Ando AQ2150

Optical Multimeter

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AQ2150 Optical Multimeter
Instruction Manual

ANDO ELECTRIC CO., LTD.

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AS-62369 Rev. 1.1

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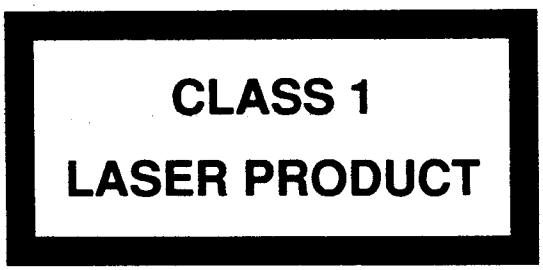

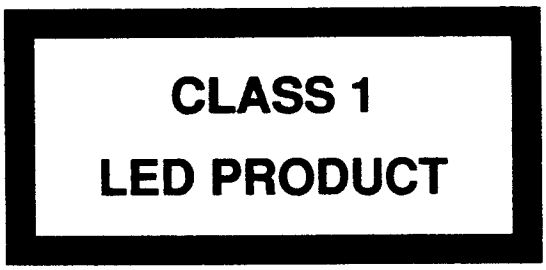

This device uses the laser light source.

This device is classified into the Class 1 laser product and the Class 1 LED produt per the IEC 825-1 Laser Product Safety (Classificatio requirements and user guide).

Use or adjustment of this device in any manner othern than the procedures specified in the Instruction Manual might result in exposure to laser beam of high danger.

When this device is used on AC supply, the attached special AC adapter msut be used. Do not try to use the attached special AC adapter for this device on ther equipments. Such could result in failure or accident.

(This special AC adapter can not be used on our AQ2101 optical power meter, AQ4121 LED light source or AQ8125B optical fiber telephone set, too. And, AC adapters for these models can not be usd on this device.)

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DEFINITION AND USAGE OF TERMS USED IN THIS MANUAL

Following section defines the terms and their usage used in this instruction manual.

1. Dangers, Warnings, Cautions, and Notes

   (1) From the definition of terms given in (2), significance attached to each informations shall be in the order shown below:
   Dangers > Warnings > Cautions > Notes

   (2) Definition of terms

   DANGER: Immediate hazards that can result in death or serious personal injuries.

   WARNING : Hazards that can result in death or serious personal injuries, or frequently recurring hazards that can result in slight personal injuries or physical damages.

   CAUTION: Hazards that can result in personal injuries, though they may not be serious, or hazards that can cause only physical damages.

   Note: Supplementary explanations on the exceptional rules, corrections or restrictions.

2. Reference

   Page to be referenced in this manual is indicated by an arrow. When, for example, page 2-1 is referenced, it will be indicated as → 2-1.

3. Representation of the operation keys in the manual.

   [ ] : Indicates the key top display.
   [ ] : Indicates the display on the panel or at top of each key.

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○ **Read this manual and the precautions for safety in it carefully before using the device.**

○ **Maintain this manual at a location easy to access.**

Precautions for Safety

1. Restrictions on use environments

- Take care so that water may not get into the device or the device may not be exposed to water. Such could cause fire, electrical shock or device trouble.

2. Restrictions on Use Conditions

- Use the device only at the voltages indicated on the marking. Using the device off the specified voltages could result in fire, electrical shock or device trouble.
- When the AC adapter or charger is attached, they must be used. Otherwise, fire, electrical shock or device trouble could result.
- When using supply mains, the device must be connected directly to the dedicated plug socket. Do not use an extension cord because it can cause heat build up or firing.

3. Erection and installation

3.1 Notes for personnel in charge of erecting and installing the device

- Avoid putting many loads on one electrical outlets. Such could cause firing or heat build up.
- Power plug must be securely inserted to the plug socket. Fire or electrical shock may be caused if the power plug blade is contacted against metals.

3.2 Restrictions and prohibitions on the installing environments and conditions

- Do not install the device in humid or dusty environment. Such environment can cause electrical shock or device trouble.
- Do not erect the device in an unstable place such as shaky bench or inclined location. That could cause personal injuries if the device has fallen or tumbled down.
- Avoid environment of high vibration or shock. Personal injuries could result if the device has fallen or tumbled down.
- Take care so that metals may not be dropped or inserted into the device through its openings. Such could cause fire, electrical shock or device trouble.
- Do not the place power cord near to heat generating equipments. Fire or electrical shock can result if coating on the cord melts away.

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- When pulling out the power plug, hold the plug instead of cord. Otherwise the cord can be damaged possibly resulting in fire or electrical shock.
- Do not insert or pull out the power plug when your hands are wet. Electrical shock might result.
- Do not install the device in a high temperature environment or a place exposed to direct sun. Fire might develop due to internal heat build up.

3.3 Prohibitions on the installation

- When moving the device, make sure that the power plug has been pulled out of the plug socket and the external connection wire has been removed. Damaged cord can cause fire or electrical shock.
- Take care so that the power cord may not be damaged or broken. Do not try to rework the power cord. Avoid placing the cord under a heavy load, heating it or pulling it forcibly. Damaged cord can cause fire or electrical shock.

4. Preparation before Use

- Read the instruction manual carefully.

5. Device Operation

- Read the instruction manual carefully.
- When the warning marking (Notes, Warning or Danger) is provided, operate the device according to the instructions given the instruction manual.
- If the light source is controlled or adjusted off the procedures, hazards such as exposure to highly dangerous laser beam can result. Handling of optical equipments such as lenses require caution because they can give adverse effects to your eyes.
- Do not place containers filled with water or small metals near the device. If such is spilt or falls into the device, fire, electrical shock or device trouble can be caused.
- Do not use unspecified batteries. Avoid combined use of new and old batteries.
- Rupture or leak of the liquid on the battery can cause fire, personal injuries or contamination of environment.
- Check polarity marking (direction of the plus and minus) on the battery before use. Improper use may cause rupture or leakage of the liquid resulting in fire, personal injuries or contamination of environment.
- Do not try to rework the power cord. And, do not try to bend, twist or pull it forcibly. Such could result in fire or electrical shock.
- Do not try to disassemble or rework the device. Such can be a cause of fire, electrical shock or device trouble.
- Be careful so that the charger terminal may not be shorted with a metal piece. Fire or device trouble can be caused.

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- Before charging, make sure that water drops are eliminated from the charger terminal. Water on the terminal can cause fire or device trouble.
- When the device is not to be used for a long time, the power plug must be removed from the plug socked. This is for safety. Otherwise, fire, electrical shock or device trouble can result if struck by lightning.

6. Maintenance and Inspection

- Implementation of periodical maintenance and inspection are recommended. If dusts inside the device are not cleaned for a long time, fire or device trouble can be caused. Refer to the list of our offices attached at end of this manual and contact the office most convenient to you.

7. Troubleshooting Guide

- Damaged power cord must be replaced. Such cord can cause fire or electrical shock.
- If inside of the device has been contaminated by foreign substance, turn the body power switch off, pull the power plug out of plug socket and contact us. If the device is used in such state without any proper actions, fire, electrical shock or device trouble can be caused.
- If smoke or offensive odor is detected on the device, turn the power switch off immediately, pull the power plug out of plug socket and contact us for repair making sure that smoke has been eliminated. If you use the device in such abnormal state, fire, electrical shock or device trouble might be caused. Do not try to fix the trouble by yourself. It will be extremely dangerous.
- If the device is dropped or damaged, turn the body power switch off, pull the power cord out of plug socked and contact us. If the device is used without any proper action, fire, electrical shock or device trouble might be caused.

8. Precautions on Waste Disposal

- Do not throw used batteries into fire. Explosion of the battery can cause fire or skin burns.

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FIGURE AND TABLE CONTENTS

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1. Overview

This manual describes how to operate AQ2150 Optical Multimeter (hereafter called the device) and its optional units.

1.1 General Description of Device

AQ2150 is a handy type basic optical meter which functions, by equipping its diverse units, as an optical power meter, voltage regulator and return-loss tester. Through combinations with its divers tical source and return loss unit, this device can be used in a variety of applications such as optical loss tests.

This device can be very useful in the field since it is small, light weight and can be driven by battery. And, we also believe this device is very useful for various optical research and development departments and manufacturing department.

Only the devoted units can be connected to this device. You can not connect units for the conventional models to this device.

1.2 Specifications

The device specifications are shown in Table 1-1.

1.3 Configuration

Standard configuration of the device consists of AQ2150 optical multi-meter body and accessories listed in the List of Standard Accessories List.

List of standard system accessories

No.	Accessory Name	Quantity	Description
1	Instruction manual	1	
2	Blank panel (large)	1	Mounted on the light source housing.
3	Blank panel (small)	1	Mounted on the sensor unit housing
4	DC pack	1	Mounted on the body
5	Dry cell pack	1	4 size AA dry cells are needed (NiCd can not be used)
6	AC adapter	1	
7	Power cord	1	3-pole (switching adapter is provided for conversion between 3-pole and 2-pole)
8	Plug for analog out	1	To be connected before use

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Table 1-1 AQ2150 Specifications

Display of measurement value	7 segments, 4 digits
Unit display	Absolute value: dBm, mW, μW, nW, pW. Relative value: dB
Calibration factor	Compensation of the sensor wavelength sensitivity (in 5 nm step)
Switching of range	Automatic or fixed (up/down)
Measurement mode	Switching of CW light and chop light (270 Hz/1 kHz/2 kHz)
Optical output waveform	Selection of CW light and chop light (270 Hz/1 kHz/2 kHz) is available
Measurement interval	Approximately 330 ms
Averaging	Serial adding and averaging method (10/50/100). Switching between on and off is available.
Display resolution	Switching between 0.1 and 0.01 dB is available.
Zero adjustment	Automatic zero point adjustment
Relative value measurement	• Relative measurement based on displayed measurements. • Relative measurement against the reference measurements.
Back light	Back light goes on as long as the back light key is depressed. It remains turned on approximately 5 seconds after the key has been released.
Auto power off	Power is automatically turned off 3 or 10 minutes after the last key operation. (Turning off of the power off function can be selected, too)
Battery check	Display of low battery
Buzzer function	Activated upon input of a level larger than the set level (variable).
Resume function	Reproduces conditions being set at the time when power has been turned off
Back-up function	Set conditions are backed up during battery replacement (for 15 minutes)
Analog out	0 to approx. +2V (for each range)
Power supply	4 dry cell batteries (size AA) and AC adapter (100 to 240VAC, 48 to 63 Hz)
Environmental conditions	Operating temperature: 0 to +50°C, Constant temperature: –25 to +70°C, Humidity: 85% or less
Dimension and weight	Approx. 205 (H) × 88 (W) × 43 (D). Weighs approximately 450 grams.

