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Certificate of Conformity

CE

This is to certify, that

Optical Spectrum Analyzer

Q8383

instrument, type, designation

complies with the provisions of the EMC Directive 89/336/EEC in accordance with EN50081-1 and EN50082-1 and Low Voltage Directive 73/23/EEC in accordance with EN61010.

ADVANTEST Corp.
Tokyo, Japan

ROHDE&SCHWARZ
Engineering and Sales GmbH
Munich, Germany

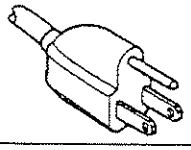
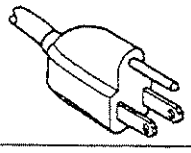
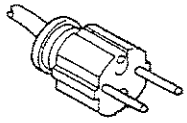
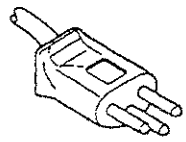
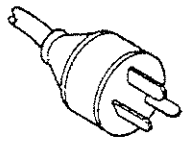
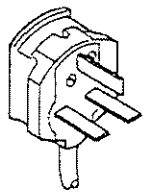
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Table of Power Cable Options

There are six power cable options (refer to following table).

Order power cable options by Model number.

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

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TABLE OF CONTENTS

1. GENERAL 1-1

1.1 How to Use This Manual 1-2
1.2 Outline 1-3
1.3 Before Using the Analyzer 1-4
1.3.1 Checking the exterior and accessories 1-4
1.3.2 Environment and precautions 1-4
1.3.3 Power source and fuse 1-5
1.3.4 Damage to circuit element due to power line CMV loop 1-7
1.3.5 CRT display 1-7
1.3.6 Handling the input optical connector 1-8
1.3.7 Operation when power is turned ON 1-8
1.3.8 Setting the print paper 1-10
1.3.9 Storage, Carrying, Transportation and Cleaning 1-11
1.3.10 Maintenance 1-11

2. PANELS 2-1

2.1 Front Panel 2-2
(1) FUNCTION section 2-3
(2) CURSOR section 2-4
(3) MEASURE section 2-4
(4) DATA section 2-5
(5) INPUT section 2-5
(6) DISPLAY section 2-6
(7) DATA OUT section 2-7
(8) GP-IB section 2-7
(9) Softkeys 2-8
(10) Others 2-8
2.2 Rear Panel 2-9

3. BASIC OPERATION
<For those using the analyzer for the first time> 3-1

3.1 Functions 3-2
3.2 Entering the Light to be Measured 3-4
3.3 Reading the CRT Screen 3-6
3.4 Basic Operation Procedure 3-10
3.5 Setting the Measurement Conditions 3-12
3.6 Setting the Display Conditions 3-13

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3.7 Measurement and Data Output 3-14
3.8 Analyzing the Measured Data 3-15
3.9 Measurement Data Memory 3-16

4. PANEL OPERATION 4-1
4.1 FUNCTION Section 4-2
4.1.1 CENTER key 4-2
4.1.2 SPAN key 4-4
4.1.3 REF LEVEL key 4-6
4.1.4 LEVEL SCALE key 4-8
4.1.5 AUTO key 4-9
4.1.6 AVG key 4-10
4.1.7 SWEEP MODE key 4-11
4.1.8 RESOLUTION key 4-13
4.2 CURSOR Section 4-15
4.2.1 Cursor Control 4-15
4.2.2 Rotary Knob 4-17
4.3 DATA Section 4-18
4.3.1 Numeric keys, arrow keys 4-18
4.3.2 Setting the label 4-18
4.4 MEASURE Section 4-21
4.4.1 SINGLE key 4-21
4.4.2 REPEAT key 4-21
4.4.3 STOP key 4-21
4.5 DISPLAY Section 4-22
4.5.1 CONTROL key 4-22
4.5.2 SAVE key, RECALL key 4-28
4.5.3 NORMALIZE (LOSS/TRANS key) 4-37
4.5.4 SPECTRAL WIDTH key 4-42
4.5.5 ADVANCE key 4-48
4.6 DATA OUT Section 4-68
4.6.1 DEVICE key 4-68
4.6.2 COPY key 4-77
4.6.3 FEED key 4-77
4.7 GP-IB Section 4-78
4.7.1 LOCAL (ADDRESS) key 4-78
4.7.2 Status lamp 4-79
4.8 Other Keys 4-80
4.8.1 INSTR PRESET key 4-80
4.8.2 CAL key 4-82

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5. SOFT KEY MENU FUNCTIONS (SUMMARY) 5-1

5.1 FUNCTION Section 5-2
5.2 CURSOR Section 5-6
5.3 DATA Section 5-7
5.4 DISPLAY Section 5-8
5.5 DATA OUT Section 5-17
5.6 GP-IB Section 5-20
5.7 Others 5-21

6. GP-IB INTERFACE 6-1

6.1 General 6-2
6.2 Specifications 6-4
6.2.1 GP-IB specifications 6-4
6.2.2 Interface functions 6-6
6.3 GP-IB Handling 6-7
6.3.1 Connecting other devices 6-7
6.3.2 Program code (Listener format) 6-8
6.3.3 Talker format (Data output format) 6-25
6.3.4 Service request 6-36
6.3.5 Device trigger function 6-38
6.3.6 Device clear function 6-38
6.3.7 Status modification by command 6-39
6.3.8 Sample programs 6-40

7. FLOPPY DISK 7-1

7.1 Handling the Floppy Disk 7-2
7.1.1 Overview 7-2
7.1.2 Initialization (formatting) 7-2
7.1.3 Write protect 7-2
7.1.4 Inserting/Ejecting the floppy disk 7-3
7.2 Restoring Data from the Floppy Disk 7-4
7.2.1 Types of data in the floppy disk 7-4
7.2.2 Data file items 7-5
7.2.3 Example of floppy data restore program 7-8

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8. MEASUREMENT EXAMPLES 8-1
8.1 SMSR Measurement of DFB Laser Diode 8-2
8.2 Spectrum/Spectral Half-width Measurement of LED 8-5
8.3 Loss Wavelength Characteristics Measurement of Optical Filter 8-8
8.4 Pulse light measurement by Gated MEAS Input 8-11

9. PRINCIPLE OF OPERATION 9-1
9.1 Operation Principle 9-1

10. SPECIFICATIONS 10-1

APPENDIX 1 LIST OF SOFTKEY MENUS A1-1

APPENDIX 2 EXPLANATION OF TECHNICAL TERMS A2-1

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Safety Summary

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

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

- **Warning Labels**

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

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

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

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

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

- **Basic Precautions**

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

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

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

- **Caution Symbols Used Within this Manual**

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

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

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

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

- **Safety Marks on the Product**

The following safety marks can be found on Advantest products.

 : ATTENTION - Refer to manual.

 : Protective ground (earth) terminal.

 : DANGER - High voltage.

 : CAUTION - Risk of electric shock.

- **Replacing Parts with Limited Life**

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

There is a possibility that each product uses different parts with limited life. For more information, refer to Chapter 1.

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Main Parts with Limited Life

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

- **Hard Disk Mounted Products**

The operational warnings are listed below.

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

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

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

- **Precautions when Disposing of this Instrument**

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

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

Example: fluorescent tubes, batteries

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Environmental Conditions

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

- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations

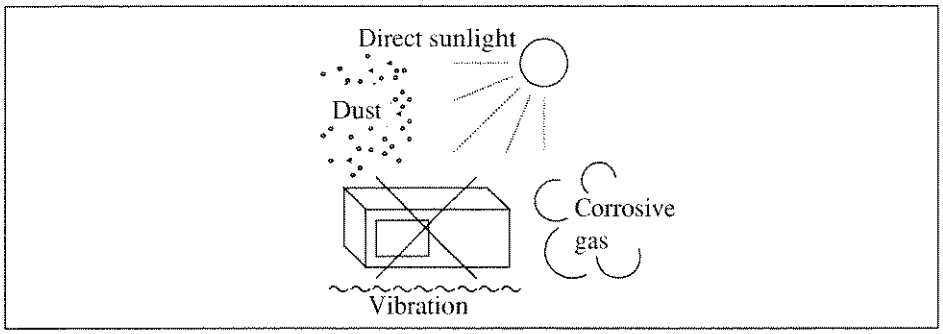


Figure-1 Environmental Conditions

- Operating position

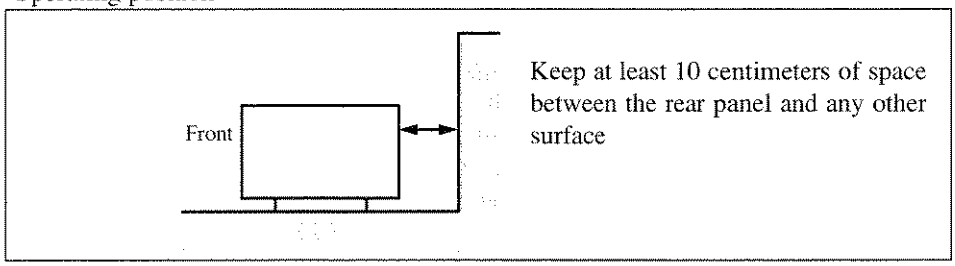


Figure-2 Operating Position

- Storage position

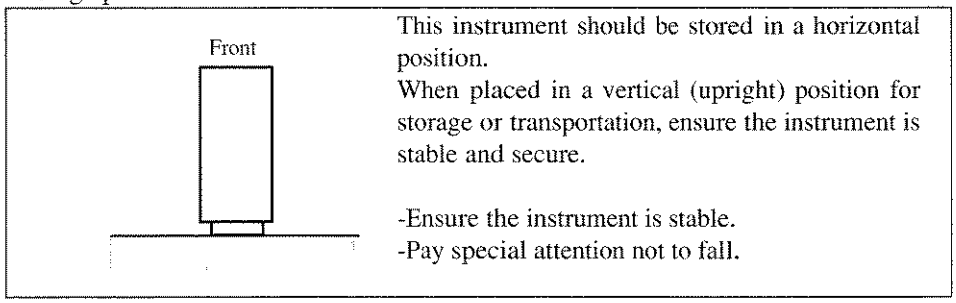


Figure-3 Storage Position

This instrument can be used safely under the following conditions:

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

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LIST OF ILLUSTRATIONS

No.	Title	Page
1-1	Checking Fuse	1-6
1-2	Power Line CMV Loop	1-7
1-3	Initial Screen at Power On	1-9
1-4	Setting the print paper	1-10
3-1	Input section Block Diagram	3-4
3-2	How to Read the CRT Display	3-6
4-1	Example of Dual Screen Display	4-23
4-2	Example of Superimpose Display	4-24
4-3	Example of 3-dimensional Display	4-27
4-4	Directory of Measurement Data Memory	4-33
4-5	Directory of Panel Conditions Memory	4-33
4-6	Directory of Measurement Data Files (floppy disk)	4-34
4-7	Directory of Panel Conditions Files (floppy disk)	4-34
4-8	Peak Normalization Function	4-38
4-9	LOSS Normalization Data Example	4-41
4-10	TRANS Normalization Data Example	4-42
4-11	Example of Spectral Width Data Display	4-43
4-12	Example of Curve Fit	4-48
4-13	Example of Luminosity Offset	4-50
4-14	Power Monitor Display Screen and How to Read the Data	4-51
4-15	Data Area in P_{ASE} calculation	4-61
4-16	List Display under WDM Mode On	4-65
4-17	Method of Obtaining ASE Curve	4-66
4-18	Case of Σ pase mode On	4-67
4-19	Case of list all mode On	4-67
4-20	Example of Plotting	4-72
4-21	Floppy Disk Directory (all files)	4-73
4-22	Self Diagnosis Function Screen	4-81
6-1	Outline of GP-IB Interface	6-3
6-2	Signal Line Terminals	6-4
6-3	GP-IB Connector Pin Arrangement	6-5
8-1	Internal Operation Timing by Gated MEAS Input	8-11
9-1	Internal Block Diagram	9-4
10-1	Gated Measurement Input Circuit	10-2

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LIST OF TABLES

No.	Title	Page
1-1	Standard Accessories	1-4
1-2	Specifications of the Power Source Voltage and Fuse	1-6
3-1	Functions	3-2
3-2	Standard for Measurement Level Error and Maximum Resolution According to the Optical Fiber	3-5
3-3	Internal State Messages	3-8
3-4	Alarm Messages	3-8
3-5	Measurement Condition Setting Items and Keys Used	3-12
3-6	Display Condition Setting Items and Keys Used	3-13
3-7	Measurement and Data Output Items and Keys Used	3-14
3-8	Measurement Data Analysis Items and Keys Used	3-15
3-9	Measurement Data Memory Items and Keys Used	3-16
4-1	Sweep Modes and Their Functions	4-12
4-2	Standard Relative Luminosity Factor	4-49
4-3	Keys Enabled Under the Power Monitor Mode, and Their Functions	4-54
4-4	Capacity of the Floppy Disk	4-74
4-5	Initial Status by INSTR PRESET	4-80
6-1	Interface Functions	6-6
6-2	GP-IB Standard Bus Cables (sold separately)	6-7
6-3	Error Codes Used in Self-Diagnosis	6-24
6-4	Initial State at Power On	6-38
6-5	Status Modification by Command	6-39

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1. GENERAL

This manual is commonly used in both Q8381A and Q8383.
The display-screen examples represent the Q8381A on the label display, however, are basically the same as the Q8383.
This chapter explains how to use this instruction manual, the outline of the Q8381A and Q8383 optical spectrum analyzer, precautions when using it and the procedure for setting it up.
Be sure to read this manual carefully before starting measurement.
The configuration in Chapter 1 is shown in the following.

Table of Contents

1. GENERAL 1-1
1.1 How to Use This Manual 1-2
1.2 Outline 1-3
1.3 Before Using the Analyzer 1-4
1.3.1 Checking the exterior and accessories 1-4
1.3.2 Environment and precautions 1-4
1.3.3 Power source and fuse 1-5
1.3.4 Damage to circuit element due to power line CMV loop 1-7
1.3.5 CRT display 1-7
1.3.6 Handling the input optical connector 1-8
1.3.7 Operation when power is turned ON 1-8
1.3.8 Setting the print paper 1-10
1.3.9 Storage, Carrying, Transportation and Cleaning 1-11*

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1.1 How to Use This Manual

This manual consists of ten chapters and two appendixes.
If you are about to use the Q8381A/Q8383 for the first time, you should not skip any of the chapters. When you come across an unknown term, refer to the glossary at the end of the manual.
Those who have used the Q8381A/Q8383 more than once or who are familiar with optical spectrum analyzers should have no difficulty finding the appropriate section or paragraph.

1. General	. . . . .	Be sure to read this chapter before using the Q8381A/Q8383. Chapter 1 explains the outline of the Q8381A/Q8383, precautions when using it and the procedure before starting measurement.
2. Panels	. . . . .	Chapter 2 provides brief information on the panel configurations along with the names and functions of switches.
3. Basic operation	. . . . .	Chapter 3 explains the preparations for starting measurement up to data output. Those using the Q8381A/Q8383 for the first time should become familiar with the outline of the operation.
4. Panel operation	. . . . .	Chapter 4 explains the seven panel sections, including the function and operation of each one.
5. Key functions	. . . . .	Chapter 5 briefly explains the softkey menus functions.
6. GP-IB interface	. . . . .	Chapter 6 explains the program code and data output format when the Q8381A/Q8383 is controlled via the GP-IB interface, giving some program examples.
7. How to use floppy disk	. . . . .	Chapter 7 explains handling the floppy disk and reproducing the data by the computer.
8. Examples of measurement	. . . . .	Chapter 8 offers some typical measurement examples using the Q8381A.
9. Principle of operation	. . . . .	Chapter 9 shows the internal blocks and briefly explains their operation.
10. Specifications	. . . . .	Chapter 10 lists the specifications of the Q8381A/Q8383.
Appendix 1, 2	. . . . .	Lists of the softkey menus and glossary of technical terms are explained. Refer to this as required.
External view	. . . . .	External dimensions are shown on the drawings. Illustrations of the front and rear panels are enlarged.

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1.2 Outline

The Q8381A/Q8383 is an optical spectrum analyzer of the decentralized spectrum method employing diffraction lattice monochrometor. Its main features are given below.

Features

① Wide dynamic range
Wide dynamic range in the Q8381A is obtained by an optical design to suppress an internal stray light level.
The range of 40 dB in a state 1 nm away from peak wavelength.
The range of 50 dB in a state 5 nm away from peak wavelength.
Wide dynamic range in the Q8383 is obtained by the adoption of double-pass monochrometor.
The range of 55 dB in a state 0.5 nm away from peak wavelength.
The range of 65 dB in a state 1 nm away from peak wavelength.

② High-speed measurement
High-speed measurement can be done by the adoption of the high-speed drive system which controls the rotation of the diffraction lattice. (SWEEP-MODE: NORMAL)
0.8 seconds or less in 200 nm span.
1.5 seconds or less in 500 nm span.

③ Pulse light measurement
The Q8381A/Q8383 incorporates the AMP system for high-speed measurement of light pulse under test. By synchronizing measurement by the external TTL signal, more stable spectrum can be obtained.

④ Easy operation and abundant functions
Various aspects have been taken into consideration to make measurement easier.
The panel key arrangement, softkey menus and basic key functions can be specified in the first hierarchy.
They include four types of spectral width measurement functions, power monitor function, cursor function, and various display (3-dimensional data, dual screen, and super-impose).

⑤ Built-in high-speed printer
Measurement data can be easily output using a high-speed thermal printer having a printing speed of less than 8 seconds.

⑥ Enhanced memory function
3.5 inch floppy disks in accordance with MS-DOS* format in addition to 32 data memories (battery backup) are equipped normally.
The measurement data by an outside computer can be easily analyzed.
*: MS-DOS is a registered trademark of the United States microsoftware company.

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1.3 Before Using the Analyzer

Upon taking delivery of the analyzer, check whether any part of it has been broken during transportation. Then, check the quantity and specifications of the standard accessories against Table 1-1.
If any part is broken or accessory missing, contact the sales dealer and the support offices.
The addresses and phone numbers of the support offices are given at the end of this manual.

1.3.1 Checking the exterior and accessories

Pay attention to the corners of the Q8381A/Q8383 when checking its exterior.
Check the number and specification of the accessories against to the table below.

Table 1-1 Standard Accessories

Name	Type	Q'ty	Remarks
Power cable	*1	1	
Power fuse	EAWK4A	2	Time-lag T4.0A/250V
Printer paper	A09075	1	114 mm-wide thermal paper
3.5 inch floppy disk	——	1	2DD
Instruction manual	EQ8381A/8383	1	English version

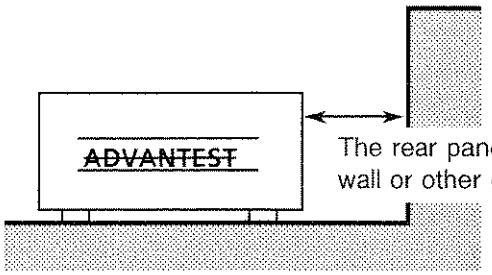
*1 ADVANTEST provides the power cables for each country.

Note: Order the additional of the accessory etc. with type name.

1.3.2 Environment and precautions

(1) Do not use this analyzer in a dusty place or expose it to direct sunlight or corrosive gases.

(2) A cooling fan is provided in the analyzer to prevent abnormal temperature rise. Since the fan blows air inside, make sure that the area around the analyzer is well ventilated.
The fan filter should be cleaned periodically. Also avoid blocking the air intake holes of the analyzer.



The rear panel shall be 10 cm or more distant from the wall or other equipments.

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(3) Since the analyzer is a precision instrument, do not subject it to vibration or use it on a table where it was overturn.
When transporting the analyzer, use the box and shock-absorbing material used when shipped from the factory. When you must pack this analyzer using a packing material other than the original, be sure to pack it so the analyzer will not receive its impact value limit of 20 G during transport. (The buffer material from our company is designed so the analyzer receives an impact of less than 20 G when the analyzer falls from a height of 0.55 m).

(4) Never connect the power cable to an AC line when the power switch is ON.

(5) Before using the power cable, confirm that the power source is within the voltage specified on the rear panel.
The analyzer can be used without the change within the range of the voltage of 90 to 250VAC.

(6) The analyzer should be placed horizontally.
Due to its internal configuration, the analyzer may not indicate the correct value if inclined to much.

(7) In case of the Q8383, the ghost which level is approx. 30 dB to 40 dB lower than the input signal appears around 1.5 μm when the signal of 1.3 μm is input. The same ghost appears around 1.7 μm when the signal of 1.55 μm is input.
Note that the occurrence is based on the restriction of measurement method. (Not a mechanical failure)

(8) Warm up the analyzer for approximately 30 minutes to satisfy the measurement and the setting accuracy shown in Chapter 10, SPECIFICATIONS.

1.3.3 Power source and fuse

(1) Power cable
Be sure to use the cable attached to the analyzer.

(2) Power source
Before connecting the power cable, make sure that the analyzer power switch is OFF (set to the front position).
The analyzer operates within the range of 90 to 250 VAC.
The socket-outlet shall be installed near the equipment and shall be easily accessible.

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(3) Fuse

- Fuse check and replacement

① POWER switch is turned off.

② Remove the power cable from the AC line connector.

③ Remove the fuse holder from the AC line connector.

④ Confirm that the fuse has blown and replace it with a new one.
(The fuse of the same standard can be used within the range of 100 to 240 VAC.)

Table 1-2 Specifications of the Power Source Voltage and Fuse

Power source voltage	Applicable fuse
90 to 250VAC	EAWK4A (Time-lag T4.0A/250V)

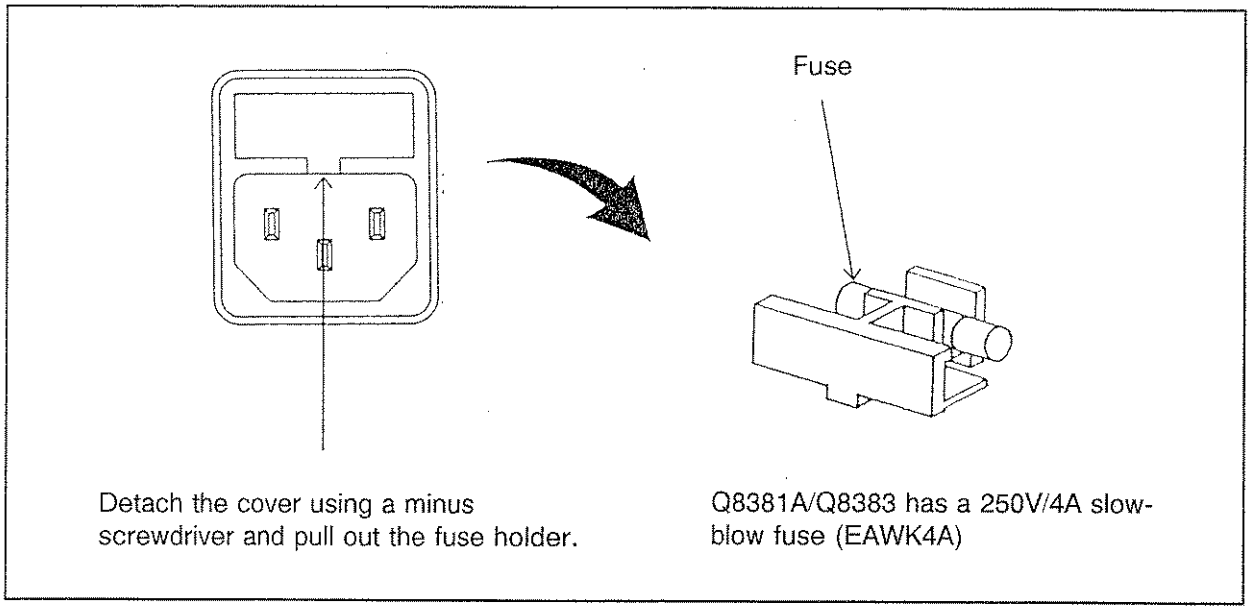


Fig. 1-1 Checking Fuse

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1.3.4 Damage to circuit element due to power line CMV loop

The analyzer can be used in combination with peripheral devices such as a desk-top computer and plotter.

When connecting a peripheral device, pay special attention to the CMV (common mode noise voltage) which may be caused by wiring failure of the power source grounding.

If a power line is used without grounding, an AC voltage (CMV) of about 50 V is generated between terminals a1 and a2, and b1 and b2, by the loop illustrated in Fig. 1-2.

In this case, if the a1 signal terminal is connected to a2, leaving ground terminals b1 and b2 open, the input/output circuit elements of circuits 1 and 2 may be damaged or deteriorated.

To eliminate this, it is necessary to use a power line connected to ground wiring. CMV is instantaneous if the power is turned ON or OFF using the power source plug. The power source must be turned ON or OFF using the power source switch.

If the power source line is to be used without ground wiring, connect ground terminal GND1 to GND2 before connecting the signal cable. Then insert the power plug and turn the power switch ON.

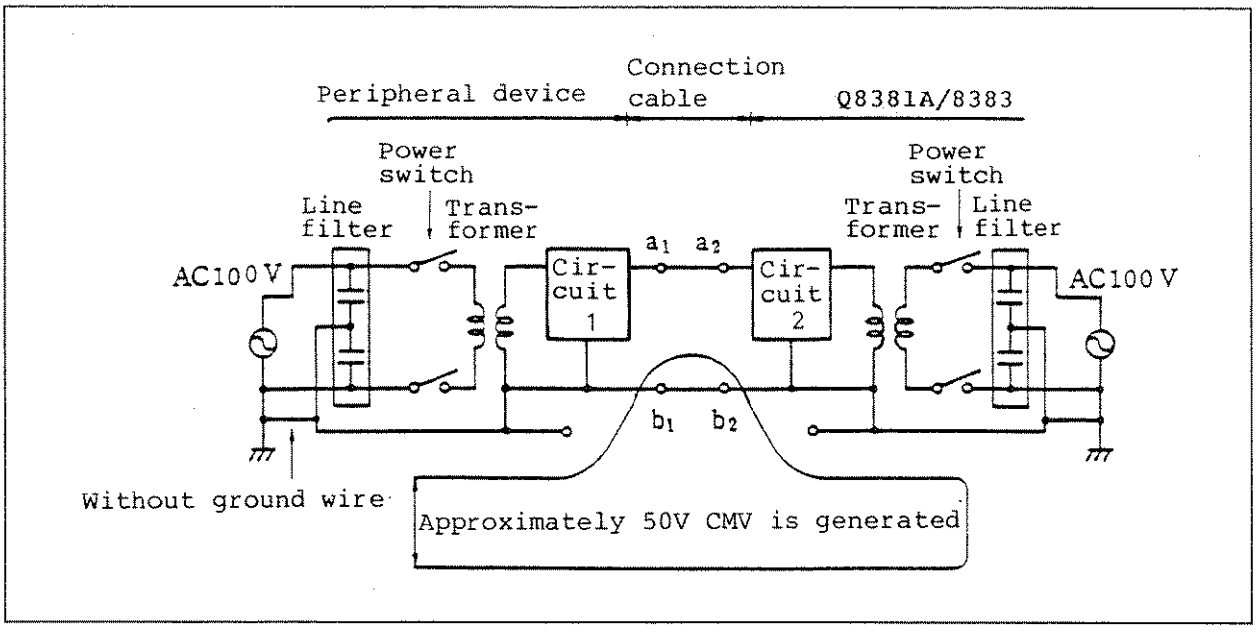


Fig. 1-2 Power Line CMV Loop

1.3.5 CRT display

Adjust the brightness of the CRT display to suit the ambient brightness using the brightness adjustment knob located at the lower center of the front panel.

Adjust to desired brightness. Note that the CRT will become burnt if used on high brightness for a long time.

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1.3.6 Handling the input optical connector

The connector at the optical input of this analyzer does not need cleaning because it does not use the optical fiber inside.
Never change the position of the input optical connector since it is adjusted at the reference position for the internal optical system. If it is changed, normal measurement data cannot be obtained.
The effective numerical aperture for the internal optical system is 0.1. Therefore, use a optical fiber with numerical aperture less than 0.1. Otherwise, the measurement level may be lowered.
The Q8381A/Q8383 has the allowable input power level (Q8381A: +10dBm, Q8383: +20dBm). Never apply the power exceeding the limit to the input optical connector.

1.3.7 Operation when power is turned ON

When the power is turned on, all the LEDs on the panel will light and self-diagnosis is executed automatically.
If the diagnosis results are normal, the measurement data display screen appears in about 20 seconds, a buzzer sounds and the system enters the ready state.
Fig. 1-2 shows the initial screen when the power switch is turned on.
The analyzer has a built-in Ni-Cd (nickel-cadmium) battery to keep the stored setting conditions and measurement data while the power is off. The battery is automatically charged while the power is on and the data can be retained for about six months when fully charged. If the power remains off for more than six months, the setting conditions and measurement data may be lost. (In this case, FAIL appears against the backup RAM item on the self-diagnosis screen. The setting conditions are initialized and all data saved is cleared. When this state occurs, turn the power switch on to charge the battery. About 15 hours are required to fully charge the battery.)
If an error is found during self-diagnosis, "FAIL" appears in the corresponding column along with an error code indicating the type of error. If the error is other than backup RAM, contact the dealer or support office.
The addresses and phone numbers of the support offices are listed at the end of this manual.

Note: When a backup RAM error occurs, self-diagnosis is executed without stopping operation. In this case, a buzzer sounds three times upon completion of the diagnosis and the following message appears on the screen.

"backup memory destroyed!! > press any key to continue."

To specify the measurement screen, press one of the panel keys.

CAUTION

If the power switch is turned on after remaining off for more than 5 minutes, the CRT display appears in about 10 seconds.

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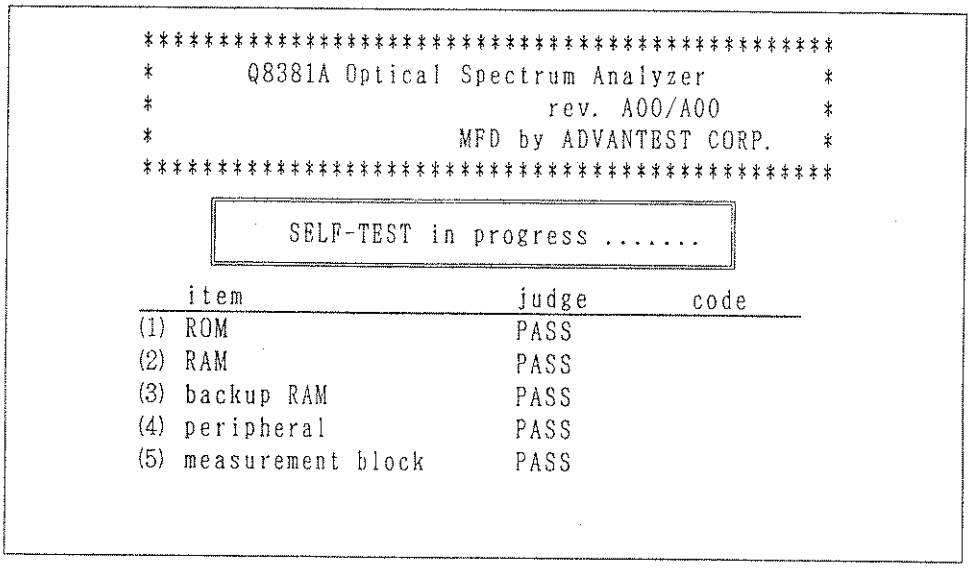


Fig. 1-3 Initial Screen at Power On

Note: The "rev. A00/A00" in the above screen indicates the revision of the internal software. It may be modified when the function is improved.
Also the display of the product name is either Q8381A or Q8383.

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1.3.8 Setting the print paper

Mount the paper in the internal printer as illustrated on the rear of the printer cover.

Procedure

① Set the head up lever to the open position.

② Load the roll paper in the holder with the outside of the paper roll down.

③ Set up the paper as shown in the following figure.

NOTE

Be sure to insert the paper from the upper slit. The printer does not operate even if the paper is inserted into the lower slit.

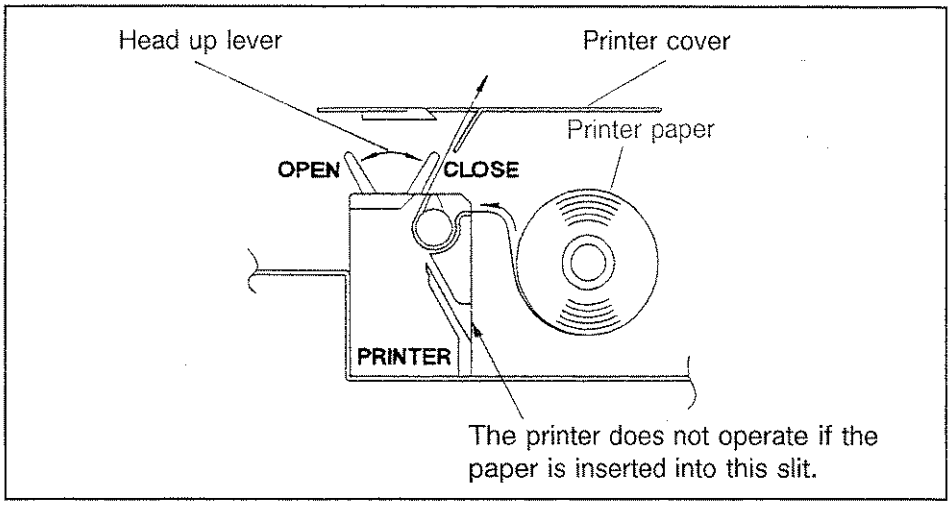


Fig. 1-4 Setting the print paper

④ Set the head up lever to the close position.

⑤ Press the FEED key on the front panel and check whether the paper is correctly installed. Return to the point ① if the paper is not correctly installed.

Printer paper : A09075 (Order No.)
5 rolls/box (Order unit : 1 box)
Thermosensitive paper length : 30m
Paper width : 114mm

Note: Use only the specified paper.

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1.3.9 Storage, Carrying, Transportation and Cleaning

(1) Storage

To store the Q8381A/Q8383 for a long time, put it in a corrugated paper box and store the box in a place where humidity is low and direct sunlight does not come in.
Storage temperature and humidity are -10°C to +50°C, and 85% or less, respectively.

(2) Carrying

To carry the analyzer, use two handles and lift it horizontally. Be sure to carry by two or more persons.

(3) Transportation

To transport the Q8381A/Q8383, use the packing material with which the analyzer was packed when delivered to you. When you have no longer the packing material, pack the device in the following manner.

1. Wrap the analyzer in a vinyl sheet (with desiccant put it to prevent influence of moisture).

2. Prepare a corrugated paper box with 5 mm or more thickness. Put cushioning material in the box to approximately 40 mm thickness so that the analyzer is surrounded by the cushioning material.

3. After wrapping the analyzer by cushioning material, put accessories in the box, and put cushioning material again in the box. Then close the box, and bind by packing string.

(4) Cleaning

To clean the Q8381A/Q8383, wipe with the cloth which is dry or soaked in the neutral detergent. And observe the following precaution.

CAUTION

To maintain or clean the analyzer, do not use any solvent which may degrade plastics (organic solvent such as benzene, toluene and acetone).

1.3.10 Maintenance

CAUTION

No operator serviceable parts inside. Servicing to be provided by trained individuals.

For the maintenance or the inspection of Q8381A/Q8383's inside or the replacement of various parts other than fuse, contact your nearest ADVANTEST dealer.

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2. PANELS

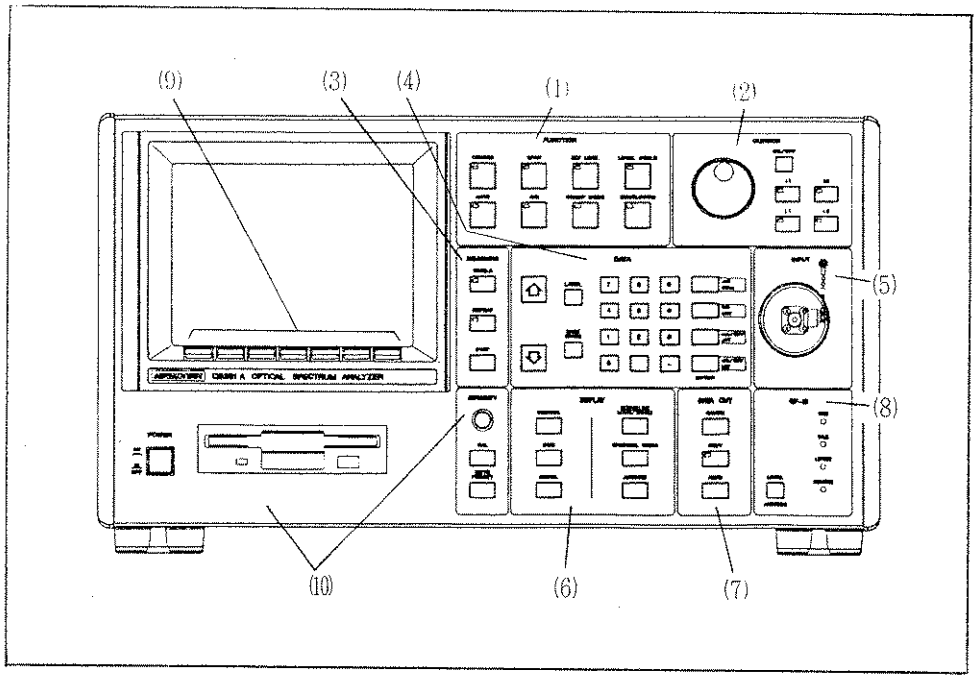
This chapter briefly explains the functions of the keys and switches on the analyzer panels. The configuration in Chapter 2 is shown in the following.

Table of Contents

2. PANELS 2-1
2.1 Front Panel 2-2
(1) FUNCTION section 2-3
(2) CURSOR section 2-4
(3) MEASURE section 2-4
(4) DATA section 2-5
(5) INPUT section 2-5
(6) DISPLAY section 2-6
(7) DATA OUT section 2-7
(8) GP-IB section 2-7
(9) Softkeys 2-8
(10) Others 2-8
2.2 Rear Panel 2-9*

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2.1 Front Panel

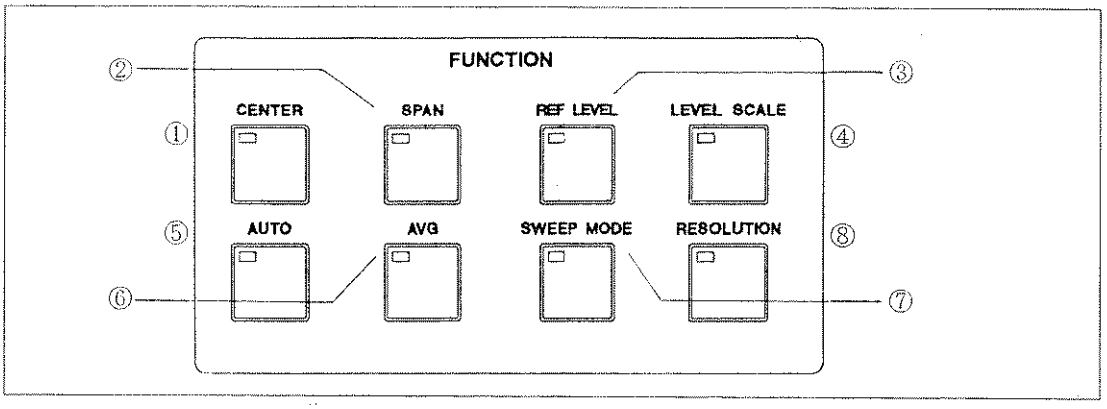


The front panel switches are explained below in the sequence shown above.

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(1) FUNCTION section

Basic measurement conditions are specified using this section.

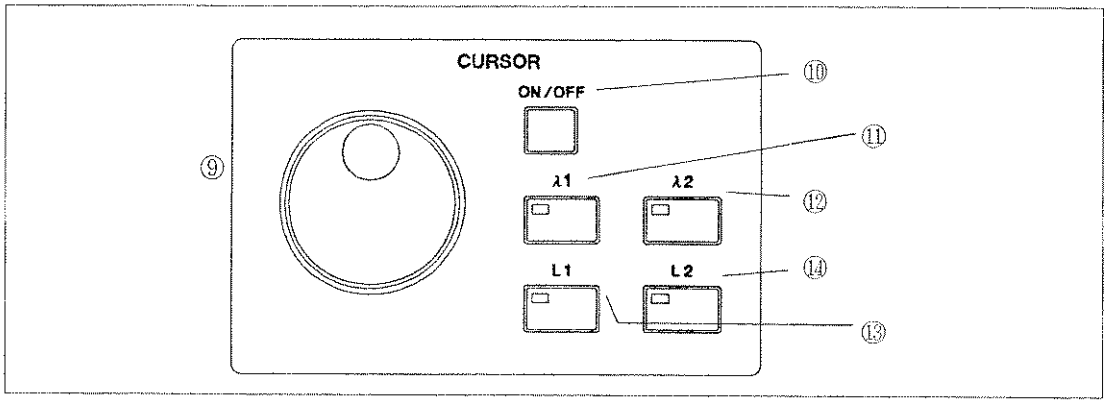


①	CENTER key	:	Specifies the center wavelength.
②	SPAN key	:	Specifies the wavelength span and the start/stop wavelengths.
③	REF LEVEL key	:	Specifies the reference level in display.
④	LEVEL SCALE key	:	Selects the level axis (LIN/LOG) and specifies the scale.
⑤	AUTO key	:	Executes the automatic setting functions for most suitable wavelength/ level.
⑥	AVG key	:	Specifies the number of averaging processings.
⑦	SWEEP MODE key	:	Specifies the sweep mode correspond to the input signal.
⑧	RESOLUTION key	:	Specifies the wavelength resolution.

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(2) CURSOR section

This section is used to control cursor display.



⑨ Rotary knob : Moves the cursor selected and continuously changes the data set.

⑩ CURSOR ON/OFF key : Controls ON/OFF of all cursors and the cursor display mode.

⑪ λ 1 key : Selects display and erases wavelength cursor 1.

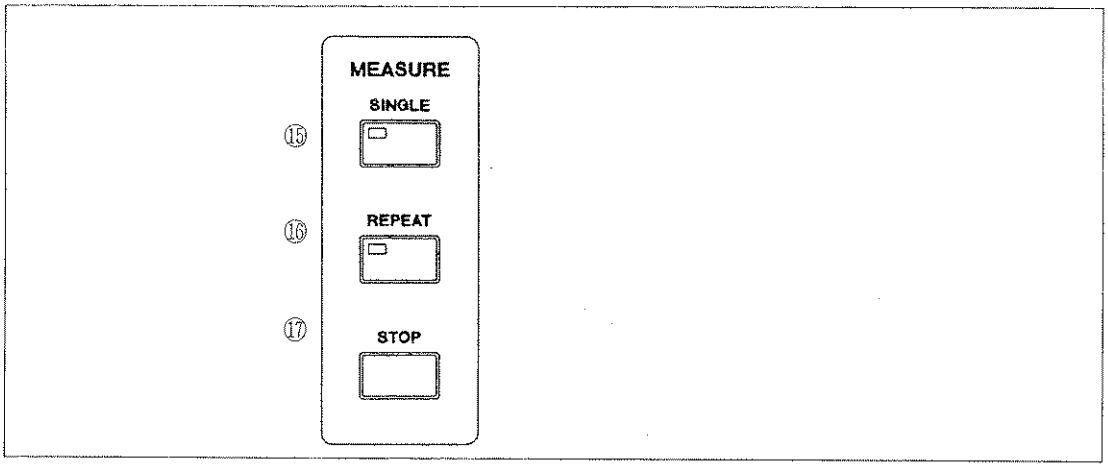
⑫ λ 2 key : Selects display and erases wavelength cursor 2.

⑬ L1 key : Selects display and erases level cursor 1.

⑭ L2 key : Selects display and erases level cursor 2.

(3) MEASURE section

This section performs sweeping control.



⑮ SINGLE key : Executes one time sweeping.

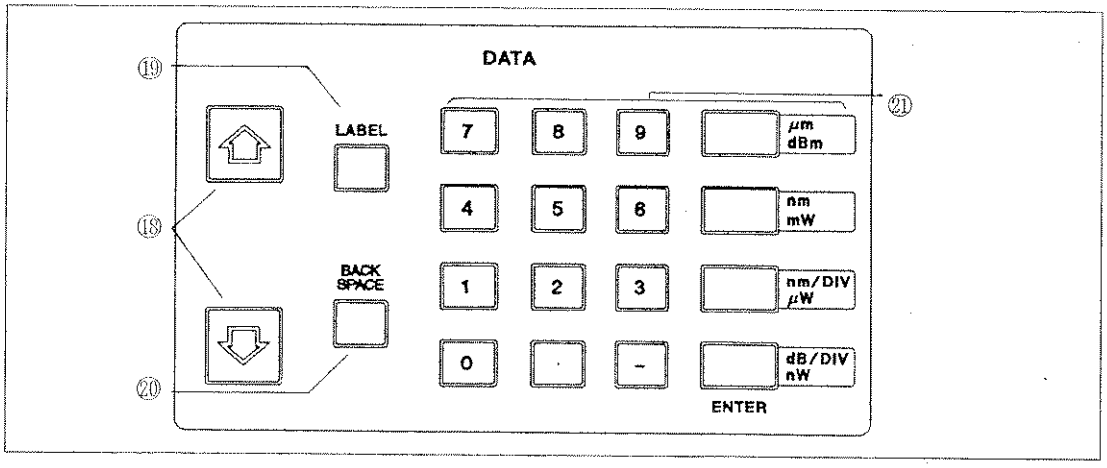
⑯ REPEAT key : Repeats sweeping.

⑰ STOP key : Stops sweeping.

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(4) DATA section

This section is for changing the set value and setting the lavel.



⑱ Arrow keys : Used to move the cursor selected and change the data set, step by step.

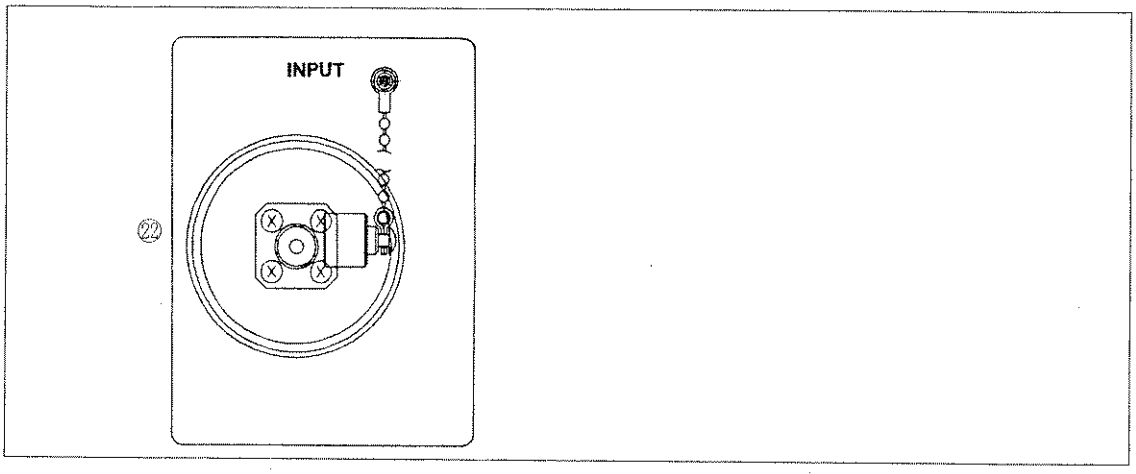
⑲ LABEL key : Specifies the label data.

⑳ BACK SPACE key : Deletes a character from the input data.

㉑ Numeric keys : Used to specify values for condition setting.
Unit key : Specifies the unit (input terminator).
Enter key : Setting terminator of other than the unit key.

(5) INPUT section

This section is for optical signal input.

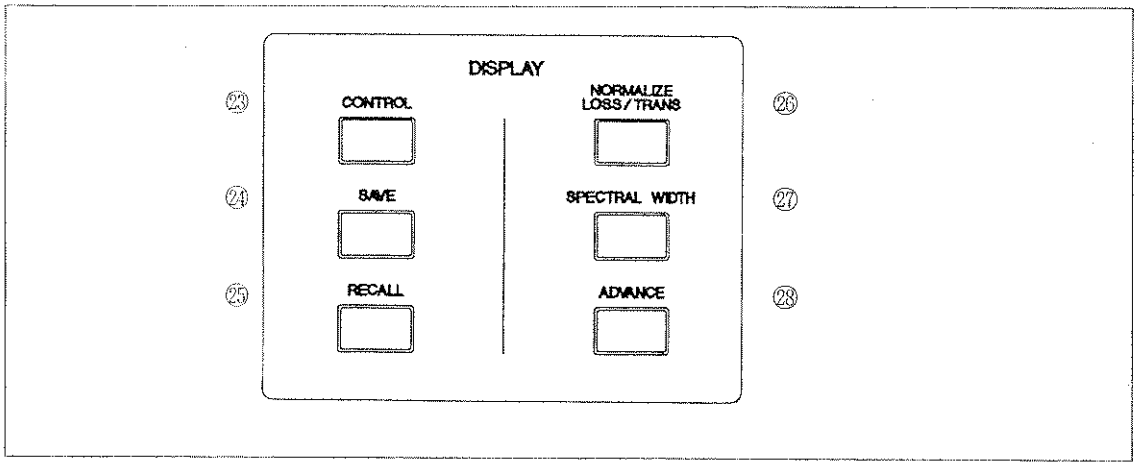


㉒ INPUT terminal : Input terminal for optical signals.

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(6) DISPLAY section

This section is used to select display and analysis functions.



㉓ CONTROL key : Specifies the display mode (superimpose, dual-screens, three-dimensional).

㉔ SAVE key : Saves the measurement data and setting conditions. (Memory/FDD)

㉕ RECALL key : Recalls the measurement data and setting conditions. (Memory/FDD)

㉖ NORMALIZE key : Executes measurement data normalization and measurement of loss and transparency characteristics.

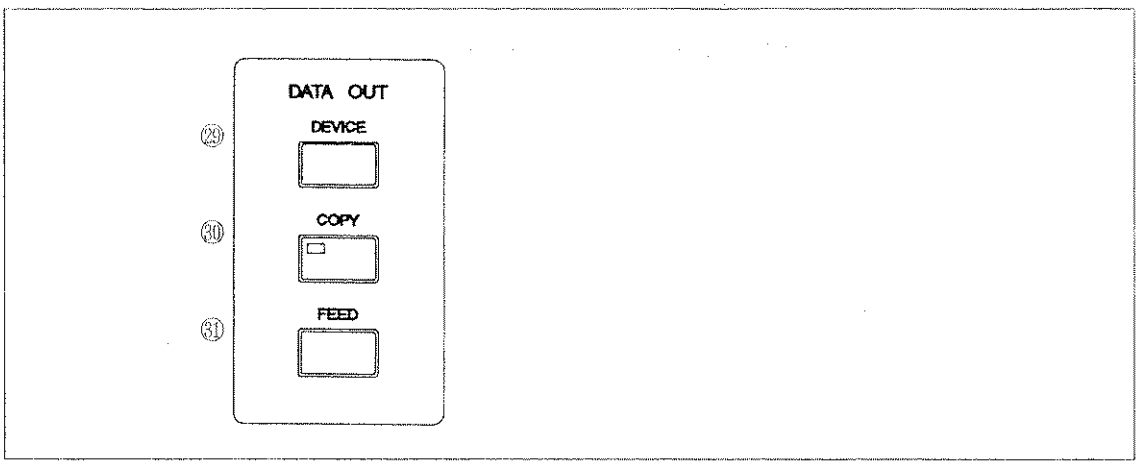
㉗ SPECTRAL WIDTH key : Calculates the spectral width.

㉘ ADVANCE key : Specifies higher level analysis.

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(7) DATA OUT section

This section controls data output.



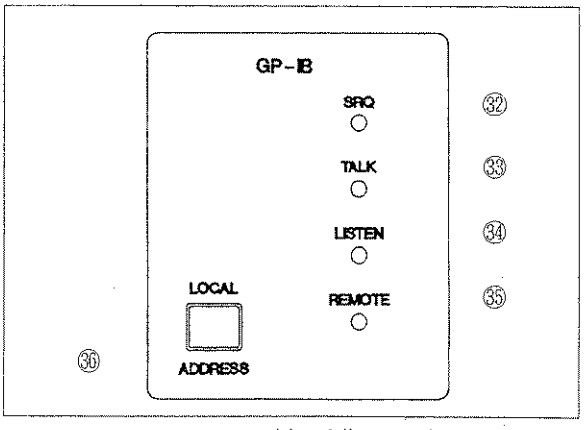
㉙ DEVICE key : Specifies a device (plotter, printer floppy disk, clock or buzzer).

㉚ COPY key : Executes data out processing.

㉛ FEED key : Feeds paper to the printer.

(8) GP-IB section

This section is used to display the GP-IB status and switch Remote/Local.



㉜ SRQ lamp : Lit while service request is transmitted.

㉝ TALK lamp : Lit when the data transmitabled status is set.

㉞ LISTEN lamp : Lit when the data receivabled status is set.

㉟ REMOTE lamp : Lit while the system is under external control.

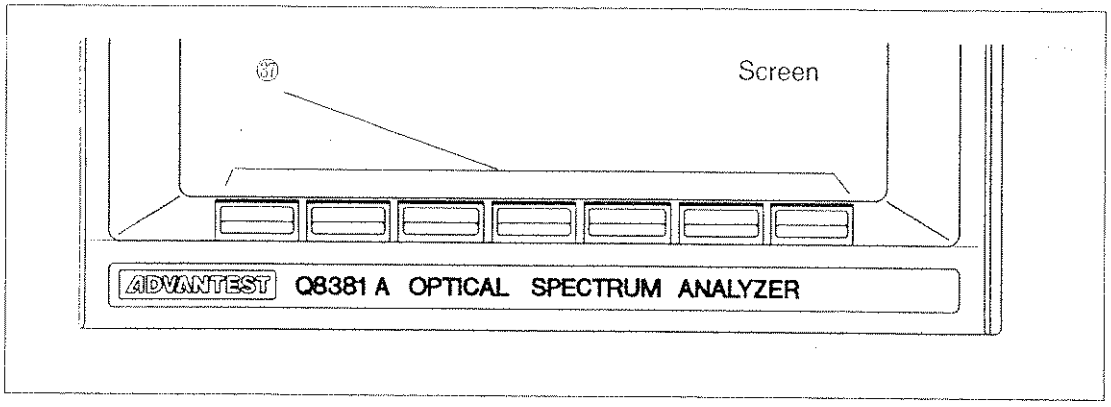
㊱ LOCAL key : Specifies the local mode to make the panel keys valid (when the REMOTE lamp is lit).

ADDRESS key : Specifies the GP-IB address (when the REMOTE lamp is off).

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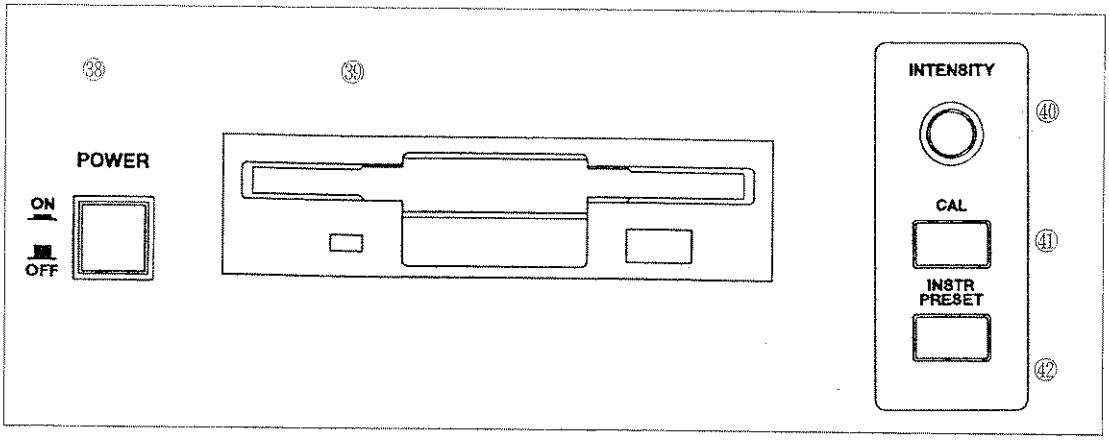
(9) Softkeys

The Softkeys are used to select and specify the Softkey menu displayed.



㊲ Softkeys : Each key executes the menu function corresponding to one of the seven keys.

(10) Others



㊳ POWER switch : Turns power ON/OFF.

㊴ 3.5 inch floppy disk drive: Saves the measurement data and measurement conditions. 2DD and 2HD are possible to use.

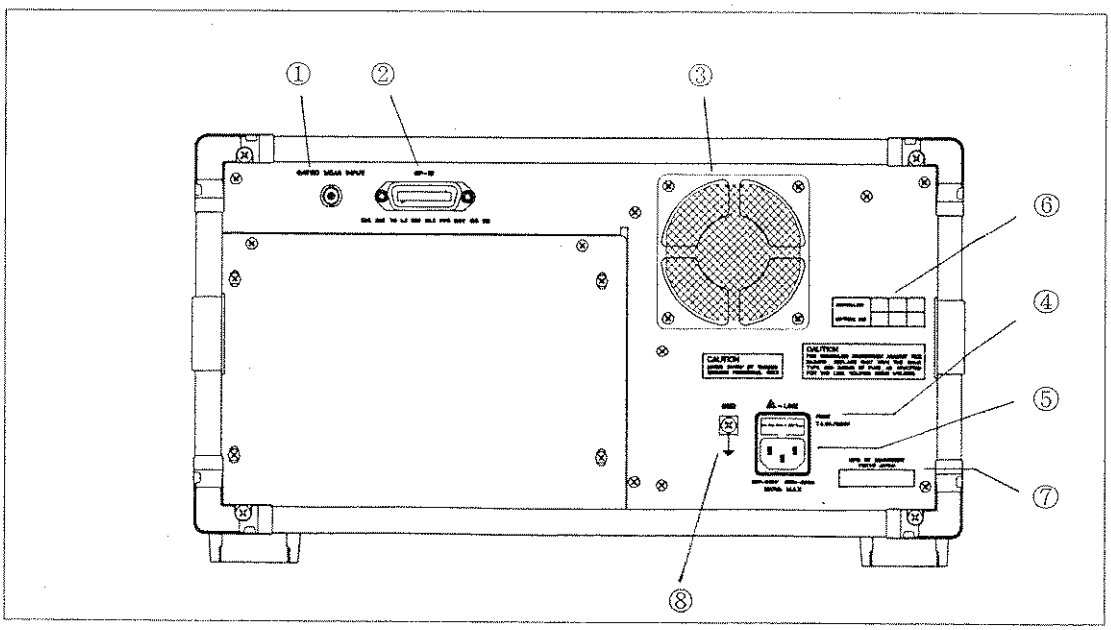
㊵ INTENSITY knob : Adjusts the CRT brightness.

㊶ CAL key : Calibrates the wavelength and the level.

㊷ INSTR PRESET key : Initializes the setting modes.
Executes self-diagnosis.

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2.2 Rear Panel



① GATED MEAS INPUT
This is used when internal measurement is synchronized by the TTL-level positive pulse signal. It is effective in measuring pulse signal light.

② GP-IB connector
This connector is used when controlling the analyzer via an external controller with an GP-IB interface and when outputting data from the CRT to the plotter corresponding to the GP-IB.

③ Fan
This is an intake type fan for cooling the internal circuit. When the filter is dirty, the cooling effect is weaken. Clean the filter regularly about once every month.

④ Fuse

⑤ AC power socket

⑥ Option information table
When the option is installed in the Q8381A/Q8383, stick the label written the option number.

⑦ Serial number

⑧ Earth terminal
It is used as functional ground.

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3. BASIC OPERATION <For those using the analyzer for the first time>

This chapter gives explanation on basic operation needed to use this machine.
Here is the configuration of Chapter 3.

Table of Contents

3. BASIC OPERATION <For those using the analyzer for the first time> 3-1
3.1 Functions 3-2
3.2 Entering the Light to be Measured 3-4
3.3 Reading the CRT Screen 3-6
3.4 Basic Operation Procedure 3-10
3.5 Setting the Measurement Conditions 3-12
3.6 Setting the Display Conditions 3-13
3.7 Measurement and Data Output 3-14
3.8 Analyzing the Measured Data 3-15
3.9 Measurement Data Memory 3-16*

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3.1 Functions

This machine measures the optical spectrum, and displays the wavelength on the horizontal axis, and the level on the vertical axis. The machine offers variation on the display method, measurement data analysis, etc. of the basic spectrum measurement.
Table 3-1 is an overview of the functions.

Table 3-1 Functions (1/2)

Classification	Item	Description
Display	① Scale selection, scale setting	Log/linear scale selection and log/scale scale setting of the level axis (10 dB/D, 5 dB/D, 2 dB/D, 1 dB/D, 0.5 dB/D, 0.2 dB/D)
	② Dual screen display (DUAL)	The screen display is divided into the upper and lower parts.
	③ Super impose (S.IMPOSE)	Two data are displayed at the same time on a single screen.
	④ 3-dimensional display (3D)	3-dimensional display of up to 16 data. The display angle, number of data, etc. can be changed.
	⑤ Power monitor display	All the input power levels are numerically displayed without causing internal spectrum. The trend chart display that displays the power by the time axis is also provided.
Processing/ Analysis	① Auto peak search	Automatically searches and displays the peak wavelength/level of the measured spectrum.
	② Cursor display	Can display two wavelength/level cursors each. Four display modes are offered.
	③ Spectral width operation	Operation and display of the center wavelength, spectrum width by four types of operation methods.
	④ Peak normalization	Normalizes the measured spectrum peak level as the reference value (0 dB/100%).
	⑤ Loss/Trans	Operates the loss/transparence characteristics by division with the reference memory data.
	⑥ Luminosity offset display	Offsets the measured raw data by the comparative luminosity, and normalizes the result with the peak level. Note that this function is not provided for the Q8383.
	⑦ Curve fit	Calculates and displays the secondary function curve from the measured curve by method of least square approximation.
	⑧ Optical amplifier measurement function	Calculates the optical amplifier gain and the noise figure to display.

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Table 3-1 Functions (2/2)

Classification	Item	Description
Measurement	① Averaging process	Up to 1024 averaging can be done to measure low level signals stably.
	② Automatic optimization measurement conditions setting	The optimum measurement conditions are automatically judged and set according to the input light.
	③ Wavelength/level calibration	The wavelength/level signal can be calibrated by optional wavelength, level signal.
	④ Synchronization of measurement/Pulse light measurement	Measurements can be synchronized by the external TTL signal. (Gated measurement input) The internal AMP line circuit for measurement of the pulse light is also provided.
Others	① Memory	Provides backup memory for measurement condition : 10, and measurement data : 32 + 1. Up to 111/191 combination of condition/data files can be stored on a single 3.5-inch floppy disk.
	② Direct plot	The tube face data can directly be output onto the "HP-GL" specification GP-IB plotter.
	③ Label setting	Data with maximum 48 characters can be set as the label. The label is displayed on the top of the CRT.
	④ Clock function	The year-, month-, day-, hour:, minute:, second: data are displayed on the upper right part of the CRT.

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3.2 Entering the Light to be Measured

Use the FC connector at the right center of the front panel to enter the optical signals.
Figure 3-1 is the block diagram of the input section. The position of this input connector is the reference position of the internal optical system in this analyzer. (Strictly saying the reference is the outgoing end of the optical fiber.) Therefore, the incoming optical fiber must be connected firmly. (If the outgoing position of the optical fiber is shifted, the optical system will not focus, and normal spectrum cannot be measured.)
The effective NA is 0.1 according to the area of the parabolic mirror that receives the incoming light, so optical fiber of 0.1 NA or less must be used. If the NA is large, only a part of the incident light can be collected, resulting in low level measurement. Table 3-2 shows a sample of the level error for various typical optical fibers.
The incoming optical fiber is used as the incident slit of the spectrograph. Thus, the maximum resolution of the measurement differs according to the diameter of the optical fiber's core.
(See Table 3-2.)
Fix the fiber to be connected firmly so that it does not vibrate during measurement.
Any vibration can cause the spectrum to vary.

