INSTRUCTION MANUAL

FOR

AQ6319 OPTICAL SPECTRUM ANALYZER

Yokogawa Electric Corporation

AS-62642-01Y Rev. 1.0

Thank you for purchasing this Yokogawa Electric product.

Yokogawa Electric Corporation. designs and develops products using leading-edge technologies to meet the needs of today's users. All of our staffs are proactively involved in these efforts on a daily basis, and we look forward to providing you with quality products into the future.

The AQ6319 Optical Spectrum Analyzer provides improved measurement performance and advanced features based on leading-edge technologies. To improve ease of use, it includes functions such as mouse-based user operation and a brand-new zoom function.

AQ6319 Features
The AQ6319 is an optical spectrum analyzer which can measure loss wavelength characteristics and propagation characteristics on optical fiber cables, optical filters and the like, in addition to spectral measurements on light sources such as LDs and LEDs.
The measurement wavelength range is wide at 600 to 1700 nm, enabling optical spectrum analysis in the near infrared range. In addition to basic features such as high resolution, high sensitivity, high accuracy, wide dynamic range and superior linearity, the AQ6319 has a wide variety of functions such as program measurement functions and numerous data processing functions, including analysis functions and template functions.

In terms of data output capabilities, the AQ6319 can provide screen hard copies through the internal high-speed printer or an external printer. In addition, waveforms and programs can be read from and written to the internal hard disk and floppy disk, or read/written through the LAN interface. The AQ6319 also includes GP-IB and RS-232C interfaces as standard features, enabling fully remote control. Lastly, the AQ6319 has an intuitive graphical user interface using a keyboard and mouse for user-friendly operation.

⚠ Caution

- This product uses products customized for Microsoft® Windows XP. Before using this product, be sure to read the End User License agreement, attached at the end of this document.
  Use of this product constitutes agreement on your part with the terms of the End User License Agreement.
  Microsoft® is a registered trademark or trademark of Microsoft Corporation in the US and other countries.

1 Safety Marks and Labels

- **Before using this product, be sure to read the Safety Precautions.**
- **Be sure to follow the danger and caution labels shown below in order to ensure safe and proper use of this product while avoiding danger to yourself and others and preventing property damage.**

In order to ensure safe use of this product, the safety marks shown below are used with the meanings shown in the table. Areas where these marks appear in the document are extremely important in terms of safety. Be sure to read the meanings of these safety marks to ensure safe use of this product.

Safety mark	Meaning
⚠ **Danger**	Ignoring this mark and performing an operation incorrectly could result in a hazardous situation involving personal injury or death.
⚠ **Warning**	Ignoring this mark and performing an operation incorrectly could possibly result in serious personal injury or lead to hazardous situations in which minor injury or property damage frequently occur.
⚠ **Caution**	Ignoring this mark and performing an operation incorrectly is not likely to result in serious personal injury, but could possibly lead to injury or simply result in property damage.
NOTE	This mark flags an explanatory note pertaining to exceptions, corrections, or limitations in the text. Such notes present information which is outside the scope of the Danger, Warning, and Caution safety marks.

The following icons are used in the text with the meanings shown below.

	A triangle with a picture inside it represents a *notification* which is a warning or caution. Handle this unit carefully in performing the action specified in the text pertaining to a warning or caution with this type of icon. The picture inside the triangle denotes the specific type of warning (a fire caution is presented in the example at left).
	A circle with a crossed-out picture inside it represents an action that is *prohibited*. You must never perform the action specified in the text pertaining to a warning or caution with this type of icon. The picture inside the circle denotes the specific type of prohibited action (in the example at left, disassembly is not allowed).
	A black circle with a picture inside it represents an action that *must be performed*. You must perform the action specified in the text pertaining to a warning or caution with this type of icon. The picture inside the circle denotes the specific type of required action (in the example at left, the AC adapter is to be removed from the power outlet).

Other labels

[SWEEP] Square brackets denote a panel switch. The word enclosed by square brackets is the name of the panel switch.

<TRACE A> Angle brackets denote a soft key located on the right side of the screen. The words enclosed by angle brackets denote the type of soft key.

(☛ See section 2.2 Rear Panel)

The words enclosed by parentheses indicate an associated item or an item to be referred to.

⚠Warning

Ignoring this mark and performing an operation incorrectly could possibly result in serious personal injury or lead to hazardous situations in which minor injury or property damage frequently occur.

Cautions related to power supply

This product is designed to operate at supply voltages of 100-120,200-240V AC. Do not use it at voltages outside these rated supply voltage ranges.

□ Doing so may result in fire, electric shock, or equipment damage.

Do not use an AC adapter other than the included adapter or one specified by the manufacturer.

□ Doing so may result in fire, electric shock, or equipment damage.

Do not connect the power cord to a multi-outlet power strip.

□ Doing so may result in fire or overheating.

If there is lightning nearby, quickly turn off the power and remove the power plug from the outlet. In addition, remove the interface cables from this product and refrain from using it.

□ A lightning strike may result in fire, electric shock, or equipment damage.

Securely insert the power plug in the power outlet.

□ Touching the power plug terminals with metal or the like may result in fire, electric shock, or equipment damage.

Cautions related to handling

Do not insert or drop any metal objects through any opening.

□ Doing so may result in fire, electric shock, or equipment damage.

Do not take this product apart or attempt to modify it.

□ Doing so may result in fire, electric shock, or equipment damage.

Do not unplug or plug in the power plug with wet hands.

□ Doing so may result in electric shock.

Do not connect network cables from the LAN port or PC port to a commercial power supply, analog telephone line, digital telephone line (ISDN line), PBX digital telephone line, or the like.

□ Doing so may result in fire, electric shock, or equipment damage.

If water enters this product, immediately remove the power plug from the power outlet and contact your dealer.

□ Using this product in this condition may result in fire, electric shock, or equipment damage.

If this product emits smoke or a strange odor, immediately remove the power plug from the power outlet, make sure the smoke stops coming out, and then ask your dealer for repair.

□ Using this product in this condition may result in fire, electric shock, or equipment damage.

⚠Warning

	Cautions related to the installation environment and conditions
	Do not place small metal objects or flower vases, cups, cosmetics, medicine, potted plants, or other containers holding liquids on top of or near this product. □ If they spill on or enter this product, fire, electric shock, or equipment damage may occur.
	Do not set heavy objects on the power cord or AC adapter, or yank on them or allow them to overheat. □ Doing so may damage the cord, resulting in fire or electric shock.
	If you drop this product or damage the cabinet, remove the power plug from the power outlet and contact your dealer. □ Using this product in this condition may result in fire, electric shock, or equipment damage.
	Ask your dealer to handle internal checks and repairs. □ For contact information, see section 1.3 Warranty. (☛ See section 1.3 Warranty)
	Close the connector cover when you are not using the reference light source. □The reference light source inside this product is an infrared light source. Infrared light is not visible to the naked eye, but if the output light enters the eyes, it can damage them or cause vision to weaken.
	Do not disassemble or attempt to modify the inside of the reference light source. □ If you disassemble or attempt to modify the reference light source, this product's alignment adjustment and wavelength calibration operations may no longer function properly. In addition, doing so may result in fire, electric shock, or equipment damage.

⚠ Caution

Ignoring this mark and performing an operation incorrectly is not likely to result in serious personal injury, but could possibly lead to injury or simply result in property damage.

Cautions related to installation environment and conditions

	Do not install the unit in a location where it is exposed to smoke or steam, such as a kitchen table or near a humidifier, and do not place it in a dusty, dirty area. □ Doing so may result in fire, electric shock, or equipment damage.
	Do not install the unit in an unstable location, such as on an unsteady platform or a tilted surface. □ The unit may fall or tip over, resulting in injury.
	Do not install the unit in a location exposed to direct sunlight or high humidity. □ Doing so may increase the temperature inside the unit, resulting in fire or equipment damage.
	Do not block the air vents on the product. □ If the air vents are blocked, heat will build up inside the unit, possibly resulting in fire or equipment damage.
	Do not install the unit in a location with heavy vibrations. □ Doing so may result in fire, electric shock, or equipment damage, and may result in unstable operations.
	Install the unit away from strong magnetic fields and electromagnetic noise sources. □Doing so may result in fire, electric shock, or equipment damage.
	This unit is designed to be installed horizontally. Do not install it vertically or upside down. □ Heat will build up inside the unit, possibly resulting in fire or equipment damage.

Cautions related to handling

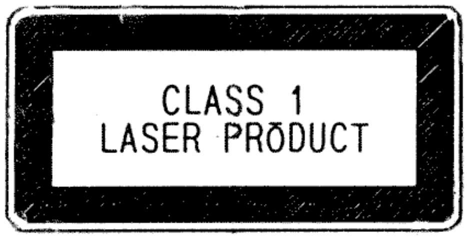
	Be sure to grasp the plug directly when removing the power plug from a power outlet. □ Yanking on the cord may damage the cord, resulting in fire or electric shock.
	Before moving the unit, first turn off the power switch (following the procedure for turning off the unit's power switch) and remove the power plug from the power outlet. Next, disconnect all external connector cables, such as communication cables. (☛ See section 3.3 Power ON/OFF) □ Turning the power switch off incorrectly may cause an abnormality in the unit. Make sure that all connector cables are disconnected before moving the unit. Yanking on the cord may damage the cord, resulting in fire, electric shock, or equipment damage.
	If water drips on the unit, wipe it off with a dry towel. □ If water drips inside the unit, it may cause a fire or damage the unit.
	As a safety precaution, remove the power plug from the power outlet prior to maintenance work. □ Doing so may result in fire, electric shock, or equipment damage.
	Be sure to ground the unit. □ Doing so may result in fire, electric shock, or equipment damage.

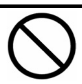
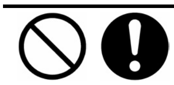
2 Internal light source

This unit has an internal light source with the specifications shown in Table 1.

Table 1 Internal Light Source

Parameter	AQ6319
Laser type	LED
Laser class	1
Maximum output power	−50 dBm
Absorption wavelength	1525.68nm / 1540.8nm
Neighboring wavelength interval	0.5nm
Absorption amount	1dB

Safety mark


	A very small amount of gas is sealed inside the unit. If the glass cell breaks and this gas leaks out, ventilate the room and keep all flame sources far away from the room.
	Acetylene gas (isotope, 99% purity) is sealed in the wavelength absorption glass cell inside the unit. □ This gas is flammable, so if the glass cell breaks, it could be ignited by a flame or static electricity.
	Infrared light is output from the output source. The light output unit is located on the front panel of the unit.
	Never look at the light output unit or the tip of the optical fiber connected to the light output unit.

3 Usage Environment

3.1 Operating temperature range

Operation temperature : +5～+40 ℃
Operation humidity : 80% or less (No condesation)

3.1.2 Environmental conditions

This unit contains an extremely precise monochromator (optical unit), so it is important to avoid extreme temperatures, shock impacts, and vibrations in storing and transporting the unit.
In particular, if the following environmental conditions are exceeded, this unit's performance levels may not recover.

Environmental conditions

(1) Storage temperature range: −10 to +50°C

(2) Vibration

Oscillation frequency:	10 Hz
Compound amplitude:	2±0.5 mm
Vibration directions:	Up/down, left/right, forward/backward
Vibration duration:	Vibrations equivalent to 10 minutes in each vibration direction

(3) Shock impact: Shock impact equivalent to natural fall when the unit is resting on a hardwood floor and one side of bottom is lifted 2.5 cm

(4) Altitude: 2000m or less

(5) EMC: EN61326:1997+A1:1998+A2:2001

3.1.3 Usage precautions

(1) Screen display

This unit's screen display consists of a color LCD module (called "LCD" below). The LCD must be handled carefully because a forceful shock impact could crack the filter plate which is attached to the front of the LCD, or could damage the LCD itself.

(2) Handling problems

If you experience problems such as those listed below when measuring light, there may be debris adhering to the end of the optical fiber cord which connects the light source to this unit. In such cases, clean the end of the optical fiber cord with alcohol or the like.
(☛ See section 9.2.5 Regular Maintenance)

- Deterioration of resolution
- Wavelength error
- Level error

3.1.4 Installation

If this unit is left in a vertical or upside-down position for an extended period of time, the precision of the internal monochromator will be adversely affected. Always use this unit in a horizontal position.
Install this unit in a stable location for use. If it is installed in a location with heavy vibrations or if it is vibrated or jarred during operations, operations will become unstable and normal measurements will not be possible.
This unit must also be kept in a horizontal position during transport and storage.

⚠ Caution

- The AQ6319 contains a precise monochromator. If this unit is installed in a location with heavy vibrations or if it is vibrated or jarred during operations, operations will become unstable or the measurement process will be halted before completion. As a result, measurement performance on the wavelength and level axes will decline significantly. Therefore, be sure to install this unit in a stable location for use.
- If sweeping stops during the measurement process or performance changes significantly, turn the power off, then on again to initialize this unit. If this unit's performance and operations are not restored/improved as a result of initialization by turning the power off and then back on, repairs will be necessary. In such cases, contact the sales department at our main office, or the nearest branch office or sales office.
  (☛ Contact information is located at the end of this document.)

4 Power supply and power cord

The AQ6319 is Class I safety class equipment which has a protective ground and is structured to provide sufficient protection against electric shock.
This unit can be grounded to protect against electric shocks from AC power supplies by connecting the ground pin of a three-prong power cord or the ground terminal of a 3-prong/2-prong adapter to a power outlet. This unit has passed safety standards IEC65 and 348.

(1) Power supply

The AQ6319 works with 100-120,200-240V AC power supplies. The supply frequency should be in the range of 48–63 Hz. In addition, use a rated voltage cable that satisfies the operating voltage requirements.

(2) Power cable

The power cable is a 3-pin plug-type cable in which the pin in the center serves as the ground pin. To the extent possible, this unit should be connected to a 3-prong outlet. If you use a two-prong outlet, connect the power cable to the outlet through an adapter. The ground wire from the adapter must be connected to an external ground or the earth.

4.1 Safety measures related to power supply

The AQ6319 will operate normally with 100-120,200-240V AC/48–63 Hz power supplies. However, steps must be taken to protect against the following in supplying the AC power.

- Injury due to electric shock
- Damage to the unit's interior due to abnormal voltage
- Problems caused by ground current

(1) Power cord polarities

A 3-prong (or grounded-type 2-prong) power outlet with an earth terminal (E) is connected as shown in Fig. 1 to the live line (L), neutral line (N), and protective earth line (earth ground). Therefore, the included 3-wire power cord is designed so that the power supply polarities will match when the plug on the cord is simply inserted in a 3-prong (or grounded-type 2-prong) outlet.

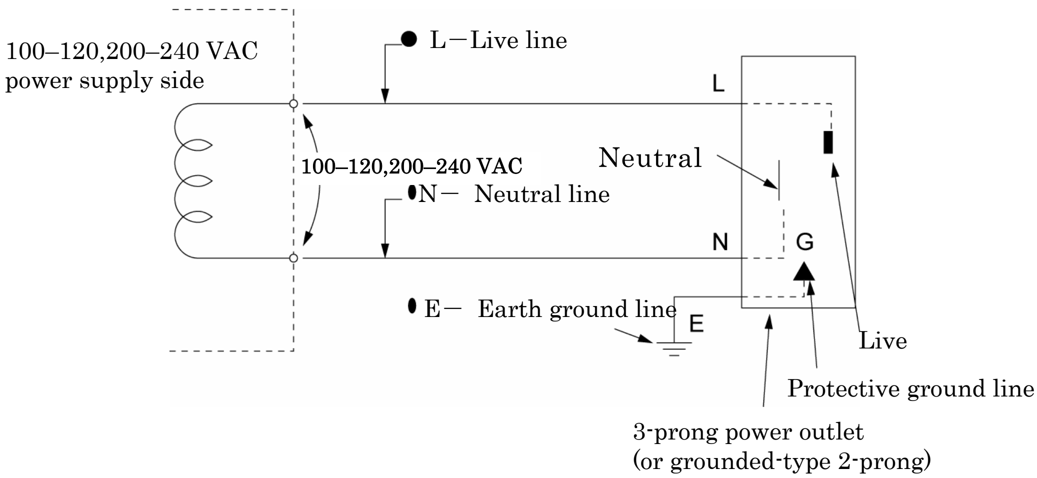


Fig. 1 3-wire power cord plug and power outlet

(2) Protective ground

[Grounding with adapter]

If a 3-prong power outlet like that shown in Fig. 1 is not provided, ground the terminal coming out of the 3-prong/2-prong adapter shown in Fig. 2.

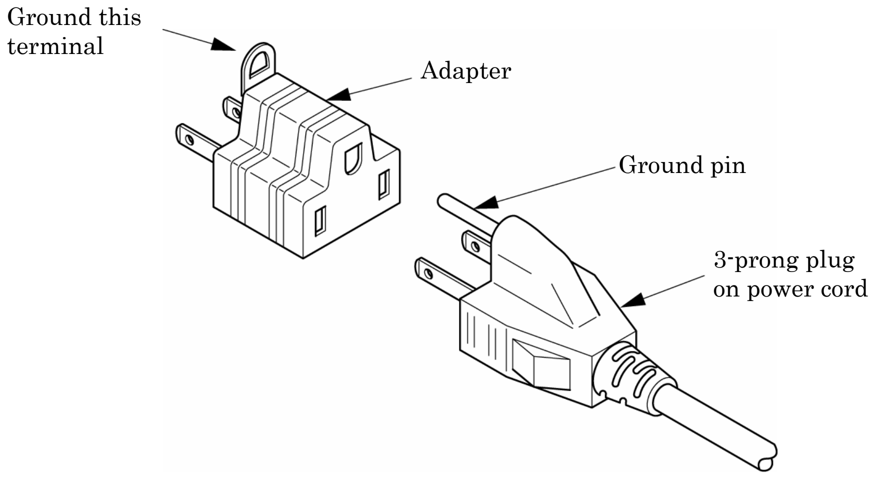


Fig. 2 Grounding from adapter

[Grounding with 3-prong power outlet]

In this case, as explained in section 4.1.(1), if a 3-prong (or grounded-type 2-prong) outlet is available, the plug on the 3-wire power cord will match the power supply's polarities, so the unit's casing will be connected to ground potential when the power cord is inserted in the power outlet. A 3-prong/2-prong adapter plug is not needed in this case.

5 Fuses

The AQ6319 uses ordinary fusing-type 5-amp fuses with a 100–120V power supply, and use time lag-type 3.15-amp fuses with a 200–240V power supply.

5.1 Replacing fuses

Under the standard configuration, the unit includes the fuses listed in the standard accessories list (☛ see section 1.2 Product and Accessories Check). If you need to replace a fuse due to an equipment failure, first determine the cause of the failure and solve the problem before replacing the fuse.

⚠ Danger

- Turn off the power switch and unplug the power plug from the power outlet before replacing a fuse. Replacing a fuse while the power is on may result in injury due to electric shock.
- After replacing a fuse, perform one of the protective grounding procedures described in section 4.1 before turning the power back on. Make sure the AC supply voltage is at the proper level before turning the power switch on. Turning the power on without a protective ground may result in injury due to electric shock. If the AC supply voltage is not at the proper level, turning the power switch on may damage the inside of the unit.

An AC power connector is located on the back side of this unit. The AC power connector contains an inlet noise filter (made by Schaffner). The fuses are set in the inlet noise filter.

When you pull the fuse holder out as shown below, it folds down so that the fuses can be easily replaced. (Be careful not to pull on the fuse holder with excessive force.)

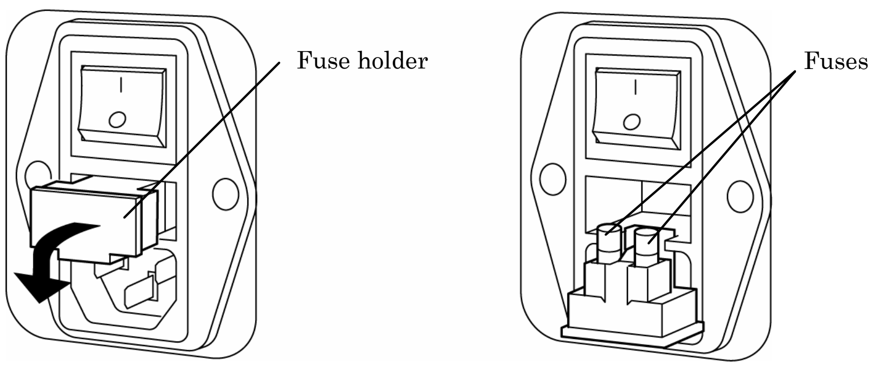


Fig. 3 Replacing the fuses

Whenever you pull out the fuse holder and push it back in order to replace or check a fuse, be sure to push it in to the point where the filter body and fuse holder are flush with each other. As you push in the fuse holder, you will feel a click (there is some variation in the position at which this occurs) (see illustration below).

If you stop pushing in the fuse holder when you feel the click, the electrical contact may be incomplete or there may be no electrical contact. Using the equipment in this condition may cause overheating and blow the fuses.

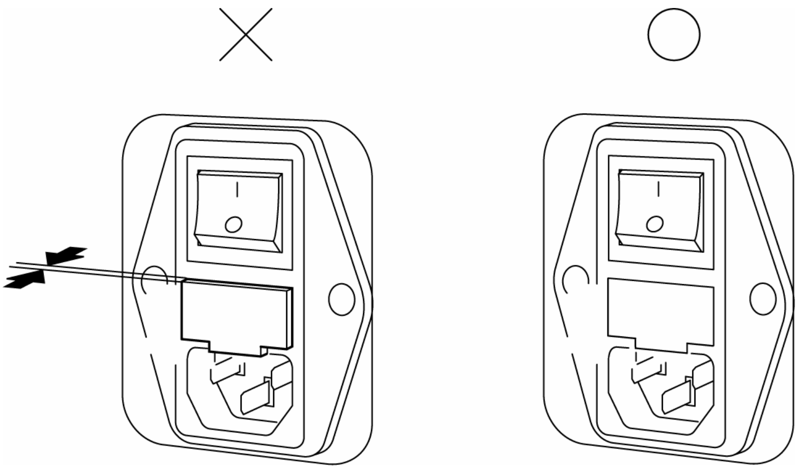


Fig. 4 Properly closing the fuse holder

CONTENTS

Chapter1 Introduction

Chapter2 Part Names and Functions

Chapter 3 Before You Start

Chapter 4 Usage Preparations

Chapter 5 Measurement Procedures

Chapter 6 Function Switches and Soft Keys

Chapter 7 Useful Functions

Chapter 8 Functional Descriptions

1

Chapter 1 Introduction

1.1 Overview of the AQ6319

The AQ6319 is an optical spectrum analyzer which can measure loss wavelength characteristics and propagation characteristics on optical fiber cables, optical filters and the like, in addition to spectral measurements on light sources such as LDs and LEDs.
The measurement wavelength range is wide at 600 to 1700 nm, enabling optical spectrum analysis in the near infrared range. In addition to basic features such as high-speed sweeping, high sensitivity, high accuracy, high resolution, wide dynamic range and superior linearity, the AQ6319 has a wide variety of functions such as program measurement functions and numerous data analysis functions, including analysis functions and template functions.

In terms of data output capabilities, the AQ6319 can provide screen hard copies through the internal high-speed printer or an external printer. In addition, waveforms and programs can be read from and written to the internal hard disk and floppy disk, or read/written through the LAN interface. The AQ6319 also includes GP-IB and RS-232C interfaces as standard features, enabling fully remote control. Lastly, the AQ6319 has an intuitive graphical user interface using a keyboard and mouse for user-friendly operation.

1.2 Checking the Equipment and Accessories

When you first open the package, make sure that it contains all of the equipment and accessories listed below and in the standard accessories list. (☛ Table 1 Standard Accessories List)

Also check to make sure the quantities in the package shown in the list. If there are missing parts or if the equipment is damaged, please contact our service department, the sales department at our main office, or the nearest branch office or sales office.

(☛ Contact information is located at the end of this document.)

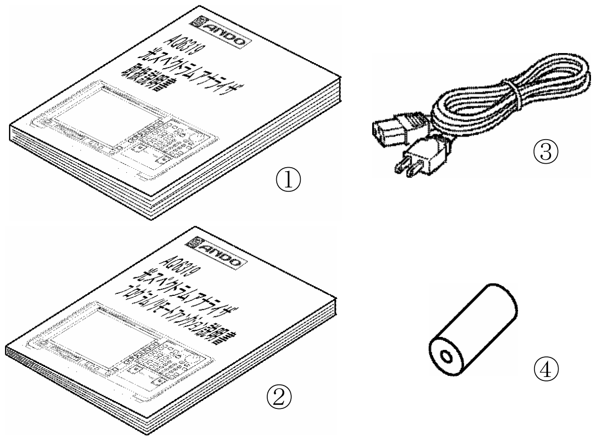


Fig. 1-1 Standard Accessories

Table 1-1 Standard Accessories List

Number	Part name	Quantity	Remarks
①	Instruction Manual	1 copy	This manual
②	Program/remote function manual	1 copy	
③	Power cord	1 pc.	3 m
④	Recording paper	1 roll	For internal printer TF50KS-E2 (Jujo Seishi)
–	Fuses	2 pcs.	5.00A normal fusing type for operation at 100–120 V 3.15A time lag-type for operation at 200–240 V * Already installed in unit

2

Chapter 2
Part Names and Functions

2.1 Front Panel

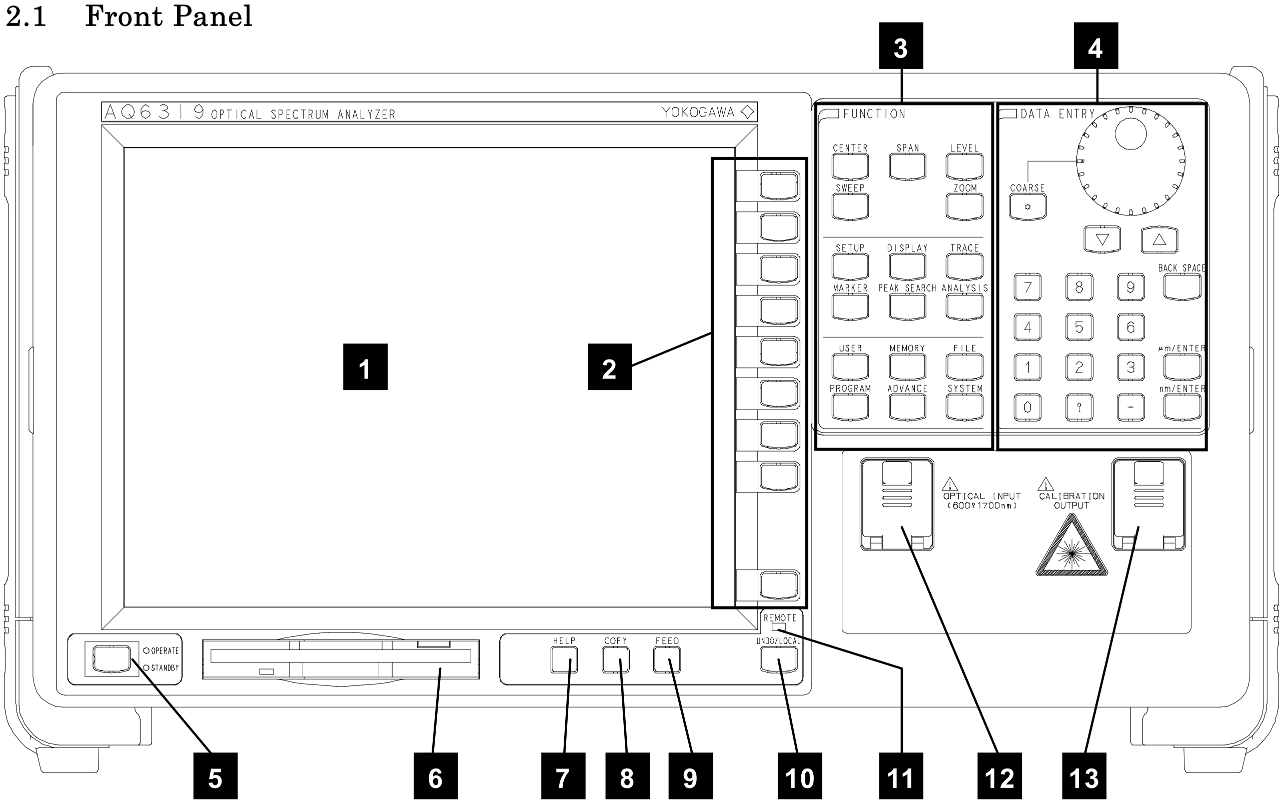


Fig. 2-1 Front panel

No.	Name	Function
1	LCD display	Displays measured waveform, measurement conditions, measurement values, etc.
2	Soft key section	Used to execute the functions assigned to the soft keys on the right side of the LCD display
3	[FUNCTION] section	Used to enter settings pertaining to all measurements (sweep, measurement conditions, data analysis, and various functions)
4	[DATA ENTRY] section	Used for measurement condition parameter input, label input, etc.
5	[OPERATE] switch	Power switch(☛section 3.3 Turning the Power ON/OFF)
6	Floppy disk drive (3.5-inch)	Used to save waveform data, programs, etc.
7	[HELP]	Used to check the contents of the soft key menu displayed on the screen.
8	[COPY]	Used to make hard copies of the screen through the internal printer
9	[FEED]	Used to feed recording paper
10	[UNDO/LOCAL]	UNDO/LOCAL switch (☛section 6.19 UNDO/LOCAL)
11	Remote lamp	Turns on when the unit is in the remote state
12	[OPTICAL INPUT]	Optical input connector
13	[CALIBRATION OUTPUT]	Reference light source optical output connector used for alignment adjustments and wavelength calibration

2.2 Rear Panel

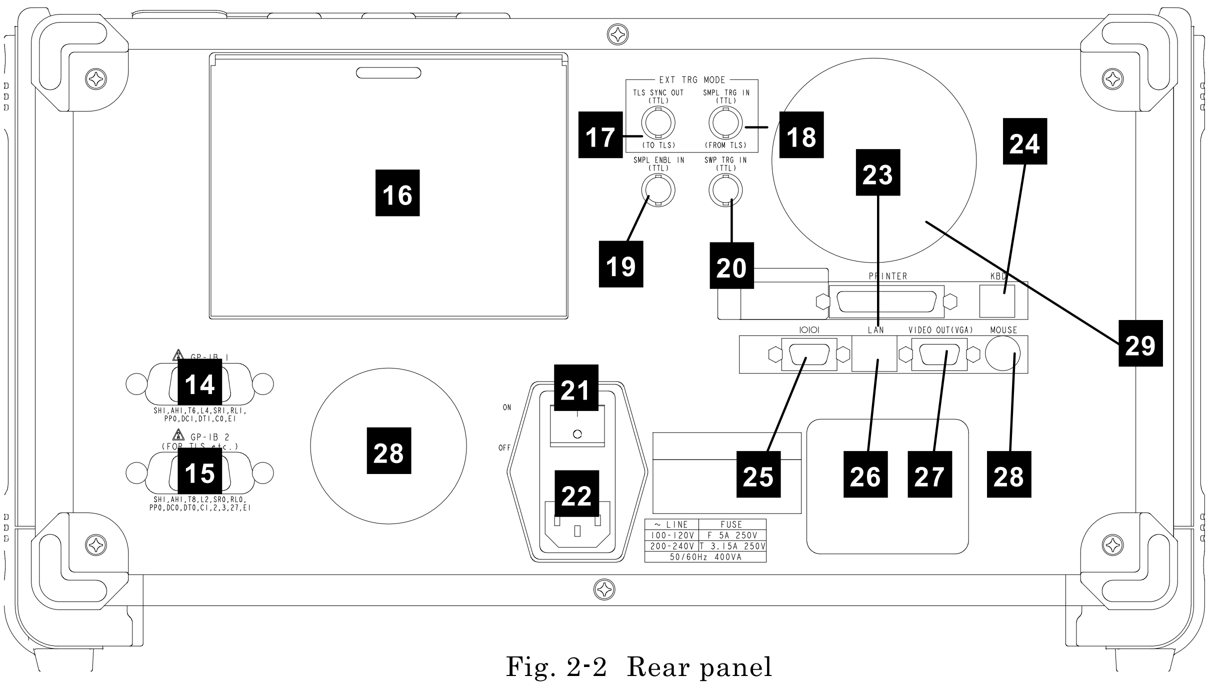


Fig. 2-2 Rear panel

No.	Name	Function
14	[GP-IB1]	GP-IB port for controlling this unit through an external computer
15	[GP-IB2]	GP-IB port that allows this unit to serve as a system controller on the GP-IB bus for controlling an external device
16	Printer paper holder	Open this door outward to replace the recording paper
17	[SMPL TRG IN]	Input connector for external sampling trigger signal
18	[TLS SYNC OUT]	Output connector for synchronous signals for the synchronous measurement function with the Tunable Laser Source
19	[SWP ENBL IN]	Input connector for sweep enable signal (currently not supported)
20	[SWP TRG IN]	Input connector for sweep trigger signal (performs same operation as SINGLE sweep key)
21	[POWER]	Used to turn on main power
22	Power cord connector	Connect the power cord to this connector
23	[PRINTER]	External printer interface
24	[KBD]	External keyboard interface
25	[| ○ | ○ |]	RS-232C interface
26	[LAN]	LAN (local area network) interface
27	[VIDEO OUT (VGA)]	Analog RGB video signal (VGA-compliant) interface
28	[MOUSE]	External PS/2 mouse interface
29	Fan	Heat vent fan (make sure the fan vent is not blocked)

2.3 LCD Screen

This unit's LCD screen displays the measured waveform as well as various other information, including measurement conditions and marker values. The names of the screen elements on the typical LCD screen are shown below.

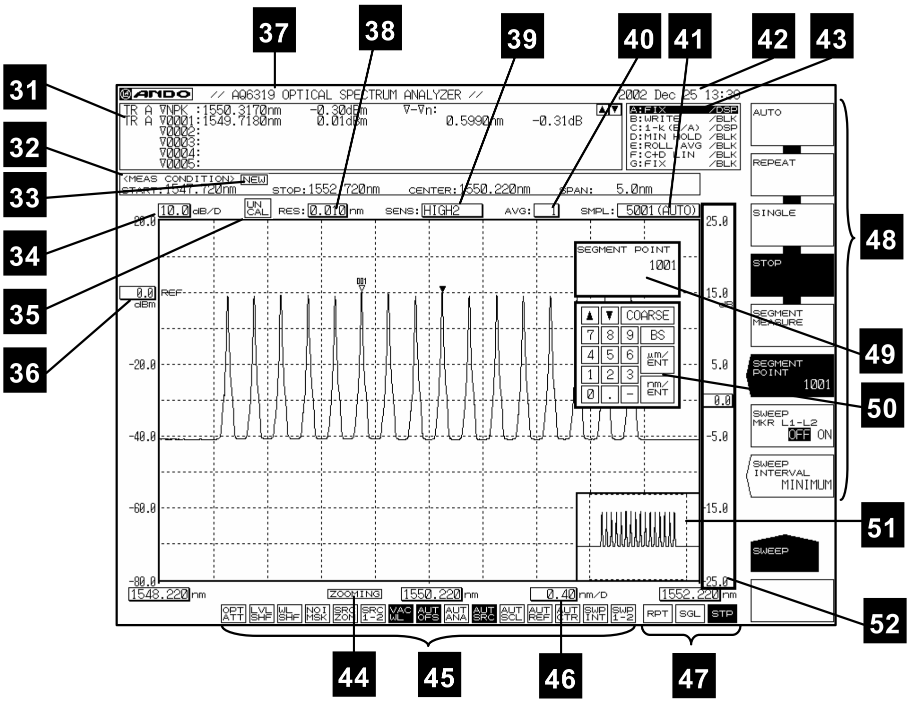


Fig. 2-3 Waveform screen

No.	Function	No.	Function
31	Data area	42	Displays date and time
32	Measurement conditions area	43	Displays each trace status
33	NEW (Displayed when any of the measurement conditions are changed.)	44	ZOOMING (Only displayed when ZOOM function is used)
34	Displays level axis scale per DIV	45	Displays the statuses of main settings (When a setting is ON, its display is depressed, or is displayed with white on black background if the display colors are black and white.)
35	UN CAL (Displayed when measurement is not correctly carried out.)	46	Displays wavelength axis scale per DIV
36	Displays reference level	47	Displays sweep status (RPT=Repeat; SGL=Single; STP=Stop)
37	Label area (56 characters)	48	Displays soft key menu (Displays markers and data analysis results.)
38	Displays wavelength resolution	49	Interrupt display area
39	Displays measurement sensitivity	50	Numeric keypad input area
40	Displays averaging times	51	OVERVIEW display screen (Only displayed when ZOOM function is used.)
41	Displays the number of measurement samples	52	Displays sub-scale

2.4 Internal Printer

This unit contains an internal printer which can print displayed waveforms as well as information related to waveforms.

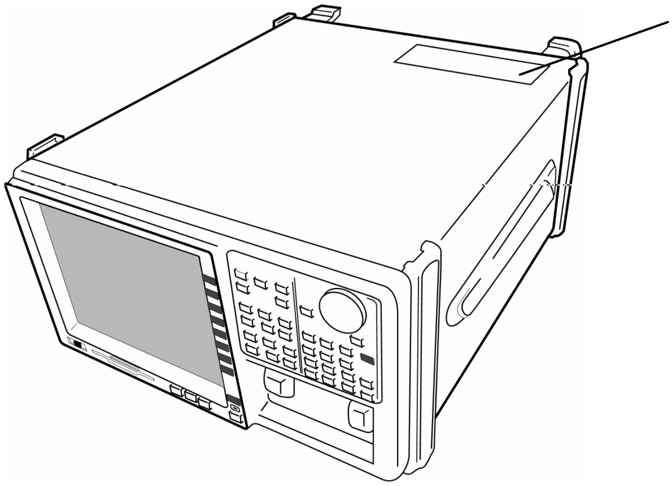


Fig. 2-4 Internal printer

2.4.1 Inserting Printer Paper

A roll of printer recording paper is included with the unit. The printer recording paper must be installed in the printer in order to use the printer.

① Open the printer cover and lift the pressure lever until it clicks. (The thermal head is held in a raised position.) Be careful not to cut yourself on the paper cutting teeth on the printer cover.

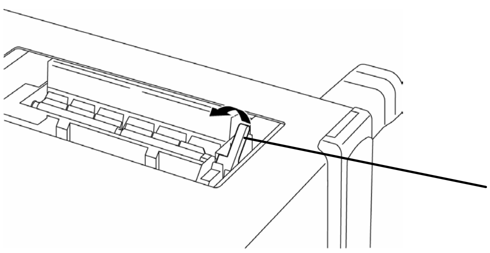
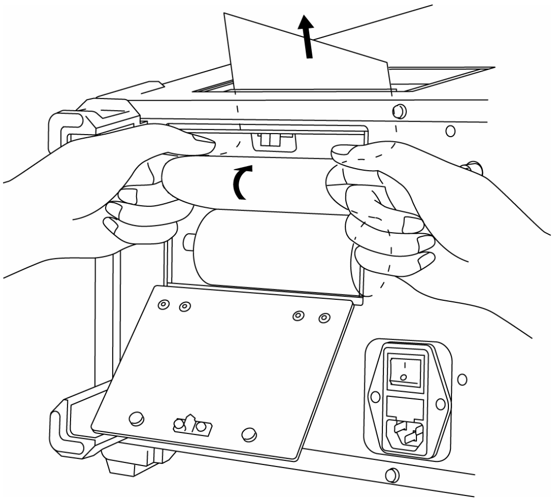
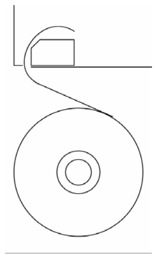


Fig. 2-5 Raising the pressure lever

② Open the door on the recording paper hopper (located on the back). Remove the spool and insert it in the recording paper, then put it back in the unit. Set the paper so that it comes out from back to front.

③ Feed the paper with both hands as shown below. Set the recording paper so that it comes out through the top of the printer. When the front end of the recording paper passes through the gap between the thermal head and the platen and emerges on top, pull on the front end of the recording paper and make sure the paper is set straight. Next, lower the pressure lever to move the thermal head back down.





Recording paper feeding path

Fig. 2-6 Feeding the recording paper

④ Lastly, close the backside roll recording paper hopper door and the printer cover, and cut off any protruding paper.

2.4.2 [FEED] Switch

The unit has a feed function for feeding the printer recording paper. A [FEED] switch is located on the front of the unit, and another [FEED] switch is located inside the printer cover.

You can feed the printer recording paper by pressing the [FEED] switch.

NOTE

- Only use the designated type of paper in the printer.
- If the print becomes light in color or is blurred in some areas, clean the thermal head with a swab soaked in pure alcohol. Before proceeding, remove the printer paper from the printer and raise the pressure lever.

⚠ Caution

- Be sure to turn off the main power before cleaning the thermal head. The printer is designed so that electricity will not flow to the thermal head when the head is raised, but if the head becomes electrified during cleaning it could ignite, which would be very dangerous.
- If electricity flows to the thermal head while highly volatile cleaning materials such as pure alcohol adhere to it, the head could ignite, which would be very dangerous. Therefore, after cleaning the thermal head, use a dust cleaner (e.g., compressed air) to fully remove the cleaning material.

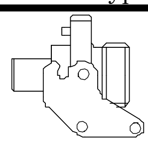
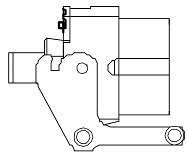
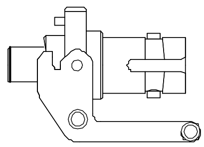
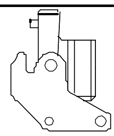
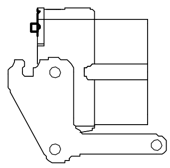
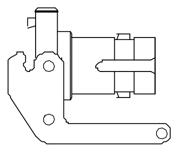
3

Chapter 3 Before You Start

3.1 Attaching the Connector Adapter

The AQ6319 has a universal optical connector. The connector is not attached to the optical section at the factory, so you will need to attach optional connector adapters before using this unit. (☛ See subsection 10.2 Options for information on the different types of connector adapters.)

Table 3-1 Connector Adapters

Connector Adapter	Description	Connector Type(**)
AQ9441(**) Connector Adapter	Universal adapter for [CALIBRATION UTPUT] connector.	 FC  SC  ST
AQ9447(**) Connector Adapter	Connector adapter for [OPTICAL INPUT] connector	 FC  SC  ST

⚠ Caution

- The connector adapters used for [OPTICAL INPUT] and [CALIBRATION OUTPUT] are different from each other, therefore be certain to differentiate the connector adapters before attaching them to the optical I/O section.

3.1.1 Attachment Procedure

This section describes the procedure for attaching a connector adapter to the unit.

① Open the optical connector cover on the front side of this unit.

② Clean the ferrule edge of the optical I/O section using a swab soaked with a small amount of pure alcohol.

③ After cleaning the connector adapter, attach it to this unit.

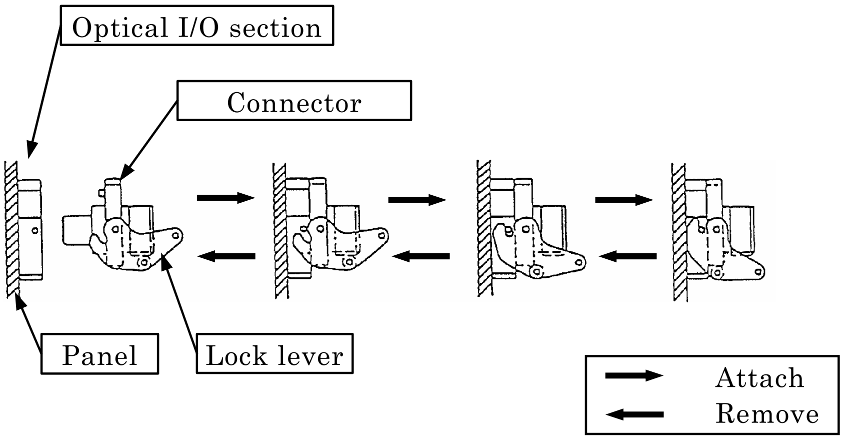


Fig. 3-1 Attaching the connector adapter

⚠Caution

- There may be dust adhering to [CALIBRATION OUTPUT], so be sure to clean it before attaching the connector adapter.
- Do not blow compressed air or the like into the monochromator through [OPTICAL INPUT]. Doing so may allow dust or other materials to enter the monochromator, adversely affecting its optical performance. Also, if debris is adhering to the optical components inside the monochromator when high-power light is input, the monochromator may be irreparably damaged.
- When attaching or removing a connector adapter, be careful not to damage anything.

3.2 Interface Connection Procedures

3.2.1 Connecting the Mouse and Keyboard

To use the mouse and keyboard, connect them on the back side of this unit by following the procedure shown below.

① Make sure the [POWER] switch on the back side of the unit is set to the [OFF] position.
② Connect the mouse connector in the proper direction, so that it is perpendicular to the [MOUSE] and [KBD] ports on the back side of this unit.

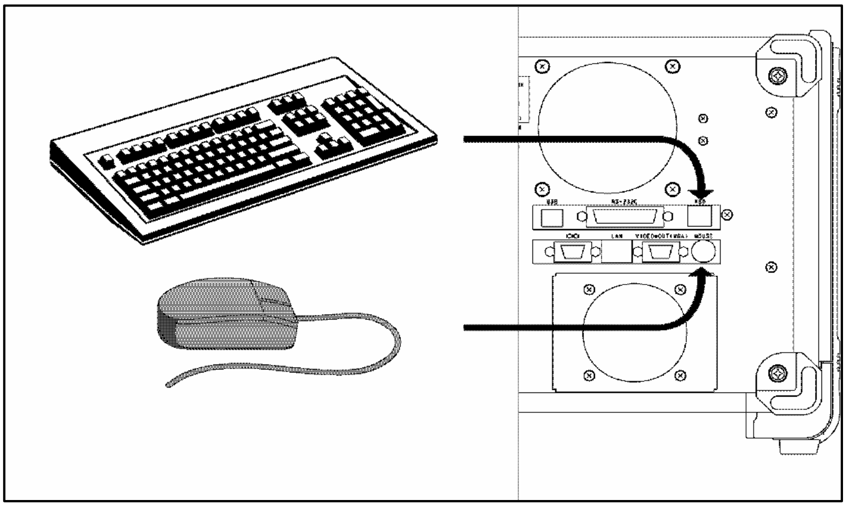


Fig. 3-2 Connecting the mouse cable

The recommendation mouse is as follows.

Table 3-2 Recommended Product

Part to be connected	Model
Mouse	Microsoft® wheel mouse

⚠ Caution

- If you use a mouse other than the one recommended in Table 3-2, it may not function properly with the AQ6319.
- The power consumption of the mouse and keyboard should be 20 mA or less.
  If power consumption is higher than this value, the unit's operations may become unstable.

3.2.2 Connecting with Other Devices

An external device can be connected to this unit through the GP-IB port or another port to remotely control this unit. This function requires a special connector cable for connecting with the external device.

For details, please refer to the Program/Remote Function manual, subsections 2.3.2 "Connecting to a GPIB System" and 2.8.2 "Connecting to a GPIB System".

⚠ Caution

- Before connecting a GP-IB device (e.g., external computer) or CRT monitor to the unit, check the wiring and always move the [POWER] switches on the AQ6319 and the other device to their [OFF] positions. Connecting them while the power is on may damage the equipment.

3.3 Turning the Power ON/OFF

The AQ6319 has a [POWER] switch for turning the main power ON/OFF, and an [OPERATE] switch for turning this unit ON/OFF. Follow the procedures shown below to use ensure proper use.

3.3.1 Preparations for Power-On

Check the following before plugging the power cord into a power cord connector of this unit.

- Make sure the [POWER] switch on the back side of this unit is set to the [OFF] position.
- Make sure the voltage of the power outlet matches this unit's supply voltage.
- Before replacing a fuse, always move the [POWER] switch to the [OFF] position and remove the power cord from the power outlet.

  (☛ See section Safety precaution; "5.1 Replacing Fuses")
- Make sure the location is not subject to heavy vibrations, high humidity or dust levels, or direct sunlight. Also make sure there is no risk of exposure to activated gas, and that this unit will not tilt or tip over.

3

3.3.2 Power-On and Screen Display

After performing the power supply and connection checks as described in subsection 3.1.1, follow the procedure shown below to turn on the power.

① Connect the power cord to the power cord connector on the back side of the unit.

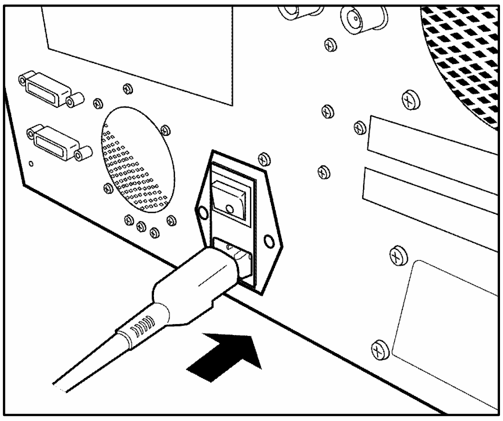


Fig. 3-3 Connecting the power cord

② Move the [POWER] switch on the back side of this unit to the [ON] position. The orange “STANDBY” LED next to the [OPERATE] switch on the front side turns on.

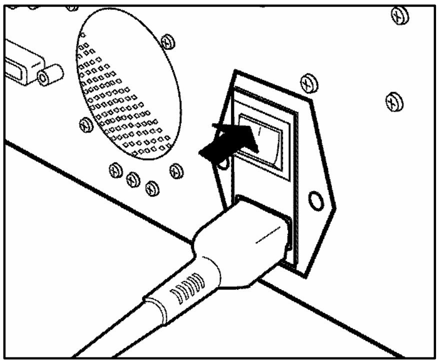


Fig. 3-4 Turning on the back side [POWER] switch

③ Press the [OPERATE] switch on the front side of this unit to boot the operating system and start initializing operation. The orange “STANDBY” LED turns off, and the green “OPERATE” LED turns on.

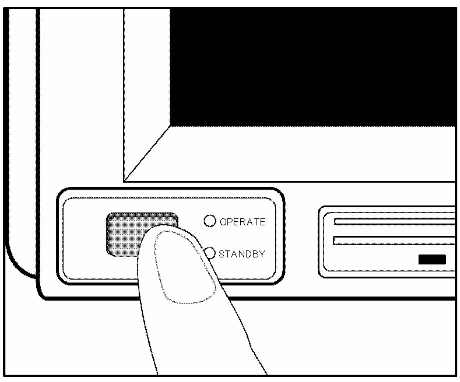


Fig. 3-5 Turning on the front side [OPERATE] switch

④ The initialization screen appears, and the internal initialization process starts. During the initialization process, "STEP 1/9" through "STEP 9/9" are displayed in the lower right part of the screen to indicate progress through initialization.

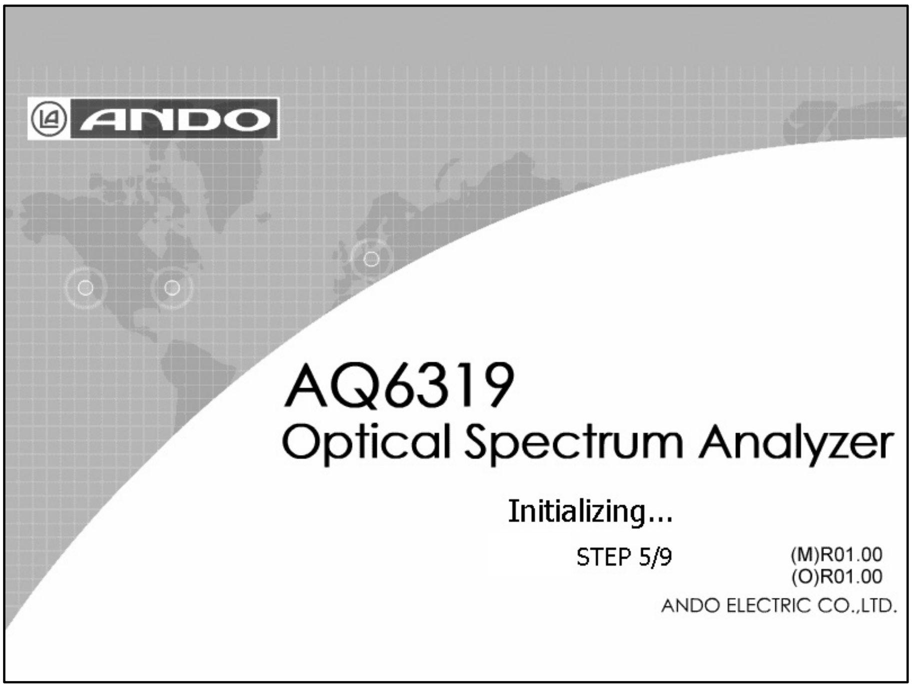


Fig. 3-6 Initialization screen

NOTE

- This unit stores information such as measurement conditions, soft key selection statuses, and the currently displayed waveform. When the power is turned on, the settings existing when the power was last turned off are restored. The very first time you turn the power on, the factory defaults are set. (☛ See the Table8-24 List of Warnings)

⚠ Caution

- Do not subject this unit to a strong light source when turning on the power.
  Doing so may cause the internal attenuator to temporarily turn off upon initialization, resulting in damage to the optical system of this unit.
- If a problem such as a memory problem occurs during ④, the boot step display and the system's operations will stop. If this happens, the unit will need to be repaired. Immediately contact our service department, the sales department at our main office, or the nearest branch office or sales office. (☛ Contact information is listed at the end of this manual.)

⑤ After the initialization operation ends, the screen in Fig. 3-6 disappears and the screen in Fig 3-7 appears, displayed message which urge optical alignment and wavelength calibration.

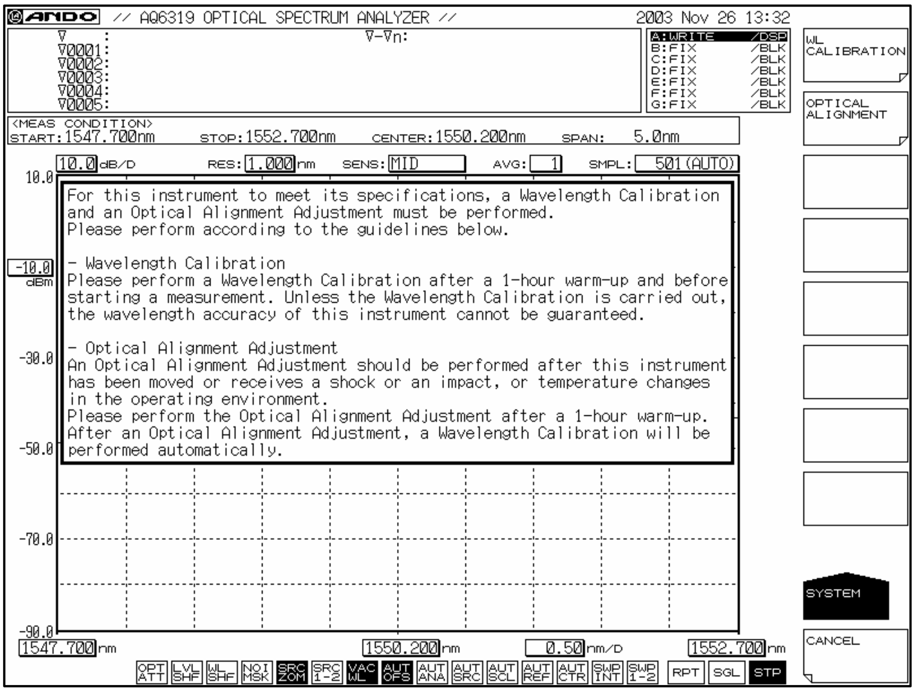


Fig. 3-7 Message screen after the initialization operation

The message displayed serves as the following contents.

For this instrument to meet its specification, a Wavelength Calibration and an Optical Alignment Adjustment must be performed. Please perform according to the guidelines below. -Wavelength Calibration Please perform a Wavelength Calibration after a 1-hour warm-up and before starting a measurement. Unless the Wavelength Calibration is carried out, the wavelength accuracy of the instrument cannot be guaranteed. -Optical Alignment Adjustment An Optical Alignment Adjustment should be performed after this instrument has been moved or receives a shock or an impact, or temperature changes in the operating environment. Please perform the Optical Alignment Adjustment after a 1-hour warm-up. After an Optical Alignment Adjustment, a Wavelength Calibration will be performed automatically.

⑥ Please perform a wavelength calibration and optical alignment by <WL CALIBRATION> and <OPTICAL ALIGNMENT>key if needed.
For details of wavelength calibration and optical alignment, see Chapter 4 Usage Preparations.
(☛ 4.4 Alignment Adjustment、4.5 Wavelength Calibration)

⑦ When after the wavelength calibration and optical alignment ends or you press <CANCEL> key, the waveform screen that was displayed the last time the power was turned off is displayed again.

3.3.3 Shutdown procedure

① When you press [OPERATE] switch on the front side of this unit, displayed the following message, which confirms shutdown and <YES>, and <NO> key.

SHUT DOWN Are you sure ?

When you press <YES> key, execute the shutdown operation and transit to the standby state.
When the shutdown operation is started, the following message is displayed. When you see this message, let go of the [OPERATE] switch.

AQ6319 shutting down Please wait.....

Press the <NO> key, when you cancel the shutdown operation.
After the shutdown operation is completed, the operating system transit to the standby state automatically. It may take several minutes for this processing. In the standby state, the green “OPERATE” LED turns off and the orange “STANDBY” LED turns on.

② Move the [POWER] switch on the back side of the unit to the [OFF] position.

③ Remove the optical fiber cord from the [OPTICAL INPUT] connector, then close the cover.

(☛ See subsection 4.3.2 Connecting the Optical Fiber)

④ Remove the power cord from the power outlet.

⑤ Wind the power cord around the power cord holder on the back side of the unit.

⚠ Caution

- If this is the first time you are using the AQ6319, or if this unit has been moved and was shaken considerably during the moving process, execute the alignment function after the warmup period before proceeding. See Chapter 4 for information on the alignment function. (☛ See Chapter 4, Usage Preparations)
- If this unit became impossible for a shutdown to perform normally by certain cause, holding down the [OPERATE] switch for 4 seconds or longer forces the system to change to the standby state. When this happens, the operating system’s configuration file is not backed up, so the system may not start properly the next time it is started. Therefore, the above procedure should always be used to shut down the system.
- Do not turn off the power using the [POWER] switch on the back side of the unit while this unit is operating. When this happens, the operating system’s configuration file is not backed up, so the system may not start properly the next time it is started. Therefore, the above procedure should always be used to shut down the system.

3.4 Using the Panel Keys

3.4.1 FUNCTION Section and Soft Key Switches

The FUNCTION section contains 17 hard keys. When you select a function key switch, information about the function is displayed on the soft key menu located on the right side of the LCD display.

The soft key menu items on the LCD display are linked to the soft keys located on the right side of the LCD display. Pressing a soft key switch executes the corresponding soft key menu item.

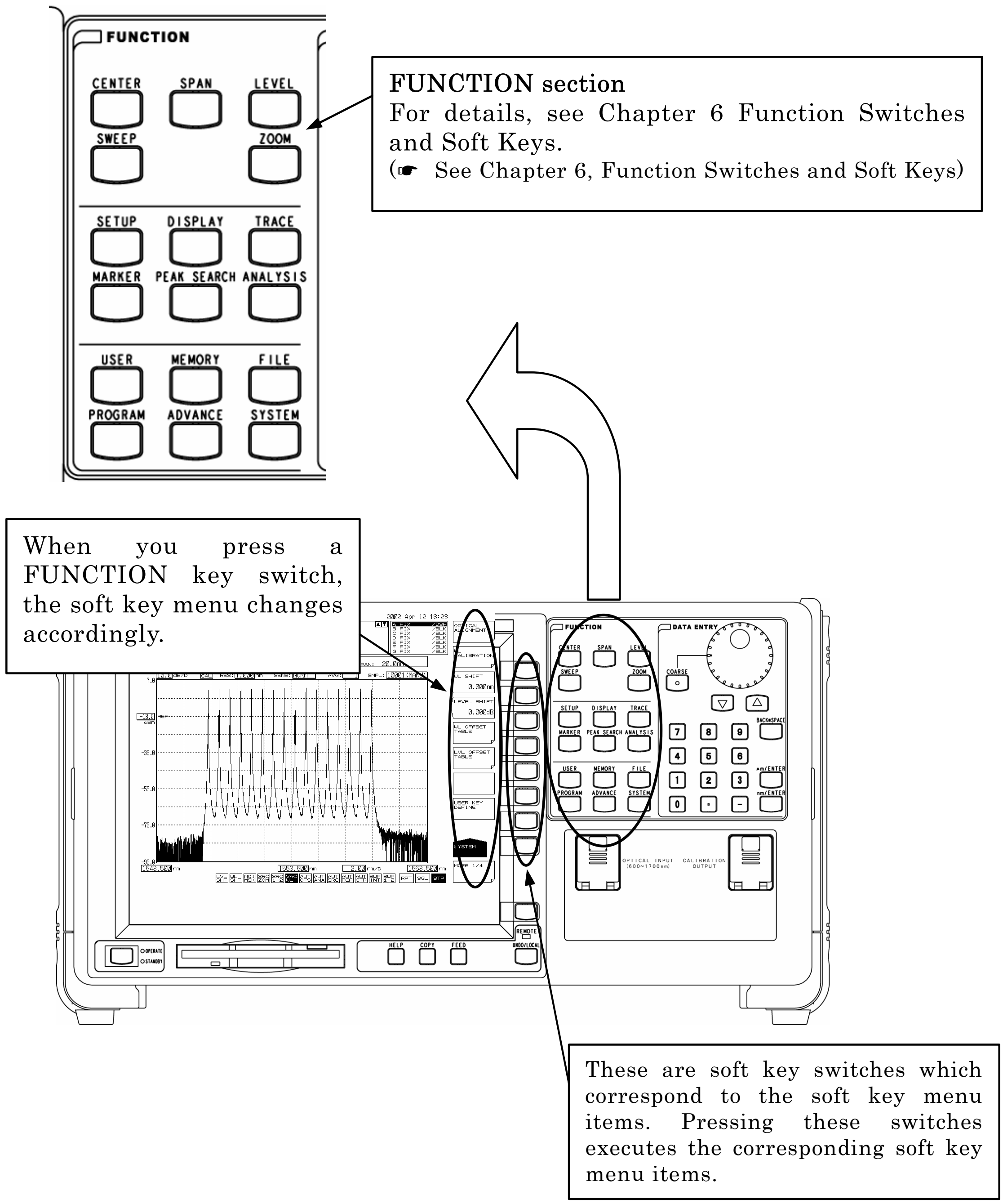


Fig. 3-7 Function Switches and Soft Keys

3.4.2 Parameter Input (DATA ENTRY)

This unit allows you to enter measurement conditions and various other parameters through the DATA ENTRY section. Three different entry methods can be used in the DATA ENTRY section, the rotary knob, the step keys, and the numeric keypad.

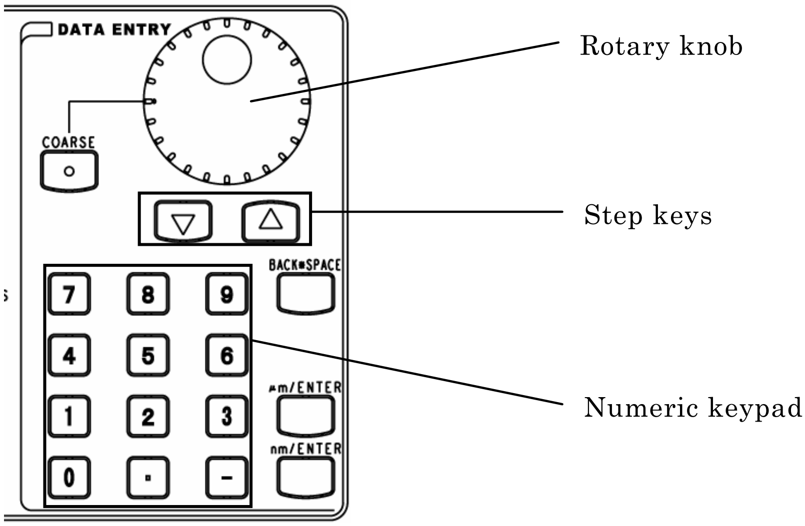


Fig. 3-8 Parameter Input Area

- Using the rotary knob

  When you press a soft key which has a parameter, the current setting is displayed in the interrupt display area. Turning the rotary knob raises or lowers the numeric value shown in the interrupt display area (turn clockwise to increase and counterclockwise to decrease), and the internal setting changes at the same time.

  Note that if the [COARSE] switch is on (lamp on), the numeric value increase/decrease step will be larger.

- Using the step keys ([△], [▽])

  Pressing the [△] key has the same effect as turning the rotary knob clockwise. Likewise, pressing the [▽] key has the same effect as turning the rotary knob counterclockwise. Holding a step key down for 0.5 second or longer activates auto-repeat.

  If the multi-marker function has been selected, the step keys can be used to scroll the marker value display in the data area.

- Using the numeric keypad

After you have pressed a soft key which has a parameter to display the current setting in the interrupt display area, pressing the numeric keypad displays the numeric keypad input area, where the entered numeric value is shown. When you press one of the input parameter unit keys (either [μm/ENTER] or [nm/ENTER]), the numeric value in the numeric keypad input area is displayed in the interrupt display area and set internally. If a parameter does not have a unit associated with it, either [μm/ENTER] or [nm/ENTER] may be pressed. If you press the wrong key during a numeric keypad entry, you can use the [BACK SPACE] key to erase the last entered digit (on the far right) in the numeric keypad input area, then enter the correct digit.

By holding the [BACK SPACE] key down and erasing the entire entry in the numeric keypad input area, you can make the numeric keypad input area disappear and return to the condition preceding numeric keypad input.

If the value entered through the numeric keypad is not in the allowed value range, the nearest allowed value will be set.

3.5 Using the Mouse and External Keyboard

3.5.1 Using the Mouse

When you connect a mouse to this unit, you can perform the actions in the FUNCTION section using just the mouse. The mouse gives you an intuitive way to perform actions on the waveform screen, without losing any of the traditional user interface capabilities. (☛ For information on how to connect the mouse, see subsection 3.2.1 Connecting the Mouse and Keyboard.)

This section describes the basic mouse-based actions and the functions of the mouse during each action. For information on mouse actions with the marker and zoom functions, see Chapter 7 Useful Functions.

(☛ See subsection 7.1.2 Enlarging and Reducing the Display Using the Mouse.)

＜Basic Actions＞

Table 3-3 shows the basic mouse-based actions.

Table 3-3 Basic Mouse-Based Actions

Button	Function
Left	Entry confirmation Selections on hard key menu and soft key menu
Right	Opening hard key menu

NOTE

- When you move the mouse over a clickable screen item, the pointer changes into a "☝" , indicating that the action is available using the mouse.

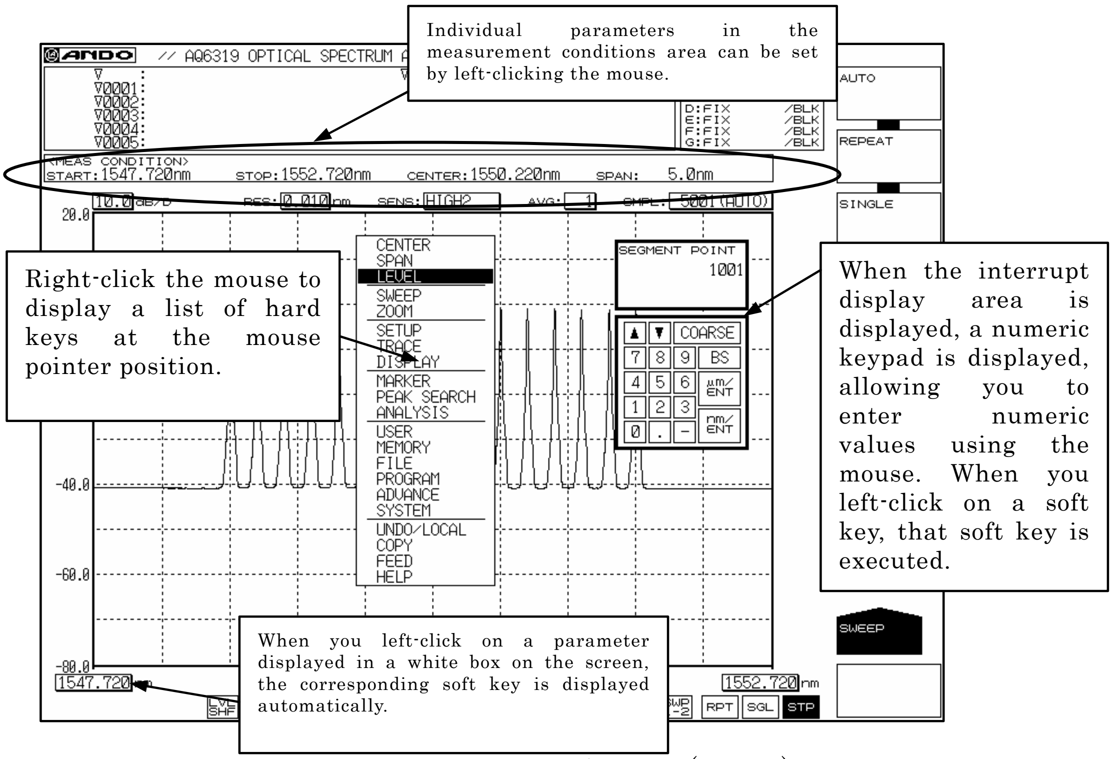


Fig. 3-9 Mouse-Based Actions (Part 1)

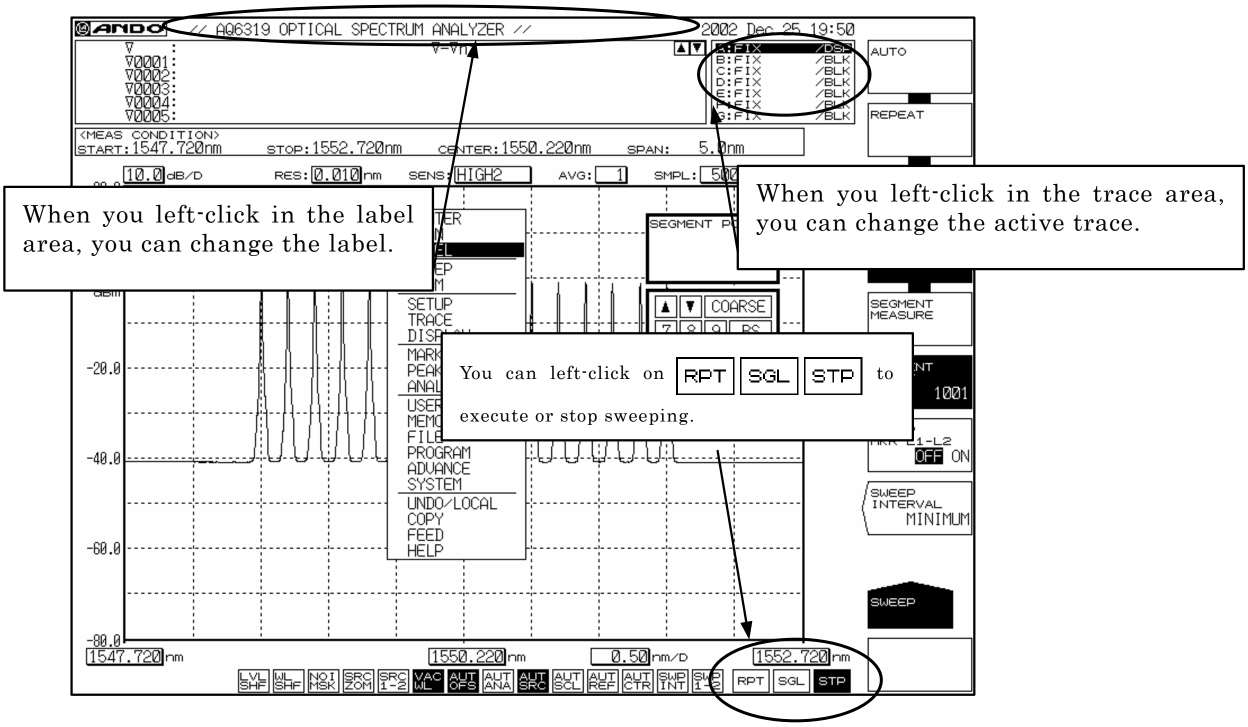


Fig. 3-10 Mouse-Based Actions (Part 2)

Hard key menu displayed by right-clicking the mouse

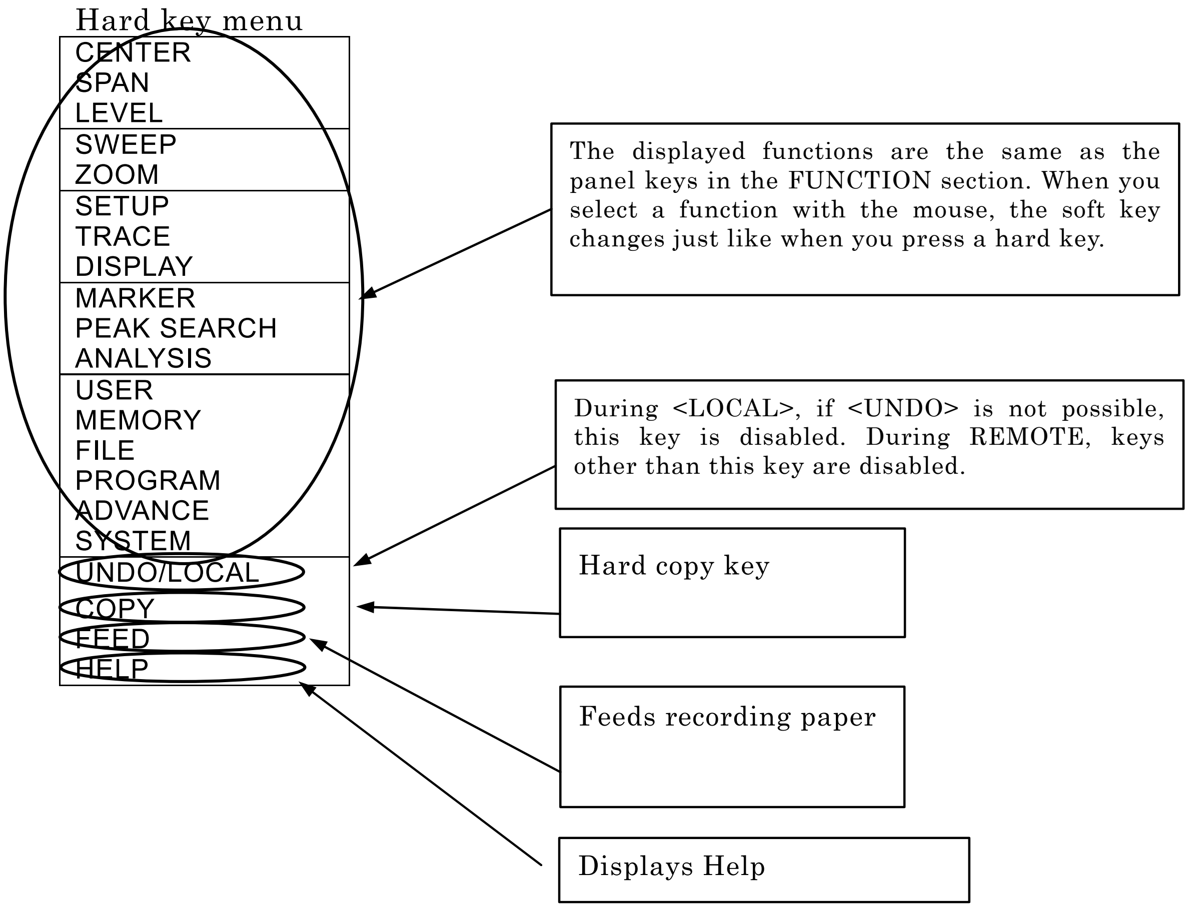


Fig. 3-11 Hard Key Menu

<Markers Controls>

You can use the mouse to control the various markers displayed on the screen.

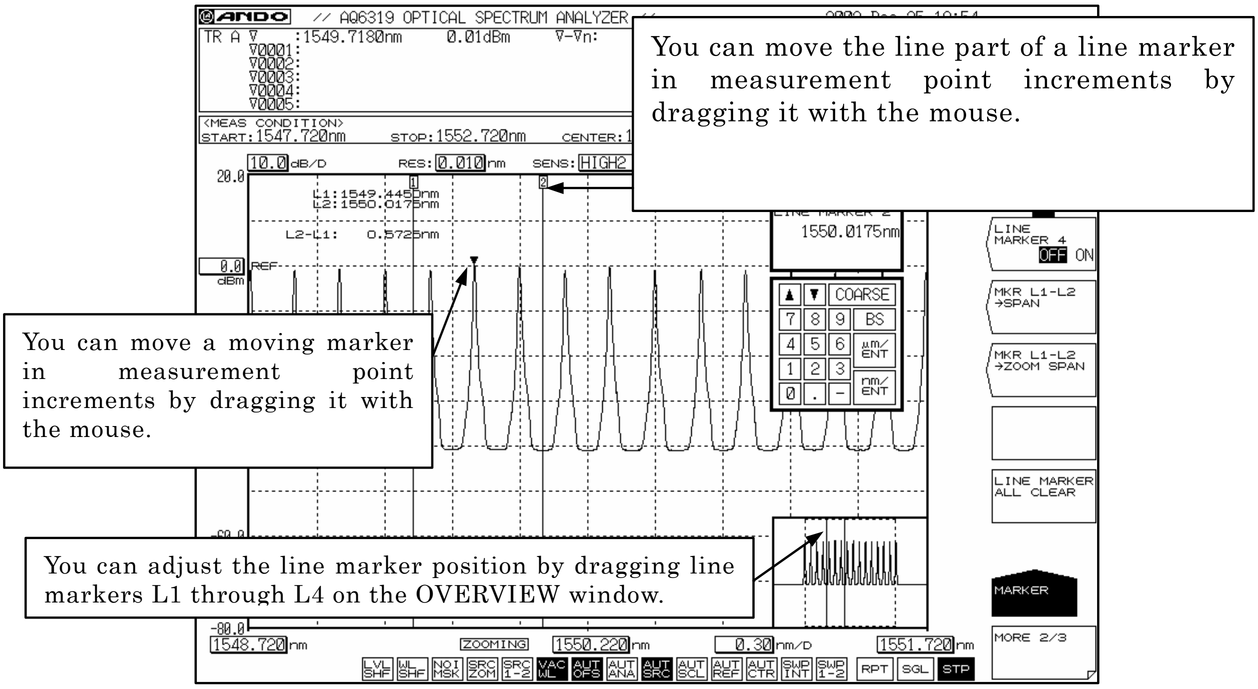


Fig. 3-12 Using the Mouse to Control Markers

<ZOOM Controls>

You can use the mouse to easily increase or decrease the scale through hard key settings.

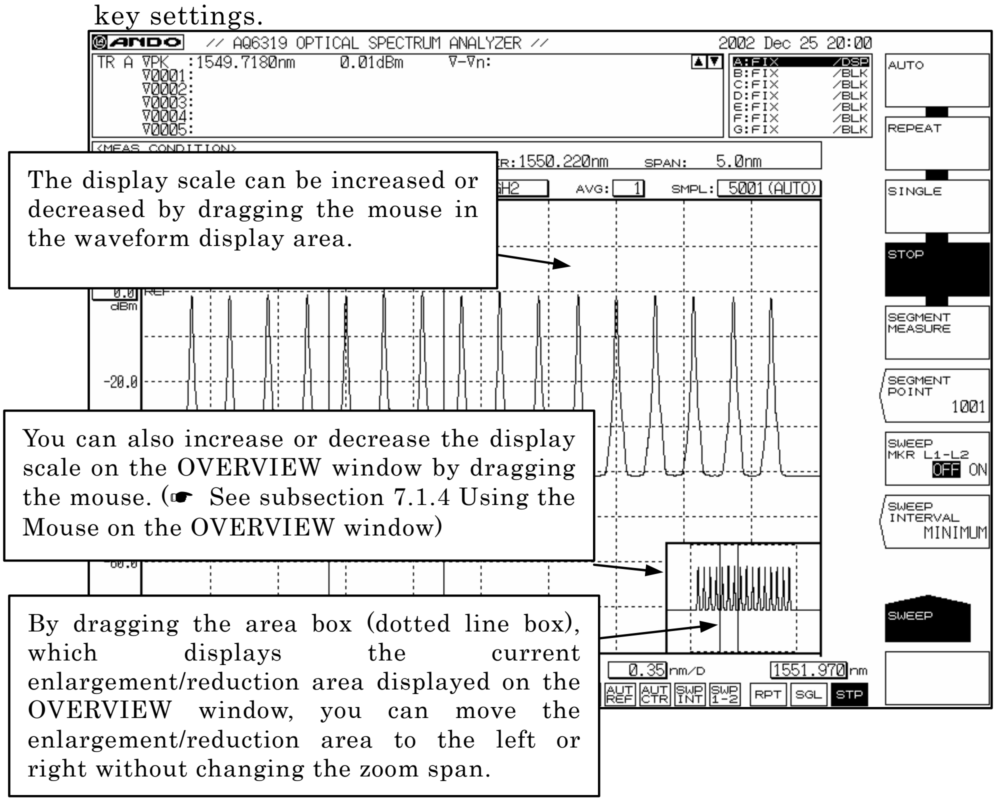


Fig. 3-13 Using the Mouse to Change the Enlargement/Reduction Area

3.5.2 Using the External Keyboard

When you connect a keyboard to the [KBD] port on the back side of the unit, you can use all of the panel keys through the keyboard. (☛ For the connection procedure, see subsection 3.2.1 Connecting the Mouse and Keyboard.)

Table 3-3 Hard Key Correspondence Table shows the correspondences between the panel keys and the keys on the keyboard. You can also use the alphanumeric keys on the keyboard to directly enter labels and file names.

Table 3-4 Hard Key Correspondence Table

Category		Function	External keyboard	Description
FUNCTION	Sweep	SWEEP	[SHIFT]+[F1]	Executes/sets sweep
	Measurement settings	CENTER	[SHIFT]+[F2]	Sets measurement center wavelength
		SPAN	[SHIFT]+[F3]	Sets measurement span
		LEVEL	[SHIFT]+[F4]	Sets level axis
		SETUP	[SHIFT]+[F5]	Sets resolution, sensitivity, etc.
	Display settings	TRACE	[SHIFT]+[F6]	Sets trace
		ZOOM	[SHIFT]+[F7]	Sets display scale
		DISPLAY	[SHIFT]+[F8]	Sets screen display
	Analysis functions	MARKER	[SHIFT]+[F9]	Sets marker
		SEARCH	[SHIFT]+[F10]	PEAK/BOTTOM search function
		ANALYSIS	[SHIFT]+[F11]	Sets analysis function
	Other	USER	[ALT]+[F1]	User settings menu
		MEMORY	[ALT]+[F2]	Memory
		FILE	[ALT]+[F3]	Saves/opens files, file actions
		PROGRAM	[ALT]+[F4]	Program functions
		ADVANCE	[ALT]+[F5]	Advanced functions
		SYSTEM	[ALT]+[F6]	System settings
Soft keys		F1 to F9	F1 to F9	Depends on FUNCTION menu
Auxiliary keys		UNDO/LOCAL	[ALT]+[F9]	Local: UNDO function Remote: Returns to local
		COPY	[ALT]+[F10]	Screen copy
		FEED	[ALT]+[F11]	Feeds internal printer paper
		HELP	[ALT]+[F12]	Displays Help (use UNDO/LOCAL to exit Help)
DATA ENTRY		Numeric keypad	0123456789.-	Numeric value input
		BACK SPACE	Back Space	Deletes one character from input value
		μm/ENTER	None	Confirms entry
		nm/ENTER	ENTER	Confirms entry
		Encoder	[→],[←]	Changes numeric values/items
		Step keys（▲▼）	[↑],[↓]	Numeric value one-step change, item change, table scrolling
		COARSE	[ALT]+[N]	Switches between fine and coarse encoder

Chapter 4 Usage Preparations

4.1 Overview

The AQ6319 optical spectrum analyzer uses leading-edge measurement technology to provide improved measurement performance and advanced functions. To ensure proper use of this unit, a connector adapter must be connected and preparations such as alignment adjustment are required.
(☛ See Safety Precautions, 2 Internal Reference Light Source)

Be sure to perform the alignment adjustment function and wavelength calibration in the following cases:

- The first time you use this unit
- If it seems likely that this unit has been shaken (e.g., during shipping)
- If this unit has not been used for an extended period of time
- If measurement errors are at problematic levels

<Alignment adjustment>

Alignment adjustment consists of adjusting the optical axis of the monochromator optical system used with this unit. The reference light source built in this unit is used as the adjustment light source.
After turning on the power, we recommend allowing the unit to heat up for about 1 hour before adjusting the alignment. After completing alignment adjustment, wavelength calibration is performed automatically.

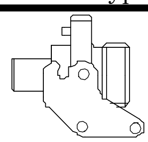
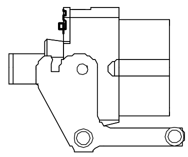
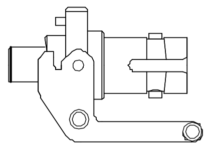
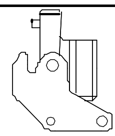
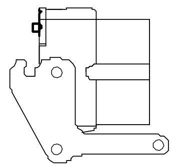
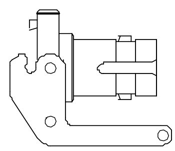
<Wavelength calibration>

Wavelength calibration consists of connecting a light source with a known wavelength value (the internal reference light source, a laser-type external light source, or a gas cell absorption line-type external light source) to the unit and calibrating it so that the error at the calibration wavelength is zero.
An offset is applied to the grating angle inside the monochromator, so the entire wavelength range (600 to 1700 nm) is calibrated. Calibration on multiple wavelengths is not necessary. If you do perform calibration on multiple wavelengths, only the final calibration is used.

4.2 Attaching the Connector Adapter

The AQ6319 has a universal optical connector. The connector is not attached to the optical section at the factory, so you will need to attach optional connector adapters before using this unit. (☛ See subsection 10.2 Options for information on the different types of connector adapters.)

Table 4-1 Connector Adapters

Connector Adapter	Description	Connector Type(**)
AQ9441(**) Connector Adapter	Universal adapter for [CALIBRATION UTPUT] connector.	 FC  SC  ST
AQ9447(**) Connector Adapter	Connector adapter for [OPTICAL INPUT] connector	 FC  SC  ST

⚠Caution

- The connector adapters used for [OPTICAL INPUT] and [CALIBRATION OUTPUT] are different from each other, therefore be certain to differentiate the connector adapters before attaching them to the optical I/O section.

4.2.1 Attachment Procedure

This section describes the procedure for attaching a connector adapter to the unit.

① Open the optical connector cover on the front side of this unit.

② Clean the ferrule edge of the optical I/O section using a swab soaked with a small amount of pure alcohol.

③ After cleaning the connector adapter, attach it to this unit.

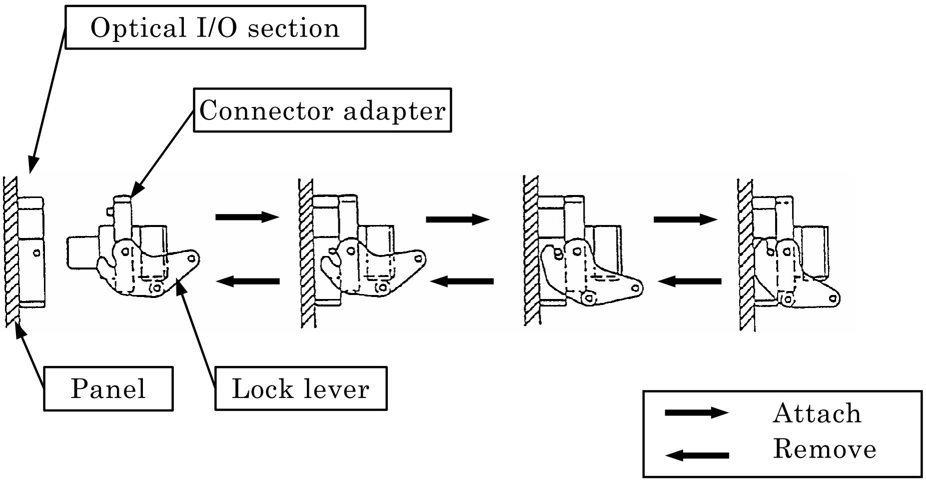


Fig. 4-1 Attaching the connector adapter

⚠Caution

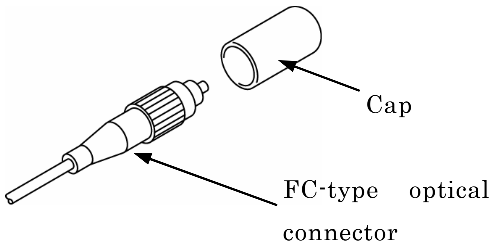
- There may be dust adhering to [CALIBRATION OUTPUT], so be sure to clean it before attaching the connector adapter.
- Do not blow compressed air or the like into the monochromator through [OPTICAL INPUT]. Doing so may allow dust or other materials to enter the monochromator, adversely affecting its optical performance. Also, if debris is adhering to the optical components inside the monochromator when high-power light is input, the monochromator may be irreparably damaged.
- When attaching or removing a connector adapter, be careful not to damage anything.

4.3 Handling the Optical Connectors

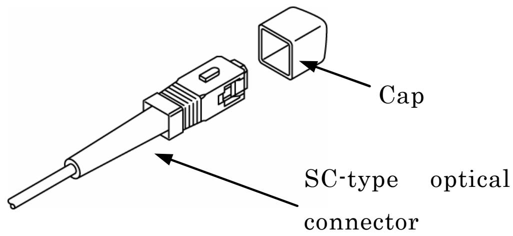
4.3.1 Opening and Closing the Protective Connector Caps

Connections are always made through optical connectors when using this unit, and they must be handled very carefully.
Be sure to clean the connector contacts with alcohol before using them so that dust or the like does not adhere to them. (☛ See subsection 9.2.5 Regular Cleaning)

Fig. 4-2 shows the shapes of typical FC-type and SC-type optical connectors.



FC type
Screw-lock type optical connector



SC type
Single-touch type optical connector

Fig. 4-2 Shapes of FC- and SC-type connectors

4.3.2 Connecting Optical Fibers

This section describes how to connect an optical fiber to a connector adapter that has been attached to the unit. The procedure for attaching an optical fiber for an FC-type connector is presented here.

① Clean the end of the optical plug with a fiber cleaner.
①-1 Push the tip of the optical plug against the cleaning surface of the fiber cleaner so that it is perpendicular to the cleaning surface.
①-2 With the tip of the optical plug pressing against the cleaning surface, turn it one full rotation, then slide it horizontally.
①-3 Now perform this process again.

② Clean the output plug on the unit.

③ Connect the optical plug to the unit.
③-1 Open the optical adapter cover on the input light side on the front side of the unit.
③-2 Insert the optical plug so that its key engages with the guide on the optical adapter.
③-3 Turn the plug housing clockwise to fasten the optical plug.

⚠ Caution

- Be sure to clean the end of the optical fiber being used before connecting it.
- Do not try to forcefully attach the optical fiber plug with the plug inserted at a slanted angle.
  Doing so may damage the optical fiber plug or the unit’s optical connector.
- Before connecting the input light, make sure that it does not exceed the AQ6319’s maximum rated level. With the attenuator function on, this is +27dBm. If the input light exceeds the maximum rated level, the optical section may be damaged.
- Press the optical plug hard against the cleaning surface of the special cleaner to clean it.
  If it is not pressed hard against the cleaning surface, it may not be possible to properly clean the optical plug.

4.4 Alignment Adjustment

If you are using this unit for the first time or using it after it has been severely shaken while being moved, perform the alignment adjustment procedure after warmup ends. The alignment adjustment procedure is performed as follows.

① Turn this unit's power on.
Turn the standby power switch on the back side to ON and press the power switch on the front side to enter the [OPERATE] state. (☛ See subsection 3.1.2 Power-On and Screen Display)

② Use a 9.5/125 μm SM optical fiber to connect the unit's optical input connector with the optical output connector. (☛ See subsection 4.3.2 Connecting Optical Fibers and Fig. 4-3 Measurement System During Alignment Adjustment)

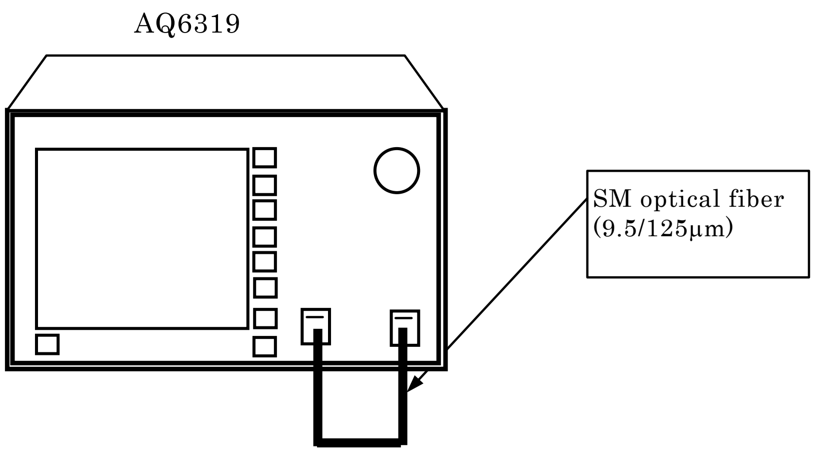


Fig. 4-3 Measurement system during alignment adjustment

⚠ Caution

Monochromator alignment adjustments

- Since an extremely precise monochromator is incorporated in this unit, the alignment of the monochromator may have shifted due to vibrations while being moved, or to temperature variations in the operating environment.
  If you are using the unit for the first time, or using it after it has been subjected to extreme vibrations while being moved, be sure to perform the alignment adjustment procedure following warmup.
  Unless alignment adjustments are carried out, the optical performance of this unit cannot be guaranteed.
- Always use the internal reference light source for alignment adjustments.
  Alignment adjustments will be incorrect if an external light source is used.
- Be very careful in handling the optical connectors during the connection process.
  (☛ For details, see section 4.3 Handling the Optical Connectors)

③ Press the [SYSTEM] switch.

④ Press the <OPTICAL ALIGNMENT> key.
When you press this key, the screen appears as shown in Fig. 4-4.

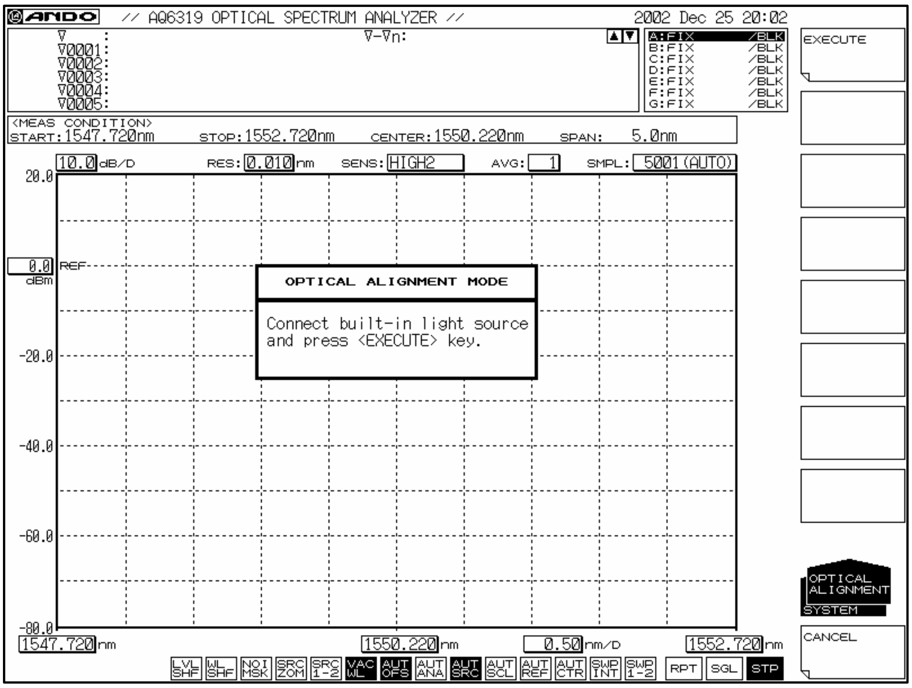


Fig. 4-4 Screen appearing when [OPTICAL ALIGNMENT] key is pressed

⑤ Press the <EXECUTE> key to execute the alignment adjustment process. When you press this key, alignment adjustment is performed automatically and ends in approximately Several minutes. After the alignment adjustment process ends, the previous screen is displayed again. Press the <CANCEL> key to cancel alignment adjustment partway through the process.

NOTE

- After alignment has been executed, wavelength calibration is also performed automatically inside the unit.
- If you cancel alignment adjustment, the alignment adjustment will not be applied and the state existing prior to the alignment adjustment process will be restored.

4.5 Wavelength Calibration

If wavelength calibration is not performed for an extended period of time, the unit's wavelength accuracy will decline and it may become impossible to obtain accurate measurements. Therefore, wavelength calibration should be performed periodically.
Wavelength calibration is performed automatically following alignment adjustment using the internal reference light source. In addition, an external light source may also be used for wavelength calibration.

4

4.5.1 Wavelength Calibration Using the Internal Reference Light Source

This section describes the procedure for performing wavelength calibration using the internal reference light source.

① Turn the unit's power on.
Turn the standby power switch on the back side to ON and press the power switch on the front side to enter the [OPERATE] state. (☛ See subsection 3.1.2 Power-On and Screen Display)

⚠ Caution

- If you are using the unit for the first time or using it after it has been severely shaken while being moved, be sure to perform the wavelength calibration procedure after warmup ends.
- When connecting the power cord, **follow the Power Supply Precautions** presented in the section entitled "Safety Marks and Notations".

② Use a 9.5/125 μm SM optical fiber to connect the unit's optical input connector with the optical output connector. (☛ See subsection 4.3.2 Connecting Optical Fibers and Fig. 4-5 Measurement System During Wavelength Calibration (using Internal Reference Light Source)

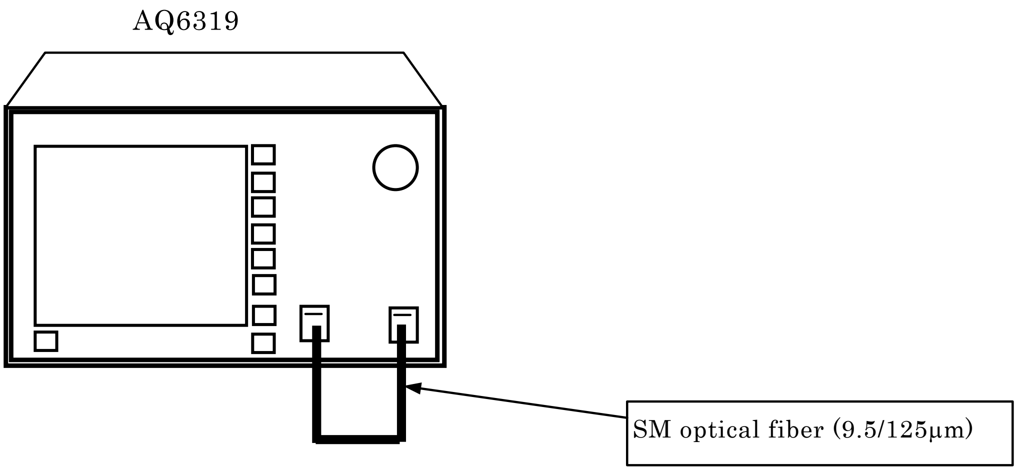


Fig. 4-5 Measurement System During Wavelength Calibration (using Internal Reference Light Source)

⚠ Caution

- Be very careful in handling the optical connectors during the connection process. (☛ For details, see 4.3 Handling the Optical Connectors)

③ Press the [SYSTEM] switch.

④ Press the <WL CALIBRATION> key.
When you press this key, the screen appears as shown in Fig. 4-6.

⑤ Select the <BUILT-IN SOURCE> key.

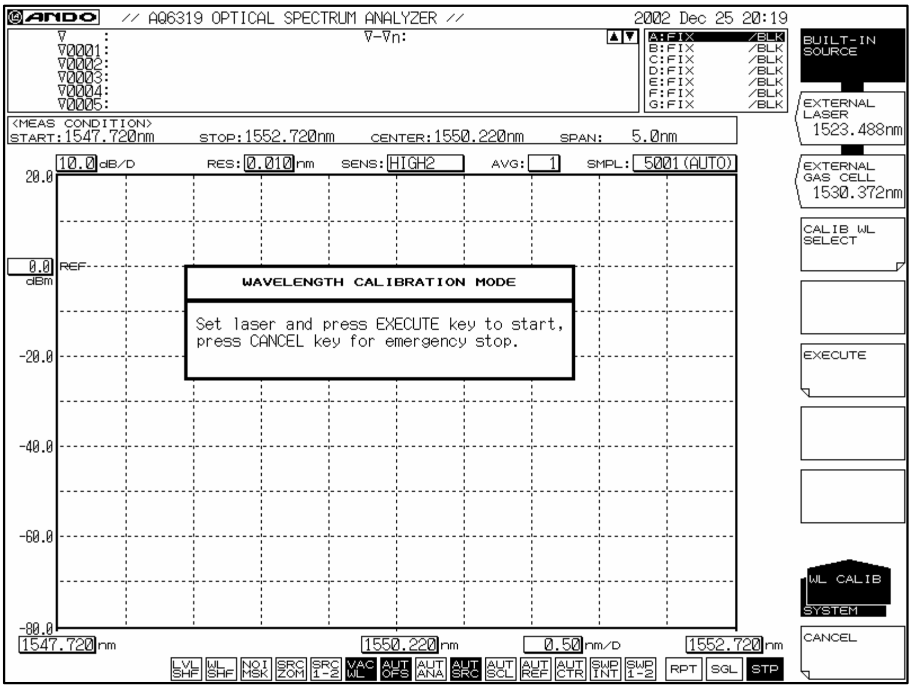


Fig. 4-6 Screen appearing when <WL CALIBRATION> key is pressed

⑥ Press the <EXECUTE> key.
Pressing this key executes the wavelength calibration process. After the wavelength calibration process ends, the previous screen is displayed again. Press the <CANCEL> key to cancel wavelength calibration partway through the process.

⚠Caution

- If this unit's wavelength error is ±1 nm or greater, wavelength calibration using the internal reference light source is not possible. (In this case, readjustment is necessary. Please contact Yokogawa Electric.)

4.5.2 Wavelength Calibration Using an External Light Source

Instead of using the internal reference light source, it is also possible to calibrate the unit using an external light source. Note, however, that wavelength calibration cannot be performed usinpg light sources listed under ① through ③ in the following Caution.

4

⚠Caution

- A light source cannot be used as an external light source in the following cases:
  - ① If the set wavelength is not the same as the calibration light source
  - ② If the unit's wavelength error is ±1 nm or greater (in such cases, readjustment is necessary, so contact Yokogawa Electric)
  - ③ If you are using a reference light source with multiple absorption lines, and the unit's wavelength shift is greater than the wavelength interval of the absorption lines (with the result that an adjacent absorption line is used as the reference wavelength)
- Do not use this function to intentionally change the unit's display wavelength. Use the <WL SHIFT> key for that purpose. (☛ See section 6.16 System)
- The user is only allowed to set vacuum and air wavelength modes. If frequency mode is set, wavelength mode will be used within the wavelength calibration function.

① Turn the unit's power on.

Turn the standby power switch on the back side to ON and press the power switch on the front side to enter the [OPERATE] state. (☛ See subsection 3.1.2 Power-On and Screen Display)

⚠Caution

- If you are using the unit for the first time or using it after it has been severely shaken while being moved, be sure to perform the alignment adjustment procedure after warmup ends.
- When connecting the power cord, **follow the Power Supply Precautions** presented in the section entitled "Safety Marks and Notations".

② Use an SM optical fiber to connect the output connector of the external light source to the unit's INPUT connector. (☛ See subsection 4.3.2 Connecting Optical Fibers and Fig 4-7 Measurement System During Wavelength Calibration (using External Light Source))

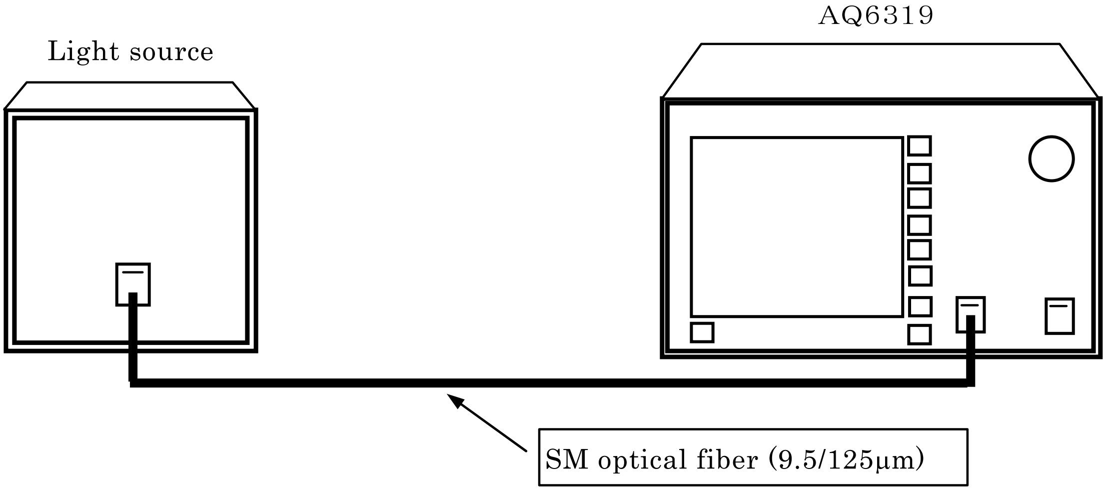


Fig. 4-7 Measurement System During Wavelength Calibration (using External Reference Light Source

⚠ Caution

- Be very careful in handling the optical connectors during the connection process.
  (☛ For details, see section 4.3 Handling the Optical Connectors)

③ Press the [SYSTEM] switch.

④ Press the <WL CALIBRATION> key.

⑤ Select the type of external light source (laser-type external light source, gas cell absorption line-type external light source) and set the calibration wavelength value. There are three different ways to set the wavelength value:

● If the external light source is a laser-type light source
Press the <EXTERNAL LASER> key. The interrupt display area is displayed. Set the laser's wavelength value using the rotary knob or step keys. (The allowed wavelength range is 600 to 1700 nm.)

● If the external light source is a gas cell absorption line-type light source

Press <EXTERNAL GAS CELL>. The interrupt display area is displayed. Set the gas cell absorption line-type light source's wavelength value using the rotary knob or step keys. (The allowed wavelength range is 600 to 1700 nm.)

● If the unit's internal calibration wavelength value is used

Press the <CALIB WL SELECT> key. When you press this key, the wavelength values shown in Table 4-2 are displayed as soft keys. Select the desired wavelength value.

Table 4-2 Calibration wavelength values in <CALIB WL SELECT> key

Vacuum wavelength mode [nm]	Air wavelength mode [nm]
632.991	632.816
1152.589	1152.274
1523.488	1523.072
1530.372	1538.954
1552.116	1551.692

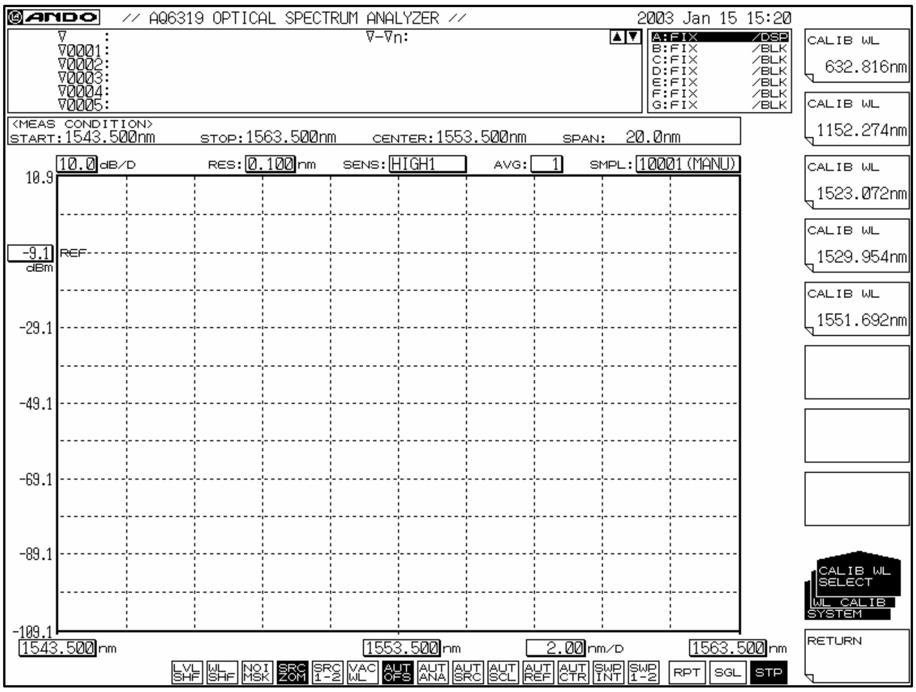


Fig. 4-8 Screen displayed when <CALIB WL SELECT> key is pressed

⑥ Press the <EXECUTE> key.

When you press this key, wavelength calibration is performed. The previous screen is displayed again after the calibration process ends. Press the <CANCEL> key during wavelength calibration to cancel the wavelength calibration process.

NOTE

- Calibration on multiple wavelengths is not necessary. If you do perform calibration on multiple wavelengths, only the final calibration is used.

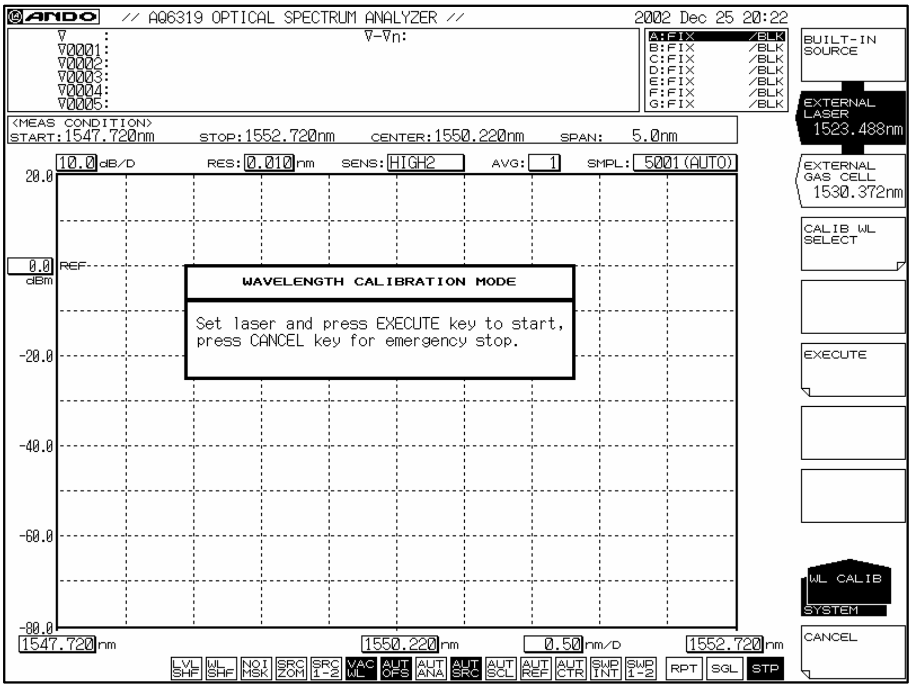


Fig. 4-9 Wavelength calibration screen for laser-type external light source

Chapter 5 Measurement Procedures

5

5.1 Important Points During Measurement

The unit is designed to for use in a wide range of applications, but it does have some limitations. The following must be taken into consideration during measurements.

5.1.1 Types of Optical Fibers

The unit can use single mode optical fibers with core diameters of 5 to 9.5 μm, and multimode (GI) optical fibers with core diameters of 50 and 62.5 μm. Functions may be limited or restricted depending on which type of optical fiber is used. Table 5-1 shows which of the typical types of fiber may be used and the limitations on their use.

Note that the unit is designed for input through optical fiber only. It will not work with inputs that do not pass through optical fiber, such as direct input of a gas laser beam to the optical input connector, or bonding an LED to the optical input connector. It is important to note that optical spectrum measurements taken through such inputs are completely unreliable.

For space light measurements, input the space light to the optical fiber and from the optical fiber to the unit. A variety of adapters are available for this purpose. (☛ See section 10.2 Options)

Table 5-1 Summary of usable optical fiber types and usage limitations

Optical fiber type		Obtained wavelength resolution (in nm)	Absolute level accuracy
Type	Core diameter		
SM	5	0.010	×
SM	9.5	0.010	○
GI	50	0.050	×
GI	62.5	0.050	×
SI	50	0.050	×
SI	80	0.100	×
SI	100	0.200	×
SI	200	0.500	×
SI	400	1.000	×
SI	800	1.000	×

5.1.2 Input Optical Fiber Numerical Aperture (NA) and Level Measurement Values

The level measurement error of the unit changes as shown in Fig. 5-1, according to the numerical aperture (NA) of the optical fiber connected to the input connector. The unit's absolute level is calibrated using a 9.5/125 μm single-mode optical fiber (SSMA type in JIS C6835, with PC polishing, 9.5 μm mode field diameter, and 0.104 to 0.107 NA). Even if a single-mode optical fiber is used, the level accuracy will be outside the specifications if the NA is not in the range shown above.
If you connect an optical fiber with an unknown NA to the unit for level measurements, accurate measurements can be obtained by setting the unit's level shift as shown below.

5

① Use a light source with a narrow spectral width such as a DFB-LD (1310 nm or 1550 nm wavelength).

② Connect the light source and the unit using an optical fiber cord and set the unit's resolution to 1.000 nm. Execute measurement and determine the peak level.

③ Disconnect the optical fiber cord from the unit and connect it to a light power meter to measure the light power.

④ Calculate the difference between the peak level value obtained from the unit and the power value obtained from the light power meter, and set this amount as the unit's level shift. (☛ See section 6.16 SETUP)

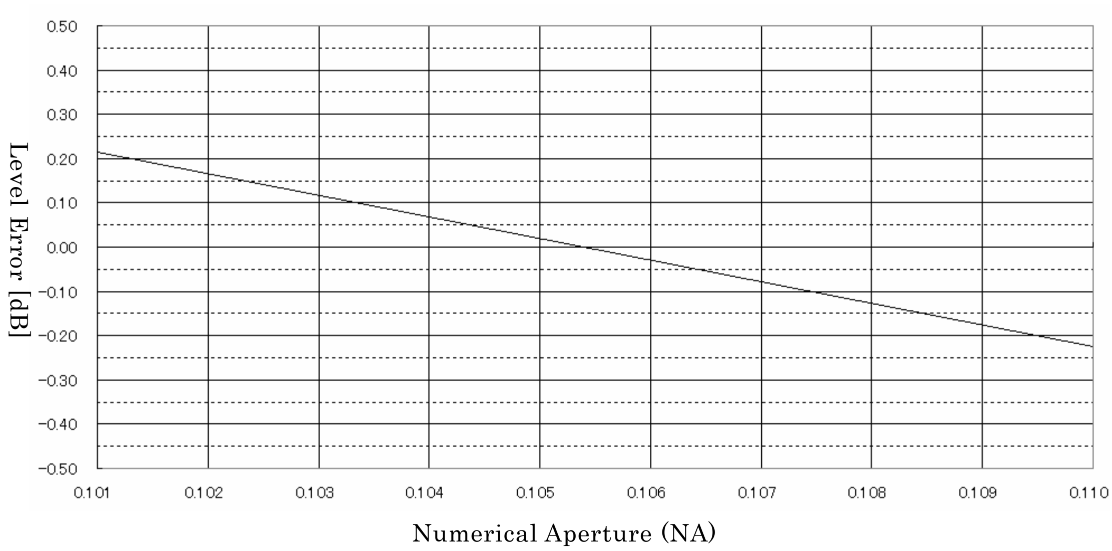


Fig. 5-1 Input Optical Fiber Numerical Aperture and Level Error (typical characteristics)

5.1.3 Limitations on Wavelength Resolution

The maximum wavelength resolution for the unit is 0.010 nm when using a single-mode optical fiber with a core diameter of 9.5 μm. As shown in Table 5-1, maximum wavelength resolution is higher when optical fibers with thicker core diameters are used.

Setting a resolution value finer than those shown in Table 5-1 will simply result in an inaccurate measurement level without improving resolution.

Optical fibers with a thick core diameter are especially useful for inputting space light for measurement, but they have poor resolution. Choose the best type of optical fiber for your particular application.

5.1.4 Absolute Level Accuracy

The unit's absolute level is calibrated using a single-mode optical fiber with a core diameter of 9.5 μm. Therefore, level accuracy obtained using optical fibers with a different core diameter are outside the specifications.

