ADVANTEST

ADVANTEST CORPORATION

Q7607

Optical Chirpform Test Set

Operation Manual

MANUAL NUMBER FOE-8440029A00

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Safety Summary

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

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

- **Warning Labels**

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

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

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

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

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

- **Basic Precautions**

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

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

product.

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

- **Caution Symbols Used Within this Manual**

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

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

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

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

- **Safety Marks on the Product**

The following safety marks can be found on Advantest products.

 : ATTENTION - Refer to manual.

 : Protective ground (earth) terminal.

 : DANGER - High voltage.

 : CAUTION - Risk of electric shock.

- **Replacing Parts with Limited Life**

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

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

Main Parts with Limited Life

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

- **Hard Disk Mounted Products**

The operational warnings are listed below.

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

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

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

- **Precautions when Disposing of this Instrument**

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

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

Example: fluorescent tubes, batteries

Environmental Conditions

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

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

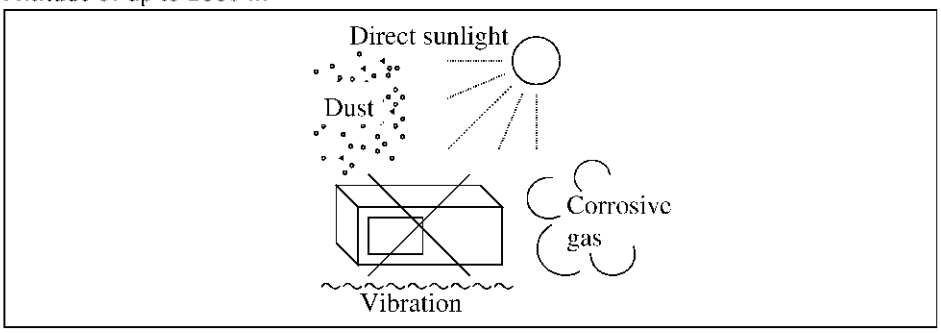


Figure-1 Environmental Conditions

- Operating position

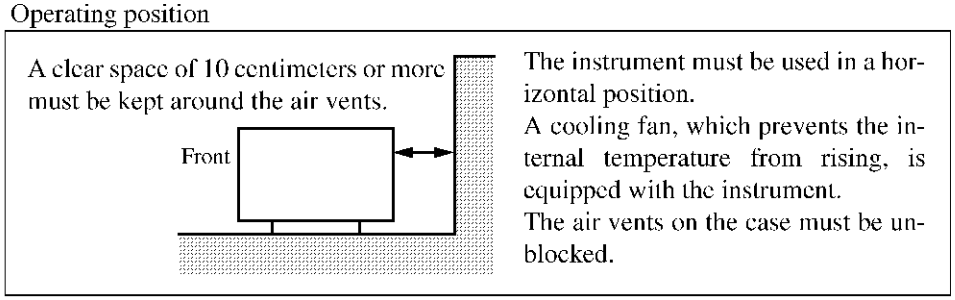


Figure-2 Operating Position

- Storage position

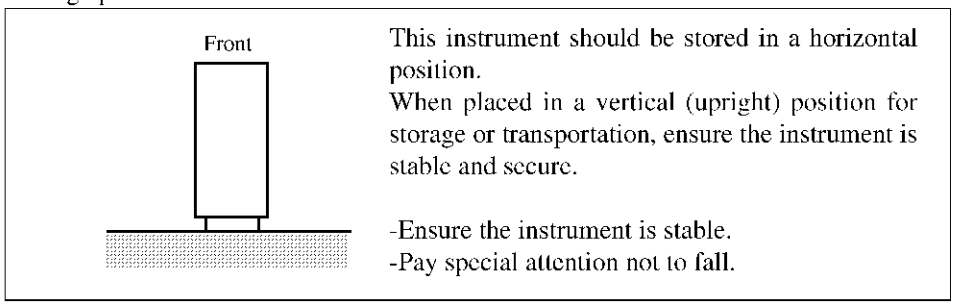


Figure-3 Storage Position

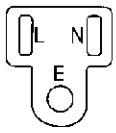
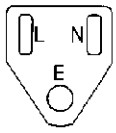
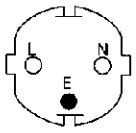
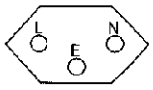
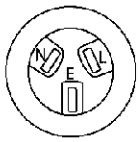
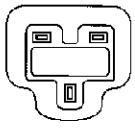
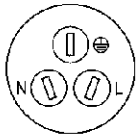
- The classification of the transient over-voltage, which exists typically in the main power supply, and the pollution degree is defined by IEC61010-1 and described below.

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

  Pollution Degree 2

Types of Power Cable

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

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

CAUTIONS ON USING THE Q7607

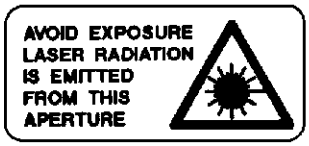
An optical amplifier can be equipped with the Q7607 as an option. When an optical amplifier is equipped, there is a danger that a laser of power 1 mW or less will be emitted from the output port. To avoid injury caused by exposure to laser, the operator should have a sufficient knowledge of laser. Information concerning lasers and relevant safety precautions are described below.

1. Information for the Safety of Laser Used in the Q7607+OPT10

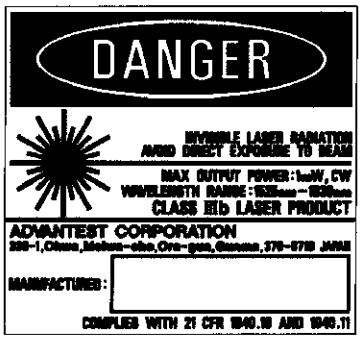
Laser Type	Semiconductor laser
Laser Class	IIIb: 21CFR 1040.10 (USA) 3A : IEC 825+A1(Non-USA)
Permissible Output Power	1 mW max
Beam Diameter	9 μm
Numerical Aperture	0.1
Wavelength	1525 nm to 1630 nm

2. Laser Warning Labels

The following laser warning labels are used on this instrument.



Warning label on the front panel of the instrument



FDA standard

IEC standard

Warning label on the top surface of the instrument

Figure 1 Warning labels for the class 3A laser

3. CLASS 3A LASER PRODUCT Label

The Q7607+OPT10 is a class 3A laser product. Class 3A laser product labels are provided as a standard accessory.

Attach the appropriate stickers from the label sheet for the country of use (see below).

Attach a label written in the appropriate language on the top surface of the instrument at the location indicated by "a" as shown in Figure 2. The labels written in English are to be attached to the instrument when it is shipped.

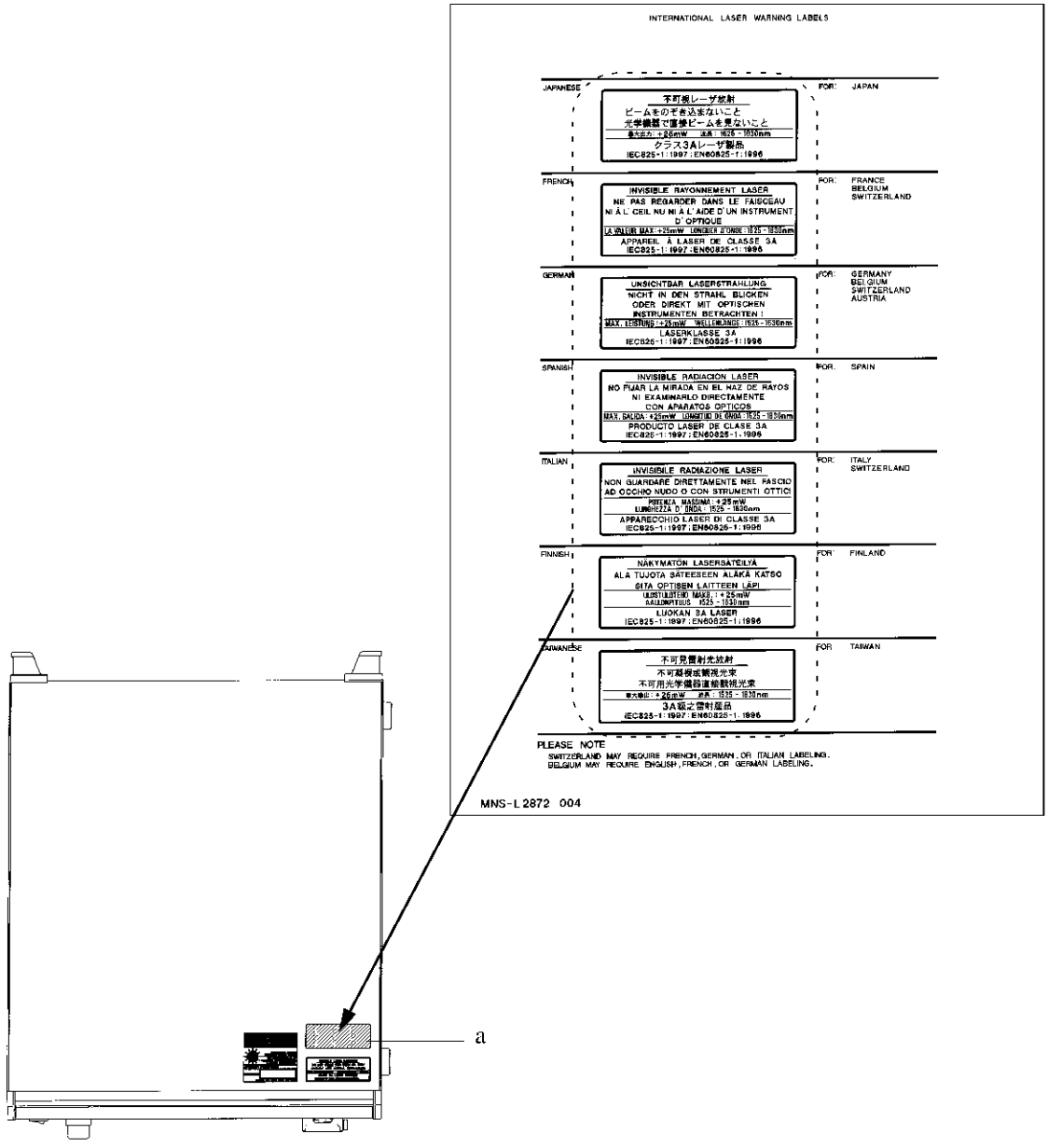
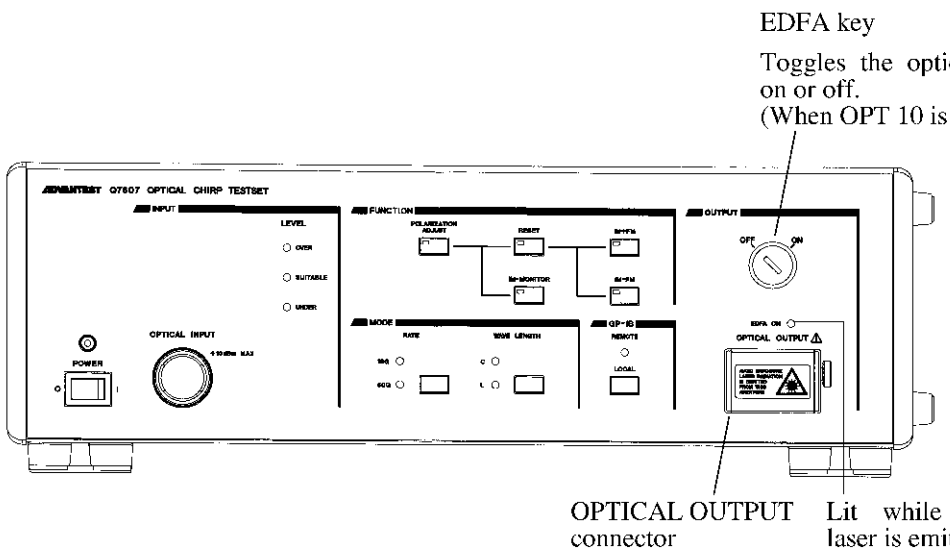


Figure 2 Where the CLASS 3A LASER PRODUCT Label is Affixed

4. Warnings on the Laser

1. Never attempt to emit a laser beam when no fiber is connected to the OPTICAL OUTPUT connector on the front panel.



2. Never attempt to look into the OPTICAL OUTPUT connector to observe the emitted laser beam. While the laser beam is emitted, never attempt to look into the optical fiber cord at the end, because an invisible light is emitted. The invisible light may seriously damage your eyesight.
3. Never attempt to look into the OPTICAL OUTPUT connector or the end of optical fiber cord to observe the emitted laser beam using an optical instrument. Your eyesight may be seriously damaged.
4. Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
5. Do not attempt to open the Q7607. The Q7607 should be serviced only by ADVANTEST representatives. ADVANTEST assumes no responsibility for any damage caused by unauthorized service.

