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AS-61740-1-1
INSTRUCTION MANUAL
FOR
AQ-2105 OPTICAL POWER METER

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LIST OF ATTACHED DRAWINGS

List of Standard Accessories

AQ-2105 Optical Power Meter External View ASD-61740-1-1/3
AQ-2105 Optical Power Meter External View (Front) ASD-61740-1-2/3
AQ-2105 Optical Power Meter External View (Rear) ASD-61740-1-3/3
AQ-2106 OPM Unit External View (Front) ASD-61751
AQ-2107 OPM Unit External View (Front) ASD-61750
AQ-2109 OPM Unit External View (Front) ASD-61752
AQ-2715 Sensor External View ASD-61767

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AQ-2716 Sensor External View ASD-61830
AQ-2717 Sensor External View ASD-61831
AQ-2718 Sensor External View ASD-61765
AQ-2719 Sensor External View ASD-61764

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Thank you for purchasing the AQ-2105 Optical Power Meter.

The AQ-2105 is one of the most advanced optical power meters developed by Ando Electric Co. utilizing its long-accumulated asset of optical measurement technologies.

It has been designed for use for diversified purposes which include not only R&D and manufacture in the field of optical communications and other optics-applied fields but also applications to equipment maintenance and construction work.

It is wished that this instruction manual will enable the user to fully utilize the apparatus.

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SECTION 1
GENERAL INFORMATION

1.1 INTRODUCTION

This instruction manual contains information required for proper operation and simple maintenance of AQ- 2105 Optical Power Meter (which will be referred to as the apparatus or AQ-2105 in this manual).

1.2 GENERAL

This apparatus is a general-purpose 2-channel optical power meter operable with plug-in units.

This apparatus permits a light source unit to be connected to it. When connected with a light source unit, it enables measurement operation which formerly required a system comprising a light source, an optical power meter, a controller and a data collector to be prepared. (This apparatus is capable of storing up to 1,500 measured values per channel in its memory.)

Besides being connectable to a commercial AC outlet, this apparatus can also operate on a DC power supply. It is therefore useful in outdoor measurement operations, too. An adequate variety of accessories including connector adapters and bare fiber adapters are available for use with this apparatus.

1.3 FEATURES

- o Measurement functions dependent on plug-in units
  - (1) Optical power level measurement on up to two channels
    This apparatus permitting the use of optical power meter (OPM) units of two types, one with a built-in sensor and the other without, is usable in a wide range of ways.
  - (2) Optical loss (attenuation)/insertion loss measurement
    This apparatus can accommodate an OPM unit for B channel and a light source unit incorporating an LED for A channel to make up a single-frame system for optical loss(attenuation)/insertion loss measurement.
- o Wide wavelength band (0.85 to 1.7 μm) and high dynamic range (-90 to + 10 dBm)
- o Data memory function
  Up to 1500 measured values can be stored for each of channels A and B.
- o The plug-in units and sensors for use with this apparatus need not be adjusted before use.

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- o Various operation functions designed to enhance measurement efficiency
- o Memory backup function for retaining the last memory contents
- o Measurement condition storage (10 modes)
- o GP-IB provided as a standard feature

1.4 SPECIFICATIONS

The specifications of this apparatus are shown in Table 1-1, and those of the OPM unit and sensor are shown in Table 1-2.

Table 1-3 gives the names of typical LED light source units for use with this apparatus. For their performance specifications, refer to the specifications of AQ-4137/AQ-4141 Stabilized Light Sources.

1.5 COMPOSITION

This apparatus is supplied with the standard accessories listed in the standard accessory table at the end of this manual.

Table 1-1 AQ-2105 Optical Power Meter specifications

Display	Absolute or relative measured values on 2 channels in 5 decimal digits each (in dBm, mW-pW, or dB) and corresponding bar graphs
Calibration factor	Inputtable in log, linear or nm value
Display resolution	0.1/0.01/0.001 dB for dBm display, or 1/0.1/0.01% for W display; switchable
Range switching	Automatic or fixed (Range setting by up/down method)
Averaging	On/Off switchable
Channel switching	A, B, or B/A switchable
Analog output voltage	0 to 2 V (in each range)
Measuring accuracy	± 0.22 dB (± 5%) (at -23 dBm, reference wavelength, and 0-40°C)
GP-IB	Standard feature, complying with IEEE- 488
Power requirements	100, 115 to 127, 220, 230 to 240VAC, 50/60Hz, or external DC supply (–10.2 to –13.8 V)
Dimensions	About 110 (H) x 212 (W) x 300 (D) mm

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Table 1-2 OPM unit and sensor specifications

OPM unit		AQ-2106	AQ-2107	AQ-2109				
Sensor		Built-in		AQ-2715	AQ-2716	AQ-2717	AQ-2718	AQ-2719
Application		Large diameter fiber transmission light *2	Small diameter silica optical fiber transmission light *1 *2	Small diameter silica optical f iber transmission light *1		Free-space propagation light or large-diameter optical fiber transmission light *4		Small diameter silica optical fiber transmission light *1
Wavelength range		400 to 1150nm	750 to 1700nm	750 to 1700nm	400 to 1150nm	750 to 1700nm	400 to 1150 nm	750 to 1700nm
Input method and sensitive area diamete		Direct to photodiode (about 10 mmϕ)	Direct to photodiode (about 2 mmϕ)	Via optical connector *3 (FC:standard)	Via optical connector. *3 (FC:standard)	Direct to photodiode (about 5 mmϕ)	Direct to photodiode (about 10 mmϕ)	Direct to photodiode (about 2 mmϕ)
Optical power measuring ra	CW light	−70 to + 10dBm 0.1nW to 10mW	−60 to + 10dBm 1nW to 10mW	− 90 to 0 dBm 1pW to 1mW	− 90 to 0 dBm 1pW to 1mW	− 40 to 10dBm 0.1μW to 10mW	− 70 to 10dBm 0. 1nW to 10mW	− 60 to + 10dBm 1nW to 10mW
	270-Hz chopped light	−90 to 0dBm 1pW to 1mW	−80 to 0dBm 10pW to 1mW	− 90 to 0 dBm 1 pW to 1 mW	− 90 to 0 dBm 1 pW to 1 mW	− 60 to 0 dBm 1 nW to 1 mW	− 90 to 0 dBm 1 pW to 1 mW	− 80 to 0 dBm 10 pW to 1 mW
Reference wavelength		850 nm	1300nm	1300 nm	850 nm	1300 nm	850 nm	1300 nm

NOTE: *1 Small-dia. silica optical fiber GI-62.5/125 μm, GI-50/125 μm, or SM-10/125 μm

*2 AQ−2719 sensor, AQ−2106, AQ−2107 OPM units are provided with the AQ−9335 connector adapter. Specify connector type when ordering.

*3 Inquire with regard to optical connectors other than the above.

*4 The AQ−9335 connector adapter is required when optical fiber transmission light is measured.

Table 1-3 Light source unit specifications

Type	Emission wavelength (nm)	Spectral half-value width (nm)	Optical output level (dBm)	Applicable optical fiber
AQ-4140 (130)	1300 ± 10	25 or less	− 35 or more − 50 or more	GI SM
AQ-4140 (131)	1310 ± 10	25 or less	− 50 or more −40 or more	SM GI
AQ-4140 (155)	1550 ± 15	25 or less	− 55 or more	
AQ-4142 (066)	660 ± 20	35 or less	− 25 ± 1	SI
AQ-4142 (085)	850 ± 15	55 or less	− 15 ± 1	GI
AQ-4142 (130)	1300 ± 30	135 or less	− 20 ± 1 −40 or more	GI SM
AQ-4142 (131)	1310 ± 20	135 or less	− 40 or more −30 or more	SM GI
AQ-4142 (155)	1550 ± 50	250 or less	− 45 or more	SM
AQ-4148 (131/155)	1310 ± 20 or 1550 ± 20	75 or less	−45or more −50 or more	SM

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SECTION 2
PREPARATION FOR USE

2.1 INTRODUCTION

This section contains the procedures for unpacking, acceptance inspection, and repacking.

2.2 UNPACKING AND ACCEPTANCE INSPECTION

This apparatus has been factory inspected, mechanically and electrically, prior to shipment to ensure that it gives satisfactory performance. When it is received, promptly unpack and check it for damage sustained in transit.

When unpacking the apparatus, save the wooden box, corrugated cardboard box, cushions, and other packing materials except consumables like steel bands and wrapping paper where possible so that they may be reused when the apparatus is to be packed again for shipment.

2.2.1 Mechanical Inspection

Visually inspect the apparatus for damage sustained in transit, then check its panel controls like switches and knobs for looseness or other faults. It is also recommended that the accessories and spare parts be checked against the packing list.

2.2.2 Performance Test

If the apparatus is found by the mechanical inspection to be in good order externally, then test it according to the procedures described in Section 5 to check its performance for compliance with the specifications set forth in Table 1-1.

2.3 DAMAGE OR FAULT

If the apparatus is found damaged or faulty in the acceptance inspection, immediately report the damage or fault to the nearest dealer.

2.4 REPACKING

When repacking the apparatus, use the packing materials, if saved for later use. If they have not been saved, repack the apparatus, exercising care as suggested below.

(1) Wrap the apparatus in strong paper like tarpaulin paper or vinyl sheeting. Protect all the protrusions with cushions against damage.

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(2) Place the wrapped apparatus in a wooden or cardboard box which is larger by about 10 cm than the apparatus on all sides.

(3) Fill all open spaces between the apparatus and the box with polyurethane foam or any other suitable cushioning material. The apparatus may rattle and be damaged in transit, if cushioning is insufficient.

(4) Cover the wooden box and brace it up with steel bands.
If a corrugated cardboard box is used, seal it with adhesive tape.

(5) Indicate the contents and shipping marks in a legible and durable way.

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SECTION 3
PRECAUTIONS IN APPARATUS HANDLING

3.1 GENERAL PRECAUTIONS

This apparatus has been designed to withstand use in an adverse environment as much as possible. However, since it incorporates many precision parts, the user is required to observe the following points:

1) Do not subject the apparatus to an excessive impact.
   Its display section incorporating glass parts is particularly susceptible to impacts.
2) Do not leave the apparatus in a hot and humid environment for extended periods of time.
3) Do not set the apparatus near an object which transmits strong radiowaves or creates a strong magnetic field.
   Using the apparatus in such a location may cause it to malfunction.
4) Do not connect any unit other than the designated ones to this apparatus; or apparatus failure may result.

3.2 PRECAUTIONS IN USING OPTICAL PARTS

The precautions to be taken in using optical parts are set forth below.

3.2.1 Precautions in Handling

The plug-in units for use with this apparatus have optical parts on their front, so that observe the following cautions when handling them:

1) The optical output connector have been superfine- processed. Take care not to subject them to any strong impact.
2) When using a light source unit, take adequate care not to directly look at the output light; or your eye (retina) may be impaired.
3) Do not connect an optical fiber core to a light source unit using a bare fiber adapter. (An optical fiber core protruding from a bare fiber adapter may damage the optical output section of the unit.)

3.2.2 Precautions in Measurement

1) Avoid, whenever possible, using the apparatus in a dusty place.
2) When connecting an optical fiber to this apparatus, clean the optical fiber end-face to come in the optical connector with absolute alcohol or Freon gas.

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SECTION 4

OPERATION

4.1 INTRODUCTION

This section contains the procedures for operation of this apparatus, OPM unit and light source unit.

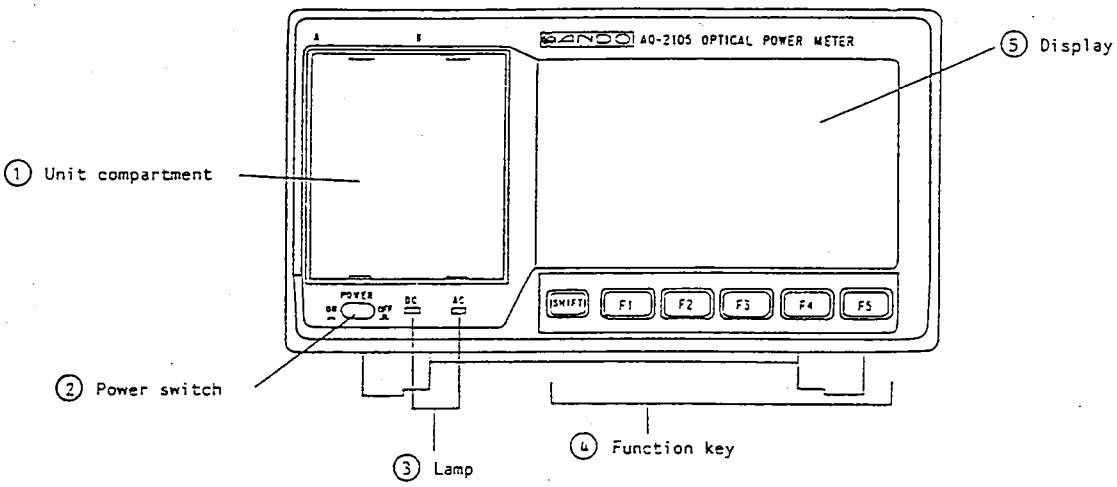
4.2 PANEL CONTROLS

4.2.1 Panel Controls of AQ-2105

The names and arrangement of the panel controls of this apparatus are shown in Figure 4-1. The functions of the panel controls are explained in Table 4-1. The numbers attached to the control names are the same between Figure 4-1 and Table 4-1.

1) External view

o Front view



o Rear view

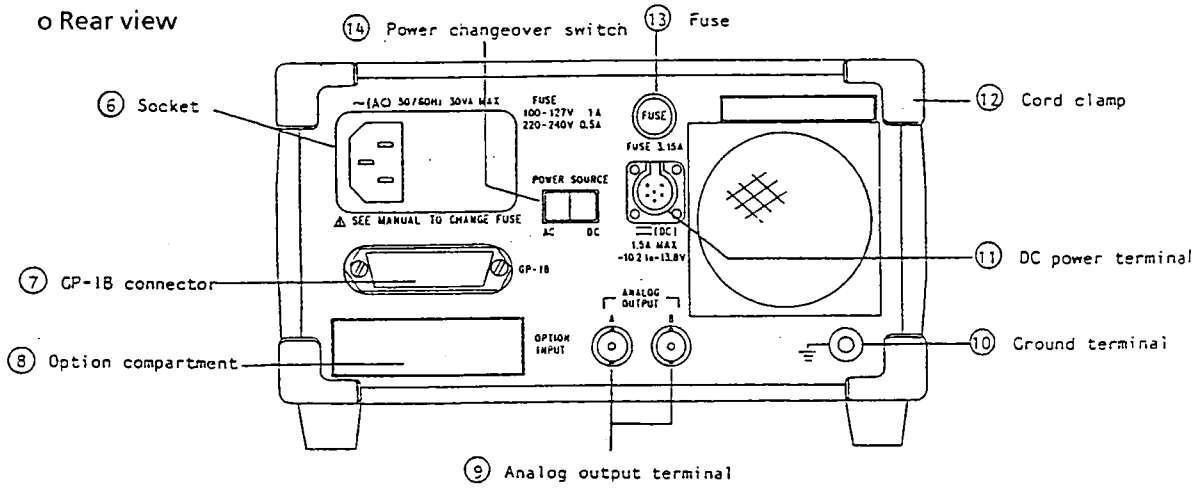


Fig. 4-1 Panel controls of AQ-2105

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2) Functions

Table 4-1 Functions of panel controls of AQ-2105

No.	Control name	Marking	Explanation
①	Unit compartment	A	Compartment for an OPM unit or a light source unit
		B	Compartment exclusively for an OPM unit If a light source unit is set in this compartment, an error results. See Subsection 4.6 for more information.
②	Power switch	POWER ON OFF	Switch used to turn the apparatus on and off
③	Lamp	DC, AC	The LED marked DC lights when the apparatus is powered by an external DC power supply, and the one marked AC lights when the apparatus is powered by commercial AC power.
④	Function key	<SHIFT> <F1> <F2> <F3> <F4> <F5>	These keys are used to perform the corresponding functions whose names are shown on display 5. See Subsection 4.4 for more information.
⑤	Display		This display shows measured values, measurement conditions, function names, etc. See Subsection 4.4 for more information.
⑥	Socket	AC100-127V 220-240V	Socket into which a power cord is to be plugged to connect the apparatus to a commercial AC power outlet.
⑦	GP-IB connector	GP-IB	Connector for GP-IB. The GP-IB address is to be set using [PRMTR].
⑧	Option compartment		Compartment reserved for an optional unit.
⑨	Analog output terminal	ANALOG OUTPUT A, B	Two terminals corresponding to channels A and B. Each of these terminals outputs voltage proportional to the linear value in a preset range measured on the corresponding channel. External recorders may be connected to them to record varying measurements.
⑩	Frame ground terminal	⏚	Frame grounding terminal Terminal to be used when connecting an external DC power supply to the
⑪	DC power terminal	⎓ (DC) 1.5A MAX	apparatus. When connecting an external DC power supply, use the special plug attached as a standard accessory. See Sub-subsection 4.3.1 for more information.
⑫	Cord clamp		Wind the unplugged power cord around these cord clamps.
⑬	Fuse	FUSE 3.15A	Fuse holder to hold a fuse with a DC capacity of 3.15A.
⑭	Power changeover switch	POWER SOURSE AC, DC	Switch used to make a changeover between a commercial AC power supply and an external DC power supply; set this switch to AC to use the former or DC to use the latter. Be sure to turn off the apparatus before changing the setting of this switch.

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4.2.2 Controls of OPM Unit

The controls of the OPM unit are described in the following:

1) OPM unit with sensor

o External view

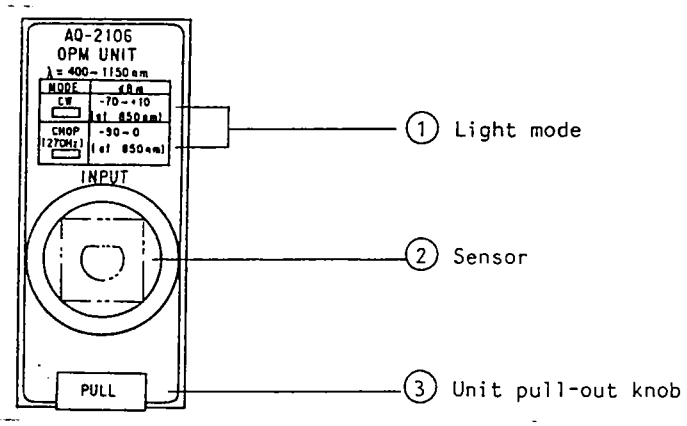


Fig. 4-2 Controls of OPM unit with sensor

o Functions

Table 4-2 Functions of controls of OPM unit with sensor

No.	Control name	Marking	Explanation
①	Light mode	MODE CW SHOP (270Hz)	Two LEDs to indicate the selected mode of light to be received. The one marked CW lights when the continuous-wave light mode is selected, and the one marked CHOP lights when the 270Hz chopped light mode is selected.
②	Sensor	INPUT	Photoelectric sensor
③	Unit pull-out knob	PULL	Knob by which this OPM unit is to be pulled out

NOTE

When low optical power is measured, press the offset switch after shielding the sensor and then measure.

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2) OPM unit without sensor

o External view

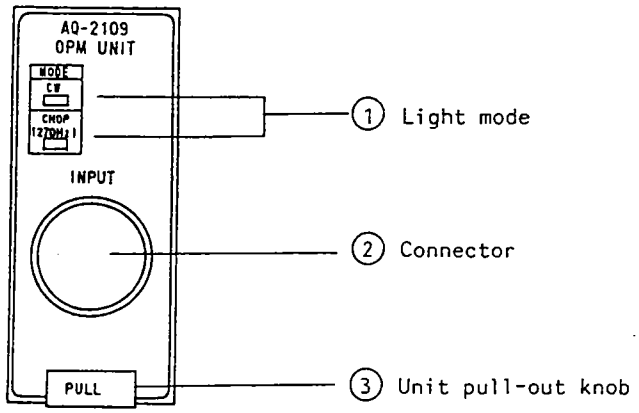


Fig. 4-3 Controls of OPM unit without sensor

o Functions

Table 4-3 Functions of controls of OPM unit without sensor

No.	Control name	Marking	Explanation
①	Light mode	MODE CW SHOP (270Hz)	Two LEDs to indicate the selected mode of light to be received. The one marked CW lights when the continuous-wave light mode is selected, and the one marked CHOP lights when the 270Hz chopped light mode is selected.
②	Sensor	INPUT	Sensor connector
③	Unit pull-out knob	PULL	Knob by which this OPM unit is to be pulled out

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4.2.3 Controls of Sensor

The controls of the sensor are described in the following:

o External view

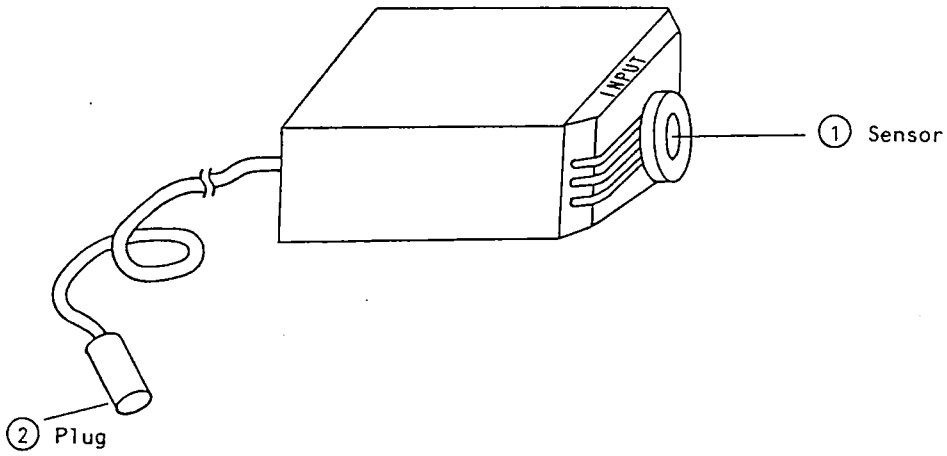


Fig. 4-4 Controls of sensor

o Functions

Table 4-4 Functions of controls of sensor

No.	Control name	Marking	Explanation
①	Sensor	INPUT	Sensor in which photoelectric conversion is made NOTE: Do not directly touch the sensor face with finger. Handle the sensor with utmost care not to scratch or soil its surface.
②	Plug		Plug used to connect this sensor to AQ-2109 OPM unit.

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4.2.4 Controls of Light Source Unit

The controls of the light source unit are described in the following:

1) Single-wavelength light source unit

o External view

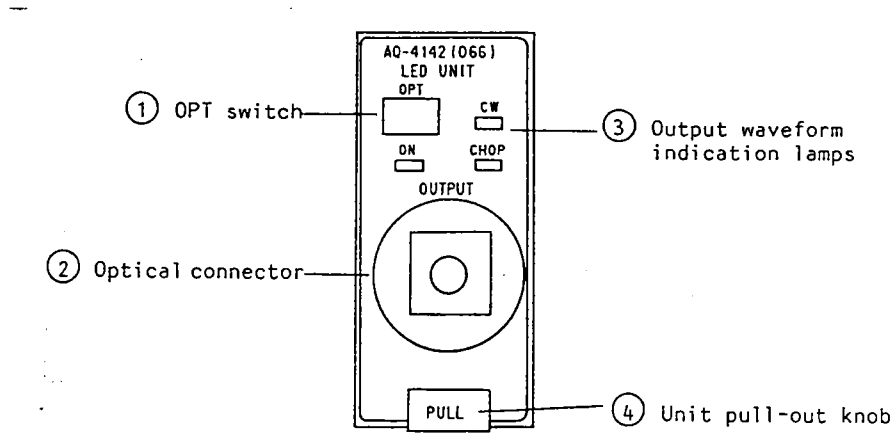


Fig. 4-5 Controls of single-wavelength light source unit

o Function

Table 4-5 Functions of controls of single-wavelength light source unit

Control name	Marking	Explanation
① OPT switch	OPT ON	Switch used to turn the optical output on and off. While this switch is on, its lamp stays on.
② Optical connector		Connector used to connect an optical fiber
③ Output waveform indication lamps	CW CHOP	Optical output waveform indicator lamps to indicate selection between CW light and 270Hz chopped light
④ Unit pull-out knob	PULL	Knob by which this unit is to be pulled out

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2) Double-wavelength light source unit

o External view

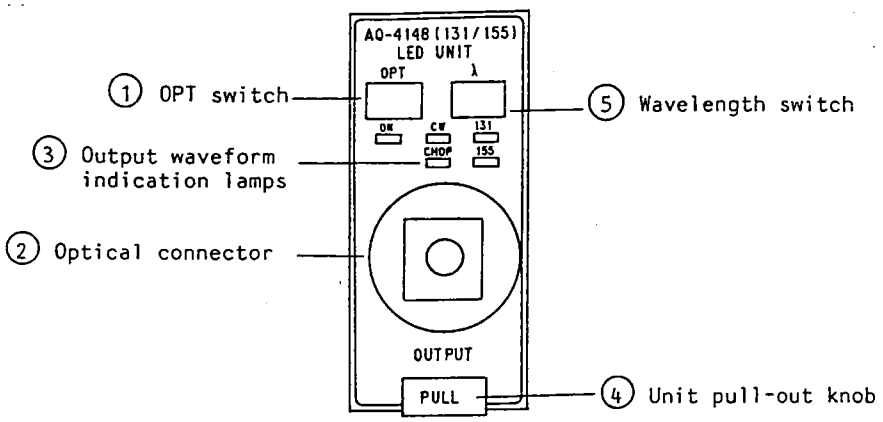


Fig. 4-6 Controls of double-wavelength light source unit

o Functions

Table 4-6 Functions of controls of double-wavelength light source unit

Control name	Marking	Explanation
① OPT switch	OPT ON	Switch used to turn the optical output on and off. While this switch is on, its lamp stays on.
② Optical connector		Connector used to connect an optical fiber
③ Output waveform indication lamps	CW CHOP	Optical output waveform indicator lamps to indicate selection between CW light and 270Hz chopped light
④ Unit pull-out knob	PULL	Knob by which this unit is to be pulled out
⑤ Wavelength switch	1.31, 1.55	Output wavelength selection switch. Every time this switch is pressed, wavelength selection alternates between 1.31 and 1.55 µm. 1.31 → 1.55 → 1.31, 1.55

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4.3 HOW TO USE

4.3.1 Preparation

1) When using commercial AC power supply

   ① Make sure that the <POWER> switch ② is at <OFF. ▟ >.

   ② Make sure that the fuse set inside the socket ⑥ on the rear panel is of the specified capacity.