(☛ See subsection 5.1.2 Input Optical Fiber Numerical Aperture (NA) and Level Measurement Values)

In terms of actual capability, even single-mode optical fibers that do not have a core diameter of 9.5 μm provide nearly the same level of accuracy.

Multimode (GI) fiber provides a relatively accurate spectrum if the light source is low-coherent light such as white light, natural light, or an LED. If the light source has high coherency as in the case of a laser beam, interference will occur inside the optical fiber, and the intensity distribution of light radiating from the fiber tip will vary according to the fiber form. As a result, the spectrum (measurement level) may fluctuate if the fiber is moved.

When an optical fiber with a large core diameter or large NA value is used (☛ see subsection 5.1.2 Input Optical Fiber Numerical Aperture (NA) and Level Measurement Values), a low fraction of the light emitted from the optical fiber is received. Therefore, the measurement level is lower than the true value, but the optical spectrum is accurate in relative terms.

5.1.5 Level Axis Effective Range with Measurement Sensitivity Set to <NORMAL HOLD>

When the measurement sensitivity is set to <NORMAL HOLD>, the internal amplifier has a fixed gain. Five different gains are set automatically according to the reference (REF) level setting. However, the effective range of measurement data is limited to the following range, using the reference (REF) level (dBm) as a reference.

REF-20<(effective range)<REF+10

If the level scale is set to 10 dB/DIV, the display would exceed the effective range, so the areas at 10 dB from the screen stop and 20 dB from the bottom are inaccurate. For this reason, when measurement sensitivity is set to <NORMAL HOLD>, we recommend setting the level scale to 5 dB/DIV or less.
Under the measurement sensitivity settings <NORMAL AUTO>, <MID>, and <HIGH 1–3>, an automatic gain is used, permitting measurements over a wide level range through a single sweep. Select the appropriate sensitivity level based on the light reception level required for the particular measurement application.

5.1.6 Stray Light from the Monochromator

The unit has a newly designed, high-performance monochromator. Depending on the measurement conditions, stray light at a level 30 to 50 dB below the original spectrum, as well as other stray light specific to the monochromator may occur in wavelength areas 100 to 200 nm from the peak wavelength. If this stray light is likely to have a severe impact on measurements, the sensitivity can be set to <HIGH 1–3> and <CHOP MODE> can be set to <CHOP> or <SWITCH> in order to reduce the effects of the stray light.

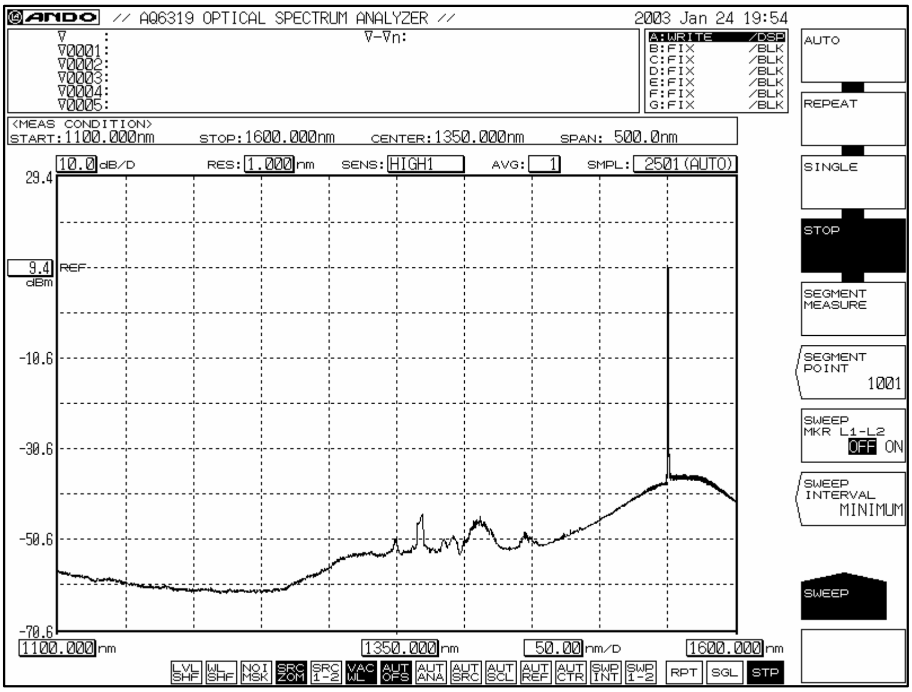


Fig. 5-2 Waveform with <NORMAL HOLD> measurement sensitivity

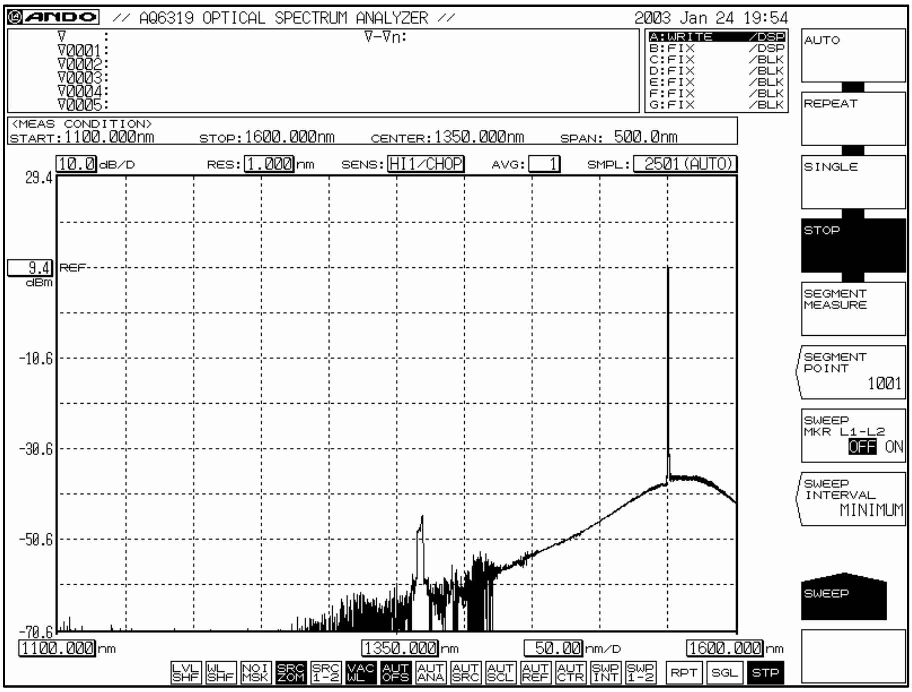


Fig. 5-3 Waveform with <HIGH1/CHOP> measurement sensitivity

The principle and feature describes various mode(<CHOP> and <SWITCH>key) int the <CHOP MODE>key.

- <CHOP>

  Measurement can be performed with monochromator stray light by chopper operates every one sampling point.
  Sweeping will take an extremely long time by sensitivity improves.
  Note, however, if the DUT's state is unstable, this mode is effective.

- <SWITCH>

  The first sweep is measured noise elements. The second sweep is displayed waveform which substract the current measurement data form noise elements.
  The sweeping time of this mode is faster than CHOP mode.
  Note, however, if the DUT's state is unstable, this mode may cause improper waveform.

  Fig 5-4 sweeping time and relation fo various chopper mode shows, then set the measurement sensitivity which correspond to measurement condition.

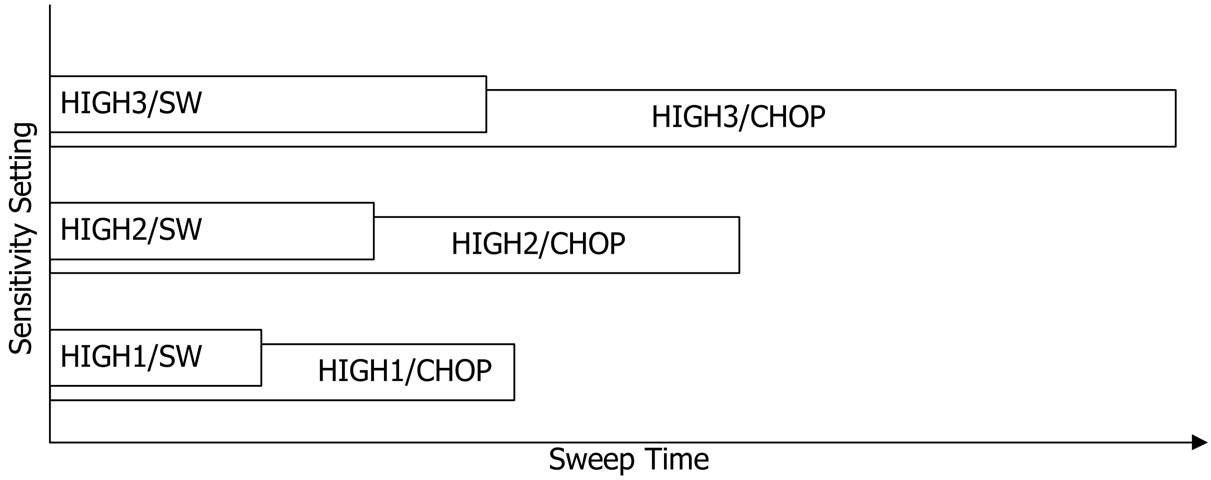


Fig 5-4 sweeping time and relation fo various chopper mode

NOTE

- When setting of <CHOP MODE>key is set <SWITCH>, waveform on first sweep is not displayed.

5.1.7 Ripples in 1350–1450 nm Area

Water (OH^-) ions present in the monochromator absorb light in the 1350–1450 nm area, resulting in ripples in the measurement waveform. Either set a coarser resolution or use the monochromator in a lower-humidity environment to reduce the amount of ripples.

5.1.8 Level Accuracy below the Cutoff Frequency (Short Wavelength) of a Connection Optical Fiber

Level accuracy below the cutoff frequency of a connection optical fiber, light propagates through the optical fiber in multiple modes. When high-coherent light from a light source such as a gas laser or DFB-LD light source propagates in multiple modes, speckle noise contained in the optical fiber output light may become unstable by the optical fiber's form, resulting in an inaccurate measurement level.
In such cases, improving the coupling between the light source and the optical fiber will lessen the level inaccuracy.

5.1.9 Waveforms with Resolution of 0.010 nm

When the resolution is set to 0.010 nm for measurements from a DFB laser or other light source in which the spectral width is narrower than the unit's resolution, very small spikes may occur at the skirts of the waveform.
(☛ See Fig. 5-5 Waveform with 0.010 nm Resolution)
This type of spike occurs due to characteristics of the optical block and is not an indication of any problem. Even if such spikes occur, satisfactory performance in terms of resolution, dynamic range, and the like can be ensured. Note that these spikes will disappear if the resolution is set to a coarser value.

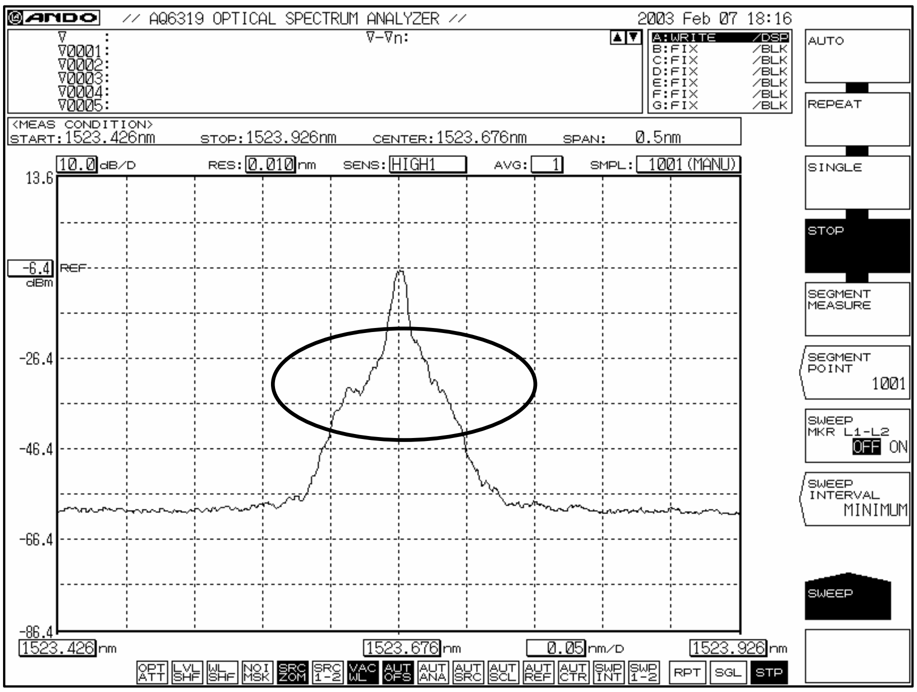


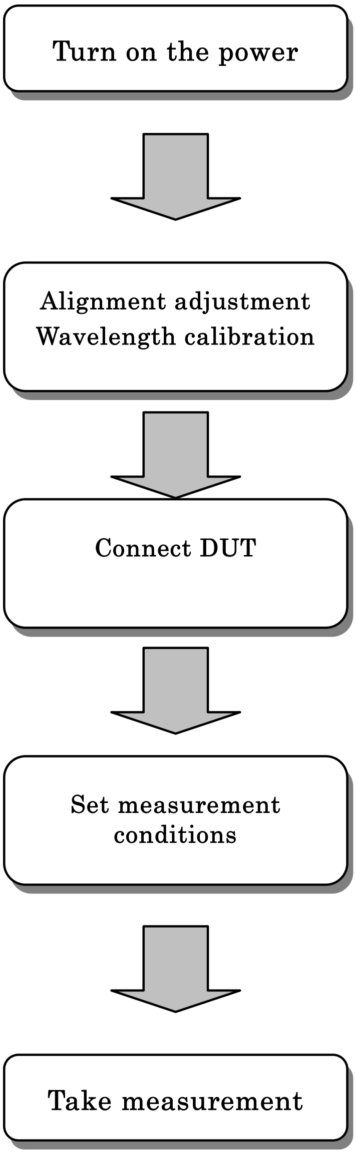
Fig. 5-5 Waveform with 0.010 nm Resolution

5.2 Basic Measurements

This section on the basic measurements describes the steps from connecting a DUT (device under test) to performing [SWEEP] to execute actual measurement.

5.2.1 Flow of Basic Measurements

The flow chart below shows the flow of the optical device measurement process. For detailed information on the procedures in each step, see the corresponding sections of the manual shown on the right.



Turn on the unit's power.
(☛ See section 3.1 Turning the Power ON/OFF)

To obtain accurate measurements, first perform alignment adjustment and wavelength calibration.
(☛ See sections 4.4 Alignment Adjustment and 4.5 Waveform Calibration)

Connect the DUT to the unit using optical fiber.
(☛ See subsection 5.2.2 Connecting the DUT)

Set the measurement conditions according to the device being measured.
(☛ See subsection 5.2.3 Measurement Condition Settings, (2) Manual Settings)

When measurement starts, the swept waveform is displayed on the display screen. Measurement conditions can be optimized during the measurement process.

5.2.2 Connecting the DUT

The DUT is connected to the unit with a measurement system like that shown in Fig. 5-6. The procedure is described below.

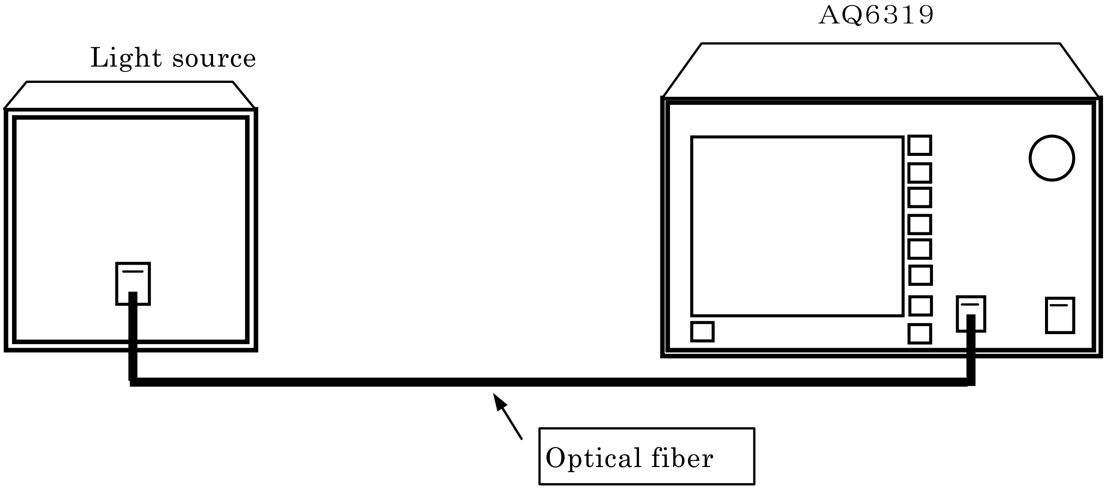


Fig. 5-6 Basic Measurement System

The following attachment procedure pertains to an FC-type connector.

① Clean the tip of the optical plug with a fiber cleaner.

② Clean the output plug on the unit.

③ Connect the optical plug to the unit.

③-1 Open the input light-side optical adapter cover on the front side of the unit.

③-2 Insert the optical plug so that its guide couples with the key on the optical adapter.

Also perform steps ① through ③ for the DUT to connect the unit with the DUT.

⚠ Caution

- Be sure to clean the tip of the optical fiber being used before connecting it.
- Do not try to forcefully attach the optical fiber plug with the plug inserted at a slanted angle.
  □ Doing so may damage the optical fiber plug or the unit's optical connector.
- Before connecting the input light, make sure that it does not exceed the unit's maximum rated level. With the attenuator function on, this is +27dBm or higher. If the input light exceeds the maximum rated level, the optical section may be damaged.
- Slanted angled PC-type optical connectors cannot be used with the unit. Forcefully connecting a slanted angled PC-type optical connector may damage the equipment. Always use a physical contact (PC) type optical connector.

5.2.3 Measurement Condition Settings and Measurement Execution

The unit allows automatic measurement through AUTO sweeping, in which the minimum settings required for measurement are set automatically. In addition, there are manual settings which allow the user to perform measurements with manually entered settings. This section describes the automatic and manual procedures as well as how to set the measurement conditions.

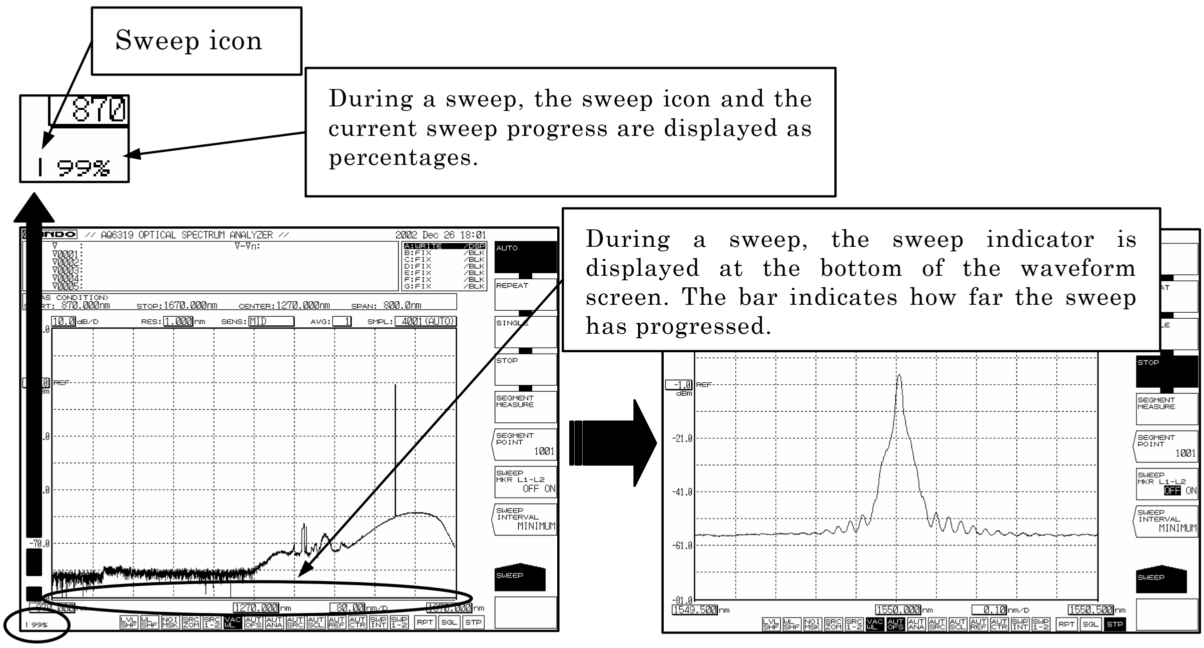
- AUTO sweep

Pressing the <AUTO> key inside the [SWEEP] switch displays the spectrum with the measurement conditions set to the optimal settings for the input light.
AUTO sweep measurement is performed through the following procedure.

① Press the [SWEEP] switch.
② Press the <AUTO> key.

⚠Caution

- The following four parameters are set automatically by AUTO sweep:
  1. Span (SPAN)
  2. Center wavelength (CENTER)
  3. Reference level (REF LEVEL)
  4. Resolution (RESOLN)
- When AUTO sweep ends, the operation changes to repeat sweep.



Screen on first sweep after pressing <AUTO> key Screen after AUTO sweep ends

Fig. 5-7 AUTO Sweep Execution Screens

- Manual settings

It may not be possible to obtain the desired measurement waveform through AUTO sweep using the <AUTO> key. In such cases, you can manually set various measurement conditions. Manual settings are entered through the following steps.

A Set center wavelength

The center wavelength setting on the measurement screen can be set through the following three procedures.

A-1. Set using <CENTER WL>/<CENTER FREQ> key

A-2. Set using <START WL>/<START FREQ> and <STOP WL>/<STOP FREQ> keys

A-3. Set using one-action key

↓

B Set SPAN

The span setting on the measurement screen can be set through the following three procedures.

B-1. Set using <SPAN WL>/<SPAN FREQ> key

B-2. Set using <START WL>/<START FREQ> and <STOP WL>/<STOP FREQ> keys

B-3. Set using one-action key

↓

C Set reference level

The reference level can be set through the following two procedures.

C-1. Set using <REF LEVEL>

C-2. Set using one-action key

↓

D Set resolution

Set the wavelength resolution.

↓

E Sweep

Start the measurement.

A Center wavelength setting

The center wavelength setting on the measurement screen can be set through the following three procedures.

A-1 Set using <CENTER WL>/<CENTER FREQ> key

This setting procedure is described below.

① Press the [CENTER] switch.

② Press the <CENTER WL> or <CENTER FREQ> key.
The <HORIZON SCALE> key in the [SET UP] switch can be used to change the horizontal axis display mode to wavelength or frequency. (☛ See section 6.3 CENTER)

③ The interrupt display area is displayed. Enter the center wavelength using the rotary knob or the numeric keypad.

NOTE
● When the center wavelength is set, the start wavelength and stop wavelength values change. ● The set value is applied in the measurement conditions area. ● When a setting is changed, NEW appears in the measurement conditions area. ● Changing the center wavelength does not change the span.

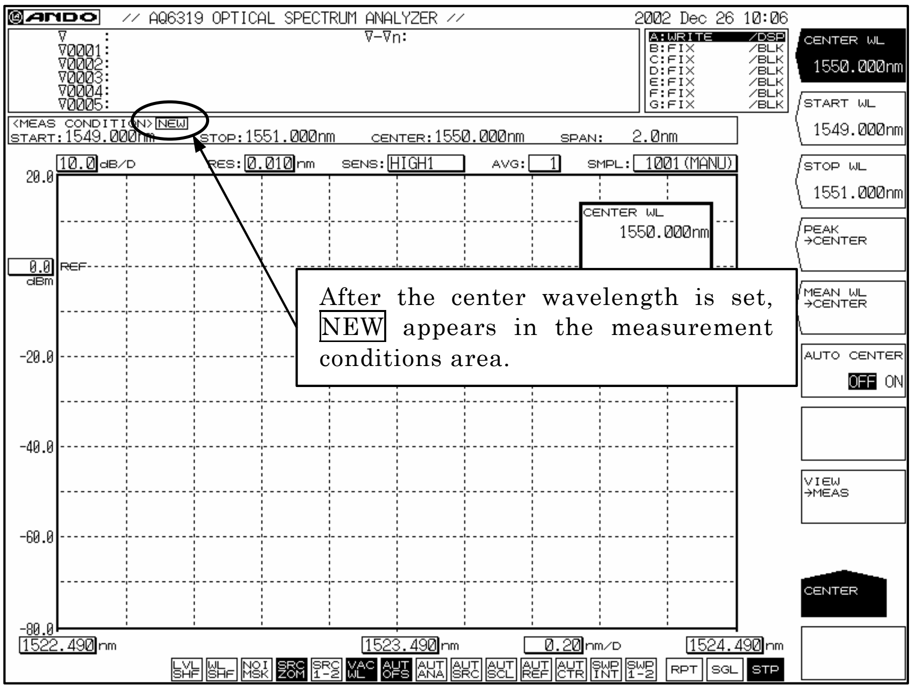


Fig. 5-8 Center wavelength setting screen using <CENTER WL> key

A-2 Set using <START WL>/<START FREQ> and <STOP WL>/<STOP FREQ> keys

This setting procedure is described below.

① Press the [CENTER] switch or [SPAN] switch.

② Press the <START WL>/<START FREQ> or <STOP WL>/<STOP FREQ> key.
Using the rotary knob, step keys or the numeric keypad, enter the start wavelength or stop wavelength.

NOTE

- When the start wavelength (or stop wavelength) is set, the center wavelength and span change accordingly. However, the stop wavelength (or start wavelength) value does not change.
- The set value is applied in the measurement conditions area.
- When a setting is changed, $\boxed{\text{NEW}}$ appears in the measurement conditions area.

A-3 Set using one-action key

The unit has functions which allow the center wavelength to be set using one-action keys. These functions are summarized in Table 5-2.

Table 5-2 Setting the center wavelength with one-action keys

Function	Description
<PEAK→CENTER>	Sets the center wavelength as the peak wavelength of the active trace measurement waveform.
<MEAN WL→CENTER>	Sets the center wavelength as the THRESH 3dB center wavelength of the active trace measurement waveform
<MARKER→CENTER>	Sets the center wavelength as the moving marker wavelength.
<VIEW→MEAS>	Sets the center wavelength as the currently displayed ZOOM scale.

NOTE

- See Chapter 6 Function Switches and Soft Keys for information on the individual functions.

B Span setting

The span setting on the measurement screen can be set through the following three procedures.

B-1 Set using <SPAN> key

This setting procedure is described below.

① Press the [SPAN] switch.

② Press the <SPAN WL>/<SPAN FREQ> key.

The interrupt display area is displayed. Enter the span using the rotary knob or numeric keypad.

NOTE

- Setting the span changes the start wavelength and stop wavelength.
- The set value is applied in the measurement conditions area.
- Setting the span does not change the center wavelength/frequency.

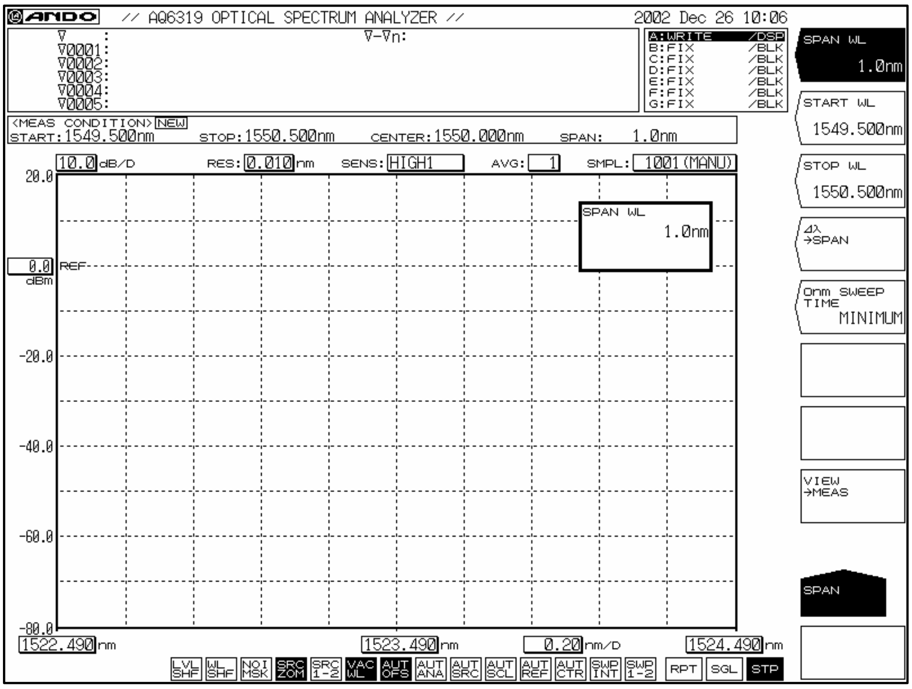


Fig. 5-9 Span setting screen

B-2 Set using <START WL>/<START FREQ> and <STOP WL>/<STOP FREQ> key

This setting procedure is described below.

① Press the [CENTER] switch or [SPAN] switch.

② Press the <START WL>/<START FREQ> or <STOP WL>/<STOP FREQ> key.
Enter the start wavelength or stop wavelength using the rotary knob or the numeric keypad.

NOTE

- When the start wavelength (or stop wavelength) is set, the center wavelength and span change accordingly. However, the stop wavelength (or start wavelength) value does not change.
- The set value is applied in the measurement conditions area.
- When a setting is changed, NEW appears in the measurement conditions area.
- The span does not change by setting the center wavelength.

B-3 Set using one-action key

The unit has functions which allow the span to be set using one-action keys. These functions are summarized in Table 5-3.

Table 5-3 Setting the span using one-action keys

Function	Description
<Δλ→SPAN>	Sets the span as the active trace measurement waveform THRESH 3dB width × 2.
<MKR L1-L2→SPAN>	Sets the span as the span between line markers 1 and 2.

NOTE

- See Chapter 6 Function Switches and Soft Keys for information on the individual functions.

C Reference level setting

The measurement screen reference level can be set through the following two procedures.

C-1 Set using <REF LEVEL> key

This setting procedure is described below.

① Press the [LEVEL] switch.

② Press the <REF LEVEL> key.

The interrupt display area is displayed. Enter the center wavelength using the rotary knob or the numeric keypad.

NOTE

- The level axis setting is applied in real time on the waveform display.

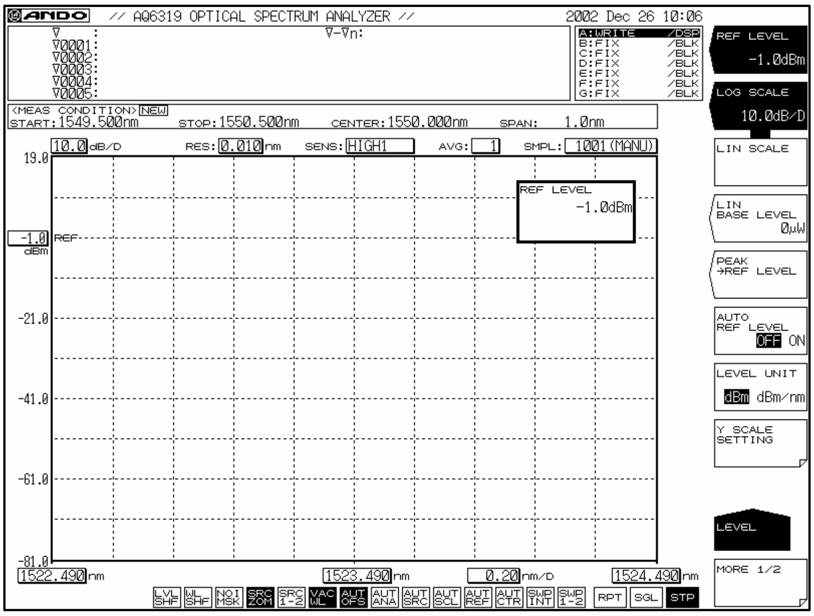


Fig. 5-10 Reference level setting screen

C-2 Set using one-action key

The unit has functions which allow the reference level to be set using one-action keys. These functions are summarized in Table 5-4.

Table 5-4 Setting the reference level using one-action keys

Function	Description
<PEAK→REF LEVEL >	Sets the reference level as the active trace measurement waveform peak level.
<MARKER→REF LEVEL>	Sets the moving marker level as the reference level.

NOTE

- See Chapter 6 Function Switches and Soft Keys for information on the individual functions.

D Wavelength resolution settings

This setting procedure is described below.

① Press the [SET UP] switch.

② Press the <RESOLUTION> key.

When this key is pressed, the following seven wavelength resolutions are displayed in soft keys. Select the desired wavelength resolution.

- ✓ <0.010 nm>
- ✓ <0.020 nm>
- ✓ <0.050 nm>
- ✓ <0.100 nm>
- ✓ <0.200 nm>
- ✓ <0.500 nm>
- ✓ <1.000 nm>

NOTE

- Pressing the <RESOLUTION> key displays the interrupt display area. The wavelength resolution can be set in this area using the encoder, step keys, or numeric keypad.
  However, the entered value is not set as is. Instead, the nearest value among the seven values shown above is set.

E Sweeping

The sweeping procedure is described below.

① Press the [SWEEP] switch.

② Press the <SINGLE> key or <REPEAT> key to start sweeping.

> **NOTE**
>
> - Sweeping can also be performed by clicking the sweep icons (RPT SGL STP) located at the bottom of the screen.
> - During a sweep, the sweep bar is displayed below the X axis, indicating conditions during the current sweep.
> - During a sweep, a sweep icon indicating the sweep status is displayed in the lower left corner of the screen. (Sweep progress from the start wavelength to the sweep wavelength is indicated as a percentage.)

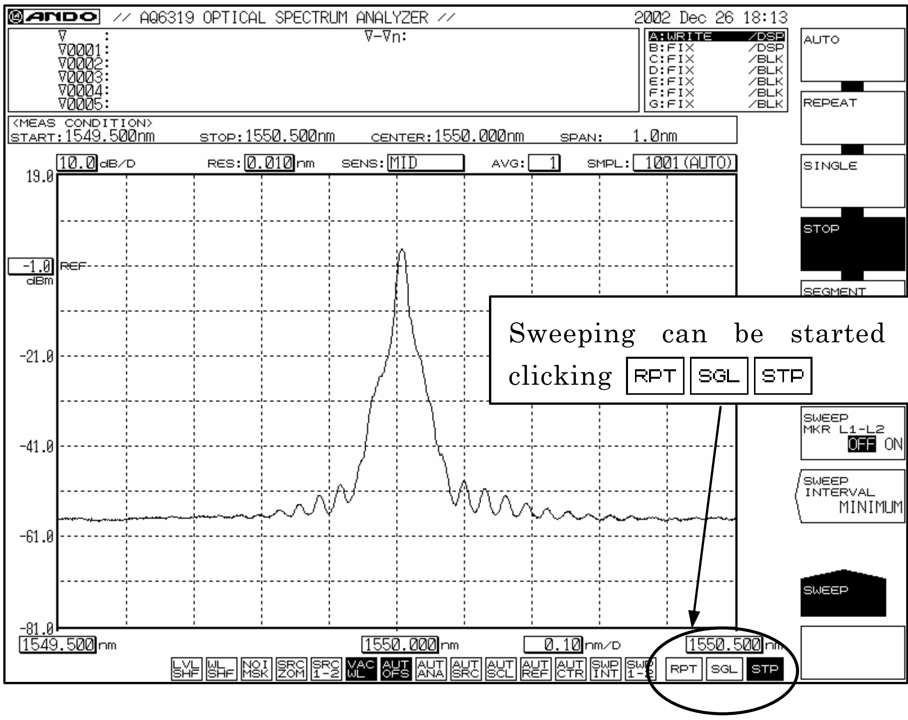


Fig. 5-11 Display screen during sweep execution

- **Other measurement condition settings**

Set the following measurement conditions as needed according to the measurement results obtained based on the procedures described above.

F Sensitivity

G Averaging count

H Sampling number/sampling interval settings

I Horizontal (wavelength/frequency) axis setting

J Vertical (level) axis setting

K Trace selection and setting

F Sensitivity

Sensitivity can be selected according to the light reception level required for measurement.

This setting procedure is described below.

① Press the [SET UP] switch.

② Press the <SENS/MODE> key to select one of the six alternative measurement sensitivity settings.

- ✓ <NORMAL/HOLD>
- ✓ <NORMAL/AUTO>
- ✓ <MID>
- ✓ <HIGH1>
- ✓ <HIGH2>
- ✓ <HIGH3>

NOTE

- If the sensitivity setting is <HIGH1> through <HIGH3>, the <CHOP MODE> key may be used to select the chopper operation mode in the monochromator. Stray light specific to the monochromator can be reduced by turning the chopper.

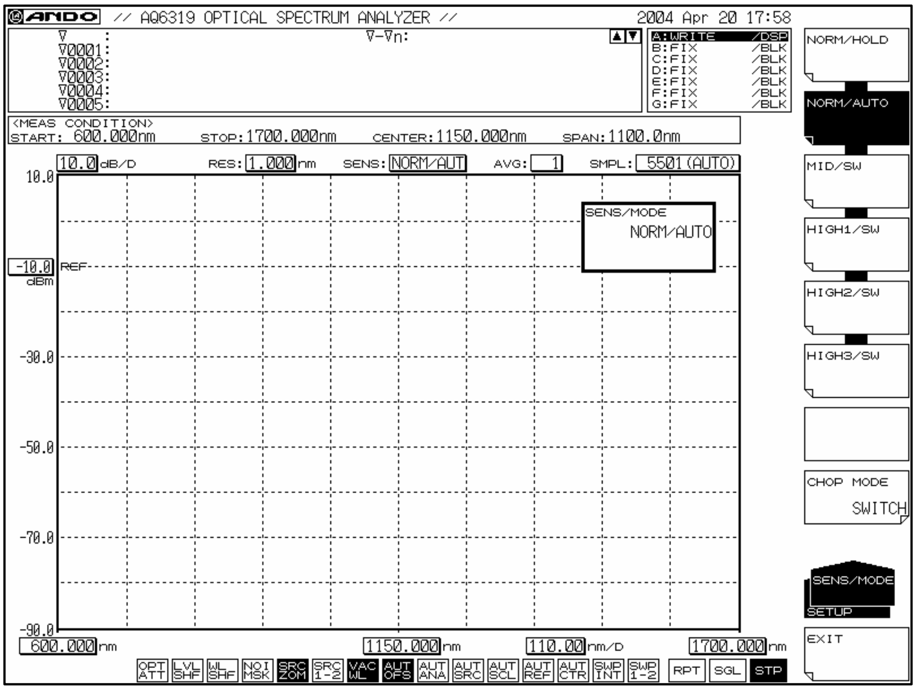


Fig. 5-12 Sensitivity setting screen

The various sensitivity settings are shown in Table 5-5.

Table 5-5 Sensitivity Settings

Measurement sensitivity	Description
NORMAL HOLD	Measurement with fixed gain based on reference level
NORMAL AUTO	Measurement with auto-gain. The auto-gain adjustment range and bandwidth vary and sensitivity changes according to each measurement sensitivity setting. The following sensitivity settings are available: "NORMAL AUTO"、"MID"、"HIGH1"、"HIGH2"、HIGH3". "HIGH3" provides the best sensitivity, but is slowest in terms of sweeping speed. (☛ See Table 5-6 Relationship Between Set Sensitivity and Sweeping Speed)
MID	
HIGH1	
HIGH2	
HIGH3	

Table 5-6 Relationship Between Set Sensitivity and Sweeping Speed

Measurement sensitivity	NORMAL AUTO	MID	HIGH1	HIGH2	HIGH3
Sweeping speed	Faster ←				
Sensitivity					→ Higher

⚠ Caution

- The <CHOP MODE> setting only applies to the <HIGH1> through <HIGH3> sensitivity settings. Under other sensitivity settings, the chopper in the monochromator does not rotate even if it is set to ON.
- When the <CHOP MODE> key is set to <CHOP> or <SWITCH>, the measurement sensitivity names of the <HIGH1> through <HIGH3> keys change. (☛ See Fig. 5-13 Display Screen During Sensitivity Setting)

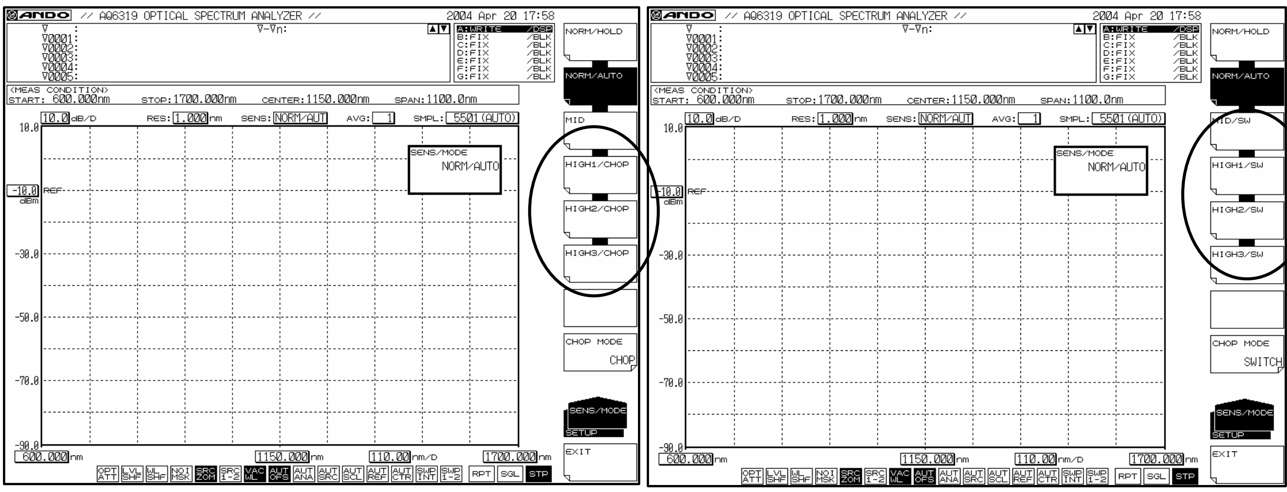


Fig. 5-13 Display Screen During Sensitivity Setting

G Averaging time

The averaging function is used in cases such as the following:

- When the light source's level is fluctuating
- When measuring a modulated signal of several kHz or less
- When the waveform is disrupted and difficult to measure
- When it is necessary to obtain even higher measurement sensitivity

This setting procedure is described below.

① Press the [SET UP] switch.

② Press the <AVERAGE TIME> key.

The interrupt display area is shown. Use the rotary knob, step keys, or numeric keypad to set the averaging time.

⚠ Caution

- Increasing the averaging time reduces the sweeping speed.

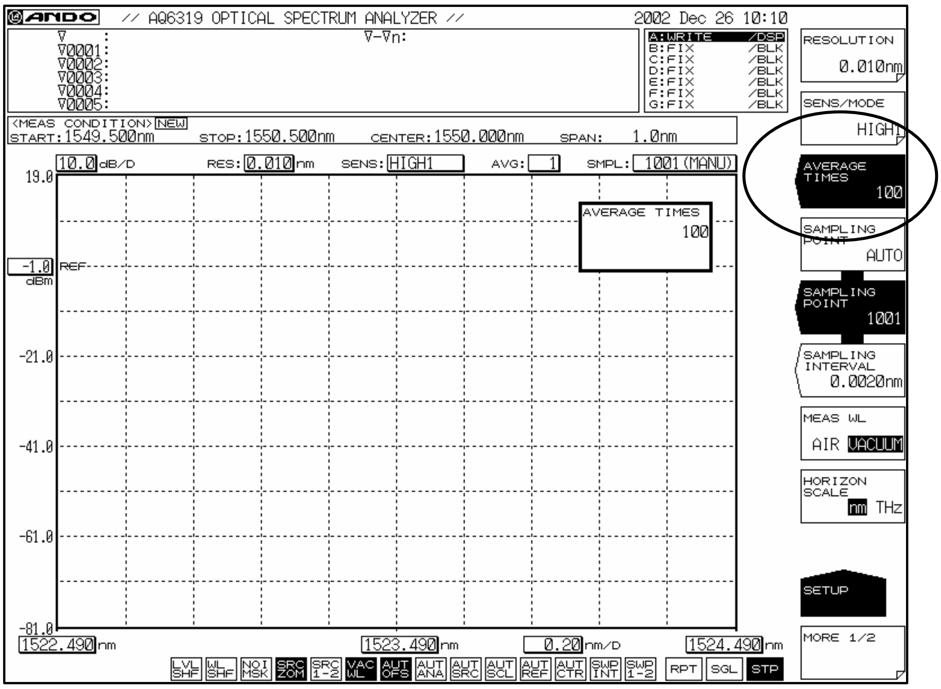


Fig. 5-14 Averaging Time Setting

H Sampling points/sampling interval settings

Set the sampling points or sampling interval for each sweeping range.

H-1 Sampling points

This setting procedure is described below.

① Press the [SET UP] switch.

② Press the <SAMPLING POINT> key.
The interrupt display area is shown. Use the rotary knob, step keys, or numeric keypad to set the sampling points.

5

NOTE

- The factory default setting is <SAMPLING POINT AUTO>, which determines the sampling points through internal processing.
(☛ See subsection 8.7.2 List of Initial Values)
- In cases where the number of sampling points per sweeping area is extremely small, UNCAL is displayed in the measurement conditions area
- Increasing the number of sampling points reduces the sweeping speed.
- When this setting is changed, the <SAMPLING INTERVAL> value also changes.

H-2 Sampling interval

The procedure for setting the sampling interval is described below.

① Press the [SET UP] switch.

② Press the <SAMPLING INTERVAL> key.
The interrupt display area is shown. Use the rotary knob, step keys, or numeric keypad to set the sampling interval.

NOTE

- Setting a narrow sampling interval reduces the sweeping speed.
- When this setting is changed, the <SAMPLING POINT> value also changes.

I Horizontal (wavelength/frequency) axis setting

The horizontal axis can be set as the wavelength axis or frequency axis.

This setting procedure is described below.

① Press the [SET UP] switch.

② Press the <HORIZON SCALE nm/THz> key to set the unit to be used on the horizontal axis.

NOTE

- Pressing the <HORIZON SCALE nm/THz> key alters the setting "nm"→ "THz" and vice versa.
- For further details, see <HORIZON SCALE nm/THz> in Chapter 6 Function Switches.
  (☛ See section 6.6 SET UP)

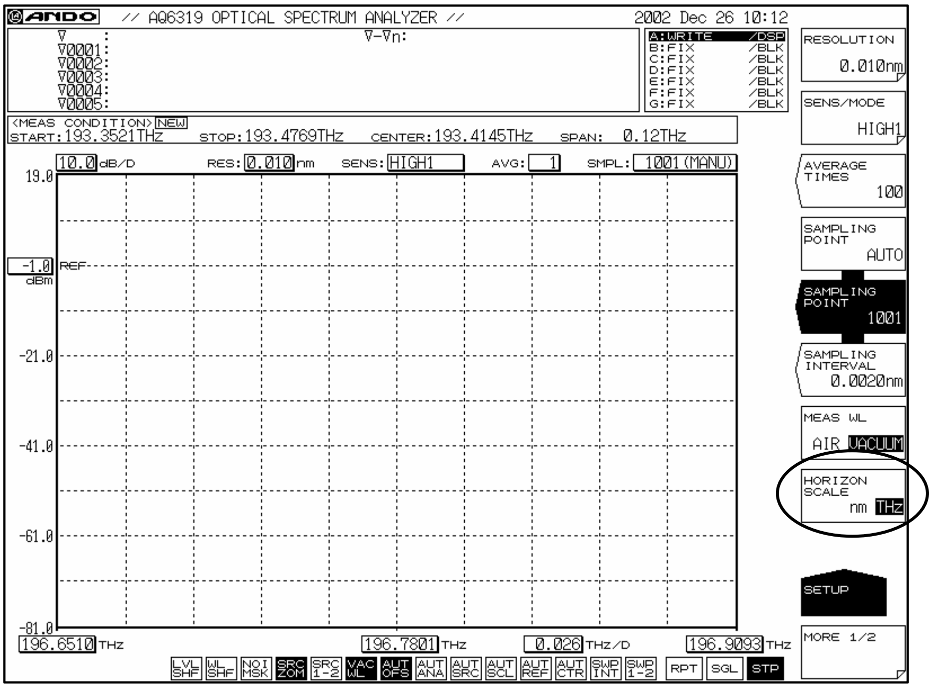


Fig. 5-15 Horizontal (wavelength/frequency) axis scale setting

J Vertical (level) axis setting

The vertical axis can be set as a log scale or linear scale.

This setting procedure is described below.

① Press the [LEVEL] switch.

② Press the <LOG SCALE> key to select log scale display, and press the <LIN SCALE> key to select linear scale display.
When you press the <LOG SCALE> key, the interrupt display area is shown. You can use the rotary knob or step keys to set the vertical axis scale.

NOTE

- For further details, see <LOG SCALE> and <LIN SCALE> in Chapter 6 Function Switches.
(☛ See section 6.5 LEVEL)

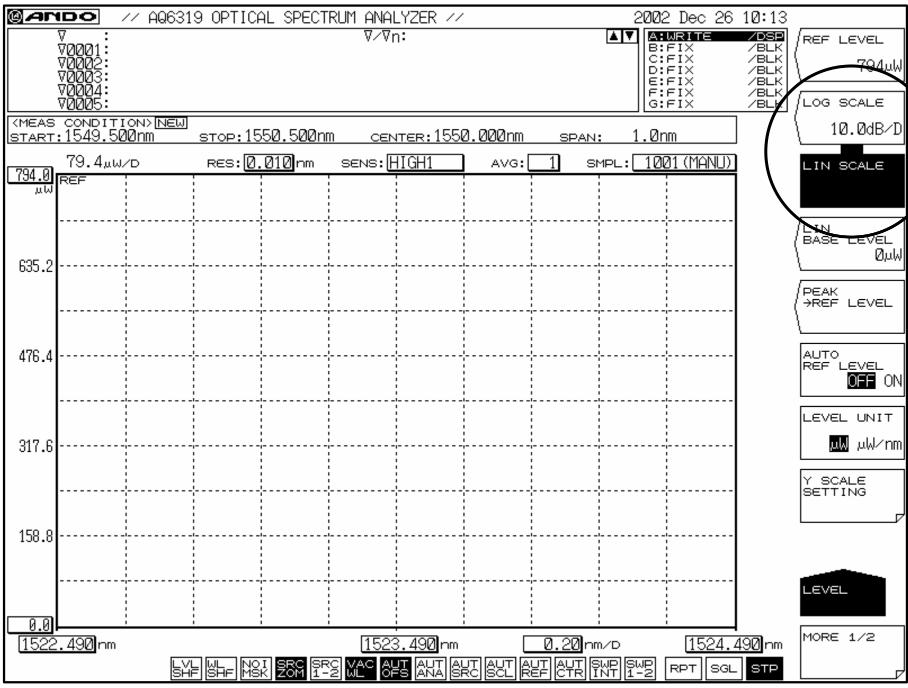


Fig. 5-16 Vertical (level) axis scale setting

K Trace selection and setting

The unit has seven independent traces (A through G). The settings related to writing and waveform fixation each trace are described below.

The trace selection and setting procedure is described below.

① Press the [TRACE] switch.

② Press the <ACTIVE TRACE> key.
When you press this key, the soft keys are displayed as A through G. Select the trace you want to make active from these seven traces.

③ Use the <VIEW @ DISP/BLANK> key to set the trace selected in ② as [DISP] and to display it.

④ Use the <WRITE @> key to set the trace activated in ② to write mode.

NOTE
● ☛ For further details, see sections 6.5 LEVEL and 7.2 Trace Functions.

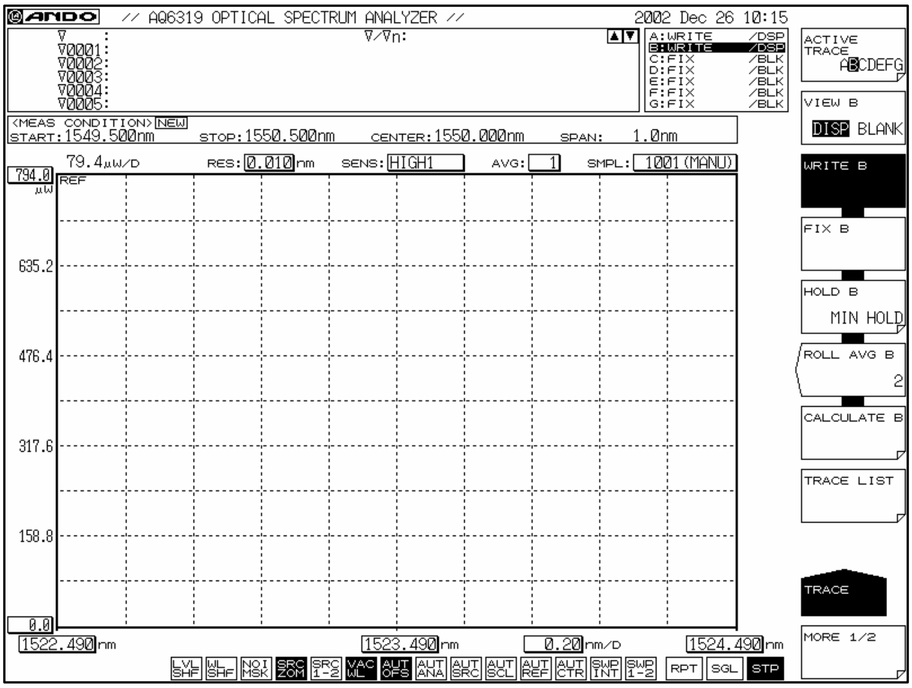


Fig. 5-17 Trace selection and setting

5.3 Applied measurements

This section describes how to perform various types of analysis on measured waveforms in applied measurements. See Chapter 8 for detailed information on the analysis functions. (☛ See Chapter 8 Explanation of Various Functions)

The following applied measurements are described in detail here:

5.3.2 Spectrum width measurement
5.3.3 Notch width measurement
5.3.4 SMSR measurement
5.3.5 POWER measurement
5.3.6 DFB-LD, FP-LD, and LED light source measurements
5.3.7 PMD measurement
5.3.8 WDM transmission signal measurement
5.3.9 Optical amp gain and NF measurement
5.3.10 WDM optical fiber characteristic measurement

5.3.1 Applied measurement flow

The procedures from waveform measurement to execution of analysis are described below as the actual applied measurement flow using the following flow chart.

Waveform measurement

Measure the subject light.
(☛ See section 5.2 Basic Measurements)

Selection of analysis method

Select the analysis method to be used.

① Press the [ANALYSIS] switch.

② Select an analysis method by pressing one of three keys (<SPEC WIDTH>, <ANALYSIS1>, <ANALYSIS2>). (☛ See Chapter 8 Details of Various Functions for information on the different types of analysis and their algorithms.)

> **NOTE**
>
> - When you select an analysis method, the currently set parameters are used for analysis and the results are displayed on the screen.

Parameter settings

Set the parameters for the selected analysis function.

① Press the <PARAMETER SETTING> key.
The parameter setting screen is displayed. (Fig. 5-17)

② Use the <↑>, <↓>, <→>, and <←> keys to move the cursor to settings that need to be changed.

③ Change the parameter settings.

- Numerical parameters
  Use the rotary knob, step keys, or numeric keypad to set these parameters.
- Selectable parameters
  Move the cursor to the parameter you want to select, then press the <SELECT> key.

④ After you have completed all settings, select the <CLOSE WINDOW> key to close the parameter settings screen.

> **NOTE**
>
> - To restore a parameter setting to its default value, press the <DEFAULT> key.
> - If the parameter settings screen consists of multiple pages, use the <NEXT PAGE> key to move to the next page.

Execute analysis

Press the <ANALYSIS EXECUTE> key to execute analysis. The analysis results, which incorporate the changed parameter settings, are displayed on the screen.

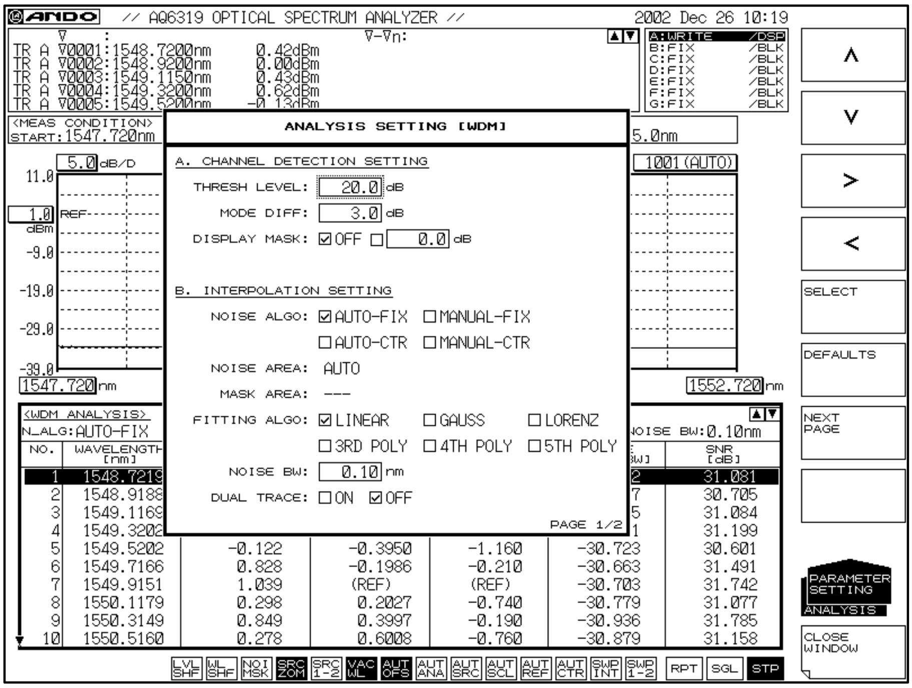


Fig. 5-18 Parameter settings screen (example)

5.3.2 Spectrum width measurement

Spectrum width can be analyzed from the measured waveform.
Spectrum width analysis can be performed on waveforms measured using various light sources, optical filters, and the like.

<Execution procedure>

① Press the [ANALYSIS] switch.

② When you press the <SPEC WIDTH> key, the spectrum width analysis algorithms are displayed as soft keys. Select the calculation algorithm to be used in the spectrum width analysis.

(☛ See Table 5-7 Spectral Width Analysis Algorithms)

③ When you press the key, analysis is performed and the results are displayed in the data area.

④ To change the analysis parameters, press the <PARAMETER SETTING> key and set the parameters on the parameter settings screen.

⑤ After you have set the analysis parameters, press the <CLOSE WINDOW> key to close the parameter settings screen.

⑥ When you press the <ANALYSIS EXECUTE> key, analysis is performed using the changed parameters, and the analysis results are displayed in the data area.

Table 5-7 Spectrum Width Analysis Algorithms

Algorithm	Description
THRESH	Determines spectrum width from width of points where waveform crosses threshold value
ENVELOPE	Determines spectrum width from waveform envelope
RMS	Determines spectrum width from waveform standard deviation
PEAK RMS	Determines spectrum width from waveform mode peak standard deviation

NOTE

- See section 8.3 Spectral Width Data Calculation Algorithms for a description of the spectral width analysis algorithms and parameters.

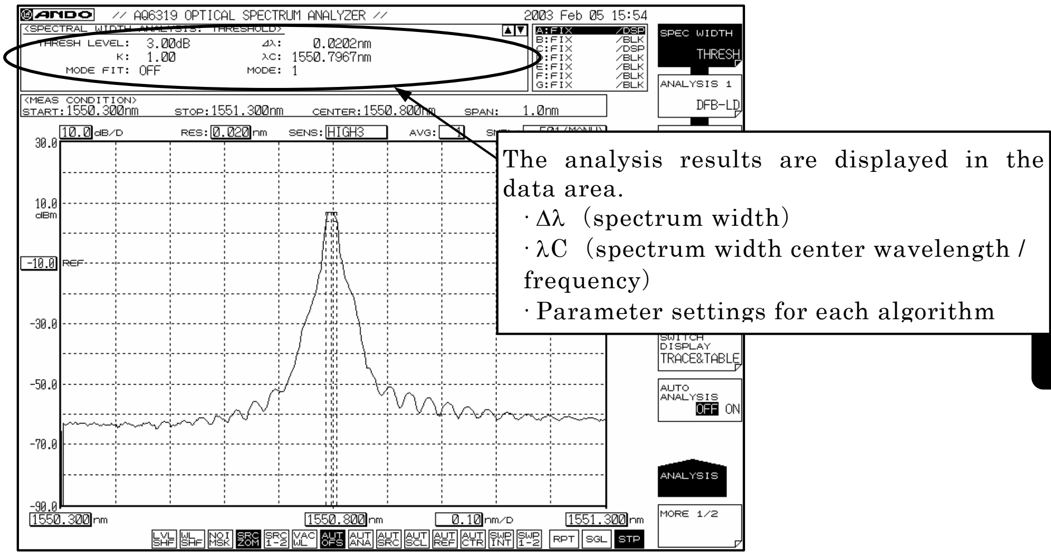


Fig. 5-19 Spectral width analysis results screen (THRESH)

5.3.3 Notch width measurement

With notch width measurement, it is possible to measure pass band width / notch width from the measured waveform of a filter with V-character type or U-character type wavelength characteristics.

<Execution procedure>

① Press the [ANALYSIS] switch.

② When you press the <SPEC WIDTH> key, the spectrum width analysis algorithms are displayed as soft keys. Press the <NOTCH> key.

③ When you press this key, analysis is performed and the results are displayed in the data area.

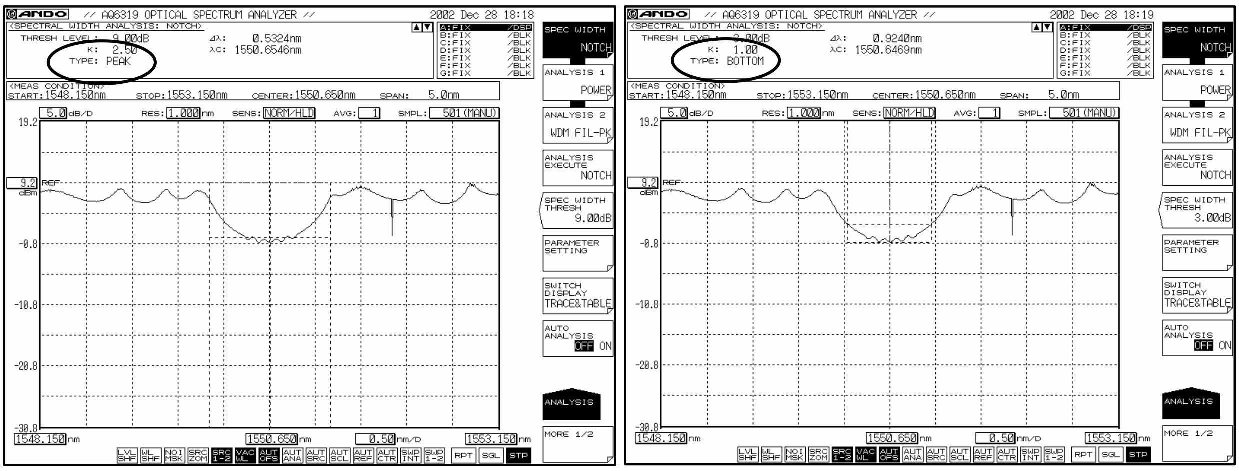
④ To change the analysis parameters, press the <PARAMETER SETTING> key and set the parameters on the parameter settings screen.

⑤ After you have set the analysis parameters, press the <CLOSE WINDOW> key to close the parameter settings screen.

⑥ When you press the <ANALYSIS EXECUTE> key, analysis is performed using the changed parameters and the analysis results are displayed in the data area.

NOTE

- See subsection 8.3.5 NOTCH PEAK for a description of the notch width analysis algorithm and parameters.



NOTCH PEAK NOTCH BOTTOM

Fig. 5-20 Notch width measurement results

5.3.4 DFB-LD SMSR measurement

The side-mode suppression ratio (SMSR) can be measured from the DFB-LD measured waveform.

<Execution procedure>

① Press the [ANALYSIS] switch.

② When you press the <ANALYSIS1> key, multiple analysis algorithms are displayed as soft keys. Press the <SMSR> key.

③ When you press this key, analysis is performed and the results are displayed in the data area.

④ To change the analysis parameters, press the <PARAMETER SETTING> key and set the parameters on the parameter settings screen.

⑤ After you have set the analysis parameters, press the <CLOSE WINDOW> key to close the parameter settings screen.

⑥ When you press the <ANALYSIS EXECUTE> key, analysis is performed using the changed parameters and the analysis results are displayed in the data area.

NOTE

- SMSR is an abbreviation for side-mode suppression ratio.
- SMSR represents the difference between the peak level and the side-mode level. It is one of the parameters used to evaluate the performance of DFB-LD and the like.
- See subsection 8.4.1 SMSR Analysis Function for a description of the SMSR analysis algorithm and parameters.

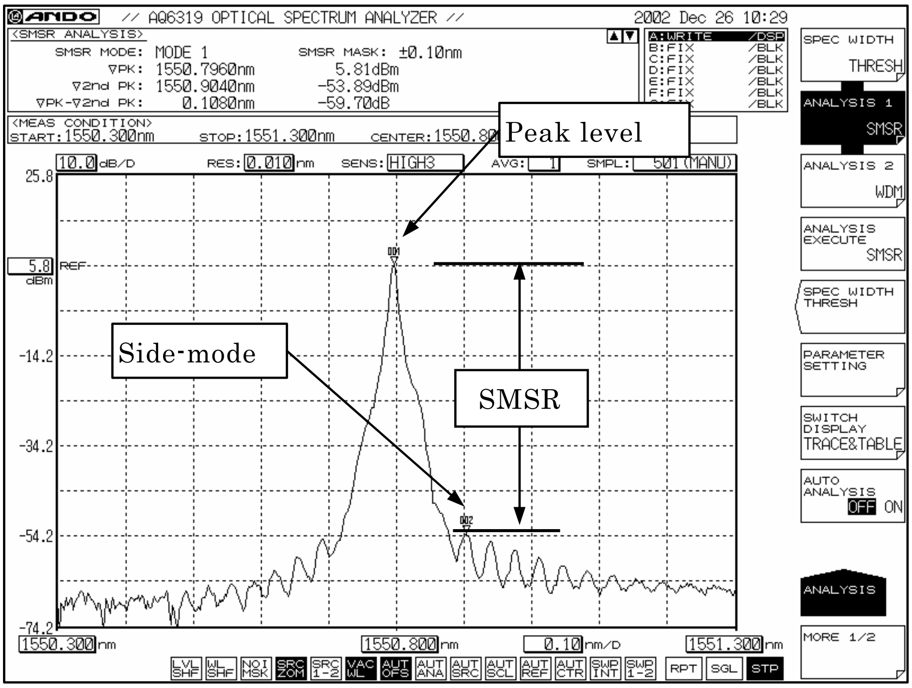


Fig. 5-21 SMSR analysis screen

5.3.5 POWER measurement

Optical power can be measured by integrating the measured waveform level measurements.

<Execution procedure>

① Press the [ANALYSIS] switch.

② When you press the <ANALYSIS1> key, multiple analysis algorithms are displayed as soft keys. Press the <POWER> key.

③ When you press this key, analysis is performed and the results are displayed in the data area.

④ To change the analysis parameters, press the <PARAMETER SETTING> key and set the parameters on the parameter settings screen.

⑤ After you have set the analysis parameters, press the <CLOSE WINDOW> key to close the parameter settings screen.

⑥ When you press the <ANALYSIS EXECUTE> key, analysis is performed using the changed parameters and the analysis results are displayed in the data area.

NOTE

- The power between display areas can be measured when the <SEARCH/ANA ZOOM AREA> key is used in combination with POWER measurement.
  (☛ See subsection 7.1.5 Function for Power Measurements between ZOOM Areas)
- The power between wavelength line markers can be measured when the <SEARCH/ANA L1-L2> key is used in combination with POWER measurement. (☛ See subsection 7.3.9 Function for Power Measurements between Markers)
- See subsection 8.4.2 POWER Analysis Function for a description of the POWER analysis algorithm and parameters.

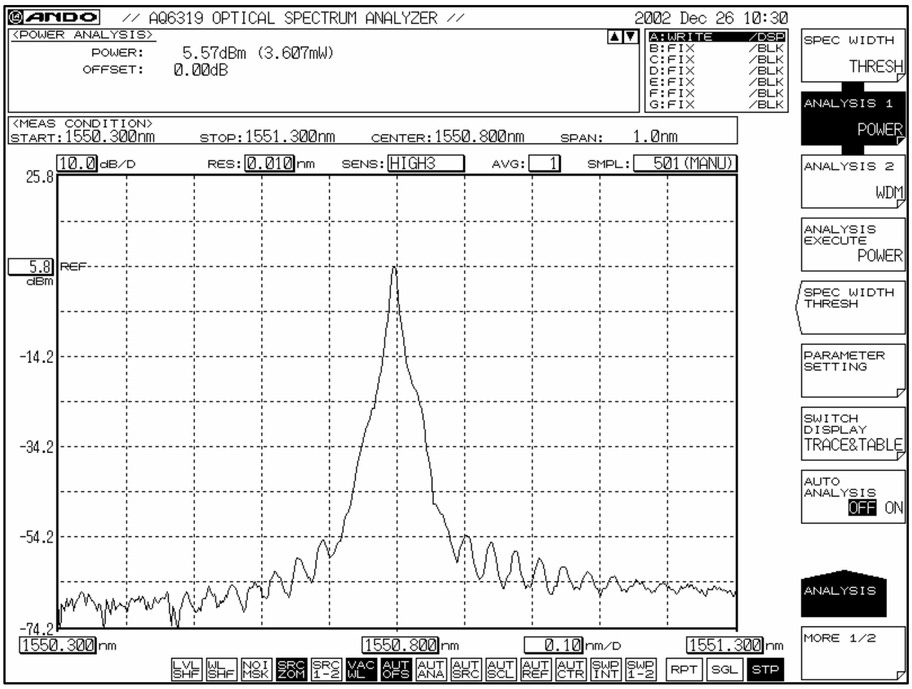


Fig. 5-22 POWER analysis screen

5.3.6 Parameter Analysis Procedures for Various Light Sources

Light source parameters can be analyzed from the measured waveform of each light source (DFB-LD, FP-LD, LED).

<Execution procedure>

① Press the [ANALYSIS] switch.

② When you press the <ANALYSIS1> key, multiple analysis algorithms are displayed as soft keys. Press the <DFB-LD>, <FP-LD>, or <LED> key according to the type of light source you want to analyze.

③ When you press this key, analysis is performed and the results are displayed in the data area.

④ To change the analysis parameters, press the <PARAMETER SETTING> key and set the parameters on the parameter settings screen.

⑤ After you have set the analysis parameters, press the <CLOSE WINDOW> key to close the parameter settings screen.

⑥ When you press the <ANALYSIS EXECUTE> key, analysis is performed using the changed parameters and the analysis results are displayed in the data area.

NOTE
● See subsections 8.4.4 DFB-LD Analysis Function, 8.4.5 FP-LD Analysis Function, and 8.4.6 LED Analysis Function for a description of the analysis algorithms and parameters.

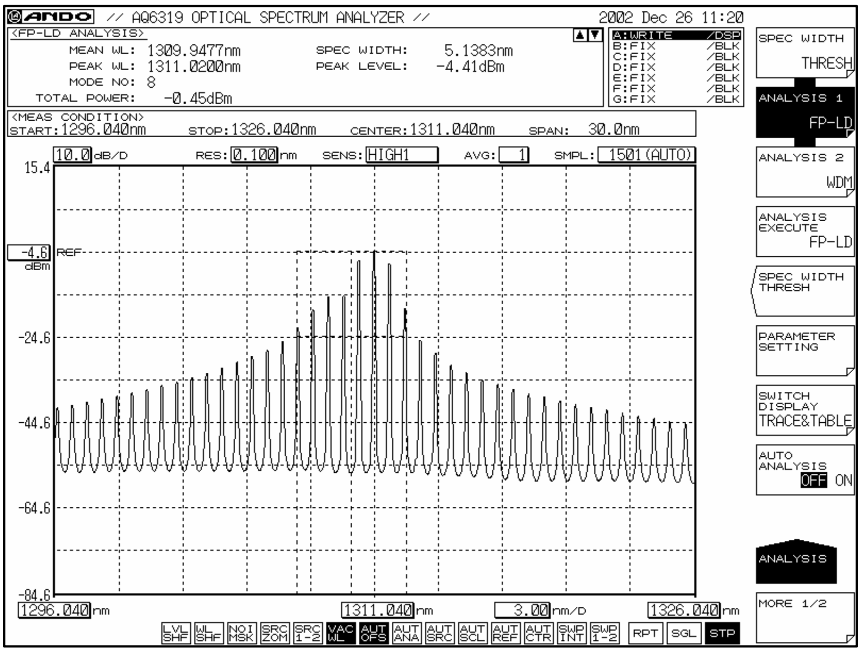


Fig. 5-23 Parameter analysis for various light sources (FP-LD)

5.3.7 PMD measurement

- Overview

  It is possible to measure the polarization mode dispersion (PMD) of a DUT (e.g., optical fiber) by using the unit in combination with an analyzer, polarization controller, polarizer, and an Amplified Spontaneous Emission (ASE) light source, high-output LED light source, or other wideband light source.

- Measurement system

  Fig. 5-24 shows a PMD measurement system.

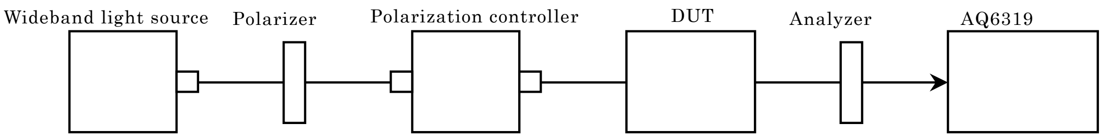


Fig. 5-24 PMD measurement system

- Measurement procedure

  The measurement procedure is described below.

  ① Prepare the measurement system shown in Fig. 5-23.

  ② Measure the waveform of the wideband light source. Perform sweeping after setting the measurement conditions so that it is possible to measure the entire wavelength range of the light source. (☛ See section 5.2 Basic Measurements)
  Set the resolution to about 0.050 nm, and use the <REPEAT> key on the [SWEEP] switch to perform repeat sweeping.

  ③ While watching the waveform during repeat sweeping, adjust the polarization controller so as to maximize the waveform's peak/bottom difference (the level difference between the maximum and minimum values).

  ④ After the polarization controller has been adjusted, press the <SINGLE> key on the [SWEEP] switch to perform a single sweep.

  ⑤ After the single sweep ends, perform PMD analysis on the measured waveform. When you press the <ANALYSIS1> key on the [ANALYSIS] switch, multiple analysis algorithms are displayed as soft keys. Press the <PMD> key.

  ⑥ When you press this key, analysis is performed and the results are displayed in the data area.

  ⑦ To change the analysis parameters, press the <PARAMETER SETTING> key and set the parameters on the parameter settings screen.

  ⑧ After you have set the analysis parameters, press the <CLOSE WINDOW> key to close the parameter settings screen.

  ⑨ When you press the <ANALYSIS EXECUTE> key, analysis is performed using the changed parameters and the analysis results are displayed in the data area.

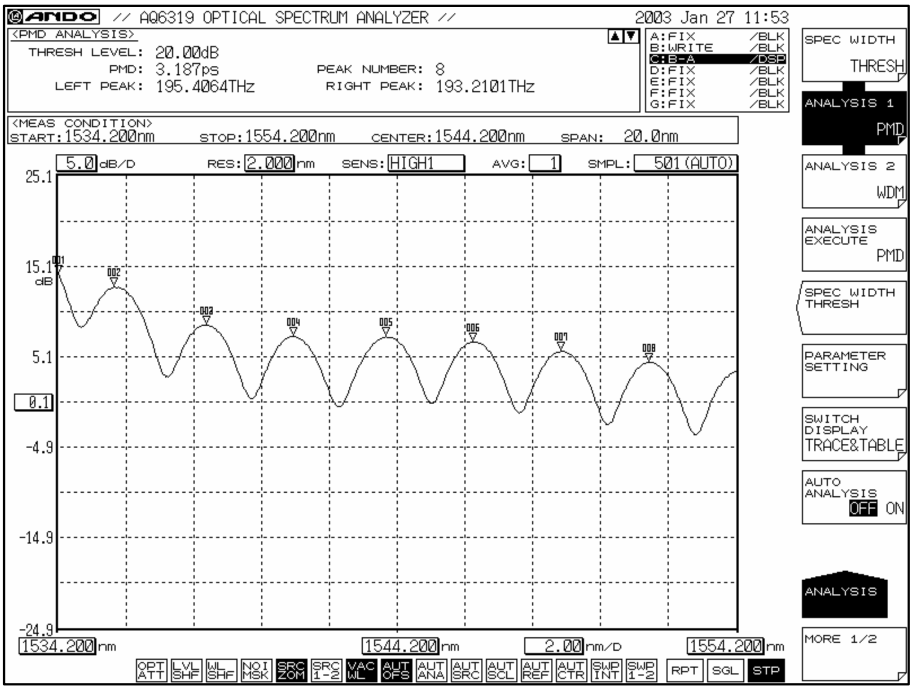


Fig. 5-25 PMD analysis screen

NOTE

- When PMD measurement is performed, waveform data at or below the threshold level from the peak are not used in analysis. The threshold level is set in the “THRESH LEVEL” parameter in the <PARAMETER SETTING> key.
- The mode-determination threshold level during PMD analysis execution is set using the <MODE DIFF> key in the [PEAK SEARCH] switch. The level difference which exceeds the value set with the <MODE DIFF> key is recognized as a mode.
- See subsection 8.4.3 PMD Analysis Function for a description of the PMD analysis algorithm and parameters.

5.3.8 WDM Transmission Signal Analysis

- Overview

It is possible to analyze each channel's center wavelength, level, SNR, etc. from the light waveform of a WDM signal light. See Chapter 8 for details on this function. (☛ See subsection 8.5.1 WDM Analysis Function)

- Measurement system

Fig. 5-26 illustrates an example of a measurement system for measuring WDM signal light.

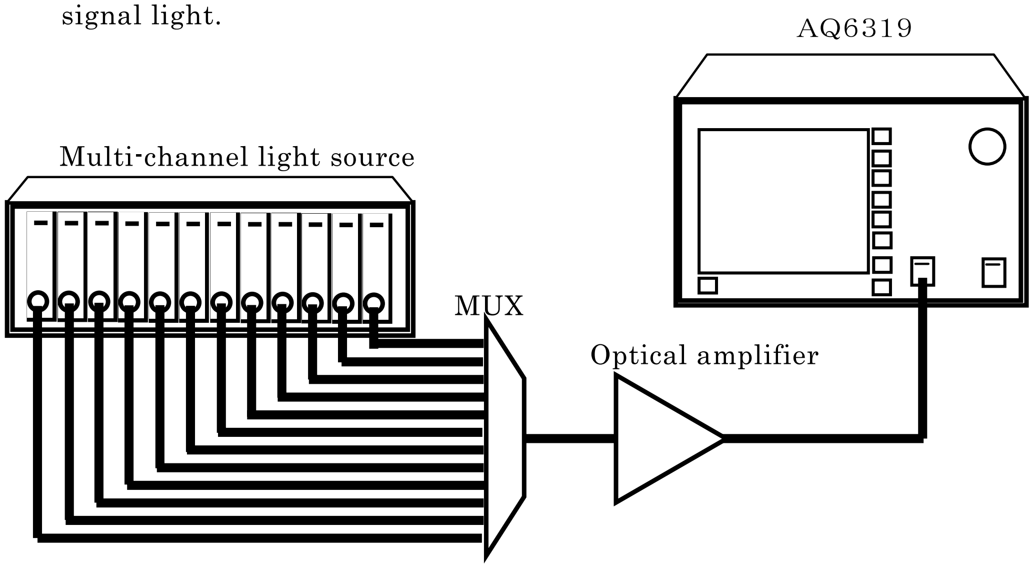


Fig. 5-26 WDM signal light measurement system

- Execution procedure

The measurement procedure is described below.

① Measure the WDM signal light and write the waveform to the active trace.
(☛ See section 5.2 Basic Measurements)

② Press the [ANALYSIS] switch and select the <ANALYSIS2> key.

③ Press the <WDM> key.
Analysis is performed using the defaults or previously set parameters, and the results are displayed on the screen.

④ To change the analysis parameters, press the <PARAMETER SETTING> key and set the parameters on the parameter settings screen.

⑤ After you have set the analysis parameters, press the <CLOSE WINDOW> key to close the parameter settings screen.

⑥ When you press the <ANALYSIS EXECUTE> key, analysis is performed using the changed parameters, and the analysis results are displayed on the screen.

NOTE

- See subsection 8.5.1 WDM Analysis Function for a description of the WDM analysis algorithm and parameters.

- Setting the analysis parameters

  WDM analysis function parameters may be broadly divided into the three types shown below. Change the parameter settings as desired according to the details of the particular analysis. See Chapter 8 for details on the parameters. (☛ See subsection 8.5.1 WDM Analysis Function)

  A Parameters related to channel detection (CHANNEL DETECTION SETTING)

  B Parameters related to noise level measurement (INTERPOLATION SETTING)

  C Parameters related to analysis results display method (DISPLAY SETTING)

<u>A Parameter settings related to channel detection</u>

These parameters are used to set threshold level and the like for WDM channel detection.

- "THRESH"

  This parameter sets the threshold level for channel detection. This setting determines how far down in decibels from the peak level to detect a mode peak as a channel.

- "MODE DIFF"

  This parameter sets the minimum value for the peak/bottom difference during channel peak detection. If the waveform peak/bottom difference equals or exceeds this value, it is detected as a mode peak.

- "DISPLAY MASK"

  This parameter sets the mask level value for channel masking. Channels at a level equal to or below this setting are masked.

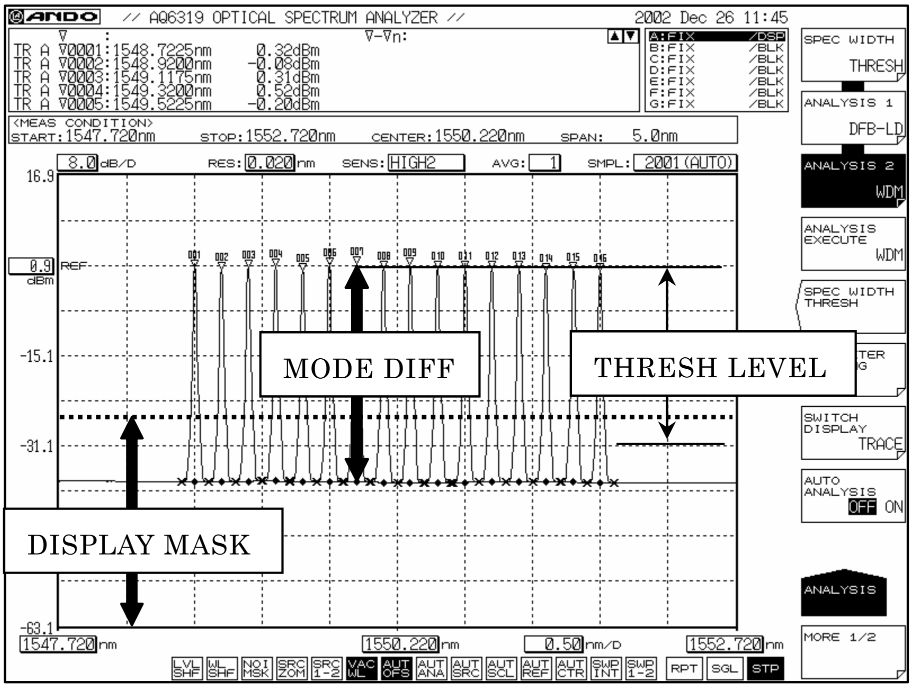


Fig. 5-27 Illustration of channel detection parameters

B Parameter settings related to noise level measurement

These parameters are used to set the interpolation method and bandwidth for noise level measurement.

- "NOISE ALGO"

  Select one of the four algorithms shown below for measuring the noise level. If AUTO-FIX or AUTO-CTR is set, the measurement parameters at another noise level are set automatically. To set the values manually, select MANUAL-FIX or MANUAL-CTR. (☛ See subsection 8.5.1 WDM Analysis Function)

  - ✓ AUTO-FIX Automatic measurement (FIX type)
  - ✓ MANUAL-FIX Manual measurement (FIX type)
  - ✓ AUTO-CTR Automatic measurement (CENTER type)
  - ✓ MANUAL-CTR Manual measurement (CENTER type)
  - ✓ PIT Automatic measurement (PIT type)

> **NOTE**
>
> - If "AUTO-FIX" or "AUTO-CTR" or "PIT" is selected, the "NOISE AREA" and "MASK AREA" parameters are set automatically according to the measured waveform. In addition, "FITTING ALGO" is set to LINEAR. For details on the parameters, see subsection 8.5.1 WDM Analysis Function.

- "FITTING ALGO"

  This parameter is used to select the interpolation algorithm for determining the noise level. This parameter is only set when "NOISE ALGO" is set to MANUAL-FIX or MANUAL-CTR. (☛ See Table 5-8 Description of Fitting Algorithms)

Table 5-8 Description of Fitting Algorithms

Fitting algorithm	Description
LINER	Linear interpolation
GAUSS	Normal distribution curve
LORENZ	Lorenz curve
3RD POLY	3rd poly
4TH POLY	4th poly
5TH POLY	5th poly

> **NOTE**
>
> - If "NOISE ALGO" is AUTO-FIX or AUTO-CTR, then "FITTING ALGO" is automatically set to LINEAR and does not need to be set manually.

- "NOISE AREA"

  This parameter is used to set the range of waveform data to be used in determining the noise level through interpolation. This parameter is only set when "NOISE ALGO" is set to MANUAL-FIX.

- "MASK AREA"
  This parameter is used to set the range of signal light to be masked when determining the noise level through interpolation. This parameter is only set when "FITTING ALGO" is not set to LINEAR.
- "NOISE BW"
  This parameter is used to set the noise bandwidth.
- "DUAL TRACE"
  This parameter is used to turn the dual trace function ON/OFF. When the dual trace function is used, the signal level and noise level during SNR measurement can each be determined from different traces.
  (☛ See subsection 8.5.1 WDM Analysis Function)

5

C Parameter settings for analysis results display

These parameters are set with respect to the display format for displaying analysis results on the screen.

- DISPLAY TYPE
  This parameter is used to select the analysis results display format. (☛ See Table 5-9 "DISPLAY TYPE" Settings)

Table 5-9 "DISPLAY TYPE" Settings

"DISPLAY TYPE"	Description and procedure
ABSOLUTE (absolute value display)	① Set "CH RELATION" as OFFSET or SPACING. OFFSET: Displays the relative value, channel to the reference channel. SPACING: Displays the wavelength difference and level difference compared to the following adjacent channel. ② If OFFSET is selected, the reference channel is set through "REF CH". ✓ If the highest channel is used as a reference Set to "HIGHEST". ✓ If any desired channel is used as a reference Set the reference channel number in "***CH".
RELATIVE (relative value display relative to grid)	There are no setting fields for this display type. (☛ See subsection 8.2.2 GRID for information on changing the grid table)
DRIFT(MEAS) (drift display using past measurement wavelength as a reference)	The procedure for this display type varies depending on the reference. ✓ Press the "MAX/MIN RESET" key if you want to use the waveform data of the current active trace as a reference. ✓ If you change the measurement conditions and want to use the first measured waveform as a reference, then there are no parameter setting fields, for the first measured data being a reference.
DRIFT(GRID) (drift display using grid wavelength as a reference)	The procedure for this display type varies depending on the reference. ✓ Press the "MAX/MIN RESET" key if you want to use the waveform data of the current active trace as a reference. ✓ If you change the measurement conditions and want to use the first measured waveform as a reference, then there are no parameter setting fields. (☛ See subsection 8.2.2 GRID for information on changing the grid table)

- "OUTPUT SLOPE"

  Displays the least square approximation line passing through the detected channel peak. The channel slope can be obtained as a numerical value.

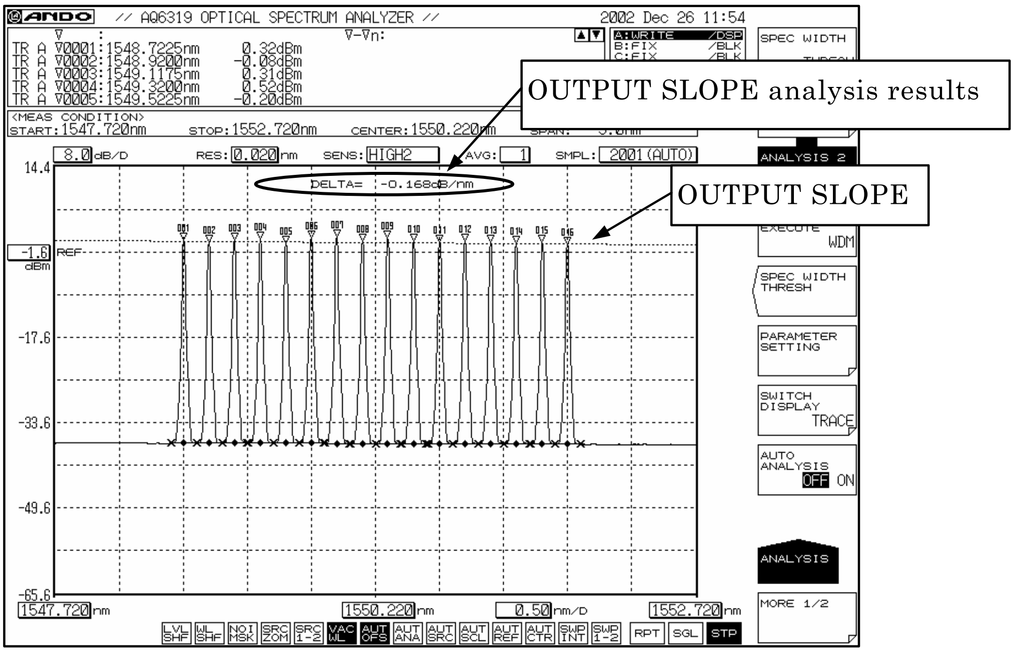


Fig. 5-28 Display of channel peak least square approximation line

- "POINT DISPLAY"

  This parameter is used to display the range of data used in interpolation for determining the noise level.

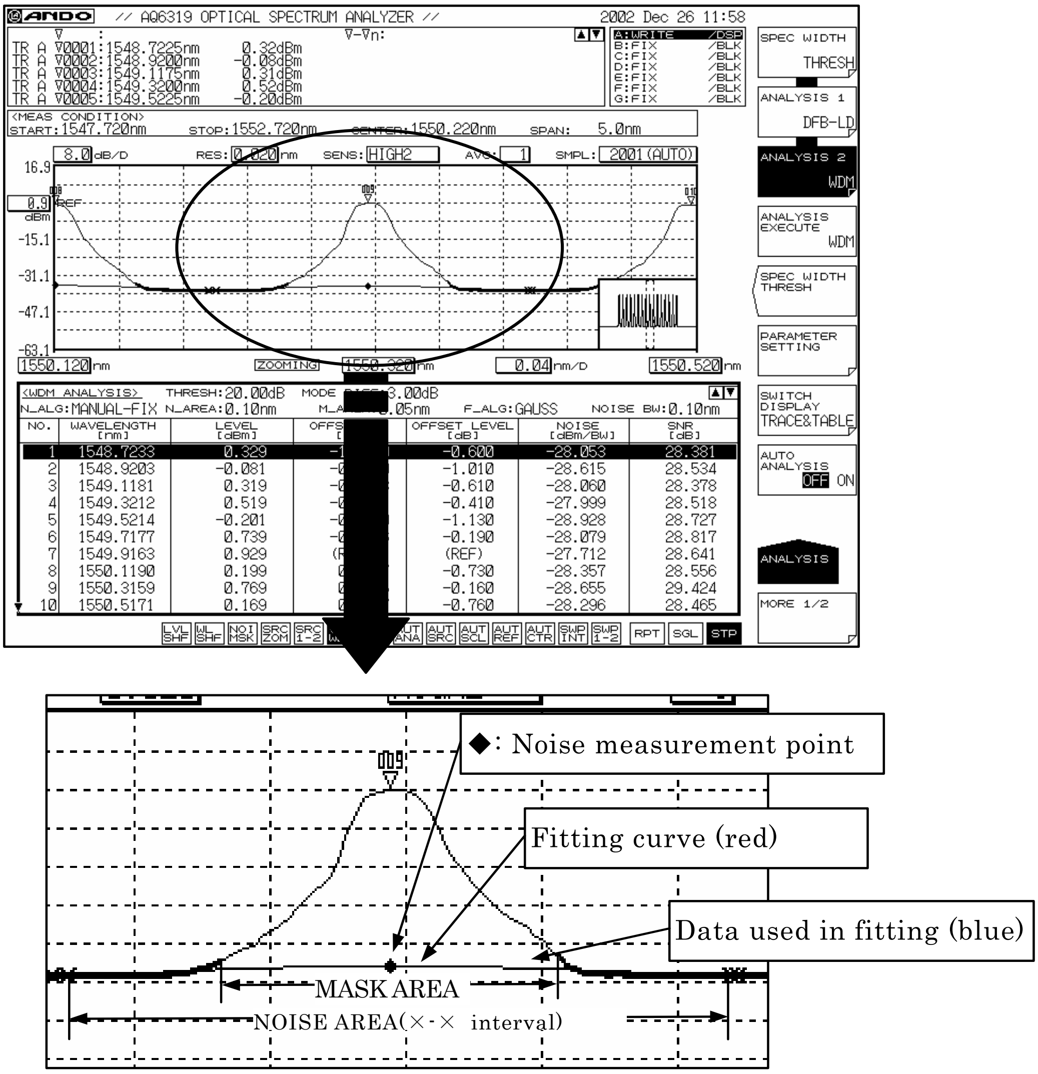


Fig. 5-29 Screen when "POINT DISPLAY" is ON

NOTE

- When set to ON, the following data are displayed on the waveform screen:
  - ✓ Both ends of noise area: Indicated by × (fitting done in × to × interval)
  - ✓ Data range used in fitting: Shown in blue
  - ✓ Fitting curve: Curve is shown in red.
  - ✓ Noise measurement points: Indicated by ◆.
- When set to OFF, only the fitting curve is displayed.

5.3.9 Optical Amp Gain and NF Analysis

- Overview

  An optical amp’s gain and noise figure (NF) can be analyzed using the unit. Analysis is done on multiple WDM channels in a single operation. Analysis is performed after measuring the waveform of the signal light going into the amp, as well as the waveform of the output light leaving the optical amp.

- Measurement system

  In order to measure an optical amp’s gain and NF, it is necessary to measure the waveform of the signal light going into the optical amp, as well as the waveform of the output light leaving the optical amp. Figs. 5-30 and 5-31 show examples of a measurement system.

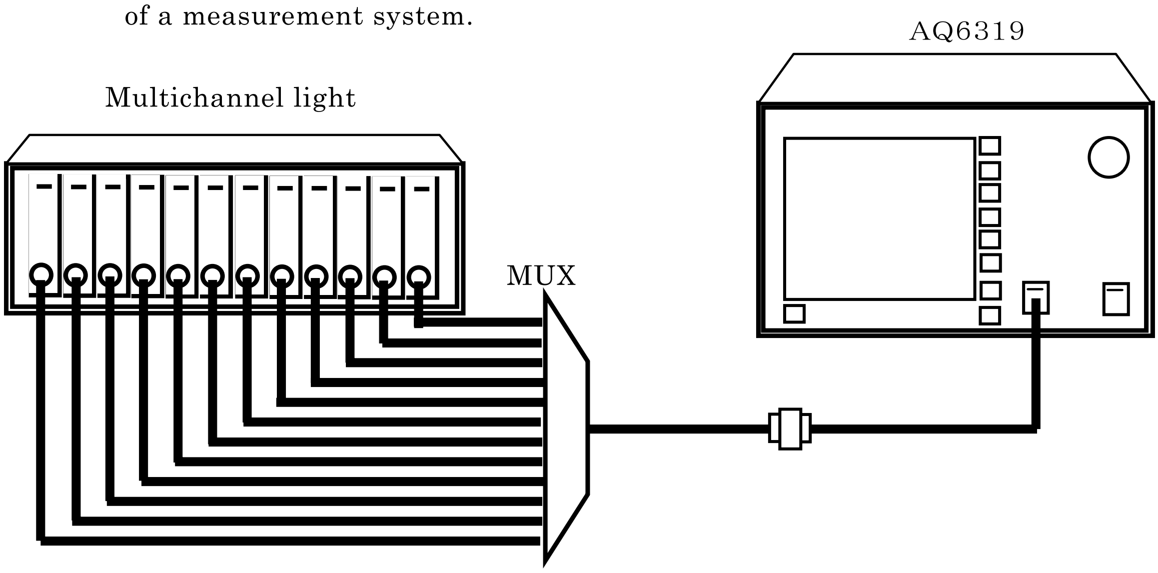


Fig. 5-30 Optical amp analysis (signal light measurement)

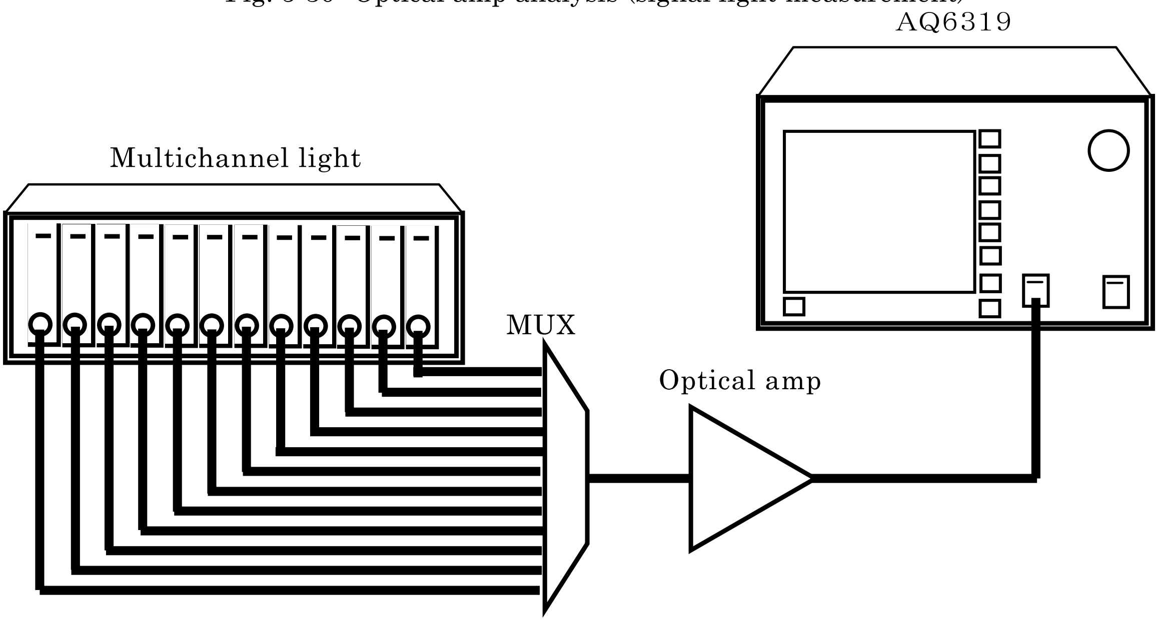


Fig. 5-31 Optical amp analysis (output light measurement)

- Execution procedure

The optical amp gain and NF analysis procedure is described below. The procedure consists of the following three main steps:

STEP 1 Measure signal light going into optical amp (trace A)
STEP 2 Measure output light from optical amp (trace B)
STEP 3 Execute analysis function

STEP 1 Measure signal light going into optical amp

Measure the waveform of the signal light input to the optical amp on trace A.

① Input, to the unit, the signal light going into the optical amp. (Fig. 5-30)

② Set trace A as the active trace.

- Press the [TRACE] switch and set the <ACTIVE TRACE> key to “A”.
- Set the trace A <VIEW> key to DISP.
- Press the <WRITE A> key to set trace A to write mode.

③ Measure the signal light waveform according to measurement conditions matching the signal light waveform.
(☛ See section 5.2 Basic Measurements)

④ Press the [TRACE] switch <FIX A> key to set trace A to fix mode. (If all traces from trace A to trace G have been set to fix mode (FIX) as a result of this action, a warning is displayed. However, this does not pose a problem because trace B is set to write mode in the next step.)

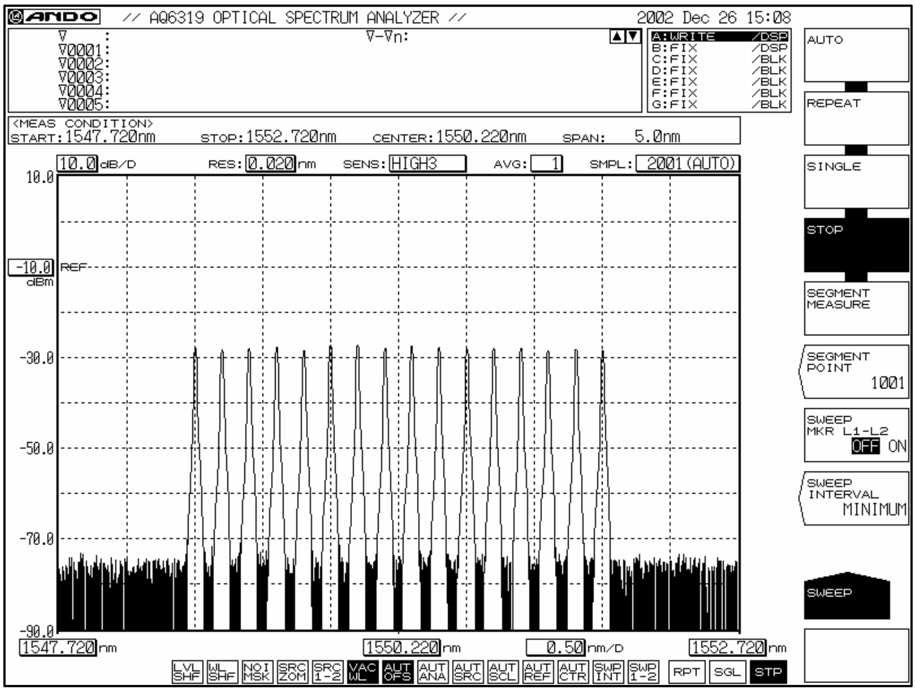


Fig. 5-32 Signal light waveform measurement screen

STEP 2 Measure output light from optical amp

Measure the waveform of the output light from the optical amp on trace B.

① Input, to the unit, the output light from the optical amp. (Fig. 5-31)

② Set trace B as the active trace.

- Press the [TRACE] switch and set the <ACTIVE TRACE> key to "B".
- Set the trace B <VIEW> key to DISP.
- Press the <WRITE B> key to set trace B to write mode.

③ Perform sweeping and measure the output light waveform while maintaining the measurement conditions used during signal light measurement.

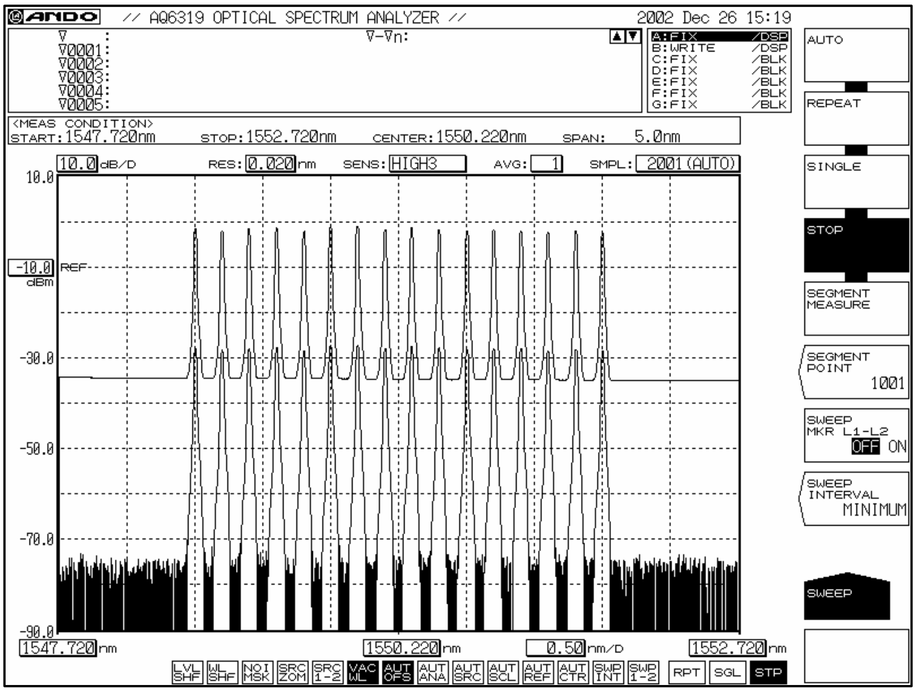


Fig. 5-33 Waveform screen after input signal measurement

STEP 3 **Execute analysis function**

① Press the [ANALYSIS] switch and select the <ANALYSIS2> key.

② Press the <EDFA-NF> key.
Analysis is performed using the defaults or the previously set parameters, and the results are displayed on the screen.

③ To change the analysis parameters, press the <PARAMETER SETTING> key and enter the settings on the parameter settings screen.

④ After you have set the analysis parameters, press the <CLOSE WINDOW> key to close the parameter settings screen.

⑤ When you press the <ANALYSIS EXECUTE> key, analysis is performed based on the changed parameters, and the analysis results are displayed on the screen.

- Parameter setting procedure

  The NF analysis function parameters may be broadly divided into the two types shown below. Parameter settings may be changed as desired according to the details of the particular analysis. See Chapter 8 for details on the parameters.

  (☛ See subsection 8.5.2 EDFA NF Analysis Function)

  A Parameters related to channel detection (CHANNEL DETECTION SETTING)

  B Parameters related to ASE level measurement (INTERPOLATION SETTING)

A Parameter settings related to channel detection

These parameters are used to set threshold level and the like for WDM channel detection.

- "THRESH"

  This parameter is used to set the threshold level for channel detection. This setting determines how far down in decibels from the peak level to detect a mode peak as a channel.

- "MODE DIFF"

  This parameter sets the minimum value for the peak/bottom difference during channel peak detection. If the waveform peak/bottom difference equals or exceeds this value, it is detected as a mode peak.

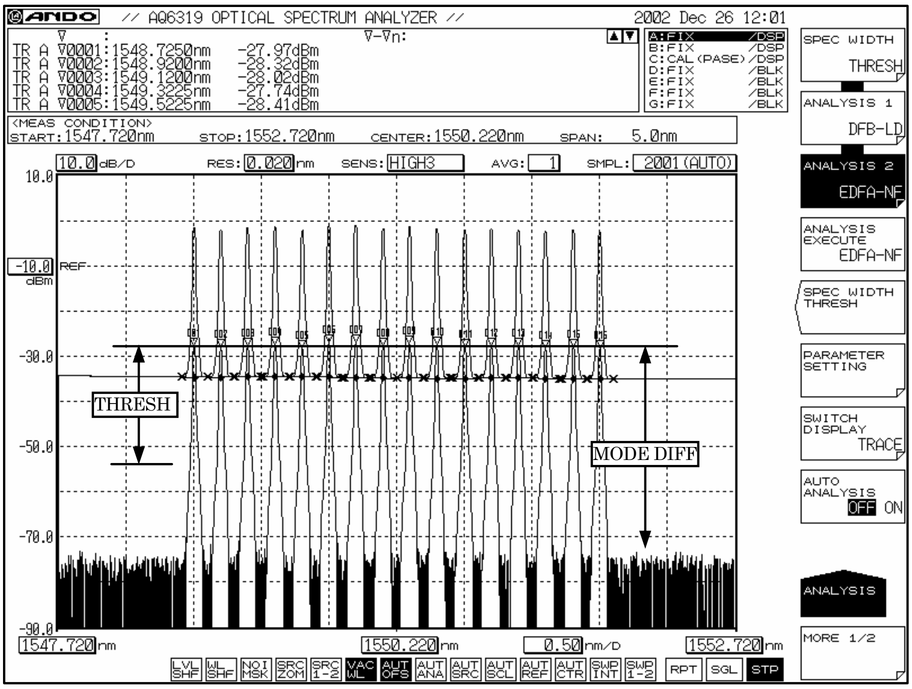


Fig. 5-34 Channel detection parameters

B Parameter settings related to ASE level measurement

These parameters are used to set the waveform level, offset, and interpolation method for ASE level measurement.

- "OFFSET(IN)"
  A level offset can be set on a signal light waveform (trace A). Set "0.00" if a level offset is not needed.

- "OFFSET(OUT)"
  A level offset can be set on an output light waveform (trace B). Set "0.00" if a level offset is not needed.

- "ASE ALGO"
  Select one of the four algorithms shown below for measuring the ASE level. If AUTO-FIX or AUTO-CTR is set, the measurement parameters at another ASE level are set automatically. To set the values manually, select MANUAL-FIX or MANUAL-CTR. (☛ See subsection 8.5.2 EDFA-NF Analysis Function)
  - ✓ AUTO-FIX Automatic measurement (FIX type)
  - ✓ MANUAL-FIX Manual measurement (FIX type)
  - ✓ AUTO-CTR Automatic measurement (CENTER type)
  - ✓ MANUAL-CTR Manual measurement (CENTER type)

NOTE

- If "AUTO-FIX" or "AUTO-CTR" is selected, the "FITTING AREA" and "MASK AREA" parameters are set automatically according to the measured waveform. In addition, "FITTING ALGO" is set to LINEAR. For details on the parameters, see subsection 8.5.2 EDFA-NF Analysis Function.

- "FITTING ALGO"
  This parameter is used to select the interpolation algorithm for determining the ASE level. This parameter is only set when "ASE ALGO" is set to MANUAL-FIX or MANUAL-CTR. (☛ See Table 5-10 Description of Fitting Algorithms)

Table 5-10 Description of Interpolation Algorithms

Fitting algorithm	Description
LINER	Linear interpolation
GAUSS	Normal distribution curve
LORENZ	Lorenz curve
3RD POLY	3rd poly
4TH POLY	4^{th} poly
5TH POLY	5^{th} poly

NOTE

- If "ASE ALGO" is AUTO-FIX or AUTO-CTR, then "FITTING ALGO" is automatically set to LINEAR and does not need to be set manually.

- "FITTING AREA"

  This parameter is used to set the range of waveform data to be used in determining the ASE level through interpolation. This parameter is only set when "ASE ALGO" is set to MANUAL-FIX.
- "MASK AREA"

  This parameter is used to set the range of signal light to be masked when determining the ASE level through interpolation. This parameter is only set when "FITTING ALGO" is not set to LINEAR.
- "POINT DISPLAY"

  This parameter is used to display the range of data used in interpolation for determining the noise level.

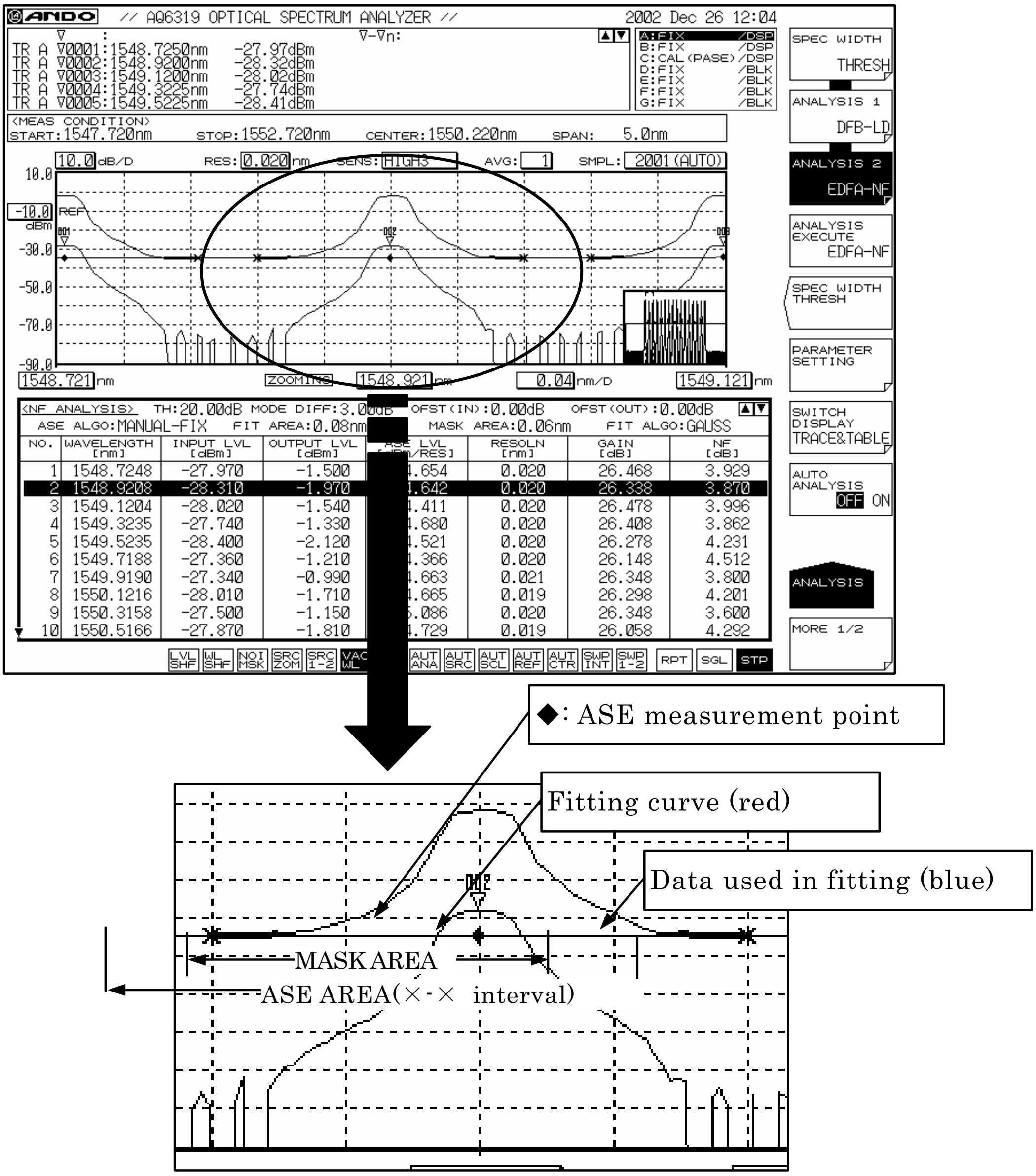


Fig. 5-35 Screen when "POINT DISPLAY" is ON

5.3.10 WDM Optical Filter Characteristics Measurement

- Overview

  Parameters such as the WDM optical filter pass band width and crosstalk can be measured using the unit.

- Measurement system

  Input light from a wideband light source to the WDM optical filter, then measure the characteristics of the WDM optical filter from the waveform of the output light. First it is necessary to measure the waveform of the wideband light source as a reference waveform, then subtract the WDM optical filter's output light from the reference waveform to remove the light source's spectrum. Fig. 5-36 shows an example of a measurement system.

