ADVANTEST®

ADVANTEST CORPORATION

Q8492

Coherent OTDR

Operation Manual

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Safety Summary

To ensure thorough understanding of all functions and to ensure efficient use of this instrument, please read the manual carefully before using. Note that Advantest bears absolutely no responsibility for the result of operations caused due to incorrect or inappropriate use of this instrument.

If the equipment is used in a manner not specified by Advantest, the protection provided by the equipment may be impaired.

- **Warning Labels**

  Warning labels are applied to Advantest products in locations where specific dangers exist. Pay careful attention to these labels during handling. Do not remove or tear these labels. If you have any questions regarding warning labels, please ask your nearest Advantest dealer. Our address and phone number are listed at the end of this manual.

  Symbols of those warning labels are shown below together with their meaning.

  DANGER: Indicates an imminently hazardous situation which will result in death or serious personal injury.

  WARNING: Indicates a potentially hazardous situation which will result in death or serious personal injury.

  CAUTION: Indicates a potentially hazardous situation which will result in personal injury or a damage to property including the product.

- **Basic Precautions**

  Please observe the following precautions to prevent fire, burn, electric shock, and personal injury.

  - Use a power cable rated for the voltage in question. Be sure however to use a power cable conforming to safety standards of your nation when using a product overseas.
  - When inserting the plug into the electrical outlet, first turn the power switch OFF and then insert the plug as far as it will go.
  - When removing the plug from the electrical outlet, first turn the power switch OFF and then pull it out by gripping the plug. Do not pull on the power cable itself. Make sure your hands are dry at this time.
  - Before turning on the power, be sure to check that the supply voltage matches the voltage requirements of the instrument.
  - Connect the power cable to a power outlet that is connected to a protected ground terminal. Grounding will be defeated if you use an extension cord which does not include a protected ground terminal.
  - Be sure to use fuses rated for the voltage in question.
  - Do not use this instrument with the case open.
  - Do not place anything on the product and do not apply excessive pressure to the product. Also, do not place flower pots or other containers containing liquid such as chemicals near this

product.

- When the product has ventilation outlets, do not stick or drop metal or easily flammable objects into the ventilation outlets.
- When using the product on a cart, fix it with belts to avoid its drop.
- When connecting the product to peripheral equipment, turn the power off.

- **Caution Symbols Used Within this Manual**

Symbols indicating items requiring caution which are used in this manual are shown below together with their meaning.

DANGER: Indicates an item where there is a danger of serious personal injury (death or serious injury).

WARNING: Indicates an item relating to personal safety or health.

CAUTION: Indicates an item relating to possible damage to the product or instrument or relating to a restriction on operation.

- **Safety Marks on the Product**

The following safety marks can be found on Advantest products.

 : ATTENTION - Refer to manual.

 : Protective ground (earth) terminal.

 : DANGER - High voltage.

 : CAUTION - Risk of electric shock.

- **Replacing Parts with Limited Life**

The following parts used in the instrument are main parts with limited life.
Replace the parts listed below before their expected lifespan has expired to maintain the performance and function of the instrument.
Note that the estimated lifespan for the parts listed below may be shortened by factors such as the environment where the instrument is stored or used, and how often the instrument is used.
The parts inside are not user-replaceable. For a part replacement, please contact the Advantest sales office for servicing.

Each product may use parts with limited life.
For more information, refer to the section in this document where the parts with limited life are described.

Main Parts with Limited Life

Part name	Life
Unit power supply	5 years
Fan motor	5 years
Electrolytic capacitor	5 years
LCD display	6 years
LCD backlight	2.5 years
Floppy disk drive	5 years
Memory backup battery	5 years

- **Hard Disk Mounted Products**

The operational warnings are listed below.

- Do not move, shock and vibrate the product while the power is turned on.
  Reading or writing data in the hard disk unit is performed with the memory disk turning at a high speed. It is a very delicate process.

- Store and operate the products under the following environmental conditions.
  An area with no sudden temperature changes.
  An area away from shock or vibrations.
  An area free from moisture, dirt, or dust.
  An area away from magnets or an instrument which generates a magnetic field.

- Make back-ups of important data.
  The data stored in the disk may become damaged if the product is mishandled. The hard disc has a limited life span which depends on the operational conditions. Note that there is no guarantee for any loss of data.

- **Precautions when Disposing of this Instrument**

When disposing of harmful substances, be sure dispose of them properly with abiding by the state-provided law.

Harmful substances: (1) PCB (polycarbon biphenyl)
(2) Mercury
(3) Ni-Cd (nickel cadmium)
(4) Other
Items possessing cyan, organic phosphorous and hexadic chromium and items which may leak cadmium or arsenic (excluding lead in solder).

Example: fluorescent tubes, batteries

Environmental Conditions

This instrument should be only be used in an area which satisfies the following conditions:

- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations
- Altitude of up to 2000 m

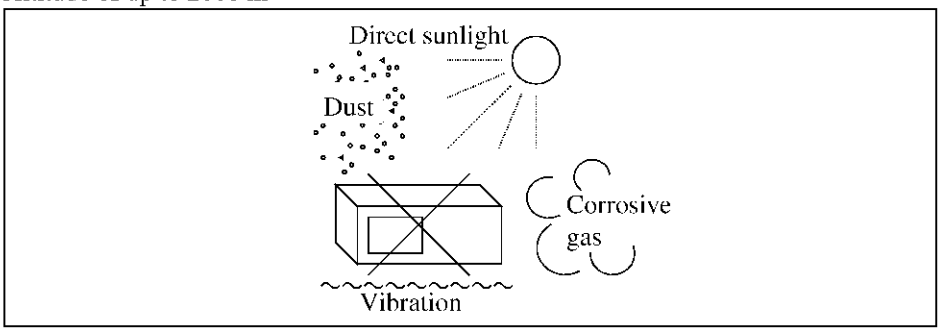


Figure-1 Environmental Conditions

- Operating position

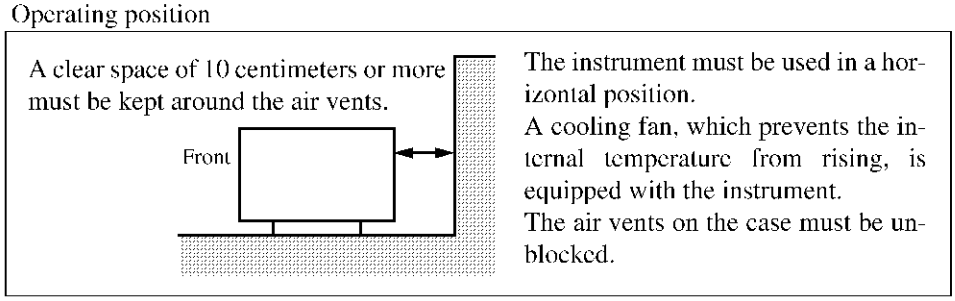


Figure-2 Operating Position

- Storage position

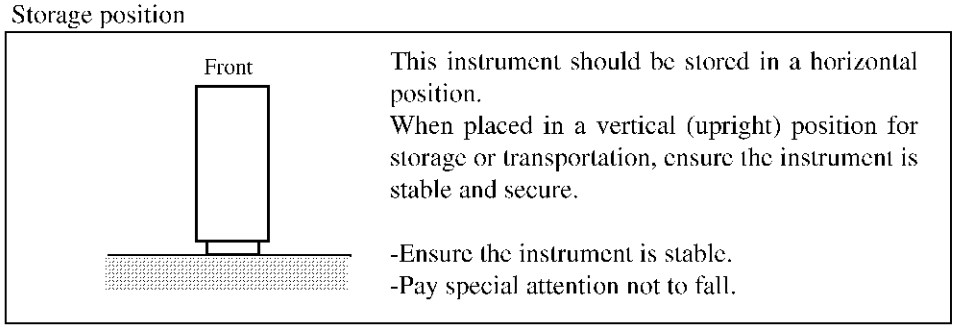


Figure-3 Storage Position

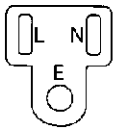
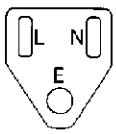
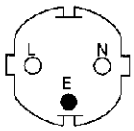
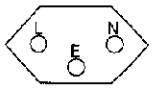
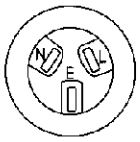
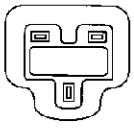
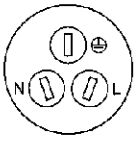
- The classification of the transient over-voltage, which exists typically in the main power supply, and the pollution degree is defined by IEC61010-1 and described below.

  Impulse withstand voltage (over-voltage) category II defined by IEC60364-4-443

  Pollution Degree 2

Types of Power Cable

Replace any references to the power cable type, according to the following table, with the appropriate power cable type for your country.

Plug configuration	Standards	Rating, color and length	Model number (Option number)
	PSE: Japan Electrical Appliance and Material Safety Law	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
	UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) Angled: A01413
	CEE: Europe DEMKO: Denmark NEMKO: Norway VDE: Germany KEMA: The Netherlands CEBEC: Belgium OVE: Austria FIMKO: Finland SEMKO: Sweden	250 V at 6 A Gray 2 m (6 ft)	Straight: A01404 (Option 96) Angled: A01414
	SEV: Switzerland	250 V at 6 A Gray 2 m (6 ft)	Straight: A01405 (Option 97) Angled: A01415
	SAA: Australia, New Zealand	250 V at 6 A Gray 2 m (6 ft)	Straight: A01406 (Option 98) Angled: ---------
	BS: United Kingdom	250 V at 6 A Black 2 m (6 ft)	Straight: A01407 (Option 99) Angled: A01417
	CCC:China	250 V at 10 A Black 2 m (6 ft)	Straight: A114009 (Option 94) Angled: A114109

CAUTION TO USE THE Q8492 SAFELY

1. The specifications for the Q8492 laser source are as follows:

Laser Class	Q8492	
	OTDR Unit	Laser Source
In compliance with IEC 825 (Europe)	3 A	1
In compliance with 21 CFR 1040.10 (Canada, USA)	1	1

2. Never attempt to look directly into the laser beam emitted by the connectors. While it is invisible, it may irrecoverably damage your eyesight.

   The connectors which emit laser beams are listed below :

   - OUTPUT connector mounted on the front panel of the OTDR unit
   - MONITOR A connector mounted on the front panel of the OTDR unit
   - MONITOR B connector mounted on the front panel of the OTDR unit
   - OPTICAL OUTPUT A connector mounted on the rear panel of the Light Source unit
   - OPTICAL OUTPUT B connector mounted on the rear panel of the Light Source unit

   CAUTION!
   Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

3. Do not attempt to open the unit. The unit should be serviced only be ADVANTEST representatives. ADVANTEST assumes no responsibility for any damage caused by unauthorized service.

   CAUTION!
   The Q8492 produces high voltages which may cause electric shock it put the power on without care.
   The laser beam emitted by Q8492 may expose the user to radiation.

4. Failure to replace the fuse with one of the same type and standards may cause a fire.

5. Make sure to insert the Fuse holder correctly when replacing the fuse.

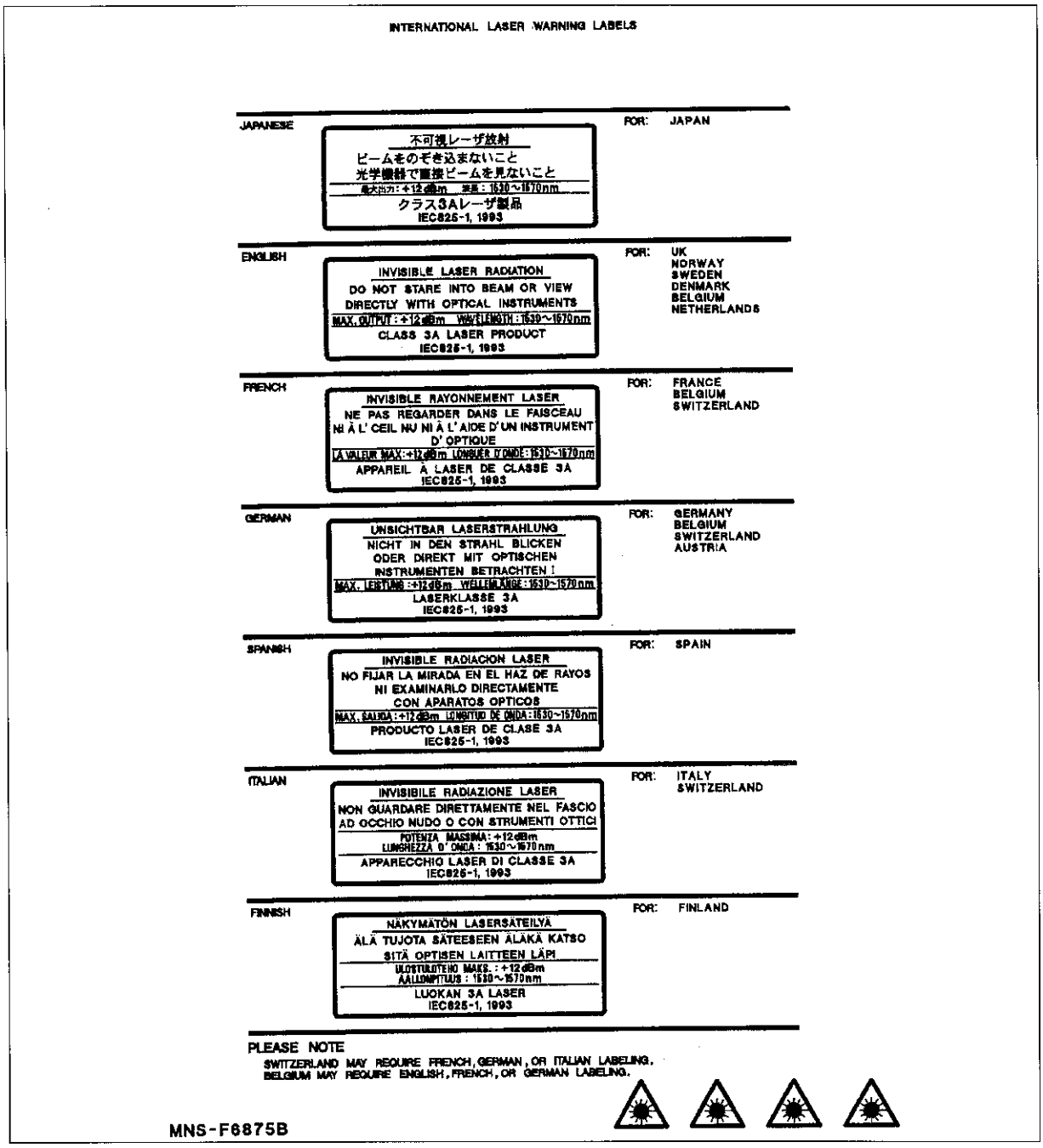
   Since the Fuse holder of the Light Source unit is incorporated with an AC Voltage Change switch, note that the AC voltage setting changes depending on the orientation of the Fuse holder.

6. Please contact your nearest ADVANTEST sales office or agency if you have any problems or any unusual conditions occur. The address and phone number are listed at the end of this manual.

7. Do not try to calibrate the unit yourself. Contact ADVANTEST Corporation to order the calibration. The address and the telephone number of ADVANTEST Corporation are described in the end of this manual.

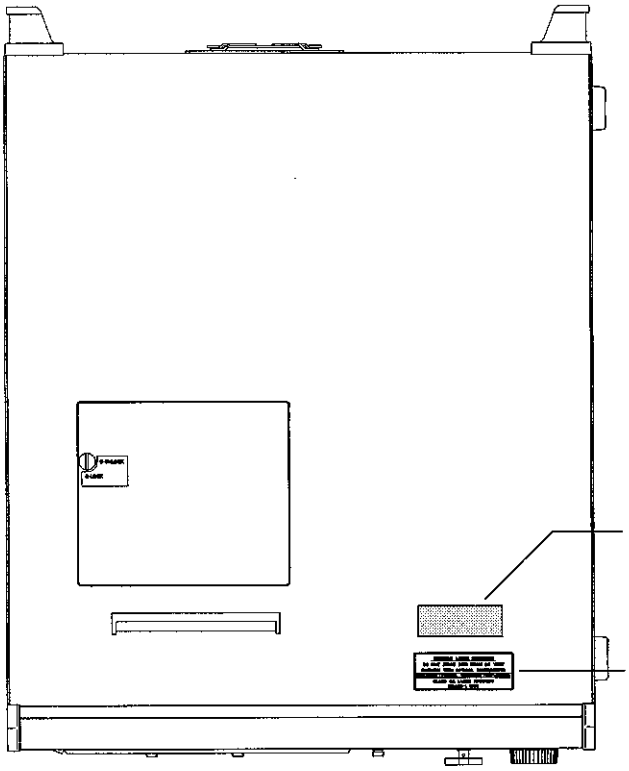
CLASS 3A LASER PRODUCT LABELS

The Q8492 is a class 3A (in compliance with IEC 825) laser product.
The following warning labels are contained in the accessory kit. Be sure to use the label in the appropriate language in the location shown in the next page.
Class 3A laser product label in English has been sticked prior to shipment.

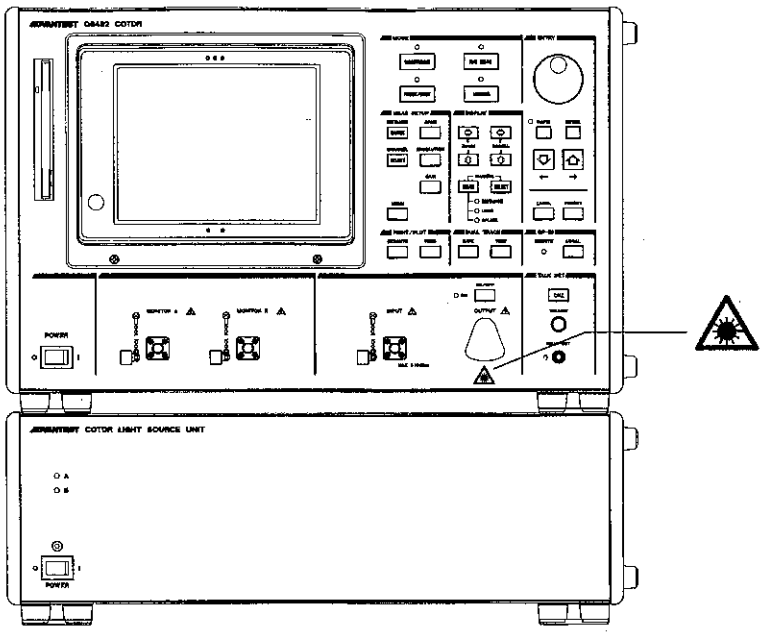


Samples of CLASS 3A Laser Product Labels

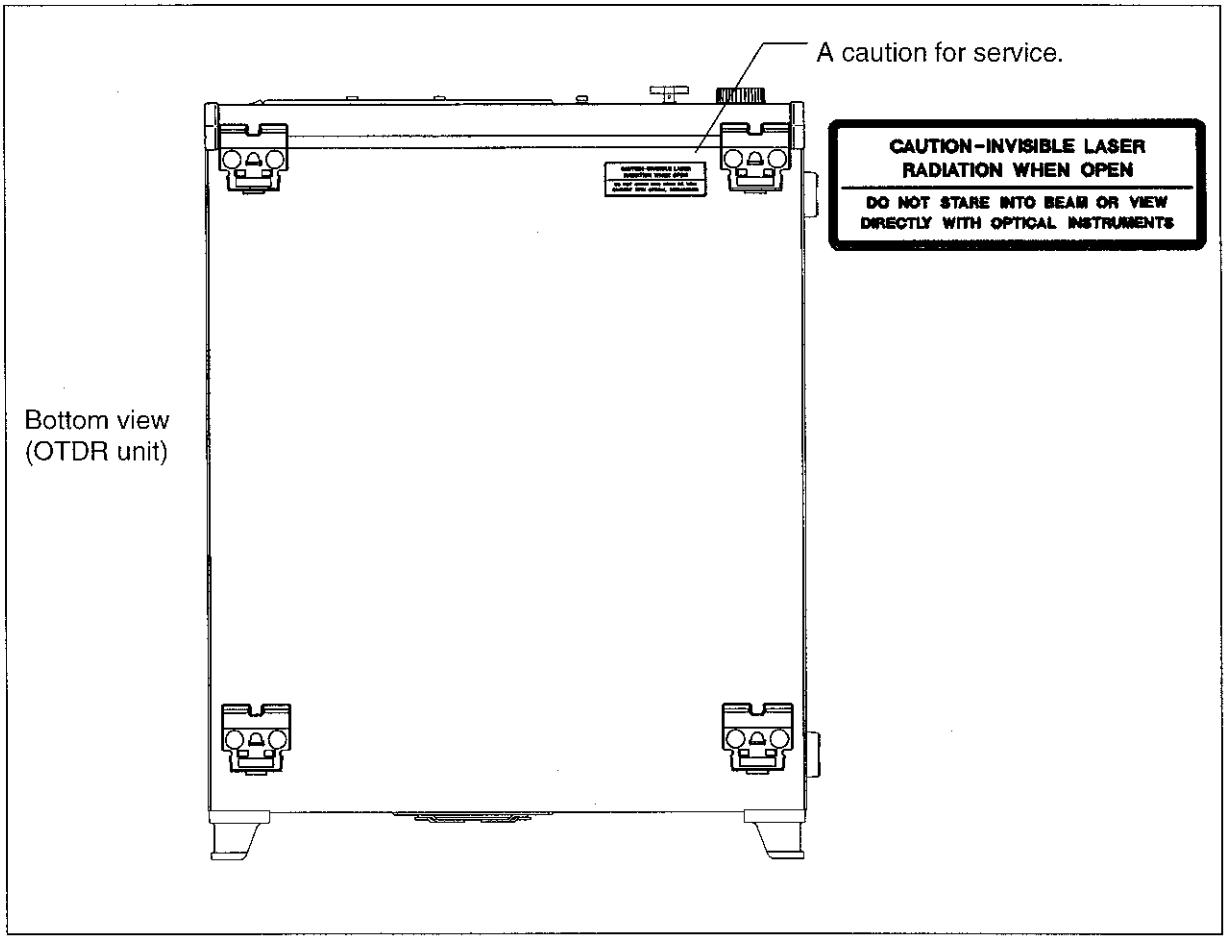
Top view



Front view



CLASS 3A Laser Product Label Locations (1 of 2)



CLASS 3A Laser Product Label Locations (2 of 2)

HOW TO USE THIS MANUAL

This manual is intended for those who have some familiarity with optical measuring instruments (or optical systems). If you are using the Q8492 for the first time, you should read this manual completely.
Chapter 6 explains the GPIB (General Purpose Interface Bus). To understand this chapter, basic programming knowledge is required. Refer to a general programming guide and controller instructions if necessary.

Chapter 1	General.....	Be sure to read this chapter if you are using the Q8492 for the first time. This chapter describes the product, accessories, and safety precautions.
Chapter 2	Panel Description	This chapter describes briefly the names and functions of each of the Q8492 panel parts.
Chapter 3	Basic Operation.....	This chapter gives a brief description of the operation of the Q8492 from setup to measurement procedure.
Chapter 4	How to Operate the Q8492	This chapter gives a full description of all functions of the Q8492.
Chapter 5	Floppy Disk.....	This chapter describes how to use the floppy disk drive and how to save or load data using a computer.
Chapter 6	Talkset.....	This chapter describes the talkset function.
Chapter 7	GPIB.....	This chapter describes program codes, data output formats and program examples used when the Q8492 is controlled by the GPIB.
Chapter 8	Specifications and External View	This chapter describes the specifications and external dimensions of the Q8492.

Certificate of Conformity

CE

This is to certify, that

Coherent OTDR

Q8492

instrument, type, designation

complies with the provisions of the EMC Directive 89/336/EEC in accordance with EN50081-1 and EN50082-1 and Low Voltage Directive 73/23/EEC in accordance with EN61010.

ADVANTEST Corp.
Tokyo, Japan

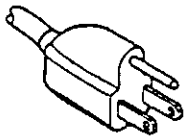
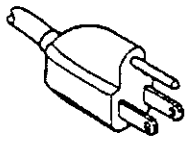
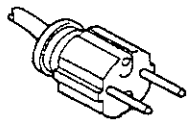
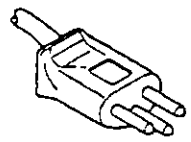
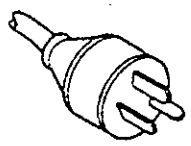
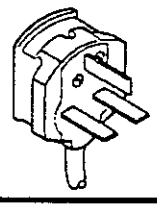
ROHDE&SCHWARZ
Engineering and Sales GmbH
Munich, Germany

8492.00

Table of Power Cable Options

There are six power cable options (refer to following table).

Order power cable options by Model number.

	Plug configuration	Standards	Rating, color and length	Model number (Option number)
1		JIS: Japan Law on Electrical Appliances	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
2		UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) Angled: A01413
3		CEE: Europe DEMKO: Denmark NEMKO: Norway VDE: Germany KEMA: The Netherlands CEBEC: Belgium OVE: Austria FIMKO: Finland SEMKO: Sweden	250 V at 6 A Gray 2 m (6 ft)	Straight: A01404 (Option 96) Angled: A01414
4		SEV: Switzerland	250 V at 6 A Gray 2 m (6 ft)	Straight: A01405 (Option 97) Angled: A01415
5		SAA: Australia, New Zealand	250 V at 6 A Gray 2 m (6 ft)	Straight: A01406 (Option 98) Angled: ---------
6		BS: United Kingdom	250 V at 6 A Black 2 m (6 ft)	Straight: A01407 (Option 99) Angled: A01417

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1 GENERAL

This chapter contains the following topics.

- Unit configuration
- Accessories
- First power on after unpacking
- Precautions for safety
- Cleaning, storing and transporting the Q8492

1.1 Product Overview

The Q8492 Coherent OTDR is an instrument used to search for fault points along the repeater and cable in the WDM (Wavelength Division Multiplex) optical amplifier submarine cable system. This unit also measures optical transmission loss and connection loss with high accuracy.

The backscattered light measuring method used by the Q8492 is detailed below.

Optical modulating form:	FSK sequential signal/FSK pulse signal
Optical wave detecting form:	self-heterodyne detection
Optical receiving form:	balance-type single polarized wave receiving
Demodulating form:	envelope detection

<Features>

- Tunable wavelength range
  1530 to 1570nm
- Wavelength accuracy
  ±0.025nm
- Dynamic range

  ONE-WAY 7dB

Input accumulated noise level:	-7dBm/nm
Optical noise band:	2nm
Backscattered light level:	-65dBm
Number of averaging times:	2^{16} times

  ONE-WAY 17dB

Input accumulated noise level:	-27dBm/nm
Optical noise band:	2nm
Backscattered light level:	-65dBm
Number of averaging times:	2^{16} times

- Measuring distance range
  100km to 15,000km
- Resolution for reading loss
  0.001dB

- Built-in thermal printer
  Prints the on-screen data in approx. 7 seconds.
- 3.5-inch floppy disk drive
  3.5-inch FDD can be used for saving or loading waveforms and measurement conditions (up to 190 waveforms).
- Internal waveform memory (backup memory)
  Waveforms and measurement conditions can be saved or loaded from internal memory (up to 32 waveforms).
- Built-in polarization scrambler
  Suppresses the fluctuation of waveforms due to polarized waves.

1.2 Unit Configuration

The Q8492 consists of the following two units:

- The OTDR unit
- The Light Source unit

The Light Source unit is controlled by the OTDR unit.
See chapter 3 for instructions on how to connect the OTDR unit to the Light Source unit.

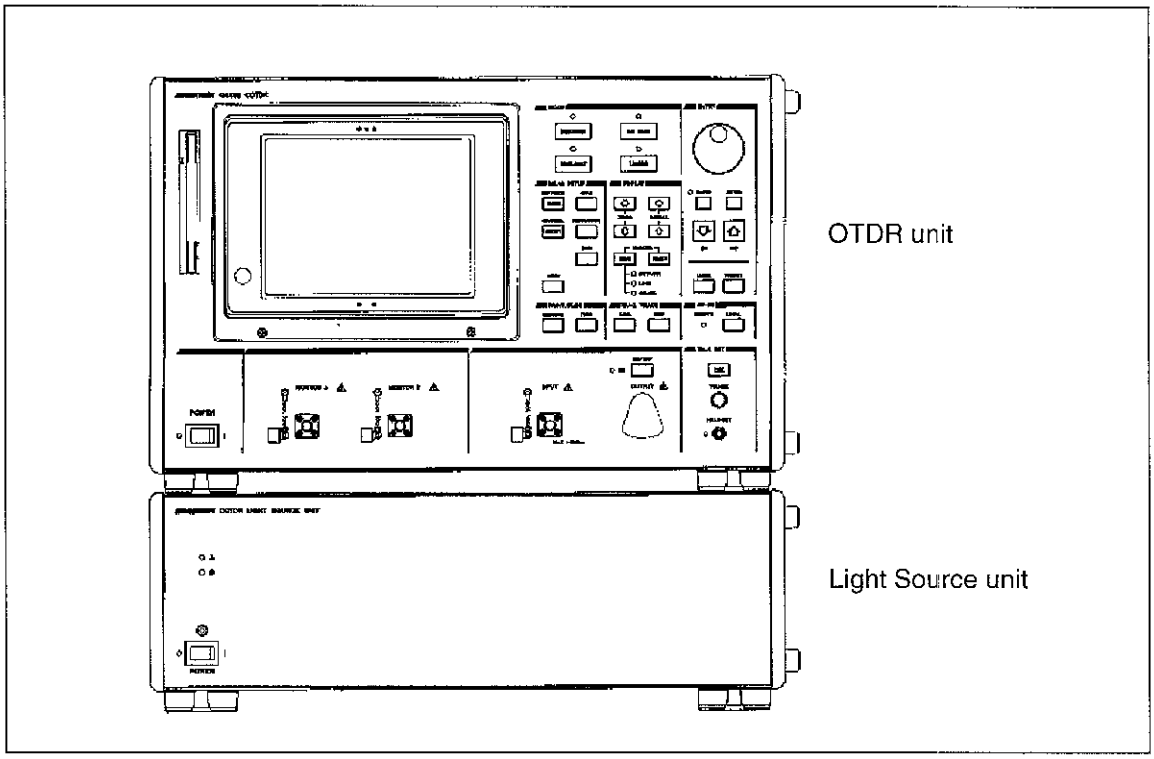


Figure 1-1 The Q8492 Unit Configuration

1.3 Accessories

Accessories for the Q8492 are listed in Table 1-1. If any items are missing or damaged, contact your nearest ADVANTEST sales office or agency. Order accessories by the model numbers.

Table 1-1 List of Standard Accessories

Accessory name	Model number	Quantity	Remarks
Power cable *1	A01403	2	
Power fuse	EAWK3.15A	2	Used with the OTDR unit AC connector
	EAWK2A	2	Used with the 100 V and 120 V Light Source unit
	EAWK1A	2	Used with the 220 V and 240 V Light Source unit
Control cable	408JE-101	1	GPIB cable
Optical fiber cable	A01283	1	
Printing paper	A09075	3	
Floppy disk		1	2HD
Head set		1	
CLASS 3A Laser Product label		1	
Operation manual	JQ8492	1 *2	Japanese version
	EQ8492		English version

*1 Can be changed according to option specifications when purchasing.
There are 11 types of Power cables (see yellow page "Table of Power Cable options").
Order Power cable by type name or option number.

*2 Either a Japanese or an English operation manual is provided with this unit.

1.4 Operating the Q8492 for the First Time

Environmental conditions, AC power supply voltage, and the powering on sequence required for operating the Q8492 for the first time are described in this section.

1.4.1 Environmental Conditions

The Q8492 storage temperature range: -10°C to +45°C.
The Q8492 operating temperature range: +10°C to +35°C (relative humidity: RH 85 % or less).

Sudden temperature changes may cause condensation to form which in turn can cause damage to the unit if it is turned on with any moisture on it. Make sure the unit is completely dry before using it.

CAUTION!
To prevent damage, do not put materials such as paper and plastics near the air vent.

