ADVANTEST®

ADVANTEST CORPORATION

Q8347

Optical Spectrum Analyzer

Operation Manual

MANUAL NUMBER FOE-8324212G02

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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.
- 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 after their expected lifespan has expired.
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.

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

Main Parts with Limited Life

Part name	Life
Unit power supply	5 years
Fan motor	5 years
Electrolytic capacitor	5 years
LCD panel	6 years
LCD backlight	2.5 years
Floppy disk drive	5 years

- **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

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

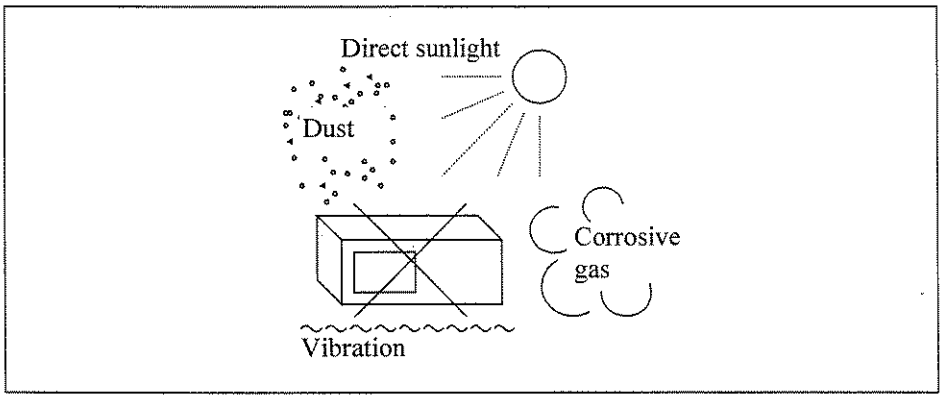


Figure-1 Environmental Conditions

- Instrument Placement

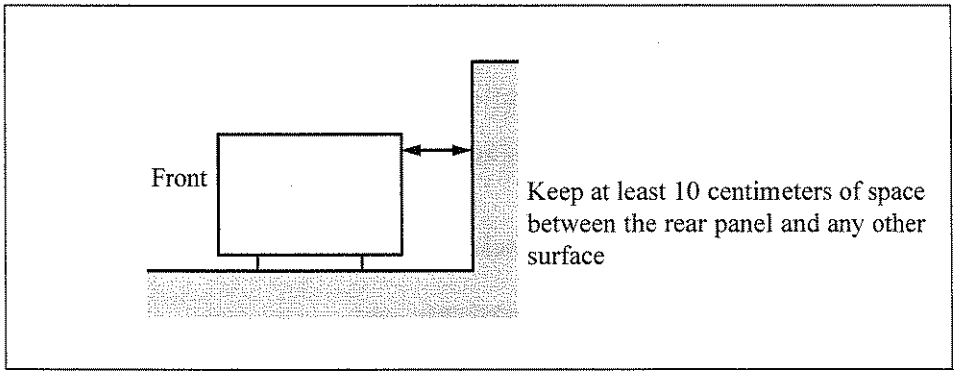


Figure-2 Instrument Placement

This instrument can be used safely under the following conditions:

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

Certificate of Conformity

CE

This is to certify, that

Optical Spectrum Analyzer

Q8347

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

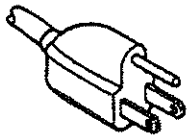
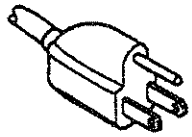
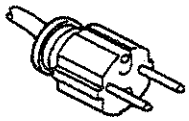
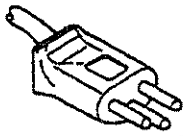
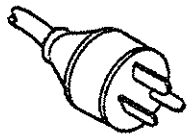
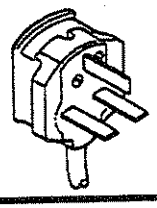
ROHDE&SCHWARZ
Engineering and Sales GmbH
Munich, Germany

8347.00

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

How to Use This Manual

This manual consists of ten chapters and two appendixes.
If you are about to use the Q8347 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 Q8347 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 Q8347. Chapter 1 explains the outline of the Q8347, 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 Q8347 for the first time should become familiar with the outline of the operation.
4. Panel operation	..... Chapter 4 explains the eight panel sections, including the function and operation of each one.
5. Key functions	..... Chapter 5 briefly explains the list of softkey menus functions.
6. GPIB interface	..... Chapter 6 explains the program code and data output format when the Q8347 is controlled via the GPIB 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 Q8347.
9. Principle of operation	..... Chapter 9 shows the internal blocks and briefly explains their operation.
10. Specifications	..... Chapter 10 lists the specifications of the Q8347.
Appendix	..... Glossary of technical terms. Refer to this as required.
External view	..... External dimensions are shown on the drawings. Illustrations of the front and rear panels are enlarged.

CAUTION: Use of controls, adjustments or performance of procedures other than those specified in this manual may result in hazardous radiation exposure.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

1. GENERAL

This chapter explains how to use this instruction manual, the outline of the Q8347 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

1.1 Outline of the Analyzer

The Q8347 is an optical spectrum analyzer employing a Michelson interferometer. Its main features are given below.

Features

- High-resolution wavelength measurement
  The analyzer measures wavelength with high resolution of 0.01nm at 1.5μm band and 0.001nm at 0.5μm band.
  Therefore, the analyzer can analyze the devices used for multi-mode light or wavelength division multiplexing that cannot be dissolve heretofore.
- Coherent length can be measured.
  The coherent length which cannot be measured by dispersion spectroscopy using a grating can be measured by the Q8347 using the interference method. Therefore, the Q8347 can easily determine the noise suppression performance of the CD/VD laser diode due to the reflected light. The analysis range is as wide as ±165mm.
- High-speed measurement
  As the analyzer employs Fourier spectroscopy using an interferometer, high-speed measurement is realized.
  Even when the GPIB is used in system, the entire procedure from the measurement start trigger to data output can be carried out in 2.5 seconds (in the high-resolution mode) or in 1.0 second (in the normal-resolution mode). (In this case, the wavelength range is the long wavelength.)
- ±0.01nm wavelength measurement accuracy
  As a He-Ne laser is used as the internal reference light source, a high wavelength accuracy of 0.01nm is realized. Wavelength calibration is not required.

- Easy operation
  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.
  The Q8347 has a built-in level meter which greatly facilitates adjustment of the measurement light coupling.
- Zoom function
  The measurement data can be analyzed again and displayed with the zoom function.
  Data can be displayed from wide to narrow span without repeating measurement.
- Various processing functions
  Various processing functions are available. They include four types of FWHM (full width half maximum) measurement function, an automatic peak search function, four types of cursor indication modes, a peak value listing function and 16 data memory areas.
- 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.

1.2 Before Using the Analyzer

1.2.1 Checking the Exterior and Accessories

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

Table 1-1 Standard Accessories

Name	Type	Parts code	Q'ty	Remarks
Power cable	Refer to page plug-1	——	2	
Power fuse (Display Unit)	EAWK4A	DFT-AA4A	2	For 90 to 250VAC
Power fuse (Optical Unit)	EAWK2A	DFT-AA2A	2	For 90 to 250VAC
Conect cable	——	DCB-RR5882X01	1	
FLOPPY DISK	——	ESM-000270	1	2DD
Printer paper	A09075	——	1	114mm-wide thermal paper
Operation Manual	——	EQ8347	1	English version

Note: When ordering additional accessories, do not forget the parts code (Type).

1.2.2 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 outside, make sure that the area around the analyzer is well ventilated. Do not place any other device up against the rear panel.

(3) Since the analyzer is a precision instrument, do not subject it to vibration or use it on a table where it may overturn.
When transporting the analyzer, use the box and shock-absorbing material used when shipped from the factory. If the box has been discarded, use another one 5 to 10 cm larger than the analyzer and pack it with a sufficient amount of shock-absorbing material.

(4) Use only the cable provided as standard accessories.

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

(6) Before using the power cable, confirm that the power source is within the voltage specified on the rear panel.
Use the power source voltage shown on the Optical Unit. When using the analyzer out of the voltage specification, contacts the near ADVANTEST's sales and support offices.

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

1.2.3 Power Source and Fuse

(1) Power source
Before connecting the power cable, make sure that the analyzer power switch is OFF.
Use the power source voltage shown on the Optical Unit. When using the analyzer out of the voltage specification, contacts the near ADVANTEST's sales and support offices.

CAUTION

The excessive voltage out of the specification shown on the Optical Unit causes the analyzer to break.

(2) Fuse

- Fuse replacement

① Remove the power cable from the AC line connector.

② Remove the fuse holder from the AC line connector.

③ Confirm that the fuse has blown and replace it with a new one.
(The fuse capacity is identical to the power voltage range which can be used.)

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

	Power source voltage	Applicable fuse (Parts code)	Nominal current
Dispay Unit	AC 90V to 132V AC 198V to 250V	EAWK4A (DFT-AA4A) Specifies parts	T4A
Optical Unit	AC 90V to 132V AC 198V to 250V	EAWK2A (DFT-AA2A) Measurement parts	T2A

1.2.4 Expendables

The following part of the analyzer must be changed periodically.

Parts	Life time	Conditions
Laser tube	10000 hours	After powering on, a message of "Lo He-Ne LASER POWER!! > press any key for continue" is displayed to indicate self diagnosis failure. In this case, contact the sales dealer or the support office.

1.2.5 Setup

The analyzer consists of Display Unit (including colore TFT display and operation keys) and Optical Unit (including interferometer).
Connect the OPTICAL I/O (on rear panel) in the analysis section with the OPTICAL I/O (on rear panel) in the measurement part by using a connection cable of accessory.
Connect the both power source cables to AC power source plugs.

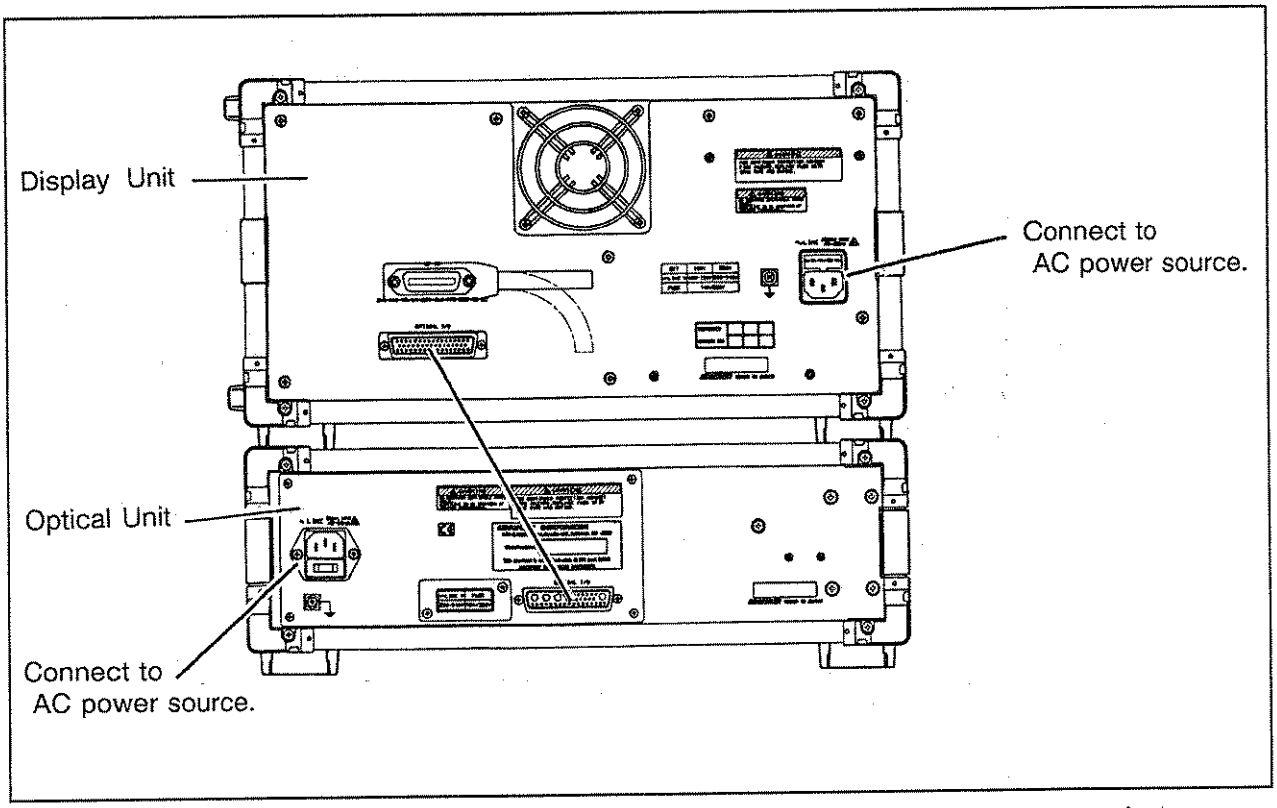


Figure 1-1 Setup for Analyzer (connecting analysis section with measurement section)

1.2.6 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 50V 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 inset the power plug and turn the power switch ON.

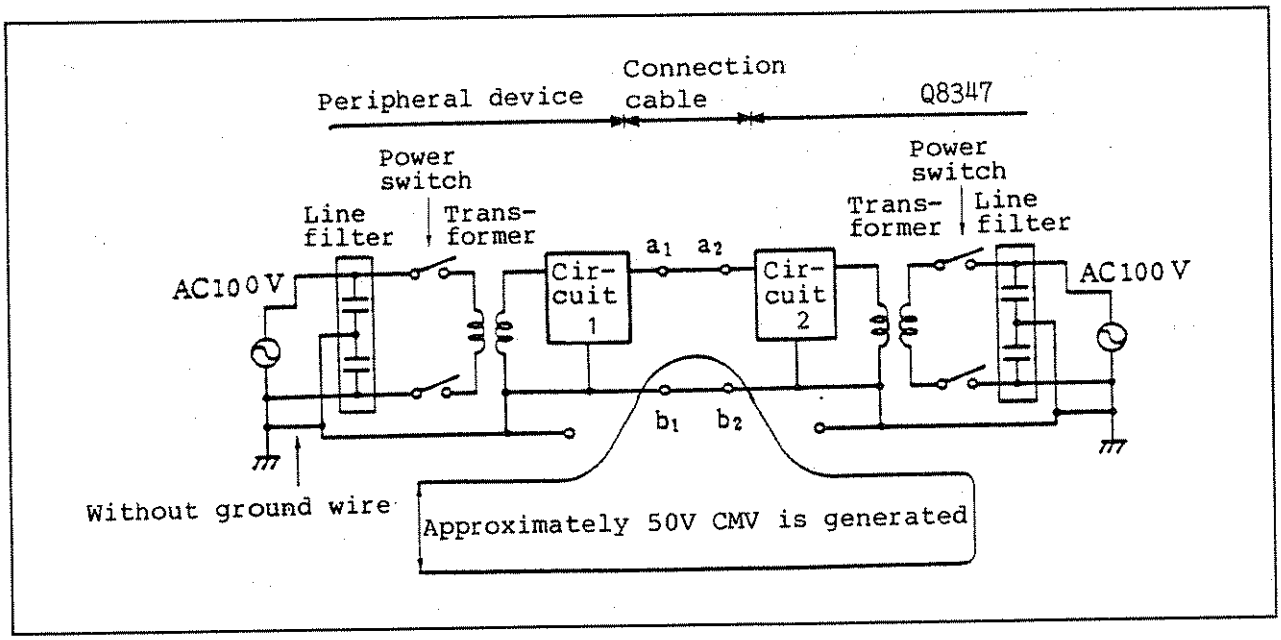


Figure 1-2 Power Line CMV Loop

1.2.7 Colored Liquid Crystal Display

Adjust the brightness of the liquid crystal display (LCD display) to suit the ambient brightness using the brightness adjustment knob located on the lower center of the front panel.
The view angle of LCD display is narrow in comparison with that of CRT. Therefore, tilt mechanism is employed to tilt up or down the display.
Adjust the display to desired angle.

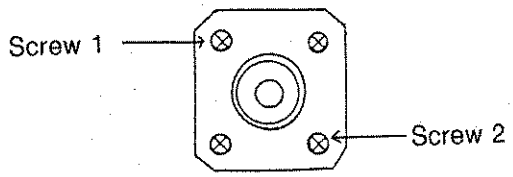
1.2.8 Cleaning the Input Optical Connector

If the end of the internal optical connector in the optical input section of the analyzer is not clean, normal level may not be displayed or spectrum distortion result.
When connecting an optical connector to the analyzer, confirm that the end is sufficiently clean.
Also, do not forget to clean the end of the internal optical connector in the optical input section of the analyzer.

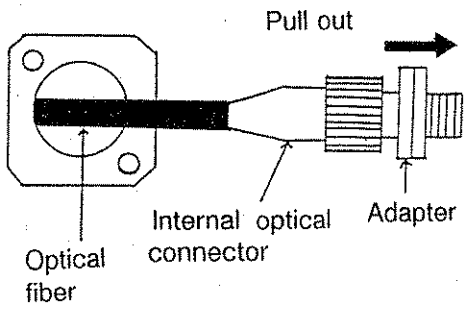
<Cleaning the end of the internal optical connector>

- Removing the optical input section

① Remove screws 1 and 2 using a 2mm screwdriver.



② Slowly pull the optical input section out. (Pull out about 3 to 5cm.)

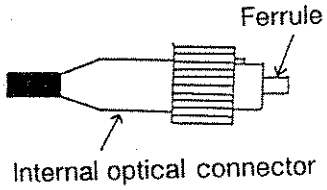


Note

Take care not to break the fiber.

(2) Cleaning the end of the internal optical connector

③ Remove the connector from the adapter and clean the end and sides of the connector ferrule using an absorbent gauze moistened with alcohol.



④ Lightly dab the end of the connector with the alcohol-moistened gauze and wipe off excess alcohol with a piece of dry gauze.

Note

Take care not to rub the fiber too vigorously to avoid scratching the surface.

(3) After cleaning

⑤ After drying the end of the fiber, mount the internal optical connector on the adapter and slowly set it in its original position. Fix the adapter with the two screws.

1.2.9 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. 1-3 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 for 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 buzzer sound is heard three times 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.

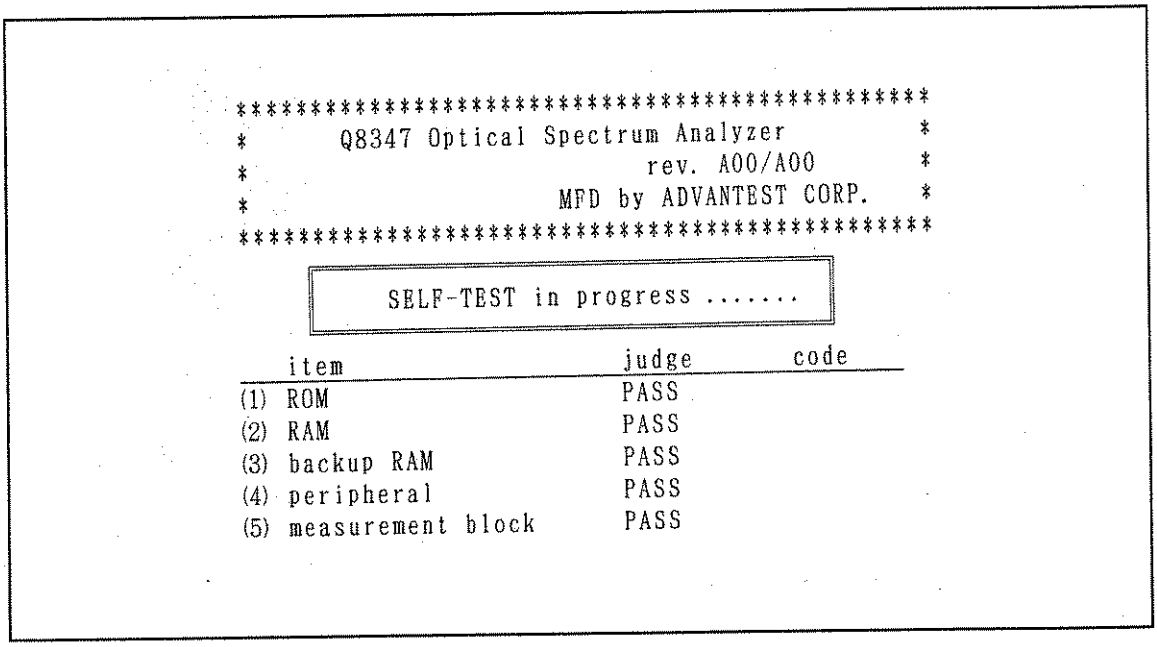


Figure 1-3 Initial Screen at Power ON

Note

When the power switch is turned on, a mechanical sound is hear. This is the sound of mechanical relay switching and is not a problem.

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.

1.2.10 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.

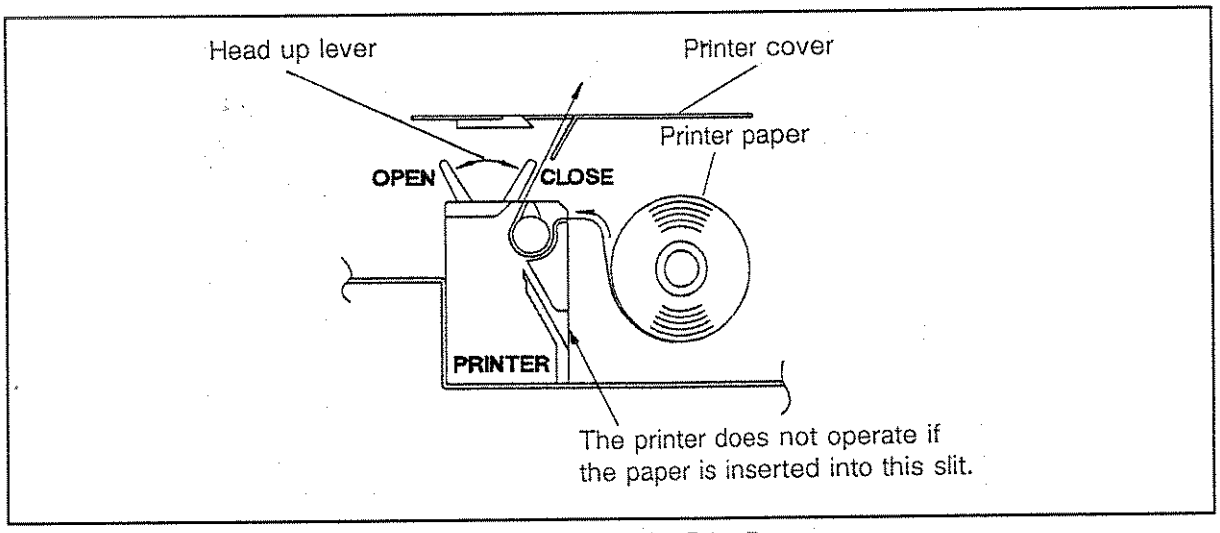


Figure 1-4 Setting the Print Paper

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.

1.2.11 Cleaning, Storage and Transportation

(1) Cleaning

Dirt on the analyzer can be wiped off with a soft (or damp) cloth. When cleaning the analyzer, take care of the following:

- Be careful not to leave fibers on the analyzer or let water soak into it.
- Do not use any organic solvent which may degrade plastics (such as benzene or acetone).

(2) Storage

When the analyzer is not used for a long time, cover it with a vinyl sheet or put it in a corrugated fiberboard box to protect it from dust. Store in a dry place free from direct sunshine.

Storage temperature : -10°C to +50°C

(3) Transportation

To transport the analyzer, pack it in its original packing material or the equivalent (5 mm or thicker corrugated fiberboard box).

[Packing procedure]

① Wrap the analyzer in a cushioning material and place in a corrugated fiberboard box.

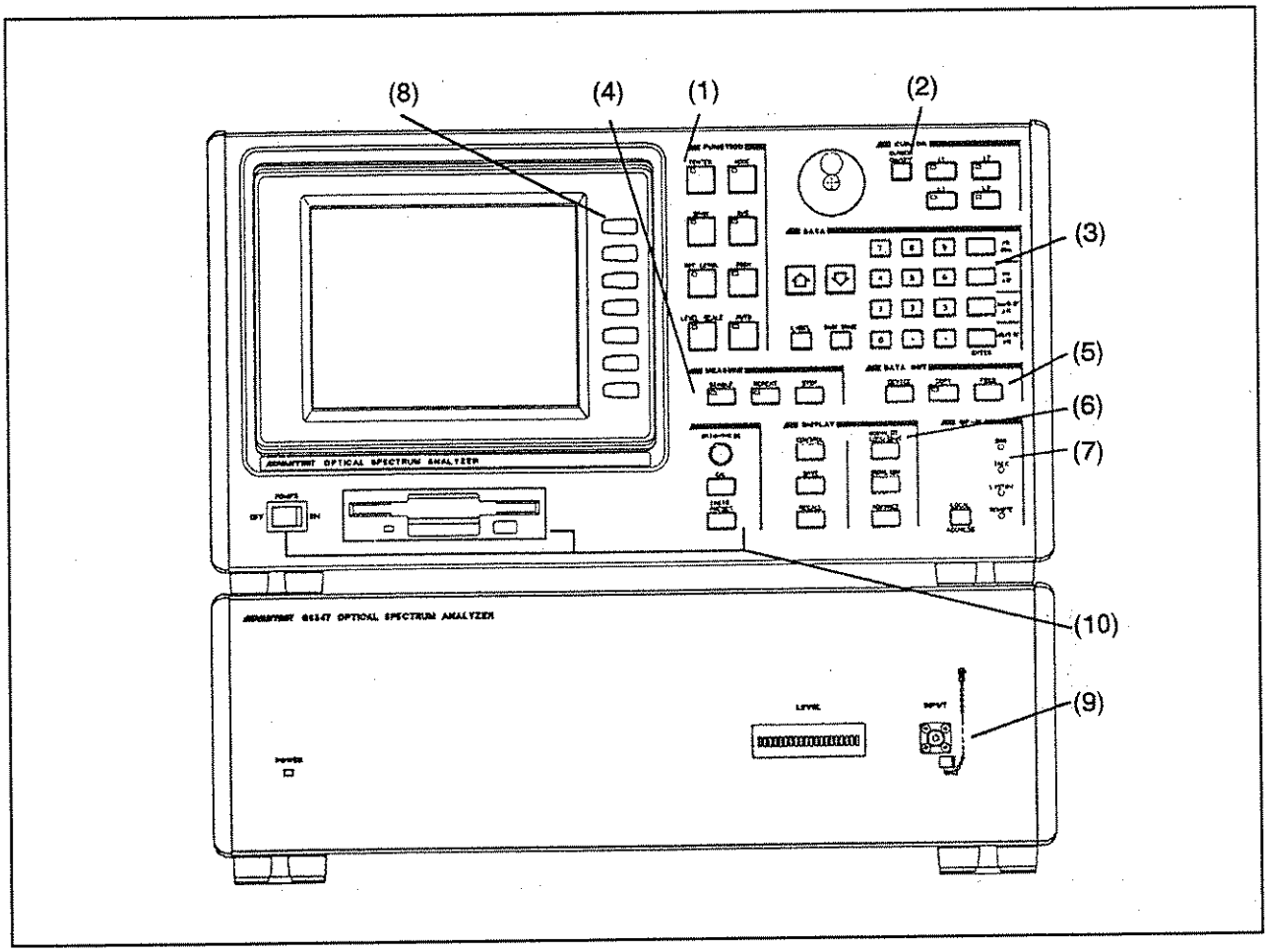
② Place accessories in the box with the cushioning material on top of teem.

③ Close the corrugated fiberboard box, and bind it with packing string.

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.

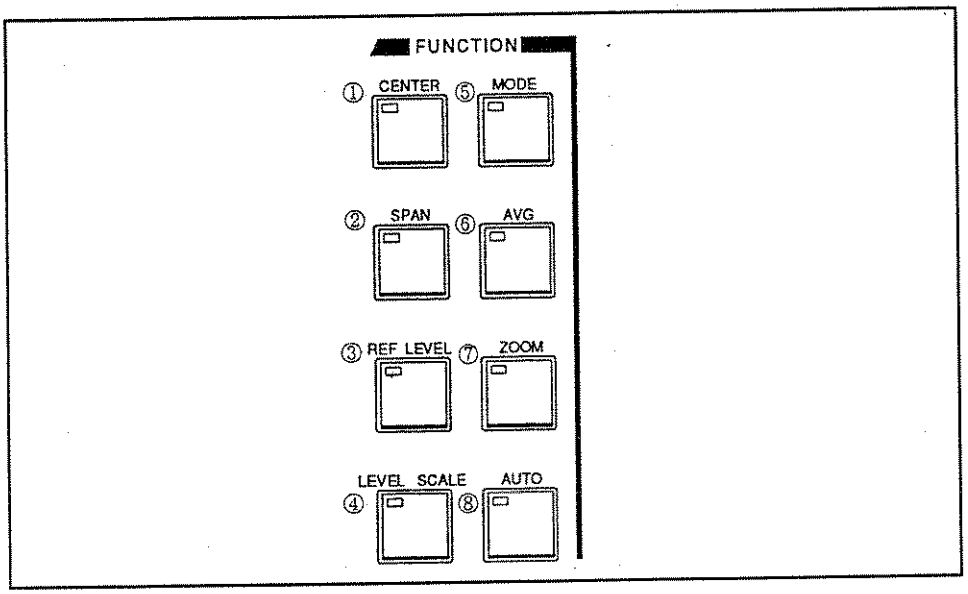
2.1 Front Panel



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

(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, the start/stop wavelengths and the coherent analysis range.

③ REF LEVEL key : Specifies the input sensitivity.

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

⑤ MODE key : Selects coherence or spectrum analysis and high-resolution mode, normal-resolution mode or high-sensitivity mode.

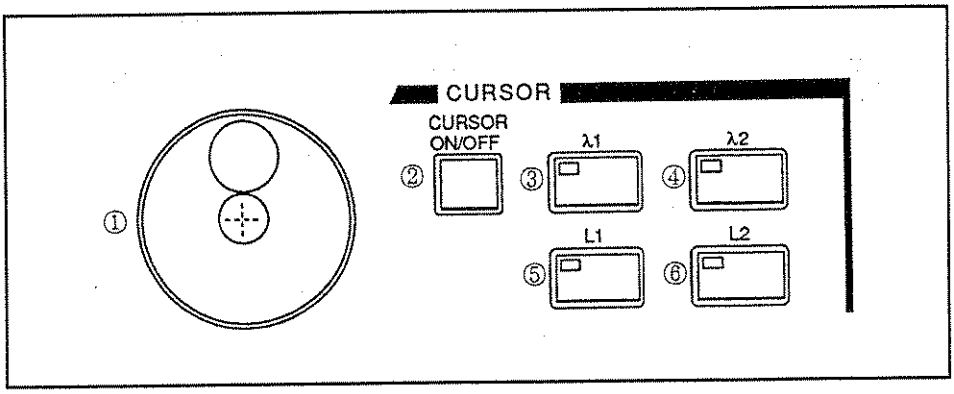
⑥ AVG key : Specifies the averaging function ON/OFF and the number of processings.

⑦ ZOOM key : Selects and executes the zoom function to re-analyze the measured data in a different span, and specifies the zooming indication.

⑧ AUTO key : Executes the automatic setting functions for wavelength range and input sensitivity.

(2) CURSOR section

This section is used to control cursor display.



① Rotary knob : Moves the cursor selected and continuously changes the data set.

② CURSOR ON/OFF key : Controls ON/OFF of all cursors and the cursor display mode.

③ λ1 key : Selects display and erases wavelength cursor 1.

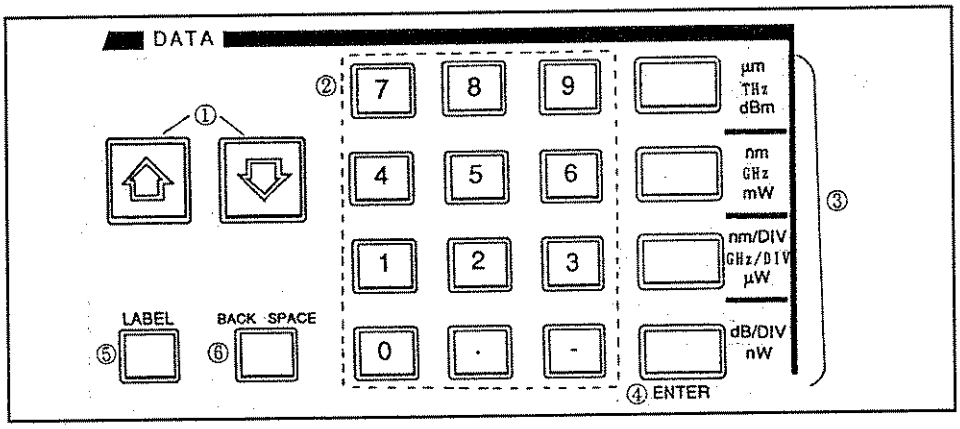
④ λ2 key : Selects display and erases wavelength cursor 2.

⑤ L1 key : Selects display and erases level cursor 1.

⑥ L2 key : Selects display and erases level cursor 2.

(3) DATA section

This section is used to control the measurement operations.



① Arrow keys : Used to move the cursor selected and change the data set, step by step.

② Numeric keys : Used to specify values for condition setting.

③ Unit key : Specifies the unit (input terminator).

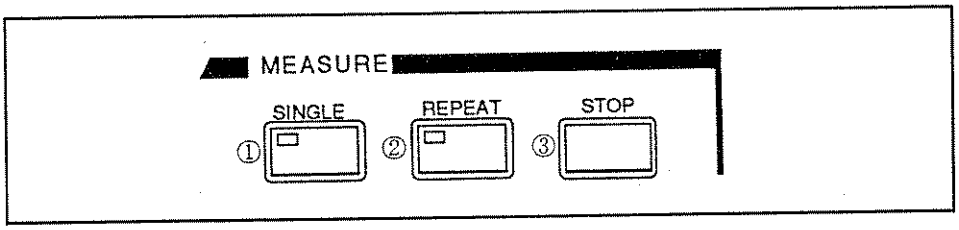
④ ENTER key : Setting terminator of other than the unit key.

⑤ LABEL key : Specifies the label data.

⑥ BACK SPACE key : Deletes a character from the input data.

(4) MEASURE section

The keys in this section are used to control the measurement operations.



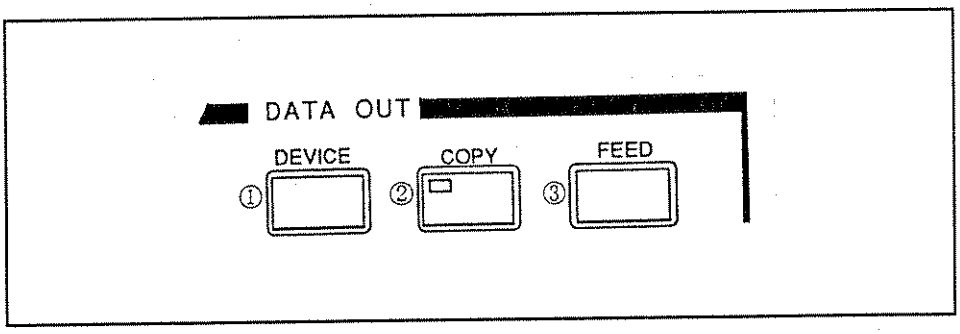
① SINGLE key : Executes one measurement.

② REPEAT key : Executes the measurement repeatedly.

③ STOP key : Stops the measurement.

(5) DATA OUT section

This section controls data output.



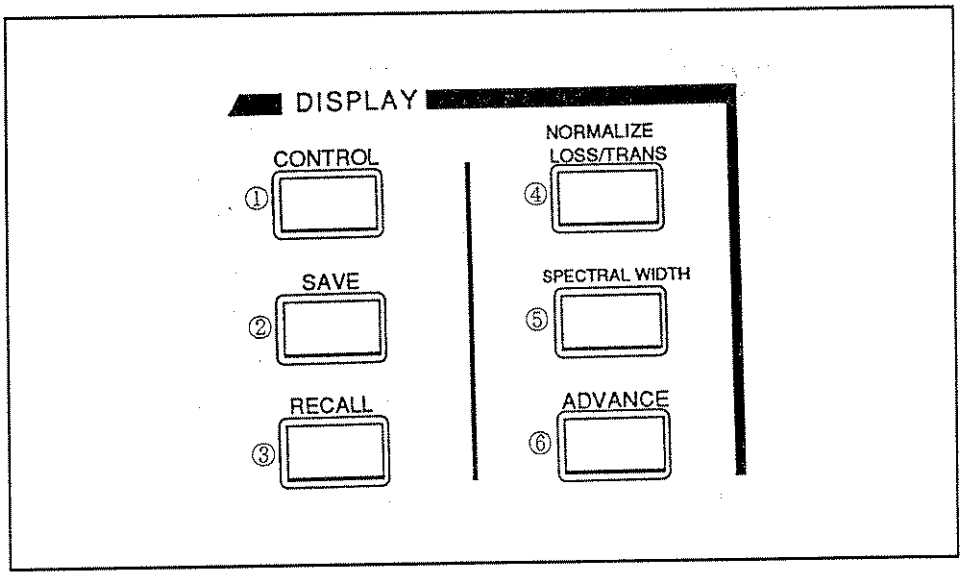
① DEVICE key : Specifies a device (plotter, printer floppy disk, coler, clock or buzzer).

② COPY key : Executes data out processing.

③ FEED key : Feeds paper to the printer.

(6) DISPLAY section

This section is used to select display and analysis functions.



① CONTROL key : Specifies the display mode (superimpose, dual-screens, three-dimensional).

② SAVE key : Saves the measurement data and setting conditions. (Memory/FDD)

③ RECALL key : Recalls the measurement data and setting conditions. (Memory/FDD)

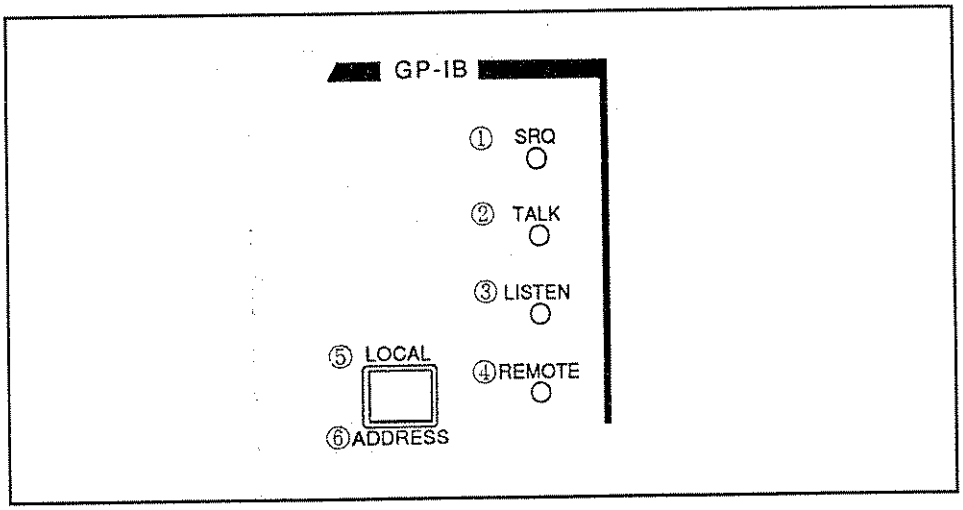
④ NORMALIZE LOSS/TRANS [ ] key : Executes measurement data normalization and measure-ment of loss and transparency characteristics.

⑤ SPECTRAL WIDTH [ ] key : Calculates the spectral width.

⑥ ADVANCE [ ] key : Specifies higher level analysis.

(7) GPIB section

This section is used to display the GPIB status and switch Remote/Local.



① SRQ lamp : Lit while service request is transmitted.

② TALK lamp : Lit when the data transmitabled status is set.

③ LISTEN lamp : Lit when the data receivabled status is set.

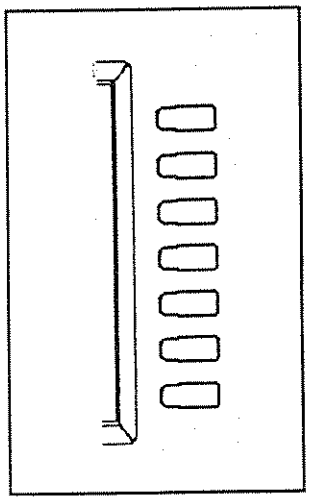
④ REMOTE lamp : Lit while the system is under external control.

⑤ LOCAL [ ] key : Specifies the local mode to make the panel keys valid (when the REMOTE lamp is lit).

⑥ [ ] key (ADDRESS) : Specifies the GPIB address (when the REMOTE lamp is off).
Specifies whether put a header on the data at output
Changes the mode to the talk only mode or the addressable mode.

(8) Softkeys

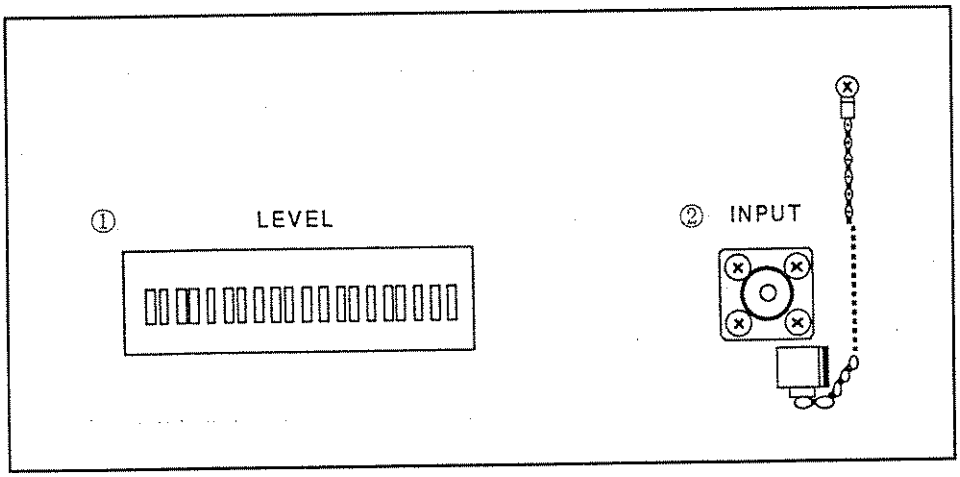
The Softkeys are used to select and specify the Softkey menu displayed.



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

(9) INPUT section

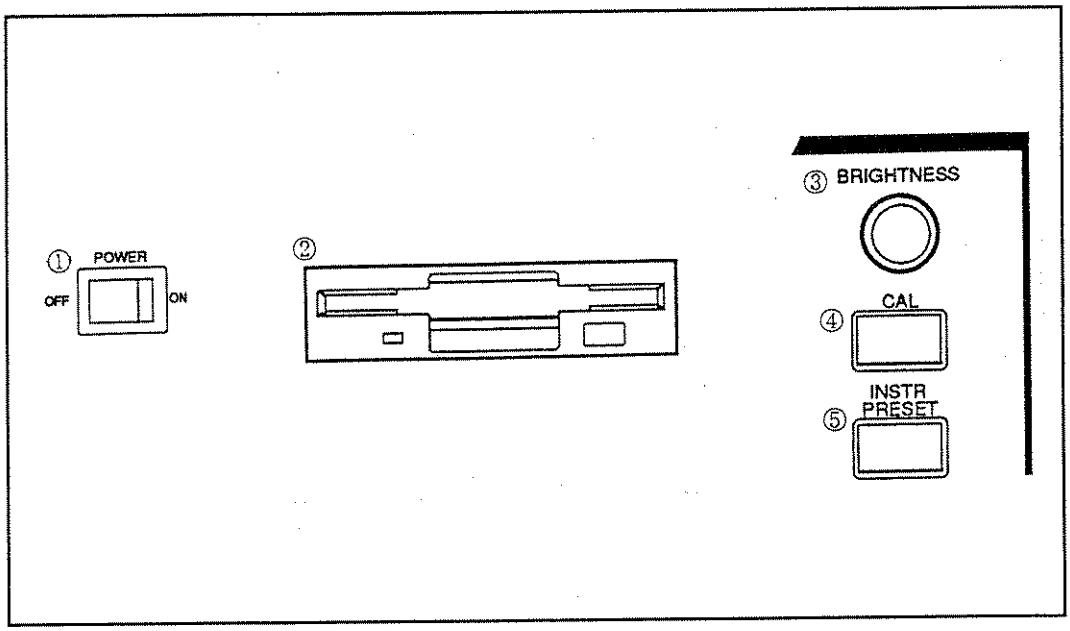
This section is for optical signal input.



① Level meter: The input light can be monitored in real time.
This meter is useful for adjusting the optical axis.
It has five internal ranges (-30dBm or below, -20dBm or below, -10dBm or below, 0dBm or below and 10dBm or below). The range is automatically specified according to the REF LEVEL on the panel. (The range is changed when measurement is executed at the specified REF LEVEL.)

② INPUT terminal: Input terminal for optical signals.

(10) Others



① POWER switch : Turns power ON/OFF.

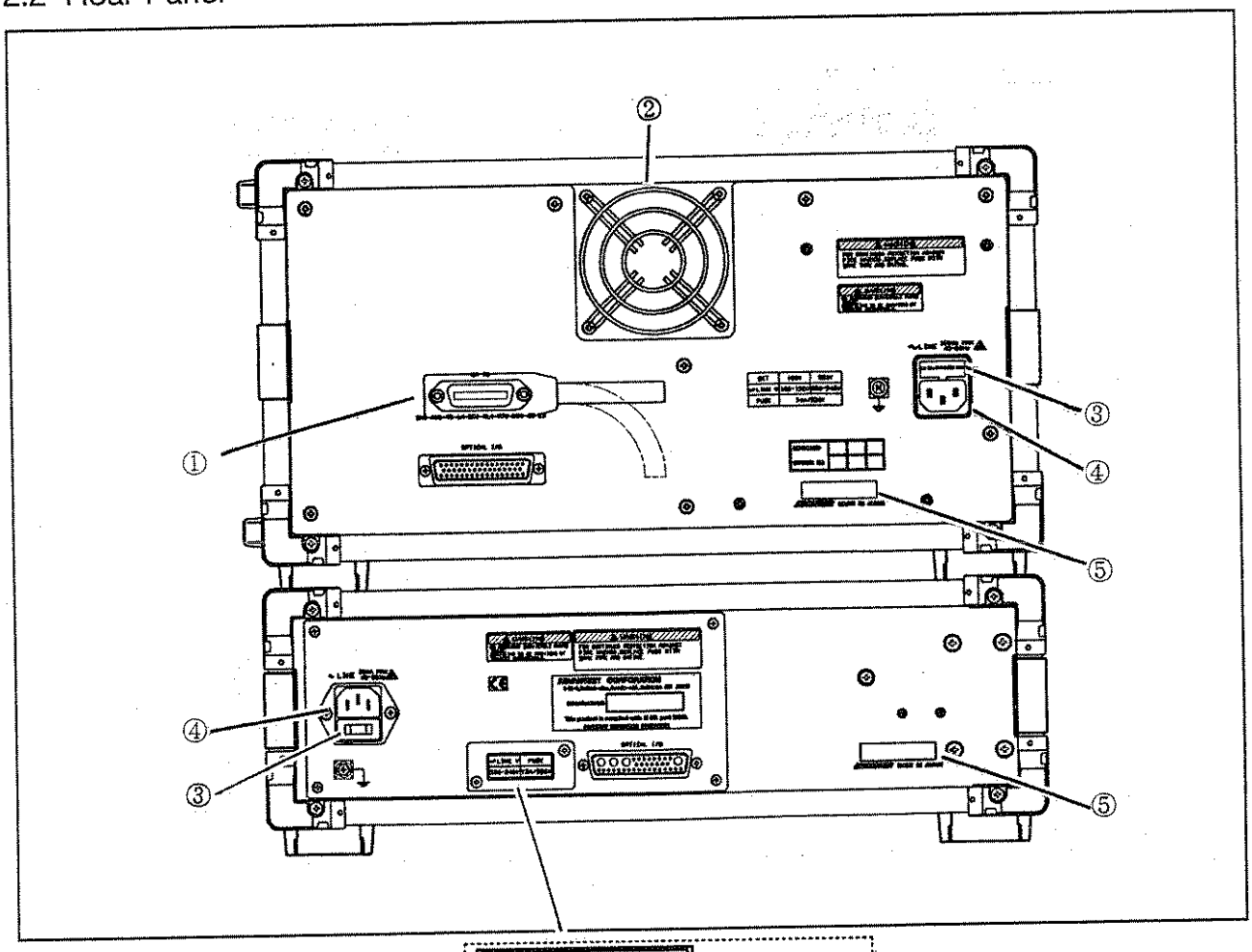
② 3.5 inch floppy disk drive : Saves the measurement data and measurement conditions. 2DD and 2HD are possible to use.