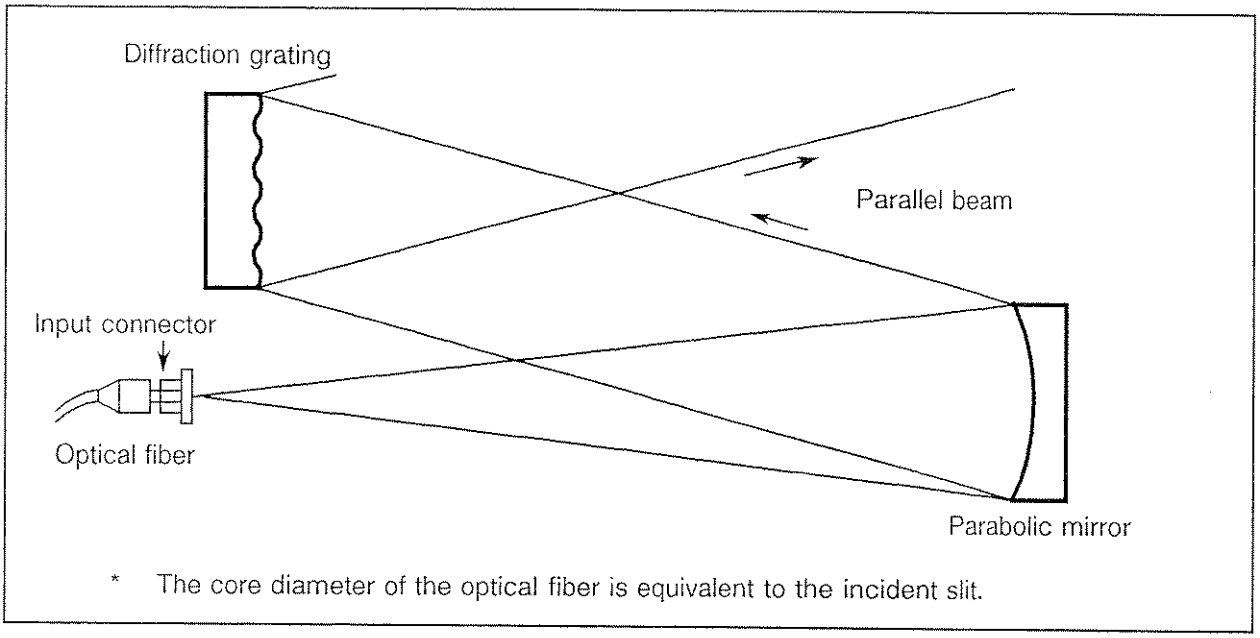


Fig. 3-1 Input Section Block Diagram

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Table 3-2 Standard for Measurement Level Error and Maximum Resolution According to the Optical Fiber

Fiber type	NA	Measurement level error standard	Maximum resolution
SM 10 μm	0.1	—— (0 dB)	0.1 nm
GI 50 μm	0.21	Appendix. −1 dB	0.2 nm
GI 62.5 μm	0.27	Appendix. −2 dB	0.2 nm
SI 100 μm	0.21	Appendix. −1 dB	0.5 nm
GI 200 μm	0.21	Appendix. −1 dB	1.0 nm
SI 200 μm	0.5	Appendix. −7 dB	1.0 nm
SI 400 μm	0.35	Appendix. −4 dB	2.0 nm
SI 800 μm	0.21	Appendix. −1 dB	5.0 nm

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3.3 Reading the CRT Screen

Various setting conditions and internal statues as well as measurement data are displayed on the screen. Figure 3-2 shows the CRT display and how to read the display.
For the power monitor display screen, refer to page 4-49.

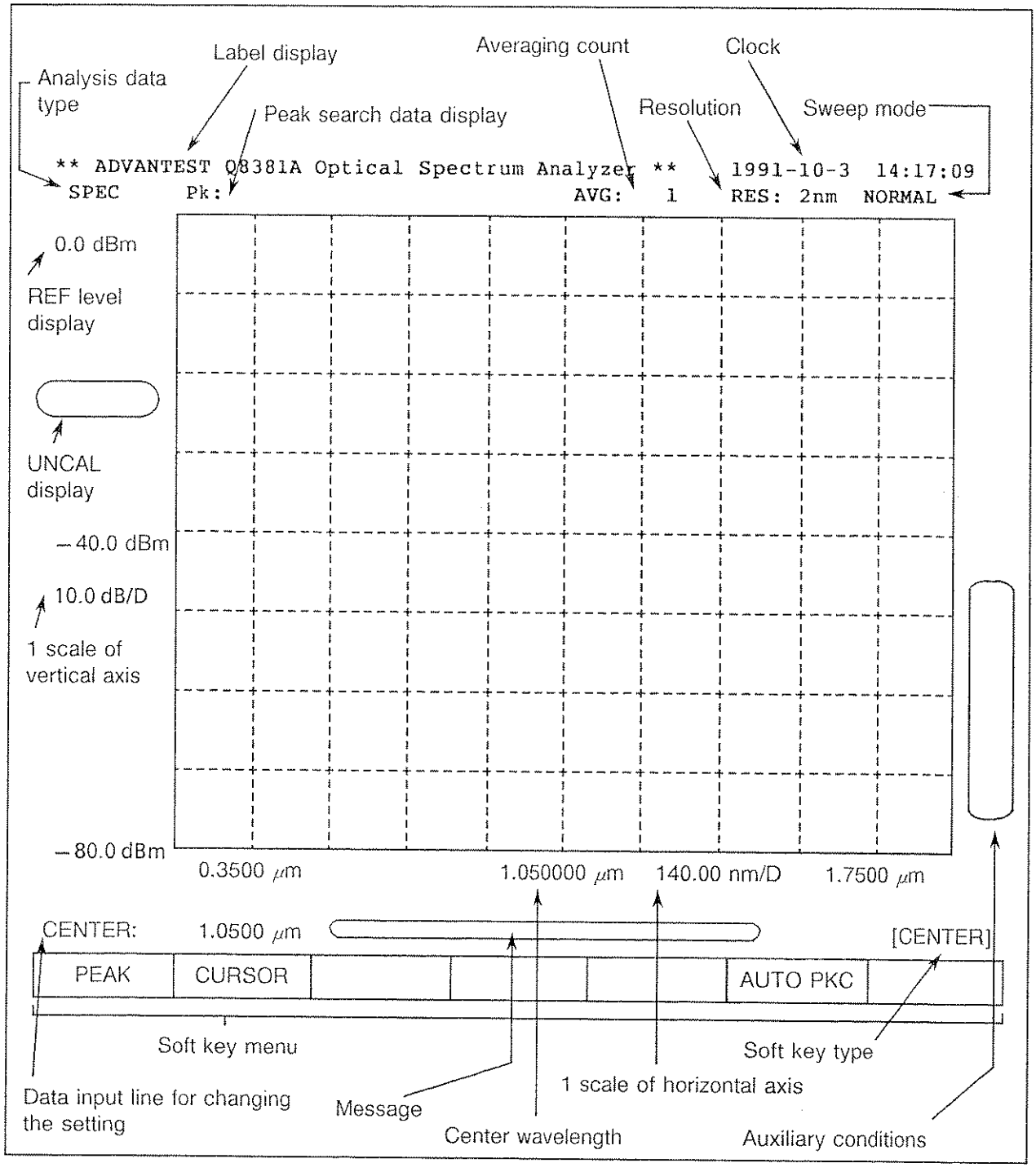


Fig. 3-2 How to Read the CRT Display

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(1) Additional explanation on the CRT display

(a) Type of data to be analyzed

SPEC : Spectrum analysis
P.NORM : Peak-normalized data
LOSS : Loss characteristics data
TRANS : Transparency characteristics data
DOMI : Luminosity offset data

(b) Displaying the auxiliary conditions

The setting of auxiliary items of measurement and display conditions is displayed by three upper case alphabets. The position of display is fixed for each item, as follows.
(Three characters are basically displayed when the specified function is selected, and nothing is displayed in other cases.)

Types and meaning of auxiliary condition display

① RAU : Displayed when "AUTO" mode is selected for the REF level.

② APC : Displayed when the APC (auto peak center) function is selected to automatically set the center wavelength as the peak wavelength when the measurement ends.

③ SIM : Displayed when the "S.IMPOSE" (super impose) function is selected.

④ RCL : Displayed when the displayed data is memory recall data. The display turns off when the data is updated after measurement.

Display position : ①
②
③
④

(c) UNCAL display

Displayed when the following condition that destructs the peak level to be measured because of the relation between the preset span and resolution exists. This "UNCAL" is displayed only to the upper screen at dual mode and the latest data at super impose mode.

Resolution x Measurement point count - 1 (500) < Preset span

(d) Message

In case of operation error, the analyzer displays the error message. It also displays the internal status of the analyzer.

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Table 3-3 Internal State Messages

Message	Description
① AUTO function in progress···	Executing the AUTO function to obtain the optimum measurement conditions
② PRINT-out in progress···	Outputting data to the internal printer.
③ PLOT-out in progress···	Executing direct plotting.
④ peak-lambda search in progress···	Detecting peak wavelength by power monitor display
⑤ read data from FD in progress···	Reading data from the floppy disk.
⑥ write data to FD in progress···	Writing data onto the floppy disk.
⑦ disk formatting in progress···	Formatting the floppy disk.

Table 3-4 Alarm Messages (1/2)

Message	Description
⑧ input data out of range!!	The input data exceeds the given range.
⑨ AUTO function failed!!	Illegal input signal level caused illegal operation of the AUTO function.
⑩ super-impose cannot execute!!	Pressed the S.IMPOSE key when the measurement conditions on the upper and lower parts of the screen were different.
⑪ condition cannot change at 3D ON!!	Tried to change the measurement conditions when 3-dimensional display is ON.
⑫ no REF or MEAS1 data!!	Tried to execute the LOSS/TRANS function without the REF memory or MEAS1 memory.
⑬ different condition at REF < > MEAS!!	Tried to execute the LOSS/TRANS function between data of different measurement conditions.
⑭ no plotter!!	The plotter is not connected, or the plotter address is other than LISTEN ONLY.
⑮ no printer paper!!	The COPY key was pressed when the printer paper was not set.
⑯ printer head up!!	The COPY key was pressed with the printer head up.
⑰ illegal λ/level data input!!	Data exceeding the allowable range is set as internal calibration data.
⑱ media not in drive!!	No disk is in the drive.

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Table 3-4 Alarm Messages (2/2)

Message	Description
⑲ unformatted disk!!	Not formatted, or used disk of different format.
⑳ disk full!!	The disk accommodates files to its capacity, and cannot make new files. (Maximum files in a disk: 111/191)
㉑ illegal file name!!	Set an illegal file name.
㉒ disk read error!!	Data cannot be read normally from the disk.
㉓ disk write error!!	Data cannot be written normally onto the disk.
㉔ disk formatting failed!!	Disk was not formatted normally.
㉕ write protected!!	The disk is write protected.

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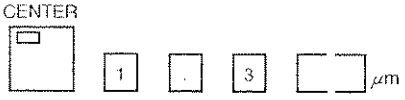
3.4 Basic Operation Procedure

The basic function of this analyzer is to measure the spectrum of the light.

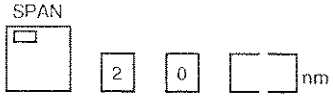
<How to measure a 1.3 μm laser diode>

Operation procedure

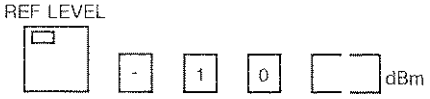
① The center wavelength is set at 1.3 μm.



② The analysis span is set at 20 nm.

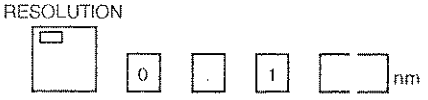


③ The REF LEVEL is set at −10 dBm.



(The LOG scale is set by setting the unit dBm .
The REF LEVEL specifies the display level and has no effect on the measurement data. Therefore, optimum display can be done after the measurement.)

④ The resolution is set at 0.1 nm.



(The maximum resolution is normally set to allow resolution of any vibration mode when measuring optical source of narrow specter, as in laser diode.)

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⑤ The measurement is executed once (sweeping).

SINGLE



→ The SINGLE LED lights, and measurement is executed. The measurement data is swept and displayed from the start wavelength in sequence.
(The LED turns off when measurement ends.)

The above completes the basic measurement. Section 3.5 and after describes how to change the measurement conditions, display conditions, data output operation, etc., and the keys used.

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3.5 Setting the Measurement Conditions

The FUNCTION key is basically used to set the measurement conditions.
There are roughly three kinds of measurement conditions, as follows.

① Setting the wavelength (center wavelength, span, etc.)
② Setting the level conditions (input sensitivity)
③ Other settings (resolution, sweep mode, etc.)

Keys shown in Table 3-5 are used for the above setting.

Table 3-5 Measurement Condition Setting Items and Keys Used

Setting item	Key for selection	Keys enabled for changing the setting
① Center wavelength	[CENTER]	[PEAK] [CURSOR] [AUTO PKC] Numeric keys, knob, arrow keys
② Wavelength span	[SPAN]	[FULL] [0.35 to 1.0] (Q8383 : 0.55 to 1.0) [0.9 to 1.75] [△λ→SPAN] Numeric keys, knob, arrow keys
③ Start wavelength	[SPAN] + [START]	Numeric keys, knob, arrow keys
④ Stop wavelength	[SPAN] + [STOP]	Numeric keys, knob, arrow keys
⑤ Input sensitivity (Display level)	[REF LEVEL]	[PEAK] [CURSOR] [AUTO] Numeric keys, knob, arrow keys
⑥ Sweep mode	[SWEEP MODE]	[NORMAL] [ADAPTIVE] [HI-SENS 1] [HI-SENS 2] [PULSE] [△λ→SWEEP]
⑦ Resolution	[RESOLUTION]	[0.1 nm] [0.2 nm] [0.5 nm] [1.0 nm] [2.0 nm] [5.0 nm]
⑧ Averaging count	[AVG]	[1 (OFF)] [2] [5] [10] [20] [50] [100] Numeric keys, knob, arrow keys

* [ ] : Panel key, [ ] : Soft key

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3.6 Setting the Display Conditions

In addition to the normal single screen display, the analyzer also provided dual-screen, superimpose, and 3-dimensional displays. The display conditions can be set using the LEVEL SCALE and the CONTROL keys.
Keys shown in Table 3-6 are used for the above setting.

Table 3-6 Display Condition Setting Items and Keys Used

Setting item	Key for selection	Keys enabled for changing the setting
① Display scale	LEVEL SCALE	LIN/LOG, 10 dB/D, 5 dB/D, 2 dB/D, 1 dB/D, 0.5 dB/D, 0.2 dB/D Knob, arrow keys
② Grid display (ON/OFF)	CONTROL	GRID
③ Dual screen display	CONTROL	DUAL
④ Superimpose	CONTROL	S. IMPOSE
⑤ 3-dimensional display ON/OFF	CONTROL + 3D	3D ON/OFF
⑥ 3-dimensional display condition setting	CONTROL + 3D	INC ANGLE, DEC ANGLE, INC N, DEC N, N LOCK, ROLL
⑦ 3-dimensional data recall, deletion, etc.	CONTROL + 3D	CSR NEXT, DELETE, CLEAR, RECALL
⑧ Selection of power monitor display	ADVANCE + power-mon	ON/OFF
⑨ Selection of power monitor display conditions	ADVANCE + power-mon	search λ, set λ, N-MAX, INTERVAL Numeric keys, knob, arrow keys

* [ ] : Panel key, [ ] : Soft key
[ ] :Soft key (2nd level) [ ] : Soft key (3rd level)

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3.7 Measurement and Data Output

Measurement is executed and data is output according to the measurement/display conditions set in 3.5 and 3.6.

The measurement is basically controlled by three keys on the MEASURE section for single measurement, repeated measurement, and measurement stop.

The displayed data can be output onto the printer and plotter, using the keys on the DATA OUT section.

Table 3-7 are the keys used for measurement and data output.

Table 3-7 Measurement and Data Output Items and Keys Used

Item	Key for selection/execution	Keys enabled for changing the setting
① Execution of single measurement	SINGLE	———
② Execution of repeated measurement	REPEAT	———
③ Stop the sweeping	STOP	———
④ Designation of the output device	DEVICE	PRINTER, PLOTTER, CLOCK, BUZZER
⑤ Execution of data output	COPY	———
⑥ Printer paper feed	FEED	———
⑦ Setting the plotter output conditions	DEVICE + PLOTTER	TYPE: AT, TYPE: HPGL, DATA: ALL, DATA: SIG, PAPER ADV, plot size, A4 (H1), H2, H4, V1, V2, V4
⑧ Setting the printer output conditions	DEVICE + PRINTER	MENU OUT
⑨ Setting the clock	DEVICE + CLOCK	ON/OFF, YEAR, MONTH, DAY, HOUR, MINUTE
⑩ Setting the buzzer	DEVICE + BUZZER	BEEP, WARNING, QUIET

* [ ] : Panel key, [ ] : Soft key

[ ] :Soft key (2nd level) [ ] : Soft key (3rd level)

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3.8 Analyzing the Measured Data

Data analysis can be executed using the cursor, half-width operation, normalization functions, etc. Table 3-8 shows the keys used for measurement data analysis.

Table 3-8 Measurement Data Analysis Items and Keys Used

Item	Key for selection/execution	Keys enabled for changing the setting
① Selection of cursor display mode	CURSOR ON/OFF	NORMAL / △MODE / POWER / 2ND PEAK
② All cursor ON/OFF	CURSOR ON/OFF	———
③ λ1/λ2/L1/L2 selection ON/OFF and cursor movement	λ1 / λ2 / L1 / L2	LEFT PEAK / RIGHT PEAK Knob, arrow keys
④ Half-width operation execution/ selection of operation type	SPECTRAL WIDTH	Pk. −XdB / RMS / ENVELOPE / Peak RMS
⑤ Setting of half-width operation parameter	SPECTRAL WIDTH + parameter + X dB / Y dB / K / Kr (RMS)	Numeric keys
⑥ Standardization in peak value and loss / transparence characteristics in peak value	NORMALIZE	Pk. NORM / MEM NORM / LOSS / TRANS SAV REF / SAV MEAS1
⑦ Curve fit	ADVANCE	CURVE FIT
⑧ Luminosity offset display (This function is not provided in Q8383)	ADVANCE	DOMINANT
⑨ Operation execution / selection of operation method for optical amplifier gain / noise figure	ADVANCE + O.AMP	NF (s-sp) / NF (total) FIT MEM-3 / SPE DIV
⑩ Setting the gain / noise figure operation parameter	ADVANCE + O.AMP + parameter + SPAN-A / SPAN-B / K / FILTER Δλ / Pin LOSS / Pout LOSS	Numeric keys

* [ ] : Panel key, [ ] : Soft key

[ ] :Soft key (2nd level)

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3.9 Measurement Data Memory

This analyzer is equipped with the measurement condition/data memory function, which allows use of internal backup RAM or internal floppy disk drive.
Table 3-9 shows the keys used for the measurement data memory.

Table 3-9 Measurement Data Memory Items and Keys Used

Item	Key for selection/execution	Keys enabled for changing the setting
① Initialization of the floppy disk	DEVICE + FLOPPY + format	2DD (720 K) EXECUTE 2HD (1.2 M) ABORT
② Memory/Floppy selection	DEVICE + FLOPPY	ON/OFF
③ File directory display	DEVICE + FLOPPY	DIR
④ Floppy disk volume label setting	DEVICE + FLOPPY + volume	← → DEL CHR INS SP CLR LINE ENTER Knob, arrow keys, numeric keys
⑤ Saving measurement data in the memory (REF, 1 to 3)	SAVE	SAV REF SAV MEAS1 SAV MEAS2 SAV MEAS3
⑥ Recalling measurement data from the memory (REF, 1 to 3)	RECALL	RCL REF RCL MEAS1 RCL MEAS2 RCL MEAS3
⑦ Saving measurement data/conditions from the memory/ floppy disk	SAVE + sav meas / sav panel	SAVE DELETE RECOVER
⑧ Recalling measurement data/conditions from the memory/ floppy disk	RECALL + rcl meas / rcl panel	RECALL
⑨ Setting the memory name/ file name (when saving)	SAVE + sav meas / sav panel + name	← → ↑ (No) ↓ (No) CLR LINE ENTER Knob, arrow keys, numeric keys

* [ ] : Panel key, [ ] : Soft key
[ ] :Soft key (2nd level) [ ] : Soft key (3rd level)

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4. PANEL OPERATION

This chapter describes the panel key operation along the functions of the analyzer.

Table of Contents

4. PANEL OPERATION 4-1
4.1 FUNCTION Section 4-2
4.1.1 CENTER key 4-2
4.1.2 SPAN key 4-4
4.1.3 REF LEVEL key 4-6
4.1.4 LEVEL SCALE key 4-8
4.1.5 AUTO key 4-9
4.1.6 AVG key 4-10
4.1.7 SWEEP MODE key 4-11
4.1.8 RESOLUTION key 4-13
4.2 CURSOR Section 4-15
4.2.1 Cursor control 4-15
4.2.2 Rotary knob 4-17
4.3 DATA Section 4-18
4.3.1 Numeric keys, arrow keys 4-18
4.3.2 Setting the label 4-18
4.4 MEASURE Section 4-21
4.4.1 SINGLE key 4-21
4.4.2 REPEAT key 4-21
4.4.3 STOP key 4-21
4.5 DISPLAY Section 4-22
4.5.1 CONTROL key 4-22
4.5.2 SAVE key, RECALL key 4-28
4.5.3 NORMALIZE (LOSS/TRANS key) 4-37
4.5.4 SPECTRAL WIDTH key 4-42
4.5.5 ADVANCE key 4-48
4.6 DATA OUT Section 4-68
4.6.1 DEVICE key 4-68
4.6.2 COPY key 4-77
4.6.3 FEED key 4-77
4.7 GP-IB Section 4-78
4.7.1 LOCAL (ADDRESS) key 4-78
4.7.2 Status lamps 4-79
4.8 Other Keys 4-80
4.8.1 INSTR PRESET key 4-80
4.8.2 CAL key 4-82

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4.1 FUNCTION Section

The FUNCTION section consists of eight keys used to set basic measurement conditions of the optical spectrum analyzer.

(1) CENTER key : Specifies the center wavelength.

(2) SPAN key : Specifies the wavelength span, as well as the start or stop wavelength.

(3) REF LEVEL key : Specifies the level axis display range.

(4) LEVEL SCALE key : Selects and specifies the vertical axis scale (LIN/LOG).

(5) AUTO key : Used to set the optimum measurement conditions automatically.

(6) AVG key : Specifies the averaging count.

(7) SWEEP MODE key : Selects the sweep mode (5 types according to the combination of the maximum measurement sensitivity and measurement speed) according to the type of the signal to be measured.

(8) RESOLUTION key : Specifies the wavelength resolution.

4.1.1 CENTER key

The CENTER key is used to specify the center wavelength. Setting is done using the numeric keys, knob, arrow keys, and soft keys. Press the CENTER key, and the following message appears on the bottom of the CRT, to inform the current setting value.

CENTER: X.XXXX μm

The soft key menu is then as shown below.

Soft key menu

[CENTER]

PEAK	CURSOR				AUTO PKC	

Details of the soft key menu

① PEAK
Sets the wavelength of the peak level obtained by the auto-peak search function as the center wavelength.

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② CURSOR

The wavelength indicated by the X cursor is set as the center wavelength.
When two X cursors are displayed, the wavelength at the intermediate position of the two cursors is set as the center wavelength. In case the X cursor is off, this key is disabled.

③ AUTO PKC

This key sets the APC (auto-peak center) function that automatically sets the measured peak wavelength as the center wavelength and remeasures wavelength. The APC function turns on and off each time this key is pressed. "APC" is displayed on the lower right part of the screen while the APC function is on.
While this function is selected, measurement is done two times for a single measurement. (When the center wavelength has varied.)

<< APC (Auto Peak Center) function >>

Automatically sets the measured peak wavelength as the center wavelength, and measures the wavelength again. Operates if the peak wavelength is shifted for more than about 1/100 of the preset span against the center wavelength.

Example : When the SPAN is 100 nm and the center wavelength is 1.3 μm, operates if the peak wavelength falls out of the 1.299 to 1.301 μm range.

This function operates only when under the spectrum mode. (When both the upper and lower screens in dual display are both active (other than under the power monitor display), the peak-search wavelength is set in the lower screen and the center wavelength on the upper screen, before measurement starts.
In other cases, the measured peak wavelength is set as the center wavelength, and measurement and display are done again.
The APC function does not work under the following conditions:

1. When the LOSS or TRANS mode is on.

2. When it is under the 3-dimensional display mode.

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Functions of keys and knobs

① Numeric keys

Clears the current setting and displays the entered figures as input.
The unit key (μm, nm) must be pressed to set the input figures.
Measurement can be done within the range of 0.35 to 1.75 μm (Q8383 : 0.55 to 1.75μm), with effective figures to the 0.001 nm position. (The scale can display only up to the 0.1nm digit.)
The entered figures can be canceled by pressing the CENTER key and entering a fresh numeral, or by erasing the previously entered figure by the BACK SPACE key.

② Knob

The setting value increases by turning the knob the clockwise (CW) direction, while it decreases by turning it to the counter clockwise (CCW) direction.
The increment/decrement step is approximately 1/100 of the currently set span.

③ Arrow keys

The setting value increases by the [↑] key, and decreases by the [↓] key.
The increment/decrement steps is approximately 1/500 of the currently set span.

4.1.2 SPAN key

This key is used to set the analysis wavelength span and the start/stop wavelengths.
Setting can be done using the numeric keys, knob, arrow keys, and the soft keys.
Press the SPAN key, and the current setting is displayed on the lower part of the CRT as follows.

SPAN: XXXX.X nm

The following soft key menu appears.

Soft key menu

[SPAN]

SPAN	START	STOP	△λ→SPAN	0.35 to 1.0	0.9 to 1.75	FULL

Note : In the case of the Q8383, the range of 0.55 to 1.0 is displayed instead of 0.35 to 1.0 above.

Details of the soft key menu

① SPAN

Used to set the span. (This key is selected when the SPAN key is pressed.) Press this key and enter the desired setting through the numeric keys, knob, or arrow keys to change the setting.

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② START

Used to set the start wavelength. Press this key, and enter the desired setting through the numeric keys, knob, or arrow keys.

③ STOP

Used to set the stop wavelength. Press this key, and enter the desired setting through the numeric keys, knob, or arrow keys.

④ $\Delta\lambda \rightarrow$SPAN

Used to set the area sandwiched by two X cursors as the span. The center wavelength also changes by pressing this key. This key does not function when the X cursor is off or when there is a single X cursor.

⑤ 0.35 to 1.0 or 0.55 to 1.0

Used to set the maximum span (0.35 μm to 1.0 μm in Q8381A, 0.55 μm to 1.0 μm in Q8383) of the short wavelength range.
The center wavelength also changes by pressing this key.

⑥ 0.9 to 1.75

Used to set the maximum span (0.9 μm to 1.75 μm) of the long wavelength range.
The center wavelength also changes by pressing this key.

⑦ FULL

Used to set the maximum span (0.35 μm to 1.75 μm in Q8381A, 0.55 μm to 1.75 μm in Q8383).
The center wavelength also changes by pressing this key.

Functions of keys and knobs

① Knob, arrow keys

The setting value increases by turning the knob the clockwise (CW) direction or by pressing the [↑] key, while it decreases by turning the knob to the counter clockwise (CCW) direction or by [↓] .
The increment/decrement step is 1 - 2 - 5.
The maximum span to be set is 1400 nm (1200nm in Q8383) and the minimum span is 0 nm.

② Numeric keys

Clears the current setting and displays the figures as entered. The unit key (μm, nm) must be pressed to set the input figures.
Setting can be done within the range of 1 to 1400 nm (1200 nm in Q8383) and 0 nm, with effective figures to the 0.1 nm position.
The entered figures can be canceled by pressing the SPAN key and entering a fresh numeral. Newly entered figures can be erased by the BACK SPACE key.

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4.1.3 REF LEVEL key

This key is used to set the display range of the level axis, to allow optimum display level of the signal to be measured. Setting is done using the numeric keys, knob, arrow keys, and soft keys.
Press the REF Key, and the current setting is displayed on the lower part of the CRT as follows.

REF LEVEL: XX.XdBm (LOG display)
REF LEVEL: XX.XxW (LIN display)

The following soft key menu is displayed.

Soft key menu

[REF LEVEL]

PEAK	CURSOR				MAX HOLD	AUTO

Details of the soft key menu

① PEAK
Sets the REF LEVEL value so that the peak level obtained by the auto peak search function is approximately 95% on the display.

② CURSOR
Sets the position of the Y cursor as the REF LEVEL. (When there is a single Y cursor.)
When there are two Y cursors, the position of the upper cursor is set as the REF LEVEL, while the position of the lower cursor is set as the lowest level. (When LOG display is selected, the level scale is automatically changed according to the difference of level between the two cursors, to decide the lowest level by the REF LEVEL and LEVEL SCALE.)
The initial value is automatically set as the lowest level when the setting of the REF LEVEL, LEVEL SCALE is changed. (The value decided by the relation between the REF LEVEL and the LEVEL SCALE when LOG display is selected, and 0 when LIN display is selected.)

③ AUTO
Used to set the mode (REF AUTO mode) that automatically changes the REF LEVEL so that the spectrum data displays its optimum value.
The REF AUTO mode turns on/off each time this key is pressed. (AUTO is inversed when on, with auxiliary display "RAU" on the upper right part of the display.)
This function works after each sweep. (This function automatically performs the above ① PEAK internally.)

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④ MAX HOLD

The spectrum data being measured now is compared with the spectrum data had been measured and the data which the level is larger is displayed.

The MAX HOLD mode turns on/off each time this key is pressed. (MAX HOLD is inversed when on, with "MAX HOLD" on the upper left part of the display.)

Functions of keys and knobs

① Knob

The setting value increases by turning the knob to the clockwise (CW) direction, and decreases by turning it to the counter clockwise (CCW) direction.

The increment/decrement step is 1/2 (0.5 DIV) the level scale (LOG display) or 1-2-5 step (LIN display).

② Numeric keys

Clears the current setting and displays the figures as entered. The unit key (dBm, mW, uW, nW) must be pressed to set the entered figures.

When dBm unit key is pressed, the LOG scale is set; the LIN scale is set in other cases.

The entered figures can be canceled by pressing the REF LEVEL key and entering a fresh numeral. The previously entered figure can be erased by the BACK SPACE key.

The setting range is −90 dBm to 20 dBm (LOG), 0.001 nW to 100 mW (LIN).

③ Arrow keys

Used to change the displayed REF LEVEL. (Effective when operation processing is applied to the raw measurement data: for peak normalization. LOSS/TRANS, luminosity offset display)

The setting value increases by the [↑] key, and decreases by the [↓] key.

The increment/decrement step is 1/2 (0.5 DIV) the level scale (LOG display) and 1-2-5 step (LIN display).

When the REF LEVEL is changed by the knob or the numeric keys, the displayed REF LEVEL set through this key will be reset.

CAUTION

The input sensitivity is automatically switched in this analyzer. Therefore, the REF LEVEL setting is done only to set the display range of the level axis.
(Inappropriate REF LEVEL for sweep will not affect the measurement data.)

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4.1.4 LEVEL SCALE key

This key is used to select the vertical axis scale (LIN/LOG) and to set the LOG scale. Setting is done by the numeric keys, knob, arrow keys, and soft keys.
The CRT displays the current setting by pressing the LEVEL SCALE key as follows.

LEVEL SCALE: XdB/DIV (LOG display)
LEVEL SCALE: LIN (LIN display)

The following soft key menu is displayed.

Soft key menu

[LEVEL SCALE]

LIN/LOG	10 dB/D	5 dB/D	2 dB/D	1 dB/D	0.5 dB/D	0.2 dB/D

Details of the soft key menu

① LIN/ LOG
Used to select the LIN or LOG display scale.
The display scale switches between LIN and LOG each time this key is pressed.

② 10 dB/D, 5 dB/D, 2 dB/D, 1 dB/D, 0.5 dB/D, 0.2 dB/D
Sets the LOG scale, and selects the division from 10, 5, 2, 1, 0.5, 0.2 dB/DIV.
The grid scale is 8 when 10 dB/D is selected, and 10 in other cases.

Functions of keys and knobs

① Knob, arrow keys
Switches the scale when LOG scale is selected (6 choices from 10 dB/D to 0.2 dB/D).
The setting value increases by turning the knob to the clockwise (CW) direction or by pressing the [↑] key, while it decreases by turning the knob to the counter clockwise (CCW) direction or by pressing the [↓] key.

② Numeric keys
Clears the current setting and displays the figures as entered. The unit key (dB/DIV) must be pressed to set the input figures.
In case the input scale is other than the above six, the nearest scale is selected.

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4.1.5 AUTO key

Used to automatically set the optimum measurement conditions of wavelength, level, etc. according to the input signal. Effective especially for measurement when the wavelength and level are unknown.
"AUTO function in progress ... " is displayed while this function is being executed, and goes out when the optimum conditions are set.
The soft key menu changes as follows by pressing the AUTO key, and the automatic optimum condition setting function is executed through the soft key.

Soft key menu

[AUTO]

FULL	0.35 to 1.0	0.9 to 1.75				ABORT

Note : In the case of the Q8383, the range of 0.55 to 1.0 is displayed instead of 0.35 to 1.0 above.

Details of the soft key menu

① FULL
Used to set the wavelength and level by searching for the optimum conditions in the entire wavelength range (0.35 μm to 1.75 μm in Q8381A, 0.55 μm to 1.75 μm in Q8383). When this key is pressed, the optimum conditions are searched for in both the short wavelength range and long wave range, so the processing to set the optimum conditions takes more time than when keys of ② or ③ is used.

② 0.35 to 1.0 or 0.55 to 1.0
Searches the optimum conditions within the short wavelength range (0.35 μm to 1.0 μm in Q8381A, 0.55 μm to 1.0 μm in Q8383), and sets the wavelength and level.

③ 0.9 to 1.75
Searches the optimum conditions within the long wavelength range (0.9 μm to 1.75 μm), and sets the wavelength and level.

(Note) The soft key is inversed when keys of ① , ② , ③ are pressed, and returns to normal display as soon as the AUTO function is completed.

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④ ABORT
Used to stop the AUTO function in midstream.

< < Notes when using the AUTO function > >

- The AUTO function may not operate normally, when the power level of the light to be measured is less than −40 dBm.
- Execution of the AUTO function can be canceled in midstream by pressing the "ABORT" soft key. All other keys are disabled.

4.1.6 AVG key

This key is used to set the count of averaging to measure signals of low power level stably. Setting can be done through the numeric keys, knob, arrow keys, and soft keys.
Press the AVG key, and the current setting appears on the lower part of the CRT as follows.

AVG: XXXX

The following soft key menu appears.

Soft key menu

[AVG]

1 (OFF)	2	5	10	20	50	100

Details of the soft key menu

① 1 (OFF), 2, 5, 10, 20, 50, 100
Used to set the averaging count at 1 (OFF), 2, 5, 10, 20, 50, 100.

Functions of keys and knobs

① Knob, arrow keys
The setting value increases by turning the knob to the clockwise (CW) direction or by pressing the [↑] key, while it decreases by turning the knob to the counter clockwise (CCW) direction or by pressing the [↓] key. The increment/decrement step is 1 - 2 - 5 (1, 2, 5, 10, 20....). The minimum value is 1 while the maximum is 1024.

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② Numeric keys
The setting range is 1 to 1024.
Clears the current setting and displays the figures as entered. The ENTER key must be pressed to set the input figures.
The entered figures can be canceled by pressing the AVG key and entering a fresh numeral. Newly entered figures can be erased by the BACK SPACE key.

4.1.7 SWEEP MODE key

This analyzer provides five sweep modes as follows, to allow measurement of various lights. The measurement time and minimum measurement level (sensitivity) differs in each sweep mode, and the optimum mode is to be selected for each type of light to be measured.
Table 4-1 shows the sweep modes and the functions.
The following soft key menu appears by pressing this key.

Soft key menu

[SWEEP MODE]

NORMAL	ADAPTIVE	HI-SENS 1	HI-SENS 2	PULSE	Gate Time	△λ→SWEEP

Functions of the soft key menu

① NORMAL
Selected to measure relatively high level signal in high speed.

② ADAPTIVE
Selected when the measurement requires both high speed and high sensitivity.
Also selected when the measurement is done synchronizing with external signals as the pulse emission status signal.

* Always select this mode when using the GATED MEAS INPUT terminal. Other modes do not allow synchronous measurement with external signals.

③ HI-SENS 1
Selected for stable measurement with sensitivity of approximately −80 dBm.
A single sweep time is 60 to 70 seconds (Q8383:Approx. 30 sec) under this mode. (AVG 1)

④ HI-SENS 2
Selected when sensitivity of about -85 dBm is required.
A single sweep time is approximately 400 seconds (Q8383:Approx. 60 sec) under this mode. (AVG 1)

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⑤ PULSE

Selected when measuring pulse emission spectrum without using external synchronization signal. (The measurement sensitivity is approximately −50 dBm under this mode.)
When this pulse measurement mode is set, the internal measurement system is switched so that the maximum level signals input within the time specified by "⑥ Gate Time" alone are accepted as effective measurement data. The time required for measurement in a single sweep under this mode is the gate time × measurement points (501). (This time plus the time to rotate the diffraction grating is the sweep time.)

⑥ Gate Time

Sets the gate time for measurement of a single point when under the pulse measurement mode ⑤.
The setting range is 0.001 to 10 seconds. (In 0.001 sec step.)
Set a value exceeding the emission pulse period to allow exact measurement.
Press this key to display the current gate time. If necessary, use the numeric keys, arrow keys, knob, to change the setting, and press the "ENTER" key to establish the setting. The value of the knob and arrow keys changes in 1-2-5 step.

⑦ $\Delta\lambda$→SWEEP

Used to sweep (partial sweep) the area sandwiched by two X cursors. The inverse switches between partial sweep mode and all-sweep mode each time this key is pressed. (The number of measurement points in the partial sweep mode changes according to the width of the area.)
The partial sweep mode is automatically reset when either X cursor turns off, or when the center wavelength or span is changed.

Table 4-1 Sweep Modes and Their Functions

Sweep mode	Measurement time	Maximum sensitivity	Main applications
NORMAL	Short (≦1 sec)	Approx. −60 dBm (DC-AMP)	• High-speed measurement of relatively high power level signals as the laser diode signals.
ADAPTIVE	Normal (8 to 10 sec)	Approx. −70 dBm (DC-AMP)	• Measurement of signals requiring both measurement speed and sensitivity. • Measurement of pulse light (flashing light) by external synchronization signal (GATED MEAS INPUT).
HI-SENS 1	Long (Q8381A:60 sec) (Q8383:30 sec)	Q8381A: Approx. −80 dBm Q8383: Approx. −88 dBm	• Stable measurement of low level signals.
HI-SENS 2	Longest (Q8381A:400 sec) (Q8383:60 sec)	Q8381A: Approx. −85 dBm Q8383: Approx. −92 dBm	• Measurement of low level signals in wide dynamic range.
PULSE	Gate Time ×501	Approx. −50 dBm	• Measurement of pulse lights (without using external synchronization signals)

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4.1.8 RESOLUTION key

This key sets the wavelength resolution.
The resolution can be selected from the 6 choices of 0.1 nm, 0.2 nm, 0.5 nm, 1.0 nm, 2.0 nm, 5.0 nm. The slit width in the spectrograph is changed according to each choice.
Setting is done through the numeric keys, knob, arrow keys, or the soft keys. (The current resolution is constantly displayed on the upper right part of the CRT.) Set the optimum resolution according for the selected sweep width. As the number of measurement points is 501 points, it is recommended to set the resolution R so that the following expression is satisfied. (If the following expression is not satisfied, "UNCAL" will appear on the upper left part of the CRT.)

$$R\ [nm] \geqq \frac{SPAN\ [nm]}{500}$$

When it does not satisfy the above expression, measurement may not be able to be done with the normal peak level. (As the internal resolution setting has roughly up to 20% error, set the span so that this error will not affect the above expression.)
Press the RESOLUTION key, and the current setting appears on the lower part of the CRT as shown below.

RES X.Xnm

The following soft key menu appears.

Soft key menu

[RESOLUTION]

0.1 nm	0.2 nm	0.5 nm	1.0 nm	2.0 nm	5.0 nm	

Details of the soft key menu

① 0.1nm, 0.2 nm, 0.5 nm, 1.0 nm, 2.0 nm, 5.0 nm
Sets the wavelength resolution at 0.1 nm, 0.2 nm, 0.5 nm, 1.0 nm, 2.0 nm, 5.0 nm respectively.

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Functions of keys and knobs

① Numeric keys

Clears the current setting and displays the figures as entered. The unit key (nm) must be pressed to set the input figures.

If values other than the above 6 choices are input, the nearest value will be set.

② Knob and arrow keys

The setting value increases by turning the knob to the clockwise (CW) direction or by pressing the [↑] key, while it decreases by turning the knob to the counter clockwise (CCW) direction or by pressing the [↓] key. The six values appear in ascending or descending sequence.

(Note 1) This analyzer uses the input optical fiber in place of the incident slit. Therefore, the core diameter of the optical fiber restricts the maximum resolution that allows measurement. (Table 3-1 in Section 3.1 shows a typical relation between the optical fiber and maximum resolution.)

(Note 2) When measuring light with wide spectrum width as the LED, the measurement level changes according to the setting of the resolution. (When the resolution is 1 nm to 2 nm, the measurement level becomes 3 dB higher.) Therefore, set the maximum resolution at 5 nm regardless of the span, when high S/N measurement is to be done.

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4.2 CURSOR Section

This section controls the cursor for measurement data analysis. The section consists of the rotary knob and cursor ON/OFF keys.

4.2.1 Cursor control

The "CURSOR ON/OFF" key that controls the on/off of all the cursors and sets the cursor display mode, and four keys (λ1, λ2, L1, L2) that individually selects the four cursors are provided.
The following soft key menu appears and the cursor display mode is selected, by pressing the ON/OFF key.

Soft key menu

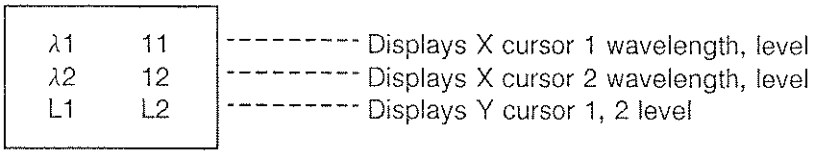
[CURSOR]

NORMAL	ΔMODE	2ND PEAK	POWER	P-P	LEFT PK	RIGHT PK

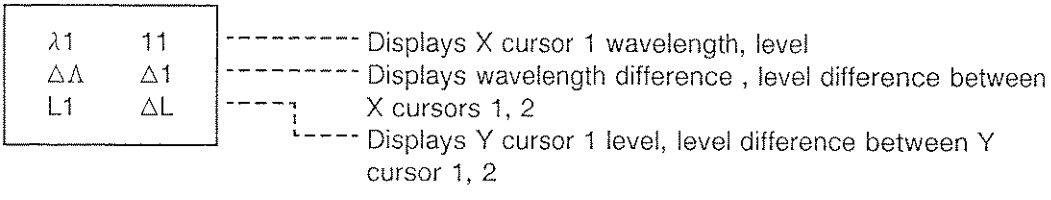
Details of the soft keys

The cursor data is displayed in the dedicated area at the upper right part of the CRT.
The display mode is selected by keys of ① to ⑤.

① NORMAL
Selects the NORMAL display mode. The data display format is as follows.



② Δ MODE
Selects the Δ MODE display mode. The data display format is as follows.



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③ 2ND PEAK

Selects the 2ND PEAK display mode. The data display format is as follows. The X cursor 1 automatically moves to the maximum peak and the X cursor 2 to the secondary peak by pressing this key.

λ1	11	--------- Displays the peak wavelength, level
ΔΛ	Δ1	--------- Displays wavelength difference, level difference between peak and 2nd peak

④ POWER

Selects the POWER display mode. The data display format is as follows.

λ1		--------- Displays X cursor 1 wavelength
λ2	ΣL	--------- Displays X cursor wavelength and total level of X cursors 1, 2

⑤ Selects the p-p display mode. The data display format is as follows. The X cursor 1 automatically moves to the wavelength of the maximum data and the X cursor 2 to the wavelength of the minimum data.

λ	11	--------- Displays wavelength and level of X cursor 1
λ2	12	--------- Displays wavelength and level of X cursor 2
Δλ	PP	--------- Displays wavelength difference, level difference between X cursor 1 and X cursor 2

⑥ LEFT PK

Moves X cursor 1 from the current position to the peak position at the left side.
The key is disabled when X cursor 1 is off or when there is no peak at the left.
When Y cursor 2 is also displayed, peaks that exceed the level of Y cursor 2 alone are considered.

⑦ RIGHT PK

Moves X cursor 1 from the current position to the peak position at the right side.
The key is disabled when X cursor 1 is off or when there is no peak at the right.
When Y cursor 2 is also displayed, peaks that exceed the level of Y cursor 2 alone are considered.

Functions of each key

① ON/OFF key

This key is used to control the display of all the cursors.
Press this key when the cursor is ON, and all the cursors turn off.
Press this key when the cursor is OFF, and the following occurs, according to the previous status.

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(a) When any of the λ1, λ2, L1, L2 keys are pressed to move the cursor, and the measurement conditions as the center, span, REF level, etc. do not change;

→ The previous cursor position information is maintained.
(The cursor is still not displayed, but can also be displayed by pressing the λ1, λ2, L1, L2 keys, as desired.)

(b) Other cases

→ The λ1 LED lights, and the X cursor 1 is displayed on the peak wavelength position.

(Note) When the cursor display mode "2nd peak" is selected, X cursor 1 is automatically displayed and set at the peak wavelength position and X cursor 2 at the second peak wavelength position, regardless of the previous status.

② λ1, λ2, L1, L2 keys
The λ1, λ2, L1, L2 keys are for X cursor 1, 2, Y cursor 1, 2, respectively.
When the cursor is not displayed and the keys are pressed the corresponding LED lights, the cursor is displayed, and the cursor will become mobile by the knob and arrow keys.
When the keys are pressed while the cursor is displayed and the LED is off, the LED is on, and the cursor will become mobile by the knob and arrow keys.
When the keys are pressed while the LED is on, the corresponding cursor turns off.
When the FUNCTION section, DISPLAY section, keys are pressed, three previously lighted LED turns off.

4.2.2 Rotary knob

Used to change the setting and to move the cursor. The CW (clockwise) direction increases the setting while the CCW (counter clockwise) direction decreases the setting.
The knob will be effective to move the cursor while the λ1, λ2, L1, or L2 key is on.

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4.3 DATA Section

This section is structured by numeric keys (keys that represent numerals and units) and arrow keys used to change the setting, and the LABEL key used to change the single line comment (label).

4.3.1 Numeric keys, arrow keys

(1) Numeric keys

Used to change the setting by direct input.
0" to "9" ten-keys, ".", "−" keys, as well as input value terminator keys
(4 types : um dBm , nm mW , nm/DIV uW , dB/DIV nW) and the BACK SPACE key that erases the character input immediately before are provided.

(2) Arrow keys

Used to change the setting according to the specified step, and to move the cursor.
The [↑] key increases the setting, while the [↓] key decreases the setting.
When λ1, λ2, L1 or L2 LED is on, the keys will be available for moving the cursor.

4.3.2 Setting the label

One line (max. 48 optional characters) of label data can be input to set comments to the measurement data.
The label display area is fixed to the top of the CRT screen. The following is the initial setting.

```
** ADVANTEST Q8381A Optical Spectrum Analyzer **
```

Note : In the case of the Q8383, the product (instrument) name "Q8383" is displayed instead of "Q8381A" above.

Press the LABEL key, and a list of characters that can be used for the setting (character menu) appears on the lower right part of the CRT. The current label data is displayed on the lower left part of the CRT.

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Character menu display

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
0	1	2	3	4	5	6	7	8	9	.	,	"	'	`	:	;	(	)	[	]	<	>	-	+	=
/	¥	_	|	~	!	@	#	$	%	^	&	*	?	{	}	α	β	γ	δ	λ	μ	Δ	Λ	Σ	∫

The soft keys, knob, arrow keys, and numeric keys are used to change the label data.
The label setting mode is ended by pressing the LABEL key again, or by updating the label data pressing the ENTER key.
By resetting the label setting mode, the soft key menu returns to the previous display.

Soft key menu

[LABEL]

←	→	DEL CHR	INS SP	CLR LINE	ENTER	UNDO

Details of the soft key menu

① ←
Moves the cursor within the label input buffer one position to the left.

② →
Moves the cursor within the label input buffer one position to the right.

③ DEL CHR
Deletes the character within the label input buffer at position of the cursor.

④ INS SP
Inserts a single space at the position of the cursor in the label input buffer. The data at the right side of the cursor position shifts one character to the right.

⑤ CLR LINE
Erases all the data in the label input buffer.

⑥ ENTER
Used to set the character at the cursor position in the character menu, at the cursor position within the label data.

⑦ UNDO
Recovers the label data set before the LABEL key was pressed. Effective when wrong setting was done.

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Functions of the keys

(a) Knob

Moves the cursor within the character menu to the left and right to select the character to be input . The cursor moves to the right by turning the knob CW (clockwise) and to the left by turning it CCW (counter clockwise).

(b) Arrow keys

Moves the cursor within the character menu up and down, to select the character to be input.

The [↑] key moves the cursor up, while the [↓] key moves it down.

(c) BACK SPACE key

Used to erase 1 character immediately before the cursor in the label data.

(d) 0 to 9 keys, . key, – key

Sets the data specified by the key input at the cursor position in the label data.

(e) ENTER key

Sets the data in the label input buffer as the label data.

By pressing this key, the label input mode is reset, and the character menu, label input buffer both goes out.

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4.4 MEASURE Section

This section is structured by the following 3 keys that controls execution of the measurement.

4.4.1 SINGLE key

Used to execute a single measurement.
The LED on this key lights while measurement is performed, and turns off as soon as the measurement ends.
When this key is pressed during measurement (while the LED is on), the currently executed measurement is canceled, and a new measurement is executed.

4.4.2 REPEAT key

Used to repeat execution of the measurement.
When this mode is selected, the LED is on till the SINGLE key or STOP key is pressed.
When this key is pressed during measurement (while the LED is on), the currently executed measurement is canceled, and a new measurement is executed.

4.4.3 STOP key

Used to stop the measurement.
By pressing this key, the measurement stops immediately, and the SINGLE or REPEAT LED turns off.
When measurement is stopped by this key, then the displayed analysis data is maintained as is.

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4.5 DISPLAY Section

This section is structured by the following 6 keys to perform display format setting, measurement data analysis, and data memory processing.

(1) CONTROL key : Sets the display mode of the measurement data.

(2) SAVE key : Saves the measurement data or panel setting into the internal memory or floppy disk.

(3) RECALL key : Reads the saved measurement data or panel setting.

(4) NORMALIZE key
LOSS/TRANS : Performs normalization of the measurement data, to analyze the loss characteristics and transparency, etc.

(5) SPECTRAL WIDTH key : Operates and displays the spectral width.

(6) ADVANCE key : Performs advanced level waveform analysis.

4.5.1 CONTROL key

Used to set the display mode (dual screen, superimpose, 3-dimensional, etc.) of the measurement data.
The following soft key menu appears by pressing the CONTROL key. The display mode is set through the soft keys.

Soft key menu

[CONTROL]

DUAL	S. IMPOSE	3D	GRID	act. U&L	xcng U/L	

Details of the soft key menu

① DUAL
Used to divide the data to be displayed on two upper/lower screens.
By pressing this key, the currently displayed data is displayed on both the upper and lower screens. The upper screen is updated when the next measurement ends, but the lower screen is fixed. (The double updating mode can also be set by the ⑤ "act. U&L" soft key.) When under the dual screen display mode, change of the measurement conditions, cursor processing, etc. are all effective against the upper screen only. When the key is pressed while under the dual screen display mode, it returns to the single screen display mode, displaying the upper screen only.
Soft keys of ⑤ and ⑥ are effective only when under the dual screen display mode.

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The dual screen display mode turns on and off each time this key is pressed, switching the "DUAL" display between inverse and normal display.

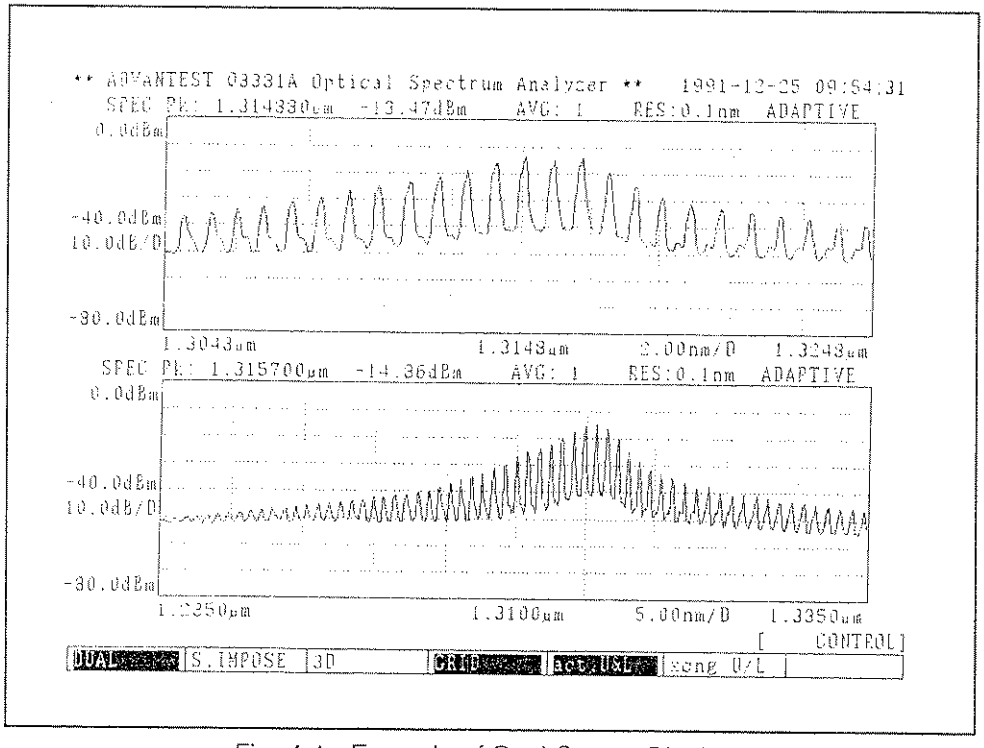


Fig. 4-1 Example of Dual Screen Display

② S. IMPOSE

Controls the superimpose mode.

When this key is pressed under normal mode, the current measurement data is stored on the CRT as the background data, and is displayed along with the new measurement data.

When this key is pressed under dual screen display mode, the lower screen becomes the background data, while the upper screen is replaced by the new data. (Only when the measurement conditions except the REF LEVEL are the same in the upper and lower screen.)

This mode is automatically reset by changing the measurement conditions (X axis conditions as center wavelength, span, etc.).

The superimpose mode turns on and off each time this key is pressed, switching the "S.IMPOSE" display between inverse and normal display.

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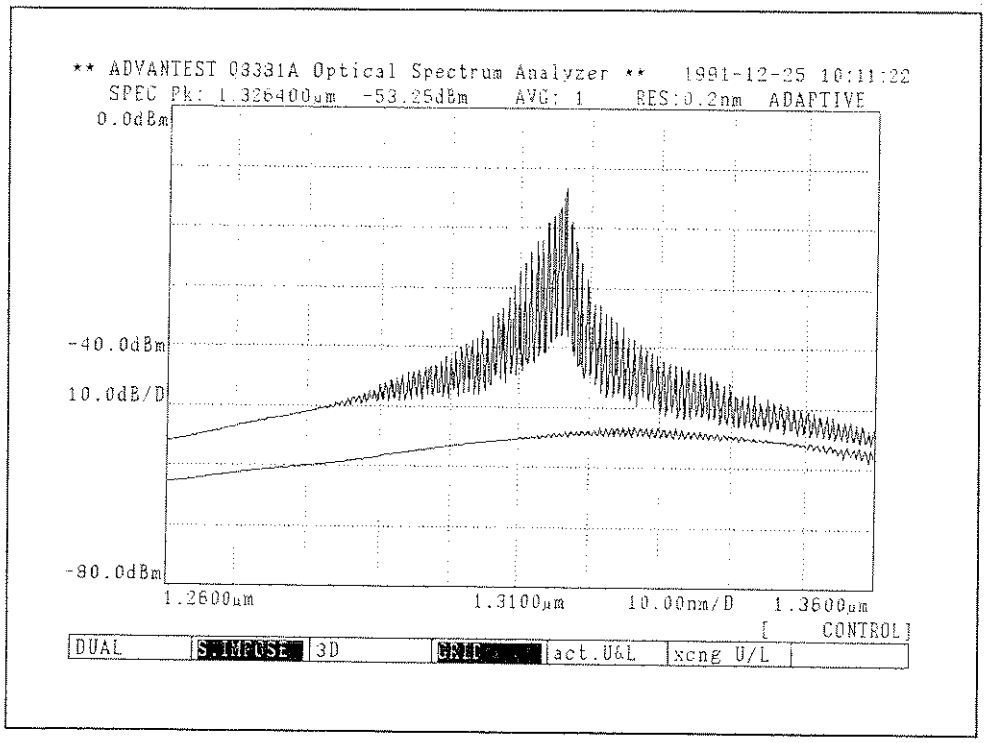


Fig. 4-2 Example of Superimpose Display

③ 3D

Turns on/off the 3-dimensional display mode, and sets the display conditions. The following soft key menu appears by pressing this key.

3-dimensional display function

(a) Max. display data : 16 (stored in the internal memory)

(b) Display angle : −75° to +75° (Settable per step (15°))

(c) Other functions : Cursor display, data recall function, etc.

Soft menu display

[3D(1)]

3D ON/OFF	INC ANGLE	DEC ANGLE	CSR NEXT	DELETE	more	prev menu

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Details of the soft key menu

③-1 3D ON/OFF

Turns on/off the 3-dimensional display mode. The mode switches between the 3-dimensional display mode and the normal mode each time this key is pressed.
When the mode is turned off, the 3-dimensional data displayed immediately before is stored in the internal memory, and the newest measurement data is displayed under normal mode.
When the 3-dimensional display is on, the display conditions are displayed with the following format on the soft key menu.

(θ : xx, C : c, D : i/n)
xx : Display angle, c : Cursor data number, i : Number of displayed data,
n : Maximum number of data

(Note 1) Measurement conditions cannot be changes while the 3-dimensional display is on.
(If attempted, a "condition cannot change at 3D ON!!" message appears.)

(Note 2) When a previous 3-dimensional data is recalled, the measurement conditions as the wavelength, level, etc. will automatically be changed to the old conditions.

③-2 INC ANGLE

Increases the display angle step by step (15°). (Clockwise rotation of the displayed data)
The maximum display angle is +75°.

③-3 DEC ANGLE

Decreases the display angle step by step (15°).
(Counter clockwise rotation of the displayed data)
The maximum display angle is −75°.

③-4 CSR NEXT

Moves the cursor to the next measurement data. When the cursor is at the newest data, the cursor moves to the oldest data.
The data number where the cursor is set is displayed at the lower left part of the screen.

③-5 DELTE

Deletes the newest data.

③-6 more

The following soft key menu is displayed by pressing this key.

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Soft key menu

[3D(2)]

CLEAR	INC N	DEC N	N LOCK	ROLL	RECALL	prev menu

Details of the soft key menu

③-6-1 CLEAR

Clears the entire 3-dimensional display data memory with measurement results.

③-6-2 INC N

Increments the maximum data display by 1.
(The maximum number of settable data is 16.)
The initial value of the maximum display data is 16, and the current number "i" of display data is displayed on the soft key menu in format of i/n.

③-6-3 DEC N

Decrements the maximum data display by 1.
(The minimum number of settable data is 2.)

③-6-4 N LOCK

Sets whether to stop the measurement when measurement of the maximum number of displayed data ends.
The lock mode is on when "N LOCK" is inversed, and measurement stops as soon as the measurement of the maximum number of data is completed.
(The LED automatically turns off when "REPEAT" is selected.)
The lock is off when the "N LOCK" display is normal; measurement continues after measuring the maximum number of data, replacing the oldest data with the new data.
The lock mode turns on and off each time this key is pressed.

③-6-5 ROLL

Sets how to display the measurement data after it exceeds the maximum number of data display.
The roll mode is on when the "ROLL" display is inversed; the new measurement data is set at the end, replacing the oldest data.
The roll mode is off when the "ROLL" display is normal; the new measurement data is displayed as the first data. The roll mode turns on and off each time this key is pressed.

③-6-6 RECALL

Recalls and displays the 3-dimensional data measured before.
This key is effective only when there is no data display.
The "previously measured 3-dimensional data" is the data displayed immediately before turning off the 3-dimensional display mode.

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(Note) Internal memory that can accommodate 16 data is provided for the 3-dimensional display. This memory is cleared when the first data is measured after turning on the 3-dimensional display mode. Therefore, the "RECALL" key is effective only after the 3-dimensional display mode is turned on till the first data is measured.

③-6-7 prev menu

Returns the display to the previous soft key menu display.

③-7 prev menu

Returns the display to the previous soft key menu display.

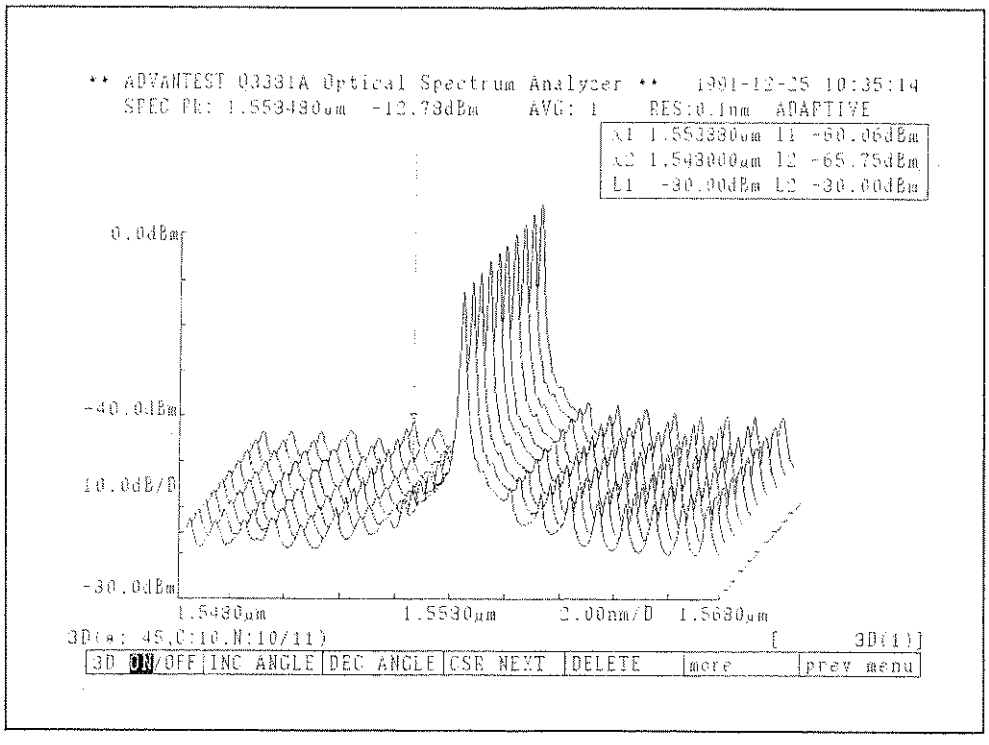


Fig. 4-3 Example of 3-dimensional Display

④ GRID

This key is used to set whether to display grid in the data display frame.

