OPERATION MANUAL
PROGRAMMABLE OPTICAL ATTENUATOR
MN9610A/MN9611A

1991.10 Ver. I

ANRITSU CORPORATION

CERTIFICATION

ANRITSU CORPORATION certifies that this instrument has been thoroughly tested and inspected, and found to meet published specifications prior to shipping.
Anritsu further certifies that its calibration measurements are based on the Japanese Electrotechnical Laboratory and Radio Research Laboratory standards.

WARRANTY

All parts of this product are warranted by Anritsu Corporation of Japan against defects in material or workmanship for a period of one year from the date of delivery.
In the event of a defect occurring during the warranty period, Anritsu Corporation will repair or replace this product within a reasonable period of time after notification, free-of-charge, provided that: it is returned to Anritsu; has not been misused; has not been damaged by an act of God; and that the user has followed the instructions in the operation manual.

Any unauthorized modification, repair, or attempt to repair, will render this warranty void.

This warranty is effective only for the original purchaser of this product and is not transferable if it is resold.

ALL OTHER EXPRESSED WARRANTIES ARE DISCLAIMED AND ALL IMPLIED WARRANTIES FOR THIS PRODUCT, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO A PERIOD OF ONE YEAR FROM THE DATE OF DELIVERY. IN NO EVENT SHALL ANRITSU CORPORATION BE LIABLE TO THE CUSTOMER FOR ANY DAMAGES, INCLUDING LOST PROFITS, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES, ARISING OUT OF THE USE OR INABILITY TO USE THIS PRODUCT.

All requests for repair or replacement under this warranty must be made as soon as possible after the defect has been noticed and must be directed to Anritsu Corporation or its representative in your area.

WARNING

NO OPERATOR SERVICEABLE PARTS INSIDE.
REFER SERVICING TO QUALIFIED PERSONNEL.

CAUTION

FOR CONTINUED FIRE PROTECTION REPLACE
ONLY WITH SPECIFIED TYPE AND RATED FUSE.

Note 1:

1. The instrument is operable on a nominal voltage of 100 to 127 Vac or 200 to 250 Vac by changing the connection between the power inlet and the power transformer.

   The voltage and current ratings are indicated on the rear panel when the instrument is shipped from the factory.

   To operate on the other voltage, change the connections on the power supply transformer. The plate on the rear panel indicating the voltage and current ratings should be changed to the appropriate one. Order the plate from ANRITSU CORPORATION if needed.

2. In this manual, the power supply voltage and current ratings are represented by **Vac and ***A, respectively.

3. The relationship between power supply voltage and current rating is shown below.

**Vac	***A (MN9610A/MN9611A)
100 to 127V	1.6 A
200 to 250V	0.8 A

Note 2:

WARNINGs, CAUTIONs, Notes, and Explanatory footnotes are used in this manual. Their meanings are given below:

WARNING:	WARNING is used when there is a personal injury hazard.
CAUTION:	CAUTION is used when the equipment may be damaged.
Note:	Note is used to provide information about exceptions, corrections, and restrictions.
Explanatory footnote:	Explanatory footnotes provide comments on the same page as the text, figure or table. They are referenced by either an asterisk (*) or by combination of an asterisk and numeral.

Note 3:

STORAGE MEDIUM

This equipment stores data and programs using backed-up memories.
Data and programs may be lost due to improper use or failure.
ANRITSU therefore recommends that you back-up the memory.
ANRITSU CANNOT COMPENSATE FOR ANY MEMORY LOSS.
Please pay careful attention to the following points. Do not remove the backed-up memory from equipment being accessed.

For details refer to the relevant operation manual.

(Back-up memory)

- Isolate the memory from static electricity.

Note:

(Primary battery used)

The battery lift is about 7 years. Early battery replacement is recommended.

TABLE OF CONTENTS

SECTION 1
GENERAL

1.1 Product Outline

The MN9610A/MN9611A Programmable Optical Attenuator is used to attenuate the optical input from a single mode (SM) optical fiber and output it. It can be remotely operated via its GP-IB interface and can cover a 0 to 60 dB attenuation range in 0.01 dB units, as well as manual operation. The unit can perform reflection countermeasures for −40 dB and above to prevent intersymbol interference between signals during digital transmission. To guard against errors when measuring the error rate, it is an uninterruptible optical attenuator that reduces sudden signal level fluctuations.

Its applicable wavelength range is 1.1 to 1.65 μm, and is calibrated at 1.31 ± 0.02 μm or 1.55 ± 0.02 μm. The MN9610A/MN9611A Programmable Optical Attenuator can be used to adjust the input optical level to DUT (device under test) and high-speed error rate systems.

1.2 Manual Composition

This operation manual is composed of the following sections.

SECTION 1 GENERAL
SECTION 2 PREPARATION BEFORE USE
SECTION 3 PRINCIPLES OF OPERATION
SECTION 4 PANEL LAYOUT
SECTION 5 OPERATION
SECTION 6 GP-IB INTERFACE
SECTION 7 PERFORMANCE TEST
SECTION 8 STORAGE AND TRANSPORTATION

1.3 Machine Composition

Standard compositions of the MN9610A/MN9611A are shown in Table 1-1.

Table 1-1 Standard Composition

Item	Model type, number	Name	Qty.	Remarks
Main frame	MN9610A MN9611A	Programmable optical attenuator Programmable optical attenuator	1	1 of either model
Accessories supplied	J0017	Power cord, 2.5 m Fuse, *** A MN9610A/MN9611A operation manual	1 2 1	 T***A 250 V, 1.6A (T1.6 A 250V, F0010) for 100 V system, 0.8A (T 800MA 250V, F007) for 200V system

1.4 Application Equipment and Peripherals

Table 1-2 Application equipment and peripherals

Item	Model type, number	Name	Remarks
Application equipment	ML9001A MA9612A	Optical power meter Optical sensor	
Application peripherals	B0317	Rack mount	Non-metric, for attaching 1 unit to left side
	B0318	Rack mount	Non-metric, for mounting 2 units horizontally
	J0575	Optical fiber, 2 m	With FC-super PC connector on both ends. SM (10/125 μm)

1.5 Specifications

Table 1-3 Specifications

Model	MN9610A	MN9611A
Wavelength range	1.1 to1.65 μm *1	
Applicable optical fiber	SM (10 / 125 μm)	
Maximum attenuation	60 dB (excluding insertion loss)	
Minimum attenuation step	0.01 dB	
Switching repeatability	±0.03 dB	
Insertion loss	≦2.8 dB *2	≦8 dB *3
Attenuation accuracy	±0.4 dB	
Linearity	±0.2 dB	
Overshoot	≦0.5 dB	
Switching time	≦150 ms for attenuation change of 0.01 dB ≦500 ms for attenuation change of 60 dB	
Crosstalk	≧80 dB (when shutter is closed)	
Return loss	≧40 dB *4	
Output for monitoring optical signal Optical output ratio Difference in loss Optical output stability Isolation	———	 1 : 1 ≦2.5 dB ≦0.1 dB ≧40 dB
Input/output connector	FC·super PC-type *5	
Maximum input level	23 dBm (200 mW)	
Power	AC **V $^{+10\,\%}_{-15\,\%}$, 50 / 60 Hz, ≦ 45 VA	
Operating temperature, rated range of use	0° to 50 °C	
Dimensions and weight	132.5H × 213W × 351 D mm, <6.5 kg	

*1 Measured at 1.3±0.02 μm or 1.55±0.02 μm
*2, *3, *4, *5

Input/output connectors (optional)	PC	DIN	ST	SC	HMS-10 / A
Insertion loss (MN9610A)	≦2.8 dB	≦2.8 dB	≦2.8 dB	≦2.8 dB	≦2.8 dB
Insertion loss (MN9611A)	≦8 dB	≦8 dB	≦8 dB	≦8 dB	≦8 dB
Return loss	≧30 dB	≧31 dB	≧31 dB	≧20 dB	≧31 dB

Note: The return loss value depends on types of connector.

SECTION 2
PREPARATION BEFORE USE

2.1 Environmental Conditions of Installation Position

The MN9610A/MN9611A Programmable Optical Attenuators are designed to function properly at the ambient temperature of 0° to 50°C. However, in order to make the best use, avoid using this equipment in places as mentioned below.

- Places with severe vibration
- Places with high humidity or dust
- Places exposed to direct sunshine
- Places where active gasses may exist

2.2 Safety Measures for Power Supply

The MN9610A/MN9611A attenuators work with the power supply of **Vac±10% or −15%, 48 Hz to 63 Hz. In order to avoid troubles as mentioned below, proper safety measures for the AC power source shall be taken.

- Injury or death to human body due to electric shock
- Damage of internal components due to abnormal voltage
- Trouble by grounding current

For this purpose, the following precautions shall be strictly observed.

2.2.1 Polarity of the power cord

Three lines of a 3-pole (ground-type 2-pole) AC outlet having a grounding (E) terminal are connected to the voltage side line (L: live line), the grounding side line (N: neutral) and the protective grounding line respectively as shown in Fig. 2-1. The three-wire power cord connected to the equipment is designed to match the polarity when the plug is connected to a 3-pole (ground-type 2-pole) AC outlet.

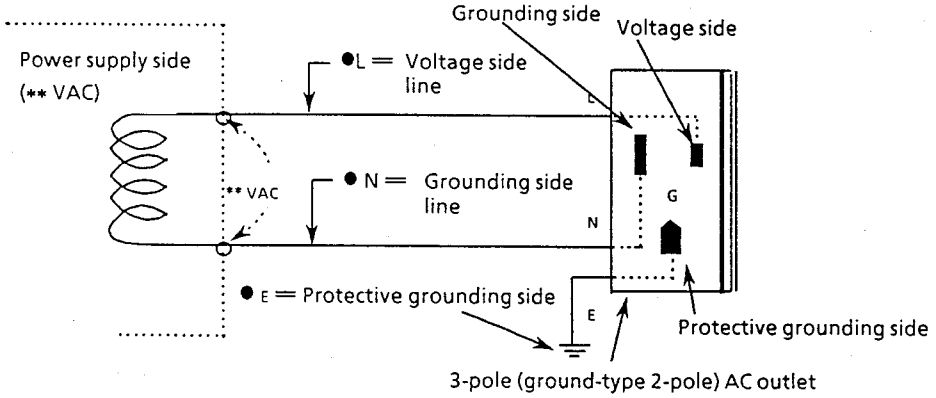


Fig. 2-1 3-wire Power Cord Plug and Outlet

2.2.2 Protective grounding

(1) Grounding of the frame ground (FG) terminal

Where a 3-pole outlet as shown in Fig. 2-1 is not available, connect the FG terminal (Fig. 2-2) at the rear panel of the equipment directly to the ground.

