MT9810B
Optical Test Set
Operation Manual

Ninth Edition

For safety and warning information, please read this manual before attempting to use the equipment.
Keep this manual with the equipment.

ANRITSU CORPORATION

Document No.: M-W1886AE-9.0

Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Ensure that you clearly understand the meanings of the symbols BEFORE using the equipment. Some or all of the following symbols may be used on all Anritsu equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.

Symbols used in manual

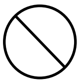
DANGER ⚠ This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.

WARNING ⚠ This indicates a hazardous procedure that could result in serious injury or death if not performed properly.

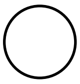
CAUTION ⚠ This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manual

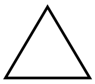
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.



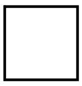
This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.



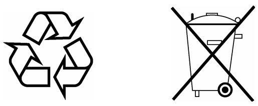
This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.



This indicates a warning or caution. The contents are indicated symbolically in or near the triangle.



This indicates a note. The contents are described in the box.



These indicate that the marked part should be recycled.

MT9810B
Optical Test Set
Operation Manual

28 June 2001 (First Edition)
9 May 2008 (Ninth Edition)

For Safety

WARNING

1. ALWAYS refer to the operation manual when working near locations at which the alert mark shown on the left is attached. If the advice in the operation manual is not followed there is a risk of personal injury or reduced equipment performance. The alert mark shown on the left may also be used with other marks and descriptions to indicate other dangers.

2. IEC 61010 Standard
   The IEC 61010 standard specifies four categories to ensure that an instrument is used only at locations where it is safe to make measurements. This instrument is designed for measurement category I (CAT I). DO NOT use this instrument at locations specified as category II, III, or IV as defined below.
   Measurement category I (CAT I):
   Secondary circuits of a device that is not directly connected to a power outlet.
   Measurement category II (CAT II):
   Primary circuits of a device that is directly connected to a power outlet, e.g., portable tools or home appliance.
   Measurement category III (CAT III):
   Primary circuits of a device (fixed equipment) to which power is supplied directly from the distribution panel, and circuits running from the distribution panel to power outlet.
   Measurement category IV (CAT IV):
   Building service-line entrance circuits, and circuits running from the service-line entrance to the meter or primary circuit breaker (distribution panel).

3. Laser radiation warning
   - NEVER look directly into the cable connector on the equipment nor into the end of a cable connected to the equipment. There is a risk of injury if laser radiation enters the eye.
   - The Laser Safety label is attached to the equipment for safety use as indicated in "Laser Safety" later in this section.

For Safety

WARNING ⚠

Electric Shock

4. To ensure that the instrument is earthed, always use the supplied 3-pin power cord, and insert the plug into an outlet with an earth terminal. If power is supplied without earthing the equipment, there is a risk of receiving a severe or fatal electric shock or causing damage to the internal components.

Repair

WARNING ⚠

5. This equipment cannot be repaired by the operator. DO NOT attempt to remove the equipment covers or unit covers or to disassemble internal components. Only qualified service personnel with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision components.

Calibration

6. The performance-guarantee seal verifies the integrity of the equipment. To ensure the continued integrity of the equipment, only Anritsu service personnel, or service personnel of an Anritsu sales representative, should break this seal to repair or calibrate the equipment. If the performance-guarantee seal is broken by you or a third party, the performance of the equipment cannot be guaranteed. Be careful not to break the seal by opening the equipment or unit covers.

Falling Over

7. This equipment should always be positioned in the correct manner. If the cabinet is turned on its side, etc., it will be unstable and may be damaged if it falls over as a result of receiving a slight mechanical shock.
   Always set up the equipment in a position where the power switch can be reached without difficulty.

For Safety

CAUTION ⚠

Fuse Replacement

CAUTION ⚠

1. Always remove the mains power cable from the power outlet before replacing blown fuses. There is a risk of electric shock if fuses are replaced with the power cable connected. Always use new fuses of the type and rating specified on the rear panel of the instrument. There is a risk of fire if a fuse of a different rating is used.

   T2A indicates a time-lag fuse.

Cleaning

2. Keep the power supply and cooling fan free of dust.
   - Clean the power inlet regularly. If dust accumulates around the power pins, there is a risk of fire.
   - Keep the cooling fan clean so that the ventilation holes are not obstructed. If the ventilation is obstructed, the cabinet may overheat and catch fire.

For Safety

Class 1, 1M indicate the danger degree of the laser radiation specified below according to IEC 60825-1:2001.

Class 1: Lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

Class 1M: Lasers emitting in the wavelength range from 302.5 to 4000 nm that are safe under reasonably foreseeable conditions of operation, but may be hazardous if the user employs optics within the beam. Two conditions apply:

a) for diverging beams, if the user views the laser output with certain optical instruments (for example, eye loupes, magnifiers and microscopes) within a distance of 100 mm; or

b) for collimated beams, if the user views the laser output with certain optical instruments (for example, telescopes and binoculars).

Class I, IIa, II, IIIa, IIIb indicate the degree of danger of the laser radiation outlined below as defined by 21 CFR 1040.10:1995.

Class I: Class I levels of laser radiation are not considered to be hazardous.

Class IIa: Class IIa levels of laser radiation are not considered to be hazardous if viewed for any period of time less than or equal to 1×10^3 seconds but are considered to be a chronic viewing hazard for any period of time greater than 1×10^3 seconds. The wavelength range of laser radiating is in 400 to 710 nm.

Class II: Class II levels of laser radiation are considered to be a chronic viewing hazard. The wavelength range of laser radiating is in 400 to 710 nm.

Class IIIa: Class IIIa levels of laser radiation are considered to be, depending upon the irradiance, either an acute intrabeam viewing hazard or chronic viewing hazard, and an acute viewing hazard if viewed directly with optical instruments. The wavelength range of laser radiating is in 400 to 710 nm.

Class IIIb: Class IIIb levels of laser radiation are considered to be an acute hazard to skin and eyes from direct radiation.

For Safety

CAUTION

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

The use of optical instruments with this product will increase eye hazard.

WARNING ⚠

Laser Safety

Before using this instrument, always ensure that the warning light is lit when the optical output switch is turned on.

If this warning light does not turn on, the equipment may be faulty and for safety reasons should be returned to an Anritsu service center or representative for repair.

The laser in the plug-in unit provided for this equipment is classified as Class 1, 1M according to the IEC 60825-1:2001 standard, or as Class I, IIIb according to the 21 CFR 1040.10:1995 standard.

Never use optical instruments to directly view Class 1M laser products. Doing so may result in serious damage to the eyes.

Table 1 Laser Safety Classifications Based on IEC 60825-1:2001

Model Name	Class	Max. Optical Output Power (mW)*	Pulse Width (s)/ Repetition Rate	Emitted Wavelength (nm)	Laser Aperture
MU954501A	Class 1	10	CW	1550	Fig. 1, [1]
MU952501A	Class 1M	40	CW	1545-1553	Fig. 1, [1]
MU952502A	Class 1M	40	CW	1553-1561	Fig. 1, [1]
MU952503A	Class 1M	40	CW	1561-1564	Fig. 1, [1]
MU952504A	Class 1M	40	CW	1537-1545	Fig. 1, [1]
MU952505A	Class 1M	40	CW	1530-1537	Fig. 1, [1]
MU952601A	Class 1M	40	CW	1564-1569	Fig. 1, [1]
MU952602A	Class 1M	40	CW	1569-1578	Fig. 1, [1]
MU952603A	Class 1M	40	CW	1577-1586	Fig. 1, [1]
MU952604A	Class 1M	40	CW	1586-1594	Fig. 1, [1]
MU952605A	Class 1M	40	CW	1594-1603	Fig. 1, [1]
MU952606A	Class 1M	40	CW	1603-1610	Fig. 1, [1]
MU951301A	Class 1M	40	CW	1310	Fig. 1, [1]
MU951501A	Class 1M	40	CW	1550	Fig. 1, [1]
MU951001A	Class 1M	40	CW	1310/1550	Fig. 1, [1]

*: Indicates the possible optical output power when each and every reasonably foreseeable single-fault condition is included.

Table 2 Laser Safety Classifications Based on FDA21 CFR 1040.10:1995

Model Name	Class	Max. Optical Output Power (mW)	Pulse Width (s)/ Repetition Rate	Emitted Wavelength (nm)	Laser Aperture
MU954501A	Class I	10	CW	1550	Fig. 1, [1]
MU952501A	Class IIIb	40	CW	1545-1553	Fig. 1, [1]
MU952502A	Class IIIb	40	CW	1553-1561	Fig. 1, [1]
MU952503A	Class IIIb	40	CW	1561-1564	Fig. 1, [1]
MU952504A	Class IIIb	40	CW	1537-1545	Fig. 1, [1]
MU952505A	Class IIIb	40	CW	1530-1537	Fig. 1, [1]
MU952601A	Class IIIb	40	CW	1564-1569	Fig. 1, [1]
MU952602A	Class IIIb	40	CW	1569-1578	Fig. 1, [1]
MU952603A	Class IIIb	40	CW	1577-1586	Fig. 1, [1]
MU952604A	Class IIIb	40	CW	1586-1594	Fig. 1, [1]
MU952605A	Class IIIb	40	CW	1594-1603	Fig. 1, [1]
MU952606A	Class IIIb	40	CW	1603-1610	Fig. 1, [1]
MU951301A	Class IIIb	40	CW	1310	Fig. 1, [1]
MU951501A	Class IIIb	40	CW	1550	Fig. 1, [1]
MU951001A	Class IIIb	40	CW	1310/1550	Fig. 1, [1]

For Safety

Table 3   Indication Labels on Product

	Type	Sample	Affixed to:	Model Name
1	Explanation	IEC 60825-1 : 2001 CLASS 1 LASER PRODUCT	Fig. 1, A	MU954501A
2	Explanation	IEC 60825-1:2001 INVISIBLE LASER RADIATION DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS (MAX OUTPUT POWER) (PULSE DURATION) (WAVELENGTH) 40mW CW 1530 to 1610nm CLASS 1M LASER PRODUCT	Fig. 1, B	MU952501A/02A/03A/04A/05A MU952601A/02A/03A/04A/05A/06A MU951301A MU951501A MU951001A
3	Explanation	DANGER INVISIBLE LASER RADIATION AVOID DIRECT EXPOSURE TO BEAM MAXIMUM POWER : 40mW WAVELENGTH :1.31/1.55μm CLASS Ⅲb LASER PRODUCT	Fig. 1, C	MU952501A/02A/03A/04A/05A MU952601A/02A/03A/04A/05A/06A MU951301A MU951501A MU951001A
4	Certification	CERTIFICATION LABEL THIS PRODUCT CONFORMS TO ALL APPLICABLE STANDARDS UNDER 21 CFR 1040.10	Fig. 1, D	MT9810B MT9812B
5	Identification	IDENTIFICATION LABEL ANRITSU CORP. 5-1-1,ONNA,ATSUGI-SHI KANAGAWA 243-8555,JAPAN MANUFACTURED AT:TOHOKU ANRITSU CO., LTD KORIYAMA PLANT, .20	Fig. 1, E	MT9810B MT9812B
6	Warning		Fig. 1, F	MU954501A MU952501A/02A/03A/04A/05A MU952601A/02A/03A/04A/05A/06A MU951301A MU951501A MU951001A
7	Aperture	AVOID EXPOSURE INVISIBLE LASER RADIATION IS EMITTED FROM THIS APERTURE	Fig. 1, G	MU954501A MU952501A/02A/03A/04A/05A MU952601A/02A/03A/04A/05A/06A MU951301A MU951501A MU951001A

Laser Radiation Markings

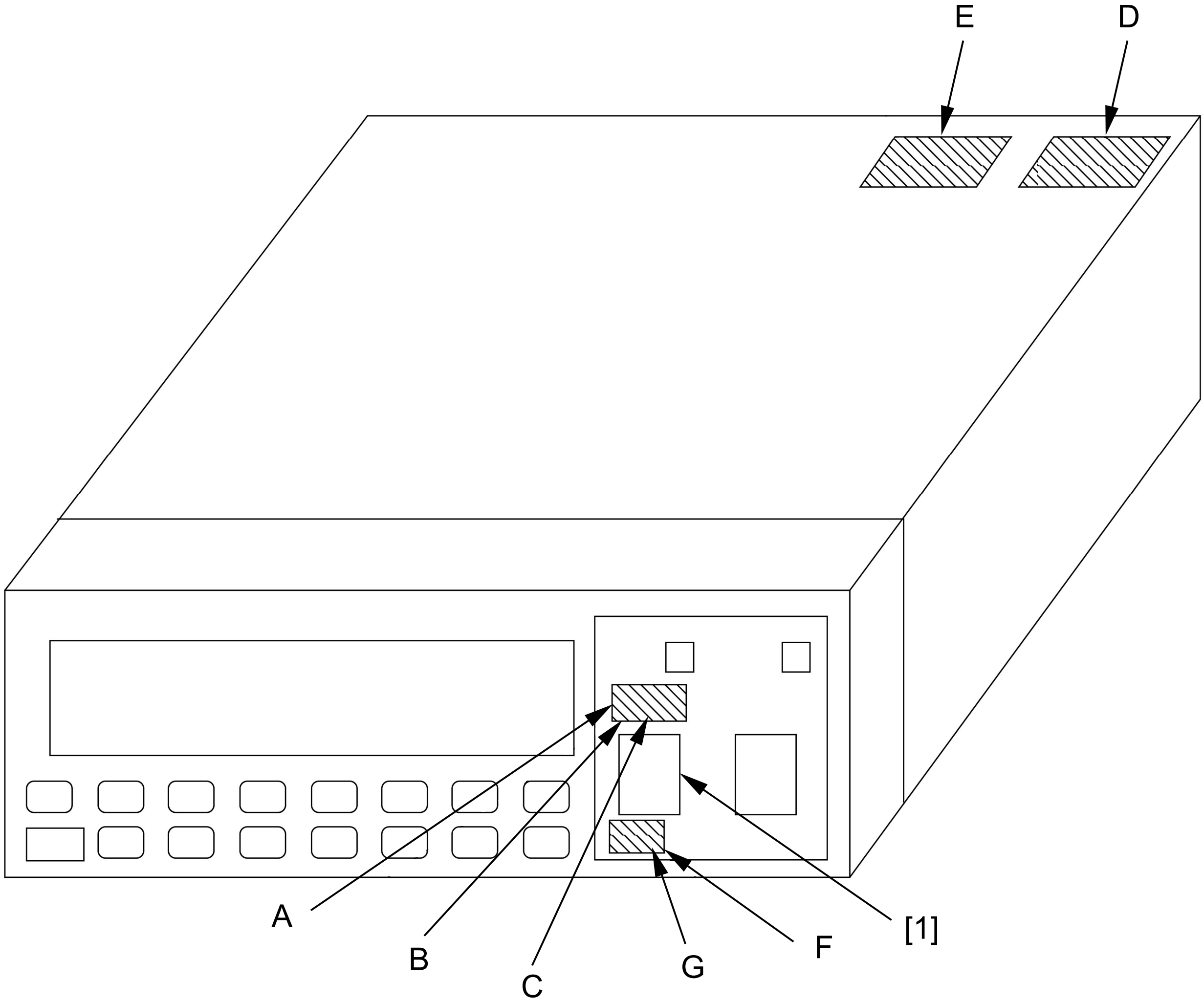


Fig. 1 Locations of Laser Beam Apertures and Affixed Labels

For Safety

CAUTION ⚠

Replacing Memory Back-up Battery

This equipment uses a Poly-carbomonofluoride lithium battery to backup the memory. This battery must be replaced by service personnel when it has reached the end of its useful life; contact the Anritsu sales section or your nearest representative.

Note: The battery used in this equipment has a maximum useful life of 7 years. It should be replaced before this period has elapsed.

Use in a residential environment

This instrument is designed for an industrial environment.
In a residential environment this instrument may cause radio interference in which case the user may be required to take adequate measures.

Equipment Certificate

Anritsu Corporation certifies that this equipment was tested before shipment using calibrated measuring instruments with direct traceability to public testing organizations recognized by national research laboratories, including the National Institute of Advanced Industrial Science and Technology, and the National Institute of Information and Communications Technology, and was found to meet the published specifications.

Anritsu Warranty

Anritsu Corporation will repair this equipment free-of-charge if a malfunction occurs within one year after shipment due to a manufacturing fault, under the condition that this warranty is void when:

- The fault is outside the scope of the warranty conditions described in the operation manual.
- The fault is due to mishandling, misuse, or unauthorized modification or repair of the equipment by the customer.
- The fault is due to severe usage clearly exceeding normal usage.
- The fault is due to improper or insufficient maintenance by the customer.
- The fault is due to natural disaster including fire, flooding, earthquake, etc.
- The fault is due to use of non-specified peripheral equipment, peripheral parts, consumables, etc.
- The fault is due to use of a non-specified power supply or in a non-specified installation location.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation shall assume no liability for injury or financial loss of the customer due to the use of or a failure to be able to use this equipment.

Anritsu Corporation Contact

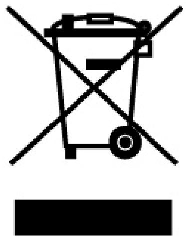
In the event that this equipment malfunctions, contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.

Notes On Export Management

This product and its manuals may require an Export License/Approval by the Government of the product's country of origin for re-export from your country.
Before re-exporting the product or manuals, please contact us to confirm whether they are export-controlled items or not.
When you dispose of export-controlled items, the products/manuals need to be broken/shredded so as not to be unlawfully used for military purpose.

Crossed-out Wheeled Bin Symbol

Equipment marked with the Crossed-out Wheeled Bin Symbol complies with council directive 2002/96/EC (the “WEEE Directive”) in European Union.



For Products placed on the EU market after August 13, 2005, please contact your local Anritsu representative at the end of the product's useful life to arrange disposal in accordance with your initial contract and the local law.

CE Conformity Marking

Anritsu affixes the CE conformity marking on the following product(s) in accordance with the Council Directive 93/68/EEC to indicate that they conform to the EMC and LVD directive of the European Union (EU).

CE marking

1. Product Model

Model: MT9810B Optical Test Set

2. Applied Directive

EMC: Directive 2004/108/EC
LVD: Directive 2006/95/EC

3. Applied Standards

- EMC: Emission: EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003 (Class A)
  Immunity: EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003 (Annex A)

	Performance Criteria*
IEC 61000-4-2 (ESD)	B
IEC 61000-4-3 (EMF)	A
IEC 61000-4-4 (Burst)	B
IEC 61000-4-5 (Surge)	B
IEC 61000-4-6 (CRF)	A
IEC 61000-4-11 (V dip/short)	B

*: Performance Criteria
A: During testing, normal performance within the specification limits.
B: During testing, temporary degradation, or loss of function or performance which is self-recovering.

Harmonic current emissions:
EN 61000-3-2: 2000 + A2: 2005 (Class A equipment)

- LVD: EN 61010-1: 2001 (Pollution Degree 2)

4. Authorized representative

Name:	Loic Metais European Quality Manager ANRITSU S.A. France
Address, city:	16/18 Avenue du Québec SILIC 720 Zone de Courtaboeuf 91951 Les Ulis Cedex
Country:	France

C-tick Conformity Marking

Anritsu affixes the C-tick mark on the following product(s) in accordance with the regulation to indicate that they conform to the EMC framework of Australia/New Zealand.

C-tick marking

N274

1. Product Model

Model: MT9810B Optical Test Set

2. Applied Standards

EMC:Emission: EN 61326: 1997 + A1: 1998 + A2: 2001 + A3: 2003
(Class A equipment)

Power Line Fuse Protection

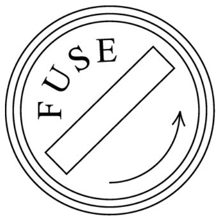
For safety, Anritsu products have either one or two fuses in the AC power lines as requested by the customer when ordering.

Single fuse: A fuse is inserted in one of the AC power lines.

Double fuse: A fuse is inserted in each of the AC power lines.

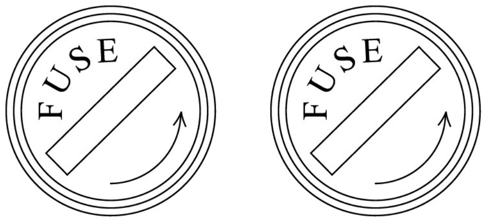
Example 1: An example of the single fuse is shown below:

Fuse Holder



Example 2: An example of the double fuse is shown below:

Fuse Holders



About This Manual

This manual provides descriptions of the operation, calibration and maintenance methods of the MT9810B Optical Test Set. Section 4 outlines the basic functions and operations of this device.

Indicator indicates item numbers for which more detailed explanations and relevant descriptions are available.
Moreover, matters that require attention in terms of operations and useful information are given as "Point"; use these as reference.

It is possible to connect the computer to execute remote control of this device or capture measured values into the computer. See the following manual for more information on the interface to connect the computer.

MT9810B Remote Control Operation Manual (M-W1887AE)

This device can be used in combination with MG9541A Tunable Laser Source. See the following manual for using combined device.

MX789400A Optical Component Raster Control Software Operation Manual (M-W1926AE)

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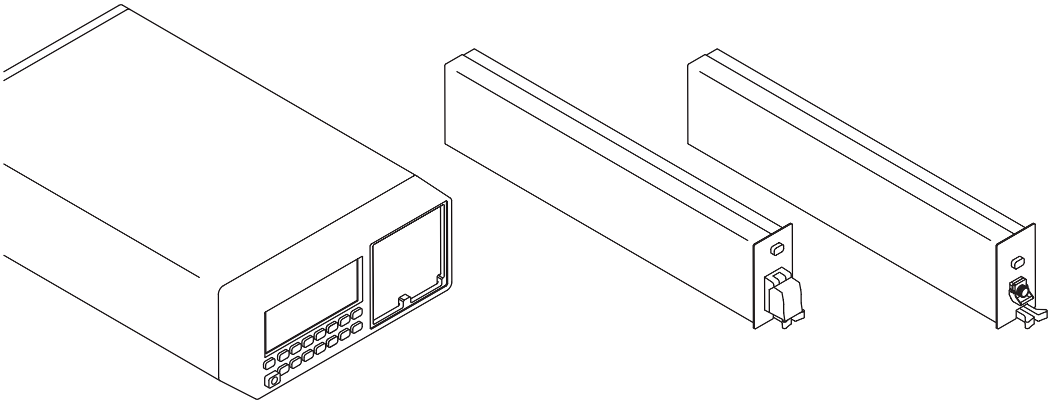
Section 1 General

This chapter provides an outline of functions of the MT9810B Optical Test Set and the plug-in unit, and explanations of the product structure.

As for functions, operating method, specifications, etc. for high-speed measurement by the MU931002 Sensor Adapter + the MA9332A/33A Optical Sensor, refer to the MX789400A Operation Manual (M-W1926AW) provided with the MU931002A.

1.1 MT9810B Optical Test Set

The main unit of the MT9810B Optical Test Set (hereafter referred to as the "Device") forms the core of a group of optical test set models. It has slots to enable mounting of two plug-in units. The Device is designed to operate units mounted in the slots and display the status and measured results.



1.2 Plug-in Unit

The Device enables mounting of the units shown below.

MU931311A Optical Sensor
High-sensitivity type ☞ Appendix A Specifications

MU931421A Optical Sensor
General-purpose type ☞ Appendix A Specifications

MU931422A Optical Sensor
General-purpose type ☞ Appendix A Specifications

MU931431A Optical Sensor
High-power type ☞ Appendix A Specifications

MU931001A + MA9331A Sensor Adapter
+ Optical Sensor Pull-out High-power Type
☞ Appendix A Specifications

MU931001A + MA9332A Sensor Adapter
+ Optical Sensor Pull-out General-purpose Type
☞ Appendix A Specifications

MU931002A + MA9332A Sensor Adapter
+ Optical Sensor for Optical Component Tester
☞ Appendix A Specifications

MU931002A+MA9333A Sensor Adapter + Optical Sensor
for Optical Component Tester

☞ Appendix A Specifications

MU952501A - MU952505A Light Source
DFB-LD light source (With optical frequency variable function.)

☞ Appendix A Specifications

MU951301A Light Source
FP-LD light source

☞ Appendix A Specifications

MU951501A Light Source
FP-LD light source

☞ Appendix A Specifications

MU951001A Light Source
Switchable FP-LD light source

☞ Appendix A Specifications

MU952601A - MU952606A Light Source
DFB-LD light source (With optical frequency variable function.)

☞ Appendix A Specifications

See the ordering information to select the model name and option number when specifying the optical frequency (wavelength) of the light source.

☞ Appendix B Ordering Information

Incidentally, to specify an optical connector, add the double figure shown below together with a hyphen at the end of each unit model name. The absence of the double figure means to specify a unit with an FC connector.

Unit with a FC connector	(Model name)-37
Unit with an ST connector	(Model name)-38
Unit with a DIN connector	(Model name)-39
Unit with an SC connector	(Model name)-40
Unit with a HMS-10/A connector	(Model name)-43
Unit with an MU connector	(Model name)-32

Note: An MU connector can only be specified with the MU931422A/MA9331A/32A/33A unit.

☞ Appendix B Ordering Information

1.3 Main Functions

- Function to vary the wavelength
  Varies the center optical frequency of the DFB-LD light source to the maximum of ±60 GHz.

- Switching display between optical frequency and wavelength
  Switches display between optical frequency and wavelength in the vacuum state.

- Function to vary the interval of the light power measurement
  Sets the interval of the light power measurement to the optimum value of the application, for example, short intervals for high-speed measurement and long intervals for long-time measurement.

- Function to vary the bandwidth of the light power measurement
  Sets the bandwidth appropriate for the measurement target, for example, slow bandwidth for the measurement of the mean power of the pulsed light and quick bandwidth for the measurement of the light power surge at the time of light switch switchover.

- Function to measure the maximum and minimum values and fluctuations of the light power
  Enables instantaneous evaluation of the light source stability and PDL characteristics without recording the measured values of the light power into memory as the maximum and minimum values measured of the light power and its fluctuations are constantly on display.

- Function to record measurement conditions
  Records a maximum of nine measurement conditions for each channel. (Default setting is separately kept.)

- Function to copy the measurement conditions
  When units of the same type are used on Channel 1 and Channel 2, the measurement conditions for one of the units can be copied for the other. Therefore, two identical measuring instruments can be made available instantaneously.

- Function to record measured values of the light power
  Records a maximum of 1,000 measured values of the light power per channel. It is possible to read the measured values by remote control and to use them for a range of analyses and processing.

- Interlocking Operations with Tunable Laser Source
  With Sensor for Optical Component Tester (MU931002A + MA9332A/33A), Wavelength characteristics of the optical filters, etc. can be measured at high-speed by interlocking with MG9541A Tunable Laser Source. Refer to the MX789400A Optical Component Tester Controls Software Operation Manual for details on standard accessories for the MU931002A Sensor Adapter.

1.4 Features

- Wide dynamic range
  Enables measurement of optical loss of up to 120 dB when a high output light source of +10 dBm and a high sensitivity optical sensor that measures up to -110 dBm are used.

- High output and stability DFB-LD light source
  Enables high precision measurement despite high output of +10 dBm as high stability of limited deviations of ±0.005 dB and center optical frequency not exceeding ±2 GHz are achieved.

- Compatible with wavelength conforming to ITU-T
  Provides a lineup of DFB-LD light sources of optical frequencies conforming to ITU-T compatible with Dense-WDM. Available at intervals ranging from 186.3 and 195.9 THz/100 GHz.

- High-precision light power measurement (MU931311A/1421A/22A/MA9332A)
  Enables high-precision measurement of the light power as the reference condition, operating condition and linearity achieve precision of deviations not exceeding ±2%, ±3.5% and ±0.01 dB, respectively.

- High return loss and low polarized wave dependency (MU931311A/1421A)
  Optimum for evaluation of devices and systems which use the optical amplifier as the return loss exceeds 40 dB, signifying small amount of light returned and the polarized wave dependency is limited to not greater than 0.02 dB, in the absence of adapters and other equipment to reduce reflection.

- High-speed light power measurement
  Enables measurement of the light power at a minimum interval of 1 ms by using the recording and measuring function.

- High-speed analog output (MU931311A)
  Demodulates intense modulated radiation of a maximum of 100 kHz (3 dB bandwidth).

- High resolution light power measurement
  Enables light power measurement at high resolution of 1/10000 dB on the display of MT9810B set at resolution of 1/1000 dB when GPIB and RS-232C are used.

- Standard mounting of GPIB and RS-232C
  As RS-232C in addition to GPIB is mounted as the standard remote interface, remote control can be enabled by using the notebook-sized personal computer. Moreover, the LabVIEW driver for remote control is also attached with a standard feature.

- High Output Optical Power Measurement (MU931431A/MA9331A) (MU931431A: up to +33 dBm)
  High output optical power up to +35 dBm can be measured.

- AHigh-speed wave characteristics measurement (MU931002A+MA9332A/33A)
  Enables wave characteristics of the optical components at high-speed (10 µs or less, wave length: 500 points) by combination with the MG9541A.

Point

Although RS-232C is named EIA-232-E in accordance with the formal standards of ANSI/EIA, this document and descriptions relating to the Device use the general name of RS-232C for explanations.

Section 2 Nomenclature and Function

This chapter provides the nomenclature of each section on the front and back panels of the Device as well as explanations of functions and operations.

2.1 Unpacking

Take the main unit and the plug-in unit out from the packing carton and check the articles provided with the component list. If any article is found missing or broken, quickly contact ANRITSU or an ANRITSU dealer.

Example of components

Item Name	Quantity	Model Name/Ordering No.
Main unit		
Optical Test Set	1	MT9810B
Standard accessories		
AC power source code	1	
Tripolar to bipolar conversion adapter	1	J0266
2.0 A fuse	2	T2.0 A250 V
Remote interlock connection plug	1	J0896
Remote interlock short plug	1	J0895
Optical output modifier key	2	Z0391
Operation manual (this document)	1	W1886AE
Operation manual for remote control	1	W1887AE
LabVIEW driver	1	MX981001A
Blank panel	1	B0425

Plug-in unit components

Item Name	Quantity	Model Name/Ordering No.
Main unit		
Optical Sensor	1	MU931311A
	1	MU931421A
	1	MU931422A
	1	MU931431A
Light Source	1	MU951301A
	1	MU951501A
	1	MU951001A
	1	MU952501A
	1	MU952502A
	1	MU952503A
	1	MU952504A
	1	MU952505A
	1	MU952601A
	1	MU952602A
	1	MU952603A
	1	MU952604A
	1	MU952605A
	1	MU952606A

Plug-in unit components

Item Name	Quantity	Model Name/Ordering No.
Main unit		
Sensor adapter	1	MU931001A
Standard accessories		
Optical sensor connection cable	1	J1073A

Plug-in unit components

Item Name	Quantity	Model Name/Ordering No.
Main unit		
Sensor adapter	1	MU931002A
Standard accessories		
Optical sensor connection cable	1	J1073A
Optical Component Tester Control Software	1	MX789400A
MX789400A Operation Manual	1	W1926AE

MU931001A Optical Sensor Components for Sensor Adapter

Item Name	Quantity	Model Name/Ordering No.
Main unit		
Optical sensor	1	MA9331A

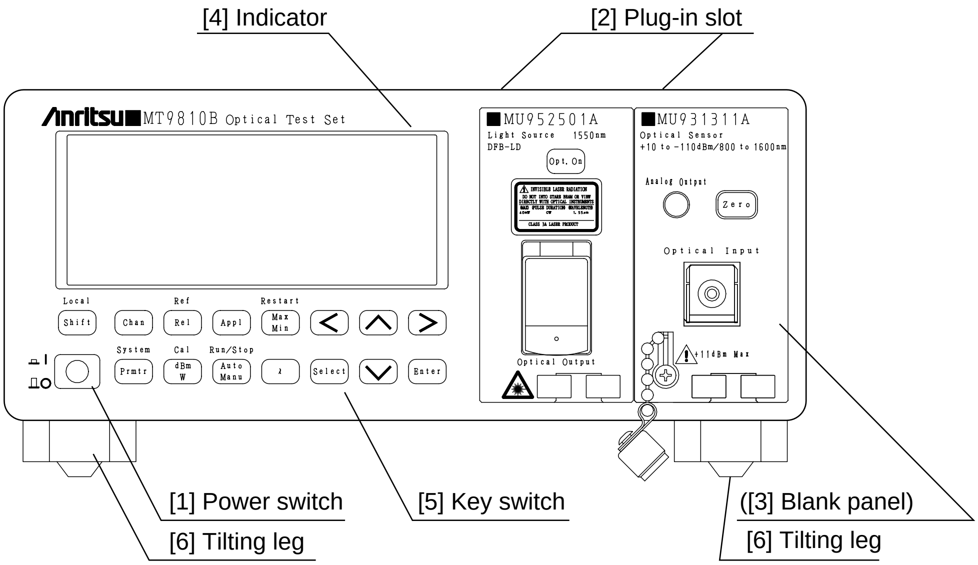
MU931001A/02A Optical Sensor Components for Sensor Adapter

Item Name	Quantity	Model Name/Ordering No.
Main unit		
Optical sensor	1	MA9332A

MU931002A Optical Sensor Components for Sensor Adapter

Item Name	Quantity	Model Name/Ordering No.
Main unit		
Optical sensor	1	MA9333A

2.2 Front Panel



[1] Power switch
A switch to turn ON/OFF the power source.
Pressing the switch (I) turns the power source ON. Pressing it again to switch it into the projected state (0) turns the power source OFF.

[2] Plug-in slot
Places to mount units. When no units are mounted, blank panels can be mounted. The left side is Channel 1 and the right side is Channel 2.

[3] Blank panel
A cover to be used when no units are mounted.
(It is not possible to concurrently mount the blank panel and the unit.)

[4] Indicator
Displays the measured value and set value. ☞ 2.4 Indicator

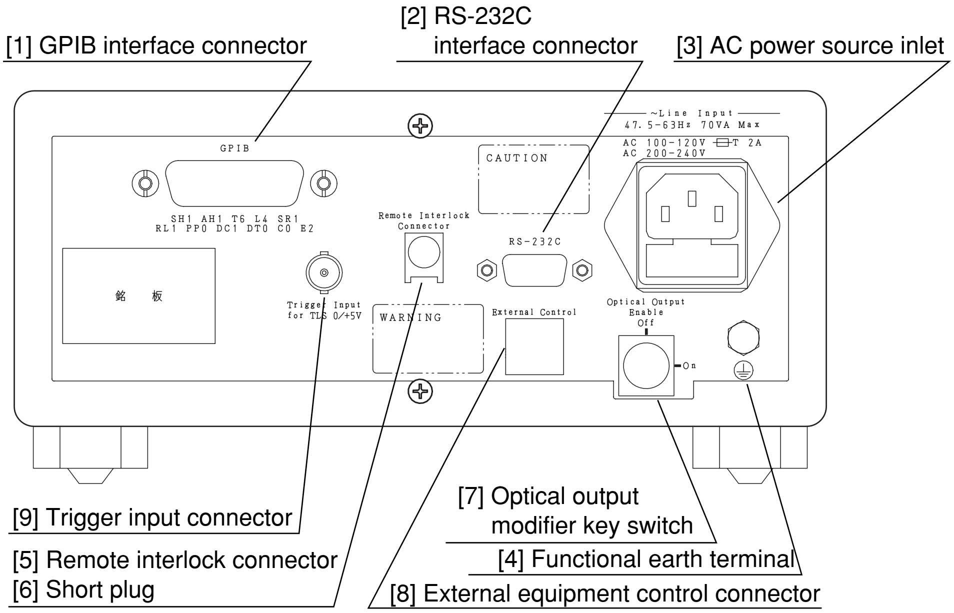
[5] Key switch
Keys to operate the Device. ☞ 2.5 Display and Function of Key Switch

[6] Tilting leg
Legs affixed to the bottom face. Lifting up the legs and tilting the Device when the Device is set up at an elevation lower than eye level makes it easier to view the display.

Caution ⚠

Do not place any object on the Device when the tilting legs are lifted as the tilting legs or the Device may be broken. This may cause the Device to tip over or fall, causing injuries.

2.3 Back Panel



[1] GPIB interface connector
GPIB interface to connect an external computer and execute remote control of the Device.

[2] RS-232C interface connector
RS-232C interface to connect an external computer and execute remote control of the Device.

[3] AC power source inlet A connector for the AC power source input, with a built-in fuse. 3.8 Replacement of Optical Connector

[4] Functional earth terminal A terminal to connect the ground line to ground the Device to ensure safety.

[5] Remote interlock connectorA connector for laser safety. In the open status, no light will be output even when the light output switch on the front panel of the light source is turned ON.
3.5 Connection of Remote Interlock Connector

[6] Short plug A plug to switch the remote interlock connector into the short-circuited status and enable optical output.
3.5 Connection of Remote Interlock Connector

[7] Optical output modifier key switch
A switch with a key for the purpose of laser safety. When the switch is set OFF, no light will be output even when the light output switch on the front panel of the light source is turned ON.