This function is effective when the grid is disturbing a clear view of the measurement data.

The grid display turns on and off each time this key is pressed.

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⑤ act. U&L

This key is effective only when under the dual screen display mode. Sets whether to update the upper and lower screens after each measurement.
When the "act. U&L" display is inversed, both the upper and lower screens are active; both screens are updated after each measurement.
When the "act. U&L" display is normal, the upper screen alone is active; data in the lower screen is not updated by the measurement.
The dual active mode turns on and off each time this key is pressed.

⑥ xcng U/L

This key is effective only when under the dual screen display mode. Used to switch the upper and lower screens.

(Note) When under the dual screen display mode, measurement conditions can be set only against the upper screen. Therefore, when measurement conditions of the lower screen need change, switch the upper and lower screens using the "xcng U/L" soft key first. Also note that saving/recalling of the measurement data, half value operation, normalization, curve fit, cursor display processing/analysis functions are all effective only against the upper screen.

4.5.2 SAVE key, RECALL key

Used to save the measurement data and panel condition into the internal memory and floppy disk, or to recall the data from the memory or floppy disk.
(The media can be switched between the internal memory and floppy disk as follows. Press the ADVANCE key, and then the soft key "FLOPPY". Select the displayed ON/OFF; "ON" selects the floppy disk, while "OFF" selects the internal memory.)
This analyzer provides internal memory for 33 screen of measurement data and 10 types of panel conditions (the memory is backed up by battery), and drive for 3.5-inch floppy disk that allows storage of 111/191 files.
When the SAVE key or RECALL key is pressed, the following soft key menu appears; use the soft keys, knob, arrow keys, and numeric keys to save or recall the data.
The following are parameters stored as panel conditions; all panel conditions are included in the measurement data.

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< < Stored panel conditions parameters > >

① Center
② Span
③ REF level
④ Level scale
⑤ Average count
⑥ Sweep mode
⑦ Resolution
⑧ Power monitor measurement conditions
⑨ Grid
⑩ Cursor display mode
⑪ 3-dimensional display conditions
⑫ Half-width operation type, parameter
⑬ Label
⑭ Plotter
⑮ Printer
⑯ Buzzer
⑰ Clock on/off, clock
⑱ CAL valid and calibration

* The following conditions are always off when the data is recalled.
"Δλ→Sweep", "3D"

(Note) When under the dual screen display mode, save and recall is done to upper screen. 3-dimensional display data cannot be saved in the memory/ floppy disk.

Soft key menu

(1) FLOPPY OFF (memory)

- SAVE key

[SAVE < MEM >]

SAV REF	SAV MEAS1	SAV MEAS2	SAV MEAS3	sav meas	sav panel	

- RECALL key

[RECALL < MEM >]

RCL REF	RCL MEAS1	RCL MEAS2	RCL MEAS3	rcl meas	rcl panel	

(2) FLOPPY ON (floppy disk)

- SAVE key

[SAVE < FD >]

SAV REF	SAV MEAS1	SAV MEAS2	SAV MEAS3	sav meas	sav panel	

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- RECALL key

[RECALL<FD>]

RCL REF	RCL MEAS1	RCL MEAS2	RCL MEAS3	rcl meas	rcl panel	

Details on the soft key menu

① SAV REF
Used to store the displayed data in the reference memory (used for normalization process LOSS/TRANS).

② SAV MEAS 1 to 3
Used to store the displayed data into measurement data memory 1 to 3.

* The above soft keys ① and ② function against the internal memory, regardless of the FLOPPY ON/OFF selection.
Spectrum display measurement raw data alone can be saved in the REF, MEAS1 memories. (Data after execution of operation cannot be saved.)
When the data except for measurement data is saved, the following message will appear on the bottom of the CRT.
"REF, MEAS1 can save only SPECTRUM!!"

③ sav meas, sav panel
Used to store the displayed data into measurement data memory 1 to 32 (sav meas) or to store the current panel setting conditions into panel memory 1 to 10 (sav panel).
When the measurement data is not measured, the following message appears on the bottom of the CRT.
"no data for save!!"
Also used when FLOPPY is ON, to store the displayed data in the measurement data file (sav meas) or the current panel setting conditions in the file (sav panel).
When these keys are pressed when FLOPPY is ON without inserting the floppy disk in the drive, a beep is given along with the following error message.

"media not in drive !!"

When the keys are pressed, a list of the currently stored measurement data or panel conditions is displayed, and the following soft key menu appears.
(Figures 4-4 and 4-5 show the display format of the memory directory, while Figures 4-6 and 4-7 show the display format of the floppy disk directory.)

- save meas key

[sav meas]

SAVE	DELETE	RECOVER			name	EXIT

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*When the sav panel key is pressed the [sav meas] of the above is replaced with [sav panel].

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<< How to read the directory (memory) >>

No. : Memory number. Measurement data is numbered from 01 to 32, while panel conditions are numbered from 01 to 10. When there is a "*" in front of the number, data with this number is erased by DELETE.

name : Name set in the memory. Max. 8 characters.

type : Extension that indicates the data type. One of the following 7 types.

- .SPE : Normal spectrum data
- .DOM : Luminosity offset data
- .PNR : Peak normalized data
- .LOS : Loss characteristics data
- .TRA : Transparency characteristics data
- .PWR : Power monitor trend chart data
- .CON : Measurement conditions

date, time : Date and time of save.

(Note) Those with numbers only are unused memory.

<< How to read the directory (floppy disk) >>

No. : File number. (This number is for recognizing the number of files in the floppy, and is not always the same when saved and recalled.)

name : File name. Max. 8 characters.

type : Extension that indicates the data type. One of the following 7 types.

- .SPE : Normal spectrum data
- .DOM : Luminosity offset data
- .PNR : Peak normalized data
- .LOS : Loss characteristics data
- .TRA : Transparency characteristics data
- .PWR : Power monitor trend chart data
- .CON : Measurement conditions

date, time : Date and time of save.

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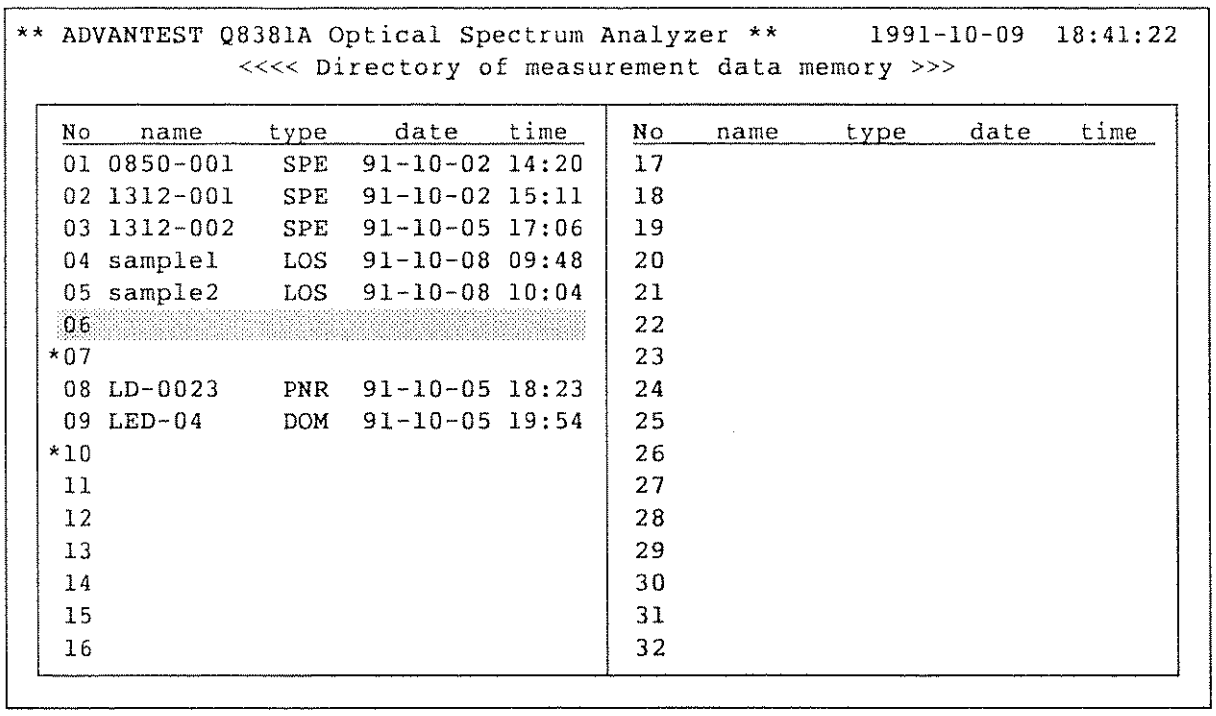


Fig.4-4 Directory of Measurement Data Memory

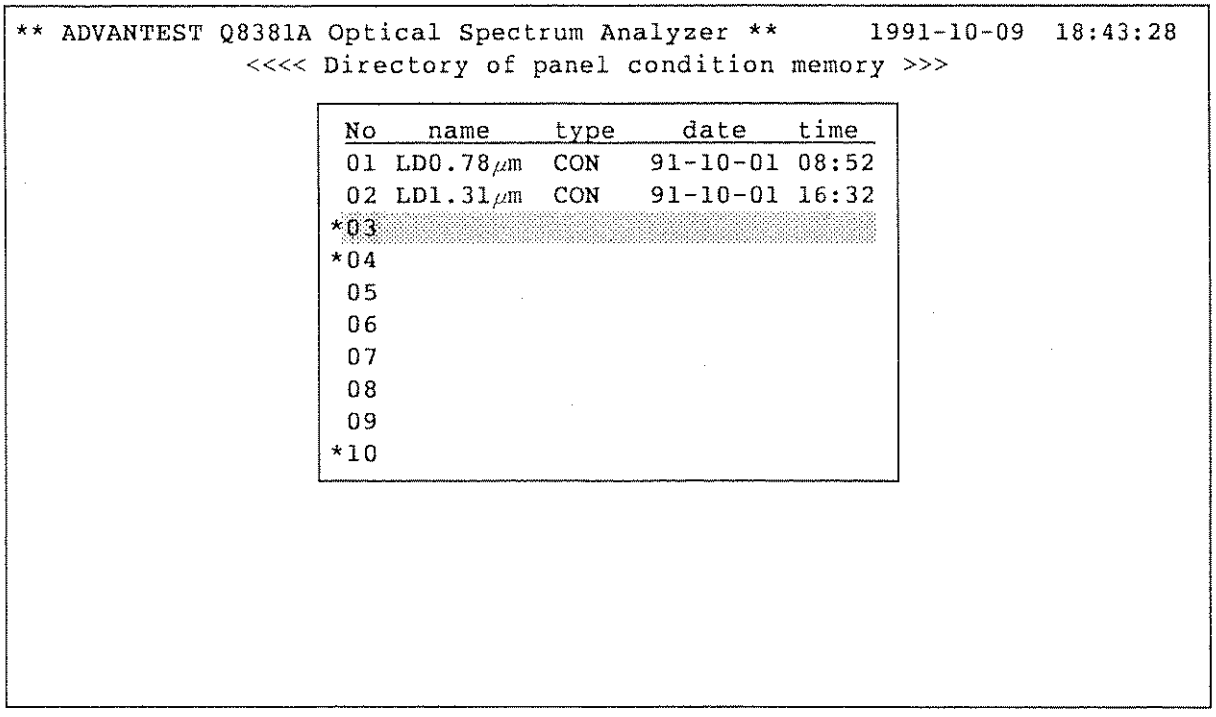


Fig.4-5 Directory of Panel Conditions Memory

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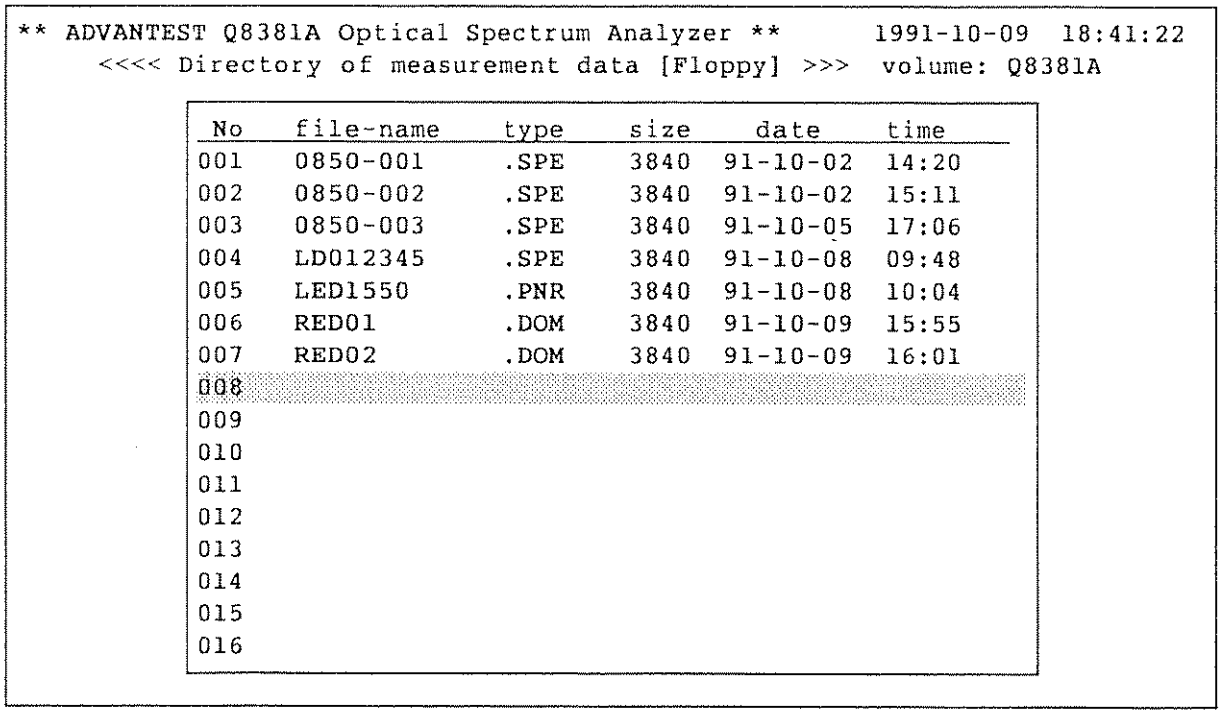


Fig.4-6 Directory of Measurement Data Files (floppy disk)

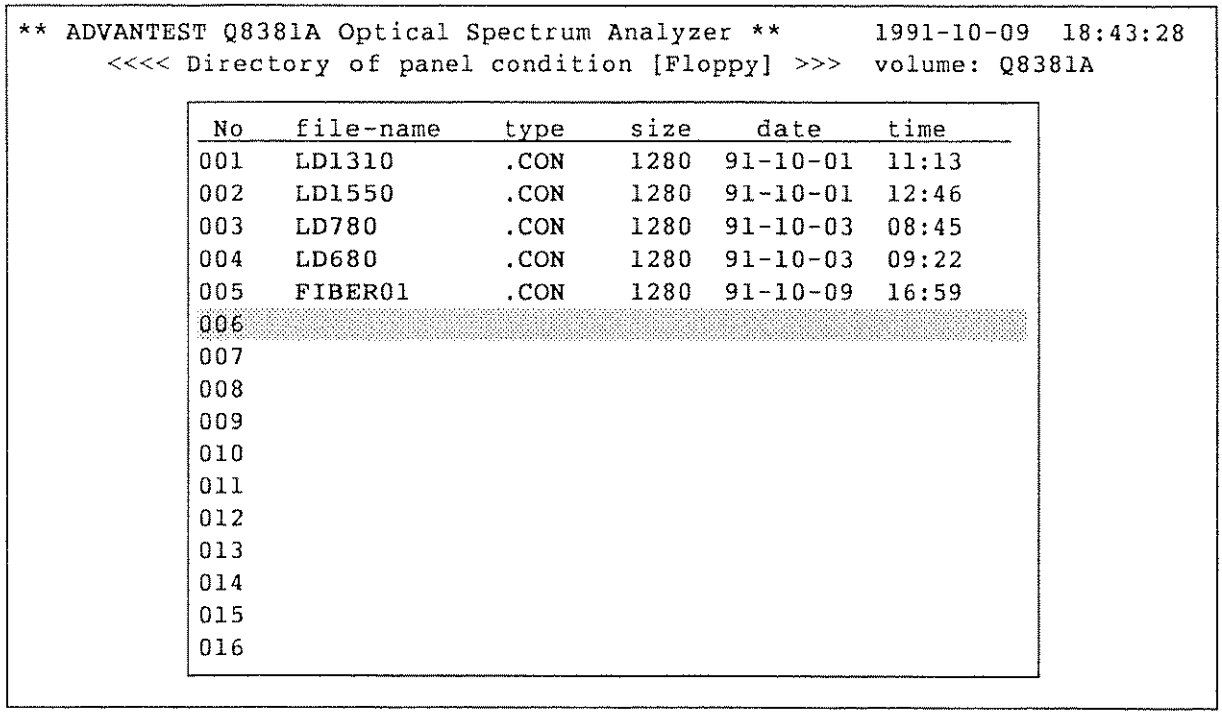


Fig.4-7 Directory of Panel Conditions Files (floppy disk)

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③-1 SAVE

Saves the measurement data or panel conditions into the selected number (inversed in the directory display). If number that already includes data is selected, data of the previous memory/file is erased. If the both the old and new data must be stored, specify a vacant number. (The number itself is useless in floppy disks, just specify a vacant area.)

The number can be selected by the knob or arrow keys. The selected number, memory name/file name are displayed on the upper left of the soft key menu.

③-2 DELETE

Deletes the measurement data or panel conditions of the selected number (inversed in the directory display).

A "*" is marked on the deleted memory number, which can be restored by the ③-3 RECOVER key.

③-3 RECOVER

Used to restore the memory/file deleted by DELETE.

Effective only to memories marked with "*". The previous name, date as well as data are recovered by pressing this key.

When used against files, a single file deleted immediately before can be recovered.

③-4 name

Used to set an individual name for the memory/file.

(Max. 8 characters can be used for the name.)

By pressing this key, the following soft key menu appears, along with the character menu and name input frame; set the name in the same manner as for setting the label.

Move the cursor in the character menu to the desired character using the knob or arrow keys, and press the "ENTER" soft key to set the character.

Keys 0 to 9, –, . can directly be set through the [0] to [9], [-], [.] keys.

Input the name, and set the data with the ENTER key.

Then return to the soft key menu and save the name.

[name]

←	→	↑ (No)	↓ (No)	CLR LINE	ENTER	prev menu

③-4-1 ←

Moves the cursor to the left in the name input frame.

③-4-2 →

Moves the cursor to the right in the name input frame.

③-4-3 ↑ (No)

Selects the memory/file number one position above (smaller number).

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③-4-4 ↓ (No)

Selects the memory/file number one position below (larger number).

③-4-5 CLR LINE

Clears the input name data.

③-4-6 ENTER

Used to set the character of the character menu at the cursor position in the cursor position of the name data buffer.

③-4-7 prev menu

Displays the previous soft key menu.

③-5 EXIT

Used to return the memory directory display to the measurement screen.

(Note 1) All characters in the character menu can be used for memory names, but the following characters alone can be used for file name.

Alphabet A to Z, numeral 0 to 9, $ & # % ' - @ _ ^ ( ) { } ~ !

(Note 2) When save is executed without setting a name, the then center wavelength value is adopted as the name. (If memory/file names with the same center wavelength already exists, the maximum value of the current branch number +1 is added within the range of 001 to 999.)

<Examples of automatically set memory name/file name>

CENTER: 1.55um	> > > >	1550-001
CENTER: 0.7825um	> > > >	0782-001
CENTER: 0.7821um	> > > >	0782-002
CENTER: 0.855um	> > > >	0855-002

④ RCL REF

Reads and displays the reference memory data.

⑤ RCL MEAS 1 to 3

Reads and displays the data in measurement data memory 1 to 3.

* The above ④, ⑤ function against the internal memory, regardless of the FLOPPY ON/OFF status. (Recalled from the internal memory.)

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⑥ rcl meas, rcl panel

Used to read and display the measurement data memory 1 to 32, panel condition memory 1 to 10.

When FLOPPY is on, used to read and display the measurement data file (rcl meas) or the panel setting condition file (rcl panel).

When the keys are pressed with FLOPPY ON but the floppy disk is not found in the drive, the following error message is given with a beep.

"media not in drive !!"

When the keys are pressed, a list of the currently stored measurement data or panel conditions is displayed, and the following soft key menu appears.

(Figures 4-4 and 4-5 show the display format of the memory directory, while Figures 4-6 and 4-7 show the display format of the floppy disk directory.)

Selects the number by the knob or arrow keys, and read the data by the "RECALL" soft key.

[rcl meas]

RECALL						EXIT

* When the rcl panel key is pressed, "[rcl panel]" appears on the top of the menu instead.

⑥-1 RECALL

Reads and displays the measurement data or panel condition data of the selected number.

When the measurement data is read, the clock display is fixed to the value when the last save is done, and "RCL" appears on the right end of the CRT. The clock and "RCL" display returns to normal status when executing the measurement.

⑥-2 EXIT

Used to return the directory display screen of the memory/floppy disk to the original measurement screen.

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4.5.3 NORMALIZE (LOSS/TRANS) key

This measurement data key is used to normalize the measurement data by the stored reference memory data or the maximum spectrum value.
This key is effective when measuring the transparency, loss wavelength characteristics of optical parts as the fiber and filter using the analyzer and white light source TQ8111.
Press this key, and the following soft key menu appears. Use the soft keys to execute the normalization process.

Soft key menu

[NORMALIZE]

Pk. NORM	MEM NORM	LOSS	TRANS	SAV REF	SAV MEAS1	FUNC MENU

Details of the soft key menu

① Pk. NORM (Peak Normalize)
Selects the function that normalizes and displays the measurement data at the peak level (peak normalization function). The display data moves so that the peak level is 0 dB on the screen (100% for linear display).
The unit of the vertical axis is dB for LOG display, and % for LINEAR display. "Pk. NORM" is inversed while executing the peak normalization function. The peak normalization function turns on and off each time this key is pressed.

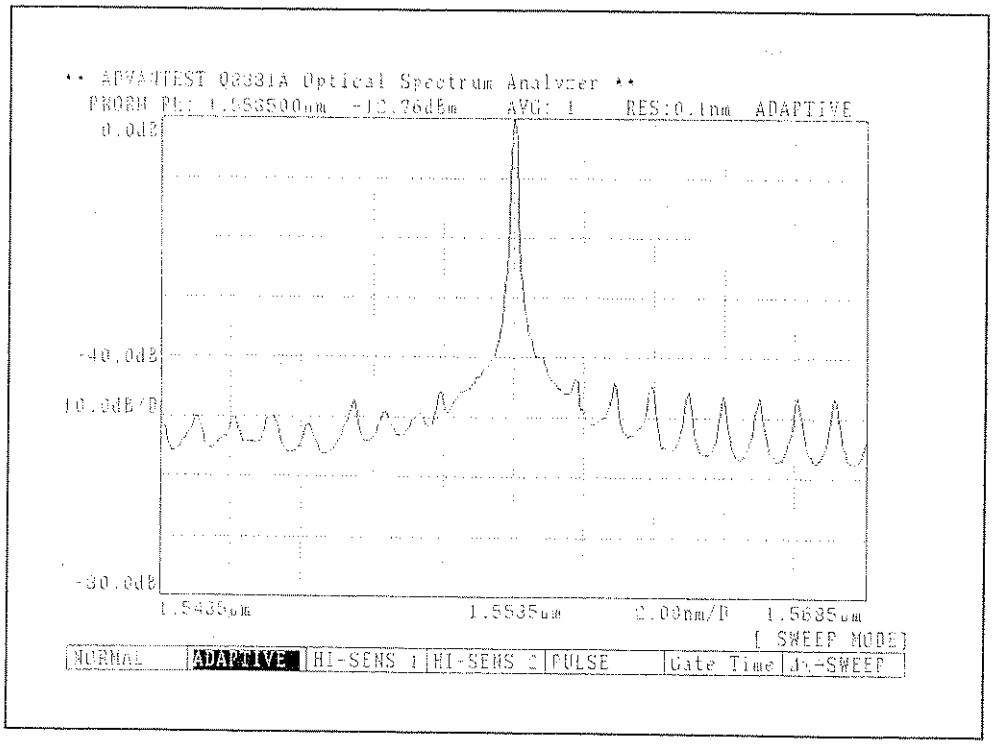


Fig. 4.8 Peak Normalization Function

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② MEM NORM (Memory Normalize)

Used to set whether the operation between the memory data and reference memory is to be done between memories, or between the current measurement data and the reference memory.

When the memory normalization function is on ("MEM NORM" is inversed), operation is done between the measurement data memory 1 and the reference memory.

When the memory normalization function is off ("MEM NORM" is normal), operation is done between the current measurement data and the reference memory.

When this key is pressed with "MEM NORM", "LOSS", "TRANS" all off, "MEM NORM" and "TRANS" turn on. "MEM NORM" alone is inversed when this key is pressed in other cases.

The following is the "MEM NORM", "LOSS", "TRANS" statuses and the data to be operated.

(a) When "MEM NORM" is on

- "LOSS" is on → Normalized = Reference / Measure memory 1 [Loss characteristics]
- "TRANS" is on → Normalized = Measure memory 1 / Reference [Transparency characteristics]

(b) When "MEM NORM" is off

- "LOSS" is on → Normalized = Reference / Measure [Loss characteristics]
- "TRANS" is on → Normalized = Measure / Reference [Transparency characteristics]

(Note)

Normalized :	Result of operation
Reference :	Reference memory
Measure memory 1 :	Measurement data memory 1
Measure :	Current measurement data

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< <Notes upon using the normalization (LOSS/ TRANS) function> >

1. The LOSS/TRANS function must be done between data with the same center, span measurement conditions. Therefore, this function cannot be executed if the measurement conditions differ between the reference memory, measurement data memory 1, and current measurement data.
   If attempted to execute this function in this case, the following message appears with a beep.
   "different condition at REF< >MEAS!!"

2. The REF LEVEL key will function to move up/down the display when executing the normalization function. (Change the display level of the result of operation)

3. The center, span measurement conditions cannot be changed when executing the normalization function. If necessary, turn off the normalization function once and change the conditions.

4. Operation is done between the memories when "MEM NORM" is on, and the displayed data does not change when the measurement ends.

5. LINEAR display is not available when "LOSS" is on.

③ LOSS
Used to measure the loss characteristics.
Either "LOSS" or "TRANS" is on (inversed).
When this key is pressed with "LOSS" already on, the normalization function turns off. ("MEM NORM" turns off as soon as this key is pressed.)

④ TRANS
Used to measure the transparency characteristics.
As with "LOSS", when this key is pressed with "TRANS" on, the normalization function turns off. ("MEM NORM" turns off as soon as this key is pressed.)

⑤ SAV REF
Saves the newest measurement data in the reference memory.

⑥ SAV MEAS1
Saves the newest measurement data in the measurement data memory 1.

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⑦ FUNC MENU

Used to set whether the soft key menu corresponding to the function keys are to be displayed when the FUNCTION section keys are pressed. The FUNCTION menu display mode turns on/off each time this key is pressed.

The FUNCTION menu display is on when the "FUNC MENU" display is inversed; the corresponding menu is displayed when the FUNCTION section keys are pressed.

The FUNCTION menu display is off when the "FUNC MENU" display is normal; the menu does not change by pressing the FUNCTION section keys.

Effective when measurement is done changing the measurement conditions when executing the LOSS/TRANS function.

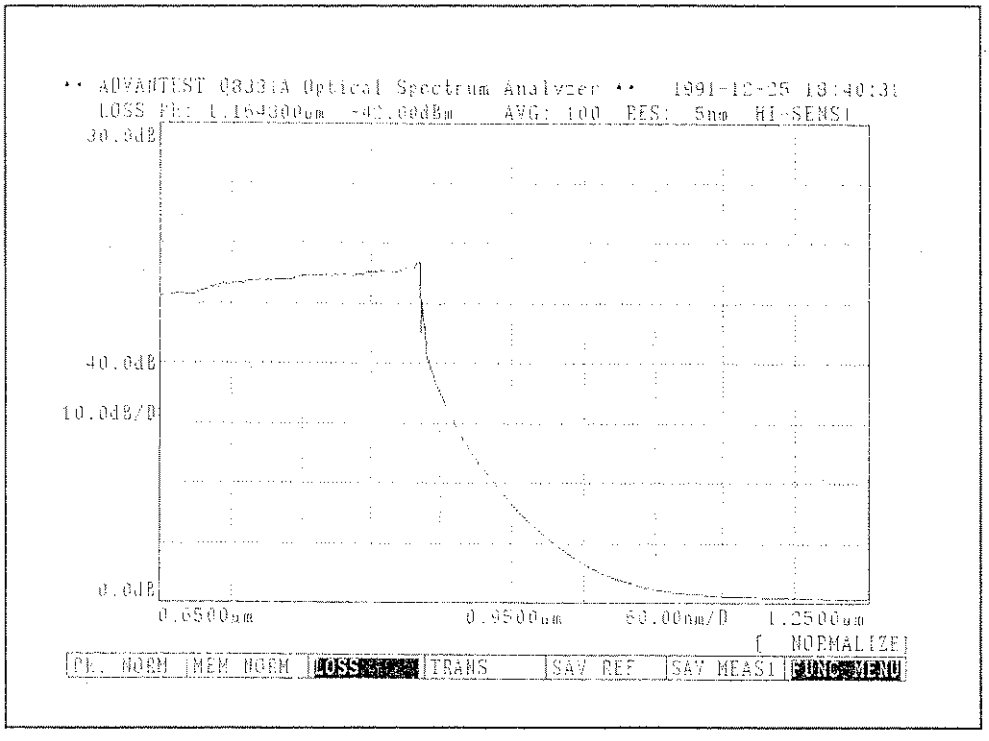


Fig. 4-9 LOSS Normalization Data Example

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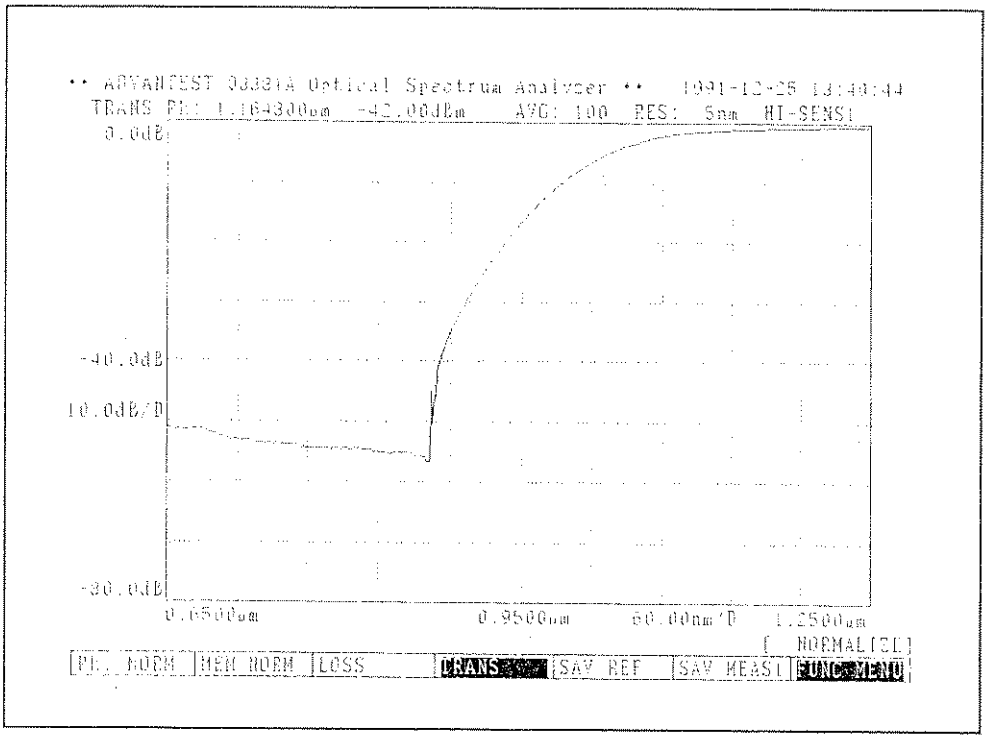


Fig. 4-10 TRANS Normalization Data Example

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4.5.4 SPECTRAL WIDTH key

This key executes the spectral width operation and displays the result.
Four calculation methods are provided for spectral width in this analyzer; the center wavelength, spectral width, and peak count are calculated and displayed on the upper right part of the CRT.
Press this key to calculate the spectral width by the currently set calculation method, and display the result.
The following soft key menu appears to allow selection of the calculation method and setting of calculation parameters.

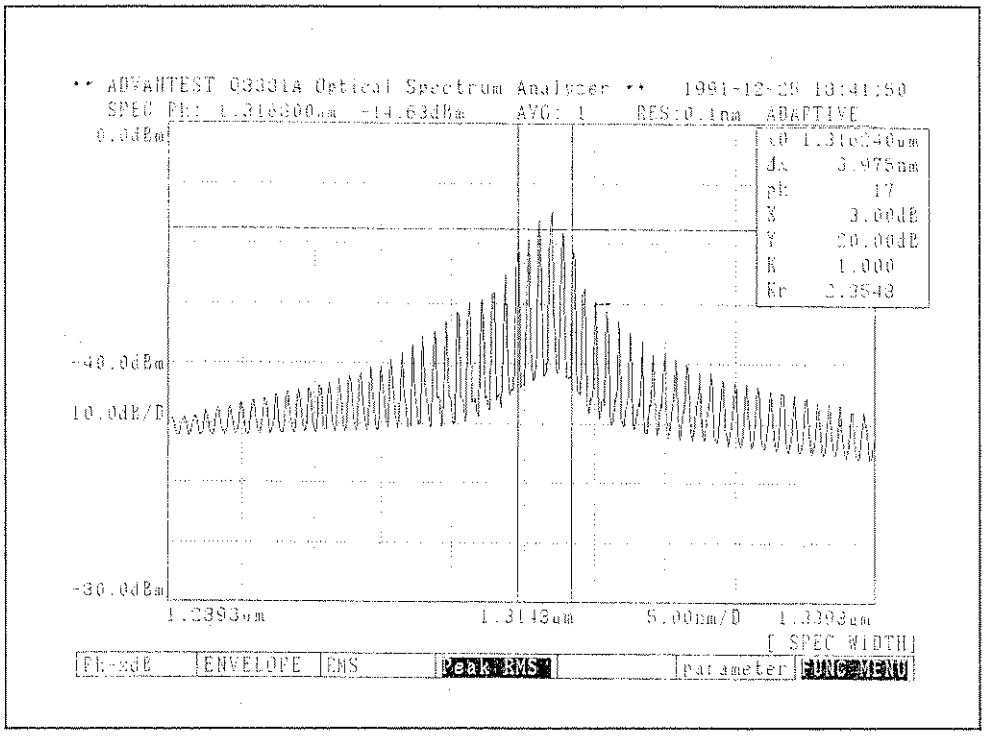


Fig. 4-11 Example of Spectral Width Data Display

Soft key menu

[SPEC WIDTH]

Pk. – XdB	ENVELOPE	RMS	Peak RMS		parameter	FUNC MENU

Calculation result data

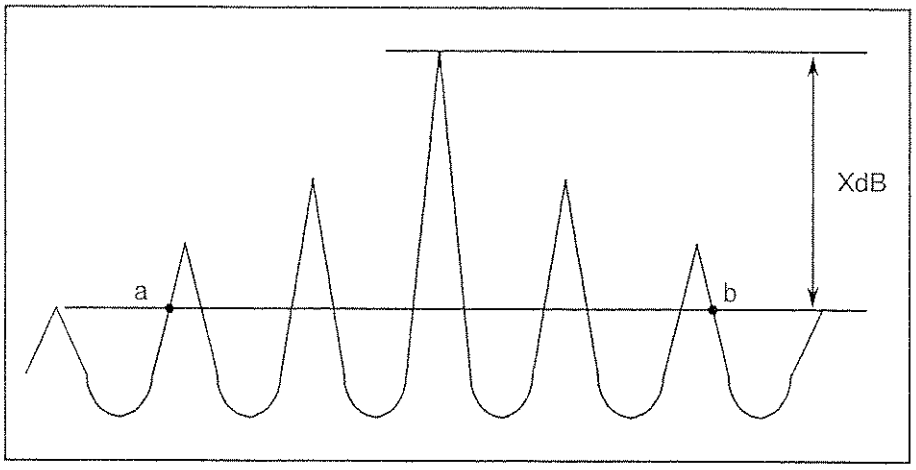
λ0	X.XXXXXX	μm	Center wavelength. 0 when calculation error occurred.
Δλ	XXXX>XXX	nm	
pk No.	XXX		Spectral width. 0 when calculation error occurred.
XdB:	XX.X	dB	
YdB:	XX.X	dB	Number of peaks.
K:	XXX.XXX		Setting parameter XdB.
Kr(RMS):	XX.XXXX		Setting parameter YdB.
			Setting parameter K.
			Setting parameter Kr (RMS).

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Details of the soft key menu

The center wavelength and spectral width is calculated by this analyzer according to the following four types of calculation method.
When two X cursors are displayed, the data between the two cursors alone is operated.

① Pk. – XdB (XdB attenuation method)
The spectral width is the difference between the left /right intersections a and b of the XdB-attenuation level line from the maximum peak of the spectrum with the spectrum, while the intermediate position of a and b is the center wavelength. The left/right intersection a, b of the level line and spectrum are calculated by linear interpolation between measurement points.
(Linear interpolation is done based on the then display scale LOG/LINEAR.)



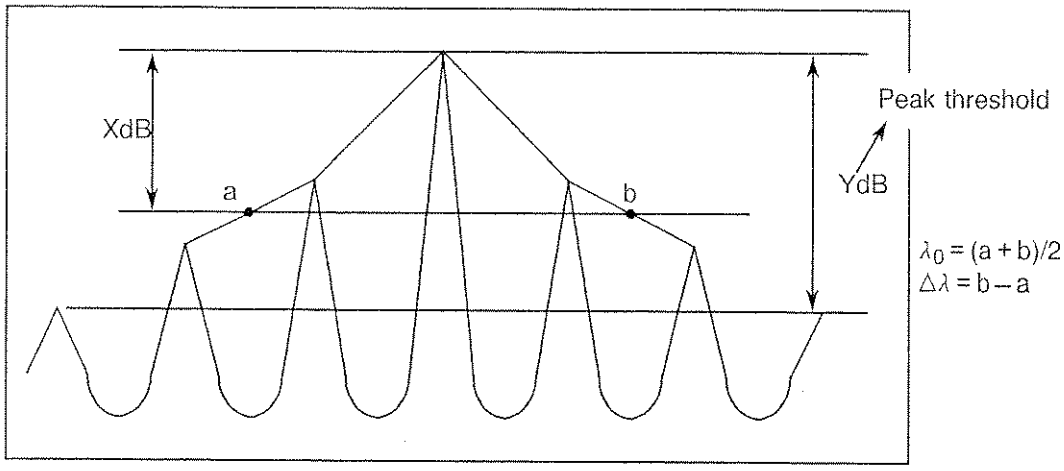
XdB attenuation method

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② ENVELOPE (envelope method)

The peaks above the specified peak threshold are connected by lines. Regarding the connected lines as envelope, the difference between intersections a, b of the XdB-attenuation level line from the maximum peak value is the spectral width, while the intermediate position of a, b is the center wavelength.

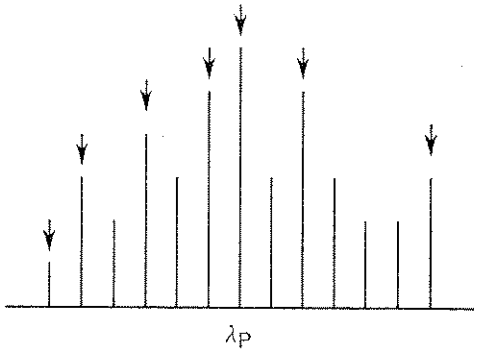
Connect the peaks with lines in the LOG/LINEAR display scale. The value somewhat differs in LINEAR display and LOG display.



Envelope method

Algorithm for calculating the envelope

(a) The spectrum is divided into left (short wavelength) and right (long wavelength) sides, centering the peak wavelength. At each side, peaks which make monotone increase are selected (peaks indicated by downward arrow below).



(b) Peaks exceeding the peak threshold (YdB) are selected from those selected in step (a), and connected with direct lines to form an envelope.

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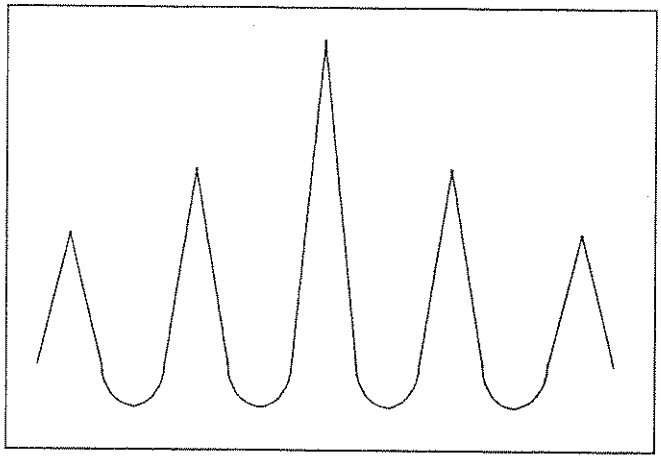
(Note) The envelope cannot be formed in the following conditions, In this case, "0" is given as the result.

- When there is no peak exceeding the threshold on the left side of λ_P.
- When there is no peak exceeding the threshold on the right side of λ_P.

③ RMS (RMS method)

The weighted average wavelength of the spectrum is calculated and specified as the center wavelength. The standard deviation from this center wavelength is multiplied by the coefficient Kr (RMS) to determine the spectral width.

This method is effective when obtaining the center wavelength and spectral width of, for example, the LED.



RMS method

When spectrum at χ_i is λ_i

$$\lambda_0 = \frac{1}{\Sigma\chi_i} \Sigma\lambda i\, \chi_i$$

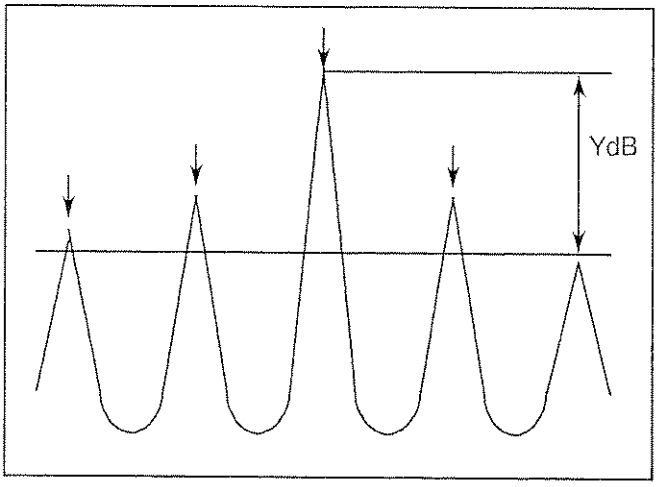
$$\Delta\lambda = K_{RMS} \sqrt{\frac{1}{\Sigma\chi_i} \Sigma\,(\lambda i - \lambda_0)^2 \chi_i}$$

$$\left(= K_{RMS} \sqrt{\frac{\Sigma\chi_i\lambda_i^2}{\Sigma\chi_i} - \lambda_0^2} \right)$$

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④ Peak RMS (peak RMS method)

The peak RMS method is basically the same as the RMS method. The difference is that in the peak RMS method, the center wavelength and spectral width are calculated from the weighted average and standard deviation of peaks exceeding the peak threshold (YdB), while in the RMS method, they are calculated in the entire spectrum area.



Peak RMS method

When spectrum at peak χ_{ip} is λ_{ip};

$$\lambda_0 = \frac{1}{\Sigma\chi_{ip}} \Sigma\lambda_{ip}\,\chi_{ip}$$

$$\Delta\lambda = K_{RMS}\sqrt{\frac{1}{\Sigma\chi_{ip}}\Sigma\,(\lambda_{ip}-\lambda_0)^2\chi_i}$$

$$\left(= K_{RMS}\sqrt{\frac{\Sigma\chi_{ip}\lambda_{ip}^2}{\Sigma\chi_{ip}} - \lambda_0^2}\right)$$

⑤ parameter

This key is used to set the parameters used to operate the spectral width.
Press this key, and the settable parameters appear as the soft key menu as shown below. Select the parameter by the soft key, and set the desired value through the numeric keys, and then press the ENTER key.

Soft key menu

[parameter]

XdB	YdB	K	Kr (RMS)			prev menu

Details on the soft key menu

⑤-1 XdB

Sets the level difference X from the peak used in the XdB attenuation method and envelope method. The default of X is 3 dB, and settable range 0.1 dB to 59.9 dB (setting resolution 0.1 dB).

⑤-2 YdB

Sets the peak threshold Y from the peak used in the envelope method and peak RMS method. The default of Y is 20 dB, and settable range 0.1 dB to 99.9 dB (setting resolution 0.1 dB).

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4.5.5 ADVANCE key

This key is used to execute advanced waveform analysis and to select the display mode.
The following soft key menu is displayed by pressing this key.

Soft key menu

[ADVANCE]

CURVE FIT	DOMINANT	power-mon	O.AMP	WDM		FUNC MENU

Note : In the case of the Q8383, DOMINANT above is not displayed.

Details of the soft key menu

① CURVE FIT
Used to display the measured spectrum waveform with curve-fit specific function waveform (secondary function curve). (Coefficients are calculated similarly as secondary function from all the measured point data, using the method of least square and fit to gaussian curve.)
Effective for evaluation of the natural emission mode (EL mode) of laser diodes.
The curve fit waveform display turns on and off each time this key is pressed.
Figure 4-12 is an example of the curve fit waveform.

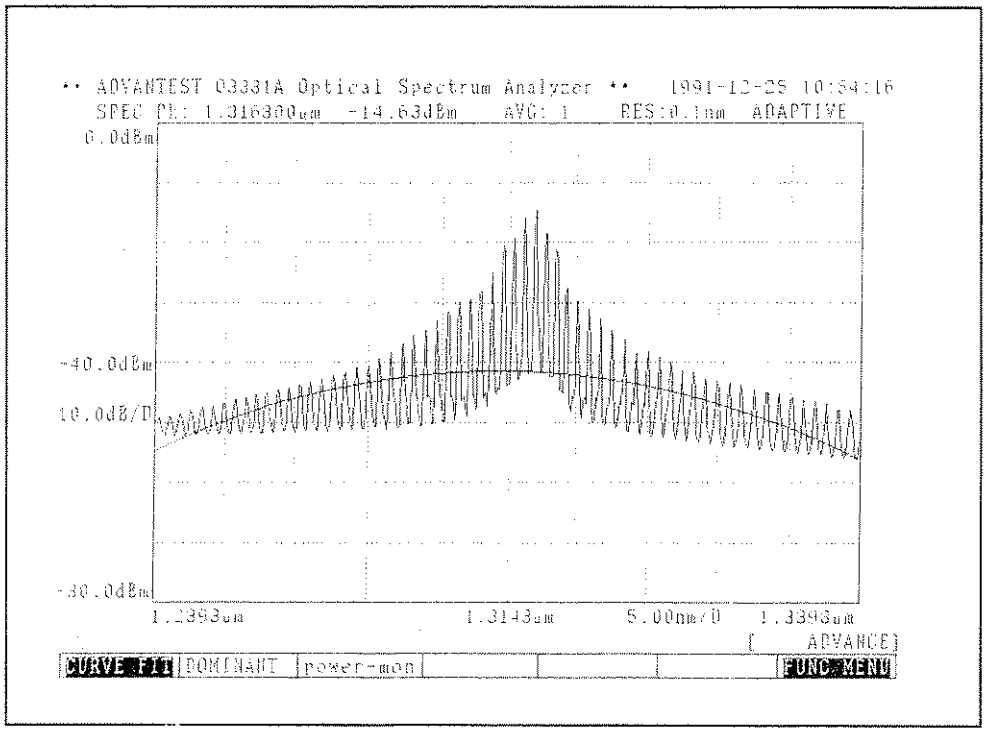


Fig. 4-12 Example of Curve Fit

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② DOMINANT*1

Used to apply luminosity offset to display the measured spectrum waveform.
Table 4-2 is the standard relative luminosity factor.
Data within range of 400 nm to 760 nm alone is effective; 10^{-6} is used for data outside this range.
The displayed data is the relative data after the luminosity offset and peak normalization. (The unit of the level axis is dB for LOG, and % for LIN.)
The display is switched between normal display and luminosity offset display each time this key is pressed.
Figure 4-13 is an example of the luminosity offset display.

*1 : This function is available for the Q8381A only.

Table 4-2 Standard Relative Luminosity Factor

Wavelength [nm]	Standard relative luminosity factor	Wavelength [nm]	Standard relative luminosity factor
400	0.000396	600	0.631
410	0.00121	610	0.503
420	0.0040	620	0.381
430	0.0116	630	0.265
440	0.023	640	0.175
450	0.038	650	0.107
460	0.060	660	0.061
470	0.09098	670	0.032
480	0.13902	680	0.017
490	0.20802	690	0.00821
500	0.323	700	0.004102
510	0.503	710	0.002091
520	0.710	720	0.001047
530	0.862	730	0.000520
540	0.954	740	0.000249
550	0.99495	750	0.000120
560	0.995	760	0.000060
570	0.952		
580	0.870		
590	0.757		

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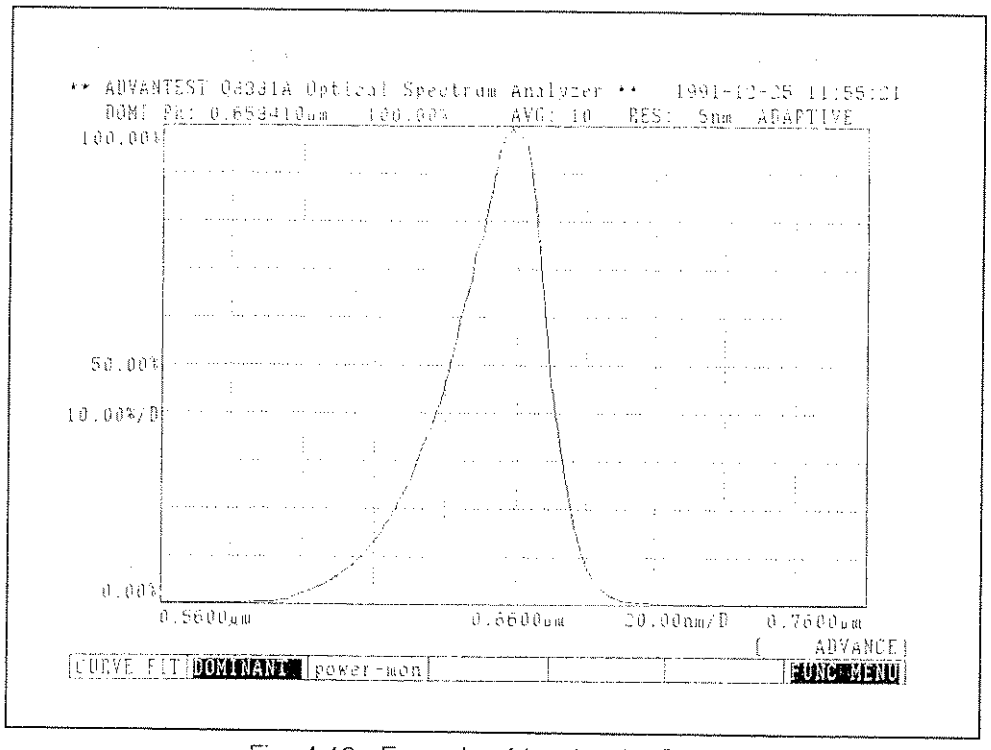


Fig. 4-13 Example of Luminosity Offset

③ power-mon

Used to select the power monitor display function.

The following soft key menu is displayed by pressing this key.

[power-mon]

ON/OFF	search λ	set λ	N-MAX	INTERVAL		prev menu

③-1 ON/OFF

Sets on/off the power monitor display function. The display switches between the power monitor display and normal spectrum display each time this key is pressed.

Figure 4-14 is the power monitor display screen and how to read the data displayed on the screen.

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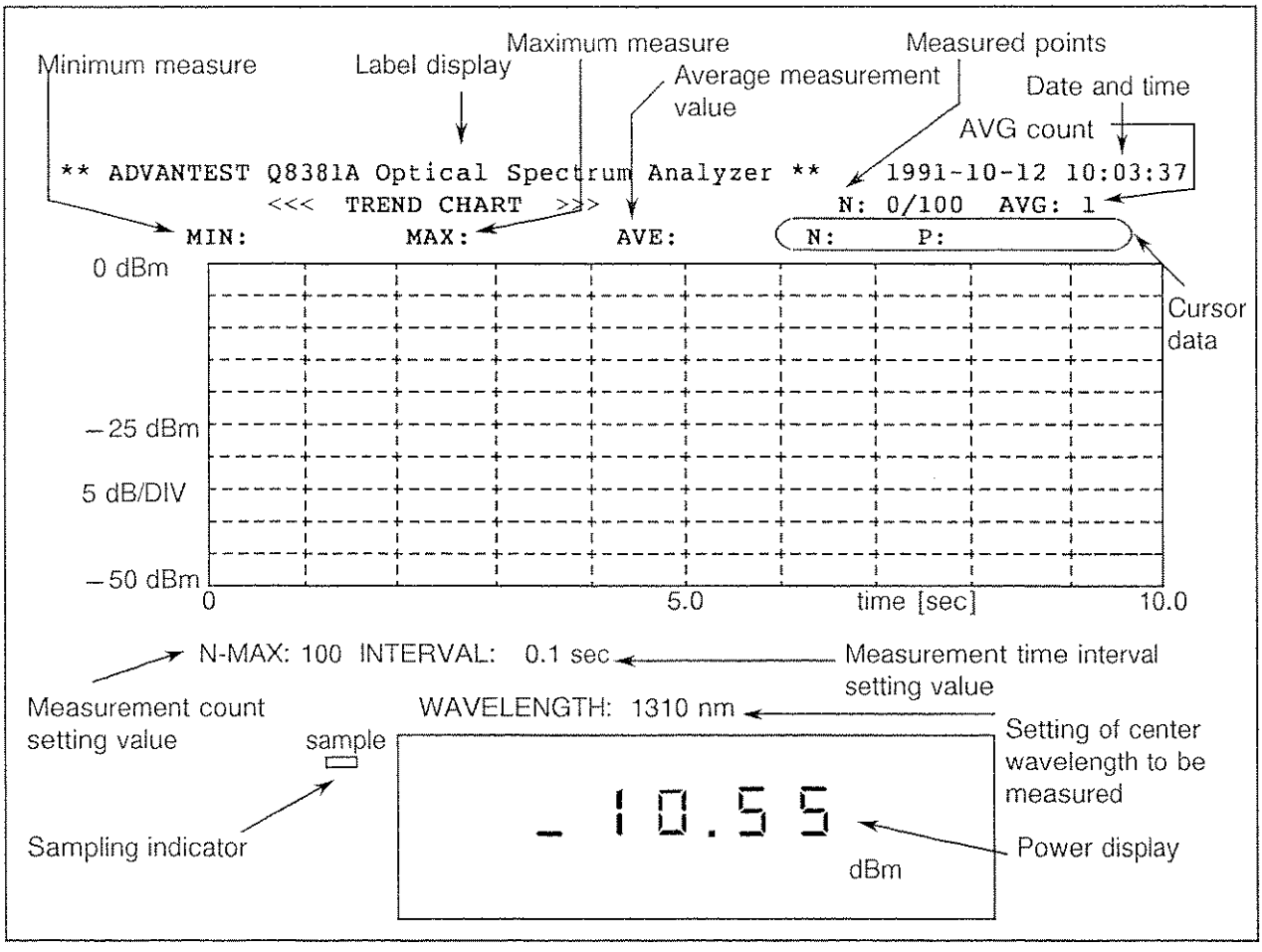


Fig.4-14 Power Monitor Display Screen and How to Read the Data

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<< Power monitor display function >>

This analyzer incorporates a spectrograph (monochromator), that normally sweeps the wavelength by the rotation of the diffraction grating and displays the spectrogram.
The power monitor function allows measurement of the optical power in the same way as the optical power meter, by fixing the diffraction grating to an angle (0-dimension light) that reflects all the wavelength to the same direction, and receiving all the input light by the detector.
When this mode is selected, the measured light power is displayed on the CRT (digital display). The "trend chart display function" is also provided to monitor the time variation of the light power. Up to 1001 points of data is measured with constant time interval (specified within the 0.1 sec to 3600 sec range), to display the time vs. level graph. Trend chart display allows setting of the display level and scale, as well as the display of the cursor. (The data number and the level are displayed as the cursor data.)
The measurement sensitivity under the power monitor status is equivalent to that of the spectrum mode "ADAPTIVE".

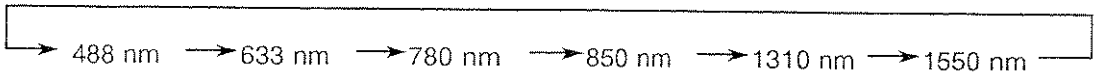
Table 4-2 shows the keys that can be used under the power monitor mode and their functions.

③-2 search λ

Used to automatically set the wavelength during power monitor operation at the peak wavelength of the input optical spectrum.
The "search λ" display is inversed by pressing this key, and the peak wavelength of the input light is automatically searched and set. Then it returns to normal display. (1 nm resolution) The message, "peak-λ search in progress ..." is displayed during the search.
This key is disabled during measurement ("SINGLE" or "REPEAT" statuses)

③-3 set λ

Used to set the wavelength during power monitor operation. Press this key, and set the wavelength using the numeric keys, arrow keys, or knob. When the numeric keys are used to directly enter the wavelength, terminate the input by the μm, nm unit keys. The arrow keys or knob will select the wavelength from the following. (The wavelengths change cyclically.)



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③-4 N-MAX

Sets the number of data points to be measured in the trend chart. The initial setting is 101, and the settable range 11 to 1001. Use the numeric keys, arrow keys, or knob to set the count. When the data set by the numeric keys, always press ENTER to terminate the entry. The arrow keys or knob can be used to set the count by 1-2-5 step plus 1 (11 > 21 > 51 > 101 ...).

Note that the previous trend data is erased by changing the measurement data count.

The X axis display of the trend chart is automatically switched by this data count and sampling interval.

③-5 INTERVAL

Sets the sampling interval of the data. The initial value is 0.1 seconds, and the setting range is 0.1 to 3600 seconds. Use the numeric keys, arrow keys, or knob for the setting. Always press the ENTER key after setting the value by the numeric keys. The arrow keys or knob can be used to set the data by 1-2-5 step.

As in "N-MAX", note that the previous trend data is erased by changing the sampling interval data.

If measurement of 1 point does not end within the time specified by this sampling interval in, for example averaging count setting, the interval is decided by the measurement time, and will not match with the time displayed on the X axis.

③-6 prev menu

Returns the soft key display to the previous menu.

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Table 4-3 Keys Enabled Under the Power Monitor Mode, and Their Functions

Keys enabled	Function
① REF LEVEL	Sets the display level of the trend chart.
② LEVEL SCALE	Switches the power display unit (dBm/ xW), switches the trend chart LIN/ LOG, and sets the LOG scale.
③ AVG	Sets the averaging process count at measurement of a single point.
④ SINGLE	Executes trend measurement a single time.
⑤ REPEAT	Repeats execution of trend measurement.
⑥ STOP	Stops the trend measurement. * The above ④ ⑤ ⑥ also control the digital power display.
⑦ CAL	Executes level calibration of the power monitor display.
⑧ λ1	Turns on/off the cursor display on the trend chart.
⑨ ADVANCE	Turns on/off the power monitor mode, and sets the conditions.
⑩ Numeric keys, arrow keys, rotary knob	Operation against the setting item.
⑪ SAVE, RECALL, DEVICE, COPY, FEED, LOCAL, INSTR PRESET	Same operation as the normal spectrum display.

(Note) Keys other than mentioned above are all disabled.

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④ O.AMP

Used to calculate the gain and the noise figure from the input/output spectrum data of the optical amplifier and display the results.

Pressing this key causes the optical amplifier gain (GAIN) and the noise figure (NF) to be automatically calculated from the input/output data of the optical amplifier and the results to be displayed on the upper right of the CRT. The soft key menu is displayed as follows, enabling the calculation conditions to be changed.

Note that any key on the panel may be pressed to turn off the display of the calculation results.

[O.AMP]

NF(s-sp)	NF(total)		FIT MEM-3	SPE DIV	parameter	prev menu

④-1 NF(s-sp)

Is selected when only one item of beat noise between the signal light (s:signal) and spontaneous emission light (sp) is used for noise figure calculation. (Initial state)

It is available when the input signal level to the optical amplifier is approx. -20dBm or more. If the input signal level is too low, it is possible that the error will be greater because of the influence of the other items.

When this key is pressed, the NF (total) in ④-2 is turned off and the noise figure is calculated again and displayed.

④-2 NF(total)

Is selected when four items of the shot noise of signal light, shot noise of spontaneous emission light, beat noise between signal light and spontaneous emission light, and beat noise between spontaneous emission lights, are used for the noise figure (NF) calculation. It is used when the noise figures are correctly measured in all input level ranges. (particularly, for input levels below -20dBm)

For this mode, it is required to set beforehand the value $\Delta\lambda$ of the effective optical filtering width (filtering width at the signal light wavelength) of the optical amplifier.

When this key is pressed, NF (s-sp) in ④-1 is turned off and the gain and the noise figure are calculated again and displayed.

④-3 Σ PASE

When this key is pressed, the total power of the area between two cursors is calculated and is displayed in the upper right of the screen.

In the SPAN-A area, set by the soft key menu 4)-6 "parameter", in the area between two cursors, the data is used by quadratic-function approximating the output spectrum data in the specified range using the least square method and fitting the approximation on the Gaussian curve.

In the area other than SPAN-A, the output spectrum is used.

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④-4 FIT MEM-3

Selects the mode which used the spectrum stored in measurement data memory 3 when the ASE (Amplified Spontaneous Emission) level is obtained. It is effective for correct estimation of the ASE level when the optical amplifier is equipped with a narrow bandwidth optical filter at its output.

When this mode is used, the output spectrum of the optical amplifier should first be measured then stored in the measurement data memory. (At this time, measurement conditions such as the central wavelength and the span should be the same as when normal input/output is measured.)

The entire level of the spectrum in memory 3 should beshifted so that the data in the specified range of the measured normal output spectrum is identical to the data level in memory 3, and the level of memory 3 at this signal light wavelength should be set to the ASE level.

When this mode is off, the ASE level is obtained by quadratic-function approximating the output spectrum data in the specified range using the least square method and fitting the approximation on the Gaussian curve.

Each time this key is pressed, the mode using memory 3 is turned on or off and the gain and the noise figure are calculated again and displayed.

④-5 SPE DIV

Is the mode which cancels errors affected by the stray light of this instrument, the spontaneous emission light of the input signal light, or the side mode when the ASE level is to be obtained. It is effective for high input levels of the optical amplifier (saturation area) .

When this mode is turned on, the correction spectrum (P_{CORR}) is obtained from the output spectrum (P_{OUT}) and input spectrum (P_{IN}) using the following expression. The ASE level is calculated from the correction spectrum.

$$P_{CORR} = P_{OUT} - G \cdot P_{IN}$$

G : Gain at the signal light wavelength [$G = (P_{OUT} - P_{ASE})/P_{IN}$]

P_{ase} : Temporary ASE level obtained using fitting

When this mode is off, the ASE level can be obtained directly from the output spectrum.