A cooling fan is mounted on the rear panel of this unit. To maintain proper airflow, the rear panel of the unit should be no closer than 10cm to a wall or any other object.

The Q8492 should not be used in any of the following places:

- locations where corrosive gases are produced.
- locations where excessive dust exists.
- locations where excessive vibration occurs.
- locations exposed to direct sunlight.
- locations where the unit may fall over.
- locations where extremely high levels of noise exists.

While the Q8492 is designed to withstand noise interference from the AC power supply line, other noise sources may interfere with its' operation. If necessary, noise suppression filters can be used.

WARNING!
1. ***This is a heavy product. Use proper caution when transporting or moving the unit.***
2. ***Do not attempt to use the unit unless it is horizontal with the front panel facing forwards. If the unit is standing on its' side or end it could fall over and cause personal injury or damage its' internal components.***

1.4.2 Power Source Conditions

CAUTION!
Do not exceed the specified input voltage or frequency limits of the Q8492.

(1) OTDR unit

Table 1-2 OTDR Unit Power Source Conditions

Input voltage	90 to 250VAC
Frequency	48Hz to 66Hz
Fuse	T3.15A
Power consumption	220VA or less
Remarks	You do not need to change the AC voltage.

(2) Light Source unit

Table 1-3 Light Source Unit Power Source Conditions

Input voltage	90 to 110VAC	103 to 132VAC	198 to 242VAC	207 to 250VAC
Frequency	48 to 66 Hz			
Fuse	T2A		T1A	
Power consumption	220VA or less			
Setting of AC Voltage Change switch	100	120	220	240
Remarks	Manually changed to AC voltage			

CAUTION!
The Light Source unit power source is changed manually. Set the AC Voltage Change switch and use an appropriate fuse(s) for the input voltage used (see subsection 1.4.3).

1.4.3 Replacing Power Fuse and Changing AC Voltage

CAUTION!

1. ***To prevent fire and electrical shock, use the fuses shown in Table 1-1. Never use fuses other than the specified type or you may short-circuit the Fuse holder.***

2. ***Visual checks alone are not enough to determine whether or not the fuse is open. Measure the resistance of the fuse to determine if the fuse is good (the fuse is normal when resistance is 15Ω or less).***

3. ***Never cut internal or external grounding wires, or remove the ground terminal.***

(1) OTDR unit

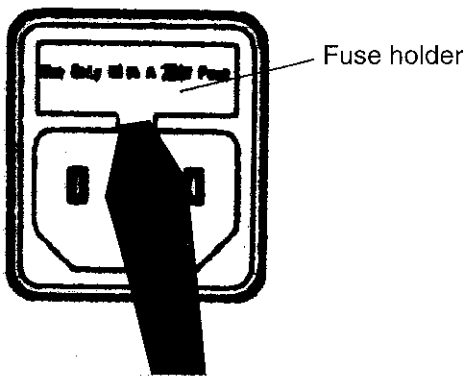
The OTDR unit is automatically changed to an AC voltage. The power fuse is placed in the Fuse holder which is mounted on the rear panel.
Check and replace the power fuse using the following procedure:

Procedure:

① Turn the power switch OFF.

② Unplug the power cable at the outlet.

③ Remove the Fuse holder on the rear panel.



Pull out the Fuse holder using a slotted head screwdriver.

Figure 1-2 Replacing Power Fuse 1

④ Check or replace the power fuse and replace the power fuse holder.

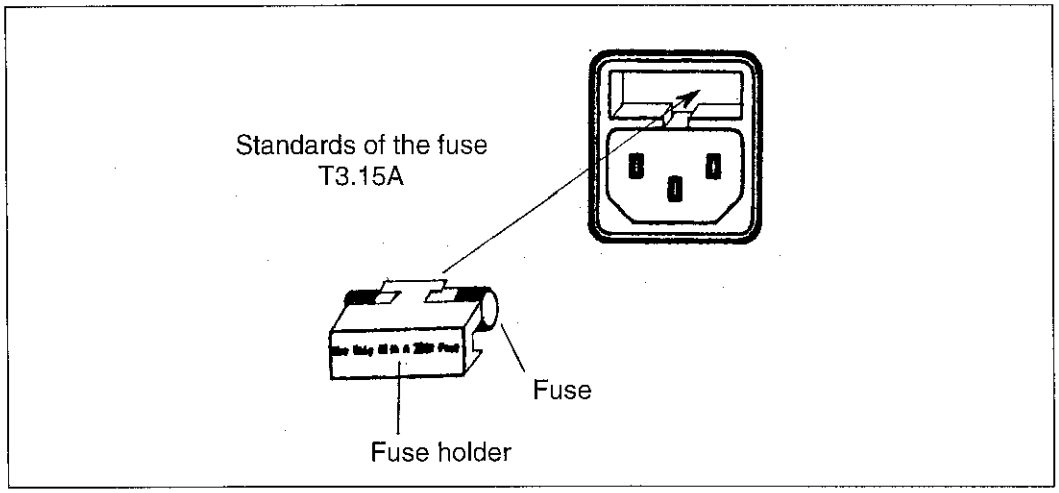
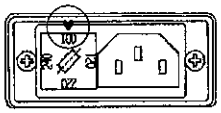
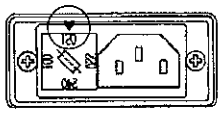
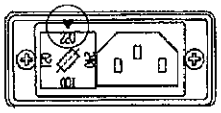
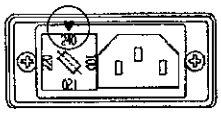


Figure 1-3 Replacing Power Fuse 2

(2) Light Source

The Light Source Unit AC voltage must be manually changed. This is done by accessing the AC Voltage Change switch. The power fuse may need to be replaced, depending on the input voltage which is set.

Table 1-4 Setting the AC Voltage Change switch and Replacing Fuse according to the Input Voltage Standards

Input voltage	Setting AC Voltage Change switch	Fuse standards
90 to 110VAC	Set the 100 at ▼ 	T2A
103 to 132VAC	Set the 120 at ▼ 	T2A
198 to 242VAC	Set the 220 at ▼ 	T1A
207 to 250VAC	Set the 240 at ▼ 	T1A

The power fuse is placed in the AC Voltage Change switch/Fuse holder on the rear panel. To check or replace the power fuse and set the AC Voltage Change switch, do the following procedure:

Procedure:

① Turn the unit off.

② Unplug the power cable at the outlet.

③ Remove the AC Voltage Change switch/Fuse holder on the rear panel.

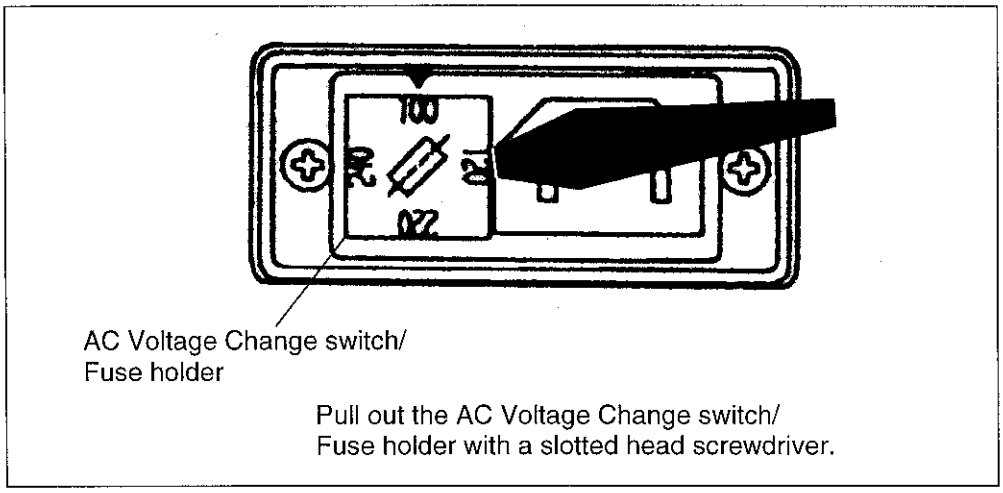


Figure 1-4 Replacing Power Fuse and Changing AC Voltage 1

④ Check or replace the power fuse according to the input voltage.

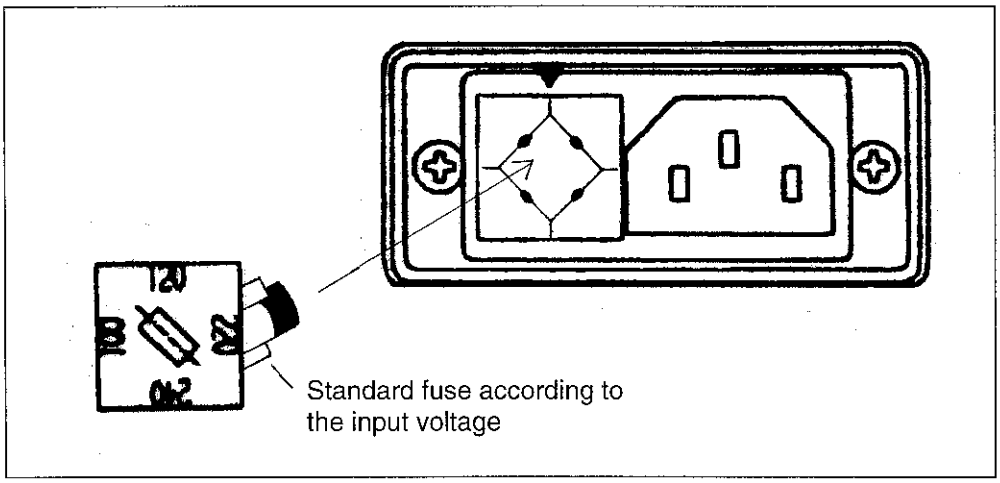


Figure 1-5 Replacing the Power Fuse and Changing AC Voltage 2

⑤ Set the AC Voltage Change switch to AC 100V, AC 120V, AC 220V or AC 240V depending on the input voltage and put it back carefully into the appropriate position.

(Example) In the case of 198 to 242VAC, set the 220 at ▼

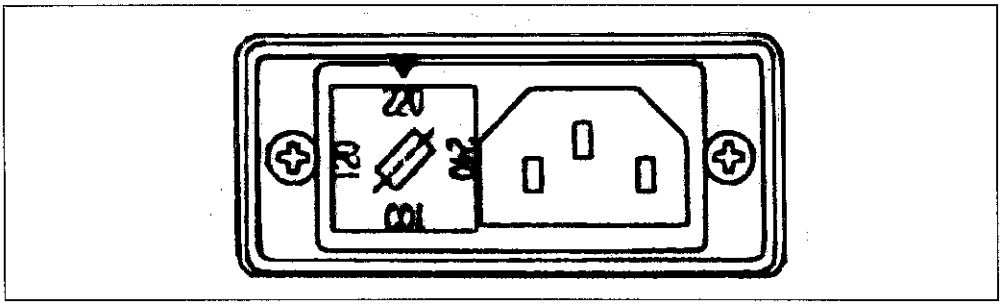


Figure 1-6 Replacing Power Fuse and Changing AC Voltage 3

1.4.4 Connecting Power Cable

WARNING!

1. ***Power Cable***
   - ***Use the attached cable to prevent fire or electrical shock.***
     The attached cable conforms to the electric articles management method.
   - ***Use the power cable which conforms to the safety standards of the country in which it is used.***
   - ***After turning the unit off, connect the power cable to the outlet.***
   - ***Hold the plug when you pull out the power cable from the outlet.***

2. ***Ground terminal***
   - ***Connect the power plug cable to a power outlet with a ground terminal.***
   - ***If an extension cord without a ground terminal is used, ground protection will be lost.***

The following power plugs are available at ADVANTEST for each country. See page plug-1*.
Contact ADVANTEST for more information on available power plugs.

1.4.5 First Time Usage

When the Q8492 is turned on for the first time, perform the following procedure.

Note: ***To obtain accurate measurements, use the Q8492 within the specified environmental conditions. Also, wait five minutes or more for the unit to warm up.***

(1) OTDR unit

Procedure:

① Turn the power switch (located on the front panel) OFF.

② Plug the power cable to the AC power connector on the rear panel.

CAUTION!
Do not use a higher input voltage or frequency than specified limits of the Q8492 to prevent damage (see subsection 1.4.2).

③ Connect the plug of the power cable to the AC outlet.

④ Turn the power switch (located on the front panel) on.

While the self-test is running, the product number, company's name and product version are displayed on the screen.
On completion of the self-test, the startup screen is displayed (see Figure 1-8).

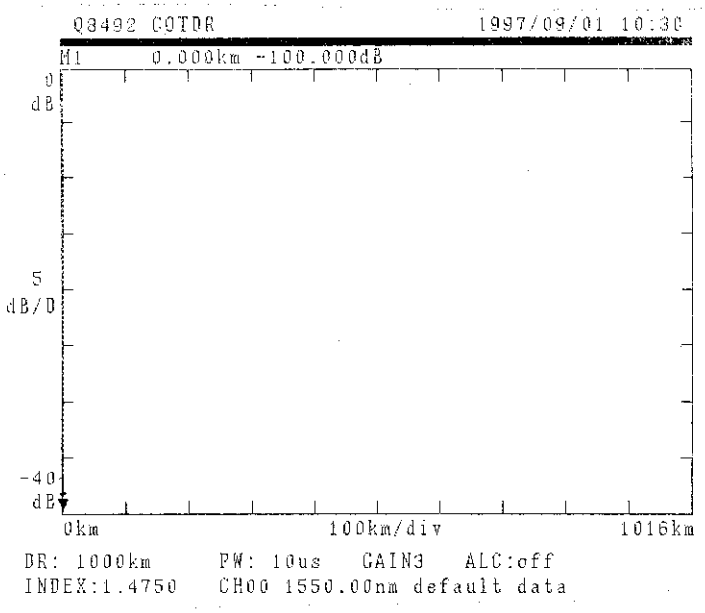


Figure 1-7 Display Screen after Power On

Note1: ***When the Q8492 is turned on, measuring conditions set previously when the unit was turned off are recalled, but the waveform is not displayed.***

⑤ If the display is different from the Figure 1-8, press the PRESET key to initialize the set conditions.

(2) Light Source Unit

Procedure:

① Turn the power switch (located on the front panel) OFF.

② Plug the power cable to the AC power connector on the rear panel.

CAUTION!
Do not use a higher input voltage or frequency than specified limits.

③ Connect the power cable to the AC outlet.

④ Turn the unit (located on the front panel) on.

1.4.6 Color Liquid Crystal Display (LCD)

The brightness knob for the color LCD is located next to the screen on the front panel.
Use this knob to adjust the intensity to fit to the ambient brightness.
Since a vertical view angle of the color LCD is narrower than that of the CRT display, a tilt mechanism to tilt the LCD vertically is used. Adjust it so that you can see the LCD easily when operating the unit.

1.5 CAUTION to Use Q8492

(1) Never attempt to look directly into the laser beam emitted by the connectors. While it is invisible, it may irrecoverably damage your eyesight.

The connectors from which the laser beam is irradiated are as follows:

- OUTPUT connector mounted on the front panel of the OTDR unit
- MONITOR A connector mounted on the front panel of the OTDR unit
- MONITOR B connector mounted on the front panel of the OTDR unit
- OPTICAL OUTPUT A connector mounted on the rear panel of the Light Source unit
- OPTICAL OUTPUT B connector mounted on the rear panel of the Light Source unit

CAUTION!
Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

(2) Do not open the case. ADVANTEST assumes no responsibility for problems caused by opening the case without permission.

CAUTION for electric shock:
The Q8492 has a high voltage section and it may cause electric shock when accessing it directly.

CAUTION!
The laser beam emitted by the Q8492 may cause radiation exposure.

(3) When replacing fuses, be sure to use fuses of the same type and standards in order to prevent fire.

(4) Insert AC Voltage Change switch/Fuse holder correctly when replacing the fuse.

Since AC Voltage Change switch/Fuse holder of the Light Source unit is incorporated with an AC voltage change switch, note that the setting of AC voltage changes depending on the orientation of the use holder.

(5) When failures or abnormal conditions occur in this unit, please contact your nearest ADVANTEST sales office or agency.

The address and phone number are listed at the end of this manual.

1.6 Cleaning, Storing and Transporting

1.6.1 Cleaning

Wipe off the dirt on the Q8492 unit with a soft cloth or small brush. Do not use the brush to clean the keys on the front panel. Wipe off the heavy dirt using cloth wet with water and a natural detergent. Do not use polishing materials.

CAUTION!
Be careful not to let water enter into the Q8492 unit. Do not use organic solvents such as benzene, toluene, xylene, acetone and so on. These solvents cause deterioration in the quality of plastics.

1.6.2 Storing

Store this unit under the temperature of -10°C to +45°C. If the unit is not used for long period (90 days or more), store the unit in a moisture-proof bag with a desiccant.

Also, store the unit in a place free from dust and direct sunlight.

1.6.3 Transporting

When transporting the Q8492, use the packing materials used when the unit was first delivered to the customer. If you don't have these packing materials, pack the unit as per the following procedure.

Procedure:

① Use a corrugated carton of internal dimensions 15 cm larger than the external dimensions of the unit so that the cushions can be put into the carton.

② Cover the Q8492 with plastic sheets to protect the unit.

③ Put cushions or plastic foams into the corrugated carton to cover all sides of the unit.

④ Staple the corrugated carton with strong industrial staples and seal the carton with packing tape.

When sending the Q8492 to ADVANTEST for repair, attach a label detailing the following information onto the carton.

- Customer's company name and address
- Name of responsible person
- Unit serial number (written on the rear panel)
- Contents of service request

2 PANEL DESCRIPTION

This chapter describes the following items.

- The front panel, rear panel, and the names of each part of the front panel
- Annotation of the screen (comment character)

2.1 Front Panel

The panel keys and connectors on the front panel are described according to their function. For each section, its panel part is shown, then its associated panel keys and connectors are described.

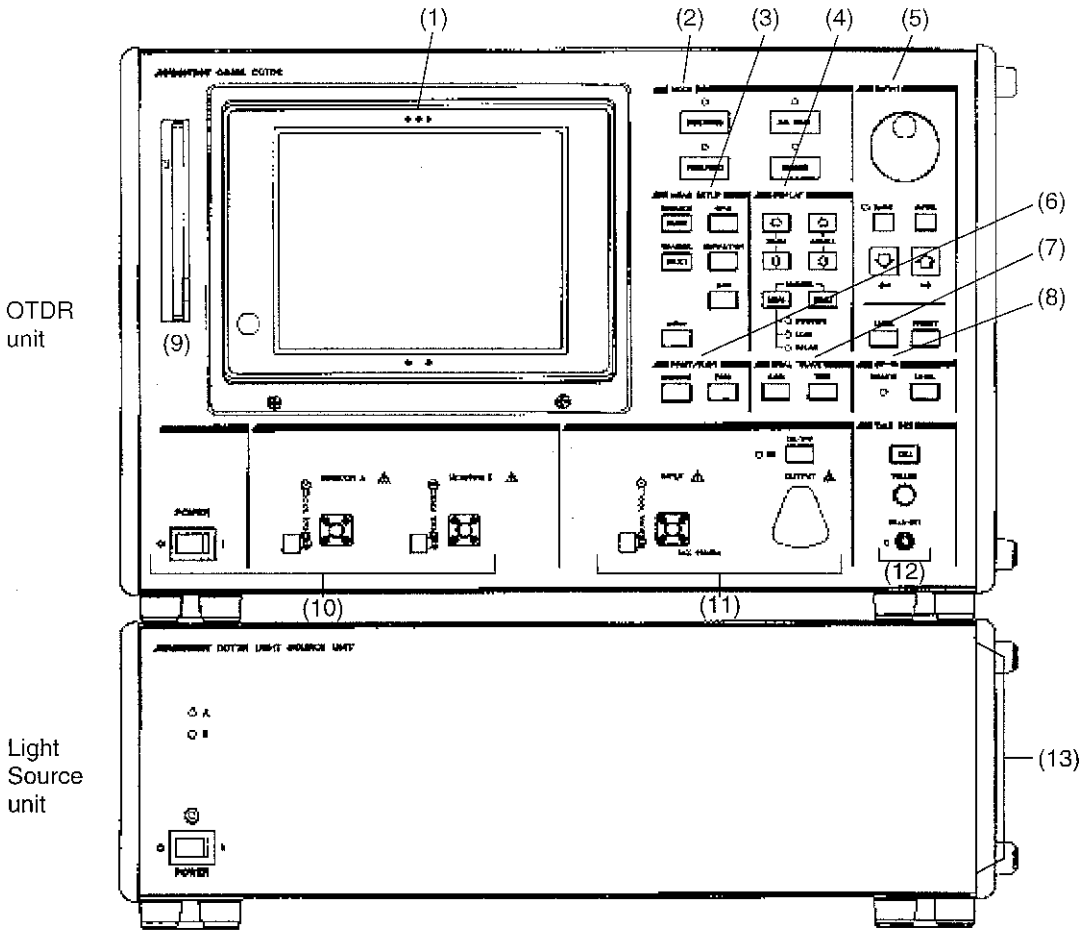
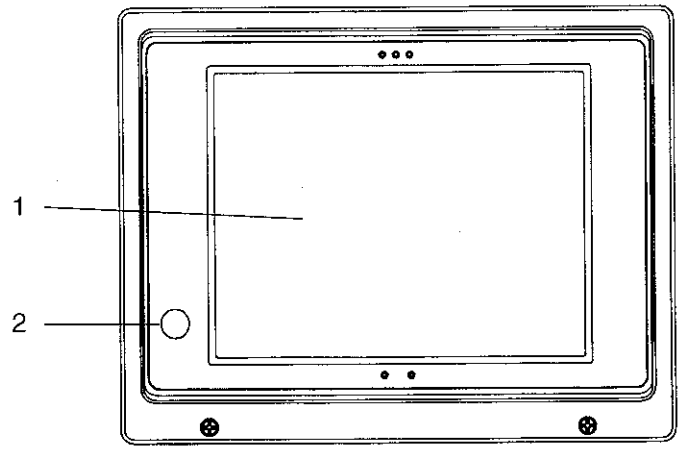


Figure 2-1 Front Panel Description

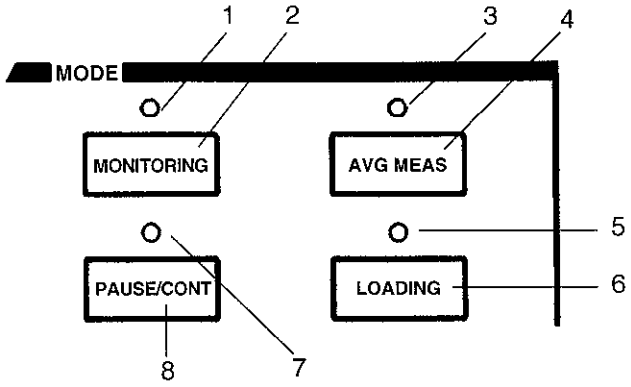
(1) Display



1 Liquid Crystal Display (LCD): This LCD displays the waveforms, measuring data, and settings. The entire display can be tilted.

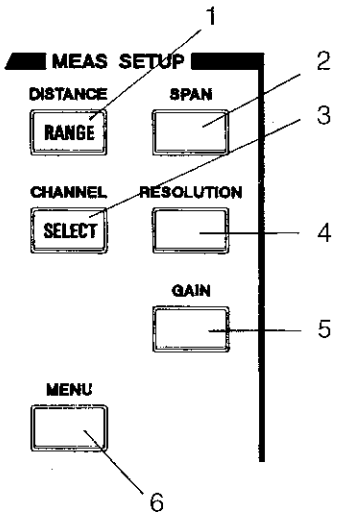
2 Brightness control knob: This knob adjusts the brightness of the display (can be adjusted from 70 % to the 100%).

(2) Mode Section



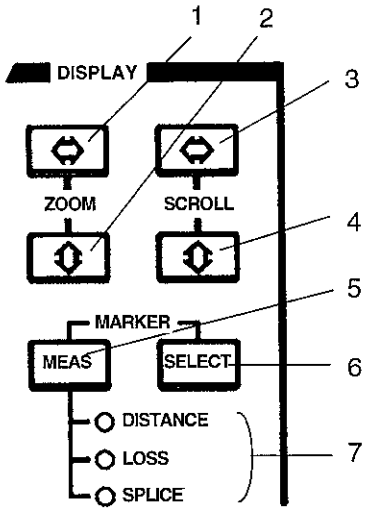
1	MONITORING LED:	This LED is lit in the MONITORING mode.
2	MONITORING key:	Pressing this key repeats measurement and displays data by executing averaging 2^8 times. The measurement conditions can be set in this mode.
3	AVG MEAS LED:	This LED is lit in the averaging measurement mode.
4	AVG MEAS key:	Pressing this key executes averaging 2^8 times or more under the conditions that are set in the MONITORING mode.
5	LOADING LED:	This LED is lit in the LOADING mode.
6	LOADING key:	Pressing this key in the MONITORING mode or in the MONITORING pause time turns the LOADING mode ON.
7	PAUSE LED:	This LED is lit in the pause time of the MONITORING mode and in the averaging measurement mode.
8	PAUSE/CONT key:	Pressing this key while in MONITORING mode or in averaging measurement mode causes a temporary pause. Pressing this key again causes the unit to continue processing.

(3) MEAS SETUP Section



1	DISTANCE RANGE key:	Pressing this key in the MONITORING mode allows the user to change the distance range.
2	SPAN key:	Pressing this key in the MONITORING mode allows the user to change the measuring span.
3	CHANNEL SELECT key:	Pressing this key in the MONITORING mode causes the wavelength list to appear on the screen and allows the user to change the measuring wavelength.
4	RESOLUTION key:	Pressing this key in the MONITORING mode allows the user to change the pulse width/resolution of the measuring light.
5	GAIN key:	Pressing this key when the ALC is set OFF in the MONITORING mode allows the user to change the internal gain.
6	MENU key:	Pressing this key turns the menu display ON or OFF.

(4) Display Section



1 ZOOM ⇔ key: Pressing this key expands/compresses the horizontal axis of the display screen.

2 ZOOM ⇕ key: Pressing this key expands/compresses the vertical axis of the display screen.

3 SCROLL ⇔ key: This key is used to move the display waveform to the left or right.

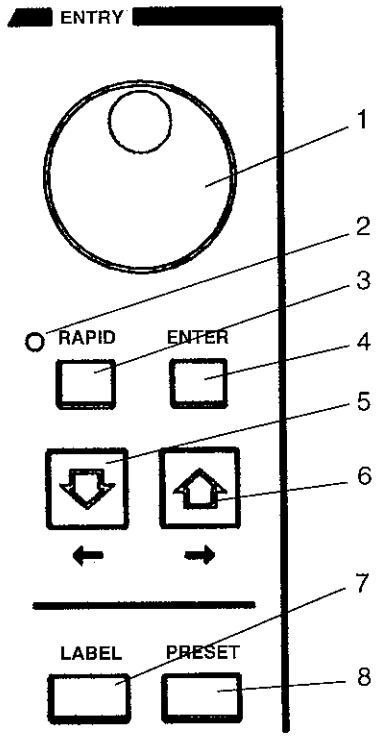
4 SCROLL ⇕ key: This key is used to move the display waveform up or down.

5 MARKER MEAS key: Pressing this key selects the measuring modes using the marker.

6 MARKER SELECT key: Pressing this key allows the markers that can be moved with the data knobs to be selected.

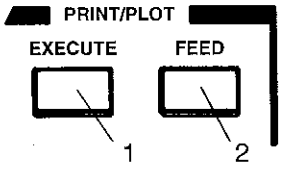
7 MARKER MEAS LED (DISTANCE/LOSS/SPLICE):
The LED for the selected marker (from three markers) is lit.

(5) ENTRY Section



1	DATA Knob:	Turning this knob performs changing data in each mode such as moving a marker, inputting a label and moving a waveform position.
2	RAPID LED:	This LED is lit when the data knob is set to rapid mode.
3	RAPID key:	Pressing this key changes the data knob's operating mode to high speed.
4	ENTER key:	Pressing this key selects functions in the window and executes the functions.
5	⇩ key: ←	• Pressing this key reduces the setting. • Pressing this key while in MENU mode moves the cursor to the left.
6	⇧ key: →	• Pressing this key increases the setting. • Pressing this key while in MENU mode moves the cursor to the right.
7	LABEL key:	Pressing this key allows the user to set a label.
8	PRESET key:	Pressing this key initializes the Q8492 measuring conditions.

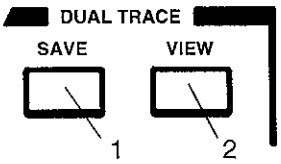
(6) Print/Plot Section



1 EXECUTE key: Pressing this key copies the screen on the built-in printer or the external plotter.

2 FEED key: Pressing this key feeds approx. 6 cm of paper.

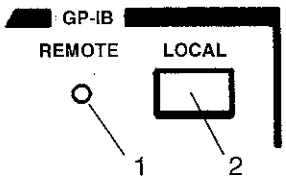
(7) DUAL TRACE Section



1 SAVE key: Pressing this key saves the waveforms into the internal memory.

2 VIEW key: Pressing this key displays the current waveform and the previously saved one simultaneously.

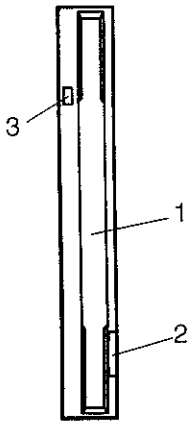
(8) GPIB Section



1 REMOTE LED: This LED is lit when the Q8492 is externaly controlled by the GPIB.

2 LOCAL key: Pressing this key when the Q8492 is externaly controlled by the GPIB allows panel key control.

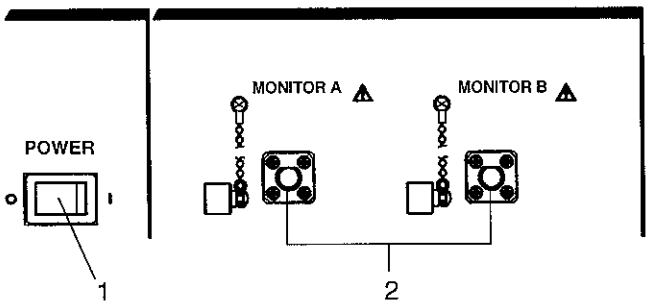
(9) Floppy Disk Drive Section



1	Floppy Disk Drive:	Used to save data or to load previously saved data from floppy disks.
2	Eject Button:	Pressing this button ejects the floppy disk. When pressed, the floppy disk will be ejected.
3	Disk Drive Lamp:	This lamp is lit when reading/writing data.

WARNING!
Do not press the eject button when the disk drive lamp is lit in green.

(10) Power/Monitor Section



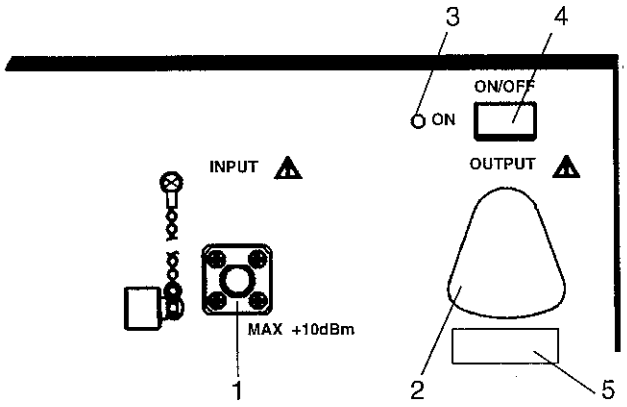
1 POWER Switch: Pressing this button turns the OTDR unit power supply ON or OFF.

2 MONITOR A/B Connectors: Each light output connector is used to monitor wavelength of either the A or B channel.

WARNING!
Never attempt to look directly into the laser beam emitted by the connectors. While it is invisible, it may irrecoverably damage your eyesight.

CAUTION!
When the fiber cable is not connected, cover the connector with the supplied cap to keep it free of dust and dirt.

(11) INPUT/OUTPUT Section



1 INPUT Connector: This is the input connector for the light signal being measured.

CAUTION!