   ③ Make sure that the supply voltage agrees with the input voltage rating of this apparatus.

   ④ Set the <POWER SOURCE> switch ⑭ on the rear panel to <AC>.

   ⑤ Connect the apparatus and the commercial AC power outlet with the power cord supplied as a standard accessory.

2) When using external DC power supply

   ① Make sure that the <POWER> switch ② is at <OFF. ▟ >.

   ② Make sure that the fuse in the <FUSE> ⑬ on the rear panel is of the specified capacity.

   ③ Set the <POWER SOURCE> switch ⑭ on the rear panel to <DC>.

   ④ Connect the external DC power supply and the DC power plug supplied as a standard accessory such that terminals 1 and 4 of the plug are connected to GND and - 12 V, respectively; then connect the plug to the DC power terminal ⑪.

The allowable input voltage range is from -10.2 V to - 13.8 V. When using an external DC power supply, take adequate care not to apply overvoltage to the apparatus or power it with the wrong polarity. If overvoltage or reverse-polarity voltage is applied to the apparatus, its protection circuit will work to below the power circuit fuse.

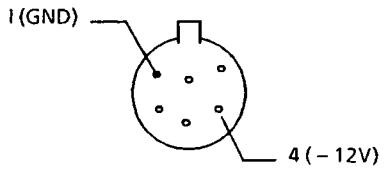


Fig. 4-7 Wirings for DC power connection plug (As viewed from the plug wiring side)

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4.3.2 Unit and Sensor Setting

1) Unit setting

To set a light source unit or OPM unit in a unit compartment, slide it in along the guide rail until it clicks. (See Fig. 4-9)

Either a light source unit or an OPM unit may be set for channel A, but only an OPM unit is settable for channel B.

NOTE: Do not connect any unit other than the designated ones to this apparatus. (Connecting a wrong unit may result in causing an apparatus failure.)

2) Sensor setting

Each sensor to be used must be connected to an AQ-2109 OPM unit as follows:

① Set the AQ-2109 OPM unit in this apparatus as illustrated in Figure 4-9. (See also 4.3.2 (1).)

② Aligning the red marks of the sensor plug and the OPM unit as shown in Figure 4-8, insert the sensor plug into the OPM unit until it clicks.

NOTE: Do not connect any sensor plug other than the specified one to the AQ-2109 OPM unit.
(Connecting a wrong sensor plug may result in causing an apparatus failure.)

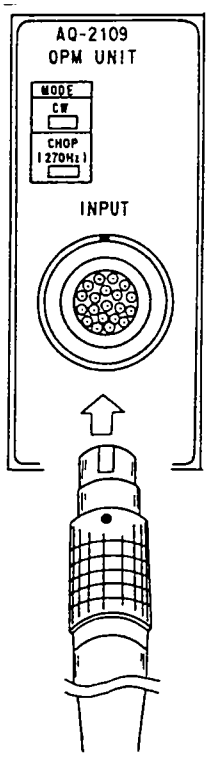


Fig. 4-8 How to connect sensor and OPM unit

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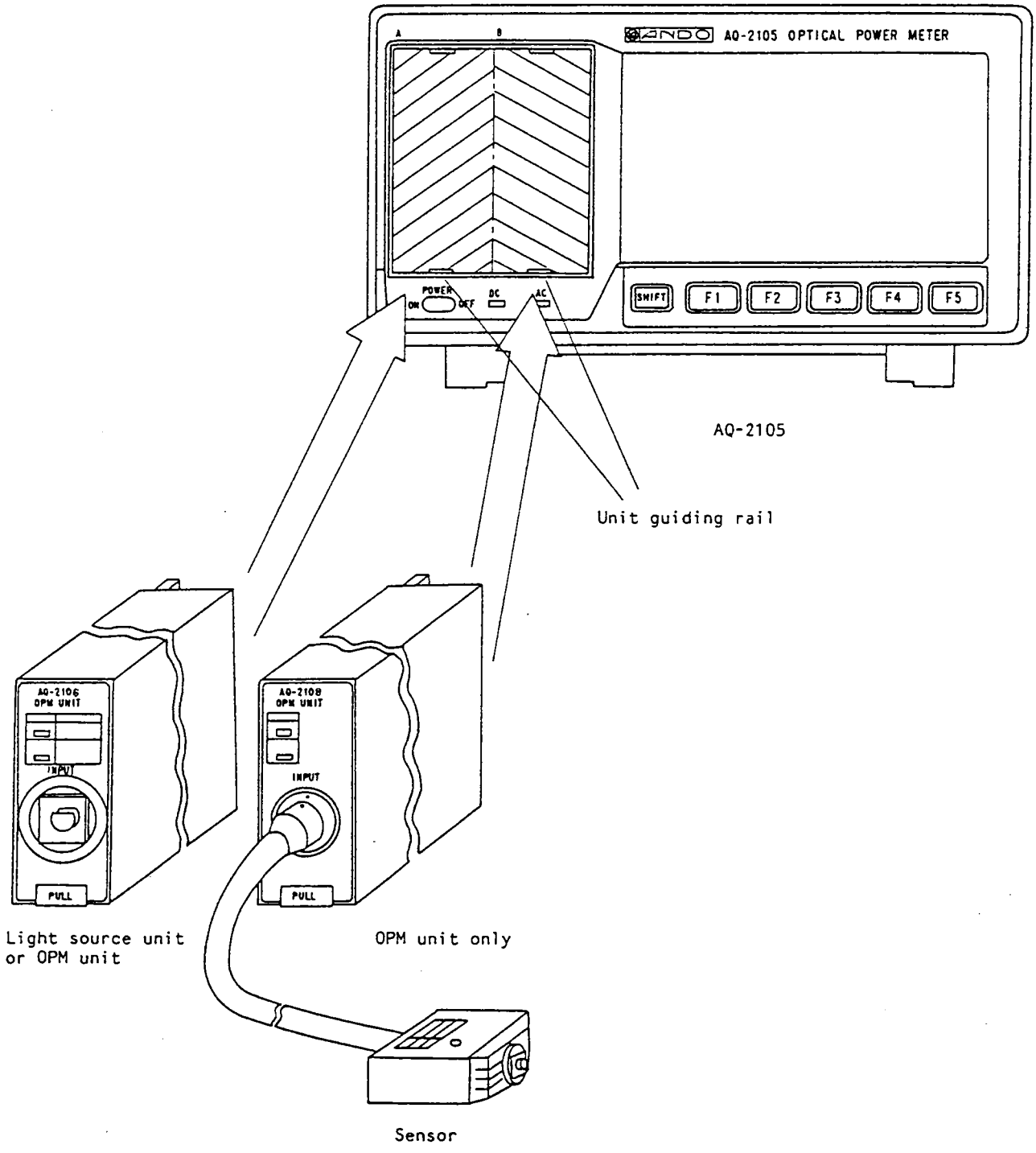


Fig. 4-9 How to set unit and sensor

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4.3.3 Shielding Cap and Connector Adapter Setting

Remember that the method of sensor shielding differs between sensor types.

> NOTE: Be sure to securely shield each sensor; or leakage light may hinder offsetting.

1) Shielding cap setting

Each sensor is provided with a shielding cap. It is effective in shielding the sensor from spatial light.

(The method described in (2) will be convenient in optical fiber testing.)

To shield a sensor, shield the sensor front with the shielding cap and screw the cap in by turning it fully clockwise as shown in Figure 4-10.

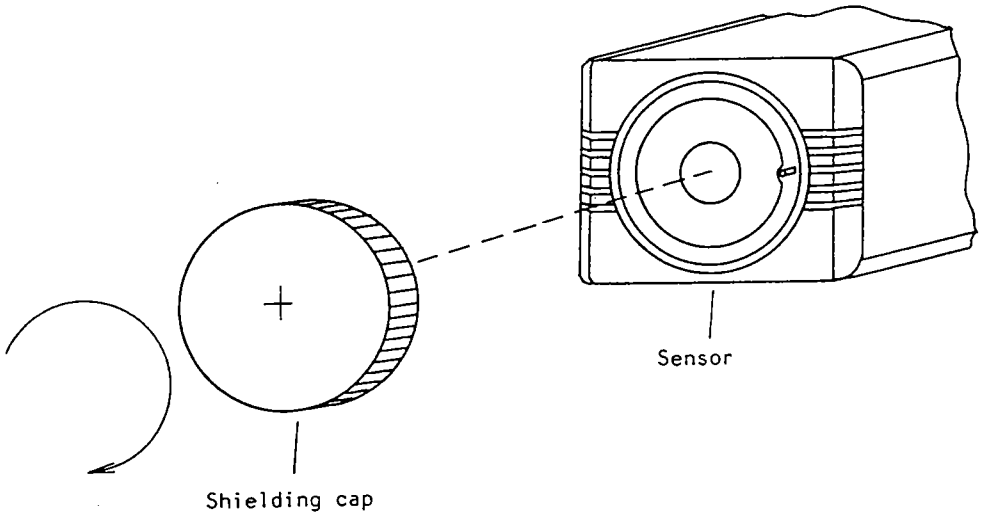


Fig. 4-10 How to set shielding cap

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2) Connector adapter setting

The OPM unit and sensor can be connected to different makes of connectors by using different connector adapters.
(except AQ–2715, AQ–2716)

NOTE: o The connector adapter and the sensor have precision-finished fitting surfaces. Clean their fitting surfaces with absolute alcohol or Freon gas before fitting them together and after putting them apart.

o In handling the sensor, give utmost care to its sensitive part. (If their lens surface is scratched, they may fail to meet their performance specifications.)

a) How to set AQ-9335 connector adapter and shield sensor

Fix the connector adapter to the sensor, aligning their alignment marks as shown in Figure 4-11.

Next, screw the ring onto the connector adapter by turning it fully clockwise. To shield the sensor, put the black shielding cap over the optical receptacle.

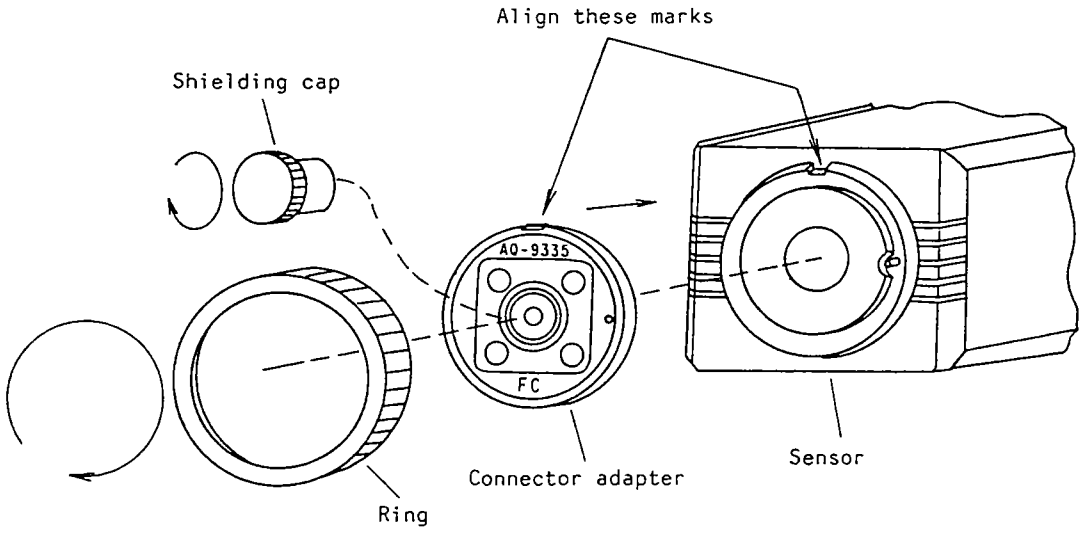


Fig. 4-11 How to set connector adapter and shield sensor

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note

The connector adapter of AQ–2715 and AQ–2716 sensers cannot be exchanged.

4.4 BASIC DISPLAY OPERATION

4.4.1 Display Areas

Display on the screen is partitioned as shown in Figure 4-13.

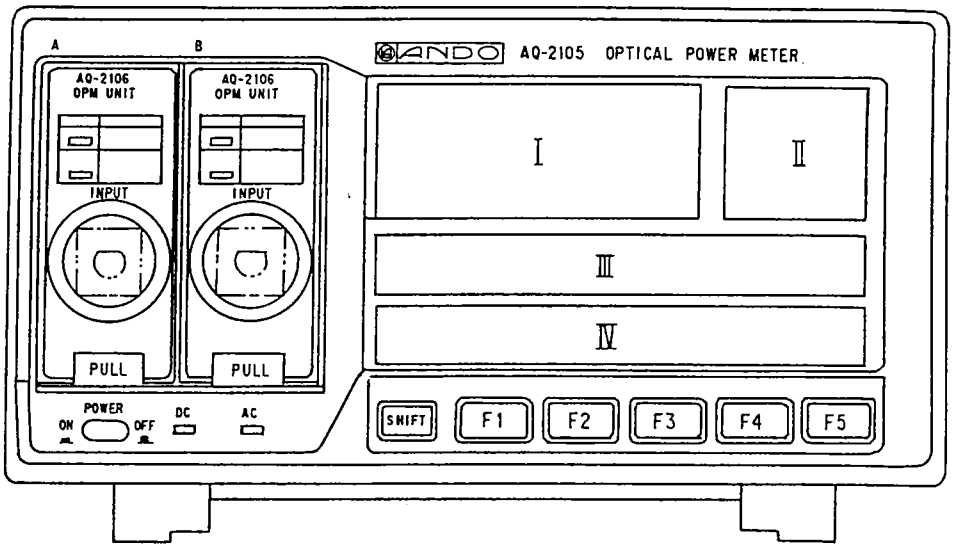


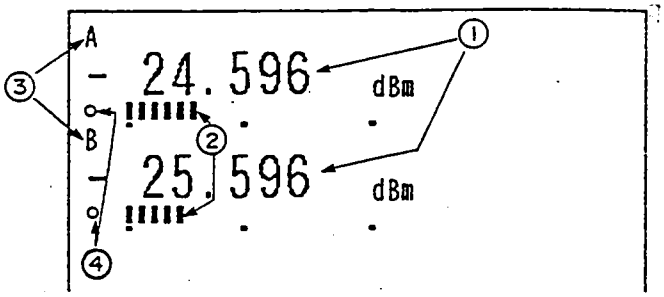
Fig. 4-12 Display areas

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I. Measured-value display area

In this area, measured values are displayed in 7- segment figures. The corresponding linear values are also indicated by analog bars in this area.

Example)



① Measured value
② Analog bars
③ Channel indication
④ Gate

NOTE: When a light source unit is connected to the apparatus, indication " ----- " appears in place of the 7-segment numeric display for the corresponding channel.

II. Unit and status display area

In this display area, the unit or status of measurement is displayed.

III. Parameter display area (Graphic display)

In this display area, the parameter settings made according to the selected functions are displayed.

Example)

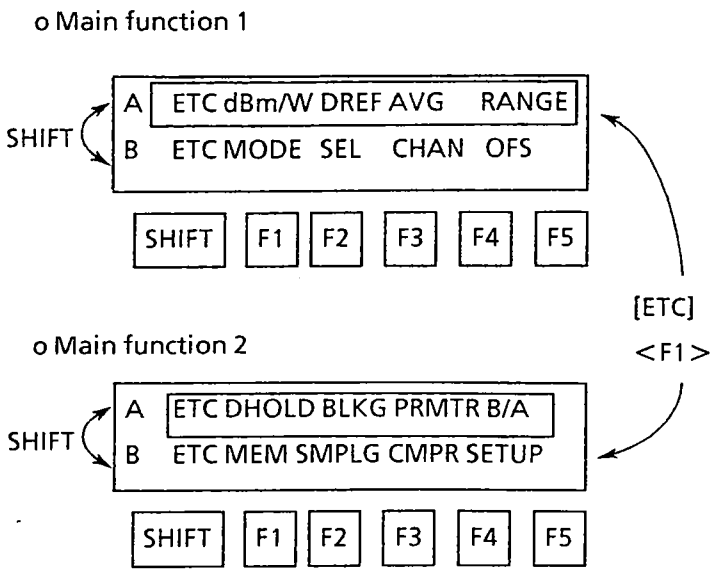
Ach WL = 1300nm dB = + 00.000dB MODE = CW
Bch WL = 1300nm dB = + 00.000dB MODE = CW

The contents of display in this area vary according to the selected functions.

IV. Function display area (Graphic display)

In this display area, the functions available for use are indicated. The functions comprise two groups, main function 1 and main function 2, and there are subfunctions subordinate to each main function.

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The keys <SHIFT>, <F1> to <F5> are used to select the functions to be executed. Indications A and B represent channels A and B. The functions indicated in the line headed by indication A or B are usable for channel A or B, correspondingly. When <SHIFT> is pressed, selection between the two function lines is altered; the characters in the currently selected function line are inverted.

NOTE: The following symbols will be used in the subsequent explanation:

< >	---	Key	Example) <F1>
[ ]	---	Function name displayed on the screen.	Example) [ETC]
☐	---	A frame containing characters in the illustration of a display denotes that the characters are actually inverted in the display.	
" "	---	Contents of display other than the function names will be enclosed in double quotation marks when they are referred to in the explanation.	
☐	---	Display area on the screen	

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4.4.2 Functions

(1) Explanation of individual functions

* There are cases in which some functions are not usable depending on the combination of units connected to the apparatus.

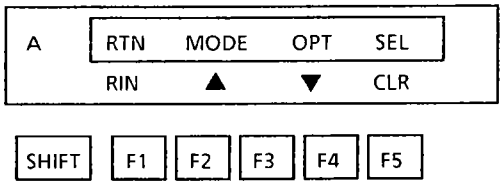
Table 4-7 Functions

Main function	Subfunction	Explanation	Display area / Display	Refer to section:
[ETC] (Etcetra)	—	Used for switching between the two function groups: main function 1 and main function 2.	—	
[dBm/W]	Momentary	Used for switching between two units of measurement display: dBm and W.	II — dBm W	
[DREF] (Display Reference)	—	When the key for setting this function is pressed, relative measurement is started to display the measured value relative to that obtained at the instant the key is pressed. If the key is pressed in the W display mode, the percentage of the measurement relative to the reference value is displayed without being accompanied by any unit of measurement. To reset the relative measurement mode, use [dBm/W].	II — dB	4.4.3.5)
[AVG] (Average)	Momentary	Used to start and stop sequential averaging measurement. To set the number of measurements to the made for averaging, use [PRMTR].	II — AVG	
[RANGE]	[RTN] (Return) [▲]/[▼] [SEL] (Select) [AUTO]	Used to fix a measurement range and manually shift the measurement range up or down. When the corresponding key is pressed, the current measurement range is fixed. The fixed measurement range can be raised or lowered using [▲]/[▼]. To reset the fixed measurement range mode, use [AUTO]. Used to restore the main-function display with the measurement range fixed. Used to shift the measurement range up or down. Used to select the channel for which the selection of [RANGE] is to be made effective. Used to reset the fixed measurement range mode and restore the main-function display.	II — HLD	4.4.3.6)
[MODE] (Mode)	Momentary	Used for switching between CW light measurement and chopped light measurement. When switching is made, the display of measurement unit also changes.	III — CW CHOP	
[CHAN] (Channel)	Momentary	Used to stop displaying the measurement on either channel A or channel B; measurement is continued without being affected by this function.		4.4.3.4)
[OFS] (Offset)	—	Used to make offsetting for the OPM unit. When this function is used, measurement is interrupted. This function has no effect on the unit requiring no offsetting to be made.	II OFS	
[DHOLD] (Data hold)	Momentary	Used to display the maximum and minimum measured values. If measurement conditions such as the measurement mode and measurement unit are changed after this function has been set, data display is restarted after the display is once cleared.	III — MAX MIN	4.4.3.7)

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Table 4-7 Functions

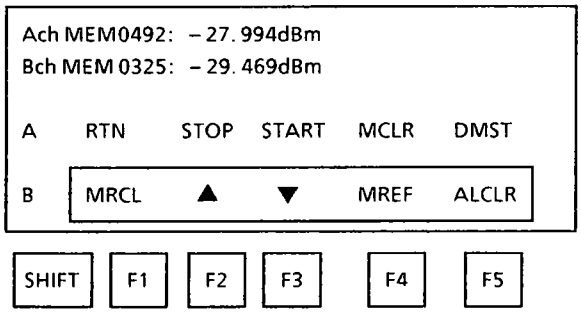
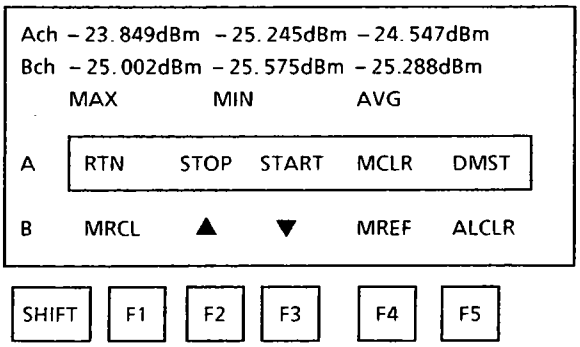
(Con't)

Main function	Subfunction	Explanation	Display area Display	Refer to section:
[BLKG] (Blanking)		Used to change the measurement display resolution. o In the W display mode, the resolution setting varies with the input power. o In the dB/dBm display mode, one of the three resolutions in selected: 0.1 ↔ 0.01 ↔ 0.001		4.4.3.8)
[SEL] (Select)	(OPM unit) Momentary	Used to specify the channel or channels for which the selected functions are to be effective. It is possible to specify both of channels A and B if two sensor units (OPM units) have been set for the two channels.	Ⅳ — A B	4.4.3.3)
	(OPT unit) Momentary	Used, with a light source unit (OPT unit) set for channel A, to make or change settings for the unit by means of the following subfunctions. 	Ⅲ — MODE = OPT = λ = ATT =	4.4.3.3)
	[RTN] (Return)	A Used to restore the main-function display.		
	[MODE] (Mode)	B Used to make switching between CW light and chopped light.		
	[OPT] (Optical)	C Used to turn the optical output on and off.		
	[SEL] (Select)	D Used to make switching between the two wavelengths. This subfunction is effective only for a double- wavelength light source unit.		
	[▲]/[▼]	E Used to increment or decrement the attenuator setting.		
	[CLR] (Clear)	F Used to clear the attenuator setting.	Ⅲ	
[PRMTR] (Parameter)		Used to make or change measurement parameter settings. When this subfunction is used, measurement is interrupted. This function is effective only for the channels for which an OPM unit has been set. The parameters that can be set using this function include the wavelength, correction value, averaging, upper limit value and lower limit value. For more information, see "(2)-(a) [PRMTR] setting."	— WL = dB = UPR = LWR = etc	4.4.2.a)
	[MEAS] (Measure)	Used to start measurement based on the current parameter settings.		
	[ ]/[ ]	Used to move the cursor.		
	[NEXT] (Next)	Used to set a value. Use [▲]/[▼] to select a numerical value and [RTN] to restore the mainfunction display.		
	[ETC] (Et centra)	Used to change the display frame.		

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Table 4-7 Functions

(Con't)

Main function	Subfunction	Explanation	Display area Display	Refer to section:
[B/A]	Momentary	Used to display the ratio in dB of the value measured on channel B to that measured on channel A, that is, B ÷ A. The absolute value measured on channel A is displayed in display area III. This function is effective only when two OPM units have been set for two channels A and B with the same unit of measurement set for both.	II B/A	4.4.3.9)
[MEM] (Memory)	[RTN] (Return) [START]	Used to store up to 1,500 measured values per channel. When using this function, set the unit of measurement to dBm/dB; values in watt cannot be stored. Used to restore the main-function display. Used to automatically store data. In the automatic memory mode, measured values are stored at the specified measurement intervals. Therefore, if the measurement interval is set to 60 minutes, the values measured in up to 1,500 hours (1,500 times 60 minutes) can be stored. The minimum measurement interval that can be set is 500 ms.  	III —— MEM MAX MIN AVG	4.4.3.10)
	[STOP]	Used to reset the automatic memory mode and, at the same time, display the maximum, minimum and average values.  		
	[DMST] (Data Memory Store)	Used to store a measured value at a time.		

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Table 4-7 Functions

(Con't)

Main function	Subfunction	Explanation	Display area Display	Refer to section:
	[MCLR] (Memory Clear)	Used to erase the data stored at the currently displayed memory address.		
	[MRCL] (Memory Recall)	Used to recall the data stored at the specified memory address. To specify a memory address, use [▲]/[▼]. The data at the address is displayed when [RTN] is subsequently executed. If [START] is executed with the specified memory address and recalled data displayed on the screen, operation in the automatic memory mode is restarted with the next memory address.		
	[▲]/[▼]	Used to increment or decrement the memory address for data recalling.		
	[MREF] (Memory Reference)	Used to display the measured value relative to the value stored at the displayed memory address.		
	[ALCLR] (All Clear)	Used to clear the entire memory.		
[SMPLG] (Sampling)		Used to sample a measured value at a time. Eery time the corresponding key is pressed, a measured value is sampled and the running average value is displayed. Up to 100 values can be sampled for averaging. This function does not work in the W display mode.	III — AVE =	4.4.3.11)
	[RTN] (Return)	Used to restore the main-function display while retaining the setting of [SMPLG].		
	[DIN] (Data Input)	Used to input a measured value.		
	[CLR] (Clear)	Used to erase the last-input data.		
	[ALCLR] (All Clear)	Used to clear all the input data and rest the function.		
[CMPR] (Compart)	(Momentary)	Used to compare the measured value with the UPR (upper limit value) and LWR (lower limit value) preset using [PRMTR]. If the measured value is found falling outside the range defined by the two limit values, the value display flashes on and off. At the same time, the buzzer starts sounding, if it has been set to do so also by using [PRMTR].	II ·)) IV UPR LWR	4.4.3.12)
[SET UP]		Used to store up to 10 sets of SETUP parameters. Each set of parameters can be assigned a label. If 0 is specified, the SETUP parameters are initialized for the unit that has been set and measurement is then started. To set the SETUP parameters after selecting this function, use [SET]; to start measurement based on the settings, use [MEAS]. See the explanation under 2-(b) "[SETUP] Setting" for more information.		4.4.22-b)

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Table 4-7 Functions

(Con't)

Main function	Subfunction	Explanation	Display area Display	Refer to section:
	[CHNG] (Change)	Used to change the SETUP parameter contents without changing the measurement parameters.		
	[STORE]	Used to store the measurement parameters as a set of SETUP parameters. To select a number, use [▲]/[▼].		
	[MEAS] (Measure)	Used to start measurement.		
	[LABEL]	Used to enter a label (consisting of up to 16 characters inclusive of spaces) to be assigned to the parameters being set.		
	[SET]	Used to set or change parameters. When parameters are set using this subfunction, they are entered in memory and, at the same time, are loaded as the measurement parameters.		