5. SAFETY DEVICES FOR THE LASER (OPT10)

The following safety devices have been installed on the Q7607 to prevent incidental light radiation:

1. Fail/Safe Function

   When cleaning the optical connector or when replacing the optical connector-adapter, even if the **POWER** switch is turned on and the laser output is in the ACTIVE status, light will not be output if the optical connector is removed.

2. Remote Interlock

   If the remote interlock connector is not terminated, light will not be output.

   NOTE: ***To deactivate the interlock, use the short connector provided as an accessory with the instrument.***

3. Indicator

   When light is being output, the **EDFA ON** LED will light up. After the power is turned on, it will take approximately 3 seconds to transmit the laser beam.

4. Note

   - The maximum power of incident light for this instrument is +10 dBm. If incident light of power greater than +10 dBm is input, fatal damage may be caused to the instrument.
   - Due to the risk of electrical shock, do not attempt to disassemble this instrument for any reason.

Certificate of Conformity

CE

This is to certify, that

Optical Chirpform Test Set

Q7607

instrument, type, designation

complies with the provisions of the EMC Directive 89/336/EEC in accordance with EN61326 and Low Voltage Directive 73/23/EEC in accordance with EN61010.

ADVANTEST Corp.

Tokyo, Japan

ROHDE&SCHWARZ

Engineering and Sales GmbH
Munich, Germany

PREFACE

This manual provides the information necessary to check functionality, operate and program the Q7607 Optical Chirpform Test Set Operation. Be sure to read this manual carefully in order to use the Q7607 safely.

- Organization of this manual

  This manual consists of the following chapters:

Safety Summary	To use the Q7607 safely, be sure to read this manual first.
1. Introduction	Includes the accessories along with information on the Q7607 operating environment, and information on how to perform a system checkout for users who operate the Q7607 for the first time.
2. Operation	Describes the names and the functions of each part on the panels. Describes the basic operations of the Q7607.
3. Reference	Shows a list of operation keys, and describes the function of each key.
4. Remote Programming	Gives an outline of the GPIB interface, and how to connect and set them up. Also included are a list of commands necessary for programming.
5. Technical Information	Describes the principle of operation necessary for taking measurements more accurately.
6. Specifications	Shows the specifications of the Q7607.

- Key notations in this manual

  Typeface conventions used in this manual.

  Panel keys: In bold type Example: **RESET, WAVE LENGTH**

- Trademarks

  Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and other countries.

  Tektronix is registered trademarks of Tektronix,inc.

  National Instruments, LabVIEW, NI-488.2 are either trademarks or registered trademarks of National Instruments Corporation.

  All other marks referenced herein are trademarks or registered trademarks of their respective owners.

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1. INTRODUCTION

Includes the accessories along with information on the Q7607 operating environment, and information on how to perform a system checkout for users who operate the Q7607 for the first time.

1.1 Product Description

The Q7607 is an optical chirpform test set that contains fiber-type Mach-Zehnder interferometers and can convert the frequency modulated elements of incident light with intensity. The Q7607 can selectively output the sum of or difference between the chirp elements and intensity elements by switching measurement modes.
Using a sampling oscilloscope and a personal computer, the Q7607 can separate the chirp and intensity elements, and can generate these time-domain characteristics.

Features:

- Optimal FSR according to the signal rate can be selected: 10 Gbps or 50 Gbps.
- Wide wavelength range: 1510 nm to 1610 nm (When OPT 10 is installed: 1530 nm to 1610 nm)
- An optical amplifier can be equipped
- Dynamic chirp can be measured in a short time: 30 seconds or less
- Chirp measurement can be performed with easy operation: Chirp measurement software is available

1.2 Recommended Devices

Measuring dynamic chirp with the Q7607 instrument requires devices including an O/E converter, sampling oscilloscope, and personal computer. Software provided with the Q7607 can be used with the devices described below.

Table 1-1 Recommended Devices

Device type	Recommended device	Recommended Manufacturers
GPIB interface	PCI-GPIB(for Windows), PCMCIA-GPIB(for Windows)	National Instruments Corporation
Sampling oscilloscope	11802,CSA8000,CSA8000B	Tektronix Inc.
	83480A and 86100A	Agilent Technologies
Plug-in board for sampling oscilloscope	SD-48, SD-32, 80C85, and 80C86	Tektronix Inc.
	83482A, 83485A, 83485B, a combination of 86116A and 86107A	Agilent Technologies

1.3 SYSTEM REQUIREMENTS

The following describes the operating environment for the supplied software.

- Personal computer: PC/AT compatibles
- OS: Microsoft® Windows® 98 or Windows2000
- CPU: Pentium®; Clock frequency: 200 MHz or higher recommended
- Main Memory: 32 MB or more recommended
- Hard Disc: 20 MB or more of hard disk space recommended
- GP-IB Board and driver software

  Recommended parts

  GP-IB board: National Instruments® GP-IB board

  Driver software: NI-488.2® Ver1.6 or later (The operation has been tested using Ver 1.6.)

  The use of the National Instruments GP-IB board compatible with the personal computer used is recommended.

  Before installing the software, ensure that a GP-IB board and driver software are installed.

Peripherals, such as printers, must be compatible with Microsoft Windows 98 or Windows 2000 operating environment.

1.4 Accessories

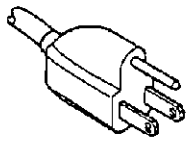
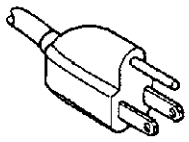
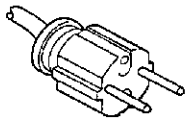
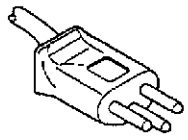
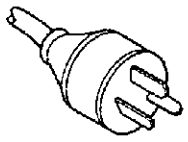
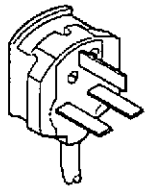
The table below lists the standard accessories shipped with the Q7607. If any of the accessories are damaged or missing, contact the nearest ADVANTEST Field Office or representative. Additional accessories should be referred to by model name when ordered.

Table 1-2 Standard Accessories List

Name	Model name	Quantity	Remarks
Power cable	A01413	1	*1
Power fuse	21802.5	2	AC250V/2.5A
CLASS 3A LASER PRODUCT label	MNS-L2872A004A	1	OPT10 only
Chirp measurement software	PQ76000402-CD	1	CD-ROM (For Windows98 and Windows2000)
FIBER GUARD	MBT-L4429A	1	
FIBER GUARD screw	YKG-WS2×6	2	
Laser key	KSE-000840	2	Used only when OPT10 is installed in the instrument.
Q7607 Operation manual	EQ7607	1	English version

* 1: The cable supplied with the Q7607 depends on what type (specified by model number above) was ordered when the Q7607 was purchased (see Table 1-3).

Table 1-3 Power Cable Options

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

1.5 Options and Accessories (Sold Separately)

The options and accessories used for the Q7607 are shown below. Accessories should be referred to by model name when ordered.

Table 1-4 Options

Name	Model name	Remarks
Pre-installed optical amplifier	Option 10	Factory option
Retrofitting optical amplifier	Option 10A	Retrofitting at Advantest factory

Table 1-5 Accessories

Name	Model name	Remarks
FC connector	A08161	Optical connector
SC connector	A08162	Optical connector
ST connector	A08163	Optical connector
Rack mount kit	A02708	With front handles
	A02718	Without front handles
	A02709	With front handles
	A02719	Without front handles

1.6 Operating Environment

This section describes the environmental conditions and power requirements necessary to use the Q7607.

1.6.1 Environmental Conditions

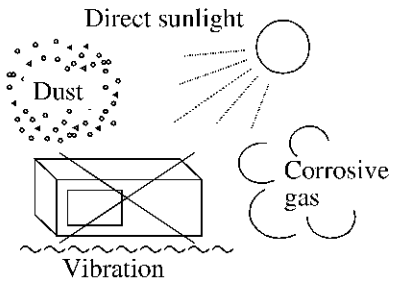
The Q7607 should be only be used in an area which satisfies the following conditions:

- Ambient temperature: 0 °C to +40 °C (operating temperature)
- Relative humidity: 85% or less (without condensation)
- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations
- A low noise area

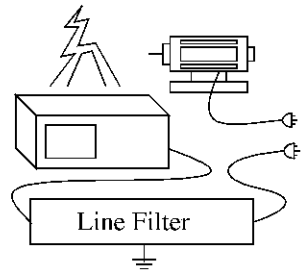
  Although the Q7607 has been designed to withstand a certain amount of noise riding on the AC power line, it should be used in an area of low noise. Use a noise cut filter when ambient noise is unavoidable.
- An area allowing unobstructed air flow

  The Q7607 has ventilators on the side panels. Do not block the ventilators.

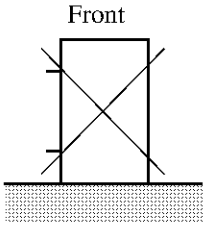
  Keep the rear panel 10 centimeters away from the wall. In addition, do not use the Q7607 upright turned the rear panel side down. The resulting internal temperature rise will affect measurement accuracy.



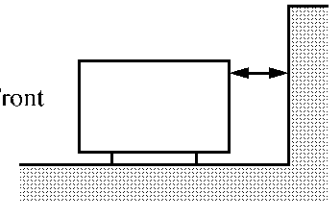
- Avoid operation in the following areas.



- Use a noise cut filter when there is a large amount of noise riding on the power line.



- Do not use the Q7607 upright turned the rear panel side down.



- Keep the rear panel 10 centimeters away from the wall

Figure 1-1 Operating Environment

The Q7607 can be used safely under the following conditions:

- Altitude of up to 2000 m
- Installation Categories II
- Pollution Degree 2

1.6.2 Power Supply Specifications

The power supply specifications of the Q7607 are listed in Table 1-6.

Table 1-6 Power Supply Specifications

	100 VAC Operation	200 VAC Operation	Remarks
Input voltage range	90 V to 132 V	198 V to 250 V	Automatically switches between input levels of 100 VAC and 200 VAC.
Frequency range	48Hz to 66Hz		
Power consumption	100 VA or below		

CAUTION: ***To prevent damage, operate the Q7607 within the specified input voltage and frequency ranges.***

1.6.3 Power Cable

CAUTION:

1. ***Use a power cable rated for the voltage in question. Be sure however to use a power cable conforming to safety standards of your nation when using a product overseas (See Table 1-4).***
2. ***Be sure to plug the power cable into an electrical outlet which has a safety ground terminal. Grounding will be defeated if you use an extension cord which dose not include a safety ground terminal.***

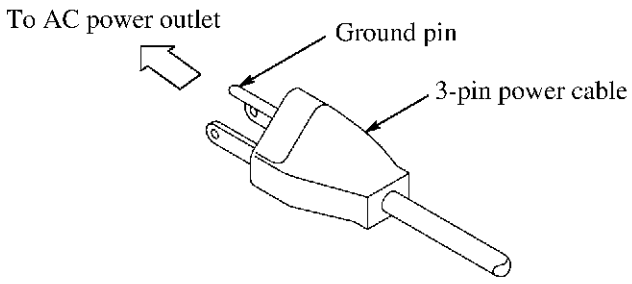


Figure 1-2 Precautions in Use

1.6.4 Power Fuse

CAUTION:

1. ***When a fuse blows, there may be some problem with the Q7607. Contact a sales representative before replacing the fuse.***
2. ***For fire prevention, use only fuses with the same rating and same type.***

To replace the fuse, set the **POWER** switch to OFF and disconnect the power cable from the AC LINE connector. The fuse holder can be taken off by pulling the fuse holder notch at the top of the AC LINE connector. When replacing the fuse, be sure to use the type provided (21802.5).

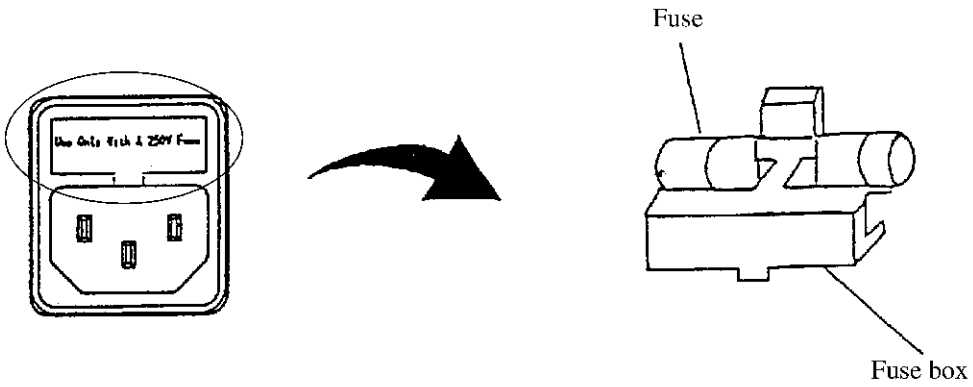


Figure 1-3 Replacing the Power Fuse

1.7 Precautions in Use

1. Before starting the measurement

   When turning on the power, don't connect DUT.