③ INTENSITY knob : Adjusts the brightness of the colored LCD display.

④ CAL key : Calibrates the wavelength and the level.

⑤ INSTR PRESET key : Initializes the setting modes.
Executes self-diagnosis.

2.2 Rear Panel



~ LINE V	FUSE	
100-120V	T2A/250V	(Opt. 00)
~ LINE V	FUSE	
220-240V	T2A/250V	(Opt. 40)

① GPIB connector
This connector is used when controlling the analyzer via an external controller with an GPIB interface and when outputting data from the ITFT display to the plotter corresponding to the GPIB.

② Fan
This is a discharge type fan for cooling the internal circuit.

③ Fuse

④ AC power socket

⑤ Serial Number
Shows the product number of the analyzer.

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.

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 of 2)

Classification	Item	Description
Display	• 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)
	• Dual screen display (DUAL)	The screen display is divided into the upper and lower parts.
	• Super impose (S.IMPOSE)	Two data are displayed at the same time on a single screen.
	• 3-dimensional display (3D)	3-dimensional display of up to 16 data. The display angle, number of data, etc. can be changed.
	• Power monitor display	Displays the all input power level in numerals. The trend chart is available to display the power with the time axis.
	• Wanelength monitor display	Displays the input wavelength in numerals. The trend chart is available to display the wavelength with the time axis.

Table 3-1 Functions (2 of 2)

Classification	Item	Description
Processing/ Analysis	• Auto peak search	Automatically searches and displays the peak wavelength/level of the measured spectrum.
	• List display	Lists and displays the peak data of the measured spectrum in numerical data.
	• Cursor display	Can display two wavelength/level cursors each. Four display modes are offered.
	• Spectral width operation	Operation and display of the center wavelength, spectrum width by four types of operation methods.
	• Peak normalization	Normalizes the measured spectrum peak level as the reference value (0 dB/100%).
	• Loss/Trans	Operates the loss/transparence characteristics by division with the reference memory data.
	• Curve fit	Calculates and displays the secondary function curve from the measured curve by method of least square approximation.
Measurement	• Averaging process	Up to 1024 averaging can be done to measure low level signals stably.
	• Automatic optimization measurement conditions setting	The optimum measurement conditions are automatically judged and set according to the input light.
Others	• Memory	Provides backup memory for measurement condition : 10, and measurement data : 16. Up to 111/191 combination of condition/data files can be stored on a single 3.5-inch floppy disk.
	• Direct plot	The tube face data can directly be output onto the "HP-GL" specification GPIB plotter.
	• Label setting	Data with maximum 48 characters can be set as the label. The label is displayed on the top of the LCD dipslay.
	• Clock function	The year-, month-, day-, hour:, minute:, second: data are displayed on the upper right part of the LCD display.

3.2 Entering the Light to be Measured

The FC connector located at the lower right of the front panel is used to enter the optical signals. The block diagram of the input section is illustrated in Fig. 3-1. The light to be measured is fed to the internal interferometer of the analyzer through a GI fiber having a core diameter of 50 μm. (If optional 10 is specified, a 200 μm diameter GI fiber is used). The core diameter of the fiber to be connected to the FC connector should not exceed that of the internal fiber. If a fiber having a core diameter exceeding that of the internal fiber is used, not all the light to be measured is fed to the internal fiber and the measurement level is lowered.

The fiber to be connected should have a clean end. If a fiber with dirty end is used, the level may not be indicated correctly or the spectrum may be distorted. End cleanness is also required of the fiber used inside the analyzer.
Clean the end of the fiber periodically. For the cleaning procedure, see paragraph 1.2.8 (Cleaning the input light connector).

The fiber to be connected should be fixed firmly so that it will not vibrate during measurement. If the fiber vibrates, the spectrum may fluctuate.

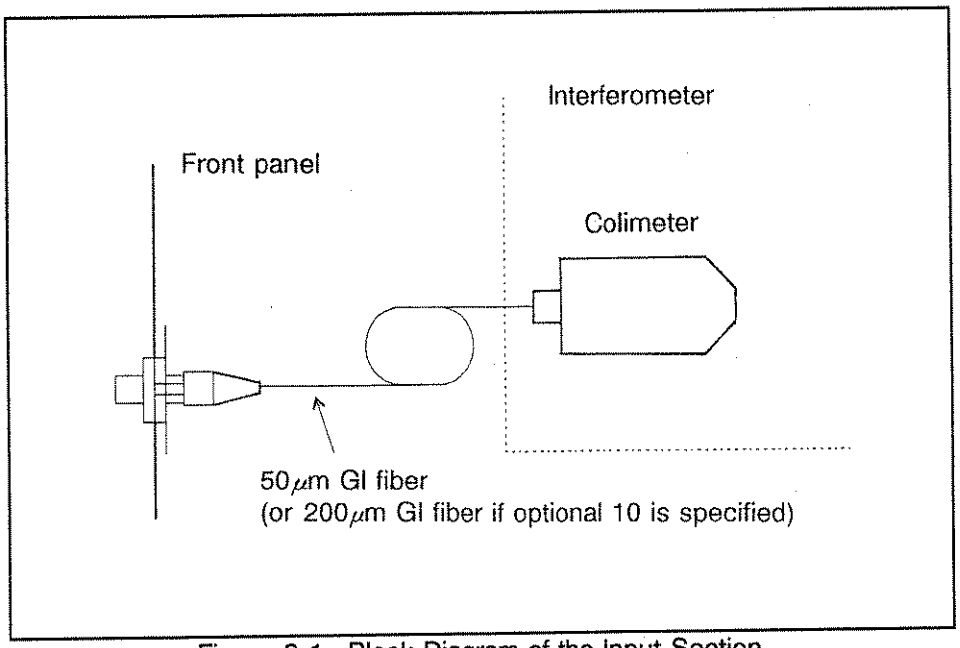


Figure 3-1 Block Diagram of the Input Section

3.3 Reading the LCD Display

The Q8347 analyzer displays the measurement data along with the setting conditions and internal modes on the screen. Fig. 3-2 shows how to read the display.

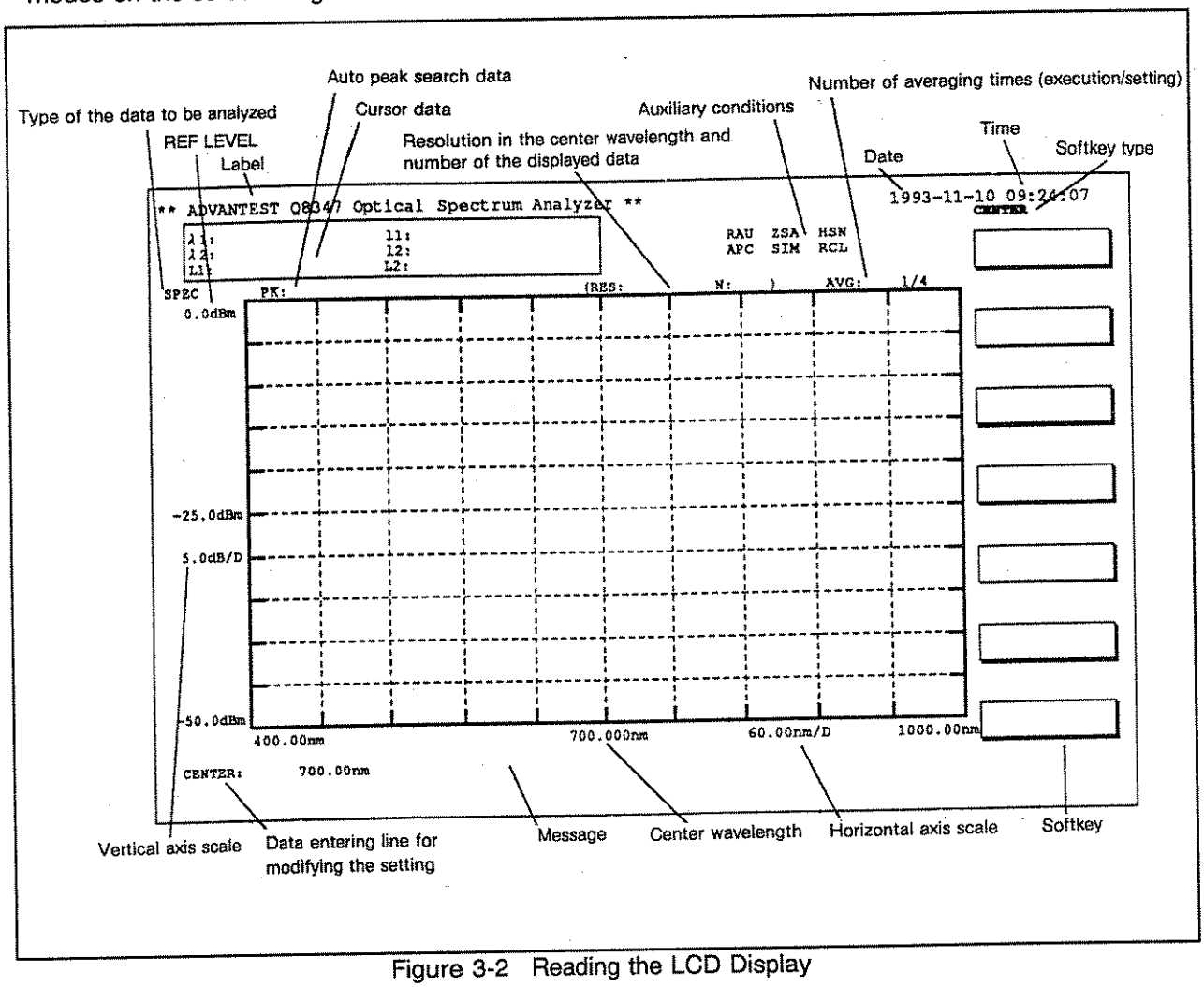


Figure 3-2 Reading the LCD Display

(1) Additional explanation on the LCD display

① Type of data to be analyzed

SPEC	:	Spectrum analysis
COH	:	Coherent analysis
P.NORM	:	Peak-normalized data
LOSS	:	Loss characteristics data
TRANS	:	Transparency characteristics data

② Displaying the peak search data

Spectrum analysis: Peak wavelength and peak level are displayed.

Coherence analysis: The second peak distance and level (α) and the intermediate distance and level between the first and second peaks (β) are displayed.

③ X-axis during coherence analysis

Center position: The center wavelength is indicated between parentheses ( ).

Left and right ends: The distance range specified as Xmm is indicated as −Xmm and +Xmm.

④ Message

If the analyzer's internal state or operation results in an error, message is displayed and an alarm sounds.

A list of messages is given in Table 3-2 on the next page.

Table 3-2 List of Internal State and Alarm Messages (1 of 2)

Message	Description
① AVERAGE in progress	Averaging is in progress.
② HOLD-ZOOM in progress	HOLD-ZOOMing is in progress.
③ AUTO function in progress	The AUTO function to determine the optimal measurement condition is in progress.
④ PRINT-out in progress	The data is being output to the built-in printer (optional).
⑤ PLOT-out in progress	Direct plotting (drawing with the plotter) is in progress.
⑥ paek-lambda search in progress...	The peak wavelength is being searched in the power monitor display mode, or the wavelength monitor display mode.
⑦ read data from FD in progress...	Data are being read from the floppy disk.
⑧ write data to FD in progress...	Data are being written to the floppy disk.
⑨ disk formatting in progress...	Formatting of the disk is in progress.
⑩ input data out of range!!	The data entered to modify the setting exceeds the allowable range.
⑪ HOLD-ZOOM cannot execute!!	HOLD-ZOOM was tried on the recall data or data in the short and long wavelength range. This occurs when [START] is pressed.
⑫ AUTO function failed!!	The AUTO function did not operate correctly because the input signal level was improper.
⑬ superimpose cannot execute!!	The [S. IMPOSE] key was pressed when the measurement conditions in the upper and lower sections of the screen differed.
⑭ condition cannot change at 3D ON!!	Modification of the setting conditions was tried when the three-dimensional display was ON.
⑮ condition cannot change at TREND ON!!	The measurement condition that cannot be changed in the power monitor display or the wavelength monitor display is tried to change.
⑯ no REF or MEAS1 data!!	The LOSS/TRANS function was tried when no REF data or MEAS1 data was found in memory.

Table 3-2 List of Internal State and Alarm Messages (2 of 2)

Message	Description
⑰ different condition at REF < > MEAS!!	The LOSS/TRANS function was tried between data having different measurement conditions.
⑱ no plotter!!	The plotter is disconnected or the plotter address is other than LISTEN ONLY.
⑲ no printer paper!!	The COPY key was pressed with the printer head was raised.
⑳ printer head up!!	The COPY key was pressed with the printer head was raised.
㉑ illegal level data input!!	A value exceeding the ±9.9dB range was entered during level calibration.
㉒ media not in drive!!	Disk is not in the drive.
㉓ unformatted disk!!	An unformatted disk or a disk having illegal format is in the drive.
㉔ disk full!!	The maximum number of files are in a disk. A new file cannot be created. (Maximum number of the files: 111/191)
㉕ illegal file name!!	An illegal file name is specified in writing.
㉖ disk read error!!	Data cannot correctly be read from the disk.
㉗ disk write error!!	Data cannot correctly be written to the disk.
㉘ disk formatting failed!!	Disk was not formatted normally.
㉙ write protected!!	The disk is write protected.
㉚ press 'EXECUTE' once more!!	Confirmation whether to format the disk. Press the EXECUTE key once more.
㉛ no data for save!!	There is no data to save though data is tried to save to the backup memory or the floppy disk.
㉜ REF, MEAS1 can save only SPEC, COH	Data other than spectrum and coherent are tried to save to the REF memory or the first of the backup memory.
㉝ OVER LOAD!!	The measurement data are overloaded.

⑤ Auxiliary conditions

Auxiliary measurement and display condition items are displayed in three alphabetical characters. They are displayed at fixed positions.
(When a function is selected, the corresponding three characters appear. If no function is selected, no characters appear.)

The meanings and display positions of auxiliary conditions:

- RAU: "AUTO" mode has been selected for the REF level.
- ZCA or ZSA: "CTR AUTO" (ZCA) or "SPAN AUTO" (ZSA) has been selected for the ZOOM function.
- HSN: High sensitivity mode has been selected.
- APC: APC (Auto PkC) function has been selected.
  At the end of measurement, this function automatically sets the peak wavelength as the center wavelength.
- SIM: "S.IMPOSE" (superimpose) has been selected.
- RCL: The data displayed is memory recall data. This disappears when the data is updated by measurement.

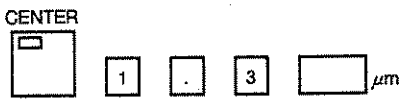
3.4 Basic Operation Procedure

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

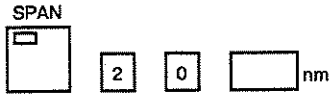
<How to measure a 1.3 μm laser diode>

Operation procedure

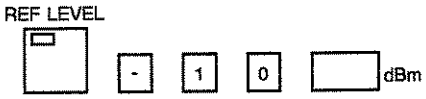
① The center wavelength is set at 1.3 μm.



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 measurement is executed once (sweeping).

→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.

3.5 Setting the Measurement Conditions

Normally, the FUNCTION section keys are used for setting the measurement conditions. Basically, the measurement conditions can be divided into three types as follows:

(1) Setting the wavelength conditions (center wavelength, span and others)
(2) Setting the level conditions (input sensitivity)
(3) Other settings (the number of averaging times, measurement light selection, and others)

Set the measurement conditions using the keys shown in Table 3-3.

Table 3-3 Measurement Condition Items and Corresponding Keys (1 of 2)

Setting item	Item selection keys	Keys for modifying settings
① Center wavelength (Center frequency)	CENTER	PEAK, CURSOR, AUTO PKC Numeric key , Rotary Knob, Arrow key
② Wavelength span (Frequency span)	SPAN	FULL, 350 to 1050, 950 to 1750 Numeric key , Rotary Knob, Arrow key
③ Start wavelength (Start frequency)	SPAN + START	Numeric key , Rotary Knob, Arrow key
④ Stop wavelength (Stop frequency)	SPAN + STOP	Numeric key , Rotary Knob , Arrow key
⑤ Coherent analysis range	SPAN	AUTO, MIN, MAX Numeric key , Rotary Knob, Arrow key
⑥ Input sensitivity	REF LEVEL	TOTAL PWR, AUTO Numeric key , Rotary Knob, Arrow key
⑦ Selecting the light to be measured	REF LEVEL	LASER/LED
⑧ Selecting the resolution mode / sensitivity mode	MODE	HIGH RES, HIGH SENS, NORM RES

* [ ] : Softkey

Table 3-3 Measurement Condition Items and Corresponding Keys (2 of 2)

Setting item	Item selection keys	Keys for modifying settings
⑨ Selecting the type of the data to be analyzed	MODE	SPEC (λ) | COHERENCE SPEC (f)
⑩ Number of averaging times	AVG	2 | 4 | 8 | 16 | 32 64 | ON/OFF Numeric key ,Rotary Knob, Arrow key

* [ ] : Softkey

3.6 Setting the Display Conditions

In addition to the normal single screen display, dual-screen, superimpose and 3-dimensional displays are also available. Set the display conditions using the LEVEL SCALE and CONTROL keys.

Table 3-4 shows the display conditions and keys used to modify settings.

Table 3-4 Display Conditions and Keys Used (1 of 2)

Setting item	Item selection keys	Keys for modifying settings
① Display scale	LEVEL SCALE	LIN/LOG, 10dB/D, 5dB/D, 2dB/D, 1dB/D, 0.5dB/D, 0.2dB/D Rotary Knob, Arrow key
② Grid display	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 Setting the 3-dimensional display conditions	CONTROL + 3D	INC ANGLE, DEC ANGLE, INC N, DEC N, N LOCK, ROLL
⑦ Recall and erase of 3-dimensional data	CONTROL + 3D	CSR NEXT, DELETE, CLEAR, RECALL

* : Softkey : Softkey (2nd line) : Softkey (3rd line)

Table 3-4 Display Conditions and Keys Used (2 of 2)

Setting item	Item selection keys	Keys for modifying settings
⑧ Listing display ON/OFF	CONTROL + LIST	ON/OFF
⑨ Setting the listing display conditions	CONTROL + LIST	YdB, SORT LVL, SORT WL
⑩ Scrolling the listing display	CONTROL + LIST	↑ (Page), ↓ (Page)

* : Softkey : Softkey (2nd line) : Softkey (3rd line)

3.7 Measurement and Data Output

Measurement is executed and the results output according to the measurement and display conditions described in sections 3.3 and 3.4.
Measurement is controlled using the three MEASURE section keys: for single measurement, repeated measurement and measurement stop.
The data displayed can be output to a printer or a plotter using the DATA OUT section keys.
Table 3-5 describes the keys used for measurement and data output.

Table 3-5 Measurement and Data Output Items and Keys Used (1 of 2)

Item	Item selection and execution keys	Keys for modifying settings
① Executing a single measurement	SINGLE	———
② Executing a repeated measurement	REPEAT	———
③ Stopping measurement	STOP	———
④ Specifying the output device	DEVICE	PRINTER, PLOTTER, CLOCK, BUZZER, FLOPPY
⑤ Executing data output	COPY	———
⑥ Paper feed to printer	FEED	———
⑦ Setting the plotter output conditions	DEVICE + PLOTTER	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

* [ ] : Softkey [ ] : Softkey (2nd line) [ ] : Softkey (3rd line)

Table 3-5 Measurement and Data Output Items and Keys Used (2 of 2)

Item	Item selection and execution keys	Keys for modifying settings
⑨ Clock setting	DEVICE + CLOCK	ON/OFF, YEAR, MONTH, DAY, HOUR, MINUTE
⑩ Buzzer setting	DEVICE + BUZZER	BEEP, WARNING, QUIET

* [ ] : Softkey [ ] : Softkey (2nd line) [ ] : Softkey (3rd line)

3.8 Analyzing the Measurement Data

Data analysis can be executed using the cursor, spectral width calculating, normalizing and other functions.

Table 3-5 describes the keys used for analyzing the measurement data.

Table 3-5 Measurement Data Analysis Items and Keys Used (1 of 2)

Item	Items selection and execution keys	Keys for modifying settings
① Selecting the cursor display mode	CURSOR ON/OFF	NORMAL, △MODE, POWER, 2ND PEAK
② All cursors ON/OFF	CURSOR ON/OFF	———
③ λ1 selection ON/OFF	λ1	———
④ λ2 selection ON/OFF	λ2	———
⑤ L1 selection ON/OFF	L1	———
⑥ L2 selection ON/OFF	L2	———
⑦ Moving the cursor	λ1 / λ2 / L1 / L2 /	Rotary Knob, Arrow key
⑧ Executing the spectral width calculation/selecting the calculation type	SPECTRAL WIDTH	Pk. −XdB, RMS, ENVELOPE, Peak RMS

* : Softkey : Softkey (2nd line) : Softkey (3rd line)

Table 3-6 Measurement Data Analysis Items and Keys Used (2 of 2)

Item	Items selection and execution keys	Keys for modifying settings
⑨ Specifying the spectral width calculation parameters	SPECTRAL WIDTH [ ] + [parameter] + XdB / YdB / K / Kr (RMS)	Numeric key
⑩ Executing the peak normalize function	NORMALIZE LOSS/TRANS [ ]	Pk. NORM
⑪ Loss characteristics	NORMALIZE LOSS/TRANS [ ]	MEM NORM, LOSS, SAV REF, SAV MEAS1
⑫ Transparency characteristics	NORMALIZE LOSS/TRANS [ ]	MEM NORM, TRANS, SAV REF, SAV MEAS1
⑬ Curve fit	ADVANCE [ ]	CURVE FIT

* [ ] : Softkey [ ] : Softkey (2nd line) [ ] : Softkey (3rd line)

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 3-7 shows the keys used for the measurement data memory.

Table 3-7 Measurement Data Memory Items and Keys Used(1 of 2)

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, Rotary 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

* [ ] : Softkey [ ] : Softkey (2nd line) [ ] : Softkey (3rd line)

Table 3-7 Measurement Data Memory Items and Keys Used (2 of 2)

Item	Key for selection/execution	Keys enabled for changing the setting
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 Rotry Knob, arrow keys, numeric keys

* : Softkey : Softkey (2nd line) : Softkey (3rd line)

3.10 Operating Precautions (wavelength resolution/sensitivity)

The Q8347 is a Fourier spectroscopic type optical spectrum analyzer equipped with a Michelson interferometer. The definition of wavelength resolution as applied to this analyzer differs from that of the diffraction grating monochrometer type.
The input sensitivity varies according to the wavelength span specified.

(1) Wavelength resolution
In the case of the Q8347, the wavelength $\lambda_{(i)}$ resolution is the difference from the wavelength of the next measurement point $\lambda_{(i+1)}$ on the spectrum measured. This value is determined by the relationship between the center wavelength and the span. Since the frequency spectrum obtained by FFT processing is internally converted into the wavelength, the intervals between the wavelength measurement points (resolution) are not identical (they become identical on the frequency axis).
Frequency to wavelength conversion is done using the following equation:

$$\lambda = (\lambda_{He\text{-}Ne} \times f_{samp}) / (D \times f) \quad \text{----------} \quad ①$$

$\lambda_{He\text{-}Ne}$:	0.632991×10^{-6}	(Standard He-Ne wavelength in vacuum)
f_{samp}:	1×10^{6}	(Sampling frequency of A/D converter)
D:	2 or 4	(2; Multiplication factor of long wavelength bandwidth 4; Multiplication factor of short wavelength bandwidth)

Since the frequency analysis range of the A/D converter is 390kHz and the number of points obtained by FFT processing is 800 in normal-resolution mode and is 3200 in high-resolution mode, the frequency resolution is 488Hz and is 122Hz.
Actually, an internal digital filter is used to increase this resolution up the value multiplied by 256 at maximum. The multiplication factor of the digital filter can be selected as Table 3-8 to suit the wavelength bandwidth, wavelength span and resolution mode specified.

Example: When the center wavelength is 780.00nm and the span is 50nm:

CENTER: 780nm, SPAN: 50nm → START: 755.00nm, STOP: 805.00nm

Using the above equation ①, these values are converted into frequency as follows:

f0 START(f) = 209.599kHz
f1 STOP(f) = 196.581kHz
fc CENTER(f) = 202.881kHz

The multiplication factor of the digital filter is determined by the condition under which the number of measurement point is:

$400 < (f0\text{-}f1)/\Delta f \leq 800$ (Normal-resolution mode)
$1600 < (f0\text{-}f1)/\Delta f \leq 3200$ (High-resolution mode)

In this example, the value of Δf which satisfies this condition is 30.52Hz in normal-resolution mode and is 7.63Hz in high-resolution mode (multiplication factor 16) according to Table 3-8.

The resolution at the specified wavelength is obtained by the following equation:

$$\Delta\lambda = (\lambda^2 \times \Delta f \times D) / (\lambda_{He\text{-}Ne} \times f_{samp}) \quad \text{---------} \ ②$$

Therefore, the resolution at 780nm is about 0.12nm in normal-resolution mode and is about 0.029nm in high-resolution mode.

Table 3-8 Digital filter multiplication factor versus and frequency resolution

(Normal-resolution mode)

Digital filter multiplication factor	1	2	4	8	16	32	64	128	256
Frequency resolution for short wavelength bandwidth [Hz]	448.28	224.14	122.07	61.04	30.52	15.26	7.63	—	—
Frequency resolution for long wavelength bandwidth [Hz]	448.28	244.14	122.07	61.04	30.52	15.26	—	—	—

(High-resolution mode)

Digital filter multiplication factor	1	2	4	8	16	32	64	128	(256)
Frequency resolution for short wavelength bandwidth [Hz]	122.07	61.04	30.52	15.26	7.63	3.81	1.91	0.95	0.48
Frequency resolution for long wavelength bandwidth [Hz]	122.07	61.04	30.52	15.26	7.63	3.81	1.91	0.95	—

According to equation ②, if resolutions of the same frequency are compared, the shorter wavelength has a higher resolution than the longer wavelength. That is, the measurement point interval on the spectrum is smaller at the shorter wavelength and becomes larger as the wavelength becomes longer.

Although 800-point data (in normal-resolution mode) or 3200-point (in high-resolution mode) is constantly maintained internally, the number of points displayed varies according to the relationship between the center wavelength and the specified span.

(2) Sensitivity

The Q8347 is equipped with a built-in 14-bit A/D converter and FFT processing is executed according to the converter data. Since the REF level is fixed within a single measurement, dynamic range cannot be ensured unless the appropriate REF level is selected to suit the light to be measured (the measurement system has a dynamic range of approximately 40dB). Set the REF level to suit the sensitivity required.

The sensitivity (noise level) is changed not only by the REF level but also by the multiplication factor of the internal digital filter (changed by the wavelength span).

The change in the noise level due to the digital filter multiplication factor can be determined as follows.

If the noise level is assumed to be 1 at a certain multiplication factor, then the noise level at that factor multiplied by N is:

- In LASER mode : $1/\sqrt{N}$
- In LED mode : $\sqrt{N}$

That is, if multiplication factor 1 is compared to 4, the noise level is halved (− 3dB) in laser mode and doubled (+ 3dB) in LED mode.

4. PANEL OPERATION

This chapter describes panel key operations along with the analyzer's functions.

4.1 FUNCTION Section

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

(1) CENTER key : Specifies the center wavelength.

(2) SPAN key : Specifies the wavelength span, the start/stop wavelengths and the coherent analysis range.

(3) REF LEVEL key : Specifies the input sensitivity.

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

(5) MODE key : Selects coherence or spectrum analysis.

(6) AVG key : Specifies the averaging ON/OFF and number of processings.

(7) ZOOM key : Selects and executes the ZOOM function to re-analyze the measurement data under different wavelength conditions.

(8) AUTO key : Executes the automatic setting functions for optimal measurement conditions.

4.1.1 CENTER key

The CENTER key is used to specify the center wavelength and the setting are carried out using the numeric keys, rotry knobs, arrow keys and Softkeys. When the CENTER key is pressed,

CENTER: XXXX.XXXnm

appears at the bottom of the LCD display and the Softkey menu illustrated below can be used.

Softkey menu

CENTER

PEAK
CURSOR
AUTO PKC

Explanation on the Softkey menu

① PEAK
In the displayed spectrum, the wavelength of the peak level obtained by the Auto Peak Search function is specified as the center wavelength.
The data which have been displayed is cleared.

② CURSOR
The wavelength indicated by the X cursor is specified as the center wavelength.
If two X cursors are displayed, the wavelength of the intermediate position between the two cursors is specified as the center wavelength,.
If the X cursor is OFF, this key does not function.

③ AUTO PKC
When this key is pressed, the softkey is displayed in reverse highlight.
Wavelength is measured and displayed in the condition in which the wavelength of the peak level is specified as the center wavelength according to the current center wavelength and the span.

<< APC (Auto Peak Center) function >>

This function automatically performs reanalysis (using the HOLD-ZOOM function) by setting the measured peak wavelength as the center wavelength. This function works when the difference between the peak wavelength and center wavelength is more than about 1/100 of the set span.

For example, if the span is set to 100 nm and the center wavelength is 1300 nm, the function works when the peak wavelength is outside the range from 1299 nm to 1301 nm.

This function works only in the spectrum mode.
When, in the dual-screen mode, both the upper and lower screens are active and the lower screen is in the spectrum mode, the peak wavelength searched on the lower screen is set as the center wavelength on the upper screen.
Otherwise, redisplay is made with the measured peak wavelength as the center wavelength.
The APC function is not activated under any of the following conditions:

(1) The measurement condition for data to be peak-searched includes both short and long wavelengths.
(2) The measurement condition for data to be peak-searched is for coherence analysis.
(3) When both the upper and lower screens in the dual-screen mode are in the active mode, the wavelength ranges (short/long) differ between the screens.
(4) The LOSS or TRANS mode is set to ON.

If the AVERAGE function is set to ON, this function is executed only in the first measurement.
This function is subject to back-up.

Key and rotry knob functions

① Numeric keys
The current value specified is cleared and the values entered are displayed one by one. To load the entered value, press the Unit key [ ] μm, [ ] nm) at the end. Values which exceed the range of the measurement wavelength allowed (350 nm to 1750 nm) are ignored. To cancel all the values entered, press the CENTER [ ] key before entering new values. To delete the value entered immediately before, press the BACK SPACE [ ] key.

② Rotary Knob
The value to be set increases when rotry the knob is turned clockwise (to the right) and decreases when turned counterclockwise (to the left). The currently specified span is increased/decreased in about 1/100 steps.

③ The value specified increases when the [⇧] key is pressed and decreases when the [⇩] key is pressed. The currently specified span is increased/decreased in about 1/500 steps.

4.1.2 SPAN key

This key is used to specify the wavelength span, the start/stop wavelengths and the coherence analysis range. The specified values can be modified with the numeric keys, rotry knobs, arrow keys and Softkeys. Operations differ depending on the data types (spectrum coherence analysis).

When the [SPAN] key is pressed, the current values appear at the lower part of the LCD display:

SPAN: XXXX.X nm (during spectrum analysis)
SPAN: XXX.XX mm (during coherence analysis)

The following softkey menu can be used.

Softkey menu

(1) For spectrum analysis (Wavelength domain)

SPAN (SPEC)

SPAN
START
STOP
△λ→SPAN
350 ~ 1050
950 ~ 1750
FULL

Explanation on the Softkey menu

(1) For spectrum analysis (Wavelength domain)

① SPAN

This key is used to specify the span (when the 

key is pressed, this key is selected).

The specified value can be modified using the numeric keys, rotry knob and the arrow keys.

② START

This key is used to specify the start wavelength. The specified value can be modified using the the numeric keys, knob and the arrow keys.

③ STOP

This key is used to specify the stop wavelength. The specified value can be modified using the numeric keys, knob and arrow keys.

④ △λ→SPAN

This is used to specify the interval between the two cursors as the span. When this key is pressed, the center wavelength is also modified simultaneously. This key is disabled if the X cursor is OFF or only one X cursor is enabled.

⑤ 350 ~ 1050

This is used to specify the maximum span of the short wavelength range (350nm to 1050nm). When this key is pressed, the center wavelength is also modified simultaneously.

⑥ 950 ~ 1750

This is used to specify the maximum span of the long wavelength range (950nm to 1750nm). When this key is pressed, the center wavelength is also modified simultaneously.

⑦ FULL

This is used to specify the maximum span (350nm to 1750nm). When this key is pressed, the center wavelength is also modified simultaneously.

Note that the measurement time is doubled compared to normal measurement when this key is used. (Because the short and long wavelengths are measured independently.)

Softkey menu

(2) For coherence analysis

SPAN (COH)

AUTO
MIN
MAX

Explanation on the Softkey menu

① AUTO
The distance range determined by the span during spectrum analysis is automatically specified. The distance range is depend not only on the wavelength span but on the center wavelength.
See Table 4-1, and Table 4-2.

② MIN
The distance range for coherence analysis is set to a minimum.

③ MAX
The distance range for coherence analysis is set to a maximum.

Softkey menu

(3) For spectrum analysis (Frequency domain)

SPAN (SPEC)

SPAN
START
STOP
Δf→SPAN
175 ~ 300
300 ~ 750
FULL

Explanation on the Softkey menu

① SPAN

This key is used for setting of the SPAN. (This key is selected after SPAN key is pressed.)

Continue to change setting using by the numerical key, rotary knob and arrow key.

② START

This key is used for setting of the start frequency. Continue to change setting using by the numerical key, rotary knob and arrow key.

③ STOP

This key is used for setting of the stop frequency. Continue to change setting using by the numerical key, rotary knob and arrow key.

④ △λ→SPAN

This is used for setting of SPAN that is put on the section between two X cursor lines. When this key is pressed, the center frequency is also changed at the same time.
It does ignore even if this key is pressed when X cursor is OFF or one line.

⑤ 175 ~ 300

This is used for setting of the frequency among 175THz to 300THz. When this key is pressed, the center frequency is also changed at the same time.

⑥ 300 ~ 750

This is used for setting of the frequency among 300THz to 750THz. When this key is pressed, the center frequency is also changed at the same time.

⑦ FULL

This key is used for setting of the maximum span (171.3THz to 300THz). (350μm to 1750μm in the wavelength domain) When this key is pressed, the center frequency is also changed at the same time.

In case of this key is used, the measurement time becomes twice from the normal measurement. (Because both short wavelength and long wavelength are measured after pressing this key.)

Key and rotry knob functions

(1) For spectrum analysis (Wavelength domain)

① Rotary knob and arrow keys

The specified value can be increased by pressing the ⇧ key or turning the rotary knob clockwise (to the right) and decreased by pressing the ⇩ key or turning the rotary knob counterclockwise (to the left). Both key and rotry knob operation increases/decreases the value in 1-2-5 steps.

The maximum and minimum spans which can be specified are 1400 nm and 0.1 nm, respectively.

② Numeric keys

The value currently displayed is cleared and the values entered are displayed one by one. To load the entered value, press the Unit key ([ ] μm, [ ] nm, [ ] nm/DIV.) at the end.

Values which can be specified range from 0.1 to 1400nm. Values down to 0.1nm are also valid.

To cancel all values entered, press SPAN [ ] key and enter. To delete the value entered immediately before, press the BACK SPACE [ ] key.

(2) For coherence analysis

① Rotary knob and arrow keys
The specified value can be increased by pressing the ⇧ key or turning the rotary knob clockwise (to the right) and decreased by pressing the ⇩ key or turning the rotary knob counterclockwise (to the left). Six ranges from 0.32mm to 10.4mm (in normal-resolution mode) or eight ranges from 1.3mm to 165.9mm (in high-resolution mode) can be specified.

② Numeric keys
The value currently displayed is cleared and the values entered are displayed one by one. To load the entered value, press [ENTER] at the end.

Values ranging from 0.32 to 165.9 can be specified rounded up to the six types displayed in the Softkey menu.

Note 1: If a value over the short and long wavelength range (START wavelength is below 950nm and the STOP wavelength exceeds 1050nm), the wavelength below 1000nm is analyzed as the short wavelength and the one above 1000nm is analyzed as the long wavelength. Consequently, the resolution differs below or above 1000nm and the data display point interval becomes discontinuous.

Note 2: Since a spectrum having identical intervals on the frequency axis is converted into wavelength when displayed by the Q8347, the measurement points on the wavelength axis are not at identical intervals. The point of the center wavelength specified contains data while the points corresponding to the start and stop wavelengths determined by the span specification do not normally contain any data (data is contained at the position where distance equals resolution).
Up to 801 points of spectrum data can be displayed. However, this number varies depending on the center wavelength and the span, (see section 3-7).

Table 4-1 Relationship Between the Distance Range for Coherence Analysis and the Span for Spectrum Analysis (in high-resolution mode)

Distance range / Center wavelength	165.9 mm	83.0 mm	41.5 mm	20.7 mm	10.4 mm	5.2 mm	2.6 mm	1.3 mm
633 nm	≤3.8 nm	3.9 nm to 7.6 nm	7.7 nm to 15.2 nm	15.3 nm to 30.1 nm	30.2 nm to 58.9 nm	59.0 nm to 112.6 nm	112.7 nm to 206.8 nm	206.9 nm to 355.6 nm
780 nm	≤5.8 nm	5.9 nm to 11.6 nm	11.7 nm to 23.1 nm	23.2 nm to 45.5 nm	45.6 nm to 88.5 nm	88.6 nm to 167.5 nm	167.6 nm to 302.6 nm	302.7 nm to 506.9 nm
850 nm	≤6.9 nm	7.0 nm to 13.8 nm	13.9 nm to 27.4 nm	27.5 nm to 53.9 nm	54.0 nm to 104.6 nm	104.7 nm to 197.0 nm	197.1 nm to 353.2 nm	353.3 nm to 584.9 nm
1310 nm	≤16.4 nm	16.5 nm to 32.6 nm	32.7 nm to 64.5 nm	64.6 nm to 126.0 nm	126.1 nm to 240.4 nm	240.5 nm to 440.4 nm	440.5 nm to 754.1 nm	——
1550 nm	≤22.9 nm	23.0 nm to 45.6 nm	45.7 nm to 89.9 nm	90.0 nm to 174.8 nm	174.9 nm to 331.0 nm	331.1 nm to 400.0 nm	——	——

Table 4-2 Relationship Between the Distance Range for Coherence Analysis and the Span for Spectrum Analysis (in normal-resolution mode)

Distance range / Center wavelength	10.4 mm	5.2 mm	2.6 mm	1.3 mm	0.65mm	0.32 mm
633 nm	≤ 15.2 nm	15.3 nm to 30.1 nm	30.2 nm to 58.9 nm	59.0 nm to 112.6 nm	112.7 nm to 206.8 nm	206.9 nm to 355.6 nm
780 nm	≤ 23.1 nm	23.2 nm to 45.5 nm	45.6 nm to 88.5 nm	88.6 nm to 167.5 nm	167.6 nm to 302.6 nm	302.7 nm to 506.9 nm
850 nm	≤ 27.4 nm	27.5 nm to 53.9 nm	54.0 nm to 104.6 nm	104.7 nm to 197.0 nm	197.1 nm to 353.2 nm	353.3 nm to 584.9 nm
1310 nm	≤ 64.5 nm	64.6 nm to 126.0 nm	126.1 nm to 240.4 nm	240.5 nm to 440.4 nm	440.5 nm to 754.1 nm	——
1550 nm	≤ 89.9 nm	90.0 nm to 174.8 nm	174.9 nm to 331.0 nm	331.1 nm to 400.0 nm	——	——

4.1.3 REF LEVEL key

This key is used to specify the measurement input sensitivity so that the level of the signal to be measured can be displayed under optimum condition. Modifications can be made using the numeric keys, rotry knob, arrow keys and Softkeys.

When the REF LEVEL key is pressed, the current value appears at the bottom of the LCD display:

REF LEVEL: XX.XdBm (when LOG is displayed)
REF LEVEL: XXX.XxW (when LIN is displayed)

The following softkey menu can be used.

Note

As the Q8347 uses Fourier spectroscopy, power from the input light is completely radiated in the photo sensor section. In the case of a single spectrum with narrow line width, the peak level and the REF LEVEL setting can be made almost identical. In the case of an LED a with wide spectrum or LD with multiple spectra, an overload occurs if REF LEVEL is set for the peak level. In this case, specify a significantly greater REF LEVEL so that "OVERLOAD" message does not appear on the screen.

Softkey menu

REF LEVEL

TOTAL PWR
LASER/LED
AUTO

Explanation on the Softkey menu

① TOTAL PWR
The total (power) of the spectra measured is set as the REF LEVEL.

② LASER/LED
This key is used to select the type of light to be measured (LASER and LED modes are specified alternately). Use the LED mode when measuring light having a large spectrum range (such as LEDs and white light sources), while use the LASER mode for a small spectrum range (such as laser).
In LASER mode, the level of the spectrum displayed corresponds to the power indication of the spectrum around the spectrum resolution (ENBW) during measurement. The unit is dBm or W. When the signal spectrum range is smaller than the spectrum resolution of the analyzer, the spectrum peak value corresponds to the power of the input signal.
In LED mode, the spectrum resolution of the analyzer is normalized to 1nm and the spectrum power density indicated. The spectrum resolution of the analyzer varies depending on the wavelength because of the measurement method. Therefore, select this mode when measuring a spectrum having a wide range.

③ AUTO

This key controls ON/OFF switching of the mode in which the REF LEVEL appropriate for the light power measured has been automatically set.

The optical input power increases when this mode is ON. When an overload occurs, a greater value is automatically set for the REF LEVEL.

When this mode is selected, the measurement time should be multiplied by three or more if the power of the input light varies.

Key and rotry knob functions

① Rotry Knob

The value specified increases when the rotry knob is turned clockwise (to the right) and decreases when the rotry knob is turned counterclockwise (to the left).

The value is increased/decreased by 1/2 (0.5 div) when LOG is displayed and in 1-2-5 steps when LIN is displayed.

② Numeric keys

The currently displayed value is cleared and the values entered are displayed one by one. To load the entered value, press the Unit key ([ ] dBm, [ ] mW, [ ] μW, [ ] nm).

when [ ] dBm is specified by the Unit key, the LOG scale appears. Otherwise, the LIN scale appears.

To cancel the values entered, press the REF LEVEL [ ] key, and re-enter data. To delete a value entered immediately before, press the BACK SPACE [ ] key.

③ Arrow keys

The arrow keys are used to modify the REF LEVEL displayed (without modifying the input sensitivity).

The value can be increased by pressing the [⇧] key and decreased by pressing the [⇩] key. Values are modified in 1/2 (0.5 DIV) steps on the LOG scale and in 1-2-5 steps on the LIN scale.

If the REF LEVEL has been modified using the Rotry knob or numeric keys, the REF LEVEL set with the arrow keys is reset identical to the input sensitivity.

4.1.4 LEVEL SCALE key

This key is used to switch the vertical axis scale (LIN/LOG) and to set the LOG scale. Values can be modified using the numeric keys, rotry knob, arrow keys and Softkeys.

When the LEVEL SCALE key is pressed, the current value appears at the bottom of the LCD display:

LEVEL SCALE: XdB/DIV (when LOG is displayed)
LEVEL SCALE: LIN (when LIN is displayed)

The following softkey menu can be used.

Softkey menu

LEVEL SCALE

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

Explanation on the Softkey menu

① LIN/LOG
This key is used to switch the display scale to LIN or LOG.
LIN and LOG are specified alternately when the key is pressed.

② 10dB/D, 5dB/D, 2dB/D, 1dB/D, 0.5dB/D, 0.2dB/D
When the LOG scale is selected, the type can be selected from the values given in the menu: 10, 5, 2, 1, 0.5 and 0.2dB/DIV.
The grid scale is 6 if 10dB/DIV is selected, otherwise, it is 10.

Key and rotry knob functions

① Rotry knob and arrow keys

These are used to switch the LOG scale type (6 types from 10dB/div to 0.2dB/DIV). The specified value can be increased by pressing the [⇧] key or turning the rotry knob clockwise (to the right) and decreased by pressing the [⇩] key or turning the rotry knob counterclockwise (to the left).

② Numeric keys

The currently specified value is cleared and the values entered are displayed one by one. To load the entered values, press the Unit key ([ ] dB/DIV) at the end.

If a value other than the six types is entered, the scale type nearest the value is specified.

4.1.5 MODE key

In addition to normal spectrum analysis, this analyzer is equipped with the coherence analysis function using an interferogram obtained by a internal interferometer.

The [MODE] key is used to switch between spectrum and coherence analysis and to switch between normal-resolution mode and high-resolution mode.

When the [MODE] key is pressed, the following softkey menu can be used.

Softkey menu

MODE

SPEC (λ)
COHERENCE
SPEC (f)
NORM RES
HIGH RES
HIGH SENS

Explanation on the Softkey menu

① SPEC (λ)
Spectrum analysis (wavelength domain) can be selected.

② COHERENCE
Coherence analysis can be selected.

Note

Coherence analysis cannot be specified under the following conditions:
The span is set to AUTO and the wavelength condition for spectrum analysis is one of the following:

- The wavelength is over the short and long wavelength range. (The start wavelength is below 950 nm and the stop wavelength exceeds 1050nm.)
- The wavelength exceeds the span shown in Table 4-1.

③ SPEC (f)
Spectrum analysis (frequency domain) can be selected.

④ NORM RES
Normal resolution mode can be selected. When this mode is selected, the number of the horizontal axis data is set maximum 801 points.

⑤ HIGH RES
High resolution mode can be selected. When this mode is selected, the number of the horizontal axis data is set maximum 3201 points.

⑥ HIGH SENS
HIGH SENS key is used to control ON/OFF of the HIGH SENS mode. In the HIGH SENS mode, the internal moving mirror is decelerated to the 1/16 speed, the frequency bandwidth is reduced by half, and the noise level is lowered for measurement.
This mode is effective in feeble light measurement, but measurement time is multiplied by 16 as compared with ordinary measurement. This mode uses the normal-resolution mode (NORM RES).
The HIGH SENS mode is switched to ON or OFF alternately by pressing this key. When this mode is set to ON, "HSN" is displayed on the upper right of the screen.

<< Coherence Analysis >>

The interferogram obtained by the interferometer is sampled by the A/D converter at a definite distance interval (1/4 = 0.158 μm He-Ne laser wavelength of 633 nm 1050 nm) and data at 1024 points or 4096 points are measured.
The interferogram is obtained by dividing the light to be measured into two fluxes to be fed through different routes and superimposed. That is, the interferogram indicates the degree of interference of the light to be measured.

① The following are executed in coherence analysis.
Data of 1024 points (in normal-resolution mode) or 4096 points (in high-resolution mode) at a constant interval containing phase information (real, image)
(The distance intervals depends on the multiplication factor of the digital filter.)

② For each point among the 1024 points (in normal-resolution mode) or the 4096 points (in high-resolution mode) measured in step ①), the sum of squares root is determined.

$$C_i = \sqrt{(real^2 + imag^2)}$$

③ All data is normalized at the peak value (data of route difference 0) of the sum of the squares for each point (normalization is executed, assuming a peak value of 1).

④ Envelope is obtained for each point.
In coherence analysis, α (distance and level of the second maximum peak) and β (intermediate distance and level between the peak and second maximum peak) are displayed in place of the peak data in spectrum measurement.

4.1.6 AVERAGE key

This key is used to specify ON/OFF switching and the number of averaging times needed to measure low power signals in a stable state. Values can be modified using the numeric keys, Rotry knob, arrow keys and Softkeys.

When the AVG key is pressed, the current value appears at the bottom of the LCD display:

AVERAGE: XXXX

The following softkey menu can be used.

Softkey menu

AVERAGE

ON/OFF
NORMAL
ADVANCE
MAX-MIN
MAX HOLD
CLEAR M.M
smoothing

Explanation on the Softkey menu

① ON/OFF

This key controls ON/OFF switching of the averaging mode. When ON, averaging is executed the specified number of times. While averaging is ON, measurement is executed the number of times specified using the SINGLE key. (The number of times is indicated by the X of X/N on the screen and the data updated with each measurement. The average of X times is then indicated. N is the number of averaging times specified. While averaging is in progress, the "AVERAGE in progress..." message appears. While averaging is OFF, the X of X/N remains 1.)