(2) Parameter composition

o Measurement parameters and SETUP parameters

The parameters are classified into the measurement parameters to be set using [PRMTR] and the SETUP parameters to be set using [SETUP].

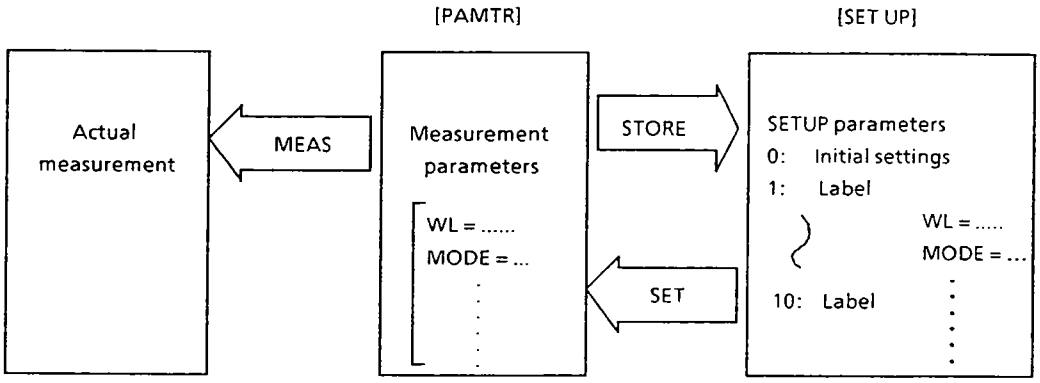


Fig. 4-13 Parameter composition

o The measurement parameters refer to the parameters set as the current conditions for measurement. They are stored in the measurement parameter area. The contents of the measurement parameter area can be changed as required. See (a) "[PRMTR] setting" for more information.

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- The SETUP parameters are the parameters prepared in the SETUP parameter area to be readily usable when required. Up to 10 sets of them can be stored in the SETUP parameter area. If parameters to be frequently used are stored in the SETUP parameter area, they can be taken out as required so that they need not be newly set every time they are required.

  Parameter set 0 represents the initialized parameters. Parameter sets 1-10 may each be assigned a label using [LABEL]. See (b) "[SETUP] setting" for more information.
- The GP-IB address can be changed only by the use of [PRMTR].
- The measurement parameter area is made of ROM whose contents are retained even after the apparatus is turned off. When measurement is started after the apparatus is turned on, the measurement parameters that have been retained are used as long as they are consistent with the corresponding unit plugged to the apparatus. If, at such a time, they are inconsistent with the connected unit, for example, due to a unit change made after the last setting of measurement parameters; the contents of the measurement parameter area are initialized.

(a) [PRMTR] setting

- The measurement conditions to be set for the unit set for each of channels A and B are stored as the measurement parameters in the measurement parameter area.
- The [PRMTR] function works for the parameters that are consistent with the specifications of the unit set for the corresponding channel. It is not effective for the settings inconsistent with the unit specifications.
- When the apparatus is turned on after the unit set for a channel was changed while it was off, the contents of the measurement parameter area for the channel are initialized to be consistent with the unit currently set for the channel.
- The measurement parameters can also be stored in the SETUP parameter area. (See (2)-(b).)
- The measurement parameters that can be set for each channel using the [PRMTR] function are dependent on the specifications of the unit set for the channel.
- Measurement parameter setting procedure

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o Every time the cursor is moved by the use of [◀] or [▶], the function corresponding to the <F4> key changes.
For a parameter whose value is fixed, [NEXT] is displayed. For a parameter whose value can arbitrarily be set, the parameter name is displayed.
Examples of measurement parameter display are shown below. The measurement parameters that can be displayed are listed in Table 4-8 and 4-9.

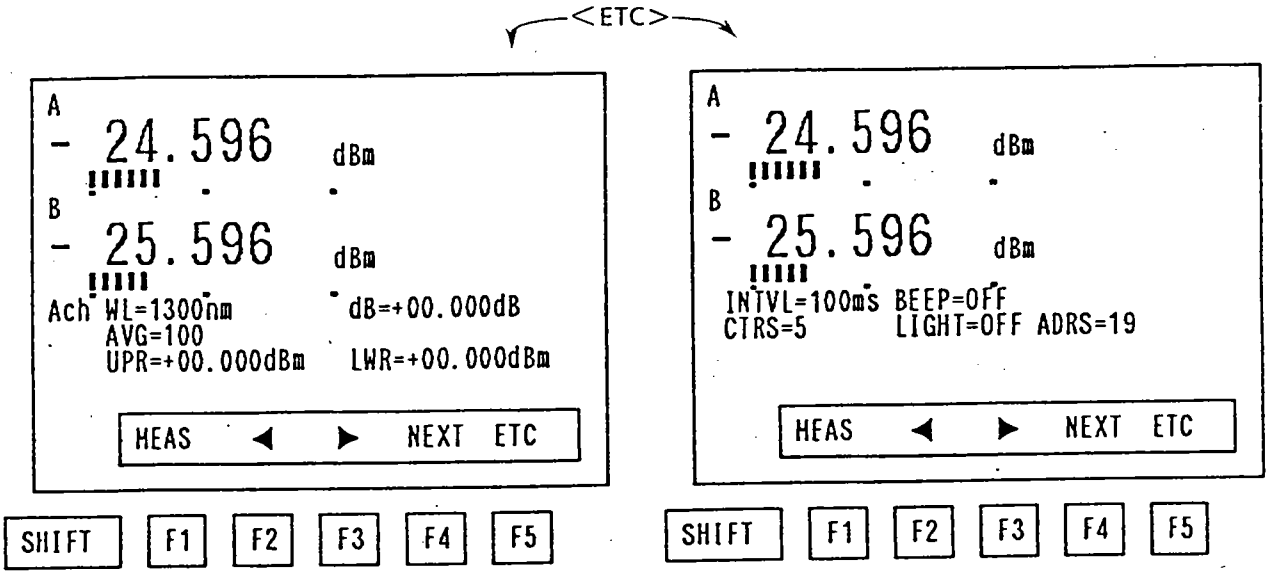


Table 4-8 Contents of measurement parameters (Displayed in 1st frame)

Display	F4 key	Remarks
<Ach>	NEXT	Switching between channels A and B can be made
WL = <wavelength>	WL	After-correction wavelength can be set
dB = <correction value> or K = <correction factor>	dB or K	Correction data in the following range can be entered: dB: ±99.999 K: 9.99E+9 to 0.01E-9
AVG = <number>	NEXT	The number of measured values to be sampled for sequential averaging can be set.(2/5/10/20/50/100/200)
UPR = <upper limit value>	UPR	An upper limit value for the comparator can be set
UPR = upper limit value <dBm>	NEXT	Switching between two units of measurement, dBm and dB, can be made for the comparator.
LWR = <lower limit value>	LWR	A lower limit value for the comparator can be set.

Use <ETC> to advance the parameter display to the second frame.

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Table 4-9 Contents of measurement parameters (Displayed in 2nd frame)

Display	F4 key	Remarks
INT = <numerical value>	INT	The measurement interval can be selected from among 17 values in the range of 100 ms to 60 min.
BEEP = <OFF>	NEXT	The buzzer can be set to ON or OFF according to whether to make it sound when a NOGO signal is issued by the comparator.
CTRS = <numerical value>	NEXT	The graphic display contrast can be adjusted.
LIGHT = <ON/OFF>	NEXT	The back light can be set to ON or OFF according to whether to back-light the display screen.
ADRS = <numerical value>	ADRS	The GP-IB address can be set in the range of 0 to 31, or the TALK ONLY mode can be selected.

The second frame of measurement parameter display is common to both channels so that settings in the frame can be made without regard to channel selection. (See Table 4-9)

NOTE: For back-lighting of the display screen, an EL lamp whose life is about 3,000 hours is used. It is recommended that the lamp be kept off as much as possible when the apparatus is used for long hours.

(b) [SETUP] setting

- The [SETUP] function enables up to 10 sets of measurement conditions to be preset as parameters for each of the OPM and OPT units. (Such parameters are called SETUP parameters.)
- If "0" is entered using [SETUP], the initialization mode is specified to cause the parameters for the currently set unit to be initialized. The initialized parameters are entered in the measurement parameter area.
- Each of the 10 sets of SETUP parameters can be assigned a label)consisting of up to 16 characters). When, for example, SETUP parameter set 1 is selected for use, its contents are loaded in the measurement parameter area and measurement is started based on the selected set of parameters.
- If the parameters loaded in the measurement parameter area are not consistent with the unit that has been set, an error indication is displayed (see Subsection 4.6). The error status can be reset by changing the measurement parameters using <PRMTR> or by initializing them by means of specifying "0" using <SETUP>.

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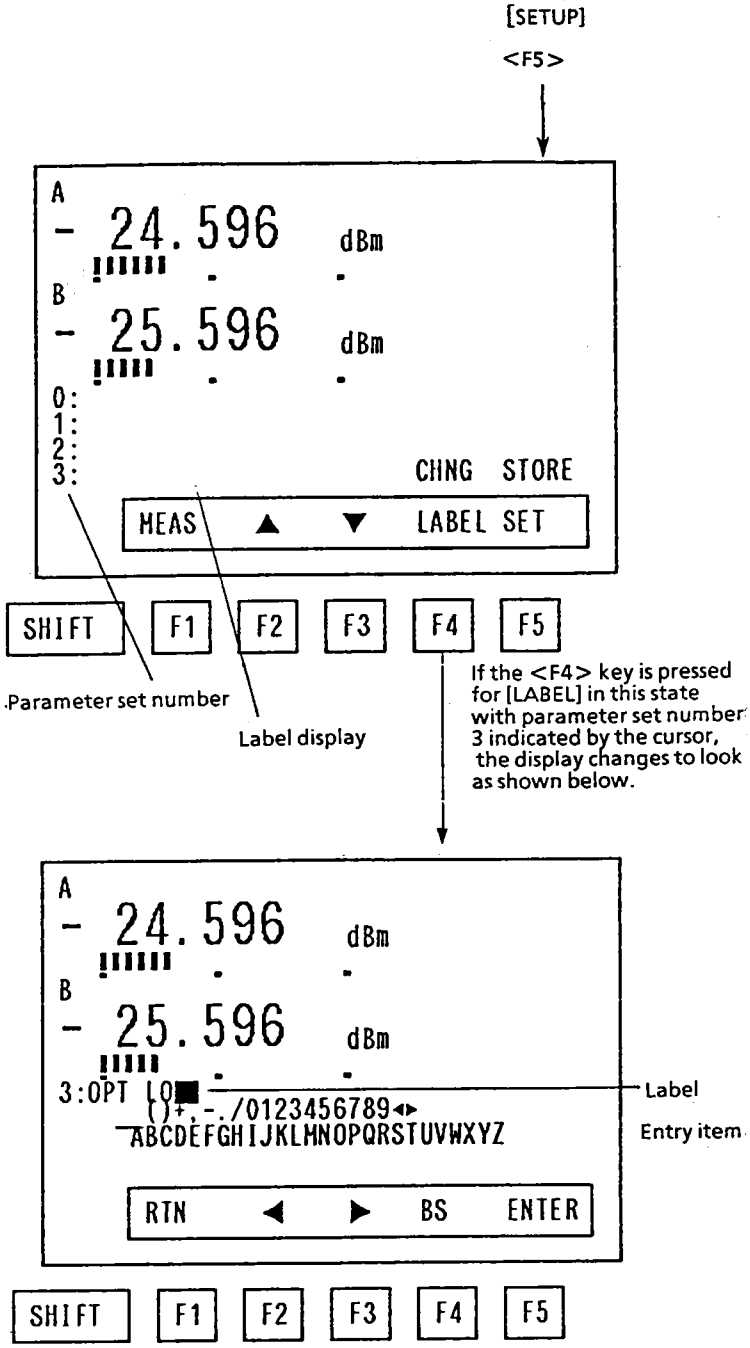
The values of the initialized parameters are listed in Table 4-10.

Table 4-10 Initial values of measurement parameters

OPM unit	OPT unit
MODE : CW	MODE : CW
FUNC : dBm	OPT : OFF
WL : Standard wavelength	λ : a
dB : +00.000dB	ATT : 0.0dB
BLKG : 0.01	
DHOLD : OFF	
CMPR : OFF	
BEEP : OFF	
UPR : +00.000dBm	
LWR : +00.000dBm	
INT : 200ms	
AVE : 100	
CTRS : 4	
LIGHT : OFF	
ADRS : 19	

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o How to use [SETUP] function



① When the <F5> key is pressed for [SETUP], parameter set numbers 0-3 are displayed.

[▼] : Used to move the cursor down. If this subfunction is used when the cursor is already at "3," the display is scrolled.

[▲] : Used to move the cursor up.

[SET] : Used to ready the parameter set indicated by the cursor for entry into the measurement parameter area.
When [MEAS] is subsequently executed, the parameter set is entered in the measurement parameter area and measurement is started.

[CHNG] : Used to change the contents of the parameter set indicated by the cursor.
The changed parameter set is not automatically used for measurement

[STORE] : Used to store the measurement parameters as the SETUP parameters of the parameter set number indicated by the cursor. Therefore, when this subfunction is used, the contents of the SETUP parameter area are updated.

[LABEL] : Used to assign a label to the selected parameter set.

[RTN] : Used to restore the parameter set number display for [SETUP].

[◀] : Used to move the entry item cursor to the left.

[▶] : Used to move the entry item cursor to the right.

[BS] : Used to move the label cursor back while erasing the character caught by the cursor.

[ENTER] : Used to enter the characters indicated by the cursor into a label.

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Aligning "◀" or "▶" for entry item with the cursor enables the label cursor to be moved.

o SETUP parameter setting procedure

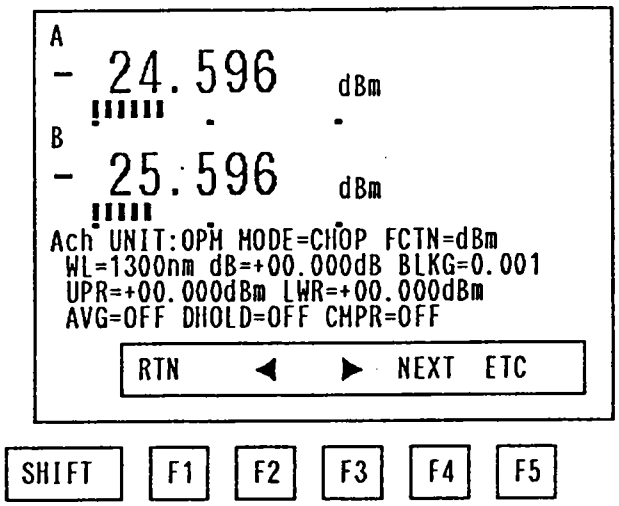
Using the subfunction [SET] is an efficient way of setting a set of parameters and starting measurement based on them.

(a) Parameter setting for OPM unit

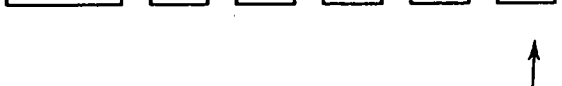
Examples of SETUP parameter display are shown below. The contents of the SETUP parameters which are displayed on the screen are shown in Tables 4-11, 4-12, and 4-13.

Every time the cursor is moved using [◀] or [▶], the function display corresponding to the <F4> key changes.

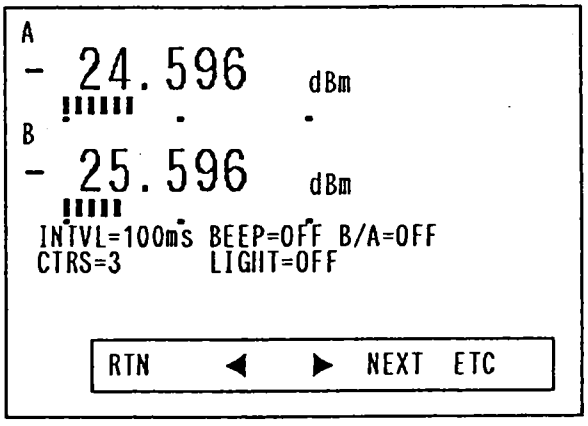
For a parameter whose value is fixed, [NEXT] is displayed. For a parameter whose value can arbitrarily be set, the parameter name is displayed.



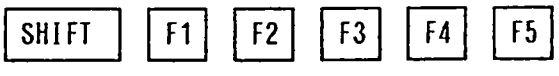
When [SET] or [CHNG] is selected, a display as shown at left appears.



Pressing the <F5> key for [ETC] causes the display to change to look as shown below.



This frame of display is common to both channels so that setting in this frame can be made without regard to channel selection.



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Table 4-11 SETUP parameters

Display	F4 key	Remarks
Ach	NEXT	Used for switching between channels A and B.
UNIT = < >	NEXT	Used for selection between OPT (light source) and OPM (sensor), (without unit)

If "OPM" is selected for "UNIT," the parameters listed in Table 4-12 are subsequently displayed. If "OPT" is selected, the parameters listed in Table 4-13 are subsequently displayed.
If a unit is set in " " with no unit installed, the initial setting is selected.

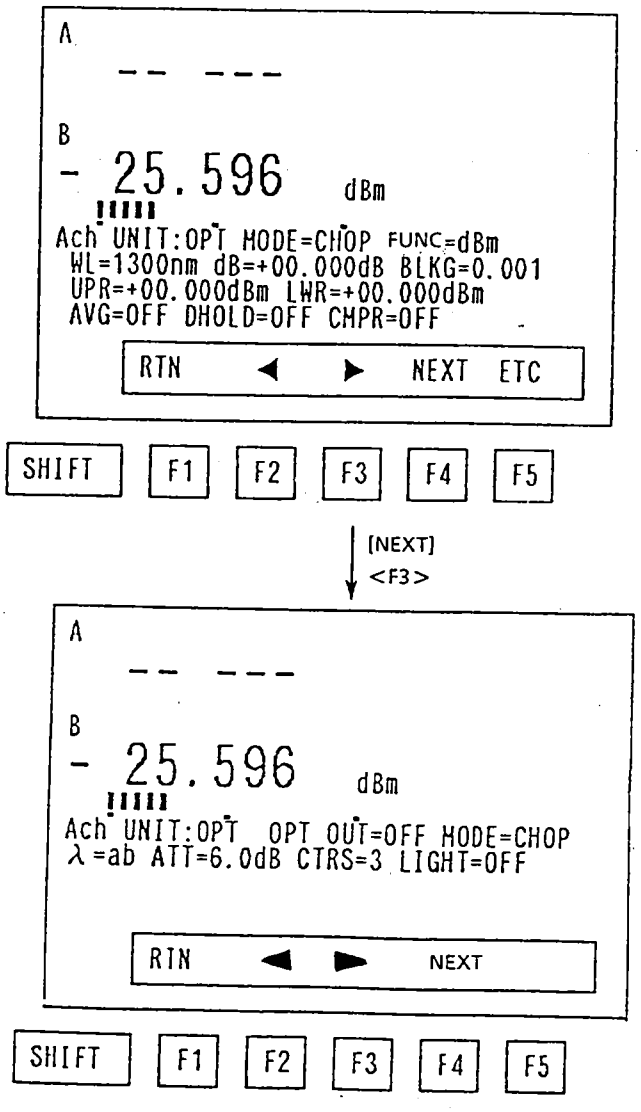
Table 4-12 SETUP parameters (for OPM)

Display	F4 key	Remarks
MODE = < >	NEXT	Used for selection between CW light and chopped light.
FUNC = < >	NEXT	Used to select a measurement function from among dBm, W, and MREF.
WL = <wavelength>	WL	Used to set the after-correction wavelength
dB = <correction value> or K = <correction factor>	dB orK	Used to enter correction data in the following range: dB: ±99.999 K: 9.99E + 9 to 0.01E-9
BLKG = <resolution>	NEXT	Used to select a display resolution from among 0.1, 0.01, and 0.001.
UPR = <upper limit value>	UPR	Used to set an upper limit value for the comparator.
UPR = <numerical value><dBm>	NEXT	Used to select a value unit, dBm or dB, for the comparator.
LWR = <lower limit value>	LWR	Used to set a lower limit value for the comparator.
AVG = <number>	NEXT	Used to specify the number of measured values to be sampled for sequential averaging. (OFF/2/5/10/20/50/100/200)
HOLD = < >	NEXT	Used to set DHOLD to ON or OFF.
CMPR = < >	NEXT	Used to set the comparator to ON or OFF.
INT = <numerical value>	INT	Used to select the measurement interval from among 17 values in the range of 100 ms to 60 min.
BEEP = < >	NEXT	Used to set the buzzer to ON or OFF according to whether to make the buzzer sound when a NOGO signal is issued by the comparator.
B/A = < >	NEXT	Used to set the function for calculating B ÷ A to ON or OFF.
CTRS = <numerical value>	NEXT	Used to adjust the graphic display contrast.
LIGHT = < >	NEXT	Used to set the back light for display to ON or OFF.

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Table 4-13 SETUP parameters (for OPT)

Display	F4 key	Remarks
Ach	NEXT	Used for switching between channels A and B.
UNIT = < >	NEXT	Used for selection between OPT (light source) and OPM (sensor).
OPT OUT = < >	WL	Used to set the optical output to ON or OFF.
MODE = < >	NEXT	Used for selection between CW light and chopped light.
λ = < >	NEXT	Used for wavelength selection from among a, b, and ab (selection of B or ab is effective when a double- wavelength unit is used).
ATT = <numerical value> dB	ATT	Used to set the value of optical attenuation. (0.0 to 6.0 dB in 0.1 dB steps)
CTRS = <numerical value>	NEXT	Used to adjust the graphic display contrast.
LIGHT = < >	NEXT	Used to set the back light for display to ON or OFF.



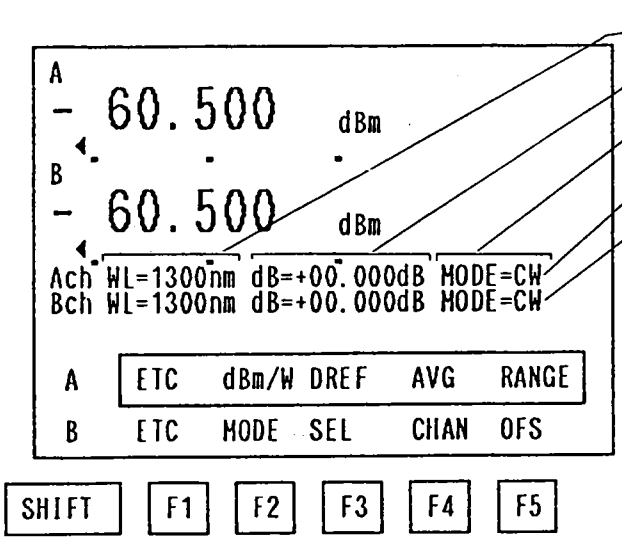
o "UNIT:OPT"
If "UNIT:OPT" is selected, the display frame for OPT is shown.

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4.4.3 Function Displays

1) Main functions

The main-function display to be used in making measurement comprises two frames. Switching between the two frames can be made using [ETC].



Sensor wavelength after sensitivity correction

Correction value

Mode of light to be received

Settings for channel A

Settings for channel B

[dBn/W] : Used for switching between dBm and W display modes.

[DREF] : Used to make relative value measurement.

[AVG] : Used to make averaging measurement.

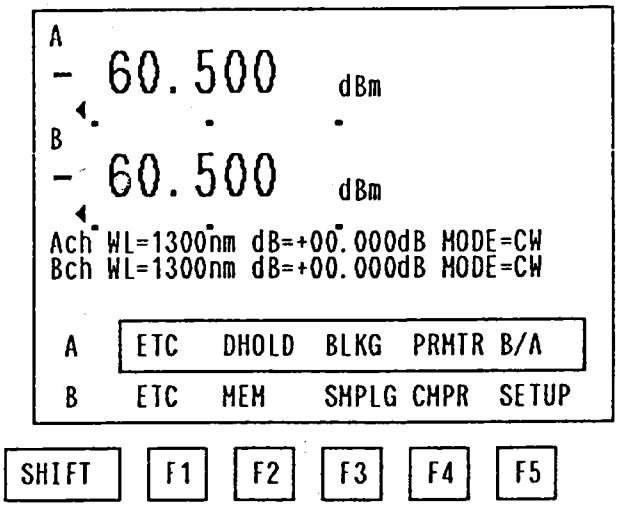
[RANGE] : Used to fix the measurement range.

[MODE] : Used for switching between CW and chopped light reception modes.

[SEL] : Used to specify the channel for which the functions being selected are to effective.

[CHAN] : Used to stop displaying the data on channel A or B.

When the <F1> key is pressed for [ETC], the contents of the function display area changes to read as shown below.



[DHOLD] : Used to display the maximum and minimum measured values.

[BLKG] : Used to change the display resolution.

[PRMTR] : Used to change the conditions for measurement.

[B/A] : Used to display the value of B/A.

[MEM] : Used to store measured values in memory.

[SMPLG] : Used to display the average of measured values.

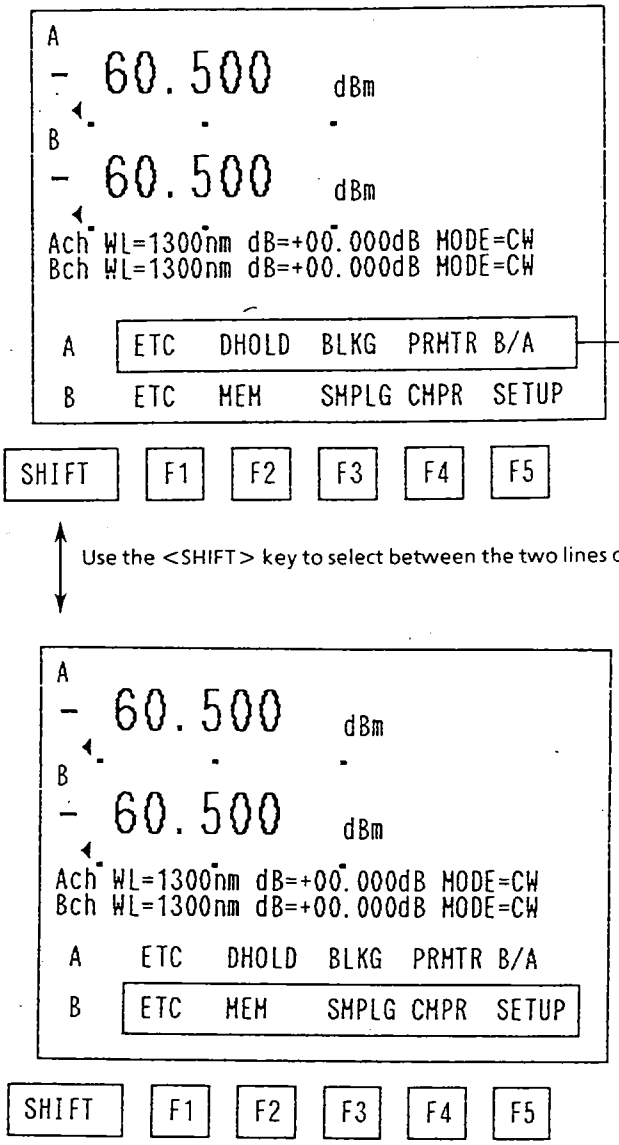
[CMPR] : Used to use the comparator for measured-value checking.

