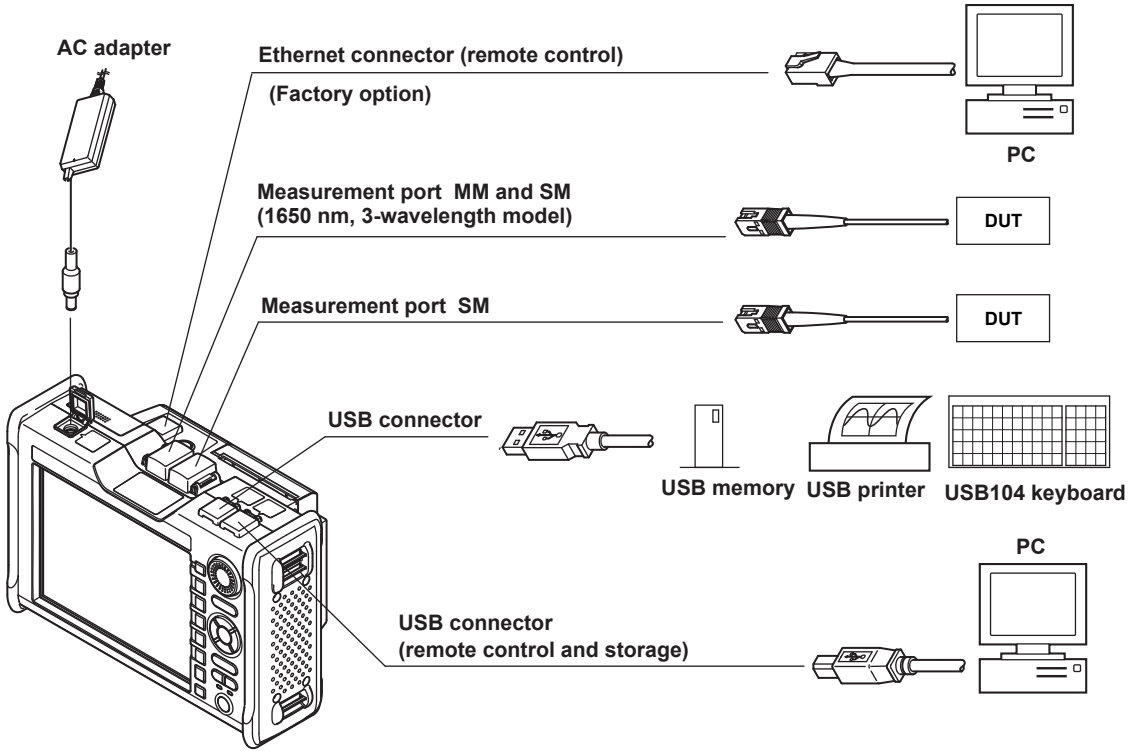
1. **Open the optical connector cover at the top of the AQ7270.**
2. **Match the direction of the optical fiber cable connector to the optical connector, and insert it.**

Note

- The connector to which the cable is to be connected varies depending on the wavelength. Connect the cable to the connector that is indicated by the red indicator at the top of the AQ7270 display.

Optical pulse output indicator

Configuration of Peripheral Devices



Setting the Measurement Conditions

Setting the Simple Mode

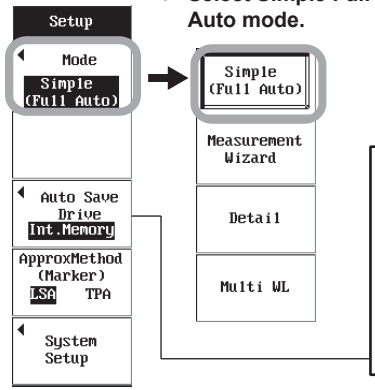
Section 4.1, “Selecting the Test Wavelength” in the user’s manual

In Simple (Full Auto) mode, you can easily make measurements simply by setting the wavelength.

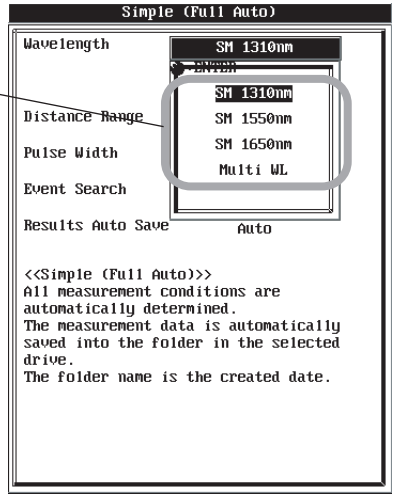
OTDR **1. Press the OTDR soft key.**

SETUP **2. Press SETUP.**

3. Select Simple Full Auto mode.



4. Select the wavelength of the optical signal to be measured.



In Full Auto mode, the measured results are automatically saved.
If you need to change the save conditions such as the file name and file format, press FILE and enter the settings.

Setting the Detail Mode

Section 6.1, “Setting the Measurement Conditions” in the user’s manual

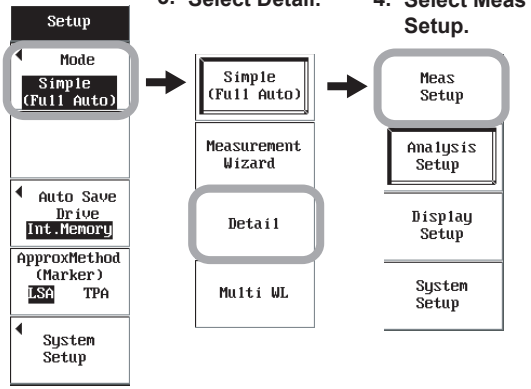
You can set the measurement conditions in detail according to the DUT.

OTDR — **1. Press the OTDR soft key.**

SETUP — **2. Press SETUP.**

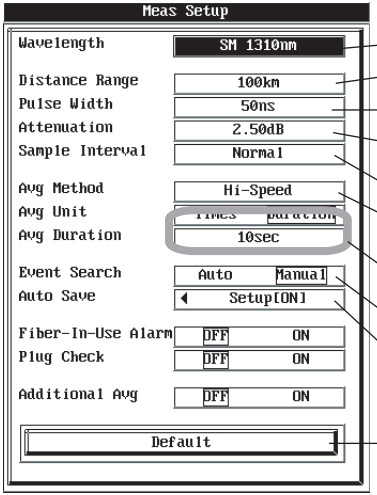
3. Select Detail.