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Table 1-2 Sensor Unit Specifications

Product name		AQ2750	AQ2751	AQ2752	AQ2755
Range of wavelength		400 to 1100 nm	750 to 1800 nm	750 to 1700 nm	400 to 1100 nm
Light sensitive element		Si □ 5.8 mm	Ge ϕ5 mm	InGaAs ϕ1 mm	Si ϕ18 mm
Application		Large diameter fiber, space light		Small diameter silicone type fiber, outgoing light	Space light
Input format		Direct to photodiode (Note 1)		AQ9431 (*) optional connector adapter (Note 2)	Direct to photodiode
Power range	CW light	–80 to +10 dBm (10 p to 10 mW)	–50 to +10 dBm (10 n to 10 mW)	–80 to +10 dBm (10 p to 10 mW)	–50 to +20 dBm (10 n to 100 mW)
	Chop light	–80 to +7 dBm (10 p to 5 mW)	–60 to +7 dBm (1 n to 5 mW)	–80 to +7 dBm (10 p to 5 mW)	–50 to +17 dBm (10 n to 50 mW)
Noise level	CW light	–70 dBm	–40 dBm	–70 dBm	–40 dBm
	Chop light	–75 dBm	–50 dBm	–75 dBm	–45 dBm
Absolute accuracy		Within ±5% (Note 3)			

Note 1: Can be combined with AQ9431 (FC) or (SC) connector adapters.

Note 2: Either AQ9431 (FC) or (SC) connector adapter (option) is needed. Contact us for other connectors.

Note 3: Conditions required for guaranteeing the measurement accuracy.

1) Wavelength: 850 nm (AQ2750/2755)
1310 nm (AQ2751/2752)

2) Power level: –20dBm (10 µW), CW light

3) Fiber: 50 µm GI fiber, master FC connector (AQ2750/2755)
10 µm SM fiber, master FC connector (AQ2751/2752)

4) Ambient temperature: 23±5°C

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Table 1-3 LED Light Source Unit Specifications

Product name		AQ4250 (850)	AQ4250 (131)	AQ4250 (155)	AQ4250 (131/155)
Center wavelength		850±15 nm	1310±30 nm	1550±35nm	1310/1550 ±35 nm
Applicable optical fiber		GI (50/125 µm)	GI (50/125 µm) SM (10/125 µm)	SM (10/125 µm)	
Spectral half value width (Note 1)		60 nm or less	140 nm or less	200 nm or less	140 nm or less (1310 nm) 200 nm or less (1550 nm)
Optical output level (Note 2)	GI	–15 dBm or more	–25 dBm or more	———	
	SM	———	–40 dBm or more	–43 dBm or more	–43 dBm or more (1310 nm) –45 dBm or more (1550 nm)
Stability in optical output level	Thermal stability	0.3 dBp-p or less (Note 3)			
	Time stability	±0.02 dB or less (Note 4)			
Optical connector		AQ9433 (*) connector adapter (option, Note 5)			

Note 1: Spectral half value width is shown in FWHM.

Note 2: CW light.

Note 3: Conditions for thermally stable measurement

1) Temperature range:

0 to 50°C (8 hours)
(AQ4250 (850)/AQ4250 (131)/AQ4250 (155))

0 to 40°C (8 hours)
(AQ4250 (131/155))

2) Fiber :

50 µm GI fiber and master FC connector.
(AQ4250 (850))

10 µm SM fiber and master FC connector.
(AQ4250 (131)/AQ4250 (155)/AQ4250 (131/155))

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Note 4: Conditions for time stable measurement

1) Measurement temperature:
   5 minutes under constant temperature (at one point between 20 to 30°C)
2) Fiber:
   50 µm GI fiber and master FC connector.
   (AQ4250 (850))
   10 µm SM fiber and master FC connector.
   (AQ4250 (131)/AQ4250 (155)/AQ4250 (131/155))

Note 5: Either AQ9433 (FC) or (SC) connector adapter (option) is needed. Contact us for other connectors.

Table 1-4 LD Unit Specifications

Product name		AQ4251 (131)	AQ4251 (155)	AQ4251 (131/155)
Center wavelength		1310±20 nm	1550±20 nm	1310±20 nm/ 1550±20 nm
Applicable fiber		SM (10/125 µm)		
Spectral width (Note 1)		5 nm or less	10 nm or less	5 nm or less/ 10 nm or less
Optical output level (Note 2)		–6 dBm or more		–7 dBm or more
Stability in optical output level	Thermal stability	1.0 dBp-p or less (Note 3)		
	Time stability	±0.05 dB or less (Note 4)		
Optical connector		AQ9434 (*) universal adapter (option, Note 5)		

Note 1: Spectral width is indicated in RMS (2σ, –20 dB).

Note 2: CW light

Note 3: Conditions for thermally stable measurement

1) Temperature range: 0 to 50°C (8 hours)
   (AQ4251 (131)/AQ4251 (155))
   0 to 40°C (8 hours)
   (AQ4251 (131/155))
2) Fiber: 10 µm SM fiber and master FC connector.

Note 4: Conditions for time stable measurement

1) Measurement temperature:
   5 minutes under constant temperature (at one point between 20 to 30°C).
2) Fiber :
   10 µm SM fiber and master FC connector.

Note 5: Either AQ9434 (FC) or (SC) universal adapter (option) is needed. Contact us for other connectors.

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Table 1-5 Return Loss Unit Specifications

Product name	AQ7350 (131)	AQ7350 (155)
Center wavelength	1310±20 nm	1550±20 nm
Applicable fiber	SM (10/125 μm)	
Dynamic range	40 dB or more (Note 1)	
Relative measurement accuracy	±0.5 dB or less (0 to 40 dB, Note 2)	
Self-reflective attenuation amount	65 dB or more (Note 3)	
Optical connector	AQ9434 (*) universal adapter (option, Note 4)	

Note 1: Air reference, when super PC type master connector is connected to the output terminal.

Note 2: Measurement accuracy when reference reflection is used as the absolute (including influences from self-reflective attenuation amount).

Note 3: Reflection on the output connector is excluded. Directivity of the optical divider/coupler.

Note 4: Either AQ9434 (FC) or (SC) universal adapter (option) is needed. Contact us for other connectors.

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2. Before Starting System Operations

This chapter describes unpackaging, re-packaging, acceptance inspections and general precautions. Read this chapter carefully to ensure proper use of this device.

2.1 Outline

This chapter describes unpackaging, re-packaging, acceptance inspections and general precautions. Read this chapter carefully to ensure proper use of this device.

2.2 Unpackaging and Acceptance Inspection

This device has been subjected to a thorough mechanical and electrical inspections to guarantee optimum operations. Upon receiving the device, open the package and check the device for any damage during transportation at an earliest time possible.

After unpackaging, wooden box, cushioning materials and internally used corrugated boxes may be preserved for your future use. (Excluding disposable materials such as band steel and wrapping papers.)

2.2.1 Mechanical operation checkout

Check the device and its switches and knobs for the appearance, appropriate actions and damages/troubles caused during transportation. And, check quantities of delivered accessories and spare parts against the packing list.

2.2.2 System operation test

Following the mechanical check, performance of the device is tested.

2.3 If any Detect or Trouble is found

If the acceptance test confirmed any damage due to transportation or failure due to specifications with the device, contact and notify us (at headquarters or a local office most convenient to you) immediately on the trouble.

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3. System Operation Notes

This chapter describes precautions on use of the device.

3.1 Handling Notes

1) Do not give excessive shocks, such as dropping, to the device. Such shock could damage internal optical parts even though the device is protected with the plastic cover.
2) Do not expose the device to high temperature or highly humid environment for long hours.
3) Do not put the device adjacent to equipments or facilities which irradiates strong electric wave or magnetic field. Such could result in malfunctioning of the device.
4) Do not connect a non-specified unit to this device. It can cause a device failure.
5) Turn power off before connecting or disconnecting a unit to this device.
The device and unit might be damaged if such is done while power is turned on.
6) When the device is not to be used for a long time, remove the dry cell batteries.
Liquid leak on the battery might damage the device.
7) This device is handy and suitable for use in the field. However, it is not a drip proof type. When using it in the rain, proper water protection measures should be provided.
8) Only service personnel are allowed to open the cover of this device.

3.2 Application Notes on Optical System Components

Units connected to the device carry parts conducted with ultra precision machining. These parts are important and indispensable to guarantee an optimum performance of the device. Observe the following handling instructions strictly.

1) Do not use a bare fiber adapter for connecting the light source unit or AQ2752 sensor unit to the optical fiber. Such could damage the optical input/output unit.
2) f the light source unit is controlled or adjusted in not standardized procedures, hazards such as exposure to dangerous laser irradiation might result.
Handling of optical equipments such as lens must be done carefully because they can harm your eyes.
3) The sensor unit must be protected from light beyond the optical power measurement range. Such excessive light could damage the light sensitive element.
Extra care is needed for low duty, high peak pulse light because it might be indicated as an average power when measured, that is lower than the actual level.

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4) Optimum function can not be expected from this device if there is any damages or stains on the optical connector connected to the optical input/output terminal. In the worst case, such damage or stains may impair the optical connections of this device.
5) Take care when mounting the connector adapter so that surface of the input/output terminal may not be damaged.
6) When the device is not used, apply the connector protection cap for protecting the optical connector from contamination by foreign substance such as dusts.
7) Clean litters or dusts, if any, on the optical input/output terminal surface and connector adapter using absolute alcohol or equivalent. (When cleaning the emitting surface of the light source unit, remove the unit from the body before cleaning to secure safety.)

3.3 Application Notes on Using Power Pack

1) Special AC adapter must be used for the DC pack. Failure might be caused if any other adapters are used. AC adapters used on our AQ-2101 optical power meter, AQ-4121 LED unit or AQ-8125B optical fiber telephone sets have different polarity and thus can not be used. Check polarity and voltage of the adapter before using it.
2) Stains on DC pack terminals can result in improper contact with the body or turning off of power. Eliminate stains on the terminal with dry cloth and maintain them clean.
3) Do not expose the power pack to water including rain and salt water. Also, strong shocks must be avoided.
4) Handling of dry cell batteries and AP2104 Ni-Cd batteries (hereafter called the battery pack) needs care. If their terminal is shorted by metal, large current will be drawn damaging or generating intense heat on the battery.
5) Do not try to disassemble the battery. Nor, it should be thrown into fire. Such actions are very dangerous.
6) Do not dispose used batteries along with other wastes. (Some city and town regulations require batteries to be disposed separate from other wastes. In such case, disposal must be done in accordance with the regulation.)
7) Check polarity marking on the battery before mounting it on the dry cell battery pack.
8) Alkaline batteries offer a longer continuous use period than manganic batteries.
9) Only size AA Ni-Cd batteries can be used on the dry cell battery pack.
10) AP2103 battery charger must be used for changing the battery pack.
11) The battery pack has been discharged before they are shipped from the plant. It must be charged before using for the first time.
12) When the battery pack is not to be used for a long time, it must be discharged before storing.

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4. Functional Description

This chapter describes functions of the operation unit and display unit of this device.

4.1 Body

4.1.1 Description on the operation unit of the device body

Figure 4-1 shows layout of the operation unit on AQ2150 optical multimeter body. Names and functions of each section on the operation unit are given in Table 4-1 in the order of the number assigned to them in the figure. Table 4-2 shows the display and function of key switches.