- ***A maximum of +10 dBm of light output power can be sent through the input connector. More than +10 dBm of light output power may damage the unit.***
- ***When the fiber cable is not connected, cover the connector with the supplied cap to keep it free of dust and dirt.***

2 OUTPUT Connector: This is a connector for attaching optical fiber behind the protective cover. The probe light is irradiated from the connector.

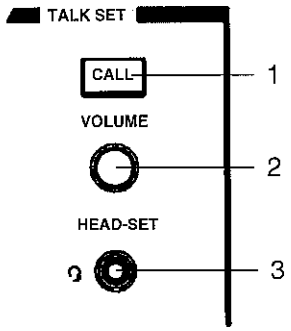
WARNING!
A maximum of +10 dBm of optical power can be irradiated.
Never attempt to look directly into the laser beam emitted by the connectors. While it is invisible, it may irrecoverably damage your eyesight.

3 OUTPUT LED: This LED is lit when light is being emitted from the output connector.

4 OUTPUT key: Pressing this key turns light output on or off.

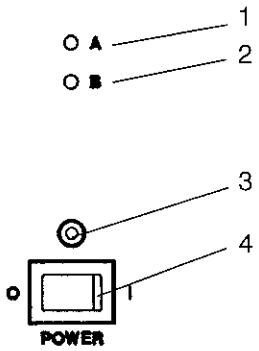
5 Stick on the seal  (which is one of the labels in "CLASS 3A LASER PRODUCT labels") to this position.

(12) Talkset Section



1	Call Key:	Pressing this key calls another Q8492 on the same line.
2	VOLUME Knob:	Turning this knob adjusts the volume when using the Talkset.
3	HEAD SET Jack:	Insert the head set terminal into this jack.

(13) Light Source Unit



1	A channel LED:	This LED is lit when A channel light is emitted.
2	B channel LED:	This LED is lit when B channel light is emitted.
3	POWER LED:	This LED is lit when the Light Source unit power supply is on.
4	POWER Switch:	This switch turns the Light Source unit power supply on or off.

2.2 Rear panel

This section describes the locations of the connectors, line fuses, and the list of installed options.

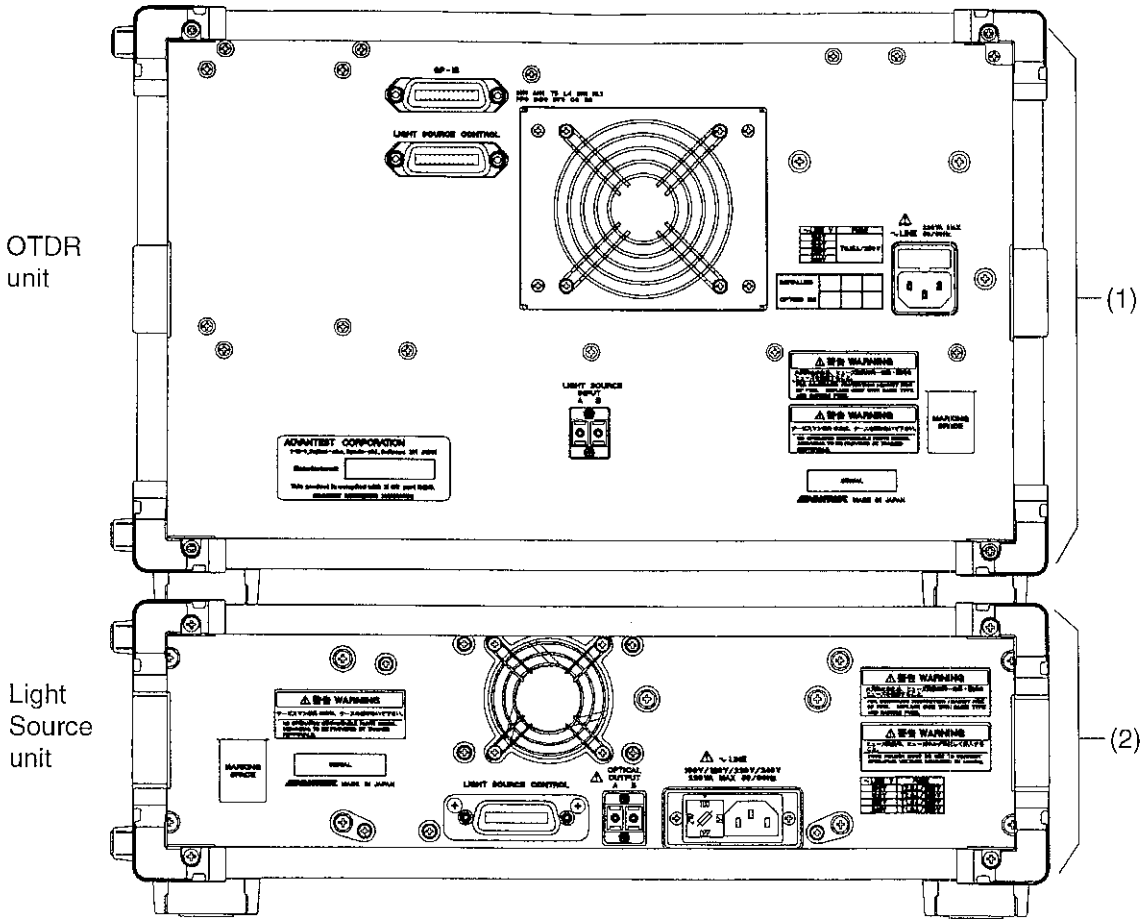
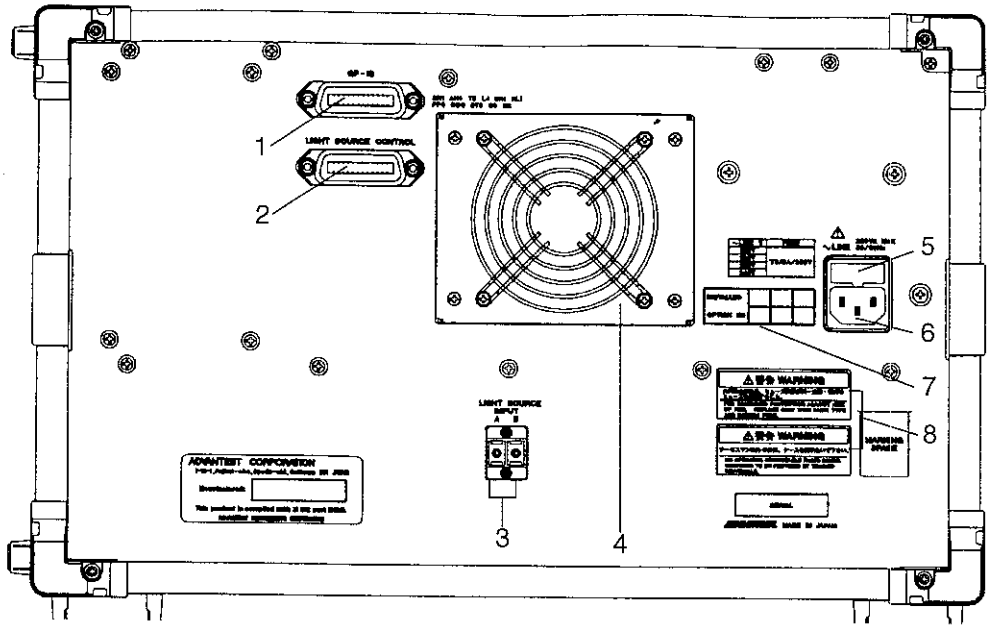


Figure 2-2 Rear Panel Description

(1) OTDR Unit



1 GPIB Connector: This connector is used when connecting the OTDR unit to the external controller/plotter using the GPIB cable.

2 LIGHT SOURCE CONTROL Connector:
This connector is used when connecting the GPIB cable to control the Light Source unit.

3 LIGHT SOURCE INPUT A/B Connectors:
Each connector is used when connecting the OTDR unit to the Light Source unit with the attached optical fiber cable.

CAUTION!
When the fiber cable is not inserted into the connector, cover the connector with the supplied cap to keep it free of dust and dirt.

4 Fan: This fan is used to discharge the heat generated by Q8492 circuitry.

CAUTION!
Keep the area surrounding the air vent free of paper, plastic or other materials which might interfere with or damage the unit.

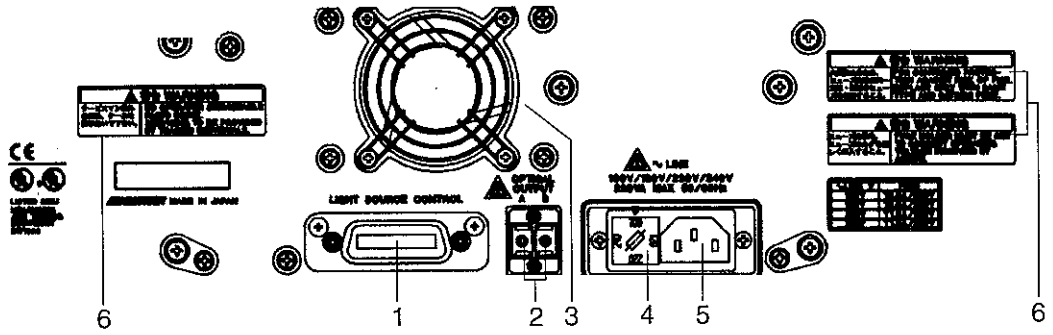
5	Fuse holder:	When the fuse holder is pulled out, the fuse can be removed.

CAUTIONS!

1. ***When replacing the fuse, use a fuse of the same standards and type to prevent against fire.***
2. ***Make sure to reconnect the Fuse holder correctly after replacing the fuse.***

6	AC power supply connector:	The power supply included is a 3-pin type.
7	Option label:	This label shows any options which have been installed in the unit.
8	WARNING label:	Read the warning labels in order to use the unit safely.

(2) Light Source Unit



1 Light Source control connector:
This connects the OTDR unit to the Light Source unit.

2 OPTICAL OUTPUT A/B connectors:
Each connector connects the Light Source unit to the OTDR unit with the attached optical fiber cable.

WARNING!
Never attempt to look directly into the laser beam emitted by the connectors. While it is invisible, it may irrecoverably damage your eyesight.

CAUTION!
When the fiber cable is not inserted into the connector, cover the connector with the supplied cap to keep it free of dust and dirt.

3 Fan: This is the fan for discharging the heat generated in the circuit of the Q8492 .

CAUTION!
Keep the area surrounding the air vent free of paper, plastic or other materials which might interfere with or damage the unit.

4 AC Voltage Change switch/Fuse holder:
Since the Fuse holder is incorporated with the AC Voltage Change switch, the setting of AC voltage changes depend on the orientation of the Fuse holder.

CAUTION!
Make sure to reattach the Fuse holder correctly when replacing the fuse.

5 AC power supply connector: The power supply included is a 3-pin type.

6 Warning label: Read all warning labels in order to use the unit safely.

2.3 Screen Annotation (comment character)

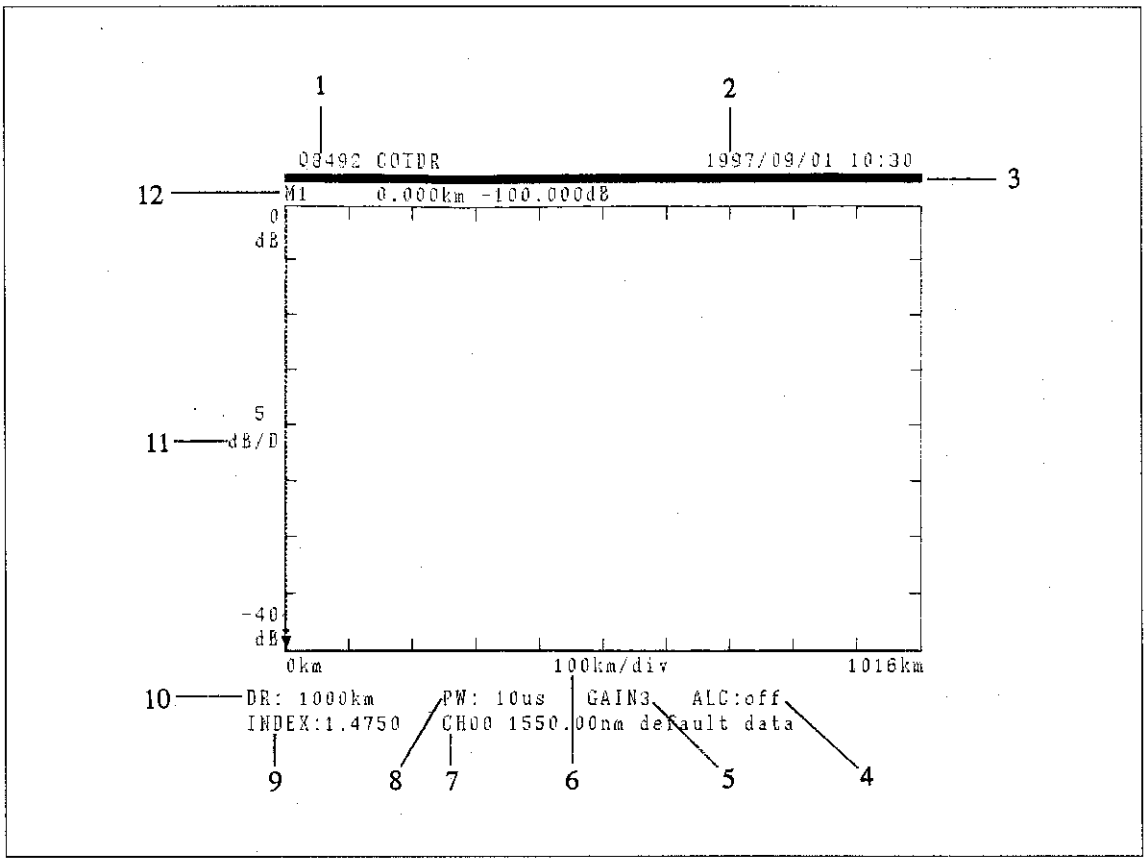


Figure 2-3 Display Description

1 Label
2 Date
3 Bar indicator
4 ALC
5 Gain
6 Horizontal scale
7 Channel No. (wavelength), wavelength, comment
8 Pulse width
9 Index
10 Distance range
11 Vertical scale
12 Marker data

2.4 Top View

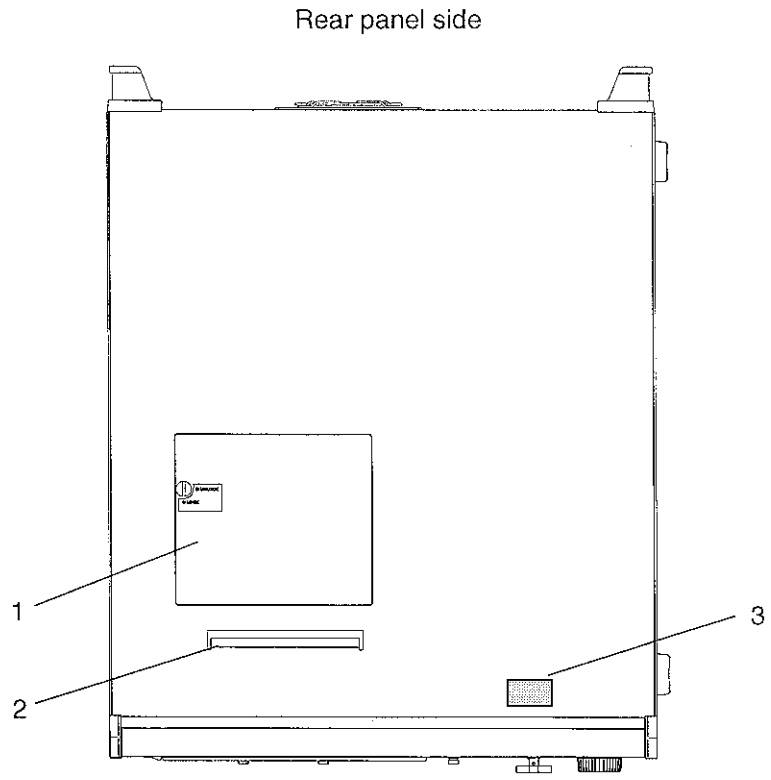


Figure 2-4 Top View

1 Built-in printer: Pages are printed out from here.

2 Printer output location: Screen data is printed out in approximately seven seconds.

3 CLASS 3A Laser Product label is put on here. Select a label in a suitable language from those included and attach it here.

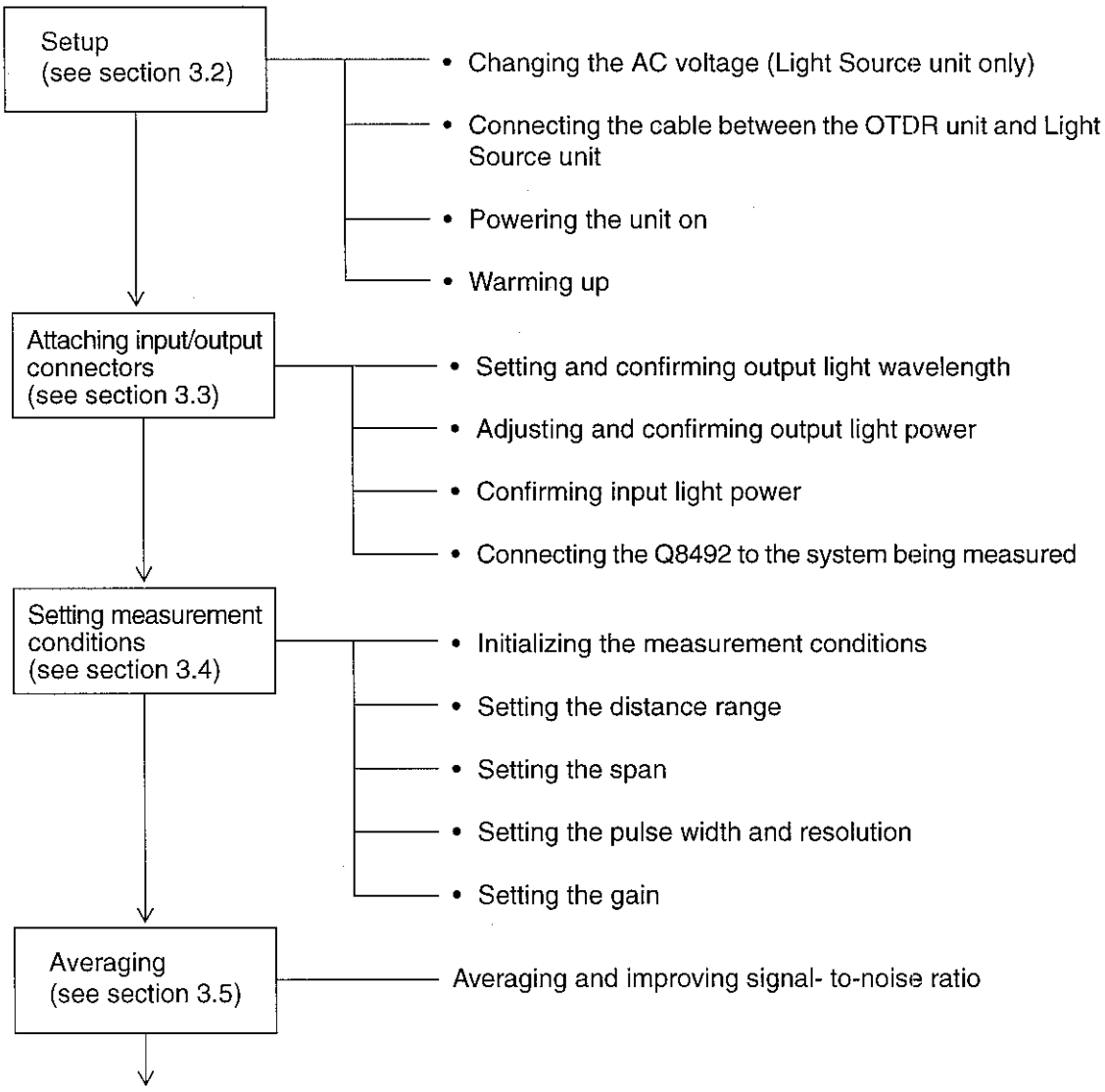
3 BASIC OPERATION

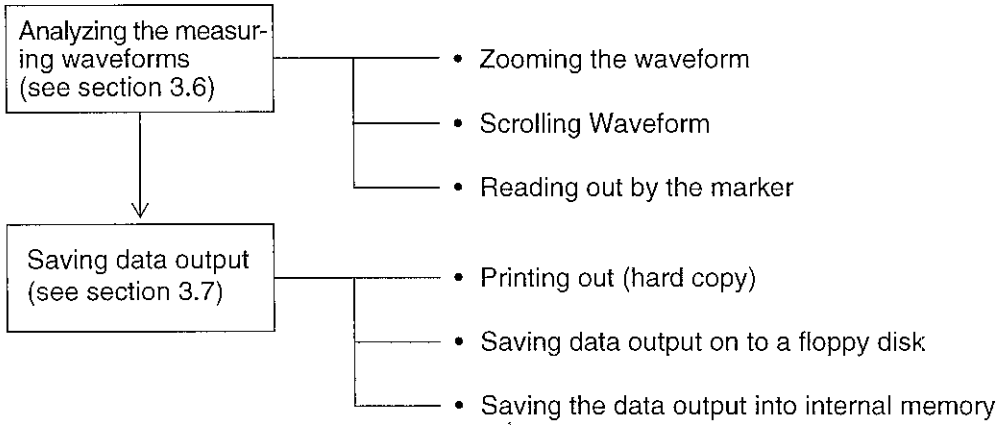
This chapter gives a brief description of the operation of the Q8492 from setup to measurement procedure.

3.1 Operation Overview

3.1.1 Operation Flow

The basic Q8492 operation flow is shown below.




Analyzing the measuring waveforms (see section 3.6)
• Zooming the waveform
• Scrolling Waveform
• Reading out by the marker
Saving data output (see section 3.7)
• Printing out (hard copy)
• Saving data output on to a floppy disk
• Saving the data output into internal memory

3.1.2 Measuring Modes

The Q8492 has four measuring modes:

- MONITORING mode: In this mode, settings can be performed while monitoring various measuring conditions (the distance range, resolution, gain, and span).
- AVERAGING MEASURING mode: In this mode, averaging is performed and signal-to-noise ratio is improved.
- PAUSE/CONTINUE mode: In this mode, monitoring and averaging measuring is stopped temporarily.
- LOADING mode: In this mode, loading light is output continuously.

(1) MONITORING mode

Pressing the MONITORING key sets the MONITORING mode.
Distance range, pulse width, gain (ALC ON/OFF) and span settings can be adjusted while using the display.

(2) AVERAGING MEASURING mode

Pressing the AVG MEAS key selects the AVERAGING MEASURING mode.
In this mode data is averaged from 2^{12} times to 2^{24} max. times and signal-to-noise ratio is improved.
During averaging, the execution progress is shown on the bar indicator.
The execution progress (using the averaging elapsed time), averaging % or averaging times can be displayed.

(3) PAUSE/CONTINUE mode

Pressing the PAUSE/CONT key temporarily stops monitoring or averaging measurement. Pressing this key again resumes the measurement.

(4) LOADING mode

Pressing the LOADING key in the MONITORING mode or in the pause of monitoring sets the LOADING mode.
In this mode, the light output status changes as shown below:

Table 3-1 Light Output Status

	MONITORING mode	AVERAGING MEASURING mode	LOADING mode*
Signal light	Modulation ON		Modulation OFF
Loading light	Modulation ON		CW

* In the LOADING mode, only the loading light is output and the signal light cannot be output from the OUTPUT connector.

3.2 Setup

3.2.1 Changing the AC Voltage (for the Light Source Unit Only)

The AC voltage must be changed manually for the Light Source unit. It is necessary to change the AC voltage change switch setting and fuse on the rear panel according to the input voltage.

See subsection 1.4.3 , item (2) for the procedure.

3.2.2 Connecting Cables

Before turning the power ON, connect the cables on the rear panel.

Procedure:

① Turn the OTDR unit power switch OFF.

② Turn the Light Source unit power switch OFF.

③ Connect the cables as shown in Figure 3-1.

CAUTION!
Use the attached optical fiber cables. If other optical fiber cables are used, the performance may be affected.

	OTDR unit	Light Source unit	Remarks
1	LIGHT SOURCE CONTROL connector	LIGHT SOURCE CONTROL connector	Connect with the GPIB cable.
2	LIGHT SOURCE INPUT A/B connectors	OPTICAL OUTPUT A/B connectors	Connect with the attached fiber optical cable.

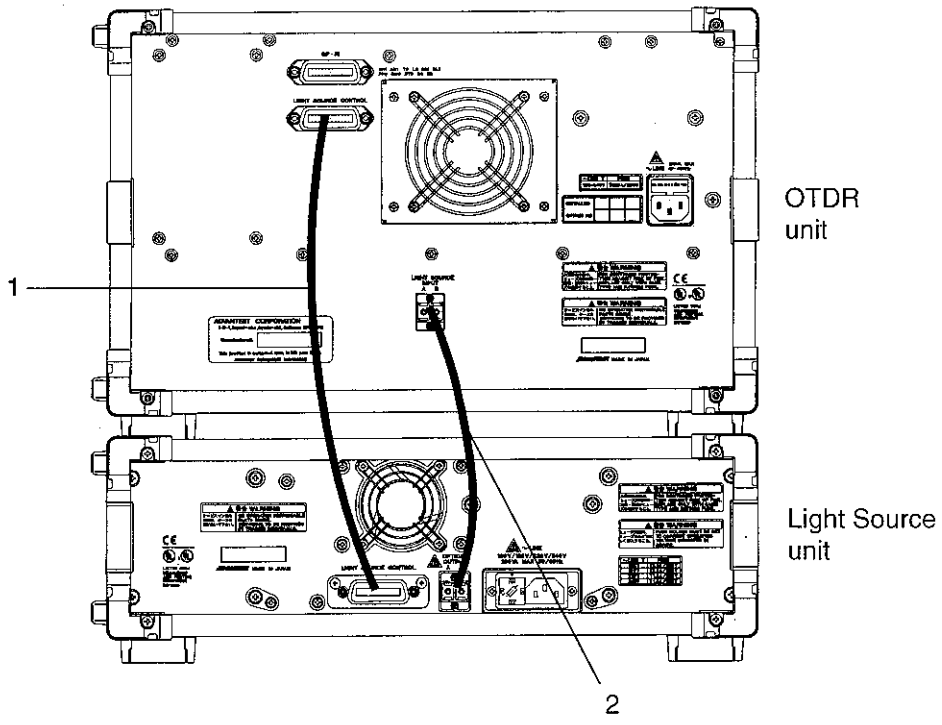


Figure 3-1 Connecting Cable on the Rear Panel

3.2.3 Powering On

After connecting the cables (see subsection 3.2.2), turn the power ON.

Procedure:

① Connect the Light Source unit power cable to the AC power supply connector.

② Connect the OTDR unit power cable to the AC power supply connector.

③ Before turning the OTDR unit power ON, turn the Light Source unit power switch ON. (Note)

④ Turn the OTDR unit power switch ON.
The product number, company logo and product version are displayed on the screen, and then initial operation check for the Light Source unit is performed.

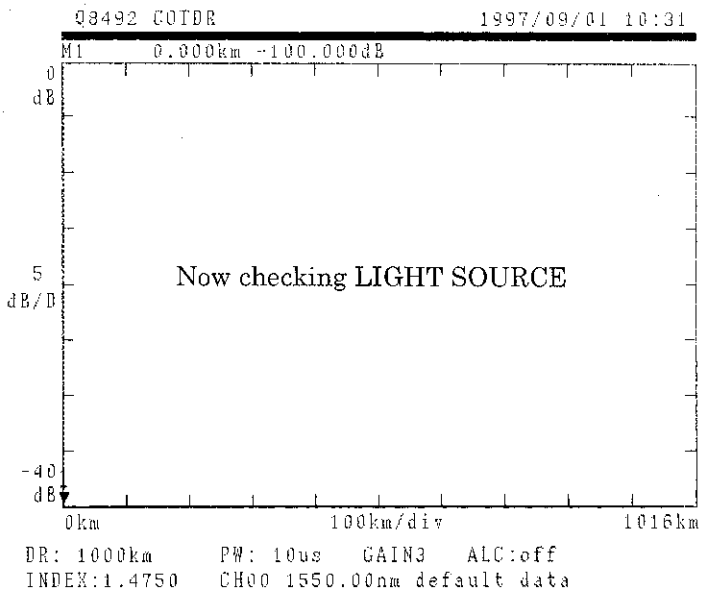


Figure 3-2 Screen During Initial Operation Check

When the initial operation check is completed, the message "Now checking LIGHT SOURCE" disappears from the screen. (approximately 2 minutes after the power is turned on)

Note: Turn the Light Source unit power ON within three seconds after turning the OTDR unit power ON (steps ③ and ④). Otherwise, the LIGHT SOURCE unit cannot be controlled (see Figure 3-3).

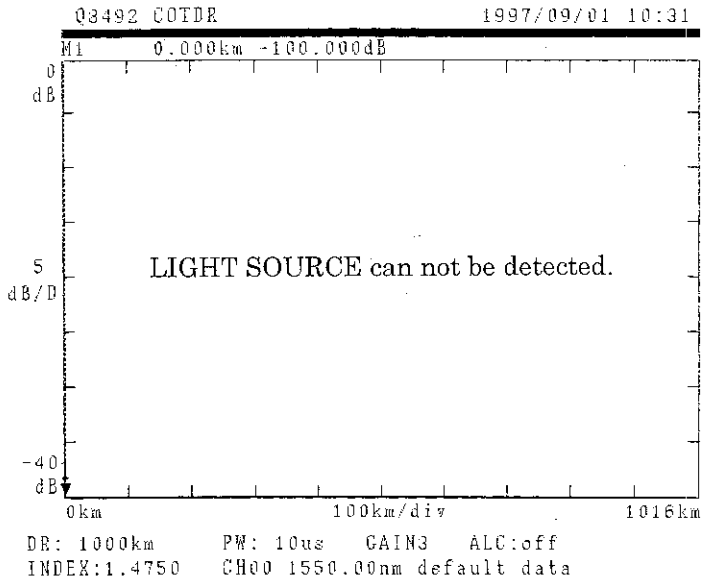


Figure 3-3 Screen When Initial Operation Check is Omitted

3.2.4 Warming Up

To ensure a stable wavelength, let the Q8492 warm up for at least five minutes after powering ON, and then start measuring.
Since the Light Source unit is an delicate mechanism, reset the unit in the monitoring mode once, and then start measurement if an abrupt ambient temperature change or external shock is received in averaging measuring mode.

CAUTION!
Performing measurements without warming up the unit may result in incorrect measurements due to wavelength fluctuations.

3.3 Connecting the INPUT/OUTPUT Connector

WARNING!
Operate the Q8492 according to the specified procedure. Failure to do so may expose otherwise, you may be exposed to laser irradiation.

3.3.1 Setting and Confirming Output Light Wavelength

(1) How to Set Wavelength

Procedure:

① Press the CHANNEL SELECT key to display the wavelength list.

② Select the CH (wavelength) to be measured using the data knob.

③ Press the ENTER key.

Note: ***When the current wavelength channel is changed, the light from the output connector is forcibly shut off.***
Press the output key to turn the light output back ON.

The initial set value of the wavelength list is as follows:
The CH00 is 1550.00 nm and a wavelength interval is +0.05 nm.

(2) How to Confirm the Wavelength

Procedure:

① When a wavelength meter TQ8325 is connected to the MONITOR A connector, the signal light being measured can be monitored.

② When the wavelength meter TQ8325 is connected to the MONITOR B connector, the loading light can be monitored.

3.3.2 Adjusting and Confirming Optical Output Power

WARNING!
Never try to look into the OUTPUT connector since +10 dBm output light power is irradiated from the OUTPUT connector.
It may cause irrecoverable damage when you look in the connector.

(1) How to Adjust Output Light Power 1:

Where the Q8492 is changed directly.

Procedure:

① Press the OUTPUT key to turn the light output ON.
The OUTPUT LED is lit.

