AQ8460 series

Optical Component Analyzer

Instruction Manual

ANDO ELECTRIC CO., LTD.

AS-62563 Rev. 2.6

WARRANTY

All Ando Electric's products have been inspected with our severe quality assurance standards. However, if any defect or trouble occurring during transportation is found, contact to our service agency.
Do not repair a defective ANDO's product by yourself in order to avoid any physical damage. A repair of defective ANDO's product must be performed by a service engineer approved by ANDO ELECTRIC CO.,LTD.

Ando Electric will replace, at no charge, the defective product(s) that occur within one year of the original date of product delivery.
However, the defects due to an operation error, modification or retrofit by the customer, or those caused by the natural disasters are serviced with charge.

Hazard Identification

This manual uses the following hazard identification markings that the operators and service personnel must be aware of all hazards associated with this system.

1. Dangers, Warnings, Cautions, and Notes

(1) Priority of hazard information

The priority of hazard information is as follows:

Danger > Warning > Caution > Note

(2) Meanings of hazard information

Danger: Identifies immediate hazards that will result in death or severe personal injury. This is the highest priority hazard identification marking.

Warning: Identifies hazards or unsafe practices that can result in severe personal injury.

Caution: Identifies hazards or unsafe practices that can result in damage to system units or can "interrupt" system operations.

Note: Identifies an auxiliary information about exceptional rules, corrections, and restrictions.

2. Reference Pages

The page or pages that you should refer to are shown.
An example of "(->2-1)".

3. Pictorials of Operation Keys

This manual shows the system operation keys as follows:

[ ] : Indicates a panel switch.
< > : Indicates a soft key.

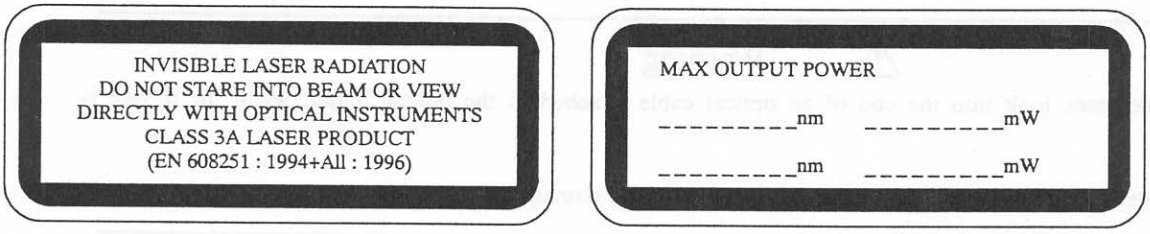
Initial Safety Information for Laser Source

The Specifications are as follows:

	AQ8460	AQ8460L
Laser Type	EC-Laser(*1)	←
	InGaAsP	←
Laser Class According to EN60825-1:1994+All:1996	3A	←
Output Power	>-3dBm	>-6dBm
Beam Diameter	10 μ m	←
Numerical Aperture	0.1	←
Wavelength	1500 to 1580nm	1520 to 1620nm

(*1) As for EC-Laser , External Cavity Laser is abbreviated.

⚠ Note



Check that the wavelength and light emission written on the attached safety caution seal (the same as the one in the center on the above) satisfy the above specifications.

You MUST return instruments with malfunctioning laser boxes to Service Center for repair and calibration.

⚠ Warning

Use of controls or adjustments or performance of procedures other than those specified for the laser source may result in hazardous radiation exposure.

⚠ Warning

Refer Servicing only to qualified and authorized personnel

⚠ Warning

Do not emit a laser light when an optical fiber is not connected on the optical output connector.

The optical output connector is located on the front panel.

The laser light is emitted when "LD ON/OFF" button is pressed.

"LD ON/OFF" button is located on the front panel ,just left side of the optical output connector.

A green LED on the front panel goes on while a laser light is emitted.

⚠ Warning

Under no circumstances look into the end of an optical cable attached to the optical output when the device is operational.

The laser radiations not visible to the human eye, but it can seriously damage your eyesight.

- ○ Read this manual and the precautions for safety in it carefully before using the device.
- ○ Maintain this manual at a location easy to access.

Precautions for Safety

This manual employs the following safety alert symbols to provide basic safety rules and precautions. They are intended to ensure correct use of the product and thus to prevent personal injury that could occur to your or other persons and physical damage. The meaning of the safety alert symbols are as follow.

Please take the time to familialize yourself with this section before going to other sections of this manual.

- Safety precautions and rules to be observed are identified with the following safety alert symbols:

This symbol represents safety precautions or rules (including Warning and Danger notices) that require users' attention.
(Actual "Signal Word" is entered inside the symbol.)

This symbol represents safety precautions or rules users must observe.
(Actual "Signal Word" is entered inside the symbol.)

This symbol represents banned user actions.

- Sample safety alert symbols

 **WARNING**	This symbol identifies hazards which can result in death or serious personal injury if this warning is unheeded and the system is improperly handled or operated.

 **CAUTION**	This symbol identifies hazards which can result in personal injury or physical damage if this caution is unheeded and the system is improperly handled or operated.

	This symbol identifies hazards which can result in fuming or fire hazard if this caution or safety rule is unheeded and they system is improperly handled or operated.
	This symbol identifies hazards which can result in electric shock if this precaution or safety rule is unheeded and the system is improperly handled or operated.
	This symbol identifies hazards which can result in bodily hurt if this precaution or safety rule is unheeded and the system is improperly handled or operated.
	This symbol instructs to remove the power plug from the plug outlet to ensure work safety.
	This symbol identifies general safety rules to be observed by users.

1. Restrictions on the Operating Environment

	Take care so that water may not flow into the system or the system may not be exposed to water, otherwise fire hazard, electric shock or system failure can result.
	Connect the system to the ground before starting it up, otherwise electric shock or system damage can result.

2. Restrictions on the Operating Conditions

	Don't operate the system at any other voltages than the specified, otherwise fire hazard, electric shock or system failure can result.
	When this system is operated on the supply mains, it must be directly connected to the dedicated plug outlet.
	Don't use an extension cord since it can cause overheat and thus fire hazard.

3. Setup and Installation Work

3.1 Precautions intended for setup and installation personnel

	Avoid disorderly, complex wiring from the power supply, otherwise cable overheating or fire hazard can result.
	Insert the power plug securely to the plug outlet, otherwise fire hazard or electric shock can result if a metal piece touches the power plug.

3.2 Restrictions and bans on the installation environment and conditions

	Don't install the system into a highly humid or dusty place, otherwise electric shock or system failure can result.
	Don't install the system on an unstable base or inclined place, otherwise personal injury can result when it falls or tumbles down.
	Don't install the system in a place exposed to severe vibrations or shocks, otherwise personal injury can result when it falls or tumbles down.
	Don't insert or drop a metal bar from the system openings, otherwise fire hazard, electric shock or other personal injury can result.
	Keep the power cord away from the heating units, otherwise fire hazard or electric shock can result from the damaged coating.
	Hold the plug portion when pulling the power cord out of the outlet, otherwise fire hazard or electric shock can result from the damaged cord.
	Don't handle the power cord with wet hands, otherwise electric shock can result.
	Don't place the system in a high temperature environment such as a place exposed to direct sunlight or inside of a vehicle, otherwise system failure can result from overheating of inside the system.

3.3 Banned actions in the system installation

	Don't try to move the system without making sure that the power plug has been removed from the plug outlet and external connection cables have been disconnected.
	Don't block the system ventilation hole, otherwise fire hazard can result from the entrapped heated air inside the system.
	Don't damage or rework the power cord, otherwise fire hazard or electric shock can result from the cord damaged by heavy substance placed on it, excessive heat or tension applied to it.

4. Precautions Before Starting the System

Please read this instruction manual carefully and familiarize yourself with the information provided in it.

5. Usage

	Operate the system in accordance with the procedure provided in the instruction manual.
	When a safety alert symbol (Warning, Danger or Caution mark) is provided, operation instructions provided in the manual must be heeded.
	Area surrounding the system must be free of a water filled container or metal pieces, otherwise fire hazard, electric shock or system failure can result from the spilt water or dropped metal piece.
	Some modules to be connected to this equipment use an angled PC connector. Failure may occur if other connectors are connected to them.
	Don't rework the power cord nor forcibly bend, twist or pull it, otherwise fire hazard or electric shock can result.
	Don't try to disassemble or retrofit the system, otherwise fire hazard, electric shock or bodily injury can result.
	When the system is not to be used for a long period of time, remove the power plug from the plug outlet to ensure safety, otherwise fire hazard, electric shock or system failure car result from lightning.
	Use caution when opening or closing doors on the system so that your fingers may not be pinched.
	The power plug must be removed from the plug outlet whenever a fuse replacement takes place, otherwise electric shock or the system damage due to shorting can result.
	Don't use any fuse other than one having the specified rating and property, use of a short bar can aggravate should an accident happened. It can also cause fire hazard.

6. Maintenance and Inspection

Periodic system maintenance and inspection is recommended.

When you have any question on the maintenance or inspection, contact us at the list attached to the end of this manual.

	Dusts settled inside the system for a long period can cause fire hazard or system failure.

7. Actions Required for a System Failure

	If the power cord is damaged, contact us for its replacement. Continued use of such cord can cause fire hazard or electric shock.
	Should a foreign substance dropped into the system, turn the system power off first, then remove the power cord from the plug outlet and contact us. Fire hazard, electric shock or system failure can result from continued use of the system in such state.
	Should an abnormal state such as fume, smoke or offensive odor is detected on the system, turn the system power switch off immediately, then remove the power plug from the plug outlet. Making sure that fume or smoke is not present any more, contact us for repair. Continued use of the system in such state can result in fire hazard, electric shock or system failure. Never try to fix the trouble on your own. It is an extremely dangerous try.
	Should the system is dropped or damaged, turn the system power off, remove the power plug from the plug outlet, then contact us. Continued use of the system in such state can result in fire hazard, electric shock or system failure.
	Should the system failed, customers strongly advised not to try fix the failure, otherwise electric shock or personal injury can result. Our warranty is not applicable to the system repaired without previous notice to and consent from us.

8. Precautions on Disposal

	Don't place the system in fire for its disposal, otherwise fire hazard or bum can result if it exploded.
	The TFT color LCD panel of AQ8460 contains cold cathode fluorescent lamps. Please follow local ordinances or regulations for its disposal.

Table of contents

Figure contents

Table contents

Appendix

Attached diagram table

AQ8460 OPTICAL COMPONENT ANALYZER (PMF output type)

OUTSIDE VIEW	ASD-62563-1/4
OUTSIDE VIEW (FRONT)	ASD-62563-2/4
OUTSIDE VIEW (REAR)	ASD-62563-3/4
OUTSIDE VIEW (WHEN THE COVER IS OPENED)	ASD-62563-4/4

Note

The difference point on externals of AQ8460 and AQ8460L is only a model name.
Therefore, only the externals chart of AQ8460 is appended in this manual.

AQ8461 EXPANSION FRAME

OUTSIDE VIEW	ASD-62571-1/3
OUTSIDE VIEW (FRONT)	ASD-62571-2/3
OUTSIDE VIEW (REAR)	ASD-62571-3/3

AQ8461-23 8 SENSOR MODULE (It is an example for the FC connector.)

OUTSIDE VIEW	ASD-62571-23

AQ8461-71 RLM MODULE

OUTSIDE VIEW	ASD-62571-71

AQ8461-91 VENT COVER

OUTSIDE VIEW	ASD-62571-91

AQ8461-93 VENT COVER

OUTSIDE VIEW	ASD-62571-93

Chapter 1 Outline

This publication explains how to use the AQ8460 series OPTICAL COMPONENT ANALYZER.
Moreover, AQ8461 EXPANSION FRAME and various modules are explained.

1.1 System Outline

The AQ8460 series consists of two models by the difference of the wave length region.

AQ8460 : 1500 to 1580nm
AQ8460L : 1520 to 1620nm

It consists of two types by the presence of the attenuator respectively.
The type which the attenuator is built into can change the optical output power in the TLS mode.
In the type by which the attenuator is not built into, the optical output power is fixed.

1.2 Specifications

Each specification is shown as follows.

Table 1-1: AQ8460 specifications (1 of 3)

Model		AQ8460	Note
Wavelength changeable width		1500 to 1580nm	
Wavelength resolution		0.001nm	
Absolute wavelength accuracy		+/-0.01nm	at 1525 to 1565nm, 2 σ
Wavelength stability		+/-100MHz/h (+/-0.8pm/h)[typ]	
Width of spectrum line	When NARROW is set	1MHz or less	Note 1
	When WIDE is set	10MHz or more	
SMSR		> 60dB	Note 1
Optical output	STANDARD	> -3dBm	Note 1
	with ATTENUATOR	< +/-1.0dB	at 1550nm. Note 1,2
Optical, changeable attenuation function		> 20dB(0.1dB step)	Note 1
Optical output stability		< +/-0.01dB	Note 1, 23℃ fixed. For five minutes.
Optical output repeatability		+/-0.04dB	Note 1
Optical output flatness		+/-1.0dB	Note 1
Wavelength sweep speed		100nm/sec (maximum)	
Applicablle fiber		SMF	Note 3
Applicablle optical connector		FC/APC	Made by Seikoh Giken or equivalent
Insertion Loss (SPLITTER INPUT to OUTPUT)		< 8.4dB	at 1550nm
Dimensions		Approx.177(H)×425(W)×450(D) mm	
Weight		Approx.20kg	
Range of operation temperature		+10 to +35℃	
Range of storage temperature		-10 to +50℃	
Humidity		80% or less	
Power supply	Range of voltage	100 to 120VAC or 200 to 240VAC	
	Frequency	50/60Hz	
	Consumption electric power	Approx.150VA	

Note 1 : With the CW light and 2m fiber output point

Note 2 : At the optical output -3 to -23dBm setting. The connector connection loss is contained.

Note 3 : Please use the fiber with which the direction of the polarization agrees for the PMF output type.

Table 1-1: AQ8460 specifications (2 of 3)

Model		AQ8460L	Note
Wavelength changeable width		1520 to 1620nm	
Wavelength resolution		0.001nm	
Absolute wavelength accuracy		+/-0.015nm	at 1560 to 1610nm, 2 σ
Wavelength stability		+/-100MHz/h (+/-0.8pm/h)[typ]	
Width of spectrum line	When NARROW is set	1MHz or less	Note 1
	When WIDE is set	10MHz or more	
SMSR		> 60dB	Note 1
Optical output	STANDARD	> -6dBm	Note 1
	with ATTENUATOR	< +/-1.0dB	at 1590nm. Note 1,2
Optical, changeable attenuation function		> 17dB(0.1dB step)	Note 1
Optical output stability		< +/-0.01dB	Note 1, 23℃ fixed. For five minutes.
Optical output repeatability		+/-0.04dB	Note 1
Optical output flatness		+/-1.0dB	Note 1
Wavelength sweep speed		100nm/sec (maximum)	
Applicablle fiber		SMF	Note 3
Applicablle optical connector		FC/APC	Made by Seikoh Giken or equivalent
Insertion Loss (SPLITTER INPUT to OUTPUT)		< 8.4dB	at 1550nm
Dimensions		Approx.177(H)×425(W)×450(D) mm	
Weight		Approx.20kg	
Range of operation temperature		+10 to +35℃	
Range of storage temperature		-10 to +50℃	
Humidity		80% or less	
Power supply	Range of voltage	100 to 120VAC or 200 to 240VAC	
	Frequency	50/60Hz	
	Consumption electric power	Approx.150VA	

Note 1 : With the CW light and 2m fiber output point

Note 2 : At the optical output -6 to -23dBm setting. The connector connection loss is contained.

Note 3 : Please use the fiber with which the direction of the polarization agrees for the PMF output type.

Table 1-1: AQ8460 specifications (3 of 3)

Model	Note
Display	6.5"color LCD panel
GP-IB	IEEE488.1 satisfied
KEYBOARD input	PS/2
DISPLAY output	A VGA color display with 16-color or more color display is supported.
PRINTER output	NEC's PC-PR201, Epson's ESC/P, Canon's LIPS II, and Postscript printers are satisfied.
TLS analog modulation input (TLS ANALOG MODULATION)	SMA connector Input impedance 50Ω Modulation ratio : 5%(typ) when the modulation frequency 10MHz, modulation power 0dBm, maximum optical power at 1550nm. Maximum modulation power level is 0dBm.
Analog Out (wavelength)	BNC connector, 1.5kΩ or less of output impedance, approximately 0 to 2 V at 10kΩ terminal from sweep start wavelength (optical signal frequency) to sweep end wavelength (optical signal frequency)

Table 1-2: AQ8461 specifications

Model		AQ8461
Control interface		Serial
Number of slots		10
Dimensions		Approx. 177(H)×425(W)×450(D) mm
Weight		Approx. 10kg
Range of operation temperature		+10 to +35℃
Range of storage temperature		-10 to +50℃
Humidity		80% or less
Power supply	Range of voltage	100 to 120V AC or 200 to 240V AC
	Frequency	50/60Hz
	Consumption electric power	Approx. 400VA

Table 1-3: AQ8461-23 specifications

Model		AQ8461-23
Wavelength range		1500 to 1620 nm
Photoreceptor		InGaAs
Application		Small-diameter silica fiber emission *1
Input		Universal adapter FC or SC or ST
Polarization dependence conditions *2		+/-0.01dB (typical)
Return loss		> 40dB
Power range(CW light) *2		-80 to 0dBm
Accuracy under reference conditions *3	FC, SC	+/-5% (at calibration point)
	ST	+/-7% (at calibration point)
Total accuracy *4	FC, SC	+/-8% (1500 to 1580nm)
	ST	+/-10% (1500 to 1580nm)
Linearity *5		+/-0.1dB (1500 to 1580nm, -50 to 0dBm)
Noise *6		-73dBm or less
Dimensions		Approx.79(W)×130(H)×339(D) mm
Weight		Approx. 2kg
Range of operation temperature		+10 to +35℃
Range of storage temperature		-10 to +50℃
Humidity		80% or less

Notes

*All specifications are for a temperature of 23+/-1℃

*1 Applicable fiber 10/125 μ m(SM)NA~=0.1

*2 Wavelength 1550nm, SM fiber.

*3 Reference conditions: Power level -20dBm, CW light.
10 μ m optical fiber, master cord when calibrated.

*4 Operating Conditions: Power level -20dBm, CW light. 10 μ m optical fiber, when calibrated.

*5 Linearity for one wavelength within wavelength specified in total measurement accuracy. CW light, Constant temperature.

*6 Averaging 1sec/1point. At 1500 to 1580nm, CW light.

Table 1-4: AQ8461-71 specifications

Model	AQ8461-71	
Wavelength range	1500 to 1580 nm	
Dynamic range	60dB or more	*1
Relative measurement accuracy	+/-0.4dB max (0 to 45dB) +/-0.7dB max (45 to 55dB)	*2
Measurement stability	+/-0.04dB max	*3
Optical input connector	FC/PC	
Measurement connector	SC/APC	*4
Applicable optical fiber	SMF	
Dimensions	Approx.39.5(W)×130(H)×339(D) mm	
Weight	Approx. 1.2kg	
Range of operation temperature	+5 to +45℃	
Range of storage temperature	0 to +50℃	
Humidity	85% or less	

Notes

*Specification condition: After executing warm up for one hour.
All specifications are for a temperature of 23+/-1℃

*1 Depends on master cord to be used.

*2 Depends on stability of light source to be used, linearity of photo receiver and isolation of optical directional coupler.

*3 Display stability in case of Fresnel reflection reference (for 5 minutes).

*4 Do not connect any master cord other than our designated ones to the output connector.

1.3 Configuration

AQ8460, AQ8461, and various modules are composed of a main body and the following accessories.

Table 1-5: List of AQ8460 accessories

No.	Accessory name	Qty	Description
1	Instruction manual	1	This manual.
2	Power cord	1	Terminated with a three-pole power plug.
3	Floppy disks	2	
4	Paper for Printer	2	
5	50-ohm terminator	1	Mounted on the [REMOTE SW CONNECTOR] connector of the rear panel.
6	Protection Cap (for FC connector)	6	Mounted on the FC connector.
7	Dust cover (for [DISPLAY])	1	Mounted on the [DISPLAY] connector of rear panel.
8	Dust cover (for [PRINTER])	1	Mounted on the [PRINTER] connector of rear panel.
9	Dust cover (for [CTRL I/O])	1	Mounted on the [CTRL I/O] connector of rear panel.
10	Dust cover (for [DATA IN])	1	Mounted on the [DATA IN] connector of rear panel.
11	Dust cover (for [|O|O|])	1	Mounted on the [|O|O|] connector of rear panel.
12	Dust cover (for [GP-IB])	1	Mounted on the [GP-IB] connector of rear panel.
13	Dust cover (for [KEYBOARD])	1	Mounted on the [KEYBOARD] connector of rear panel.
14	Dust cover (for [TLS ANALOG MODULATION])	1	Mounted on the [TLS ANALOG MODULATION] connector of rear panel.
15	Optical Fiber Cord	1	FC/APC to both ends, 1m
16	Optical Fiber Cord	1	FC/APC – FC/PC, 2m

Table 1-6: List of AQ8461 accessories

No.	Accessory name	Qty	Description
1	Power cord	1	Terminated with a three-pole power plug.
2	Dust cover (for [CTRL I/O])	2	Mounted on the [CTRL I/O] connector of rear panel.
3	Dust cover (for [DATA IN])	1	Mounted on the [DATA IN] connector of rear panel.
4	Dust cover (for [DATA OUT])	1	Mounted on the [DATA OUT] connector of rear panel.
5	Connected cable	1	RJ-11 to both ends. Straight and all connecting wires.
6	Connected cable	1	RJ-45 to both ends. Straight and all connecting wires.
7	Protection panel for transportation	1	Mounted on the front panel.

Table 1-7: List of AQ8461-23 accessories

No.	Accessory name	Qty	Description
1	FC connector adapter	8	Mounted on the Universal connector.
2	Shield Cap (for FC connector)	8	Mounted on the FC connector.

Table 1-8: List of AQ8461-71 accessories

No.	Accessory name	Qty	Description
1	Shield Cap (for SC connector)	1	Mounted on the SC connector.
2	Shield Cap (for FC connector)	1	Mounted on the FC connector.

Chapter 2 Before Use

This chapter explains the unpacking and re-packing procedures, acceptance inspection, and general notes you must use. Follow these instructions before using your AQ8460 system.

2.1 Unpacking and Acceptance Inspection

All of AQ8460 components have been tested mechanically and electrically and their normal operations are assured at factory. When delivered, you must unpack and check for AQ8460 components for a shortage and a damage occurring during transportation. Take care not to damage wooden containers, cushion materials and fiberboard containers so that you can reuse them when transporting the AQ8460 in future.

2.1.1 Acceptance inspection

Check the appearance, switch operations, and controls of AQ8460 for any damage or malfunction occurring during transportation. Also, check the inventory of accessories using the packing list.

2.1.2 Operation checkout

After inventory checkout, check the basic system operations.

2.2 If a Damage or a Problem is found

If you have found a damage of AQ8460 system or any difference from specifications during acceptance inspection, contact to our agency immediately.

2.3 Re-packing

If you transport your AQ8460 again, reuse its containers you keep in your place. If you have lost them or if these containers are damaged, use the following re-packing procedure.

(1) Wrap all of AQ8460 components using the heavy-duty paper sheets or polyethylene sheets. Protect each corner of components using cushion materials.

(2) Place all AQ8460 components in appropriate wooden or fiberboard containers. There should be a space approximately 5 to 10 cm between the each component and container wall.

(3) Use enough amounts of polyurethane forms and other cushion materials to protect the AQ8460 components in each container. The components may be damaged due to mechanical shock and vibration if not protected securely.

(4) If you have placed the AQ8460 components in wooden containers, seal the containers using steel bands. If you use the fiberboard containers, seal them using adhesive tapes or others.

(5) Attach a label showing the following names to each container for easy identification.

- Contents
- Destination address and name
- Consignor

2.4 Safety Precautions of Electrical System

The AQ8460 system (AQ8460 & AQ8461) operates normally when connected to the 100 to 120V AC or 200 to 240V AC (50/60Hz) power source. Use the following safety instructions to avoid the listed problems.

Possible problems:

- Electrical shock
- Component damage due to abnormal voltage
- Other problems due to ground current.

2.4.1 Polarity of power cord

Plug the power cord into the three-pole receptacle. As Fig. 2-1 shows, the power cord has the "L" (Live line), "N" (Neutral line), and Ground rod (for grounding). You can match the power polarities by plugging the power cord into receptacle.

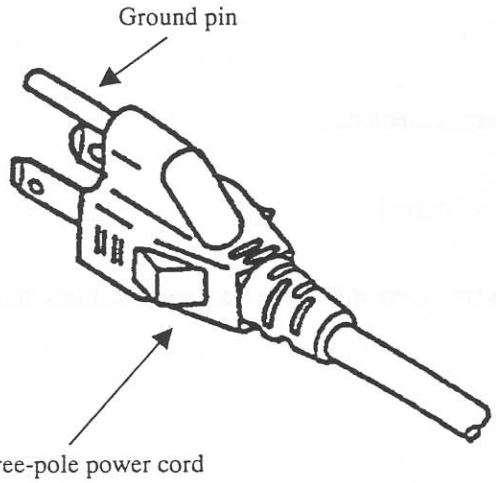


Fig. 2-1: Three-pole power cord

2.4.2 Protection by grounding

(1) Grounding by three-pole power cord

If the three-pole receptacle is available, you can match the polarities of power cord by just plugging the power cord into the receptacle. The cabinet is grounded.

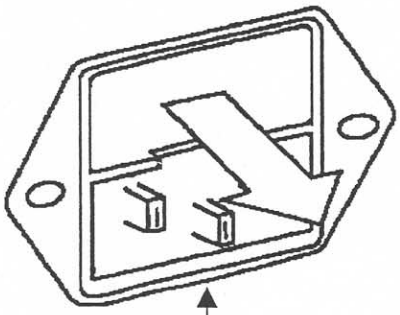
2.4.3 Replacing the fuses

The power fuses are mounted in the AC LINE connector module of the rear panel. Table 2-1 gives the fuse specifications, and Fig. 2-2 gives the fuse replacement procedure.

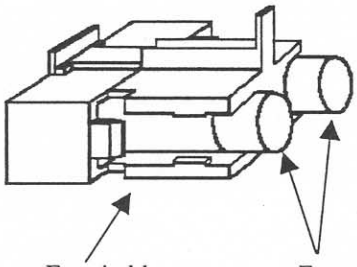
Table 2-1: Power fuse

Model	Power voltage	Power fuse	Remarks
AQ8460	100 to 120VAC	F 3.15A, 250V	Glass tube fuses (5.2mm dia by 20mm long), quick action type
	200 to 240VAC		
AQ8461	100 to 120VAC	F 6.3A, 250V	
	200 to 240VAC		

Pull out the fuse holder.



AC LINE connector module



Fuse holder Fuses

Fig. 2-2: Replacing the power fuses

In the rear panel, there is AC LINE connector module shown below. The power fuses are mounted in the fuse holder of the AC LINE connector module. Replace the blown fuses in the following steps.

(1) Turn the power switch OFF first, then unplug the power cord.

(2) Pull out the fuse holder.

(3) Replace two fuses simultaneously. If only one fuse blows, the other fuse is also damaged.

(4) Push and mount the fuse holder securely, and plug the power cord into receptacle.

⚠ Warning

Before replacing the power fuses, turn the power switch OFF first, then unplug the power cord from the receptacle. There is dread of the personal accident by the electric shock when the fuse is exchanged with the power supply turned on.

After fuse replacement, check the system grounding and the AC power voltage. Then, turn the power switch ON. If not grounded, you may be shocked again.

If the AC source voltage is abnormal, the internal components may be damaged.

2.4.4 Exchange of built-in battery

Inquire of the nearest office or agency when a built-in battery is consumed.

Our company service man exchanges a built-in battery.

⚠ Note

When a built-in battery is consumed, the system of this container does not stand up.

Chapter 3 PRECAUTIONS ON OPERATION

This chapter explains precautions on operation.

3.1 Operating Temperature Range

(1) The guaranteed operating temperature range is +10 to +35°C.

(2) The guaranteed operating humidity range is 80% or less.

3.2 Environmental Conditions

Since this system has a super-high-precision built-in light module, sufficient care is required for temperature, shock and vibration during storage or transportation.
The performance may not recover, in particular, once the following environmental conditions are exceeded.

Environmental conditions

(1) Storing temperature range: -10 to +50°C

(2) Storing humidity range: 80% or less

(3) Vibration
Vibration equivalent to Frequency: 10Hz
Double amplitude: 2+/-0.5mm
Direction of vibration: Vertical, horizontal and back and forth
Vibrating time: 10min each (in each direction)

(4) Shock: Shock equivalent to the one applied to the system when one side of the bottom surface is naturally dropped from 25mm above a solid, wooden floor.

(5) Installation: The precision of the built-in light module deteriorates if the system has been installed in the vertical or opposite position for a long time.
Keep it in the horizontal position even during transportation and storage.

3.3 Precautions on Handling

1) This system applies to laser class Ⅰ.

2) Do not apply excessive shock to the system. Otherwise, the display unit, in particular, may break since it is made of glass although covered with plastic.

3) Do not leave the system under a hot or humid environment for a long time.

4) Do not allow an object which radiates strong radio wave or magnetic field near the system. Otherwise, it may malfunction.

5) Do not block the air hole on the side of the system. Otherwise, it may break due to abnormal temperature rise.

6) This system is equipped with a built-in fuse as a protection against over current. If this fuse is burnt out, remove the power supply cord and replace the AC voltage input socket fuse.

7) This system is equipped with a built-in temperature fuse as a protection against abnormal temperature rise. If the power supply cannot be turned on even after the measure in 6) above is taken, the temperature fuse may be burnt out. In this case, contact us.

8) Only service personnel is allowed to remove the system cover.

9) Please make this container the horizontal when transporting or setting up.

10) Please note that the unit for AQ8201 cannot be used.

11) Please note that AQ8461-23 cannot be mounted on AQ8201.

3.4 Precautions for Using Optical Parts

⚠ Warning

The light output from the system is invisible since it is infrared. Pay enough attention during operation since your eyes may be damaged if you directly look at the output light.

⚠ Warning

Note that damage to your eye may increase if an optical equipment is used for this system.

Fully observe the following precautions since the stability of the system may deteriorate if the optical connector is damaged.

1) Do not use the system at a dusty place.

2) Connect an optical fiber free from a flaw on the edge to the system.

3) Before connecting an optical fiber, clean the edge to be connected to the optical connector of the system with alcohol, etc.

4) Before connecting an optical fiber to the system, check that the fiber edge is free from a flaw or dust using a microscope, etc. (in this case, check that no light is output from the fiber).

5) Do not connect an optical fiber to the system using a bare fiber adapter, etc.

6) Protect the system from dust or dirt by putting the cap on the connector when it is not in use.

3.5 Precautions for Outputting Stable Light

This system may fail to output stable light after optical connector return loss is increased due to flaws or stains on the connector. Be sure to follow the precautions below during operation.

1. Before connecting an optical connector to the system, check that the edge is free from a flaw or a stain using a microscope, etc.

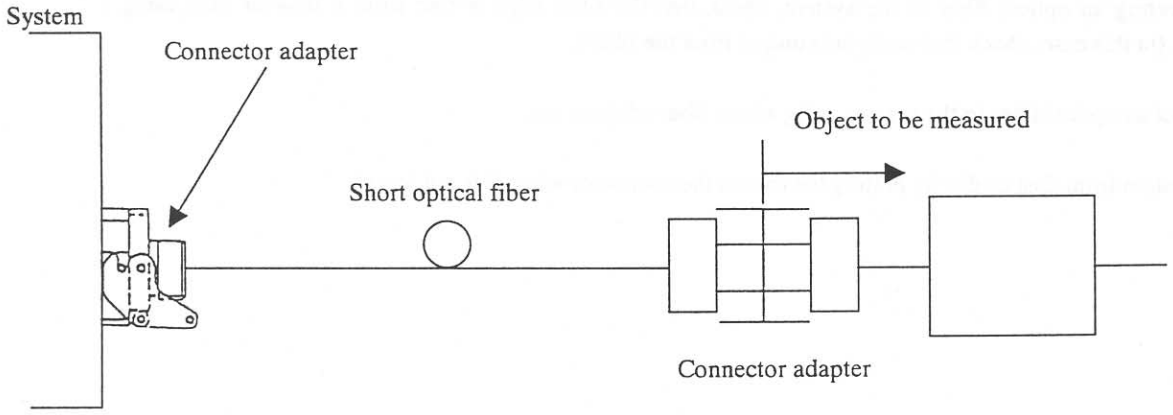
⚠ Caution

Before observing the optical connector edge using a microscope, etc., check that no light is output from it.

---

2. Clean the optical connector as follows:
(1) Slightly wipe it with a cleaning paper (which does not produce fiber powder) wet with alcohol.
(2) Wipe it again with a dry cleaning paper.
(3) If you have optical fiber edge cleaning equipment, use it to clean the connector again.

3. The optical connector edge may be damaged after the connector has been plugged in and out repeatedly. In order to prevent it, it is recommended to connect a short optical fiber to the system and the open edge of the fiber to an object to be measured using a connector adapter (J/J), etc.
In this case, using an APC (angled PC) optical connector for the object enables more stable measurement.



4. Avoid using it at a dusty place.

5. Do not connect an optical fiber to the system using a bare fiber adapter, or the connector may be damaged.

6. Protect the system from dust or dirt by putting the cap on the connector when it is not in use.

Chapter 4 FUNCTION

This chapter explains the functions of the operation part.

4.1 Operation Part

4.1.1 Operation part of AQ8460

Fig. 4-1 shows the arrangement of operation part of AQ8460 and Table 4-1 shows the names and functions corresponding to the numbers in the figure.

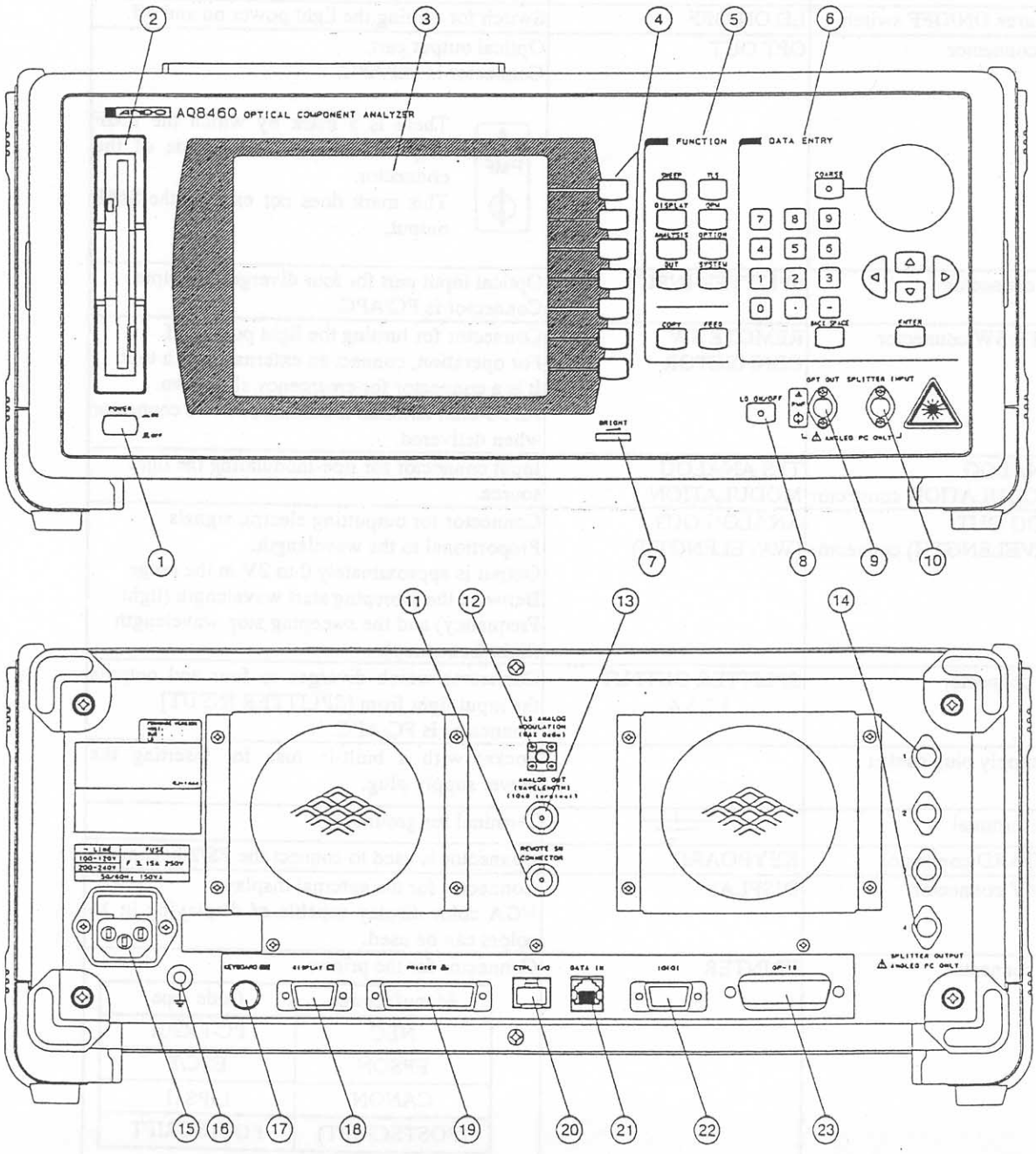
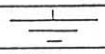


Fig. 4-1: Arrangement of operation part of AQ8460

Table 4-1: Operation part name and function (1/2)

No.	Name	Indication on system	Function
1	Power supply switch	POWER	Power supply switch for turning the power to "ON" and "OFF".
2	Floppy disk drive		Used for preservation of the measurement data and change in program.
3	Display		Displays the setting screen and screen under the operation, etc..
4	Software key switch		Used for setting the condition etc..
5	[FUNCTION] section	FUNCTION	Used for switching the operation mode.
6	[DATA ENTRY] section	DATA ENTRY	Used for entering parameters.
7	Bright	BRIGHT	Encoder for adjusting the LCD brightness. Turn it right to increase the brightness or left to decrease the brightness.
8	Light source ON/OFF switch	LD ON/OFF	Switch for turning the light power on and off.
9	Optical connector	OPT OUT	Optical output part. Connector is FC/APC.  There is a mark by which the PMF output is shown on left side of the connector. This mark does not exist at the SMF output.
10	Optical connector	SPLITTER INPUT	Optical input part for four divergence output. Connector is FC/APC.
11	REMOTE SW connector	REMOTE SW CONNECTOR	Connector for turning the light power off. For operation, connect an external switch to it. It is a connector for emergency shutdown. An 50-ohm terminal is mounted on this connector when delivered.
12	TLS ANALOG MODULATION connector	TLS ANALOG MODULATION	Input connector for fine-modulating the light source.
13	ANALOG OUT (WAVELENGTH) connector	ANALOG OUT (WAVELENGTH)	Connector for outputting electric signals Proportional to the wavelength. Output is approximately 0 to 2V in the range Between the sweeping start wavelength (light Frequency) and the sweeping stop wavelength (light frequency).
14	Optical connector	SPLITTER OUTPUT 1,2,3,4	Connector which diverges to four and outputs the input light from [SPLITTER INPUT]. Connector is FC/APC.
15	Power supply plug socket		Socket with a built-in fuse for inserting the power supply plug.
16	Ground terminal		Terminal for grounding.
17	KEYBOARD connector	KEYBOARD	Connector is used to connect the PS/2 keyboard.
18	DISPLAY connector	DISPLAY	Connector for the external display. VGA color display capable of displaying in 16 colors can be used.
19	Printer connector	PRINTER	Connector for the printer

Manufacturer	Code type
NEC	PC-PR201
EPSON	ESC/P
CANON	LIPS II
(POSTSCRIPT)	POSTSCRIPT

Table 4-1: Operation part name and function (2/2)

No.	Name	Indication on system	Function
20	Extension connector	CTRL I/O	Connector is used to connect AQ8461. It is not compatible for AQ2140. Please do not connect cables other than connected cable (RJ-45 to both ends. : 8 pole connector) appended to AQ8461.
21	Data input connector	DATA IN	Connector for the data input from the outside. Please do not connect cables other than connected cable (RJ-11 to both ends. : 6 pole connector) appended to AQ8461.
22	Serial communications connector	|O|O|	It is a connector for the expansion. It is unused now.
23	GP-IB connector	GP-IB	Connector for the GP-IB interface.