   Before starting the measurement, check to see the output power level.

2. Removing of case

   Do not open the case to one except service man of our company.

   The Q7607 has a high temperature part and a high pressure part.

3. When abnormality occurs

   When smoke rises from the Q7607, smell nastily, or rear unusual sound feel, turn off the **POWER** switch. Pull out power cable from the outlet. And contact to our company.

   The address and the telephone number of our company are in the end of this manual.

4. Electromagnetic interference.

   Electromagnetic interference may be caused to the television or the radio.

   If the Q7607 power is turned off and the electromagnetic interference is reduced, then the Q7607 has caused the problem.

   Prevent electromagnetic interference by the following procedure.

   - Change the direction of antenna of the television or the radio.
   - Place the Q7607 the other side of the television or the radio.
   - Place the Q7607 away from the television or the radio.
   - Use another line of power source for the television or the radio than the Q7607.

1.8 System Checkout

This section describes the Selftest which must be performed when operating the Q7607 for the first time. Follow the procedure below:

1. Make sure that the **POWER** switch on the front panel is turned off.
2. If the instrument is equipped with OPT10, make sure that the **EDFA** key is in the off position.
3. Connect the power cable (provided as an accessory) to the AC power supply connector on the rear panel.

CAUTION: ***To prevent damage, do not apply a voltage that exceeds the specified input voltage and frequency ranges.***

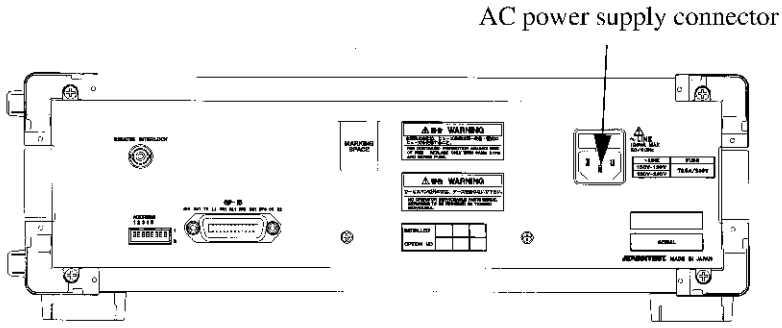


Figure 1-4 Connecting the Power Supply Cable

4. Connect the power cable to the outlet.
5. Turn on the **POWER** switch on the rear panel.

   The Q7607 performs a self-diagnostic for approximately three seconds.

   All the LEDs light up during the test. When the self-diagnostic is completed successfully, the LEDs other than those described below are turned off.

   • POWER LED
   • POLARIZATION ADJUST LED
   • 50G LED
   • C BAND LED

The checkout is now competed.

NOTE: ***If the self-diagnostic test has failed, all LEDs light up. If this occurs, contact the nearest ADVANTEST sales office or sales representative.***

1.9 Cleaning, Storing and Transporting the Q7607

1.9.1 Cleaning

Remove dust from the outside of the Q7607 by wiping or brushing the surface with a soft cloth or small brush. Use a brush to remove dust from around the panel keys. Hardened dirt can be removed by using a cloth which has been dampened in water containing a mild detergent.

CAUTION:

1. ***Do not allow water to get inside the Q7607.***
2. ***Do not use organic cleaning solvents, such as benzene, toluene, xylene, acetone or similar compounds, since these solvents may damage the plastic parts.***
3. ***Do not use cleanser.***

1.9.2 Cleaning and Replacement of Optical Connectors and Adapters

---

CAUTION:

1. ***Operating the light input part when it's dirty or the fiber key slot of the input light is not completely in contact with the Q7607 light input part may cause an error in the measurement result.***
2. ***Operating with a dirty light input part harms the ferrule surface.***
3. ***The fiber in the light input part may be damaged if a large optical light power is released when the light input part is dirty or while the fiber key slot of the light input part is not aligned correctly with the adapter key slot. If it is damaged, replacement of the fiber part is required.***

1.9.2.1 Input Connector

1. Replacing optical connector-adapter

   Although the Q7607 is equipped with FC-type connector-adapter as standard, SC-type and ST-type optical connector-adapters are also available. To replace it with other part, unscrew the adapter cap and take the connector adapter away as shown in Figure 1-5.

2. Cleaning optical connector tip

   Clean the optical connector tip using alcohol in the same manner as for the connector-adapter.

NOTE: ***When pulling out the optical connector, stop and do not pull it any more when the white label on the cable is seen.***

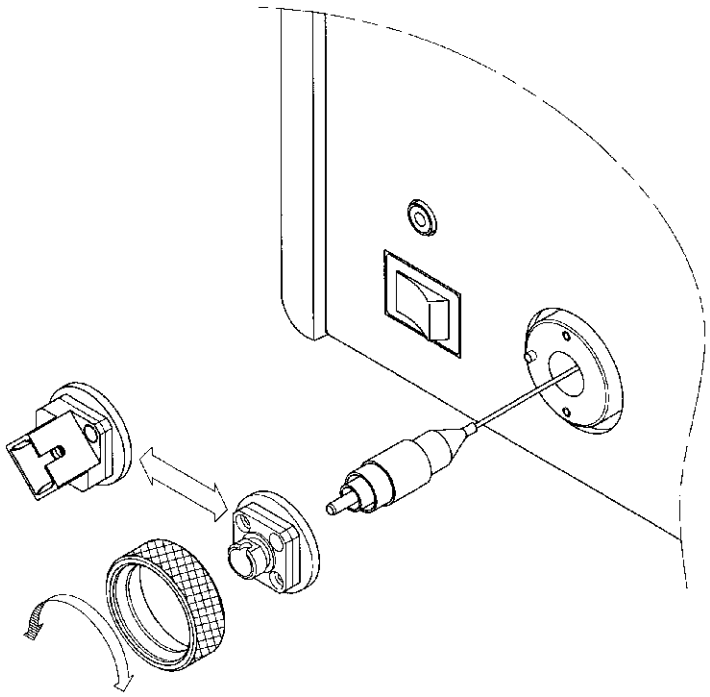


Figure 1-5 Replacing/Cleaning Optical Connector-adapters for the Q7607

CAUTION: ***Be sure to tighten the adapter cap after replacing or cleaning the optical connector-adapter.***

1.9.2.2 Output Connector

Cleaning of optical connector

1. Check to see if the **POWER** switch (on the front panel) is turned off.
2. Remove the screw for the connector-adapter and remove the optical connector from the connector-adapter carefully.

   NOTE: ***When pulling out the optical connector, stop and do not pull it any more when the white label on the cable is seen.***

3. Pull out the optical fiber and clean the tip with alcohol.
4. Push the optical fiber carefully back to where it was before, and attach the optical connector to the connector-adapter.
5. Attach the connector-adapter with the screw.

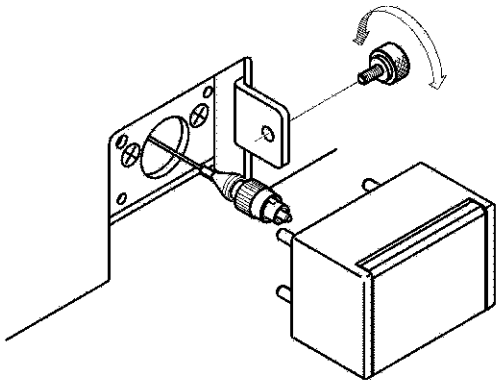


Figure 1-6 Cleaning Optical Connector for the Q7607

NOTE: ***Tighten the screw to the connector-adapter after cleaning the optical connector.***

Attaching the fiber guard

The shutter may block and give stress to the fiber cable when using some types of fiber cable.

1. Attach the fiber guard (instrument accessory) with screws.

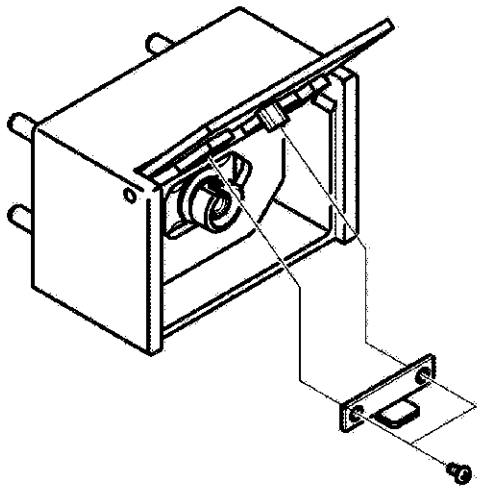


Figure 1-7 Attaching the Fiber Guard for the Q7607

Replacing optical connector-adapter

1. Remove the screw for the connector-adapter and remove the optical connector from the connector-adapter carefully.
2. Replace the connector-adapter with one of the SC or ST types (optional accessories).
3. Pull the optical fiber out, and then connect it to the FC connector side of the replacement connector-adapter.
4. Push the optical fiber back to where it was before carefully and attach the connector to the connector-adapter.
5. Attach the connector-adapter with the screw.

NOTE: ***The Q7607 provides an FC type connector-adapter as a standard accessory. In addition, connector-adapters of the SC and ST type are also available as optional accessories.***

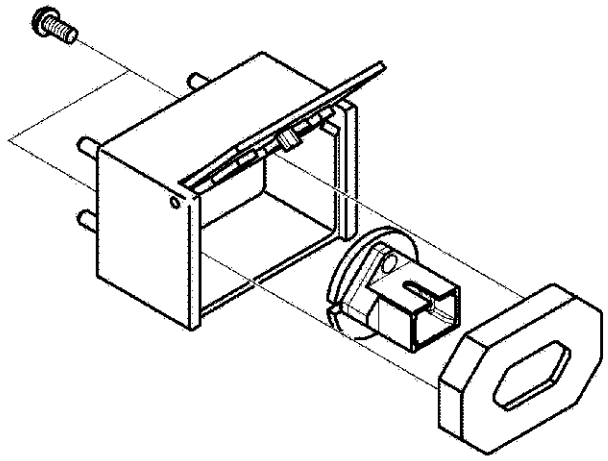


Figure 1-8 Replacing the Optical Connector-Adapter for the Q7607

CAUTION:

1. ***Make sure to tighten the screw to the new connector-adapter after replacement.***
2. ***When pulling out the optical connector, stop and do not pull it any more when the white label on the cable is seen.***

1.9.3 Description and Handling Cautions for the Light Input/Output Part of the Q7607

The light input/Output part is a high precision part. It must be handled with extreme caution.

1. The fiber tip of the light input/output part requires frequent cleaning. Dirt or dust may damage the fiber of the light input/output part. For the operation and cleaning method of the part, refer to section 1.9.2.
2. The optical connector adapter is a consumable part and has a limited life span. Under certain operational conditions, the separating sleeve inside of the optical connector adapter may become damaged. To replace of the damaged sleeves, refer to section 1.9.3.1.

1.9.3.1 Operational Care and Replacement Methods for the Optical Connector Adapter

When inserting the light fiber connector into the light input part or taking it out, move slowly and carefully, making sure the connector is kept straight.

CAUTION: ***The separating sleeve inside of the connector is made of zirconium (fine ceramics) and may be damaged if the light fiber connector is bent and is not straightened before insertion or if the connector is twisted while it is being taken out.***

The optical connector is a consumable part and has a limited life span. If it becomes damaged, purchase an accessory kit for the optical connector adapter and replace the part by removing the optical connector adapter in the same manner used when cleaning it.
To replace the optical connector adapter only, use the following procedures.

1. Remove the screws located on the upper left and lower right (opposite corners)
2. Replace with a new optical connector adapter (i.e. FC-FC, SC-FC, ST-FC).
   *: In order to conserve the performance of the adapter, using a optical connector adapter with the separating sleeve made of zirconium is recommended.