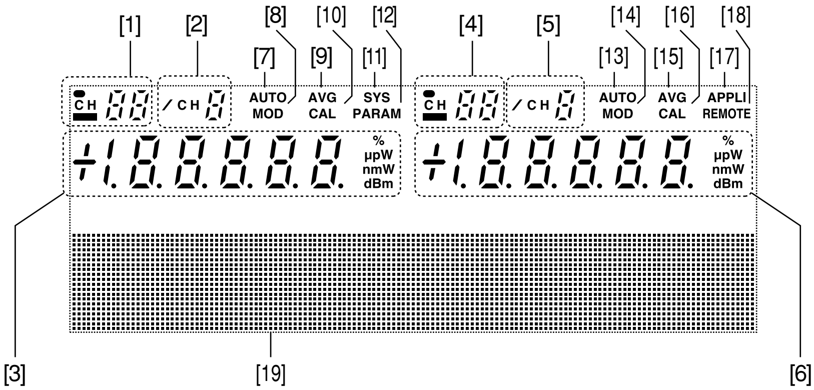
[8] External equipment control connector
A connector to control the MN96[][]A Optical Channel Selector. See the operation manual of the Optical Channel Selector.

[9] Trigger input connector
Connector for inputting the trigger signals of the MG9541A Tunable Laser Source. For connection and use, refer to the MX789400A Optical Component Tester Control Software Operation Manual.

Point

Although RS-232C is named EIA-232-E in accordance with the formal standards of ANSI/EIA, this document and descriptions relating to the Device use the general name of RS-232C for explanations.

2.4 Indicator



[1] Control CH1 display

The underline lights up when the control target channel is CH1, or CH1 and CH2.

4.2.1 Switching Channels
4.3.1 Switching Channels

[2] REF CH display

Lights up at the time of reference measurement. The CH on display indicates the channel to constitute the reference value.

4.2.13 Reference Measurement

[3] Seven-segment display

Displays the measured value of the optical sensor used on CH1 and the output status of the light source.

[4] Control CH2 display

The underline lights up when the control target channel is CH2, or CH1 and CH2.

4.2.1 Switching Channels
4.3.1 Switching Channels

[5] REF CH display

Lights up at the time of reference measurement. The CH on display indicates the channel to constitute the reference value.

4.2.13 Reference Measurement

[6] Seven-segment display

Displays the measured value of the optical sensor used on CH2 and the output status of the light source.

[7] AUTO

Lights up when the range setting of the optical sensor used on CH1 is auto.

4.2.3 Setting Measurement Range

[8] MOD

Lights up when the optical sensor used on CH1 is set at modulated radiation measurement or the light source is set at modulated radiation measurement.

4.2.7 Setting Optical Modulation Mode
4.3.4 Setting Optical Modulation Mode

[9] AVG

Lights up when the optical sensor used on CH1 is set at average measurement.

4.2.6 Average Setting

[10] CAL

Lights up when the optical sensor used on CH1 is set at CAL measurement.

4.2.14 Calibration Measurement

[11] SYS

Lights up at the time of system function setting.

4.4 System Setup

[12] PRMTR

Lights up at the time of parameter setting for the unit.

4.2 Optical Sensor Operations
4.3 Light Source Operations

[13] AUTO

ights up when the range setting of the optical sensor used on CH2 is auto.

4.2.3 Setting Measurement Range

[14] MOD

Lights up when the optical sensor used on CH2 is set at modulated radiation measurement or the light source is set at modulated radiation measurement.

4.2.7 Setting Optical Modulation Mode
4.3.4 Setting Optical Modulation Mode

[15] AVG

Lights up when the optical sensor used on CH2 is set at average measurement.

4.2.6 Average Setting

[16] CAL

Lights up when the optical sensor used on CH2 is set at CAL measurement.

4.2.14 Calibration Measurement

[17] APPL

Lights up when the application function is selected.

4.2 Optical Sensor Operations
4.3 Light Source Operations

[18] REMOTE

Lights up in the remote status when GPIB or RS-232C is connected.

2.5 Display and Function of Key Switch

[19] Message display

Displays the system setting, parameter setting, error contents and other details. Also displays the bar graphs to represent level meter indication when the optical sensor is used and to represent set optical frequency (wavelength) indication when the light source is used.

2.5 Display and Function of Key Switch

Key Representation — Functional Description

Local
[Shift]

A key to validate the function of other keys printed in blue on the panel. This key alone uses the internally lit system. When lit, the key is in the valid status (Shift status).
Moreover, when the key is lit together with the <REMOTE> display on the indicator, it signifies the remote status via GPIB or RS-232C. Pressing the key in this state can switch the mode into the local mode.

[Chan]

A key to switch channels of control target.
When units of the same type are used, the key switches channels as follows every time it is pressed.

CH1→CH2→CH1 & CH2→CH1

On the other hand, when units of different types are used, the key switches channels as follows every time it is pressed.

CH1→CH2→CH1

System
[Prmtr]

A key to enable selection of parameters of the unit. Every time the key is pressed, the following items are selected.
[Optical sensor]

REF DATA,CAL FACTOR,AVERAGE,MOD FREQ,
INTERVAL,BANDWIDTH,DISP UNIT,DISP BLANK

[Light source]

MOD FREQ,DISP UNIT,ATT

The key enables selection of the main unit functions (system functions) in the Shift status. Every time the key is pressed, the following items are selected.

REMOTE INTERFACE,GPIB ADDRESS,
RS-232C BAUDRATE,RS-232C STOP BIT,
RS-232C PARITY BIT,RS-232C CHARACTER,
DISPLAY BRIGHTNESS,BUZZER,DATE,TIME

Ref
[Rel]

A key to be used only when the optical sensor is used. Every time the key is pressed, measurement of the relative value (RELATIVE measurement) is conducted with the value measured at that time used as the reference value.
Pressing the key in the Shift status causes measurement of the relative value (REFERENCE measurement) is conducted with the REF LEVEL for which parameter is set or the value measured of the other optical sensor used as the reference value.

Cal
[dBm W]

A key to be used only when the optical sensor is used. Every time the key is pressed, the unit of representation switches between dBm and W.
When the key is pressed in the Shift status, a value minus CAL FACTOR for which parameters are set is displayed.

Appl

A key to enable selection of set application items. Every time the key is pressed, the following items are selected.
[Optical sensor]
- CLONE
- SAVE PRMTR
- LOAD PRMTR
- STORE DATA
- READ OUT (or NO DATA)

[Light source]
- CLONE
- SAVE PRMTR
- LOAD PRMTR
- READ OUT (or NO DATA)

Run/Stop
Auto Manu

A key to be used only when the optical sensor is used. Every time the key is pressed, the measurement range setting switches between automatic range setting and fixed range setting.
When the key is pressed in the Shift status, the function to record the measured values can be executed and suspended.

Restart
Max Min

A key to be used only when the optical sensor is used. Every time the key is pressed, the maximum and minimum values measured so far and the difference between the two values are indicated.
When the key is pressed in the Shift status, the data stored are cleared, followed by start of recording of new maximum and minimum values and the difference between the two values.

λ

A key to set the calibrated wavelength (optical frequency) when the optical sensor is used or set the optical frequency (wavelength) of radiation when the light source is used.
(However, the key is not available for a single-wavelength light source that does not have the optical frequency (wavelength) variable function.)

Select

A key to enable switching of selection items available for setting at the time of parameter or system setting.

< **>**

A key to enable move of the input digit at the time of parameter or system setting. The parameter details can be checked (the parameter viewing function) when the setting is other than the parameter or system setting. Pressing the key causes sequential switching of items of display.

∧ **∨**

A key to enable increase or decrease of numerical values at the time of parameter or system setting.

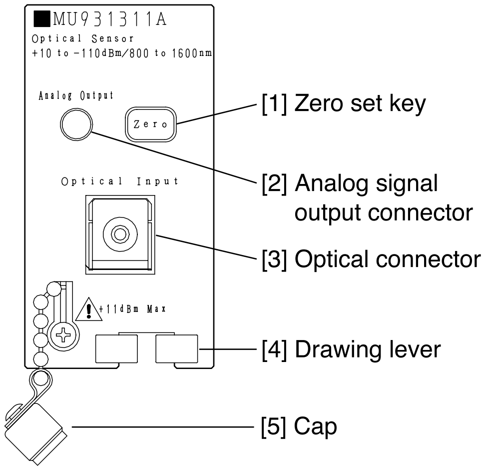
Enter

A key to establish setting and terminate the setting status at the time of parameter or system setting.

2.6 Front Panel of Plug-in Unit

2.6.1 Optical Sensor (MU931311A/1421A)

MU931311A



[1] Zero set key
Used to remove the electrical offset of the light intercepting circuit.

☞ 4.2.2 Zero Set

[2] Optical connector
Connects the optical fiber cable to input measuring beam.

☞ 3.7 Connection of Optical Fiber Cable

Caution ⚠

Never input light above the rated maximum input value. This may cause permanent damage to the equipment such as a burnout of the optical receiver and ferrule end panel.

[3] Analog signal output connector
An SMA connector for analog output with an output range between 0 and 2 V and output impedance of approximately 1 kΩ. This connector outputs a voltage proportionate to the optical input. The connector outputs a voltage of approximately 2 V when light at the full scale level of each measurement range is intercepted.*
*For example, this means optical input of -10 dBm when the range is set at –10 dBm.

Caution ⚠

The analog signal output connector is exclusively for output. When signals are input by mistake, this may cause damage to the Device or the signal source connected.
Do not pull the cord while the cord remains inserted to the analog signal output connector. This may cause damage to the connector or the internal circuit.

Point

Analog signals are directly output without correction of the wavelength sensitivity of the signals from the light intercepting circuit of the optical sensor. For this reason, the relationship between the level indication and the voltage output merely serves as a guideline and they do not necessary match each other. However, this function will prove useful to observe changes that take place more quickly than the display of numerical values on the main unit is able to indicate.

[4] Drawing lever

Incorporates a locking mechanism to be used when units are mounted on the main unit. Pinch the lever and draw it out to remove the lever.

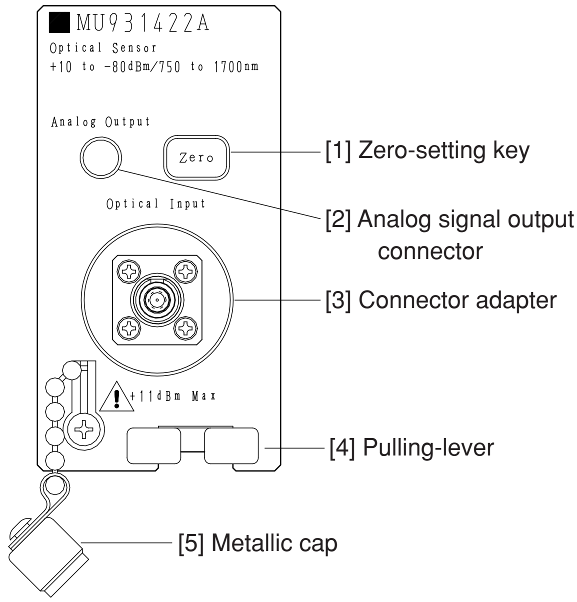
☞ 3.3 Mounting and Removal of Plug-in Unit

[5] Cap

A cap for optical connector protection and shading from light.

2.6.2 Optical Sensor (MU931422A/31A)

MU931422A



[1] Zero-setting key
Used for removing an electric error from the optical receiving circuit.

[2] Analog signal output connector
It is SMA connector for the analog-output having the output range between about 0 and 2 V and having the output impedance of 1 kΩ. The electric power proportional to an optical input is output.
When optical signal of a full-scale level is received* in each measurement range, roughly 2 V of electric power is output.
* For instance, it indicates the case when the optical signal –10 dBm is input in –10 dBm range.

CAUTION ⚠

The analog signal output connector is only for the output. This equipment or the connected signal source might be damaged if the signal is input by mistake.
Do not unplug the cord while it is connected to the analog signal output connector. The connector, the internal circuit and other equipment may be damaged.

Point

Analog signal output is directly output to the optical sensor without correcting the wavelength sensitivity for the received optical circuit signal. Therefore, the relation between the displayed level and the output voltage is a rough guide, and is not necessarily equal. However, it is effective in observing the more minute change than the numeric value change displayed in the main unit.

[3] Pulling-lever
The lever has a lock mechanism when the sensor adapter is installed in the main unit. When removing it, pull it out holding the lever.

[4] Connector adapter
To input a measured optical signal, connect the optical fiber cable.
The connector adapter can be replaced. Connector adapters (optional) compatible with connectors other than FC are available. Refer to ordering information.

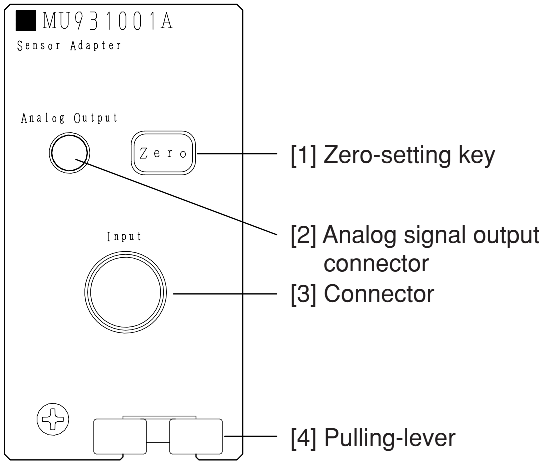
CAUTION ⚠

Never input an optical signal larger than the maximum input ratings. There is danger of causing permanent damage to the equipment by burning the optical signal receiving instrument, etc.

[5] Metallic cap
This is a cap used for optical connector protection, dust-proofing, and shading.

2.6.3 Sensor Adapter (MU931001A/02A)

MU931001A



[1] Zero setting key
Used for removing an electric error from the optical receiving circuit.

[2] Connector
Connects a special optical sensor connecting cable.

CAUTION ⚠

Do not connect other than the specialized connection cable, or allow the connector to touch any metallic objects. There is a possibility of permanent damage to the equipment.
Do not unplug the special connection cable while it is connected or the connector and the internal circuit, and other equipment may be damaged.

[3] Analog signal output connector
The connector is SMA connector for the analog-output having an output range between approximately 0 and 2 V and having the output impedance of 1 kΩ. Electric power is output proportional to the optical input.
When a full-scale optical signal is received* in each measurement range, electric power of roughly 2 V is output.
* For instance, when the optical signal 10 dBm is input in 10 dBm range.

CAUTION ⚠

The analog signal output connector is only for the output. This equipment or the connected signal source might be damaged if the signal is input by mistake.
Do not unplug the cord while it is connected to the analog signal output connector. The connector, the internal circuit and other equipment may be damaged.

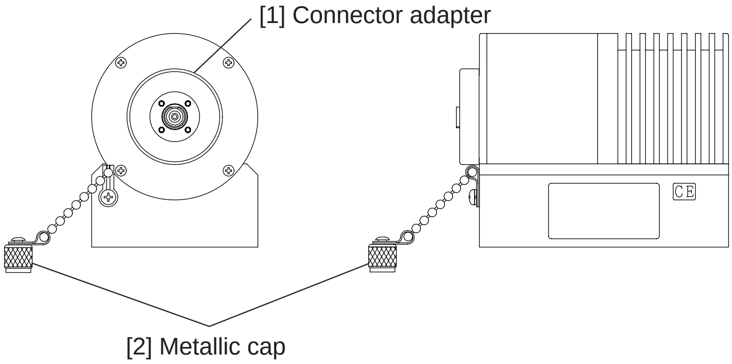
Point

Analog signal output is directly output to the optical sensor without correcting the wavelength sensitivity for the received optical circuit signal. Therefore, the relation between the displayed level and the output voltage is a rough guide, and is not necessarily equal. However, it is effective in observing the more minute change than the numeric value change displayed in the main unit.

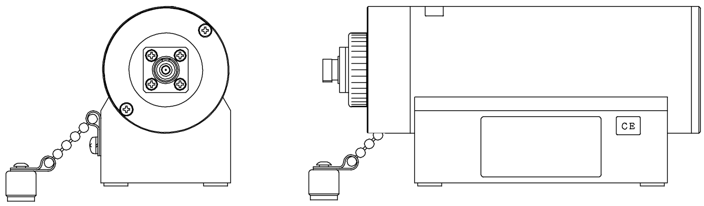
[4] Pulling-lever
The lever has a lock mechanism when the sensor adapter is installed in the main unit. When removing it, pull it out holding the lever.

2.6.4 Optical Sensor (MA9331A/32A/33A)

For MA9331A



For MA9332A/33A



[1] Connector adapter
To input a measuring optical signal, connect the optical fiber cable.
The connector adapter can be replaced. Connector adapters (optional) compatible with connectors other than FC are available. Refer to ordering information.

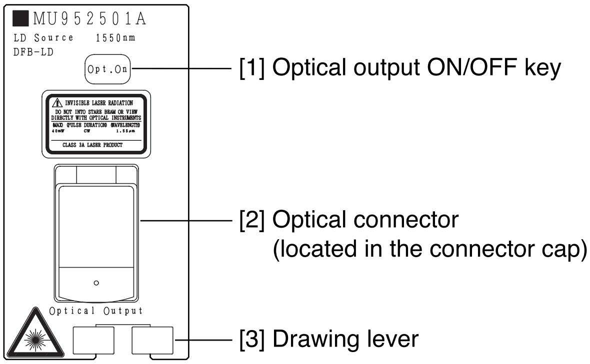
CAUTION ⚠

Never input an optical signal larger than the maximum input ratings. There is danger of causing permanent damage to the equipment by to burning the optical signal receiving instrument, etc.

[2] Metallic cap
This is a cap used for optical connector protection, dust-proofing, and shading.

2.6.5 Light Source

MU952501A



[1] Optical output ON/OFF key
Used to switch the optical output ON and OFF.

☞ 4.3.2 Optical Output ON/OFF

[2] Optical connector (located in the connector cap)
Connects optical fiber cable in order to extract radiation.

☞ 3.7 Connection of Optical Fiber Cable

[3] Drawing lever
Incorporates a locking mechanism to be used when units are mounted on the main unit. Pinch the lever and draw it out to remove the lever.

☞ 3.3 Mounting and Removal of Plug-in Unit

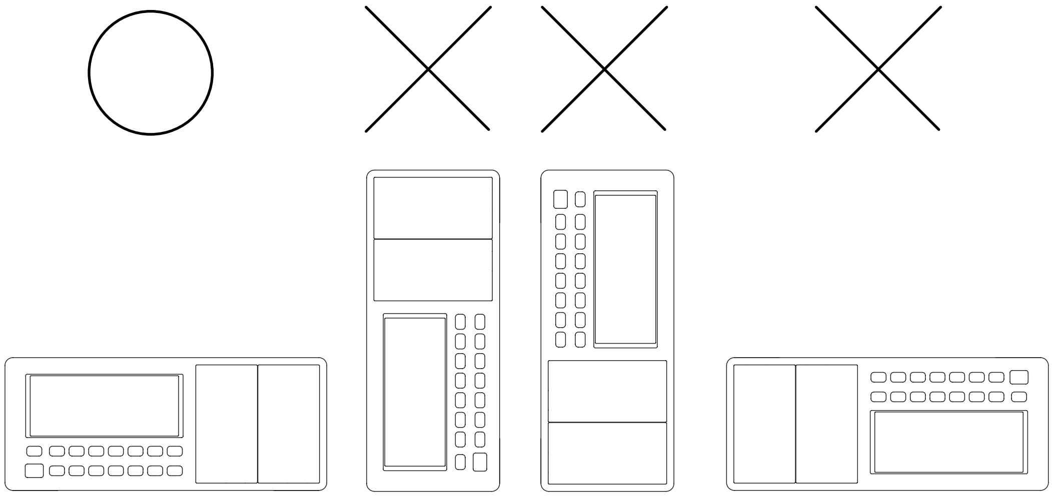
Section 3 Before Use

This chapter summarizes matters you are advised to learn before you start using the Device. It is recommended that you read through this chapter at least once since this chapter provides descriptions of matters that require attention in order to ensure safety during the Device use and avoid failures.

3.1 Installation

3.1.1 Installation Conditions

Install the Device on a level surface.



3.1.2 Installation Environment

The Device operates in the temperature range from 0 to 50 °C. However, it is advised not to use the Device under environments such as the ones listed below as this may result in failure.

- Places subject to vibrations
- Humid and dusty places
- Places with gradient
- Places exposed to direct sunlight
- Places that may be exposed to active gases
- Places to experience drastic temperature fluctuations

Moreover, moving the Device to a place of high temperature after using it for many hours in a place of low temperature may cause condensation in the Device interior. Turning the power source ON in this status may cause a failure such as short circuit. In a case like this, turn the power source ON after thoroughly drying the Device.

The Device incorporates a cooling fan inside. Accordingly, place the Device at least 10 cm away from an obstacle such as the wall and peripheral equipment to ensure excellent ventilation of air.

3.1.3 Power Source Voltage and Frequency

Supply the Device with power in the range between 85 Vac and 132 Vac or between 170 Vac and 250 Vac of voltage, and between 47.5 and 63 Hz of frequency. Although switching the setting between 100 V and 200 V systems is not required.

Warning ⚠

To replace the fuse, first turn the power source OFF and pull the power source cord out from the power receptacle, and then, replace the fuse. Attempting to replace the fuse without pulling the power source cord out from the power receptacle may cause electric shock.

Moreover, check whether the fuse to replace is the same as that prescribed in the manual, or use a fuse of the same rating or the same properties of the fuse indicated on the back of the Device frame. Using a wrong fuse may cause frequent fusing, burnout or fires.

3.2 Connecting the Power Cord

Check that the power switch on the front panel is turned off.
Insert the power plug into an outlet, and connect the other end to the power inlet on the rear panel. To ensure that the instrument is earthed, always use the supplied 3-pin power cord, and insert the plug into an outlet with a earth terminal.

Warning ⚠

If the power cord is connected without the instrument earthed, there is a risk of receiving a fatal electric shock. In addition, the peripheral devices connected to the instrument may be damaged.
When connecting to the power supply, DO NOT connect to an outlet without a earth terminal. Also, avoid using electrical equipment such as an extension cord or a transformer.

Caution ⚠

If an emergency arises causing the instrument to fail or malfunction, disconnect the instrument from the power supply by either turning off the power switch on the front panel (switch to the (O) side), or by pulling out the power cord or the power inlet.
When installing the instrument, place the instrument so that an operator may easily operate the power switch.
If the instrument is mounted in a rack, a power switch for the rack or a circuit breaker may be used for power disconnection.

3.3 Mounting and Removal of Plug-in Unit

Mounting

1. Check that the power source of the Device is OFF.
2. Check the top and bottom of the unit and gently insert the unit along the guide rail of the plug-in slot.
3. Push in the drawing lever until it clicks to slightly widen to become locked.

Removal

1. Check that the power source of the Device is OFF.
2. Pinch the drawing lever of the unit from the left and right and gently pull it out straightly toward you.

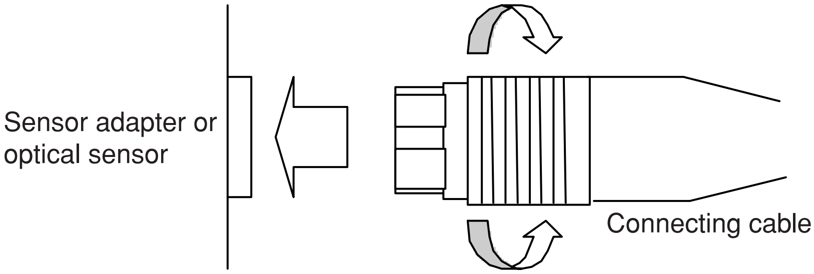
Caution ⚠

Ensure that power to the Device is OFF before mounting or removing the plug-in unit. Mounting or removing the unit while ON may cause damage to the Device and the plug-in unit.

3.4 Connecting Specialized Optical Sensor Connection Cable

Installation

1) Make sure that power for the main unit has been turned off.
2) Hold the connector on the cable side. Push the cable connector completely into the connector for the sensor adapter or optical sensor. The easiest way to find the connection point is to twist and push the connector into the sensor adapter or the optical sensor connector.



Removal

1) Make sure that power for the main unit has been turned off.
2) Hold the connector on the cable side. Unplug the connected cable pulling straight back.

CAUTION ⚠

Turn off the main unit when installing or removing the cable. This equipment may be damaged if the cable is connected or disconnected with the power turned on.

3.5 Measuring High-Power Output

WARNING ⚠

The MA9331A/MU931431A optical sensor can measure extremely high optical power. Such high optical power may injure human body even if it is a reflection beam, not a direct beam. For safety, <u>be sure to check the connection of an optical connector before measuring optical signals.</u>
<u>Make sure that a laser is cut off when connecting and disconnecting the connector of an optical fiber.</u> Refer to the manual of a light source to operate it.

- It is recommended that dirt on the fiber edge and connector should be wiped off before use. ☞ 6.1 Daily Maintenance
- Be sure to set the attached metallic cap after making measurements, or when the sensor is not used.
- Do not use the sensor in dusty places. ☞ 6.2 Notes on Storage
- Be careful in handling the optical sensor because the temperature increases* when the high-power optical signal is input.
  * The temperature increases about 10˚C when +35 dBm (about 3 W) is input using MA9331A.
- When a high-power optical signal is measured, we recommend that the APC connector be used.

CAUTION ⚠

The optical fiber edge surface reflects the laser beam when optical fiber for the PC connector is used; the laser main unit may be damaged because of this reflected beam.

3.6 Laser Safety

The light source used by the Device includes an element to radiate the laser light that corresponds to Class 1M in accordance with the IE C60825-1 stipulations and Class III B in accordance with the FDA and 21 CFR stipulations.

☞ To ensure safe use.

The Device incorporates the following two safety devices to prevent the light from being radiated suddenly.

1. Remote interlock connector

   Light will not be output unless the remote interlock connector is in the state of short circuit.

☞ 3.7 Connection of Remote Interlock Connector

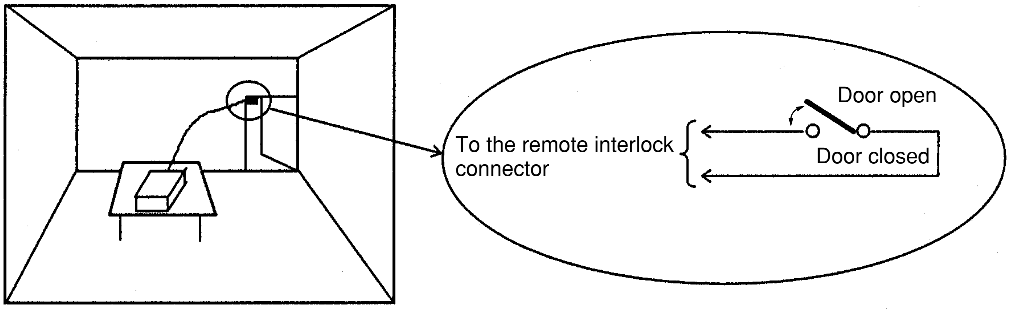
2. Optical output modifier key switch
   Light will not be output unless the switch is turned ON by the removable key. ☞ 3.8 Optical Output Modifier Key Switch

Caution ⚠

Do not look into the connection surface of the optical fiber cable of the light source optical connector or the end face of the optical fiber cable connected to the light source as invisible laser light output may cause visual deficit and other problems.
Moreover, procedures and operations other than those prescribed in this manual may cause exposure to the invisible laser light.

3.7 Connection of Remote Interlock Connector

The Device incorporates the remote interlock connector as one of the laser equipment safety devices to be used when the light source is used. Unless the terminal located in the back is in the state of short circuit, no light will be output even if the optical output key on the front panel of the unit is switched ON.
It is advised to normally use the connector together with the short plug that comes with the Device.
To output the radiation from the light source into the experiment chamber as the space light, use the connector by connecting it as shown below so that the light will not escape when the chamber door (or window) is suddenly opened.



1) Install a switch that is linked to the movements of the chamber door (or window) so that when the door opens, the switch opens and when the door is closed, the switch is short-circuited.

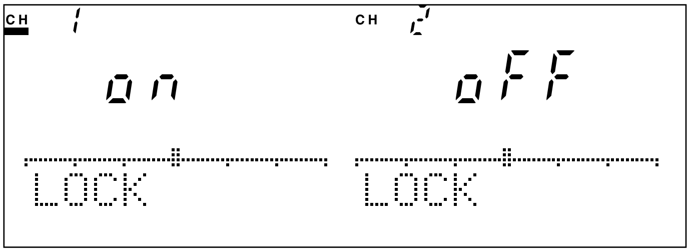
2) Remove the short plug affixed to the remote interlock connector. (Make sure not to lose the removed short plug.)

3) Connect the remote interlock connection plug that comes with the Device and the switch as shown in the figure above, and affix the plug to the remote interlock connector.

Caution ⚠

To connect the plug and switch to the remote interlock connector, first turn the power source of the Device OFF and pull out the power source cord from the power receptacle. Connecting them while the Device remains ON may cause electric shock.
Moreover, do not connect items other than the short plug or the remote interlock connection plug, and short-circuit switch to the remote interlock connector by all means. Failing to do so may cause a circuit failure or burnout.

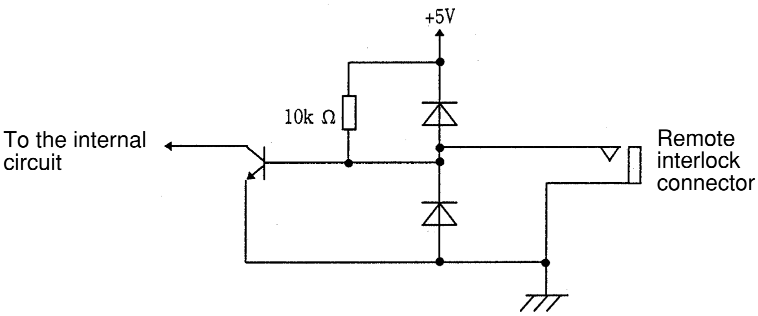
When the remote interlock connector is in the state of open, the message "LOCK" appears.



Message Display in Remote Interlock State

Point

Polarity is not particularly specified in regard to connection to the remote interlock connector. The figure below shows the interior equivalent circuit.



Unless the following three conditions are met, no optical output will be made from the light source.

1) The optical output ON/OFF key on the front panel of the light source is ON.

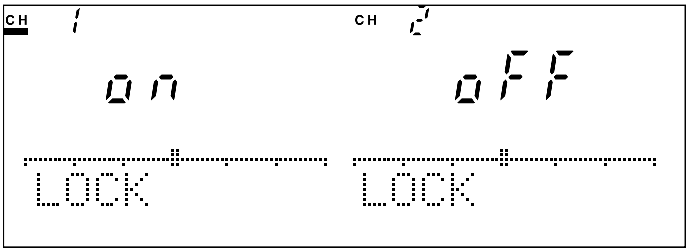
2) The remote interlock connector is in the state of short circuit.

3) Optical output modifier key switch is ON.

3.8 Optical Output Modifier Key Switch

The Device incorporates the optical output modifier key switch as one of the laser equipment safety devices to be used when the light source is used. Unless the switch with a removable key located at the back is ON, no light will be output even if the optical output key on the front panel of the unit is switched ON.
It is advised to normally keep inserted the key which comes with the Device to set the switch ON.
The key can be taken out at the OFF position.

When the optical output modifier key switch is OFF, the message, “LOCK”, appears.



Message Display when Optical Output Modifier Key Switch is OFF

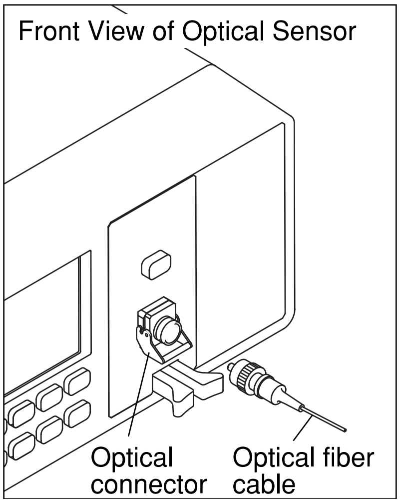
Point

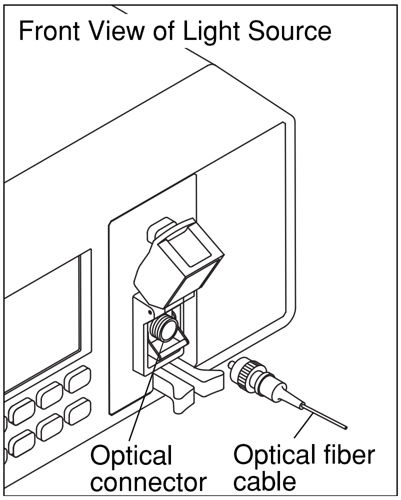
Unless the following three conditions are met, no optical output will be made from the light source.

1) **The optical output ON/OFF key on the front panel of the light source is ON.**
2) **The remote interlock connector is in the state of short circuit.**
3) **Optical output modifier key switch is ON.**

3.9 Connection of Optical Fiber Cable

Remove the cap (or open the cover) attached to the optical connector on the front panel of the plug-in unit and the pull-out type optical sensor, then connect the optical fiber cable.





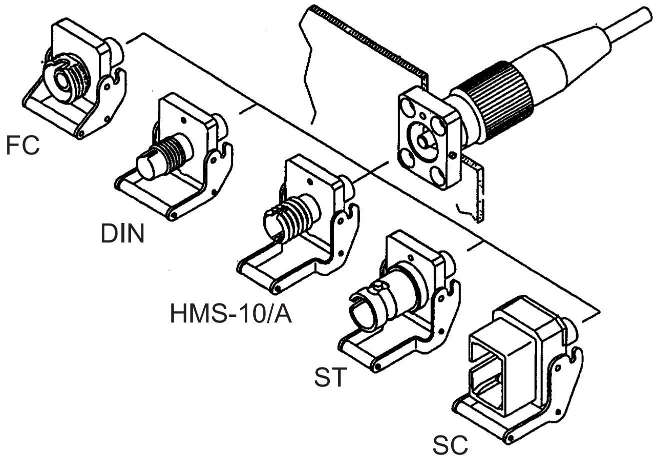
Caution ⚠

Make sure to clean the end face of the optical fiber cable to be used before the cable is connected. Moreover, check that the receptacle of the plug-in unit is regularly cleaned. Inputting or outputting intense light while they are stained may cause burnout of components. See 6.1 for the cleaning method.
Never input light above the rated maximum input value. This may cause permanent damage to the equipment such as a burnout of the optical receiver and ferrule end panel.

3.10 Replacement of Optical Connector

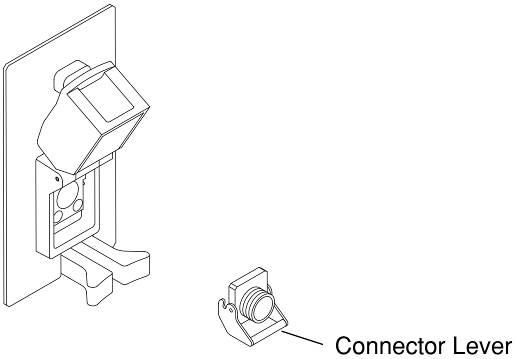
The optical connector of the plug-in unit and pull-out type optical sensor can be removed and replaced with a connector of another shape (sold separately), and its interior can be cleaned.

For the ferule connection type (MU931311A/21A and Light unit)



Follow the procedures set out below to replace the optical connector. See 6.1 for the cleaning method.

1) Remove the cap (or open the cover) affixed to the connector.
2) Pull up the connector lever toward you, check that the latch has been released, and then, gently pull the connector out straight toward you.



3) Follow the procedures on the other way around to affix the connector. In this case, pay due attention so that the connector or other items will not scratch the end face of the ferrule.

When no particular specification is given, the FC-PC connector (<Model name>-37) is affixed to each unit. This connector can be replaced with any one of connectors listed below by the customer.

FC connector	<Model name>-37
ST connector	<Model name>-38
DIN connector	<Model name>-39
SC connector	<Model name>-40
HMS-10/A connector	<Model name>-43

Appendix B Ordering Information

For the spatial input type (MU931422A/MA9331A/32A/33A)

Follow the procedures set out below to replace the optical connector. See 6.1 for the cleaning method.

Replace the optical connector adapter as follows. Refer to Section 6.1 for the cleaning method.

1) Remove the cap attached to the connector.
2) Since the connector adapter is screw-type, turn to the left to remove it.
3) Follow the procedures in reverse to affix the connector adapter.

When no particular specification is given, the FC-PC connector (<model name> -37) is attached to each unit. This connector can be replaced with any one of the connectors listed below by the customer.