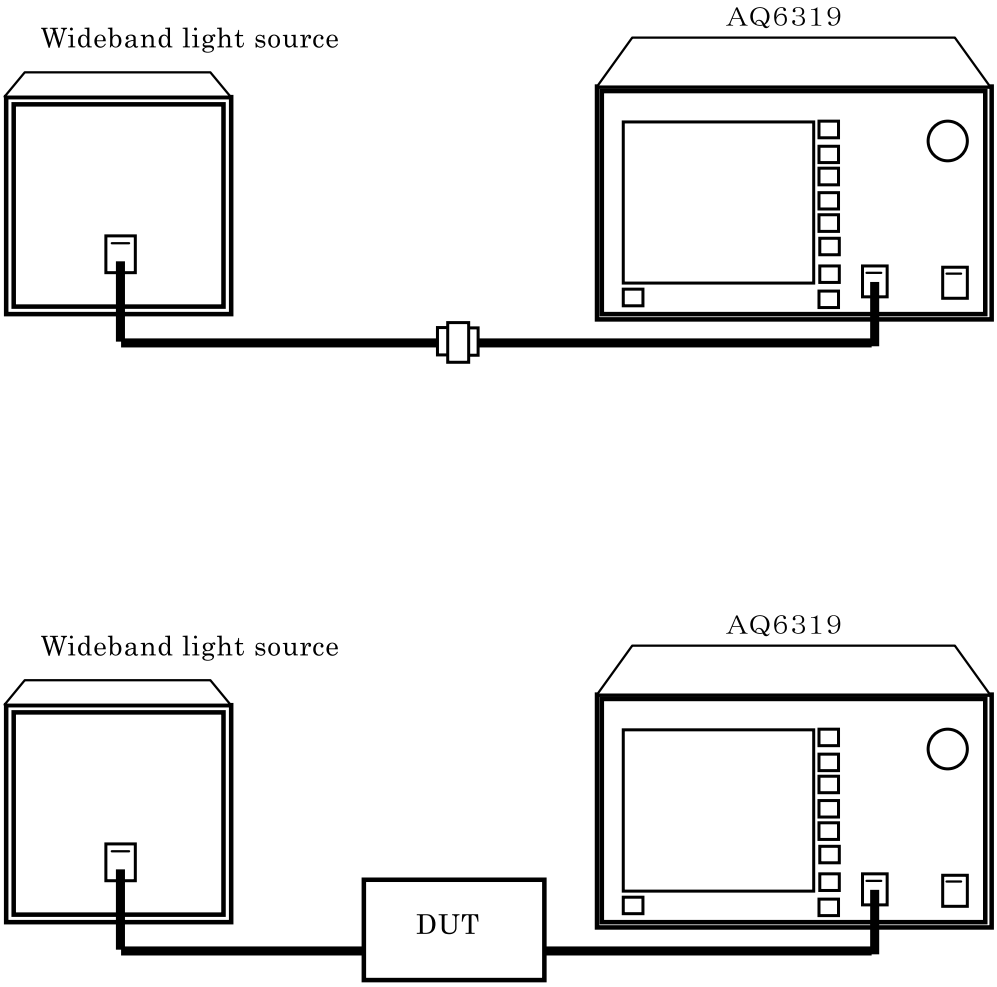


Fig. 5-36 Optical filter measurement system

- Measurement procedure

In this discussion, the <WDM FIL-PK> analysis function is used as an example of a function for measuring WDM optical filter characteristics. (If the WDM optical filter being measured is a notch-type filter as opposed to a pass-type filter, use the <WDM FIL-BTM> function.)

The procedure for measuring WDM optical filter characteristics is described below. The procedure consists of the following four main steps:

5

STEP 1	Measure light (reference light) from the wideband light source (trace A)
STEP 2	Measure output light from the WDM optical filter (trace B)
STEP 3	Execute subtraction calculation between traces
STEP 4	Execute analysis function

STEP 1 Measure wideband light source waveform (reference waveform)

Measure the waveform from the wideband light source (reference light) on trace A.

① Input the reference light to the unit. (Fig. 5-35)

② Set trace A as the active trace.

・ Press the [TRACE] switch and set the <ACTIVE TRACE> key to "A".

・ Set the trace A <VIEW> key to DISP.

・ Press the <WRITE A> key to set trace A to write mode.

③ Measure the reference light waveform based on the measurement conditions matching the reference light waveform.
(☛ See section 5.2 Basic Measurements)

④ Press the [TRACE] switch <FIX A> key to set trace A to fix mode. (If all traces from trace A to trace G have been set to fix mode (FIX) as a result of this action, a warning is displayed. However, this does not pose a problem because trace B is set to write mode in the next step.)

STEP 2 Measure output light from WDM optical filter

Measure the waveform of the output light from the WDM optical filter on trace B.

① Input the reference light to the WDM optical filter, and input the output light from the WDM optical filter to the unit. (Fig. 5-35)

② Set trace B as the active trace.

・Press the [TRACE] switch and set the <ACTIVE TRACE> key to "B".

・Set the trace B <VIEW> key to DISP.

・Press the <WRITE B> key to set trace B to write mode.

③ Perform sweeping and measure the output light waveform while maintaining the measurement conditions used during reference light measurement.

STEP 3 Execute subtraction between traces (trace C)

Subtract the reference light waveform from the WDM optical filter's output light waveform to obtain the WDM filter's characteristic waveform.

① Set trace C as the active trace.

- Press the [TRACE] switch and set the <ACTIVE TRACE> key to "C".
- Set the trace C <VIEW> key to DISP.

② Set trace C to subtraction mode.

- Press the <CALCULATE C> key.
- Use the soft keys to set the calculation equation.
- Press the <LOG MATH> key, then select the <C=A-B(LOG)> key.

③ When you select the calculation equation, the waveform which is obtained by subtracting the trace B waveform from the trace A waveform is displayed on trace C.

STEP 4 Execute analysis function

① Press the [ANALYSIS] switch and select the <ANALYSIS2> key.

② Press the <WDM FIL-PK> key.
Analysis is performed using the defaults or the previously set parameters, and the results are displayed on the screen.

③ To change the analysis parameters, press the <PARAMETER SETTING> key and enter the settings on the parameter settings screen.

④ After you have set the analysis parameters, press the <CLOSE WINDOW> key to close the parameter settings screen.

⑤ When you press the <ANALYSIS EXECUTE> key, analysis is performed based on the changed parameters, and the analysis results are displayed on the screen.

- Parameter setting procedure

The WDM FIL-PK analysis function parameters may be broadly divided into the two types shown below. Parameter settings may be changed as desired according to the details of the particular analysis. See Chapter 8 for details on the parameters.
(☛ See subsection 8.5.5 WDM FILTER-PEAK Analysis Function)

A Parameters related to channel detection
B Parameter settings for each analysis item

A Parameter settings related to channel detection

These parameters are used to set algorithms and threshold level for WDM channel detection.

- "ALGO"

Depending on the selected algorithm, select one of the following four algorithms for WDM channel detection and reference wavelength analysis on each channel.

✓ PEAK
✓ MEAN
✓ GRID FIT
✓ GRID

- "THRESH"

This parameter is used to set the threshold level for channel detection.

- "MODE DIFF"

This parameter sets the minimum value for the peak/bottom difference during channel peak detection.

- "TEST BAND"

This parameter is used to set the bandwidth for reference wavelength analysis.

The channel detection and reference wavelength analysis results for each channel vary depending on the algorithm selected in the “ALGO” parameter.

(1) When "ALGO" is PEAK

Each mode peak is detected as a channel. The peak wavelength of each channel is the reference wavelength.

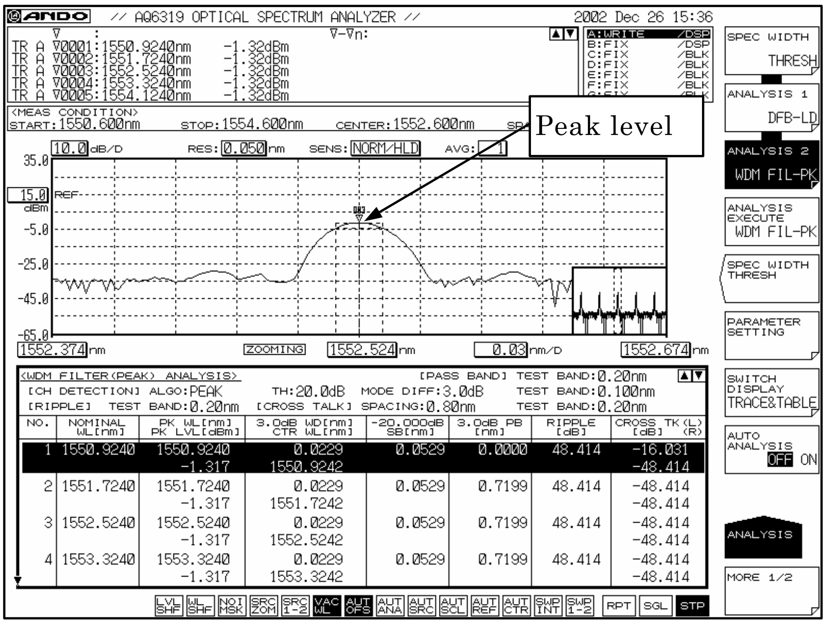


Fig. 5-37 Channel detection when "ALGO" is PEAK

(2) When "ALGO" is MEAN

Each mode peak is detected as a channel. The 3dB center wavelength of each channel is the reference wavelength.

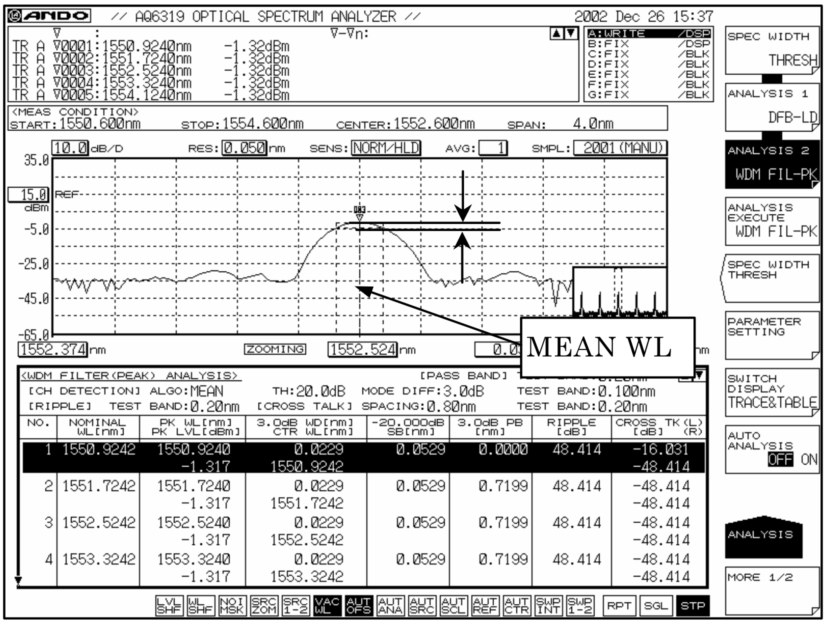


Fig. 5-38 Channel detection when "ALGO" is MEAN

(3) When "ALGO" is GRID FIT

The mode peaks matching the GRID table wavelengths are recognized as channels. The wavelength of the peak detected within GRID WL ± (TEST BAND/2) is set as the reference wavelength.

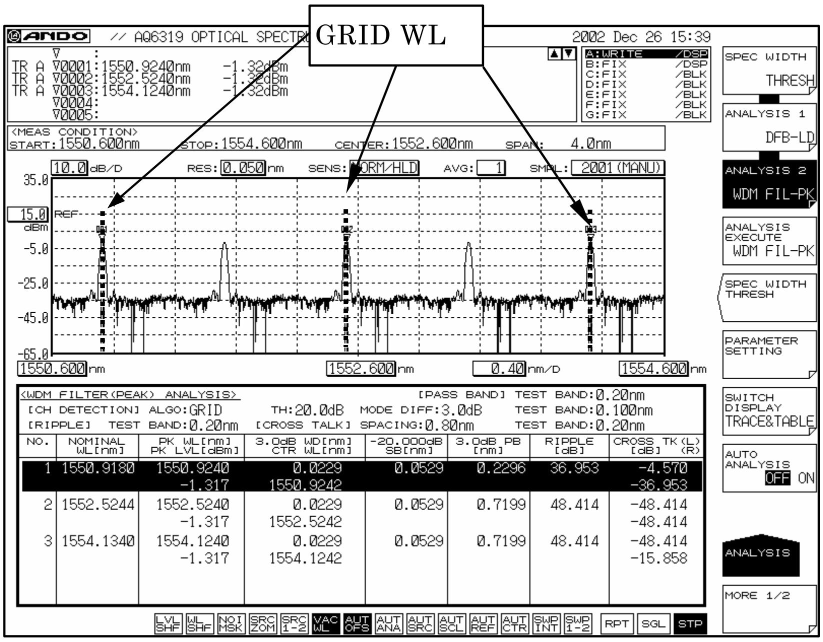


Fig. 5-39 Channel detection when "ALGO" is GRID FIT

(4) When "ALGO" is GRID

The wavelengths registered in the GRID table wavelength are recognized as channels. GRID WL is set as the reference wavelength.

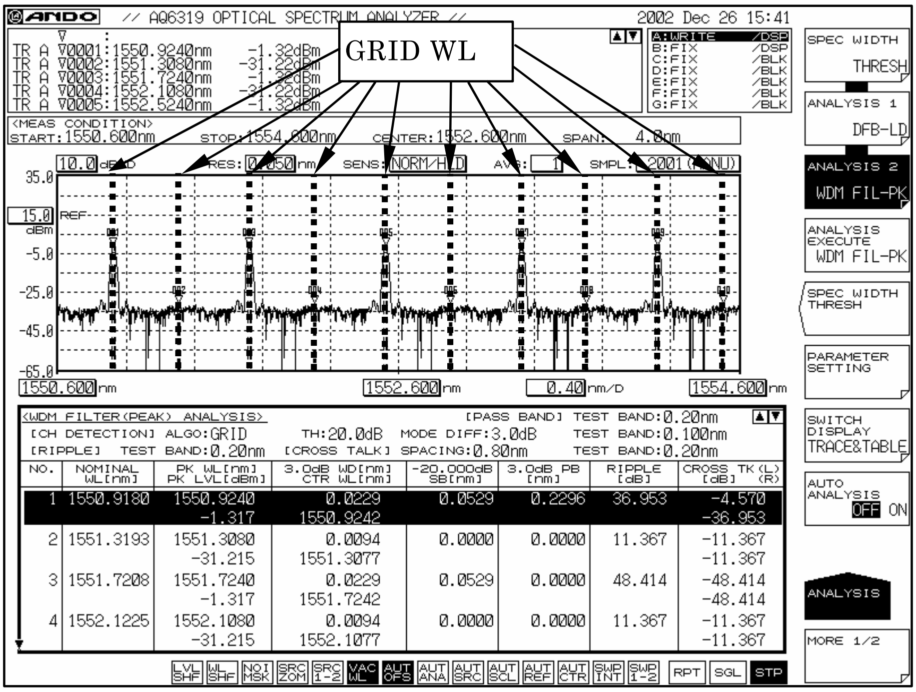


Fig. 5-40 Channel detection when "ALGO" is GRID

B Parameter settings for each analysis item

These parameters are set for each WDM optical filter analysis item.
See Chapter 8 for details on the parameters.
(☛See subsection 8.5.5 WDM FILTER-PEAK Analysis Function)

Chapter6 Function switches and soft keys

6.1 Overview

The various setting functions in the AQ6319 are organized in function switches for efficient, accurate measurement. There are 17 function switches in the function section, and 2 more ([COPY] and [FEED]) at the bottom part of the front center.
When you press a function switch, the soft key menu (inside the screen) located on the right side of the screen changes. Depending on the particular function, the soft key menu changes in a variety of ways. For example, it may have a tree structure, ask for numerical value inputs, or require you to make selections.
The soft key menus are designed to provide a certain level of understanding of the switch functions, with the individual soft key menus having particular shapes which make them easy to understand.

6.1.1 Description of Soft Keys

The soft keys have five different shapes shown below, depending on the function.

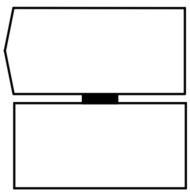
This is the shape of ordinary soft keys. When you press a key with this shape, the function is executed immediately.

This is the shape of a soft key which has another menu tree. This shape indicates that information related to the menu item is located on the next tree. When you press a key with this shape, the soft key at the next tree is displayed.

This is the shape of a soft key with an interrupt display area. This shape indicates that the soft key has an interrupt function such as numerical value input. When you press a key with this shape, the interrupt display area is displayed on the screen and enables entry of a parameter, etc.

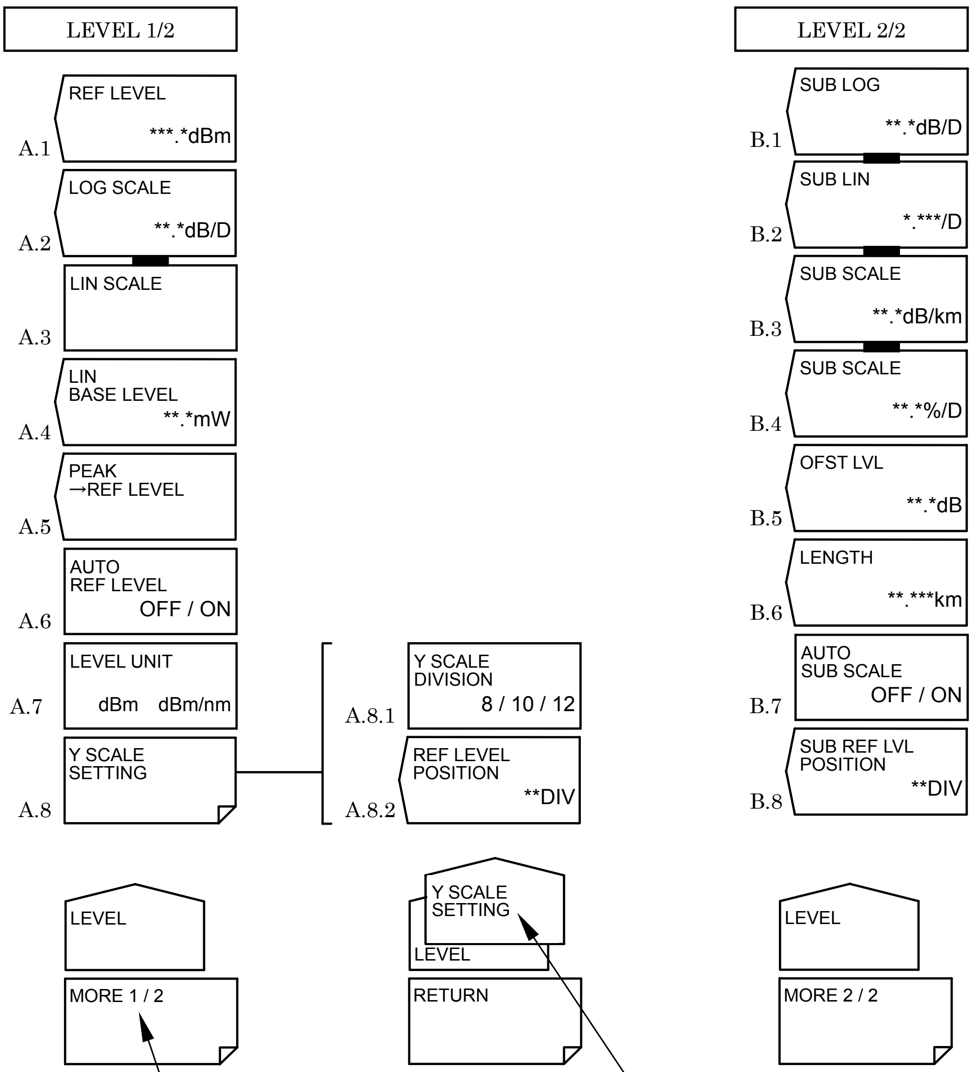
This is the shape of a soft key which provides an interrupt display while moving to the next tree. This shape indicates that information related to the menu item is located on the next tree, and that the soft key has an interrupt function such as numerical value input.

This is the shape of a soft key which goes back to the previous tree. When you press a key with this shape, you go back to the soft key of the previous tree.



A black band connecting soft keys together indicates that you should press any one of the connected soft keys. Black bands may connect numerous soft keys together. The selected soft key is highlighted.

Example [LEVEL]



The [LEVEL] switch soft key menu is split into two parts. This key switches between the menu parts. In addition, in some cases this may change to a function which, for example, closes the window.
In the example, when the [MORE 1/2] key is pressed, the menu changes to the [LEVEL] 2/2 soft key menu, and the key display changes to [MORE 2/2].

This indicates the tree of the soft key menu. In the example, it indicates that the soft key menu is located under the Y SCALE SETTING level. (This is not a key; it is simply displayed.)

In the example, each soft key menu has a number, such as A.1 or B.2. These numbers are not shown on the actual screen. They are simply used here as key numbers in describing the actions on the soft key menus in this manual.

The letters appearing in the example on the preceding page show how the soft key menu is divided.

The letters assigned to the soft key menus here have the following meanings.

A	Represents the first soft key to appear when a function key is pressed.
B	Represents the <MORE 2/@>(@≥2) soft key of a function key.
C	Represents the <MORE 3/@>(@≥3) soft key of a function key.
D	Represents the <MORE 4/@>(@≥4) soft key of a function key.

The numbers indicate the position of a soft key from the top of the unit screen.

Example

A.8.1

Y SCALE DIVISION 8 / 10 / 12

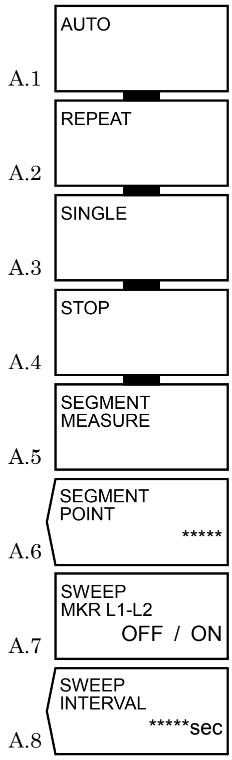
In the example, the soft key is the eighth key from the top of the function key <MORE 1/@>(@≥2), and is the soft key at the very top of the tree under that level (the <MORE 1/@>(@≥2) level).

NOTE

- In cases where a soft key is missing partway through a sequence, the corresponding key number is missing.

6-2 SWEEP

The [SWEEP] switch contains functions related to sweeping. When you press the [SWEEP] switch, the following soft key menu is displayed.



A.1 <AUTO>

This key automatically sets the optimal measurement conditions for the light source being measured. When you press the <AUTO> key, the soft key display is highlighted and the optimal measurement conditions (center wavelength, span, reference level, resolution) for measuring the input light source are set.
After optimization is completed, the highlight moves to the <REPEAT> key and repeat sweeping is performed. If optimization is not possible, sweeping is stopped and the following warning message is displayed.

WARNING: 109
Auto sweep failed

During the automatic setting process, only the following keys are enabled: <REPEAT>, <SINGLE>, <STOP>, <UNDO/LOCAL>.
(The <UNDO/LOCAL> key is only enabled during remote control.)

A.2 <REPEAT>

This key is used to perform repeat sweeping. When you press this key, the soft key is highlighted and repeat sweeping starts.

A.3 <SINGLE>

This key is used to perform a single sweep. When you press this key, the soft key is highlighted and a single sweep starts.

A.4 <STOP>

This key is used to stop sweeping.

A.5 <SEGMENT MEASURE>

This key is used to measure just the number of sampling points set using the <SEGMENT POINT> key, with the current stopped position serving as the sweeping start position.

A.6 <SEGMENT POINT>

This key is used to set the number of sampling points for performing <SEGMENT MEASURE>. When you press this key, the current number of sampling points is displayed in the interrupt display area. The number of sampling points can be set in the range of 1 to 50,001 in the DATA ENTRY section. When the setting value of SEGEMENT POINT is larger than the value which deducted points in this time from measurement sampling points , it measures to the last sampling points.

A.7 <SWEEP MKR L1-L2>

This key is used to set a function which limits the sweeping range during a sweep to the space between line markers (line marker sweeping function). When the <SWEEP MKR L1-L2> key is set to ON, sweeping is performed only between wavelength line markers 1 and 2 (WL1 and WL2). When the <SWEEP MKR L1-L2> key is set to OFF, sweeping is performed fully between the start and stop wavelength (i.e., A.2, A.3). When the <SWEEP MKR L1-L2> key is set to ON, SWP 1-2 is reverse displayed

NOTE

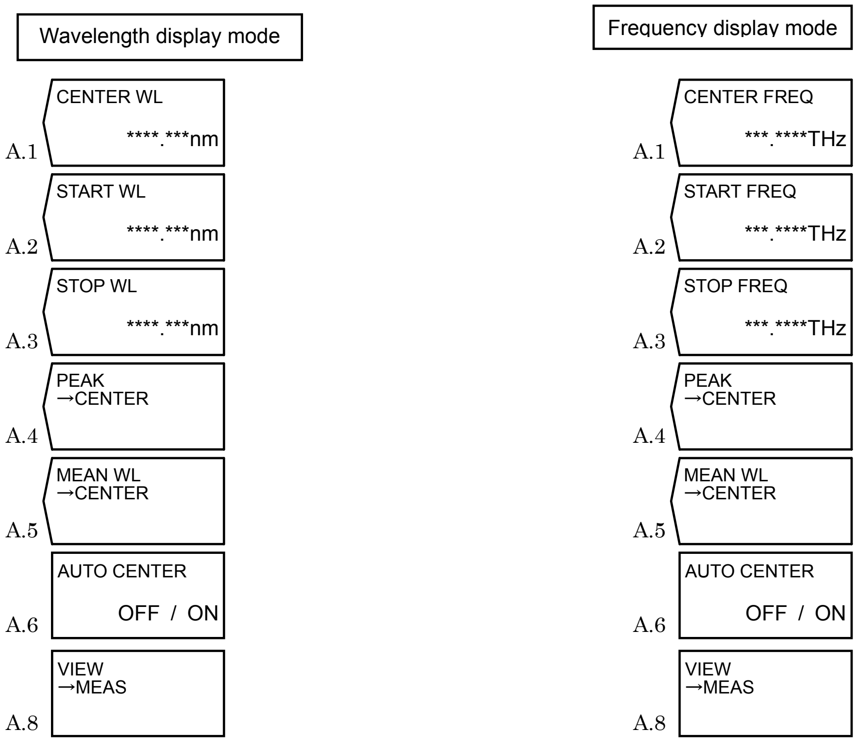
- If both WL1 and WL2 are set, sweeping is performed between line markers 1 and 2.
- If only WL1 is set, sweeping is performed between line marker 1 and the right side of the screen.
- If only WL2 is set, sweeping is performed between the left side of the screen and line marker 2.
- If neither WL1 nor WL2 is set, sweeping is performed from the set start wavelength to the end wavelength.

A.8 <SWEEP INTERVAL>

This key is used to set the time from one sweeping start to the next sweeping start during repeat sweeping. If the time required for sweeping is greater than the set time, the next sweeping is started immediately after sweeping ends. When you press this key, the current set time is displayed in the interrupt display area. The setting range is MINIMUM or 1 to 99,999 seconds, and is set in the DATA ENTRY section. If “0” is entered through the numeric keypad, then MINIMUM is set. If a setting other than MINIMUM is entered, SWP INT is highlighted at the very bottom of the screen.

6-3 CENTER

The [CENTER] switch contains functions related to setting the center wavelength and center frequency for measurements. The soft key functions change depending on whether the screen display mode is wavelength display mode or frequency display mode. When you press the [CENTER] switch, one of the following soft key menus is displayed. (☛ See the B.8 <HORIZON SCALE nm/THz> key of the [SETUP] switch for information on switching between wavelength display mode and frequency display mode.)



Wavelength display mode

A.1 <CENTER WL>

This key is used to set the measurement center wavelength. The setting range is 600.000 to 1700.0000 nm (fine: 0.1 nm steps; coarse: 1 nm steps), and the value is set in the DATA ENTRY section. (Default: 1150.000 nm)

A.2 <START WL>

This key is used to set the measurement start wavelength. When you press this key, the current measurement start wavelength is displayed in the interrupt display area. The setting range is 50.000 to 1700.000 nm (fine: 0.1 nm steps; coarse: 1 nm steps) and the value is set in the DATA ENTRY section. (Default: 600 nm)

A.3 <STOP WL>

This key is used to set the measurement stop wavelength. When you press this key, the current measurement end wavelength is displayed in the interrupt display area. The setting range is 600.000 to 2250.000 nm (fine: 0.1 nm steps; coarse: 1 nm steps) and the value is set in the DATA ENTRY section. (Default: 1700.000 nm)

> **NOTE**
>
> - When the measurement start or measurement stop wavelength is set, the span setting is modified accordingly. In addition, the center wavelength setting is also changed at the same time. If a value outside the setting range is entered, the nearest permitted value is set.

A.4 <PEAK →CENTER>

This key is used to internally search for a peak in the active trace waveform, and set the center wavelength. After execution, the center wavelength set in the interrupt display area is displayed. The center wavelength setting can be set even after the setting is made.

Note: Pressing this key will not change the center wavelength if the waveform is not displayed in the active trace.

A.5 <MEAN WL→CENTER>

This key is used to set the center wavelength as the THRESH 3 dB center wavelength of the active trace measured waveform. The center wavelength can be set even after this setting is made.

Note: Pressing this key will not change the center wavelength if the waveform is not displayed in the active trace.

A.6 <AUTO CENTER OFF / ON>

This key is used to turn OFF/ON the <PEAK →CENTER> function, which is executed for each sweep. When this key is set to ON, the peak is searched in the active trace waveform and set as the center wavelength automatically for each sweep.

Note: This function does not operate if the active trace is not set to WRITE (i.e., if it is set to MAX HOLD, MIN HOLD, CALCULATE, or ROLL AVG).

When this key is highlighted (selected), $\boxed{\text{AUT CTR}}$ is displayed at the very bottom of the screen.

A.8 <VIEW→MEAS>

This key is used to set the currently set ZOOM scale (ZOOM CENTER, ZOOM SPAN, ZOOM START, ZOOM STOP) as the measurement scale (CENTER, START, STOP, SPAN). When you press this key, the current waveform display scale is set as the measurement scale for the next sweep.

Frequency display mode

A.1 <CENTER FREQ>

This key is used to set the measurement center frequency. The setting range is 176.5000 to 500.0000 THz (fine: 0.01 THz steps; coarse: 0.1 THz steps), and the value is set in the DATA ENTRY section. (Default: 338.0013 THz)

A.2 <START FREQ>

This key is used to set the measurement start frequency. When you press this key, the current measurement start frequency is displayed in the interrupt display area. The setting range is 11.5000 to 500.0000 THz (fine: 0.01 THz steps; coarse: 0.1 THz steps), and the value is set in the DATA ENTRY section. (Default: 176.3485 THz)

A.3 <STOP FREQ>

This key is used to set the measurement stop frequency. When you press this key, the current measurement stop frequency is displayed in the interrupt display area. The setting range is 176.5000 to 665.0000 THz (fine: 0.1 THz steps; coarse: 1 THz steps), and the value is set in the DATA ENTRY section. (Default: 499.6541 THz)

NOTE

- When the measurement start or measurement stop frequency is set, the span setting is modified accordingly.

A.4 <PEAK →CENTER>

This key is used to internally search for a peak in the active trace waveform, and set the center frequency. After execution, the center frequency set in the interrupt display area is displayed. At this time, the settings for the center frequency, measurement start frequency, and measurement end frequency are changed. The center frequency can be set even after the setting is made.

Note: Pressing this key will not change the center frequency if the waveform is not displayed in the active trace.

A.5 <MEAN WL →CENTER >

This key is used to set the center frequency as the THRESH 3 dB center frequency of the active trace measured waveform. At this time, the settings for the center frequency, measurement start frequency, and measurement stop frequency are changed. The center frequency can be set even after this setting is made.

Note: Pressing this key will not change the center frequency if the waveform is not displayed in the active trace.

A.6 <AUTO CENTER OFF / ON>

This key is used to turn OFF/ON the <PEAK →CENTER> function, which is executed for each sweep. When this key is set to ON, the peak is searched in the active trace waveform and set as the center frequency automatically for each sweep.

Note: This function does not operate if the active trace is not set to WRITE (i.e., if it is set to MAX HOLD, MIN HOLD, CALCULATE, or ROLL AVG).

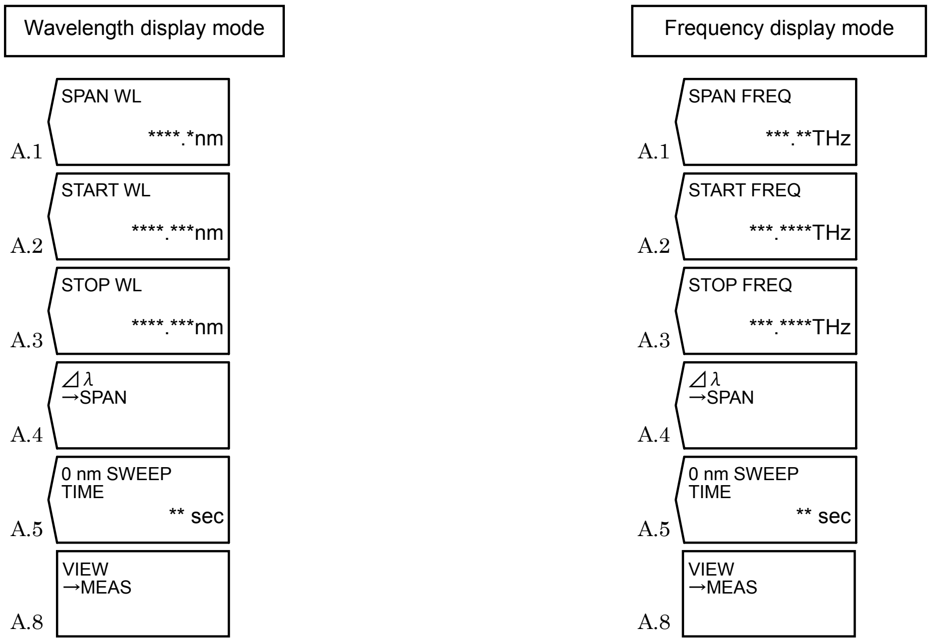
When this key is highlighted (selected), AUT CTR is displayed at the very bottom of the screen.

A.8 <VIEW→MEAS>

This key is used to set the currently set ZOOM scale (ZOOM CENTER, ZOOM SPAN, ZOOM START, ZOOM STOP) as the measurement scale (CENTER, START, STOP, SPAN). When you press this key, the current waveform display scale is set as the measurement scale for the next sweep.

6-4 SPAN

The [SPAN] switch contains functions pertaining to settings for the wavelength span or frequency span being measured. The soft key functions change according to whether the screen display mode is wavelength display mode or frequency display mode.
When you press the [SPAN] switch, the following soft key menu is displayed.
(☛See the B.8 <HORIZON SCALE nm/THz> key of the [SETUP] switch of information on switching between wavelength display mode and frequency display mode.)



Wavelength display mode

A.1 <SPAN WL>

This key is used to set the measurement span.
The allowed settings are 0 and the range of 0.1 to 1100.0 nm (fine: 0.1 nm steps; coarse: steps of 1, 2, or 5 nm), and the value is set in the DATA ENTRY section. (Default: 1100.00 nm)
When the span setting is changed, the measurement start wavelength and measurement stop wavelength settings also change at the same time.

A.2 <START WL>

This key is used to set the measurement start wavelength.
When you press this key, the current measurement start wavelength is displayed in the interrupt display area.
The setting range is 50.000 to 1700.000 nm (fine: 0.1 nm steps; coarse: 1 nm steps), and the value is set in the DATA ENTRY section. (Default: 600.000 nm)

A.3 <STOP WL>

This key is used to set the end wavelength for the measured waveform.
When you press this key, the current measurement stop wavelength is displayed in the interrupt display area.
The setting range is 600.000 to 2250.000 nm (fine: 0.1 nm steps; coarse: 1 nm steps), and the value is set in the DATA ENTRY section. (Default: 1700.000 nm)

NOTE

- When the measurement start or measurement stop wavelength is set, the span setting is modified accordingl. In addition, the center wavelength setting is also changed at the same time. If a value outside the setting range is entered, the nearest permitted value is set.

A.4 < Δ λ→SPAN>

This key is used to set the measurement span to the active trace measured waveform's THRESH 3 dB width × 2.
The span can be set using the DATA ENTRY section even after this setting is made. When this key is executed, the center frequency, span, measurement start wavelength, and measurement stop wavelength are changed.

A.5 <0 nm SWEEP TIME>

This key sets the time required to measure from the left edge to the right edge of the screen during sweeping with a span of 0 nm. The number of sampling points is set to 1001 points during this process.
The allowed settings are MINIMUM and the range of 1 to 50 sec (fine: 1 sec steps; coarse: steps of 1, 2, or 5 sec), and the value is set in the DATA ENTRY section. (Default: MINIMUM)
If "0" is entered in the DATA ENTRY section, "MINIMUM" is shown on the display.
In addition, the sweeping time varies depending on the measurement sensitivity (<SENS/MODE> key in [SETUP] switch). If the setting for this key is less than the sweeping time for each sensitivity, the setting for the key is invalid and the MINIMUM setting is used.

A.8 <VIEW→MEAS>

This key is used to set the currently set ZOOM scale (ZOOM CENTER, ZOOM SPAN, ZOOM START, ZOOM STOP) as the measurement scale (CENTER, START, STOP, SPAN).
When you press this key, the current waveform display scale is set as the measurement scale for the next sweep.

> **NOTE**
>
> **"UNCAL" Mark**
>
> - If the resolution is set too low for the sampling interval (which is determined by the span and the sampling number), data may be lost. Therefore, the unit displays an "UNCAL" mark in the resolution display area on the waveform box if the settings for span, the sampling number, and the resolution are inappropriate. When "UNCAL" is displayed, normal measurement is not possible, so either reduce the span or increase the sampling number or the resolution so that "UNCAL" is no longer displayed. If the sampling number is set for automatic setup using the <SAMPLING AUTO> key in the [SETUP] switch, then the optimal sampling number for the span and resolution settings will be set automatically.

Frequency display mode

A.1 <SPAN FREQ>

This key is used to set the span of the measured waveform.
The allowed settings are 0 and the range of 0.01 to 330.000 THz (fine: 0.1 THz steps; coarse: steps of 1, 2, or 5 THz), and the value is set in the DATA ENTRY section. (Default: 323.31 THz)
The setting for the measurement start or measurement stop frequency is changed at the same time.

A.2 <START FREQ>

This key is used to set the start frequency for the measured waveform.
When you press this key, the current measurement frequency is displayed in the interrupt display area.
The setting range is 11.5000 to 500.000 THz (fine: 0.01 THz steps; coarse: 0.1 THz steps), and the value is set in the DATA ENTRY section. (Default: 176.3485 THz)

A.3 <STOP FREQ>

This key is used to set the stop frequency for the measured waveform.
When you press this key, the current measurement stop frequency is displayed in the interrupt display area.
The setting range is 176.5000 to 665.0000 THz (fine: 0.01 THz steps; coarse: 0.1 THz steps), and the value is set in the DATA ENTRY section. (Default: 499.6541 THz)

> **NOTE**
>
> - When the measurement start or measurement stop frequency is set, the span setting is modified accordingly. In addition, the center wavelength setting is also changed at the same time. If a value outside the setting range is entered, the nearest permitted value is set.

A.4 <Δλ→SPAN>

This key is used to set the measurement span to the active trace measured waveform's THRESH 3 dB width × 2.
The span can be set using the DATA ENTRY section even after this setting is made. The allowed settings are 0 and the range of 0.01 to 330.000 THz (fine: 0.1 THz steps; coarse: steps of 1, 2, or 5 THz).
When this key is executed, the center frequency, span, measurement start frequency, and measurement stop frequency are changed.

A.5 <0 nm SWEEP TIME>

This key sets the time required to measure from the left edge to the right edge of the screen during sweeping with a span of 0 nm. The number of sampling points is set to 1001 points during this process.
The allowed settings are MINIMUM and the range of 1 to 50 sec (fine: 0.1 sec steps; coarse: steps of 1, 2, or 5 sec), and the value is set in the DATA ENTRY section. (Default: MINIMUM)
If "0" is entered in the DATA ENTRY section, "MINIMUM" is shown on the display.
In addition, the sweeping time varies depending on the measurement sensitivity (<SENS/MODE> key in [SETUP] switch). If the setting for this key is less than the sweeping time for each sensitivity, the setting for the key is invalid and the MINIMUM setting is used.

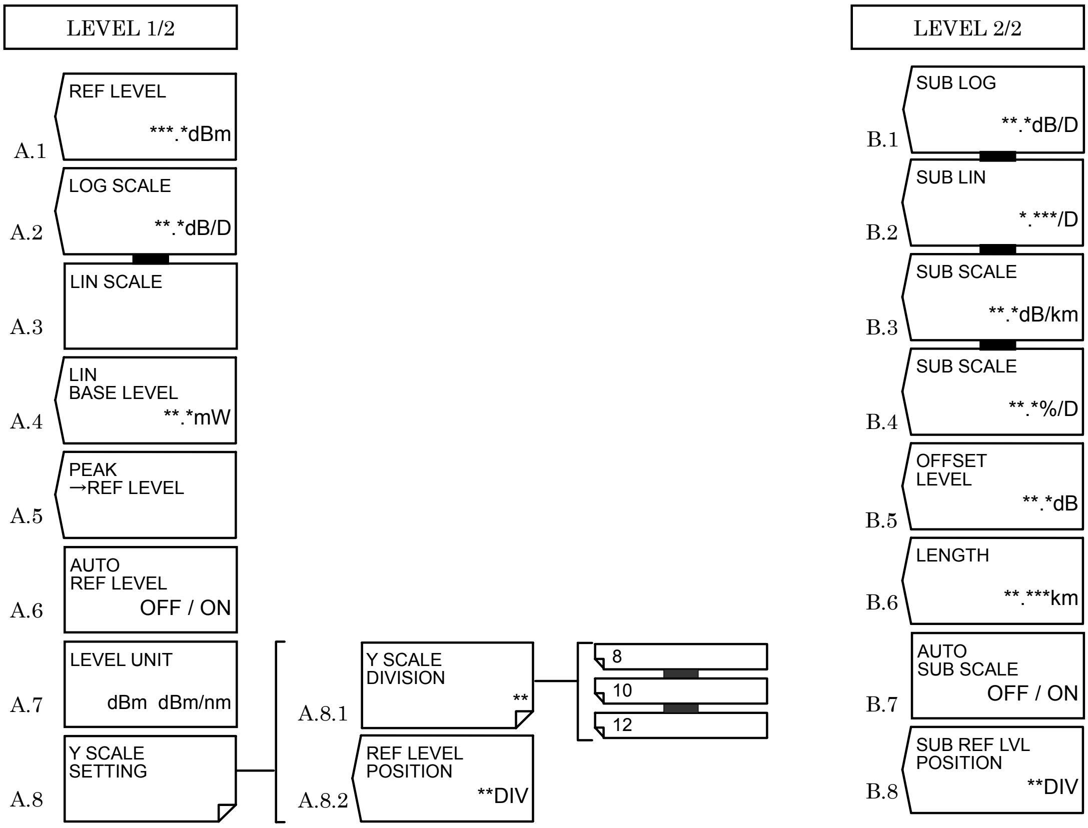
A.8 <VIEW→MEAS>

This key is used to set the currently set ZOOM scale (ZOOM CENTER, ZOOM SPAN, ZOOM START, ZOOM STOP) as the measurement scale (CENTER, START, STOP, SPAN).
When you press this key, the current waveform display scale is set as the measurement scale for the next sweep.

> **NOTE**
>
> "UNCAL" Mark
>
> - If the resolution is set too low for the sampling interval (which is determined by the span and the sampling number), data may be lost. Therefore, the unit displays an "UNCAL" mark in the resolution display area on the waveform box if the settings for span, the sampling number, and the resolution are inappropriate. When "UNCAL" is displayed, normal measurement is not possible, so either reduce the span or increase the sampling number or the resolution so that "UNCAL" is no longer displayed. If the sampling number is set for automatic setup using the <SAMPLING AUTO> key in the [SETUP] switch, then the optimal sampling number for the span and resolution settings will be set automatically.

6-5 LEVEL

The [LEVEL] switch contains functions related to level axis settings. When you press the switch, the following soft key menu is displayed. In addition, the <REF LEVEL> key function is executed immediately, so reference level settings can be entered directly.



A.1 <REF LEVEL>

This key is used to set the reference level. The unit switches to “dBm” or “*W” depending on whether the level scale display is LOG or linear. In addition, the reference level display position also varies depending on whether the display is LOG scale or linear scale. (See the next page for more information) The setting range for the LOG scale is –90.0 to 30.0 dBm (fine: 0.1 steps; coarse: steps of 1), and the value is set in the DATA ENTRY section.(Default: –10 dBm)

The setting range for the linear scale is 1.00 pW–1000 mW【1.00–9.99[pW, nW, μW, mW]: 0.01 steps; 10.0–99.9(100) [pW, nW, μW, (mW)]: 0.1 steps, 100–999 [pW, nW, μW]: steps of 1】, and the value is set in the DATA ENTRY section.

In cases where a setting is entered through the numeric keypad, soft keys for selecting the unit (pW, nW, μW, mW) are displayed when the numeric keypad is pressed. Immediately after entering the numeric value, press the soft key corresponding to the desired unit. If you press [ENTER] on the numeric keypad instead of selecting one of the soft unit keys, the current unit setting will remain. If you make a change such as changing 999 to 1.00 or 1.00 to 999, the unit will be changed.

(Example: Changing pW to nW or changing nW to pW)

When the reference level during the LOG or linear scale setting is changed, the displayed waveform is redrawn according to the changed reference level.

When the main scale is linear

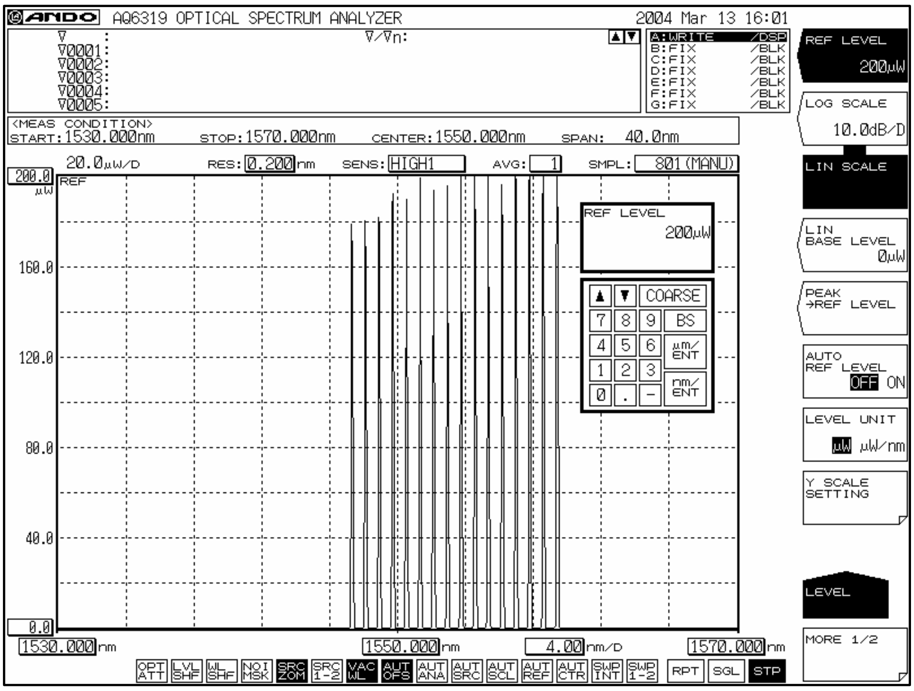


Fig. 6-1 Screen when the main scale is linear

When the main scale is LOG

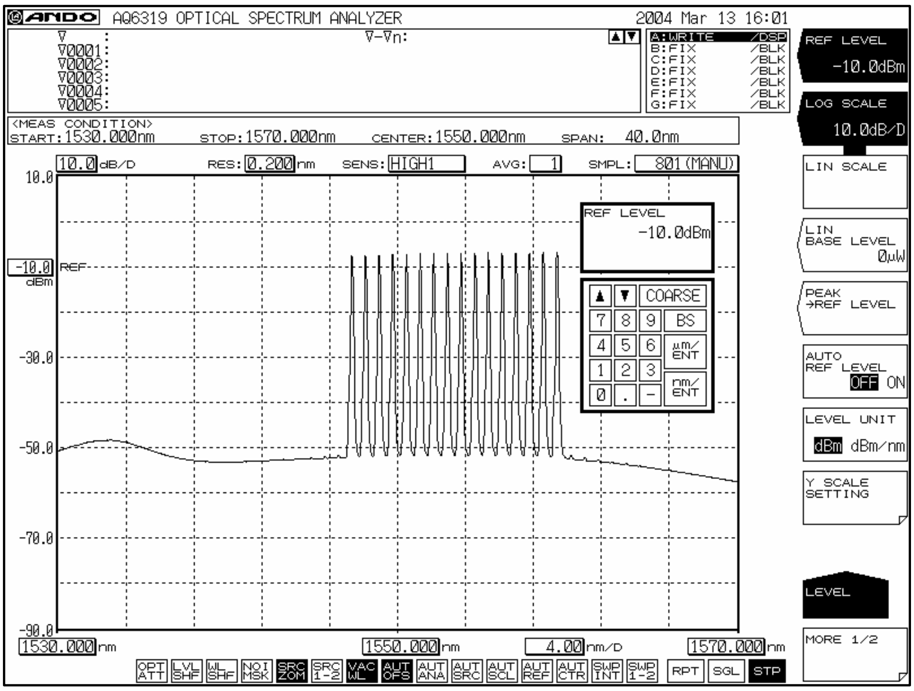


Fig. 6-2 Screen when the main scale is LOG

A.2 <LOG SCALE**.*dB/D>

This key switches the level axis to LOG display and sets the level scale. When you press this key, the level axis is set to LOG scale, and the current setting is displayed in the interrupt display area.
The setting range is 0.1 to 10.0 dB/DIV (fine: 0.1 steps; coarse: steps of 1, 2, or 5), and the value is set in the DATA ENTRY section. (Default: 10.0 dB,ON)
When the setting is changed, the displayed waveform is redrawn according to the changed level axis scale. If the value is set to a scale larger than 5 dB/DIV in range fixing mode (SENS:NORMAL/HOLD) or pulse light measurement mode, the waveform will not be correctly measured in the vertical direction so a warning is displayed.
(☛ See subsection 5.1.4 Level Axis Effective Range When Measurement Sensitivity is Set to NORMAL/HOLD)

A.3 <LIN SCALE>

This key is used to set the main scale to linear scale. Settings per 1 DIV are set in the reference level.

A.4 <LIN BASE LEVEL **.*mW>

This key is used to set the level scale low-end value when the level axis scale is linear scale. It is disabled when LOG scale is active. The setting range is 0.0 to the REF level × 0.9 (fine: 0.1 steps; coarse: steps of 1). Values can only be set in the unit set for the REF level. The value is set in the DATA ENTRY section. (Default: 0.0 mW) When the setting is changed, the displayed waveform is redrawn according to the changed scale. Note that the scale display in the upper left part of the waveform is 1/10 the value (*W/D) of the reference (REF) level minus the low-end (BASE) level.

A.5 <PEAK → REF LEVEL>

This key is used to internally search for the peak level of the active trace waveform, then set the obtained value as the reference level. After execution, the set reference level (peak level value) is displayed in the interrupt display area, and the displayed waveform is redrawn according to the changed reference level. The reference level can be set by continuing in the DATA ENTRY section. The range in which the value can be changed for LOG scale is –90.0 to +20.0 dBm (0.1 steps), and the range in which the value can be changed for linear scale is 1.00 pW–1000 mW【1.00–9.99[pW, nW, μW, mW]: 0.01 steps; 10.0–99.9(100) [pW, nW, μW, (mW)]: 0.1 steps, 100–999 [pW, nW, μW]: 1 step】. If the peak level value exceeds the allowed range, it is set to the nearest value in the range and a warning is displayed.

A.6 <AUTO REF LEVEL OFF/ON >

This key is used to turn OFF/ON the <PEAK → REF LEVEL> function which is performed on each sweep. When this key is set to ON, during each sweep the peak level is searched for automatically in the active trace waveform, and is set as the reference level. This function does not operate if the active trace is set to something other than WRITE (i.e., MAX HOLD, MIN HOLD, CALCULATE, ROLL AVG). When it is highlighted, $\boxed{\text{AUT REF}}$ is displayed at the very bottom of the screen.

A.7 <LEVEL UNIT dBm dBm/nm>

This key is used to set the level axis scale display to either dBm (nW, μW, mW or pW for linear scale) or dBm/nm (nW/nm, μW/nm, mW/nm or pW/nm for linear scale).
dBm: Power per resolution
dBm/nm: Power per 1 nm (power density)
(☛ See subsection 8.1.3 Power Density Display Function for information on when to use dBm and when to use dBm/nm.)

A.8 <Y SCALE SETTING>

This key is used to display the Y scale setting menu.

A.8.1 <Y SCALE DIVISION **>

This key is used to set the number of level scale divisions. If the main scale is linear scale, the <Y SCALE DIVISION **> key is disabled and the display is fixed at 10 DIV. (Default: 10)

8 Sets the number of level scale divisions to 8 DIV.
10 Sets the number of level scale divisions to 10 DIV.
12 Sets the number of level scale divisions to 12 DIV.

A.8.2 <REF LEVEL POSITION **DIV>

This key is used to set the REF position. The REF position is set at DIV number **, counting from the bottom of the screen. If the main scale is linear scale, the <REF LEVEL POSITION **DIV> key is disabled and the REF position is set at the very top (10 DIV). The setting range is 0 to 12 (fine: steps of 1; coarse: steps of 1, 2, or 5), and the value is set in the DATA ENTRY section. (Default: 8 DIV)

When the <Y SCALE DIVISION> key setting is switched to 8, the <REF LEVEL POSITION **DIV> key setting is switched to 8 automatically if it is currently set to 9, 10, 11, or 12. When the <Y SCALE DIVISION> key setting is switched to 10, the <REF LEVEL POSITION **DIV> key setting is switched to 10 automatically if it is currently set to 11 or 12.

B.1 <SUB LOG **.*dB/D>

This key is used to set the sub-scale to LOG. When you press this key, the current setting is displayed in the interrupt display area. The setting range is 0.1 to 10.0 dB/DIV (fine: 0.1 steps ; coarse : 1-2-5 step), and the value is set in the DATA ENTRY section. When the setting is changed, the displayed waveform is redrawn according to the changed scale.

B.2 <SUB LIN /D>

This key is used to set the sub-scale to linear. When you press this key, the current setting is displayed in the interrupt display area. The setting range is 0.005–1.250/DIV (fine: 0.005 steps ; coarse : 1-2-5 step), and the value is set in the DATA ENTRY section. When the setting is changed, the displayed waveform is redrawn according to the changed scale.

B.3 <SUB SCALE **.*dB/km>

This key is used to set the sub-scale to dB/km. When you press this key, the current setting is displayed in the interrupt display area. The setting range is 0.1 to 10.0 dB/km (fine: 0.1 steps ; coarse : 1-2-5 step), and the value is set in the DATA ENTRY section. When the setting is changed, the displayed waveform is redrawn according to the changed scale.

B.4 <SUB SCALE ***.*%/D>

This key is used to set the sub-scale to %. When you press this key, the current setting is displayed in the interrupt display area. The setting range is 0.5 to 125%/D (fine: 0.1 steps ; coarse : 1-2-5 step), and the value is set in the DATA ENTRY section. When the setting is changed, the displayed waveform is redrawn according to the changed scale.

NOTE

Sub-scale

- The level scale is displayed based on relative values when a differential waveform (based on LOG values) or normalized waveform is displayed. With the unit, a level scale based on relative values is called a sub-scale. When the above waveform is displayed over a waveform based on absolute values, the absolute value scale is shown on the left and the relative value scale is shown simultaneously on the right. If the left scale (main scale) is changed to LOG (8 DIV) or linear (10 DIV), the sub-scale is displayed to correspond to the DIV count on the main scale.

B.5 <OFFSET LEVEL> or <SCALE MIN>

This key is used to display <OFFSET LEVEL> or <SCALE MIN> according to whether the sub-scale display is LOG or linear. If the sub-scale is dB/D or dB/km, the <OFFSET LEVEL> key is used to set the offset value. The setting range for dB/D is 0 to ±99.9 dB (0.1 steps ; coarse : 1-2-5 step). The setting range for dB/km is 0 to ±99.9 dB/km (0.1 steps ; coarse : 1 step). The value is set in the DATA ENTRY section. If the sub-scale is LIN or %, the <SCALE MIN> key is used to set the scale low-end value. The setting range for LIN is 0 to the sub-scale value (***.*/D)×10. The setting range for % is 0 to the sub-scale value (***.*%/D)×10. The value is set in the DATA ENTRY section.

B.6 <LENGTH **.***km>

This key is used to set the length of the optical fiber. The setting range is 0.001 to 99.999 km (fine: 0.001 steps), and the value is set in the DATA ENTRY section. It is enabled when the sub-scale is dB/km.

B.7 <AUTO SUB SCALE OFF/ON>

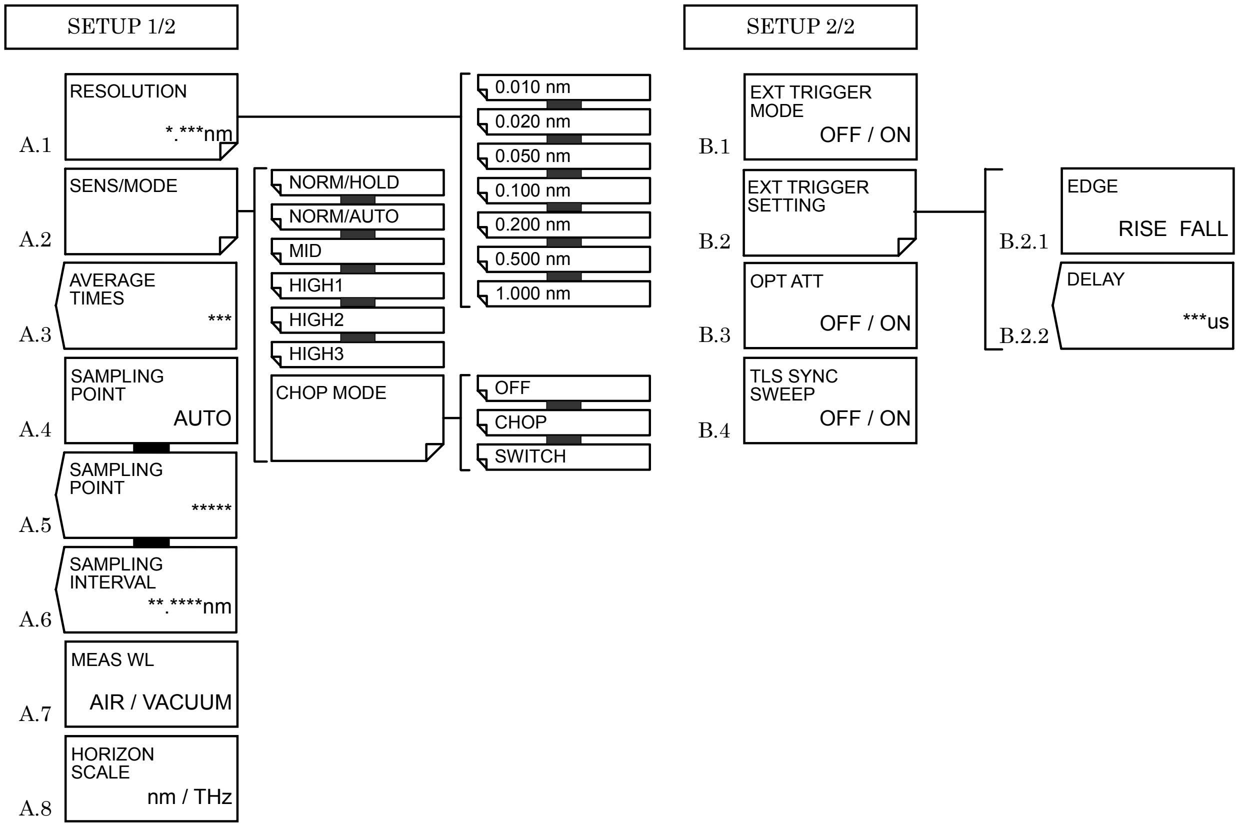
This key is used to turn OFF/ON the function for automatically scaling the sub-scale following calculation when trace C is set to <CALCULATE>. When this key is set to ON, during trace C display, scaling is done automatically, and the SUB LOG or SUB LIN and OFFSET LEVEL change. In addition, the displayed waveform is redrawn according to the changed scale. When this key is set to ON, AUT SCL is displayed at the very bottom of the screen.

B.8 <SUB REF LVL POSITION **DIV>

This key is used to set the sub-scale REF position. The REF position is set at DIV number **, counting from the bottom of the screen. The setting range is 0 to 12 (fine: steps of 1; coarse: steps of 1, 2, or 5), and the value is set in the DATA ENTRY section. (Default: 5 DIV)

6-6 SETUP

The [SETUP] switch contains functions related to measurement condition settings. When you press the switch, the following soft key menu is displayed.



A.1 <RESOLUTION>

This key is used to set the measurement resolution. When you press this key, the current resolution is displayed in the interrupt display area. The setting range is 0.010 to 1.000 nm (steps of 1, 2, or 5). The setting may be selected through the interrupt display area, or entered in the DATA ENTRY section.(Default: 1.000 nm) When you enter a value through the numeric keypad, the value is set as the closest value among seven values from 0.010 to 1.000 nm. Measurement resolution is set based on wavelength even during frequency display mode (<HORIZON SCALE> key of [SETUP] switch).

0.010 nm	Sets the resolution to 0.010 nm.
0.020 nm	Sets the resolution to 0.020 nm.
0.050 nm	Sets the resolution to 0.050 nm.
0.100 nm	Sets the resolution to 0.100 nm.
0.200 nm	Sets the resolution to 0.200 nm.
0.500 nm	Sets the resolution to 0.500 nm.
1.000 nm	Sets the resolution to 1.000 nm.

NOTE

- If you use an optical fiber with a large core diameter, the maximum resolution is limited. For this reason, it may not be possible to obtain the resolution you set. (☛ See subsection 5.1.3 Limitations on Wavelength Resolution)

A.2 <SENS/MODE>

This key is used to set the measurement sensitivity and CHOP mode. When you press this key, the current measurement sensitivity is displayed in the interrupt display area. A measurement sensitivity setting may be selected from the soft keys, or entered through the DATA ENTRY section. (Default: NORM/AUTO) (☛ See (3) Other Measurement Condition Settings, in section 5.2 Basic Measurements, for details on measurement sensitivity and CHOP mode.)

NORM/HOLD	Sets the measurement sensitivity to NORMAL HOLD.
NORM/AUTO	Sets the measurement sensitivity to NORMAL AUTO.
MID	Sets the measurement sensitivity to MID.

(When CHOPPER mode is OFF)

HIGH1	Sets the measurement sensitivity to HIGH1.
HIGH2	Sets the measurement sensitivity to HIGH2.
HIGH3	Sets the measurement sensitivity to HIGH3.

(When CHOPPER mode is CHOP)

HIGH1/CHOP	Sets the measurement sensitivity to HIGH1/CHOP.
HIGH2/CHOP	Sets the measurement sensitivity to HIGH2/CHOP.
HIGH3/CHOP	Sets the measurement sensitivity to HIGH3/CHOP.

(When CHOPPER mode is SWITCH)

MID/SW	Set the measurement sensitivity toMID/SW.
HIGH1/SW	Set the measurement sensitivity toHIGH1/SW.
HIGH2/SW	Set the measurement sensitivity toHIGH2/SW.
HIGH3/SW	Set the measurement sensitivity toHIGH3/SW.

CHOP MODE — Set the CHOP mode OFF/CHOP/SWITCH.
Measurements can be performed with monochromator stray light removed by setting CHOP mode to CHOP and WSWITCH.

OFF	Chopper does not operate.
CHOP	Chopper operates , and measurements can be performed with monochromator stray light
SWITCH	Measurement is performed the sweeping two times. The sweeping time of this mode is faster than CHOP mode , and measurements can be performed with monochromator stray light

NOTE

- When setting of <CHOP MODE>key is set <SWITCH>, waveform on first sweep is not displayed.

6.6 SETUP

A.3 <AVERAGE TIMES>

This key is used to set the average times for each point.
When you press this key, the current number of averagings is displayed in the interrupt display area.
The setting range is 1 to 999 times (fine: steps of 1; coarse: steps of 1, 2, or 5), and the value is set in the DATA ENTRY section. (Default: 1)

NOTE

- If the measurement sensitivity setting is HIGH1/CHOP, HIGH2/CHOP, or HIGH3/CHOP and measurement is performed with a large number of average times, sweeping will take an extremely long time.
- When setting of <CHOP MODE>key is set <SWITCH>, this setting is fixed one , which cannot be changed.

A.4 <SAMPLING POINT AUTO>

This key is used to turn OFF/ON the function for automatically setting the sampling number during measurement. When this key is selected (when it is highlighted), the sampling number is automatically set based on the span and resolution. The automatically calculated sampling number is displayed in the <SAMPLING POINT *****> key (A.5).

A.5 <SAMPLING POINT *****>

This key is used to manually set the number of sampling points (the number of points measured in a single sweep) during measurement. When you press this key, the current number of sampling points is displayed in the interrupt display area. The setting range is 101 to 50001 (fine: steps of 1; coarse: steps of 1, 2, or 5), and the value is set in the DATA ENTRY section. (Default: Value calculated by <SAMPLING POINT AUTO>)

NOTE

"UNCAL" Mark

- If the resolution is set too low for the sampling interval (which is determined by the span and the number of sampling points), data may be lost. Therefore, the unit displays an "UNCAL" mark in the resolution display area on the waveform box if the settings for span, the number of sampling points, and the resolution are inappropriate. When "UNCAL" is displayed, normal measurement is not possible, so either reduce the span or increase the number of sampling points or the resolution so that "UNCAL" is no longer displayed. If the number of sampling points is set for automatic setup using the <SAMPLING AUTO> key in the [SETUP] switch, then the optimal number of sampling points for the span and resolution settings will be set automatically.

A.6 <SAMPLING INTERVAL **.***nm>

This key is used to set the number of sampling points used for measurement based on the sampling interval. The setting range is SPAN/100 to SPAN/50000 (fine: 0.0001 steps; coarse: steps of 1, 2, or 5), and the value is set in the DATA ENTRY section. The minimum allowed setting is 0.0005 nm. However, if the measurement wavelength range includes 1450 nm and below, then the minimum value is 0.001 nm.

A.7 <MEAS WL AIR / VACUUM>

This key is used to switch the measurement wavelength to either an air wavelength or a vacuum wavelength.

AIR Air wavelength
VACUUM Vacuum wavelength (Default)

When the vacuum wavelength is set, VAC WL is selected at the very bottom of the screen.

> **NOTE**
>
> - This function is only for switching the measurement wavelength. Therefore, the wavelength is not converted even if the <MEAS WL AIR/VAC> key is switched while the waveform is displayed after measurement.

A.8 <HORIZON SCALE nm/THz>

This key is used to set the X axis display mode to wavelength display mode or frequency display mode.
(Default: nm (wavelength display mode))

Wavelength display mode

- Displays the measured waveform with the wavelength on the X axis.
- The measurement scale and display scale are set based on the wavelength.
- The X axis unit for marker values and analysis function results is the wavelength.

(☛ See <MARKER UNIT> key in the [MARKER] switch)

Frequency display mode

- Displays the measured waveform with the frequency on the X axis.
- The measurement scale and display scale are set based on the frequency.
- The X axis unit for marker values and analysis function results is the frequency.

(☛ See <MARKER UNIT> key in the [MARKER] switch)

B.1 <EXT TRIGGER MODE OFF / ON>

This key is used to set ON/OFF the mode in which pulse light is measured using an external trigger signal. (☛ See subsection 8.1.1 Pulse Optical Measurement Function) When this key is set to ON, sweeping is performed in external trigger mode, wherein sampling is done based on an external trigger signal. In external trigger mode, the <SENS/MODE> key is disabled and "EXTTRG" is displayed as the sensitivity indicator on the measurement screen. At this time, the internal measurement sensitivity set is NORM/AUTO.

B.2 <EXT TRIGGER SETTING>

This key is used to set parameters for external trigger mode.

B.2.1 <EDGE RISE / FALL>

This key is used to set the external trigger signal detection edges.

RISE	The rising edge is recognized as a trigger.
FALL	The falling edge is recognized as a trigger.

B.2.2 <DELAY ****.*us>

This key is used to set the delay time between trigger signal edge detection and data measurement.

The setting range is 0 to 1000.0 (fine: 0.1 steps; coarse: steps of 1), and the value is set in the DATA ENTRY section. (Default: 0 us)

B.3 <OPT ATT OFF / ON>

This key is used to set whether or not to insert the optical attenuator inside the monochromator. When this key is set to ON, an optical attenuator is inserted.
(Default: OFF)
When the key is set ON, OPT ATT is reverse displayed.

⚠ Caution

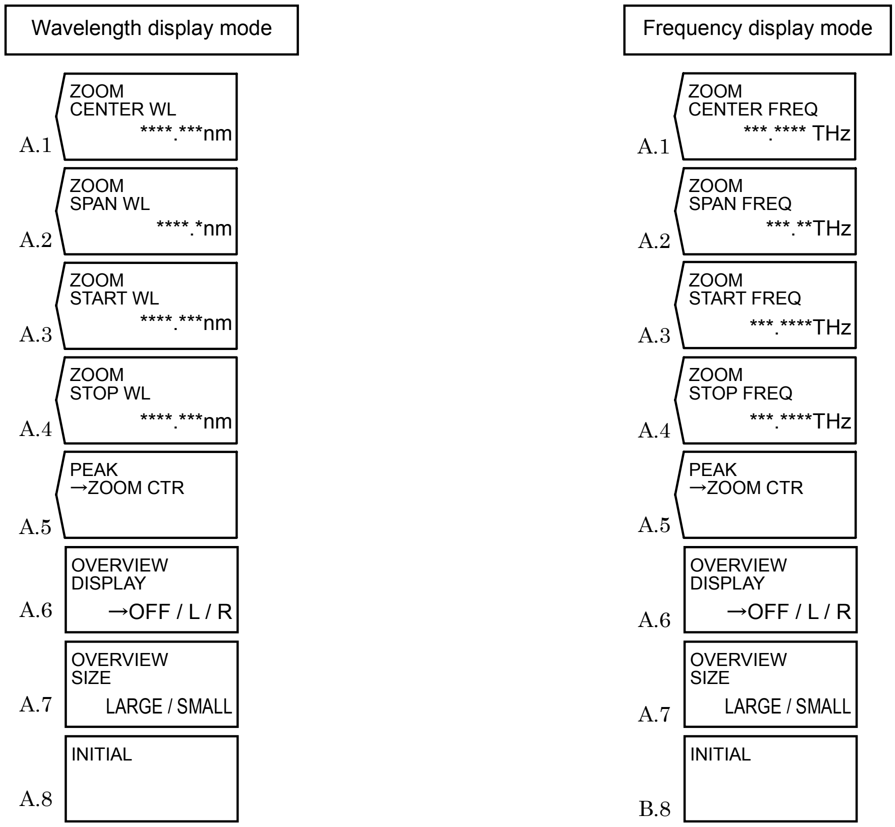
- If the input light power per 1 resolution exceeds +13 dBm, or if the total input light power exceeds +17 dBm, this switch must be turned ON to insert the optical attenuator.
  □ If high-power light is measured without inserting the optical attenuator, the monochromator may be damaged.
- The maximum input power for the unit is +23 dBm (input light power per 1 resolution) or +27 dBm (total input light power) with the internal optical attenuator ON. Input light exceeding the ratings may damage the unit's internal monochromator.

B.4 <TLS SYNC SWEEP OFF / ON>

Sets on and off the synchronous sweep function for the Tunable Laser Source. When this key is selected, the Tunable Laser Source connected to the GP-IB 2 port is swept in sync with the sweep of this equipment. (☛ 7.7 Synchronus measurement function with the Tunable Laser Source)
When the key is set ON, TLS SYC reverse displayed.(Default: OFF)

6-7 ZOOM

The [ZOOM] switch contains the zoom function, which is a feature of the AQ6319. When you press the [ZOOM] switch, the following soft key menu is displayed. (☛ See Chapter 7 Useful Functions for a detailed explanation.)



Wavelength display mode

A.1 <ZOOM CENTER WL>

This key is used to set the center wavelength of the display scale. The setting range is 600.000 to 1700.000 (fine: 0.1 steps; coarse: steps of 1), and the value is set in the DATA ENTRY section. (Default: Measurement center wavelength of last measured or loaded trace) The <ZOOM CENTER WL> key is disabled when both of the split screen windows are set to HOLD and when the measurement data span is 0 nm.

A.2 <ZOOM SPAN WL>

This key is used to set the span of the display scale. The setting range is 0.1 to 1100.0 (fine: steps of 1; coarse: steps of 1, 2, or 5), and the value is set in the DATA ENTRY section. (Default: Measurement span of last measured or loaded trace) The <ZOOM SPAN WL> key is disabled when both of the split screen windows are set to HOLD and when the measurement data span is 0 nm.

A.3 <ZOOM START WL>

This key is used to set the start wavelength of the display scale. The setting range is 50.000 to 1699.950 (fine: 0.1 steps; coarse: steps of 1), and the value is set in the DATA ENTRY section. (Default: Measurement span of last measured or loaded trace) The <ZOOM START WL> key is disabled when both of the split screen windows are set to HOLD and when the measurement data span is 0 nm.

A.4 <ZOOM STOP WL>

This key is used to set the stop wavelength of the display scale. The setting range is 600.050 to 2250.000 (fine: 0.1 steps; coarse: steps of 1), and the value is set in the DATA ENTRY section. (Default: Measurement span of last measured or loaded trace) The <ZOOM STOP WL> key is disabled when both of the split screen windows are set to HOLD and when the measurement data span is 0 nm.

A.5 <PEAK →ZOOM CTR>

This key is used to set the center wavelength of the display scale as the peak wavelength of the active trace measured waveform. The <PEAK → ZOOM CTR> key is disabled when both of the split screen windows are set to HOLD and when the measurement data span is 0 nm. After the value is set, you can continue by setting the display scale center wavelength.

A.6 <OVERVIEW DISPLAY OFF / L / R>

This key is used to set OVERVIEW display ON/OFF and its position during ZOOM.
(default: R) The <OVERVIEW DISPLAY> key is disabled during split display and when the measurement data span is 0 nm.

A.7 <OVERVIEW SIZE LARGE / SMALL>

This key is used to set the OVERVIEW display size.(default: LARGE)
The <OVERVIEW SIZE> key is disabled during split display and when the measurement data span is 0 nm. (During split screen display, the OVERVIEW display size is always set to SMALL.)

A.8 <INITIAL>

This key is used to restore the display scale to the default (measurement condition for the last measured or loaded trace). The <INITIAL> key is disabled when both of the split screen windows are set to HOLD and when the measurement data span is 0 nm.

Frequency display mode

A.1 <ZOOM CENTER FREQ>

This key is used to set the center frequency of the display scale. The setting range is 176.5000 to 500.0000 (fine: 0.01 steps; coarse: 0.1 steps), and the value is set in the DATA ENTRY section. (Default: Measurement center frequency of last measured or loaded trace) The <ZOOM CENTER FREQ> key is disabled when both of the split screen windows are set to HOLD and when the measurement data span is 0 THz.

A.2 <ZOOM SPAN FREQ>

This key is used to set the span of the display scale. The setting range is 0.01 to 330.00 (fine: 0.1 steps; coarse: steps of 1, 2, or 5), and the value is set in the DATA ENTRY section. (Default: Measurement span of last measured or loaded trace) The <ZOOM SPAN FREQ> key is disabled when both of the split screen windows are set to HOLD and when the measurement data span is 0 THz.

A.3 <ZOOM START FREQ>

This key is used to set the start frequency of the display scale. The setting range is 11.5000 to 499.9950 (fine: 0.01 steps; coarse: 0.1 steps), and the value is set in the DATA ENTRY section. (Default: Measurement start frequency of last measured or loaded trace) The <ZOOM START

FREQ> key is disabled when both of the split screen windows are set to HOLD and when the measurement data span is 0 THz.

A.4 <ZOOM STOP FREQ>

This key is used to set the stop frequency of the display scale. The setting range is 176.5050 to 665.0000 (fine: 0.01 steps; coarse: 0.1 steps), and the value is set in the DATA ENTRY section. (Default: Measurement stop frequency of last measured or loaded trace) The <ZOOM STOP FREQ> key is disabled when both of the split screen windows are set to HOLD and when the measurement data span is 0 THz.

A.5 <PEAK →ZOOM CTR>

This key is used to set the center frequency of the display scale as the peak frequency of the active trace measured waveform. The <PEAK → ZOOM CTR> key is disabled when both of the split screen windows are set to HOLD and when the measurement data span is 0 THz. After the value is set, you can continue by setting the display scale center frequency.

A.6 <OVERVIEW DISPLAY OFF / L / R>

This key is used to set OVERVIEW display ON/OFF and its position during ZOOM. (default: R)
The <OVERVIEW DISPLAY> key is disabled during split display and when the measurement data span is 0 THz.

A.7 <OVERVIEW SIZE LARGE / SMALL>

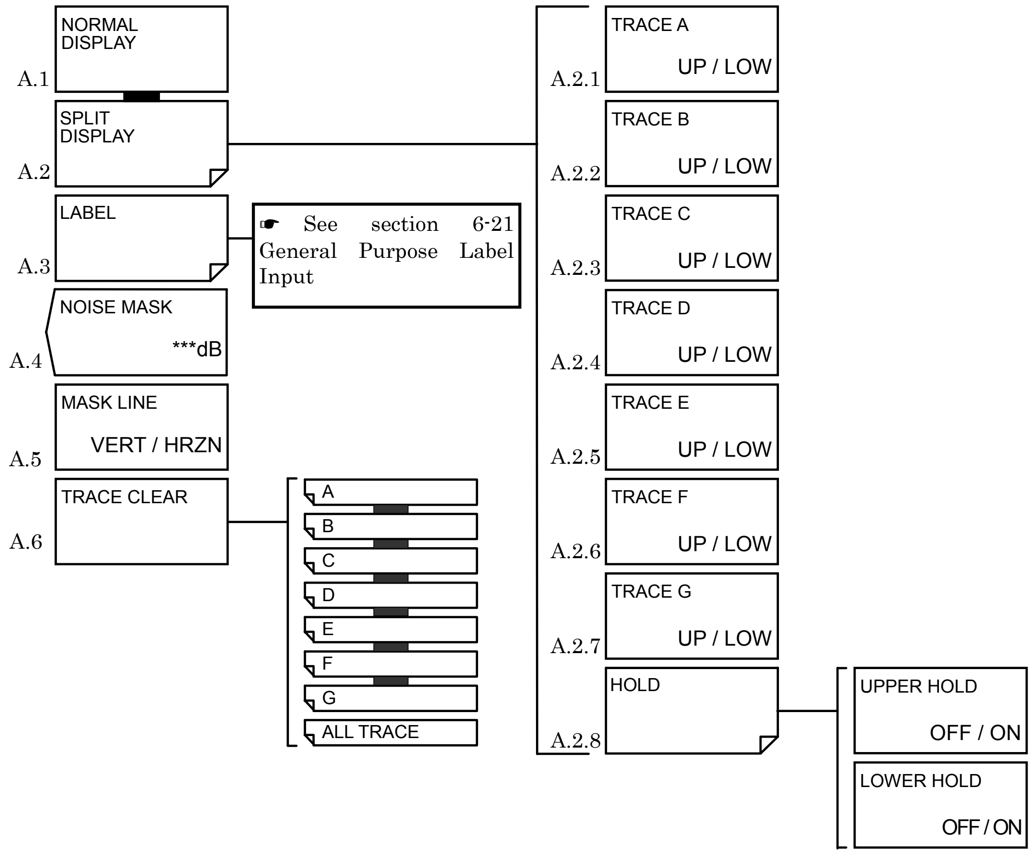
This key is used to set the OVERVIEW display size. (default: LARGE)
The <OVERVIEW SIZE> key is disabled during split display and when the measurement data span is 0 THz. (During split screen display, the OVERVIEW display size is always set to SMALL.)

A.8 <INITIAL>

This key is used to restore the display scale to the default (measurement condition for the last measured or loaded trace). The <INITIAL> key is disabled when both of the split screen windows are set to HOLD and when the measurement data span is 0 THz.

6-8 DISPLAY

The [DISPLAY] switch contains functions related to screen display. When you press the [DISPLAY] switch, the following soft key menu is displayed.



A.1 <NORMAL DISPLAY>

This key is used to set the screen to normal display mode. (☛ See section 2.3 LCD Screen for information on normal display mode.)

A.2 <SPLIT DISPLAY>

This key is used to set the screen to upper/lower 2-split display mode (split mode).

A.2.1 <TRACE A UP/LOW>

This key is used to set whether to put trace A on top or on bottom during upper/lower 2-split display.
If you select “UP”, it is assigned to the top. (Default)
If you select “LOW”, it is assigned to the bottom.

A.2.2 <TRACE B UP/LOW>

This key is used to set whether to put trace B on top or on bottom during upper/lower 2-split display.
If you select “UP”, it is assigned to the top. (Default)
If you select “LOW”, it is assigned to the bottom.

A.2.3 <TRACE C UP/LOW>

This key is used to set whether to put trace C on top or on bottom during upper/lower 2-split display.
If you elect "UP", it is assigned to the top.
If you select "LOW", it is assigned to the bottom. (Default)

A.2.4 <TRACE D UP/LOW>

This key is used to set whether to put trace D on top or on bottom during upper/lower 2-split display.
If you select "UP", it is assigned to the top. (Default)
If you select "LOW", it is assigned to the bottom.

A.2.5 <TRACE E UP/LOW>

This key is used to set whether to put trace E on top or on bottom during upper/lower 2-split display.
If you select "UP", it is assigned to the top. (Default)
If you select "LOW", it is assigned to the bottom.

A.2.6 <TRACE F UP/LOW>

This key is used to set whether to put trace F on top or on bottom during upper/lower 2-split display.
If you select "UP", it is assigned to the top.
If you select "LOW", it is assigned to the bottom. (Default)

A.2.7 <TRACE G UP/LOW>

This key is used to set whether to put trace G on top or on bottom during upper/lower 2-split display.
If you select "UP", it is assigned to the top.
If you select "LOW", it is assigned to the bottom. (Default)

A.2.8 <HOLD>

<HOLD> contains the <UPPER HOLD OFF/ON> key and the <LOWER HOLD OFF/ON> key. Both of these keys have the following features.

○ The display scale is fixed.
○ The trace is fixed.
○ When <HOLD> is applied to a screen with the active trace (WRITE @), the active trace automatically changes to the FIX state.(FIX @)
○ When a screen setting is changed from the <HOLD> state to <NORMAL DISPLAY>, the last set display scale is set as the display scale.
○ When a trace in the <HOLD> state (<FIX> state) is set to a state other than FIX, the <HOLD> is cleared automatically. When this happens, a warning message is displayed.

<UPPER HOLD OFF / ON>

When the <UPPER HOLD OFF/ON> key is pressed, the trace assigned to the top in upper/lower 2-split display is fixed and the scale is also fixed. When the <UPPER HOLD OFF/ON> key is pressed again, the HOLD is cleared, the display scale changes to the most recent setting, and the waveform is overwritten accordingly.

<LOWER HOLD OFF / ON>

When the <LOWER HOLD OFF/ON> key is pressed, the trace assigned to the bottom in upper/lower 2-split display is fixed and the scale is also fixed. When the <LOWER HOLD OFF/ON> key is pressed again, the HOLD is cleared, the display scale changes to the most recent setting, and the waveform is overwritten accordingly.

A.3 <LABEL>

The <LABEL> key is used to enter various messages, such as entering comments in the label area and entering program names for program functions. When you press the <LABEL> key, the character selection window is displayed. The [General Purpose LABEL INPUT] key appears in the soft keys.

○ If the unit is started with an external keyboard connected to it, the external keyboard can be used to enter letters of the alphabet.
○ A character in the character selection window can be entered using the mouse by double-clicking on the character.
○ Input is completed when the <DONE> soft key is pressed. (The applies to the mouse, keyboard, and DATA ENTRY section.)
○ When you press the <DONE> key, the character string is entered and the previous level of soft keys is displayed.

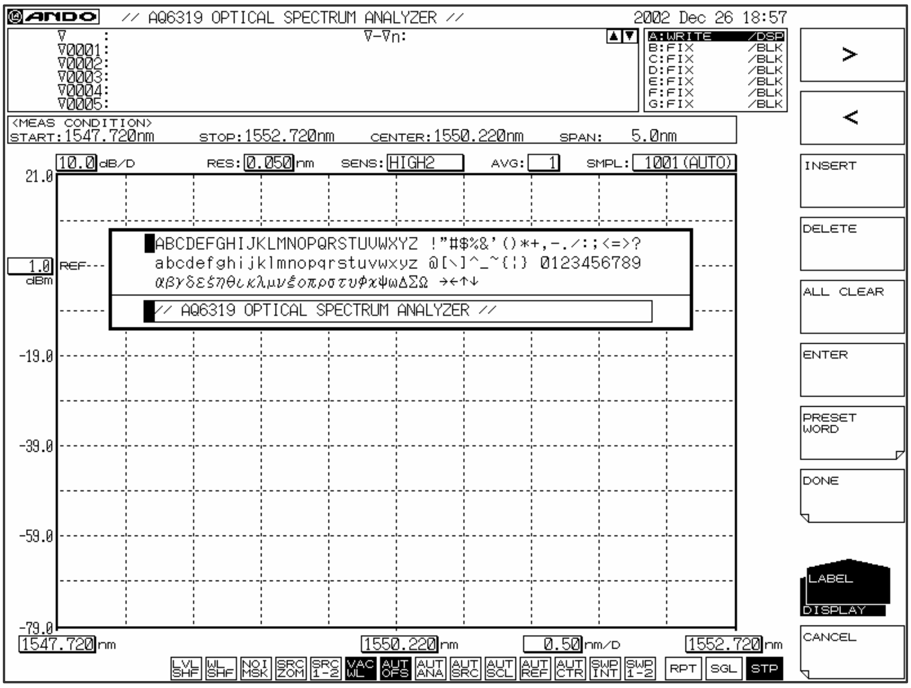


Fig. 6-3 Screen display when <LABEL> key is pressed

A.4 <NOISE MASK>

This key is used to display a waveform so that parts of the waveform at or below the set value are masked. In addition, when a noise mask value is set, the waveform is overwritten in real time. (The noise mask function is disabled when the vertical axis is set to linear.) When you press the <NOISE MASK> key, the current noise mask value is displayed in the interrupt display area. The allowed settings are OFF (-999) and the range of -100 to 0 (fine: 1 step; coarse: 10 steps), and the value is set in the DATA ENTRY section.

If a setting other than OFF is entered, the NOI MSK button will be depressed at the bottom of the screen, and VERT masking method is selected (i.e., A.5).

If there is a marker at the noise mask level and the <MARKER → REF LEVEL> key is executed, a warning is displayed.

WARNING 3: Unsuitable Ref Level

A.5 <MASK LINE VERT / HRZN>

This key is used to set the masking method for the noise mask function.

VERT Displays the waveform with level values at or below the mask value set to -999 dB.

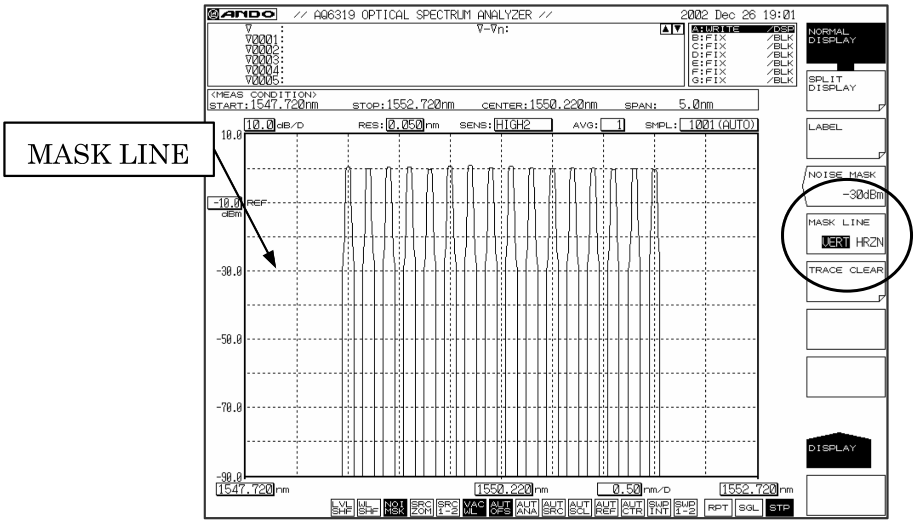


Fig. 6-4 Screen display when < MASK LINE VERT/HRZN> is set to VERT

HRZN Displays the waveform with level values at or below the mask value set to the mask value.

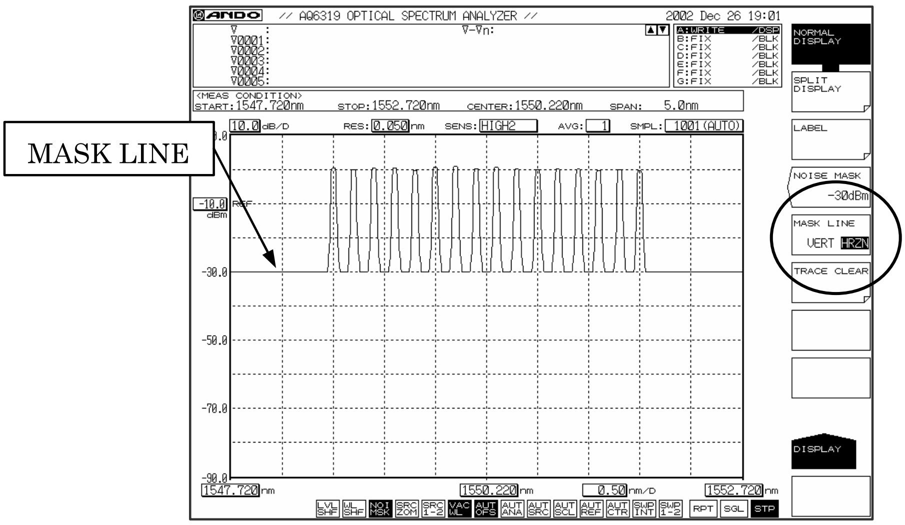


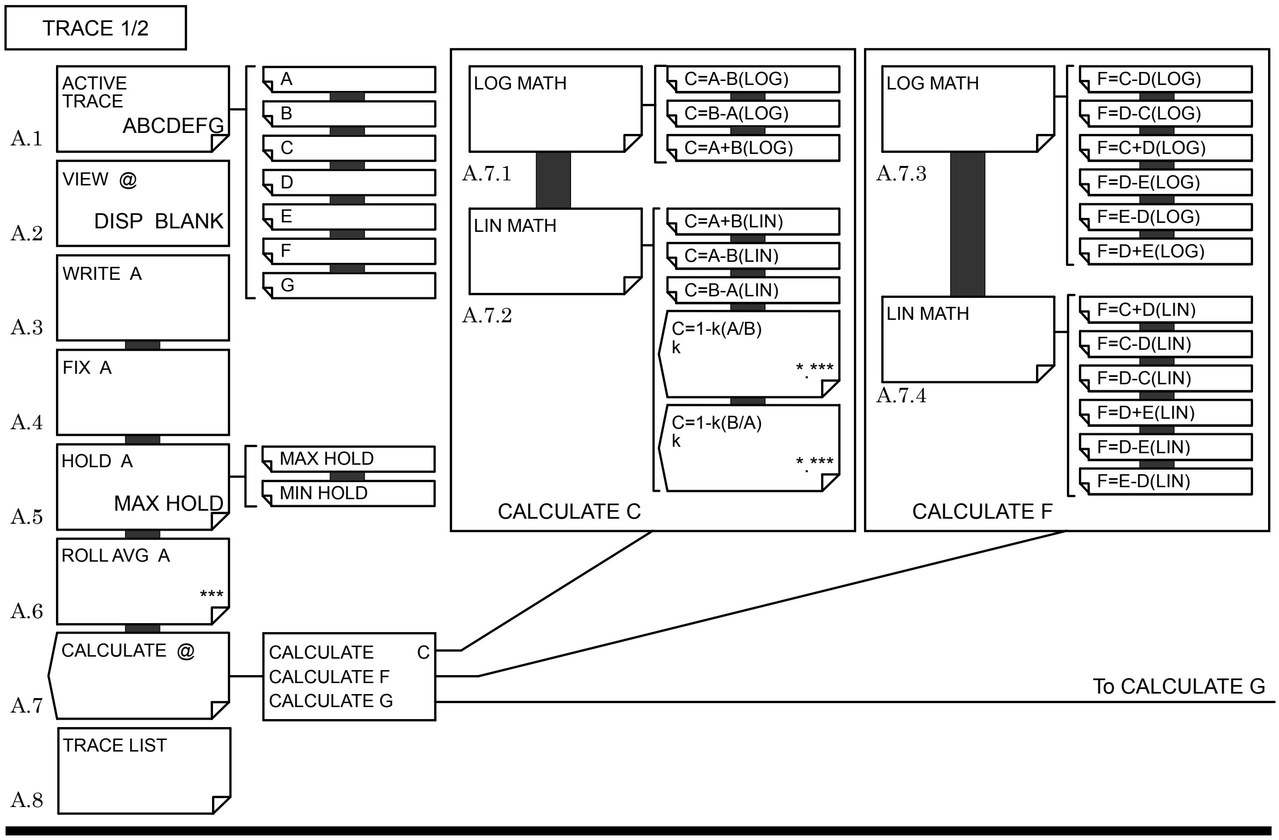
Fig. 6-5 Screen display when < MASK LINE VERT/HRZN> is set to HRZN

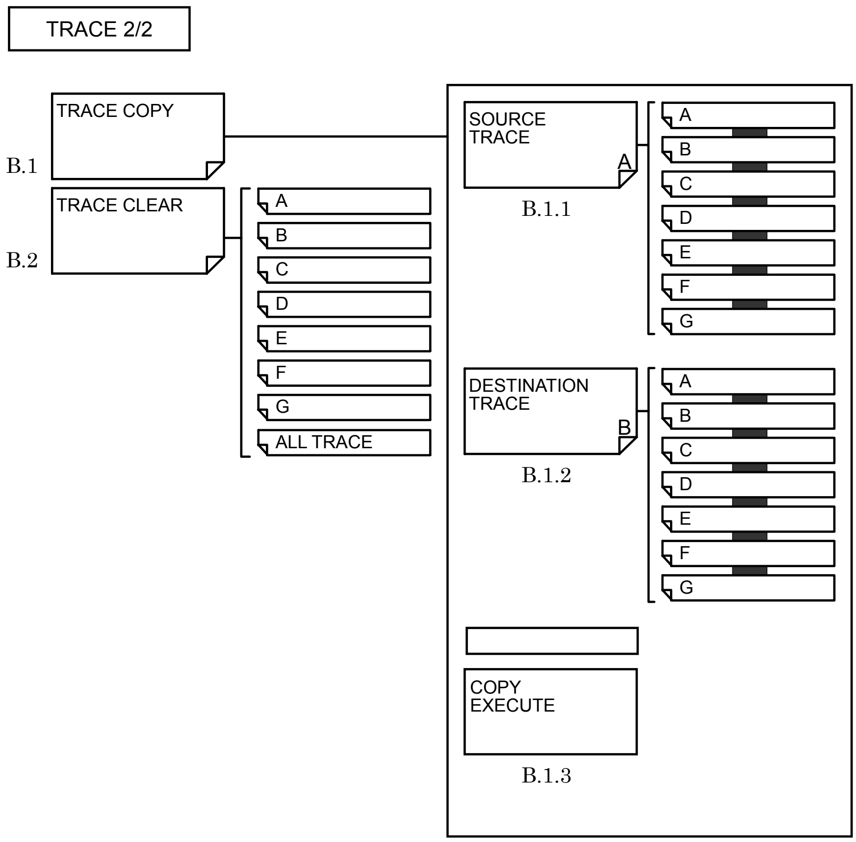
A.6 <TRACE CLEAR>

This key is used to clear the waveform for the specified trace (A through G) so that it has no data. (During normal display and upper/lower 2-split display)

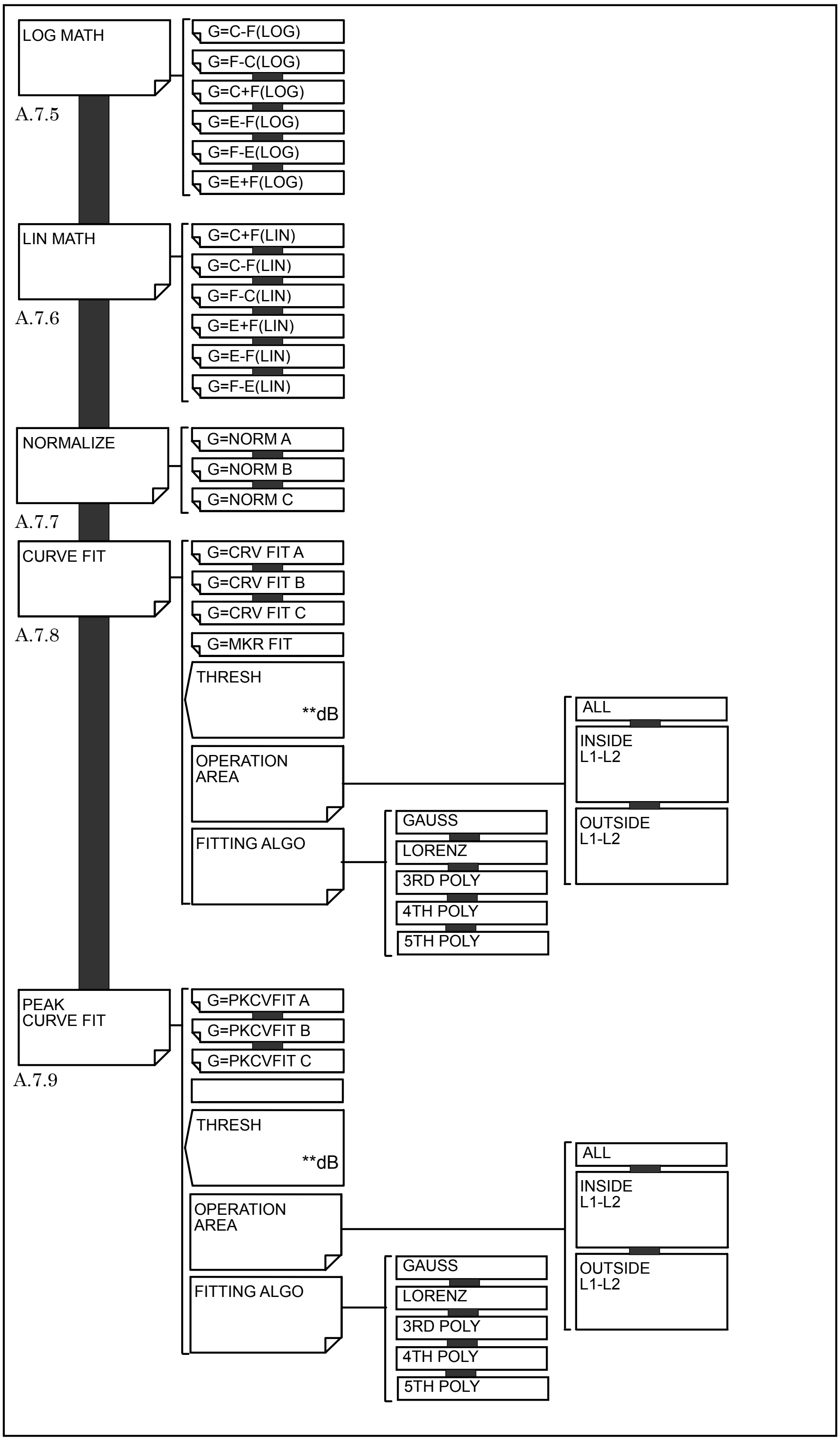
A	Clears the trace A data. Restores the previous tree after clearing.
B	Clears the trace B data. Restores the previous tree after clearing.
C	Clears the trace C data. Restores the previous tree after clearing.
D	Clears the trace D data. Restores the previous tree after clearing.
E	Clears the trace E data. Restores the previous tree after clearing.
F	Clears the trace F data. Restores the previous tree after clearing.
G	Clears the trace G data. Restores the previous tree after clearing.
ALL TRACE	Clears the data for all traces. Restores the previous tree after clearing.

6-9 TRACE


TRACE 1/2
ACTIVE TRACE ABCDEFG
A.1
VIEW @ DISP BLANK
A.2
WRITE A
A.3
FIX A
A.4
HOLD A MAX HOLD
A.5
ROLL AVG A ***
A.6
CALCULATE @
A.7
TRACE LIST
A.8
A
B
C
D
E
F
G
MAX HOLD
MIN HOLD
CALCULATE C
CALCULATE F
CALCULATE G
To CALCULATE G
LOG MATH
A.7.1
C=A-B(LOG)
C=B-A(LOG)
C=A+B(LOG)
LIN MATH
A.7.2
C=A+B(LIN)
C=A-B(LIN)
C=B-A(LIN)
C=1-k(A/B) k *.***
C=1-k(B/A) k *.***
CALCULATE C
LOG MATH
A.7.3
F=C-D(LOG)
F=D-C(LOG)
F=C+D(LOG)
F=D-E(LOG)
F=E-D(LOG)
F=D+E(LOG)
LIN MATH
A.7.4
F=C+D(LIN)
F=C-D(LIN)
F=D-C(LIN)
F=D+E(LIN)
F=D-E(LIN)
F=E-D(LIN)
CALCULATE F


TRACE 2/2
TRACE COPY
B.1
TRACE CLEAR
B.2
A
B
C
D
E
F
G
ALL TRACE
SOURCE TRACE A
B.1.1
A
B
C
D
E
F
G
DESTINATION TRACE B
B.1.2
A
B
C
D
E
F
G
COPY EXECUTE
B.1.3

CALCULATE G



6.9 TRACE

A.1 <ACTIVE TRACE…ABCDEFG>

This key is used to select the active trace from traces A through G. The active trace data are used by some analysis functions and for marker calculations.
In addition, trace settings entered with the keys (A.2) through (A.7) apply to the active trace. Before turning the trace display ON/OFF or changing trace attributes, first set the trace you want to change as the active trace. You can also switch the active trace using the mouse by clicking TRACE display A through G on the screen.
Default:A

A.2 <VIEW @…DISP / BLANK>

This key is used to determine whether to display the trace selected using <ACTIVE TRACE> (A.1).
When you press this key, the highlight toggles between "VIEW @ DISP" and "VIEW @ BLANK".
Note that if BLANK is set, markers applied to the trace set in DISP will be cleared.

"VIEW @ DISP"	Displays the waveform on the screen. At this time, the trace display on the side of the data area changes to "DSP".
"VIEW @ BLANK"	Does not display the waveform on the screen. At this time, the trace display on the side of the data area changes to "BLK". In addition, markers and marker values also disappear.

A.3 <WRITE A>

This key is used to set the active trace to write mode.
When a trace is set to write mode, waveform data are written to it and updated during measurement.
In addition, the trace display on the side of the data area changes to "WRITE".

A.4 <FIX A>

This key is used to set the active trace to data fixing mode.
When a trace is set to this mode, its waveform data do not change even when measurement is performed. Therefore, the waveform on the screen is not overwritten. The trace display on the side of the data area changes to "FIX".
When the <FIX> key is pressed during sweeping, the waveform displayed at that time is fixed.
If all traces are fixed, a warning is displayed because waveform data will not be updated in any traces when measurement is performed.

WARNING MESSAGE 101: All Traces in FIXed state

In addition, when all traces are fixed, a warning message is displayed if the <AUTO>/<REPEAT>/<SINGLE> keys in the [SWEEP] switch are pressed.

WARNING MESSAGE 101: All Traces in FIXed state

A.5 <HOLD>

This key is used to set the active trace to maximum value/minimum value detection mode.

MAX HOLD With this setting, each time sweeping is performed, each measurement point is compared with previous measurements. The highest value is then written to TRACE@. The trace display at the side of the data area changes to "MAX HOLD".

MIN HOLD With this setting, each time sweeping is performed, each measurement point is compared with previous measurements. The lowest value is then written to TRACE@. The trace display at the side of the data area changes to "MIN HOLD".

Maximum value/minimum value detection is not affected by the noise mask setting. The noise mask is applied when the maximum value/minimum value detection results are displayed.

A.6 <ROLL AVG>

This key is used to set the active trace to roll averaging mode. When this key is executed, the current averaging time is displayed in the interrupt display area. The trace display on the side of the data area changes to "ROLL AVG ***". (The asterisks denote the set number of times)
When a trace is set to ROLL AVG mode, each time measurement is performed the roll averaging of the current measurement and past measurements is calculated, and the measurement data are updated. The averaging time may be changed in the range of 2 to 100 times (1 step) using the rotary knob, step keys, or numeric keypad.
The roll averaging calculation is not affected by the noise mask function setting (☛ See [DISPLAY] switch <NOISE MASK> key). The noise mask function is applied when the roll averaging calculation results are displayed.
The roll averaging is calculated according to the following equation.

$$Wj\ (i) = Wj\text{-}1\ (i) \cdot \frac{n-1}{n} + W\ (i)\frac{1}{n} \qquad (\ i=1,\ 2 \cdots\cdots\cdots\cdots N)$$

Wj (i): Newly displayed waveform
Wj–1(i): Previously displayed waveform
W (i): Newly obtained waveform
N: Number of sampling points
n: Number of averagings

NOTE

- When setting of <CHOP MODE>key in measurement sensitivity is set <SWITCH> , two sweeping is counted up the roll average.

A.7 <CALCULATE @> (@ = C,F,G)

This key is used to set the active trace to trace-to-trace calculation mode. The trace-to-trace calculation function can be used to subtract or add together the data from different traces; to produce normalized displays; and to produce curve-fit displays. The available calculations vary from trace to trace.
Trace-to-trace calculation mode can only be set for traces C, F, and G. The <CALCULATE> key is disabled except when C, F, or G is selected using <ACTIVE TRACE>(A.1).
During trace-to-trace calculation, if the measurement of the calculated trace is redone, then it is recalculated and redisplayed. In addition, a trace is recalculated and redisplayed when the measurement center wavelength and measurement span are changed. If the measurement conditions (resolution) for the calculated trace do not match, then a warning is displayed after

the calculation is performed.

Default: <CALCULATE C> C=A-B(LOG)
<CALCULATE F> F=C-D(LOG)
<CALCULATE G> G=C-F(LOG)

<Executable trace-to-trace calculations>

TRACE C

LOG calculations: A-B, B-A, A+B
Linear calculations: A+B, B-A, A+B, 1-k(A/B), 1-k(B/A)

TRACE F

LOG calculations: C-D, D-C, C+D, D-E, E-D, D+E
Linear calculations: C+D, C-D, D-C, D+E, D-E, E-D

TRACE G

LOG calculations: C-F, F-C, C+F, E-F. F-E. E+F
Linear calculations: C+F, C-F, F-C, E+F, E-F, F-E
NORMALIZE (A, B, C)
CURVE FIT (A, B, C)
PEAK CURVE FIT (A, B, C)
MARKER FIT

The <CALCULATE> key operations in cases where C, F, or G is selected as the active trace are described below.

CALCULATE C: When C is selected using <ACTIVE TRACE>

CALCULATE F: When F is selected using <ACTIVE TRACE>

CALCULATE G: When G is selected using <ACTIVE TRACE>

CALCULATE C

A.7.1 <LOG MATH>

This key is used to perform LOG calculations on trace-to-trace data and write the results to trace C.
Calculations can be applied to trace A and trace B.
If both traces selected for calculation are set to “BLANK” , then the sub-scale is displayed on the left side of the screen. Otherwise it is displayed on the right side. The calculation results are displayed in the sub-scale.

C=A-B(LOG)	Subtracts trace B from trace A in LOG form.
C=B-A(LOG)	Subtracts trace A from trace B in LOG form.
C=A+B(LOG)	Adds trace A and trace B in LOG form.

A.7.2 <LIN MATH>

This key is used to perform linear calculations on trace-to-trace data and write the results to trace C.
Calculations can be applied to trace A and trace B.
The calculation results are displayed in the main scale.

C=A+B(LIN)	Adds trace A and trace B in linear form.
C=A-B(LIN)	Subtracts trace B from trace A in linear form.
C=B-A(LIN)	Subtracts trace A from trace B in linear form.
C=1-k(A/B)	Performs the calculation 1-k(A/B) on trace A and trace B. Performs the calculation 1-k × (trace A／trace B) (linear value) and writes the result to trace C. The coefficient k may be changed in the range of 1.0000 to 20000.0000 (0.0001 step) using the rotary knob, step keys, or numeric keypad. The coefficient k setting applies to both the <C=1-k(A/B)> key and <C=1-k(B/A)> key. The trace display on the side of the data area changes to “1-k(A/B)”.
C=1-k(B/A)	Performs the calculation 1-k(B/A) on trace A and trace B. Performs the calculation 1-k × (trace B／trace A) (linear value) and writes the result to trace C. The coefficient k may be changed in the range of 1.0000 to 20000.0000 (0.0001 step) using the rotary knob, step keys, or numeric keypad. The coefficient k setting applies to both the <C=1-k(A/B)> key and <C=1-k(B/A)> key. The trace display on the side of the data area changes to “1-k(B/A)”.

As shown below, this ＜1-kA/B→C k=*****.*＞ key or ＜1-kB/A→C k=*****.*＞ key may be used to estimate the transmission efficiency from the reflection light spectrum, or estimate the reflectivity from the transmission light spectrum for DUT.

(1) Estimating the transmission efficiency (trace C) from the reflection light spectrum (trace A)

Transmitted light spectrum (TRACE C) = 1-k (TRACE A/TRACE B)

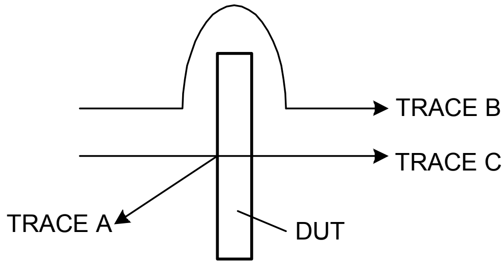


Fig. 6-6 Estimating the transmission efficiency (trace C) from the reflection light spectrum (trace A)

(2) Estimating the reflectivity (trace C) from the transmission light spectrum (trace A)

Reflected light spectrum (TRACE C) = 1-k (TRACE A/TRACE B)

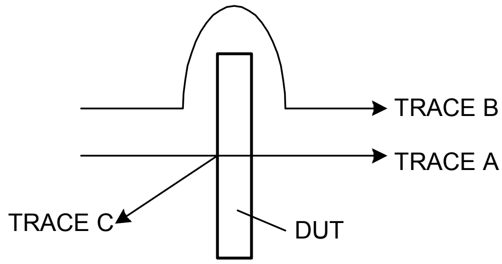


Fig. 6-7 Estimating the reflectivity (trace C) from the transmission light spectrum (trace A)

The value of k is an absorption coefficient which is used in determining the DUT reflectivity and transmission efficiency. Different algorithms are used depending on whether transmission efficiency or reflectivity is estimated, so the k value also varies accordingly.

The following equation can be used to determine "kr" and "kt". In the equation, Pin is the level prior to DUT input; Pout is the level after DUT input; Pre is the DUT reflection level; "kr" is the absorption coefficient used to determine the reflectivity; and "kt" is the absorption coefficient used to determine the transmission efficiency. (Each level is a linear value)

Estimating the reflected light spectrum from the transmission light spectrum

$kt = (Pin - Pre) / Pout$

Estimating the transmitted light spectrum from the reflection light spectrum

$kr = (Pin - Pout) / Pre$

CALCULATE F

A.7.3 <LOG MATH>

This key is used to perform LOG calculations on trace-to-trace data and write the results to trace F.
Calculations can be applied to trace C, trace D, and trace E.
If both traces selected for calculation are set to "BLANK", then the sub-scale is displayed on the left side of the screen. Otherwise it is displayed on the right side. The calculation results are displayed in the sub-scale.

F=C-D(LOG)	Subtracts trace D from trace C in LOG form.
F=D-C(LOG)	Subtracts trace C from trace D in LOG form.
F=C+D(LOG)	Adds trace C and trace D in LOG form.
F=D-E(LOG)	Subtracts trace E from trace D in LOG form.
F=E-D(LOG)	Subtracts trace D from trace E in LOG form.
F=D+E(LOG)	Adds trace D and trace E in LOG form.

A.7.4 <LIN MATH>

This key is used to perform linear calculations on trace-to-trace data and write the results to trace F.
Calculations can be applied to trace C, trace D, and trace E.
The calculation results are displayed in the main scale.

F=C+D(LIN)	Adds trace C and trace D in linear form.
F=C-D(LIN)	Subtracts trace D from trace C in linear form.
F=D-C(LIN)	Subtracts trace C from trace D in linear form.
F=D+E(LIN)	Adds trace D and trace E in linear form.
F=D-E(LIN)	Subtracts trace E from trace D in linear form.
F=E-D(LIN)	Subtracts trace D from trace E in linear form.

CALCULATE G

A.7.5 <LOG MATH>

This key is used to perform LOG calculations on trace-to-trace data and write the results to trace G.
Calculations can be applied to trace C, trace E, and trace F.
If both traces selected for calculation are set to “BLANK”, then the sub-scale is displayed on the left side of the screen. Otherwise it is displayed on the right side.
The calculation results are displayed in the sub-scale.

G=C-F(LOG)	Subtracts trace F from trace C in LOG form.
G=F-C(LOG)	Subtracts trace C from trace F in LOG form.
G=C+F(LOG)	Adds trace C and trace F in LOG form.
G=E-F(LOG)	Subtracts trace F from trace E in LOG form.
G=F-E(LOG)	Subtracts trace E from trace F in LOG form.
G=E+F(LOG)	Adds trace E and trace F in LOG form.

A.7.6 <LIN MATH>

This key is used to perform linear calculations on trace-to-trace data and write the results to trace G.
Calculations can be applied to trace C, trace E, and trace F.
The calculation results are displayed in the main scale.

G=C+F(LIN)	Adds trace C and trace F in linear form.
G=C-F(LIN)	Subtracts trace F from trace C in linear form.
G=F-C(LIN)	Subtracts trace C from trace F in linear form.
G=E+F(LIN)	Adds trace E and trace F in linear form.
G=E-F(LIN)	Subtracts trace F from trace E in linear form.
G=F-E(LIN)	Subtracts trace E from trace F in linear form.

A.7.7 <NORMALIZE>

Normalizes the specified trace data and writes the data to trace G.
Normalizes the data so that the waveform peak goes to 1 or 0 dB, and writes the data to trace G.
Calculations can be applied to traces A through C.
Data are displayed when sweeping is completed at the stop.
If both traces selected for calculation are set to “BLANK”, then the sub-scale is displayed on the left side of the screen. Otherwise it is displayed on the right side.
The calculation results are displayed in the sub-scale.
The trace display at the side of the data area changes to "NORM @".

G=NORM A	Normalizes trace A and writes the normalized data to trace G.
G=NORM B	Normalizes trace B and writes the normalized data to trace G.
G=NORM C	Normalizes trace C and writes the normalized data to trace G.

A.7.8 <CURVE FIT>

Curve-fits the specified trace waveform and writes the results to trace G.
Calculation data are applied to all data at or above the cutoff value. The cutoff value is set in the range of 0 to 99 dB (1 step) using the <THRESH> key.

The trace display at the side of the data area changes to "CRV FIT @" and "MKR FIT".

G=CRV FIT A	Curve-fits trace A.
G=CRV FIT B	Curve-fits trace B.
G=CRV FIT C	Curve-fits trace C.
G=MKR FIT	Make the curve-fit data form delta markers which is set currently. MKR FIT is independent on the trace. If delta markers is not sufficient, warning message is displayed and trace G data is set to 0. (Linear) WARNING 111 : <G=MKR FIT>failed
OPERATION AREA	Set the data area which is used at curve-fit calculation.

ALL	All of the data that is the trace or delta markers are made applicable for calculation.
INSIDE L1-L2	The data of between line markers are made applicable for calculation.
OUTSIDE L1-L2	The data of outside line markers are made applicable for calculation.

FITTING ALGO — Set the fitting algorithm for obtaining curve-fits.

GAUSS	Normal distribution curve
LORENZ	Lorenz curve
3RDPOLY	3rd poly
4TH POLY	4th poly
5TH POLY	5th poly

NOTE

- Trace G cannot write fitting curve and displayed warning because numbers of data is not sufficient during <G=MKR FIT>.
  A incidence condition in warning depending on the <FITTING ALGO>key's setting.
  The following a incidence condition in warning.

Fitting Algorithm	Possible errors resulting in warning
GAUSS	The delta markers set three or less which set currently.
LORENZ	The delta markers set three or less which set currently.
3RD POLY	The delta markers set four or less which set currently.
4TH POLY	The delta markers set five or less which set currently.
5TH POLY	The delta markers set six or less which set currently.

- Except for the <G=MKR FIT>key, if sampling numbers is not sufficient , trace G cannot write fitting curve and displayed target trace's waveform data.

A.7.9 <PEAK CURVE FIT>

Peak-curve-fits the specified trace waveform and writes the results to trace G. Calculations are applied to mode peaks at or above the cutoff value. The cutoff value is set in the range of 0 to 99 dB (1 step) using the <THRESH> key.
The trace display at the side of the data area changes to “PKCVFIT @".

G= PKCVFIT A	Peak-curve-fits trace A.
G= PKCVFIT B	Peak-curve-fits trace B.
G= PKCVFIT C	Peak-curve-fits trace C.
OPERATION AREA	Set the data area which is used at curve-fit calculation.

ALL	All of the data that is the trace or delta markers are made applicable for calculation.
INSIDE L1-L2	The data of between line markers are made applicable for calculation.
OUTSIDE L1-L2	The data of outside line markers are made applicable for calculation.

FITTING ALGO Set the fitting algorithm for obtaining curve-fits.