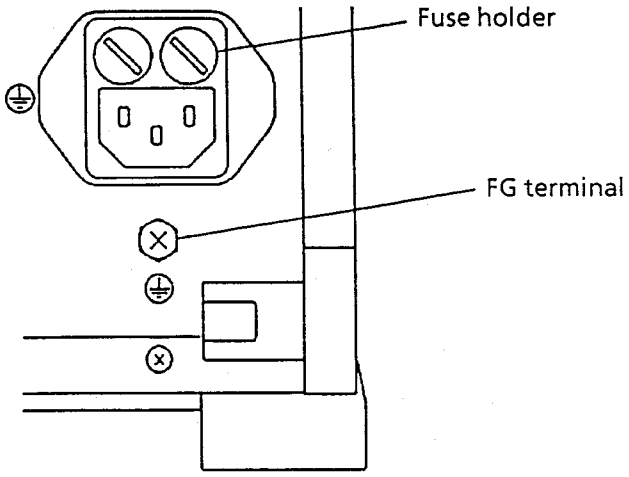


Fig. 2-2

(2) Grounding by a 3-pole outlet

As described in paragraph 2.2.1, where a 3-pole (ground-type 2-pole) AC outlet is available, the frame of the MN9610A/MN9611A can be connected to the ground potential only by connecting the power cord to the outlet because the polarities of the 3-wire power cord and the power source are matched. Therefore, grounding of the FG terminal is not required.

2.2.3 Fuse Replacement

Two fuses of ***A load capacity are attached. Make sure to confirm the current value. Before replacing a fuse for trouble, check the cause of the trouble and remove the it.

WARNING

- *Fuse replacement with power connected may result in electric shocks. Before changing the fuse, make sure to turn off the power switch and disconnect the power plug from the AC outlet.*
- *Turning on the power switch without making the protective grounding may result in electric shocks. Furthermore, in case the AC power voltage is abnormal, the internal components of the equipment may be damaged due to abnormal voltage. After the fuse if changed, and before turning on the power switch; perform either of protective grounding measures described in paragraph 2.2.2, and confirm that the AC power voltage is correct.*

Standing on the above-mentioned safety measures, fuse replacement procedures are described below. The location of the fuses is shown in Fig. 2-2.

Step	Operation
1	Turn off the POWER switch on the front panel, and disconnect the power cord from the AC outlet.
2	Turn the fuse-holder cap counterclockwise with a screw driver (−), and then the cap and the fuse are dismounted from the fuse holder.
3	Remove the fuse from the fuse cap and insert a spare fuse in place.
4	Replace the fuse and the fuse cap into the fuse holder, and turn the cap clockwise to tighten.

CAUTION

If the spare fuse is also melted, use a fuse of the same size and the same rated voltage and load capacity as the original one.

- *If the size is different, difficulty of mounting and dismounting, faulty contact, or delay of melting time may occur.*
- *If the rated voltage and current are larger than the original one, the fuse may not be blown when a trouble occurs again, which may result in damage of the equipment because of fire.*

2.3 Preparatory Work before Turning ON the Power Switch

(1) When the GP-IB interface is employed

Fix the GP-IB cable firmly with screws. Set the GP-IB address with the address switch at the rear panel (see paragraph 6.3.2).

(2) Connection to the power source

Connect the power cord to the power input connector of the equipment.

SECTION 3
PRINCIPLES OF OPERATION

3.1 Principles of Operation

Incident light (from the optical fiber cord connected to the INPUT connector) is transmitted in the optical fiber cord inside the equipment to the collimator lens, where it is converted to a parallel ray. After transmitted through the attenuation filters located in the path of the parallel ray, the incident light is condensed by the condenser lens to the outgoing optical fiber.

For the MN9610A, the light from the outgoing fiber is output through the OUTPUT connector.

For the MN9611A, the light from the outgoing fiber is branched by the optical coupler and output through the OUTPUT connector and the MONITOR OUTPUT connector.

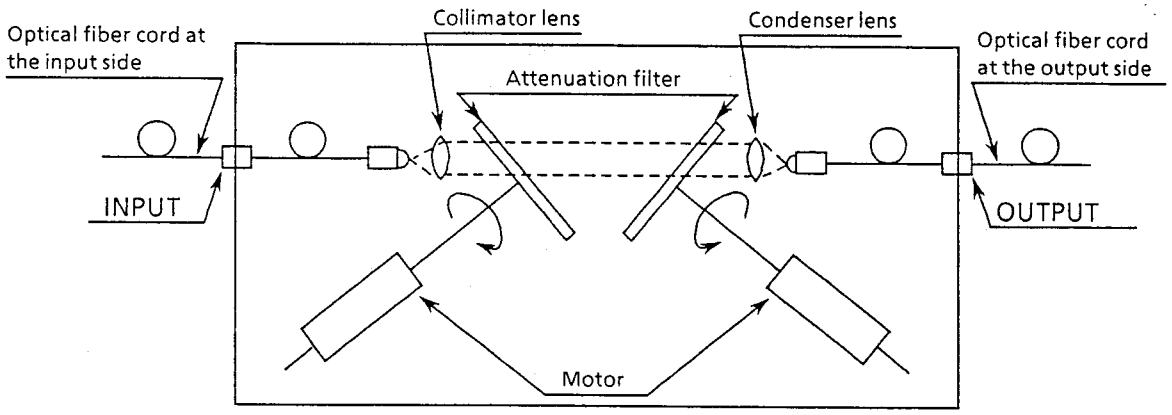


Fig. 3-1 Optical System of the MN9610A

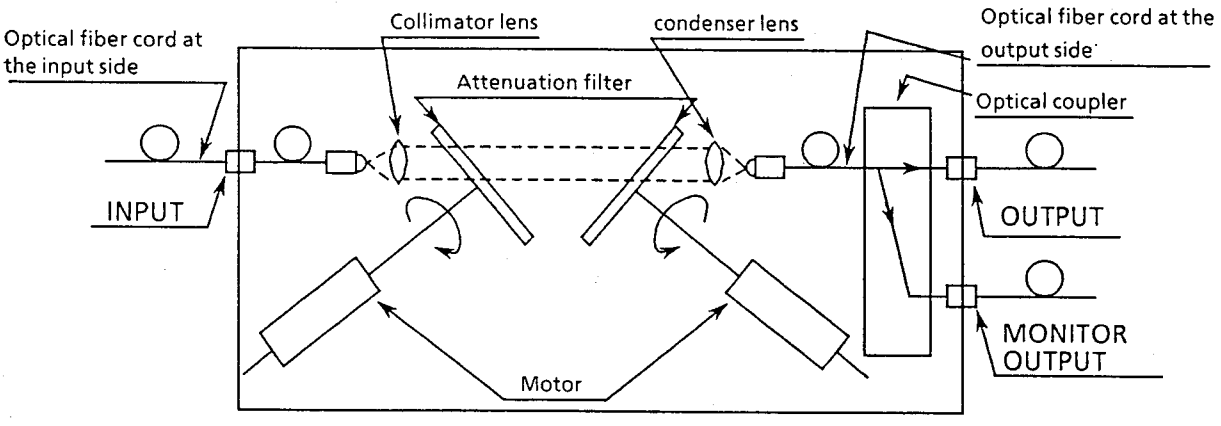


Fig. 3-2 Optical System of the MN9611A

3.2 Block Diagram

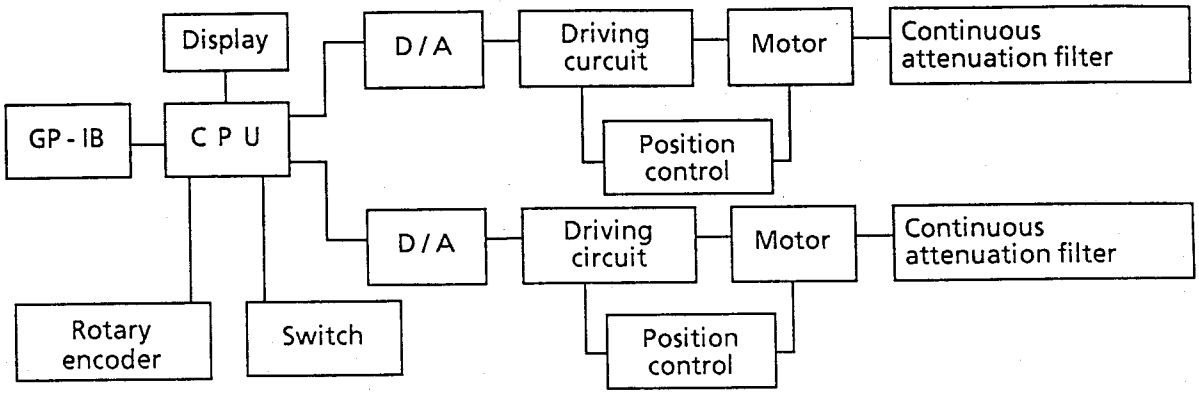


Fig. 3-3 Block Diagram

SECTION 4
PANEL LAYOUT

4.1 Front Panel

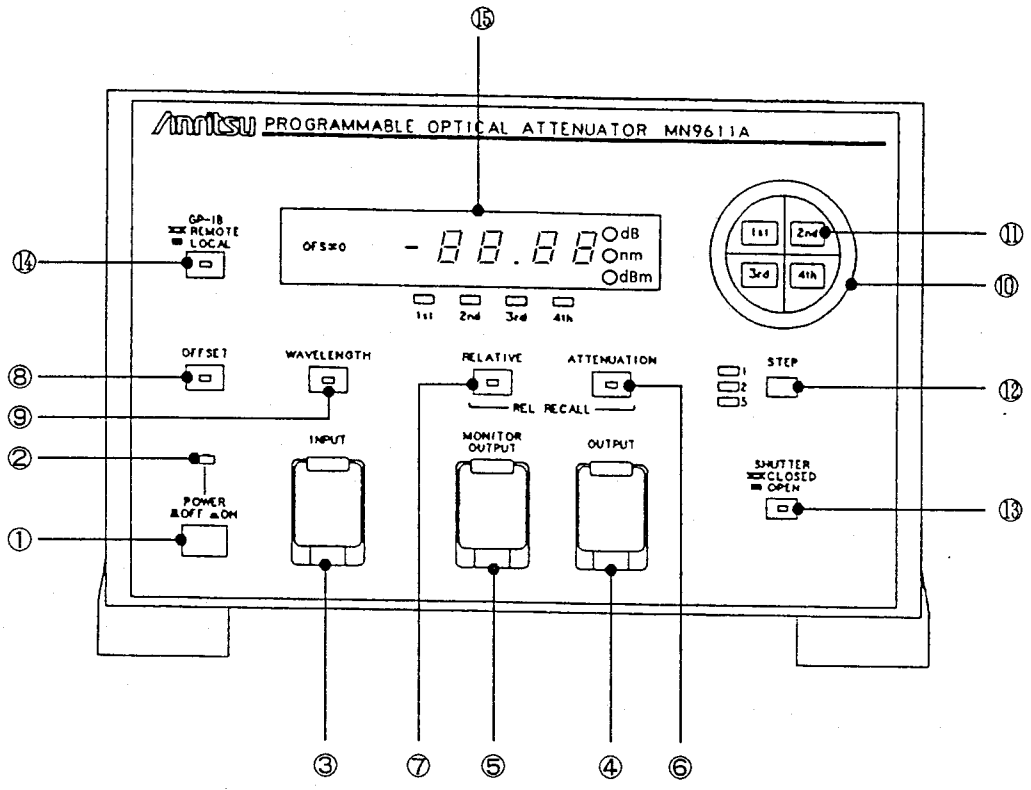


Fig. 4-1 Front Panel Layout

① POWER switch : ON/OFF switch of **Vac

② Lamp : Power indicator lamp of **Vac

③ INPUT : Input connector for light

④ OUTPUT : Output connector for light

⑤ MONITOR OUTPUT : Output connector for monitor light (MN9611A only)

⑥ [ATTENUATION] key : When this key is pressed, the lamp on the key is lit up and the attenuation is displayed on the indicator, enabling to change the amount. Relative value is cancelled.