Each time this key is pressed, the modecorrecting the input spectrum in turned on or off and the gain and the noise figure are calculated again and displayed.

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④-6 parameter

Used to set data ranges for obtaining the ASE level or constants used for the gain and noise figure calculation. When this key is pressed, the following soft key menu is displayed.

[parameter]

K	SPAN-A	SPAN-B	FILTER Δλ	Pin Loss	Pout Loss	prev menu

④-6-1 K

Sets the coefficient for the noise figure calculated. This parameter is used when the correction is required other than input/output loss.
The initial value is 1.000, and the setting range is 0.100 to 10.000.

④-6-2 SPAN-A

Sets the data ranges except for fitting process with the signal light wavelength as center and used for the ASE level calculation.
The initial value is 2.0nm, and the setting range is 0.1nm to 100.0nm. (See Figure 4-15)

④-6-3 SPAN-B

Set the data ranges for which fitting is made with the signal light wavelength as center and which are used for the ASE level calculation.
The initial value is 5.0nm, and the setting range is 0.1nm to 100.0nm. (See Figure 4-15)

④-6-4 FILTER Δλ

Sets the effective optical filtering width of the optical amplifier output which is used for the niose figure calculation when NF (total) in ④-2 is on.
The initial value is 3.0nm, and the setting range is 0.01nm to 999.9nm.

④-6-5 Pin Loss

Sets the differences between the optical signal level input into the instrument and the optical signal level actually input into the optical amplifier. This setting value is used for the gain calculation.
The initial value is 0.00dB, and the setting range is -10.00dB to +10.00dB. If the input into the instrument is small, the polarity should be positive. If the input is not small, the polarity should be negative.

④-6-6 Pout Loss

Sets the differences between the output optical signal level of the optical amplifier input into the instrument and the optical signal level actually output from the optical amplifier. This setting value is used for the gain calculation.
The initial value is 0.00dB, and the setting range is -10.00dB to +10.00dB. If the input into the instrument is small, the polarity should be positive. If the input is not small, the polarity should be negative.

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④-6-7 prev menu

Used to return the soft key menu to the previous menu.

④-7 prev menu

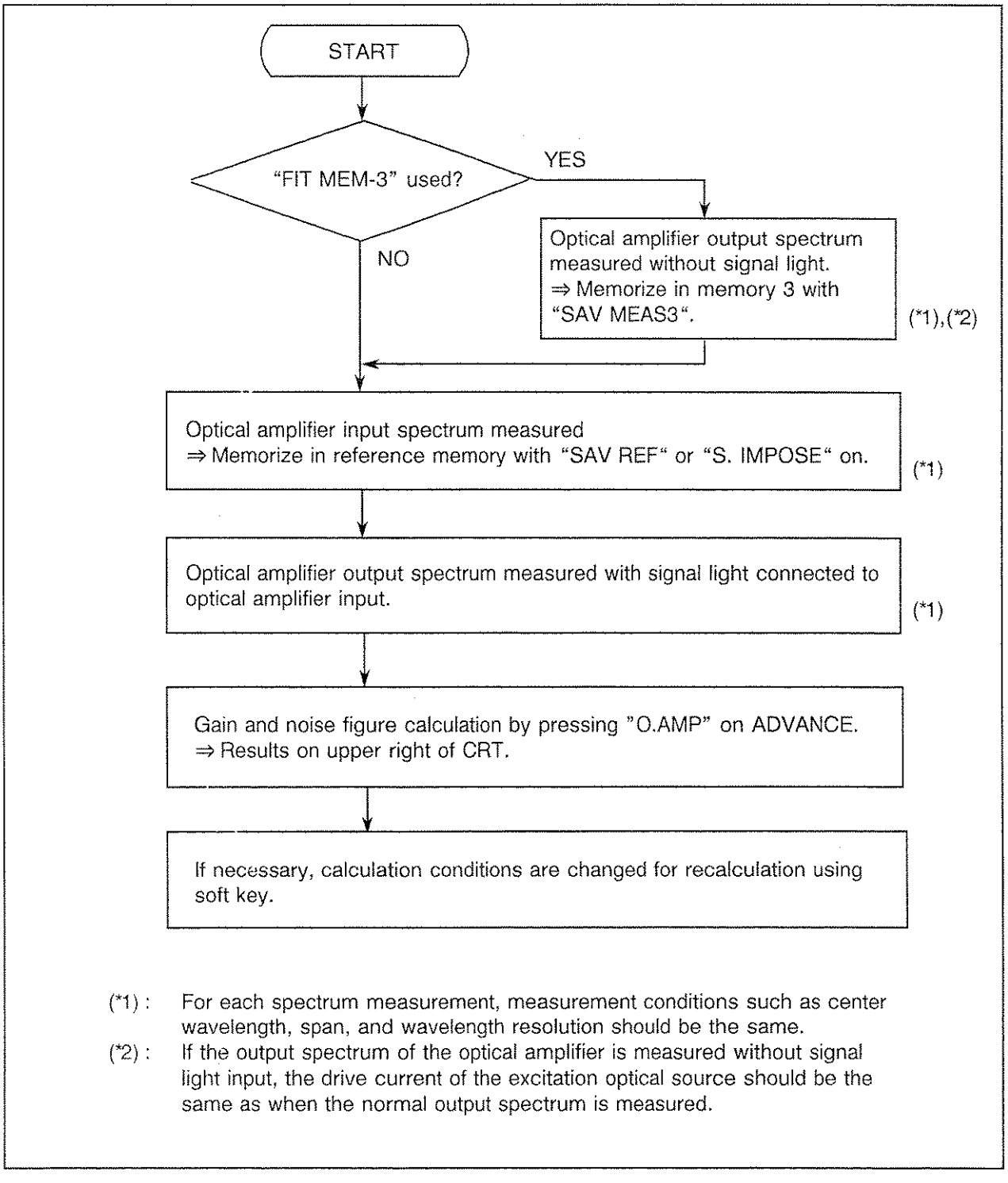
Used to return the soft key menu to the previous menu.

Display and explanation of calculation results

λ0 :	Center wavelength of signal light
GAIN :	Gain
Pase :	ASE optical power
NF :	Noise figure
K :	Setting value of coefficient for NF calculation
Σ Pase :	Total power of the ASE light in the area between two cursors
SPN-A :	Setting value of data range A for P_{ASE} calculation (nm)
SPN-B :	Setting value of data range B for P_{ASE} calculation (nm)
Δλ :	Setting value of optical filtering width for NF (total) calculation (dB)

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Operating method



(*1) : For each spectrum measurement, measurement conditions such as center wavelength, span, and wavelength resolution should be the same.

(*2) : If the output spectrum of the optical amplifier is measured without signal light input, the drive current of the excitation optical source should be the same as when the normal output spectrum is measured.

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Calculation method

1. Gain (GAIN) calculation metod

$$GAIN = \frac{(P_{OUT} - P_{ASEM}) \cdot L_{out}}{P_{in} \cdot L_{out}}$$

Pin : Input signal optical level (W) (measured value)
P_{OUT} : output signal optical level (W) (measured value)
P_{ASEM} : ASE optical level before correction (W) (calculated value)
Lin : "P_{IN} LOSS" value (setting value)
L_{OUT} : "P_{OUT} LOSS" value (setting value)

2. Noise figure calculation method

① NF(s-sp) calculation method

$$NF = K \cdot \frac{P_{ASE}}{h \cdot \nu \cdot G \cdot \Delta\nu}$$

h : Plank's constant ($6.63*10^{-34}$[J·S])
ν : Signal light frequency (Hz)
G : Gain
$\Delta\nu$: Frequency resolution during ASE measurement (Hz)
P_{ASE} : ASE optical level (W)
K : Coefficient for the calculation result (setting value) (initial value: 1.000)

② NF(total) calculation method

$$NF = K \cdot \left(\frac{1}{G} + \frac{2\mu_X \cdot \Delta f}{G \cdot N} + 2\mu_X + \frac{2\mu_X^2 \cdot \Delta f}{N} \right)$$

First term : Shot noise of signal light.
Second term : Shot noise of spontaneous emission light.
Third term : Beat noise between signal light and spontaneous emission light.
Forth term : Beat noise between spontaneous emission light.

$$N = \frac{P_{IN} \cdot L_{IN}}{h \cdot \nu}$$

$$\mu x = \frac{P_{ASE}}{2 \cdot h \cdot \nu \cdot G \cdot \Delta\nu}$$

$$\Delta f = \frac{C}{\lambda_S - \Delta\lambda/2} - \frac{C}{\lambda_S + \Delta\lambda/2}$$

C : The velocity of a light ($2.9979*10^8$ [m/s])
λ_S : Wavelength of signal light
$\Delta\lambda$: Effective optical filtering width of optical amplifier output (setting value)

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P_{ASE} calculation method

(1) If "FIT MEM-3" is off

In the output spectrum of the optical amplifier, the data in the specified wavelength range is quadratic-function approximated using the least squares method and fitted on the Gaussian curve. The level at the signal light wavelength position on the fitting curve is P_{ASE}.

(2) If "FIT MEM-3" is on

The ratio of the average level of the optical amplifier output spectrum (*1) to the average level of the spectrum in the specified wavelength range (*2) which is stored in the memory 3 is obtained.

By the multiplying the ratio by the spectrum in the memory 3, the spectrum is corrected. The level of the corrected spectrum at the signal light wavelength position is P_{ASE}.

(*1) : Result obtained by subtracting the input spectrum multiplied by the gain from the output spectrum if "SPE DIV" is on

(*2) : Result obtained by subtracting the data in the SPAN-A area from the data in the SPAN-B area having the signal light wavelength as center (See Figure 4-15)

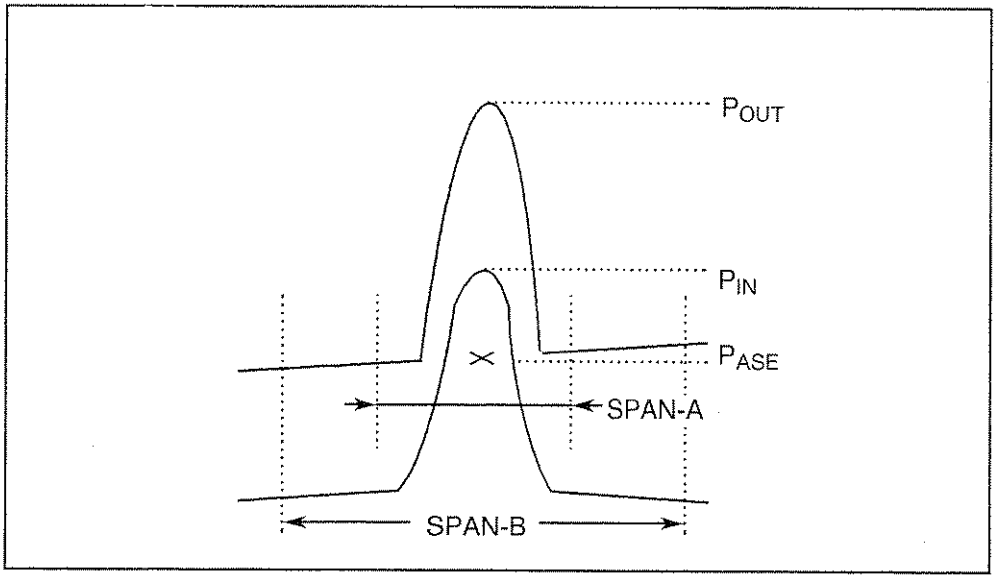


Fig. 4-15 Data Area in P_{ASE} calculation

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⑤ WDM

Calculates the gain/noise figure (GAIN, NF) for up to 16 channels from the input/output spectrum data of the optical amplifier with wavelength division multiplex. The results are listed on the screen.
The following soft key menu is displayed. Settings on the operation condition and so on are set by using the soft key.

[WDM]

ON/OFF	AUTO	Σ PASE	FIT-MEM3	LIST ALL	parameter	prev menu

⑤-1 ON/OFF

Switches the list display of the gain/noise figure (GAIN, NF) for up to 16 signal lights calculated from the input/output spectrum data of the optical amplifier.
Each time pressing this key switches the mode between list display (see Figure 4-16) and normal spectrum display.
When ON is set, spectrum waveform is displayed on the upper section of the screen and the list of the gain/noise figure (GAIN, NF) for up to 8 signal lights is displayed on the lower section of the screen. To display the list of 9 to 16 signal lights, turn the knob.
When this mode is set to OFF, the standard spectrum display is made.

⑤-2 AUTO

When AUTO is set to ON, if the number of signal lights is 8 or less, the minimum data between signal lights is fitted at the second interpolation. Or, if the number of signal lights is 9 or more, the minimum data between signal lights is fitted at the first interpolation. The level of each signal light wavelength point in this fitting curve is ASE (Amplified Spontaneous Emission).
When AUTO is set to OFF, data of the wavelength range set by SPAN-A and SPAN-B of parameter is fitted for each signal light at the second interpolation. The level of each signal light wavelength point in this curve is ASE. (See Figure 4-17.)

⑤-3 Σ PASE

When this key is pressed, two cursors are displayed. The total power of the area between two cursors on the fitting curve for obtaining ASE is calculated and is displayed in the upper right of the screen. (See Figure 4-18.)

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⑤-4 FIT-MEM3

Selects the mode which used the spectrum stored in measurement data memory 3 when the ASE (Amplified Spontaneous Emission) level is obtained. It is effective for correct estimation of the ASE level when the optical amplifier is equipped with a narrow bandwidth optical filter at its output.
When this mode is used, the output spectrum of the optical amplifier should first be measured then stored in the measurement data memory. (At this time, measurement conditions such as the central wavelength and the span should be the same as when normal input/output is measured.)
The entire level of the spectrum in memory 3 should be shifted so that the data in the specified range of the measured normal output spectrum is identical to the data level in memory 3, and the level of memory 3 at this signal light wavelength should be set to the ASE level.

⑤-5 LIST ALL

When this mode is set to ON, the list of the gain/noise figure for up to 16 signal lights is displayed in the entire screen.
When it is set to OFF, the normal spectrum waveform is displayed in the upper section of the screen and the list of the gain/noise figure for up to 16 signal lights is displayed in the lower section of the screen. (See Figure 4-19.)

⑤-6 parameter

Used to set data ranges for obtaining the ASE level or constants used for the gain and noise figure calculation. When this key is pressed, the following soft key menu is displayed.

[parameter]

Y-dB	K	SPAN-A	SPAN-B	PEAK→	PEAK←	prev menu

⑤-6-1 Y-dB

Sets the peak threshold Y from the peak used in the envelope method and peak RMS method. The signal light at or more the level less than the peak level by Y dB is detected and the list of the gain/noise figure (GAIN, NF) of the optical amplifier is displayed.
The initial value of Y is 20 dB, and the setting range is 0.1 dB to 99.99 dB (setting resolution 0.1 dB).

⑤-6-2 K

Sets the coefficient for the noise figure calculated. This parameter is used when the correction is required other than input/output loss.
The initial value is 1.000, and the setting range is 0.100 to 10.000.

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⑤-6-3 SPAN-A

Used to calculate the ASE level. Set the data ranges except for fitting process with the signal light wavelength as center.
The initial value is 1.0 nm, and the setting range is 0.1 nm to 100.0 nm.
Set this parameter to each signal light wavelength.

⑤-6-4 SPAN-B

Used to calculate the ASE level. Set the data ranges for which fitting is made with the signal light wavelength as center.
The initial value is 1.5 nm, and the setting range is 0.1 nm to 100.0 nm.
Set this parameter to each signal light wavelength.

⑤-6-5 PEAK→

Selects the next right signal light to set SPAN-A or SPAN-B. The wavelength of the signal light selected here is displayed in the upper left section of the soft key menu.

⑤-6-6 PEAK←

Selects the next left signal light to set SPAN-A or SPAN-B. The wavelength of the signal light selected here is displayed in the upper left section of the soft key menu.

⑤-6-7 prev menu

Used to return the soft key menu to the previous menu.

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⑤-7 prev menu

Used to return the soft key menu to the previous menu.

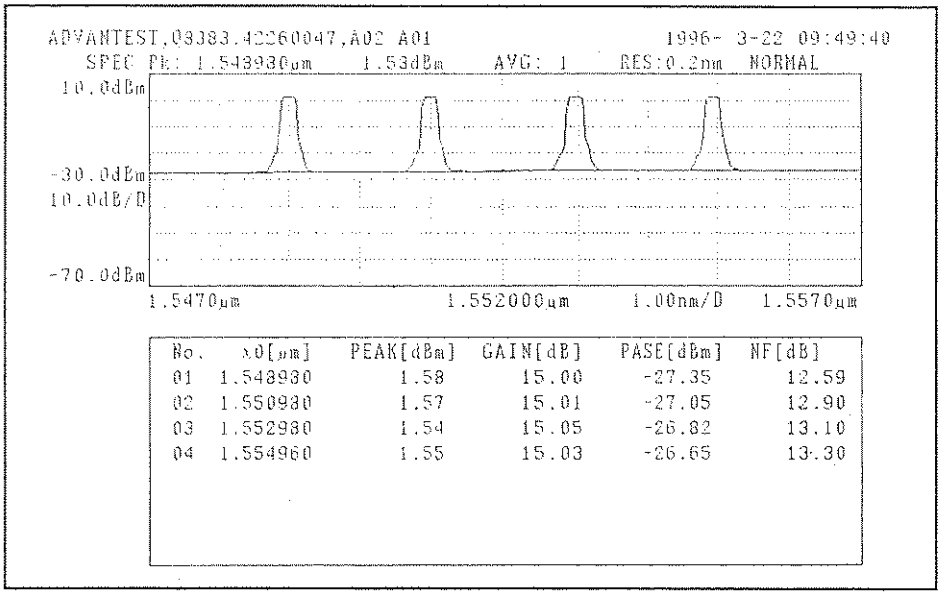


Fig.4-16 List Display under WDM Mode On

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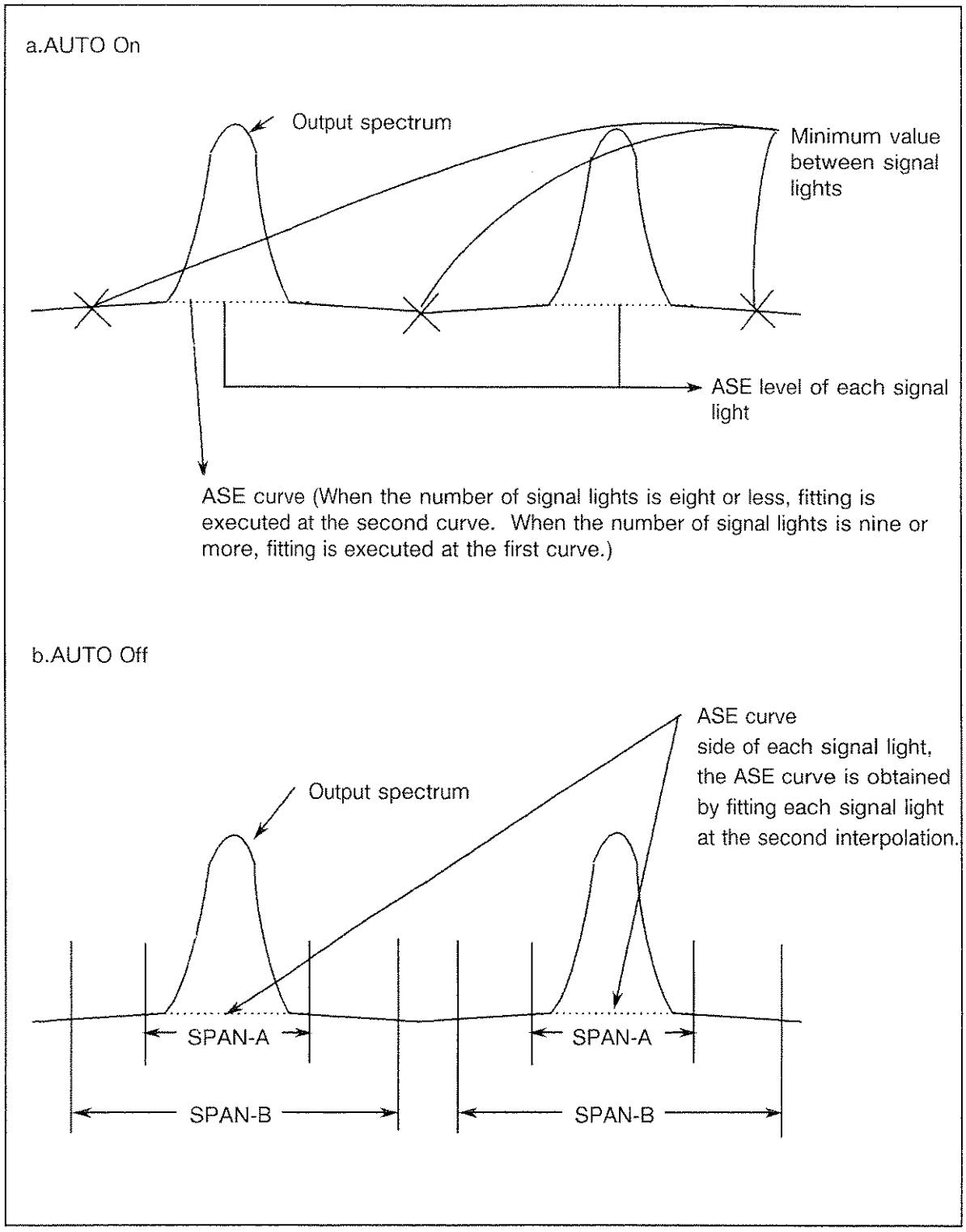


Fig.4-17 Method of Obtaining ASE Curve

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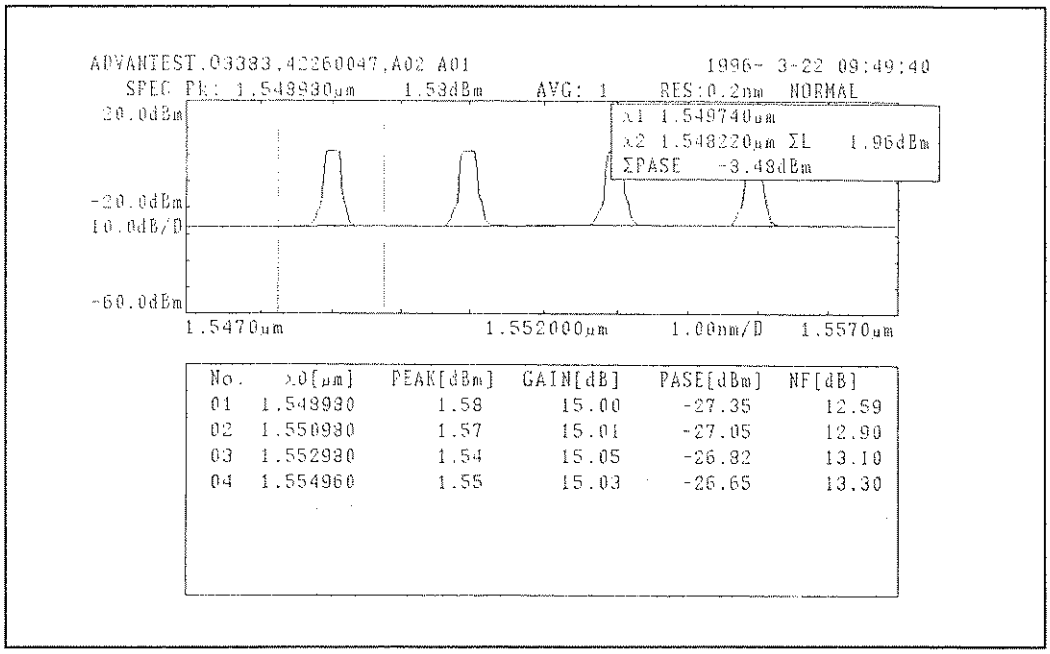


Fig.4-18 Case of Σ pase mode On

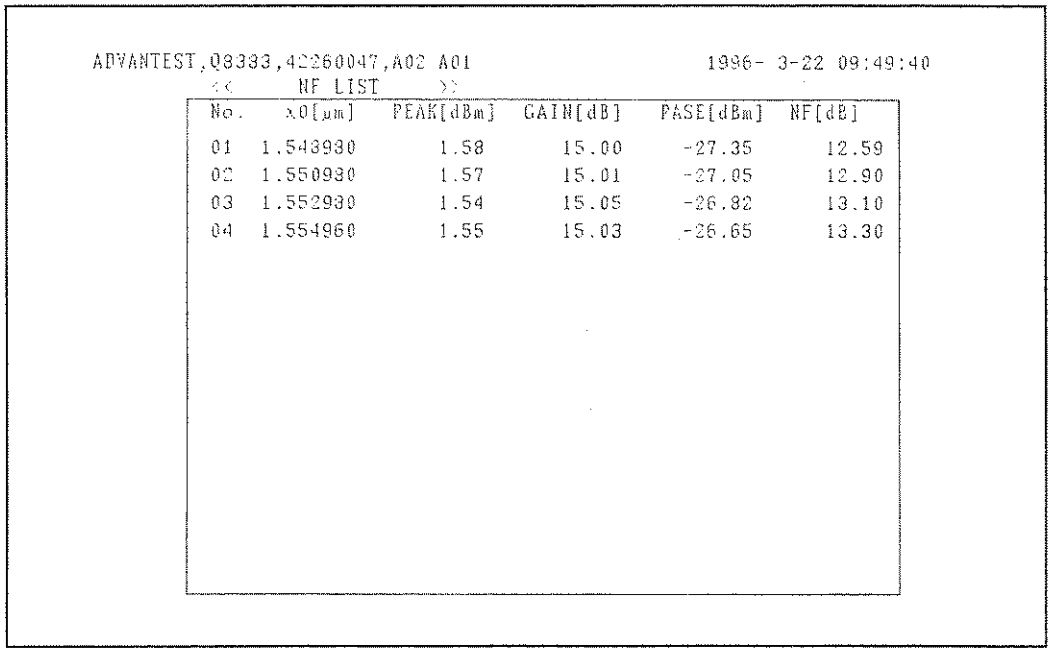


Fig.4-19 Case of list all mode On

⑥ FUNC MENU

Used to set to display or not to display the corresponding soft key menu when the key of the FUNCTION section is pressed.
For details, refer to soft key menu 7) in Subsection 4.5.3.

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4.6 DATA OUT Section

This section is used to specify display data output (to the plotter and printer), initialization of the floppy disk, on/off, or setting of the clock and buzzer.
This section is structured by the following three keys.

(1) DEVICE : Specifies the output device, format, initializes the floppy disk, sets on/off, clock, or buzzer.

(2) COPY : Starts data output to the printer or the plotter.

(3) FEED : Feeds the printer paper.

4.6.1 DEVICE key

Specifies the output device and format, initializes the floppy disk, sets on/off, clock, or buzzer.
The following soft key menu appears by pressing this key.
The printer is the default.

Soft key menu

[DEVICE]

PRINTER	PLOTTER		FLOPPY		CLOCK	BUZZER

Details on the soft key menu

① PRINTER
Used to select the internal printer as the output device. When this key is pressed, "PRINTER" is inversed, and the following soft key menu appears.

[PRINTER]

MENU OUT						prev menu

①-1 MENU OUT
Selects whether to output all the displayed data (MENU OUT is ON), or to output all the data except for the soft key menu (MENU OUT is OFF) onto the printer. This function is ON when the "MENU OUT" display is inversed.

①-2 prev menu
Returns the soft key menu to the previous display.

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② PLOTTER

Specifies the plotter as the output device.

Our R9833 plotter and "HP-GL" (HP-GL : Hewlett Packard's Graphic Language) specification plotter can be connected to this analyzer. The "PLOTTER" display is inverted by pressing this key, and the following soft key menu appears. The plotter type, output data type, output size, etc. can be set through the soft keys. Figure 4-15 is an example of plotter output.

(Note) The GP-IB address of this analyzer and GP-IB address of the plotter must both be set under the only mode to execute output to the plotter.

[PLOTTER]

TYPE: AT	TYPE: HPGL	DATA: ALL	DATA: SIG	PAPER ADV	plot size	prev menu

②-1 TYPE: AT

Selected to use our plotter R9833. The language used is the HP-GL language, but the plotting position, etc. is set at the optimum position for the R9833. (Default)

②-2 TYPE: HPGL

Selected to use HPGL plotters of other manufacturers.

②-3 DATA: ALL

Selected to plot all the information (except for the soft key menu) displayed on the CRT. (Default)

②-4 DATA: SIG

Selected to plot the waveform information on the CRT alone.

②-5 PAPER ADV

Effective agains plotter with paper feed structure. Sets whether to automatically perform paper feed after plotting. The automatic paper feed function turns on/off each time this key is pressed. The "PAPER ADV" display is inversed while the automatic paper feed function is on.

②-5 plot size

Specifies the size (number of figures on a single sheet, vertical/ horizontal drawing) of the plot.

The following soft key menu appears by pressing this key; specify the size using the soft keys.

[plot size]

A4(H1)	H2	H4	V1	V2	V4	prev menu

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②-5-1 A4 (H1)

One plot is drawn on horizontally-set A4 paper. (Default)

②-5-2 H2

Two plots are drawn on horizontally-set A4 paper.

②-5-3 H4

Four plots are drawn on horizontally-set A4 paper.

②-5-4 V1

One plot is drawn on vertically-set A4 paper.

②-5-5 V2

Two plots are drawn on vertically-set A4 paper.

②-5-6 V4

Four plots are drawn on vertically-set A4 paper.

②-5-7 prev menu

Returns the soft key display to the previous screen.

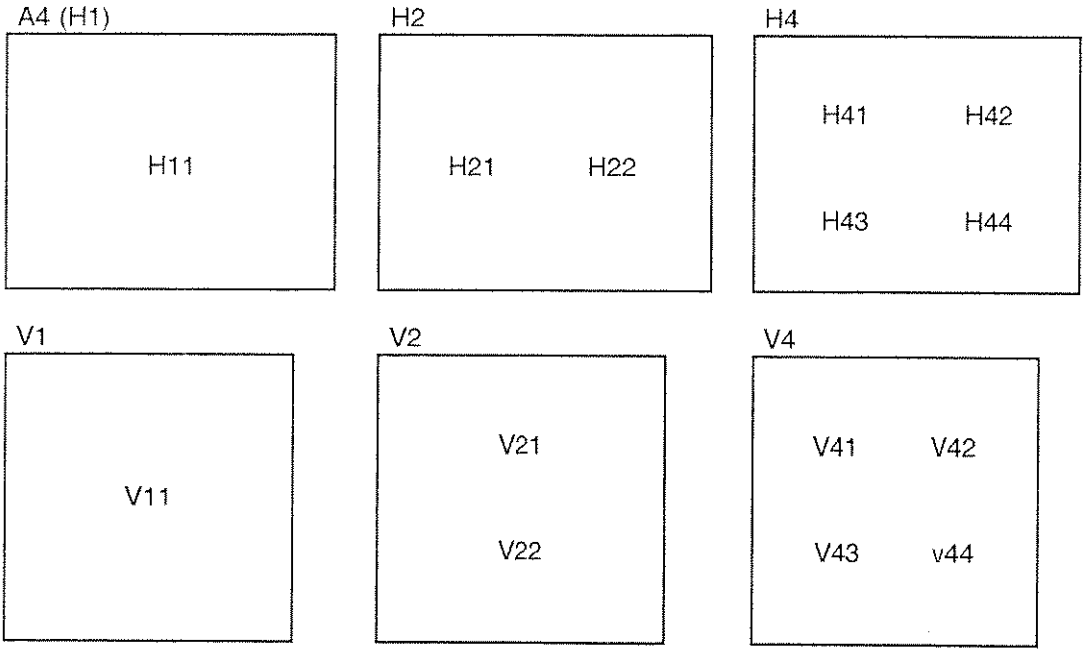
(Note) When the mode is set to allow multiple plots on a single sheet, the [↑] [↓] keys can be used to specify the plotting position. (Normally, plotting is done according to the preset sequence and position.) The information of the position to be plotted next appears on the soft key menu.
When the plot size is changed, the plot position automatically returns to the original position.

②-6 prev menu

Returns the soft key display to the previous screen.

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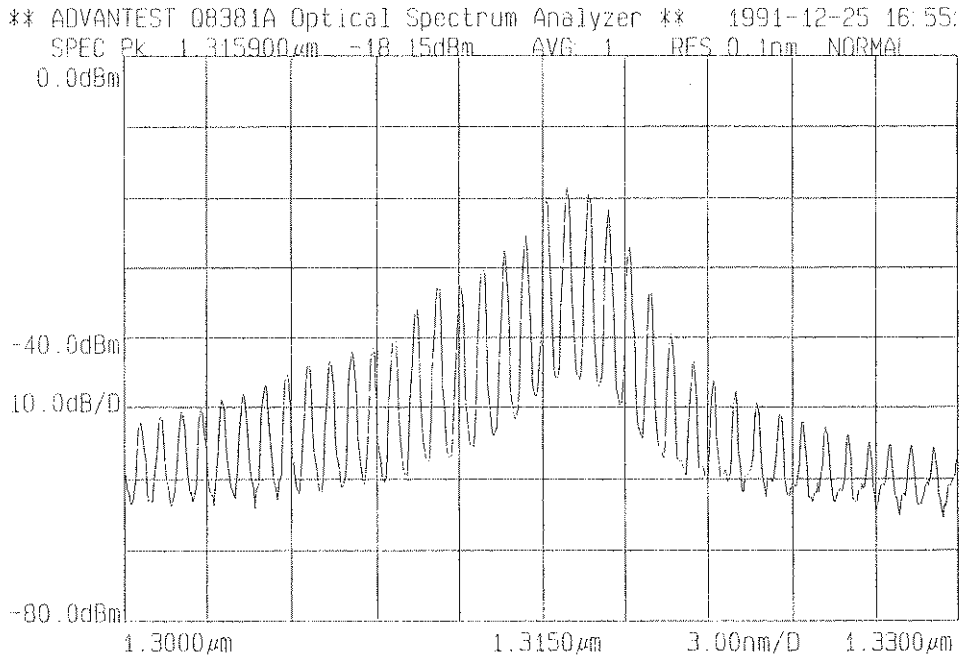
Plotting position and sequence for various plot sizes



* The y value of Hxy, Vxy in the above figure is the plotting sequence.

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(a) H1



A4 horizontal plot

(b) V2

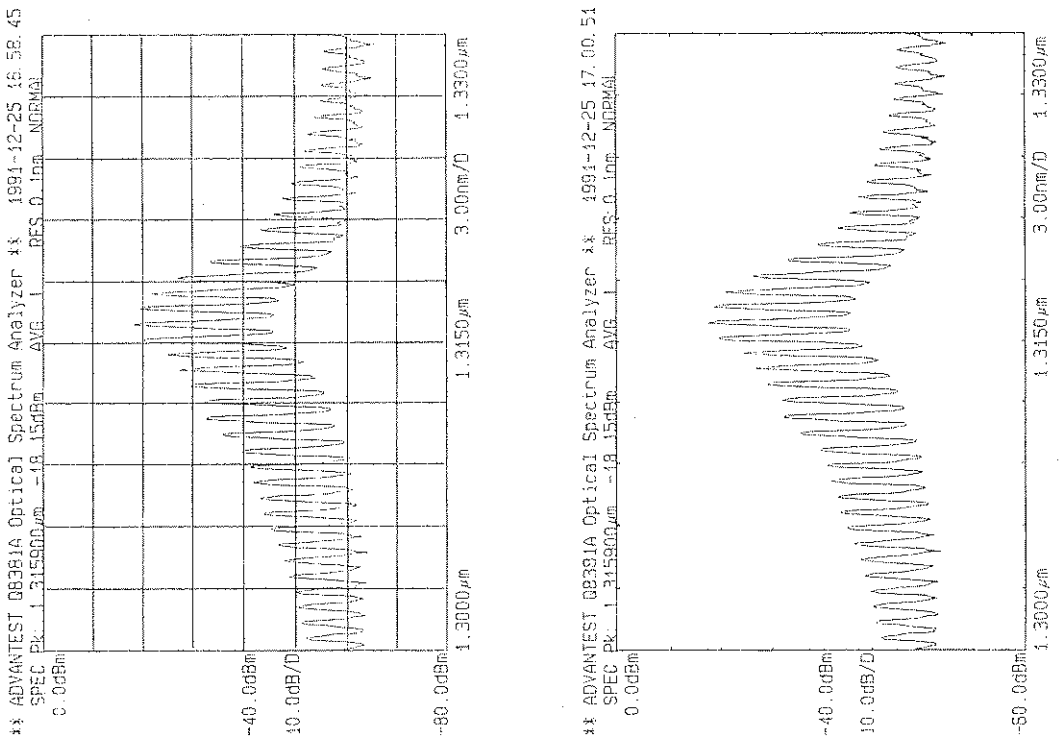


Fig. 4-20 Example of Plotting

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③ FLOPPY

Used to initialize the floppy disk and turn on/off the floppy disk status.
The following soft key menu appears by pressing this key.
(When the floppy disk mode is specified in the SAVE/ RECALL function, the "FLOPPY" display is inversed.)

[FLOPPY]

ON/OFF	DIR		format		volume	prev menu

③-1 ON/OFF

Selects whether to use (ON) or not use (OFF) the floppy disk when saving or recalling the data (SAVE/ RECALL). The default is OFF, and the ON/OFF is switched each time this key is pressed.

③-2 DIR

Used to display the directory information (all the files) of the floppy disk. Figure 4-16 is an example of the display. 16 files are displayed on a single screen, which can be scrolled in page unit by the arrow keys and knob. The directory display is reset and it returns to the normal measurement screen, when panel keys of other sections are pressed.

```
** ADVANTEST Q8381A Optical Spectrum Analyzer **      1991-10-09  18:41:22
      <<<< Directory of floppy-disk (all files) >>>  volume: Q8381A
```

No	file-name	type	size	date	time
001	0850-001	.SPE	3840	91-10-02	14:20
002	0850-002	.SPE	3840	91-10-02	15:11
003	0850-003	.SPE	3840	91-10-05	17:06
004	LD012345	.SPE	3840	91-10-08	09:48
005	LED1550	.PNR	3840	91-10-08	10:04
006	RED01	.DOM	3840	91-10-09	15:55
007	RED02	.DOM	3840	91-10-09	16:01
008	TEST1	.BAS	380	91-10-16	09:53
009	TEST2	.BAS	746	91-10-16	12:44
010	LD1550	.C	1252	91-10-16	19:32
011					
012					
013					
014					
015					
016					

Fig.4-21 Floppy Disk Directory (all files)

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③-3 format

Used to initialize the floppy disk.

The following soft key menu, which is used for initialization of the floppy disk, appears by pressing this key.

[format]

EXECUTE	2DD (720 K)	2HD (1.2 M)			ABORT	prev menu

③-3-1 EXECUTE

Used to start initialization of the floppy disk. Initialization is executed with the specified format and capacity. (Table 4-4 shows the format capacity and maximum number of files.)

By pressing this key, "press 'EXECUTE' once more!!" appears on the screen; press this key once more to start the formatting.

The following message is displayed during the formatting, and 2 beeps are given when the formatting ends. The progress of the formatting is displayed on the left side of the message in form of NN/XX. (NN : number of formatted tracks, XX : Total number of tracks)

"disk formatting in progress ..."

* All keys except the "ABORT" key are ignored during formatting.

Table 4-4 Capacity of the Floppy Disk

Type	Capacity (bytes)	Max. number of files	Applied
2DD (720 K)	730,112	111	NEC-PC/IBM-PC
2HD (1.2 M)	1,250,304	191	NEC-PC

③-3-2 2DD (720 K)

Specifies format capacity of 720 K bytes. (Double sided, double density)

This format is common to the NEC-PC and IBM-PC. (Default)

③-3-3 2HD (1.2 M)

Specified format capacity of 1.2 M bytes. (Double sided, high density)

This format is effective on the NEC-PC.

③-3-4 ABORT

Used to cancel the initialization of the disk.

③-3-5 prev menu

Returns the soft key menu to the previous screen.

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③-4 volume

Used to change the disk volume label. ("Q8381A" or "Q8383" is set as the default volume label.)

Press this key, and the following soft key menu appears to allow setting in the same manner as setting the label.

Characters that can be used for the volume label are the same as the file name. Up to 11 characters can be set. The following characters can be used in the character menu.

Alphabet A to Z, numerals 0 to 9, $ & # % ' - @ _ ^ ( ) { } ~ !

[volume]

←	→	DEL CHR	INS SP	CLR LINE	ENTER	EXIT

③-4-1 ←

Moves the cursor one position to the left in the volume label input buffer.

③-4-2 →

Moves the cursor one position to the right in the volume label input buffer.

③-4-3 DEL CHR

Deletes the character at the cursor position in the volume label input buffer.

③-4-4 INS SP

Inserts a single space at the cursor position in the volume label input buffer. The data at the right side of the cursor shifts 1 character each to the right.

③-4-5 CLR LINE

Erases all the data in the volume label input buffer.

③-4-6 ENTER

Sets the character at the cursor position in the character menu, to the cursor position in label data.

③-4-7 EXIT

Used to exit from the volume label input mode.

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Functions of the keys

(a) Knob

Moves the cursor in the character menu to the left and right to select the desired character. CW (clockwise) moves the cursor to the right, while CCW (counter clockwise) moves the cursor to the left.

(b) Arrow keys

Moves the cursor in the character menu up and down to select the desired character. The [↑] key moves the cursor up, while the [↓] moves the cursor down.

(c) BACK SPACE key

Used to erase 1 character immediately before the cursor.

(d) 0 to 9 keys, – key

Sets the input key data in the cursor position.

(e) ENTER key

Sets the data in the input buffer as the volume label data.
By pressing this key, the volume input mode is reset, and both the character menu and input buffer goes out.

③-5 prev menu

Used to return the soft key menu to the previous display.

④ CLOCK

This analyzer is equipped with a battery-backed-up internal clock function that displays the date and time data on the upper right position of the CRT. This key is used to change the date and time, or to turn on/off the clock display.
The following soft key menu appears by pressing this key. Select the item to be changed by the soft key, and change the data by the [↑] key, [↓] key, or the knob.
The setting is increased by the [↑] key or by turning the knob to the CW (clockwise) direction, and decreased by the [↓] key or by turning the knob to the CCW (counter clockwise) direction.

[CLOCK]

ON/OFF	YEAR	MONTH	DAY	HOUR	MINUTE	prev menu

④-1 ON/OFF

Sets whether or not to display the clock. The ON/OFF mode is switched each time this key is pressed.

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④-2, 3, 4, 5, 6 YEAR, MONTH, DAY, HOUR, MINUTE
Used to change the year, month, day, hour and minute.

④-7 prev menu
Returns the soft key menu to the previous screen.

⑤ BUZZER
Controls the conditions to activate the buzzer. The following soft key menu appears by pressing this key.

[BUZZER]

BEEP	WARNING				QUIET	prev menu

⑤-1 BEEP
Sets whether to beep or not when the panel key is pressed.
The panel key beeps each time it is pressed when the "BEEP" display is inversed.

⑤-2 WARNING
Sets whether to beep when illegal setting is attempted when setting the measurement conditions, etc.
A relatively low beep is given when illegal setting is attempted, while the "WARNING" display is inversed.

⑤-3 QUIET
Used to decrease the sound of the buzzer.
The buzzer given when the panel key is pressed or when illegal operation is attempted will become somewhat quieter while the "QUIET" display is inversed.

⑤-4 prev menu
Returns the soft key menu to the previous screen.

4.6.2 COPY key

Used to start data output. Pressing this key starts data output to the printer or plotter under the conditions set by the DEVICE Key. The LED is on while the data is output. The LED turns off when the output ends. The plotter output can be stopped by pressing this key while the LED is on. (If the plotter has internal buffer, the plotting does not always stop immediately after this key is pressed.)

4.6.3 FEED key

This key is used to feed the paper.
About 5 mm of paper is fed by pressing this key.

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4.7 GP-IB Section

This section sets the GP-IB address, switches to local operation, and displays the GP-IB status. This section is structured by the LOCAL (ADDRESS) key and four status LEDs.

4.7.1 LOCAL (ADDRESS) key

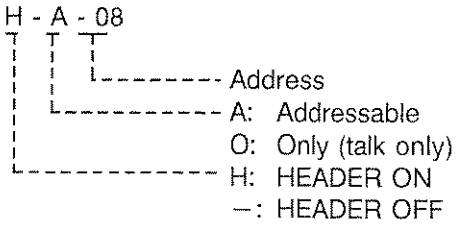
When the "REMOTE" LED is on, this key is used to switch from the remote status to the local status. (In the local status, other keys on the panel are enabled.)
When the "REMOTE" LED is off, this key is used to set the GP-IB address. The following soft key menu appears to enable setting, by pressing this key.

Soft key menu

[GPIB]

HEADER	ONLY	ADR UP	ADR DOWN			

How to read the displayed setting value



Details of the soft key menu

① HEADER
Sets whether to add the header when sending data through the GP-IB. The ON/OFF display is switched each time this key is pressed. (The default is OFF)
When HEADER is on, the "HEADER" display is inversed.

② ONLY
Switches the mode between the talk only mode (used for plotter output) and the addressable mode (mode that receives address designation from external controller).
ONLY < > ADDRESSABLE is switched each time this key is pressed.
When the ONLY mode is selected, the "ONLY" display is inversed.

③ ADR UP, ADR DOWN

0 to 30 GP-IB addresses can be set in this analyzer. "ADR UP" increments the address by 1, and "ADR DOWN" decrements the address by 1.
The [↑] key can be used instead of the "ADR UP" key, and the [↓] key instead of the "ADR DOWN" key.

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4.7.2 Status lamps

The following four LEDs indicate the GP-IB status.

① SRQ : Lights while this analyzer is transmitting the service request signal onto the GP-IB bus.

② TALK : Lights when it is under the talker status that allows data transmission.

③ LISTEN : Lights when it is under the listener status that allows data reception.

④ REMOTE : Lights when the analyzer can be controlled from external devices. All panel keys except LOCAL are disabled while this LED is on.
This LED turns off by pressing the LOCAL key. (When the universal command LLO "Local LockOut" is not set.)

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4.8 Other Keys

In addition to the keys describe above, the INSTR PRESET key and CAL key are provided to initialize the analyzer and perform level calibration, respectively.

4.8.1 INSTR PRESET key

Used to set the panel setting to the initial status or to execute the self diagnosis function. The following soft key menu appears by pressing this key.

Soft key menu

[INSTR PRESET]

PRESET					SELF TEST	

Details of the soft key menu

① PRESET
Initializes the panel setting of this analyzer. The following table shows the initial status.

Table 4-5 Initial Status by INSTR PRESET

Item	Setting
① CENTER	1.050 μm, APC:OFF
② SPAN	1400 nm (0.35 μm to 1.75 μm)
③ REF LEVEL	0 dBm, AUTO:OFF
④ LEVEL SCALE	LOG, 10 dB/DIV
⑤ AVG	1 (OFF)
⑥ SWEEP MODE	NORMAL
⑦ RESOLUTION	5 nm
⑧ Measurement	Stop status
⑨ Cursor	All off, normal mode
⑩ Display	Spectrum display single screen, grid on
⑪ Normalization	All off
⑫ Spectral width operation	"Pk. -xdB" XdB: 3 dB, YdB : 20 dB K: 1.0, Kr(RMS): 2.3548
⑬ CURVE FIT	OFF
⑭ Output device	Printer (MENU OUT : off)
⑮ Clock display	ON
⑯ Buzzer	BEEP, WARNING: ON QUIET: OFF
⑰ Label	** ADVANTEST Q8381A Optical Spectrum Analyzer **
⑱ Power monitor	λ: 1.55 μm, N-MAX: 101, INTERVAL: 0.1 sec

(Note) • Items other than above cannot be changed.
• In the case of the Q8383, the items are modified as CENTER; 1.150 μm, SPAN; 1200 nm (0.55 μm to 1.75 μm), and Label; "Q8383" instead of "Q8381A".

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Operate the key as follows to change the initial status.

SAVE → sav panel → 9 → 9 → ENTER

The above operation stores the current panel conditions as the initial status.
The analyzer can be returned to the original initial status (the setting of Table 4-5) after changes are made, by the following key operation.

SAVE → sav panel → 0 → 0 → ENTER

② SELF TEST

Used to execute the self diagnosis function.
The CRT displays the following screen by pressing this key. The result of self diagnosis is sequentially displayed. If no error is detected, it returns to the previous measurement data display screen.
If error is detected, the error item is displayed with the error code, and the operation stops. (If error occurred in the backup RAM item, operation does not stop and the diagnosis continues. Three beeps are given after the diagnosis is completed.
"backup memory destroyed!! > press any key for continue."
is displayed as error message. Press any panel key to return to the measurement screen.)

```
************************************************
*      Q8381A Optical Spectrum Analyzer        *
*                          rev. A00/A00        *
*                    MFD by ADVANTEST CORP.    *
************************************************
      SELF-TEST in progress·····

   item                          judge      code
(1) ROM                          PASS
(2) RAM                          PASS
(3) backup RAM                   PASS
(4) peripheral                   PASS
(5) measurement block            PASS
```

Fig.4-22 Self Diagnosis Function Screen

(Note) In case "FAIL" is detected as result of the self diagnosis, record the item and error code, and notify details to the ATCE, nearest sales station, or your agent. The address and phone number are given at the end of this book.

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4.8.2 CAL key

Used to calibrate the wavelength or level of this analyzer.
Input a light source of a known wavelength or level, execute measurement, and then press this key.
When calibrating with the level of the optical power meter value as reference, use light source with single spectrum. Light source with wide spectral width will result in difference between the peak level of spectrum measured by this analyzer and the measurement of the optical power meter. (Note that the spectral width of the input light source will have no effect when calibrating the level of the power monitor mode.)
When level calibration is executed, the same calibration data is applied to the entire area of the measurable wavelength range.
The following soft key menu used for calibration appears by pressing this key.

Soft key menu

[CAL]

λ	LEVEL (SP)	LEVEL (PW)			EXECUTE	CAL VALID

Details of the soft key menu

① λ
Used to calibrate the wavelength.
Press this key, and then input the known wavelength data of the input signal through the numeric keys.
The "λ" display is inversed by pressing this key, indicating that it is ready for wavelength calibration. The wavelength calibration mode is reset by pressing this key again.
This key is effective only when under the spectrum measurement status.

② LEVEL (SP)
Used to calibrate the spectrum measurement level.
Press this key, and then input the known level data of the input signal through the numeric keys.
The "LEVEL (SP)" display is inversed by pressing this key, indicating that it is ready for wavelength calibration. The level calibration mode is reset by pressing this key again.
This key is effective only when under the spectrum measurement status.

③ LEVEL (PW)
Used to calibrate the level of the power monitor measurement.
Press this key, and then input the known level data of the input signal through the numeric keys.
The "LEVEL (PW)" display is inversed by pressing this key, indicating that it is ready for wavelength calibration. The level calibration mode is reset by pressing this key again.
This key is effective only when under the power monitor measurement status.

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④ EXECUTE

Used to execute the wavelength/level calibration. The calibration data is calculated from the difference between the data input in ①, ②, ③ and the measured peak wavelength/level data.

If the calibration data exceeds ± 9.9 nm or ± 9.9 dB, warning beep is given with the following message when this key is pressed.

"illegal λ/level data input!!"

⑤ CAL VALID

Used to enable the calibration data. The calibration data is effective when the "CAL VALID" display is inversed. This calibration data is added to the measured wavelength/level and displayed.

The calibration data is disabled by pressing this key again, and the measurement data is displayed using the default calibration data only.

Once calibration is executed, this calibration data is stored in the internal backup memory.

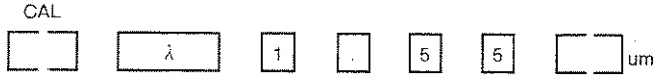
< Operation example >

(1) Wavelength calibration

Operation procedure

① Input the wavelength of a known light source, and execute measurement of the spectrum. (Turn off "CAL VALID".)

② When the known wavelength is 1.55 um, enter this data as follows.



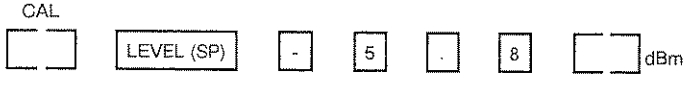
③ Execute the calibration by pressing the "EXECUTE" soft key, and then press "CAL VALID" to enable the calibration data.

(2) Level calibration in spectrum measurement

Operation procedure

① Input the known level of a single spectrum light source, and perform spectrum measurement. (Turn off "CAL VALID".)

② When the known level is −5.8 dBm, enter this data as follows.



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③ Execute the calibration by pressing the "EXECUTE" soft key, and then press "CAL VALID" to enable the calibration data.

* The power monitor measurement level calibration can be done by measuring under the power monitor mode, and then performing the above steps ② (using the LEVEL (PW) key)and ③.

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5. SOFT KEY MENU FUNCTIONS (SUMMARY)

The soft keys can be classified into those that start operation as soon as they are pressed, those that display the soft key menu, and those that allow input of the setting data.
There are soft keys that executes the operation as soon as they are pressed, those that make selections, or those that enters the nesting. (Generally saying, soft key menu described by lower case alphabets display the menu of other nesting.)
The knob is used to set the function (CENTER, SPAN, REF LEVEL, etc.) or to move the cursor, but when the LED of the key corresponding to the cursor is on, the cursor move has the priority.
The following is the contents of Chapter 5.

Table of Contents

5. SOFT KEY MENU FUNCTIONS (SUMMARY) 5-1
5.1 FUNCTION Section 5-2
5.2 CURSOR Section 5-6
5.3 DATA Section 5-7
5.4 DISPLAY Section 5-8
5.5 DATA OUT Section 5-16
5.6 GP-IB Section 5-20
5.7 Others 5-21*

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5.1 FUNCTION Section

This section consists of keys used to set the most basic measurement conditions of the optical spectrum analyzer.

CENTER

Sets the center waveform for analysis.
The numeric keys, knob, arrow keys, soft keys are enabled.

<Softkey menu>

PEAK	The peak level wavelength is set as the center wavelength.
CURSOR	The wavelength at the cursor is set as the center wavelength. When two cursors are displayed, the wavelength at the middle position is set as the center wavelength.
AUTO PKC	Selects the APC (Auto Peak Center) function that automatically sets the peak wavelength as the center wavelength when the measurement ends and performs measurement again.

SPAN

Sets the analysis wavelength span, start, stop wavelength. The numeric keys, knob, arrow keys, soft keys are enabled.

<Softkey menu>

SPAN	Sets the analyzed wavelength span.
START	Sets the start wavelength.
STOP	Sets the stop wavelength.
$\triangle\lambda \rightarrow$SPAN	Sets the part sandwiched by two wavelength (X) cursors as the span.
0.35 to 1.0 or 0.55 to 1.0	Sets the short wavelength area (Q8381A : 650 nm from 0.35 to 1.0, and Q8383 : 450 nm from 0.55 to1.0) as the span.
0.9 to 1.75	Sets the long wavelength area (850 nm from 0.9 to 1.75) as the span.
FULL	Sets the maximum span (1400 nm from 0.35 to 1.75).

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REF LEVEL

Sets the display range of the level axis.
The numeric keys, knob, arrow keys, soft keys are enabled.

<Softkey menu>

PEAK	Sets the measured peak level as the REF level.
CURSOR	Sets the level cursor position as the REF level. When two cursors are displayed, the sandwiched area is set as the display range.
MAX HOLD	Selects the maximum hold mode in each wavelength. ON/OFF operation.
AUTO	Selects the optimum REF level according to the input signal. ON/OFF operation (inverse/normal display).

LEVEL SCALE

Switches between linear and log display, and sets the scale for log display.
The numeric keys, knob, arrow keys, soft keys are enabled.

<Softkey menu>

LIN/LOG	Switches between linear and log display.
10 dB/D	Sets the log scale at 10 dB/DIV.
5 dB/D	Sets the log scale at 5 dB/DIV.
2 dB/D	Sets the log scale at 2 dB/DIV.
1 dB/D	Sets the log scale at 1 dB/DIV.
0.5 dB/D	Sets the log scale at 0.5 dB/DIV.
0.2 dB/D	Sets the log scale at 0.2 dB/DIV.

AUTO

Automatically sets the optimum wavelength span, level etc. to match the input signal. The following soft keys can be used.

<Softkey menu>

FULL	Searches for the optimum conditions within the entire measured wavelength range, and sets the result.
0.35 to 1.0 or 0.55 to 1.0	Searches the optimum conditions within the range of 0.35 μm to 1.0 μm (Q8381A) or 0.55 μm to 1.0 μm (Q8383), and sets the result.
0.9 to 1.75	Searches for the optimum conditions within the range of 0.9 μm to 1.75 , and sets the result.
ABORT	Stops execution of the AUTO function.

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AVG

Sets the averaging count and controls on/off of the averaging process. The numeric keys, knob, arrow keys, soft keys are enabled.

<Softkey menu>

1 (OFF)	Sets the averaging count at 1 (OFF).
2	Sets the averaging count at 2.
5	Sets the averaging count at 5.
10	Sets the averaging count at 10.
20	Sets the averaging count at 20.
50	Sets the averaging count at 50.
100	Sets the averaging count at 100.

SWEEP MODE

Selects the sweep mode.
The numeric keys, knob, arrow keys, soft keys are enabled.

<Softkey menu>

NORMAL	Selects sweep mode "NORMAL". Measures relatively high level signal with high speed.
ADAPTIVE	Selects sweep mode "ADAPTIVE". Measures signals that requires both speed and sensitivity. Also measures pulse light (flash light) by external synchronization signal (GATED MEAS INPUT).
HI-SENS1	Selects sweep mode "HI-SENS 1". Measures low level signal stably. The measurement sensitivity is about −80 dBm.
HI-SENS2	Selects sweep mode "HI-SENS 2". Measures low level signal in wide dynamic range. The measurement sensitivity is about −85 dBm.
PULSE	Selects sweep mode "PULSE". Measures the pulse light by measuring the peak level within the gate time.
Gate Time	Sets the measurement gate time for pulse light measurement mode.
△λ→SWEEP	Selects the mode (PARTIAL SWEEP) that sweeps the area sandwiched by two wavelength (X) cursors. Switches between on/off each time pressed.

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RESOLUTION



Sets the wavelength resolution.
The numeric keys, knob, arrow keys, soft keys can be used.

<Softkey menu>

0.1 nm	Sets the resolution at 0.1 nm.
0.2 nm	Sets the resolution at 0.2 nm.
0.5 nm	Sets the resolution at 0.5 nm.
1.0 nm	Sets the resolution at 1.0 nm.
2.0 nm	Sets the resolution at 2.0 nm.
5.0 nm	Sets the resolution at 5.0 nm.

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5.2 CURSOR Section

ON/OFF

Turns on/off the cursor display, and selects the display format of the cursor data. The soft keys can be used.

<Softkey menu>

NORMAL	This mode displays the cursor position wavelength and level as are.
△MODE	This mode displays the wavelength difference, level difference at the cursor position.
2ND PEAK	This mode displays the wavelength difference, level difference between the peak and the 2nd peak.
POWER	This ode displays the total level (power) between the wavelength cursors.
LEFT PK	Moves the current wavelength cursor 1 to the left peak position.
RIGHT PK	Moves the current wavelength cursor 1 to the right peak position.

λ1

Controls the on/off of wavelength cursor 1.

λ2

Controls the on/off of wavelength cursor 2.

L1

Controls the on/off of level cursor 1.

L2

Controls the on/off of level cursor 2.

Note: When the LEDs on λ1, λ2, L1, L2 are on, the cursor can be moved.

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5.3 DATA Section

This section includes the numeric keys, unit keys, arrow keys, used to change the setting data, and the LABEL key to enter the comment.

LABEL [ ]

Changes the label (comment).
The numeric keys, knob, arrow keys, soft keys can be used.

<Softkey menu>

←	Moves the cursor in the label input buffer to the left.
→	Moves the cursor in the label input buffer to the right.
DEL CHR	Erases the character at the cursor position in the label input buffer.
INS SP	Inserts a space in the cursor position in the label input buffer.
CLR LINE	Clears all the data in the label input buffer.
ENTER	Sets the character currently selected in the character menu.
UNDO	Returns the label data to the status before the LABEL key was pressed.

Keys that can be used to change the label

- Knob : Moves the cursor in the character menu to the left and right.
- [↑] [↓] : Moves the cursor in the character menu up and down.
- BACK SPACE [ ] : Erases the character immediately before the cursor in the label input buffer.
- [ ] ENTER : Sets the data in the label input buffer as the label data. This key resets the label setting mode.

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5.4 DISPLAY Section

This section consists of keys used to set the display format, to analyze the measurement data, and to save and recall data.

CONTROL
[ ] Sets the display mode.
The soft keys can be used.

<Softkey menu>

- DUAL — Controls on/off of the dual screen mode.
- S.IMPOSE — Controls on/off of the super impose mode.
- 3D — Sets the on/off as well as display conditions of the 3-dimensional display mode.
  - 3D ON/OFF — Controls on/off of the 3-dimensional display mode.
  - INC ANGLE — Increases the display angle by 1 step (15°). (Max.: +75°)
  - DEC ANGLE — Decreases the display angle by 1 step (15°). (Min.: −75°)
  - CSR NEXT — Moves the cursor to the next measurement data.
  - DELETE — Deletes the measurement data where the cursor number is set.
  - more — Displays the next soft key menu.
    - CLEAR — Clears all previous 3-dimensional display data memory.
    - INC N — Increases the maximum display data by +1. (Max. : 16)
    - DEC N — Decreases the maximum display data by −1. (Min. : 2)
    - N LOCK — Sets whether to stop the measurement when measurement of the maximum number of display data ends. Switches between on/off each time pressed.
    - ROLL — On/off control of the roll display mode (mode where the data is overwritten from the old data when it exceeds the maximum display data).
    - RECALL — Calls and displays the previous 3-dimensional display data.
    - prev menu — Displays the previous soft key menu.
  - prev menu — Displays the previous soft key menu.
- GRID — Controls the on/off of the grid of the data display frame.
- act U&L — Controls on/off (inverse/normal display) of the mode that updates the upper/lower screen data in dual screen display.
- xcng U/L — Switches the upper and lower screens in the dual screen display.

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SAVE

Stores (saves) the measurement data, panel conditions in the internal memory. Numeric keys, knob, arrow keys, soft keys can be used.

<Softkey menu>

SAV REF	Stores the current measurement data into the reference memory.
SAV MEAS1	Stores the current measurement data in measurement data memory 1.
SAV MEAS2	Stores the current measurement data in measurement data memory 2.
SAV MEAS3	Stores the current measurement data in measurement data memory 3.
sav meas	Stores the current measurement data in measurement data memory 1 to 32 or in the floppy disk. This key displays the measurement data directory.

SAVE	Stores the current measurement data in the selected number.
DELETE	Deletes the data of the selected number.
RECOVER	Recovers the memory/file deleted by DELETE.
name	Used to set specific memory name/file name. Displays the name input character menu. (Max. 8 characters)

←	Moves the name input cursor 1 character to the left.
→	Moves the name input cursor 1 character to the right.
↑ (No)	Selects one previous memory/file number.
↓ (No)	Selects the next memory/file number.
CLR LINE	Clears the input name
ENTER	Sets the selected character of the character menu as the data.
prev menu	Displays the previous soft key menu.

EXIT	Exits from the measurement data save mode and returns to the normal mode.

sav panel	Stores the current panel conditions in condition setting memory 1 to 10 or in the floppy disk. This key displays the condition setting directory information.

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SAVE	Stores the current measurement conditions in the selected number.
DELETE	Deletes the conditions of the selected number.
RECOVER	Recovers the memory/file deleted by DELETE.
name	Used to set specific name beside the name. The character menu to set the name is displayed by pressing this key. (Max. 8 characters)

←	Moves the name input cursor 1 character to the left.
→	Moves the name input cursor 1 character to the right.
↑ (No)	Selects the previous memory/file number.
↓ (No)	Selects the next memory/file number.
CLR LINE	Clears the input name.
ENTER	Sets the selected character of the character menu as the data.
prev menu	Displays the previous soft key menu.