② Connect a optical power meter or optical spectrum analyzer to the OUTPUT connector.

③ Press the MENU key and select the item of OUTPUT POWER with the ⇩ or ⇧ keys.

④ Set the output power to the specified value using the data knob.

Note: The values displayed on the screen are relative, not absolute.

(2) How to Adjust Output Light Power 2:

Where an optical attenuator is used.
This is a method that changes the Q8492 optical output using an optical attenuator.

Procedure:

① Connect the optical attenuator to the OUTPUT connector.

② Connect the optical power meter to the output of the optical attenuator.

③ Set the output power to the specified value.

3.3.3 Confirming Optical Input Power

CAUTION!
The maximum optical input power of +10 dBm (including ASE light) can be input to the Q8492. Inputting the light power of more than +10 dBm can damage the Q8492.

How to measure the optical input power

Procedure:

① Measure the light system output using the optical power meter or optical spectrum analyzer.

② If the measured values of the signal light power and all light power(including ASE light) exceed -15 dBm and +4 dBm respectively, reduce the power with the optical attenuator because the internal circuit is saturated and a correct measurement cannot be obtained.

3.3.4 Connecting to the System under Measurement

After performing the operation described in subsection 3.3.1 through 3.3.3, connect the system under measurement to the Q8492 INPUT/OUTPUT connectors.

Procedure:

① Connect the INPUT connector of the system under measurement to the Q8492 OUTPUT connector with the optical fiber cable as shown in Figure 3-4.

② • Connect the OUTPUT connector of the system under measurement to the Q8492 INPUT connector with the optical fiber cable as shown in Figure 3-4.

• Make the connection as shown in Figure 3-5 when the optical attenuator is used.

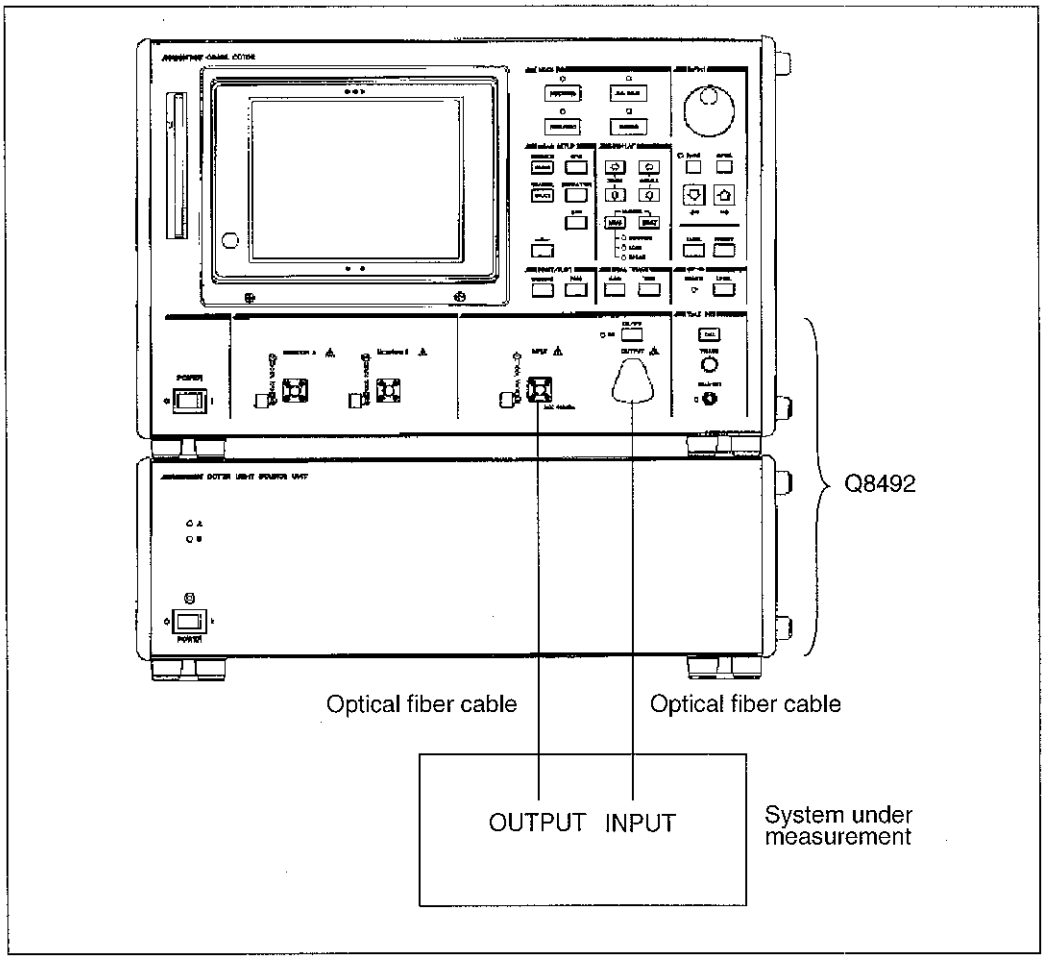


Figure 3-4 Connection with System Under Measurement

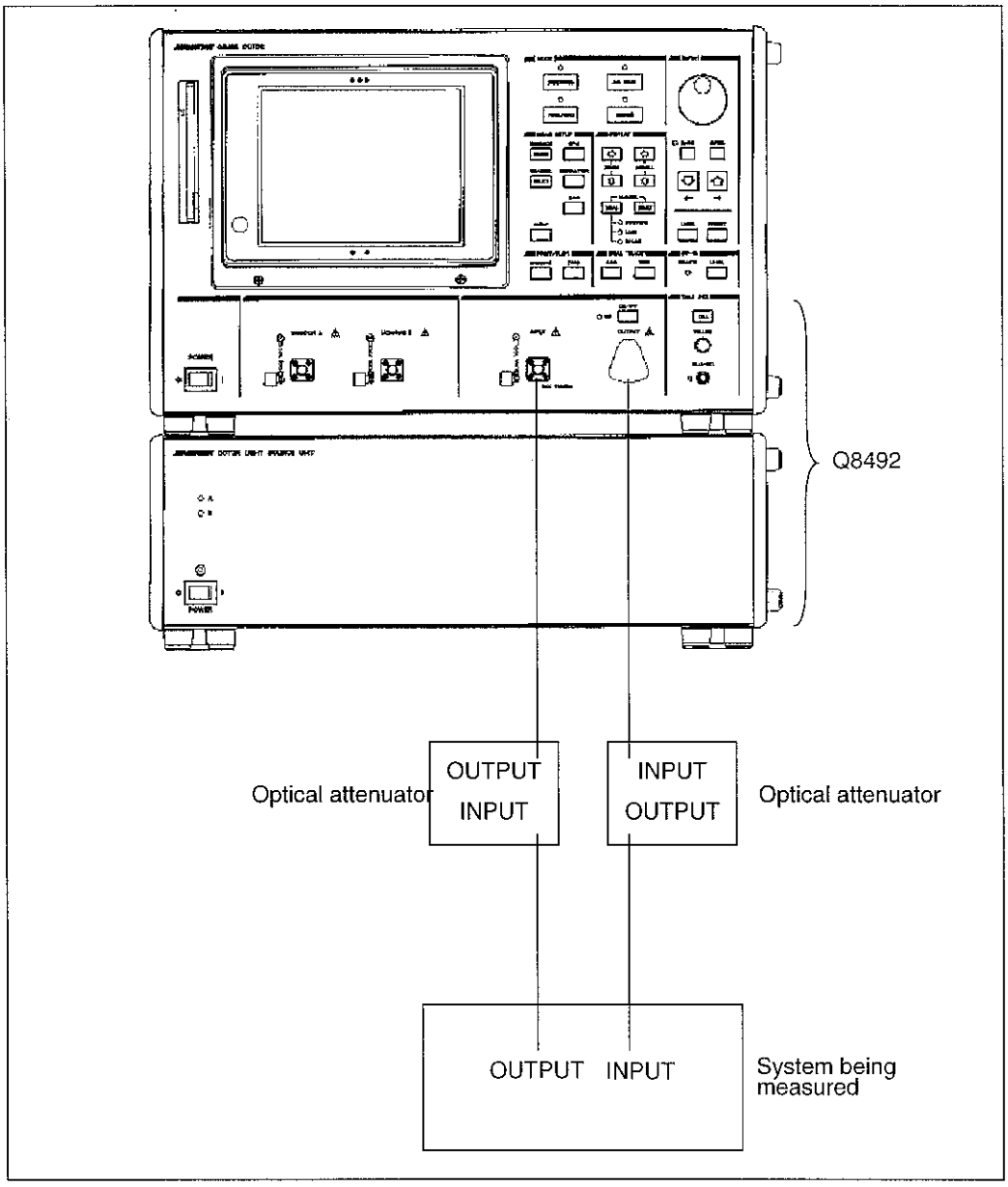


Figure 3-5 Connection to the System under Measurement (when using attenuator)

3.3.5 Measurement Using 3dB Coupler

Using the 3 dB coupler allows the Q8492 to perform the same measurement as the standard OTDR does.
An example for measurement is shown below.

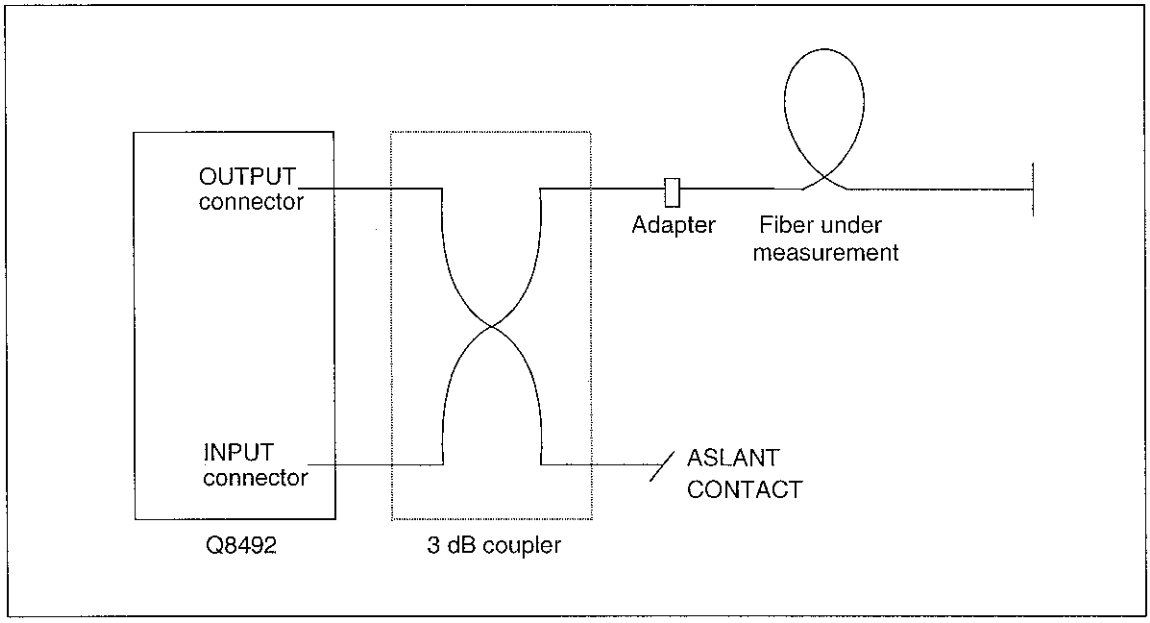


Figure 3-6 Measurement Using 3 dB Coupler

The Q8492 is designed to measure the optical paths that use optical amplifiers using a loop-back method. In the measuring method using the 3 dB coupler as shown above, the linearity can deteriorate, because the optical signal level and optical noise differ from the premise. In such a case, turn the ALC off and adjust the gain to GAIN 3 manually.

3.4 Setting Measurement Conditions

3.4.1 Initializing Measuring Conditions (Initialize)

Pressing the PRESET key initializes the measuring conditions.

Note: ***Pressing the PRESET key does not initialize the internal memory data or wavelength list.***

Table 3-2 Initializing Measuring Conditions by PRESET Key

Item	Set value
Measuring mode	MONITOR PAUSE
SPAN	Maximum SPAN
Horizontal axis start distance	0km
Vertical scale	5dB/DIV
Vertical position	0dB to -40dB
GAIN	GAIN 3 (ALC OFF)
DUAL TRACE function	OFF
DUAL TRACE waveform	CLEAR
Averaging times	256
BUZZER	ON
DATA KNOB RAPID	OFF
MARKER	DISTANCE
FILTER	OFF
Light output	OFF

Procedure:

① Press the PRESET key.
The following message is displayed.
`[If you are going to preset, press "PRESET" key again.]`

② Pressing the PRESET key once more initializes the measuring conditions.

3.4.2 Setting Distance Range

The distance range setting is performed in the MONITORING mode.

Procedure:

① If the current mode is other mode than the MONITORING mode, press the MONITORING key.

② Press the DISTANCE RANGE key.
The part of the screen for displaying the distance range is displayed in reverse video.

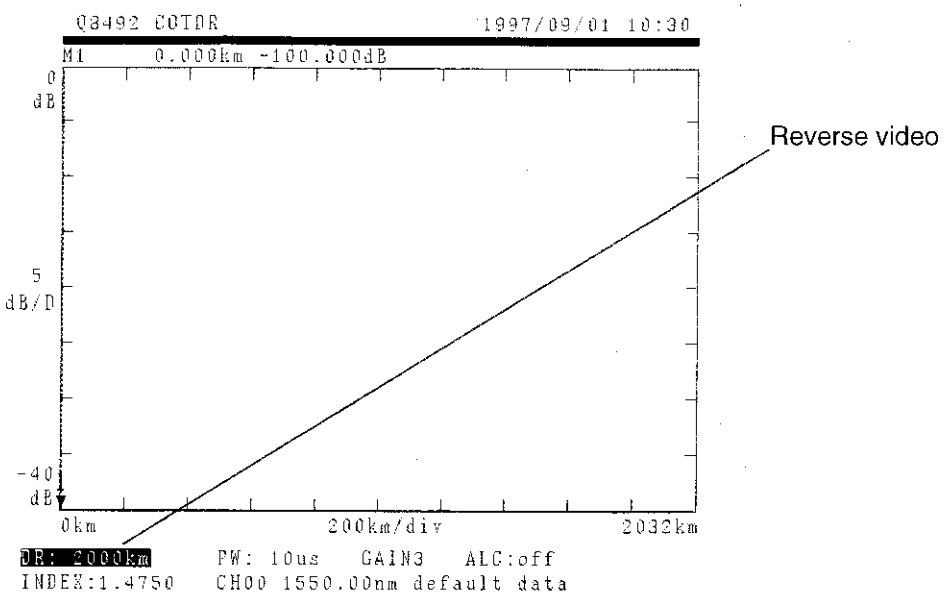


Figure 3-7 Setting Distance Range

③ Set the desired distance range using the data knob or the ⇩ and ⇧ keys.
Select a longer distance range than that of the system used for the measurement.

④ Press the DISTANCE RANGE key.

3.4.3 Setting Span

The span sets the sampling range for the distance range that is set. After averaging, the display range can be expanded or compressed only within the sampling range.
The span that can be set against the distance range is shown in Table 3-3.

Procedure:

① Press the MONITORING key if the unit is not currently in the MONITORING mode.

② Press the SPAN key. The span portion of the screen is displayed in reverse video.

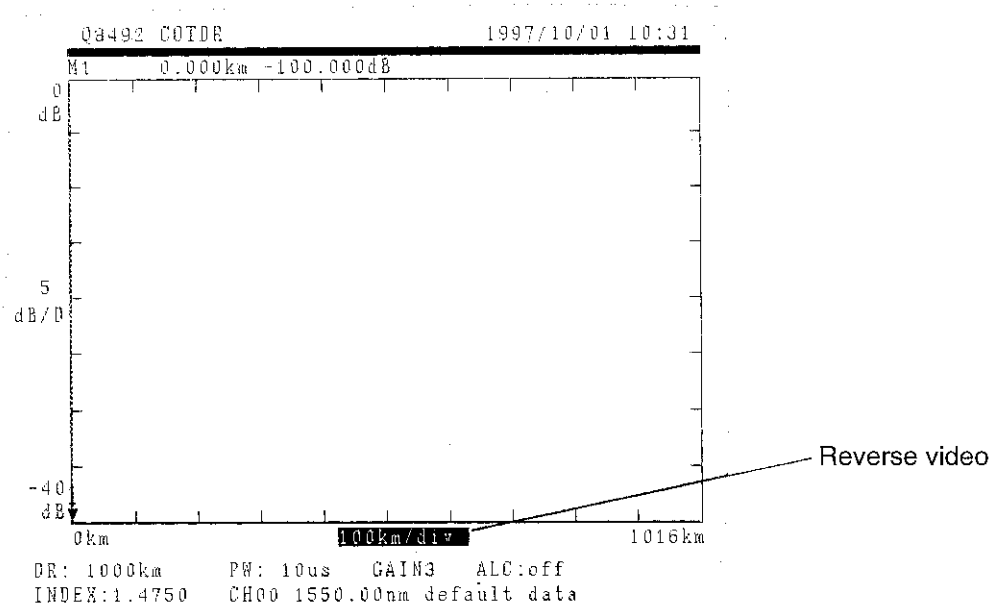


Figure 3-8 Setting Span

③ Set the desired span using the data knob or the ⇩ and ⇧ keys.
The span is expanded or compressed with the marker position as the center.

④ Press the SPAN key.

Table 3-3 Relationship between the Distance Range and Allowable Spans

DISTANCE \ SPAN	5km	10km	20km	50km	100km	200km	300km	400km	500km	600km	700km	800km	900km	1000km	2000km	3000km	4000km	5000km	6000km	7000km	8000km	9000km	10000km	11000km	12000km	13000km	14000km	15000km
100km	○	○	○	○	○																							
200km	○	○	○	○	○	○																						
300km	○	○	○	○	○	○	○																					
400km	○	○	○	○	○	○		○																				
500km	○	○	○	○	○	○			○																			
600km	○	○	○	○	○	○			○	○																		
700km	○	○	○	○	○	○			○		○																	
800km	○	○	○	○	○	○			○			○																
900km	○	○	○	○	○	○			○				○															
1000km	○	○	○	○	○	○			○					○														
2000km	○	○	○	○	○	○			○					○	○													
3000km	○	○	○	○	○	○			○					○	○	○												
4000km	○	○	○	○	○	○			○					○	○		○											
5000km	○	○	○	○	○	○			○					○	○			○										
6000km	○	○	○	○	○	○			○					○	○			○	○									
7000km	○	○	○	○	○	○			○					○	○			○		○								
8000km	○	○	○	○	○	○			○					○	○			○			○							
9000km	○	○	○	○	○	○			○					○	○			○				○						
10000km	○	○	○	○	○	○			○					○	○			○					○					
11000km	○	○	○	○	○	○			○					○	○			○					○	○				
12000km	○	○	○	○	○	○			○					○	○			○					○		○			
13000km	○	○	○	○	○	○			○					○	○			○					○			○		
14000km	○	○	○	○	○	○			○					○	○			○					○				○	
15000km	○	○	○	○	○	○			○					○	○			○					○					○

○: Allowable spans

3.4.4 Setting Pulse Width/Resolution

The pulse width/resolution can be set while in MONITORING mode.

Procedure:

① Press the MONITORING key if the unit is not currently in the MONITORING mode.

② Press the RESOLUTION key.
The portion for displaying the pulse width/resolution is displayed in reverse video.

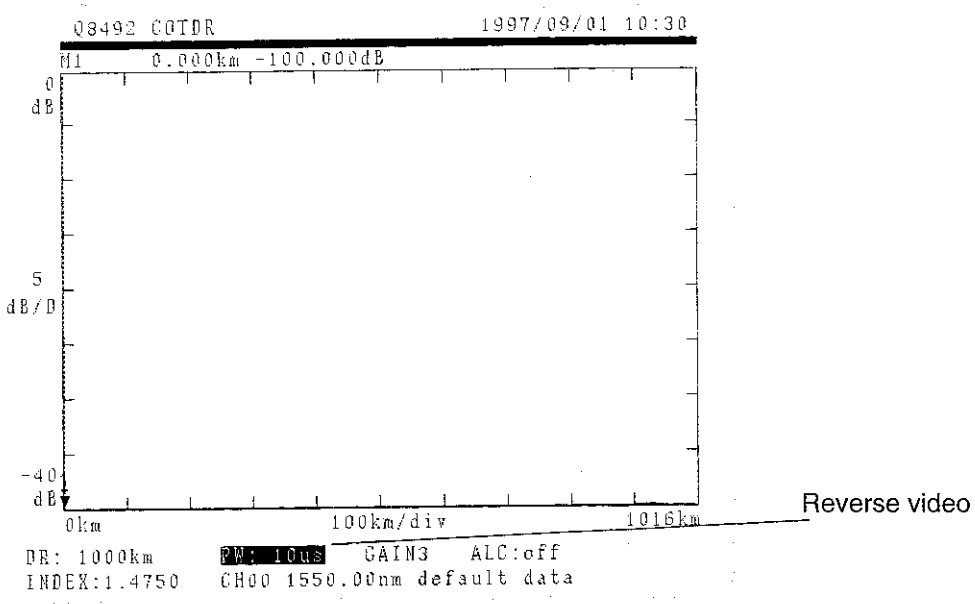


Figure 3-9 Setting Pulse Width/Resolution

③ Set the desired pulse width/resolution using data knob or the ⇩ and ⇧ keys.

④ Press the RESOLUTION key.

3.4.5 Setting the Gain

The gain can be set while in MONITORING mode.

Procedure:

① Press the MONITORING key if the unit is not currently in the MONITORING mode.

② • When the ALC is on, pressing the AVG MEAS key allows the gain to be set automatically.

• When the ALC is off, press the GAIN key. The gain can be adjusted by the data knob or the ⇩ and ⇧ keys.

Note: The GAIN 3 is the proper gain for a normal system.

③ Press the GAIN key.

3.4.6 Measuring the Wavelength

The wavelength can be set while in MONITORING mode.

Procedure:

① Press the MONITORING key if the unit is not currently in the MONITORING mode.

② Press the CHANNEL SELECT key.

③ Set the desired channel using the data knob.

Note: See Section 4.1 for information on how to change the wavelength list.

④ Press the ENTER key.

Note: The output light at the OUTPUT section will automatically shut off. Press the OUTPUT key after checking the wavelength.

3.5 Averaging

Averaging improves the signal-to-noise ratio.

3.5.1 Setting Procedure

① Press the MENU key.

② Set the number of averaging times (16 to 65536) using the data knob.

③ Select the AVERAGE with the ⇩ and ⇧ keys.

The time required for averaging varies depending on the distance range and the number of averaging times. The approximate averaging time is shown on the screen.

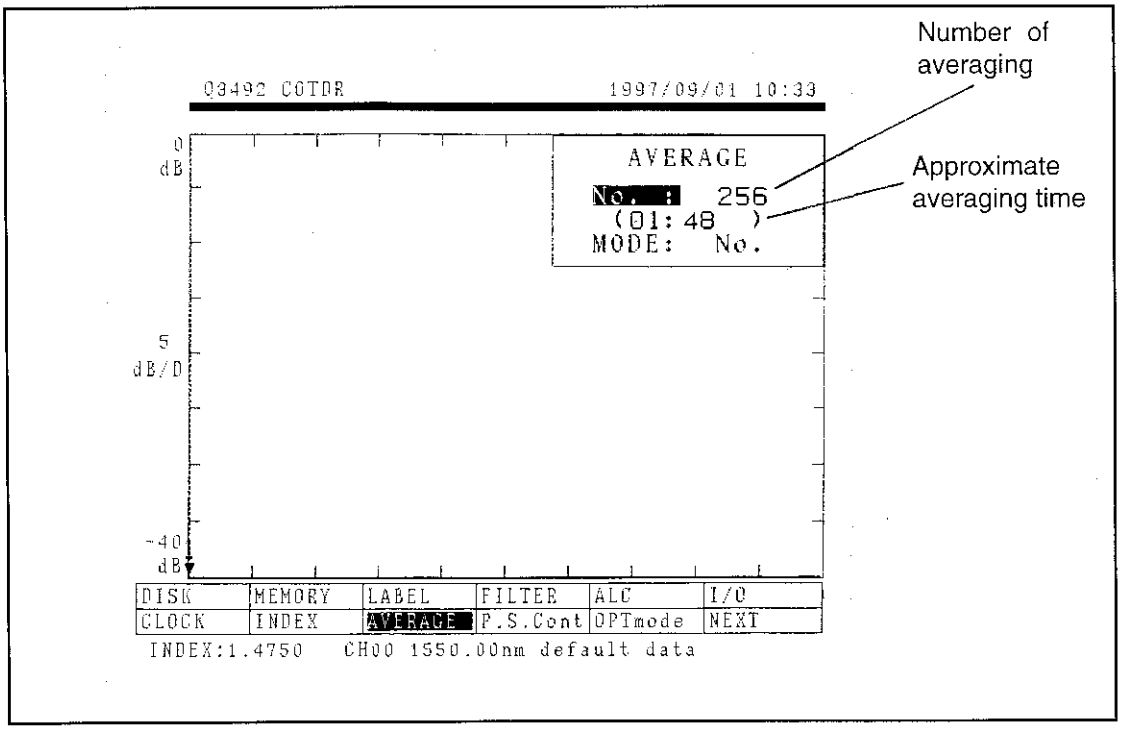


Figure 3-10 Executing Averaging

3.5.2 Averaging

Procedure:

Pressing the AVG MEAS key starts the averaging. When the averaging is completed, beeps are sounded.

Note: ***The measurement conditions cannot be changed during the averaging.***

3.6 Analyzing the Measuring Waveform

3.6.1 Zooming the Waveform

Use the ZOOM ⇔ key when zooming in the direction of distance.

Use the ZOOM ⇕ key when zooming in the direction of level.

The zoom function enlarges or reduces an area centered on the marker.

Note1: The zooming in the direction of distance can be performed within the sampling range that is set in subsection 3.4.3.

Note2: The changeable range is dependent on the distance range and the set span (see table 3-4).

Procedure:

① Pressing the ZOOM ⇔ key or ZOOM ⇕ key causes the scale portion of the screen to be displayed in reverse video.

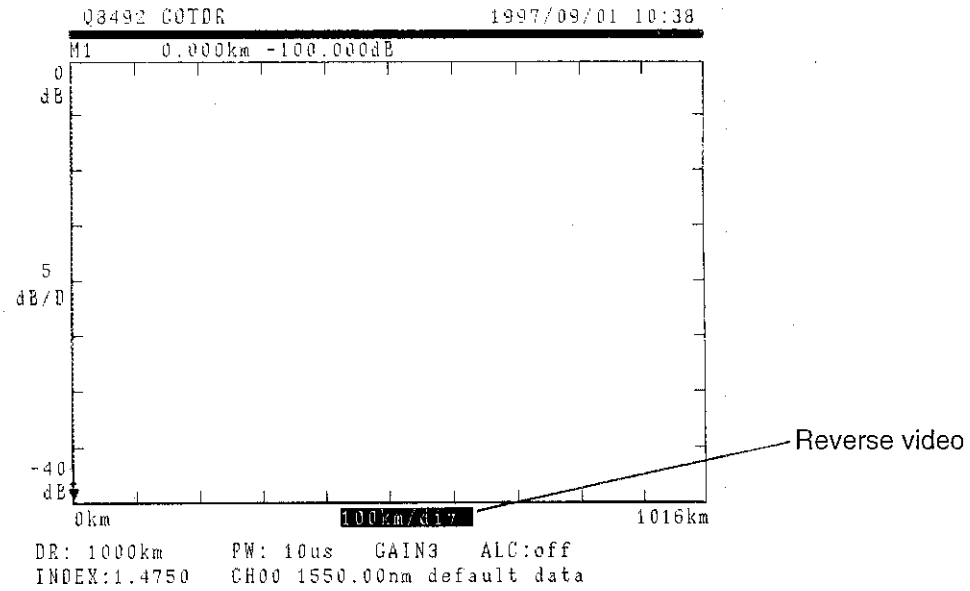


Figure 3-11 Screen When ZOOM ⇔ Key is Pressed

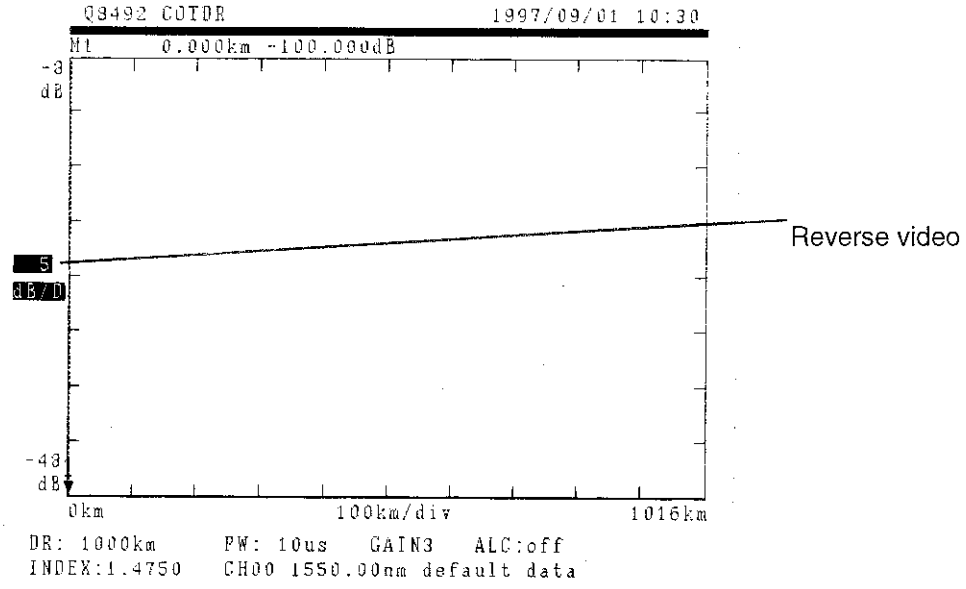


Figure 3-12 Screen When ZOOM ⇕ Key is Pressed

② The scale can be changed with the data knob or the ⇩ and ⇧ keys.