② NORMAL

This mode averages the measured spectrum and coherence data.
The previously obtained average data is not used for this.

③ ADVANCE

This mode averages complex spectrum data.
Averaging in this mode helps to increase the S/N ratio.
This key is disabled during coherence analysis, waveform or power monitoring, or 3D display. The previously obtained average data is not used for this.

④ MAX-MIN

The maximum and the minimum spectrum levels of a measured signal are traced and held on the display.
This key is disabled during coherence analysis, waveform or power monitoring, LOSS/TRANS, or 3D display. The previously obtained average data is used for averaging the maximum and the minimum spectrum level. (See ⑥.)

⑤ MAX HOLD

The maximum spectrum of a measured signal is displayed.
This key is disabled during coherence analysis, waveform or power monitoring, LOSS/TRANS, or 3D display. The previously obtained average data is used for averaging the maximum spectrum level. (See ⑥.)

⑥ CLEAR M.M

If this key is pressed, the previously obtained average data is not used when executing ④ MAX-MIN and ⑤ MAX HOLD.

⑦ Smoothing

a. ON/OFF: When turned on, the measured data is smoothed out.

b. YdB: This key allows you to set the threshold (Y dB) at which level the measured data is smoothed. Y dB lower spectrum level than the maximum level is traced and smoothed out.
The value Y can be set in the range of 0.1 to 99.9 dB (in increments of 0.1 dB). Its initial value is 3 dB.

c. 5, 7, 9, 11: An averaging count is set. (When using the numeric keys, an odd number between 5 and 15 can be set for the count.)

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Key and rotry knob functions

① Rotry knob and arrow keys
The specified value can be increased by pressing the ⇧ key or turning the rotry knob clockwise (to the right) and decreased by pressing the ⇩ key or turning the rotry knob counterclockwise (to the left). Values are increased/decreased in powers of 2, 4, 8, 16, 32 or 64. The minimum and maximum values are 1 and 1024, respectively.

② Numeric keys
Values from 1 to 1024 can be specified.
The currently specified value is cleared and the values entered are displayed one by one. To load the entered value, press the ENTER key at the end.

To cancel all the values entered, press the AVG key and re-enter new values.

To delete the value entered immediately before, use the BACK SPACE key.

Note: Averaging can be executed only for data obtained under identical wavelength and level measurement conditions. Averaging is cleared if one of the followings modifications occurs during processing:

- The center wavelength or span is modified.
- REF LEVEL is modified.
- Switching between spectrum coherence analysis is executed.
- The AUTO function is executed.
- The measurement data is recalled (in this case, the system automatically stops measurement).
- The display mode (dual-screen/superimpose/3-dimensional) is modified.
- The mode (normal-resolution mode/high-resolution mode/HIGH SENS mode) is changed.
- The number of averaging times is changed.

4.1.7 ZOOM key

Press this key when using the HOLD-ZOOM function.

< <HOLD-ZOOM function> >

This function is used to re-analyze the measurement data under different wavelength conditions (spectrum analysis) at different distances (coherence analysis).
Once measurement is executed, 1024k (in normal-resolution mode) or 4096k (in high-resolution mode) of data are stored in the internal buffer independent of the center wavelength/span setting.
HOLD-ZOOM function cannot be executed due to a shortage of the internal buffer memory when the multiplication factor of the digital filter is 256 (e.g. CENTER 780nm, SPAN 5.84nm or less) for the short wavelength bandwidth in high-resolution mode (see Table 3-8).
The execution time varies about 0.5 to 3.0 seconds, depending on the span setting. (The time becomes shorter when the span is wide and longer when the span is narrow.)
Note that this function is only valid when measurement has been stopped.

When ZOOM key is pressed, the following Softkey menu can be used.

Softkey menu

ZOOM

START
STOP
CTR AUTO
SPAN AUTO
EXPAND

Explanation on the Softkey menu

① START

According to the measurement data obtained immediately before, re-analysis is executed under currently specified wavelength conditions or distance range.

While the HOLD-ZOOM function is in progress, the "HOLD-ZOOM in progress ..." message appears on the screen. This key is disabled under the following conditions.

Conditions under which HOLD-ZOOM processing is not executed.

- Measurement processing is in progress.
- The wavelength conditions of measurement data obtained immediately before or the current wavelength conditions exceed both the short and long wavelength ranges.
- The wavelength range (short/long) of preceding measurement data differs from the current wavelength range.
- The preceding data was found to be recall data from memory.
- Normalization (LOSS/TRANS) is ON.
- Averaging is ON.
- The multiplication factor of the digital filter is 256 for the short wavelength bandwidth in high-resolution mode.

② STOP

This key is used to stop the HOLD-ZOOM processing currently being executed.

③ CTR AUTO

This key selects automatic HOLD-ZOOM processing when the center wavelength setting is modified. In this mode, CTR AUTO is displayed in reverse state each time this key is pressed. The [CTR AUTO] and [SPAN AUTO] ④ described below are selected alternately.

The conditions under which HOLD-ZOOM processing is not executed are the same as those described in paragraph ①.

④ SPAN AUTO

This key selects automatic HOLD-ZOOM processing when the span setting is modified. In this mode, SPAN AUTO is displayed in reverse state each time this key is pressed. The [SPAN AUTO] and [CTR AUTO] ③ described below are selected alternately.

The conditions under which HOLD-ZOOM processing is not executed are the same as those described in paragraph ①.

⑤ EXPAND

When the EXPAND key is pressed, the softkey menu appears as shown left. The data displayed on the LCD display can be magnified 2 to 32 times.

If a cursor is displayed, the data is magnified with X cursor 1 as the center.

Softkey menu

EXPAND

OFF
X2
X4
X8
X16
X32
prev menu

Additional explanation on the HOLD-ZOOM function

The interferogram obtained from the interferometer is A/D converted at a definite shift interval of the moving mirror and subjected to FFT processing to display the spectrum.
FFT processing is executed on the time-axis data on 1024 points to obtain spectrum data on 800 points. Since the frequency analysis range of the internal A/D converter is 100kHz, the resolution by simple calculation becomes 1.25Hz.
To improve this resolution, the ZOOM function is used to enlarge the frequency around the wavelength of the light to be measured, using the internal digital filter. (The multiplication factor is 128 at maximum, corresponding to a frequency resolution of 9.766 Hz.) The multiplication factor of the digital filter varies depending on the center wavelength and span settings. As the span becomes wider, the multiplication factor becomes smaller, and as the span becomes narrower, the multiplication factor becomes greater. (The relationship between a typical center wavelength and span are shown in Table 3-7.)
Since the digital filter requires sampling data of double the multiplication factor, up to 256K (128 x 2 x 1024) of A/D-converted data is used. The analyzer has a buffer large enough to store 256k of data. All the data required to analyze the entire short and long wavelength ranges at various spans does not exceed 256k.
In normal measurement, the center wavelength (center frequency) and multiplication factor are specified for the digital filter and the A/D converted data is input directly to the digital filter. When HOLD-ZOOM is ON, data from a particular buffer area (varies depending on the span multiplication factor) is input to the digital filter.

4.1.8 AUTO key

When this key is pressed, optimum measurement conditions are automatically specified in accordance with the input signals such as wavelength and level. This function is especially helpful when the wavelength and level are unknown.
While this function is in progress, the "AUTO function in progress..." message appears on the screen. This message disappears when the of optimum conditions are complete.
Since this function is executed internally based to the spectrum data, the distance range corresponding to the optimum span on the spectrum is specified when this function is used in coherence analysis mode.

When the AUTO key is pressed, the following softkey menu can be used.

Softkey menu

AUTO

FULL
350 ~ 1050
950 ~ 1750
ABORT

Explanation on the Softkey menu

① FULL
Optimum conditions are determined, the entire wavelength range (350 nm to 1750 nm) searched, and the wavelength and the level specified.
When this key is used, more time is required compared with ② and ③ because both the short and long wavelength ranges are searched.

② 350 ~ 1050
Optimum conditions are determined, the short wavelength range (350 nm to 1050 nm) searched, and the wavelength and level specified.

③ 950 ~ 1750
Optimum conditions are determined, the long wavelength range (950 nm to 1750 nm) searched, and the wavelength and level specified.

④ ABORT
Use6d to stop the AUTO function in midstream.

Note: When Softkey ①, ② or ③ is pressed, the display is reversed. It returns to normal upon completion of the AUTO function.

<< Precautions when using the AUTO function >>

- The AUTO function may not operate normally for light sources having a power level of less than −40dBm.
- While the AUTO function is in progress, only the [ABORT] key is enabled. To interrupt execution, press [ABORT].
- While the AUTO function is in progress, normal-resolution mode (NORM RES) is set. The modes other than normal-resolution mode are automatically set OFF.

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 softkey menu appears and the cursor display mode is selected, by pressing the CURSOR ON/OFF key.

Softkey menu

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

CURSOR

NORMAL
ΔMODE
2ND PEAK
POWER
LEFT PK
RIGHT PK

Explanation on the Softkey menu

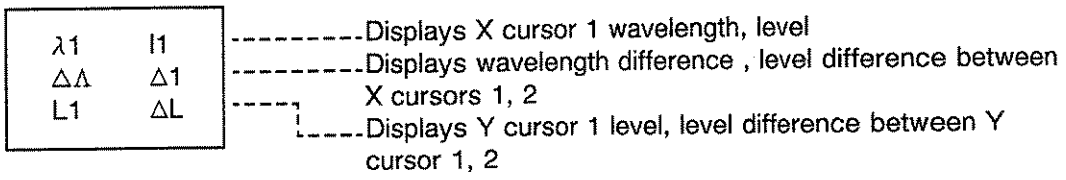
① NORMAL

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

λ1	I1	--------- Displays X cursor 1 wavelength, level
λ2	I2	--------- Displays X cursor 2 wavelength, level
L1	L2	--------- Displays Y cursor 1, 2 level

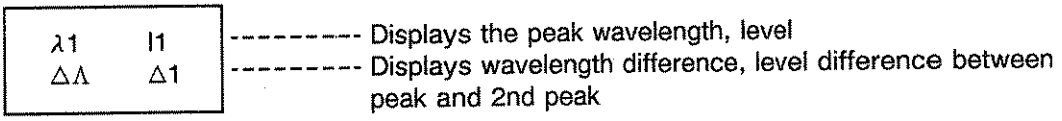
② △ MODE

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



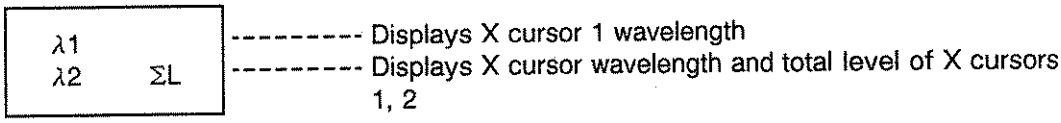
③ 2ND PEAK

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.



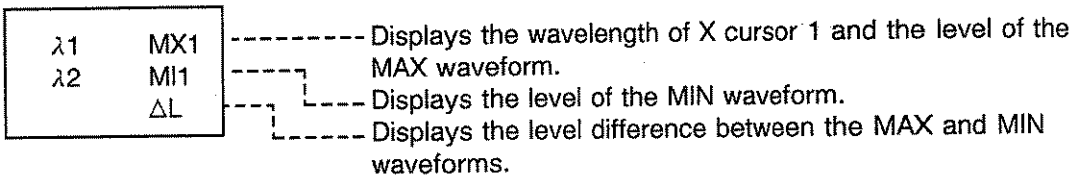
④ POWER

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



⑤ Display mode

Selects the MAX-MIN mode. This mode is valid only when MAX-MIN is selected from the AVERAGE menu. The data display format is shown below.



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.

(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 Rotry 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 , L2 key is on.

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 : μm dBm , nm dBm , nm/DIV μW , 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 , 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 LCD display screen. The following is the initial setting.

```
** ADVANTEST Q8347 Optical Spectrum Analyzer **
```

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 LCD display. The current label data is displayed on the lower left part of the LCD display.

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 softkeys, rotry 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 softkey menu returns to the previous display.

Softkey menu

LABEL

⇦
⇨
DEL CHR
INS SP
CLR LINE
ENTER
UNDO

Explanation on the Softkey 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.

Functions of the keys

(a) Rotry 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 rotry knob CW (clockwise) and to the left by turning it CCW (counter clockwise).

(b) Arrow key
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.

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 STOP LED turns off.
When measurement is stopped by this key, then the displayed analysis data is maintained as is.

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 : Sets the display mode of the measurement data.

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

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

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

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

(6) ADVANCE : 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 softkey menu appears by pressing the CONTROL key. The display mode is set through the softkeys.

Softkey menu

CONTROL

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

Explanation on the Softkey 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 act. U&L softkey.) 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 act. U&L and xcng U/L are effective only when under the dual screen display mode.
The dual screen display mode turns on and off each time this key is pressed, switching the "DUAL" display between inverse and normal display.

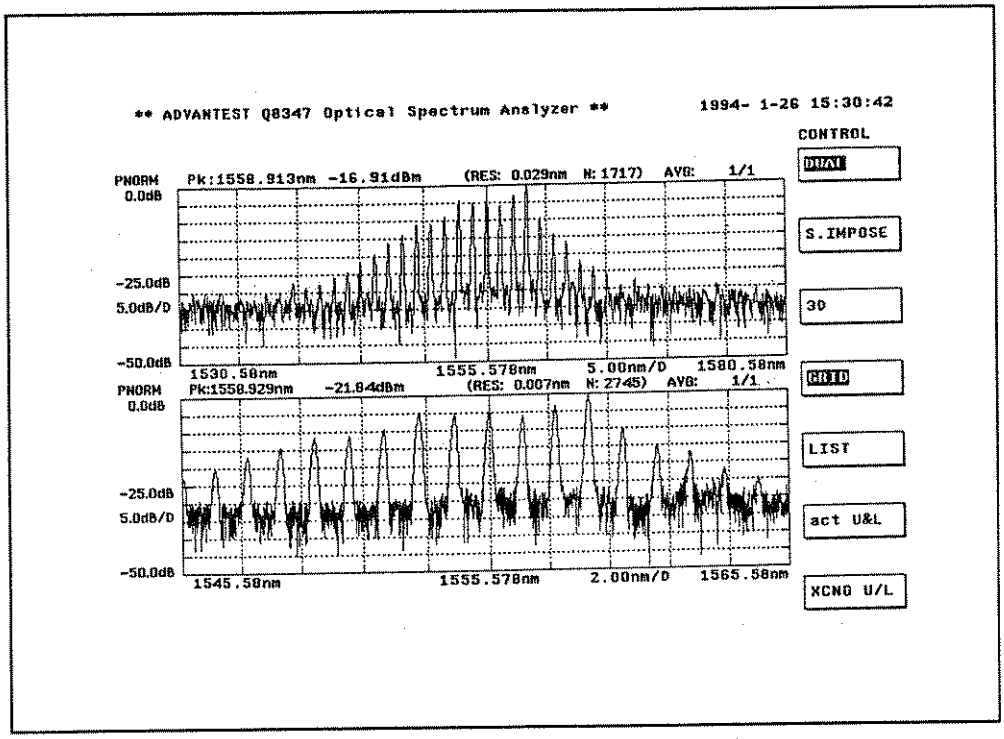


Figure 4-1 Example of Dual Screen Display

② S. IMPOSE

Controls the superimpose mode.

When this key is pressed under normal mode, the current measurement data is stored on the LCD display 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.

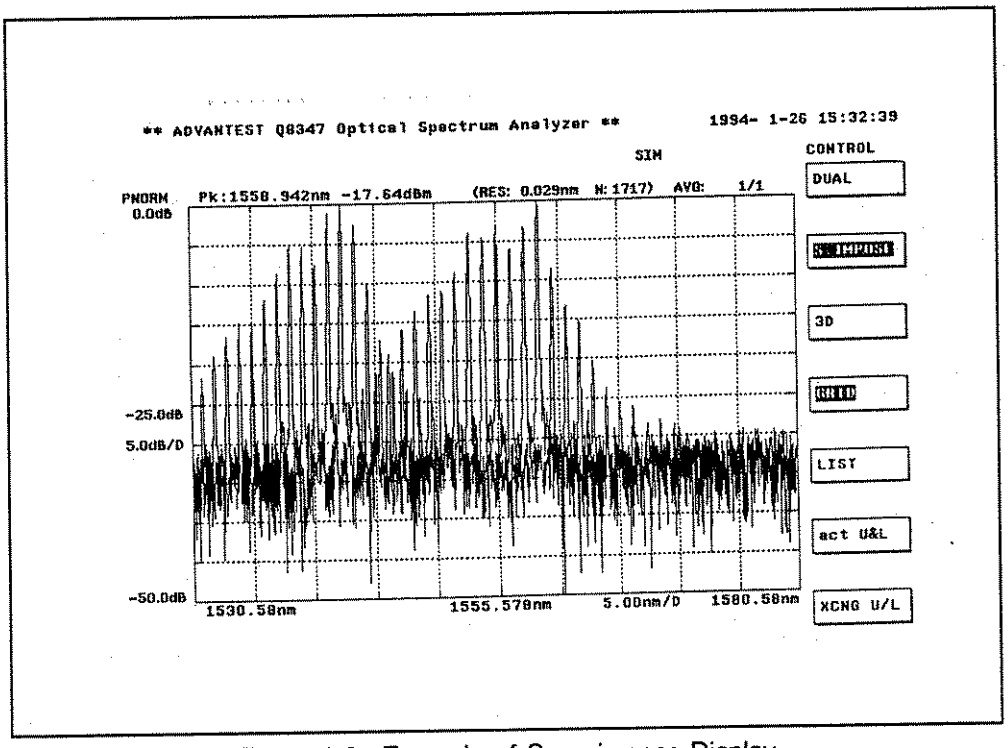


Figure 4-2 Example of Superimpose Display

③ 3D

Turns on/off the 3-dimensional display mode, and sets the display conditions.

The following softkey 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.

Softkey menu

3D(1)

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

Explanation on the Softkey 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 softkey 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 data of which number is pointed by the cursor.

③-6 more

The following softkey menu is displayed by pressing this key.

Softkey menu

3D(2)

CLEAR
INC N
DEC N
N LOCK
ROLL
RECALL
prev menu

Explanation on the Softkey 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 softkey 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.

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 softkey menu display.

③-7 prev menu

Returns the display to the previous softkey menu display.

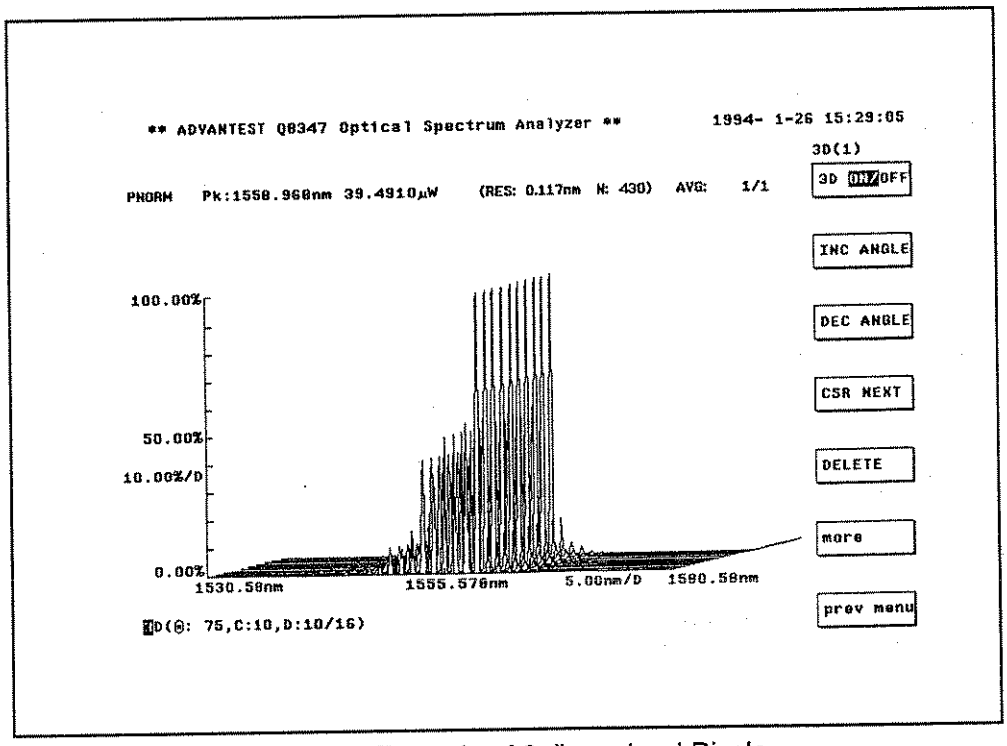


Figure 4-3 Example of 3-dimensional Display

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.

⑤ LIST

This key is used to list and display the peak value of spectrum data or coherence data in numerals.

Up to 200 points of data can be listed and the 20 points data of them can be displayed on a screen. For spectrum waveform, wavelength and level data are listed. For coherence waveform, optical-path difference length and level data are listed.This key is pressed, the following softkey menu appears.

Softkey menu

LIST

ON/OFF
SORT LVL
SORT WL
Y dB
↑ (Page)
↓ (Page)
prev menu

Explanation on the Softkey menu

⑤-1 ON/OFF
This key is used to switch the listing mode ON/OFF.
When ON is selected, the display is divided into upper and lower screens. The list window is displayed in the lower screen.

⑤-2 SORT LVL
This key is used to sort the data currently listed in the order in which level is large.

⑤-3 SORT WL
This key is used to sort the data currently listed in the order in which wavelength, frequency or optical-path difference is short.

⑤-4 Y dB
This key is used to set the threshold (YdB) of the wavelength peak to be listed.
The peak of which level is between the peak level and YdB less than the peak level is searched and listed.
The initial value of the Y is 20dB and the Y can be set from 0.1dB to 99.9dB (the setting resolution is 0.1dB).

⑤-5 ↑ (Page)
This key is pressed, the previous page of the list is displayed.

⑤-6 ↓ (Page)
This key is pressed, the next page of the list is displayed.

⑤-7 prev menu
The softkey menu is reset to the preceding one.

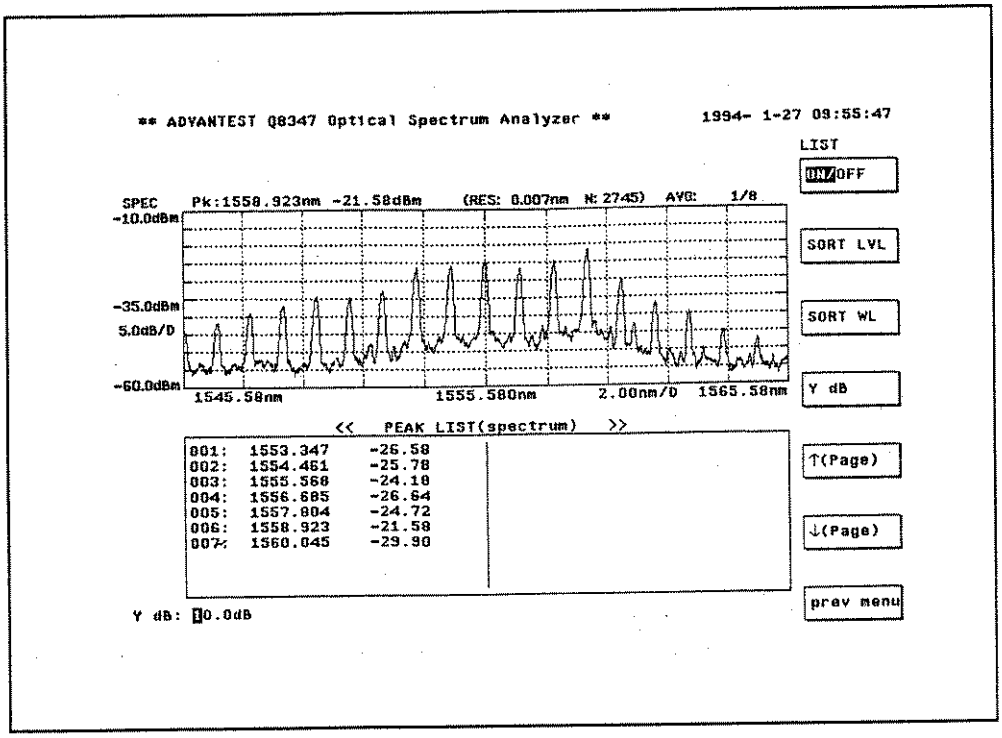


Figure 4-4 Example of List Display

⑥ act. U&L

This key is valid when the dual-screen mode is ON and is used to specify whether or not to update both upper and lower screens at each measurement.

When "act. U&L" are reversed, both upper and lower screens are active and updated by one measurement.

When "act. U&L" are displayed normally, only the upper screen is active and the data in the lower screen is not updated by a measurement.

Each time this key is pressed, active mode of both screens is turned ON or OFF.

⑦ xcng U/L

When dual-screen mode is ON, this key is used to exchange upper screen data with lower screen data.

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] softkey 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

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

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

DEVICE [ ] key, and then the softkey [FLOPPY] .

Select the displayed ON/OFF; ("ON" selects the floppy disk, while "OFF" selects the internal memory.)
This analyzer provides internal memory for 16 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 softkey menu appears; use the softkeys, rotry 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.

< < Stored panel conditions parameters > >

① CENTER
② SPAN
③ REF LEVEL
④ LEVEL SCALE
⑤ SPECTRUM/COHERENCE, Resolution
⑥ AVERAGE ON/OFF
⑦ ZOOM Mode
⑧ Power monitor measurement conditions
⑨ Waveform monitor measurement condition
⑩ GRID
⑪ Cursor display mode
⑫ Half-width operation type, parameter
⑬ Label
⑭ Setting of plotter
⑮ Setting of printer
⑯ Setting of buzzer
⑰ CLOCK ON/OFF, CLOCK
⑱ CAL valid and calibration value, VAC/AIR
⑲ Display color mode, color setting

※ The following conditions are always off when the data is recalled.
"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.

Softkey menu

(1) SAVE key

SAVE

SAV REF
SAV MEAS1
SAV MEAS2
SAV MEAS3
sav meas
sav panel
sav p.seq

Explanation on the Softkey 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.

Note: The above softkeys ① and ② function against the internal memory, regardless of the FLOPPY ON/OFF selection.
Spectrum display or coherent 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 LCD display.
"REF, MEAS1 can save only SPEC, COH!!"

③ sav meas, sav panel, sav p.seq
Used to store the displayed data into measurement data memory 1 to 15 (sav meas), or to store the current panel setting conditions or panel sequence setting data into panel memory 1 to 10 (sav panel, sav p.seq).
When the measurement data is not measured, the following message appears on the bottom of the LCD display.
"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) or the panel sequence setting data in the file (sav p.seq).

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 softkey menu appears.
(Figures 4-5 and 4-6 show the display format of the memory directory, while Figures 4-7 and 4-8 show the display format of the floppy disk directory.)

- sav meas key
- sav panel key
- sav p.seq key

sav meas

SAVE
DELETE
RECOVER
name
EXIT

sav panel

SAVE
DELETE
RECOVER
name
EXIT

sav p.seq

SAVE
DELETE
RECOVER
name
EXIT

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

No. : Memory number. Measurement data is numbered from 01 to 32, while panel conditions and panel sequence setting data 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 8 types.

- .SPE : Normal spectrum data
- .PNR : Peak normalized data
- .LOS : Loss characteristics data
- .TRA : Transparency characteristics data
- .PWR : Power monitor trend chart data
- .CON : Measurement conditions
- .COH : Coherence data
- .WAV : Wavelength monitor trend chart data

date, time : Date and time of save.

Note: Those with numbers only are unused memory.

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

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 8 types.

- .SPE : Normal spectrum data
- .PNR : Peak normalized data
- .LOS : Loss characteristics data
- .TRA : Transparency characteristics data
- .PWR : Power monitor trend chart data
- .CON : Measurement conditions
- .COH : Coherence data
- .WAV : Wavelength monitor trend chart data
- .PSQ : Panel sequence setting data

date, time : Date and time of save.

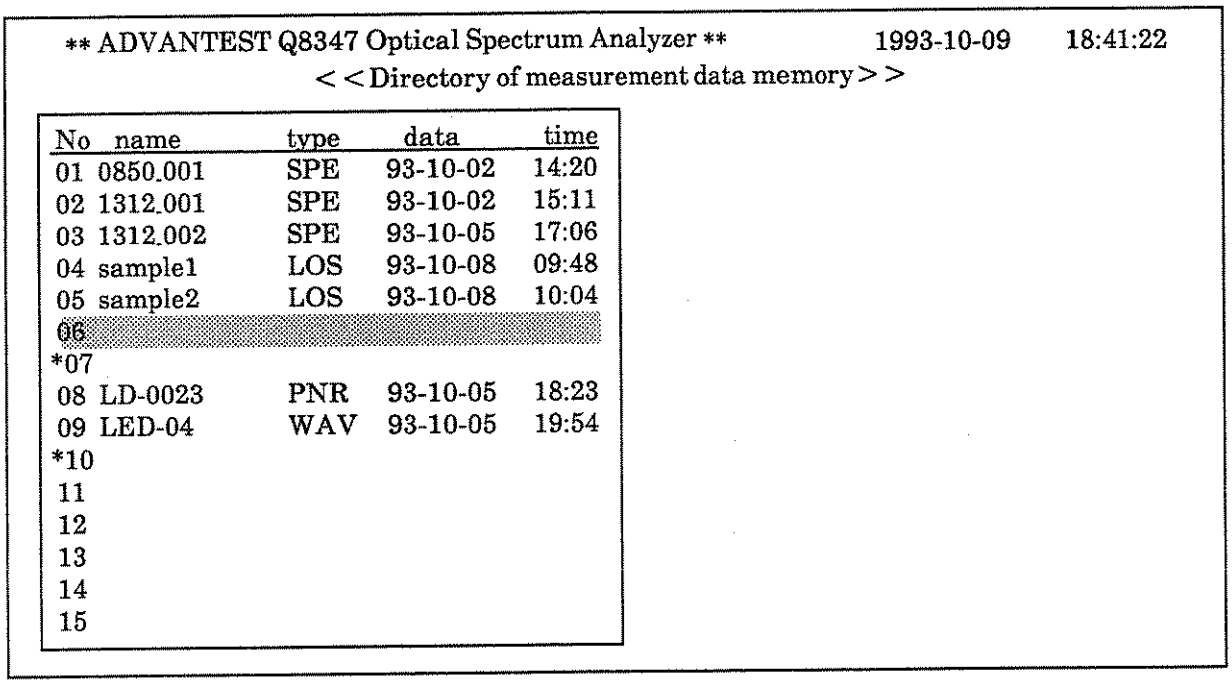


Figure 4-5 Directory of Measurement Data Memory (internal memory)

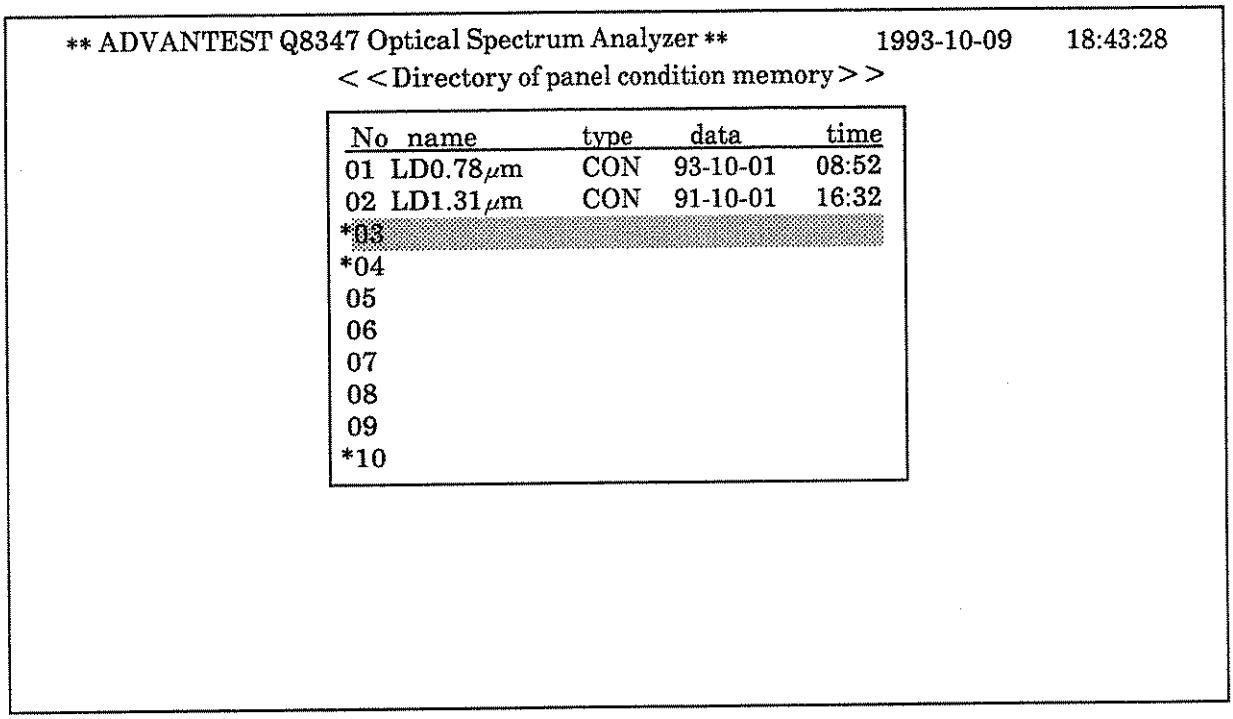


Figure 4-6 Directory of Panel Condition Memory (internal memory)

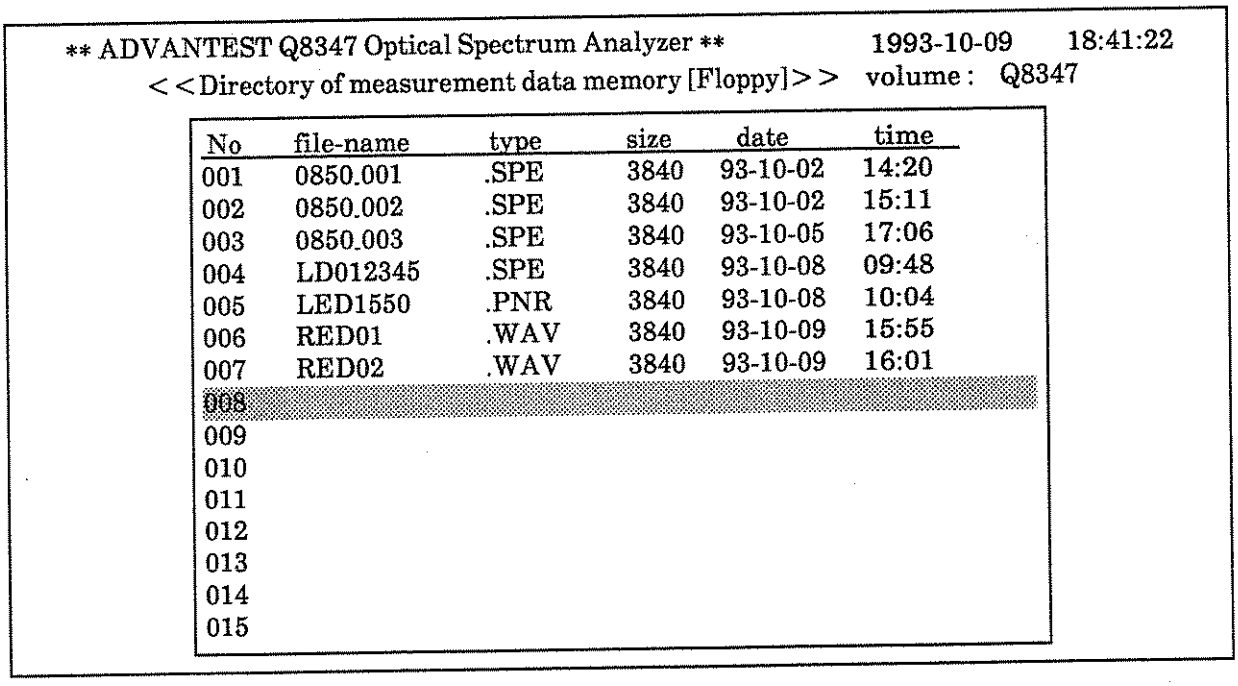


Figure 4-7 Directory of Measurement Data File (floppy disk)

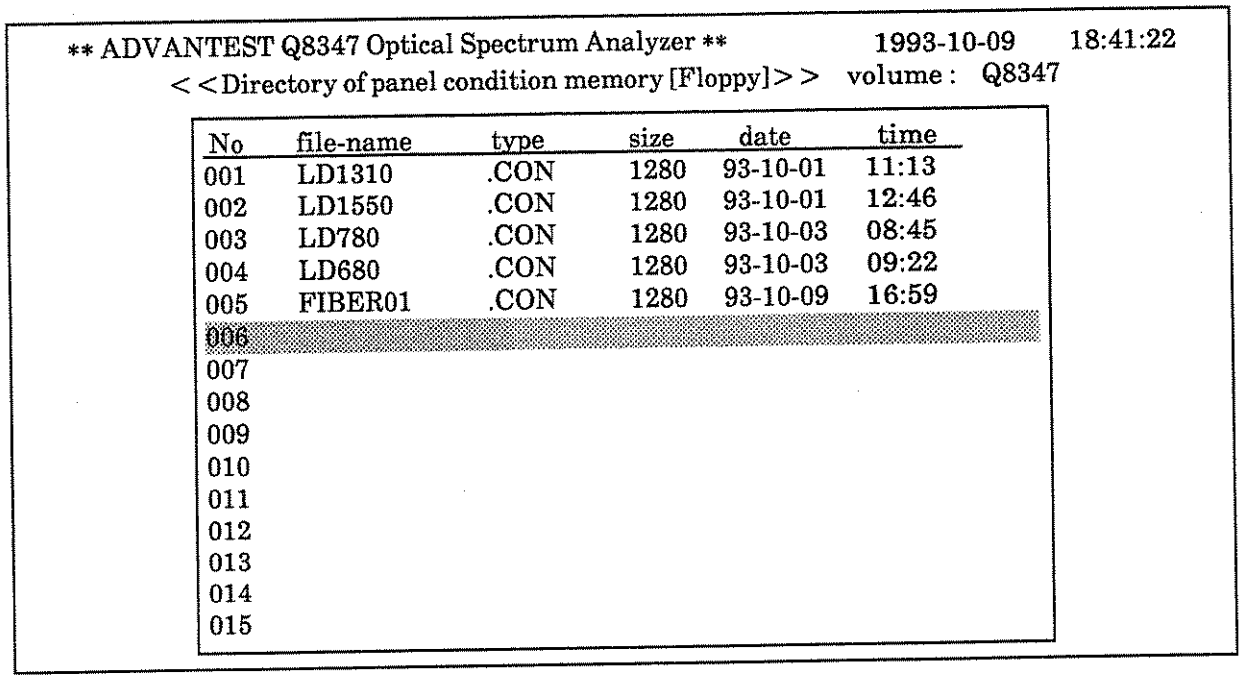


Figure 4-8 Directory of Panel Condition File (floppy disk)

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 softkey 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 softkey 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] softkey to set the character.

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

Input the name, and set the data with the [ ] (ENTER) key.

Then return to the softkey menu and save the name.

Softkey menu

name

⇦
⇨
⇧ (No)
⇩ (No)
CLR LINE
ENTER
prev menu

Explanation on the Softkey 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).

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 softkey 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 or center frequency 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.)
The name is set at the center wavelength in the coherent display. However, in case of setting data of panel sequence, the name of "PSEQ_xxx" is set arose the board.

<Examples of automatically set memory name/file name>

CENTER: 1550 nm	>>>	1550.001
CENTER: 782.5 nm	>>>	0782.001
CENTER: 782.1 nm	>>>	0782.002
CENTER: 855 nm	>>>	0855.002
CENTER: 600 THz	>>>	0600.001

Softkey menu

(2) RECALL [ ] key

RECALL

RCL REF
RCL MEAS1
RCL MEAS2
RCL MEAS3
rcl meas
rcl panel
rcl p.seq

Explanation on the Softkey menu

① RCL REF
Reads and displays the reference memory data.

② RCL MEAS 1 to 3
Reads and displays the data in measurement data memory 1 to 3.

Note: The above ①, ② function against the internal memory, regardless of the FLOPPY ON/OFF status. (Recalled from the internal memory.)

③ rcl meas, rcl panel, rcl p.seq
Used to read and display the measurement data memory 1 to 16, panel condition memory 1 to 10, panel sequence setting data 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 or the panel sequence file (rcl panel, rcl p.seq).
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 softkey menu appears.
(Figures 4-5 and 4-6 show the display format of the memory directory, while Figures 4-7 and 4-8 show the display format of the floppy disk directory.)
Selects the number by the rotry knob or arrow keys, and read the data by the
[RECALL] softkey.

- [rcl meas] key
- [rcl panel] key
- [rcl p.seq] key

rcl meas

RECALL
EXIT

rcl panel

RECALL
EXIT

rcl p.seq

RECALL
EXIT

③-1 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 LCD display. The clock and "RCL" display returns to normal status when executing the measurement.

③-2 EXIT
Used to return the directory display screen of the memory/floppy disk to the original measurement screen.

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 softkey menu appears. Use the softkeys to execute the normalization process.

Softkey menu

NORMALIZE

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

Explanation on the Softkey 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.

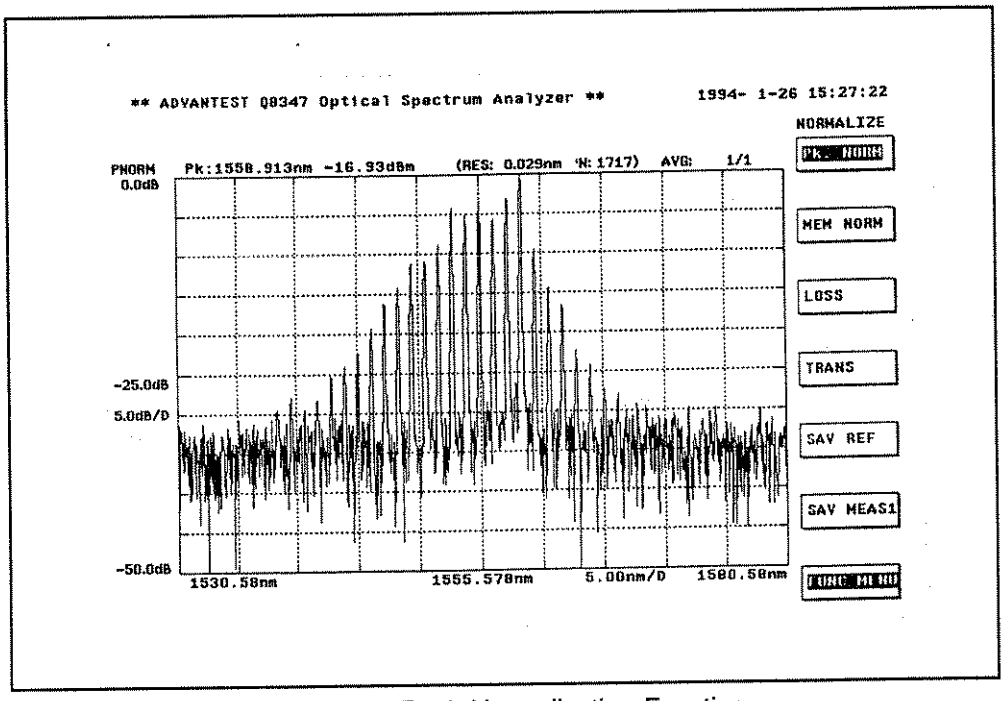


Figure 4-9 Peak Normalization Function

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

<< 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.

⑦ FUNC MENU

Used to set whether the softkey 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.

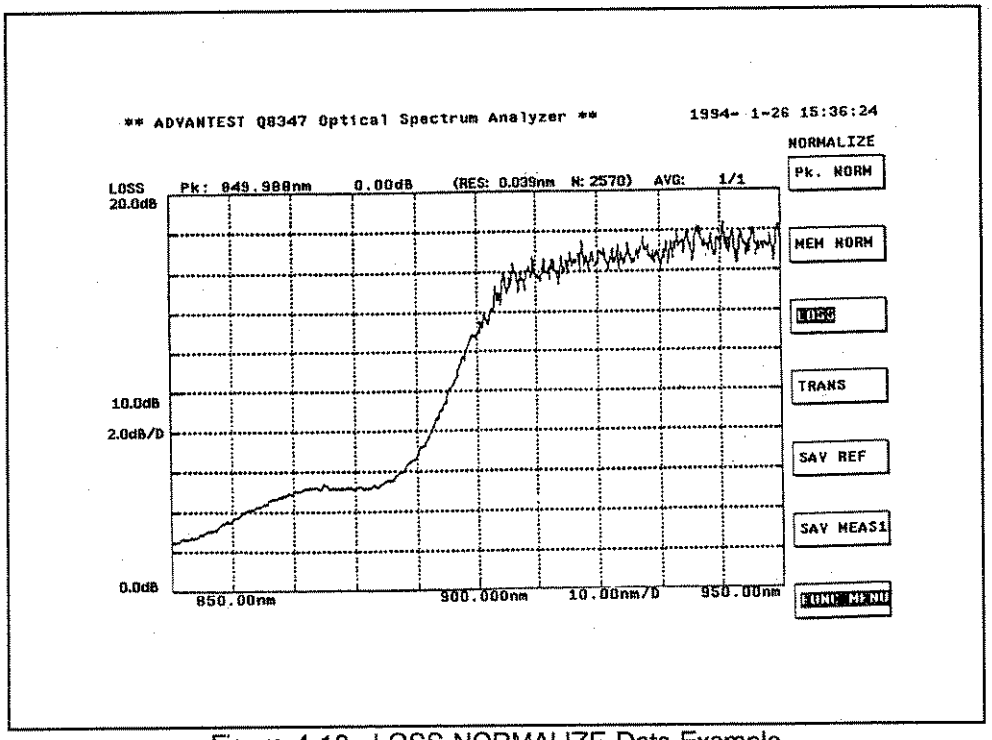


Figure 4-10 LOSS NORMALIZE Data Example

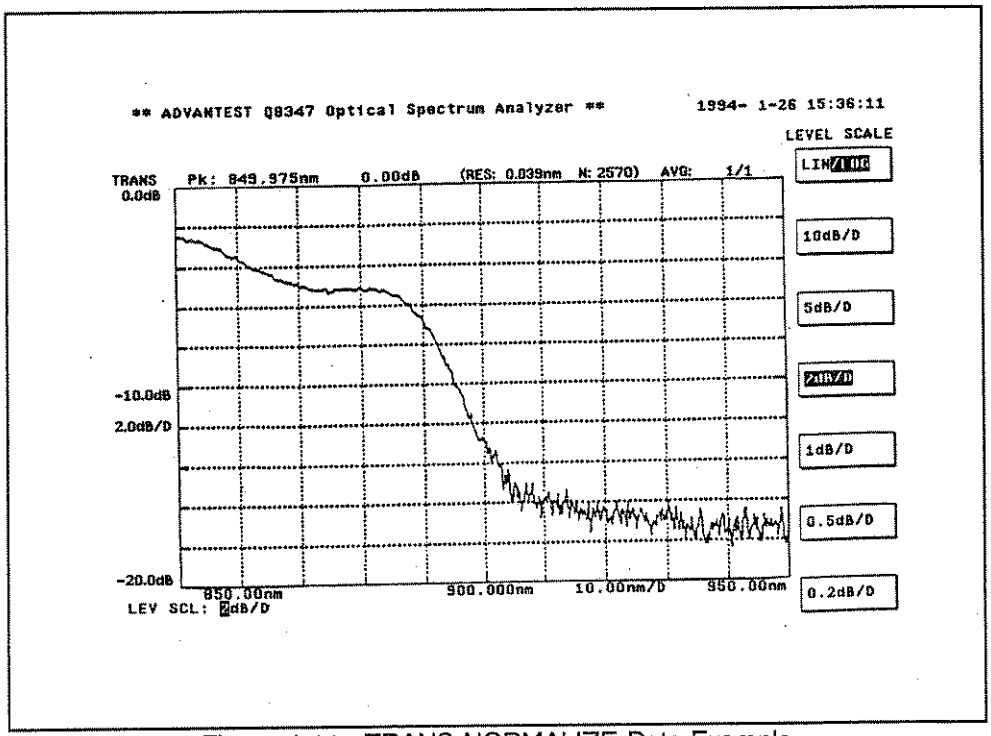


Figure 4-11 TRANS NORMALIZE Data Example

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 LCD display.
Press this key to calculate the spectral width by the currently set calculation method, and display the result.
The following softkey menu appears to allow selection of the calculation method and setting of calculation parameters.