⑦ [RELATIVE] key : When this key is pressed, the lamp on the key is lit up and [0.00 dB] is displayed on the indicator, which represents the attenuation in a relative value. Then, by turning the rotary encoder, the attenuation in the relative value display is changed.

⑧ [OFFSET] key : When this key is pressed, the lamp on the key is lits up and the offset value is displayed, enabling to change the offset value. When the offset value is other than 0 dB, the indicator displays "OFS≠0". By pressing the [ATTENUATION] key, the [RELATIVE] key, or the [WAVELENGTH] key; the offset value changing status is released.

⑨ [WAVELENGTH] key : When this key is pressed, the lamp on the key is lit up and the wavelength is displayed on the indicator, enabling to change the wavelength. As the key is pressed, the display switches between "1310 nm" and "1550 nm"; and at this time, by turning the rotary encoder, setting by 1 nm step can be made.

⑩ Rotary encoder : By turning the rotary encoder; the attenuation, the offset, and the wavelength values can be varied. Clockwise turning increases the value.

⑪ Digit selector keys : These keys ([1st], [2nd], [3rd], [4th]) are used to select the digit to set the attenuation, the offset, and the wavelength values. When one of the keys is pressed, the corresponding lamp under the indicator is lights up.

⑫ [STEP] key : When changing the attenuation, the offset, or the wavelength value by the rotary encoder; figures can be varied by a multiple of 1, 2, or 5.
Ex.: When the 3rd digit three-digit-figure like 0.00 dB is changed by a multiple of 2, the value changes as follows:
0.00, 0.20, 0.40, 0.60, 0.80, 1.00, 1.20, 1.40, ·····

⑬ [SHUTTER] key : This key is used to open/close the built-in shutter. When the lamp on the key is lit up, the shutter is closed; and when it goes off, the shutter is open.

⑭ [GP-IB] key : This key is used to switch from the remote mode to the local mode, when GP-IB is employed.

⑮ Indicator : The indicator displays the attenuation, the offset, and the wavelength values.

4.2 Rear Panel

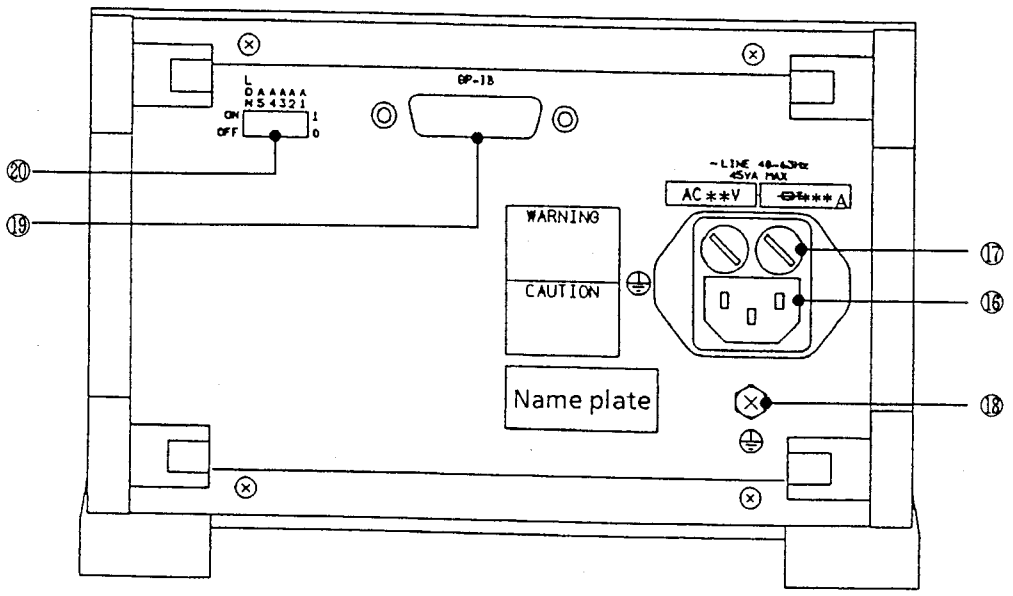


Fig. 4-2 Rear Panel Layout

⑯ Power input connector	:	Connect the equipment to a commercial ac power line of **Vac with the dedicated power cord.
⑰ Fuse holders	:	Fuses of ***A capacity are mounted.
⑱ Frame ground terminal	:	Ground the equipment to avoid accidental electric shock during measurement.
⑲ GP-IB connector	:	This is the connector for the GP-IB interface. To connect with another device, the dedicated GP-IB cable shall be used.
⑳ Address switch	:	When the GP-IB interface is employed, this switch is used to set the equipment GP-IB adddress No. The initial setting value is "1". It can also be set to "listen only" mode.

SECTION 5
OPERATION

5.1 Operation Procedure

1. Connect optical fiber cords to the "INPUT", "OUTPUT" and "MONITOR OUTPUT" connectors. The "MONITOR OUTPUT" is provided only for the MN9611A.
2. Connect the GP-IB interface connector of the equipment to the GP-IB interface connector of a controller.
3. Press the POWER switch to supply power to the equipment. At the startup, the equipment is placed in the GP-IB local mode. Furthermore, the attenuation, the offset, and the wavelength values at the time of the previous power ON are maintained by the backup function, and when the power is turned ON again, one of these values is recovered to be displayed on the indicator.
4. In the local mode, the ATTENUATION setting key, the RELATIVE key, the OFFSET key, the WAVELENGTH setting key, the rotary encoder, the digit selector key, the STEP key and the SHUTTER key are effective.
5. To set the wavelength; use the WAVELENGTH setting key, the rotary encoder and the digit selector key together.
6. To set the attenuation; use the ATTENUATION setting key, the rotary encoder and the digit selector key together.
7. In the remote mode; the attenuation, the relative value, the offset value, the wavelength, the digit, the step value and the opening/closing of the shutter can be automatically set by the controller. Furthermore, in the remote mode, switches (other than the POWER switch and the GP-IB key) on the front panel are made ineffective.

5.2 Cleaning INPUT/OUTPUT Connectors

1. Open the cover of the protective cap (see Fig. 5-1).
2. Lift up the lever (see Fig. 5-2).

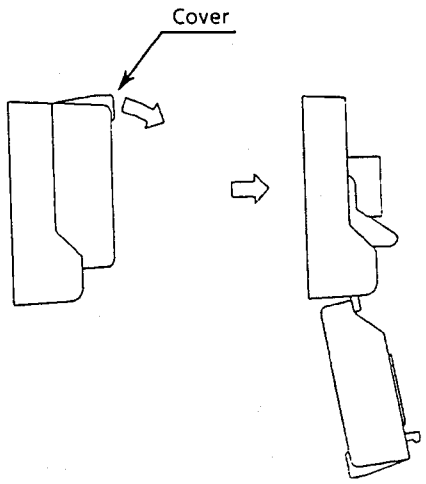


Fig. 5-1

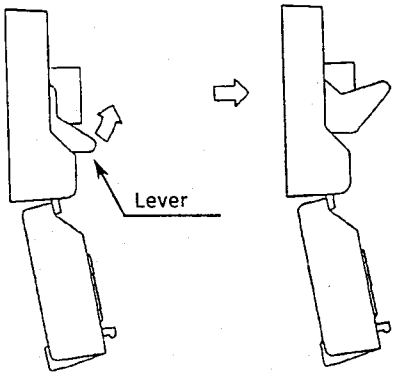


Fig. 5-2

3. Pull the lever to the "A" direction and remove the optical adaptor. Then, the ferrule end of the built-in optical fiber can be seen. Clean it with cleaning paper for optical devices soaked with alcohol (see Fig. 5-3).

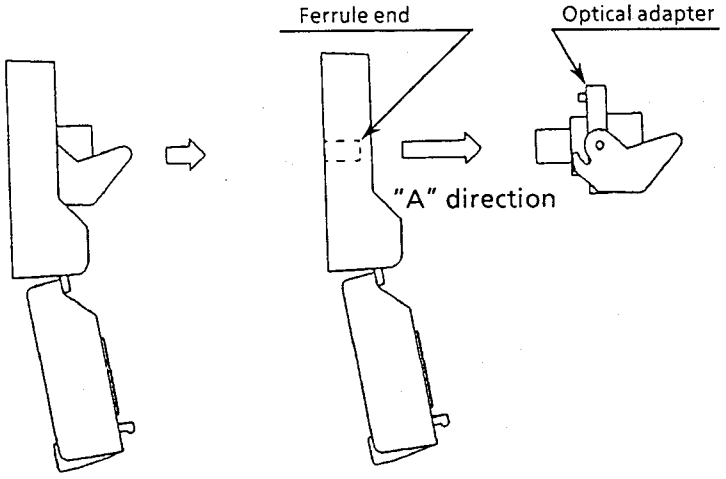


Fig. 5-3

4. Lifting up the lever, insert the optical adapter in the "B" direction until it touches the ferrule of the built-in optical fiber. At this time, pay sufficient attention to align the hole in the equipment and the guide pin of the optical adaptor so as not to damage the ferrule end (see Fig. 5-4).

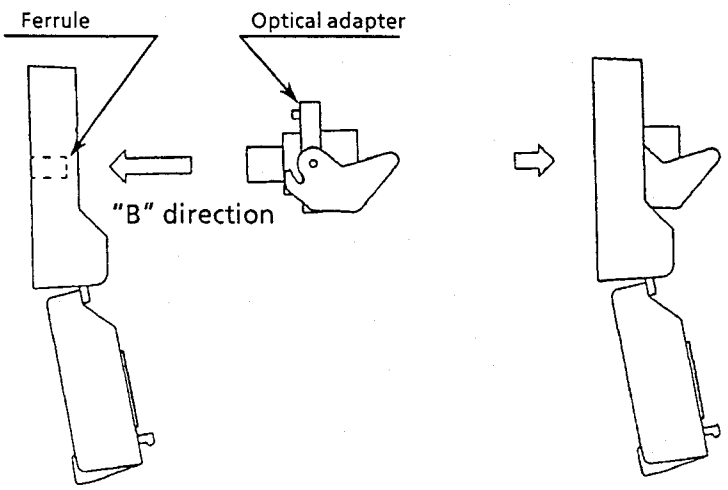


Fig. 5-4

5. Then, hold down the lever until it clicks. Thus, the lever is locked (see Fig. 5-5).

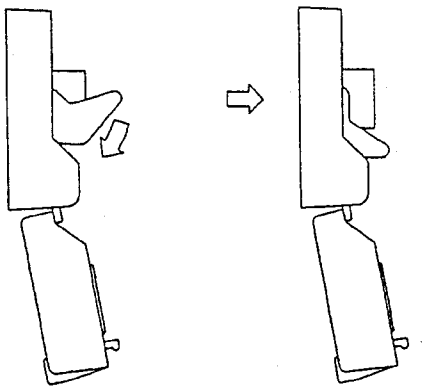


Fig. 5-5

5.3 Precautions for Handling

(1) Precautions when connecting the optical INPUT/OUTPUT connectors and the MONITOR OUTPUT connector.