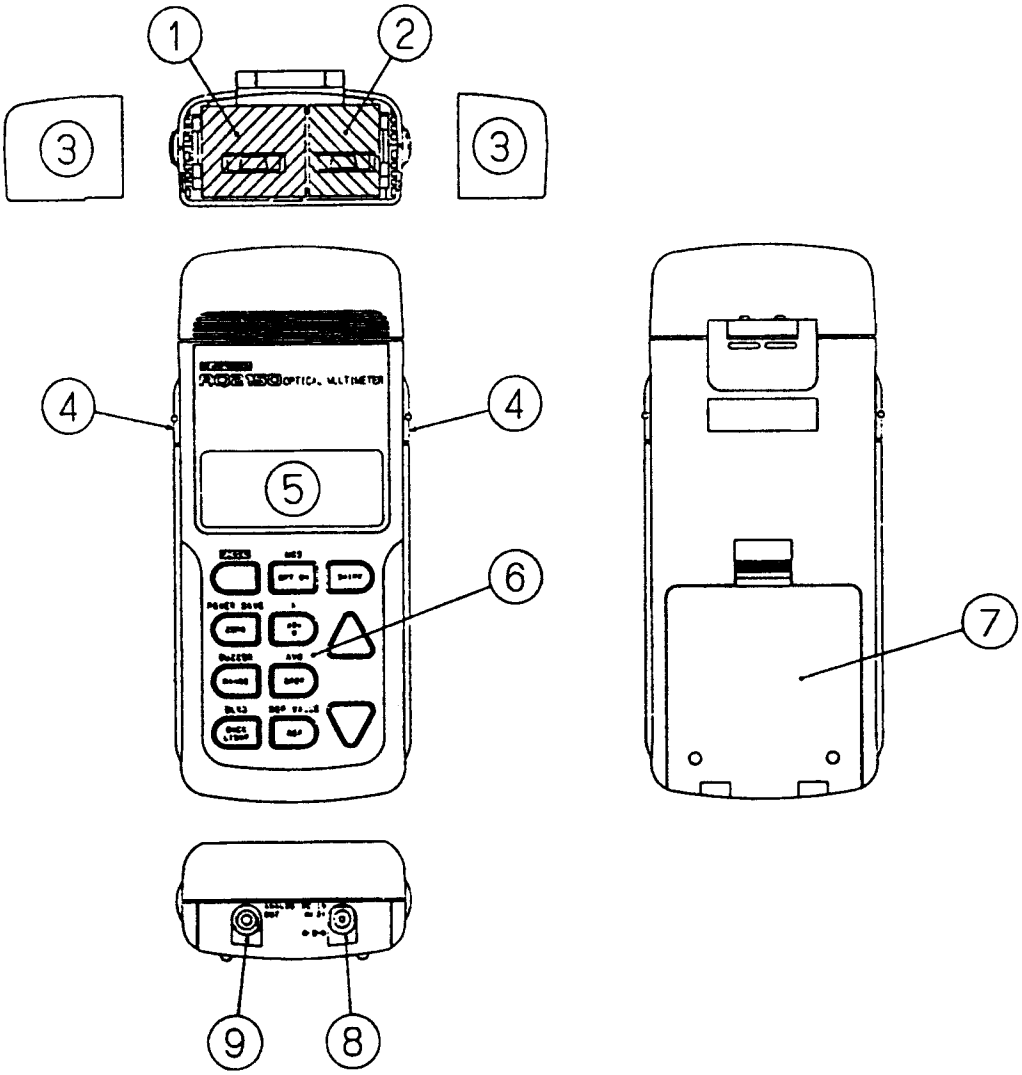

Figure 4-1 Layout of the Operation Unit

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Table 4-1 Names and Functions of Each Section on the Operation Unit

No.	Name	Display on body	Functional description
①	Unit housing (large)		Used for housing LED unit
②	Unit housing (small)		Used for housing sensor unit
③	Blank panel		Used when unit is not housed. Two types, a large and a small, are provided.
④	Unit release lever		This lever is used for removing the unit. Two are provided, one for each side.
⑤	Display unit		Displays measurement values and set values.
⑥	Key switch		The key used for controlling the device. See Table 4-2 for details.
⑦	Power pack housing		The power pack is mounted to this location. Three types of power packs are prepared - DC pack, dry cell pack and AP2104 Ni-Cd battery pack (option).
⑧	DC voltage input unit (for DC pack only)	[DC IN]	The jack for applying 9VDC to DC pack from AC adapter.
⑨	Analog out (for DC pack only)	[ANALOG OUT]	Provides voltage output proportional to the input optical level (For each range. Approx. 2V maximum.)

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Table 4-2 Display and function of key switches (1/3)

Display of key	Functional description
[POWER]	Upon pressing this key, power is turned on and all lamps go on approximately for 1 second. Then all lamps will be cleared to start measurement. Press this key again for approximately 1 second to turn power off.
SHIFT	Performs switching between the measurement mode and setting mode. Every time the key is pressed, following switching takes place on the mode. Measurement mode → Setting mode → Measurement mode → --- In the setting mode, the function displayed above the key is valid. In the measurement mode, the function displayed at key top is valid.
[MOD] OPT ON	**Setting mode** Sets internal modulation frequency of the light source and modulation frequency of the measurement light. Every time the key is pressed, following switching takes place on the setting. CW → 270 Hz → 1 KHz → 2 KHz → CW → ---
	Measurement mode Turns on or off the optical output. Every time the key is pressed, following switching takes place on the setting. ON → OFF → ON → ---
[λ] dBm W	**Setting mode** Sets wavelength on the light source unit and compensation wavelength on the sensor unit.
	Measurement mode Switches the display unit in the absolute value measurement. Every time the key is pressed, following switching takes place on the unit. dBm → W → dBm → ---
[AVG] DREF	**Setting mode** Turns on or off the averaging. Every time the key is pressed, following switching takes place on the setting. OFF → 10 times → 50 times → 100 times → OFF → ---
	Measurement mode The measurement value being displayed at the time when the key is pressed will be made the reference value. And, successive measurement values are shown in relative value against the reference. The display unit is dB. When the return loss unit is connected, this key will be used for setting reference value for the total reflection cord.

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Table 4-2 Display and Function of Key Switches (2/3)

Display of key	Functional description
[REF VALUE] REF	**Setting mode** Sets reference value for the relative measurement done with REF key.
	Measurement mode This key is used for relative display of the measurement values against the reference value being set with REF VALUE (→ 5-16). Reference value and measurement value will be shown in middle and bottom of the display unit, respectively. Unit is dB. When the return loss unit is connected, it will be used for setting reference value for air.
[POWER SAVE] ZERO	**Setting mode** Performs switching in the power save time. Every time the key is pressed, following switching takes place on the setting. OFF → 3 (minutes) → 10 (minutes) → OFF → ---
	Measurement mode Performs automatic compensations on the measurement results obtained while breaking the light to the optical input terminal on the sensor unit (zero error). Press the key for 1 second or more to start this function (light to the light input terminal must be securely blocked).
[BUZZER] RANGE	**Setting mode** The buzzer goes on if a level higher than its reference level is measure. The key is used to set on or off the buzzer. Every time the key is pressed, following switching takes place on the setting. OFF → Buzzer reference value → OFF → ---
	Measurement mode Switches the measurement range between the auto and fixed. Every time the key is pressed, following switching takes place on the setting. Fixed → Auto → Fixed → ---

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Table 4-2 Display and Function of Key Switches (3/3)

Display of key	Functional description
[BLANK] BACK LIGHT	**Setting mode** Sets display resolution of measurement values. Every time the key is pressed, following switching takes place on the setting. All digit display → Omission of the least meaningful digit → All digits display → ---
	Measurement mode Turns on the indicator back light. • When the DC pack is used Every time the key is pressed, following switching takes place on the setting. ON → OFF → ON → --- • When the dry cell battery pack or AP2104 Ni-Cd battery pack is used The back light goes on as long as the key is pressed. The back light remains turned on for 5 seconds after the key is released. Then it goes off automatically.
△ ▽	**Setting mode** This is up/down key used for setting values for wavelength sensitivity compensation, REF VALUE, buzzer and other.
	Measurement mode When the measurement range is fixed, this key is used for moving up or down the fixed range.

4.1.2 Description on the indicator mounted on the body

Figure 4-2 shows displays which appear on the indicator. Description on the displays are given in Table 4-3.

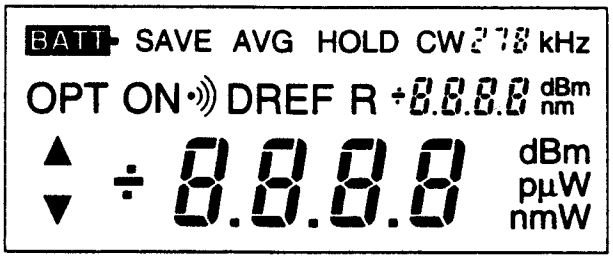

Figure 4-2 Displays On the Indicator

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Table 4-3 Description On the Display

Display	Description on the display	Relevant key
BATT	Displayed when battery is too low to perform its function.	
SAVE	Displayed when the power save function is set.	POWER SAVE
AVG	Displayed when averaging is done in the measurements.	AVG
HOLD	Displayed when the fixed range is set.	RANGE
CW 270 Hz 1 KHz 2 KHz	Displays set frequency for the optical modulation mode.	MOD
OPT ON	Displayed when the light source unit is turned on.	OPT ON
•))	Displayed when the buzzer function is set.	BUZZER
DREF	Displayed when relative measurement is done using the currently displayed value as the reference.	DREF
REF	Displayed when relative measurement is done using the set value as the reference.	REF
REF R	Displayed when the return loss measurement is done.	DREF, REF
7 segments display (small)	Varies according to the measurement applications. (Displays the reference value at wavelength setting, DREF or REF.)	
▲	Displays over range of measurement value.	
▼	Displays under range of measurement value.	
7 segments display (large)	In the measurement mode: Displays measurement value. In the setting mode: Displays "SHFT".	

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4.2 Mounting and Dismounting the Unit

4.2.1 Mounting and dismounting the sensor unit and LED unit to and from the device body

1) Opening the cover
Rotate the cover in the arrow direction as shown in Figure 1, while pressing the portion indicated as ①. This cover can also be used as a support when the device is inclined in its use.

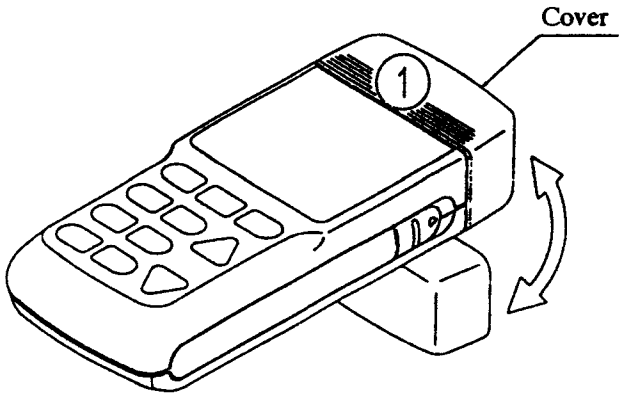

Figure 4-3 Opening the Cover

2) Assembling to the device body
As shown in Figure 4-4, assemble the sensor unit to the right side unit housing (small) and the LED unit to the left side unit housing (large). Move the pawl on the unit to the device side and insert it into the device until it clicks.