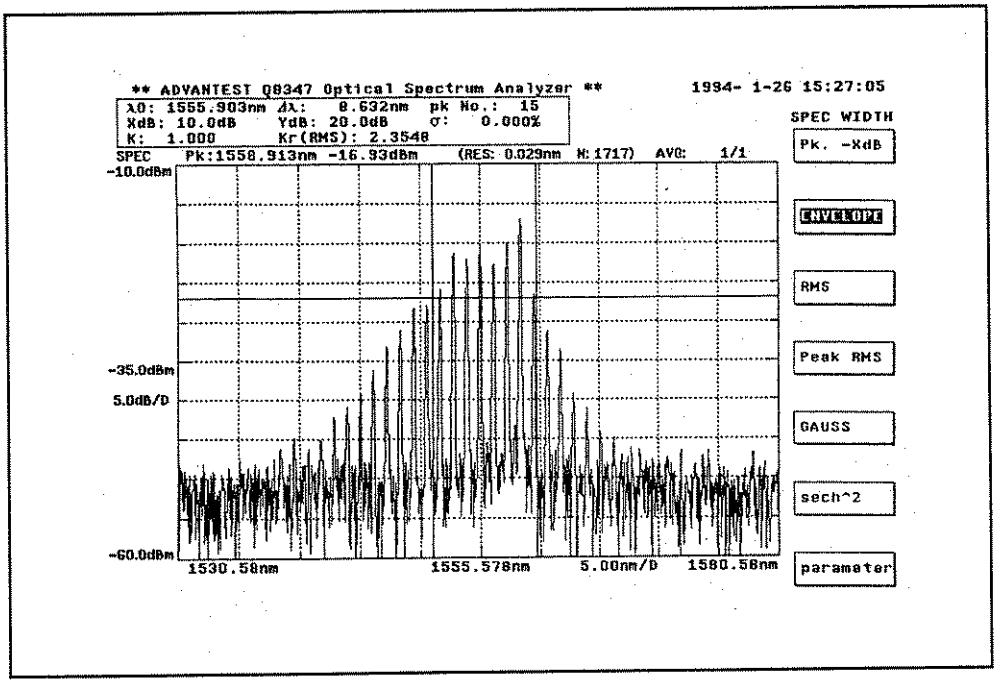


Figure 4-12 Example of Spectral Width Data Display

Calculation result data

λ0	XXXX.XXX	μm
Δλ	XXXX.XXX	nm
pk No.	XXX	
σ	XXX.XXX	%
XdB:	XX.X	dB
YdB:	XX.X	dB
K:	XXX.XXX	
Kr(RMS):	XX.XXXX	

- λ0: Center wavelength. 0 when calculation error occurred.
- Δλ: Spectral width. 0 when calculation error occurred.
- pk No.: Number of peaks.
- σ: Fitting error. (Only GAUSS method and Sech² method are effective.)
- XdB: Setting parameter XdB.
- YdB: Setting parameter YdB.
- K: Setting parameter K.
- Kr(RMS): Setting parameter Kr (RMS).

Softkey menu

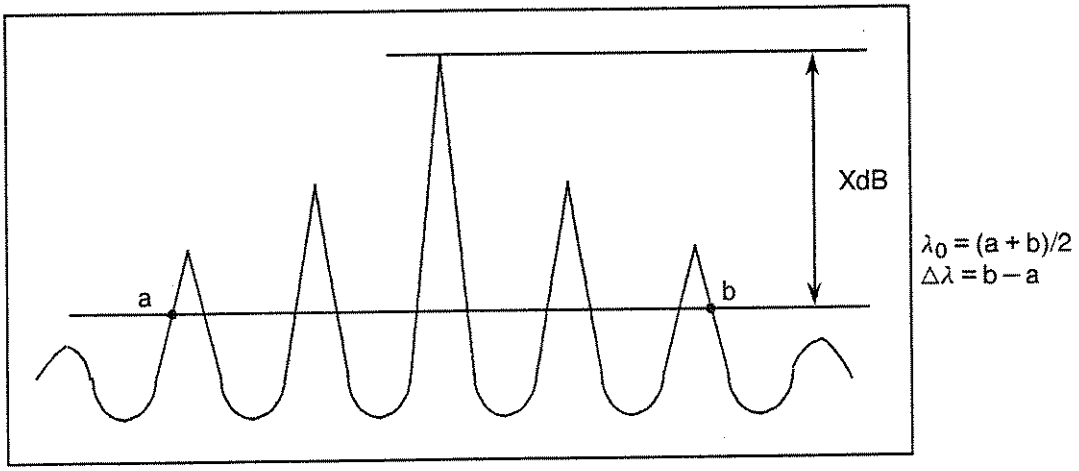
SPEC WIDTH

Pk. −XdB
ENVELOPE
RMS
Peak RMS
GAUSS
Sech^2
parameter

Explanation on the Softkey 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.)

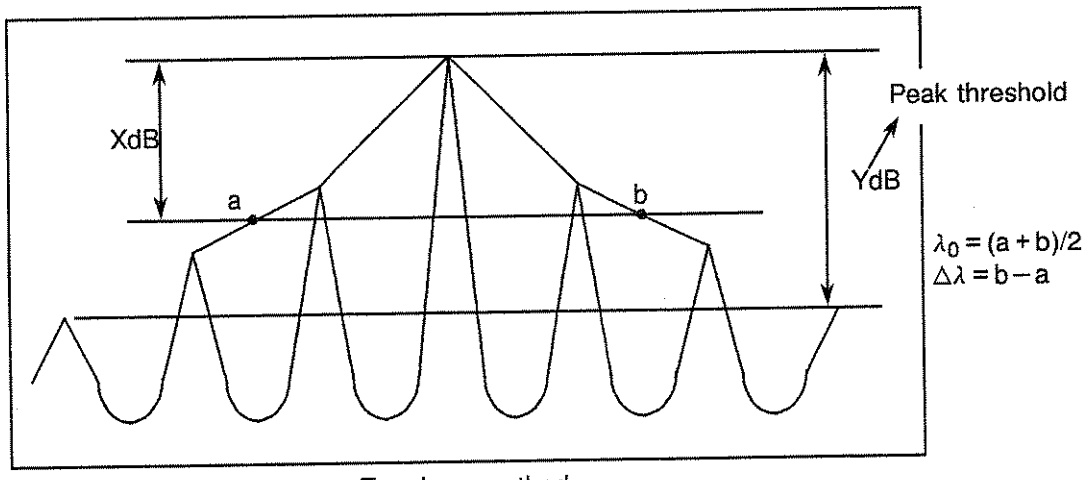


XdB attenuation method

The spectral width is determined by calculating the distance between points A and B on a level line X dB down from the maximum peak (see below).
Points A and B are calculated using linear interpolation between the measurement points (based on the display scale LOG or LINEAR currently being used).
The dip width is determined in a similar fashion: only the level line is Y dB up from the minimum peak.

Note: The dip width can be calculated only by executing the GPIB program codes MIS,OMI and ODM. For more information on how to calculate the dip width, refer to Section 6.3.2,"Controlling data output and others (3 of 4)."

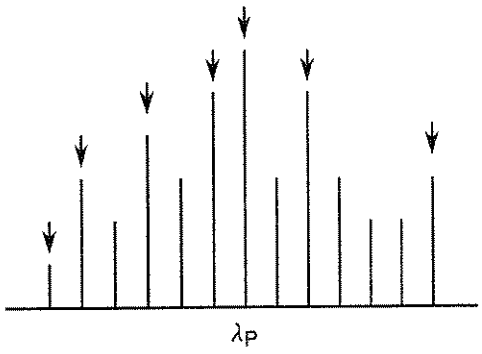
② ENVELOPE (envelope method)
The peaks above the specified peak threshold are connected by lines. Regarding the connected lines as envelope, the difference between intersections a, b of the XdB-attenuation level line from the maximum peak value is the spectral width, while the intermediate position of 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.

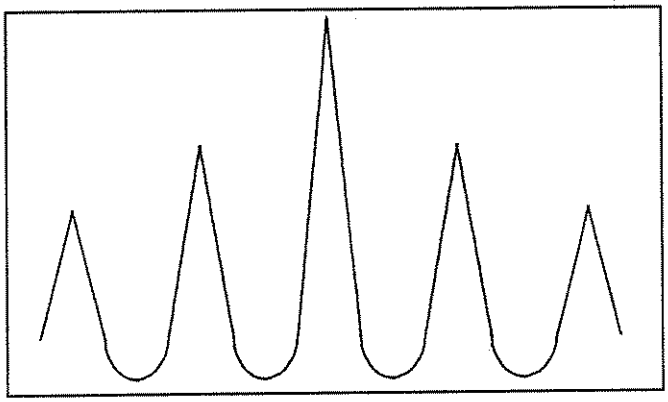
Note: The envelope cannot be formed in the following conditions, In this case, "0" is given as the result.

- 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

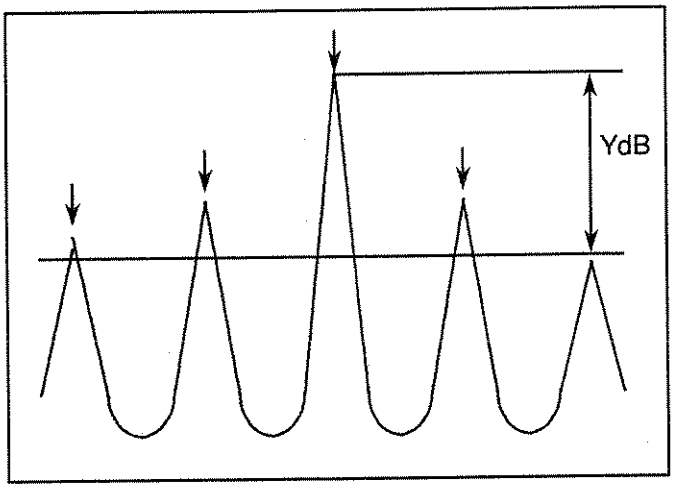
$$\lambda_0 = \frac{1}{\Sigma\chi_i} \Sigma\lambda i\, \chi_i$$

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

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

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

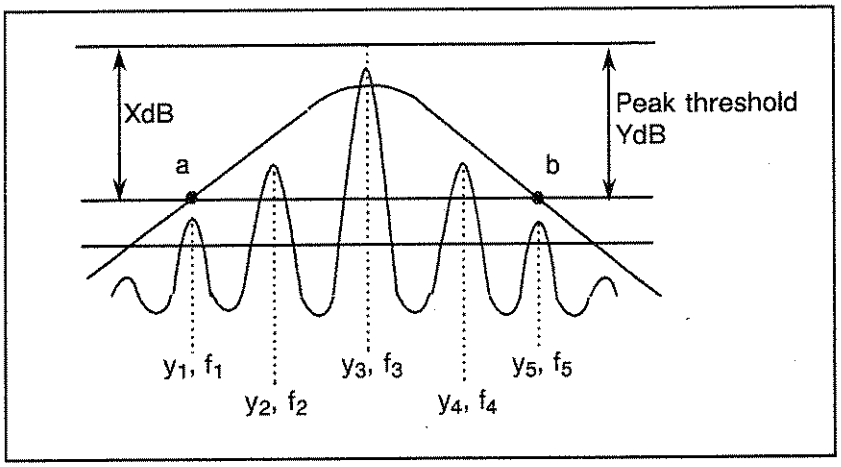
When spectrum at peak $\chi_i p$ is $\lambda_i p$;

$$\lambda_0 = \frac{1}{\Sigma \chi_i p} \Sigma \lambda_i p \, \chi_i p$$

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

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

⑤ GAUSS method



$\lambda_0 = (a+b)/2$
$\Delta\lambda = b-a$
(Δf)

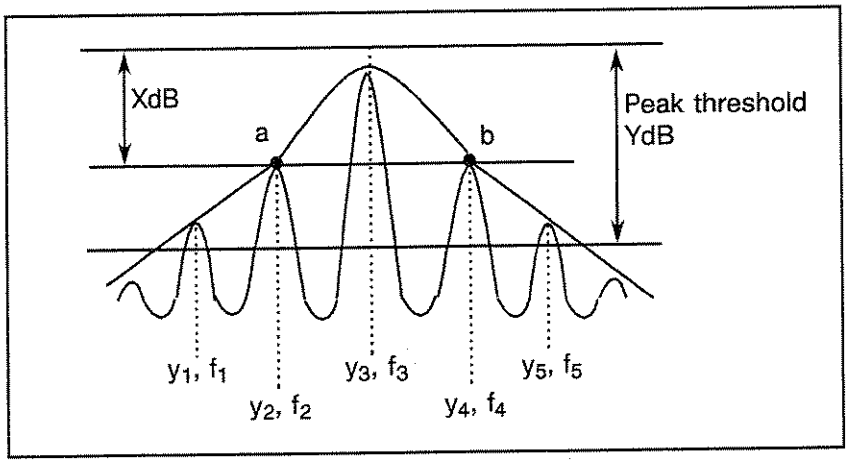
GAUSS method

The Gauss curve ($Y = e^{A(x-B)^2+C}$) is given by using the peak value more than the specified peak threshold.
The difference of intersection a−b of the level line to which xdB attenuates from maximum peak value is assumed to be peak width at half height. The middle position is defined as the center frequency (wavelength).

Fitting error of σ of measured data y_i of the peak value more than specified peak threshold and the fitted data f_i by Gauss method can be shown by the next expression.

$$\sigma \text{ (Fitting error)} = \sqrt{\frac{\Sigma(f_i - y_i)^2}{\Sigma y_i^2}}$$

⑥ Sech² method



$\lambda_0 = (a + b)/2$
$\Delta\lambda = b - a$
(Δf)

Sech² method

The sech² curve ($Y = A\ \mathrm{sech}^2(Bx - C)$)) is given by using the peak value more than the specified peak threshold. The middle position of intersection a−b of the level line to which xdB attenuates from maximum peak value is defined as the center frequency (wavelength).

Fitting error σ of measured data y_i of the peak value more than the specified peak threshold and the fitted data f_i by sech² method can be shown by the next expression.

$$\sigma\ (\text{Fitting error}) = \sqrt{\frac{\Sigma(f_i - y_i)^2}{\Sigma\, y_i^2}}$$

⑦ 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 softkey menu as shown below. Select the parameter by the softkey, and set the desired value through the numeric keys, and then press the ENTER key.

Softkey menu

parameter

XdB
YdB
K
Kr (RMS)
prev menu

Explanation on the Softkey menu

⑦-1 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).

⑦-2 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).

⑦-3 K

Sets the coefficient to be multiplied to the calculated spectral width.
The default of K is 1.0, and the settable range is 0.1 to 100 (setting resolution is 0.001 dB).

⑦-4 Kr (RMS)

Sets the coefficient to calculate the spectral width in the RMS method, peak RMS method.
This coefficient is required to show correspondence with the spectral width in the XdB attenuation and envelope methods.
(The 3 dB down spectral width for the normal distribution curve is 2.3548 multiply standard deviation.)
The default of Kr (RMS) is 2.3548, and the settable range 1 to 10 (setting resolution 0.0001)

⑦-5 prev menu

Returns the softkey menu to the previous menu.

4.5.5 ADVANCE key

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

Softkey menu

ADVANCE

CURVE FIT
wl-mon
power-mon
panel seq
FUNC MENU

Explanation on the Softkey 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.

② wl-mon
This key is used to select wavelength monitor function.
When this key is pressed, the following softkey menu appears. The softkeys are used to specify each operation.

Softkey menu

wl-mon

ON/OFF
search λ (search f)
N-MAX
INTERVAL
prev menu

Explanation on the Softkey menu

②-1 ON/OFF

This key is used to set ON/OFF wavelength monitor function. When this key is pressed, wavelength monitor display or usual spectrum display is selected by turns.
Figure 4-13 shows the power monitor display and the method to read the displayed data.

< < Description for wavelength monitor display > >

Wavelength monitor function is selected, the measured wavelength is displayed on the LCD display in digital. The "trend chart display function" is provided to monitor the time variation of the wavelength. Up to 1001 points of data is measured with constant time interval (specified within 0.1 sec. to 3600 sec.), to display the time vs. wavelength in graph. (The data number and the level are displayed as the cursor data.)

Table 4-3 shows the keys which can be used in the wavelength monitor display mode and functions of the keys.

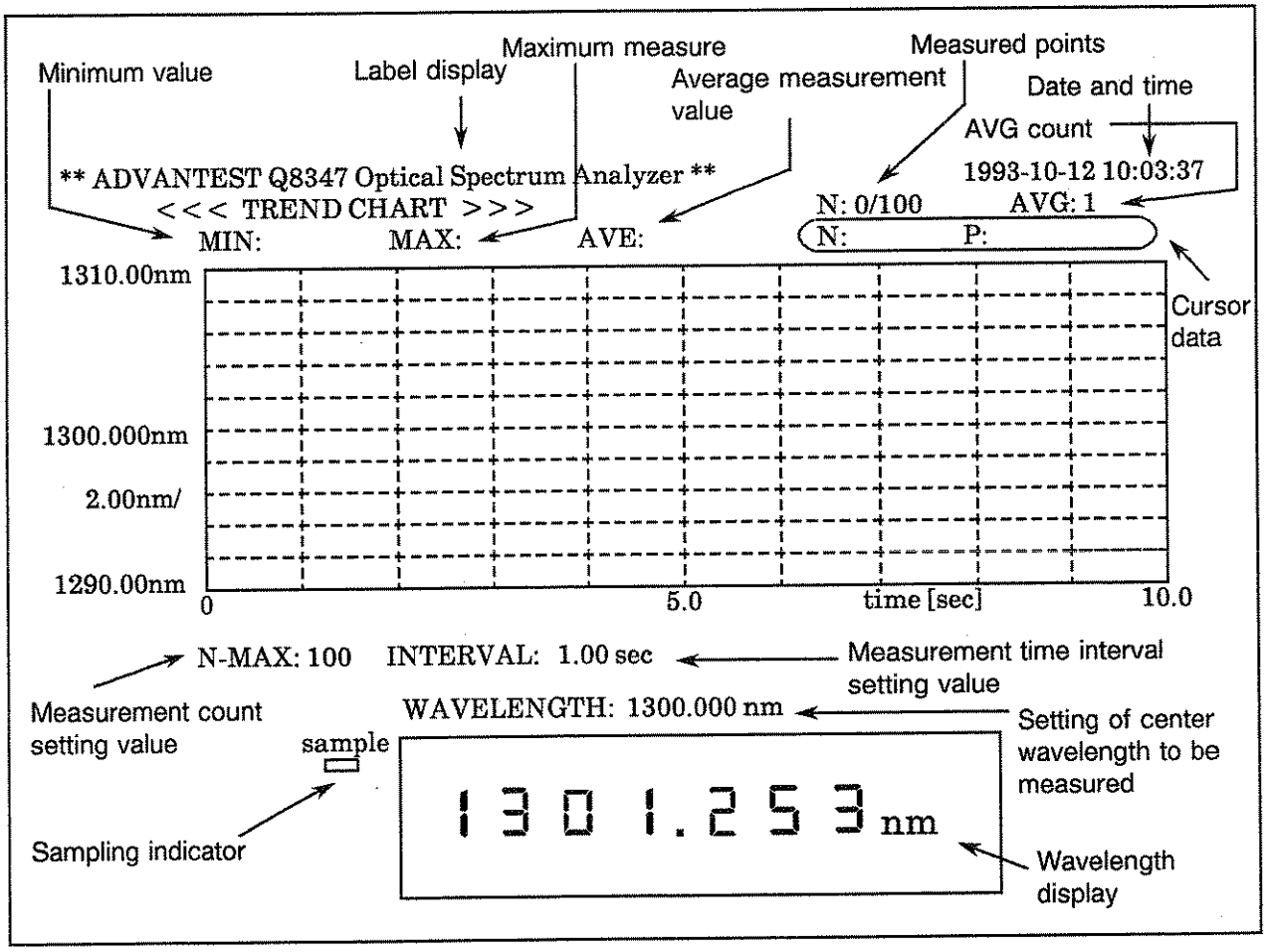


Figure 4-13 Wavelength Monitor Display Screen and How to Read the Data

②-2 search λ (search f)

Used to automatically set the wavelength during power monitor operation at the peak wavelength of the input light spectrum.

The "search λ" is displayed in reverse highlight by pressing this key, and the peak wavelength of the input light is automatically searched and set. Then the reverse display returns to the normal display.

The message of "peak-lambda search in progress..." is displayed during the search.

This key is disabled during measurement ("SINGLE" or "REPEAT" statuses).

②-3 N-MAX

Sets the number of data points to be measured in the trend chart. The initial value is 101, and the applicable setting range is 11 to 1001. Numeric keys, arrow keys and rotary knob can be used to set the value. When the data is set by using the numeric keys, always press the [ENTER] key to terminate the entry.

When arrow keys or rotary knob is used, data can be specified by 1-2-5 step.
Note that the previous trend data is erased by changing the data points count.
The X axis display of the trend chart is automatically switched by this data count and sampling interval.

②-4 INTERVAL

This key is used to select sampling interval of the data. The initial setting value is 1.00 second. The applicable setting range is 0.10 to 3600 seconds.
Numeric keys, arrow keys and rotary knob can be used for setting interval.
When numeric keys are used, press the [ENTER] key after data setting. When arrow keys or rotary knob is used, data can be specified 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.

②-5 prev menu

Pressing this key returns the softkey menu to the previous one.

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

Keys enabled	Function
① CENTER , SPAN	Sets the display level of the trend chart.
② AVG	Sets the averaging process count at measurement of a single point.
③ SINGLE	Executes trend measurement a single time.
④ REPEAT	Repeats execution of trend measurement.
⑤ STOP	Stops the trend measurement. * The above ③ ④ ⑤ also control the digital power display.
⑥ CAL	Sets whether the wavelength monitor is displayed for the wavelength data in vacuum or air.
⑦ λ1	Turns on/off the cursor display on the trend chart.
⑧ ADVANCE	Turns on/off the wavelength monitor mode, and sets the conditions.
⑨ Numeric keys, arrow keys, rotary knob	Operation against the setting item.
⑩ SAVE , RECALL , DEVICE COPY , FEED , LOCAL INSTR PRESET	Same operation as the normal spectrum display.

Note: Keys other than mentioned above are all disabled.

③ power-mon
Used to select the power monitor display function.
The following softkey menu is displayed by pressing this key.

Softkey menu

power-mon

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

Explanation on the Softkey 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.

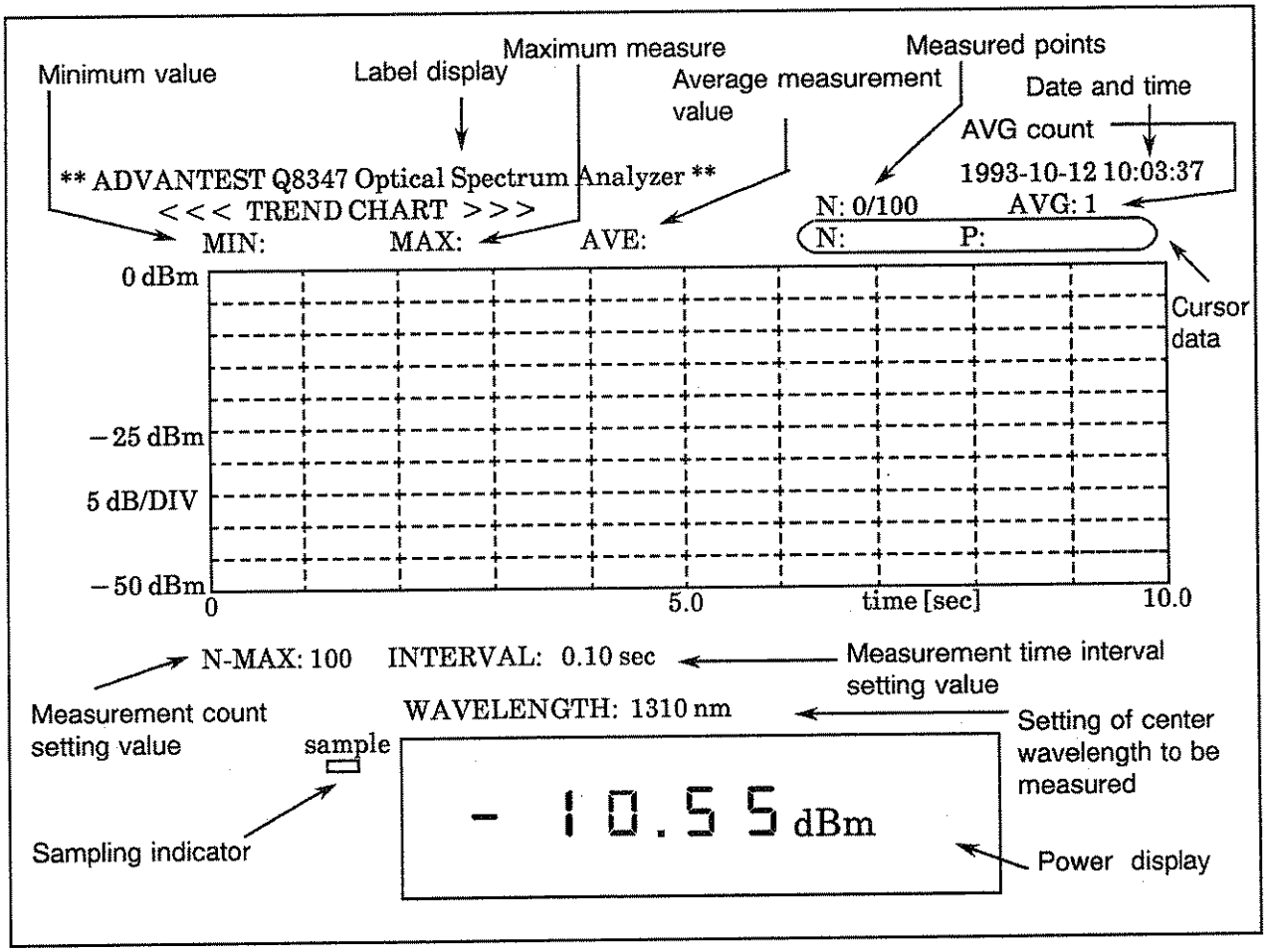


Figure 4-14 Power Monitor Display Screen and How to Read the Data

< < Power monitor display function > >

This analyzer incorporates a Michelson interferometer, that normally generates the optical path difference by moving mirror, and interferes.
Power monitor function allows measurement of the non-interference optical power by cutting off the one side of the light which is divided by the beam splitter.
When this mode is selected, the measured light power is displayed on the LCD display (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.)

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 rotry 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.)

488 nm → 633 nm → 780 nm → 850 nm → 1310 nm → 1550 nm →

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 rotry knob to set the count. When the data set by the numeric keys, always press [ENTER] key to terminate the entry. The arrow keys or rotry 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 rotry knob for the setting. Always press the [ENTER] key after setting the value by the numeric keys.
The arrow keys or rotry 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 softkey menu to the previous menu.

Table 4-4 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.

Softkey menu

panel seq

ON/OFF
edit
EXECUTE
STOP
CONTINUE
PRINT OUT
prev menu

Explanation on the Softkey menu

④ panel seq (Panel sequence)
The panel sequence executes the register of the measuring condition and the display condition, etc. Automatic measurement can be executed by using this function without using an external computer.
Moreover, maximum 200 steps can be executed per one program. This program can be stored in the internal memory or flap disk.

④-1 ON/OFF
Turn ON this key when the programming list of the panel sequence is displayed. When this key is turned OFF, the display is returned back to the normal analysis mode.
When this key is turned ON and is set measurement condition and display condition, the measurement condition and display condition on the cursor position are registered in the programming list. (Refer to figure 4-15.)

④-2 edit
This is used for the programming of the panel sequence.

Softkey menu

edit

ALL CLEAR
DEL LINE
INS LINE
command
↑ (page)
↓ (page)
prev menu

Explanation on the Softkey menu

④-2-1 ALL CLEAR

This deletes all of the program content in the registered panel sequence.

④-2-2 DEL LINE

This deletes one line of the registered program content on the cursor position in the panel sequence.

④-2-3 INS LINE

This inserts the program to the program list on the cursor position in the panel sequence.

④-2-4 command

This is used for special command except the measurement condition and the display condition.

Softkey menu

command

WAIT N
LOOP M-N
PAUSE
END
prev menu

Explanation on the Softkey menu

④-2-4-1 WAIT N

In the panel sequence execution, the waiting time of the next instruction start is set.
The set up range is 0.1seconds to 1000.0seconds.
This is set by [ENTER] key after arbitrary value is input by numerical value key.

Program example of WAIT N

```
1 CENTER 1310.00nm
2 SPAN 10.00nm
3 MEASURE=SINGLE
4 WAIT 5.2sec ———————— LINE No.5 is executed after 5.2 seconds.
5 COPY
6 END
```

④-2-4-2 LOOP M-N

This is set for the repeat of the panel sequence.
The specified LINE No. by M to the registered LINE No. of LOOP statement is repeated in N times.
M is input by numerical value key, "-" is input and N is also input by numerical value key.
Set up range of M is 1 to 200.
Set up range of N is 1 to 1000.
And the nest is only one time.

Program example of LOOP M-N

```
1 CENTER 1310.00nm
2 SPAN   100.00nm
3 MEASURE=SINGLE ┐
4 COPY           │ LINE No.3 to 5 is repeated in 10 times.
5 LOOP 3,10      ┘
6 END
```

④-2-4-3 PAUSE

This is set for the interruption of the panel sequence.
Press "CONTINUE" key in ④-5 for re-start.

Program example of PAUSE

```
1 CENTER 1310.00nm
2 SPAN 10.00nm
3 MEASURE=SINGLE
4 PAUSE ———————————— LINE No.5 is not executed until pressing "CONTINUE"
5 COPY                key.
6 END
```

④-2-4-4 END

This is used for termination of the panel sequence.

④-2-4-5 prev menu

Softkey menu is returned back to the previous display.

④-2-5 ↑ (page)

Page in the display of the program list is moved to the previous page.

④-2-6 ↓ (page)

Page in the display of the program list is moved to the next page.

④-2-7 prev menu

Softkey menu is returned back to the previous display.

④-3 EXECUTE

This is used for the execution of the panel sequence.
Screen display is changed to the normal analysis mode from the programming list, and the executing content at present time is displayed to below left of the screen display.

④-4 STOP

This is used for stop of the panel sequence under way.

④-5 CONTINUE

This is used for the re-start of the panel sequence that is interrupted by "PAUSE" of ④-2-4-3.

④-6 PRINT OUT

This is used for print out of the programming list.

④-7 prev menu

Softkey menu is returned back to the previous display.

CAUTION

1. The contents shown the here cannot be executed in the panel sequence.
   - FLOPPY DIR display
   - FLOPPY FORMAT
   - Input of FLOPPY volume name
   - Save and recall of specified data of the panel sequence
2. When following set up is executed, press [ENTER] key of the data section absolutely after setting by softkey.
   - COLOR SEL BLOCK
   - 3D ANGLE
   - 3D DATA number
   - 3D CURSOR
   - Address setting for GPIB
3. When following set up is executed, press [ENTER] key of the data section absolutely after setting by [⇧] and [⇩] key.
   - USER COLOR pattern
   - Change of CLOCK of year, month, day, hour and minute.

【 Program example of the panel sequence 】

UPPER: SPECTRUM
LOWER: COHERENCE
GRID: OFF
SPECT WIDTH: ON

In the above mentioned condition, the program that repeats five times is created. This program example is using the auto function, deciding the wavelength and reference level, and output to printer at each measurement end.

① Press ADVANCE key, and turn ON "panel seq" then program list is displayed.

② Press INSTR PRESET key, and set PRESET . (LINE No.1)

③ Press MODE key, and set SPECT (λ) . (LINE No.2)

④ Press AUTO key, and set 950 ~1750 . (LINE No.3)

⑤ Press CONTROL key, and set DUAL . (LINE No.4)

⑥ Press CONTROL key, and set GRID OFF . (LINE No.5)

⑦ Press MODE key, and set COHERENCE . (LINE No.6)

⑧ Press CONTROL key, and set xcng U/L . (LINE No.7)

⑨ Press SPECTRAL WIDTH key, and set ON for SPEC WIDTH MODE. (LINE No.8)

⑩ Press SINGLE key, and turn ON for SINGLE measurement MODE. (LINE No.9)

⑪ Press DEVICE key, and set PRINTER . (LINE No.10)

⑫ Press COPY key, and turn ON for output data. (LINE No.11)

⑬ Press ADVANCE → panel seq → edit → command → WAIT N key, and set 5 second for wait time. (LINE No.12)
The next LINE No. is executed after a lapse of 5 second from LINE No.11 is finished.

⑭ Press panel seq → edit → command → LOOP M-N key, and set LOOP. (LINE No.13)
This is repeated five times from LINE No.1 to LINE No.13.

⑮ Set panel seq → edit → command → END . (LINE No.14)
The panel sequence is finished.

Above mentioned steps become an example of panel sequence program that is shown in figure 4-15.

< < < programing list(panel sequence) > > >

1.	INSTR PRESET	21.	
2.	MODE-SPECT(λ)	22.	
3.	AUTO-LONG	23.	
4.	DUAL ON	24.	
5.	GRID ON	25.	
6.	MODE-COHERENCE	26.	
7.	DISPLAY xcng U/L	27.	
8.	SPEC WIDTH ON	28.	
9.	MEASURE=SINGLE	29.	
10.	DEVICE=PRINTER	30.	
11.	COPY	31.	
12.	WAIT 5.0sec	32.	
13.	LOOP 1-5	33.	
14.	END	34.	
15.		35.	
16.		36.	
17.		37.	
18.		38.	
19.		39.	
20.		40.	

Figure 4-15 Panel Sequence Program

⑤ FUNC MENU
FUNC MENU sets whether the corresponding softkey menu is to be displayed or not when the FUNCTION section key is pressed. For details, refer to 4.5.3 Softkey Menu ⑦.

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.

Softkey menu

DEVICE

PRINTER
PLOTTER
FLOPPY
COLOR
CLOCK
BUZZER

Explanation on the Softkey menu

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

Softkey menu

PRINTER

MENU OUT
INT/GPIB
prev menu

Explanation on the Softkey 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 softkey menu (MENU OUT is OFF) onto the printer. This function is ON when the "MENU OUT" display is inversed.

①-2 INT/GPIB

This is used for selection either internal printer or external printer.

INT is selected then it is output to internal printer.

GPIB is selected then it is output to external printer (HP2225AJ or etc.) which is supported the standard of HP raster interface.

①-3 prev menu

Returns the softkey menu to the previous display.

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 softkey menu appears. The plotter type, output data type, output size, etc. can be set through the softkeys. Figure 4-16 is an example of plotter output.

Note: The GPIB address of this analyzer and GPIB address of the plotter must both be set under the only mode to execute output to the plotter.

Softkey menu

PLOTTER

DATA: ALL
DATA: SIG
PAPER ADV
plot size
prev menu

Explanation on the Softkey menu

②-1 DATA: ALL
Selected to plot all the information (except for the softkey menu) displayed on the LCD display. (Default)

②-2 DATA: SIG
Selected to plot the waveform information on the LCD display alone.

②-3 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.

②-4 plot size
Specifies the size (number of figures on a single sheet, vertical/ horizontal drawing) of the plot.
The following softkey menu appears by pressing this key; specify the size using the softkeys.

Softkey menu

plot size

A4(H1)
H2
H4
V1
V2
V4
prev menu

Explanation on the Softkey menu

②-4-1 A4 (H1)
One plot is drawn on horizontally-set A4 paper. (Default)

②-4-2 H2
Two plots are drawn on horizontally-set A4 paper.

②-4-3 H4
Four plots are drawn on horizontally-set A4 paper.

②-4-4 V1
One plot is drawn on vertically-set A4 paper.

②-4-5 V2
Two plots are drawn on vertically-set A4 paper.

②-4-6 V4
Four plots are drawn on vertically-set A4 paper.

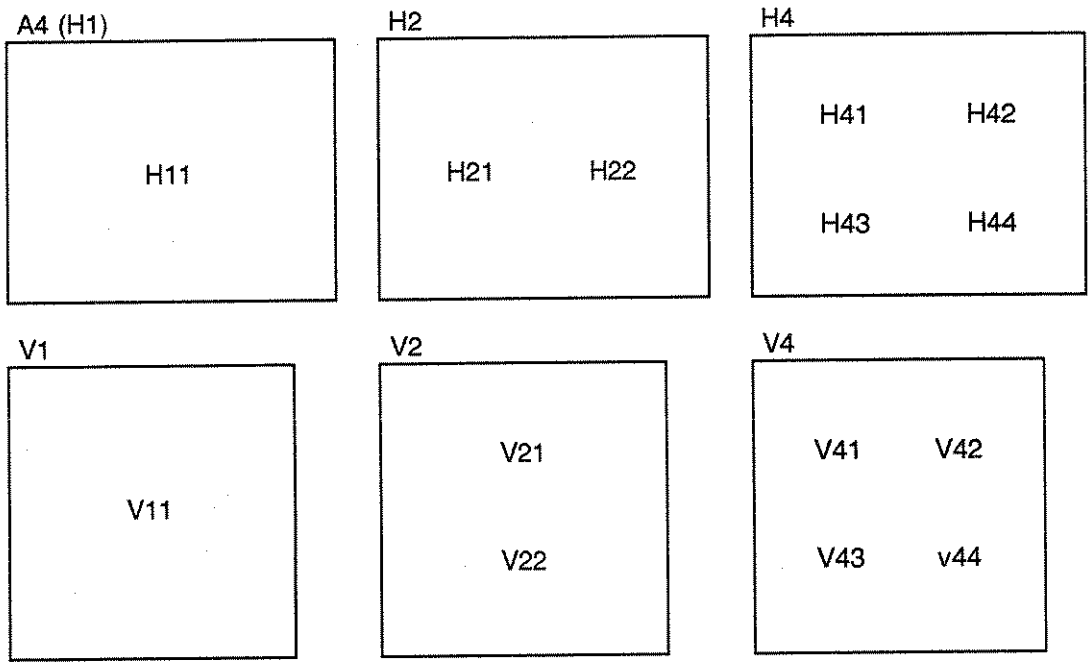
②-4-7 prev menu
Returns the softkey display to the previous screen

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 softkey menu.
When the plot size is changed, the plot position automatically returns to the original position.

②-5 prev menu

Returns the softkey display to the previous screen.

Plotting position and sequence for various plot sizes



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

Figure 4-16 Example of Plotting

③ FLOPPY

Used to initialize the floppy disk and turn on/off the floppy disk status.

The following softkey menu appears by pressing this key.

(When the floppy disk mode is specified in the SAVE/ RECALL function, the "FLOPPY" display is inversed.)

Softkey menu

FLOPPY

ON/OFF
DIR
format
volume
prev menu

Explanation on the Softkey 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 Q8347 Optical Spectrum Analyzer ** 1993-10-09 18:41:22
<<<< Directory of floppy-disk (all files) >>>> volume: Q8347

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					

Figure 4-17 Floppy Disk Directory (all files)

③-3 format

Used to initialize the floppy disk.

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

Softkey menu

format

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

Explanation on the Softkey menu

③-3-1 EXECUTE

Used to start initialization of the floppy disk. Initialization is executed with the specified format and capacity. (Table 4-5 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 4-5 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 softkey menu to the previous screen.

③-4 volume

Used to change the disk volume label. ("Q8347" is set as the default volume label.) Press this key, and the following softkey 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, $ & # % ' - @ _ ^ ( ) { } ~ !

Softkey menu

volume

⇦
⇨
DEL CHR
INS SP
CLR LINE
ENTER
prev menu

Explanation on the Softkey menu

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 prev menu

Returns the softkey menu to the previous screen.

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) [.] key
ENTER

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 softkey menu to the previous display.

④ COLOR

This key is used to change the display color pattern and to customize the display color. When this key is pressed, the following softkey menu appears. Use the softkeys for the setting.

Softkey menu

COLOR

PATTERN-1
PATTERN-2
PATTERN-3
USER
edit clr
prev menu

Explanation on the Softkey menu

④-1 PATTERN-1, PATTERN-2, PATTERN-3
Selects color pattern 1, 2 or 3 for display.

④-2 USER
Selects the customized color for display.

④-3 edit clr (color)
Changes the color pattern for display.
When this key is pressed, the following softkey menu appears.

Softkey menu

edit clr

SEL BLOCK
RED
GREEN
BLUE
UNDO
prev menu

Explanation on the Softkey menu

④-3-1 SEL BLOCK
This key is used to select the display block to be changed.
Select an item of which color is to be changed, and press RED (④-3-2), GREEN (④-3-3) or BLUE (④-3-4) to change the depth of the color. Press this key again to determine the color of the item.
The color can be changed for the following 8 items.

- SINGLE or UPPER SINGLE, READOUT
  Colors of measurement waveform data (waveform data in the upper screen if dual screens mode is selected), cursor data, and auto peak search data.
- LOWER SIGNAL
  Colors of waveform data on the lower screen in the dual screens mode, and background data in the overwriting mode
- FRAME
  Colors of the frame for data display area and grid in the frame, and data input line for setting or modifying.

- ANNOTATION
  Colors of wavelength data on horizontal axis, coherent length data, and level value on vertical axis.
- CONDITION
  Display colors for resolution and number of data for center wavelength, and averaging count.
- LABEL, CLOCK
  Display colors for label and clock.
- SOFTKEY
  Display colors for softkeys and type of the softkeys.
- BACK PLANE
  Color of the back plane

④-3-2 RED

Changes the depth of red.
When this key is pressed, the current rate is displayed in the lower part of the screen. By using the rotary knob or ⇧ , ⇩ keys, the rate can be changed from 0 to 100 % by 16 steps.

④-3-3 GREEN

Changes the depth of green.
When this key is pressed, the current rate is displayed in the lower part of the screen. By using the rotary knob or ⇧ , ⇩ keys, the rate can be changed from 0 to 100 % by 16 steps.

④-3-4 BLUE

Changes the depth of green.
When this key is pressed, the current rate is displayed in the lower part of the screen. By using the rotary knob or ⇧ , ⇩ keys, the rate can be changed from 0 to 100 % by 16 steps.

④-3-5 UNDO

Resets the color setting of the currently selected item to the former condition.
However, the SEL BLOCK key has been pressed again to determine the setting, UNDO is enable to reset the color.

④-3-6 prev menu

Used to return the softkey menu to the previous display.

④-4 prev menu

Used to return the softkey menu to the previous display.

⑤ CLOCK

This analyzer is equipped with a battery-backed-up internal clock function that displays the data and time data on the upper right position of the LCD display. This key is used to change the data and time, or to turn ON/OFF the clock display.

The following softkey menu appears by pressing this key. Select the item to be changed by the softkey, and change the data by the ⇧ key, ⇩ key, or the rotry knob.

The setting is increased by the ⇧ key or by turning the rotry knob to the CW(clock wise) direction, and decreased by the ⇩ key or by turning the rotry knob to the CCW (counter clock wise) direction.

Softkey menu

clock

ON/OFF
YEAR
MONTH
DAY
HOUR
MINUTE
prev menu

Explanation on the Softkey menu

⑤-1 ON/OFF

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

⑤-2 YEAR, MONTH, DAY, HOUR, MINUTE

Used to change the year, month, day, hour and minute.

⑤-3 prev menu

Returns the softkey menu to the previous screen.

⑥ BUZZER

Controls the conditions to activate the buzzer. The following softkey menu appears by pressing this key.

Softkey menu

BUZZER

BEEP
WARNING
QUIET
prev menu

Explanation on the Softkey menu

⑥-1 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.

⑥-2 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.

⑥-3 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.

⑥-4 prev menu

Returns the softkey 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.

4.7 GPIB Section

This section sets the GPIB address, switches to local operation, and displays the GPIB 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 GPIB address. The following softkey menu appears to enable setting, by pressing this key.

How to read the displayed setting value

```
H - A - 08
T   T   T
|   |   |
|   |   L--------- Address
|   L------------- A:  Addressable
|                  O:  Only (talk only)
L----------------- H:  HEADER ON
                   -:  HEADER OFF
```

Softkey menu

GPIB

HEADER
ONLY
ADR UP
ADR DOWN

Explanation on the Softkey menu

① HEADER
Sets whether to add the header when sending data through the GPIB. 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 GPIB 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.

4.7.2 Status Lamps

The following four LEDs indicate the GPIB status.

① SRQ : Lights while this analyzer is transmitting the service request signal onto the GPIB 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 / ADDRESS] key are disabled while this LED is on.
This LED turns off by pressing the [LOCAL / ADDRESS] key. (When the universal command LLO "Local LockOut" is not set.)

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 softkey menu appears by pressing this key.

Softkey menu

INS PRESET

PRESET
SELF TEST

Explanation on the Softkey menu

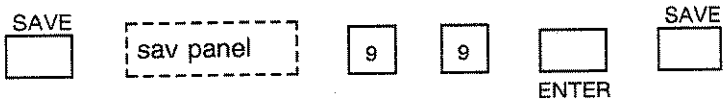
① PRESET
Initializes the panel setting of this analyzer. The following table shows the initial status.

Table 4-6 Initialization Using INSTR PRESET

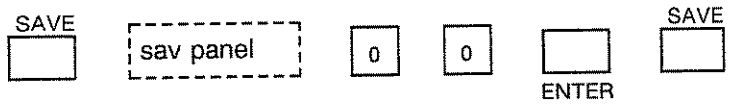
Item		Description
①	CENTER	700nm, APC: OFF
②	SPAN	700nm (350nm to 1050nm)
③	REF LEVEL	0dBm, HI-SENS: OFF, LASER mode, AUTO: OFF
④	LEVEL SCALE	LOG, 5dB/DIV
⑤	Analysis data type	Spectrum analysis (wavelength domain), Normal Resolution
⑥	AVERAGE	OFF, NORMAL mode
⑦	ZOOM	All OFF
⑧	Measurement	STOP state
⑨	Cursor	All OFF, NORMAL mode
⑩	Display	Single-screen, grid ON
⑪	Normalize	All OFF
⑫	Spectral width calculation	"Pk.–XdB" XdB: 3dB; YdB: 20dB K: 1.0, Kr (RMS): 2.3548
⑬	CURVE FIT	OFF
⑭	List display	OFF, YdB; 20dB
⑮	Output device	Plotter (DATA: ALL, PAPER ADV: OFF, SIZE: A4(H1)) Printer (MENU OUT: OFF)
⑯	CLOCK display	ON
⑰	Buzzer	BEEP, WARNING: ON, QUIET: OFF
⑱	Label	** ADVANTEST Q8347 Optical Spectrum Analyzer **
⑲	Power monitor	λ: 1550nm, N-MAX: 101, INTERVAL: 0.1s, REF LEVEL: 0dB
⑳	Wavelength monitor	λ: 1550nm, N-MAX: 101, INTERVAL: 1s
㉑	color	PATTERN 1
㉒	CAL	CAL VALID: OFF, VAC mode
㉓	Floppy	format: 2DD, volume: Q8347

Note: Other items are not modified on initialization.

When modifying the initial state, press the keys in the following sequence:



With this operation, the current panel condition setting is stored as the initial setting.
After the initial state has been modified with the above operation, it can be reset by pressing the following keys in the sequence shown.



② SELF TEST

Used to execute the self diagnosis function.

The LCD 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.)