FC connector	<Model name>-37
ST connector	<Model name>-38
DIN connector	<Model name>-39
SC connector	<Model name>-40
HMS-10/A connector	<Model name>-43
MU connector	<Model name>-32

Appendix B Ordering Information

3.11 Replacement of Fuse

When the fuse has blown, eliminate the cause and replace the fuse by following the procedure set out below.

Warning ⚠

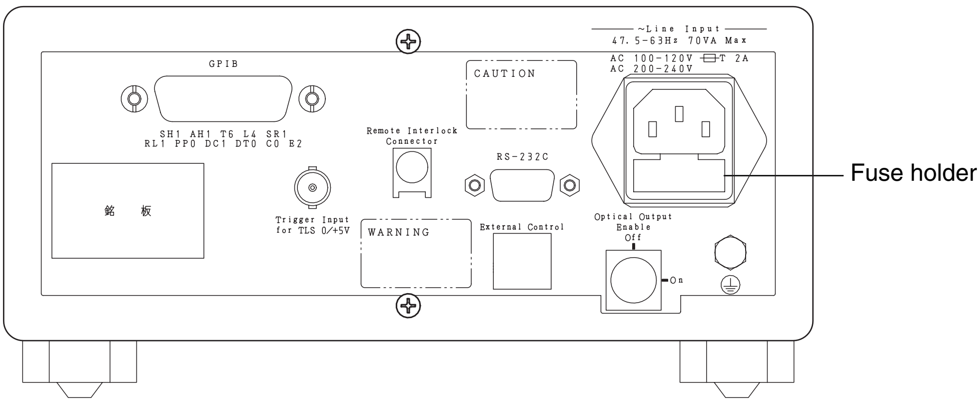
To replace the fuse, first turn the power source OFF and pull the power source cord out from the power receptacle, and then, replace the fuse. Attempting to replace the fuse without pulling the power source cord out from the power receptacle may cause electric shock.
Moreover, check whether the fuse to replace is the same as that prescribed in the manual, or use a fuse of the same rating or the same properties of the fuse indicated on the back of the Device frame. Using a wrong fuse may cause frequent fusing, burnout or fires.
A fuse indication of TxxxA signifies fuses of time lag type. The Device uses time lag type fuses of 2.0A.

Procedure for fuse replacement

1 The lower part of the AC inlet in the back of the Device incorporates a fuse holder. Apply the tip of a minus driver or similar objects to the upper edge of the fuse holder.

2 The fuse holder has two fuses mounted. Remove the fuses from the fuse holder and mount new fuses. In this case, replacing the blown fuse only normally presents no problems. However, the other fuse may retain certain stress and therefore is more likely to blow. Therefore, replacing two fuses at the same time is recommended.

3 Mount the fuse holder on the lower part of the AC inlet like it was before.



3.12 Others

The electronic circuits and optical modules of the Device and each plug-in unit are assembled and adjusted with precision. Disassembly or component replacement to be conducted by the customer without due precaution may cause not only problems in maintaining the function but also operation failures.
If you come across problems, you are advised to first refer to "6.5 Troubleshooting." Then, contact ANRITSU branch, local office or operation office that is located closest to you listed in this manual.

Section 4 Operation

This chapter describes the operation method.
This chapter first provides procedures for simple measurement to use the optical sensor to help you become familiar with the operations of the Device, followed by descriptions of detailed parameter and system settings at each unit.

When measuring the wavelength characteristics of the optical filter, etc. at high-speed through interlocking the Sensor for Optical Component Tester (MU931002A + MA9332A) and MG9541A Tunable Laser Source, refer to the MX789400A Optical Component Tester Control Software Operation Manual , a standard accessory for MU931002A Sensor Adapter for the connection and operation method of the function.

4.1 Let's start!

Perform simple measurement to become familiar with the operations of the Device.

4.1.1 Preparations

(1) Equipment required

Device (MT9810B)	1
Optical sensor (MU931311A or MU931421A)	1
Light source (MU952501A) or other light sources	1
Optical attenuator (such as MN9625A)	1
SM optical fiber cable	2

(2) Connection

Mount the optical sensor on the CH1 slot and the light source on the CH2 slot of the Device.

Mount the optical sensor only when planning to use other light sources. However, the explanations below are given on the assumption that the light source is mounted on the CH2 slot.

Caution ⚠

Ensure that power to the Device is OFF before mounting or removing the plug-in unit. Mounting or removing the unit while ON may cause damage to the Device and the plug-in unit.

Connect the equipment as shown in the figure below.

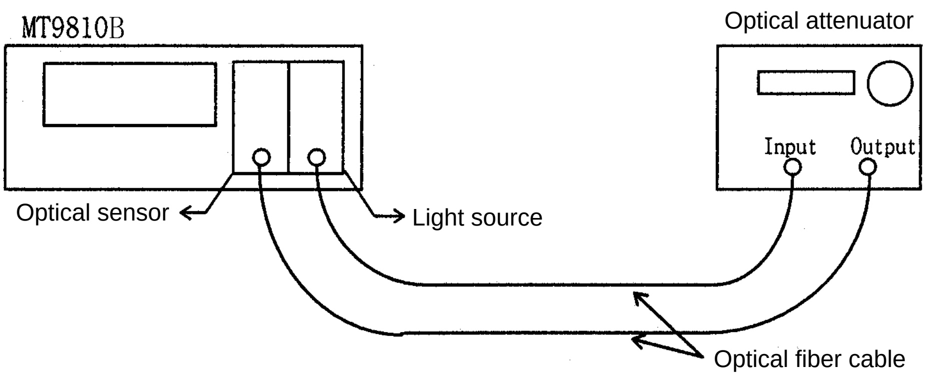


Fig. 4-1 MT9810B Connection Diagram

(3) Power activation

Press the POWER switch to turn the power source ON.

This triggers self-check to cause all the segments of the indicator to light up and the message display indicates “SELF CHECK.”

When the self-check is completed, the display switches into a state as shown below.

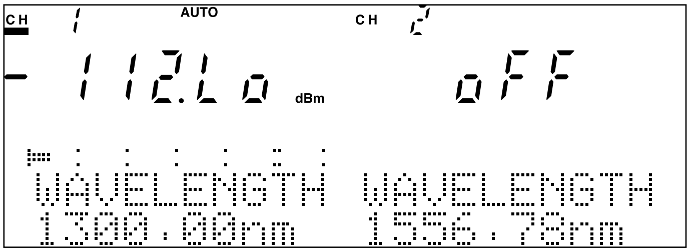


Fig. 4-2 Display upon Completion of Self-Check

If an error is found indicated on the message display after the self-check is completed, see æAppendix D Error Code.”

(4) Warming up

The Device and each unit start functioning the moment the power source is turned ON. However, start measurement after a warming up period of between 30 and 60 minutes in order to achieve the accuracy prescribed in the specification table.

Appendix A Specifications

4.1.2 Power Measurement

(1) Optical output ON

Output light by pressing the Opt Out key on the front panel of the light source.

This lights up LED in the switch and, at the same time, causes the seven-segment display on the CH2 side to switch from “off” to “on.”

(2) Setting the parameter

a) Set the control channel to CH1.

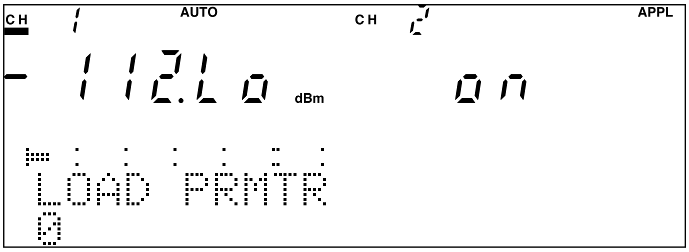
Check that the underline on the CH1 side display of the indicator is lit. If the underline on the CH2 side is found lit, press the Chan key so that the underline on the CH1 side lights up. Fig. 4-2

b) Return the setting to the default setting.

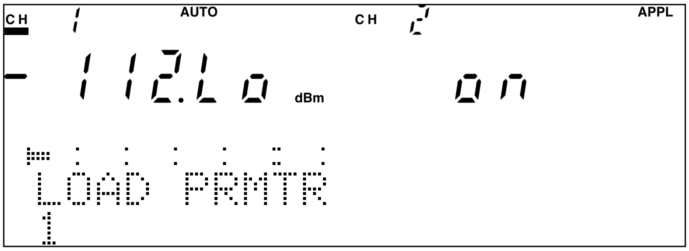
Return the parameter to the default setting. The Device has the measurement conditions and the default setting of the unit currently used for Memory No. 0 registered. Press the keys in the order shown below.

Key operations **Indication**

[1] Appl



[2] ↑ or ↓

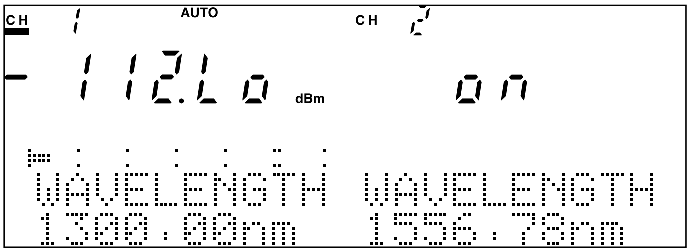
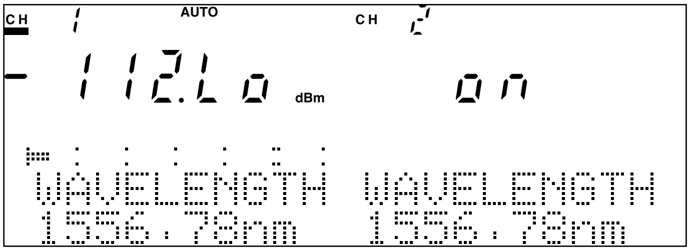


[3] Enter

4.2.17 Recording and Reading Measurement Conditions

c) Set the calibrated wavelength

Set the wavelength to that of the light source using calibrated wavelength. As the Device adds the wavelength of the unit concurrently used to the choices given at the time of wavelength setting, the set value can be easily copied. Press the keys in the order shown below.

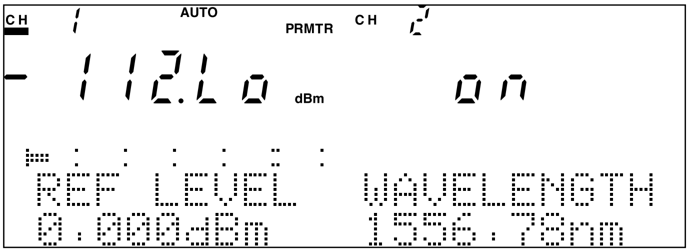
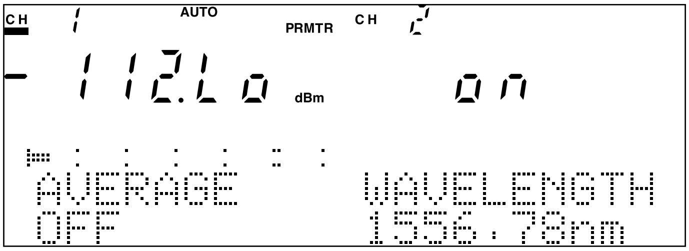
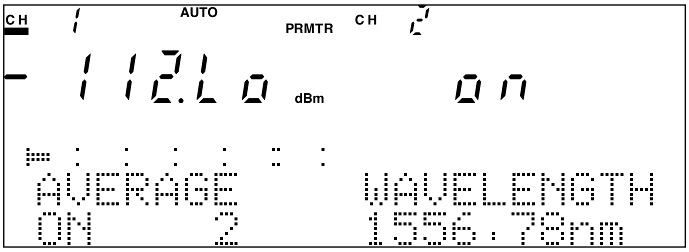
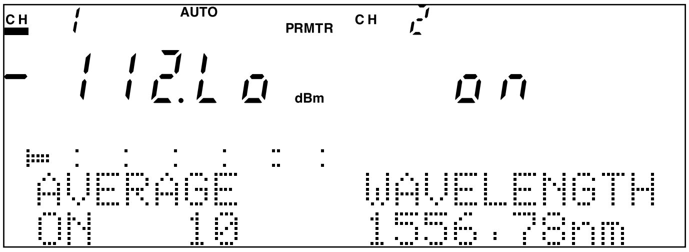
Key operations	**Indication**
[1] λ	
[2] λ (five times)*	

[3] Enter

* The frequency of pressing *l* may vary depending on the circumstances.

4.2.4 Setting Calibrated Wavelength (Calibrated Optical Frequency)

d) Set the average (averaging) processing.
Press the keys in the order shown below to perform averaging processing.

Key operations	**Indication**
[1]	
[2] Prmtr (twice)*	
[3] Select	
[4] ↑ (twice)*	

[5] Enter

* The frequency of pressing Prmtr or up may vary depending on the circumstances.

4.2.6 Average Setting

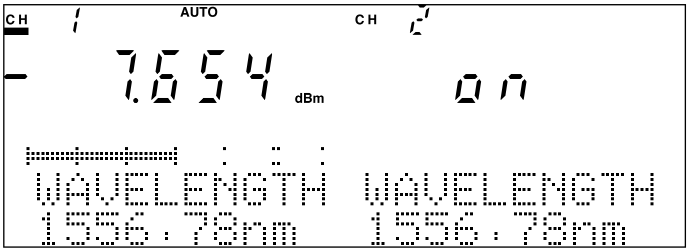
4 Operation

4.1.3 Measurement of Relative Values

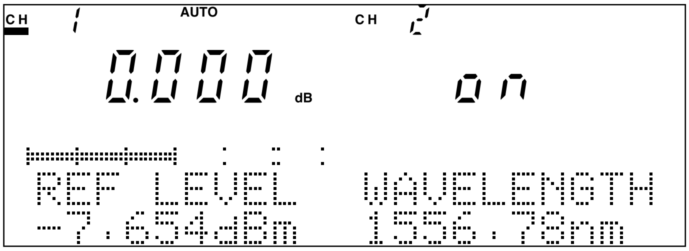
Loss measurement can be performed easily by using the function to measure relative values of the Device. This section, incidentally, provides explanations on the assumption that operations have been completed up to “4.1.2 Power Measurement,” (2) Setting the parameter, c) Set the calibrated wavelength.

a) Set the relative measurement mode.
Pressing the Rel key on the front panel of the Device causes the relative value measurement (relative measurement) to start. Using the value measured when the Rel key is pressed as the reference value, the results of deduction operation using the values to be subsequently measured are indicated.

Key operations | **Indication**



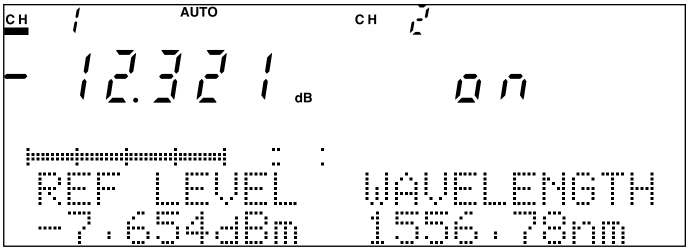
[1] Rel



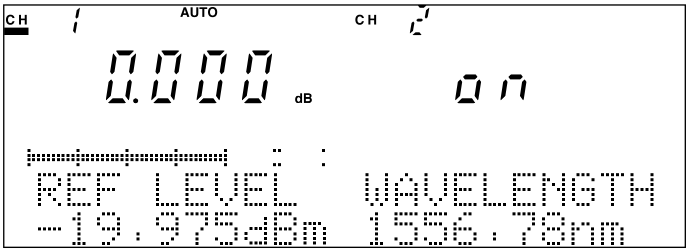
Change the magnitude of attenuation of the optical attenuator in this status. The same value as that of the magnitude of attenuation changed will be indicated.

b) Set the reference value again.
Press the Rel key again to set a new reference value at the time of relative measurement. The relative measurement is performed by using the value measured when the key is pressed (not a value displayed) as a new reference value.

Key operations | **Indication**



[1] Rel



The display immediately before the Rel key is pressed shows a value 12.321 dB lower than the reference value of -7.654 dBm. Therefore, it means that a measured value of -19.975 dBm was obtained in that state. If the Rel key is pressed, the relative measurement is performed by using -19.975 dBm as a new reference value.

c) Return to the absolute value measurement.
Press the dBm/W key to return the mode from the relative measurement to the absolute value measurement.

4.2 Optical Sensor Operations

4.2.1 Switching Channels

Before setting parameters on the Device, it is necessary to first specify the unit to constitute the target of parameter setting.

Operations	Remarks
Press the Chan key.	Continue pressing the key until the display switches to the target channel.

[When two optical sensors are mounted]

Every time the key is pressed, the channels switch in the following order.

CH1 → CH2 → CH1 & CH2 → CH1

The channel selected is displayed with an underline.

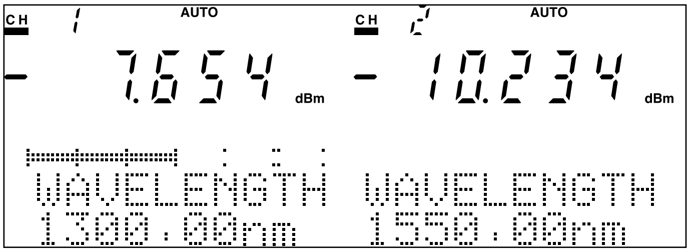


Fig. 4-3 CH1 & CH2 Setting Screen

Point

When setting parameters for CH1 & CH2 is attempted, the setting is first performed for CH1 and only when the same setting is allowed for CH2, the same setting is performed for CH2. For this reason, even when the channel is set to CH1 & CH2, the two channels are not always set at the same time.

[Cases other than above]

Every time the key is pressed, the channels switch in the following order.

CH1 → CH2 → CH1

The channel selected is displayed with an underline.

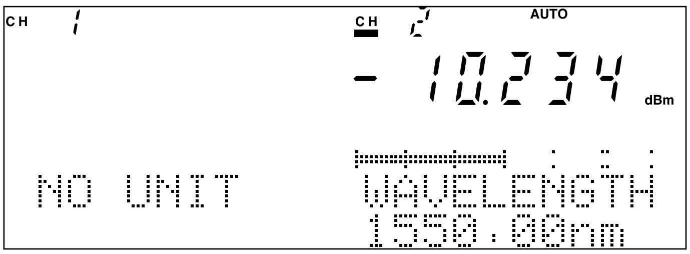


Fig. 4-4 CH2 Setting Screen

Point

If the power source is turned ON when a unit is mounted only on one of the channels, CH1 or CH2, the channel where the unit is mounted is selected.
The message display, "NO UNIT", will be indicated on the side of the channel where no unit is mounted.
Switching channels is still enabled even when a unit is mounted only on one of the channels, CH1 or CH2. However, attempting to set parameters for the channel where no unit is mounted will result in an error.

4.2.2 Zero Set

A function to remove the electrical offset of the light intercepting circuit located within the optical sensor. The illuminated key is located on the front panel of the unit.

Zero

(* Front of the unit)

1) Execution of zero setting

Operations	Remarks
Affix the light shading cap to the optical connector.	Use the metallic cap that comes with the unit in order to thoroughly shade the light.
Press the Zero key.	The screen shown in the figure below will be displayed during execution and the key will be lit.

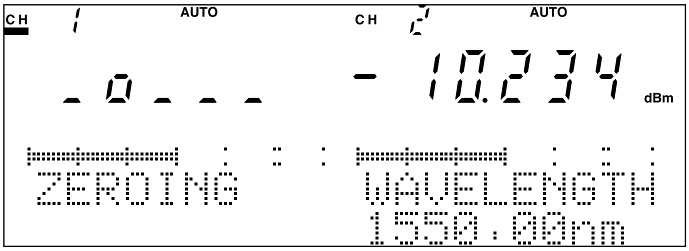


Fig. 4-5 Screen during Execution of Zero Setting

It normally takes approximately 30 seconds to execute zero setting. When the processing successfully ends, "COMPLETE" is indicated.

Point

Executing zero setting while shading of light is insufficient causes "100 ZEROSET ERROR" to be displayed, and then the unit returns to the measurement mode. However, the measurement to be performed in this state may result in incorrect measured values (absolute values). Make sure to affix the metallic light shading cap mounted on the front panel of the unit to the optical connector and execute zero setting again.

The electrical offset of the light intercepting circuit located within the optical sensor fluctuates by the ambient temperature or the passage of time. To measure light at levels lower than -40 dBm or perform high precision measurement, execute zero setting immediately before the measurement starts.

The execution time given above indicates a standard value around the normal temperature (of 25 °C). Depending on the circumstances (particularly when the temperature is high), it may take as long as two minutes. While zero setting is being executed, the "o" indication on the seven segments moves to the left and right. In this case, please wait for a while. If the display is not moving, see "6.5 Troubleshooting."

2) Aborting of zero setting

Operations	Remarks
Press the Zero key.	

Pressing the Zero key in the process of zero setting execution causes "ABORT" to be displayed and the processing is aborted.

4.2.3 Setting Measurement Range

Auto
Manu

The Device has two measurement range modes, the AUTO RANGE mode to automatically switch the measurement range in accordance with the level of light input and the MANUAL RANGE mode to set a fixed range.

1) Setting of AUTO RANGE

Operations	Remarks
Press the Auto Manu key.	Continue pressing the key until "AUTO" is indicated.
Press the Enter key.	Pressing this key establishes the setting.

Every time the Auto Manu key is pressed, the mode switches between AUTO RANGE and MANUAL RANGE. When the mode is set to AUTO RANGE, the "AUTO" indication lights up at the top of the indicator shown in the figure below. "AUTO" on the message display flickers, indicating that the mode is currently being set.

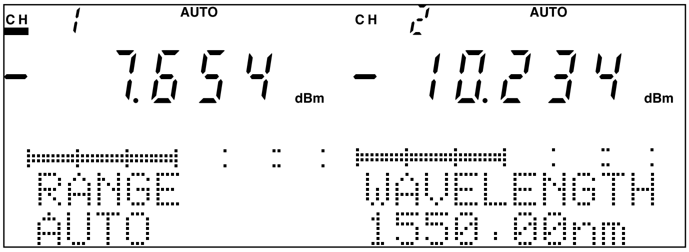
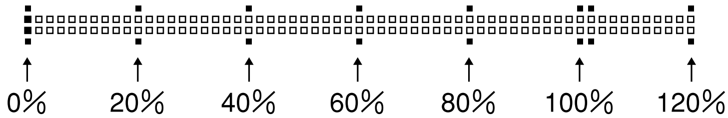


Fig. 4-6 Auto Range Setting Screen

The bar graph at the top of the indicator displays the level in the using range.



Point

It is advised to perform measurement in the AUTO RANGE mode when the level of the measuring beam is not identified or the fluctuations in the level are large (greater than 10 dB). On the other hand, it is advised to set the mode to MANUAL RANGE and fix the measurement range when the level of the measuring beam is identified and the I-L measurement is performed.

The range setting has already been modified without pressing the Enter key. However, as the message display continues to flicker, it is recommended to press the Enter key to establish the setting and terminate the setting mode.

Inputting light at a level higher than the limit of the measurement range of the optical sensor used triggers the overrange display, while inputting light at a level lower than the limit of the measurement range triggers the underrange display. These signify the possibility that the values currently being measured are not correct (outside specifications).

☞ Appendix F Overrange and Underrange Indication when Optical Sensor is Used

2) Setting of MANUAL RANGE

Operations	Remarks
Press the Auto Manu key.	Continue pressing the key until the “AUTO” indication disappears.
Press the ↑ or ↓ key.	Pressing the key specifies the range.
Press the Enter key.	Pressing this key establishes the setting.

Every time the Auto Manu key is pressed, the mode switches between AUTO RANGE and MANUAL RANGE. When the mode is set to MANUAL RANGE, the “AUTO” indication at the top of the indicator is OFF as shown in the figure below. Change the range flickering in the message display section, using the ↑ or ↓ key.

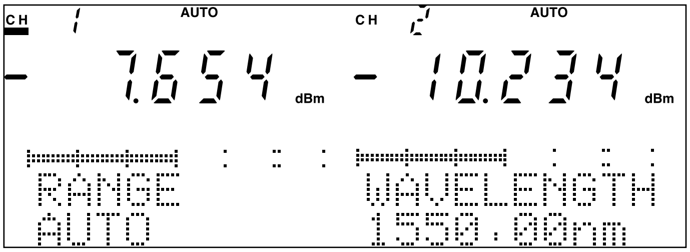


Fig. 4-7 Manual Range Setting Screen

Point

When the mode is set to AUTO RANGE, switching between ranges takes some time. It is advised to perform measurement in the MANUAL RANGE mode when the level of the measuring beam is identified to a certain extent or the fluctuations of the level are relatively small (between 2 and 3 dB).
When the mode has switched from AUTO RANGE to MANUAL RANGE, the range set in the AUTO RANGE mode will be set, not the range previously set in the MANUAL RANGE mode.
The range allowed to be set varies with the optical sensor used. See “Appendix A Standards” for more information.
The range allowed to be set varies with the bandwidth setting. See “4.2.9 Setting Bandwidth.”
The range setting has already been modified without pressing the Enter key. However, as the message display continues to flicker, it is recommended to press the Enter key to establish the setting and terminate the setting mode.
Inputting light at a level higher than the limit of the measurement range of the optical sensor used triggers the overrange display, while inputting light at a level lower than the limit of the measurement range triggers the underrange display. These signify the possibility that the values currently being measured are not correct (outside specifications).

Appendix F Overrange and Underrange Indication when Optical Sensor is Used

4.2.4 Setting Wavelength (Optical Frequency)

λ

The optical receiver of the optical sensor used by the Device is characterized by the wavelength sensitivity. For this reason, it is necessary to correct the sensitivity to obtain correct absolute values. The Device automatically performs correction by setting the wavelength of the measuring beam. Incidentally, when the optical frequency display is set in accordance with “4.2.10 Switching Representation Unit (Wavelength/Optical Frequency),” the mode switches to the optical frequency display.

1) Setting of the preset value of the unit

Operations	Remarks
Press the λ key.	Continue pressing the key until the display switches to the intended wavelength (optical frequency).
Press the Enter key.	Pressing this key establishes the setting.

Every time the *l* key is pressed, the typical wavelength values preset in the unit switch in a sequential order. Although these values vary with the unit, they switch as follows in the case of MU931311A.

850.00nm → 1200.00nm → 1300.00nm → 1310.00nm → 1480.00nm →1550.00nm → (Optionally set wavelength) → 850.00nm

The optical frequency display switches as follows.

352.697THz → 249.827THz → 230.610THz → 228.849THz → 202.562THz →193.414THz → (Optionally set optical frequency) → 352.697THz

A numerical character constituting one of the digits of the wavelength shown on the message display (“1300.00 nm” in the case of the figure below) flickers to signify that it is currently being set.

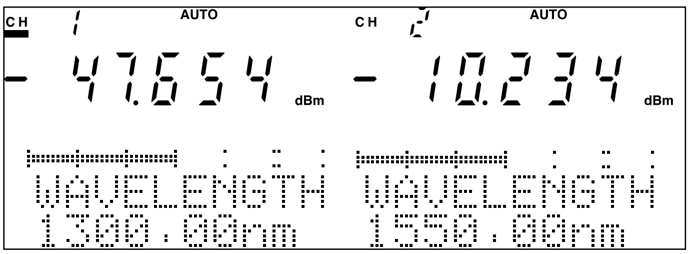


Fig. 4-8 Preset Calibrated Wavelength Setting Screen

Point

The optionally set wavelength (optical frequency) is the wavelength (optical frequency) set in "2) Setting of the optional calibrated wavelength value." No display will be made when no value is set or a value that exists as a preset value is again optionally set.
Even when the wavelength (optical frequency) on the message display is modified by pressing the lambda key, the setting has not been changed yet in this state. Make sure to press the Enter key without fail to establish the setting and terminate the setting status.

2) Setting of the optional wavelength value

Operations	Remarks
Press the λ key.	
Press the ← or → key.	Pressing the key enables selection of the input digit.
Press the ↑ or ↓ key.	Pressing the key enables setting of the numerical value.
Press the Enter key.	Pressing this key establishes the setting.

A numerical character constituting one of the digits of the wavelength shown on the message display ("1300.00 nm" in the case of the figure below) flickers to signify that it is currently being set. The numerical character constituting the flickering digit can be changed by pressing the or ↓ key. Moreover, the flickering digit (the digit allowed to be input) can be changed by pressing the ← or → key.

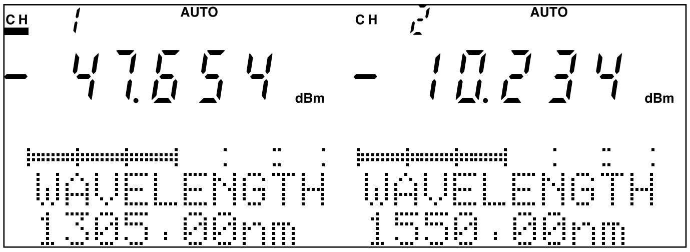


Fig. 4-9 Optional Wavelength Setting Screen

Point

When setting an optional calibrated wavelength, directly modifying the numerical value of the fourth digit is not possible. As the input digit can only shift to the third digit, set the fourth digit by entering a numerical value in the third digit to carry a digit to the fourth digit or bring a digit down from the fourth digit.
Even when the wavelength on the message display is modified by changing the numerical value, the setting has not been changed yet in this state. Make sure to press the Enter key without fail to establish the setting and terminate the setting status.

3) Setting of the value of the wavelength output from the light source

Operations	Remarks
Press the λ key.	Continue pressing the key until the wavelength (optical frequency) output from the light source is displayed.
Press the Enter key.	Pressing this key establishes the setting.

Although the operations are the same as those for “1) Setting of the preset value of the unit,” when one channel is used for the optical sensor and the other channel is used for the light source, the wavelength (optical frequency) output from the light source will be added next to the optionally set wavelength (optical frequency) found in the preset wavelengths (optical frequencies) of the optical sensor. Namely, the values switch as follows in the case of MU931311A.

850.00nm → 1200.00nm → 1300.00nm → 1310.00nm → 1480.00nm →1550.00nm → (Optionally set wavelength) → Wavelength output from the light source → 850.00nm

Point

Even when the wavelength (optical frequency) on the message display is modified by pressing the λ key, the setting has not been changed yet in this state. Make sure to press the Enter key without fail to establish the setting and terminate the setting status.

4) Aborting of the wavelength setting

Operations	Remarks
Press the λ key.	Pressing this key causes the original wavelength (optical frequency) to be displayed.
Press the Enter key.	Pressing this key establishes the setting.

As the wavelength (optical frequency) setting remains unmodified until the Enter key is pressed, pressing the Enter key after pressing the λ key again to display the original value will trigger aborting of the setting and return to the original state.

4.2.5 Switching Representation Unit (dBm/W)

dBm
W

When the absolute value measurement is performed, the dBm and W display can be switched. On the other hand, when the relative value measurement (REL, REF) is performed, the dB and % display can be switched.

1) Switching of the representation unit at the time of absolute value measurement

Operations	Remarks
Press the dBm W key.	Continue pressing the key until the intended unit is displayed.

Every time the dBm W key is pressed, the mode switches between dBm and W.

2) Switching of the representation unit at the time of relative value measurement

Operations	Remarks
Press the dBm W key.	Pressing this key causes the mode to switch back to the absolute value measurement.
Press the dBm W key again.	Continue pressing the key until the intended unit is displayed.

When the relative value measurement is performed, the representation unit cannot be modified. First return to the absolute value measurement and modify the representation unit, and switch the mode to the relative value measurement again. The representation unit changes as follows when the mode is switched.

Representation Unit during Absolute Value Measurement		Representation Unit during Relative Value Measurement
dBm	←→	dB
W	←→	%

Point

When the relative value measurement is performed, the representation unit cannot be modified. It is necessary to first return to the absolute value measurement. As the reference values that have been used for the relative measurement currently being performed will be cleared, modifying the representation unit will require due attention.

4.2.6 Average Setting

When the measuring beam includes the noise element, the S/N ratio can be improved by executing the average processing.

Prmtr

1) Execution of the averaging processing (setting of the averaging frequencies)

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the “PRMTR” indication to light up at the top of the indicator. Continue pressing the key until “AVERAGE” is indicated.
Press the Select key.	Pressing this key causes “ON xxx (number of times)” to be displayed.
Press the ↑ or ↓ key.	Pressing this key enables setting of the number of times.
Press the Enter key.	Pressing this key establishes the setting.

The frequencies of averaging can be selected from 2, 5, 10, 20, 50, 100, 200, 500 and 1,000 times. When the averaging processing is set, the “AVG” indication at the top of the indicator lights up.

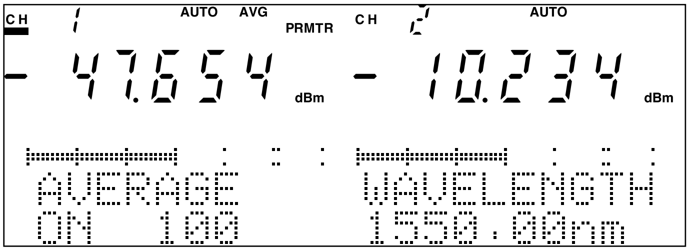


Fig. 4-10 Average Setting Screen

The averaging processing of the Device uses the moving average as shown in the figure below.

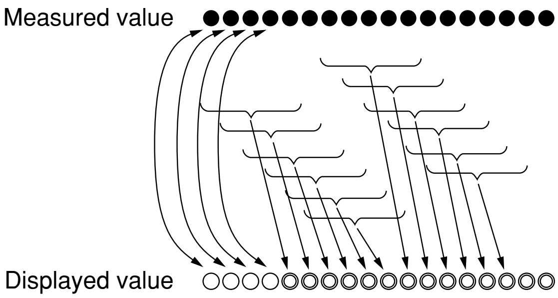


Fig. 4-11 Operations when Averaging Frequency is Set at Five Times

Point

When the number of measured values has not reached the frequency of averaging (the section marked with a circle in Fig. 4-11), the “AVG” indication continues to flicker.

2) Aborting of the averaging processing

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the "PRMTR" indication to light up at the top of the indicator. Continue pressing the key until "AVERAGE" is indicated.
Press the Select key.	Pressing this key causes "OFF" to be displayed.
Press the Enter key.	Pressing this key establishes the setting.

When the averaging processing is not set, the "AVG" indication at the top of the indicator is unlit.

Point

The average setting has already been modified without pressing the Enter key. However, as the message display continues to flicker, it is recommended to press the Enter key to establish the setting and terminate the setting mode.

4.2.7 Setting Optical Modulation Mode

The level of the modulated radiation can be measured by specifying the modulation frequency of the measuring beam.

Prmtr

1) Modulated radiation measurement ON (setting of the modulation frequency)

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the "PRMTR" indication to light up at the top of the indicator. Continue pressing the key until "MOD FREQ" is indicated.
Press the Select key.	Pressing this key causes "MOD xxx (frequency)" to be displayed.
Press the ↑ or ↓ key.	Pressing this key enables setting of the frequency.
Press the Enter key.	Pressing this key establishes the setting.

The modulation frequency can be selected from 270 Hz, 1 kHz and 2 kHz. When the modulated radiation measurement is set, the "MOD" indication at the top of the indicator lights up.

Point

The value measured at the time of modulated radiation measurement is the average value of the set frequency component. For example, when modulated radiation of extinction ratio of ∞ and duty ratio of 50% is measured, the value measured is half the peak value.

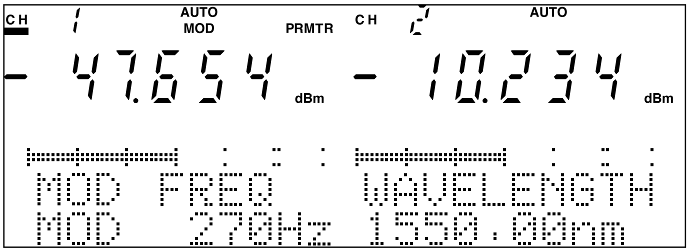


Fig. 4-12 Modulated Radiation Measurement ON Setting Screen

2) Modulated radiation measurement OFF

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the "PRMTR" indication to light up at the top of the indicator. Continue pressing the key until "MOD FREQ" is indicated.
Press the Select key.	Pressing this key causes "CW" to be displayed.
Press the Enter key.	Pressing this key establishes the setting.

When the modulated radiation measurement is not set, the "MOD" indication at the top of the indicator is OFF.

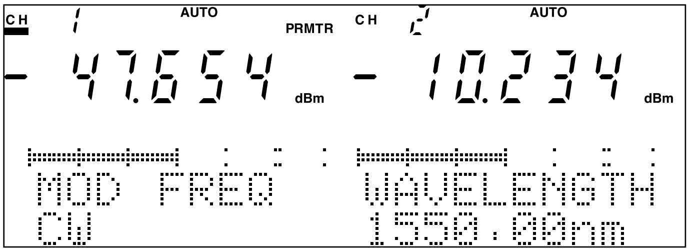


Fig. 4-13 Modulated Radiation Measurement OFF Setting Screen

Point

The optical modulation mode setting has already been modified without pressing the Enter key. However, as the message display continues to flicker, it is recommended to press the Enter key to establish the setting and terminate the setting mode.