3) Dismounting from the device body
As shown in Figure 4-4, push the release lever on side of the body in the (A) direction to remove the unit from the body.

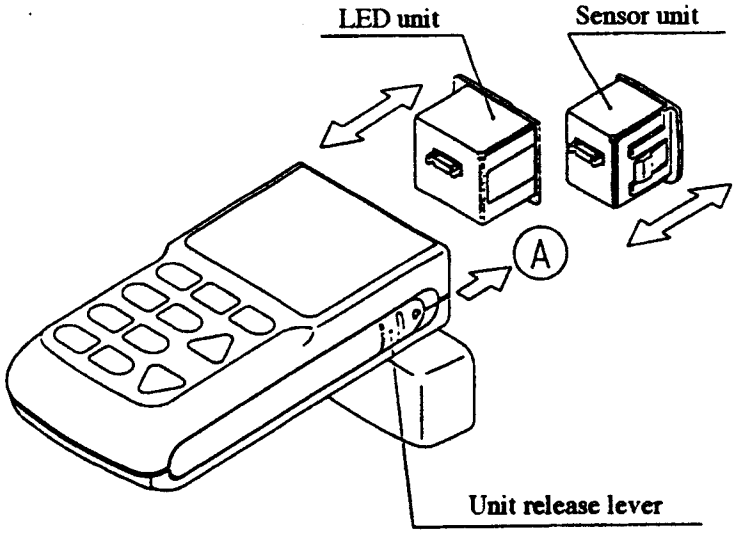

Figure 4-4 Mounting and Dismounting the LED Unit and Sensor Unit

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4.2.2 Mounting and dismounting the LED unit and return loss unit to and from the device body

1) How to remove the cover
First, open the cover as shown in Figure 4-3 and remove the unit as shown in Figure 4-4. Then pull the cover in (A) direction as shown in Figure 4-5 to remove the cover.

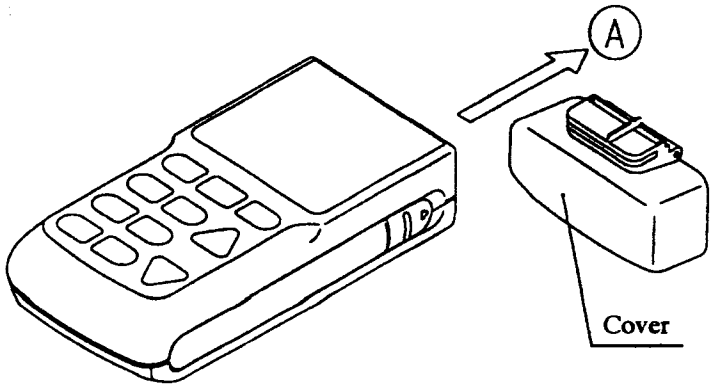

Figure 4-5 Removing the Cover

2) Assembling to the device body
As shown in Figure 4-6, insert each unit to the device body in (B) direction until the unit clicks.

3) Mounting the cover
After each unit have been mounted, push the cover into the gap between the device and the units in (B) direction, as shown in Figure 4-6.

4) Assembling the sensor unit to the LED unit
Assemble the sensor unit to the LED unit after the cover has been mounted to the LED unit. Move pawl on the sensor unit to the side of the LED unit and insert into the LED unit until it clicks.

5) Dismounting from the device body
Push the release lever on both sides of the device body in (A) direction to remove the unit from the device.

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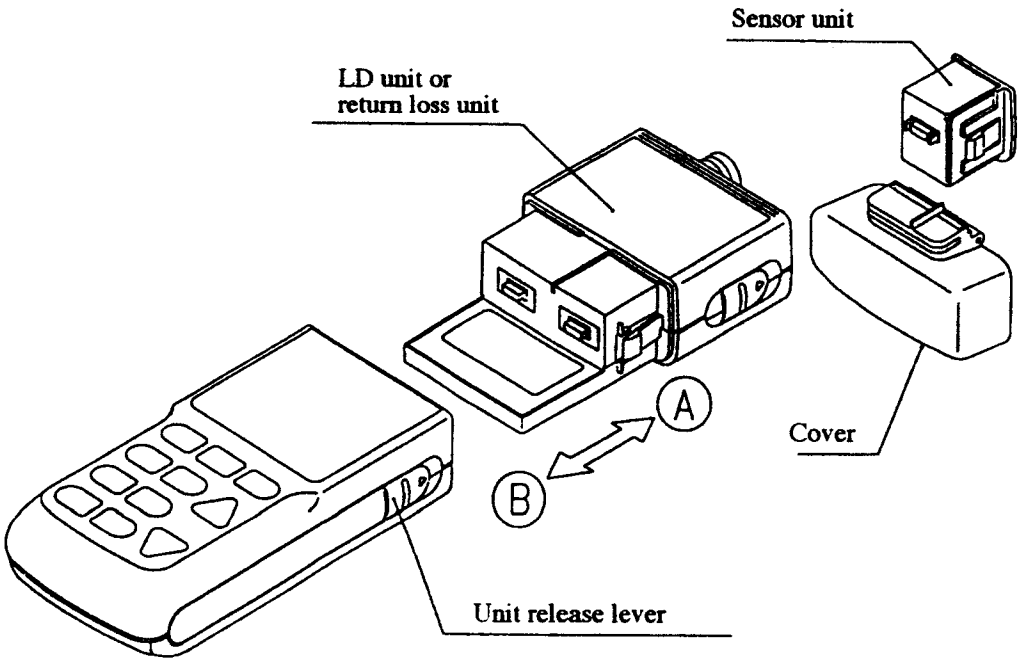

Figure 4-6 Mounting and Dismounting the LED and Return Loss Unit

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4.3 Mounting and Dismounting the Connector Adapter

4.3.1 Mounting and dismounting the connector adapter and sensor unit

1) Mounting to and dismounting from the sensor unit
When mounting the connector adapter, contact it to the sensor unit and fasten by turning in arrow direction, as shown in Figure 4-7, with your fingers or equivalent force.
When removing the adapter, turn it in direction opposite to the arrow.

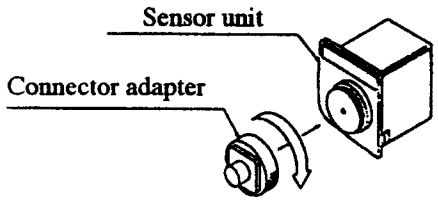

Figure 4-7 Mounting and Dismounting the Connector Adapter and Sensor Unit

4.3.2 Mounting and Dismounting Connector Adapter to and from LED Unit

1) Mounting to and dismounting from the LED unit
When mounting the connector adapter, move it to the positioning pin on the LED unit and fasten the stopper ring by turning in arrow direction with your fingers or an equivalent force, as shown in Figure 4-8.
When removing it, turn the stopper ring in direction opposite to the arrow.

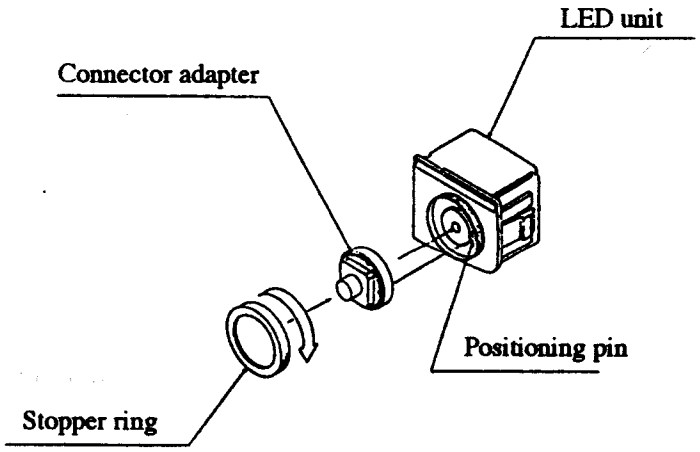

Figure 4-8 Mounting and Dismounting the Connector Adapter and LED Unit

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4.3.3 Mounting and dismounting the universal adapter to and from the LD unit and return loss unit

1) Mounting to and dismounting from the LD unit/return loss unit
When mounting the universal adapter, insert it to the unit paying attention so that it is not hit against tip of the ferrule. See Figure 4-9. Then fasten it by turning in arrow direction with your fingers or an equivalent force.
When removing, turn it in direction opposite to the arrow.

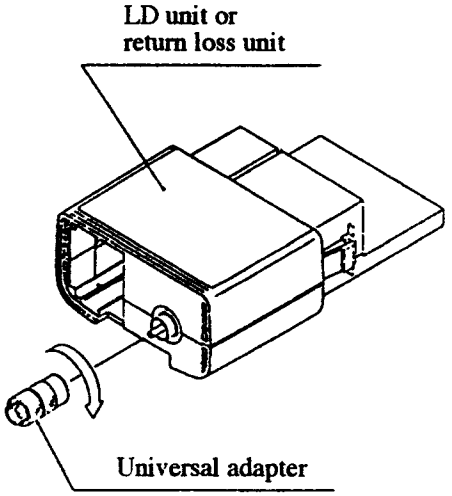

Figure 4-9 Mounting and Dismounting the Universal Adapter to and from the LD Unit or Return Loss Unit

Caution:

- **High precision machining is conducted on the engagements of units and adapters. Litters or dusts on the engagement must be wiped out before mounting an adapter. If the adapter is contaminated with dusts, designed performance may not be guaranteed.**
- **Extra care is needed when handling the light receiving and emitting surface of the units. Especially, if the glass face is damaged, designed performance may not be guaranteed.**
- **At OPT ON, strong light is emitted from the emitting surface. Straight look at the light can harm your eyes, so the units should be removed from the body whenever mounting or cleaning the connector adapter.**

Note:
- *When the device is not used, apply the light blocking cover for protecting it from litters or dusts.*
- *Positioning pawl and groove are provided on the optical connector and universal adapter. When you can not mount the universal adapter properly, check position of the pawl at bottom of the optical connector ferrule and the groove on the universal adapter side.*

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4.4 How to Use the Power Pack

4.4.1 Mounting and dismounting the power pack

1) Dismounting from the body
As shown in Figure 4-10, push pawl ① in (A) direction and pull it up in (B) direction to remove the power pack from the device.

2) Assembling to the body
As shown in Figure 4-10, move pawl ② to the guide under the device and insert into the device until it clicks.