4.1.2 Operation part of AQ8461

Fig. 4-2 shows the arrangement of operation part of AQ8461 and Table 4-2 shows the names and functions corresponding to the numbers in the figure.

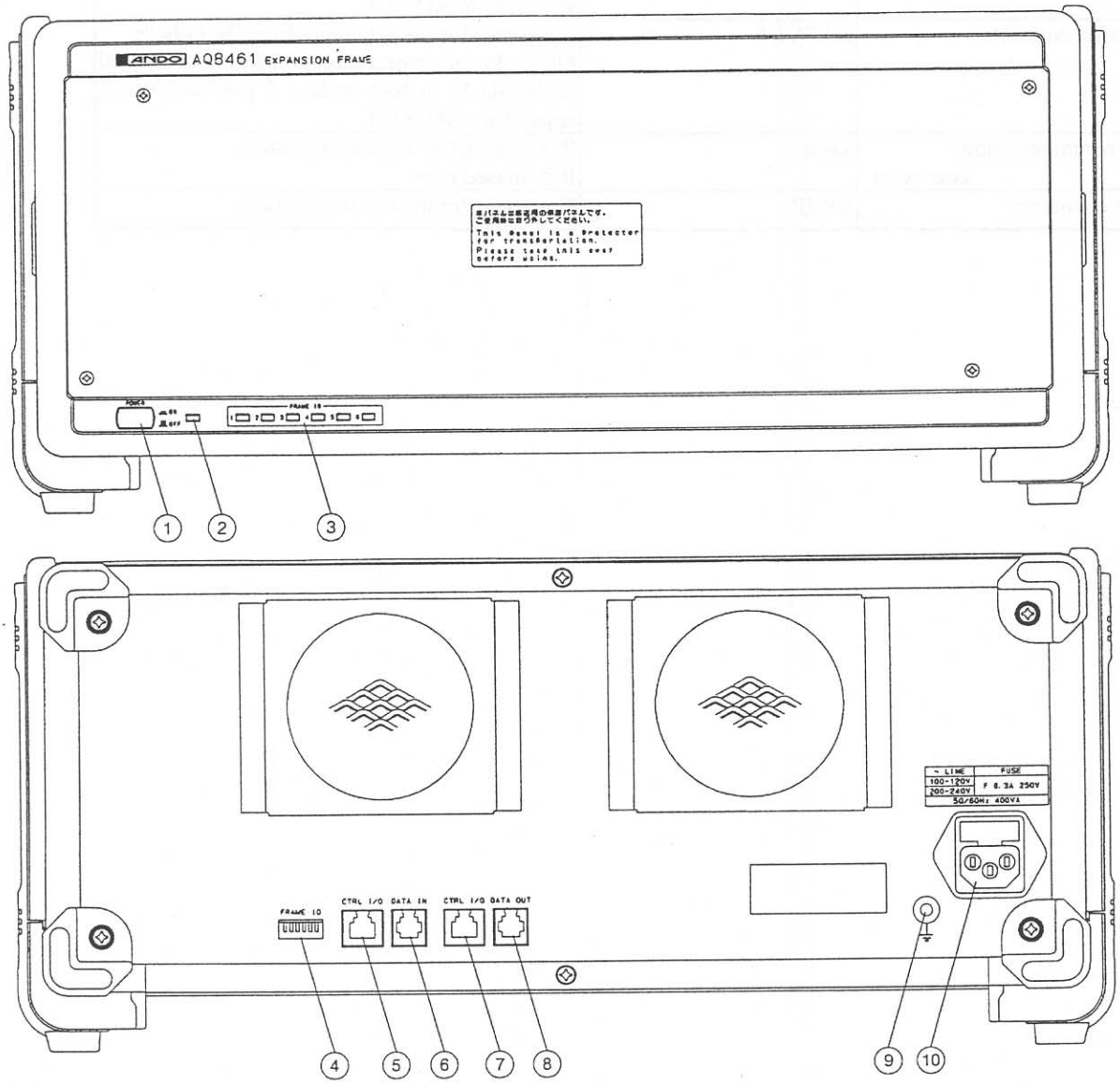
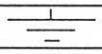


Fig. 4-2: Arrangement of operation part of AQ8461

Table 4-2: Operation part name and function

No.	Name	Indication on system	Function
1	Power supply switch	POWER	Power supply switch for turning the power to "ON" and "OFF".
2	Power lamp		It lights by turning on the [POWER] switch.
3	Frame ID Display	FRAME ID	Displays the setting number of frame ID.
4	Frame ID switch	FRAME ID	Used for setting the number of frame ID.
5	Extension connector	CTRL I/O	Connector is used to connect AQ8461. It is not compatible for AQ2140. Please do not connect cables other than connected cable (RJ-45 to both ends. : 8 pole connector) appended to AQ8461.
6	Data input connector	DATA IN	Connector for the data input from the outside. Please do not connect cables other than connected cable (RJ-11 to both ends. : 6 pole connector) appended to AQ8461.
7	Extension connector	CTRL I/O	Connector is used to connect AQ8461. It is not compatible for AQ2140. Please do not connect cables other than connected cable (RJ-45 to both ends. : 8 pole connector) appended to AQ8461.
8	Data output connector	DATA OUT	Connector for the data output. Please do not connect cables other than connected cable (RJ-11 to both ends. : 6 pole connector) appended to AQ8461.
9	Ground terminal		Terminal for grounding.
10	Power supply plug socket		Socket with a built-in fuse for inserting the power supply plug.

4.2 Keyboard operation

AQ8460 has the external keyboard connector in the back.
It is possible to operate it by connecting the PS/2 keyboard as well as the panel key.

⚠ Caution

Always turn OFF the [POWER] switch (" ■ OFF") before connecting or disconnecting the Keyboard cable to/from the AQ8460.

Table 4-3 shows the correspondence table of the AQ8460 operation part and the keyboard operation.

Table 4-3 : Correspondence table of AQ8460 operation part and keyboard operation (1/2)

Name	Indication on system	Correspondence key for keyboard operation
Softkey switch	(Softkey1)	[F1]
	(Softkey2)	[F2]
	(Softkey3)	[F3]
	(Softkey4)	[F4]
	(Softkey5)	[F5]
	(Softkey6)	[F6]
	(Softkey7)	[F7]
Light source ON/OFF switch	LD ON/OFF	[Ctrl] + [F2]
[DATA ENTRY] section		
COARSE key	COARSE	[Alt]
Ten-key (numeric key)	0	[0]
	1	[1]
	2	[2]
	3	[3]
	4	[4]
	5	[5]
	6	[6]
	7	[7]
	8	[8]
	9	[9]
	.	[.]
	-	[-]
BACK SPACE key	BACK SPACE	[BACK SPACE]
Rotary encoder (increased by clockwise) (decreased by counterclockwise)		[Page Up] [Page Down]
Cursor key		[↑][↓][←][→]
ENTER key	ENTER	[ENTER]

Table 4-3 : Correspondence table of AQ8460 operation part and keyboard operation (2/2)

[FUNCTION] section		
SWEEP key	SWEEP	[Shift] + [F1]
DISPLAY key	DISPLAY	[Shift] + [F2]
ANALYSIS key	ANALYSIS	[Shift] + [F3]
DUT key	DUT	[Shift] + [F4]
TLS key	TLS	[Shift] + [F5]
OPM key	OPM	[Shift] + [F6]
OPTION key	OPTION	[Shift] + [F7]
SYSTEM key	SYSTEM	[Shift] + [F8]
COPY key	COPY	[Shift] + [F9]
FEED key	FEED	[Shift] + [F10]

* The input of the alphabet can be input from the keyboard operation.
* The input of the sign can be input from the keyboard operation.

Chapter 5 OPERATION

This chapter explains how to use this system and its various units.

5.1 Before Operation

1) Check that the [POWER] switch is set at [■ OFF].

2) Check that the fuse in the power supply plug socket has the specified capacity.

3) Check that the power supply voltage is applicable to the input voltage of this system.

4) Connect the power supply cord of the attachment to the specified commercial power supply of this system.

5) Check that the operating environment is applicable to this system.
Do not use the system at a dusty place.

6) Install this system at a stable, flat site. During installation, check that the air holes are not blocked (especially for the air holes on the side and rear surfaces, clearances of 15 cm or more shall be obtained between the hole and the wall.

7) Connection with other equipment
Before connecting the external controller, keyboard, signal generator, etc. to this system, be sure to turn the power supply off.
Otherwise, the system may break.

Note

After the power supply is turned on, this container can usually be measured in about 30 minutes. Before performing high-accuracy measurement, perform 3-hour heating-up operation after powering-on.

5.1.1 Connecting and removing of connector adapter

The connector adapter can be connected simply by lowering the lock lever after inserting the adapter to the optical output part. In order to remove it, raise the lever to release the lock.

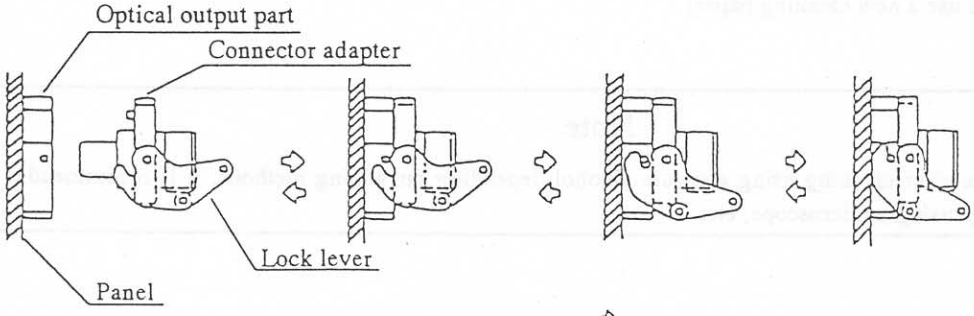


Fig. 5-1: How to connect/remove connector adapter

5.1.2 Cleaning of optical output part

Before connecting an optical connector (e.g. optical fiber cord) to the connector adapter, be sure to clean the connector connection and optical output part. Otherwise, the connector and the optical parts of the system may be damaged by dust or dirt.

1) Cleaning of connector adapter connection
When cleaning the connector adapter connection, it is recommended to use "CreTop Stick Type"of NTT-ME.

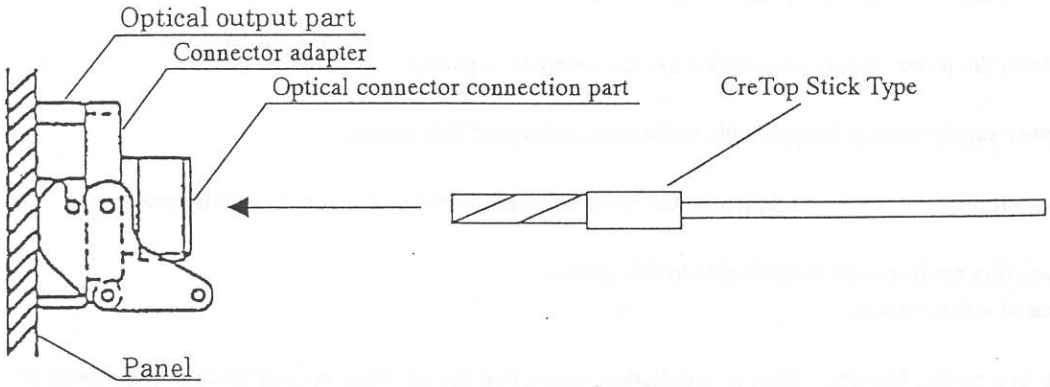


Fig. 5-2: How to clean optical connector connection

2) Cleaning of optical output part
After removing the connector adapter, clean the optical output part ferrule using a cotton on a stick slightly wet with absolute alcohol. Always use a new cotton.

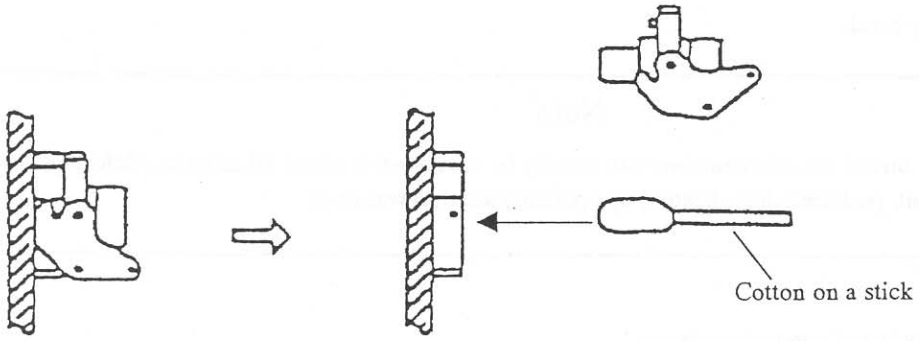


Fig. 5-3: How to clean optical output part

3) Cleaning of optical connector to be connected
Wipe off stains on the optical fiber connector ferrule and edge to be connected using a cleaning paper slightly wet with absolute alcohol (always use a new cleaning paper).

Note

Since stains may remain after cleaning using absolute alcohol depending on wiping methods, it is recommended to check the connector edge using a microscope, etc.

5.2 Connection Method

1) When the measurement object is one
The appended optical fiber code is connected with the [OPT OUT] connector in front of AQ8460.
Please select from among that and use it because two kinds of optical fiber codes are appended.

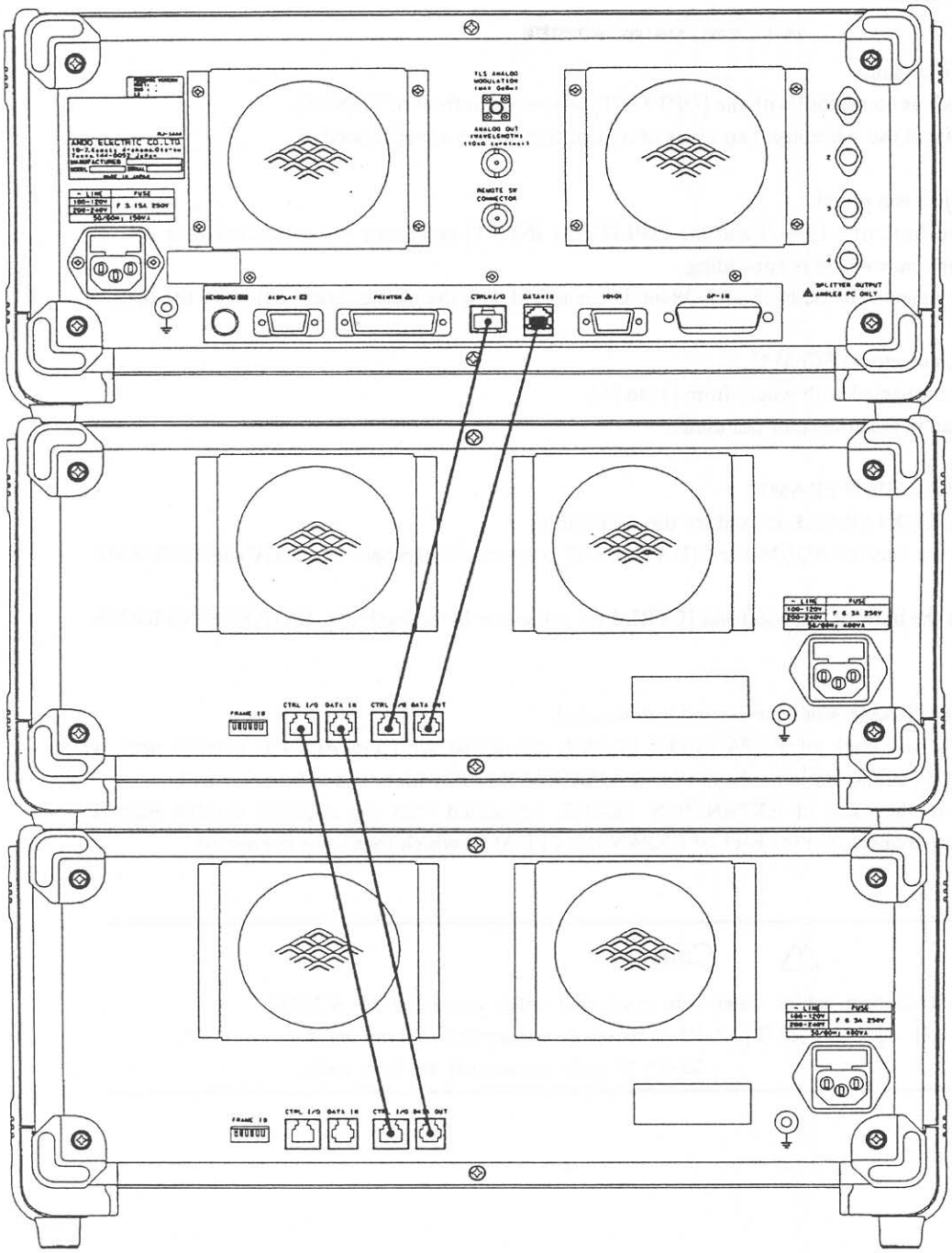
2) When the measurement object is a plural
The [OPT OUT] connector in front of AQ8460 and the [SPLITTER INPUT] connector are connected with optical fiber cord with FC/APC to both ends which is appending.
The [SPLITTER OUTPUT] connector in the back of AQ8460 is connected with the measurement object by the optical fiber code.
The [SPLITTER OUTPUT] connector is FC/APC.
The optical fiber code can be connected with where from [1] to [4].
Please install the protection cap in the connector not used.

3) Connection of AQ8461 EXPANSION FRAME
The cable appended to EXPANSION FRAME is used for the connection.
The [DATA IN] connector in the back of AQ8460 and [DATA OUT] connector in the back of EXPANSION FRAME are connected.
The [CTRL I/O] connector in the back of AQ8460 and [CTRL I/O] connector in the back of EXPANSION FRAME are connected.

In the same way, EXPANSION FRAME since the second is connected.
The [DATA IN] connector in the back of EXPANSION FRAME connected with the AQ8460 coming near is connected with the [DATA OUT] connector in the back of EXPANSION FRAME which tries to be connected.
The [CTRL I/O] connector in the back of EXPANSION FRAME connected with the AQ8460 coming near is connected with the [CTRL I/O] connector in the back of EXPANSION FRAME which tries to be connected.

⚠ Caution

Please do not connect cables other than connected cable appended to AQ8461.
[DATA IN] , [DATA OUT] : RJ-11 (6 pole connector) to both ends.
[CTRL I/O] : RJ-45 (8 pole connector) to both ends.



AQ8460

AQ8461
FRAME ID: 1

AQ8461
FRAME ID: 2

Fig. 5-4: Connection of AQ8460 and AQ8461

4) Setting of identification number of AQ8461 EXPANSION FRAME

EXPANSION FRAMEs can be connected up to six in the maximum. To identify connected EXPANSION FRAME, the identification number is set in the dip switch in the back.

Only the switch corresponding to the identification number must be turned on and another must turn off all.

Moreover, please set the identification number from one in order connecting it with AQ8460.

The set identification number can be confirmed with LED of a front panel of each EXPANSION FRAME.

5) Mounting of module on AQ8461 EXPANSION FRAME

Please mount so that there is not becoming empty from a left slot when you mount the module on EXPANSION FRAME.

Please draw left and mount two slot size module as shown in Fig. 5-5 when you mount the module with different size on one EXPANSION FRAME.

Please mount AQ8461-91 VENT COVER or AQ8461-93 VENT COVER on an empty slot for the protection of EXPANSION FRAME and the module.

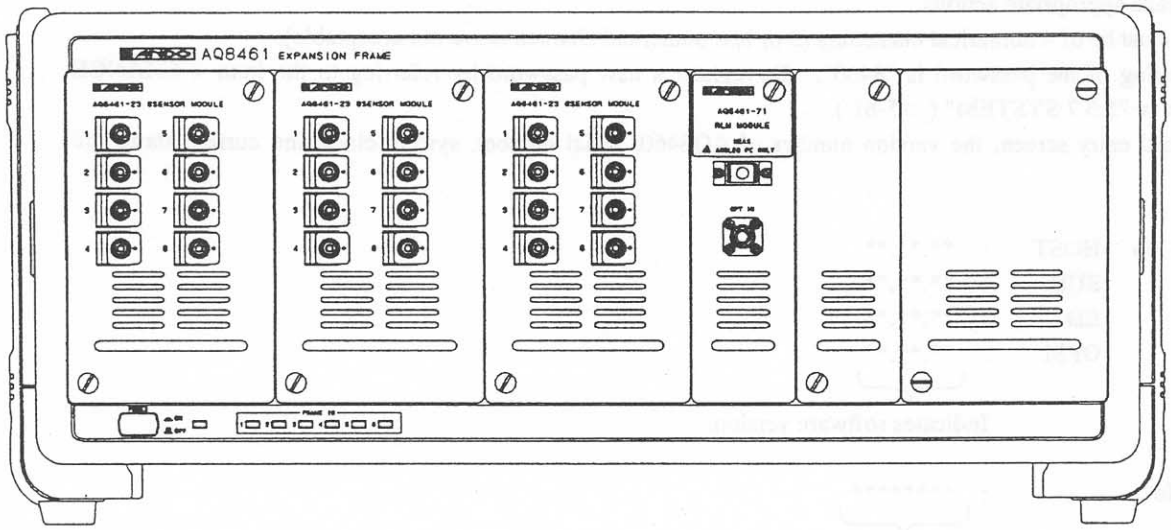


Fig. 5-5: Mounting on AQ8461 EXPANSION FRAME

⚠ Caution

Please attach/detach the module after confirming the power supply of AQ8461 is always OFF.
Please stop it because attaching/detaching the module with the power supply turned on causes the breakdown of the module and AQ8461.

⚠ Caution

Please note that the module for AQ8201 cannot be used.

5.3 Turning on and Checking

After checking the power supply and connection by referring to 5.1 to 5.2, turn this system on as follows:

1) Turn the [POWER] switch to [▬ ON].
After the power supply of AQ8461 is turned on, the power supply of AQ8460 is turned on.

⚠ Caution

Please turn on the power supply from AQ8461 previously.
The module mounted on AQ8461 might not be recognized and it become a cause of the breakdown of AQ8460.

2) If the system starts and error is not detected, it becomes a password entry screen as shown in Fig. 5-6.
If an error occurs during initialization, an error message appears, stopping operation. Refer to 6.1.7 for error messages and take appropriate actions.
The password must be of 4 numerical characters (3 or less numerical characters are not acceptable).
The factory setting of the password is "8460". Re-register a new password by referring to the item < CHANGE PASSWORD > in "5.5.7 SYSTEM" (->5-61).
On the password entry screen, the version number of AQ8460, serial number, system clock and current status are displayed.

VERSION No HOST : **.**.**
SUB : **.**.**
LD : **.**.**
OPM : **.**.**

Indicates software version.

SERIAL No : ********

Indicates serial number.

SYSTEM CLOCK : ****.**.** **:**

Indicate year, month, day and time.

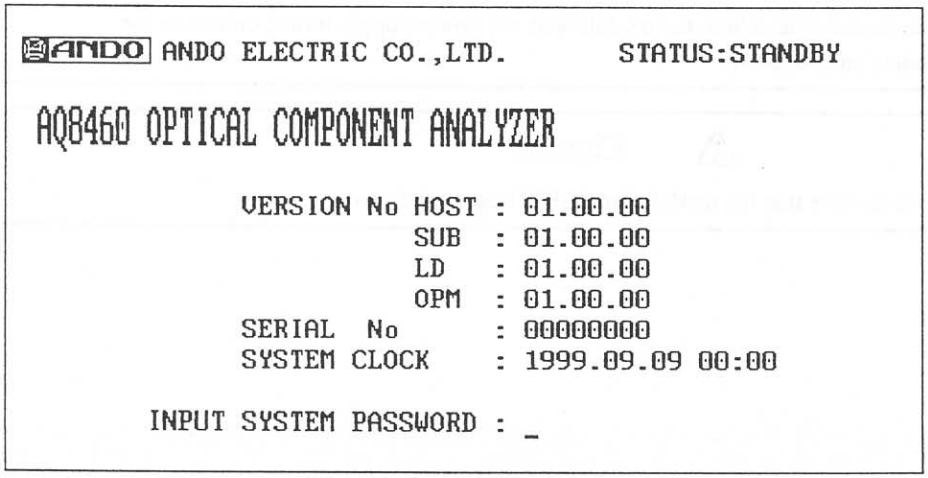


Fig. 5-6: Password entry screen

3) STATUS indicates the current status of the system.
NORMAL: Heating-up operation has been completed and the system is ready for normal operation. The state confirmation on the start-up screen is necessary.
STANDBY: Heating-up operation is being performed.
Even when the system is in STANDBY status, the password can be accepted and the system can be operated. However, in this case, the system specifications may not be satisfied completely.
If the system is operated while in STANDBY status, calibrate the wavelength after the system is brought in NORMAL status. The state of NORMAL is in the state, that display (STAUS:STANDBY) of upper right at the display of Fig. 5-6 changes into NORMAL.
It is a state that display (STANDBY) on the left at the display of Fig. 5-7 goes out.
The wavelength is automatically proofread when entering the state of NORMAL in no sweep of the wavelength it while remotely controlling if software key < AUTO CAL ON/OFF > is set in turning on.

4) Unless a wrong password is entered, wavelength is automatically calibrated (when POWER ON CAL is set at ON), and the initial screen shown in Fig. 5-7 will be displayed.
The values on the actual initial screen may differ from the ones shown in Fig. 5-7.

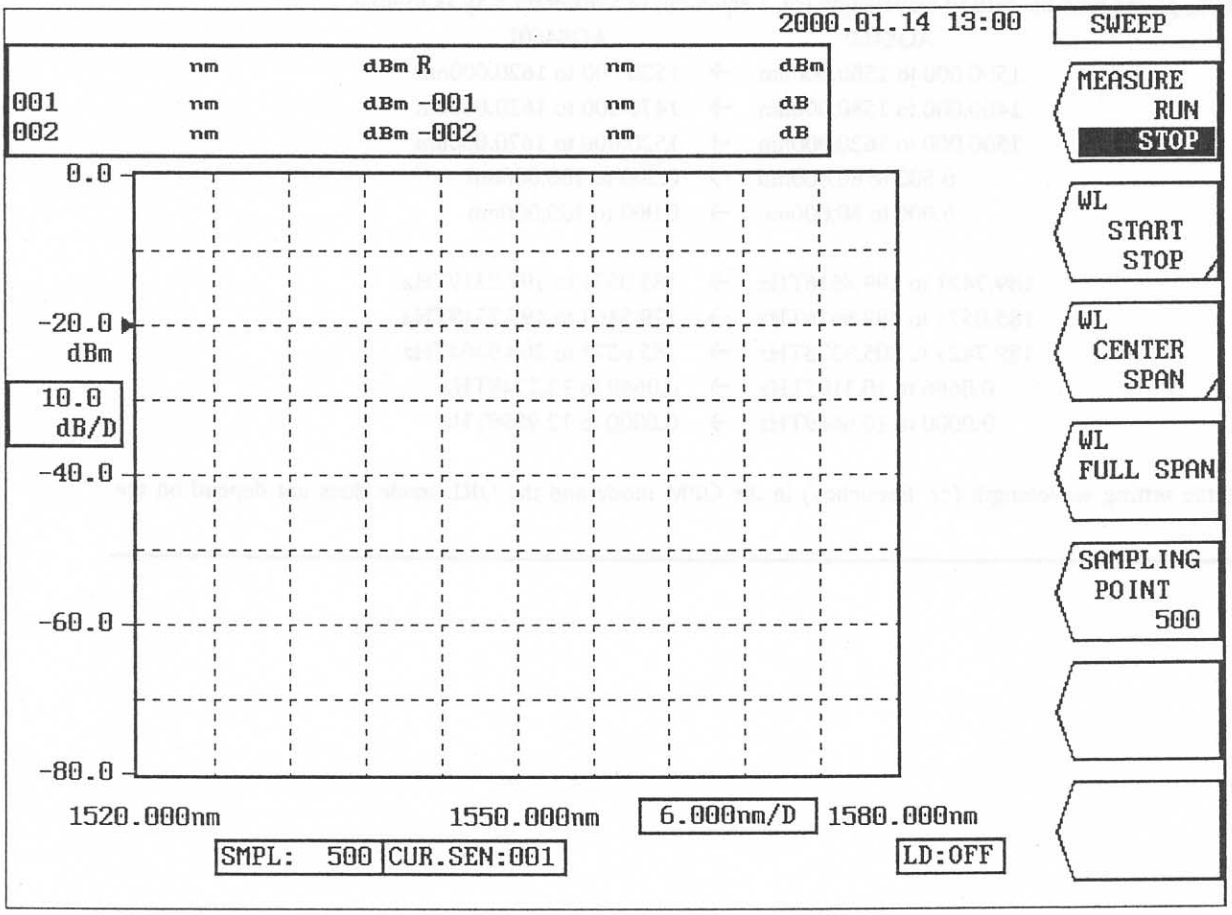


Fig. 5-7: Initial screen

5.4 Turning off

Turn the [POWER] switch to [■OFF].
After the power supply of AQ8460 is turned off, the power supply of AQ8461 is turned off.

5.5 How to Operate

The SWEEP mode after the system is started.
The operation mode is selected with FUNCTION KEY of a front panel.

The function is not allocated in [OPTION] and [DUT] key.

After the operation mode is selected, it operates it with a software key and a numeric key.

It is possible to operate it from an external keyboard by connecting an external keyboard with the keyboard connector in the back of AQ8460.
In that case, please refer to "4.2 Keyboard operation" (->4-6).

Note

In AQ8460L, please read the setting wavelength (or, frequency) in a different way as follows.

AQ8460		AQ8460L
1500.000 to 1580.000nm	→	1520.000 to 1620.000nm
1460.000 to 1580.000nm	→	1470.000 to 1620.000nm
1500.000 to 1620.000nm	→	1520.000 to 1670.000nm
0.500 to 80.000nm	→	0.500 to 100.000nm
0.000 to 80.000nm	→	0.000 to 100.000nm
189.7421 to 199.8616THz	→	185.0571 to 197.2319THz
185.0571 to 199.8616THz	→	179.5164 to 197.2319THz
189.7421 to 205.3373THz	→	185.0571 to 203.9404THz
0.0666 to 10.1195THz	→	0.0649 to 12.1748THz
0.0000 to 10.6669THz	→	0.0000 to 12.9899THz

However, the setting wavelength (or, frequency) in the OPM mode and the ORL mode does not depend on the model.

5.5.1 Common operating method

(1) How to input parameter

a) Parameters can be entered in three ways, namely using numeric keys, the rotary encoder and the cursor keys.

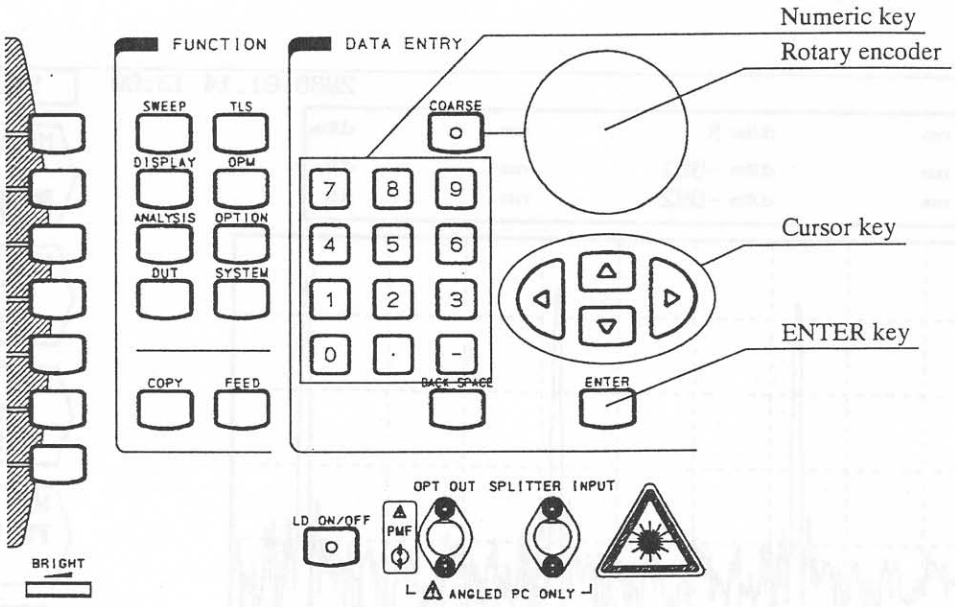


Fig. 5-8: Panel key

The digit of the parameter to be entered can also be selected by pressing the [←] or [→] key in addition to using numeric keys, the rotary encoder or the cursor keys. The selected digit can be moved to left by pressing the [←] key or right by the [→] key.

When the parameter is input with numeric keys, the software key on the lowest portion turns to < CANCEL >. Pressing this < CANCEL > key cancels the entry.

b) Using numeric keys

Numeric values can be entered by inputting them using numeric keys and pressing the [ENTER] key.

If you press a wrong numeric key, the entered value can be cleared by pressing the [BACK SPACE] key.

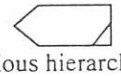
If the decimal places of the parameter to be entered are omitted, "0" is automatically entered there.

c) Using rotary encoder

Numeric values can be increased by turning the rotary encoder clockwise or decreased by turning it counterclockwise. During the [COARSE] key is turned on (the lamp lights up), the step for increasing or decreasing numeric values becomes wider.

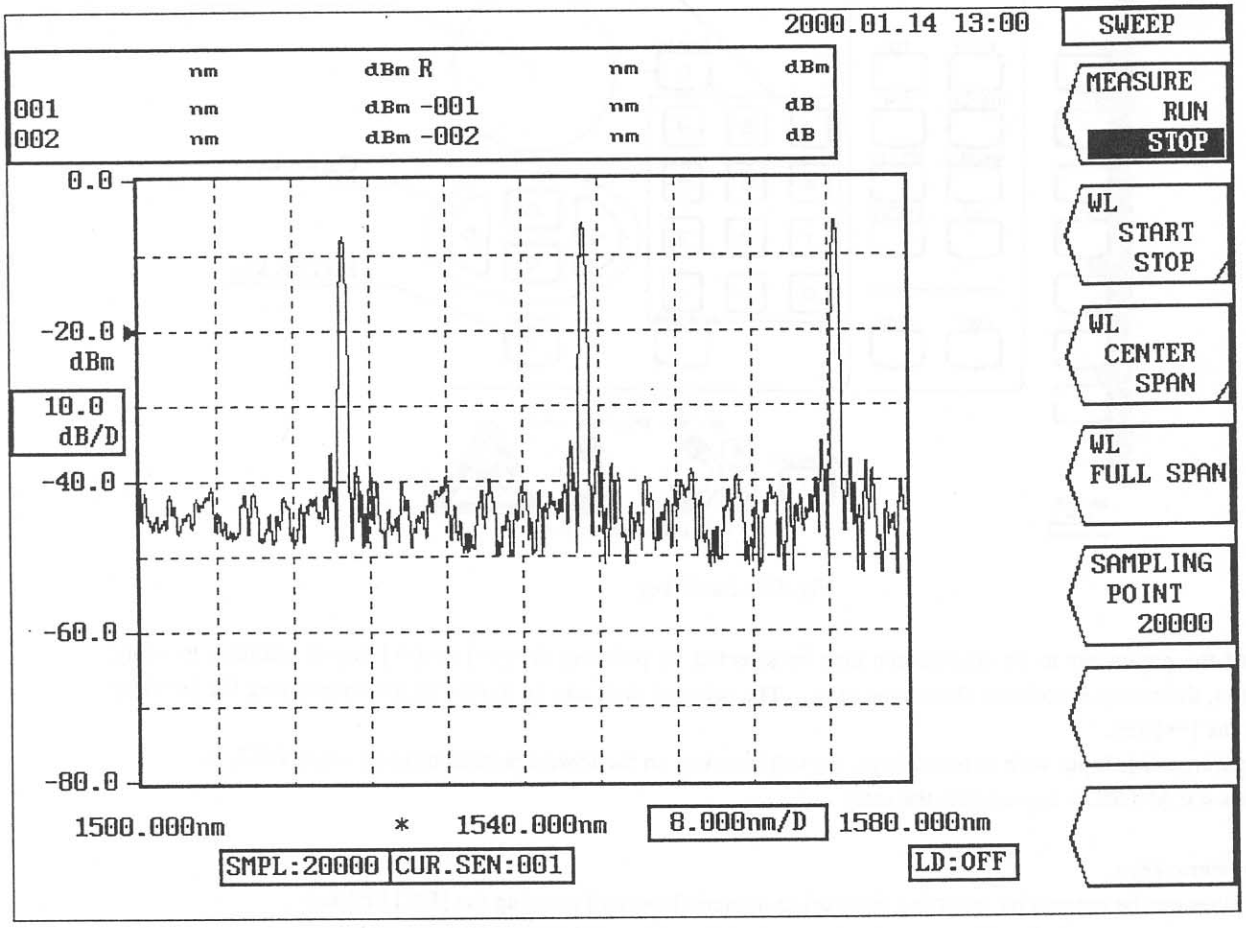
d) Using cursor key

Pressing the [↑] key functions in the same way as when turning the rotary encoder clockwise and pressing the [↓] key as when turning it counterclockwise.

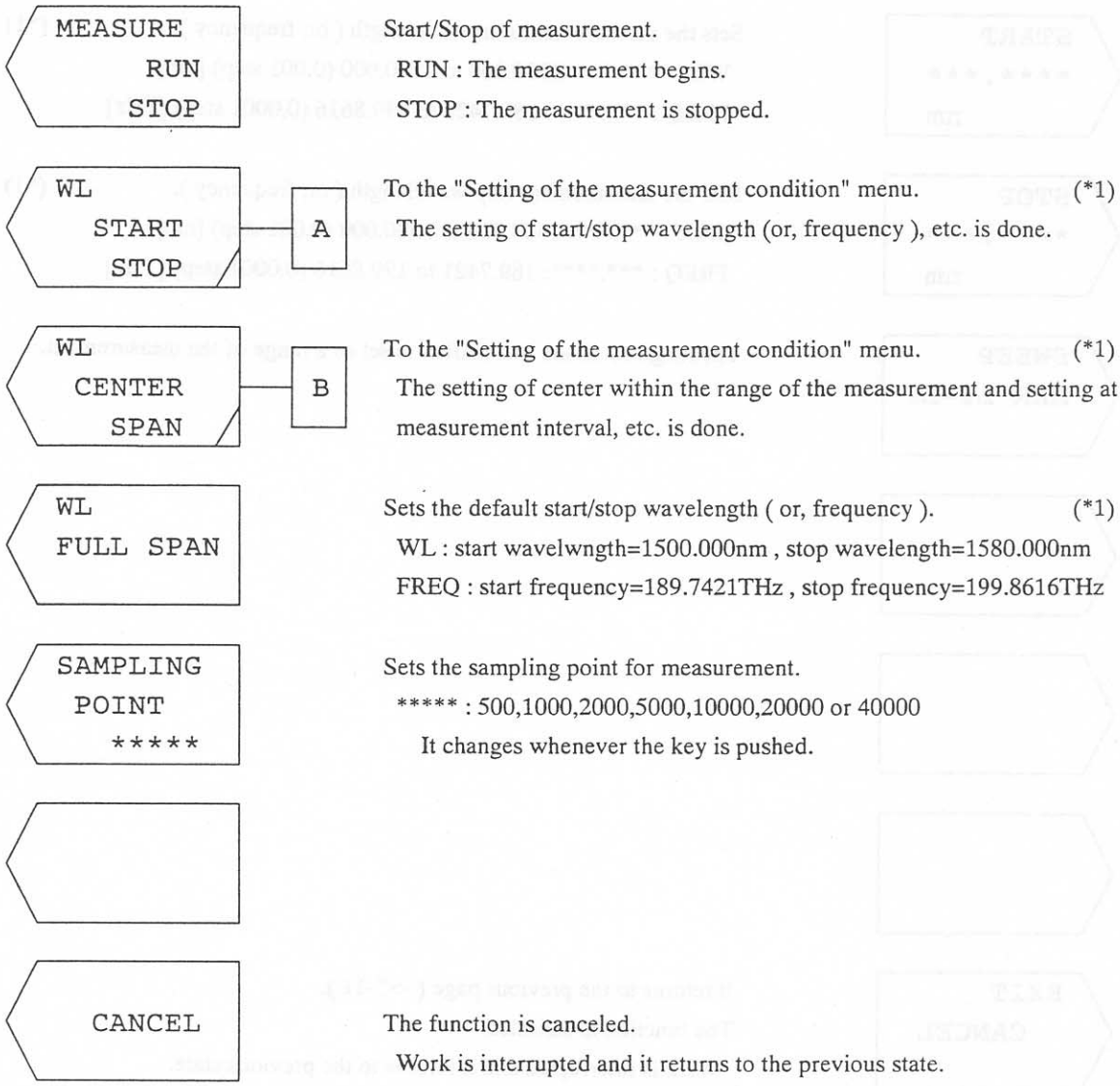
(2) The software key menu is hierarchically structured and pressing the software key shaped  proceeds to the next hierarchy, displaying the related software key menus. In order to return to the previous hierarchy, press the < EXIT > key on the lowest part of the menu.