GAUSS	Normal distribution curve
LORENZ	Lorenz curve
3RDPOLY	3rd poly
4TH POLY	4th poly
5TH POLY	5th poly

NOTE

- Except for the <G=MKR FIT>key, if sampling numbers is not sufficient , trace G cannot write fitting curve and displayed target trace’s waveform data.

Fig 6-8 shows the data area of curve-fit by the <OPERATION AREA> key (INSIDE L1-L2、OUTSIDE L1-L2) setting.
The <OPERATION AREA> key setting applies to both <CURVE FIT> key and <PEAK CURVE FIT> key.

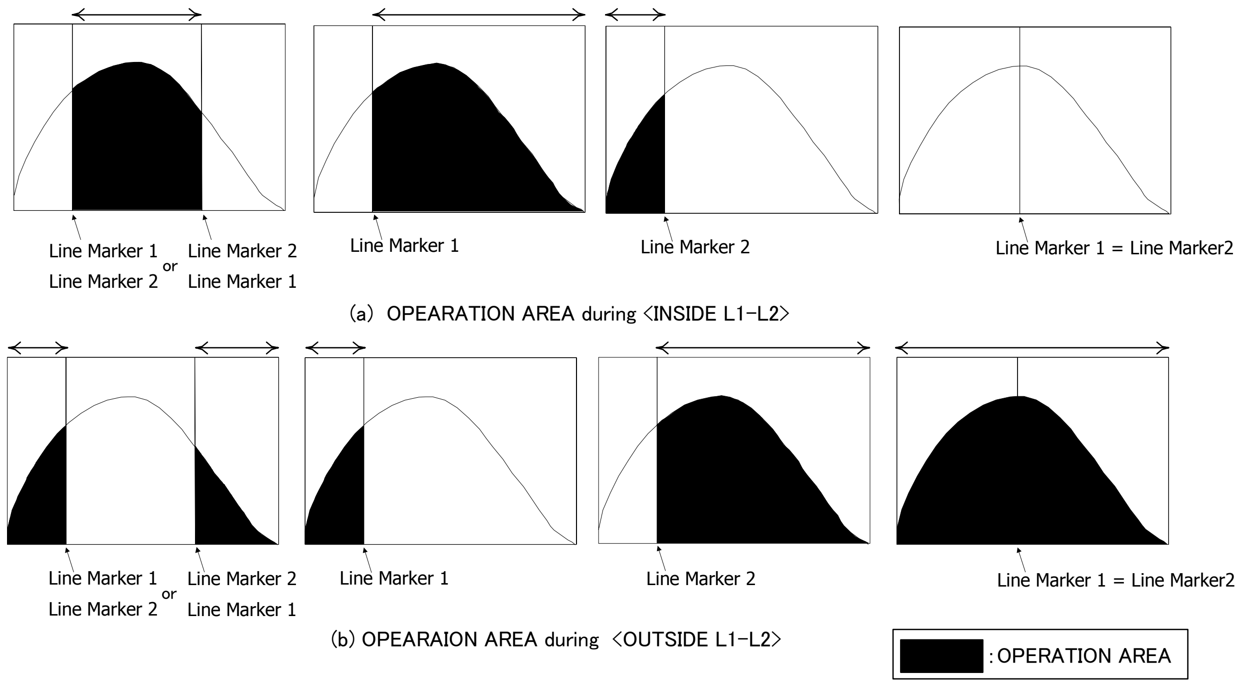


Fig 6-8 Curve fit calculate area by the <OPEARATIO AREA> key setting

NOTE

- The cutoff value is calculated from the peak value which is on the operation area as noted above.

A.8 <TRACE LIST>

Opens the trace conditions list window.
The window closes when the <RETURN> key is pressed.

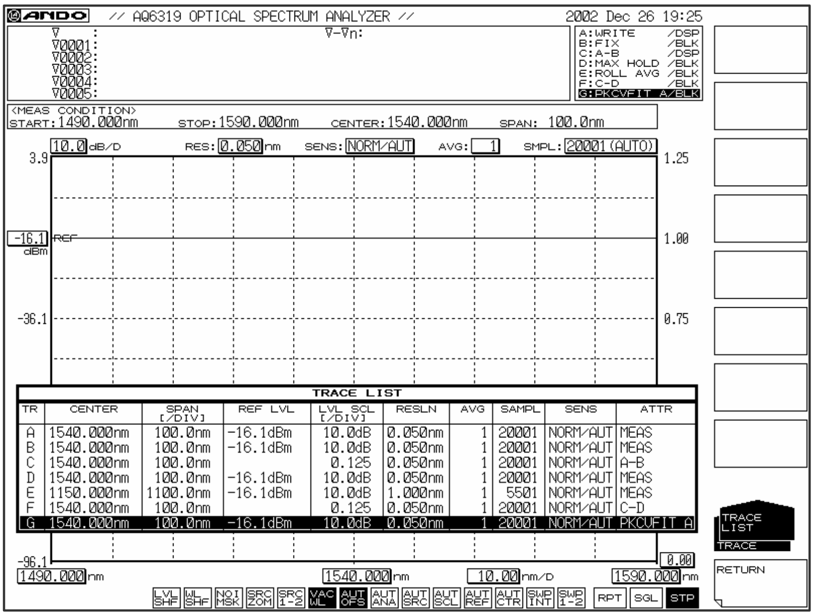


Fig. 6-9 Screen display when <TRACE LIST> key is pressed

B.1 <TRACE COPY>

Copies the trace data to another trace.

B.1.1 <SOURCE TRACE>

Selects the trace data (among traces A to G) to be copied. Restores the previous tree after a selection is made.

B.1.2 <DESTINATION TRACE>

Selects the destination trace (among traces A to G) for copying. Restores the previous tree after a selection is made.

B.1.5 <COPY EXECUTE>

Copies the trace data.
The copy destination trace status changes to “FIX” and “DISP”.
If SOURCE (B.1.1) and DESTINATION (B.1.2) are the same, then the <COPY EXECUTE> key is disabled.

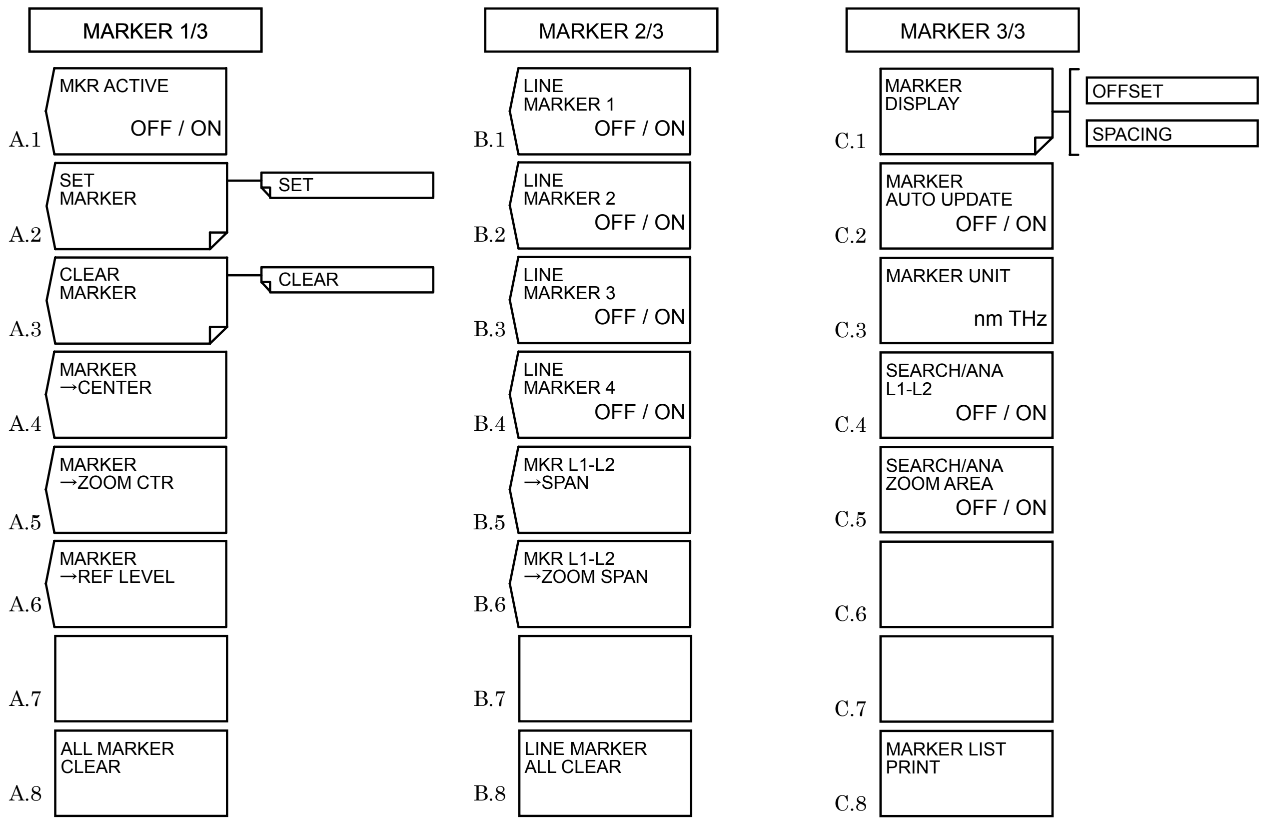
B.2 <TRACE CLEAR>

Clears the specified trace data (among traces A to G).

A	Clears the trace A data. Restores the previous tree after clearing.
B	Clears the trace B data. Restores the previous tree after clearing.
C	Clears the trace C data. Restores the previous tree after clearing.
D	Clears the trace D data. Restores the previous tree after clearing.
E	Clears the trace E data. Restores the previous tree after clearing.
F	Clears the trace F data. Restores the previous tree after clearing.
G	Clears the trace G data. Restores the previous tree after clearing.
ALL TRACE	Clears the data for all traces. Restores the previous tree after clearing.

6-10 MARKER

The [MARKER] switch contains functions related to markers. When you press the [MARKER] switch, the following soft key menu is displayed.



A.1 <MARKER ACTIVE OFF / ON>

This key is used to display a moving marker. If the active trace is not set to DISP, the moving marker cannot be used. Therefore, this key is disabled in such cases.
If the moving marker is not visible, this key displays it on the waveform in the screen center and displays the marker value in the data area. If the moving marker is already visible, it stays in its displayed position with no change.
If the moving marker is ON and the <MARKER ACTIVE OFF/ON> key is selected, the interrupt display area is displayed, allowing the marker wavelength to be entered directly.
In this state, you can scroll through the marker area using the step keys.

A.2 <SET MARKER>

This key is used to set the moving marker as a fixed marker with the specified number.
A maximum of 1024 fixed marker numbers can be set.
Moving markers can be set across multiple traces.

SET	The next marker number to be set (one greater than the highest fixed marker number among the currently set markers, or the number "1" if no markers have been set) is displayed in the interrupt display area.

A.3 <CLEAR MARKER>

This key is used to clear the specified fixed marker number. The marker value in the data area is also cleared.
When you press this key, the marker number is displayed in the interrupt display area, and can be changed in the DATA ENTRY section.
The fixed marker number to be cleared (default value) is the last set fixed marker number.

CLEAR	Clears the specified fixed marker number. Restores the previous level after execution.

A.4 <MARKER →CENTER>

This key is used to set the moving marker wavelength as the measurement center wavelength.
When this key is executed, the set measurement center wavelength is displayed in the interrupt display area. The settings for the measurement center wavelength, measurement start wavelength, and measurement stop wavelength are changed at this time.
The measurement center wavelength can be set by continuing in the DATA ENTRY section.
The value can be changed in the range of 600.00 to 1700.00 (0.01 step).
In the following states, the <MARKER →CENTER> key is disabled.

- When the moving marker is OFF
- When both split screens are on HOLD
- When the measurement data SPAN is 0 nm

A.5 <MARKER ZOOM CTR>

This key is used to set the moving marker wavelength as the display scale center wavelength.
After the value is set, you can continue by setting the display scale center wavelength.
In the following states, the <MARKER →ZOOM CCTR > key is disabled.

- When the moving marker is OFF
- When both split screens are on HOLD
- When the measurement data SPAN is 0 nm

A.6 <MARKER →REF LEVEL>

This key is used to set the moving marker level as the reference level.
After execution, the set reference level is displayed in the interrupt display area, and the displayed waveform is redrawn according to the changed reference level.
The reference level can be set by continuing in the DATA ENTRY section.

Permitted value changing range for LOG scale: -90.0 to +30.0 dBm (0.1 step)
Permitted value changing range for linear scale: 1.00 pW to 1000 mW
1.00 to 9.99[pW, nW, μW, mW] (0.01 step)
10.0 to 99.9(100) [pW, nW, μW, (mW)] (0.1 step)
100 to 999[pW, nW, μW] (1 step)

If the moving marker value exceeds the allowed range, it is set to the nearest value in the range and a warning is displayed.
In the following states, the <MARKER → REF LEVEL> key is disabled.

- When the moving marker is OFF
- When both split screens are on HOLD

A.8 <ALL MARKER CLEAR>

This key is used to clear the displayed moving marker and fixed markers. The marker values in the data area are also cleared.
The moving marker is turned OFF.
If the moving marker is OFF and there are no fixed markers, the <ALL MARKER CLEAR> key is disabled.

B.1 <LINE MARKER 1 OFF / ON>

When you press the <LINE MARKER 1 OFF / ON> key, a line marker is displayed. The interrupt display area appears, allowing the line marker wavelength value to be changed. (Default: OFF)
When you press the key again, line marker 1 disappears from the screen.
If the active trace span is 0 nm, this key is disabled.
The marker position setting range is the same as for START WL/STOP WL and START FREQ/STOP FREQ.
The mouse can be used to manipulate a line marker displayed on the waveform screen.

B.2 <LINE MARKER 2 OFF / ON>

When you press the <LINE MARKER 2 OFF / ON> key, a line marker is displayed. The interrupt display area appears, allowing the line marker wavelength value to be changed. (Default: OFF)
When you press the key again, line marker 2 disappears from the screen.
If the active trace span is 0 nm, this key is disabled.
The marker position setting range is the same as for START WL/STOP WL and START FREQ/STOP FREQ.
The mouse can be used to manipulate a line marker displayed on the waveform screen.

B.3 <LINE MARKER 3 OFF / ON>

When you press the <LINE MARKER 3 OFF / ON> key, a line marker is displayed. The interrupt display area appears, allowing the line marker wavelength value to be changed. (Default: OFF)
When you press the key again, line marker 3 disappears from the screen.
The marker position setting range is the same as for REF LEVEL and LIN LEVEL.
The mouse can be used to manipulate a line marker displayed on the waveform screen.

B.4 <LINE MARKER 4 OFF / ON>

When you press the <LINE MARKER 4 OFF / ON> key, a line marker is displayed. The interrupt display area appears, allowing the line marker wavelength value to be changed. (Default: OFF)
When you press the key again, line marker 4 disappears from the screen.
The marker position setting range is the same as for REF LEVEL and LIN LEVEL.
The mouse can be used to manipulate a line marker displayed on the waveform screen.

B.5 <MKR L1-L2 →SPAN>

This key is used to set the measurement span between line markers 1 and 2.
When this key is executed, the set measurement span is displayed in the interrupt display area.
The span can be set by continuing in the DATA ENTRY section.
The value can be changed in the range of 0.1 to 1100 nm (0.1 step).
When the <MKR L1-L2 →SPAN> key is executed, the measurement span, measurement start wavelength, and measurement stop wavelength are changed.
If L1 and L2 are OFF, the <MKR L1-L2 →SPAN> key is disabled. It is also disabled if the active trace span is 0 nm.

NOTE

- If both WL1 and WL2 are set, the one with the smaller value is set as the measurement start wavelength, and the one with the larger value is set as the measurement stop wavelength.
- If just WL1 is set, the marker value is set as the measurement start wavelength, and the right edge of the screen is set as the measurement stop wavelength.
- If just WL2 is set, the left edge of the screen is set as the measurement start wavelength, and the marker value is set as the measurement stop wavelength.

B.6 <MKR L1-L2 →ZOOM SPAN>

This key is used to set the zoom span from line marker 1 to line marker 2 as the display scale ZOOM SPAN.
When this key is executed, the set ZOOM SPAN is displayed in the interrupt display area. In conjunction with the ZOOM SPAN change, the displayed waveform is overwritten to match the set ZOOM SPAN.
If L1 and L2 are OFF, the <MKR L1-L2 →ZOOM SPAN> key is disabled. It is also disabled if the active trace span is 0 nm.

B.8 <LINE MARKER ALL CLEAR>

This key is used to clear a displayed line marker.
If L1 through L4 are OFF, the < LINE MARKER ALL CLEAR> key is disabled.

C.1 <MARKER DISPLAY>

This key is used to set whether to display the difference relative to the moving marker (OFFSET) or the difference relative to the next marker (SPACING) in the marker display (Fig. 6-10 "Data area when <MARKER DISPLAY> is set to OFFSET" and Fig. 6-11 "Data area when <MARKER DISPLAY> is set to SPACING").
(Default: OFFSET)
(☛ "Fig. 6-10 Data area when <MARKER DISPLAY> is set to OFFSET " , "Fig. 6-11 Data area when <MARKER DISPLAY> is set to SPACING ")

If the active trace span is 0 nm, the wavelength difference relative to the moving marker is 0.000 nm.
If a fixed marker is placed at the -210 dBm wavelength value, "????????" is displayed as the level difference from that fixed marker.
When a fixed marker is positioned and the active marker is set to a wavelength value of -210 dBm, the level difference is set to 23.22 dB, regardless of the fixed marker's level.
The step keys can be used to scroll through the window.

OFFSET Sets the difference value display as the difference between each marker and the moving marker (OFFSET).

▽:	1552.000 nm	−10.000 dBm	▽−▽n:	
▽01:	1552.100 nm	−20.000 dBm	0.100 nm	−10.000 dBm
▽02:	1552.200 nm	−30.000 dBm	0.200 nm	−20.000 dBm
▽03:	1552.300 nm	−40.000 dBm	0.300 nm	−30.000 dBm

Difference relative to moving marker (▽)

Fig. 6-10 Data area when <MARKER DISPLAY> is set to OFFSET

SPACING Sets the difference value display as the difference between each marker and the next marker.

▽:	1552.000 nm	−10.000 dBm	SPACING:	
▽01:	1552.100 nm	−20.000 dBm	0.100 nm	−10.000 dBm
▽02:	1552.200 nm	−30.000 dBm	0.100 nm	−10.000 dBm
▽03:	1552.300 nm	−40.000 dBm	0.100 nm	−10.000 dBm

Difference relative to previous marker

Fig. 6-11 Data area when <MARKER DISPLAY> is set to SPACING

C.2 <MARKER AUTO UPDATE OFF / ON>

This key is used to select whether to track, to the waveform, the level position of the fixed marker displayed in the data area each time the active trace waveform is updated. (Default: OFF)
When it is set to ON, the fixed marker's level value is updated to track the waveform each time the active trace waveform is updated.
When it is set to OFF, the fixed marker's level value is not changed even if the active trace waveform is updated.

C.3 <MARKER UNIT nm THz>

This key is used to switch the marker value display between wavelength display mode and frequency display mode.
When you press the <MARKER UNIT nm THz> key, the display unit for the marker value (wavelength or frequency) can be set independently of the waveform display's horizontal axis unit (wavelength or frequency), which is set using the <HORZN SCALE nm/THz> key of the [SETUP] switch. (Default: nm)
The <MARKER UNIT nm THz> key's setting changes in conjunction with the setting for the <HORZN SCALE> key. However, changing the <MARKER UNIT nm THz> key's setting does not change the setting for the <HORZN SCALE nm/THz> key of the [SETUP] switch.
(This key can be used to enter settings such as frequency display mode on the X axis and wavelength display mode for the marker value.)

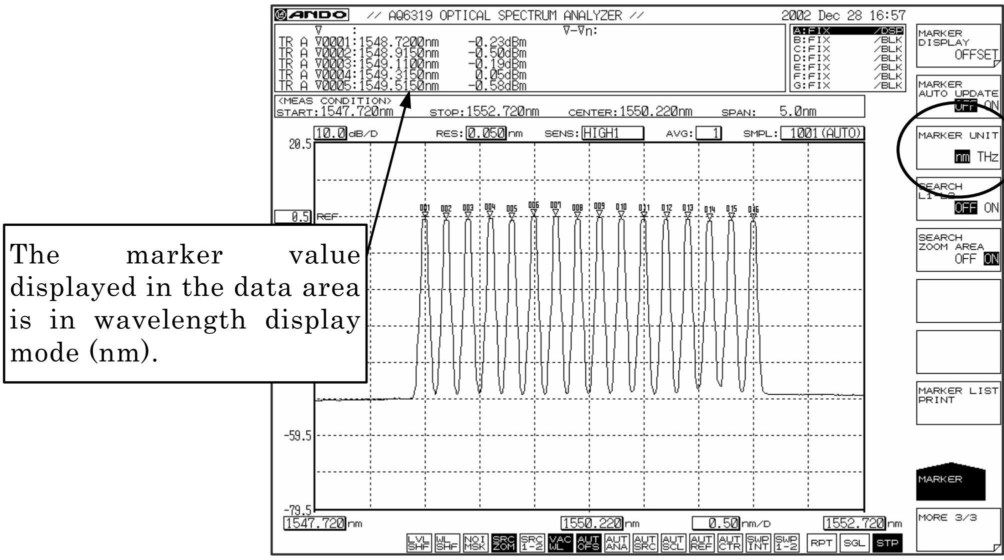


Fig. 6-12 Screen display when <MARKER UNIT nm THz> is set to nm

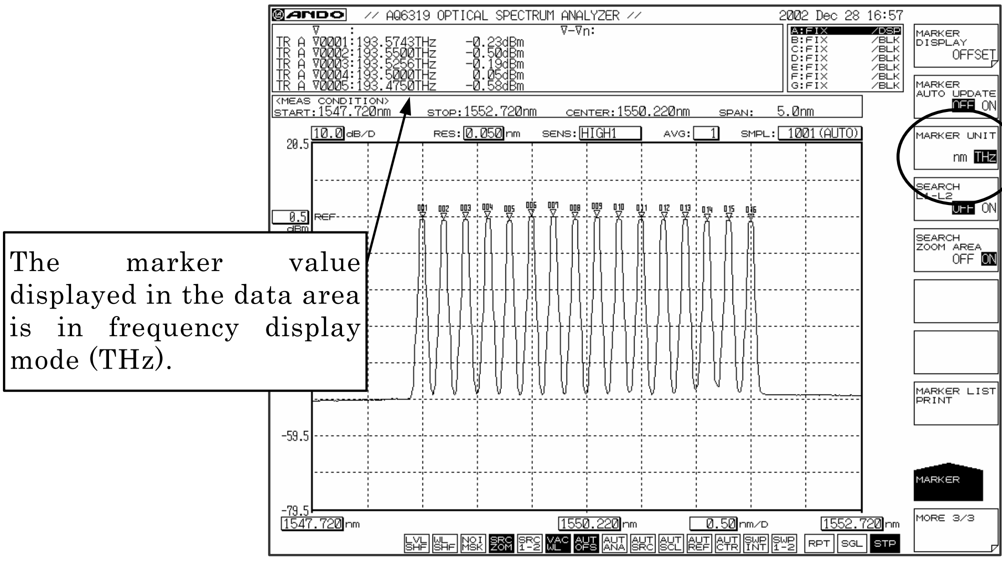


Fig. 6-13 Screen display when <MARKER UNIT nm THz> is set to THz

C.4 <SEARCH/ANA L1-L2 OFF / ON>

When the <SEARCH/ANA L1-L2 OFF / ON> key is set to ON and wavelength line markers WL1 and WL2 are set, peak searching, bottom searching ([PEAK SEARCH] switch), and analysis function ([ANALYSIS] switch) calculations are only applied over the span between line marker 1 and 2.
The <SEARCH/ANA L1-L2 OFF / ON> setting applies to both the [MARKER] , [PEAK SEARCH] and [ANALYSIS] switch.
If wavelength line markers WL1 and WL2 are not set, the <SEARCH/ANA L1-L2 OFF / ON> key is disabled.
(Default: OFF)
When this key is set to ON, SRC 1-2 is displayed at the very bottom of the screen.

NOTE

- If both WL1 and WL2 are set, execution applies over the span between line markers 1 and 2.
- If just WL1 is set, execution applies over the span from line marker 1 to the right edge of the screen.
- If just WL2 is set, execution applies over the span from the left edge of the screen to line marker 2.

C.5 <SEARCH ZOOM/ANA AREA OFF / ON>

When the <ZOOM AREA/ANA SEARCH> key is set to ON, peak searching, bottom searching ([PEAK SEARCH] switch), and analysis function ([ANALYSIS] switch) calculations are only applied to data in the ZOOM SPAN range.
The <SEARCH/ANA L1-L2 OFF / ON> setting applies to both the [MARKER] , [PEAK SEARCH] and [ANALYSIS] switch.
When this key is set to ON and the <SEARCH/ANA L1-L2> key is also set to ON, calculations are applied to the overlapping data between the ZOOM SPAN range and the range of line markers 1 and 2.
(Default: ON)
When this key is set to ON, SRC ZOM is displayed at the very bottom of the screen.

C.8 <MARKER LIST PRINT>

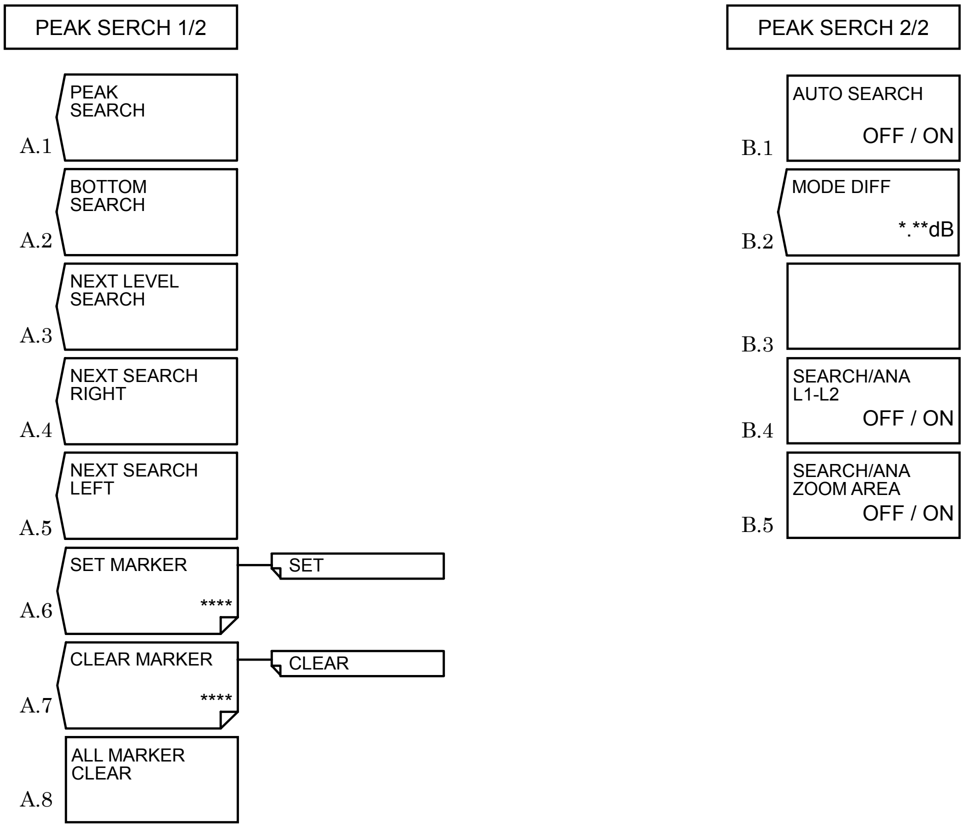
This key is used to print multiple marker values on the internal thermal printer.
To cancel a print job which is in progress, press the [COPY CANCEL] key, which appears after the <MARKER LIST PRINT> key is pressed.

NOTE

Even the <HARD COPY DEVICE> key in the [SYSTEM] switch is set other than INTERNAL, the internal thermal printer is selected.

6-11 PEAK SEARCH

The [PEAK SEARCH] switch contains functions for searching for peaks and bottoms in measured waveforms.
When you press the [PEAK SEARCH] switch, the following soft key menu is displayed.



A.1 <PEAK SEARCH>

This key is used to perform a peak search (detecting the maximum level value) on the active trace waveform. A moving marker is set and the marker value is displayed in the data area. If the peak level is above the screen top or below the screen bottom, a marker is displayed at the screen top or bottom, and the actual (correct) marker value is displayed in the data area.
After this key is executed, the marker can be moved using the rotary knob.

A.2 <BOTTOM SEARCH>

This key is used to perform a bottom search (detecting the minimum level value) on the active trace waveform. A moving marker is set and the marker value is displayed in the data area. If the bottom level is above the screen top or below the screen bottom, a marker is displayed at the screen top or bottom, and the actual (correct) marker value is displayed in the data area.
After this key is executed, the marker can be moved using the rotary knob.

A.3 <NEXT LEVEL SEARCH>

This key is used to set a moving marker at the peak (maximum level value) or bottom (minimum level value) which follows the currently set moving marker value (level value) in the active trace waveform. If there is no such peak or bottom, a warning data is displayed.

WARNING 103: No data in active trace

A.4 <NEXT SEARCH RIGHT>

This key is used to set a moving marker at the peak (maximum level value) or bottom (minimum level value) which is to the right of the currently set moving marker value (level value) in the active trace waveform. If there is no such peak or bottom, a warning data is displayed.

WARNING 103: No data in active trace

A.5 <NEXT SEARCH LEFT>

This key is used to set a moving marker at the peak (maximum level value) or bottom (minimum level value) which is to the left of the currently set moving marker value (level value) in the active trace waveform. If there is no such peak or bottom, a warning data is displayed.

A.6 <SET MARKER >

SET	This key is used to set the active marker as a fixed marker with the specified number.

The setting range is 1 to 1024. (Default: One greater than the highest fixed marker number among the currently set markers, or the number "1" if no markers have been set)
The <SET MARKER> key is disabled if the active marker is OFF.

A.7 <CLEAR MARKER>

CLEAR	This key is used to clear the specified fixed marker number. The marker value in the data area is also cleared.

The fixed marker number to be cleared (default value) is the last set fixed marker number.

A.8 <ALL MARKER CLEAR>

This key is used to clear all currently displayed moving markers and fixed markers.

B.1 <AUTO SEARCH ON/OFF>

This key is used to turn ON/OFF the peak/bottom function, which is used each time a sweep is performed.
If the <AUTO SEARCH> key is se to ON, a peak/bottom search is performed and a moving marker is set automatically after sweeping ends. (Default: OFF)
When this key is set to ON, AUT SRC is displayed at the very bottom of the screen.

B.2 <MODE DIFF *.**dB>

This key is used to set the minimum peak/bottom difference (dB) serving as a basis for mode determination during mode detection.
When you press the <MODE DIFF *.**dB> key, the current setting is displayed in the interrupt display area.
The setting range is 0.01 to 50.00 dB (fine: 0.01 steps; coarse: steps of 1), and the value is set in the DATA ENTRY section. (Default: 3.00 dB)

B.4 <SEARCH/ANA L1-L2 OFF / ON>

When the <SEARCH/ANA L1-L2 OFF / ON> key is set to ON and wavelength line markers WL1 and WL2 are set, peak searching, bottom searching ([PEAK SEARCH] switch), and analysis function ([ANALYSIS] switch) calculations are only applied over the span between line marker 1 and 2.
The <SEARCH/ANA L1-L2 OFF / ON> setting applies to both the [MARKER] , [PEAK SEARCH] and [ANALYSIS] switch.
If wavelength line markers WL1 and WL2 are not set, the <SEARCH/ANA L1-L2 OFF / ON> key is disabled.
(Default: OFF)
When this key is set to ON,  is displayed at the very bottom of the screen.

NOTE

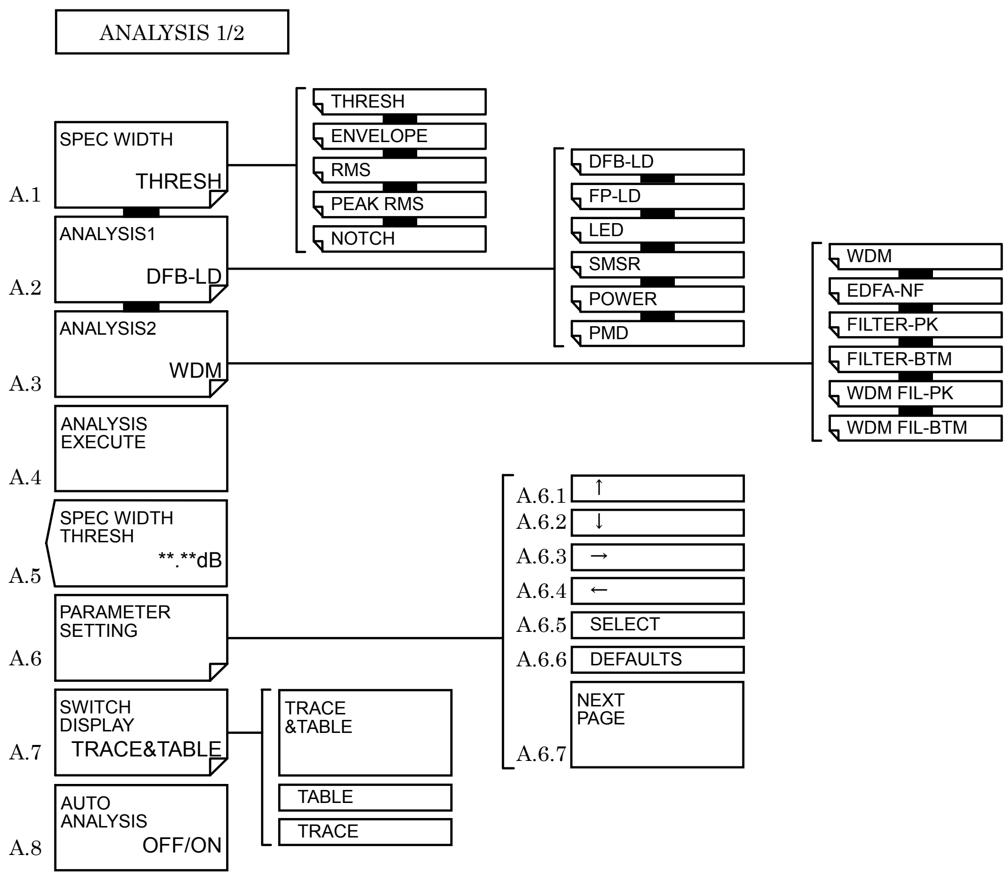
- If both WL1 and WL2 are set, execution applies over the span between line markers 1 and 2.
- If just WL1 is set, execution applies over the span from line marker 1 to the right edge of the screen.
- If just WL2 is set, execution applies over the span from the left edge of the screen to line marker 2.

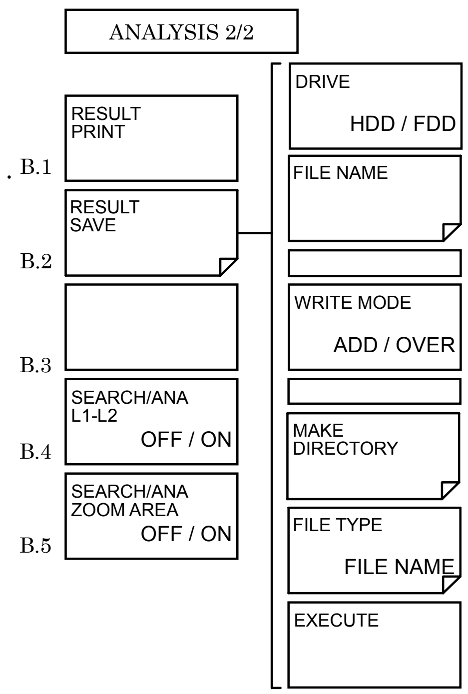
B.5 <SEARCH ZOOM/ANA AREA OFF / ON>

When the <ZOOM AREA/ANA SEARCH> key is set to ON, peak searching, bottom searching ([PEAK SEARCH] switch), and analysis function ([ANALYSIS] switch) calculations are only applied to data in the ZOOM SPAN range.
The <SEARCH/ANA L1-L2 OFF / ON> setting applies to both the [MARKER] , [PEAK SEARCH] and [ANALYSIS] switch.
When this key is set to ON and the <SEARCH/ANA L1-L2> key is also set to ON, calculations are applied to the overlapping data between the ZOOM SPAN range and the range of line markers 1 and 2.
(Default: ON)
When this key is set to ON,  is displayed at the very bottom of the screen.

6-12 ANALYSIS

The [ANALYSIS] switch contains functions related to measured waveform analysis.
When you press the [ANALYSIS] switch, the following soft key menu is displayed. The highlighted key among soft keys A.1 through A.3 is executed.





A.1 < SPEC WIDTH >

This key is used to select a spectrum width analysis algorithm and execute analysis. (Default: THRESH)

See Chapter 8 for details on the algorithms and set parameters for the individual analysis functions.

(☛ See section 8.3 Spectrum Width Data Calculation Algorithm)

THRESH — Determines the spectrum width based on THRESH from the active trace waveform, and displays it in the marker area. Also sets special markers.
The threshold value is set using the <SPEC WIDTH THRESH> key.
Other parameters are set through the Parameter setting window which appears when the <PARAMETER SETTING> key is pressed.
If there is no data in the active trace, a warning is displayed.
WARNING 103: No data in active trace

ENVELOPE — Determines the spectrum width based on the envelope method from the active trace waveform, and displays it in the marker area. Also sets special markers.
The threshold value is set using the <SPEC WIDTH THRESH> key.
Other parameters are set through the Parameter setting window which appears when the <PARAMETER SETTING> key is pressed.
If there is no data in the active trace, a warning is displayed.
WARNING 103: No data in active trace

RMS — Determines the spectrum width based on the RMS method from the active trace waveform, and displays it in the marker area. Also sets special markers.
The threshold value is set using the <SPEC WIDTH THRESH> key.
Other parameters are set through the Parameter setting window which appears when the <PARAMETER SETTING> key is pressed.
If there is no data in the active trace, a warning is displayed.
WARNING 103: No data in active trace

PEAK RMS — Determines the spectrum width based on the PEAK RMS method from the active trace waveform, and displays it in the marker area. Also sets special markers.
The threshold value is set using the <SPEC WIDTH THRESH> key.
Other parameters are set through the Parameter setting window which appears when the <PARAMETER SETTING> key is pressed.
If there is no data in the active trace, a warning is displayed.
WARNING 103: No data in active trace

NOTCH — Measures a notch width, such as the fiber grating transmission spectrum. Also sets special markers.
The threshold value is set using the <SPEC WIDTH THRESH> key.
Other parameters are set through the Parameter setting window which appears when the <PARAMETER SETTING> key is pressed.
If there is no data in the active trace, a warning is displayed.
WARNING 103: No data in active trace

A.2 < ANALYSIS1>

This key is used to select an analysis function and execute analysis.
After selecting which analysis function to be executed, the <PARAMETER SETTING> key is used to set the parameters for the particular analysis function.
See Chapter 8 for details on the algorithms and set parameters for the individual analysis functions.
(☛ See section 8.4 Detailed Explanation of Analysis Functions (ANALYSIS1))

DFB-LD
: Performs analysis required for DFB-LD (Distributed Feedback-Laser Diode) on the active trace waveform, and displays the results in the marker area. Restores the previous level after execution.
Note that the entire area of the active trace is analyzed, regardless of whether the <SEARCH/ANA L1-L2> key has been selected. In addition, the following parameters are analyzed. (Parameters can be set for SMSR and bandwidth.)

・Side-Mode Suppression Ratio[SMSR]
・Mode offset (interval between one peak level and the next) [MODE OFFSET]
・Peak wavelength [PEAK WL]
・Peak level [PK WL]
・Bandwidth [-XdB WD]

FP-LD
: Performs analysis required for FP-LD (Fabry Perot-Laser Diode) on the active trace waveform, and displays the results in the marker area. Note that the entire area of the active trace is analyzed, regardless of whether the <SEARCH/ANA L1-L2> key has been selected.
In addition, the following parameters are analyzed. (Parameters other than peak wavelength and peak level can be set). Restores the previous level after execution.

・Mean wavelength [MEAN WL] ・Peak wavelength [PK WL]
・Mode lines [MODE] ・Peak level [PK LVL]
・Total power [TOTAL POWER] ・Spectrum width [SPEC WD]

LED
: Performs analysis required for LED (Light Emitting Diode) on the active trace waveform, and displays the results in the marker area. Note that the entire area of the active trace is analyzed, regardless of whether the <SEARCH/ANA L1-L2> key has been selected. Restores the previous level after execution.
If a noise mask has been set, this analysis is done after noise masking.
In addition, the following parameters are analyzed. (Parameters other than peak wavelength and peak level can be set)

・Mean wavelength [MEAN WL] ・Peak level [PK LVL]
・Total power [TOTAL POWER] ・Spectrum width [SPEC WD]
・Peak wavelength [PK WL]

SMSR
: Measures the SMSR (Side-Mode Suppression Ratio) based on the active trace waveform. Sets a moving marker and fixed marker 1 at the waveform's peak level, and sets fixed marker 2 at the next highest level. Also displays the results in the marker area. This function is used primarily for DFB laser measurements.
Restores the previous level after execution. If there is no data in the active trace, a warning is displayed.
WARNING 103: No data in active trace

POWER — Integrates the level data with respect to the active trace waveform to determine the totalized power.
If the <SEARCH/ANA L1-L2> key is highlighted , when the <SEARCH/ANA ZOOM AREA> is reverse displayed, the totalized power for the area enclosed by wavelength line markers 1 and 2 is calculated, and the totalized power value is displayed in the data area.

PMD — When you press the <PMD> key, PMD analysis is performed on the active trace waveform, and the results are displayed in the marker area.
Restores the previous level after execution.

A.3 < ANALYSIS2>

This key is used to select an analysis function.
After the analysis function to be executed is selected, the <PARAMETER SETTING> key is used to set the parameters for the particular analysis function.
See Chapter 8 for details on the algorithms and set parameters for the individual analysis functions.
(☛ See section 8.5 Detailed Explanation of Analysis Functions (ANALYSIS2))

WDM — When you press the <WDM> key, the peak wavelength, peak level, and SNR for each channel are calculated from the active trace WDM waveform. In addition, the wavelength difference and level difference at the time that any channel is selected are calculated. The results are displayed as a list.
The screen display follows the settings entered using the <SWITCH DISPLAY> key.
Restores the previous level after execution.

EDFA-NF — When you press the <EDFA-NF> key, the NF (noise figure) and gain are calculated, under the assumption that the waveforms before and after amplification by the optical amp have been input to traces A and B.
If the waveforms to be analyzed are WDM waveforms, analysis is done on each channel. The analysis results are displayed as a list.
The screen display follows the settings entered using the <SWITCH DISPLAY> key.
If the measurement conditions for traces A and B are not the same, a warning is displayed.
Restores the previous level after execution.

FILTER-PK — Executes filter analysis (PEAK) on a single channel. The results are displayed in the data area.
Restores the previous level after execution.

FILTER-BTM — Executes filter analysis (BOTTOM) on a single channel. The results are displayed in the data area.
Restores the previous level after execution.

WDM FIL-PK — Executes filter analysis (PEAK) on multi channels. The analysis results are displayed as a list.
The screen display follows the settings entered using the <SWITCH DISPLAY> key.
Restores the previous level after execution.

WDM FIL-BTM — Executes filter analysis (BOTTOM) on multi channels, and displays the

results in the data area. The screen display follows the settings entered using the <SWITCH DISPLAY> key.
Restores the previous level after execution.

A.4 <ANALYSIS EXECUTE>

This key is used to execute the analysis function selected with the <SPEC WIDTH> key, <ANALYSIS 1> key, or <ANALYSIS 2> key.

A.5 <SPEC WIDTH THRESH>

This key is used to set the threshold value for spectrum width analysis (equivalent to TH or TH1 in each algorithm). After the setting is made, analysis is executed and the display is updated.
The setting range is 0.01 to 50.00 (fine: 0.01 step; coarse: 1.00 step), and the value is set in the DATA ENTRY section. This setting is held independently by each analysis algorithm. (Default: 3.00 dB)
When the <SPEC WIDTH> key is OFF, the <SPEC WIDTH THRESH> key is disabled.

A.6 <PARAMETER SETTING>

This key is used to open the parameter setting window for each analysis function.

A.6.1 <↑>

Moves the cursor up.

A.6.2 <↓>

Moves the cursor down.

A.6.3 <→>

Moves the cursor to the right.

A.6.4 <←>

Moves the cursor to the left.

A.6.5 <SELECT>

Selects the parameter at the cursor position.
(This key is disabled if the parameter at the cursor position is a numerical parameter.)

A.6.6 <DEFAULTS>

Resets the parameter at the cursor position to the default setting.

A.6.7 <NEXT PAGE>

Moves to the next parameter settings screen.
(This key is disabled if there is only one parameter settings screen.)

A.7 <SWITCH DISPLAY>

This key is used to select the display screen for the ANALYSIS2 analysis results. (Default: TRACE &TABLE)
If the [ANALYSIS2] key is OFF, the <SWITCH DISPLAY> key is disabled.

TRACE & TABLE	Displays both the waveform and table in the analysis results display.
TABLE	Displays just the table in the analysis results display.
TRACE	Displays just the trace screen.

A.8 <AUTO ANALYSIS OFF/ON>

This key is used to turn OFF/ON the ANALYSIS function which is performed on each sweep.
If the <AUTO ANALYSIS OFF/ON> key is ON, the selected function (among A.1 through A.3) is executed automatically. (Default: OFF)
If the <AUTO PEAK SEARCH> key has already been selected when the <AUTO ANALYSIS OFF/ON> key is set to ON, the <AUTO PEAK SEARCH> key selection is automatically cleared.

WARNING 6: <AUTO PEAK SRCH> off

A warning is displayed in cases where analysis is not possible at the end of sweeping or the <AUTO PEAK SEARCH> key selection is cleared as a result of setting the <AUTO ANALYSIS OFF/ON> key to ON.

WARNING 5: <AUTO ANALYSIS> off

When the <AUTO ANALYSIS OFF/ON> key is set to ON, AUT ANA is displayed at the very bottom of the screen.

B.1 <RESULT PRINT>

This key is used to print the analysis results on the internal thermal printer.
It may be used when ANALYSIS2 (A.3) is ON. This key is disabled when ANALYSIS2 (A.3) is OFF.

NOTE

Even the <HARD COPY DEVICE> key in the [SYSTEM] switch is set other than INTERNAL, the internal thermal printer is selected.

B.2 <RESULT SAVE>

This key is used to save the analysis results in text format. All analysis result types can be saved.
If analysis has been not performed, this key is disabled.
When you press this key, it changes in the same state (Except for <OUTPUT ITEM SETTING>key.) as the key, which saves DATA of [FILE] switch.
(☛ 6.14 FILE)
The item saved are as follows:

DATE & TIME
LABEL
DATA AREA

B.4 <SEARCH/ANA L1-L2 OFF / ON>

When the <SEARCH/ANA L1-L2 OFF / ON> key is set to ON and wavelength line markers WL1 and WL2 are set, peak searching, bottom searching ([PEAK SEARCH] switch), and analysis function ([ANALYSIS] switch) calculations are only applied over the span between line marker 1 and 2.
The <SEARCH/ANA L1-L2 OFF / ON> setting applies to both the [MARKER] , [PEAK SEARCH] and [ANALYSIS] switch.
If wavelength line markers WL1 and WL2 are not set, the <SEARCH/ANA L1-L2 OFF / ON> key is disabled.
(Default: OFF)
When this key is set to ON, SRC 1-2 is displayed at the very bottom of the screen.

NOTE

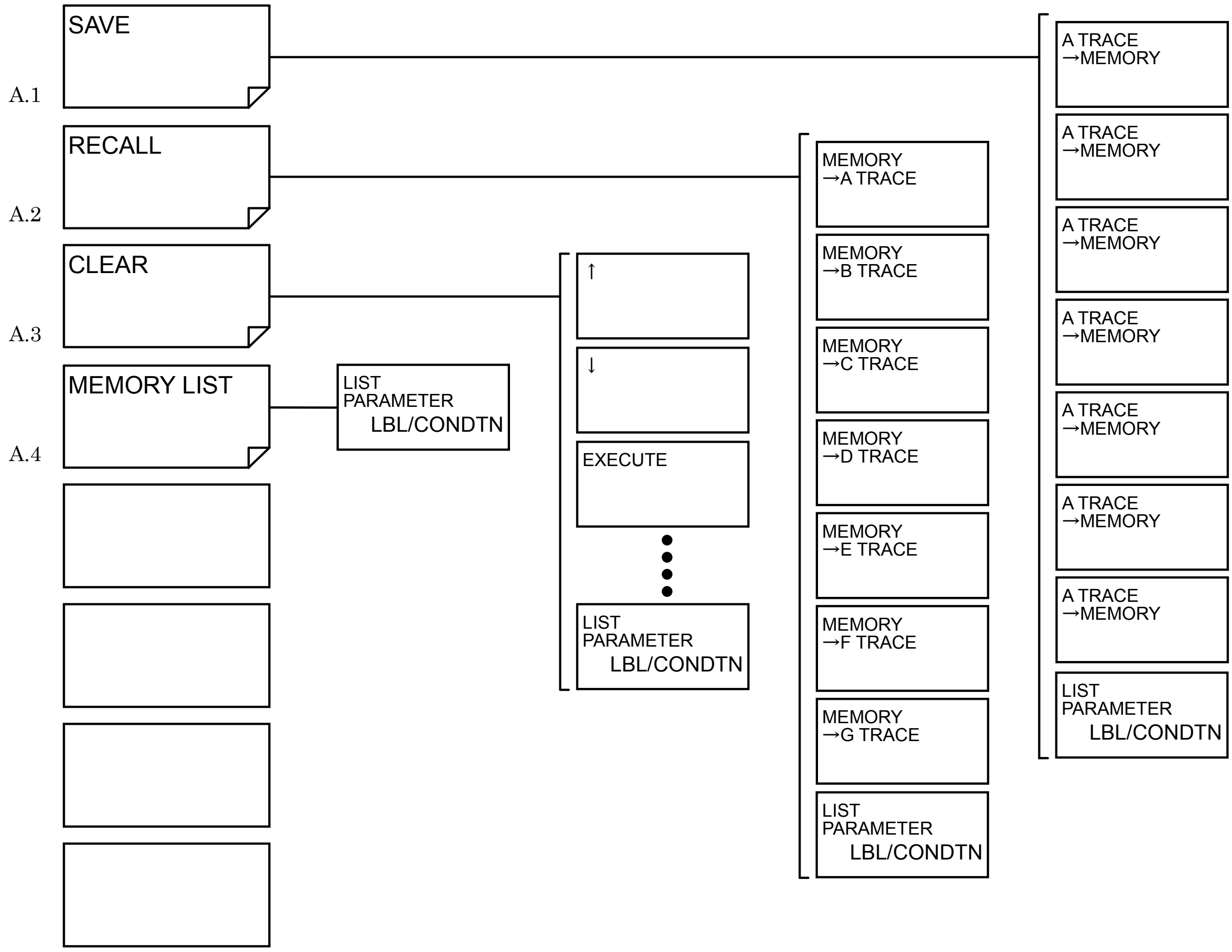
- If both WL1 and WL2 are set, execution applies over the span between line markers 1 and 2.
- If just WL1 is set, execution applies over the span from line marker 1 to the right edge of the screen.
- If just WL2 is set, execution applies over the span from the left edge of the screen to line marker 2.

B.5 <SEARCH ZOOM/ANA AREA OFF / ON>

When the <ZOOM AREA/ANA SEARCH> key is set to ON, peak searching, bottom searching ([PEAK SEARCH] switch), and analysis function ([ANALYSIS] switch) calculations are only applied to data in the ZOOM SPAN range.
The <SEARCH/ANA L1-L2 OFF / ON> setting applies to both the [MARKER] , [PEAK SEARCH] and [ANALYSIS] switch.
When this key is set to ON and the <SEARCH/ANA L1-L2> key is also set to ON, calculations are applied to the overlapping data between the ZOOM SPAN range and the range of line markers 1 and 2.
(Default: ON)
When this key is set to ON, SRC ZOM is displayed at the very bottom of the screen.

6-13 MEMORY

The [MEMORY] switch contains functions for writing the contents of the active trace to the unit's internal memory. When you press the [MEMORY] switch, the following traces and memory list screen (soft key menu) are displayed. A memory number may be entered in the DATA ENTRY section, or selected using the rotary knob or step keys.



The unit has 64 memory slots (numbered 0 to 63), which may be used for storing and loading displayed waveforms.
In addition, the <LBL LIST CONDTN> key may be used to display a list of the main measurement conditions or label contents for each memory slot. This allows you to check the information stored in memory. The following table presents the information displayed in the ATTR (waveform type) column of the label list and conditions list.

Table 6-1 Waveforms stored in memory

1. Measured waveform	MEAS
2. Normalized display waveform	NORM A, NORM B, NORM C
3. Maximum value detection display waveform	MAX_H
4. Minimum value detection display waveform	MIN_H
5. Curve-fit waveform	CRV FIT A, CRV FIT B, CRV FIT C
6. Peak-curve-fit waveform	PKCVFIT A, PKCVFIT B, PKCVFIT C
7. LOG calculation display waveform	A-B, B-A, A+B, C-D, D-C, C+D, D-E, E-D, D+E, C-F, F-C, C+F, E+F, F-E, E+F, F-E, E+F
8. Linear calculation display waveform	A+B LIN, A-B LIN, B-A LIN , 1-k(A/B), 1-k(B/A), C+D LIN, C-D LIN ,D-C LIN, D+E LIN, D-E LIN, E-D LIN, C+F LIN, C-F LIN, F-C LIN, E+F LIN, E-F LIN, F-ELIN

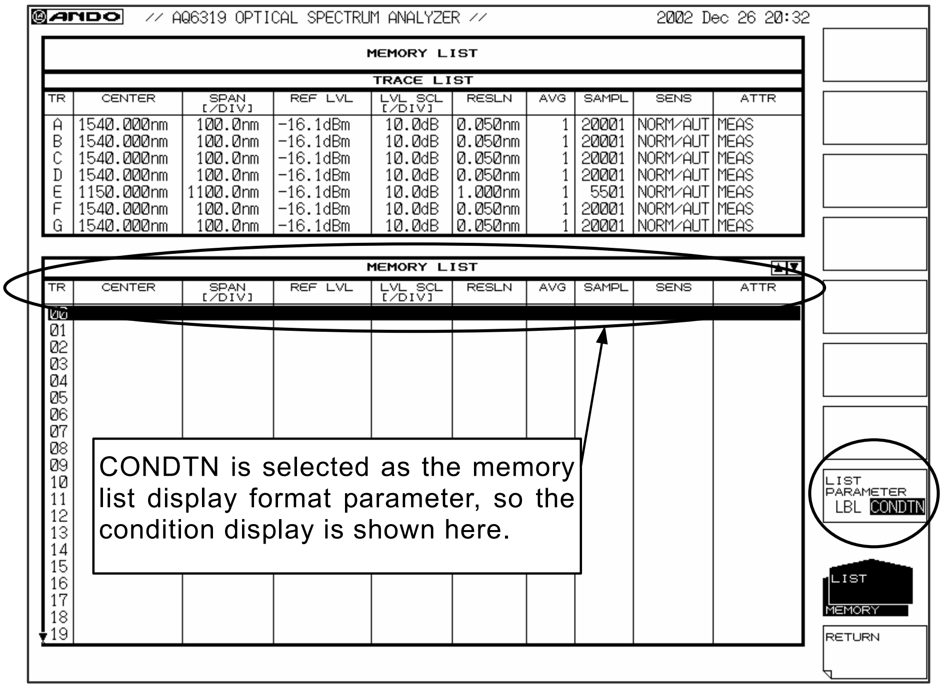


Fig. 6-14 Screen display when the <LIST PARAMETER> key is set to CONDTN

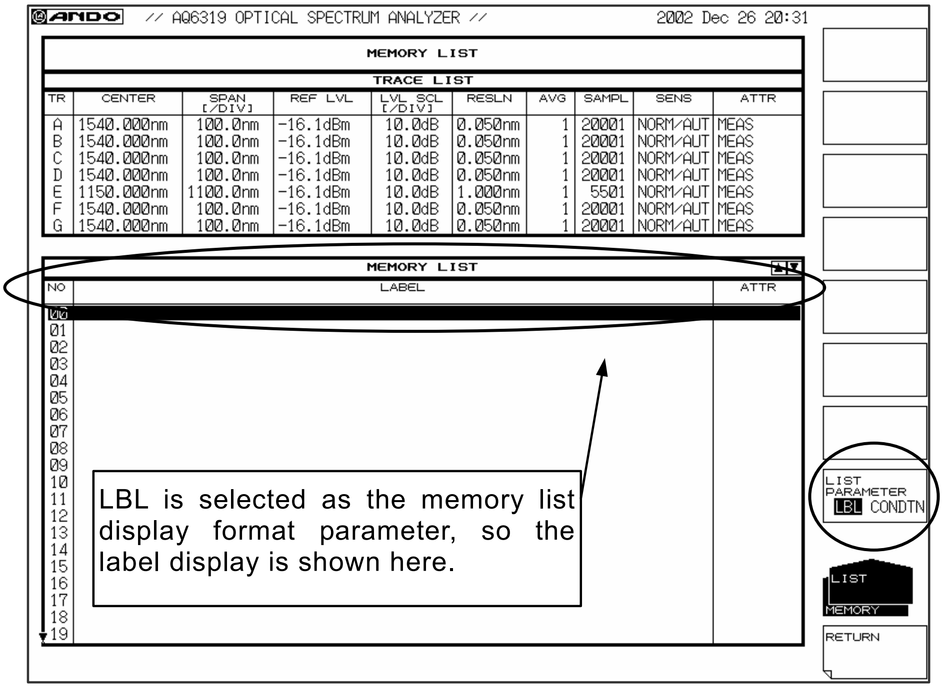


Fig. 6-15 Screen display when the <LIST PARAMETER> key is set to LBL

A.1 <SAVE>

This key is used to write the waveform data for any trace (A through G) to memory.
When you press the <SAVE> key, the trace list and memory list are displayed.
On the memory list, move the cursor to the memory number you want to save, then press the <@ TRACE → MEMORY> key. The waveform data for the specified trace will be saved to memory.
The destination memory slot number may be specified while the memory list is displayed using the numeric keypad, or may be selected using the rotary knob or step keys.

A TRACE→MEMORY	Writes the contents of trace A to the specified memory slot number.
B TRACE→MEMORY	Writes the contents of trace B to the specified memory slot number.
C TRACE→MEMORY	Writes the contents of trace C to the specified memory slot number.
D TRACE→MEMORY	Writes the contents of trace D to the specified memory slot number.
E TRACE→MEMORY	Writes the contents of trace E to the specified memory slot number.
F TRACE→MEMORY	Writes the contents of trace F to the specified memory slot number.
G TRACE→MEMORY	Writes the contents of trace G to the specified memory slot number.
LIST PARAMETER	Selects the memory list display format. LBL: Label list display (default) CONDTN: Condition parameter display

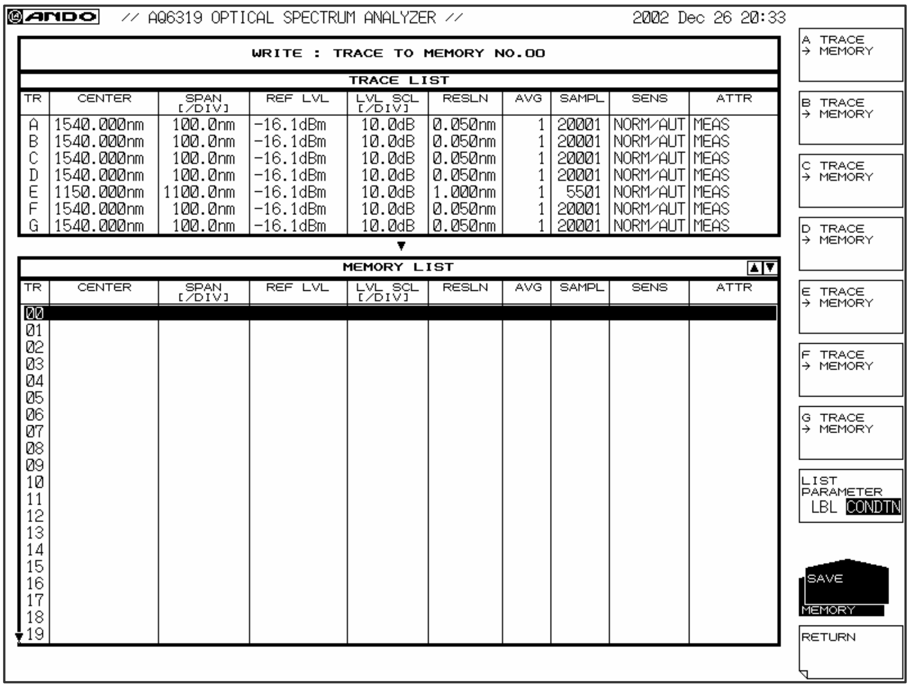


Fig. 6-16 Screen display when <SAVE> key is pressed

6.13 MEMORY

A.2 <RECALL>

This key is used to load the waveform data stored in a memory slot to a trace.
When you press the <RECALL> key, the trace list and memory list are displayed.
On the memory list, move the cursor to the memory number you want to load, then press the <MEMORY →@ TRACE> key. The waveform data in the specified memory slot number will be loaded to the trace.
The memory slot number to be loaded may be specified while the memory list is displayed using the numeric keypad, or may be selected using the rotary knob or step keys.

MEMORY → A TRACE	Loads the contents of the specified memory slot number to trace A.
B TRACE→MEMORY	Loads the contents of the specified memory slot number to trace B.
C TRACE→MEMORY	Loads the contents of the specified memory slot number to trace C.
D TRACE→MEMORY	Loads the contents of the specified memory slot number to trace D.
E TRACE→MEMORY	Loads the contents of the specified memory slot number to trace E.
F TRACE→MEMORY	Loads the contents of the specified memory slot number to trace F.
G TRACE→MEMORY	Loads the contents of the specified memory slot number to trace G.
LIST PARAMETER	Selects the memory list display format. LBL: Label list display (default) CONDTN: Condition parameter display

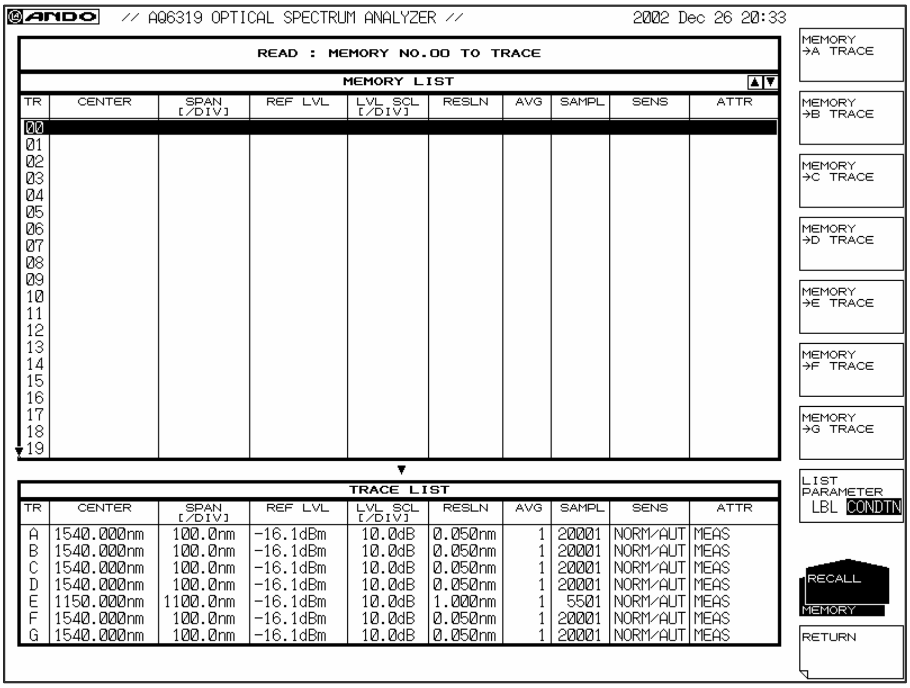


Fig. 6-17 Screen display when <RECALL> key is pressed

A.3 <CLEAR>

This key is used to clear waveform data stored in memory.
When you press the <CLEAR> key, the trace list and memory list are displayed.
On the memory list, move the cursor to the memory slot number you want to clear, then press the <EXECUTE> key. The contents of the memory slot at the cursor position will be cleared.
The memory slot number to be cleared may be specified using the up arrow (↑) and down arrow (↓) soft keys or using the numeric keypad while the memory list is displayed; or may be selected using the rotary knob or step keys.

↑	Moves the cursor up one position on the memory list.
↓	Moves the cursor down one position on the memory list.
EXECUTE	Clears the trace data in the specified memory slot number.
LIST PARAMETER	Selects the memory list display format. LBL: Label list display (default) CONDTN: Condition parameter display

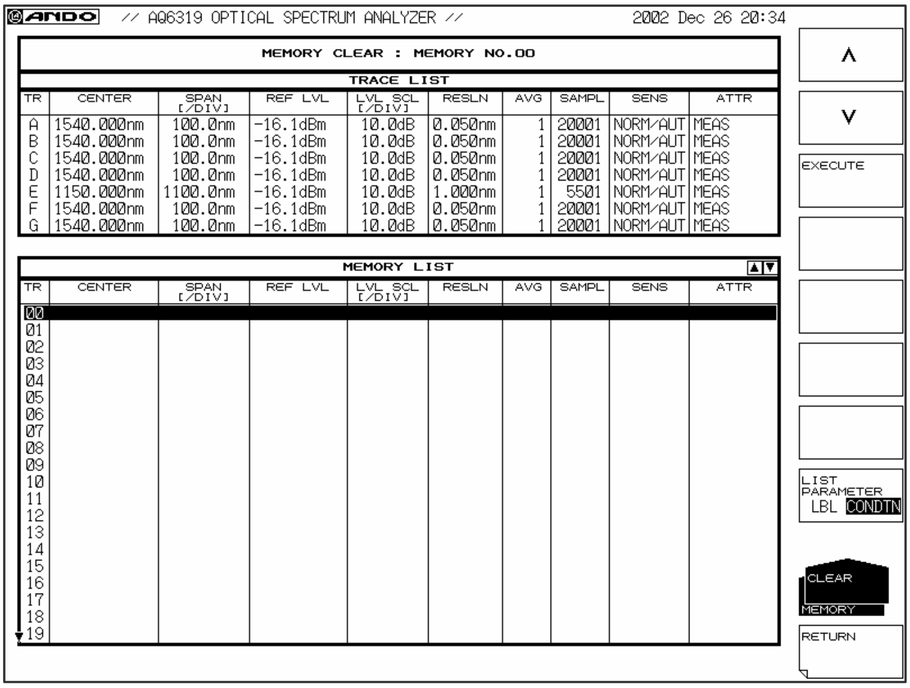


Fig. 6-18 Screen display when <CLEAR> key is pressed

A.4 <MEMORY LIST>

This key is used to display the memory list window.
The memory list contains the information in the traces. Therefore, a trace list (showing the measurement conditions for traces A through G) and a memory list (label list or conditions list) are displayed on the screen.

LIST PARAMETER Selects the memory list display format.
LBL: Label list display (default)
CONDTN: Condition parameter display

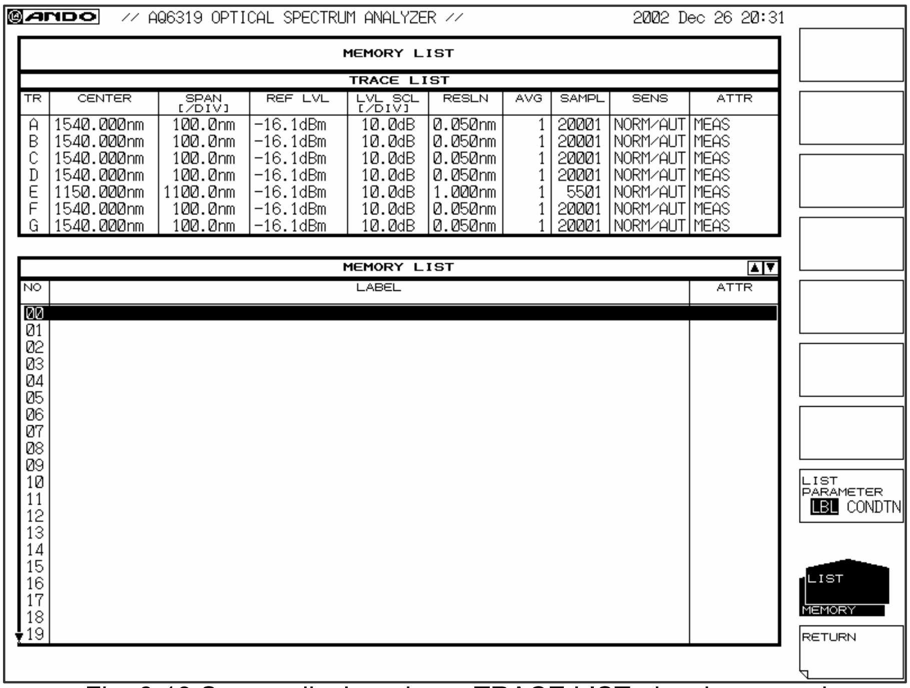
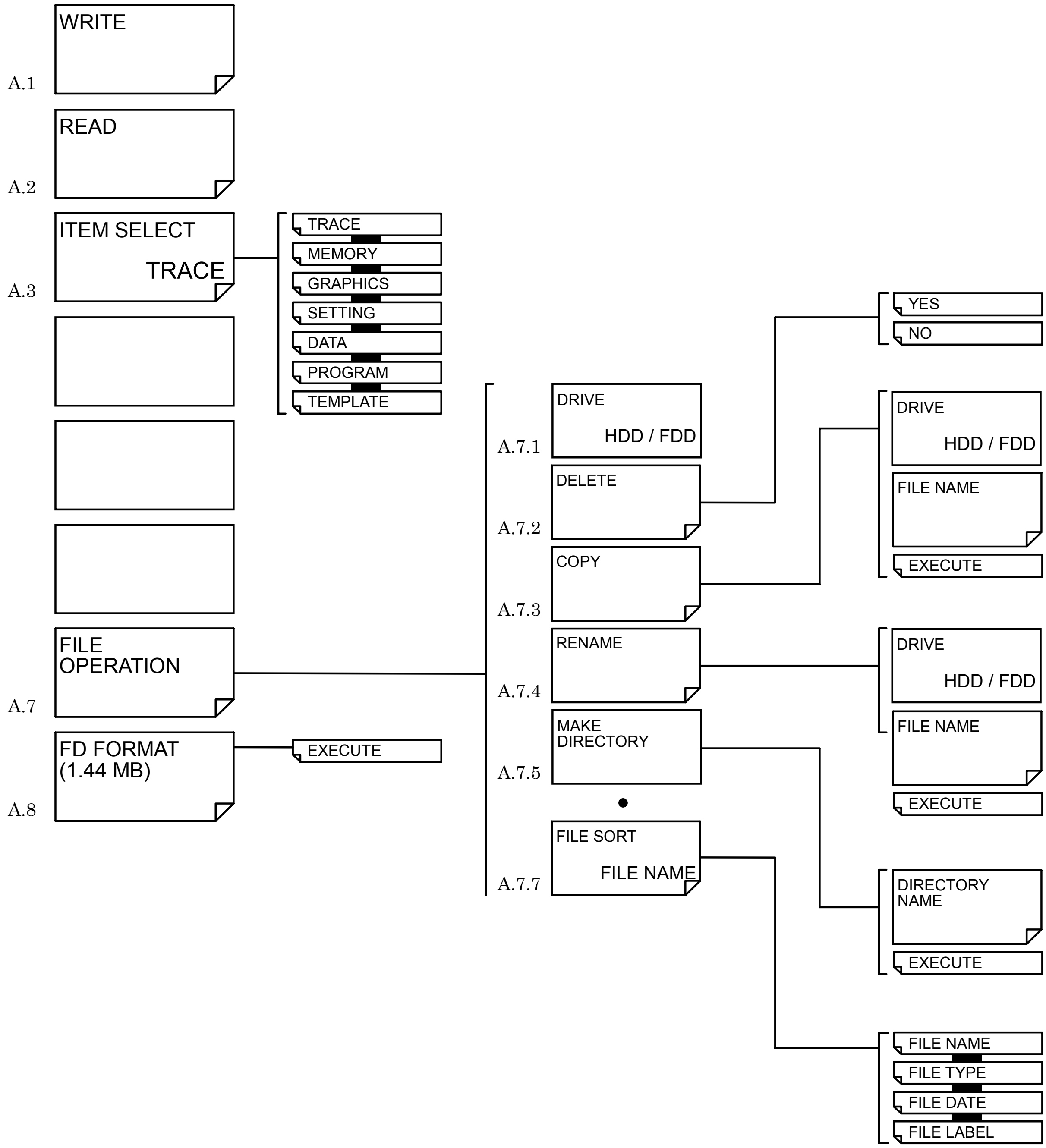


Fig. 6-19 Screen display when <TRACE LIST> key is pressed

6-14 FILE

The [FILE] switch contains functions for saving and loading waveform data, program data, and the like to and from the internal hard drive or floppy drive. See Chapter 7 for detailed information on these functions. (☛ See section 7.5 Data Writing/Reading Function) When you press the [FILE] switch, the following soft key menu is displayed.



A.1 WRITE

The <WRITE> key is used to save the information specified using the <ITEM SELECT> key (A.3).

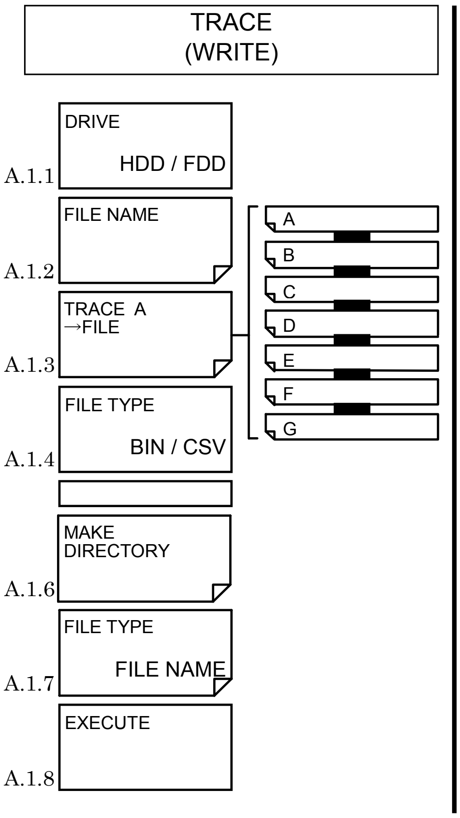
The soft keys which appear after pressing the <WRITE> key vary depending on the type of information to be written.

(☛ See subsection 7.5.4 Saving to a Storage Disk for detailed information on these procedures.)

<ITEM SELECT> key

(1) TRACE	Specifies a trace for writing.
(2) MEMORY	Specifies a memory location for writing.
(3) GRAPHICS	Specifies a screenshot for writing.
(4) SETTING	Specifies setting parameters for writing.
(5) DATA	Specifies the data area for writing.
(6) PROGRAM	Specifies program data for writing.
(7) TEMPLATE	Specifies template data for writing.

(1) When TRACE is selected as the item



A.1.1 DRIVE HDD / FDD

Selects either the hard drive (HDD) or floppy drive (FDD) as the file saving location.
Default: HDD
A warning is displayed if "FDD" is selected but no floppy disk is inserted.
WARNING MESSAGE 120: Disk not inserted

A.1.2 FILE NAME

Changes to the mode for inputting the file name for the data being recorded.

A.1.3 TRACE @ → FILE

Selects the trace (among traces A to G) with the data to be saved.
Default: Active trace

A.1.4 FILE TYPE BIN / CSV

Specifies the file format for the data being saved.
BIN : Binary format (default)
CSV : Excel CSV format

A.1.6 MAKE DIRECTORY

Creates a new directory for the data being saved.

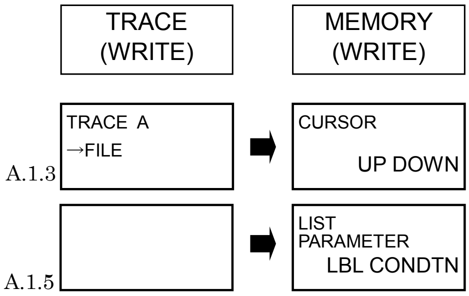
A.1.7 FILE SORT

Sets sorting conditions for file display.

A.1.8 EXECUTE

Executes the data saving operation.

(2) When MEMORY is selected as the item



A.1.3 CURSOR UP DOWN

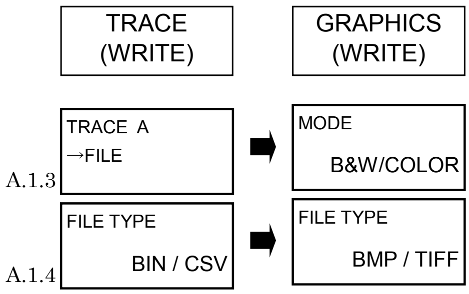
Sets whether to place the cursor in the memory list or in the file list.
The cursor moves each time you press the key.

A.1.5 LIST PARAMETER

Selects the memory list display format.
LBL: Label list display (default)
CONDTN: Condition parameter display

* Other keys have the same functions as when TRACE is selected.

(3) When GRAPHICS is selected as the item



A.1.3 MODE B&W / COLOR

Sets the color mode for the image data being recorded.

B&W:	Black and white 2-color mode
COLOR:	Screen color mode (default)

A.1.4 FILE TYPE BMP / TIFF

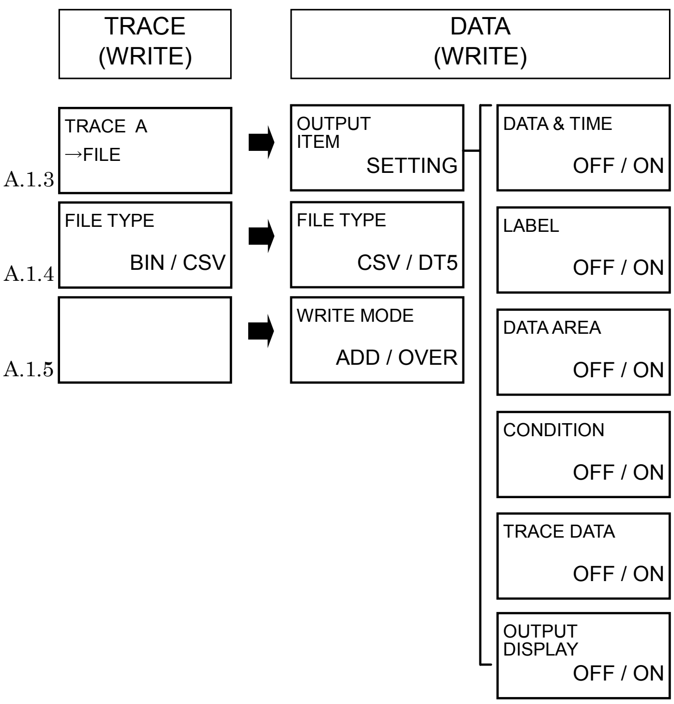
Specifies the file format for the image data being saved.

BMP:	Windows bitmap (default)
TIFF:	Mac TIFF format

* Other keys have the same functions as when TRACE is selected.

(4) When SETTING is selected as the item
The trace selection step (A.1.3 key) and file format setting step (A.1.4 key) are not performed. Other keys have the same functions as when TRACE is selected.

(5) When DATA is selected as the item



A.1.3 OUTPUT ITEM SETTING

DATA & TIME
Date and time output ON (Default)
LABEL
Label output ON (Default)
DATA AREA
Data area output ON (Default)
CONDITION
Measurement conditions output ON (Default)
TRACE DATA
Waveform data output Off (Default)
OUTPUT DISPLAY
OUTPUT DISPLAY output Off (Default)

A.1.4 FILE TYPE CSV / DT5

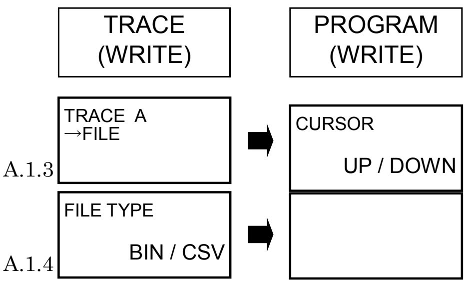
Sets the file format to be used when storage data.
CSV: Excel CSV format (Default)
DT5: Compatible format for previous models

A.1.5 WRITE MODE ADD / OVER

Sets the data writing method.
ADD: Addition mode (Default)
OVER: Overwrite mode

* Other keys have the same functions as when TRACE is selected.

(6) When PROGRAM is selected as the item



A.1.3 CURSOR UP / DOWN

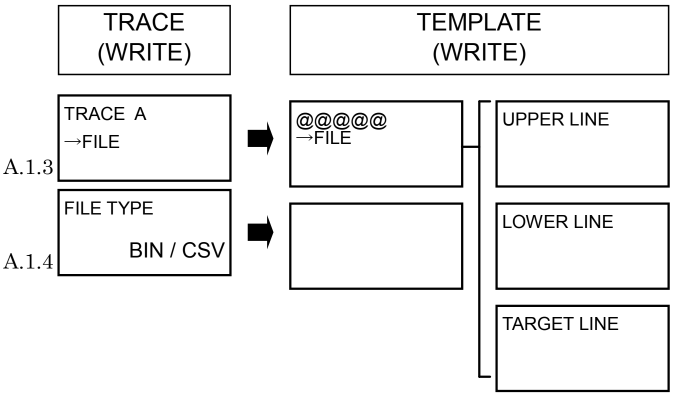
Sets whether to place the cursor in the program list or in the file list.
The cursor moves each time you press the key.

A.1.4

No function.

* Other keys have the same functions as when TRACE is selected.

(7) When TEMPLATE is selected as the item



A.1.3 @@@@@→FILE

Selects the template to be written. The selected template is displayed where @@@@@ is.
(Default: UPPER)

UPPER LINE
Sets UPPER LINE to be saved.
LOWER LINE
Sets LOWER LINE to be saved.
TARGET LINE
Sets TARGET LINE to be saved.

A.1.4

No function.

* Other keys have the same functions as when TRACE is selected.

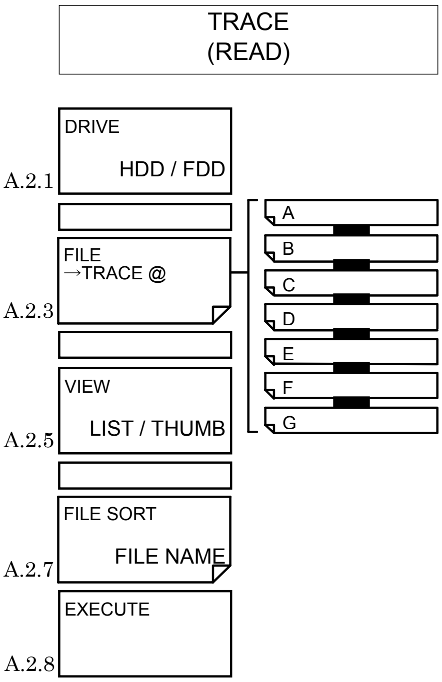
A.2 READ

The <READ> key is used to load the information specified using the <ITEM SELECT> key (A.3).
The soft keys which appear after pressing the <READ> key vary depending on the type of information to be loaded.
(☛ See subsection 7.5.5 Loading Saved Files for detailed information on these procedures.)

<ITEM SELECT> key

(1) TRACE	Specifies a trace for loading.
(2) MEMORY	Specifies memory for loading.
(3) GRAPHICS	(Not loaded.)
(4) SETTING	Specifies setting parameters for loading.
(5) DATA	Specifies the data area for loading.
(6) PROGRAM	Specifies program data for loading.
(7) TEMPLATE	Specifies template data for loading.

(1) When TRACE is selected as the item



A.2.1 DRIVE HDD / FDD

Selects either the hard drive (HDD) or floppy drive (FDD) as the file loading source.
Default: HDD
A warning is displayed if "FDD" is selected but no floppy disk is inserted.
WARNING MESSAGE 120: Disk not inserted

A.2.3 FILE → TRACE @

Selects the trace (among traces A to G) with the data to be loaded.
Default: Active trace

A.2.5 VIEW LIST / THUMB

Choose the format to display of file list
LIST: file list display (Default)
THUMB: thumbnail display

A.2.7 FILE SORT

Sets sorting conditions for file display.

A.2.8 EXECUTE

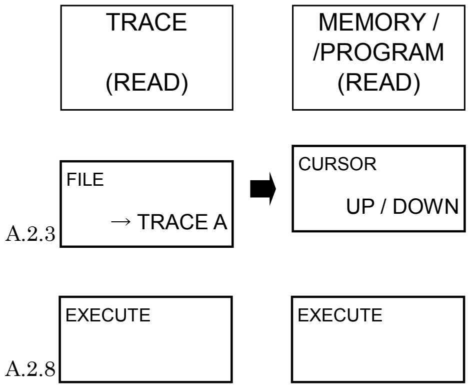
Executes the operation of loading the selected file.

NOTE

- <VIEW LIST/THUMB> key operates 、only when choose hard drive(HDD) as the file loading source.
  When floppy drive(FDD) is selected, this key is disabled.

6.14 FILE

(2) When MEMORY or PROGRAM is selected as the item



A.2.3 CURSOR UP / DOWN

When MEMORY is selected
Sets whether to set the cursor in the memory list or the file list.
The cursor moves each time you press the key.

When PROGRAM is selected
Sets whether to set the cursor in the program list or the file list.
The cursor moves each time you press the key.

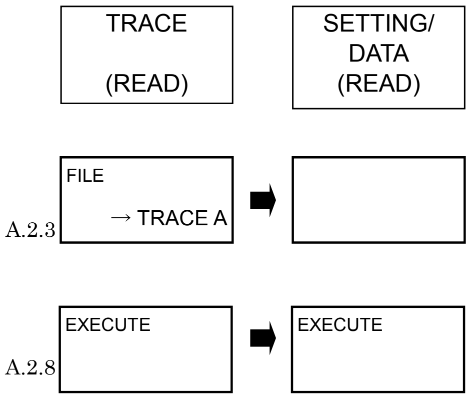
A.2.8 EXECUTE

When MEMORY is selected
Loads the data from the specified memory location

When PROGRAM is selected
Loads the specified program.

* Other keys have the same functions as when TRACE is selected.

(3) When SETTING or DATA is selected as the item



A.2.3

No function.

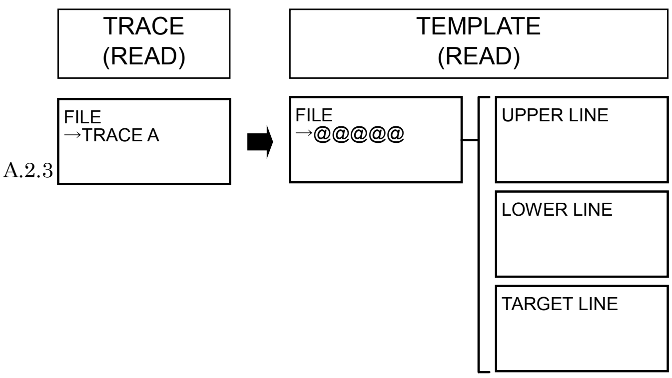
A.2.8 EXECUTE

When SETTING is selected
Loads the setting information.

When DATA is selected
Loads the data and displays it on the screen.

* Other keys have the same functions as when TRACE is selected.

(4) When TEMPLATE is selected as the item



A.2.3 FILE→@@@@@

Selects the template to be loaded. The selected template is displayed where @@@@@ is.
(Default: UPPER)

UPPER LINE
Sets UPPER LINE to be loaded.
LOWER LINE
Sets LOWER LINE to be loaded.
TARGET LINE
Sets TARGET LINE to be loaded.

* Other keys have the same functions as when TRACE is selected.

A.3 ITEM SELECT

This key is used to select the type of data to be loaded or written. To load or write a file, use the <ITEM SELECT> key to select the type of data, then press the <WRITE> or <READ> key.

TRACE	Specifies a trace for writing/loading.
MEMORY	Specifies memory for writing/loading.
GRAPHICS	Specifies a screenshot image for writing. (Not loaded.)
SETTING	Specifies setting parameters for writing/loading.
DATA	Specifies the data area for writing/loading.
PROGRAM	Specifies program data for writing/loading.
TEMPLATE	Specifies template data for writing/loading.

A.7 FILE OPERATION

This key is used to perform operations on files located on the hard drive (HDD) or floppy drive (FDD).

A.7.1 DRIVE HDD / FDD

Selects either the hard drive (HDD) or floppy drive (FDD) as the location for performing file operations.
Default: HDD

A.7.2 DELETE

Deletes the selected file. Press the <EXECUTE> key to delete the file.

A.7.3 COPY

Copies the selected file. Press the <EXECUTE> key to copy the file.

DRIVE HDD / FDD

Sets whether to copy to the hard drive (HDD) or floppy drive (FDD).

Default: HDD

NEW FILE NAME

Sets a new name for the file to be copied.

After setting, press the <EXECUTE> key to copy the file.

A.7.4 RENAME

Changes the file name.

NEW FILE NAME

Sets a new name for the file to be copied.

After setting, press the <EXECUTE> key to change the file name.

A.7.5 MAKE DIRECTORY

Creates a new directory at the currently displayed file viewing level.

DIRECTORY NAME

Sets the name of the new directory being created.

After setting, press the <EXECUTE> key to change the file name.

A.7.7 FILE SORT

Selects how to sort the files on the display.

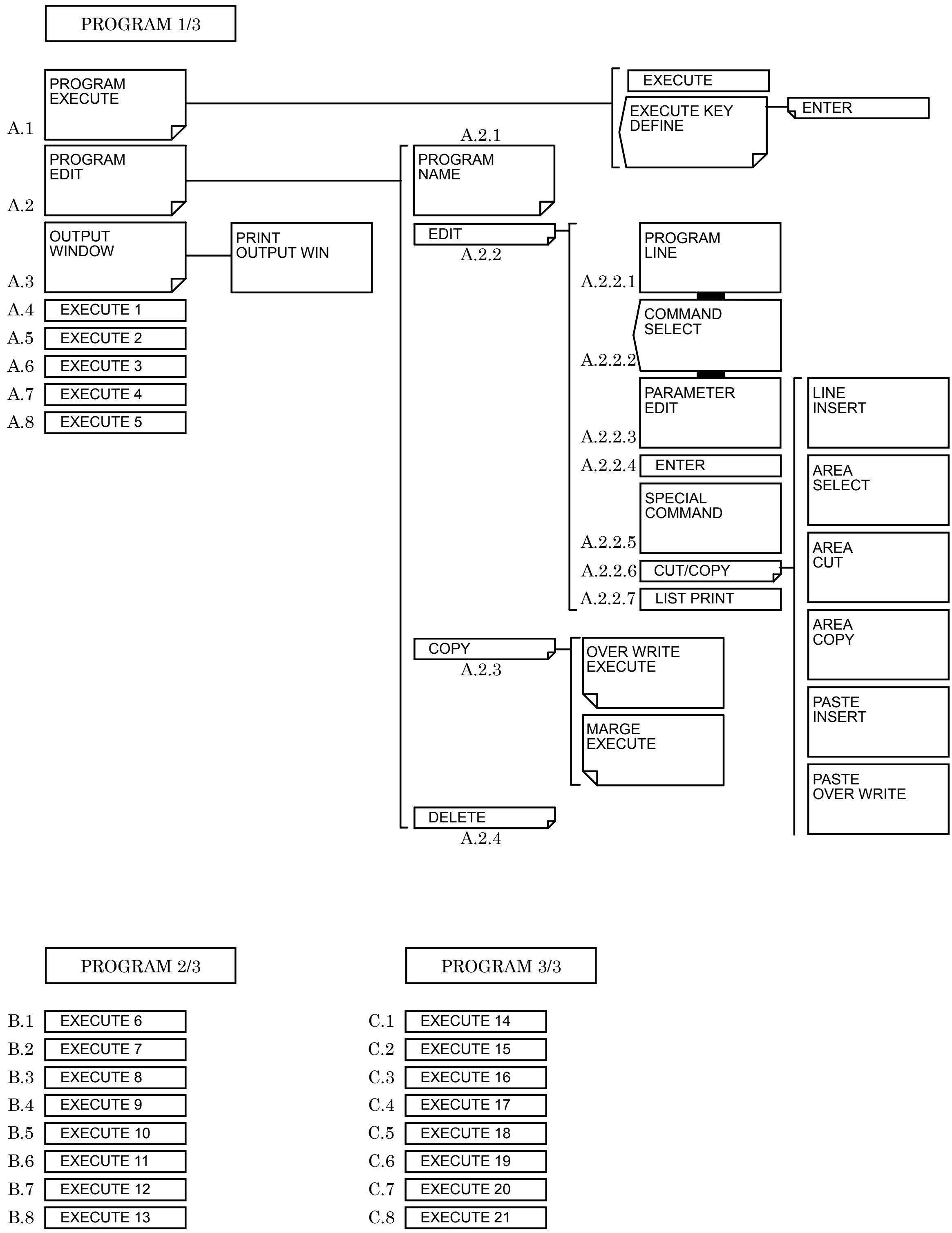
FILE NAME	Sort by file name (default)
FILE TYPE	Sort by file type
FILE DATE	Sort by file date
FILE LABEL	Sort by waveform file label

A.8 FD FORMAT(1.44MB)

Formats the floppy disk (FD).

6-15 PROGRAM

The [PROGRAM] switch contains keys related to program functions for controlling measurements through a program. When you press the [PROGRAM] switch, the following soft key menu is displayed.
See the attachment (Program/Remote Function Manual) for detailed information on the program functions.
(☛ See Chapter 1 "Program Functions" of AQ6319 Optical Spectrum Analyzer Program/Remote Function Manual)



A.1 <PROGRAM EXECUTE>

This key is used to execute a program that has been created. When you press this key, the program list is displayed. On the program list, move the cursor to the program number you want to execute, then press the <EXECUTE> key. Execution of the specified program starts. In addition, the <EXECUTE KEY DEFINE> key can be used to assign frequently used programs to the <EXECUTE 1–21> keys. A program which is assigned to one of these keys can be executed simply by pressing the corresponding <EXECUTE 1–21> key after pressing the [PROGRAM] switch. The program number to be executed may be specified on the program list display using the numeric keypad, or using the rotary knob or step keys.

EXECUTE Executes the program selected by the cursor.

EXECUTE KEY DEFINE

Assigns a program to an <EXECUTE 1–21> key.
Move the cursor to the program you want to assign, then press the <EXECUTE KEY DEFINE> key. Next, enter the location where the program is to be registered (EXECUTE 1–21).
When you press the <ENTER> key, the program is assigned.

A.2 <PROGRAM EDIT>

This key is used to input and edit programs. When you press this key, the program list is displayed.
On the program list, move the cursor to the program number you want to edit, then press the <EDIT> key. A screen for editing the specified program appears. This key can also be used to delete a created program, copy a program to a different program number, and set a name for a program.

A.2.1 <PROGRAM NAME>

Enters a program name for the program selected on the list. The entered program name is displayed on the program list. If a program has been assigned to one of the <EXECUTE 1–21> keys, the first 11 characters in its program name are displayed on the key.

A.2.2 <EDIT>

This key can be used to create or edit the program corresponding to the program number selected on the list.

A.2.2.1 <PROGRAM LINE>

Moves the cursor, which is displayed on a line number in the program area. A line can be selected directly using the keyboard, mouse, or numeric keypad.

- Keyboard
  Enter the line number through the keyboard, then press the <ENTER> key.
- Mouse
  Move the mouse pointer to the line you want to select, then left-click to select it.
- Numeric keypad in DATA ENTRY section
  You can also select a line number by entering it through the numeric keypad.

A.2.2.2 < COMMAND SELECT >

Displays the panel switch command list.
If you press the panel switch while the key is selected, the command list for the pressed panel switch is displayed.

A.2.2.3 < PARAMETER EDIT >

Used to edit the parameter part of a command registered on the current line. This key is disabled if a program command which does not require parameter changes is currently selected.

A.2.2.4 < ENTER >

Enters selected command and the parameter input value for the command.

A.2.2.5 < SPECIAL COMMAND >

Displays the special command list.

A.2.2.6 < CUT/COPY >

This key is used for program editing (cut, copy, and insert).

LINE INSERT	Inserts a blank line in front of the current line. If this key is pressed after 200 program lines have been entered, the command on the 200th line is erased.
AREA SELECT	Sets the current line as the starting line for copying or deletion, and opens line range selection. Press this key again to complete the line range selection.
AREA CUT	Copies and deletes the current line or the entire selected line range.
AREA COPY	Copies the current line or the entire selected line range.
PASTE INSERT	Inserts the line(s) copied with the <AREA CUT> or <AREA COPY> key above the current line. The program extends down a number of lines equal to the inserted number of lines. If the program extends past 200 lines, the excess program command lines are erased.
PASTE OVER WRITE	Overwrites the line(s) copied with the <AREA CUT> or <AREA COPY> key starting at the current line.

A.2.2.7 < LIST PRINT >

Outputs the displayed program list to the internal thermal printer.

NOTE

Even the <HARD COPY DEVICE> key in the [SYSTEM] switch is set to other than INTERNAL, the internal thermal printer is selected.

A.2.3 <COPY>

Copies the program to another program number. Move the cursor to the copy-source program number, then press the <COPY> key. Next, move the cursor to the copy-destination program number and press the <OVER WRITE EXECUTE> key or <MERGE EXECUTE> key to copy the program.

OVER WRITE EXECUTE

Copies the specified program to the copy-destination number.

MERGE EXECUTE

Adds the specified program at the end of the copy-destination program.

<DELETE>

This key is used to delete the selected program. When you press the <DELETE> key, the message "Are you sure?" is displayed. This message is displayed to prevent accidental deletions. At this time, the <YES> , <NO> soft keys are displayed. If you wish to delete , press <YES> key. If you wish to cancel deletion , press the <NO>key.

A.3 <OUTPUT WINDOW>

This key is used to display, on the screen, the information output to the OUTPUT WINDOW during the previous program execution. This key is disabled if no data have been output to the OUTPUT WINDOW. See the attachment (Program/Remote Function Manual) for information on the OUTPUT WINDOW.

PRINT OUTPUT WIN	Outputs the contents of the OUTPUT WINDOW to the internal thermal printer.

NOTE

Even the <HARD COPY DEVICE> key in the [SYSTEM] switch is set other than INTERNAL, the internal thermal printer is selected.

A.4 – A.8 <EXECUTE @>

This key is used to execute the program registered in the <EXECUTE @> key. Use the <EXECUTE KEY DEFINE> key to register a program in the <EXECUTE @> key. This key is disabled if no program is registered in the <EXECUTE @> key. The registered program's name (up to 11 single-byte alphanumeric characters) is displayed in the <EXECUTE @> key.

B.1 – B.8 <EXECUTE @>

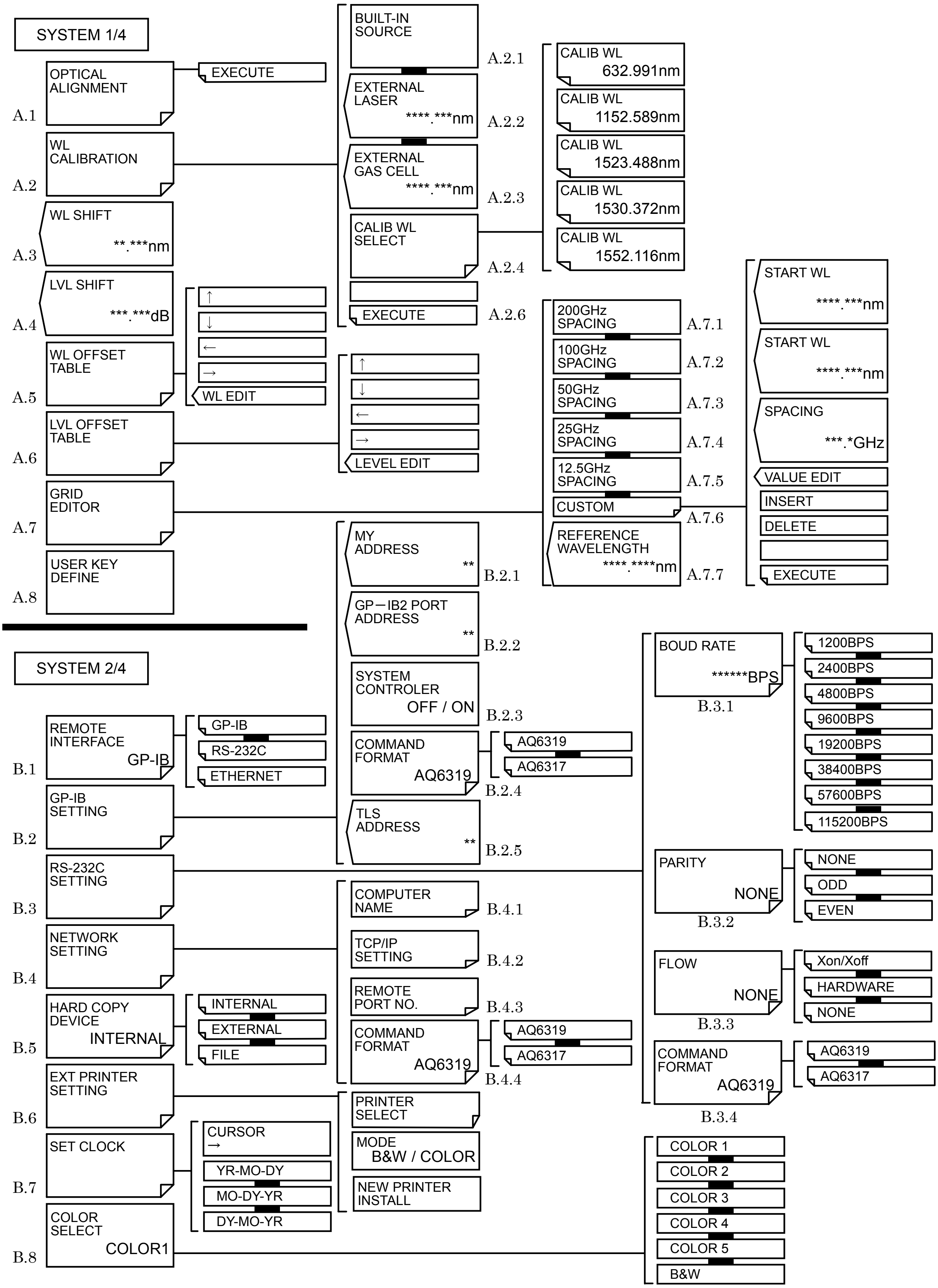
This key is used to execute the program registered in the <EXECUTE @> key. Use the <EXECUTE KEY DEFINE> key to register a program in the <EXECUTE @> key. This key is disabled if no program is registered in the <EXECUTE @> key. The registered program's name (up to 11 single-byte alphanumeric characters) is displayed in the <EXECUTE @> key.

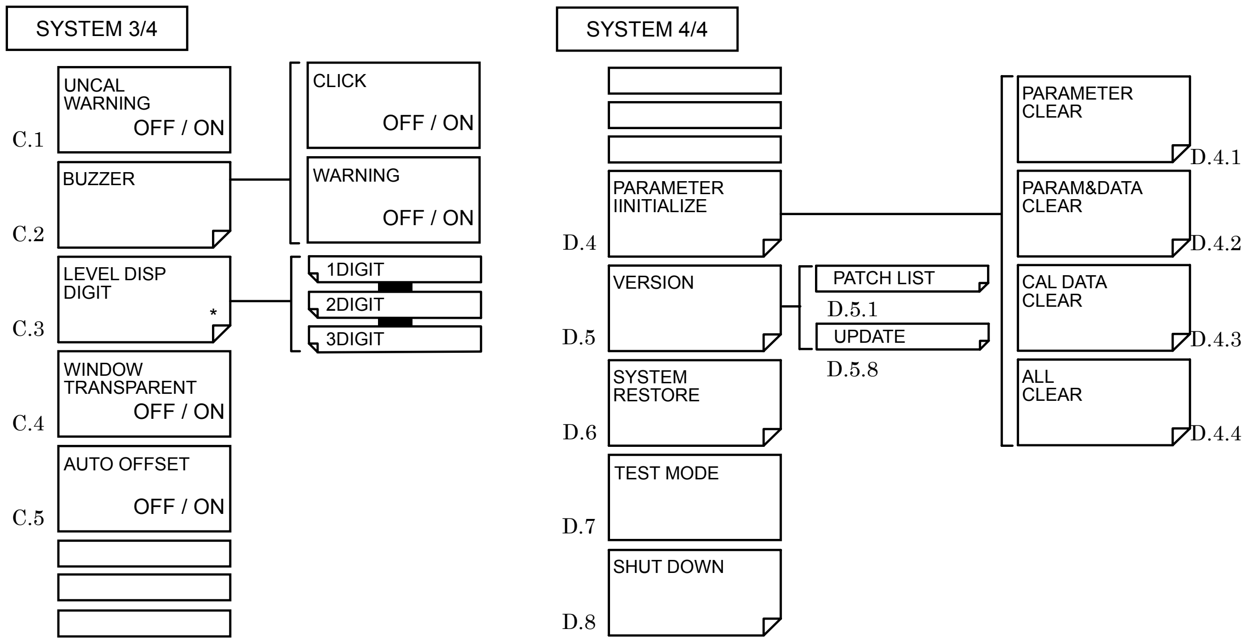
C.1 – C.8 <EXECUTE @>

This key is used to execute the program registered in the <EXECUTE @> key. Use the <EXECUTE KEY DEFINE> key to register a program in the <EXECUTE @> key. This key is disabled if no program is registered in the <EXECUTE @> key. The registered program's name (up to 11 single-byte alphanumeric characters) is displayed in the <EXECUTE @> key.

6-16 SYSTEM

The [SYSTEM] switch contains system-related functions such as monochromator adjusting optical alignment, wavelength adjustment, hardware setup, and setting initialization. When you press the [SYSTEM] switch, the following soft key menu is displayed.





A.1 <OPTICAL ALIGNMENT>

This key is used to execute the alignment adjustment function on the unit's internal monochromator.
Be sure to adjust the alignment prior to use after the unit has been shipped, and in cases where, for example, the temperature of the operating environment has changed. The unit's optical performance is not guaranteed until the alignment adjustment function has been executed.
The internal reference light source is used in executing the alignment adjustment function.
Turn on the power and wait at least one hour (warmup period) before executing the alignment adjustment function.
See Chapter 4 for information on how to execute the alignment adjustment function. (☛ See section 4.4 Alignment Adjustment)
After alignment has been executed, wavelength calibration is also performed automatically inside the unit.

⚠ Caution

Monochromator alignment adjustment

- The unit contains an extremely precise monochromator. The monochromator may become misaligned due to vibrations during shipping, temperature changes in the operating environment, and other factors.
  Be sure to adjust the alignment following warmup before using the unit for the first time, and when using it after it has been subjected to heavy vibrations while being moved.
  The unit's optical performance is not guaranteed if alignment adjustment has not been executed.
- Always use the reference light source inside the unit when executing the alignment adjustment function.
  Alignment adjustment cannot be done properly with a light source other than the internal reference light source.

A.2 <WL CALIBRATION>

This key is used to perform wavelength calibration.

Wavelength calibration can be performed using either the internal reference light source or an external light source.
See Chapter 4 for details on wavelength calibration. (☛ See section 4.5 Wavelength Calibration)

NOTE

- It is not necessary to perform calibration on multiple wavelengths. If calibration is performed on multiple wavelengths, only the results from the final calibration are applied.

A.2.1 <BUILT-IN SOURCE>

Select the <BUILT-IN SOURCE> key to perform wavelength calibration using the unit's internal reference light source.
To perform wavelength calibration using the internal reference light source, press the <BUILT-IN SOURCE> key, then connect the unit's INPUT connector and the CALIBRATION OUTPUT connector using a 9.5/125 μm SM optical fiber. Press the <EXECUTE> key to execute wavelength calibration.
The time from the start to the end of waveform calibration execution is about 30 seconds.
(☛ See subsection 4.5.1 Wavelength Calibration Using the Internal Reference Light Source)

⚠ Caution

- If the unit's wavelength error is ±1 nm or greater, wavelength calibration cannot be done using the internal reference light source. (In such cases, readjustment is needed, so contact Yokogawa Electric.)

A.2.2 <EXTERNAL LASER>

Select the <EXTERNAL LASER> key to perform wavelength calibration using an external reference light source (laser type) without using the internal reference light source.
Wavelength calibration can be done using light sources such as an He-Ne laser or a wavelength-stabilized DFB-LD. The light source's precise wavelength value must be known in order to use an external laser.
To perform wavelength calibration using an external reference light source, press the <EXTERNAL LASER> key, then connect the external reference light source being used for calibration to the unit using a 9.5/125 μm SM optical fiber. Next, input the external reference light source's wavelength value and press the <EXECUTE> key to execute wavelength calibration.
The external reference light source's wavelength value can be entered through the interrupt display area or selected using the <CALIB WL SELECT> key.
(☛ See subsection 4.5.2 Wavelength Calibration Using an External Reference Light Source)

A.2.3 <EXTERNAL GAS CELL>

Select the <EXTERNAL GAS CELL> key to perform wavelength calibration using an external reference light source (gas cell absorption line type) without using the internal reference light source.
Wavelength calibration can be performed using an external reference light source in which the gas absorption line wavelength serves as the reference wavelength. For example, an EE-LED or other wideband light source may be combined with an absorption gas cell. The light source's precise wavelength value must be known in order to use an external laser.
To perform wavelength calibration using an external reference light source, press the <EXTERNAL GAS CELL> key, then connect the external reference light source being used for calibration to the unit using a 9.5/125 µm SM optical fiber. Next, input the external reference light source's wavelength value and press the <EXECUTE> key to execute wavelength calibration.
The external reference light source's wavelength value can be entered through the interrupt display area or selected using the <CALIB WL SELECT> key.
(☛ See subsection 4.5.2 Wavelength Calibration Using an External Reference Light Source)

⚠ Caution

- A light source cannot be used as an external light source in the following cases:
  - ① If the set wavelength is not the same as the calibration light source
  - ② If the unit's wavelength error is ±1 nm or greater (in such cases, readjustment is necessary, so contact Yokogawa Electric))
  - ③ If you are using a reference light source with multiple absorption lines, and the unit's wavelength shift is greater than the wavelength interval of the absorption lines (with the result that an adjacent absorption line is used as the reference wavelength)
- Do not use this function to intentionally change the unit's display wavelength. Use the <WL SHIFT> key for that purpose. (☛ See section 6.16 System)
- The user is only allowed to set vacuum and air wavelength modes. Wavelength axis mode is used even if frequency mode is set.

A.2.4 <CALIB WL SELECT>

This key is used to select the calibration wavelength for wavelength calibration using an external reference light source. The calibration wavelength is selected from wavelength values that are already stored in the unit's memory. The calibration wavelength may be selected from known wavelength value, such as the wavelengths of an He-Ne laser or acetylene gas absorption lines.
The following five wavelengths may be selected.

Table 6-2 Calibration wavelength values in <CALIB WL SELECT> key

Vacuum wavelength mode [nm]	*Air wavelength mode [nm]*
632.991	*632.816*
1152.589	*1152.274*
1523.488	*1523.072*
1530.372	*1538.954*
1552.116	*1551.692*

A.3 <WL SHIFT **.**nm>

This key is used to set the wavelength shift.
When you press the <WL SHIFT **.*** nm> key, the current setting is displayed in the interrupt display area.
The setting may be changed in the range of -5.000 to 5.000 nm (0.001 steps) in the DATA ENTRY section.
When the wavelength shift is changed, the set value is added to the display value on the wavelength axis. This key is used for purposes such as correcting differences in wavelength display values among different measurement instruments.
If the wavelength shift setting is not zero, then WL SHF is displayed at the very bottom of the screen.

A.4 <LEVEL SHIFT***.***dB>

This key is used to set the level shift.
When you press the <LEVEL SHIFT***.***dB> key, the current setting is displayed in the interrupt display area.
The setting may be changed in the range of -60.00 to 60.00 dB (0.01 steps) in the DATA ENTRY section.
When the level shift is changed, the set value is added to the display value on the level axis.
This key is used for purposes such as correcting level errors due to differences in the NA values of 9.5/125 μm SM optical fibers connected to the unit, and correcting loss on externally connected isolators, filters and the like.
(☛ See subsection 5.1.2 Input Optical Fiber Numerical Aperture (NA) and Level Measurement Values)
If the level shift setting is not zero, then LVL SHF is displayed at the very bottom of the screen.

A.5 <WL OFFSET TABLE>

This key is used to edit the user wavelength calibration table.
When you press the <WL OFFSET TABLE> key, the wavelength calibration table and a soft key menu are displayed.
Note that normally, it is not necessary to use this function.

A.6 <LVL OFFSET TABLE>

This key is used to edit the user level calibration table.
When you press the <LVL OFFSET TABLE> key, the level calibration table and a soft key menu are displayed. Note that normally, it is not necessary to use this function.

A.7 <GRID EDITOR>

This key is used to edit the grid table which is referenced when an analysis function is executed.
When you press this key, the currently active grid table is displayed.
For the default settings, a grid table with 200 GHz grid spacing is used.
See Chapter 8 for detailed information on this function. (☛ Subsection 8.2.2 GRID)

200GHz SPACING	Creates a grid table with 200 GHz grid spacing.
100GHz SPACING	Creates a grid table with 100 GHz grid spacing.
50GHz SPACING	Creates a grid table with 50 GHz grid spacing.
25GHz SPACING	Creates a grid table with 25 GHz grid spacing.
12.5GHz SPACING	Creates a grid table with 12.5 GHz grid spacing.
CUSTOM	Allows the grid table to be customized by the user.
REFERENCE WAVELENGTH	Sets the grid table reference wavelength. This can be set in the range of 1000.0000 to 1700.0000 nm.

A.8 <USER KEY DEFINE>

This key is used to register a user key.
When you press the <USER KEY DEFINE> key, the screen changes to the registration screen.
The registration procedure is described below.

1. Press the <USER KEY DEFINE> key to start the user key registration process.
2. When you press the panel switch for the soft key to be registered, the soft key menu changes to the applicable soft key. Note that soft keys that cannot be registered are not displayed.
3. Press the soft key you want to register. The soft key pressed in step 2 is displayed in the registration key display area on the screen.
4. When you press the [USER] switch while the soft key to be registered is displayed in the registration key display area, the soft key menu changes to the [USER] switch key menu.
5. Press the key you want to register on the [USER] switch soft key menu to register the selected soft key as a user key. At the same time, the registration key display area goes blank again. If a user key has already been registered, it is overwritten.

Press the [UNDO/LOCAL] switch to exit user key registration mode.
As a basic rule, only the soft key displayed after pressing the panel switch can be registered. The soft key which is pressed next cannot be registered. Note that soft keys that cannot be registered are not displayed.
If you wish to delete the registered user key, register a blank key following the above procedure.

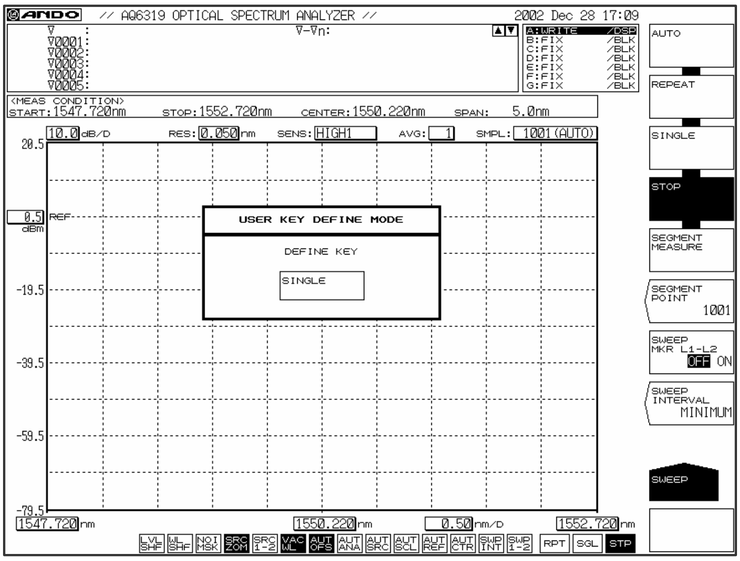


Fig. 6-20 Screen display when <USER KEY DEFINE> key is pressed

B.1 <REMOTE INTERFACE>

This key is used to select the interface to be used in remotely controlling the unit using an external PC.

GP-IB	Uses GP-IB as the remote interface.
RS-232C	Uses RS-232C as the remote interface.
ETHERNET	Uses LAN port as the remote interface.

B.2 <GP-IB SETTING>

This key is used to set the GP-IB interface. See the attachment (Program/Remote Function Manual) for detailed information of the GP-IB function.