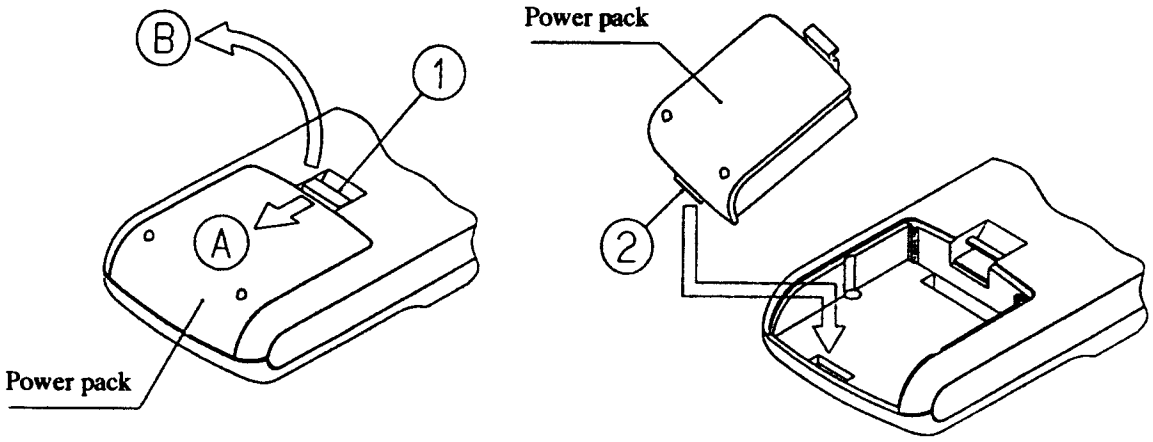

Figure 4-10 Mounting and Dismounting the Power Pack

4.4.2 How to use the DC pack

1) Output of the dedicated AC adapter is connected to [DC IN] on the DC pack and the AC adapter input is connected to receptacle.

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5. Device Operation

This chapter describes how to operate the device.

5.1 Preparation before Operation

5.1.1 Power on

1) After making sure that power is turned off (nothing displayed on the indicator), mount the desired power pack on back side of the device.
2) Make sure that power for the AC adapter is within 90 VAC to 264 VAC range and supply frequency is within 47 Hz to 63 Hz range. Maximum input voltage for the attached standard cable is 125 VAC. For a voltage higher than 125 VAC, a cable rated for that operating voltage must be used.
3) 3-pin plug type power cable is used. The round pin in the center is ground. Use of 3-pin receptacle is recommended.
   When 2-pin receptacle is used, connection to the receptacle should be done through an adapter. Connect wire to the ground exit the adapter. It must be connected to an external ground or earth.
4) Remove the blank panel and mount a desired unit. (→ 4-7.)
5) Press the POWER key. Power is turned on and the indicator gives full display for approximately 1 second. (→ 4-5).

Caution:

- **When the unit is not placed in the unit housing, the blank panel must be placed in there. Take care so that foreign substance such as metal pieces might not enter the housing. Such could cause trouble on the device.**

Caution:

- **Approximately an hour of heat up is required after power on to ensure accurate and stable operation.**
- **When the sensor unit is used, zero point adjustment (zero set) must be done before measurement while blocking the light to the sensor input unit.**

Note : The AQ2150 does not satisfy the specification during the application of noise in some cases.

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5.1.2 Zero set

Zero set (zero point adjustment) function is provided to the device for eliminating electrical offset in the circuit.

1) Blockout the light to the device sensor unit with a light blocking cap or equivalent.
2) Press [ZERO] key to execute the zero adjsutment. Normally, the zero adjustment requires 30 seconds to 1 minute to complete.
   If [ZERO] key is pressed in the course of the zero adjustment, the zero adjustment is interrupted returning the mode to normal measurement mode.
3) When the zero adjustment is complete, mode returns to the normal measurement mode.

Note 1: When executing the zero adjustment, light to the sensor input section must be blocked. If the blocking is insufficient, measurement values might contain errors. If the zero adjustment is conducted with extremely low level of blocking, the zero adjusment will not complete. Instead, the error display (→ 5-18) will appear returning the mode to normal measurement mode.

Note 2: The electrical offset on the circuit is influenced by ambient temperature and power on duration. Thus, when the measurement of high accuracy is required, the zero adjusment must be done just prior to the measurement.

Note 3: The zero set is not required in the modulation light measurement mode except for CW light, thus [ZERO] key is not operative.

5.1.3 Power off

1) Press [POWER] key for approximately 1 second to turn power off.

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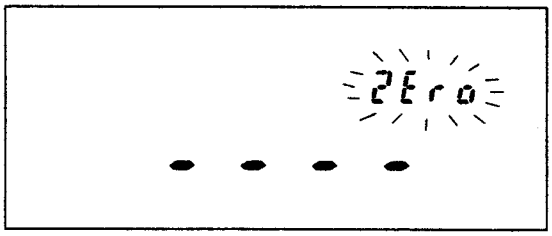
5.2 Operation in the Measurement Mode

The measurement mode is set at power on and measurement is started. Valid or invalid keys depend on the unit connected. If an invalid key is pressed, alarm buzzer will be activated (beep sound).

Following section describes operation and display in the measurement mode.

5.2.1 Zero adjustment

Operation key	Description
ZERO	This key is used for an automatic compensation of the measurement results obtained when the light to the sensor unit light input terminal is blocked (zero error). (Light to the terminal must be securely blocked in this measurement.)



During execution of the zero adjustment, "2Ero" will be shown in flash in the middle column of the display unit.

Upon normal completion of the zero adjustment, the mode returns to normal measurement mode. The zero adjustment usually takes approximately 30 to 60 seconds.

If ZERO key is pressed again during execution of the zero adjustment, the zero adjustment is interrupted returning the mode to the measurement mode. In this case, all the offsets obtained in the zero set are canceled.

Note 1: Blockout the light to the sensor input section before conducting the zero adjustment. If the blocking is insufficient, measurment values might contain errors. If the zero adjustment is conducted with extremely low level of blocking, the zero adjustment will not complete.
Instead, the error display will appear (→ 5-18) returning the mode to normal measurement mode.

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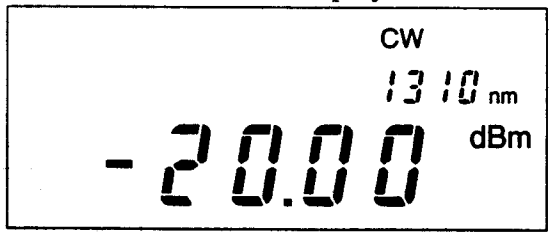
Note 2: The electrical offset on the circuit is influenced by ambient temperature and power on duration. Thus, when the measurement of high accuracy is required, the zero adjusment must be done just prior to the measurement.

Note 3: The zero set is not required in the modulation light measurement mode except for CW light, thus [ZERO] *key is not operative.*

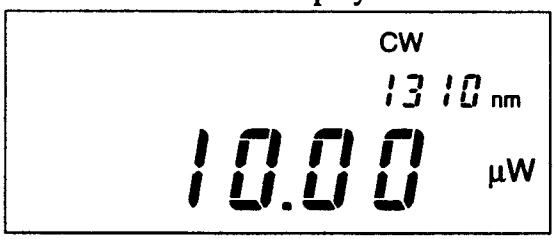
5.2.2 Switching of display unit in the absolute value measurement

Operation key	Description
[dBm W]	This key is used for switching the display unit in the absolute value measurement. Every time the key is pressed, following switching takes place on the display unit. dBm → W → dBm → --- This key is also used for releasing the relative value measurement and returning to absolute measurement.

For dBm display



For W display



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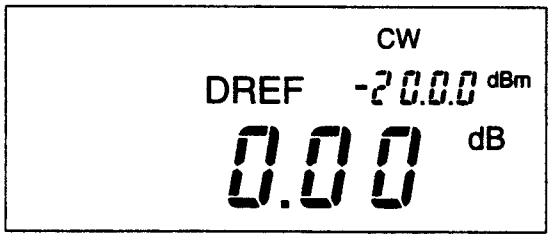
5.2.3 Relative value measurement

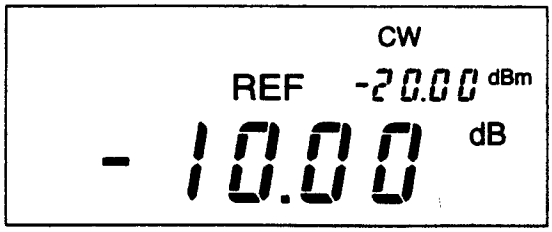
Operation key	Description
DREF	The measurement value being displayed at the time when this key is pressed is used as the reference value and succeeding measurements are shown in relative value to the reference. The reference value is displayed in the middle column of the display unit and the relative value will be shown in the bottom. The display unit is dB. Press dBm/W key to release the relative display.



Displayed relative value [dB] = Measurement value [dBm] – Measurement value upon pressing [DREF] [dBm] (reference value).

The reference value will be updated every time the DREF key is pressed.

Operation key	Description
REF	This key makes the value being set through the REF VALUE setting (→ 5 - 13) as the reference value and displays measurements in relative value to the reference. The reference value and the measurement value are shown in the middle and bottom columns of the display unit, respectively. Display unit is dB. Press dBm/W key to release the relative display.



Displayed relative value [dB] = Measurement value [dBm] – REF VALUE setting [dBm] (reference value).

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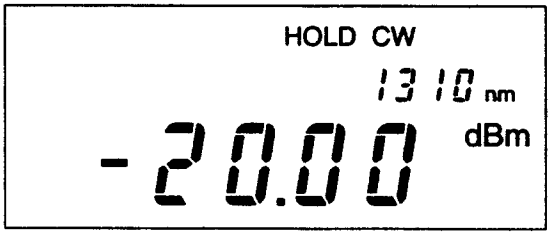
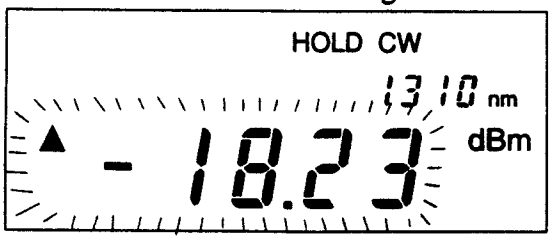
5.2.4 Fixing the measurement range

Operation key	Description
RANGE	This key switches the measurement range between the auto and fixed. Every time the key is pressed, following switching takes place on the setting. Fixed → Auto → Fixed → --- For the fixed range, "HOLD" will be indicated at top the display unit.
△	Every time the key is pressed, the fixed range will be incremented by 1 range.
▽	Every time the key is pressed, the fixed range will be decremented by 1 range.

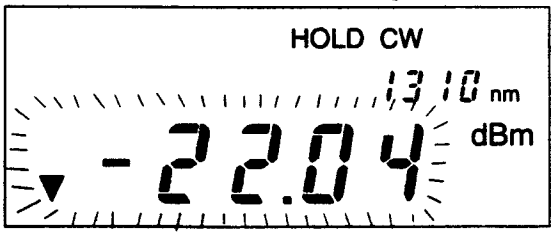


Measurable range for one range is specified. If any light beyond the current measurement range enters when the range is fixed, the measurement value flashes indicating the measurement is impossible. If a measurement value exceeds the upper limit, ▲ will be shown and if the lower limit is exceeded, ▼ will be indicated.