4. Select Meas Setup.



Select the condition values using the rotary knob or arrow keys, and press ENTER to confirm.

5. Move the cursor to the item you want to set, and press ENTER.



- **Select the wavelength.**
- **Set a range that is longer than the length of the fiber to be measured.**
- **Set automatically if you change the distance range.**
- **Can be specified only if the averaging method is set to high speed.**
- **Select the sampling interval.**
- **Select high reflection if you are measuring the return loss or a fiber that is longer than or equal to approximately 20 km.**
- **Set the averaging count or average duration of the waveform.**
- **Select the automatic measurement of the return loss or splice loss.**
- **Set the conditions for automatically saving the measured results.**
- **Initializes the settings.**

Note

- You can set the AQ7270 manually in the same way also in measurement wizard and multi wavelength modes. In measurement wizard mode, a screen containing an explanation of items is displayed when setting the conditions.

Making Measurements

Making Measurements Automatically

Section 12.1, “Viewing the Measured Results” in the user’s manual

[If the setup mode was set to Simple on page 18 or if the event search was set to Auto on page 19]

AVE — **1. Press AVE.**

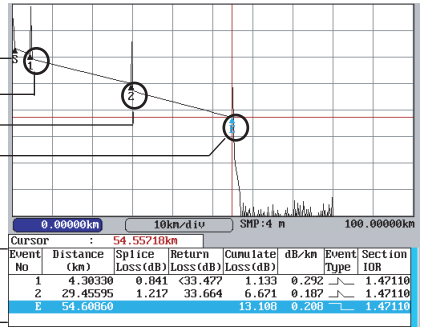
The measurement starts. The AQ7270 performs averaging and then automatically detects the return loss and splice loss. The AQ7270 displays the detected events on the screen and stops the measurement.
If you press AVE again while waveform acquisition is in progress, the measurement stops at that point.

The progress of the averaging process is shown at the top section of the screen.
The measurement stops when 100% is reached.

LASER ON is indicated during the waveform acquisition.

Measurement reference point: S

[Display example: waveform + list]



Event number 1

Event number 2

Last detected event: E

Event list

Event number

An event number is displayed near an event on the waveform. The events are numbered in order from the left edge.

Event type

Indicates the type of detected event.

: Event without reflections from fused points, etc.

: Event without reflections from fused points, etc. (negative splice loss)

: Event with reflections from the connector connection point, etc.

Performing Averaging and Viewing Waveforms

Section 7.2, “Averaging Measurement” in the user’s manual

[If the event search was set to Manual on page 19]

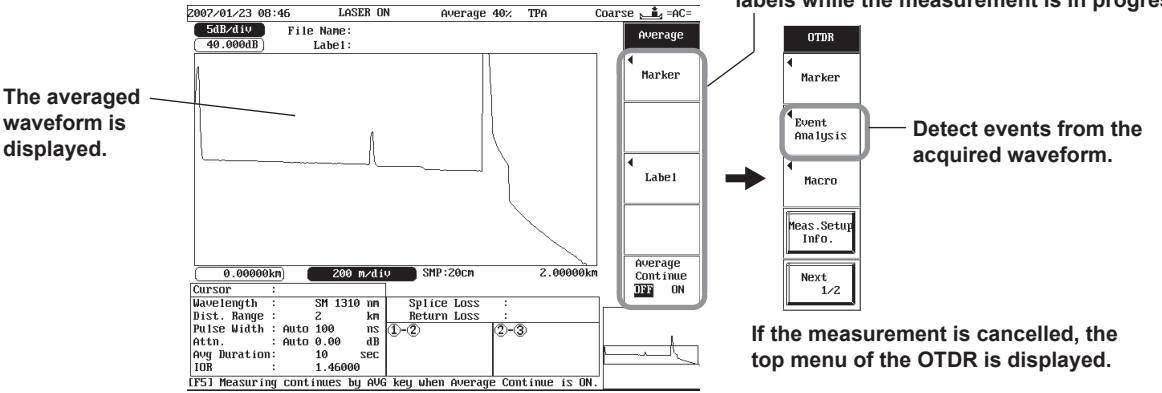
AVE **1. Press AVE.**

The measurement starts. The AQ7270 performs averaging and stop the measurement. If you press AVE again while waveform acquisition is in progress, the measurement stops at that point.

The progress of the averaging process is shown at the top section of the screen. The measurement stops when 100% is reached.

LASER ON is indicated during the waveform acquisition.

You can only operate the markers and edit the labels while the measurement is in progress.



The averaged waveform is displayed.

Detect events from the acquired waveform.

If the measurement is cancelled, the top menu of the OTDR is displayed.

Viewing Waveforms in Realtime

Section 7.1, “Realtime Measurement” in the user’s manual

REAL TIME — **1. Press REAL TIME.**

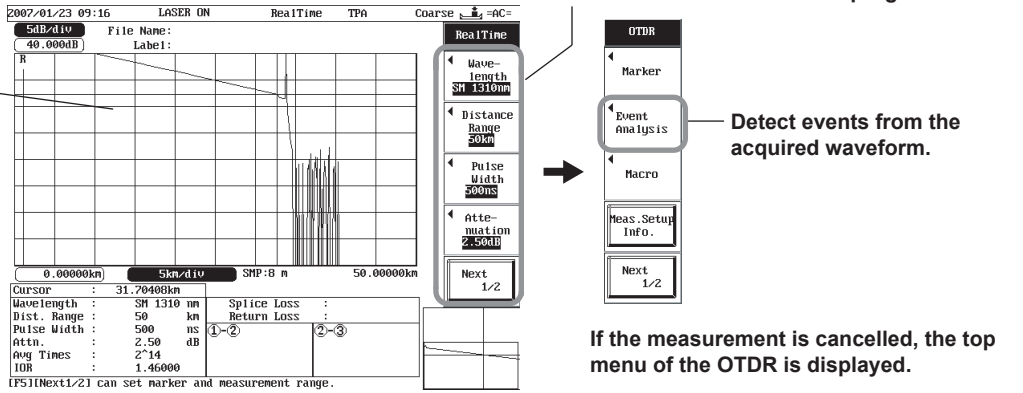
The measurement starts. Press REAL TIME again to stop the measurement.

LASER ON | RealTime

LASER ON is indicated during the waveform acquisition.

You can change the measurement conditions while the measurement is in progress.

Constantly updates the waveform while the measurement is in progress.



Detect events from the acquired waveform.