Before connecting the plugs to the "INPUT", "OUTPUT", and "MONITOR OUTPUT" connectors; clean the ferrule ends of the plugs with cleaning paper for optical devices soaked with alcohol, and make sure that there is no dust remaining. If connected with dust attached; the optical path is obstructed, causing increase of loss and degradation of performance.

(2) Handing of the optical module inside the equipment

Since the optical modules contained in the equipment are preciously assembled, carelessly removing them or opening the covers may result in trouble of the equipment.

For any question, please contact service personnel of Anritsu Corporation.

SECTION 6
GP-IB INTERFACE

6.1 Overview

The MN9610A/MN9611A attenuators are equipped with the GP-IB interface as a standard accessory. The GP-IB (General Purpose Interface Bus) denotes a standard interface bus for measurement conforming to the specifications of IEEE-488 (Institute of Electrical and Electronics Engineers) and IEC-625 (International Electrotechnical Commission).

With the GP-IB, functions necessary for measurement can be controlled outside of the equipment, and therefore, an automatic measuring system can be constructed by connecting the equipment with a personal computer.

6.2 GP-IB Function

GP-IB functions of the MN9610A/MN9611A are mentioned in Table 6-1.

Table 6-1 Interface Functions

Symbol	Description
SH1	All source handshake functions
AH1	All acceptor handshake functions
L3	Basic listener functions Listen-only function Listener cleared by MTA
T8	Basic talker functions Talker cleared by MLA
SR0	No service request function
RL0	All remote/local functions
PP0	No parallel polling function
DC1	All device-clear functions
DT0	No device-trigger function
C0	No controller function
E2	Tri-state

6.3 Precautions before Using the GP-IB

In order to perform the remote control with the GP-IB, it is necessary to connect the equipment with the GP-IB cable and perform the GP-IB address setting. The GP-IB cable connector socket is mounted on the rear panel. For the reason mentioned in paragraph 6.3.1 below, the GP-IB cable must be connected before turning on the power.

6.3.1 Connection/disconnection of the GP-IB cable

Before connecting/disconnecting the GP-IB cable, make sure to turn off the power switch and disconnect the power cord. This is because, though it is a rare case, as a result of disconnection manner, only the signal-common line of the cable may be disconnected before other lines. If the power is supplied in such the case, the AC leak voltage, etc. may be applied up on ICs, and therefore, the circuit components such as IC's in the interface unit may be damaged.

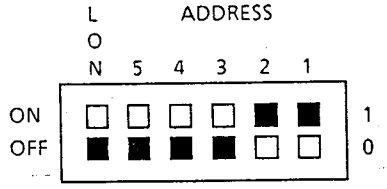
6.3.2 Setting and confirmation of the GP-IB address

GP-IB address of the equipment shall be set before turning on the power switch. GP-IB address of the MN9610A/MN9611A can be freely set by the address switch located at the rear panel.

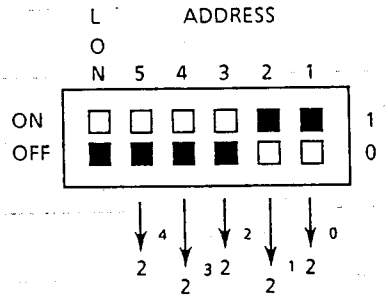
(1) Address confirmation

The GP-IB address can be confirmed as the following procedure.

(Ex.) When the GP-IB address is set as follows:



Confirmation step 1: Address switches are loaded with weights as shown below.



Confirmation step 2: Calculation

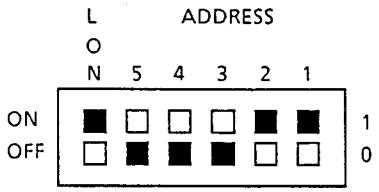
$2^1 + 2^0 = 2 + 1 = 3$

Summed value (of weights of address switches set to "1") is the address of the GP-IB. In this example, the GP-IB address is "3".

(2) Address setting

Since each address switch is loaded with weight as shown above in paragraph (1), calculate the setting value and set the switch. The address can be set in the range from 0 to 30.

(3) For listen-only mode



The setting for listen-only mode is also done before turning on the power switch. Meaning of the above setting example is:

① Listen-only mode

② GP-IB address is "3".

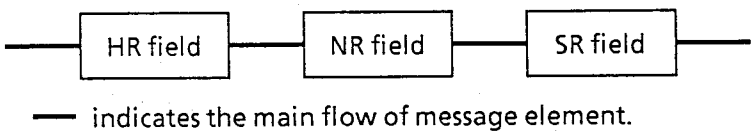
Referring to the above explanation in paragraphs (1) and (2), set and confirm the GP-IB address of your equipment.

6.4 Device Message

6.4.1 Outline of device message

The device message denotes a command for controlling the MN9610A/MN9611A or sending/receiving data. There are two types of device message. One is the control message for controlling the MN9610A/MN9611A, and the other is the data request message to read data from the MN9610A/MN9611A. Fig. 6-1 shows the syntax of the device messages of the MN9610A/MN9611A.

(1) Control message



— indicates the main flow of message element.

(2) Data request message

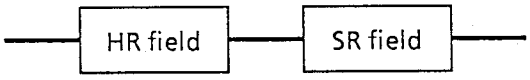


Fig. 6-1 Device Message Syntax

(a) HR field (Header)

The HR field indicates the contents and type of a device message, which comes to the top of the message. For the MN9610A/MN9611A, it is described with 1- to 4-character string or 1- to 4-character string + "?" corresponding to the keys on the front panel.

(b) NR field (Numeric)

The NR field indicates numeric values. For the MN9610A/MN9611A, the following three types are used.

- NR1 type ..... Integer
- NR2 type ..... Real number
- NR3 Type ..... Exponent

(c) SR Field (Separator)

The SR field is a punctuation indicating the end of a value or a message. For the MN9610A/MN9611A, the following two types are used.

- SR2 type ..... Line feed (LF), or carriage return (CR) and line feed (LF)
- SR3 type ..... Final data byte <END>

6.4.2 MN9610A/MN9611A device message list

(1) Emulation mode = 0 (MN9610A mode)

Function	Device (control) message	Query (data request) message	Response message	Remarks
Attenuation	ATT△ <att_arg>	ATT?	<att_val>	Unit: dB
Relative attenuation	RATT△ <ratt_arg>	RATT?	<ratt_val>	Unit: dB Only when relative ON
Wavelength	WVL△ <wave_arg>	WVL?	<wave_val>	Unit: m Exponent type expression
Relative n=0 ATT mode n=1 RATT mode	REL△n	REL?	0/1	
Offset	OFS <offset_arg>	OFS?	<offset_val>	Unit: dB
Relative recall		REF?	<ref_val>	Unit: dB Only when relative ON
Shutter n=0 OPEN n=1 CLOSE	D△n	D?	0/1	
Emulation n=0 MN9610A n=1 MN939C	EMU△n	EMU?	0/1	
Terminator n=0 <LF> n=1 <CR><LF>	TRM△n	TRM?	0/1	
Header n=0 ON n=1 OFF	HEAD△n	HEAD?	0/1	
Error		ERR?	0 to 3	

<att_arg> −99.99 to 159.99
<att_val> −99.99 to 159.99
<ratt_arg> −60.00 to 60.00
<ratt_val> −60.00 to 60.00
<wave_arg> 1.100E−6 to 1.650E−6
<wave_val> 1100E−9 to 1650E−9
<ref_val> −99.99 to 159.99
<offset_arg> −99.99 to 99.99
<offset_val> −99.99 to 99.99

(2) Emulation mode = 1 (MN939C mode)

Function	Device (control) message	Query (data request) message	Response message	Remarks
Attenuation	A a b c d a b c d : integer (Ex.) 0.1 dB → A0010	None	None	
Wavelength n=0 1.3 μm n=1 1.55 μm	Wn (Ex.) 1.3 μm → W0	None	None	
Emulation n=0 MN9610A n=1 MN939C	EMU△n	EMU?	0/1	

6.5 Detailed Description of Device Message

The following sample programs are for PC-9801 (NEC, Japan) personal computers.

6.5.1 ATTENUATION

(1) Control message

Set ATT△ <att_arg>. △: Space
<att_arg> Numeric type: NR1, NR2 type
Range: −99.99 to 159.99

(a) Sample program

```
10  PRINT  @2;"ATT△10.00"
```

10.00 dB
Indicates attenuation

When this program is executed, the indicator displays "10.00 dB".

This program has the same function as pressing the [ATTENUATION] key on the panel and turning the rotary encoder.

(2) Data request message

ATT? Inquires the attenuation.

(a) Sample program

```
        ≀
200  PRINT @2;"ATT?"
```

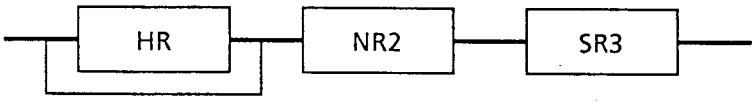
When this program is executed, the equipment prepares for the attenuation data output.

```
210  INPUT @2;A
```

When this program is executed, the attenuation data are output and substituted for the variable "A".

```
        ≀
```

The data format is as follows.



The header field may be omitted by "HEAD" command.

(For "HEAD" command, see para. 6.5.10.)

(b) Sample data for a attenuation value

(ATT△) 10.00 <CR> <LF> <^END>

6.5.2 RELATIVE ATTENUATION

(1) Control message

Set RATT△<ratt_arg>. △: Space
<ratt_arg> Numeric type: NR1, NR2 type
Range: −60.00 to 60.00

Notes:

1. When "ATT=10.00 dB", the range of RATT becomes −10.00 dB to 50.00 dB.
2. When "ATT=10.00 dB" and "OFS=−10.00 dB", the range of RATT becomes −20.00 dB to 40.00 dB.

(a) Sample program

```
10  PRINT  @2;"REL△1"
```

When this program is executed, the indicator displays "0.00 dB".

```
20  PRINT  @2;"RATT△10.00"
                        └── 10.00 dB
                └────────── Indicates the relative attenuation
```

When this program is executed, the indicator displays "10.00 dB".

This program has the same function as turning the rotary encoder with the [RELATIVE] key on the panel pressed.

(2) Data request message

RATT? Inquires the relative attenuation.

(a) Sample program

```
                {
200  PRINT  @2;"RATT?"
```

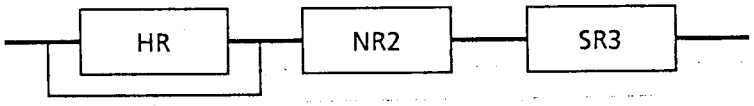
When this program is executed, the equipment prepares for the relative attenuation data output.

```
210  INPUT @2;A
```

When this program is executed, the relative attenuation data are output and substituted for the variable "A".

```
                }
```

The data format is as follows.



The header field may be omitted by "HEAD" command.

(For "HEAD" command, see para. 6.5.10.)

(b) Same data for a relative attenuation value

(RATT△) 10.00 <CR> <LF> <^END>

Note: Unless the equipment is put in the relative attenuation mode, even if this inquiry is done, "OFF" is displayed.