In case of over range



In case of under range



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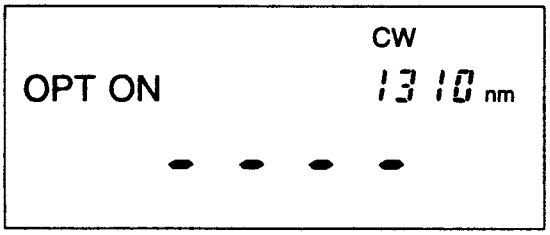
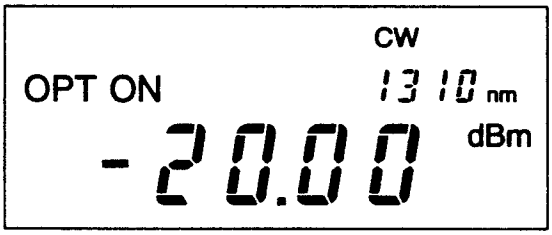
5.2.5 Emission from the light source

Operation key	Description
OPT ON	This key turn on or off the optical output. Every time the key is pressed, following switching takes place on the setting. ON → OFF → ON → --- When the optical output is turned on, "OPT ON" will be shown in the middle of the display unit.

When only the light source unit is mounted



When the sensor unit is also mounted



Upon pressing the key, "OPT ON" is shown and the light source will be turned on.
At this time, the wavelength displayed is that of the light source unit.
When the sensor unit is connected, calibration wavelength of the sensor unit will be updated to the wavelength of the light source unit.
When optical output is to be done from the light source unit having two wavelengths, select desired wavelength with [λ] key setting (→ 5 - 10) before turning on the output.
When the light source unit is switched from the unit with single wavelength being used in the preceding operation to the
current unit with two wavelengths, 1310 mm will be set as the initial value.
However, when the sensor unit is connected, the wavelength nearer to λ being set on the sensor unit (1310 nm when λ is set to 1250 nm and 1550 nm when λ is set to 1530) will be set as the initial value. At this time, λ set on the sensor unit will be updated to 1310 nm or 1550 nm, too.

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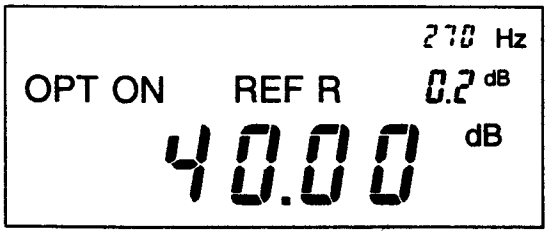
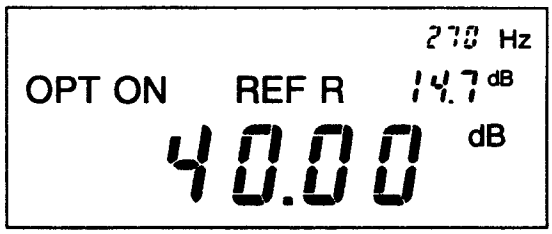
5.2.6 Measurement of return loss

Operation key	Description
DREF	This key measures reflective attenuation using the total reflection cord as the reference. Connect the total reflection cord and press DREF key to set the reference. "REF R 0.2 dB" will be shown in the middle of the display unit. Connect the connector under measurement and the reflective attenuation will be shown at bottom of the display unit.
REF	Measurement of the reflective attenuation is done without using air as the standard. Press REF key without setting any value. "REF R 14.7dB" will appear at middle column of the display unit. Connect the connector under measurememnt and the reflective attenuation will be shown at bottom of the display unit.

When the total reflection cord is used as the reference



When air is used as the reference



Connect the return loss unit and turn power on. The unit awaits for OPT ON key input. The DREF and REF keys are not operative at this stage.
Press OPT ON key to start the return loss measurement.

In the above, the reference value of 0.2 dB is used assuming the reflection rate of the total reflection cord to be approximately 95%.

The reference value of 14.7 dB is employed when air is used as the reference.

Note: *The optical modulation mode will be fixed to 270 Hz. The zero adjustment is not needed.*

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5.2.7 Back light

Operation key	Description
BACK LIGHT	This key turns on the display unit back light. • When the DC pack is used Every time the key is pressed, following switching takes place on the setting. ON → OFF → ON → --- • When the dry cell battery or AP2104 Ni-Cd battery pack is used The back light remains on as long as the key is pressed. The light will remain on 5 seconds after the key is released, then it goes off automatically.

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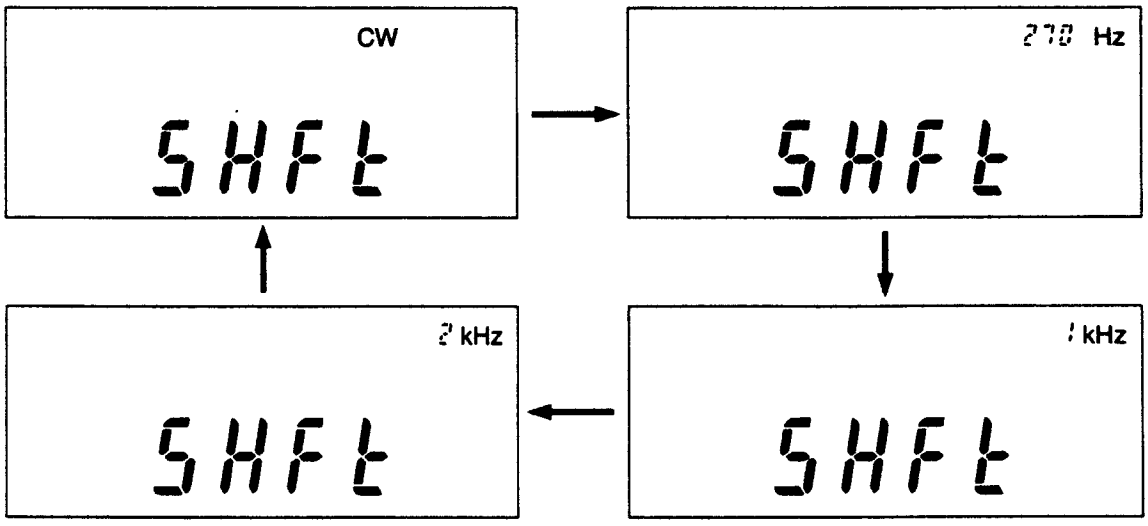
5.3 Operation in the Setting Mode

If [SHIFT] key is pressed in the measurement mode, the measurement is interrupted and the mode shifts to the setting mode. In the setting mode, following keys will enable modifications of the settings on each function.
Press [SHIFT] key again to return to the measurement mode.

Note: *Following functions are not available when the return loss unit is connected:*
MOD ..... Switching in the optical modulation mode.
BUZZER ..... The buzzer function setting.
λ ..... Setting of the light sensitivity compensation.
REF VALUE ..... The REF VALUE setting.

5.3.1 Switching in the optical modulation mode

Operation key	Remarks
[SHIFT] ( ) [MOD]	This key is used for setting internal modulation frequency of the light source and modulation frequency of the measurement light. Every time the key is pressed, following switching takes place on the setting. CW → 270 Hz → 1 KHz → 2 KHz → CW → --- The set modulation frequency will be shown at top of the display unit.



Note: *Frequency on the external light source, when such is used, must be adjusted to the modulation frequency of this deice. If they do not match, measurement values will not be displayed or values lower than actual measurements will be shown.*

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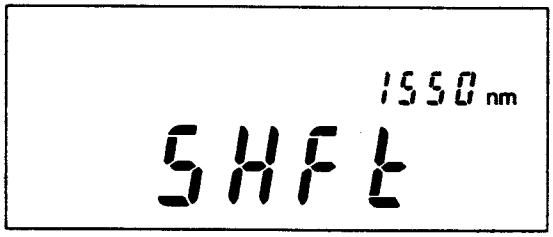
5.3.2 Wavelength measurement

Operation key	Remarks
(SHIFT) + λ	This key is used for setting wavelength on the light source unit having 2 wavelengths and for setting compensation wavelength on the sensor unit. Every time the key is pressed, following switching takes place on the compensation wavelength of the sensor unit. • When the sensor unit is connected 830 → 850 → 1200 → 1300 → 1310 → 1550 → 1650 → returns to 830. • When the sensor unit of short wavelength is connected 633 → 780 → 830 → 850 → returns to 633. The set wavelength will be shown in the middle of the display unit.
△	Every time the key is pressed, wavelength will increases by 5 nm.
▽	Every time the key is pressed, wavelength will decrease by 5 nm.



Keep △ or ▽ key held down to modify the wavelength in higher speed.
The alarm buzzer will be activated when the compensation wavelength reaches upper or lower limit of the set range. However, the alarm activation level depends on the type of the sensor used in the allowable setting range.
A different approach is needed for setting the wavelength sensitivity compensation when the optical output on the light source unit is turned on.

- When the connected light source unit has 1 wavelength
  Setting for the wavelength sensitivity compensation is not available because the wavelength is fixed to that of the light source unit.
- When the connected light source unit has 2 wavelengths
  Wavelength will be switched between 1310 and 1550 every time [λ] key is pressed.

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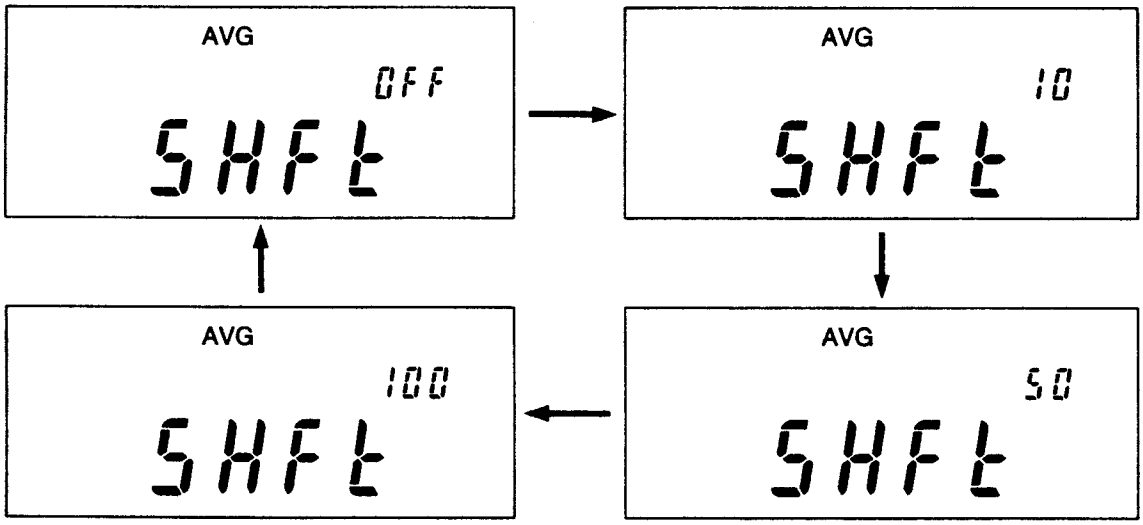
5.3.3 Setting for the averaging

Operation key	Remarks
(SHIFT) + AVG	The key sets on or off of the averaging process. Every time the key is pressed, following switching takes place on the setting. OFF → 10 times → 50 times → 100 times → OFF → --- When the setting is valid, "AVG" will be shown at top of the display unit.