If the measurement is cancelled, the top menu of the OTDR is displayed.

Viewing High-Resolution Waveforms in Realtime

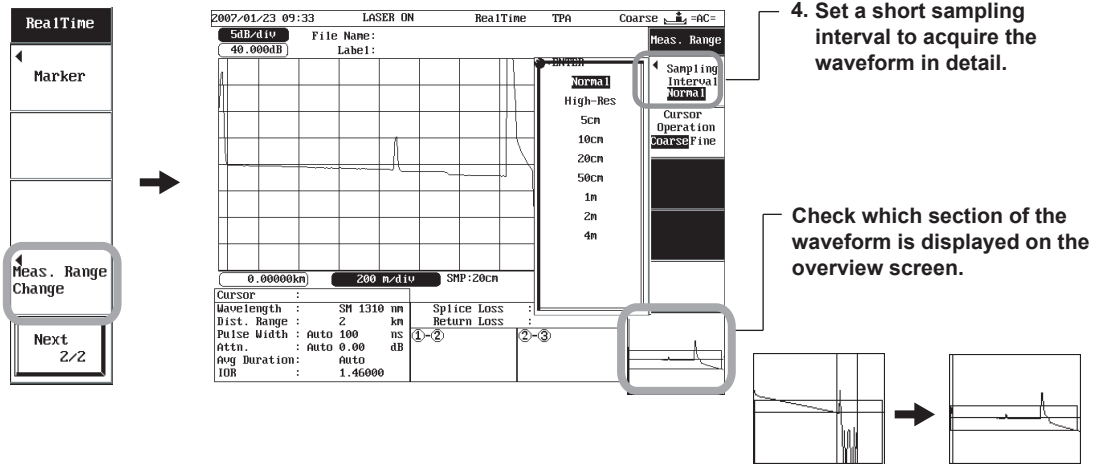
Section 7.4, “High Resolution Measurement of the Selected Location” in the user’s manual

*** Cannot be used in Simple (Full Auto) mode.**

REAL TIME — **1. Press REAL TIME.**

Meas. Range Change — **2. Press the Meas. Range Change soft key. (Page 2/2 of the soft key menu) The waveform is acquired at the selected sampling interval (up to 50,000 points) around the marker displayed on the screen.**

3. Move the marker to the location of the waveform you want to view in detail.



4. Set a short sampling interval to acquire the waveform in detail.

Check which section of the waveform is displayed on the overview screen.

If you set a short sampling interval, the range defined by sampling interval × 50,000 points is displayed on the screen.

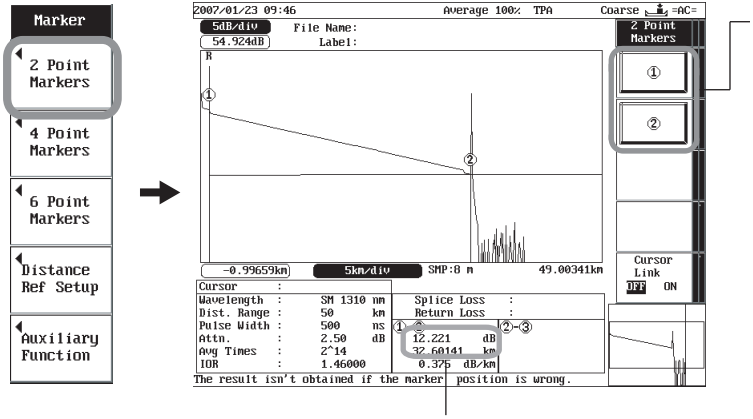
Measuring the Distance and Loss between Two Points

Section 10.1, “Measuring the Distance from the Instrument” in the user’s manual.

Markers — **1. Press the Marker soft key.**

2 Point Markers — **2. Press the 2 Point Markers soft key.**

3. Turn the rotary knob to the right to display the cursor.



4. Markers
Move the cursor to the start point of the distance measurement, and press the ① soft key.
Move the cursor to the end point of the distance measurement, and press the ② soft key.

*** If you are measuring the loss and there are events (connection points) between ① and ②, set the marker approximation to TPA.**

You can change the marker approximation method using Approx.Method (Marker) in the analysis setup of the detail setup mode.

Displays the distance between markers ① and ② and the measured result of the loss (loss and distance displayed in the first and second lines, respectively).

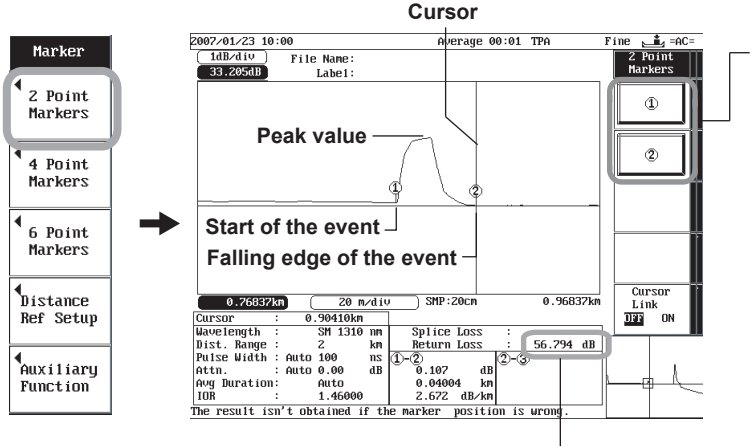
Measuring the Return Loss

Section 11.4, “Measuring the Return Loss and Reflection Level” in the user’s manual

Markers — **1. Press the Marker soft key.**

2 Point Markers — **2. Press the 2 Point Markers soft key.**

3. Turn the rotary knob to the right to display the cursor.



4. Markers
Move the cursor to the start point of the event, and press the ① soft key.
Move the cursor to the end of the falling edge of the event, and press the ② soft key.

*** Set marker ② to the right of the waveform peak value.**

Displays the measured result of the return loss between markers ① and ②.