6.5.3 WAVELENGTH

(1) Control message

Set WVL△ <wave_arg>. △: Space
<wave_arg> Numeric type: NR3 type
Range: 1.100E-6 to 1.650E-6
As the exponential, −6 to −9 can be specified.
When −9 is specified, the range becomes 1100E-9 to 1650E-9.

(a) Sample program

```
10  PRINT  @2;"WVL△1.310E−6"
```

1.310 μm
Indicates wavelength

When this program is executed, the indicator displays "1310 nm".

This program has the same function as pressing the [WAVELENGTH] key on the panel and turning the rotary encoder.

Since the unit of the wavelength uses "m" as the reference value, "μm" is expressed as "E-6".

(2) Data request message

WVL? Inquires the wavelength.

(a) Sample program

```
        ≀
200  PRINT  @2;"WVL?"
```

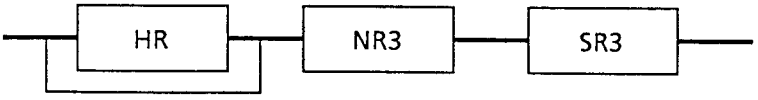
When this program is executed, the equipment prepares for the wavelength data output.

```
210  INPUT  @2;A
```

When this program is executed, the wavelength data are output and substituted for the variable "A".

```
        ≀
```

The data format is as follows.



The header field may be omitted by "HEAD" command.

(For "HEAD" command, see para. 6.5.10.)

(b) Sample data for a wavelength value

The wavelength data corresponds to the indicated value of the MN9610A/MN9611A. So, the unit of data is fixed at "E-9" for "nm".

(WVL△) 1310E−9 <CR> <LF> <^END>

6.5.4 RELATIVE (Mode switching between ATTENUATION and RELATIVE ATTENUATION)

(1) Control message

Set REL△n. △: Space
n : (0 or 1)

(a) Sample program 1

```
10  PRINT  @2;"REL△0"
```

ATTENUATION mode
ATTENUATION ←→ RELATIVE ATTENUATION

When this program is executed, the indicator displays the selected attenuation data.

This program has the same function as pressing the [ATTENUATION] key on the panel.

(b) Sample program 2

```
10  PRINT  @2;"REL△1"
```

RELATIVE ATTENUATION mode
ATTENUATION ←→ RELATIVE ATTENUATION

When this program is executed, the equipment is put into the relative attenuation mode and the indicator display "0.00 dB".

This program has the same function as pressing the [RELATIVE] key on the panel.

(2) Data request message

REL? Inquires the mode switching between ATTENUATION and RELATIVE ATTENUATION.

(a) Sample program

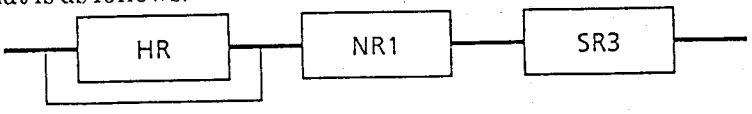
```
200  PRINT  @2;"REL?"
```

When this program is executed, the equipment prepares for the mode switching data output.

```
210  INPUT  @2;A
```

When this program is executed, the mode switching data are output and substituted for the variable "A".

The data format is as follows.



The header field may be omitted by "HEAD" command.

(For "HEAD" command, see para. 6.5.10.)

(b) Sample data for mode switching

(REL△)1<CR> <LF> < ^END>

6.5.5 OFFSET

(1) Control message

Set OFS△ <offset_arg>. △: Space
<offset_arg> Numeric type: NR1, NR2 type
Range: −99.99 to 99.99

(a) Sample program

```
10  PRINT  @2;"OFS△10.00"
                    └── 10.00 dB
                └── Indicates offset
```

When this program is executed, the indicator displays "10.00 dB".

This program has the same function as pressing the [OFFSET] key on the panel and turning the rotary encoder.

(2) Data request message

OFS? Inquires the offset.

(a) Sample program

```
                ⌇
200 PRINT @2;"OFS?"
```

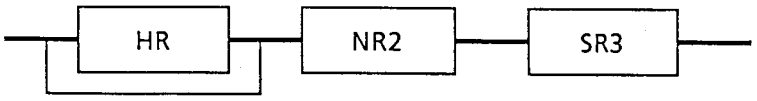
When this program is executed, the equipment prepares for the offset data output.

```
210 INPUT @2;A
```

When this program is executed, the offset data are output and substituted for the variable "A".

```
                ⌇
```

The data format is as follows.



The header field may be omitted by "HEAD" command.

(For "HEAD" command, see para. 6.5.10.)

(b) Sample data for a offset value

(OFS△) 10.00 <CR> <LF> <^END>

6.5.6 RELATIVE RECALL (Recalling the reference attenuation)

Data request message

REF? Inquires the attenuation in the relative attenuation mode.

(a) Sample program

```
        ≀
210 INPUT @2;"REL 1"
```

Executing this program enters into the relative attenuation mode. However, if the mode is the relative attenuation mode, this command is not required.

```
210 PRINT @2;"REF?"
```

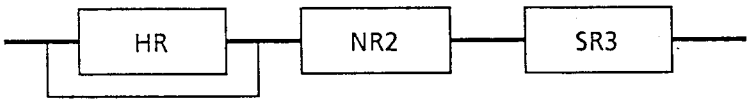
When this program is executed, the equipment prepares for the attenuation recall data output.

```
220 INPUT @2;A
```

When this program is executed, the attenuation recall data are output and substituted for the variable "A".

```
        ≀
```

The data format is as follows.



The header field may be omitted by "HEAD" command.

(For "HEAD" command, see para. 6.5.10.)

(b) Same data for a attenuation recall value

(REF△) 10.00 <CR> <LF> <^END>

If the REL command is OFF, "OFF" is output.

6.5.7 SHUTTER

(1) Control message

Set D△n. △: Space
n= (0 or 1)

(a) Sample program 1

```
10  PRINT  @2;"D△0"
```

Shutter open
Indicates the shutter

When this program is executed, the display does not change but the SHUTTER LED goes off.

This program has the same function as pressing the [SHUTTER] key on the panel.

(a) Sample program 2

```
10  PRINT  @2;"D△1"
```

Shutter closed
Indicates the shutter

When this program is executed, the display does not change but the SHUTTER LED is lit up.

This program has the same function as pressing the [SHUTTER] key on the panel.

(2) Data request message

D? Inquires the shutter status.

(a) Sample program

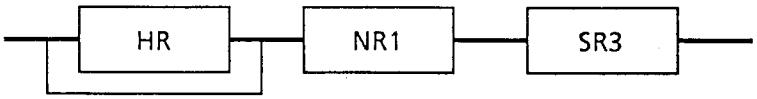
```
        ≀
200  PRINT  @2;"D?"
```

When this program is executed, the equipment prepares for the shutter data output.

```
210  INPUT  @2;A
```

When this program is executed, the shutter data are output and substituted for the variable "A".

The data format is as follows.



The header field may be omitted by "HEAD" command.

(For "HEAD" command, see para. 6.5.10.)

(b) Sample of shutter data

(D△) 1 <CR> <LF> <^END>

6.5.8 EMULATION

(1) Control message

Set EMU△n. △: Space
n : (0 or 1)

(a) Sample program 1

```
10  PRINT  @2;"EMU△0"
```

MN9610A mode
Indicates the emulation mode

When this program is executed, the display does not change but the internal setting changes.

(b) Sample program 2

```
10  PRINT  @2;"EMU△1"
```

MN939C mode
Indicates the emulation mode

When this program is executed, the display does not change but the internal setting changes.

(2) Data request message

EMU? Inquires the emulation status.

(a) Sample program

```
        ≀
200  PRINT  @2;"EMU?"
```

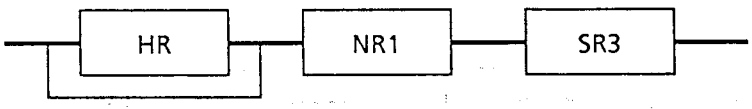
When this program is executed, the equipment prepares for the emulation status data output.

```
210  INPUT  @2;A
```

When this program is executed, the emulation status data are output and substituted for the variable "A".

```
        ≀
```

The data format is as follows.



The header field may be omitted by "HEAD" command.

(For "HEAD" command, see para. 6.5.10.)

(b) Sample of emulation data

(EMU△)1 <CR> <LF> <^END>

6.5.9 TERMINATOR

(1) Control message

Set TRM△n. △: Space
n : (0 or 1)

(a) Sample program 1

```
10  PRINT  @2; "TRM△0"
                       └──── <LF>
                  └──────── Indicates the terminator status
```

When this program is executed, the display does not change but the internal setting changes.

(b) Sample program 2

```
10  PRINT  @2; "TRM△1"
                       └──── <CR> <LF>
                  └──────── Indicates the terminator status
```

When this program is executed, the display does not change but the internal setting changes.

(2) Data request message

TRM? Inquires the terminator status.

(a) Sample program

```
                ⋮
200  PRINT  @2;"TRM?"
```

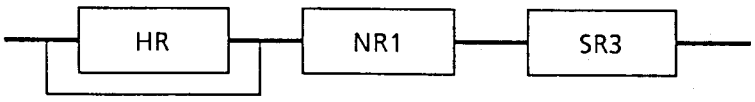
When this program is executed, the equipment prepares for the terminator status data output.

```
210  INPUT  @2;A
```

When this program is executed, the terminator status data are output and substituted for the variable "A".

```
                ⋮
```

The data format is as follows.



The header field may be omitted by "HEAD" command.

(For "HEAD" command, see para. 6.5.10.)

(b) Sample of terminator status data

(TRM△) 1 <CR> <LF> <^END>

6.5.10 HEADER

(1) Control message

Set HEAD△n. △: Space
n : (0 or 1)

(a) Sample program 1

```
10  PRINT  @2; "HEAD△0"
```

Header added when output
Indicates the header status

When this program is executed, the display does not change but the internal setting changes.

(b) Sample program 2

```
10  PRINT  @2; "HEAD△2"
```

Header not added when output
Indicates the header status

When this program is executed, the display does not change but the internal setting changes.

(2) Data request message

HEAD? Inquires the header status.

(a) Sample program

```
        ≀
200  PRINT  @2;"HEAD?"
```

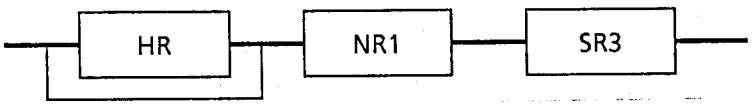
When this program is executed, the equipment prepares for the header status data output.

```
210  INPUT  @2;A
```

When this program is executed, the header status data are output and substituted for the variable "A".

```
        ≀
```

The data format is as follows.



The header is omitted when the header command specifies "1".

(b) Sample of header status data

(HEAD△)1 <CR> <LF> <^END>

6.5.11 ERROR

Data request message

ERR? Inquires the error status.

Data is as follows:

0: No error

1: Command error ..... This error occurs when command or the data format is different from the one described in the Operation Manual.

2: Execution error ..... This error occurs when the range to be specified is different from the specification.