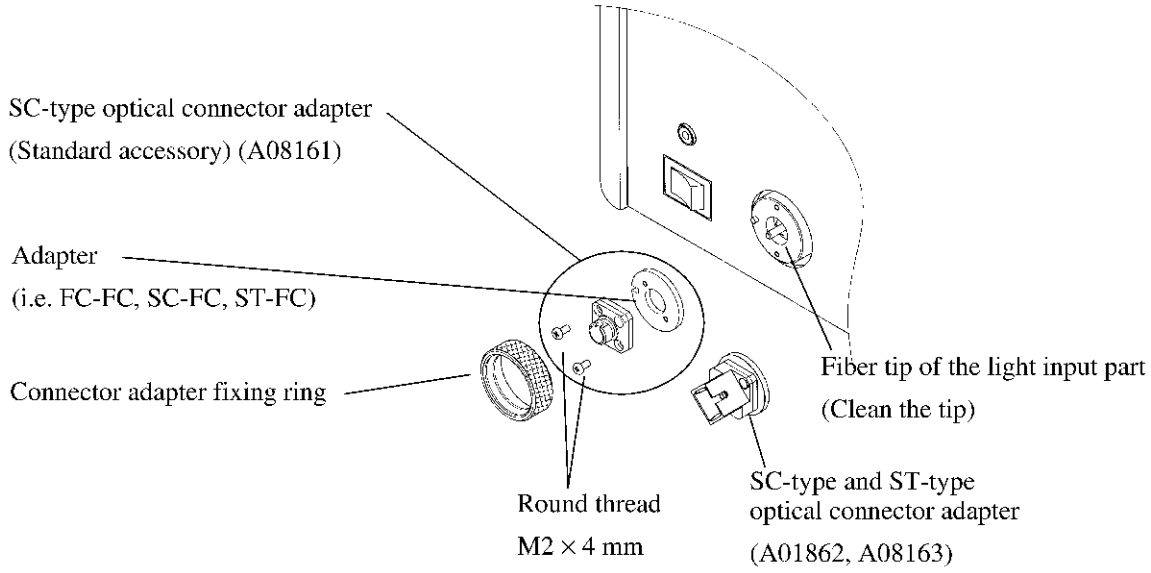


Figure 1-9 Light Input Part Structure

1.9.4 Storing

Store the Q7607 in an area which has a temperature from -20 °C to +60 °C. If you plan to store the Q7607 for a long period (more than 90 days), put the Q7607 in a vapor-barrier bag with a drying agent and store the Q7607 in a dust-free location out of direct sunlight.

1.9.5 Transporting

When you ship the Q7607, use the original container and packing material. If the original packaging is not available, use the following repackaging guidelines:

Packing Procedure

1. To allow for cushioning, use a corrugated cardboard container that is at least 15 centimeters larger than those of the Q7607.
2. Surround the Q7607 with protective sheeting.
3. Cushion the Q7607 on all sides with packing material.
4. Seal the corrugated cardboard container with shipping tape or an industrial stapler.

If you are shipping the Q7607 to a sales representative for service or repair, attach a tag to the Q7607 that shows the following information:

- Owner and address
- Name of a contact person at your location
- Serial number of the Q7607 (located on the rear panel)
- Description of the service requested

1.10 Warm up

After the Q7607 temperature has reached the room temperature level, turn the **POWER** switch ON and warm it up for 30 minutes.

1.11 Calibration

Calibration work should be performed at an ADVANTEST CORPORATION site.
When you want to calibrate the Q7607, please contact a sales representative.

Desirable Period	1 year

2. OPERATION

This chapter describes the front and rear panels.

2.1 Front Panel Description

Panel keys and connectors in each section of the front panel are described as follows:

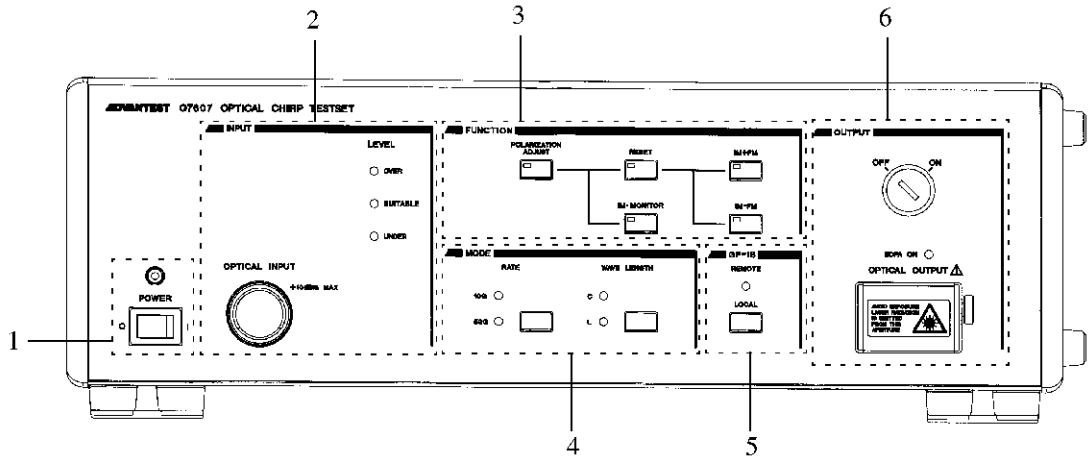


Figure 2-1 Power Switch Section

1. POWER switch section
2. INPUT section
3. FUNCTION section
4. MODE section
5. GP-IB section
6. OUTPUT section

2.1.1 POWER Switch Section

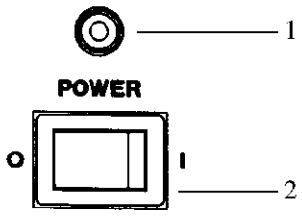


Figure 2-2 Power Switch

1. POWER LED — When the power is on, the LED is turned on.
2. **POWER** switch — Used to turn the power on or off.

2.1.2 INPUT Section

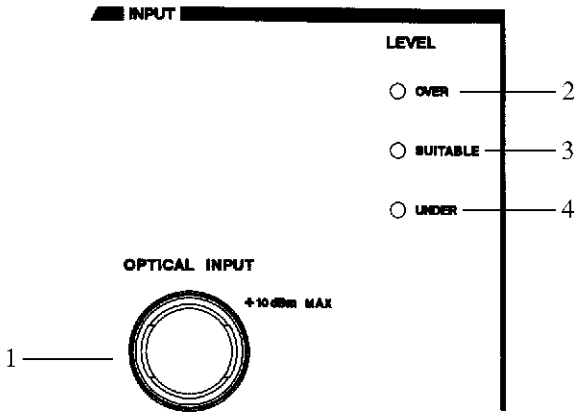


Figure 2-3 INPUT Section

1. **OPTICAL INPUT** connector — Used to input the signal from a DUT. The maximum input level is +10 dBm.

   NOTE: Make sure that the tip of the connector is cleaned.

2. **OVER** LED — Lights up when the input signal level is too high.
3. **SUITABLE** LED — Lights up when the input signal level is appropriate.
4. **UNDER** LED — Lights up when the input signal level is too low.

2.1.3 FUNCTION Section

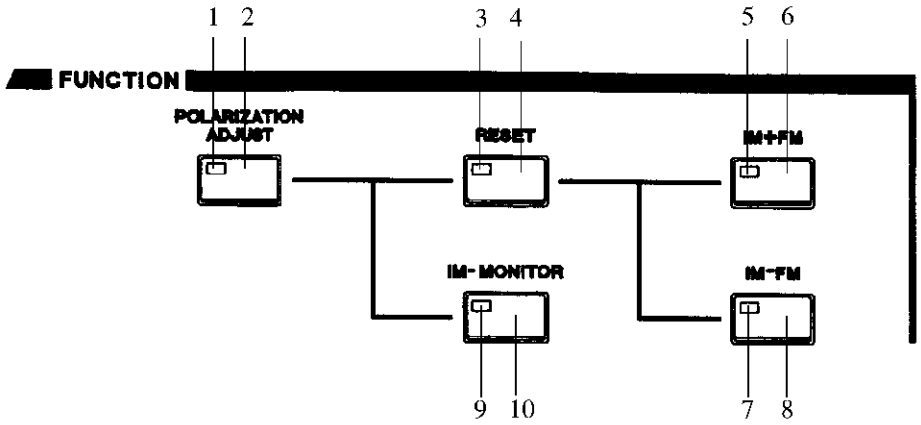


Figure 2-4 Function Section

1. POLARIZATION ADJUST LED — Lights up when the polarization adjustment mode is selected.
2. **POLARIZATION ADJUST** key — Used to select whether or not polarization is adjusted before measurement.
3. RESET LED — Flashes while RESET is being executed. RESET LED is lit when it is completed. (The IM+FM mode is turned on.)
4. **RESET** key — Used to reset the interferometer
5. IM+FM LED — Flashes while the interferometer is being adjusted. When the IM+FM mode has been set, the LED is lit.
6. **IM+FM** key — Used to adjust the interferometer to output the intensity modulation (IM) element and frequency modulation (FM) element of incident light in the same phase.
7. IM-FM LED — Flashes while the interferometer is being adjusted. When the IM-FM mode is set, the LED is lit.
8. **IM-FM** key — Used to adjust the interferometer to output the intensity modulation (IM) element and frequency modulation (FM) element of incident light in the opposite phases.
9. IM-MONITOR LED — Flashes while the interferometer is being adjusted. When the IM-MONITOR mode has been set, the LED is lit.
10. **IM-MONITOR** key — Used to adjust the interferometer to output only the intensity modulation (IM) element of incident light.

2.1.4 MODE Section

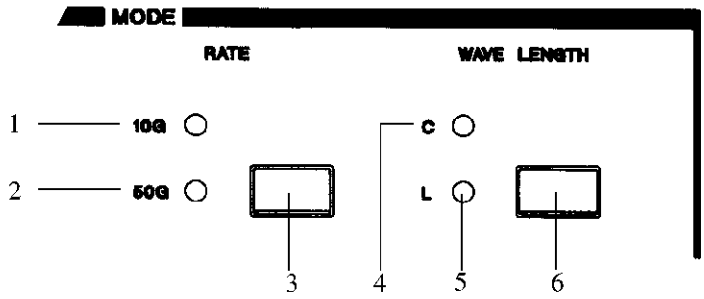


Figure 2-5 Mode Section

1. **10G** LED — When the modulated signal rate is set to 10 Gbps, the indicator is lit.
2. **50G** LED — When the modulated signal rate is set to 50 Gbps, the indicator is lit.
3. **RATE** key — Select the modulated signal rate according to the following ranges:
   10 Gbps or less: 10G
   10 Gbps to 50 Gbps: 50G
4. **C** BAND LED — Lights up when the C bandwidth is set for the wavelength.
5. **L** BAND LED — Lights up when the L bandwidth is set for the wavelength.
6. **WAVE LENGH** key — Used to switch the C bandwidth and L bandwidth according to the incident light wavelength.

*NOTE: **The WAVE LENGH key is activated only when OPT 10 has been installed.***

2.1.5 GP-IB Section

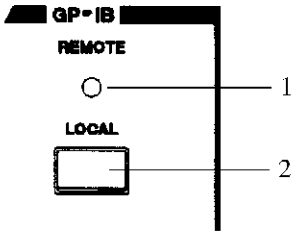


Figure 2-6 GP-IB Section

1. REMOTE LED — Lights up when REMOTE is selected.
2. **LOCAL** key — Used to turn off the remote control by GPIB. (When REMOTE LED is lit.)

2.1.6 OUTPUT Section

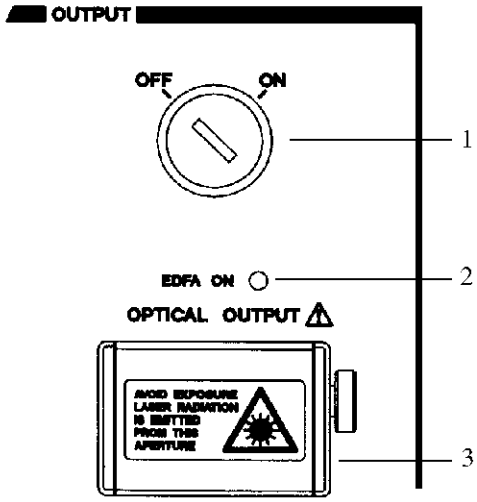


Figure 2-7 OUTPUT Section

1. **EDFA** key

When this switch is turned on, the internal EDFA output is controlled.
When it is set to OFF, EDFA output is disabled.

NOTE:

1. ***The EDFA key is activated only when OPT 10 has been installed.***
2. ***Do not operate the EDFA key during measurements.***

2. **EDFA ON** LED

Lights up when the internal EDFA outputs.

NOTE: ***The EDFA LED is operative only when OPT 10 has been installed.***

3. **OPTICAL OUTPUT** connector

Used to output signals from the interferometer.