Serial adding and averaging method is employed for the averaging. In this averaging approach, measurement values are sequentially added and their average is displayed at approximately 330 ms measurement intervals. If the set averaging frequency is not reached, average value of the measurements done up to that point will be computed.

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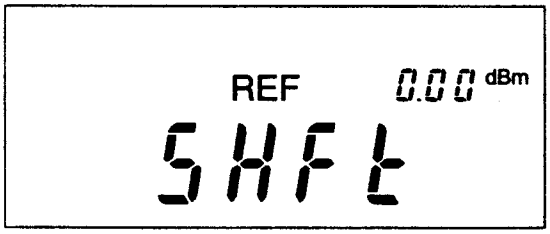
5.3.4 Setting the REF VALUE

Operation key	Description
(SHIFT) + REF VALVE	This key is used to set the reference value for the relative measurement to be conducted with REF key (See 5-5).
△	The reference value will be increased by 0.01 dB every time the key is pressed.
▽	The reference value will be decreased by 0.01 dB every time the key is pressed.



Keep △ or ▽ key held down for charging the reference value in higher speed.
Allowable reference value setting range is from –99.99 to 99.99 dB.

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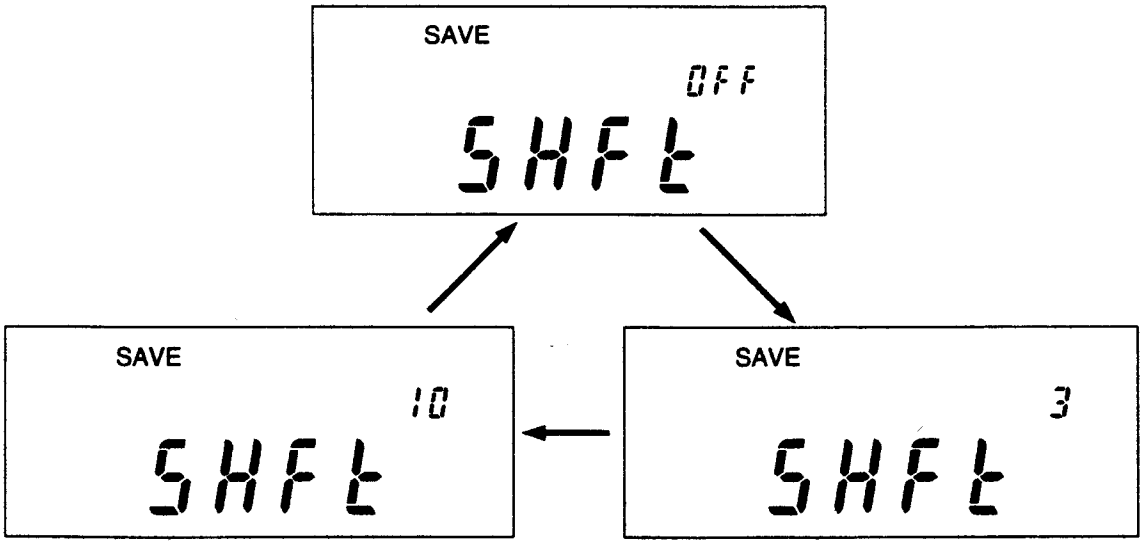
5.3.5 Setting the power save function

Operation key	Description
(SHIFT) + POWER SAVE	This key is used for changing the power save time settings. Every time the key is pressed, following switching takes place on the setting. OFF → 3 (minutes) → 10 (minutes) → OFF → --- If no key is operated for certain duration (for 3 or 10 minutes), power will be automatically turned off by this function. This function is valid when dry cell batteries or AP2104 Ni-Cd battery pack is not used. It is invalid when DC pack is used. When valid, "SAVE" will be shown at top of the display unit.



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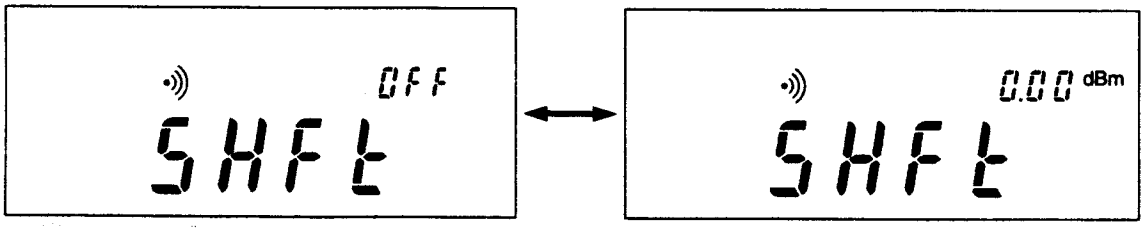
5.3.6 Setting the buzzer function

Operation key	Description
SHIFT + BUZZER	This key is used for setting on or off of the buzzer. Every time the key is pressed, following switching takes place on the setting. OFF → Buzzer reference value → OFF → --- This function activates the buzzer when input of a light larger than the buzzer reference value has been measured. When valid, •)) will be shown in the middle of the display unit.
△	The reference value will be increased by 1 dB every time the key is pressed.
▽	The reference value will be decreased by 1 dB every time the key is pressed.



Keep holding △ or ▽ key down to change the buzzer reference value in higher speed.
Allowable buzzer reference value setting range is from –99.99 to 99.99.
If the measured value exceeds the buzzer reference value while the buzzer function is on, the buzzer will beep.

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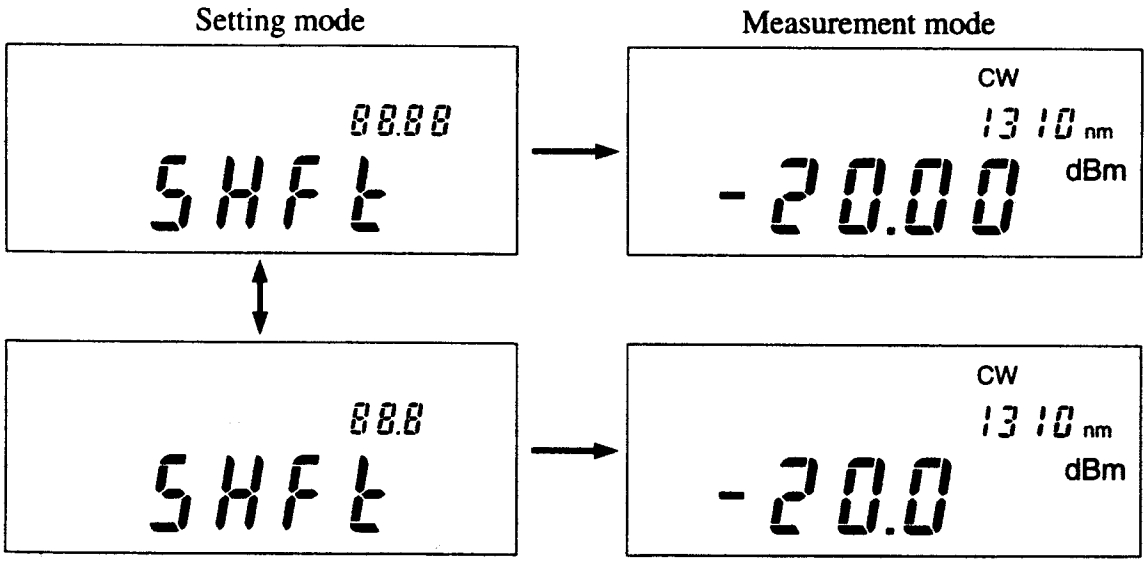
5.3.7 Setting the blanking function

Operation key	Description
(SHIFT) BLKG	This key is used to set resolution for displaying the measurement values. Every time the key is pressed, following switching takes on the setting. All digits display → Omission of least significant digit → All digit display → --- When the least significant digit is omitted, the value after rounding that digit will be shown.



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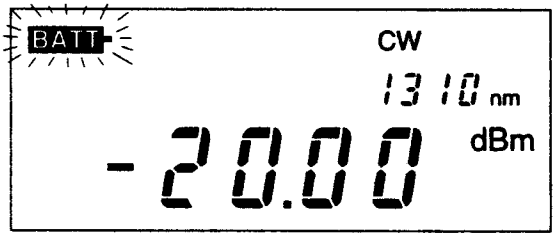
5.4 Other Functions

This device has following functions that do not require key entry or setting.

5.4.1 Low battery detection

When the supply voltage goes low, the low battery state will be indicated. If the low battery is detected, the battery must be replaced for preventing measurement errors or loss of stable measurements.



5.4.2 Analog out

Jack for the analog out is installed on the DC power pack of this device. It is used for generating measurement results at the recorder.

For the analog out, output voltage from 0 to about 2V is available for each range in proportion to the input optical power. (For example, if –20 dBm is input in –20 to -30 dBm range, output voltage of approximately 1V will be obtained. Output impedance at that time is approximately 1 KΩ.)

In the fixed range, under range disply and over range display will appear if the analog out voltage goes below approx. 0.1V and beyond approx. 1.5V, respectively.
However, since up to approximately 2V is available for the analog out, measurement results can be continuously generated at the recorder.

In the auto range, switching of the range takes place if the voltage goes below approximately 0.1V or beyond approximately 1.5V.
Therefore, this operation must be done in the fixed range.

Plug for the analog out is a standard with this device. Figure 5-1 shows structure of the plug for the analog out. Refer to the figure to do wire connection best suided for your application.

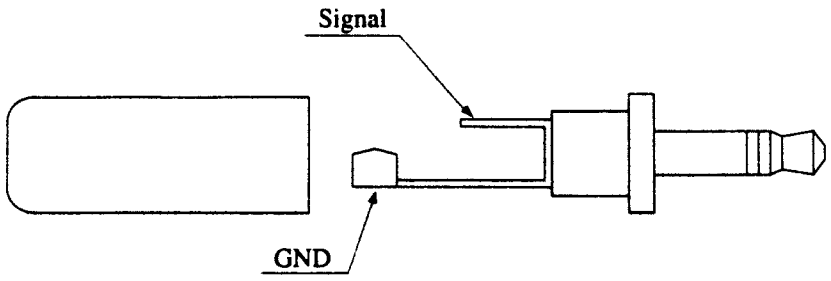


Figure 5-1 Structure of the Plug for Analog Out

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5.4.3 Resume function

The resume function stores the conditions set in the preceding operation and reproduces them when power is turned on for the next operation.
This device also equips with the battery back up function which enables to hold following items up to approximately for 15 minutes if power is turned off for replacement of dry cell batteries or Ni-Cd battery pack.
When the sensor unit has been changed, items will be initialized to the default state.