Table 3-4 Zooming Range Corresponding to Distance Range and Span (1 of 10)

Distance range	Span (km)				
100km	5	10	20	50	100
	○	→	→	→	→
	←	○	→	→	→
	←	←	○	→	→
		←	←	○	→
		←	←	←	○

○ : Set span

←→ : Zoomable span

Distance range	Span (km)					
200km	5	10	20	50	100	200
	○	→	→	→	→	
	←	○	→	→	→	
	←	←	○	→	→	
		←	←	○	→	→
		←	←	←	○	→
		←	←	←	←	○

Distance range	Span (km)						
300km	5	10	20	50	100	200	300
	○	→	→	→	→		
	←	○	→	→	→		
	←	←	○	→	→		
		←	←	○	→	→	→
		←	←	←	○	→	→
			←	←	←	○	→
			←	←	←	←	○

Table 3-4 Zooming Range Corresponding to Distance Range and Span (2 of 10)

Distance range	Span (km)						
400km	5	10	20	50	100	200	400
	○	→	→	→	→		
	←	○	→	→	→		
	←	←	○	→	→		
		←	←	○	→	→	
		←	←	←	○	→	
			←	←	←	○	→
			←	←	←	←	○

Distance range	Span (km)						
500km	5	10	20	50	100	200	500
	○	→	→	→	→		
	←	○	→	→	→		
	←	←	○	→	→		
		←	←	○	→	→	
		←	←	←	○	→	
			←	←	←	○	→
			←	←	←	←	○

Distance range	Span (km)							
600km	5	10	20	50	100	200	500	600
	○	→	→	→	→			
	←	○	→	→	→			
	←	←	○	→	→			
		←	←	○	→	→		
		←	←	←	○	→		
			←	←	←	○	→	→
				←	←	←	○	→
				←	←	←	←	○

Table 3-4 Zooming Range Corresponding to Distance Range and Span (3 of 10)

Distance range	Span (km)							
700km	5	10	20	50	100	200	500	700
	○	→	→	→	→			
	←	○	→	→	→			
	←	←	○	→	→			
		←	←	○	→	→		
		←	←	←	○	→		
			←	←	←	○	→	
					←	←	○	→
					←	←	←	○

Distance range	Span (km)							
800km	5	10	20	50	100	200	500	800
	○	→	→	→	→			
	←	○	→	→	→			
	←	←	○	→	→			
		←	←	○	→	→		
		←	←	←	○	→		
			←	←	←	○	→	
				←	←	←	○	→
				←	←	←	←	○

Distance range	Span (km)							
900km	5	10	20	50	100	200	500	900
	○	→	→	→	→			
	←	○	→	→	→			
	←	←	○	→	→			
		←	←	○	→	→		
		←	←	←	○	→		
			←	←	←	○	→	
				←	←	←	○	→
				←	←	←	←	○

Table 3-4 Zooming Range Corresponding to Distance Range and Span (4 of 10)

Distance range	Span (km)							
1,000km	5	10	20	50	100	200	500	1,000
	○	→	→	→	→			
	←	○	→	→	→			
	←	←	○	→	→			
		←	←	○	→	→		
		←	←	←	○	→		
			←	←	←	○	→	
				←	←	←	○	→
					←	←	←	○

Distance range	Span (km)								
2,000km	5	10	20	50	100	200	500	1,000	2,000
	○	→	→	→	→				
	←	○	→	→	→				
	←	←	○	→	→				
		←	←	○	→	→			
		←	←	←	○	→			
			←	←	←	○	→		
				←	←	←	○	→	
					←	←	←	○	→
					←	←	←	←	○

Distance range	Span (km)									
3,000km	5	10	20	50	100	200	500	1,000	2,000	3,000
	○	→	→	→	→					
	←	○	→	→	→					
	←	←	○	→	→					
		←	←	○	→	→				
		←	←	←	○	→				
			←	←	←	○	→			
				←	←	←	○	→		
					←	←	←	○	→	→
					←	←	←	←	○	→
					←	←	←	←	←	○

Table 3-4 Zooming Range Corresponding to Distance Range and Span (5 of 10)

Distance range	Span (km)									
4,000km	5	10	20	50	100	200	500	1,000	2,000	4,000
	○	→	→	→	→					
	←	○	→	→	→					
	←	←	○	→	→					
		←	←	○	→	→				
		←	←	←	○	→				
			←	←	←	○	→			
				←	←	←	○	→		
					←	←	←	○	→	
					←	←	←	←	○	
						←	←	←	←	○

Distance range	Span (km)									
5,000km	5	10	20	50	100	200	500	1,000	2,000	5,000
	○	→	→	→	→					
	←	○	→	→	→					
	←	←	○	→	→					
		←	←	○	→	→				
		←	←	←	○	→				
			←	←	←	○	→			
				←	←	←	○	→		
					←	←	←	○	→	
					←	←	←	←	○	
						←	←	←	←	○

Table 3-4 Zooming Range Corresponding to Distance Range and Span (6 of 10)

Distance range	Span (km)										
6,000km	5	10	20	50	100	200	500	1,000	2,000	5,000	6,000
	○	→	→	→	→						
	←	○	→	→	→						
	←	←	○	→	→						
		←	←	○	→	→					
		←	←	←	○	→					
			←	←	←	○	→				
				←	←	←	○	→			
					←	←	←	○	→		
					←	←	←	←	○		
						←	←	←	←	○	→
							←	←	←	←	○

Distance range	Span (km)										
7,000km	5	10	20	50	100	200	500	1,000	2,000	5,000	7,000
	○	→	→	→	→						
	←	○	→	→	→						
	←	←	○	→	→						
		←	←	○	→	→					
		←	←	←	○	→					
			←	←	←	○	→				
				←	←	←	○	→			
					←	←	←	○	→		
					←	←	←	←	○		
						←	←	←	←	○	
							←	←	←	←	○

Table 3-4 Zooming Range Corresponding to Distance Range and Span (7 of 10)

Distance range	Span (km)										
8,000km	5	10	20	50	100	200	500	1,000	2,000	5,000	8,000
	○	→	→	→	→						
	←	○	→	→	→						
	←	←	○	→	→						
		←	←	○	→	→					
		←	←	←	○	→					
			←	←	←	○	→				
				←	←	←	○	→			
					←	←	←	○	→		
					←	←	←	←	○		
						←	←	←	←	○	
							←	←	←	←	○

Distance range	Span (km)										
9,000km	5	10	20	50	100	200	500	1,000	2,000	5,000	9,000
	○	→	→	→	→						
	←	○	→	→	→						
	←	←	○	→	→						
		←	←	○	→	→					
		←	←	←	○	→					
			←	←	←	○	→				
				←	←	←	○	→			
					←	←	←	○	→		
					←	←	←	←	○		
						←	←	←	←	○	
							←	←	←	←	○

Table 3-4 Zooming Range Corresponding to Distance Range and Span (8 of 10)

Distance range	Span (km)										
10,000km	5	10	20	50	100	200	500	1,000	2,000	5,000	10,000
	○	→	→	→	→						
	←	○	→	→	→						
	←	←	○	→	→						
		←	←	○	→	→					
		←	←	←	○	→					
			←	←	←	○	→				
				←	←	←	○	→			
					←	←	←	○	→		
					←	←	←	←	○		
						←	←	←	←	○	
							←	←	←	←	○

Distance range	Span (km)											
11,000km	5	10	20	50	100	200	500	1,000	2,000	5,000	10,000	11,000
	○	→	→	→	→							
	←	○	→	→	→							
	←	←	○	→	→							
		←	←	○	→	→						
		←	←	←	○	→						
			←	←	←	○	→					
				←	←	←	○	→				
					←	←	←	○	→			
					←	←	←	←	○			
						←	←	←	←	○		
							←	←	←	←	○	→
							←	←	←	←	←	○

Table 3-4 Zooming Range Corresponding to Distance Range and Span (9 of 10)

Distance range	Span (km)											
12,000km	5	10	20	50	100	200	500	1,000	2,000	5,000	10,000	12,000
	○	→	→	→	→							
	←	○	→	→	→							
	←	←	○	→	→							
		←	←	○	→	→						
		←	←	←	○	→						
			←	←	←	○	→					
				←	←	←	○	→				
					←	←	←	○	→			
					←	←	←	←	○			
						←	←	←	←	○		
							←	←	←	←	○	→
							←	←	←	←	←	○

Distance range	Span (km)											
13,000km	5	10	20	50	100	200	500	1,000	2,000	5,000	10,000	13,000
	○	→	→	→	→							
	←	○	→	→	→							
	←	←	○	→	→							
		←	←	○	→	→						
		←	←	←	○	→						
			←	←	←	○	→					
				←	←	←	○	→				
					←	←	←	○	→			
					←	←	←	←	○	→		
						←	←	←	←	○		
							←	←	←	←	○	→
							←	←	←	←	←	○

Table 3-4 Zooming Range Corresponding to Distance Range and Span (10 of 10)

Distance range	Span (km)											
14,000km	5	10	20	50	100	200	500	1,000	2,000	5,000	10,000	14,000
	○	→	→	→	→							
	←	○	→	→	→							
	←	←	○	→	→							
		←	←	○	→	→						
		←	←	←	○	→						
			←	←	←	○	→					
				←	←	←	○	→				
					←	←	←	○	→			
					←	←	←	←	○			
						←	←	←	←	○		
							←	←	←	←	○	→
							←	←	←	←	←	○

Distance range	Span (km)											
15,000km	5	10	20	50	100	200	500	1,000	2,000	5,000	10,000	15,000
	○	→	→	→	→							
	←	○	→	→	→							
	←	←	○	→	→							
		←	←	○	→	→						
		←	←	←	○	→						
			←	←	←	○	→					
				←	←	←	○	→				
					←	←	←	○	→			
					←	←	←	←	○	→		
						←	←	←	←	○		
							←	←	←	←	○	→
							←	←	←	←	←	○

3.6.2 Scrolling Waveform

Press the SCROLL ⇔ key to scroll the waveform in the direction of distance.

Press the SCROLL ⇕ key to scroll the waveform in the direction of level.

Scrolling Waveform in the direction of distance can be performed within the sampling range that is set in subsection 3.4.3.

Procedure:

① Pressing the SCROLL ⇔ key or SCROLL ⇕ key causes the upper limit or starting point portion of the screen to be displayed in reverse video.

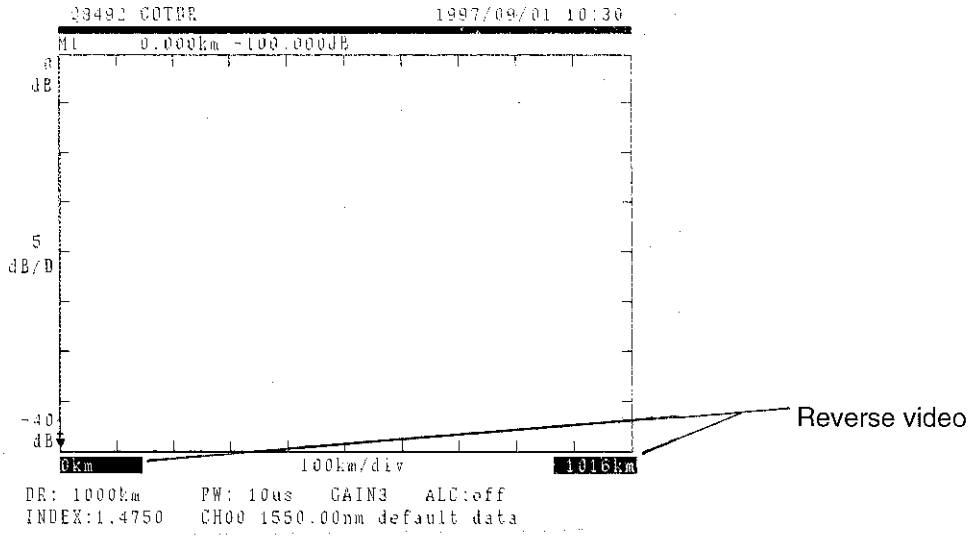


Figure 3-13 Screen When Scroll ⇔ Key is Pressed

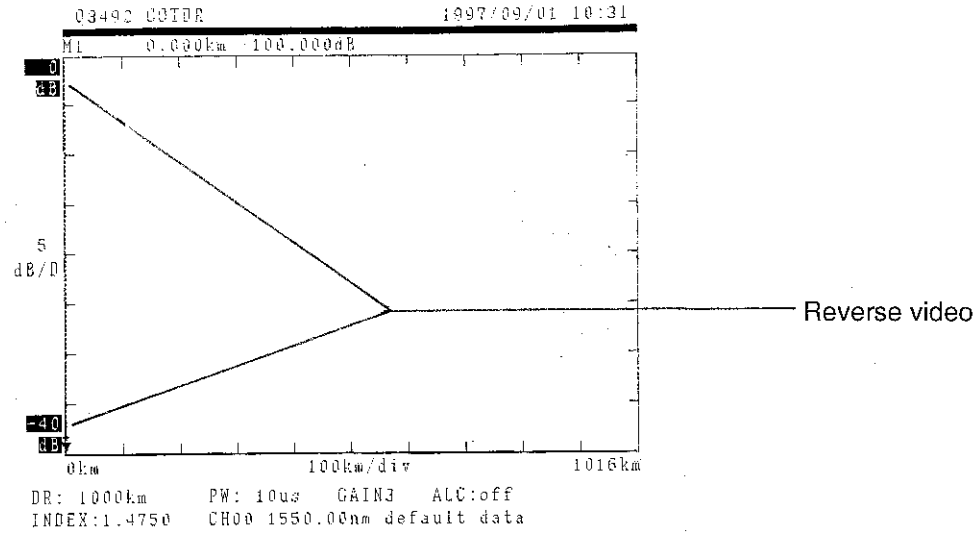


Figure 3-14 Screen When Scroll ⇕ Key is Pressed

② The desired value can be set using the data knob.

3.6.3 Reading OUT by Marker

Three types of readout, DISTANCE, LOSS, and SPLICE, can be performed using the marker. The readout can be selected by pressing the MARKER MEAS key. The function whose LED is lit can be monitored.

(1) Distance Indication (DISTANCE)

DISTANCE (M1): The M1 marker is displayed on the screen. The distance [km] from the output terminal to the M1 and the level [dB] can be measured.

(2) Loss Indication (LOSS)

LOSS (M1, M2): The M1 and M2 markers are displayed on the screen. The signal level difference [dB] between the M1 and M2, the distance [km] between the M1 and M2, and the signal loss per kilometer [dB/km] (calculated in the method of least squares) between the M1 and M2 can be measured.

The marker which is moved by the data knob can be selected by the MARKER SELECT key.

(3) Splice Loss Indication (SPLICE)

SPLICE (M1, M2, M3): The M1, M2 and M3 markers are displayed on the screen. The fusion splicing or connection loss due to the connector can be measured by using these three markers. Markers can be displayed by moving the data knob.

Pressing the MARKER SELECT key selects the current marker displayed.

Procedure:

① As shown in Figure 3-15, set the M2 at a splice change point. Then set the M1 and M3 markers at any two points of both fibers with the splice point as the center.

② After the three markers are set, set the m1 at a distance of σ_1 and m2 at a distance of σ_2 from the center of the M2 to calculate internally using the method of least squares. The m1 and m2 are displayed on the screen as X.

③ The intersections of the marker M2 and the extension line calculated in the least squares approximation from the distance data between M1 and m1 and between M3 and m2 are set as P0 and P1. The level difference between the P0 and P1 is referred as the splice loss.

④ After the M3 is set, pressing the MARKER SELECT key displays the M1, M2 and M3 markers, and they can be moved with their interval fixed.

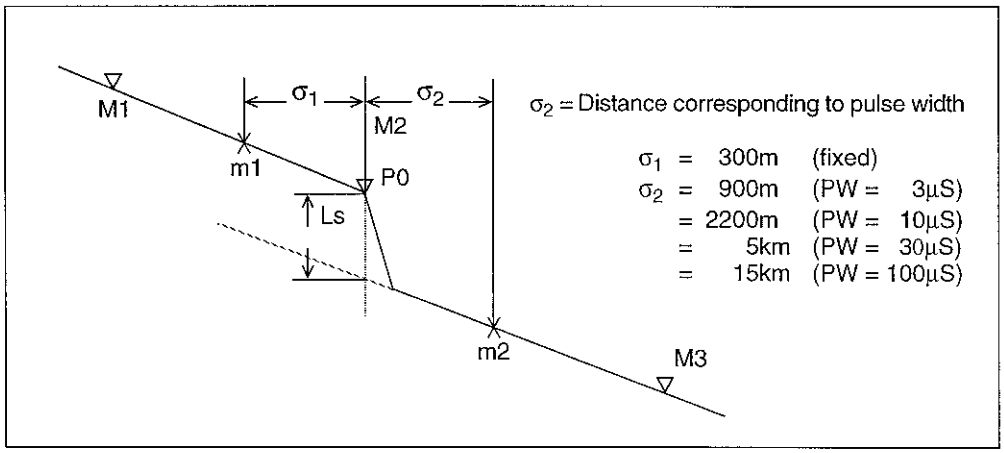


Figure 3-15 Splice Loss Indication Measurement

3.6.4 Displaying Two Waveforms Simultaneously

This function displays two waveforms simultaneously and allows the two waveforms to be compared with each other.

Procedure:

① Pressing the SAVE key saves the waveform data currently displayed on the screen.

Note: Only one waveform can be saved. The measuring conditions cannot be saved.

② Pressing the VIEW key recalls the saved waveform.
The saved waveform and waveform under measurement can be displayed simultaneously on the screen. This function is useful for comparing two waveforms.

③ Pressing the VIEW key again deletes the recalled waveform from the screen.

Note: The waveform saved by pressing the SAVE key is not backed up and is cleared when the power is turned off.

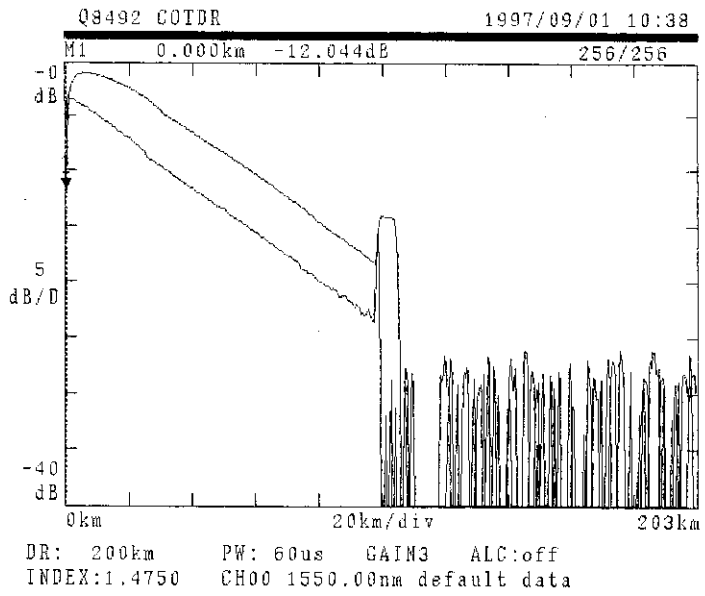


Figure 3-16 Comparing Two Waveforms Simultaneous by SAVE/VIEW Function

3.7 Reading Out Data and Saving

3.7.1 Sending Hard Copy (HDCOPY) to the Printer/Plotter

The Q8492 screen data can be printed from the built-in printer or an external plotter.

(1) Printing from the built-in printer

Procedure:

① Press the MENU key.

② Select the I/O with the the ⇩ and ⇧ keys.

③ Verify that the HDCOPY in the I/O window is set to the printer.

④ If the plotter is set in step ③, select HDCOPY using the ENTER key and then set the HDCOPY to the printer using the data knob.

⑤ Pressing the EXECUTE key outputs the screen data to the printer.

⑥ Pressing the FEED key feeds paper and the paper can be cut off .

Supplying Printing Paper

Procedure:

① Set the lock knob to the UNLOCK and remove the cover of the printer input section.

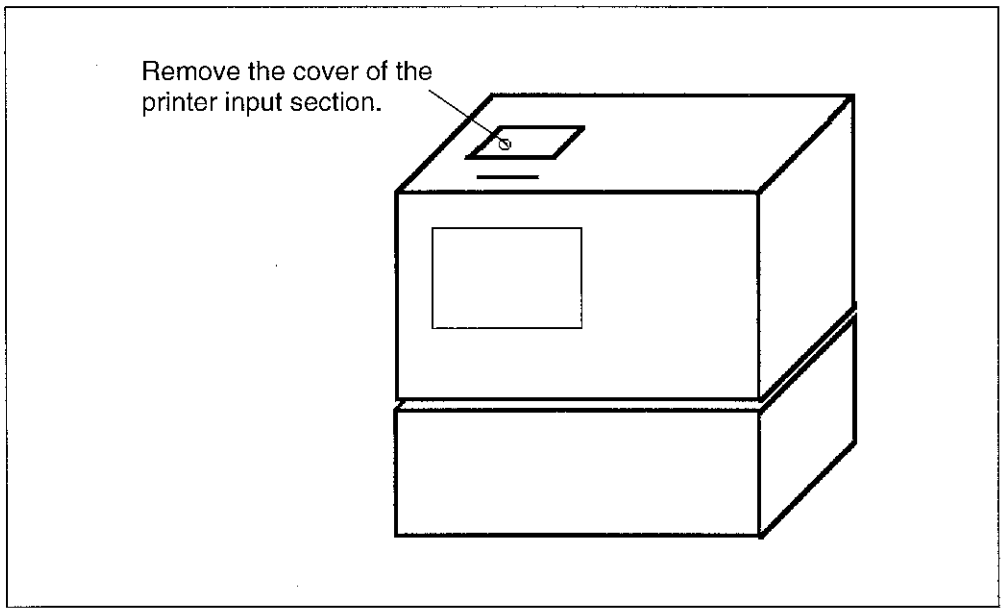


Figure 3-17 Supplying Printing Paper 1

② Raise the head-up lever.

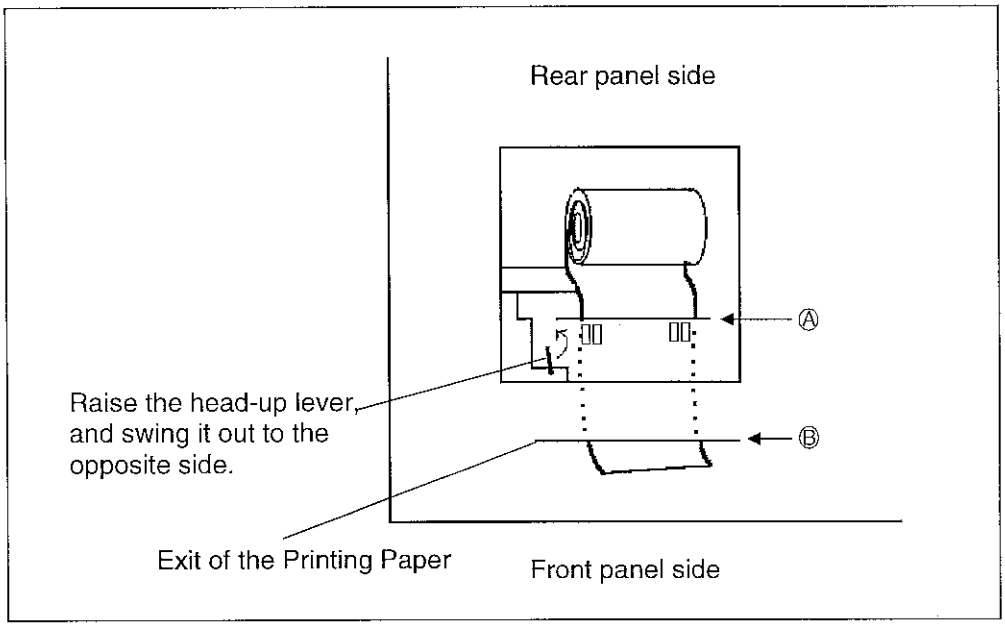


Figure 3-17 Supplying Printing Paper 2

③ Put the rolled paper into the holder with the outside down.

④ Let paper go through Ⓐ and pull it out 2cm from Ⓑ.

⑤ Put the head-up lever down.

⑥ Verify that paper is correctly positioned by pressing the FEED key.

<Printing paper>

Type name:	A09075
Five rolls per box:	Paper can be ordered by the box.
Thermal sensitive face outside roll:	30m
Paper width:	114mm

Note: Use the specified paper for the Q8492.

(2) Printing on the external plotter

Procedure:

① Press the MENU key.

② Select the I/O using the the ⇩ and ⇧ keys.

③ Verify that the HDCOPY in the I/O window is set to the plotter.

④ If the printer is set in step ③, select the HDCOPY using the ENTER key and then set the HDCOPY to the plotter using the data knob.

⑤ Pressing the EXECUTE key outputs the screen information to the plotter.

CAUTION!
When printing on an external plotter, GPIB control is disabled.

<Available plotter type>

R9833 (ADVANTEST)
HP7470A (HP)
HP7475A (HP)

<Selection of pen>

Each pen number and its plotter output are shown below.

Table 3-5 Pen Selection

Pen number	Plotter output
1	Character line
2	Window display (including characters in the window)
3	Bar, signal border, and window border
4	Waveform
5	Dual waveforms
6	Marker
7	Cursor

3.7.2 Saving to Floppy Disk (Saving)

See section 5.2 for the operation procedure.

3.7.3 Saving to Internal Memory (Saving)

See section 4.13 for the operation procedure

4 MENU FUNCTIONS AND THEIR OPERATION

4.1 Wavelength List Editing Function

This function sets the wavelength list editing and wavelength interval (the loading light wavelength to the probe light). A maximum number of 100 wavelengths can be controlled.

Procedure:

① Press the MENU key.

② Select the W. LENGTH using the ⇩ (←) and ⇧ (→) keys.

③ Select the channel. When the CH is displayed in reverse video, select the CH to be edited by turning the data knob.

④ Editing the Wavelength:
Pressing the ENTER key at the CH selected in step ③, allows the wavelength to be changed by turning the data knob. When the RAPID feature is turned on (indicated by the LED indicator next to the data knob), the wavelength can be changed in increments of 0.1nm. When the RAPID feature is turned off, the increments are 0.05nm. The wavelength range is from 1530 nm to 1570 nm.

⑤ Pressing the ENTER key rewrites the wavelength list, and also allows comment editing.

⑥ Comment editing:
In the previous step ⑤ state, select characters one by one by turning the data knob and enter the characters by pressing the ENTER key. Up to16 characters can be entered.

⑦ To change the wavelength interval, turn the data knob. This indicates the interval after 99 when the CH is displayed in reverse video. Pressing the ENTER key sets the selected wavelength.

⑧ Select the wavelength interval by turning the data knob. Then press the ENTER key to change the wavelength interval. It takes several seconds to change this interval.

CAUTIONS!

1. ***When the wavelength interval is changed, connect the system under measurement to the OUTPUT connector after confirming the wavelength with a wavelength meter or spectrum analyzer connected to the MONITOR A/B connector.***

2. ***When the wavelength of the channel that is currently set and that is displayed on the screen is changed, the Light Source wavelength is also changed.***

3. ***When the wavelength interval or the wavelength of the current channel is changed, the light from the output connector is forcibly shut off. Press the OUTPUT key to turn the light output back on.***

4.2 Variable Output Power Function

The light power emitted from the OUTPUT connector on the front panel is of variable strength. Change the power coming from the OUTPUT connector while monitoring it with an optical power meter or optical spectrum analyzer.

Procedure:

① Press the MENU key.

② Select the OUT POWER using the ⇩ and ⇧ keys.

③ Set the OUT POWER to the desired light power using the data knob while monitoring it.

4.3 Setting Averaging

4.3.1 Setting the Number of Averaging Times

Procedure:

① Press the MENU key.

② Select the AVERAGE using the ⇩ and ⇧ keys.

③ Select No. using the ENTER key.

④ Select No. (16 to 65536) from the window using the data knob.
In the Q8492, the waveform averaged 2^8 times is the base waveform.
The total number of averaging times is as follows:

When the number of averaging times 16 is selected: $2^8 \times 16 = 2^{12}$
When the number of averaging times 256 is selected: $2^8 \times 256 = 2^{16}$
When the number of averaging times 65536 is selected: $2^8 \times 65536 = 2^{24}$

⑤ To return to the measuring screen, press the MENU key.

4.3.2 Setting Averaging Process Indication

Procedure:

① Press the MENU key.

② Select the AVERAGE with the ⇩ and ⇧ keys.

③ Select the MODE using the ENTER key.

④ Select one item from among No., TIME and % with the data knob.

When No. is selected, the number of averaging process times is displayed.

When TIME is selected, the averaging process elapsed time (from the beginning to the current time of the averaging process) is displayed.

When % is selected, the ratio of the number of averaging process times to the number of averaging set times is displayed.

4.4 Setting Index (Refractive Index)

The Q8492 measures the time (referred to as "T (seconds)"), for a light pulse to travel through the optical fiber and calculates the distance according to the core refractive index of the optical fiber. The following procedure allows the user to set the core refractive index of the optical fiber to be measured.

Procedure

① Press the MENU key.

② Use the arrow keys to select INDEX from the menu in the window in the upper right corner of the screen.

③ Set the refraction ratio by turning the data knob.

④ To set the ratio, press the MENU key.

4.5 Setting ALC (Auto Level Control) and Gain

The setting can be changed only in the MONITORING mode.

Procedure:

① Press the MENU key.

② Select the ALC with the ⇩ and ⇧ keys.

③ Select the ALC (ON/OFF) with the data knob.

ALC on: To avoid over-scaling, the maximum level is detected when the AVG MEAS is set and an optimum gain is set automatically.

ALC off: When measuring low level signals precisely by over-scaling higher level signals such as Fresnel reflections, switch to the MONITORING mode and then set the gain higher manually.
Four gain settings (0 through 3), can be selected. Gain 0 is the lowest and the Gain 3 is the highest.
If over-scaling occurs in Gain 0, the internal circuit may be saturated. In this case, add an optical attenuator to the light signal input to lower the level, then measure the signals.

④ To return to the measuring screen, press the MENU key.

4.6 Setting the Pulse Output Mode

Two kinds of output mode (FSK and Pulse) can be set for the Q8492 output light.

Procedure:

① Press the MENU key.

② Select the OPT mode using the ⇩ (←) and ⇧ (→) keys.

③ Select the FSK/Pulse using the data knob.

When FSK is set, FSK CW light is output. It is used when the loading light is required.

When only the pulse modulated probe light is output. The loading light is not output.

④ To return to the measuring screen, Press the MENU key.

4.7 Setting Polarization Scrambler

The polarization scrambler in each operation mode can be set to ON or OFF.

Procedure:

① Press the MENU key.

② Select the P.S.cont with the ↓ and ↑ keys.

③ Select the MEASURE MODE/LOADING MODE using the ENTER key.

④ Select on or off using the data knob.

The polarization scrambler status in each operation mode is shown below.

Table 4-1 Polarization Scrambler Status

OPT mode	P.S. cont	
	MEASURE MODE	LOADING MODE
FSK	When the FSK is on in the MEASURE MODE/AVG MEAS MODE, the polarization scramble is applied to probe light and loading light.	When the Pulse is on in the MEASURE MODE/AVG MEAS MODE, the polarization scramble is applied to probe light.
Pulse	When the FSK is on in the LOADING MODE, the polarization scramble is applied to loading light.	Disabled (the loading light is not output.)

4.8 Initializing Function

4.8.1 Initializing by RESET Key

See subsection 3.4.1

4.8.2 Initializing by the LOCAL Key

When the power switch is turned on, all green LEDs are lit. Pressing the MENU key at this moment sets the measuring conditions as shown in Table 4-2 and clears all internal data such as the memory data and wavelength list (the same conditions as the unit shipped from the factory).

Table 4-2 Initial Status on Shipment from the Factory

Item	Status
Measuring mode	MONOTORING PAUSE
Label	Q8492 COTDR
Clock	NOT CHANGE
Distance range	1000km
Span	100km/DIV
Horizontal start distance	0km
Vertical scale	5dB/DIV
Vertical position	0dB to -40dB
Pulse width	10μs
Index	1.4750
Gain	ALC OFF (GAIN3)
Disk function file name	00000000. DSP
Disk function data type	DSP, BINARY
Disk function information	CLEAR
Internal memory data	CLEAR
Dual trace function	OFF
Dual trace waveform	CLEAR
Averaging times	256
Buzzer	ON
GPIB address	11
HDCOPY	PRINTER
Filter	NORMAL
Data knob rapid	OFF
Marker	DISTANCE
Printer	SHORT
Averaging process indication	NO.

4.9 L. S. CHK (Light Source Check) Function

This function checks the Light Source output power.

Procedure:

① Press the MENU key.

② Select the L. S. CHK with the ⇩ and ⇧ keys.

③ Pressing the ENTER key checks the Light Source output power.

The Light Source output power is displayed and operation verification is completed.

4.10 Writing Label

Up to 23 alphanumeric characters can be input in the upper right corner of the screen.
This function is used as a title for storing data.

Procedure:

① Press the LABEL key.

② • Input characters one by one in the LABEL window using the data knob and ENTER key.

• Use the DELETE, ←, →, and ALL DELETE in the LABEL window to correct the characters. Pressing the ENTER key performs the following functions.

DELETE:	Deletes the character pointed by the cursor.
←:	Moves the cursor to the left.
→:	Moves the cursor to the right.
ALL DELETE:	Deletes all characters in the LABEL window.

③ To return to the measuring screen, press the LABEL key again.