3: Both command error and execution error

(a) Sample program

```
        ≀

200  PRINT  @2;"ERR?"
```

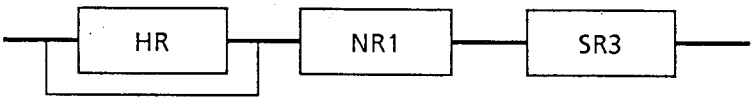
When this program is executed, the equipment prepares for the error data output.

```
210  INPUT  @2;A
```

When this program is executed, the error data are output and substituted for the variable "A".

```
        ≀
```

The data format is as follows.



The header field may be omitted by "HEAD" command.

(For "HEAD" command, see para. 6.5.10.)

(b) Sample of error status data

(ERR△) 1 <CR> <LF> <^END>

6.5.12 ATTENUATION when the EMULATION mode is ON

(1) Control message

Set A a b c d.

a b c d: 4-digit integer from 0000 to 6000, or – – – –

When the attenuation is 0.10 dB, it becomes "A0010".

(a) Sample program 1

```
10   PRINT   @2;"A 1000"
                 |   |
                 |   └──────── 10.00 dB
                 └──────────── Indicates attenuation
```

When this program is executed, the indicator displays "10.00 dB".

This program has the same function as pressing the [ATTENUATION] key on the panel and turning the rotary encoder.

(b) Sample program 2

```
10   PRINT   @2;A----"
                |  |
                |  └────────── Indicates the shutter is closed
                └───────────── Indicates the attenuation
```

When this program is executed, the display does not change but the SHUTTER LED is lit up.

This program has the same function as pressing the [SHUTTER] key on the panel.

Note: To open the shutter, set the attenuation again, and the shutter is open.

(2) Data request message

(a) Sample program

```
        ⋮
200   INPUT   @2;A
```

When this program is executed, the data are substituted for the variable "A".

⋮

The data format is as follows:

── HR ── NR2 ── SR3 ──

(b) Sample data when the emulation is ON.

```
W1 10.00
|   |
|   └──────── Indicates "10.00 dB"
└──────────── Indicates the wavelength status (see para. 6.5.13)
```

6.5.13 WAVELENGTH when the EMULATION mode is ON

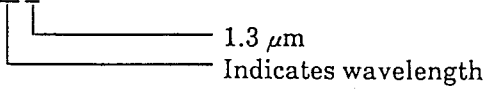
(1) Control message

Set Wn.

n: (0 or 1)

(a) Sample program 1

```
10  PRINT  @2;"W0"
```

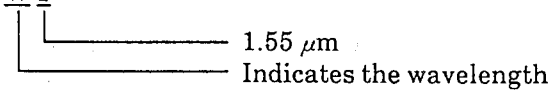


When this program is executed, the indicator displays "1300 nm".

This program has the same function as pressing the [WAVELENGTH] key on the panel and turning the rotary encoder.

(b) Sample program 2

```
10  PRINT  @2;"W1"
```



When this program is executed, the indicator displays "1550 nm".

This program has the same function as pressing the [WAVELENGTH] key on the panel and turning the rotary encoder.

(2) Data request message

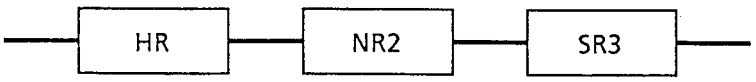
(a) Sample program

```
      ≀
200  INPUT  @2;A
```

When this program is executed, the data are substituted for the variable "A".

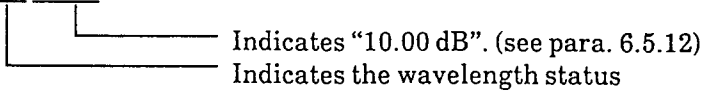
≀

The data format is as follows:



(b) Sample data when the emulation is ON.

```
W1 10.00
```



Note: When the emulation mode is OFF and the wavelength is set to values other than 1.55 μm; if the emulation is turned ON, the wavelength becomes 'W0".

6.6 Listen-Only Function

The MN9610A/MN9611A attenuators have the "listen only" function, and by keeping the monitor level of the ML9001A Optical Power Meter constant, the outgoing light level from the MN9610A/MN9611A is kept constant.

(1) Usage

1. Turn off the power of the MN9610A/MN9611A and the ML9001A.
2. Connect the MN9610A/MN9611A to the ML9001A with a GP-IB cable.
3. Set the address switch [LON] of the MN9610A/MN9611A to "1", and [TON] of the ML9001A to "1". And turn on the power of each equipment.

   Note: For the setting of the address, refer to para. 6.3.2.
4. Connect the [MONITOR OUTPUT] of the MN9611A to the MA9612A Optical Sensor with an optical fiber cord.
5. Optical power monitored by the ML9001A can be set with the rotary encoder, the STEP key and the digit selector key. At this time, the OFFSET key, the WAVELENGTH setting key, the RELATIVE key and the ATTENUATION setting key are not effective.

(2) Precautions for use

1. If the set level is out of the specified range, the indicator blinks.
2. When the SHUTTER key is pressed; the level is cut off, and the indicator blinks.

(3) Measuring system

The measuring systems are shown in Figs. 6-2 and 6-3.