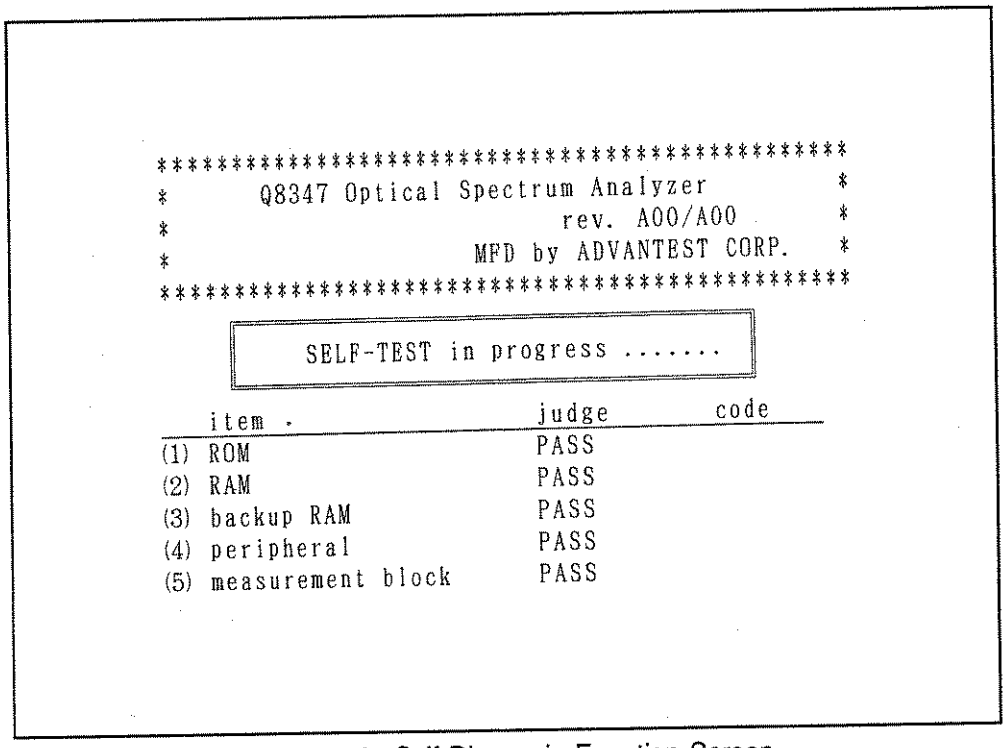


Figure 4-18 Self Diagnosis Function Screen

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

4.8.2 CAL Key

This key is used to calibrate the analyzer level.
Before pressing this key, enter a light source having a single spectrum and accurately determined level into the analyzer and execute measurement.
When this key is pressed, the following Softkey menu appears.

Softkey menu

CAL

LEVEL (SP)
LEVEL (PW)
VAC/AIR
EXECUTE
CAL VALID

Explanation on the Softkey menu

① 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.

② 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.

③ VAC/AIR

Used to select whether the measured wavelength is displayed for the conditions in vacuum or air. (The initial setting is VAC.)

The wavelength of the He-Ne laser (reference light source) can be displayed for conditions in vacuum (632.9914nm) or air (632.8164nm) by selecting in the analyzer.

④ EXECUTE

This key is used to execute level calibration. The level calibration data is determined by the difference between the level data entered in step ① and the peak level measured.

If the value of the level calibration data exceeds ±9.9dB, a WARNING sound is heard when this key is pressed and "illegal level data input!!" appears.

⑤ CAL VALID

This key is used to make the level calibration data valid. The calibration data is valid when the characters "CAL VALID" are reversed. When measurement is executed, this calibration data is added to the level displayed.

When this key is pressed again, the calibration data is made invalid and only the data stored when the analyzer was shipped is used for measurement.

Once calibration is executed the level calibration data determined during calibration is stored in the internal backup memory.

<A typical level calibration operation>

- Enter a light source having a known level and single spectrum into the analyzer and execute spectrum measurement (at this time, execute measurement in "LASER" mode with "CAL VALID" OFF).
- If the known level is -5.8dBm, press the following keys in the sequence shown.

SAVE [ ] LEVEL (SP) [-] [5] [.] [8] [ ] dBm

- Execute calibration using the EXECUTE Softkey, then press CAL VALID to validate the calibration data.

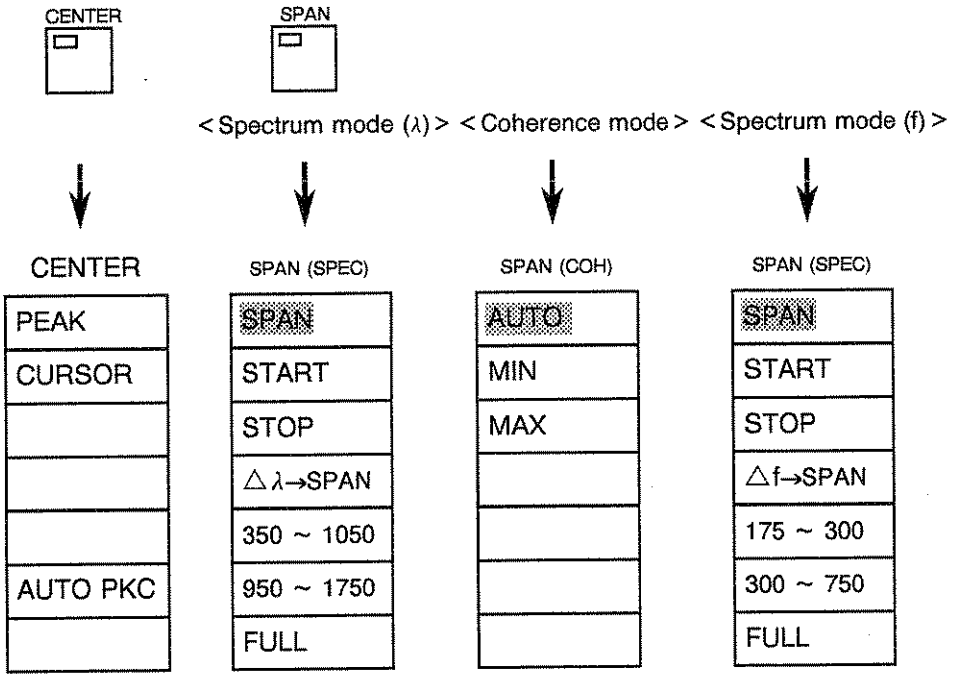
5. EXPLANATION ON FUNCTIONS

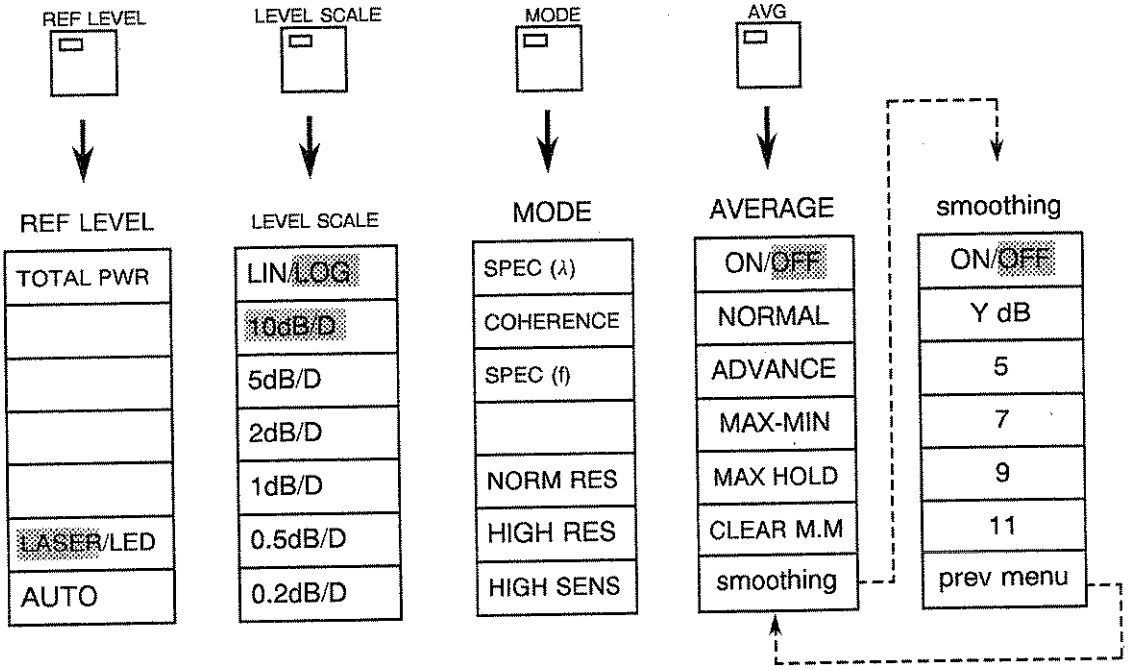
Section 5.1 lists the Softkey menus and section 5.2 describes the key functions and corresponding Softkey operations.

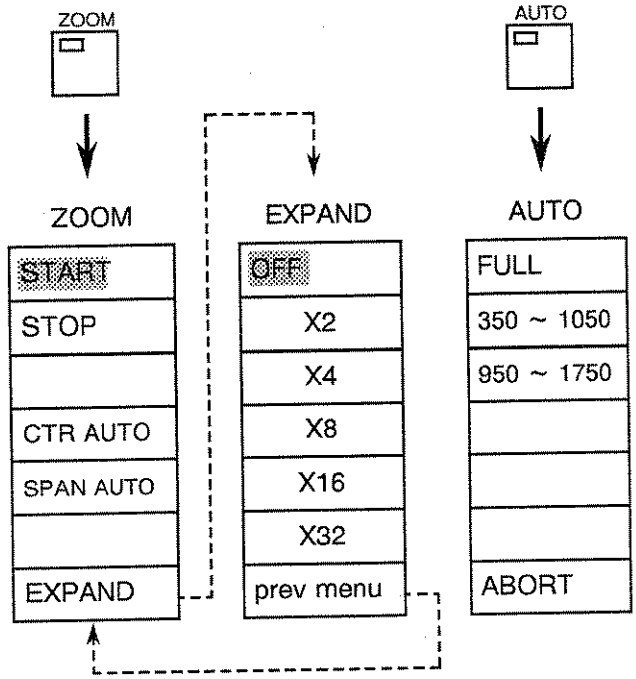
5.1 List of Softkey Menus

The Softkey menus are listed below according to the corresponding hardkeys.

(1) FUNCTION section







(2) CURSOR section

CURSOR ON/OFF

When [ ] is ON

CURSOR

NORMAL
△ MODE
2ND PEAK
POWER
LEFT PK
RIGHT PK

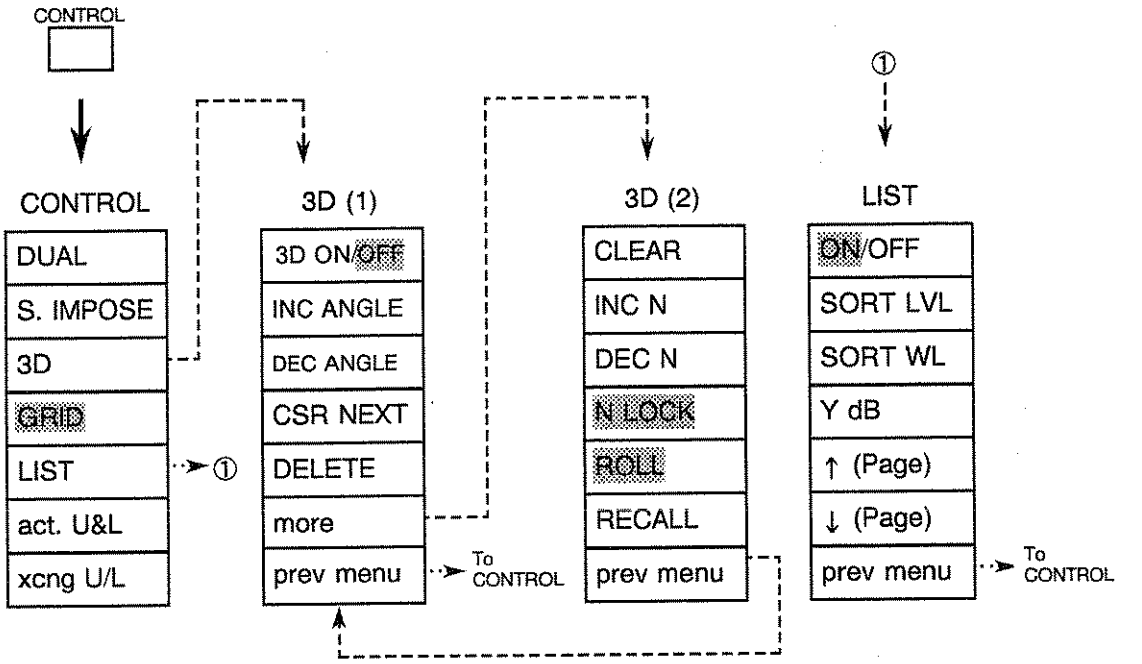
(3) DATA section

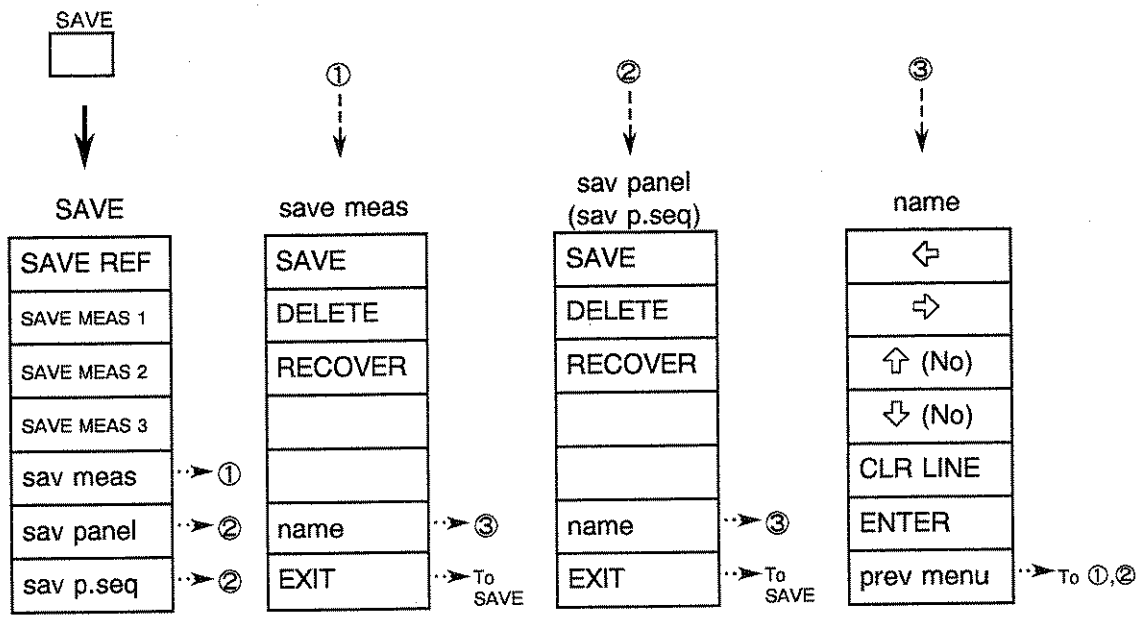
LABEL

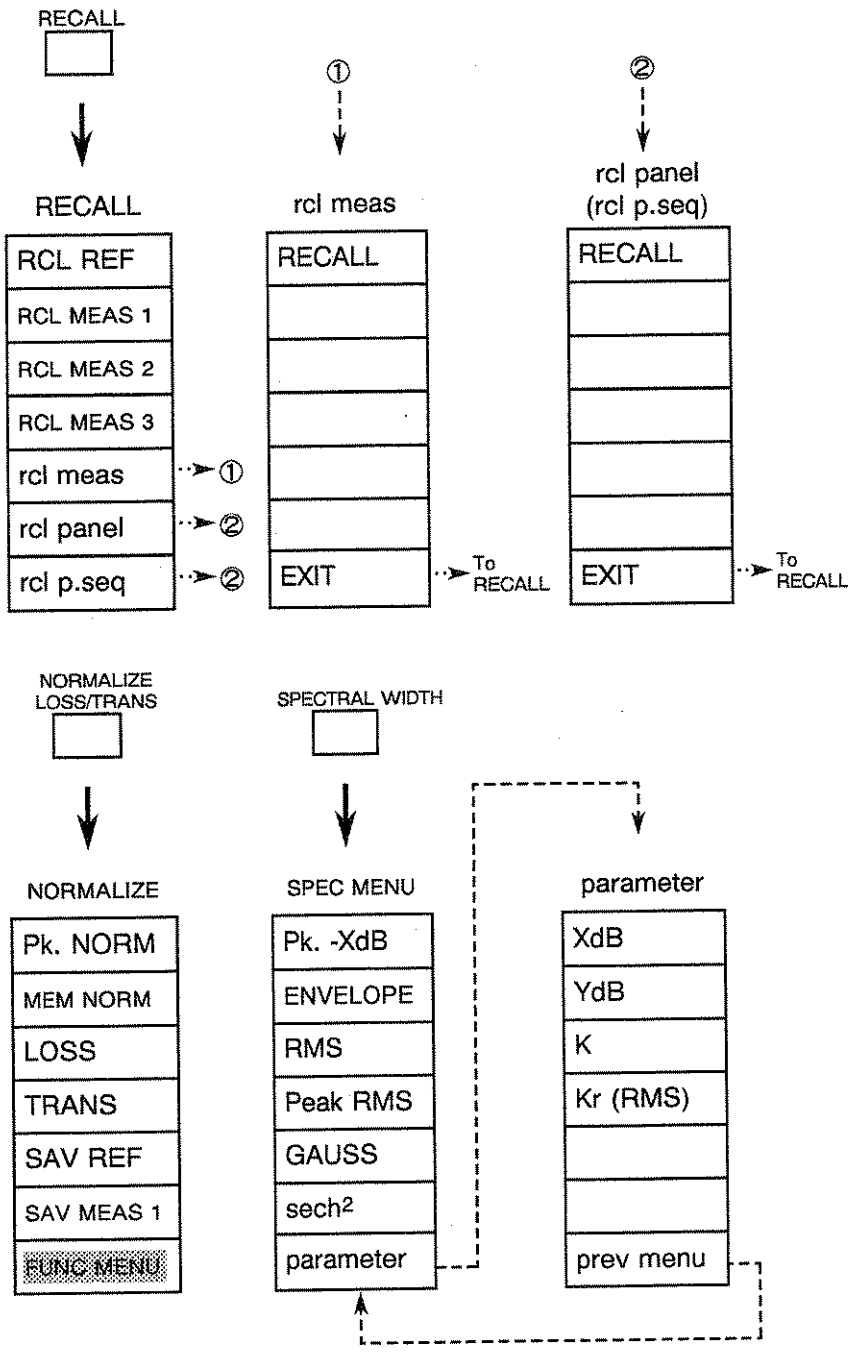
LABEL

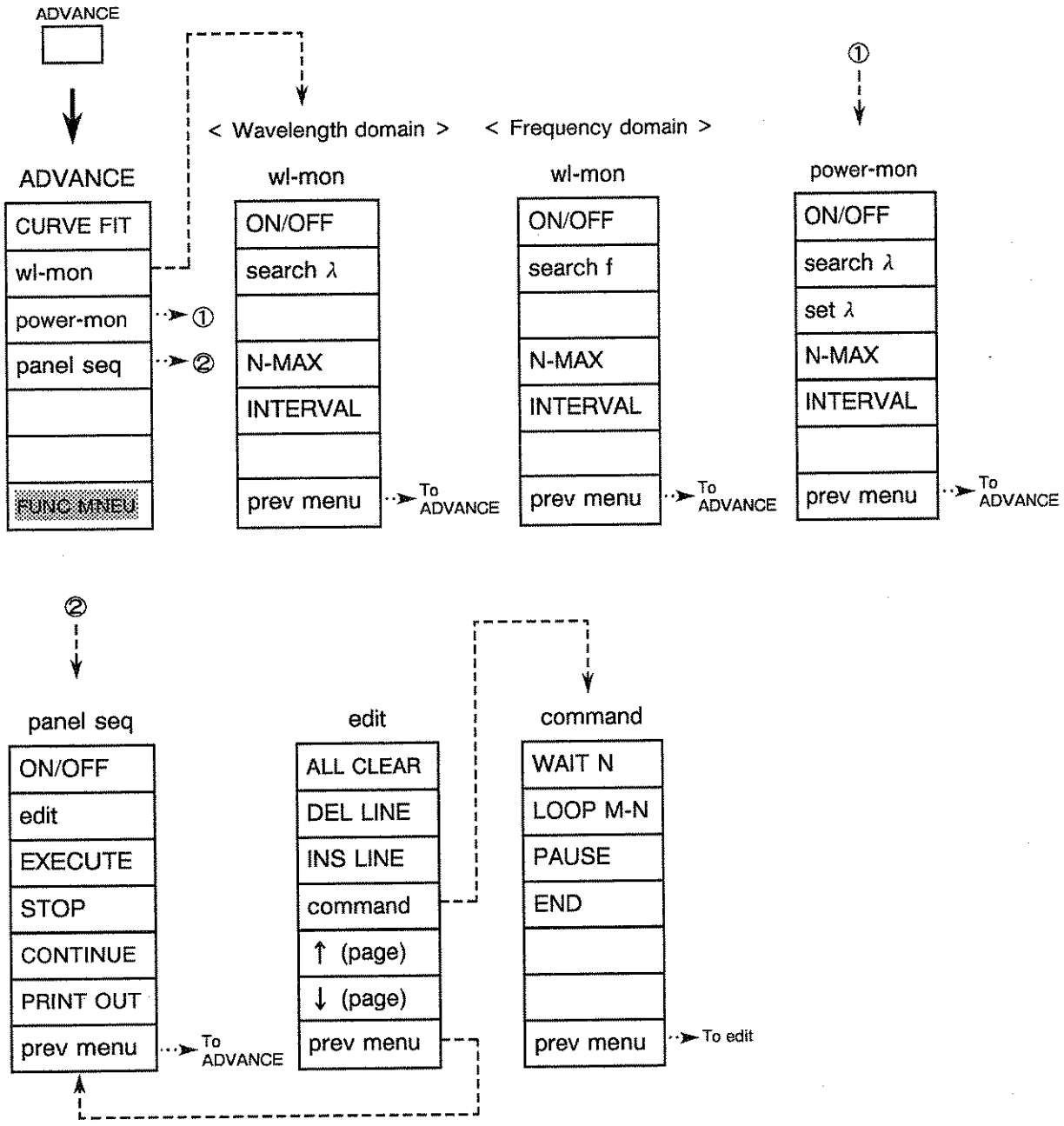
⇦
⇨
DEL CHR
INS SP
CLR LINE
ENTER
UNDO

(4) DISPLAY section

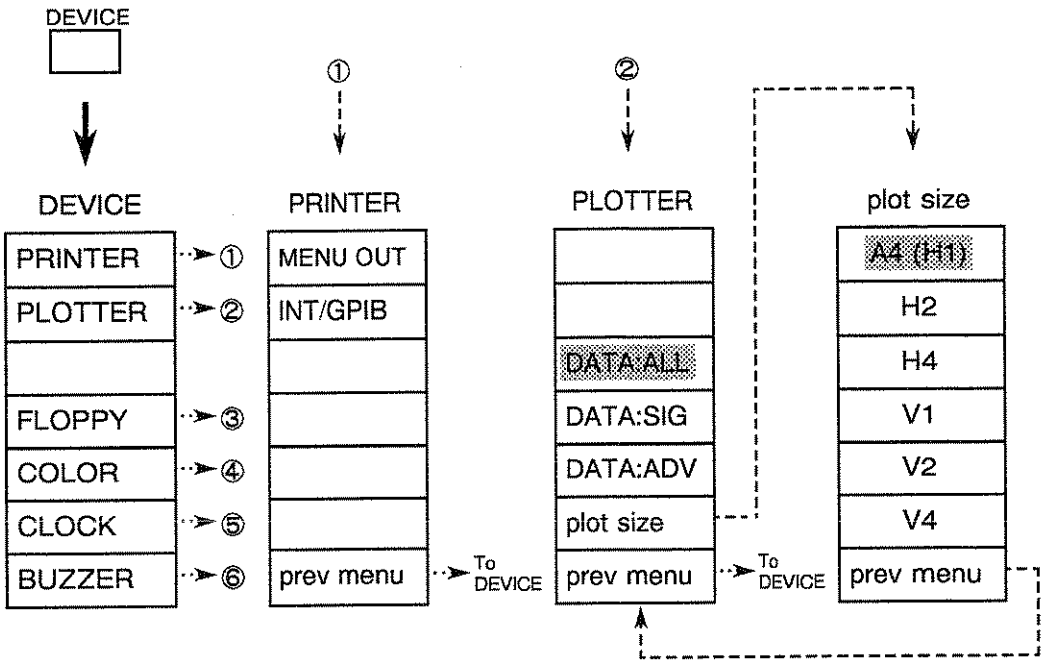


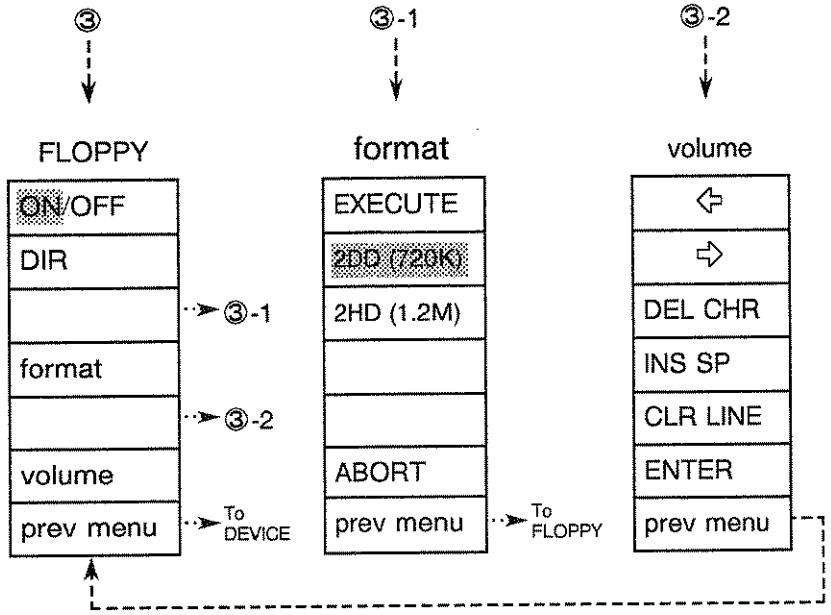


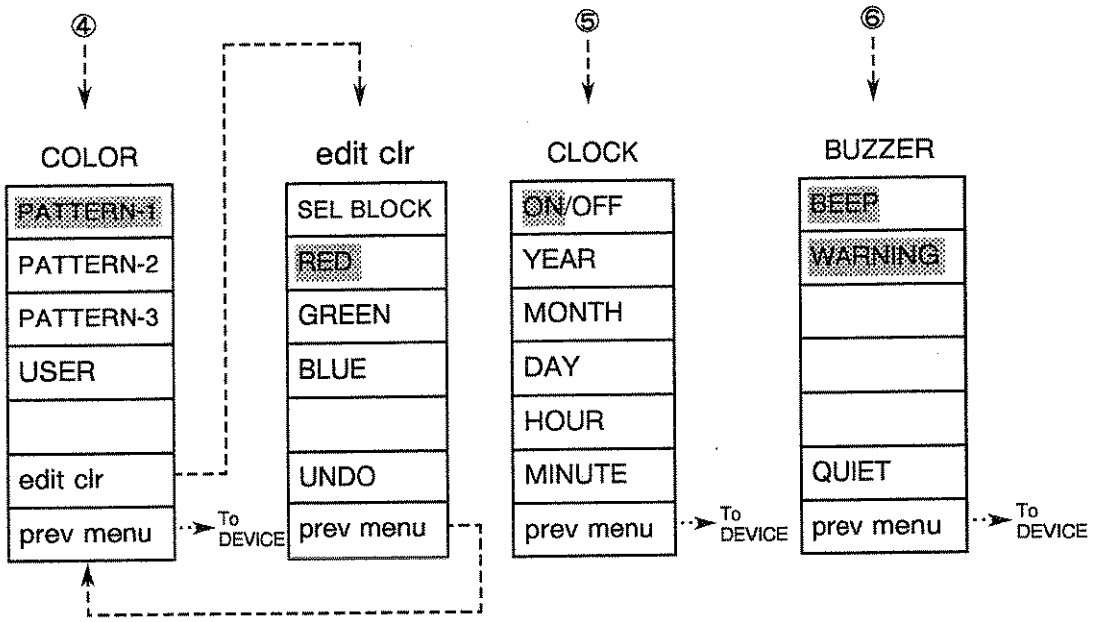




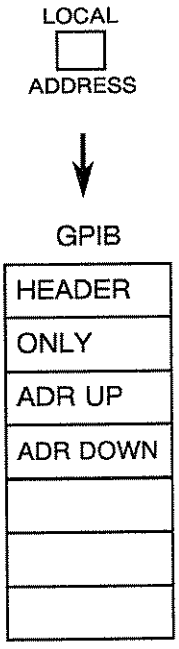
(5) DATA OUT section



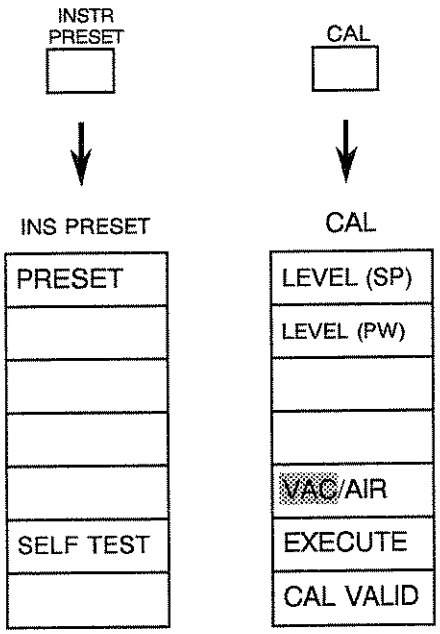




(6) GPIB section



(7) Others



5.2 Key Function and Corresponding Softkey Menus

The hardkey functions can be divided into the following three types: functions executed immediately after the keys are pressed; functions to display corresponding Softkey menus when the keys are pressed; and functions to load setting data.
The Softkeys also function as: keys for executing corresponding functions immediately after the keys are pressed, keys for selecting particular functions, keys for displaying Softkey menus of lower nodes and others. (Normally, keys represented by lower case alphabets are used to display Softkey menus or lower or upper nodes.)
The knob is used to specify a particular function such as CENTER, SPAN and REF LEVEL or to move cursors. If the LED of the key corresponding to the cursor is ON, cursor movement has priority.

5.2.1 FUNCTION Section

This section consists of keys which are used to specify the basic measurement conditions of the optical spectrum analyzer.

Specifies the center wavelength for analysis.
Numeric keys, rotry knob, arrow keys and Softkeys can be used.

<Softkey menu>

PEAK	Specifies the peak level wavelength as the center wavelength.
CURSOR	Specifies the wavelength at the cursor positions as the center wavelength. If two cursors are displayed on the screen, the wavelength at the intermediate position is specified as the center wavelength.
AUTO PKC	Switches ON/OFF the APC function which automatically sets the peak wavelength as the center wavelength at the end of measurement.

Specifies the wavelength span, and start/stop wavelengths analysis.
Numeric keys, knob, arrow keys and Softkeys can be used.
The Softkey menu in Spectrum mode is different from that in Coherence mode.

<Softkey menu> Spectrum mode (Wavelength domain)

SPAN	Specifies the wavelength span for analysis.
START	Specifies the start wavelength.
STOP	Specifies the stop wavelength.
△λ→SPAN	Specifies the area between the two wavelength (X) cursors as the span.
350 ~ 1050	Specifies the short wavelength (700nm from 350nm to 1050nm) as the span.
950 ~ 1750	Specifies the long wavelength (800nm from 950nm to 1750nm) as the span.
FULL	Specifies the maximum span (1400nm from 350nm to 1750nm).

<Softkey menu> Coherence mode

AUTO	The span determined by the spectrum analysis is automatically set.
MIN	Minimum set for the coherent length analysis span.
MAX	Maxmum set for the coherent length analysis span.

<Softkey menu> Spectrum mode (Frequency domain)

SPAN	Specifies the analysis frequency.
START	Specifies the start frequency.
STOP	Specifies the stop frequency.
△f→SPAN	Specifies the area between the two frequency (X) cursors as the span.
175 ~ 300	Specifies 175THz to 300THz as the span.
300 ~ 750	Specifies 300THz to 750THz as the span.
FULL	Specifies 171.3THz to 856.5THz (350μm to 1750μm).

REF LEVEL

Specifies the input sensitivity.
Numeric keys, knob, arrow keys and Softkeys can be used.

<Softkey menu>

TOTAL PWR	The total (power) spectra measured is set as the REF LEVEL.
LASER/LED	Selects the light to be measured. The level unit is /nm when LED is selected.
AUTO	Selects the mode in which the optimum REF LEVEL is set in accordance with the input signal. ON/OFF operation (Reversed/Normal display)

LEVEL SCALE

Switches between linear and logarithm and sets the scale for logarithm.
Numeric keys, knob arrow keys and Softkeys can be used.

<Softkey menu>

LIN/LOG	Switches between Linear/Log display.
10dB/D	Specifies 10dB/DIV for the log scale.
5dB/D	Specifies 5dB/DIV for the log scale.
2dB/D	Specifies 2dB/DIV for the log scale.
1dB/D	Specifies 1dB/DIV for the log scale.
0.5dB/D	Specifies 0.5dB/DIV for the log scale.
0.2dB/D	Specifies 0.2dB/DIV for the log scale.

MODE

Selects the Spectrum/Coherence analysis mode.
Selects the high-resolution/normal-resolution resolution mode.
Softkeys can be used.

<Softkey menu>

SPEC (λ)	Selects spectrum analysis mode (wavelength domain).
COHERENCE	Selects coherence analysis mode.
SPEC (f)	Selects spectrum analysis mode (frequency domain).
NORM RES	Selects normal-resolution mode.
HIGH RES	Selects high-resolution mode.
HIGH SENS	Switches ON/OFF the mode which decelerates the internal moving mirror speed, decreases the frequency range and lowers the noise level.

AVG

Specifies the number of averaging times and controls ON/OFF switching of averaging. Numeric keys, rotry knob, arrow keys and Softkeys can be used.

<Softkey menu>

ON/OFF	Starts averaging. Processing stops if the key is pressed during averaging.
NORMAL	Averages measured data.
ADVANCE	Performs an advanced average for S/N improvement.
MAX-MIN	Holds the maximum and minimum spectrums.
MAX HOLD	Holds the maximum spectrum.
CLEAR M.M	Clears the data obtained in MAX-MIN and MAX HOLD modes.
smoothing	Selects smoothing.

ON/OFF
Y dB
5
7
9
11
prev menu

ZOOM

This key is used to re-analyze previous measurement data under different wavelength conditions (HOLD-ZOOM processing). Analysis can be executed without re-measuring at various spans.
The measured data currently displayed can be magnified in the screen.
Softkeys can be used. (This key cannot be used in "REPEAT" mode.)

<Softkey menu>

START	Starts ZOOMing under the specified wavelength conditions.
STOP	Interrupts current ZOOMing.
CTR AUTO	Selects the mode in which ZOOMing is automatically started when the CENTER wavelength is modified.
SPAN AUTO	Selects the mode in which ZOOMing is automatically started when the span is modified.
EXPAND	Displays the measured data by expanding.

OFF	Set to OFF the expanded display mode.
X2	Expands the data by twice.
X4	Expands the data by 4-fold.
X8	Expands the data by 8-fold.
X16	Expands the data by 16-fold.
X32	Expands the data by 32-fold.
prev menu	Displays the previous softkey menu.

AUTO

The optimum conditions including the wavelength span and level are automatically specified in accordance with the input signal. Softkeys can be used.

<Softkey menu>

FULL	The entire measurement wavelength is searched and the optimum condition specified.
350 ~ 1050	The range from 350nm to 1050nm is searched and the optimum condition specified.
950 ~ 1750	The range from 950nm to 1750nm is searched and the optimum condition specified.
ABORT	Stops execution of the AUTO function.

5.2.2 CURSOR Section

CURSOR ON/OFF

This switch controls cursor display ON/OFF. When ON, the following Softkey menu appears.
The cursor data display format can be selected using the Softkeys.

<Softkey menu>

NORMAL	Mode for displaying wavelength and level at the cursor position as they are.
△MODE	Mode for displaying wavelength and level differences at the cursor position.
2ND PEAK	Mode for displaying wavelength and level differences between the 1st and 2nd peaks.
POWER	Mode for displaying the total levels (Power) between wavelength cursors.
LEFT PEAK	The current wavelength cursor 1 is shifted to the nearest peak on the left.
RIGHT PEAK	The current wavelength cursor 1 is shifted to the nearest peak on the right.

λ1 — Controls ON/OFF switching of wavelength cursor 1.

λ2 — Controls ON/OFF switching of wavelength cursor 2.

L1 — Controls ON/OFF switching of level cursor 1.

L2 — Controls ON/OFF switching of level cursor 2.

Note: The cursors can be shifted when the corresponding LEDs (λ1 , λ2 , L1 and L2) are lit.

5.2.3 DATA Section

This section consists of numeric keys, unit keys and arrow keys used to modify the setting data and a LABEL key for entering comments.

LABEL — Modifies label (comment).
Numeric keys, knob, arrow keys and Softkeys 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	Deletes the character at the cursor position in the label input buffer.
INS SP	Inserts a space at the cursor position in the label input buffer. Data to the right of the cursor is shifted right one character.
CLR LINE	The label input buffer is cleared of all data.
ENTER	Loads the data in the label input buffer as the label data. The label setting mode is released when this key is pressed.
UNDO	The label data is reset to the previous state before the LABEL key was pressed.

Keys which can be used for label modification

- Rotry knob : Moves the cursor in the character menu to the right and left.
- ⇩ ⇧ : Moves the cursor in the character menu up and down.
- BACK SPACE : Deletes a character immediately before the cursor in the label input buffer.
- ENTER : Loads the character at the cursor position in the character menu to the cursor position in the label data.

5.2.4 DISPLAY Section

This section consists of keys for specifying the display format, analyzing measurement data and controlling data memory.

CONTROL

Specifies the display mode.
Softkeys can be used.

<Softkey menu>

- DUAL — Controls ON/OFF switching of the dual-screen mode.
- S.IMPOSE — Controls ON/OFF switching of the superimpose mode.
- 3D — Specifies ON/OFF switching of the 3-dimensional mode and display condition.
  - 3D ON/OFF — Controls ON/OFF switching of the 3-dimensional mode.
  - INC ANGLE — Increases the display angle one step (15°) (maximum +75°).
  - DEC ANGLE — Decreases the display angle one step (15°) (minimum –75°).
  - CSR NEXT — Moves the cursor to the next measurement data.
  - DELETE — Deletes the latest measurement data.
  - more — Displays the next Softkey menu.
    - CLEAR — Clears all 3-dimensional display data.
    - INC N — Increases the maximum number of display data by +1 (maximum: 16).
    - DEC N — Decreases the maximum number of display data by –1 (minimum: 2).
    - N LOCK — Specifies whether or not to stop measurement when the maximum number of data has been measured.
    - ROLL — Controls ON/OFF switching of the ROLL display mode (older data is deleted when the maximum number of display data is exceeded).
    - RECALL — Recalls and displays the previous 3-dimensional display data.
    - prev menu — Displays the preceding Softkey menu.
  - prev menu — Displays the preceding Softkey menu.

GRID	Controls ON/OFF switching of the grid in the data display area.
LIST	Lists the peak data of the measured data.

ON/OFF	Selects ON or OFF for listing display.
SORT LVL	Sorts the listed data in the order in which level is large.
SORT WL	Sorts the listed data in the order in which wavelength is short.
Y dB	Sets the value of the peak threshold level. (Initial value is 20dB.)
↑ (page)	Displays the previous page of the list.
↓ (page)	Displays the next page of the list.
prev menu	Displays the previous Softkey menu.

act U&L	Controls ON/OFF (Reversed/Normal display) switching of the mode used to modify the data in both the upper and lower screens in dual-screen mode.
xcng U/L	Replaces upper screen data with lower screen data in dual-screen mode.

SAVE

Saves measurement data and panel condition settings in the internal memory or floppy disk.
SAVE Numeric keys, rotry knob, arrow keys and Softkeys can be used.

<Softkey menu>

SAV REF	Saves the current measurement data in the reference memory.
SAV MEAS1	Saves the current measurement data in measurement data memory 1.
SAV MEAS2	Saves the current measurement data in measurement data memory 2.
SAV MEAS3	Saves the current measurement data in measurement data memory 3.
sav meas	Saves the current data in one of measurement data memories 1 to 16 or the floppy disk. When this key is pressed, the measurement data memory or file directory is displayed.

SAVE	Saves the current measurement data in the memory number (file name) selected.
DELETE	Deletes data from the memory number (file) selected.
RECOVER	Recovers the memory (file) deleted with the DELETE key.
name	Specifies a particular memory name (file name) separate from the memory number. When this key is pressed, the character menu for memory name (file name) is displayed (the memory name or the file name can contain up to 10 characters).

⇦	Moves the memory name (file name) input cursor to the left one character.
⇨	Moves the memory name (file name) input cursor to the right one character.
⇧ (No)	Selects the preceding memory number (file).
⇩ (No)	Selects the next memory number (file).
CLR LINE	Clears the memory name (file name) entered.
ENTER	Specifies the data in the input buffer as the memory name (file name).
prev menu	Displays the preceding Softkey menu.

EXIT	Returns to normal mode from measurement data save mode. The measurement data memory (or file) directory is replaced with the normal measurement data on the screen.

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sav panel — Saves the current panel condition in one of the condition setting memories 1 to 10 or the floppy disk.
When this key is pressed, the condition setting memory or condition setting file directory is displayed.

- SAVE — Saves the current panel condition in the memory number (file name) selected.
- DELETE — Deletes data from the memory number (file) selected.
- RECOVER — Recovers the memory (file) deleted with the DELETE key.
- name — Specifies a particular memory name (file name) separate from the memory number.
  When this key is pressed, the character menu for memory name (file name) input is displayed (the memory name or the file name can contain up to 10 characters.)
  - ⇦ — Moves the memory name (file name) input cursor to the left one character.
  - ⇨ — Moves the memory name (file name) input cursor to the right one character.
  - ⇧ (No) — Selects the preceding memory number (file).
  - ⇩ (No) — Selects the next memory number (file).
  - CLR LINE — Clears the memory name (file name) entered.
  - ENTER — Specifies the data in the input buffer as the memory name (file name).
  - prev menu — The preceding Softkey menu is displayed.
- EXIT — The system returns to normal mode from panel condition setting save mode.
  The panel condition setting directory is replaced with the normal measurement data on the screen.

sav p.seq — Saves the current panel sequence setting data in one of the panel sequence setting memories 1 to 10 or the floppy disk.
When this key is pressed, the panel sequence setting memory (or file) directory is displayed.

- SAVE — Saves the current panel sequence setting data in the memory number (file name) selected.

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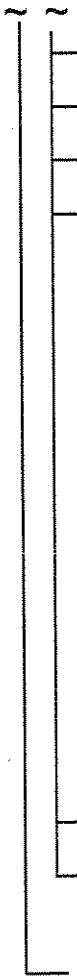

DELETE	Deletes data from the memory number (file) selected.
RECOVER	Recovers the memory (file) deleted with the DELETE key.
name	Specifies a particular memory name (file name) separate from the memory number. When this key is pressed, the character menu for memory name (file name) input is displayed (the memory name or the file name can contain up to 10 characters.)
⇦	Moves the memory name (file name) input cursor to the left one character.
⇨	Moves the memory name (file name) input cursor to the right one character.
⇧ (No)	Selects the preceding memory number (file).
⇩ (No)	Selects the next memory number (file).
CLR LINE	Clears the memory name (file name) entered.
ENTER	Specifies the data in the input buffer as the memory name (file name).
prev menu	The preceding Softkey menu is displayed.
EXIT	The system returns to normal mode from panel sequence setting data save mode. The panel sequence setting data directory is replaced with the normal measurement data on the screen.

Keys which can be used in 'sav meas', 'sav panel' and 'sav p.seq' functions:

- Rotry knob : ① Selects a memory number (file) in the directory window.
  ② Moves the cursor in the character menu to the left and right.
- ⇩ ⇧ : ① Selects a memory number (file) in the directory window.
  ② Moves the cursor in the character menu up and down.
- BACK SPACE : Deletes the character immediately before the cursor in the memory name (file name) data.
- ENTER : Moves the character at the cursor position in the character menu to the cursor position in the memory name (file name) data.

RECALL

Recalls the measurement data and panel condition from the internal memory or the floppy disk. Numeric keys, knob, arrow keys and Softkeys can be used.

<Softkey menu>

RCL REF — Recalls data from the reference memory.

RCL MEAS1 — Recalls data from measurement data memory 1.

RCL MEAS2 — Recalls data from measurement data memory 2.

RCL MEAS3 — Recalls data from measurement data memory 3.

rcl meas — Recalls data from one of the measurement data memories 1 to 16 or the floppy disk.
When this key is pressed, the current measurement data memory (or file) directory is displayed.

- RECALL — Recalls data from the memory number (file) selected.
  After the data is recalled, the directory information is replaced with the normal measurement data on the screen.
- EXIT — The system is reset to normal mode from measurement data recall mode. The measurement data memory (or file) directory is replaced by the normal measurement data on the screen.

rcl panel — Recalls the panel condition setting from one of memories 1 to 10 or the floppy disk.
When this key is pressed, the directory information from the current panel condition setting or the panel condition setting file is displayed.

- RECALL — Recalls the panel condition setting from the memory number (file) selected.
  After recall is executed, the directory information is replaced by the normal measurement data on the screen.
- EXIT — The system is reset to normal mode from the panel condition setting recall mode. The panel condition setting directory is replaced by the normal measurement data on the screen.

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rcl p.seq	Recalls the panel sequence setting data from one of memories 1 to 10 or the floppy disk. When this key is pressed, the directory information from the current panel sequence setting memory or the file is displayed.
RECALL	Recalls the panel sequence setting data from the memory number (file) selected. After recall is executed, the directory information is replaced by the normal measurement data on the screen.
EXIT	The system is reset to normal mode from the panel sequence setting data recall mode. The panel sequence setting data directory is replaced by the normal measurement data on the screen.

Keys which can be used in 'rcl meas', 'rcl panel' and 'rcl p.seq' modes

- Rotry knob : Selects a memory number (file) in the directory window.
- ⇩ ⇧ : Selects a memory number (file) in the directory window.

NORMALIZE
LOSS/TRANS

Normalizes the measurement data with the saved reference memory or the maximum measurement data value and displays the results.

<Softkey menu>

Pk.NORM	Specifies the mode for normalizing the measurement data with the maximum level value and displays the results.
MEM NORM	Selects data to be calculated from the reference memory. Measurement data memory 1 (Reversed display) or measurement data (Normal display). This function is not enabled (reversed) unless both reference memory and measurement data memory 1 are stored. When the function is ON (reversed), "LOSS" is automatically selected.
LOSS	Specifies the calculation/display mode of loss characteristics (REF/MEAS or REF/MEAS-MEM1). When 'MEM NORM' is OFF (normal display), the loss characteristics mode and normal modes are reversed each time this key is pressed. The LOSS mode is switched off when 'TRANS' is pressed. If no data is found in the reference memory (REF) or the wavelength condition of the reference memory differs from the current one, key operation is ignored.
TRANS	Specifies the calculation/display mode of transparency characteristics (MEAS/REF or MEAS-MEM1/REF). When 'MEM NORM'is OFF (normal display), the transparency characteristics and normal modes are reversed each time this key is pressed. The 'TRANS' mode is switched off when 'LOSS' is pressed. If no data is found in the reference memory (REF) or the wavelength condition of the reference memory differs from the current one, key operation is ignored.
SAV REF	Saves the current measurement data in the reference memory.
SAV MEAS1	Saves the current measurement data in measurement data memory 1.
FUNC MENU	Controls whether or not to modify the Softkey menu when a FUNCTION key section is pressed. The Softkey menu is modified when this key is ON (reversed).

SPECTRAL WIDTH

Executes spectral width calculation and displays the results.
The following four types of calculation are available.

<Softkey menu>

Pk.–XdB	Calculates the spectral width using the XdB method and displays the results.
ENVELOPE	Calculates the spectral width using the Envelope method and displays the results.
RMS	Calculates the spectral width using the RMS method and displays the results.
Peak RMS	Calculates the spectral width using the Peak RMS method and displays the results.
GAUSS	Calculates the spectral width using the Gaussian method and displays the results.
sech^2	Calculates the spectral width using the sech^2 method and displays the results.
parameter	Specifies the parameters required for spectral width calculation.