[SETUP] : Used to store or call measurement conditions.

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2) Selection between function display lines <SHIFT>

The function keys correspond to the functions indicated in either one of the two lines of function display at a time. Selection between the two lines can be made using the <SHIFT> key

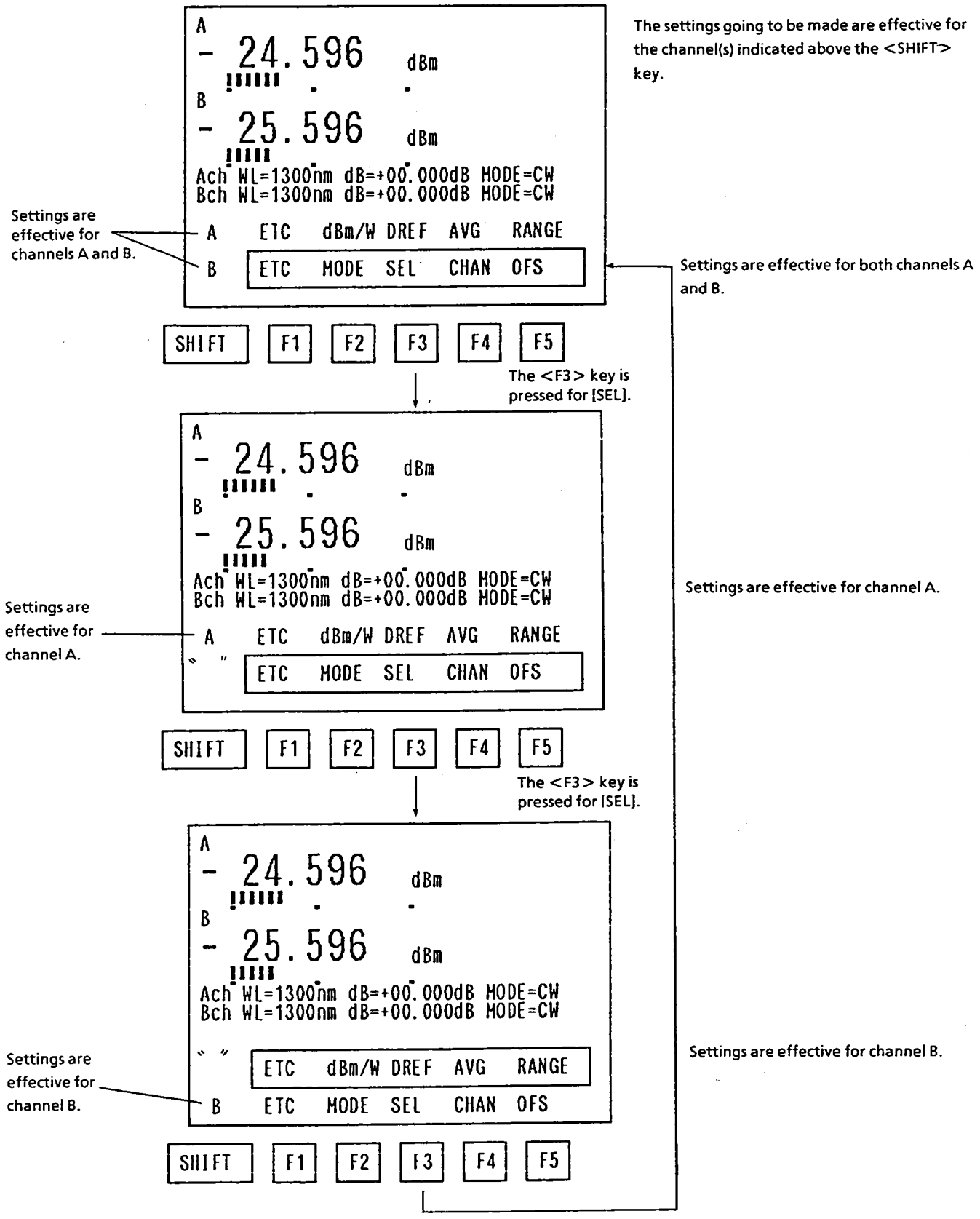


The function keys correspond to the functions indicated in inverted characters.
The box denotes that the characters inside it are inverted.

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3) Channel selection [SEL]

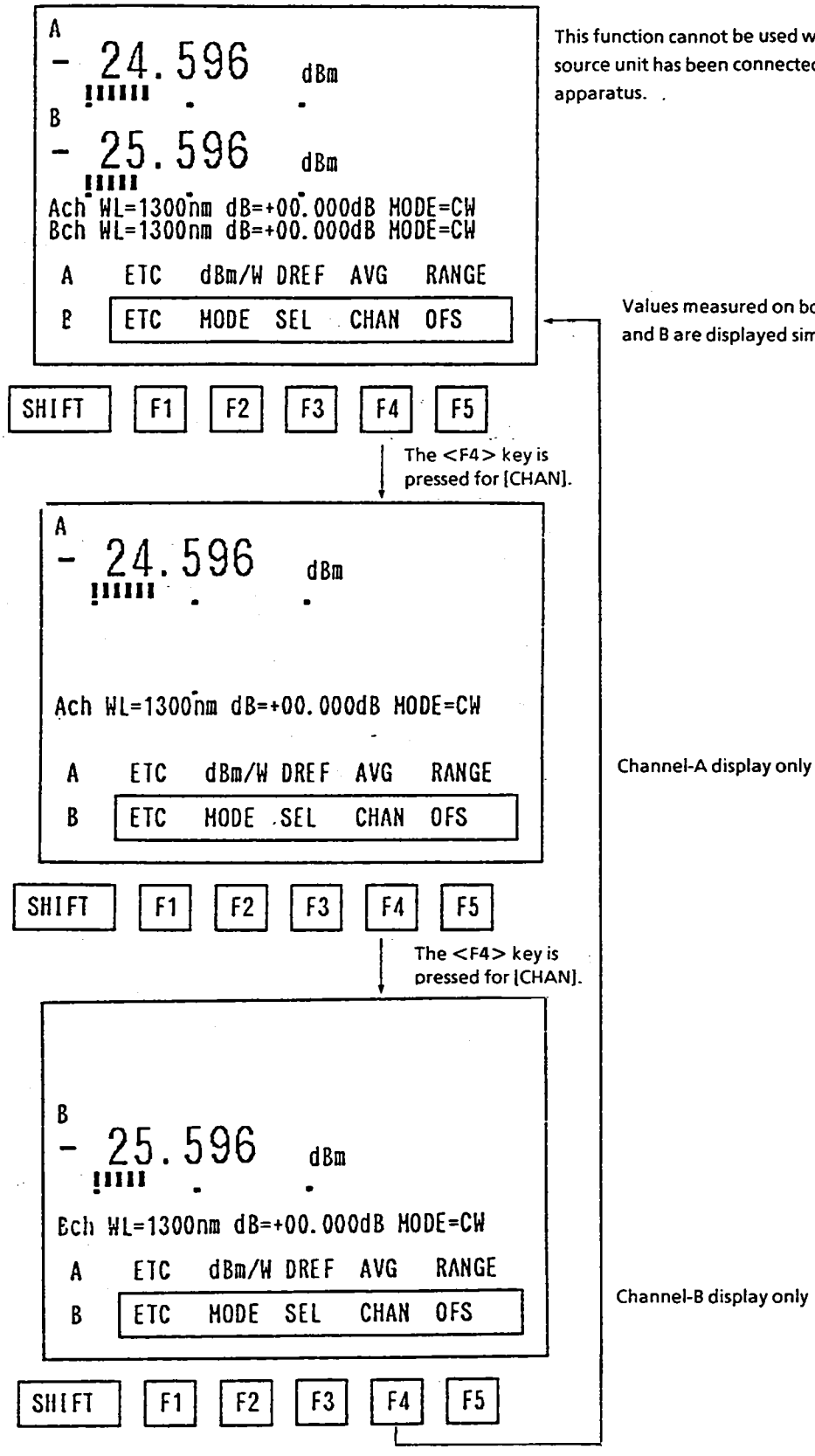
When making settings for either one of the two channels, specify the channel using [SEL].



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4) Single-channel display [CHAN]

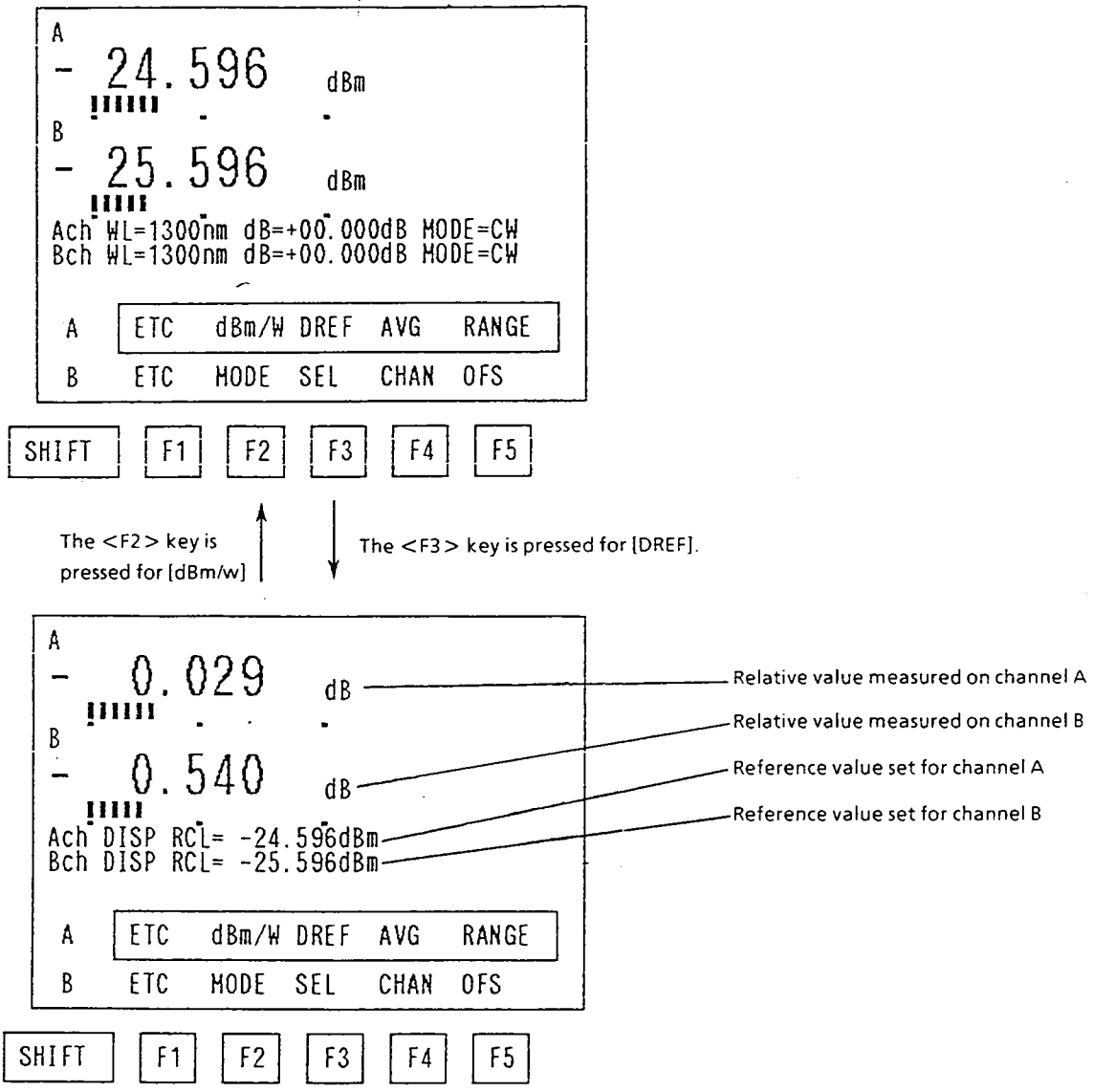
To stop displaying the measurement on either one of channels A and B, specify the channel using [CHAN].



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5) Relative value measurement [DREF]

This function is used to display measured values relative to a reference value set for each channel; the value measured on the channel when this function is turned on is used as the reference value.

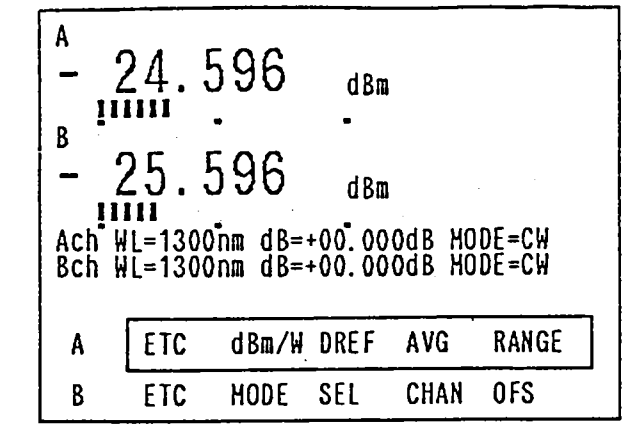


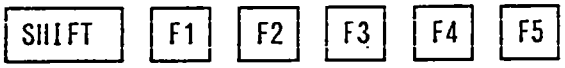
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6) Measurement range fixing [RANGE]

This function is used to fix the measurement range.

a) Fixing measurement ranges for both channels A and B

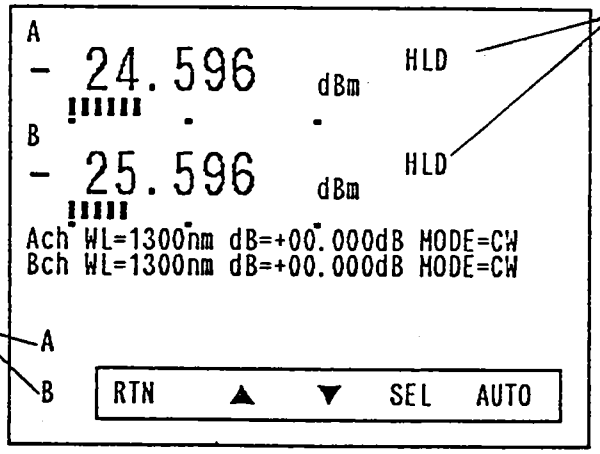




If the <F5> key is pressed for [AUTO], automatic range mode is entered.

If the <F5> key is pressed for [RENGE], fixed range mode is entered.

Indication of range holding



Indication of range holding

Channels for which settings being made are to be effective.



[RTN] : Used to restore the main-function display while holding the current measurement range.

[▲] : Used to raise the measurement range.

[▼] : Used to lower the measurement range.

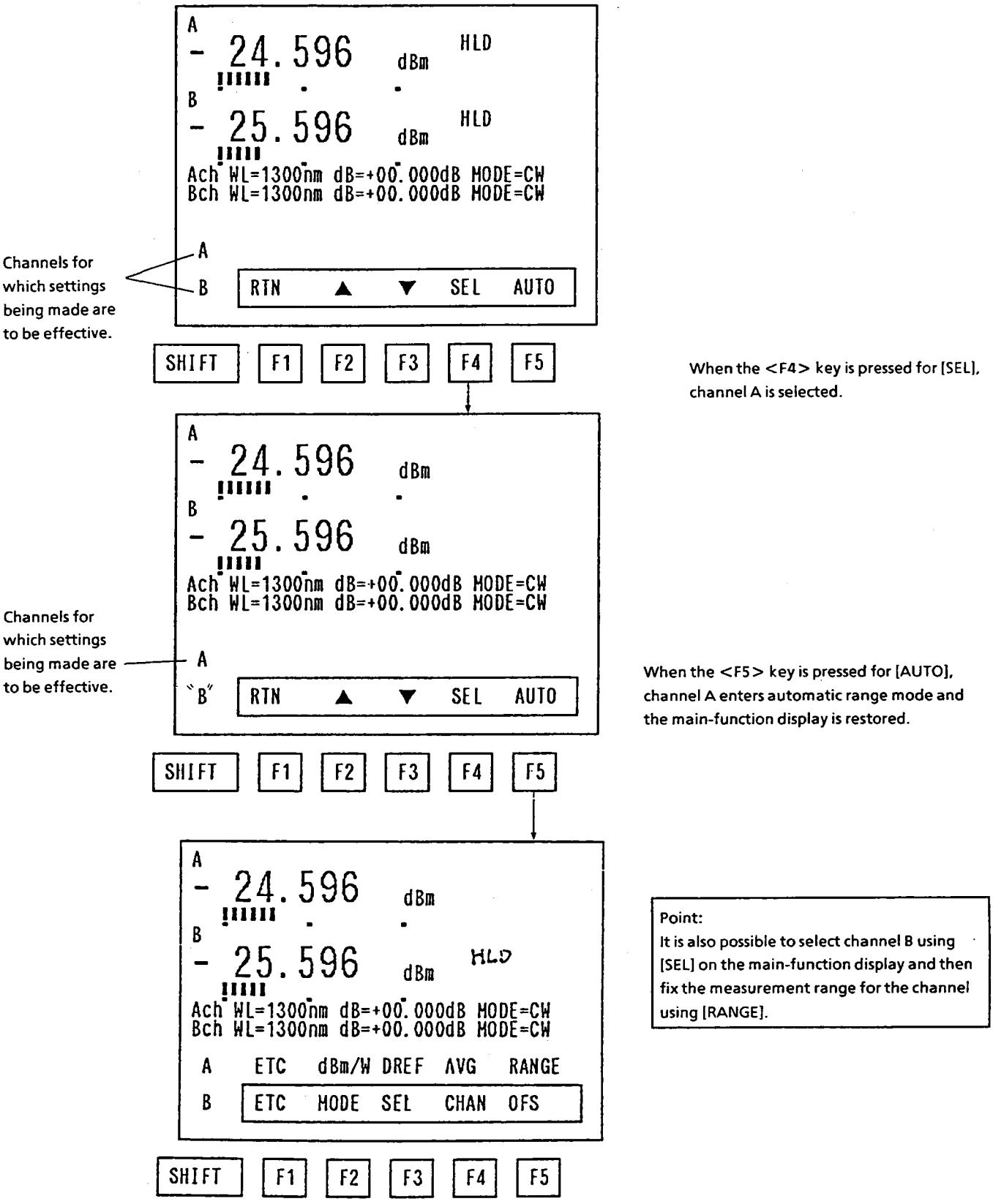
[SEL] : Used to select channel A or B for which the settings being made are to be effective.

NOTE) This subfunction is usable only when two OPM units have been connected to the apparatus.

[AUTO] : Used to release range holding.

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b) Fixing measurement range for channel B only



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7) Maximum and minimum value display [DHOLD]

This function is used to display the varying maximum and minimum values out of the measurements taken, as shown in Figure 4-12, at the specified ntervals on the specified channel.

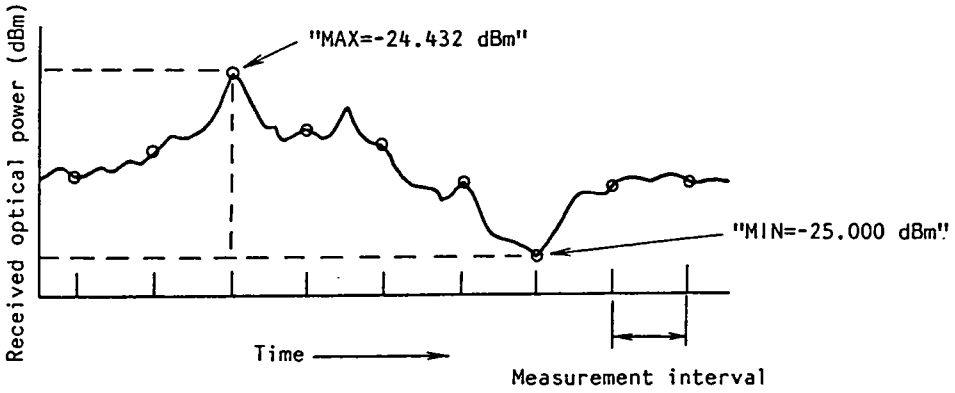
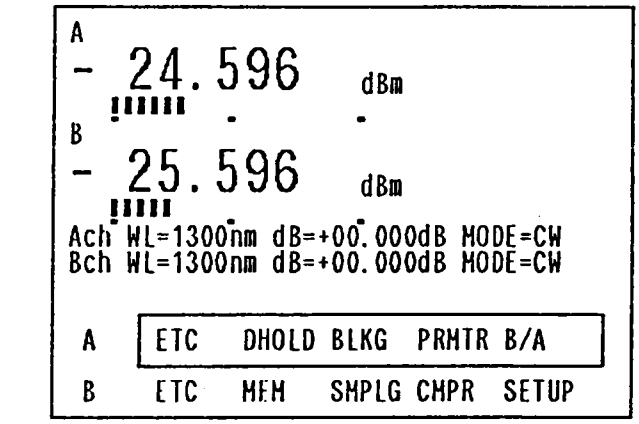


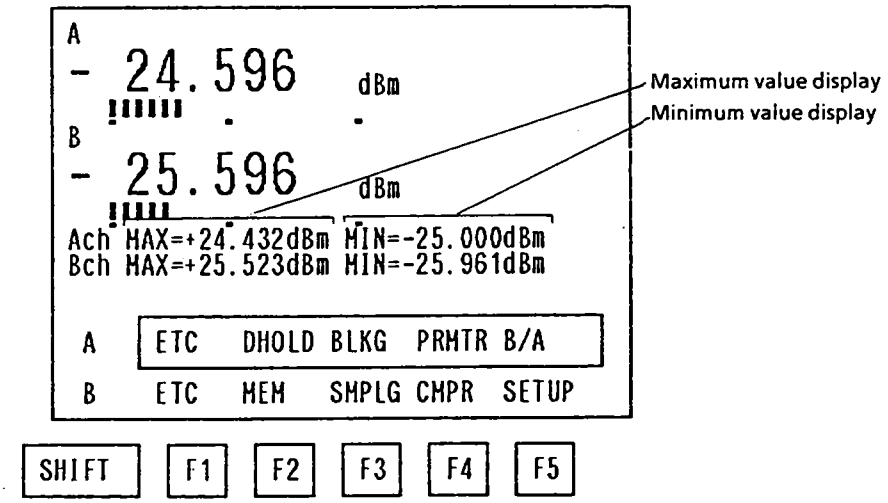
Fig. 4-14 Maximum and minimum value sampling



NOTE: While [DHOLD] is in use, [SMPLG] cannot be used.



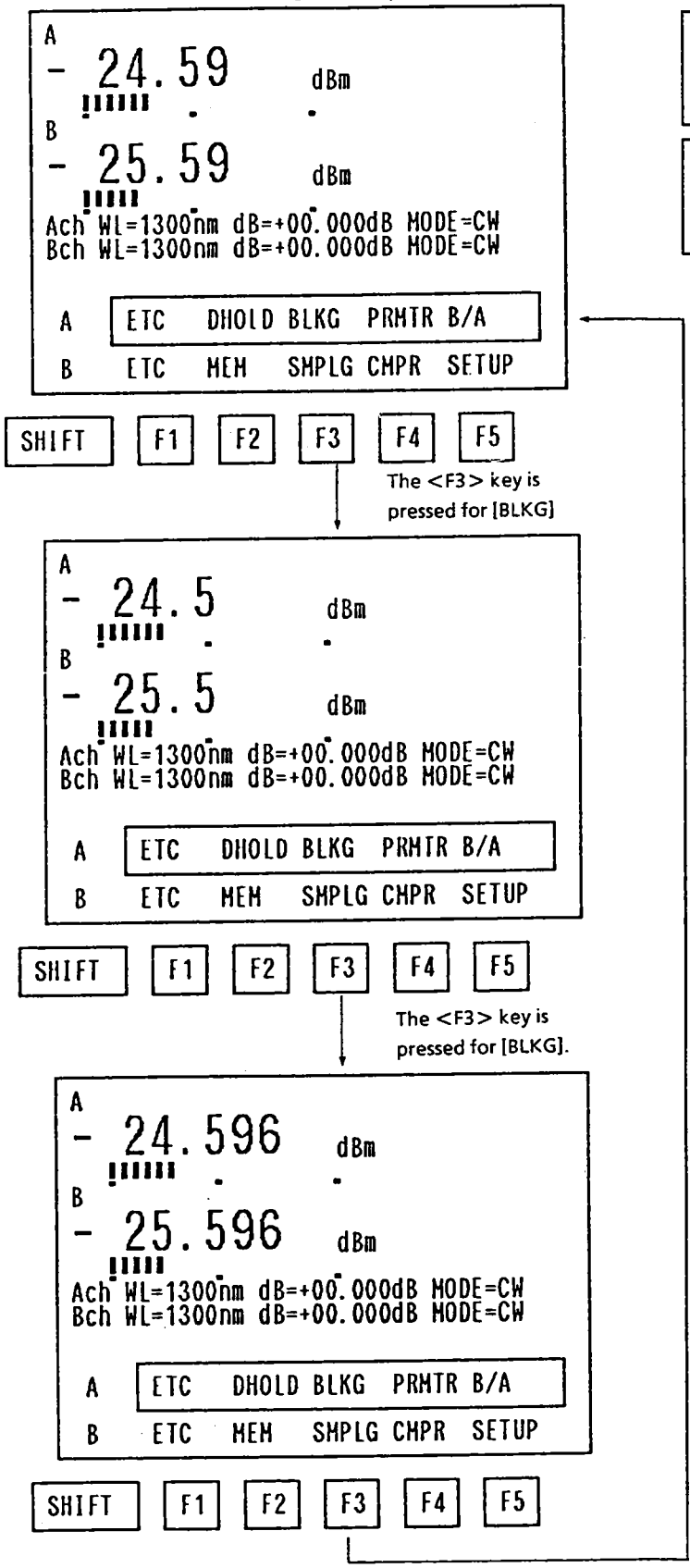
The <F2> key is pressed for [DHOLD].