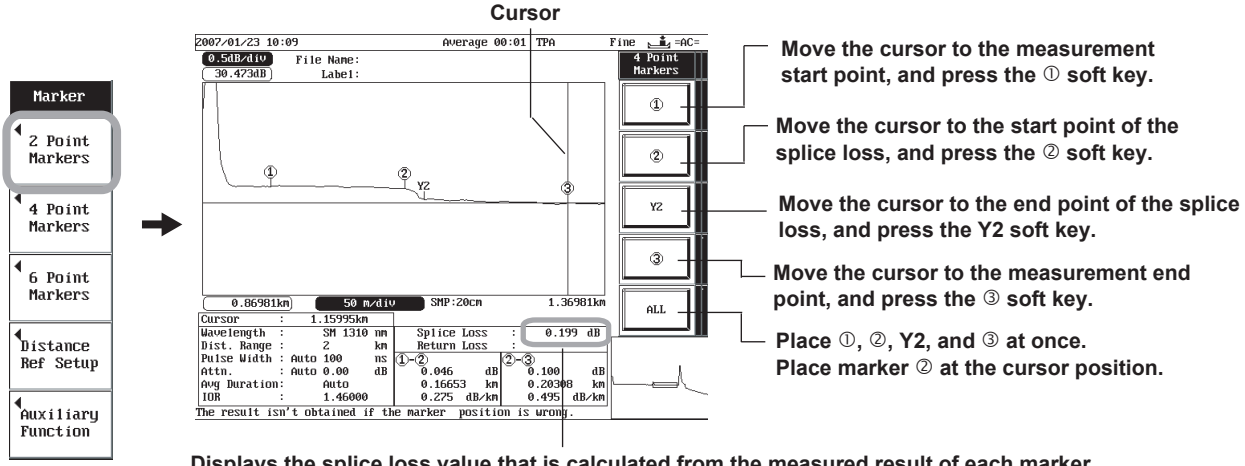
Measuring the Splice Loss

Section 11.2, “Measuring the Splice Loss” in the user’s manual

Markers → **1. Press the Marker soft key.**

4 Point Markers → **2. Press the 4 Point Markers soft key.**

3. Turn the rotary knob to the right to display the cursor.



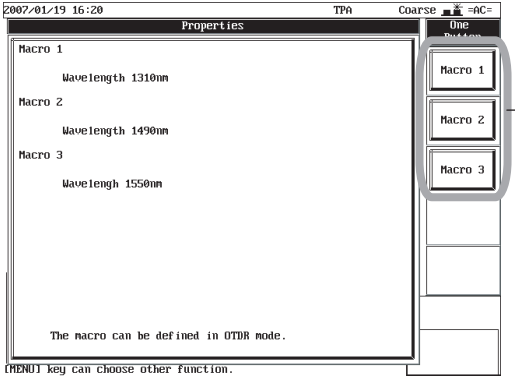
Making One-Button Measurements

Section 9.4, “Executing the Macro” in the user’s manual

MENU — **1. Press MENU.**

One Button — **2. Press the One Button soft key.**

One-button measurement requires the measurement conditions to be registered (macro definition) in advance.
For the setup procedure, see section 9.1, “Creating the Measurement Conditions (Defining the Macro Conditions)” in the user’s manual.



Press any of the Macro 1 to 3 soft keys corresponding to the measurement conditions. Press the soft key to start the measurement.

Expanding the Waveform and Moving the Display Area

Section 8.1, “Zooming the Display” in the user’s manual

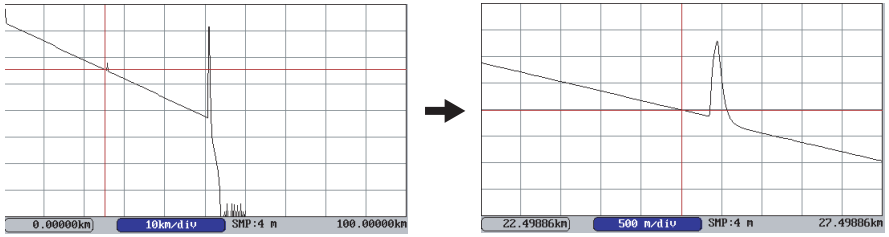
Expand

SCALE — 1. Press SCALE.

Zoom — 2. Press the Zoom soft key.

3. Turn the rotary knob to move the cursor to the point on the waveform you want to expand.
4. Press the arrow keys to expand or reduce the waveform.

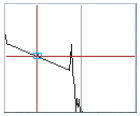
↓: Expand the waveform vertically. ↑: Reduce the waveform vertically.
←: Expand the waveform horizontally. →: Reduce the waveform horizontally.



Normal scale

Zoom scale

Check the zoom position of the waveform on the overview screen.



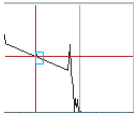
Moving the display area

Shift — 2. Press the Shift soft key.

3. Turn the rotary knob to move the cursor to the point on the waveform you want to move.
4. Press the arrow keys to move the waveform.

↓: Move the display area down. ↑: Move the display area up.
←: Move the display area to the left. →: Move the display area right.

The waveform display area (the section enclosed in a square) within the entire screen moves.



Printing/Saving Waveforms

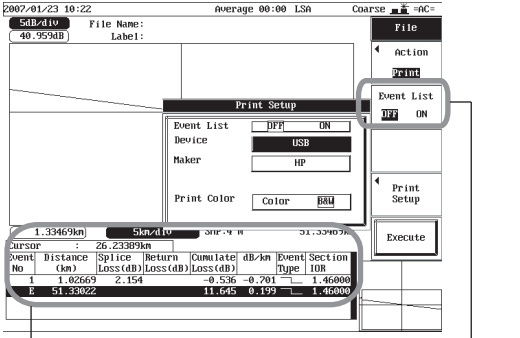
16.5, “Printing Waveforms” in the user’s manual

Printing

FILE — 1. Press FILE.

Action — 2. Press the Action soft key.

3. From the item list, select Print.



To also print the event list on the screen, set the Event List setting to ON.

Print Setup — 4. Select the internal printer or any external printer.

Execute — 5. Press the Execute soft key to print.

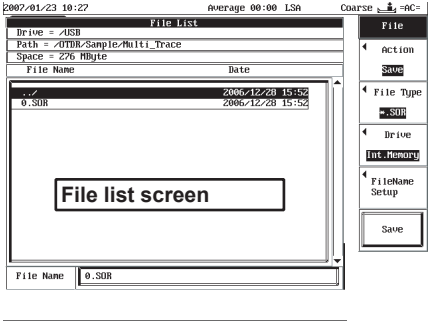
16.1, “Loading and Saving Waveforms” in the user’s manual

Saving

FILE — 1. Press FILE.

Action — 2. Press the Action soft key.

3. From the item list, select Save.



File Type — 4. Select the desired file type.

Drive — 5. Set the save destination to the internal memory or USB memory.