XdB	Specifies the downward level difference X from the peak (the initial value is 3dB).
YdB	Specifies the peak threshold level Y (the initial value is 20dB).
K	Specifies the value of factor K for multiplying the spectral width calculated (the initial value is 1.0).
Kr(RMS)	Specifies the value of multiplication factor Kr when RMS and Peak RMS methods are used (the initial value is 2.3548).
prev menu	The preceding Softkey menu is displayed.

FUNC MENU	Controls whether or not to modify the Softkey menu when a FUNCTION key is pressed.

ADVANCE

This key is used when executing advanced wavelength analysis.

<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.
- wl-mon — Used to select the power wavelength display function. This key displays the following soft key menu.
  - ON/OFF — Sets the wavelength monitor display ON/OFF.
  - search λ (search f) — Measures the center wavelength (center frequency) for starting wavelength monitor operation. It is specified as the center wavelength of trend display.
  - N-MAX — Sets the number of measurement points of the trend display under the wavelength monitor display mode. Press this key, and then enter the value by using numeric keys, rotary knob or arrow keys. (Initial value is 101.)
  - INTERVAL — Sets the data sampling interval in the wavelength monitor display. Same as the measurement interval in trend display. (Initial value is 1 sec.)
  - prev menu — Displays the previous soft key menu.
- 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 — Sets the wavelength in the power monitor operation. Press this key, and then enter the value by using numeric keys, rotary knob or arrow keys. (Initial value is 1550nm.)
  - N-MAX — Sets the number of measurement points of the trend display under the power monitor display mode. Press this key, and then enter the value by using numeric keys, rotary knob or arrow keys. (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.

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panel seq	This used for selection of the panel sequence function. Following soft menu is displayed by this key.
ON/OFF	ON and OFF of programming list of the panel sequence are displayed.
edit	This is used for programming.
ALL CLEAR	This is used for the clear of all the program list.
DEL LINE	This is used for the deletion of the set line by cursor in the program list.
INS LINE	This is used for the insertion of the set line by cursor in the program list.
command	This is used for the set when the program command is used.
WAIT N	This is used for the set of the waiting time for next instruction command.
LOOP M-N	This is used for the repetition of the panel sequence.
PAUSE	This is used for the stop of the panel sequence.
END	This is used for the finishing of the panel sequence.
prev menu	This is displayed previous Softkey menu.
↑ (page)	Page in the display of the program list is moved to the previous page.
↓ (page)	Page in the display of the program list is moved to the next page.
prev menu	This is displayed previous Softkey menu.
EXECUTE	This is used for the execution of the panel sequence.
STOP	This is used for stop of the panel sequence under way.
CONTINUE	This is used for the re-start of the panel sequence that is interrupted by PAUSE.
PRINT OUT	This is used for print out of the programming list.
prev menu	This is displayed previous Softkey menu.
FUNC MENU	Controls whether or not to modify the Softkey menu when a FUNCTION key is pressed.

5.2.5 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 or not to output the Softkey menu to the printer.
  - INT/GPIB — Select either internal printer or external printer.
  - prev menu — Displays the preceding Softkey menu.
- PLOTTER — Selects a GPIB plotter as the output device.
  - DATA: ALL — Uses all the information displayed on the LCD display for plotting.
  - DATA: SIG — Specifies only the waveform data displayed on the LCD display for plotting.
  - PAPER ADV — Specifies ON/OFF switching of the automatic paper feeder.
  - plot size — Specifies plot size (the number of plottings on a single sheet; horizontally or vertically).
    - A4(H1) — Executes one horizontal plotting on A4 paper.
    - H2 — Executes two horizontal plottings on A4 paper.
    - H4 — Executes four horizontal plottings on A4 paper.
    - V1 — Executes one vertical plotting on A4 paper.
    - V2 — Executes two vertical plottings on A4 paper.
    - V4 — Executes four vertical plottings on A4 paper.
    - prev menu — Displays the preceding Softkey menu.
  - prev menu — Displays the preceding Softkey 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/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.
    - prev menu — Displays the previous soft key menu.
  - prev menu — Displays the previous soft key menu.

- COLOR — Used to change the display color pattern or to customize the display color.
  - PATTERN-1 — Selects display color pattern 1.
  - PATTERN-2 — Selects display color pattern 2.
  - PATTERN-3 — Selects display color pattern 3.
  - USER — Selects the customized display color.
  - edit clr — Changes the display color.
    - SEL BLOCK — Selects the display block of which color is to be changed.
    - RED — Changes the depth of red.
    - GREEN — Changes the depth of green.
    - BLUE — changes the depth of blue.
    - UNDO — Resets the each color depth to the former condition when the SEL BLOCK is pressed once to select the item of which display color is to be changed.
    - prev menu — Display the previous softkey menu.
  - prev menu — Displays the previous soft key menu.
- CLOCK — Sets the clock (calendar).
  - ON/OFF — Sets the clock dosplay ON/OFF.
  - YEAR — Used to change the year.
  - MONTH — Used to change the month.
  - DAY — Used to change the day.
  - HOUR — Used to change the hour.
  - MINUTE — Used to change the minute. (The second is reset to 0 when the minute is changed.)
  - prev menu — Displays the previous softkey menu.

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BUZZER — Sets the conditions to beep.

- BEEP — Sets whether to beep when the panel keys are pressed.
- WARNING — Sets ON/OFF the warning beep against wrong setting.
- QUIET — Controls the volume of the beep. When set ON (QUIET mode), the beep becomes quieter than normal.
- prev menu — Displays the previous soft key menu.

COPY — Used to start data output.

FEED — Used to start paper feed to the printer.

5.2.6 GPIB Section

This section is used for specifying the GPIB address and switching to local operation.

LOCAL
ADDRESS

Specifies the GPIB address and switching to local operation. LOCAL Switches the system to local operation when the REMOTE lamp is ON, or specifies the GPIB address when the REMOTE lamp is OFF.

<Softkey menu>

HEADER	Specifies whether or not to add a header during data output.
ONLY	Switches between Talk only (valid during plotter output) and addressable mode (to accept address specified from an external controller).
ADR UP	The GPIB address is increased by one.
ADR DOWN	The GPIB address is decreased by one.

5.2.7 Others

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.

CAL

Calibrates the wavelength, level.

<Softkey menu>

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.
VAC/AIR	Selects the wavelength in vacuum or in air.
EXECUTE	Used to execute the calibration.
CAL VALID	Used to enable the calibrated data.

6. GPIB INTERFACE

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

6.1 General

(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 GPIB interface can be used for connecting the analyzer to a controller and other peripheral devices using a simple cable (bus line).

The GPIB 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 GPIB 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 GPIB 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.

- 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.
  EOI (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.

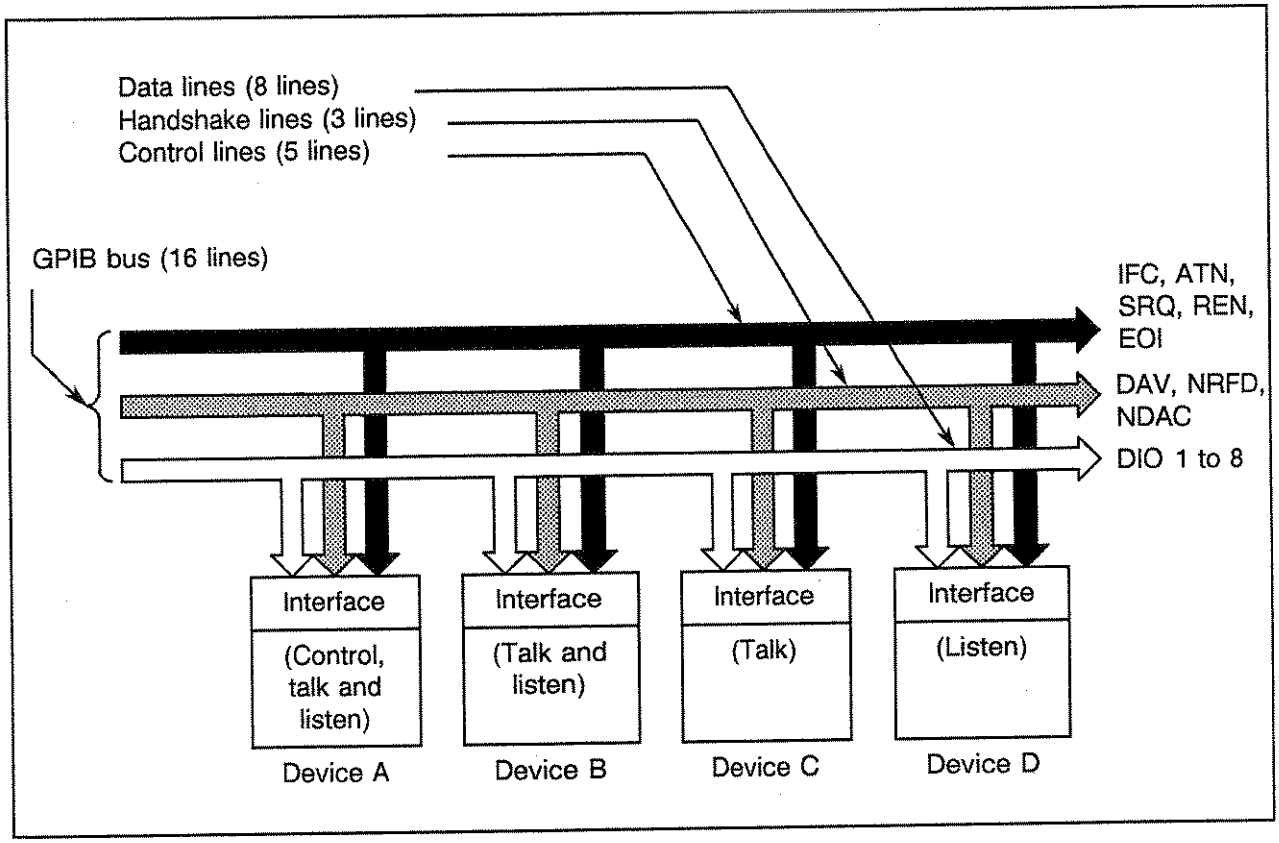


Figure 6-1 Outline of GPIB Interface

6.2 Specifications

6.2.1 GPIB 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 Figure 6-2.

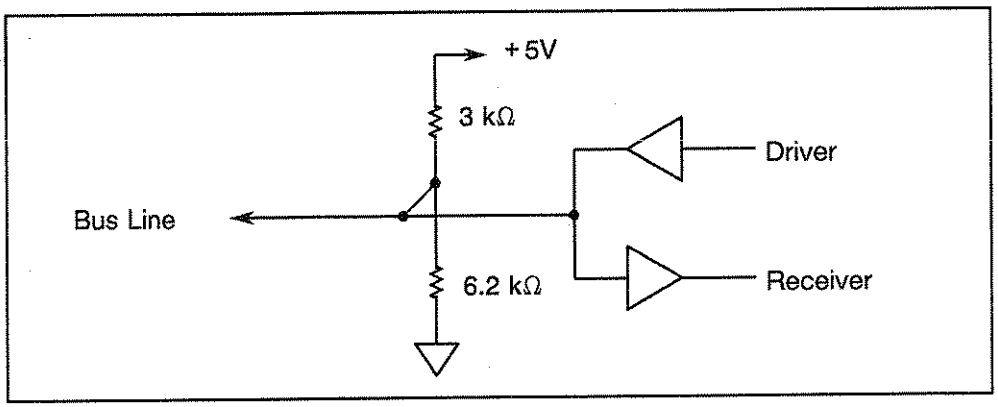


Figure 6-2 Signal Line Terminals

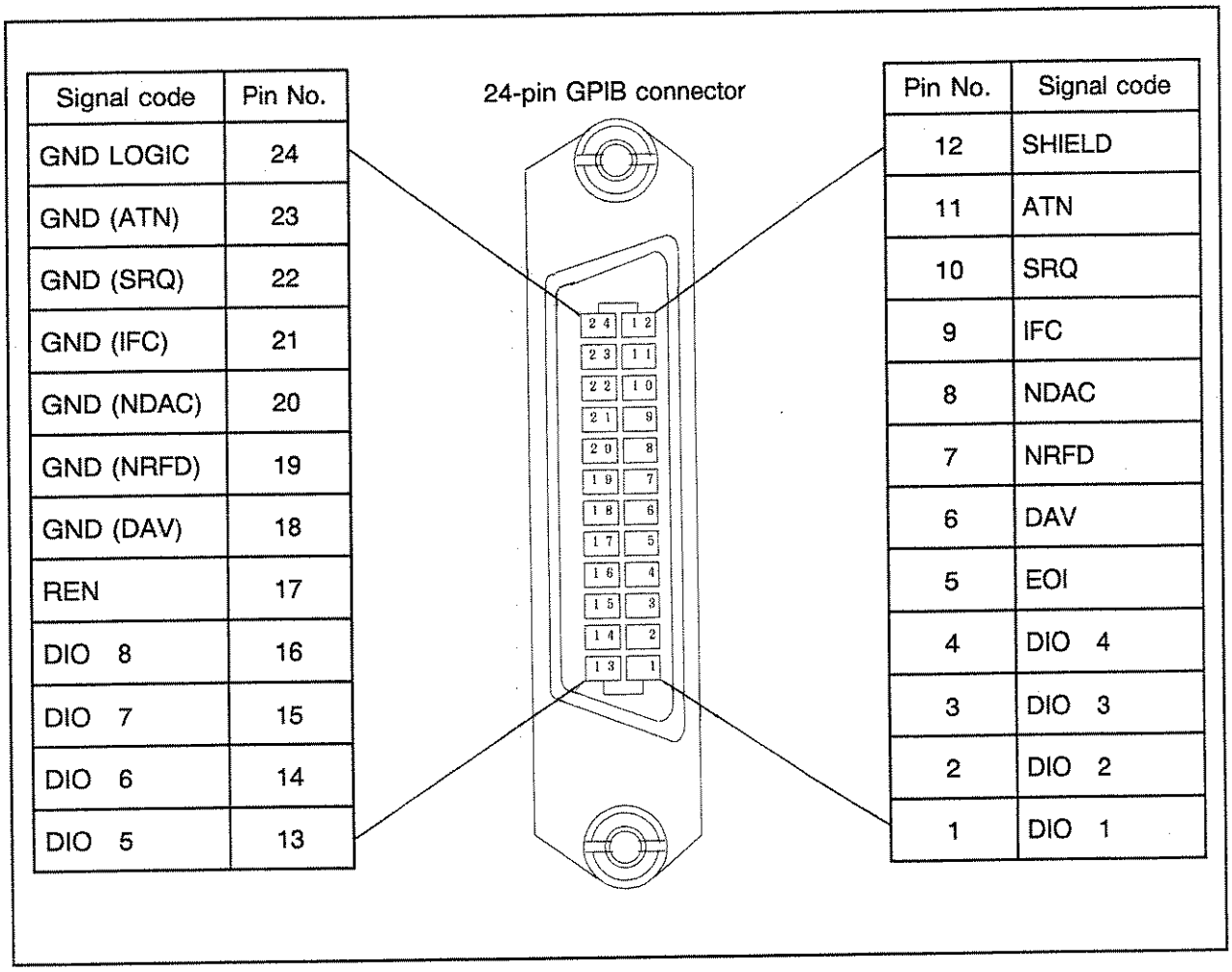
Driver : Three-state type
Output voltage in "Low" state: +0.4 V or below, 48 mA
Output voltage in "High" state: +2.4 V or above, –5.2 mA

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 GPIB connector
57-20240-D35A (Amphenol equivalent)



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

Figure 6-3 GPIB Connector Pin Arrangement

6.2.2 Interface Function

The GPIB 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.

6.3 GPIB Handling

6.3.1 Connecting Other Device

Since the GPIB 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 GPIB Standard Bus Cables (sold separately)

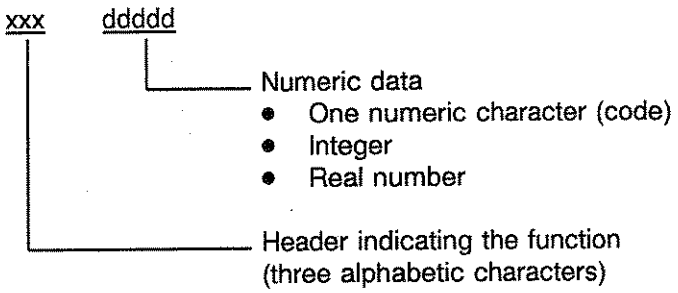
Length	Specification
0.5 m	408JE-1P5
1 m	408JE-101
2 m	408JE-102
4 m	408JE-104

(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.

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

- FUNCTION (1 of 4)

Item		Program code		Contents	Read
		Function header	Setting		
CENTER	CENTER	CEN	Numeric + (unit)	Unit UM: μm (Default) NM: nm THZ: THz (Frequency domain) GHZ: GHz (Frequency domain) 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 MM: mm (Coherence) (*1) THZ: THz (Frequency domain) GHZ: GHz (Frequency domain) THZD: THz/DIV (Frequency domain) GHZD: GHz/DIV (Frequency domain) Example SPA50NM, SPA10.4 mm	○

(*1) : Distance of coherence can be select from 6 types of value within 0.32mm to 10.4mm in the normal-resolution mode or 8 types of value within 1.3mm to 165.9mm in the high-resolution mode. If other value than the type is specified, fractions of the value is counted as a unit. And, an approximate value to the specified one is selected from the multiple of 0.32 and set.

- FUNCTION (2 of 4)

Item		Program code		Contents	Read
		Function header	Setting		
SPAN	START	STA	Numeric + (unit)	Unit UM: μm (Default) NM: nm THZ: THz (Frequency domain) GHZ: GHz (Frequency domain) Example STA0.5UM, STA755nm	○
	STOP	STO	Numeric + (unit)	Unit UM: μm (Default) NM: nm THZ: THz (Frequency domain) GHZ: GHz (Frequency domain) Example STO1.6um, STO805NM	○
	△λ→SPAN (△f→SPAN)	LSP	——	λ1⇌λ2 set to span	×
	350 to 1050 /175 to 300 950 to 1750 /300 to 750	HSP	0, 1	0: 350nm to 1050nm (Wavelength domain) /175THz to 300THz (Frequency domain) 1: 950nm to 1750nm (Wavelength domain) /300THz to 750THz (Frequency domain)	×
	FULL	FSP	——	FULL SPAN (350nm to 1750nm /171.3THz to 856.5THz)	×
	AUTO (COH span)	CAU	0, 1, 2, 3	0: OFF, 1: AUTO, 2:MIN, 3:MAX	○

- FUNCTION (3 of 4)

Item		Program code		Contents	Read
		Function header	Setting		
REF LEVEL	REF LEVEL	REF	Numeric + (unit) (*2)	Unit DBM: dbm (Default) MW: mW, UM: μm NW: nW DB: dB, RU: Example REF-10DBM REF0.1UW	○
	TOTAL PWR	TPL	———	total power to ref level	×
	LASER/LED	LED	0, 1	0: LASER 1: LED	○
	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: 10dB/D 1: 5dB/D 2: 2dB/D 3: 1dB/D 4: 0.5dB/D 5: 0.2dB/D	○
MODE	COHERENCE	COH	0, 1, 2	0: SPECTRUM (Wavelength) 1: COHERENCE 2: SPECTRUM (Frequency)	○
	RESOLUTION	RES	0, 1,	0: NORMAL RESOLUTION 1: HIGH RESOLUTION	○
	HIGH SENSE	HSE	0, 1	0: OFF 1: ON	○

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

- FUNCTION (4 of 4)

Item		Program code		Contents	Read
		Function header	Setting		
AVERAGE	ON/OFF	EAV	0, 1	0: OFF (STOP) 1: ON (START)	○
	AVERAGE	AVG	1 to 1024	Integers Example AVG 16 AVG128	○
	AVERAGE MODE	AVM	0 to 3	0: NORMAL 1: ADVANCE 2: MAX-MIN 3: MAX HOLD	○
	CLEAR M.M	CMM	—	Clear the MAX and MIN buffers when the average mode is MAX-MIN or MAX HOLD.	×
	smoothing	SMO	0, 1	0: OFF 1: ON	○
	smoothing No.	SMN	5 to 15	Only an odd value can be set.	○
	smoothing YdB	SPY	Numeric	Numeric value Setup range: 0.1 to 99.9 (Example) SPY20, SPY35.0	○
ZOOM	START STOP	ZOO	0, 1	0: STOP 1: START	×
	CENTER AUTO	CZO	0, 1	0: OFF 1: ON	○
	SPAN AUTO	SZO	0, 1	0: OFF 1: ON	○
	EXPAND	EXP	0 to 5	0: EXPAND OFF 1: 2-fold 2: 4-fold 3: 8-fold 4: 16-fold 5: 32-fold	○
AUTO		AUT	0 to 3	0: OFF (STOP) 1: FULL SPAN 2: 350nm to 1050nm 3: 950nm to 1750nm	×

- CURSOR

Item		Program code		Contents	Read
		Function header	Setting		
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) (*1)	Unit UM: μm NM: nm, MM: mm THZ: THz, GHZ: GHz Example XAS0.78UM	○
λ2	ON/OFF	XBC	0, 1	0: λ2 OFF 1: λ2 ON	○
	SET λ2	XBS	Numeric + (unit) (*1)	Unit UM: μm NM: nm, MM: mm THZ: THz, GHZ: GHz Example XBS630.5nm	○
L1	ON/OFF	YAC	0, 1	0: L1 OFF 1: L1 ON	○
	SET L1	YAS	Numeric + (unit) (*2)	Unit DBM: dBm, DB: dB MW: mW, UM: μW NW: nW PC: %	○
L2	ON/OFF	YBC	0, 1	0: L2 OFF 1: L2 ON	○
	SET L2	YBS	Numeric + (unit) (*2)	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: MAX-MIN	○
LEFT PEAK		LPK	——	λ1 set next left peak	×
RIGHT PEAK		RPK	——	λ1 set ext right peak	×

(*1) The default is μm in spectrum (wavelength domain) mode and mm in coherence mode.

(*2) The default is the current display scale unit.

- 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 of 7)

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	×

- DISPLAY (2 of 7)

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 data of which number is pointed by the cursor is deleted.	×
	3D CLEAR	TCL	——	All 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.	×
	LIST	LMD	0, 1	0: OFF 1: ON (LIST mode)	○
	LIST SORT LEVEL	LSL	——	LEVEL SORTING	×
	LIST SORT WAVELENGTH	LSW	——	Wavelength SORTING	×
	LIST YdB parameter	LPY	Numeric	Setting range : 0.1 to 99.9 Example LPY20, LPY35.0	○

- DISPLAY (3 of 7)

Item		Program code		Contents	Read
		Function header	Setting		
SAVE	SAVE MEAS DATA (Memory or floppy)	SAV##	0 to 15 + (*1) [# Memory name #] or [# File name #](*1) Terminator characters (# or !)	0: REF (no memory name) 1 to 15: MEAS 1 to 15 (MEMORY) Example: SAV15#LD-No.15# (MEMORY) SAV#LD-No.15# (FLOPPY)	×
	SAVE PANEL (Memory or floppy)	SVP##	1 to 10,00,99 + (*1) [# Memory name #] or [# File name #](*1) Terminator characters (# 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 data name for data Nos. 00 and 99.)	×
	SAVE PANEL SEQUENCE (Memory or floppy)	SPS##	1 to 10 + (*1) [# Memory name #] or [# File name #](*1) Terminator characters (# or !)	1 to 10: PANEL SEQUENCE 1 to 10 Example: SPS9#SEQUE-1# (MEMORY) SPS#SEQUE-1# (FLOPPY)	×
	DELETE MEAS (Memory only)	DMD	0 to 15	0: REF 1 to 15: MEAS 1 to 15	×
	DELETE PANEL (Memory only)	DPC	1 to 10	1 to 10: PANEL 1 to 10	×
	DELETE PANEL SEQUENCE	DPS	1 to 10	1 to 10: PANEL SEQUENCE 1 to 10	×

(*1) The memory name or file name can consist of up to 8 characters, using alphabets, numerics or symbol.

- DISPLAY (4 of 7)

Item		Program code		Contents	Read
		Function header	Setting		
RECALL	RECALL MEAS (Memory or floppy)	RCL	0 to 15 or # File name # (*1) Terminator characters (# or !)	0: REF 1 to 15: MEAS 1 to 15 Example: RCL10 (Memory) RCL#LD123.SPE# (FLOPPY) (*2)	×
	RECALL PANEL (Memory or floppy)	RCP	0 to 10 or # File name # (*1) Terminator characters (# or !)	1 to 10: PANEL 1 to 10 Example: RCP5 (Memory) RCP#LD123# (FLOPPY)	×
	RECALL PANEL SEQUENCE (Memory or floppy)	RPS	1 to 10 (Memory) or # File name # (*1) Terminator characters (# or !)	1 to 10: PANEL SEQUENCE 1 to 10 Example: RPS5 (Memory) RPS#SEQUE-1# (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	○
SPECTRAL WIDTH	SPEC. WIDTH	SPW	0, 1	0: OFF 1: ON	○

(*1) The file name can consist of up to 8 characters, using alphabets, numerics or symbol.

(*2) When specifying a file to be recalled, attach a extension to the file name (refer to the type in <How to read the directory (floppy)>). If no extension is attached to the file name, the extension ".SPE" is automatically attached to the file name to search th efile to be recalled. In this case, the file name must be within 12 characters.

- DISPLAY (5 of 7)

Item		Program code		Contents	Read
		Function header	Setting		
SPECTRAL WIDTH	WIDTH TYPE	WTY	0 to 5	0: Pk-XdB 1: ENVELOPE 2: RMS 3: Peak RMS 4: GAUSS 5: sech^2	○
	XdB parameter	WPX	Numeric	Setting range: 0.1 to 59.9 Example WPX3.0, WPX12.0	○
	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	○
	WAVELENGTH MON ON/OFF	WMO	0, 1	0: OFF (WAVELENGTH MON OFF) 1: ON (WAVELENGTH MON ON)	○
	WAVELENGTH MON search λ	WSR	———	Sets automatically the center wavelength (center frequency) of wavelength monitor internally.	×
	WAVELENGTH MON N-MAX	WNX	Integers (11 to 1001)	Point of Trend-chart Example : PNX201	○
	WAVELENGTH MON INTERVAL	WIN	Numeric (1 to 3600)	Measurement interval of wavelength monitor [SEC]	○

- DISPLAY (6 of 7)

Item		Program code		Contents	Read
		Function header	Setting		
ADVANCE	POWER MONITOR ON/OFF	PMO	0, 1	0: OFF (POWER MONITOR OFF) 1: ON (POWER MONITOR ON)	○
	POWER MONITOR search λ	PSR	———	Sets automatically the center wavelength of power monitor internally.	×
	POWER MONITOR set λ	PWV	Numeric + (unit)	Unit UM: μm NM: nm Example PNV1.31UM	○
	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	○
	PANEL SEQUENCE ON/OFF	PSO	0, 1	0: OFF (PANEL SEQ OFF) 1: ON (PANEL SEQ ON)	○
	PANEL SEQUENCE EXECUTE	PSE	———	Execution of the panel sequence.	×
	PANEL SEQUENCE STOP	PSS	———	Stop of the panel sequence.	×
	PANEL SEQUENCE CONTINUE	PSC	———	Continuty of the panel sequence.	×
	PANEL SEQUENCE PROGRAMING LIST PRINT OUT	PSP	———	Print out of the panel sequence program list.	×
	PANEL SEQUENCE PROGRAMING LIST ALL CLEAR	PAC	———	All clear of the penal sequence program list.	×

- DISPLAY (7 of 7)

Item		Program code		Contents	Read
		Function header	Setting		
ADVANCE	PANEL SEQUENCE DELETE LINE	PDL	Integers (1 to 200)	Deletion of the panel sequence program list. Example PDL10	×
	PANEL SEQUENCE INSERT LINE	PIL	Integers (1 to 200)	Insertion of the panel sequence program list. Example PIL11	×
	PANEL SEQUENCE SET CURSOR	PCN	Integers (1 to 200)	Moving of the cursor of the panel sequence program list. Example PCN21	○
	PANEL SEQUENCE READ LIST	PPL (PRL?)	———	Read out of the cursor position of the panel sequence program list.	×
	PANEL SEQUENCE WAIT N	PWA	Numeric	Setting for waiting time. Set up range: 0.1 to 1000.0	×
	PANEL SEQUENCE LOOP M-N	PLO	See below	Setting for LOOP Line No. and the number of times of LOOP. PL01;10 Set up range: LOOP Line NO.; 1 to 200 The number of times of LOOP; 1 to 1000	×
	PANEL SEQUENCE PAUSE	PPS	———	Stop of the panel sequnce.	×
	PANEL SEQUENCE END	PEN	———	Finish of the panel sequence.	×

- DATA OUT(1 of 3)

Item		Program code		Contents	Read
		Function header	Setting		
DEVICE	DEVICE TYPE	DEV	0, 1	0: PRINTER 1: PLOTTER	○
	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, Vn: Vertical	○
	FLOPPY ON/OFF	FON	0, 1	0: FLOPPY-OFF (MEMORY) 1: FLOPPY-ON	○
	FLOPPY FORMATTING	FFO	1, 2	Initialization of floppy disk 1: 2DD (720k) 0: 2HD (1.2M)	×
	FLOPPY VOLUME LABEL	FVO##	#Volume name# Terminator characters (# or !)	Sets volume name to the floppy disk. (up to 11 characters) Example: FVO9#LD-1330# FVO#BLUE-LED#	○
	COLOR PATTERN	CPT	0 to 3	Sets color pattern 0: COLOR PATTERN 1 1: COLOR PATTERN 2 2: COLOR PATTERN 3 3: USER COLOR	○

- DATA OUT (2 of 3)

Item		Program code: Function header	Program code: Setting	Contents	Read
DEVICE	COLOR BLOCK	CBK	0 to 7	Sets color block 0: Measured data, readout (single screen, upper screen) 1: Measured data (lower screen) 2: Frame 3: Annotation 4: Measurement conditions 5: Label, CLOCK 6: Softkey 7: Back plane	○
	USER COLOR	CUS##	See below.	Sets the user color. CUS _# RRR-GGG-BBB _# Terminator (# or !) RRR: RED (000 to 100) GGG: Green (000 to 100) BBB: BLUE (000 to 100) However, any of 0, 7, 13, 20, 27, 33, 40, 47, 53, 60, 67, 73, 80, 87, 93 and 100 is selected after setting.	○
	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 (01 to 59) ss: second (01 to 59)	○

- DATA OUT (3 of 3)

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	○
	PRINTER TYPE	PRT	0, 1	0: Internal printer 1: External printer	○
COPY& FEED	COPY	COP	——	Output to printer	×
	FEED	FEE	——	Paper fed about 5mm to printer.	×

- Codes corresponding to other keys

Item		Program code		Contents	Read
		Function header	Setting		
INSTR PRESET		IPR	——	Measurement conditions initialized.	×
CAL	LEVEL (SP)	CLV	Numeric + (unit)	Sets level calibration data for spectrum. Unit DBM: dBm, MW: mW UW: μW	○
	LEVEL (PW)	CLP	Numeric + (unit)	Sets level calibration data for power monitor. Unit DBM: dBm, MW: mW UW: μW	○
	Selects of display wavelength	AIR	0, 1	0: Wavelength in vacuum 1: Wavelength in air	○
	EXECUTE	CEX	——	Level calibration executed.	×
	VALID	CVA	0, 1	0: Mode not using CAL data 1: Mode using CAL data	○

- Controlling data output and others (1 of 4)

Item	Program code		Contents	Read
	Function header	Setting		
SRQ signal control-1	SRQ	0, 1	0: Mode not transmitting SRQ 1: Mode 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 (ASCII waveform data)	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)	○
Data output screen	OVS	0, 1	0: upper (upper screen) 1: lower (lower screen) (Valid in dual screen mode)	○
Request for waveform data output	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	×

- Controlling data output and others (2 of 4)

Item	Program code		Contents	Read
	Function header	Setting		
Request for peak search data output	OPK (OPK?)	——	Output data differs between Spectrum and Coherent modes	×
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 list data output	OLS (OLS?)	——	Output of the listed peak value	×
Request for output of the number of list data	OLN (OLN?)	——	Output of the number of peak listed	×
MIN data output request	OMN (OMN?)	——	MIN data output when the average mode is MAX-MIN. *	×
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?)	——	Output of the point data measured by power monitor	×
Request for wavelength monitor data output	OWM (OWM?)	——	Output of the point data measured by wavelength monitor	×
Measurement data display ON/OFF	DSP	0, 1	Specifies if display should be updated at the end of measurement. 0: Display OFF 1: Display ON (initial value)	○
SRQ signal control-2	S	0, 1	0: Mode to output SRQ 1: Mode not to output SRQ	○

*: The MAX data output is requested using the regular Y-axis data output code "OSD1."

- Controlling data output and others (3 of 4)

Item	Program code		Contents	Read
	Function header	Setting		
Setting the offset value from peak to level line and calculating the peak width (pk - xdB method)	MXS	Numeric or —	Set range: 0.1 to 59.9 When numeric is not inputted, calculation is executed by the parameter set just before. (Example) MXS3.0 MXS12.0	○
Setting the offset value from minimum peak to level line and calculating the peak width (pk - xdB method)	MIS	Numeric or —	Set range: 0.1 to 59.9 When numeric is not inputted, calculation is executed by the parameter set just before. (Example) MIS3.0 MIS12.0	○
Request for outputting peak values	OMX (OMX?)	——	Output of the peak wavelength and level (which are calculated by MXS) Be sure to calculate the peak values by using MXS prior to transmitting OMX.	—
Request for outputting dip values	OMI (OMI?)	——	Output of the dip wavelength and level (which are calculated by MIS) Be sure to calculate the dip values by using MIS prior to transmitting OMI.	—
Request for outputting the result of calculating the peak width or dip width	ODM (ODM?)	——	Output of the following items which are calculated by MXS or MIS: - Center wavelength - Spectral width (the peak width or dip width) - Level (the spectral width and level at operating point) Be sure to transmit MXS or MIS prior to transmitting ODM.	—

- Controlling data output and others (4 of 4)

Item	Program code		Contents	Read
	Function header	Setting		
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.)	○

Table 6-3 Error Codes Used in Self-Diagnosis

Code	Description
0000	Normal
010X	ROM error
02XX	RAM error
030X	Backup-RAM error
040X ≀ 070X	Peripheral circuit error (Internal clock, timer, printer interface and others)
110X ≀ 30XX	Measurement error (Measurement memory, interferometer, A/D converter and others)

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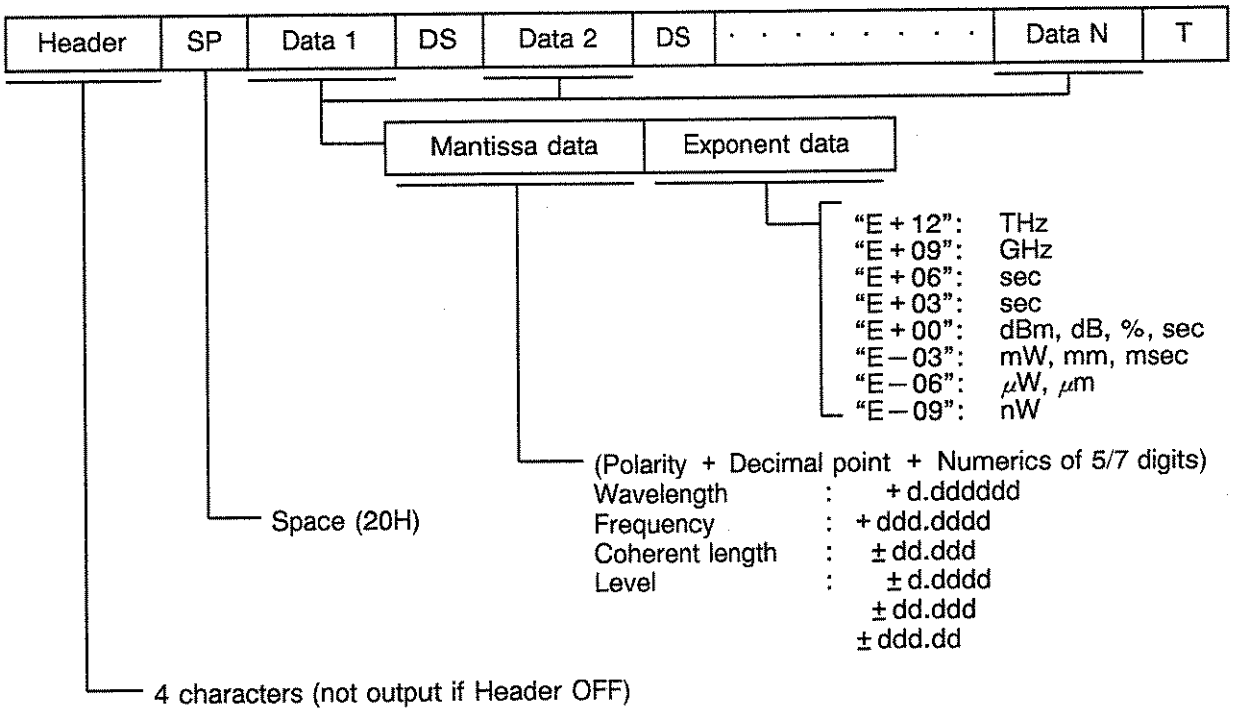
6.3.3 Talker Format (Data output format)

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.

(1) Waveform data (Program code "OSD0", "OSD1", "OCF", "OTDn")

① ASCII format (code for specifying "FMT0" format)

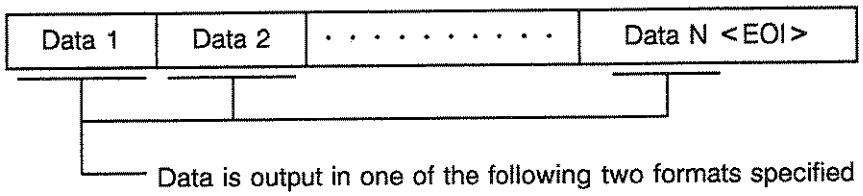


Header	Data type
LMUM	Wavelength [μm]
FQTH	Frequency [THz]
CLMM	Coherent length [mm]
LVLG	Log scale level data [dBm, dB]
LVLI	Linear scale level data
LVPC	% unit level data
TM S	Trend data time data

DS: Data separate (",", ";", CR or NL)
Can be specified with program code "SDLn" ("DSn")

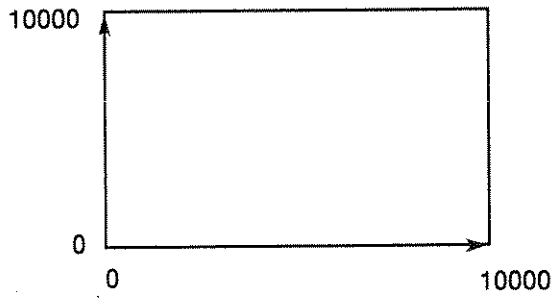
T: Terminator (NL<EOI> NL <EOI> or CR,NL<EOI>)
Can be specified with program code "DELn" ("DLn")

② BINARY format (Format specification code "FMT1", "FMT2")

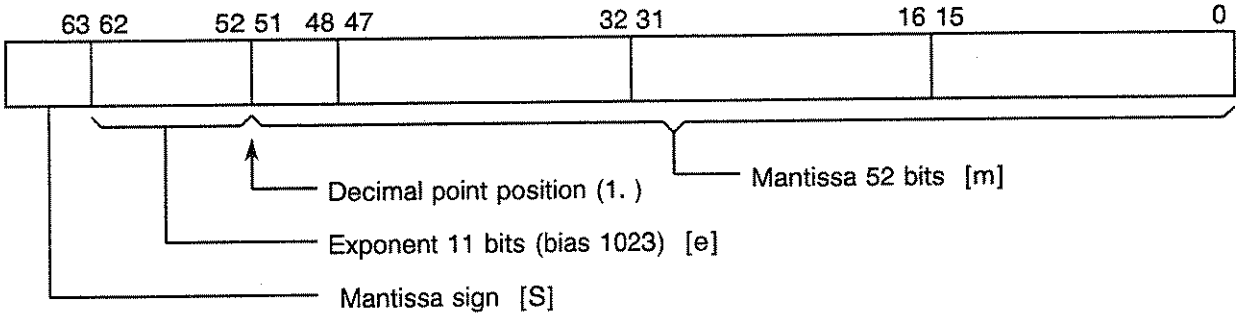


Data is output in one of the following two formats specified by "FMTn".

① "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.



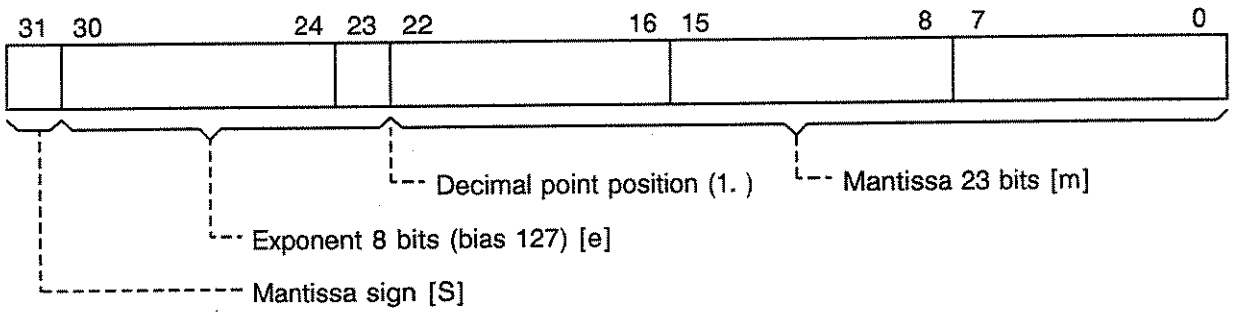
② "FMT2"……64-bit (Floating point type)
Data is output in floating point format (IEEE Std. 754-1985 format) as shown below.



The value is expressed as follows:

$(-1)^S \times 2^{(e-1023)} \times 1.m$

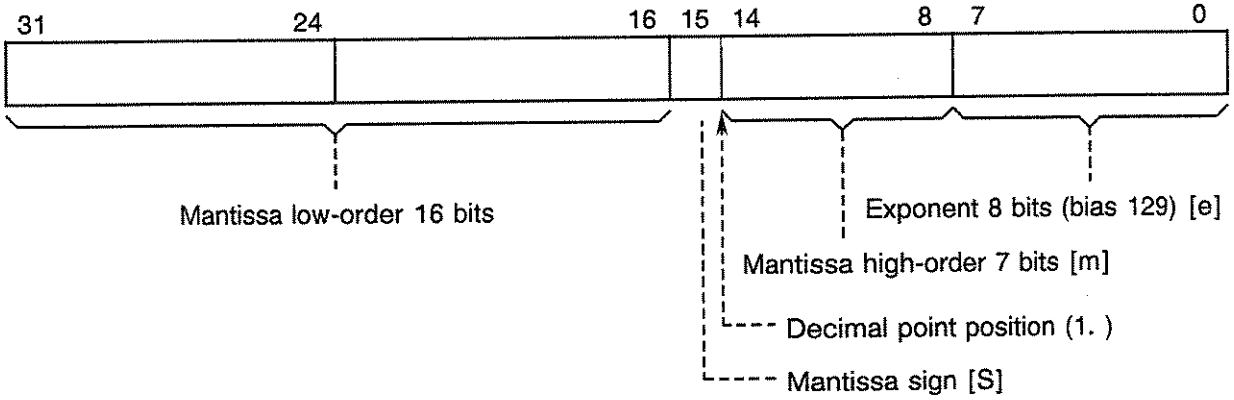
③ "FMT3"……32-bit (IEEE floating point type)
Data is output in floating point format (IEEE Std. 754-1985 format) as shown below.



The value is expressed as follows:

$(-1)^S \times 2^{(e-127)} \times 1.\ m$

④ "FMT4"……32-bit (NEC floating point type)
Data is output in floating point format (Internal format on NEC-PC) as shown below.