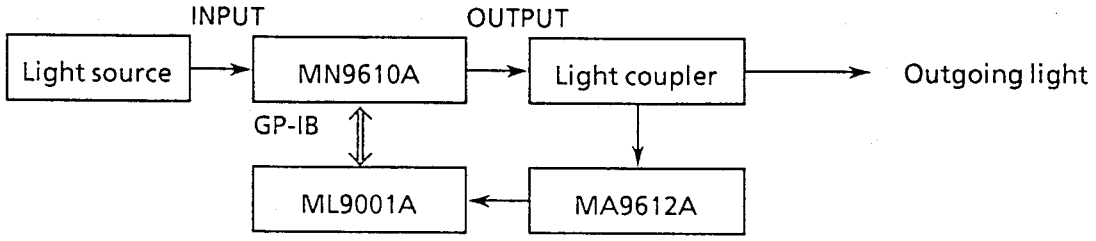


Fig. 6-2 Measuring System with MN9610A in Listen-Only Mode

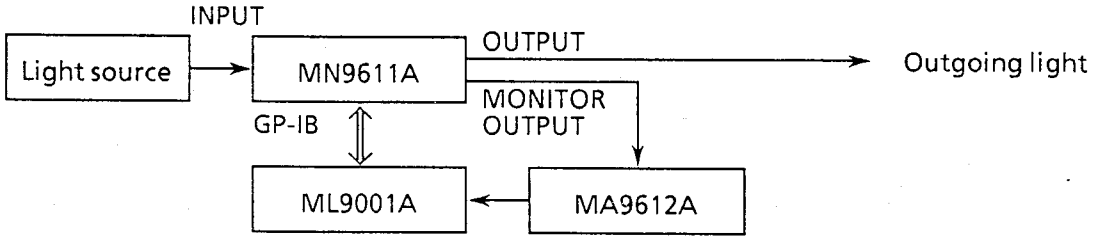


Fig. 6-3 Measuring System with MN9611A in Listen-Only Mode

6.7 Sample List of GP-IB Program

This sample program is for PC-9801 (NEC, Japan) as the controller.

```
10 '*****************************************************************
20 '*                                                               *
30 '*      MN9610A/MN9611A      GP-IB SAMPLE PROGRAM                *
40 '*                                                               *
50 '*****************************************************************
60 '
70      ISET IFC              'Interface Clear
80      ISET REN              'Remote Enable
90      CMD DELIM=2           'Delimiter <LF>
100     CMD TIMEOUT=5         'Timer Out Set
110 '
120 DEV1=1                    'MN9610A GP-IB address setting
130 '                         For the MN9610A, "0" cannot be used (Because the address for
                              the controller PC-9801 is "0".)
140 '
150 CLS 3:WIDTH 80,25:CONSOLE 0,25,0,1
160 '
170 CLS 3:COLOR 5
180 LOCATE 32,2:PRINT "******************"      'Select a command used from
190 LOCATE 32,3:PRINT "*    M E N U    *"      'the menu.
200 LOCATE 32,4:PRINT "******************"
210 COLOR 4
220 LOCATE 16,6:PRINT "1    ATT                  7    D"
230 LOCATE 16,8:PRINT "2    RATT                 8    EMU"
240 LOCATE 16,10:PRINT "3    WVL                 9    TRM"
250 LOCATE 16,12:PRINT "4    REL                 10   HEAD"
260 LOCATE 16,14:PRINT "5    REF?                11   ERR?"
270 LOCATE 16,16:PRINT "6    OFS"
280 '
290 COLOR 4:LOCATE 30,20:INPUT "Select a number",N
300     IF N<1 OR N>11 THEN GOTO 170
310 '
320 CLS 3:COLOR 5
330 ON N GOSUB 400,1000,1110,1210,1310,1410,1510,1610,1720,1820,1920
340 '                                                    Branches to each process
350 FOR T=1 TO 15000:NEXT T                  'Wait
360 GOTO 170
```

```
370 END
380 '= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
390 '
400 '   ATT command                          'Attenuation setting
410 '
420       PRINT @DEV1;"ATT 0.00"             '0 dB setting
430        FOR T=1 TO 1000:NEXT T            'Wait
440       PRINT @DEV1;"ATT?"                 'Inquiry of setting status
450 '     ----------
460       INPUT @DEV1;A$:PRINT A$            'Enter a response message
470 '
480       FOR T=1 TO 10000:NEXT T            'Wait
490 '
500       PRINT @DEV1;"ATT 10.00"            'Set 10 dB
510        FOR T=1 TO 1000:NEXT T            'Wait
520       PRINT @DEV1;"ATT?"                 'Inquiry of setting status
530 '     ----------
540       INPUT @DEV1;A$:PRINT A$            'Enter a response message
550 '
560       FOR T=1 TO 10000:NEXT T            'Wait
570 '
580       PRINT @DEV1;"ATT 20.00"            'Set 20 dB
590        FOR T=1 TO 1000:NEXT T            'Wait
600       PRINT @DEV1;"ATT?"                 'Inquiry of setting status
610 '     ----------
620       INPUT @DEV1;A$:PRINT A$            'Enter a response msssage
630 '
640       FOR T=1 TO 10000:NEXT T            'Wait
650 '
660       PRINT @DEV1;"ATT 30.00"            'Set 30 dB
670        FOR T=1 TO 1000:NEXT T            'Wait
680       PRINT @DEV1;"ATT?"                 'Inquiry of setting status
690 '     ----------
700       INPUT @DEV1;A$:PRINT A$            'Enter a response message
710 '
720       FOR T=1 TO 10000:NEXT T            'Wait
730 '
740       PRINT @DEV1;"ATT 40.00"            'Set 40 dB
750        FOR T=1 TO 1000:NEXT T            'Wait
```

```
760       PRINT @DEV1;"ATT?"              'Inquiry of setting status
770 '     ----------
780       INPUT @DEV1;A$:PRINT A$         'Enter a response message
790 '
800       FOR T=1 TO 10000:NEXT T         'Wait
810 '
820       PRINT @DEV1;"ATT 50.00"         'Set 50 dB
830        FOR T=1 TO 1000:NEXT T         'Wait
840       PRINT @DEV1;"ATT?"              'Inquiry of setting status
850 '     ----------
860       INPUT @DEV1;A$:PRINT A$         'Enter a response message
870 '
880       FOR T=1 TO 10000:NEXT T         'Wait
890 '
900       PRINT @DEV1;"ATT 60.00"         'Set 60 dB
910        FOR T=1 TO 1000:NEXT T         'Wait
920       PRINT @DEV1;"ATT?"              'Inquiry of setting status
930 '     ----------
940       INPUT @DEV1;A$:PRINT A$         'Enter a response message
950 '
960     RETURN
970 '
980 '-------------------------------------------------------------
990 '
1000 '    RATT command
1010        PRINT @DEV1;"REL 1"           'RELATIVE ON
1020        PRINT @DEV1;"RATT 23.45"      'Set 23.45 dB as relative attenuation
1030         FOR T=1 TO 1000:NEXT T       'Wait
1040        PRINT @DEV1;"RATT?"           'Inquiry of setting status
1050 '      ----------
1060        INPUT @DEV1;A$:PRINT A$       'Enter a response message
1070      RETURN
1080 '
1090 '-------------------------------------------------------------
1100 '
1110 '    WVLcommand
1120        PRINT @DEV1;"WVL 1550E-9"     'Set 1550 nm as wavelength
1130         FOR T=1 TO 1000:NEXT T       'Wait
1140        PRINT @DEV1;"WVL?"            'Inquiry of setting status
1150 '      ----------
```

```
1160        INPUT @DEV1;A$:PRINT A$          'Enter a response message
1170      RETURN
1180  '
1190  '-------------------------------------------------------------
1200  '
1210  '   REL command
1220        PRINT @DEV1;"REL 1"              'RELATIVE ON
1230         FOR T=1 TO 1000:NEXT T          'Wait
1240        PRINT @DEV1;"REL?"               'Inquiry of setting status
1250  '     ----------
1260        INPUT @DEV1;A$:PRINT A$          'Enter a response message
1270      RETURN
1280  '
1290  '-------------------------------------------------------------
1300  '
1310  '   REF? command
1320        PRINT @DEV1;"REL 1"              'RELATIVE ON
1330         FOR T=1 TO 1000:NEXT T          'Wait
1340        PRINT @DEV1;"REF?"               'Inquire the reference value
1350  '     ----------

1360        INPUT @DEV1;A$:PRINT A$          'Enter a response message
1370      RETURN
1380  '
1390  '-------------------------------------------------------------
1400  '
1410  '   OFS command
1420        PRINT @DEV1;"OFS 11.11"          'Set 11.11 dB as a compensation value
1430         FOR T=1 TO 1000:NEXT T          'Wait
1440        PRINT @DEV1;"OFS?"               'Inquiry of setting status
1450  '     ----------
1460        INPUT @DEV1;A$:PRINT A$          'Enter a response message
1470      RETURN
1480  '
1490  '-------------------------------------------------------------
1500  '
1510  '   D command
1520        PRINT @DEV1;"D 1"                'Shutter closed
1530         FOR T=1 TO 1000:NEXT T          'Wait
1540        PRINT @DEV1;"D?"                 'Inquiry of setting status
```

```
1550 '      ----------
1560        INPUT @DEV1;A$:PRINT A$          'Enter a response message
1570      RETURN
1580 '
1590 '-------------------------------------------------------------
1600 '
1610 '    EMU command
1620        PRINT @DEV1;"EMU 1"              'Set the MN939C mode
1630         FOR T=1 TO 1000:NEXT T          'Wait
1640        PRINT @DEV1;"EMU?"               'Inquiry of setting status
1650 '      ----------
1660        INPUT @DEV1;A$:PRINT A$          'Enter a response message
1670        PRINT @DEV1;"EMU 0"              'Set the MN9610A mode
1680      RETURN
1690 '
1700 '-------------------------------------------------------------
1710 '
1720 '     TRM command
1730        PRINT @DEV1;"TRM 1"              'Set terminator  <CR>+<LF>
1740         FOR T=1 TO 1000:NEXT T          'Wait
1750        PRINT @DEV1;"TRM?"               'Inquiry of setting status
1760 '      ----------
1770        INPUT @DEV1;A$:PRINT A$          'Enter a response message
1780      RETURN
1790 '
1800 '-------------------------------------------------------------
1810 '
1820 '    HEAD command
1830        PRINT @DEV1;"HEAD 1"             'Set no-header state
1840         FOR T=1 TO 1000:NEXT T          'Wait
1850        PRINT @DEV1;"HEAD?"              'Inquiry of setting status
1860 '      ----------
1870        INPUT @DEV1;A$:PRINT A$          'Enter a response message
1880      RETURN
1890 '
1900 '-------------------------------------------------------------
1910 '
1920 '    ERR? コマンド
1930        PRINT @DEV1;"BTT 45.67"          'Generate a command error
1940         FOR T=1 TO 1000:NEXT T          'Wait
```

```
1950        PRINT @DEV1;"ERR?"              'Inquiry of error status
1960 '      ----------
1970        INPUT @DEV1;A$:PRINT A$         'Enter a response message
1980      RETURN
1990 'END
```

SECTION 7
PERFORMANCE TEST

7.1 Insertion Loss

1. Figure 7-1 shows the block diagram of the test system that measures the insertion loss. Optical fiber cords (used for input and output) shall be the master cords or other optical fiber cords equivalent to the master cord.
2. First of all, connect the A-end (of the optical fiber cord ① from the light source) to the MA9612A, measure the optical power, put the ML9001A in the MEASURE mode, and press the ML9001A [RELATIVE] key to display "0 dB".
3. Then, pressing the [ATTENUATION] setting key of the MN9610A/MN9611A, turn the rotary encoder to set the attenuation to "0"; and then, pressing the [OFFSET] key, turn the rotary encoder to set the offset value to "0". After that, connect the A-end of the optical fiber cord ① to the INPUT connector of the MN9610A/MN9611A, and connect one end of the optical fiber ② to the OUTPUT connector of the MN9610A/MN9611A and other end to the MA9621A.

   The value displayed on the indicator of the ML9001A is the insertion loss.

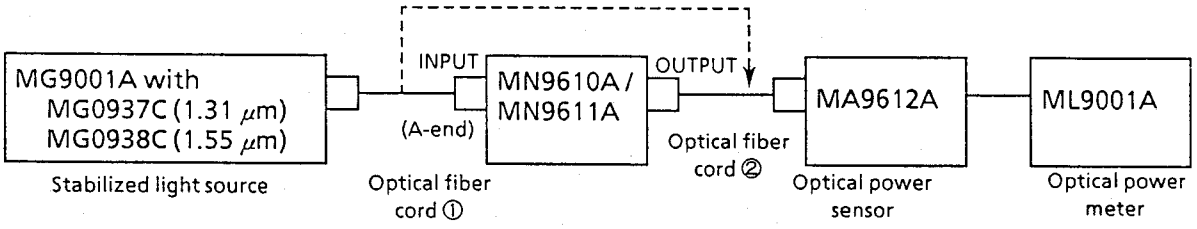


Fig. 7-1 Test System (1)

7.2 Attenuator Accuracy

1. Setup the MN9610A/MN9611A and other measuring devices as shown in Fig. 7-1.
2. After setting the attenuation to "0" by pressing the [ATTENUATION] setting key of the MN9610A/MN9611A and turning the rotary encoder, and setting the offset value to "0" by pressing the [OFFSET] key and turning the rotary encoder; press the [RELATIVE] key of the ML9001A to display "0 dB" on the indicator.
3. Then, pressing the [ATTENUATION] setting key of the MN9610A/MN9611A, turn the rotary encoder to set the attenuation to arbitrary value. The difference (between this setting value and the displayed value on the ML9001A) is the attenuator accuracy of the equipment.

7.3 Crosstalk between INPUT and OUTPUT Connectors

1. Setup the MN9610A/MN9611A and other measuring devices as shown in Fig. 7-1. After setting the attenuation to "0" by pressing the [ATTENUATION] setting key of the MN9610A/MN9611A and turning the rotary encoder, press the [RELATIVE] key of the ML9001A to display "0 dB" on the indicator.
2. Then, press the [SHUTTER] key of the MN9610A/MN9611A to close the shutter. The value displayed on the indicator of the ML9001A is the crosstalk between the INPUT and the OUTPUT connectors.

7.4 Switching Repeatability

1. Setup the MN9610A/MN9611A and other measuring devices as shown in Fig. 7-1. After setting the attenuation to an arbitrary value by pressing the [ATTENUATION] setting key of the MN9610A/MN9611A and turning the rotary encoder, press the [RELATIVE] key of the ML9001A to display "0 dB" on the indicator.
2. Then, change the attenuation to any value other than the one set in the above step 1, and then change the attenuation again to the originally set value in step 1. The value displayed on the indicator of the ML9001A represents the switching repeatability.

7.5 Return Loss

1. Figure 7-2 shows the block diagram of the test system that measures the return loss. Connect a total internal reflection cord to the MN9604B Optical Directional Coupler, and press the [RELATIVE] key of the ML9001A to display "0 dB".
2. Then, connect the INPUT connector of the MN9610A/MN9611A to the MN9604B with an FC Super PC type optical fiber cord. To the OUTPUT connector, connect another FC Super PC type optical fiber cord; and to the free end of the cord, apply the refractive-index matching grease to eliminate the reflection from this end. At this time, the displayed value on the indicator of the ML9001A is the return loss.

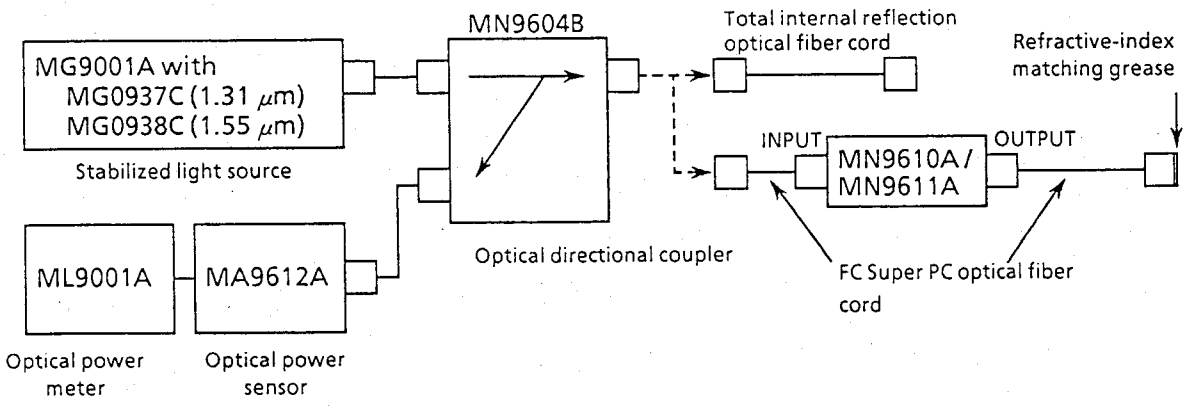


Fig. 7-2 Test System (2)

7.6 Linearity

The linearity denotes the deviation of the measurement values (at each set attenuation point) from the straight line (which is drawn between two measurement values at the set attenuation of 0 dB and 60 dB).