B.2.1 <MY ADDRESS **>

This key is used to set the unit's GP-IB address. (Default: 1)
When you press the <MY ADDRESS **> key, the current setting is displayed in the interrupt display area.
The setting may be changed in the range of 0 to 30 in the DATA ENTRY section.
Note that the <MY ADDRESS **> key sets the address for port 1 on the unit. Use the <GP-IB2 PORT ADDRESS> key to set the address for port 2.

B.2.2 <GP-IB2 PORT ADDRESS **>

This key is used to set the GP-IB2 port address. (Default: 2)
When you press the <GP-IB2 PORT ADDRESS **> key, the current setting is displayed in the interrupt display area. The setting range is 0 to 30 (steps of 1), and the value is set in the DATA ENTRY section.

B.2.3 <SYSTEM CONTROLLER OFF / ON>

The GP-IB2 port can be given system control privileges.
To set the unit as the system controller for a GP-IB device connected to the GP-IB2 port, set <SYSTEM CONTROLLER OFF/ON> to ON. Set it to OFF to use a system controller such as an external PC.
The default setting is ON, in which case the AQ6319 serves as the system controller for a GP-IB device connected to the GP-IB2 port. Set this key to OFF if you want to control a peripheral device connected to the GP-IB2 port from an external computer connected to the GP-IB1 port. This setting requires a special connection and program. Separate detailed documentation on this topic is available from us.

NOTE

- Do not use the GP-IB2 port as a system controller to remotely control the unit with its GP-IB2 port connected to the GP-IB1 port. Proper operations under remote control are not guaranteed.

B.2.4 <COMMAND FORMAT>

This key is used to set the command mode for remote commands which are used when the unit is remotely controlled.
Setting of command format is common to <GP-IB SETTING> and <RS-232C SETTING> and <NETWORK SETTING>.
Normally AQ6319 mode is used. Set AQ6317 mode to control the AQ6319 using AQ6317-compatible commands. See the attachment (Program/Remote Function Manual) for detailed information of the GP-IB function.

AQ6319	Remotely controls the unit using AQ6319 commands (SCPI-compatible).
AQ6317	Remotely controls the unit using AQ6317-compatible commands

B.2.5 <TLS ADDRESS>

Sets the address of the Tunable Laser Source connecting to the port "GP-IB 2".(Default : 20)
When entry of the setting has been made, the current address appears in the interrupt indication section.
The address can be changed within the range 0 to 30 (1 step) using the rotary knob, step keys or numeric keys.

B.3 <RS-232C SETTING>

This key is used to set the RS-232C interface.

B.3.1 <BAUD RATE>

This key is used to select the RS-232C baud rate.

1200BPS	Sets the baud rate to 1200 bps.
2400BPS	Sets the baud rate to 2400 bps.
4800BPS	Sets the baud rate to 4800 bps.
9600BPS	Sets the baud rate to 9600 bps. (Default)
19200BPS	Sets the baud rate to 19200 bps.
38400BPS	Sets the baud rate to 38400 bps.
57600BPS	Sets the baud rate to 57600 bps.
115200BPS	Sets the baud rate to 115200 bps.

B.3.2 <PARITY>

This key is used to select the RS-232C parity. Restores the previous tree after execution.

NONE	Sets the parity to NONE. (Default)
ODD	Sets the parity to ODD.
EVEN	Sets the parity to EVEN.

B.3.3 <FLOW>

This key is used to set RS-232C flow control. Restores the previous tree after execution.

Xon/Xoff	Sets flow control to Xon/Xoff mode.
HARDWARE	Sets flow control to hardware mode.
NONE	Sets flow control to NONE.(Default)

B.3.4 <COMMAND FORMAT>

This key is used to set the command mode for remote commands which are used when the unit is remotely controlled.
Setting of command format is common to <GP-IB SETTING> and <RS-232C SETTING> and <NETWORK SETTING>.
Normally AQ6319 mode is used. Set AQ6317 mode to control the AQ6319 using AQ6317-compatible commands. See the attachment (Program/Remote Function Manual) for detailed information of the GP-IB function.

AQ6319	Remotely controls the unit using AQ6319 commands (SCPI-compatible).
AQ6317	Remotely controls the unit using AQ6317-compatible commands

B.4 <NETWORK SETTING>

This key is used to enter settings required to connect the unit to a network.

COMPUTER NAME	Sets a name for identifying the unit on the network. The name is the host name for network connections to the unit using FTP. After the name is entered, the unit must be rebooted in order to apply the name. The factory default setting is as follows. "AQ6319@@@@@@@@@" (where "@@@@@@@@@" is the serial number) (The machine number is an 9-digit alphanumeric number on the back of the unit.)
TCP/IP SETTING	Sets the unit's IP address. After the IP address is set, the unit must be rebooted in order to apply the setting.
REMOTE PORT NO.	Sets the port number for remote control.
COMMAND FORMAT	This key is used to set the command mode for remote commands which are used when the unit is remotely controlled. Setting of command format is common to <GP-IB SETTING> and <RS-232C SETTING> and <NETWORK SETTING>. Normally AQ6319 mode is used. Set AQ6317 mode to control the AQ6319 using AQ6317-compatible commands. See the attachment (Program/Remote Function Manual) for detailed information of the GP-IB function.

AQ6319	Remotely controls the unit using AQ6319 commands (SCPI-compatible).
AQ6317	Remotely controls the unit using AQ6317-compatible commands

NOTE

- See "7.8 FTP server function" for detailed information on FTP function.
  (☛ See section 7.8 FTP server function)

B.5 <HARD COPY DEVICE>

This key is used to set the destination for outputting a hard copy when the [COPY] switch is pressed. (Default: INTERNAL)

INTERNAL	Sets the internal printer as the hard copy output destination.
EXTERNAL	Sets an external printer as the hard copy output destination.
FILE	Sets a file as the hard copy output destination. The file is saved to the current directory, which is set using the [FILE] switch.

B.6 <EXT PRINTER SETTING>

This key is used to set an external printer which is connected to the unit.
See Chapter 7 for information on how to use an external printer. (☛ See section 7.7 Using an External Printer)

PRINTER SELECT	Selects the printer driver to use for actual printing among the printer drivers installed on the unit. If multiple printer drivers have been installed, use this key to select the desired driver. When you press this key, the installed printer drivers are displayed.
MODE	Sets the color mode for output to an external printer. B&W Outputs in black and white mode. (Default) COLOR Outputs in color mode.
NEW PRINTER INSTALL	Installs printer driver software on the unit. If you want to use an external printer, you must install its driver software using this key. When you press this key, the driver installation screen displayed. See Chapter 7 for information on how to install driver software. (☛ See subsection 7.7.1 Installing a Printer Driver)

B.7 <SET CLOCK>

This key is used to set up the unit's internal clock.
When you press this key, the internal clock setup window is displayed on the screen.

CURSOR→	Moves the internal clock setup window cursor to the right.
YR-MO-DY	Sets the date display in "Year-Month-Day" format. (Default)
MO-DY-YR	Sets the date display in "Month-Date-Year" format.
DY-MO-YR	Sets the date display in "Day-Month-Year" format.

B.8 <COLOR SELECT>

This key is used to select the screen display color. (Default: COLOR 1)

COLOR1	Sets the screen display color to "COLOR 1".
COLOR2	Sets the screen display color to "COLOR 2".
COLOR3	Sets the screen display color to "COLOR 3".
COLOR4	Sets the screen display color to "COLOR 4".
COLOR5	Sets the screen display color to "COLOR 5".
B&W	Sets the screen display color to "B&W".

C.1 < UNCAL WARNING OFF / ON>

This key is used to set whether to display UNCAL marks and warnings. (Default: ON)
See the SAMPLING POINT key provided in the [SETUP] switch for information on UNCAL marks.

C.2 < BUZZER >

This key is used to set the buzzer function.
It sets whether to sound a buzzer when a hard key or soft key is pressed, or when a warning is displayed.

CLICK	Turns OFF/ON the click sound which is output when a panel key or soft key is pressed. (Default: ON)
WARNING	Turns OFF/ON the warning sound which is output when an event such as a warning occurs. (Default: ON)

C.4 <LEVEL DISP DIGIT>

This key is used to set the number of display digits (below the decimal point) for the level data displayed in the marker area and analysis results.
When this setting is changed, data such as marker values are redrawn immediately.

1DIGIT	Sets the number of level data display digits (below the decimal point) to 1 digit.
2DIGIT	Sets the number of level data display digits (below the decimal point) to 2 digits. (Default)
3DIGIT	Sets the number of level data display digits (below the decimal point) to 3 digits.

C.5 < WINDOW TRANSPARENT OFF / ON>

This key is used to turn OFF/ON the function for making the interrupt display and OVERVIEW display window semi-transparent.
Screen drawing speed may be increased by setting semi-transparent display to OFF. (Default: ON)

C.6 < AUTO OFFSET OFF/ON>

This key is used to set whether to perform automatic offset adjustment on the unit's internal amplifier circuit.
When the <AUTO OFFSET> key is set to ON, the offset of the internal amplifier circuit is adjusted at fixed time intervals. If auto-offset is not selected, then the auto-offset adjustment operation is not performed. (Default: ON)
If auto-offset has not been selected and the <AUTO OFFSET> key is pressed, the key is selected and the offset adjustment operation is executed immediately.
During offset adjustment is displayed "ZEROING..." in the lower left corner of the display screen.

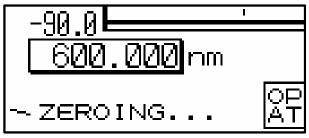


Fig 6-21 Display screen during offset adjustment

Subsequently, auto-offset adjustment is performed at fixed time intervals.

⚠ Caution

Auto-offset function

- If the <AUTO OFFSET> key is set to OFF, level axis performance may decline due to offset fluctuations over time. Normally the unit should be used with this function set to ON.

D.4 <PARAMETER INITIALIZE>

This key is used to initialize the AQ6319's settings and data.
It is used to restore the AQ6319 to a known initial state.
Note, however, that system configuration settings, such as the unit's network name, IP address, and installed external printer driver software, are not initialized.
See Chapter 8 for detailed information on this function. (☛ See section 8.9 Data Initialization Function)

D.4.1 <PARAMETER CLEAR>

This key is used to clear current settings. In addition, the waveform data on traces A through G are initialized.
This key is used to restore the unit's settings to a known initial state.

EXECUTE Executes the initialization operation.

D.4.2 <PARAM&DATA CLEAR>

This key is used to clear current settings and data (including program data created with the [PROGRAM] switch and waveform data saved with the [MEMORY] switch) and restore the initial state.

EXECUTE Executes the initialization operation.

D.4.3 <CAL DATA CLEAR>

This key is used to clear alignment adjustment values set with the <OPTICAL ALIGNMENT> key and wavelength calibration values set with the <WL CALIBRATION> key.

EXECUTE Executes the initialization operation.

D.4.4 <ALL DATA CLEAR>

This key is used to clear the current settings and data, as well as alignment adjustment values and wavelength calibration values.

EXECUTE Executes the initialization operation.

D.5 <VERSION>

This key is used to display the versions of firmware and hardware installed on the unit.
When you press the <VERSION> key, the version display window is shown on the screen.
Firmware can be updated while the version display window is open.

D.5.1 <PATCH LIST>

This key is used to display the patch list, which is applied in this unit of OS(Operating System)
See Chapter 8 for detailed information on this function.
(☛8.8 Updating the Firmware)

D.5.8 <UPDATE>

This key is used to update firmware.
See Chapter 8 for detailed information on this function.
(☛ See section 8.8 Updating Firmware)

D.6 <SYSTEM RESTORE>

This key is used to restore the internal hard drive to its condition when it was shipped from the factory.
This action initializes all settings, waveform data and program data, as well as the entire unit system, including network settings and external printer drivers.
Use this key in an emergency, such as if the unit's system operations become unstable.
See Chapter 8 for detailed information on this function.
(☛ See section 8.10 System Restore Function)

NOTE

- The <PARAMETER INITIALIZE> key is a function for initializing the unit's parameters and data. This key can be used to reset the unit to the initial settings.
- The <SYSTEM RESTORE> key is used to restore the internal hard drive to its initial condition when shipped from the factory. This key is used in cases where, for example, the system becomes unstable. Use the <PARAETER INITIALIZE> key without using the <SYSTEM RESTORE> key for purposes such as clearing the unit's settings or initializing its data.

D.7 <TEST MODE>

This key is used to enter test mode.
The <TEST MODE> key is used in adjusting the unit at the factory, and is not typically used by end users.
When you press the <TEST MODE> key, the password input window is displayed. You can close this window by pressing another soft key or switch.

D.8 <SHUT DOWN>

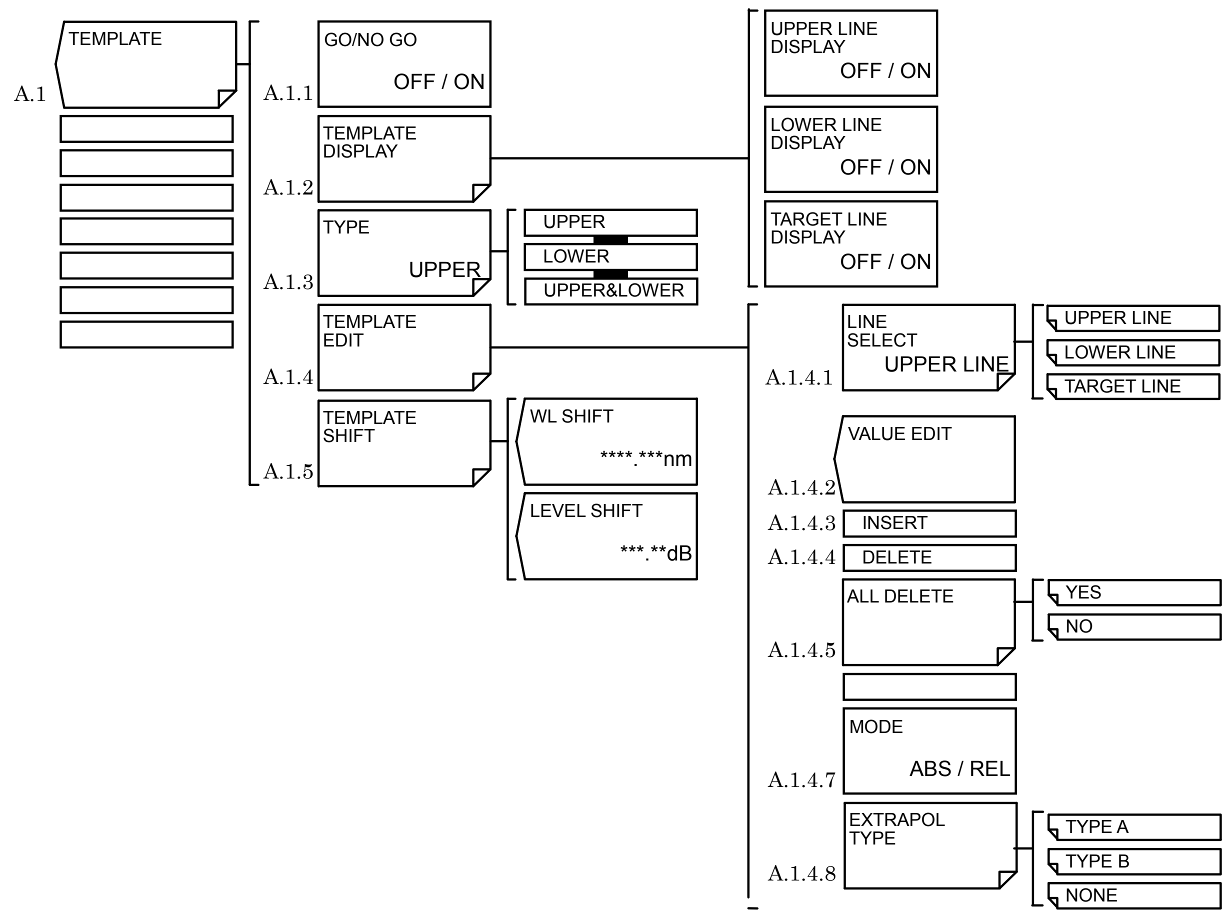
This key is used to halt unit operations and enter the standby state.
When you press this key, the shutdown operation is executed, and transition to the standby state starts.
When the shutdown operation starts, the following message is displayed on the screen.

AQ6319 is shutting down Please wait...

After the shutdown operation ends, the operating system automatically enters the standby state.
It may take several minutes to enter this state.
In the standby state, the green “OPERATE” LED turns off and the orange “STANDBY” LED turns on.
Before turning off the unit’s main power, make sure the unit has entered the standby state, then turn the [POWER] switch on the back of the unit to [OFF].

6-17 ADVANCE

The [ADVANCE] switch contains functions related to template function settings. When you press the [ADVANCE] switch, the following soft key menu is displayed.



A.1 <TEMPLATE>

This key is used to set the template function.
The template function compares the measured waveform against reference data (a template) preset by the user, and performs a test on the measured waveform (Go/No Go test).
See Chapter 7 for detailed information on this function. (☛ See section 7.6 Template Function)

A.1.1 <GO/NO GO OFF / ON>

This key is used to turn ON/OFF the function for comparing and judging the measured waveform against the template (Go/No Go test).
If the key is set to ON, the measured waveform is compared and judged against the template after sweeping ends, and the test results are displayed on the screen.
This key is disabled if the template is undefined.

A.1.2 <TEMPLATE DISPLAY OFF / ON>

This key is used to switch OFF/ON the template screen display.

UPPER LINE DISPLAY	Turns ON/OFF the level upper limit line display. (Default: OFF)
LOWER LINE DISPLAY	Turns ON/OFF the level lower limit line display. (Default: OFF)
TARGET LINE DISPLAY	Turns ON/OFF the level target line display. (Default: OFF)

A.1.3 <TEST TYPE>

This key is used to select one of the following three test types for the Go/No Go test function.

UPPER	Performs the test only on the level upper limit value with respect to the measured waveform.
LOWER	Performs the test only on the level lower limit value with respect to the measured waveform.
UPPER&LOWER	Performs the test on both the level upper limit value and lower limit value with respect to the measured waveform.

A.1.4 <TEMPLATE EDIT>

This key is used to edit a template.

A.1.4.1 <LINE SELECT>

This key is used to select the template to be edited.

UPPER LINE	Selects the upper line for editing. (Default)
LOWER LINE	Selects the lower line for editing.
TARGET LINE	Selects the target line for editing.

A.1.4.2 <VALUE EDIT>

Edits the data at the cursor position.

A.1.4.3 <INSERT>

Inserts data at the cursor position.

A.1.4.4 <DELETE>

Deletes the data at the cursor position.

A.1.4.5 <ALL DELETE>

Deletes all data points in the edited template.

A.1.4.7 <MODE ABS/REL>

Selects absolute value mode or relative value mode for the edited template.
When ABS is set, absolute value mode is used. When REL is set, relative value mode is used.(Default: ABS)

A.1.4.8 <EXTRAPOL TYPE>

Sets the extrapolation type for the edited template.

TYPE A	Sets the extrapolation type to TYPE A.
TYPE B	Sets the extrapolation type to TYPE B.
NONE	Sets a mode in which extrapolation is not performed.

A.1.5 <TEMPLATE SHIFT>

This key is used to set the template's wavelength shift and level shift.
The wavelength shift and level shift are set as common values for the three template types.
This key is disabled if the template data are undefined.

WL SHIFT	This key is used to set the template's wavelength shift. The setting range is -999.999 nm to 999.999 nm.
LVL SHIFT	This key is used to set the template's level shift. The setting range is -99.99 dB to 99.99 dB.

6-18 COPY / FEED

The [COPY] switch is used to output the measurement screen to the internal printer, an external printer, or a file.
When you press the [COPY] switch, the measured waveforms and lists displayed on the screen are output to the internal printer, an external printer, or a file.
The [UNDO/LOCAL] switch (6-19) can be used to cancel a copying operation.
The [FEED] switch is used to feed printer paper. Paper feeding continues as long as you hold down the [FEED] switch.
See Chapter 2 (Part Names and Functions) for information on how to insert the special printer paper. (☛ See section 2.4 Internal Printer)

How to use the [COPY] switch

(1) When you press the [COPY] switch, a hard copy of the currently displayed screen is output to the printer.

(2) If you press the [COPY] switch during sweeping, the sweeping operation is stopped. After printing, sweeping is started again.

(3) If the printer runs out of recording paper during printing or if you press the [COPY] switch without inserting any recording paper, the following warning is displayed.

WARNING 160: Printer paper empty

If you press the [COPY] switch while the head-raising lever is in the [UP] position, the following warning is displayed.

WARNING 161: Printer head up

Insert recording paper or lower the head-raising lever, then press the [COPY] switch to start printing.

6-19 UNDO／LOCAL

The [UNDO/LOCAL] switch contains switch functions which vary depending on the state of the unit when the [UNDO/LOCAL] switch is pressed.

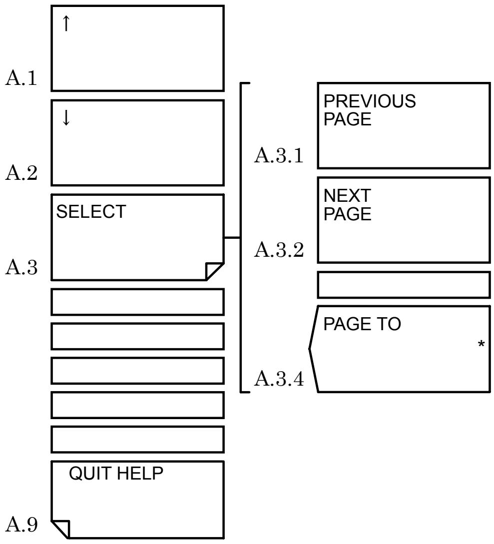
The following table shows the switch functions in different unit states.

Table 6.3 Function of [UNDO/LOCAL] switch according to states

Unit state	Function
If UNDO action is allowed	If the [UNDO] switch is pressed after changing parameter settings, changing or deleting data, etc., the previous action (change, deletion, etc.) is canceled and the state preceding that action is restored.
During user key registration	If the [UNDO] switch is pressed during user key registration, registration mode is cancelled and the soft key menu which appeared when the [SYSTEM] switch was pressed is displayed again.
During remote control by external PC (Remote light is on)	Changes the state from the remote state back to the local state. The remote light turns off.

6-20 HELP

When you press the [HELP] switch, a soft key menu of the currently displayed screen is displayed explanations.
Soft keys for selecting the “MORE INFO” which indicate additional information are displayed by some soft keys in HELP screen. Additional information (“MORE INFO”) is indicated a detail explanations to the applicable soft keys.
Press the <QUIT HELP> key or Function switch to exit HELP screen.



A.1 < ↑ >

Moves the cursor up.
(This key is disabled, if “MORE INFO” in the HELP screen does not exist.)

A.2 < ↓ >

Moves the cursor down.
(This key is disabled, if “MORE INFO” in the HELP screen does not exist.)

A.3 <SELECT>

Selects the “MORE INFO” at the cursor position.
(This key is disabled, if “MORE INFO” in the HELP screen does not exist.)

A.3.1 <PREVIOUS PAGE>

Moves to the previous additional information.
If you press this key the first page of additional information, final page is displayed.
(This key is disabled, if additional information does not exit two or more pages.)

A.3.2 <NEXT PAGE>

Moves to the next additional information.
If you press this key the last page of additional information, first page is displayed.
(This key is disabled, if additional information does not exit two or more pages.)

A.3.2 <PAGE TO *>

Select to the page number of additional information.
When you press this key, the current numbers of page displayed in the interrupt display area.
The setting range for this key is from first page to final page, which selected additional information of soft key.
(This key is disabled, if additional information does not exit two or more pages.)

A.9 <QUIT HELP>

This key used to cancel HELP screen and the previous screen is displayed again.

Fig 6-22 and Fig 6-23 presents an example of display screen when [HELP] switch was pressed.

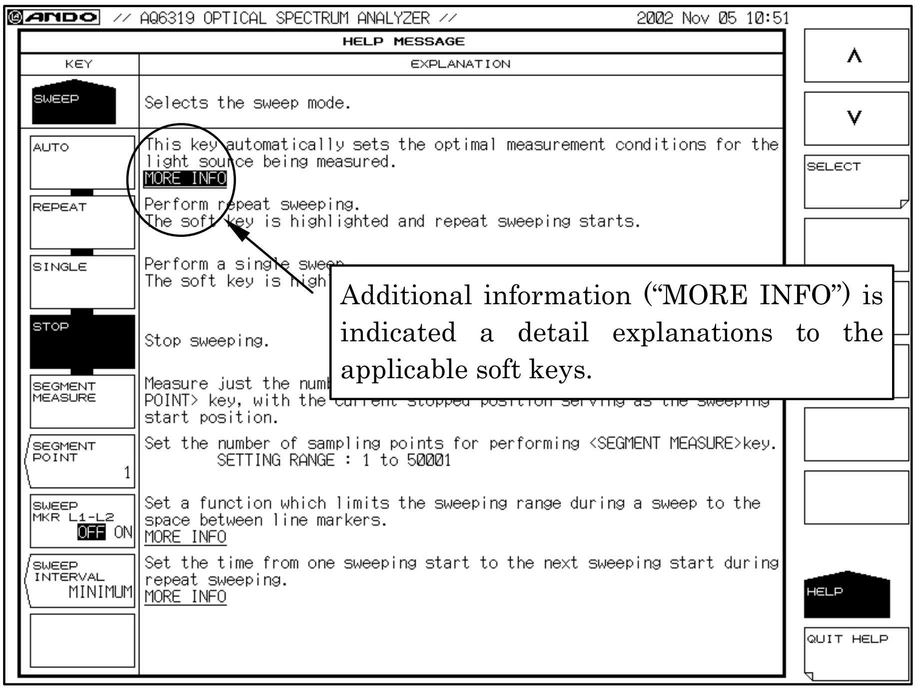


Fig 6-22 HELP display screen

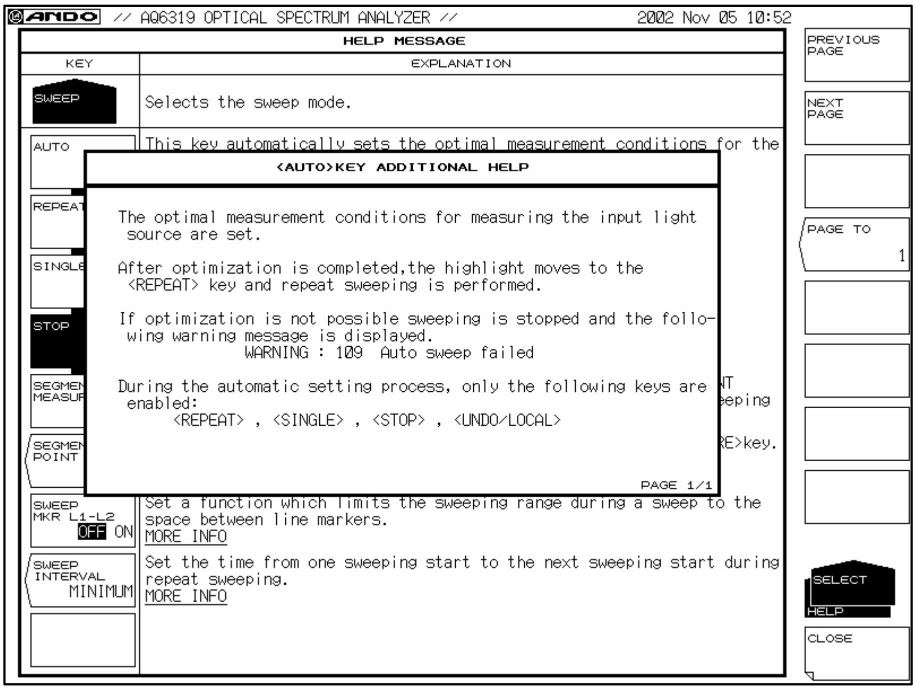


Fig 6-23 Additional information display screen

6.20 HELP

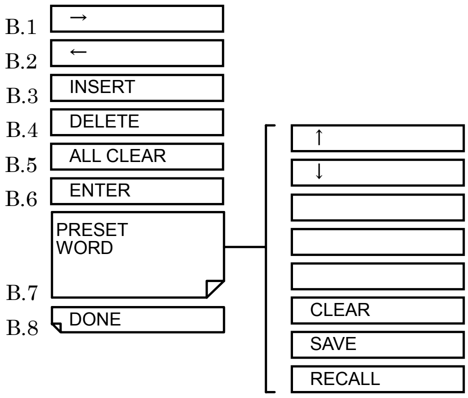
6-21 USER

Frequently used soft keys can be registered on the soft key menu in the [USER] switch.
Registering frequently used soft keys in the [USER] switch allows you to execute frequently used functions in a small number of steps.
The <USER KEY DEFINE> key in the [SYSTEM] switch is used to register soft keys in the [USER] switch. (☛ See [SYSTEM] Switch <USER KEY DEFINE> key)

There are three [USER] switch soft key menu pages (1/3 through 3/3), allowing 24 different soft key menus to be registered. For the default setting, all keys are unregistered.
Soft keys registered in the [USER] switch by means of the [SYSTEM] switch execute different actions based on the registered information, in the same manner as the soft keys of other switches.

6-22 General Purpose LABEL INPUT

[General Purpose LABEL INPUT] does not exist as an independent switch.
It appears together with the LABEL INPUT screen when a character string is input to the unit, such as when the [DISPLAY] switch <LABEL> key is pressed or when a file name is entered while saving a file with the [FILE] switch.



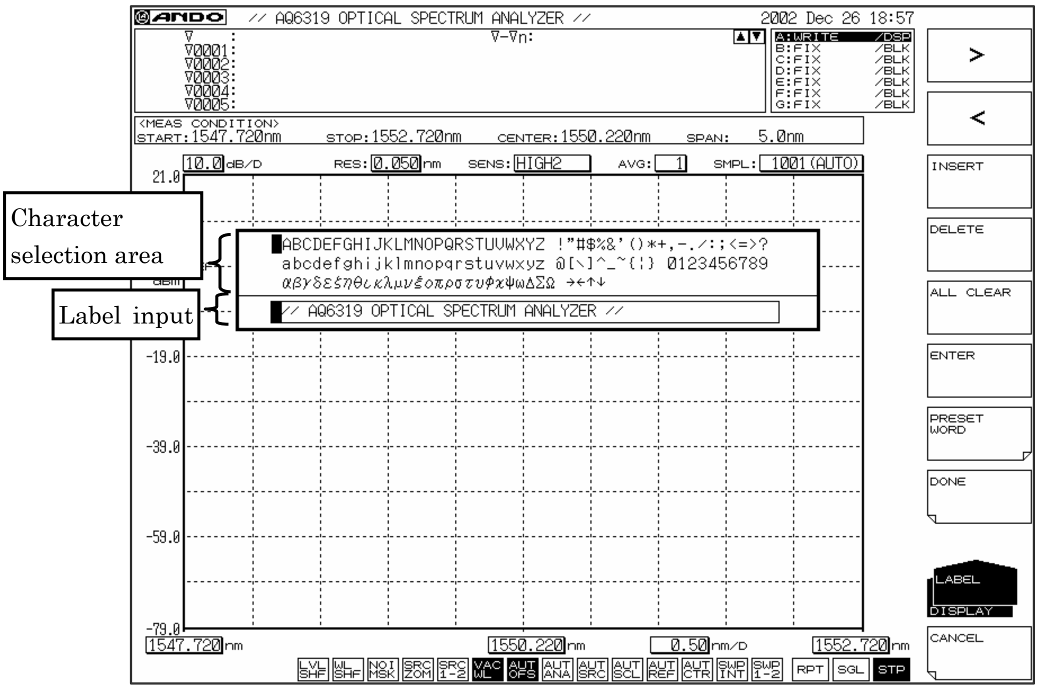


Fig. 6-2 LABEL INPUT screen

B.1 < → >

This key is used to move the cursor in the label input area one space to the right.

B.2 < ← >

This key is used to move the cursor in the label input area one space to the left.

B.3 <INSERT>

This key is used to insert a blank space at the cursor position in the label input area.

B.4 <DELETE>

This key is used to delete the character at the cursor position in the label input area.

B.5 <ALL CLEAR>

This key is used to clear the entire character string in the label input area.

B.6 <ENTER>

This key is used to enter, in the label input area, the character at the cursor position in the character selection area.

B.7 <PRESET WORD>

This key is used to work with preset data.
When you press this key, the preset data window appears, serving as the preset data selection screen.
Frequently used character strings can be registered as preset data, and registered preset data can be recalled for use.

↑	Moves the cursor up in the preset data window.
↓	Moves the cursor down in the preset data window.
CLEAR	Clears the preset data selected by the cursor.
SAVE	This key is used to register the character string in the label input area as preset data.
RECALL	This key is used to insert the preset data selected by the cursor at the cursor position in the label input area.

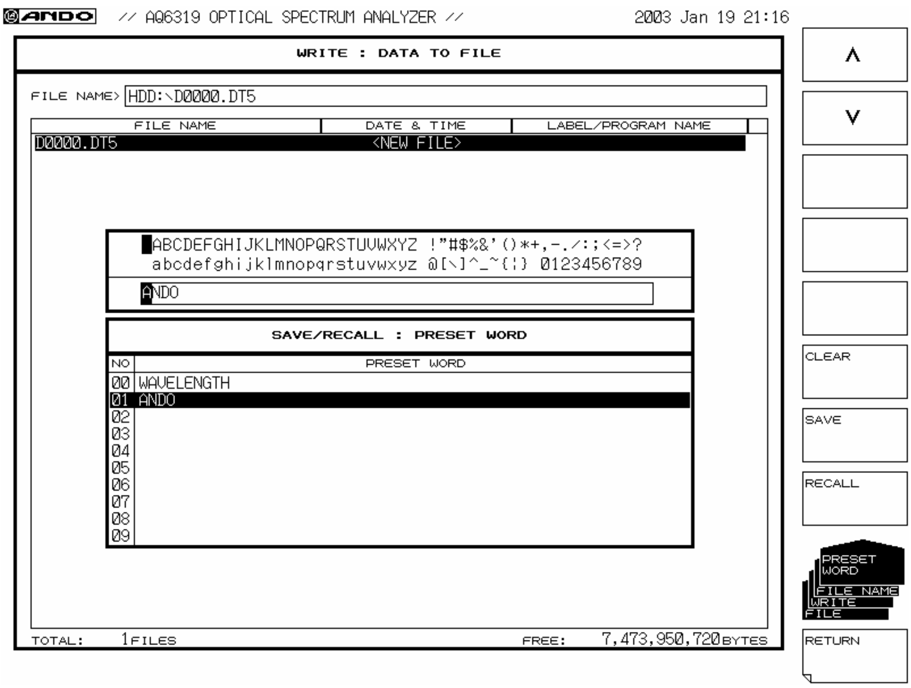


Fig. 6-25 Preset data window

B.8 <DONE>

This key is used to apply the character string entered in the label input area and return to the previous level.

Chapter 7 Useful Functions

7.1 Waveform enlarged/reduced display function

The unit has a zoom function which allows the user to freely enlarge or reduce a measured waveform in order to check a small area of the measured waveform, or to check the overall waveform.

The [ZOOM] switch of the function key is used to set the waveform enlarged/reduced display conditions.

In addition, the mouse can be used to enlarge or reduce any part of a waveform.

(☛ See section 6-7 ZOOM)

> **NOTE**
>
> - When the display scale is changed to a different setting than the measurement scale, ZOOMING is displayed on the screen. In addition, the OVERVIEW window, which shows the measurement scale, is displayed in a corner of the measurement screen. (☛ See section 6-7 ZOOM)
> - The display scale is independent of the measurement scale.

7.1.1 Setting display conditions using the panel keys

The following procedure is used to set the display conditions for the zoom function with the panel keys.

① Press the [ZOOM] switch.

② Press the <ZOOM CENTER WL> key to set the display scale center wavelength.

③ Press the <ZOOM SPAN> key to set the display scale span.

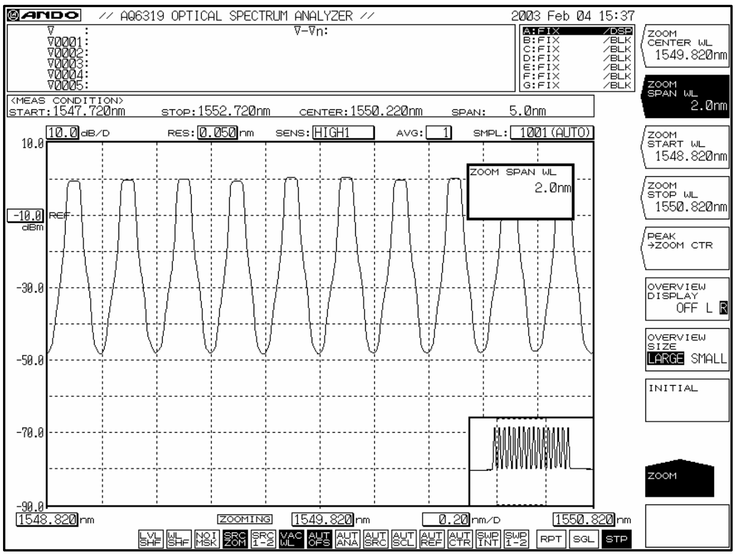


Fig. 7-1 Display scale change according to the [ZOOM] switch

NOTE

- If the setting for the display scale center wavelength (<ZOOM CENTER WL>) is changed, the display scale start wavelength and stop wavelength (ZOOM START WL>、<ZOOM STOP WL>) change accordingly.
  * However, the display scale span (<ZOOM SPAN WL>) does not change.
- If the setting for the display scale span (<ZOOM SPAN WL>) is changed, the display scale start wavelength and stop wavelength (ZOOM START WL>、<ZOOM STOP WL>) change accordingly.
  * However, the display scale center wavelength (<ZOOM CENTER WL>) does not change.

The display scale can also be set using the ZOOM START WL> and <ZOOM STOP WL> keys. The procedure for doing this is shown below.

① Press the [ZOOM] switch.

② Press the <ZOOM START WL> key to set the display scale start wavelength.

③ Press the <ZOOM STOP WL> key to set the display scale stop wavelength.

NOTE

- When the display scale start wavelength (or stop wavelength) is changed, the display scale center wavelength and span change accordingly.
  * However, the display scale stop wavelength (or start wavelength) does not change.

7

7.1.2 Procedure for directly setting enlarged display range using mouse

With the mouse, it is even easier to directly select the enlarged display range.

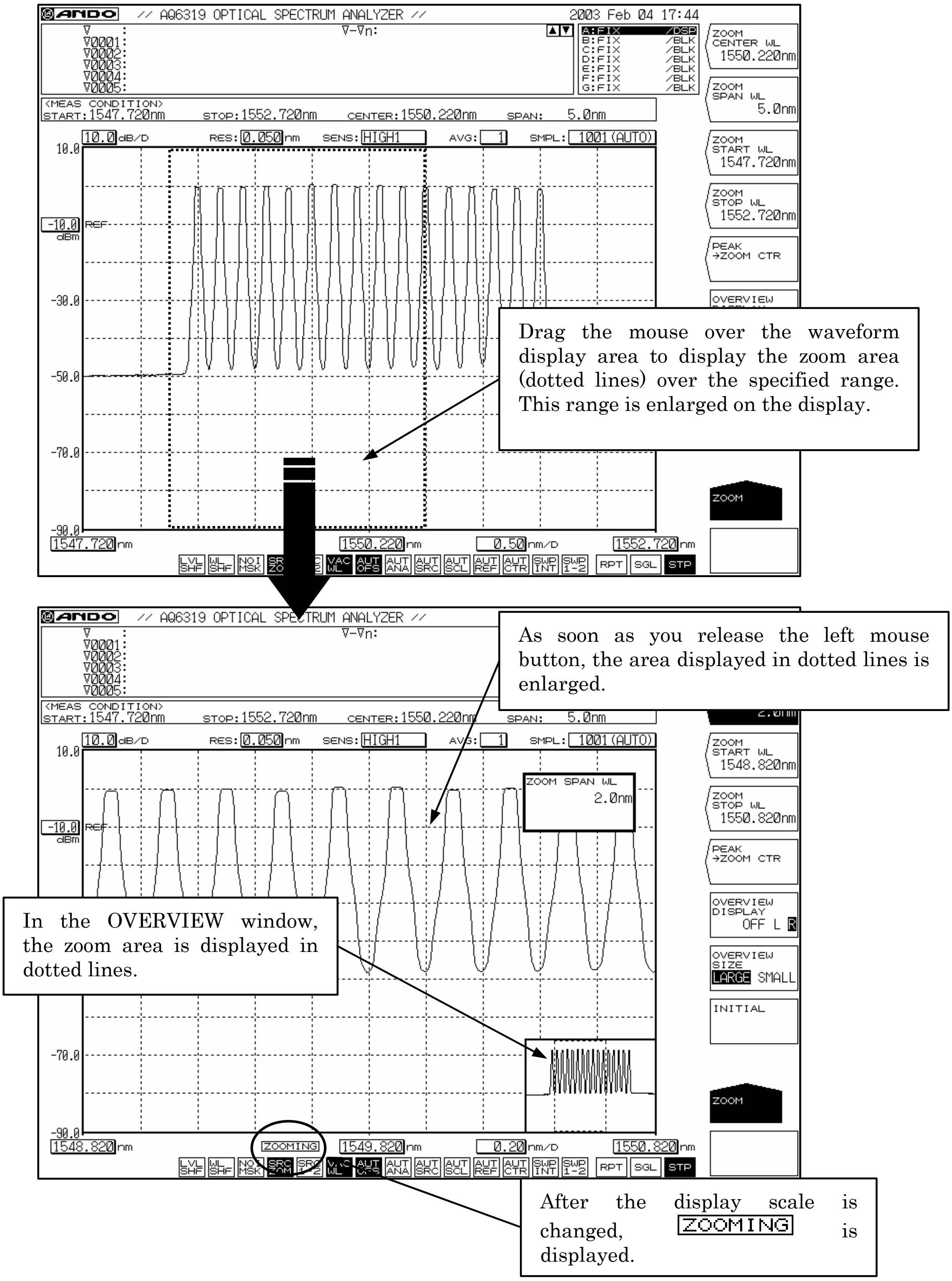


Fig. 7-2 Enlarged/Reduced Display Using Mouse

7.1.3 Settings in OVERVIEW Window

When the waveform display is enlarged or reduced using the zoom function, the OVERVIEW window is displayed at the very bottom of the waveform display area. This window makes it easy to check the enlarged area relative to the measured waveform. User settings can be used to show/hide, the OVERVIEW window, and set its display position and size.

● Changing the OVERVIEW window display position and hiding the window

The OVERVIEW window can be displayed in the lower right or lower left corner of the screen. It is also possible to hide the OVERVIEW window.

Press the [ZOOM] switch, then press the <OVERVIEW DISPLAY> key.

Each time you press the soft key, its state changes, cycling from “R” to “OFF” to “L”, and then back to “R”.

The initial setting is “R”. (☛ Table 8-24: Parameter Default Value for Each Function)

● Changing the size of the OVERVIEW window

Press the [ZOOM] switch, then press the <OVERVIEW SIZE> key repeatedly to select the desired size for the OVERVIEW window.

Each time you press the soft key, its state changes, altering between “LARGE” and “SMALL”.

The initial setting is “LARGE”.(☛ Table 8-24: Parameter Default Value for Each Function)

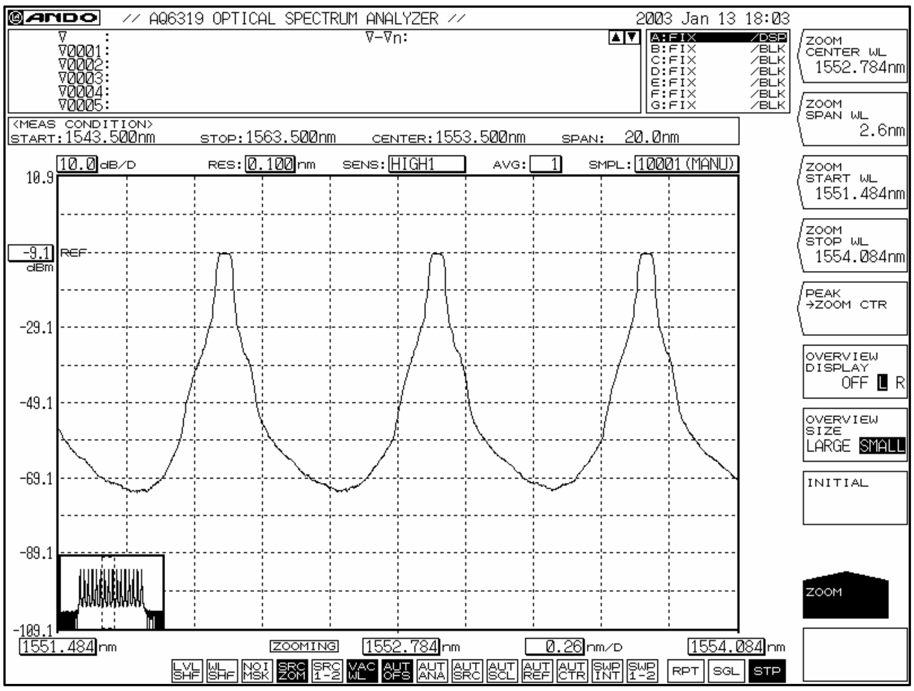


Fig. 7-3 Screen display when <OVERVIEW DISPLAY> is set to “L” and <OVERVIEW SIZE> is set to “SMALL”

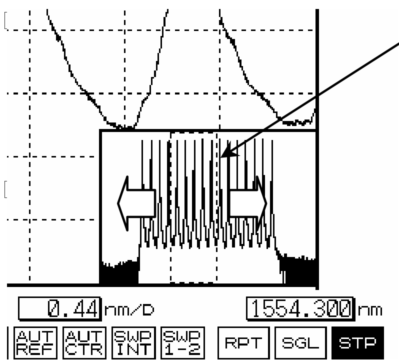
7.1.4 Mouse actions in the OVERVIEW window

The mouse can be used to change the display scale settings through the OVERVIEW window.
The available actions that can be performed by dragging vary depending on the shape of the mouse pointer in the OVERVIEW window.

● If the mouse pointer is a hand (✋)
When the mouse pointer is in the zoom area of the OVERVIEW window, its shape changes to a hand (✋).
The mouse pointer can be dragged in this condition to change the display scale center wavelength (center frequency).

● If the mouse pointer is a plus sign (+)
When the mouse pointer is outside the zoom area of the OVERVIEW window, its shape changes to a plus sign (+).
The mouse pointer can be dragged in the OVERVIEW window in this condition to easily specify a new zoom area for the measurement scale, even when an enlarged or reduced waveform is displayed.
(This function is the same as the procedure described in subsection “7.1.2 Enlarged/reduced display using the mouse”.)

● If the mouse pointer is a double-arrow sign (□)
When the mouse pointer is located on the zoom area display line of the OVERVIEW window, its shape changes to a double-arrow sign (□).
The mouse pointer can be dragged in this condition to easily change the display start wavelength or display stop wavelength.



When the mouse pointer is a hand (✋) and is used to drag the zoom area box, the zoom area can be moved to the left or right.
The waveform display area is scrolled in real time in conjunction with the movement of the zoom area on the OVERVIEW window.

Fig. 7-4 Mouse actions in the OVERVIEW window

7.1.5 Power measurement function in zoom area

Totalized power between display scales can be calculated using this function. (☛ See subsection 5.3.5 Various types of analysis)
This function is effective for purposes such as ASE evaluation on optical amplifiers.

The measurement procedure is described below.

① Set the totalized power range you want to measure to the display scale.

(☛ See subsections 7.1.1 “Setting display conditions using the panel keys” and 7.1.2 “Procedure for directly setting enlarged display range using mouse”)

② Press the [MARKER] switch.

③ Press the <MORE 1/3> key and <MORE 2/3> key.

④ Set the <SEARCH/ANA ZOOM AREA> key to ON.

NOTE

- When the zoom area search function is enabled, SRC ZOM is highlighted at the bottom of the display area.

⑤ Press the [ANALYSIS] switch.

⑥ Press the <ANALYSIS 1> key, then select the <POWER> key.

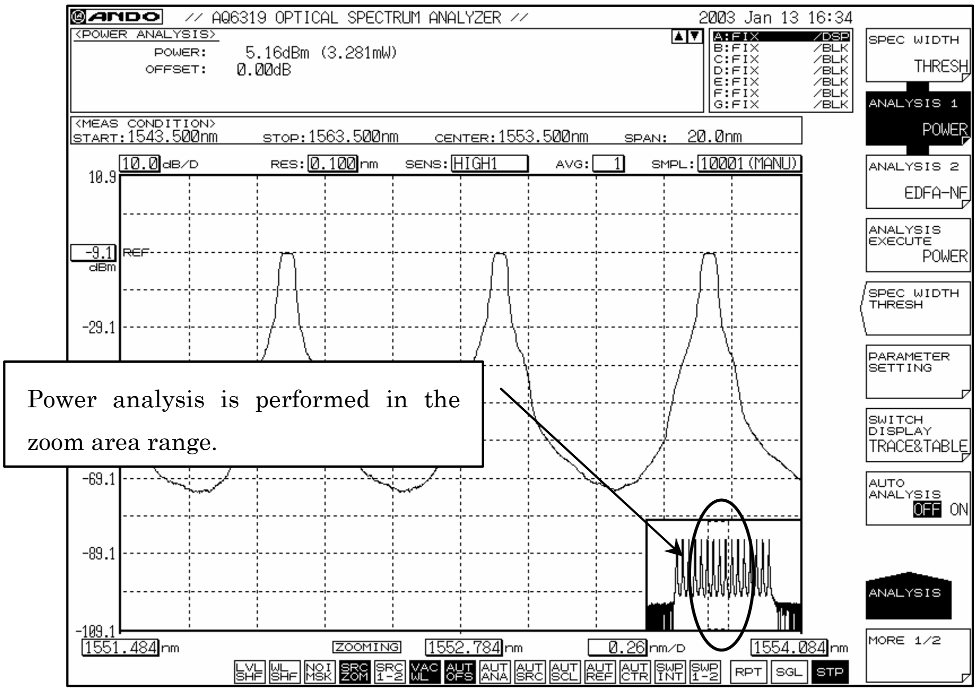


Fig. 7-5 Screen for executing power measurement between zoom areas

When you press this key, analysis is executed between the display scales. The totalized power is calculated and displayed in the data area. If the <SEARCH/ANA ZOOM AREA> key is OFF, power is calculated over the entire range of the measurement scale.

⚠ Caution

- If the line marker search function and the zoom area search function are enabled at the same time, the analysis range will be the overlapping range between the line markers and in the zoom area. (☛ See Fig. 7-6, "Analysis range when the line marker search function and zoom area search function are both ON")

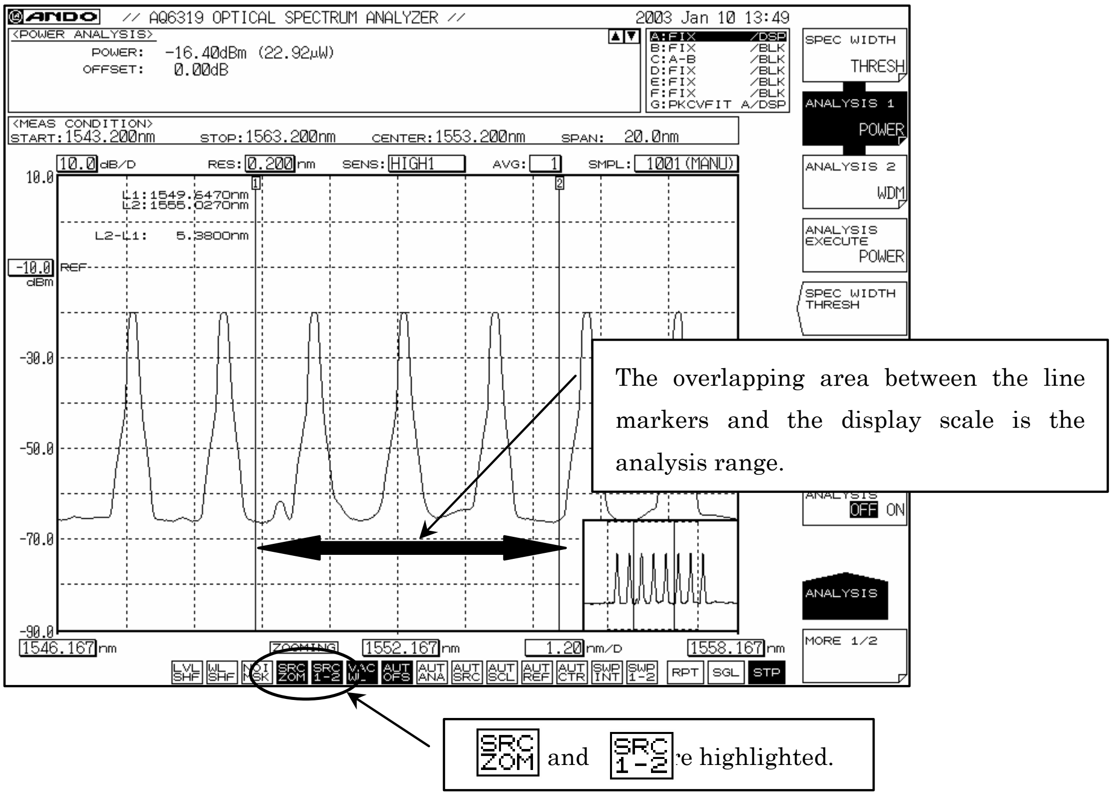


Fig. 7-6 Analysis range when the line marker search function and zoom area search function are both ON

7.2 Trace function

A trace shows a waveform and measurement conditions. The unit has a total of seven independent traces (A through G). Multiple traces can be displayed at the same time on the waveform screen.
In addition, display ON/OFF and mode settings can be set separately for each trace.

Traces can be set to the following modes.

・WRITE mode	Waveform data are written during sweeping.
・FIX mode	Fixes the data; does not write waveform data.
・MAX/MIN HOLD mode	Writes the maximum/minimum values in the waveform data during each sweep.
・ROLL AVG mode	Writes the rolling average value of the waveform data during each sweep.
・CALCULATE mode	Writes the results of calculations performed between data from different traces.

The trace mode setting procedure is shown below.

① Press the [TRACE] switch

② Press the <ACTIVE TRACE> soft key to set, as the active trace, the trace in which the mode setting is to be changed.

③ Press the key corresponding to the mode you want to set. (Press one of the following keys: <WRITE>, <FIX>, <HOLD>, <ROLL AVG>, <CALCULATE>.)

7.2.1 WRITE mode

When a trace is set to WRITE mode, waveform data are written during measurement, and the data are updated. Traces used in measurements are normally set to WRITE mode.
The trace display at the side of the data area changes to "WRITE”.

7.2.2 FIX mode

When a trace is set to FIX mode, its waveform data are not overwritten even when measurement is performed. Therefore, the waveform on the screen is not overwritten.
If you want to fix the waveform data of a trace, set the trace to FIX mode.
The trace display at the side of the data area changes to "FIX”.

7.2.3 Maximum/minimum value detection mode (MAX/MIN HOLD mode)

When a trace is set to MAX/MIN HOLD mode, each time a sweep is performed, the data at the individual measurement points are compared with prior measurements, and the measurement with the higher level (MAX HOLD) or lower level (MIN HOLD) is written.

If you want to measure the maximum or minimum value of a waveform which changes each time a sweep is performed, set the trace you want to measure to MAX/MIN HOLD mode and perform REPEAT sweeping.

Note that the <NOISE MASK> setting applies when a waveform is displayed, and is not affected when a maximum or minimum value is detected.

The trace display at the side of the data area appears as “MAX HOLD” or “MIN HOLD”.

7.2.4 Rolling average mode（ROLL AVG mode）

When a trace is set to ROLL AVG mode, each time measurement is performed the rolling average of the current measurement and past measurements is calculated, and the measurement data are updated.
The number of averagings is set in the range of 2 to 100.
The trace display at the side of the data area changes to "ROLL AVG".

7.2.5 CALCULATE mode

When a trace is set to CALCULATE mode, subtraction or normalized display between data from different traces, or curve-fit display, is performed according to the set CALCULATE mode.
Note that CALCULATE mode can only be set for traces C, F, and G.
The available calculation types vary depending on the trace. See Chapter 6 for details.
(☛See section 6-9 TRACE)

7.2.6 Normalized display function

This function is one of the trace CALCULATE modes. It normalizes and displays the trace data.
When trace G is set to CALCULATE mode and "NORMALIZE" is selected from the formulas, the normalized display function can be used.
With normalized display, normalization is performed and the waveform is displayed with the waveform peak set to 1 if the su-scale is linear, or set to 0 dB if the sub-scale is LOG.
Any of the traces A through C may be selected for normalization.（NORMALIZE A, NORMALIZE B, NORMALIZE C）

⚠ **Caution**
• Normalization is not possible if the waveform level is too low.

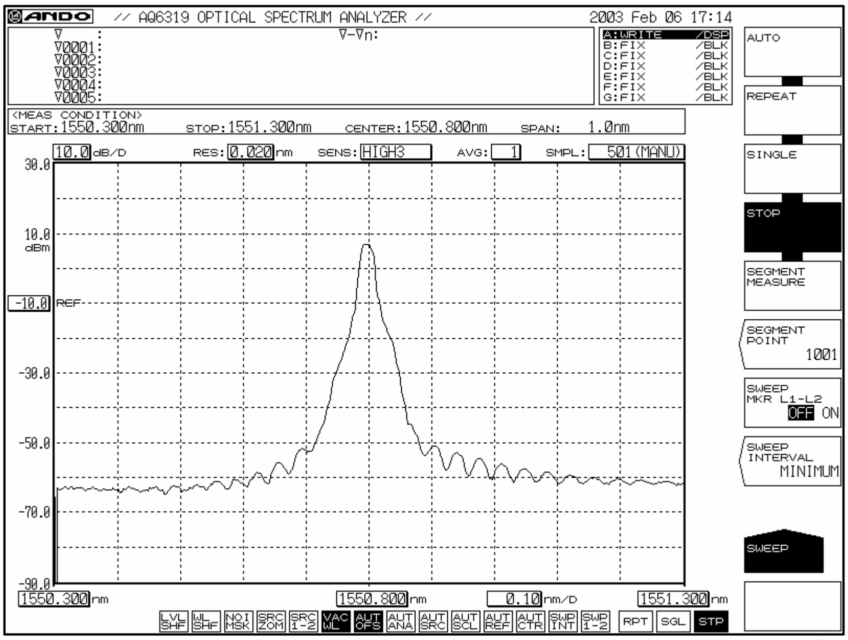


Fig. 7-7 Screen display before normalized display function is executed (trace A)

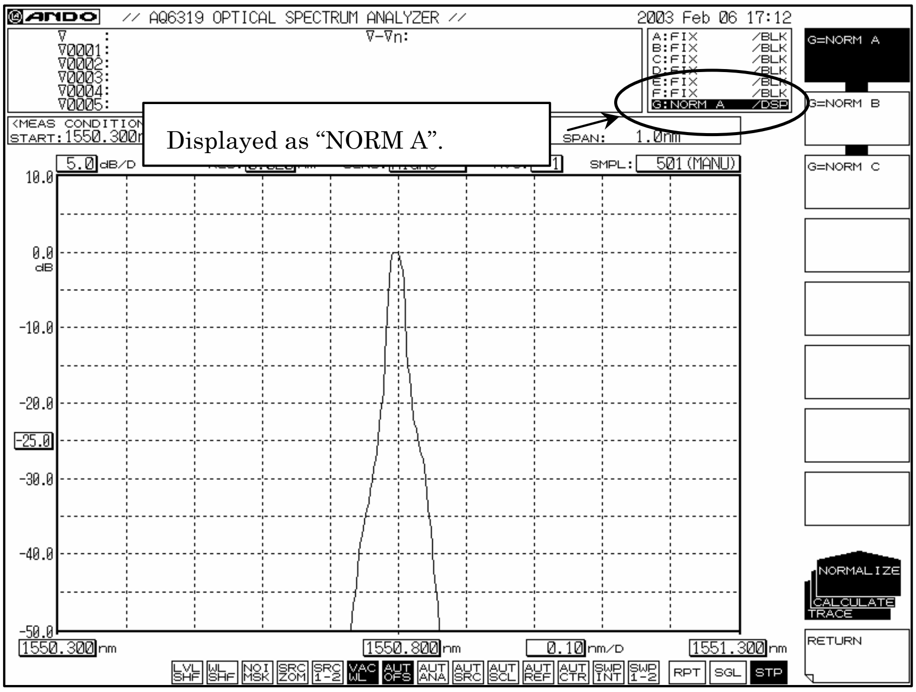


Fig. 7-8 Screen display after <NORMALIZE A> key is pressed (with sub-scale set to LOG SCALE)

7.3 Marker functions

Marker functions can be used to easily measure wavelength differences and level differences, and to search for peak wavelengths, peak levels, and spectrum widths.

7.3.1 Marker types and names

Markers may be broadly divided between delta markers (∇) and line markers.

● Delta markers (∇)

A total of 1025 delta markers (one moving marker and 1024 fixed markers) are provided. They are used to measure the level value of any wavelength.

In addition, when multiple delta markers are set, it is possible to display wavelength differences and level differences between a given marker and adjacent markers.

● Line markers

There are four line markers—two wavelength line markers and two level line markers.

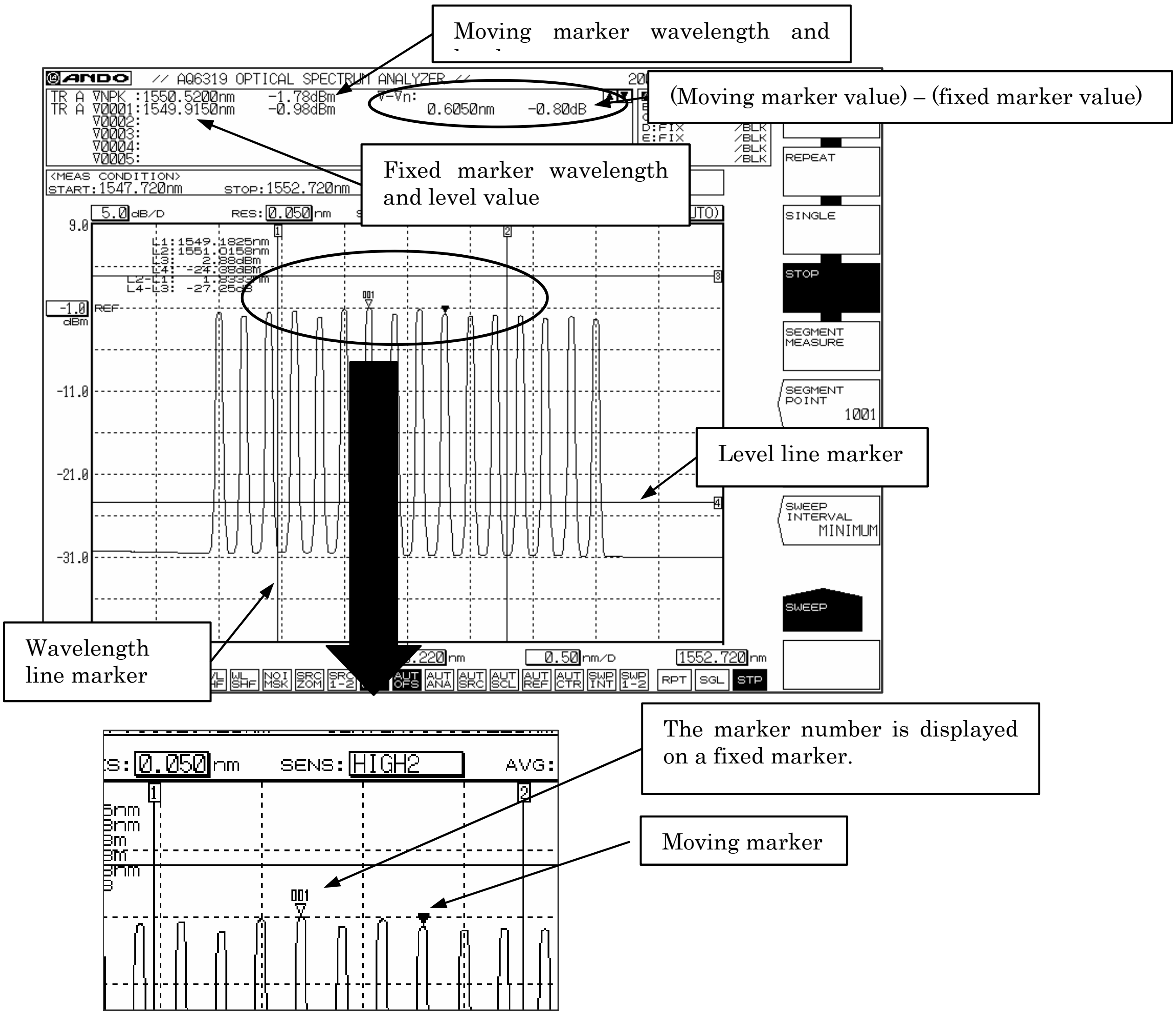


Fig. 7-9 Various markers

7.3.2 Delta markers (∇)

The unit has two types of delta markers—moving and fixed markers.

(1) Moving marker

A moving marker is a delta marker that can be moved to the desired wavelength using the rotary knob or step keys.

The moving marker cannot be used when the active trace display is OFF.

To display the moving marker, press the [PEAK SEARCH] switch or press the [MARKER] switch, then turn the <MARKER ACTIVE ON/OFF> key to ON.

If the moving marker is not visible, this key displays it on the waveform in the screen center and displays the marker value in the data area. If the moving marker is already displayed on the waveform screen, its display position will not change even if the <MARKER ACTIVE OFF/ON> key is pressed. To move the moving marker, turn the <MARKER ACTIVE OFF/ON> key to ON.

NOTE

- When the <VIEW @ DISP/BLANK> key for the active trace is set to BLANK, the moving marker cannot be used, so the <ACTIVE MARKER> key is disabled.

(2) Fixed markers

Fixed markers are delta markers which fix the moving marker to a specified number.

A maximum of 1024 fixed markers can be set. In addition, fixed markers can be set across different traces.

A fixed marker can be set at the current moving marker position by pressing the <SET> key while the moving marker is displayed. The number of the fixed marker to be set can be entered in the DATA ENTRY section.

(3) Marker data in the data area

Marker values (wavelength values and level values) for the displayed moving and fixed markers are shown in the data area.

If there are five or more fixed markers, they cannot all be displayed in the data area. To check the values of markers that are not displayed, scroll through the display using the step keys. Scrolling can be done when the moving marker is ON and active.

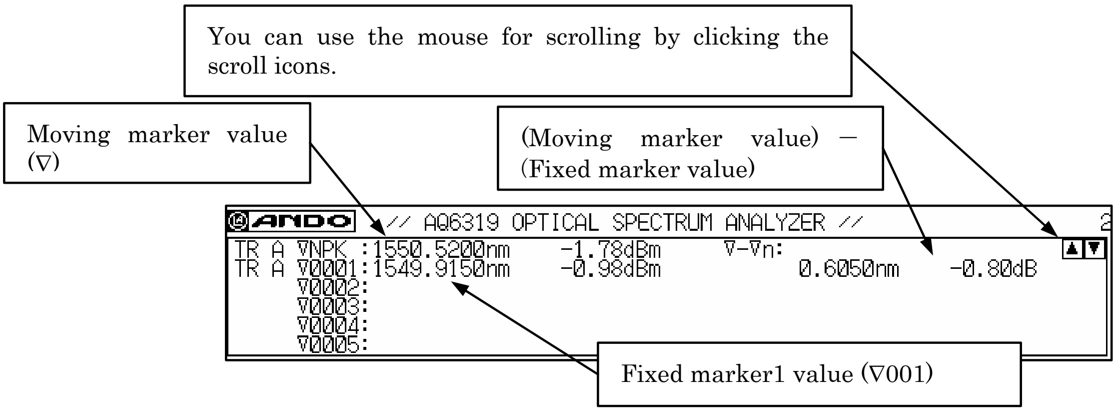


Fig. 7-10 Marker data in data area

(4) Clearing a fixed marker

To clear a displayed fixed marker, press the <CLEAR MARKER> key. Next, enter the number of the fixed marker you want to clear, then press the <CLEAR> key.

(5) Clearing all delta markers

To clear all displayed delta markers, press the <ALL MARKER CLEAR> key. When you press this key, all delta markers (moving marker and fixed markers) displayed on the screen are cleared. In addition, the <MARKER ACTIVE> key changes to OFF.

7

7.3.3 Wavelength line markers

Use the following procedure to display wavelength line markers on the screen.

① Press the [MARKER] switch.

② Press the <MORE 1/3> key.

③ Press the <LINE MARKER 1> key or <LINE MARKER 2> key.

Note that wavelength line markers cannot be displayed if the active trace measurement span is 0.000 nm.

When line markers are displayed, the marker values are shown in the upper left part of the waveform area.
When both wavelength line markers 1 and 2 are displayed, the wavelength difference (L2–L1) is shown below the marker values.

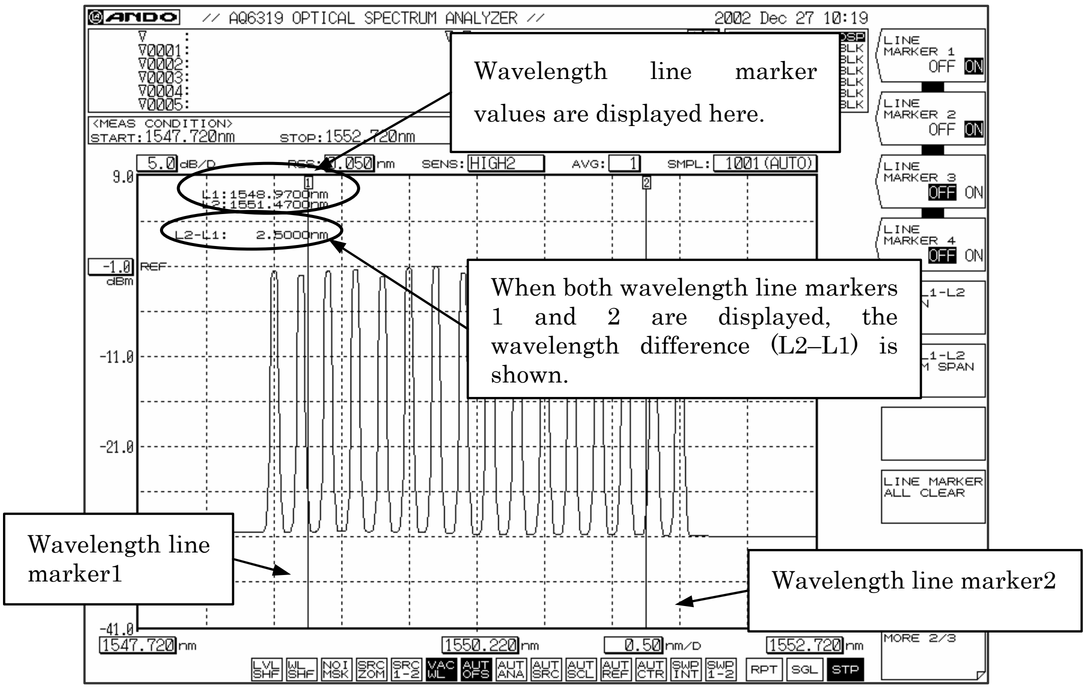


Fig. 7-11 Wavelength line marker display example

A wavelength line marker may be moved after it is displayed either through settings in the DATA ENTRY section or by using the mouse.
(☛ See subsection 3.5.1 Using the Mouse)

Table 7-1 Methods for moving wavelength line markers

Wavelength line marker	Moving procedure
Move to right	Turn the rotary knob to the right. Or press the [↑] step key.
Move to left	Turn the rotary knob to the left. Or press the [↓] step key.

When you press the <LINE MARKER ALL CLEAR> switch, all line markers on the screen are cleared. This also clears the level line markers.

7.3.4 Level line markers

Use the following procedure to display level line markers on the screen.

① Press the [MARKER] switch.

② Press the <MORE 1/3> key.

③ Press the <LINE MARKER 1> key or <LINE MARKER 2> key.

When line markers are displayed, the marker values are shown in the upper left part of the waveform area.

When both level line markers 3 and 4 are displayed, the level difference (L4–L3) is shown below the marker values.

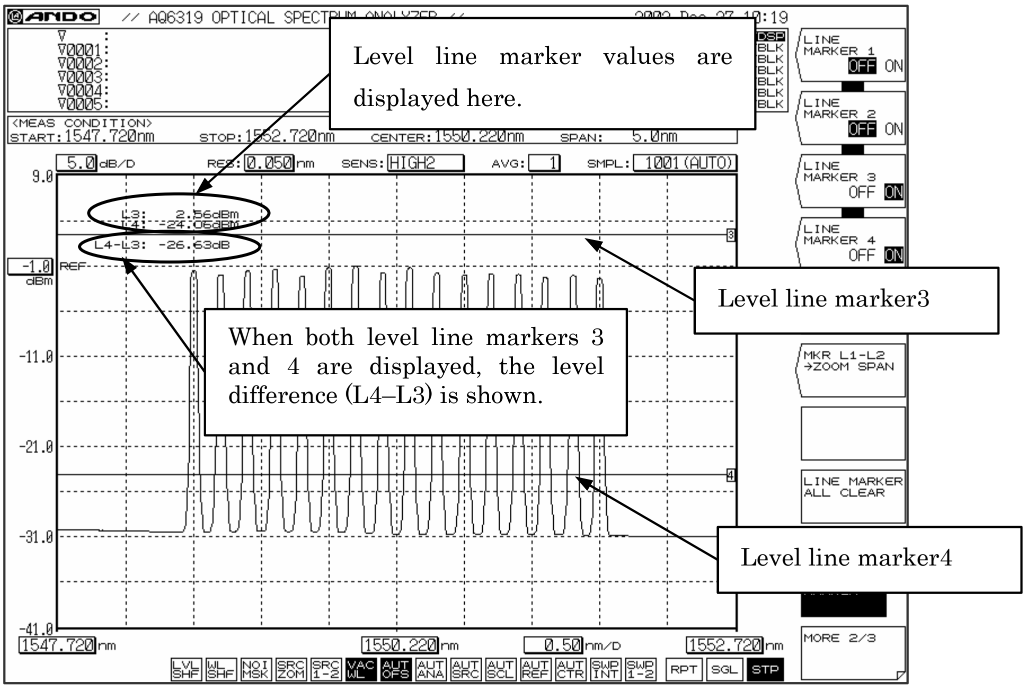


Fig. 7-12 Level line marker display example

A level line marker may be moved after it is displayed either through settings in the DATA ENTRY section or by using the mouse.

(☛ See subsection 3.5.1 Using the Mouse)

Table 7-2 Methods for moving level line markers

Level line marker	Moving procedure
Move upward	Turn the rotary knob to the right. Or press the [↑] step key.
Move downward	Turn the rotary knob to the left. Or press the [↓] step key.

When you press the <LINE MARKER ALL CLEAR>switch, all line markers on the screen are cleared. This also clears the wavelength line markers.

7.3.5 Line markers on the OVERVIEW window

The unit's OVERVIEW window is displayed when the display scale is enlarged or reduced. (☛ See section 7.1 Waveform Enlarged/Reduced Display Function)

When line markers are displayed, they are also displayed on the OVERVIEW window.

In addition, line markers can be moved on the OVERVIEW window using the mouse.

When you move the mouse pointer close to a line marker on the OVERVIEW window, the pointer changes to a hand (✋) shape. In this condition, you can move the individual line markers by dragging them with the mouse. When a line marker is moved on the OVERVIEW window, it also moves on the waveform screen.

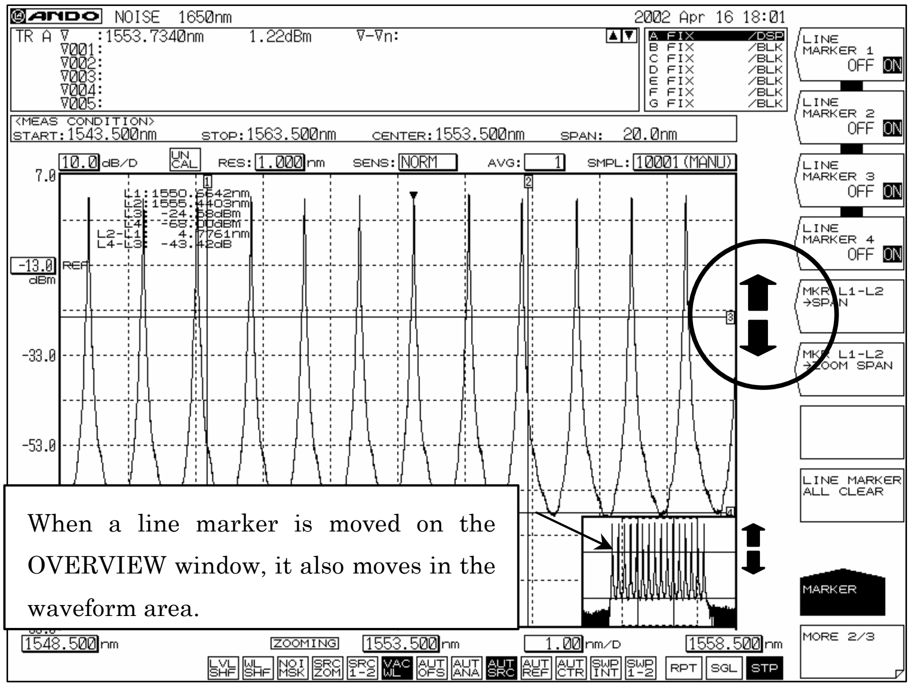


Fig. 7-13 Working with line markers in the OVERVIEW window

7.3.6 Auto-search

This function automatically performs peak/bottom searches each time sweeping is performed. It is very useful for purposes such as observing peak/bottom level changes during repeat sweeping.

The setting procedure is described below.

① Press the [SEARCH] switch.

② Press the <MORE 1/2> key.

③ Press the <AUTO SEARCH> key to set it to ON.

If the <AUTO SEARCH> key is set to ON, a peak/bottom search is performed and a moving marker is set automatically after sweeping ends.

When this key is set to ON AUT SRC is displayed at the very bottom of the screen.

If the <BOTTOM SEARCH> key is pressed while the <AUTO SEARCH> key is on, a bottom search is performed automatically and a moving marker is displayed each time sweeping is performed.

To cancel auto-searching, press the <AUTO SEARCH> key again to set it to OFF.

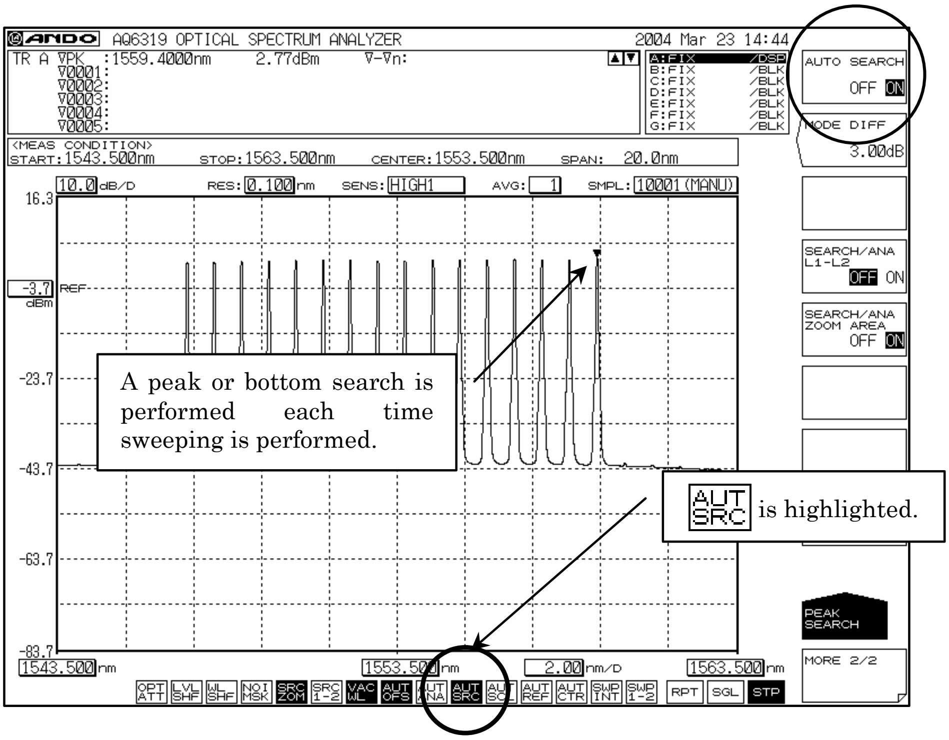


Fig. 7-14 Auto-search settings

7.3.7 Wavelength difference and level difference measurements

This function uses a fixed marker and measures the wavelength difference and level difference compared to a moving marker.

The setting procedure is described below.

① To display the moving marker, press the [PEAK SEARCH] switch or press the [MARKER] switch, then turn the <MARKER ACTIVE ON/OFF> key to ON.

② Move the moving marker to the desired position and press the <SET> key. Fixed marker 1 appears at the moving marker position, and the fixed marker 1 wavelength difference and level difference are simultaneously displayed at □1 in the data area.

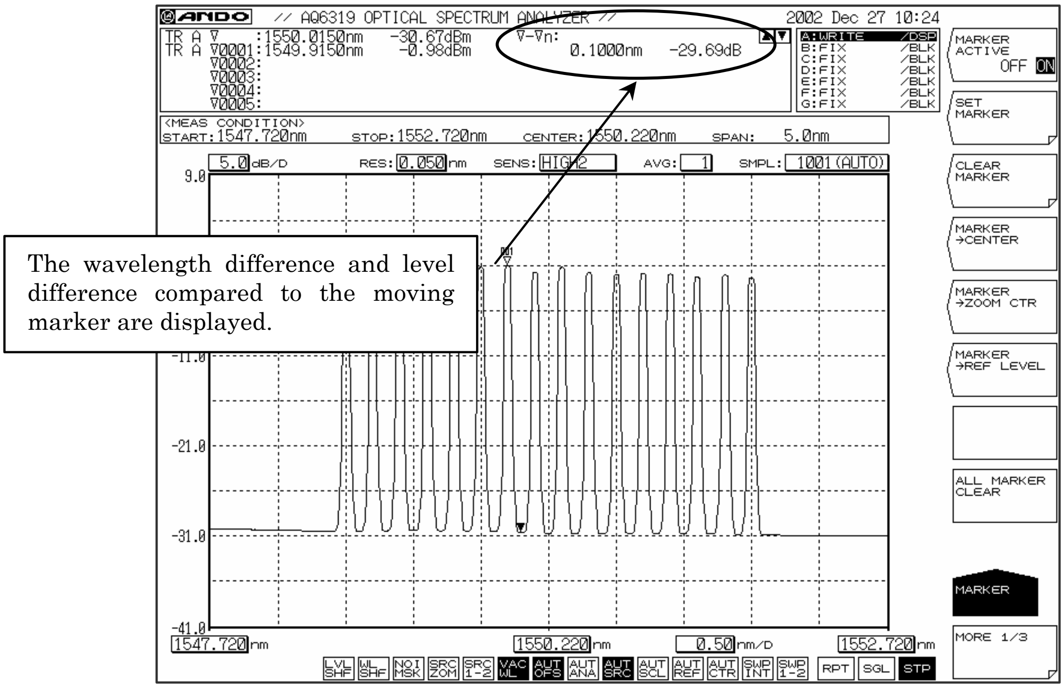


Fig. 7-15 Wavelength difference measurement

③ Move the moving marker to the desired position and press the <SET> key. Fixed marker 2 appears at the moving marker position, and the wavelength differences and level differences between the moving marker and fixed markers 1 and 2 are displayed.

NOTE

- The level difference is displayed as (Fixed marker 2 – Fixed marker 1) if the level axis is LOG scale, and is displayed as (Fixed marker 2/Fixed marker 1) if the level axis is linear scale.
- When you press <MORE 2/3> and <MORE 3/3>, and then use <MARKER DISPLAY> to select SPACING, the wavelength difference and level difference between fixed markers are displayed.

7.3.8 Line marker sweeping function

The line marker sweeping function is a function for performing sweeps between wavelength line marker 1 and wavelength line marker 2.
The sweeping range is limited to the interval between marker 1 and marker 2, so sweeping can be done quickly.
This function is useful for observing fluctuations in a specific part of the spectrum.
(□ See section 6.2 SWEEP)
The procedure for using the line marker sweeping function is described below.

① Set wavelength line marker 1 and wavelength line marker 2 at either end of the range you want to sweep.

(☛ See subsection 7.3.3 Wavelength line markers)

② Press the [SWEEP] switch in the FUNCTION section.

③ Set the <SWEEP MKR L1-L2> key to ON.

When this key is set to ON SWP 1-2 is displayed at the very bottom of the screen.

④ When you press the [SWEEP] switch, then press the <REPEAT> or <SINGLE> key to start sweeping, sweeping is executed between the line markers only.
To turn off the line marker sweeping function, press the [SWEEP] switch, then again press the <SWEEP MKR L1-L2> key from the displayed soft key menu to turn the indicator to OFF.

When you turn off the highlighted indicator, line marker sweeping is turned off and sweeping is performed over the entire screen range.

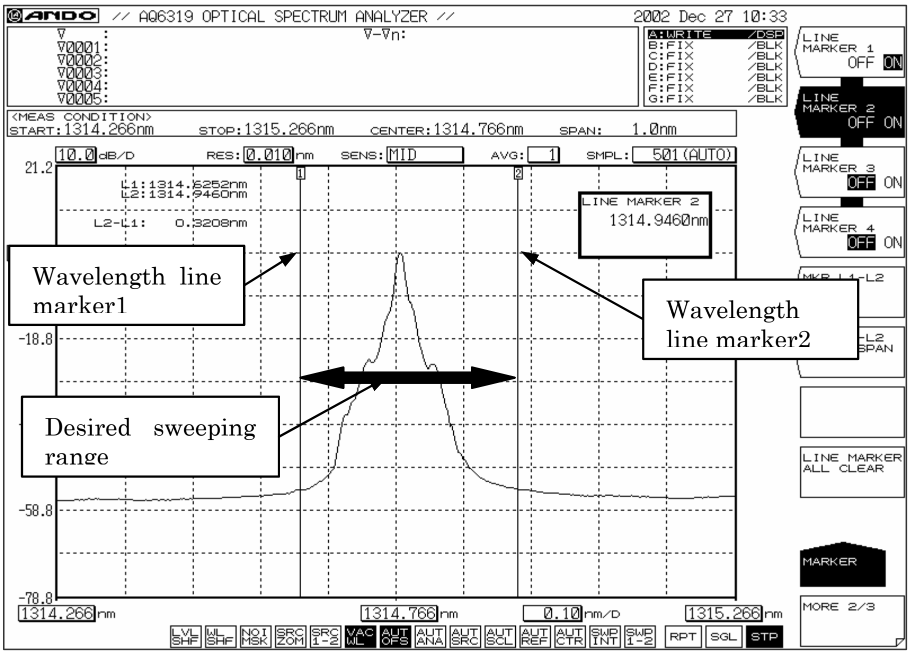


Fig. 7-16 Line marker sweeping range setting

NOTE

- If both WL1 and WL2 are set, sweeping is executed between line markers 1 and 2.
- If just WL1 is set, execution applies over the span from line marker 1 to the right edge of the screen.
- If just WL2 is set, execution applies over the span from the left edge of the screen to line marker 2.
- If neither WL1 nor WL2 is set, analysis is performed from the set start wavelength to the stop wavelength.

7.3.9 Line marker totalized power measurement function

This function can be used to determine the totalized power for the area enclosed by wavelength line marker 1 and wavelength line marker 2 in the displayed waveform. (□ See subsection 5.3.2 Various types of analysis)

This function is effective for purposes such as ASE evaluation on optical amplifiers.

The measurement procedure is described below.

① Set wavelength line marker 1 and wavelength line marker 2 at either end of the range where you want to measure the totalized power. (□ See subsection 7.3.4 Wavelength line markers)

② Press the [MARKER] switch.

③ Press the <MORE 1/3> key and <MORE 2/3> key.

④ Set the <SEARCH/ANA L1-L2> key to ON.When this key is set to ON, SRC 1-2 is displayed at the very bottom of the screen.

⑤ Press the [ANALYSIS] switch.

⑥ Press the <ANALYSIS 1> key, then select the <POWER> key.

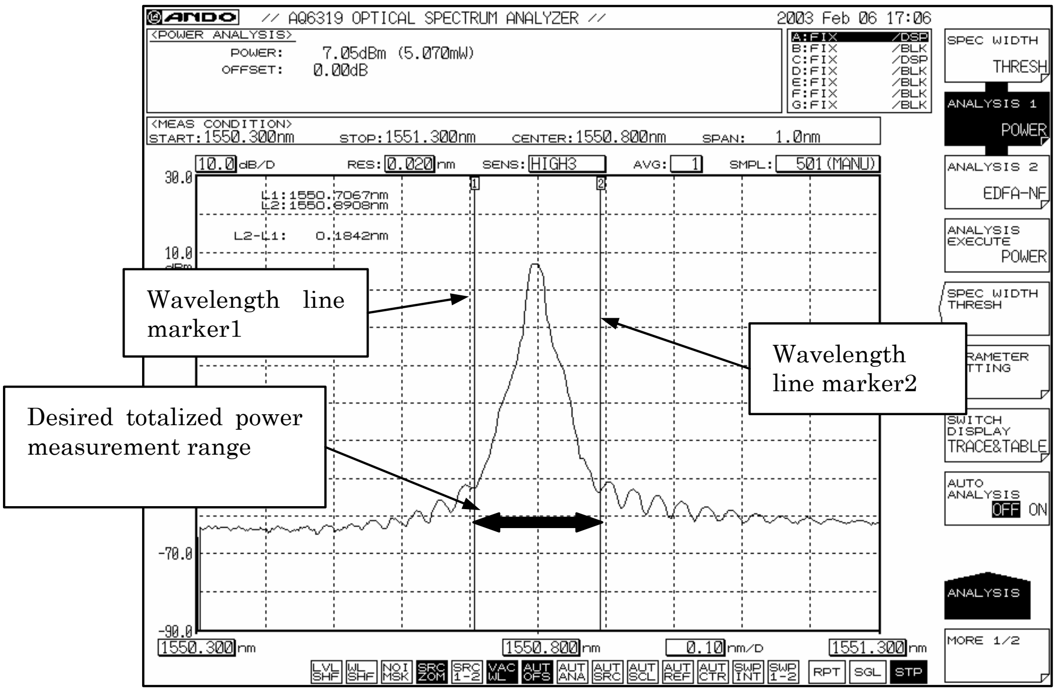


Fig. 7-17 Line marker totalized power measurement range setting

When totalized power analysis is performed, totalized power is calculated between the line markers and the calculation results are shown in the data area.

To turn off the line marker totalized power function, press the [MARKER] switch, then again press the <SEARCH/ANA L1-L2> key from the displayed soft key menu to turn the indicator to OFF.

When you turn off the highlighted indicator, the line marker analysis function is turned off and analysis is performed over the entire screen range.

NOTE

- If both WL1 and WL2 are set, analysis is executed between line markers 1 and 2.
- If just WL1 is set, execution applies over the span from line marker 1 to the right edge of the screen.
- If just WL2 is set, execution applies over the span from the left edge of the screen to line marker 2.
- If neither WL1 nor WL2 is set, analysis is performed from the set start wavelength to the stop wavelength.

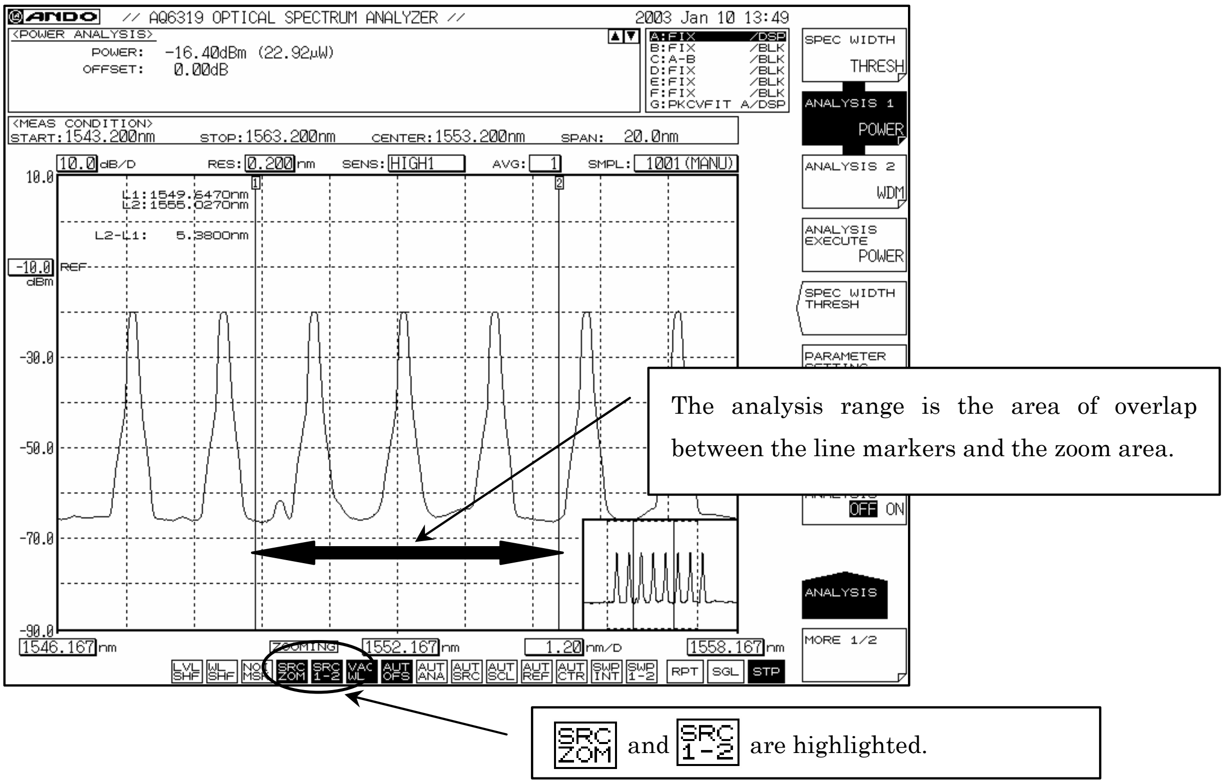


Fig. 7-18 Analysis range when line marker search function and zoom area search function are both ON

⚠Caution

- If the line marker search function and zoom area search function are enabled at the same time, the analysis range is the area of overlap between the line markers and the zoom area.
  (☛ Fig. 7-18, "Analysis range when line marker search function and zoom area search function are both ON")

7.4. 0 nm sweeping function

This function is used to measure changes over time in level of a specific wavelength level. It is useful for purposes such as optical axis alignment when a light source is input to an optical fiber. (□ See section 6-4 SPAN)

The following discussion pertains to an example in which the space light of an He-Ne gas laser (1152.274 nm) is input to an optical fiber as shown in Fig. 7-19.

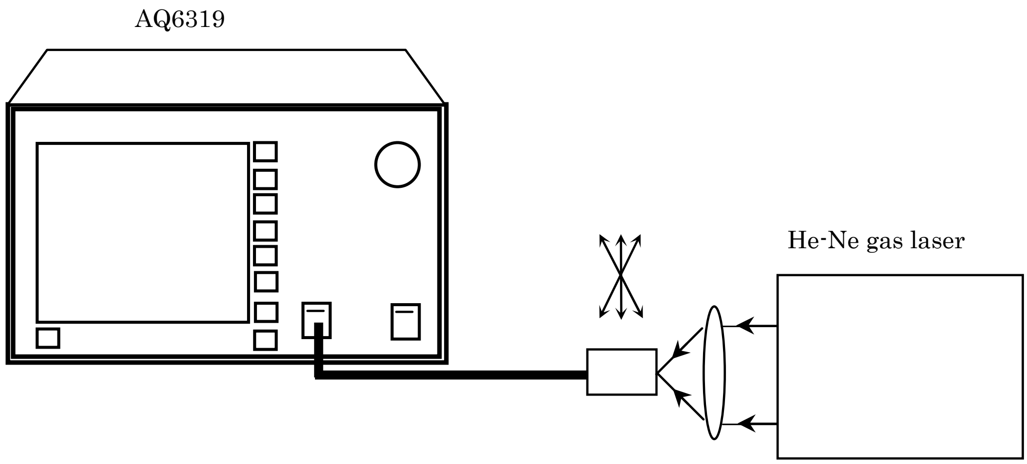


Fig. 7-19 Spatial light fiber input

① Set the unit's center wavelength to 1152.274 nm, and set the resolution to 1.000 nm.

② Set the sweep range to 0 nm.
When the sweeping is set to 0 nm, the measurement start wavelength, measurement center wavelength, and measurement stop wavelength are all set to 1152.274 nm.

NOTE

- When the sweep range is set to 0 nm, the horizontal axis is set as the time axis as a

③ The <0nm SWEEP TIME> key sets the time required to measure from the left edge to the right edge of the screen during sweeping with a span of 0 nm. The number of sampling points is automatically set to 1001 points during this process.
In addition, the sweeping time varies depending on the measurement sensitivity (<SENS/MODE> key in [SETUP] switch). If the setting for this key is less than the sweeping time for each sensitivity, the setting for the key is invalid and the MINIMUM setting is used.

④ Press the [SWEEP] switch, then press the <REPEAT> soft key.
When you press this key, repeat sweeping is performed, and changes over time at the 1152.274 nm level can be observed.

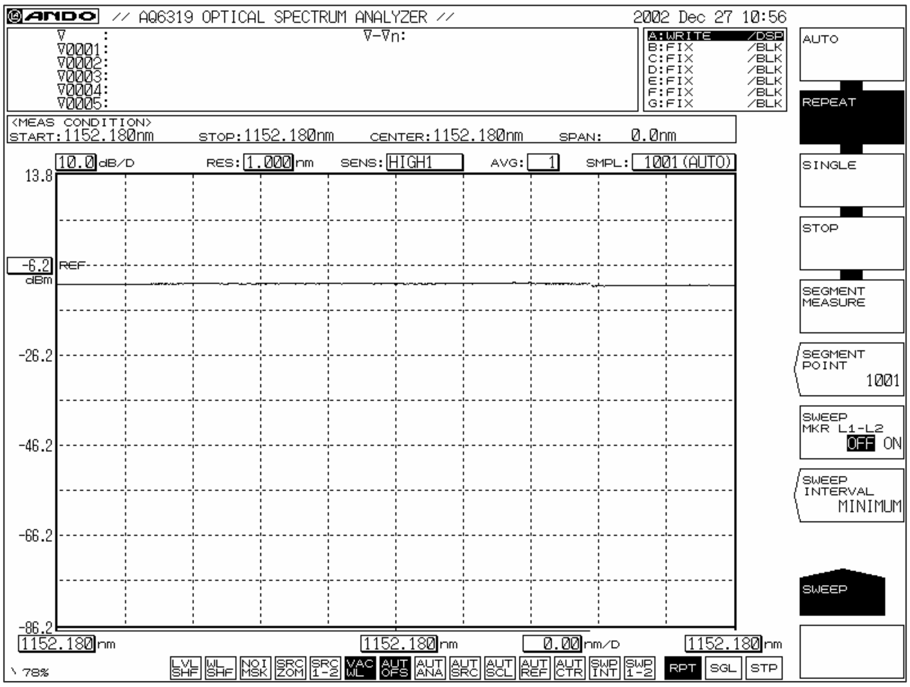


Fig. 7-20 Waveform during 0nm sweeping

⑤ Finely adjust the optical fiber plug while observing the displayed waveform so as to set the light source input level to the peak.

7

7.5 Data writing/reading function

The unit has a hard disk drive (HDD) and floppy disk drive (FDD). Programs created with the program function, waveforms displayed on the unit, waveforms stored in memory, and other information can be written to the disks and read from them.
Press the FUNCTION [FILE] switch to use the data writing/reading function.
The file types that can be written/read with the unit are the items shown in Table 7-3, which is displayed when the [FILE] switch <ITEM SELECT> key is pressed.
Whether a file can be written and/or read depends on the file type.

Table 7-3 Writing/reading availability for various file types

Type	WRITE	READ	Description
TRACE	○	○	Writes/reads traces. Files may be saved in binary or text (comma demarcated) format.
MEMORY	○	○	Writes/reads memory data.
GRAPHICS	○	×	Writes/reads screen images. Files may be saved in BMP or TIF format. Graphics can be saved in color or black and white.
SETTING	○	○	Writes/reads setting parameters. Writes/reads parameter information and selection status for all soft keys.
DATA	○	○ (display only)	Writes/reads data in the data area. Saves date/time, labels, data area, set conditions, and waveform data all together. File contents are displayed on the screen during reading.
PROGRAM	○	○	Writes/reads program data.
TEMPLATE	○	○	Writes/reads template data

7.5.1 Disk capacity

The unit can write/read various types of data on the hard drive and floppy drive. Table 7-4 shows the disk capacities for data saved by the user.

Table 7-4 Disk capacities

Disk	Capacity (bytes)
Hard drive	4G or more
Floppy drive	1457664

7.5.2 File types and sizes

Data can be saved to disks as files in Windows-compatible formats.

Table 7-5 shows the types and sizes of files saved with the unit. A single disk can hold a mixture of all these file types.

Table 7-5 File types and sizes

File type	File extension	Saved format	Size (bytes)
Normal waveform files	.WV5	Binary	(See Note 1)
	.CSV	Text	(See Note 1)
Graphics files	.BMP(Color)	Binary	(See Note 1)
	BMP(B&W)	Binary	52000
	.TIF(Color)	Binary	412000
	.TIF(B&W)	Binary	52000
Settings files	.ST5	Binary	74000
Data files	.CSV	Text	(See Note 1)
	.DT5	Text	(See Note 2)
Program files	.PG5	Binary	13000
Template files	.CSV	Text	(See Note 1)

(Note 1) The file size varies depending on the amount of data.

(Note 2) If additional data are written to a single file, the capacity is incrementally increased.

7.5.3 Inserting and Removing Floppy Disks

Fig. 7-21 shows the exterior of the floppy disk drive. Make sure the floppy disk is facing in the correct direction, then insert it through the opening.

To remove the disk, press the eject button shown in Fig. 7-21.

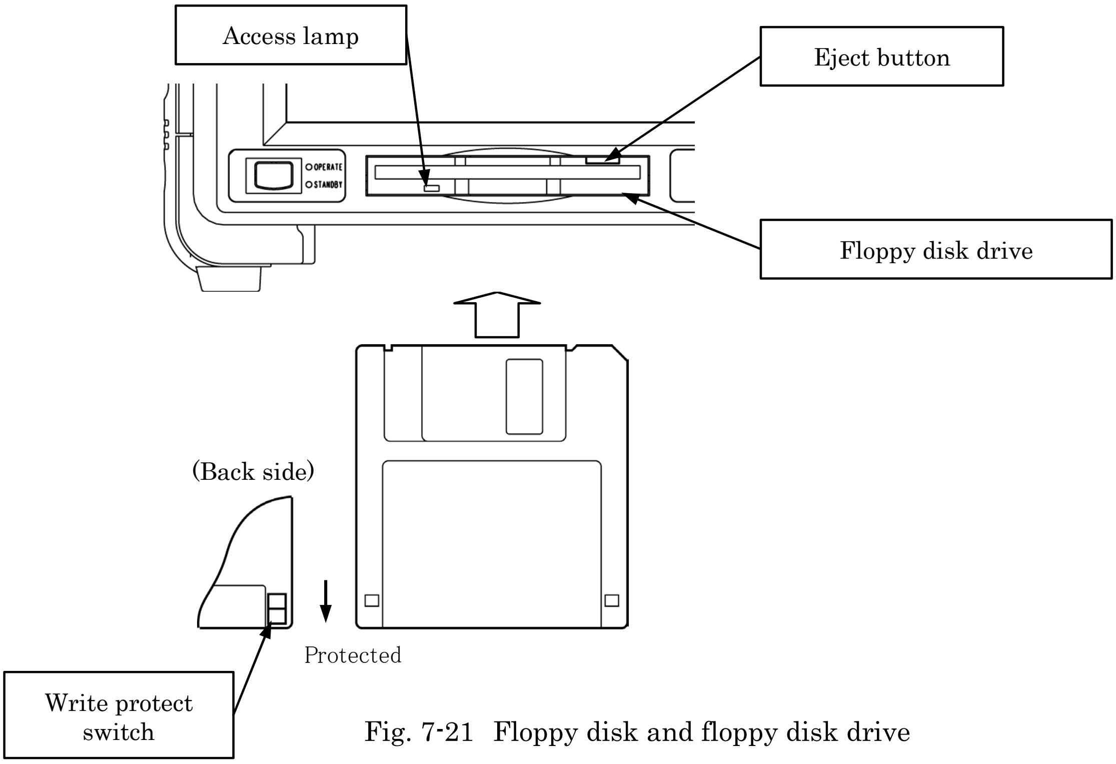


Fig. 7-21 Floppy disk and floppy disk drive

⚠Caution

- Always make sure the floppy disk drive access lamp is off before inserting or removing a floppy disk. If you remove a floppy disk while the lamp is on, the information saved to the disk may be destroyed.
- Files cannot be saved to or deleted from a floppy disk if the disk's write protect switch is set to the protected position.
- Clean the floppy disk drive about once every three months.
- Use a commercially available head cleaner to clean the head.
- Both wet and dry head cleaners are available, but wet cleaners are more effective for removing debris from the head surface. See the instructions provided by the head cleaner manufacturer for information on how to use the cleaner.
- Do not touch the magnetic surface. Also do not put any magnetized object close to the floppy disk.
- If a floppy disk is worn down or dirty, a failure may occur during use.

7.5.4 Saving files

Use the following procedure to save waveform data from measurements, programs created with the program function, and other data to a disk.

(1) Select a file type

First, select the type of file you want to save.

① Press the [FILE] switch.

② Press the <ITEM SELECT> key, then use the soft keys to select the type of file you want to save. (□ See Table 7-3 “Writing/reading availability for various file types”)

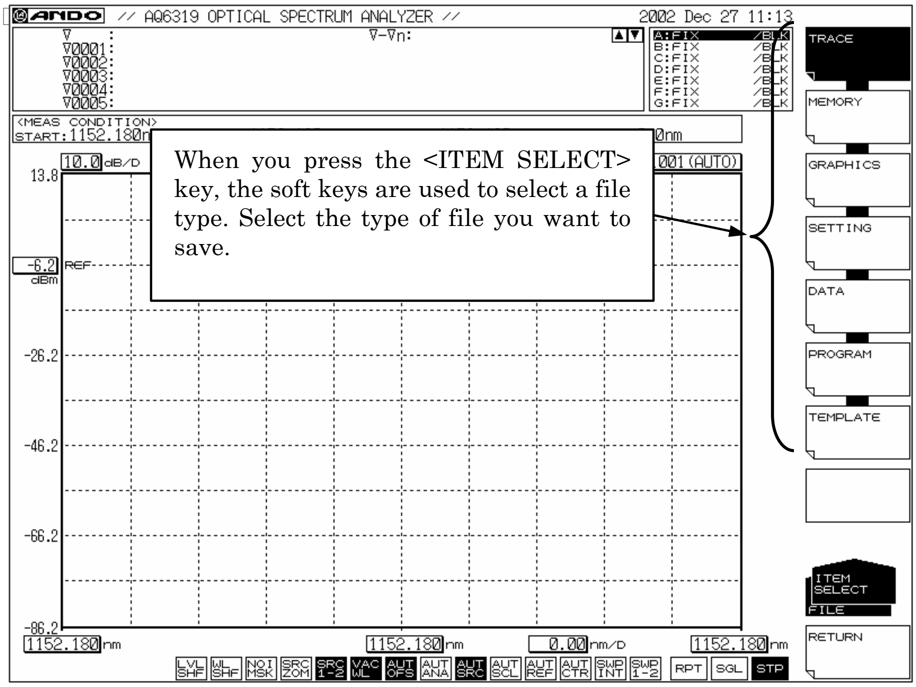


Fig. 7-21 Selecting the type of file to be saved

③ Press the <WRITE> key

When you press this key, the soft key corresponding to the file type selected in step ② is displayed.

See (4) “Save settings for each file format” for information on the soft keys. (□ See (4) “Save settings for each file format”)

7

(2) Select a drive

① Use the <DRIVE HDD/FDD> key to select either the hard drive (HDD) or floppy disk drive (FDD) as the destination drive for saving the file.

NOTE

- If you select FDD on the <DRIVE HDD/FDD> key while a floppy disk is not inserted in the unit, the following warning message is displayed.
  WARNING 120: Disk not inserted

(3) Set the name of the file to be saved

Immediately after the <SAVE> key is pressed, the file name to be saved is set as the file name shown in Table 7-6. The numerical part of the file name is assigned automatically so as not to be redundant with other files.

To set a custom name for the file being saved, move the cursor to the file name displayed as <NEW FILE> in the “DATE & TIME” field of the file list, then press the <FILE NAME> key.

When you press this key, the character input window and the corresponding soft key menu are displayed, just as during label input. Use the same procedure as during label input to enter the file name. When you finish, press the <DONE> key. (□ See section 6.8 DISPLAY)

To overwrite an existing file without creating a new one, move the cursor to the file name to be overwritten, using the rotary knob or step keys.

Table 7-6 Extensions and saved file names for individual items

Type	File extension	Saved file name
TRACE /MEMORY(BIN)	.BIN	W0000.WV5
TRACE /MEMORY(ASCII)	.CSV	W0000.CSV
GRAPHICS	.BMP	G0000.BMP
	.TIF	G0000.TIF
SETTING	.ST5	S0000.ST5
DATA	.CSV	D0000.CSV
	.DT5	D0000.DT5
PROGRAM	.PG5	P0000.PG5
TEMPLATE	.CSV	T0000.CSV

⚠Caution

- Only use the characters allowed in file names by MS-DOS when changing a file name. The maximum file name length is 56 characters (including the extension). The following characters can be used in file names.
  !#$%&’()-
  0123456789@
  ABCDEFGHIJKLMNOPQRSTUVWXYZ^
  abcdefghijklmnopqrstuvwxyz{}‾

(4) Save settings for each file format

The items to be set for saving vary depending on the type of file selected in step (1).

For example, when you save a measured waveform, either binary or ASCII may be selected as the data format.

When you save a graphic, BMP or TIFF may be selected as the image format.

The settings to be made for saving for each file type are described below.

● Waveform files (when the <TRACE> key is selected)

This selection is used to save a measured waveform. Enter the following settings.

・Select the trace to be saved

・Data format for saving the file (binary/ASCII)

① Select the trace to be saved

Press the <TRACE @→FILE> to select the trace to be saved.

② Select the data format

Press the <FILE TYPE BIN/CSV> key to select the data format.

(□ See subsection 7.5.12 File Formats)

BIN Saves the file in binary format.

With this selection, the waveform data cannot be directly checked using an external application. The file size is smaller than that obtained with ASCII format.

CSV Saves the file in CSV (Comma Separated Value) ASCII format.

With this selection, the waveform data can be directly checked using an external application. The file size is larger than that obtained with binary format.

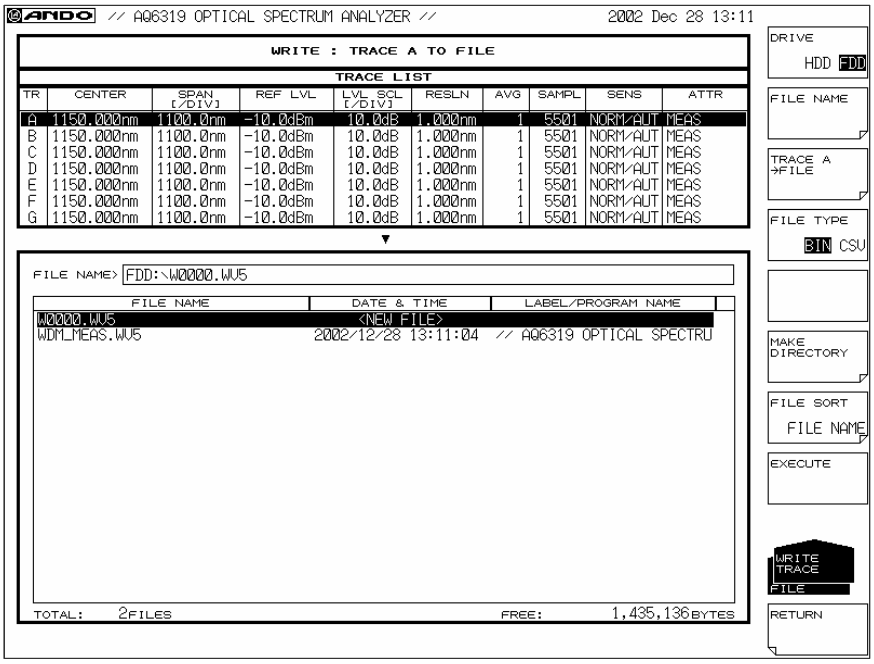


Fig. 7-23 Waveform file saving screen

● Memory data (when <MEMORY> key is selected)

This selection is used to save, as a file, waveform data that have been saved to the unit using the [MEMORY] switch.

Enter the following settings.

・Select the memory number to be saved

・Data format for saving the file (binary/ASCII)

① Select the memory number to be saved

Use the <CURSOR UP/DOWN> key to move the cursor between the memory list and file list. While the cursor is in the memory list, use the step keys or numeric keypad to move the cursor to the memory number to be saved.

② Select the data format

Press the <FILE TYPE BIN/CSV> key to select the data format. This procedure is the same as when saving waveform data. (□ See subsection 7.5.12 File Formats)

BIN Saves the file in binary format.
With this selection, the waveform data cannot be directly checked using an external application. The file size is smaller than that obtained with ASCII format.

CSV Saves the file in CSV (Comma Separated Value) ASCII format.
With this selection, the waveform data can be directly checked using an external application. The file size is larger than that obtained with binary format.

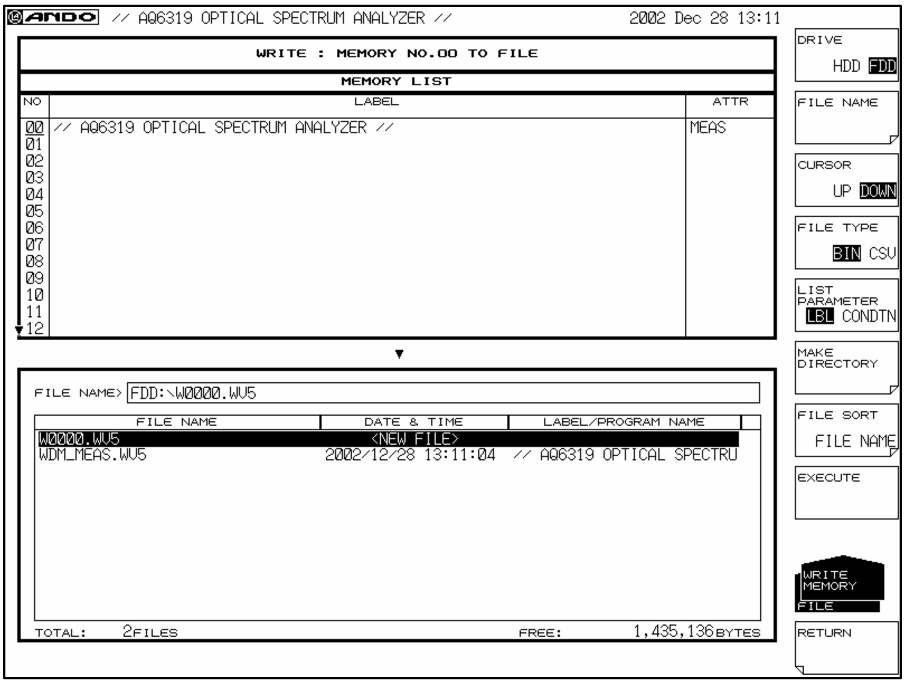


Fig. 7-24 Memory data saving screen

NOTE

- The memory list display format can be changed using the <LIST PARAMETER> key (☛ See section 6-13 FILE).

Table 7-7 Information displayed in memory list when <LIST PARAMETER> is set to CONDTN

Information	Description
TR	Displays the trace type.
CENTER	Displays the center wavelength.
SPAN	Displays the span (sweep range).
REF LVL	Displays the reference level.
RSLN	Displays the resolution.
LSCL [/DIV]	Displays the level axis scale.
AVG	Displays the averaging times.
SAMPL	Displays the number of measurement sampling points.
SENS	Displays the measurement sensitivity.
ATTR	Displays the type of waveform stored in each memory slot.

● Graphics data (when <GRAPHICS> key is selected)

This is selected to save the measurement screen as a graphics file.

Enter the following settings.

- Image file color mode setting (black & white/color)
- Image format (BMP/TIFF)

(Select the color mode

Press the <MODE B&W/COLOR> key to select the color mode.

B&W Saves the screen as a black and white image.

COLOR: Saves the screen as a color image.