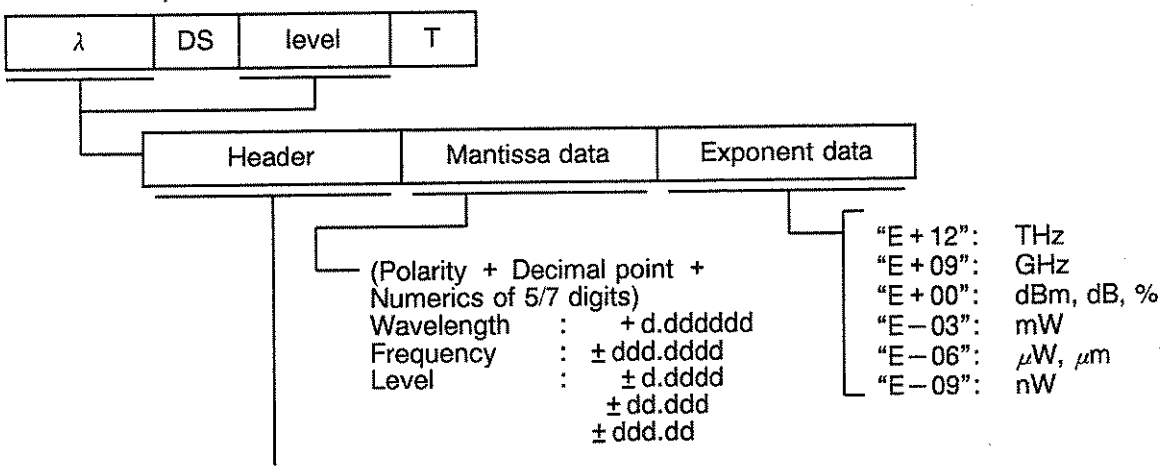


The value is expressed as follows:

$(-1)^S \times 2^{(e-129)} \times 1.\ m$

(2) Peak search data (Program code "OPK")

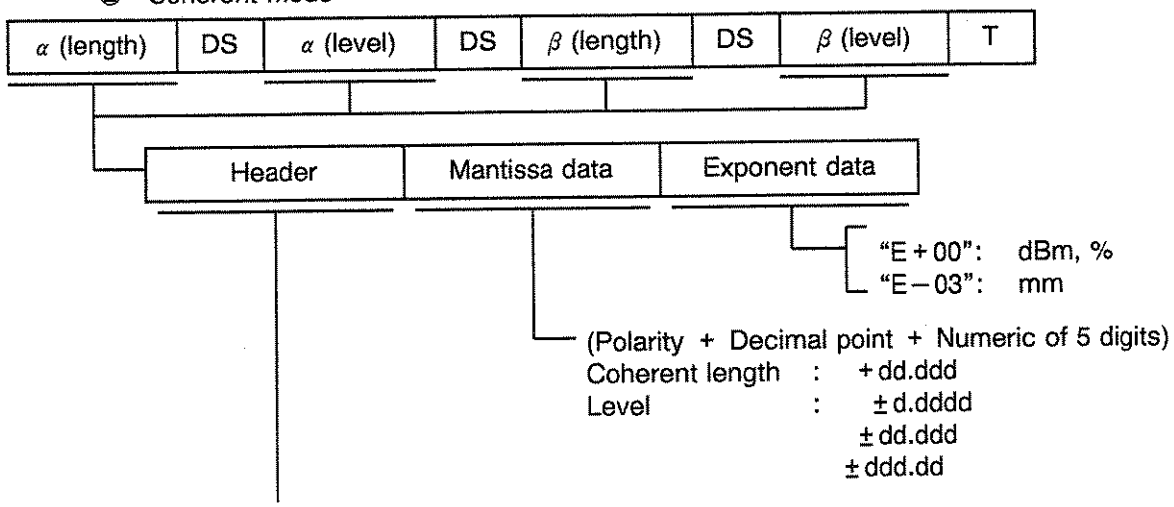
① Spectrum mode



4 characters (not output if Header OFF)

Header	Data type
LMPK	Peak wavelength (λ)
LVPK	Peak level (level)
FQPK	Peak frequency (f)

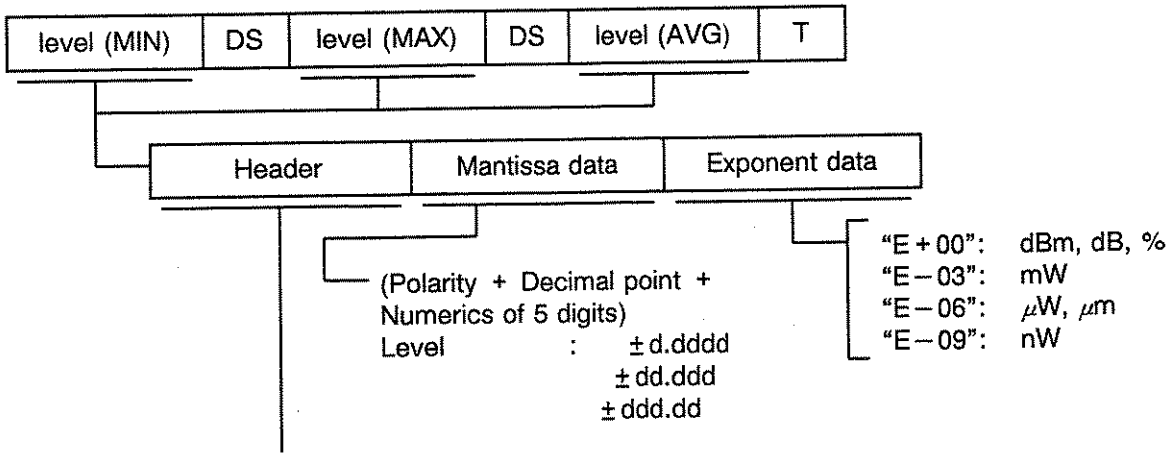
② Coherent mode



4 characters (not output if Header OFF)

Header	Data type
CLAL	α (length)
LVAL	α (level)
CLBE	β (length)
LVBE	β (level)

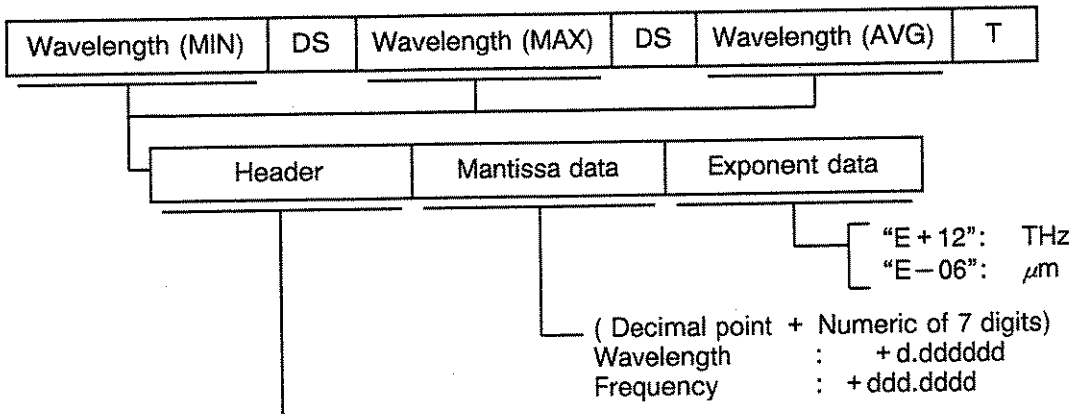
③ Power monitor mode



4 characters (not output if Header OFF)

Header	Data type
LVMN	Minimum of the level data
LVMX	Maximum of the level data
LVAV	Average of the level data

④ Wavelength monitor mode



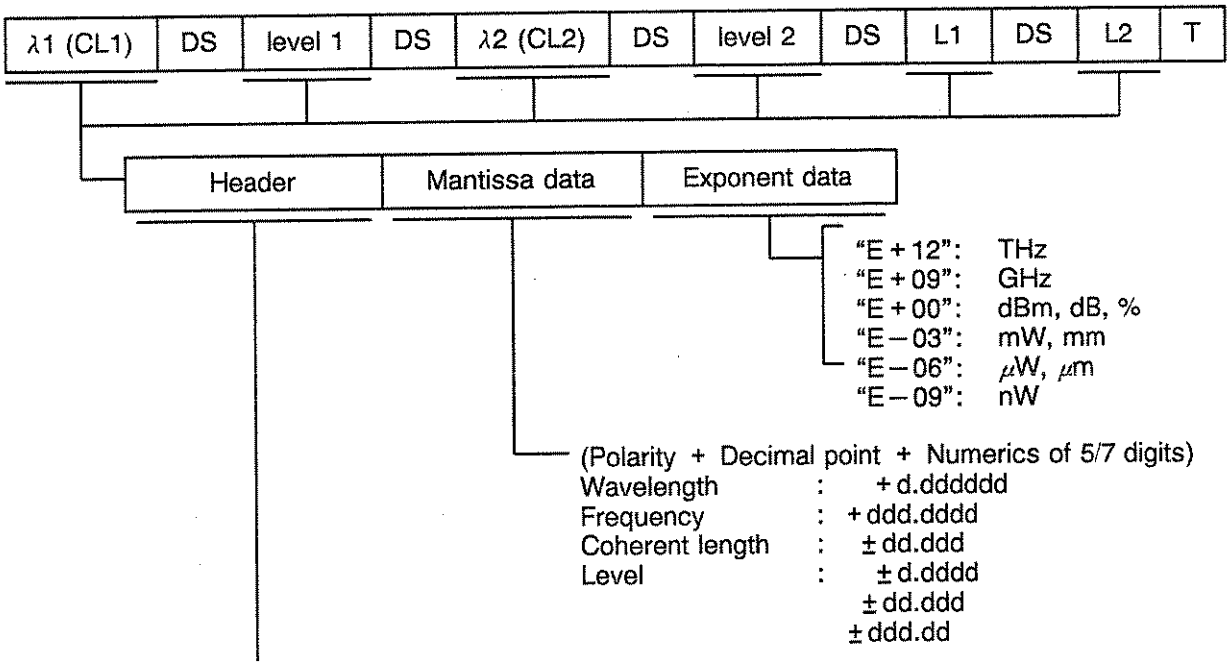
4 characters (not output if Header OFF)

Header	Data type
LMMN	Minimum of the wavelength data
LMMX	Maximum of the wavelength data
LMMV	Average of the wavelength data
FQMN	Minimum of the frequency data
FQMX	Maximum of the frequency data
FQMV	Average of the frequency data

(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.

① "CUD0"·····Normal



Header	Data type
LMXA	Wavelength of X cursor 1 (λ1)
CLXA	Coherent length of X cursor 1 (CL1)
LVXA	Level of X cursor 1 (level1)
LMXB	Wavelength of X cursor 2 (λ2)
FQXA	Frequency of X cursor 1 (f1)
FQXB	Frequency of X cursor 2 (f2)
CLXB	Coherent length of X cursor 2 (CL2)
LVXB	Level of X cursor 2 (level2)
LVYA	Level of Y cursor 1 (L1)
LVYB	Level of Y cursor 2 (L2)

DS: Data separator (',', ';', CR or NL)
Can be specified using program code "SDLn" ("DSn")

T: Terminator (NL<EOI>, NL, <EOI>, or CR,NL<EOI>)
Can be specified using program code "DELn" ("DLn").

Note 1: Data is "0" if the corresponding cursor is OFF.
Note 2: The mantissa and exponent formats are common to all "CUDn" codes.

② "CUD1"…… △MODE

λ1 (CL1)	DS	level 1	DS	△λ (△CL)	DS	△level	DS	L1	DS	△L	T

Header: 4 characters (not output if Header OFF)

Header	Data type
LMXA	Wavelength of X cursor 1 (λ1)
CLXA	Coherent length of X cursor 1 (CL1)
LVXA	Level of X cursor 1 (level1)
LMDX	Wavelength difference between X cursors 1 and 2 (△λ)
FQXA	Frequency of X cursor 1 (f1)
FQDX	Frequency difference between X cursors 1 and 2 (△f)
CLDX	Coherent length difference between X cursors 1 and 2 (△CL)
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 (not in coherence mode)

λ1	DS	level 1	DS	△λ	DS	△level	T

Header: 4 characters (not output if Header OFF)

Header	Data type
LMPK	Peak wavelength (λ1)
LVPK	Peak level (level1)
LMDP	Wavelength difference between 1st and 2nd peaks (△λ)
FQPK	Peak frequency (f1)
FQDP	Frequency difference between 1st and 2nd peaks (△f)
LVDP	Level difference between 1st and 2nd peaks (△level)

④ "CUD3"…… POWER (not in coherence mode)

λ1	DS	λ2	DS	ΣL	T

Header: 4 characters (not output if Header OFF)

Header	Data type
LMXA	Wavelength of X cursor 1 (λ1)
LMXB	Wavelength of X cursor 2 (λ2)
FQXA	Frequency of X cursor 1 (f1)
FQXB	Frequency of X cursor 2 (f2)
LVPW	Sum of levels between X cursors 1 and 2 (ΣL)

⑤ "CUD4"……MAX-MIN (coherence mode unavailable)

λ1	DS	MAX level	DS	MIN level	DS	△level	T

Header: 4 characters (not output if Header OFF)

Header	Data type
LMXA	Wavelength of X cursor 1 (λ1)
LVMX	MAX wavelength level (MAX level)
LYMI	MIN wavelength level (MIN level)
LVDM	Level difference between MAX and MIN wavelengths (△ level)

- Cursor data output in power monitor display (trend chart)

No	DS	level	T

(Integer of 4 digits)

The exponent part and mantissa part are the same as the usual level data.

- Cursor data output in wavelength monitor display (trend chart)

No	DS	Wavelength	T

(Integer of 4 digits)

The exponent part and mantissa part are the same as the usual level data.

Header	Data type
NOTC	Data number at cursor position
LVTC	Level data at cursor position
LMTC	Wavelength data at cursor position
FQTC	Frequency data at cursor position

(4) List data (Program code "OLS")

① Spectrum mode

λ1 (CL1)	DS	level 1	DS	· · · · · · · · · ·	λN (CLN)	DS	level N	T

Header	Mantissa data	Exponent data

"E+12": THz
"E+09": GHz
"E+00": dBm, dB, %
"E−03": mW, mm
"E−06": μW, μm
"E−09": nW, nm

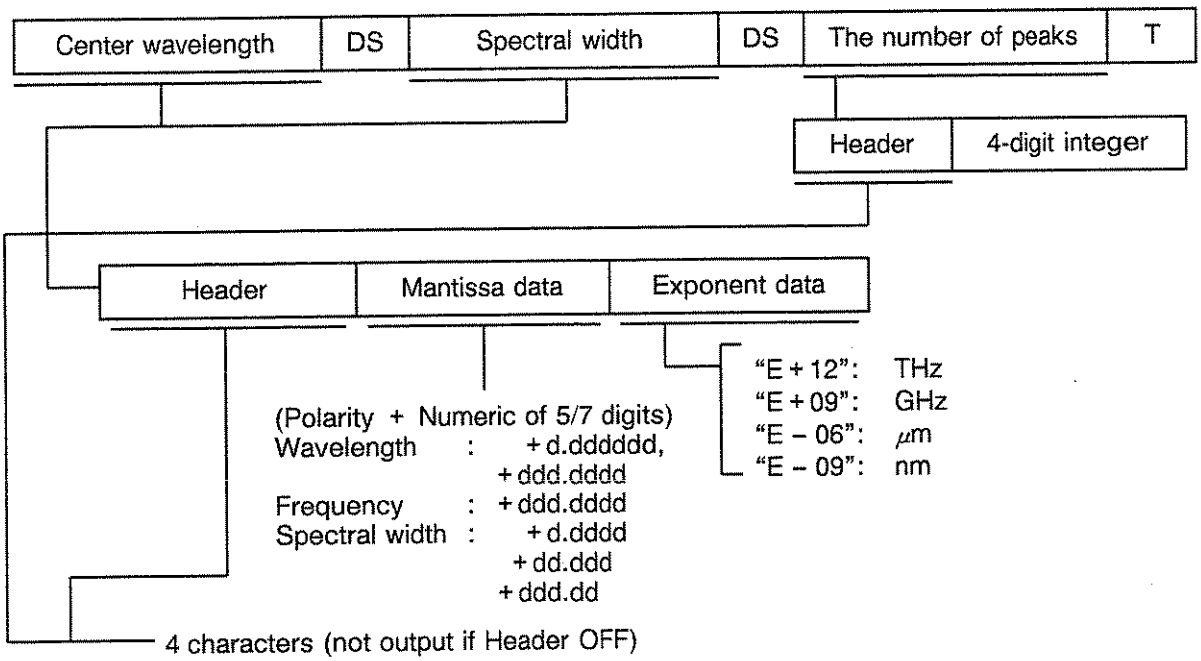
(Polarity + Decimal point + Numerics of 5/7 digits)
Wavelength : +d.dddddd
Frequency : +ddd.dddd
Coherent length : +dd.ddd
Level : ±d.dddd
±dd.ddd
±ddd.dd

4 characters (not output if Header OFF)

Header	Data type
LMLS	Wavelength (λ)
FQLS	Frequency (f)
CLLS	Coherent length (CL)
LVLS	Level (level)

(5) Spectral width data (Program code "OSW")

The results of four types of calculations are all output in the following format:



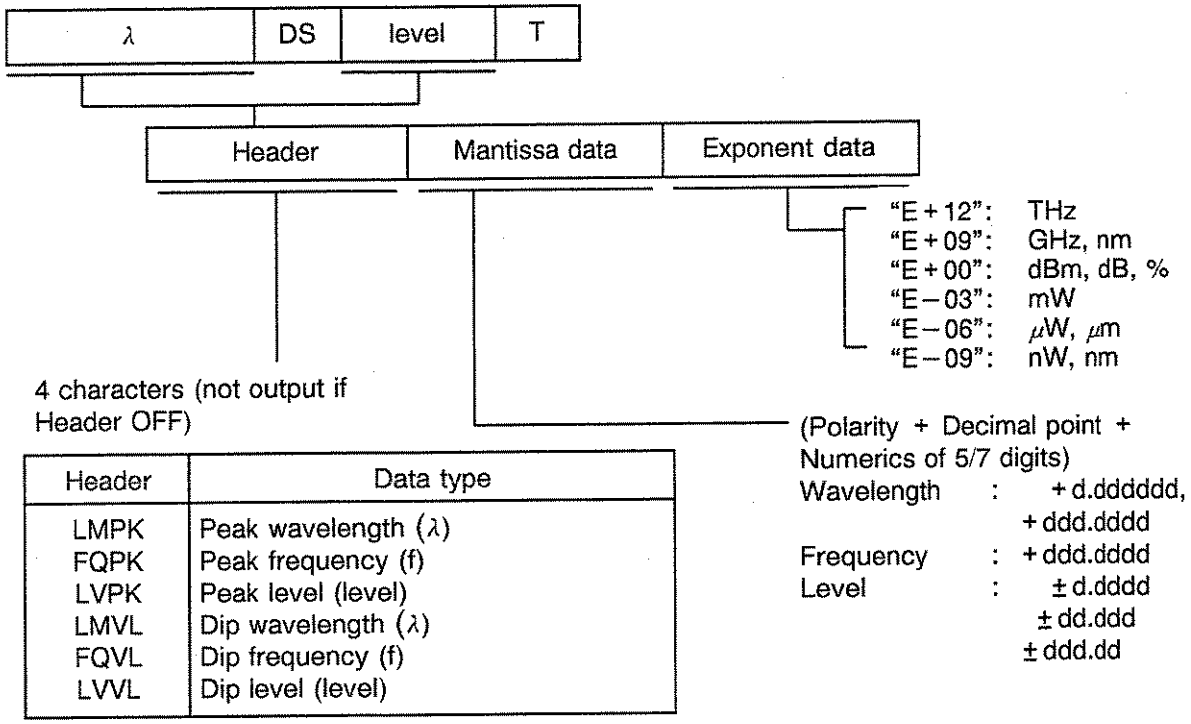
Header	Data type
LMCN	Center wavelength
LMHW	Spectral width (wavelength domain)
FQCN	Center frequency
FQHW	Spectral width (frequency domain)
NOSP	Number of peaks
ERFT	Fitting error

DS: Data separator (',', ';', CR or NL)
Can be specified using program code "SDLn" ("DSn").

T: Terminator (NL<EOI>, NL, <EOI> or CR,NL<EOI>)
Can be specified using program code "DELn" ("DLn").

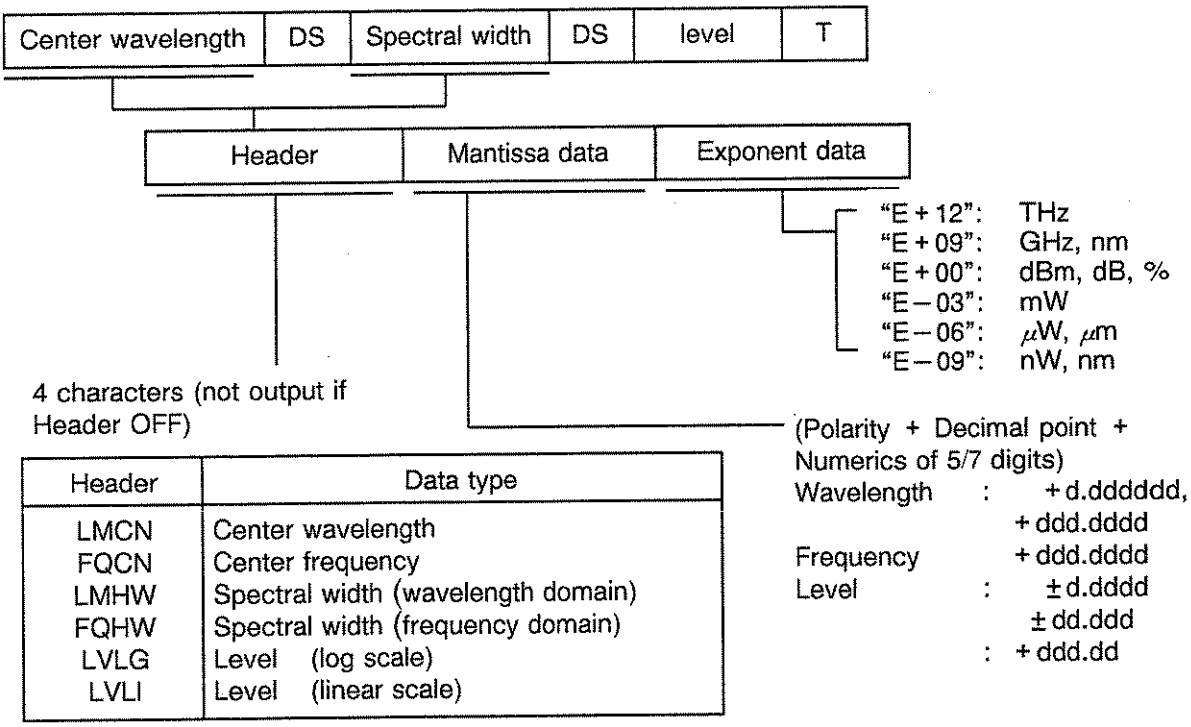
(6) Data format

① Read modes "OMX" and "OMI" which are used to read the peak and dip values



Header	Data type
LMPK	Peak wavelength (λ)
FQPK	Peak frequency (f)
LVPK	Peak level (level)
LMVL	Dip wavelength (λ)
FQVL	Dip frequency (f)
LVVL	Dip level (level)

② Read mode "ODM" which is used to read the spectral width (the peak width and the dip width)



Header	Data type
LMCN	Center wavelength
FQCN	Center frequency
LMHW	Spectral width (wavelength domain)
FQHW	Spectral width (frequency domain)
LVLG	Level (log scale)
LVLI	Level (linear scale)

(7) Device identification

When program code "*IDN?" is received, the following data is output:

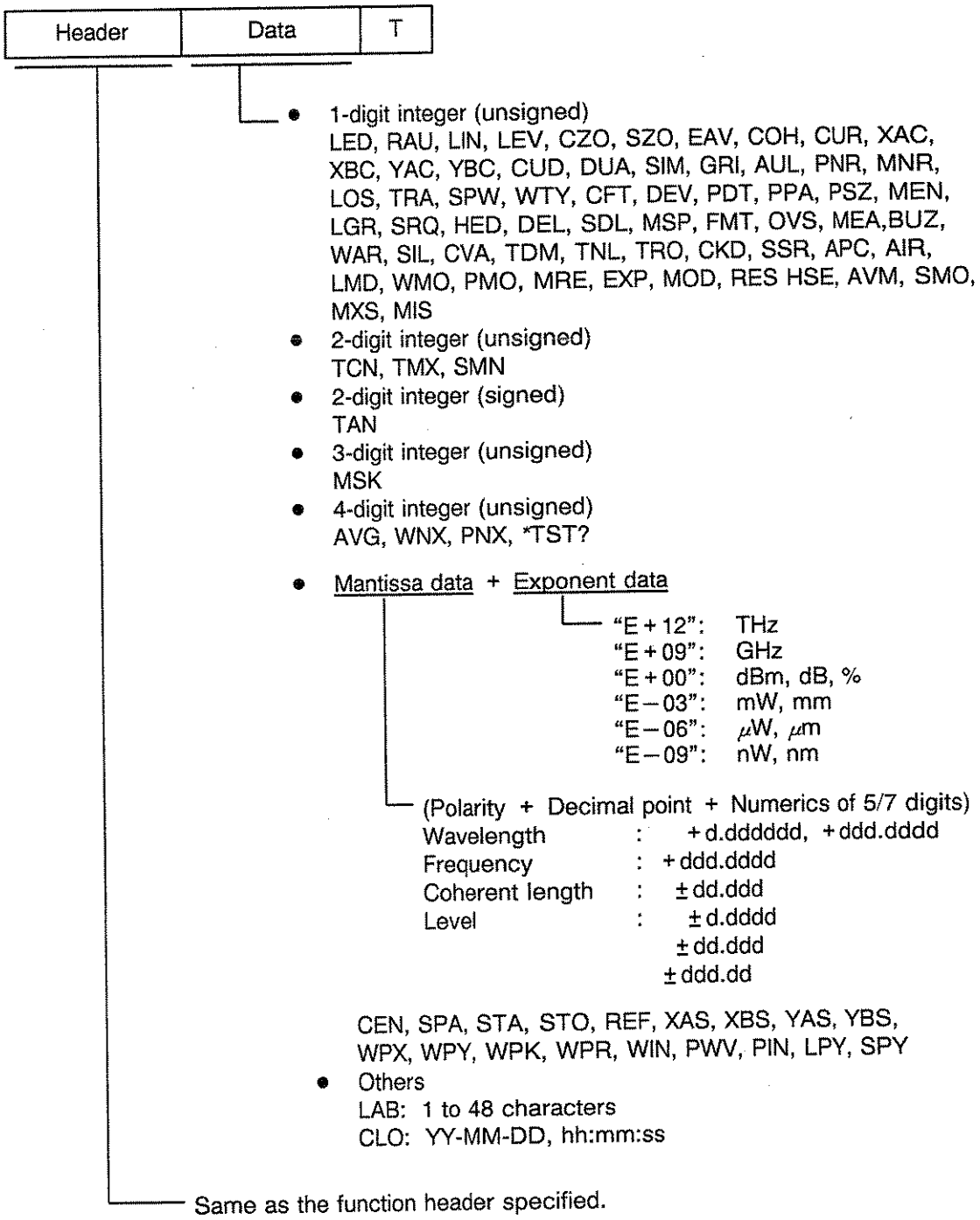
ADVANTEST, Q8344A, 12345678, A01 A01

- A01 A01: Software revision (Processing, Measurement)
- 12345678: Serial number (Production number)

(8) 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:



(This page has been intentionally left blank.)

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.

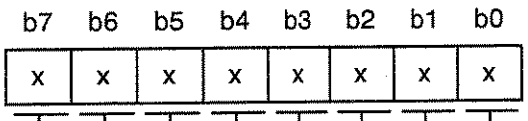
< Status byte >
Bits contained in the status byte are set and cleared according to the conditions described below. The status byte relates to three program codes: "SRQn", "MSKnnn" and "CSB".
The "SRQn" is used to control SRQ signal transmission: "SRQ1" is the mode for transmitting the SRQ signal and "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.

- Meanings and set/reset conditions of status byte bits



b0: measure end
Set to 1 when measurement is complete.
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 or list display end.
Set to 1 when spectral width, curve fit calculation or list display is complete.
Set to 0 when measurement or ZOOMing is started or output of calculation data is complete.

b3: copy end or floppy access end
Set to 1 when output to the printer or access (writing, reading or initializing) for the floppy disk is complete.
Set to 0 when measurement is started, "COP" code is received, or access is started for the floppy disk.

b4: zoom end or trend end
Set to 1 when zooming to re-analyze the previous measurement data with different wavelength condition is complete or when a trend chart measurement is complete in power monitor or wavelength monitor display.
Set to 0 when measurement or zooming is started.

b5: average end
Set to 1 when the specified number of measurements is complete for averaging.
Set to 0 at measurement start or when averaging is switched OFF.

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.

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 (FUNCTION section)	Preceding state
② Data display	Normal display (dual-screen, superimpose, and 3-dimensional display modes are all OFF)
③ Cursor display	All OFF
④ Spectral width calculation	OFF
⑤ Normalize	OFF
⑥ Curve fit	OFF
⑦ GPIB • Status byte • Status byte mask • SRQ signal transmit • Waveform data output format • Terminator • Data separator • Message separator	 0 (cleared) "MSK0" (unmasked) "SRQ0" (mode not to transmit SRQ signal) "FMT0" (ASCII) "DEL0" ("DL0") ⇨ (NL<EOI>) "SDL0" ("DS0") ⇨ (,) "MSP0" ("MS0") ⇨ (;)

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	Initalization
"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

6.3.8 Sample Program

The sample programs given in this paragraph 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 GPIB 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 HP 9000 series 300

```
10    !*****************************************
20    !     Q8347  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 Q8347  GP-IB address (8)
120  ON INTR 7 GOSUB Srq              ! define SRQ interrupt routine
130  CLEAR Spa                        ! initialize Q8347
140  OUTPUT Spa;"COH 0"               ! select 'SPECTRUM' mode
150  OUTPUT Spa;"CEN 0.78um"          ! 'CENTER' set to 0.78um
160  OUTPUT Spa;"SPA 20nm"            ! 'SPAN' set to 20nm
170  OUTPUT Spa;"REF 0dBm"            ! 'REF LEVEL' set to 0dBm
180  OUTPUT Spa;"LIN 0,LEV 1"         ! select LOG display and set 5dB/DIV
190  OUTPUT Spa;"EAV 0"               ! 'AVERAGE' 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 Q8347
320  Meas_end=1                       ! set measure end flag
330  RETURN
340   !
350  END
```

- Explanation on program 1 for ① HP9000 series 300

Line No.	Description
10 to 70	Comment
80 to 90	Definition of variables
110	The Q8347's GPIB 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 0.78 μm.
160	Span is set to 20nm.
170	Reference level is set to 0dBm.
180	In LOG display, Y-axis scale is set to 5dB/DIV.
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 research 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.

② Program 1 for PC9800 series

```
10  '**************************************
20  '    Q8347  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 Q8347  GP-IB address (8)
170 PRINT @SPA;"C"              ' initialize Q8347
180 ON SRQ GOSUB *SSRQ          ' define SRQ interrupt routine
190 PRINT @SPA;"COH 0"          ' select 'SPECTRUM' mode
200 PRINT @SPA;"CEN 0.78um"     ' 'CENTER' set to 0.78um
210 PRINT @SPA;"SPA 20nm"       ' 'SPAN' set to 20nm
220 PRINT @SPA;"REF 0dBm"       ' 'REF LEVEL' set to 0dBm
230 PRINT @SPA;"LIN 0,LEV 1"    ' select LOG scale and set to 5dB/DIV
240 PRINT @SPA;"EAV 0"          ' 'AVERAGE' OFF
250 PRINT @SPA;"MSK 254"        ' enable only 'measurement 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
```

- Explanation on program 1 for ② 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 to 150	The SRQ bit of the PC9800's GPIB interface is cleared.
160	The Q8347's GPIB 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 0.78 μm.
210	Span is set to 20nm.
220	Reference level is set to 0dbm.
230	In LOG display, Y-axis scale is set to 5db/DIV.
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.

(2) Example 2

For coherence analysis, averaging is executed and α (2nd peak distance and level) and β (intermediate distance between the maximum peak and 2nd peak and level) are read into memory.

① Program 2 for HP 9000 series 300

```
10    !*****************************************
20    !     Q8347 Optical Spectrum Analyzer
30    !     == sample program 2 ==
40    !     ( set coherence mode and read alpha,
50    !       beta parameters)
60    !*****************************************
70    !
80   INTEGER Spa
90   REAL A_len,A_lvl,B_len,B_lvl
100   !
110  Spa=708                          ! define Q8347 GP-IB address (8)
120  ON INTR 7 GOSUB Srq              ! define SRQ interrupt routine
130  CLEAR Spa                        ! initialize Q8347
140  OUTPUT Spa;"COH 1"               ! select 'COHERENCE' mode
150  OUTPUT Spa;"CEN 850nm"           ! 'CENTER' set to 850nm
160  OUTPUT Spa;"SPA 5.2mm"           ! 'SPAN'(distance range) set to 5.2mm
170  OUTPUT Spa;"REF 0.1mW"           ! 'REF LEVEL' set to 0.1mW(linear scale)
180  OUTPUT Spa;"AVG 8,EAV 1"         ! average number set to 8,'AVERAGE' ON
190  OUTPUT Spa;"MSK 223"             ! enable only 'average end' bit
200  OUTPUT Spa;"SRQ 1"               ! enable SRQ signal
210  OUTPUT Spa;"MEA 1"               ! start single measurement(average of 8)
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 alpha,beta data output
260  ENTER Spa;A_len,A_lvl,B_len,B_lvl    ! read alpha,beta(length,level)
270  DISP A_len,A_lvl,B_len,B_lvl     ! display alpha,beta(length,level)
280  STOP
290   !
300 Srq:S=SPOLL(Spa)                  ! read status byte of Q8347
310  Meas_end=1                       ! set measure end flag
320  RETURN
330   !
340  END
```

- Explanation on program 2 for ① HP9000 series 300

Line No.	Description
10 to 70	Comment
80 to 90	Definition of variables
110	The Q8347's GPIB 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	Coherence analysis mode is selected.
150	Center wavelength is set to 850nm.
160	Distance range is set to 5.2mm.
170	Reference level is set to 0.1mW (when using mW, linear scale is automatically set).
180	Number of averaging times is set to 8 with averaging set to ON.
190	Only b5 (average-end) in the status byte is made valid.
200	Mode to transmit SRQ signal is set.
210	Measurement starts (for the number of averaging times).
220	Flag (variable) to indicate the end of measurement is cleared.
230	Interrupt by SRQ signal is allowed.
240	Waiting for end of measurement (completion of averaging)
250	Output of peak search data (α , β) is requested.
260	Distance and level of α and $\beta$are read into variables.
270	The distance and level of α and β 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.

② Program 2 for PC9800 series

```
10  '****************************************
20  '     Q8347  Optical Spectrum Analyzer
30  '     == sample program 2 ==
40  '     (set coherence mode and read alpha,
50  '      beta parameters)
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 Q8347  GP-IB address (8)
170 PRINT @SPA;"C"                  ' initialize Q8347
180 ON SRQ GOSUB *SSRQ              ' define SRQ interrupt routine
190 PRINT @SPA;"COH 1"              ' select 'COHERENCE" mode
200 PRINT @SPA;"CEN 850nm"          ' 'CENTER' set to 850nm
210 PRINT @SPA;"SPA 5.2mm"          ' 'SPAN'(distance range) set to 5.2mm
220 PRINT @SPA;"REF 0.1mW"          ' 'REF LEVEL' set to 0.1mW(LINEAR SCALE)
230 PRINT @SPA;"AVG 8,EAV 1"        ' average number set to 8,'AVERAGE' ON
240 PRINT @SPA;"MSK 223"            ' enable only 'average end' bit
250 PRINT @SPA;"SRQ 1"              ' enable SRQ signal
260 PRINT @SPA;"MEA 1"              ' start single measurement(average of 8)
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 alpha,beta data output
330 INPUT @SPA;A.LEN.A.LVL,B.LEN,B.LVL     ' read alpha,beta(length,level)
340 PRINT A.LEN.A.LVL,B.LEN,B.LVL          ' print alpha,beta(length,level)
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
```

- Explanation on program 2 for ② 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's GPIB interface series is cleared.
160	The Q8347's GPIB 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	Coherence analysis mode is selected.
200	Center wavelength is set to 850nm.
210	Distance range is set to 5.2mm.
220	Reference level is set to 0.1mW (when using mW, Linear scale is set automatically).
230	Number of average times is set to 8 with averaging set to ON.
240	Only b5 (average-end) in the status byte is made valid.
250	Mode to transmit SRQ signal is set.
260	Measurement starts (for the number of averaging times).
270	Flag (variable) to indicate the end of measurement is cleared.
280	Interrupt by SRQ signal is allowed.
290	Waiting for end of measurement (completion of averaging).
300	Terminator is set to CR/NL(EOI) and data separator to ','.
320	Header OFF and output of peak search data (α, β) is requested.
330	Distance and level of α and β are read into variables.
340	Distance and level of α and β 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 averaging) is set.
390	Return to main routine.

(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 HP 9000 series 300

```
10    !*****************************************
20    !     Q8347  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(1:3201),Level(1:3201)
100    !
110   Spa=708                          ! define Q8347  GP-IB address (8)
120   ON INTR 7 GOSUB Srq              ! define SRQ interrupt routine
130   CLEAR Spa                        ! initialize Q8347
140   OUTPUT Spa;"COH 0"               ! select 'SPECTRUM' mode
150   OUTPUT Spa;"STA 1275nm"          ! 'START lambda' set to 1275nm
160   OUTPUT Spa;"STO 1325nm"          ! 'STOP lambda' set to 1325nm
170   OUTPUT Spa;"REF 0.1mW"           ! 'REF LEVEL' set to 0.1mW(select LINEAR)
180   OUTPUT Spa;"AVG 2,EAV 1"         ! average number set to 2,'AVERAGE' ON
190   OUTPUT Spa;"MSK 223"             ! enable only 'average end' bit
200   OUTPUT Spa;"SRQ 1"               ! enable SRQ signal
210   OUTPUT Spa;"MEA 1"               ! start single measurement(average of 2)
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 Q8347
370   Meas_end=1                       ! set measure end flag
380   RETURN
390    !
400   END
```

- Explanation on program 3 for ① 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 Q8347's GPIB 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	Start wavelength is set to 1275nm.
160	Stop wavelength is set to 1325nm.
170	Reference level is set to 0.1mW (when using mW, linear scale is automatically set).
180	Number of averaging times is set to 2 with averaging set to ON
190	Only b5 (average-end) in the status byte is made valid.
200	Mode to transmit SRQ signal is set.
210	Measurement starts (for the number of averaging times).
220	Flag (variable) to indicate the end of measurement is cleared.
230	Interrupt by SRQ signal is allowed.
240	Waiting for end of measurement (completion of averaging).
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, is because wavelength axis data is not arranged at identical intervals).
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.

② Program 3 for PC9800 series

```
10  '****************************************
20  '    Q8347  Optical Spectrum Analyzer
30  '    == sample program 3 ==
40  '    (set-up measurement condition
50  '     and read spectrum data)
60  '****************************************
70  '
80  DIM LAMBDA(3201),LEVEL(3201)
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 Q8347  GP-IB address (8)
180 PRINT @SPA;"C"                  ' initialize Q8347
190 ON SRQ GOSUB *SSRQ              ' define SRQ interrupt routine
200 PRINT @SPA;"COH 0"              ' select 'SPECTRUM' mode
210 PRINT @SPA;"STA 1275nm"         ' 'START lambda' set to 1275nm
220 PRINT @SPA;"STO 1325nm"         ' 'STOP lambda' set to 1325nm
230 PRINT @SPA;"REF 0.1mW"          ' 'REF LEVEL' set to 0.1mW(select LINEAR)
240 PRINT @SPA;"AVG 2,EAV 1"        ' average number set to 2,'AVERAGE' ON
250 PRINT @SPA;"MSK 223"            ' enable only 'average end' 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
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
```

- Explanation on program 3 for ② 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 GPIB interface is cleared.
170	The Q8347's GPIB address (8) is set as a variable.
180	The analyzer 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 1275nm.
220	Stop wavelength is set to 1325nm.
230	Reference level is set to 0.1mW (when using mW, linear scale is automatically set).
240	Number of averaging times is set to 2 with averaging set to ON.
250	Only b5 (average-end) in the status byte is made valid.
260	Mode to transmit SRQ signal is set.
270	Measurement starts (for the number of averaging times).
280	Flag (variable) to indicate the end of measurement is cleared.
290	Interrupt caused by SRQ signal is allowed.
300	Data output format is set to ASCII and Header to OFF.
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, because wavelength axis data is not arranged at identical intervals.)
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.

(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).

This way, the data transfer time is minimized.

① Program 4 for HP 9000 series 300

```
10    !*****************************************
20    !     Q8347  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
100   REAL Lambda(1:3201) BUFFER,Level(1:3201) BUFFER
110    !
120   Spa=708                          ! define Q8347  GP-IB address (8)
130   ON INTR 7 GOSUB Srq              ! define SRQ interrupt routine
140   CLEAR Spa                        ! initialize Q8347
150   OUTPUT Spa;"COH0"                ! select 'SPECTRUM' mode
160   OUTPUT Spa;"CEN1.55um"           ! 'CENTER' set to 1.55um
170   OUTPUT Spa;"SPA50nm"             ! 'SPAN' set to 50nm
180   OUTPUT Spa;"REF -10dBm"          ! 'REF LEVEL' set to -10dBm
190   OUTPUT Spa;"EAV0"                ! 'AVERAGE' OFF
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;"OSD1"                ! request X-axis data output(lambda)
320   ASSIGN @Buf TO BUFFER Lambda(*)      ! assign path-name for variable
330   ASSIGN @Spa TO Spa               ! assign path-name for Q8347
340   TRANSFER @Spa TO @Buf;END,WAIT     ! Q8347  lambda data xfer to Lambda(*)
350   OUTPUT Spa;"OSD0"                ! request Y-axis data output(level)
360   ASSIGN @Buf TO BUFFER Level(*)       ! assign path-name for variable
370   TRANSFER @Spa TO @Buf;END,WAIT     ! Q8347  level data xfer to Level(*)
380    !***  spectrum data transaction write here  ***
390   STOP
400    !
410 Srq:S=SPOLL(Spa)                   ! read status byte of Q8347
420   Meas_end=1                       ! set measure end flag
430   RETURN
440    !
450   END
```

- Explanation on program 4 for ① 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 Q8347's GPIB address (8) is set as a variable.
130	Definition of the processing routine used when an interrupt by SRQ signal occurs.
140	The analyzer is initialized at power on.
150	Spectrum analysis mode is selected.
160	Center wavelength is set to 1.55 μm.
170	Span is set to 50nm.
180	Reference level is set to –10dBm.
190	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.
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 X-axis data (wavelength) is requested.
320 to 330	The I/O route name is defined in the arrangement variable for the wavelength data read and in the Q8347 to enable the buffer transfer mode.
340	Buffer transfer starts and wavelength data is read in.
350	Output of Y-axis data is requested.
360	The I/O route name is defined in the arrangement variable for level data read to enable the buffer transfer mode.
370	Buffer transfer starts and level data is read.
380	(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, because the wavelength axis data is not arranged at identical intervals.)
410	<Interrupt processing routine Srq> Serial poling is executed and the status byte read into the variable.
420	Flag to indicate end of measurement is set.
430	Return to the routine.

② Program 4 for PC9800 series

```
10  '****************************************
20  '    Q8347  Optical Spectrum Analyzer
30  '    == sample program 4 ==
40  '    (set-up measurement condition
50  '     and read spectrum data with BINARY)
60  '****************************************
70  '
80  DIM LAMBDA(3201),LEVEL(3201),BX$[4]
90  ISET IFC                        ' send 'IFC' signal
100 ISET REN                        ' 'REN' signal set to true
110 CMD DELIM = 0                   ' delimitter CR/LF
120 CMD TIMEOUT = 10                ' timeout set to 10sec
130 DEF SEG = &H60                  ' --
140 A% = PEEK(&H9F3)                '   |
150 A% = A% AND &HBF                '   --clear SRQ bit of PC9801
160 POKE &H9F3,A%                   ' --
170 SPA = 8                         ' define Q8347 GP-IB address (8)
175 PC = IEEE(1) AND &H1F           ' read GP-IB address of PC
180 PRINT @SPA;"C"                  ' initialize Q8347
190 ON SRQ GOSUB *SSRQ              ' define SRQ interrupt routine
200 PRINT @SPA;"COH 0"              ' select 'SPECTRUM' mode
210 PRINT @SPA;"CEN1.55um,SPA50nm"      ' CENTER:1.55um , SPAN:50nm
220 PRINT @SPA;"REF -10dBm"         ' 'REF LEVEL' set to -10dBm(select LOG)
230 PRINT @SPA;"BAV 0"              ' 'AVERAGE' OFF
240 PRINT @SPA;"MSK 254"            ' enable only 'measure end'(b0) bit
250 PRINT @SPA;"SRQ 1"              ' enable SRQ signal
260 PRINT @SPA;"MEA 1"              ' start signal measurement
270 M.END = 0                       ' clear measure end flag
280 SRQ ON                          ' enable SRQ interrupt
290 IF M.END=0 THEN 290             ' wait measurement end
300 PRINT @SPA;"HED 0,ODN"          ' request no-of-measured data output
310 INPUT @SPA;N.DATA               ' read no-of-measured data
320 PRINT @SPA;"FMT 4"              ' select 32bit NEC-floating format
330 PRINT @SPA;"OSD1"               ' request X-axis data output(lambda)
340 WBYTE &H5F,&H3F,&H20+PC,&H40+SPA;     ' PC:listener , Q8347:talker
350 FOR N=1 TO N.DATA               '
360   RBYTE ;B1,B2,B3,B4            ' read 1point(4bytes) data
370   BX$=CHR$(B1)+CHR$(B2)+CHR$(B3)+CHR$(B4)    ' 4bytes data set to string
380   LAMBDA(N)=CVS(BX$)            ' convert to numeric data
390 NEXT N                          '
400 PRINT @SPA;"OSD0"               ' request Y-axis data output(level)
410 WBYTE &H5F,&H3F,&H20+PC,&H40+SPA;     ' PC:listener , Q8347:talker
420 FOR N=1 TO N.DATA               '
430   RBYTE ;B1,B2,B3,B4            ' read 1point(4bytes) data
440   BX$=CHR$(B1)+CHR$(B2)+CHR$(B3)+CHR$(B4)    ' 4bytes data set to string
450   LEVEL(N)=CVS(BX$)             ' convert to numeric data
460 NEXT N                          '
470 '*** spectrum data transaction write here ***
480 STOP
490 *SSRQ: POLL SPA,S               ' execute serial-poll and read status
500 M.END = 1                       ' set measure end flag
510 RETURN
520 '
530 END
```

- Explanation on program 4 for ② 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 output.
100	"REN" signal is set to TRUE.
110	Delimiter is set to CR/LF (= CR/NL) for the command setting.
120	Time out is set at 10 seconds for handshaking.
130 to 160	SRQ bit of the GPIB interface in the PC9800 series is cleared.
170	The Q8347's GPIB address (8) is set as a variable.
180	The analyzer is initialized to the condition of powering on.
190	Routine is defined according to the interruption with the SRQ signal.
200	Spectrum analysis mode is selected.
210	Center wavelength is set to 1.55um and span is set to 50nm.
220	Reference level is set to -10dBm.
230	Averaging is set to once (OFF).
240	Only b0 (measure-end) in the status byte is validated.
250	Mode to output SRQ signal is set.
260	Measurement starts.
270	Flag (variable) to indicate the end of measurement is cleared.
280	Interrupt by SRQ signal is allowed.
290	Waiting for the end of the measurement.
300	Request for output the number of measurement points for the spectrum
310	Number of measurement points is read into the variable.
320	Data output format is set to binary (floating point of 32 bits NEC format). (If the binary format is selected, the terminator is always <EOI>.)
330	Request for output X-axis data (wavelength)
340	Q8347 is set as the talker and PC is set as the listener.
350	Data is read repeatedly enough for the number of measurement points
360	Data of 1 point (4 bytes) is read.
370	Data of 4 bytes is assigned to the character string to convert it to numerics.
380	Character string is converted to the floating point data, and it is stored into the array variable of waveform data.
400	Request for output Y-axis data (level)
410	Q8347 is set as the talker and PC is set as the listener.
420	Data is read repeatedly enough for the number of measurement points
430	Data of 1 point (4 bytes) is read.
440	Data of 4 bytes is assigned to the character string to convert it to numerics.
450	Character string is converted to the floating point data, and it is stored into the array variable of level data.
470	(Normally, write a program after this line number to process the read data.)
490	<Interrupt processing routine *SSRQ> Serial poling is executed and the status byte is read into the variable.
500	Flag to indicate end of measurement is set.
510	Return to the main routine.

(5) Example 5

Spectrum measurement is executed and the 2nd peak (cursor data) and spectral width calculation data read.

① Program 5 for HP 9000 series 300

```
10    !*****************************************
20    !     Q8347  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 Lmi,Lvi,D_lm,D_lv
110  REAL Lambda_0,S_width,N_peak
120   !
130  Spa=708                          ! define Q8347  GP-IB address (8)
140  ON INTR 7 GOSUB Srq              ! define SRQ interrupt routine
150  CLEAR Spa                        ! initialize Q8347
160  OUTPUT Spa;"COH 0"               ! select 'SPECTRUM' mode
170  OUTPUT Spa;"CEN 830nm"           ! 'CENTER' set to 830nm
180  OUTPUT Spa;"SPA 20nm"            ! 'SPAN' set to 20nm
190  OUTPUT Spa;"REF 0dBm,LEV 0"      ! 'REF LEVEL':0dBm,'LEVEL SCALE':10dB/DIV
200  OUTPUT Spa;"EAV 0"               ! 'AVERAGE' OFF
210  OUTPUT Spa;"MSK 254"             ! enable only 'measurement end' bit
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;Lmi,Lvi,D_lm,D_lv      ! read lambdai,Li,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 Q8347
370  Meas_end=1                       ! set measure end flag
380  RETURN
390   !
400  END
```

- Explanation on program 5 for ① HP9000 series 300

Line No.	Description
10 to 80	Comment
90 to 110	Definition of variables (to assure arrangement of the maximum number of data items).
130	The Q8347's GPIB address (8) is set as a variable.
140	Definition of the processing routine used when an interrupt by SRQ signal occurs.
150	The analyzer is initialized at power on.
160	Spectrum analysis mode is selected.
170	Center wavelength is set to 830nm.
180	Span is set to 20nm.
190	Reference level is set to 0dBm and level scale to 10dB/DIV.
200	Averaging is set to OFF.
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, $\triangle\lambda$, $\triangle$ level).
300	Spectral width calculation -0(Pk-XdB) is selected and parameter XdB to 3dB.
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.

② Program 5 for PC9800 series

```
10  '****************************************
20  '     Q8347  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 Q8347  GP-IB address (8)
175 PC=IEEE(1) AND & 1F             ' 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 Q8347
200                                 ' UNL,MTA(adr 30),LA of Q8347  ,SDC
210 ON SRQ GOSUB *SSRQ              ' define SRQ interrupt routine
220 PRINT @SPA;"COH 0"              ' select 'SPECTRUM' mode
230 PRINT @SPA;"CEN 830nm"          ' 'CENTER' set to 830nm
240 PRINT @SPA;"SPA 20nm"           ' 'SPAN' set to 20nm
250 PRINT @SPA;"REF 0dBm,LEV 0"     ' 'REF LEVEL':0dBm,'LEVEL SCALE':10dB/DIV
260 PRINT @SPA;"EAV 0"              ' 'AVERAGE' OFF
270 PRINT @SPA;"MSK 254"            ' enable only 'measurement end' 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 Q8347  ,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;"HED 0,OCD"          ' header OFF, 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
```

- Explanation on program 5 for ② PC9800 series

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 GPIB interface is cleared.
170	The Q8347's GPIB address (8) is set as a variable.
175	PC's GPIB address is read.
180 to 200	The analyzer 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 830nm.
240	Span is set to 20nm.
250	Reference level is set to 0dBm and the level scale to 10dB/div.
260	Averaging is set to OFF.
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	Header OFF and 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 3dB.
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 the routine.

(6) Example 6

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 6 for HP 9000 series 300

```
10    !*****************************************
20    !     Q8347  Optical Spectrum Analyzer
30    !     == sample program 6 ==
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 Q8347  GP-IB address (8)
120  ON INTR 7 GOSUB Srq            ! define SRQ interrupt routine
130  CLEAR Spa                      ! initialize Q8347
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,EAV1"        ! 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 Q8347
310  Meas_end=1                     ! set measure end flag
320  RETURN
330   !
340  END
```

- Explanation on program 6 for ① 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 Q8347's GPIB 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 850nm.
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 0.1mW (when using mW, liner 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	A 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.