5.5.2 SWEEP

If the system starts normally, it automatically becomes SWEEP mode.
The operation and the setting of SWEEP can be done.



Main Menu



*1 The display changes by the setting of a horizontal axis.
For the wavelength : "WL"
For the frequency : "FREQ"

A)Setting of the measurement condition (measurement START/STOP)

START ****.*** nm	Sets the measurement start wavelength (or, frequency). (*1) WL : ****.***: 1500.000 to 1580.000 (0.001 step) [nm] FREQ : ***.****: 189.7421 to 199.8616 (0.0001 step) [THz]
STOP ****.*** nm	Sets the measurement stop wavelength (or, frequency). (*1) WL : ****.***: 1500.000 to 1580.000 (0.001 step) [nm] FREQ : ***.****: 189.7421 to 199.8616 (0.0001 step) [THz]
SWEEP MKR L1-L2	The range set in the line marker is set as a range of the measurement.
EXIT CANCEL	It returns to the previous page (->5-11). The function is canceled. Work is interrupted and it returns to the previous state.

*1 The display changes by the setting of a horizontal axis.
For the wavelength : "nm"
For the frequency : "THz"

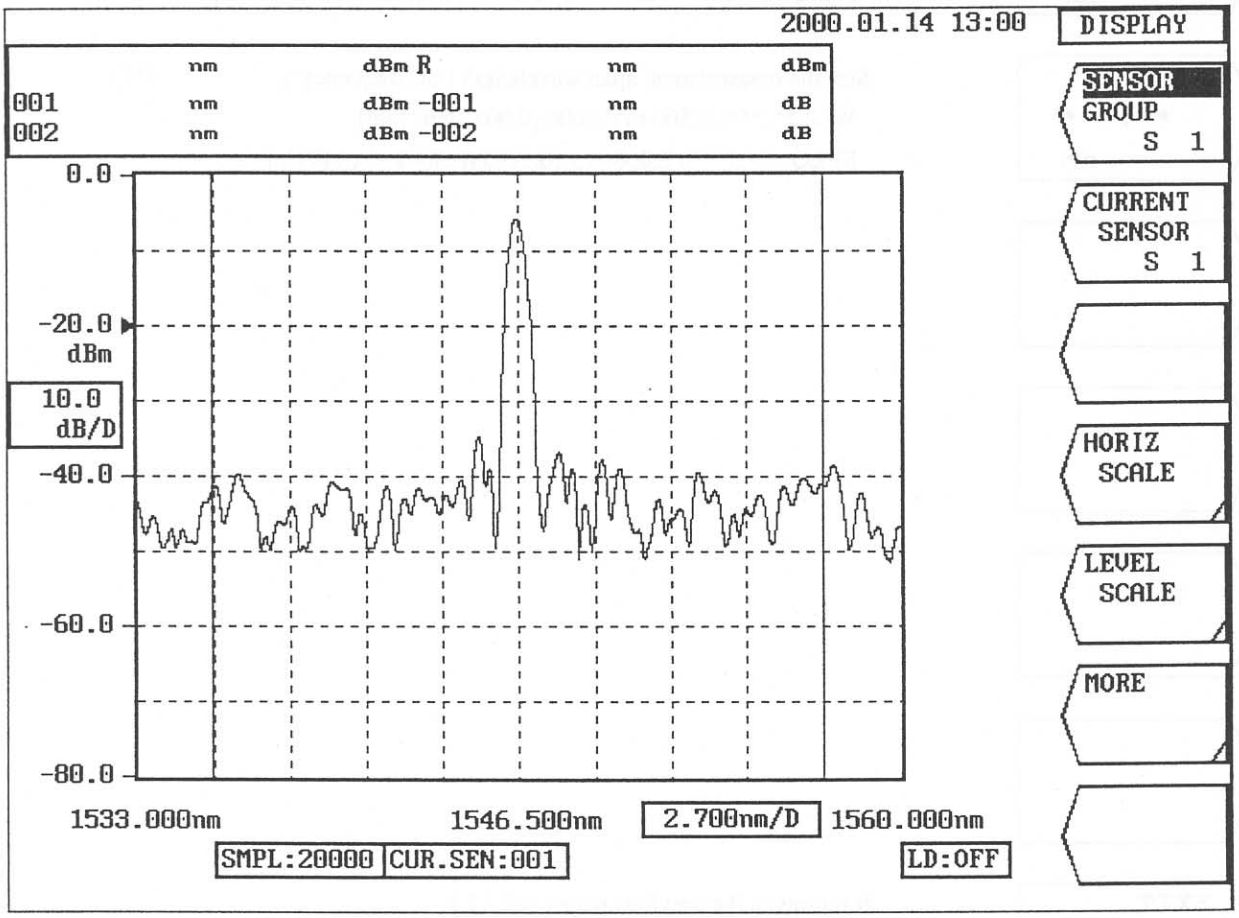
B)Setting of the measurement condition (measurement CENTER/SPAN)

CENTER ****.*** nm	Sets the measurement center wavelength (or, frequency). (*1) WL : ****.***: 1500.000 to 1580.000 (0.001 step) [nm] FREQ : ***.****: 189.7421 to 199.8616 (0.0001 step) [THz]
SPAN **.*** nm	Sets the measurement span wavelength (or, frequency). (*1) WL : **.***: 0.500 to 80.000 (0.001 step) [nm] FREQ : **.****: 0.0666 to 10.1195 (0.0001 step) [THz]
EXIT	It returns to the previous page (->5-11).
CANCEL	The function is canceled. Work is interrupted and it returns to the previous state.

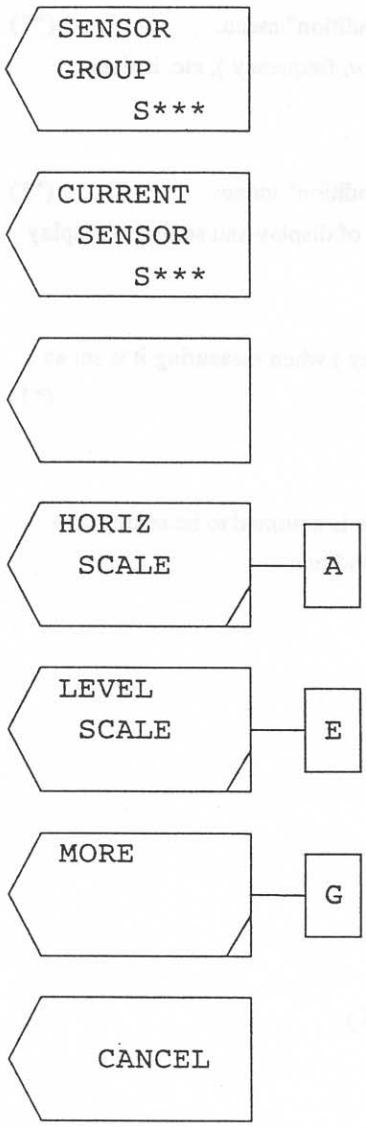
*1 The display changes by the setting of a horizontal axis.
For the wavelength : "nm"
For the frequency : "THz"

5.5.3 DISPLAY

Setting concerning the screen display is done.
The sensor which displays the graph and the display scale in the graph, etc. are set.



Main Menu



The sensor or the group which displays it is selected. (*1)
SENSOR : S*** : 1 to 240
GROUP : G** : 00 to 99

A current sensor is selected.
S*** : 1 to 240

To the "Setting menu of a HORIZONTAL SCALE" menu.

To the "Setting menu of a LEVEL SCALE" menu.

To the following menu.

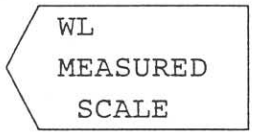
The function is canceled.
Work is interrupted and it returns to the previous state.

*1 The content of the group does setting by "L)GROUP" (->5-29).

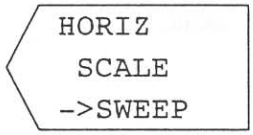
A)Setting of the HORIZONTAL SCALE

To the "Setting menu of the display condition" menu. (*1)
The setting of start/stop wavelength (or, frequency), etc. is done.

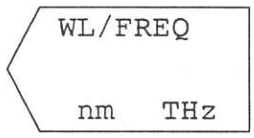
To the "Setting menu of the display condition" menu. (*1)
The setting of center within the range of display and setting at display interval, etc. is done.



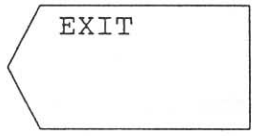
The start/stop wavelength (or, frequency) when measuring it is set as a value of a horizontal scale. (*1)



The setting of a present horizontal scale is assumed to be setting of a horizontal scale of the measurement condition.



Switch of wavelength and frequency.



It returns to the previous page (->5-15).

*1 The display changes by the setting of a horizontal axis.
For the wavelength : "WL"
For the frequency : "FREQ"

B)Setting of the display condition (START/STOP)

START ****.*** nm	Sets the start wavelength (or, frequency). (*1) WL : ****.***: 1460.000 to 1580.000 (0.001 step) [nm] FREQ : ***.****: 185.0571 to 199.8616 (0.0001 step) [THz]
STOP ****.*** nm	Sets the stop wavelength (or, frequency). (*1) WL : ****.***: 1500.000 to 1620.000 (0.001 step) [nm] FREQ : ***.****: 189.7421 to 205.3373 (0.0001 step) [THz]
DISPLAY MKR L1-L2	The range of the line marker is set as a range of the display.
EXIT CANCEL	It returns to the previous page (->5-16). The function is canceled. Work is interrupted and it returns to the previous state.

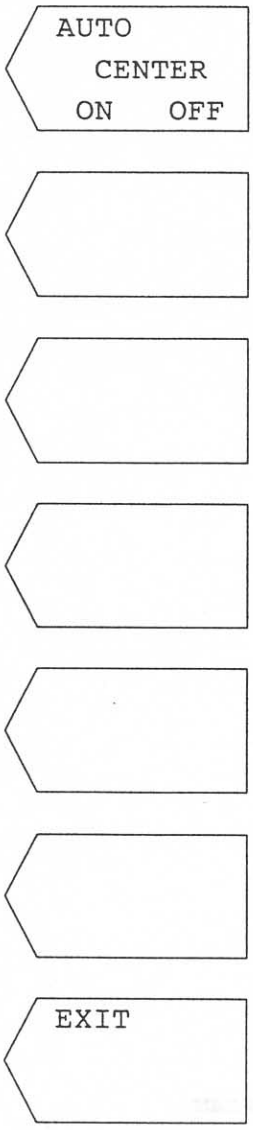
*1 The display changes by the setting of a horizontal axis.
For the wavelength : "nm"
For the frequency : "THz"

C)Setting of the display condition (CENTER/SPAN)

CENTER ****.*** nm	Sets the center wavelength (or, frequency). (*1) WL : ****.***: 1500.000 to 1580.000 (0.001 step) [nm] FREQ : ***.****: 189.7421 to 199.8616 (0.0001 step) [THz]
SPAN **.*** nm	Sets the span wavelength (or, frequency). (*1) WL : **.***: 0.000 to 80.000 (0.001 step) [nm] FREQ : **.****: 0.0000 to 10.6669 (0.0001 step) [THz]
MARKER ->CENTER	Sets the wavelength of the moving marker to the center wavelength.
PEAK ->CENTER	Sets the waveform peak/bottom to the center wavelength. PEAK or BOTTOM is selected by < CONDITION >.
CONDITION PEAK BOTTOM	The condition of < PEAK ->CENTER > is set.
MORE → D	To the following menu.
EXIT CANCEL	It returns to the previous page (->5-16). The function is canceled. Work is interrupted and it returns to the previous state.

*1 The display changes by the setting of a horizontal axis.
For the wavelength : "nm"
For the frequency : "THz"

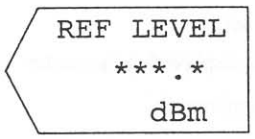
D)Setting of the display condition (CENTER/SPAN) 2



The screen display when the measurement ends is set.
ON : The peak/bottom wavelength (or, frequency) is displayed at the center.
OFF : The range of the measurement is displayed as usual.

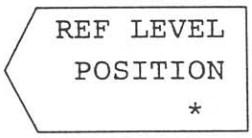
It returns to the previous page (->5-18).

E)Setting of the LEVEL SCALE



Sets the reference level.

***.* : -90.0 to 20.0 (0.1 step) [dBm]

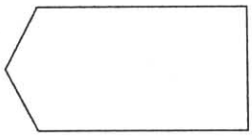


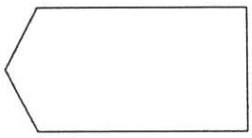
Selects the reference level position.

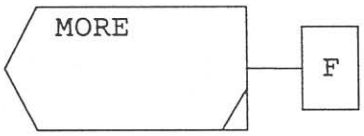
* : 0 to 8

Sets the scale of the level scale.

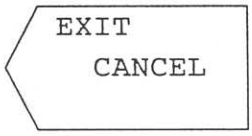
**.* : 0.1 to 12.5 (0.1 step) [dB/DIV]







To the following menu.

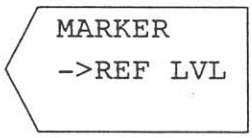


It returns to the previous page (->5-15).

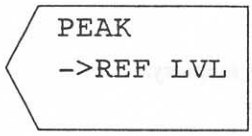
The function is canceled.

Work is interrupted and it returns to the previous state.

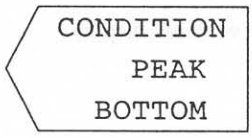
F)Setting of the LEVEL SCALE 2



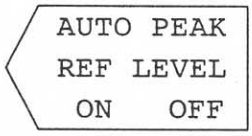
Sets the level of the moving marker in the reference level.



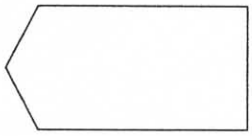
Sets the peak/bottom level to the reference level.
PEAK or BOTTOM is selectes by < CONDITION >.

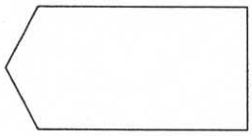


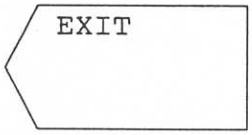
The condion of < PEAK ->REF LVL > is set.



The screen display when the measurement ends is set.
ON : The peak/bottom level is displayed as a reference level.
OFF : At the set reference level, it displays it.

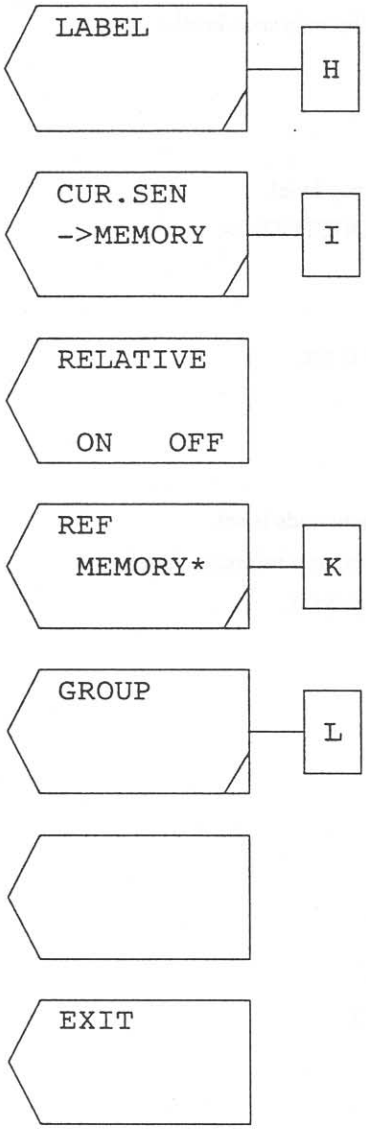






It returns to the previous page (->5-20).

G)Main Menu 2



The label is input.

To the "Wave data storage" menu.
The wave data of a current sensor is stored in the memory.

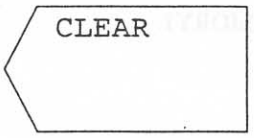
The absolute value display is switched to the relative value display.
ON : The relative value is displayed.
OFF : The absolute value is displayed.

To the "Setting of reference memory" menu.

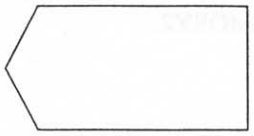
To the "GROUP" menu.

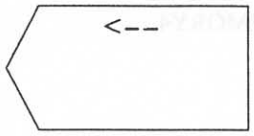
It returns to the previous page (->5-15).

H)input assistance

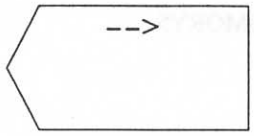


All character strings under the input are deleted.

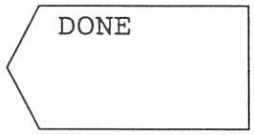




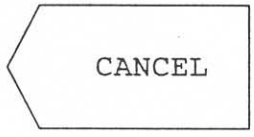
The cursor which shows the character input position moves left.



The cursor which shows the character input position moves right.

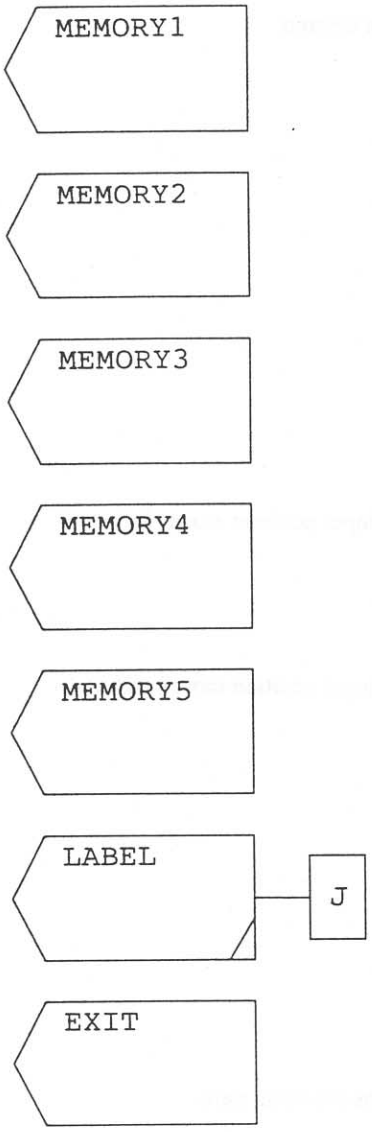


The input character string is fixed.



The function is canceled.
Work is interrupted and it returns to the previous state.

I)Wave data storage



The wave data of a current sensor is stored in MEMORY1.

The wave data of a current sensor is stored in MEMORY2.

The wave data of a current sensor is stored in MEMORY3.

The wave data of a current sensor is stored in MEMORY4.

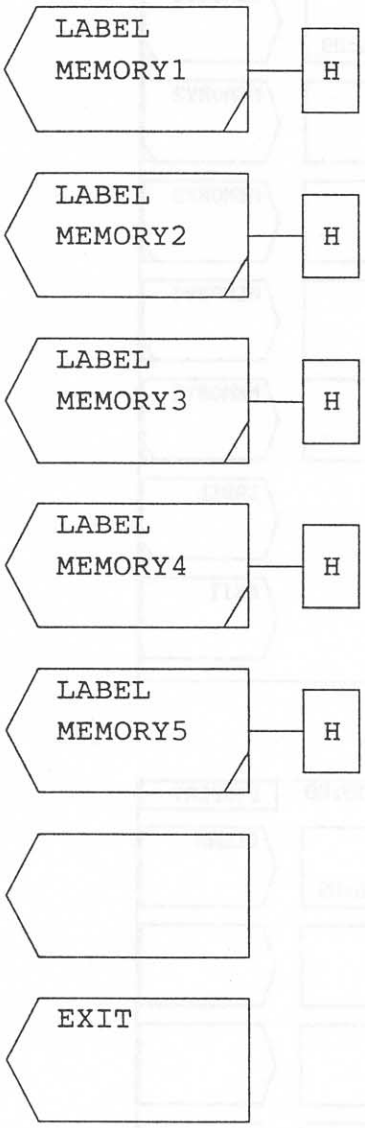
The wave data of a current sensor is stored in MEMORY5.

To the "Input of memory label" menu.

It returns to the previous page (->5-22).

* It becomes a screen in Fig. 5-9.
When the wave data is stored in the memory, the wave length region of the wavy data and the measured date, etc. are displayed.
The memory where the wave data is not stored is displayed as "NO DATA".

J)Input of memory label



The label of MEMORY1 is input.

The label of MEMORY2 is input.

The label of MEMORY3 is input.

The label of MEMORY4 is input.

The label of MEMORY5 is input.

It returns to the previous page (->5-24).

* The input screen becomes Fig. 5-10.
The number of characters which can be input as a label is up to 60 characters.

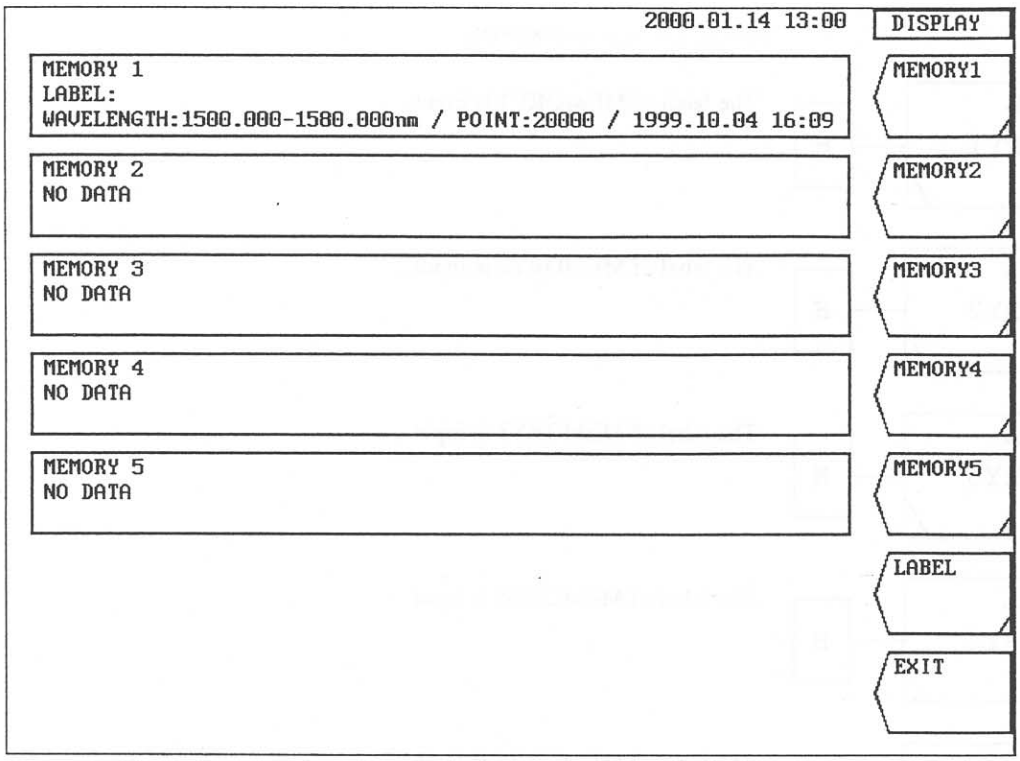


Fig. 5-9: Storage of wave data

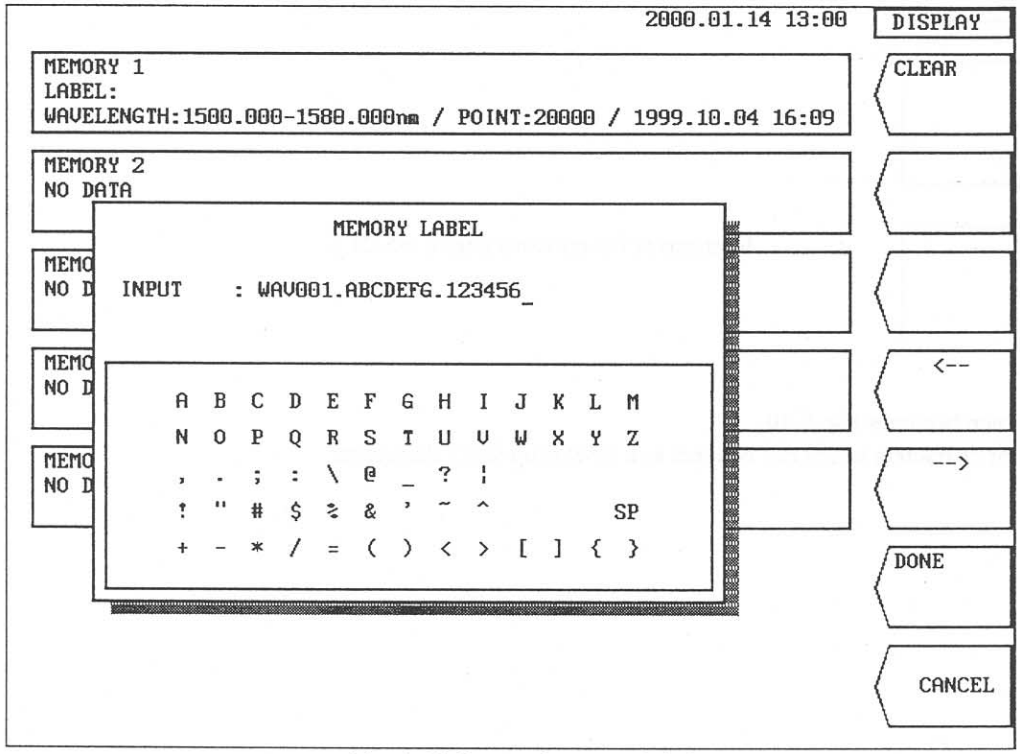
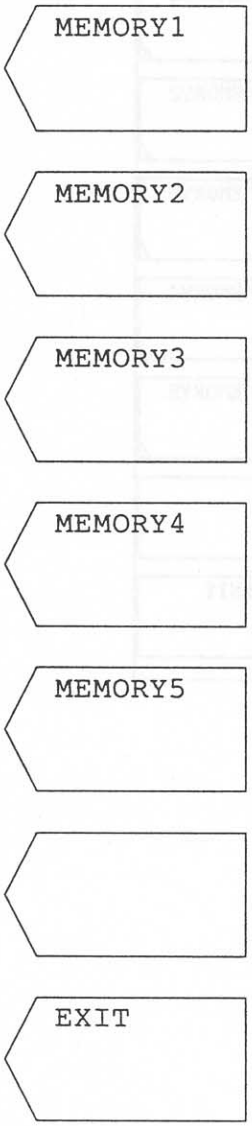


Fig. 5-10: Input of memory label

K)Setting of reference memory



The wave data of MEMORY1 is stored in the reference memory.

The wave data of MEMORY2 is stored in the reference memory.

The wave data of MEMORY3 is stored in the reference memory.

The wave data of MEMORY4 is stored in the reference memory.

The wave data of MEMORY5 is stored in the reference memory.

It returns to the previous page (->5-22).

* The setting screen becomes Fig. 5-11.
Please select the necessary wave data (MEMORY) because the measurement condition of the wave data in the memory is displayed.
It returns to the previous page (->5-22) when the <MEMORY1> to <MEMORY5> key is pushed.

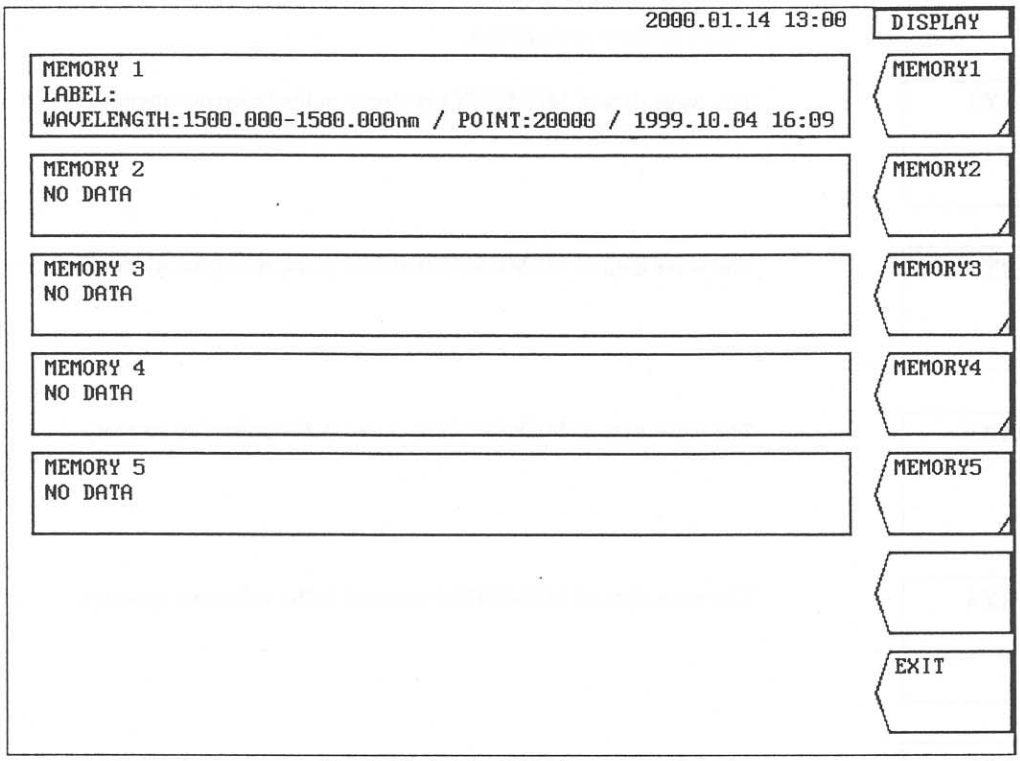
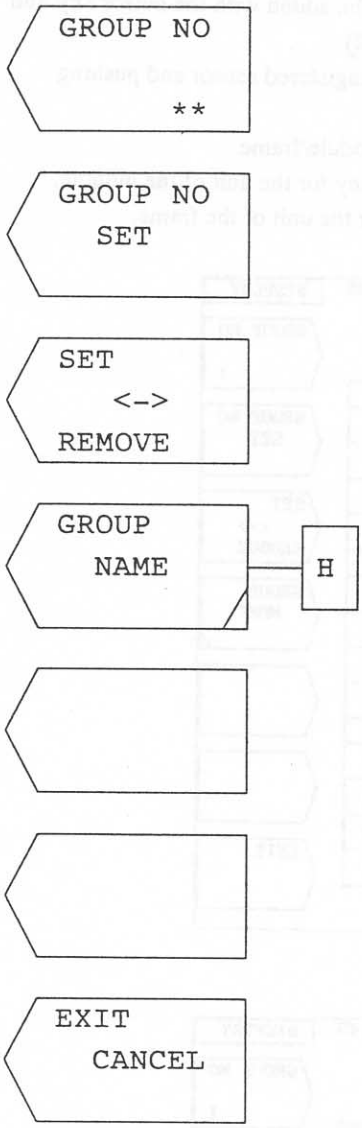


Fig. 5-11: Setting of reference memory

L)GROUP



The group number is selected.
** : 0 to 99
However, GROUP 0 cannot change the content only by the reference.

The group number is fixed.
It is possible to fix it also with the [ENTER] key.

The sensor is added or is deleted for the group being selected now.
The addition or the deletion with the sensor, the module, and the frame is possible. (->5-30)

The group name is input.

It returns to the previous page (->5-22).
The function is canceled.
Work is interrupted and it returns to the previous state.

< SET <-> REMOVE > : addition/deletion of sensor

The sensor is added or is deleted for the group being selected now.

The group can add the sensor by matching the cursor to the sensor which wants to be added with the cursor key and pushing < SET <-> REMOVE > key. The registered sensor discolors. (Fig. 5-12)

Oppositely, the sensor can be deleted from the group by matching the cursor to the registered sensor and pushing < SET <-> REMOVE > key.

Moreover, the sensor can be added and be deleted in the same way by the unit of module/frame.

Please match the cursor to M** (** : 01 to 30) and push < SET <-> REMOVE > key for the unit of the module.

Please match the cursor to F* (* : 1 to 6) and push < SET <-> REMOVE > key for the unit of the frame.

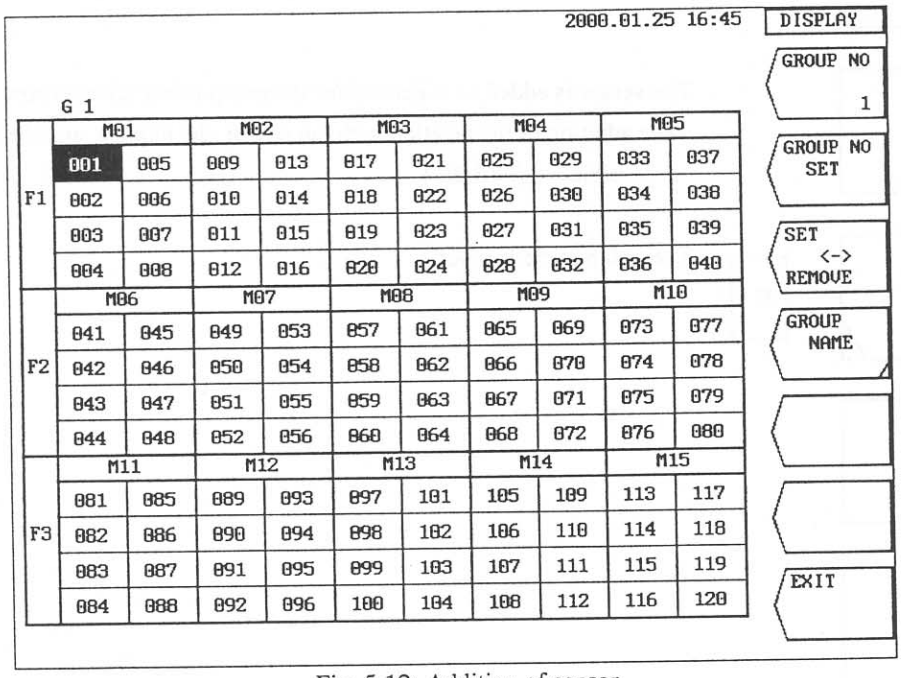


Fig. 5-12: Addition of sensor

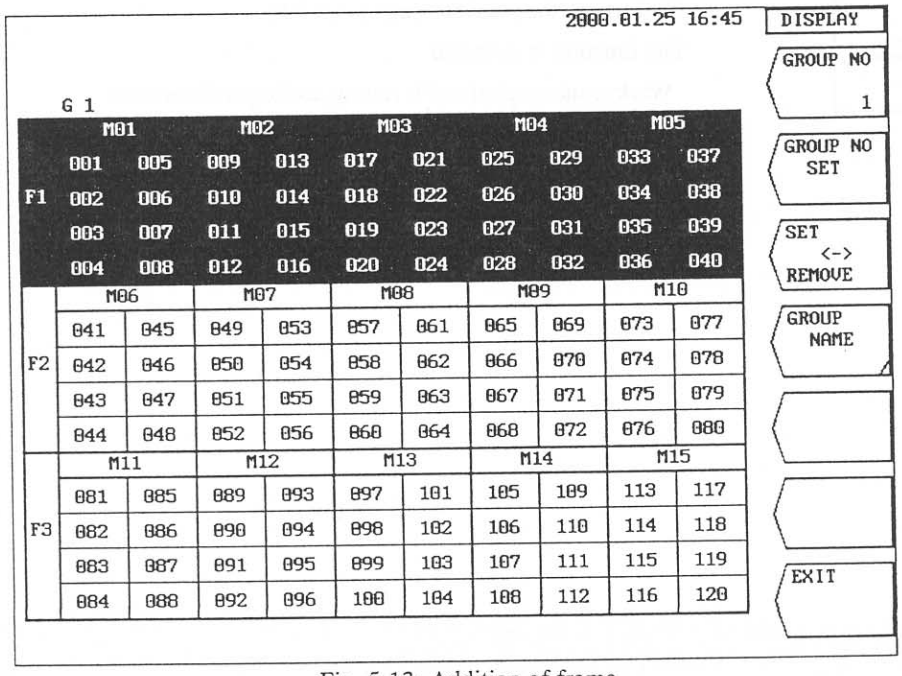
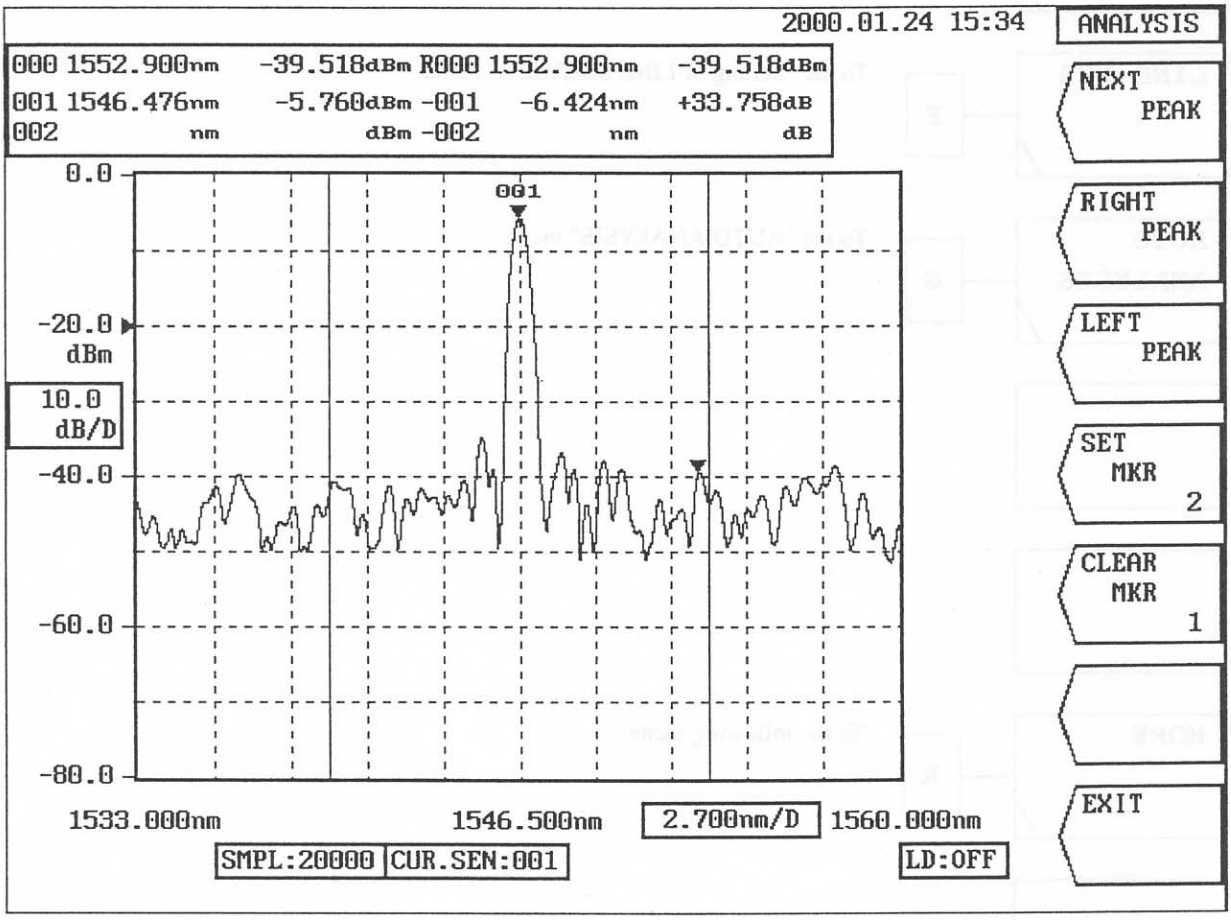


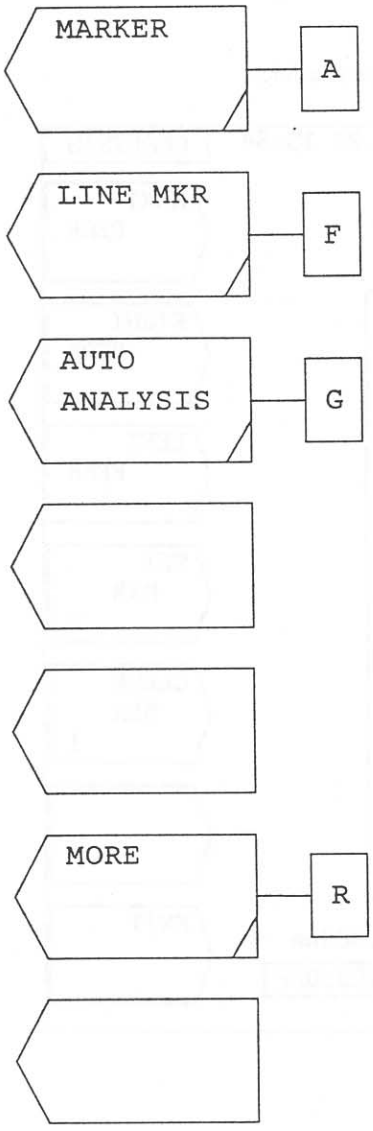
Fig. 5-13: Addition of frame

5.5.4 ANALYSIS

The wave data is analyzed.
The wave data is automatically analyzed by giving the parameter.
Moreover, the observation of the wave data with the marker and the line marker is also possible.