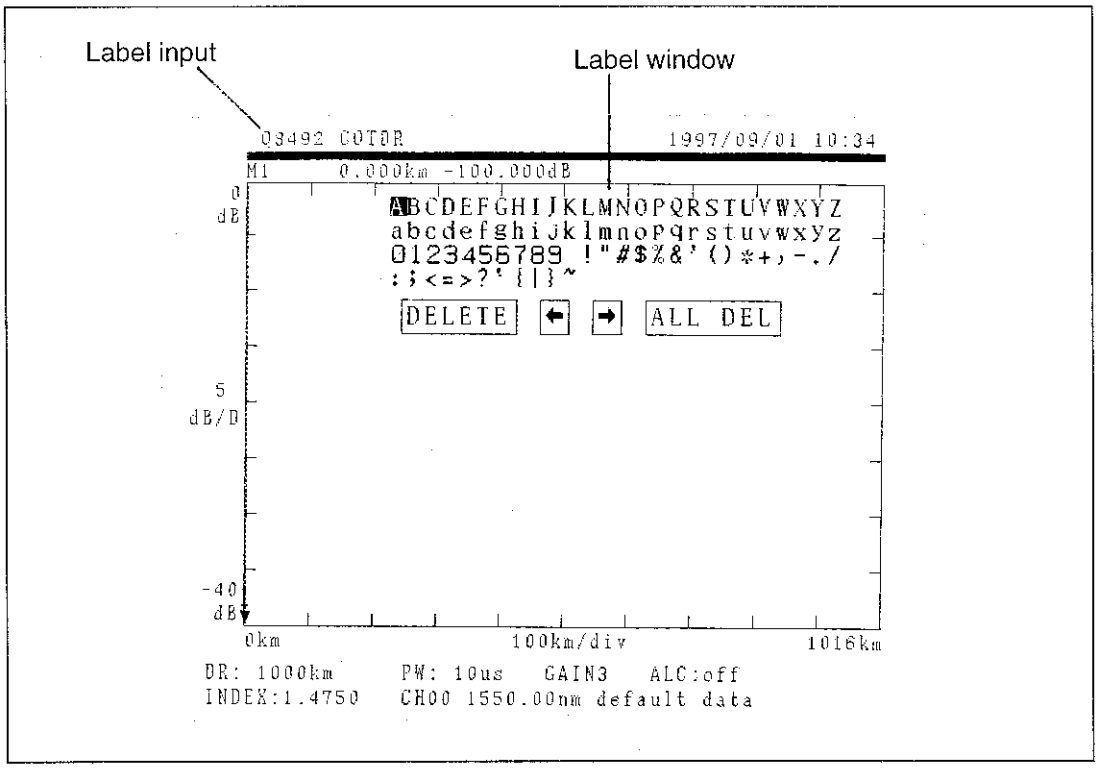


Figure 4-1 Writing Label

4.11 Setting the Clock

Year/month/day/hour/minute can be set.

Procedure:

① Press the MENU key.

② Select the CLOCK with the ⇩ and ⇧ keys.

③ Select the item to be set using the ENTER key.

Year: Verify that the cursor is on the YEAR, and then set the year with the data knob.

Month: Move the cursor to the MONTH with the enter key, and then set the month with the data knob.

Day: Move the cursor to the DAY using the ENTER key, and then set the day with the data knob.

Hour: Move the cursor to the HOUR using the ENTER key, and then set the hour with the data knob.

Minute: Move the cursor to the MIN. using the ENTER key, and then set the minute with the data knob.

④ To return to the measuring screen, press the MENU key.

4.12 Smoothing the Display Waveform

This function is used to smooth a waveform by using a method of moving averages.

Procedure:

① Press the MENU key.

② Select the FILTER using the ⇩ or ⇧ keys.

③ Select the NORMAL/Wide D. Range using the data knob.

NORMAL:	Moving average is executed with a bandwidth of one-fourth pulse width.
Wide D. Range:	Moving average is executed with a bandwidth of a half pulse width. The dead zone and spatial resolution are lowered by 1.5 times.

④ To return to the measuring screen, press the MENU key.

4.13 Internal Memory Function

The internal memory is capable of storing 32 waveform screens along with their measuring conditions. It is also capable of measuring the changes per time of the fiber cable under measurement.

The stored waveform and measuring conditions are backed up after the power is turned OFF.

4.13.1 Writing (Saving)

Procedure:

① Press the MENU key.

② Select SAVE from the MEMORY window with the data knob and press the ENTER key.

③ Move the cursor on a waveform number (1 to 32) to be stored with the data knob. Then press the ENTER key to save the waveform.

Enter a title, data and time into the appropriate fields.

Selecting the data item and then pressing the ENTER key displays the following message.

```
*** If you are going to rewrite,
                please push "ENTER" key. ***
```

④ Pressing the ENTER key again clears the previous data and saves the current waveform. Then the display returns to the memory initial screen. Selecting "EXIT" and pressing the ENTER key also switches the screen to the memory initial screen.

⑤ To complete the MENU procedure, press the MENU key.

4.13.2 Reading (Recalling)

Procedure:

① Press the MENU key.

② Select the RECALL from the MEMORY window with the data knob and press the ENTER key.

③ Move the cursor to the waveform number (1 to 32) to be read using the data knob and press the ENTER key. Then the waveform is recalled from the memory and the memory initial screen is displayed.

Selecting "EXIT" and pressing the ENTER key also displays the memory initial screen.

④ • To finish reading, press the MENU key.

• To start measurement, press the MONITORING key or AVG MEAS key.
Except for the wavelength and wavelength span, measurement can be performed with the same conditions.
The wavelength and wavelength interval are set to the set values before reading.
Date and time are updated to the current ones.

4.13.3 Deleting

Procedure

① Press the MENU key.

② Select the DELETE from the MEMORY window with the data knob and press the ENTER key.

③ Move the cursor on the waveform number (1 to 32) to be deleted with the data knob and press the ENTER key. The following message is then displayed.

```
*** If you are going to delete the file,
                please push "ENTER" key. ***
```

④ • To proceed, press the ENTER key.
  • To delete all data, select the "ALL DELETE" and press the ENTER key.
  • To return to the memory initial screen, select "EXIT" and press the ENTER key.
  • To complete the MENU procedure, press the MENU key.

4.14 I/O

The following settings can be performed using the MENU key and I/O MENU.

- GPIB AD: Setting the GPIB address
- HDCOPY: Setting hard copy to the printer/plotter
- PRINTER: Setting printing mode
- BUZZER: Setting buzzer sound

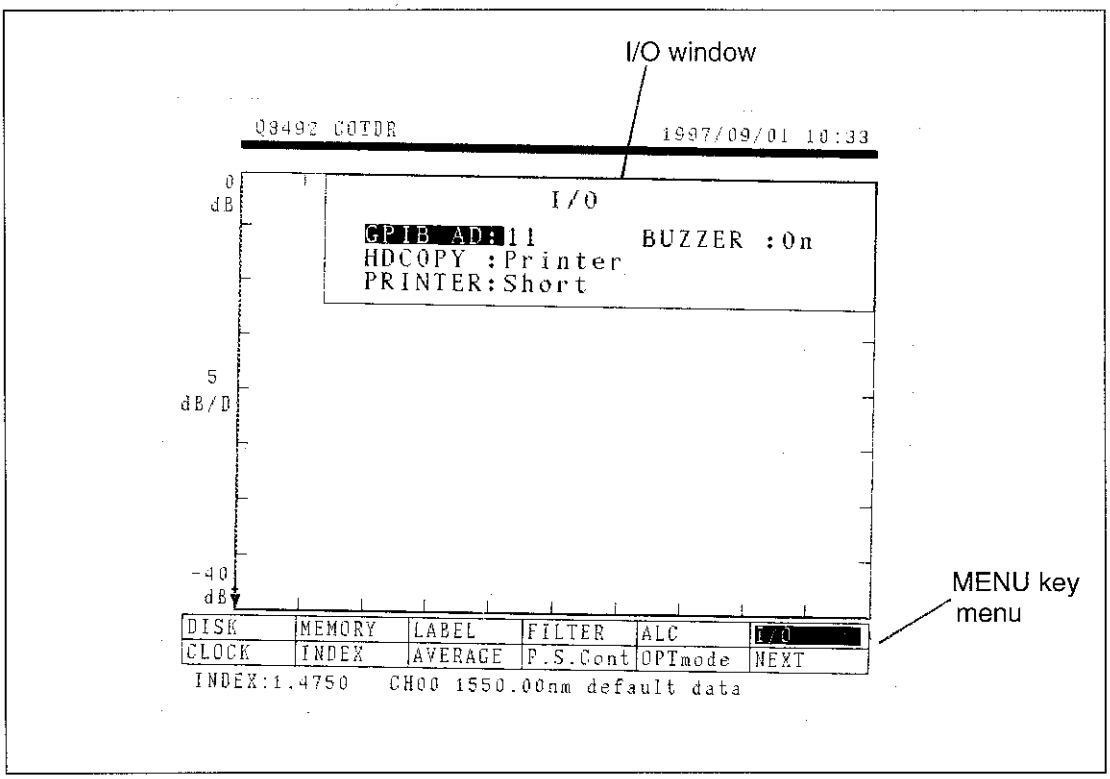


Figure 4-2 I/O Menu Screen of MENU Key

4.14.1 Setting GPIB Address (GPIB AD)

When the Q8492 is controlled by the GPIB, set the address for the Q8492.

Addresses between 0 to 30 can be set.

Procedure:

① Press the MENU key.

② Select the I/O with the the ⇩ and ⇧ keys.

③ Select the GPIB AD from the I/O window using the ENTER key.

④ Set the GPIB address using the data knob.

4.14.2 Printer Output Mode (PRINTER)

This function sets the waveform output mode when the built-in printer is selected.

Procedure:

① Press the MENU key.

② Select the I/O using the ⇩ and ⇧ keys.

③ Select the PRINTER from the I/O window using the ENTER key.

④ Set Short or Long using the data knob.

Short: The waveform displayed on the screen is output with the same resolution.

Long: The waveform displayed on the screen is output with the internal data resolution. A maximum of 3 m can be printed out depending upon the setting.

⑤ To stop printing, press the EXECUTE key again.

4.14.3 Buzzer Sound (BUZZER)

This setting controls whether the buzzer sounds or not during unit operation.

Procedure:

① Press the MENU key.

② Select the I/O with the ⇩ and ⇧ keys.

③ Select the BUZZER from the I/O window with the ENTER key.

④ Set the ON or OFF using the data knob.

ON: buzzer sounds during operation

OFF: buzzer does not sound during operation

5 FLOPPY DISK FUNCTION

The floppy disk drive can be used to save measured data and set conditions, or load previously saved data and conditions. Data is saved in MS-DOS format allowing the disks to be used in DOS-compatible computers.

<Floppy disk drive specifications>

Disk type:	3.5-inch micro floppy disk drive
Floppy disk to be used:	2DD (double-sided double-density) 2HD(double-sided high-density)
Capacity when formatted:	720 Kbytes (2DD)/1 Mbytes (2HD)
Recording format:	2DD IBM/NEC common format 2HD IMB format
Number of saved files:	As shown in Table 5-1

Table 5-1 Number of Saved Files

	Number of saved files		
Data type (wave-form data point number)	Screen data (DSP) (see Note 1) (501 points)		Internal data (ALL) (see Note 2) (15344 points max.) (see Note 3)
Data format	Binary	ASCII	Binary
2DD (720 Kbytes)	112 files	101 files	5 files
2HD (1.44 Mbytes)	224 files	219 files	10 files

Note1: ***The screen data is composed of the waveform data being displayed only. Waveform expansion or compression cannot be performed.***

Note2: ***The internal data is composed of the waveform being displayed and all the measured data.***
Waveform expansion or compression cannot be performed.

Note3: ***The number of saved files differs depending on the number of the internal data points. The internal data cannot be recorded in ASCII format.***

5.1 Handling Floppy Disks

(1) Write-protection

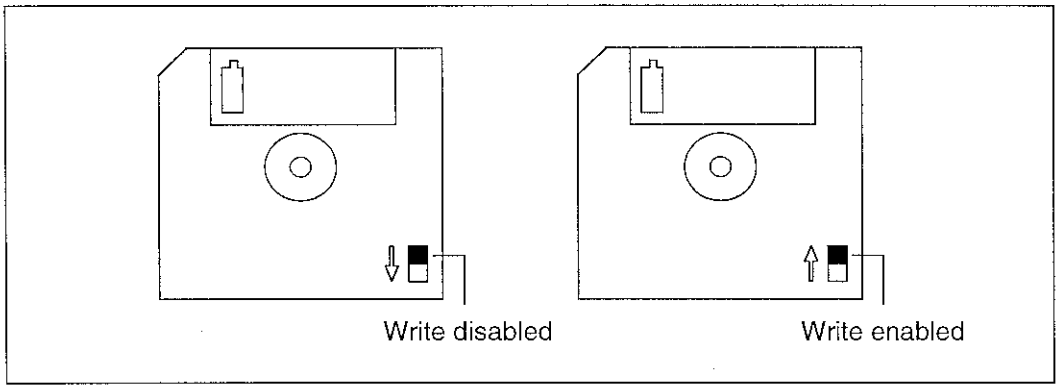


Figure 5-1 Floppy Disk Write-Protection

A 3.5 inch micro floppy disk can be write-protected to prevent data from being accidentally erased. Write-protect the disk by sliding the write-protect slide as shown in Figure 5-1.

(2) CAUTION for Correct Floppy Disk Drive handling

- Applying a strong shock to the floppy disk drive may damage the drive head or floppy disk.
- Pulling out the floppy disk before it is completely ejected may cause the head to be caught by the disk shutter window. This may damage the disk head.
- Inserting the floppy disk in a half-eject state may damage the drive head.

Insert a floppy disk into the slot with the labeled side to the left.
Push the floppy disk forward with a finger and verify that it reached the end and is fixed on the drive.

To remove the floppy disk, press the eject button. The disk will automatically eject.

WARNING!
Do not press the eject button when the disk drive lamp is red.

5.2 Writing (Save)

The waveform data and set condition conditions can be saved to floppy disk.

Procedure:

① Press the MENU key.

② Select the DISK using the ⇩ and ⇧ keys.

③ Select the SAVE from the DISK window using the data knob and press the ENTER key.

④ Perform steps (1) through (5) as shown below.

(1) Setting File Name

- Up to eight alphanumeric characters can be entered. Input the characters one by one using the data knob and ENTER key.
- Use the DELETE ←, →, and ALL DEL keys to correct the characters. Pressing the ENTER key performs the following functions.

DELETE: Deletes a character on the cursor position.
←: Moves the cursor to the left.
→: Moves the cursor to the right.
ALL DEL: Deletes the file name in a lump.

(2) Setting Naming Mode

Select the item to be entered with the data knob. Every time the ENTER key is pressed, the AUTO ON/AUTO OFF is set by turns.
When the AUTO ON is selected, the seventh and eighth characters are updated automatically after saving so that it is not necessary to enter the file name every time the file is saved.
When the AUTO ON is selected, specify six characters for a file name and use numeric characters for the seventh and eighth characters.

(Example) File name: FIBER-00

(3) Setting Data Type

Select the DATA TYPE with the data knob. Every time the ENTER key is pressed, the DSP/ALL are set by turns.

DSP: Saves the screen data and set conditions.
(this waveform data cannot be expanded/compressed in the horizontal direction when loading.)
ALL: Saves the all points waveform data and set conditions.
(this waveform data can be expanded/compressed in the horizontal direction when loading.)

(4) Setting Data Format

Select the DATA FORMAT with the data knob. Every time the ENTER key is pressed, the BINARY/ASCII are set by turns.

BINARY: The waveform data is saved in binary format.
When the DSP type is set, a large number of waveforms are saved. (when the ALL is selected , only BINARY can be selected.)

ASCII: The waveform data is saved in ASCII format. This selection is useful for reading out data with a personal computer. (when ALL is selected, ASCII cannot be selected.)

(5) Saving

- Select the EXECUTE with the data knob. Pressing the ENTER key saves the waveform data, and so forth on the disk. After saving, the screen returns to the floppy disk function initial screen.
- Selecting EXIT using the data knob and then pressing the ENTER key returns to the FDD function screen without saving.

CAUTION!

1. ***The data recalled from the internal memory cannot be saved to floppy disk.***

2. ***If the data type and data format conditions as loaded are different from the current conditions, the data cannot be saved.***

5.3 Reading (LOAD)

The waveform data and set conditions saved on the floppy disk can be loaded.
After the measurement can be performed using the same conditions except for the wavelength and wavelength interval.
The wavelength and wavelength interval settings remain the same as before.

Procedure:

① Press the MENU key.

② Select the DISK using the ⇩ and ⇧ keys.

③ Select the LOAD from the DISK window with the data knob.

④ Press the ENTER key.

⑤ • Move the cursor to the file number that the user wishes to read with the data knob and press the ENTER key. The waveform data is read out from the floppy disk and the screen display returns to the floppy disk function screen.

• Select EXIT using the data knob and press the ENTER key. The data is not read out from the floppy disk and the screen display returns to the floppy disk function screen.

⑥ After reading out, press the MENU key and then press the MONITORING key or AVG MEAS key. The measurement starts with the same conditions except that the date and time are current.

<Changing the span for a waveform after loading, and moving horizontal position>

For waveform data loaded, the span change and horizontal position move operation differ depending on the data type.

DSP (DISPLAY):	The span change and horizontal position move cannot be performed.
ALL (ALL-LINEAR):	The span change and horizontal position move can be performed.

5.4 Other Floppy Disk Functions

The functions displayed when the DISK is selected by pressing the MENU key are described below.

(1) DIRECTORY Mode

This function displays a list of files stored on the disk.

Procedure:

① To scroll through the list, turn the data knob.

Display List Items

No.:	Shows the file number.
FILE NAME:	Shows the file name.
TYPE:	Shows the type of data stored.
SIZE:	Shows the file size in bytes
DATE:	Shows the year, month, and day when the file was stored.
TIME:	Shows the time when the file was stored.

② Select EXIT and press the ENTER key. The screen returns to the initial screen.

(2) DELETE Mode

This function deletes the file.

Procedure:

① Move the cursor to the file to be deleted and press the ENTER key. The following message is displayed to confirm the file deletion.

DELETE:	PUSH "ENTER KEY"
ESCAPE:	ROTATE "KNOB"

② • Pressing the ENTER key again deletes the file.

• Turning the data knob returns to the previous screen.

• Selecting EXIT and pressing the ENTER key causes the screen to return to the floppy disk function initial screen.

(3) TYPE Mode

This function sets the data type when saving the waveform to the disk.

① DATA TYPE

Select the data type using the data knob and press the ENTER key. This sets the type of data to be saved and the appropriate file extension is automatically added.

DSP (DISPLAY):	Shows the screen waveform data which has been LOG-converted.
ALL (ALL-LINEAR):	Shows all the internal measuring data prior to LOG-conversion (raw data). Waveform expansion or compression and left and right positioning can be performed after the waveform has been loaded.

② DATA FORMAT

Select the data format using the data knob and press the ENTER key.
DATA FORMAT sets the data format used when saving data (see below).

BINARY:	Saves the waveform data in a binary format.
ASCII:	Saves the waveform data in an ASCII format.

Note: When the data type "ALL" is selected, ASCII cannot be selected as the data format.

(4) FORMAT Mode

This function formats a disk.

Procedure:

① Select EXECUTE with the data knob and press the ENTER key. The following message is displayed to confirm the format.

FORMAT:	PUSH "ENTER KEY"
ESCAPE:	ROTATE "KNOB"

② • Pressing the ENTER key again starts formatting.
• Turning the data knob returns to the previous screen.
• Selecting EXIT then pressing the ENTER key causes the screen to return to the floppy disk function screen.

(5) INFORMATION Mode

Various information can be added when saving data. All this information is saved and loaded along with the waveform and measuring conditions.

5.5 Error Messages

When using the floppy disk function, the following error messages may appear on the screen.

Table 5-2 Error Messages

Error messages	Contents
ERROR:DRIVE NOT READY	The disk drive is empty or an unformatted disk, or a disk with an unreadable format has been inserted.
ERROR:WRITE PROTECTED	The floppy disk is write-protected.
ERROR:FILE NOT FOUND	The specified file is not contained in the disk.
ERROR:DISK FULL	The disk is full of data.
ERROR:FILE NAME ERROR	There is a problem with the file name.
ERROR:DATA TYPE ERROR	When in the REFLECTION mode, LOG-data type data cannot be saved or the data is of a type which the Q8492 cannot load.
ERROR:CAN NOT SAVE	Data recalled by using the memory function cannot be saved. This occurs if the DATA TYPE and DATA FORMAT of the data loaded from the floppy disk differ from the settings of the current data.
OVERWRITE: PUSH "ENTER KEY" ESCAPE: ROTATE "KNOB"	A file with the same name already exists. Pressing the Enter key will replace the old file with the current one. Turning the Data Knob returns to the previous screen.
DELETE: PUSH "ENTER KEY" ESCAPE: ROTATE "KNOB"	This message is displayed before executing a file delete command to confirm the file deletion. Pressing the ENTER key again execute the deletion. Turning the Data Knob returns to the previous screen.
FORMAT: PUSH "ENTER KEY" ESCAPE: ROTATE "KNOB"	This message is displayed before executing a formatting command. Pressing the ENTER key again executes the initialization. Turning the Data Knob returns to the previous screen.

5.6 FD Format

The Q8492 uses the MS-DOS data file format. The specifications of this format are as shown below.

The FD format consists of five blocks.

Table 5-3 Format Configuration

Block name	Total number of bytes
Header	128
Measuring conditions	352
Information data	256
Internal flag information	256
Waveform data	*

* Differs depending on the data type and waveform point number.

(1) Header

Table 5-4 Header

Item	Number of bytes
Company name	16
Product name	16
Software version	16
Save waveform data type	16
Save waveform data format	16
Number of data (display, internal)	16
Averaging times	16
Spare	16

(2) Measuring Conditions

Table 5-5 Measuring Conditions

Item	Number of bytes
Measuring mode	14
Label	24
Clock	17
Distance range	11
Span	11
Data start distance (display, internal)	26
Data end distance (display, internal)	24
Vertical scale	8
Display screen upper limit level	12
Display screen lower limit level	12
Index	13
Pulse width	9
ALC setting	8
Gain	7
Filter function	20
OPT mode	14
Averaging times	23
Measuring channel	6
Measuring wavelength	19
Measuring interval	17
Measuring channel comment	25
Spare	32

(3) Information Data (number of bytes = 256)

Floppy function information data is contained consecutively in the information data.

(4) Internal Flag Information (number of bytes = 256)

This is the Q8492 internal set data. This data is not required when processing data with a personal computer.

(5) Waveform Data

Three kinds of data are used for the save waveform data type and format.

Table 5-6 Waveform Data

	Save waveform data type	Save waveform data format	Number of bytes
①	DSP	ASC	Number of data (header) × 8
②	DSP	LIN	Number of data (header) × 4
③	ALL	LIN	Number of data (header) × 4 × 2

[Data conversion method]

In the case of ①: One data consists of eight bytes.
(Example): -100.000

In the case of ②: One data consists of the four bytes data that are read out.
The read out data, D1, D2, D3, and D4 are sequentially processed per byte as shown below.

$$D = D1 \times 2^{24} + D2 \times 2^{16} + D3 \times 2^{8} + D4$$

Where $D < 2^{16}$; $DATA = D/2^{16}$
Where $D \geq 2^{16}$; $DATA = (D - 2^{32})/2^{16}$

In the case of ③: The waveform data is divided into two data (waveforms A and B).
The order includes all of the the waveform A and all of the waveforms B.

Waveform A	Waveform B

Each data consists of four bytes.
The read out data, D1, D2, D3, and D4 are sequentially processed per byte as shown below.

$$D = D1 \times 2^{24} + D2 \times 2^{16} + D3 \times 2^{8} + D4$$

Assuming that the data of the processed waveform A are D_{A1}, D_{A2}, D_{A3}, ... D_{AN} and the data of the processed waveform B are D_{B1}, D_{B2}, D_{B3}, ... D_{BN}, then the nth data will be as shown below.

$$DATA_N = 5 \times Log(D_{AN}/2^{16}/AVG) + 5 \times Log(D_{BN}/2^{16}/AVG)$$
$$= 5 \times Log(D_{AN} \times D_{BN}/2^{16}/AVG)$$

AVG: Averaging times of the header, but where AVG > 33023,
AVG = AVG/2

6 TALKSET

The Q8492 user is capable of talking to the Q8492 user connected on the opposite side via the line under measurement. This function can be used while in LOADING mode.

6.1 Setup

Connect the attached head set to the jack on the front panel.

CAUTION!
Loud volume may damage your ears. Increase the volume gradually from the minimum volume to set the optimum volume.

Procedure:

① Press the LOADING key.

② Press the MENU key, select the NEXT then select the O/W Func.

③ Select the O/W Func with the ENTER key.

④ Set the O/W Func ON with the data knob.

6.2 Calling Opposite Side Operator and Talking

Press the CALL key to call the opposite side operator.
While the CALL key is pressed, the call signal (150 Hz sine wave) is transmitted and then the "There is a call from the other terminal." is displayed for 10 seconds on the other Q8492 screen. If the opposite side operator puts on the head set, he or she should be able to hear the 150 Hz call signal.

The CALL signal can be received even when the opposite side Q8492 is in MONITORING mode or AVG MEAS mode. When the CALL occurs, the opposite side operator needs to set the unit to LOADING mode and set the O/W Func ON to talk to the other operator.
However, the CALL signal cannot be received if the other side masks the CALL signal.

6.3 Masking CALL Signal

If the CALL signal is erroneously received for some reason when the other side has not sent the CALL signal, turn on call masking by setting CALL MASK ON. The call will no longer be displayed. Note that this makes it impossible to receive the call signal when it is actually sent. To receive calls from the opposite side, simply turn off call masking.

7 GPIB: REMOTE CONTROL

7.1 General

The Q8492 can be remote-controlled via the standard IEEE 488-1978 measuring bus, or GPIB(General Purpose Interface Bus).

7.1.1 Outline of GPIB

The GPIB is an interface system that can be used to configure automatic measuring systems by connecting measuring instruments to controllers and peripheral devices using simple bus cables. When compared with conventional interface systems, the GPIB provides much higher system expandability. Also, it provides electrical, mechanical, and functional compatibility with different manufacturers' products. A full lineup from a simple system with a single bus cable to a system with higher functions can be configured.
In the GPIB system, each device connected to the bus lines is assigned a unique address. Each device can undertake one or more functions (out of the three functions as the controller, talker or listener). Only one talker can send data onto the bus, and more than one listeners can receive the data. The controller gives addresses to both the talker and listener so that the data can be transferred from the talker to the listener. Also, the controller (as the talker) sets measuring conditions for the listener.

Eight data lines of bit parallel and byte serial type are provided for transferring data between system devices. Data is transferred asynchronously in both directions. Since the system is asynchronous, both high-speed and low-speed devices can be mixed. Data(message) which can be transferred between devices include measuring data, measuring conditions, and various commands. ASCII codes are used for data transfer.
In addition to eight data lines, three handshaking lines are also provided to control asynchronous data transfer between devices. In addition, five control lines are provided to control information flow on the bus.

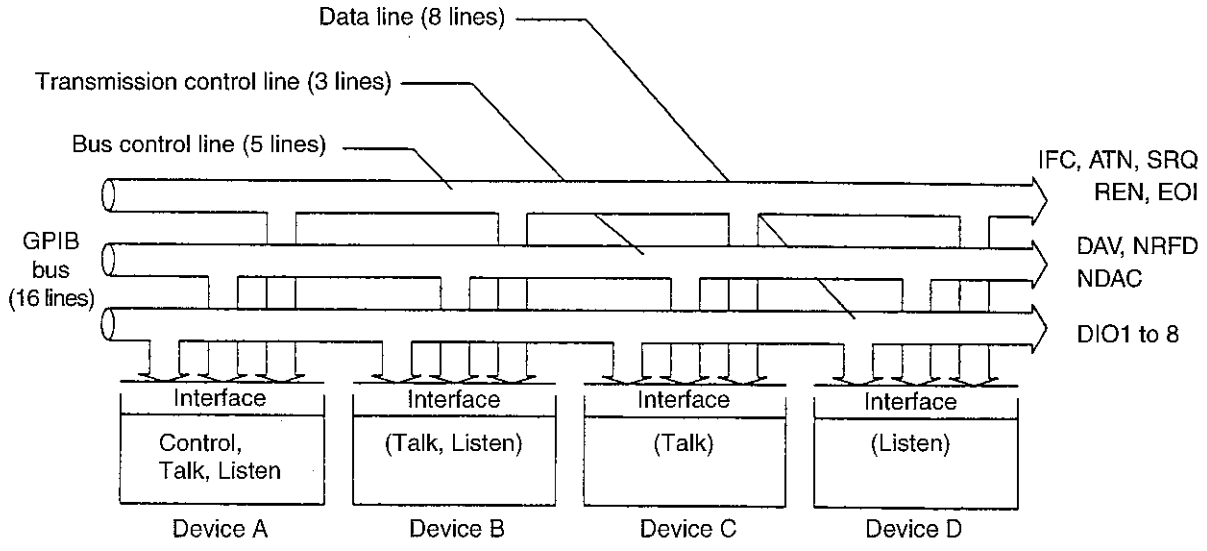


Figure 7-1 GPIB Bus Lines

- The following signals are transferred via the handshaking lines.

  DAV (Data Valid): The signal which indicates that the data is valid.
  NRFD (Not Ready For Data): The signal which indicates that the data can be received.
  NDAC (Not Data Accepted): The signal which indicates that the data reception is complete.

- The following signals are transferred via the control lines.

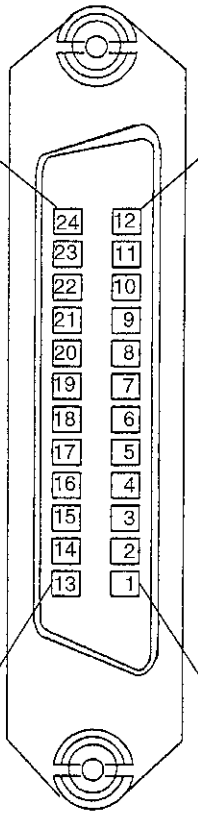
  ATN (Attention): The signal used to indicate that the signals on the data lines are an address or a command or other type.
  IFC (Interface Clear): The signal to clear the interface.
  EOI (End of Identify): The signal used to indicate the end of data transfer.
  SRQ (Service Request): The signal used by any device to request service to the controller.
  REN (Remote Enable): The signal used for remote-controlling devices that can be programmed via remote programming.

7.1.2 GPIB Standards and the Q8492 GPIB Specifications

Standards:	IEEE 488-1978
Codes used:	ASCII codes or binary codes when the packed format is used.
Logical level:	Logical "0" (High state) at +2.4V or higher Logical "1" (Low state) at +0.4V or lower
Driver specifications:	Open collector type (except EOI and DAV) "Low" state output voltage at +0.4V or lower, 48mA "High" state output voltage at +2.4V or higher, -5.2mA
Receiver specifications:	Low state at +0.6V or lower and High state at +2.0V or higher
Addressing:	Up to 31 talk and listen addresses can be set by the address switch.
Cable length:	The total bus cable length must meet the following: (number of devices connected to the bus) × 2m or less and not exceeding 20m.

Connector: 24-pin GPIB connector 57-20240-D35A (Amphenol or equivalent)

Signal name	Pin No.
GND. LOGIC	24
GND. (ATN)	23
GND. (SRQ)	22
GND. (IFC)	21
GND. (NDAC)	20
GND. (NRFD)	19
GND. (DAV)	18
REN	17
DIO 8	16
DIO 7	15
DIO 6	14
DIO 5	13



Pin No.	Signal name
12	SHIELD
11	ATN
10	SRQ
9	IFC
8	NDAC
7	NRFD
6	DAV
5	EOI
4	DIO 4
3	DIO 3
2	DIO 2
1	DIO 1

Figure 7-2 GPIB connector

Interface functions: [Table 7-1]

Table 7-1 Interface Functions

Code	Function and description
SH1	Source handshaking function
AH1	Acceptor handshaking function
T5	Basic talker function, Serial polling function, Talker only function, Talker release function by specifying the listener
L4	Basic listener function, Listener release function by specifying the talker
SR1	Service request function
RL1	Remote control function
PP0	Without parallel function
DC0	Device clear function
DT0	Without device trigger function
C0	Without controller function
E2	Tristate output

7.1.3 Connecting System Devices

Since the GPIB system is comprised of more than one devices, the following checks should be made during system preparation.