FileName Setup — 6. Set the file name as necessary.

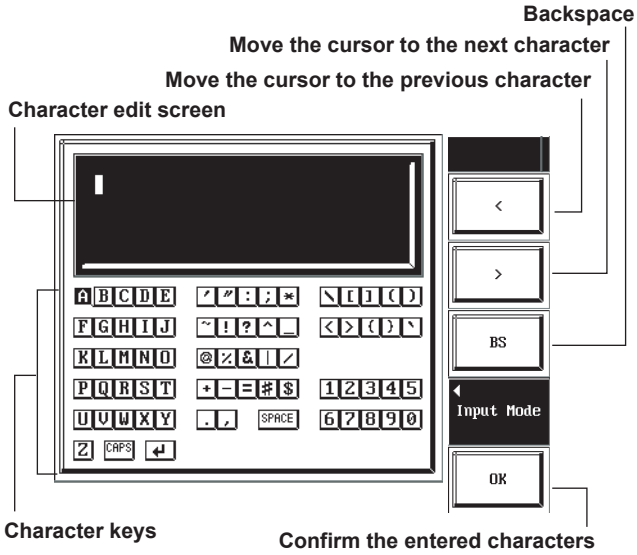
Save — 7. Press the Save soft key to save the file.

Entering Characters

You can enter file names and comments from the character input screen shown below when saving the measured waveforms.

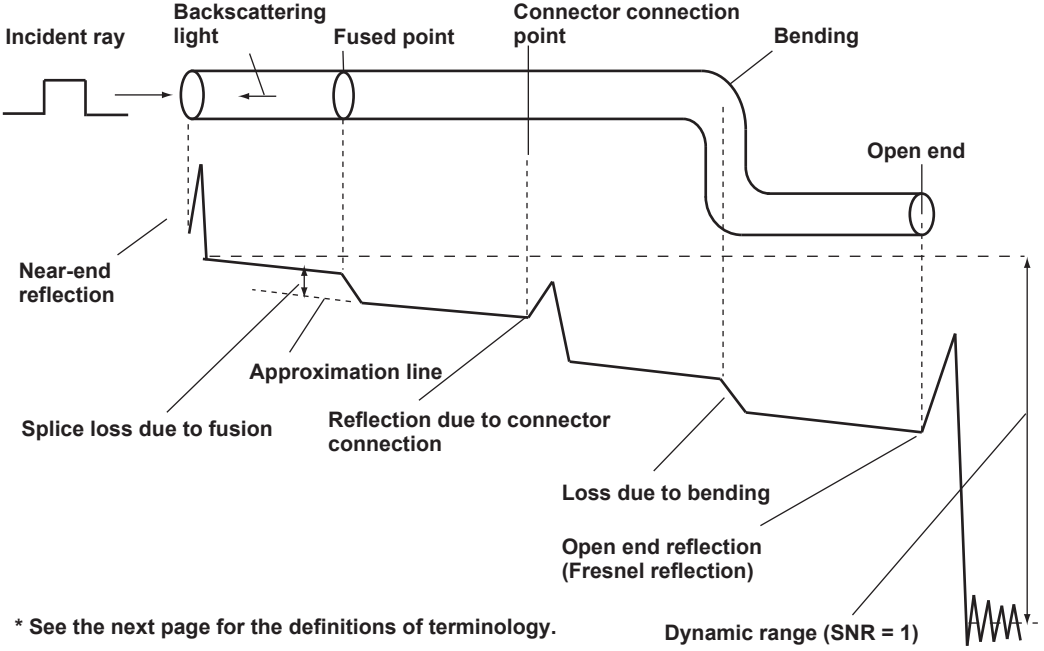
Character Input Screen

Section 16.6, “Entering Characters” in the user’s manual



Background Information on Measurements

Viewing the Optical Pulse Measurement Waveform



* See the next page for the definitions of terminology.

Terminology

Near-end reflection

A reflection occurs in the gap between the AQ7270 and the connector for the optical fiber cable. Losses and reflections of the connection points cannot be detected in the section in which this reflection is detected. This section is called a dead zone.

Backscattering light

When light propagates through the optical fiber cable, a phenomenon called Rayleigh Scattering occurs due to the nonuniformity of the density or constituents of materials smaller than the wavelength unit. The scattered light that is transmitted opposite to the direction of propagation is called backscattering light.

Splice loss due to fusion

A splice loss occurs at the fused section mainly due to axis offset and angle offset.

Reflection due to connector connection

Unlike the fused section, a slight gap occurs in the connection section of connectors. Because the group refraction index changes in this gap, a reflection occurs causing a loss.

Fresnel reflection at the far end of the optical fiber cable

Fresnel reflection occurs at the location where the optical fiber cable is broken or a location where the group refraction index changes such as the far end of the cable (glass and air) when light enters the cable. If the end face of the optical fiber cable is vertical, approximately 3.4 % (–14.7 dB) of the incident light power is reflected.

Dynamic range

Dynamic range refers to the difference between the backscattering light level at the near end and the noise (RMS = 1).

Dead zone

The locations where measurements cannot be made due to the effects of Fresnel reflection, connection point of connectors, etc.

Specifications

MODEL

MODEL	Suffix Code	Description
735020		1550 nm, 32 dB
735021		1650 nm, 28 dB
735022		1310/1550 nm, 34/32 dB
735023		1310/1550 nm, 40/38 dB
735024		1550/1625 nm, 38/35 dB
735025		1310/1490/1550 nm, 34/30/32 dB
735026		1310/1550/1625 nm, 34/32/28 dB
735027		1310/1550/1650 nm, 34/32/28 dB
735028		1310/1550/1625 nm, 40/38/35 dB
735029		850/1300 nm, 22.5/24 dB
735030		850/1300/1310/1550 nm, 22.5/24/34/32 dB
735032		1310/1550 nm, 34/32 dB
735033		1310/1550 nm, 40/38 dB
735037		1310/1550/1650 nm, 40/38/30 dB
735040		850/1300/1310/1550 nm, 22.5/24/40/38 dB
Optical connector	-SCC	SC connector (fixed)
	-FCC	FC Connector (fixed)
	-ASC	Angled PC SC Connector *1
	-NON	No universal adapter
	-USC	SC universal adapter
	-UFC	FC universal adapter
Language	-HE	English
	-HC	Chinese/English
	-HK	Korean/English
	-HR	Russian/English