Main Menu



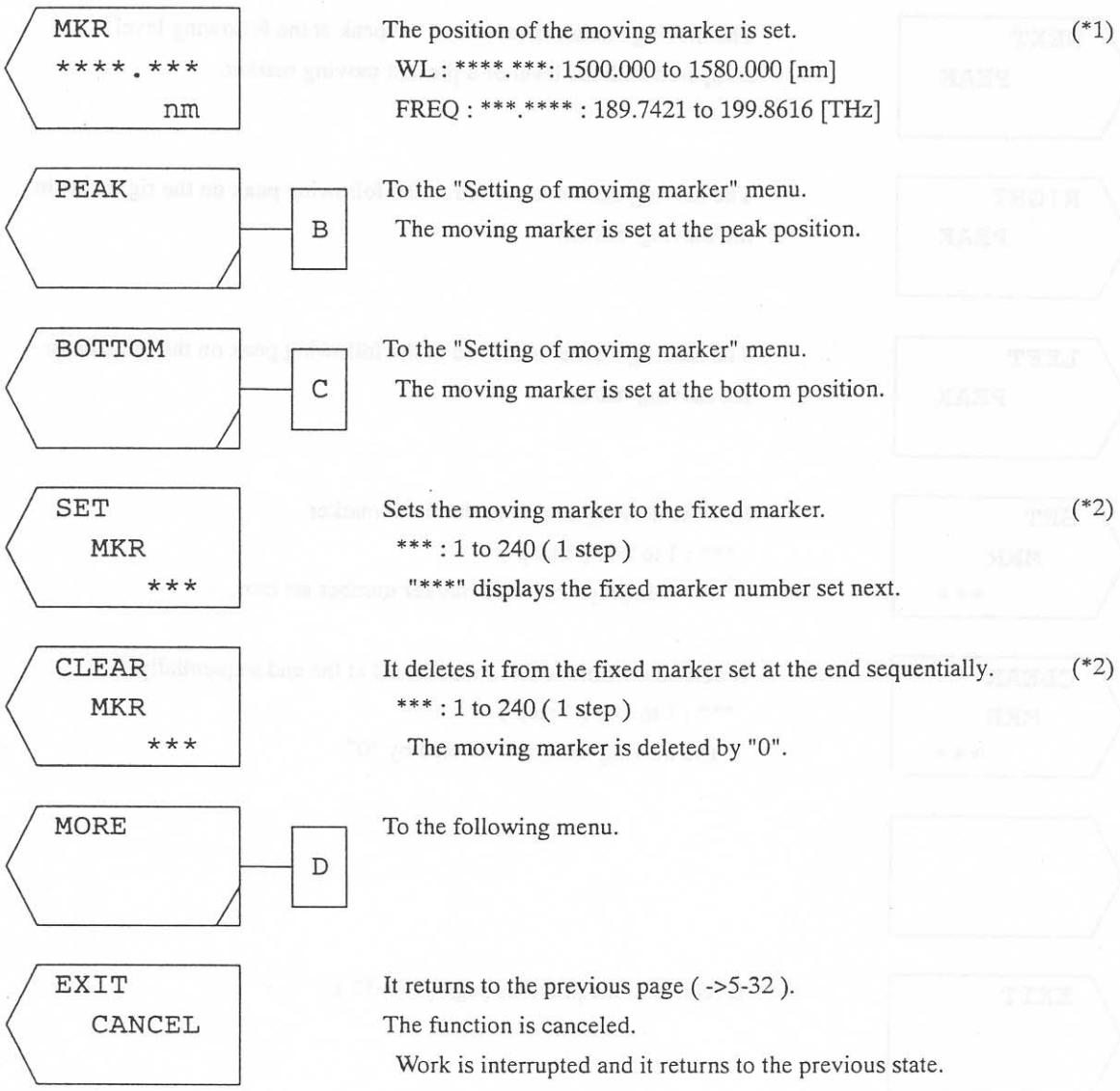
To the "Setting of MARKER" menu.

To the "Setting of LINE MARKER" menu.

To the "AUTO ANALYSIS" menu.

To the following menu.

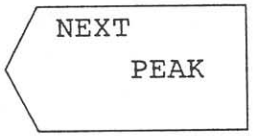
A) Setting of MARKER



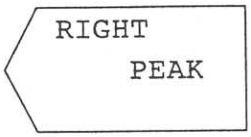
*1 The display changes by the setting of a horizontal axis.
For the wavelength : "nm"
For the frequency : "THz"

*2 < SET MKR > and < CLEAR MKR > cannot select an arbitrary marker number.

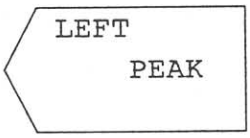
B) Setting of movimg marker (PEAK)



The moving marker is moved to the peak at the following level compared with the level of a present moving marker.

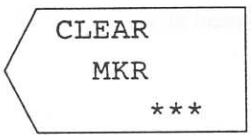


The moving marker is moved to the following peak on the right side in the moving marker.

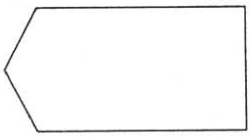


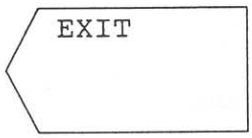
The moving marker is moved to the following peak on the left side in the moving marker.

Sets the moving marker to the fixed marker .
*** : 1 to 240 (1 step)
"***" displays the fixed marker number set next.



It deletes it from the fixed marker set at the end sequentially.
*** : 1 to 240 (1 step)
The moving marker is deleted by "0".





It returns to the previous page (->5-33).

C) Setting of movimg marker (BOTTOM)

NEXT BOTTOM	The moving marker is moved to the bottom at the following level compared with the level of a present moving marker.
RIGHT BOTTOM	The moving marker is moved to the following bottom on the right side in the moving marker.
LEFT BOTTOM	The moving marker is moved to the following bottom on the left side in the moving marker.
SET MKR ***	Sets the moving marker to the fixed marker . *** : 1 to 240 (1 step) "***" displays the fixed marker number set next.
CLEAR MKR ***	It deletes it from the fixed marker set at the end sequentially. *** : 1 to 240 (1 step) The moving marker is deleted by "0".
EXIT	It returns to the previous page (->5-33).

D) Setting of MARKER 2

MOVE ->MKR ***	Move the moving marker to fixed marker ***. *** : 0 to 240 (It is up to the maximum number that a fixed marker is set to be able to do setting.)
REF MKR ***	The moving marker or fixed marker*** is set as a reference marker. *** : 0 to 240 (It is up to the maximum number that a fixed marker is set to be able to do setting.) "0" shows the moving marker.
MKR LIST UP	The marker list is scrolled up.
MKR LIST DOWN	The marker list is scrolled down.
MORE	To the following menu.
EXIT	It returns to the previous page (->5-33).

E) Setting of MARKER 3

MKR ON OFF	The screen display of the marker is set. ON : The marker and the marker list are displayed. OFF : The marker and the marker list are non-displayed.
CLEAR ALL MKR	Clears the moving marker, fixed markers and the Marker values in the area.
MKR FIT HOLD	The movement condition of a fixed marker is set. FIT : A fixed marker moves according to a current sensor. HOLD : A fixed marker does not move when a current sensor is changed.
PRINT MKR LIST	When the marker list is displayed, the marker list is printed.
EXIT	It returns to the previous page (->5-36).

< MKR FIT/HOLD > : Setting of movement condition of fixed marker.

It is assumed that a fixed marker is set for the shape of waves of "SENSOR1".

Here, a current sensor is changed to "SENSOR5".

A fixed marker is on the shape of waves of the former even if a current sensor is changed to "HOLD" when set (refer to Fig. 5-14).

A fixed marker moves to be suitable for the shape of waves of "SENSOR5" when a current sensor is changed to "FIT" when set (refer to Fig. 5-15). The movement of a fixed marker is only a vertical direction.

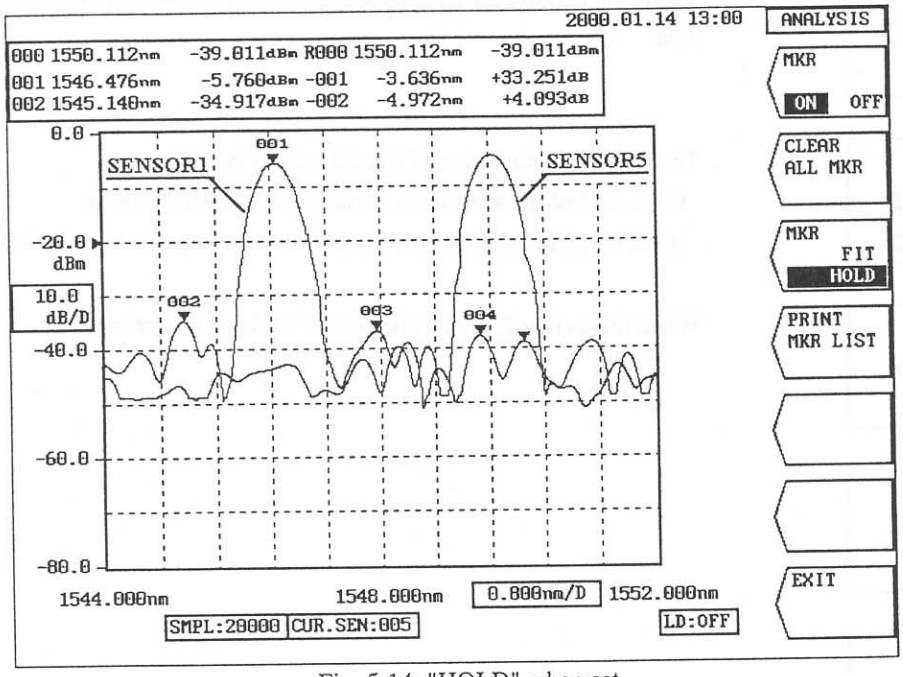


Fig. 5-14: "HOLD" when set

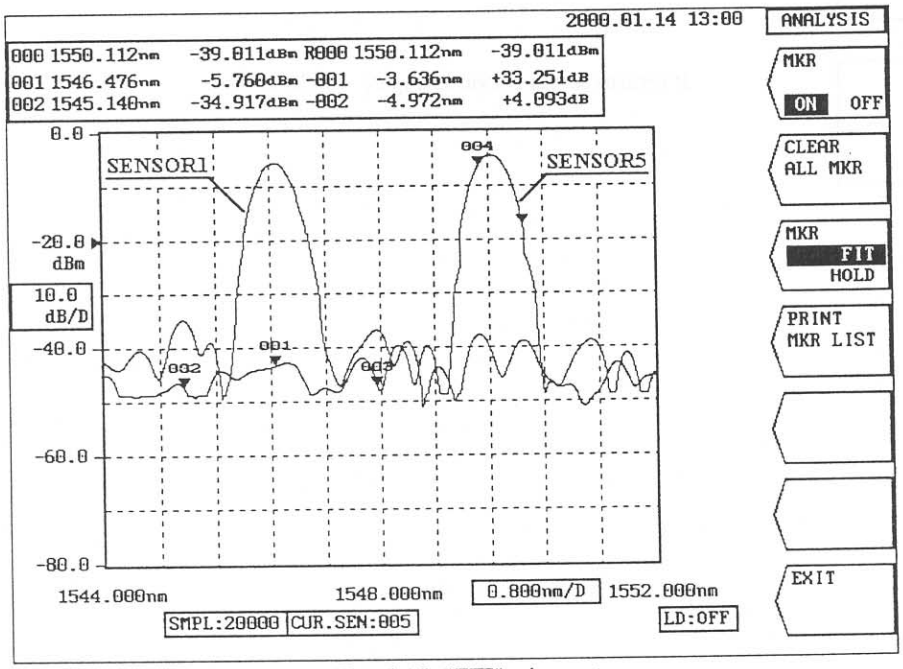


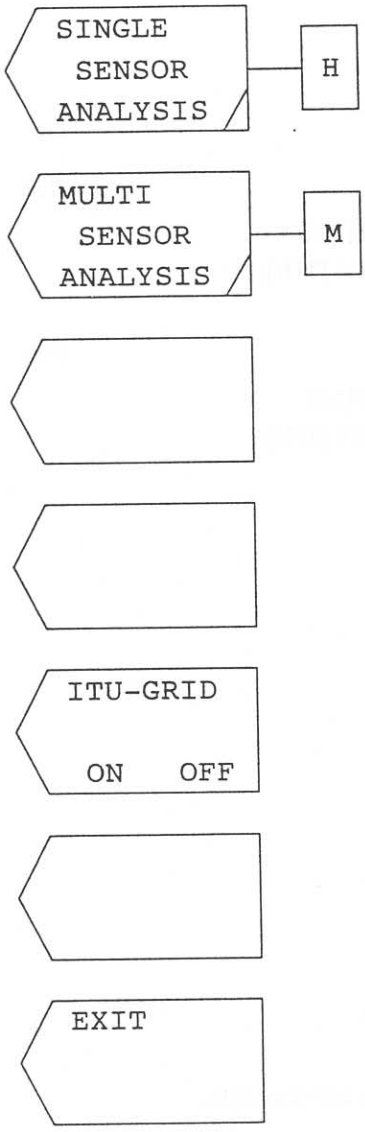
Fig. 5-15: "FIT" when set

F) Setting of LINE MARKER

LINE MKR ON OFF	The screen display of the marker is set. ON : The line marker is displayed. OFF : The line marker is non-displayed.
SET LINE MKR L1	Sets the line marker L1. (*1) WL : ****.*** : 1500.000 to 1580.000 [nm] FREQ : ***.**** : 189.7421 to 199.8616 [THz]
SET LINE MKR L2	Sets the line marker L2. (*2) WL : ****.*** : 1500.000 to 1580.000 [nm] FREQ : ***.**** : 189.7421 to 199.8616 [THz]
EXIT CANCEL	It returns to the previous page (->5-32). The function is canceled. Work is interrupted and it returns to the previous state.

*1 Please set becoming to L1≦L2 when you set the line marker.
L1 and L2 reach the same value when setting becoming to L1>L2.
It becomes the value of setting later.

G) AUTO ANALYSIS



To the "Setting of SS_ANALYSIS" menu.

To the "Setting of MS_ANALYSIS" menu.

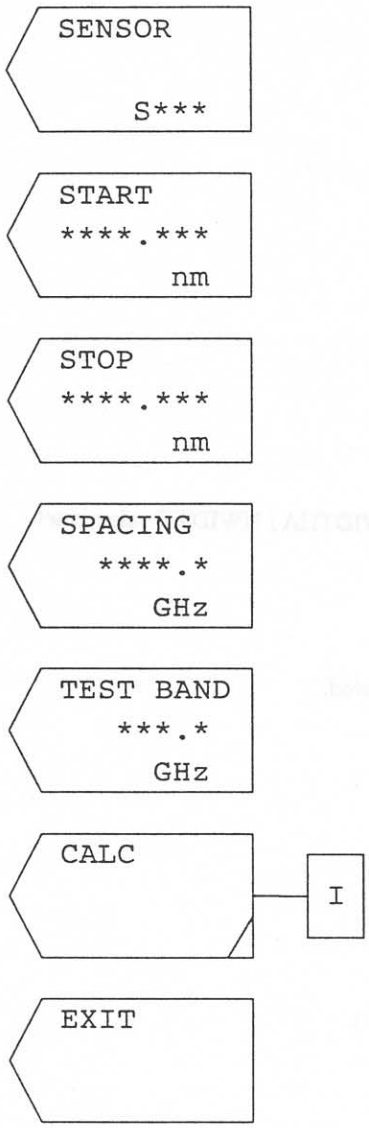
Setting of numeric input.

ON : Only ITU-GRID can be input. (The encoder input is also similar.)

OFF : The numerical value within the range of the measurement can be input.

It returns to the previous page (->5-32).

H) Setting of SS_ANALYSIS



The sensor to be analyzed is selected.
S*** : 1 to 240

Sets the start wavelength (or, frequency). (*1)
WL : ****.***: 1500.000 to 1580.000 (0.001 step) [nm]
FREQ : ***.****: 189.7421 to 199.8616 (0.0001 step) [THz]
However, setting is possible only within the measured range.

Sets the stop wavelength (or, frequency). (*1)
WL : ****.***: 1500.000 to 1580.000 (0.001 step) [nm]
FREQ : ***.****: 189.7421 to 199.8616 (0.0001 step) [THz]
However, setting is possible only within the measured range.

SPACING is set.
****.* : 1 to 9999.9 (0.1 step) [GHz]
Only setting by the frequency.

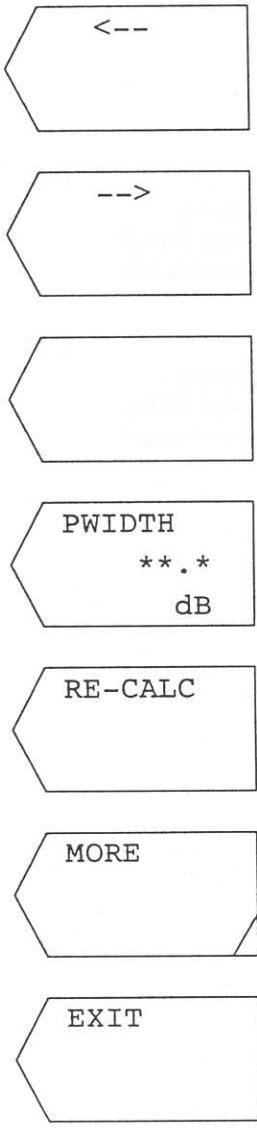
TEST BAND is set.
***.* : 0 to 100.0 (0.1 step) [GHz]
Only setting by the frequency.

To the "SS_LIST" menu.

It returns to the previous page (->5-40).

*1 The display changes by the setting of a horizontal axis.
For the wavelength : "nm"
For the frequency : "THz"

I) SS_LIST



The list part is scrolled left.

The list part is scrolled right.

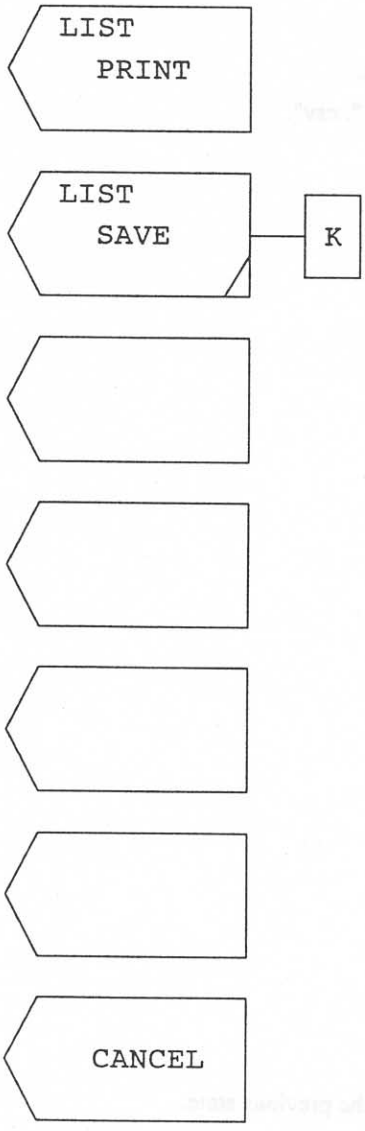
The level to calculate the PWIDTH / PWIDTHA / NWIDTH value is set.
**.* : 0 to 99.9 (0.1 steep) [dB]

The re-calculation (re-analysis) is executed.

To the following menu.

It returns to the previous page (->5-41).

J) SS_LIST 2

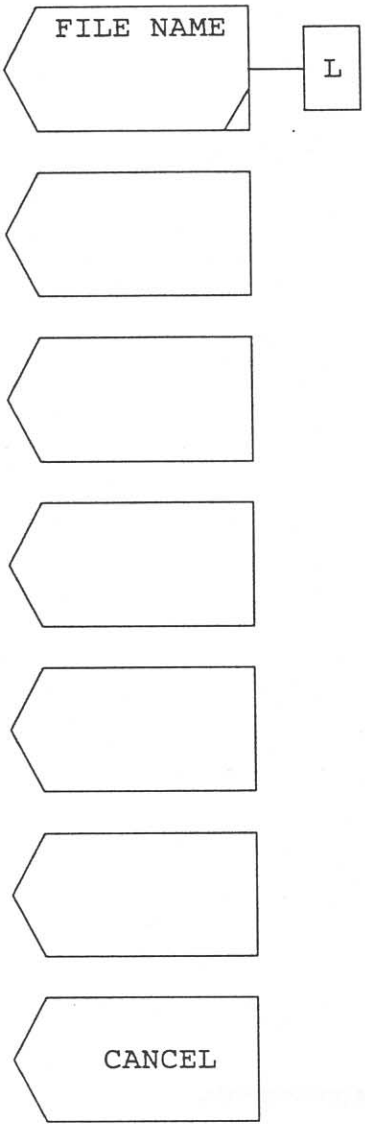


The list is printed.

To the "LIST SAVE" menu.

The function is canceled.
Work is interrupted and it returns to the previous state.

K) LIST SAVE



The file name is input.

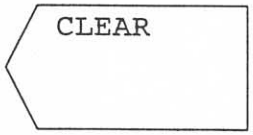
The file name is up to eight characters.

The extension automatically becomes ". csv".

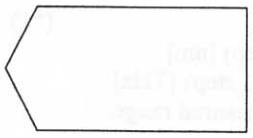
The function is canceled.

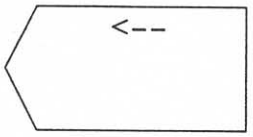
Work is interrupted and it returns to the previous state.

L) input assistance

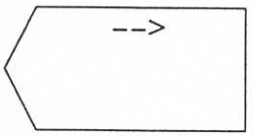


All character strings under the input are deleted.

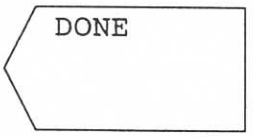




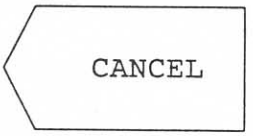
The cursor which shows the character input position moves left.



The cursor which shows the character input position moves right.



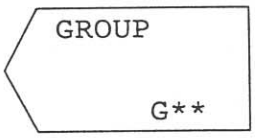
The input character string is fixed.



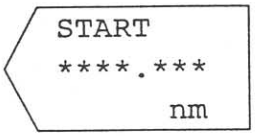
The function is canceled.

Work is interrupted and it returns to the previous state.

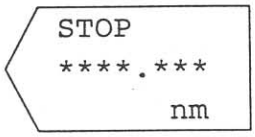
M) Setting of MS_ANALYSIS



The group to be analyzed is selected.
G** : 1 to 99

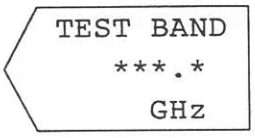


Sets the start wavelength (or, frequency). (*1)
WL : ****.***: 1500.000 to 1580.000 (0.001 step) [nm]
FREQ : ***.****: 189.7421 to 199.8616 (0.0001 step) [THz]
However, setting is possible only within the measured range.

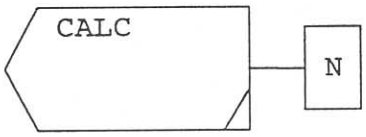


Sets the stop wavelength (or, frequency). (*1)
WL : ****.***: 1500.000 to 1580.000 (0.001 step) [nm]
FREQ : ***.****: 189.7421 to 199.8616 (0.0001 step) [THz]
However, setting is possible only within the measured range.

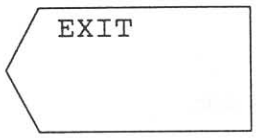
SPACING is set.
****.* : 1 to 9999.9 (0.1 step) [GHz]
Only setting by the frequency.



TEST BAND is set.
***.* : 0 to 100.0 (0.1 step) [GHz]
Only setting by the frequency.



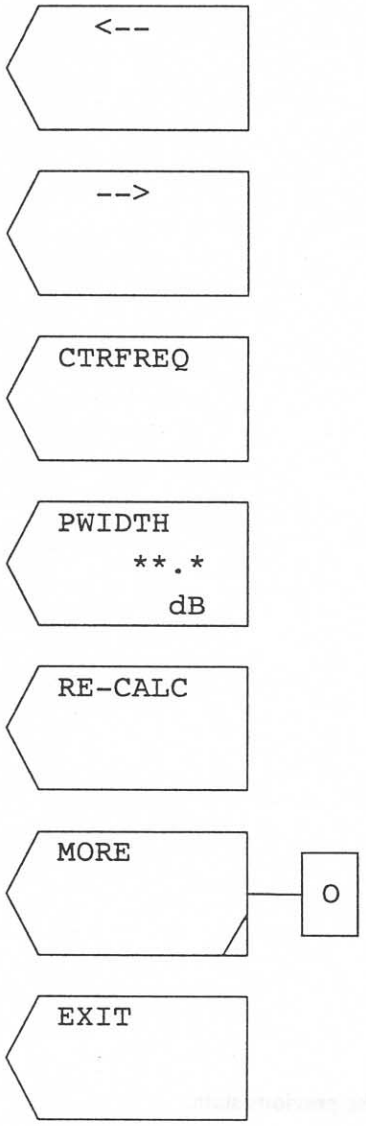
To the "MS_LIST" menu.



It returns to the previous page (->5-40).

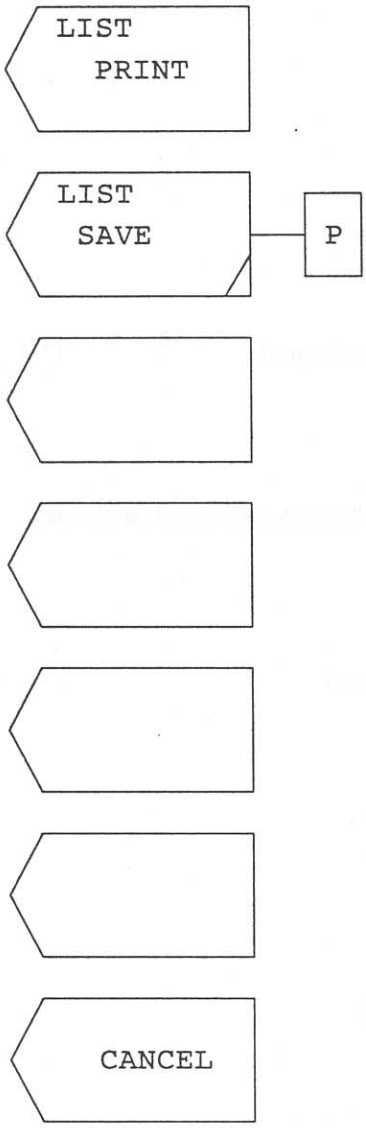
*1 The display changes by the setting of a horizontal axis.
For the wavelength : "nm"
For the frequency : "THz"

N) MS_LIST



*1 The display changes by the setting of a horizontal axis.
For the wavelength : "CTRWL"
For the frequency : "CTRFREQ"

O) MS_LIST 2

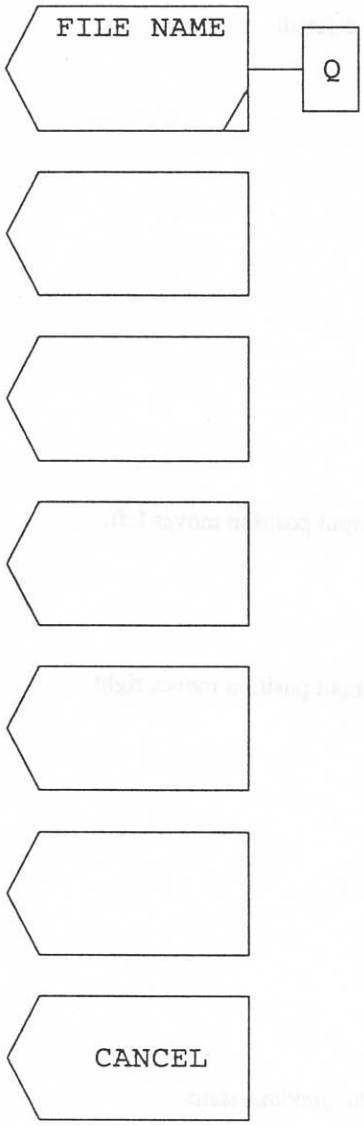


The list is printed.

To the "LIST SAVE" menu.

The function is canceled.
Work is interrupted and it returns to the previous state.

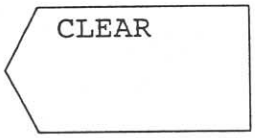
P) LIST SAVE



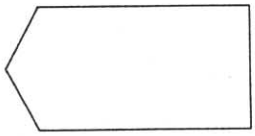
The file name is input.
The file name is up to eight characters.
The extension automatically becomes ". csv".

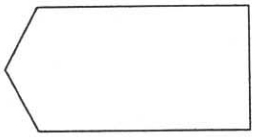
The function is canceled.
Work is interrupted and it returns to the previous state.

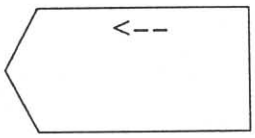
Q) input assistance



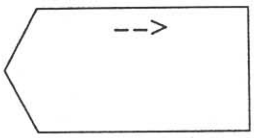
All character strings under the input are deleted.



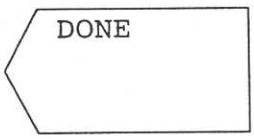




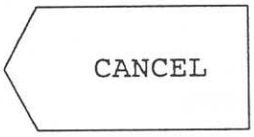
The cursor which shows the character input position moves left.



The cursor which shows the character input position moves right.

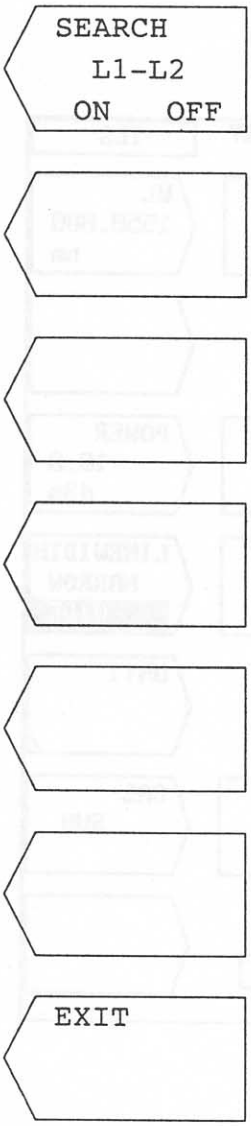


The input character string is fixed.



The function is canceled.
Work is interrupted and it returns to the previous state.

R) Main Menu 2



Setting within the range of the analysis is done.

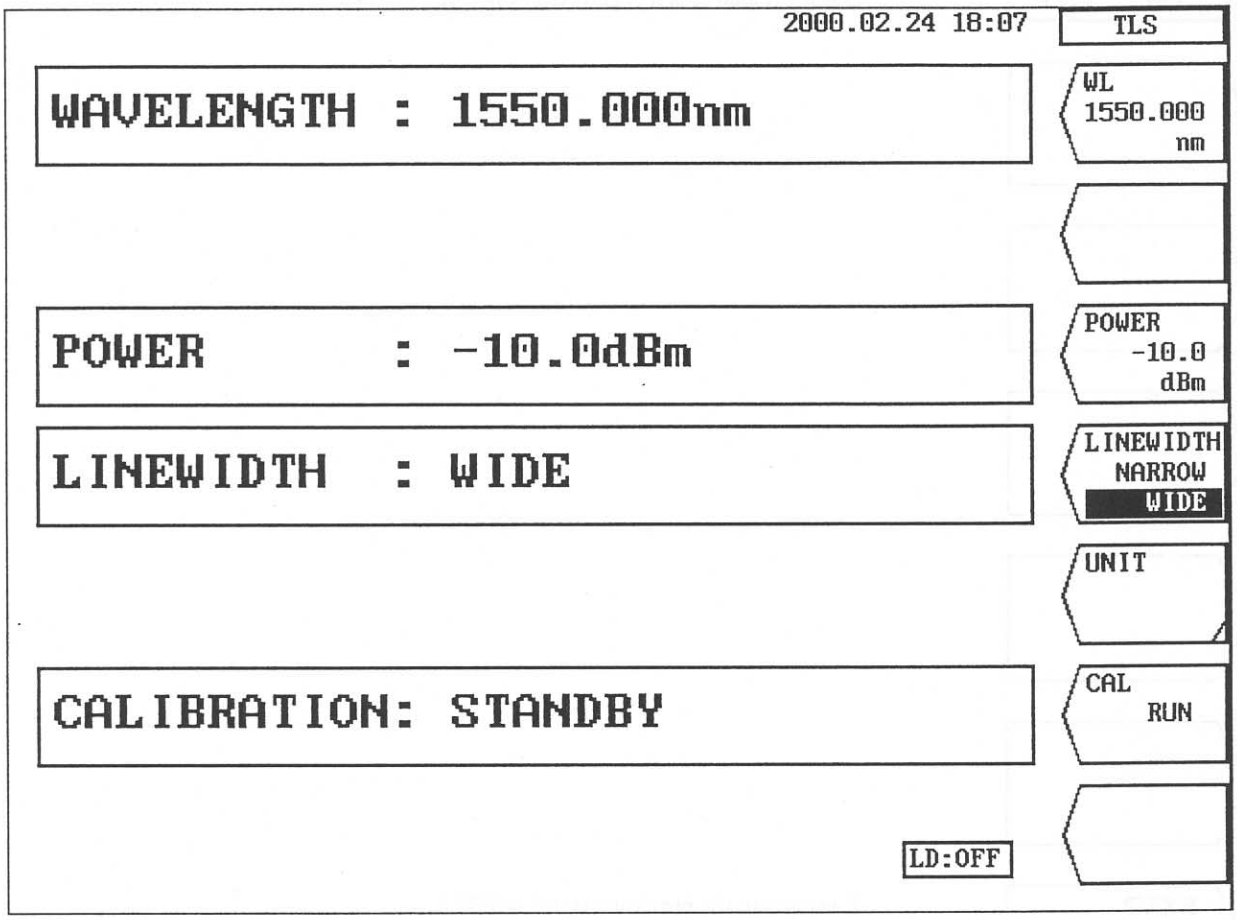
ON : It targets only between line markers of the analysis.

OFF : It analyzes it regardless of the line marker.

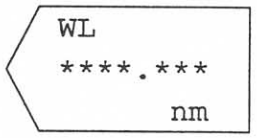
It returns to the previous page (->5-32).

5.5.5 TLS

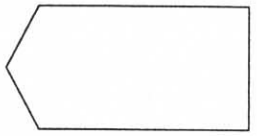
It is a tunable laser source mode.
Wavelength (or, frequency) and an optical output can be arbitrarily changed.
However, SWEEP cannot be done in this mode.

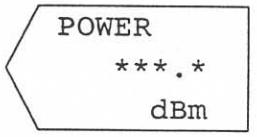


Main Menu

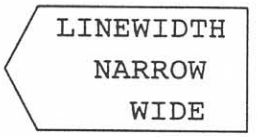


The wavelength (or, frequency) of an optical output is set. (*1)
WL : ****.*** : 1500.000 to 1580.000 (0.001 step) [nm]
FREQ : ***.**** : 189.7421 to 199.8616 (0.0001 step) [THz]

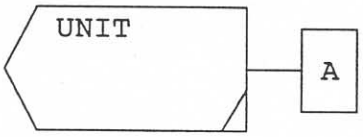




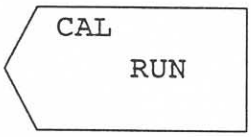
Sets the optical output to the specified level. (*2)
***.* : -23.0 to –3.0 (0.1 step) [dBm]



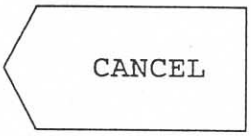
Sets the spectrum line width.



To the "Setting of unit" menu.



The wavelength of the tunable laser source built into AQ8460 is calibrated.
ON : The calibration succeeds with STANDBY released.
UNCAL : The calibration fails with STANDBY released.
STANDBY : It is a state of STANDBY.

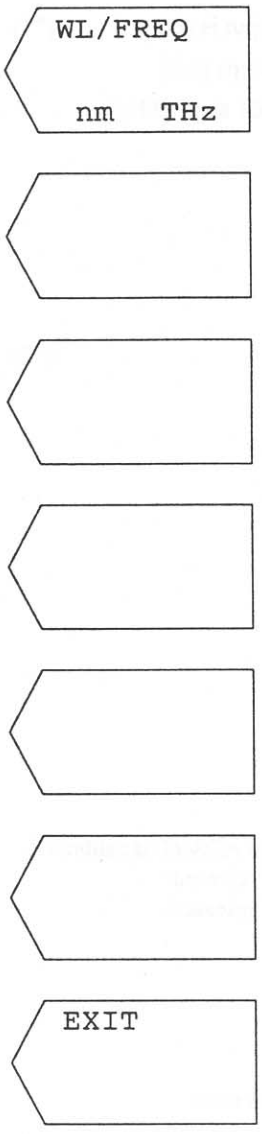


The function is canceled.
Work is interrupted and it returns to the previous state.

*1 The display changes by the setting of a horizontal axis.
For the wavelength : "nm"
For the frequency : "THz"

*2 This function is not installed in the model by which the attenuator is not built into.