EXIT	Exits from the panel condition save mode. The panel condition directory information display goes out to return to normal measurement data display.

Keys that can be used by 'sav meas', 'sav panel'

- Knob : ① Selects the number in the directory window.
  ② Moves the cursor in the character menu to the left and right.
- [↑] [↓] : ① Selects the number in the directory window.
  ② Moves the cursor in the character menu up and down.
- BACK SPACE [ ] : Erases 1 character in the name data immediately before the cursor position.
- [ ] ENTER : Sets the data in the name input buffer as the memory name/file name.

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RECALL

Reads (RECALL) the measurement data, panel conditions from the internal memory or floppy disk.
Numeric keys, knob, arrow keys, soft keys can be used.

<Softkey menu>

RCL REF — Recalls the data from the reference memory.

RCL MEAS1 — Recalls the data from the measurement data memory 1.

RCL MEAS2 — Recalls the data from the measurement data memory 2.

RCL MEAS3 — Recalls the data from the measurement data memory 3.

rcl meas — Recalls the data from measurement data memory 1 to 32, or floppy disk.
The directory information of the current measurement data is displayed by pressing this key.

- RECALL — Recalls the measurement data from the selected number.
  After recalling the data, the directory information goes off and returns to normal measurement data display.
- EXIT — Exits from the recall mode and returns to normal mode.
  The measurement data directory information display goes out to return to normal measurement data display.

rcl panel — Recalls the panel condition setting from memory 1 to 10, or from the floppy disk.
The directory information of the current panel conditions is displayed by pressing this key.

- RECALL — Recalls the panel setting conditions from the selected number.
  After recalling the data, the directory information goes off and returns to normal measurement data display.
- EXIT — Exits from the panel condition setting recall mode and returns to normal mode.
  The panel condition setting directory information display goes out to return to normal measurement data display.

Keys that can be used by 'rcl meas', 'rcl panel'

- Knob : Selects the memory/file number in the directory window.
- ↑ ↓ : Selects the memory/file number in the directory window.

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NORMALIZE
LOSS/TRANS

Normalizes and displays the measurement data with the maximum value of the stored reference memory or measurement data.

<Softkey menu>

Pk.NORM

Sets the mode to normalize and display the measurement data at the maximum value level.

MEM NORM

Selects the data to be operated with the reference memory.
The measurement data memory 1 (inversed) or the measurement data (normal). Cannot be turned on (inversed) unless both the reference memory and the measurement data memory 1 are stored.
Automatically selects "LOSS" when ON (inversed) is set.

LOSS

Sets the operation/display modes of the loss characteristics (REF/MEAS or REF/MEAS-MEM1).
It switches between the loss characteristics mode and normal mode each time this key is pressed. This mode turns off when "TRANS" is pressed.
This key is disabled when data is not stored in the reference memory (REF), or when the reference wavelength condition of the reference memory is different from the current status.

TRANS

Sets the operation/display modes of the transparency characteristics (MEAS/REF or MEAS-MEM1/REF).
It switches between the transparency characteristics mode and normal mode each time this key is pressed. This mode turns off when "LOSS" is pressed. This key is disabled when data is not stored in the reference memory (REF), or when the reference wavelength condition of the reference memory is different from the current status.

SAV REF

Stores the current measurement data in the reference memory.

SAV MEAS1

Stores the current measurement data in measurement data memory 1.

FUNC MENU

Controls whether to change the soft key menu when the FUNCTION section key is pressed. Turns on/off each time the key is pressed.
When this key is on (inversed), the soft key menu corresponding to the FUNCTION section keys is displayed.

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SPECTRAL WIDTH [ ] Executes and displays the spectrum width operation. The following four calculation types are available.

<Softkey menu>

Pk.–XdB	Calculates and displays the spectrum width by the XdB method.
ENVELOPE	Calculates and displays the spectrum width by the envelope method.
RMS	Calculates and displays the spectrum width by the RMS method.
Peak RMS	Calculates and displays the spectrum width by the peak RMS method.
parameter	Sets parameter to calculate the spectrum width.

XdB	Sets the down level difference X from the peak. (Initial value is 3 dB.)
YdB	Sets the peak threshold level Y. (Initial value is 20 dB.)
K	Sets the coefficient K to be multiplied to the calculated spectrum width. (Initial value is 1.0.)
Kr(RMS)	Sets the coefficient Kr to be multiplied in the RMS method and peak RMS method. (Initial value is 2.3548).
prev menu	Displays the previous soft key menu.

FUNC MENU	Controls whether to change the soft key menu when the FUNCTION section keys are pressed.

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ADVANCE

Used to select the curve fit, luminosity display, and power monitor display.

<Softkey menu>

CURVE FIT — Curve-fits and displays the measured spectrum waveform to a specific secondary function waveform. Turns on/off each time this key is pressed.

DOMINANT — Selects the mode to add luminosity offset against the measured data and display the result. Turns on/off each time this key is pressed. (Enable for Q8381A only)

power-mon — Used to select the power monitor display function. This key displays the following soft key menu.

- ON/OFF — Sets the power monitor display on/off.
- search λ — Used to automatically set the wavelength setting of the power monitor operation as the peak wavelength.
- set λ — Used to set the wavelength of the power monitor operation. The wavelength is set by pressing this key, and then the numeric keys, knob, and arrow keys to set the value. (Initial value is 1.55 μm)
- N-MAX — Sets the number of measurement points of the trend display under the power monitor display mode. Press this key, and then the numeric keys, knob, and arrow keys to set the value. (Initial value is 101.)
- INTERVAL — Sets the data sampling interval in the power monitor display. Same as the measurement interval in trend display. (Initial value is 0.1 sec.)
- prev menu — Displays the previous soft key menu.

O.AMP — Used to calculate the gain/noise figure of the optical amplifier. This key displays the following soft key menu.

- NF (s-sp) — Selected to perform the noise figure calculation by only the item of the beat noise between the signal light and the spontaneous.
- NF (total) — Selected to perform the noise figure calculation by the total noise of 4 items.
- Σ PASE — Calculates the total power of ASE in the area between two cursors.
- FIT MEM-3 — Specifies whether to use the data of memory 3 when the ASE level is obtained. ON/OFF operation.
- SPE DIV — Specifies whether to perform the compensation by the measured input signal spectrum when the ASE level is obtained. ON/OFF operation.

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parameter — Sets parameter to calculate the gain and the noise figure.

- K — Sets the coefficient K to be multipled to the calculated noise figure. (Initial value is 1.0.)
- SPAN-A — Sets the range A of the measurement data area used when the ASE level is obtained. (Initial value is 2 nm.)
- SPAN-B — Sets the range B of the measurement data area used when the ASE level is obtained. (Initial value is 5 nm.)
- FILTER $\Delta\lambda$ — Sets the valid light filter width used when the noise figure is obtained by the total noise of 4 items. (Initial value is 3 nm.)
- Pin LOSS — Sets the level difference between the signal input to optical amplifier and the signal in this analyzer at measurement. (Initial value is 0 dB.)
- Pin LOSS — Sets the level difference between the signal output to optical amplifier and the signal in this analyzer at measurement. (Initial value is 0 dB.)
- prev menu — Displays the previous soft key menu.

prev menu — Displays the previous soft key menu.

WDM — Used to calculate the gain/noise figure of the optical amplifier in the wavelength multiplex method. Pressing this key displays the following soft key menu.

- on/off — Turns on/off the list display of gain/noise figure of the optical amplifier for each signal light.
- AUTO — Selects to obtain the PASE curve automatically or to obtain it by setting parameters. ON/OFF operation.
- Σ PASE — Two cursors are displayed on the PASE curve. The total power in the area between two cursors is calculated.
- FIT-MEM3 — Specifies whether to use the data of memory 3 when the ASE level is obtained. ON/OFF operation.
- LIST ALL — Specifies to display or not to display the gain/noise figure of up to 16 signal lights of the optical amplifier by using all of screen. ON/OFF operation.

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parameter — Sets parameter to calculate the gain and the noise figure.

- Y-dB — Sets the peak threshold level Y. (Initial value is 20 dB. Peak at the peak threshold level Y or over is used.) Calculates the gain and the noise figure.
- K — Sets the coefficient K to be multiplied to the calculated noise figure. (Initial value is 1.0.)
- SPAN-A — Sets the inside range of the measurement data used when the PASE curve is obtained. (Initial value is 1.0 mm.)
- SPAN-B — Sets the outside range of the measurement data used when the PASE curve is obtained. (Initial value is 1.5 mm.)
- PEAK→ — Selects the next right signal light when SPAN-A/B is set.
- PEAK← — Selects the next left signal light when SPAN-A/B is set.
- prev menu — Displays the previous soft key menu.

prev menu — Displays the previous soft key menu.

FUNC MENU — Controls whether to change the soft key menu when the FUNCTION section keys are pressed.

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5.5 DATA OUT Section

This section consists of keys used for output of the measurement data, initialization and on/off of the floppy disk, and setting of the clock (calendar) and buzzer.

DEVICE

Sets the output device, specifies the format, initializes and sets/resets the floppy disk, and sets the clock and buzzer.
The following soft keys are available.

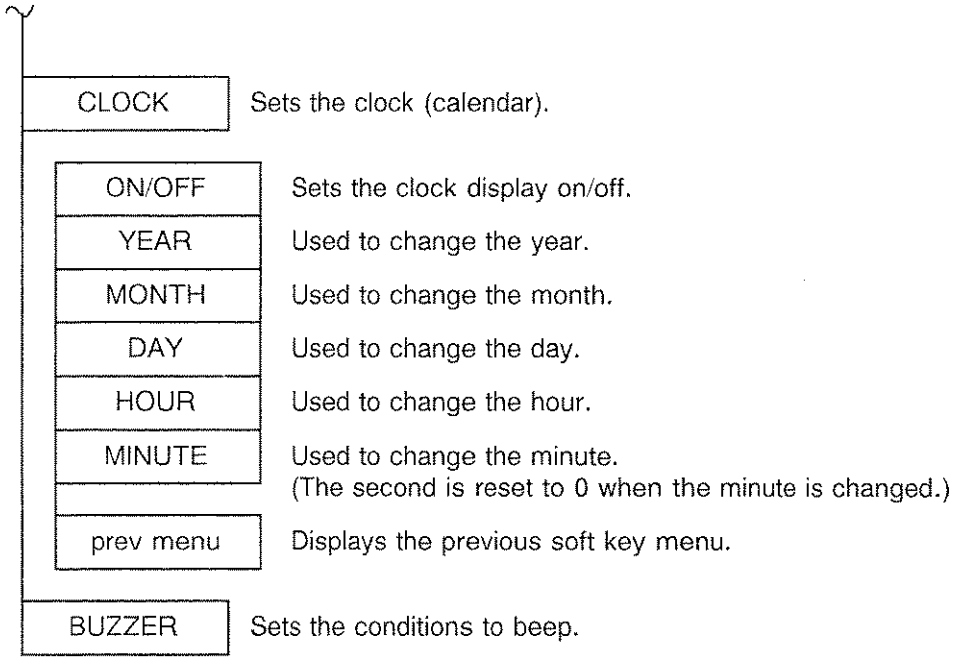
< Softkey menu >

- PRINTER — Selects the internal printer as the output device.
  - MENU OUT — Controls whether to output the soft key menu on the printer.
  - prev menu — Displays the previous soft key menu.
- PLOTTER — Selects the GP-IB plotter as the output device.
  - TYPE: AT — Our R9833 plotter is used.
  - TYPE: HPGL — HPGL-specification plotter is used.
  - DATA: ALL — Plots all the information displayed on the CRT.
  - DATA: SIG — Plots only the waveform information displayed on the CRT.
  - PAPER ADV — Sets on/off the automatic paper feed structure.
  - plot size — Specifies the plot size. (Number of figures to be plotted on a single sheet, vertical and horizontal size.)
    - A4 (H1) — One figure is to be plotted on horizontal A4 paper.
    - H2 — Two figures are to be plotted on horizontal A4 paper.
    - H4 — Four figures are to be plotted on horizontal A4 paper.
    - V1 — One figure is to be plotted on vertical A4 paper.
    - V2 — Two figures are to be plotted on vertical A4 paper.
    - V4 — Four figures are to be plotted on vertical A4 paper.
    - prev menu — Displays the previous soft key menu.
  - prev menu — Displays the previous soft key menu.

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- FLOPPY — Initializes the floppy disk, and controls on/off the floppy disk status.
  - ON/OFF — Sets whether to use the floppy disk for save and recall. The floppy disk is used when ON.
  - DIR — Used to display the directory information of all the files in the floppy disk.
  - format — Used to initialize the floppy disk.
    - EXECUTE — Executes initialization of the floppy disk.
    - 2DD (720 K) — Selects format capacity 2DD-720K. (Common to NEC-PC and IBM-PC.)
    - 2HD (1.2 M) — Selects format capacity 2HD-1.2M. (NEC-PC)
    - ABORT — Cancels the initialization of the floppy disk.
    - prev menu — Displays the previous soft key menu.
  - volume — Used to add volume label to the floppy disk.
    - ← — Moves the cursor in the input buffer one position to the left.
    - → — Moves the cursor in the input buffer one position to the right.
    - DEL CHR — Deletes the character at the cursor position in the input buffer.
    - INS SP — Inserts a space at the cursor position in the input buffer.
    - CLR LINE — Clears all the data in the input buffer.
    - ENTER — Sets the character at the cursor position in the character menu into the input buffer.
    - EXIT — Used to exit from the volume label input mode.
  - prev menu — Displays the previous soft key menu.

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COPY
Used to start data output.

FEED
Used to start paper feed to the printer.

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5.6 GP-IB Section

This section is used to specify the GP-IB address and switch to local operation.

LOCAL
[ ]
ADDRESS

Sets the GP-IB address (when the REMOTE lamp is off), or switches to local operation (when the REMOTE lamp is on).

< Softkey menu >

HEADER	Sets whether to add header when outputting the data.
ONLY	Switches between talk only mode (effective for plotter output) and addressable mode (mode to receive external controller address designation).
ADR UP	Increments the GP-IB address by 1.
ADR DOWN	Decrements the GP-IB address by 1.

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5.7 Others

CAL

Calibrates the wavelength, level.

<Softkey menu>

λ	Used to input the wavelength calibration data.
LEVEL (SP)	Used to input the level calibration data for spectrum measurement.
LEVEL (PW)	Used to input the level calibration data for power monitor measurement.
EXECUTE	Used to execute the calibration.
CAL VALID	Used to enable the calibrated data.

INSTR
PRESET

Resets the panel conditions to the initial status, or executes the self diagnosis function.

<Softkey menu>

PRESET	Resets the panel conditions to the initial status.
SELF TEST	Executes the self diagnosis function. Displays any error if detected. It returns to the initial status when power is supplied, after the self diagnosis is completed.

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6. GP-IB INTERFACE

This chapter describes the program codes (listener format), data output (talker format) and program example for remotely controlling this analyzer through the GP-IB interface. The configuration of this chapter is as follows.

Table of Contents

6. GP-IB INTERFACE 6-1
6.1 General 6-2
6.2 Specifications 6-4
6.2.1 GP-IB specifications 6-4
6.2.2 Interface functions 6-6
6.3 GP-IB Handling 6-7
6.3.1 Connecting other devices 6-7
6.3.2 Program code (Listener format) 6-8
6.3.3 Talker format (Data output format) 6-25
6.3.4 Service request 6-36
6.3.5 Device trigger function 6-38
6.3.6 Device clear function 6-38
6.3.7 Status modification by command 6-39
6.3.8 Sample programs 6-40*

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6.1 General

The Q8381A/Q8383 is equipped with a GP-IB interface (GP-IB: General Purpose Interface Bus) and can be remotely controlled via the 488-1978 measurement bus which meets IEEE specifications.
The GP-IB interface contains the following functions.

(1) Setting

① Panel setting : Same as the manual panel setting functions (including label setting).

② Data transmit mode setting : The data transmit mode setting, delimiter selection, header ON/OFF, and read command setting can be executed.

(2) Read

① The panel setting condition can be read.

② Data read: Cursor, wavelength and level data can be read.

(3) Service request

The service request function can be used whenever an error occurs and upon completion of processing. Particular service request factors can be masked.

The GP-IB interface can be used for connecting the analyzer to a controller and other peripheral devices using a simple cable (bus line).
The GP-IB is a superior interface designed to ensure extendibility as well as electrical, mechanical and functional compatibility with products of other companies. Using a single bus cable, it is possible to construct a simple system as well as an automatic measurement system with advanced functions.
With the GP-IB system it is first of all necessary to specify the "address" of devices connected to the bus line. These devices can be assigned to one or more of three roles: controller, talker and listener.
During system operation, although only one "Talker" can transmit data to the bus line, multiple "Listeners" can receive the data.
The controller specifies the address of the "Talker" and "Listener" and transfers data from the "Talker" to the "Listener". The controller can also specify setting conditions from the "Talker" to the "Listener".
Eight bit-parallel and byte-serial type data lines are used for data transfer between devices and transfer is executed in synchronous two-way mode. Thanks to synchronous transfer, both high and low speed devices can be connected.
The ASCII code is used for data (messages) transmitted and received between devices, including measurement data, measurement conditions (programs) and commands.
The GP-IB interface is equipped with eight data lines, three handshake lines for controlling synchronous data transfer between devices and five control lines for controlling information flow on the bus.

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- The handshake lines are used for the following signals:

  DAV (Data Valid) : Signal indicating data valid state.

  NRFD (Not Ready for Data) : Signal indicating ready state for transmitting or receiving data.

  NDAC (Not Data Accepted) : Signal indicating completion of data reception.

- The control lines are used for the following signals:

  ATN (Attention) : Signal for determining whether the data line signal is an address, command or other information.

  IFC (Interface Clear) : Signal which clears the interface.

  E0I (End of Identify) : Signal used upon completion of data transfer.

  SRQ (Service Request) : Signal used to request the controller for service from a device.

  REN (Remote Enable) : Signal used to control a device enabled for remote program processing.

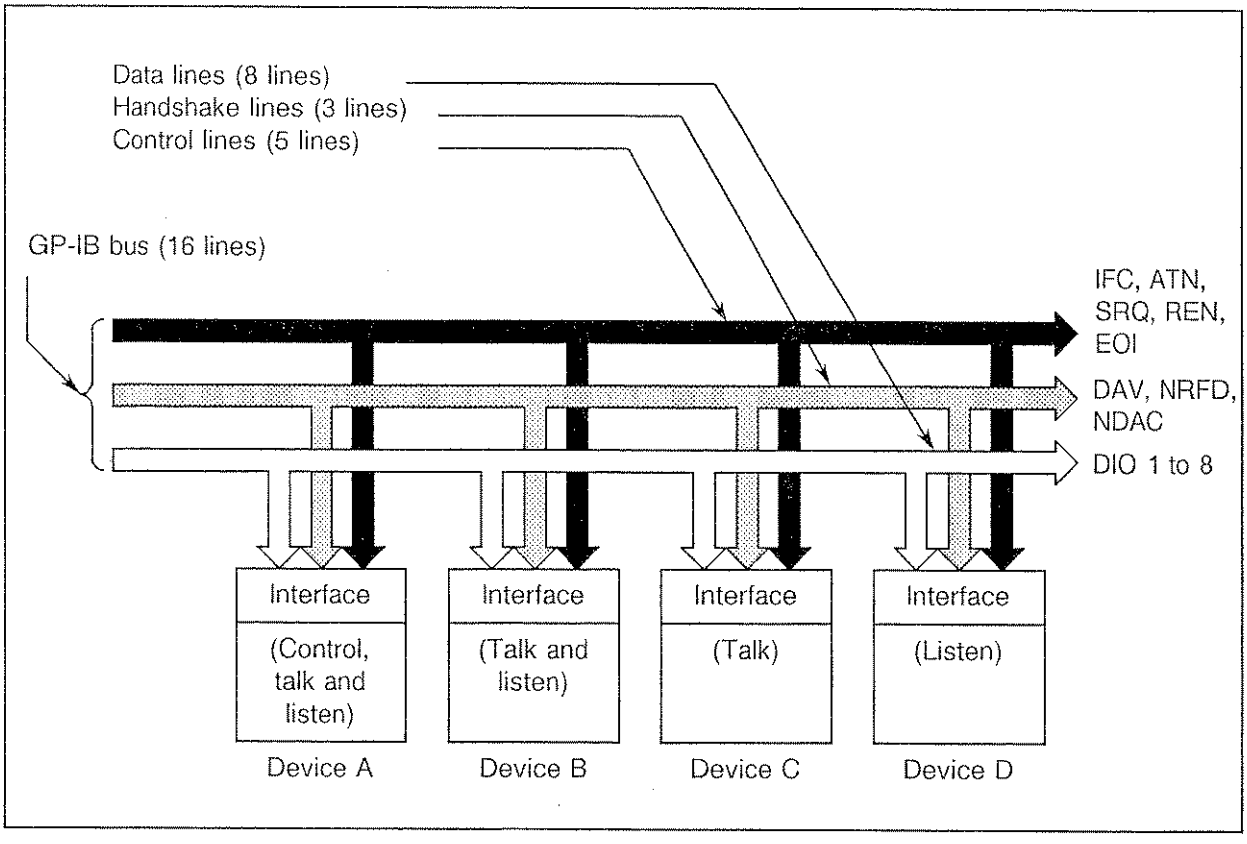


Fig. 6-1 Outline of GP-IB Interface

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6.2 Specifications

6.2.1 GP-IB specifications

Specification	:	IEEE488-1978
Code used	:	ASCII code However, binary code is used in packed format.
Logic level	:	Logic "0" (High) +2.4 V or above Logic "1" (Low) +0.4 V or below
Signal line terminal	:	The 16 bus lines are terminated as shown in Fig. 6-2.

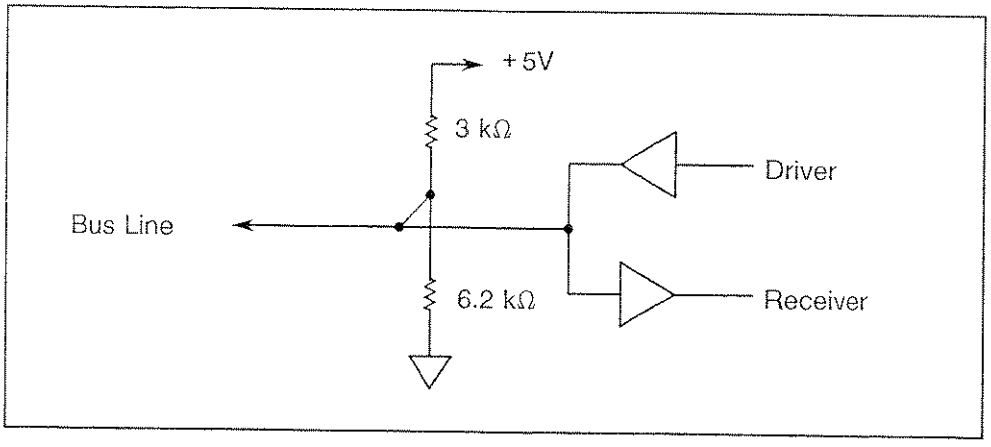
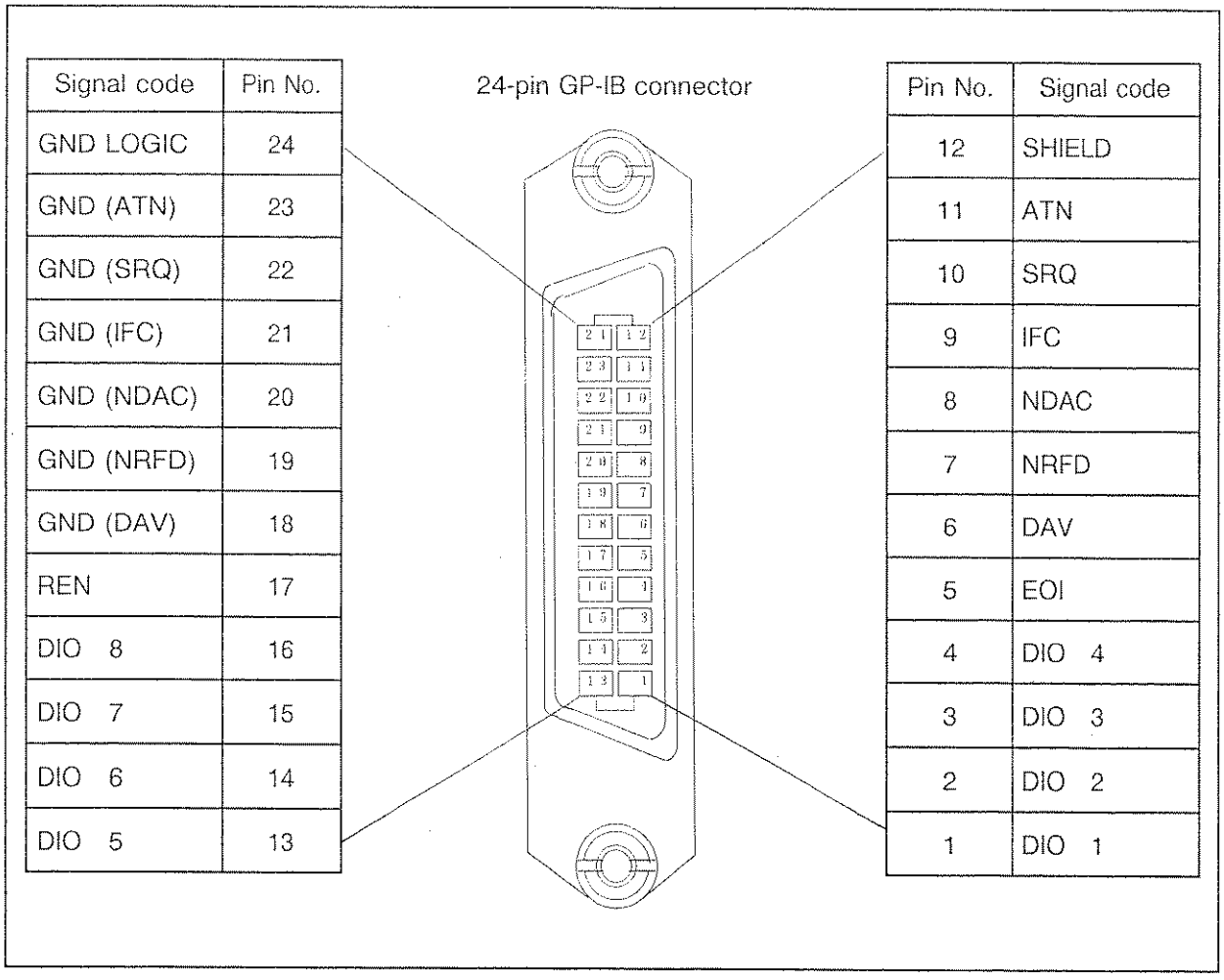


Fig. 6-2 Signal Line Terminals

Driver	:	Three-state type Output voltage in "Low" state: +0.4 V or below, 48 mA Output voltage in "High" state: +2.4 V or above, –5.2 mA
Receiver	:	"Low" state when +0.6 V or below "High" state when +2.0 V or above
Overall length of bus cable	:	(Number of devices connected to the bus) × 2 m or less, and not exceeding 20 m
Address	:	Up to 31 Talk and Listen addresses can be specified using the LOCAL / ADDRESS local address switch on the front panel (8 addresses specified when shipped).
Connector	:	24-pin GP-IB connector 57-20240-D35A (Amphenol equivalent)

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Signal code	Pin No.
GND LOGIC	24
GND (ATN)	23
GND (SRQ)	22
GND (IFC)	21
GND (NDAC)	20
GND (NRFD)	19
GND (DAV)	18
REN	17
DIO 8	16
DIO 7	15
DIO 6	14
DIO 5	13

Pin No.	Signal code
12	SHIELD
11	ATN
10	SRQ
9	IFC
8	NDAC
7	NRFD
6	DAV
5	EOI
4	DIO 4
3	DIO 3
2	DIO 2
1	DIO 1

Fig. 6-3 GP-IB Connector Pin Arrangement

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6.2.2 Interface functions

The GP-IB interface functions are listed in Table 6-1.

Table 6-1 Interface Functions

Code	Description
SH1	Source handshake function
AH1	Acceptor handshake function
T5	Basic talker, serial poll and talk only* functions as well as talker release function specified by the listener
L4	Basic listener function, and listener release function specified by the talker
SR1	Service request function
RL1	Remote function
PR0	No parallel poll function
DC1	Device clear function enabled
DT1	Device trigger function enabled
C0	No controller function
E2	Three-state bus driver is used.

* The talk only function operates on the plotter.
When the analyzer is used in Only mode, press the "ONLY" Softkey at the address specified from the panel and set "0" for address mode. The remote device to be connected by bus cable should also be set to Only mode.

CAUTION

During Only mode, the controller should not be operated simultaneously since operation in Only mode is not guaranteed.

Note: If the "ATN" signal is switched to True during message transfer, the previous transfer states are released.

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6.3 GP-IB Handling

6.3.1 Connecting other devices

Since the GP-IB system consists of multiple devices, pay attention to the following when preparing the system.

(1) Check the condition (preparation) and operation of the analyzer, controller and peripheral devices, and read the respective instruction manuals before starting connection.

(2) The total length of the bus cable for connecting the devices should not exceed that specified.
The total length of the bus cable should be (number of devices connected to the bus) × 2 m, not exceeding 20 m.
The following standard bus cables are provided.

Table 6-2 GP-IB Standard Bus Cables (sold separately)

Length	Specification
0.5 m	408JE-1P5
1 m	408JE-101
2 m	408JE-102
4 m	408JE-104

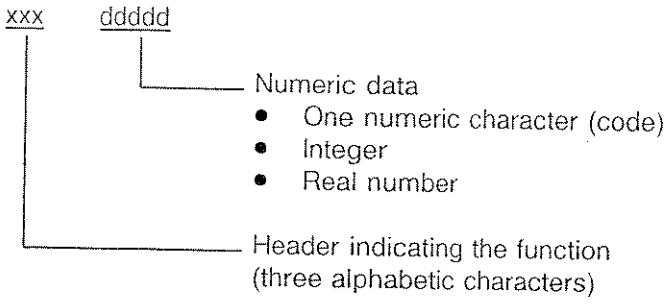
(3) When connecting the bus cable, do not use three or more connectors together.
Connectors should be fixed firmly with screws.
The bus cable connector is a piggy-back type and one connector has a pair of male and female threads which can be used simultaneously.

(4) Before turning the power switches of the devices on, check their power conditions, grounding state and setting conditions (if required).
The power switches of all devices connected to the bus line should be turned ON.
If any device is not turned ON, the operation of the entire system cannot be guaranteed.

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6.3.2 Program code (Listener format)

This paragraph describes the program codes used by an external controller to set the conditions of the analyzer.
Each program code basically consists of three alphabetic characters to indicate the function and numeric data to specify the value.



The condition state is read when "?" is added to the end of the function header.
(After "xxx?" is transmitted, the analyzer is set to Talker to read the data.)
This is valid for those codes with a circle in READ column.

Notes:

1. Characters of both upper and lower cases can be used for describing the function header and the unit. Any space code (20H) can be used in the program code.

2. The analyzer processes the program codes by one line up to the terminator.
   Up to 255 characters can be set in one line.
   When describing multiple program codes in a line, they should be separated from one another by a comma (,) or semicolon (;). The codes with function header attached by ## should be specified solely.

Program codes used to set various conditions are listed below.

[ ] : Can be omitted.
( ) : Header with identical function

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- FUNCTION (1/3)

Item		Program code		Contents	Read
		Function header	Setting		
CENTER	CENTER	CEN	Numeric + unit	Unit UM: μm (Default) NM: nm Example CEN1.55UM CEN780nm CEN1.31	○
	PEAK	PKC	———	peak to center	×
	CURSOR	CUC	———	cursor to center	×
	AUTO PKC	APC	0,1	0: OFF, 1: ON	○
SPAN	SPAN	SPA	Numeric + unit	Unit UM: μm NM: nm (Default) NMD:nm/DIV Example SPA50NM, SPA10NMD	○
	START	STA	Numeric + unit	Unit UM: μm (Default) NM: nm Example STA0.6UM, STA755nm	○
	STOP	STO	Numeric + unit	Unit UM: μm (Default) NM: nm Example STO1.6um, STO805NM	○
	△λ→SPAN	LSP	———	λ1⇌λ2 set to span	×
	0.35 to 1.0 0.9 to 1.75	HSP	0, 1	0: 0.35 to 1.0 (Q8381A) 0.55 to 1.0 (Q8383) 1: 0.9 to 1.75	×
	FULL	FSP	———	FULL SPAN 0.35 to 1.75 (Q8381A) 0.55 to 1.75 (Q8383)	×
	AUTO (COH span)	CAU	0, 1	0: OFF, 1: ON	○

(Note) ○: Can be read.
×: Can not be read.

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- FUNCTION (2/3)

Item		Program code		Contents	Read
		Function header	Setting		
REF LEVEL	REF LEVEL	REF	Numeric + unit *	Unit DBM: dbm (Default) MW: mW, UW: μW NW: nW Example REF-10DBM REF0.1UW	○
	PEAK	PKL	——	total power to ref level	×
	CURSOR	CUL	——	0: OFF 1: ON	×
	MAX HOLD	MXH	0, 1	0: OFF 1: ON	○
	AUTO	RAU	0, 1	0: OFF 1: ON	○
LEVEL SCALE	LIN/LOG	LIN	0, 1	0: OFF (LOG) 1: ON (LINEAR)	○
	LEVEL SACLE	LEV	0 to 5	0: 10 dB/D 1: 5 dB/D 2: 2 dB/D 3: 1 dB/D 4: 0.5 dB/D 5: 0.2 dB/D	○
AUTO		AUT	0 to 3	0: ABORT (STOP) 1: FULL SPAN 2: 0.35 to 1.0 μm (Q8381A) 0.55 to 1.0 μm (Q8383) 3: 0.9 to 1.75 μm	×
AVG		AVG	1 to 1024	Integers Example AVG 10 AVG128	○

* No unit can be specified in LOSS/TRANS mode (the unit is determined by the current display scale).

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- FUNCTION (3/3)

Item		Program code		Contents	Read
		Function header	Setting		
SWEEP MODE	SWEEP MODE	SWE	0 to 4	0: NORMAL 1: ADAPTIVE 2: HI-SENS 1 3: HI-SENS 2 4: PULSE	○
	Gate Time	PGT	Numeric + unit	UNIT SEC: sec (Default) MSEC: msec (Example) PGT0.1ms PGT10ms	○
	△λ→SWEEP	PSW	0, 1	0: OFF 1: ON	○
RESOLUTION		RES	0 to 5	0: 0.1 nm 1: 0.2 nm 2: 0.5 nm 3: 1.0 nm 4: 2.0 nm 5: 5.0 nm	○

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- CURSOR

Item		Program code: Function header	Program code: Setting	Contents	Read
CURSOR ON/OFF		CUR	0, 1	0: CURSOR OFF 1: CURSOR ON	○
λ1	ON/OFF	XAC	0, 1	0: λ1 OFF 1: λ1 ON	○
	SET λ1	XAS	Numeric* + unit	Unit UM: μm (Default) NM: nm Example XAS0.78UM	○
λ2	ON/OFF	XBC	0, 1	0: λ2 OFF 1: λ2 ON	○
	SET λ2	XBS	Numeric + unit	Unit UM: μm (Default) NM: nm Example XBS630.5nm	○
L1	ON/OFF	YAC	0, 1	0: L1 OFF 1: L1 ON	○
	SET L1	YAS	Numeric + unit **	Unit DBM: dBm DB: dB MW: mW UW: μW NW: nW PC: %	○
L2	ON/OFF	YBC	0, 1	0: L2 OFF 1: L2 ON	○
	SET L2	YBS	Numeric + unit **	Unit DBM: dBm DB: dB MW: mW UM: μW NW: nW PC: %	○
CURSOR DATA		CUD	0 to 4	0: NORMAL 1: △MODE 2: 2ND PEAK 3: POWER 4: P-P	○
LEFT PEAK		LPK	——	λ1 set next left peak	×
RIGHT PEAK		RPK	——	λ1 set ext right peak	×

* Set the measurement data No. with numerics when power monitor. (without unit)

** The default is the current display scale unit.

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- LABEL

Item	Program code		Contents	Read
	Function header	Setting		
LABEL	LAB##	Alphabet, Numeric, Symbol (up to 48 characters)	LAB #——— # (Up to 48 characters) (Terminator (# or !))	○

- MEASURE

Item	Program code		Contents	Read
	Function header	Setting		
MEASURE	MEA	0, 1, 2	0: STOP 1: SINGLE 2: REPEAT	○

- DISPLAY (1/6)

Item		Program code		Contents	Read
		Function header	Setting		
CON-TROL	DUAL	DUA	0, 1	0: OFF 1: ON (Dual-screen)	○
	SUPER IMPOSE	SIM	0, 1	0: OFF 1: ON (Super-impose)	○
	GRID	GRI	0, 1	0: OFF 1: ON	○
	act. U&L	AUL	0, 1	0: Upper screen active 1: Both upper and lower screens active	○
	xcng U/L	XUL	———	Upper screen replaced with lower screen	×

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- DISPLAY (2/6)

Item		Program code		Contents	Read
		Function header	Setting		
CON-TROL	3D	TDM	0, 1	0: OFF 1: ON (3-dimensional mode)	○
	3D ANGLE	TAN	–75 to +75	–75 to +75: Display angle (in by 15° steps)	○
	3D CURSOR NO	TCN	1 to 16	1 to 16: Data number	○
	3D DELETE	TDL	———	The latest data or the data specified by cursor No. deleted.	×
	3D CLEAR	TCL	———	All 3D data cleared.	×
	3D MAX NO	TMX	2 to 16	2 to 16: Maximum number of data displayed	○
	3D N LOCK	TNL	0, 1	0: N-lock mode OFF 1: N-lock mode ON	○
	3D ROLL	TRO	0, 1	0: Roll mode OFF 1: Roll mode ON	○
	3D RECALL	TRC	———	Previous 3-dimensional data recalled.	×
SAVE	SAVE MEAS DATA (Memory or floppy)	SAV##	0 to 32 + [#memory name#] or [#file name#]	0: REF (no memory name) 1 to 32: MEAS 1 to 32 (Memory) Example: SAV15#LD-No15# (Memory) SAV#LD-No15# (Floppy) * Terminator(# or !)	×
	SAVE PANEL (Memory or floppy)	SVP##	1 to 10,00,99 + [#memory name#] or [#file name#] Terminator (# or !)	1 to 10: PANEL 1 to 10 00: Initialized from the INSTR PRESET condition 99: The INSTR PRESET condition is replaced with the current setting. Example: SVP9#LED1310# (Memory) SVP#LED1310# (Floppy) (No memory name for data Nos. 00 and 99.)	×

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- DISPLAY (3/6)

Item		Program code		Contents	Read
		Function header	Setting		
SAVE	DELETE MEAS (Memory only)	DMD	0 to 32	0:REF 1 to 32: MEAS 1 to 32	×
	DELETE PANEL (Memory only)	DPC	1 to 10	1 to 10: PANEL 1 to 10	×
RECALL	RECALL MEAS (Memory or floppy)	RCL	0 to 32(Memory) or #file name# (File) Terminator (# or !)	0: REF 1 to 32: MEAS 1 to 32 Example RCL10 (Memory) RCL#LD123# (Floppy)	×
	RECALL PANEL (Memory or floppy)	RCP	1 to 10(Memory) or #file name# (File) Terminator (# or !)	1 to 10 : PANEL 1 to 10 Example RCP5 (Memory) RCP#RED660# (Floppy)	×
NOR-MALIZE	PEAK NORM.	PNR	0, 1	0: OFF 1: ON (Peak normalize)	○
	MEM NORM.	MNR (RNR)	0, 1	0: OFF 1: ON (REF< > MEAS1)	○
	LOSS	LOS	0, 1	0: OFF 1: ON	○
	TRANS	TRA	0, 1	0: OFF 1: ON	○
	SPEC. WIDTH	SPW	0, 1	0: OFF 1: ON	○
SPEC-TRAL WIDTH	WIDTH TYPE	WTY	0 to 3	0: Pk-XdB 1: ENVELOPE 2: RMS 3: Peak RMS	○
	XdB parameter	WPX	Numeric	Setting range: 0.1 to 59.9 Example WPX3.0, WPX12.0	○

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- DISPLAY (4/6)

Item		Program code		Contents	Read
		Function header	Setting		
SPEC-TRAL WIDTH	YdB parameter	WPY	Numeric	Setting range: 0.1 to 99.9 Example WPY20, WPY35.0	○
	K parameter	WPK	Numeric	Setting range: 0.1 to 100	○
	Kr (RMS) parameter	WPR	Numeric	Setting range: 1 to 10	○
ADVANCE	CURVE FIT	CFT	0, 1	0: OFF 1: ON	○
	DOMINANT	DOM	0, 1	0: OFF 1: ON	○
	POWER MONITOR ON/OFF	PMO	0, 1	0: OFF (SPECTRUM) 1: ON (POWER MONITOR)	○
	POWER MONITOR search λ	PSR	——	Sets automatically the wavelength of power monitor internally.	×
	POWER MONITOR set λ	PWV	Numeric + unit	Unit UM: μm NM: nm Example PWV 1.31 UM	○
	POWER MONITOR N-MAX	PNX	Integers (11 to 1001)	Point of trend-chart Example PNX201	○
	POWER MONITOR INTERVAL	PIN	Numeric (0.1 to 3600)	Measurement interval of power monitor [SEC] Example PIN0.5	○
	Optical AMP ON/OFF	OAM	0, 1	0: OFF 1: ON	○

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- DISPLAY (5/6)

Item		Program code		Contents	Read
		Function header	Setting		
ADVANCE	NF (s-sp) or NF (total)	NFT	0, 1	0: NF (s-sp) 1: NF (total)	○
	NF Σ PASE	SNE	———	Calculates the total ASE power (Σ PASE)	×
	FIT MEM-3	FTM	0, 1	0: OFF 1: ON	○
	SPECTRUM DIVISION	SDV	0, 1	0: OFF 1: ON	○
	K parameter	NFK	Numeric	Setting range : 0.100 to 10.000	○
	SAPN-A	SNA	Numeric + [Unit]	Unit UM: μm NM: nm (Default)	○
	SPAN-B	SNB	Numeric + [Unit]	Unit UM: μm NM: nm (Default)	○
	FILTER Δλ	FDL	Numeric + [Unit]	Sets the valid light filter width. Unit UM: μm NM: nm (Default)	○
	Pin LOSS	LPI	Numeric (10 to -10)	Sets the input loss. Example : LPI-0.5	○
	Pout LOSS	LPO	Numeric (10 to -10)	Sets the input loss. Example : LPO+2.65	○
	Select Pin	NPK	0, 1	Selects either display data or setting value in PLV as the Pin value for gain calculation 0: OFF (Display data or REF data) 1: ON (Setting value in PLV)	○

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- DISPLAY (6/6)

Item		Program code		Contents	Read
		Function header	Setting		
ADVANCE	Set Pin level	PLV	Numeric + [Unit]	Sets Level for NPK 1 UnitDBM: dBm (Default) MW : mW UW : μW NW : nW	○
	Set Pin wavelength	PLW	Numeric + [Unit]	Sets Center wavelength for NPK 1 Unit UM : μm (Default) NM : nm	○
	WDM List display	WDM	0, 1	0: OFF 1: ON	○
	WDM SPAN AUTO	WAU	0, 1	0: OFF 1: ON	○
	WDM SPASE	WSN	0, 1	0: OFF 1: ON	○
	WDM FIT MEM-3	WFT	0, 1	0: OFF 1: ON	○
	WDM LIST ALL	WAL	0, 1	0: OFF 1: ON	○
	WDM Y-dB parameter	WYD	Numeric	Setting range: 0.1 to 99.9 Example: WYD3.0,WYD11.1	○
	WDM K parameter	WFK	Numeric	Setting range: 0.1 to 100.0 Example: WFK2.0,WFK10.0	○
	WDM SPAN-A	WSA	Numeric + [Unit]	Unit UM : μm NM : nm (Default)	○
	WDM SPAN-B	WSB	Numeric + [Unit]	Unit UM : μm NM : nm (Default)	○
	Function menu	FUN	0, 1	0: OFF 1: ON	○

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- DATA OUT (1/2)

Item		Program code		Contents	Read
		Function header	Setting		
DEVICE	DEVICE TYPE	DEV	0, 1	0: PRINTER 1: PLOTTER	○
	PLOTTER TYPE	PTY	0, 1	0: ADVANTEST (R9833) 1: HPGL	○
	PLOT DATA	PDT	0, 1	0: ALL 1: SIGNAL only	○
	PAPER ADV.	PPA	0, 1	0: OFF 1: ON	○
	PLOT SIZE	PSZ	0 to 5	0: A4 (H1), 3: V1 1: H2 , 4: V2 2: H4 , 5: V4 Hn: Horizontal writing, Vn: Vertical writing	○
	FLOPPY ON/OFF	FON	0, 1	0: FLOPPY-OFF (MEMORY) 1: FLOPPY-ON	○
	FLOPPY FORMATTING	FFO	1, 2	Initialization of floppy disk 1: 2DD (720 K) 2: 2HD (1.2 M)	×
	FLOPPY VOLUME LABEL	FVO##	#volume name# Terminator (# or !)	Sets volume name on the floppy disk. (up to 11 characters) Example FVO#LD-LOT005# FVO#BLUE-LED#	○
	BUZZER (BEEP)	BUZ	0, 1	0: OFF 1: ON	○
	WARNING	WAR	0, 1	0: OFF 1: ON	○
	QUIET BEEP	QUI	0, 1	0: NORMAL 1: QUIET	○
	CLOCK	CLO##	See below.	Setting the date and time	○

CLO _# YY-MM-DD, hh:mm:ss _#
Terminator (# or !)

YY: Year (00 to 99)
MM: Month (01 to 12)
DD: Day (01 to 31)
hh: Hour (00 to 23)
mm: Minute (00 to 59)
ss: second (00 to 59)

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- DATA OUT (2/2)

Item		Program code		Contents	Read
		Function header	Setting		
DEVICE	CLOCK ON/OFF	CKD	0, 1	0: Clock not displayed 1: Clock displayed	○
	MENU OUT (PRINTER)	MEN	0, 1	0: OFF 1: ON	○
COPY		COP	——	Output to printer	×
FEED		FEE	——	Paper fed about 5 mm to printer.	×

- Codes corresponding to other keys

Item		Program code		Contents	Read
		Function header	Setting		
INSTR PRESET		IPR	——	Measurement conditions initialized.	×
CAL	λ	CLM	Numeric + unit	Sets wavelength calibration data. Unit UM: μm NM: nm	○
	LEVEL (SP)	CLV	Numeric + unit	Sets level calibration data for power monitor. Unit DBM:dBm(Default) MW: mW UW: μW	×
	LEVEL (PW)	CLP	Numeric + Unit	Sets level calibration data for power monitor. Unit DBM:dBm (Default) MW: mW UW: μW	○
	EXECUTE	CEX	——	Calibration executed.	×
	VALID	CVA	0, 1	0: Mode not using CAL data 1: Mode using CAL data	○

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- Controlling data output and others (1/3)

Item	Program code		Contents	Read
	Function header	Setting		
SRQ signal control-1	SRQ	0, 1	0: Mode not transmitting SRQ 1: Mode transmitting SRQ	○
SRQ signal control-2	S	0, 1	0: Mode transmitting SRQ 1: Mode not transmitting SRQ	○
Status byte mask	MSK	0 to 255 (Bit 6 can not be masked.)	Status byte bit "1" to be masked switched on. (Initial value: 0) Example: b1 and b2 are to be masked: MSK6	○
Status byte clear	CSB	——		×
Header data output control	HED (HD)	0, 1	0: HEADER OFF 1: HEADER ON	○
Terminator	DEL (DL)	0 to 3	0: NL <EOI> 1: NL 2: <EOI> 3: CR NL <EOI>	○
Data separator	SDL (DS)	0, 1, 2	0: , (Comma) 1: SP (Space) 2: CR NL	○
Message separator	MSP (MS)	0, 1	0: ; (Semicolon) 1: CR NL	○
Data output format (valid for waveform data)	FMT	0 to 4	0: ASCII 1: BINARY (16 bit) 2: BINARY (64 bit float) 3: BINARY (32 bit float) 4: BINARY (32 bit float NEC)	○

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- Controlling data output and others (2/3)

Item	Program code		Contents	Read
	Function header	Setting		
Data output screen	OVS	0, 1	0: upper (upper screen) 1: lower (lower screen) (Valid in dual screen mode)	○
Request for waveform data output (Spectrum data or trend chart data)	OSD	0, 1	0: Y-axis data output 1: X-axis data output	×
Request for output of the number of waveform data	ODN (ODN?)	——	Output of the number of data contained on the screen specified by 0VSn	×
Request for peak search data output	OPK (OPK?)	——		×
Request for cursor data output	OCD (OCD?)	——	Output data differs depending on cursor display mode.	×
Request for spectral width data output	OSW (OSW?)	——	Output of the spectral width calculated.	×
Request for curve fit data output	OCF (OCF?)	——		×
Request for 3-dimensional display data output	OTD	1 to 16	1 to 16: Data number	×
Request for measurement data status output	OST (OST?)	——	Output data is 0 or 1. 0: Normal 1: Overload No header is output.	×
Request for power monitor data output	OPM (OPM?)	——		×
Request for operation result of gain and noise figure	OGN (OGN?)	——	Output of gain and noise figure calculated.	×
Request for outputting operation results of gain, noise figure and total ASE power	OPN (OPN?)	——	Output of gain, noise figure and total ASE power calculated.	×

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- Controlling data output and others (3/3)

Item	Program code		Contents	Read
	Function header	Setting		
WDM PEAK NO	OWP (OWP?)	———	Number of WDM signal lights.	×
Request for outputting operation results of WDM	OLS (OLS?)	———	Output of gain and noise figure of each WDM signal light.	×
Request for outputting start point at the X axis of the ASE fitted data	PAS (PAS?)	———	Output of start point at the X axis of the ASE fitted data in gain or WDM operation.	×
Request for outputting the number of ASE fitted data	PAN (PAN?)	———	Output of the number of ASE fitted data in gain or WDM operation.	×
Request for outputting ASE fitted data	OPA (OPA?)	———	Output of ASE fitted data in gain or WDM operation.	×
Single measurement	E (*TRG)	———	Code identical to "MEA1" Single measurement executed	×
Initialization	C (*RST)	———	Analyzer initialized (to mode at power on)	×
Device identification	*IDN?	———	Request to output company name, device name, serial number and software revision.	○
Execution of self-diagnosis and output of results.	*TST?	———	Request to execute self-diagnosis and output results. (See Table 6-3.)	○

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Table 6-3 Error Codes Used in Self-Diagnosis

Code	Description
0000	Normal
010X	ROM error
02XX	RAM error
030X	Backup-RAM error
040X { 080X	Peripheral circuit error (Internal clock, timer, printer interface and others)
110X { 30XX	Measurement error (Measurement memory, monochromator and others)

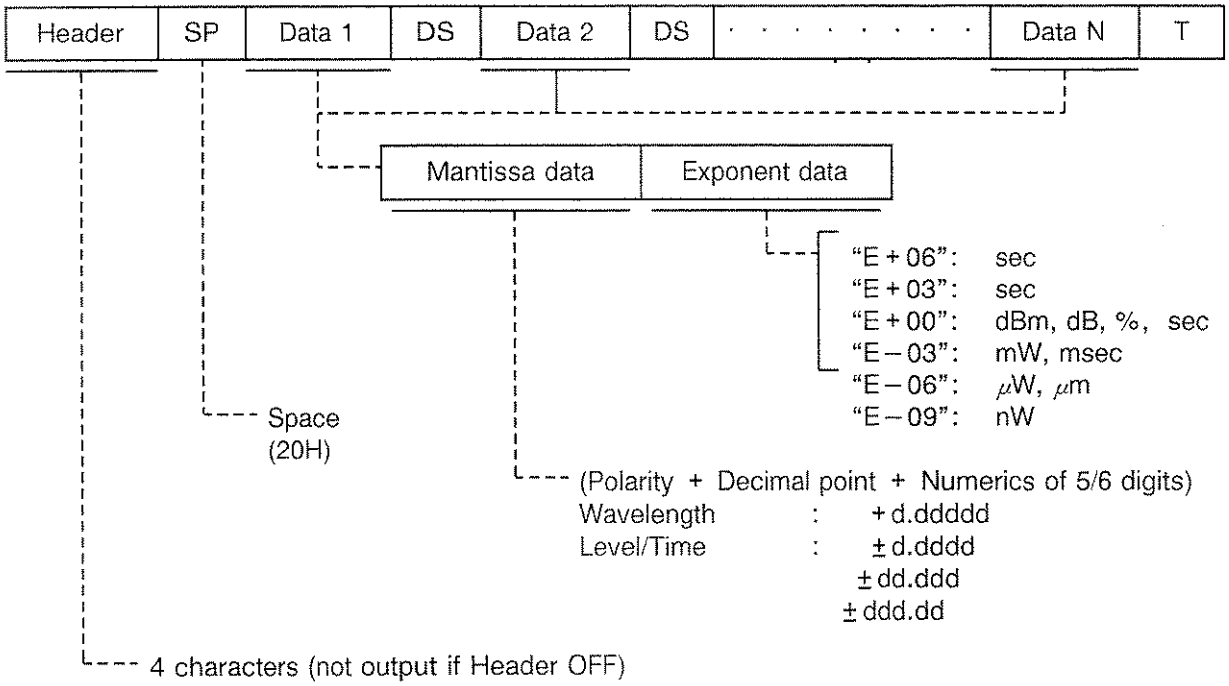
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6.3.3 Talker format (Data output format)

This paragraph describes the talker format required to transmit data from the analyzer to an external controller.
Six formats are used for data transmission depending on the data contents: waveform, peak search, cursor, spectral width and setting condition data.
(Waveform data shows spectrum, curve fit and trend chart data.)

(1) Waveform data (Program code "OSD0", "OSD1", "OCF", "OTDn", "OPA")

① ASCII format (Code for specifying "FMT0" format)



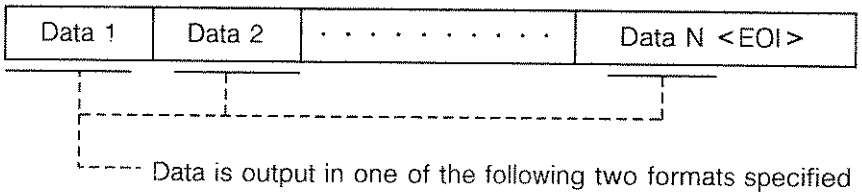
Header	Data type
LMUM	Wavelength [μm]
LVLG	Log scale level data [dBm, dB]
LVLI	Linear scale level data
LVPC	% unit level data
TMS	Time data of trend chart

DS: Data separate (",", ";", CR or NL)
Can be specified with program code "SDLn" ("DSn")

T: Terminator (NL<EOI> NL <EOI> or CR,NL<EOI>)
Can be specified with program code "DELn" ("DLn")

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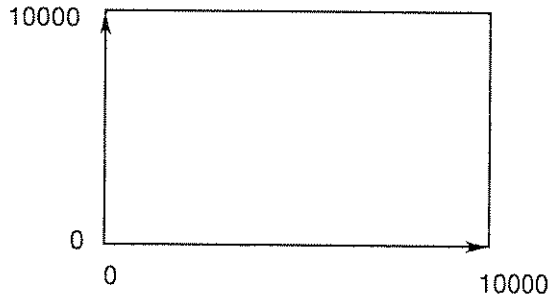
② BINARY format (Format specification code "FMT1", "FMT2")



Data is output in one of the following two formats specified by "FMTn".

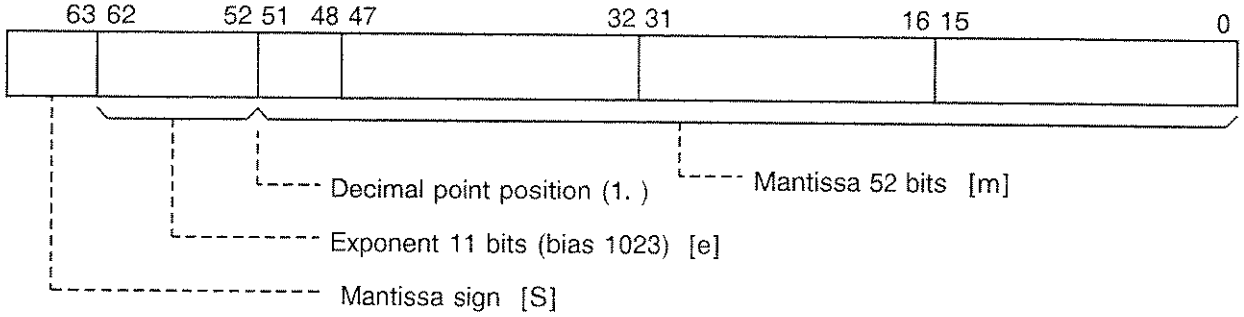
(a) "FMT1"……16-bit (Integer type)

All data on the screen assumed to be linear scale. Both X- and Y-axis data output ranging from 0 to 10000.



(b) "FMT2"……64-bit (IEEE floating point type)

Data is output in floating point format (IEEE Std. 754-1985 format) as shown below.

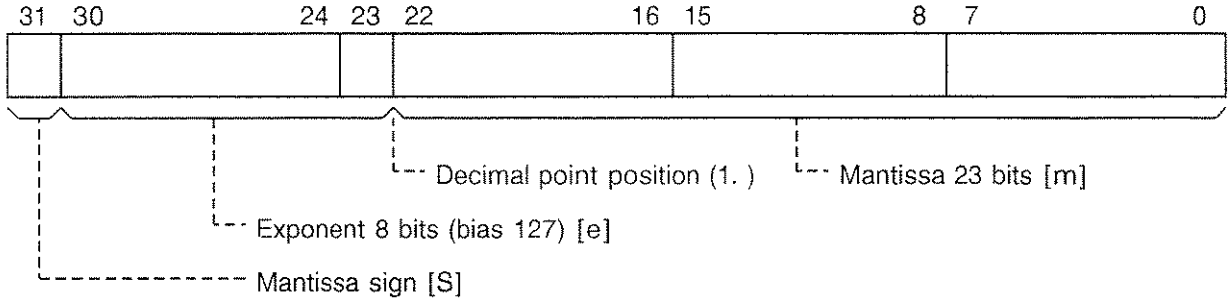


The value is expressed as follows:

$(-1)^S \times 2^{(e-1023)} \times 1.m$

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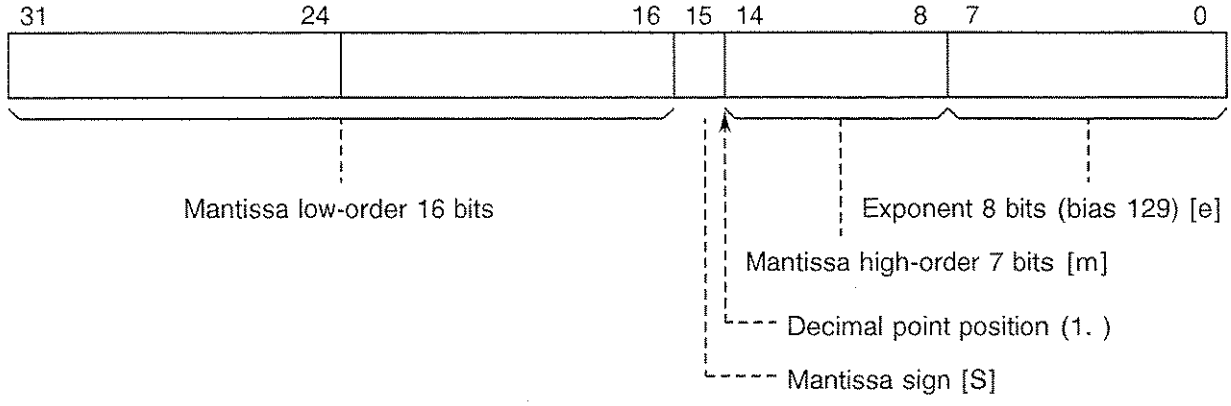
(c) "FMT3"……32-bit (IEEE floating point type)
Data is output in floating point format (IEEE Std. 754-1985 format) as shown below.



The value is expressed as follows:

$(-1)^S \times 2^{(e-127)} \times 1.\ m$

(d) "FMT4"……32-bit (NEC floating point type)
Data is output in floating point format (Internal format on NEC-PC) as shown below.