MODEL

MODEL	Suffix Code	Description	
Power cord	-D	UL/CSA standard	Max. rated voltage: 125 V
	-F	VDE standard	Max. rated votlage: 250 V
	-R	AS standard	Max. rated votlage: 250 V
	-Q	BS standard	Max. rated votlage: 250 V
	-H	GB standard	Max. rated votlage: 250 V
Options	/PM	Optical power monitor function *2	
	/SLS	Stability Light source function *3	
	/LS	Light source function *4	
	/PL	Internal printer and LAN (Ethernet interface)	
	/DF	Dummy fiber (SMF) *5	
	/SB	Shoulder belt	

*1 Supported by the SMF port of the 735032, 735033, 735037 and 735040
*2 Not supported by 735029 and 735030, and the MMF of 735021
*3 Not supported by 735029 and 735030
*4 not supported by the MMF of the 735029 and 735030
*5 not supported by 735029 and 735030

Optical Specifications

MODEL: 735020

Center wavelength	1550 nm ± 25 nm	
Event dead zone[*5]	0.8 m (max.)	
Attenuation dead zone[*6]	8 m (typ.)	
Dynamic range (min.)[*4]	32 dB	
Light source (optical output)	–5 dBm or more	(/LS option)
Optical power monitor (input level)	–50 dBm to –5 dBm	(/PM option)
Optical power monitor (accuracy)[*3]	±0.5 dB or less	(/PM option)

MODEL: 735021

Center wavelength	1650 nm ± 5 nm[*1], ±10 nm[*2]
Measuring pulse optical output	≤15 dBm (max.)
Event dead zone[*5]	0.8 m (max.)
Attenuation dead zone[*6]	12 m (typ.)
Dynamic range (min.)[*4.10]	30 dB
Light source (optical output)	–5 dBm or more (/LS option)

MODEL: 735022/735032

Center wavelength	1310 nm ± 25 nm, 1550 nm ± 25 nm
Event dead zone[*5]	0.8 m (max.)
Attenuation dead zone[*6]	7 m (typ.)@1310 nm, 8 m(typ.)@1550 nm
Dynamic range (min.)[*4]	34 dB@1310 nm, 32 dB@1550 nm
Light source (optical output)	–5 dBm or more (/LS option) 735022: /LS option 735032: /SLS option
Optical power monitor (input level)	–50 dBm to –5 dBm (/PM option)
Optical power monitor (accuracy)[*3]	±0.5 dB or less (/PM option)

MODEL: 735023/735033

Center wavelength	1310 nm ± 25 nm, 1550 nm ± 25 nm
Event dead zone[*5]	0.8 m (max.)
Attenuation dead zone[*6]	7 m (typ.)@1310 nm, 8 m(typ.)@1550 nm
Dynamic range (min.)[*4]	40 dB@1310 nm, 38 dB@1550 nm
Light source (optical output)	–5 dBm or more 735023: /LS option 735033: /SLS option
Optical power monitor (input level)	–50 dBm to –5 dBm (/PM option)
Optical power monitor (accuracy)[*3]	±0.5 dB or less (/PM option)

MODEL: 735024

Center wavelength	1550 nm ± 25 nm, 1625 nm ± 25 nm	
Event dead zone[*5]	0.8 m (max.)	
Attenuation dead zone[*6]	8 m (typ.)@1550 nm, 12 m(typ.)@1625 nm	
Dynamic range (min.)[*4]	38 dB@1550 nm, 35 dB@1625 nm	
Light source (optical output)	–5 dBm or more	(/LS option)
Optical power monitor (input level)	–50 dBm to –5 dBm	(/PM option)
Optical power monitor (accuracy)[*3]	±0.5 dB or less	(/PM option)

MODEL: 735025

Center wavelength	1310 nm ± 25 nm, 1490 nm ± 25 nm, 1550 nm ± 25 nm	
Event dead zone[*5]	0.8 m (max.)	
Attenuation dead zone[*6]	7 m (typ.)@1310 nm, 8 m (typ.)@1490 nm, 8 m (typ)@1550 nm	
Dynamic range (min.)[*4]	34 dB@1310 nm, 30 dB@1490 nm, 32 dB@1550 nm	
Light source (optical output)	–5 dBm or more	(/LS option)
Optical power monitor (input level)	–50 dBm to –5 dBm	(/PM option)
Optical power monitor (accuracy)[*3]	±0.5 dB or less	(/PM option)

MODEL: 735026

Center wavelength	1310 nm ± 25 nm, 1550 nm ± 25 nm, 1625 nm ± 25 nm	
Event dead zone[*5]	0.8 m (max.)	
Attenuation dead zone[*6]	7 m (typ.)@1310 nm, 8 m (typ.)@1550 nm, 12 m (typ)@1625 nm	
Dynamic range (min.)[*4]	34 dB@1310 nm, 32 dB@1550 nm, 28 dB@1625 nm	
Light source (optical output)	–5 dBm or more	(/LS option)
Optical power monitor (input level)	–50 dBm to –5 dBm	(/PM option)
Optical power monitor (accuracy)[*3]	±0.5 dB or less	(/PM option)

MODEL: 735027/735037

Center wavelength	1310 nm ± 25 nm, 1550 nm ± 25 nm, 1650 nm ± 5 nm[*1], ± 10 nm[*2]	
Measuring pulse optical output	≤15 dBm (max.)@1650 nm	
Event dead zone[*5]	0.8 m (max.)	
Attenuation dead zone[*6]	7 m (typ.)@1310 nm, 8 m (typ.)@1550 nm, 12 m (typ)@1650 nm	
Dynamic range (min.)[*4,10]	34 dB@1310 nm, 32 dB@1550 nm, 30 dB@1650 nm	: 735027
	40 dB@1310 nm, 38 dB@1550 nm, 30 dB@1650 nm	: 735037
Light source (optical output)	–5 dBm or more (/LS option)	
	735027: /LS option	
	735037: /SLS option	
Optical power monitor (input level)	–50 dBm to –5 dBm (/PM option)	
Optical power monitor (accuracy)[*3]	±0.5 dB or less (/PM option)	

MODEL: 735028

Center wavelength	1310 nm ± 25 nm, 1550 nm ± 25 nm, 1625 nm ± 25 nm	
Event dead zone[*5]	0.8 m (max.)	
Attenuation dead zone[*6]	7 m (typ.)@1310 nm, 8 m (typ.)@1550 nm, 12 m (typ)@1625 nm	
Dynamic range (min.)[*4]	40 dB@1310 nm, 38 dB@1550 nm, 35 dB@1625 nm	
Light source (optical output)	–5 dBm or more	(/LS option)
Optical power monitor (input level)	–50 dBm to –5 dBm	(/PM option)
Optical power monitor (accuracy)[*3]	±0.5 dB or less	(/PM option)