A)Setting of unit

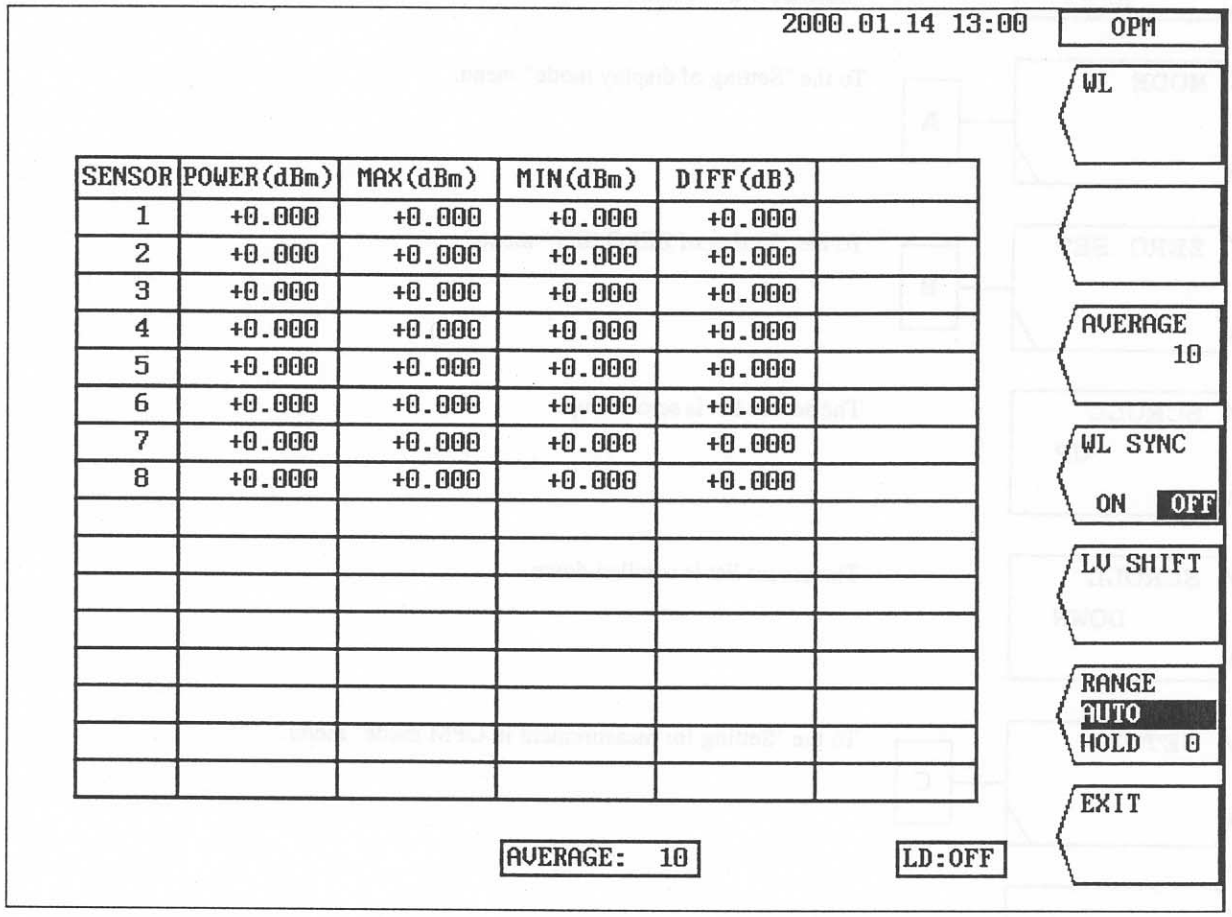


Switch of wavelength and frequency.

It returns to the previous page (->5-53).

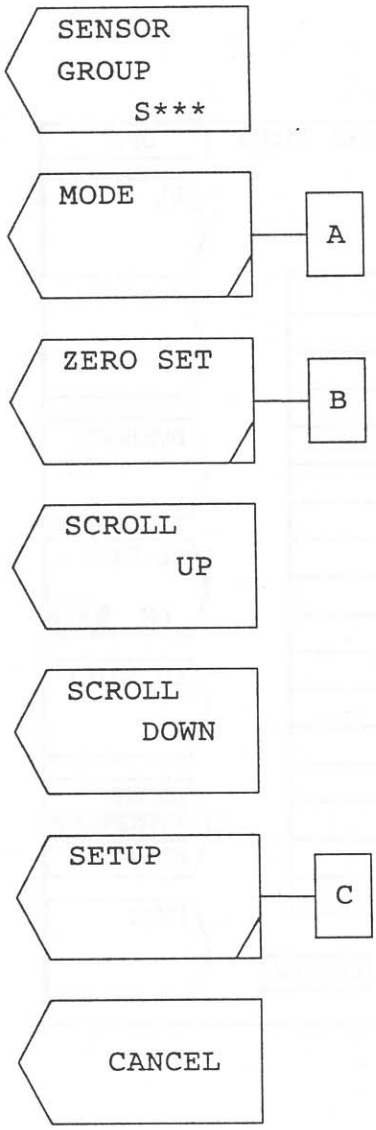
5.5.6 OPM

It is power meter mode.
The mounted sensor module can be used as a power meter of real time.
The setting of the measurement condition is done here.



SENSOR	POWER(dBm)	MAX(dBm)	MIN(dBm)	DIFF(dB)	
1	+0.000	+0.000	+0.000	+0.000	
2	+0.000	+0.000	+0.000	+0.000	
3	+0.000	+0.000	+0.000	+0.000	
4	+0.000	+0.000	+0.000	+0.000	
5	+0.000	+0.000	+0.000	+0.000	
6	+0.000	+0.000	+0.000	+0.000	
7	+0.000	+0.000	+0.000	+0.000	
8	+0.000	+0.000	+0.000	+0.000	

Main Menu



The sensor or the group which measures it is selected. (*1)
SENSOR : S*** : 1 to 240
GROUP : G** : 0 to 99

To the "Setting of display mode" menu.

To the "Setting of ZERO SET" menu.

The sensor list is scrolled up.

The sensor list is scrolled down.

To the "Setting for measurement in OPM mode" menu.

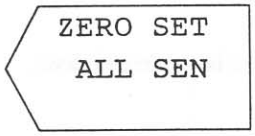
The function is canceled.
Work is interrupted and it returns to the previous state.

*1 The content of the group does setting by "DISPLAY - L)GROUP" (->5-29).

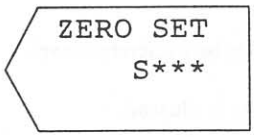
A)Setting of display mode

ABSOLUTE	It switches to the absolute value mode. The absolute value when the key is pushed is assumed to be a reference level. Relativity with the reference level is measured.
DREF	It switches to the DREF mode. The absolute value when the key is pushed is assumed to be a reference level. Relativity with the reference level is measured. When the key is pushed, the MAX/MIN/DIFF value is cleared.
REF	It switches to the REF mode. Relativity with the reference level is measured. The reference level is set in < REF VALUE >.
REF VALUE ****.*** dBm	The reference level is set. ****.*** : -199.999 to +199.999 (0.001 step) [dBm]
START MAX MIN	The maximum value/minimum value/difference between the maximum value and minimum value of the measurement power is displayed. The current measurement result is cleared by pushing the key again.
EXIT CANCEL	It returns to the previous page (->5-56). The function is canceled. Work is interrupted and it returns to the previous state.

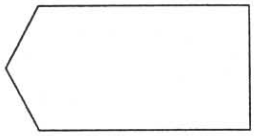
B)Setting of ZERO SET

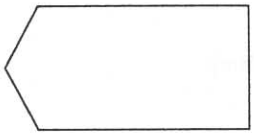


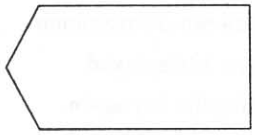
Zero set of all mounted sensor.
The time which hangs to zero set is about five seconds.

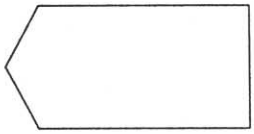


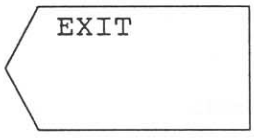
Zero set only of the selected sensor or group among mounted sensors.
Selected sensor or group is displayed.





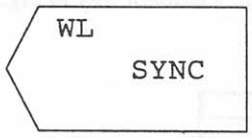




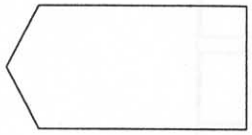


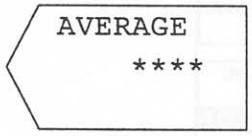
It returns to the previous page (->5-56).

C)Setting for measurement in OPM mode

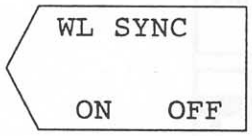


The measurement wavelength (or, frequency) is set for each sensor. (->5-60) (*1)
WL : 1500.000 to 1620.000 (0.001 step) [nm]
FREQ : 185.0571 to 199.8616 (0.0001 step) [THz]

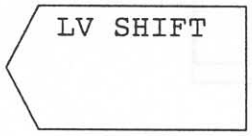




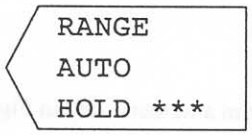
Sets the number of averaging times for measurement.
**** : OFF,2,5,10,20,50,100,200,500 or 1000
It changes whenever the key is pushed.



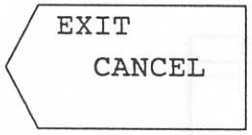
Synchronous setting with the wavelength (or, frequency) of the source of light is done. (*1)
ON : Sync ("SYNC" is displayed in < WL > (or, < FREQ >).)
OFF : Async



The measurement level is corrected. (->5-60)
-199.999 to 199.999 [dB]



Sets the measuring sensitivity. (*2)
"AUTO","HOLD 0","HOLD –30" or "HOLD –60"
It changes whenever the key is pushed.



It returns to the previous page (->5-56).
The function is canceled.
Work is interrupted and it returns to the previous state.

*1 The display changes by the setting of a horizontal axis.
For the wavelength : "WL"
For the frequency : "FREQ"

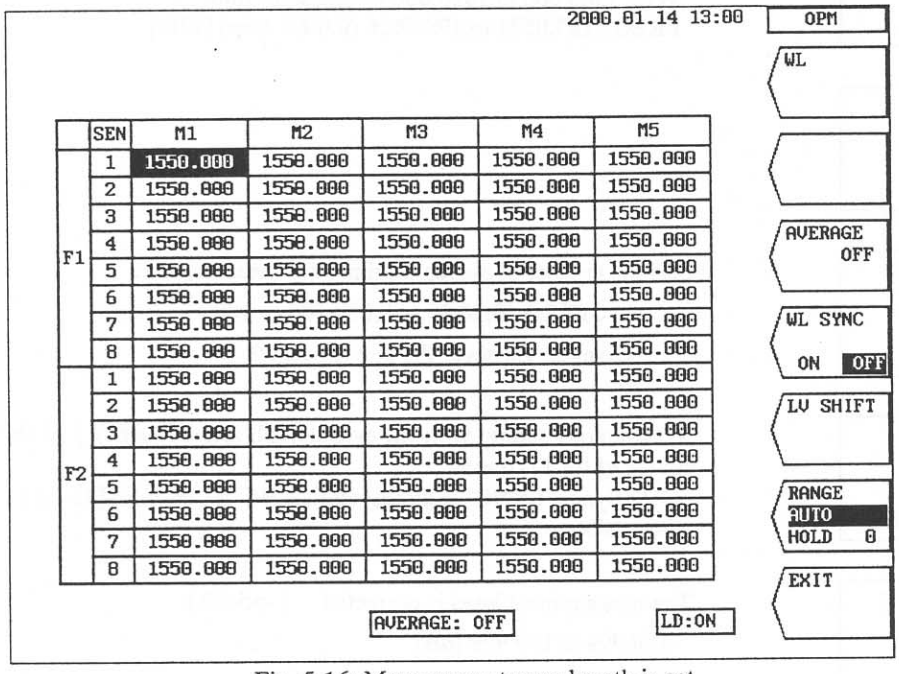
*2 The range of the measurement in each range is as follows. (at 1550nm, no correction value)

AUTO	:	-95 to 0 [dBm]
HOLD 0	:	-20 to 0 [dBm]
HOLD –30	:	-50 to -19 [dBm]
HOLD –60	:	-95 to –49 [dBm]

< WL > : The measurement wavelength (or, frequency) is set for each sensor.

The measurement wavelength of each sensor is input for the wave length sensitivity correction.

The cursor is matched to the sensor which wants to be set and the numerical value is input from a numeric key in Fig. 5-16. It fixes it with the [ENTER] key.



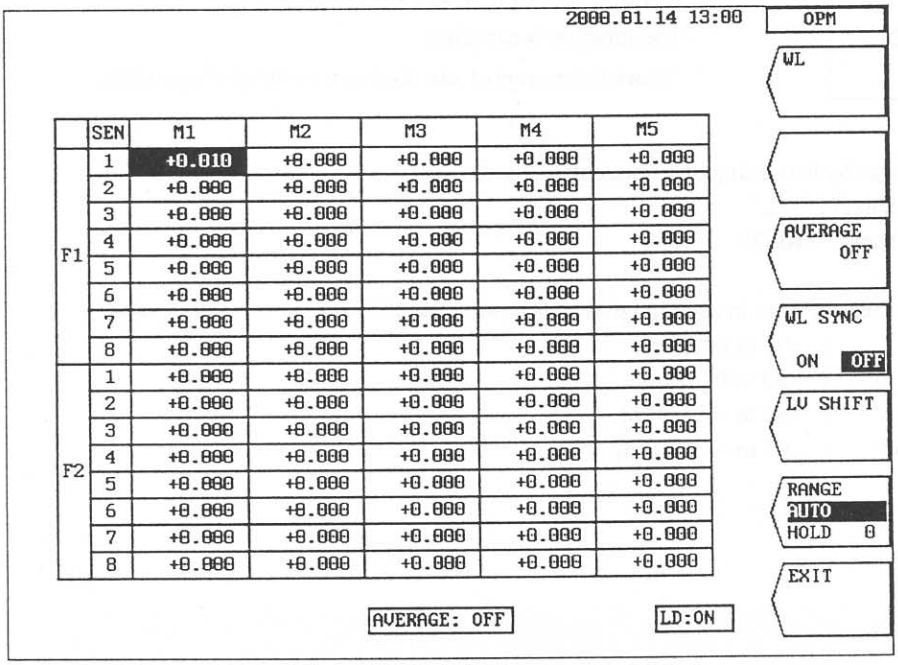
	SEN	M1	M2	M3	M4	M5
F1	1	1550.000	1550.000	1550.000	1550.000	1550.000
	2	1550.000	1550.000	1550.000	1550.000	1550.000
	3	1550.000	1550.000	1550.000	1550.000	1550.000
	4	1550.000	1550.000	1550.000	1550.000	1550.000
	5	1550.000	1550.000	1550.000	1550.000	1550.000
	6	1550.000	1550.000	1550.000	1550.000	1550.000
	7	1550.000	1550.000	1550.000	1550.000	1550.000
	8	1550.000	1550.000	1550.000	1550.000	1550.000
F2	1	1550.000	1550.000	1550.000	1550.000	1550.000
	2	1550.000	1550.000	1550.000	1550.000	1550.000
	3	1550.000	1550.000	1550.000	1550.000	1550.000
	4	1550.000	1550.000	1550.000	1550.000	1550.000
	5	1550.000	1550.000	1550.000	1550.000	1550.000
	6	1550.000	1550.000	1550.000	1550.000	1550.000
	7	1550.000	1550.000	1550.000	1550.000	1550.000
	8	1550.000	1550.000	1550.000	1550.000	1550.000

Fig. 5-16: Measurement wavelength is set

< LV SHIFT > : Correction of measurement level.

The correction value of each sensor is input.

The cursor is matched to the sensor which wants to be set and the numerical value is input from a numeric key in Fig. 5-17. It fixes it with the [ENTER] key.

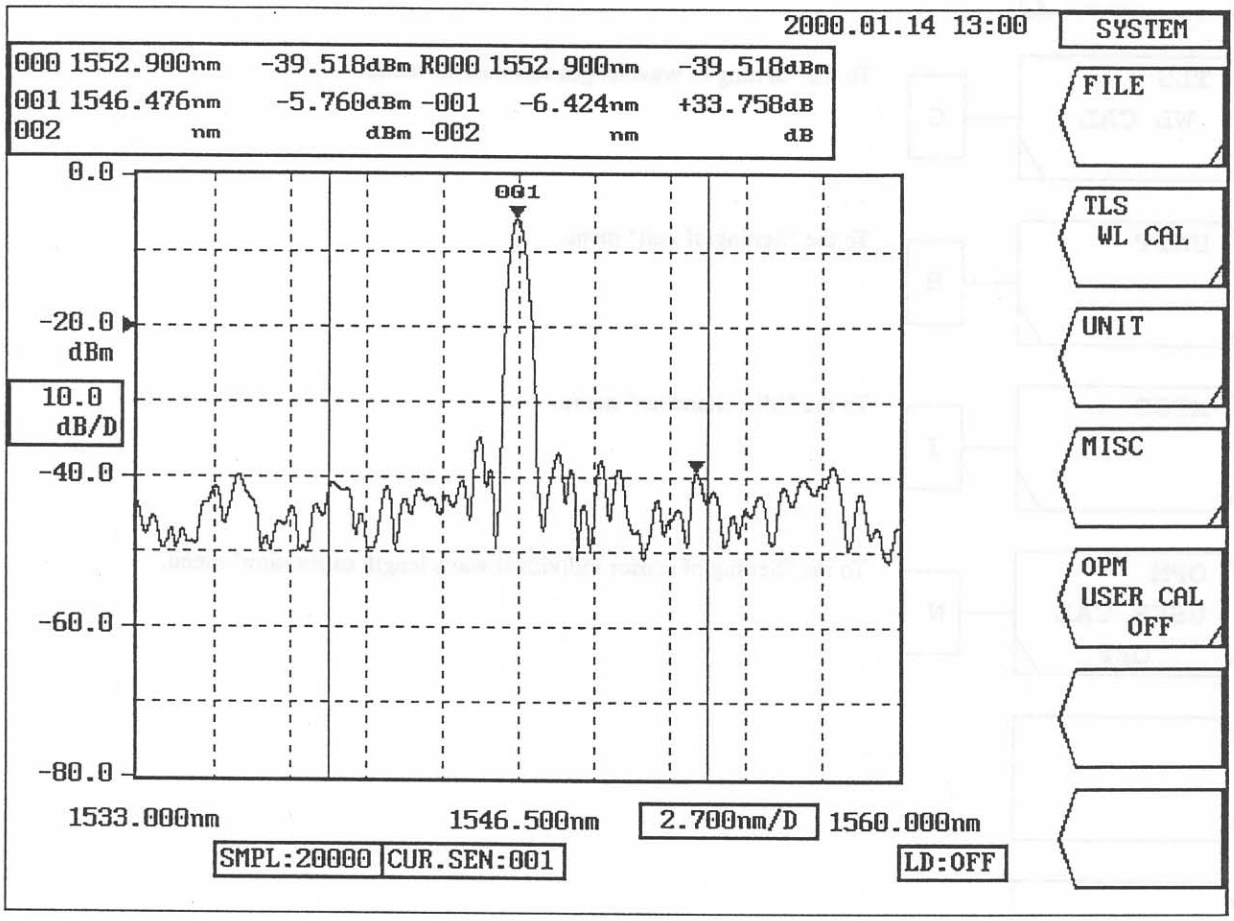


	SEN	M1	M2	M3	M4	M5
F1	1	+0.010	+0.000	+0.000	+0.000	+0.000
	2	+0.000	+0.000	+0.000	+0.000	+0.000
	3	+0.000	+0.000	+0.000	+0.000	+0.000
	4	+0.000	+0.000	+0.000	+0.000	+0.000
	5	+0.000	+0.000	+0.000	+0.000	+0.000
	6	+0.000	+0.000	+0.000	+0.000	+0.000
	7	+0.000	+0.000	+0.000	+0.000	+0.000
	8	+0.000	+0.000	+0.000	+0.000	+0.000
F2	1	+0.000	+0.000	+0.000	+0.000	+0.000
	2	+0.000	+0.000	+0.000	+0.000	+0.000
	3	+0.000	+0.000	+0.000	+0.000	+0.000
	4	+0.000	+0.000	+0.000	+0.000	+0.000
	5	+0.000	+0.000	+0.000	+0.000	+0.000
	6	+0.000	+0.000	+0.000	+0.000	+0.000
	7	+0.000	+0.000	+0.000	+0.000	+0.000
	8	+0.000	+0.000	+0.000	+0.000	+0.000

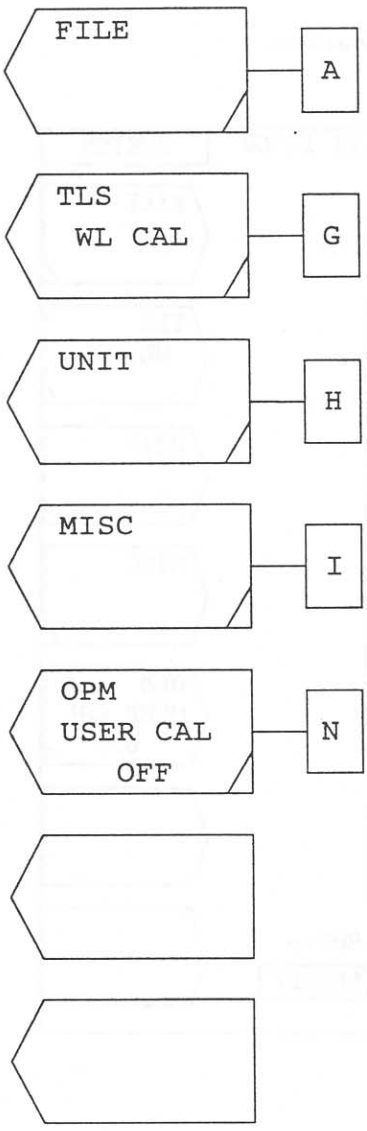
Fig. 5-17: Correction value is set

5.5.7 SYSTEM

The setting of the system whole is done.
The wave length calibration, the preservation of the wavy data, and reading, etc. are done here.



Main Menu



To the "FILE" menu.

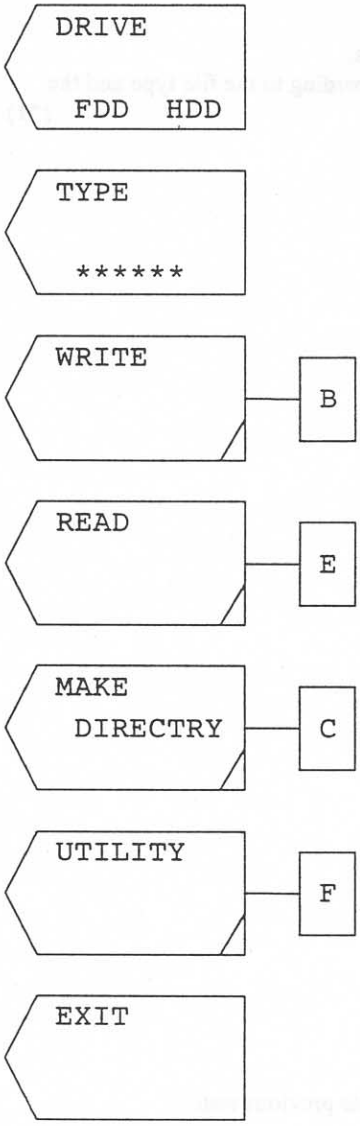
To the "Setting of wavelength calibration" menu.

To the "Setting of unit" menu.

To the "Miscellaneous" menu.

To the "Setting of sensor individual wave length calibration" menu.

A)FILE



The drive is set.
FDD : Please insert FD of 1.44M format.
HDD : It is HD built into AQ8460.

The file type is set.
****** : PACKET,WAVE
It changes whenever the key is pushed.

To the "Preservation of wave data" menu.

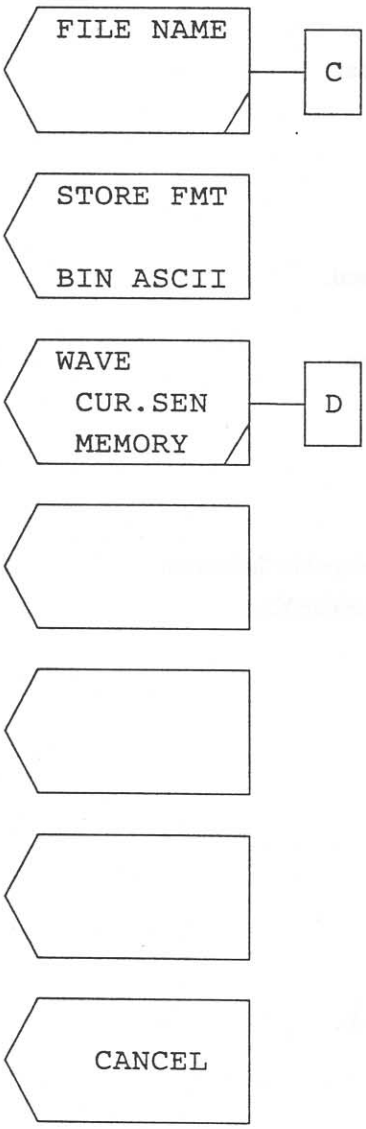
The wave data is read.
PACKET : The read wave data is displayed in the screen.
WAVE : It reads to MEMORY1 to MEMORY5.

The directory is made.

To the "UTILITY" menu.

It returns to the previous page (->5-62).

B)Preservation of wave data



The file name is input.
The file name is up to eight characters.
The extension is automatically set according to the file type and the preservation form. (*1)

The preservation form is specified.

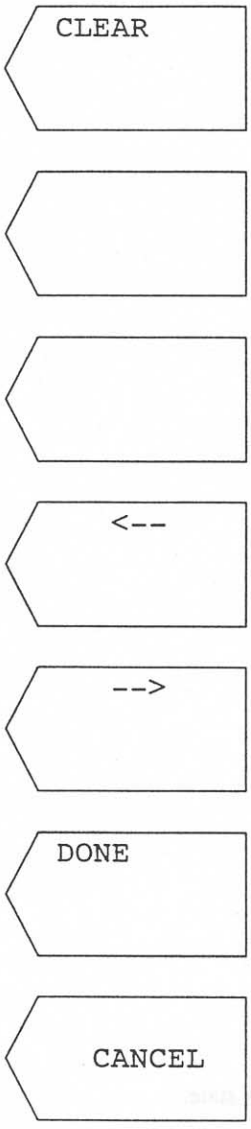
To the "Selection of wave data" menu.

The function is canceled.
Work is interrupted and it returns to the previous state.

*1 Automatic set of extension by file type and the preservation form :

TYPE	STORE FMT	Extension
WAVE	BIN	.wav
WAVE	ASCII	.csv
PACKET	————	.pkt

C)input assistance



All character strings under the input are deleted.

The cursor which shows the character input position moves left.

The cursor which shows the character input position moves right.

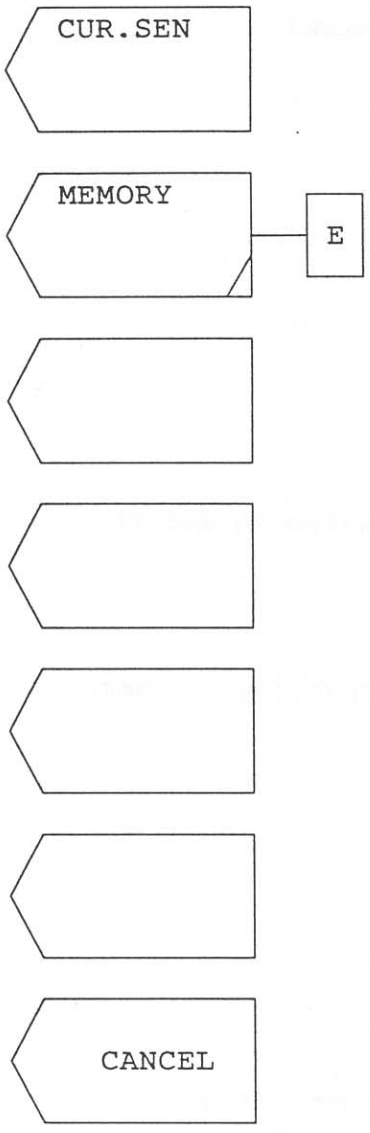
DONE

The input character string is fixed.

CANCEL

The function is canceled.
Work is interrupted and it returns to the previous state.

D)Selection of wave data

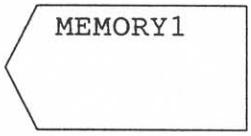


A current sensor is selected.

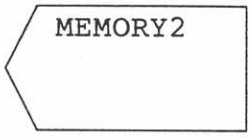
To the "Selection of MEMORY" menu.

The function is canceled.
Work is interrupted and it returns to the previous state.

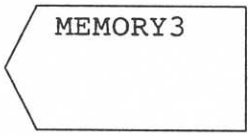
E)Selection of MEMORY



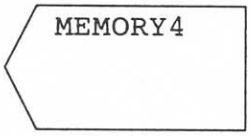
MEMORY1 is selected.



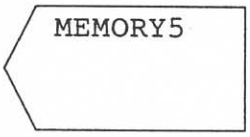
MEMORY2 is selected.



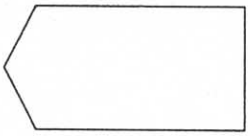
MEMORY3 is selected.

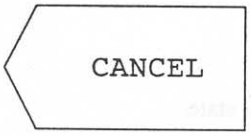


MEMORY4 is selected.



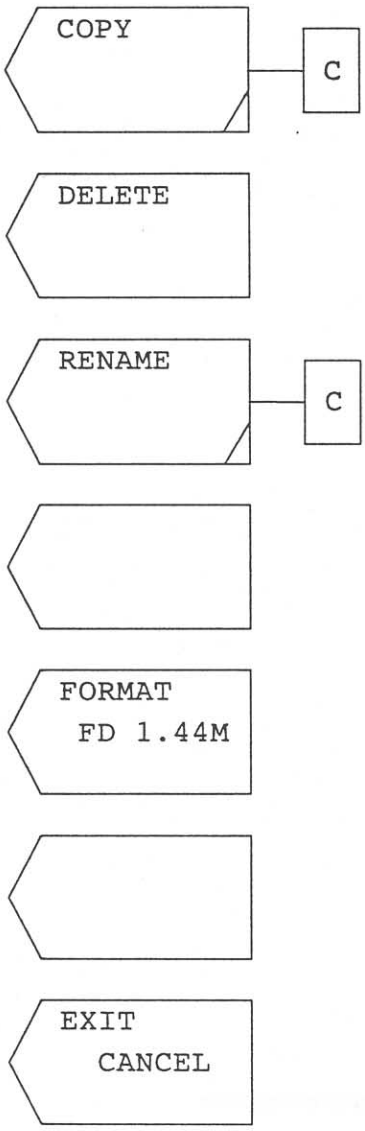
MEMORY5 is selected.





The function is canceled.
Work is interrupted and it returns to the previous state.

F)UTILITY



The file is copied.

The file is deleted.

The file name is changed.

The floppy disk is formatted (1.44MB).

It returns to the previous page (->5-63).

The function is canceled.

Work is interrupted and it returns to the previous state.

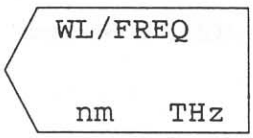
G)Setting of wavelength calibration

CAL RUN	The wavelength of the tunable laser source built into AQ8460 is calibrated.
POWER ON CAL ON OFF	Setting of power on calibration. ON : When the standby operation ends, it calibrates automatically. OFF : When the standby operation ends, it does not calibrate.
AUTO CAL ON OFF	Setting of auto calibration. ON : It calibrates automatically. OFF : It calibrates manually.
WL SHIFT **** pm	The wavelength actual only as for wavelength's worth specified for a present wavelength set value is shifted. **** : -200 to +200 (1 step) [pm]
EXIT CANCEL	It returns to the previous page (->5-62). The function is canceled. Work is interrupted and it returns to the previous state.

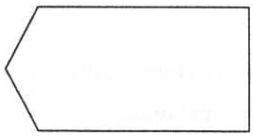
⚠ Caution

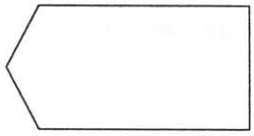
Set the linewidth and turn on LD before calibrating the wavelength.
Moreover, do not turn off LD to the measurement end because the mode hops occasionally when LD is turned on and off.

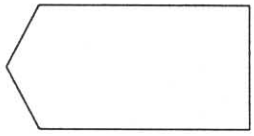
H)Setting of unit

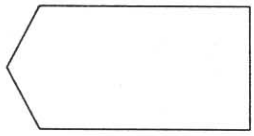


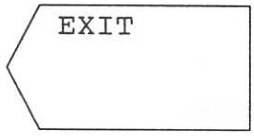
Switch of wavelength and frequency.





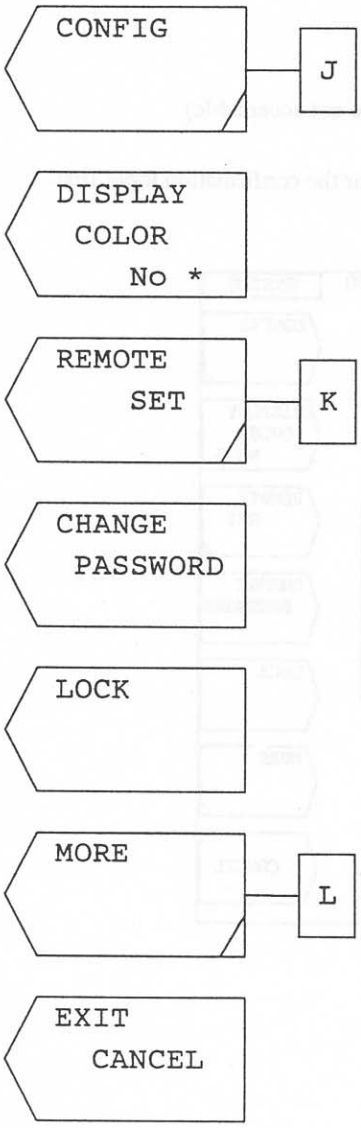






It returns to the previous page (-> 5-62).

I)Miscellaneous



To the "Setting of configuration" menu.

Sets the display color.
* : 1 to 5

To the "Setting of remote" menu.

The password is changed. (->5-72)

The operation system of AQ8460 is locked with a present state maintained.
It is necessary to input the password to the lock/release.
(->5-73)

To the following menu.

It returns to the previous page (->5-62).
The function is canceled.
Work is interrupted and it returns to the previous state.

< CHANGE PASSWORD > : The password is changed.

It becomes a screen in Fig. 5-18 if the key is pushed.

A present password is input to "OLD PASSWORD".

When the password is wrong, it becomes an error. Try to input it.

A new password is input to "NEW PASSWORD".

The password must be of 4 numerical characters (3 or less numerical characters are not acceptable).

A new password is input twice for the confirmation.

It becomes an error when differing from the password which the password input for the confirmation input first.

Try to input be a new password.

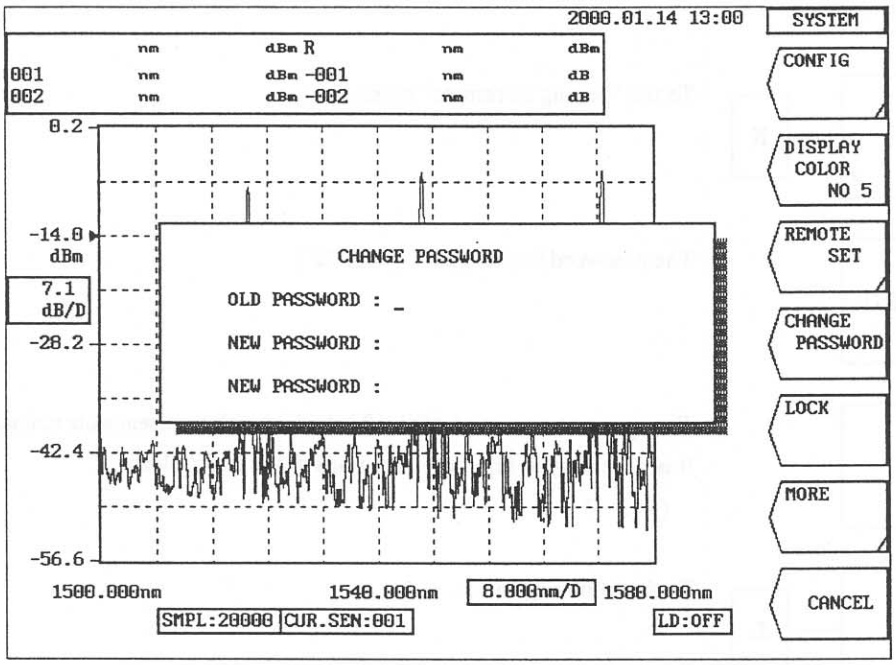


Fig. 5-18: Screen of password input

< LOCK > : The operation system of AQ8460 is locked.
It becomes a screen in Fig. 5-19 if the key is pushed.
It becomes a screen in Fig. 5-20 if the password is input and the operation system of AQ8460 is locked.
The lock is released by inputting the password in Fig. 5-20.

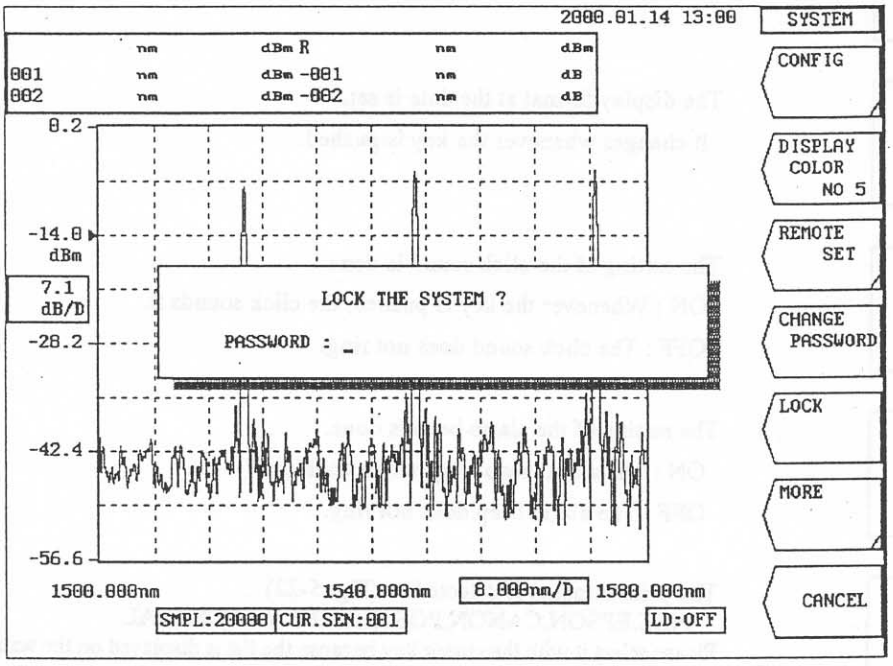


Fig. 5-19: Screen of password input

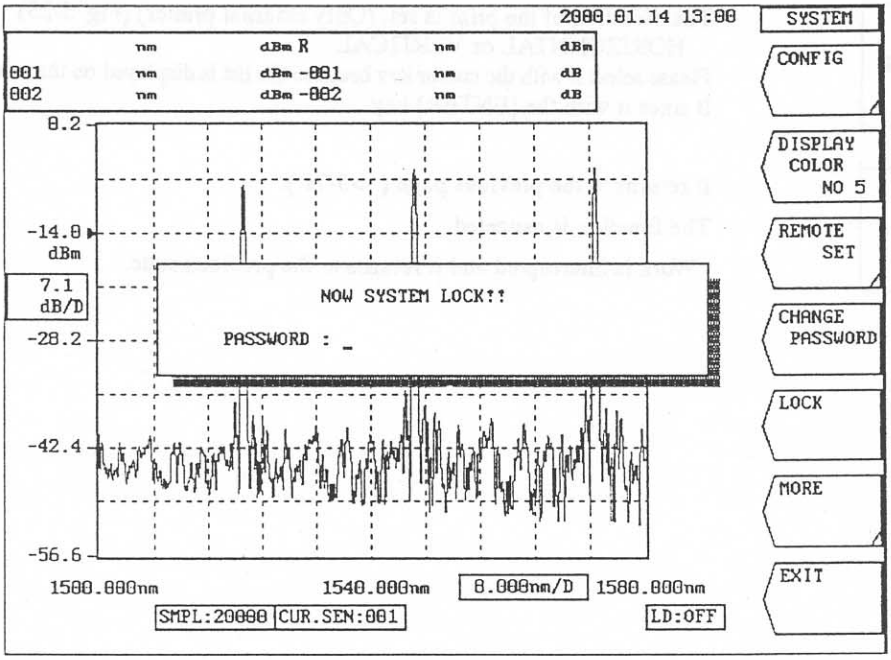


Fig. 5-20: Screen of system lock

J)Setting of configuration

CLOCK SET	The date and the time of AQ8460 are set. (Fig. 5-21)
Y-M-D M-D-Y D-M-Y	The display format at the date is set. It changes whenever the key is pushed.
BUZZER CLICK ON OFF	The setting of the click sound is done. ON : Whenever the key is pushed, the click sounds it. OFF : The click sound does not ring.
BUZZER WRN ON OFF	The setting of the alarm beep is done. ON : The alarm beep rings when warning. OFF : The alarm beep does not ring.
PRINTER MAKER	The printer maker is selected. (Fig. 5-22) NEC,EPSON,CANON,POSTSCRIPT or INTERNAL Please select it with the cursor key because the list is displayed on the screen. It fixes it with the [ENTER] key.
PRINTER DIRECTION	The direction of the print is set. (Only external printer) (Fig. 5-23) HORIZONNTAL or VERTICAL Please select it with the cursor key because the list is displayed on the screen. It fixes it with the [ENTER] key.
EXIT CANCEL	It returns to the previous page (->5-71). The function is canceled. Work is interrupted and it returns to the previous state.