4.2.8 Setting Measurement Interval

Prmtr

The interval of data sampling can be set to a fixed value within the range between 1 ms and 500 ms, or to any value between 1 second and 99 hours 59 minutes and 59 seconds at the setting resolution of 1 second.

1) Setting of the fixed value

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the "PRMTR" indication to light up at the top of the indicator. Continue pressing the key until "INTERVAL" is indicated.
Press the Select key.	Continue pressing the key until the intended time is displayed.
Press the Enter key.	Pressing this key establishes the setting.

Every time the Select key is pressed, the interval switches as follows.
1 ms → 10 ms → 20 ms → 50 ms → 100 ms → 200 ms → 500 ms → status of optional value setting (xxHxxMxxS) → 1 ms.

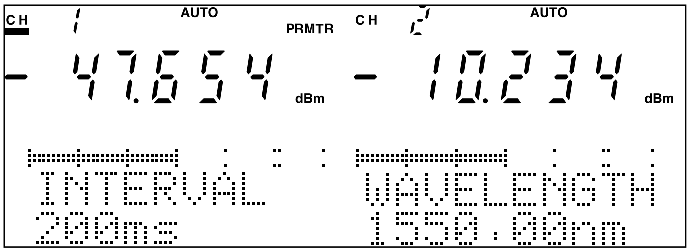


Fig. 4-14 Interval (Fixed Value) Setting Screen

2) Setting of the optional value

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the "PRMTR" indication to light up at the top of the indicator. Continue pressing the key until "INTERVAL" is indicated.
Press the Select key.	Continue pressing the key until the optional value setting status (xxHxxMxxS) is displayed.
Press the ← or → key.	Pressing the key enables selection of the input digit.
Press the ↑ or ↓ key.	Pressing the key enables setting of the numerical value.
Press the Enter key.	Pressing this key establishes the setting.

Every time the Select key is pressed, the interval switches as follows.
1 ms → 10 ms → 20 ms → 50 ms → 100 ms → 200 ms → 500 ms → status of optional value setting (xxHxxMxxS) → 1 ms. When the status of optional value setting (xxHxxMxxS) is selected, one of the numerical values indicating the hour, minute and second flickers to signify that it is in the state of setting. The numerical value of the item flickering can be changed by pressing the ↑ or ↓ key. Moreover, the flickering digit (the digit allowed to be input) can be changed by pressing the ← or → key.

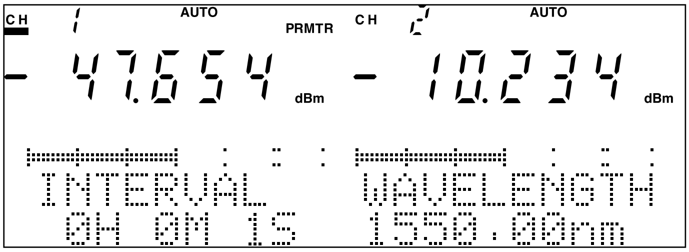


Fig. 4-15 Interval (Optional Value) Setting Screen

Point

The interval of the measured value display is approximately 200 ms. For this reason, when the measurement interval is not greater than 100 ms, the measured value cannot be fully reflected on the seven-segment display. If accurate measured values are continuously required when the measurement interval is set at a value not greater than 100 ms, it is advised to refer to "4.2.18 Recording Measurement Data."

The measurement interval setting has already been modified without pressing the Enter key. However, as the message display remains flickering, it is recommended to press the Enter key to establish the setting and terminate the setting mode.

When setting an optional value, only the figure constituting the first digit can be changed for the hour, minute and second display. Change the figure constituting the second digit by either carrying a digit to the second digit or bringing a digit down from the second digit.

4.2.9 Setting Bandwidth

Prmtr

The bandwidth of the light intercepting circuit can be set to either AUTO designed to automatically set an optimum bandwidth or an optional fixed value. The bandwidth displayed is 3 db bandwidth.

1) Setting of AUTO

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the “PRMTR” indication to light up at the top of the indicator. Continue pressing the key until “BANDWIDTH” is indicated on the message display.
Press the Select key.	Pressing this key causes “AUTO” to be displayed.
Press the Enter key.	Pressing this key establishes the setting.

2) Setting of the optional bandwidth (fixed)

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the “PRMTR” indication to light up at the top of the indicator. Continue pressing the key until “BANDWIDTH” is indicated on the message display.
Press the Select key.	Pressing this key causes “xxxHz” to be displayed.
Press the ↑ or ↓ key.	Pressing this key enables setting of the bandwidth (frequency).
Press the Enter key.	Pressing this key establishes the setting.

The bandwidth allowed to be set varies with the optical sensor to be used. Moreover, even when the mode is set to MANUAL RANGE, the bandwidth allowed to be set is limited. The combination marked with an x in the table below means that it cannot be set. The combination marked with a circle in the table below, on the other hand, means that it can be set.
Incidentally, if increasing the bandwidth while keeping the same range causes the combination to become invalid, the range automatically changes to the one marked with a circle.

(Example) Changing the bandwidth from 100 Hz to 1 kHz on the range of -60 dBm for MU931421A will cause the range to switch to -50 dBm.

(Example) Changing the range from -50 dBm to -60 dBm on the range of -50 dBm for MU931421A will cause the bandwidth to switch from 1 Hz to 100 Hz.

Relationship between range and bandwidth

Table 4-1 Relationship between measurement range and bandwidth when the bandwidth of MU931421A/22A is AUTO.

Range	Bandwidth
+7 to 0 dBm	1 kHz
0 to -10 dBm	1 kHz
-10 to -20 dBm	1 kHz
-20 to -30 dBm	1 kHz
-30 to -40 dBm	1 kHz
-40 to -50 dBm	10 Hz
-50 to -60 dBm	10 Hz
-60 to -70 dBm	1 Hz
-70 to -80 dBm	1 Hz

Table 4-2 Relationship between measurement range and band-width for MU931421A/22A

Range	0.1 Hz	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz
+10 to 0 dBm	○	○	○	○	○	○
0 to -10 dBm	○	○	○	○	○	○
-10 to -20 dBm	○	○	○	○	○	○
-20 to -30 dBm	○	○	○	○	○	○
-30 to -40 dBm	○	○	○	○	○	○
-40 to -50 dBm	○	○	○	○	○	○
-50 to -60 dBm	○	○	○	○	○	×
-60 to -70 dBm	○	○	○	○	×	×
-70 to -80 dBm	○	○	○	×	×	×

Table 4-3 Relationship between measurement range and bandwidth when the bandwidth of MU931311A is AUTO.

Range	Bandwidth
+10 to 0 dBm	1 kHz
0 to -10 dBm	1 kHz
-10 to -20 dBm	1 kHz
-20 to -30 dBm	1 kHz
-30 to -40 dBm	1 kHz
-40 to -50 dBm	1 kHz
-50 to -60 dBm	1 kHz
-60 to -70 dBm	10 Hz
-70 to -80 dBm	10 Hz
-80 to -90 dBm	1 Hz
-90 to -110 dBm	1 Hz

Table 4-4 Relationship between measurement range and bandwidth for MU931311A

Range	0.1 Hz	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz
+10 to 0 dBm	○	○	○	○	○	○	○
0 to -10 dBm	○	○	○	○	○	○	○
-10 to -20 dBm	○	○	○	○	○	○	○
-20 to -30 dBm	○	○	○	○	○	○	○
-30 to -40 dBm	○	○	○	○	○	○	○
-40 to -50 dBm	○	○	○	○	○	○	○
-50 to -60 dBm	○	○	○	○	○	○	○
-60 to -70 dBm	○	○	○	○	○	×	×
-70 to -80 dBm	○	○	○	○	×	×	×
-80 to -90 dBm	○	○	×	×	×	×	×
-90 to -110 dBm	○	○	×	×	×	×	×

Table 4-5 Relationship between measurement range and band-width when the bandwidth of MU931001A+MA9331A is AUTO.

Range	Bandwidth
+35 to +30 dBm	1 kHz
+30 to +20 dBm	1 kHz
+20 to +10 dBm	1 kHz
+10 to 0 dBm	1 kHz
0 to -10 dBm	1 kHz
-10 to -20 dBm	10 Hz
-20 to -30 dBm	10 Hz
-30 to -40 dBm	1 Hz
-40 to -50 dBm	1 Hz

Table 4-6 Relationship between measurement range and band-width when the bandwidth of MU931431A is AUTO.

Range	Bandwidth
+33 to +30 dBm	1 kHz
+30 to +20 dBm	1 kHz
+20 to +10 dBm	1 kHz
+10 to 0 dBm	1 kHz
0 to -10 dBm	1 kHz
-10 to -20 dBm	10 Hz
-20 to -30 dBm	10 Hz
-30 to -40 dBm	1 Hz
-40 to -50 dBm	1 Hz

Table 4-7 Relationship between measurement range and band-width when the bandwidth manual is set

Range	0.1 Hz	1 Hz	10 Hz	100 Hz	1 kHz	20 kHz
+33 to +30 dBm	○	○	○	○	○	○
+30 to +20 dBm	○	○	○	○	○	○
+20 to +10 dBm	○	○	○	○	○	○
+10 to 0 dBm	○	○	○	○	○	○
0 to -10 dBm	○	○	○	○	○	○
-10 to -20 dBm	○	○	○	○	○	○
-20 to -30 dBm	○	○	○	○	○	×
-30 to -40 dBm	○	○	○	○	×	×
-40 to -50 dBm	○	○	○	×	×	×

Table 4-8 Relationship between measurement range and bandwidth for MU931001A+MA9331A

Range	0.1 Hz	1 Hz	10 Hz	100 Hz	1 kHz	20 kHz
+35 to +30 dBm	○	○	○	○	○	○
+30 to +20 dBm	○	○	○	○	○	○
+20 to +10 dBm	○	○	○	○	○	○
+10 to 0 dBm	○	○	○	○	○	○
0 to -10 dBm	○	○	○	○	○	○
-10 to -20 dBm	○	○	○	○	○	○
-20 to -30 dBm	○	○	○	○	○	×
-30 to -40 dBm	○	○	○	○	×	×
-40 to -50 dBm	○	○	○	×	×	×

Table 4-9 Relationship between measurement range and bandwidth when the bandwidth of MU931001A/02A+MA9332A is AUTO.

Range	Bandwidth
+7 to 0 dBm	1 kHz
0 to -10 dBm	1 kHz
-10 to -20 dBm	1 kHz
-20 to -30 dBm	1 kHz
-30 to -40 dBm	1 kHz
-40 to -50 dBm	10 Hz
-50 to -60 dBm	10 Hz
-60 to -70 dBm	1 Hz
-70 to -80 dBm	1 Hz

Table 4-10 Relationship between measurement range and bandwidth for MU931001A/02A+MA9332A

Range	0.1 Hz	1 Hz	10 Hz	100 Hz	1 kHz	20 kHz
+7 to 0 dBm	○	○	○	○	○	○
0 to -10 dBm	○	○	○	○	○	○
-10 to -20 dBm	○	○	○	○	○	○
-20 to -30 dBm	○	○	○	○	○	○
-30 to -40 dBm	○	○	○	○	○	○
-40 to -50 dBm	○	○	○	○	○	○
-50 to -60 dBm	○	○	○	○	○	×
-60 to -70 dBm	○	○	○	○	×	×
-70 to -80 dBm	○	○	○	×	×	×

Table 4-11 Relationship between measurement range and bandwidth when the bandwidth of MU931002A+MA9332A/33A is AUTO.

Range	Bandwidth
+7 to 0 dBm	1 kHz
0 to -10 dBm	1 kHz
-10 to -20 dBm	1 kHz
-20 to -30 dBm	1 kHz
-30 to -40 dBm	1 kHz
-40 to -50 dBm	10 Hz
-50 to -60 dBm	10 Hz
-60 to -70 dBm	1 Hz
-70 to -80 dBm	1 Hz

Table 4-12 Relationship between measurement range and bandwidth for MU931002A+MA9332A/33A

Range	1 Hz	10 Hz	100 Hz	1 kHz	20 kHz
+7 to 0 dBm	○	○	○	○	○
0 to -10 dBm	○	○	○	○	○
-10 to -20 dBm	○	○	○	○	○
-20 to -30 dBm	○	○	○	○	○
-30 to -40 dBm	○	○	○	○	○
-40 to -50 dBm	○	○	○	○	○
-50 to -60 dBm	○	○	○	○	×
-60 to -70 dBm	○	○	○	×	×
-70 to -80 dBm	○	○	×	×	×

Point

It is recommended to normally use the unit with the bandwidth set to AUTO. Using the unit with the bandwidth set at an optional value may cause the displayed value to include errors.
The bandwidth setting has already been modified without pressing the Enter key. However, as the message display continues to flicker, it is recommended to press the Enter key to establish the setting and terminate the setting mode.

4.2.10 Switching Representation Unit (Wavelength/Optical Frequency)

Prmtr

The wavelength display or optical frequency display is set in regard to "4.2.4 Setting Calibrated Wavelength (Calibrated Optical Frequency)."

1) Setting of the wavelength display

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the "PRMTR" indication to light up at the top of the indicator. Continue pressing the key until "DISP UNIT" is indicated on the message display.
Press the Select key.	Continue pressing the key until "WAVELENGTH" is indicated on the message display.
Press the Enter key.	Pressing this key establishes the setting.

Every time the Select key is pressed, the mode switches between WAVELENGTH and FREQUENCY.

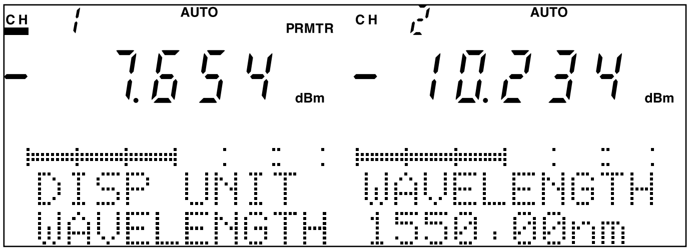


Fig. 4-16 Wavelength Display Setting Screen

2) Setting of the optical frequency display

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the "PRMTR" indication to light up at the top of the indicator. Continue pressing the key until "DISP UNIT" is indicated on the message display.
Press the Select key.	Continue pressing the key until "FREQUENCY" is indicated on the message display.
Press the Enter key.	Pressing this key establishes the setting.

Every time the Select key is pressed, the mode switches between WAVELENGTH and FREQUENCY.

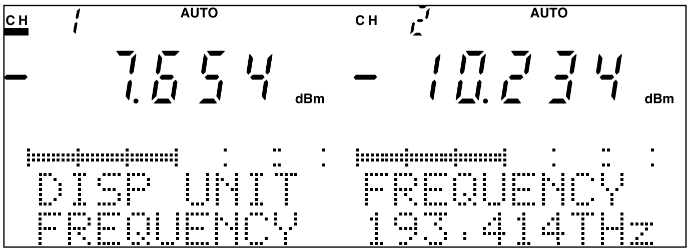


Fig. 4-17 Optical Frequency Display Setting Screen

Point

The representation unit has already been switched without pressing the Enter key. However, as the message display remains flickering, it is recommended to press the Enter key to establish the setting and terminate the setting mode.
The optical frequency and the wavelength are converted in accordance with the following formula.

λ = c/f c=2.99792458x10^8m/s

(Light velocity under the vacuum state)

As the results of operations are displayed by rounding off the values that come below the digit displayed, the values converted from the optical frequency to the wavelength and from the wavelength to the optical frequency may not always match.

Example: 192.859THz → 1554.46nm
1554.46nm → 192.860THz

4.2.11 Setting Display Resolution (Blank)

When numerical values below the decimal point are dispersed when represented by the dBm or dB unit, or when the number of digits of reading is too large to come within the effective number of digits, the display resolution (Blank) can be set to make it readily visible.

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the “PRMTR” indication to light up at the top of the indicator. Continue pressing the key until “DISP BLANK” is indicated on the message display.
Press the ← or → key.	Pressing this key enables setting of required number of digits to be displayed.
Press the Enter key.	Pressing this key establishes the setting.

Pressing the ← key causes the seven-segment display to light off in the order of the third decimal place → the second decimal place.
Pressing the → key causes the seven-segment display to light off in the order of the second decimal place → the third decimal place.

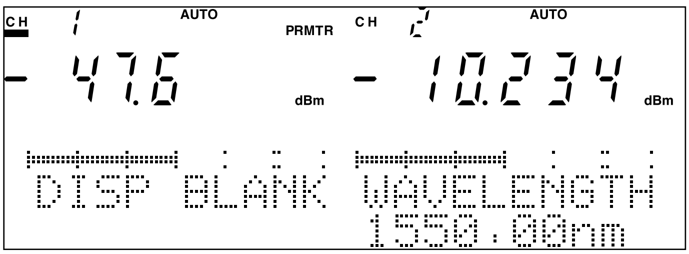


Fig. 4-18 Display Resolution (Blank) Setting Screen

Point

When the seven-segment display indicates the overrange or underrange, the display resolution cannot be set. Set the unit to the state where the measured value is displayed.
The display resolution setting has already been modified without pressing the Enter key. However, as the message display remains flickering, it is recommended to press the Enter key to establish the setting and terminate the setting mode.

4.2.12 Relative Measurement

With the value displayed when the key is input set as the reference value, a value calculated by deducting a value subsequently displayed* from the reference value is displayed.

Rel

* This value displayed should be indicated in the seven segments, if the mode is not set to the relative measurement.

1) Starting of the relative measurement

Operations	Remarks
Press the Rel key.	

[When switching from the absolute value measurement to the relative value measurement]

A value calculated through deduction operation using the absolute value displayed when the Rel key is input as the reference value will be displayed.

[Display when the mode remains in the absolute value measurement]

[Display when the mode is in the relative measurement]

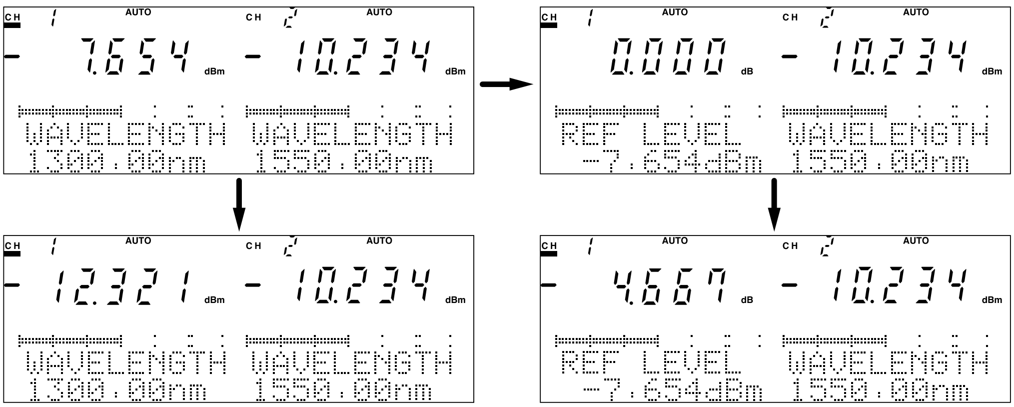


Fig. 4-19 Shift from Absolute Value Measurement to Relative Measurement

[When switching from the reference measurement to the relative measurement]

A value calculated through deduction operation using the reference value displayed when the Rel key is input as the reference value will be displayed.

[Display when the mode remains in the reference measurement]

[Display when the mode is in the relative measurement]

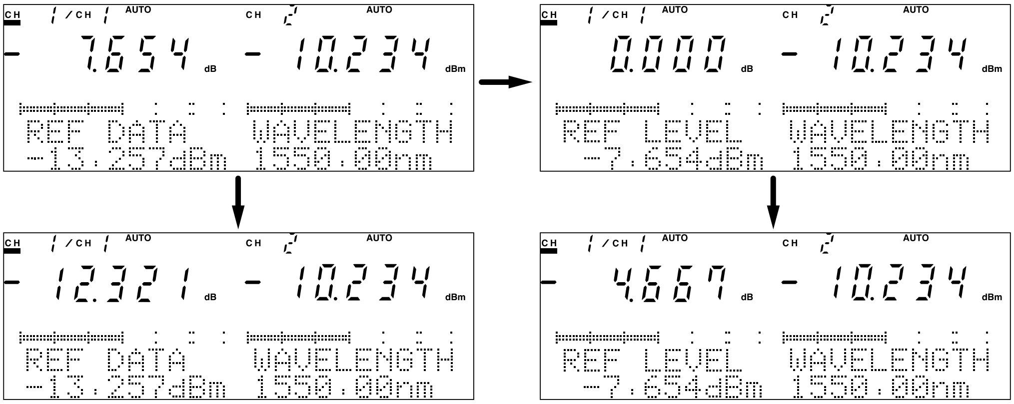


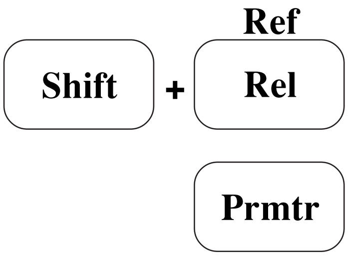
Fig. 4-20 Shift from Reference Measurement to Relative Measurement

These examples suggest that the absolute value in the upper column measures -20.911 dBm , while the absolute value in the lower column measures -25.578 dBm. When the mode is switched from the reference measurement to the relative measurement, the fluctuations of the reference values measured can be measured. ☞ 4.2.13 Reference Measurement

2) Aborting of the relative measurement (returning to the absolute value measurement)

Operations	Remarks
Press the dBm W key.	

4.2.13 Reference Measurement



The Device enables the relative value measurement using a preset level (reference value) as the reference value as well as the relative value measurement using the value measured on one of the channels set as the reference value for the value measured on the other channel when two sensor units are mounted.

1) Setting the reference value (REF DATA)

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the "PRMTR" indication to light up at the top of the indicator. Continue pressing the key until "REF DATA" is indicated on the message display.
Press the ← or → key.	Pressing the key enables selection of the input digit.
Press the ↑ or ↓ key.	Pressing the key enables setting of the numerical value.
Press the Enter key.	10 Pressing this key establishes the setting.

A numerical character constituting one of the digits of the reference value shown on the message display ("-13.257 dBm" in the case of the figure below) flickers to signify that it is currently being set. The numerical character constituting the flickering digit can be changed by pressing the ↑ or ↓ key. Moreover, the flickering digit (the digit allowed to be input) can be changed by pressing the ← or → key.

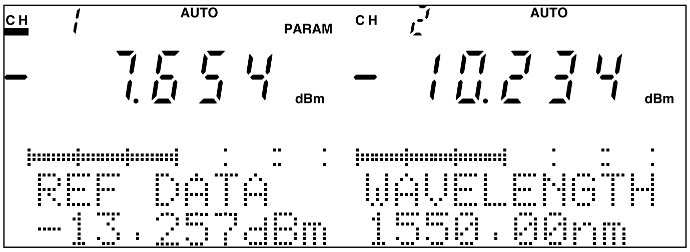


Fig. 4-21 Reference Value (REF DATA) Setting Screen

Point

The reference value (REF DATA) setting has already been modified without pressing the Enter key. However, as the message display remains flickering, it is recommended to press the Enter key to establish the setting and terminate the setting mode.

2) Reference measurement with the reference value (REF DATA) set as the reference value

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the Ref (Rel) key.	Pressing this key causes “CH1/CH1” to be displayed at the top of the indicator.

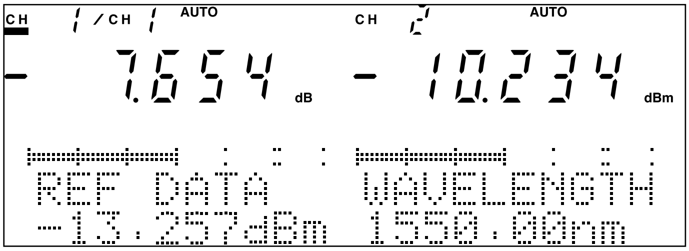


Fig. 4-22 Reference Measurement Screen

3) Reference measurement with the value measured on the other channel set as the reference value (measurement between two channels)

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the Ref (Rel) key.	Pressing this key causes “CH/CH2” to be displayed at the top of the indicator.

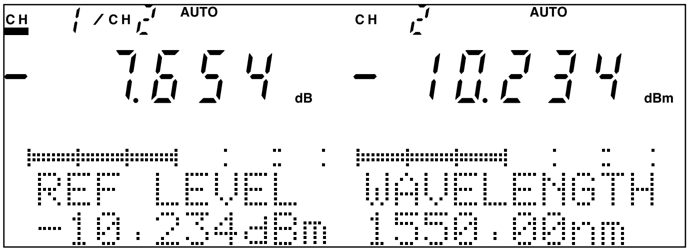


Fig. 4-23 Reference Measurement Screen

4) Aborting of the reference measurement (returning to the absolute value measurement)

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up off to cancel the Shift status.
Press the dBm W key.	

4.2.14 Calibration Measurement

The Device enables the seven-segment display of the result minus the preset correction value (CAL FACTOR).

Shift + **Cal dBm W**

Prmtr

1) Setting of the correction value

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the “PRMTR” indication to light up at the top of the indicator. Continue pressing the key until “CAL FACTOR” is indicated on the message display.
Press the ← or → key.	Pressing the key enables selection of the input digit.
Press the ↑ or ↓ key.	Pressing the key enables setting of the numerical value.
Press the Enter key.	Pressing this key establishes the setting.

A numerical character constituting one of the digits of the correction value shown on the message display (“13.257 dB” in the case of the figure below) flickers to signify that it is currently being set. The numerical character constituting the flickering digit can be changed by pressing the ↑ or ↓ key. Moreover, the flickering digit (the digit allowed to be input) can be changed by pressing the ← or → key.

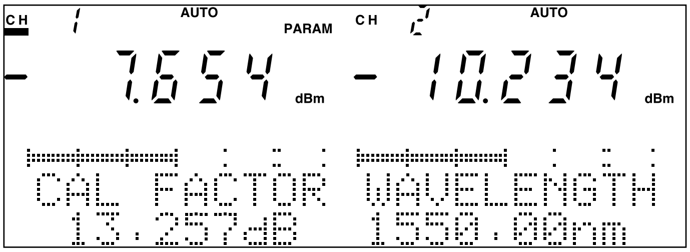


Fig. 4-24 Correction Value (CAL FACTOR) Setting Screen

Point

The correction value (CAL FACTOR) setting has already been modified without pressing the Enter key. However, as the message display continues to flicker, it is recommended to press the Enter key to establish the setting and terminate the setting mode.

2) Starting of the calibration measurement

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the Cal (dBm W) key.	Pressing this key causes “CAL” to be displayed at the top of the indicator.

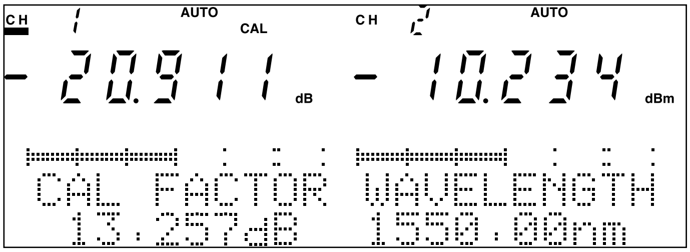


Fig. 4-25 Calibration Measurement Screen

Point

As the value minus the correction value of 13.257 dB is -20.911 dBm in the case of Fig. 4-25, the level measured comes to -7.654 dBm.

3) Aborting of the calibration measurement (returning to the absolute value measurement)

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the Cal (dBm W) key.	Pressing this key causes the “CAL” indication at the top of the indicator to disappear.

4.2.15 Maximum and Minimum Value Display

Restart

Max Min

The maximum and minimum values measured and the difference between the two values can be viewed.

1) Viewing of the maximum and minimum values and the difference between the two values

Operations	Remarks
Press the Max Min key.	

Every time the key is pressed, the message display switches as follows in a sequential order.

Maximum value → Minimum value → Difference → Maximum value

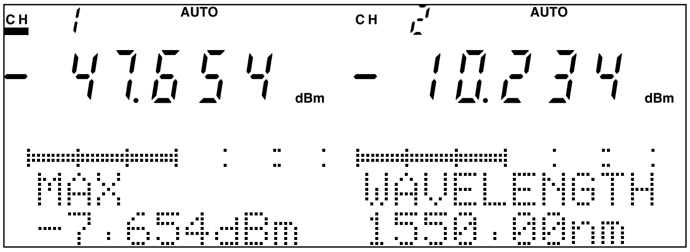


Fig. 4-26 Maximum Value Display Screen

2) Restarting of the measurement of the maximum and minimum values and the difference between the two value

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the Restart (Max Min) key.	

Recording the maximum and minimum values continue without a break from the start of measurement. However, pressing the Restart key causes the maximum and minimum values to be taken from values to be measured after pressing of the Restart key.

Point

To measure the maximum and minimum values, press the Restart key to start recording after the measurement system switches into the normal state. Failing to do so will cause, for example, the value measured when no light is input to be recorded as the minimum value.

Point

The maximum and minimum value display can be cancelled by pressing another parameter setting key. In this case, however, the setting status of the key pressed will apply.

4.2.16 Clone Function

When two optical sensors of the same model name are used, the setting for one of the unit can be copied to make the same setting for the other unit.

Appl

1) Execution of the cloning function

Operations	Remarks
Press the Appl key.	Pressing this key causes the “APPL” indication to light up at the top of the indicator. Continue pressing the key until “CLONE” is indicated on the message display.
Press the Select key.	Pressing this key enables selection of the copying direction.
Press the Enter key.	

The copying direction switches as follows, every time the Select key is pressed.

CH1 → CH2: Copy the setting of channel 1 to channel 2
CH2 → CH1: Copy the setting of channel 2 to channel 1

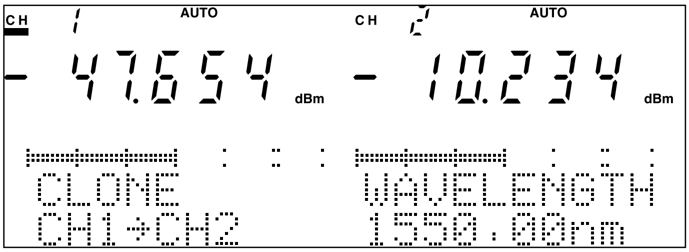


Fig. 4-27 Clone Function Screen

Point

This function can be executed regardless of the channel setting.

2) Aborting of the cloning function

Operations	Remarks
Press the dBm W key.	

4.2.17 Recording and Reading Measurement Conditions

The measurement conditions (parameter setting) currently used can be stored in memory. Moreover, the measurement conditions recorded can be read out (set).

Appl

1) Recording of the measurement conditions

Operations	Remarks
Press the Appl key.	Pressing this key causes the “APPL” indication to light up at the top of the indicator. Continue pressing the key until “SAVE PRMTR” is indicated on the message display.
Press the ↑ or ↓ key.	Pressing the key enables selection of the memory No.
Press the Enter key.	

The memory numbers that can be used for recording the measurement conditions are 1 to 9. A flickering number signifies that it is currently being set.

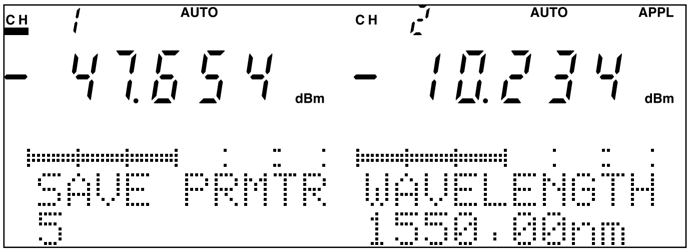


Fig. 4-28 Measurement Condition Recording Screen

Point

When recording of measurement is executed, no overwrite check is run. Pressing the Enter key means that the conditions will be written into memory unconditionally. Therefore, keep an important measurement condition separately.

2) Reading of measurement conditions

Operations	Remarks
Press the Appl key.	Pressing this key causes the “APPL” indication to light up at the top of the indicator. Continue pressing the key until “LOAD PRMTR” is indicated on the message display.
Press the ↑ or ↓ key.	Pressing the key enables selection of the memory No.
Press the Enter key.	

The memory numbers that can be used for reading the measurement conditions are 0 to 9. A flickering number signifies that it is currently being set. Memory number 0 is used to read the unit's default setting (setting at the time of shipment from factory).

Appendix C Default Setting

Memory numbers 1 to 9 are used to read measurement conditions recorded in the section of measurement condition recording.

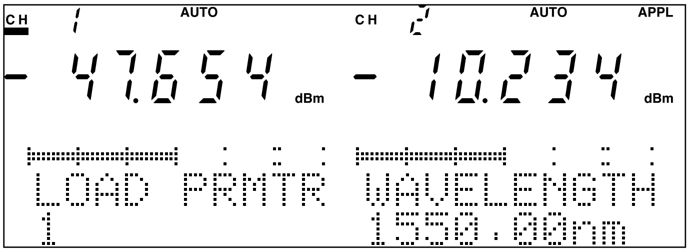


Fig. 4-29 Measurement Condition Reading Screen

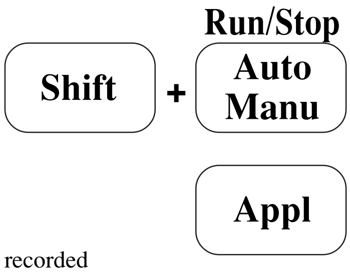
Point

When reading of the measurement conditions is executed when a unit with a different model name to that of the unit used when the measurement conditions were recorded into Memory numbers 1 to 9 is used, only parameters allowed to be set are set.

Example: Reading the memory recording the range of -90 dBm on MU931311A on MU931421A will fail to modify the range setting.

When a unit different to the unit used when the measurement conditions were recorded into Memory numbers 1 to 9 is used, attempting to execute reading of the measurement conditions will result in an error.

4.2.18 Recording Measurement Data



At an interval set (see 4.2.8), a maximum of 1000 measured values can be recorded into memory on CH1 and CH2, respectively.

1) Setting of the number of data to be recorded

Operations	Remarks
Press the Appl key.	Pressing this key causes the “APPL” indication to light up at the top of the indicator. Continue pressing the key until “STORE DATA” is indicated on the message display.
Press the ← or → key.	Pressing the key enables selection of the input digit.
Press the ↑ or ↓ key.	Pressing the key enables setting of the numerical value.
Press the Enter key.	Pressing this key establishes the setting.

A numerical character constituting one of the digits of the number of data to be recorded shown on the message display (“500” in the case of the figure below) flickers to signify that it is currently being set. The numerical character constituting the flickering digit can be changed by pressing the ↑ or ↓ key. Moreover, the flickering digit (the digit allowed to be input) can be changed by pressing the ← or → key.

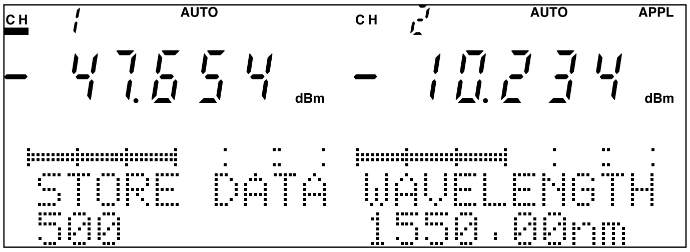


Fig. 4-30 Screen to Set Number of Data to be Recorded

Point

Even when the number of data to be recorded on the message display is changed by changing the numerical value, the setting has not been changed in this state. Make sure to press the Enter key without fail to establish the setting and terminate the setting status.

2) Starting of recording and measurement

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the Run/Stop (Auto Manu) key.	Pressing the button causes “NOW RECORDING” or “COUNT xxx/yyy” to be displayed on the message display to start recording and measurement.

The display at the time of recording and measurement varies with the interval (see 4.2.8). When the interval is set at 200 ms or less, a minus (-) is displayed in the seven segments, and the message display indicates “NOW RECORDING.” This remains unchanged until the measurement is completed.

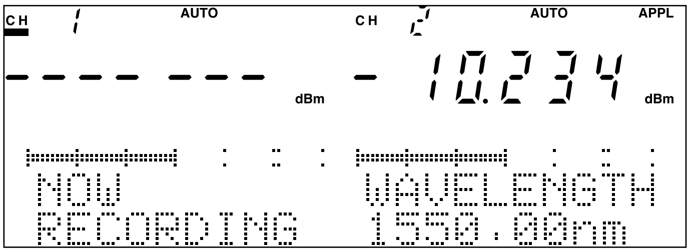


Fig. 4-31 Screen to Set Number of Data to be Recorded (When the Interval is 200 ms or Less)

When the interval is set at 500 ms or greater, a measured value will be displayed in the seven segments, and the message display indicates “COUNT xxx/yyy.” The section marked with xxx indicates the number of data actually recorded and the section marked with yyy indicates the number of data set to be recorded.