2.2 Rear Panel

Connectors on the rear panel are described as follows:

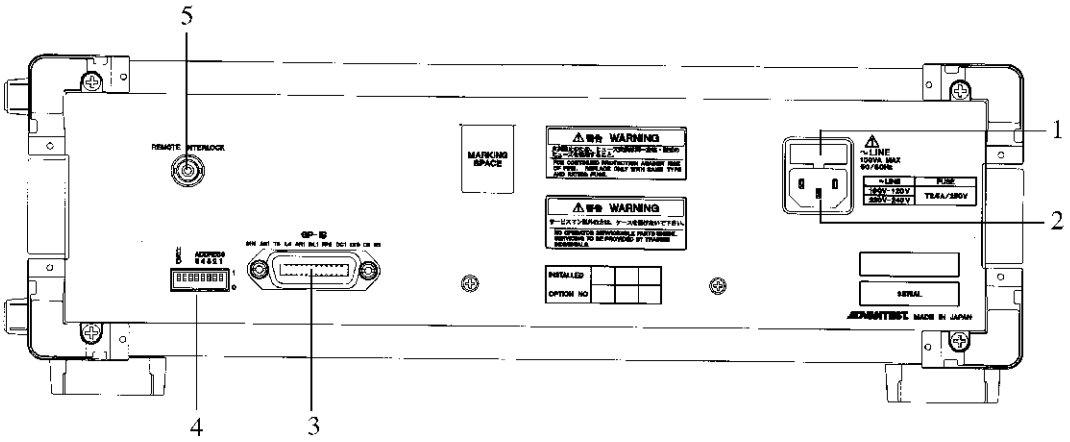


Figure 2-8 Rear Panel

1. FUSE folder — Used to contain a fuse to prevent the instrument from over-current.

2. Power supply connector — Used to connect the Q7607 to the AC power cable (provided as an accessory).

3. **GP-IB** connector — When remotely controlled by GPIB, the connector is used to connect the GPIB cable to the external controller.

4. **ADDRESS** switch — Used to set the GPIB address.
The leftmost bit is used to select using or not using the header.
"1" indicates with header and "0" indicates without header.

5. **REMOTE INTERLOCK** connector
Used to remotely control the internal EDFA. When it is not remotely controlled, attach the short connector (provided as an accessory).

NOTE: The REMOTE INTERLOCK connector is activated only when OPT 10 is installed.

CAUTION:

1. *The remote interlock must be shorted. If it is open, the internal EDFA output is blocked.*
2. *Do not apply voltage to the REMOTE INTERLOCK connector. Otherwise, the circuit will be damaged.*

2.3 Operation

2.3.1 System Setup

An example of the system setup is described below:

1. Connect the Q7607, personal computer, and sampling oscilloscope with GPIB cables. Install the chirp measurement software (provided as an accessory) to the personal computer.
2. Apply an evaluation pattern to the DUT using a device such as a PPG (pulse pattern generator). Connect the DUT output to the INPUT connector of the Q7607.
3. Connect the Q7607 output connector to the optical input connector of the sampling oscilloscope with an optical fiber.

2.3.2 Important Tips

To measure chirp accurately, read the following items.

1. Use a sampling oscilloscope that provides sufficient bandwidth characteristics to the signal. Using an inappropriate bandwidth will result in obtaining inaccurate waveforms.
2. Input optical power level is -10 dBm to +10 dBm. If the input level is too low, the signal S/N is low, and a correct waveform cannot be obtained. If the input level is too high, it may damage the Q7607 and the sampling oscilloscope.
3. When Option 10 is installed, attaching an optical filter to the output is recommended. Doing so may result in an increase of measurement error by the influence of the ASE element.
4. Make sure to adjust the sampling oscilloscope at zero level. Set the trigger offset to a minimum value.
5. The polarization of incident light must be maintained constant during the measurement. Make sure to attach the optical fiber tightly, or use polarization-maintaining fibers as necessary.

3. REFERENCE

This chapter describes the functions of all panel and soft keys.

- Menu index: Use this index as a key index to Chapter 3.
- Menu map: Shows a list of hierarchical menus on a panel key basis.
- Functional descriptions: Explains the functions of the panel keys.

The panel keys are arranged in alphabetical order.

3.1 Menu Index

This menu index is used to easily find the keys described in Chapter 3.

3.2 Panel Key Functions

This chapter describes the functions of panel key.

EDFA Key

When this switch is turned on, the internal EDFA output is controlled.
When it is set to OFF, EDFA output is disabled.

NOTE: The EDFA key is activated only when OPT 10 is installed.

IM+FM key

Used to adjust the interferometer to output the intensity modulation (IM) element and frequency modulation (FM) element of incident light in the same phase.
LED flashes while the interferometer is being adjusted.
When the IM+FM mode is selected, the LED is lit.

NOTE: After the interferometer is reset (when the RESET LED is lit), the IM+FM key is activated.

IM-FM key

Used to adjust the interferometer to output the intensity modulation (IM) element and frequency modulation (FM) element of incident light in the opposite phases.
The LED flashes while the interferometer is being adjusted.
When the IM-FM mode is selected, the LED is lit.

NOTE: After the interferometer is reset (when RESET LED is lit), the IM-FM key is activated.

IM-MONITOR KEY

Used to adjust the interferometer to only output the intensity modulation (IM) element of incident light.
IM-MONITOR LED Flashes while the interferometer is being adjusted.
When the IM-MONITOR mode is selected, the IM-MONITOR LED is lit.

LOCAL key

Used to turn off the remote control by GPIB. When the instrument is in the remote control mode, the REMOTE LED is lit.

GPIB address setting

GPIB address setting must be adjust before the Q7670 is turned on. LSB is located on the left side of the switch. Turning each switch to the upper side sets the bit to 1.

Address=(1 or 0 of the first bit)*2^0+(1 or 0 of the second bit)*2^1+(1 or 0 of the third bit)*2^2+(1 or 0 of the fourth bit)*2^3

POLARIZATION ADJUST key

Used to select the polarization adjust mode.
When the polarization adjustment mode is selected, the POLARIZATION ADJUST LED is lit.

RATE key

Used to switch the interferometer rate.

10G LED:Lights up when the interferometer rate is set for a 10 Gbps signal.

50G LED:Lights up when the interferometer rate is set for a 50 Gbps signal.

RESET key

Used to reset the interferometer. The IM+FM mode is selected. The RESET LED Flashes while RESET is being executed. The RESET LED is lit when the reset is completed.

NOTE:

1. ***After the interferometer is reset, the IM+FM key and IM-FM key are operative.***
2. ***If the incident light status (polarization status) has changed, make sure to reset the interferometer.***

WAVE LENGH key

Used to switch between the C bandwidth and L bandwidth according to the incident light wavelength.

C bandwidth: λ= 1530 nm to 1570 nm

L bandwidth: λ= 1570 nm to 1610 nm

C BAND LED Lights up when the C bandwidth is selected.

L BAND LED Lights up when the L bandwidth is selected.

NOTE: ***The WAVE LENGTII key is activated only when OPT 10 is installed.***

---

4. PERFORMANCE VERIFICATION

4.1 Procedures

This section describes the Q7607 performance verification procedures.

NOTE: Before the performance verification is performed, allow at least two hours warm-up time.

4.1.1 Insertion Loss (When options are not installed)

Measure the Q7607insertion loss.

Specification: -13 dB or less.

Required devices: Light source (1550 nm)
Optical power meter (calibrated for 1550 nm wavelength)

Procedures

1. Connect equipment as shown in Figure 4-1.

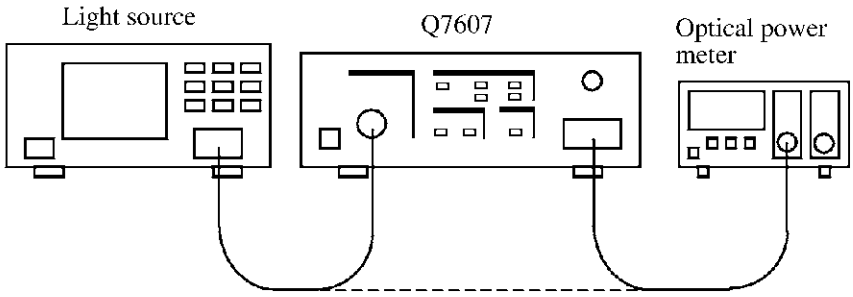


Figure 4-1 Setup for Measuring a Insertion Loss

2. Set the light source output to the 1550 nm waveform and 0 dBm output.
3. Connect the light source to the Optical power meter directly and read the Optical power meter value (P0).
4. Connect the light source output to the Q7607 input. Connect the Optical power meter input to the Q7607 output.
5. Press the **RESET** key on the Q7607 front panel.
6. When the LED on the **IM+FM** key lights up, read the Optical power meter value (P1).

The above procedures must be performed for both 10G and 50G channels.

Reference specification: P0-P1 ≤ 13 dB

4.1.2 Optical Output Power (only if installed)

Measure the Q7607 optical output power.

Specification: -3 dBm to 0 dBm

Required devices: Light source (1550 nm)
Optical power meter (calibrated for 1550 nm)

Procedures

1. Connect equipment as shown in Figure 4-2.

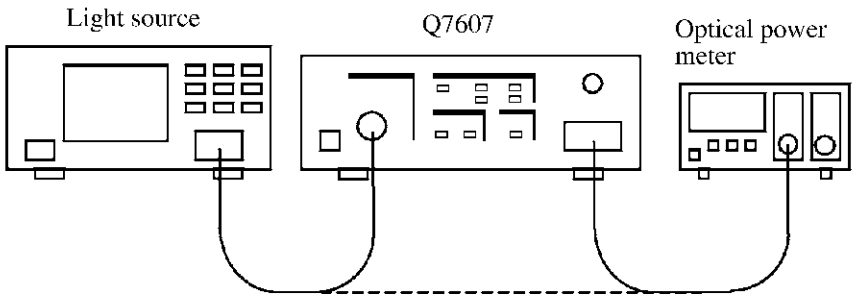


Figure 4-2 Setup for Measuring a Optical Output Power

2. Set the light source output to the 1550 nm wavelength and 0 dBm output.
3. Connect the light source output to the Q7607 input. Connect the Optical power meter input to the Q7607 output.
4. Press the **RESET** key on the Q7607 front panel.
5. When the LED on the **IM+FM** key lights up, read the power meter value (P0).

The above procedures must be performed for both 10G and 50G channels.

Reference specification: $-3\ \text{dBm} \leq P0 \leq 0\ \text{dBm}$

4.1.3 FSR Measurement

Measure the Q7607 FSR.

Specifications: 150 GHz ± 15 GHz (10G channel is used.)

300 GHz ± 15 GHz (50G channel is used.)

Required devices: Optical tunable light source
Optical power meter (calibrated for 1550 nm wavelength)
Wavelength meter (calibrated for 1550 nm wavelength)

Procedures

1. Connect equipment as shown in Figure 4-3.

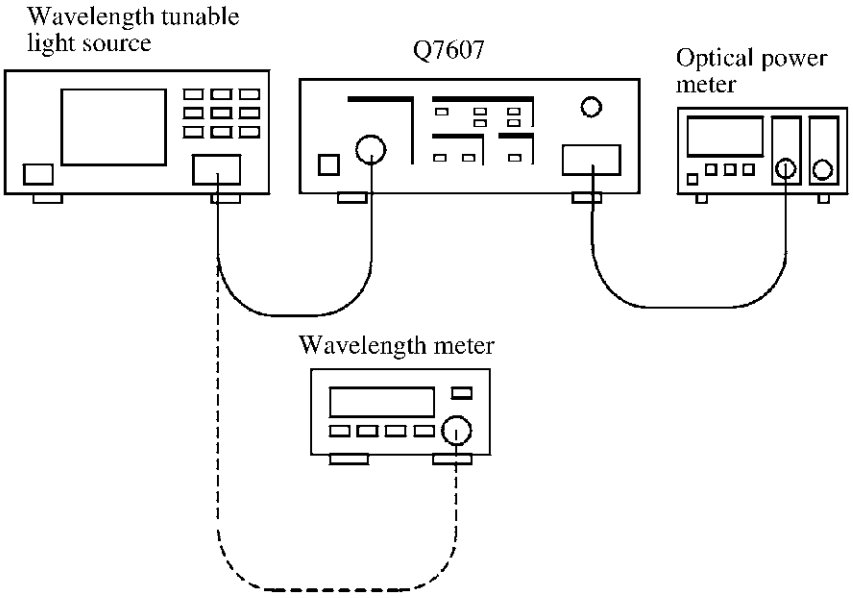


Figure 4-3 Setup for Measuring a FSR Measurement

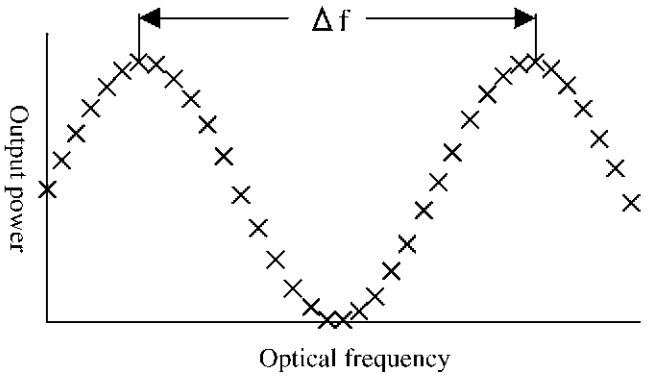
2. Connect the wavelength tunable light source to the wavelength meter.
3. Sweep the wavelength tunable light source according to the conditions in Table 4-1.