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8) Display resolution change [BLKG]

This function is used to change the display resolution.



In the W display mode, the number of effective digits dependent on the resolution varies with the unit of measurement.

Changes made in the display resolution affect only the display of measured values.

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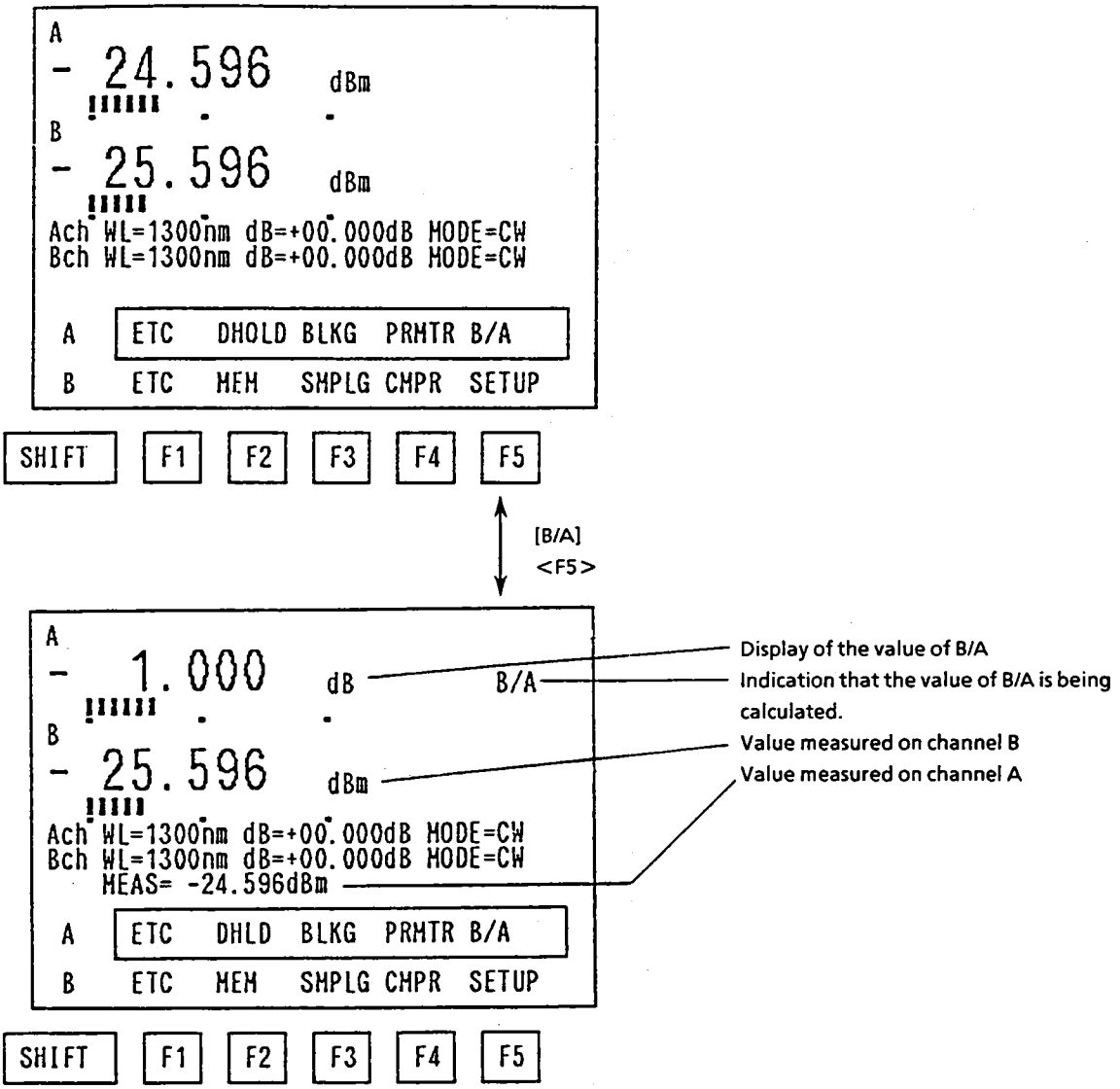
9) Interchannel relative value display [B/A]

This function is used to display the difference (B/A) in measurements between channels A and B.

B/A(dB) = Value (dBm) measured on channel B - Value (dBm) measured on channel A

NOTE: In W mode;

B/A = Value (W) measured on channel B ÷ Value (W) measured on channel A

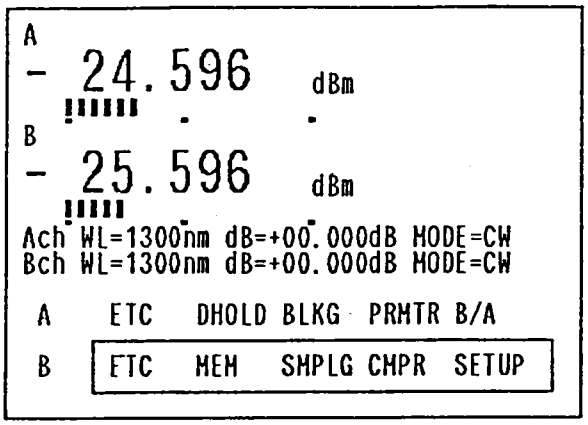


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10) Measurement memory [MEM]

This function is used to store up to 1,500 measured values per channel in memory.

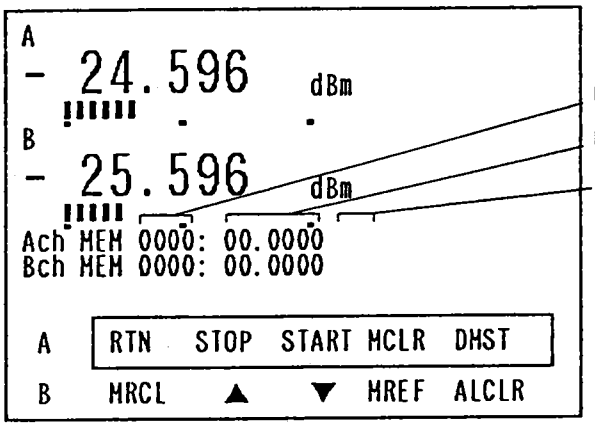
a) Display



SHIFT F1 F2 F3 F4 F5

The <F1> key is pressed for [RTN].

The <F2> key is pressed for [MEM].



Memory address

Measured value

Unit of measurement

SHIFT F1 F2 F3 F4 F5

NOTE:

- o The [MEM] function is usable to store values in dBm or dB only. Values in W cannot be stored using this function.
- o This function is not usable while the [SMPLG] function is in use.

[RTN] : Used to restore the main-function display.

[STOP] : Used to stop automatic data storing.

[START] : Used to start automatic data storing.

[MCLR] : Used to clear the data stored at the displayed memory address.

[DMST] : Used to store a measured value at the displayed memory address.

[MRCL] : Used to directly specify a memory address to be called.

[▲] : Used to increment the displayed memory address.

[▼] : Used to decrement the displayed memory address.

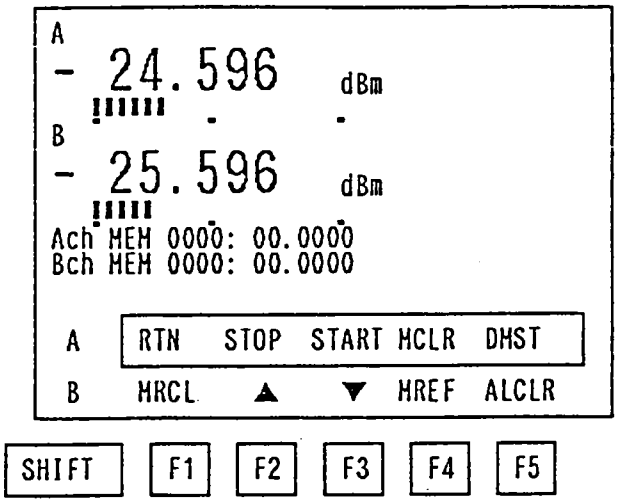
[MREF] : Used to display the measured value relative to the value stored at the displayed memory address.
While this subfunction is sued, indication "MREF" is kept in the parameter display area.

[ALCLR] : Used to clear all data stored in memory.

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b) Arbitrary data storing [DMST]

This subfunction is sued to have a measured value entered in memory every time the [DMST]<F5> key is pressed; the memory address is automatically updated.

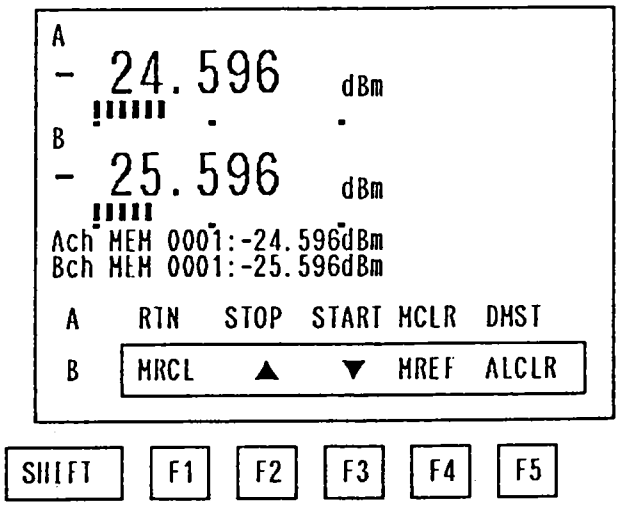


(Memory address 0)

The <K4> key is pressed for [MCLR].

The <F5> key is pressed for [DMST].

(Memory address is updated.)



(Data is stored at memory address 0001.)

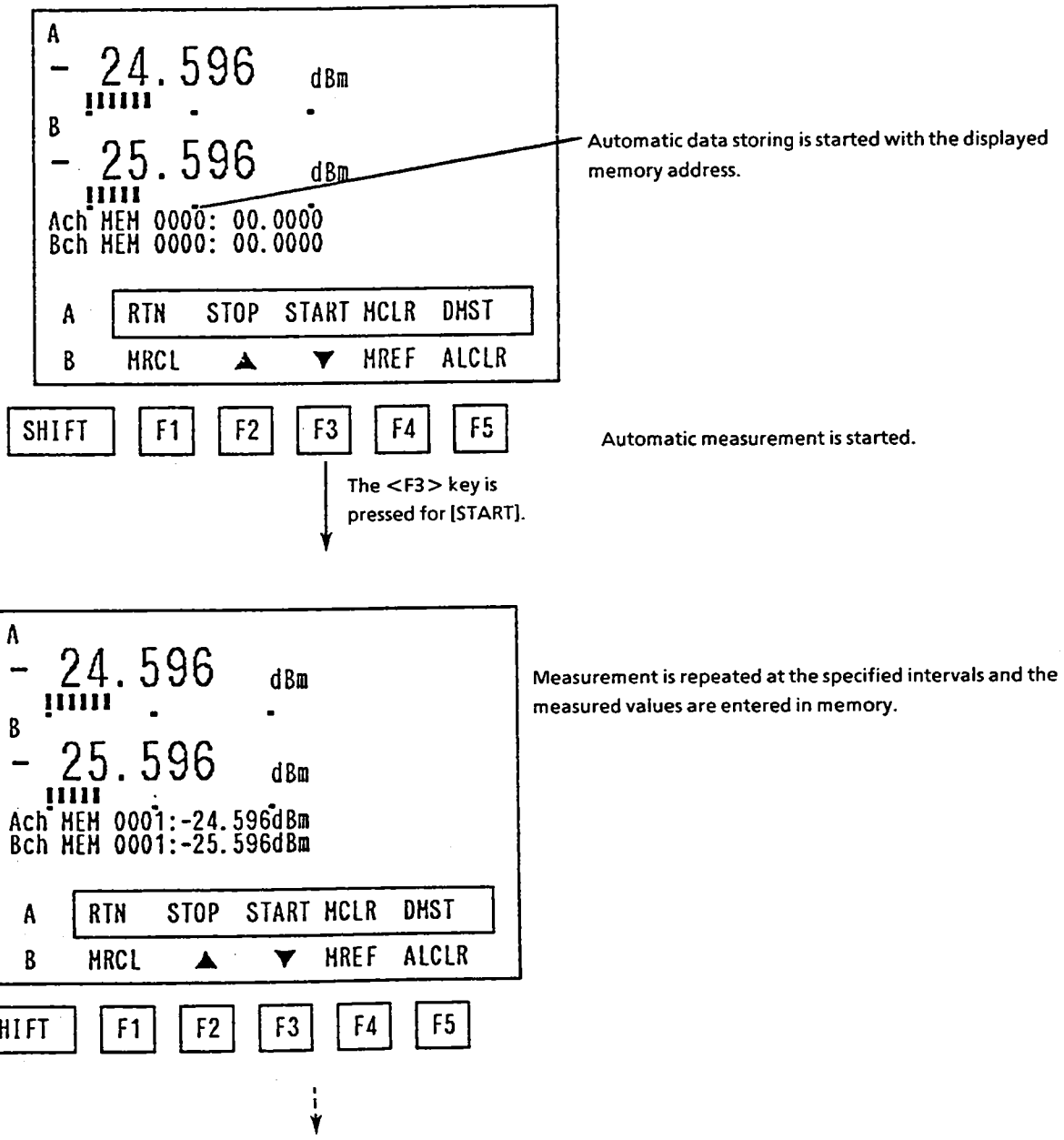
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c) Automatic measurement [START]

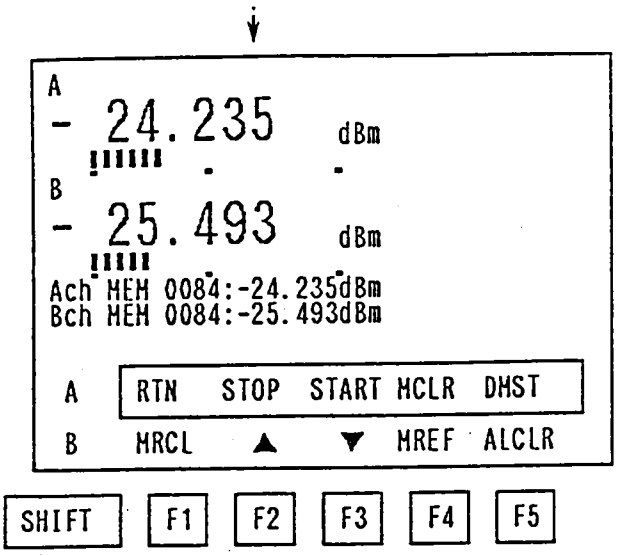
This subfunction enables measured values to be automatically entered in memory. Thanks to this subfunction, it is possible to repeat unattended measurements for up to 1,500 hours while automatically storing the measured values using this apparatus alone.

To set the measurement interval, use [PRMTR] or [SETUP].

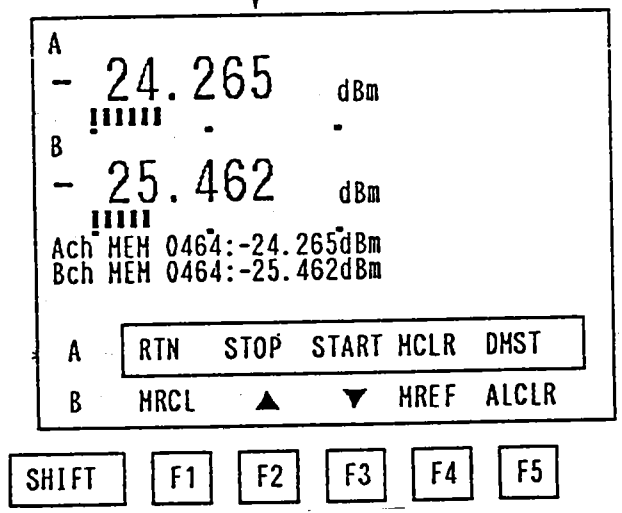
NOTE: The measurement interval that can be set for automatic measurement is 500 ms to 60 min. If a shorter interval than 500 ms is specified, the measurement interval is automatically set to 500 ms.



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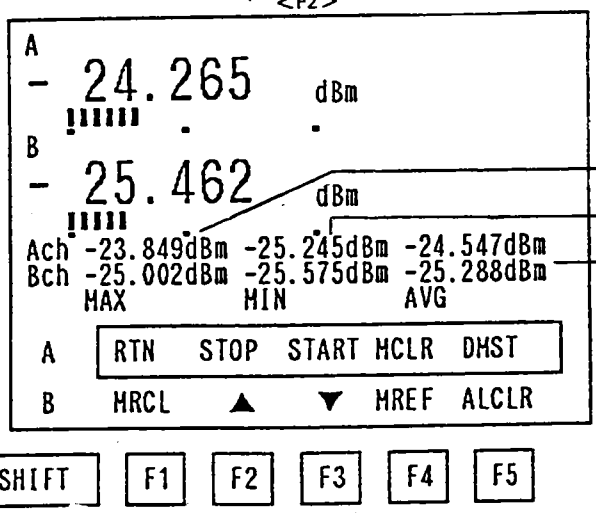


Automatic measurement



Measurement is temporarily stopped.

[STOP]
<F2>



When the <F2> key is pressed for [STOP], the maximum, minimum, and average of the values stored at memory addresses 1 through 464 are displayed.

Maximum value display

Minimum value display

Average value display

NOTE: Automatic measurement is stopped when memory address 1500 is reached.

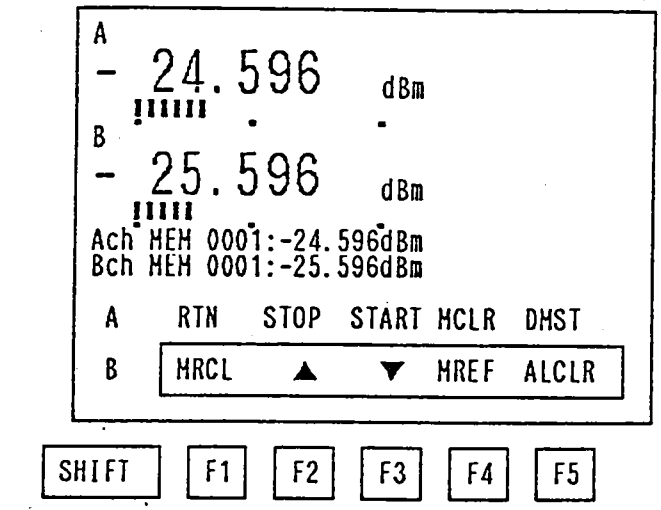
The previous display is restored when a function key is pressed. It is possible to restart automatic measurement after restoring the previous display.

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d) Arbitrary memory address recalling [MRCL]

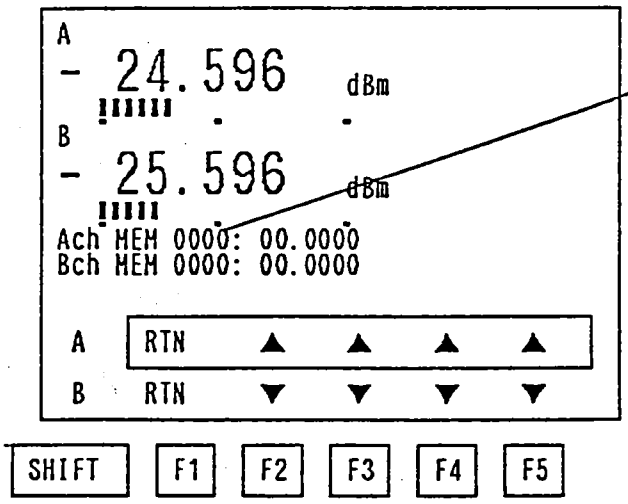
Since the memory addresses range from 1 to 1500, memory address recalling must be made efficiently.

The [MRCL] subfunction enables any memory address to be directly specified for recalling.



The <F1> key is pressed for [RTN].

The <F1> key is pressed for [MRCL].



Direct address specification

[RTN] : Used to display the specified memory address and restore the main-function display.

[▲] : Used to increment the displayed memory address.

[▼] : Used to decrement the displayed memory address.

(0-1) Thousands (0-9) Hundreds (0-9) Tens (0-9) Units

Correspondence between function keys and memory address digits:

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(e) Relative measurement display based on arbitrarily specified memory address [MREF]

This subfunction is used to display measured values relative to the value stored at an arbitrarily specified memory address.

This subfunction is useful, for example, in measuring the optical loss in a multicore optical fiber. The difference in optical power between the end connected to a light source of an optical fiber and the other end of the optical fiber can be displayed by one key operation using this subfunction.

A system for measurement to be made using this subfunction is shown in Figure 4-16.

If a light source unit and an OPM unit are connected to this apparatus, it enables optical loss measurement to be made with ease. (See 5.6.2)

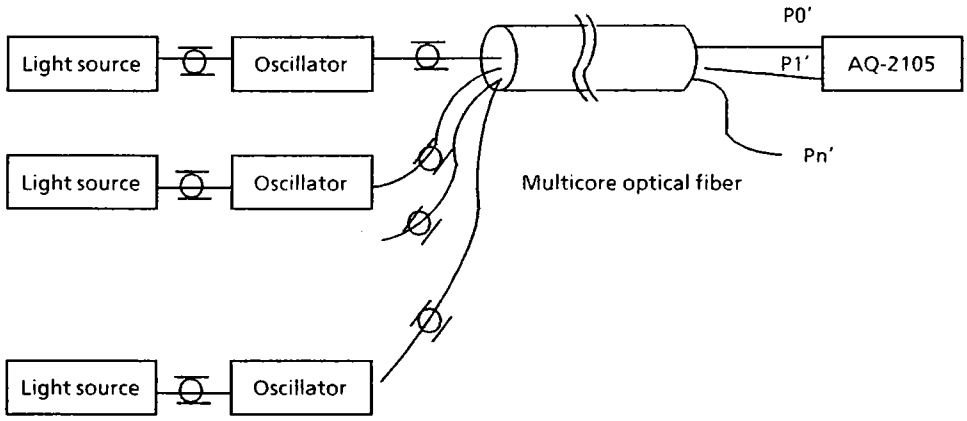


Fig. 4-15 System for measuring optical losses in multicore optical fiber

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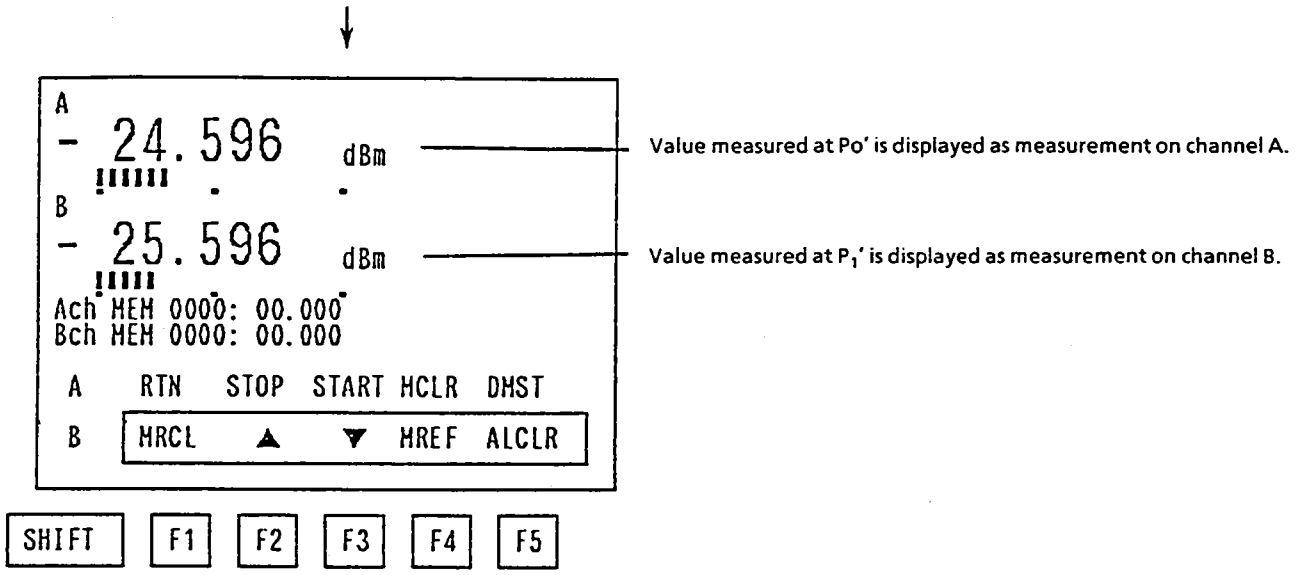
<Measurement>

① Enter the optical power value measured at each of Po through Pn in memory using the procedure explained in b).

In the present example, assume that the measurement taken at Po is entered in memory address 7 for channel A and that taken at P_1 is entered at memory address 7 for channel B.

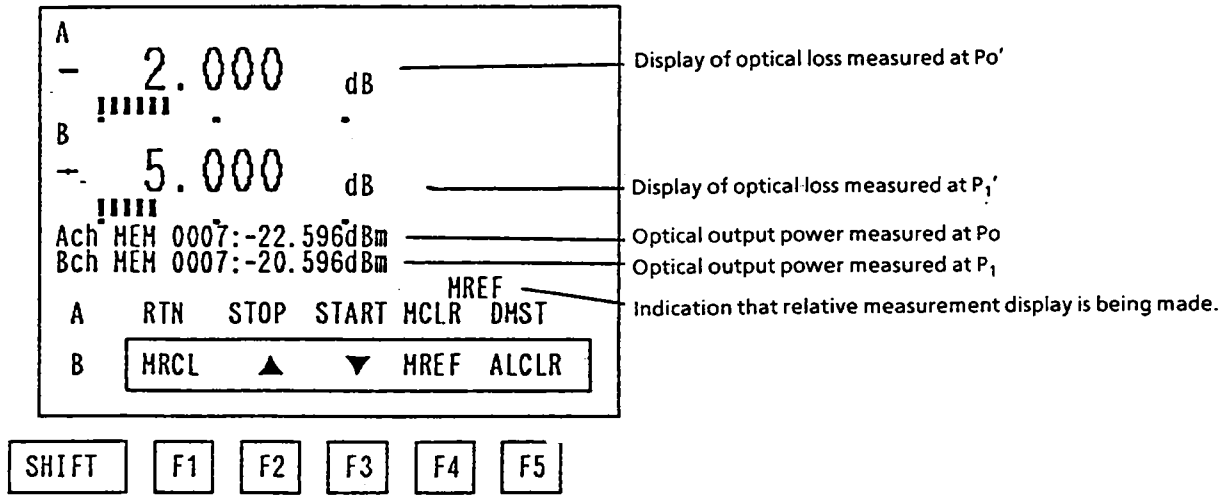
② Measure the optical power sequentially at fiber ends Po' through Pn'.