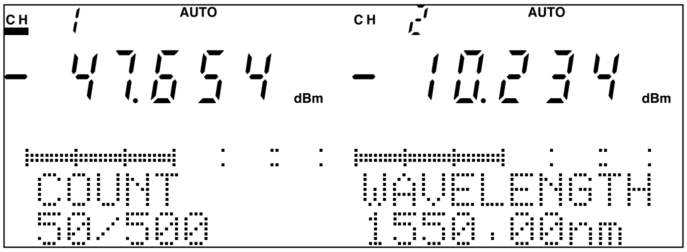


Fig. 4-32 Screen to Set Number of Data to be Recorded (When the Interval is 500 ms or Greater)

When recording and measurement are completed (when the number of data set to be recorded are recorded), the message display indicates "COMPLETE." Then, the mode switches back to the measurement status before recording and measurement.

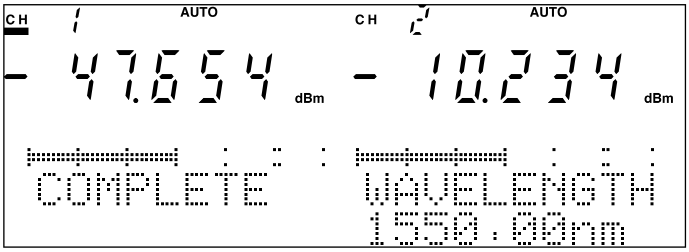


Fig. 4-33 Recording and Measurement Ending Screen

3) Aborting of recording and measurement

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the Run/Stop (Auto Manu) key.	Pressing this key causes "ABORT" to be displayed on the message display to abort recording and measurement.

Pressing the Run/Stop (Auto Manu) key in the Shift status causes the mode to switch between execution and aborting every time the key is pressed.
The recording and measurement are not aborted when the measurement interval is set less than 10ms.
(The measurement is excuted until it will be completed.)

4.2.8 Setting Measurement Interval

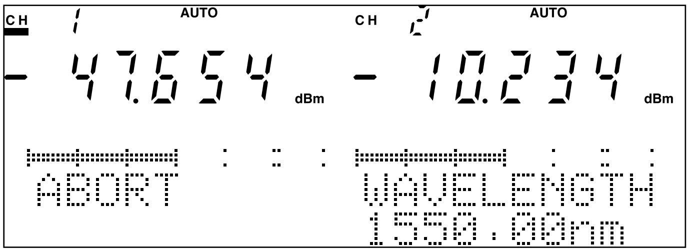


Fig. 4-34 Recording and Measurement Aborting Screen

4) Viewing of the recorded data

Operations	Remarks
Press the Appl key.	Pressing this key causes the "APPL" indication to light up at the top of the indicator. Continue pressing the key until "READ OUT" is indicated on the message display.
Press the Select key.	Press this key only when recording and measurement are performed with the channel mode switched to CH1 & CH2.
Press the ↑ or ↓ key.	Pressing the key enables selection of the item to be viewed.

* When recording and measurement are performed with the channel set to CH1 & CH2, press the Select key to select a channel to view the data of the channel. Every time the key is pressed, the mode switches between data viewing on CH1 "No. 1 (1/2)" and data viewing on CH2 "No. 2 (2/2)."
To view the results of recording and measurement on CH1 or CH2, "No. 1 (1/1)" is indicated, and in this case, the Select key is invalid.

Pressing the ↓ key causes the items shown in the table below to be displayed in the order starting from top to bottom. When the last item in the table is displayed, the item that comes at the top of the table is displayed next. On the other hand, pressing the ↑ key causes the items to be displayed in the order from the other way around.

Items displayed at the time of data viewing

Items Displayed	Example of Indication	Remark
Record No.	READ OUT No.1 (1/2)	
Unit model name	UNIT MU931311A	
Date of completing measurement	DATE 98/12/24	YY/MM/DD
Time of completing measurement	TIME 12 : 34 : 56	HH:MM:SS
Averaging frequency	AVERAGE ON 5	
Interval time	INTERVAL 10ms	
Number of measurement data	CARRY OUT 420/500	Number of data recorded/number of data set
MAX data	MAX 10.345dBm	The data of processing target refer to data handled from the start to the end of the measurement.
MIN data	MIN -99.999dBm	The data of processing target refer to data handled from the start to the end of the measurement.
Peak to Peak data	P–P 110.344dB	The data of processing target refer to data handled from the start to the end of the measurement.
Average value of data	AVERAGE -23.678dBm	The data of processing target refer to data handled from the start to the end of the measurement.
Data No.	D–No. 321	Data to be displayed in the seven segments.

The measurement data recorded is displayed in the seven segments when the data No. is displayed on the message display.

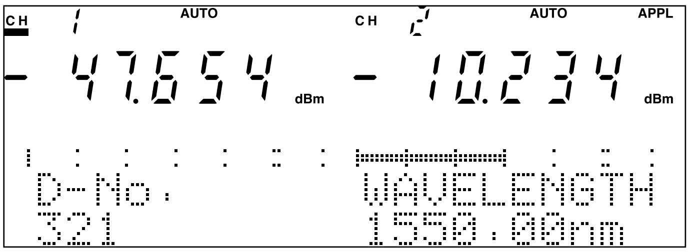
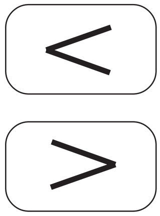


Fig. 4-35 Recording and Measurement Aborting Screen

4.2.19 Viewing Parameter

The details of the parameters set can be viewed (confirmed) without switching the mode to parameter setting.



Operations	Remarks
Press the ← or → key.	Pressing the key enables selection of the item to be viewed.

Pressing the → key causes the display to switch as follows.

WAVELENGTH (FREQUENCY) → RANGE → REF DATA → CAL FACTOR → AVERAGE →MOD FREQ → INTERVAL → BANDWIDTH → WAVELENGTH (FREQUENCY)

Pressing the ← key causes the setting to switch in the order reverse to above.

Point

Pressing the Prmtr key after checking the contents by parameter viewing causes the mode to switch to the setting status of the parameter viewed. As pressing the Prmtr key causes setting items of selection target to switch only in one direction, when the item of setting target is passed, it becomes necessary to make another round of setting items to come to the item of setting target. However, as the parameter viewing function enables switching of setting items in the other direction as well, it is possible to more quickly move to the item of setting target.

4.3 Light Source Operations

4.3.1 Switching Channels

Before setting parameters on the Device, it is necessary to first specify the unit to constitute the target of parameter setting.

Chan

Operations	Remarks
Press the Chan key.	Continue pressing the key until the display switches to the target channel.

[When two light sources are mounted]

Every time the key is pressed, the channels switch in the following order.

CH1 → CH2 → CH1 & CH2 → CH1

The channel selected is displayed with an underline.

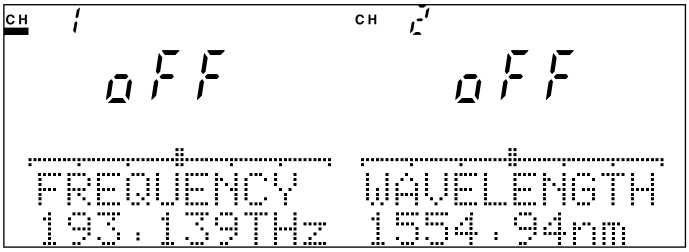


Fig. 4-36 CH1 Setting Screen

Point

When setting parameters for CH1 & CH2 is attempted, the setting is first performed for CH1 and only when the same setting is allowed for CH2, the same setting is performed for CH2. For this reason, even when the channel is set to CH1 & CH2, the two channels are not always set at the same time.

[Cases other than above]

Every time the key is pressed, the channels switch in the following order.

CH1 → CH2 → CH1

The channel selected is displayed with an underline.

Point

If the power source is turned ON when a unit is mounted only on one of the channels, CH1 or CH2, the channel where the unit is mounted is selected.
The message display, “NO UNIT,” will be indicated on the side of the channel where no unit is mounted.
Switching channels is still enabled even when a unit is mounted only on one of the channels, CH1 or CH2. However, attempting to set parameters for the channel where no unit is mounted will result in an error.

4.3.2 Optical Output ON/OFF

The optical output is set ON or OFF. The illuminated key is located on the front panel of the unit.

Opt.On

(* Front of the unit)

Operations	Remarks
Press the Opt. On key.	

Every time the key is pressed, the mode switches ON and OFF alternately. When the mode is set ON, “on” is indicated in the seven segments. On the other hand, when the mode is set OFF, “oFF” is indicated in the seven segments.
When the light is output, the key remains lit. Even when the mode is set ON, if a safety device such as remote interlock is working to shade light, the key flickers.
When the mode is set OFF, the key is unlit.

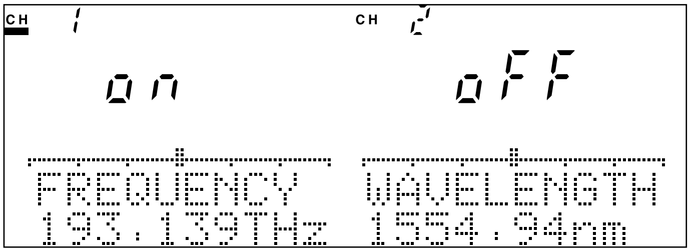


Fig. 4-37 Optical Output ON/OFF Screen

Point

The Device incorporates the remote interlock connector and optical output modifier key as light safety devices to be used when the light source is used. Unless the remote interlock connector is in the state of short circuit or the optical output modifier switch is ON, no light will be output even if the optical output key is switched ON.
See “3.5 Connection of Remote Interlock Connector” for more information on how to use the remote interlock connector.

4.3.3 Setting Radiation Frequency (Wavelength)

λ

For a light source with optical frequency (wavelength) variable function, frequency or wavelength can vary within the range defined in the specification, using the center optical frequency (wavelength) as the reference. The setting can be done by the representation unit set by "4.3.8 Switching Representation Unit (Optical Frequency/Wavelength)."
The optical frequency or wavelength displayed when the representation unit is changed is a guideline. When an absolute value is required, check the value by the light wavelength indicator or optical spectrum analyzer.
For a switchable light source, the output optical frequency (wavelength) can be switched.

[When a light source has the optical frequency (wavelength) variable function]

1) Setting of the output optical frequency (wavelength)

Operations	Remarks
Press the λ key.	
Press the ← or → key.	Pressing the key enables selection of the input digit.
Press the ↑ or ↓ key.	Pressing the key enables setting of the numerical value.
Press the Enter key.	Pressing this key establishes the setting.

A numerical character constituting one of the digits of the output optical frequency ("193.139 THz" in the case of Fig. 4-38) or the output wavelength ("1552.19 nm" in the case of Fig. 4-39) shown on the message display flickers to signify that it is currently being set. The numerical character constituting the flickering digit can be changed by pressing the ↑ or ↓ key. Moreover, the flickering digit (the digit allowed to be input) can be changed by pressing the ← or → key.

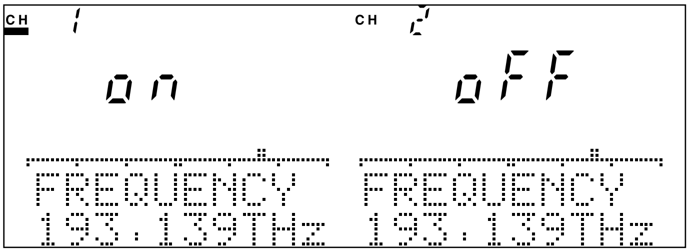


Fig. 4-38 Output Optical Frequency Setting Screen

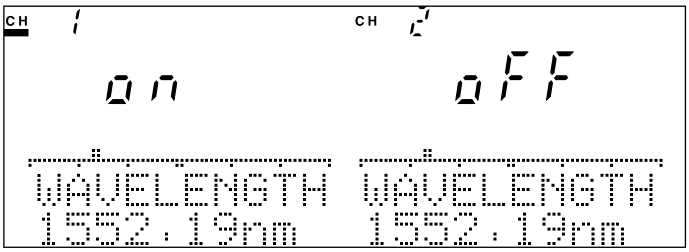


Fig. 4-39 Output Wavelength Setting Screen

Point

The deviation from the center optical frequency can be readily detected from the bar graph.
The center of bar graph indicates the center optical frequency (wavelength). Both sides of bar graph indicate the maximum variable range. Moreover, the bar graph moves to the right when the value becomes greater and to the left when the value becomes smaller for both the optical frequency and wavelength representations.
The optical frequency (wavelength) setting has already been modified without pressing the Enter key. However, as the message display continues to flicker, it is recommended to press the Enter key to establish the setting and terminate the setting mode.

2) Returning to the center optical frequency (wavelength)

Operations	Remarks
Press the λ key.	Every time you press the key, the selection is switched between the center optical frequency (wavelength) and the optical frequency (wavelength) currently set.

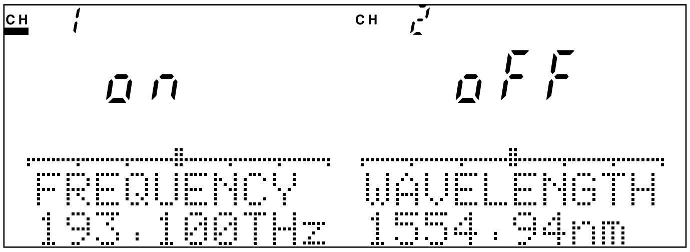


Fig. 4-40 Center Optical Frequency Representation Screen

[Switchable light source]

1) Switch the output optical frequency (wavelength)

Operations	Remarks
Press the λ key.	The output optical frequency (wavelength) in the message display is switched. Select the optical frequency (wavelength) to be output.
Press the Enter key	The setting is determined.

Point

The optical frequency (wavelength) setting has already been modified without pressing the Enter key. However, as the message display continues to flicker, it is recommended to press the Enter key to establish the setting and terminate the setting mode.

4.3.4 Setting Optical Modulation Mode

The mode can be switched between continuous light output and modulated light output.

Prmtr

1) Modulation mode ON (Modulation frequency setting)

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the “PRMTR” indication to light up at the top of the indicator. Continue pressing the key until “MOD FREQ” is indicated.
Press the Select key.	Pressing this key causes “MOD xxx (frequency)” to be displayed.
Press the ↑ or ↓ key.	Pressing the key enables setting of the frequency.
Press the Enter key.	Pressing this key establishes the setting.

The modulation frequency can be selected from 270 Hz, 1 kHz and 2 kHz. When the modulation output is set, the “MOD” indication at the top of the indicator will light up.

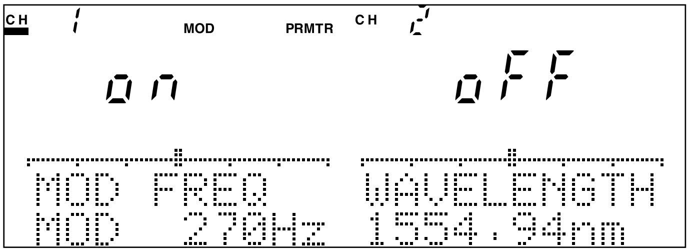


Fig. 4-41 Modulation Mode ON Screen

2) Modulation mode OFF

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the “PRMTR” indication to light up at the top of the indicator. Continue pressing the key until “MOD FREQ” is indicated.
Press the Select key.	Pressing this key causes “CW” to be displayed.
Press the Enter key.	Pressing this key establishes the setting.

When the modulation output is not set, the “MOD” indication at the top of the indicator is unlit.

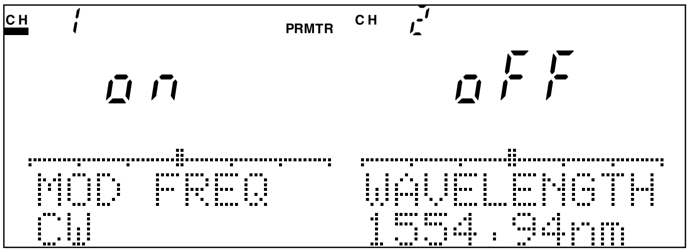


Fig. 4-42 Modulation Mode OFF Screen

Point

The optical modulation mode setting has already been modified without pressing the Enter key. However, as the message display remains flickering, it is recommended to press the Enter key to establish the setting and terminate the setting mode.

4.3.5 Setting ATT

The light source incorporates an attenuator function, which can be set in the range between 0.00 dB and 6.00 dB. The resolution is set at 0.01 dB.

Prmtr

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the “PRMTR” indication to light up at the top of the indicator. Continue pressing the key until “ATT” is indicated.
Press the ← or → key.	Pressing the key enables selection of the input digit.
Press the ↑ or ↓ key.	Pressing the key enables setting of the numerical value.
Press the Enter key.	Pressing this key establishes the setting.

A numerical character constituting one of the digits of the attenuator value shown on the message display flickers to signify that it is currently being set. The numerical character constituting the flickering digit can be changed by pressing the ↑ or ↓ key. Moreover, the flickering digit (the digit allowed to be input) can be changed by pressing the ← or → key.

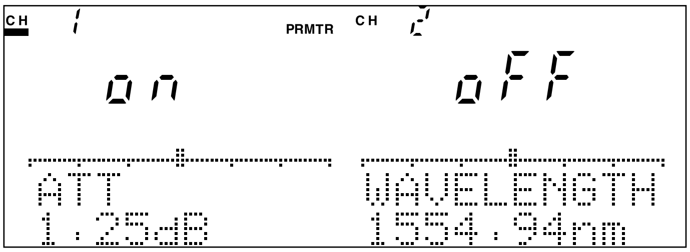


Fig. 4-43 ATT Setting Screen

Point

The magnitude of attenuation set by the ATT setting function is merely a guideline and therefore does not guarantee absolute accuracy. Moreover, as this function adjusts the magnitude of attenuation by varying the electric current that drives the LD element, this may cause deviation in the output optical frequency (wavelength). If an absolute magnitude of attenuation is required, use the optical attenuator separately.
The ATT setting has already been modified without pressing the Enter key. However, as the message display remains flickering, it is recommended to press the Enter key to establish the setting and terminate the setting mode.

4.3.6 Clone Function

When two light sources of the same model name are used, the setting for one of the unit can be copied to make entirely the same setting for the other unit.

Appl

1) Execution of the cloning function

Operations	Remarks
Press the Appl key.	Pressing this key causes the “APPL” indication to light up at the top of the indicator. Continue pressing the key until “CLONE” is indicated on the message display.
Press the Select key.	Pressing this key enables selection of the copying direction.
Press the Enter key.	

The copying direction switches as follows, every time the Select key is pressed.

CH1 → CH2: Copy the setting of channel 1 to channel 2

CH2 → CH1: Copy the setting of channel 2 to channel 1

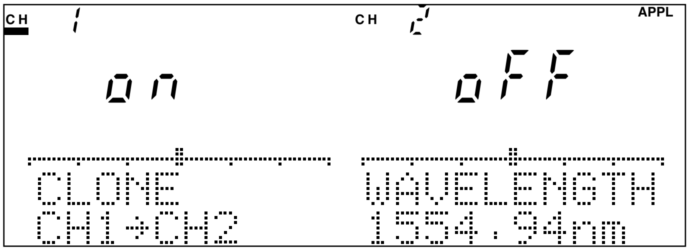


Fig. 4-44 Clone Function Screen

Point

This function can be executed regardless of the channel setting.

2) Aborting of the cloning function

Operations	Remarks
Press the dBm W key.	

4

Operation

4.3.7 Recording and Reading Measurement Conditions

The measurement conditions (parameter setting) currently used can be stored in memory. Moreover, the measurement conditions recorded can be read out (set).

Appl

1) Recording of the measurement conditions

Operations	Remarks
Press the Appl key.	Pressing this key causes the “APPL” indication to light up at the top of the indicator. Continue pressing the key until “SAVE PRMTR” is indicated on the message display.
Press the ↑ or ↓ key.	Pressing the key enables selection of the memory No.
Press the Enter key.	

The memory numbers that can be used for recording the measurement conditions are 1 to 9. A flickering number signifies that it is currently being set.

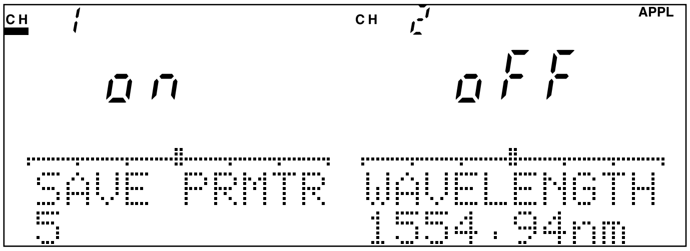


Fig. 4-45 Measurement Condition Recording Screen

Point

When recording of measurement is executed, no overwrite check is run. Pressing the Enter key means that the conditions will be written into memory unconditionally. Therefore, keep an important measurement condition separately.

2) Reading of measurement conditions

Operations	Remarks
Press the Appl key.	Pressing this key causes the “APPL” indication to light up at the top of the indicator. Continue pressing the key until “LOAD PRMTR” is indicated on the message display.
Press the ↑ or ↓ key.	Pressing the key enables selection of the memory No.
Press the Enter key.	

The memory numbers that can be used for reading the measurement conditions are 0 to 9. A flickering number signifies that it is currently being set. Memory number 0 is used to read the unit's default setting (setting at the time of shipment from factory).

Appendix C Default Setting

Memory numbers 1 to 9 are used to read measurement conditions recorded in the section of measurement condition recording.

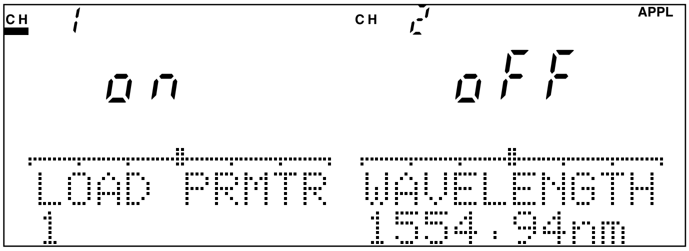


Fig. 4-46 Measurement Condition Reading Screen

Point

When reading of the measurement conditions is executed when a unit with a different model name to that of the unit used when the measurement conditions were recorded into Memory numbers 1 to 9, only parameters allowed to be set are set.
When a unit different to the unit used when the measurement conditions were recorded into Memory numbers 1 to 9 is used, attempting to execute reading of the measurement conditions will result in an error.

4.3.8 Switching Representation Unit (Optical Frequency/Wavelength)

Prmtr

The optical frequency or wavelength display is set in regard to “4.3.3 Setting Radiation Frequency (Wavelength).”

1) Setting of the optical frequency display

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the “PRMTR” indication to light up at the top of the indicator. Continue pressing the key until “DISP UNIT” is indicated on the message display.
Press the Select key.	Continue pressing the key until “FREQUENCY” is indicated on the message display.
Press the Enter key.	Pressing this key establishes the setting.

Every time the Select key is pressed, the mode switches between FREQUENCY and WAVELENGTH.

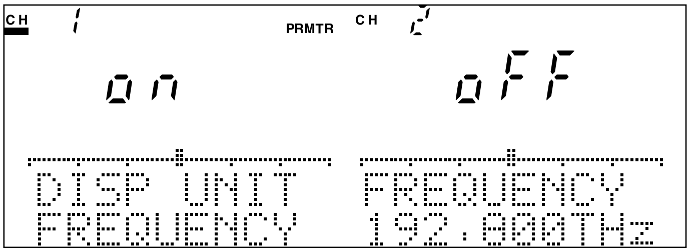


Fig. 4-47 Optical Frequency Display Setting Display

2) Setting of the wavelength display

Operations	Remarks
Press the Prmtr key.	Pressing this key causes the “PRMTR” indication to light up at the top of the indicator. Continue pressing the key until “DISP UNIT” is indicated on the message display.
Press the Select key.	Continue pressing the key until “WAVELENGTH” is indicated on the message display.
Press the Enter key.	Pressing this key establishes the setting.

Every time the Select key is pressed, the mode switches between WAVELENGTH and FREQUENCY.

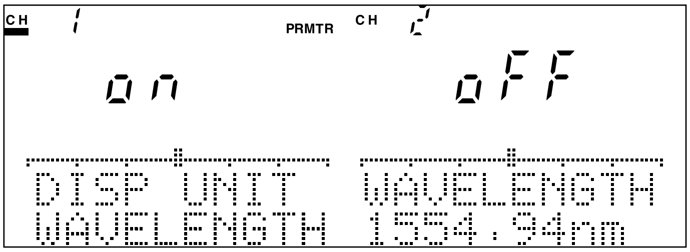


Fig. 4-48 Wavelength Display Setting Screen

Point

The representation unit has already been switched without pressing the Enter key. However, as the message display remains flickering, it is recommended to press the Enter key to establish the setting and terminate the setting mode.
The optical frequency and the wavelength are converted in accordance with the following formula.

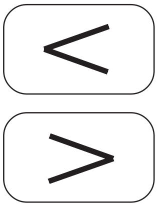
λ = c/f c=2.99792458X10^8m/s
(Light velocity under the vacuum state)

As the results of operations are displayed by rounding off the values that come below the digit displayed, the values converted from the optical frequency to the wavelength and from the wavelength to the optical frequency may not always match.

Example: 192.859THz → 1554.46nm
1554.46nm → 192.860THz

4.3.9 Viewing Parameter

The details of the parameters set can be viewed (confirmed) without switching the mode to parameter setting.



Operations	Remarks
Press the ← or → key.	Pressing the key enables selection of the item to be viewed.

Pressing the → key causes the display to switch as follows.

FREQUENCY (WAVELENGTH) → ATT → MOD FREQ → FREQUENCY (WAVELENGTH)

Pressing the ← key causes the display to switch in the order reverse to above.

Point

Pressing the Prmtr key after checking the contents by parameter viewing causes the mode to switch to the setting status of the parameter viewed. As pressing the Prmtr key causes setting items of selection target to switch only in one direction, when the item of setting target is passed, it becomes necessary to make another round of setting items to come to the item of setting target. However, as the parameter viewing function enables switching of setting items in the other direction as well, it is possible to more quickly move to the item of setting target.

4.4 System Setup

System
Shift + Prmtr

The system setting is designed to set basic items of MT9810B.
Therefore, it can be set regardless of the presence of a unit or the channel setting.

REMOTE INTERFACE,GPIB ADDRESS,
RS-232C BAUDRATE, RS-232C STOP BIT,
RS-232C PARITY BIT, RS-232C CHARACTER,
DISPLAY BRIGHTNESS, BUZZER, DATE,TIME

4.4.1 Setting Remote Interface

The Device incorporates GPIB and RS-232C as remote interfaces. It is necessary to preset the interface to be used.

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the System (Prmtr) key.	Pressing this key causes the “SYS” indication to light up at the top of the indicator. Continue pressing the key until “REMOTE INTERFACE” is indicated on the message display.
Press the Select key.	Pressing this key enables selection of the interface to be used.
Press the Enter key.	Pressing this key establishes the setting.

Every time the Select key is pressed, the mode switches between GPIB and RS-232C.

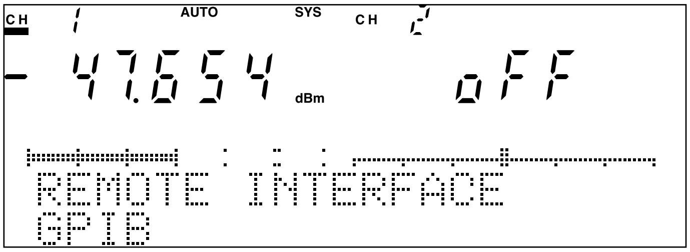


Fig. 4-49 Remote Interface Setting Screen

Point

Even when the interface system on the message display is modified by pressing the Select key, the setting has not been changed yet in this state. Make sure to press the Enter key without fail to establish the setting and terminate the setting status.

4.4.2 Setting GPIB Address

This function is designed to set the address when the GPIB is specified as the remote interface.

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the System (Prmtr) key.	Pressing this key causes the “SYS” indication to light up at the top of the indicator. Continue pressing the key until “GPIB ADDRESS” is indicated on the message display.
Press the ↑ or ↓ key.	Pressing the key enables selection of the address.
Press the Enter key.	Pressing this key establishes the setting.

The GPIB address can be set within the range between 0 and 30. The flickering numerical value signifies that it is currently being set.

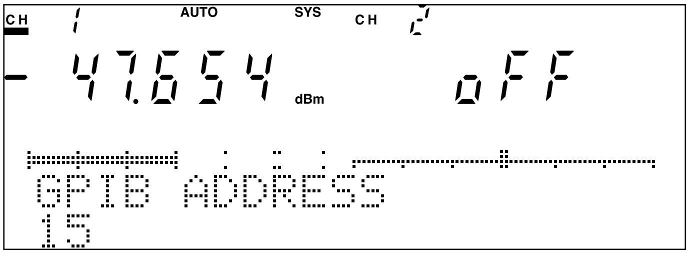


Fig. 4-50 GPIB Address Setting Screen

Point

Even when the GPIB address on the message display is modified by pressing the ↑ or ↓ key, the setting has not been changed yet in this state. Make sure to press the Enter key without fail to establish the setting and terminate the setting status.

4.4.3 Setting RS-232C Baud Rate

This function is designed to set the baud rate when the RS-232C is specified as the remote interface.

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the System (Prmtr) key.	Pressing this key causes the “SYS” indication to light up at the top of the indicator. Continue pressing the key until “RS-232C BAUDRATE” is indicated on the message display.
Press the Select key.	Pressing this key enables selection of the baud rate to be used.
Press the Enter key.	Pressing this key establishes the setting.

The baud rate can be selected from 1200 bps, 2400 bps, 4800 bps, 9600 bps, 14400 bps and 19200 bps.

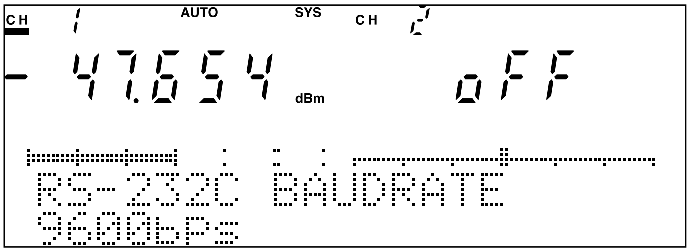


Fig. 4-51 RS-232C Baud Rate Setting Screen

Point

Even when the RS-232C baud rate on the message display is modified by pressing the Select key, the setting has not been changed yet in this state. Make sure to press the Enter key without fail to establish the setting and terminate the setting status.

4.4.4 Setting RS-232C Stop Bit

This function is designed to set the stop bit when RS-232C is specified as the remote interface.

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the System (Prmtr) key.	Pressing this key causes the “SYS” indication to light up at the top of the indicator. Continue pressing the key until “RS-232C STOP BIT” is indicated on the message display.
Press the Select key.	Pressing this key enables selection of the stop bit to be used.
Press the Enter key.	Pressing this key establishes the setting.

Every time the Select key is pressed, the baud rate switches as follows:
1 → 2 → 1

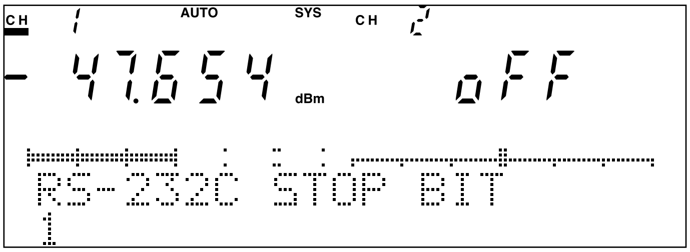


Fig. 4-52 RS-232C Stop Bit Setting Screen

Point

Even when the RS-232C stop bit on the message display is modified by pressing the Select key, the setting has not been changed yet in this state. Make sure to press the Enter key without fail to establish the setting and terminate the setting status.

4.4.5 Setting RS-232C Parity Bit

This function is designed to set the parity bit when the RS-232C is specified as the remote interface.

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the System (Prmtr) key.	Pressing this key causes the "SYS" indication to light up at the top of the indicator. Continue pressing the key until "RS-232C PARITY BIT" is indicated on the message display.
Press the Select key.	Pressing this key enables selection of the parity bit to be used.
Press the Enter key.	Pressing this key establishes the setting.

The parity bit can be selected from ODD, EVEN or NONE.

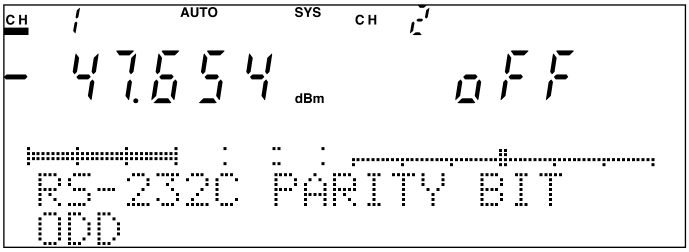


Fig. 4-53 RS-232C Parity Bit Setting Screen

Point

Even when the RS-232C parity bit on the message display is modified by pressing the Select key, the setting has not been changed yet in this state. Make sure to press the Enter key without fail to establish the setting and terminate the setting status.

4.4.6 Setting RS-232C Character Length

This function is designed to set the character length when RS-232C is specified as the remote interface.

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the System (Prmtr) key.	Pressing this key causes the "SYS" indication to light up at the top of the indicator. Continue pressing the key until "RS-232C CHARACTER" is indicated on the message display.
Press the Select key.	Pressing this key enables selection of the character length to be used.
Press the Enter key.	Pressing this key establishes the setting.

Every time the Select key is pressed, the character length switches as follows: 7 → 8 → 7

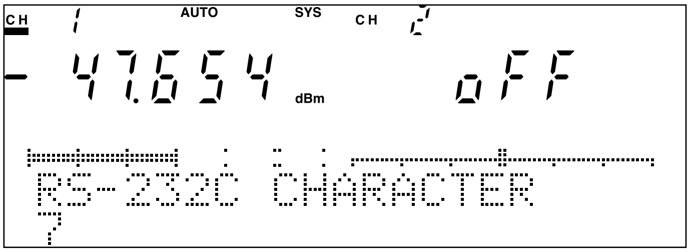


Fig. 4-54 RS-232C Character Length Setting Screen

Point

Even when the RS-232C character length on the message display is modified by pressing the Select key, the setting has not been changed yet in this state. Make sure to press the Enter key without fail to establish the setting and terminate the setting status.

4.4.7 Setting Indicator Luminance

This function is designed to set the luminance of the indicator.

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the System (Prmtr) key.	Pressing this key causes the "SYS" indication to light up at the top of the indicator. Continue pressing the key until "DISPLAY BRIGHTNESS" is indicated on the message display.
Press the ↑ or ↓ key.	Pressing the key enables selection of luminance intended.
Press the Enter key.	Pressing this key establishes the setting.

The indicator luminance can be set in ten steps.

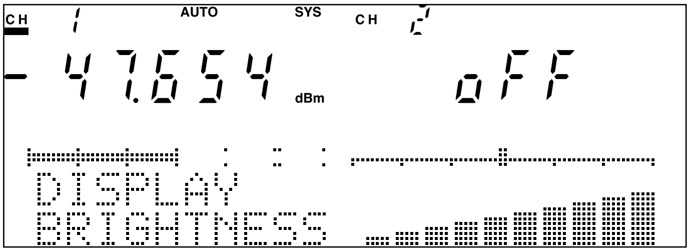


Fig. 4-55 Indicator Luminance Setting Screen

Point

The indicator of the Device uses a fluorescent character display tube. If the luminance of the indicator is constantly kept high, this may cause slight unevenness in display (uneven luminance). It is recommended that the display is used with its luminance slightly reduced.
Pressing the ↑ or ↓ key causes the luminance of the indicator to temporarily change. However, as the modification in the setting has not been established in this state, pressing another key without pressing the Enter key causes the luminance to return to the original setting. Make sure to press the Enter key without fail to establish the setting and terminate the setting status.

4.4.8 Setting Buzzer

This function is designed to set the sound volume of the buzzer to blow when an operation errs.

1) Setting of the sound volume of the buzzer

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the System (Prmtr) key.	Pressing this key causes the "SYS" indication to light up at the top of the indicator. Continue pressing the key until "BUZZER" is indicated on the message display.
Press the ↑ or ↓ key.	Pressing the key enables selection of the sound volume intended.
Press the Enter key.	Pressing this key establishes the setting.

The sound volume of the buzzer can be set in four steps.

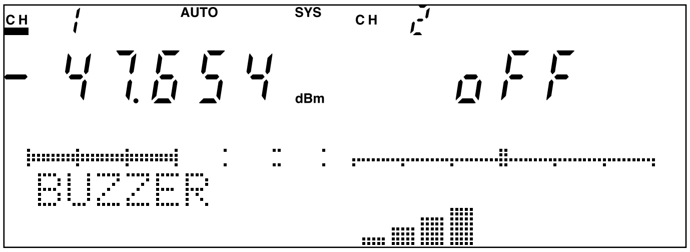


Fig. 4-56 Screen to Set Sound Volume of Buzzer

2) Setting of not blowing the buzzer

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the System (Prmtr) key.	Pressing this key causes the "SYS" indication to light up at the top of the indicator. Continue pressing the key until "BUZZER" is indicated on the message display.
Press the ↓ key.	Continue pressing the key until "OFF" is displayed.
Press the Enter key.	Pressing this key establishes the setting.