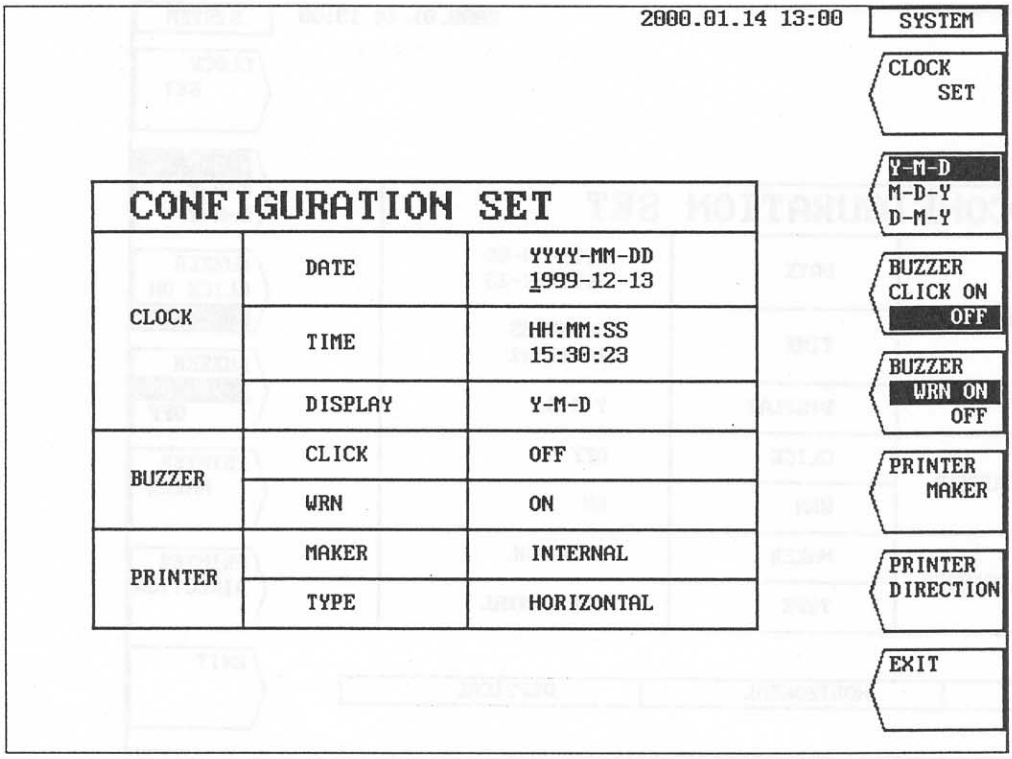


Fig. 5-21: Setting at date/time

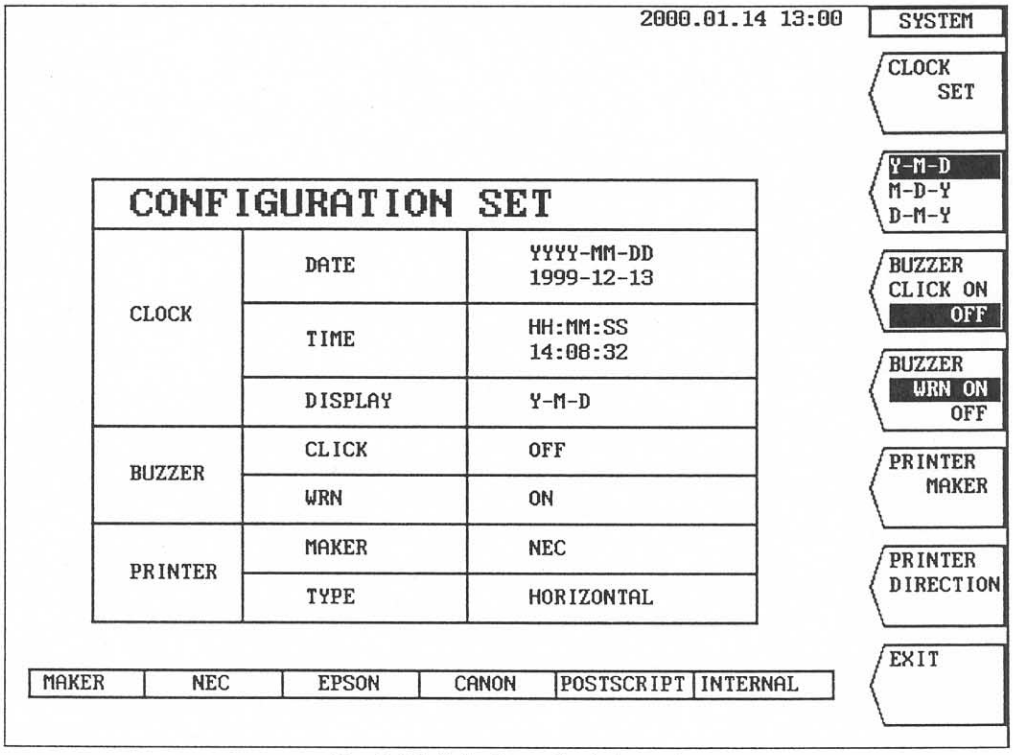


Fig. 5-22: Selection of printer maker

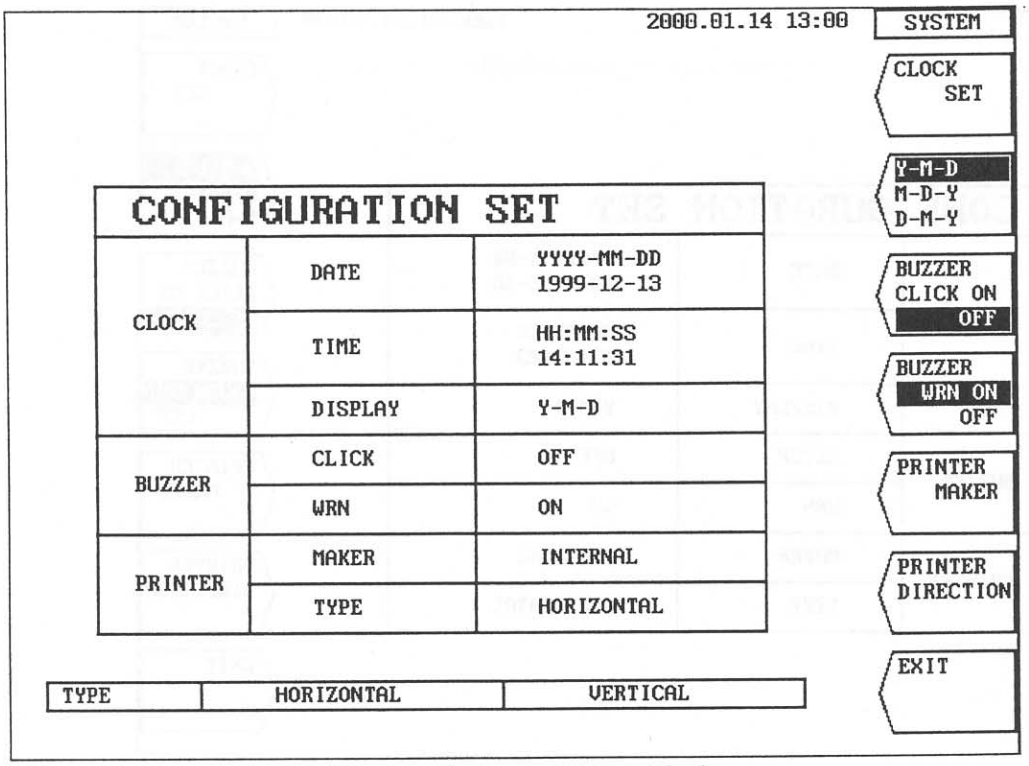


Fig. 5-23: Setting in direction of print

K)Setting of remote

GP-IB
ADDRESS
**

The GP-IB address is set. (Fig. 5-24)
** : 0 to 30

GP-IB
DELIMITER

The GP-IB delimiter is set. (Fig. 5-25)
"[EOI]" or "CR+LF+[EOI]"
Please select it with the cursor key because the list is displayed on the screen.

EXIT
CANCEL

It returns to the previous page (->5-71).
The function is canceled.
Work is interrupted and it returns to the previous state.

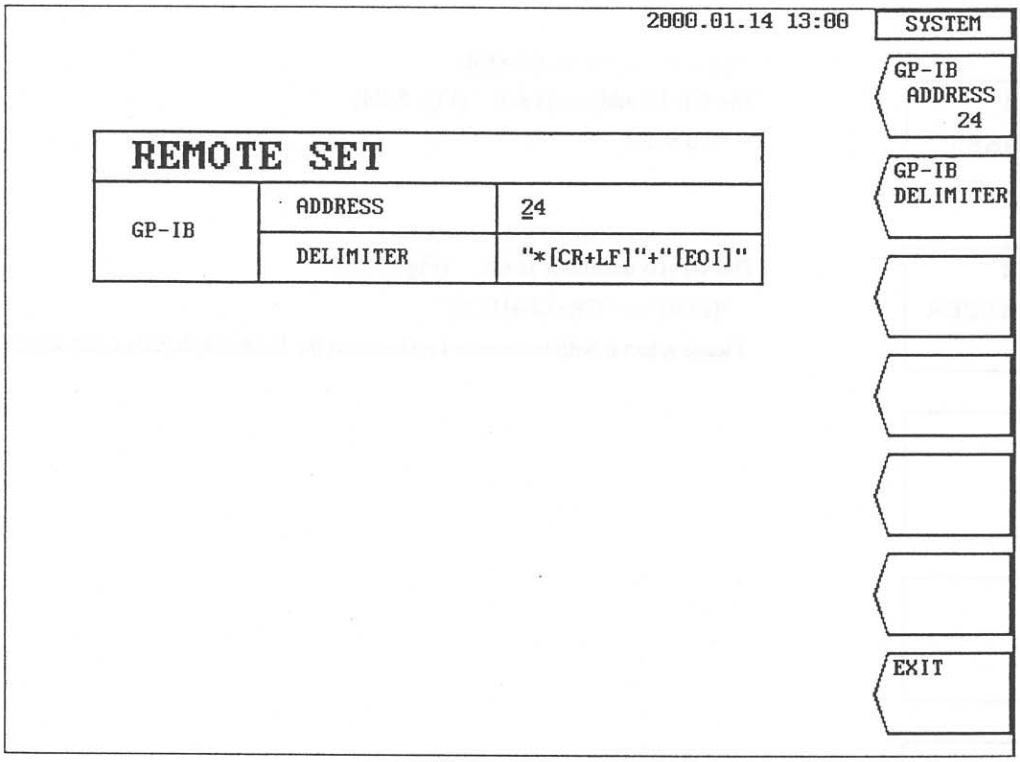


Fig. 5-24: Setting of GP-IB address

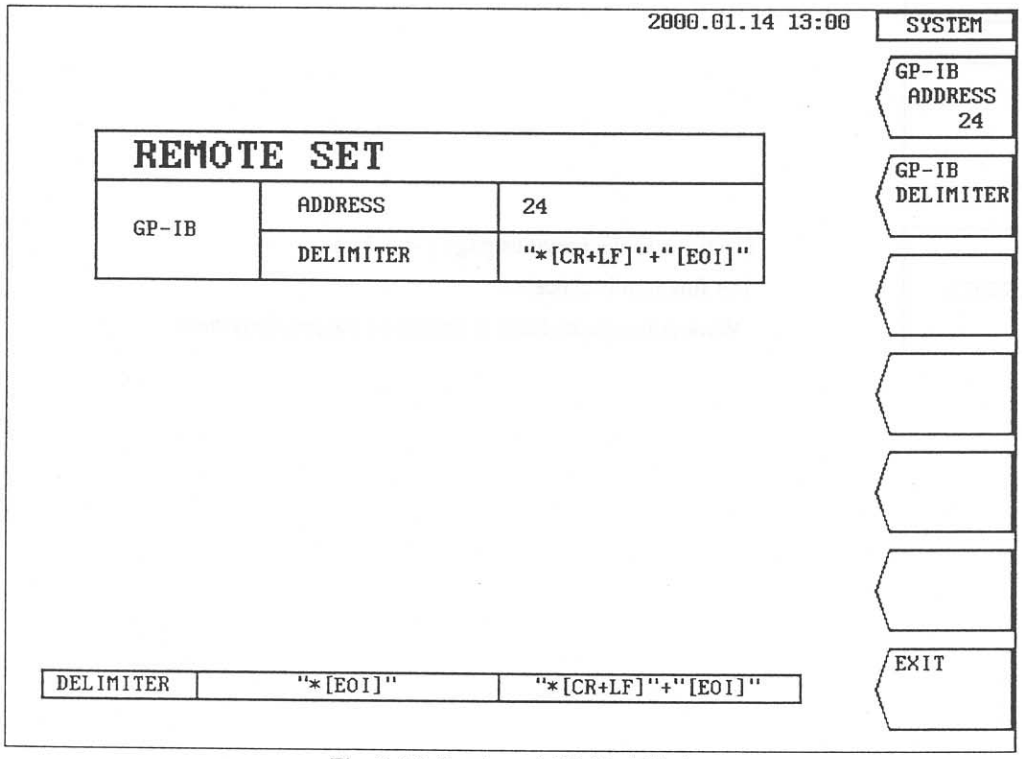
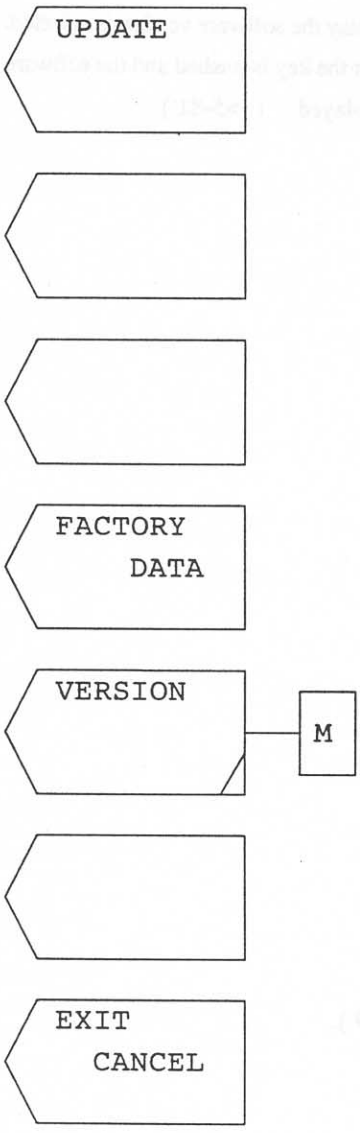


Fig. 5-25: Setting of GP-IB delimiter

L)Miscellaneous 2



The software of AQ8460 and the module is renewed.
FD which software for the update enters is inserted and the key is pushed.
Please do the update work according to the displayed message.

Various parameters are returned to an initial value (the factory shipment data).
Please note that the password etc. return to an initial value, too.

To the "Display of software version" menu.
The software version of AQ8460 and the module mounted on AQ8461 is displayed.

It returns to the previous page (->5-71).
The function is canceled.
Work is interrupted and it returns to the previous state.

M)Display of software version

FRAME 1

AQ8460 or AQ8461 which wants to display the software version is selected. AQ8460 and AQ8461 change whenever the key is pushed and the software version of the mounted module is displayed. (->5-81)

EXIT

It returns to the previous page (->5-79).

Display of software version

It becomes a screen in Fig. 5-26 if the key is pushed.

The software version of HOST/SUB/LD and the serial number of AQ8460 are displayed.

The display is switched with the first key to Software key.

It becomes a display of the software version of the module if the display is switched. (Fig. 5-27)

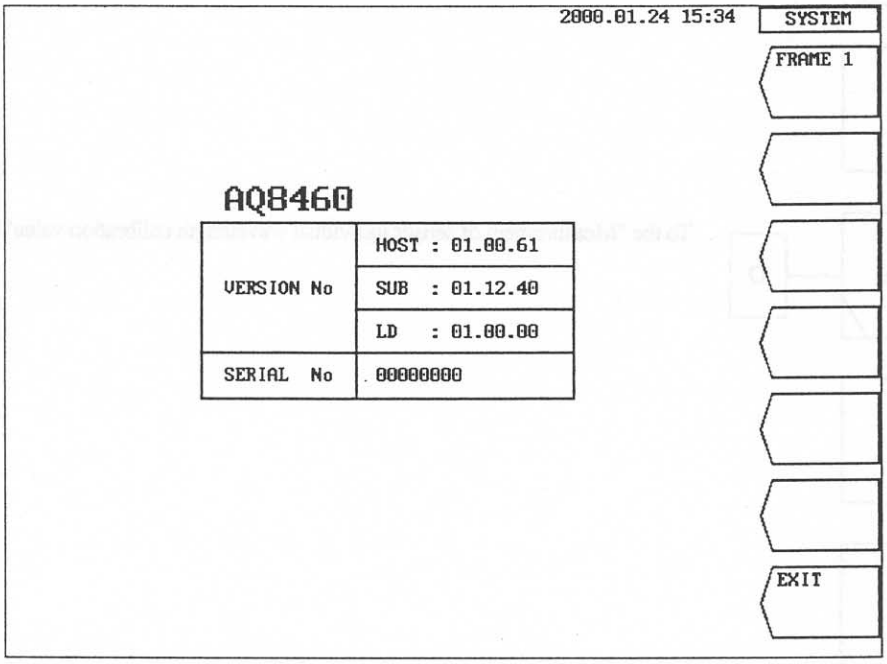


Fig. 5-26: Display of software version of AQ8460

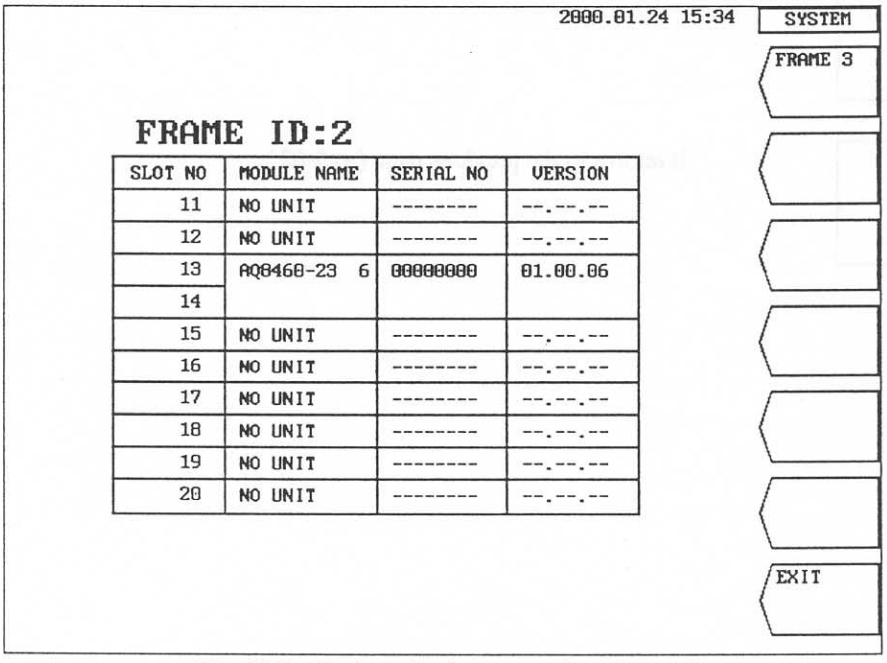
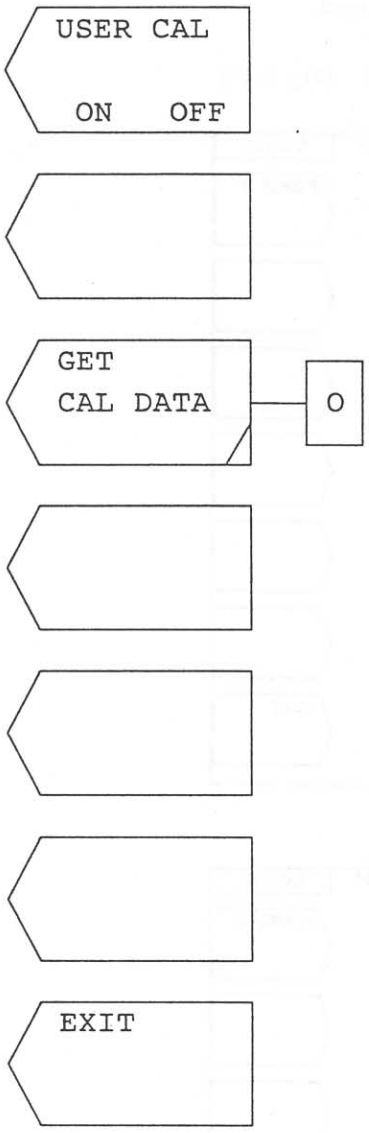


Fig. 5-27: Display of software version of module

N)Setting of sensor individual wave length calibration



It sets the calibration value whether is effective or invalid.

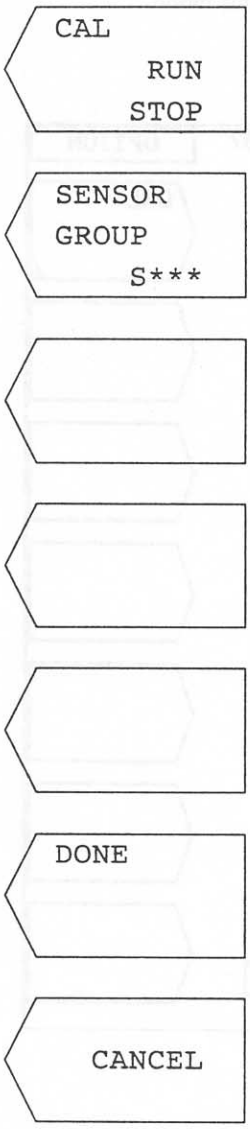
ON : Effective (The calibration value is reflected in the measurement value.)

OFF : Invalidity

To the "Measurement of sensor individual wavelength calibration value" menu.

It returns to the previous page (->5-62).

O)Measurement of sensor individual wavelength calibration value



Start/stop of calibration.
RUN : The calibration begins.
STOP : The calibration is stopped.

The sensor or the group which calibration it is selected. (*1)
SENSOR : S*** : 1 to 240
GROUP : G** : 00 to 99

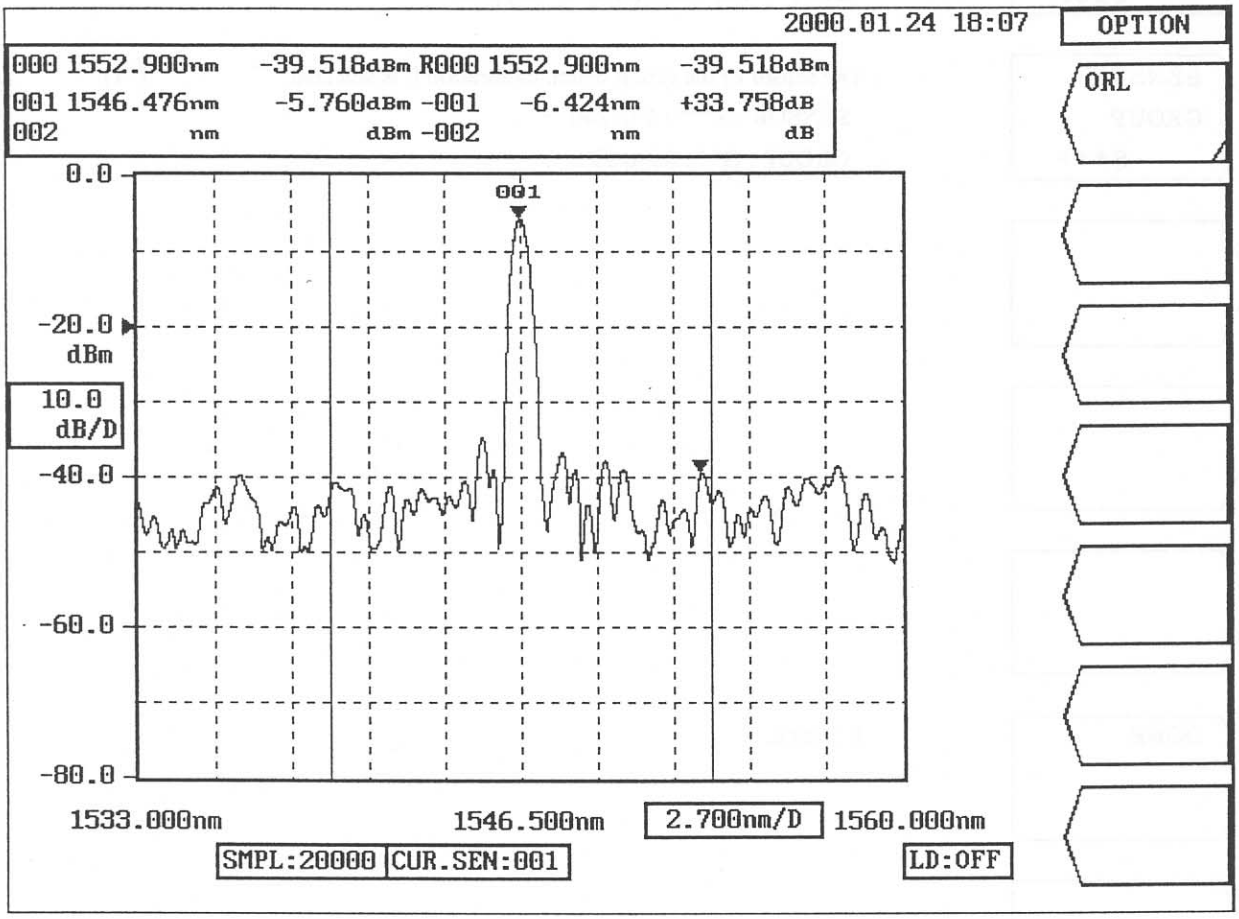
It fixes it.

The function is canceled.
Work is interrupted and it returns to the previous state.

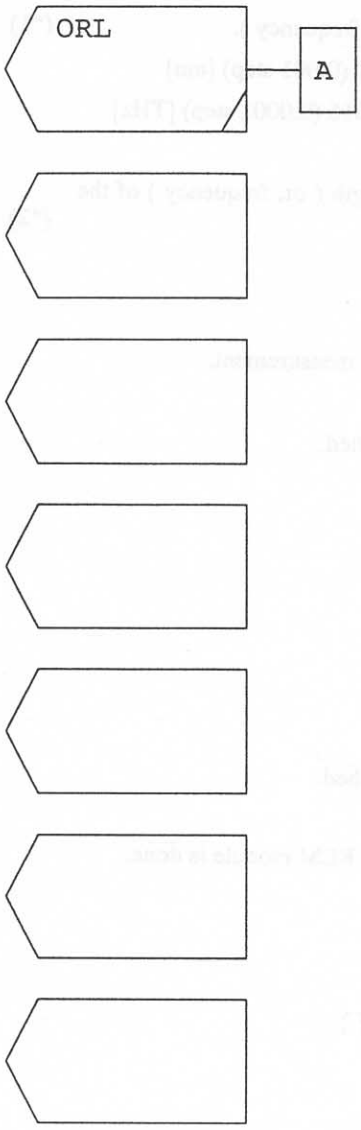
*1 The content of the group does setting by "DISPLAY - L)GROUP" (->5-29).

5.5.8 OPTION

The module which cannot be operated in other modes like the RLM module etc. is operated in this mode.

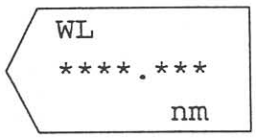


Main Menu

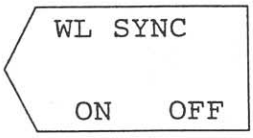


To the "Operation of ORL mode" menu.

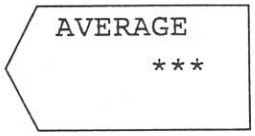
A)Operation of ORL mode



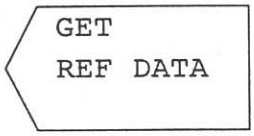
Sets the measurement wavelength (or, frequency). (*1)
WL : ****.***: 1500.000 to 1580.000 (0.001 step) [nm]
FREQ : ***.****: 189.7421 to 199.8616 (0.0001 step) [THz]



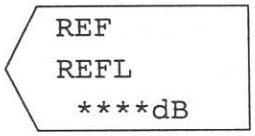
Synchronous setting with the wavelength (or, frequency) of the source of light is done. (*2)
ON : Sync
OFF : Async



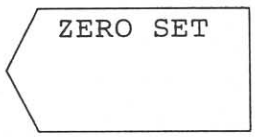
Sets the number of averaging times for measurement.
*** : OFF,2,5,10,20,50,100 or 200
It changes whenever the key is pushed.



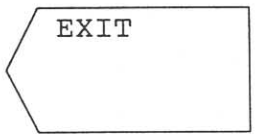
The reference reflection is measured.



Sets the reflection reference.
14.7dB : Fresnel reflection reference
0.2dB : Total reflection reference
It changes whenever the key is pushed.



ZERO SET of the sensor built into the RLM module is done.



It returns to the previous page (->5-85).

The procedure of the measurement is explained from the next page (->5-87).

*1 The display changes by the setting of a horizontal axis.
For the wavelength : "WL" and "nm"
For the frequency : "FREQ" and "THz"

*2 The display changes by the setting of a horizontal axis.
For the wavelength : "WL SYNC"
For the frequency : "FREQ SYNC"

Procedure of Return Loss measurement

1) Mounting of AQ8461-71
It is confirmed to turn off the power supply of AQ8460 and AQ8461.
AQ8461-71 is mounted on AQ8461.
Please mount AQ8461-71 on the most last position (slot) as a measurement system.

⚠ Note
It is possible to use it for one system only by one module.

2) The power supply of AQ8461 is turned on.

3) After it is confirmed that the power supply of AQ8461 entered, the power supply of AQ8460 is turned on.

4) Setting of source of light
The wavelength is set in the TLS mode and LD is turned on.
Please calibrate if necessary.

5) In the OPTION mode, the ORL mode is selected.
The screen is shown in Fig. 5-28.
In the ORL mode, the output of the source of light automatically changes from CW light into CHOP light.

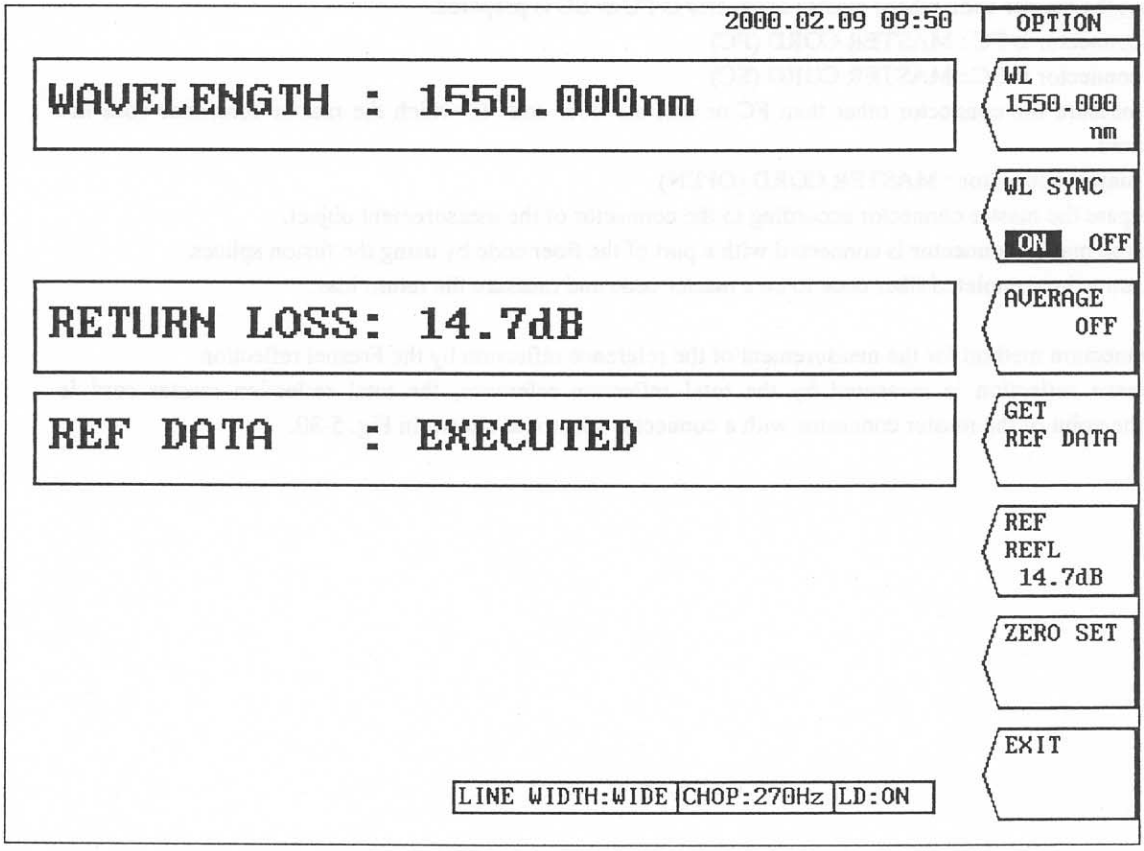


Fig. 5-28: Operation screen of return loss measurement

⚠ Note
The ORL mode cannot be selected if the RLM module is not mounted.

6) The measurement wavelength is set in <WL>.
When <WL SYNC> is "ON", <WL> becomes luminescence wavelength and cannot do setting.

7) An attached shield cap is mounted on [OPT IN] and [MEAS] connector of AQ8461-71.

8) Zero adjustments of the sensor with <ZERO SET>.

9) Connection of optical fiber code
[OPT OUT] connector of AQ8460 is connected with [OPT IN] connector of AQ8461-71 by the optical fiber code.
Please connect the optical fiber code after changing to the ORL mode.
The master code is connected with [MEAS] connector of AQ8461-71.

⚠ Caution

When the CW light is input to the RLM module, it causes the breakdown.

⚠ Caution

The master code must use the one of the our company specification or equal goods.

About the master code :

In our company, the master code whose master connector is FC or SC is prepared.

The master connector is FC : MASTER CORD (FC)

The master connector is SC : MASTER CORD (SC)

Moreover, to measure the connector other than FC or SC, the fiber code to which the master connector does not adhere is prepared.

There is no master connector : MASTER CORD (OPEN)

Please prepare the master connector according to the connector of the measurement object.

The prepared master connector is connected with a part of the fiber code by using the fusion splicer.

Please assume the completed fiber code to be a master code and measure the return loss.

Fig. 5-29 is a connection method for the measurement of the reference reflection by the Fresnel reflection.
When the reference reflection is measured by the total reflection reference, the total reflection master cord is connected with the point of the master connector with a connector adaptor as shown in Fig. 5-30.