Perform the [MEM] function.



③ Specify memory address 7 using the <F1> key for [MRCL] or <F2> key for [▲].

④ Press the <F4> key for [MREF] to display the measured values relative to the corresponding reference values stored in memory.

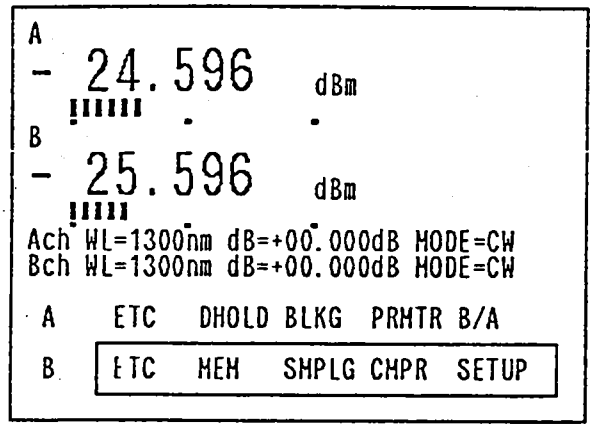


The optical losses in all optical fiber cores can be successively measured by repeatedly using [▲] while properly changing the optical fiber cores connected to the apparatus.

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11) Average display [SMPLG]

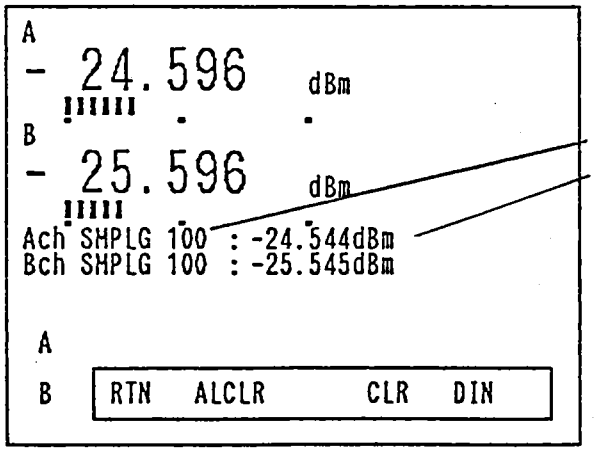
This subfunction is used to display the average of up to 100 arbitrarily sampled measurements. (Averaging is made every time the corresponding function key is pressed, without regard to gate setting.)

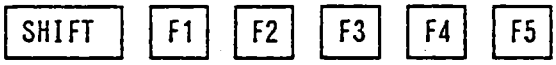




The <F1> key is pressed for [RTN].

The <F3> key is pressed for [SMPLG].





Number of measurements to be sampled
Average
[RTN] : Used to restore the main-function display.
[ALCLR]: Used to clear all the sampled measurements.
[CLR] : Used to clear one sampled measurement.
[DIN] : Used to make manual measurement.

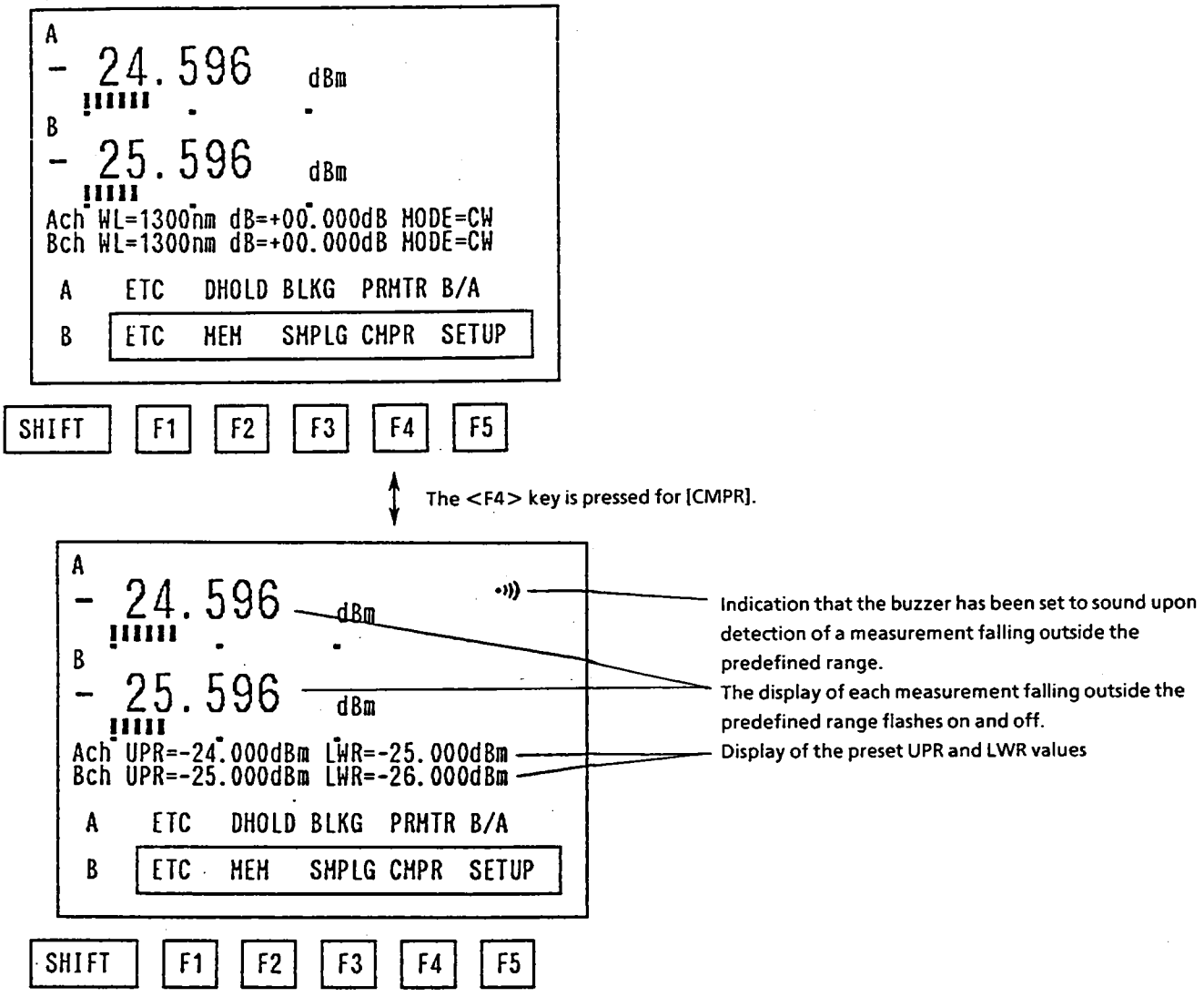
This subfunction is useful in making connection/disconnection tests for connector evaluation.

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16) GO/NOGO check [CMPR]

This subfunction is used to check measurements to see if they are within the range defined by the preset upper limit value (UPR) and lower limit value (LWR).

If a measurement falling outside the predefined range is detected, the measurement display flashes on and off and the buzzer starts sounding.



* To specify the UPR and LWR values and to set the buzzer to ON or OFF, use the [PRMTR] function.

NOTE:
- o This subfunction cannot be used while [DHOLD] or [SMPLG] is being performed.
- o This subfunction is ineffective if the UPR and LWR values are specified in different units.

(They must be specified both in dBm or dB.)

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4.5 GP-IB CONTROL (COMPLYING WITH IEEE-488)

This apparatus is equipped with a GP-IB as a standard feature. It permits the setting and changing of parameters and the transmission and reception of data to be controlled via the GP-IB.

(1) Interface functions

Table 4-14 Interface functions

Function	Explanation	States omitted
SH1	All SH functions provided	Nil
AH1	All AH functions provided	Nil
T7	Basic talker Talk only mode Talker release by MLA	SPIS SPMS & SPAS
L4	Basic listener Listener release by MTA	Nil
SR0	No SR function provided	All
RL1	All RL functions provided	Nil
PP0	No PP function provided	All
DC1	All DC functions provided	Nil
DT1	All DT functions provided	Nil
C0	No C function provided	All

(2) GP-IB address

When this apparatus is turned on, its GP-IB address is initialized to 19.

The address can be changed using <PRMTR>.

See 4.4.2-(2) "PRMTR setting" for more information.

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(3) Program codes

Note that some program codes do not function depending on the types of units connected to the apparatus or the measurement parameter settings.

See 4.4.2 for more information.

Table 4-15 Program codes

(Application: I = For optical power meter only II = For light source unit only III = For both)

Function	Contents	Programming code	NOTE No.	Application	Channel specification
Channel setting	Ach Bch A.Bch	C1 C2 C3	1	III	–
Unit Relative value display	W dBm DREF B/A MREF	FA FB FC FD FE xxxx	2	I	○
Range setting (RAMGE)	AUTO +10dBm (10mW) range +0 dBm (1mW) range –10dBm (100 µW) range –20dBm (10µW) range –30dBm (1µW) range –40dBm (100nW) range –50 dBm (10nW) range –60 dBm (1nW) range –70dBm (100pW) range –80dBm (10pW) range –90dBm (1pW) range	RA RE RF RG RH RI RJ RK RL RM RN RO		I	○
Offset (OFS)		Z		I	○
Averaging (AVG)	1 (OFF) 2 5 10 20 50 100 200	AA AB AC AD AE AF AG AH		I	○
Light mode (MODE)	CW CHOP	C P		III	○
Wavelength setting (WL)	WL = xxxxnm	W xxxx	3	I	○
Correction value	dB = ± xx.xxx dB	D ± xx.xxx	4	I	○

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Table 4-15 Program codes

(Application: I = For optical power meter only II = For light source unit only III = For both) (Con't)

Function	Contents	Programming code	NOTE No.	Application	Channel specification
Correction factor	K = x.xxE ± x	Kx.xxE ± x	5	I	○
Max. and min. display (DHOLD)	ON OFF	H1 H0		I	○
Resolution change (BLKNG)	1/1000 1/100 1/10	B0 B1 B2		I	○
Back light (LIGHT)	ON OFF	V1 V0		I	–
Contrast(CTRS)	1 to8→A to H	QA to QH		I	–
Measurement interval (gate)	100 ms 200 ms 500 ms 1 s 2 s 5 s 10 s 30 s 1 min 2 min 5 min 10 min 15 min 20 min 30 min 60 min	TAA TAB TAC TBA TBB TBC TBD TBE TCA TCB TCC TCD TCE TCF TCG TCH		I	–
Comparison measurement (CMPR)	ON OFF Upper limit value(dBm) Upper limit value(dB) Lower limit value (dBm) Lower limit value (dB)	J1 J0 UA ± xx.xxx UB ± xx.xxx LA ± xx.xxx LB ± xx.xxx	6	I	○
	BEEP ON BEEP OFF	N1 N0		I	–
Measurement (MEAS)	One measurement Free run	S or Trigger Get F	7	I	–

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Table 4-15 Program codes

(Application: I = For optical power meter only II = For light source unit only III = For both) (Con't)

Function	Contents		Programming code	NOTE No.	Application	Channel specification
Output data setting	Numerical data	Ach	OD1	8	I	–
		Bch	OD2			
		A,Bch	OD3	9		
	Parameter	Ach	OS1			
		Bch	OS2			
	Reference value	Ach	FR1			
	(DREF	Bch	FR2			
	MREF)	A,Bch	FR3			
	Memory addresses	Ach	OM1/xxxx/xxxx			
		Bch	OM2/xxxx/xxxx			
SETUP parameter selection	(0 to10) → (A toK)		GA to GK		I	–
Optical output	ON		O1		II	○
	OFF		O0			
Wavelength selection (for double-wavelength unit only)	λ = a		WL1		II	○
	λ = b		WL2			
	λ = a,b		WL3			
Attenuator	0.0 to 6.0 dB		ATL x.x		II	○
	Clear		ATC			

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NOTE 1 : Channel settings once made are retained until different settings are made. Therefore, it is not necessary to repeatedly enter channel setting codes while the same settings are retained. Be sure to enter necessary channel setting codes when changing the channel settings.

NOTE 2 : For "FExxxx", enter a number in the range of 1 to 1500. Leading zeros may be omitted.

"FE0020", for example, equals "FE20".

NOTE 3 : For "Wxxxx", it is not allowed to enter a value of wavelength outside the wavelength range indicated on the unit. A zero for the position of thousands need not be entered.

NOTE 4 : Trailing zeros for decimal places may be omitted. Values greater than 99.999 cannot be set. Be sure to attach a sign to the number to be entered.

NOTE 5 : The value to be set must be in the range of 9.99E + 9 to 0.01E-9. Be sure not to omit the exponent part.

NOTE 6 : Be sure to attach a sign to each of the upper and lower limit values. Trailing zeros for decimal places may be omitted.

NOTE 7 : One measurement; One measurement is made when the gate is opened by a signal from the controller.

Free run; The gate is opened to make measurements at the specified intervals.

The current data to be displayed is output when an order for data transmission is received. When the measurement interval is long, output of the same data for display is continued until the gate is opened next.

NOTE 8 : For "OM1/xxxx/xxxx", enter the starting and stopping memory addresses. The address numbers must be in the range of 1 to 1500 and the starting address must be smaller than the stopping address.

NOTE 9 : Use CR and LF as a delimiter.

NOTE 10 : Output format

The output format is shown below. Comma "," is used as a data separator.

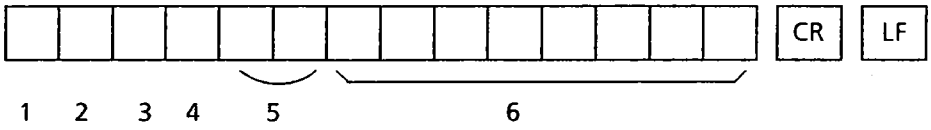
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(4) Output Format

Refer to the following. Two-channel data are separated by a comma ",".

(a) Data output format (OD, FR, and OM instructions)

o 1-channel data output format



o 2-channel data output format

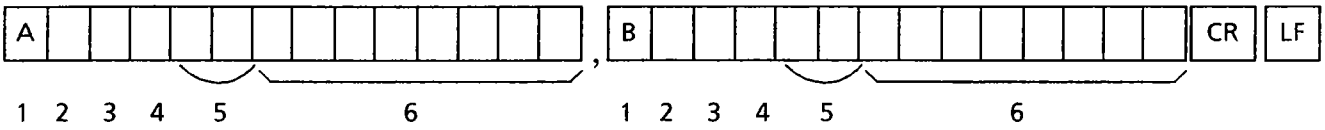


Fig. 4-16 Output format

Table 4-16 Output format

1	Output channel	A : Channel A B : Channel B
2	Status	Z : Offsetting underway I : In range U : Under O : Over R : Range change underway L : LOBATT (Supply voltage drop) C : Reference value (FR and OM instructions)
3	Function information	1 : W 2 : W-REF 3 : W-B/A 4 : W-B/A-REF A : dBm B : dBm-REF (dB) C : dBm-B/A D : dBm-B/A-REF E : dBm-MREF F : dB-MREF
4	Unit	P : mW Q : μW R : nW S : PW U : dBm V : dB W : No unit
5	Range information	Same as program code
6	Data	Signed 7-digit output (Display resolution 0.001)

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(b) Parameter output (OS instruction)

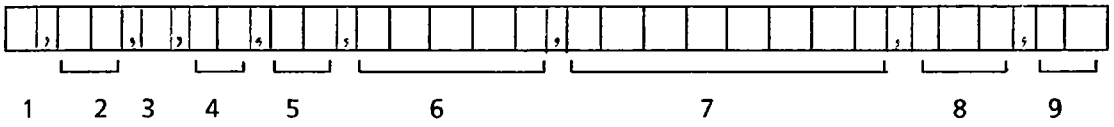


Fig. 4-17 Parameter output

Table 4-17 Parameter output

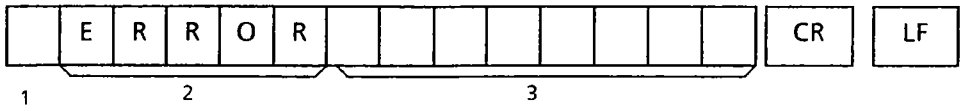
1	Output channel	A : Channel A B : Channel B
2	Channel specification	
3	Mode	
4	Function information	F1 : W F2 : W-REF F3 : W-B/A F4 : W-B/A-REF FA : dBm FB : dBm-REF (dB) FC : dBm-B/A FD : dBm-B/A-REF FE : dBm-MREF FF : dB-MREF
5	Averaging	Setting program code
6	Wavelength	
7	Correction value/Correction factor	
8	Measurement interval	
9	Range information	

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(c) GP-IB error format

In case of erroneous program code specification, an error is output. The output format is as follows.

o 1-channel data output format



o 2-channel data output format

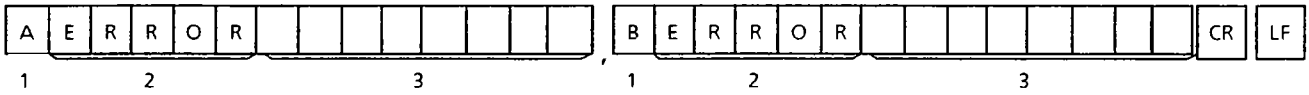


Fig. 4-18 Error Output Format

Table 4-18 Error Output Format

1	Output channel	A: Ach B: Bch
2	Status	ERROR
3	Error information	0: The unit is disconnected during operation. 1: An inoperative command is received. 2: A value outside the display range is produced. 3: A wavelength outside the specified range is set. 4: No offset adjustment can be made. The sensor should be shielded.

Example: If two or more errors are detected, the output will be as follows.
(Errors: 1, 2, 3) "AERROR00000123"

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4.6 ERROR DISPLAY

Table 4-19 Error display

When repair of the apparatus is necessary, contact the dealer.

Error message	Explanation	Display	Repair
RAM ERROR	RAM is defective	Graphic area	Required
NO UNIT	The apparatus has been turned on, but no unit has been connected for either channel. Connect required units.	Graphic area	—
UNIT ERROR Err A	① A light source unit has been connected for channel B. ② A unit is defective.	Graphic area 7-segment figures	①— ②Required
Err 0 ERROR 0	A unit was disconnected while in operation. Remedy the settings using [SETUP] or [PRMTR].	7-segment figures GP-IB	—
Err 1 ERROR 1	① The [SETUP] parameters are inconsistent with the unit that has been connected. ② A command which cannot be used via the GP-IB was received.	7-segment figures	—
Err 2 ERROR 2	The displayed value was exceeded by a measurement.	7-segment figures GP-IB	—
ERROR 3	The wavelength specified via the GP-IB is outside the range allowable for the unit that has been connected.	GP-IB	—
ERROR 4	Offsetting cannot be made. Shield the unit.	GP-IB	—

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SECTION 5
MEASUREMENT PROCEDURES

5.1 INTRODUCTION

This section will explain how to initially set the apparatus according to the conditions for measurement and how to make measurements.

5.2 BASIC PREPARATION

① Connect the units such as OPM units, sensors, or a light source unit required for measurement to the apparatus.

② Connect the apparatus to a proper power supply as described in 4.3.1 "Preparation."

Now the basic preparations have been made. Before starting measurement, make necessary settings on the apparatus according to the measurement conditions using the procedures described in the following subsections.

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5.3 CONTINUOUS-WAVE (CW) LIGHT MEASUREMENT

To make CW light measurement, proceed as follows:

<Procedure>

① <POWER ON ▬ >

↓

② CW

If <CHOP> is lighted, go to steps 6-8.

↓

③ <SHIFT>

Indication "MODE = CW" is displayed on the screen.
Select the functions in the lower row.

↓

④ [OFS]
<F5>

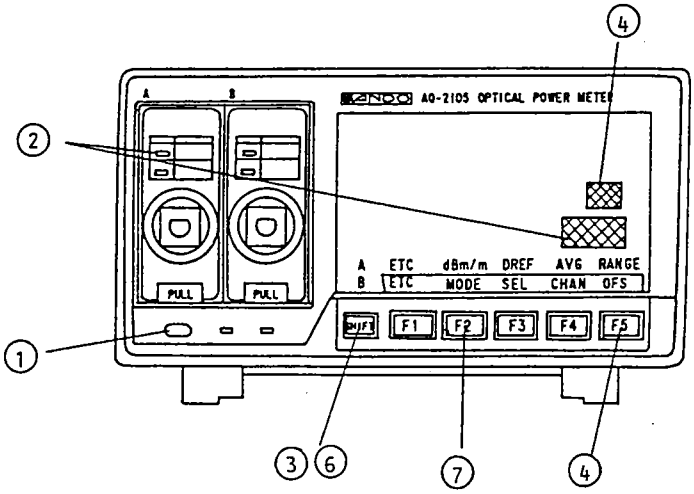
Make sure in advance that the sensor has been shielded.

If offsetting cannot be made, indication "OFS" flashes on and off on the screen.

↓

⑤ Measurement

Remove the sensor shielding cap and start measurement.



○ If <CHOP> is lighted:

⑥ <SHIFT>

Select the functions in the lower row.

↓

⑦ [MODE]
<F2>

↓

⑧ CW

Items required:

- o AQ-2105 Optical Power Meter
- o OPM unit

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5.4 CHOPPED LIGHT MEASUREMENT

To make chopped light measurement, proceed as follows:

<Procedure>

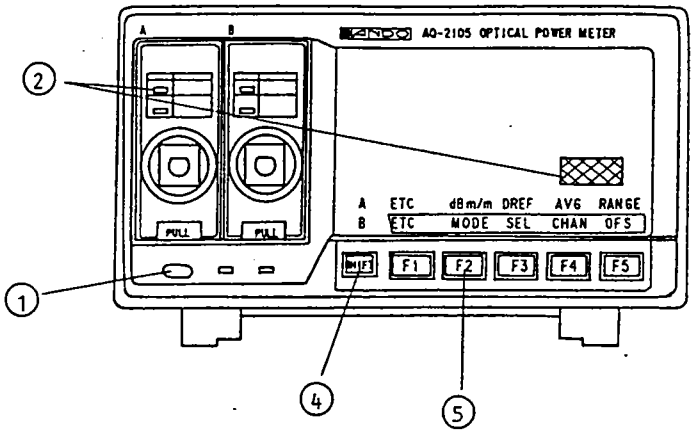
① <POWER ON >

② CHOP

③ Measurement

If <CW> is lighted, go to steps 4-6.

Indication "MODE = CHOP" is displayed on the screen.



○ If <CW> is lighted:

④ <SHIFT> Select the functions in the lower row.

⑤ [MODE] <F2>

⑥ CHOP

Items to be prepared:

- o AQ-2105 Optical Power Meter
- o OPM unit

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5.5 SPATIAL LIGHT MEASUREMENT

To make spatial light measurement, proceed as follows:

<Procedure>

① Perform the procedure described in Subsection 5.3.

↓

② Adjust the laser beam direction so that the laser beam hits the center of the shielding cap.

↓

③ Start measurement.

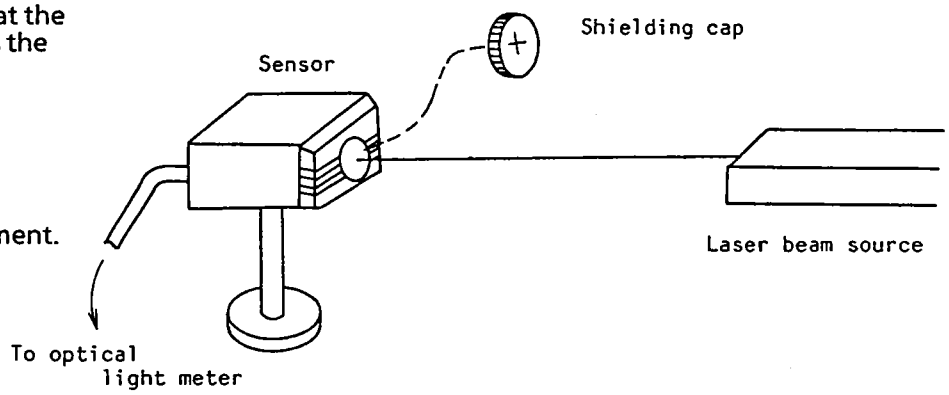


Fig. 5-1 Spatial light measurement

Fix the sensor for laser beam reception, for example, using a stand.

Items to be prepared:

- o AQ-2105 Optical Power Meter
- o AQ-2109 and sensor
- o Stand
- o Shielding cap

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5.6 OPTICAL FIBER LOSS MEASUREMENT

In optical fiber loss measurement, how much the optical power emitted by a light source is attenuated (optical power loss) while it propagates along an optical fiber is measured.

5.6.1 Optical Fiber loss Measurement

Optical loss measurement is made either by the cutback method or by the insertion method. Of the two methods, the cutback method which enables accurate measurement with high repeatability will be explained in the following.

Since a light source can be set in this apparatus, it is possible to make optical loss measurement using this apparatus without requiring any other instrument.

Figure 5-2 shows an optical loss measurement system.