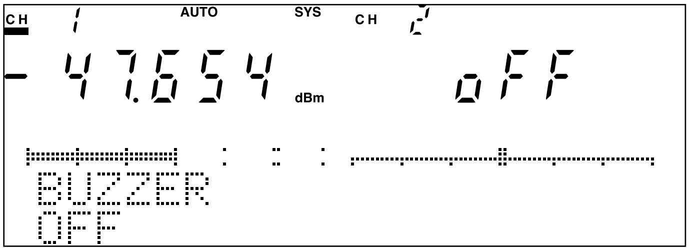


Fig. 4-57 Buzzer OFF Setting Screen

Point

Note that if the sound volume of the buzzer is set OFF, the buzzer will not blow when an operation error.
Even when the sound volume of the buzzer on the message display is modified by pressing the ↑ or ↓ key, the setting has not been changed yet in this state. Make sure to press the Enter key without fail to establish the setting and terminate the setting status.

4
Operation

4.4.9 Setting Date

This function is designed to set a date in the calendar function incorporated in the Device.

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the System (Prmtr) key.	Pressing this key causes the "SYS" indication to light up at the top of the indicator. Continue pressing the key until "DATE YY/MM/DD" is indicated on the message display.
Press the ← or → key.	Pressing the key enables selection of the input item.
Press the ↑ or ↓ key.	Pressing the key enables setting of the numerical value.
Press the Enter key.	Pressing this key establishes the setting.

The input items are

Year (YY) : The last two digits of the western calendar year
Month (MM) : Two digit numerical value
Day (DD) : Two digit numerical value

The items allowed to be input flicker and are selected by pressing the ← or → key. Trying to set a value that does not exist (such as February 30th) will result in an error.

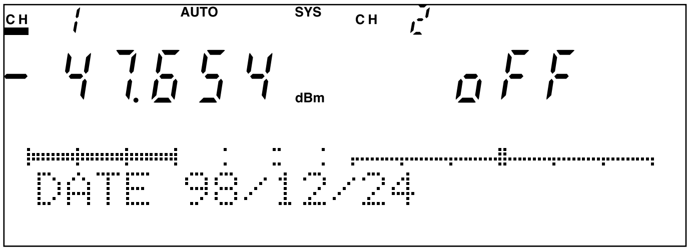


Fig. 4-58 Date Setting Screen

Point

The figure on the first digit only can be changed for the year, month and date. Set the second digit by carrying a digit to the second digit or bringing down a digit from the second digit.
Even when the date on the message display is modified by pressing the ↑ or ↓ key, the setting has not been changed yet in this state. Make sure to press the Enter key without fail to establish the setting and terminate the setting status.

4.4.10 Setting Time

This function is designed to set the time in the clock function incorporated in the Device.

Operations	Remarks
Press the Shift key.	Pressing this key causes the key to light up to switch into the Shift status.
Press the System (Prmtr) key.	Pressing this key causes the "SYS" indication to light up at the top of the indicator. Continue pressing the key until "TIME HH:MM:SS" is indicated on the message display.
Press the ← or → key.	Pressing the key enables selection of the input item.
Press the ↑ or ↓ key.	Pressing the key enables setting of the numerical value.
Press the Enter key.	Pressing this key establishes the setting.

The input items are

Hour (HH) : Two digit numerical value
Minute (MM) : Two digit numerical value
Second (SS) : Two digit numerical value

The items allowed to be input flicker and are selected by pressing the ← or → key.

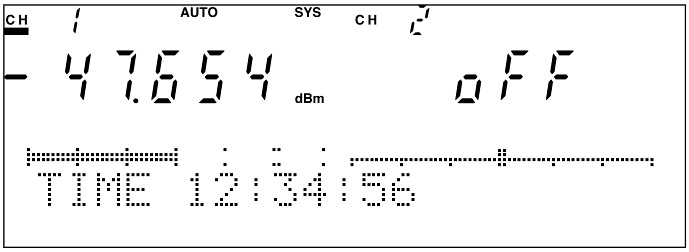


Fig. 4-59 Time Setting Screen

Point

The figure on the first digit only can be changed for the hour, minute and second. Set the second digit by carrying a digit to the second digit or bringing down a digit from the second digit.
Even when the time on the message display is modified by pressing the ↑ or ↓ key, the setting has not been changed yet in this state. Make sure to press the Enter key without fail to establish the setting and terminate the setting status.

4 Operation

Section 5 Performance Test and Calibration

This chapter provides explanations of the method to check the performance of the Device and each plug-in unit as well as the method to calibrate the measured values.

When the Device or each plug-in unit is found to fail to meet specifications given here through the performance test explained in this chapter, please contact one of the ANRITSU branches, local offices, operation offices or dealers listed in this manual which is located closest to you.

In case you ask for repair, first check the following points:

(1) Equipment name and serial number indicated on the back panel or the chassis

(2) State of the failure

(3) Name and contact number of the person in charge who will act as a liaison when we check with the state of the failure and when the repair is completed.

5.1 Optical Sensor Performance Test

Perform the five tests indicated below in order to check the performance of the optical sensor.

- Absolute level uncertainty
- Linearity between ranges
- Polarization dependability
- Reflection loss (only for MU931311A/1421A)
- Noise level

Clean the optical connector before starting the test.

☞ 6.1 Daily Care and Cleaning

Perform measurement after a sufficient time for warming up following power activation.

☞ Appendix A Specifications

Point

To record results of measurement, it is advised to copy the list of performance test result record of Appendix E at the end of this document or prepare a similar list to ensure convenience of recording.

Measuring instruments necessary for the test

- Optical attenuator
  - Wavelength : 1.1 - 1.65 µm
  - Maximum magnitude of attenuation : 60 dB or more
  - Maximum optical input level : +18 dBm or more
- Light source
  - Optical output : +10 ±1dBm
  - Stability : 0.005 dB or less
- Reference device
  - Uncertainty : ±1.1% (Power level -10 dBm, Wavelength 1310 or 1550 nm)

Main measuring instruments necessary for the absolute level accuracy/ cross-range linearity test when the high-power type optical sensor (MA9331A) is used.

- Optical attenuator
  - Wavelength : 1.1 to 1.65 µm
  - Maximum attenuation amount : 60 dB or more
  - Maximum optical input level : +35 dB or more
- Optical switch
  - Switching reproducibility : 0.02 dB or less
  - Maximum optical input level : +35 dB or more
- Light source
  - Optical signal output : +35 dB or more
  - Stability : ±0.01 dB
- Reference device
  - Uncertainty : ±2%
  - Linearity : ±0.02 dB

WARNING ⚠

For MA9331A, the power of the light source required for this performance test, conforms to IEC 825-1 Class 4 and 21CFR1040.10 (FDA) Class IV of the laser safety standards.
For the performance test, confirm that the measurement environment satisfies the above safety standards.
For the measuring instruments to be used on the test, confirm the tolerance and reliability. If the tolerance is insufficient for the test; it may damage the instruments, resulting in raid and fire by the leakage of light from the damaged portion.

5.1.1 Absolute level uncertainty

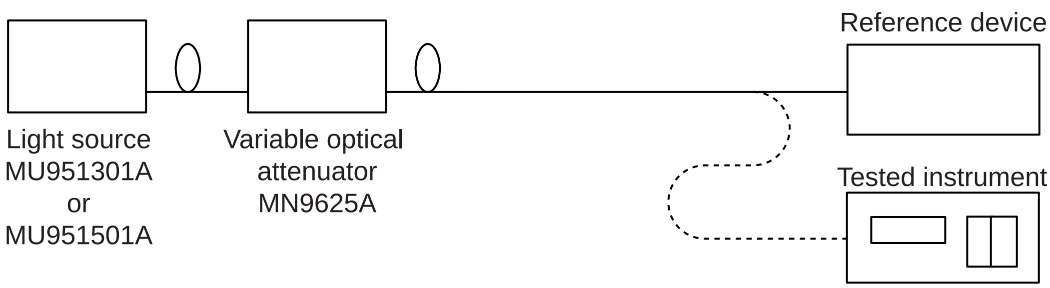


Fig. 5-1

1. Set up a measurement system as shown in Fig. 5-1.
2. Shade light and perform zero setting
3. Connect the optical fiber to the reference device and adjust the reference device to indicate -10 dBm.
4. Change the connection of the fiber from the reference device to the tested device and record the measurement value.

For the high-power type optical sensor (MA9331A/MU931431A)

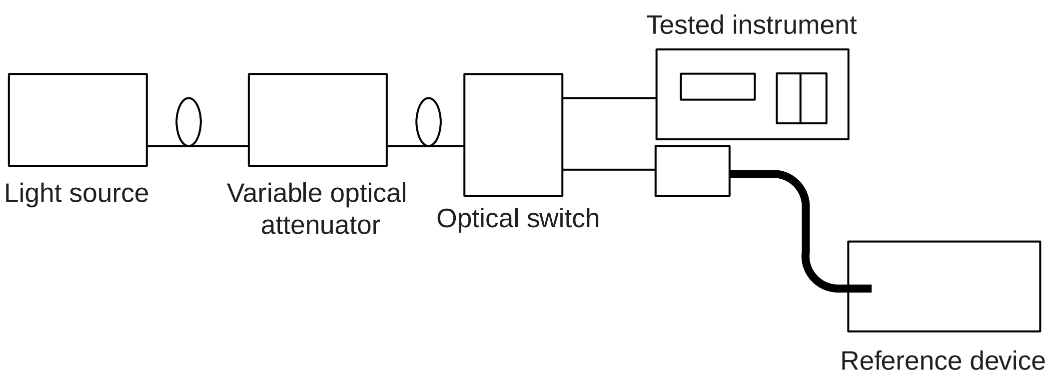


Fig. 5-2

1. Set up the measurement system as in Fig. 5-2.
2. Shade and perform the zero-setting operation.
3. Set the light source wavelength in the tested instrument. Offset the reference device if necessary and set the wavelength, calibration value, etc. necessary for the measurement.
4. Turn the switch to the reference device-side so that the display becomes +30 dBm.
5. Turn the switch to the optical sensor-side of the tested instrument and record the measured value.
6. Repeat the operation 4 to 5 five times and compare the average values.

5.1.2 Measurement of Linearity between Ranges

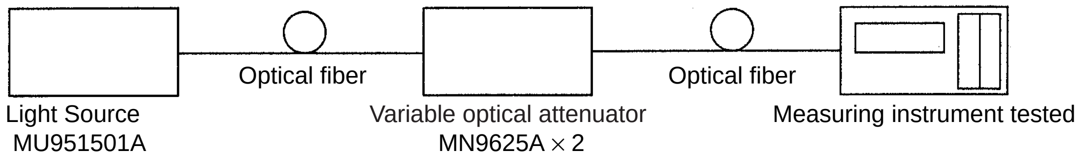


Fig. 5-3

1. Set up a measurement system like that shown in Fig. 5-3.
2. Shade light and perform zero setting.
3. Set the range of the measuring instrument to be tested to 10 dBm.
4. Adjust the optical attenuator so that the display of the measuring instrument to be tested comes to 0 dBm on the range.
5. Record the value measured (Measured value 1).
6. Lower the range of the measuring instrument being tested by a single step, and record the value measured (Measured value 2).
7. The value calculated by subtracting Measured value 2 from Measured value 1 is the deviation between the ranges.
8. Add another +10 dB to the optical attenuator and perform measurement procedures 5 to 7 until the range of the measuring instrument being tested reaches the minimum range.

For the high-power type optical sensor (MA9331A/MU931431A)

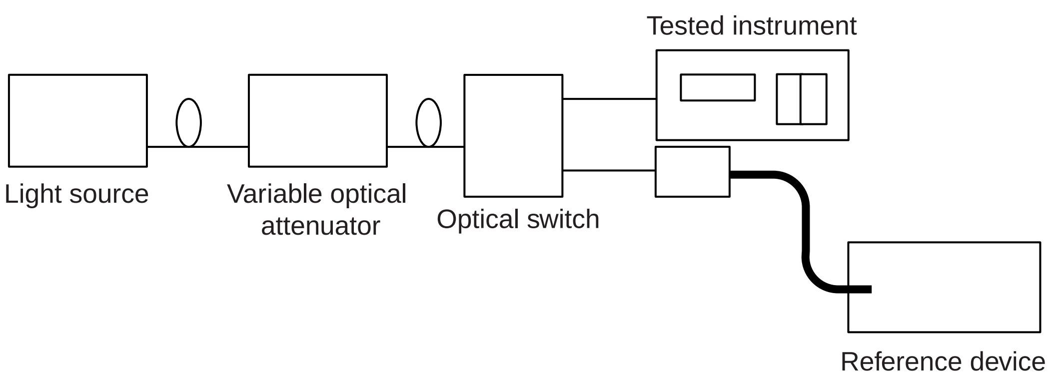


Fig. 5-4

1. Set up the measurement system as in Fig. 5-4.
2. Shade and perform the zero-setting operation.
3. Set the wavelength of light source in the tested instrument. Offset the reference device if necessary and set the wavelength and calibration value, etc. necessary for the measurement.
4. Turn the switch to the reference device-side so that its display becomes +33 dBm.
5. Turn the switch to the optical sensor-side of the tested instrument and record the measured value.
6. Repeat the operation 4 to 5 five times, assuming the average value of the reference device to be Power1 and that of the tested instrument to be Power2.
7. Turn the switch to the reference device-side so that its display becomes +30 dBm.
8. Perform the measurement for 6.
9. Repeat this operation every 10 dB up to –40 dBm.

5.1.3 Measurement of Polarization Dependability

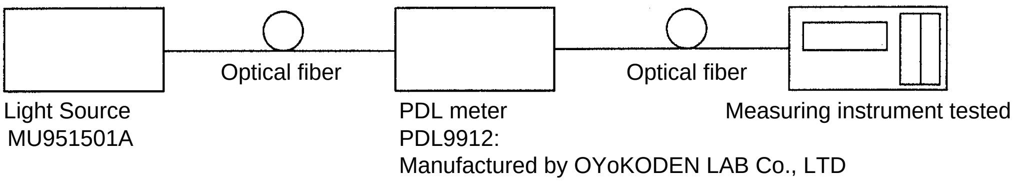


Fig. 5-5

1. Set up a measurement system like that shown in Fig. 5-5.
2. Shade light and perform zero setting.
3. Set the measuring instrument to be tested to the P-P measurement mode.
4. Rotate the plane of polarization at least by 360 degrees (a minimum of 30 seconds) and perform measurement by the PDL meter.
5. The P-P value registered after the completion of the measurement is the value of polarization dependability measured.

5.1.4 Measurement of Reflection Loss

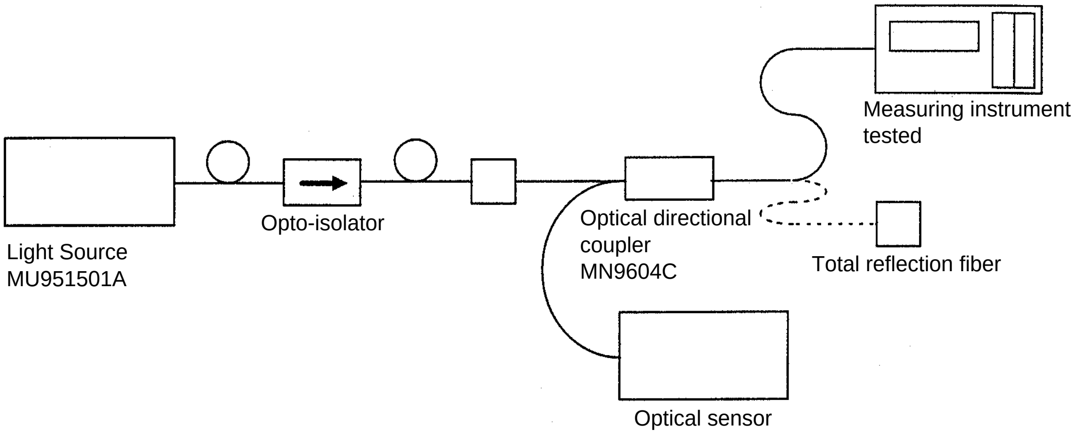


Fig. 5-6

1. Set up a measurement system as that shown in Fig. 5-6.
2. Inject light with the total reflection fiber installed.
3. Set the power meter to the relative measurement mode.
4. Connect the optical directional coupler to the measuring instrument to be tested from the total reflection fiber and perform measurement by the power meter.
5. The absolute value indicated on the power meter signifies the reflection loss.

5.1.5 Measurement of Noise Level

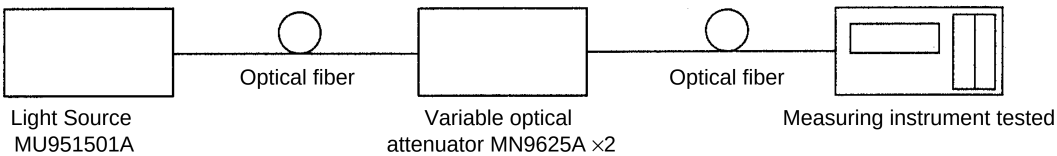


Fig. 5-7

1. Set up a measurement system like that shown in Fig. 5-7.
2. Set the bandwidth and averaging frequency of the measuring instrument to be tested to 1 Hz and 10 times, respectively.
3. Shade the light and perform zero setting.
4. Adjust the optical attenuator so that the display of the measuring instrument indicates -80 dBm.
5. Set the measuring instrument to be tested to the P-P measurement mode (% representation) and perform measurement for approximately 30 minutes.
6. The noise level can be calculated from the following formula, using the P-P value registered when the measurement is completed.

Formula : Noise level (dBm) = $-80+\log_{10}\{(100 - \text{measured value})/100\}$

5.2 Light Source Performance Test

Perform tests on two items shown below to check the performance of the light source.

- Optical output level
- Center optical frequency

Clean the optical connector before starting the test.

☞ 6.1 Daily Care and Cleaning

Perform measurement after a sufficient time for warming up following power activation.

☞ Appendix A Specifications

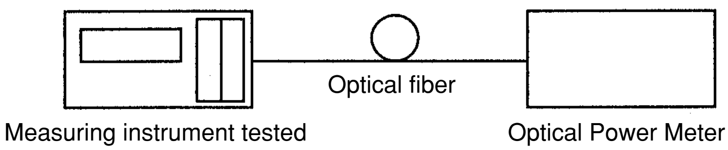
Point

To record results of measurement, it is advised to copy the list of performance test result record of Appendix E at the end of this document or prepare a similar list to ensure convenience of recording.

Measuring instruments necessary for the test

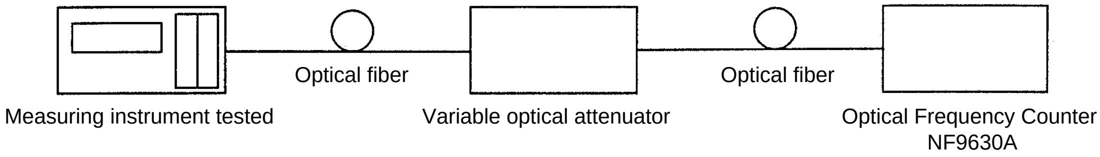
• Optical output level	Optical Power Meter MT9810B + MU931421A Wavelength: 0.75 - 1.7 *m*m Level: +10 dBm
• Center optical frequency	Optical Frequency Counter MF9630A Wavelength: 0.6 - 1.6 *m*m Measurement accuracy: ±0.5 ppm Resolution: 0.1 ppm (Max.)
• Center wavelength	Optical Spectrum Analyzer MS9710B Wavelength: 0.6 - 1.75 µm Wavelength accuracy: ±0.3 nm

5.2.1 Optical Output Level



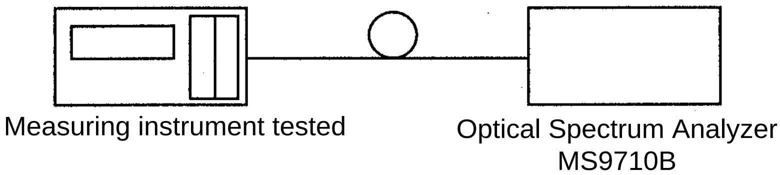
1. Set up a measurement system like that shown in the figure.
2. Set the optical output mode of the measuring instrument to be tested to the CW mode, and set ATT at 0 dB.
3. Set the measuring instrument to be tested to the center frequency.
4. Measure the optical output level by the optical power meter.
5. Check that the value measured comes within the specified level.

5.2.2 Center Optical Frequency



1. Set up a measurement system like that shown in the figure.
2. Set the optical output mode of the measuring instrument to be tested to the CW mode, and set ATT at 0 dB.
3. Set the measuring instrument to be tested to the center frequency.
4. Adjust the optical output to or below the maximum input level of the optical frequency indicator using the optical attenuator.
5. Measure the optical frequency by the optical frequency indicator.
6. Check that the value measured comes within the specified level.

5.2.3 Center Wavelength



1. Setup the measurement system as shown above.
2. Set the optical output mode of the device to be measured to the CW mode and set ATT = 0 dB.
3. Measure the center wavelength using an optical spectrum analyzer.
4. Confirm that the measured value is within the specification range.

5.3 Performance Test Results

5.3.1 Relation between Reference Value and Guard Band

The guard band is based on the idea that "the calibration value is insufficient in judging whether standards are met." Because measurement uncertainty always accompanies the calibration value, the standard value should include the uncertainty of the calibration value.
Therefore, the guard band should be set in a strict value taking into consideration the amount of uncertainty, this value should then be the reference for comparing with the calibration value.

5.3.2 How to Obtain Measurement Uncertainty

There are two types of measurement uncertainties.

(1) A type uncertainty (u_a): Uncertainty evaluated by statistical method

(2) B type uncertainty (u_b): Uncertainty evaluated by method other than statistical

Evaluation of A type uncertainty:

A series of measurement data are substituted for the next expression, and the uncertainty of the targeted element is evaluated. These are used to evaluate the difference, etc. of the measurement system.
Measure n times, and the value is obtained from the data of n pieces with the expression (1).

$$u_a = \frac{1}{n}\sqrt{\frac{\sum_{i=1}^{n}(X_i - X_m)^2}{n-1}} \quad \text{.................} (1)$$

n: Number of measurements X_i: i-th Measurement value

X_m: Average of measurement values

u_a shows the standard deviation of the difference between X_m and true value. The larger the number of measurement times n, the smaller the uncertainty.

Evaluation of B type uncertainty:

For the element of uncertainty that cannot be evaluated by a statistical technique like that of A type uncertainty, an individual element is substituted for the expression (2) and is assumed to be the evaluation of the B type uncertainty.

$$u_b = \sqrt{u_1^2 + u_2^2 + \cdots + u_n^2} \quad \text{..................} (2)$$

u_i: Uncertainty element evaluated by method other than statistical

5

Performance Test and Calibration

Evaluation of synthetic standard uncertainty:

The A type and B type uncertainty obtained with the expressions (1) and (2) are synthesized by the RSS (square root of sum of squares) method, and the uncertainty of synthetic standard (u_c) is obtained.

$$u_c = \sqrt{u_a^2 + u_b^2} \quad \text{.......................................} (3)$$

u_a: A type uncertainty u_b: B type uncertainty
u_c: Synthetic standard uncertainty

Evaluation of enhancement uncertainty:

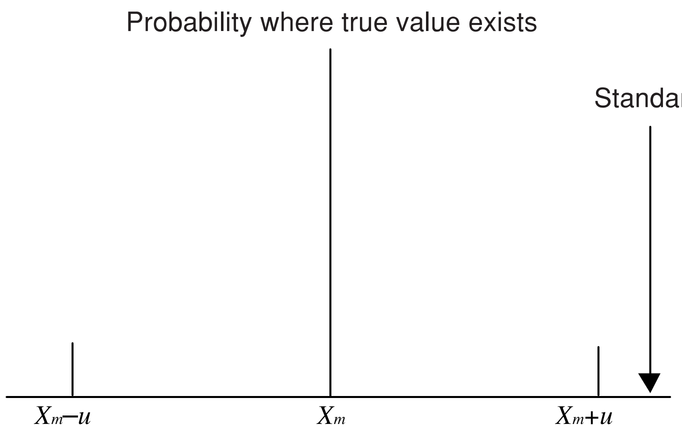
The enhancement uncertainty (u) is an amount to define the range expected to include most parts where the values that originate in the measurement objects, for the measurement results, are distributed.

It is obtained by multiplying inclusion coefficient (k) by the synthetic standard uncertainty (u_c).

$$u = k \times u_c \quad \text{...} (4)$$

k: Inclusion coefficient (when $k = 2$, reliability = 95%)

From X_m and u obtained from the measurement value of n pieces, true value exists in the range of $X_m - u$ and $X_m + u$ at the probability of 95%. If the difference between the standard of the measurement item and Xm is u or more, the probability that comes off the standard is 2.5% or less.



5.4 Calibration

To maintain the uncertainty of the measuring equipment, the calibration becomes important. Most calibrations are done by comparing the measurement result of a product with one of a standard.
Therefore, the uncertainty of the product is dependent on the quality of a standard.
This equipment is traceable in a national standard due to achieve a high uncertainty.
The uncertainty of this calibrated equipment might come off from the specifications according to the uncertainty of the equipment used as a standard when calibrating in the customer. To maintain a high uncertainty, the calibration is recommended to leave to our company.
Moreover, when this equipment is found to fail to meet the specifications through the performance tests described in Sec.5.1 and 5.2, it is necessary to repair or calibrate this. You are advised to contact right away one of the ANRITSU branches, local offices, operation offices, or dealers listed in this manual which is located closest to you.

Section 6 Maintenance and Re-Transportation

This chapter provides descriptions of matters that require attention in regard to daily care and cleaning and re-transportation and actions to be taken in the event of abnormalities.

6.1 Daily Care and Cleaning

6.1.1 External Stains

When external stains have grown conspicuous, when the Device was used in dusty location or before the Device is put to storage for a long time, lightly wipe the Device to remove stains with a cloth soaked with soapy water. Using thinner or benzene may cause damage to the coating.

Caution ⚠

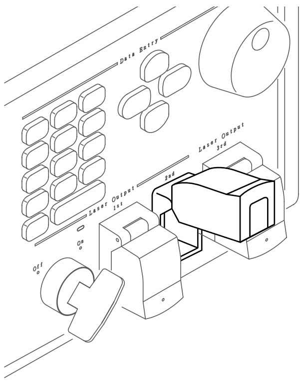
To wipe off stain with a cloth soaked with soapy water, first turn the power source of the Device OFF and pull out the power source cord from the power receptacle. Trying to perform operations without pulling the power source cord off from the power receptacle may cause electric shock.

6.1.2 Optical Connector & Optical Adapter Cleaning

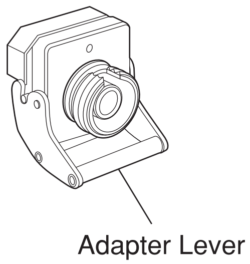
Cleaning built-in ferrule end-face

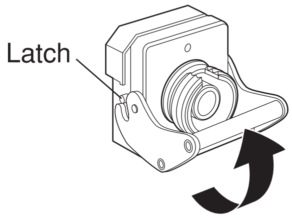
Use adapter cleaner supplies for this unit to clean the built-in optical I/O connector ferrule. Clean the ferrule periodically. An example of the FC adapter is described below. Follow similar methods and steps for cleaning other adapters.

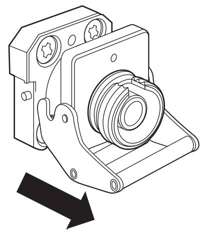
1) Open the connector cover.



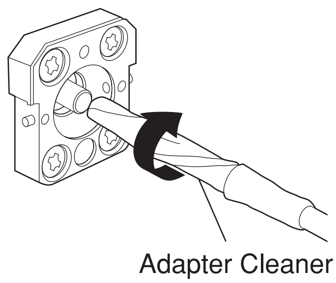
2) Pull the adapter lever up then gently pull the adapter out straight towards you after checking that the latch is released.



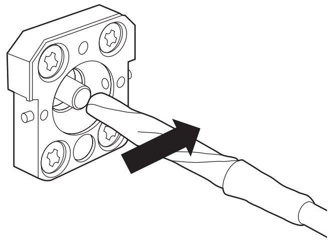




3) Clean by pressing the adapter cleaner which is soaked in alcohol to the ferrule end-face and side face.



4) Finish by pressing the tip of a new adapter cleaner without any alcohol on it to the ferrule end-face and wipe in one direction 2 or 3 times.



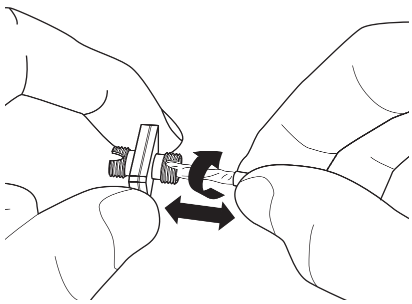
5) Clean the adapter interior with adapter cleaner.
(Refer to “Cleaning optical adapter” below.)

6) Attach the adapter using the steps in reverse order. Be careful not to scratch the ferrule end-face.

Cleaning optical adapter

Use adapter cleaner supplies for this unit to clean the optical adapter for connection to the fiber-optic cable. An example of the FC adapter is described below. Follow similar methods and steps for cleaning other adapters. In addition, clean the adapter which was removed to clean the built-in ferrule end-face using the following steps.

Insert the adapter cleaner to the split sleeve interior of the adapter then move it back and forth while rotating it in one direction.



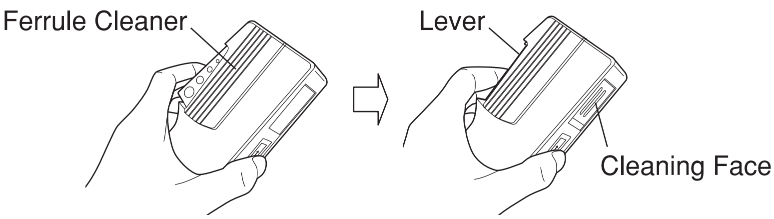
Note:

Check the ferrule radius. Use only a ϕ1.25 mm or ϕ2.5 mm dedicated adapter cleaner.

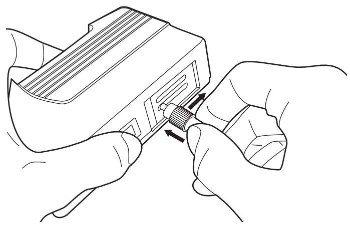
Cleaning the ferrule end-face of the fiber-optic cable

Use ferrule cleaner supplies for this device to clean the ferrule of the cable end. An example of the FC connector is described below. Follow similar methods and steps for cleaning other connectors.

1) Lift the ferrule cleaner lever to access the cleaning face.



2) Keep the lever in this position then press down the ferrule end-face of the optical connector on the cleaning face and rub in one direction.



Notes on cleaning

1) Do not clean with used adapter cleaner.
2) Do not finish clean with a cotton swab as cotton fibers may adhere to the surface.
3) Make sure to cap adapters that are not in use.

WARNING ⚠

Ensure that no light is emitted when cleaning or checking the ferrule end-face.

CAUTION ⚠

Performance may be degraded if used when dust or dirt is adhering to the ferrule end-face. In addition, the connected fiber-optic cable & ferrule end-face of this unit may burn out if high-output light is used in this state. Clean the connected fiber-optic cable and ferrule end-face of this device before performing measurements.

6.2 Matters Requiring Attention for Storage

Avoid storing the Device and the plug-in units in places such as those listed below.

- Places that experience temperatures of 70 °C or higher and of -20 °C or lower.
- Places exposed to direct sunlight
- Dusty places
- Places of high humidity that may cause condensation
- Places likely to be exposed to activated gases

6.3 Re-Transportation

Pay attention to the matters listed below to re-transport the Device and plug-in units.

- Use the packing materials used at the time of product purchase.
- As the products are classified as the precision electronic equipment, instruct the carrier that “wetting” and “throwing away” of the products is strictly prohibited during transportation.

Take the following actions in case packing materials used at the time of purchase are lost.

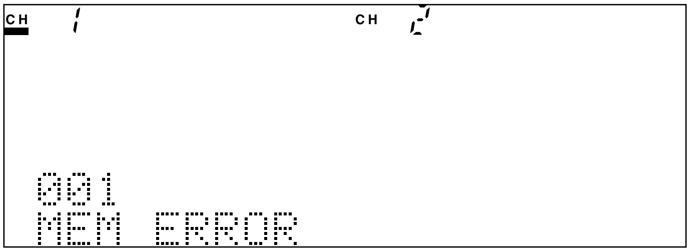
1) Make air cell mat (air cap sheet) or sheet with equivalent cushioning effects available.
2) Wrap the entire Device or plug-in unit with the sheet.
3) Make available a solid packing carton such as cardboard, wooden and aluminum boxes with between 10 and 15 cm margins in all directions over the size of the product wrapped in sheet, and fill cushioning material between 10 and 15 cm thick at the bottom of the box.
4) Put the Device or the plug-in unit packed in sheet into the box and fill cushioning material around it.
5) Pack the carton box fast with string, tape or belt.

6.4 Error Indication in Self Diagnostics

Activating power automatically triggers testing of the Device, and when an abnormality is detected, an error message is displayed.

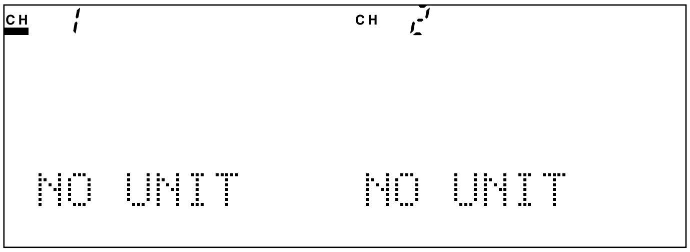
Main unit memory error

When a message such as that shown below is displayed, activate power again. If the message is still displayed, please contact ANRITSU.



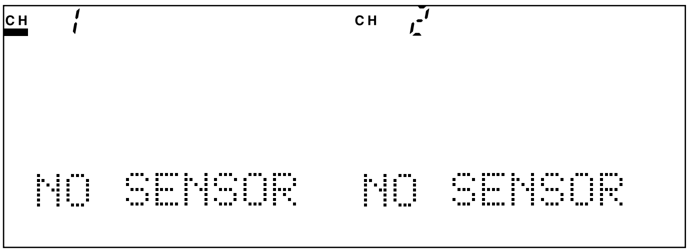
NO UNIT

When a message such as that shown below is displayed, check whether the plug-in unit is installed correctly and activate power again.
If the message is still displayed, please contact ANRITSU.



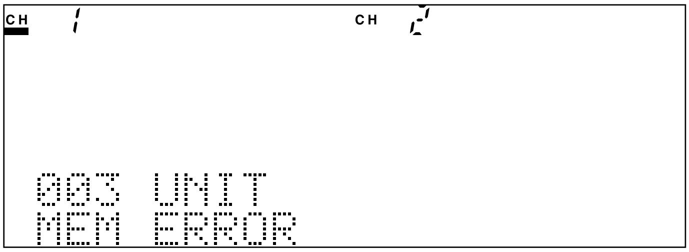
NO SENSOR

When a message such as that shown below is displayed, check whether the sensor adapter unit is installed correctly and activate power again.
If the message is still displayed, please contact ANRITSU.



Unit memory error

When a message such as that shown below is displayed, check whether the plug-in unit is installed correctly and activate power again. If the message is still displayed, please contact ANRITSU .



6.5 Troubleshooting

6.5.1 Common Items

Phenomenon	Possible cause	Action
Power is not activated.	The power switch is not properly pressed.	Press the power switch properly.
	The AC power source inlet and power source cord are not properly connected, or the power source cord and power receptacle are not properly connected.	Connect the AC power source inlet, power source cord and power receptacle properly.
	The fuse has been blown.	Replace the fuse. 3.11 Replacement of Fuse
The self check does not end even when at least a minute has elapsed after the power source is turned ON.		First turn the power source OFF and turn it ON again. If the unit still switches in the same state, turn the power source OFF promptly and contact the service center.
Even when the power source is turned ON, no indication appears on the display or the display remains dark.	The indicator is set at a reduced luminance level.	Reset the luminance to a level to make the display readily visible.
	The display is set OFF by remote control.	Set the display ON.
	The display circuit is broken.	First turn the power source OFF and turn it ON again. If no indication appears during the self check, turn the power source OFF promptly and contact the service center.
The optical fiber cable cannot be connected.	The shapes of the optical fiber cable and connector are different.	Use a connector of a correct shape. 3.10 Replacement of Optical Connector
	The directions of insertion (such as the position of the pawl) of the optical fiber cable and connector are different	Check the position and direction of the pawl.
GPIB and RS-232C do not work.	The GPIB and RS-232C cables are not properly connected.	Connect the GPIB and RS-232C cables properly.
	The RS-232C cable type is wrong.	Use the cross cable as the RS-232C cable. Remote Control Operation Manual
	The GPIB and RS-232C interface setting (selection) is not correct.	Set the GPIB and RS232C interfaces correctly.
	The GPIB address setting is wrong.	Set the correct GPIB address.
	The RS-232C setting conditions are wrong.	Set the correct RS-232C setting condi tions.