Table 4-1 Wavelength Tunable Light Source Setting Value

FSR	Output (dBm)	Sweep Range (nm)	Cycle (nm)
150	0	1550 to 1552	0.005
300	0	1550 to 1554	0.01

4. Measure the optical frequencies (f1, f2, f3, ...) for each sweep of the wavelength tunable light source.

5. Connect the wavelength tunable light source output to the Q7607 input. Connect the power meter input to the Q7607 output.
6. Press the **IM-MONITOR** key on the Q7607 front panel.
7. When the LED on the IM-MONITOR lights up, sweep the wavelength tunable light source according to the conditions in Table 4-1.
8. Measure the optical power meter values (P1, P2, P3, ...) for each sweep of the wavelength tunable light source.
9. Plot a graph using the waveform (fn) for the horizontal axis and power (Pn) for the vertical axis.
10. Calculate the optical frequency difference Δf between the peaks.



The above procedures must be performed for both 10G and 50G channels.

Reference specification: 135 GHz ≤ Δf ≤ 165 GHz (10G)
285 GHz ≤ Δf ≤ 315 GHz (50G)

4.2 Performance Verification Result

The performance verification results recorded using the procedures in Section 4.2 are described in the table below:

Test Item	RATE	Specification	Lower limit	Measurement value	Upper limit	Judgement	Unit
Insertion Loss (When no options)	10G	≤ 13	0		13		dB
	50G	≤ 13	0		13		dB
Output optical power (When options are installed)	10G	-3 to 0	-3		0		dBm
	50G	-3 to 0	-3		0		dBm
FSR measurement	10G	150 ± 15	135		165		GHz
	50G	300 ± 15	285		315		GHz

5. REMOTE PROGRAMMING

5.1 GPIB Command Index

This GPIB command index can be used as the index for Chapter 5.

5.2 Overview

The Q7607 allows remote control through the built-in IEEE 488-1987 measurement bus called GPIB (general purpose interface bus).

5.2.1 Overview of GPIB

The GPIB is an interface system allowing to configure an automatic measurement system by connecting the measurement device, controller, peripheral units, etc., through simple bus cables.

The GPIB system is advantageous in that it is more expandable than conventional interface systems, provides electrical, mechanical, and functional compatibility with other manufacturers' products, and is applicable to various system configurations ranging from those containing only one bus cable to those with high-level functions.

To use the GPIB system, first set an address for each of component devices connected to the bus line. Each component device can be assigned one or more roles from the three roles: controller, talker, or listener. Only one talker can send data to the bus line, and plural listeners can receive it. The controller specifies the talker and listener addresses, transfers data from talker to listeners, or can itself become a talker to set measurement conditions, etc. for the listeners.

Data are transferred asynchronously both ways between devices via eight data lines in the bit-parallel, byte-serial form. Because this is an asynchronous system, it is possible to mix high-speed and low-speed devices in the same system.

Data (messages) transferred between the devices include measurement data, measurement conditions (programs), various commands, and so forth; they are in ASCII code.

In addition to eight data lines, there are three handshake lines for transferring asynchronous data between devices, and five control lines for controlling the information flow on the bus.

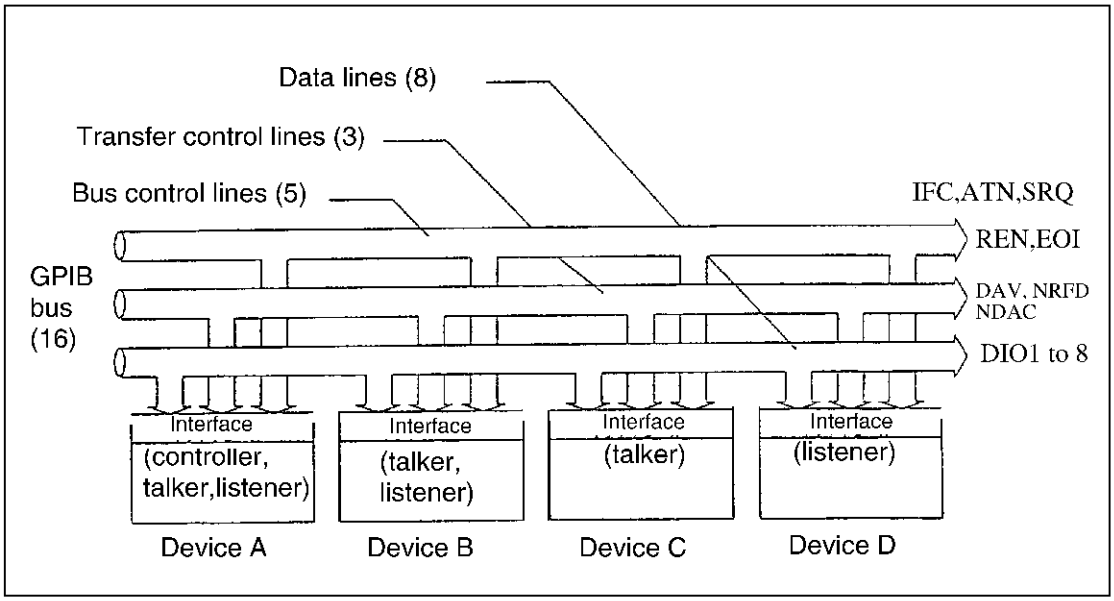


Figure 5-1 GPIB Bus Line Configuration

1. The handshake lines transfer the following signals:

DAV (Data Valid)	Indicates the validity of data.
NRFD (Not Ready For Data)	Indicates readiness to receive data.
NDAC (Not Data Accepted)	Indicates completion of data reception.

2. The control line transfers the following signals:

ATN (Attention)	Used to recognize the signal on the data lines as an address, command, or neither of the two.
IFC (Interface Clear)	Used to clear the interface.
EOI (End of Identify)	Used at the end of information transfer.
SRQ (Service Request)	Used by any device to ask the controller for a service.
REN (Remote Enable)	Used for remote control of devices applicable to remote programming.

5.2.2 GPIB and the Q7607's GPIB Specifications

Applied standards:	IEEE 488-1978
Code used:	ASCII
Logic level:	Logical "0" (HIGH) ... +2.4 V or more
	Logical "1" (LOW) ... +0.4 V or less
Driver specifications:	Open-collector format (except EOI or DAV)
	Output voltage in LOW ... +0.4V or less, 48 mA
	Output voltage in HIGH ... +2.4V or more, -5.2 mA
Receiver specifications:	LOW for +0.6 V or less, HIGH for +2.0 V or more
Address specification:	31 talker/listener addresses can be set by the ADDRESS switch.
Cable length:	The total bus cable length in a single bus system should not exceed n x 2m, where n = the number of devices to be connected, including the GPIB controller. In no case should the cable length exceed 20m.
Connector:	24-pin GPIB connector 57-20240-D35A (equivalent to Amphenol's products)

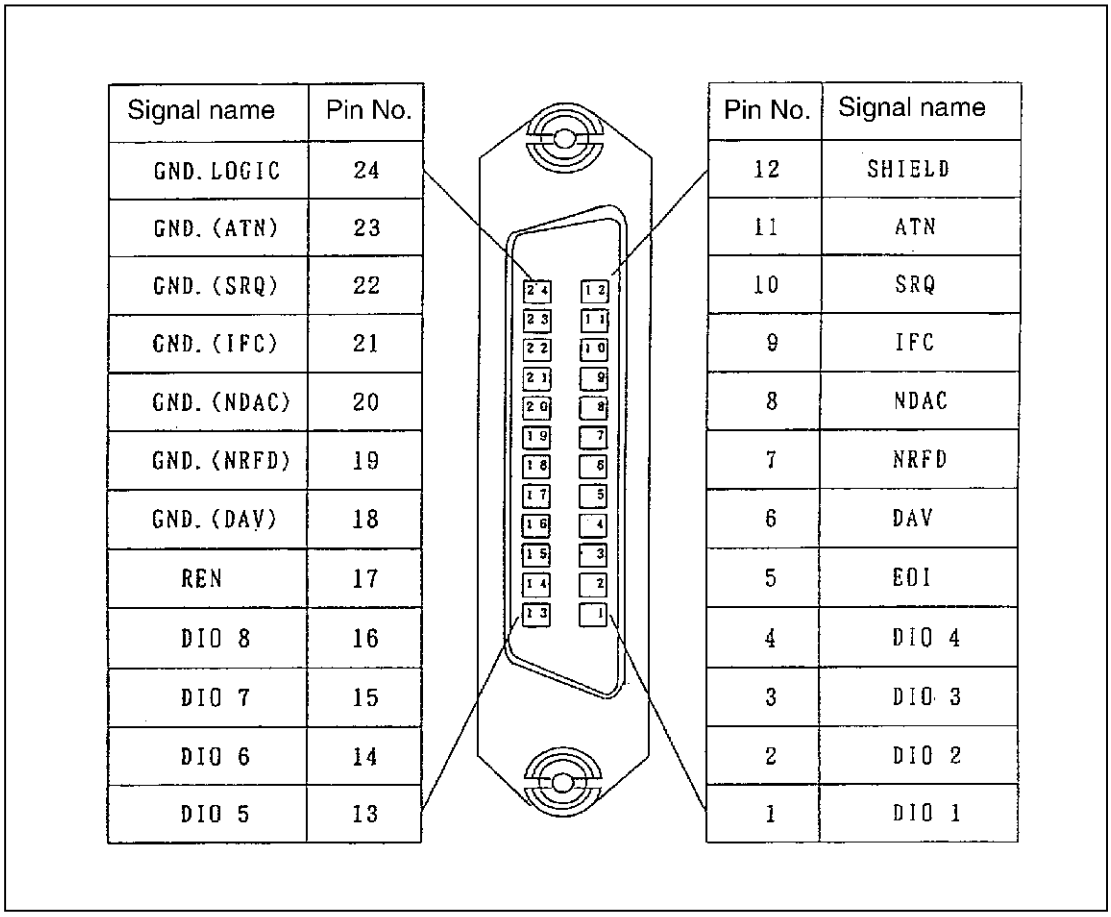


Figure 5-2 GPIB Connector Pin Assignments

5.3 Interface Functions

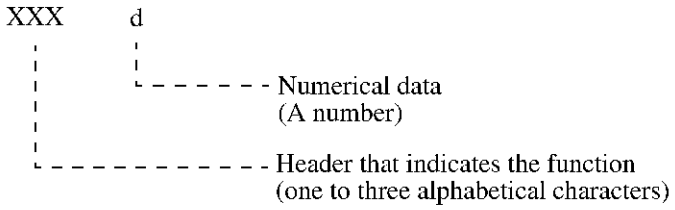
Table 5-1 shows analyzer interface functions.

Table 5-1 Interface Functions

Code	Function
SH1	Source handshake
AH1	Acceptor handshake
T6	Basic talker Serial polling Talker reset based on listener specification
L4	Basic listener Listener reset based on talker specification
SR1	Service request
RL1	Remote
PP0	No parallel polling
DC1	Device clear
DT1	Device trigger
C0	No controller function
E2	Three-state-bus-driver used

5.4 Program Code

This section explains program codes used to set individual conditions from an external controller.
The individual program codes consist of one to three characters that represent the functions described below and numerical data used to set the value.

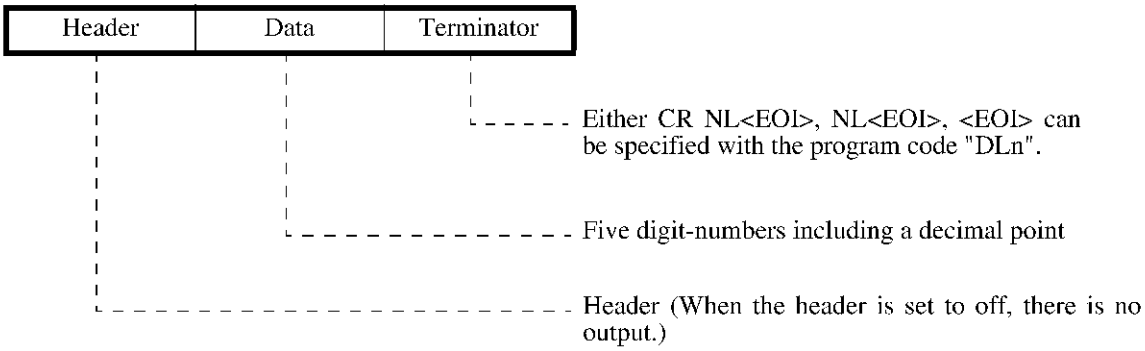


NOTE:

1. ***This instrument executes the program code one row at a time.***
   A maximum of 40 characters can be set on one row.
2. ***Upper and lowercase characters can be used for both the function header and units. Any space code (20H) can be used in the program code.***
3. ***If the ATN request is interrupted during message transfer, the previous transfer states are released.***

5.5 Talker Format (Data Output Format)

This section explains the Talker format used to send data from the Q7607 to an external controller.