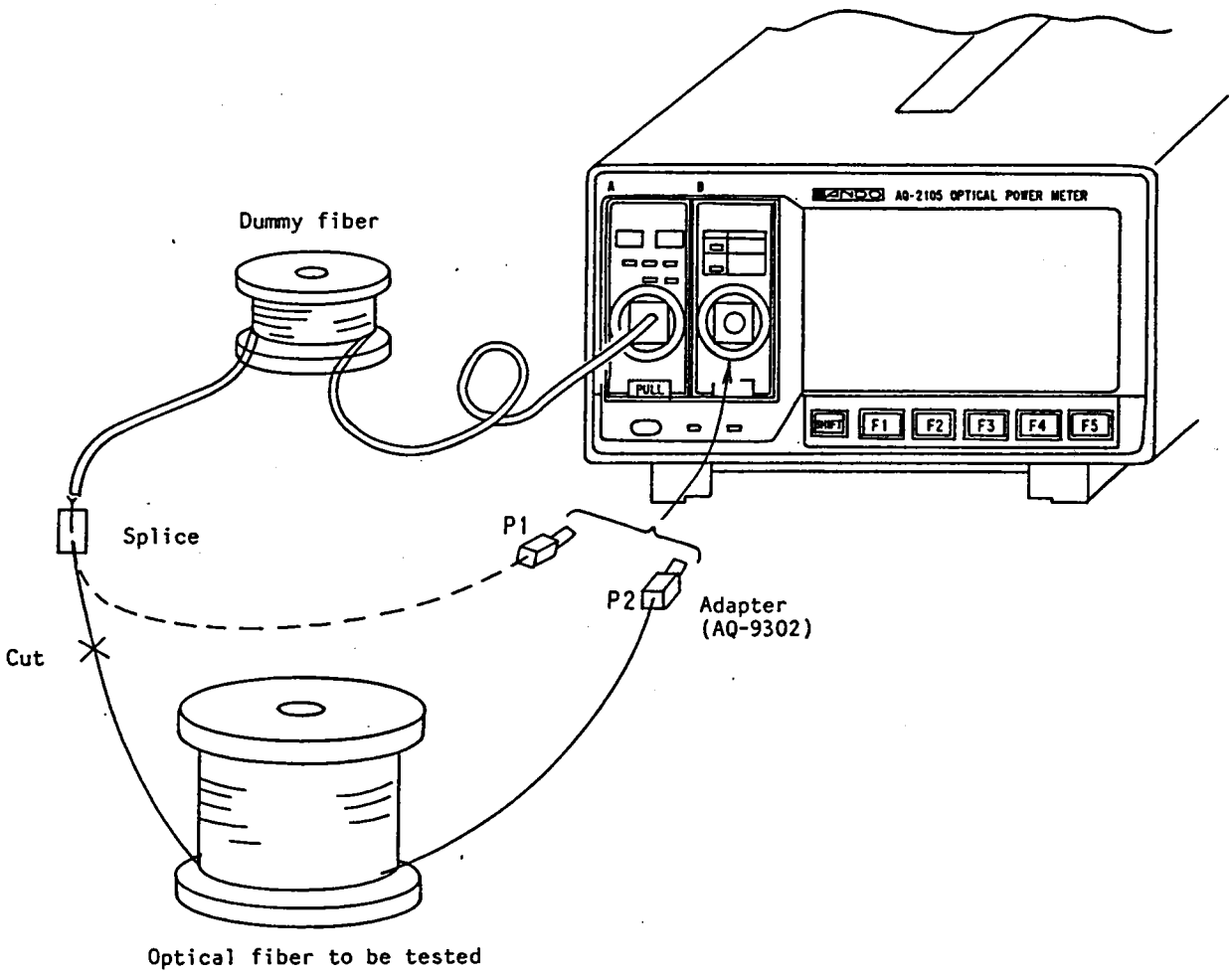


Fig. 5-2 System for optical loss measurement by cutback method

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○ The procedure for optical loss measurement to be made using a combination of AQ-4148 (131/155) and AQ-2107 will be described below.

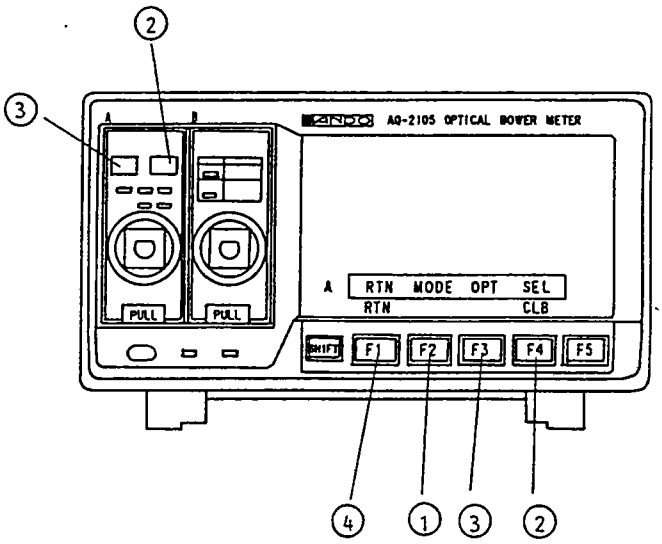
● Optical loss measurement at 1.31 μm wavelength

<Procedure>

(1) Light source setting

① [MODE] <F2>

Set the optical output waveform to CW or CHOP.



② <λ> or [SEL] <F4>

Set the wavelength to 1.31 μm.

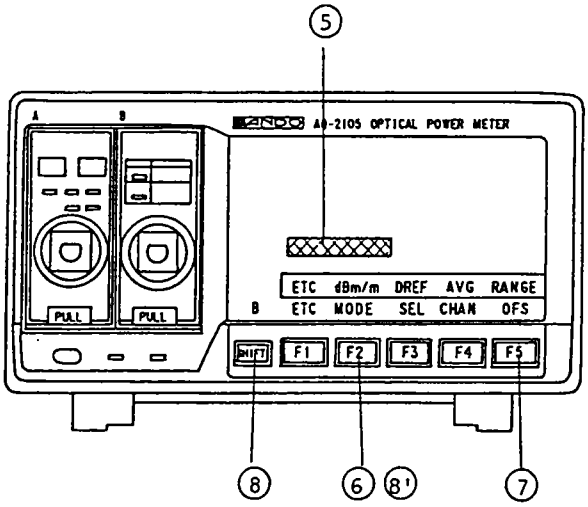
③ <OPT> or [OPT] <F3>

Output light.

(2) Power meter setting

④ [RTN] <F1>

Change the display to the frame for power meter.



⑤ "WL = 1310nm"

Make sure that the wavelength setting agrees with the actual wavelength (in this example, the light source wavelength of 1,310 nm).
To change the wavelength setting, use [PRMTR].

[MODE]

⑥ <SHIFT>, <F2>

Set the light mode for reception according to the output waveform of the light source.

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⑦ [OFS]
<F5>

When measuring CW lgiht, make offsetting.
(This indication is not displayed for chopped light measurement.)

[dBm/w]

Set the unit of value to [dBm] for display.

⑧ <SHIFT>, <F2>

(3) Preparation for measurement
See Fig. 5-2.

⑨ Connect a dummy fiber between the light source and the optical fiber to be tested.

(4) Measurement
See Fig. 5-2
For the procedure for entering data in memory, see 5.6.2 or 4.4.3-(10).

⑩ Measure optical power P_2.

Changing the light source wavelength to 1.5 μm and measuring P_2 in this stage enables optical loss measurement at two wavelengths.

⑪ Cut the optical fiber under test 1-2 meters from where it is spliced with the dummy fiber and measure optical power output P_1 at the cut.

Optical loss = $P_1 - P_2$ (dB)

In the case of relative value measurement, the sensor wavelength sensitivity correction need not be adjusted.

Points:

- If the <F3> key is pressed for [DREF] following step 8 described above, the optical loss measurement can directly be read. See Table 5-1.
- It is possible to store measured optical loss values and take them out later. (See 4.4.3-(10).)
- Measurement at different wavelengths can be facilitated by setting [SETUP] parameters for each wavelength beforehand; since such preparation makes it unnecessary to repeat parameter settings every time the wavelength is changed. See 4.4.2-(2)-(b).

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Measurement example:

If optical power P_1 is –35 dBm and P_2 is –45 dBm, the optical loss is as listed in Table 5-1.

Table 5-1 Absolute and relative optical losses

	dBm measurement	DREF measurement
Display of P_1	– 35.000 dBm	+ 10.000 dB
Display of P_2	– 45.000 dBm	0.000 dB
Optical loss	10.000 dB	10.000 dB

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5.6.2 Optical Fiber Loss Measurement Utilizing Memory

The memory function of this apparatus makes it possible to temporarily store measured values to facilitate, for example, multicore optical fiber loss measurement in which many measurements are to be made.

How the memory function can be utilized in making measurement as described in 5.6.1 will be explained in the following.

<Procedure>

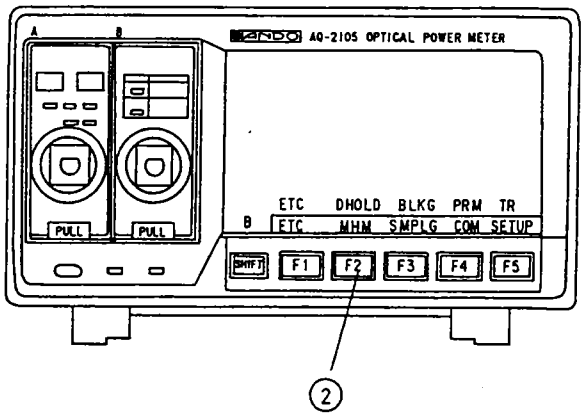
① Peform steps 1 through 9 of the procedure described in 5.6.

↓

② [ETC], <SHIFT>, [MEM] Read memory contents.
<F1> <F2>

↓

③ [DMST] Store the data in memory.
F5

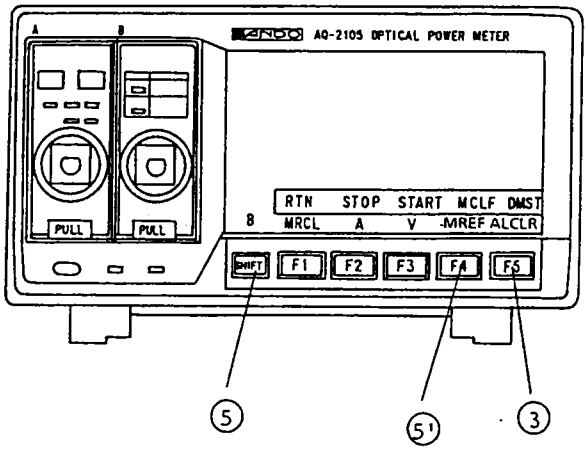


↓

④ Cut off the optical fiber under test 1-2 meters from where it is spliced with the dummy fiber and measure optical power output P_1 at the cut.

↓

⑤ <SHIFT>, [MREF] The measured value relative to that obtained in step 3 is displayed.
<F2>



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5.7 STABILITY MEASUREMENT

Optical stability measurement can be made either by the direct method or by using a system incorporating an optical directional coupler as shown in Figure 5-3. In the latter method, the coupler is used to monitor the optical power output of the light source and make up for fluctuations of the optical output in measuring the optical stability of the device under test. This method enables highly accurate stability measurement.

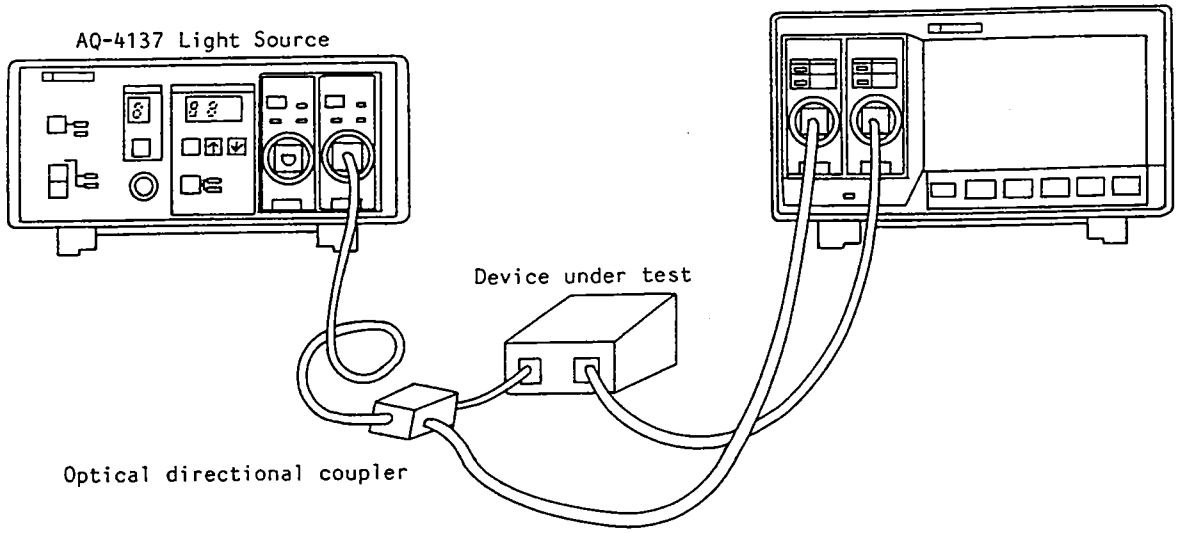


Fig. 5-3 Stability measurement utilizing optical directional coupler

o To make stability measurement using a system as shown in Figure 5-3, proceed as follows:

<Procedure>

① <CW> or <CHOP>	(1) Light source setting Set the optical output waveform.
↓	
② <OPT>	Output light
↓	(2) Power meter setting
③ "WL = ****nm"	Check the wavelength setting. (Make it the same as the wavelength of the light source.)
↓	
④ "MODE:****" <SHIFT>[MODE] <F2>	Set the light mode for receiption according to the output waveform of the light source.
↓	

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⑤ [OFS] <F5>

If CW light is to be received, make offsetting.

⑥ [ETC] <F1>

Change the display to the frame for basic function (2).

⑦ [B/A] <F5>

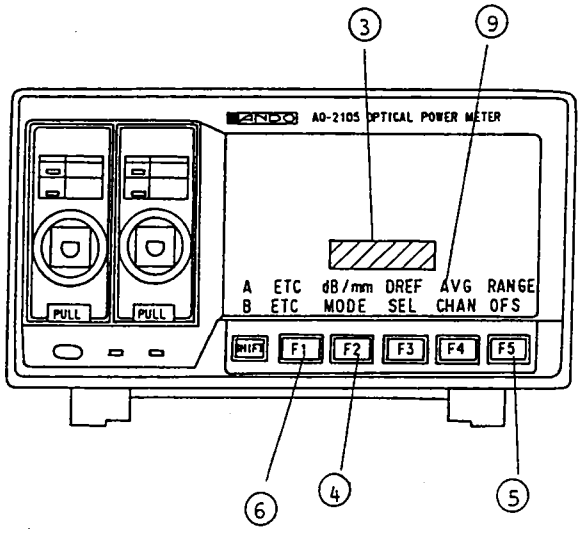
The difference between the measurements taken on channels A and B is displayed.

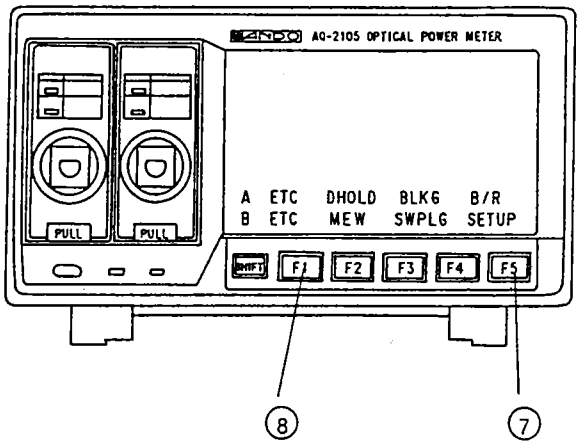
⑧ [ETC] <F1>

Change the display to the frame for basic function (1).

⑨ [DREF] <F3>

Make relative value measurement.





Points:

- The maximum and minimum data can be displayed by executing [DHOLD].
- It is possible to store measured values and take them out later. (See 4.4.3-(10).)

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5.8 UNATTENDED LONG-HOUR STABILITY MEASUREMENT

It is possible to repeat unattended stability measurements for up to 1,500 hours while storing the measured values using the memory function of this apparatus.

The procedure for making stability measurements at 10- minute intervals using a measurement system as shown in Figure 5-3 will be explained in the following.

In the above case, unattended measurements can be continued for up to 250 hours per channel as calculated below.

Max. length of time = Max. No. of measured values storable × Measurement interval = 1,500 × 10 min. = 250 hours

<Procedure>

① [ETC], [PRMTR] <F1> <F2>

(1) Measurement interval setting
Set the interval in the display frame for parameter setting.

↓

② [ETC] F5

Change the display to the second parameter frame.

↓

③ "INTVL = 10 min"

Make sure that the correct interval has been set.

↓

④ [INT] F1

If the interval setting is not [10min], correct it using [▲] or [▼].

↓

⑤ [MEAS] F1

Start measurement

↓

⑥ <SHIFT>, [MEM] <F2>

(2) Memory function
Change the display to the frame for [MEM].

↓

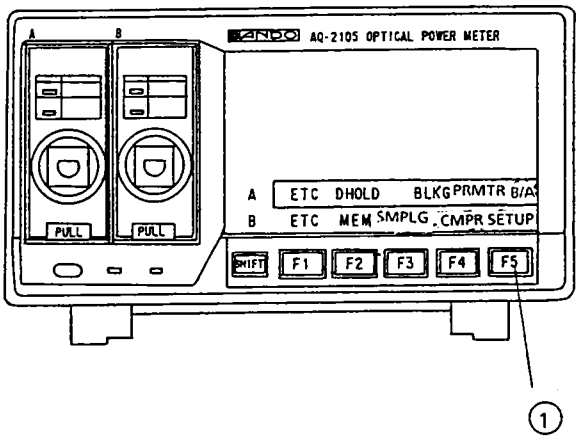
⑦ [START] <F3>

Automatic data storing is started.
At the instant the key is pressed, the gate opens to cause measurement to be started and then repeated at the specified intervals.

↓

⑧ [STOP] <F2>

Press this key to stop automatic measurement.
For a restart, press the F3 key for [START].



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5.9 GO/NOGO PRODUCT INSPECTION

The comparator function for making GO/NOGO checking of this apparatus is useful in inspecting optical products such as optical plugs.

A measurement system for making GO/NOGO checking is shown in Figure 5-4.

Fig. 5-4 Measurement system for inspecting optical connection cords attached with plug at one end

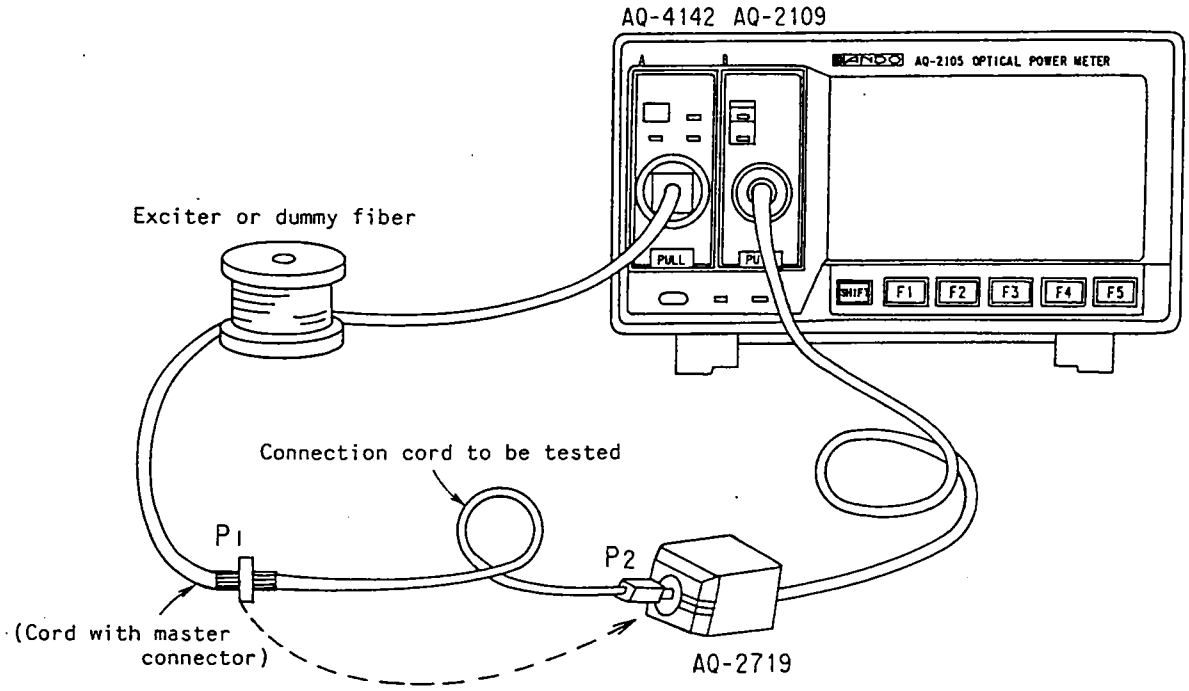


Fig. 5-4 Measurement system for inspecting optical connection cords attached with plug at one end

The procedure for inspecting optical connection cords using the comparator function of this apparatus will be explained in the following. In the following example of GO/NOGO checking, the upper limit insertion loss allowable is set to – 0.7 dB.

<Procedure>

(1) Parameter setting

① [ETC], [PRMTR] <F1> <F4>
Change the display to the parameter frame to make settings for the comparator.

↓

② [▶], [▶], [▶], [▶], "UPR = [+00.000] dBm"
Move the cursor to the position for setting the upper limit value for the comparator.

↓

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③ [NEXT]
<F4>

"UPR = +00.000dB"

Change "dBm" to "dB"

④ [▶]
<F3>

"LWR = 00.000 dBm "

Set the lower limit value to "–00.700" using [▲] or [▼]

⑤ [LWR]
<F4>

"LWR = –0.700 dB "

⑥ [RTN]
<F1>

Restore the parameter frame

⑦ [ETC]
<F5>

Change the display to the second frame for main functions.

⑧ [▶]
<F3>

"BEEP = OFF "

Set "BEEP" to "ON" if the buzzer is to be made sound upon detection of a NOGO.

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⑨ [NEXT]
<F4>

With this setting made, the buzzer is to sound when a NOGO product is detected.

"BEEP = ON "

↓

⑩ [MEAS]
<F1>

Now, with the comparator settings over, measurement can be started.

↓

(2) Measurement

↓

⑪ [ETC]
<F1>

Restore the first frame for main functions

ETC dBm/w DREF AVE RANGE
ETC MOPE SEL CHAN OFS

↓

⑫ "dBm"

Make sure that the unit of measurement has been set to "dBm"

↓

⑬ [DREF]
<F3>

Select [DREF] to make relative value measurement.

↓

⑭ Connect a cord to be tested and measure P_2.

↓

⑮ [ETC]
<F1>

Change the display to the second frame for main function.

ETC DFOLD BLKG PRMTR
ETC MEM SMPLG CMPR SETUP

↓

⑯ [CMPR]
<F4>

Start operation by the comparator function; the limit value settings will be displayed as shown at left.

"Bch UPR = + 0.700dB LWR = – 00.000dB"

↓

⑰ If a measurement outside the specified range is obtained, the measurement display flashes on and off and the buzzer starts sounding.

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SECTION 6
CIRCUITRY AND CONSTRUCTION

6.1 INTRODUCTION

This section contains general information on the circuitry and construction of this apparatus.

6.2 CIRCUITRY

The schematic circuit diagram of this apparatus is shown in Figure 6-1.

In this apparatus, photoelectric conversion is made by the sensor section. The converted signal is amplified by a variable-gain amplifier circuit. It subsequently undergoes analog-to-digital conversion and is displayed in five digits.

6.2.1 Sensor Section

The sensor section incorporates a Si, Ge, or InGaAs photodiode used as a photoelectric conversion sensor to convert the input optical power into a proportional magnitude of electrical signal.

It also includes a ROM used to adjust the wavelength sensitivity of the sensor itself and an adjuster for absolute wavelength calibration.

The AQ-2715 and AQ-2716 sensors are designed to internally make optical chopping at 270 Hz to achieve a highly dynamic measuring range of -90 to 0 dBm.

6.2.2 Variable-Gain Amplifier Section

The variable-gain amplifier section of this apparatus comprises a d.c. amplifier circuit for CW light, an a.c. amplifier circuit for 270 Hz chopped light, and a filter and amplifier circuit.

(1) D.C. amplifier circuit

This circuit includes an operational amplifier and an active LPF, and controls the gain according to the incident optical power.

(2) A.C. amplifier circuit

This circuit made of an operational amplifier and an active BPF controls the gain according to the incident optical power.

(3) Filter and rectifier circuit

This circuit comprises an active BPF and a linear detector circuit. It outputs a d.c. signal which is input to the analog-to-digital conversion circuit.

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6.2.3 Control and Display Section

(1) Control section

The amplified signal coming out of each unit undergoes analog-to-digital conversion in the A/D conversion circuit. The converted signal then enters the CPU circuit where it is converted into a linear or logarithmic signal. The processed measurement data can be transmitted out of the apparatus via the display section and GP-IB.

(2) Display section

The display section comprises a display circuit used to display the measurements taken on channels A and B and status information.

6.3 CONSTRUCTION

The external view of this apparatus is shown in Drawing ASD-61740-1.

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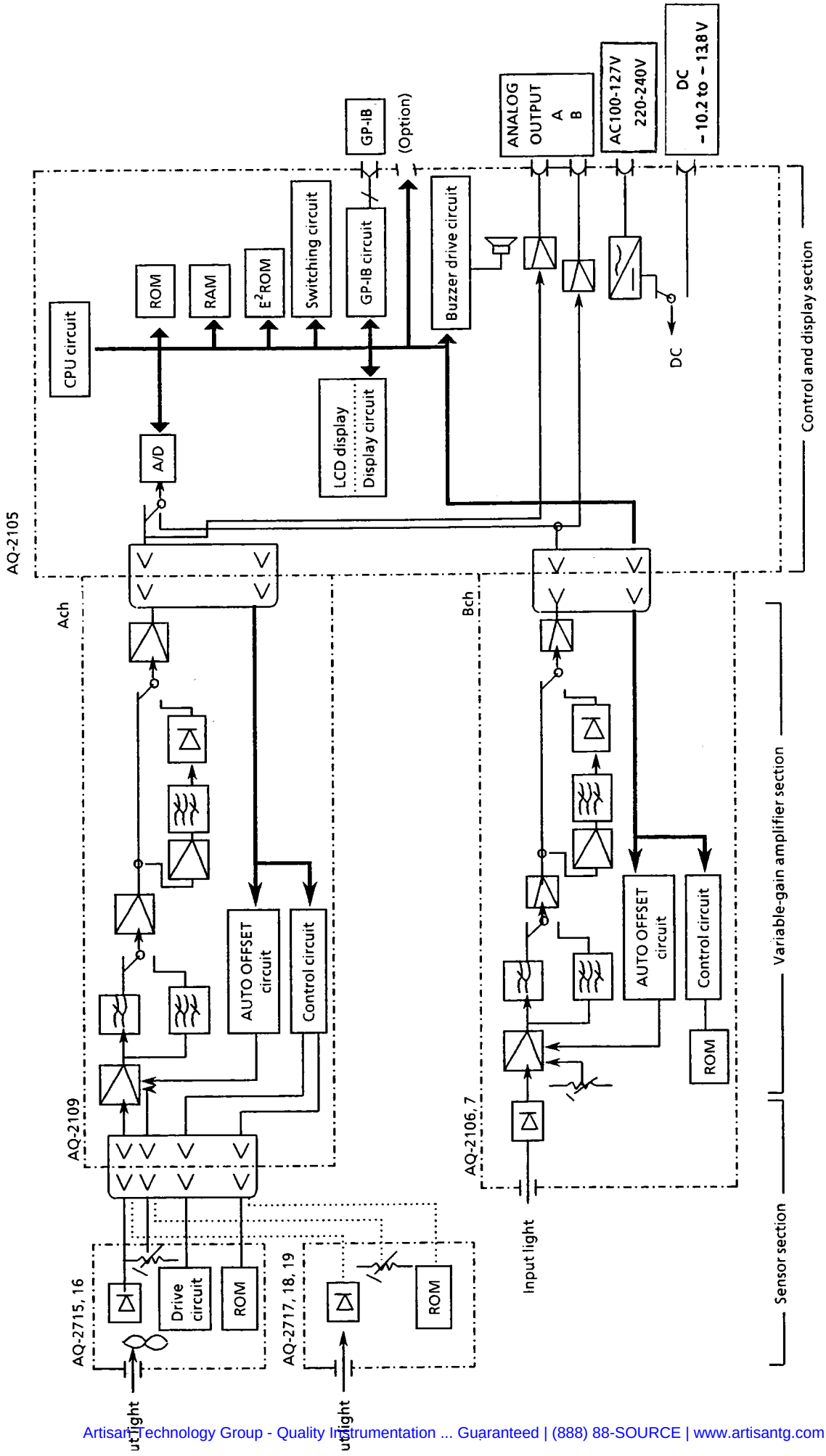


Fig. 6-1 Schematic circuit diagram of AQ-2105 Optical Power Meter

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SECTION 7
MAINTENANCE

7.1 INTRODUCTION

This section explains the procedure for maintenance required to obtain optimum performance from the apparatus for extended periods of time.