6.5.2 Optical Sensor

Phenomenon	Possible cause	Action
The measured value is low.	The settings of the measuring beam and calibrated wavelength are different.	Set the setting of the calibrated wave length to that of the wavelength of the measuring beam.
	As light of high power level was entered while the connector remains stained, the ferrule burned out.	Clean the end face of the fiber cable or the connector. 6.1 Daily Care and Cleaning If the problem remains unsolved, repair will be necessary. In this case, contact the service center.
	The end face of the fiber cable or the connector is stained.	Clean the end face of the fiber cable and connector. 6.1 Daily Care and Cleaning
The measured values do not stability.	The modulated light is measured in the CW setting.	Set the mode to the modulation mode to measure modulated light and also set the modulation frequency correctly.
The numerical values displayed are slow to change.	The time set for measurement interval is long.	Set a shorter time for measurement interval.
The indication does not change even if light is input.	The CW light is measured in the modulation mode setting.	Set the mode to the CW mode to measure CW light.
Zero setting will not end.	The ambient temperature is high.	When the ambient temperature is high, processing takes longer. Please wait until the processing ends.
	Shading of light is insufficient.	Affix the metallic light shading cap on the front panel properly and perform zero setting.
Zero setting results in error.	Shading of light is insufficient.	Affix the metallic light shading cap on the front panel properly and perform zero setting.

6.5.3 Light Source

Phenomenon	Possible cause	Action
The output power is low.	The mode is set to ATT.	Set the ATT to 0.00 dB.
	The end face of the fiber cable or the connector is stained.	Clean the end face of the fiber cable or the connector. 6.1 Daily Care and Cleaning
The optical level does not stabilize.	The mode is set to MOD.	Set the mode to CW.
	The end face of the fiber cable or the connector is stained.	Clean the end face of the fiber cable or the connector. 6.1 Daily Care and Cleaning
The optical frequency stability is poor.	The mode is set to MOD.	Set the mode to CW.
	The end face of the fiber cable or the connector is stained.	Clean the end face of the fiber cable or the connector. 6.1 Daily Care and Cleaning
No light is output.	The remote interlock connector is open.	See “3.5 Connection of Remote Inter lock Connector.”
	The optical output modifier key switch is on.	See “3.6 Optical Output Modifier Key Switch.”

APPENDIX

A.1 MT9810B Optical Test Set

Display resolution (dBm)	0.001/0.01/0.1 (Switching enabled)
Display resolution (dB)	0.001/0.01/0.1 (Switching enabled)
Display resolution (W)	Five digits
External control	GPIB, RS-232C
Environmental conditions	Operating temperature : 0 to 50 °C, humidity of not greater than 90% (must be condensation free). Storage temperature : -25 to 71 °C, humidity of not greater than 90% (must be condensation free)
Number of units to be accommodated	Two (Max.)
Dimensions	88H x 213W x 351D mm
Weight	3.5 kg (Max.)
Power source	AC 85 to 132 (RATED 100 to 120V) /170 to 250V (RATED 200 to 240V) 70 VA (Max.), 47.5 to 63 Hz

<Performance (total)>	
Setting condition recording function	10 (Max.) (each channel)
Setting status copying function	Copying setting status enabled between channels (however, only when units of the same type are used.)
Time setting	Year Month Day Hour Minute Second (24 hour display)
<Performance (when sensor is used)>	
Bar graph display	60 dots
Recording and measurement function	Recording of a maximum of 1000 data (each channel) enabled.
Operation function	Function to perform deduction between channels, maximum value/ minimum value/(maximum value - minimum value) display, relative value display (measured value set as the reference), relative value display (numerical value input), calibrated value correction display

A.2 Optical Sensor

<table>
<tr><th colspan="2">Model name</th><th>MU931311A</th><th>MU931421A</th></tr>
<tr><td colspan="2">Light receiving element</td><td colspan="2">InGaAs-PD</td></tr>
<tr><td colspan="2">Input system</td><td colspan="2">Fiber input</td></tr>
<tr><td colspan="2">Compatible fiber</td><td colspan="2">SM fiber (ITU-T.G.652) PC polishing compatibility</td></tr>
<tr><td colspan="2">Wavelength range</td><td>800 to 1600 nm</td><td>750 to 1700 nm</td></tr>
<tr><td rowspan="2">Optical power measurement range *1</td><td>Continuous light</td><td>+10 to -110 dBm</td><td>+10 to -80 dBm</td></tr>
<tr><td>Modulated light</td><td colspan="2">+7 to -90 dBm</td></tr>
<tr><td colspan="2">Noise level*2</td><td>-93 dBm</td><td>-73 dBm</td></tr>
<tr><td colspan="2">Polarization dependency*3</td><td colspan="2">0.02 dB (Max.)</td></tr>
<tr><td colspan="2">Reflection loss*3</td><td colspan="2">40 dB (Min.)</td></tr>
<tr><td rowspan="2">Optical power measurement uncertainty</td><td>Reference conditions*4</td><td colspan="2">±2%</td></tr>
<tr><td>Operating conditions*5</td><td colspan="2">±3.5%</td></tr>
<tr><td colspan="2">Linearity*6</td><td>±0.05 dB (+10 to 0 dBm)
±0.01 dB ±0.3 pW (0 to -90 dBm)</td><td>±0.05 dB (+10 to 0 dBm)
±0.01 dB ±30 pW (0 to -70 dBm)</td></tr>
<tr><td colspan="2">Zero-set operation</td><td colspan="2">Auto correction for zero point</td></tr>
<tr><td colspan="2">Wavelength sensitivity characteristic correction function</td><td colspan="2">Measured wavelength can be input in 0.01 nm units.</td></tr>
<tr><td colspan="2">Modulated light received</td><td colspan="2">Switching CW/MOD, MOD:270 Hz, 1kHz, 2kHz</td></tr>
<tr><td colspan="2">Measurement interval setting*7</td><td colspan="2">1 ms to 99 hours 59 minutes 59 seconds</td></tr>
<tr><td colspan="2">Average setting</td><td colspan="2">2 to 1,000 times</td></tr>
<tr><td colspan="2">Analog output*8</td><td colspan="2">Approximately +2V</td></tr>
<tr><td colspan="2">Band select*9</td><td>Auto, manual
Manual setting :
0.1, 1, 10, 100 Hz, 1, 10, 100 kHz (CW mode only)</td><td>Auto, manual
Manual setting :
0.1, 1, 10, 100 Hz, 1, 10 kHz (CW mode only)</td></tr>
<tr><td colspan="2">Optical connector*10</td><td colspan="2">Supporting FC, ST, DIN, HMS -10/A, SC</td></tr>
<tr><td rowspan="2">Environmental conditions</td><td>Operating temperature</td><td colspan="2">0 to 50 °C, humidity of not greater than 90%
(must be condensation free)</td></tr>
<tr><td>Storage temperature</td><td colspan="2">-40 to 71 °C, humidity of not greater than 95%
(must be condensation free)</td></tr>
<tr><td colspan="2">Dimensions and weight</td><td>78 H x 41 W x 335 D mm, 700 g (Max.)</td><td>78 H x 41 W x 335 D mm, 550 g (Max.)</td></tr>
</table>

*1: Wavelength: 1300 nm
*2: Measurement interval 100 ms, average 10 times, peak to peak noise, wavelength 1300 nm
*3: SM fiber (ITU-T.G.652) used. Reflection loss 45 dB (Min.) Wavelength 1550 nm
*4: Reference conditions: SM fiber (ITU-T.G.652), master FC connector is used
Power level 100 µW (-10dBm), CW light, wavelength 1300 nm
Ambient temperature: 23 ± 2°C
On day of calibration
Warming up time: After one hour for MU931311A and after 30 minutes for MU931421A
*5: Operating conditions: SM fiber (ITU-T.G.652), master FC connector is used
CW light, wavelength 1000 to 1600 nm for MU931311A, waveleaght 1000 to 1650 nm for MU931421A
Ambient temperature: 23 ± 5°C
Within a year after calibration
Warming up time: After one hour for MU931311A and after 30 minutes for MU931421A
*6: Measurement conditions: Constant temperature at 23 ± 5°C, one wavelength in a range between 1000 and 1600 nm (MU931311A), between 1000 and 1650 nm (MU931421A)
CW light, power level 100 µW (-10dBm) set as reference, at band AUTO 10.1/1/10 Hz setting
Warming up time: After one hour for MU931311A and after 30 minutes for MU931421A
*7: Measurement intervals nogreater than 20 ms are effective only when recording and measurement.
Based on the full-scale values of each measurement range
*8: Bandwidth of approximately 3 dB
*9: A connector specified from among optical connector options is attached as a standard feature.
*10: When no specifications are given, the FC connector (option 37) will be supplied as standard .

Model name		MU931422A
Light receiving element		InGaAs-PD
Input system		Fiber input
Compatible fiber		SM fiber (ITU-T.G.652) PC polishing compatibility
Wavelength range		750 to 1700 nm
Optical power measurement range *1	Continuous light	+10 to -80 dBm
	Modulated light	+7 to -90 dBm
Noise level*2		-73 dBm
Polarization dependency*3		0.02 dB (Max.)
Optical power measurement uncertainty	Reference conditions*4	±2%
	Operating conditions*5	±3.5%
Linearity*6		±0.05 dB (+10 to 0 dBm) ±0.01 dB ±30 pW (0 to -70 dBm)
Zero-set operation		Auto correction for zero point
Wavelength sensitivity characteristic correction function		Measured wavelength can be input in 0.01 nm units.
Modulated light received		Switching CW/MOD, MOD:270 Hz, 1kHz, 2kHz
Measurement interval setting*7		1 ms to 99 hours 59 minutes 59 seconds
Average setting		2 to 1,000 times
Analog output*8		Approximately +2V
Band select*9		Auto, manual Manual setting : 0.1, 1, 10, 100 Hz, 1, 10 kHz (CW mode only)
Optical connector*10		Supporting FC, ST, DIN, HMS -10/A, SC
Environmental conditions	Operating temperature	0 to 50 °C, humidity of not greater than 90% (must be condensation free)
	Storage temperature	40 to 71 °C, humidity of not greater than 95% (must be condensation free)
Dimensions and weight		78 H x 41 W x 335 D mm, 550 g (Max.)

*1: Wavelength: 1300 nm
*2: Measurement interval 100 ms, average 10 times, peak to peak noise, wavelength 1300 nm
*3: SM fiber (ITU-T.G.652) used. Reflection loss 45 dB (Min.) Wavelength 1550 nm
*4: Reference conditions: SM fiber (ITU-T.G.652), master FC connector is used
Power level 100 μW (-10 dBm), CW light, wavelength 1300 nm
Ambient temperature: 23 ± 2°C
On day of calibration
Warming up time: After 30 minutes
*5: Operating conditions: SM fiber (ITU-T.G.652), master FC connector is used
Power level 100 μW (-10 dBm), CW light, wavelength 1000 to 1650 nm
Ambient temperature: 23 ± 5°C
Within a year after calibration
Warming up time: After 30 minutes
Add 1% to the uncertainty when the fiber whose NA is 0.29 (Min.) or using APC connector.
*6: Measurement conditions: Constant temperature at 23 ± 5°C, one wavelength in the range between 1000 and 1650 nm, CW light, power level 100 μW (-10dBm) set as reference, at band AUTO/0.1/1/10 Hz setting, warming up time: After 30 minutes
*7: Measurement intervals no greater than 20 ms are effective only when recording and measurement.
*8: Based on the full-scale values of each measurement range
*9: Bandwidth of approximately 3 dB
*10: A connector specified from among optical connector options is attached as standard.
When no specifications are given, the FC connector (option 37) will be supplied as standard.

Model name		MU931001A+MA9332A	MU931002A+MA9332A/33A
Light receiving element		InGaAs-PD	
Input system		Fiber input	
Compatible fiber		9/125 µm to 62.5/125 µm, NA ≤ 0.29 PC/APC polishing conformance	
Wavelength range		750 to 1700 nm	
Optical power measurement range*1	Continuous light	+7 to -80 dBm	
	Modulated light	+4 to -70 dBm	—
Noise level*2		-73 dBm	
Polarization dependency*3		0.035 dB (Max.,MA9332A), 0.026 dB (Max.,MA9333A)	
Optical power measurement uncertainty	Reference conditions*4	±2%	
	Operating conditions*5	±3.5%	
Linearity*6		±0.05 dB (+7 to 0 dBm) ±0.01 dB±30pW (0 to -70 dBm)	
Zero-set operation		Auto correction for zero point	
Wavelength sensitivity characteristic correction function		Measured wavelength can be input in 0.01 nm units.	
Measurement interval setting*7		1 ms to 99 hours 59 minutes 59 seconds	
Average setting		2 to 1,000 times	
Analog output*8		Approximately +2V	
Band select*9		Auto, Manual Manual setting: 0.1,1,10,100,1k,20 kHz (CW mode only)	Auto, Manual Manual setting: 1,10,100,1k,20 kHz (CW mode only)
Optical connector*10		Supporting FC, ST, DIN, HMS -10/A, SC, MU	
Environmental conditions	Operating temperature	0 to 50 °C, humidity of not greater than 90% (must be condensation free)	
	Storage temperature	-40 to 71 °C, humidity of not greater than 95% (must be condensation free)	
Dimensions and weight		MU931001A/02A: 78 H x 41 W x 335 D mm, 700 g (Max.) MU9332A/33A: 80 H x 65 W x 110 D mm, 750 g (Max.)	

*1: Wavelength: 1550 nm
*2: Measurement interval 100 ms, average 10 times, peak to peak noise, wavelength 1550 nm
*3: SM fiber (ITU-T.G.652) used. Power level 100 µW (-10 dBm), Reflection loss 45 dB (Min.) Wavelength 1550 nm
*4: Reference conditions: SM fiber (ITU-T.G.652), master FC connector is used
Power level 100 µW (-10 dBm), CW light, wavelength 1550 nm
Ambient temperature: 23 ± 2°C
On day of calibration
Warming up time: After 30 minutes, after 1 hour for MA9333A
*5: Operating conditions: SM fiber (ITU-T.G.652), master FC connector is used
Power level 100 µW (-10 dBm), CW light, wavelength 1000 to 1650 nm
Ambient temperature: 23 ± 5°C
Within a year from calibration
Warming up time: After 30 minutes, after 1 hour for MA9333A
Add 1% to the uncertainty when APC connector or a maximum of 0.29 NA fiber is used.
*6: Measurement conditions: Constant temperature at 23 ± 5°C, one wavelength in the range between 1000 and 1650 nm, CW light, power level 100 µW (-10dBm) set as reference, at band AUTO/0.1/1/10 Hz setting, the bandwidth 0.1 Hz is available using MU931001A.
Warming up time: After 30 minutes, after 1 hour for MA9333A
*7: Measurement intervals no greater than 20 ms are effective only when recording and measurement.
*8: Based on the full-scale values of each measurement range
*9: Bandwidth of approximately 3 dB
*10: A connector specified from among optical connector options is attached as standard.
When no specifications are given, the FC connector (option 37) will be supplied as standard.

Model name		MU931001A+MA9331A	MU931431A
Light receiving element		InGaAs-PD	
Input system		Fiber input	
Compatible fiber		9/125 µm to 62.5/125 µm, NA ≤ 0.29 PC/APC polishing conformance	
Wavelength range		940 to 1640 nm	
Optical power measurement range*1	Continuous light	+35 to -50 dBm	+33 to -50 dBm
Noise level*2		-43 dBm (Max.)	
Polarization dependency *3	PC connector	0.01 dB (Max.)	0.05 dB (Max.)
	APC connector	0.05 dB (Max.)	0.10 dB (Max.)
Optical power measurement uncertainty	Reference conditions*4	±3%	±4%
	Operating conditions*5	±4%	±5%
Linearity*6		±0.05 dB ±30 nW (+35 to -40 dBm)	±0.05 dB ±30 nW (+33 to -40 dBm)
Zero-set operation		Auto correction for zero point	
Wavelength sensitivity characteristic correction function		Measured wavelength can be input in 0.01 nm units.	
Measurement interval setting*7		1 ms to 99 hours 59 minutes 59 seconds	
Average setting		2 to 1,000 times	
Analog output*8		Approximately +2V	
Band select*9		Auto, manual Manual setting :0.1, 1, 10, 100 Hz, 1K, 20 kHz (CW mode only)	
Optical connector*10		Supporting FC, ST, DIN, HMS -10/A, SC, MU	
Environmental conditions	Operating temperature	0 to 40 °C, humidity of not greater than 90% (must be condensation free)	
	Storage temperature	-40 to 71 °C, humidity of not greater than 95% (must be condensation free)	
Dimensions and weight		MU931001A: 78 H x 41 W x 335 D mm, 700 g (Max.) MA9331A: 80 H x 65 W x 110 D mm, 750 g (Max.)	78 H x 41 W x 335 D mm, 880 g (Max.)

*1: Wavelength: 1550 nm
*2: Measurement interval 100 ms, average 10 times, peak to peak noise, wavelength 1550 nm
*3: SM fiber (ITU-T.G.652) is used. Reflection loss 45 dB (Min.) wavelength 1550 nm
*4: Reference conditions: Connector adapter, SM fiber (ITU-T.G.652), APC connector is used
Power level 1 W (+30 dBm), CW light, wavelength 1550 nm
Ambient temperature: 23 ± 2°C, humidity: 60% ± 10%
On day of calibration
Warming up time: After 30 minutes
*5: Operating conditions: Connector adapter, SM fiber (ITU-T.G.652), APC connector is used
Power level 1 W (+30 dBm), CW light, wavelength 980 ± 1 nm, 1240 to 1340 nm, 1440 to 1640 nm.
Ambient temperature: 23 ± 5°C
Within six months after calibration
Warming up time: After 30 minutes
Add 1% to the uncertainty when the fiber whose NA is 0.29 (Min.). Add 2% to the uncertainty when the wavelength other than described above is used (however, humidity must be 60 % ± 10 %).
*6: Measurement conditions: Constant temperature at 23 ± 5°C, one measurement wavelength in any range, CW light, power level 1 W (+30 dBm) set as reference, at band AUTO/0.1/1/10 Hz setting
Warming up time: After 30 minutes
*7: Measurement intervals no greater than 20ms are effective only when recording and measurement.
*8: Based on the full-scale values of each measurement range
*9: Bandwidth of approximately 3 dB
*10: A connector specified from among optical connector options is attached as standard.
When no specifications are given, the FC connector (option 37) will be supplied as standard.

A.3 Light Source

Model name	MU952501A to MU952505A *1	MU952601A to MU952606A *1
Light emitting device	DFB-LD	
Specified frequency (wavelength) range	191.7 to 195.9 THz *1 (1563.86 to 1530.33 nm)	186.3 to 191.6 THz *1 (1609.19 to 1564.68 nm)
Center frequency*2	fp±0.01 THz	
Spectrum half-amplitude level*2	≤30 MHz (Max.)	
Conforming fiber	SM fiber (ITU-T.G. 652)	
Connector	Compatible with FC-PC, ST, DIN, HMS-10/A and SC *7	
Output power*2	+10 ±1 dBm	+7 ±1 dBm
Laser product safety standards	IEC 60825-1: Class 1M, 21CFR1040.10; Class IIIb	
Optical output attenuation function − Attenuation amount − Step − Accuracy	 0.00 to 6.00 dB 0.01dB ≤ ±0.5 dB (at 6.00 dB setting, 25 °C)	
Internal modulation function − Frequency − Duty − Extinction ratio	 270/1k/2kHz ±0.1% 50 ±5% ≥13dB	
Time stability (short time)*2, *3, *4	≤ ±0.005 dB	≤ ±0.01 dB
Time stability (long time)*2, *3, *5	≤ ±0.002 dB	
Temperature stability*2, *3, *6	≤ ±0.25 dB	
Center frequency time stability (short time)*2, *4	≤ ±2 GHz (Max.)	
Center frequency time stability (long time)*2, *5	≤ ±4 GHz (Max.)	
Tunable optical frequency − Tunable range − Setting resolution _ Accuracy*2	 fp ±60 GHz 1 GHz ≤ ±10 GHz (at fp -60 GHz or fp +60 GHz setting, 25 °C)	
Warming up time	One hour after the optical output is turned ON	
Environmental conditions	Operating temperature: 15 to 35 °C, humidity ≤90% (must be condensation free) Storage temperature: -40 to 71 °C, humidity ≤95% (must be condensation free)	
Dimensions and weight	78 H x 41 W x 335 D mm, ≤700 g	

Note: All the values for the frequency (wavelength) are values registered in a vacuum state.
*1: The wavelength is specified by the model name and option No. See the ordering information.
*2: At the time of CW light, magnitude of optical attenuation set at 0.00 dB and the center frequency of fp. At the time of using the SM fiber (ITU-T.G.652) and FC-PC connector.
*3: When the reflection loss viewed from the light source is 40 dB or greater.
*4: Temperature kept constant for five minutes
*5: Temperature kept constant for one hour
*6: Temperature kept between 15 and 35 °C for eight hours
*7: A connector specified from among optical connector options is attached as a standard feature. When no specifications are given, the FC-PC connector (option 37) will be supplied as a standard feature.

Model name	MU951301A	MU951501A	MU951001A
Light emitting device	FP-LD		
Center frequency*1	1310 ±20 nm	1550 ±20 nm	1310 ±20 nm/ 1550 ±20 nm
Spectrum half-amplitude level*1	≤5 nm or less	≤10 nm or less	≤5 nm or less/ ≤10 nm or less
Conforming fiber	SM fiber (ITU-T.G. 652)		
Connector	Compatible with FC-PC, ST, DIN, HMS-10/A and SC *6		
Output power*1	+7 ±1 dBm		
Laser product safety standards	IEC 60825-1: Class 1M, 21CFR1014.10; Class IIIb		
Optical output attenuation function − Attenuation amount − Step − Accuracy	 0.00 to 6.00 dB 0.01 dB ≤ ±0.5 dB (at 6.00 dB setting, 25 °C)		
Internal modulation function − Frequency − Duty − Extinction ratio	 270/1 k/2 kHz ±0.1% 50 ±5% ≥13 dB		
Time stability (short time)*1, *2, *3	≤ ±0.002 dB		≤ ±0.005 dB
Time stability (long time)*1, *2, *4	≤ ±0.02 dB		≤ ±0.05 dB
Temperature stability*1, *2, *5	≤ ±0.1 dB		≤ ±0.15 dB
Warming up time	One hour after the optical output is turned ON		
Environmental conditions	Operating temperature: 0 to 50 °C, humidity of not greater than ≤90% (must be condensation free) Storage temperature: -40 to 71 °C, humidity of not greater than ≤95% (must be condensation free)		
Dimensions and weight	78 H x 41 W x 335 D mm, ≤ 700 g (Max.)		

Note: All the values for the wavelength are values registered in a vacuum state.

*1: At the time of CW light, magnitude of optical attenuation set at 0.00dB and the center frequency of fp.
At the time of using the SM fiber (ITU-T.G. 652) and FC=PC connector.

*2: When the reflection loss viewed from the light source is 40 dB or greater.

*3: Temperature kept constant for 15 minutes between 20 and 30 °C.

*4: Temperature kept constant for six hours.

*5: Temperature kept constant for eight hours between 0 and 50 °C.

*6: A connector specified from among optical connector options is attached as a standard feature.
When no specifications are given, the FC-PC connector (option 37) will be supplied as a standard feature.

Appendix B Ordering Information

Please specify the model name, code, item name and quantity when placing an order.

Model name and code	Item name	Remarks
	- Main unit -	
MT9810B	Optical test set	
	- Standard accessories -	
W1886AW	MT9810B Operation Manual	Japanese
W1886AE	MT9810B OPERATION MANUAL	English
W1887AW	MT9810B Remote Control Operation Manual	Japanese
W1887AE	MT9810B REMOTE CONTROL OPERATION MANUAL	English
J0895	RCS short pin	
J0896	RAC plug	
Z0391	Key (for laser output protection) Two	
F0011	Fuse (2A) Two	100-120V
F0008	Fuse (1A) Two	200-240V
J0017F	Power source cord 2.5 m	
J0266	Tripolar - bipolar conversion adapter	
MX981001A	LabVIEW driver	
B0425	Blank panel One	
	- Application parts -	
J0006	GPIB cable 0.5 m	
J0007	GPIB cable 1 m	
J0008	GPIB cable 2 m	
J0009	GPIB cable 4 m	
J0655A	RS-232C cable 9P-25P cross	
J0654A	RS-232C cable 9P-9P cross	
J0897B	8P modular cable 1 m	
J0897C	8P modular cable 2 m	
J0897D	8P modular cable 5 m	
J0897E	8P modular cable 10 m	
	<Light source>	
	- Main unit -	
MU952501A	Light source (DFB-LD)	
MU952502A	Light source (DFB-LD)	
MU952503A	Light source (DFB-LD)	
MU952504A	Light source (DFB-LD)	
MU952505A	Light source (DFB-LD)	
MU951301A	Light source (FP-LD)	
MU951501A	Light source (FP-LD)	
MU951001A	Light source (Switchable FP-LD)	
MU952601A	Light source (DFB-LD)	
MU952602A	Light source (DFB-LD)	
MU952603A	Light source (DFB-LD)	
MU952604A	Light source (DFB-LD)	
MU952605A	Light source (DFB-LD)	
MU952606A	Light source (DFB-LD)	
	- Standard accessories -	
	Optical connection adapter *1	
	- Option -	
MU952501A-01	Light source	fp =193.10THz
MU952501A-02	Light source	fp =193.20THz
MU952501A-03	Light source	fp =193.30THz
MU952501A-04	Light source	fp =193.40THz
MU952501A-05	Light source	fp =193.50THz
MU952501A-06	Light source	fp =193.60THz
MU952501A-07	Light source	fp =193.70THz
MU952501A-08	Light source	fp =193.80THz

Model name and code	Item name	Remarks
MU952501A-09	Light source	fp =193.90THz
MU952501A-10	Light source	fp =194.00THz
MU952502A-01	Light source	fp =192.10THz
MU952502A-02	Light source	fp =192.20THz
MU952502A-03	Light source	fp =192.30THz
MU952502A-04	Light source	fp =192.40THz
MU952502A-05	Light source	fp =192.50THz
MU952502A-06	Light source	fp =192.60THz
MU952502A-07	Light source	fp =192.70THz
MU952502A-08	Light source	fp =192.80THz
MU952502A-09	Light source	fp =192.90THz
MU952502A-10	Light source	fp =193.00THz
MU952503A-07	Light source	fp =191.70THz
MU952503A-08	Light source	fp =191.80THz
MU952503A-09	Light source	fp =191.90THz
MU952503A-10	Light source	fp =192.00THz
MU952504A-01	Light source	fp =194.10THz
MU952504A-02	Light source	fp =194.20THz
MU952504A-03	Light source	fp =194.30THz
MU952504A-04	Light source	fp =194.40THz
MU952504A-05	Light source	fp =194.50THz
MU952504A-06	Light source	fp =194.60THz
MU952504A-07	Light source	fp =194.70THz
MU952504A-08	Light source	fp =194.80THz
MU952504A-09	Light source	fp =194.90THz
MU952504A-10	Light source	fp =195.00THz
MU952505A-01	Light source	fp =195.10THz
MU952505A-02	Light source	fp =195.20THz
MU952505A-03	Light source	fp =195.30THz
MU952505A-04	Light source	fp =195.40THz
MU952505A-05	Light source	fp =195.50THz
MU952505A-06	Light source	fp =195.60THz
MU952505A-07	Light source	fp =195.70THz
MU952505A-08	Light source	fp =195.80THz
MU952505A-09	Light source	fp =195.90THz
MU952601A-01	Light source	fp =191.10THz
MU952601A-02	Light source	fp =191.20THz
MU952601A-03	Light source	fp =191.30THz
MU952601A-04	Light source	fp =191.40THz
MU952601A-05	Light source	fp =191.50THz
MU952601A-06	Light source	fp =191.60THz
MU952602A-01	Light source	fp =190.10THz
MU952602A-02	Light source	fp =190.20THz
MU952602A-03	Light source	fp =190.30THz
MU952602A-04	Light source	fp =190.40THz
MU952602A-05	Light source	fp =190.50THz
MU952602A-06	Light source	fp =190.60THz
MU952602A-07	Light source	fp =190.70THz
MU952602A-08	Light source	fp =190.80THz
MU952602A-09	Light source	fp =190.90THz
MU952602A-10	Light source	fp =191.00THz
MU952603A-01	Light source	fp =189.10THz
MU952603A-02	Light source	fp =189.20THz
MU952603A-03	Light source	fp =189.30THz
MU952603A-04	Light source	fp =189.40THz
MU952603A-05	Light source	fp =189.50THz

Model name and code	Item name	Remarks
MU952603A-06	Light source	fp =189.60THz
MU952603A-07	Light source	fp =189.70THz
MU952603A-08	Light source	fp =189.80THz
MU952603A-09	Light source	fp =189.90THz
MU952603A-10	Light source	fp =190.00THz
MU952604A-01	Light source	fp =188.10THz
MU952604A-02	Light source	fp =188.20THz
MU952604A-03	Light source	fp =188.30THz
MU952604A-04	Light source	fp =188.40THz
MU952604A-05	Light source	fp =188.50THz
MU952604A-06	Light source	fp =188.60THz
MU952604A-07	Light source	fp =188.70THz
MU952604A-08	Light source	fp =188.80THz
MU952604A-09	Light source	fp =188.90THz
MU952604A-10	Light source	fp =189.00THz
MU952605A-01	Light source	fp =187.10THz
MU952605A-02	Light source	fp =187.20THz
MU952605A-03	Light source	fp =187.30THz
MU952605A-04	Light source	fp =187.40THz
MU952605A-05	Light source	fp =187.50THz
MU952605A-06	Light source	fp =187.60THz
MU952605A-07	Light source	fp =187.70THz
MU952605A-08	Light source	fp =187.80THz
MU952605A-09	Light source	fp =187.90THz
MU952605A-10	Light source	fp =188.00THz
MU952606A-03	Light source	fp =186.30THz
MU952606A-04	Light source	fp =186.40THz
MU952606A-05	Light source	fp =186.50THz
MU952606A-06	Light source	fp =186.60THz
MU952606A-07	Light source	fp =186.70THz
MU952606A-08	Light source	fp =186.80THz
MU952606A-09	Light source	fp =186.90THz
MU952606A-10	Light source	fp =187.00THz
	- Application parts -	
J0617B	Replaceable optical connector (FC)	Replacement by user enabled
J0618D	Replaceable optical connector (ST)	Replacement by user enabled
J0618E	Replaceable optical connector (DIN)	Replacement by user enabled
J0618F	Replaceable optical connector (HMS-10/A)	Replacement by user enabled
J0619B	Replaceable optical connector (SC)	Replacement by user enabled
Z0282	Ferrule cleaner	
Z0283	Ferrule cleaner replacement tape	Six/set
Z0284	Adapter cleaner	Stick type 200/set
	<Light source>	
	-Main unit-	
MU954501A	Light source (SLD)	
	-Standard accessories-	
	Optical adapter *1	
	-Application parts-	
J0617B	Replaceable optical connector (FC)	Replacement by user enabled
J0618D	Replaceable optical connector (ST)	Replacement by user enabled
J0618E	Replaceable optical connector (DIN)	Replacement by user enabled

Model name and code	Item name	Remarks
J0618F	Replaceable optical connector (HMS-10/A)	Replacement by user enabled
J0619B	Replaceable optical connector (SC)	Replacement by user enabled
Z0282	Ferrule cleaner	
Z0283	Ferrule cleaner replacement tape	Six/set
Z0284	Adapter cleaner	Stick type 200/set
	<Optical sensor>	
	- Main unit -	
MU931421A	Optical sensor	
MU931311A	Optical sensor	
	- Standard accessories -	
	Optical connector adapter*1	
	- Application parts -	
J0617B	Replaceable optical connector (FC)	Replacement by user enabled
J0618D	Replaceable optical connector (ST)	Replacement by user enabled
J0618E	Replaceable optical connector (DIN)	Replacement by user enabled
J0618F	Replaceable optical connector (HMS-10/A)	Replacement by user enabled
J0619B	Replaceable optical connector (SC)	Replacement by user enabled
Z0282	Ferrule cleaner	
Z0283	Ferrule cleaner replacement tape	Six/set
Z0284	Adapter cleaner	Stick type 200/set
J0575	Optical fiber cord 2 m	Both end with the FC-PC type connector RL > 50 dB, SM
MZ8012A	Connector cleaning set	
J0127A	Coaxial cord 1 m	BNC-P,RG-58A/U,BNC-P
J0003A	Coaxial cord 1 m	SMA-P, special 3D-2W, SMA-P
J0901A	HRM-517 (09)	SMA-P, BNC-J conversion connector
J0902A	HRM-518 (09)	SMA-J, BNC-P conversion connector
	<Optical sensor>	
	- Main unit -	
MU931422A	Optical sensor	
	- Standard accessories -	
	Optical connector adapter*1	
	- Application parts -	
MA9005A-37	Connector adapter (FC)	Replacement by user enabled
MA9005A-38	Connector adapter (ST)	Replacement by user enabled
MA9005A-39	Connector adapter (DIN)	Replacement by user enabled
MA9005A-40	Connector adapter (SC)	Replacement by user enabled

Model name and code	Item name	Remarks
MA9005A-43	Connector adapter (HMS-10/A)	Replacement by user enabled
MA9005A-32	Connector adapter (MU)	Replacement by user enabled
MA9013A	Fiber adapter	For bare fiber
MA9901A	Fiber adapter	For bare fiber
MA9902A	Connector adapter	For MA9901A
Z0282	Ferrule cleaner	
Z0284	Adapter cleaner	Stick type 200/set
J0575	Optical fiber cord 2 m	Both end with the FC-PC type connector RL > 50 dB, SM
MZ8012A	Connector cleaning set	
J0127A	Coaxial cord 1 m	BNC-P,RG-58A/U,BNC-P
J0003A	Coaxial cord 1 m	SMA-P, special 3D-2W, SMA-P
J0901A	HRM-517 (09)	SMA-P, BNC-J conversion connector
J0902A	HRM-518 (09)	SMA-J, BNC-P conversion connector
	<Optical sensor>	
	-Main unit-	
MU931431A	Optical sensor	
	-Standard accessories-	
	Optical adapter *1	
	-Application parts-	
MA9005B-37	Connector adapter (FC)	Replacement by user enabled
MA9005B-38	Connector adapter (ST)	Replacement by user enabled
MA9005B-39	Connector adapter (DIN)	Replacement by user enabled
MA9005B-40	Connector adapter (SC)	Replacement by user enabled
MA9005B-43	Connector adapter (HMS-10A)	Replacement by user enabled
MA9005B-32	Connector adapter (MU)	Replacement by user enabled
MA9013A	Fiber adapter	For bare fiber
MA9901A	Fiber adapter	For bare fiber
MA9902A	Connector adapter	For MA9901A
J1078A	AG adapter	
	<Sensor adapter>	
	- Main unit -	
MU931001A	Sensor adapter	
	- Standard accessories -	
J1073A	Optical sensor connection cable, 1.5m	
	- Application parts -	
J0127A	Coaxial cord 1 m	BNC-P,RG-58A/U,BNC-P
J0003A	Coaxial cord 1 m	SMA-P, special 3D-2W, SMA-P

Model name and code	Item name	Remarks
J0901A	HRM-517 (09)	SMA-P, BNC-J conversion connector
J0902A	HRM-518 (09)	SMA-J, BNC-P conversion connector
	<Sensor adapter>	
	- Main unit -	
MU931002A	Sensor adapter	
	- Standard accessories -	
J1073A	Optical sensor connection cable, 1.5m	
MX789400A	Optical component tester control software	
W1926AW	MX789400A Operation manual	
	- Application parts -	
J0127A	Coaxial cord 1 m	BNC-P,RG-58A/U,BNC-P
J0003A	Coaxial cord 1 m	SMA-P, special 3D-2W, SMA-P
J0901A	HRM-517 (09)	SMA-P, BNC-J conversion connector
J0902A	HRM-518 (09)	SMA-J, BNC-P conversion connector
	<Optical sensor>	
MA9331A	Optical sensor	
	- Standard accessories -	
	Optical connector adapter*1	
	- Application parts -	
MA9008A-37	Connector adapter (FC)	Replacement by user enabled
MA9008A-38	Connector adapter (ST)	Replacement by user enabled
MA9008A-39	Connector adapter (DIN)	Replacement by user enabled
MA9008A-40	Connector adapter (SC)	Replacement by user enabled
MA9008A-43	Connector adapter (HMS-10/A)	Replacement by user enabled
MA9008A-32	Connector adapter (MU)	Replacement by user enabled
Z0282	Ferrule cleaner	
Z0283	Ferrule cleaner replacement tape	Six/set
Z0284	Adapter cleaner	Stick type 200/set
MZ8012A	Connector cleaning set	
	<Optical sensor>	
MA9332A	Optical sensor	
MA9333A	Optical sensor	
	- Standard accessories -	
	Optical connector adapter*1	
	- Application parts -	
MA9005A-37	Connector adapter (FC)	Replacement by user enabled
MA9005A-38	Connector adapter (ST)	Replacement by user enabled
MA9005A-39	Connector adapter (DIN)	Replacement by user enabled

Model name and code	Item name	Remarks
MA9005A-40	Connector adapter (SC)	Replacement by user enabled
MA9005A-43	Connector adapter (HMS-10/A)	Replacement by user enabled
MA9005A-32	Connector adapter (MU)	Replacement by user enabled
MA9013A	Fiber adapter	For bare fiber
MA9901A	Fiber adapter	For bare fiber
MA9902A	Connector adapter	For MA9901A
Z0282	Ferrule cleaner	
Z0283	Ferrule cleaner replacement tape	Six/set
Z0284	Adapter cleaner	Stick type 200/set
MZ8012A	Connector cleaning set	
	<Optical connector option>*1	Light source, light sensor
<Model name>-37	FC-PC connector	Replacement by user enabled
<Model name>-38	ST connector	Replacement by user enabled
<Model name>-39	DIN connector	Replacement by user enabled
<Model name>-40	SC connector	Replacement by user enabled
<Model name>-43	HMS-10/A connector	Replacement by user enabled
<Model name>-32	MU connector	Replacement by user enabled

*1: A connector specified from among the optical connector options listed above will be supplied when an order is placed. When no specifications are given, the FC connector (option 37) will be supplied as a standard feature.
Only MU931422A/MA9331A/32A can be specified for MU connector.