MODEL: 735029

Center wavelength	850 nm ± 30 nm, 1300 nm ± 30 nm
Event dead zone[*9]	2 m (typ.)
Attenuation dead zone[*6]	7 m (typ.)@850 nm, 10 m(typ.)@1300 nm
Dynamic range (min.)[*8]	22.5 dB@850 nm, 24 dB@1300 nm

Specifications

MODEL: 735030 /735040

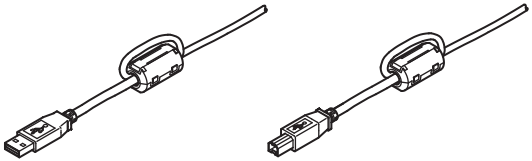
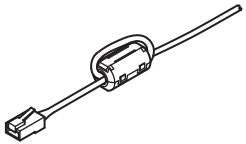
Center wavelength	850 nm ± 30 nm, 1300 nm ± 30 nm, 1310 nm ± 25 nm, 1550 nm ± 25 nm
Event dead zone[*5,9]	2 m (typ.)@850/1300 nm, 0.8 m@1310/1550 nm
Attenuation dead zone[*6]	7 m (typ.)@850 nm, 10 m (typ.)@1300 nm, 7 m (typ.)@1310 nm, 8 m (typ.)@1550 nm
Dynamic range (min.)[*4,8]	22.5 dB@850 nm, 24 dB@1300 nm, 34 dB@1310 nm, 32 dB@1550 nm : 735030 22.5 dB@850 nm, 24 dB@1300 nm, 40 dB@1310 nm, 38 dB@1550 nm : 735040
Light source (optical output)	–5 dBm or more@1310/1550 nm (/LS option)
Optical power monitor (input level)	–50 dBm to –5 dBm@1310/1550 nm (/PM option)
Optical power monitor (accuracy)[*3]	±0.5 dB or less@1310/1550 nm (/PM option)

*1 ±5 nm: –20 dB point from the peak value of the pulse optical output
*2 ±10 nm: -60 dB point from the peak value of the pulse optical output
*3 When applying input with λ = 1310 nm at –10 dBm
*4 Pulse width 20 μs, distance range 200 km, sampling resolution 32 m, and average duration 3 minutes.
*5 Pulse width 3 ns, return loss 45 dB or more, 1.5 dB point below the peak value at unsaturated condition.
*6 Pulse width 10 ns, return loss 45 dB or more, at a point where the backscattering light level is within 0.5 dB of the steady-state value.
*8 Pulse width 500 ns (850 nm)/1 μs (1300 nm), average duration 3 minutes, and sampling resolution 4 m.
*9 Pulse width 10 ns, return loss 45 dB or more, at a point where the backscattering light level is within 1.5 dB of the steady-state value.
*10 1.65 μm: With background light (1550 nm ± 75 nm, 19 dBm, CW light)

• The dynamic range values are smaller by 0.5 dB than the above values if the dummy fiber option is used.
• Typical value represents a typical or average value. It is not strictly warranted.
• The ampersand after the values in the optical specifications indicate that the value correspond to the wavelength after the ampersand.

General Specifications

Item	Specifications
Display	8.4-inch color TFT (640 × 480 dots)
Distance range	500 m, 1 km, 2 km, 5 km, 10 km, 20 km, 50 km, 100 km, 200 km, 300 km, and 400 km
Reading resolution	1 cm min.
Sampling resolution	5 cm, 10 cm, 20 cm, 50 cm, 1 m, 2 m, 4 m, 8 m, 16 m, 32 m
Number of data samples	Up to 50000 points
Group refraction index	1.30000 to 1.79999 (0.00001 steps)
Distance unit	km mile and kf for English display
Pulse width	3 ns, 10 ns, 20 ns, 50 ns, 100 ns, 200 ns, 500 ns, 1 μs, 2 μs, 5 μs, 10 μs, and 20 μs *1 5 μs for 850 nm (MM) *2 Exclude 3 ns for 850/1300 nm (MM)
Distance measurement accuracy	±1 + measured distance × 2 × 10-5 ± sampling resolution
Internal memory	Saves up to 1000 waveforms
USB (1.1)	Type A (printer and external memory) Type B (remote and storage)
LAN (option)	10/100BASE-T
Internal printer (option)	576-dot/line thermal printer, chart paper width: 80 mm
AC power supply	100 to 240 VAC 50/60 Hz
Battery pack	Duration: 6 hours (under given usage conditions), charge time: within 5 hours
Weight (excluding options)	Approx. 2.8 kg
Dimensions (projections excluded)	287 (W) × 197 (H) × 85 (D) 287 (W) × 197 (H) × 135 (D) with the /PL option
Temperature range	During use 0°C to 45°C During storage –20°C to 60°C When using the printer 0°C to 35° 80%RH or less When charging the battery pack 0°C to 35° C
Maximum relative humidity	85%RH or less (without condensation)

Item	Specifications
Emission	
Complying standard	EN61326 Class A, (C-Tick AS/NZS CISPR11) EN61000-3-2 EN61000-3-3 This instrument is a Class A (for industrial environment) product. Operation of this product in a residential area may cause radio interference in which case the user is required to correct the interference.
Cable conditions	• USB Use a shielded cable. Use cables of length 3 m or less. Attach a ferrite core (TDK: ZCAT2035-0930A, YOKOGAWA part number: A1190MN) with two windings at the AQ7270 end (see the figure below).  • Ethernet interface connector Use LAN cables of length 30 m or less. Attach a ferrite core (TDK: ZCAT2035-0930A, YOKOGAWA part number: A1190MN) with two windings at the AQ7270 end (see the figure below). 

Item	Specifications
Immunity	
Complying standard	EN61326 industrial environment
Cable conditions	Same as the cable conditions for emission.
Safety standards	
Complying standard	EN61010-1
	IEC60825-1

Laser Safety

This instrument uses a laser light source. This instrument is a Class 1M laser product as defined by IEC60825-1 Safety of Laser Products-Part 1: Equipment Classification, Requirements and User's Guide. In addition, the AQ7270 complies with 21CFR1040.10 except for the items that deviate from the standard as a result of complying with Laser Notice No.50 dated on July 26, 2001.