1. Setup the MN9610A/MN9611A and other measuring devices as shown in Fig. 7-1. Set the attenuation to "0" by pressing the [ATTENUATION] setting key of the MN9610A/MN9611A and turning the rotary encoder, and press the [RELATIVE] key of the ML9001A to display "0 dB" on the indicator.
2. Turn the rotary encoder to set the attenuation to 60 dB. The displayed value on the MN9001A at this time shall be noted as "A" (dB).
3. Then, turn the rotary encoder to change the attenuation to an arbitrary value "B" (dB). The displayed value on the ML9001A at this time shall be noted as "C" (dB). The linearity can be obtained by substituting the values for A, B and C of the following equation (1).

   Linearity (dB) = (C−[A×B/60]) ..... (1)

7.7 Overshoot

Overshoot denotes the peak deflection from the initial value when the attenuation tentatively deflects from the initial value. Or when the attenuation tentatively deflects from the final value, the peak deflection is also referred to the overshoot.

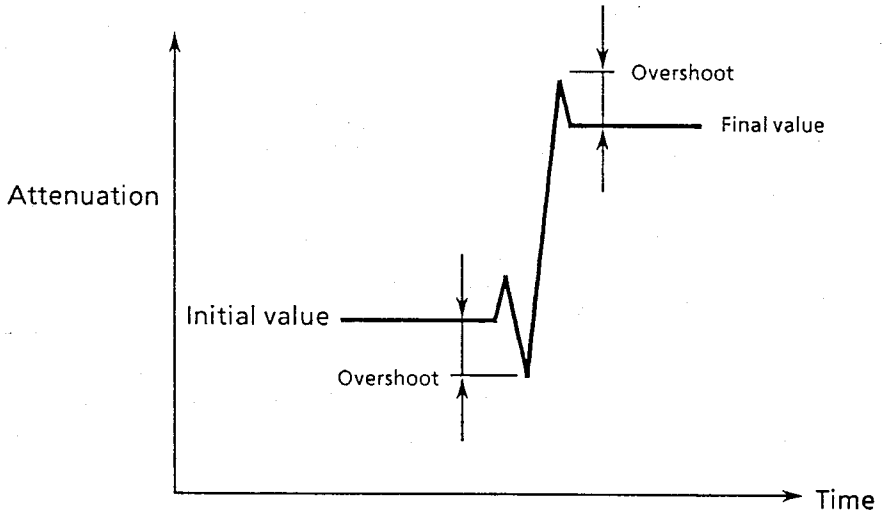


Fig. 7-3

1. Figure 7-4 shows the block diagram of the test system that measures the overshoot. Press the [ATTENUATION] setting key of the MN9610A/MN9611A and turn the rotary encoder to set the attenuation to the initial value.
2. Then, turn the rotary encoder to set the attenuation to the final value. Memorize the waveform displayed on the oscilloscope at this time.
3. Then, read the maximum deflection each from the initial value and the final value, shown on the waveform. Larger value is the overshoot.

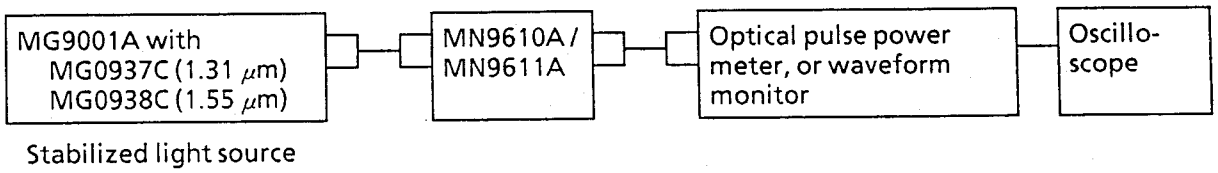


Fig. 7-4 Test System (3)

7.8 Output for Monitoring Optical Signal (MN9611A only)

7.8.1 Difference in loss

1. Figure 7-5 shows the block diagram of the test system that measures the difference in loss of output for monitoring optical signal. Connect the OUTPUT connector of the MN9611A to the MA9612A with the optical fiber cord ①, and press the [RELATIVE] key of the ML9001A to display "0 dB".
2. Then, connect the MONITOR OUTPUT connector of the MN9611A to the MN9612A with the optical fiber cord ②. At this time, the displayed value on the indicator of the ML9001A is the difference in loss.

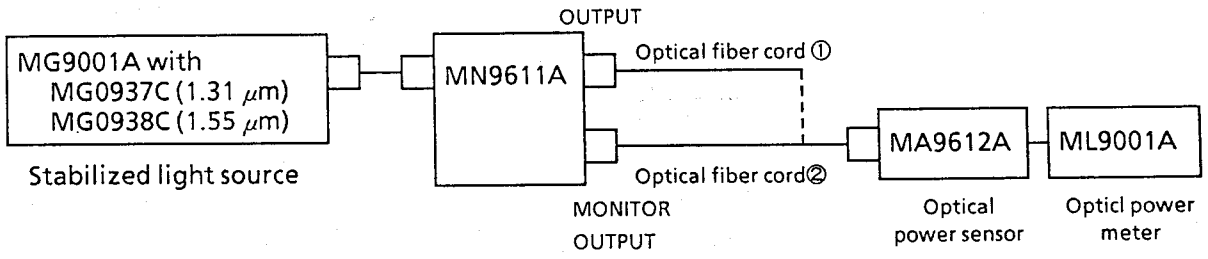


Fig. 7-5 Test System (4)

7.8.2 Optical output stability

1. Figure 7-6 shows the block diagram of the test system that measures the optical output stability of the output for monitoring optical signal. Set the attenuation to "0" by pressing the [ATTENUATION] setting key of the MN9611A and turning the rotary encoder. Then, connect the OUTPUT connector of the MN9611A to the MA9612A ① with the optical fiber cord ①. And press the [RELATIVE] key of the ML9001A ① to display "0 dB".
2. Connect the MONITOR OUTPUT connector of the MN9611A to the MA9612A ② with the optical fiber cord ②, and press the [RELATIVE] key of the ML9001A ② to display "0 dB".
3. Then, turn the rotary encoder to set the attenuation to an arbitrary value. At this time, the difference between the displayed values of the ML9001A ① and ② is the optical output stability.

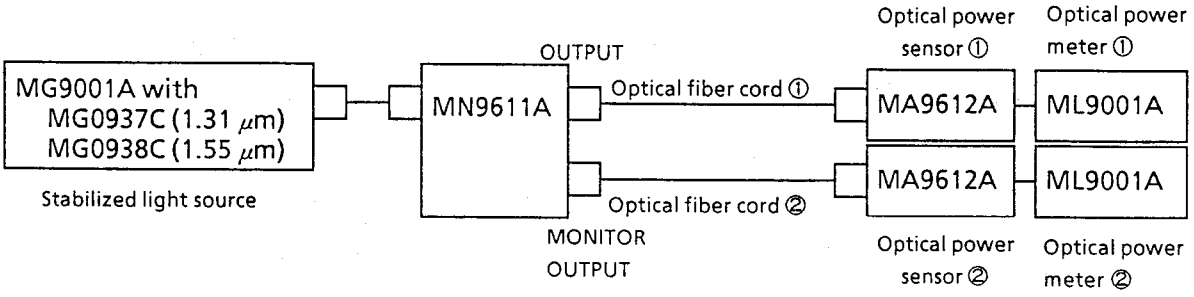


Fig. 7-6 Test System (5)

7.8.3 Isolation between MONITOR OUTPUT and OUTPUT connectors

1. Figure 7-7 shows the block diagram of the test system that measures the isolation of the output for monitoring optical signal.
2. First of all, connect the A-end of the optical fiber cord ① from the light source to the MA9612A, and measure the optical power. Then, put the ML9001A to the MEASURE mode and press the [RELATIVE] key to display "0 dB".
3. Then, connect the A-end of the optical fiber cord ① to the MONITOR OUTPUT connector of the MN9611A, and connect the OUTPUT connector of the MN9611A to the MA9612A with the optical fiber cord ②. Connect an FC Super PC optical fiber cord to the INPUT connector of the MN9611A. To the free end, apply the refractive-index matching grease to eliminate the reflection from this end. At this time, the displayed value on the indicator of the ML9001A is the isolation between the MONITOR OUTPUT and the OUTPUT connectors.

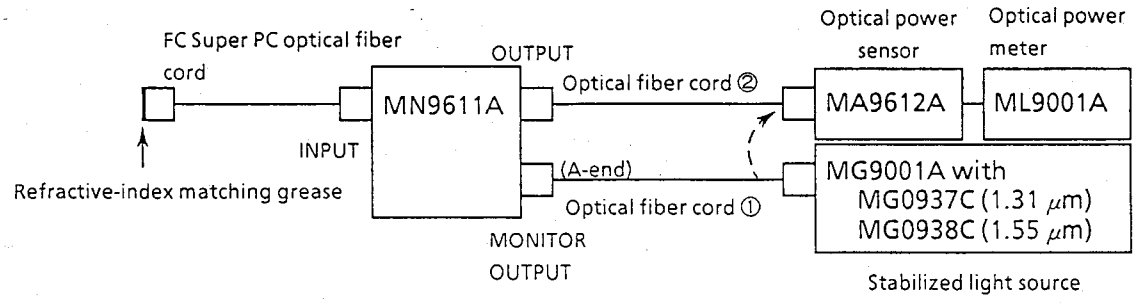


Fig. 7-7 Test System (6)

SECTION 8
STORAGE AND TRANSPORTATION

8.1 Precautions for Storage

Note the following precautions for long-term storage of the MN9610A/MN9611A.

1. Remove dust or other foreign matters attached onto the equipment.
2. Avoid storing the equipment in places where high temperature (55°C or higher), high humidity (90% or higher) or excessive low temperature (−20°C or lower) is expected.
3. Avoid storing the equipment in places where it may be exposed to direct sunshine, or in excessively dusty places.
4. Avoid storing the equipment in places where water drops may attach to it, or it may be damaged by active gasses, or where the equipment may be oxidized.
5. As well as the above, recommended storage conditions include the temperature of 0° to 30°C, the humidity of 40 to 80%, and temperature fluctuation in one day is minimized.

8.2 Repackaging and Transportation

When transporting the MN9610A/MN9611A to a remote place, observe the following precautions.

8.2.1 Repackaging

Use the packing materials used when the equipment is delivered to you. If the materials are already discarded, or broken; pack the equipment in the following procedure.

1. Wrap the MN9610A/MN9611A with a vinyl sheet.
2. Prepare a carton box, a wooden box, or an aluminum box that is 10 to 15 cm larger than the equipment in all the directions.
3. Places the MN9610A/MN9611A at the center of the box prepared in the above step 2, and fill the space of 10 to 15 cm with insulation materials sufficiently so that vibration and shock can be absorbed.
4. Fix firmly the outside of the box with packing strings, adhesive tape, or a band.

Note: Since reuse of the original packing materials make the repackaging much easier, it is recommended to keep them.

8.2.2 Transportation

As well as avoiding vibration as much as possible, it is recommended to satisfy the storage conditions mentioned in paragraph 8.1 above for transportation.

8.3 Maintenance

This equipment is precision instrument which was designed with mainly considering the accuracy and reliability.

Do not touch the inside components, unnecessarily.

In case of trouble, or readjustment is required; please contact your nearest Anritsu service personnel with the conditions of the trouble and serial No. of the equipment.