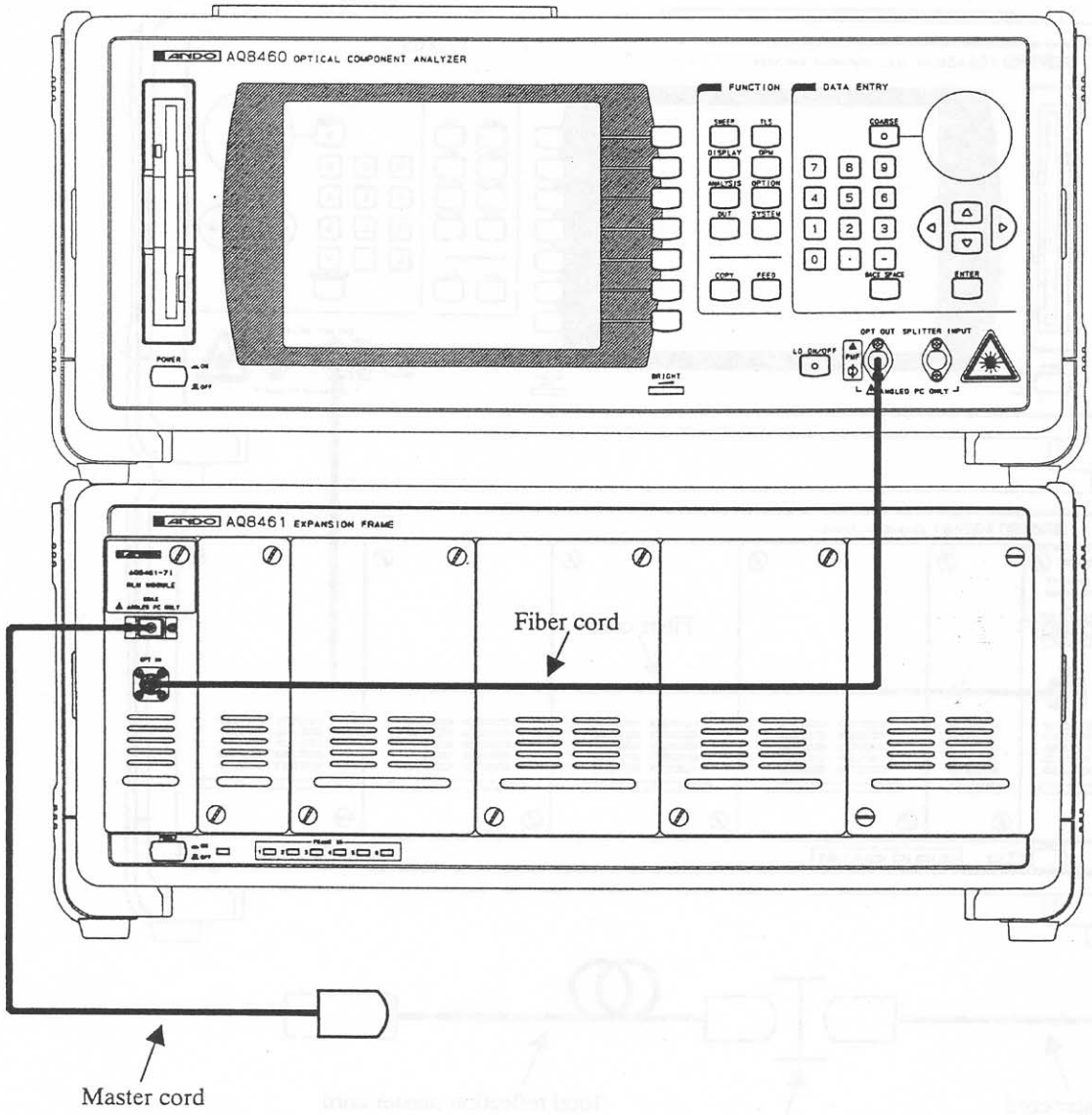


Fig. 5-29: Measurement System of Fresnel Reflection Reference

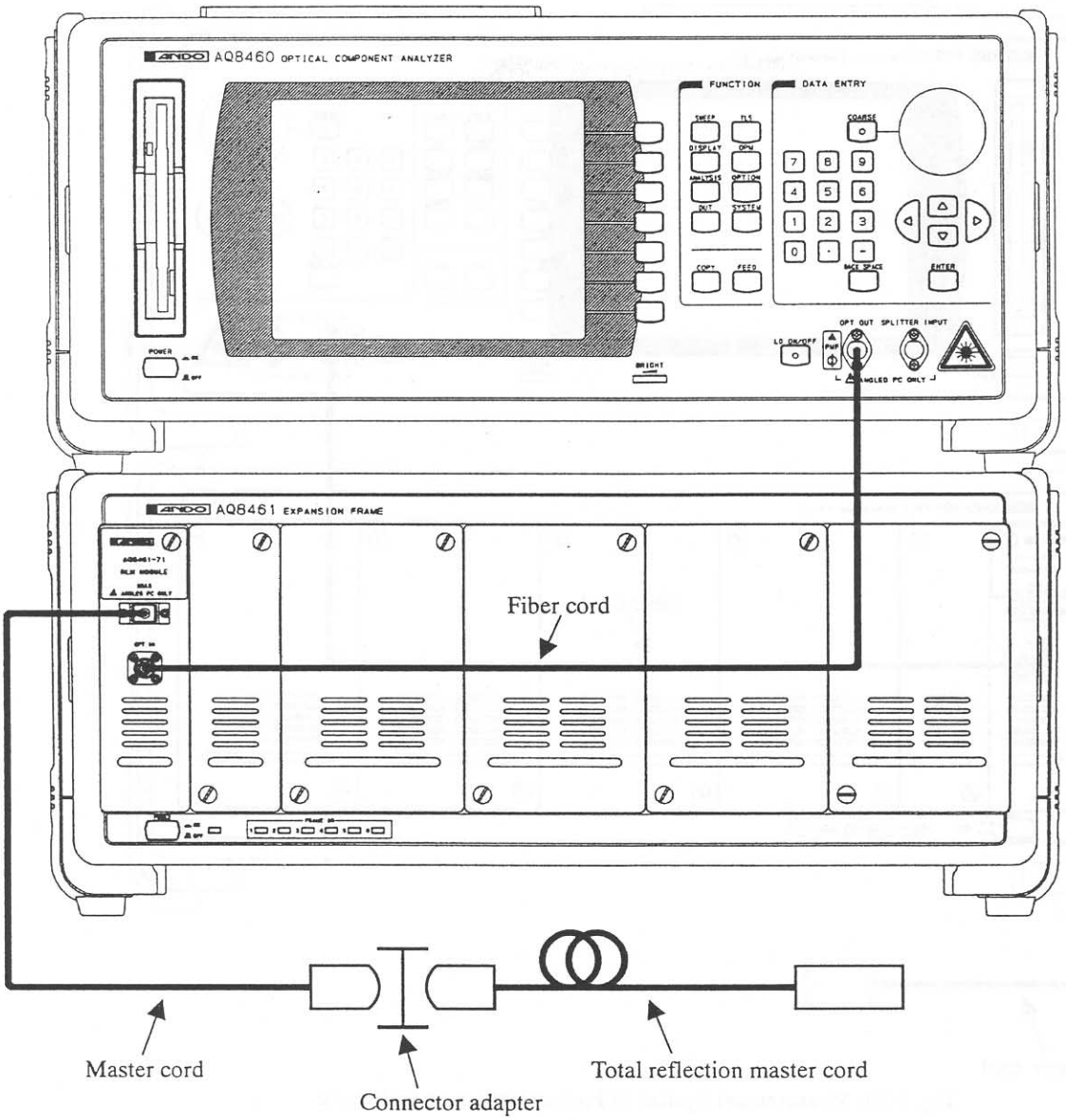


Fig. 5-30: Measurement System of Total Reflection Reference

10) The setting of the reference reflection is done with <REF REFL>.
The Fresnel reflection (14.7dB) or total reflection (0.2dB) is selected.

11) The reference reflection measurement is done with <GET REF DATA>.
When the display of REF DATA is "UNEXECUTED", the reference reflection is measured.
When the measurement ends, it is displayed by setting in <REF REFL> as 14.7dB or 0.2dB.
The return loss can be measured even if the reference reflection is not measured when the display of REF DATA is "EXECUTED".

⚠ Caution

When several measured values of reference reflection do not satisfy the tolerance of +/-0.04 dB, the light source might have been unstable or the optical fiber connections and the optical fiber connectors might have been soiled. When measured values do not satisfy the tolerance of +/-0.04 dB even after the optical fiber connector, the input section of this module or the master cord connection is cleaned by using alcohol, this device might have been out of order. In this case, contact our Service Department, the Sales Department of our head office or our branch or sales office in your area.

⚠ Note

Please measure it after confirming LD is turning on.

⚠ Note

Please clean the edge side of the master connector by alcohol etc. before measuring the reference reflection.

About the reference value :

Receiving optical power of the sensor when the GET REF DATA key is pushed is described "Reference value".
The reference value is an effective value in the range of 1nm which contains the wavelength when measuring it.
The range of 1nm is 1500.000-1500.999, 1501.000-1501.999, ... , and 1579.000-1579.999nm.
1580.000nm individually has the reference value.
For example, the setting of the measurement wave length is adjusted to 1545.322nm and the reference reflection is measured.
The reference value at that time is memorized as an effective value within the range of 1545.000-1545.999nm.
Therefore, when the setting of the measurement wave length is adjusted to 1545.720nm, the reference reflection need not be measured again.

⚠ Caution

Please note that all the reference values memorized by an undermentioned operation are deleted.
- The reference reflection is switched with REF REFL.
- Zero adjustments with ZERO SET.

12) Measurement of return loss

The measurement object is connected with the point of the master connector with a connector adaptor. (Fig. 5-31)

The return loss of the measurement object is displayed on the screen.

Please do the setting of the leveling number of times with <AVERAGE> according to the situation.

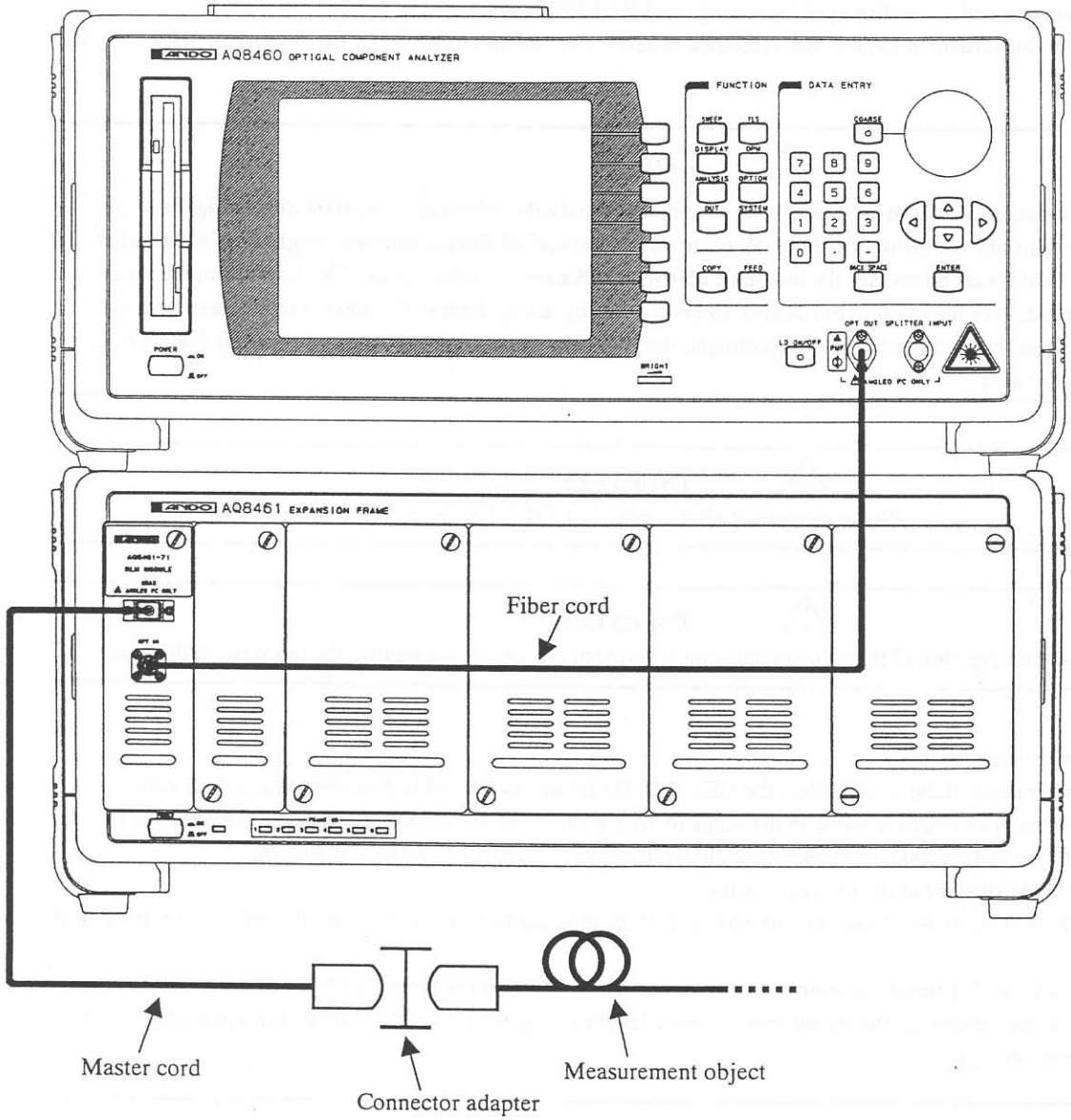


Fig. 5-31: Setup of Measurement Object

13) End of measurement

When ending as it is :

LD is turned off and the power supply is turned off.

When working continuously in other modes :

In the ORL mode, the optical fiber code is removed from [OPT IN] connector of AQ8461-71 and the shield cap is installed on the connector.

Afterwards, it moves to other modes and it works.

Chapter 6 Remote Control

This chapter explains the remote control.

6.1 GP-IB control

This system has a built-in GP-IB interface to control each parameter setup, parameter modification and data transmission and reception via the GP-IB interface bus.
This system uses an IEEE-488 standard, receptacle-type connector.

⚠ Caution

Always turn OFF the [POWER] switch ("■ OFF") before connecting or disconnecting the GP-IB interface cable to/from the AQ8460.

⚠ Caution

The AQ8460 does not accept any GP-IB program code for one minute (max.) after the power is turned on.

6.1.1 Interface functions

Table 6-1: GP-IB interface functions

Function	Explanation
SH1	Source handshaking full functions
AH1	Acceptor handshaking full functions
T6	Basic talker function
L4	Basic listener function
SR1	Service request function
RL1	Remote/Local function
PP0	No parallel polling function
DC1	Device clear function
DT0	No device trigger function
C0	No control function
E1	Open collector driver

6.1.2 Explanation of Basic functions

(1) GP-IB address

You can change the GP-IB address of AQ8460. These addresses are made valid immediately after you have completed the setup. The modified addresses are backed up by the battery power. If the battery is discharged, the backup data may be lost and the addresses are reset to their initial values.

(2) Local control mode

When the AQ8460 is operated by using its operation keys, it operates in Local control mode. All AQ8460 keys are available to use.

(3) Remote control mode

When the AQ8460 is operated from another controller via the GP-IB interface bus, it operates in Remote control mode. All keys (except for LOCAL) are made invalid. During Remote control, all LCDs light and the bottom software key functions as the LOCAL key.

6.1.3 Interface Message

(1) LLO

This system assumes the LLO state after receiving the "LLO" universal command in the Remote control mode. In this state, all operation keys (including the local switch) are disabled. To release this state, release the REN (remote enable) and turn the power of the system again.

(2) DCL

Data in the I/O buffer is cleared after receiving this command.

⚠ Caution

Handshaking may be stopped depending on controllers after a command, a program code or the lie is executed immediately after executing a DCL command.

---

(3) SDC

Data in the I/O buffer is cleared after receiving this command with the listener specified.

(4) GTL

This system returns to the local state after receiving this command with the listener specified.

6.1.4 Common Command

(1) *ESR?
The contents of the event status register (ESR) can be read in the NRf format.
The contents are cleared after reading.

(2) *ESE(NRf)
Sets the event status enable register (ESR) in the NRf format.

(3) *ESE?
ESR query. Readable in the NRf format.

(4) *STB?
The contents of the status byte register can be read in the NRf format.

(5) *SRE(NRf)
Sets the service request enable register in the NRf format.

(6) *SRE?
Service request enable query.

(7) *RST
Clears the contents of the all event registers summarized in the status bytes.
Also clears the data in the output queue.
Resets the settings of the main unit and each module to the default values.

(8) *IDN?
Reads the ID number.
ID number format:
ANDO-ELECTRIC, AQ8460, ********, HOST**.**.**, SUB**.**.**, LD**.**.**, OPM**.**.**

********	: serial No. (8 digits)
HOST**.**.**	: HOST software version (12 digits)
SUB**.**.**	: SUB software version (11 digits)
LD**.**.**	: LD software version (10 digits)
OPM**.**.**	: OPM software version (11 digits)

(9) *TST?
The self test is designed to test the GP-IB interface and output "0".

(10) *TRG
This command functions in the same way as the "SGL" interface message.

(11) *OPC?
Sets the information in 0 bit of the ESR in the output queue.
This does not depend on the enable conditions of *ESE.

(12) *WAI
Stops execution of other command or query until retention is completed.
By executing *WAI, the command to be executed following *WAI is executed after operation by the following commands is completed.
・RESET (*RST) : After RESET is completed.
・PZ : After zero set is completed.

6.1.5 Register

Event processing registers of this system are classified into three function groups.
The standard event status register (ESR) and the status byte register (SBR) are used to save the specified-type events occurring during system operation.
These registers are defined in the IEEE-488.2-1987 standard.

(1) Standard event status register
The ESR saves 8-type events occurring inside the system.
The contents of the register can be read using the *ESR? query command.

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Table 6-2: Functions of ESR Bits

Bit	Operation of set bit
7BIT	PON (power on) Set after this system is turned on.
6BIT	URQ (user request) Not used
5BIT	CME (command error) Set after a syntax error occurs, a command does not conform to the receivable format, etc.
4BIT	EXE (execution error) Set after an error occurs due to inappropriate set data or Limitation on setting/query contents during module operation.
3BIT	DDE (device error) Set after an error occurs due to module hardware and the error command is unreceivable.
2BIT	QYE (query error) Set after an output queue with no or unprocessed data is read or data in the output queue is lost.
1BIT	RQC (request control Not used
0BIT	OPC (operation complete) Set after retention has been completed.

(2) Status byte register

Each bit of the SBR saves whether data is ready in the output queue, this system requests service or any event has been saved in the ESR.

The contents of the register can be read using serial polling or the *STB? query command.

When using *STB, write the contents in the output queue.

Bit 6 assumes the RQS bit when reading the SBR using serial polling, or the MSS bit when reading it using *STB.

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
×	RQS MSS	ESB	MAV	×	×	×	×

Table 6-3: Functions of SBR Bits

Bit	Operation of set bit
7BIT	Not used
6BIT	RQS (service request) Readable using serial polling. Indicates that this system is requesting service to the GP-IB controller.
	MSS (master summary status) Readable using the *STB query command. Set after the ESB of the SBR or the MAV bit is set.
5BIT	ESB (event status bit) Indicates that the status is "enable" and some event(s) exist(s) in the ESR.
4BIT	MAV (message available) Indicates that information is available in the output queue.
3BIT	Not used
2BIT	Not used
1BIT	Not used
0BIT	Not used

(3) Conditions for clearing each register

Each status is cleared according to the following conditions.

Table 6-4: Conditions for Clearing Register

Register	Clearing condition
SBR	After the power is turned off. After *RET is executed. After status information is fetched using serial polling.
ESR	After the power is turned off. After *RET is executed. After status information is written to the output queue using *ESR. After the masking condition of the 6 bit of the SBR is changed by *SRE.

(4) Event processing sequence

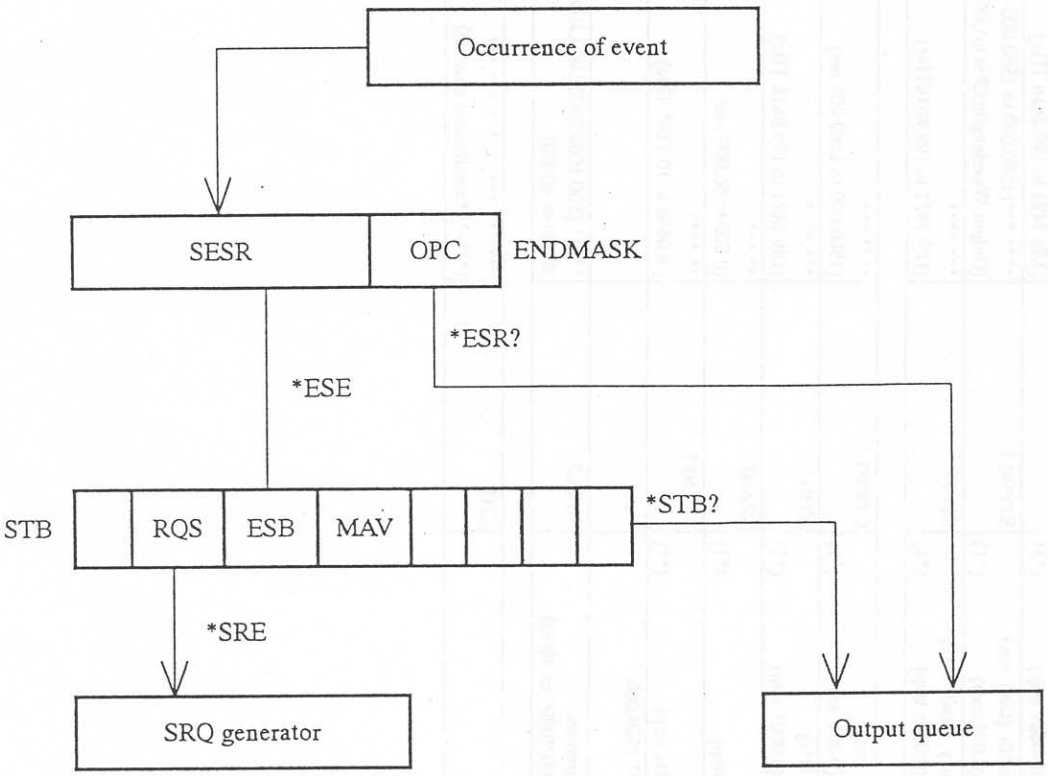


Fig. 6-1: Event Processing Sequence

Note

Be sure to read the status of the ESR before using the ESB bit.

6.1.6 GP-IB Program Codes

Table 6-5 shows the program code of GP-IB.

Table 6-5: GP-IB Program Codes (1/23)

Function	Control command	Explanation	Talker command	Talker output data format
[SWEEP]				
<STOP>	STP	Stops sweeping.	SWEEP?	0: STOP 1: SINGLE
<RUN>	SGL	Starts single sweeping.		
<START & STOP>				
<Measurement start WL>	STAWL****.***	Sets the measurement start wavelength.(Unit: nm) ****.***: 1500.000 to 1580.000 (0.001 step) (*1)	STAWL?	****.***(1500.000 to 1580.000 nm) (Output Wavelength:1500 to1580)
<Measurement start FREQ>	STAF***.****	Sets the measurement start frequency. (Unit: THz) ***.****: 189.7421 to 199.8616 (0.0001 step) (*1)	STAF?	***.**** (189.7421 to 199.8616 THz)
<Measurement end WL>	STPWL****.***	Sets the measurement end wavelength. (Unit: nm) ****.***: 1500.000 to 1580.000 (0.001 step) (*1)	STPWL?	****.***(1500.000 to 1580.000 nm) (Output Wavelength:1500 to1580)
<Measurement end FREQ >	STPF***.****	Sets the measurement end frequency. (Unit: THz) ***.****: 189.7421 to 199.8616 (0.0001 step) (*1)	STPF?	***.**** (189.7421 to 199.8616THz)
<CENTER & SPAN>				
<Measurement center WL>	CTRWL****.***	Sets the center wavelength. (Unit: nm) ****.***: 1500.000 to 1580.000 (0.001 step) (*1)	CTRWL?	****.*** (1500.000 to 1580.000 nm)
<Measurement center Freq.>	CTRF***.****	Sets the center frequency. (Unit: THz) ***.****: 189.7421 to 199.8616 (0.0001 step) (*1)	CTRF?	***.**** (189.7421 to 199.8616 THz)
<Measurement span WL>	SPAN***.***	Sets the span. (Unit: nm) ***.***: 0.500 to 80.000 (0.001 step) (*1)	SPAN?	**.*** (0.500 to 80.000 nm)
<Measurement span Freq.>	SPANF**.****	Sets the span. (Unit: THz) **.****: 0.0666 to 10.1195 (0.0001 step) (*1)	SPANF?	**.**** (0.0666 to 10.1195 THz)
<FULL SPAN>	SPANFULL	Sets the STAWL1500.000,STPWL1580.000, CTRWL1540.000,SPAN80.000.	None	
<SAMPLING PT*****>	SMPL*****	Sets the sampling point for measurement. ***** : 500,1000,2000,5000,10000,20000 or 40000	SMPL?	***** (500,1000,2000,5000,10000, 20000 or 40000)
<MEASURE CONDTN>				
<SELECT CHANNEL>	CH ***,***,...,***	Selects test sensors. *** : 001 to 240	CH?	***,***-***,...,***-***,*** (***-***:continuous channel)

(*1) When SPAN is less than 1nm, it becomes an error.

Table 6-5: GP-IB Program Codes (2/23)

Function	Control command	Explanation	Talker command	Talker output data format
[DISPLAY]				
<SELECT GROUP>	GRP**	Selects a group. **: 00 to 99 The value set with CCH is set in GRP00	GRP?	** (00 to 99)
<SELECT SENSOR>	CCH ***,***,...,***	Selects sensors. ***: 1 to 240	CCH?	***,***-***,...,***-***,*** (***-***:continuous channel)
<CURRENT SENSOR>	CURSEN *** ACTSEN***	Sets a current sensor. ***: 1 to 240	CURSEN? ACTSEN?	***
<HORIZON SCALE>				
<START & STOP>				
<Display start WL>	DSPSTAWL****.***	****.*** : 1460.000 to 1580.000 (nm)	DSPSTAWL?	****.*** (1460.00 to 1580.000 nm)
<Display start FREQ>	DSPSTAF***.****	***.**** : 185.0571 to 199.8616 (THz)	DSPSTAF?	***.**** (185.0571 to 199.8616 THz)
<Display stop WL>	DSPSTPWL****.***	****.*** : 1500.000 to 1620.000 (nm)	DSPSTPWL?	****.*** (1500.000 to 1620.000 nm)
<Display stop FREQ>	DSPSTPF***.****	***.**** : 189.7421 to 205.3373 (THz)	DSPSTPF?	***.**** (189.7421 to 205.3373 THz)
<Display MKR L1-L2>	DSPMKRL	Displays wavelength between L1 and L2.	None	

Table 6-5: GP-IB Program Codes (3/23)

Function	Control command	Explanation	Talker command	Talker output data format
<CENTER & SPAN>				
<Display center WL>	DSPCTRWL****.***	****.*** : 1500.000 to 1580.000	DSPCTRWL?	****.*** (1500.00 to 1580.00 nm)
<Display center FREQ>	DSPCTRF***.****	***.**** : 189.7421 to 199.8616	DSPCTRF?	***.**** (189.7421 to 199.8616 THz)
<Display span WL>	DSPSPAN***.***	***.*** : 0.000 to 80.000	DSPSPAN?	***.*** (0.000 to 80.000 nm)
<Display span FREQ>	DSPSPANF**.****	**.**** :0.0000 to 10.6669	DSPSPANF?	**.**** (0.0000 to 10.6669 THz)
<MARKER -> CENTER>	CTR=M CTRTOM	Sets the wavelength of the moving marker to the center wavelength.	None	
<PEAK -> CENTER>	CTR=P CTRTOP	Sets the waveform peak to the center wavelength.	None	
<BOTTOM -> CENTER>	CTR=B CTRTOB	Sets the waveform bottom to the center wavelength.	None	
SEARCH CONDITION	SEARCON* SEARCH*	Detects the seach condition of MAX or MIN value of peak. *:0 or 1 0:bottom 1:peak	SEARCON? SEARCH?	* (0 or 1)
<AUTO CENTER>	ATCTR*	Selects ON or OFF for the PEAK (BOTTOM)->CENTER function at each sweep. *:0 or 1 0:OFF 1:ON	ATCTR?	* (0 or 1)
<MEASURED SCALE>				
<WL MEASURED SCALE>	DSPMESSL	Displays wavelength of between STAWL and STPWL.	None	
<HORZN SCALE SWEEP>				
<HORZN SCALE SWEEP>	HSCLSWEP	Sets the sweep range to current display start and stop wavelength.	None	
<X SCALE UNIT>	XUNT* TWLFRU*	Switches the display of the X-axis scale to the Wavelength of frequency. * : 0 or 1	XUNT? TWLFRU?	0 : For the Wavelength (nm) 1 : For the Frequency (THz)

Table 6-5: GP-IB Program Codes (4/23)

Function	Control command	Explanation	Talker command	Talker output data format
<LEVEL SCALE>				
<REF LVL>	REFL***.*	Sets the reference level. [in LOG] (Unit: dBm) ***.* : -90.0 to 20.0 (0.1 step)	REFL?	***.* (-90.0 to 20.0 dBm)
<REF LVL POSITION>	REFPOSI*	Selects the reference level position. * : 0 to 8	REFPOSI?	* (0 to 8)
<LOG LVL SCALE>	LSCL**.*	Sets the scale of the level axis. **.* : 0.1 to 12.5 (0.1 step. Unit: dB/DIV)	LSCL?	**.* (0.1 to 12.5 dB/DIV)
<MARKER -> REF LEVEL>	REF=M REFTOM	Sets the level of the moving marker in the reference level.	None	
<PEAK -> REF LVL>	REF=P REFTOP	Sets the peak level to the reference level.	None	
<BOTTOM -> REF LVL>	REF=B REFTOB	Sets the bottom level to the reference level.	None	

Table 6-5: GP-IB Program Codes (5/23)

Function	Control command	Explanation	Talker command	Talker output data format
<LEVEL SCALE>				
<SEARCH CONDITION>	SEARCON* SEARCH*	See [Display]-<HORIZON SCALE>-<CENTER&SPAN>section. The same command is there		
<AUTO REF LEVEL>	ATREF*	Selects ON or OFF for the PEAK -> REF LEVEL function to be executed at each sweep. * : 0 or 1 0:OFF 1:ON	ATREF?	* (0 or 1)
<LABEL>	LBL'@@@... ...@@@'	Sets the label. '@@@... ...@@@' : label (max 60 characters)	LBL?	Character string on display
<ALL CLEAR>	LBLCL	Clears all characters in the label area.	None	
<CURRENT -> MEMORY>				
<CNT SAVE MEMORY>	SAVEM*	Saves the trace of current sensor data into memory. * (memory address) : 1 to 5 (1 step)	None	
<MEM LABEL>	MEMLBL*'@@@-@@@'	Sets the memory label. (max 50 characters) *: memory address(1 to 5) '@...@' : memory label.	MEMLBL*?	'@...@' memory label.
<RELATIVE>	REL*	Selects absolute value or relative value for display value. * : 0 or 1 0:OFF (absolute value) 1:ON(relative value)	REL?	* (0 or 1)
<REF -> MEMORY>				
<REF SAVE MEMORY>	REFM*	Sets measurement condition with considering REF * : 1 to 5 (The same number of SAVEM)	REFM?	* (1 to 5)

Table 6-5: GP-IB Program Codes (6/23)

Function	Control command	Explanation	Talker command	Talker output data format
<GROUP>				
<SET GROUP>	GRP**=***,***,...,***	Sets frames modules and channels in the group. **: Group No (01 to 99) *** : F**(FRAME), M**(MODULE), ***(SENSOR)	GRP**?	***,***-***,...,***-***,*** (***-***:continuous channel)
<ADD GROUP>	ADDGRP**=***,***, ...,***	Add frames, modules and channels to the group. **: Group No (01 to 99) *** : F**(FRAME), M**(MODULE), ***(SENSOR)	None	
<DEL GROUP>	DELGRP**=***,***,...,***	Delete frames,modules and channels from the group. **: Group No (01 to 99) *** : F**(FRAME), M**(MODULE), ***(SENSOR)	None	
<GRP NAME>	GRPLBL**'@@-@@'	Sets the group label. **: Group No (00 to 99) '@@-@@':group label. (max 50 characters)	GRPLBL**?	'@@-@@' group label.
<NOISE MSK****dBm>	NMSK****	Displays waveforms below set value in masked form. ****: 0 to -100(1step),-999(OFF) (unit:dBm)	NMSK?	**** : 0 to -100 -999(OFF)
<GRAPH CLEAR>	CLR	Clears trace.	None	
<DATA REQUEST>	None	Demands the current sensor data.	MEAS?	****.***(nm),***.***(dB or dBm), ...,****.***,***.*** (In case of wavelength) ***.****(THz),***.***(dB or dBm), ...,***.****,***.*** (In case of frequency)
	None	Demands measurement wavelength or frequency in the current sensor data.	MEASHSCL?	****.***(nm),...,****.*** (In case of wavelength) ***.****(THz),...,***.**** (In case of frequency)
	None	Demands measurment level in the current sensor data.	MEASLEVEL?	***.***(dB or dBm),...,***.***
<FREEZE>	FREEZE*	The display screen is fixed. * : 0 or 1 0 : off 1 : on	FREEZE?	*

Table 6-5: GP-IB Program Codes (7/23)

Function	Control command	Explanation	Talker command	Talker output data format
[ANALYSIS]				
<MARKER>				
<MARKER>	WMKR****.***	Sets the moving marker to the specified wavelength position. (Unit: nm) ****.***: 1500.000 to 1580.000	MKR?	****.***(nm),***.***(dBm) (1500.000 to 1580.000 nm) (When marker position is on
	FMKR***.****	Sets the moving marker to the specified frequency position. (Unit: THz) ***.**** : 189.7421 to 199.8616		***.****(THz),***.***(dBm) (189.7421 to 199.8616 THz) (When marker position is on frequency.)
<PEAK SEARCH>	PKSR	Detects the MAX value of level.	PKSR?	0: PEAK
<BOTTOM SEARCH>	BTSR	Detects the MIN value of level.		1: BOTTOM
<NEXT SEARCH>	NSR	Detects the next largest value (or next smallest value)	None	
<NEXT SRCH RIGHT>	NSRR	Detects the largest value (or smallest value) on the right side of the moving marker.	None	
<NEXT SRCH LEFT>	NSRL	Detects the largest value (or smallest value) on the left side of the moving marker.	None	
<SET MKR ***>	MKR	Sets the moving marker to the fixed marker. ***: 001 to 240 (1 step)	MKR***?	****.***(nm),***.**(dB) (Output of the wavelength and level at the fixed marker ***.)
<CLR MKR ***>	MCLR	Clears a marker .	None	
<MOVE MKR -> MKR***>	MOVMKR***	Move the moving marker to fixed marker***.	MOVMKR? MKR?	

Table 6-5: GP-IB Program Codes (8/23)

Function	Control command	Explanation	Talker command	Talker output data format
<REF MAKER>	MKRREF***	Makes the ***marker REF.	MKRREF?	***
<ALL MARKER ON/OFF>	ALLMKR*	Selects all markers on display or not on display. * : 0 or 1 0 : not on display 1 : on display	ALLMKR?	* (0 or 1)
<CLEAR ALL MARKER>	MKCL	Clears the moving marker,fixed markers and the Marker values in the data area.	None	
<MKR FIT or HOLD>	MKRFUNC*	Selects msrker function FIT or HOLD. * : 0 or 1 0 : FIT 1 : HOLD	MKRFUNC?	* (0 or 1)
<MKR LIST PRINT>	MKRPRT	Prints out the multi-marker value.	None	
<MKRL1-L2 -> SPAN>	SP=LM SPTOLM	Sets the L1-L2 section to the sweep range.	None	
<CLEAR LINE MKR>	LMKCL	Clears the line markers and line marker values.	None	

Table 6-5: GP-IB Program Codes (9/23)

Function	Control command	Explanation	Talker command	Talker output data format
<LINE MARKER>				
<LINE MARKER ON/OFF>	LMKR*	Selects line markers on or not on display. * : 0 or 1 0 : not on display 1 : on display	LMKR?	* (0 or 1)
<LINE MARKER1>	L1MK****.***	Sets the wavelength line marker 1. (Unit: nm) ****.*** : 1500.000 to 1580.000	L1MK?	****.*** (nm) (When line marker1 is on wavelength) ***.**** (THz) (When line marker1 is on frequency)
	L1FMK***.****	Sets the frequency line marker 1. (Unit: THz) ***.**** : 189.7421 to 199.8616		
<LINE MARKER2>	L2MK****.***	Sets the wavelength line marker 2. (Unit: nm) ****.*** : 1500.000 to 1580.000	L2MK?	****.*** (nm) (When line marker2 is on wavelength) ***.**** (THz) (When line marker2 is on frequency)
	L2FMK***.****	Sets the frequency line marker 2. (Unit: THz) ***.**** : 189.7421 to 199.8616		
<SEARCH L1-L2>	SRLMK*	Sets whether or not to execute peak or Bottom value detection between L1 and L2. * : 0 or 1 0:OFF 1:ON	SRLMK?	* (0 or 1)

Table 6-5: GP-IB Program Codes (10/23)

Function	Control command	Explanation	Talker command	Talker output data format
[ANALYSIS]				
<PRODUCT FREQUENCY INTERVAL>	PROMINFREQ ***.****	Sets the minimum frequency of the products. (Unit: THz)	PROMINFREQ?	***.****
	PROMAXFREQ ***.****	Sets the maximum frequency of the products. (Unit: THz)	PROMAXFREQ?	***.****
<CENTER FREQUENCY>	CTRFREQ***.****, ...,***.**** CNTFREQ	References to CCH in order to know the number of double values. (Unit: THz)	CTRFREQ? CNTFREQ?	***.****,***.****,...,***.****
<MULTI SENSOR ANALYSIS>				
Peak	None	Measures the peak wavelength and output power.	MS_PEAKA	See Table 6-2.
Notch	None	Measures the notch wavelength and output power.	MS_NOTCH	See Table 6-2.
Mean Wavelength	None	Measures the mean (center) wavelength at 3dB down.	MS_MEAN	See Table 6-2.
Spectrum width of peak	None	Measures the spectrum width at **.**dB down **.** : Level down[dB] , *** : TEST BAND [GHz]	MS_PWIDTH**.**,***	See Table 6-2.
Both side frequency at downed specified level from peak	None	The frequency of the point which **.***dB down from the peak first is measured in low the order. **.*** : Level down[dB]	MS_PWIDTHA**.***	See Table 6-2.
Spectrum width of notch	None	Measures the notch width at **.**dB down **.** : Level down[dB] , *** : TEST BAND [GHz]	MS_NWIDTH**.**,***	See Table 6-2.

Table 6-5: GP-IB Program Codes (11/23)

Function	Control command	Explanation	Talker command	Talker output data format
[ANALYSIS]				
<MULTI SENSOR ANALYSIS>				
Adjacent Channel Crosstalk (Both)	None	Measures both adjacent channel crosstalk. *** : CH spacing [GHz], *** : TEST BAND [GHz] (Range: PROMINFREQ to PROMAXFREQ)	MS_ACXTB ***,***	See Table 6-2.
Adjacent Channel Crosstalk	None	Measures the adjacent channel crosstalk. *** : CH spacing [GHz], *** : TEST BAND [GHz] (Range: PROMINFREQ to PROMAXFREQ)	MS_ACXT ***,***	See Table 6-2.
Non-Adjacent Channel Crosstalk	None	Measures the non adjacent channel crosstalk. ***.****,***.**** : Start [THz] , Stop [THz] *** : CH spacing [GHz], *** : TEST BAND [GHz] (Range: PROMINFREQ to PROMAXFREQ)	MS_NACXT ***.****,***.****,***,***	See Table 6-2.
Adjacent Channel Flatness	None	Measures the adjacent channel flatness of output power. ***.****,***.**** : Start [THz] , Stop [THz] *** : CH spacing [GHz] , *** : TEST BAND [GHz] (Range: PROMINFREQ to PROMAXFREQ)	MS_FLATA ***.****,***.****,***,***	See Table 6-2.
Non-Adjacent Channel Flatness	None	Measures the non-adjacent channel flatness of output power. ***.****,***.**** : Start [THz] , Stop [THz] *** : CH spacing [GHz] , *** : TEST BAND [GHz] (Range: PROMINFREQ to PROMAXFREQ)	MS_FLATN ***.****,***.****,***,***	See Table 6-2.
Total Crosstalk	None	Measures sum of all other channel crosstalk. ***.****,***.**** : Start [THz] , Stop [THz] *** : CH spacing [GHz], *** : TEST BAND [GHz] (Range: PROMINFREQ to PROMAXFREQ)	MS_TXT ***.****,***.****,***,***	See Table 6-2.

Table 6-5: GP-IB Program Codes (12/23)

Function	Control command	Explanation	Talker command	Talker output data format
[ANALYSIS]				
<SINGLE SENSOR ANALYSIS>				
Peak (Two or more peaks in a sensor)	None	Measures some peak wavelengths and output power. ***.****,***.**** : Start [THz] , Stop [THz] *** : CH spacing [GHz] , *** : TEST BAND [GHz]	SS_PEAKA***.****,***.****,***,***	See Table 6-2.
Notch (Two or more notches in a sensor)	None	Measures some notch wavelengths and output power. ***.****,***.**** : Start [THz] , Stop [THz] *** : CH spacing [GHz] , *** : TEST BAND [GHz]	SS_NOTCH***.****,***.****,***,***	See Table 6-2.
Mean Wavelength (Two or more peaks in a sensor)	None	Measures some mean (center) wavelengths at 3dB down. ***.****,***.**** : Start [THz] , Stop [THz] *** : CH spacing [GHz] , *** : TEST BAND [GHz]	SS_MEAN***.****,***.****,***,***	See Table 6-2.
Spectrum width of peak (Two or more peaks in a sensor)	None	Measures some spectrum widths at **.**dB down **.** : Level [dB] ***.****,***.**** : Start [THz] , Stop [THz] *** : CH spacing [GHz] , *** : TEST BAND [GHz]	SS_PWIDTH**.**,***.****,***.****,***,***	See Table 6-2.
Spectrum width of Notch (Two or more notches in a sensor)	None	Measures some notch widths at **.**dB down **.** : Level [dB] ***.****,***.**** : Start [THz] , Stop [THz] *** : CH spacing [GHz] , *** : TEST BAND [GHz]	SS_NWIDTH**.**,***.****,***.****,***,***	See Table 6-2.