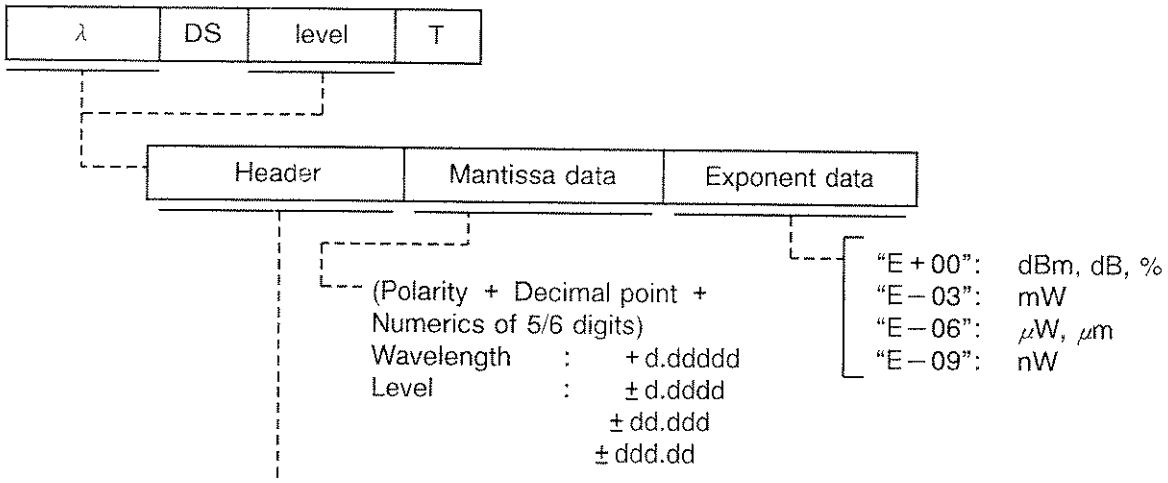
The value is expressed as follows:

$(-1)^S \times 2^{(e-129)} \times 1.\ m$

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(2) Peak search data (Program code "OPK")

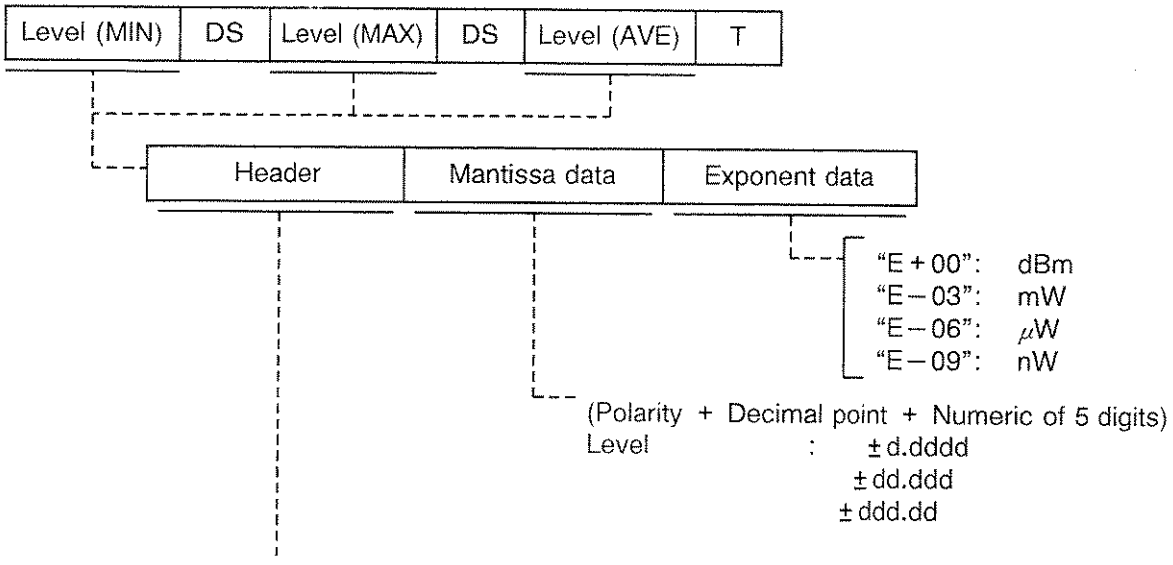
① Spectrum measurement



4 characters (not output if Header OFF)

Header	Data type
LMPK	Peak wavelength (λ)
LVPK	Peak level (level)

② Power monitor display



4 characters (not output if Header OFF)

Header	Data type
LVMN	Minimum of the level data
LVMX	Maximum of the level data
LVAV	Average value of the level data

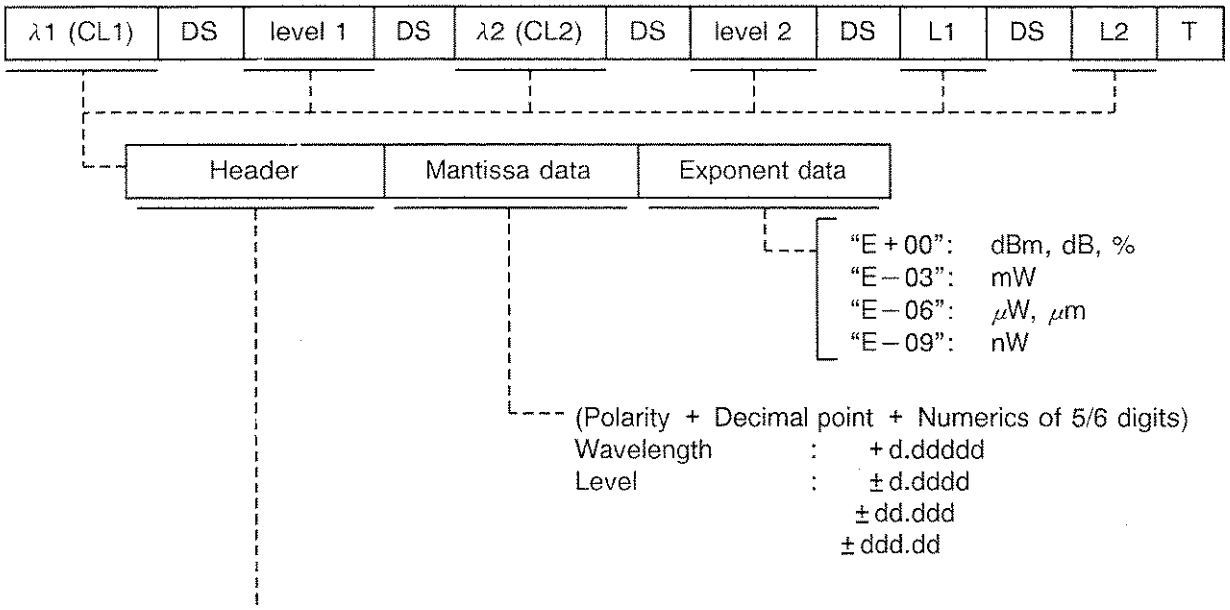
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(3) Cursor data (Program code "OCD")

One of the following four formats is used according to the "CUDn" code for specifying the cursor display mode.

(In power monitor display, the cursor data output is fixed not according to the "CUDn".)

① "CUD0"……Normal



Header	Data type
LMXA	Wavelength of X cursor 1 (λ1)
LVXA	Level of X cursor 1 (level1)
LMXB	Wavelength of X cursor 2 (λ2)
LVXB	Level of X cursor 2 (level2)
LVYA	Level of Y cursor 1 (L1)
LVYB	Level of Y cursor 2 (L2)

DS: Data separate (",", ";", CR or NL)
Can be specified with program code "SDLn" ("DSn").

T: Terminator (NL<EOI>, NL, <EOI>, or CR,NL<EOI>)
Can be specified using program code "DELn" ("DLn").

Note: The mantissa and exponent formats are common to all "CUDn" codes.

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② "CUD1"…… △MODE

λ1	DS	level 1	DS	△λ	DS	△level	DS	L1	DS	△L	T

Header	Data type
LMXA	Wavelength of X cursor 1 (λ1)
LVXA	Level of X cursor 1 (level1)
LMDX	Wavelength difference between X cursors 1 and 2 (△λ)
LVDX	Level difference between X cursors 1 and 2 (△ level)
LVYA	Level of X cursor 1 (L1)
LVDY	Level difference between Y cursors 1 and 2 (△L)

③ "CUD2" …… 2ND PEAK

λ1	DS	level 1	DS	△λ	DS	△level	T

Header	Data type
LMPK	Peak wavelength (λ1)
LVPK	Peak level (level1)
LMDP	Wavelength difference between 1st and 2nd peaks (△λ)
LVDP	Level difference between 1st and 2nd peaks (△level)

④ "CUD3"…… POWER

λ1	DS	λ2	DS	ΣL	T

Header	Data type
LMXA	Wavelength of X cursor 1 (λ1)
LMXB	Wavelength of X cursor 2 (λ2)
LVPW	Sum of levels between X cursors 1 and 2 (ΣL)

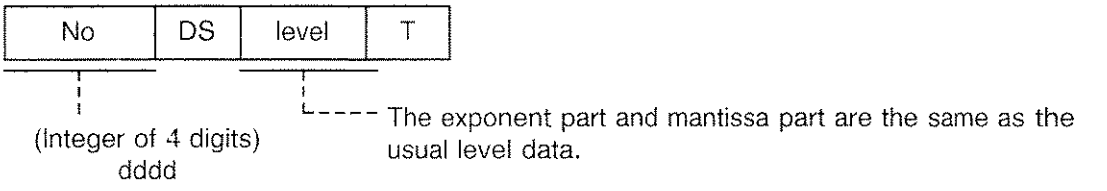
⑤ "CUD4"…… P-P

λ1	DS	level 1	DS	λ2	DS	level 2	DS	△λ	DS	△level	T

Header	Data type
LMXA	Wavelength of X cursor 1 (λ1)
LVXA	Level of X cursor 1 (level1)
LMXB	Wavelength of X cursor (λ2)
LVXB	Level of X cursor 2 (level2)
LMPP	Wavelength difference of maximum and minimum (△λ)
LVPP	Level difference of Maximum and minimum (△level)

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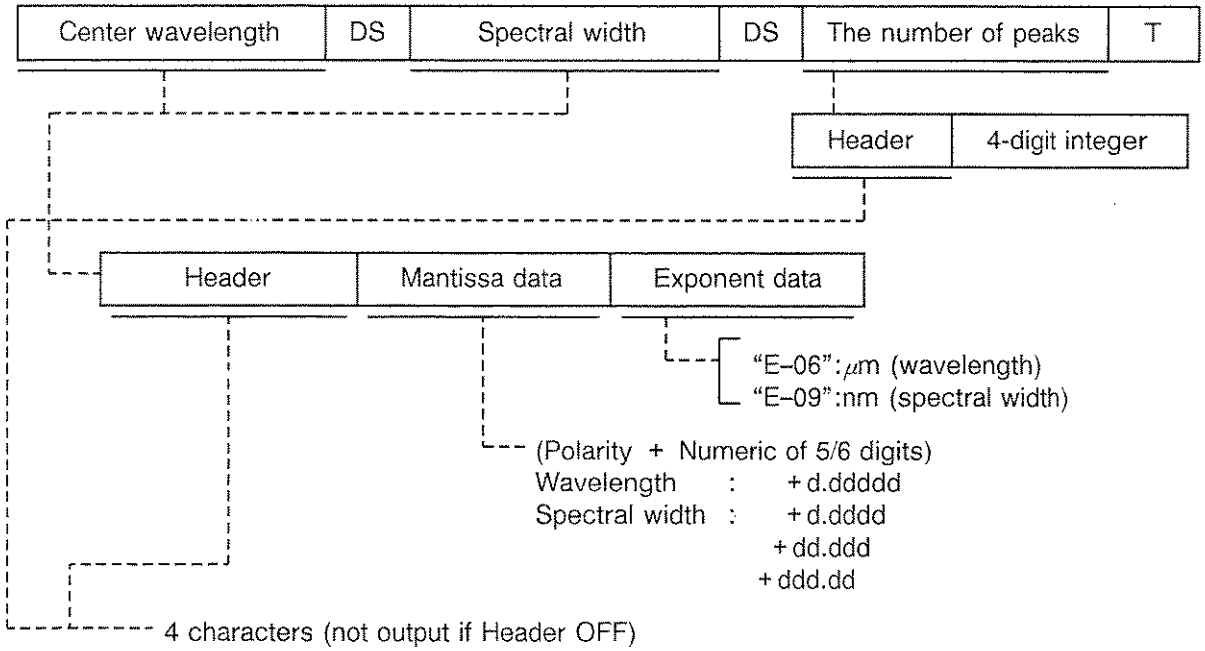
Cursor data output in power monitor display (trend chart)



Header	Data type
NOTC	Data number at cursor position
LVTC	Level data at cursor position

(4) Spectral width data (Program code "OSW")

The results of four types of calculations are all output in the following format:



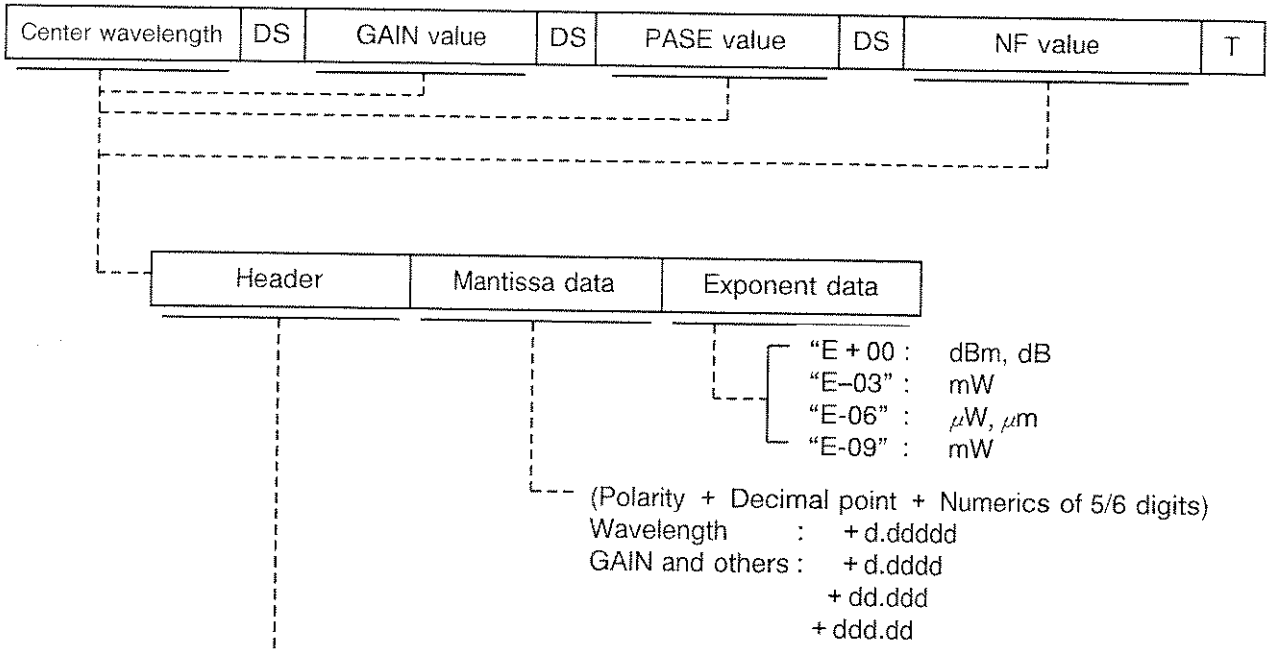
Header	Data type
LMCN	Center wavelength
LMHW	Spectral width
NOSP	Number of peaks

DS: Data separate (",", ";", CR or NL)
Can be specified with program code "SDLn" ("DSn").

T: Terminator (NL<EOI>, NL, <EOI> or CR,NL<EOI>)
Can be specified using program code "DELn" ("DLn").

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(5) GPIB output format of gain and noise figure operation result ("OGN").

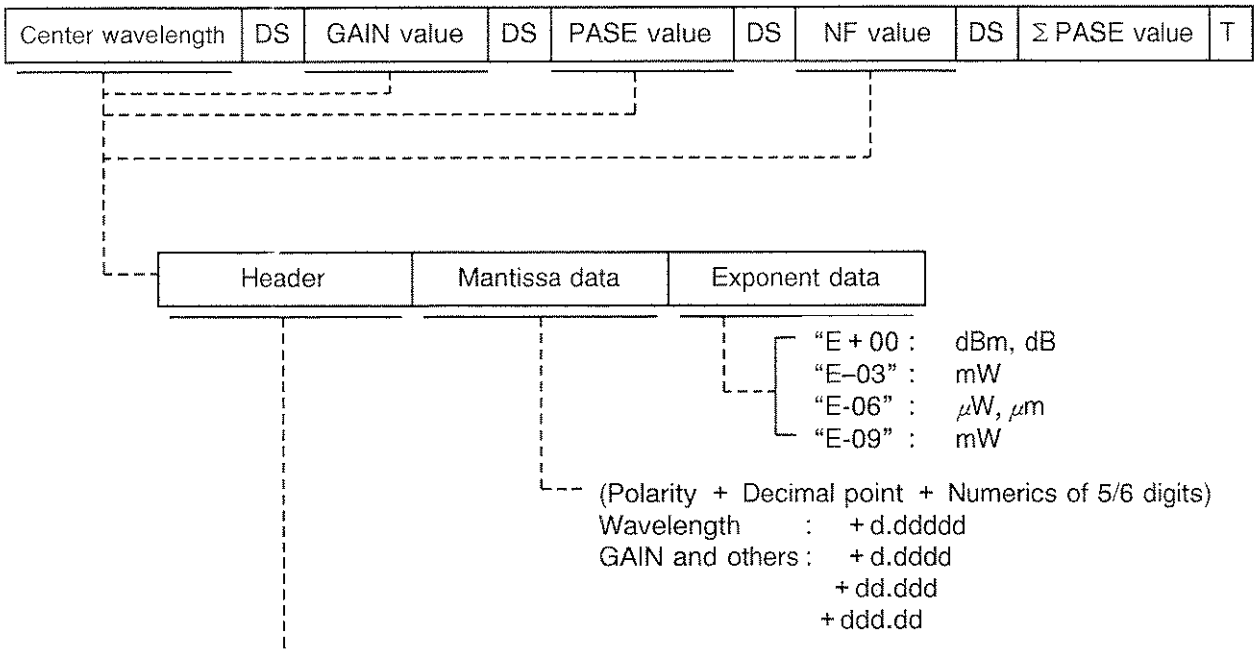


4 characters (not output if Header OFF)

Header	Data type
LMCN	Center wavelength
GAIN	GAIN value
PASE	PASE value
NF␣␣	NF value

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(6) GPIB output format of gain, noise figure and total ASE power operation result ("OPN").



Header	Data type
LMCN	Center wavelength
GAIN	GAIN value
PASE	PASE value
NF␣␣	NF value
PSPW	Σ PASE value (Total ASE power)

(7) WDM operation results output ("OLS")

Operation results are output for the number of peaks (the value read by OWP) of the output formats shown in (5) "OGN". However, the terminator is sent at the last of the output only. The terminator is sent only to the end of the output.

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(8) Device identification

When program code "*IDN?" is received, the following data is output:

For Q8381A:

ADVANTEST, Q8381A, 12346789, A00 A00

- A00 A00 — Software revision (Processing, Measurement)
- 12346789 — Serial number (Production number)
  (Note) A serial number of a product with nine digits is output by omitting the ten thousands place.

For Q8383:

ADVANTEST, Q8383, 12345678, A00 A00

- A00 A00 — Software revision (Processing, Measurement)
- 12345678 — Serial number (Production number)

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(9) Setting condition data

The current setting state can be read by using "?" instead of setting data if the code is readable.

The setting state is output in the following format:



- 1-digit integer (unsigned)
  APC, RAU, LIN, LEV, SWE, PUL, RES, CUR, XAC, XBC, YAC, YBC,CUD, MEA, DUA, SIM, GRI, AUL, TDM, TNL, TRO, PNR, MNR, LOS, TRA, SPW, WTY, CFT, DOM, PMO,OAM,NFT,FTM,SDV,NPK,WDM, WAU,WSN,WFT,WAL,FUN,DEV, PTY, PDT, PPA, PSZ, FON, BUZ, WAR, QUI, CKD, MEN, CVA, SRQ, HED, DEL, SDL, MSP, FMT, OVS
- 2-digit integer (unsigned)
  TCN, TMX
- 2-digit integer (signed)
  TAN
- 3-digit integer (unsigned)
  MSK
- 4-digit integer (unsigned)
  AVG, PNX, *TST?
- Mantissa data + Exponent data

  Exponent data:
  "E+00": dBm, dB, %
  "E−03": mW, mm
  "E−06": μW, μm
  "E−09": nW

  Mantissa data: (Polarity + Decimal point + Numerics of 5/6 digits)
  Wavelength : +d.ddddd
  Level : ±d.dddd
  (Time) ±dd.ddd
  ±ddd.dd
  Note: The polarity at time is only +.

  CEN, SPA, STA, STO, REF, PGT, XAS, XBS, YAS, YBS, WPX, WPY, WPK, WPR, PWV, PIN,NFK,SNA,SNB,FDL,LPI,LPO,PLV,PLW, WYD,WFK,WSA,WSB

- Others
  LAB: 1 to 48 characters
  CLO: YY-MM-DD, hh:mm:ss

Same as the function header specified.

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6.3.4 Service request

The analyzer transmits a service request to the controller according to the operation state. When a service request is transmitted, the status byte is transmitted in response to serial polling from the controller.

<Status byte>
Bits contained in the status byte are set and cleared according to the conditions described below. The status byte relates to three program codes: "SRQn", "MSKnnn" and "CSB".
The "SRQn" is used to control SRQ signal transmission: "SRQ1" is the mode for transmitting the SRQ signal and "SRQ0" does not transmit the SRQ signal.
The "MSKnnn" is used to mask specification of the status byte and 1 is set to the bit to be masked.

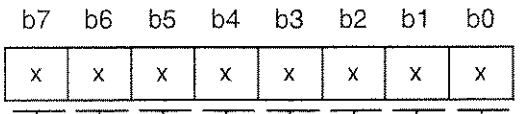
Example: Bits 1 and 3 are to be masked >> "MSK10" [10 = 00001010 binary]
Bits 2, 3 and 5 are to be masked >> "MSK44" [44 = 00101100 binary]

Note: Bit 6 cannot be masked although it can be specified.

All the bits are cleared with code "CSB", "C" or when a device clear message is received.

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- Meanings and set/reset conditions of status byte bits



b0: measure end
Set to 1 when measurement (general sweep measurement or one sample measurement in power monitor measurement) is completed.
Set to 0 when next measurement is started.

b1: syntax error
Set to 1 when a syntax or setting error is found in the program code received.
Set to 0 when the next program code is received.

b2: calculation end
Set to 1 when calculation of half-value width, noise figure, curve fit or spectral luminous efficiency correction is completed.
Set to 0 when measurement is started or output of the calculation data is complete.

b3: copy end
Set to 1 when output to the printer is completed.
Set to 0 at measurement start or when "COP" code is received.

b4: trend end
Set to 1 when one trend chart measurement is completed on the power monitor display.
Set to 0 when the next rrend measurement is started.

b5: average end
Set to 1 when access to the floppy disk (write/read or initialization) is completed.
Set to 0 when access to the floppy disk is started.

b6: RQS
Set to 1 when one of the bits b0 to b5 or b7 is switched ON to indicate that a service request has been transmitted.
Set to 0 when all bits are 0.

b7: self-test error
Set to 1 when an error is found during self-diagnosis.

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6.3.5 Device trigger function

The analyzer executes SINGLE measurement when the address-specified command "GET" (Group Execute Trigger) is received in the same way as when program codes "MEA1", "E" and "*TRG" are received.

6.3.6 Device clear function

The analyzer is initialized by the address-specified command "SDC" (Selected Device Clear) and universal command "DCL" (Device Clear) at power on in the same way as when program codes "C" and "*RST" are received.
The initial state at power on is shown in Table 6-4.

Table 6-4 Initial State at Power On

Item	Initial state
① Measurement condition	Preceding state (except for the following items)
② Measurement operation	Stopped state
③ Data display	Normal display (dual-screen, superimpose, and 3-dimensional display modes are all OFF.)
④ Cursor display	All OFF
⑤ Spectral width calculation	OFF
⑥ Normalize	OFF
⑦ GP-IB	
• Status byte	0 (cleared)
• Status byte mask	"MSK0" (unmasked)
• SRG signal transmit	"SRQ0" (mode not to transmit SRQ signal)
• Waveform data output format	"OVS0", "FMT0" (ASCII)
• Terminator	"DEL0" ("DL0")→(NL<EOI>)
• Data separator	"SDL0" ("DS0")→(,)
• Message separator	"MSP0" ("MS0")→(;)

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6.3.7 Status modification by command

The analyzer states are modified as shown in Table 6-5 at power on and when commands are received.

Table 6-5 Status Modification by Command

Command, Code	Talker (with lamp)	Listener (with lamp)	Remote (with lamp)	SRQ (with lamp)	Status byte	Transmit data	Parameter and operation status
POWER ON	Cleared	Cleared	Local	Cleared	Cleared	Cleared	Partially initialized
IFC	Cleared	Cleared	——	——	——	——	——
"DCL" command	——	——	——	Cleared	Cleared	Cleared	Partially initialized
"SDC" command	Cleared	Set	——	Cleared	Cleared	Cleared	Partially initialized
"C", "*RST" codes	Cleared	Set	Remote	Cleared	Cleared	Cleared	Partially initialized
"IPR" code	Cleared	Set	Remote	Cleared	Cleared	Cleared	Initialization
"GET" command	Cleared	Set	——	═══	b0, 2, 3, 4 cleared	Cleared	——
"E", "*TRG" codes	Cleared	Set	Remote	═══	b0, 2, 3, 4 cleared	Cleared	——
Talker specified to the analyzer	Set	Cleared	——	——	——	——	——
Talker release instruction	Cleared	——	——	——	——	——	——
Listener specified to the analyzer	Cleared	Set	——	——	——	——	——
Listener release instruction	——	Cleared	——	——	——	——	——
Serial poling	Set	Cleared	——	Cleared	——	——	——

—— : The previous state remains unchanged.
═══ : Indefinite state
"DCL" : Device Clear
"SDC" : Selected Device Clear
"GET" : Group Excute Trigger

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6.3.8 Sample programs

The sample programs given in this subsection are for controlling the analyzer using HP 300 of 9000 series and NEC PC-9800 series.
(In the examples below, "8" is used to identify the GP-IB address of the analyzer.)

(1) Example 1

Center wavelength and span are set for spectrum analysis and peak wavelength and level are read.

① Program 1 for HP9000 series 300

```
10    !*********************************************
20    !     Q8381A Optical Spectrum Analyzer
30    !     == sample program 1 ==
40    !     ( set center,span etc and read
50    !       peak lambda,level )
60    !*********************************************
70    !
80   INTEGER Spa
90   REAL Peak_lambda,Peak_level
100   !
110  Spa=708                          ! define Q8381A GP-IB address (8)
120  ON INTR 7 GOSUB Srq              ! define SRQ interrupt routine
130  CLEAR Spa                        ! initialize Q8381A
140  OUTPUT Spa;"PMO 0"               ! select 'SPECTRUM'(power monitor OFF)
150  OUTPUT Spa;"CEN1.55um,SPA20nm"   ! CENTER:1.55um , SPAN:20nm
160  OUTPUT Spa;"REF 0dBm"            ! 'REF LEVEL' set to 0dBm
170  OUTPUT Spa;"LIN 0,LEV 0"         ! select LOG display and set 10dB/DIV
180  OUTPUT Spa;"SWE 1,RES 0"         ! select 'ADAPTIVE' and 0.1nm resolution
190  OUTPUT Spa;"AVG 1"               ! 'AVG' set to 1(OFF)
200  OUTPUT Spa;"MSK 254"             ! enable only 'measurement end' bit
210  OUTPUT Spa;"SRQ 1"               ! enable SRQ signal
220  OUTPUT Spa;"MEA 1"               ! start single measurement
230  Meas_end=0                       ! clear measure end flag
240  ENABLE INTR 7;2                  ! enable SRQ interrupt
250  IF Meas_end=0 THEN 250           ! wait measurement end
260  OUTPUT Spa;"OPK"                 ! request peak data output
270  ENTER Spa;Peak_lambda,Peak_level      ! read peak lambda,level
280  DISP Peak_lambda,Peak_level      ! display peak lambda and level
290  STOP
300   !
310 Srq:S=SPOLL(Spa)                  ! read status byte of Q8381A
320  Meas_end=1                       ! set measure end flag
330  RETURN
340   !
350  END
```

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- Explanation on program 1 for HP9000 series 300

Line No.	Description
10 to 70	Comment
80 to 90	Definition of variables
110	The Q8381A's GP-IB address (8) is set as a variable.
120	Definition of the processing routine used when an interrupt by SRQ signal occurs.
130	The analyzer is initialized at power on.
140	Spectrum analysis mode is selected.
150	Center wavelength is set to 1.55 μm. Span is set to 20 nm.
160	Reference level is set to 0 dBm.
170	In LOG display, Y-axis scale is set to 10 dB/DIV.
180	Sweep mode is set to "ADAPTIVE". Resolution is set to 0.1 nm.
190	Averaging is set to OFF.
200	Only b0 (measurement-end) in the status byte is made valid.
210	Mode to transmit SRQ signal is set.
220	Measurement is started.
230	Flag (variable) to indicate end of measurement is cleared.
240	Interrupt by SRQ signal is allowed.
250	Waiting for end of measurement.
260	Output of peak search data is requested.
270	Peak wavelength and level are read into variables.
280	Peak wavelength and level which have been read are displayed.
310	<Interrupt processing routine Srq> Serial poling is executed and status byte read into the variable.
320	Flag to indicate measurement end is set.
330	Return to main routine.

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② Program 1 for PC9800 series

```
10  '****************************************
20  '     Q8381A Optical Spectrum Analyzer
30  '     == sample program 1 ==
40  '     (set center,span etc and read
50  '      peak lambda,level)
60  '****************************************
70  '
80  ISET IFC                    ' send 'IFC' signal
90  ISET REN                    ' 'REN' signal set to true
100 CMD DELIM = 0               ' delimitter CR/LF(LF=NL)
110 CMD TIMEOUT = 10            ' timeout set to 10sec
120 DEF SEG = &H60              ' --
130 A% = PEEK(&H9F3)            '   |
140 A% = A% AND &HBF            '   -- clear SRQ bit of PC9801
150 POKE &H9F3,A%               ' --
160 SPA = 8                     ' define Q8381A GP-IB address (8)
170 PRINT @SPA;"C"              ' initialize Q8381A
180 ON SRQ GOSUB *SSRQ          ' define SRQ interrupt routine
190 PRINT @SPA;"PMO 0"          ' select 'SPECTRUM'(power monitor OFF)
200 PRINT @SPA;"CEN1.55um,SPA20nm"   ' CENTER:1.55um , SPAN:20nm
210 PRINT @SPA;"REF 0dBm"       ' 'REF LEVEL' set to 0dBm
220 PRINT @SPA;"LIN 0,LEV 0"    ' select LOG scale and set to 10dB/DIV
230 PRINT @SPA;"SWE 1,RES 0"    ' select 'ADAPTIVE',resolution 0.1nm
240 PRINT @SPA;"AVG 1"          ' average number set to 1(OFF)
250 PRINT @SPA;"MSK 254"        ' enable only 'measure end' bit
260 PRINT @SPA;"SRQ 1"          ' enable SRQ signal
270 PRINT @SPA;"MEA 1"          ' start single measurement
280 M.END = 0                   ' clear measure end flag
290 SRQ ON                      ' enable SRQ interrupt
300 IF M.END=0 THEN 300         ' wait measurement end
310 PRINT @SPA;"DEL 0,SDL 0"    ' terminator NL(EOI)
320                             ' data separator ','
330 PRINT @SPA;"HED 0,OPK"      ' header OFF,request peak data output
340 INPUT @SPA;PEAK.LM,PEAK.LV  ' read peak lambda,level
350 PRINT PEAK.LM,PEAK.LV       ' print peak lambda,level
360 STOP
370 '
380 *SSRQ: POLL SPA,S           ' execute serial-poll and read status
390 M.END = 1                   ' set measure end flag
400 RETURN
410 '
420 END
```

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- Explanation on program 1 for PC9800 series

Line No.	Description
10 to 70	Comment
80	"IFC" signal is transmitted.
90	"REN" signal is set to TRUE.
100	Delimiter used when loading a command is set to CR/LF (=CR/NL).
110	Time out duration at handshake is set at 10 seconds.
120 to150	The SRQ bit of the PC9800's GP-IB interface is cleared.
160	The Q8381A's GP-IB address (8) is set as a variable.
170	The analyzer is initialized at power on.
180	Definition of the processing routine used when an interrupt by SRQ signal occurs.
190	Spectrum analysis mode is selected.
200	Center wavelength is set to 1.55 μm. Span is set to 20 nm.
210	Reference level is set to 0 dbm.
220	In LOG display, Y-axis scale is set to 10 dB/DIV.
230	Sweep mode is set to "ADAPTIVE". Resolution is set to 0.1 nm.
240	Averaging is set to OFF.
250	Only b0 (measurement-end) in the status byte is made valid.
260	Mode to transmit SRQ signal is set.
270	Measurement is started.
280	Flag (variable) to indicate end of measurement is cleared.
290	Interrupt by SRQ signal is allowed.
300	Waiting for end of measurement.
310	Terminator is set to CR/NL(EOI) and data separator to ','.
330	Header OFF and output of peak search data is requested.
340	Peak wavelength and level are read into the variables.
350	Peak wavelength and level which have been read are displayed.
380	<Interrupt processing routine *SSRQ> Serial poling is executed and the status byte is read into the variable.
390	Flag to indicate end of measurement is set.
400	Return to main routine.

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(2) Example 2

The trend data of 101 points is measured on the power monitor display.
The measurement result (minimum, maximum, and average value) is read.

① Program 2 for HP9000 series 300

```
10    !*********************************************
20    !      Q8381A Optical Spectrum Analyzer
30    !      == sample program 2 ==
40    !      ( set power monitor mode and read
50    !        trend data(MIN,MAX,AVE) )
60    !*********************************************
70    !
80   INTEGER Spa
90   REAL T_min,T_max,T_ave
100   !
110  Spa=708                          ! define Q8381A GP-IB address (8)
120  ON INTR 7 GOSUB Srq              ! define SRQ interrupt routine
130  CLEAR Spa                        ! initialize Q8381A
140  OUTPUT Spa;"PMO 1"               ! select 'power monitor' mode
150  OUTPUT Spa;"PWV 850nm"           ! wavelength set to 850nm
160  OUTPUT Spa;"PNX101,PIN0.5"       ! N-MAX:101 , interval:0.5sec
170  OUTPUT Spa;"REF 0.1mW"           ! 'REF LEVEL' set to 0.1mW(linear scale)
180  OUTPUT Spa;"AVG 8"               ! average number set to 8
190  OUTPUT Spa;"MSK 239"             ! enable only 'trend end' bit(b4)
200  OUTPUT Spa;"SRQ 1"               ! enable SRQ signal
210  OUTPUT Spa;"MEA 1"               ! start trend-chart measurement
220  Meas_end=0                       ! clear measure end flag
230  ENABLE INTR 7;2                  ! enable SRQ interrupt
240  IF Meas_end=0 THEN 240           ! wait measurement end
250  OUTPUT Spa;"OPK"                 ! request MIN,MAX,AVE data output
260  ENTER Spa;T_min,T_max,T_ave      ! read MIN,MAX,AVE data
270  DISP T_min,T_max,T_ave           ! display MIN,MAX,AVE data
280  STOP
290   !
300 Srq:S=SPOLL(Spa)                  ! read status byte of Q8381A
310  Meas_end=1                       ! set measure end flag
320  RETURN
330   !
340  END
```

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- Explanation on program 2 for HP9000 series 300

Line No.	Description
10 to 70	Comment
80 to 90	Definition of variables
110	The Q8381A's GP-IB address (8) is set as a variable.
120	Definition of the processing routine used when an interrupt by SRQ signal occurs.
130	The analyzer is initialized at power on.
140	Power monitor display mode is selected.
150	Power measurement wavelength is set to 850 nm.
160	Number of the measurement data is set to 101 and the measurement interval is set to 0.5 seconds.
170	Reference level is set to 0.1 mW (when using mW, linear scale is automatically set).
180	Number of averaging times is set to 8.
190	Only b4 (trend-end) in the status byte is made valid.
200	Mode to transmit SRQ signal is set.
210	Trend chart measurement starts.
220	Flag (variable) to indicate the end of measurement is cleared.
230	Interrupt by SRQ signal is allowed.
240	Waiting for end of measurement
250	Output of peak search data (minimum, maximum, and average value) is requested.
260	Minimum, maximum, and average values are read into variables.
270	Minimum, maximum, and average values which have been read are displayed.
300	<Interrupt processing routine Srq> Serial poling is executed and the status byte read into the variable.
310	Flag to indicate end of measurement is set.
320	Return to main routine.

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② Program 2 for PC9800

```
10  '****************************************
20  '     Q8381A Optical Spectrum Analyzer
30  '     == sample program 2 ==
40  '     (set power monitor mode(101 points),
50  '      and read MIN,MAX,AVE data)
60  '****************************************
70  '
80  ISET IFC                      ' send 'IFC' signal
90  ISET REN                      ' 'REN' signal set to true
100 CMD DELIM = 0                 ' delimitter CR/LF(LF=NL)
110 CMD TIMEOUT = 10              ' timeout set to 10sec
120 DEF SEG = &H60                ' --
130 A% = PEEK(&H9F3)              '   |
140 A% = A% AND &HBF              '   -- clear SRQ bit of PC9801
150 POKE &H9F3,A%                 ' --
160 SPA = 8                       ' define Q8381A GP-IB address (8)
170 PRINT @SPA;"C"                ' initialize Q8381A
180 ON SRQ GOSUB *SSRQ            ' define SRQ interrupt routine
190 PRINT @SPA;"PMO 1"            ' select power monitor mode
200 PRINT @SPA;"PWV 850nm"        ' wavelength set to 850nm
210 PRINT @SPA;"PNX101,PINO.5"    ' trend >> N-MAX:101 , interval:0.5sec
220 PRINT @SPA;"REF 0.1mW"        ' 'REF LEVEL' set to 0.1mW(LINEAR SCALE)
230 PRINT @SPA;"AVG 8"            ' average number set to 8
240 PRINT @SPA;"MSK 239"          ' enable only 'trend end'(b4) bit
250 PRINT @SPA;"SRQ 1"            ' enable SRQ signal
260 PRINT @SPA;"MEA 1"            ' start single measurement(trend chart)
270 M.END = 0                     ' clear measure end flag
280 SRQ ON                        ' enable SRQ interrupt
290 IF M.END=0 THEN 290           ' wait measurement end
300 PRINT @SPA;"DEL 0,SDL 0"      ' terminator NL(EOI)
310                               ' data separator ','
320 PRINT @SPA;"HED 0,OPK"        ' header OFF,request MIN,MAX,AVE data output
330 INPUT @SPA;T.MIN,T.MAX,T.AVE    ' read MIN,MAX,AVE
340 PRINT T.MIN,T.MAX,T.AVE       ' print MIN,MAX,AVE
350 STOP
360 '
370 *SSRQ: POLL SPA,S             ' execute serial-poll and read status
380 M.END = 1                     ' set measure end flag
390 RETURN
400 '
410 END
```

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- Explanation on program 2 for PC9800 series

Line No.	Description
10 to 70	Comment
80	"IFC" signal is transmitted.
90	"REN" signal is set to TRUE.
100	Delimiter for command setting is set to CR/LF (= CR/NL).
110	Time out duration at handshake is set at 10 seconds.
120 to 150	The SRQ bit of the PC9800 series's GP-IB interface is cleared.
160	The Q8381A's GP-IB address (8) is set has a variable.
170	The analyzer is initialized at power is on.
180	Definition of the processing routine used when an interrupt by SRQ signal occurs.
190	Power monitor display mode is selected.
200	Power measurement wavelength is set to 850 nm.
210	Number of measurement data is set to 101. Measurement interval is set to 0.5 seconds.
220	Reference level is set to 0.1 mW (when using mW, Linear scale is set automatically).
230	Number of average times is set to 8.
240	Only b4 (trend-end) in the status byte is made valid.
250	Mode to transmit SRQ signal is set.
260	Trend chart measurement starts.
270	Flag (variable) to indicate the end of measurement is cleared.
280	Interrupt by SRQ signal is allowed.
290	Waiting for end of measurement.
300	Terminator is set to CR/NL(EOI) and data separator to ','.
320	Header OFF and output of peak search data (minimum, maximum, and average value) is requested.
330	Minimum, maximum, and average values are read into variables.
340	Minimum, maximum, and average values which have been read are displayed.
370	< Interrupt processing routine *SSRQ > Serial poling is executed and the status byte is read into the variable.
380	Flag to indicate end of measurement (completion of trend measurement) is set.
390	Return to main routine.

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(3) Example 3

After setting measurement conditions for spectrum analysis the spectrum data obtained is read in the ASCII format (wavelength and level data are read together).

① Program 3 for HP9000 series 300

```
10    !*****************************************
20    !     Q8381A Optical Spectrum Analyzer
30    !     == sample program 3 ==
40    !     ( set-up measurement condition
50    !       and read spectrum data )
60    !*****************************************
70    !
80   INTEGER Spa
90   REAL Lambda(1:501),Level(1:501)
100   !
110  Spa=708                          ! define Q8381A GP-IB address (8)
120  ON INTR 7 GOSUB Srq              ! define SRQ interrupt routine
130  CLEAR Spa                        ! initialize Q8344A
140  OUTPUT Spa;"PMO 0"               ! select 'SPECTRUM' mode(p-mon OFF)
150  OUTPUT Spa;"STA1200nm,STO1400nm"     ! START:1200nm , STOP:1400nm
160  OUTPUT Spa;"REF 0.1mW"           ! 'REF LEVEL' set to 0.1mW(select LINEAR)
170  OUTPUT Spa;"RES 3,SWE 2"         ! resolution:1.0nm , sweep mode: HI-SENS 1
180  OUTPUT Spa;"AVG 2"               ! average number set to 2
190  OUTPUT Spa;"MSK 254"             ! enable only 'measure end' bit(b0)
200  OUTPUT Spa;"SRQ 1"               ! enable SRQ signal
210  OUTPUT Spa;"MEA 1"               ! start single measurement
220  Meas_end=0                       ! clear measure end flag
230  ENABLE INTR 7;2                  ! enable SRQ interrupt
240  IF Meas_end=0 THEN 240           ! wait measurement end
250  OUTPUT Spa;"FMT 0,HED 0"         ! select ASCII format and header OFF
260  OUTPUT Spa;"ODN"                 ! request no-of-measured data output
270  ENTER Spa;N_meas                 ! read no-of-measured data
280  REDIM Lambda(1:N_meas),Level(1:N_meas)   ! re-sizing of variables
290  OUTPUT Spa;"OSD1"                ! request X-axis data output(lambda)
300  ENTER Spa;Lambda(*)              ! read lambda data
310  OUTPUT Spa;"OSD0"                ! request Y-axis data output(level)
320  ENTER Spa;Level(*)               ! read level data
330  !***  spectrum data transaction write here  ***
340  STOP
350   !
360 Srq:S=SPOLL(Spa)                  ! read status byte of Q8381A
370  Meas_end=1                       ! set measure end flag
380  RETURN
390   !
400  END
```

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- Explanation on program 3 for HP9000 series 300

Line No.	Description
10 to 70	Comment
80 to 90	Definition of variables (to assure arrangement of the maximum number of data items).
110	The Q8381A's GP-IB address (8) is set as a variable.
120	Definition of the processing routine used when an interrupt by SRQ signal occurs.
130	The Q8381A is initialized at power on.
140	Spectrum analysis mode is selected.
150	Start wavelength is set to 1200 nm. Stop wavelength is set to 1400 nm.
160	Reference level is set to 0.1 mW (when using mW, linear scale is automatically set).
170	Resolution is set to 0.1 nm. Sweep mode is set to "HI-SENS 1".
180	Number of averaging times is set to 2.
190	Only b0 (measure-end) in the status byte is made valid.
200	Mode to transmit SRQ signal is set.
210	Measurement starts.
220	Flag (variable) to indicate the end of measurement is cleared.
230	Interrupt by SRQ signal is allowed.
240	Waiting for end of measurement.
250	The data output format is set to ASCII and Header set to OFF.
260	Request is made to output the number of measurement points in spectrum.
270	Number of measurement points is read into the data variable.
280	Re-definition of the size of the arrangement variable for reading wavelength and level data (to be read into the arrangement variable en masse).
290	Output of X-axis data (wavelength) is requested.
300	Wavelength data is read into the arrangement variable en masse.
310	Output of Y-axis data (level) is requested.
320	Level data is read into the arrangement variable en masse.
330	(Normally, this line is used to describe the processing program for data read after this line number. To display data in graph form, use the wavelength and level data in pairs.)
360	<Interrupt processing routine Srq> Serial poling is executed and status byte read into the variable.
370	Flag to indicate end of measurement (completion of averaging) is set.
380	Return to main routine.

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② Program 3 for PC9800 series

```
10  '****************************************
20  '     Q8381A Optical Spectrum Analyzer
30  '     == sample program 3 ==
40  '     (set-up measurement condition
50  '      and read spectrum data with ASCII)
60  '****************************************
70  '
80  DIM LAMBDA(501),LEVEL(501)
90  ISET IFC                        ' send 'IFC' signal
100 ISET REN                        ' 'REN' signal set to true
110 CMD DELIM = 0                   ' delimitter CR/LF
120 CMD TIMEOUT = 10                ' timeout set to 10sec
130 DEF SEG = &H60                  ' --
140 A% = PEEK(&H9F3)                '    |
150 A% = A% AND &HBF                '    -- clear SRQ bit of PC9801
160 POKE &H9F3,A%                   ' --
170 SPA = 8                         ' define Q8381A GP-IB address (8)
180 PRINT @SPA;"C"                  ' initialize Q8381A
190 ON SRQ GOSUB *SSRQ              ' define SRQ interrupt routine
200 PRINT @SPA;"PMO 0"              ' select 'SPECTRUM'(power monitor OFF)
210 PRINT @SPA;"STA1200nm,STO1400nm"    ' START:1200nm , STOP:1400nm
220 PRINT @SPA;"REF 0.1mW"          ' 'REF LEVEL' set to 0.1mW(select LINEAR)
230 PRINT @SPA;"RES 3,SWE 2"        ' resolution: 1.0nm , sweep mode: HI-SENS 1
240 PRINT @SPA;"AVG 2"              ' average number set to 2
250 PRINT @SPA;"MSK 254"            ' enable only 'measure end'(b0) bit
260 PRINT @SPA;"SRQ 1"              ' enable SRQ signal
270 PRINT @SPA;"MEA 1"              ' start single measurement(average of 2)
280 M.END = 0                       ' clear measure end flag
290 SRQ ON                          ' enable SRQ interrupt
300 IF M.END=0 THEN 300             ' wait measurement end
310 PRINT @SPA;"DEL 0,SDL 2"        ' teminator LF(EOI)
320                                 ' data separator CR/NL
330 PRINT @SPA;"FMT 0,HED 0"        ' select ASCII format and header OFF
340 PRINT @SPA;"ODN"                ' request no-of-measured data output
350 INPUT @SPA;N.DATA               ' read no-of-measured data(may be 501)
360 PRINT @SPA;"OSD1"               ' request X-axis data output(lambda)
370 FOR N=1 TO N.DATA               ' --
380   INPUT @SPA;LAMBDA(N)          '   --  read lambda data
390 NEXT N                          ' --
400 PRINT @SPA;"OSD0"               ' request Y-axis data output(level)
410 FOR N=1 TO N.DATA               ' --
420   INPUT @SPA;LEVEL(N)           '   --  read level data
430 NEXT N                          ' --
440 '*** spectrum data transaction write here ***
450 STOP
460 '
470 *SSRQ: POLL SPA,S               ' execute serial-poll and read status
480 M.END = 1                       ' set measure end flag
490 RETURN
500 '
510 END
```

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- Explanation on program 3 for PC9800 series

Line No.	Description
10 to 70	Comment
80	Definition of variables (to assure arrangement of the maximum number of data items).
90	"IFC" signal is transmitted.
100	"REN" signal is set to TRUE.
110	Delimiter for command setting is set to CR/LF (=CR/NL).
120	Time out duration at handshake is set at 10 seconds.
130 to 160	The SRQ bit of the PC9800's GP-IB interface is cleared.
170	The Q8381A's GP-IB address (8) is set as a variable.
180	The Q8381A is initialized at power on.
190	Definition of the processing routine used when an interrupt by SRQ signal occurs.
200	Spectrum analysis mode is selected.
210	Start wavelength is set to 1200 nm. Stop wavelength is set to 1400 nm.
220	Reference level is set to 0.1 mW (when using mW, linear scale is automatically set).
230	Resolution is set to 1.0 nm. Sweep mode is set to"HI-SENS 1".
240	Number of averaging times is set to 2.
250	Only b0 (measure-end) in the status byte is made valid.
260	Mode to transmit SRQ signal is set.
270	Measurement starts.
280	Flag (variable) to indicate the end of measurement is cleared.
290	Interrupt caused by SRQ signal is allowed.
300	Waiting for end of measurement.
310	Terminator is set to CR/NL (EOI) and data separator to CR/LF.
330	Data output format is set to ASCII and Header to OFF.
340	Request is made to output the number of measurement points in spectrum.
350	Number of measurement points is read into the data variable.
360	Output of X-axis data (wavelength) is requested.
370 to 390	Wavelength data for the number of points read in line 350 is read into the arrangement variables.
400	Output of Y-axis data is requested.
410 to 430	Level data for the number of points read in line 350 is read into the arrangement variables.
440	(Normally, this line is used to describe the processing program for data read after this line number. To display data in graph form, use the wavelength and level data in pairs.)
470	<Interrupt processing routine *SSRQ> Serial poling is executed and the status byte read into the variable.
480	Flag to indicate end of measurement (completion of averaging) is set.
490	Return to main routine.

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(4) Example 4

After measurement conditions are set for spectrum analysis, the spectrum data obtained is read in binary format (wavelength and level data are read together).
The data transfer time is minimized by using binary format.

① Program 4 for HP9000 series 300

```
10    !*****************************************
20    !     Q8381A Optical Spectrum Analyzer
30    !     == sample program 4 ==
40    !     ( set-up measurement condition
50    !       and read spectrum data with
60    !       64bit floating format )
70    !*****************************************
80    !
90    INTEGER Spa,N
100   REAL Lambda(1:501) BUFFER,Level(1:501) BUFFER
110    !
120   Spa=708                          ! define Q8381A GP-IB address (8)
130   ON INTR 7 GOSUB Srq              ! define SRQ interrupt routine
140   CLEAR Spa                        ! initialize Q8381A
150   OUTPUT Spa;"PM00"                ! select 'SPECTRUM' mode(p-mon OFF)
160   OUTPUT Spa;"CEN1.55um,SPA50nm"   ! CENTER:1.55um , SPAN:50nm
170   OUTPUT Spa;"REF -10dBm"          ! 'REF LEVEL' set to -10dBm
180   OUTPUT Spa;"SWE 0"               ! sweep mode set to 'NORMAL'
190   OUTPUT Spa;"RES1"                ! resolution set to 0.2nm
200   OUTPUT Spa;"MSK254"              ! enable only 'measurement end' bit
210   OUTPUT Spa;"SRQ1"                ! enable SRQ signal
220   TRIGGER Spa                      ! start single measurement
230   Meas_end=0                       ! clear measure end flag
240   ENABLE INTR 7;2                  ! enable SRQ interrupt
250   IF Meas_end=0 THEN 250           ! wait measurement end
260   OUTPUT Spa;"ODN"                 ! request no-of-measured data output
270   ENTER Spa;N_meas                 ! read no-of-measured data
280   !
290   OUTPUT Spa;"FMT 2"               ! select 64bit floating format
300                                    ! terminator (EOI)
310   OUTPUT Spa;"OSD0"                ! request Y-axis data output(level)
320   ASSIGN @Buf TO BUFFER Level(*)    ! assign path-name for variable
330   ASSIGN @Spa TO Spa               ! assign path-name for Q8381A
340   TRANSFER @Spa TO @Buf;END,WAIT     ! Q8381A level data xfer to Level(*)
350   W_start=(1.55-.05/2)*1.E-6         ! for make lambda array data
360   W_step=5.0E-8/(N_meas-1)         ! calculate step data
370   FOR N=1 TO N_meas
380     Lambda(N)=W_start+(N-1)*W_step   ! set lambda value to array
390   NEXT N
400    !***  spectrum data transaction write here  ***
410   STOP
420    !
430 Srq:S=SPOLL(Spa)                   ! read status byte of Q8381A
440   Meas_end=1                       ! set measure end flag
450   RETURN
460    !
470   END
```


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- Explanation on program 4 for HP9000 series 300

Line No.	Description
10 to 80	Comment
90 to 100	Definition of variables (to assure arrangement of the maximum number of data items).
120	The Q8381A's GP-IB address (8) is set as a variable.
130	Definition of the processing routine used when an interrupt by SRQ signal occurs.
140	The Q8381A is initialized at power on.
150	Spectrum analysis mode is selected.
160	Center wavelength is set to 1.55 μm. Span is set to 50 nm.
170	Reference level is set to –10 dBm.
180	Sweep mode is set to "NORMAL".
190	Resolution is set to 0.2 nm. Averaging is set to OFF.
200	Only b0 (measure-end) in the status byte is made valid.
210	Mode to transmit SRQ signal is set.
220	Measurement starts.
230	Flag (variable) to indicate the end of measurement is cleared.
240	Interrupt by SRQ signal is allowed.
250	Waiting for end of measurement.
260	Request is made to output the number of measurement points in the spectrum. (Usual number is 501.)
270	Number of measurement points is read into the data variable.
290	The data output format is set to binary (64-bit floating point type). (When binary format is selected, (EOI) is automatically specified as the terminator.)
310	Output of Y-axis data (level) is requested.
320 to 330	The I/O route name is defined in the arrangement variable for the level data read and in the Q8381A to enable the buffer transfer mode.
340	Buffer transfer starts and level data is read in.
350 to 390	Arrangement data of wavelength is generated from center wavelength and span. (This can be outputted from the analyzer.)
400	(Normally, this line is used to describe the processing program for data read after this line number. To display data in graph form, use the wavelength and level data in pairs.)
430	< Interrupt processing routine Srq > Serial poling is executed and the status byte read into the variable.
440	Flag to indicate end of measurement is set.
450	Return to main routine.

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② Program 4 for PC9800 series

```
10  '****************************************
20  '     Q8381A Optical Spectrum Analyzer
30  '     == sample program 4 ==
40  '     (set-up measurement condition
50  '      and read spectrum data with BINARY)
60  '****************************************
70  '
80  DIM LAMBDA(501),LEVEL(501),BX$[4]
90  ISET IFC                        ' send 'IFC' signal
100 ISET REN                        ' 'REN' signal set to true
110 CMD DELIM = 0                   ' delimitter CR/LF
120 CMD TIMEOUT = 10                ' timeout set to 10sec
130 DEF SEG = &H60                  ' --
140 A% = PEEK(&H9F3)                '   |
150 A% = A% AND &HBF                '   -- clear SRQ bit of PC9801
160 POKE &H9F3,A%                   ' --
170 SPA = 8                         ' define Q8381A GP-IB address (8)
175 PC = IEEE(1) AND &H1F           ' read GP-IB address of PC
180 PRINT @SPA;"C"                  ' initialize Q8381A
190 ON SRQ GOSUB *SSRQ              ' define SRQ interrupt routine
200 PRINT @SPA;"PMO 0"              ' select 'SPECTRUM'(power monitor OFF)
210 PRINT @SPA;"CEN1.55um,SPA50nm"    ' CENTER:1.55um , SPAN:50nm
220 PRINT @SPA;"REF -10dBm"         ' 'REF LEVEL' set to -10dBm(select LOG)
230 PRINT @SPA;"SWE 0"              ' sweep mode set to 'NORMAL'
240 PRINT @SPA;"RES 1,AVG 1"        ' resolution:0.2nm , AVG: 1(OFF)
250 PRINT @SPA;"MSK 254"            ' enable only 'measure end'(b0) bit
260 PRINT @SPA;"SRQ 1"              ' enable SRQ signal
270 PRINT @SPA;"MEA 1"              ' start single measurement(average of 2)
280 M.END = 0                       ' clear measure end flag
290 SRQ ON                          ' enable SRQ interrupt
300 IF M.END=0 THEN 300             ' wait measurement end
310 PRINT @SPA;"HED 0,0DN"          ' request no-of-measured data output
320 INPUT @SPA;N.DATA               ' read no-of-measured data(may be 501)
330 PRINT @SPA;'FMT 4"              ' select 32bit NEC-floating format
340 PRINT @SPA;"OSD0"               ' request Y-axis data output(level)
350 WBYTE &H5F,&H3F,&H20+PC,&H40+SPA;   ' PC:listener , Q8381A:talker
360 FOR N=1 TO N.DATA               '
370   RBYTE ;B1,B2,B3,B4            ' read 1point(4bytes) data
380   BX$=CHR$(B1)+CHR$(B2)+CHR$(B3)+CHR$(B4)  ' 4bytes data set to string
390   LEVEL(N)=CVS(BX$)             ' convert to numeric data
400 NEXT N                          '
410 '*** spectrum data transaction write here ***
420 STOP
430 *SSRQ: POLL SPA,S               ' execute serial-poll and read status
440 M.END = 1                       ' set measure end flag
450 RETURN
460 '
470 END
```

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- Explanation on program 4 for PC9800 series (1/2)

Line No.	Description
10 to 70	Comment
80	Definition of variables (to assure arrangement of the maximum number of data items).
90	"IFC" signal is transmitted.
100	"REN" signal is set to TRUE.
110	Delimiter for command setting is set to CR/LF (= CR/NL).
120	Time out duration at handshake is set at 10 seconds.
130 to 160	The SRQ bit of the PC9800's GP-IB interface is cleared.
170	The Q8381A's GP-IB address (8) is set as a variable.
180	The Q8381A is initialized at power on.
190	Definition of the processing routine used when an interrupt by SRQ signal occurs.
200	Spectrum analysis mode is selected.
210	Center wavelength is set to 1.55 μm. Span is set to 50 nm.
220	Reference level is set to −10 dBm.
230	Sweep mode is set to "NORMAL".
240	Resolution is set to 0.2 nm. Averaging is set to OFF.
250	Only b0 (measure-end) in the status byte is made valid.
260	Mode to transmit SRQ signal is set.
270	Measurement starts.
280	Flag (variable) to indicate the end of measurement is cleared.
290	Interrupt caused by SRQ signal is allowed.
300	Waiting for end of measurement.
310	Request is made to output the number of measurement points in the spectrum. (Usual number is 501.)
320	Number of measurement points is read into the data variable.
330	The data output format is set to binary (NEC 32-bit floating point type). (When binary format is selected, <EOI> is automatically specifed as the terminator.)
340	Output of Y-axis data (level) is requested.
350	Q8381A is formatted to talker. PC9800 is formatted to listener.
360	Data read for measurement point a few minutes is repeated.
370	Read of one point data (4 bytes)
380	Substitute the 4 bytes data for character string to convert the data into the numerical value.
390	Convert the data from the character string into the floating point data and store the data in the array variable of the level data.

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- Explanation on program 4 for PC9800 series (2/2)

Line No.	Description
410	(Normally, this line is used to describe the processing program for data read after this line number.
430	<Interrupt processing routine *SSRQ> Serial poling is executed and the status byte read into the variable.
440	Flag to indicate end of measurement is set.
450	Return to main routine.

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(5) Example 5

Spectrum measurement is executed and the 2nd peak (cursor data) and spectral width calculation data read.

① Program 5 for HP9000 series 300

```
10    !*******************************************
20    !     Q8381A Optical Spectrum Analyzer
30    !     == sample program 5 ==
40    !     ( set-up measurement condition
50    !       and read 2nd-peak(cursor data),
60    !       spectral width data )
70    !*******************************************
80    !
90   INTEGER Spa
100  REAL Lm1,Lv1,D_lm,D_lv
110  REAL Lambda_0,S_width,N_peak
120   !
130  Spa=708                          ! define Q8381A GP-IB address (8)
140  ON INTR 7 GOSUB Srq              ! define SRQ interrupt routine
150  CLEAR Spa                        ! initialize Q8381A
160  OUTPUT Spa;"PMO 0"               ! select 'SPECTRUM' mode(p-mon OFF)
170  OUTPUT Spa;"CEN660nm,SPA20nm"  ! CENTER:660nm , SPAN:20nm
180  OUTPUT Spa;"REF-20dBm,LEV0"    ! REF LEVEL:-20dBm , LEVEL SCALE:10dB/DIV
190  OUTPUT Spa;"RES0,SWE1"           ! resolution:0.1nm , sweep mode:ADAPTIVE
200  OUTPUT Spa;"AVG10"               ! average number set to 10
210  OUTPUT Spa;"MSK 254"             ! enable only 'measure end' bit(b0)
220  OUTPUT Spa;"SRQ 1"               ! enable SRQ signal
230  OUTPUT Spa;"MEA 1"               ! start single measurement
240  Meas_end=0                       ! clear measure end flag
250  ENABLE INTR 7;2                  ! enable SRQ interrupt
260  IF Meas_end=0 THEN 260           ! wait measurement end
270  OUTPUT Spa;"CUD 2,CUR 1"         ! select '2nd peak' and cursor ON
280  OUTPUT Spa;"OCD"                 ! request cursor data output
290  ENTER Spa;Lm1,Lv1,D_lm,D_lv      ! read lambda1,L1,delta-lambda,delta-L
300  OUTPUT Spa;"WTY 0,WPX 3"         ! select 'Pk-Xdb' and X set to 3dB
310  OUTPUT Spa;"SPW 1"               ! spectral width ON(execute calculation)
320  OUTPUT Spa;"OSW"                 ! request spectral width data output
330  ENTER Spa;Lambda_0,S_width,N_peak ! read lambda-0,width,no-of-peak
340  STOP
350   !
360 Srq:S=SPOLL(Spa)                  ! read status byte of Q8381A
370  Meas_end=1                       ! set measure end flag
380  RETURN
390   !
400  END
```

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- Explanation on program 5 for HP9000 series 300

Line No.	Description
10 to 80	Comment
90 to 110	Definition of variables.
130	The Q8381A's GP-IB address (8) is set as a variable.
140	Definition of the processing routine used when an interrupt by SRQ signal occurs.
150	The Q8381A is initialized at power on.
160	Spectrum analysis mode is selected.
170	Center wavelength is set to 660 nm. Span is set to 20 nm.
180	Reference level is set to −20 dBm and level scale to 10 dB/DIV.
190	Resolution is set to 0.1 nm. Sweep mode is set to "ADAPTIVE".
200	Number of average times is set to 10.
210	Only b0 (measure-end) in the status byte is made valid.
220	Mode to transmit SRQ signal is set.
230	Measurement starts.
240	Flag (variable) to indicate the end of measurement is cleared.
250	Interrupt by SRQ signal is allowed.
260	Waiting for end of measurement.
270	Cursor data display mode is set to "2ND PEAK" with cursor set to ON. (When Cursor is ON, the 2ND PEAK calculation is executed.)
280	Output of cursor data is requested.
290	Cursor data is read (λ1, level 1, $\triangle\lambda$, $\triangle$ level).
300	Spectral width calculation −0(Pk−XdB) is selected and parameter XdB to 3 dB.
310	Spectral width is set to ON (calculation is executed).
320	Output of spectral width data is requested.
330	Center wavelength, spectral width and number of peaks data read.
360	<Interrupt processing routine Srq> Serial poling is executed and the status byte read into the variable.
370	Flag to indicate end of measurement is set.
380	Return to main routine.

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② Program 5 for PC9800

```
10  '****************************************
20  '     Q8381A Optical Spectrum Analyzer
30  '     == sample program 5 ==
40  '     (set-up measurement condition
50  '      and read 2nd-peak<cursor data>,
60  '      spectral width data )
70  '****************************************
80  '
90  ISET IFC                      ' send 'IFC' signal
100 ISET REN                      ' 'REN' signal set to true
110 CMD DELIM = 0                 ' delimitter CR/LF
120 CMD TIMEOUT = 10              ' timeout set to 10sec
130 DEF SEG = &H60                ' --
140 A% = PEEK(&H9F3)              '   |
150 A% = A% AND &HBF              '    -- clear SRQ bit of PC9801
160 POKE &H9F3,A%                 ' --
170 SPA = 8                       ' define Q8381A GP-IB address (8)
175 PC = IEEE(1) AND &H1F         ' read GP-IB address of PC
180 UNL=&H3F : MTA=&H40 + PC : LA=&H20 : SDC=&H4 : GGET=&H8
190 WBYTE UNL,MTA,LA+SPA,SDC;     ' initialize Q8381A
200                               ' UNL,MTA(adr 30),LA of Q8381A,SDC
210 ON SRQ GOSUB *SSRQ            ' define SRQ interrupt routine
220 PRINT @SPA;"PM0 0"            ' select 'SPECTRUM'(power monitor OFF)
230 PRINT @SPA;"CEN660nm,SPA20nm"   ' CENTER:660nm , SPAN:20nm
240 PRINT @SPA;"REF -20dBm,LEV 0" ' REF LEVEL:-20dBm , LEVEL SCALE:10dB/DIV
250 PRINT @SPA;"RES 0,SWE 1"      ' resolution:0.1nm , sweep mode:ADAPTIVE
260 PRINT @SPA;"AVG 10"           ' average number set to 10
270 PRINT @SPA;"MSK 254"          ' enable only 'measure end'(b0) bit
280 PRINT @SPA;"SRQ 1"            ' enable SRQ signal
290 WBYTE UNL,MTA,LA+SPA,GGET;    ' start single measurement
300                               ' UNL,MTA(adr 30),LA of Q8344A,GET
310 M.END = 0                     ' clear measure end flag
320 SRQ ON                        ' enable SRQ interrupt
330 IF M.END=0 THEN 330           ' wait measurement end
340 PRINT @SPA;"DEL 0,SDL 0"      ' terminator NL(EOI)
350                               ' data separator ','
360 PRINT @SPA;"CUD 2,CUR 1"      ' select '2nd-peak' and cursor ON
370 PRINT @SPA;"OCD"              ' request cursor data output
380 INPUT @SPA;LM1,LV1,D.LM,D.LV    ' read lambda1,L1,delta-lambda,delta-L
390 PRINT @SPA;"WTY 0,WPX 3"      ' select 'Pk-XdB' and X set to 3dB
400 PRINT @SPA;"SPW 1"            ' spectral width ON(execute calculation)
410 PRINT @SPA;"OSW"              ' request spectral width data output
420 INPUT @SPA;LAMBDA.0,S.WIDTH,N.PEAK  ' read lambda-0,width,no-of-peak
430 STOP
440 '
450 *SSRQ: POLL SPA,S             ' execute serial-poll and read status
460 M.END = 1                     ' set measure end flag
470 RETURN
480 '
490 END
```

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- Explanation on program 5 for PC9800

Line No.	Description
10 to 80	Comment
90	"IFC" signal is transmitted.
100	"REN" signal is set to TRUE.
110	Delimiter for command setting is set to CR/LF (=CR/NL).
120	Time out duration at handshake is set at 10 seconds.
130 to 160	The SRQ bit of the PC9800's GP-IB interface is cleared.
170	The Q8381A's GP-IB address (8) is set as a variable.
180 to 200	The Q8381A is initialized at power on.
210	Definition of the processing routine used when an interrupt by SRQ signal occurs.
220	Spectrum analysis mode is selected.
230	Center wavelength is set to 660 nm. Span is set to 20 nm.
240	Reference level is set to 0 dBm and the level scale to 10 dB/DIV.
250	Resolution is set to 0.1 nm. Sweep modeis set to "ADAPTIVE".
260	Number of average times is set to 10.
270	Only b0 (measure-end) in the status byte is made valid.
280	Mode to transmit SRQ signal is set.
290 to 300	Measurement starts.
310	Flag (variable) to indicate the end of measurement is cleared.
320	Interrupt by SRQ signal is allowed.
330	Waiting for end of measurement.
340 to 350	Terminator is set to CR/NL (EOI) and the data separator to ','.
360	Cursor data display mode is set to "2ND PEAK" with cursor set to ON. (When cursor is ON, 2ND PEAK calculation is executed.)
370	Output of cursor data is requested.
380	Cursor data is read (λ1, level1, $\triangle\lambda$, $\triangle$ level)
390	Spectral width calculation—0(Pk—XdB) is selected and parameter XdB is set to 3 dB.
400	Spectral width is set to ON (calculation is executed).
410	Output of the spectral width data is requested.
420	Center wavelength, spectral width and number of peaks data is read.
450	<Interrupt processing routine *SRQ> Serial poling is executed and the status byte read into the variable.
460	Flag to indicate end of measurement is set.
470	Return to main routine.