Items that can be held	Relevant keys	Default values
Measurement mode	dBm/W	Absolute value measurement (unit: dBm)
Range mode	RANGE	Range auto
Light modulation mode	MOD	CW
Wavelength	λ	Default value of each sensor unit
Averaging process	AVG	Averaging process OFF
REF VALUE value	REF VALUE	0.00 dBm
Blanking	BLKG	All digits display
Buzzer	BUZZER	Buzzer OFF, buzzer setting 0.00 dBm
Power save	POWER SAVE	Power save OFF
Zero adjustment	ZERO	0

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5.5 Error Display

If there exists any failure in the operating conditions, this device issues error displays as shown in Table 5-1.

Table 5-1 Error Display

No.	Error display	Description of the error	Actions needed
1	----	Sensor unit is not mounted	This error display can be ignored when the sensor unit is used only as the light source.
2	Err1	The sensor unit wavelength and light source wavelength do not match.	Replace either of the units.
3	Err2	Zero adjustment was not available and ended unsuccessfully.	Check if the sensor unit is shielded from light.

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5.6 Operating the AP2103 Charger

5.6.1 Overview

The AP2103 charger is dedicated for the AP 2104 Ni-Cd battery pack. Low battery on the AP2104 Ni-Cd battery pack can be charged quickly within about 1 hour with this AP2103 charger.

And, the discharging function is provided for protecting the memory effect of the Ni-Cd battery pack. This discharging function may be used once a month or when the battery comes to need very frequent charging.

5.6.2 Precautions on use

1) The AP2104 Ni-Cd battery pack and AP2103 charger are dedicated for the AQ2150 optical multimeter. Do not use battery chargers or chargers intended for other devices.
2) Do not connect the AP2150 DC pack or dry cell battery pack to the AP2103 charger. Do not use universal size AA Ni-Cd batteries for charging the dry cell battery pack.
3) The discharging function may not operate if voltage on the AP2104 battery pack goes low.
4) Do not short the battery charger terminal. It could result in an accident.
5) Clean the charger and battery charger terminals regularly with a cotton swab. Dusts on the terminal can prevent charging due to improper contact.
6) Do not use the battery charger in place exposed to direct sun. Also, avoid using in following places:
   - Ambient temperature goes beyond the range of 5 to 35°C.
   - Dusty place, or environment of high humidity or high vibration.
7) Temperature on the battery charger may go up slightly during charging.
8) The battery charger must not be exposed to water or strong shock. Take care not to drop it inadvertently.
9) Do not try to disassemble or modify the battery charger.

5.6.3 How to charge

1) Mount the attached AC adapter to the AP2103 charger.
2) Insert the AC adapter cable to the plug socket.
3) Connect the AP2104 Ni-Cd pack to the charger.
4) Charging starts upon connection and the CHARGE lamp flashes.
5) Upon completion of charging, the CHARGE lamp goes on.
6) Remove the AP2104 Ni-Cd pack.

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Note:
- *An AP2104 Ni-Cd battery pack indicating low battery can be charged within approximately an hour.*
- *The AP2104 battery pack being discharged can be charged within approximately an hour and half.*
- *Charging duration varies according to remaining voltage on the AP2104 Ni-Cd charger and ambient temperature.*

5.6.4 How to charge/discharge

1) Mount the attached AC adapter to the AP2103 charger.
2) Insert the AC adapter cable to the plug socket.
3) Connect the AP2104 Ni-Cd pack to the charger and press the DISCHARGE button. The DISCHARGE lamp flashes indicating discharging has started.
4) Upon completion of discharging, the DISCHARGE lamp goes on and charging of the dry cell battery pack starts automatically. The CHARGE lamp lashes during the charging.
5) The CHARGE lamp goes on upon completion of charging.
6) Remove the AP2104 Ni-Cd pack.

Note:
- *The AP2104 Ni-Cd battery pack indicating low battery can be discharged within approximately 30 minutes.*
- *Discharging duration varies according to remaining voltage on the AP2104 Ni-Cd battery pack or ambient temperature.*

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6. Troubleshooting Guide

This chapter describes the points to be checked when the device does not operate as intended.

1) The device does not operate at power on.
   ① Is the power pack properly mounted on the body?
   ② When the device is operated on the dry cell battery pack
      - Is the battery properly placed?
        (Note: Size AA Ni-Cd battery can not be used)
      - Isn't an old battery used?
        (Combined use of old and new batteries can cause liquid leak and that can result in failure on the device.)
   ③ When the device is operated on the DC pack
      - Is the attached AC adapter used?
        (As the supply, only the attached AC adapter must be used, otherwise a failure can result.)
   ④ When the AP2104 Ni-Cd battery pack (option) is used
      - Is the pack charged sufficiently?
        (The optional AP2103 charger must be used for the charging. Use of other charges can not only deteriorate batteries but can cause accidents.)
      - Isn't the AP2104 Ni-Cd battery pack deteriorated?
        The AP2104 Ni-Cd battery pack accumulates power by use of chemical reactions. Therefore, improper storage can extremely shorten its life. It must be stored in a cool and dark place. And, it must be discharged before storing.

2) Absolute value does not match
   - Is the zero set executed?
     (Is the zero set executed completely?)
   - Is the calibration wavelength properly set?
   - When measuring modulation light, does frequency of the modulation light match the MOD frequency setting?
   - Is the connector adapter properly mounted?
   - Isn't end face of the connected fiber stained?
   - Aren't there damages on the light receiving section (especially the glass surface)?

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3) The zero adjustment can not be executed
   - Is the light to the sensor optical input section properly blocked?
   - Isn't modulation light frequency being set to the CHOP?

4) Measurement values are not displayed
   - Isn't there deviation between the internal modulation frequency of the light source and that on the measurement light?

5) Output from the light source unit is unstable
   - Isn't the optical connector of the device or end face of the connected optical fiber contaminated with dusts or stains?
   - With the LD unit or return loss unit, is treatment of the connected fiber end done with PC polishing?

Check the above items and if the trouble recurs, contact us (at head quarters or local offices) for your trouble.

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7. Maintenance

This chapter describes maintenance and care of the device.

7.1 Required Measuring Instruments

Table 7-1 shows measuring instruments required for the maintenance.

Table 7-1 Measuring Instruments for the Testing

Instrument name	Major functions
Optical power meter	Wavelength range: 400 to 1000 nm 1000 to 1700 nm Measurement accuracy: Within ±5%
LD light source	Emitting wavelength: 850±20 nm 1310±20 nm Output level: –3±1 dBm
Variable optical attenuator	Wavelength: 850 nm band 1300 nm band Max. attenuation: 65 dB or more
Optical spectrum analyzer	Wavelength range: 400 to 1700 nm Wavelength accuracy: ±1 nm Wavelength resolution: 0.1 to 10 nm
Optical fiber cord	Single mold fiber: PC polishing 2 meters minimum
Terminating set	Reflective attenuation: 40 dB or more

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7.2 Periodical Check

Periodical check is useful for maintaining the device function normally over a long period and for detecting troubles at earlier stage. Checking interval shall be decided considering storage state and use frequency. Periodical check includes mechanical check, operation test, adjustment and calibrations.

The operation test compares the device performance against the specifications.
This chapter describes the operation test done in the acceptance test, regular check and after repair work.

Generally, regular check of twice a year would be enough since this device has enabled been designed to provide a better stability and reliability.

Caution:
Do not reach your hands into the device.

1) Mechanical check

   Appearance and mechanical actions of the device are checked externally.
   Appearance of the device will be checked visually for damages or deformation.
   Assembled parts will be checked for looseness, and switches and stoppers will be checked for smooth action.

2) Check of sensor operation

   ① Connect the sensor unit to the AQ2150 body and turn power on. If there is any failure, display unit on the AQ2150 will display error messages. (→ 5 - 18).

   ② Connect the device and the reference optical power meter according to Figure 7-1 and check if the standard is satisfied by setting the level to –20 dBm.

   ③ Do the same check by varying the level and the light source wavelength.

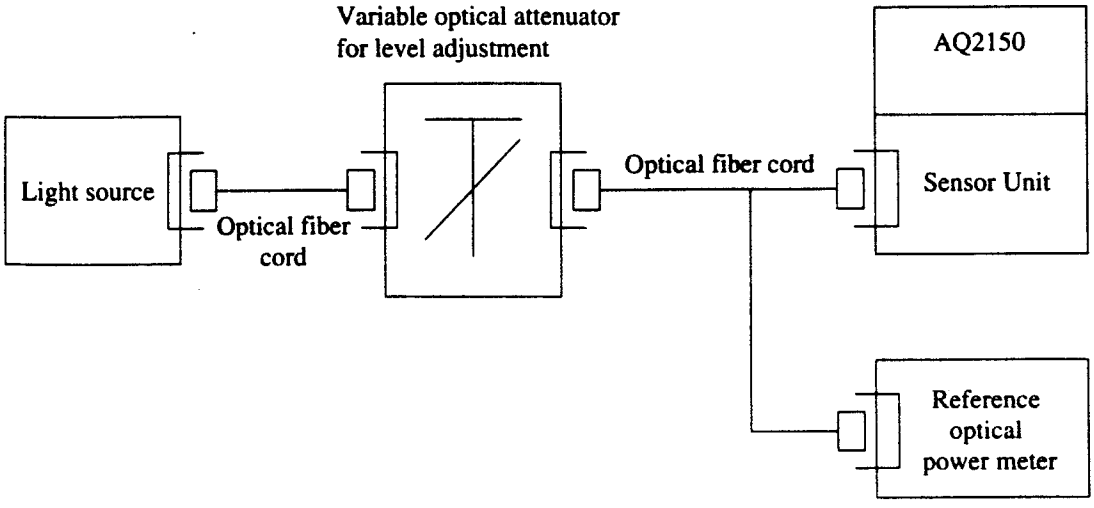

Figure 7-1 Operation Test

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3) Operation check on the optical source unit

① Set the optical modulation mode to CW (→ 5-10) and connect the unit to the optical spectrum analyzer. Measure the wavelength and half value width to confirm that the standard is satisfied.

② Set the optical modulation mode to CW (→ 5-10) and connect the unit to the optical analyzer. Measure the optical outputs to confirm that the standard is satisfied.

4) Operation check on the return loss unit

① Connect the terminating set using air as the reference (→ 5-8) and make sure that the value is 40 dB or above.

7.3 Care

Measurement accuracy of the device can not be guaranteed if the input/output end face of the device is contaminated by dusts or other foreign matters. Check for stains and remove them (if any) when replacing the connector adapter, when the appropriate absolute value can not be obtained or during a periodical check.

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List of Sensor Unit Attachments

No.	Name	Q'ty	Description
1	Light blocking cap	1	Mounted to sensor unit

List of LED Unit Attachments

No.	Name	Q'ty	Description
1	Dust protection cap	1	Mounted to LED unit
2	Stopper ring	1	Mounted to LED unit

List of LD unit/Return Loss Unit Attachments

No.	Name	Q'ty	Description
1	Connector protection cap	1	Mounted to LD unit/return loss unit

List of Connector Adapter Attachments

No.	Name	Q'ty	Description
1	Light blocking cap	1	Mounted to AQ9431
2	Dust protection cap	1	Mounted to AQ9433
3	Protection cap	1	Mounted to AQ9433

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