(1) Before connecting, verify the status (or preparation)and operation of each device referring to the controller and device instruction manuals.

(2) Do not use unnecessarily long cables and bus cables when connecting the measuring instrument and controller. Use the bus cable within the specified length limits.
The total bus cable length must meet the following:
(number of devices connected to the bus) x 2 m or less and not exceeding 20 m.

The following standard cables are available at ADVANTEST.

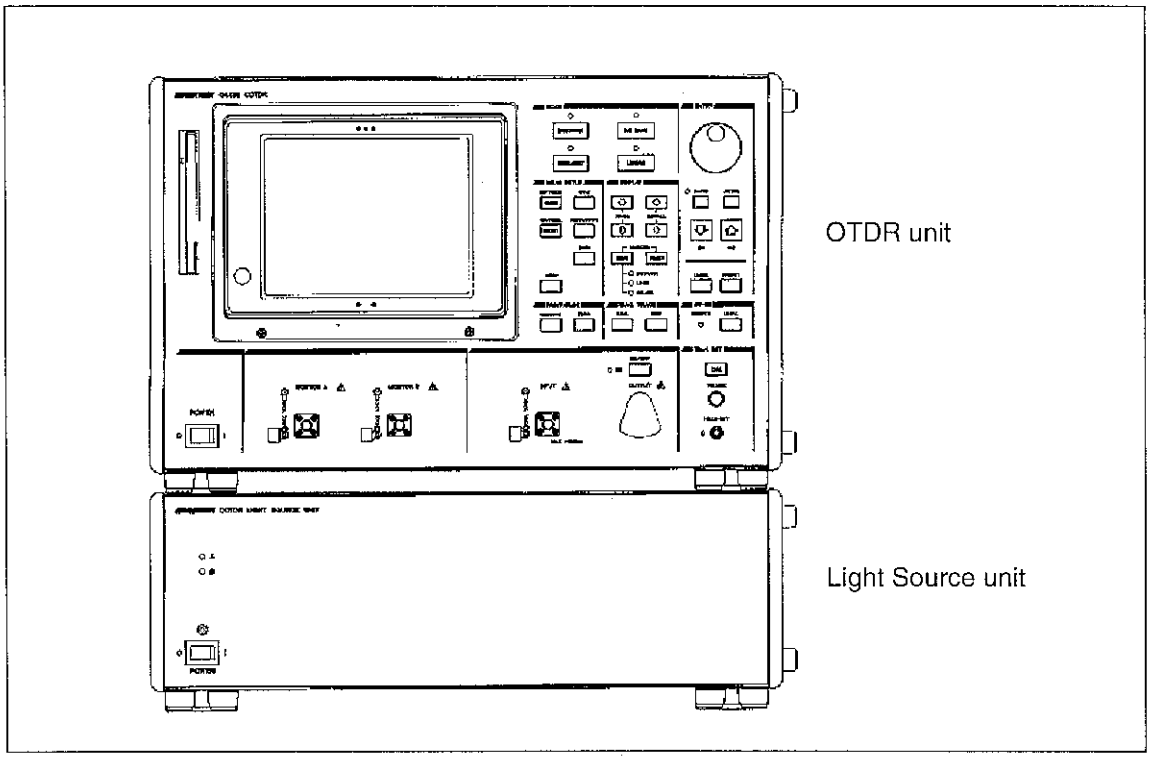
Table 7-2 Standard Bus Cables (optional)

Length	Type name
0.5m	408JE-105
1m	408JE-101
2m	408JE-102
4m	408JE-104

(3) This cable has both male and female connectors. Up to three cables can be connected to the unit in piggyback fashion. Make sure that the cables are securely attached and the screws are tight.

(4) Verify the power conditions, grounding state, and settings of each device before turning on its power supply. If all connected devices are not turned on and properly set up, the system may not function correctly.

7.1.4 GPIB Front Panel Operation



(1) LOCAL key

This key releases external control and makes the panel key input valid when the Q8492 is in remote control mode. When the system power supply is turned ON, LOCAL mode is set automatically.

(2) Remote LED

This LED is lit when the Q8492 is controlled by an external controller. In this case, any settings by the front panel keys are made invalid.

(3) Setting GPIB address

Press the MENU key. Select the I/O using the ⇩ and ⇧ keys.. Set the GPIB address with the Data Knob.

Note: ***Press the MENU key, select the I/O using the ⇩ and ⇧ keys. and select the PLT (plotter output) at HDCOPY (hardcopy) to set the Q8492 in the TALK ONLY mode. To operate the Q8492 in the ADDRESSABLE mode, change to PRT (printer output).***

7.2 Service Request

When the Q8492 is set to S0 mode and when each bit of the status byte is set to "1", the Q8492 sends a service request (SRQ) to the controller.

When the service request is sent, the status byte is sent by the controller executing serial polling.

<Status byte>

8	7	6	5	4	3	2	1
0	*4	*3	0	0	0	*2	*1

*1: "1" is set at the end of measurement.

*2: "1" is set when a syntax error occurs.

*3: "1" is set at the end of averaging.

*4: Request service (RQS)
"1" is set when one or more bits of *1, *2 and *3 are set to "1".

7.3 GPIB Talker Format

Issue the read command to read the GPIB talker format. The following two types are used according to the read command issued.

① Binary output

Applicable commands
One byte per data ... RDTB, RMDB, RADB
Two bytes per data ... RDTW, RMDW, RADW
Three bytes per data ... RDTL, RMDL, RADL

Format

Header	Data 1	Data 2		Data N	BD

Header: Six-byte ASCII data to be set by the Hn command.
It is output only when the header is set ON (see ⑧ in [7.3.1 GPIB Commands]).
Data: See each read command.
BD: Block delimiter to be set by the DLn command.

② ASCII output

- When more than one data are used:

Header	Data 1	SD	Data 2	SD		SD	Data N	BD

- When a single data is used:

Header	Data	BD

The number of the output data is determined by the read commands. See each read command.

Header: Six-byte ASCII data to be set by the Hn command.
It is output only when the header is set ON.
SD: A string delimiter to be set by the SLn command
(see ⑦ in [7.3.1 GPIB Commands]).
BD: A block delimiter to be set by the DLn command
(see ⑥ in [7.3.1 GPIB Commands]).

7.3.1 GPIB Commands

This subsection shows the GPIB Commands list and describes each command.

(1) GPIB Commands List

Table 7-3 List of GPIB Commands (1 of 2)

	Command	Function
①	C	Clear
②	Z	Initial clear
③	Sn	ON/OFF of issuing the service request
④	SMKn	Mask setting on the service request
⑤	CS	Clearing the status byte
⑥	DLn	Sets the delimiter mode
⑦	SLn	Sets the string delimiter mode
⑧	Hn	Sets the header on or off
⑨	MON	Sets the monitor mode
⑩	AVG	Sets the averaging mode
⑪	PSE	Sets the pause state/loading mode
⑫	IDXn	Sets the index
⑬	DRn	Sets the distance range
⑭	GANn	Sets the gain
⑮	SSPn	Sets the horizontal span
⑯	SSTn	Sets the horizontal position
⑰	VSLn	Sets the vertical scale
⑱	VPSn	Sets the vertical position
⑲	PWn	Sets the span width
⑳	KNBn	Sets the RAPID
㉑	TST	Saving the dual trace waveform
㉒	TVWn	Sets the dual trace waveform on or off

Table 7-3 List of GPIB Commands (2 of 2)

	Command	Function
㉓	LSSn	Selecting the marker(standard advance function)
㉔	MKAn MKBn MKCn	Sets the marker
㉕	MSTn	Saving the waveform memory
㉖	MRCn	Recalling the waveform memory
㉗	MDLn	Deleting the waveform memory
㉘	LBLn	Sets the label
㉙	PFD	Printer feeding
㉚	PRT	Printing out
㉛	PRMn	Sets the print output method
㉜	CLOCKn	Sets the clock
㉝	SAVGn	Sets the averaging times
㉞	AVMn	Sets the averaging process indication
㉟	BZn	Turns the buzzer on or off
㊱	FLTn	Sets the filtering
㊲	LDMn	Sets the loading mode
㊳	OPTn	Sets the light output measuring mode
㊴	PSCMn	Sets the polarization scrambler(measuring mode)
㊵	PSCLn	Sets the polarization scrambler(loading mode)
㊶	OUTn	Sets the light output
㊷	WCHnn	Sets the measuring channel
㊸	CWLn	Edits the wavelength list (wavelength)
㊹	CCMn	Edits the wavelength list (comment)
㊺	LSIn	Changing the wavelength interval
㊻	OPSn	Sets the output power
㊼	SALL	Sets data in the same format as the FD.

(2) GPIB Commands Description

① C

<Function> This command sets the status same as the power supply is turned ON.

<Parameter> None

<Description> The set status does not change. The set status is as follows:

Item	Status
MONITOR/AVERAGE	MONITOR
PAUSE	ON
DUAL TRACE function	OFF
MENU	OFF

② Z

<Function> This command clears the status to the initial settings.

<Parameter> None

<Description> The following initial settings are made.

Item	Status
Measuring mode	MONITORING PAUSE
Label	Q8492 OTDR
Clock	NOT CHANGE
Distance range	1000km
Span	100km/DIV
Horizontal start distance	0km
Vertical scale	5dB/DIV
Vertical position	0 to -40dB
Pulse width	10μs
INDEX	1.4750
Gain	ALC ON (GAIN3)
Disk function file name	00000000.DSP
Disk function data type	DSP, DINARY
Disk function information	CLEAR
Internal memory data	CLEAR
Dual trace function	OFF
Dual trace waveform	CLEAR
Averaging times	256
BUZZER	ON
GPIB address	NOT CHANGE
HDCOPY	PRINTER
FILTER	NORMAL
DATA KNOB RAPID	OFF
MARKER	DISTANCE
PRINTER	SHORT
Averaging process indication	TIME

③ Sn

<Function> This command controls whether the service request is sent.

<Parameter>

n = 0	Sends the service request.
n = 1	Does not send the service request.

<Description> When S0 mode is set, the service request is sent. The initial value is set to n = 1.

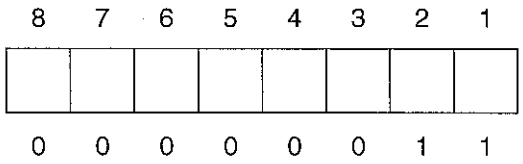
④ SMKn

<Function> This command masks the service request.

<Parameter> n = 0 to 127

<Description> This command masks the status byte.
The service request of the masked bit is ignored.
The parameter is expressed in decimal numbers.

(Example)
Where n is 3, bits 1 and 2 of the status byte are masked.



⑤ CS

<Function> This command clears the status.

<Parameter> None

<Description> This command clears the bit that is set to "1" in the status byte.

⑥ DLn

<Function> This command sets the delimiter mode.

<Parameter>

n = 0	CR/LF + EOI
n = 1	LF only
n = 2	EOI only

<Description> The delimiter indicates the end of data

Header	Data	SD	Data	SD	Data	BD

Header	Data	BD

The set block delimiter is added to the data regardless of the number of data or whether the output format is binary or ASCII.

DL0: CR/LF + EOI
DL1: LF only
DL2: EOI only

The initial value is set to the DL0.

⑦ SLn

<Function> This command sets the string delimiter mode.

<Parameter>

n = 0	","
n = 1	␣ (space)
n = 2	CRLF

<Description> The output request is made by the read command. If its output format is in ASCII format and more than one data is used, the string delimiters are added to the output data as a data delimiter.

Header	Data	SD	Data	SD	Data	BD

Added between data and data
In the case of "SL0": ","
In the case of "SL1": ␣ (space)
In the case of "SL2": CRLF

Block delimiter is added
DL0: CR/LF + EOI
DL1: LF only
DL2: EOI only

The initial value is set to the SL0.

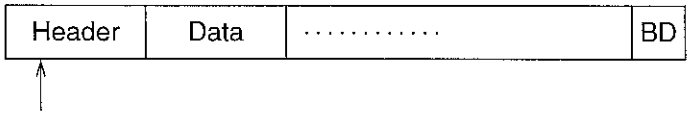
⑧ Hn

<Function> This command turns the header on or off.

<Parameter>

n = 0	OFF
n = 1	ON

<Description> If the output request is made by the read command and the header is ON, six bytes ASCII data are added to the top of the output data as a header.
The contents of the header are same as the read command.



Six-byte ASCII data

Nothing is added if the header is OFF.
The header is added if the header is ON regardless of the format.
The initial value is set to the H0.

⑨ MON

<Function> This command turns on the monitoring mode.

<Parameter> None

<Description> This command activates the monitoring mode with the current settings.
Some settings cannot be made when not in monitoring mode.

⑩ AVG

<Function> This command activates the averaging mode.

<Parameter> None

<Description>
- This command starts the averaging with the set conditions.
- This command continues averaging in the case of the averaging pause.
- If the averaging times is increased and this command is issued at the end of averaging, additional averaging is started.

⑪ PSE

<Function> This command activates the pause mode.

<Parameter> None

<Description> This function activates the pause mode while in the averaging mode or monitoring mode.

⑫ IDXn

<Function> This command sets the index value.

<Parameter> $1.4000 \leq n \leq 1.6000$
0.0001step

<Description> This command sets the index value.

⑬ DRn

<Function> This command sets the distance range.

<Parameter>

n = 0	100km	n = 9	1000km	n = 18	10000km
n = 1	200km	n = 10	2000km	n = 19	11000km
n = 2	300km	n = 11	3000km	n = 20	12000km
n = 3	400km	n = 12	4000km	n = 21	13000km
n = 4	500km	n = 13	5000km	n = 22	14000km
n = 5	600km	n = 14	6000km	n = 23	15000km
n = 6	700km	n = 15	7000km		
n = 7	800km	n = 16	8000km		
n = 8	900km	n = 17	9000km		

<Description>
- The distance range can be set while in monitoring mode only.
- Select a longer range than the fiber cable length. If a shorter range is selected, correct measurement cannot be made due to multiplex reflection.

⑭ GANn

<Function> This command sets the gain.

<Parameter>

n = 0	GAIN 0
n = 1	GAIN 1
n = 2	GAIN 2
n = 3	GAIN 3
n = 99	ALC:ON

<Description> This command can be set while in the monitoring mode only.
If n is 0, 1, 2, or 3, the ALC is set to OFF.

⑮ SSPn

<Function> This command changes the horizontal span.

<Parameter>

n = 0	5km	n = 10	700km	n = 20	8000km
n = 1	10km	n = 11	800km	n = 21	9000km
n = 2	20km	n = 12	900km	n = 22	10000km
n = 3	50km	n = 13	1000km	n = 23	11000km
n = 4	100km	n = 14	2000km	n = 24	12000km
n = 5	200km	n = 15	3000km	n = 25	13000km
n = 6	300km	n = 16	4000km	n = 26	14000km
n = 7	400km	n = 17	5000km	n = 27	15000km
n = 8	500km	n = 18	6000km		
n = 9	600km	n = 19	7000km		

<Description> The expansion or compression of the span differs depending on the display status and distance range.

Note1: The span cannot be expanded /compressed from the memory recalled waveform.

Note2: The expansion or compression of the span is made with the marker as the center.

⑯ SSTn

<Function> This command sets the horizontal position.

<Parameter> 0 to 10000

<Description> This command sets the start point(horizontal position) on the distance axis in km.
In some cases, the horizontal position cannot be set by the distance range, span, or index.
Although a decimal point number or less can be set, the results according to the setting may not be obtained due to an internal data resolution and index error.

⑰ VSLn

<Function> This command sets the vertical scale.

<Parameter>

	Vertical Scale
n = 0	5dB/div
n = 1	2
n = 2	1
n = 3	0.5

⑱ VPSn

<Function> This command sets the upper limit of the vertical position.

<Parameter> n = -59 to 15

<Description>
- This command sets the vertical axis (vertical position).
- The unit is a dB.

⑲ PWn

<Function> This command sets the pulse width.

<Parameter>

n = 0	3μs
n = 1	10μs
n = 2	30μs
n = 3	60μs
n = 4	100μs

<Description> This command can be set while in monitoring mode only.

⑳ KNBn

<Function> This command sets the RAPID function of the data knob to ON or OFF.

<Parameter>

n = 0	OFF
n = 1	ON

㉑ TST

<Function> This command stores the waveform data in dual trace memory.

<Parameter> None

<Description> Only the waveform data is stored in dual trace memory.
If the data is has already been saved in the memory, it is overwritten by the new data.
Any stored data is deleted when the power supply is turned off.

㉒ TVWn

<Function> This command turns the dual trace on or off.

<Parameter>

n = 0	OFF
n = 1	ON

<Description> This command controls whether or not saved data is displayed in dual trace mode.

㉓ LSSn

<Function> This command activates the marker function.

<Parameter>

n = 0	DISTANCE
n = 1	LOSS
n = 2	SPLICE

㉔ MKAn, MKBn, and MKCn

<Function> The MKA command moves the marker 1.
The MKB command moves the marker 2.
The MKC command moves the marker 3.

<Parameter> 0 to 500

<Description> The left end of the screen is set as "0", and the right end is set as "500".
The setting is not affected by vertical distance indications.

㉕ MSTn

<Function> This command saves the waveform data and settings into internal memory.

<Parameter> n = 1 to 32

<Description> This command saves the waveform data and settings into internal memory. If the data has already been saved in the selected file number, the old data is deleted and replaced by the new data.
See [4.13.1 Writing] for the detailed memory function.

㉖ MRCn

<Function> This command recalls the waveform and settings saved in the memory.

<Parameter> n = 1 to 32

<Description> See [4.13.2 Reading Out] for the detailed memory function.

㉗ MDLn

<Function> This command deletes the memory data.

<Parameter> 1 to 32

<Description> This command deletes the data saved in the file number entered. See [4.13.3 Deleting] for the detailed memory function.

㉘ LBLn

<Function> This command allows the user to input labels.

<Parameter> n = "# Label #"

Special characters

<Description> Using this command, the user can enter a label with up to 23 characters (see below for usable characters)

Usable special characters: #, $, %, &, (,), *, +, -, /, =, <, >, ?, {, }

㉙ PFD

<Function> Paper feed command.

<Parameter> None

<Description> This command feeds paper through the built-in printer.

㉚ PRT

<Function> Print command.

<Parameter> None

<Description> Prints out the current data. If data is sent to the plotter, GPIB control is suspended.

㉛ PRMn

<Function> This command sets the waveform output method for the built-in printer.

<Parameter>

n = 0	Short
n = 1	Long

㉜ CLOCKn

<Function> This command sets the date and time.

<Parameter> (Example) If the date and time is 20:45, December 25, 1994, n is 1994, 12, 25, 20, 45.

㉝ SAVGn

<Function> This command sets the averaging times.

<Parameter>

Parameter	0	1	2	3	4	5	6
Times	16	32	64	128	256	512	1024

Parameter	7	8	9	10	11	12
Times	2048	4096	8192	16384	32768	65536

㉞ AVMn

<Function> This command sets the averaging process displaying method.

<Parameter>

n = 0	Elapsed time
n = 1	%
n = 2	Averaging executed times/setting times

㉟ BZn

<Function> This command turns the buzzer on or off.

<Parameter>

n = 0	OFF
n = 1	ON

<Description> The buzzer sound is turned on or off. When the buzzer is turned on, it sounds whenever valid GPIB commands are received.

ON:
OFF:

㊱ FLTn

<Function> This command filters the sampled waveforms.

<Parameter>

n = 0	Normal mode
n = 1	Wide dynamic range mode

<Description> Filtering changes according to the pulse width or span.

㊲ LDMn

<Function> This command sets the loading mode.

<Parameter>

n = 0	Measuring mode
n = 1	Loading mode

<Description> While in loading mode, the unit is in a state of pause.

㊳ OPTn

<Function> This command sets the Pulse/FSK while in light output measuring mode.

<Parameter>

n = 0	FSK
n = 1	PULSE

㊴ PSCMn

<Function> This command turns the polarization scrambler to on or off while in measuring mode.

<Parameter>

n = 0	OFF
n = 1	ON

㊵ PSCLn

<Function> This command turns the polarization scrambler on or off while in loading mode.

<Parameter>

n = 0	OFF
n = 1	ON

㊶ OUTn

<Function> This command turns the light output from the output connector on or off.

<Parameter>

n = 0	OFF
n = 1	ON

㊷ WCHn

<Function> This command is used to set the predetermined channel in the wavelength list.

<Parameter> n = mm
mm: The wavelength channel numbers (00 to 99)

㊸ CWLn

<Function> This command is used to set each channel wavelength in the wavelength list.

<Parameter> n = mm: ddd
mm: Channel numbers (00 to 99)
ddd: wave length (1530.00 to 1570.00)

<Description> If the wavelength of the channel that is currently displayed on the screen is changed, the wavelength of the light source is also changed when the command is sent.

㊹ CCMn

<Function> This command is used to enter comments (of up to 16 characters) for each channel in the wavelength list.

<Parameter> n = mm: # $$$ #
mm: Channel numbers (00 to 99)
$$$: Comment (up to 16 characters)
#: Special characters used to enclose the comment

<Description> The character string is enclosed by special characters (usable characters are the same as those for the 28 LBn command). Comments can not be added to wavelengths which are not in the wavelength list.

Usable special characters: #, $, %, &, (,), *, +, -, /, =, <, >, ?, {, }

㊺ LSIn

<Function> This command is used to set the wavelength interval.

<Parameter> n = ddd
ddd: Wavelength interval (-0.50 nm to +0.50 nm)

㊻ OPSn

<Function> This command sets the output power.
N = 0.0 % to 100.0 %

Note: Refer to Section 4.2.
Discard all digits to the right of the first decimal place.

㊼ SALLn

<Function> Sets data and measurement conditions in the same format as the FD.

<Parameter> For the meaning of the suffix "n,2 refer to Section 5.6 where the format is used with the Q8492.

Note: Send a set of binary data in the FD format as a single unit to the Q8492 after the SALL command has been executed. Then, the Q8492 reads data assuming that the data is in the FD format when the next command in listener mode is issued.

- **The data (number of format data sets) is automatically searched, starting from the header section within the data. If any problems are found with the header, data read is forcibly terminated.**
- **If the number of received bytes exceeds the number of bytes specified in the header, the remaining bytes are not read.**
- **If the number of received bytes is less than the number of bytes specified in the header, data read is forcibly terminated.**
- **If the remote or listener mode is turned off during operation, data read is forcibly terminated.**

CAUTION!
There is a possibility that a command issued after a read problem may not be recognized correctly. Be sure to perform an interface clear (IFC) every time all of the data has been sent.

7.3.2 GPIB Read Commands

This section lists the GPIB read commands and provides detailed explanation for each command.

(1) GPIB read commands

Table 7-4 GPIB Read Command List (1 of 2)

	Command	Function
①	RDTB	Outputs on-screen data (one binary byte per data).
②	RDTW	Outputs on-screen data (two binary bytes per data).
③	RDTL	Outputs on-screen data (four binary bytes per data).
④	RDTS	Outputs on-screen data (eight ASCII bytes per data).
⑤	RMDB	Outputs dual trace memory data (one binary byte per data).
⑥	RMDW	Outputs dual trace memory data (two binary bytes per data).
⑦	RMDL	Outputs dual trace memory data (four binary bytes per data).
⑧	RMDS	Outputs dual trace memory data (eight ASCII bytes per data).
⑨	RADB	Outputs all internal data (one binary byte per data).
⑩	RADW	Outputs all internal data (two binary bytes per data).
⑪	RADL	Outputs all internal data (four binary bytes per data).
⑫	RADS	Outputs all internal data (eight ASCII bytes per data).
⑬	RDTC	Reads the number of the on-screen data.
⑭	RMDC	Reads the number of the dual trace memory data.
⑮	RADC	Reads the number of all internal data and the distance between the start point and end point.
⑯	RGAN	Reads the gain.
⑰	RVSL	Reads the vertical scale.
⑱	RVPS	Reads the vertical position.
⑲	RHPS	Reads the horizontal position.
⑳	RSP	Reads the horizontal span.
㉑	RDR	Reads the distance range.

Table 7-4 GPIB Read Command List (2 of 2)

	Command	Function
㉒	RLSS	Reads the marker.
㉓	RMKA	Reads the marker 1.
㉔	RMKB	Reads the marker 2.
㉕	RMKC	Reads the marker 3.
㉖	RRDO	Reads the window data.
㉗	RPW	Reads the pulse width.
㉘	RLBL	Reads the label.
㉙	RIDX	Reads the index.
㉚	RCLOCK	Reads the date and time.
㉛	RSAVG	Reads the averaging times.
㉜	RALC	Reads the ALC mode.
㉝	ROPT	Reads the light output measuring mode.
㉞	RPSCM	Reads the polarization scrambler(measuring mode) status.
㉟	RPSCL	Reads the polarization scrambler(loading mode) status.
㊱	ROUT	Reads the light status.
㊲	RWCH	Reads the measuring channel.
㊳	RLSI	Reads the wavelength interval.
㊴	RCWLn	Reads the wavelength list.
㊵	ROPS	Reads the output power.
㊶	RALL	Reading data in FD format

(2) Descriptions of the GPIB Read Commands

① RDTB

<Function> This command reads the on-screen data.

<Description> Binary format output with one byte per data

Header	Data 1	Data 2	Data 3	· ·	Data n	BD

Header: When the Hn command is used, the six-byte ASCII header data is included with the screen data sent by the Q8492 unit to the controller.

Data: One byte (0 to 255). binary data
The lower limit of the screen is "0", and the upper limit is "255".
The number of data is read out by the RDTC command.

BD: A block delimiter set by the DLn command

② RDTW

<Function). This command reads the on-screen data.

<Description> Binary format output with two bytes per data

Header	Data 1	Data 2	Data 3	· ·	Data n	BD

Header: When the Hn command is used, the six-byte ASCII header data is included with the screen data sent by the Q8492 unit to the controller.

Data: Two-byte binary data
The upper one byte indicates an integer part and the lower one byte indicates a fractional part.
The number of data is read out by the RDTC command.
See (3) Data conversion equation.

BD: A block delimiter set by the DLn command

③ RDTL

<Function> This command reads the on-screen data.

<Description> Binary format output with four bytes per data

Header	Data 1	Data 2	Data 3	· ·	Data n	BD

Header: When the Hn command is used, the six-byte ASCII header data is included with the screen data sent by the Q8492 unit to the controller.

Data: Four bytes binary data
The upper two bytes indicate an integer part and the lower two bytes indicate a fractional part.
The number of data is read out by the RDTC command.
See (3) Data conversion equation.

BD: A block delimiter set by the DLn command

④ RDTS

<Function> This command reads the on-screen data.

<Description> ASCII format output with eight bytes per data

Header	Data 1	SD	Data 2	SD	Data 3	SD	· · ·

Data n	BD

Header: When the Hn command is used, the six-byte ASCII header data is included with the screen data sent by the Q8492 unit to the controller.

Data: Eight bytes ASCII data
The number of data is read out by the RDTC command.

SD: A string delimiter set by the SLn command

BD: A block delimiter set by the DLn command

⑤ RMDB

<Function> This command reads the dual trace memory data.

<Description> Binary format output with one byte per data

Header	Data 1	Data 2	Data 3	· ·	Data n	BD

Header: When the Hn command is used, the six-byte ASCII header data is included with the screen data sent by the Q8492 unit to the controller.

Data: One byte (0 to 255). binary data
The lower limit of the screen is "0", and the upper limit is "255".
The number of data is read by the RMDC command.

BD: A block delimiter set by the DLn command

⑥ RMDW

<Function> This command reads the dual trace memory data.

<Description> Binary format output with two bytes per data

Header	Data 1	Data 2	Data 3	· ·	Data n	BD

Header: When the Hn command is used, the six-byte ASCII header data is included with the screen data sent by the Q8492 unit to the controller.

Data: Two-byte binary data
The upper one byte indicates an integer part and the lower one byte indicates a fractional part.
The number of data is read out by the RMDC command.
See (3) Data conversion equation.

BD: A block delimiter set by the DLn command

⑦ RMDL

<Function> This command reads the dual trace memory data.

<Description> Binary format output with four bytes per data

Header	Data 1	Data 2	Data 3	· ·	Data n	BD

Header: When the Hn command is used, the six-byte ASCII header data is included with the screen data sent by the Q8492 unit to the controller.

Data: Four bytes binary data
The upper two bytes indicate an integer part and the lower two bytes indicate a fractional part.
The number of data is read out by the RMDC command.
See (3) Data conversion equation.

BD: A block delimiter set by the DLn command

⑧ RMDS

<Function> This command reads the dual trace memory data.

<Description> ASCII format output with eight bytes per data

Header	Data 1	SD	Data 2	SD	Data 3	SD	· · ·

Data n	BD

Header: When the Hn command is used, the six-byte ASCII header data is included with the screen data sent by the Q8492 unit to the controller.

Data: Eight bytes ASCII data
The number of data is read out by the RMDC command.

SD: A string delimiter set by the SLn command

BD: A block delimiter set by the DLn command

⑨ RADB

<Function> This command reads all the internal data.

<Description> Binary format output with one byte per data

Header	Data 1	Data 2	Data 3	· ·	Data n	BD

Header: When the Hn command is used, the six-byte ASCII header data is included with the screen data sent by the Q8492 unit to the controller.

Data: One byte (0 to 255). binary data
The lower limit of the screen is "0", and the upper limit is "255".
The number of data is read out by the RADC command.

BD: A block delimiter set by the DLn command

⑩ RADW

<Function> This command reads all the internal data.

<Description> Binary format output with two bytes per data

Header	Data 1	Data 2	Data 3	· ·	Data n	BD

Header: When the Hn command is used, the six-byte ASCII header data is included with the screen data sent by the Q8492 unit to the controller.

Data: Two-byte binary data
The upper one byte indicates an integer part and the lower one byte indicates a fractional part.
The number of data is read out by the RADC command.
See (3) Data conversion equation.

BD: A block delimiter set by the DLn command

⑪ RADL

<Function> This command reads all the internal data.

<Description> Binary format output four bytes per data

Header	Data 1	Data 2	Data 3	· ·	Data n	BD

Header: When the Hn command is used, the six-byte ASCII header data is included with the screen data sent by the Q8492 unit to the controller.

Data: Four bytes binary data
The upper two bytes indicate an integer part and the lower two bytes indicate a fractional part.
The number of data is read out by the RADC command.
See (3) Data conversion equation.

BD: A block delimiter to be selected by the DLn command

⑫ RADS

<Function> This command reads all the internal data.

<Description> ASCII format output with eight bytes per data

Header	Data 1	SD	Data 2	SD	Data 3	SD	· · ·

Data n	BD

Header: When the Hn command is used, the six-byte ASCII header data is included with the screen data sent by the Q8492 unit to the controller.

Data: Eight bytes ASCII data
The number of data is read out by the RADC command.

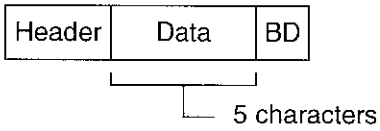
SD: A string delimiter to be selected by the SLn command

BD: A block delimiter to be selected by the DLn command

⑬ RDTC

<Function> This command reads the number of data.

<Description> This command reads the number of screen data.
Talker format



⑭ RMDC

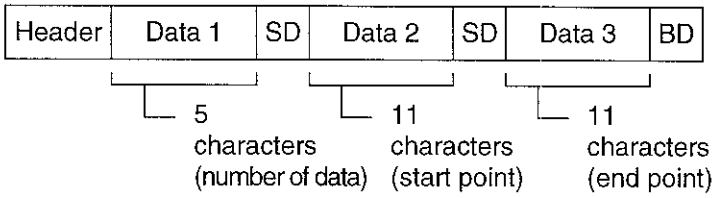
<Function> This command reads the number of data.

<Description> This command reads the number of dual trace memory data.

⑮ RADC

<Function> This command reads the number of data.

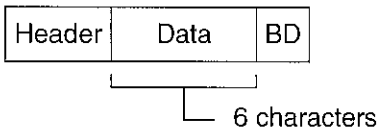
<Description> This command reads the number of all the internal data, the data start point , and data end point distance(in km).
Talker format



⑯ RGAN

<Function> This command reads the set gain.