(Select the image format (BMP/TIFF)

Press the <FILE TYPE BMP/TIFF> key to select the image format.

BMP Saves the file in BMP format.

TIFF Saves the file in TIFF format.

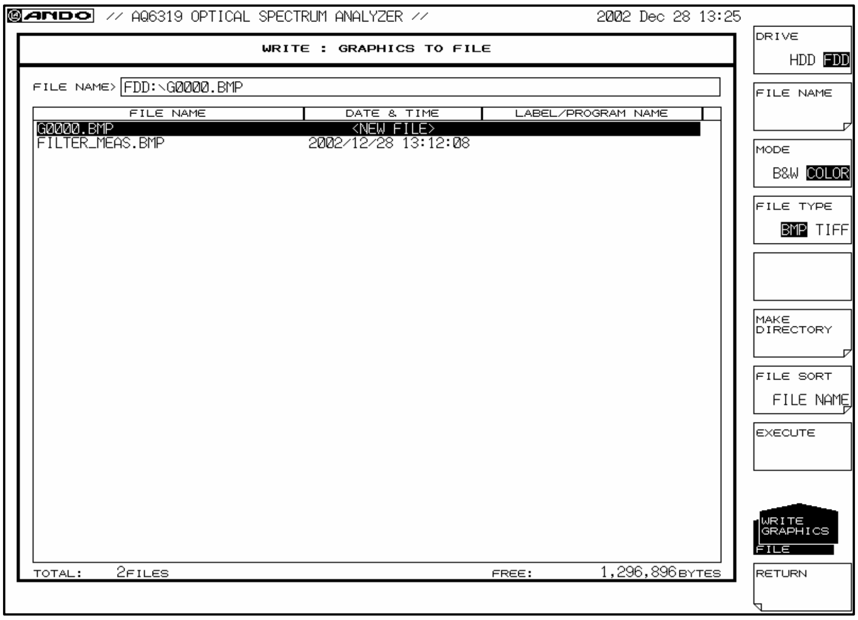


Fig. 7-25 Waveform screen saving screen

● Settings (when the <SETTING> key is selected)

This is selected to save the unit's set parameters in a file.

The set measurement conditions and soft key set statuses are saved in binary format.

There are no settings to enter other than (1) through (4).

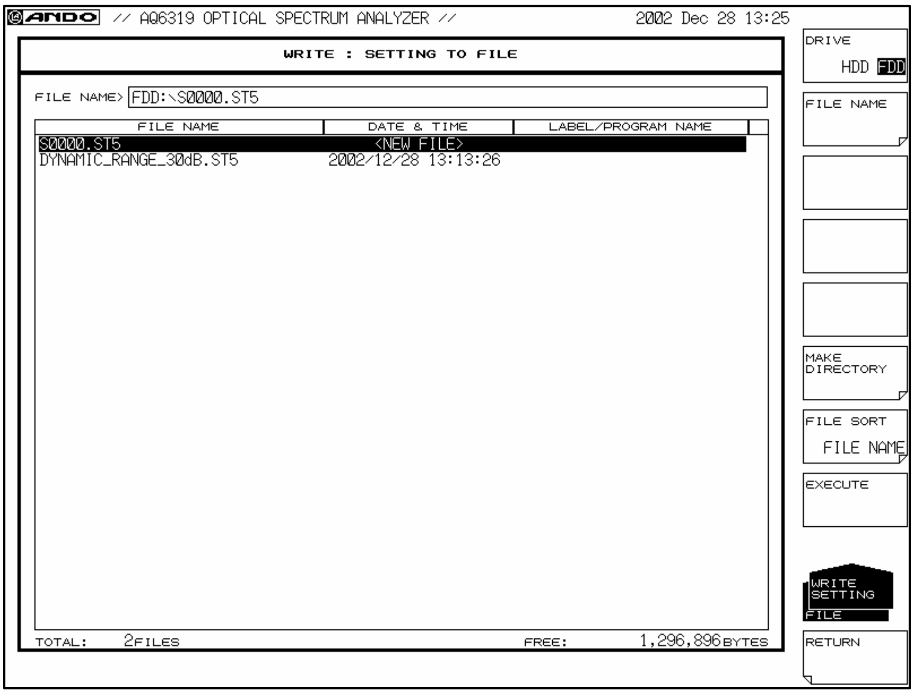


Fig. 7-26 Settings data saving screen

● Data (when <DATA> key is selected)

This is selected to save the analysis results of the unit's analysis function in ASCII format.

Information such as the time at which the file was saved and waveform data can be saved together with the analysis results.

Enter the following settings.

・Select the data to be saved in the file

・File writing methods (overwrite mode/addition mode)

① Select the type of data to be saved in the file

Table 7-8 presents the items that can be saved.

(□ See subsection 7.5.12 File Formats)

Table 7-8 Data items savable when DATA is selected

Saved item	Initial value	Description
DATE&TIME	ON	Date and time
LABEL	ON	Label
DATA AREA	ON	Data area value
CONDITION	ON	Measurement conditions
TRACE DATA	OFF	Trace data
OUTPUT DISPLAY	OFF	Output display data used by program function

② Select the file writing method (overwrite mode/addition mode)

Press the <WRITE MODE OVER/ADD> key to select the file writing method.

OVER Overwrites the data in a file if the file already exists. If there is no file, creates a new file and writes data to it.

ADD Adds data at the end of a file if the file already exists. If there is no file, creates a new file and writes data to it.

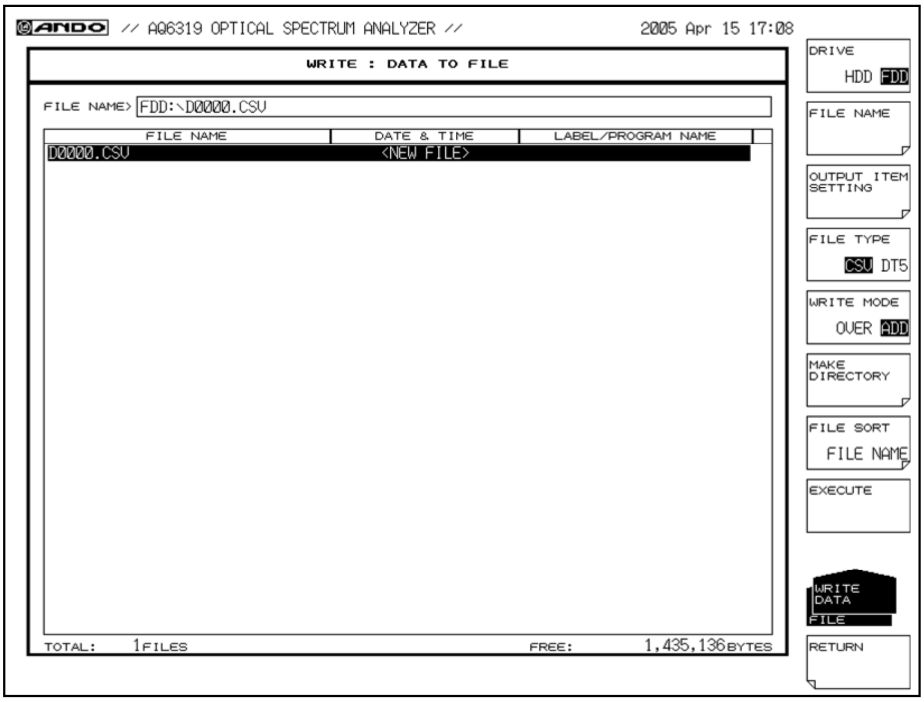


Fig. 7-27 Data saving screen

● Program (when <PROGRAM> key is selected)

This is selected to save, in binary format, program data created with the unit.

Enter the following settings.

・Select the program number to be saved in the file

① Select the program number to be saved

Use the <CURSOR UP/DOWN> key to move the cursor between the program list and file list. While the cursor is in the program list, use the step keys or numeric keypad to move the cursor to the program number to be saved.

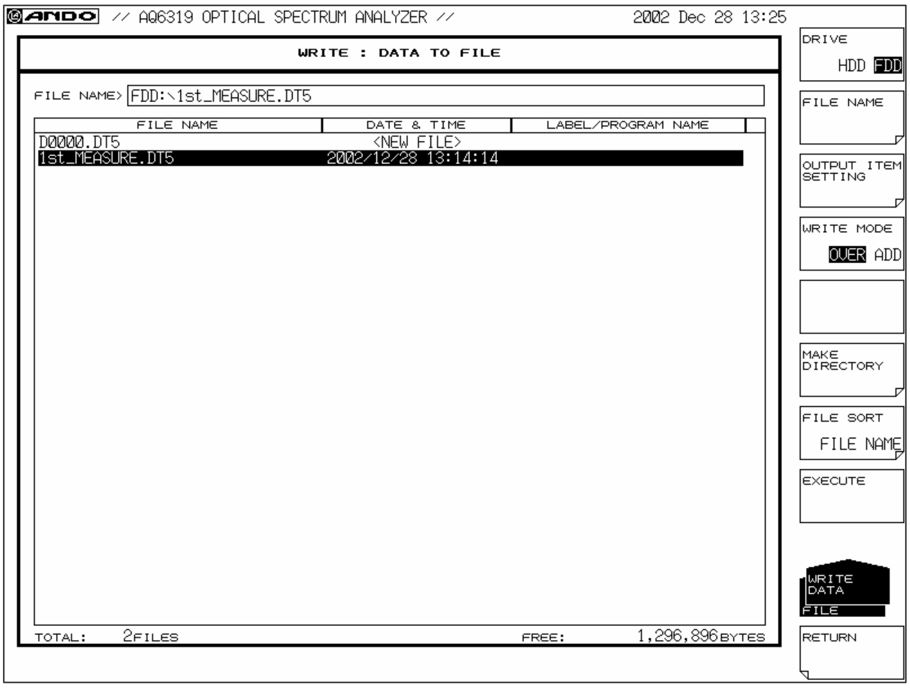


Fig. 7-28 Program saving screen

● Template (when <TEMPLATE> key is selected)

This is selected to save, in CSV (Comma Separated Value) format, template data created with the unit.

Enter the following settings.

・Select the template to be saved in the file (UPPER / LOWER / TARGET)

① Select the template to be saved

Press the <@@@@@@→FILE> key to select the template to be saved.

The selected template is displayed where @@@@ appears in the soft key.

UPPER LINE	Sets UPPER LINE to be saved.
LOWER LINE	Sets LOWER LINE to be saved.
TARGET LINE	Sets TARGET LINE to be saved.

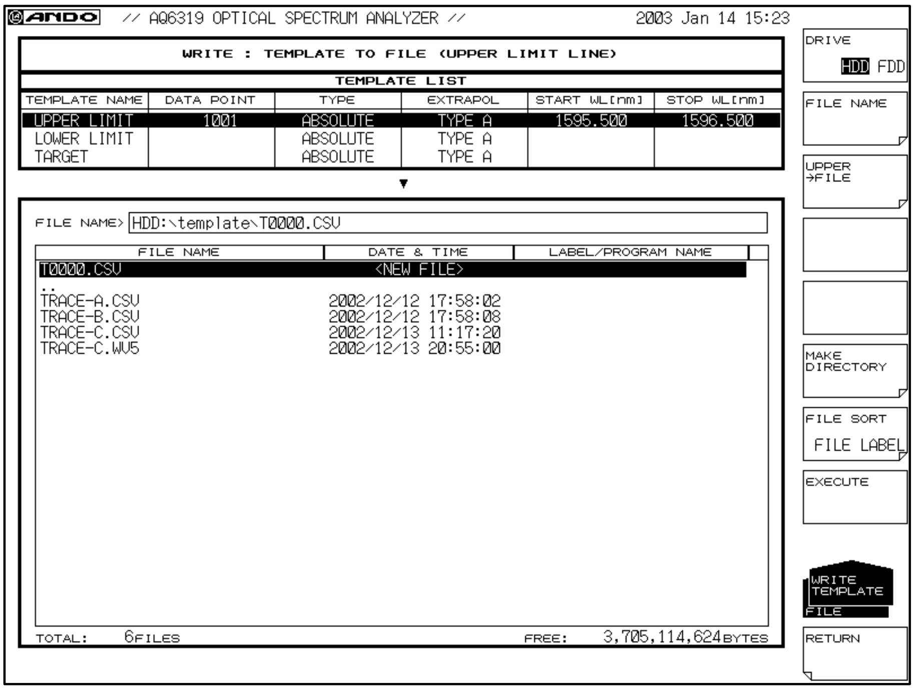


Fig. 7-29 <TEMPLATE> saving screen

7

(5) Executing the saving process

Press the <EXECUTE> key to execute the saving process.

When you press this key, the data are saved to the disk selected in step (1) under the file name set in step (3).

If you press the <RETURN> key without pressing the <EXECUTE> key, saving is not executed, and the soft key returns to the previous level.

The confirmation message shown below is displayed when you press the <EXECUTE> key if you are going to use the data to overwrite an existing file without creating a new file. Press the <YES> key to overwrite the file. Press the <NO> key to cancel the saving process.

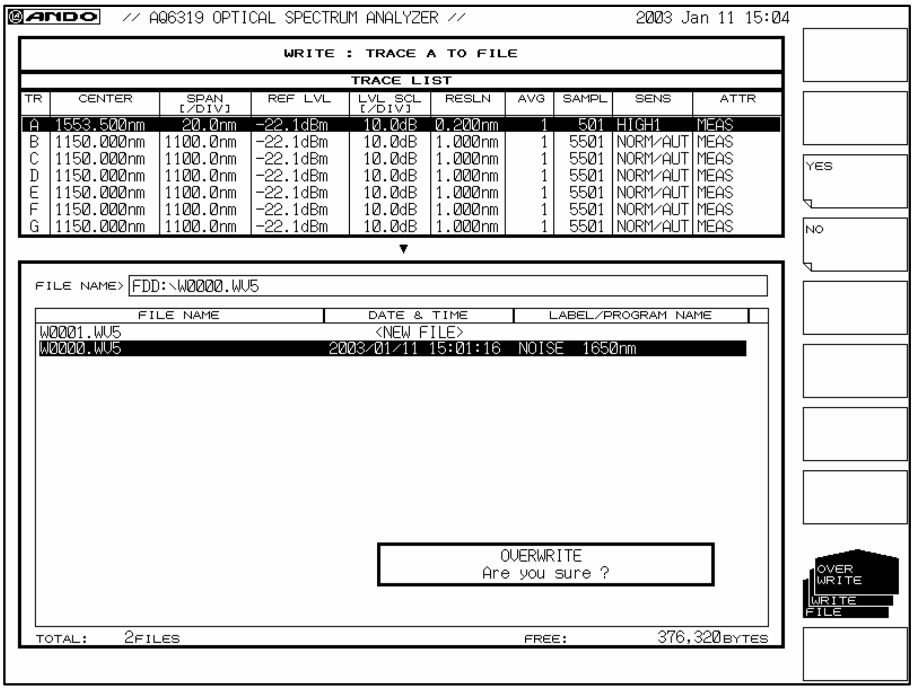


Fig. 7-30 Saving by file overwriting

7.5.5 Loading a file

The following procedure is used to load information such as saved waveform data or program data from a disk.

(1) Select a file type

First, select the type of file you want to load.

Only files of the type selected in this step will be displayed in the file list on the screen.

① Press the [FILE] switch.

② Press the <ITEM SELECT> key, then use the soft keys to select the type of file you want to load. (☛ See Table 7-3 “Writing/reading availability for various file types”) After making a selection, the selected file type appears on the <ITEM SELECT> key.

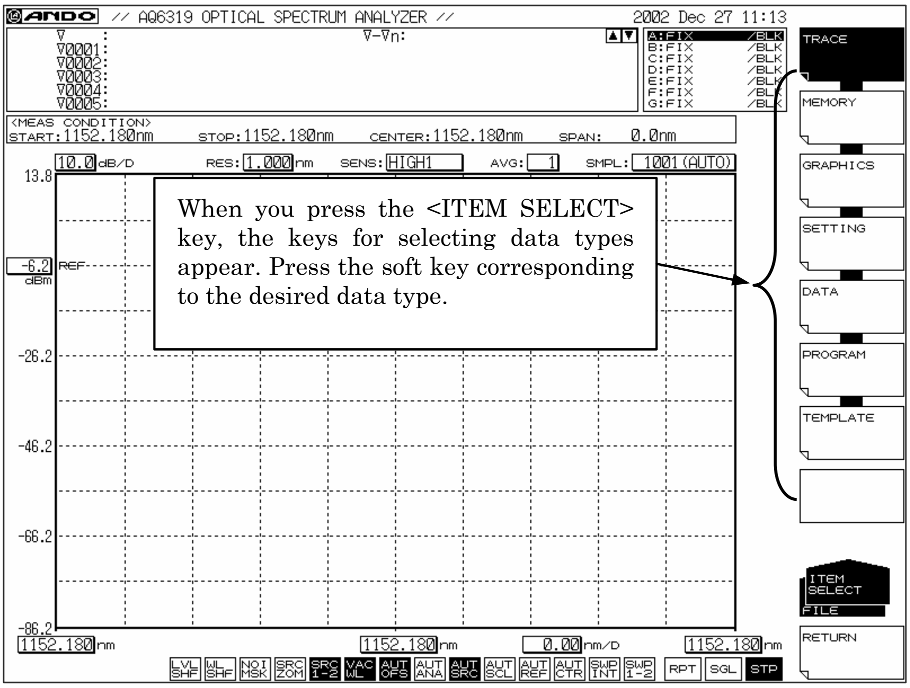


Fig. 7-31 Selecting read items

③ Press the <READ> key.

When you press this key, the soft key corresponding to the file type selected in step is displayed.

See (4) “Saving procedure for each file format” for information on the soft keys.

(☛ See (4) Saving procedure for each file format)

(2) Select a disk

(Use the <DRIVE HDD/FDD> key to select either the hard drive (HDD) or floppy disk drive (FDD) as the drive from which the file is to be loaded.

NOTE

- If you select FDD on the 〈DRIVE HDD/FDD〉 key while a floppy disk is not inserted in the unit, the following warning message is displayed.
  WARNING 120: Disk not inserted

(3) Select a file for loading

Select the file you want to load from the file list displayed on the screen. Use the rotary knob or step keys to move the cursor to the file you want to load.

(4) Loading procedure for each file format

The items to be set for loading vary depending on the type of file selected in step (1).
For example, to load a measured waveform, select a trace which loads that data format.
The settings to be made for loading for each file type are described below.

● Waveform files (when the <TRACE> key is selected)

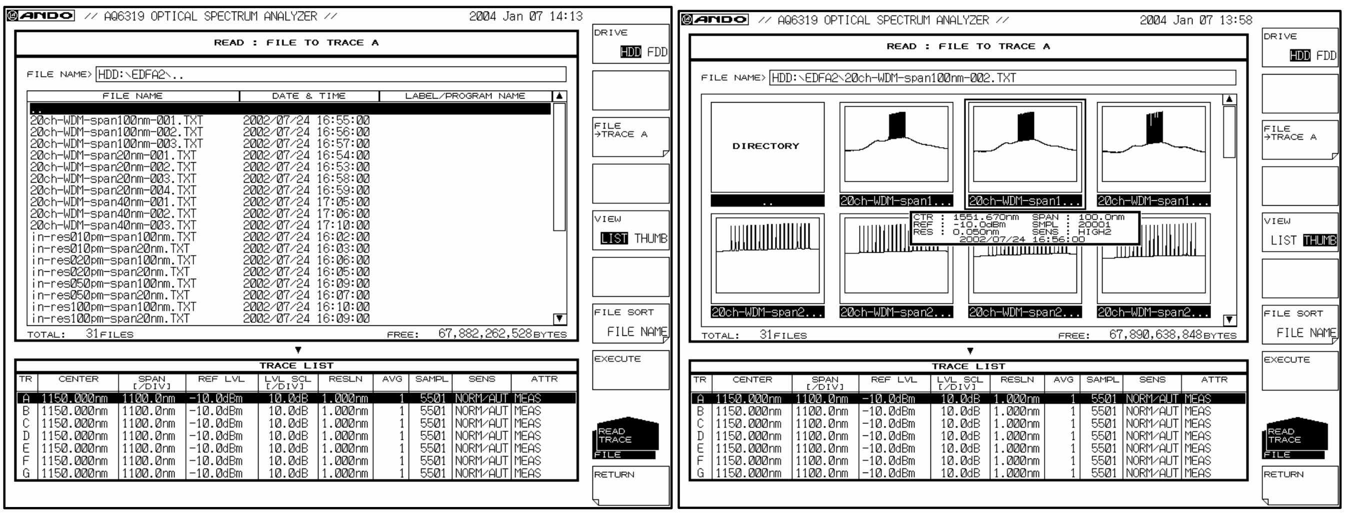
This is selected to load a measured waveform. Enter the following settings.

・Select the trace to be loaded from a file

Display type of file list can select for loading a measured waveform. When the <VIEW> key is pressed , a list display or a thumbnail display can be changed.

① Select the trace to be loaded

Use the <FILE→TRACE @> key to select the file to be loaded.



(a) File list display (b) thumbnail display

Fig. 7-32 Trace loading screen

● Memory data (when <MEMORY> key is selected)

This is selected to load waveform data from a file to the specified memory number.

Enter the following settings.

・Memory number to be loaded from the file

① Memory number to be loaded from the file

Use the <CURSOR UP/DOWN> key to move the cursor between the memory list and file list. While the cursor is in the memory list, use the step keys or numeric keypad to move the cursor to the memory number to be loaded.

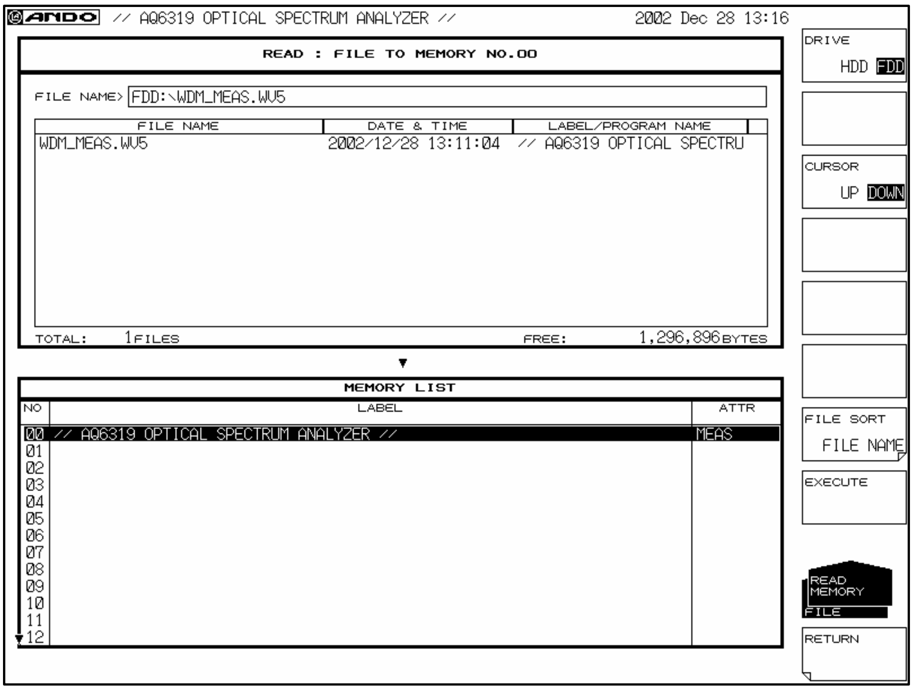


Fig. 7-33 Memory loading screen

● Settings (when the <SETTING> key is selected)

This is selected to load unit settings from a file.

As soon as the file is loaded, the settings apply as the unit settings.

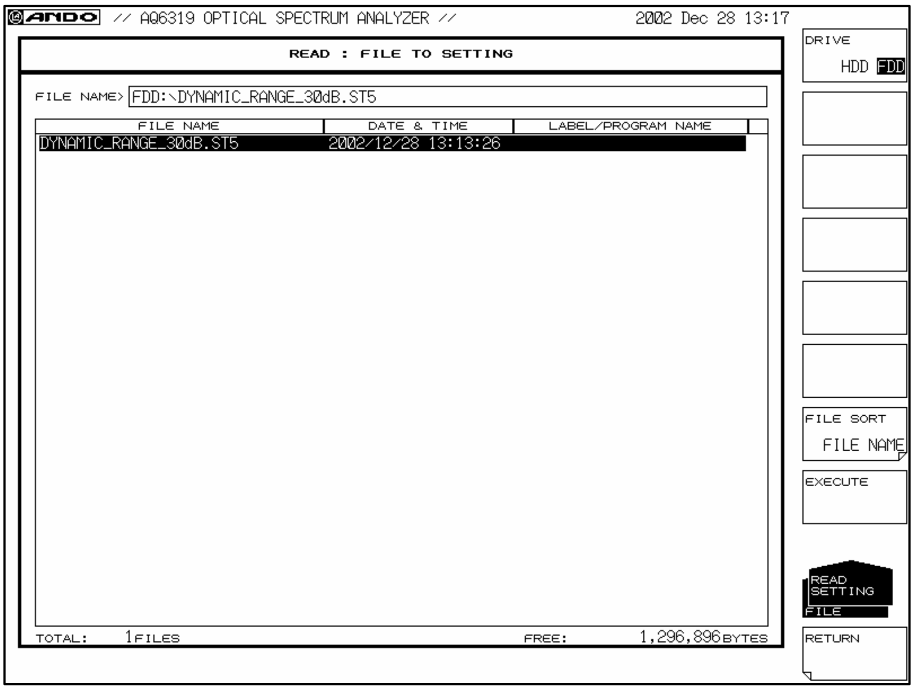


Fig. 7-34 Settings loading screen

● Data (when <DATA> key is selected)

This is selected to display the contents of the selected data file on the screen.

If the <RETURN> key is pressed, it will be in the selection state of a file name again.

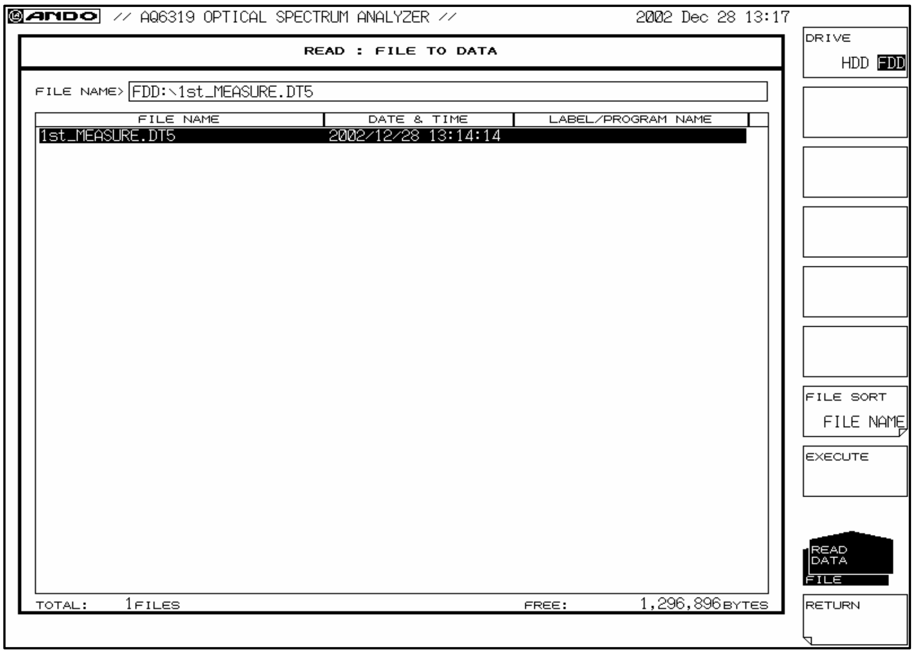


Fig. 7-35 Data loading screen

● Program (when <PROGRAM> key is selected)

This is selected to load a program from a file to the specified program number.

Enter the following settings.

・Program number to be loaded from the file

① Select the program number to be loaded from the file

Use the <CURSOR UP/DOWN> key to move the cursor between the program list and file list. While the cursor is in the program list, use the step keys or numeric keypad to move the cursor to the program number to be loaded.

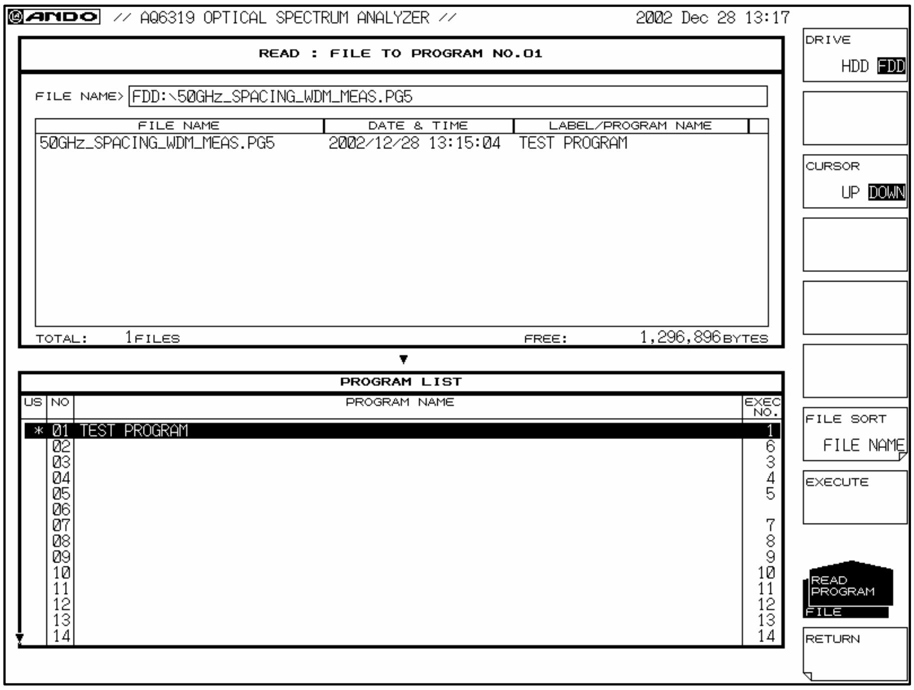


Fig. 7-36 Program loading screen

● Template (when <TEMPLATE> key is selected)

This is selected to load template data created by an external PC (CSV format) or template data saved on the unit.

Enter the following settings.

・Select the template to be loaded from the file (UPPER / LOWER / TARGET)

① Select the template to be loaded

Press the <FILE→@@@@@@> key to select the template to be loaded.

The selected template is displayed where @@@@ appears in the soft key.

UPPER LINE	Loads the data to UPPER LINE.
LOWER LINE	Loads the data to LOWER LINE.
TARGET LINE	Loads the data to TARGET LINE.

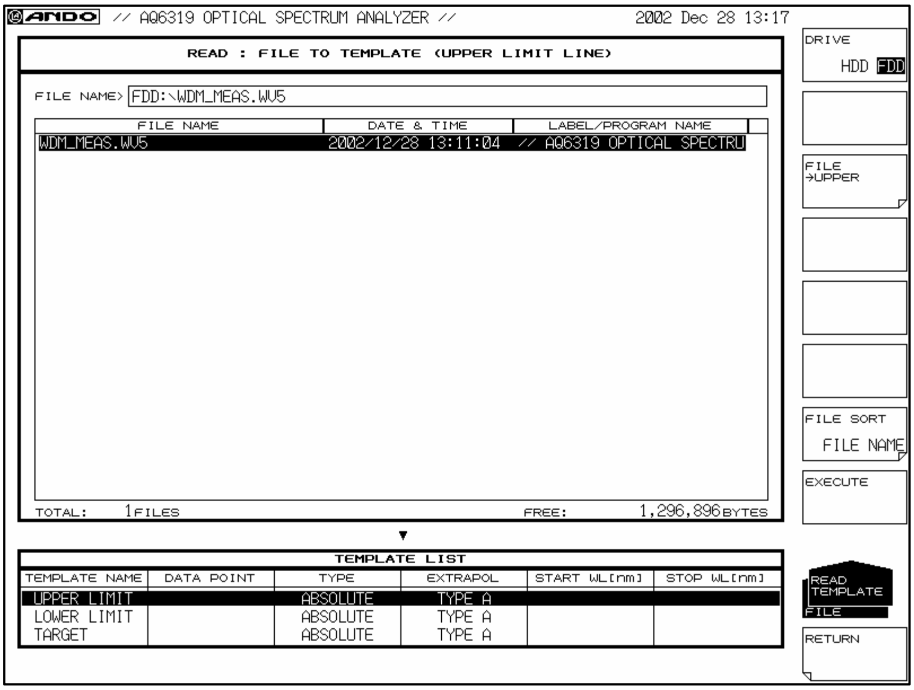


Fig. 7-37 Template loading screen

(5) Loading the data

Press the <EXECUTE> key to execute the loading process.

When you press this key, the file selected in step (3) is loaded.

If you press the <RETURN> key without pressing the <EXECUTE> key, file loading is not executed, and the soft key returns to the previous level.

7.5.6 Working with files on a disk

Files saved to the hard drive (HDD) or a floppy disk drive (FDD) can be deleted, copied, or renamed. In addition, new directories can be created on these drives.
The following procedures are used to perform these actions.

Press the [FILE] switch, then press the <FILE OPERATION> key to open the file operation screen.
You can press <FILE SORT> on this screen to sort the displayed file list. The following four sorting conditions can be selected.

FILE NAME: Sort by file name
FILE TYPE: Sort by file type
FILE DATE: Sort by file date
FILE LABEL: Sort by waveform file label

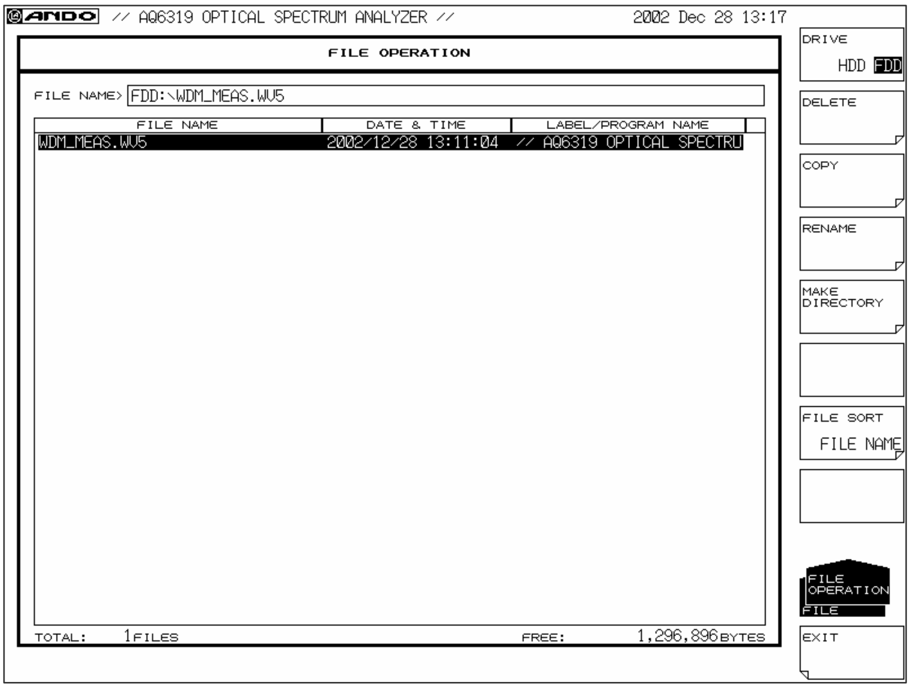


Fig. 7-38 Screen display when <FILE OPERATION> key is pressed

Information at screen bottom:	The total number of files on the disk and the remaining free space are shown.
FILENAME:	Displays a list of the files saved to the disk.
DATE&TIME:	Displays the date and time at which each file was saved.
LABEL/PROGRAM NAME:	Displays the program names and labels saved in each file.

7

7.5.7 Deleting a file

Use the following procedure to delete a file or directory saved to the hard drive (HDD) or a floppy disk drive (FDD).

① Press the <FILE OPERATION> key to display a file list.

② Move the cursor to the file or directory you want to delete.

③ After selecting a file or directory, make sure the file name appearing at the top of the screen is the one you want to delete, then press the <DELETE> key.

④ A confirmation message is displayed. Press the <YES> key to delete the file or directory.

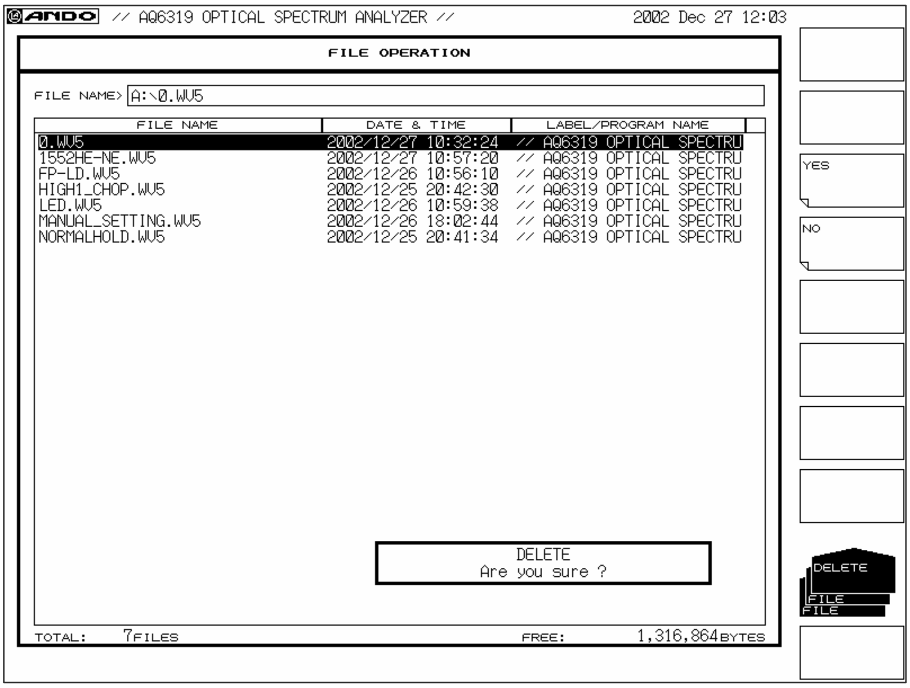


Fig. 7-39 Deleting a file or directory

7.5.8 Copying a file

Use the following procedure to copy a file or directory saved to the hard drive (HDD) or a floppy disk drive (FDD).

① Press the <FILE OPERATION> key to display a file list.

② Move the cursor to the file or directory you want to copy.

③ After selecting a file, make sure the file name appearing at the top of the screen is the one you want to copy, then press the <COPY> key.

④ If the copy source and copy destination drives are not the same, press the <DRIVE HDD/FDD> key to select the copy destination drive.

⑤ Next, press the <FILE NAME> key to input the copy destination file name. Lastly, press the <DONE> key to set the copy destination file name.

⑥ Make sure the copy source and destination file names displayed at the top of the screen are correct, then press the <EXECUTE> key to copy the file.

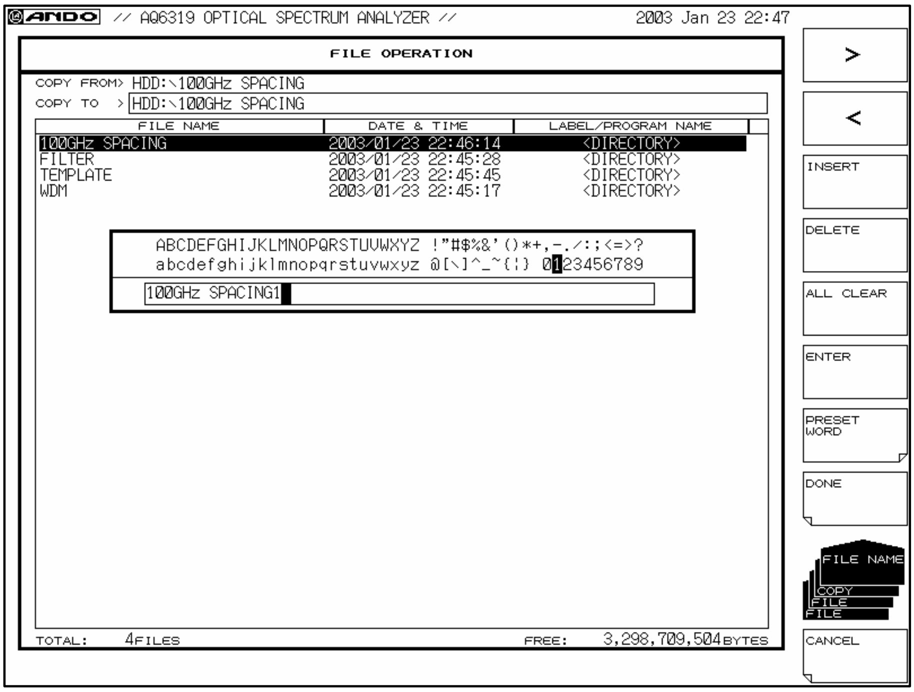


Fig. 7-40 Screen display when entering copy destination file name

7.5.9 Renaming a file

Use the following procedure to rename a file or directory saved to the hard drive (HDD) or a floppy disk drive (FDD).

① Press the <FILE OPERATION> key to display a file list.

② Move the cursor to the file or directory you want to rename.

③ After selecting a file , make sure the file name appearing at the top of the screen is the one you want to rename, then press the <RENAME> key.

④ Next, press the <FILE NAME> key to enter the new file name. Lastly, press the <DONE> key to set the file name.

⑤ Make sure the file name displayed at the top of the screen is correct, then press the <EXECUTE> key to rename the file.

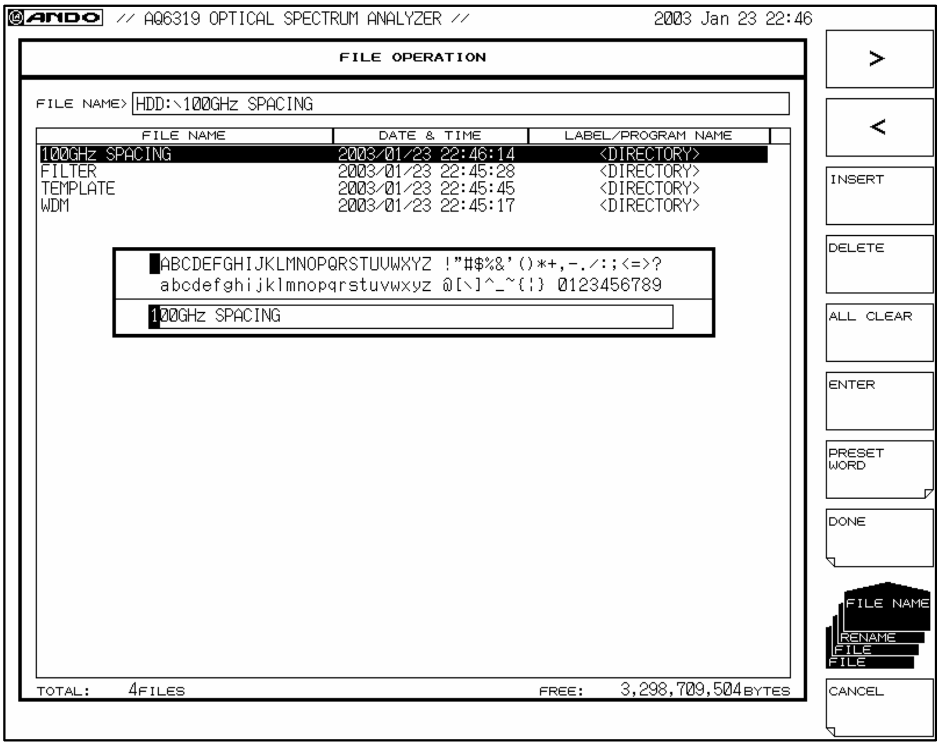


Fig. 7-41 Screen display when entering new file name

7.5.10 Creating a new directory

Use the following procedure to create a new directory.

① Press the <FILE OPERATION> key to display a file list.

② Press the <MAKE DIRECTORY> key.

③ Press the <DIRECTORY NAME> key, then enter the directory name. When you press this key, the character input window and corresponding soft key menu are displayed, just as during label input. Use the same procedure as during label input to enter the directory name, then press the <DONE> key. (□ See section 6.21 General Purpose LABEL INPUT)

④ Press the <EXECUTE> key to create a directory with the name entered in step ③.

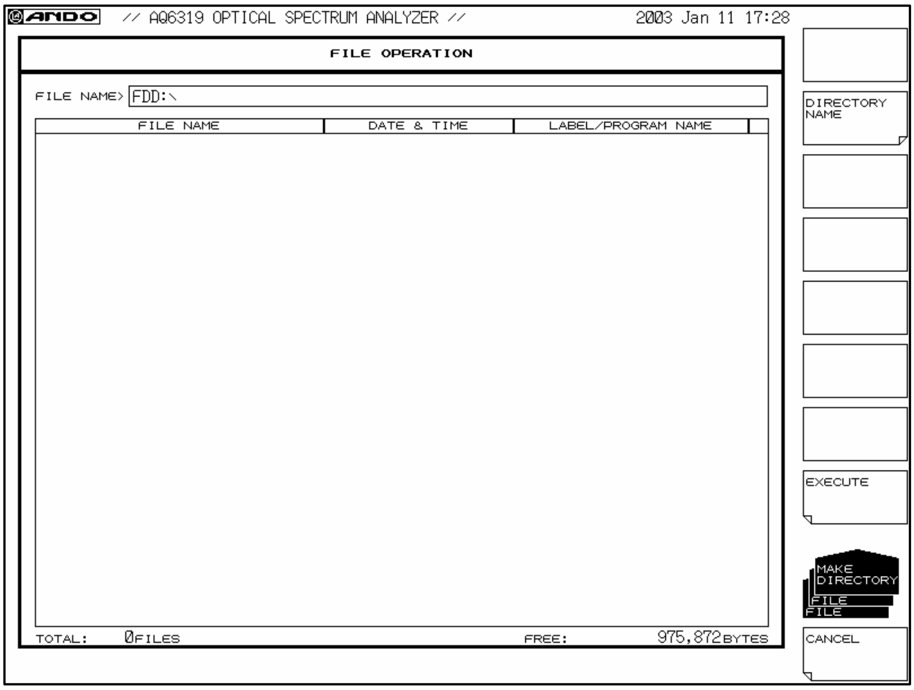


Fig. 7-42 Creating a new directory

7.5.11 Formatting a floppy disk

A new floppy disk must be formatted before it can be used.
This is done using the following procedure.

① Insert the floppy disk to be formatted in the floppy disk drive.

② Press the [FILE]switch, then press the <FD FORMAT (1.44MB)> key.

③ Press the <YES> key to format the disk.
Press the <NO> key to cancel the formatting process.

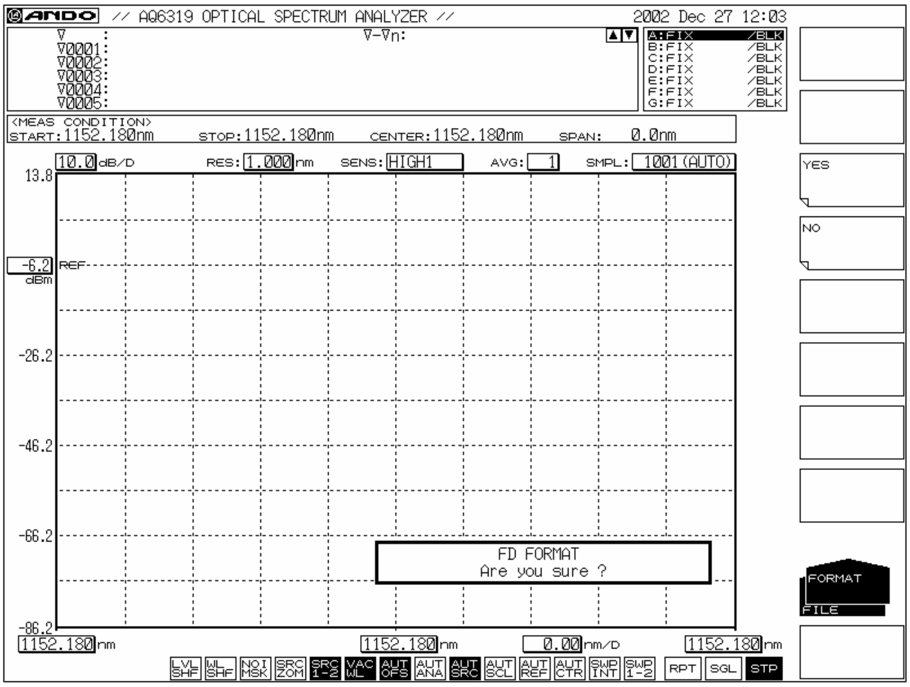


Fig. 7-43 Floppy disk formatting screen

NOTE

- Only 1.44 MB floppy disks can be formatted on the unit. 1.2 MB disks cannot be formatted.
- When a floppy disk is formatted on the unit, “AQ6319” is set as the volume label.

⚠ Caution

- Only 3.5-inch 2HD floppy disks can be used with the unit.
- When you format a floppy disk, all information stored on the disk will be lost.

7.5.12 File formats

The unit can save and load files in the formats listed below.

Table 7-9 presents the supported formats for the available file types.

Table 7-9 File formats

Type	Extension	Format	Description
TRACE/MEMORY(BIN)	.WV5	binary	Ordinary waveforms (trace data and MEMORY data; binary format)
TRACE/MEMORY(ASCII)	.CSV	text	Ordinary waveforms (trace data and MEMORY data; ASCII format)
GRAPHICS (BMP)	.BMP	binary	Screenshot data (BMP format)
GRAPHICS (TIFF)	.TIF	binary	Screenshot data (TIFF format)
SETTINGS FILE	.ST5	binary	Measurement conditions and other settings
DATA FILE	.CSV	text	Marker area and analysis results
	.DT5		
PROGRAM FILE	.PG5	binary	Program data created with PROGRAM function
TEMPLATE FILE	.CSV	text	Template data used by TEMPLATE function

7

(1) TRACE/MEMORY(ASCII) .CSV files

When a waveform is saved in text format, it is saved in comma-separated format.

Text format increases the file size, but is useful for data analysis with PC spreadsheet programs and the like.

```
19CSV2
AQ6319 OPTICAL SPECTRUM ANALYZER      (☛ See I  Header  Block)
15
"CTRWL",1553.200000
"SPAN", 20.000000
"START WL",1543.200000
"STOP WL",1563.200000
"WLFREQ", 0
"REFL",-10.0
"LSCL",10.0
"RESLN",0.200
"AVG", 1
"SMPLAUTO", 0
"SMPL", 1001                          (☛ See II Measurement Condition Parameters)
"SMPLINTVL",0.02
"HIGH 1"
"MEAS"
"LSUNT",0
"NMSKV","OFF"
"OPTATT",0



[TRACE DATA]
1543.2000, -66.267
1543.2200, -66.295                    (☛ See III Waveform Data Block)
:
:
:
1563.2000, -65.371
```

Fig. 7-44 Example format for text-format trace waveform

The format of a text file consists of the three blocks shown in Fig. 7-44 (blocks I, II, and III).

I. Header block

19CSV2(CR)(LF) ［File header］
・・・(CR)(LF) ［Label contents (57 characters)］
**(CR)(LF) [Number of measurement condition parameters]

II. Measurement conditions

The measurement conditions block is fixed at 24 lines.

□ "CTRWL",****.**(CR)(LF) ［Center wavelength］
□ "SPAN",****.*(CR)(LF) ［Span］
□ "START WL",****.** [Measurement start wavelength]
□ "STOP WL",****.** [Measurement stop wavelength]
□ "WLFREQ",* ［Horizontal axis scale mode (0: wavelength mode、1: frequency mode)］
□ "REFL",-**.*(CR)(LF) ［Reference level］
□ "LSCL",**.*(CR)(LF) ［Main level scale］
□ "RESLN",**.**(CR)(LF) ［Measurement resolution］
□ "AVG",****(CR)(LF) ［Averaging times］
□ "SMPLAUTO",*(CR)(LF) ［Sampling points setting mode (0:MANUAL,1:AUTO,2:SMPL INTVL)］
□ "SMPL",****(CR)(LF) ［Number of measurement sampling points］
□"SMPL INTVL",*.**** [Measurement sampling interval]
□"HIGH1" [Measurement sensitivity]
□ "MEAS" [Measurement type]
□"LSUN1",* [Vertical axis scale mode(0:dBm,1:dBm/nm)]
□"NMSKV","OFF" [Noise mask setting]
□"OPTATT",* [Internal attenuator setting (0:OFF,1:ON)]

For the data formats of the levels shown in ⑥ and ⑦, the formats in either Table 7-10 or 7-11 are output, depending on the particular level scale indicator.

Table 7-10 Main level scale formats

Vertical axis scale	Format	Description
LOG	"REFL",***.* "LSCL",***.*	Reference level Level scale
Linear	"REFL",***.* "LSCL",***.* "BASEL",****.**	Reference level Level scale Base level scale

Table 7-11 Sub-level scale format

Vertical axis scale	Format	Description
LOG	“REFL”,***.* “SSCLLOG “LOFST“,***.	Reference level Level scale Level offset
Linear	“REFL”,***.* “SSCLN“,***.* "SMIN“,****.**	Reference level Level scale Base scale
dB/km	“REFL“,***.* “SSKM“,**.* “OFSKM“,***.* “LENG“,**.***	Reference level Level scale Offset level Optical fiber length
%	“REFL“,***.* “SSPS“,***.* “SMINP“,***.*	Reference level Level scale Base scale

For the measurement sensitivity format shown in □, one of the formats in Table 7-12 is output, according to the measurement sensitivity type.

Table 7-12 Measurement sensitivity format

Format	Sensitivity
"NORM_HOLD"	NORMAL HOLD
"NORM_AUTO"	NORMAL AUTO
"MID"	MID
"HIGH 1"	HIGH 1(CHOP OFF)
"HIGH 2"	HIGH 2(CHOP OFF)
"HIGH 3"	HIGH 3(CHOP OFF)
"HI1_CHOP"	HIGH 1(CHOP ON)
"HI2_CHOP"	HIGH 2(CHOP ON)
"HI3_CHOP"	HIGH 3(CHOP ON)
"EXTRG"	External trigger mode

For the waveform type format shown in □, one of the formats in Table 7-13 is output, according to the waveform type.

Table 7-13 Waveform type format

Format	Waveform type	Format	Waveform type	Format	Waveform type
"MEAS"	WRITE	"E-D"	E-D(LOG)	"C+FL"	C+F(LIN)
"MAXH"	MAX HOLD	"C+D"	C+D(LOG)	"C-FL"	C-F(LIN)
"MINH"	MIN HOLD	"D+E"	D+E(LOG)	"F-CL"	F-C(LIN)
"RAVG"	ROLL AVG	"C+DL"	C+D(LIN)	"E+FL"	E+F(LIN)
"A-B"	A-B(LOG)	"C-DL"	C-D(LIN)	"E-FL"	E-F(LIN)
"B-A"	B-A(LOG)	"D-CL"	D-C(LIN)	"F-EL"	F-E(LIN)
"A+B"	A+B(LOG)	"D+EL"	D+E(LIN)	"NORM A"	NORMALIZE A
"A-BL"	A-B(LIN)	"D-EL"	D-E(LIN)	"NORM B"	NORMALIZE B
"B-AL"	B-A(LIN)	"E-DL"	E-D(LIN)	"NORM C"	NORMALIZE C
"A+BL"	A+B(LIN)	"C-F"	C-F(LOG)	"CVFT A",**	CURVE FIT A
"1-K(A/B)",*****.****	1-k(A/B)	"F-C"	F-C(LOG)	"CVFT B",**	CURVE FIT B
"1-K(B/A)",*****.****	1-k(B/A)	"E-F"	E-F(LOG)	"CVFT C",**	CURVE FIT C
"C-D"	C-D(LOG)	"F-E"	F-E(LOG)	"CVFTPK A",**	PK CURVE FIT A
"D-C"	D-C(LOG)	"C+F"	C+F(LOG)	"CVFTPK B",**	PK CURVE FIT B
"D-E"	D-E(LOG)	"E+F"	E+F(LOG)	"CVFTPK C",**	PK CURVE FIT C

III. Waveform data block

Measurement waveforms are stored as wavelength values and level values for the number of measurement sampling points.
During this process, a waveform measured in frequency mode is also stored as wavelength values.
Level values are stored as log values if the vertical axis scale is LOG, and as linear values if the vertical axis scale is linear.

(LOG scale)

[TRACE DATA]	[Header showing start of trace data]
****.****, ±***.***(CR)(LF)	[Wavelength value and level value (LOG) of first point]
****.****, ±***.***(CR)(LF)	[Wavelength value and level value (LOG) of second point]
:	
****.****, ±***.***(CR)(LF)	[Wavelength value and level value (LOG) of final point]

(Linear scale)

[TRACE DATA]	[Header showing start of trace data]
****.****,*.***E±***(CR)(LF)	[Wavelength value and level value (linear) of first point]
****.****,*.***E±***(CR)(LF)	[Wavelength value and level value (linear) of second point]
:	
****.****,*.***E±***(CR)(LF)	[Wavelength value and level value (linear) of final point]

(2) Data files (.CSV、.DT5)

Data such as the analysis results of the unit's analysis function are saved in ASCII format. Information such as the time at which the file was saved and waveform data can be saved together with the analysis results.

The soft keys <DATE&TIME>、<LABEL>、<DATA AREA>、<CONDITION>、 <TRACE DATA> and <OUTPUT DISPLAY> are used to select the data to be saved.

CSV or DT5 format can be selected for data file format.

Data fields that are not selected are simply skipped without inserting any spaces during the writing process.

Fig. 7-44 presents an example of data file writing and the data file format.

```
"19DAT "
"                                                                    "
2005 Apr 07 16:42
```

Header information
Label

```
"<NF ANALYSIS> TH:20.00dB MODE DIFF:3.00dB OFST(IN):0.00dB OFST(OUT):0.00dB"
"  ASE ALGO:AUTO-FIX  FIT AREA:AUTO  MASK AREA:---  FIT ALGO:LINEAR  "
" NO. WAVELENGTH  INPUT LVL  OUTPUT LVL  ASE LVL  RESOLN   GAIN    NF"
"        [nm]      [dBm]       [dBm]      [dBm]   [nm]     [dB]    [dB]"
"   1  1544.4983  -29.320     -2.260     -22.281   0.102   27.017   8.533   "
"   2  1545.3041  -29.530     -2.420     -22.184   0.101   27.064   8.619   "
```

Marker area contents or analysis function results

```
"CTRWL 1551.670000"
"SPAN    20.000000"
"REFL -10.0dBm"
"LSCL 10.0"
"RESLN 0.100"
"AVG    1"
"SMPL 2001"
"HIGH 2"
"NMSK OFF"
```

Measurement condition

```
1541.6700, -23.200
  . . . . . . .      . . . .
```

Waveform data for the sampling points (wavelength values and level values)

Fig. 7-45-1 Data file format example(DT5)

```
19DAT2
TEST
2005 Apr 07 16:42
<NF ANALYSIS>
TH[dB],20.00
MODE DIFF[dB],3.00
OFST(IN)[dB],0.00
OFST(OUT)[dB],0.00
ASE ALGO,AUTO-FIX
FIT AREA,AUTO
MASK AREA,---
FIT ALGO,LINEAR
NO.,WAVELENGTH[nm],INPUT LVL[dBm],OUTPUT LVL[dBm],ASE LVL[dBm],RESOLN[nm],GAIN[dB],NF[dB]
1,1544.4983,-29.320,-2.260,-22.281,0.102,27.017,8.533
2,1545.3041,-29.530,-2.420,-22.184,0.101,27.064,8.619
CTRWL,1551.670000
SPAN,20.000000
REFL[dBm],-10.0
LSCL,10.0
RESLN,0.100
AVG,1
SMPL,2001
HIGH 2
NMSK,OFF
1541.6700, -23.200
```

Header information Label

Marker area contents or analysis function results

Measurement condition

Waveform data for the sampling points (wavelength values and level values)

Fig. 7-45-2 Data file format example(CSV)

(3) Template files (.CSV)

See subsection 7.6.6 Creating Template Data for the format of template files. (□ See subsection 7.6.6 Creating Template Data)

7.6 Template function

7.6.1 Overview

The template function compares preset reference data (template data) with a measured waveform. In addition, if a function for displaying the target spectrum (target line) on the measurement screen is used, the target spectrum can be referenced while adjusting the optical axis of an optical device.

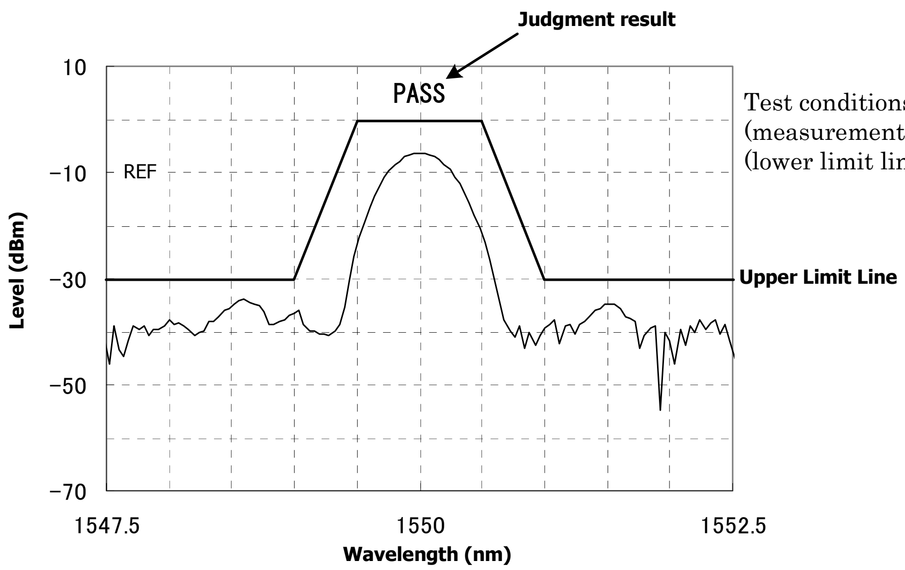
The following three templates are provided.

- Upper limit line
- Lower limit line
- Target line

7.6.2 Go/No Go test function

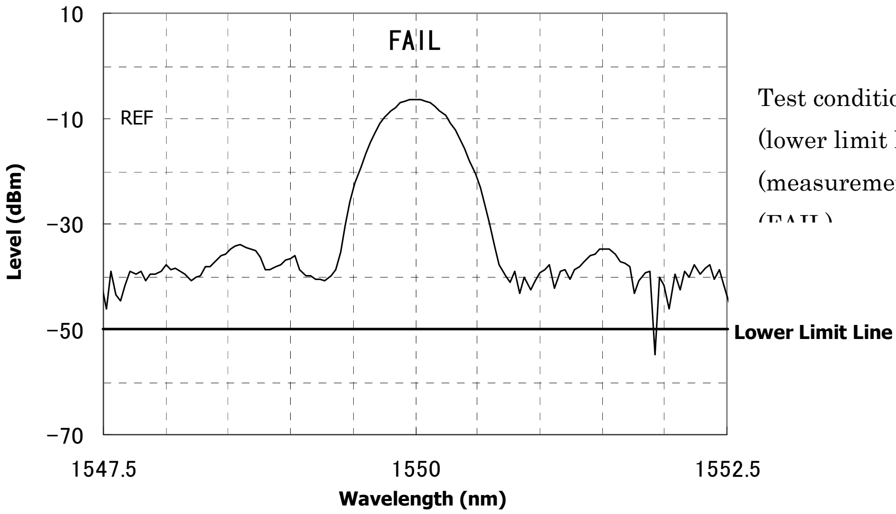
The Go/No Go test function compares the active trace waveform against reference data (template data) preset by the user, and performs a test on the measured waveform (Go/No Go test).
The template function can be used effectively in situations such as pass/fail tests on production lines.

Template data are defined as the level upper limit line, lower limit line, and target line for the waveform.
Go/No Go test functions are provided for testing just the upper limit line, just the lower limit line, and both the upper limit line and lower limit line. These three test conditions are illustrated below.



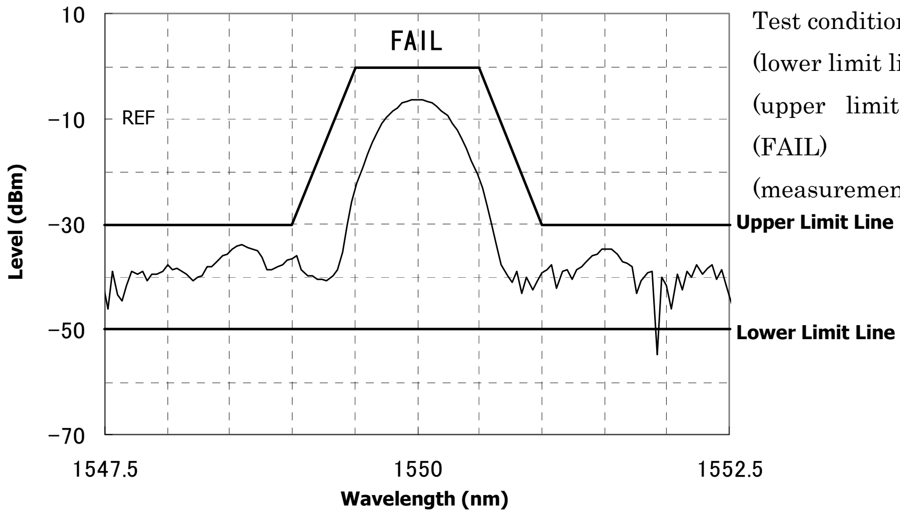
Test conditions
(measurement data) ≤ (upper limit line) →Go (PASS)
(lower limit line) ＜ (measurement data) →No go (FAIL)

Fig. 7-46 Test on upper limit line only



Test conditions
(lower limit line) ≤ (measurement data)→Go (PASS)
(measurement data) < (lower limit line)→No go (FAIL)

Fig. 7-47 Test on lower limit line only



Test conditions
(lower limit line) ≤ (measurement data)→Go (PASS)
(upper limit line) < (measurement data)→No go (FAIL)
(measurement data) < (lower limit line)→No go

Fig. 7-48 Test on both upper limit line and lower limit line

⚠Caution

Wavelength range for executing Go/No Go test function

- The Go/No Go test function is executed within the wavelength range shown on the screen.
- During execution, the line marker search (<SEARCH/ANA L1-L2> key) and zoom area search function (<SEARCH/ANA ZOOM AREA> key) are enable.

7

7.6.3 Target line function

The target line function displays the targeted spectrum on the measurement screen without comparing it to the measured waveform.

This function can be used for displaying and adjusting the target spectrum serving as a reference for adjustments such as adjusting the optical axis of an optical device.

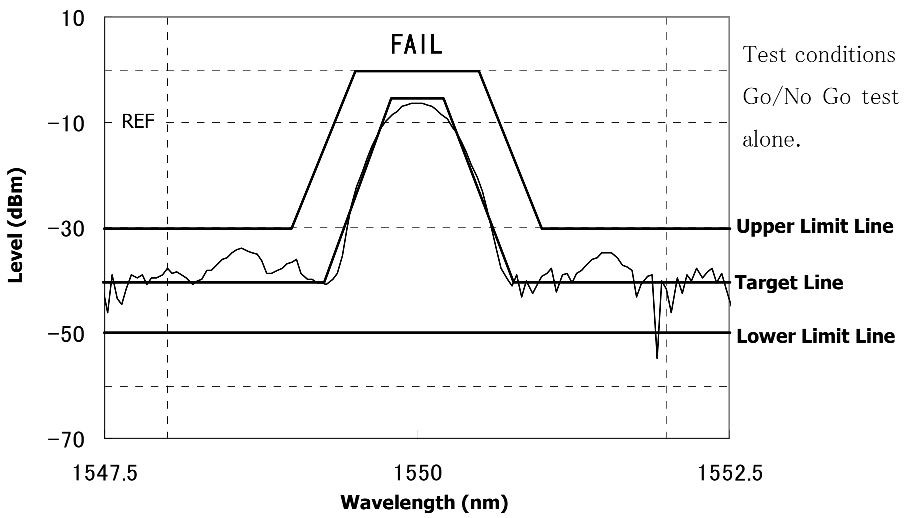


Fig. 7-49 Screen display when target line is displayed

7.6.4 Templates

Template data are defined as wavelengths and level values for wavelengths. An overview of template data is described below.

● Template data contents

・Template data consist of wavelength and level data. Up to 50,001 points of data may be defined.

・An upper limit, lower limit, and target line can be set.

・The on-screen template data display range and the Go/No Go test function execution range follow the display scale wavelength range.

Therefore, the display scale must be set to the tested wavelength range when using the Go/No Go test function. The Go/No Go testing process is not performed on wavelength ranges that are not displayed on the display scale.

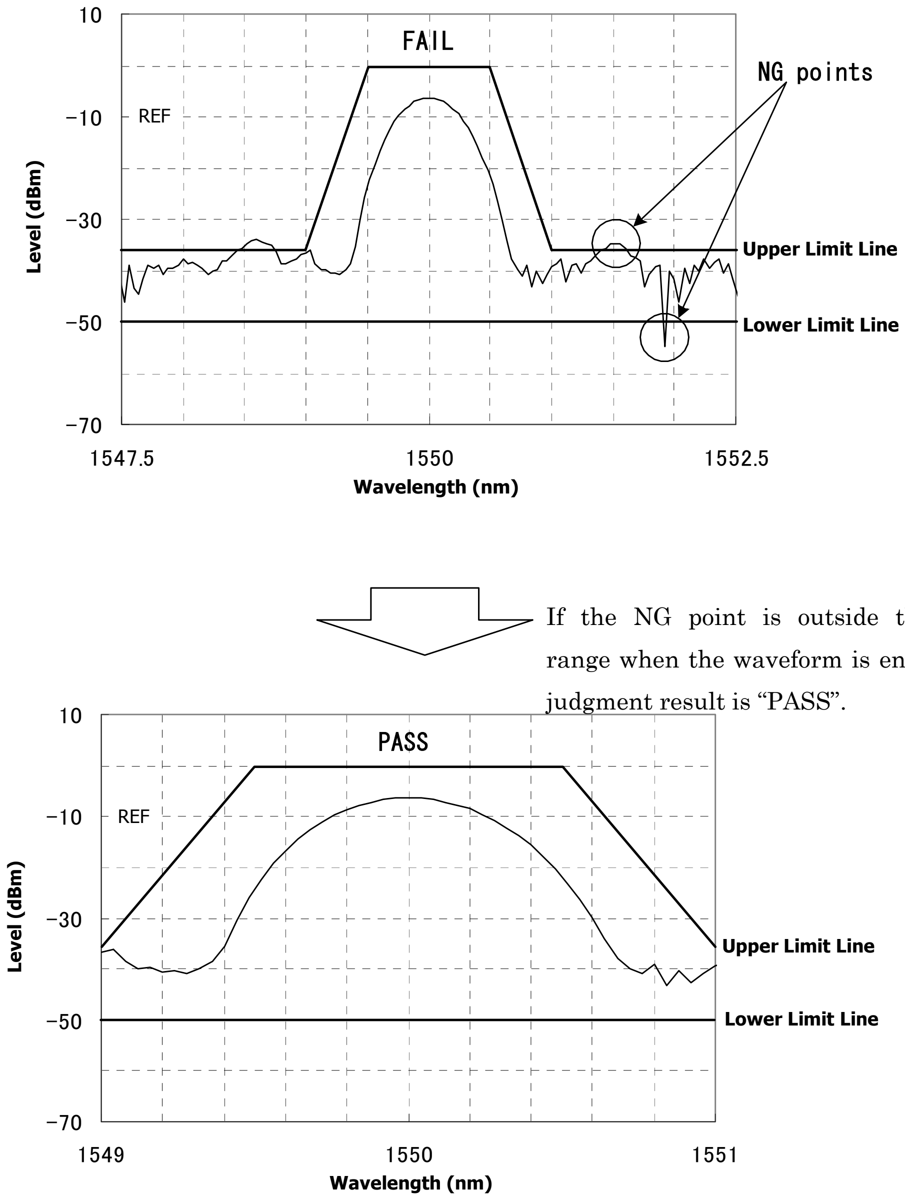


Fig. 7-50 Template function when display scale is changed

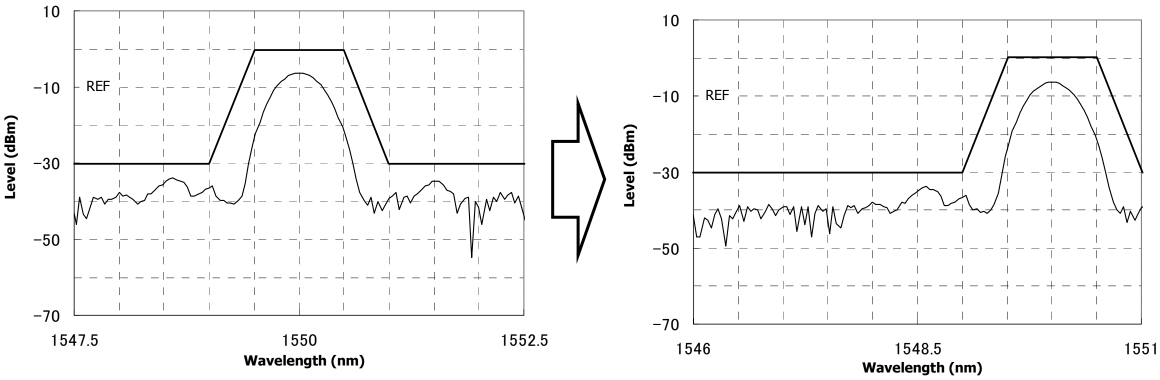
● Template data types

There are two types of template data: ABSOLUTE and RELATIVE.

The <MODE ABS&REL> key is used to select the template data type.
(See 7.6.6 Creating Template Data) When the template data type is set to RELATIVE mode, the template data themselves can be relatively shifted by changing the ZOOM CENTER WL and REF LEVEL.
(See 7.6.7 Other Useful Functions)

・ABSOLUTE templates

ABSOLUTE template data specify both wavelengths and levels as absolute values. The template data change in conjunction with changes to the center wavelength or span on the display scale.



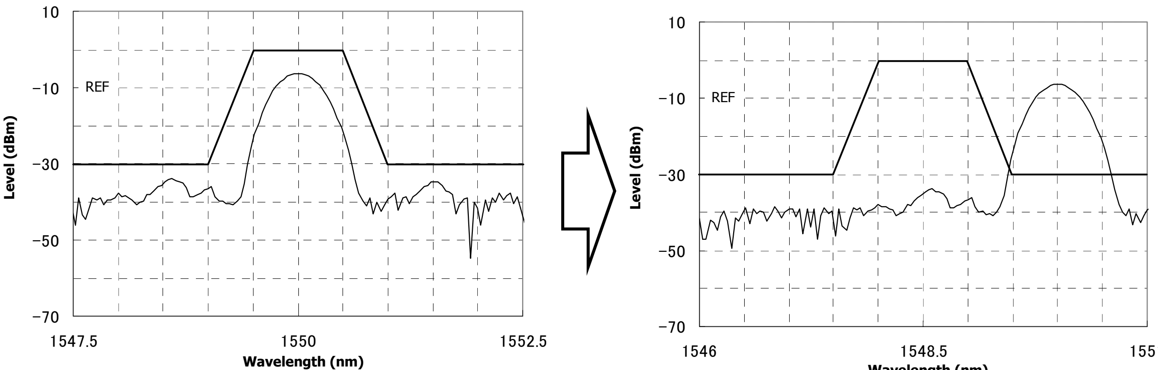
When ZOOM CENTER WL=1550nm

When ZOOM CENTER WL is changed to 1548.5nm
(The template moves in conjunction with the waveform

Fig. 7-51 ABSOLUTE templates

・RELATIVE templates

RELATIVE template data are specified as relative values with respect to the display scale. These template data are fixed even if the center wavelength or span of the display scale is changed.



When ZOOM CENTER WL=1550nm

When ZOOM CENTER WL is changed to 1548.5nm
(The template does not move.)

Fig. 7-52 RELATIVE templates

● Template data extrapolation types

In cases where the display scale is outside the defined range for template data, the template data outside the range can be extrapolated.

The following three different extrapolation methods are provided.

・Type A ‥‥	Extends the outermost data point of the template data to the outside.
・Type B ‥‥	Extends, to the outside, a line joining the outermost template data and the adjacent data point.
・None ‥‥‥	No extrapolation.

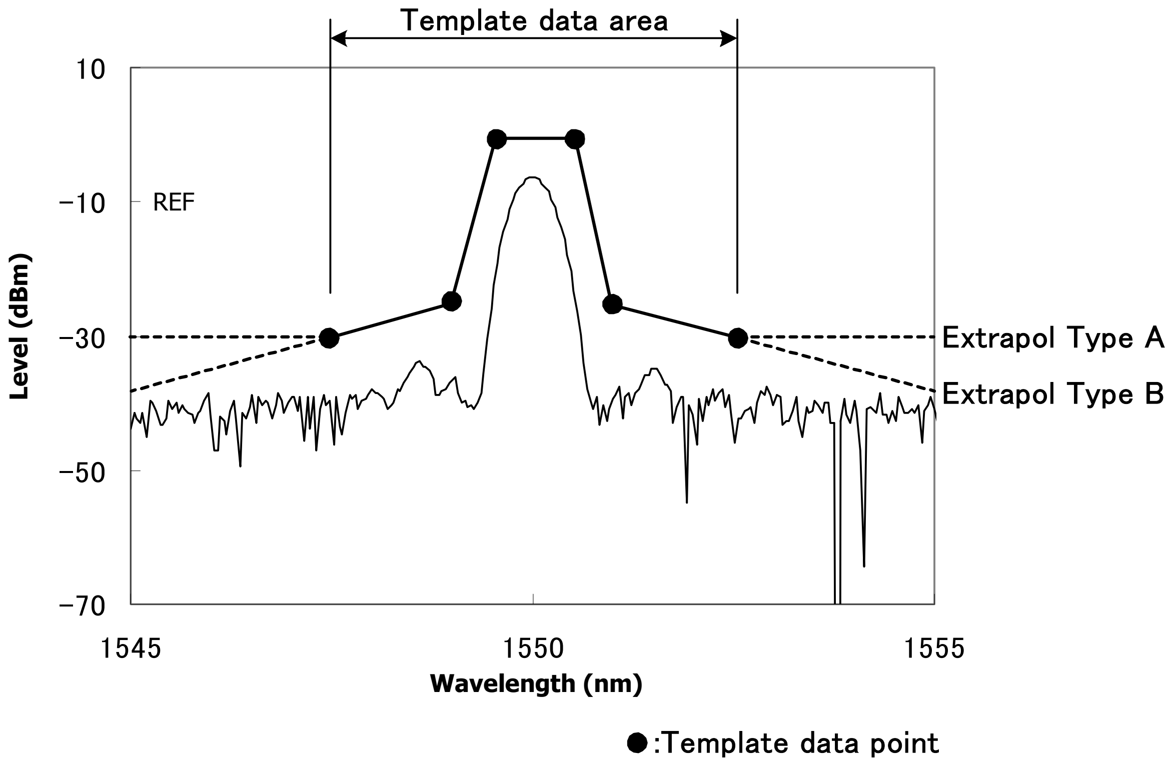


Fig. 7-53 Template extrapolation methods

NOTE
● A limit applies to the data created by extrapolation, based on the LOG LIMIT setting.

⚠ Caution

- If the extrapolation type of a template is <NONE>, the Go/No Go judgment area based on the template may be narrower than the waveform display screen. Therefore, the upper limit line and lower limit line judgment areas may not equate to the entire display screen. For this reason, the test execution area based on the upper and lower limit lines must be carefully considered.

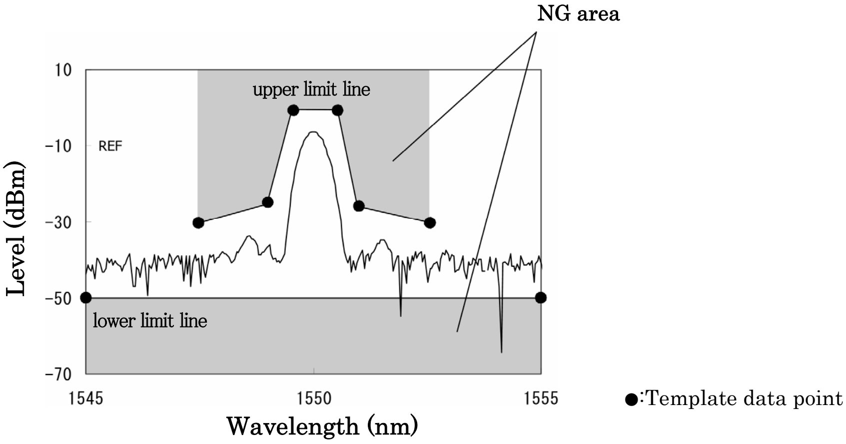


Fig. 7-54 Screen display when extrapolation method is set to None

7.6.5 Procedure for creating template data

Template data must be created in advance in order to execute the Go/No Go test function. The flow of actions from template creation to executing the Go/No Go test function is described below.

Create or load template data

Define the template data to be used. Template data can be defined using any of the following three methods. (☛ See subsection 7.6.6 Creating Template Data)

(a) Create the template data using the unit's template creation function (<TEMPLATE EDIT> key inside <TEMPLATE> key).

(b) Load, in the unit, a template data file (.CSV format) created using a spreadsheet program such as MS-Excel.

(c) Load a unit waveform file (.CSV or .BIN file) as template data in the unit.

Select Go / No go test conditions

The <TYPE> key inside the <TEMPLATE> key is used to set the template test conditions (Upper limit test/Lower limit test/Upper limit & Lower limit test).

Execute Go / No go test function

The <GO/NO GO OFF/ON> key inside the <TEMPLATE> key is used to set the Go/No Go test function to ON and start execution of the test function.

If the Go/No Go test function is set to ON, the measured waveform is compared and judged against the template data when sweeping ends, and the judgment results are displayed on the screen.

The <GO/NO GO OFF/ON> key is disabled if template data

7.6.6 Creating template data

Template data can be created on the unit or on an external PC, or a waveform file saved on the unit may be loaded.

(a) Creating template data on the unit

Create the template data using the unit's template creation function (<TEMPLATE EDIT> key inside <TEMPLATE> key). The procedure for doing this is shown below.

① Press the <TEMPLATE> key in the [ADVANCE] switch, then press the <TEMPLATE EDIT> key. When you press this key, the template creation screen is displayed.

② Press the <LINE SELECT> key to select the template to be created or edited.

<UPPER LINE>:	Upper limit line
<LOWER LINE>:	Lower limit line
<TARGET LINE>:	Target line

③ Press the <MODE ABS/REL> key to select either ABSOLUTE or RELATIVE as the type of template to be created.

④ Press the <EXTRAPOL TYPE> key to select the extrapolation method.
See the template data extrapolation types in 7.6.4 Templates for information on extrapolation types. (□ See 7.6.4 Templates)

<TYPE A>:	Extrapolation type A
<TYPE B>:	Extrapolation type B
<NONE>:	No extrapolation

⑤ Use the rotary knob or step keys to move the cursor to the template data point you want to change. Next, press the <VALUE EDIT> key and change the value in the DATA ENTRY section.
To change the next point, press the <INSERT> key. The next point will be added to the template data. Next, use the rotary knob or step keys to move the cursor, then use the <VALUE EDIT> key to enter a value.
As you enter values at each point, the template you are creating appears on the waveform screen.

NOTE

- Data similar to the wavelength/level data preceding insertion are inserted as data at the point inserted by the <INSERT> key.
- When the editing line is set to OFF by the <TEMPLATE DISPLAY> key and the template data on the target line are edited, <TEMPLATE DISPLAY> for the editing line changes to ON.

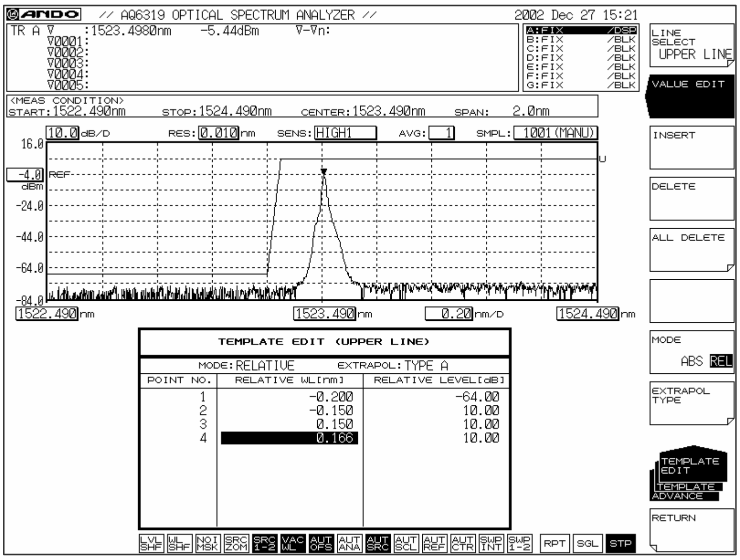


Fig. 7-55 Editing screen when template data type is <RELATIVE>

To delete the data at a given point, move the cursor to the location you want to delete, then press the <DELETE> key inside <TEMPLATE EDIT>.

NOTE

- Deleting shifts the data subsequent to that point upward (shift of minus-one point).

To delete the template data at all points, press the <ALL DELETE> key in <TEMPLATE EDIT>.

When you press the <ALL DELETE> key, a deletion confirmation message is displayed. Select <YES> to delete the data. Select <NO> to cancel.

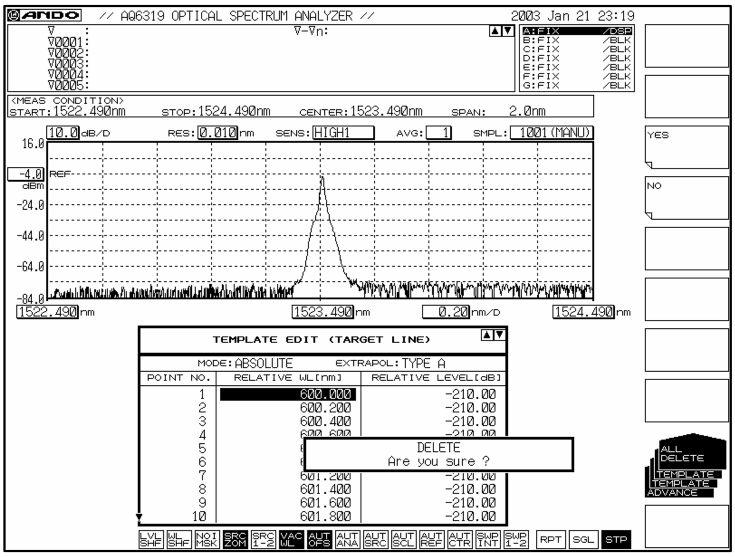


Fig. 7-56 Screen display when <ALL DELETE> key is pressed

(b) Creating template data on an external PC

Template data created in CSV format (comma-separated) on an external PC can be loaded in the unit.
The template data must be created in accordance with the set format in order to load this type of file in the unit.

● Template data format

The file extension for template data file names is always ".CSV".

The template data format is shown below.

Single-byte, upper-case letters (all of them) are the only type of alphanumeric characters that can be used in this format. As many as 50,001 template data points can be defined.

Save the template data created on an external PC to a floppy disk for loading in the unit.

	A	B	
1	AQ6319		←Header indicating unit
2	TEMPLATE		←Header indicating template data
3	TYPE	ABSOLUTE	←Header indicating template type (ABSOLUTE or RELATIVE)
4	EXTRAPOL	A	←Extrapolation type (A or B or NONE)
5	1540.000	-20.00	←Wavelength and level data (1550.123,-20.00)
6	1550.000	-10.00	Up to 50,001 points of data are listed in ascending order, starting with the smallest wavelength value.
7	1560.000	-20.00	

.CSV file containing the above template data

```
AQ6319,
TEMPLATE,
TYPE,ABSOLUTE
EXTRAPOL,A
1540.000,-20.00
1550.000,-10.00
1560.000,-20.00
```

Fig. 7-57 Creating template data on an external PC

⚠Caution

- In template data, the only supported alphanumeric characters are single-byte, upper-case letters (all of these are supported).
- As in normal templates, the maximum number of template data points is 50,001.
- Be sure to set ".CSV" as the file extension when saving the data.
- The AQ6319 cannot read template data if the format does not match the requirements.

The following procedure is used to load, in the unit, template data created on an external PC.

① Press the [FILE] switch.

② Press the <ITEM SELECT> key, then select the <TEMPLATE> key.

③ Press the <READ> key.

④ Press the <FILE → @@@@> key and select one of the following three editing lines.
Select from the following: <UPPER LINE> key, <LOWER LINE> key, <TARGET LINE> key.
The previous tree is restored after a selection is made.

⑤ Move the cursor to the template data file you want to load from the file list, then press the <EXECUTE> key.

(c) Loading a waveform file

Load a unit waveform file (.CSV or .BIN file) as template data in the unit. The procedure for doing this is shown below.

① Press the [FILE] switch.
② Press the <ITEM SELECT> key, then select the <TEMPLATE> key.
③ Press the <READ> key.
④ Press the <FILE → @@@@> key and select one of the following three editing lines.
Select from the following: <UPPER LINE> key, <LOWER LINE> key, <TARGET LINE> key.
The previous tree is restored after a selection is made.
⑤ Move the cursor to the template data file you want to load from the file list, then press the <EXECUTE> key.

NOTE

- After the file is loaded, the template status is set as shown below.
  - After loading, the template type is set to ABSOLUTE.
  - The extrapolation type setting remains the same as prior to loading.
  - After loading, WL SHIFT and LVL SHIFT in the template are set to zero.

It is also possible to load, as template data in the AQ6319, template data (.CSV files) created on the previous model (AQ6317). The procedure for doing this is similar to loading data created in the AQ6319's template data format.

⚠Caution

- The following restrictions apply for loading template data created for the AQ6317.
  - Both the upper limit line and lower limit line are loaded at the same time.
  - The maximum number of data points is 501.
  - After loading, the template type is set to RELATIVE.

7

7.6.7 Other useful functions

The functions described below make it easier to use the template function.

- Template data wavelength/level shift

The template data wavelength/level can be shifted without changing the template data. The procedure for doing this is shown below.

① Press the [ADVANCE] switch.

② Press the <TEMPLATE> key, then select the <TEMPLATE SHIFT> key.

③ To shift the wavelength, select <WL SHIFT ****.***nm>. To select the level, select <LEVEL SHIFT ***.**dB>. Use the rotary knob or step keys to enter the shift amount.

NOTE

- Use of this function does not change the template data.
- Both absolute and relative template types are supported.
- Shifts set by this function apply to all three line types (UPPER LIMIT LINE, LOWER LIMIT LINE, AND TARGET LINE). To shift just one line, edit the template data.

- Useful function based on template data RELATIVE/ABSOLUTE switching

This function shifts the wavelength/level for the template data themselves based on the ABSOLUTE/RELATIVE switching function. The template data themselves can be shifted by changing the ZOOM CENTER WL or REF LEVEL.
Switching is done using the <MODE ABS/REL> key in <TEMPLATE EDIT>. This switching action causes the data in the template editing table to be redisplayed with the ABSOLUTE/RELATIVE setting switched.

For example, if a template is created with the following settings and ABSOLUTE/RELATIVE switching is performed, the data changes as shown below.

- ZOOM CENTER WL: 1550.800 nm
- REF LEVEL: –10 dBm

- Edit the template in ABSOLUTE mode.

MODE: ABSOLUTE EXTRAPOL: TYPE A		
POINT NO.	ABSOLUTE WL[nm]	ABSOLUTE LVL[dBm]
1	1550.650	-50.00
2	1550.900	10.00
3	1551.150	-50.00

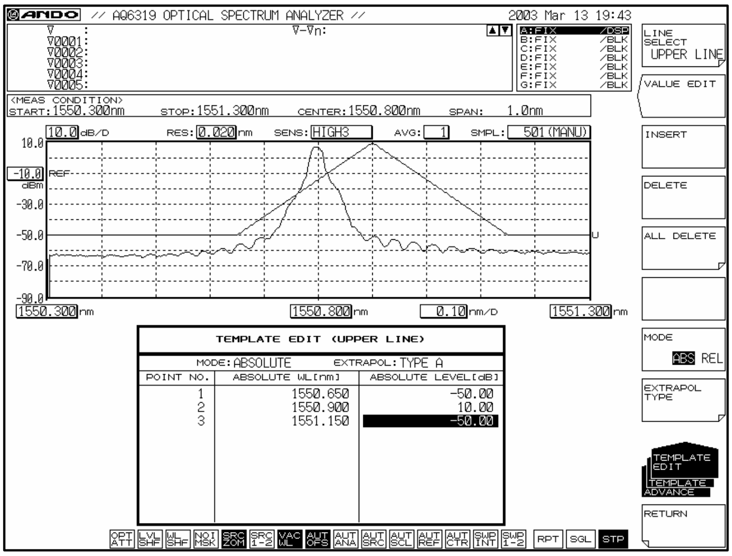


Fig. 7-58 Editing template in ABSOLUTE mode

- Now switch to RELATIVE mode.

MODE: ABSOLUTE EXTRAPOL: TYPE A		
POINT NO.	RELATIVE WL[nm]	RELATIVE LVL[dB]
1	–0.150	-40.00
2	0.100	20.00
3	0.350	-40.00

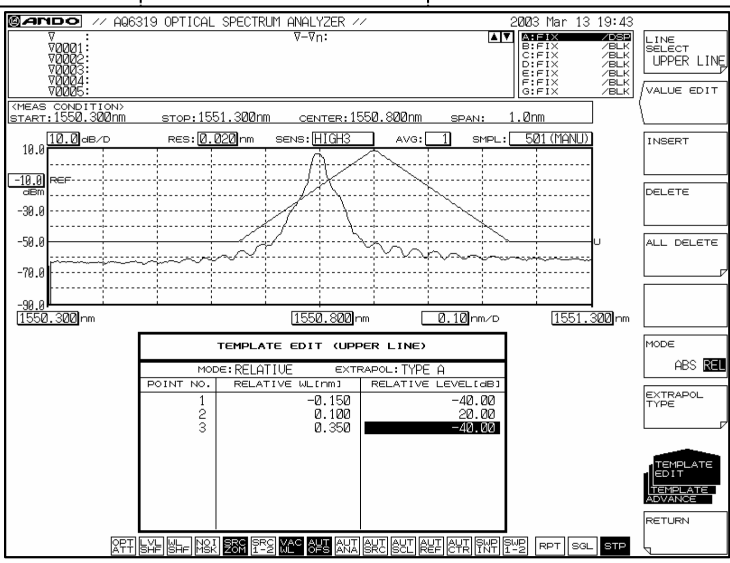


Fig. 7-59 Switching to RELATIVE mode

7

- Now change <ZOOM CENTER WL> and <REF LEVEL> as shown below. The values do not change in RELATIVE mode.

  ZOOM CENTER WL: 1550.800 nm

  REF LEVEL: 0.00 dBm

MODE: ABSOLUTE EXTRAPOL: TYPE A		
POINT NO.	RELATIVE WL[nm]	RELATIVE LVL[dB]
1	–0.150	-40.00
2	0.100	20.00
3	0.350	-40.00

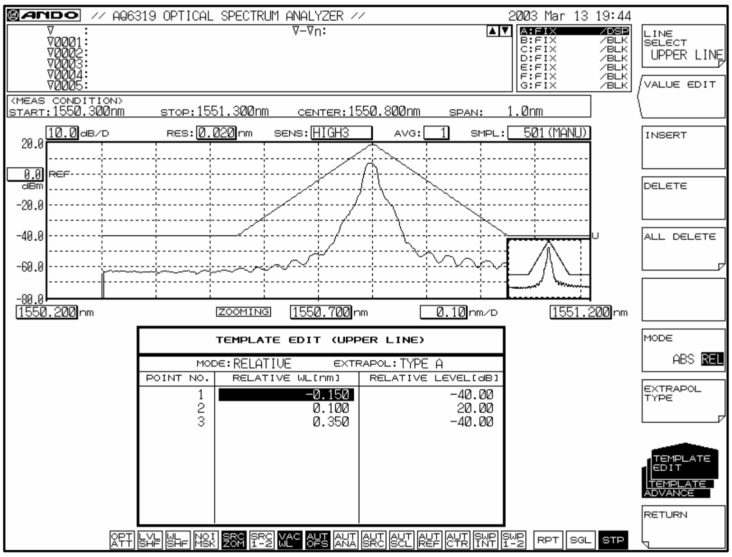


Fig. 7-60 Changing display scale

□ Now switch back to ABSOLUTE mode.

The <ZOOM CENTER WL> and <REF LEVEL> changes are applied.

MODE: ABSOLUTE EXTRAPOL: TYPE A		
POINT NO.	ABSOLUTE WL[nm]	ABSOLUTE LVL[dBm]
1	1550.550	–40.00
2	1550.800	20.00
3	1551.050	-40.00

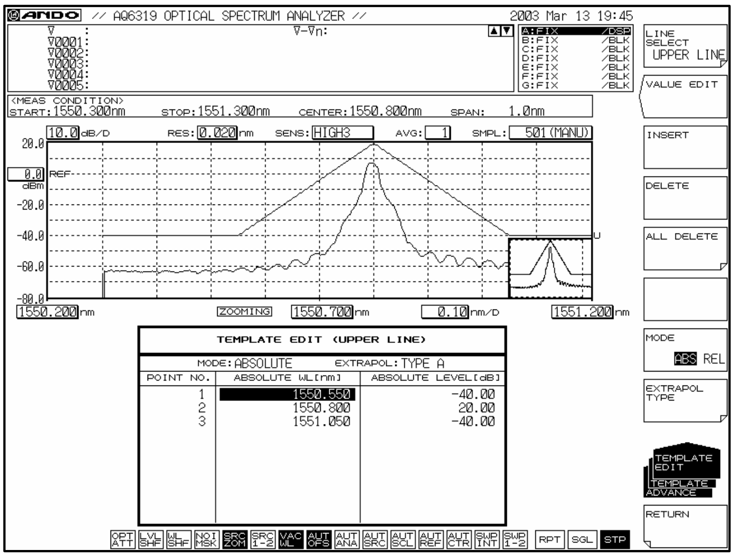


Fig. 7-61 Switching back to ABSOLUTE mode

See subsection 7.6.4 "Templates" for information on switching template data between ABSOLUTE and RELATIVE modes.

- Template data display ON/OFF function

This function turns the template data display ON/OFF. The procedures for doing this are shown below.

① Press the [ADVANCE] switch.

② Press the <TEMPLATE> key.

③ Press the <TEMPLATE DISPLAY> key and set display ON/OFF for each of the three lines (<UPPER LINE DISPLAY>、<LOWER LINE DISPLAY>、<TARGET LINE DISPLAY>).

7

⚠Caution

- If the <GO/NO GO> key is set to ON, a Go/No Go test is performed according to the test type, even if the <TEMPLATE DISPLAY> key indicator is set to OFF.

7.7 Synchronous measurement function with the Tunable Laser Source

7.7.1 Outline

This equipment carries the synchronous measurement function to work with the Tunable Laser Source.

When measuring the wavelength loss characteristics with the optical filters, optical fiber gratings, etc., wideband light source such as the ASE light source have thus far been used.

With the synchronous sweeping function, the Tunable Laser Source with narrower wavelength band is being used instead of the ASE light source and the wavelength sweeping function of this equipment and the wavelength sweeping of the Tunable Laser Source are synchronous.

By so doing, higher resolution can be obtained since the wavelength resolution is being determined by the spectral line width of the Tunable Laser Source. Also, since the Tunable Laser Source scarcely outputs any other components than the measuring wavelength, and as the noise light which comes out faintly is being totally cut except for the section corresponding to the resolution range of this equipment, extremely high optical dynamic range can be acquired.

This equipment can execute synchronous sweep with the following Tunable Laser Sources.

- AQ4321 Series Tunable Laser Source
- AQ2200-136 Tunable Laser Source

7.7.2 Connections

Before turning on the power supply, make the following connections:

(1) When using AQ4321 Series

① Connect the connector “GP-IB2 ” of this equipment and the connector “GP-IB” of the AQ4321A/D using the GP-IB cable.

② Connect the “SMPL TRIG IN “ terminal of this equipment and the “SMPL TRIG OUT“ terminal of the AQ4321A/D using a coaxial cable.

③ Connect the “TLS SYNC OUT” terminal of this equipment and the “OSA SYNC IN” terminal of the AQ4321A/D using a coaxial cable.

(2) When using AQ2200-136

① Connect the connector “GP-IB2 ” of this equipment and the connector “GP-IB” of the AQ2201/AQ2202 mainframe using the GP-IB cable.

② Connect the “SMPL TRIG IN“ terminal of this equipment and the “TRIGGER OUT“ terminal of the AQ2201/2202 mainframe using a coaxial cable.

③ Connect the “TLS SYNC OUT” terminal of this equipment and the “TRIGGER IN” terminal of the AQ2201/2202 mainframe using a coaxial cable.

7.7.3 Operation

When using synchronous sweeping function, make the following setting.

① Pressing the <MORE 2/4> key and <GP-IB SETTING> key and <TLS ADDRESS> key of the [SYSTEM] switch, set the GP-IB address of Tunable Laser Source which connected this equipment using the rotary knob, step keys or numeric keys.
Meanwhile, the GP-IB address of the Tunable Laser Source is being set to " 24 (AQ4321 Series) " or " 20 (AQ2201/2202) " when shipped out from the factory.
Also, pressing the <MORE 2/4> key and <GP-IB SETTING> key and <GP-IB2 PORT ADDRESS> key of the [SYSTEM] switch, make due setting not to let the address of the GP-IB2 port and the address of the Tunable Laser Source duplicated.
Also, make sure the <SYSTEM CONTROLLER> key of the same soft key menu is "OK".

② Press the <MORE 2/2> key and <TLS SYNC SWEEP> key of the [SET UP] switch to set "OK".

③ Execute sweeping of this equipment using the [SWEEP] <REPEAT> or <SINGLE> key sweeping of the wavelength of Tunable Laser Source is also carried out interlocking with the sweeping of this equipment.

④ Press the <TLS SYNC SWEEP> key to set "OFF", the synchronous sweeping function with the Tunable Laser Source becomes in valid.

When using synchronous sweeping function, settings are limited as below.

- The resolution is set to 1nm fixed, [SET UP] <RESOLUTION> key will be disabled.
- The minimum setting for sampling interval will be 1pm.
- "CHOP" for CHOP mode is not selectable. When you execute synchronous sweeping when setting "CHOP" , "SWITCH" will be automatically selected.
- Wavelength mode will be vacuum wavelength mode.

7.7.4 Precautions

① When making measurements of optical devices, first, execute sweeping under the status where the Tunable Laser Source and this equipment are being connected directly by means of short fibers to use the obtained optical spectrum as the reference value. Then, execute sweeping with the specimen device being connected between the Tunable Laser Source and this equipment and deem the acquired optical spectrum as the measured value.
After that, by finding out the ratio between the two optical spectra using the trace to trace computing function, the wavelength-loss/transmission-factor can be measured accurately. Refer to Section 5.3.10 regarding how to use the trace to trace computing function.

② When performing synchronous sweeping of the wavelength, the difference between the wavelength of this equipment and that of the Tunable Laser Source must be fully smaller than a half of the resolution setting of this equipment. For this reason, the resolution setting for the function is fixed to 1nm. The resolution of actual measurements is being determined by the sampling interval (the quotient of dividing the "sweep width" by the "number of sample – 1" at the time of performing the measurement and, since the resolution setting for this equipment is merely to determine how far to suppress the noise light coming out from the Tunable Laser Source, setting a wider resolution will not influence the actual measurement resolution.

③ Preset to the output power and line width of the Tunable Laser Source in advance.

④ When the sweeping range exceeds the wavelength setting range of the Tunable Laser Source. ”WARNING” appears while sweeping is being performed. When this warning is issued, adjust the center wavelength and span setting for this equipment.

⑤ Synchronous sweeping is not workable under the pulse light measurement mode, while “AUTO” measurement is being performed.

⑥ Power measurement difference of around 0.1 dB may occur when you perform synchronous sweeping with the Tunable Laser Source set to WIDE mode.

7.8 Using an External Printer

The unit has a printer port to which an external printer can be connected for printing measured waveforms. Driver software must be installed after connecting the external printer to the unit in order to use the external printer.

Yokogawa Electric has verified operations using the following printers and driver software.
(☞ See Table 7-14 Printers with verified operations)

Table 7-14 Printers with verified operations

Type	Model	Driver
Monochrome printer	EPSON LP-8400	Windows XP driver software Version 1.08fm
Color printer	EPSON LP-8000C	Windows XP driver software Version 1.08fc

The following procedures must be performed in order to use an external printer connected to the unit.

- ✓ Install external printer
- ✓ Select printer to be used for printing
- ✓ Execute printing operation

⚠Caution

- External printer driver software is not preinstalled on the unit.
- The unit uses a special, customized version of Microsoft® Windows XP as its operating system. To use an external printer with the unit, you will need a floppy disk containing the Windows XP driver software for the printer you want to use.
- A mouse and keyboard are also required to install driver software.
(☛ See subsection 3.2.2 Connecting a Mouse and Keyboard)
- If you use an external printer connected to the unit and the printer does not operate properly or an equipment failure occurs in the unit, Yokogawa Electric will not provide any warranty coverage.
- A network printer cannot be used. Use a cable to connect the printer directly to the external printer port on the back side of the unit.

7

7.8.1 Installing a printer driver

Use the following procedure to install an external printer in the unit.

① Connect the external printer to the printer port while the unit power is off.

② Connect a mouse and keyboard to the mouse port and keyboard port on the unit.

③ Turn on the unit power and boot up as usual.

④ When the unit boot-up sequence finishes and the measurement screen is displayed, press the [SYSTEM] switch.

⑤ Press the <MORE 1/4> key, then press the <EXT PRINTER SETTING> key.

⑥ When you press the <NEW PRINTER INSTALL> key, the Add Printer Wizard shown below is displayed. Follow the instructions to install the driver software. Install the driver software from a floppy disk during this procedure.

⑦ Once the driver software has been fully installed, the normal waveform screen is displayed again.

Fig. 7-62 Add Printer Wizard

7.8.2 Selecting a printer for printing

After you have installed an external printer and are ready to use it for actual printing, you must set “EXTERNAL PRINTER” as the print data output destination in the unit software. The procedure for doing this is shown below.

① Press the [SYSTEM] switch.

② Press the <MORE 1/4> key, then use the <HARD COPY DEVICE> key to set “EXTERNAL” as the printer for printing.

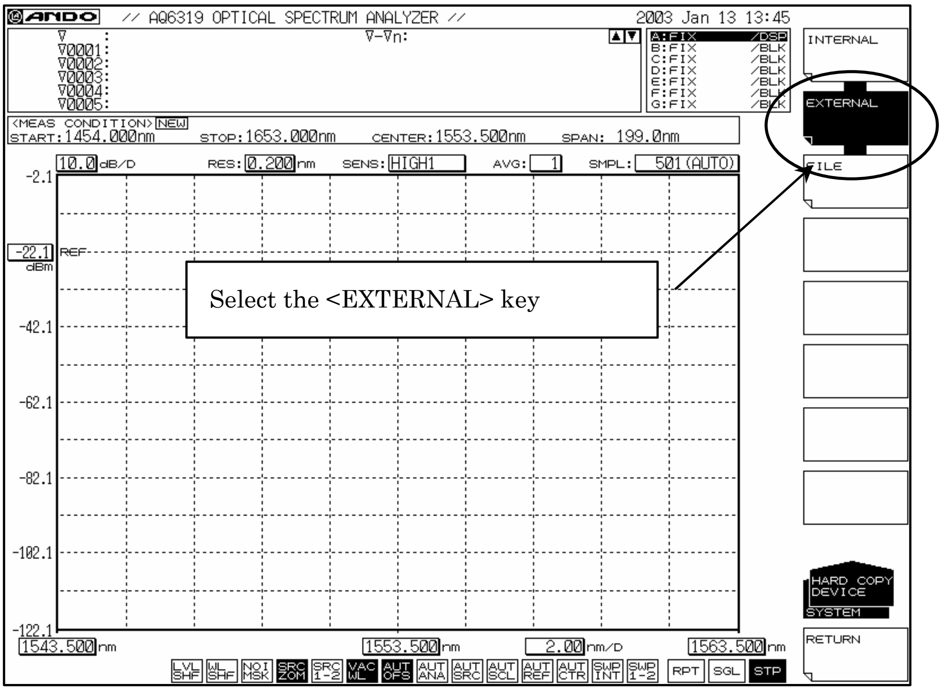


Fig. 7-63 Setting an external printer as the hard copy destination

If you have installed driver software for more than one printer, you must select the specific printer to be used for actual printing.
The procedure for doing this is shown below.

① Press the [SYSTEM] switch.

② Press the <MORE 1/4> key, then press the <EXT PRINTER SETTING> key.

③ Press the <PRINTER SELECT> key, then select the external printer to be used for printing.

7

7.8.3 Printing

After the external printer setup process has been completed, press the [COPY] switch on the unit to output print data to the external printer.

7.9 FTP Server Function

The unit is equipped with an FTP server function.
This function enables the user to read/write at high speed from an external PC by means of an FTP, waveform data and program data which the user has saved in the HDD of the unit.

7.9.1 LAN cable connection

In order to make this function available, a LAN cable needs to be connected to the unit.
Mate the terminals of the cable and the unit with each other, as shown in Fig. 7-64, and ensure that the cable is securely connected.

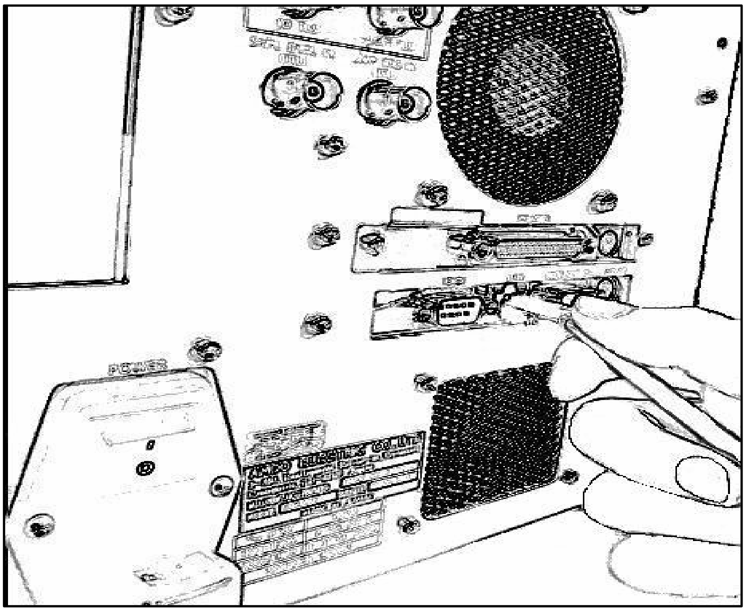


Fig. 7-64 LAN cable connection

7.9.2 Setup

The FTP connection can be made from the PC on the network to which the unit is connected, by means of FTP Client software. The setup of the FTP Client software is as follows:

HOST NAME: Computer name of the unit

Computer name can be given according to the [SYSTEM] switch → <NETWORK SETTING> key → <COMPUTER NAME> key.
(☛ 6.16 [SYSTEM] switch)
The following parameter is set by default upon factory shipment:
Default: "AQ6319@@@@@@@@@" [@@@@@@@@@: Serial number of the unit]
The serial number is given in 9-digit alphanumerics at the back of the unit.

LOGIN NAME: Anonymous

PASSWORD: none

FTP Client software can be confirmed and set by clicking the [SYSTEM] switch and then the <NETWORK SETTING> key.

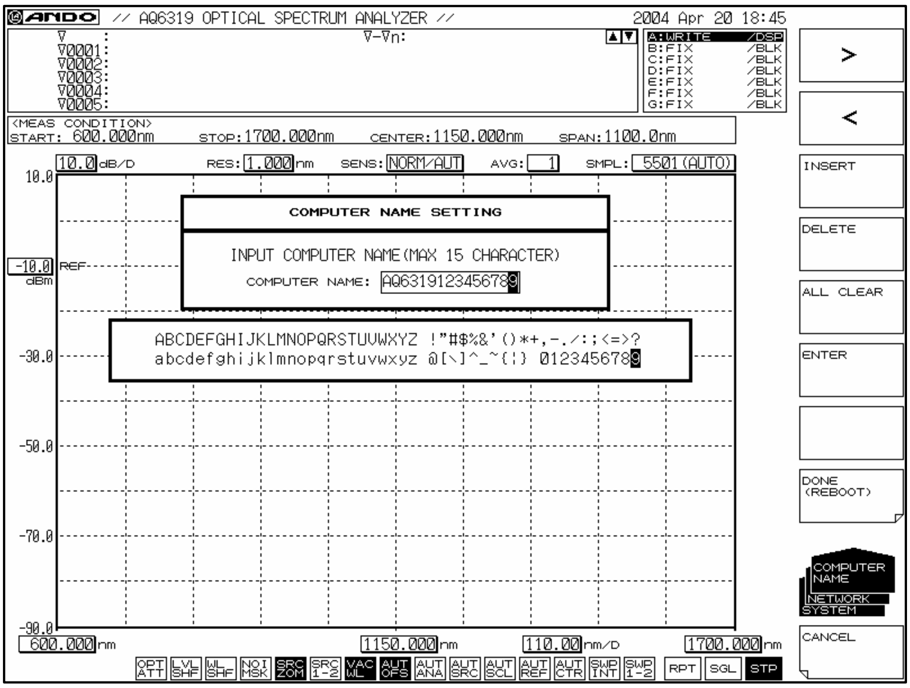


Fig. 7-65 Computer Name Setting screen

⚠ Caution

- It is necessary to set up the IP address of the AQ6319 correctly so that the FTP server function is available.
- If a DHCP server is provided on the network to which this unit is connected, the IP address given to the unit is automatically set. Thus, set the item IP ADDRESS SETTING in the [SYSTEM] →<NETWORK SETTING>→<TCP/IP SETTING> to "☑AUTO (DHCP)".
- Please ask the network administrator of your company about the details of a network.

Chapter 8 Functional Descriptions

8

8.1 Detailed Explanations of Measurement Functions

8.1.1 External Trigger Measurement Function

(1) Outline

With the external trigger interface, the AQ6319 provides an external trigger measurement function to perform measurements in synchronization with external trigger signals.

(2) Setting method

To set this unit to the external trigger mode, press the [SETUP] switch. Then, press the <MORE 1/2> key and set the <EXT TRIGGER MODE> key to ON. It is also possible to set signal logic and delay time for external trigger signals. Perform this setting with the <EXT TRIGGER SETTING> key. (☛Section 6-6 [SETUP] Switch)

(3) Function

Measurement is performed at a desired timing by allowing control signals synchronized with the measured light to enter the SMPL TRG IN terminal (input terminal for external trigger signals) at the back of this unit.

The SMPL TRG IN terminal is an input terminal on the TTL level and in positive/negative logic (which can be set by the <EXT TRIGGER SETTING> key).

A measurement point (wavelength/frequency) is incremented every time the edge of an input external trigger signal is detected. Therefore, the sweep will end when the number of input external trigger signals becomes equal to the sampling number set (set by the [SET UP] <SAMPLING POINT> key).

(However, when the <REPEAT> sweep is performed, the sweep will be repeated until the <STOP> key is pressed or until trigger signals are no longer entered.)

NOTE

- If the averaging ([SETUP] <AVERAGE TIMES>) has been set, the sweep will end when the number of input external trigger signals becomes equal to the number that is obtained by multiplying the sampling number set by the averaging times.

(4) It is not possible to change the measurement sensitivity of the external trigger mode, which is fixed (about -70dBm). When the external trigger mode is used, maximum response frequency of the internal amplifier

circuit is 30 kHz. Frequency elements of 30 kHz or more will be smoothed. The delay time (from the time when a trigger signal is detected until the time when the sampling is performed) specific to this unit is about 70 μs. An optional delay time can be set to this specific delay time. With the <DELAY> key of the <EXT TRIGGER SETTING> key, the 0.0 μs to 1000.0 μs range can be set in units of 0.1 μs. Note that, after the measurement points are set, input trigger signals during the movement to the next measurement point are ignored. The time varies depending on the measurement wavelength band and the sampling number (sampling intervals). Since the SMPL TRG IN terminal is pulled up internally, it can be set to the HIGH level while it is in the open state and to the LOW level while it is in the GND short state.

8.1.2 Sweep Trigger Function

(1) Outline

The AQ6319 provides the sweep trigger function to enable a single sweep measurement by using trigger signals, which are entered externally.

(2) Function

This unit starts a single sweep measurement by allowing sweep trigger signals on the TTL level and in negative logic to enter the SWP TRG IN terminal (sweep trigger input terminal) at the back of this unit.

The signal logic of the sweep trigger input signals is fixed to the negative logic, which cannot be changed.

The pulse width of sweep trigger signals must be 5ms or more.

This function is independent of the external trigger measurement function and operates in all measurement modes.