Header	Contents
FSR	FSR
RE	Input status

5.6 Device Clear Function

The Q7607 is initialized by the address specification command SDC (Selected Device Clear), universal command DCL (Device Clear) at such times as when the program code C is received.

Table 5-2 shows the initial status when the Q7607 power is turned on.

Table 5-2 The Initial Status When the Q7607 Power is Turned on

Items	Initial status
Controlling the polarization adjustment	ON
Modulated signal rate	50 Gbps
Wavelength bandwidth	C bandwidth
GP-IB Status byte Sending the SRQ signal Terminator String delimiter	 0 (clear) S0 (Mode in which the SRQ signal is send) DL0:(CR NL <EOI>) SL0:,

5.7 Status Change by Each Command

When the Q7607 power is turned on or each command is received, the status changes as described below:

Table 5-3 Status Change by Each Command

Command code	Talker	Listener	Remote	SRQ	Status byte	Parameter and operating status
POWER ON	Clear	Clear	Local	Clear	Clear	Initialization
IFC	Clear	Clear	-	-	-	-
DCL	-	-	-	Clear	Clear	Initialization
SDC	Clear	Set	-	Clear	Clear	Initialization
C	Clear	Set	Remote	Clear	Clear	Initialization
Specifying the Q7607 as Talker	Set	Clear	-	-	-	-
Talker reset for the Q7607	Clear	-	-	-	-	-
Specifying the Q7607 as Listener	Clear	Set	-	-	-	-
Listener reset for the Q7607	-	Clear	-	-	-	-
Serial polling	Set	Clear	-	Clear	-	-

5.8 Status Byte

When the Q7607 is set to the "S0" mode and all bits of the status byte are set to 1, a SRQ signal is sent to the controller.
When the SRQ signal is sent to the controller, the controller executes the serial pole, and then the Q7607 sends the status byte to the controller.

Status byte

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Range Error	RQS	Hardware Error	IM-MONITOR	IM-FM	IM+FM	Syntax Error	Ready

Bit 0: When RESET is completed, 1 is set.

Bit 1: Syntax error

Bit 2: When the IM+FM mode is locked, 1 is set.

Bit 3: When the IM-FM mode is locked, 1 is set.

Bit 4: When IM-MONITOR is set, 1 is set.

Bit 5: When a hardware error occurred, 1 is set

Bit 6: Mode in which the SRQ signal is send: When one or more bits of Bit 0 through Bit 5 is set to 1, 1 is set.
Mode in which the SRQ signal is not send: This is always 0.

Bit 7: "OVER" or "UNDER" (By the Query command "RE?")
0; No Error
1; OVER
2; UNDER

5.9 GPIB Command List

The GPIB Commands for the Q7607 are listed as described below:

Function		Listener code	Talker request		Remarks
			Code	Output format	
Measure-ment	Measurement mode setting	MDx	MD?	MDx	X = -1: Measurement mode is not specified. (Read only) X =0: Executes RESET X =1: Executes IM+FM X =2: Executes IM-FM X =3: Executes IM-MONITOR
	Polarization adjust-ment ON and OFF	AJx	AJ?	AJx	X =0: Not operated X =1: Operated (Initial status)
	Modulation signal rate setting	RTx	RT?	RTx	X = 0: 10 Gbps X = 1: 50 Gbps (Default)
	Wavelength band-width setting	WLx	WL?	WLx	X = 0: C Bandwidth (Default) X = 1: L Bandwidth
	FSR readout	-	FSR?	FSRxxx.x(string delimiter) yyy.y	xxx.x: FSR in the 10 Gbps mode yyy.y: FSR in the 50 Gbps mode
Configu-ration	Reset	C	-	-	Block delimiter: CR/LF+EOI String delimiter:, Measurement mode: -1 Polarization adjustment: Operated
	Block delimiter set-ting	DLx	DL?	DLx	X = 0: CR/LF+EOI (Default) X = 1: LF X =2: EOI
	String delimiter mode setting	SLx	SL?	SLx	Parameter X = 0: , (Default) X = 1: _ (Space) X =2: CR/LF
	SRQ setting	Sx	S?	Sx	X =0: Send SRQ X =1: Do not send SRQ
	Clearing status	CS	-	-	
	Input level detection	-	RE?	REx	x=0: appropriate level x=1: OVER x=2: UNDER

The output format with the header or without the header can be selected with the GPIB setting on the rear panel.

5.10 Example Programs

This section describes remote control examples used with GPIB port.

CAUTION: ***Visual Basic 5.0 (referred to as VB henceforth) is used in the sample programs shown here. Also, National Instruments-made GPIB board (referred to as NI-made for brevity henceforth) is used for the GPIB control board; NI-made driver is used for the control driver.***

- Sample program 1

  The following program is used to reset the instrument and set the IM+FM and IM-FM measurements.

```
Dim boardID%, Dev%
Dim Q7607 As Integer
Dim sp As Integer
Dim RD As String

boardID = 0                                              'GPIB initialization
Q7607 = ildev(boardID, 3, 0, T3s, 1, BIN + XEOS + LF)    'Q7607 GPIB setting

Call ibwrt(Q7607, "CS")
Call ibwrt(Q7607, "MD0")                                 'RESET

Debug.Print "RESET"
'********************RESET
Do                                                       'Waits for reset completion.
  Call ibrsp(Q7607, sp)
  If sp = 2 Then Exit Do
  DoEvents
Loop

Debug.Print "IM+FM Setting..."                            'IM+FM
'********************IM+FM
Do                                                       'Waits for IM+FM measurement.
  Call ibrsp(Q7607, sp)
  If sp = 5 Then Exit Do
  DoEvents
Loop
Debug.Print "IM+FM Set"

'
'Read IM+FM DATA from OSC
'

Call ibwrt(Q7607, "CS")
Call ibwrt(Q7607, "MD2")                                 'IM-FM

Debug.Print "IM-FM Setting..."
'********************IM-FM
Do                                                       'Waits for IM FM measurement.
  Call ibrsp(Q7607, sp)
  If sp = 8 Then Exit Do
  DoEvents
Loop
Debug.Print "IM FM Set"

'
'Read IM FM DATA from OSC
'

ibonl Q7607, 0                                           'GPIB completion
```

- Sample program 2

  The following program is used to set the output of the instrument to IM-Monitor.

```
Dim boardID%, Dev%
Dim Q7607 As Integer
Dim sp As Integer
Dim RD As String

boardID = 0                                              'GPIB Initialization
Q7607 = ibdev(boardID, 3, 0, T3s, 1, BIN   XEOS + LF) 'Q7607 GPIB setting

Call ibwrt(Q7607, 'CS')
Call ibwrt(Q7607, 'MD3')                                 'IM-MONITOR

Debug.Print 'IM MONITOR Setting...'
'********************IM-MONITOR
Do                                                       'Waiting for setting completion.
  Call ibrsp(Q7607, sp)
  If sp = 16 then Exit Do
  DoEvents
Loop

Debug.Print 'IM-MONITOR Set'                             'IM-Monitor setting completion


ibonl Q7607, 0                                           'GPIB completion
```

6. OPERATING PRINCIPLES

This section explains the principles of the way in which the Q7606A/B can be used to separate and measure the chirpform frequency modulation (FM) and intensity modulation (IM) characteristics.

6.1 Operating Principles

6.1.1 Separating FM and IM Components

In order to separate the FM and IM components from each other, two different measurement points of the Mach-Zehnder interferometer are used for measurement (see Figure 6-1.) While the interferometer is in state A, it outputs both the IM and FM components in the same phase (IM+FM). In contrast, in state B, the interferometer outputs the IM and FM components in the reverse phase (IM-FM). Same phase data (IM+FM) and reverse phase data (IM-FM) can be obtained using the sampling oscilloscope, and then IM and FM data can be separated by calculating the sum and difference between those two data with a personal computer.

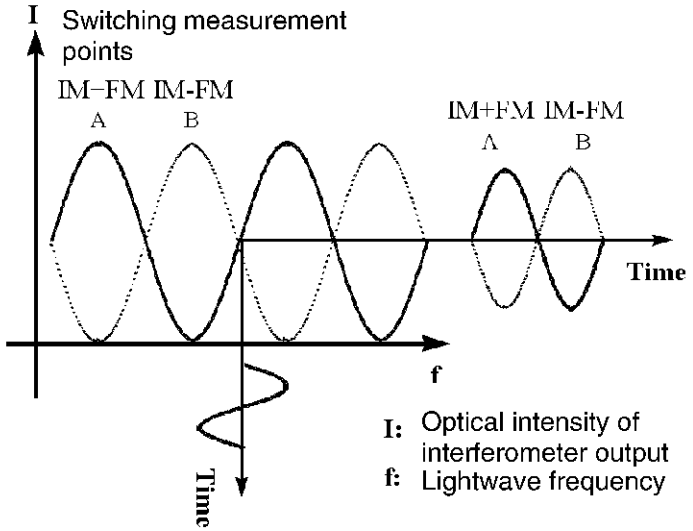


Figure 6-1 Switching Measurement Points of the Mach-Zehnder Interferometer Lightwave Frequency Discriminator

6.2 Interferometer Characteristics and Q7607 Operations

The Q7607 has a pair of interferometers: HIGH-SENS and WIDE-BAND. This section describes the relationships between the interferometer characteristics and Q7607 operations.

The characteristics of the Q7607's built-in Mach-Zehnder interferometer are given below.

1. Interferometer characteristics measured by RESET

   The interferometer output maximum and minimum values are obtained by shifting the lightwave frequency discriminated characteristics. Data obtained here is used when the IM+FM and IM-FM settings are performed.

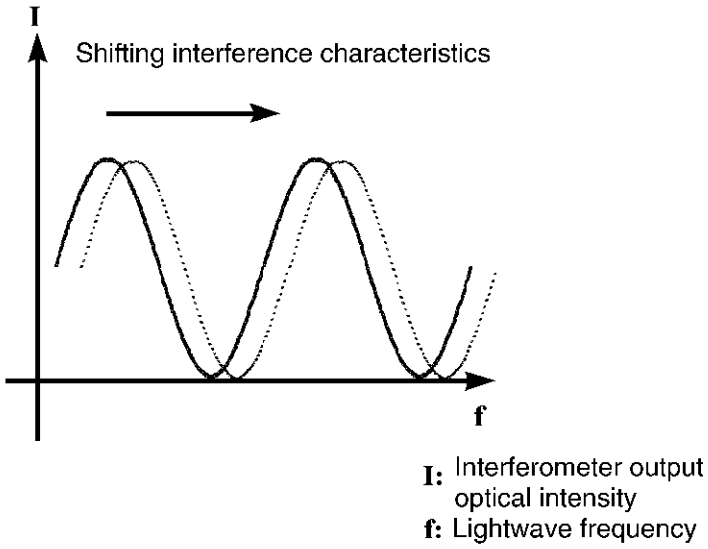


Figure 6-2 Interferometer Characteristics Measured by RESET

2. Interferometer characteristics measured by IM+FM

   The lightwave frequency-discriminate characteristics are controlled so that the interferometer output is the sum of the IM and FM characteristics.

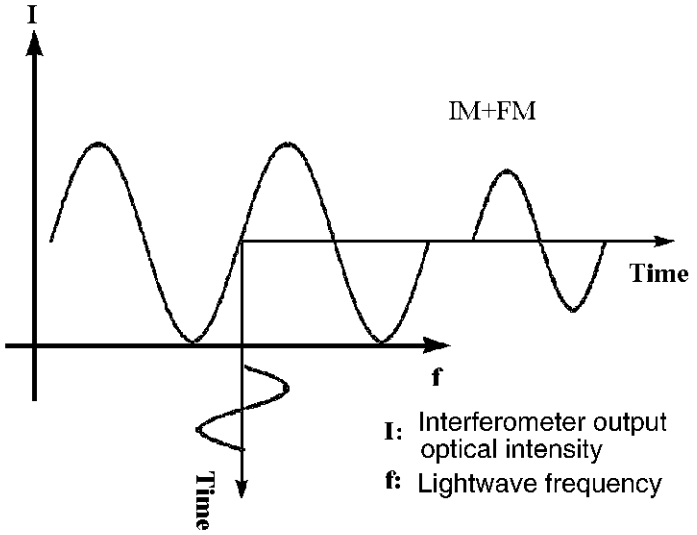


Figure 6-3 Interferometer Characteristics Measured by IM+FM

3. Interferometer characteristics measured by IM-FM

   The lightwave frequency-discriminate characteristics are controlled so that the interferometer output is the difference between the IM and FM characteristics.