7.2 TROUBLESHOOTING BEFORE REQUESTING REPAIR

If the apparatus malfunctions, inspect the apparatus by referring to Table 7-1.

Table 7-1 Simple troubleshooting

Conditions	Correction
Gate does not light	Measurement interval [INT] set using [PRMTR] is too long. Specify shorter interval.
"OFS" is flickering	Leakage light is sensed. Shield sensor.
Apparatus does not operate with power switch on	Check fuse set on rear panel for blow-out
Absolute values are incorrect.	o Wavelength sensitivity correction value is inappropriate. Set proper correction value for measurement system. o Offsetting is erroneous. Make offsetting after shielding sensor. o Calibrate apparatus
[MEM] function cannot be performed	Unusable in "W" mode
[SMPLG] function cannot be performed	Unusable with [DHOLD] in use
In W mode, [BLKG] occasionally fails to function.	There are cases resolution does not change depending on unit of measurement.
[CHAN] function cannot be performed.	[CHAN] does not function if light source unit has been connected.

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7.3 MAINTENANCE AND INSPECTION

7.3.1 TESTING INSTRUMENTS

The testing instruments required are listed in Table 7- 2. The performance characteristics shown in the table represent the minimum requirements with which the testing instruments are expected to comply.

Table 7-2 Testing instruments

Instrument name	Specifications
Optical power meter	Power measuring range Short wavelength region 1 pw to 10 mW Long wavelength region 10 pw to 10 mW Wavelength range Short wavelength region 0.4 to 1.0 μm Long wavelength region 1.0 to 1.6 μm Measuring accuracy and resolution Within ±3%, 0.01 dB
Optical variable attenuator	0.85 μm band 0 to 60dB, ∞ 1.30 μm band 0 to 60dB, ∞
Light source	Wavelength 0.63 μm, 0.85 μm and 1.30 μm Output level −3 ± 1 dB or more
Optical fiber cord	GI 50/125 μm
Exciter	Dummy fiber of several handred meters in length, or mode scrambler.

7.3.2 Periodical Inspection

Periodical inspections are effective in obtaining optimum performance from this apparatus throughout its life and finding malfunctioning elements, if any, before trouble occurs. Inspection periods are determined according to the conditions of operation and storage.

The periodical inspections include mechanical inspections, performance tests, adjustment and calibration.

Though this apparatus is designed to give stable and reliable service, it is recommended that periodical inspection be performed twice a year.

NOTE:
Do not tamper with the circuit parts of the apparatus unless the apparatus is obviously at fault or fails to meet the specifications.

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7.3.3 Mechanical Inspection

Visually inspect the apparatus and its panel controls for damage or deformation. Also check its assembled parts for looseness and switches and connectors for smooth movement.

7.3.4 Performance Test

The performance test is carried out to check the performance of the apparatus against the specification.

The procedure for performance test to be made at the time of acceptance inspection, periodical inspection or inspection after repair will be described in the following.

1) Basic operation checks

Make the following checks to ascertain that the apparatus is capable of basic operations:

① Connect an OPM unit to the apparatus and turn the apparatus on. If any abnormal condition is detected, an error message appears on the LCD display and the apparatus makes no further operation.

② Set up a system as shown in Figure 7-1 (adjust the light source and optical attenuator according to the wavelength type [long or short] of the sensor) and make sure that the measurement displayed by the apparatus changes following the changes made in the optical attenuator setting.

NOTE:
Be sure that the optical plugs attached to the optical fiber cords and the light receiving surface of the sensor are clean of dust. If necessary, wipe them clean with cotton wet with absolute alcohol.

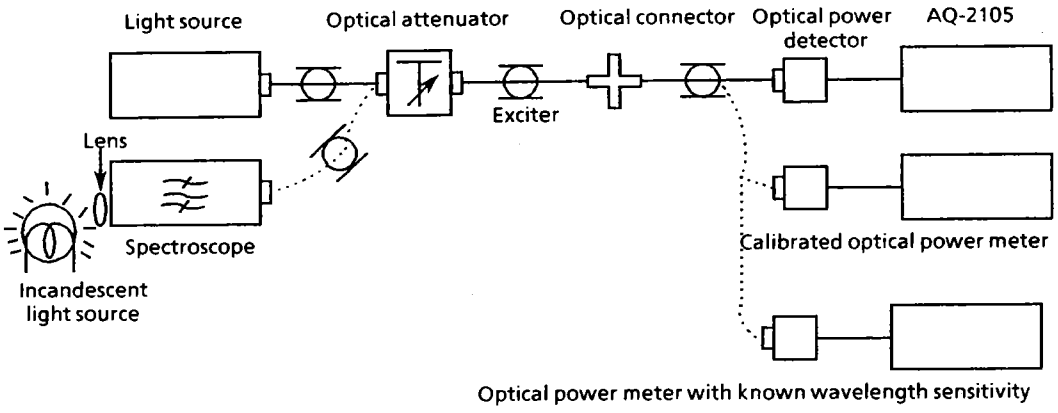


Fig. 7-1 Setup for performance test and calibration

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2) Performance test

① In the measurement system set up as shown in Figure 7-1, check the performance of this apparatus against the calibrated optical power meter.

② Photoelectrically inspect the apparatus by varying the optical attenuator setting.

③ Check the apparatus for a wavelength sensitivity correction error using the optical power meter with known wavelength sensitivity.

> NOTE:
> The short wavelength sensor has been calibrated for absolute power level at a wavelength of about 850 nm and the long wavelength sensor at a wavelength of about 1,300 nm using Ando Electric's standard calorimeter.

7.4 CALIBRATION

The sensor is provided, on its top or side as shown in Figure 7-2, with a control for use in calibration. To calibrate the sensor with regard to absolute wavelength, remove the rubber cap of the control and adjust the control until the standard wavelength for the sensor is read.

> NOTE:
> The sensor has been factory calibrated to the designated wavelength. Do not tamper with the control for calibration unless recalibration becomes necessary. Unnecessarily tampering with it may result in impairing the calibrated state of the sensor.

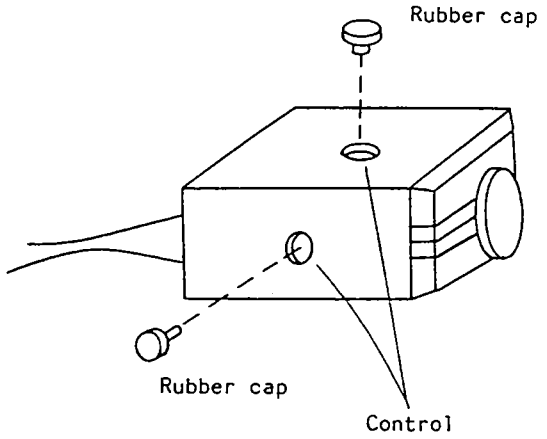


Fig. 7-2 Control for sensor calibration

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The sensor can be factory calibrated according to user specifications.

NOTE:
- o The wavelength sensitivity correction function of this apparatus cannot be used for a sensor calibrated to a different wavelength.
- o It is recommended that sensors calibrated to different wavelengths be kept under proper control not to allow them to be mistaken for those calibrated to the standard wavelength.

7.5 INSTRUCTION CARD REPLACEMENT

At the bottom of the apparatus are provided five instruction cards which contain a brief description of the operating instructions for the apparatus.

The instructions are written in Japanese on one side and in English on the other side. The cards can be set so that the desired side is exposed to view.

To remove or reinstall the cards, bow them one by one. The cards can be conveniently used if they are set so that the protruding labels come in order.

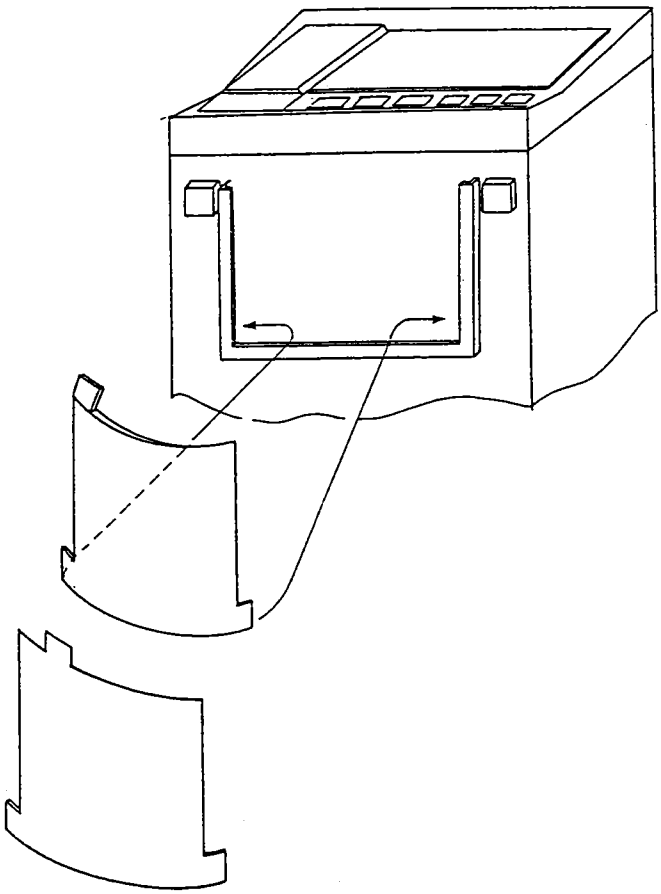


Fig. 7-3 Instruction Card Replacement

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NOTE:
When removing or reinstalling the instruction cards, use care not to bend them excessively. Otherwise, they may be broken.

7.6 BLANK PANEL INSTALLATION AND REMOVAL

The apparatus is provided with one blank panel.

The blank panel serves to protect the apparatus when it contains no unit. When no unit is set in the apparatus, the blank panel should be therefore installed in the apparatus.

If a piece of metal enters the portion where a unit is to be installed, the apparatus may fail to operate properly.

7.6.1 Installation

The blank panel should be installed using the following procedure.

(1) Align the blank panel protrusion with the groove in the upper section.

(2) Push the bottom of the blank panel as indicated in Fig. 7-1 to secure the blank panel.

7.6.2 Removal

The blank panel should be removed performing the following procedure.

(3) Slightly lift the knob at the bottom of the blank panel and draw it toward you.

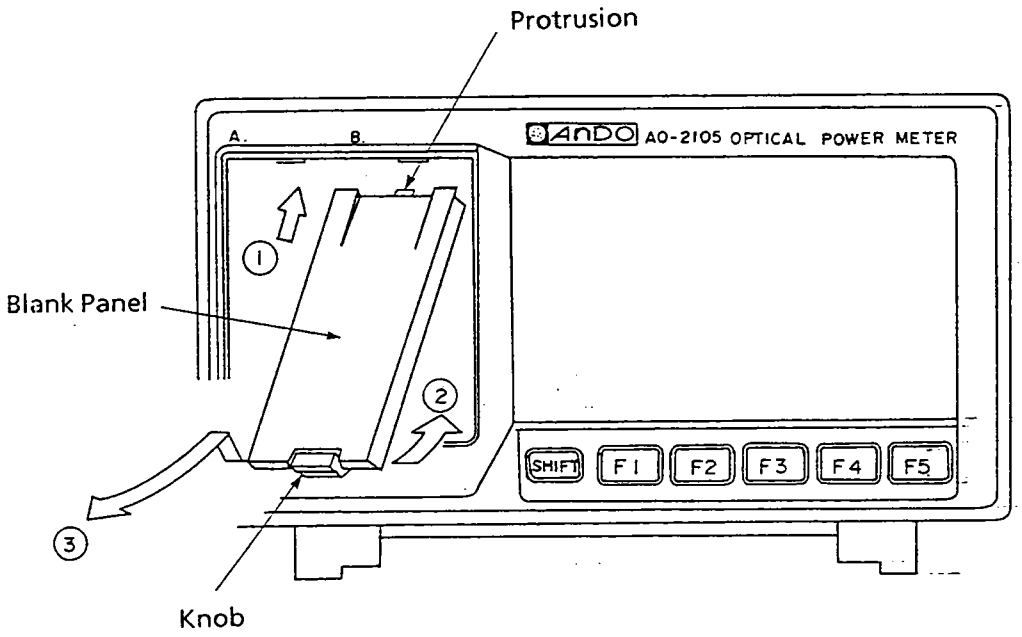


Fig. 7-4 Blank Panel Installation and Removal

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7.7 Fuse Replacement and Input Voltage Change

To perform input voltage change and fuse replacement, open the AC voltage input socket on the rear panel. (See Fig. 7-5.)

Set the voltage selector to the input voltage matching the commercial AC power voltage. (The selector should be set so that the desired input voltage marking is seen through the window when the socket is closed.)

Install a correct fuse, referring to the input voltage-fuse rating relationship given below.

Iuput Voltage	Voltage Selector	Fuse
100～109V	100V	1A
110～127V	120V	1A
220～229V	220V	0.5A
230～240V	240V	0.5A

The fuse holder can be removed by drawing it toward you.

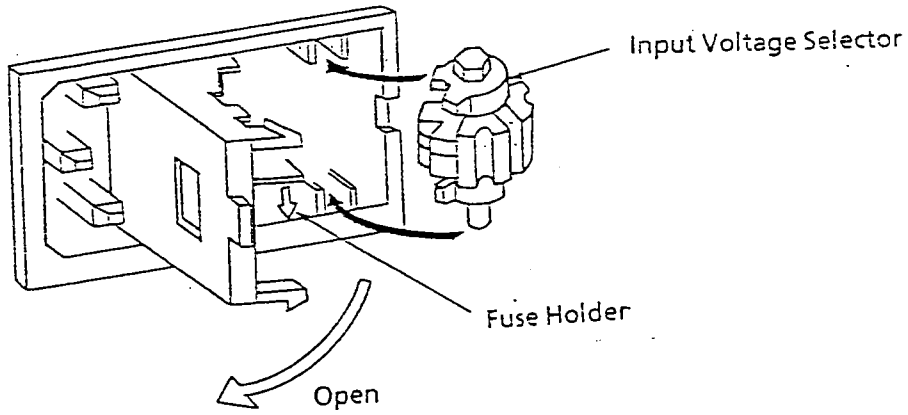


Fig. 7-5 Fuse Replacement and Input Voltage Change

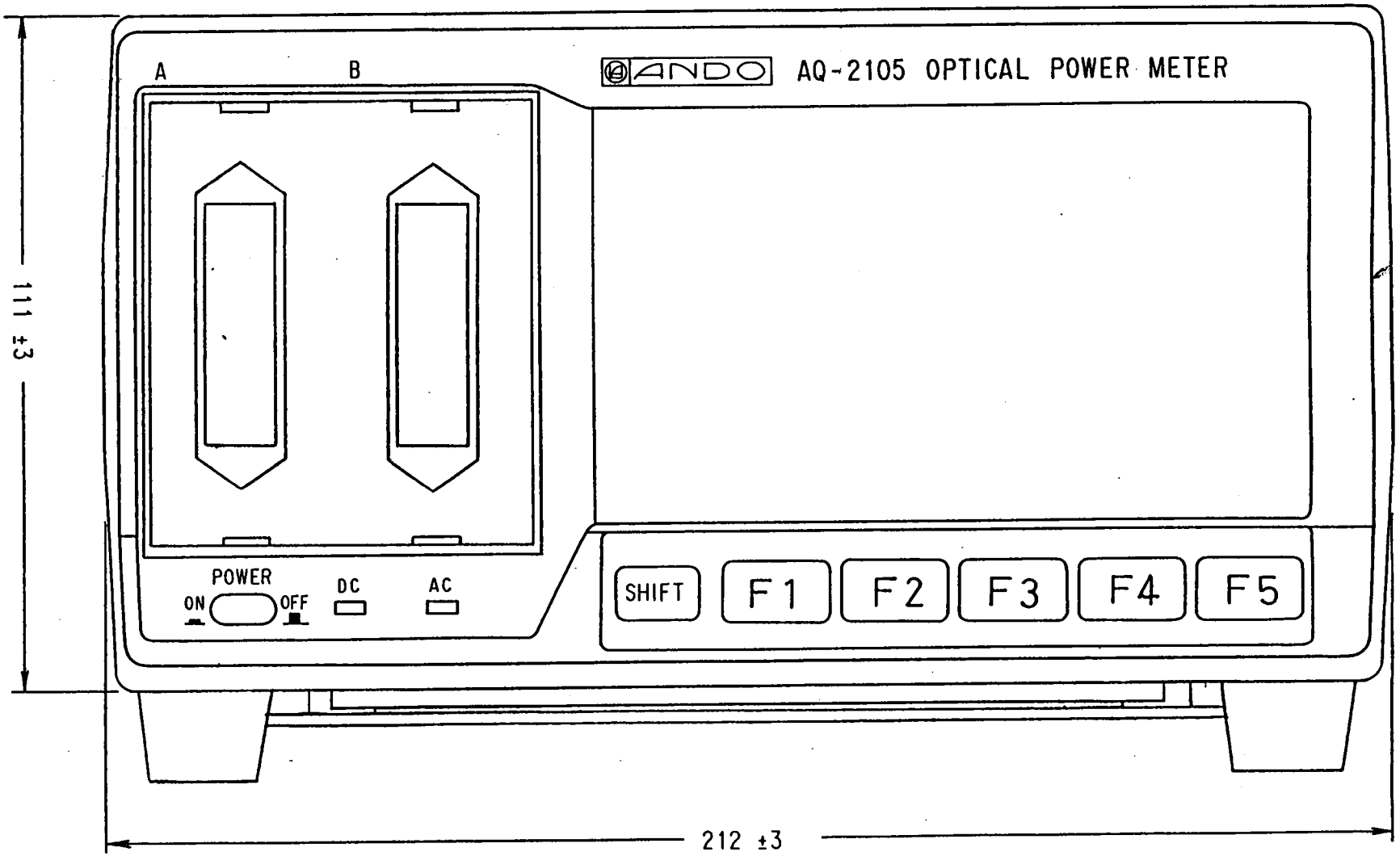
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Standard Accessories

Accessory name	Qty	Remarks
Instruction manual	1	
Fuse	2	Normal Use
Power cord	1	
Instruction cards	1 set	1 set of 5 cards as set in apparatus
Blank panel	1	
DC connector	1	

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EXTERNAL VIEW OF AQ-2105 OPTICAL POWER METER

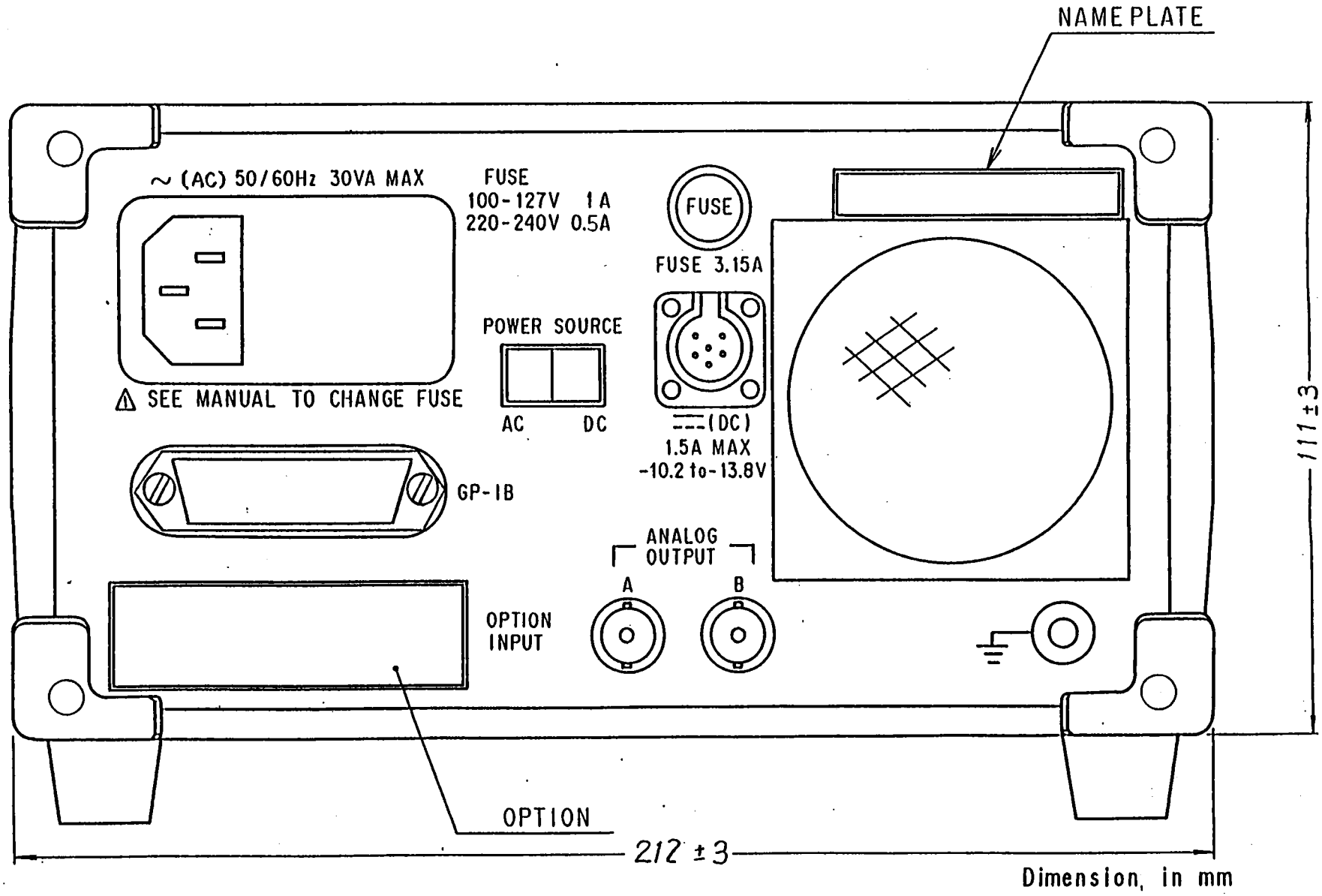


Dimension in mm

ASD-61740-1-2/3

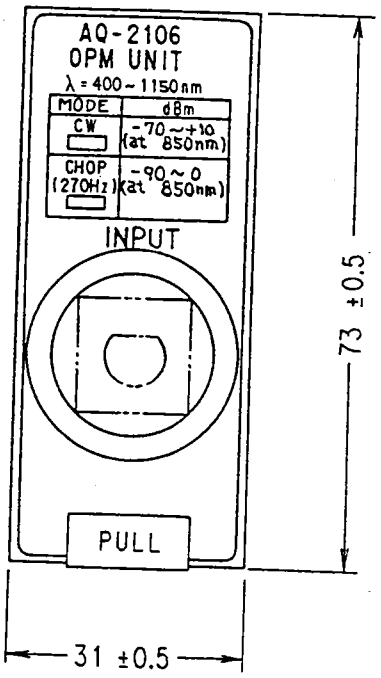
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EXTERNAL VIEW OF AQ-2105 OPTICAL POWER METER



ASD-61740-1-3/3

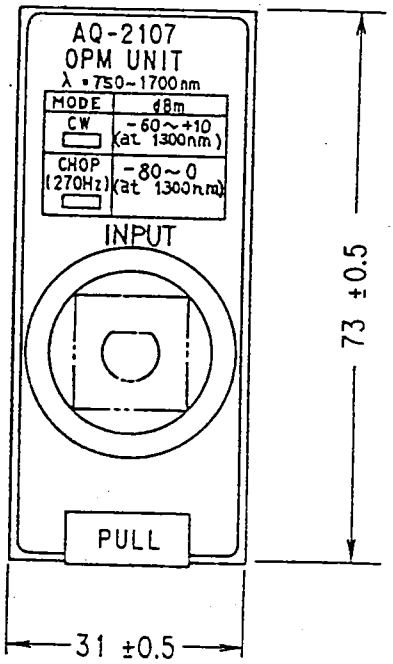
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Dimensions in mm

EXTERNAL VIEW OF AQ 2106 OPM UNIT

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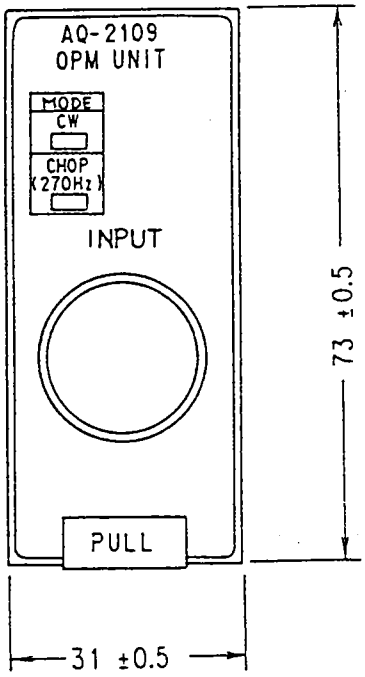


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Dimensions in mm

EXTERNAL VIEW OF AQ 2107 OPM UNIT

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Dimensions in mm

EXTERNAL VIEW OF AQ-2109 OPM UNIT

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