NOTE

- The SWP TRG IN terminal (sweep trigger input terminal), which differs from the SMPL TRG IN terminal, is an input terminal on the TTL level and in negative logic which enables sweeping with trigger signals. This function is enabled in the same way as when the [SWEEP]<SINGLE> key is pressed.
- The sweep trigger function detects sweep trigger signals by polling in certain cycles. Thus, the time after a sweep trigger signal is entered until the sweep starts will fluctuate in the range of 5ms.

8.1.3 Power Density Display Function

The level axis of the AQ6319 indicates the absolute power per wavelength resolution. For example, if the resolution is set to 0.1 nm, the power per 0.1 nm will be displayed. Since the optical spectrum of such devices as a gas laser or a laser diode is narrower than the wavelength resolution of this unit, the entire power is accommodated within the band of a resolution. Therefore, the measured power (peak level) is equal to the total power of the light source. This unit has been calibrated to display accurate power under such conditions.

On the other hand, natural light or lights such as fluorescent lamps or LEDs, have, in many cases, optical spectrums wider than the wavelength resolution set for this unit. Therefore, if this unit measures these lights, measured power will vary, depending on the resolution setting.

In order to deal with this issue, this unit is equipped with the <dBm dBm/nm> key to allow the level axis displays to switch from the absolute power (dBm, mW, μW, nW, pW) per resolution to power density (dBm/nm, mW/nm, μW/nm, nW/nm, pW/nm). In the case of power density displays, a measured value is converted to power per 1 nm. Therefore, whatever resolution is used for measurement, certain measured values will always be available. Differences in usage between the absolute power display and the power density display are shown below:

Absolute power display: measurement of light sources with narrow spectrum widths, such as gas lasers or laser diodes.

Power density display: measurement of light sources with wide spectrum widths, such as natural light or LEDs.

If the subtraction function between traces is used for such cases as A-B(A/B)→C or B-A(B/A)→C, results will be the same whether the absolute power display or the power density display is used. Since the power measurement function performs different calculations according to the level axis display, correct results will be available whichever display is employed.

Note that, if the NF measurement function (<ANALYSIS 2 EDFA-NF> key) and the WDM analysis function (<ANALYSIS 2 WDM> key) are executed, the level axis display will be forcibly changed to the absolute power display.

NOTE

- Specifications such as level accuracy, measurement level range, and level linearity of this unit are provided for the absolute power display.

8.2 Overview of Analytical Functions

The AQ6319 provides various analytical functions, such as WDM analysis, filter analysis, and EDFA-NF analysis, in addition to basic analyses such as the peak-level measurement of measured waveforms. Also, parameters for each analysis can be collectively set in the setting window, which facilitates these analyses.

These analytical functions are shown in Table 8-1 below:

Table 8-1: List of Analytical Functions

Switch	Function		Description
[SEARCH]	PEAK		Peak wavelength/level
	BOTTOM		Bottom wavelength/level
	NEXT LEVEL SEARCH		Peak/bottom on the next level
	NEXT SEARCH RIGHT/LEFT		Peak/bottom on the right/left of the current marker position
[ANALYSIS]	SPECWD	THRESH	Analysis of spectrum widths by the THRESH method
		ENVELOPE	Analysis of spectrum widths by the ENVELOPE method
		RMS	Analysis of spectrum widths by the RMS method
		PEAK RMS	Analysis of spectrum widths by the PEAK RMS method
		NOTCH	Analysis of NOTCH widths
	ANALYSIS 1	DFB-LD	Parameter analysis of DFB-LD
		FP-LD	Parameter analysis of FP-LD
		LED	Parameter analysis of LED
		SMSR	Analysis of SMSR
		POWER	Integral power of spectrums
		PMD	Analysis of PMD
	ANALYSIS 2	WDM	Analysis of WDM channels
		EDFA-NF	GAIN/NF analysis of a single/multiple channels by interpolation
		FILTER-PK	Parameter analysis of optical filters for a single channel
		FILTER-BTM	Parameter analysis of optical filters for a single channel
		WDM FIL-PK	Parameter analysis of optical filters for multiple channels
		WDM FIL-BTM	Parameter analysis of optical filters for multiple channels

8.2.1 Common Issues for Analytical Functions

There are some common issues for analyses. Pay due attention to these issues when analytical functions are employed.

(1) Applicable trace for calculation

Traces subject to calculation will become active traces. For analytical algorithms to which traces are specified (such as the WDM analysis function or the EDFA-NF analysis function), data for analysis are to be entered into specified traces. If an analysis is executed without data in an active trace, a warning message will be shown (WARNING: 103 No data in active trace).

(2) Applicable data for calculation

Data outside the measurement wavelength range is not applicable to calculation. In addition, if zero or infinite data exists in the measurement wavelength range, the relevant data is applicable to calculation.

(3) Applicable data for calculation when the between line markers search function and/or the zoom area search function is valid

If the between line markers search function is valid (<SEARCH/ANA L1-L2> key in the [MARKER] switch), data among markers is applicable to calculation.
If the search function in the zoom area is valid (<SEARCH/ANA ZOOM AREA> key in the [MARKER] switch), data within the zoom range is applicable to calculation.
If both the between line markers search function and the zoom area search function are valid, applicable data for calculation is from the area of overlap between the respective search ranges.

⚠ Caution

Applicable data for calculation for the zoom area search function

- The zoom area search function is invalid for some analytical functions. The four analytical functions below become invalid. Even if the <SEARCH/ANA ZOOM AREA> key is turned on, calculation is applicable to the entire measurement wavelength range. Note, however, that the setting of the search between line markers function (<SEARCH/ANA L1-L2> key) is reflected.
  - WDM
  - EDFA-NF
  - WDM FIL-PK
  - WDM FIL-BTM

(4) Units for setting parameters and analytical results

Some parameters require settings to be made per wavelength axis. Units of setting parameters are fixed to wavelength values independent of the wavelength mode/frequency mode settings (<HORIZON SCALE nm/THz> key setting in the [SET UP] switch). Concerning the unit of wavelength axis to be used for displaying analytical results, wavelength values and frequency values can be changed by the setting of the marker unit (<MARKER UNIT> key in the [MARKER] switch).

8.2.2 GRID Table

Some analytical functions refer to the GRID table for analysis. (☛ Table 8-2 List of Analytical Functions with GRID Tables)

The AQ6319 contains the nominal center frequencies specified by the ITU-T (International Telecommunication Union-Telecommunication sector) G692 as the GRID table. It also contains two tables: the standard GRID table created according to the pre-defined wavelength (frequency) range and the custom GRID table that users can edit freely.

Table 8-2: List of Analytical Functions with GRID Tables

Function	Item	Parameter Name	Setting Parameter
WDM	DISPLAY SETTING	DISPLAY TYPE	DRIFT(GRID)
FILTER PEAK	CROSS TALK	ALGO	GRID
FILTER BOTTOM	CROSS TALK	ALGO	GRID
WDM FILTER PEAK	CHANNEL DETECTION/ NOMINAL WAVELENGTH	ALGO	GRIF FIT GRID
WDM FILTER BOTTOM	CHANNEL DETECTION/ NOMINAL WAVELENGTH	ALGO	GRIF FIT GRID

NOTE

- Concerning the units of wavelength axis for GRID tables, wavelength values and frequency values can be changed by the setting of marker units (<MARKER UNIT> key in the [MARKER] switch).

The two GRID tables (standard and custom) have different parameter ranges, which are shown in Table 8-3:

Table 8-3: Parameter Ranges for Each GRID Table

	Type	Parameter Range
Standard GRID Table	Start frequency	192.1000THz (fixed)
	Stop frequency	196.1000THz (fixed)
	Reference frequency	176.3486 - 299.7924THz
	Frequency spacing	To be selected from among 200GHz/100GHz/50GHz/25GHz/12.5GHz.
Fixed GRID Table	Start frequency	176.3486 - 229.7924THz
	Stop frequency	176.3486 - 299.7924THz
	Reference frequency	176.3486 - 299.7924THz
	Frequency spacing	1.0 - 999.9GHz

Each of these two GRID tables can be set as follows:

(1) Standard GRID Table

This GRID table is created with pre-defined wavelength (frequency) ranges. It can be created in the following manner by setting the reference wavelength (frequency) and frequency spacing.

① Press the [SYSTEM] switch and then press the <GRID EDITOR> key. The GRID Table editing window as shown in Figure 8-1 is displayed.

② Choose a frequency spacing from among the following five options:

200GHz SPACING
100GHz SPACING
50GHz SPACING
25GHz SPACING
12.5GHz SPACING

③ For the reference wavelength, press the <REFERENCE WAVELENGTH> key and set it in the DATA ENTRY section.

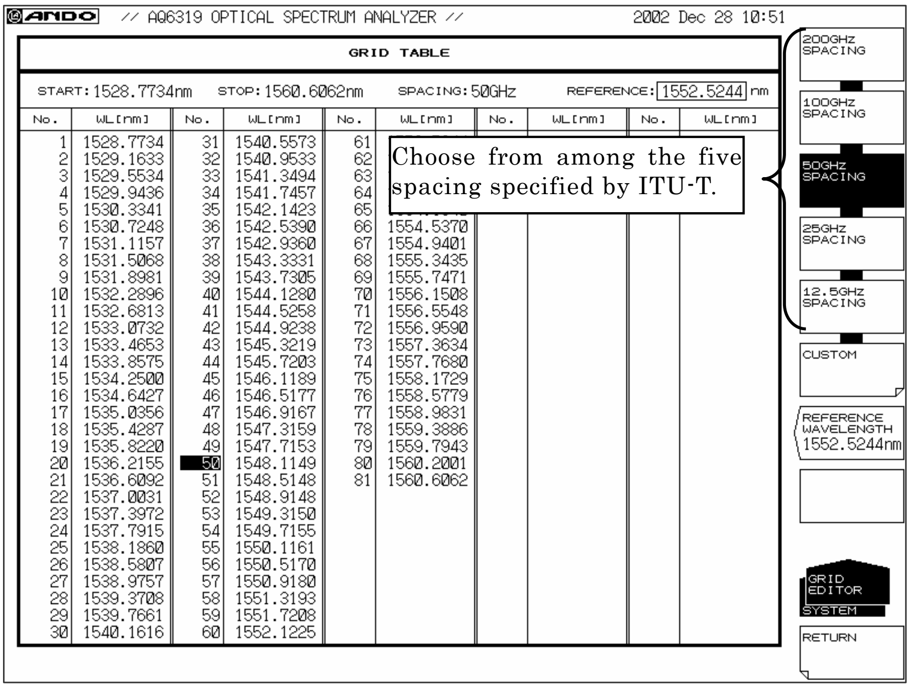


Fig. 8-1: Editing of the Standard GRID Table

8

(2) Custom GRID Table

Users can edit this GRID table freely. It is created automatically by setting the start/stop wavelength (frequency), reference wavelength (frequency), and frequency spacing. Users can add or delete an arbitrary channel to/from the created GRID table or edit wavelength (frequency) values for each channel there. If the <GRID EDITOR> key in the [SYSTEM] switch is pressed and then the <CUSTOM> key is pressed, the Custom GRID Table editing window as shown in Figure 8-2 is displayed.
If this GRID Table is edited and then the <EXECUTE> key is pressed, the table is reflected in analytical functions. After this process, the soft key (<CUSTOM> key) will be inverted.

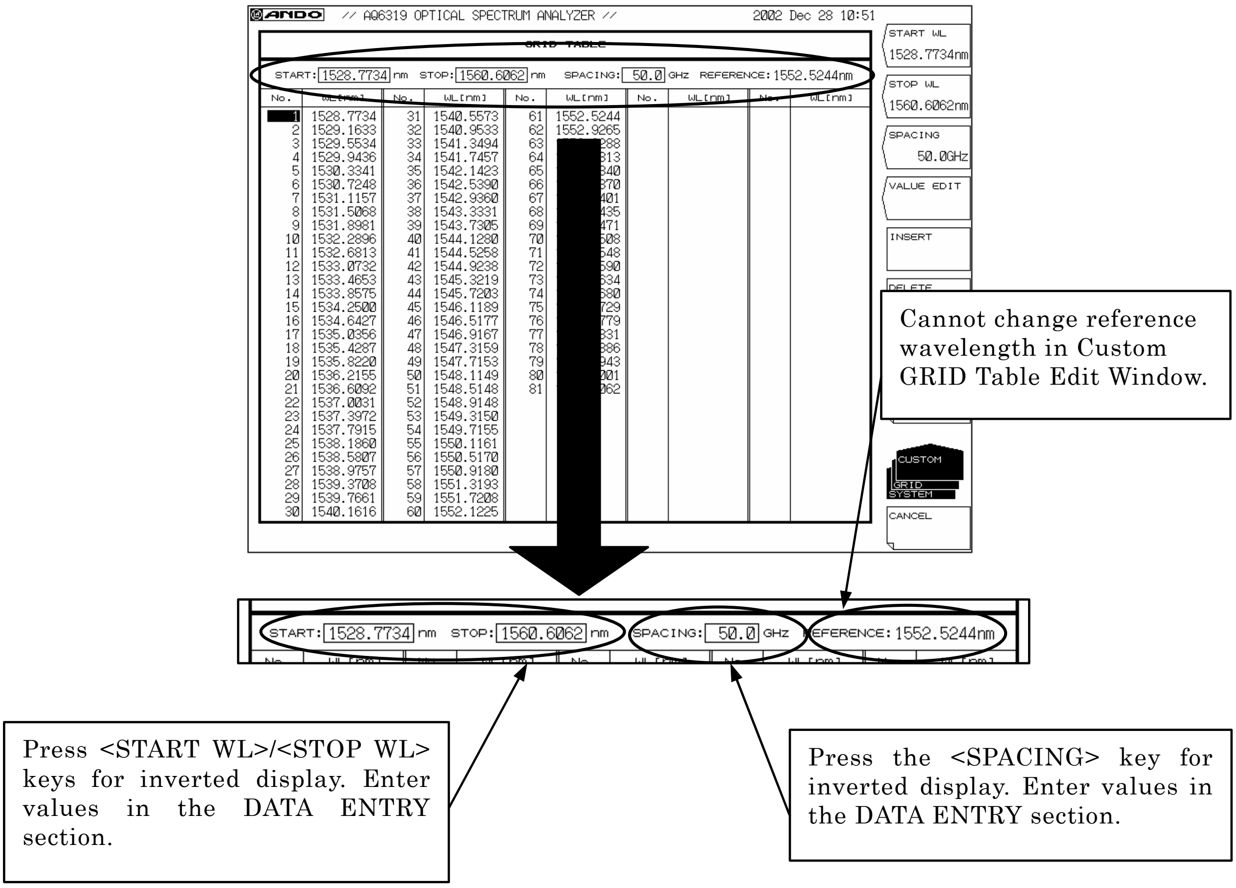


Fig. 8-2: Editing Window of Custom GRID Table

⚠Caution

- If you press the <CANCEL> key without pressing the <EXECUTE> key after the editing of Custom GRID Table, the edited data will be cancelled.

The Custom GRID Table can be edited in the following manner:

✓ Setting of start/stop wavelength(frequency) values

To set start/stop wavelengths in the Custom GRID Table, press the soft <START WL>/<STOP WL> keys so that the START/STOP frames in the table will be inverted. Enter values in the DATA ENTRY sections.

✓ Setting of frequency spacing

To set frequency spacing, press the soft <SPACING> key so that SPACING in the table will be inverted. Enter values in the DATA ENTRY section.

✓ Setting of the reference frequency

As in the setting of the reference frequency in the Standard GRID Table, press the <REFERENCE WAVELENGTH> key in the GRID Table editing window shown in Figure 8-1. Then, set the frequency in the DATA ENTRY section.

✓ Setting of the wavelength (frequency) value for a channel point

Apply the inverted display to a channel point to be changed. Press the <VALUE EDIT> key so that the interrupt display will appear. Change values in the DATA ENTRY section.

8

✓ Insertion of channel points

To insert a value between certain channel points, apply the inverted display to the channel points for insertion and press the <INSERT> key. Then, the same values as the wavelength (frequency) values of inverted channel points will be inserted into the channel points. Inverted points and subsequent ones will be shifted downward by one point.

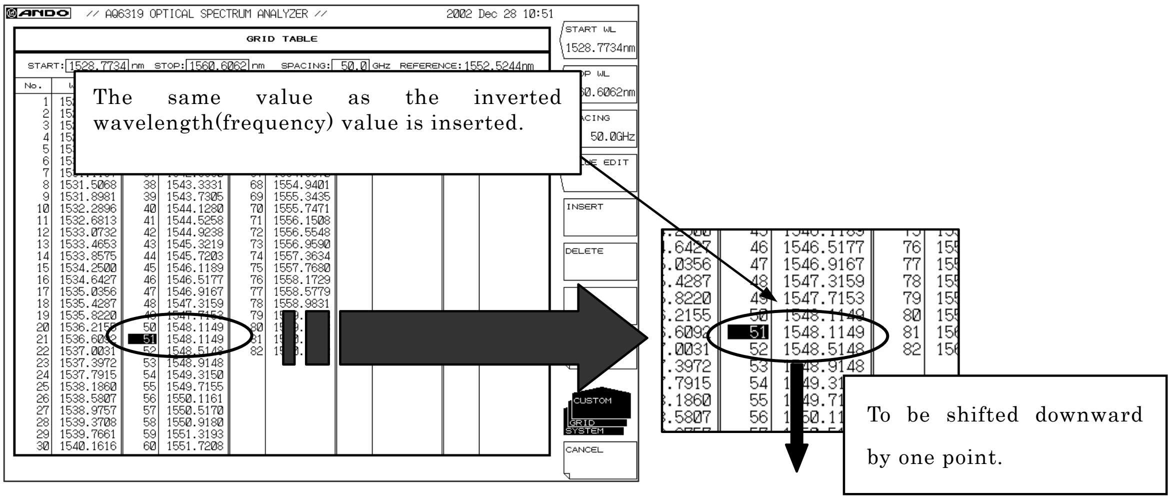


Fig. 8-3: Insertion of Channel Points

✓ Deletion of channel points

Apply the inverted display to a channel point to be deleted and press the <DELETE> key. The wavelength (frequency) value of the selected channel point will be deleted. The inverted point and subsequent points will be shifted upward by one point.

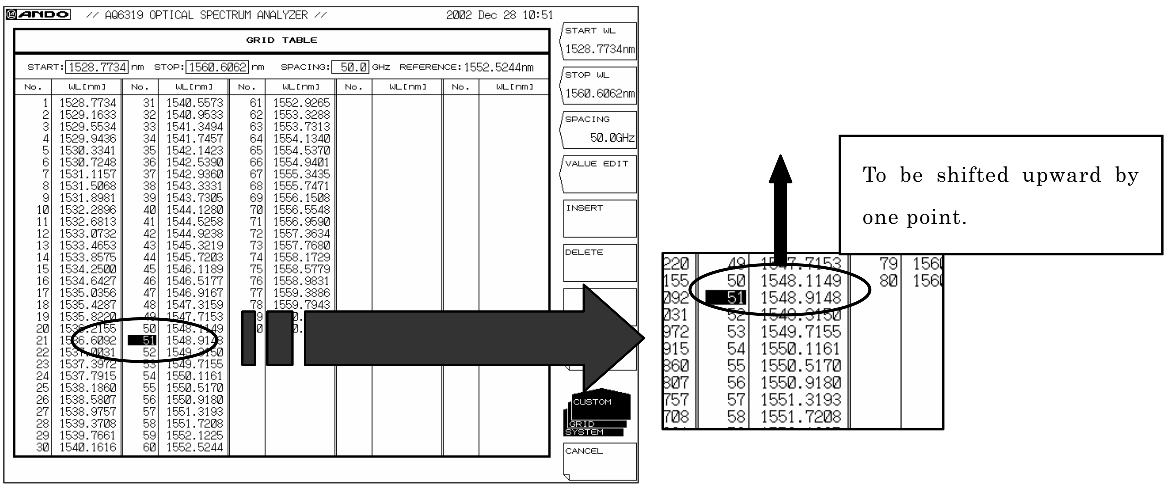


Fig. 8-4: Deletion of Channel Points

8.3 Data Calculation Algorithms for Spectrum Widths

With the [ANALYSIS] switch, the AQ6319 can calculate spectrum widths of waveforms being displayed. This section provides four types of spectrum width calculation methods as well as algorithms for the NOTCH width calculation.

8.3.1 THRESH method

This method is used to obtain the spectrum widths of two points, which are lower than the peak level by a threshold value (THRESH [dB]) specified by a parameter, as well as their center wavelengths.
Table 8-4 below shows the details of parameters for the THRESH method.

Table 8-4: Details of Parameters for THRESH Analysis

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
THRESH	TH	3.00	0.01 to 50.00	DB	Threshold value
THRESH K	K	1.00	1.00 to 10.00	-	Multiplying factor
MODE FIT	MODE FIT	OFF	ON / OFF	-	Set whether the half-of-maximum point is aligned to the mode peak or not.

Algorithms differ depending on the number of mode peaks. Algorithms for these numbers are described below:

(1) In the case of one mode peak,

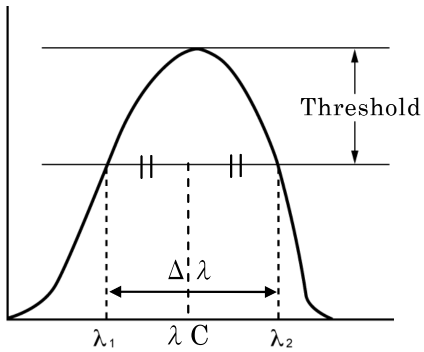


Fig. 8-5: In case of one mode peak

① Perform a mode search to obtain the mode peak.

② Set the wavelengths, which cross the line below the mode peak by the threshold value (THRESH[dB]), to $\lambda 1$ and $\lambda 2$.

③ Use the following equations, which incorporate multiplication by the multiplying factor K for $\lambda 1$ and $\lambda 2$, to obtain new $\lambda 1$ and $\lambda 2$.

$\lambda' C = (\lambda 2 + \lambda 1)/2$

$\lambda 1 = K \times (\lambda 1 - \lambda' C) + \lambda' C$

$\lambda 2 = K \times (\lambda 2 - \lambda' C) + \lambda' C$

④ Obtain the spectrum width from the following equation:

$\Delta \lambda = \lambda 2 - \lambda 1$

⑤ Obtain the center wavelength λC from the following equation:

$\lambda C = (\lambda 2 + \lambda 1)/2$

NOTE

- If "MODE FIT" is set to ON in the case of a one mode peak, the spectrum width $\Delta\lambda$ and the center wavelength λC will become as follows:
  $\Delta\lambda = 0.0000\text{nm}$
  λC = center wavelength of the mode peak

(2) In the case of two or more mode peaks:

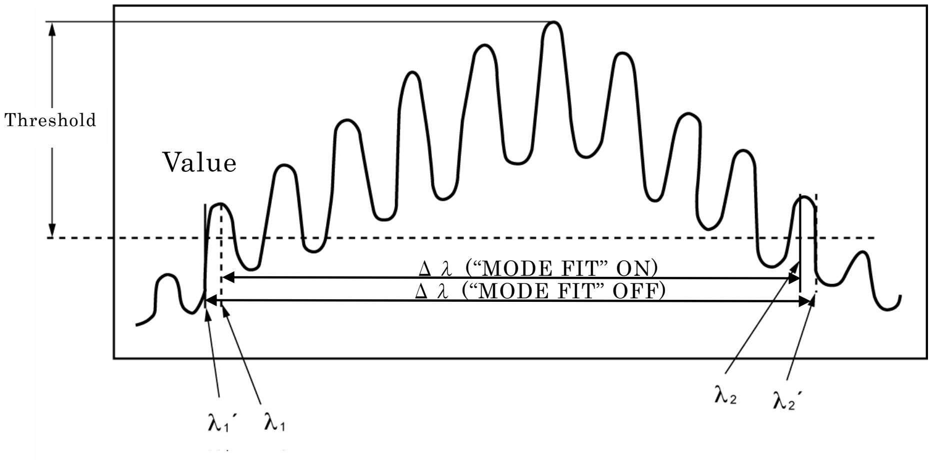


Fig. 8-6: In the case of two or more mode peaks

① If "MODE FIT" is ON, set the wavelengths of the mode peaks, which are outmost from the threshold value (THRESH[dB]) among the mode peaks, to $\lambda 1$ and $\lambda 2$. If "MODE FIT" is OFF, set the wavelengths, which are located outside $\lambda 1$ and $\lambda 2$, and which cross the line below the mode peak with the largest mode peak level by the threshold value (THRESH[dB]), to $\lambda' 1$ and $\lambda' 2$.

② If "MODE FIT" is ON, use the following equations, which incorporate multiplication by the multiplying factor K for $\lambda 1$ and $\lambda 2$, to obtain new $\lambda 1$ and $\lambda 2$.

$$\left.\begin{aligned} \lambda C' &= (\lambda 2+\lambda 1)/2 \\ \lambda 1 &= K \times (\lambda 1 - \lambda' C) + \lambda' C \\ \lambda 2 &= K \times (\lambda 2 - \lambda' C) + \lambda' C \end{aligned}\right\}\text{When "MODE FIT" is ON}$$

$$\left.\begin{aligned} \lambda C' &= (\lambda' 2+\lambda' 1)/2 \\ \lambda' 1 &= K \times (\lambda' 1 \ \lambda' C) + \lambda' C \\ \lambda' 2 &= K \times (\lambda' 2 - \lambda' C) + \lambda' C \end{aligned}\right\}\text{When "MODE FIT" is OFF}$$

③ Obtain spectrum widths from the following equations:

$\Delta\lambda = \lambda 2 - \lambda 1$ (when "MODE FIT" is ON)

$\Delta\lambda = \lambda' 2 - \lambda' 1$ (when "MODE FIT" is OFF)

④ Obtain center frequencies λC from the following equations:

$\lambda C = (\lambda 2+\lambda 1)/2$ (when "MODE FIT" is ON)

$\lambda C = (\lambda'2+\lambda'1)/2$ (when "MODE FIT" is OFF)

MODE displayed in the data area shall be the number of mode peaks between $\lambda 1$ and $\lambda 2$.

8.3.2 ENVELOPE method

This method is used in conjunction with a straight line (envelope) connecting mode peaks to obtain the spectrum widths of the two points, which are lower than the peaks by a configured threshold value (THRESH [dB]), as well as their center wavelengths. Table 8-5 shows the details of parameters for the ENVELOPE method.

Table 8-5: Details of Parameters for ENVELOPE Analysis

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
THRESH 1	TH1	3.00	0.01 to 50.00	DB	Threshold value
THRESH 2	TH2	13.00	0.01 to 50.00	dB	Lower limit value when the number of modes is calculated
K	K	1.00	1.00 to 10.00	-	Multiplying factor

Algorithms differ depending on the number of valid mode peaks. Valid mode peaks mean the mode peaks, among the mode peaks obtained from a mode search, whose level (LOG) is equal to or greater than the line that is below the peak level by the lower limit (THRESH2). Algorithms for these numbers of valid modes are described below:

(1) In the case of one valid mode peak,

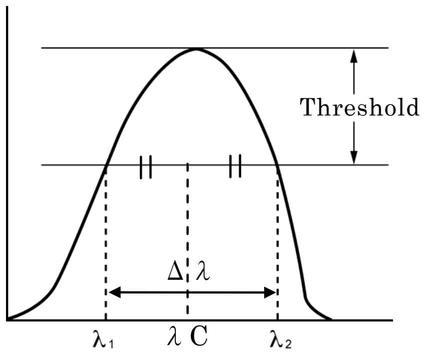


Fig. 8-7: In the case of one valid mode peak or less

① Perform a mode search to obtain the mode peak.

② Set the wavelengths, which cross the line below the mode peak by the threshold value (THRESH[dB]), to $\lambda 1$ and $\lambda 2$.

③ Use the following equations, which incorporate multiplication by the multiplying factor K for $\lambda 1$ and $\lambda 2$, to obtain new $\lambda 1$ and $\lambda 2$.

$\lambda'C = (\lambda 2+\lambda 1)/2$

$\lambda 1 = K \times (\lambda 1 - \lambda'C) + \lambda'C$

$\lambda 2 = K \times (\lambda 2 - \lambda'C) + \lambda'C$

④ Obtain the spectrum width from the following equation:

$\Delta\lambda = \lambda 2 - \lambda 1$

⑤ Obtain the center wavelength λC from the following equation:

$\lambda C = (\lambda 2 + \lambda 1)/2$

(2) In the case of two valid mode peaks,

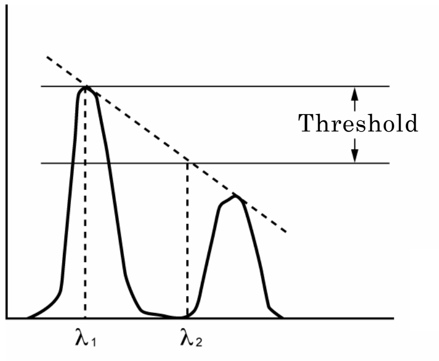


Fig. 8-8: ENVELOPE method for two valid mode peaks

① Set the levels (LOG) of the two valid mode peaks to LG1 and LG2 in order from the left.

② Obtain $\lambda 1$ and $\lambda 2$ in the following manner.

②-1 In the case of |LG2-LG1| ≦ threshold value (THRESH1[dB])

λ becomes $\lambda 1$ and $\lambda 2$ from the left in order.

②-2 In the case of |LG2-LG1| > threshold value (THRESH1[dB])

(i) Connect two valid mode peaks with a straight line (envelope).

(ii) In the case of LG1>LG2, set the wavelength for the left mode peak to $\lambda 1$. Set the wavelength of the point, where the line below the peak level by the threshold value (THRESH[dB]) and the straight line (envelope) cross, to $\lambda 2$.

(iii) In the case of LG1<LG2, set the wavelength for the right mode peak $\lambda 2$. Set the wavelength of the point, where the line below the peak level by the threshold value (THRESH[dB]) and the straight line (envelope) cross, to $\lambda 2$.

8

③ Use the following equations, which incorporate multiplication by the multiplying factor K for $\lambda 1$ and $\lambda 2$, to obtain new $\lambda 1$ and $\lambda 2$.

$\lambda C' = (\lambda 2 + \lambda 1)/2$

$\lambda 1 = K \times (\lambda 1 - \lambda' C) + \lambda' C$

$\lambda 2 = K \times (\lambda 2 - \lambda' C) + \lambda' C$

④ Obtain the spectrum width from the following equation: $\Delta\lambda = \lambda 2 - \lambda 1$

⑤ Obtain the center wavelength λC from the following equation: $\lambda C = (\lambda 2 + \lambda 1)/2$

(3) In the case of three or more valid mode peaks,

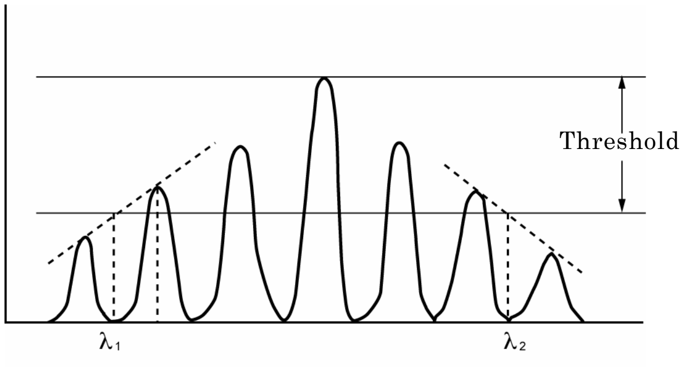


Fig. 8-9: ENVELOPE method for three or more valid mode peaks

① Set the levels (LOG) of three or more valid mode peaks to LG1, LG2・・・LGn in order from the left. Set the level of the mode peak at the highest level to LGp.

② Obtain $\lambda 1$ in the following manner:

②-1 In the case of |LGp-LG1| ≦ threshold value (THRESH1[dB])
Set the wavelength of the LG1 mode peak to $\lambda 1$.

②-2 In the case of |LGp-LG1| > threshold value (THRESH1[dB])

(ⅰ) Obtain the leftmost mode peak with |LGp-THRESH1| or more.

(ⅱ) Use a straight line to connect the mode peak obtained in (ⅰ) with the mode peak on the left of (ⅰ) and also at the highest level.

(ⅲ) Set the point, where the line of |LGp-THRESH1| and the straight line (envelope) cross, to $\lambda 1$.

③ Obtain $\lambda 2$ in the following manner:

③-1 In the case of |LGp-LGn| ≦ threshold value (THRESH1[dB])
Set the wavelength of the LG1 mode peak to $\lambda 2$.

③-2 In the case of |LGp-LGn|> threshold value (THRESH1[dB])

(i) Obtain the rightmost mode peak with |LGp-THRESH1| or more.

(ii) Use a straight line to connect the mode peak obtained in (i) with the mode peak on the right of (i) and also at the highest level.

(iii) Set the point, where the line of |LGp-THRESH1| and the straight line (envelope) cross, to $\lambda 2$.

④ Use the following equations, which incorporate multiplication by the multiplying factor K for $\lambda 1$ and $\lambda 2$, to obtain new $\lambda 1$ and $\lambda 2$.

$\lambda C' = (\lambda 2+\lambda 1)/2$

$\lambda 1 = K \times (\lambda 1 - \lambda 'C) + \lambda 'C$

$\lambda 2 = K \times (\lambda 2 - \lambda 'C) + \lambda 'C$

⑤ Obtain the spectrum width from the following equation: $\Delta \lambda = \lambda 2 - \lambda 1$

⑥ Obtain the center wavelength λC from the following equation: $\lambda C = (\lambda 2+\lambda 1)/2$

8

8.3.3 RMS Method

Use the RMS method to obtain the spectrum width and its center wavelength. Table 8-6 shows the details of parameters for the RMS method.

Table 8-6: Details of Parameters for RMS Analysis

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
THRESH	TH	20.00	0.01 to 50.00	dB	Lower limit value
K	K	1.00	1.00 to 10.00	-	Multiplying factor

Algorithms for the analysis are described below:

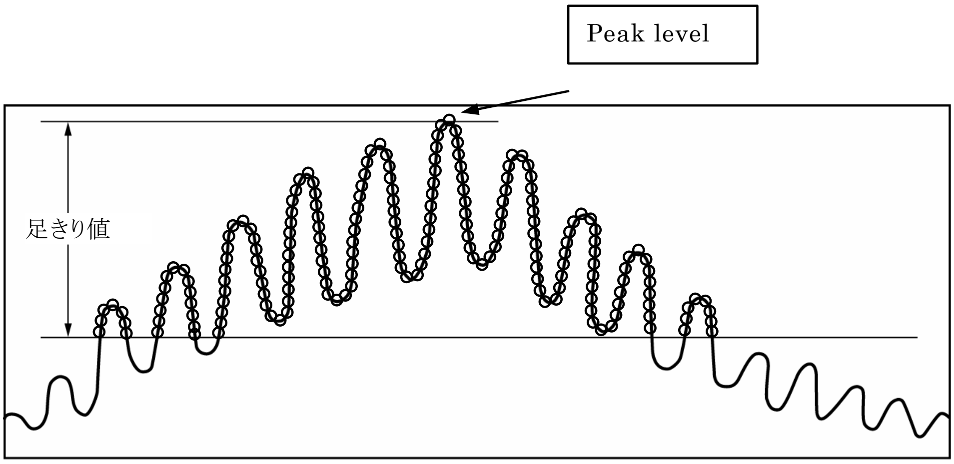


Fig. 8-10: RMS Analysis

① Take out the data points exceeding the limit value TH, as shown in the Fig 8-10, within the displayed waveform, and find the spectrum width by the following calculation.

② When the wavelength at beach point is λi and the level at the point is Pi, the mean wavelength λc can be found by the following expression.

$$\lambda_c = \frac{\sum Pi \times \lambda i}{\sum Pi}$$

③ By using the mean wavelength λc obtained in ②, find the spectrum width Δλ by the following expression.

$$\Delta\lambda = \sqrt{\frac{\sum Pi \times (\lambda i - \lambda c)^2}{\sum Pi}}$$

K : Magnification by which the spectrum width is multiplied.

8.3.4 PEAK RMS Method

Use the PEAK RMS method to obtain the spectrum width and its center wavelength.

Table 8-7 shows the details of the parameters for the PEAK RMS method.

Table 8-7: Details of Parameters for PEAK RMS Analysis

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
THRESH	TH	20.00	0.01 to 50.00	dB	Lower limit value
K	K	1.00	1.00 to 10.00	-	Multiplying factor

Algorithms for the analysis are described below:

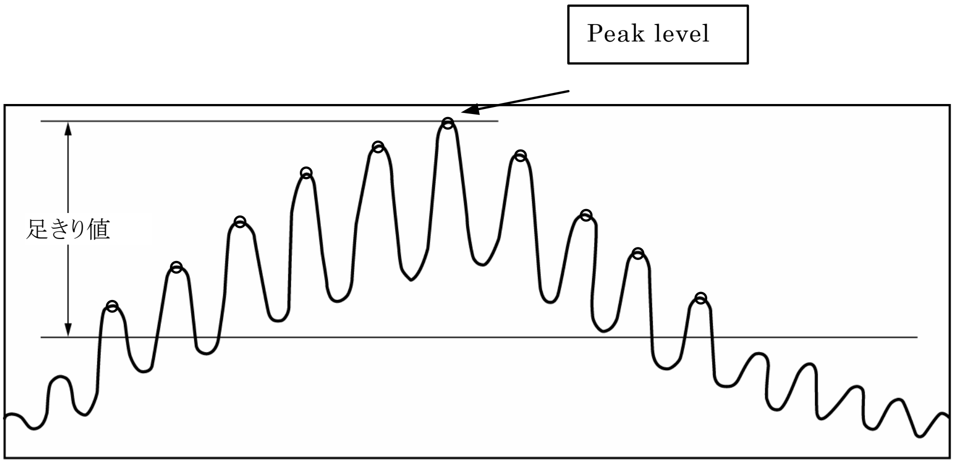


Fig. 8-11: PEAK RMS Analysis

① Take out the data points exceeding the limit value TH, as shown in the Fig 8-11, within the displayed waveform, and find the spectrum width by the following calculation.
The mode peak count above the TH is shown in the MODE data area.

② When the wavelength at beach point is λi and the level at the point is Pi, the mean wavelength λc can be found by the following expression.

$$\lambda_c = \frac{\sum Pi \times \lambda i}{\sum Pi}$$

③ By using the mean wavelength λc obtained in ②, find the spectrum width Δλ by the following expression.

$$\Delta\lambda = \sqrt{\frac{\sum Pi \times (\lambda i - \lambda c)^2}{\sum Pi}}$$

K : Magnification by which the spectrum width is multiplied.

8

8.3.5 NOTCH Width Measurement

Obtain a bottom level. Then, obtain the NOTCH width for the bottom level and its center wavelength.

Table 8-8 shows the details of parameters for NOTCH analyses.

Table 8-8: Details of Parameters for NOTCH Width Measurement Function

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
THRESH	TH	3.00	0.01 to 50.00	dB	Threshold value
K	K	1.00	1.00 to 10.00	-	Multiplying factor
TYPE	TYPE	BOTTOM	BOTTOM / PEAK	-	Reference position for search

Algorithms for analyses are described here. They differ depending on the types of analysis (BOTTOM/PEAK). Algorithms for each type of analysis are described below.

(1) If "TYPE" is BOTTOM,

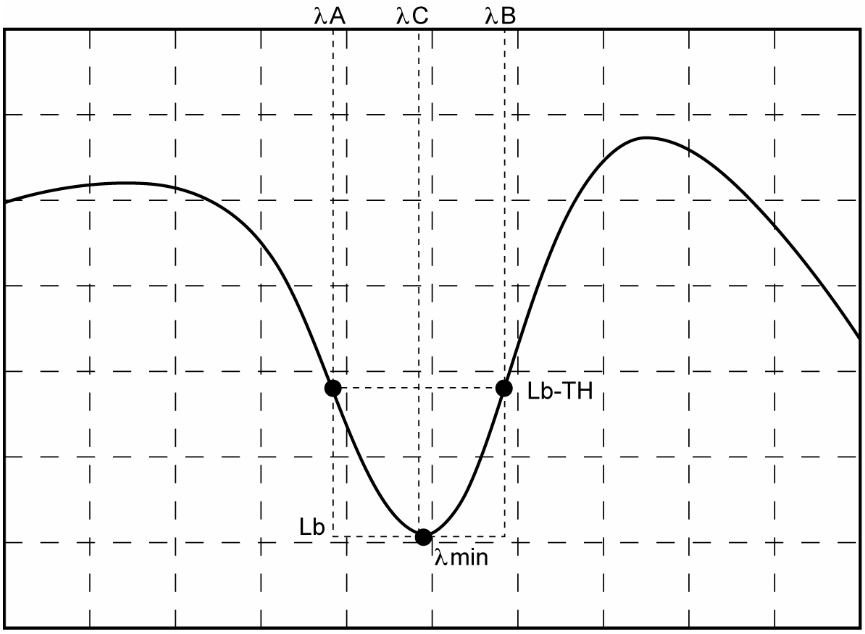


Fig. 8-12: NOTCH Width Measurement (BOTTOM)

① Obtain the minimum level "LGmin." Also, set the wavelength of this point to λmin.

② Set the rightmost wavelength, which is located on the left of λmin and which crosses the level (LOG) of |LGmin-threshold value (THRESH[dB])|, to λA.

③ Set the leftmost wavelength, which is located on the right of λmin and which crosses the level (LOG) of |LGmin-threshold value (THRESH[dB])|, to λB.

④ Obtain λA and λB through multiplication by the value which is set to the multiplying factor K.

$\lambda C' = (\lambda B + \lambda A)/2$

$\lambda A = K \times (\lambda A - \lambda' C) + \lambda' C$

$\lambda B = K \times (\lambda B - \lambda' C) + \lambda' C$

⑤ Obtain the NOTCH width from the following equation:

$\Delta\lambda = \lambda B - \lambda A$

⑥ Obtain the center wavelength λC from the following equation:

$\lambda C = (\lambda A + \lambda B) / 2$

(2) If “TYPE” is PEAK,

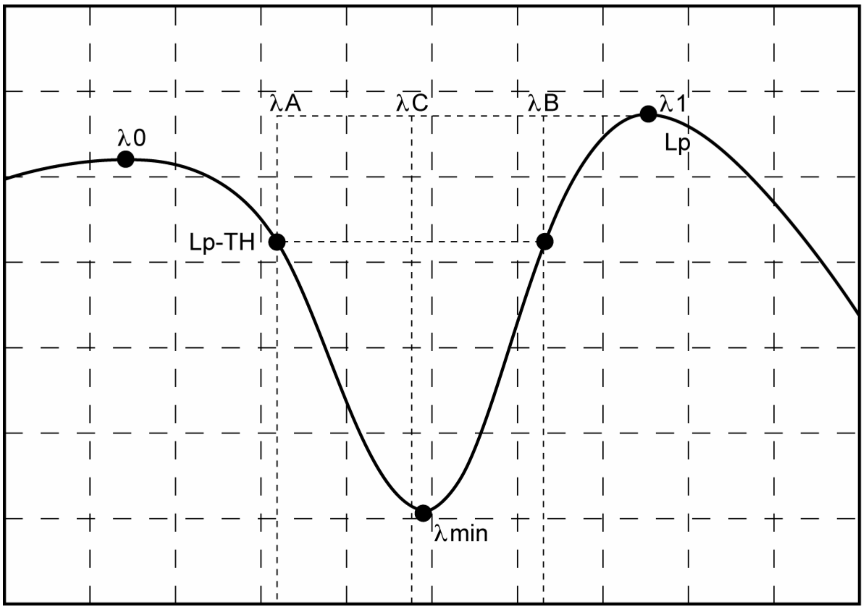


Fig. 8-13: NOTCH Width Measurement (PEAK)

① Obtain the minimum level “LGmin.” Also, set the wavelength of this point to λmin.

② Obtain LG0 at the peak level (LOG) on the left of LGmin. Also, set the wavelength of this point to λ0.

③ Obtain LG1 at the peak level (LOG) on the right of LGmin. Also, set the wavelength of this point to λ1.

④ Of LG0 and LG1, set whichever is greater to Lp.

⑤ Between λ0 and λ1, set the leftmost wavelength crossing the level (LOG) of |Lp-threshold value (THRESH[dB])| to λA.

⑥ Between λ0 and λ1, set the rightmost wavelength crossing the level (LOG) of |Lp-threshold value (THRESH[dB])| to λB.

⑦ Obtain λA and λB through multiplication by the value which is set to the multiplying factor K.

$\lambda C' = (\lambda B + \lambda A)/2$

$\lambda A = K \times (\lambda A - \lambda' C) + \lambda' C$

$\lambda B = K \times (\lambda B - \lambda' C) + \lambda' C$

8

⑧ Obtain the NOTCH width from the following equation:

$$\Delta\lambda = \lambda B - \lambda A$$

⑨ Obtain the center wavelength λC from the following equation:

$$\lambda C = (\lambda A + \lambda B) / 2$$

8.4 Details of Various Analytical Functions (ANALYSIS1)

This section describes the algorithms for analyses using the <ANALYSIS 1> key in the [ANALYSIS] switch. <ANALYSIS 1> provides such functions as collective analysis of various light sources, POWER analysis, SMSR analysis, and PMD analysis.

8.4.1 SMSR Analysis Function

Use the optical spectrum after the measurement of DFB-LD to analyze the SMSR (Side Mode Suppression Ratio) of DFB-LD.
Table 8-9 shows the details of parameters for NOTCH analyses.

Table 8-9: Details of Parameters for SMSR Analyses

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
SMSR MODE	MODE	SMSR1	SMSR1/ SMSR2	-	Execution mode during SMSR measurement
SMSR MASK	MASK	±0.00	0.00 to 99.99	nm	Setting of near-peak mask range during SMSR1 measurement

Algorithms for analyses are described here. They differ depending on the SMSR modes. Algorithms for each mode of analysis are described below.

(1) SMSR1

The next highest mode peak after excluding the highest mode peak level and the mask setting range is defined as the side mode.

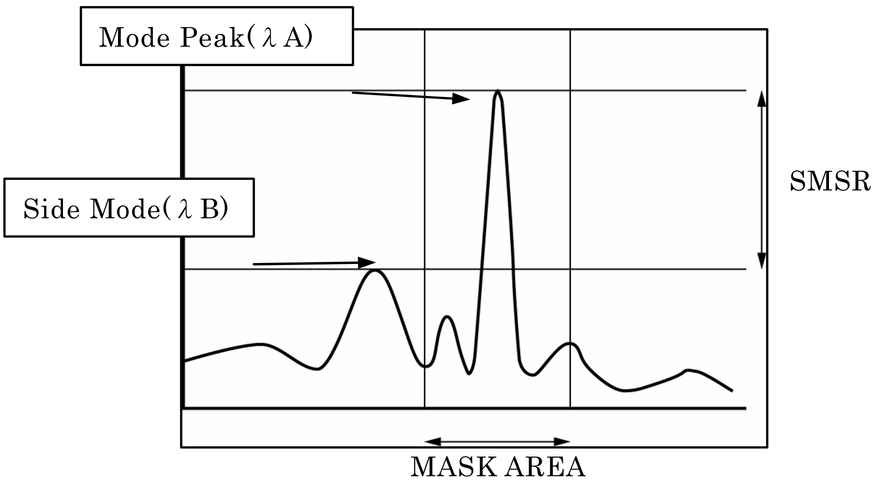


Fig. 8-14: Definition of Side Mode in SMSR1

Algorithms of analysis for the SMSR1 mode are as follows:

① Perform a mode search to obtain the mode peak.

② Of the obtained mode peaks, set the point of the mode peak at the highest level (LOG) to PA. Also, set the wavelength value of this point to λA.

③ Except for the mode peaks within the range of PA ± 1000 × (SMSR MASK)/SPAN, set the wavelength of the highest mode peak, which is next to PA, to λB. If a relevant point does not exist, set the wavelength value at the highest level outside the range of PA±1000×(SMSR MASK)/SPAN to λB. If there is more than one λB, set the leftmost wavelength value to λB. Also, set the levels (linear values) for each point of λA and λB to LA and LB.

④ Obtain SMSR and Δλ from the following equations:

$$SMSR = LA / LB$$

$$\Delta\lambda = \lambda B - \lambda A$$

(2) SMSR2

Of the highest mode peak level and the mode peaks on either side, whichever is higher is defined as the side mode.

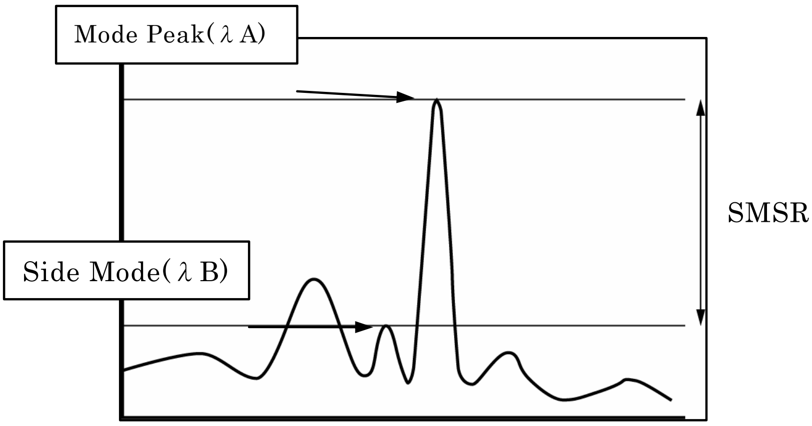


Fig. 8-15: Definition of Side Mode in SMSR1

Algorithms of analysis for the SMSR1 mode are as follows:

① Perform a mode search to obtain the mode peak.

② Of the obtained mode peaks, set the wavelength value of the mode peak at the highest level (LOG) to λA.

③ Of the mode peaks on either side of λA, set the wavelength value at the higher level to λB. If there is no mode peak other than λA, λB = λA shall be applicable.

④ Also, set the levels (linear values) for each point of λA and λB to LA and LB.

⑤ Obtain SMSR and Δλ from the following equations:

$$SMSR = LA / LB$$

$$\Delta\lambda = \lambda B - \lambda A$$

8.4.2 POWER Analysis Function

This function allows the user to add up level values of measured waveforms, thereby enabling the calculation of total power. It would be more convenient if the between line markers search function and the zoom area search function were also used for the POWER analysis. For details, refer to Subsections 7.1.5 Power Measurement Function in Zoom Area and 7.3.9 Line Marker Totalized Power Measurement Function in Chapter 7.

Table 8-10 shows the details of the parameters for POWER analysis.

Table 8-10: Details of the Parameter for POWER Analysis

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
POWER OFFSET	OFST	0.00	-10.00 to 10.00	dB	Compensation value in power measurement

Algorithms for the analysis are as follows:

① Obtain actual wavelength resolutions for all display points. (Use the table to interpolate the values for $\lambda x = \lambda SHIFT + \lambda OFST$.)
While in the vacuum wavelength mode (<MEAS WL AIR/VACUUM> key in the [SET UP] switch), use the following equation to obtain λx.

$$\lambda 0 = \lambda + \lambda SHIFT$$
$$\lambda x = \lambda 0 / N(\lambda 0) + \lambda OFST$$

If the display mode on the X axis (<HORIZON SCALE nm/THz> key in the [SET UP] switch) is the frequency display mode, use the equation below to convert an actual resolution (frequency) Ri for all display points to a wavelength value.

$$Ri = \frac{\lambda i \times \lambda i \times Rfi}{C}$$

Note:
λi : wavelength (nm) at each point
Rfi : actual resolution (THz)
C: Speed of light in the vacuum (2.99792458×10^8[m/s])

② Set the actual resolution for the i*th* point to Ri, while setting the level to Li.

③ Obtain the total power in the equation below:

$$POWER = \frac{SPAN}{SAMPLE - 1} \times \sum \frac{Li}{Ri} \times POWEROFFSET$$

If the display scale for the waveform and level axis of A-B(LOG) and B-A(LOG), which are calculation functions of trace C, is set to dBm/nm (<LEVEL UNIT dBm/dBm/nm> key in the [LEVEL] switch) display, obtain the total power from the equation below:

$$POWER = \frac{SPAN}{SAMPLE - 1} \times \sum Li \times POWEROFFSET$$

8.4.3 PMD Analysis Function

Measured waveforms are used to analyze PMD values.

Table 8-11 shows the details of the parameter for PMD analysis.

Table 8-11: Details of the Parameter for PMD Analysis

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
THRESH	TH	10.00	0.01 to 50.00	dB	Threshold value

Algorithms of the analysis are as follows:

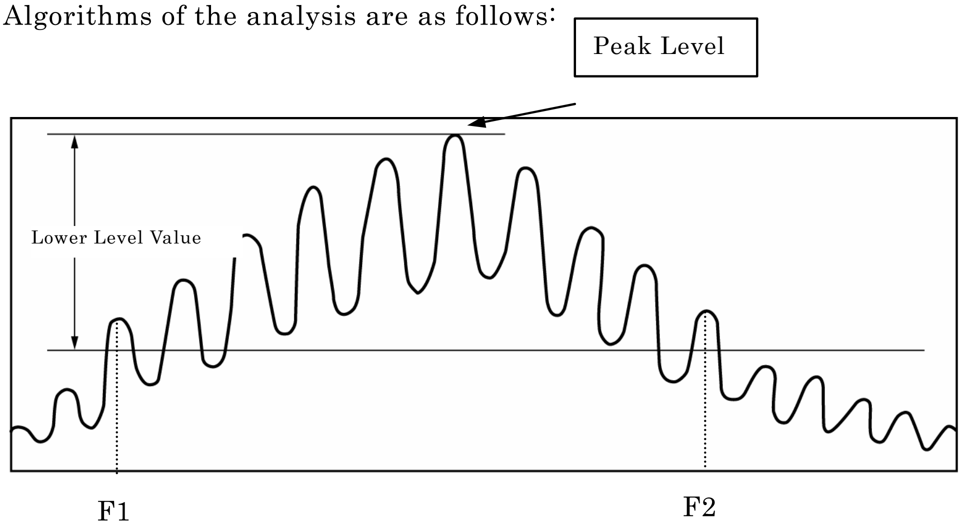


Fig. 8-16: PMD Analysis

① Perform a mode search to obtain mode peaks.

② Of these mode peaks, set the ones whose level (LOG) is equal to or greater than the line that is below the peak level by the lower limit (THRESH), to the valid mode peaks.

③ Set the frequency of the leftmost valid mode peak to F1(THz).

④ Set the frequency of the rightmost valid mode peak to F2(THz).

⑤ Set the number of mode peaks between F1 and F2 to N.

⑥ Obtain the PMD value from the following equation:

PMD = (N-1) / (F2-F1)

8.4.4 DFB-LD Analysis Function

The following parameters for DFB-LD light sources are analyzed collectively.

- -XdB WIDTH
- SMSR

Table 8-12 shows the details of parameters for DFB-LD analysis.

Table 8-12: Details of Parameters for DFB-LD Analysis

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
-XdB WIDTH	ALGO	THRESH	ENVELOPE / THRESH / RMS / PK-RMS	-	
	THRESH	20.00	0.01 to 50.00	dB	
	THRESH2	20.00	0.01 to 50.00	dB	Valid only when ALGO is ENVELOPE.
	K	1.00	1.00 to 10.00		
	MODE FIT	OFF	ON / OFF	-	Valid only when ALGO is THRESH.
	MODE DIFF	3.00	0.01 to 50.00	dB	
SMSR	SMSR MODE	SMSR1	SMSR1 / SMSR2	-	
	SMSR MASK	±0.00	0.00 to 99.99	nm	
	MODE DIFF	3.00	0.01 to 50.00	dB	

Concerning the algorithms for DFB-LD analysis, refer to data calculation algorithms for spectrum widths and SMSR analysis algorithms.

(☛ Section 8.3 Data Calculation Algorithms for Spectrum Widths and Subsection 8.4.1 SMSR Analysis Function)

8

8.4.5 FP-LD Analysis Function

The following parameters for FP-LD light sources are analyzed collectively.

- SPECTRUM WIDTH
- MEAN WAVELENGTH
- TOTAL POWER
- MODE NO.

Table 8-13 shows the details of parameters for FP-LD analysis.

Table 8-13: Details of Parameters for FP-LD Analysis

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
SPECTRUM WIDTH	ALGO	PK-RMS	ENVELOPE / THRESH / RMS / PK-RMS	-	
	THRESH	20.00	0.01 to 50.00	dB	
	THRESH2	20.00	0.01 to 50.00	dB	Valid only when ALGO is ENVELOPE.
	K	1.00	1.00 to 10.00	-	
	MODE FIT	OFF	ON / OFF	-	Valid only when ALGO is THRESH.
	MODE DIFF	3.00	0.01 to 50.00	dB	
MEAN WAVELENGTH	ALGO	PK-RMS	ENVELOPE / THRESH / RMS / PK-RMS	-	
	THRESH	20.00	0.01 to 50.00	dB	
	THRESH2	20.00	0.01 to 50.00	dB	Valid only when ALGO is ENVELOPE.
	K	1.00	1.00 to 10.00		
	MODE FIT	OFF	ON / OFF	-	Valid only when ALGO is THRESH.
	MODE DIFF	3.00	0.01 to 50.00	dB	
TOTAL POWER	OFFSET LEVEL	0.00	-10.00 to 10.00	dB	
MODE NO.	ALGO	PK-RMS	ENVELOPE / THRESH / RMS / PK-RMS	-	
	THRESH	20.00	0.01 to 50.00	dB	
	THRESH2	20.00	0.01 to 50.00	dB	Valid only when ALGO is ENVELOPE.
	K	1.00	1.00 to 10.00		
	MODE FIT	OFF	ON / OFF	-	Valid only when ALGO is THRESH.
	MODE DIFF	3.00	0.01 to 50.00	dB	

Concerning the algorithms for FP-LD analysis, refer to data calculation algorithms for spectrum widths and power analysis algorithms.
(☛ Section 8.3 Data Calculation Algorithms for Spectrum Widths and Subsection 8.4.2 POWER Analysis Function)

8.4.6 LED Analysis Function

The following parameters for LED light sources are analyzed collectively.

- SPECTRUM WIDTH
- MEAN WAVELENGTH
- TOTAL POWER

Table 8-14 shows the details of parameters for LED analysis.

Table 8-14: Details of Parameters for LED Analysis

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
SPECTRUM WIDTH	ALGO	THRESH	ENVELOPE / THRESH / RMS / PK-RMS	-	
	THRESH	20.00	0.01 to 50.00	dB	
	THRESH2	20.00	0.01 to 50.00	dB	Valid only when ALGO is ENVELOPE.
	K	1.00	1.00 to 10.00		
	MODE FIT	OFF	ON / OFF	-	Valid only when ALGO is THRESH.
	MODE DIFF	3.00	0.01 to 50.00	dB	
MEAN WAVELENGTH	ALGO	RMS	ENVELOPE / THRESH / RMS / PK-RMS	-	
	THRESH	20.00	0.01 to 50.00	dB	
	THRESH2	20.00	0.01 to 50.00	dB	Valid only when ALGO is ENVELOPE.
	K	1.00	1.00 to 10.00		
	MODE FIT	OFF	ON / OFF	-	Valid only when ALGO is THRESH.
	MODE DIFF	3.00	0.01 to 50.00	dB	
TOTAL POWER	OFFSET LEVEL	0.00	-10.00 to 10.00	dB	

Concerning the algorithms for LED analysis, refer to data calculation algorithms for spectrum widths and power analysis algorithms. (☛ Section 8.3 Data Calculation Algorithms for Spectrum Widths and Subsection 8.4.2 POWER Analysis Function)

8.5 Detailed Explanations of Analytical Functions(ANALYSIS2)

8.5.1 WDM Analysis Function

This function provides the analyses of NOISE level and SNR in each mode within the measurement range of WDM waveforms.

(1) Items for analysis

NO.:	Channel No. i
WAVELENGTH:	Center wavelength λi of the channel
LEVEL:	Level (peak level – noise level) Li of the channel
OFFSET WL:	Relative wavelength to the wavelength of the reference channel (REF)
OFFSET LVL:	Relative level to the level of the reference channel (REF)
SPACING:	Wavelength spacing to the adjacent channel
LVL DIFF:	Level difference from then adjacent channel
NOISE:	Noise level LNi of the channel
SNR:	SNR value SNi of the channel
GRID WL:	Nearest GRID wavelength to the channel
MEAS WL:	Center wavelength λi of the channel
REL WL:	Relative wavelength to the nearest GRID wavelength of the channel

(Note) Indications of dBm/nm and dBm/THz are forcibly changed to dBm indications before execution.

(2) List of Parameters

Table 8-15: Parameters to be set for WDM Analysis Function

Parameter	Default	Setting Range	Unit	Description
Related to channel detection				
THRESH	20.0	0.1 to 99.9	dB	Threshold value for channel detection
MODE DIFF	3.0	0.0 to 50.0	dB	Minimum value for peak/bottom difference during channel detection
DISPLAY MASK	OFF	OFF, 0.0 to −100.0	dBm	Levels equal to or below this level are not detected as WDM channels.
Related to SNR analysis				
NOISE ALGO	AUTO-FIX	AUTO-FIX MANUAL-FIX AUTO-CTR MANUAL- CTR		Selection of algorithms for noise level measurement
NOISE AREA	0.40nm	0.01 to 10.00nm	nm	A range of waveform data for use in noise level analysis is specified as a range centering on channel wavelengths. When N_ALGO is: ・AUTO-FIX: "AUTO" ・MANUAL-FIX: **.** ・AUTO-CTR: "Between Ch" ・MANUAL-CTR: "Between Ch" ・PIT: "-"

Parameter	Default	Setting Range	Unit	Description
MASK AREA	0.20nm	0.01 to 10.00nm	nm	Specify the signal optical spectrum range to be masked within the waveform data, while using the channel wavelength as its center. When N_ALGO is: ・AUTO-FIX: "—" ・MANUAL-FIX When F_ALGO is LINEAR:"—" Other cases : input of parameter values ・AUTOL-CTR: "—" ・MANUAL-CTR When F_ALGO is LINEAR:"—" Other cases : input of parameter values Limiter is applied during input to ensure NOISE AREA ≧ MASK AREA. ・PIT: "—"
FITTING ALGO	LINEAR	LINEAR GAUSS LORENZ 3RD POLY 4TH POLY 5TH POLY		Selection of a fitting algorithm for obtaining noise levels
NOISE BW	0.10nm	0.01 to 1.00nm	nm	Setting of noise bandwidth
DUAL TRACE	OFF	ON/OFF		OFF: Active trace is handled as the target for analysis. ON: Wavelengths and levels are calculated from TRACE A. Noise levels are calculated from TRACE B.
Related to display				
DISPLAY TYPE	ABSOLUTE	ABSOLUTE RELATIVE DRIFT(MEAS) DRIFT(GRID)		Setting of the format to display wavelengths, levels, noises, and SNRs, which are the results of analyses. ABSOLUTE: display of absolute values RELATIVE: display of relative values compared to GRID. DRIFT(MEAS): display of drift values by using wavelengths measured previously as references. DRIFT(GRID) : display of drift values by using the grid wavelengths as references.
CH RELATION	OFFSET	OFFSET SPACING		Setting of the format to display wavelengths between channels and level relative values during

Parameter	Default	Setting Range	Unit	Description
				DISPLAY: ABSOLUTE. This parameter is valid only when DISPLAY is set to ABSOLUTE. OFFSET: Display of offset values by using one arbitrary channel as the reference. SPACING: Display of offset values compared to an adjacent channel
REF CH	HIGHEST	HIGHEST ****		Setting of the reference channel when CH RELATION is set to OFFSET. This parameter is valid only when DISPLAY is set to ABSOLUTE and also when CH RELATION is set to OFFSET. HIGHEST: A channel at the highest level is used as the reference. ****: A ****th channel is used as the reference.
MAX/MIN RESET	—	—		If pressed, MAX/MIN is RESET. Button valid only when DISPLAY is set to DRIFT.
OUTPUT SLOPE	OFF	ON/OFF		ON/OFF of the function to obtain the least square approximation line of the channel peak.
POINT DISPLAY	ON	ON/OFF		ON/OFF of the function to display the data range used for fitting into the waveform window.

8

(3) Algorithm for Analysis

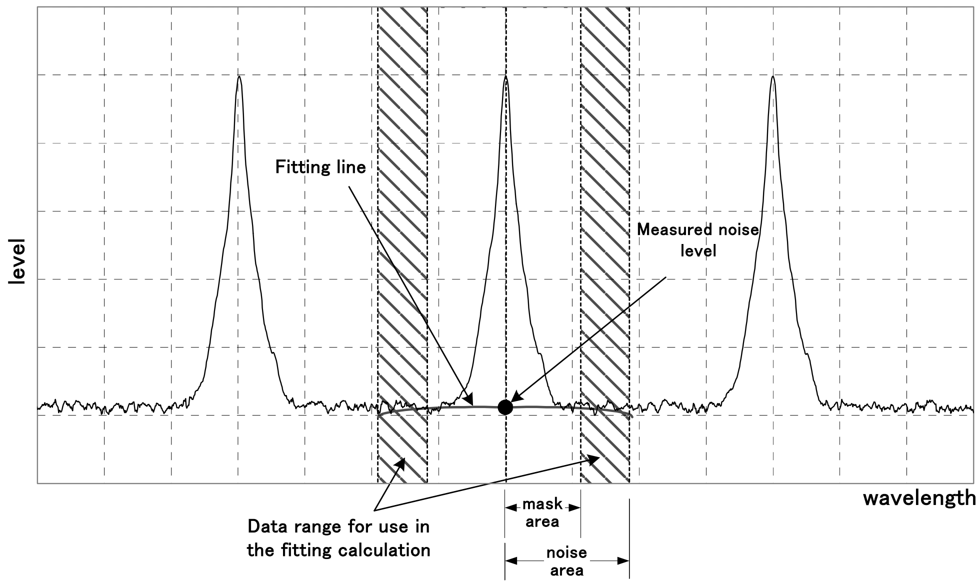


Fig. 8-17: Noise Level Measurement via Fitting

① Apply channel detection to measured waveform data using the following procedure:

1. Find all maximum points and minimum points to obtain mode peaks where peak/bottom differences between maximum points and minimum points on both sides are equal to or greater than MODE DIFF.
2. Of the obtained mode peaks, choose only the ones whose level difference compared to the highest peak is equal to or greater than THRESH. Note, however, that mode peaks with a level difference equal to or less than DISPLAY MASK shall be excluded. The number of mode peaks chosen in this manner shall be the Number of Channels "N."

② Obtain the wavelength λ'i of each mode peak.

③ Obtain the level LPi of each mode peak.

④ Obtain the center wavelength λi of each mode peak, which is the center of the two points below the mode peak λ'i by A[dB] both on the left and on the right. (A[dB] shall be either 3dB or the setting value of MODE DIFF, whichever is smaller.)

⑤ Follow the setting of the parameter NOISE ALGO to determine the noise area and mask area for performing the NOISE fitting.

* If the mask area is set outside the noise area when the channel wavelength λi is the center, the mask area and the noise area will become the same value.

⑥ Obtain the measurement resolution RBi of each channel from the values stored in the AQ6319.

⑦ According to the setting of the parameter FITTING ALGO, generate fitting waveforms from the noise area and mask area determined in ⑤ and obtain the level at the center wavelength λi as the noise level Lni.

⑧ Use the peak level LPi and the noise level LNi obtained in ③ and ⑦ to obtain the level Li of each channel from the following equation:

$$Li = LPi(linear) - LNi(linear)$$

⑨ Obtain the normalized noise level LNNi from the equation below:

* NBW = noise bandwidth (configurable parameter)

$LNNi = [LNi(LOG) - 10 \times Log(RBi[nm])] + 10 \times Log(NBW)$

⑩ Use the mode peak level Li obtained in ⑧ and ⑨ and the normalized noise level LNNi to obtain SNi from the following equation:

$SNi = Li - LNNi$

⑪ Display the results of foregoing analyses according to the settings of the parameter DISPLAY SETTING.

(4) Automatic Parameter Setting Function

This unit provides the noise area/mask area automatic setting function. To activate the automatic setting, set the algorithm to AUTO-FIX or AUTO-CTR.

●AUTO-FIX

・Noise Algorithm

Obtain the left and right noise areas (NA_Ri, NA_Li) of each channel according to the number of detected WDM channels as follows:

A. When the number of WDM channels "n" is 1

Internally obtain the measurement resolution of SNi calculation trace and the value of the noise measurement point NOISE AREA in accordance with the resolution, and then obtain the values from the following equations:

$NA\_Ri = \lambda i + NOISE\ AREA$

$NA\_Li = \lambda i - NOISE\ AREA$

B. When the number of WDM channels "n" is 2 or more

Obtain the channel spacing of each channel (spacing of λi). With the minimum spacing set to SPACING as well as NOISE AREA = SPACING / 2, obtain the NOISE AREA. Finally, obtain the values from the following equations:

$NA\_Ri = \lambda i + NOISE\ AREA\ (i = 1,2,\ldots,n)$

$NA\_Li = \lambda i - NOISE\ AREA\ (i = 1,2,\cdots,n)$

・Fitting Algorithm

While the setting is at AUTO-FIX, LINEAR is used for the fitting algorithm, which is calculated as follows:

i Obtain ELi and ERi as the level (LOG) of each position of the noise areas NA_Li and NA_Ri.

ii Use the data of the straight line connecting the two points of ELi and ERi to fill the inside of the fitting range.

iii Set the level of λi of the data generated in the fitting to the noise level LNi.

* Due to being set to LINEAR, it is not possible to set the mask areas.

●AUTO-CTR

・Noise Algorithm

Obtain the left and right noise areas (NA_Ri, NA_Li) of each channel according to the number of detected WDM channels as follows (while treating the center points between channels as NA_Ri and NA_Li).

A. When the number of WDM channels “n” is 1

Internally obtain the measurement resolution of SNi calculation trace and the value of the noise measurement point NOISE AREA in accordance with the resolution, and then obtain the values from the following equations:

NA_Ri = λi + NOISE AREA

NA_Li = λi − NOISE AREA

B. When the number of WDM channels “n” is 2 or more

$\lambda N1 = (3\lambda_1 - \lambda_2) \div 2$

①i=2,3,···,n

$\lambda Ni = (\lambda_i - \lambda_{i-1}) \div 2$

$\lambda Nn+1 = (3\lambda_n - \lambda_{n-1}) \div 2$

If the above values are calculated, the following results will be generated:

②i=1,2,···,n

NA_Li = λNi

NA_Ri = λNi+1

・ Fitting Algorithm

While the setting to AUTO-CTR, LINEAR is used for the fitting algorithm, which is calculated as follows:

i Obtain ELi and ERi as the level (LOG) of each position of the noise areas NA_Li and NA_Ri.

ii Use the data of the straight line connecting the two points of ELi and ERi to fill the inside of the fitting range.

iii Set the level of λi of the data generated in the fitting to the noise level LNi.

* Due to being set to LINEAR, it is not possible to set the mask areas.

●**PIT**

・**Noise Algorithm**

Obtain the noise areas for measured waveform to the minimum level position of a before the next channel in each channel.

When inside noise areas obtain at the left and right noise areas of each channel. outside noise areas is applied.

A. When the number of WDM channels "n" is 1

Internally obtain the measurement resolution of SNi calculation trace and the value of the noise measurement point NOISE AREA in accordance with the resolution, and then obtain the values from the following equations:

$NA\_Ri = \lambda i + NOISE\ AREA$

$NA\_Li = \lambda i - NOISE\ AREA$

B. When the number of WDM channels "n" is 2 or more

①i=1

$NA\_Li = \lambda i - (\lambda Ni - \lambda i)$

$NA\_Ri = \lambda Ni$

②i=2,3,…,n−1

$NA\_Li = \lambda N(i - 1)$

$NA\_Ri = \lambda Ni$

③i=n

$NA\_Li = \lambda N(i - 1)$

$NA\_Ri = \lambda i + (\lambda i - \lambda N(i - 1))$

・ **Fitting Algorithm**

While the setting to PIT, LINEAR is used for the fitting algorithm, which is calculated as follows:

i Obtain ELi and ERi as the level (LOG) of each position of the noise areas NA_Li and NA_Ri.

ii Use the data of the straight line connecting the two points of ELi and ERi to fill the inside of the fitting range.

iii Set the level of λi of the data generated in the fitting to the noise level LNi.

* Due to being set to LINEAR, it is not possible to set the mask areas.

(5) Setting of the parameter "DUAL TRACE"

This function enables more precise analyses by measuring waveforms with different measurement resolutions at trace A and trace B and also by performing measurements with resolutions different in noise level from the signal level of each channel.

When "DUAL TRACE" is ON, targets for the analysis of each trace will be:

TRACE A: trace subject to channel detection

TRACE A: calculation traces λi and Li

TRACE B: noise level LNi calculation trace

(6) OUTPUT SLOPE function

The parameter <OUTPUT SLOPE> provides a function to obtain the least square approximation curve of channel peaks. This function makes it possible to measure gain tilts. If <OUTPUT SLOPE> is set to ON, results will be displayed in the waveform display section and in the analysis table.

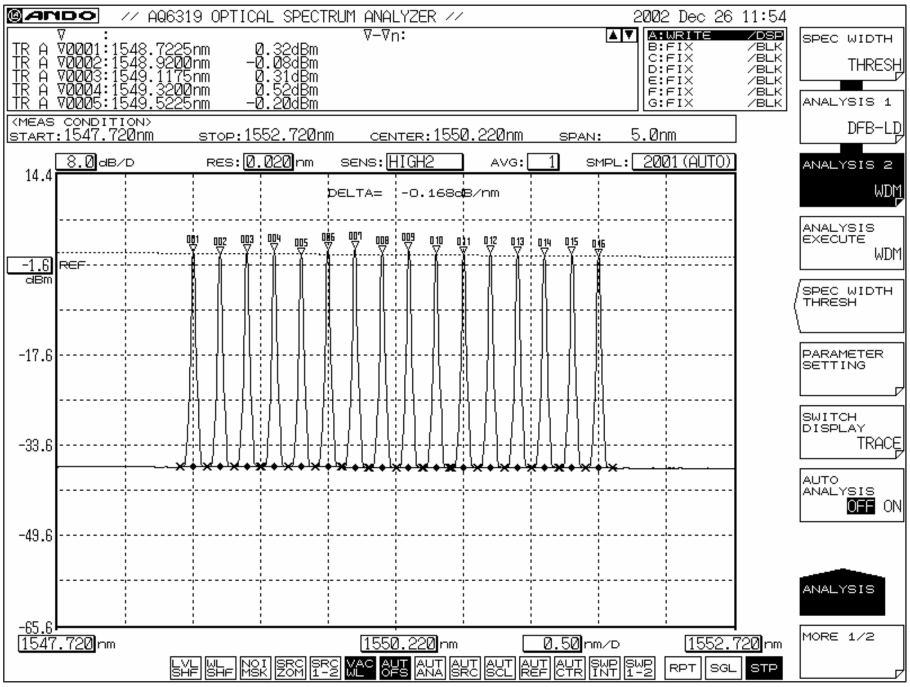


Fig. 8-18: Screen when OUTPUT SLOPE is set to ON

(7) Items to be displayed when DISPLAY is set

ABSOLUTE

Results of analyses are displayed in absolute values.

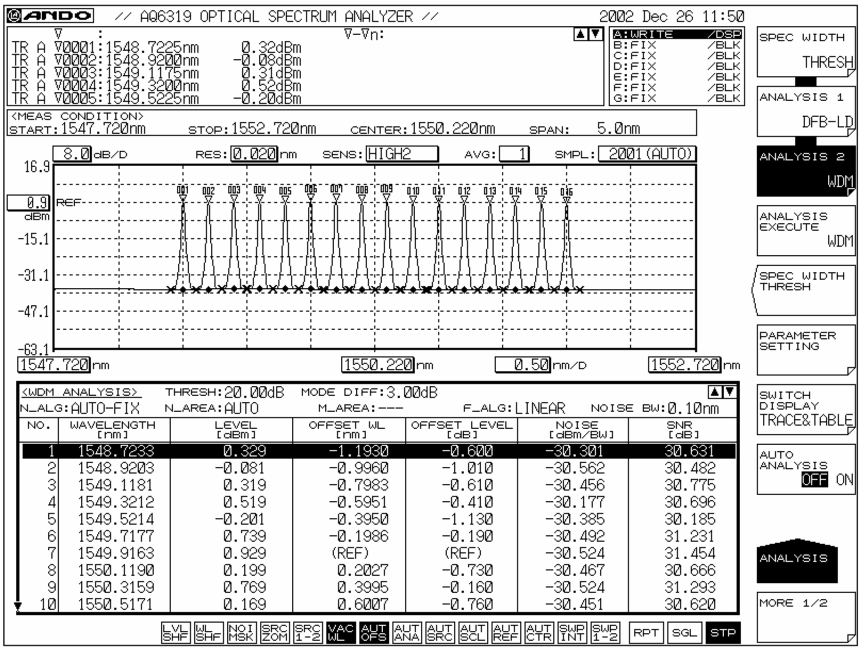


Fig. 8-19: Measured Results during DISPLAY: ABSOLUTE

WAVELENGTH:	center wavelength of the channel
LEVEL:	level of the channel (peak level – noise level)
OFFSET WL:	relative wavelength to the wavelength of the reference channel (REF)
OFFSET LVL:	relative level to the wavelength of the reference channel (REF)
SPACING:	wavelength spacing with the adjacent channel
LVL DIFF:	level difference from the adjacent channel
NOISE:	noise level of the channel
SNR:	SNR value of the channel

* OFFSET WL/LVL is displayed when the parameter CH RELATION is “OFFSET.” SPACING and LVL DIFF are displayed when the parameter CH RELATION is “SPACING.”

* When ABSOLUTE and CH RELATION are OFFSET, it is possible either to set the reference channel to the mode peak with the highest level or to set a mode peak that will become the reference arbitrarily.

・when REF CH is HIGHEST

The WDM mode peak with the highest level shall be the reference. The wavelength difference and level difference (LOG) compared to it shall be OFFSET WL and OFFSET LVL of each WDM mode peak.

8

・when REF CH is ***

REF CHANNEL*** shall be the reference. The wavelength difference and level difference (LOG) against it shall be OFFSET WL and OFFSET LVL of each WDM mode peak. (If the ****th* mode peak does not exist, the WDM mode peak on the longest wavelength shall be the reference.)

RELATIVE

Of the analytical results, wavelength values are displayed as relative values to the values in the grid table.

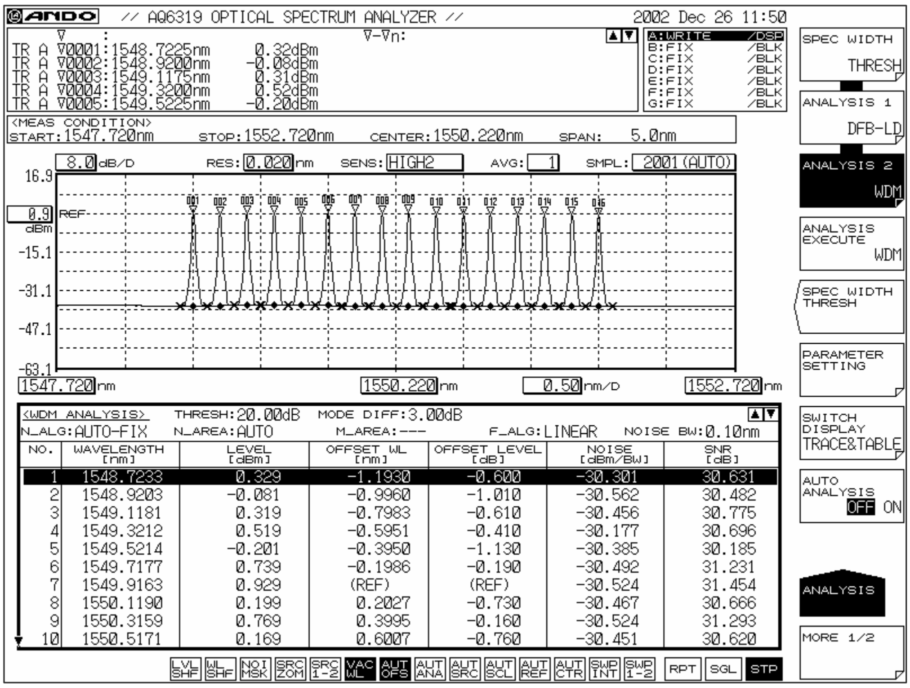


Fig. 8-20: Measured Results during DISPLAY: RELATIVE

<Explanations of display items>

NO:	channel number
GRID WL:	GRID wavelength of the channel
MEAS WL:	center wavelength of the channel
REL WL:	relative wavelength to the GRID wavelengths of the channel
MEAS LVL:	level of the channel (peak level – noise level)
NOISE:	noise level of the channel
SNR:	SNR value of the channel

DRIFT(MEAS)

Wavelengths measured previously are used as references to display wavelength/level changes (drifts).

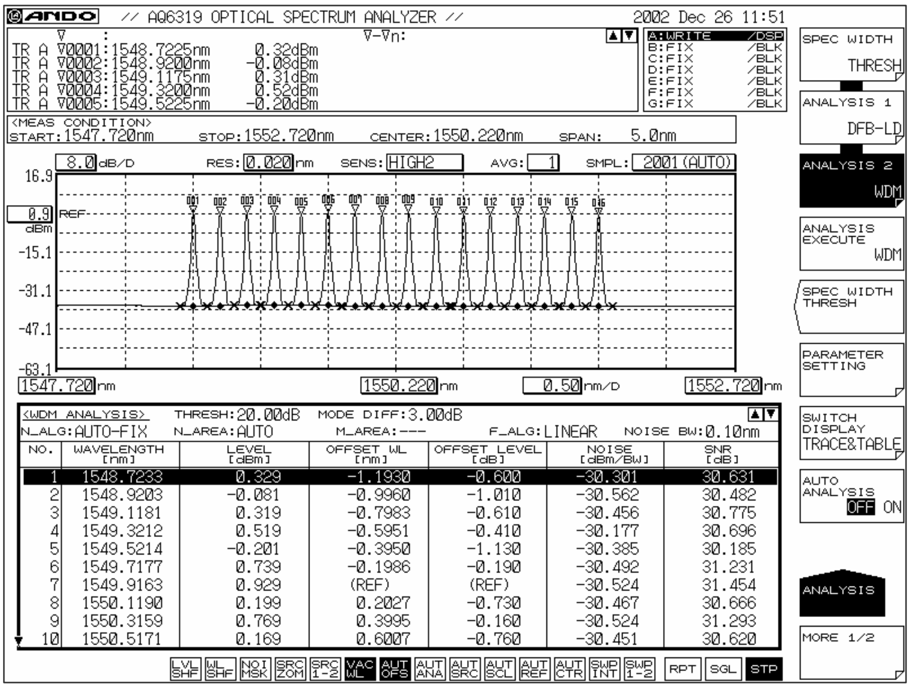


Fig. 8-21: Measured Results during DISPLAY: DRIFT(MEAS)

<Explanations of display items>

NO: channel number

REF WL: reference wavelength of the channel (previous wavelength measured)

MEAS WL: center wavelength of the channel

DIFF MAX (wavelength): Maximum value of the relative wavelength to the reference wavelength of the channel

DIFF MIN (wavelength): Minimum value of the relative wavelength to the reference wavelength of the channel

REF LVL: reference level of the channel (previous measurement level)

MEAS WL: measurement level of the channel

DIFF MAX (level): Maximum value of the relative level to the reference level of the channel

DIFF MIN (level): Minimum value of the relative level to the reference level of the channel

Reference wavelength/level can be changed under the following conditions:

- active trace waveform data when MAX/MIN RESET is set by the parameter
- the first waveform data measured when wavelength axes (SPAN WL/START WL/STOP WL) were changed according to the measurement conditions

DRIFT(GRID)

Grid wavelengths are used as references to display wavelength/level changes (drifts). Note that reference levels are previous measurement levels.

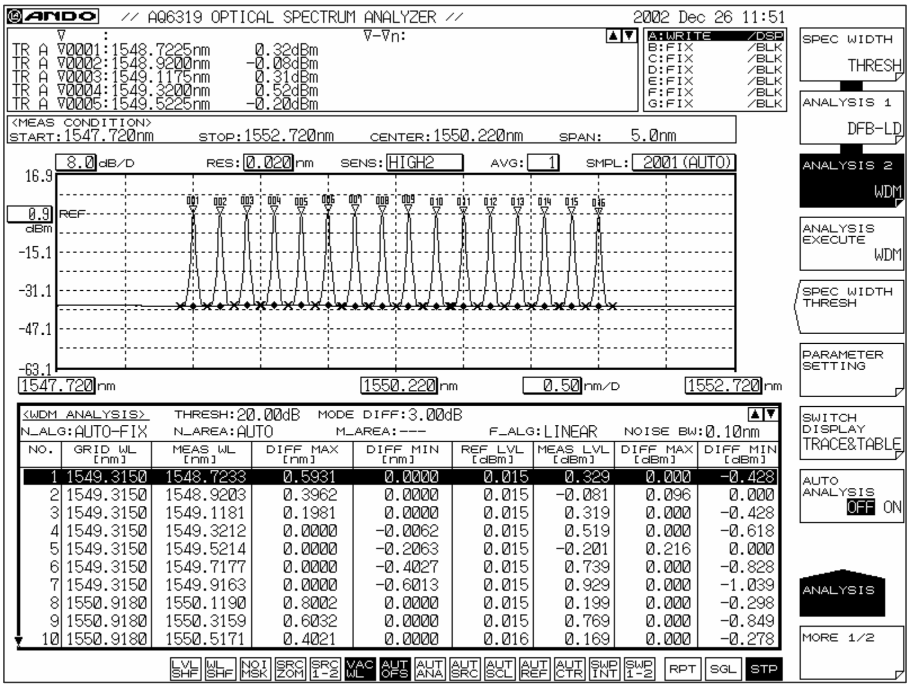


Fig. 8-22: Measured Results during DISPLAY: DRIFT(GRID)

<Explanations of display items>

NO: channel number

GRID WL: reference wavelength of the channel (grid wavelength)

MEAS WL: center wavelength of the channel

DIFF MAX (wavelength): Maximum value of the relative wavelength to the reference wavelength of the channel

DIFF MIN (wavelength): Minimum value of the relative wavelength to the reference wavelength of the channel

REF LVL: reference level of the channel (previous measurement level)

MEAS WL: measurement level of the channel

DIFF MAX (level): Maximum value of the relative level to the reference level of the channel

DIFF MIN (level): Minimum value of the relative level to the reference level of the channel

* Absolute values and reference values to the GRID table are displayed. The GRID table can be freely configured by the user with the [SYSTEM] → <GRID EDITOR> key.
* Reference wavelengths/levels can be changed under the following conditions:
    - When MAX/MIN RESET is set by the parameter, reset is performed by the active trace waveform data.
    - Reset is performed by the first waveform data that was measured when wavelength axes (SPAN WL/START WL/STOP WL) were changed by measurement conditions.

8.5.2 EDFA NF Analysis Function

This function enables the analysis of gains and NF (noise figures) of optical fiber amplifiers.

(1) Items to be analyzed

λi Center wavelength of each channel
→ center frequency during the frequency mode
LINi Signal optical power of each channel
(after OFFSET compensation) * linear value
LOUTi Output optical power of each channel
(after OFFSET compensation) * linear value
LASEi ASE power of each channel
(after OFFSET compensation) * linear value
Rbi Measurement resolution of each channel
Gi Gain of each channel
Nfi NF of each channel

(2) List of parameters

Table 8-16: Parameters for EDFA-NF Analysis Function

Parameter	Default	Setting Range	Unit	Description
Related to channel detection				
THRESH	20.0	0.1 to 99.9	dB	Threshold value for channel detection
MODE DIFF	3.0	0.0 to 50.0	dB	Minimum value of the peak/bottom difference during channel detection
OFFSET(IN)	0.00	−99.99 to 99.99	dB	Level offset value of signal optical power
OFFSET(OUT)	0.00	−99.99 to 99.99	dB	Level offset value of output optical power
ASE ALGO	AUTO-FIX	AUTO-FIX MANUAL-FIX AUTO-CTR MANUAL-CTR		Selection of the algorithm for ASE level measurement
FIT AREA	0.40nm	0.01 to 10.00nm	nm	A range of waveform data for use in ASE level analysis is specified as a range centering on channel wavelengths. When A_ALGO is ・AUTO-FIX: "AUTO" ・MANUAL-FIX: **.** ・AUTO-CTR: "Between Ch" ・MANUAL-CTR: "Between Ch"
MASK AREA	0.20nm	0.01 to 10.00nm	nm	Of the waveform data, specify the signal optical spectrum range for masking, which centers on the channel wavelength. When A_ALGO is ・AUTO-FIX: "−" ・MANUAL-FIX When F_ALGO is LINEAR:"−" Other cases: input of parameter value.

Parameter	Default	Setting Range	Unit	Description
				・AUTOL-CTR: "－" ・MANUAL-CTR When F_ALGO is LINEAR:"－" Other cases: input of parameter value. Apply the limiter during input to ensure FITTING AREA ≧ MASK AREA.
FITTING ALGO	LINEAR	LINEAR GAUSS LORENZ 3RD POLY 4TH POLY 5TH POLY		Selection of the fitting algorithm for obtaining ASE levels
POINT DISPLAY	ON	ON / OFF		ON/OFF for the function to display data range used for fitting in the waveform window.

(3) Algorithm for analysis

① Apply the WDM analysis to the signal optical waveform data of TRACE A to perform channel detection. Note, however, that the parameter DISPLAY MASK is not used.

② Obtain the center wavelength λ i of each channel and signal optical level LIN'i of TRACE A optical signal.

③ Obtain the output optical level LOUT'i of each channel from the output optical waveform data of TRACE B.

④ Obtain LINi and LOUTi, which are generated by compensating OFFSET(IN,OUT) for signal optical level and output optical level, respectively.

⑤ According to the setting of the parameter ASE ALGO, determine fitting area and mask area for performing the ASE fitting.

⑥ Obtain the measurement resolution RBi of each channel from the waveform of TRACE A.

⑦ Remove the signal optical SE elements contained in the output optical spectrum in the following order and write the result into TRACE C.

1 Obtain levels (linear) on both sides of the channel of the fitting area that was obtained in ⑤.

2 Use the obtained levels on both sides to obtain the provisional ASE level LB'i via the linear interpolation.

3 Obtain LBi, which is generated by compensating OFFSET(OUT) for the provisional ASE level LB'i.

4 Obtain the provisional gain G'I using the following equation:

G'i=(LOUTi−LBi)/LINi

5 Multiply the TRACE A data (linear) by the provisional gain G'I and subtract the result from the TRACE B data (linear). Then, write the result into TRACE C.

⑧ In the TRACE C data (linear) generated in ⑦, perform a fitting according to the settings of the parameter FITTING ALGO and create the estimated ASE spectrum in TRACE C. The data for use in the fitting is from the range of the center wavelength of each channel ± FIT AREA to the range of MASK AREA. Obtain the level at λi in TRACE C as the ASE level LASE'I (linear). Then, obtain LASEi, which is generated by compensating OFFSET (OUT) for it.

8

・Calculate gain G and NF (linear) from the following equations:

gain G

Gi = (LOUTi−LASEi)/LINi

NF value (during the air wavelength mode)

$$\text{Nfi} = NFi = \frac{N(\lambda i)^2}{h\times c^2}\times\frac{\lambda i^3}{RBi}\times\frac{LASEi}{G}+\frac{1}{G}$$

NF value (during the vacuum wavelength mode)

$$NFi = \frac{1}{h \times c^2} \times \frac{\lambda i^3}{RBi} \times \frac{LASEi}{G} + \frac{1}{G}$$

N(λi): refraction index of the air

C: speed of light in the vacuum 2.99792458×10^{8}[m/s]

h: Planck's constant 6.6260755×10^{34}[J・s]

・Perform LOG conversion for Nfi, Gi, and LASEi.

(4) Automatic parameter setting function

The AQ6319 provides a fit area/mask area automatic setting function. Function.

AUTO-FIX

・ASE algorithm

The fitting algorithm is LINEAR.

Since the algorithm is LINEAR, the mask area setting will not be required.

Obtain the left and right fit areas (NA_Ri, NA_Li) of each channel by using the number of detected channels as follows:

A. When the number of channels "n" is 1

Internally obtain the measurement resolution of trace B and the value of the noise measurement point NOISE AREA in accordance with the resolution, and obtain the fit areas from the following equations:

NA_Ri = λi + NOISE AREA

NA_Li = λi − NOISE AREA

B. When the number of channels "n" is 2 or more

Obtain the channel spacing (spacing of λi) of each channel. Set the minimum spacing to SPACING and also use the following to obtain the NOISE AREA.

NOISE AREA = SPACING / 2

Then, obtain the fit areas from the following equations:

NA_Ri = λi + NOISE AREA (i =1,2,...,n)

NA_Li = λi − NOISE AREA (i =1,2,···,n)

AUTO-CTR

・ASE algorithm

The fitting algorithm is LINEAR.

Since the algorithm is LINEAR, the mask area setting will not be required.

Obtain the left and right fit areas (NA_Ri, NA_Li) of each channel by using the number of detected channels as follows (center points between channels are treated as NA_Ri, NA_Li):

A. When the number of channels "n" is 1

Internally obtain the measurement resolution of trace B and the value of the noise measurement point NOISE AREA in accordance with the resolution, and obtain the fit areas from the following equations:

NA_Ri = λi + NOISE AREA

NA_Li = λi − NOISE AREA

B. When the number of channels "n" is 2 or more

λN1 = $(3\lambda_1 - \lambda_2) \div 2$

①i=2,3,⋯,n

λNi = $(\lambda_i + \lambda_{i-1}) \div 2$

λNn+1 = $(3\lambda_n - \lambda_{n-1}) \div 2$

Perform the calculations:

②i=1,2,⋯,n

NA_Li = λNi

NA_Ri = λNi+1

8

8.5.3 FILTER PEAK Analysis Function

This function enables the collective analysis of measured waveforms of optical filters via multiple parameters.
It can be used for filter analysis only if the number of modes is one. Items and algorithms for analysis are the same as in the AQ6317 series.

(1) Items for analysis

- PEAK LVL: peak level
- PEAK WL: peak wavelength
- CENTER WL: center wavelength
- SPECTRUM WIDTH: wavelength width at threshold value TH
- RIPPLE WIDTH: ripple width
- CROSS TALK: cross talk

(2) List of Parameters

Table 8-17: Parameters for FITER PEAK analysis function

Item	Parameter	Default	Setting Range	Unit	Description
PEAK LEVEL	SW	ON	ON or OFF	-	ON/OFF switchover of display
PEAL WL	SW	ON	ON or OFF	-	ON/OFF switchover of display
CENTER WL	SW	ON	ON or OFF	-	ON/OFF switchover of display
	ALGO	THRESH	THRESH RMS	-	Selection of algorithm for spectrum width
	THRESH LVL	THRESH: 3.00 RMS: 3.00	0.1 to 50.0	dB	Lower limit value for channel detection. Valid only when ALGO is THRESH.
	K	THRESH: 1.00 RMS: -	1.00 to 10.00	-	Multiplying factor. Valid only when ALGO is THRESH.
	MODE FIT	THRESH: OFF RMS: -	ON or OFF	-	Whether “half of maximum point” is set to the mode peak or not. Valid only when ALGO is THRESH.
	MODE DIFF	THRESH: 3.00 RMS: -	0.0 to 50.0	dB	Minimum value of the peak/bottom difference during channel detection. Valid only when ALGO is THRESH.
SPECTRUM WIDTH	SW	ON	ON or OFF	-	ON/OFF switchover of display
	ALGO	THRESH	THRESH RMS	-	Selection of algorithm for spectrum width
	THRESH LVL	THRESH: 3.00 RMS: 3.00	0.1 to 50.0	dB	Lower limit value for channel detection

Item	Parameter	Default	Setting Range	Unit	Description
	K	THRESH: 1.00 RMS: -	1.00 to 10.00	-	Multiplying factor. Valid only when ALGO is THRESH.
	MODE FIT	THRESH: OFF RMS: -	ON or OFF	-	Whether “half of maximum point” is set to the mode peak or not. Valid only when ALGO is THRESH.
	MODE DIFF	THRESH: 3.00 RMS: -	0.0 to 50.0	dB	Minimum value of the peak/bottom difference during channel detection. Valid only when ALGO is THRESH.
RIPPLE WIDTH	SW	ON	ON or OFF	-	ON/OFF switchover of display
	THRESH LVL	3.00	0.1 to 50.0	dB	Lower limit value for channel detection
	MODE DIFF	0.500	0.000 to 50.000	dB	Minimum value of the peak/bottom difference during channel detection
CROSS TALK	SW	ON	ON or OFF	-	ON/OFF switchover of display
	ALGO	THRESH	THRESH PK LVL GRID	-	Selection of algorithm for spectrum width
	THRESH LVL	THRESH: 3.00 PK LVL: - GRID: -	0.1 to 50.0	dB	Lower limit value for channel detection. Valid only when ALGO is THRESH.
	K	THRESH: 1.00 PK LVL: - GRID: -	1.00 to 10.00	-	Multiplying factor. Valid only when ALGO is THRESH.
	MODE FIT	THRESH: OFF PK LVL: - GRID: -	ON or OFF	-	Whether “half of maximum point” is set to the mode peak or not. Valid only when ALGO is THRESH.
	MODE DIFF	THRESH: 3.00 PK LVL: - GRID: -	0.0 to 50.0	-	Minimum value of the peak/bottom difference during channel detection. Valid only when ALGO is THRESH.
	CH SPACE	0.40	0.00 to 50.00	nm	Setting of channel spacing
	SEARCH AREA	0.01	0.01 to 10.00	nm	Setting of the analysis range. Valid only when ALGO is GRID.

8

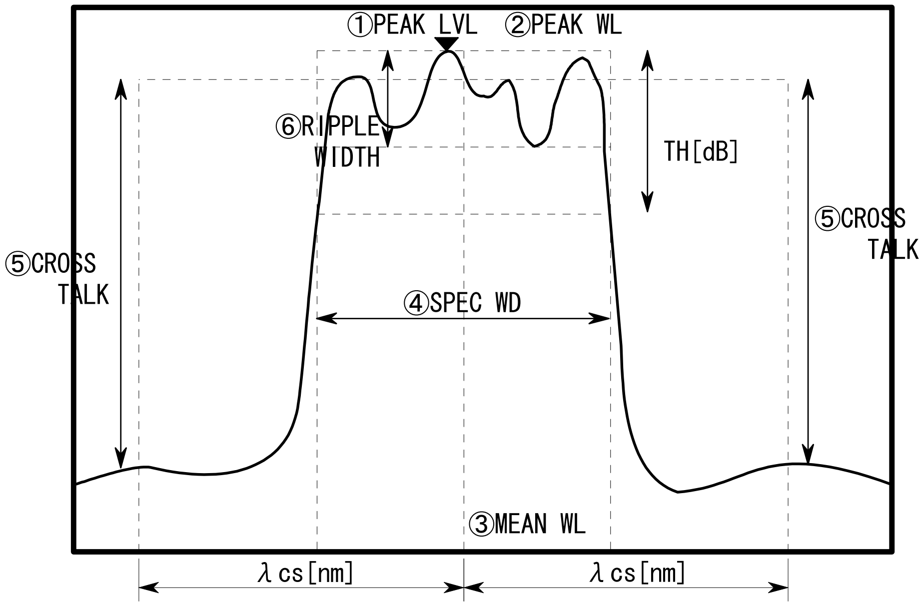


Fig. 8-23: Details of Analyses by FILTER PEAK Analysis Function

(3) Details of Analyses

① peak level (PEAK LVL): value of the level at the waveform peak position

② peak wavelength (PEAK WL): value of the wavelength at the waveform peak position

③ center wavelength (MEAN WL): value of the center wavelength at the threshold value TH

④ spectrum width (SPEC WD): spectrum width at the threshold value TH

⑤ cross talk (CRS TALK)

a. In the case of THRESH / PEAK LV algorithms

Obtain the value of the level on the reference wavelength (MEAN WL for THRESH and PEAK WL for PEAK LV). Also, obtain the value of the level at the wavelength which is ±λ CH SPACE[nm] away from the reference wavelength. Then, set the difference in level value between the two to the cross talk.

b. In the case of ITU-T algorithms

Set the ITU-T grid wavelength, which is nearest to the peak wavelength, to the reference wavelength. Set the difference between the bottom level within the range of the reference wavelength ±λ SEARCH AREA[nm] and the peak level within the range of the position ±λ CH SPACE[nm] away from the reference wavelength ±λ SEARCH AREA[nm] to the cross talk.

⑥ ripple width (RIPPLE WD): Perform a spectrum width search. Set the value of the peak level – bottom level within the obtained spectrum width to the ripple width.

NOTE

- Unless the parameter "MODE DIFF" is set to a value smaller than uneven portions of a waveform regarded as a ripple, RIPPLE = 0 will result.
- RIPPLE = 0 if the parameter setting is "THRESH" < "MODE DIFF"

8

8.5.4 FILTER BOTTOM Analysis Function

This function enables the collective analysis of multiple parameters via the measured waveforms of optical filters.

It is used for filter analysis if the number of modes is one. Items and algorithms for analysis are the same as in the AQ6317 series.

(1) Items for analysis

・BOTTOM LVL:	bottom level
・BOTTOM WL:	bottom wavelength
・CENTER WL:	center wavelength
・NOTCH WIDTH:	notch width
・CROSS TALK:	cross talk

(2) List of parameters

Table 8-18: Parameters for FILTER BOTTOM Analysis Function

Item	Parameter	Default	Setting Range	Unit	Description
BOTTOM LEVEL	SW	ON	ON or OFF	-	ON/OFF switchover of display
BOTTOM WL	SW	ON	ON or OFF	-	ON/OFF switchover of display
CENTER WL	SW	ON	ON or OFF	-	ON/OFF switchover of display
	ALGO	BOTTOM	PEAK BOTTOM	-	Selection of algorithm for spectrum width
	THRESH LVL	3.00	0.1 to 50.0	dB	Lower limit value for channel detection
	MODE DIFF	3.00	0.0 to 50.0	dB	Minimum value of the peak/bottom difference during channel detection
NOTCH WIDTH	SW	ON	ON or OFF	-	ON/OFF switchover of display
	ALGO	BOTTOM	PEAK BOTTOM	-	Selection of algorithm for spectrum width
	THRESH LVL	3.00	0.1 to 50.0	dB	Lower limit value for channel detection
	MODE DIFF	3.00	0.0 to 50.0	dB	Minimum value of the peak/bottom difference during channel detection. Valid only when ALGO is THRESH.
CROSS TALK	SW	ON	ON or OFF	-	ON/OFF switchover of display
	ALGO	BOTTOM	PEAK BOTTOM BOTTOM_LVL GRID	-	Selection of algorithm for spectrum width
	THRESH LVL	3.00	0.1 to 50.0	dB	Lower limit value for channel detection. Valid when ALGO is PEAK/ BOTTOM.
	MODE DIFF	3.00	00 to 50.0	-	Multiplying factor. Valid only when ALGO is THRESH.
	CH SPACE	0.40	0.0 to 50.00	nm	Setting of channel spacing
	SEARCH AREA	0.01	0.01 to 10.00	nm	Setting of the range of analysis. Valid only when ALGO is GRID.

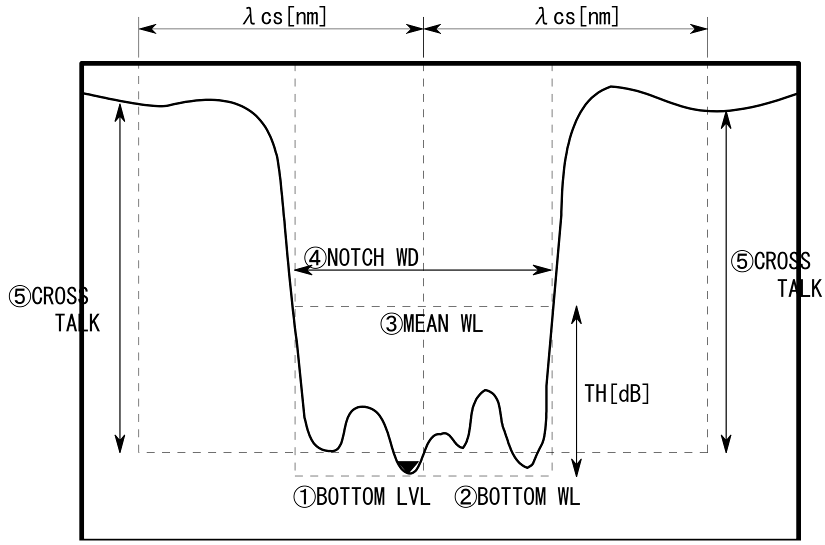


Fig. 8-24: Details of Analysis by FILTER BOTTOM Analysis Function

(3) Details of Analysis

① bottom level (BTM LVL): value of level at the waveform bottom position

② bottom wavelength (BTM WL): value of wavelength at the waveform bottom position

③ center wavelength (MEAN WL): value of center wavelength at the threshold value TH

④ notch width (NOTCH WD): notch width at the threshold value TH

⑤ cross talk (CRS TALK)

a. In the case of PEAK / BOTTOM / BOTTOM LV algorithms

Obtain the level value at the reference wavelength (MEAN WL for PEAK/BOTTOM, BOTTOM WL for BOTTOM LV). Also, obtain the level value at the wavelength which is ±λCH SPACE[nm] away from the reference wavelength. Then, set the difference in level value between the two to the cross talk.

b. In the case of ITU-T algorithms

Set the ITU-T grid wavelength, which is nearest the bottom wavelength, to the reference wavelength. Set the difference between the peak level within the range of the reference wavelength ±λ SEARCH AREA[nm] and the bottom level within the range of the position ±λCH SPACE[nm] away from the reference wavelength ±λ SEARCH AREA[nm] to the cross talk.

8.5.5 WDM FILTER PEAK Analysis Function

This function enables the collective analysis of multiple items for each channel via the measured waveforms of multi-channel optical filters.
It also enables filter analysis for multi-mode waveforms, which is different from FILTER PEAK analysis.

(1) Items for analysis

Table 8-19: Details of Analysis by WDM FILTER PEAK Analysis Function

Item for Analysis	Description
1. Nominal Wavelength	Reference wavelength/frequency of each channel
2. Peak Wavelength / Level	Peak wavelength/frequency and level of each channel
3. xdB Width / Center Wavelength	xdB width of each channel and its center wavelength/frequency
4. xdB stop-band	Wavelength width/frequency width across xdB of each channel
5. xdB pass-band	Pass band xdB from the bottom within the test band of each channel
6. Ripple	Max-min level (flatness) within the test band of each channel
7. Cross Talk	Difference in level from the position xnm away from each channel

8

(2) List of Parameters

Table 8-20: Parameters for WDM FILTER PEAK Analysis

Item	Parameter	Default	Setting Range	Unit
Channel Detection, Nominal Wavelength	ALGORITHM	MEAN	PEAK / MEAN / GRID / GRID FIT	-
	MODE DIFF	3.0	0.1 to 50.0	dB
	THRESH	20.0	0.1 to 99.9	dB
	TEST BAND	0.100	0.001 to 9.999	nm
Peak Wavelength/Level	SW	ON	ON / OFF	-
XdB Width Center Wavelength	SW	ON	ON / OFF	-
	THRESH	3.00	0.1 to 50.0	dB
XdB Stop-band	SW	ON	ON / OFF	-
	THRESH LVL	-10.00	-90.00 to 30.00	dB
XdB Pass-band	SW	ON	ON / OFF	
	THRESH	3.0	0.1 to 50.0	dB
	TEST BAND	0.20 / 25.0	0.01 to 99.99 / 1.0 to 999.9	nm / GHz
Ripple	SW	ON	ON / OFF	
	TEST BAND	0.20 / 25.0	0.01 to 99.99 / 1.0 to 999.9	nm / GHz
Cross Talk	SW	ON	ON / OFF	
	SPACING	0.80 / 100.0	0.01 to 99.99 / 1.0 to 999.9	nm / GHz
	TEST BAND	0.20 / 25.0	0.01 to 99.99 / 1.0 to 999.9	nm / GHz

(3) Algorithms for analysis

Channel Detection, Nominal Wavelength

- Parameter
  - THRESH
  - MODE DIFF
  - ALGO
  - TEST BAND
- Procedure

a. PEAK

・Channel: each mode peak detected via a mode search

(Except for the mode peaks at levels which are lower than the mode at the highest level by THRESH[dB] or less.)

・Reference wavelength: wavelength of each mode peak

・Peak wavelength/level: wavelength and level of each mode peak

b. MEAN

・Channel: each mode peak detected via a mode search

(Except for the mode peaks at levels which are lower than the mode at the highest level by THRESH[dB] or less.)

・Reference wavelength: 3dB center wavelength at each mode peak

・Peak wavelength/level: wavelength and level of each mode peak

c. GRID FIT

・Channel: modes within the range of GRID wavelength ± (TEST BAND/2) among the mode peaks detected via a mode search (except for the mode peaks at levels which are lower than the mode at the highest level by THRESH[dB] or less).

If the number of relevant modes in one GRID is more than one, only the mode at the highest level will be regarded as the channel.

・Reference wavelength: GRID wavelength nearest to each channel

・Peak wavelength/level: wavelength and level of the mode peak of each channel

d. GRID

・Channel: A mode search shall not be performed. All GRID wavelengths within the range of analysis shall be the channels.

・Reference wavelength: GRID wavelength of each channel

・Peak wavelength/level: Peak wavelength and peak level within the range of GRID wavelength ± (TEST BAND/2) of each channel

PEAK LVL/PEAK WL

- Parameter
  THRESH
  MODE DIFF
- Procedure
  ① Apply WDM analysis to the waveform data of an active trace and perform channel detection. Note that the parameter DISPLAY MASK is not used.
  ② Obtain the mode peak wavelength (PEAK WL) of each channel of the active trace and its signal optical level (PEAK LVL).

XdB Width

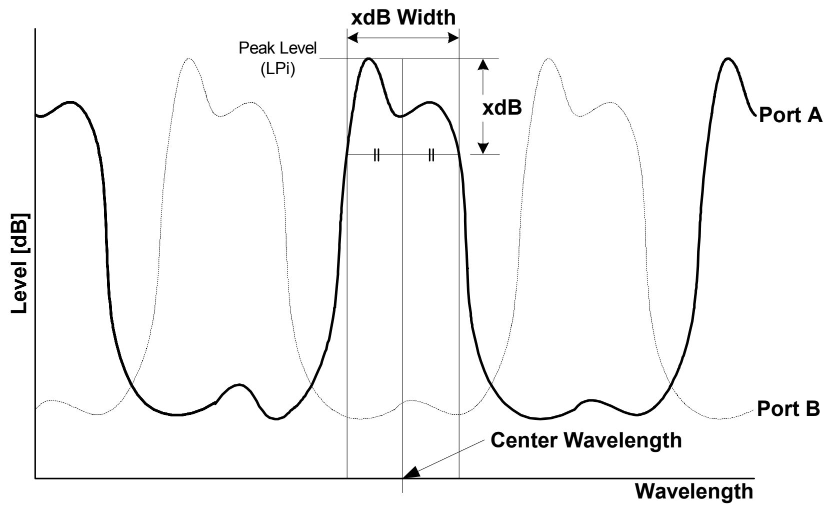


Fig. 8-25: xdB Width and Center Wavelength

- Parameter
  THRESH
- Procedure
  Obtain the width (xdB_Width), which is below the peak level LPi of each channel by the parameter THRESH_LEVEL both on the left and on the right, and its center wavelength.
  * The algorithm for analysis is the same as the algorithm THRESH of the spectrum width.

XdB Stop-band

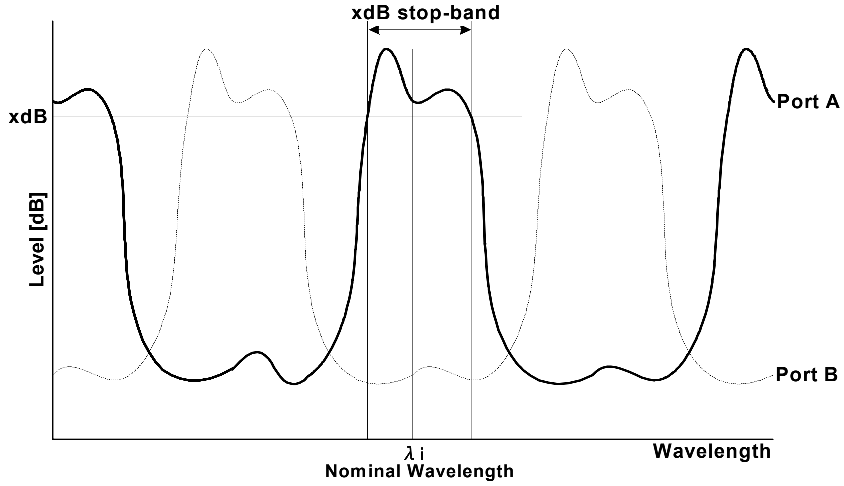


Fig. 8-26: xdB Stop-band

- Parameter
  THRESH
- Procedure
  Obtain the width (xdB_stop-band) that centers on the reference wavelength λi of each channel and that is located below by the parameter THRESH_LEVEL both on the left and on the right.

XdB Pass-band

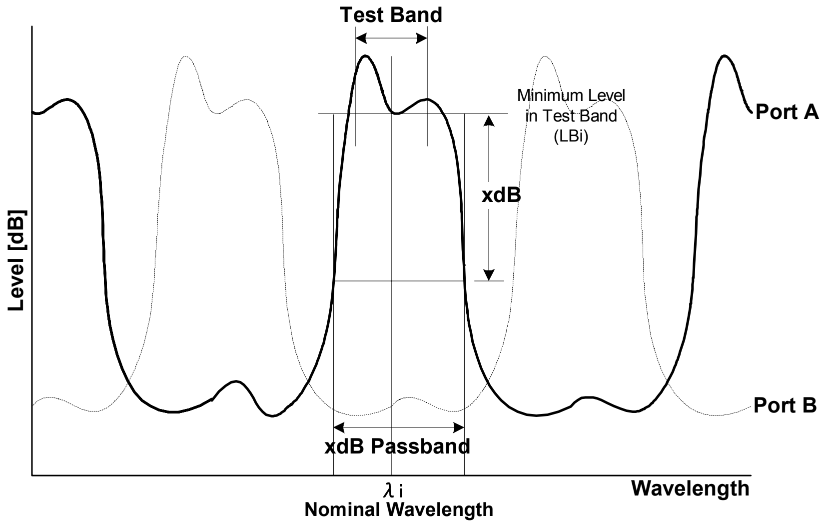


Fig. 8-27: XdB Pass-band

- Parameter
  THRESH
  TEST BAND
- Procedure
  ① Perform the bottom search within the range of parameter Test_Band/2 by centering on reference wavelength λi of each channel and obtain the bottom level (LBi).
  ② Obtain the width (xdB_pass-band) that is below the bottom level LBi obtained in ① by the parameter THRESH _LEVEL.

Ripple

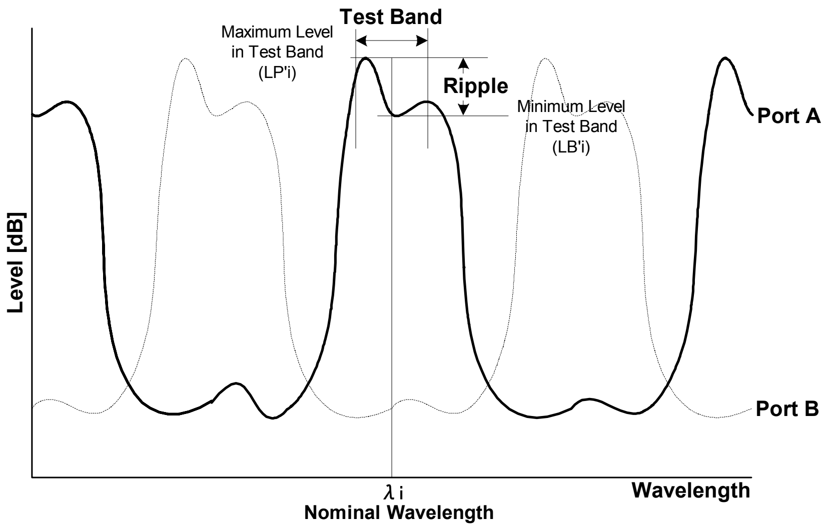


Fig. 8-28: Ripple

- Parameter
  TEST BAND
- Procedure
  ① Perform the peak search and bottom search within the range of parameter Test_Band/2 by centering on the reference wavelength λi of each channel, and obtain the peak level (LP'i) and the bottom level (LB'i).
  ② Use the peak level (LP'i) and bottom level (LB'i) obtained in ① to obtain the ripple from the following equation:
  Ripple = LP'i − LB'i

8

Cross Talk

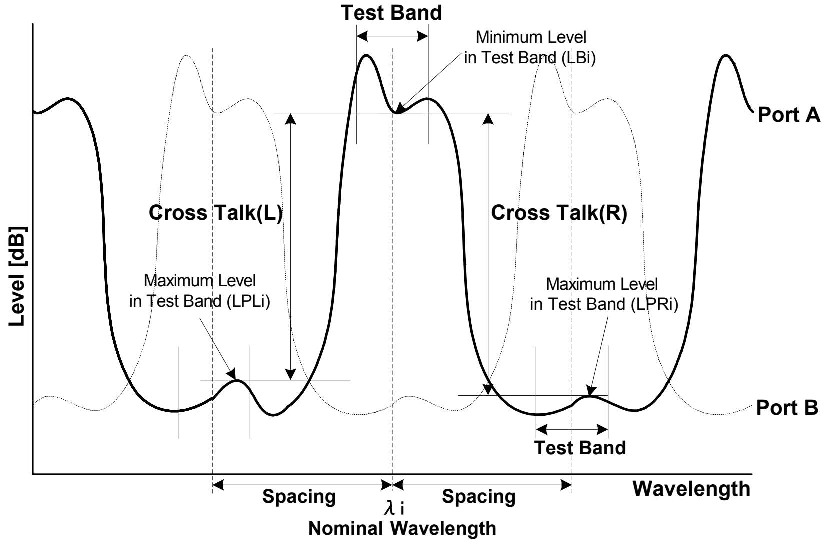


Fig. 8-29: Cross Talk

- Parameter
  - SPACING
  - TEST BAND
- Procedure

① Perform a bottom search within the range of parameter Test_Band/2 while centering on reference wavelength (λ i) of each channel and obtain the bottom level (LBi).