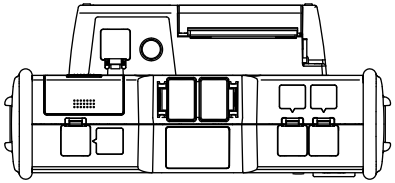
Laser Class 1M Label

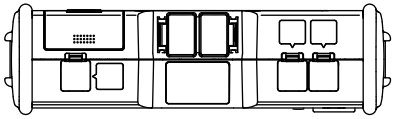
If the laser output is observed at a distance of 100mm or less from the laser beam emitting part by means of optical method (loupe, magnifying glass, microscope, etc.), this may cause eye injury.

MODEL	Class	Center Wavelength	Output Power
735020	1M	1550 nm	CW: ≤ 5 mW@1550 nm PULSE: ≤ 200 mW@1550 nm PULSE width: ≤20 us@1550 nm (duty cycle: ≤2.5%)
735021	1M	1650 nm	CW: ≤ 5 mW@1650 nm PULSE: ≤ 32 mW@1650 nm PULSE width: ≤20 us@1650 nm (duty cycle: ≤2.5%)
735022	1M	1310/1550 nm	CW: ≤5 mW@1310/1550 nm PULSE: ≤200 mW@1310/1550 nm PULSE width: ≤20 us@1310/1550 nm (duty cycle: ≤2.5%)
735023	1M	1310/1550 nm	CW: ≤5 mW@1310/1550 nm PULSE: ≤200 mW@1310/1550 nm Pulse width: ≤20 us@1310/1550 nm (duty cycle: ≤2.5%)
735024	1M	1550/1625 nm	CW: ≤5 mW@1550/1625 nm PULSE: ≤200 mW@1550/1625 nm Pulse width: ≤20 us@1550/1625 nm (duty cycle: ≤2.5%)
735025	1M	1310/1490/1550 nm	CW: ≤5 mW@1310/1490/1550 nm PULSE: ≤200 mW@1310/1490/1550 nm Pulse width: ≤20 us@1310/1490/1550 nm (duty cycle: ≤2.5%)
735026	1M	1310/1550/1625 nm	CW: ≤5 mW@1310/1490/1625 nm PULSE: ≤200 mW@1310/1490/1625 nm Pulse width: ≤20 us@1310/1550/1625 nm (duty cycle: ≤2.5%)
735027	1M	1310/1550/1650 nm	CW: ≤5 mW@1310/1490/1650 nm PULSE: ≤200 mW@1310/1550 nm PULSE: ≤ 32 mW@1650 nm Pulse width: ≤20 us@1310/1550/1650 nm (duty cycle: ≤2.5%)
735028	1M	1310/1550/1625 nm	CW: ≤5 mW@1310/1490/1625 nm PULSE: ≤200 mW@1310/1490/1625 nm Pulse width: ≤20 us@1310/1550/1625 nm (duty cycle: ≤2.5%)

MODEL	Class	Center Wavelength	Output Power
735029	1M	850/1300 nm	PULSE: ≤50 mW@850 nm, PULSE: ≤100 mW@1300 nm Pulse width: ≤1 us@850 nm (duty cycle: ≤5%) ≤5 us@1300 nm (duty cycle: ≤0.6%)
735030	1M	850/1300 nm	PULSE: ≤50 mW@850 nm, PULSE: ≤100 mW@1300 nm Pulse width: ≤1 us@850 nm (duty cycle: ≤5%) ≤5 us@1300 nm (duty cycle: ≤0.6%)
		1310/1550 nm	CW: ≤5 mW@1310/1550 nm PULSE: ≤200 mW@1310/1550 nm Pulse width: ≤20 us@1310/1550 nm (duty cycle: ≤2.5%)
735032	1M	1310/1550 nm	CW: ≤ 5 mW@1310/1550 nm PULSE: ≤ 200 mW@1310/1550 nm PULSE width: ≤ 20 us@1310/1550 nm (duty cycle: ≤ 2.5%)
735033	1M	1310/1550 nm	CW: ≤ 5 mW@1310/1550 nm PULSE: ≤ 200 mW@1310/1550 nm PULSE width: ≤ 20 us@1310/1550 nm (duty cycle: ≤ 2.5%)
735037	1M	1310/1550/1650 nm	CW: ≤ 5 mW@1310/1550/1650 nm PULSE: ≤ 200 mW@1310/1550 nm PULSE: ≤ 32 mW@1650 nm PULSE width: ≤ 20 us@1310/1550/1650 nm (duty cycle: ≤ 2.5%)
735040	1M	850/1300 nm	PULSE: ≤ 50 mW@850 nm,PULSE: ≤ 100 mW@1300 nm PULSE width: ≤ 1 us@850 nm (duty cycle: ≤ 5%) ≤ 5 us@1300 nm (duty cycle: ≤ 0.6%)
		1310/1550 nm	CW: ≤ 5 mW@1310/1550 nm PULSE:≤ 200 mW@1310/1550 nm PULSE width: ≤ 20 us@1310/1550 nm (duty cycle: ≤ 2.5%)

External Dimensions

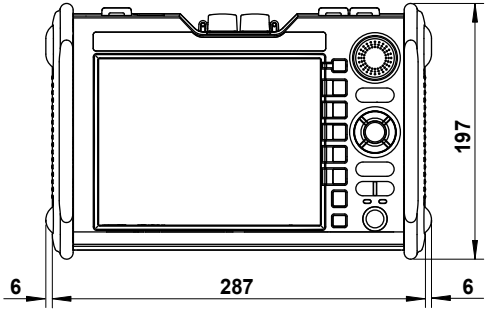




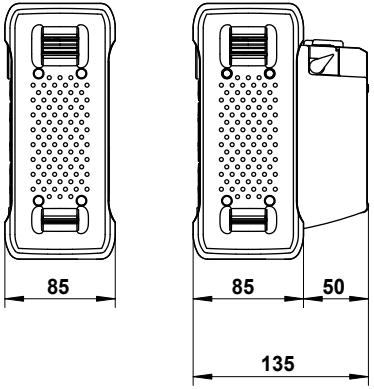
Top view

Unit: mm
Unless otherwise specified, tolerance is ±3% (however, tolerance is ±0.3 mm when below 10 mm).

/PL option: LAN and internal printer options



Front view



Side view (/PL)