② Program 6 for PC9800 series

```
10  '****************************************
20  '     Q8347  Optical Spectrum Analyzer
30  '     == sample program 6 ==
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 Q8347  GP-IB address (8)
170 PRINT @SPA;"C"                  ' initialize Q8347
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,PIN0.5"      ' 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,EAV1"         ' 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
```

- Explanation on program 6 for ② 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's GPIB interface is cleared.
160	The Q8347's GPIB 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	Power monitor display mode is selected.
200	Power measurement wavelength is set to 850nm.
210	Number of the measurement data is set to 101 and the measurement interval is set to 0.5 seconds.
220	Reference level is set to 0.1mW (when using mW, liner scale is automatically set).
230	Number of averaging 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	A trend chart measurement starts.
270	Flag (variable) to indicate the end of measurement is cleared.
280	Mode to transmit SRQ signal is set.
290	Waiting for end of measurement.
300	Terminator is set to CR/NL (EOI) and the data separator to ','.
320	Output of the header OFF or peak seach data (minumum, maxmum and
330	average) is requested.
340	Minimum, maximum and average values are read into variables.
370	<Interrupt processing routine *SRQ> Serial poling is executed and the status byte read into the variable.
380	Flag to indicate end of measurement is set.
390	Return to the routine.

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.

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.

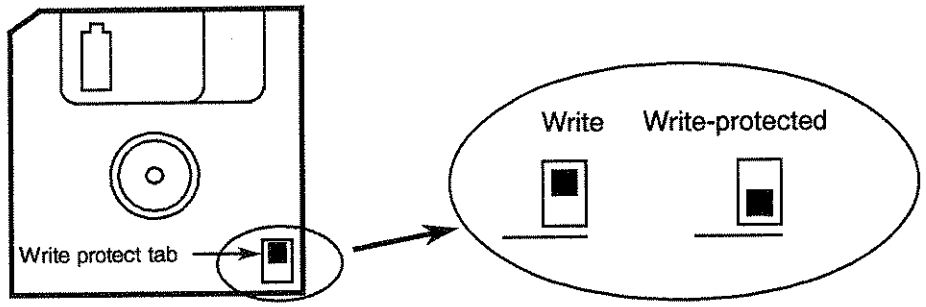
Disk type:	3.5 inch micro floppy disk
Usable media:	2DD (Double-sided double density)
	2HD (Double-sided high density)
Format capacity:	720K bytes (2DD)
	1.2M bytes (2HD)
Max. files:	111 files /disk (2DD)
	191 files /disk (2HD-1.2M)
Storage format:	In conformance with MS-DOS
	2DD (720K bytes) .... IBM/ 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 section" 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.



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.

7.2 Restoring Data from 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	128
(2) Measurement condition (ASCII)	640
(3) Measurement condition (binary)	768

< Measurement data file >

Item	Size (bytes)	
(1) Header	128	
(2) Measurement data	max 122	
(3) Measurement condition (ASC Ⅱ)	640	
(4) Measurement condition (binary)	768	
(5) Data Ⅰ Measurement condition (binary)	640	
(6) Data Ⅱ Measurement condition (binary)	640	} *1

*1: (6) is recorded only when data in LOSS/TRANS.

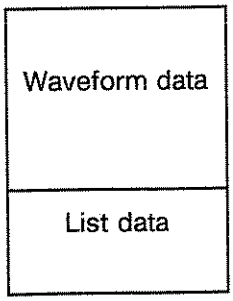
7.2.2 Data File Item

(1) Header
Records information as the company name, product name and software revision,etc.

(2) Measurement data (ASCII)
Stores the wavelength data, measured level data, list data, etc.
The level data is aiways stored in (W) unit irrespective of the scale (LIN/LOG) when saved. Use the following expression to convert the unit into (dBm) unit.

(W) ⇨ (dBm) conversion: $P_{dBm} = 10 \times \log_{10} (P_W \times 1.0e+3)$
$(= 10 \times (\log_2 P_W \times 1.0e+3) / \log_2 10))$

The data part is divided into waveform data part and list data part. If the list data is not displayed, only the waveform data can be displayed.
The data number N of the waveform data is recorded in the head of the waveform data. And then, waveform data X(n) and level data Y1(n) are recorded with delimiter of tab code (0 x 09). After Y1(n), CR(0 x 0D)/LF(0 x 0A) is recorded.
The recording format is shown below.
For the spectrum data, if LOSS/TRANS is enabled or the average mode is MAX-MIN, the level data of REF memory or MIN data Y2(n) is recorded following the level data or the level data of memory 1 Y1(n) and tab code.



Waveform data

Data number N	CR	LF	X (1)	\t	Y1 (1)	\t	Y2 (1)	CR	LF	X (2)	\t	Y1 (2)	.....	CR	LF	X (N)	\t	Y1 (N)	\t	Y1 (N)	CR	LF

List data

Data number N	CR	LF	X (1)	\t	Y (1)	CR	LF	X (2)	\t	Y (2)	CR	LF	.....	CR	LF	X (N)	\t	Y (N)	CR	LF

(3) 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]	** Q8347 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 Averaging count	[16]	20 , 100
⑪ Year-month-day	[16]	1991-10-28
⑫ Hour:minute:second	[16]	20:35:14
⑬ Power monitor wavelength	[16]	1.4800E−06
⑭ Power monitor N-MAX	[16]	101 , 501
⑮ Power monitor interval	[16]	2.0E+00 , 0.1E+00
⑯ Power monitor average	[16]	1 , 30
⑰ Power monitor REF level (LINEAR)	[16]	100.0E−06
⑱ Power monitor REF level (LOG)	[16]	−10.00E+00
⑲ Power monitor start time	[16]	0.0E+00
⑳ Power monitor stop time	[16]	10.0E+00 , 20.0E+03
㉑ Wavelength monitor center wavelength	[16]	1.480000E-06
㉒ Wavelength monitor N-MAX	[16]	101 , 501
㉓ Wavelength monitor interval	[16]	2.0E+00
㉔ Wavelength monitor average	[16]	1 , 30
㉕ Wavelength monitor minimum data	[16]	1.450000E-06
㉖ Wavelength monitor maximum data	[16]	1.510000E-06
㉗ Wavelength monitor start time	[16]	0.0E+00
㉘ Wavelength monitor stop time	[16]	10.0E+00
㉙ Average mode	[16]	NORMAL, ADVANCE *
㉚ Vacant area	[112]	

*: This is set in software revision B00 or later.

(4) Measurement conditions (binary
The same parameters as (3) is basically stored, and used for measurement conditions or restoring measurement data using this analyzer.
Though (3) is structured by ASCII code character string, this part is binary floating point form integer or numerical code data.

(5) Data Ⅰ measurement condition (binary)
Stores the measurement conditions concerning the measurement block Ⅰ of (2).
This part is also binary form as same in (3).

(6) Data Ⅱ measurement condition (binary)
Stores the measurement conditions concerning the LOSS/TRANS data of the measurement data in (2).
This block exists only for the LOSS/TRANS data of spectrum.

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 measured data and measurement conditions are stored to the floppy disk in ASCII data. Therefore, they can directly be read by using spreadsheet program, such as Excel *1 or Lotus 1-2-3 *2, on the market without creating special program. Because the data is recorded corresponding to the row and column of the spreadsheet, it is easy to make the data into graph.

< Example to restore data using spreadsheet program >

When reading data using spreadsheet program, file header data is input to cell A1 and data number N is to cell A2.
Wavelength data is input to cell A3 to An(n:N + 2) and level data (mW) is to cell B3 to Bn.
LOSS/TRANS data is input to cell C3 to Cn.

*1: Excel is a trademark of Microsoft Corp., America.
*2: Lotus 1-2-3 is a trademark of Lotus Development Corporation, America.

8. EXAMPLES OF MEASUREMENT

This chapter describes actual operation procedures using typical measurements of three devices: a laser diode, an LED and an optical filter.

8.1 Measuring Coherence of a Laser Diode

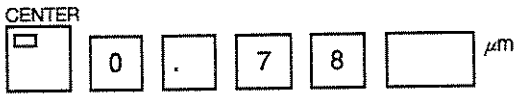
By analyzing the coherence of a laser diode having a center wavelength of 0.78 μm (Fabry-Perot type LD), to measure α (2nd peak distance and level data) and β (intermediate distance between the maximum and 2nd peaks, and level data) and output the results to a plotter.

(1) Turn power on.
After self-diagnosis is executed, the normal measurement screen is displayed.
(The measurement conditions at power off are restored. However, measurement operation remains at stop state.)

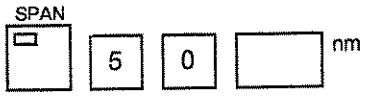
(2) Couple the output light of the laser diode to be measured to the fiber (SMF-10 μm or MMF-50 μm) and connect it to the input connector on the front panel of the analyzer.
(Insert the fiber, aligning it with the connector key position, and screw firmly in place. The fiber should be fixed in the proper position so that it will not vibrate. If the fiber vibrates, measurement data may fluctuate.)

(3) First of all, determine the center wavelength and the optimum reference level in the spectrum analysis mode. Press the corresponding display key.

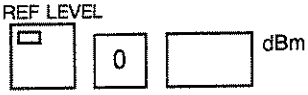
① Set the center wavelength: (0.78 μm)



② Set the wavelength span: (50nm)



③ Set the reference level: (0dBm)

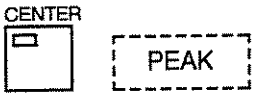


Confirm on the Softkey menu, that the system is set to LASER mode (the characters LASER of LASER/LED are reversed).

④ Execute a single measurement:

⑤ Set the optimum reference level:

⑥ Set the peak wavelength as the center wavelength:



⑦ Repeat measurement to confirm that the proper wavelength and reference level have been specified:

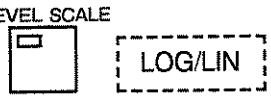
(4) Select coherence analysis mode and execute measurement.

① Select coherence analysis:

② Set the span: (5.18mm)

Set to 5.18mm using the arrow keys.

③ Set the Y-axis scale to Linear:



Press the LOG/LIN so that the characters LIN are reversed.

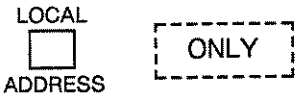
④ Execute a single measurement:

The values α and β are calculated by the auto search function and displayed at the upper left of the waveform data column along with the coherence data.

(5) Output the measurement data to the plotter.

① Connect the analyzer to a plotter using a GPIB cable (the AC cable should be disconnected before connecting the GPIB cable). Set the plotter address to Only mode (LISTEN ONLY).

② Set the GPIB address of the analyzer to Only mode (TALK ONLY).



③ Check the plotter interface specification: "GP-GL" (TYPE: AT) or "HP-GL" (TYPE: HPGL), and set the type.

(If required, use the Softkeys to set the plotter size.)

④ Start output to the plotter.

Note: Unless the plotter address is set to Only mode, "no plotter!!"

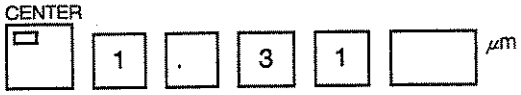
8.2 Measuring the Spectral Half-width of an LED

Measure an LED having a center wavelength of 1.31 μm and obtain the spectral half-width.
Output the measurement results to the built-in printer (optional).

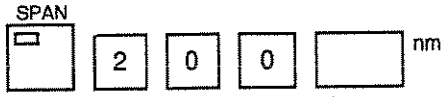
(1) Turn the power switch of the analyzer on, and connect the light to be measured to a fiber (see section 7.1).

(2) Set the measurement conditions including the center wavelength and span, and execute measurement.

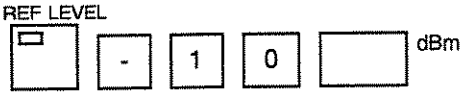
① Set the center wavelength: (1.31 μm)



② Set the wavelength span: (200nm)



③ Set the reference level: (-10dBm)



④ Set LED mode:

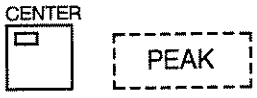
Press LESER/LED so that the characters LED are reversed. In this case, REF LEVEL is displayed in XX/nm units.

⑤ Execute a single measurement:

⑥ Set the optimum reference level:

If the LED has a wide spectral width, the peak level will be small and the power level, which is the sum of the entire spectra, will a large.
As the power of the light to be measured is completely absorbed by the analyzer's internal photo sensor, "OVERLOAD" occurs if the reference level is set according to the peak level.

⑦ Set the peak wavelength as the center wavelength:



⑧ Repeat measurement:

(3) Execute spectral half-width calculation (using XdB attenuation method).

① Execute/display the spectral half-width calculation: SPECTRAL WIDTH

When the spectral half-width calculation is executed by the specified calculation method, the center wavelength, spectral half-width and the number of peaks are displayed. The calculation method can be selected using the Softkeys. To use the XdB attenuation method, press Pk-XdB (the characters Pk-XdB are reversed).

To change the value of X, the following operation is required.
(Set 3 for XdB)

parameter → XdB → 3 → ENTER

To execute spectral half-width calculation using this modified value, press the SPECTRAL WIDTH key.

(4) Output the measurement results to the printer.

① Specify printer as the output device: DEVICE

② Printer output starts: COPY → PRINTER

Printing starts about 1.5 seconds after the key is pressed.

Note: If no paper is set in the printer, "no printer paper!!" appears on the screen. If the printer head is raised, "printer head up!!" appears.

8.3 Measuring the Loss Wavelength Characteristics of an Optical Filter

Measure the loss wavelength characteristics of an optical filter, using a TQ8111 white light source produced by our company. Since the power level per resolution is small in measure loss wavelength characteristics using a white light source, averaging is required. (An example of optical filter measurement is given below. An optical fiber can also be measured using the same panel operation.)

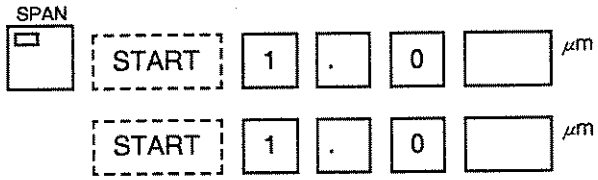
(1) Turn the power switches on the analyzer and the TQ8111 white light source on.
Warm up the devices for about 10 minutes to permit stabilized measurement.

(2) Connect the analyzer to the CH2 white light source using a GI-50 μm fiber (if equipped with 200 μm option-10 input, fiber with a core diameter of up to 200 μm can be connected).
In this example a CH2 white light source is used, and the filter to be measured is placed in its internal chamber.

(3) First, measure the reference data to obtain the loss characteristics (the spectrum of the white light source output to CH2). In this example, the wavelength range is set to 1.0μm to 1.6 μm.

① Set the Start wavelength: (1.0 μm)

② Set the Stop wavelength: (1.6 μm)



③ Set the reference level: (AUTO)

As the measurement sensitivity is required, select the AUTO mode so that the optimum reference level is set for every measurement (when the Softkey [AUTO] Softkey is pressed, the characters AUTO are reversed).

④ Set LED mode: LASER/LED

Since the wavelength range to be analyzed is wide, use LED mode so that the difference in resolution caused by the wavelength can be absorbed.

Press LASER/LED so that the characters LED are reversed.

At this time, REF LEVEL is displayed in XX/nm units.

⑤ Set the number of averaging times: (16 times)

AVG [ ] [16] [ON/OFF]

Press [ON/OFF] so that the characters ON are reversed.

⑥ Measure the reference data:

SINGLE [ ]

The data for the specified number of measurements is measured and averaging executed. While averaging is in progress, "average in progress..." is displayed. The number of measurements X in AVG: X/N which appears at the upper right of the LCD display is incremented as measurement proceeds and measurement is completed when X = N.

(4) Save the data obtained in step (3) in the reference memory and select the loss characteristics measurement mode.

① Save the measurement data in the reference memory:

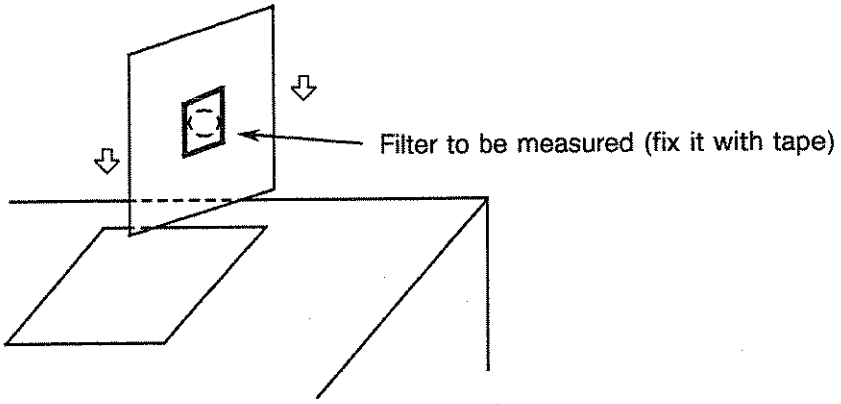
NORMALIZE LOSS/TRANS [ ] [SAV REF]

Press the NORMALIZE LOSS/TRANS [ ] key to display the Softkey menu required for measuring the loss characteristics.

② Select loss measurement mode: [LOSS]

When [LOSS] is pressed, the characters LOSS are reversed and the loss measurement mode is set. At this time, the characters "SPEC" indicating the type of analysis data are replaced with "LOSS" at the upper left of the LCD display, and the Y-axis display unit is changed from dBm to dB. The data obtained in step (3) disappears from the LCD display.

(5) Insert the filter to be measured in the chamber of the TQ8111 white light source.



(6) The loss wavelength characteristics of the filter can be obtained by measuring the spectrum of the white light source after passing it througt the filter.

① Measure the filter transparency data: SINGLE

By dividing (or deleting if LOG scale is used) the measurement data by the data saved in the reference memory in step (4), LOSS data is displayed. If averaging is in progress, the current LOSS data (after averaging the current number of measurements) is displayed until the specified number is reached.

Note 1: If LOSS or TRANS is ON, the REF LEVEL key can be used to raise or lower the display (used to modify the lowest level in case of LOSS and the highest level in case of TRANS (the initial value is 0dB in either case)).

Note 2: In this example, LOSS is obtained by calculation between the reference memory and the measurement data. If the measurement data is saved in measurement data memory 1 (using the SAV MEAS1 Softkey) with the MEM NORM Softkey set to ON, calculation is executed between the reference memory and measurement data memory 1. While MEM NORM mode is ON, the displayed data is not modified by measurement.

9. PRINCIPLE OF OPERATION

This chapter describes the operating principle of the analyzer using its block diagram.

9.1 Explanation of the Operation Principle

A basic illustration of the analyzer is shown in the block diagram in Fig. 8-1.
The analyzer consists of three blocks: interferometer, measurement controller (FFT block) and display processing block.
The operating principle is briefly described below based on the block diagram.

(1) Interferometer (Michelson interferometer)
The measurement light is fed into the collimator through a 50 μm GI fiber. The light is modified into parallel beams in the collimator and divided into two parts by the beam splitter: one for the moving mirror and the other for the fixed mirror. Both beams are reflected by the mirrors and returned to the beam splitter for rejoining. When the two beams become one, interference is caused by the difference in their routes.
An interferogram (interference curve) can be obtained by moving the movable mirror continuously to modify the route difference. Since the interferogram is a spectrum of the light which has undergone Fourier conversion (discovered by A. A. Michelson in 1902), it can be obtained by sampling at a definite interval by A/D converter and executing FFT processing.

The Q8347 is equipped with a He-Ne gas laser (having wavelength of 632.991nm) which is passed through the different route as the light source to be measured but through a same optical system so that an interferogram can be obtained. As the He-Ne laser is a single spectrum with significantly high interference, the interferogram obtained accurately indicates the position of the moving mirror (route difference). Consequently, sampling at a definite interval not affected by mirror movement error is possible by multiplying the interferogram by two (or four) using the PLL circuit and executing clock sampling in the A/D converter. (The PLL circuit is used to satisfy the FFT sampling theory that "sampling frequency should be more than twice of the frequency to be measured"). By using this He-Ne reference light source, measurement with high wavelength accuracy can be executed without calibration.
Although only one measurement light detector is shown in the block diagram, two types of photodiodes are actually used, an Si photodiode for the short wavelength region and an InGaAs photodiode for the long wavelength region, in order to cover a wide wavelength range.
The light accepted by the photodiode undergoes current-voltage conversion before being fed into the A/D converter which has a 14-bit accuracy (polarity + 13bits) and range in 1.25dB units.

(2) Measurement control block (FFT block)

This block controls the movable mirror drive as well as the range of the measurement system and executes signal processing of the A/D conversion data.

The A/D converter operates in the 1MHz frequency range, and a digital filter is used to improve resolution. The digital filter improves resolution by enlarging a particular frequency region. This zoom processing normally operates in parallel with interferogram sampling. (In the block diagram, transfer of the A/D-converted data to the digital filter and of the digital filter zoom results to the buffer memory are executed at real time, —RUNNING-ZOOM).

The A/D-converted data is always stored in buffer memory 1. The data in memory 1 is used to analyze the measured data under different wavelength conditions, which is referred to as the HOLD-ZOOM function. That is, A/D-converted data is normally fed directly to the digital filter, but in HOLD-ZOOM mode, the previous measurement data is fed from buffer memory 1 to the digital filter of which the center wavelength and multiplication factor have been modified.

Data from the digital filter is stored in buffer memory 2 as a 4096-point complex number. Using DSP (Digital Signal Processor), window processing, FFT processing and power calculation are executed on this 4096-point data to obtain spectrum data.

The data obtained is sent via dual-port memory to the display processing block.

During coherence analysis of the latter half of the 4096-point data, the squares of the real number and imaginary parts are summed up respectively and normalized with the peak value (data of light route difference 0).

(3) Display processing block

This block is used to control the measurement system based on the conditions set by the panel keys or via the GPIB interface, and executes measurement data output (display, GPIB and printer).

Data transfer with the measurement system is executed via the dual-port memory. Measurement conditions including center wavelength, span and reference level are transmitted and the measurement data after FFT processing is received. Sensitivity correction and display scaling are performed on the measurement data and the results displayed.

This block also executes cursor processing and analysis such as spectral half-width and normalization calculation.

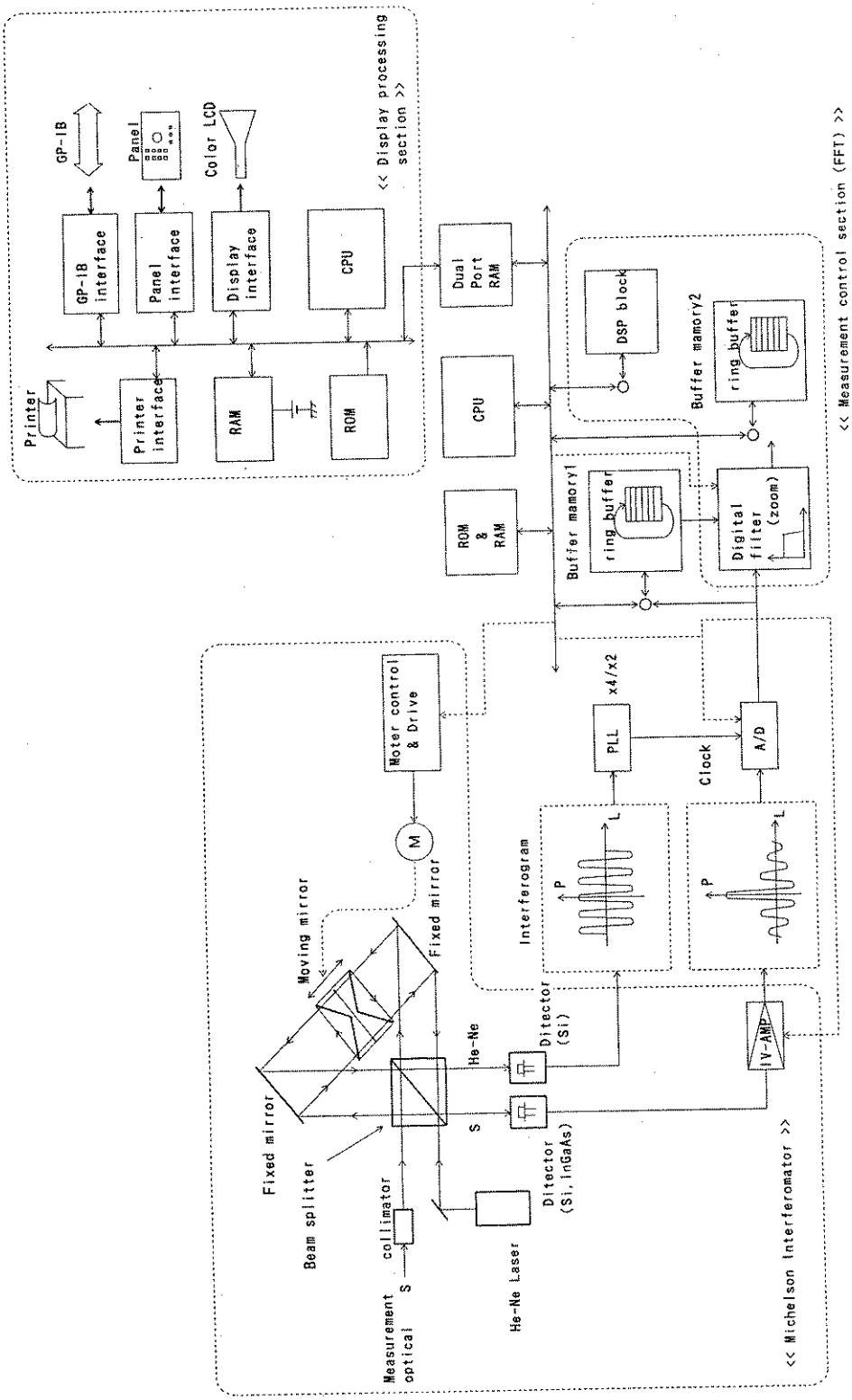


Figure 9-1 Internal Block Diagram

10. SPECIFICATIONS

(1 of 2)

Items		Specifications	
		Normal resolution mode	High resolution mode
Wavelength	Measurement range	0.35 μm to 1.75 μm	
	Maximum resolution	Approx. 0.1nm / 1.55 μm Approx. 0.05nm / 0.85 μm	Approx. 0.01nm / 1.55 μm Approx. 0.003nm / 0.85 μm
	Accuracy	±0.1 nm or less	±0.01 nm or less
	Span	0.01 nm / DIV to 140 nm / DIV	
Level	Measurement range (input sensitivity)	-72 dBm to +10 dBm (1.2 μm to 1.6 μm) -65 dBm to +10 dBm (0.7 μm to 1.6 μm) -52 dBm to +10 dBm (0.45 μm to 1.7 μm) -42 dBm to +10 dBm (0.35 μm to 1.7 μm) (Minimum level is SPAN 50 nm, after AVG 16 times)	
	Accuracy	±1.0dB (780nm), ±0.7dB(1310nm,1550nm), Input level -10dBm	
	Linearity (*1)	±0.1dB/-20dB or less ±0.5dB/-30dB or less	
	Dynamic range(*2)	35dB or more(Value between peak and average display noise level)	
	Repeatabillty Including polarization dependence (*3)	±0.1dB or less (+23°C±5°C) at 1.55μm	
	Scale	0.2, 0.5, 1.0, 2.0, 5.0, 10.0 dB/DIV and LINEAR	
Processing function	Measurement time (*4)	1 sec. or less	2.5 sec. or less (at long wavelength band: 0.95μm to 1.75 μm)(*5)
			3.5 sec. or less(at long wavelength band: 0.35μm to 1.05 μm)
	Memory function	16 screens (measurement data) with battery backup 10 screens (measurement condition) with battery backup Floppy disk (MS-DOS format: 720KB / 1.2MB)	

(2 of 2)

Items		Specifications	
		Normal resolution mode	High resolution mode
Processing function	Display	Frequency, Superimpose, 3-dimensional trend monitor (power, wavelength), dual screen (up / down) display, Cursor function, Color display customization, Listing	
	Calculation / Analysis	●Spectrum analysis ●Coherence analysis (analysis range: ±165mm maximum) ●Spectral half-width calculation ●Averaging ●Automatic optimum measurement ●Smoothing ●Automatic peak search ●normalizing (LOSS/TRANS) ●Curve fit (sech^2,Gauss) ●MAX/MIN hold	
Input/Output	Input connector	FC connector (Internal fiber:PC rubbed,GI 50/ 125)	
	Data output	GPIB standard equipment Direct plotter output(*6) Built-in printer (printing speed 8 sec. or less)	
General specifications	Operating environment	Temperature +10 °C to +40 °C, relative humidity 85% or less (No condensation allowed)	
	Storage environment	Temperature –10°C to +50 °C, relative humidity 90% or less (No condensation allowed)	
	Power source (Main Unit) (Optical Unit)	 100 to 120VAC/220 to 240VAC, 48Hz to 66Hz, 180VA or less 100 to 120VAC/220 to 240VAC, 48Hz to 66Hz, 80VA or less	
	External dimensions (Main Unit) (Optical Unit)	 Approx. 424(W) × 221(H) × 500(D) mm Approx. 424(W) × 132(H) × 500(D) mm	
	Mass (Main Unit) (Optical Unit)	 16 kg or less 20 kg or less	

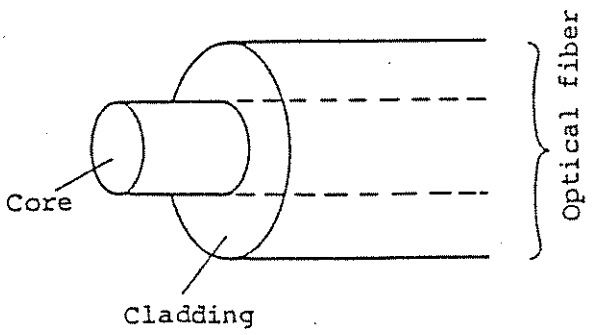
(*1) With an input level of 0dBm or less.
(*2) At 1.55μm band,Span 20nm or less,advance averaging 16.
Smoothing at 11point,spectral width calcuration at 1nm or less.
(*3) At a wavelength of 1.53 μm to 1.57 μm. In the case of coherent light input, wavelength shift cause the level change of $\pm$0.4dB or less.
(*4) Measurement conditions: On SINGLE measurement, one averaging performed,
Measuring time is from triggering to SRQ output. At long wavelength band.
(*5) Approx.5sec/measurement with advance averaging
(*6) Plotters which can be connected: R9833 (made by ADVANTEST)
7575A, 7440A, 7470A (made by HP)

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.

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.

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.

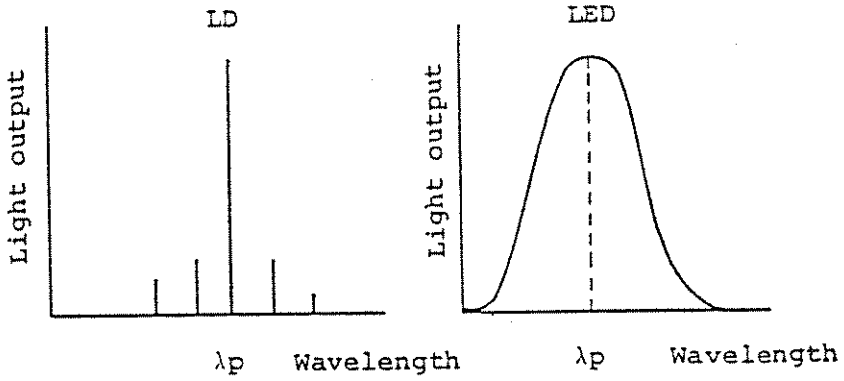
Directivity
Cases when the light output or the light receiving sensitivity is greater in the specific direction.

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



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).

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.

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 (50 100 m) 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).

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 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.

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.

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.

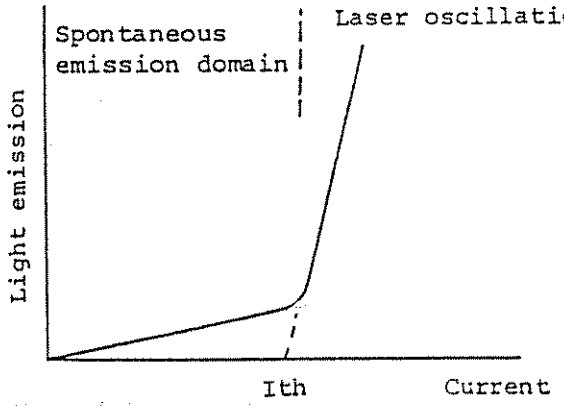
Spectrum
Light is usually composed of sinusoidal waves. The wavelength axis components are called the spectrum. A white light source has a flat spectrum while that of a laser diode is concentrated in a narrow range.

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.

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 nm to 380 nm.

Visible light

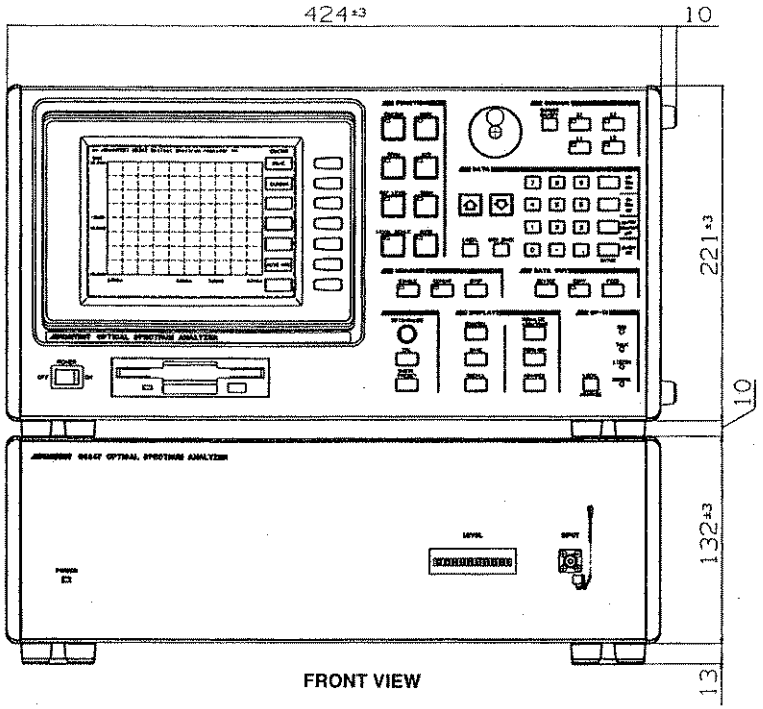
Light which can be seen by the human eye. Wavelength of 380 nm to 780 nm.

Wavelength

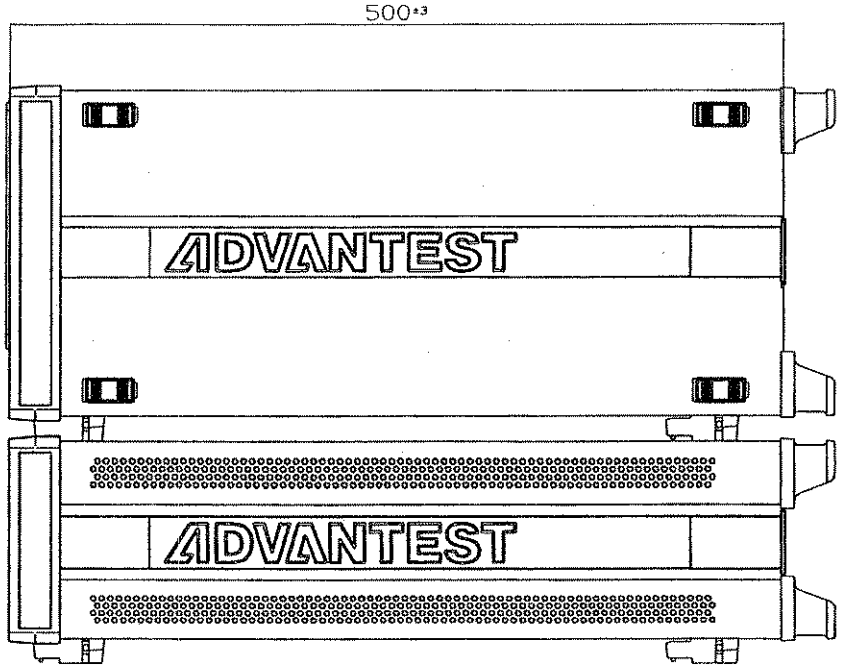
A wavelength of which the force distribution of the light emitting spectrum is located at the center.

Wavelength division multiplexing

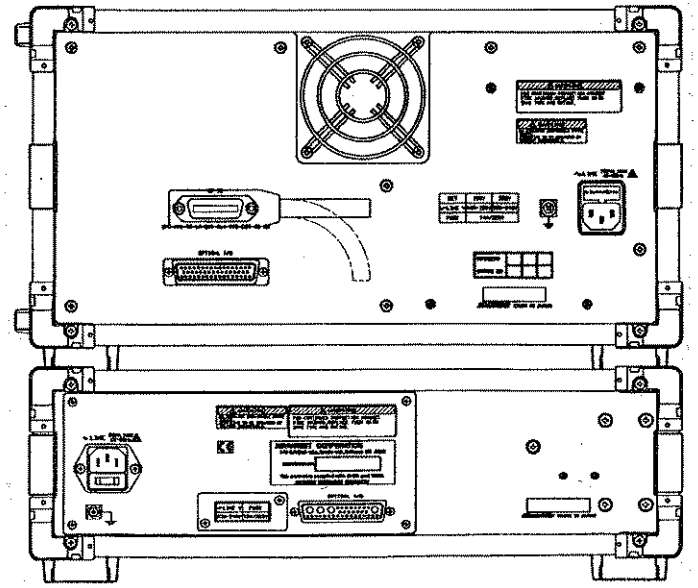
A communication system to transmit two or more kinds of signals through the one optical fiber at the same time. In this case, as a transmitter, light emitting diodes with various wavelengths and laser diodes are used. Both unidirectional systems and bidirectional systems are available.



FRONT VIEW



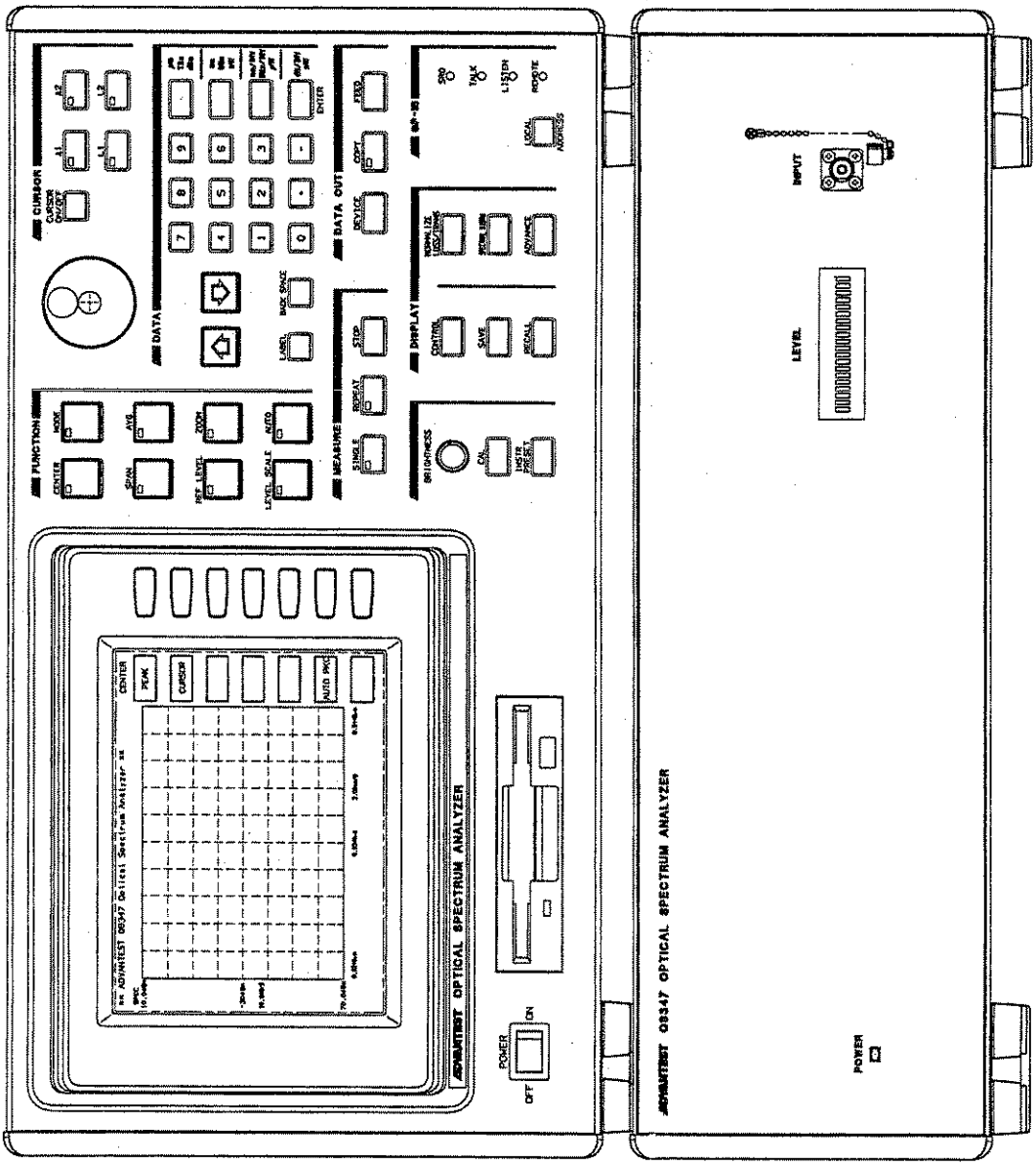
SIDE VIEW



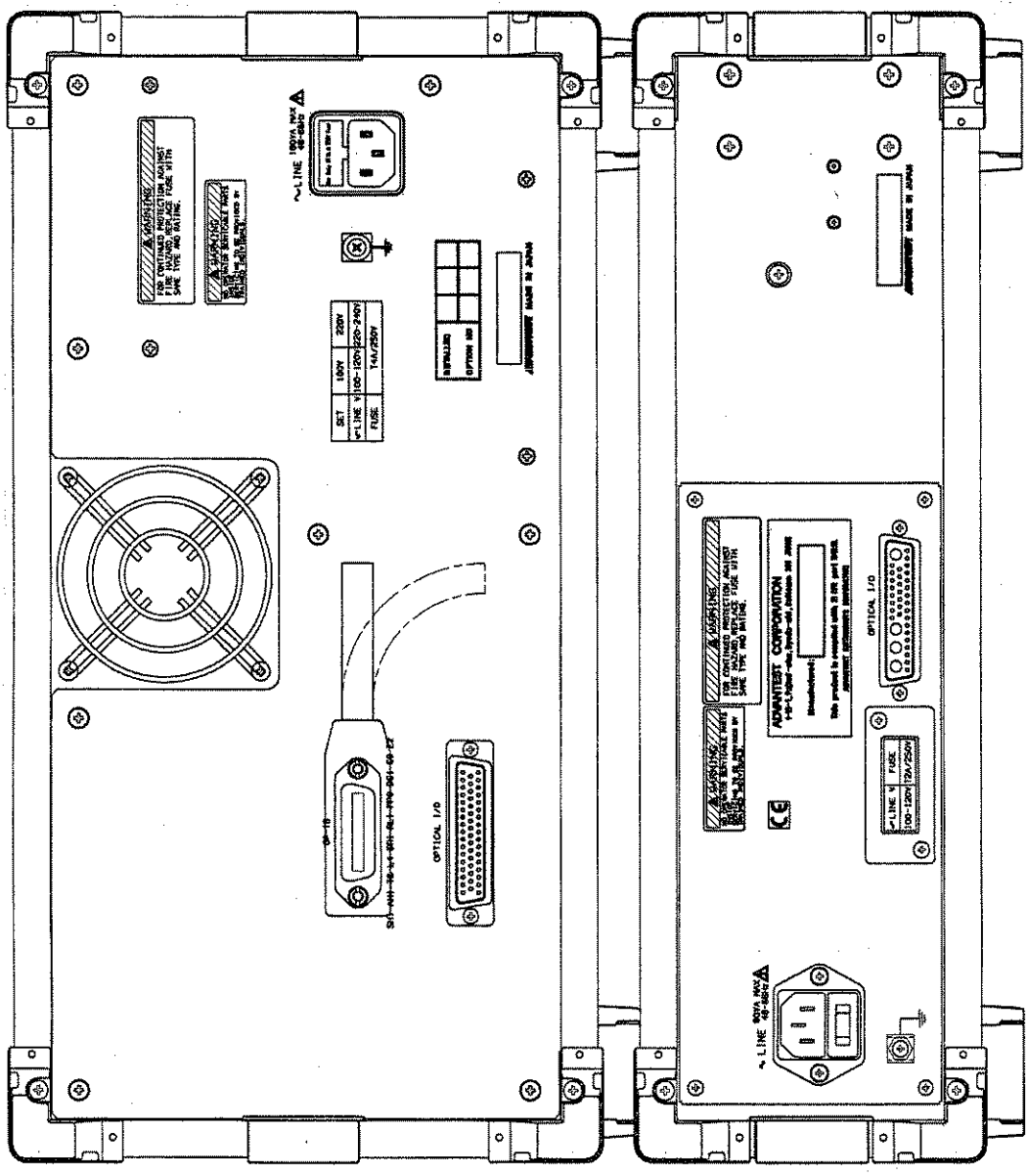
REAR VIEW

Unit; mm

Q8347
EXTERNAL VIEW



Q8347 FRONT VIEW



Q8347 REAR VIEW

ALPHABETICAL INDEX

1. Unless otherwise specifically agreed by Seller and Purchaser in writing, ADVANTEST will warrant to the Purchaser that during the Warranty Period this Product (other than consumables included in the Product) will be free from defects in material and workmanship and shall conform to the specifications set forth in this Operation Manual.

2. The warranty period for the Product (the "Warranty Period") will be a period of one year commencing on the delivery date of the Product.

3. If the Product is found to be defective during the Warranty Period, ADVANTEST will, at its option and in its sole and absolute discretion, either (a) repair the defective Product or part or component thereof or (b) replace the defective Product or part or component thereof, in either case at ADVANTEST's sole cost and expense.

4. This limited warranty will not apply to defects or damage to the Product or any part or component thereof resulting from any of the following:

   (a) any modifications, maintenance or repairs other than modifications, maintenance or repairs (i) performed by ADVANTEST or (ii) specifically recommended or authorized by ADVANTEST and performed in accordance with ADVANTEST's instructions;

   (b) any improper or inadequate handling, carriage or storage of the Product by the Purchaser or any third party (other than ADVANTEST or its agents);

   (c) use of the Product under operating conditions or environments different than those specified in the Operation Manual or recommended by ADVANTEST, including, without limitation, (i) instances where the Product has been subjected to physical stress or electrical voltage exceeding the permissible range and (ii) instances where the corrosion of electrical circuits or other deterioration was accelerated by exposure to corrosive gases or dusty environments;

   (d) use of the Product in connection with software, interfaces, products or parts other than software, interfaces, products or parts supplied or recommended by ADVANTEST;

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

   (f) any negligent act or omission of the Purchaser or any third party other than ADVANTEST.

5. EXCEPT TO THE EXTENT EXPRESSLY PROVIDED HEREIN, ADVANTEST HEREBY EXPRESSLY DISCLAIMS, AND THE PURCHASER HEREBY WAIVES, ALL WARRANTIES, WHETHER EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, (A) ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND (B) ANY WARRANTY OR REPRESENTATION AS TO THE VALIDITY, SCOPE, EFFECTIVENESS OR USEFULNESS OF ANY TECHNOLOGY OR ANY INVENTION.

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

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

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

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

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

CLAIM FOR DAMAGE IN SHIPMENT TO ORIGINAL BUYER

The product should be thoroughly inspected immediately upon original delivery to buyer. All material in the container should be checked against the enclosed packing list or the instruction manual alternatively. ADVANTEST will not be responsible for shortage unless notified immediately.
If the product is damaged in any way, a claim should be filed by the buyer with carrier immediately. (To obtain a quotation to repair shipment damage, contact ADVANTEST or the local supplier.) Final claim and negotiations with the carrier must be completed by buyer.

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