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7. FLOPPY DISK

This chapter describes the floppy disk where the measurement data and measurement conditions are stored. Details on how to handle the floppy disk, and how to restore the saved measurement data and conditions on external computers are described here.
Details on how to initialize the floppy disk, and how to read/write data from/on the floppy disk are given in Chapter 4.
Chapter 7 is structured as follows.

Table of Contents

7. FLOPPY DISK 7-1
7.1 Handling the Floppy Disk 7-2
7.1.1 Overview 7-2
7.1.2 Initialization (formatting) 7-2
7.1.3 Write protect 7-2
7.1.4 Inserting/Ejecting the floppy disk 7-3
7.2 Restoring Data from the Floppy Disk 7-4
7.2.1 Types of data in the floppy disk 7-4
7.2.2 Data file items 7-5
7.2.3 Example of floppy data restore program 7-8*

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7.1 Handling the Floppy Disk

7.1.1 Overview

This analyzer incorporates a 3.5-inch floppy disk drive, to store and restore the measured data or conditions.

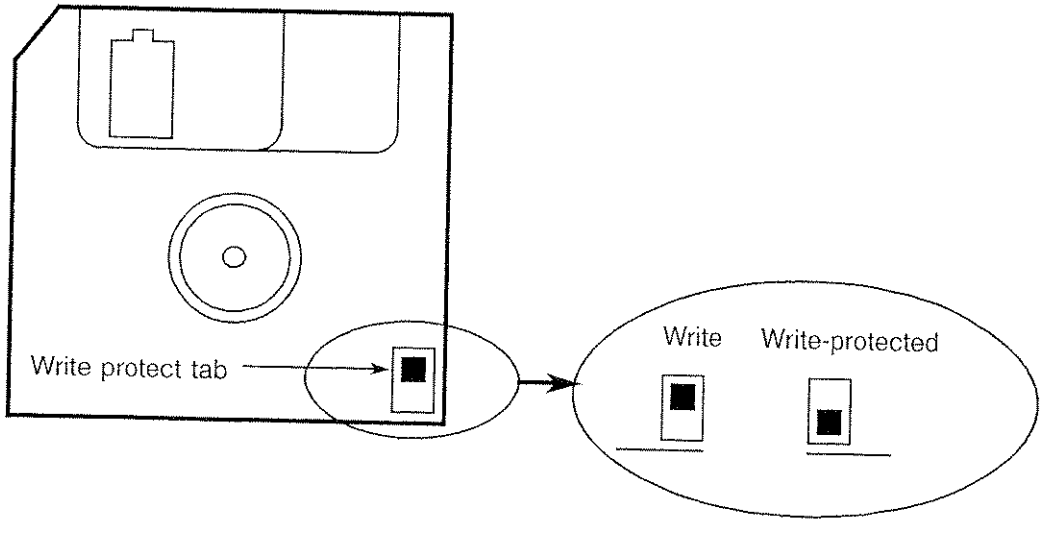
Disk type	:	3.5 inch micro floppy disk
Usable media	:	2DD (Double-sided double density)
		2HD (Double-sided high density)
Format capacity:		720K bytes (2DD)
		1.2M bytes (2HD)
Max. files	:	111 files /disk (2DD)
		191 files /disk (2HD-1.2M)
Storage format	:	In conformance with MS-DOS
		2DD (720K bytes) .... IBM/ NEC common format
		2HD (1.2M bytes) .... NEC format

7.1.2 Initialization (formatting)

The floppy disk must be formatted before put into use. This is to divide the disk into blocks (sectors, tracks) and set marks, to allow read and write.
See ③-3 of "4.6.1" for how to initialize the floppy disk on this analyzer.
The floppy disk can also be formatted on MS-DOS computers.

7.1.3 Write protect

Disk media has write protect structure so that precious data will not be erased by operation mistake. When initializing the floppy disk, or when writing data onto the disk, set the write protect tab as shown in the figure to the "write" side.



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7.1.4 Inserting/Ejecting the floppy disk

The floppy disk is inserted in the disk drive as follows.

Operation procedure

① Face the label side of the floppy disk up, and the media protection shutter side to the drive.

② Insert the floppy disk into the drive taking care that the floppy disk and drive are parallel with each other (so as not to apply unnecessary stress on the floppy disk).
Then, insert the floppy disk to the end, so that it is completely inserted and fixed in the drive.

The floppy disk is ejected from the disk drive as follows.

Operation procedure

① Press the eject button.
The disk will pop out of the drive allowing it to be taken out by hand.

CAUTION

1. Do not press the eject button while the LED on the disk drive is on.
(The LED indicates that write/read of the disk is in process.)
If the eject button is pressed with the LED on, the disk drive may be damaged, or the data in the floppy disk may be destroyed.

2. Do not extract the disk before the disk is completely ejected from the drive.
The shutter window of the disk may damage the head of the drive.
If the eject is not completed, insert the disk again and press the eject button once more.

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7.2 Restoring Data from the Floppy Disk

The following describes how to directly read and restore by external computers, the measurement data/measurement conditions stored on the floppy disk using this analyzer.
As the floppy disk is of MS-DOS format, the data can directly be read only on computers that use the MS-DOS as the system OS.

7.2.1 Types of data in the floppy disk

The measurement conditions and measurement data are recorded on the floppy disk according to the following format.

< Measurement condition file >

Item	Size (bytes)
(1) Header	256
(2) Measurement condition (ASCII)	512
(3) Measurement condition (binary)	512 (Note 1)

< Measurement data file >

Item	Size (bytes)	
(1) Header	256	
(2) Measurement condition (ASCII)	512	
(3) Measurement condition (binary)	512 (Note 1)	
(4) Data I Measurement condition (binary)	512	
(5) Measurement data I (float)	2048	
(6) Data II Measurement condition (binary)	512	*
(7) Measurement data II (float)	2048	

*: (6), (7) are recorded only when there are 513 or more measurement data in LOSS/TRANS or power monitor.

Note 1: The file size is 896 bytes in Q8383 using the software program of revision A03 or later.
The file size is 896 bytes in Q8381A using the software program of revision A09 or later.

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7.2.2 Data file items

(1) Header

Records information as the company name, product name and software revision, etc.

(2) Measurement condition (ASCII)

Records the measurement condition parameters as ASCII code character string.

The measurement conditions are read from this part when restoring data by the computer from the floppy disk.

The values are in form of "mantissa + exponent" based on the reference unit [m, W, dBm, sec], and are recorded according to the following sequence. The occupied size of the parameters are fixed, and the "0" (null) code is inserted in unused parts.

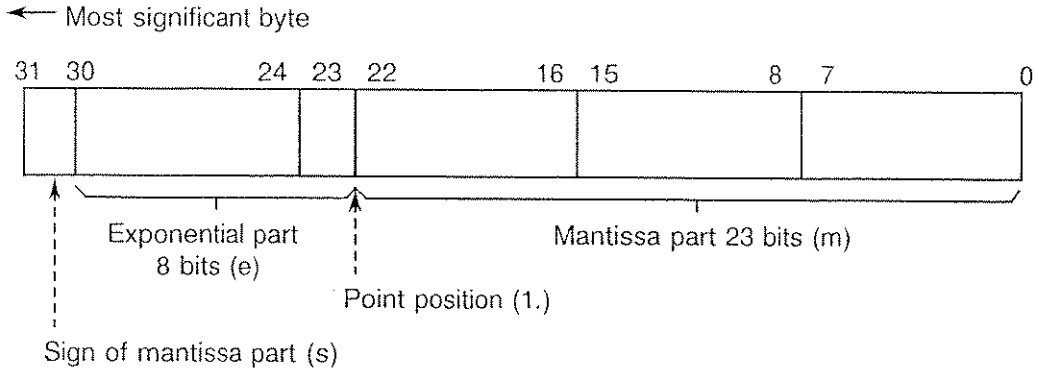
Parameter	Size [bytes]	Data example
① Label	[80]	** Q8381A Optical SPA **
② Measurement data count	[16]	501 , 1001
③ Start wavelength	[16]	1.5432E−06
④ Stop wavelength	[16]	1.5520E−06
⑤ Center wavelength	[16]	1.3125E−06
⑥ Span	[16]	200.00E−09
⑦ Resolution	[16]	0.1 nm , 5.0 nm
⑧ REF level (LINEAR)	[16]	10.00E−06 , 1.000E−03
⑨ REF level (LOG)	[16]	−20.00E+00 , +0.000E+00
⑩ Sweep mode	[16]	NORMAL , HI-SENS 1
⑪ Averaging count	[16]	20 , 100
⑫ Year-month-day	[16]	90-10-28
⑬ Hour:minute:second	[16]	20:35:14
⑭ Power monitor wavelength	[16]	1.4800E−06
⑮ Power monitor N-MAX	[16]	101 , 501
⑯ Power monitor interval	[16]	2.0E+00 , 0.1E+00
⑰ Power monitor average	[16]	1 , 30
⑱ Power monitor REF level (LINEAR)	[16]	100.0E−06
⑲ Power monitor REF level (LOG)	[16]	−10.00E+00
⑳ Power monitor start time	[16]	0.0E+00
㉑ Power monitor stop time	[16]	10.0E+00 , 20.0E+03
㉒ Vacant area	[112]	

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(3) Measurement conditions (binary)
The same parameters as (2) is basically stored, and used for measurement conditions or restoring measurement data using this analyzer.
Though (2) is structured by ASCII code character string, this part is binary floating point form integer or numerical code data.

(4) Data I measurement condition (binary)
Stores the measurement conditions concerning the measurement block I of (5).
This part is also binary form as same in (3).

(5) Measurement data I (float)
Stores the measured level data. Each data is in 32-bit floating point form (IEEE Std. 754-1985 format), and is stored in byte unit from the most significant byte.



$$\text{Numeral} = (-1)^S \times 2^{(e-127)} \times 1.\ m$$

The level data is always stored in [mW] unit, regardless of the scale (LIN/LOG) when saved. Therefore, use the following expression to convert the unit into [dBm] unit.

[mW] → [dBm] conversion : $P_{dBm} = 10^* \log_{10} (Pw)$

$(= 10^* (\log_2 Pw / \log_2 10))$

The size of this block is equivalent to 512 data. The first 501 spectrum data is effective, or 1 to 512 power monitor (trend) data is effective. (In power monitor, the setting of the measurement conditions affects the number of data within the range of 11 to 1001.)
The LOSS/TRANS spectrum data stores measurement data (MEAS) in this block.

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(6) Data II measurement condition (binary)
Stores the measurement conditions of the measurement data block II of (7).
This block and (7) exists only when the number of measurement data is 513 or more in the spectrum LOSS/TRANS data or power monitor.

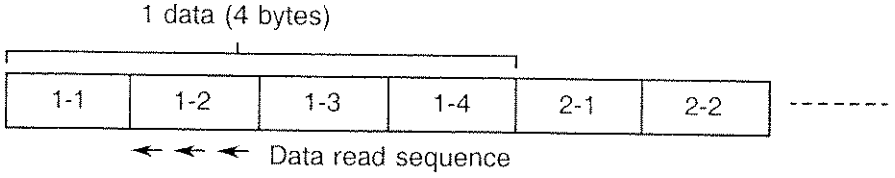
(7) Measurement data II (float)
Stores the measured level data. The format is the same as (5). 501 reference data (REF) points (LOSS/ TRANS) or 513 to 1001 (power monitor) spectrum data can be stored in this block.

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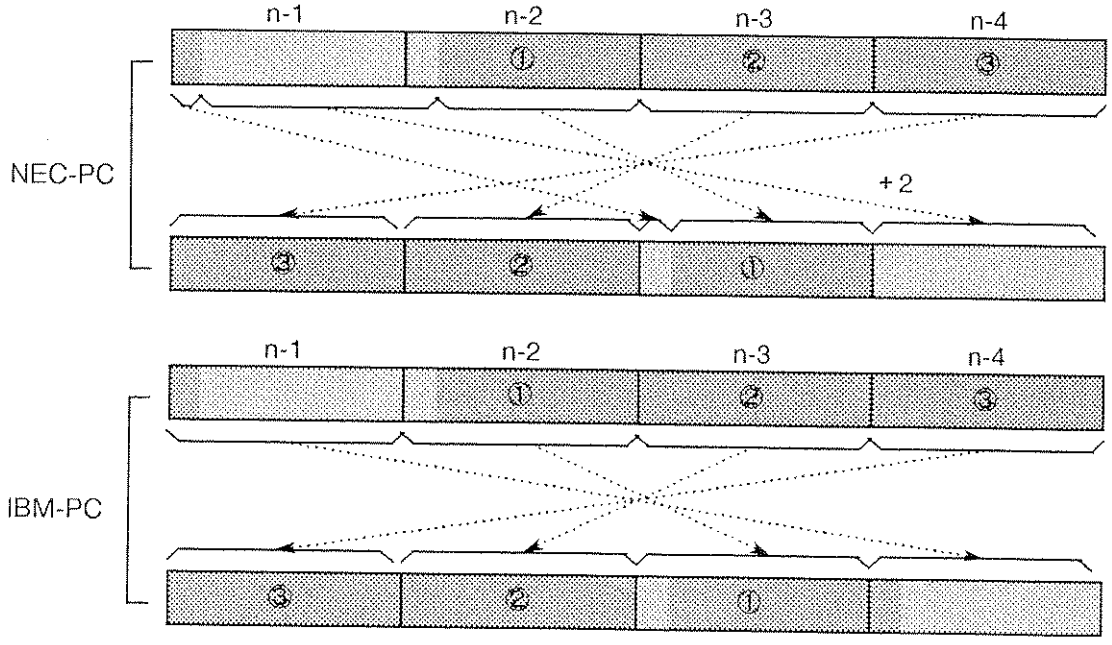
7.2.3 Example of floppy data restore program

The following is an example of the program to directly read the measurement data/measurement conditions stored on the floppy disk using this analyzer, on external computers.
The floppy disk is of MS-DOS format. Therefore, computers using the MS-DOS system as OS alone can do the direct reading.

The following is an example of the program described in NEC-PC and IBM-PC BASIC language.
The main part of the program is the part that reads the measurement data and internally converts the data into numerical format. Create the program referring to the instruction manual of the computers for data display and analysis.
When using language other that BASIC, as the C language, data in the file can be read and numerical conversion done also in the same procedure as the example program.
The floating data of NEC-PC and IBM-PC is read and the format is converted according to the following rule.



- Conversion of numerical (32-bit floating) data into internal format.



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(1) Program example 1

The spectrum measurement data is read, the data is converted into LOG (dBm) value, and stored in the array variable.

① NEC-PC (N88 BASIC)(1/2)

```
10  '*****************************************
20  '     Q8381A Optical Spectrum Analyzer
30  '     == Floppy sample program 1 ==
40  '     (read spectrum data,convert to float
50  '      and store to array)
60  '*****************************************
70  '
80  DIM LEVEL[501]
90  '
100 FILENAME$="1310_001.SPE"     ' set read file name
110 OPEN FILENAME$ FOR INPUT AS #1   ' open specified file for read
120 R.SIZE = 256 : GOSUB *R.DUMMY    ' dummy read(HEADER block-256bytes)
130 GOSUB *R.CON                 ' read condition block(512bytes)
140 R.SIZE = 512 : GOSUB *R.DUMMY    ' dummy read(condition -512bytes)  (Note 2)
150 R.SIZE = 512 : GOSUB *R.DUMMY    ' dummy read(data condition-512bytes)
160 N.DATA = 501 : GOSUB *R.FLOAT    ' read 501points spectrum data
170 L10# = LOG(10)
180 FOR N = 1 TO N.DATA
190   LEVEL(N) = 10*LOG(LEVEL(N))/L10#   ' [W] convert to [dBm]
200   PRINT N;": ";LEVEL(N)      ' display read spectrum data
210 NEXT N
220 CLOSE #1                     ' close file
230 STOP
240 '
250 *R.FLOAT
260 FOR N = 1 TO N.DATA
270   B1$ = INPUT$( 1 , #1 )     ' for read 1 point data(4bytes)
280   B2$ = INPUT$( 1 , #1 )
290   B3$ = INPUT$( 1 , #1 ) : B4$ = INPUT$( 1 , #1 )
300   NB1 = ASC(B1$) : NB2 = ASC(B2$)    ' character convert to ASCII code
310                              ' for IEEE float convert to NEC float
320   S1 = (NB1 AND 128) + (NB2 AND 127) ' sign + upper 7bits of fraction
330   E1 = (NB1 AND 127)*2 + (NB2 AND 128)/128 + 2    ' exponent
340   FD$ = B4$ + B3$ + CHR$(S1) + CHR$(E1)
350   LEVEL(N) = CVS(FD$)        ' convert to floating value(linear[W])
360 NEXT N
370 RETURN
380 '
390 *R.CON
400 LABEL$ = INPUT$( 80 , #1)    ' read LABEL
410 DSIZE$ = INPUT$( 16 , #1)    ' read number of data
420 W.STT$ = INPUT$( 16 , #1)    ' read START wavelength
430 W.STP$ = INPUT$( 16 , #1)    ' read STOP wavelength
440 W.CEN$ = INPUT$( 16 , #1)    ' read CENTER wavelength
450 W.SPA$ = INPUT$( 16 , #1)    ' read SPAN
460 W.RES$ = INPUT$( 16 , #1)    ' read RESOLUTION(char)
470 RF.LN$ = INPUT$( 16 , #1)    ' read REF LEVEL(LINEAR)
480 RF.LG$ = INPUT$( 16 , #1)    ' read REF LEVEL(LOG)
490 SMODE$ = INPUT$( 16 , #1)    ' read SWEEP MODE
500 AVG$   = INPUT$( 16 , #1)    ' read AVG number
```

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① NEC-PC (N88 BASIC)(2/2)

```
510 XDATE$ = INPUT$( 16 , #1)    ' read date
520 XTIME$ = INPUT$( 16 , #1)    ' read time
530 DMY$   = INPUT$( 16*8 , #1) ' dummy read (power monitor condition)
540 DMY$   = INPUT$( 112 , #1)   ' read empty area
550 RETURN
560 '
570 *R.DUMMY                     ' dummy read
580 FOR RDN = 1 TO R.SIZE
590   DMY$ = INPUT$( 1 , #1)
600 NEXT RDN
610 RETURN
620 '
630 END
```

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- Explanation of program example
  ① NEC-PC (N88 BASIC)(1/2)

Line No.	Description
10 to 70	Comment
80	Definition of variable to store the measurement data
100	Designation of file name to read the measurement data
110	Opens the specified file under the input mode
120	Reads the header (256 bytes) - Dummy read
130	Reads the measurement condition part (ASCII 512 bytes) (The conditions are read but not used in this example.)
140	Reads the measurement condition part (binary 512 bytes)- Dummy read (Note 2)
150	Reads the condition part (binary 512 bytes) attached to the measurement data - Dummy read
160	Reads the measurement data (501 points), converts the format, and stores it in the array variable
170	Sets the constant to calculate the logarithm with 10 as base
180, 210	Repeats the processing of 190, 200 for as many times as the data points (501).
190	Converts the [W] unit data into [dBm] unit
200	Displays data number and data converted into dBm
220	Closes the file opened in 110
250	<Measurement data read, format conversion subroutine>
260, 360	Repeats the processing of 270 to 350 for as many times as specified
270 to 290	Reads 1 point (4 bytes) data into the character string, in byte unit
300	Calculates the ASCII code value of the data in the 1st and 2nd bytes
320	Adds the mantissa part sign and decimal part most significant 7 bits
330	Calculates the exponential part (IEEE + 2 matches with the NEC-PC)
340	Replaces the sequence of the bytes and substitutes them in the character string
350	Converts the character string into floating point data, and stores it in the array
370	Returns to the main routine
390	<Measurement condition part read subroutine>
400 to 520	Reads label, number of data, start wavelength, etc. into the specified character string
530	Reads conditions related to the power monitor - Dummy read
540	Read vacant area - Dummy read
550	Returns to the main routine

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① NEC-PC (N88 BASIC)(2/2)

Line No.	Description
570	<Dummy read subroutine> (Because the INPUT$ function can read only 255 bytes)
580 to 600	Reads the specified bytes
610	Returns to the main routine

*: The spectrum data is read in this program example. When LOSS/TRANS is selected, the data of MEAS and REF are paired, so read the measurement data block II in the same way.
(In this example, the entire measurement data block-I data is not read, so the remaining 11 data is read before it reads the next block.)

Note 2: 512 bytes has been changed to 896 bytes in the following software revision:
For Q8383: Revision A03 or later
For Q 8381A: Revision A09 or later

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② IBM-PC (Quick BASIC)

```
10  '*****************************************
20  '     Q8381A Optical Spectrum Analyzer
30  '     == Floppy sample program 1 ==
40  '     (read spectrum data,convert to float
50  '      and store to array)
60  '*****************************************
70  '
80  DIM LEVEL(501)
90  '
100 FILENAME$ = "a:1545_001.SPE"  ' set read file name
110 OPEN FILENAME$ FOR BINARY AS #1   ' open specified file for read
120 R.SIZE = 256: GOSUB R.DUMMY          ' dummy read(HEADER block-256bytes)
130 GOSUB R.CON                       ' read condition block(512bytes)
140 R.SIZE = 512: GOSUB R.DUMMY          ' dummy read(condition -512bytes)(Note 3)
150 R.SIZE = 512: GOSUB R.DUMMY          ' dummy read(data condition-512bytes)
160 N.DATA = 501: GOSUB R.FLOAT          ' read 501points spectrum data
170 L10 = LOG(10)
180 FOR N = 1 TO N.DATA
190   LEVEL(N) = 10 * LOG(LEVEL(N)) / L10' [W] convert to [dBm]
200   PRINT N; ": "; LEVEL(N)    ' display read spectrum data
210 NEXT N
220 CLOSE #1                      ' close file
230 STOP
240 '
250 R.FLOAT:
260 FOR N = 1 TO N.DATA
270   B1$ = INPUT$(1, #1)         ' for read 1 point data(4bytes)
280   B2$ = INPUT$(1, #1)
290   B3$ = INPUT$(1, #1): B4$ = INPUT$(1, #1)
300                               ' for IEEE float convert to NEC float
310   FD$ = B4$ + B3$ + B2$ + B1$
320   LEVEL(N) = CVS(FD$)         ' convert to floating value(linear[W])
330 NEXT N
340 RETURN
350 '
360 R.CON:
370 LABEL$ = INPUT$(80, #1)       ' read LABEL
380 DSIZE$ = INPUT$(16, #1)       ' read number of data
390 W.STT$ = INPUT$(16, #1)       ' read START wavelength
400 W.STP$ = INPUT$(16, #1)       ' read STOP wavelength
410 W.CEN$ = INPUT$(16, #1)       ' read CENTER wavelength
420 W.SPA$ = INPUT$(16, #1)       ' read SPAN
430 W.RES$ = INPUT$(16, #1)       ' read RESOLUTION(char)
440 RF.LN$ = INPUT$(16, #1)       ' read REF LEVEL(LINEAR)
450 RF.LG$ = INPUT$(16, #1)       ' read REF LEVEL(LOG)
460 SMODE$ = INPUT$(16, #1)       ' read SWEEP MODE
470 AVG$ = INPUT$(16, #1)         ' read AVG number
480 XDATE$ = INPUT$(16, #1)       ' read date
490 XTIME$ = INPUT$(16, #1)       ' read time
500 DMY$ = INPUT$(16 * 8, #1)     ' dummy read (power monitor condition)
510 DMY$ = INPUT$(112, #1)        ' read empty area
520 RETURN
530 '
540 R.DUMMY:                     ' dummy read
550 FOR RDN = 1 TO R.SIZE
560   DMY$ = INPUT$(1, #1)
570 NEXT RDN
580 RETURN
590 '
600 END
```

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- Explanation of program example
  ② IBM-PC (Quick BASIC)(1/2)

Line No.	Description
10 to 70	Comment
80	Definition of variable to store the measurement data
100	Designation of file name to read the measurement data
110	Opens the specified file under the bynary mode
120	Reads the header (256 bytes) - Dummy read
130	Reads the measurement condition part (ASCII 512 bytes) (The conditions are read but not used in this example)
140	Reads the measurement condition part (binary 512 bytes) - Dummy read (Note 3)
150	Reads the condition part (binary 512 bytes) attached to the measurement data - Dummy read
160	Reads the measurement data (501 points), converts the format, and stores it in the array variable
170	Sets the constant to calculate the logarithm with 10 as base
180, 210	Repeats the processing of 190, 200 for as many times as the data points (501).
190	Converts the [W] unit data into [dBm] unit
200	Displays data number and data converted into dBm
220	Closes the file opened in 110
250	<Measurement data read, format conversion subroutine>
260, 330	Repeats the processing of 270 to 320 for as many times as specified
270 to 300	Reads 1 point (4 bytes) data into the character string, in byte unit
310	Replaces the sequence of the bytes and substitutes them in the character string
320	Converts the character string into floating point data, and stores it in the array
330	Returns to the main routine
360	<Measurement condition part read subroutine>
370 to 490	Reads label, number of data, start wavelength, etc. into the specified character string
500	Reads conditions related to the power monitor - Dummy read
510	Read vacant area - Dummy read
520	Returns to the main routine

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② IBM-PC (Quick BASIC)(2/2)

Line No.	Description
540	< Dummy read subroutine > (Because the INPUT$ function can read only 255 bytes)
550 to 570	Reads the specified bytes
580	Returns to the main routine

*: The spectrum data is read in this program example, When LOSS/TRANS is selected, the data of MEAS and REF are paired, so read the measurement data block II in the same way.
(In this example, the entire measurement data block-I data is not read, so the remaining 11 data is read before it reads the next block.)

Note 3: 512 bytes has been changed to 896 bytes in the following software revision:
For Q 8383: Revision A03 or later
For Q 8381A: Revision A09 or later

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(2) Program example 2

The power monitor data (trend chart) file is read, the data is converted into LOG (dBm) value, and stored in the array variable.

- NEC-PC (N88 BASIC) (1/2)

```
10  '*****************************************
20  '    Q8381A Optical Spectrum Analyzer
30  '    == Floppy sample program 2 ==
40  '    (read trend chart data,convert to
50  '     float and store to array)
60  '*****************************************
70  '
80  DIM D.TREND[1001]
90  '
100 FILENAME$="LD_DRIFT.PWR"     ' set read file name
110 OPEN FILENAME$ FOR INPUT AS #1   ' open specified file for read
120 R.SIZE = 256 : GOSUB *R.DUMMY    ' dummy read(HEADER block-256bytes)
130 GOSUB *R.CON                     ' read condition block(512bytes)
140 R.SIZE = 512 : GOSUB *R.DUMMY    ' dummy read(condition -512bytes)   (Note 4)
150 R.SIZE = 512 : GOSUB *R.DUMMY    ' dummy read(data condition-512bytes)
160 N.DATA = VAL(DSIZE$) : GOSUB *R.FLOAT    ' read trend chart data
170 L10# = LOG(10)
180 FOR N = 1 TO N.DATA
190   D.TREND(N) = 10*LOG(D.TREND(N))/L10#   ' [W] convert to [dBm]
200   PRINT N;": ";D.TREND(N)    ' display read trend chart data
210 NEXT N
220 CLOSE #1                         ' close file
230 STOP
240 '
250 *R.FLOAT
260 FOR N = 1 TO N.DATA
270   B1$ = INPUT$( 1 , #1 )     ' for read 1 point data(4bytes)
280   B2$ = INPUT$( 1 , #1 )
290   B3$ = INPUT$( 1 , #1 ) : B4$ = INPUT$( 1 , #1 )
300   NB1 = ASC(B1$) : NB2 = ASC(B2$)    ' character convert to ASCII code
310                                      ' for IEEE float convert to NEC float
320   S1 = (NB1 AND 128) + (NB2 AND 127) ' sign + upper 7bits of fraction
330   E1 = (NB1 AND 127)*2 + (NB2 AND 128)/128 + 2    ' exponent
340   FD$ = B4$ + B3$ + CHR$(S1) + CHR$(E1)
350   D.TREND(N) = CVS(FD$)          ' convert to floating value(linear[W])
360   IF N<>512 THEN GOTO 380    ' jump if not block-1 end
370     R.SIZE = 512 : GOSUB *R.DUMMY   ' dummy read( block-2 512bytes )
380 NEXT N
390 RETURN
400 '
410 *R.CON
420 LABEL$ = INPUT$( 80 , #1)    ' read LABEL
430 DSIZE$ = INPUT$( 16 , #1)    ' read number of data
440 DMY$   = INPUT$( 16*9 , #1) ' dummy read (spectrum condition)
450 XDATE$ = INPUT$( 16 , #1)    ' read date
460 XTIME$ = INPUT$( 16 , #1)    ' read time
470 P.WAV$ = INPUT$( 16 , #1)    ' read wavelength
480 P.NMX$ = INPUT$( 16 , #1)    ' read N-MAX
490 P.INT$ = INPUT$( 16 , #1)    ' read INTERVAL
500 P.RLN$ = INPUT$( 16 , #1)    ' read REF LEVEL(LINEAR)
```

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- NEC-PC (N88 BASIC) (2/2)

```
510 P.RLG$ = INPUT$( 16 , #1)    ' read REF LEVEL(LOG)
520 P.STT$ = INPUT$( 16 , #1)    ' read start time
530 P.STP$ = INPUT$( 16 , #1)    ' read stop time
540 DMY$   = INPUT$( 112 , #1)   ' read empty area
550 RETURN
560 '
570 *R.DUMMY                     ' dummy read
580 FOR RDN = 1 TO R.SIZE
590   DMY$ = INPUT$( 1 , #1)
600 NEXT RDN
610 RETURN
620 '
630 END
```

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- Explanation of program example
  NEC-PC (N88 BASIC)(1/2)

Line No.	Description
10 to 70	Comment
80	Definition of variable to store the measurement data
100	Designation of file name to read the measurement data
110	Opens the specified file under the input mode
120	Reads the header (256 bytes) - Dummy read
130	Reads the measurement condition part (ASCII 512 bytes) (The data size of the conditions alone are used in this example.)
140	Reads the measurement condition part (binary 512 bytes) - Dummy read (Note 4)
150	Reads the condition part (binary 512 bytes) attached to the measurement data - Dummy read
160	Reads the measurement data (trend data), converts the format, and stores it in the array variable
170	Sets the constant to calculate the logarithm with 10 as base
180, 210	Repeats the processing of 190, 200 for as many times as the data points
190	Converts data in [W] unit into [dBm] unit
200	Displays data number and data converted into dBm
220	Closes the file opened in 110
250	< Measurement data read, format conversion subroutine >
260, 380	Repeats the processing of 270 to 370 for as many times as specified
270 to 290	Reads 1 point (4 bytes) data into the character string, in byte unit
300	Obtains the ASCII code value of the data in the 1st and 2nd bytes
320	Adds the mantissa part sign and decimal part most significant 7 bits
330	Calculates the exponential part (IEEE + 2 matches with the NEC-PC)
340	Replaces the sequence of the bytes and substitutes them in the character string
350	Converts the character string into floating point data, and stores it in the array
360	Checks the end of data block-1
370	When block-1 is ended, reads the condition part of block-2 (512 bytes) - Dummy read
390	Returns to the main routine Reads conditions related to the power monitor - Dummy read
410	< Measurement condition part read subroutine >
420, 430	Reads label and number of data into the specified character string

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NEC-PC (N88 BASIC)(2/2)

Line No.	Description
440	Reads conditions related to the spectrum - Dummy read
450 to 530	Reads power monitor related conditions into the specified character string
540	Reads vacant area - Dummy read
550	Returns to the main routine
570	<Dummy read subroutine> (Because the INPUT$ function can read only 255 bytes)
580 to 600	Reads the specified bytes
610	Returns to the main routine

*: When the computer is the IBM-PC (Quick BASIC), change line Nos. 270 to 350 as program example 1 line Nos. 270 to 320.

Note 4: 512 bytes has been changed to 896 bytes in the following software revision:
For Q8383: Revision A03 or later
For Q8381A: Revision A09 or later

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8. MEASUREMENT EXAMPLES

The actual operation procedure for measurement of three types of device (laser diode, LED and optical filter) on this analyzer is described in this chapter.
The following is the configuration of Chapter 8.

Table of Contents

8. MEASUREMENT EXAMPLES 8-1
8.1 SMSR Measurement of DFB Laser Diode 8-2
8.2 Spectrum/Spectral Half-width Measurement of LED 8-5
8.3 Loss Wavelength Characteristics Measurement of Optical Filter 8-8
8.4 Pulse light measurement by Gated MEAS Input 8-11*

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8.1 SMSR Measurement of DFB Laser Diode

In this example the SMSR (Side Mode Suppression Ratio) of the DFB laser diode which center wavelength is 1.55 μm is measured, and the result is output to the plotter.

Operation procedure

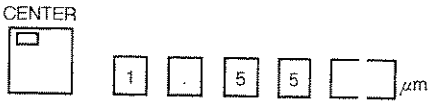
(1) Supply power to the analyzer.

The self diagnosis function is executed, and the normal measurement screen is displayed. (The measurement conditions when the power was disconnected last time is recovered. However, the measurement is held.)

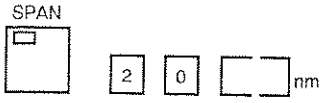
(2) Couple the output light of the laser diode to be measured with the fiber (SMF-10μm or MMF-50μm), and connect it to the input connector on the front panel of the analyzer.
As the core diameter of the optical fiber affects the measurement wavelength resolution, do not use optical fiber of 50 μm diameter or more. (See Section 3.2.)
Then, match the connector key position, insert the fiber, and tighten the screw firmly.
Also, fix the connected fiber firmly so that the fiber does not vibrate.
Vibration of the fiber can cause measurement data to vary.

(3) Set the center wavelength, span, and measure the spectrum.

① Set the center wavelength (1.55 μm):



② Set the wavelength span (20 nm):

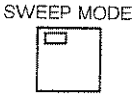


③ Set the reference level (AUTO):



[AUTO]

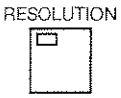
④ Set the sweep mode (ADAPTIVE):



[ADAPTIVE]

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⑤ Set the wavelength resolution (0.1 nm):



[0.1 nm]

⑥ Execute a single measurement:



(4) Set the center wavelength, level scale, etc. again and execute the measurement, so that the measurement data is displayed at the appropriate position.

① Set the peak wavelength at the center wavelength:



[PEAK]

② Set the level scale (10 dB/D):



[10 dB/D]

③ Execute a single measurement:



→Check that the measurement data is at the appropriate display position.

(5) Set the cursor display mode at "2ND PEAK" to obtain the SMSR.

① Turn on the cursor display, and select the "2ND PEAK" mode:



[2ND PEAK]

→The $\lambda 1$ cursor automatically moves to the peak position, and the $\lambda 2$ cursor to the next peak position, to display the level difference of the two cursors.
(This value is equivalent to the SMSR.)

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(6) Output the measurement data onto the plotter.

① Use the GP-IB cable to connect this analyzer with the plotter. (Connection of the GP-IB cable must be done before connecting the AC cable of the plotter.)
Set the address of the plotter at the only mode (LISTEN ONLY).

② Set the GP-IB address of the analyzer at the only mode (TALK ONLY).

LOCAL
□
ADDRESS [ONLY]

③ When the type of the connected plotter is our R9833, set "TYPE: AT", when the type is otherwise, set "TYPE: HPGL".

DEVICE
[PLOTTER] [TYPE: AT] or [TYPE: HPGL]

(If necessary, set the plot size through the soft keys.)

④ Start output to the plotter.

COPY

(Note) If the plotter side address is not set under the only mode, error message, "no plotter!!" is displayed.

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8.2 Spectrum/Spectral Half-width Measurement of LED

In this example a red visual LED (wavelength 660 nm) is measured, luminosity offset is performed, and the half-width is calculated.
The result of measurement is output to the internal printer.
(For Q8383, the luminosity offset is not performed.)

Operation procedure

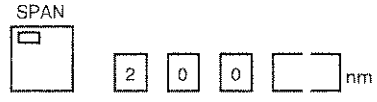
(1) Supply power to the analyzer, and connect the light to be measured by the fiber.
(See Section 8.1.)

(2) Set the center wavelength, span, and start the measurement.

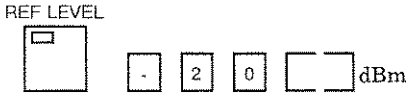
① Set the center wavelength (660 nm):



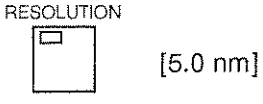
② Set the wavelength span (200 nm):



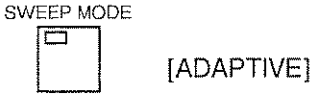
③ Set the reference level (−20 dBm):



④ Set the resolution (5.0 nm):



⑤ Set the sweep mode (ADAPTIVE):



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⑥ Set the averaging count (10):

AVG [10]

*: Generally, the level of the LED is lower than the laser, so averaging is effective to perform stable measurement.
(The averaging count can be set according to the input level.)

⑦ Execute a single measurement:

SINGLE

⑧ Set the peak wavelength at the center wavelength:

CENTER [PEAK]

*: If necessary, also set the REF level and level scale.

⑨ Execute the measurement once more:

SINGLE

(3) Perform the luminosity offset.

① Select the luminosity offset display:

ADVANCE [DOMINANT]

→Data which wavelength range is 400 nm to 760 nm is offset by the standard relative luminosity, and normalized and displayed by the peak level of the result.
The display on the upper left part of the CRT that represents the type of measurement data changes from "SPEC" to "DOM".

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(4) Execute the half-width operation. (XdB attenuation method)

① Execute/Display the half-width operation:

SPECTRAL WIDTH

By executing the half-width operation by the preset operation method, the center wavelength, spectral width, and peak count are displayed.
The operation method is selected by the soft keys.
The XdB attenuation method is used in this example, so press the [Pk-XB] key.
(The Pk-XdB character is inversed.)
If necessary, the X value of XdB can be changed as follows.

[parameter] [XdB] 3 ENTER

Press the SPECTRAL WIDTH key to perform spectral width operation again using the new value.

(5) Output the measurement result onto the printer.

① Set the printer as the output device:

DEVICE [PRINTER]

② Start printer output:

COPY

Printing starts about 1.5 seconds after the key is pressed.

(Note) If the paper is not set on the printer, error message, "no printer paper!!" is displayed.
If the printer head is up, error message, "printer head up!!" is displayed.

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8.3 Loss Wavelength Characteristics Measurement of Optical Filter

(white light source : TQ8111 is also used)

In this example the loss wavelength characteristics of an optical filter is measured using our white light source. As the power level per resolution is small when measuring the loss wavelength characteristics using a white light source, averaging is necessary.
(The following is an example using the optical filter. Optical fiber can also be measured following the same panel operation.)

Operation procedure

(1) Turn the power switch of this analyzer and the white light source.

(2) Wait for about 10 minutes to warm up the machines.

(3) Connect the analyzer and the CH2 of the white light source with a GI-50μm fiber.
In this example, the filter to be measured is placed in the chamber within the white light source, so CH2 is used.

First, measure the reference data to measure the loss characteristics.
(This is the spectrum of the white light source itself output to CH2.)
The wavelength range of this example is 1.0 μm to 1.6 μm.

① Set the START wavelength (1.0 μm):

SPAN [ ] [START] [1] [.] [0] [ ] [ ] μm

② Set the STOP wavelength (1.6 μm):

[STOP] [1] [.] [6] [ ] [ ] μm

③ Set the reference level (AUTO):

REF LEVEL [ ] [AUTO]

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④ Set the resolution (5 nm):

RESOLUTION [5.0 nm]

When the light has wide spectral width, set the maximum resolution.
(So that more light can be received for wide dynamic range measurement.)

⑤ Set the sweep mode (HI-SENS 1):

SWEEP MODE [HI-SENS 1]

Measurement under the sweep mode "HI-SENS 1" is done with sensitivity of approximately −80 dBm or less.
"HI-SENS 2" can be used when sensitivity of −85 dBm or less is required, but measurement time will be about 500 seconds. (The measurement time for "HI-SENS 1" is about 70 seconds.)
Also set the averaging process count as necessary. (When under the "HI-SENS 1/2" modes, the measurement time is the above time multiply the averaging count.)

⑥ Measure the reference data:

SINGLE

→Check that the measured data is as desired. If not, change the measurement conditions and measure again.

(4) Store the data measured in the above (3) into the reference memory, and select the loss characteristics measurement mode.

① Store the measurement data into the reference memory:

NORMALIZE LOSS/TRANS [SAV REF]

Press the NORMALIZE key, and the soft key menu necessary for the loss characteristics measurement appears.

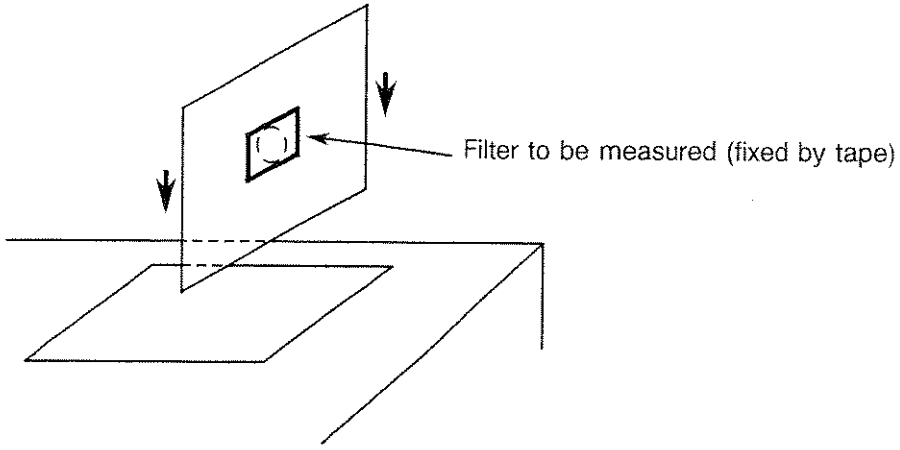
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② Select the loss characteristics measurement mode:

[LOSS]

Press [LOSS], and the LOSS characters is inversed to indicate that it is under the loss measurement mode. The display on the upper left part of the CRT that represents the type of analysis data changes from "SPEC" to "LOSS", and the Y axis display unit changes from dBm to dB. The data measured in the above (3) goes out of the CRT.

(5) Set the filter to be measured inside the chamber of the white light source TQ8111.



(6) The loss wavelength characteristics of the filter to be measured can be obtained by measuring the spectrum of the white light source that passes through the filter.

① Measure the filter loss data:

SINGLE

The loss wavelength characteristics (LOSS) data is displayed by dividing (subtracting in LOG scale) the measured data with the reference memory data stored in (4).

(Note 1) When the LOSS or TRANS mode is on, the REF LEVEL key will move the display of result of operation up and down. (Used under the LOSS mode to change the lowest level, and under the TRANS mode to change the highest level (the initial values are both 0 dB)).

(Note 2) In this measurement example, the LOSS is obtained by operation of the reference memory and measurement data.
The operation of the reference memory and measurement data memory 1 is done by storing the measurement data in measurement data memory 1 (using the soft key [SAV MEAS1]), and turning on the soft key [MEM NORM].
The display data does not change if the MEM NORM mode is on. (Measurement is done internally, but the data to be displayed cannot be obtained by operation with the memory.)

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8.4 Pulse Light Measurement by Gated MEAS Input

The GATED MEAS INPUT terminal of this analyzer is used to stabilize measurement of pulse light or non-sequential burst light by external synchronization. This input is operated under the TTL level positive logic. (The input circuit is shown in page 10-2.)

Figure 8-1 is the internal operation timing against this input signal. Measurement (A/D conversion) is basically executed when the GATED MEAS INPUT signal is Hi. (If this input terminal is not used, the internal pull-up resistance enables the measurement. Sweep is executed according to the timing decided by the internal processing time.) Therefore, when a signal is emitting pulse light, measurement can be arranged to be done only when the light is emitted, by inputting the same TTL positive logic signal as the emission timing into this terminal, thus allowing stable spectrum.

The minimum input pulse width that can be recognized is 10 nsec, but considering the restrictions of the internal IV-AMP response time, pulse width of 30 μsec is recommended. (When signal of 30 μsec or less is input, the pulse is automatically widened, and measurement is done only after waiting for the AMP response time, so the measurement data can becomes unstable.)

This input effective only when under the sweep mode "ADAPTIVE".
(Synchronous measurement by this input cannot be done under other modes.)

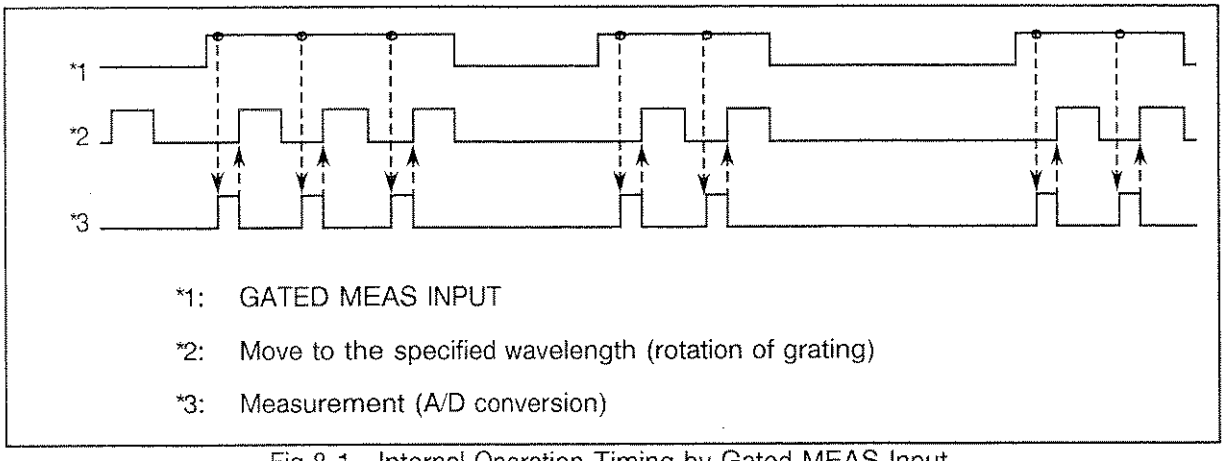


Fig.8-1 Internal Operation Timing by Gated MEAS Input

*: The "PULSE" key is included in the soft key menu by the "SWEEP MODE" key.
This mode is used for measurement of the pulse light without using the GATED MEAS INPUT terminal. (A/D conversion of the peak level signal within the preset gate time is performed, but the measurement time when the repeat cycle is long is longer than synchronous measurement. The measurement sensitivity is also inferior compared to the normal mode by 5 dB to 10 dB.)

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9. PRINCIPLE OF OPERATION

This Chapter describes the principle of the analyzer, along the block diagram.

9.1 Operation Principle

Figure 9-1 is a rough internal block diagram of the analyzer. (Q8381A).
The analyzer is structured by the three blocks of spectrum part (monochromator), measurement part, and display processing part.
The following is some explanation on the operating principle based on this block diagram.
(Compared with the Q8381A, the optical arrangement of monochromator is different in the Q8383, however, the basic operation is same.)

(1) Spectrum part (monochromator)

According to the spectrum characteristics (characteristics of the light to divide the wavelengths) of the diffraction grating, "the wavelength of the incident light varies the angle of the reflecting light." The monochromator uses this diffraction grating to take the so-called "Zerny-Turner" type optical arrangement.
The light to be measured is radiated on the collimate mirror, modified into parallel beams, and incident into the diffraction grating. The direction of the light reflected from the diffraction grating differs according to the wavelength of the measured light. When the rotary angle of the diffraction grating is at a position that matches the incident light wavelength, the light is radiated on the plane mirror. The light reflected from the plane mirror enters the converging mirror, where the converged light passes through the slit and is irradiated on the photo detector. (The Q8383 employs the double path method. Therefore, the light to be measured passes through this optical system twice, and is irradiated on the photo detector.)
The optical performance of the monochromator depends on the form of the spot of the light after spectrum, and this spot is dominated by the performance of parts as the collimate mirror, diffraction grating, converging mirror, etc. This analyzer adopts the off-axis paraboloid mirror that has no aberration for the collimate mirror and converging mirror, and holographic grating that has no ghost for the diffraction grating.

The diffracted light from the diffraction grating differs according to the dimension -m. This analyzer uses the primary or secondary light according to the wavelength.

Special element is used near the input connector to override the polarization dependency (polarization status of the input light - P wave/S wave changes the diffraction efficiency) of the diffraction grating, so that measurement can be done at a constant level regardless of the polarization status.
The wavelength is swept by rotating the diffraction grating. The rotation has high repeatability with the DC servo motor and the high-precision gear.

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Normally, the monochromator sets the wavelength resolution according to the incoming slit and outgoing slit. However this analyzer has no incoming slide, which is replaced by the core diameter of the input optical fiber. The outgoing slit plays its role by inputting only the selected wavelength into the detector. The width changes according to the preset resolution and wavelength.
The chopper in front of the outgoing slit chops the light and changes it into alternative signal, to cancel the offset of the detector and AMP system and allow high sensitivity measurement. (Chop frequency ; 190 Hz) (Q8381A only) It is also used to shut the incoming light when measuring the internal offset operated by the direct current AMP.

The detector part consists of three photo diodes (Si for shortwave, and InGaAs for longwave) to cover the wide wavelength range of 0.35 μm to 1.75 μm. The following is the applied wavelength of the photo diodes. (The Q8383 consists of one photo diode that is cooled InGaAs type.)

	Q8381A	Q8383
Photo diode -1 :	350 nm to 595 nm	None
Photo diode -2 :	565 nm to 1055 nm	None
Photo diode -3 :	1025 nm to 1750 nm	550 nm to 1750 nm

In case of Q8381A, when wavelength exceeding the above range is set, the photo diode is automatically switched by 580 nm and 1040 nm wavelength.
The light received on the photo diode passes the current - voltage conversion amplifier, range selection amplifier, and is input in the A/D converter. The amplifier part consists of 10 ranges in 10 dB step, where the optimum range is automatically selected according to the input signal level. The used minimum range differs according to the sweep mode. When under the HI-SENS mode, AC connection amplifier is structured (Q8381A only), while when under the pulse mode, it passes other dedicated circuit (peak hold circuit).

(2) Measurement control part

This part controls the rotary angle of the diffraction grating, the slit width, and the measurement range, performs the A/D conversion, etc., and transfers the measurement data to the display processing part.
The digital servo circuit by the rotary encode is used for control of the rotary angle of the diffraction grating, allowing high speed, high precision position control.
The stepping motor is used for opening/closing the slit and rotating the chopper, to control the pulse count corresponding to the slit width and to control the pulse period corresponding to the chopper frequency.
Measurement range control includes the auto range control that selects the optimum range, and gate time control when under the pulse mode. The measurement timing (A/D conversion) by the external input signal "GATED MEAS INPUT" is also controlled.
There is also the EEPROM that stores the calibration data (wavelength offset, level offset, wavelength sensitivity offset, etc.) of each monochromator.

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(3) Display processing part

This part controls the measurement system by the conditions set through the panel keys or by the GP-IB, and performs various output processes (display, GP-IB, printer, floppy disk, etc.).
Data exchange with the measurement system is done through the dual-port memory. Measurement conditions as the center wavelength, span, resolution, sweep mode, etc. are sent, while measurement data are received. Wavelength sensitivity offset, display scaling, etc. are performed against the measurement data, and output to the display.
Analysis as cursor processing, spectral width operation, normalization operation, as well as save/ recall against the memory/ floppy disk are done.

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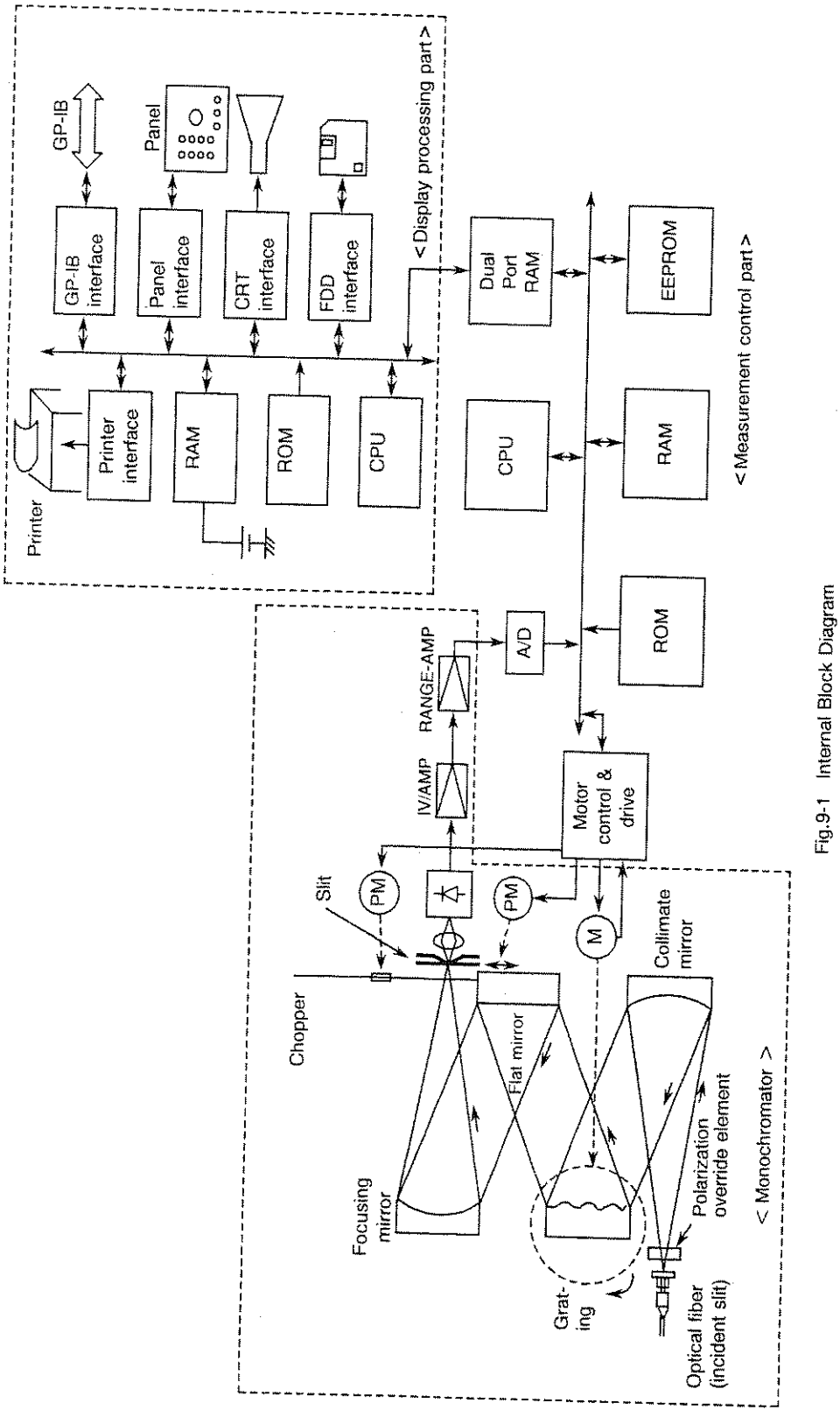


Fig.9-1 Internal Block Diagram

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10. SPECIFICATIONS

The following is the specifications of this analyzer.

<Q8381A>

Wavelength	Measurement range	0.35 to 1.75 μm
	Resolution	0.1 nm, 0.2 nm, 0.5 nm, 1.0 nm, 2.0 nm, 5.0 nm
	Accuracy	±0.5 nm (23°C±5°C), ±1.0 nm (10°C to 40°C)
	Repeatability	0.1 nm or less (1-minute repeat sweep)
Level	Measurement range (input sensitivity)	−85 to +10 dBm (1.1 to 1.6 μm) −75 to +10 dBm (0.7 to 1.6 μm) −70 to +10 dBm (0.4 to 1.65 μm) −60 to +10 dBm (0.35 to 1.75 μm)
	Polarization dependency	±0.1dB
	Accuracy (*1)	±1.5 dB (at wavelength 0.633 μm, 1.31 μm, 1.55 μm)
	Linearity (*2)	±0.5 dB/20 dB, ±1.0 dB/40 dB
	Scale	0.2, 0.5, 1.0, 2.0, 5.0, 10.0 dB/DIV and LINEAR
	Dynamic range (*3)	40 dB or more (±1 nm level difference from peak wavelength) 50 dB or more (±5 nm level difference from peak wavelength)
Sweep	Span	0.1 nm to 140 nm/ DIV and 0
	Measurement time (*4)	0.8 seconds or less (200 nm span or less) 1.5 seconds or less (500 nm span or less)
Pulse light measurement	Pulse light mode	Incorporates peak level measurement circuit within specified gate time (1 msec to 10 sec) (Recommended light pulse width : 30 μmsec or more)
	Gated measurement input	Can control measurement timing by external input signal BNC connector Input level : 74 AC (Hi : 3.5 V, Lo : 1.5 V), positive logic Minimum pulse width: 10 nsec or more. (Recommended light pulse width : 30 μsec or more)

(*1): −30 dBm input by SM fiber at 0.2 nm to 5 nm resolution. (CW light)

(*2): With −10 dBm input as reference.

(*3): With SM fiber wavelength 0.633 μm, 1.152 μm, 1.523 μm (0.1 nm resolution).

(*4): With center wavelength 1.3 μm, normal mode, 1 averaging.
(Same with other wavelength, if not within the sweep width set by the internal sweep selection wavelength.)

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Processing function	Memory function	Internal RAM	Measurement data : 33, Measurement condition : 10 (battery backup)
		Internal floppy drive	In conformance with MS-DOS format (2DD/ 2HD floppy disks) Format capacity : 720 KB, 1.2 MB
	Display	Superimpose display, dual screen (up/ down) display, 3-dimensional cursor display function	
	Operation/analysis	• Automatic optimum measurement condition setting • Automatic peak search • Normalization (LOSS/TRANS) • Power monitor function (with trend-chart) • Spectral width measurement • Averaging • Luminosity offset display	
Input/ output	Input connector	FC type	
	Data output	GP-IB standard, internal printer (printing speed : 8 seconds or less), direct plotter output (*5)	
General specifications	Operation environment	Temperature +10°C to +40°C, relative humidity 85% or less (no condensation)	
	Shelf environment	Temperature –10°C to +50°C, relative humidity 90% or less (no condensation)	
	Power supply	100 VAC to 240 VAC, 50 Hz/60 Hz, 180 VA or less	
	External dimension	Approx. 424 (W) × 221 (H) × 450 (D) mm	
	Mass	29 kg or less	

(*5): Connectable plotter
R9833 (Advantest-made)
7475A, 7440A, 7470A (HP-made)

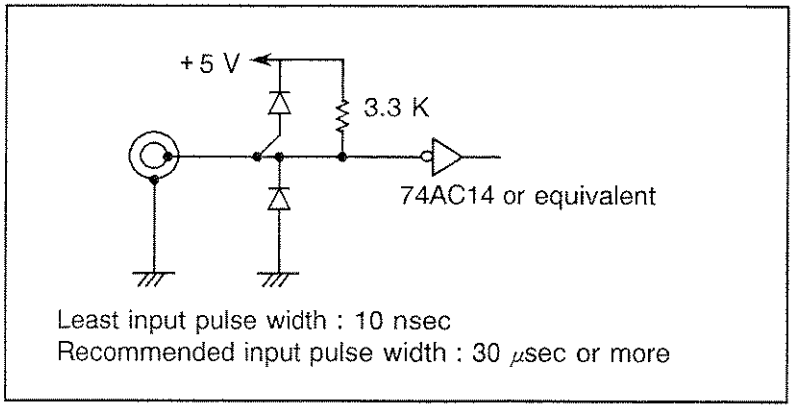


Fig.10-1 Gated Measurement Input Circuit

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< Q8383 >

Wavelength	Measurement range		0.55 to 1.75 μm
	Resolution	Setting	0.1 nm, 0.2 nm, 0.5 nm, 1.0 nm, 2.0 nm, 5.0 nm
		Accuracy (*1)	±3% or less/0.1 nm to 0.2 nm, ±2% or less/0.5 nm to 5.0 nm (23°C±5°C)
	Accuracy		±0.2 nm (23°C±5°C) (*1), ±0.5 nm (23°C±5°C), ±1.0 nm (10°C to 40°C)
	Repeatability		0.1 nm or less (1-minute repeat sweep)
Level	Measurement range (input sensitivity)		–92 to +20 dBm (1.2 to 1.6 μm) (23°C±5°C) –85 to +20 dBm (1.0 to 1.65 μm) –70 to +20 dBm (0.85 to 1.7 μm) –55 to +20 dBm (0.55 to 1.75 μm)
	Polarization dependency		±0.05dB or less (23°C±5°C)
	Reproducibility at connection insertion		±0.02dB or less/(23°C±5°C, at nonpolarization input by SM fiber)
	Repeatability		±0.02dB or less/(*2) (23°C±5°C)
	Accuracy (*3)		±0.4dB or less/(*1) (23°C±5°C)
	Linearity		±0.05 dB (23°C±5°C at wavelength 1.2 to 1.65 μm range –50 to –10 dBm)
	Scale		0.2, 0.5, 1.0, 2.0, 5.0, 10.0 dB/DIV and LINEAR
	Dynamic range (*4)		55 dB or more (±0.5 nm level difference from peak wavelength) 65 dB or more (±1.0 nm level difference from peak wavelength)
Sweep	Span		0.1 nm to 120 nm/ DIV and 0
	Measurement time (*5)		0.8 seconds or less (200 nm span or less) 1.5 seconds or less (500 nm span or less)

(*1): With wavelength from 1.53 μm to 1.57 μm.

(*2): With 20 nm measurement span, 0.2 nm resolution, and 1-minute repeat sweep.

(*3): With -30 dBm input by SM fiber (CW light) at resolution of 0.5 nm to 5.0 nm. (Including polarization dependency, except for power monitor function)

(*4): With wavelength 1.152 μm, 1.523 μm (0.1 nm resolution) by SM fiber.