② Perform a peak search within the range of parameter Test_Band/2 while centering on the point (λi-λSP) that is obtained by subtracting the parameter SPACING from the reference wavelength λi of each channel. Then, obtain the peak level (LPLi).

③ Perform a peak search within the range of parameter Test_Band/2 while centering on the point (λi+λSP) that is obtained by adding the parameter SPACING to the reference wavelength λi of each channel. Then, obtain the peak level (LPRi).

④ Use the values obtained in ①, ②, and ③ to obtain the left and right cross talks (XTLi, XTRi) of each channel from the following equations:

XTLi = Lbi − LPLi

XTRi = Lbi − LPRi

8.5.6 WDM FILTER BOTTOM Analysis Function

This function enables the collective analysis of multiple items of each channel via the measured waveforms of multi-channel optical filters.
It also enables filter analysis for multi-mode waveforms, which is different from the FILTER BOTTOM analysis.

(1) Items for analysis

Table 8-21: Details of Analysis by WDM FILTER BOTTOM Analysis Function

Item for Analysis	Description
1. Nominal Wavelength	Reference wavelength/frequency of each channel
2. Bottom Wavelength / Level	Peak wavelength/frequency and level of each channel
3. xdB Notch Width / Center Wavelength	xdB notch width of each channel and its center wavelength/frequency
4. xdB-Stop-band	Wavelength width / frequency width across xdB of each channel
5. xdB Elimination-Band	Elimination band that is xdB from the bottom within the test band of each channel
6. Ripple	Max-min level (flatness) within the test band of each channel
7. Cross Talk	Difference in level between the positions that are xnm away in each channel

(2) List of Parameters

Table 8-22: Parameters for WDM FILTER BOTTOM Analysis Function

Item	Parameter	Default	Setting Range	Unit
Channel Detection, Nominal Wavelength	ALGORITHM	NOTCH(B)	PEAK / NOTCH(P) / NOTCH(B) / GRID	-
	MODE DIFF	3.0	0.1 to 50.0	dB
	THRESH	20.0	0.1 to 99.9	dB
	TEST BAND	0.100	0.001 to 9.999	nm
Bottom Wavelength/Level	SW	ON	ON / OFF	-
XdB Width Center Wavelength	SW	ON	ON / OFF	-
	ALGORITHM	NOTCH(B)	NOTCH(P) / NOTCH(B)	
	THRESH	3.0	0.1 to 50.0	dB
XdB Stop-band	SW	ON	ON / OFF	-
	THRESH	-10.00	-90.00 to 30.00	dB
XdB Elimination-Band	SW	ON	ON / OFF	
	THRESH	3.0	0.1 to 50.0	dB
	TEST BAND	0.20 / 25.0	0.01 to 99.99 / 1.0 to 999.9	nm / GHz
Ripple	SW	ON	ON / OFF	
	TEST BAND	0.20 / 25.0	0.01 to 99.99 / 1.0 to 999.9	nm / GHz

Item	Parameter	Default	Setting Range	Unit
Cross Talk	SW	ON	ON / OFF	
	SPACING	0.80 / 100.0	0.01 to 99.99 / 1.0 to 999.9	nm / GHz
	TEST BAND	0.20 / 25.0	0.01 to 99.99 / 1.0 to 999.9	nm / GHz

(3) Algorithm for analysis

NOMINAL WAVELENGTH

- Parameter
  - ALGO
  - MODE DIFF
  - THRESH
  - TEST BAND
- Procedure

a. BOTTOM

・Channel: each mode bottom detected by a mode search

(Except for the mode bottoms at levels which are above the mode at the lowest level by THRESH[dB] or more.)

・Reference wavelength: wavelength of each mode bottom

・Bottom wavelength/level: wavelength/level of each mode bottom

b. NOTCH(B)

・Channel: each mode bottom detected by a mode search

(Except for the mode bottoms at levels which are above the mode at the lowest level by THRESH[dB] or more.)

・Reference wavelength: 3dB-center wavelength with each mode bottom as the reference

(ALGO=BOTTOM)

・Bottom wavelength/level: wavelength and level of each mode peak

c. NOTCH(P)

・Channel: each mode peak detected by a mode search

(Except for the mode bottoms at levels which are above the mode at the lowest level by THRESH[dB] or more.)

・Reference wavelength: 3dB-center wavelength with each mode bottom as the reference (ALGO=PEAK)

・Bottom wavelength/level: wavelength and level of each mode bottom d . GRID FIT

・Channel: modes within the range of GRID wavelength ± (TEST BAND/2) among the mode bottoms detected via a mode search (except for the mode bottoms at levels which are higher than the mode at the lowest level by THRESH[dB] or more).
If the number of relevant modes in one GRID is more than one, only the mode at the lowest level will be regarded as the channel.

・Reference wavelength: GRID wavelength nearest to each channel

・Bottom wavelength/level: wavelength and level of the mode bottom of each channel

e. GRID

・Channel: A mode search shall not be performed. All the GRID wavelengths within the range of analysis shall be the channels.

・Reference wavelength: GRID wavelength of each channel

・Peak wavelength/level: Bottom wavelength and bottom level within the range of GRID wavelength ± (TEST BAND/2) of each channel

BOTTOM WL / BOTTOM LVL

- Parameter

  THRESH

  MODE DIFF
- Procedure

  Obtain the wavelength λ'i of the mode bottom of each channel and its signal optical level LBi.

XdB_NOTCH_WIDTH/CENTER WAVELENGTH

- Parameter

  ALGO
- Procedure

  According to the settings of the parameter ALGO, obtain the xdB notch width (xdB_Notch_Width) of each channel and its center wavelength/frequency (Center_Wavelength).

a. NOTCH (B)

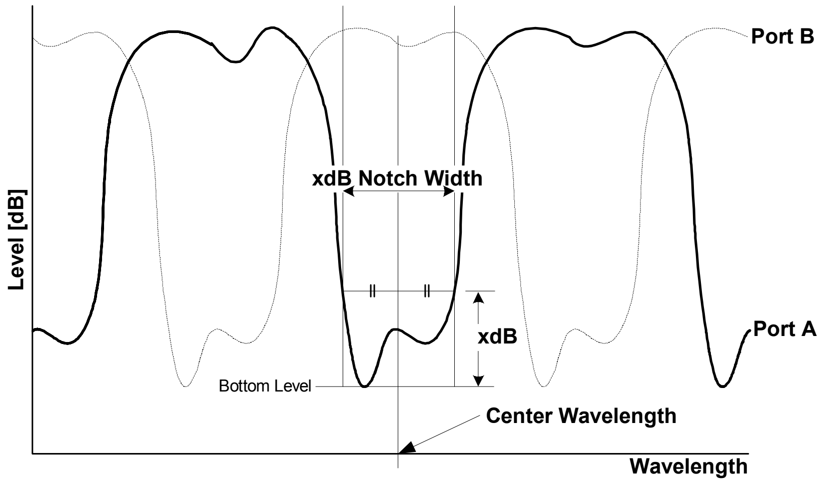


Fig. 8-30: xdB Width and Center Wavelength (Algorhythm = NOTCH(B))

Obtain the width (xdB_Notch_Width) between the two points, which are above the bottom level of each channel by the parameter THRESH_LEVEL, and its center wavelength (Center_Wavelength).

b. NOTCH(P)

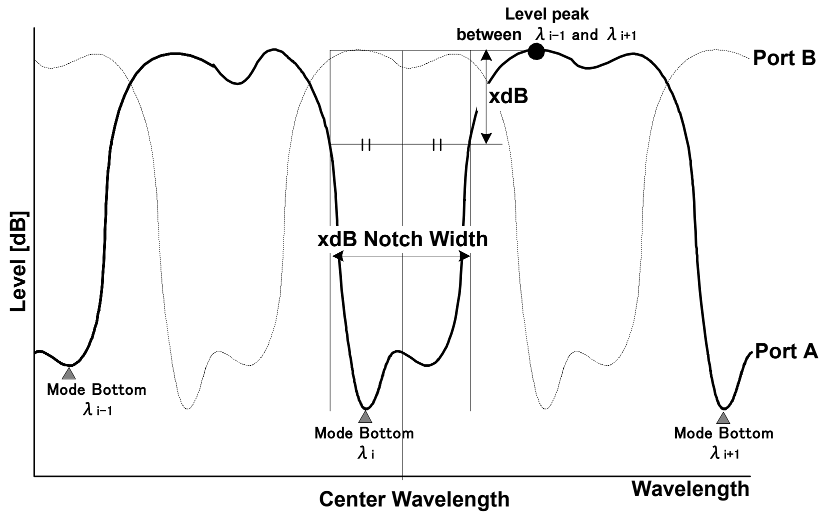


Fig. 8-31:xdB Width and Center Wavelength (Algorhythm = NOTCH(P))

Obtain the width (xdB_Notch_Width) between the two points, which are below the higher point of either the left peak level or the right peak level of each channel by the parameter THRESH_LEVEL, and its center wavelength/frequency (Center_Wavelength).

XdB_STOP-BAND

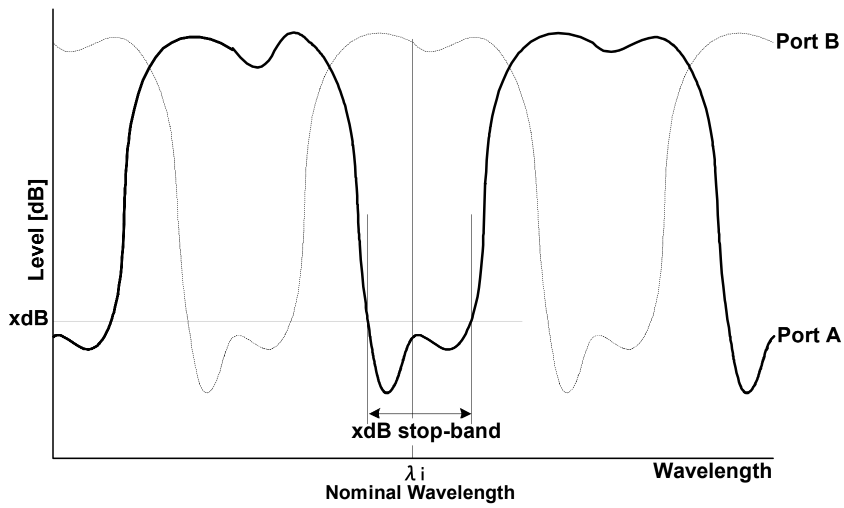


Fig. 8-32 xdB Stop-band

- Parameter
  THRESH
- Procedure
  Obtain the width (xdB_stop-Band) that centers on the nominal wavelength λi of each channel and that is located below by the parameter THRESH_LEVEL both on the left and on the right.

XdB_ELIMINATION BAND

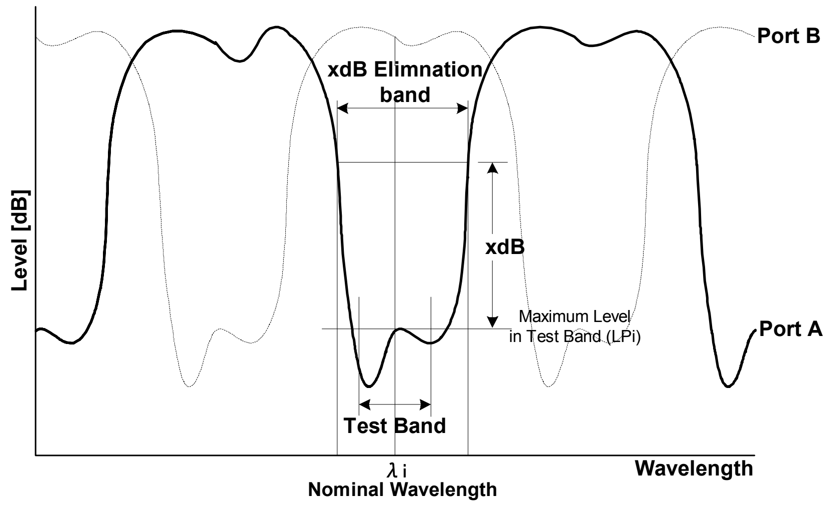


Fig. 8-33: xdB Elimination band

- Parameter
  THRESH
  TEST BAND
- Procedure
  ① Perform the peak search within the range of the parameter Test_Band/2 by centering on the nominal wavelength λi of a channel and obtain the peak level (LPi).
  ② Obtain the width (xdB_Elimination_Wavelength) that is above the peak level LPi obtained in ① by the parameter THRESH_LEVEL both on the left and on the right.

RIPPLE

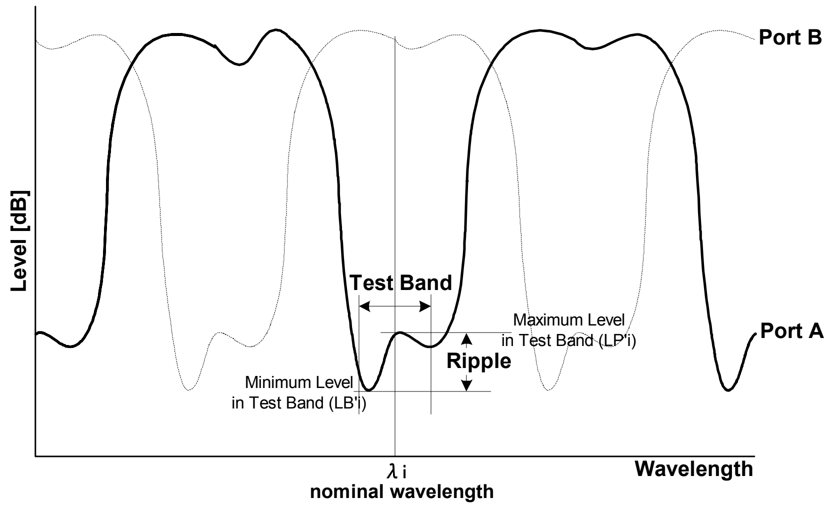


Fig. 8-34: Ripple

- Parameter
  TEST BAND
- Procedure
  ① Perform the peak search and bottom search within the range of parameter Test_Band/2 by centering on reference wavelength λi of each channel, and obtain the peak level (LP'i) and the bottom level (LB'i).
  ② Use the peak level (LP'i)and bottom level (LB'i) obtained in ① to obtain the ripple (Ripple) from the following equation:
  Ripple = LP'i − LB'i

8

CROSS TALK

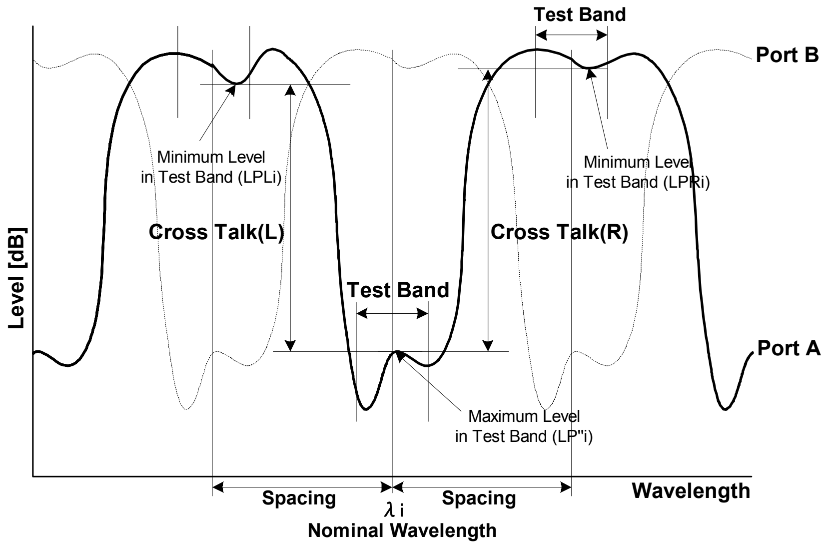


Fig. 8-35: Cross Talk

- Parameter
  - SPACING
  - TEST BAND
- Procedure
  - ① Perform a peak search within the range of parameter Test_Band/2 while centering on the reference wavelength λi of each channel and obtain the peak level (LP"i).
  - ② Perform a bottom search within the range of parameter Test_Band/2 while centering on the point (λi-λSP) that is obtained by subtracting the parameter SPACING from the reference wavelength λi of each channel. Then, obtain the bottom level (LPLi).
  - ③ Perform the bottom search within the range of parameter Test_Band/2 while centering on the point (λi+λSP) that is obtained by subtracting the parameter SPACING from the reference wavelength λi of each channel. Then, obtain the bottom level (LPRi).
  - ④ Use the values obtained in ①, ②, and ③ to obtain the left and right cross talks (XTLi、XTRi) of each channel from the following equations:

    XTLi = LP"i − LPLi

    XTRi = LP"i − LPRi

8.6 How to Set the Clock

The AQ6319 displays the date and time in the upper right corner of the screen. This data is also used as indications of date/time when outputs are generated for the printer or the plotter, or as time stamps when data is stored on disks.

If you press the <SET CLOCK> key in the [SYSTEM] switch, the internal clock setting window shown in Figure 8-36 is displayed. The clock has the following three formats. Use the soft key to choose one of them.

YM-MO-DY: year-month-day
MO-DY-YR: month-day-year
DY-MO-YR: day-month-year

To change the date and time, use the <CURSOR→> key to move the inverted positions in the internal clock setting window and perform changes in the DATA ENTRY section.

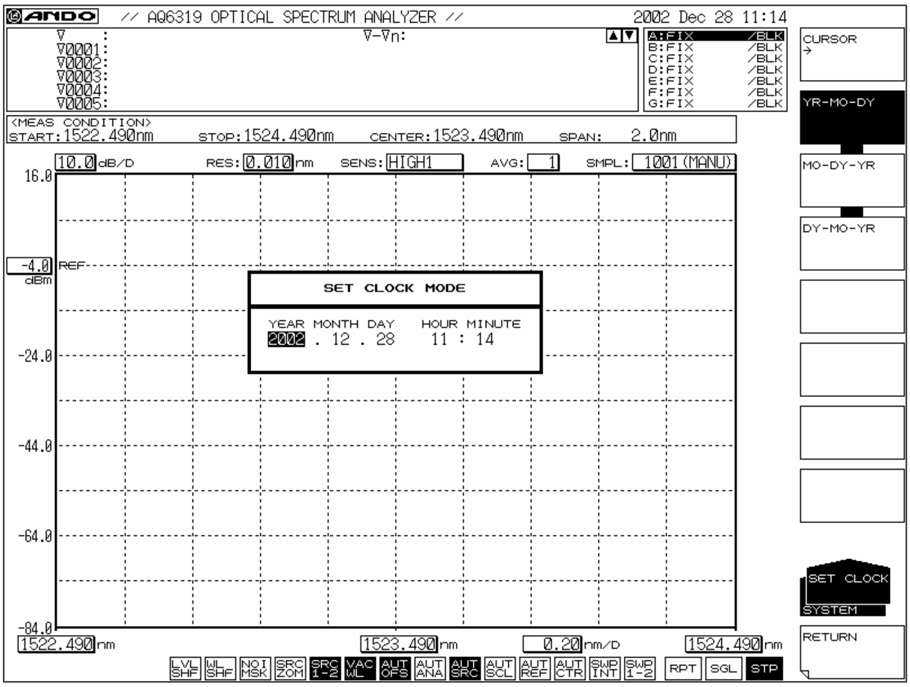


Fig. 8-36: Internal Clock Setting Window

8

8.7 WARNING Display Function

The AQ6319 displays warning messages, for example, if a failure occurs due to erroneous operations or if the selection status of a soft key is forced to change because the selection status of another soft key is changed.

A warning message comprising a number and a short message is displayed in the window that appears in the center of the screen.

The default setting is such that a warning message is displayed if a warning situation occurs. However, if you press the <UNCAL WARNING OFF/ON> key in the [SYSTEM] switch to turn off the key in the switch, you can disable the UNCAL and warning displays. It is recommended that the <UNCAL WARNING OFF/ON> key be set to ON.

In addition, if you use the <BUZZER> key of the [SYSTEM] switch to select the <WARNING> key, this unit calls attention to warning situations through the message display and a buzzer sound.

Table 8-23 shows the list of warning numbers, short messages, and possible causes.

Classifications of warning numbers:

1 - 20:	Message generation after the execution of functions.
50 - 171:	Generation of a reason why a function cannot be executed.
200 - 299:	Warnings for hardware failures
300 - 399:	Errors during the execution of program functions

Although the errors in 300 - 399 are described in Table 8-23, they are also described in the Program/Remote Function Manual. Refer to these descriptions when you use program functions. (☛ Chapter 1, "Program Functions" of Program/Remote Function Manual). You can read out the warning numbers as talk data in response to the GP-IB talker command “SYSTem:ERRor[:NEXT]?.”

NOTE

Priority of warnings:

- Of the warnings mentioned above, those in the 200 level (hardware-related errors) have the highest priority: their processing is given a higher priority if they occur simultaneously with other factors.

Table 8-23: List of Warnings

No.	Message	Possible errors resulting in warnings
No.1 - 49: Message generation after the execution of functions		
1	Unsuitable Resolution	Data may not be extracted completely, because the resolution setting is not appropriate for the span and the sampling number.
2	Unsuitable Level Scale	A level scale larger than 5 dB/DIV has been set in the range fixed mode (SENS:NORM HOLD). If a level scale is set to 5 dB/DIV or more in the range fixed mode, data from the top and bottom of the screen may not be properly displayed.
3	Unsuitable Ref Level	Although an attempt was made to set the peak level of a waveform to the reference level, the nearest value within the range was chosen because the peak level value was outside the setting range of the reference level values.
4	Unsuitable Marker Value	Although an attempt was made to set a maker value to the reference level, the nearest value within the range was chosen because the marker value was outside the setting range of the reference level values.
5	<AUTO ANALYSIS> off	Selection of the <AUTO ANALYSIS> key was canceled.
6	<AUTO SEARCH> off	Selection of the <AUTO SEARCH> key was canceled.
7	Each Trace resolution mismatch	When the calculation between traces was performed, resolutions of traces were set differently.
8	<HOLD> off	HOLD was canceled because the allocation of traces to the divided screen was changed.
9	Trace * state changed	The HOLD state was canceled because the state of traces under HOLD was changed from FIX to another state.
10	<AUTO REF LEVEL> off	Selection of the <AUTO REF LEVEL> key was canceled.
11	<AUTO SUB SCALE> off	Selection of the <AUTO SUB SCALE> key was canceled.
12	Input light power is too high	Since the intensity of input light is too high, measuring waveforms may be saturated.
No.50 - 199: Generation of a reason why a function cannot be executed		
50	TLS does not respond	The Tunable Laser Source does not respond.
51	TLS is not connected	The Tunable Laser Source is not connected.
52	Unsuitable TLS mode	The Tunable Laser Source is sct incorrectly.
53	Unsuitable wavelength range	The wavelength range exceeds the settable range of the Tunable Laser Source.
101	All traces in FIXed state	Waveforms cannot be re-written, because all traces have been set to FIX.
102	Sweep stopped	Sweep was stopped, because all traces were set to FIX during the sweep.
103	No data in active trace	An attempt was made to execute analysis functions when there was no data in an active trace.
107	Unsuitable memory number	A number other than 0 – 99 was specified when the memory was saved or recalled. Or, an attempt was made to recall data from a memory where waveforms have not been saved.
108	Marker setting out of range	An attempt was made to execute the analysis function between markers in the state where both line marker 1 and line marker 2 were set outside the measurement range.
109	Auto sweep failed	Although the AUTO sweep started, the sweep stopped because optimum conditions were not found.
110	No data between line markers	An attempt was made to execute the analysis function in a state where there was no data in the line markers of an active trace.
111	<G=MKR FIT> failed	Trace G cannot write fitting curve because numbers of data is not sufficient during <G=MKR FIT>.
120	Disk not inserted	A floppy disk has not been inserted to the drive.
121	Disk not initialized	The floppy disk has not been initialized.
122	Disk is write protected	The floppy disk has been write-protected.
123	File not found	The specified file cannot be read because it has not been found. Or, the file does not exist on the disk.
125	Illegal file name	The file cannot be saved because its name is not appropriate.
128	File is write protected	The file cannot be re-written or deleted because its property has been set to READ ONLY.
129	Disk full	The file cannot be saved, because the hard disk or the floppy disk is full.
130	Directory full	No files can be created because the directory area is full.
131	No data	There was no data to be saved, although an attempt was made to save the file.
132	File is not a trace file	The file cannot be read because it is not a waveform file.

No.	Message	Possible errors resulting in warnings
	No.50 - 199: Generation of a reason why a function cannot be executed	
133	File is not a program file	The file cannot be read because it is not a program file.
134	File is not a data file	The file cannot be read because it is not a data file.
135	File is not a settings file	The file cannot be read because it is not a settings file.
138	Cannot copy	The file copy cannot be executed because the "copy from" file and the "copy to" file have the same name.
140	No paste possible	The paste operation cannot be executed during the editing of programs because the number of blank rows is not sufficient.
141	No merge possible	It is not possible to execute a merge during the editing of programs because the merged result would exceed the maximum number of rows.
142	WL calibration failed	Calibration cannot be executed because the level of a light source is not sufficient during the wavelength calibration or because wavelength deviations exceed the calibration range.
143	Optical Alignment failed	Alignment adjustment cannot be executed because the level of a light source is not sufficient during the alignment adjustment.
144	Go/No go judgment stopped	Go/No go judgment stopped because template data reading or AUTO sweep was carried out with Go/No go judgment function set to ON.
145	No template data	Go/No go judgment or template data display was attempted to be made with no template data provided.
160	Printer paper empty	There was no printer paper, although an attempt was made to use the internal printer for printing.
161	Printer head up	It was not possible to execute printing because the head-up lever of the internal printer was raised.
170	Illegal character	An illegal character was entered for a network name.
171	Illegal address	An illegal address was set to an IP address.
	No.200 - 299: Warnings for hardware failures	
200	Fan motor stopped!	The fan motor stopped.
201	Calibration data failed	This unit has some no normal calibration data.
202	Version information failed!	This unit started in the emulation mode due to abnormal system version information.
203	Version information mismatch!	This unit started in the emulation mode due to abnormal system version information.
204	Memory error (OPT-FROM)!	This unit started in the emulation mode due to abnormal program in memory.
205-206	Internal communication error!	This unit has a communication error.
207	Calibration data failed!	This unit has some no normal calibration data.
210	Opt firmware not found!	The firmware program contains some abnormal information.
211/212	Auto offset error!	An abnormal situation occurred during the automatic offset operations of the amplifier.
213	Auto temperature control error!	Temperature of the optical detector in the monochromator went to an abnormal level.
220-229	Boot sequence error!	An abnormal situation occurred during initialization upon startup.
230-249	Monochromator error!	An abnormal situation occurred during operations in the monochromator.
250-269	Measurement sequence error!	The sweep stopped because measurement sequence fell into disorder during the sweep.
	No.300 - 399: Errors during the excution of program functions	
300	Parameter out of range	A variable value is out of range or is not defined for a command that sets a parameter using variables.
302	Scale unit mismatch	There is a difference between the Y-axis scale of the active trace and the unit of a parameter in the "LINE MKR 3 or 4" command.
303	No data in active trace	Setting of the moving marker, a peak (or bottom) search, or activation of the analysis function was made with no data in the active trace.
304	Marker value out of range	Specified wavelength was out of the sweep range in the moving marker or line wavelength marker setting command.
305	No data in traces A or B	No waveform data in traces A or B when executing the "EDFA NF" command
306	Invalid data	Trace had no data when attempting to save it to memory or to write it to FD/HDD.
307	Unsuitable Write item	All data items were OFF at execution of "WRITE DATA".
320	Undefined variable	A command containing an undefined variable was executed.

No.	Message	Possible errors resulting in warnings
No.300 - 399: Errors during the excution of program functions		
321	Variable unit mismatch	The unit of each variable does not agree within a command containing two or more variables.
322	Overflow	An overflow occurred in an arithmetic operation.
323	Undefined marker variable	A command containing a marker-value variable was executed when no marker had been displayed.
324	Invalid marker variable	A command containing the corresponding variable was executed at a time other than immediately after execution of a spectrum width search, peak search, etc.
325	Undefined line number	GOTO command's jumping destination is a number other than 1 to 200.
326	F1 greater than F2	F1>F2 when the "IF F1 ≦@@@@@ ≦F2" command was executed.
340	Printer paper empty	No printer paper
341	Printer head up	No print is made because the printer's head-up lever is raised.
345	Option does not respond	No response from an external device
346	Option is not connected	No external device is connected.
347	GPIB2 not system controller	System controller connected to the GP-IB2 port has been set to an external computer.
360	Disk full	No file can be created due to insufficient free space on the floppy disk.
361	Disk not inserted	No floppy disk is in the FDD.
362	Disk is write protected	The floppy disk is write protected.
363	Disk not initialized	The floppy disk has not been initialized or has been formated in a format not usable in this unit.
364	Directory full	Directory is full, therefore no file can be created.
365	File not found	Because no specified file is found, it cannot be read, or there is no file on the disk.
366	File is write protected	The file is specified to be read only, so that it cannot be rewritten or deleted.
367	No data	No data to store
368	File is not a trace file	A file cannot be read because it is not a trace file.
369	Illegal file name	A file cannot be saved due to an incorrect file name.
380	Undefined program	An attempt was made to run a program that is not defined.
381	Syntax error	Wrong command (a program has been rewritten for some reason)

8.8 Updating the Firmware

Users may be requested to update the software of the AQ6319 for functional additions or modifications. The update disk is required for this purpose.

Software is updated in the following manner:

(1) Press the [SYSTEM] switch. Then, press the <VERSION> key on the soft key <MORE 4/4> page so that the version of the current firmware is displayed.

(2) While the firmware version is displayed, press the <UPDATE> key so that "Insert Update Disk 1" appears on the screen. Then, insert the update disk into this unit.

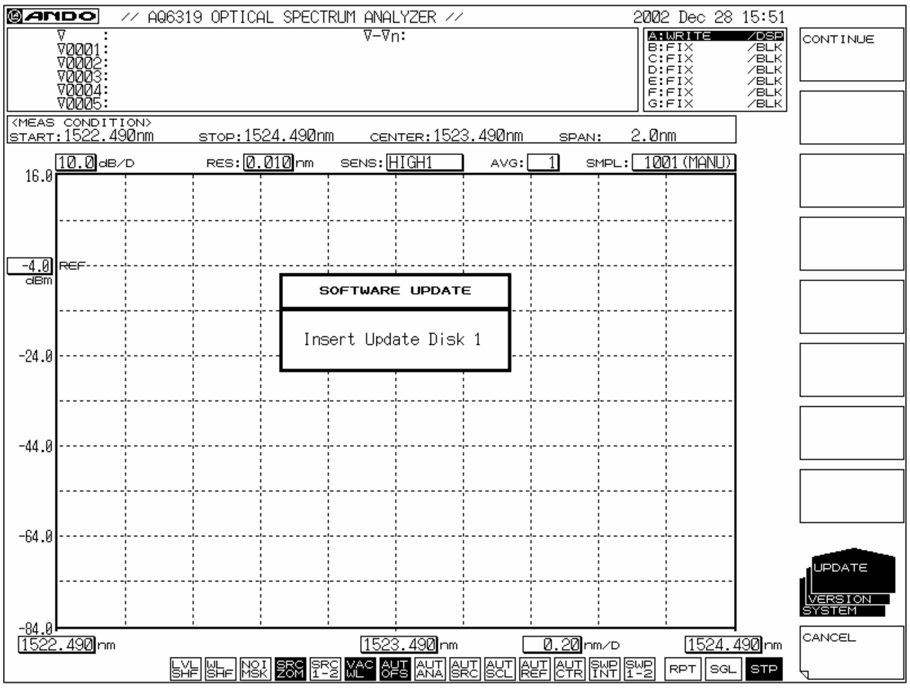


Fig. 8-37: Screen when the <UPDATE> key is pressed

(3) Press the <CONTINUE> key to read the update file. If you press the <CONTINUE> key without inserting the update disk, a warning message appears.

WARNING: 123 File not found

(4) The version of the firmware included in the update disk as well as the update confirmation message "Are you sure?" are displayed. To execute the update, press the <YES> soft key to start reading the update file. To cancel the update, press the <NO> key.

(5) After the file is read, the message “REBOOT for system update. Are you sure?” appears on the screen. Press the <YES (REBOOT)> soft key to restart the system automatically.

(6) If the system starts as usual after the re-start, the initialization window displays “NOW UPDATE” to update the internal flash memory. When the update of the flash memory is completed, the usual initialization starts and the waveform window is displayed.

⚠Caution

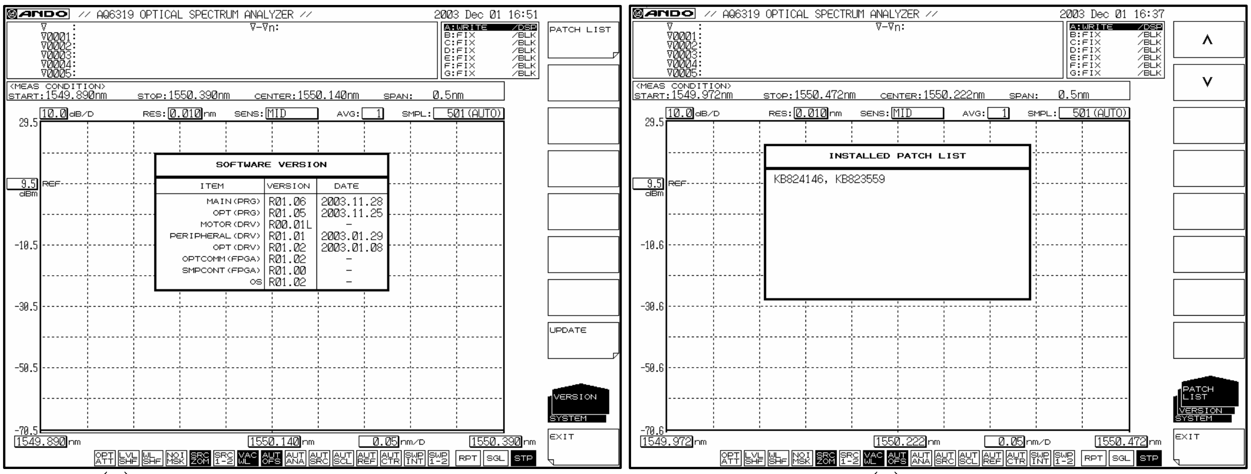
- It takes about five minutes to update the internal flash memory. Do not turn the power off during processing:
  Content of the flash memory may be destoyed.
- If the power is turned off mistakenly, turn on the power again so that the update processing will be executed again.

After the update is completed, use the <VERSION> key in the [SYSTEM] switch to confirm that the software version of this unit is the same as the one in the update disk.

When you press the <PATCH LIST> key, patch list, which installed in OS (Operating System) of this unit indicate. This key is used to confirm that the patch list applied brand-new patch.

Please contact us at the Yokogawa Electric on the detailed patch information.

(☛ Contact information is described at the end of the document.)



(a)Software version information (b)Installed patch list

Fig 8-38 Software version information and installed patch list

8.9 Data Initialization Function

The AQ6319 internally memorizes parameters such as waveform data, measurement conditions, soft key selection states (display states of inverse display keys or keys that are inversed by being pressed) and retains these states even after the power is turned off after use.

NOTE

- System environments such as the AQ6319's network name and IP address, the driver software of the installed external printer as well as the key settings registered in the [USER] switch will not be initialized. To clear the key settings of the [USER] switch, use the <USER KEY DEFINE> key of the [SYSTEM] switch to register a blank key. If a blank key is registered, the registered USER key will be cleared.

Follow the operations below to enable the initialization of saved data.
Types of nonvolatile data as well as the default value of each item of data are shown in "Table 8-24 Parameter Default Values for Functions."

Initialization procedure:

① Press the <PARAMETER INITIALIZE> key in the [SYSTEM] switch.

② Choose items to be initialized.

PARAMETER CLEAR	The parameter setting value of each function is initialized. Waveform data of TRACE A - G is also initialized. This shall be used when the settings of this unit are returned to the already-known states.
PARAM&DATA CLEAR	Parameter setting values as well as data including MEMORY and PROGRAM are initialized.
CAL DATA CLEAR	Alignment adjustment values and wavelength calibration values are initialized.
ALL CLEAR	Current parameter setting values and data as well as alignment adjustment values and wavelength calibration values are initialized.

③ Press the <EXECUTE> key to execute the initialization. To cancel the initialization, press the <CANCEL> key.

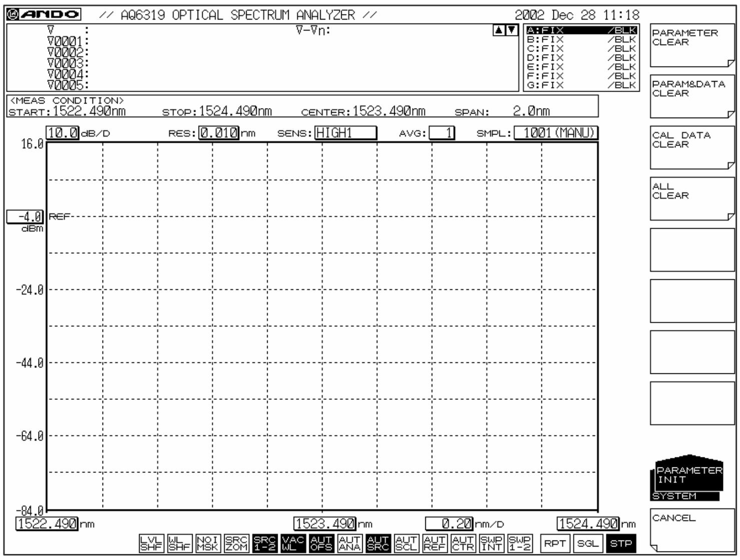


Fig. 8-39: Screen when the <PARAMETER INIT> key is pressed

Table 8-24: Parameter Default Value for Each Function

Function	Default Value	Maximum Value	Minimum Value
SWEEP			
SEGMENT POINT*****	1	50001	1
SWEEP MKR L1-L2 OFF/ON	OFF	-	-
SWEEP INTERVAL *****sec	MINIMUM=0	99999	MINIMUM=0
CENTER			
CENTER WL ****.***nm	1150.000	1700.000	600.000
CENTER FREQ ***.****THz	338.0013	500.0000	176.5000
START WL ****.***nm	600.000	1700.000	50.000
START FREQ ***.****THz	176.3485	500.0000	11.5000
STOP WL ****.***nm	1700.000	2250.000	600.000
STOP FREQ ***.****THz	499.6541	665.0000	176.5000
AUTO CENTER OFF/ON	OFF	-	-
SPAN			
SPAN****.*nm	1100.0	1100.0	0 / 0.1
SPAN FREQ***.**THz	323.31	330.00	0.00
START WL****.***nm	600.000	1700.000	50.000
START FREQ***.****THz	176.3485	500.0000	11.5000
STOP WL****.***nm	1700.000	2250.000	600.000
STOP FREQ***.****THz	499.6541	665.0000	176.5000
0nm SWEEP TIME**sec	MINIMUM	50	MINIMUM
LEVEL 1/2			
REF LEVEL LOG	-10.0	30.0	-90.0
REF LEVEL LINEAR	100uW	1000mW	1.00pW
LOG SCALE**.*dB/D	10.0 , ON	10.0	0.1
LIN SCALE	OFF	-	-
LIN BASE LEVEL**.*mW	0.0	REF×0.9	0.0
AUTO REF LEVEL OFF/ON	OFF	-	-
LEVEL UNIT dBm / dBm/nm	dBm	-	-

8

Function		Default Value	Maximum Value	Minimum Value
LEVEL 2/2				
Y SCALE SETTING	Y SCALE DIVISION 8/10/12	10	12	8
	REF LEVEL POSITION **DIV	8	12	0
SUB LOG**.*dB/D		5.0 , ON	10.0	0.1
SUB LIN*.***/D		0.125 , OFF	1.250	0.005
SUB SCALE**.*dB/km		5.0 , OFF	10.0	0.1
SUB SCALE**.*%/D		10.0 , OFF	125.0	0.5
OFFSET LEVEL**.*dB		0.0	99.9	-99.9
SCALE MIN ***		0.00	1.25	0.00
OFFSET LEVEL**.*dB/km		0.0	99.9	-99.9
SCALE MIN **.*%		0.0	100.0	0.0
LENGTH**.***km		1.000	99.999	0.001
AUTO SUB SCALE OFF/ON		OFF	-	-
SUB REF LVL POSITION **DIV		5	10	0
SETUP				
RESOLUTION @@@@nm		1.000	1.000	0.010
SENS/MODE	NORM/HOLD	OFF	-	-
	NORM/AUTO	ON	-	-
	MID	OFF	-	-
	HIGH1	OFF	-	-
	HIGH2	OFF	-	-
	HIGH3	OFF	-	-
	CHOPPER OFF/CHOP/SWITCH	OFF	-	-
AVG TIMES ***		1	999	1
SAMPLING POINT AUTO		ON	-	-
SAMPLING POINT *****		Calculated value of <SAMPLING POINT AUTO>, OFF	50001	101
SAMPLING INTERVAL *.****nm		Calculated value of <SAMPLING POINT AUTO>, OFF	SPAN/100	0.0010
MEAS WL AIR/VACUUM		VAC	-	-
HORZN SCALE nm/THz		nm	-	-
EXT TRIGGER MODE OFF/ON		OFF	-	-
EXT TRIGGER SETTING	EDGE RISE/FALL	RISE	-	-
	DELAY ****.*μs	0.0	1000.0	0.0
OPT ATT OFF/ON		OFF	-	-
TLS SYNC SWEEP OFF/ON		OFF	-	-
ZOOM 1/2				
ZOOM CENTER WL ****.***nm		Measured center wavelength of the trace that was measured or read last	1700.0000	600.0000
ZOOM CENTER FREQ ***.****THz		Measured center frequency of the trace that was measured or read last	500.0000	176.5000
ZOOM SPAN WL****.*nm		Measured span of the trace that was measured or read last	1100	0.1
ZOOM SPAN FREQ***.**THz		Measured span of the trace that was measured or read last	330.0000	0.01

Function	Default Value	Maximum Value	Minimum Value
ZOOM 2/2			
ZOOM START WL ****.***nm	Measured start wavelength of the trace that was measured or read last	1699.950	50.000
ZOOM START FREQ ***.****THz	Measured start frequency of the trace that was measured or read last	499.9950	11.5000
ZOOM STOP WL ****.***nm	Measured stop wavelength of the trace that was measured or read last	2250.000	600.050
ZOOM STOP FREQ ***.****THz	Measured stop frequency wavelength of the trace that was measured or read last	665.0000	176.5050
OVERVIEW DISPLAY OFF/L/R	R	-	-
OVERVIEW SIZE LARGE/SMALL	LARGE	-	-
DISPLAY			
NORMAL DISPLAY	ON	-	-
SPLIT DISPLAY	OFF	-	-
SPLIT DISPLAY TRACE A UP/LOW	UP	-	-
TRACE B UP/LOW	UP	-	-
TRACE C UP/LOW	LOW	-	-
TRACE D UP/LOW	UP	-	-
TRACE E UP/LOW	UP	-	-
TRACE F UP/LOW	LOW	-	-
TRACE G UP/LOW	LOW	-	-
HOLD UPPER HOLD OFF/ON	OFF	-	-
LOWER HOLD OFF/ON	OFF	-	-
LABEL	// AQ6319 OPTICAL SPECTRUM ANALYZER //		
NOISE MASK ***dB	OFF	0	OFF(-999)
MASK LINE VERT / HRZN	HRZN	-	-
TRACE 1/2			
ACTIVE TRACE A/B/C/D/E/F/G	TRACE A	-	-
VIEW @ DISP/BLANK	TRACE A=DISP , TRACE B/C/D/E/F/G =BLANK	-	-
WRITE @	TRACE A= ON		
FIX @	TRACE B/C/D/E/F/G		
HOLD @ MAX HOLD	No TRACE , TRACE A,C,E,G	-	-
MIN HOLD	No TRACE , TRACE B,D,F	-	-
ROLL AVG *	No TRACE , 2	100	2
CALCULATE C @@@@ LOG MATH @@@@	C=A-B(LOG) , ON	-	-
LIN MATH @@@@	C=A+B(LIN) , OFF		
CALCULATE F @@@@ LOG MATH @@@@	F=C-D(LOG) , ON	-	-
LIN MATH @@@@	F=C+D(LIN) , OFF	-	-
CALCULATE G @@@@@@@@ LOG MATH @@@@	G=C-F(LOG) , ON	-	-
LIN MATH @@@@	G=C+F(LIN) , OFF	-	-
NORMALIZE @@@@	G=NORM A , OFF	-	-
CURVE FIT @@@@	G=CVFIT A, OFF		
THRESH **dB	20	99	0

Function			Default Value	Maximum Value	Minimum Value
TRACE 2/2					
CALCULATE G @@@@@@@@@	CURVE FIT @@@@	OPERATION AREA	ALL	-	-
		FITTING ALGO	GAUSS		
	CURVE FIT PK @@@@				
		THRESH **dB	20	99	0
		OPERATION AREA	ALL	-	-
		FITTING ALGO	GAUSS	-	-
TRACE COPY	SOURCE TRACE @		A	-	-
	DESTINATION TRACE @		B	-	-
MARKER					
MARKER ACTIVE OFF/ON			OFF	-	-
SET MARKER	SET		1	1024	1
LINE MARKER 1 OFF/ON			OFF	WL=1700.000 FREQ=499.65410	WL=600.000 FREQ=176.34850
LINE MARKER 2 OFF/ON			OFF	WL=1700.000 FREQ=499.65410	WL=600.000 FREQ=176.34850
LINE MARKER 3 OFF/ON			OFF	LOG=30.0 LINEAR=1000mW	LOG=-90.0 LINEAR=1.00pW
LINE MARKER 4 OFF/ON			OFF	LOG=30.0 LINEAR=1000mW	LOG=-90.0 LINEAR=1.00pW
MAKER DISPLAY OFFSET/SPACING			OFFSET	-	-
MARKER AUTO UPDATE OFF/ON			OFF	-	-
MARKER UNIT nm/THz			nm	-	-
SEARCH/ANA L1-L2 OFF/ON			OFF	-	-
SEARCH/ANA ZOOM AREA OFF/ON			ON	-	-
PEAK SEARCH					
PEAK SEARCH			ON	-	-
BOTTOM SEARCH			OFF	-	-
SET MARKER			1	1024	1
AUTO SEARCH OFF/ON			OFF	-	-
MODE DIFF **.**dB			3.00	50.00	0.01
SEARCH/ANA L1-L2 OFF/ON			OFF	-	-
SEARCH/ANA ZOOM AREA OFF/ON			ON	-	-
ANALYSIS 1/7					
SPEC WIDTH @@@@	THRESH	THRESH LEVEL *.**dB	3.00	50.00	0.01
		K	1.00	10.00	1.00
		MODE FIT OFF/ON	OFF	-	-
	ENVELOPE	THRESH LEVEL1 *.**dB	3.00	50.00	0.01
		THRESH LEVEL2 *.**dB	13.00	50.00	0.01
		K	1.00	10.00	1.00
	RMS	THRESH LEVEL *.**dB	20.00	50.00	0.01

Function				Default Value	Maximum Value	Minimum Value
ANALYSIS 2/7						
SPEC WIDTH @@@@	RMS		K	2.00	10.00	1.00
	PEAK RMS		THRESH LEVEL *.**dB	20.00	50.00	0.01
	PEAK RMS		K	2.00	10.00	1.00
	NOTCH		THRESH LEVEL *.**dB	3.00	50.00	0.01
			K	1.00	10.00	1.00
			TYPE PEAK/BOTTOM	BOTTOM	-	-
ANALYSIS1 @@@@@@@@	DFB-LD	-XdB WIDTH	ALGO	THRESH	-	-
			THRESH **.**dB	20.00	50.00	0.01
			THRESH2 **.**dB	20.00	50.00	0.01
			K	1.00	10.00	1.00
			MODE FIT OFF/ON	OFF	-	-
			MODE DIFF *.**dB	3.00	50.00	0.01
		SMSR	SMSR MODE SMSR1/SMSR2	SMSR1	-	-
			SMSR MASK ± *.**nm	0.00	99.99	0.00
			MODE DIFF *.**dB	3.00	50.00	0.01
	FP-LD	SPECTRUM WIDTH	ALGO	PK-RMS	-	-
			THRESH **.**dB	20.00	50.00	0.01
			THRESH2 **.**dB	20.00	50.00	0.01
			K	1.00	10.00	1.00
			MODE FIT OFF/ON	OFF	-	-
			MODE DIFF *.**dB	3.00	50.00	0.01
		MEAN WAVELENGTH	ALGO	PK-RMS	-	-
			THRESH **.**dB	20.00	50.00	0.01
			THRESH2 **.**dB	20.00	50.00	0.01
			K	1.00	10.00	1.00
			MODE FIT OFF/ON	OFF	-	-
			MODE DIFF *.**dB	3.00	50.00	0.01
		TOTAL POWER	OFFSET LEVEL *.**dB	0.00	10.00	-10.00
		MODE NO.	ALGO	PK-RMS	-	-
			THRESH **.**dB	20.00	50.00	0.01
			THRESH2 **.**dB	20.00	50.00	0.01
			K	1.00	10.00	1.00
			MODE FIT OFF/ON	OFF	-	-

Function				Default Value	Maximum Value	Minimum Value
ANALYSIS 3/7						
ANALYSIS1 @@@@@@@	LED	SPECTRUM WIDTH	ALGO	THRESH	-	-
			THRESH **.**dB	20.00	50.00	0.01
			THRESH2 **.**dB	20.00	50.00	0.01
			K	1.00	10.00	1.00
			MODE FIT OFF/ON	OFF	-	-
			MODE DIFF *.**dB	3.00	50.00	0.01
		MEAN WAVELENGTH	ALGO	RMS	-	-
			THRESH **.**dB	20.00	50.00	0.01
			THRESH2 **.**dB	20.00	50.00	0.01
			K	1.00	10.00	1.00
			MODE FIT OFF/ON	OFF	-	-
			MODE DIFF *.**dB	3.00	50.00	0.01
		TOTAL POWER	OFFSET LEVEL *.**dB	0.00	10.00	-10.00
	SMSR		SMSR MODE SMSR1/SMSR2	SMSR1	-	-
			SMSR MASK ± *.**nm	0.00	99.99	0.00
	POWER		OFFSET LEVEL *.**dB	0.00	10.00	-10.00
	PMD		THRESH LEVEL *.**dB	3.00	50.00	0.01
ANALYSIS2 @@@@	WDM	CHANNEL DETECTION SETTING	THRESH LEVEL *.**dB	3.00	50.00	0.01
			MODE DIFF *.**dB	3.00	50.00	0.01
	WDM	CHANNEL DETECTION SETTING	DISPLAY MASK OFF/*.*dB	OFF	0.0	-100.0
		INTERPOLATAION SETTING	NOISE ALGO AUTO-FIX/MANUAL-FIX AUTO-CTR/MANUAL-CTR	AUTO-FIX	-	-
			NOISE AREA *.**nm	0.40	10.00	0.01
			MASK AREA *.**nm	0.20	10.00	0.01
			FITTING ALGO LINEAR/GAUSS/LORENZ 3RD POLY/4TH POLY/5TH POLY	LINEAR	-	-
			NOISE BW *.**nm	0.10	1.00	0.01
			DUAL TRACE OFF/ON	OFF	-	-

Function				Default Value	Maximum Value	Minimum Value
ANALYSIS 4/7						
ANALYSIS2 @@@@	WDM	DISPLAY SETTING	DISPLAY TYPE ABSOLUTE/RELATIVE /DRIFT(MEAS)/DRIFT(GRID)	ABSOUTE	-	-
			CH RELATION OFFSET/SPACING	OFFSET	-	-
			REF CH HIGHEST/****CH	HIGHEST	1024	1
			OUTPUT SLOPE OFF/ON	OFF	-	-
			POINT DISPLAY OFF/ON	ON	-	-
	EDFA-NF	CHANNEL DETECTION SETTING	THRESH LEVEL *.**dB	3.00	50.00	0.01
			MODE DIFF *.**dB	3.00	50.00	0.01
		INTERPOLATAION SETTING	OFFSET(IN) *.**dB	0.00	99.99	-99.99
			OFFSET(IN) *.**dB	0.00	99.99	-99.99
			ASE ALGO LINEAR/GAUSS/LORENZ 3RD POLY/4TH POLY/5TH POLY	LINEAR	-	-
			FITTING AREA *.**nm	0.40	10.00	0.01
			MASK AREA *.**nm	0.20	10.00	0.01
	EDFA-NF	INTERPOLATAION SETTING	FITTING ALGO LINEAR/GAUSS/LORENZ 3RD POLY/4TH POLY/5TH POLY	LINEAR	-	-
			POINT DISPLAY OFF/ON	ON	-	-
	FILTER-PK	PEAK LEVEL	SW OFF/ON	ON	-	-
		PEAK LEVEL	SW OFF/ON	ON	-	-
		CENTER WAVELENGTH	SW OFF/ON	ON	-	-
			ALGO THRESH/RMS	THRESH	-	-
			THRESH LEVEL *.**dB	3.00	50.00	0.01
			K	1.00	10.00	1.00
			MODE FIT OFF/ON	OFF	-	-
			MODE DIFF *.**dB	3.00	50.00	0.01

8

Function				Default Value	Maximum Value	Minimum Value
ANALYSIS 5/7						
ANALYSIS2 @@@	FILTER-PK	SPECTRUM WIDTH	SW OFF/ON	ON	-	-
			ALGO THRESH/RMS	THRESH	-	-
			THRESH LEVEL *.**dB	3.00	50.00	0.01
			K	1.00	10.00	1.00
			MODE FIT OFF/ON	OFF	-	-
			MODE DIFF *.**dB	3.00	50.00	0.01
		RIPPLE WIDTH	SW OFF/ON	ON	-	-
			THRESH LEVEL *.**dB	3.00	50.00	0.01
			MODE DIFF *.**dB	0.500	50.000	0.001
		CROSS TALK	SW OFF/ON	ON	-	-
			ALGO THRESH/PK LEVEL/GRID	THRESH	-	-
			THRESH LEVEL *.**dB	3.00	50.00	0.01
			K	1.00	10.00	1.00
			MODE FIT OFF/ON	OFF	-	-
			MODE DIFF *.**dB	3.00	50.00	0.01
			CH SPACE ± *.**nm	0.40	50.00	0.00
			SEARCH AREA ±*.**nm	0.01	10.00	0.01
	FILTER-BTM	BOTTOM LEVEL	SW OFF/ON	ON	-	-
		BOTTOM WAVELENGTH	SW OFF/ON	ON	-	-
		CENTER WAVELENGTH	SW OFF/ON	ON	-	-
			ALGO PEAK/BOTTOM	BOTTOM	-	-
			THRESH LEVEL *.**dB	3.00	50.00	0.01
			MODE DIFF *.**dB	3.00	50.00	0.01
		NOTCH WIDTH	SW OFF/ON	ON	-	-
			ALGO PEAK/BOTTOM	BOTTOM	-	-
			THRESH LEVEL *.**dB	3.00	50.00	0.01
			MODE DIFF *.**dB	3.00	50.00	0.01
		CROSS TALK	SW OFF/ON	ON	-	-
			ALGO PEAK/BOTTOM/BOTTOM LVL/GRID	BOTTOM	-	-

Function				Default Value	Maximum Value	Minimum Value
ANALYSIS 6/7						
ANALYSIS2 @@@@	FILTER-BTM	CROSS TALK	THRESH LEVEL *.**dB	3.00	50.00	0.01
			MODE DIFF *.**dB	3.00	50.00	0.01
			CH SPACE ± *.**nm	0.40	50.00	0.00
			SEARCH AREA ±*.**nm	0.01	10.00	0.01
	WDM FIL-PK	CHANNEL DETECTION / NOMINAL WAVELENGTH	ALGO PEAK/MEAN/GRID FIT/GRID	MEAN	-	-
			THRESH LEVEL *.**dB	3.00	50.00	0.01
			MODE DIFF *.**dB	3.00	50.00	0.01
			TEST BAND *.***nm	0.100	9.999	0.001
		PEAK WAVELENGTH / LEVEL	SW OFF/ON	ON	-	-
		XdB WIDTH / CENTER WAVELENGTH	SW OFF/ON	ON	-	-
		XdB STOP BAND	SW OFF/ON	ON	-	-
			THRESH LEVEL *.**dB	-10.000	30.000	-90.000
		XdB PASS BAND	SW OFF/ON	ON	-	-
			THRESH LEVEL *.**dB	3.00	50.00	0.01
			TEST BAND *.***nm	0.20	99.99	0.01
		RIPPLE	SW OFF/ON	ON	-	-
			TEST BAND *.***nm	0.20	99.99	0.01
		CROSS TALK	SW OFF/ON	ON	-	-
			SPACING *.**nm	0.80	99.99	0.01
			TEST BAND *.***nm	0.20	99.99	0.01
	WDM FIL-BTM	CHANNEL DETECTION / NOMINAL WAVELENGTH	ALGO BOTTOM/NOTCH(P)/NOTCH(B) GRID FIT/GRID	NOTCH(B)	-	-
			THRESH LEVEL *.**dB	3.00	50.00	0.01
			MODE DIFF *.**dB	3.00	50.00	0.01
			TEST BAND *.***nm	0.100	9.999	0.001
		BOTTOM WAVELENGTH / LEVEL	SW OFF/ON	ON	-	-
		XdB NOTCH WIDTH / CENTER WAVELENGTH	SW OFF/ON	ON	-	-
			ALGORHYTHM NOTCH(P)/NOTCH(B)	NOTCH(B)	-	-
			THRESH LEVEL *.**dB	3.0	50.0	0.1

Function				Default Value	Maximum Value	Minimum Value
ANALYSIS 7/7						
ANALYSIS2 @@@@	WDM FIL-BTM	XdB STOP BAND	SW OFF/ON	ON	-	-
			THRESH LEVEL *.**dB	-20.000	30.000	-90.000
		XdB ELIMINATION BAND	SW OFF/ON	ON	-	-
			THRESH LEVEL *.**dB	3.0	50.0	0.1
			TEST BAND *.***nm	0.20	99.99	0.01
		RIPPLE	SW OFF/ON	ON	-	-
			TEST BAND *.***nm	0.20	99.99	0.01
		CROSS TALK	SW OFF/ON	ON	-	-
			SPACING *.**nm	0.80	99.99	0.01
			TEST BAND *.***nm	0.20	99.99	0.01
SPEC WIDTH THRESH *.**dB				3.00	50.00	0.01
SWITCH DISPLAY TREACE&TABLE/TABLE/TRCE				TRACE&TABLE	-	-
AUTO ANALYSIS OFF/ON				OFF	-	-
SEARCH/ANA L1-L2 OFF/ON				OFF	-	-
SEARCH/ANA ZOOM AREA OFF/ON				ON	-	-
MEMORY						
SAVE	LIST PARAMETER LBL/CONDTN			LBL	-	-
RECALL	LIST PARAMETER LBL/CONDTN			LBL	-	-
CLEAR	LIST PARAMETER LBL/CONDTN			LBL	-	-
MEMORY LIST	LIST PARAMETER LBL/CONDTN			LBL	-	-
FILE 1/2						
WRITE	DRIVE HDD/FDD			HDD	-	-
	TRACE	TRACE@ → FILE		A	-	-
		FILE TYPE BIN/CSV		BIN	-	-
	MEMORY	CURSOR UP/DOWN		DOWN	-	-
		FILE TYPE BIN/CSV		BIN	-	-
		LIST PARAMETER LBL/CONDTN		LBL	-	-
	GRAPHICS	MODE B&W/ COLOR		COLOR	-	-
		FILE TYPE BMP/TIFF		BMP	-	-
	DATA	OUTPUT ITEM SETTING	DATE&TIME OFF/ON	ON	-	-
			LABEL OFF/ON	ON	-	-
			DATA AREA OFF/ON	ON	-	-
			CONDITION OFF/ON	ON	-	-
			TRACE DATA OFF/ON	OFF	-	-

Function				Default Value	Maximum Value	Minimum Value
FILE 2/2						
WRITE	DATA	OUTPUT ITEM SETTING	OUTPUT DISPLAY OFF/ON	ON		- -
		FILE TYPE CSV/DT5		CSV	-	-
		WRITE MODE OVER/ADD		OVER		
	PROGRAM		CURSOR UP/DOWN	DOWN		
	TEMPLATE		@@@@→ FILE	UPPER LINE	-	-
	FILE SORT @@@@			FILE NAME	-	-
READ	DRIVE HDD/FDD			HDD	-	-
	TRACE	FILE → TRACE @		A	-	-
	MEMORY	CURSOR UP/DOWN		DOWN	-	-
	FILE SORT @@@@@@@@@@			FILE NAME	-	-
ITEM SELECT @@@@@				TRACE	-	-
FILE OPERATION	DRIVE HDD/FDD			HDD	-	-
	COPY	DRIVE HDD/FDD		HDD	-	-
	FILE SORT @@@@@@@@@@			FILE NAME	-	-
PROGRAM						
EXECUTE1 **	01 (program number)			-	-	
EXECUTE2 **	02 (program number)			-	-	
EXECUTE3 **	03 (program number)			-	-	
EXECUTE4 **	04 (program number)			-	-	
EXECUTE5 **	05 (program number)			-	-	
EXECUTE6 **	06 (program number)			-	-	
EXECUTE7 **	07 (program number)			-	-	
EXECUTE8 **	08 (program number)			-	-	
EXECUTE9 **	09 (program number)			-	-	
EXECUTE10 **	10 (program number)			-	-	
EXECUTE11 **	11 (program number)			-	-	
EXECUTE12 **	12 (program number)			-	-	
EXECUTE13 **	13 (program number)			-	-	
EXECUTE14 **	14 (program number)			-	-	
EXECUTE15 **	15 (program number)			-	-	
EXECUTE16 **	16 (program number)			-	-	
EXECUTE17 **	17 (program number)			-	-	
EXECUTE18 **	18 (program number)			-	-	
EXECUTE19 **	19 (program number)			-	-	
EXECUTE20 **	20 (program number)			-	-	
EXECUTE21 **	21 (program number)			-	-	

Function			Default Value	Maximum Value	Minimum Value
ADVANCE					
TEMPLATE	GO/NO GO OFF/ON		OFF	-	-
TEMPLATE	TEMPLATE DISPLAY	UPPER LINE DISPLAY OFF/ON	OFF	-	-
TEMPLATE	TEMPLATE DISPLAY	LOWER LINE DISPLAY OFF/ON	OFF	-	-
TEMPLATE	TEMPLATE DISPLAY	TARGET LINE DISPLAY OFF/ON	OFF	-	-
TEMPLATE	TEST TYPE @@@@		UPPER&LOWER	-	-
TEMPLATE	TEMPLATE EDIT	LINE SELECT @@@@	UPPER LINE	-	-
TEMPLATE	TEMPLATE EDIT	MODE ABS/REL	ABS	-	-
TEMPLATE	TEMPLATE EDIT	EXTRAPOL TYPE	TYPE A	-	-
TEMPLATE	TEMPLATE SHIFT	WL SHIFT**.**nm	0.00	999.999	-999.999
TEMPLATE	TEMPLATE SHIFT	LEVEL SHIFT *.**dB	0.00	99.99	-99.99
SYSTEM 1/2					
WL CALIBRATION	BUILT-IN SOURCE		ON	-	
WL CALIBRATION	EXTERNAL LASER ****.***nm		1523.488 , OFF	1700.000	600.000
WL CALIBRATION	EXTERNAL GAS CELL ****.***nm		1530.372 , OFF	1700.000	600.000
WL SHIFT **.***nm			0.000	5.000	-5.000
LEVEL SHIFT ***.***dB			0.000	60.000	-60.000
GRID EDITOR	200GHz SPACING		ON	-	-
GRID EDITOR	100GHz SPACING		OFF	-	-
GRID EDITOR	50GHz SPACING		OFF	-	-
GRID EDITOR	25GHz SPACING		OFF	-	-
GRID EDITOR	12.5GHz SPACING		OFF	-	-
GRID EDITOR	CUSTOM	START WL ****.****nm	1528.7734	1700.000	1000.0000
GRID EDITOR	CUSTOM	START WL ****.****THz	192.1000	299.7924	176.3486
GRID EDITOR	CUSTOM	STOP WL ****.****nm	1560.6062	1700.000	1000.0000
GRID EDITOR	CUSTOM	STOP WL ****.****THz	196.1000	299.7924	176.3486
GRID EDITOR	CUSTOM	SPACING ***.*GHz	50.0	999.9	0.1
GRID EDITOR	REFERENCE WAVELENGTH ****.****nm		1552.5244	1700.0000	1000.0000
GRID EDITOR	REFERENCE WAVELENGTH ****.****THz		193.1000	299.7924	176.3486
REMOTE INTERFACE @@@@			GP-IB	-	-
GP-IB SETTING	MY ADDRESS **		1	-	-
GP-IB SETTING	GP-IB2 PORT ADDRESS **		2	-	-
GP-IB SETTING	SYSTEM CONTROLLER OFF/ON		ON	-	-
GP-IB SETTING	COMMAND FORMAT @@@@		AQ6319	-	-
GP-IB SETTING	TLS ADDRESS **		20	30	0
RS-232C SETTING	BAUD RATE @@@@		9600	115200	1200
RS-232C SETTING	PARITY @@@@		NONE	-	-
RS-232C SETTING	FLOW @@@@		NONE	-	-
NETWORK SETTING	COMPUTER NAME		AQ6319@@@@@@@@@	-	-

Function		Default Value	Maximum Value	Minimum Value
SYSTEM 2/2				
NETWORK SETTING	TCP/IP SETTING	AUTO(DHCP)	-	-
NETWORK SETTING	REMOTE PORT NO.	10001	65535	1024
HARD COPY DEVICE @@@@		INTERNAL	-	-
EXT PRINTER SETTING@@@@	MODE B&W/COLOR	B&W	-	-
SET CLOCK	YR-MO-DY	ON	-	-
SET CLOCK	MO-DY-YR	OFF	-	-
SET CLOCK	DY-MO-YR	OFF	-	-
SELECT COLOR @@@@		COLOR1	-	-
UNCAL WARNING DISPLAY OFF/ON		ON	-	-
BUZZER	CLICK OFF/ON	ON	-	-
BUZZER	WARNING OFF/ON	ON	-	-
LEVEL DISP DIGIT *		2	3	1
WINDOW TRANSPARENT OFF/ON		ON	-	-
AUTO OFFSET OFF/ON		ON	-	-

8

8.10 System Restore Function

This function brings all the states of the AQ6319, including the OS, back to the default states. All of the system environment states and other states such as the parameter setting values, memory, program data, user-installed printer drivers, and network settings will be brought back to the default states. Be sure to back up necessary data stored in this unit before executing this function.

> **NOTE**
>
> - The <PARAMETER INITIALIZE> key is intended to initialize this unit's parameters and data. Use this key to restore the initial already-known states.
> - The <SYSTEM RESTORE> key is intended to bring this unit's internal HDD states back to the default states in emergency situations (for example, if the system becomes unstable). To clear the setting values of this unit or initialize data, use the <PARAMETER INITIALIZE> key instead of the <SYSTEM RESTORE> key.
> - Even after System Restore has been performed, the version of this unit firmware will be the one prior to the System Restore: firmware that has been updated before the execution of the System Restore function remains installed.

8.10.1 How to Execute

The System Restore function is executed in the following manner:

(1) Press the [SYSTEM] switch. Then, press the <SYSTEM RESTORE> key on the soft key <MORE 4/4> page to display the window shown in Figure 8-40.

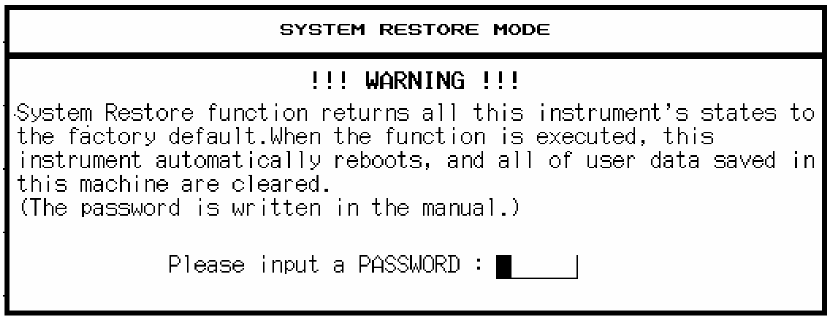


Fig. 8-40: Message when the <SYSTEM RESTORE> key is pressed

(2) Input of the password is requested. Input the password below in the same manner as in the input of LABEL and press the <DONE> key. Note that the setting of the password cannot be changed.

PASSWORD : AQ6319

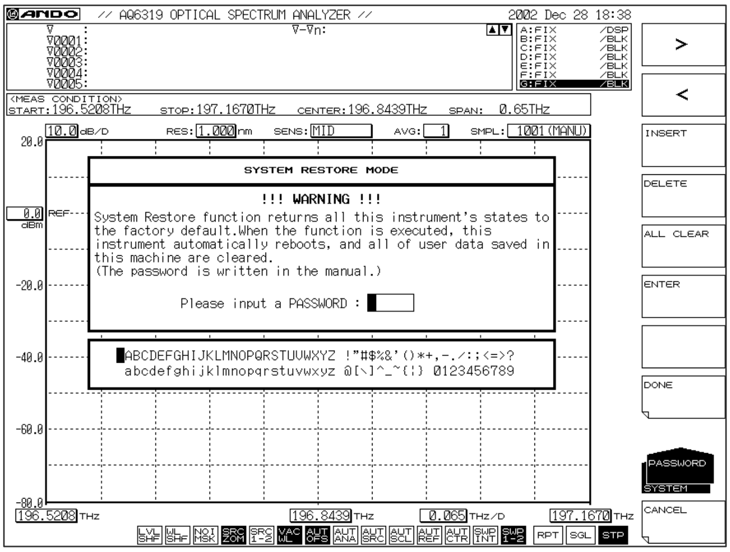


Fig. 8-381: Window for Password Input

(3) To confirm the execution, input of the password is requested again. Input the same password again.

(4) After the input of the correct password, press the displayed soft key <YES(REBOOT)> so that the system will restart automatically and that the System Restore function will be executed. To cancel the System Restore function, press the <CANCEL> key.

When the execution of the System Restore function is completed, the system will automatically restart again. The system will start up as usual with all the states of this unit initialized completely to display the measurement screen.

⚠Caution

- After pressing the <EXECUTE(REBOOT)> key, you cannot cancel the System Restore function.
- The System Restore function is intended to initialize all the states of this unit. Use caution when executing this function.
- After the System Restore function starts, do not turn off the power of this unit until the execution of the System Restore function is completed and the usual measurement screen is dislayed again. If the power is turned off before the execution of the System Restore function is completed, this unit system may be destroyed.

8

Chapter 9
Maintenance, Inspection and Storage

9

9.1 Mechanical Inspection

For external views, visually check that there are no deformities or damage. Also check that switches, connectors, and other assembled parts are firmly in place and that switches can be operated smoothly.

> ⚠ **Caution**
>
> - Before conducting the mechanical inspection, be sure to turn off the power supply on the rear panel and remove the power supply cables.
> - Do not disassemble the unit or remove case covers or other portions.

- Check external views:
  - ✓ Visually check that there are no deformities or damage.
  - ✓ In particular, check the internal terminals of the connectors on the rear panel.

> ⚠ **Caution**
>
> - Any foreign debris inside the connectors may cause abnormal operations or failures.

- Check mechanical operations:
  - ✓ Check that switches can be operated smoothly.
  - ✓ Check that connectors are correctly connected.
  - ✓ Check that there is no looseness in other assembled parts.

> ⚠ **Caution**
>
> - Looseness in connectors may cause improper operations of the unit.
> - If any abnormal situation is discovered, contact our office immediately.

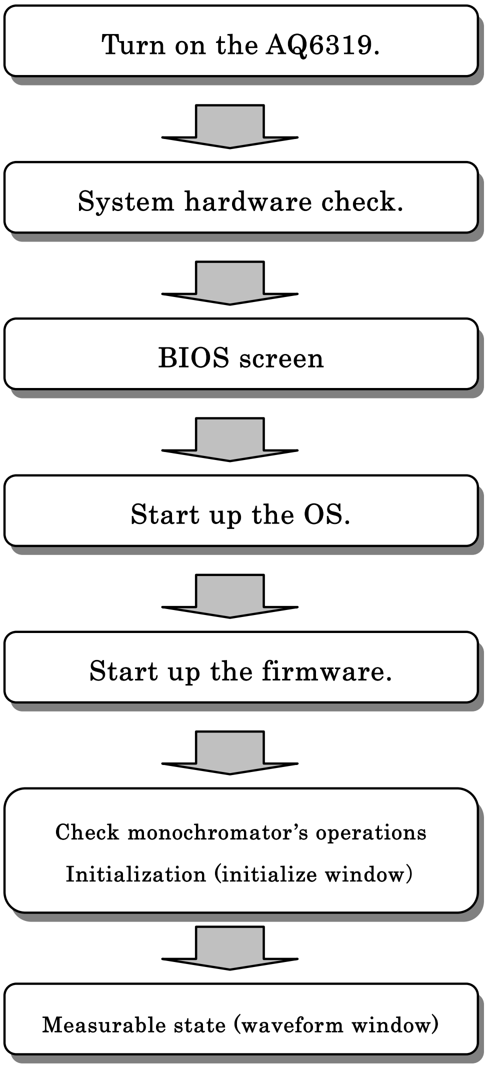
9.2 Operational Inspection

9.2.1 Inspection when the unit is turned on

The unit performs the initialization processing described below from the time when it is turned on until the time when it becomes operable (when the waveform measurement window is displayed). It takes about two minutes for the process to be completed.

For starting up the unit, refer to Chapter 3.

(☛ Section 3.3 Turning the Power ON/OFF)



⚠Caution

- Do not operate the [OPERATE] switch or the [POWER] switch during initialization processing, which may cause the unit to fail.
- If any abnormal situation occurs in the hardware or software during initialization processing, a warning message is shown in the waveform window after the unit is started. (☛ Subsection 8.7.1 List of Warnings)
  If this situation occurs, the unit must be repaired. Contact our Service Dept., Sales Dept., or nearest office immediately.
  (☛ Contact information is described at the end of the document.)

9.2.2 Operational inspection of each switch and the internal thermal printer

- Check the operations of each switch.

  Operate each switch once briefly to check that the unit functions properly.

- Check the operations of the internal thermal printer.

  The procedures are described as follows:

  ① Open the cover of the printer inside the unit. Check that the printer paper has been placed properly.
  (☛ Section 2.4 Internal Printer)

  ② When the window shows waveforms, press the [FEED] switch and check that paper is being fed into the printer.

  ③ Press the [COPY] switch and check that the indications on the window are printed properly.

⚠Caution

- Before performing the above inspections, confirm that the <HARD COPY DEVICE> key in the [SYSTEM] switch has been set to "INTERNAL."

9.2.3 Inspection of wavelength accuracy

- Measurement system

  Use the measurement system as shown in Figure 9-2 to check the wavelength accuracy of the unit.

  Use a light source, such as a gas laser, whose accurate wavelength is already known.

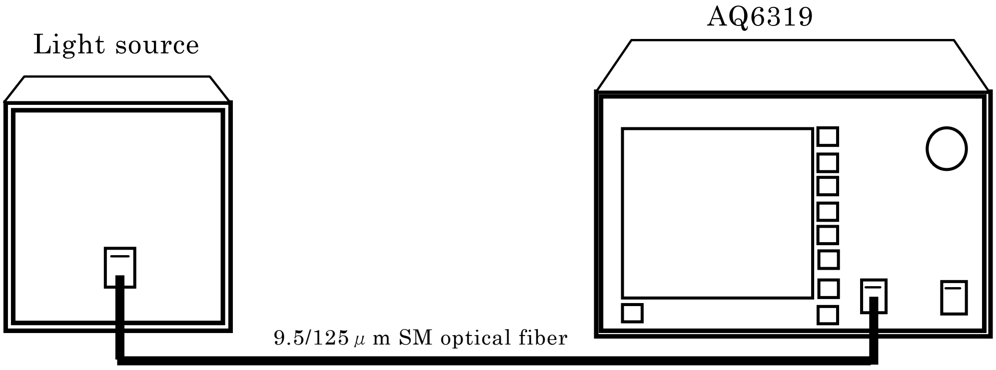


Figure 9-1: Inspection of wavelength accuracy

- Measurement procedures

  ① Set up the measurement system as shown in Figure 9-2 to measure spectrums of the light source.
  Check that the center wavelength at THRESH 3dB of a measured spectrum agrees with the wavelength of the light source (within the specified wavelength accuracy).
  (☛ Subsection 5.3.2 Spectrum Width Measurement)
  (☛ Section 10.1 Summary of Specifications)

  ② If the wavelength error is large, use the internal reference light source to calibrate wavelengths.
  (☛ Section 4.5 Wavelength Calibration)

  ③ For performing wavelength calibration, check wavelength accuracy again according to procedure ①.

⚠Caution

- If a wavelength error of the unit is ± 1 nm or more, wavelengths cannot be calibrated with the internal reference light source. (Contact us for re-adjustment.)

9

9.2.4 Inspection of level accuracy

- Measurement System

Use the measurement system as shown in Figure 9-3 to check the level accuracy of the unit.

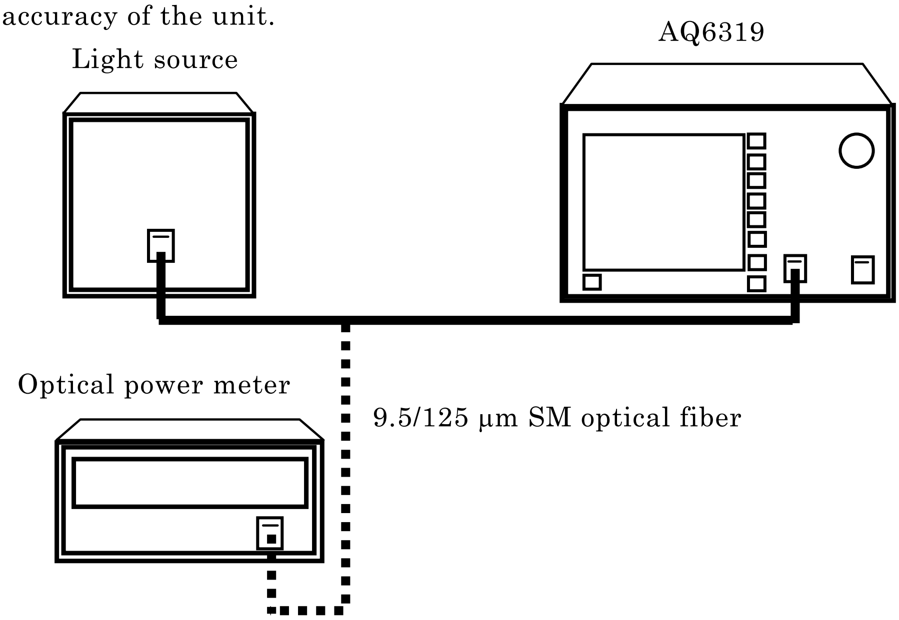


Figure 9-2: Measurement system for checking level accuracy

- Measurement Procedures

① Turn on the unit to enable measurements.

② Execute the alignment adjustment function of the monochromator in the unit.
(☛ Section 4.4 Alignment Adjustment)

③ Set up the measurement system as shown in Figure 9-3.
For a light source, choose either 1310[nm] or 1550[nm].

⚠Caution

- For a light source, be sure to use one with a spectrum width of less than 1nm, such as a gas laser or a DFB-LD.
If a light source with a wider spectrum is used, power cannot be measured accurately. (☛ Subsection 8.1.3 Power Density Display Function)

④ Connect the light source with the unit via the 9.5/125 μm SM optical fiber. Then, turn on the light source.

⑤ Press the [SWEEP] switch. Then, use the <AUTO> key to perform automatic measurement of light source spectrums.

⑥ When the automatic measurement is finished and has become the REPEAT sweep, press the [SETUP] switch. Then, use the <RESOLUTION> key to set the wavelength resolution of the unit to 1.000[nm].

⑦ Use the [PEAK SEARCH] switch or the [MARKER] switch to measure peak levels of waveforms.

⑧ Remove the SM optical fiber from the unit and connect it to the optical power meter.

⑨ Use the optical power meter to measure power values.

⑩ Check that peak level values obtained in ⑦ agree with the ones obtained by the optical power meter (within the specified level acccuracy). (☛ Section 10.1 Summary of Specifications)

9

9.2.5 Daily maintenance

● Clean the exterior of the unit.

Use a cloth dampened with cold or lukewarm water to clean the LCD screen and the exterior of the unit, followed by wiping with a dry cloth.

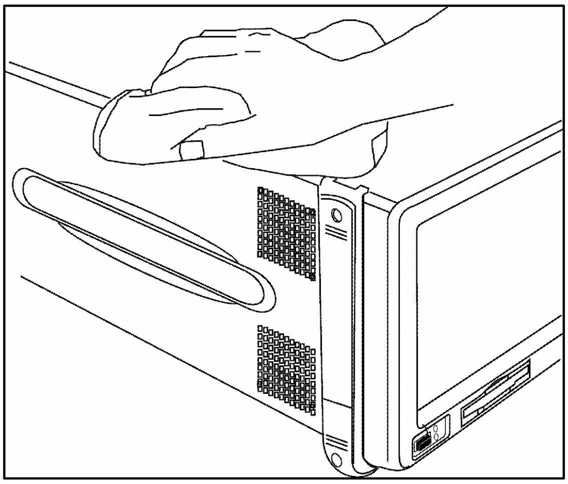


Figure 9-3: Maintenance of the exterior of the unit

⚠Caution

- For daily maintenance, be sure to turn the [POWER] switch off and also remove the power supply cables.
- Do not use chemicals such as thinner, benzine, or alcohol, which may cause deterioration or discoloration of the exterior of the unit.

● Clean the optical output section of the internal reference light source.

(1) How to clean the optical connector connection section of the connector adapter

It is recommended that the following cleaner be used for this procedure.

Recommended cleaner: "CLETOP" stick type cleaner (made by NTT-ME)

<Procedure>

① Open the optical connector cover at the front of the unit.

② Use the cleaner to clean the optical connector connection section.
Grasp it as close to the cleaner support (base) as possible. Insert the cleaner straight into the optical connector connection section and rotate it.

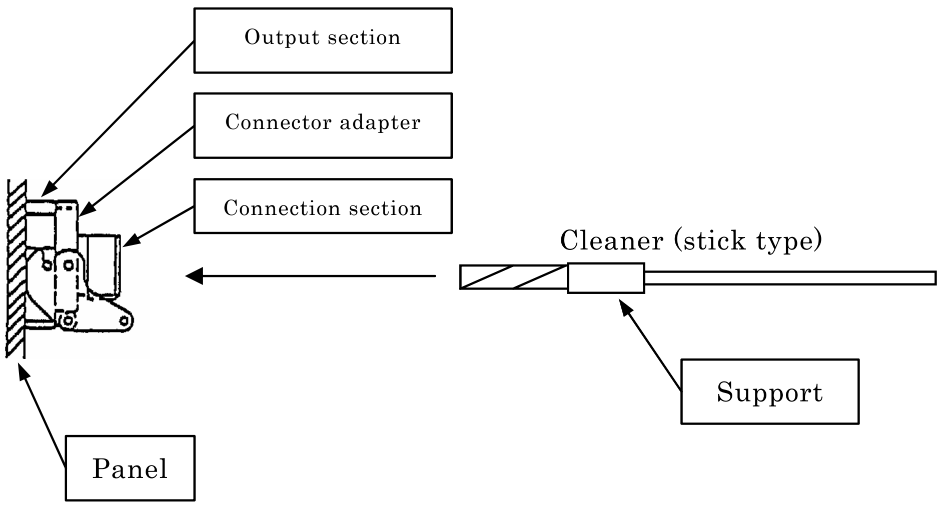


Figure 9-4: How to clean the connection section of the optical connector

⚠Caution

- If a dirty cleaner is used for cleaning, the optical output section may be damaged.

9

(2) How to clean the optical output section

Remove the connector adapter. Then use a swab dipped into a small quantity of absolute alcohol to clean the ferrule end of the optical output section. Be sure to use a new swab each time.

<Procedure>

① Remove the connector adapter from the unit. For removal, refer to Chapter 4. (☛ Section 4.2 Attaching the Connector Adapter)

② Use a swab dipped into a small quantity of absolute alcohol to clean the ferrule end of the optical output section.

③ After the cleaning is finished, connect the connector adapter to the unit.

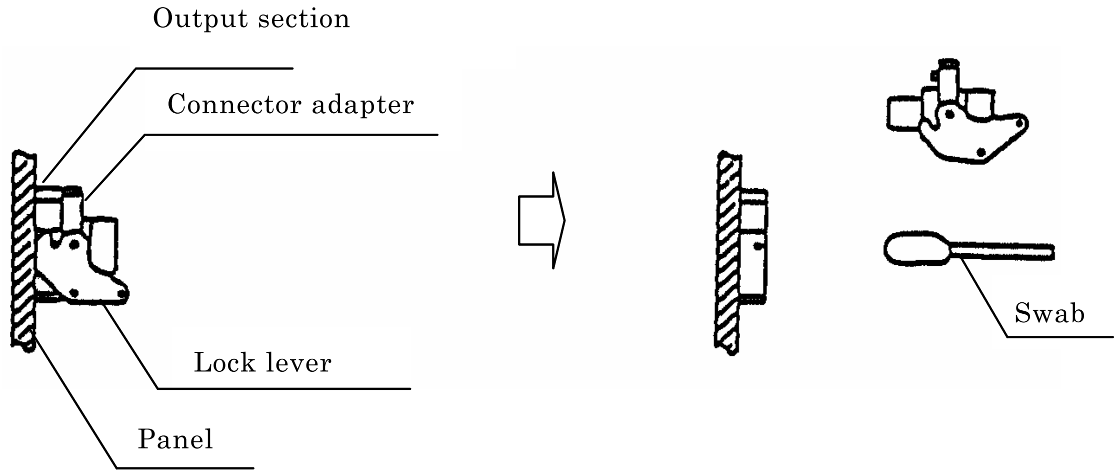


Figure 9-5: How to clean the optical output section

⚠ Caution

- When you remove or connect the connector adapter, take sufficient care not to damage the ferrule end or the connector adapter.
- If a dirty swab is used for cleaning, the optical output section may be damaged.

9.3 Care during Storage

If the unit is stored for a long time, sufficient care should be taken of the following:

① Ensure that the unit has been wiped clean of fingerprints, dust, etc.

② Perform instructions given in Section 9.2 Operational Inspection to check that the unit operates properly.

③ Do not store the unit in the following locations:

- ✓ where it would be exposed to direct sunlight or excessive dust
- ✓ where there is high humidity that could result in the formation of water droplets or exposure to them
- ✓ where it would be exposed to activated gas or the possibility of oxidization
- ✓ where temperature and humidity conditions are as shown below:
  - ・Temperature >50℃, <-10℃
  - ・Humidity >80%

For extended storage, it is desirable that the unit be stored within the range of the following environmental conditions while, at the same time, the above conditions are met.

- ✓ Temperature 5 - 30°C
- ✓ Humidity 40 - 70%
- ✓ Daily fluctuations of temperature/humidity are small.

⚠Caution

- When the unit is used again after storage, perform instructions given in Section 9.2 "Operational Inspection" to check that it operates properly. (☛ Section 9.2 Operational Inspection)
- To resume usage, alignment adjustment and wavelength calibration procedures must be performed. (☛ Sections 4.4 Alignment Adjustment and 4.5 Wavelength Calibration)

9.4 Repackaging and Transportation

9.4.1 Repackaging

To repack the unit for transportation, re-use the original packing materials. If these have been discarded or destroyed, pack it in the following manner:

① For protection, apply cushioning to projecting portions of the front and rear panels of the unit.

② Wrap the unit with, for example, vinyl.

③ Prepare a corrugated cardboard, wooden, or aluminum box larger than the unit by about 10 - 15 cm in each direction.

④ Place the unit in the center of the box. Then, pack sufficient shock absorbing material into the 10 - 15 cm space surrounding the unit.

⑤ Fasten the outside of the box firmly with packing string, adhesive tape, bands or other materials.

NOTE

- It is recommended that you retain the unit's original packing materials to use for repackaging.

9.4.2 Transportation

When the unit is transported, avoid shocks as much as possible. At the same time, the requirements described in Chapter 3 Usage Environment in "Safety Precautions" must be satisfied.

⚠Caution

- If during transportation the unit is exposed to temperatures, impacts, or shocks exceeding specified environmental conditions, its performance may be irreparably damaged.

9.5 Troubleshooting

This unit may not equate to operate properly during use.

Make sure not failure this unit , refer to the Table 9-1 Troubleshooting list before ask your dealer for repair.

Table 9-1 Troubleshooting list

	Condition	Confirmation item
Before boot-up sequence	Although an attempt was made to turn on the power , the “OPERATE” LED is not turns on.	Please confirm turn on the power switch on the back side of this unit. Please confirm connect the power cord to the power cord connector on the back side of the unit. Please confirm inculudes the fuses in the fuse holder. Please confirm rotate the fan motor on the back side of this unit.
	Although an attempt was made to turn on the power , BIOS screen in not displayed.	Please confirm use the this unit in a lower-humidity environment or higher-humidity. Please use the unit in operatiing temperture range.(+5～50℃)
		Please confirm display monitor screen , connected to the back side of VGA interface. ・If monitor screen is not displayed anything , LCD display may not equate to operate. ・If motitor screen is displayed , unit's interior may not equate to operate. Repairs will be necessary. In such cases , contact the sales department at our main office , or the nearest branch office or sales office. (☛ Contact information is located at the end of this document.)
	Initialization screen is not displayed ,although BIOS screen is displayed.	The unit must be rebooted. If the unit is not rebooted normally , unit's interior may not equate to operate. Repairs will be necessary. In such cases , contact the sales department at our main office , or the nearest branch office or sales office. (☛ Contact information is located at the end of this document.)
Boot-up process	The unit's interior occurred to allophone during initialize process.	Repairs will be necessary. In such cases , contact the sales department at our main office , or the nearest branch office or sales office. (☛ Contact information is located at the end of this document.)
	The display area is displayed warning message after initialize ends.	See the table 8-23 List of warnings.
Mesurement	The waveform data has some normal.	Please confirm use the this unit in a lower-humidity environment or higher-humidity. Please execute alignment adjustment. (☛ 4.4 Alignment Adjustment) If waveform data has some normal after alignment adjustment ends , unit’s interior may not equate to operate. Repairs will be necessary. In such cases , contact the sales department at our main office , or the nearest branch office or sales office. (☛ Contact information is located at the end of this document.)
	The waveform data has some normal by by measurement sensitivity settings.	The unit's interior may not equate to operate. Repairs will be necessary. In such cases , contact the sales department at our main office , or the nearest branch office or sales office. (☛ Contact information is located at the end of this document.)
	When measurement waveform while it is in the CHOPPER ON mode , waveform data has some normal or occured wavelength error.	The unit's interior may not equate to operate. Repairs will be necessary. In such cases , contact the sales department at our main office , or the nearest branch office or sales office. (☛ Contact information is located at the end of this document.)
	The sweep cannot start while it is in the CHOPPER ON mode. ※The sweep can start except CHOPPER ON mode in measurement sensitivity.	The unit's interior may not equate to operate. Repairs will be necessary. In such cases , contact the sales department at our main office , or the nearest branch office or sales office. (☛ Contact information is located at the end of this document.)
	Warning message of number 211(Auto offset error!) is displayed.	Offset adjustment not equate to operate normally in a location with heavy vibration. Always use the unit after it moved without heavy vibration. If warning message is displayed nevertheless , unit's interior may not equate to operate. Repairs will be necessary. In such cases , contact the sales department at our main office , or the nearest branch office or sales office. (☛ Contact information is located at the end of this document.)
	Warning message of number 212(Auto offset error!) is displayed.	The unit's interior may not equate to operate. Repairs will be necessary. In such cases , contact the sales department at our main office , or the nearest branch office or sales office. (☛ Contact information is located at the end of this document.)
	Current sweep progress retains 0 percentages state after sweeping start.	The unit's interior may not equate to operate. Repairs will be necessary. In such cases , contact the sales department at our main office , or the nearest branch office or sales office. (☛ Contact information is located at the end of this document.)
	An abnormal situation occured during measurement process.	Amp offset may not equate to operate. Please execute alignment adjustment or wavelength calibration it back after perform amp offset by <AUTO OFFSET>key in [SYSTEM]switch.

	Condition	Confirmation item
Mesurement	Alignment adjustment or wavelength calibration does not end properly.	Output level of reference light source may decline significantly. Please comfirm measure output level of reference light source by the power meter. Repairs will be necessary. In such cases , contact the sales department at our main office , or the nearest branch office or sales office. (☛ Contact information is located at the end of this document.)
	Mouse or keyboard does not operated.	Please confirm connect error on the back side of the unit.
	Mouse or keyboard does not operated.	Please confirm connect the [MOUSE] or [KYB] ports during turning the power on the unit.? Make sure the [POWER] switch is set to the [OFF] position and turn on the power while connect the each port.
		Please confirm use the recommended mouse. Please use the recommended mouse and keyboard or the power consumption of its should be 20mA or less. (☛ 3.2.1 Connecting the mouse and keyboard)

If you judged that repair of the unit was required even if you refer to the above table , confirm following item and contact the sales department at our main office , or the nearest branch office or sales office.
(☛ Contact information is located at the end of this document.)

- Model name : It is displayed at the front side of the unit.
- Serial number : It is displayed at the back side of the unit.
- Soft version : It can confirm that use the <VERSION>key in the [SYSTEM] switch.
- Condition : Were using it in what environment.
  Were occurring it in what condition.
  Warning message
- Date and time

Chapter 10 Specifications

10

10.1 Summary of Specifications

Table 10-1: Specifications

Wavelength			
	Range	600 to 1700 nm	
	Span	0.1 nm to full range and zero span	
	Accuracy	±10 pm (1520 to 1580 nm, after calibration with built-in source) ±20 pm (1450 to 1520 nm, after calibration with built-in source) ±20 pm (1580 to 1620 nm, after calibration with built-in source) ±50 pm (Full range, after calibration with built-in source)	a,c,h,k
	Linearity	±10 pm (1520 to 1580 nm, after calibration with built-in source) ±20 pm (1450 to 1520 nm, after calibration with built-in source) ±20 pm (1580 to 1620 nm, after calibration with built-in source)	a,c,h,k
	Repeatability	±2 pm (1 min. or less, 1450 to 1620 nm)	a,c,h,k
	Number of samplings	101 to 50001	
Resolution			
	Resolution bandwidth	0.01, 0.02, 0.05, 0.1, 0.2, 0.5 and 1 nm	
	Bandwidth accuracy	±2% (RES.: 0.1 nm or wider, 1450 to 1620 nm) ±2.5% (RES.: 0.05 nm, 1450 to 1620 nm) ±6% (RES.: 0.02 nm, 1450 to 1620 nm)	a,d,h,k
Level			
	Sensitivity setting	NORM_HOLD, NORM_AUTO, MID, HIGH1, HIGH2 and HIGH3	e
	Sensitivity	−90 dBm (1250 to 1620 nm, RES.: 0.05 nm or wider, SENS.: HIGH3) −80 dBm (1000 to 1250 nm, RES.: 0.05 nm or wider, SENS.: HIGH3) −60 dBm (800 to 1000 nm, 1620 to 1680 nm, RES.: 0.05 nm or wider, SENS.: HIGH3)	a,b,d,h
	Accuracy	±0.3 dB (1550/1600 nm, 0/-20 dBm, RES.: 0.02 nm or wider) ±0.3 dB (1310 nm, 0/-20 dBm, RES.: 0.05 nm or wider)	a,b,d,f
	Linearity	±0.05 dB (−50 to +10dBm, RES.: 0.02nm or wider, SENS.: HIGH1 to 3)	a,b,d,h
	Flatness	±0.1 dB (1520 to 1620 nm, -20 dBm, RES.: 0.02 nm or wider)	a,b,d,f
	Stability	±0.01 dB at 1 min., ±0.02 dB at 15 min. (1550/1600 nm, -20 dBm, RES.: 0.05 nm or wider)	a,b,d,f
	Maximum input power	+23 dBm (Per channel, Full span, Attenuation on)	a
	Maximum safe power	+27 dBm (Total safe power, Attenuation on)	a
	Close-in dynamic range	40 dB (±50 pm from peak at 1523 nm, RES.: 0.01 nm) 60 dB (±100 pm from peak at 1523 nm, RES.: 0.01 nm) 70 dB (±200 pm from peak at 1523 nm, RES.: 0.01 nm) 60 dB (±200 pm from peak at 1523 nm, RES.: 0.1 nm)	a,b,d,g
	Polarization dependency	±0.05 dB (1520 to 1620 nm, RES.: 0.02 nm or wider) ±0.07 dB (1450 to 1520 nm, RES.: 0.02 nm or wider) ±0.07 dB typ. (1310 nm, RES.: 0.05 nm or wider)	a,b,d
Sweep			
	Sweep speed	0.5 sec (any 100 nm, SMPL.: 1001, SENS.: NORM_HOLD) 1 sec (any 100 nm, SMPL.: 1001, SENS.: MID) 3 sec (any 100 nm, SMPL.: 1001, SENS.: HIGH1) 15 sec (any 100 nm, SMPL.: 1001, SENS.: HIGH3) 120 sec (any 100 nm, SMPL.: 1001, SENS.: HIGH3 with chop mode on)	i i i j j

a. With 9.5/125 μm SMF, after 1 hour warm-up, after optical alignment
b. With applied input fiber Type B1.1 9.5/125 μm SMF defined on IEC60793-2 (Mode field diameter: 9.5 μm, NA: 0.104 to 0.107, PC polished), attenuation off, vertical scale: absolute power display mode
c. At 15 to 30°C.
d. At 23 ± 3°C.
e. Internal chop mode available at HIGH1 to 3 sensitivity settings
f. Sensitivity setting is MID, HIGH1 to 3 and chop mode off
g. Sensitivity setting is HIGH3 and chop mode on.
h. At chop mode off
i. For wavelength resolution ≤ 0.2 nm
j. For wavelength resolution ≤ 0.5 nm
k. Horizontal scale: wavelength display mode

Function			
	Automatic measurement	Program function (64 programs, 200 steps)	
	Setting of measuring conditions	Span setting: 0 to 1100 nm, Number of averaging setting: 1 to 999 times, Automatic measuring condition setting function, Sweep between line markers function, 0 nm sweep function, External trigger measurement function, Air/Vacuum wavelength measurement function Synchronous sweep function for Tunable Laser Source	
	Display	Level scale setting: 0.1 to 10 dB/div., Vertical division number setting: 8, 10 or 12, Ref level position setting function, Linear scale display, Simultaneous display of 7 independent traces, Data table display, Label display, Split display, Normalized display, Curve-fit display, Power density display, % display, dB/nm display, dB/km display, Template display, horizontal scale zoom in/out display, Frequency display of horizontal axis scale	
	Trace	7 independent traces, Max/Min hold, Calculate between traces, Roll average, Normalize, Curve-fit	
	Marker/Search	Delta marker (Max. 1024), Line marker, Peak search, Next peak search, Bottom search, Next bottom search, Auto search, Peak/Bottom search between line markers, Search in the zooming area	
	Analysis	WDM analysis, EDFA analysis, Optical filter analysis, WDM filter analysis, Spectral width, Notch width, SMSR analysis, PMD analysis, LED/FP-LD/DFB-LD analysis, Power analysis, Go/NoGo judgment, Auto analysis, Analysis between line markers, Analysis in the zooming area	
	Ethernet	TCP/IP protocol, FTP function	
	External printer	ESC/P	l
	Others	Self wavelength calibration with built-in reference light source, Optical alignment with built-in reference light source	m
Computer interface			
	Remote control compatibility	AQ6317 series compliant commands (IEEE488.1), IEEE488.2 full support	
	Interface	GPIB×2, RS232C, Printer port, External SVGA, PS/2×2, LAN	
	Storage	FDD (MS-DOS format), HD (FAT32), Binary/CSV(Text) and BMP/TIFF	
Optical input			
	Fiber	SM (9.5/125 μm), GI (50/125 μm)	
	Coupling	Free space	
	Connector	Connector adapter	m
Dimension and mass			
	Dimension	Approx. 425 (W) × 222 (H) × 500 (D) mm (Except protector)	
	Mass	Approx. 33 kg	
Power requirement			
	Input voltage and frequency	100 – 120 , 200 – 240 VAC, 50/60 Hz, Approx. 400 VA	
Environment			
	Operation temperature	+5 to +40 °C	
	Storage temperature	−10 to +50 °C	
	Humidity	80% or less (No condensation)	

l: Please ask local agent for printer type.
m: Supports FC, SC and ST connector. (Optional connector adapters are required.)

10.2 Options

Options for the AQ6319 are described below:

- AQ9441 (**) connector adapter (**): (FC)/(SC)/(ST)
  Connector adapter for the integral reference light source

- AQ9447 (**) connector adapter (**): (FC)/(SC)/(ST)
  Connector adapter for the optical input

- AQ4321A/4321D Tunable Laser Source

Table 10-2: Specifications for AQ4321A/4321D

Function	
Wavelength range (Tunable Laser Source)	AQ4321A; 1480 - 1580 nm AQ4321D; 1520 - 1620 nm
Optical output level	AQ4321A; +10 dBm(TYP.)(peak) AQ4321D; +7 dBm(TYP.)(peak)

- AQ2200-136 Tunable Laser Source Module

Table 10-3: Specifications for AQ2200-136

Function	
Wavelength range	1440 - 1640nm
Optical output level	+7dBm or more (maximum output wavelength) −8 dBm or more (all wavelength range)

- AQ4315A ASE light source unit
  This unit can be used for the measurement of loss wavelength characteristics.

Table 10-4: Specifications for AQ4315A ASE light source unit

Function	
Optical spectrum density	-13 dBm/nm(typ)(1530 - 1605 nm) -20 dBm/nm (1530 - 1610 nm)
Optical output level	+13 dBm or more

- AQ-8201-110 DFB-LD module WDM light source
  This light source can be used for the evaluation of DWDM optical devices.

Table 10-5: Specifications for AQ-8201-110 DFB-LD module WDM light source

Function	
Emitted light wavelength	1524.11 - 1620.50 nm
Optical output level	+10 dBm or more

Note: Extension frames and controllers in AQ8200 series are required.

- AQ-4305 white light source

  This light source can be used for the measurement of loss wavelength characteristics.

Table 10-6: Specifications for AQ-4303B white light source

Function	
Emitted light wavelength	400 - 1800 nm
Optical output level	−40 dBm or more (wavelengths 850 nm and 1300 nm, wavelength zone 10 nm, GI 50/125 μm optical fiber, CW light)
Light emitting element	Halogen lamp

- AQ-9313 device adapter

  This adapter can be used to measure characteristics of CAN-type LD elements.

Table 10-7: Specifications for AQ-9313 device adapter

Function	
Applicable packages	TO-5 (standard). Other packages (TO-46 or TO-52, etc.) are adaptable.
Usable fiber	SM10/125 μm, FC plug, with collimator.
Rated current output	5 - 150 mA

- AQ-9314B Parallel beam mount

  This option can be used to measure loss wavelength characteristics of optical devices, optical materials, and so on.

Table 10-8: Specifications for AQ-9314B parallel beam mount

Function	
External dimensions of DUT (device under test)	10 x 15 mm or more, 50 x 50 mm or less, thickness of 12 mm or less
Coupling loss	5 dB or less (for wavelength of 850 nm)
Usable fiber	800 μm large-caliber fiber (separately sold)

- Silica cell for liquid measurement

  This option can be used in combination with the AQ-9314B parallel beam mount to measure transmission efficiency of liquids.

Recommended: T-56A-UV-3-1 (made by Tosoh Quartz Corporation (formerly, Nippon Silica Glass))

- AQ-9343 parallel optical measurement adapter

  This adapter can be used to measure spectrums of gas lasers.

Table 10-9: Specifications for AQ-9343 parallel optical measurement adapter

Function	
Usable fiber	SM10/125 μm fiber with FC plug
Possible maximum diameter	Parallel light with beam diameter of φ6 mm or less
Coupling loss	5 dB or less

- AQ-9346 point light measurement adapter (for measuring point light sources such as LD or LED elements)

  This adapter is suitable for a system in which LD or LED is incorporated. It is mounted on the following fine adjustment table for use. For connection with the optical spectrum analyzer, choose an optical fiber cord suitable for the light source. (The optical fiber cord and the fine adjustment table are not attached to the adapter.)

Table 10-10: Specifications for AQ-9346 point light source measurement adapter

Function	
Output type	FC connector
Recommended fine adjustment table	Σ-2001-(1) precision XY component (made by Sigma Koki Co., Ltd.)

END USER LICENSE AGREEMENT

- You have acquired a device ("DEVICE") that includes software licensed by YOKOGAWA ELECTRIC CORPORATION from Microsoft Licensing Inc. or its affiliates ("MS"). Those installed software products of MS origin, as well as associated media, printed materials, and "online" or electronic documentation ("SOFTWARE") are protected by international intellectual property laws and treaties. The SOFTWARE is licensed, not sold. All rights reserved.
- IF YOU DO NOT AGREE TO THIS END USER LICENSE AGREEMENT ("EULA"), DO NOT USE THE DEVICE OR COPY THE SOFTWARE. INSTEAD, PROMPTLY CONTACT YOKOGAWA ELECTRIC CORPORATION FOR INSTRUCTIONS ON RETURN OF THE UNUSED DEVICE(S) FOR A REFUND. **ANY USE OF THE SOFTWARE, INCLUDING BUT NOT LIMITED TO USE ON THE DEVICE, WILL CONSTITUTE YOUR AGREEMENT TO THIS EULA (OR RATIFICATION OF ANY PREVIOUS CONSENT).**
- **GRANT OF SOFTWARE LICENSE.** This EULA grants you the following license:
  - You may use the SOFTWARE only on the DEVICE.
  - **NOT FAULT TOLERANT.** THE SOFTWARE IS NOT FAULT TOLERANT. YOKOGAWA ELECTRIC CORPORATION HAS INDEPENDENTLY DETERMINED HOW TO USE THE SOFTWARE IN THE DEVICE, AND MS HAS RELIED UPON YOKOGAWA ELECTRIC CORPORATION TO CONDUCT SUFFICIENT TESTING TO DETERMINE THAT THE SOFTWARE IS SUITABLE FOR SUCH USE.
  - NO WARRANTIES FOR THE SOFTWARE**. THE SOFTWARE is provided "AS IS" and with all faults. THE ENTIRE RISK AS TO SATISFACTORY QUALITY, PERFORMANCE, ACCURACY, AND EFFORT (INCLUDING LACK OF NEGLIGENCE) IS WITH YOU**. **ALSO, THERE IS NO WARRANTY AGAINST INTERFERENCE WITH YOUR ENJOYMENT OF THE SOFTWARE OR AGAINST INFRINGEMENT.** IF YOU HAVE RECEIVED ANY WARRANTIES REGARDING THE DEVICE OR THE SOFTWARE, THOSE WARRANTIES DO NOT ORIGINATE FROM, AND ARE NOT BINDING ON, MS.
  - **Note on Java Support.** The SOFTWARE may contain support for programs written in Java. Java technology is not fault tolerant and is not designed, manufactured, or intended for use or resale as online control equipment in hazardous environments requiring fail-safe performance, such as in the operation of nuclear facilities, aircraft navigation or communication systems, air traffic control, direct life support machines, or weapons systems, in which the failure of Java technology could lead directly to death, personal injury, or severe physical or environmental damage. Sun Microsystems, Inc. has contractually obligated MS to make this disclaimer.
  - No Liability for Certain Damages**. EXCEPT AS PROHIBITED BY LAW, MS SHALL HAVE NO LIABILITY FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL OR INCIDENTAL DAMAGES ARISING FROM OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THE SOFTWARE. THIS LIMITATION SHALL APPLY EVEN IF ANY REMEDY FAILS OF ITS ESSENTIAL PURPOSE. IN NO EVENT SHALL MS BE LIABLE FOR ANY AMOUNT IN EXCESS OF U.S. TWO HUNDRED FIFTY DOLLARS (U.S.$250.00).**
  - **Limitations on Reverse Engineering, Decompilation, and Disassembly.** You may not reverse engineer, decompile, or disassemble the SOFTWARE, except and only to the extent that such activity is expressly permitted by applicable law notwithstanding this limitation.
  - **SOFTWARE TRANSFER ALLOWED BUT WITH RESTRICTIONS.** You may permanently transfer rights under this EULA only as part of a permanent sale or transfer of the Device, and only if the recipient agrees to this EULA. If the SOFTWARE is an upgrade, any transfer must also include all prior versions of the SOFTWARE.
  - **EXPORT RESTRICTIONS.** You acknowledge that SOFTWARE is of US-origin. You agree to comply with all applicable international and national laws that apply to the SOFTWARE, including the U.S. Export Administration Regulations, as well as end-user, end-use and country destination restrictions issued by U.S. and other governments. For additional information on exporting the SOFTWARE, see http://www.microsoft.com/exporting/.

- **Installation and Use.** The SOFTWARE may not be used by more than two (2) processors at any one time on the DEVICE. You may permit a maximum of ten (10) computers or other electronic devices (each a "Client") to connect to the DEVICE to utilize the services of the SOFTWARE solely for file and print services, internet information services, and remote access (including connection sharing and telephony services). The ten (10) connection maximum includes any indirect connections made through "multiplexing" or other software or hardware which pools or aggregates connections. Except as otherwise permitted in the NetMeeting/Remote Assistance/Remote Desktop Features terms below, you may not use a Client to use, access, display or run the SOFTWARE, the SOFTWARE's user interface or other executable software residing on the DEVICE.
- If you use the DEVICE to access or utilize the services or functionality of Microsoft Windows Server products (such as Microsoft Windows NT Server 4.0 (all editions) or Microsoft Windows 2000 Server (all editions)), or use the DEVICE to permit workstation or computing devices to access or utilize the services or functionality of Microsoft Windows Server products, you may be required to obtain a Client Access License for the Device and/or each such workstation or computing device. Please refer to the end user license agreement for your Microsoft Windows Server product for additional information.
- **Restricted Uses.** The SOFTWARE is not designed or intended for use or resale in hazardous environments requiring fail-safe performance, such as in the operation of nuclear facilities, aircraft navigation or communication systems, air traffic control, or other devices or systems in which a malfunction of the SOFTWARE would result in foreseeable risk of injury or death to the operator of the device or system, or to others.
- **Restricted Functionality**. You are licensed to use the SOFTWARE to provide only the limited functionality (specific tasks or processes) for which the DEVICE has been designed and marketed by YOKOGAWA ELECTRIC CORPORATION. This license specifically prohibits any other use of the software programs or functions, or inclusion of additional software programs or functions, on the DEVICE.

- **Security Updates**. Content providers are using the digital rights management technology ("Microsoft DRM") contained in this SOFTWARE to protect the integrity of their content ("Secure Content") so that their intellectual property, including copyright, in such content is not misappropriated. Owners of such Secure Content ("Secure Content Owners") may, from time to time, request MS, Microsoft Corporation or their subsidiaries to provide security related updates to the Microsoft DRM components of the SOFTWARE ("Security Updates") that may affect your ability to copy, display and/or play Secure Content through Microsoft software or third party applications that utilize Microsoft DRM. You therefore agree that, if you elect to download a license from the Internet which enables your use of Secure Content, MS, Microsoft Corporation or their subsidiaries may, in conjunction with such license, also download onto your DEVICE such Security Updates that a Secure Content Owner has requested that MS, Microsoft Corporation or their subsidiaries distribute. MS, Microsoft Corporation or their subsidiaries will not retrieve any personally identifiable information, or any other information, from your DEVICE by downloading such Security Updates.
- **NetMeeting/Remote Assistance/Remote Desktop Features.** The SOFTWARE may contain NetMeeting, Remote Assistance, and Remote Desktop technologies that enable the SOFTWARE or other applications installed on the Device to be used remotely between two or more computing devices, even if the SOFTWARE or application is installed on only one Device. You may use NetMeeting, Remote Assistance, and Remote Desktop with all Microsoft products; provided however, use of these technologies with certain Microsoft products may require an additional license. For both Microsoft products and non-Microsoft products, you should consult the license agreement accompanying the applicable product or contact the applicable licensor to determine whether use of NetMeeting, Remote Assistance, or Remote Desktop is permitted without an additional license.
- **Consent to Use of Data.** You agree that MS, Microsoft Corporation and their affiliates may collect and use technical information gathered in any manner as part of product support services related to the SOFTWARE. MS, Microsoft Corporation and their affiliates may use this information solely to improve their products or to provide customized services or technologies to you. MS, Microsoft Corporation and their affiliates may disclose this information to others, but not in a form that personally identifies you.
- **Internet Gaming/Update Features.** If the SOFTWARE provides, and you choose to utilize, the Internet gaming or update features within the SOFTWARE, it is necessary to use certain computer system, hardware, and software information to implement the features. By using these features, you explicitly authorize MS, Microsoft Corporation and/or their designated agent to use this information solely to improve their products or to provide customized services or technologies to you. MS or Microsoft Corporation may disclose this information to others, but not in a form that personally identifies you.
- **Internet-Based Services Components.** The SOFTWARE may contain components that enable and facilitate the use of certain Internet-based services. You acknowledge and agree that MS, Microsoft Corporation or their affiliates may automatically check the version of the SOFTWARE and/or its components that you are utilizing and may provide upgrades or supplements to the SOFTWARE that may be automatically downloaded to your Device.
- **Links to Third Party Sites.** The SOFTWARE may provide you with the ability to link to third party sites through the use of the SOFTWARE. The third party sites are not under the control of MS, Microsoft Corporation or their affiliates. Neither MS nor Microsoft Corporation nor their affiliates are responsible for (i) the contents of any third party sites, any links contained in third party sites, or any changes or updates to third party sites, or (ii) webcasting or any other form of transmission received from any third party sites. If the SOFTWARE provides links to third party sites, those links are provided to you only as a convenience, and the inclusion of any link does not imply an endorsement of the third party site by MS, Microsoft Corporation or their affiliates.
- **Additional Software/Services.** The SOFTWARE may permit YOKOGAWA ELECTRIC CORPORATION, MS, Microsoft Corporation or their affiliates to provide or make available to you SOFTWARE updates, supplements, add-on components, or Internet-based services components of the SOFTWARE after the date you obtain your initial copy of the SOFTWARE ("Supplemental Components").
- If YOKOGAWA ELECTRIC CORPORATION provides or makes available to you Supplemental Components and no other EULA terms are provided along with the Supplemental Components, then the terms of this EULA shall apply.
- If MS, Microsoft Corporation or their affiliates make available Supplemental Components, and no other EULA terms are provided, then the terms of this EULA shall apply, except that the MS, Microsoft Corporation or affiliate entity providing the Supplemental Component(s) shall be the licensor of the Supplemental Component(s).

YOKOGAWA ELECTRIC CORPORATION, MS, Microsoft Corporation and their affiliates reserve the right to discontinue any Internet-based services provided to you or made available to you through the use of the SOFTWARE.

This EULA does not grant you any rights to use the Windows Media Format Software Development Kit ("WMFSDK") components contained in the SOFTWARE to develop a software application that uses Windows Media technology. If you wish to use the WMFSDK to develop such an application, visit http://msdn.microsoft.com/workshop/imedia/windowsmedia/sdk/wmsdk.asp, accept a separate license for the WMFSDK, download the appropriate WMFSDK, and install it on your system.