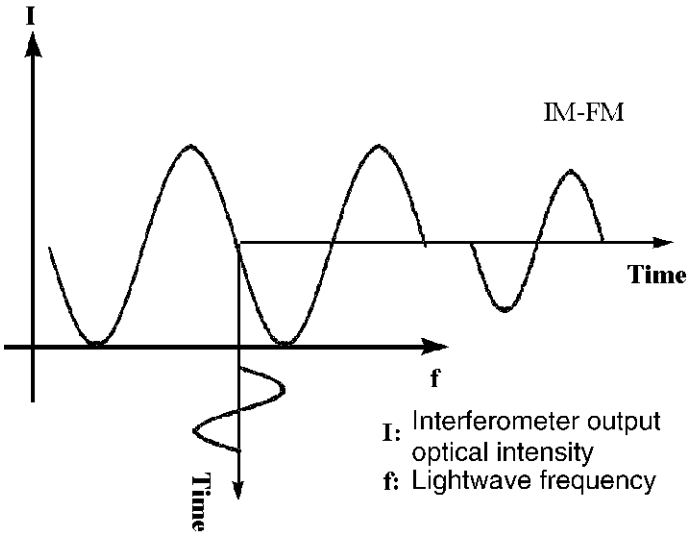


Figure 6-4 Interferometer Characteristics Measured by IM-FM

4. Interferometer characteristics measured by IM-MONITOR

   The lightwave frequency-discriminate characteristics are controlled so that the interferometer output is the IM characteristics only.

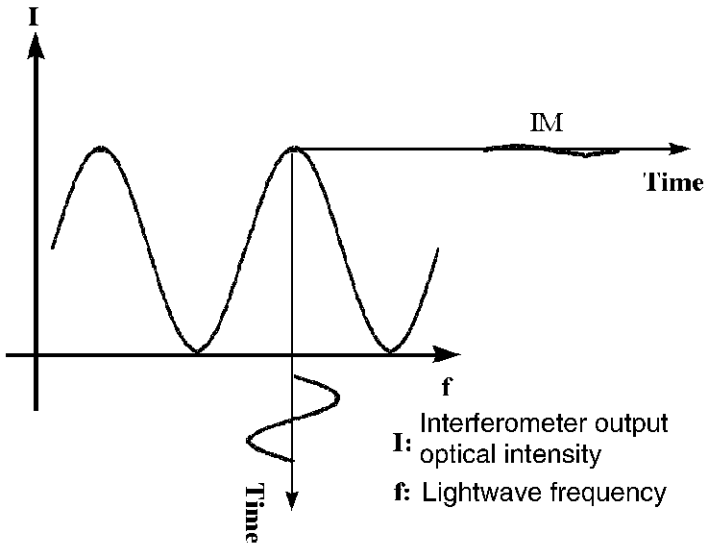


Figure 6-5 Interferometer Characteristics Measured by IM-MONITOR

6.3 System Block Diagram

The system block diagram is shown below:

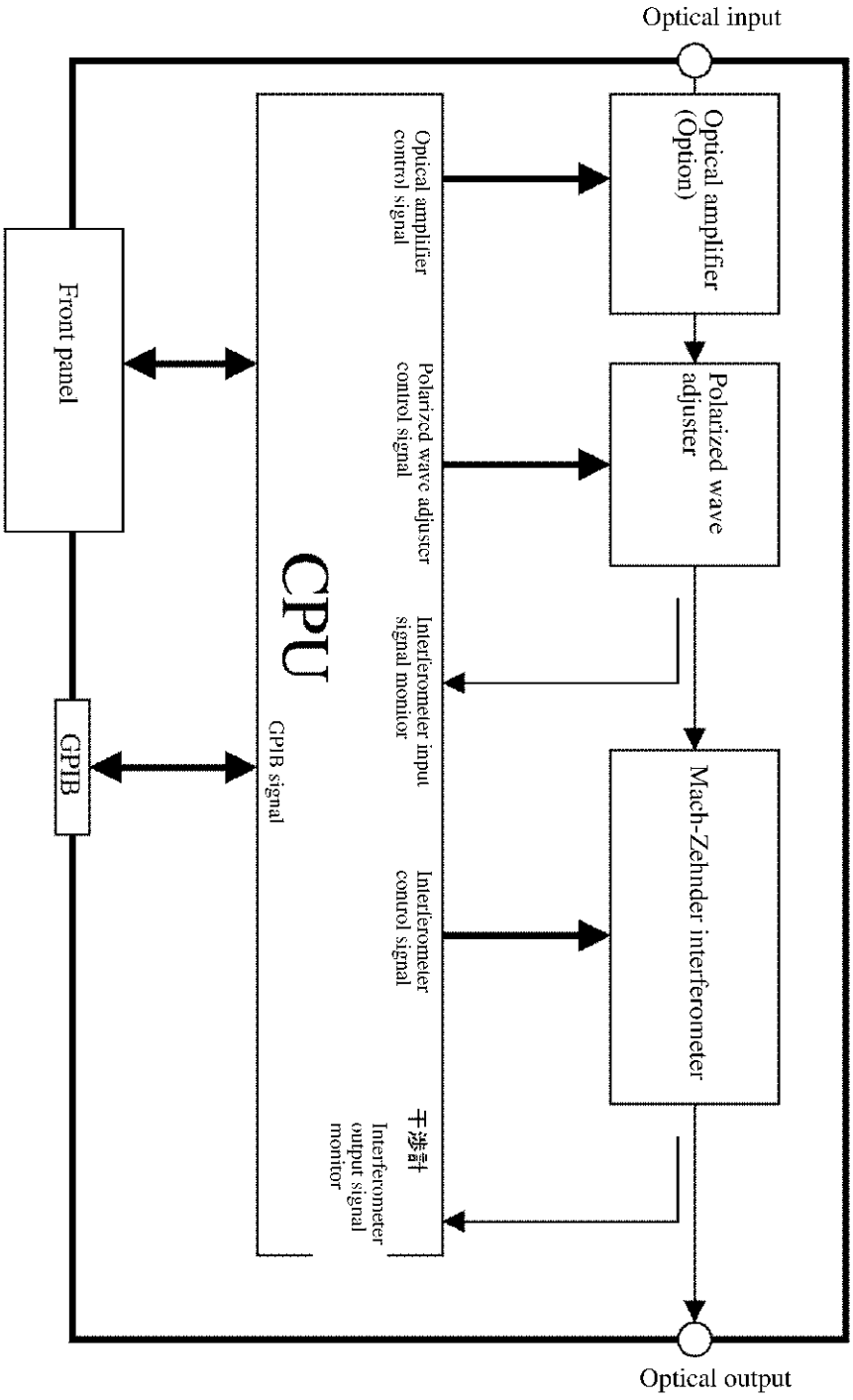


Figure 6-6 System Block Diagram

7. SPECIFICATIONS

1. Main specifications *1

Item	Q7607	OPT7607+10
Wavelength measurement range	1510 nm to 1610 nm	1530 nm to 1610 nm
Incident light range	-10 dBm to +10 dBm	
Frequency conversion accuracy	± 15 % or less	
Demodulation coefficient (10 G and 50G) *2	P × 0.042/GHz / P × 0.021/GHz	
FSR (10 G and 50G)	150 GHz ± 15 GHz / 300 GHz ± 15 GHz	
Demodulation bandwidth (10 G and 50G) *3	100 Hz to 50 GHz / 100 Hz to 100 GHz	
Demodulation frequency Deviation	65 GHz_{P-P} or less / 135 GHz_{P-P} or less	
Insertion loss	13 dB or less	-
Output level	-	-1.5 dBm ± 1.5 dB *4
Incident light polarization compensation	Yes	

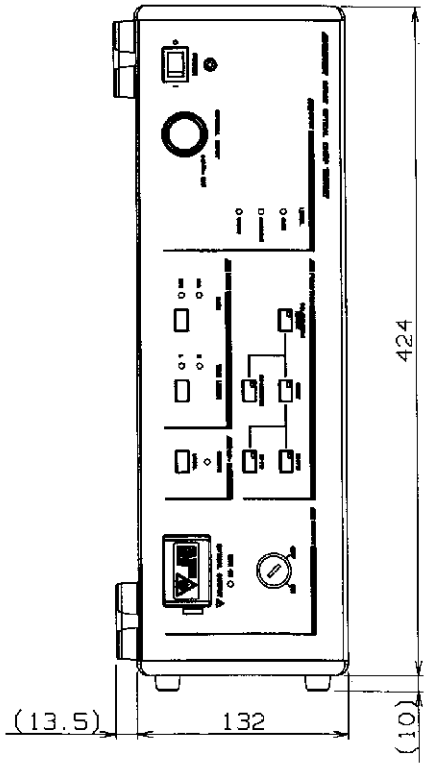
*1: With 23 °C ± 5 °C
*2: P indicates the average optical power
*3: Range of 1 dB down with 100 MHz as center.
*4: Total output power, Repeatability after setting of measuring point

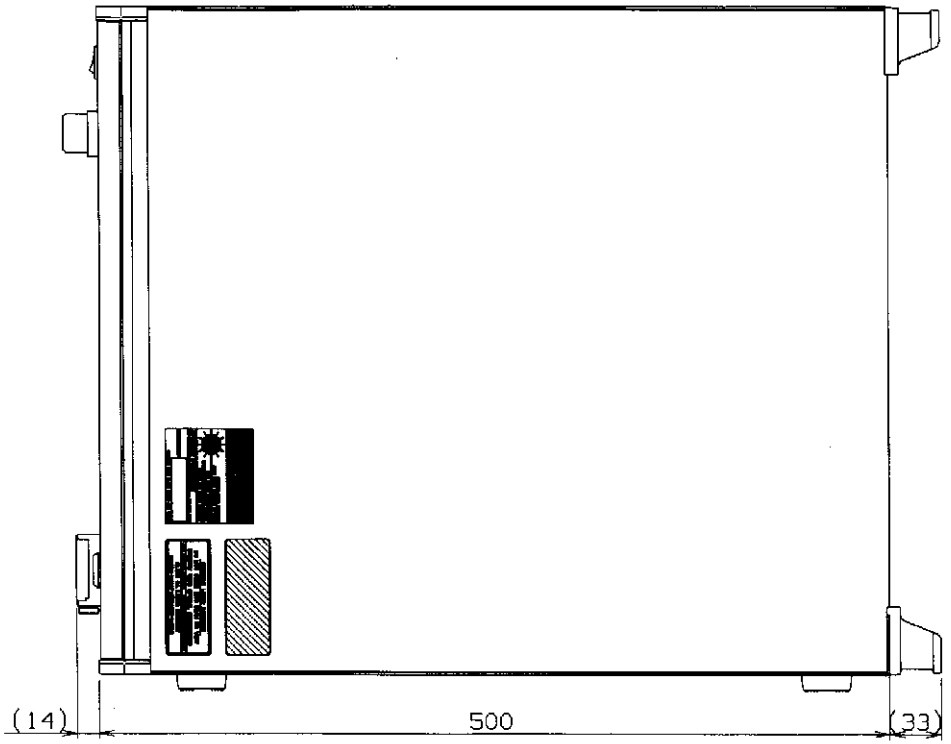
2. Interface specifications

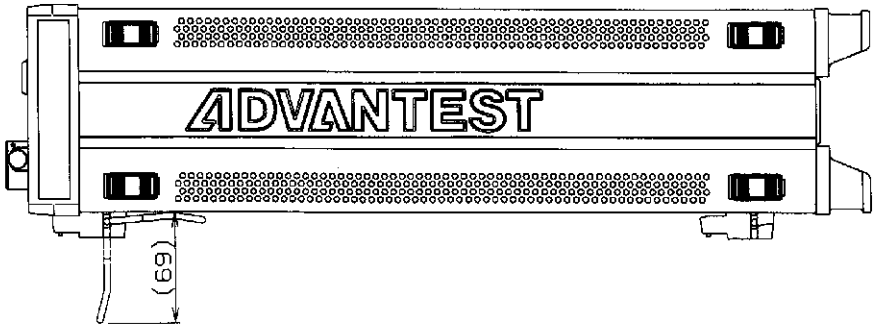
Item	Contents
Optical Input and output	FC and PC connectors (FC type and PC type are also available)
GPIB	Conforming IEEE488-1978
Optical remote interlock	BNC connector (Used only when OPT10 is installed in the instrument.)

3. General specifications

Item	Specifications
Operating environment	Temperature: 0 °C to 40 °C
	Relative humidity: 85 % or less (non-condensing)
Storage conditions	Temperature: -20 °C to 60 °C
	Relative humidity: 90 % or less (non-condensing)
Power supply	100 VAC to 120 VAC, 220 VAC to 240 VAC, 50 or 60 Hz, 100 VA or less
	100 VAC and 200 VAC: automatically selected
External dimensions	Approx. 424 (W) × 132 (H) × 500 (D) mm
Mass	13 kg or less







Unit : mm

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

DIMENSIONAL OUTLINE DRAWING

ALPHABETICAL INDEX

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

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

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

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

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

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

CUSTOMER SERVICE DESCRIPTION

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

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

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

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