Table 6-5: GP-IB Program Codes (13/23)

Function	Control command	Explanation	Talker command	Talker output data format
[TLS]				
<Wavelength setup>	TWL****.***	Uses the specified wavelength for oscillation. (Unit:nm) ****.***: 1500.000 to 1580.000 (0.001step)	TWL?	****.*** (nm)
<Optical frequency setup>	TFR***.****	Uses the specified frequency for optical oscillation. Optical frequency range set. (Unit:THz) ***.****: 189.7421 to 199.8616 (0.0001 step)	TFR?	***.**** (THz)
<Optical output setup (dBm)>	TPDB***.*	Sets the optical output to the specified level. ***.*: -23.0 to -3.0 (0.1 step)	TPDB?	***.* (dBm)
<Line width setup>	TLINEWIDTH*	Sets the spectrum line width. *: 0 Narrow, 1 Wide	TLINEWIDTH?	* (0 or 1)
<UNIT>				
<X Scale unit>	XUNT* TWLFRU*	See [DISPLAY] - <HORIZON SCALE> section. The same command is there.		

Table 6-5: GP-IB Program Codes (14/23)

Function	Control command	Explanation	Talker command	Talker output data format
[TLS]				
<Optical output On/Off setup>	L*	* : 0 Turns optical output Off. 1 Turns optical output On.	L?	* (0 or 1)
<TLS module status inquiry>	None	0:Ready (End of standby) 1:Standby	STANDBY? (STNBY?)	* (0 or 1)
<Max wavelength inquiry>	None	Returns the maximum wavelength that you can set.	WLMAX?	****.*** (nm)
<Min wavelength inquiry>	None	Returns the minimum wavelength that you can set.	WLMIN?	****.*** (nm)
<Max optical frequency inquiry (THz)>	None	Returns the maximum optical frequency that you can set.	FRMAX?	***.**** (THz)
<Min optical frequency inquiry (THz)>	None	Returns the minimum optical frequency that you can set.	FRMIN?	***.**** (THz)
<Max optical output dBm inquiry>	None	Returns the maximum optical output (in dBm) that you can	PDBMAX?	+/-**.* (dBm)
<Min optical output dBm inquiry>	None	Returns the minimum optical output (in dBm) that you can	PDBMIN?	+/-**.* (dBm)
<Calibration discontinuance>	TWCALCL	The calibration is discontinued.		

Table 6-5: GP-IB Program Codes (15/23)

Function	Control command	Explanation	Talker command	Talker output data format
[OPM]				
<SELECT GROUP>	GRP**	See the [DISPLAY] section. The same command is there.		
<SELECT SENSOR>	CCH***,...,***	See the [DISPLAY] section. The same command is there.		
<MODE>				
<MEASURE DATA>	None	Displays measurement data value.	PMTR?	See Table 6-2.
<ABSOLUTE>	ABS	Set absolute measurement.	None	
<DREF****.***dBm>	DREF	Sets the DREF value automatically and displays relative value between DREF value and measurement value.	None	
<REF>	None	Displays relative value between REF value and measurement varue of selected sensors. *** : 1 to 240	REF***?	+/-***.***(dB)
<SET REF VALUE +/-***.***dBm>	REFVALUE+/-***.***	Sets the REF value. [in LOG] (Unit:dBm) +/-***.*** : REF value	REFVALUE?	+/-***.***(dBm)
<MAX VALUE>	None	Displays measurement max value.	MAXP?	See Table 6-2.
<MIN VALUE>	None	Displays measurement minimum value.	MINP?	
<DIFF VALUE>	None	Display difference value between max and min value.	DIFFP?	
<MAX MIN RESET>	PMRST	Sets the maximum value and minimum value.	None	
<SENS NORM RANGE HOLD>	SNHD***	Sets the measuring sensitivity. *** : -60 to 0 (30[dB] step)	SENS?	4,*** : SENS NORM ***dBm RANGE HOLD 5 : SENS NORM RANGE AUTO
<SENS NORM RANGE AUTO>	SNAT			
<ZERO SET>				
<ALL SENSOR ZEROSET>	PZ	Zero set all of the sensor.	None	
<SETUP>				
<Wavelength setup>	PMWL***,****.***, ...,***,****.***	Uses the specified wavelength for oscillation. (Unit: nm) ***: sensor No ****.***: 1500.000 to 1580.000 (0.001 step)	PMWL***?	(WL SYNC OFF) ****.*** (WL SYNC ON) ****.***,SYNC
	PMWLALL****.***	Uses the specified wavelength for oscillation. (Unit: nm) ****.***: 1500.000 to 1580.000 (0.001 step)	PMWLALL?	***,****.***,...,***,****.***

Table 6-5: GP-IB Program Codes (16/23)

Function	Control command	Explanation	Talker command	Talker output data format
<SETUP>				
<Optical frequency setup>	PMFR***,****.***, ...,***,****.***	Uses specified frequency for optical oscillation. Optical frequency range set. (Unit:THz) ***: sensor No ***.****: 189.7421 to 199.8616 (0.0001 step)	PMFR***?	(WL SYNC OFF) ***.**** (WL SYNC ON) ***.****,SYNC
	PMFRALL***.****	Uses specified frequency for optical oscillation. Optical frequency range set. (Unit:THz) ***: sensor No ***.****: 189.7421 to 199.8616 (0.0001 step)	PMFRALL?	***,***.****,...,***,***.****
<AVERAGE ****>	AVG****	Sets the number of averaging times for measurement. **** : 1(=OFF),2,5,10,20,50,100,200,500,1000	AVG?	****
<WL SYNC ON/OFF>	PMSYNC*	Selects sync or not sync with wavelength of TLS. * : 0 or 1 0 : not sync 1 : sync	PMSYNC?	* (0 or 1)
<LEVEL SHIFT>	LVSFT ***, +/-***.***,...,***, +/- ***.***	Sets the shift level. *** : Sensor No +/-***.*** : Shift level -199.999 to +199.999[dB]	LVSFT?	***,+/-***.*** ,..., ***,+/-***.*** (excludes level "0.000dB") (When the shift level is all "0.000dB", the return value becomes "0".)
			LVSFT***?	+/-***.***
			LVSFTALL?	***,+/-***.*** ,..., ***,+/-***.***
<LEVEL ADJUST>	LVADJ OFF	The adjustment function is made effective.	LVADJ?	0:OFF 1:ON
	LVADJ ON	The adjustment function is invalidated.		
	LVADJ***,+/-**.***, ...,***,+/-**.***	Sets the adjustment level. *** : Sensor No +/-**.*** : Adjustment level -99.999 to +99.999[dB]	LVADJ***?	+/-**.***
			LVADJALL?	***,+/-**.***,...,***,+/-**.***

Table 6-5: GP-IB Program Codes (17/23)

Function	Control command	Explanation	Talker command	Talker output data format
[SYSTEM]				
<FILE>				
<WRITE>				
<PACKET>				
<PACKET -> FD or HD>	WRDT '@@@@@@@@@'.pkt	Records data into FD or HD. @-@ : File name. Pkt : fixed extension. When the underlined part is omitted, the default file name is set.	None	
<CURRENT SENSOR>				
<CUR SENSOR -> FD or HD >	WRA '@@@@@@@@@'.***	Records current sensor data into FD or HD. @-@:File name. ***:fixed extension.('wav'or'csv') When the underlined part is omitted, the default file name is set.	None	

Table 6-5: GP-IB Program Codes (18/23)

Function	Control command	Explanation	Talker command	Talker output data format
<MEMORY>				
<MEMORY -> FD or HD >	WRMEM* '@@@@@@@@@'.***	Records the contents of memory into FD or HD . * : (memory address) : 1 to 5 (1 step) @-@:File name. ***:fixed extension.('wav'or'csv') When the underlined part is omitted, the default file name is set.	None	

Table 6-5: GP-IB Program Codes (19/23)

Function	Control command	Explanation	Talker command	Talker output data format
<READ>				
<PACKET>				
<FD or HD -> PACKET>	RDDT '@@@@@@@@'.pkt	Reads packet data from FD or HD. @-@ : File name pkt : Extension	None	
<WAVE>				
<FD or HD -> MEMORY>	RDMEM* '@@@@@@@@'.***	Reads the tracedata from FD or HD into memory and trace. * (memory address) : 1 to 5 (1 step) @-@ : File name *** : Extension('wav')	None	
<MAKE DIRECTORY>	MD '@@@@@@@@'	Makes a directory in FD or HD. @-@: Directory name	None	
<UTILITY>				
<DELETE>	DEL '@@@@@@@@'	Deletes a directory or file in FD or HD. @-@: Directory or File name	None	
<DISK INITIALIZE>	DSKIN	Initializes FD. (Unit: Mbyte) 1.44M format	None	
<RENAME>	RENAME '@-@"@-@'	Rename a directory or a fole in FD or HD. 1st @-@ : Current name 2nd @-@ : New name	None	
<CHANGE>	CD*, '@@@@@@@@'	Changes the directory. *: 0 Floppy, 2 Hard Disk @-@: Directory name	CD?	*, @@@@@@@@ (*:0 or 2) (@-@:Directory name)

Table 6-5: GP-IB Program Codes (20/23)

Function	Control command	Explanation	Talker command	Talker output data format
<WL CALIBRATION>				
<CALIBRATION RUN>	TWCAL	Starts wavelength calibration.	TWCAL?	* 0:Calibration failure 1:Calibration success 2:Calibrating
<AUTO CAL ON/OFF>	AUTOCAL*	* : 0 or 1 0 : Auto calibration OFF. 1 : Auto calibration ON.	AUTOCAL?	* (0 or 1)
<Amount of wavelength shift setup>	TWLSHIFT****	The wavelength actual only as for wavelength's worth specified for a present wavelength set value is shifted. ****:-200 to +200 step 1 (pm)	TWLSHIFT?	**** (-200 to +200)
<UNIT>				
<Wavelength / frequency and optical output inquiry>	None	WL FREQ 0:(nm), 1:(THz) POWER 0:(dB)	TUNIT?	** The unit of the parameter shown in Explanation is displayed as follows. [WL FREQ(0or1)] [POWER (0or1)]

Table 6-5: GP-IB Program Codes (21/23)

Function	Control command	Explanation	Talker command	Talker output data format
<MISC>				
<CONFIG>				
<SET CLOCK>	DATE YYYY.MM.DD	Sets the built-in clock. YYYY:YEAR, MM:01 to 12, DD: 01 to 31	DATE?	YYYY. MM. DD
	TIME HH:MM:SS	Sets the built-in clock. HH: 00 to 23, MM : 00 to 59, SS: 00 to 59	TIME?	HH. MM. SS
<Y-M-D M-D-Y D-M-Y>	DATEFORM*	Sets the built-in clock. * : 0 YYYY-MM-DD 1 MM-DD-YYYY 2 DD-MM-YYYY	DATEFORM?	* (0 to 2)
<CLICK>	BZCLK*	Selects use or non-use of a click. * : 0 or 1 0 : OFF 1 : ON	BZCLK?	* (0 or 1)
<WARNING>	BZWRN*	Selects use or non-use of an alarm. * : 0 or 1 0 : OFF 1 : ON	BZWRN?	* (0 or 1)
<PRINTER MAKER>	PRMAKER*	Selects printer maker. * : 0 to 4 0 : NEC 1 : EPSON 2 : CANON 3 : POSTSCRIPT 4 : INTERNAL	PRMAKER?	* (0 to 4)
<PRT DIRECTION>	PRDIR*	Selects print direction for the external printer. * : 0 or 1 0 : horizontal 1 : vertical	PRDIR?	* (0 or 1)
<PRINT OUT>	PRINT*	Outputs to the printer. * : 0 or 1 0 : OFF 1 : ON	PRINT?	* 0 : OFF(except copy) 1 : ON (copy)
<FEED>	PRFED**	Printer paper feed ** : 1 to 10 (Amoount of feed, Unit : *5 mm)	None	
<SET COLOR*>	DEFCL*	Sets the display color. * : 1 to 5 patterns	DEFCL?	* (*:1 to 5)

Table 6-5: GP-IB Program Codes (22/23)

Function	Control command	Explanation	Talker command	Talker output data format
<REMOTE SETUP>				
<Delimiter setup> (for GP-IB interface only)	DELIM*	Sets up a delimiter. * : 0 or 1 0:[EOI] 1:CR+LF+[EOI]	DELIM?	* (0 or 1)
<CHANGE PASSWORD>	CHGPASS '@@@@"@@@@'	Changes password. 1st @-@ : Current password 2nd @-@ : New password	None	
<LOCK/UNLOCK>	LOCK*, PASSWORD	*: 0 or 1 0:Unlocks (by up to four digits of password). 1:Locks.(The password can be omitted at the time of the LOCK ON).	LOCK?	* (0 or 1)
OPM USER CAL	PMCAL*	User calibration data of opm is made effective. * : 0 OR 1 0 : OFF 1 : ON	PMCAL?	*
GET OPM USER CAL DATA	PMCALRUN	User calibration data of OPM is acquired.	PMCALST?	* 0 : RUN 1 : STOP
	PMCALSTP	The acquisition of user calibration data of OPM is stopped.		
<SRQ mask setup> (for GP-IB interface only)	I***	0 for full mask, 001 to 255 for separate mask (The mask to BIT6 is invalid.)	I?	* (1 to 255)
<SRQ status byte request> (for GP-IB interface only)	None	Returns an SRQ status byte.	SRQ?	* (1 to 255)
<Error number inquiry>		Returns an error number (see Table 6-8).	ERROR?	E**** (****:error number)
<Initialize status check>	INIT	0:Initialization has completed. 1:Initialization in progress	INIT?	* (0 or 1)

Function	Control command	Explanation	Talker command	Talker output data format
[OPTION]				
[ORL]				
ORL MODE	RLMODE*	Sets the ORL function. * : 0 The ORL function is released. 1 Sets the ORL function.	RLMODE?	*
WL(FREQ)	RWL****.***	Sets the measurement wavelength in ORL function. (Unit:nm) ****.*** : 1500.000 to 1580.000 (0.001 step)	RWL?	****.***
	RFR***.****	Sets the measurement frequency in ORL function. (Unit:nm) ***.**** : 189.7421 to 199.8616 (0.0001 step)	RFR?	***.****
WL SYNC	RLSYNC*	The wavelength(or frequency) of the ORL function is synchronized with the wavelength(or frequency) of the TLS. * : 0 not sync 1 sync	RLSYNC?	*
AVERAGE	RA***	Sets the averaging times for measurement. *** : 1(OFF),2,5,10,20,50,100,200	RA?	***
GET REF DATA	RREF	Measures the reference reflection.	RREF?	* 0 : not measured 1 : measured 2 : measuring
REF REFL	RFL*	Sets the refelence reflection. * : 0 Total reflection (0.2dB) 1 Fresnel reflection (14.7dB)	RFL?	*
ZERO SET	RPZ	Zero set of ORL module.	RPZ?	* 0 : stop 1 : running
DATA REQUEST	None	Requests the measuring return loss value.	RD?	***.** -999.99 : no data (in measuring ref data or averaging)

* The commands of ORL function,SRQ?,I***,I?,PRINT*,PRINT?,PRFED**,INIT,INIT?,ERROR?,L*,L?,CHGPASS and LOCK becomes effective at ORL function(RLMODE1).

Table 6-6: GP-IB Output Data Formats (1/4)

Data output item	Output request command	Talker output data format
Peak	MS_PEAKA	(In case of wavelength) ****.***[nm],***.***[dBm],***.***[dB] (In case of frequency) ***.****[THz],***.***[dBm],***.***[dB] Returns peak wavelength, absolute output level and output level (include LVADJ).
Notch	MS_NOTCH	(In case of wavelength) ****.***[nm],***.***[dBm],***.***[dB] (In case of frequency) ***.****[THz],***.***[dBm],***.***[dB] Returns notch wavelength, absolute output level and output level (include LVADJ).
Mean Wavelength	MS_MEAN	(In case of wavelength) ****.***[nm] (In case of frequency) ***.****[THz]
Spectrum width of peak	MS_PWIDTH	(In case of wavelength) ****.***[nm] (In case of frequency) ***.****[THz]

Table 6-6: GP-IB Output Data Formats (2/4)

Data output item	Output request command	Talker output data format
Both side frequency at downed specified level from peak	MS_PWIDTHA**.***	(In case of wavelength) ****.***[nm], ****.***[nm] (In case of frequency) ***.****[THz] , ***.****[THz] The detection result returns in the ascending order of the frequency.
Spectrum width of notch	MS_NWIDTH	(In case of wavelength) ****.***[nm] (In case of frequency) ***.****[THz]
Adjacent Channel Crosstalk(Both)	MS_ACXTB	***.***[dB] (left side),***.***[dB] (right side)
Adjacent Channel Crosstalk	MS_ACXT	***.***[dB] (bad side)
Non- Adjacent Channel Crosstalk	MS_NACXT	***.***[dB] (worst closstalk)
Total Crosstalk	MS_TXT	***.***[dB]

Table 6-6: GP-IB Output Data Formats (3/4)

Data output item	Output request command	Talker output data format
Power meter function measurement data	PMTR? MAXP? MINP? DIFFP?	Absolute value LOG scale +/-***.***[dBm] Relative value LOG scale +/-***.***[dB]
		• In OVER, numeral section is replaced by "OVR". • In UNDER, numeral section is replaced by "UND".
Peak (Two or more peaks in a sensor)	SS_PEAKA	(In case of wavelength) ****.***[nm],***.***[dBm],***.***[dB],****.***[nm],***.***[dBm],***.***[dB], ... (1st channel),(2nd channel), ... (In case of frequency) ***.****[THz],***.***[dBm],***.***[dB],***.****[THz],***.***[dBm],***.***[dB], ... Returns peak wavelength, absolute output level and output level (include LVADJ) on each channels.
Notch (Two or more peaks in a sensor)	SS_NOTCH	(In case of wavelength) ****.***[nm],***.***[dBm],***.***[dB],****.***[nm],***.***[dBm],***.***[dB], ... (1st channel),(2nd channel), ... (In case of frequency) ***.****[THz],***.***[dBm],***.***[dB],***.****[THz],***.***[dBm],***.***[dB], ... Returns notch wavelength, absolute output level and output level (include LVADJ) on each channels.

Table 6-6: GP-IB Output Data Formats (4/4)

Data output item	Output request command	Talker output data format
Mean Wavelength (Two or more peaks in a sensor)	SS_MEAN	(In case of wavelength) ****.***,****.***, ... [nm] (In case of frequency) ***.****,***.****, ... [THz]
Spectrum width of peak (Two or more peaks in a sensor)	SS_PWIDTH	(In case of wavelength) ****.***,****.***, ... [nm] (In case of frequency) ***.****,***.****, ... [THz]
Spectrum width of Notch (Two or more peaks in a sensor)	SS_NWIDTH	(In case of wavelength) ****.***,****.***, ... [nm] (In case of frequency) ***.****,***.****, ... [THz]

6.1.7 Error Message

This system displays errors in Table 6-7. Only the item concerning GP-IB is written in the output cue.

Table 6-7: Error code list (1/2)

Error code	Error message	Contents
E0001	FONT FILE(KANJI16) LOAD ERROR	Font file (KANJI16) cannot be read.
E0002	FONT FILE(ANK16) LOAD ERROR	Font file (ANK16) cannot be read.
E0003	FONT FILE(DOS/V) LOAD ERROR	The font file (DOS/V) cannot be read.
E0004	PRINTER NOT READY	The printer is not prepared.
E0005	PRINTER I/O ERROR	I/O is abnormal of the printer.
E0006	PRINTER OFFLINE	The printer is off-line.
E0007	PRINTER NOT PAPER	The form is not set by the printer. (no form)
E0008	COOLING FAN ERROR	The operation is abnormal of the cooling fan.
E0009	INTERNAL PRINTER HEADUP ERROR	Do the head-up of the printer.
E0010	PRINT BUFFER ALLOCATION ERROR	The memory work area to do the print output cannot be secured.
E0011	GP-IB BUFFER OVERFLOW	The buffer of GP-IB overflows.
E0012	GP-IB RECEIVE DATA ERROR	The reception is abnormal of the GP-IB data.
E0013	GP-IB SEND DATA ERROR	The transmission is abnormal of the GP-IB data.
E0014	GP-IB COMMAND SYNTAX ERROR	The format of the GP-IB command is wrong.
E0015	GP-IB COMMAND EXECUTE ERROR	It failed in the execution of the GP-IB command.
E0017	MISTAKE INPUT PASSWORD	The input password is different.
E0018	SUB CPU SEND DATA ERROR	The transmission is abnormal of the sub-CPU data.
E0019	SUB CPU RECEIVE ERROR	The reception is abnormal of the sub-CPU data.
E0020	REMOTE CONST CALIBRATION ERROR	It failed in the execution of a constrained calibration.
E0021	REMOTE AUTO CALIBRATION ERROR	It failed in the execution of an automatic calibration.
E0022	MARKER CAN NOT BE SET	The marker cannot be set.
E0023	MISTAKE SWEEP DATA(START/STOP) ERROR	The sweep cannot be done by setting sweep START to STOP.
E0025	SERIAL DATA COMMUNICATION ERROR	The communication is abnormal of the serial data.
E0026	AQ8461-23 HARDWARE ERROR	Abnormality of hardware of AQ8461-23.
E0027	AQ8461-23 ZERO SET ERROR	AQ8461-23 failed in ZERO SET.
E0028	FAILED IN USER CAL	It is Failed in the measurement of the USER CAL data.
E0030	AQ8461-23 M** EEPROM ILLEGAL DATA	The EEPROM data of MODULE ** is abnormal.
E0031	AQ8461-23 M** EEPROM WRITE ERROR	The data is not preserved in EEPROM of MODULE **.
E0032	AQ8461-71 ZERO SET ERROR	AQ8461-71 failed in ZERO SET.
E0041	DIRECTORY IS NOT FOUND	The directory is not found.
E0042	DRIVE IS NOT FOUND	The drive is not found.
E0043	CAN'T COPY FILE	The file cannot be copied.
E0044	CAN'T DELETE FILE	The file cannot be deleted.
E0045	CAN'T MAKE DIRECTORY	The directory cannot be made.

Table 6-8: Error code list (2/2)

Error code	Error message	Contents
E0046	SAME DIRCTORY EXISTS	The same directory exists.
E0047	CAN'T FORMAT THE FLOPPY	The floppy disk cannot be formatted.
E0048	CAN'T FILE NAME CHANGE ERROR	The file name cannot be changed.
E0060	THE FLOPPY DISK NOT FOUND	There is no floppy disk in FDD.
E0061	VERSION UP SUB PROGRAM LOAD ERROR	The SUB program for version up cannot be read.
E0062	VERSION UP LD PROGRAM LOAD ERROR	The LD program for version up cannot be read.
E0063	VERSION UP MOD PROGRAM LOAD ERROR	The MODULE program for version up cannot be read.
E0064	WAV DATA FILE SAVE ERROR	The wave data cannot be preserved.
E0065	WAV DATA FILE LOAD ERROR	The wave data cannot be read.
E0066	AQ8461-23 OPM DATA FILE SAVE ERROR	The AQ8461-23 OPM data cannot be preserved.
E0067	AQ8461-23 OPM DATA FILE LOAD ERROR	The AQ8461-23 OPM data cannot be read.
E0068	CONDITION DATA FILE SAVE ERROR	The condition data cannot be preserved.
E0069	CONDITION DATA FILE LOAD ERROR	The condition data cannot be read.
E0070	LABEL DATA FILE SAVE ERROR	The label data cannot be preserved.
E0071	LABEL DATA FILE LOAD ERROR	The label data cannot be read.
E0072	DISPLAY DATA FILE SAVE ERROR	The screen display data cannot be preserved.
E0073	DISPLAY DATA FILE LOAD ERROR	The screen display data cannot be read.
E0074	ENVIRONMENT FILE READ ERROR	The environmental data cannot be read.
E0075	ENVIRONMENT FILE WRITE ERROR	The environmental data cannot be preserved.
E0076	GASCELL DATA FILE WRITE ERROR	The gas cell data cannot be preserved.
E0077	WAVE DATA MALLOC ERROR	Memory allocation error of the wave data.
E0078	INCOMPATIBLE DATA REQUEST	The setting data and the range combine suitable.
E0079	LD IS INACTIVE	LD does not emit light.
E0080	FAILED IN SWEEP	SWEEP failed.
E0081	NO WAVE DATA	A current sensor without the wave data was analyzed.
E0082	USER CAL DATA FILE SAVE ERROR	The USER CAL data cannot be preserved.
E0083	USER CAL DATA FILE LOAD ERROR	The USER CAL data cannot be read.
E0084	DATA FILE PACKET SAVE ERROR	The packet data cannot be preserved.
E0085	DATA FILE PACKET LOAD ERROR	The packet data cannot be read.
E0086	MEMORY WAVE BIN TYPE DATA FILE SAVE ERROR	The wave data in BIN type cannot be preserved.
E0087	WAVE BIN TYPE DATA FILE LOAD ERROR	The wave data in BIN type cannot be read.
E0088	WAVE CSV TYPE DATA FILE SAVE ERROR	The wave data in CSV type cannot be preserved.
E0089	MEMORY WAVE CSV TYPE DATA FILE SAVE ERROR	The memory wave data in CSV type cannot be read.
E0091	PASSWORD FILE READ ERROR	The password data cannot be read.
E0092	PASSWORD FILE WRITE ERROR	The password data cannot be preserved.
E0093	ANALYSIS DATA MALLOC ERROR	The memory of the analysis data cannot be secured.
E0094	FAILED IN REF REFLECT MEASURMENT	AQ8491-71 failed in the measurement of the reference reflection.
E0095	ITU-GRID ARE NOT ON WAVE DATA	The ITU-GRID does not exist within the analysis range.

Chapter 7 System Circuits and Structure

This chapter describes the basic AQ8460 system circuits and structure.

7.1 System Circuits

Fig. 7-1 shows the AQ8460 system block diagram.

(1) LD module section

Consists of an LD, monitor PD, Peltier effect elements, thermistors, motors and optical devices such as diffraction effect elements. The optical emission is sent to the optical output section.

(2) Gas cell module section

Consists of the gas cell having the absorption characteristics of specific wavelength only, photodiodes and others. The reference wavelength is determined based on the gas cell characteristics.

(3) LD driver section

Drives the LD unit and controls the LD module temperature. The driver is under CPU1 control.

(4) Controllers

The CPU2 controls the motors of LD module section, searches the wavelength of the gas cell module wavelength absorption, and uses it as the reference wavelength.

The CPU3 controls the GP-IB interface sections.

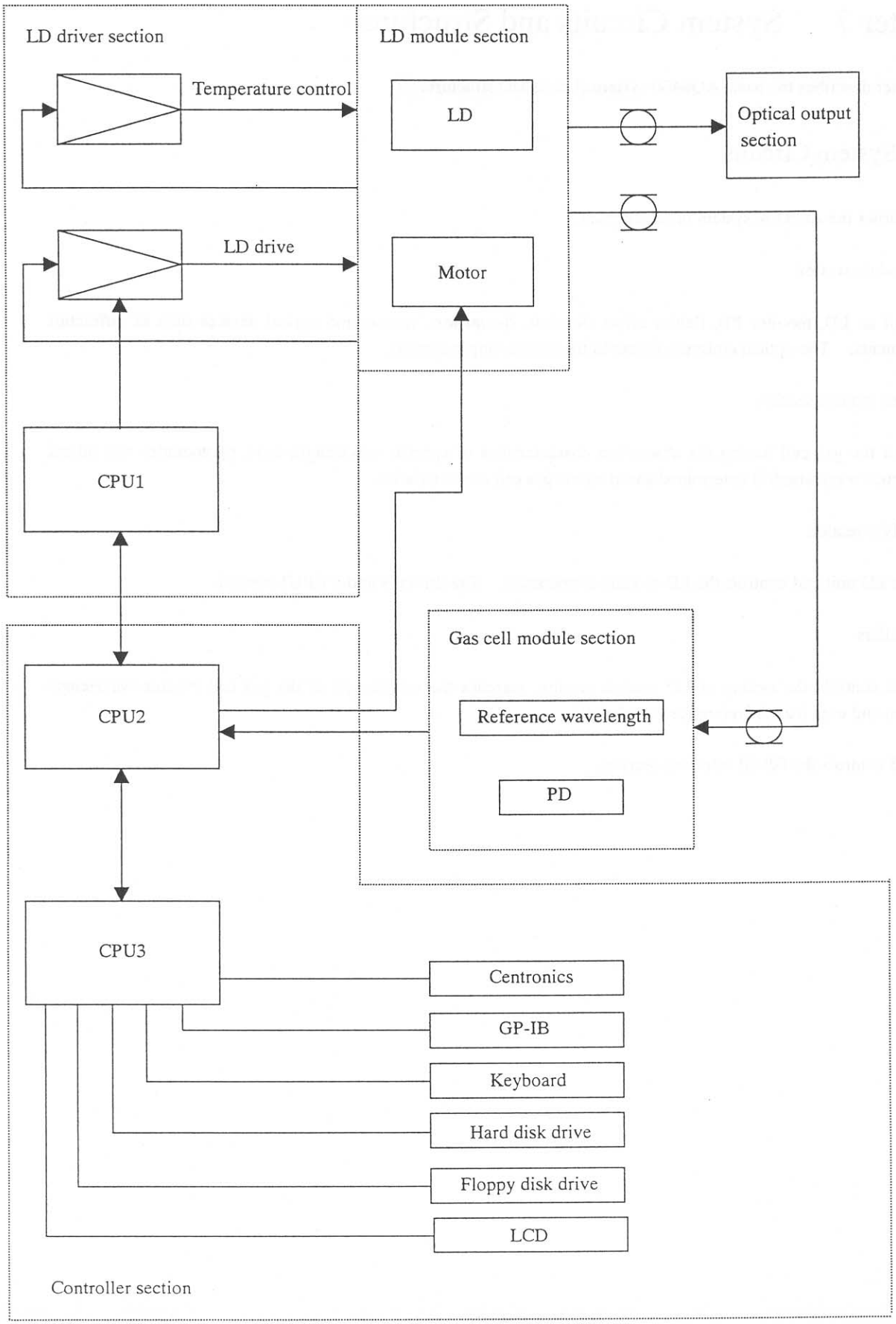


Fig. 7-1: System block diagram

7.2 Structure

Chart ASD-62563 shows an AQ8460 appearance. (PMF output type)

Note

The difference point on externals of AQ8460 and AQ8460L is only a model name.
Therefore, only the externals chart of AQ8460 is appended in this manual.

Chart ASD-62571 shows an AQ8461 appearance.
Chart ASD-62571-23 shows an AQ8461-23 appearance. (It is an example for the FC connector.)
Chart ASD-62571-71 shows an AQ8461-71 appearance.
Chart ASD-62571-91 shows an AQ8461-91 appearance.
Chart ASD-62571-93 shows an AQ8461-93 appearance.

Chapter 8 Operation Principle

8.1 Variable Wavelength Measurement

The AQ8460 system uses an external resonator as shown in Fig. 8-1. This structure can minimize the mode hop generation but provide the better wavelength selection.

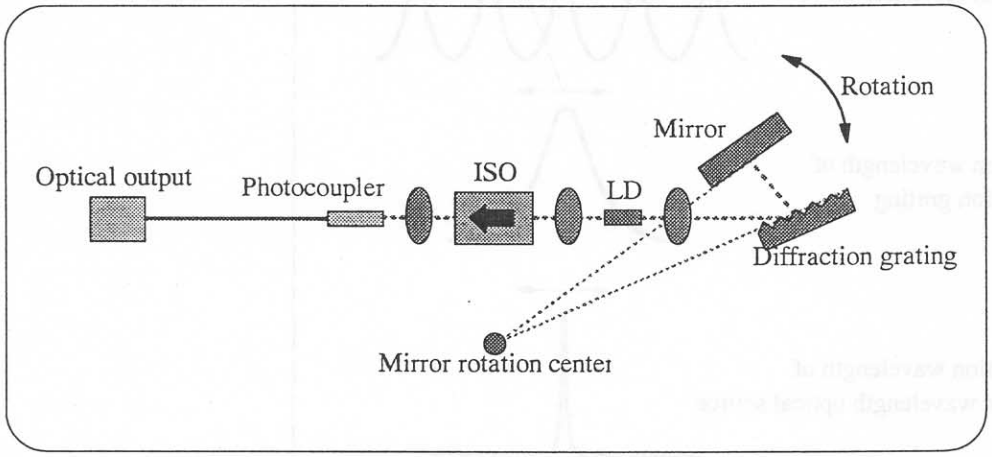


Fig. 8-1: External resonator structure

- Mode hop of variable wavelength source

When the wavelength of variable wavelength source is changed, the vertical mode signals of external resonator may not synchronize with the selection wavelength of diffraction grating and a mode hop of wavelength may occur. However, the external resonator design of Fig. 8-1 can minimize the mode hop generation as it changes the selection wavelength of diffraction grating in synchronous with vertical mode signals of external resonator as shown in Fig. 8-2.

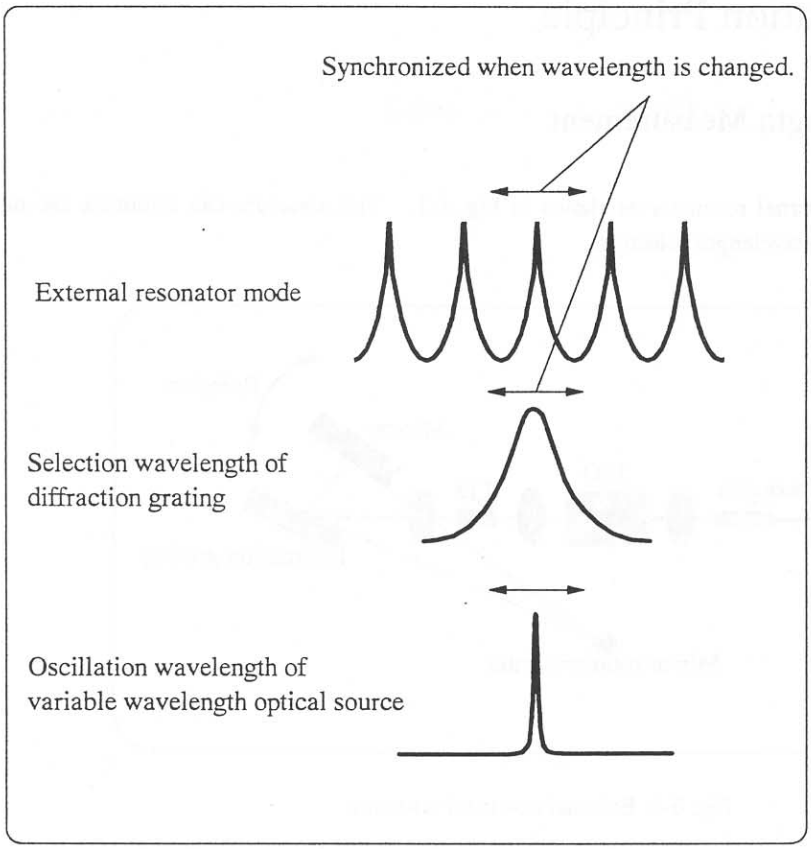


Fig. 8-2: Vertical mode signals of external resonator

8.2 Reference Wavelength

The AQ8460 has a built-in acetylene gas module and can determine its reference wavelength using absorption lines of acetylene gas. When the optical wavelength is changed in the analyzer, the level of optical signals passing through the acetylene gas is detected and the reference wavelength is determined.

Chapter 9 Troubleshooting Guide

(1) The AQ8460 does not operate when powered on.
- Check the power fuse at the rear panel.
- There is a possibility consuming the battery.
  For replacement, contact the nearest sales office or agency.
  (Backup battery type name: CR2450)

(2) No optical power is output.
- Make sure that the [LD ON/OFF] switch is ON.
- Check the optical fibers for poor connection.
- Check the [REMOTE SW CONNECTOR] connection at the rear panel.

(3) The optical output is blow the standard.
- Check the optical outputs and connected optical fiber ends for dirt and foreign materials.
- Check the optical output level setup.
- Check the optical fiber connection.
- Check the insertion loss of optical fibers.

(4) The optical output level is unstable.
- Check the terminals of AQ8460 optical output section for scratches and dirt.
- Warning! Turn the AQ8460 power switch OFF and make sure that no beams are emitted at all.
  Then, check the connected optical fiber ends for scratches and dirt using a microscope or others.

(5) No keys operate, or the optical output does not turn On or Off.
- Release the AQ8460 from Remote control mode (via GP-IB interface).
- Disconnect the attached keyboard.

(6) The optical power measurement value (absolute value) shifts.
- Please confirm whether the edge side in the optical input part of the sensor module is scratches and dirt.
- Please confirm whether the correction value joins in "LV SHIFT" etc.
- Please confirm whether to differ from the wave length which the setting wave length input.

Chapter 10 Maintenance

This chapter provides the routine maintenance guidance information.

10.1 Instruments and Tools required

Table 10-1 lists the instruments you need to prepare during maintenance.

Table 10-1: List of test instruments

Note: The Ando's equivalent instrument is shown in parentheses.

Instrument	Basic performance
AQ2140 optical multimeter	
Optical power meter (Combination of AQ2140 and AQ2733)	Power measuring range: -110 to +10 dBm Wavelength range: 0.7 to 1.7 micrometers
Optical spectrum analyzer (AQ6315A)	Wavelength range: 0.35 to 1.75 micrometers Resolution: 0.05 nm
Optical frequency counter	

10.2 Periodical Inspection

As the AQ8460 has been designed to have the highest possible stability and reliability, you need to inspect your AQ8460 once a half year only in the following procedure.

⚠ Caution

Do not touch inside of AQ8460.

---

(1) Absolute wavelength and stability
Measure the absolute wavelength and wavelength stability using an optical frequency counter.

(2) Optical output level and stability
Connect an optical power meter to the AQ8460 using a 2-meter long fiber, and measure the optical output level and stability.

(3) SMSR
Set the optical output to its maximum level. Then, measure the SMSR using an optical spectrum analyzer.

(4) Optical output flatness
Set the optical output to the MAX value in the minimum wavelength. Change the wavelength every 100pm within the wavelength range, and check the optical power on the power meter.

10.3 Cleaning

The AQ8460 must always be kept clean as its optical output level and stability drop if its optical output section is contaminated by dusts or others. Carefully wipe and clean the optical fibers using an alcohol before connecting them to your AQ8460. We recommend to use an NTT-ME's Cletop stick cleaners for cleaning.

Appendix

Table of ITU-T grid for spacing of 50 GHz

Frequency (THz)	Wavelength (nm)
196.10	1528.773
196.05	1529.163
196.00	1529.553
195.95	1529.944
195.90	1530.334
195.85	1530.725
195.80	1531.116
195.75	1531.507
195.70	1531.898
195.65	1532.290
195.60	1532.681
195.55	1533.073
195.50	1533.465
195.45	1533.858
195.40	1534.250
195.35	1534.643
195.30	1535.036
195.25	1535.429
195.20	1535.822
195.15	1536.216
195.10	1536.609
195.05	1537.003
195.00	1537.397
194.95	1537.792
194.90	1538.186
194.85	1538.581
194.80	1538.976
194.75	1539.371
194.70	1539.766
194.65	1540.162
194.60	1540.557
194.55	1540.953
194.50	1541.349
194.45	1541.746
194.40	1542.142
194.35	1542.539
194.30	1542.936
194.25	1543.333
194.20	1543.730
194.15	1544.128
194.10	1544.526

Frequency (THz)	Wavelength (nm)
194.05	1544.924
194.00	1545.322
193.95	1545.720
193.90	1546.119
193.85	1546.518
193.80	1546.917
193.75	1547.316
193.70	1547.715
193.65	1548.115
193.60	1548.515
193.55	1548.915
193.50	1549.315
193.45	1549.715
193.40	1550.116
193.35	1550.517
193.30	1550.918
193.25	1551.319
193.20	1551.721
193.15	1552.122
193.10	1552.524
193.05	1552.926
193.00	1553.329
192.95	1553.731
192.90	1554.134
192.85	1554.537
192.80	1554.940
192.75	1555.343
192.70	1555.747
192.65	1556.151
192.60	1556.555
192.55	1556.959
192.50	1557.363
192.45	1557.768
192.40	1558.173
192.35	1558.578
192.30	1558.983
192.25	1559.389
192.20	1559.794
192.15	1560.200
192.10	1560.606