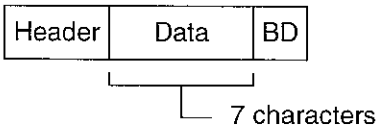
<Description> This command reads the gain that is set.
Talker format



⑰ RVSL

<Function> This command reads the vertical scale.

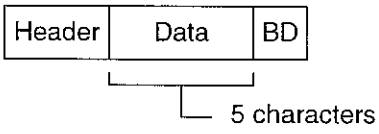
<Description> This command reads the vertical scale displayed on the screen in a dB/D form.
Talker format



⑱ RVPS

<Function> This command reads the vertical position.

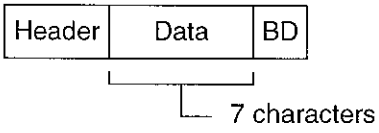
<Description> This command reads the vertical position shown on the screen.
This command reads the upper limit.
Talker format



⑲ RHPS

<Function> This command reads the horizontal position.

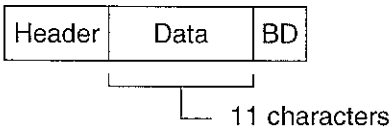
<Description> This command reads the position of the distance that is set.
This command reads the left end value of the screen.
Talker format



⑳ RSP

<Function> This command reads the horizontal span.

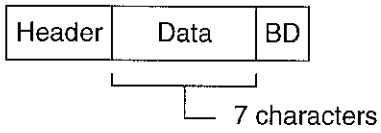
<Description> This command reads information of the horizontal span that is set.
Talker format



㉑ RDR

<Function> This command reads the distance range.

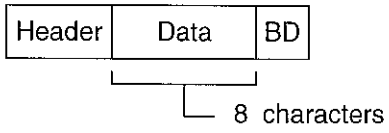
<Description> This command reads the distance range shown in the upper right corner of the screen.
Talker format



㉒ RLSS

<Function> This command reads the kinds of the marker.

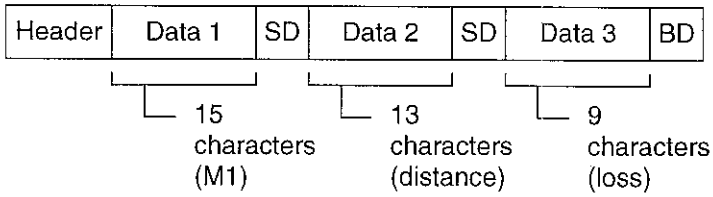
<Description> This command reads the set marker function.
Talker format



㉓ RMKA

<Function> This command reads the marker 1.

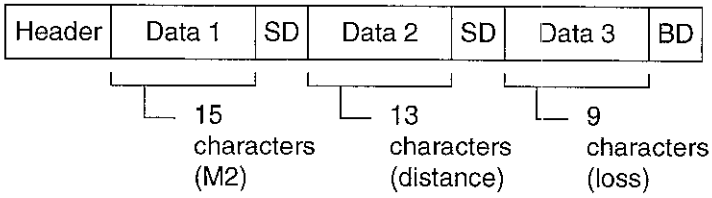
<Description> This command reads the data indicated by marker 1 shown on the screen.
Talker format



㉔ RMKB

<Function> This command reads marker 2.

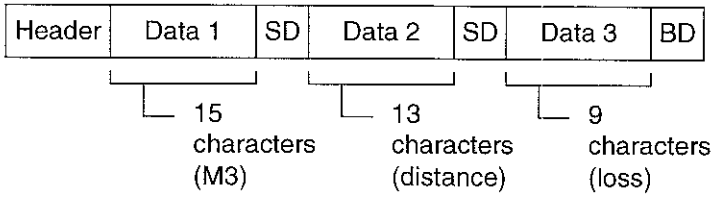
<Description> This command reads the data indicated by the marker 2 shown on the screen.
Talker format



㉕ RMKC

<Function> This command reads the marker 3.

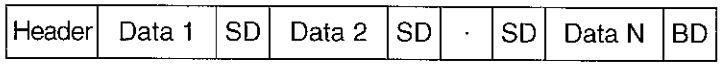
<Description> This command reads the data indicated the marker 3 shown on the screen.
Talker format



㉖ RRDO

<Function> This command reads the data in the window.

<Description> This command reads the data indicated by the marker shown on the screen.
Talker format



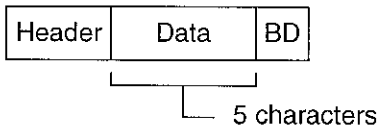
The character number of the data 1 through data n is as follows.

STANDARD	Data No.	Character number	Contents
(DISTANCE)	1	15	Title
	2	13	Distance
	3	9	Loss
(LOSS)	1	15	Title
	2	13	Distance
	3	9	Loss
	4	14	Loss/distance
(SPLICE)	1	15	Title
	2	9	Loss
	3	13	Distance

㉗ RPW

<Function> This command reads the set pulse width.

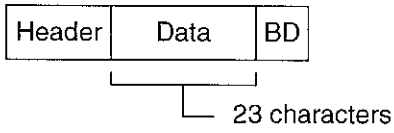
<Description> Talker format



㉘ RLBL

<Function> This command reads the set label.

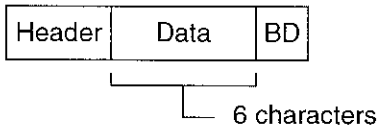
<Description> Talker format



㉙ RIDX

<Function> This command reads the set index.

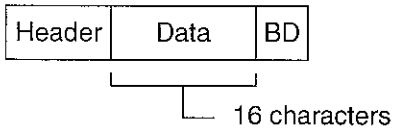
<Description> Talker format



㉚ RCLOCK

<Function> This command reads the date and time.

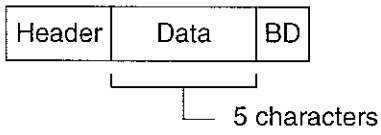
<Description> Talker format



㉛ RSAVG

<Function> This command reads the set averaging times.

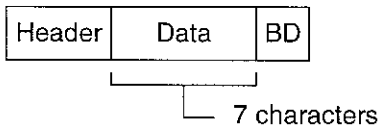
<Description> Talker format



㉜ RALC

<Function> This command reads the set ALC.

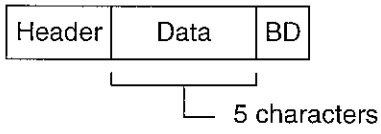
<Description> Talker format



㉝ ROPT

<Function> This command reads the light output mode.

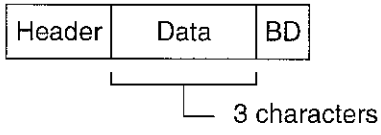
<Description> Talker format



㉞ RPSCM

<Function> This command reads the polarization scrambler (measuring mode) status.

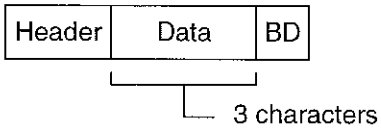
<Description> Talker format



㉟ RPSCL

<Function> This command reads the polarization scrambler (loading mode) status.

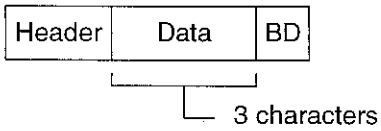
<Description> Talker format



㊱ ROUT

<Function> This command reads the light Read status.

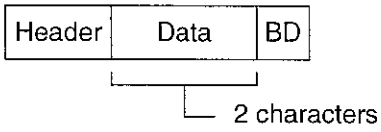
<Description> Talker format



㊲ RWCH

<Function> This command reads the channel number.

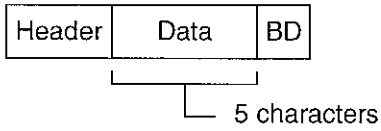
<Description> Talker format



㊳ RLSI

<Function> This command reads the wavelength interval.

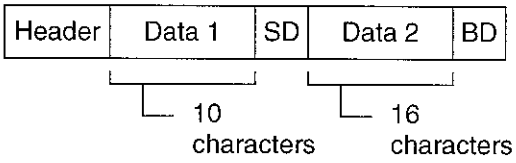
<Description> Talker format



㊴ RCWLn

<Function> This command reads the wavelength list (wavelength and comment) of the n channel.

<Description> Talker format



Data 1: the set wavelength of n channel

Data 2: the comment of n channel

If the wavelength is not set in the read channel, spaces are input.

(3) Data conversion equation

- When using binary format, the output is two bytes per data.

  The upper and lower bytes are output in sequence.
  The upper byte represents an integer and the lower byte represents a fraction.

  <conversion equation>

$$\text{Data} = (\text{upper one byte}) + \frac{(\text{lower one byte})}{256} - 256$$

- When using binary format, the output is four bytes per data.

  The four bytes are output in sequence from upper to lower.
  The upper two bytes represents an integer and the lower two bytes represents a fraction.
  (however, the uppermost byte of the upper two bytes is not normally used.)

  <conversion equation>

  Assuming that the four bytes be A, B, C, and D in the upper to the lower order, the conversion equation is as follows:

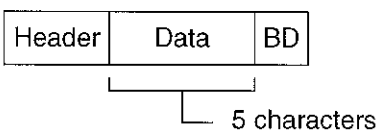
$$\text{Data} = B + \frac{C}{256} + \frac{D}{65536} - 256$$

  (A is not used.)

㊵ ROPS

<Function> Reads the output power.

<Description> Talker format



㊶ RALLn

<Function> Reading data in FD format

<Description> n = 0: DSP + ASCII

n = 1: DSP + BINARY

n = 2: ALL + BINARY

Executing the RALLn command outputs data in the following format.

For information on the data2 format, refer to section 5.6, "FD Format."

Header	Data 1	BD	Data 2	BD

Header: Six characters ("RALL ")

Data1: Same as the number of bytes in Data2 (variable for ASCII)

Bd: Block delimiter (refer to the DLn command)

Note: ***The output is forcibly terminated if the talker mode is turned off.***

7.4 Program Examples

Program examples using a PC-9801 series controller are shown below.
(N88BASIC is used)

(1) A program used to set measuring parameters

```
1000 '
1010 ' EXAMPLE PROGRAM
1020 '
1030 '
1040  OTDR=11
1050 '
1060  ISET IFC
1070  ISET REN
1080 '
1090  PRINT @OTDR;"MON"
1100  PRINT @OTDR;"IDX1.4700"
1110  PRINT @OTDR;"DR2"
1120  PRINT @OTDR;"PW1"
1130 '
1140  END
```

- Program description

Line number	Contents
1040	Define the Q8492 address as 11
•	
1060	Interface clear
1070	Remote enable
•	
1090	Set the monitoring mode
1100	Set the index to 1.4700
1110	Set the distance range to 2000km
1120	Set the pulse width to 10μs

(2) A program used to read the setting data

```
1000 '
1010 ' EXAMPLE PROGRAM
1020 '
1030 '
1040 '
1050 '
1060  OTDR=11
1070 '
1080  ISET IFC
1090  ISET REN
1100 '
1110  PRINT @OTDR;"RPW"
1120  INPUT @OTDR;A$
1130 '
1140  PRINT @OTDR;"RLBL"
1150  INPUT @OTDR;B$
1160 '
1170  PRINT @OTDR;"RIDX"
1180  INPUT @OTDR;C$
1190 '
1200  PRINT A$,B$,C$
1210 '
1220  END
```

- Program description

Line number	Contents
1060	Define the Q8492 address as 11
•	
1080	Interface clear
1090	Remote enable
•	
1110	Set to read the pulse width
1120	Read the pulse width in A$
•	
1140	Set to read the label
1150	Read the label in B$
•	
1170	Set to read the index
1180	Read the index in C$
•	
1200	Output the pulse width, label, and index to the screen

(3) A program to read the waveform on the screen in ASCII format

```
1000 '
1010 ' EXAMPLE PROGRAM
1020 '
1030  DIM A$(501)
1040 '
1050 '
1060  OTDR=11
1070 '
1080  ISET IFC
1090  ISET REN
1100 '
1110  NDATA=501
1120  CMD DELIM=0
1130  PRINT @OTDR;"DL0"
1140  PRINT @OTDR;"SL2"
1150  PRINT @OTDR;"RDTS"
1160 '
1170  FOR N=1 TO NDATA
1180    INPUT @OTDR;A$(N)
1190  NEXT N
1200 '
1210  FOR I=1 TO NDATA
1220    PRINT A$(I)
1230  NEXT I
1240 '
1250  END
```

- Program description

Line number	Contents
1030	Define the buffer
•	
1060	Define the Q8492 address as 11
•	
1080	Interface clear
1090	Remote enable
•	
1110	Assign the number of data to the variable
1120	Set the controller delimiter to the CR + LF
1130	Set the Q8492 block delimiter to the CR + LF + EOI
1140	Set the Q8492 string delimiter to the CR + LF
1150	Set to read the waveform data
•	
1170	Loop the number of data (501) times
1180	Read one data
1190	Loop
•	
1210	Loop the number of data (501) times
1220	Print the data
1230	Loop

(4) A program used to read the waveform data on the screen in a one byte binary format

```
1000 '
1010 ' EXAMPLE PROGRAM
1020 '
1030 '
1040  DIM A(501)
1050 '
1060  UNL=&H3F : UNT=&H5F : MTA=&H40 : MLA=&H20
1070  OTDR=11
1080  PC98=IEEE(1) AND &H1F
1090 '
1100  ISET IFC
1110  ISET REN
1120 '
1130  NDATA=501
1140  PRINT @OTDR;"DL2"
1150  PRINT @OTDR;"RDTB"
1160 '
1170  TALK=MTA+OTDR : LISTEN=MLA+PC98
1180  WBYTE UNL,TALK,LISTEN;
1190 '
1200  FOR N=1 TO NDATA
1210   RBYTE;RDT1
1220 '
1230   A(N)=RDT1
1240  NEXT N
1250 '
1260  FOR I=1 TO NDATA
1270   PRINT A(I)
1280  NEXT I
1290 '
1300  END
```

- Program description

Line number	Contents
1040	Define the buffer
•	
1060	Assign the interface message code to the variable
1070	Define the Q8492 address as 11
1080	Read the controller address and assign it to the variable
•	
1100	Interface clear
1110	Remote enable
•	
1130	Assign the number of data to the variable
1140	Set the block delimiter to the EOI only
1150	Set to read waveform data
•	
1170	Assign the talker address and listener address to the variable
1180	Define the Q8492 as a talker and the controller as a listener
•	
1200	Loop the number of data (501) times
1210	Read one byte
•	
1230	Assign the one byte to the buffer
1240	Loop
•	
1260	Loop the number of data (501) times
1270	Print the data
1280	Loop

(5) A program used to read the waveform data on the screen in a two bytes binary format

```
1000 '
1010 ' EXAMPLE PROGRAM
1020 '
1030 '
1040  DIM A(501)
1050 '
1060  UNL=&H3F : UNT=&H5F : MTA=&H40 : MLA=&H20
1070  OTDR=11
1080  PC98=IEEE(1) AND &H1F
1090 '
1100  ISET IFC
1110  ISET REN
1120 '
1130  NDATA=501
1140  PRINT @OTDR;"DL2"
1150  PRINT @OTDR;"RDTW"
1160 '
1170  TALK=MTA+OTDR : LISTEN=MLA+PC98
1180  WBYTE UNL,TALK,LISTEN;
1190 '
1200  FOR N=1 TO NDATA
1210   RBYTE;RDT1
1220   RBYTE;RDT2
1230 '
1240   RDT=RDT1+(RDT2/256)-256
1250 '
1260   A(N)=RDT
1270  NEXT N
1280 '
1290  FOR I=1 TO NDATA
1300   PRINT A(I)
1310  NEXT I
1320 '
1330  END
```

- Program description

Line number	Contents
1040	Define the buffer
•	
1060	Assign the interface message code to the variable
1070	Define the Q8492 address as 11
1080	Read the controller address and assign it to the variable
•	
1100	Interface clear
1110	Remote enable
•	
1130	Assign the number of data to the variable
1140	Set the block delimiter to the EOI only
1150	Set to read the waveform data
•	
1170	Assign the talker address and listener address to the variable
1180	Define the Q8492 as a talker and the controller as a listener
•	
1200	Loop the number of data (501) times
1210	Read one byte (integer part)
1220	Read one byte (fractional part)
•	
1240	Convert the two bytes to the data
•	
1260	Assign the data to the buffer
1270	Loop
•	
1290	Loop the number of data (501) times
1300	Print the data
1310	Loop

(6) A program used to read the waveform data on the screen in a four bytes binary format

```
1000 '
1010 ' EXAMPLE PROGRAM
1020 '
1030 '
1040  DIM A(501)
1050 '
1060  UNL=&H3F : UNT=&H5F : MTA=&H40 : MLA=&H20
1070  OTDR=11
1080  PC98=IEEE(1) AND &H1F
1090 '
1100  ISET IFC
1110  ISET REN
1120 '
1130  NDATA=501
1140  PRINT @OTDR;"DL2"
1150  PRINT @OTDR;"RDTL"
1160 '
1170  TALK=MTA+OTDR : LISTEN=MLA+PC98
1180  WBYTE UNL,TALK,LISTEN;
1190 '
1200  FOR N=1 TO NDATA
1210   RBYTE;RDT1
1220   RBYTE;RDT2
1230   RBYTE;RDT3
1240   RBYTE;RDT4
1250 '
1260   RDT=RDT2+(RDT3/256)+(RDT4/65536!)-256
1270 '
1280   A(N)=RDT
1290  NEXT N
1300 '
1310  FOR I=1 TO NDATA
1320   PRINT A(I)
1330  NEXT I
1340 '
1350  END
```

- Program description

Line number	Contents
1040	Define the buffer
•	
1060	Assign the interface message code to the variable
1070	Define the Q8492 address as 11
1080	Read the controller address and assign it to the variable
1100	Interface clear
1110	Remote enable
•	
1130	Assign the number of data to the variable
1140	Set the block delimiter to the EOI only
1150	Set to read waveform data
•	
1170	Assign the talker address and listener address to the variable
1180	Define the Q8492 as a talker and the controller as a listener
•	
1200	Loop the number of data (501) times
1210	Read one byte (the upper byte of the integer part is not used)
1220	Read one byte (the lower byte of the integer part)
1230	Read one byte (the upper byte of the fractional part)
1240	Read one byte (the lower byte of the fractional part)
•	
1260	Convert the four bytes to the data
•	
1280	Assign the data to the buffer
1290	Loop
•	
1310	Loop the number of data (501) times
1320	Print the data
1330	Loop

(7) A program used to issue the service request

```
1000 '
1010 ' EXAMPLE PROGRAM
1020 '
1030  OTDR=11
1040 '
1050  ISET IFC
1060  ISET REN
1070 '
1080  ON SRQ GOSUB *SRQFUN
1090  SRQ ON
1100 '
1110  PRINT @OTDR;"CS"
1120  PRINT @OTDR;"S0"
1130  PRINT @OTDR;"SMK67"
1140  PRINT @OTDR;"AVG"
1150 '
1160  *LOOP1
1170   GOTO *LOOP1
1180 '
1190  *SEQFUN
1200   POLL OTDR,STS
1210   PRINT "AVERAGE COMPLETED"
1220   END
```

- Program description

Line number	Contents
1030	Define the Q8492 address as 11
•	
1050	Interface clear
1060	Remote enable
•	
1080	Specify the SRQ subroutine
1090	Accept to receive the SRQ
•	
1110	Clear the status
1120	Set the service request sending mode
1130	Mask the factors except the averaging end
1140	Set the function to the averaging
•	
1160	*LOOP1
1170	Permanent loop
•	
1190	*SRQFUN
1200	Execute serial polling and assign the status to the variable
1210	Print the characters
1220	Stop the program

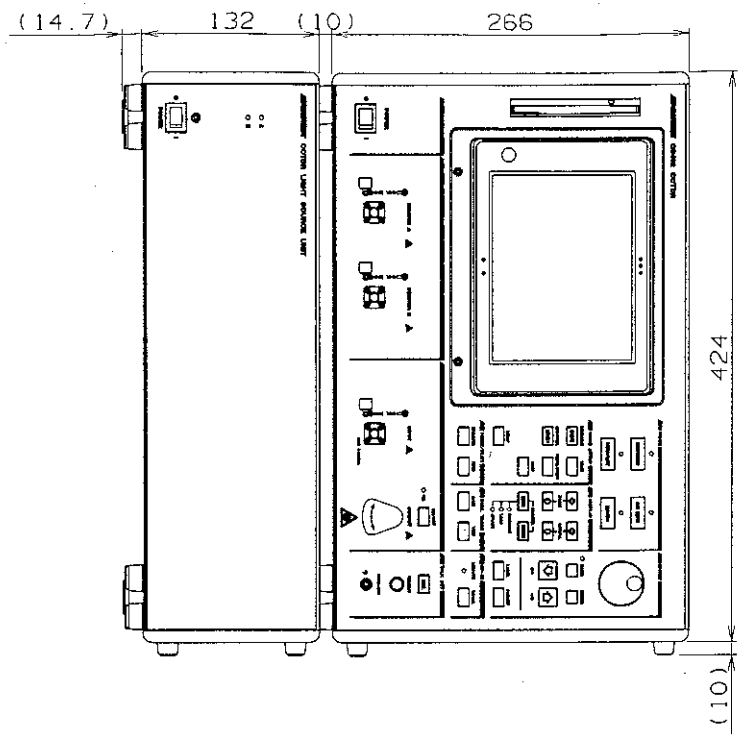
8 SPECIFICATIONS

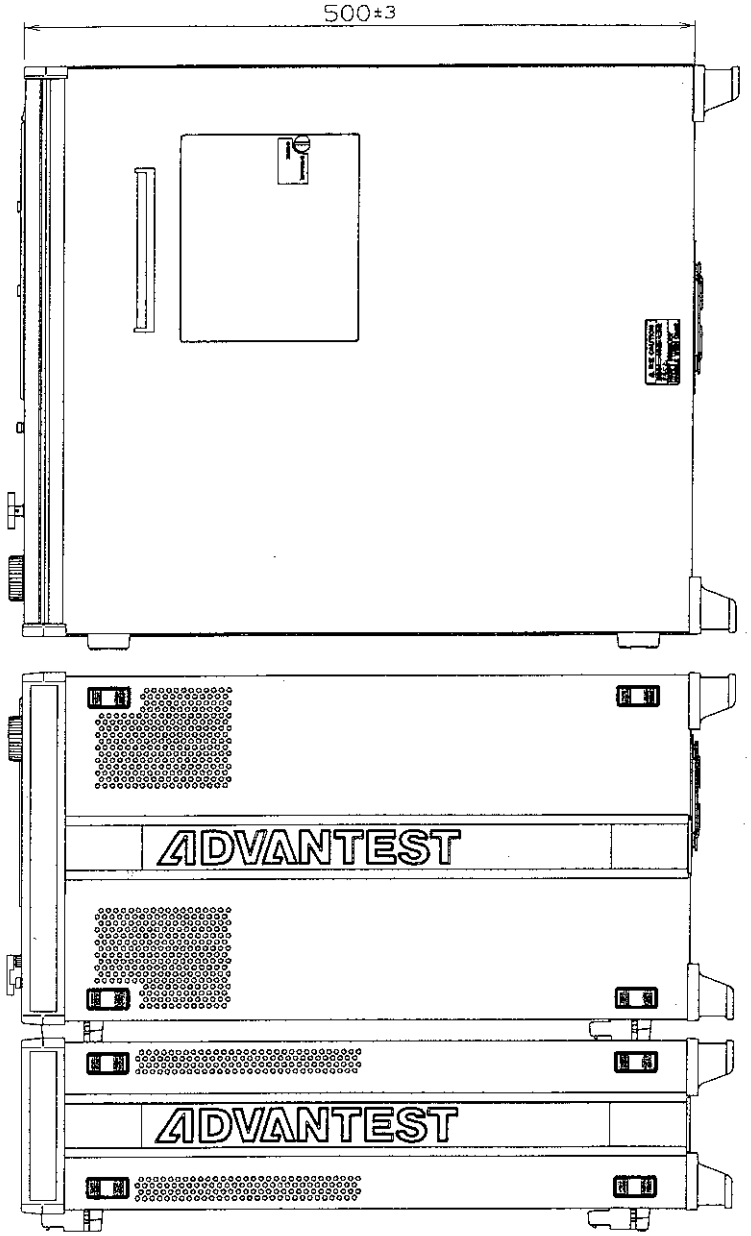
(1) Performance specifications

Item	Performance
Wavelength	1530nm to 1570nm
Wavelength accuracy	±0.025nm
Set wavelength resolution	0.05nm
Light output level	+2dBm to +10dBm variable (1530nm to 1565nm) +2dBm to +5dBm variable (1565nm to 1570nm)
Pulse width/resolution	3, 10, 30, 60, 100μs/300m, 1km, 3km, 6km, 10km
Dynamic range	7dB (Pulse width = 10μs, ASE = -7dBm/nm, BS level = -65dBm, averaging times = 2^{16}) 17dB (Pulse width = 10μs, ASE = -27dBm/nm, BS level = -65dBm, averaging times = 2^{16})
Maximum input level	
ASE total light power	+4dBm MAX
Fresnel reflection light power	-25dBm MAX
Dead zone	1.5km
Distance axis	
Distance range	100km to 15,000km
Span	5; 10; 20; 50; 100; 200; 500; 1,000; 2,000; 5,000; 10,000; 15,000km
Reading resolution	10m to 30km
Accuracy	±50m ±5 × 10^{-6} × (measuring distance (m)), excluding set index errors
Vertical axis	
Scale	0.5dB/div; 1dB/div; 2dB/div; 5dB/div
Reading resolution	0.001dB
Averaging times	
Monitoring	2^8 times
Averaging	Max 2^{24} times
Index set range	1.4000 to 1.6000 (0.0001 step)
GPIB	IEEE488-1978
Printer	Built-in thermal printer
Floppy disk	3.5 inch floppy disk

(2) General specifications

Item	Performance
Power supply voltage OTDR unit Light source unit	 100 to 240VAC, automatic change 100VAC, 120VAC, 220VAC, or 240VAC, manual change
Power supply frequency	50Hz or 60Hz
Power consumption OTDR unit Light source unit	 220VA or less 220VA or less
Operating temperature and humidity range	+10°C to +35°C (relative humidity: 85% or less)
Storing temperature range	−10°C to +45°C (relative humidity: 90% or less)
External dimensions OTDR unit Light source unit	 Approx. 424mm (width) × 265mm (height) × 500mm (depth) Approx. 424mm (width) × 132mm (height) × 500mm (depth)
Weight OTDR unit Light source unit	25kg or less 27kg or less





Unit : mm

CAUTION
This drawing shows external dimensions of this instrument.
The difference in products and options used can cause a change in the appearance of the instrument.

DIMENSIONAL OUTLINE DRAWING

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⇧ key → 2-6

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(3) You may not reverse engineer, de-compile, or disassemble, all or any part of, the SOFTWARE.

Liability

Advantest shall have no liability (1) for any PRODUCT failures, which may arise out of any misuse (misuse is deemed to be use of the SOFTWARE for purposes other than it's intended use) of the SOFTWARE. (2) For any dispute between you and any third party for any reason whatsoever including, but not limited to, infringement of intellectual property rights.

LIMITED WARRANTY

1. Unless otherwise specifically agreed by Seller and Purchaser in writing, Advantest will warrant to the Purchaser that during the Warranty Period this Product (other than consumables included in the Product) will be free from defects in material and workmanship and shall conform to the specifications set forth in this Operation Manual.

2. The warranty period for the Product (the "Warranty Period") will be a period of one year commencing on the delivery date of the Product.

3. If the Product is found to be defective during the Warranty Period, Advantest will, at its option and in its sole and absolute discretion, either (a) repair the defective Product or part or component thereof or (b) replace the defective Product or part or component thereof, in either case at Advantest's sole cost and expense.

4. This limited warranty will not apply to defects or damage to the Product or any part or component thereof resulting from any of the following:

   (a) any modifications, maintenance or repairs other than modifications, maintenance or repairs (i) performed by Advantest or (ii) specifically recommended or authorized by Advantest and performed in accordance with Advantest 's instructions;

   (b) any improper or inadequate handling, carriage or storage of the Product by the Purchaser or any third party (other than Advantest or its agents);

   (c) use of the Product under operating conditions or environments different than those specified in the Operation Manual or recommended by Advantest, including, without limitation, (i) instances where the Product has been subjected to physical stress or electrical voltage exceeding the permissible range and (ii) instances where the corrosion of electrical circuits or other deterioration was accelerated by exposure to corrosive gases or dusty environments;

   (d) use of the Product in connection with software, interfaces, products or parts other than software, interfaces, products or parts supplied or recommended by Advantest;

   (e) incorporation in the Product of any parts or components (i) provided by Purchaser or (ii) provided by a third party at the request or direction of Purchaser or due to specifications or designs supplied by Purchaser (including, without limitation, any degradation in performance of such parts or components);

   (f) Advantest's incorporation or use of any specifications or designs supplied by Purchaser;

   (g) the occurrence of an event of force majeure, including, without limitation, fire, explosion, geological change, storm, flood, earthquake, tidal wave, lightning or act of war; or

   (h) any negligent act or omission of the Purchaser or any third party other than Advantest.

5. **EXCEPT TO THE EXTENT EXPRESSLY PROVIDED HEREIN, ADVANTEST HEREBY EXPRESSLY DISCLAIMS, AND THE PURCHASER HEREBY WAIVES, ALL WARRANTIES, WHETHER EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, (A) ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND (B) ANY WARRANTY OR REPRESENTATION AS TO THE VALIDITY, SCOPE, EFFECTIVENESS OR USEFULNESS OF ANY TECHNOLOGY OR ANY INVENTION.**

6. **THE REMEDY SET FORTH HEREIN SHALL BE THE SOLE AND EXCLUSIVE REMEDY OF THE PURCHASER FOR BREACH OF WARRANTY WITH RESPECT TO THE PRODUCT.**

7. **ADVANTEST WILL NOT HAVE ANY LIABILITY TO THE PURCHASER FOR ANY INDIRECT, INCIDENTAL, SPECIAL, CONSEQUENTIAL OR PUNITIVE DAMAGES, INCLUDING, WITHOUT LIMITATION, LOSS OF ANTICIPATED PROFITS OR REVENUES, IN ANY AND ALL CIRCUMSTANCES, EVEN IF ADVANTEST HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES AND WHETHER ARISING OUT OF BREACH OF CONTRACT, WARRANTY, TORT (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE. TORT (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE.**

8. **OTHER THAN THE REMEDY FOR THE BREACH OF WARRANTY SET FORTH HEREIN, ADVANTEST SHALL NOT BE LIABLE FOR, AND HEREBY DISCLAIMS TO THE FULLEST EXTENT PERMITTED BY LAW ANY LIABILITY FOR, DAMAGES FOR PRODUCT FAILURE OR DEFECT, WHETHER ARISING OUT OF BREACH OF CONTRACT, TORT (INCLUDING, WITHOUT LIMITATION, NEGLEGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE.**

CUSTOMER SERVICE DESCRIPTION

In order to maintain safe and trouble-free operation of the Product and to prevent the incurrence of unnecessary costs and expenses, Advantest recommends a regular preventive maintenance program under its maintenance agreement.

Advantest's maintenance agreement provides the Purchaser on-site and off-site maintenance, parts, maintenance machinery, regular inspections, and telephone support and will last a maximum of ten years from the date the delivery of the Product. For specific details of the services provided under the maintenance agreement, please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest 's sales representatives.

Some of the components and parts of this Product have a limited operating life (such as, electrical and mechanical parts, fan motors, unit power supply, etc.). Accordingly, these components and parts will have to be replaced on a periodic basis. If the operating life of a component or part has expired and such component or part has not been replaced, there is a possibility that the Product will not perform properly. Additionally, if the operating life of a component or part has expired and continued use of such component or part damages the Product, the Product may not be repairable. Please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest's sales representatives to determine the operating life of a specific component or part, as the operating life may vary depending on various factors such as operating condition and usage environment.

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