Setting Item	Default Value
Channel	Select a channel based on the following priority (The smaller number has the higher priority.)
	1) Select Channel 1 when the unit is mounted on Channel 1.
	2) Select Channel 2 when the unit is mounted on Channel 2.
	3) Select Channel 1 when no unit is mounted on the main unit.
Application selection	Recording of the measurement condition
Clone function	CH1 → CH2
Measurement condition record No.	1
Measurement condition reading No.	0
Number of measurement data	500
Parameter selection	Reference level
Reference level	0.000dBm
CAL FACTOR	0.000dB
Average selection	OFF
Optical modulation mode	CW
Measurement interval	100ms
Bandwidth	AUTO
Unit	Optical sensor : Wavelength Light source : Optical frequency
Display resolution	0.001
ATT	0.00dB
System selection	Remote interface
Remote interface	GPIB
GPIB address	15
RS-232C baud rate	9600bps
RS-232C stop bit	One bit
RS-232C parity bit	Even number
RS-232C character length	8
Indicator luminance	7
Buzzer	ON 2
Range	AUTO
Wavelength or optical frequency	Optical sensor : 1300.00 nm Light source : Value displayed by the unit (See the model name and option No.) A displayed unit value of the short wavelength for a switchable light source.
Optical output	OFF
dBm/W	dBm
Reference selection	Measurement of the relative value with the reference level set as the standard
Relative state	State of relative cancelled
CAL	OFF
Display status	Parameter viewing
Measurement status	Absolute value measurement (dBm)
Shift key	OFF

D.1 System related errors

No.	Indication	Output Condition and Action	Remarks
000		No error detected	
001	MEM ERROR	Error detected in the memory of the main body. Activate power again. If the indication is still displayed after reactivation of power, turn the power source OFF promptly and contact the service center.	
002	(Unused)		
003	UNIT MEM ERROR	Error detected in the memory of the unit. Activate power again. If the indication is still displayed after reactivation of power, turn the power source OFF promptly and contact the service center.	
004	(Unused)		
005	INNER TEMP ERROR	The temperature in the unit interior falls outside the specified range. Check whether the ambient temperature comes within the specified range.	
006	MEAS CKT ERROR	Error detected in the power measurement circuit. Activate power again. If the indication is still displayed after reactivation of power, turn the power source OFF promptly and contact the service center.	*1
007	ZERO ERROR	Abnormality in the offset level. See 4.2.2 and execute zero setting again.	*1
008	PD TEMP ERROR	The temperature of the PD module falls outside the specified range. Turn the power source OFF first and activate power again after 30 minutes. If the indication is still displayed after reactivation of power, turn the power source OFF promptly and contact the service center.	*1
009	ATC CUR ERROR	The ATC circuit current has exceeded the limiting value. Turn the power source OFF first and activate power again after 30 minutes. If the indication is still displayed after reactivation of power, turn the power source OFF promptly and contact the service center.	*1, *2
010	OPT PWR ERROR	The optical output monitor has exceeded the limiting value. Turn the power source OFF first and activate power again after 30 minutes. If the indication is still displayed after reactivation of power, turn the power source OFF promptly and contact the service center.	*2
011	LD CUR ERROR	The LD driving current has exceeded the limiting value. Turn the power source OFF first and activate power again after 30 minutes. Activate power again. If the indication is still displayed after reactivation of power, turn the power source OFF promptly and contact the service center.	*2

No.	Indication	Output Condition and Action	Remarks
012	LD TEMP ERROR	The LD temperature has exceeded the limiting value. Turn the power source OFF first and activate power again after 30 minutes. If the indication is still displayed after reactivation of power, turn the power source OFF promptly and contact the service center.	*2
013	APC ERROR	APC control error	*2
014	ATC ERROR	APC control error Turn the power source OFF first and activate power again after 30 minutes. If the indication is still displayed after reactivation of power, turn the power source OFF promptly and contact the service center.	*2
015	(Unused)		
016	NO SENSOR	An optical sensor is not connected to the sensor adapter unit. Turn the power OFF once, and connect the optical sensor correctly then turn the power ON again. If the message is displayed even after restart, turn the power off promptly and contact the service center.	
017 to 019	(Unused)		
020	NO UNIT	A unit which cannot be recognized is mounted. Activate power again. If the indication is still displayed after reactivation of power, turn the power source OFF promptly and contact the service center.	
021	NO UNIT	No unit is mounted. Mount a unit to be used correctly.	

Symbols in the column of the remarks
*1: Targeting the Optical Censor
*2: Targeting the Light Source

D.2 Operation related error

No.	Indication	Output Condition	Remarks
200	(Unused)		
201	INVALID IN THIS UNIT	Calling setting conditions for a different unit was attempted. Check the type of the unit currently used.	
202	(Unused)		
203	(Unused)		
204	INVALID IN DIFFERENT UNIT	Cannot be executed between different unit types. Check the type of the unit currently used.	
205	INVALID IN THIS UNIT	Cannot be executed for this unit. Check the type of the unit currently used.	
206	INVALID IN MOD CONDTN	Cannot be executed when the modulation mode is set. Cancel the modulation mode.	

Optical Sensor List of Performance Test Result Record

Model: MU931311A
Serial No.:

Date:
Temperature: °C
Humidity: %
Atmospheric pressure: hPa
Person in charge:

1. Uncertainty Test

Minimum (dBm)		Reading (dBm)		Maximum (dBm)
-10.154	≤		≤	-9.846

2. Linearity Test

Range	Power1 (dBm)		Power2 (dBm)		Power1–Power2 (dB)	
+10 dBm → 0 dBm		–		=		= ①
0 dBm → -10 dBm		–		=		= ②
-10 dBm → -20 dBm		–		=		= ③
-20 dBm → -30 dBm		–		=		= ④
-30 dBm → -40 dBm		–		=		= ⑤
-40 dBm → -50 dBm		–		=		= ⑥
-50 dBm → -60 dBm		–		=		= ⑦
-60 dBm → -70 dBm		–		=		= ⑧
-70 dBm → -80 dBm		–		=		= ⑨
-80 dBm → -90 dBm		–		=		= ⑩

Range	Minimum		Calculation		Maximum
+10 dBm (-①-②)	-0.050 dB	≤		≤	0.050 dB
0 dBm (-②)	-0.010 dB	≤		≤	0.010 dB
-10 dBm			0.000 dB		
-20 dBm (③)	-0.010 dB	≤		≤	0.010 dB
-30 dBm (③+④)	-0.010 dB	≤		≤	0.010 dB
-40 dBm (③+④+⑤)	-0.010 dB	≤		≤	0.010 dB
-50 dBm (③+④+···+⑥)	-0.010 dB	≤		≤	0.010 dB
-60 dBm (③+④+···+⑦)	-0.011 dB	≤		≤	0.011 dB
-70 dBm (③+④+···+⑧)	-0.023 dB	≤		≤	0.023 dB
-80 dBm (③+④+···+⑨)	-0.138 dB	≤		≤	0.138 dB
-90 dBm (③+④+···+⑩)	-1.149 dB	≤		≤	1.149 dB

3. Polarization Dependence Test

Reading		Maximum
dB	≤	0.02 dB

4. Return Loss Test

Reading		Minimum
dB	≥	40 dB

5. Noise Dependence Test

Calculation		Maximum
dBm	≤	-93 dBm

Optical Sensor List of Performance Test Result Record

Model: MU931421A
Serial No.:

Date:
Temperature: °C
Humidity: %
Atmospheric pressure: hPa
Person in charge:

1. Uncertainty Test

Minimum (dBm)		Reading (dBm)		Maximum (dBm)
-10.154	≤		≤	-9.846

2. Linearity Test

Range	Power1 (dBm)		Power2 (dBm)		Power1–Power2 (dB)	
+10 dBm → 0 dBm		–		=		= ①
0 dBm → -10 dBm		–		=		= ②
-10 dBm → -20 dBm		–		=		= ③
-20 dBm → -30 dBm		–		=		= ④
-30 dBm → -40 dBm		–		=		= ⑤
-40 dBm → -50 dBm		–		=		= ⑥
-50 dBm → -60 dBm		–		=		= ⑦
-60 dBm → -70 dBm		–		=		= ⑧

Range	Minimum		Calculation		Maximum
+10 dBm (-①-②)	-0.050 dB	≤		≤	0.050 dB
0 dBm (-②)	-0.010 dB	≤		≤	0.010 dB
-10 dBm			0.000 dB		
-20 dBm (③)	-0.010 dB	≤		≤	0.010 dB
-30 dBm (③+④)	-0.010 dB	≤		≤	0.010 dB
-40 dBm (③+④+⑤)	-0.011 dB	≤		≤	0.011 dB
-50 dBm (③+④+···+⑥)	-0.023 dB	≤		≤	0.023 dB
-60 dBm (③+④+···+⑦)	-0.138 dB	≤		≤	0.138 dB
-70 dBm (③+④+···+⑧)	-1.149 dB	≤		≤	1.149 dB

3. Polarization Dependence Test

Reading		Maximum
dB	≤	0.02 dB

4. Return Loss Test

Reading		Minimum
dB	≥	40 dB

5. Noise Dependence Test

Calculation		Maximum
dBm	≤	-73 dBm

Optical Sensor List of Performance Test Result Record

Model: MU931422A	Date:
Serial No.:	Temperature: °C
	Humidity: %
	Atmospheric pressure: hPa
	Person in charge:

1. Uncertainty Test

Minimum (dBm)		Reading (dBm)		Maximum (dBm)
-10.154	≤		≤	-9.846

2. Linearity Test

Range	Power1 (dBm)		Power2 (dBm)		Power1–Power2 (dB)	
+10 dBm → 0 dBm		–		=		= ①
0 dBm → -10 dBm		–		=		= ②
-10 dBm → -20 dBm		–		=		= ③
-20 dBm → -30 dBm		–		=		= ④
-30 dBm → -40 dBm		–		=		= ⑤
-40 dBm → -50 dBm		–		=		= ⑥
-50 dBm → -60 dBm		–		=		= ⑦
-60 dBm → -70 dBm		–		=		= ⑧

Range		Minimum		Calculation		Maximum
+10 dBm	(-①-②)	-0.050 dB	≤		≤	0.050 dB
0 dBm	(-②)	-0.010 dB	≤		≤	0.010 dB
-10 dBm				0.000 dB		
-20 dBm	(③)	-0.010 dB	≤		≤	0.010 dB
-30 dBm	(③+④)	-0.010 dB	≤		≤	0.010 dB
-40 dBm	(③+④+⑤)	-0.011 dB	≤		≤	0.011 dB
-50 dBm	(③+④+···+⑥)	-0.023 dB	≤		≤	0.023 dB
-60 dBm	(③+④+···+⑦)	-0.138 dB	≤		≤	0.138 dB
-70 dBm	(③+④+···+⑧)	-1.149 dB	≤		≤	1.149 dB

3. Polarization Dependence Test

Reading		Maximum
dB	≤	0.1 dB

4. Noise Dependence Test

Calculation		Maximum
dBm	≤	-73 dBm

Optical Sensor List of Performance Test Result Record

Model: MU931431A
Serial No.:

Date:
Temperature: °C
Humidity: %
Atmospheric pressure: hPa
Person in charge:

1. Uncertainty Test

Minimum (dBm)		Reading (dBm)		Maximum (dBm)
29.847	≤		≤	30.153

2. Linearity Test

Range	Power1 (dBm)		Power2 (dBm)		Power1–Power2 (dB)	
+33 dBm → +30 dBm		–		=		= ①
+30 dBm → +20 dBm		–		=		= ②
+20 dBm → +10 dBm		–		=		= ③
+10 dBm → 0 dBm		–		=		= ④
0 dBm → -10 dBm		–		=		= ⑤
-10 dBm → -20 dBm		–		=		= ⑥
-20 dBm → -30 dBm		–		=		= ⑦
-30 dBm → -40 dBm		–		=		= ⑧
-40 dBm → -50 dBm		–		=		= ⑨

Range	Minimum		Calculation		Maximum
+35 dBm (①-②)	-0.050 dB	≤		≤	0.050 dB
+30 dBm			0.000 dB		
+20 dBm (③-②)	-0.050 dB	≤		≤	0.050 dB
+10 dBm (④-②)	-0.050 dB	≤		≤	0.050 dB
0 dBm (⑤-②)	-0.050 dB	≤		≤	0.050 dB
-10 dBm (⑥-②)	-0.051 dB	≤		≤	0.051 dB
-20 dBm (⑦-②)	-0.063 dB	≤		≤	0.063 dB
-30 dBm (⑧-②)	-0.178 dB	≤		≤	0.178 dB
-40 dBm (⑨-②)	-1.189 dB	≤		≤	1.189 dB

3. Polarization Dependence Test

Reading		Maximum
dB	≤	0.05 dB

4. Noise Dependence Test

Calculation		Maximum
dBm	≤	-43 dBm

Optical Sensor List of Performance Test Result Record

Model: MU931001A+MA9331A
Serial No.:

Date:
Temperature: °C
Humidity: %
Atmospheric pressure: hPa
Person in charge:

1. Uncertainty Test

Minimum (dBm)		Reading (dBm)		Maximum (dBm)
29.847	≤		≤	30.153

2. Linearity Test

Range	Power1 (dBm)		Power2 (dBm)		Power1–Power2 (dB)	
+35 dBm → +30 dBm		–		=		= ①
+30 dBm → +20 dBm		–		=		= ②
+20 dBm → +10 dBm		–		=		= ③
+10 dBm → 0 dBm		–		=		= ④
0 dBm → -10 dBm		–		=		= ⑤
-10 dBm → -20 dBm		–		=		= ⑥
-20 dBm → -30 dBm		–		=		= ⑦
-30 dBm → -40 dBm		–		=		= ⑧
-40 dBm → -50 dBm		–		=		= ⑨

Range	Minimum		Calculation		Maximum
+35 dBm (①-②)	-0.050 dB	≤		≤	0.050 dB
+30 dBm			0.000 dB		
+20 dBm (③-②)	-0.050 dB	≤		≤	0.050 dB
+10 dBm (④-②)	-0.050 dB	≤		≤	0.050 dB
0 dBm (⑤-②)	-0.050 dB	≤		≤	0.050 dB
-10 dBm (⑥-②)	-0.051 dB	≤		≤	0.051 dB
-20 dBm (⑦-②)	-0.063 dB	≤		≤	0.063 dB
-30 dBm (⑧-②)	-0.178 dB	≤		≤	0.178 dB
-40 dBm (⑨-②)	-1.189 dB	≤		≤	1.189 dB

3. Polarization Dependence Test

Reading		Maximum
dB	≤	0.01 dB

4. Noise Dependence Test

Calculation		Maximum
dBm	≤	-43 dBm

Optical Sensor List of Performance Test Result Record

Model: MU93002A+MA9333A	Date:
Serial No.:	Temperature: °C
	Humidity: %
	Atmospheric pressure: hPa
	Person in charge:

1. Uncertainty Test

Minimum (dBm)		Reading (dBm)		Maximum (dBm)
-10.154	≤		≤	-9.846

2. Linearity Test

Range	Power1 (dBm)		Power2 (dBm)		Power1–Power2 (dB)	
+7 dBm → 0 dBm		–		=		= ①
0 dBm → -10 dBm		–		=		= ②
-10 dBm → -20 dBm		–		=		= ③
-20 dBm → -30 dBm		–		=		= ④
-30 dBm → -40 dBm		–		=		= ⑤
-40 dBm → -50 dBm		–		=		= ⑥
-50 dBm → -60 dBm		–		=		= ⑦
-60 dBm → -70 dBm		–		=		= ⑧

Range	Minimum		Calculation		Maximum
+7 dBm (-①-②)	-0.050 dB	≤		≤	0.050 dB
0 dBm (-②)	-0.010 dB	≤		≤	0.010 dB
-10 dBm			0.000 dB		
-20 dBm (③)	-0.010 dB	≤		≤	0.010 dB
-30 dBm (③+④)	-0.010 dB	≤		≤	0.010 dB
-40 dBm (③+④+⑤)	-0.011 dB	≤		≤	0.011 dB
-50 dBm (③+④+··+⑥)	-0.023 dB	≤		≤	0.023 dB
-60 dBm (③+④+··+⑦)	-0.138 dB	≤		≤	0.138 dB
-70 dBm (③+④+··+⑧)	-1.149 dB	≤		≤	1.149 dB

3. Polarization Dependence Test

Reading		Maximum
dB	≤	0.026 dB

4. Noise Dependence Test

Calculation		Maximum
dBm	≤	-73 dBm

Optical Sensor List of Performance Test Result Record

Model: MU931001A/02A+MA9332A
Serial No.:

Date:
Temperature: °C
Humidity: %
Atmospheric pressure: hPa
Person in charge:

1. Uncertainty Test

Minimum (dBm)		Reading (dBm)		Maximum (dBm)
-10.154	≤		≤	-9.846

2. Linearity Test

Range	Power1 (dBm)		Power2 (dBm)		Power1–Power2 (dB)	
+7 dBm → 0 dBm		–		=		= ①
0 dBm → -10 dBm		–		=		= ②
-10 dBm → -20 dBm		–		=		= ③
-20 dBm → -30 dBm		–		=		= ④
-30 dBm → -40 dBm		–		=		= ⑤
-40 dBm → -50 dBm		–		=		= ⑥
-50 dBm → -60 dBm		–		=		= ⑦
-60 dBm → -70 dBm		–		=		= ⑧

Range	Minimum		Calculation		Maximum
+7 dBm (-①-②)	-0.050 dB	≤		≤	0.050 dB
0 dBm (-②)	-0.010 dB	≤		≤	0.010 dB
-10 dBm			0.000 dB		
-20 dBm (③)	-0.010 dB	≤		≤	0.010 dB
-30 dBm (③+④)	-0.010 dB	≤		≤	0.010 dB
-40 dBm (③+④+⑤)	-0.011 dB	≤		≤	0.011 dB
-50 dBm (③+④+··+⑥)	-0.023 dB	≤		≤	0.023 dB
-60 dBm (③+④+··+⑦)	-0.138 dB	≤		≤	0.138 dB
-70 dBm (③+④+··+⑧)	-1.149 dB	≤		≤	1.149 dB

3. Polarization Dependence Test

Reading		Maximum
dB	≤	0.035 dB

4. Noise Dependence Test

Calculation		Maximum
dBm	≤	-73 dBm

Light Source (DFB-LD) List of Performance Test Result Record

Model: MU95250 ☐A- ☐☐

Serial No.:

Date:

Temperature: °C

Humidity: %

Atmospheric pressure: hPa

Person in charge:

1. Center Optical Frequency

Minimum*		Reading		Maximum*
THz	≤	☐ THz	≤	THz

*Minimum,Maximum: Select the appropriate one from the table below and enter it.

Model Name	Minimum	fc	Maximum
MU952501A-01	193.09THz	193.10THz	193.11THz
MU952501A-02	193.19THz	193.20THz	193.21THz
MU952501A-03	193.29THz	193.30THz	193.31THz
MU952501A-04	193.39THz	193.40THz	193.41THz
MU952501A-05	193.49THz	193.50THz	193.51THz
MU952501A-06	193.59THz	193.60THz	193.61THz
MU952501A-07	193.69THz	193.70THz	193.71THz
MU952501A-08	193.79THz	193.80THz	193.81THz
MU952501A-09	193.89THz	193.90THz	193.91THz
MU952501A-10	193.99THz	194.00THz	194.01THz
MU952502A-01	192.09THz	192.10THz	192.11THz
MU952502A-02	192.19THz	192.20THz	192.21THz
MU952502A-03	192.29THz	192.30THz	192.31THz
MU952502A-04	192.39THz	192.40THz	192.41THz
MU952502A-05	192.49THz	192.50THz	192.51THz
MU952502A-06	192.59THz	192.60THz	192.61THz
MU952502A-07	192.69THz	192.70THz	192.71THz
MU952502A-08	192.79THz	192.80THz	192.81THz
MU952502A-09	192.89THz	192.90THz	192.91THz
MU952502A-10	192.99THz	193.00THz	193.01THz
MU952503A-07	191.69THz	191.70THz	191.71THz
MU952503A-08	191.79THz	191.80THz	191.81THz
MU952503A-09	191.89THz	191.90THz	191.91THz
MU952503A-10	191.99THz	192.00THz	192.01THz

Model Name	Minimum	fc	Maximum
MU952504A-01	194.09THz	194.10THz	194.11THz
MU952504A-02	194.19THz	194.20THz	194.21THz
MU952504A-03	194.29THz	194.30THz	194.31THz
MU952504A-04	194.39THz	194.40THz	194.41THz
MU952504A-05	194.49THz	194.50THz	194.51THz
MU952504A-06	194.59THz	194.60THz	194.61THz
MU952504A-07	194.69THz	194.70THz	194.71THz
MU952504A-08	194.79THz	194.80THz	194.81THz
MU952504A-09	194.89THz	194.90THz	194.91THz
MU952504A-10	194.99THz	195.00THz	195.01THz
MU952505A-01	195.09THz	195.10THz	195.11THz
MU952505A-02	195.19THz	195.20THz	195.21THz
MU952505A-03	195.29THz	195.30THz	195.31THz
MU952505A-04	195.39THz	195.40THz	195.41THz
MU952505A-05	195.49THz	195.50THz	195.51THz
MU952505A-06	195.59THz	195.60THz	195.61THz
MU952505A-07	195.69THz	195.70THz	195.71THz
MU952505A-08	195.79THz	195.80THz	195.81THz
MU952505A-09	195.89THz	195.90THz	195.91THz

2. Optical Output Level

Minimum		Reading		Maximum
9.0dBm	≤	☐ dBm	≤	11.0dBm

Light Source (DFB-LD) List of Performance Test Result Record

Model: MU95260☐A-☐☐	Date:
Serial No.:	Temperature: °C
	Humidity: %
	Atmospheric pressure: hPa
	Person in charge:

1. Center Optical Frequency

Minimum*	Reading	Maximum*
THz ≤	☐ THz ≤	THz

*Minimum,Maximum: Select the appropriate one from the table below and enter it.

Model Name	Minimum	fc	Maximum	Model Name	Minimum	fc	Maximum
MU952601A-01	191.09THz	191.10THz	191.11THz	MU952604A-02	188.19THz	188.20THz	188.21THz
MU952601A-02	191.19THz	191.20THz	191.21THz	MU952604A-03	188.29THz	188.30THz	188.31THz
MU952601A-03	191.29THz	191.30THz	191.31THz	MU952604A-04	188.39THz	188.40THz	188.41THz
MU952601A-04	191.39THz	191.40THz	191.41THz	MU952604A-05	188.49THz	188.50THz	188.51THz
MU952601A-05	191.49THz	191.50THz	191.51THz	MU952604A-06	188.59THz	188.60THz	188.61THz
MU952601A-06	191.59THz	191.60THz	191.61THz	MU952604A-07	188.69THz	188.70THz	188.71THz
MU952602A-01	190.09THz	190.10THz	190.11THz	MU952604A-08	188.79THz	188.80THz	188.81THz
MU952602A-02	190.19THz	190.20THz	190.21THz	MU952604A-09	188.89THz	188.90THz	188.91THz
MU952602A-03	190.29THz	190.30THz	190.31THz	MU952604A-10	188.99THz	189.00THz	189.01THz
MU952602A-04	190.39THz	190.40THz	190.41THz	MU952605A-01	187.09THz	187.10THz	187.11THz
MU952602A-05	190.49THz	190.50THz	190.51THz	MU952605A-02	187.19THz	187.20THz	187.21THz
MU952602A-06	190.59THz	190.60THz	190.61THz	MU952605A-03	187.29THz	187.30THz	187.31THz
MU952602A-07	190.69THz	190.70THz	190.71THz	MU952605A-04	187.39THz	187.40THz	187.41THz
MU952602A-08	190.79THz	190.80THz	190.81THz	MU952605A-05	187.49THz	187.50THz	187.51THz
MU952602A-09	190.89THz	190.90THz	190.91THz	MU952605A-06	187.59THz	187.60THz	187.61THz
MU952602A-10	190.99THz	191.00THz	190.01THz	MU952605A-07	187.69THz	187.70THz	187.71THz
MU952603A-01	189.09THz	189.10THz	189.11THz	MU952605A-08	187.79THz	187.80THz	187.81THz
MU952603A-02	189.19THz	189.20THz	189.21THz	MU952605A-09	187.89THz	187.90THz	187.91THz
MU952603A-03	189.29THz	189.30THz	189.31THz	MU952605A-10	187.99THz	188.00THz	188.01THz
MU952603A-04	189.39THz	189.40THz	189.41THz	MU952606A-03	186.29THz	186.30THz	186.31THz
MU952603A-05	189.49THz	189.50THz	189.51THz	MU952606A-04	186.39THz	186.40THz	186.41THz
MU952603A-06	189.59THz	189.60THz	189.61THz	MU952606A-05	186.49THz	186.50THz	186.51THz
MU952603A-07	189.69THz	189.70THz	189.71THz	MU952606A-06	186.59THz	186.60THz	186.61THz
MU952603A-08	189.79THz	189.80THz	189.81THz	MU952606A-07	186.69THz	186.70THz	186.71THz
MU952603A-09	189.89THz	189.90THz	189.91THz	MU952606A-08	186.79THz	186.80THz	186.81THz
MU952603A-10	189.99THz	190.00THz	190.01THz	MU952606A-09	186.89THz	186.90THz	186.91THz
MU952604A-01	188.09THz	188.10THz	188.11THz	MU952606A-10	186.99THz	187.00THz	187.01THz

2. Optical Output Level

Minimum		Reading		Maximum
6.0dBm	≤	☐ dBm	≤	8.0dBm

Light Source (FP-LD) List of Performance Test Result Record

Model: MU951☐☐☐A-

Serial No.:

Date:

Temperature: °C

Humidity: %

Atmospheric pressure: hPa

Person in charge:

1. Center Wavelength

Minimum		Reading			Maximum
1290 mn	≤		nm	≤	1330 nm [1310 nm]
1530 mn	≤		nm	≤	1570 nm [1550 nm]

2. Optical Output Level

Minimum		Reading			Maximum
6.0 dBm	≤		dBm	≤	8.0 dBm [1310 nm]
6.0 dBm	≤		dBm	≤	8.0 dBm [1550 nm]

Appendix F Overrange and Underrange Indication when Optical Sensor is Used

This Device switches into the overrange or underrange indications in such cases as those listed below when the optical sensor is used.

- Measurement beyond the range of optical power measurement of the unit was attempted.
- Measurement beyond the range of manual range was attempted when the manual range is set.
- The results of the relative, reference and calibration measurements exceeded the numerical value allowed to be displayed by the Device.

F.1 Overrange Indication

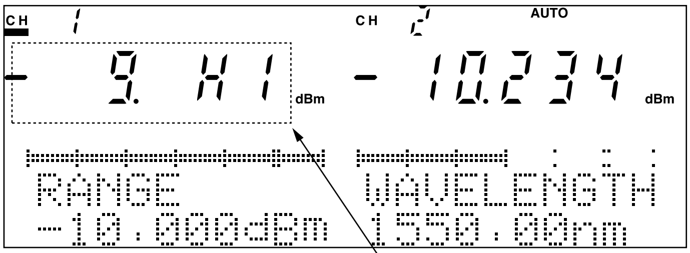
F.1.1 Outside the range of measurement

The range indication set on the Device constitutes the full scale value on the range. When the optical power being measured exceeds 120% (0.8 dB) of the value, the Device switches into the overrange indication as shown below.

* The range indication here refers to the maximum range when the mode is set to AUTO RANGE and the range set when the mode is set to MANUAL RANGE. The following example provides explanations of the range set at -10 dBm (100 μW) in the MANUAL RANGE mode.

[dBm representation]

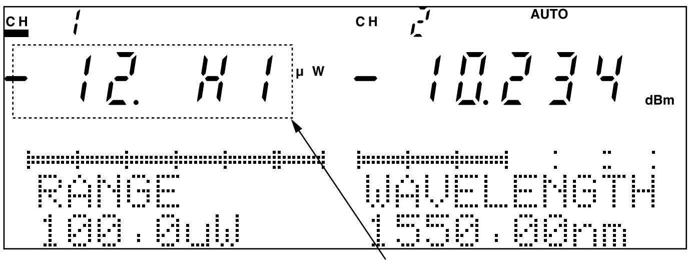
On the range of -10 dBm, -9.2 dBm constitutes the upper limit of indication. If light that exceeds this value is entered, the indications of “-9,” which constitutes the integer part of the values allowed to be displayed, and “HI” flicker to signify the overrange.



Flickering display

[W representation]

On the range of 100 μW, 120 μW constitutes the upper limit of indication. If light which exceeds this value is entered, the indications of “12,” which constitutes the top two digits of the values allowed to be displayed, and “HI” flicker to signify the overrange.



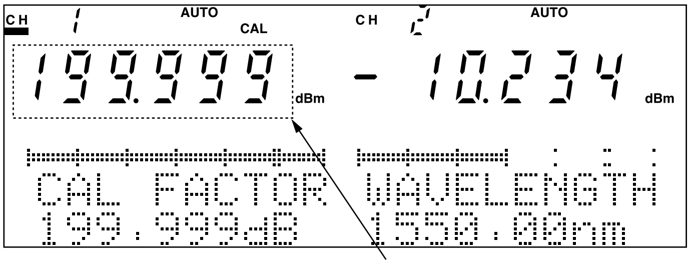
Flickering display

F.1.2 Outside the range of numerical values allowed to be displayed

The Device sets the upper limit of numerical values allowed to be displayed by the representation unit as follows.

199.999dBm
199.999dB
99999W
199.99%

If the result of the relative, reference or calibration measurement exceeds the value, the upper limit value shown above flickers to signify the overrange.



Flickering display

F.2 Underrange Indication

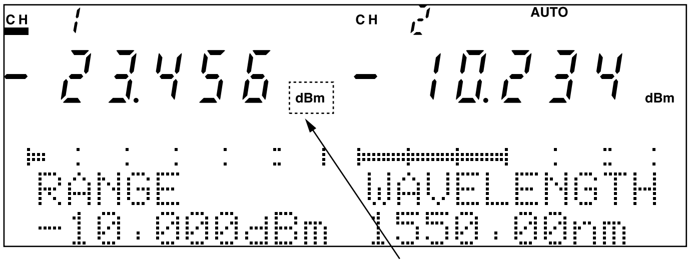
F.2.1 Outside the range of measurement

The range indication set on the Device constitutes the full scale value on the range. When the optical power being measured falls below 10% (-10 dB) of the value or when the optical power being measured falls below 0.1% (-30 dB) of the value, the Device switches into the underrange indication as shown below.

* The range indication here refers to the minimum range when the mode is set to AUTO RANGE and the range set when the mode is set to MANUAL RANGE. The following examples provide explanations of the range set at -10 dBm (100 *m*W) in the MANUAL RANGE mode and of the minimum range set at -90 dBm (1 pW) in the AUTO RANGE and MANUAL RANGE modes.

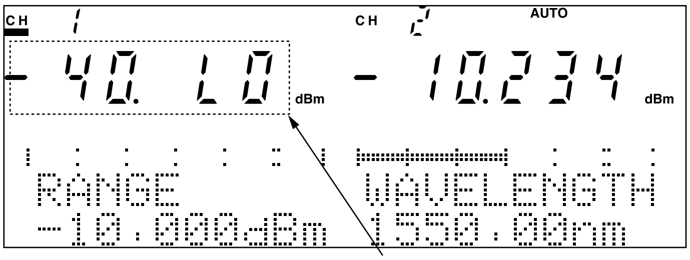
[dBm representation]

On the range of -10 dBm, when light that falls below -20 dBm is entered, the dBm representation showing the unit flickers with the measured value (numerical value) remaining displayed, to signify the underrange.



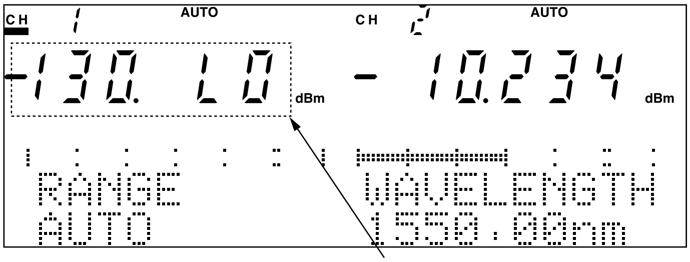
Flickering display

Moreover, when light that falls below -40 dBm is input, indications of "-40," the value that is the range display minus 30 dB, and "LO" flicker to signify the underrange.



Flickering display

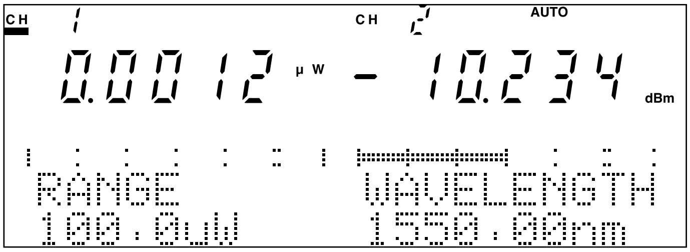
When the minimum range of -90 dBm is set in the AUTO RANGE or MANUAL RANGE mode, if light that falls below -100 dBm is input, the measured value (numerical value) remains displayed and the dBm representation that constitutes the unit flickers to signify the underrange. Moreover, when light that falls below -120 dBm is input, indications of "-130," the value that is the range display minus 40 dB, and "LO" flicker to signify the underrange.

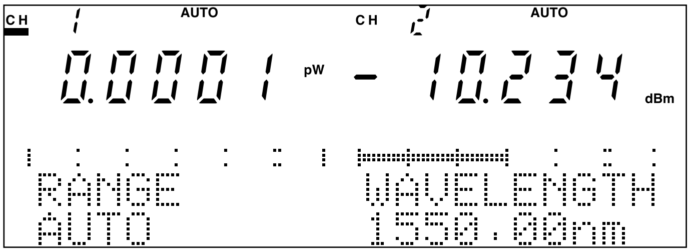


Flickering display

[W representation]

In the case of W representation, no "LO" indication or flickering display takes place. But, a measured value is displayed with the decimal point position and unit remaining unchanged.



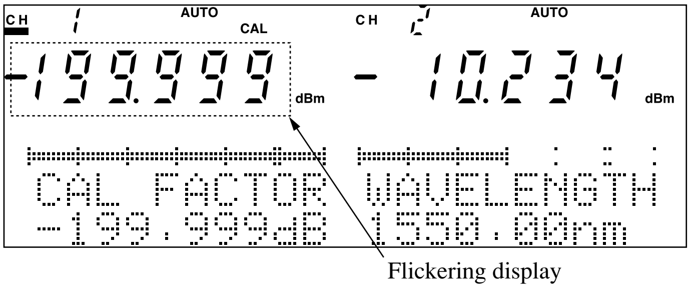


F.2.2 Outside the range of numerical values allowed to be displayed

The Device sets the upper limit of numerical values allowed to be displayed by the representation unit as follows.

-199.999dBm
-199.999dB
0.0001pW or -0.0001pW
-199.99%

If the result of the relative, reference or calibration measurement falls below the value, the lower limit value shown above flickers to signify the underrange.



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