(*5):With center waveformlength 1.3 μm or 1.55 μm, normal mode, 1 averaging.

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Pulse light measurement	Peak hole mode	Minimum light pulse width : 10 ns (Recommended light pulse width : 30 μsec or more) Pulse light repetition frequency : 0.1 Hz or more Gate time : 1 ms to 10 s	
	External synchronization mode	Synchronization signal input level : 74AC (Hi : 3.5V, Lo : 1.5V) positive logic Synchronization signal pulse width : 10 ns (Recommened light pulse width : 30 μs or more) Pulse light repetition frequency : DC to 100 MHz or more)	
Processing function	Memory function	Internal RAM	Measurement data : 33, Measurement condition : 10 (battery backup)
		Internal floppy drive	In conformance with MS-DOS format (2DD/ 2HD floppy disks) Format capacity : 720 KB (111), 1.2 MB (191)
	Display	Superimpose display, dual screen (up/ down) display, 3-dimensional cursor display function	
	Operation/analysis	• Automatic optimum measurement condition setting • Automatic peak search • Normalization (LOSS/TRANS) • Power monitor function (with trend-chart) • Spectral width measurement • Averaging • Optical amplifier NF measurement function	
Input/ output	Input connector	FC type	
	Data output	GP-IB standard, internal printer (printing speed : 8 seconds or less), direct plotter output (*6)	
General specifications	Operation environment	Temperature +10°C to +40°C, relative humidity 85% or less (no condensation)	
	Shelf environment	Temperature –10°C to +50°C, relative humidity 90% or less (no condensation)	
	Power supply	100 VAC to 240 VAC, 50 Hz/60 Hz, 180 VA or less	
	External dimension	Approx. 424 (W) × 221 (H) × 450 (D) mm	
	Mass	30 kg or less	

(*6): Connectable plotter
R9833 (Advantest-made)
7475A, 7440A, 7470A (HP-made)

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APPENDIX 1 LIST OF SOFTKEY MENUS

The Softkey menus are listed below according to the corresponding hardkeys.

(1) FUNCTION section

CENTER → ①

[CENTER]

PEAK	CURSOR				AUTO PKC	

SPAN → ②

< Spectrum mode > [SPAN]

SPAN	START	STOP	△λ→SPAN	0.35 to 1.0* 0.55 to 1.0	0.9 to 1.75	FULL

REF LEVEL → ③

[REF LEVEL]

PEAK	CURSOR				MAX HOLD	AUTO

LEVEL SCALE → ④

[LEVEL SCALE]

LIN/LOG	10dB/D	5dB/D	2dB/D	1dB/D	0.5dB/D	0.2dB/D

AUTO → ⑤

[AUTO]

FULL	0.35 to 1.0* 0.55 to 1.0	0.9 to 1.75				ABORT

AVG → ⑥

[AVG]

1(OFF)	2	5	10	20	50	100

SWEEP MODE → ⑦

[SWEEP MODE]

NORMAL	ADAPTIVE	HI-SENS1	HI-SENS2	PULSE	Gate Time	△λ→SWEEP

RESOLUTION → ⑧

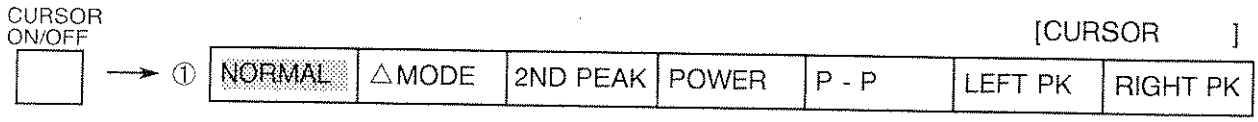
[RESOLUTION]

0.1 nm	0.2 nm	0.5 nm	1.0 nm	2.0 nm	5.0 nm	

* : Q8381A ; 0.35 to 1.0
Q8383 ; 0.55 to 1.0

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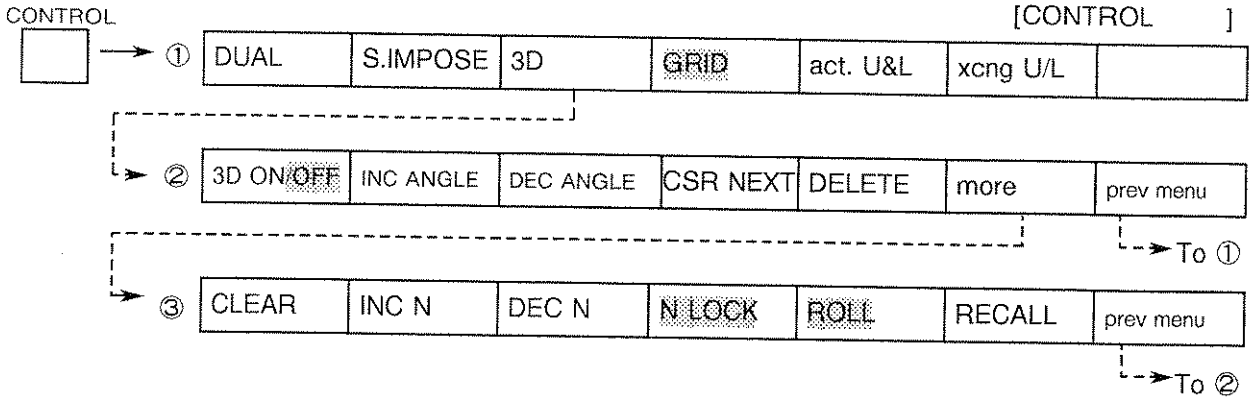
(2) CURSOR section

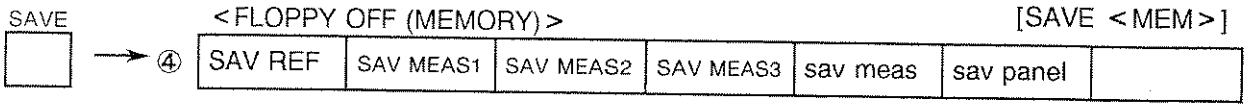


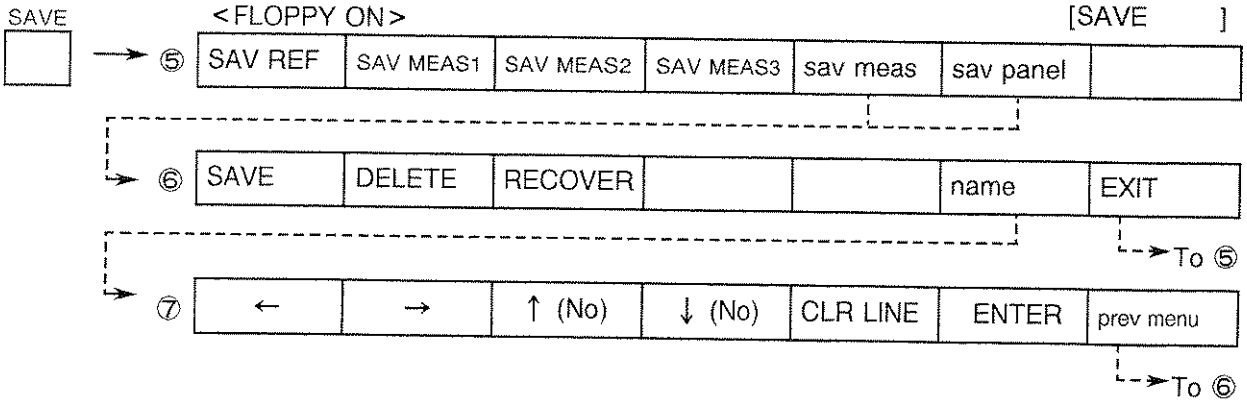
(3) DATA section



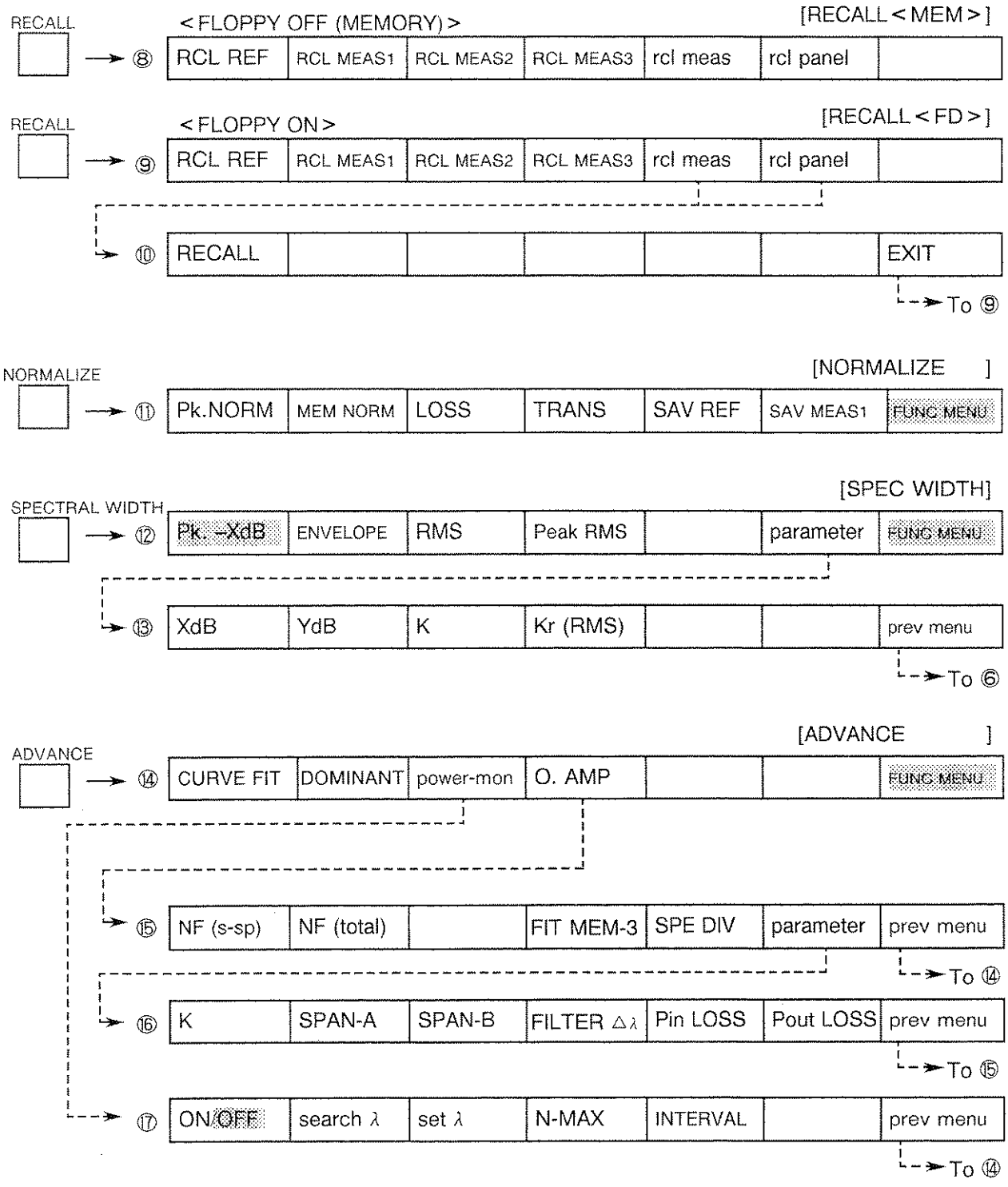
(4) DISPLAY section





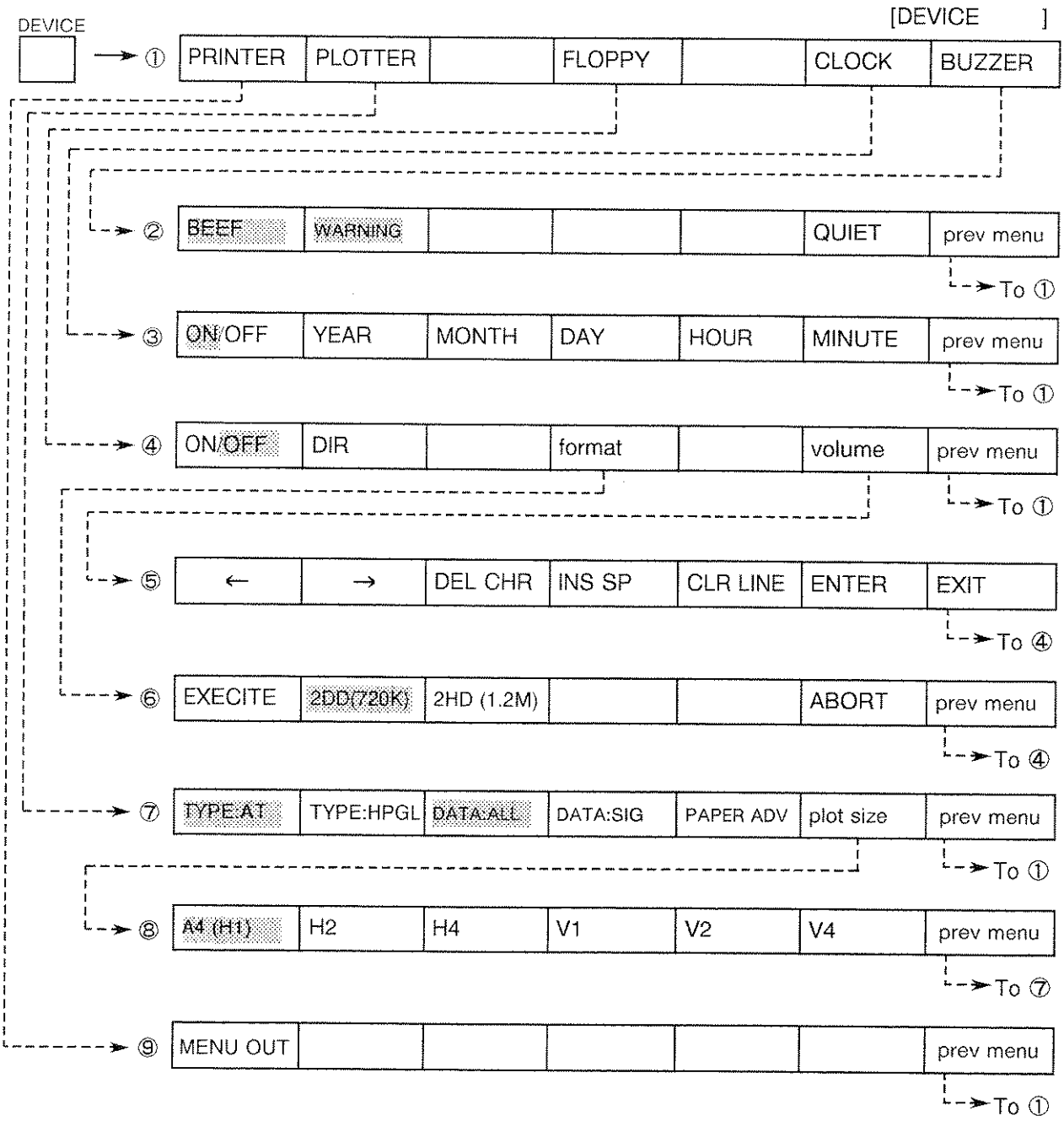


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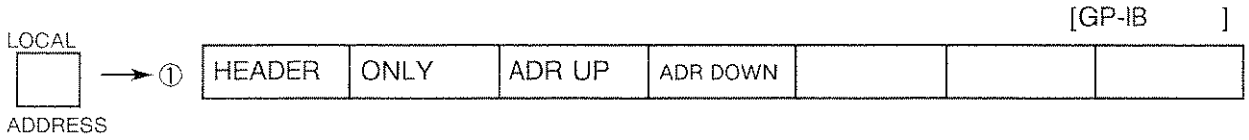
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(5) DATA OUT section

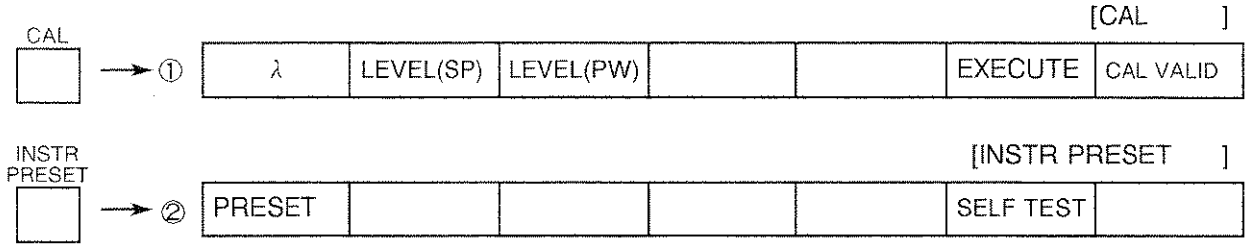


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(6) GP-IB section



(7) Others



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APPENDIX 2 EXPLANATION OF TECHNICAL TERMS

Automatic power control (APC)

Current feeding in such a that optical output is kept at a definite level.
When a laser diode is driven by a constant current, its optical output decreases or oscillation stops as the temperature increases and optical output increases as the temperature decreases. If the temperature decreases significantly, the optical output may exceed the maximum nominal value. In order to protect the laser diode and obtain stable optical output, an APC circuit is provided so that the laser diode monitoring light is received by the photodiode and fed back to the drive circuit.

Avalanche photodiode

This photodiode uses the avalanche effect and is often used as photo sensor in optical fiber communications. When a p-n junction semiconductor is subject to high reverse-bias voltage (100 to 200 V), slight carrier shift occurs, generating carriers one after another. As a result, the current increases with increasing speed. This is known as the avalanche effect.

Back-scattered light

When light travels through an optical fiber, Rayleigh scattering occurs at all points along the fiber. This scattering occurs both in the forward and backward directions. However, light which is scattered in the backward direction and returns to the incident end is called back-scattered light. For Rayleigh scattered light, the weakly reflected light which returns to the incident end in the wave guiding mode of the optical fiber is also called back-scattered light.

Baseband transmission characteristics

When pulse light is incident onto one end of an optical fiber, the width of the output pulse at the other end is greater than that of the incident pulse. This phenomenon is called dispersion. It illustrates the increase of transmission loss in time domain. When converting this dispersion phenomenon into that in the frequency domain, it is determined that the transmission loss in the high-frequency range increases. These transmission characteristics in the frequency domain are called the baseband transmission characteristics. It is an important optical fiber performance factor.

Beam divergence angle

An angle at which radiation intensity becomes one half of that of the optical axis (where the radiation intensity is maximum). In the case of a laser diode, an angle between a junction and a horizontal direction is θ, and an angle between a junction and a vertical direction is θ.

Breakpoint detection

Detection of the part of the core of an optical fiber at which a break occurred. When light is directed into a broken optical fiber, it is scattered at the breakpoint and leaks to the outside of the core. The breakpoint in an optical fiber can be found by detecting such leaked light.

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CW light

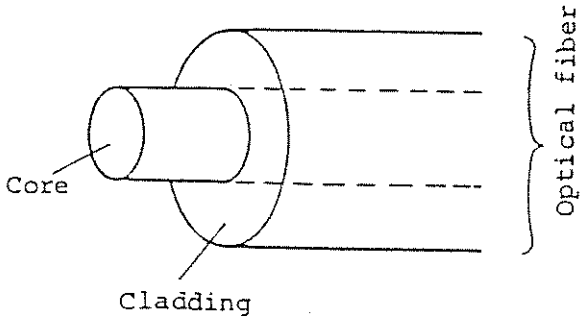
Light which constant intensity and without modulation. It is also called DC light.

Chopped light

The intensity of the light modulated by a rectangular wave. That is, the light is intermittently output at certain repetitive periods.

Cladding

A part of the structure of an optical fiber. An optical fiber consists of a core at the center and cladding surrounding the core. It is generally made of quartz glass or plastic. The cladding has a refractive index which is about 1% lower than that of the core so as to confine the light in the core with stability.



Coated fiber

A core and a cladding of an optical fiber covered with a primary coating (of silicone resin) and a secondary coating (of a nylon protective layer).

Coherence

1. Opposite of random, and a temporary relationship between two or more waves.
2. If the wavelength, phase and wavefront are homogeneous, the light is assumed to be coherence. There are two types of coherence: temporal coherence and spatial coherence. Temporal coherence means that the wavelength is identical and the phase is continuous, while spatial coherence means that the light can be focused to one point through a lens. Light with interference ability, having an identical wavelength and a phase at a definite relationship, such as laser, is called coherence.

Coherent

Light having an frequency, phase and wavefront is called coherent.
The light of a laser diode used in optical communication has significantly high coherence, although not perfect.

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Core

The central part of an optical fiber, which is surrounded by cladding. The light travels through the core. It is made of quartz and its refractive index is greater than that of the cladding by about 1%. There are two kinds of optical fibers, distinguished according to the thickness of the core; multi-mode fiber of about 50 to 100 m in diameter and single-mode fiber of about 10 m in diameter. In addition, optical fiber is classified into a GI type and an SI type according to the difference in the distribution of the refractive index of the core.

Core and cladding

Optical fiber consists of core and cladding. As the refractive index of the cladding is lower than that of the core, light entering the core propagates within the core repeating total reflection at the boundary between the core and the cladding.
"50/125" means that the core diameter is 50 μm and the cladding diameter is 125 μm.

Dark current

Output current of a photo sensor when no light is present.

Direct modulation

The modulation signal is used as the drive current to illuminate the light source. The method by which a light modulator is used is known as external modulation.

Directivity

Cases when the light output or the light receiving sensitivity is greater in the specific direction.

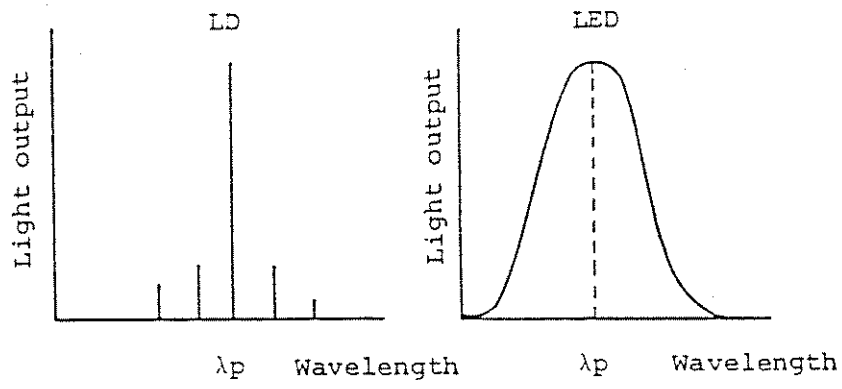
Double heterojunction

A heterojunction means a junction between crystals having a different atomic composition. In the case of double heterojunction used in a laser diode, cladding layers having wide energy gaps are placed on both sides of an activated layer to confine the carrier in order to increase the density of the minority carrier. It is used to form an optical waveguiding path.

Emission peak wavelength

The wavelength where the energy concentration of the light emitting spectrum is maximum.

Symbol: λp



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Excess noise factor

The coefficient of the shot noise multipled in an avalanche photodiode. It is defined as $F = M^x$. The shot noise current iN increases with fluctuations in the multiplication process, according to the following equation:

$$< iN^2 > = 2qIPoM^{2+x}B$$

M: multiplication factor
B: signal bandwidth
x: excess noise index
q: charge of electron

Exciter

A device to excite an optical fiber to be tested, in the stationary mode, in light loss measurement or transmission characteristics measurement, etc. For this purpose, the following methods are used:

Using a dummy optical fiber of several hundred meters in length; controlling the incident mode power distribution by using microbending of an optical fiber, controlling the mode distribution by sequentially connecting graded type optical fiber, step type optical fiber, and so on. (GSG type or SGS type exciting optical fiber cord, and so on are available.)

Fiber identification

Individual distinction of the many fibers in an optical fiber cable. Particularly, light is directed at one end of an optical fiber and the transmitted light is detected at the other end.

Fresnel reflection

The reflection when light passes through a boundary face between materials of different light refractive indexes. When a light pulse is directed into an optical fiber, a portion of the pulse is reflected from the media boundary face such as that of optical fiber and air, for example, at the end of the optical fiber or at a breakpoint in the optical fiber. Such reflection is called Fresnel reflection. In the case of an ideal break face (a mirror-like break at right angles to the axis of an optical fiber), about 4% reflection (– 14 dB) occurs.

Fundamental mode

0-order distribution in an electromagnetic field. Also known as single lateral mode.

Graded-index fiber

A kind of a multi-mode fiber having a core with a refractive index distribution in radial form. Therefore, the light through the center of the core travels slower and light through the peripheral part travels faster, so that the light propagation time becomes constant regardless of the path of the light. As a result, it is possible to decrease the spreading of the emitted pulse with time. (In other words, the mode dispersion is less.) Therefore this fiber has a much wider transmission bandwidth compared with that of a step-index fiber (several hundreds MHz-km).

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Infrared rays

Light having a wavelength which is longer than that of visible light.

Near infrared rays:	0.78 to 3 μm in wavelength
Middle infrared rays:	3 to 30 μm in wavelength
Far infrared rays:	30 μm to 1 mm in wavelength
Microwave:	Over 1 mm in wavelength

Laser

Solid lasers, gas lasers, liquid lasers, and so on are available. A semiconductor laser is used as the light source used in optical fiber communication because of its compactness and the capability of direct modulation, compared with other lasers. The laser has excellent coherence, and has high speed response, compared with LEDs, which means that laser is an important light source. The abbreviation for semiconductor laser is LD.

Laser diode (LD)

A semiconductor light emitting element. Laser stands for Light Amplification by Simulated Emission of Radiation. An oscillator applying this principle is called a laser diode. A laser diode has a high optical output, is capable of being directly modulated at high speed, and shows high fiber connection efficiency. LEDs are mainly used, however, because of their light emission stability. This problem has now been solved, permitting laser diodes to be used as long-distance, high-speed light emission sources.

Leak light

When an optical fiber is bent or when pressure is applied to an optical fiber, the path of the light propagating through a core is bent and can be seen externally. The light is called leak light.

Light emitting diode (LED)

A semiconductor emitting element. As with a laser diode, the light used is emitted when the carrier fed into the p-n junction boundary of the semiconductor is reconnected. LEDs emit light as natural radiation, while laser diodes emit light as induced radiation. The LED is known for its long life, high stability, cheapness and good linearity. Since the power input to the fiber is small and it cannot be modulated at high speed, the LED is an ideal light emitting element for comparatively short-distance, small-capacity or analog systems.

Light sensor

A photodiode applying optical electromotive force or optical conductivity used in the optical fiber communications. Two types of photodiode are used: p-n junction and pin types. The photodiode that makes use of the avalanche effect caused when reverse-bias voltage is applied is called avalanche photodiode. In addition to these diodes which are mainly used in measuring instruments, thermopiles, which are not wavelength-dependent, are used as detectors in reference power meters.

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Long wavelength region

In optical fiber communications, the region from approximately 1.0 μm to 1.5 μm is referred to as long wavelength region. It is used for long-distance communication because the transfer loss of the optical fiber is low.

Longitudinal mode

A status in which emission spectrum having very small half value widths are not continuously present, or else individual luminescent spectra. The difference in wavelength from the adjacent mode is called a longitudinal mode interval. When the number of modes is one, it is called a single longitudinal mode.

Luminous flux

$$F = Km\int_{380}^{780} V(\lambda)d\lambda$$

Unit: lm (lumen)
Km: Maximum visibility 6801 m/W
V (λ): Standard relative visibility
Value decided by CIE
λ = 1.0004 at = 555 nm (yellow-green)
P (λ): Spectral distribution

Luminous intensity

$$i = \frac{dF}{d\omega}$$

Unit : Cd (candela)
F : Luminous flux ω: Solid angle
When expressed in units of energy, it is known as radiant intensity.

Monitor current

When the light emitted from the rear surface of a laser diode chip is received by a built-in monitor diode. The output of this diode is called monitor current.

Monitor output

Light emitted from the rear surface of a laser diode chip.

Multi-mode fiber

Optical fiber with multiple waveguide modes in which multiple modes of light (light at various angles to the center axis of the optical fiber) propagate through the core simultaneously. The difference in core refractive index distribution is used to distinguish step, graded and other types fibers. They all having a large core diameter (50 to 100 μm) and can be connected easily compared with single mode fiber. However, as different modes propagate at different speeds, the transfer region is comparatively narrow (mode dispersion).

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Numerical aperture

The degree of extension of light at the end of an optical fiber, which has a cylindrical core having a refractive index of n1 and which is surrounded by clad having a refractive index of n2 (n1 > n2), due to a similarity in the lens system. Of the light falling on a plane, which includes the axis of the core of the optical fiber and which crosses the axis (the meridian light), if some light, which attains critical angle with respect to the axis, crosses the axis of the core outside the optical fiber at angle θ, the NA of the optical fiber can be expressed by the equation given below.

$$NA = n\sin\theta = \sqrt{n_1^2 - n_2^2}$$

n: Refractive index of the media in which the optical fiber is placed

OTDR method

An abbreviation of optical time domain reflectometer method. A system to detect a defective point or a loss characteristic of optical cable by using a light pulse as a signal, transmitted through the optical cable to be tested, and detecting the Fresnel reflection at a breakpoint or the Rayleigh scattered light of the optical fiber circle. Fiber optic time domain reflectometer (FOTDR).

Optical rotary power

A phenomenon of the rotation of a plane of polarization when linearly polarized light passes through material.

Optical fiber

Optical waveguide consisting of internal material having a high refractive index and external material having a low refractive index so that light passes through the fiber even when it is bent. A fiber having a diameter of about 0.12 mm consists of core and cladding, both made of quartz glass but having different refractive indexes. It is characterized by a wide bandwidth low loss and no induction.

Optical fiber connector

Removable connector used to connect an optical fiber to another optical fiber or device. Normally, the end of one fiber is brought into direct contact with the end of the other via the connector with strict centering. Unlike an electrical connector, the mechanical accuracy of an optical fiber connector needs to be very high, a connection loss 0.5 to 1 dB attained, and care taken to keep the end of the connector clean.

Optical output

Optical power output from a specific optical fiber.

Output power from fiber-end

Optical output at the fiber-end of the light emitting element attached to the fiber. Optical output from the light emitting element itself deteriorates due to loss at the fiber connection so that fiber transfer loss becomes the output power.

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Pigtail fiber

An optical fiber with one or both ends open.

Polarizer

An element to convert natural light into linearly polarized light.

Quantum efficiency

1) Light emitting element (light emitting diode or laser diode)
   The ratio of the number of carriers caused by current application to the photons generated (internal quantum efficiency) or photons radiated outside (external quantum efficiency).
   Quantum efficiency is expressed:

$$\eta = \frac{q\lambda}{hc} \cdot \frac{P}{I} = \frac{\lambda}{1.24} \cdot \frac{P}{I}$$

   h: Plank constant, c: Light speed in vacuum,
   q: Electron charge, λ: Wavelength (μm), P: Optical output, I: Current
   Note: In the case of a laser diode, differential quantum efficiency is also used.

2) Light sensor (PIN photodiode APD)
   The ratio of the photons received to the number of carriers generated.
   In this case, quantum efficiency η' is expressed:

$$\eta' = \frac{hC}{q\lambda} \cdot \frac{I}{P} = \frac{1.24}{\lambda} \cdot \frac{I}{P}$$

   The quantum efficiency of an avalanche diode is expressed by a reproduction factor of 1.

Radiant flux

The amount of light energy which is emitted or propagated per unit time.

Rayleigh scattering

Light scattering by a slight fluctuation of the refractive index of material when the light propagates through such material. The light scattering which is generated by the fluctuation of a refractive index which is shorter than the wavelength in an optical fiber.

Responsivity

Current which can be taken out when a unit of radiation flux has entered the light sensor.

$$R = \frac{I}{P} = 0.806 \times \eta \times \lambda \times M(A/W)$$

η: Quantum efficiency, λ: Wavelegnth, M: Reproduction factor

Short wavelength region

The light wavelength used in optical fiber communications ranges from approximately 0.8 to 1.5 μm which is in the vicinity of infrared rays. Light around 0.8 μm is called the short wavelength region, developed earlier than the other region for use in optical fiber communications.

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Short-term stability

The stability of an optical output over a short time, when the ambient temperature is constant.

Single-mode fiber

When the diameter of a core is decreased to about 10 μm, and optical fiber having only one propagating mode is obtained. This optical fiber is called a single-mode fiber. One feature of this fiber is its very wide bandwidth (several GHz), because it is free from the mode dispersion of a multi mode fiber. However, connection of such fiber is difficult because of its small core diameter. It has other problems such as a greater connection loss when it is connected to a light source.

Specific rotatory power

A quantity to indicate the intensity of optical activity power of optically active substances.

Speckle noise

The noise produced by the interference of coherent light scattered in an optical fiber in an irregular phase relationship.

Spectral width and full width at half maximum, $\triangle\lambda$

In light emitting elements, the interval between two wavelengths where the energy concentration of the light emitting spectrum is 1/2 the maximum value.

Spectrum

Light is usually composed of sinusoidal waves. The wavelength axis components are called the spectrum. A white light source has a flat spectrum while that of a laser diode is concentrated in a narrow range.

Splicing

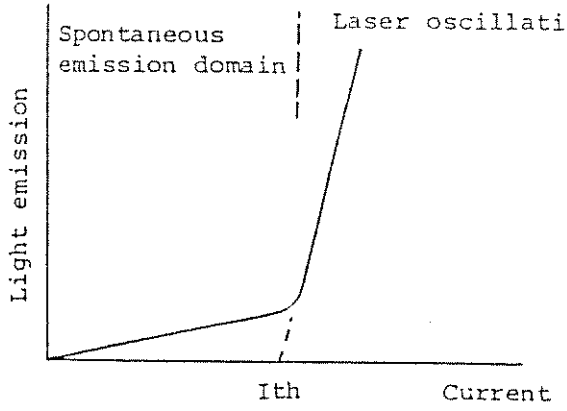
A permanent connection between one optical fiber and another required in the installation of an optical fiber cable. Various splicing methods are now available. Generally, a fusing connection method is used in which one optical fiber is fused with another by the arc discharge method. This method is predominant because of its minimum connection loss and high stability.

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Threshold current

Minimum current required for laser oscillation. As the area where natural radiation changes into laser oscillation cannot be determined strictly, the point where the optical output zero line intersects the extension of the current-optical output characteristics at the time of laser oscillation is normally used as the threshold.

Symbol: Ith



Ultraviolet rays

Light having a wavelength shorter than that of visible light in the wavelength range of 300 to 380 nm.

Visible light

Light which can be seen by the human eye. Wavelength of 380 to 780 nm.

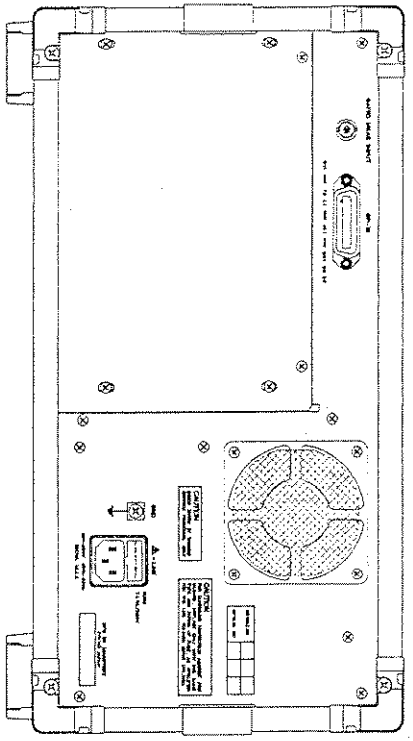
Wavelength

A wavelength of which the force distribution of the light emitting spectrum is located at the center.

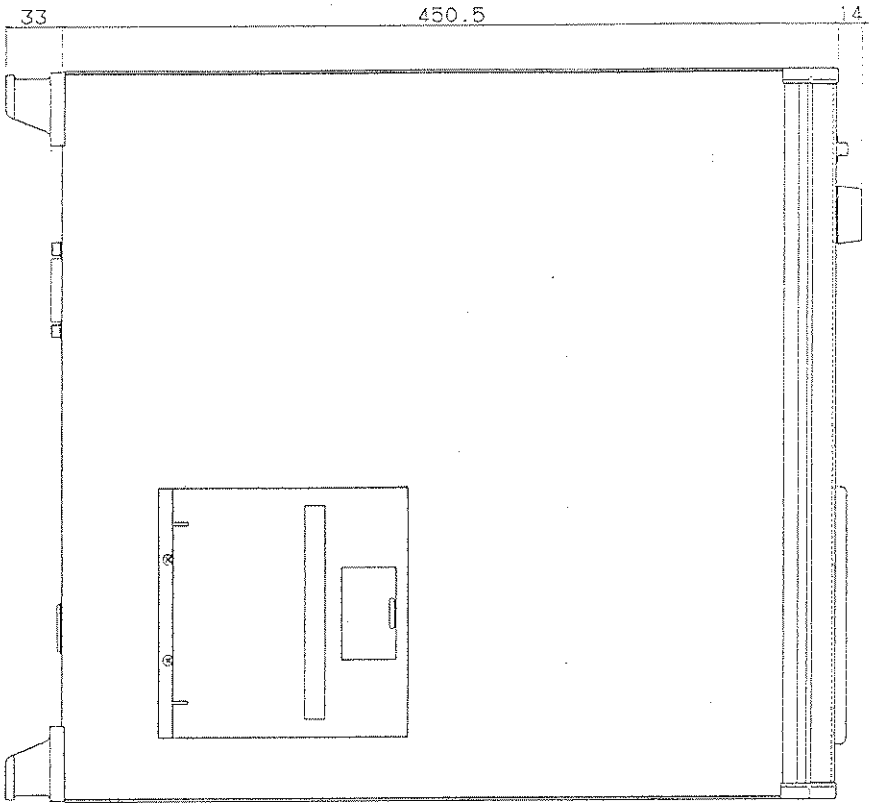
Wavelength division multiplexing

A communication system to transmit two or more kinds of signals through the one optical fiber at the same time. In this case, as a transmitter, light emitting diodes with various wavelengths and laser diodes are used. Both unidirectional systems and bidirectional systems are available.

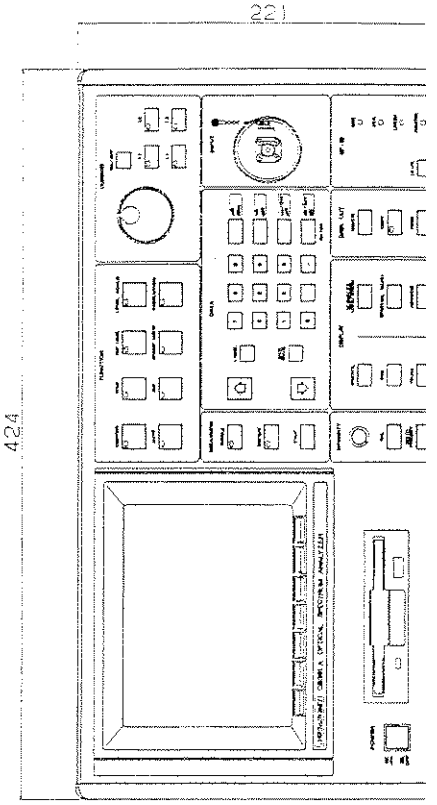
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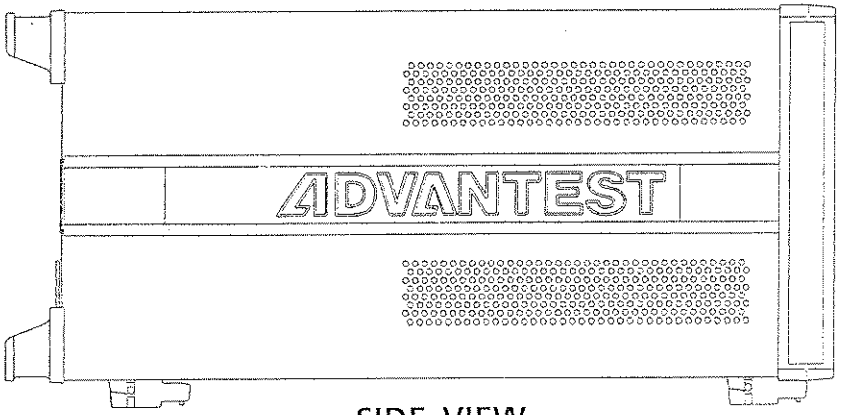
REAR VIEW



TOP VIEW



FRONT VIEW



SIDE VIEW

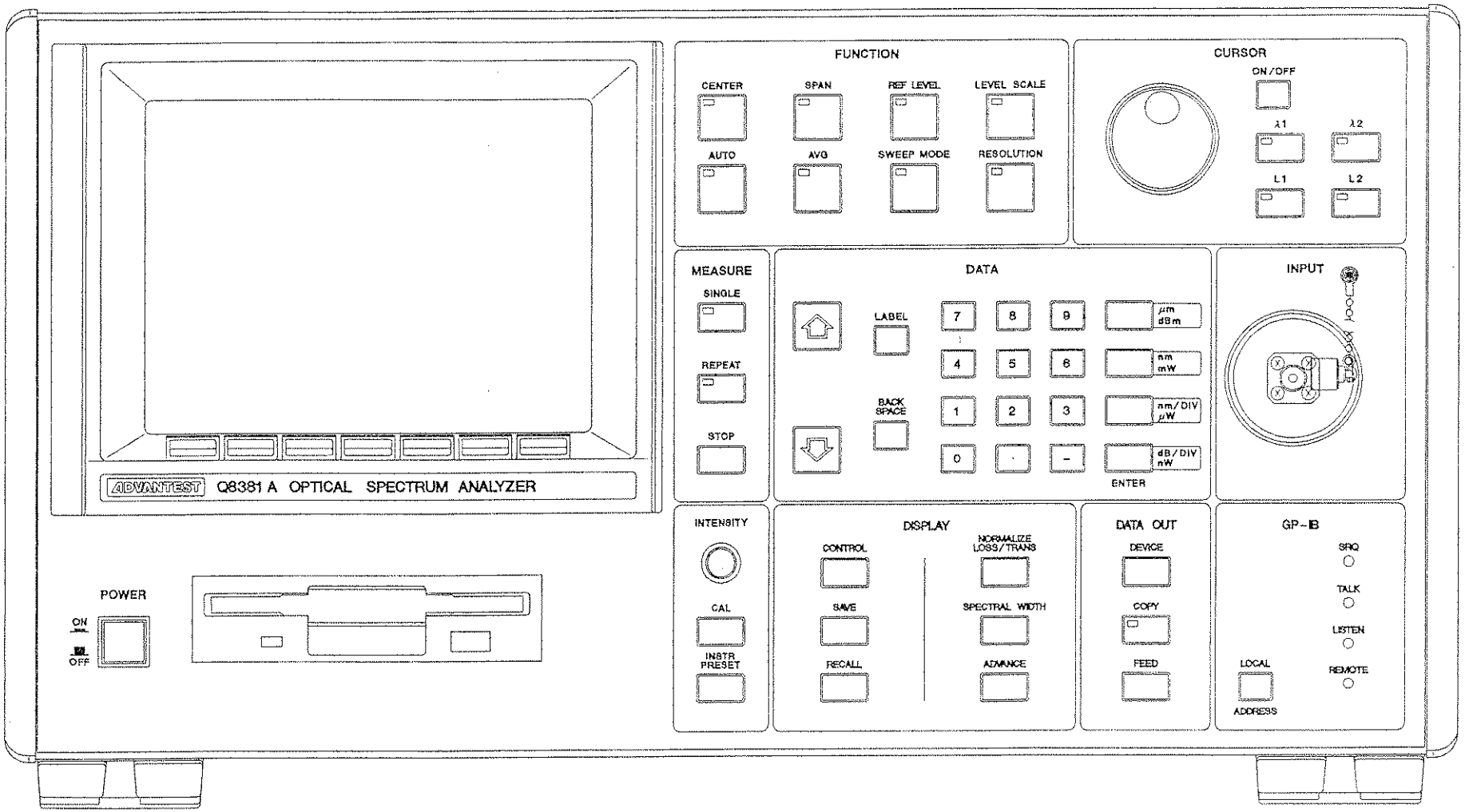
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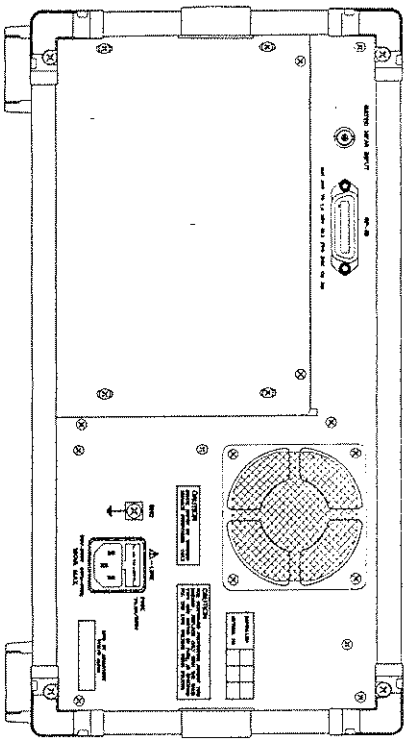


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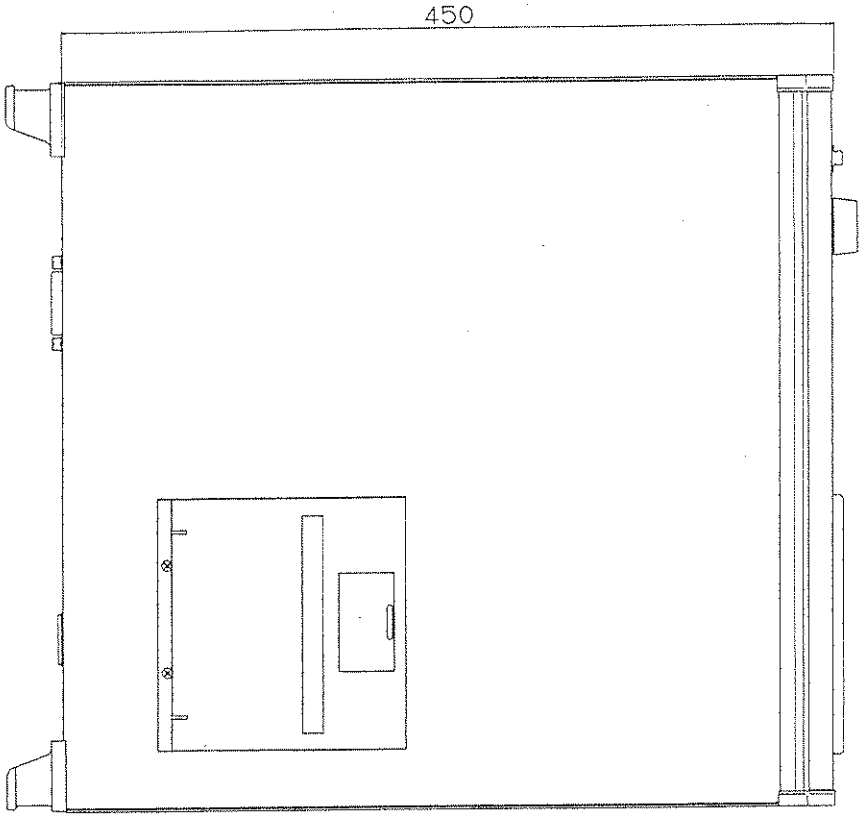
FRONT VIEW

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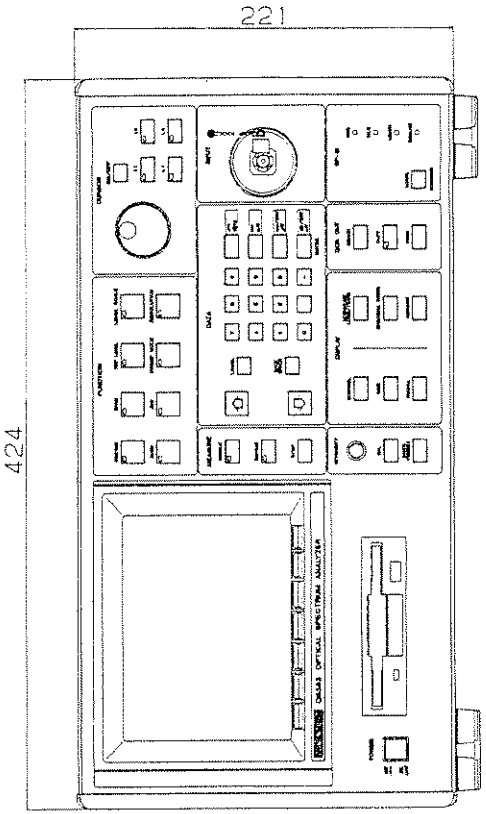
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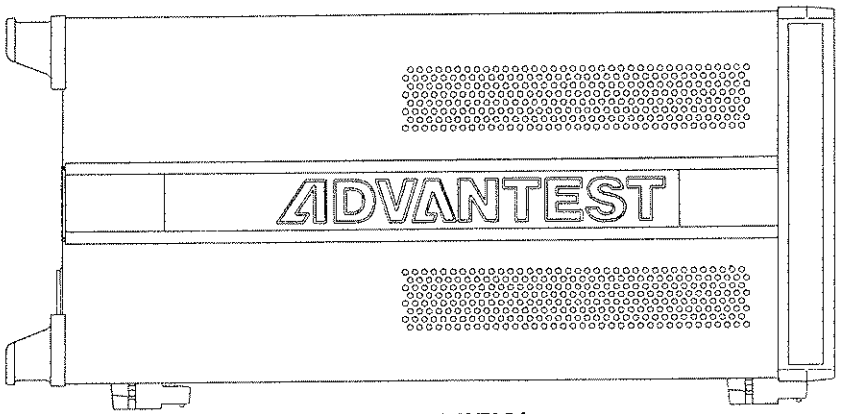
REAR VIEW



TOP VIEW



FRONT VIEW



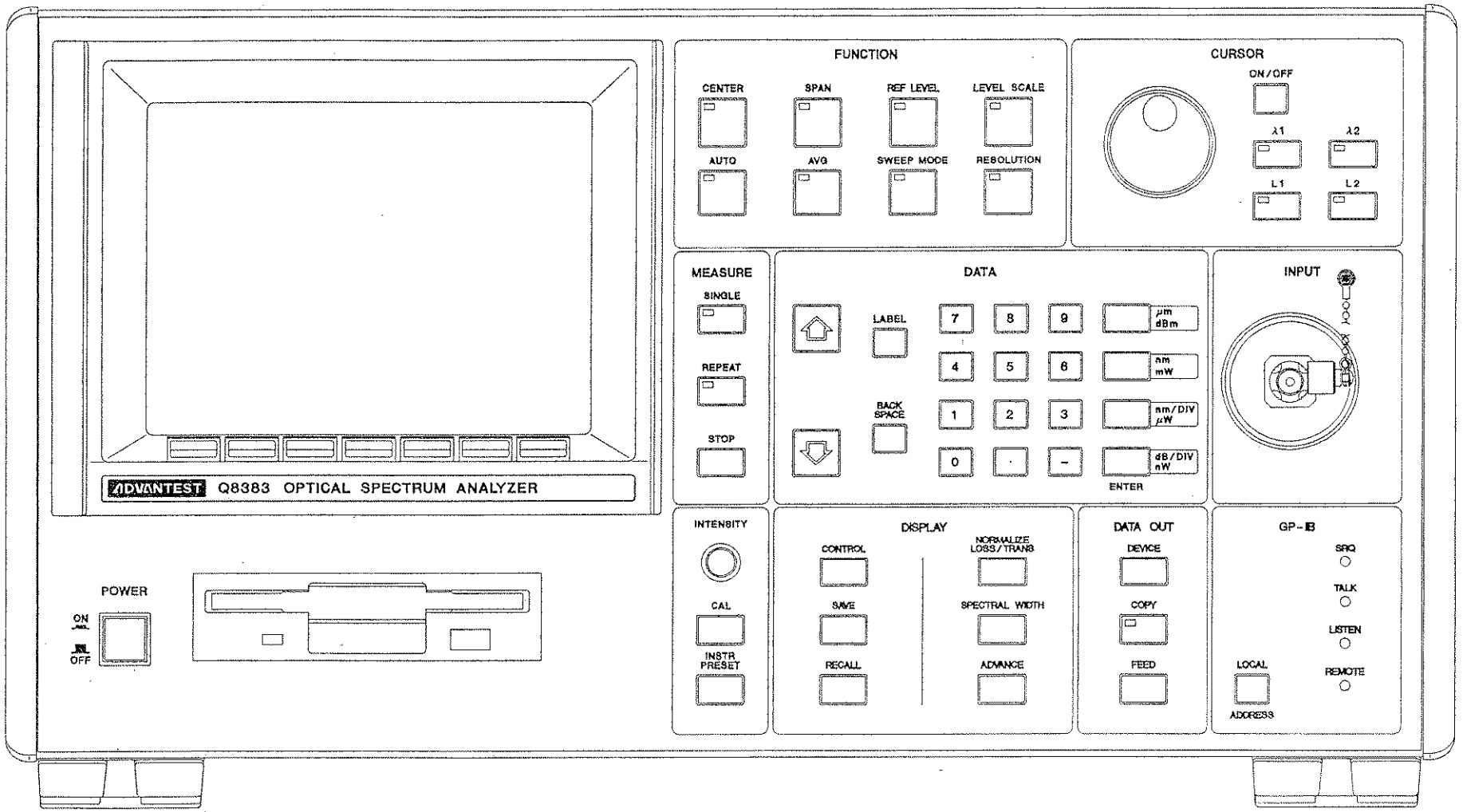
SIDE VIEW

Unit; mm

Q8383
EXTERNAL VIEW

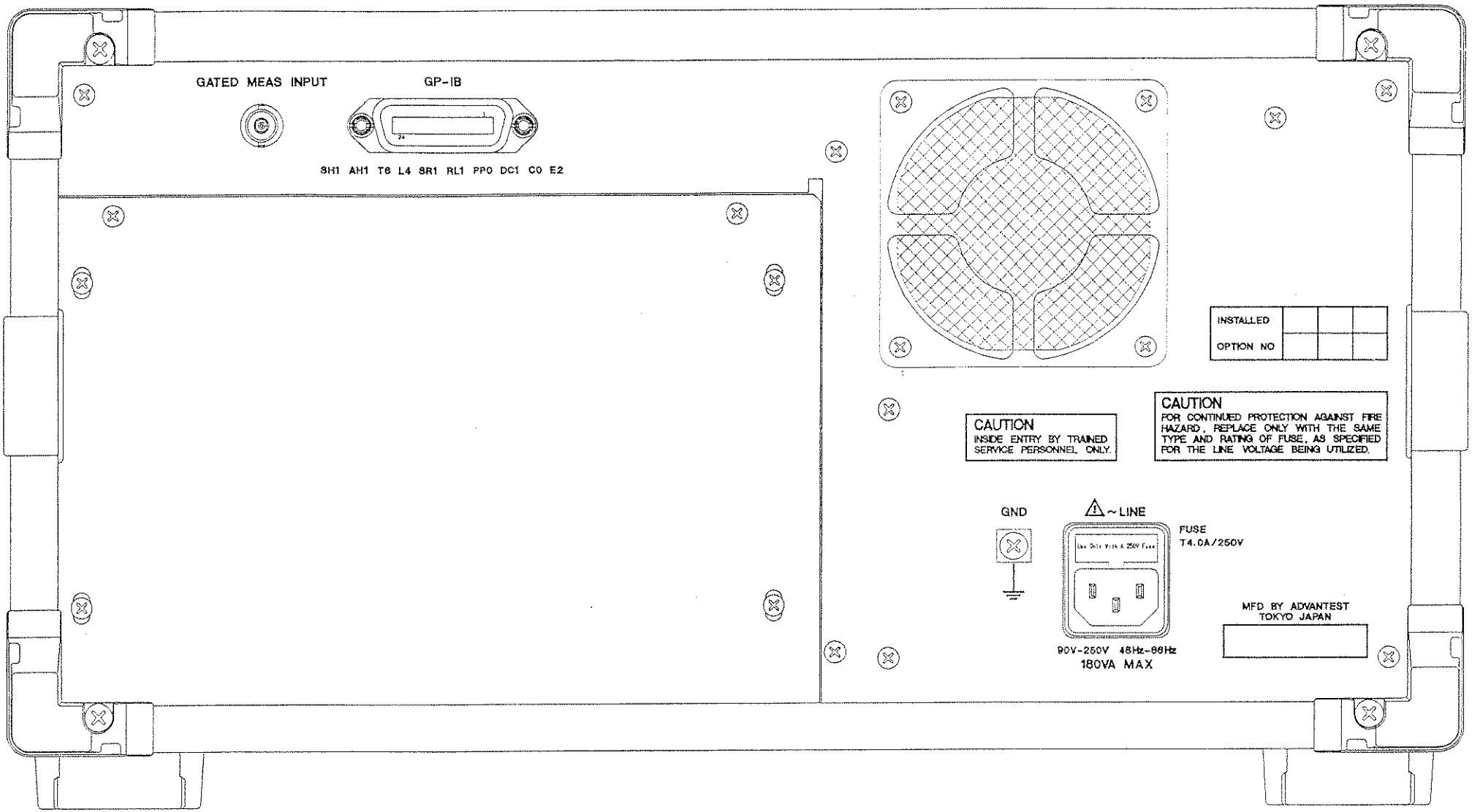
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REAR VIEW

Q8381/8383EXT5-9309-A

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ALPHABETICAL INDEX

[1]

2ND PEAK 4-16
3D 4-24

[A]

AC-power socket 2-9
ADDRESS key 4-67
address setting 4-67
ADVANCE key 4-48
Alarm Message 3-8
APC 3-7
AUTO key 4-9
AUTO PKC 4-3
Automatic power control A2-1
Avalanche photodiode A2-1
averaging 4-10
AVG key 4-10

[B]

Back-scattered light A2-1
Baseband transmission characteristics . A2-1
Basic Operation Procedure 3-10
Beam divergence angle A2-1
Breakpoint detection A2-1
BUZZER 4-66

[C]

CAL key 4-71
Capacity 4-63
Carrying 1-11
CENTER key 4-2
Character menu display 4-19
Chopped light A2-2
Cladding A2-2
Cleaning 1-11
CLOCK 4-65
CMV loop 1-7
Coated fiber A2-2
Connecting other devices 6-7
CONTROL key 4-22
COPY key 4-66
Core A2-3
Core and cladding A2-3
CRT display 3-6
Cursor control 4-15
CURSOR Section 4-15
. 5-6
CURSOR section 2-4
CURVE FIT 4-48
CW light A2-2

[D]

Dark current A2-3
DATA OUT Section 4-57
. 5-16
DATA OUT section 2-7
DATA Section 4-18
. 5-7
DATA section 2-5
Device clear function 6-34
DEVICE key 4-57
Device trigger function 6-34
Direct modulation A2-3
Directivity A2-3
directory 4-31
Display Condition 3-13
DISPLAY Section 4-22
. 5-8
DISPLAY section 2-6
DOMINANT 4-49
Double heterojunction A2-3
DUAL 4-22

[E]

Earth terminal 2-9
Emission peak wavelength A2-3
Entering the Light to be Measured 3-4
ENVEROPE 4-44

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Environment 1-4
Error Code 6-22
Excess noise factor A2-4
Exciter A2-4

[F]

Fan 2-9
FEED key 4-66
Fiber identification A2-4
file name 4-34
FLOPPY 4-62
FLOPPY data restore program example . 7-8
FLOPPY data types 7-4
FLOPPY handling 7-2
Fresnel reflection A2-4
Front Panel 2-2
full width at half maximum A2-9
FUNCTION Section 4-2
. 5-2
FUNCTION section 2-3
Functions 3-2
Fundamental mode A2-4
Fuse 1-6
. 2-9

[G]

Gated MEAS Input 2-9
. 8-11
GATED MEAS INPUT 2-9
. 4-11
Gated Measurement Input 10-2
GP-IB connector 2-9
GP-IB Connector Pin Arrangement 6-5
GP-IB Section 2-7
. 4-67
. 5-19
GP-IB specifications 6-4
Graded-index fiber A2-4
GRID 4-27

[I]

Infrared rays A2-5
Initial Screen 1-9
initialize floppy 4-62
Input 1-8
. 3-4
INPUT section 2-5
INSTR PRESET key 4-69
Interface functions 6-6
Internal State Message 3-8

[L]

LABEL key 4-18
Laser A2-5
Laser diode A2-5
Leak light A2-5
LEVEL SCALE key 4-8
Light emitting diode A2-5
Light sensor A2-5
LISTEN 4-68
LOCAL key 4-67
Long wavelength region A2-6
Longitudinal mode A2-6
LOSS 4-39
Loss Wavelength Characteristics
Measurement 8-8
luminosity offset display 4-49
Luminous flux A2-6
Luminous intensity A2-6

[M]

MEASURE Section 4-21
MEASURE section 2-4
Measurement and Data Output 3-14
Measurement Condition 3-12
Measurement Data Analysis 3-15
memory name 4-34
Message 3-8
Monitor current A2-6

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Monitor output A2-6
Multi-mode fiber A2-6

[N]

Normalization Function 4-37
NORMALIZE key 4-37
Numerical aperture A2-7

[O]

O.AMP 4-48
. 4-54
Operation Principle 9-1
Optical fiber A2-7
Optical fiber connector A2-7
Optical output A2-7
Optical rotary power A2-7
Option information table 2-9
OTDR method A2-7
Outline 1-3
Output power from fiber-end A2-7

[P]

PASE calculation 4-56
peak RMS method 4-46
Pigtail fiber A2-8
Pk. NORM 4-37
PLOTTER 4-58
Plotting 4-61
Plotting position 4-60
plotting sequence 4-60
Polarizer A2-8
Power cable 1-5
power monitor 4-50
power monitor display function 4-50
power ON 1-8
PRINCIPLE OF OPERATION 9-1
PRINTER 4-57
print paper setting 1-9
Program code 6-8
PULSE 4-12
Pulse light measurement 8-11

[Q]

Quantum efficiency A2-8

[R]

Radiant flux A2-8
RAU 3-7
Raleigh scattering A2-8
RCL 3-7
Rear Panel 2-9
RECALL 4-29
RECALL key 4-28
REF LEVEL key 4-6
REMOTE 4-68
REPEAT key 4-21
RESOLUTION key 4-13
Responsivity A2-8
restore program example 7-8
RMS method 4-45
Rotary knob 4-17

[S]

S. IMPOSE 4-23
Sample programs 6-36
SAVE 4-29
SAVE key 4-28
SELF TEST 4-70
Self-Diagnosis 6-22
sensitivity 4-11
serial number 2-9
Service request 6-32
Setting label 4-18
Short wavelength region A2-8
Short-term stability A2-9
Signal line terminal 6-4
SIM 3-7
SINGLE key 4-21

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Single-mode fiber A2-9
SMSR Measurement 8-2
Softkey 2-8
SOFTKEY MENU A1-1
SPAN key 4-4
Specific rotatory power A2-9
SPECIFICATIONS 10-1
Speckle noise A2-9
Spectral width A2-9
SPECTRAL WIDTH key 4-42
spectral width operation 4-42
Spectrum A2-9
Spectrum/Spectral Half-width
Measurement 8-5
Splicing A2-9
SRQ 4-68
Standard Accessory 1-4
status byte 6-33
Status lamp 4-68
STOP key 4-21
Storage 1-11
Stored parameter 4-29
Sweep Mode 4-12
SWEEP MODE key 4-11

[T]

TALK 4-68
talk only 4-67
. 6-6
Talker format 6-23
TECHNICAL TERM A2-1
Threshold current A2-10
TRANS 4-39
Transportation 1-11
trend chart 4-52

[U]

Ultraviolet rays A2-10
UNCAL display 3-7
. 4-13

[V]

Visible light A2-10
volume label 4-64

[W]

Wavelength A2-10
Wavelength division multiplexing A2-10
wavelength resolution 4-13

[X]

XdB attenuation method 4-43

[△]

△λ A2-9

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