AQ6140
Multi-Wavelength Meter
Instruction Manual

ANDO ELECTRIC CO., LTD. JAPAN

AS-62527-1 Rev. 2.0

Introduction

Thank you for purchasing the AQ6140 wavelength meter. The AQ6140 has been developed as a measuring instrument compatible for the characteristic evaluation of WDM (wavelength divided multiplex) systems and Fabry-Perot laser multiplexing.
Always read through this manual before using the AQ6140 (hereinafter, device).
Always read through and comprehend the "Safety Precautions" given at the beginning of this manual before using this device.
Keep this manual near the device for future reference.

This manual

This manual describes the handling and maintenance of the AQ6140 wavelength meter (hereinafter, device).

・Always read the "Precautions" given before Chapter 1 before using this device.

・Read "Chapter 1 Outline" to find the features and functions of this device.

・First-time users of this device, should start from "Chapter 2 Preparing for Use".

・The basic functions are described in "Chapter 3 Explanation of Basic Functions".

・The menu configuration of this device is described in "Chapter 4 Menu Configuration".

・Operation examples for using this device are given in "Chapter 5 Operation Methods".

・Remote operation of this device is described in "Chapter 6 Remote Functions".

・Periodic inspection of this device is indispensable for maintaining the correct operation of this device. The periodic maintenance items and procedures, etc., are described in "Chapter 7 Maintenance".

Guarantee

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Precautions regarding backup battery

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Precautions for Safety and Handling

Example of illustration

⚠Warning
Indicates matters that could cause fatal accidents or severe injury if ignored and handling is mistaken.

⚠Caution
Indicates matters that could cause severe injury or physical damage if ignored and handling is mistaken.

	Indicates matters that could lead to smoke or fire if handling is mistaken.
	Indicates matters that could lead to electric shock if handling is mistaken.
	Indicates matters that could lead to injury if handling is mistaken.
	Indicates to always disconnect the power cable from the plug for safety purposes.
	Indicates unspecified general operator actions.

Precautions related to Working Environment and Conditions

Limitations to working environment

	Make sure that water does not enter or contact this device. →Failure to observe this could lead to fires, electric shocks or accidents. Always connect the grounding when using in highly humid areas.

Limitations to working conditions

	Do not use a voltage other than the indicated power voltage. →Failure to observe this could lead to fires, electric shocks or accidents.
	When connecting with a commercial power supply, directly connect to a dedicated socket. →Do not use an extension cord as there is a risk of heating and fires.

Precautions related to installation

Precautions for persons carrying out installation

	When installing on a product with casters (dolly, etc.), always lock the casters. →Failure to observe this could lead to injuries if product moves or tilts over.
	Do not use branched wiring when connecting the power supply. →Failure to observe this could lead to the cables heating and a fire starting.
	Securely insert the power plug into the socket. →Contact of metals, etc., against the power plug could lead to fire or electric shock.

Limitations and prohibited matters related to installation environment and conditions

	Do not install the device in areas with high levels of humidity or dust. →Failure to observe this could lead to electric shock or trouble.
	Do not place the device on an unstable place such as an unstable table or inclined surface. →Failure to observe this could lead to injuries if the product drops or tilts over.
	Do not install the device in places with high levels of vibration or impact. →Failure to observe this could lead to injuries if the product drops or tilts over.
	Do not insert or drop metal rods into the device from the openings. →Failure to observe this could lead to fires, electric shocks or accidents.
	Do not place the power cord near heating appliances. Failure to observe this could lead to the cord sheath tearing, fires and electric shocks.
	Always hold the plug when disconnecting the power plug. →Pulling on the power cord could damage the cord and lead to fires and electric shocks.
	Do not connect/disconnect the power plug with wet hands. →Failure to observe this could lead to electric shocks.
	Do not place the device in areas with high temperatures, such as in direct sunlight, or an automobile subject to direct sunlight. →Failure to observe this could cause the internal temperature to rise and trouble to occur.

Prohibited matters related to installation methods

	Before moving the device, always disconnect the power plug from the socket, and confirm that the external connection wires have been disconnected. →Failure to observe this could lead to cord damage, fires and electric shocks.
	Do not scratch, damage or treat the power cord. →Placing heavy items on the cord, heating the cord or pulling on the cord could damage the cord and lead to fires and electric shocks.
	Do not block this device's ventilation holes. →Blocking the ventilation holes could cause heat to build up inside and lead to fires.

Precautions related to handling

Follow the procedures given in the instruction manual when handling this device.
If there are warning marks ("Warning", "Caution"), always follow the instructions given in the instruction manual.

	Do not place a container containing fluids or small metallic items on or near this device. →If the fluids spill or the items enter the device, fires, electric shocks or trouble could occur.
	Do not treat, excessively bend, twist or pull on the power cord. →Failure to observe this could lead to fires or electric shocks.
	Do not disassemble or modify this device. →Failure to observe this could lead to fires, electric shocks or trouble.
	When not using this device for a long time, disconnect the power plug from the socket for safety purposes. →Failure to observe this could lead to fires, electric shocks or trouble caused by lightning.
	When closing the openings, take care not to pinch or injure fingers.
	Do not use this device at 0℃ or less. →The display operation cannot be guaranteed.
	Always turn the power OFF before connecting/disconnecting the connectors to and from this device. →Failure to observe this could lead to fires, electric shocks or trouble.

Precautions related to maintenance and inspection

Periodically service and inspect the device.
Consult your nearest Sales Office, listed at the back of this manual, if you have any questions.

	If dust accumulates inside this device and is not cleaned out, fires or trouble could occur.

Remedies for in case of trouble

	Contact Ando Electric to have the power cable replaced if damaged. →Use in the damaged state could lead to fires or electric shocks.
	If foreign matter enters the device, first turn OFF the power switch and disconnect the power plug from the socket. Then contact Ando Electric. →Use in this state could lead to fires or electric shocks.
	Using the device in an abnormal state, such as when smoke is apparent or there is a strange odor, could lead to fires, electric shock or trouble. If an abnormal state occurs, turn the power switch OFF immediately, and always disconnect the power plug from the socket. Confirm that the smoke has stopped, and then contact Ando Electric for repairs. The user must not carry out the repairs as a hazardous state could be created.
	If the device has been dropped or is damaged, turn OFF the power switch and disconnect the power plug from the socket. Then contact Ando Electric. →Use in this state could lead to fires or electric shocks.
	The user must not carry out repairs even if the device is faulty. →Failure to observe this could lead to electric shocks or injuries. Unauthorized repairs are not covered by the guarantee.。
	If the fan motor has heated up due to an increase in the temperature, turn OFF the power switch and disconnect the power plug from the socket. Then contact Ando Electric. →Use in this state could lead to fires or electric shocks.

Precautions for disposal

	Do not dispose of this product by incinerating it. →Failure to observe this could lead to explosions, fires and burns.
	The TFT color LCD panel of AQ6140 contains cold cathode fluorescent lamps. Please follow local ordinances or regulations for its disposal.

Safety of laser

The AQ6140 does not have an output laser aperture.

However, light less than 1nW escapes out of the mainframe.

A harmful radiation is not discharged into the human body by the AQ6140.

Laser Class

Contents

Chapter1

1.1 Outline of device

The device has been developed as a measuring instrument compatible for the characteristic evaluation of WDM (wavelength divided multiplex) systems and Fabry-Perot laser multiplexing. The wavelength measurement range is 1270 to 1650nm, and up to 256 laser beams can be measured simultaneously.
The GP-IB and RS-232-C interfaces are provided as a standard allowing remote control.

1.2 Specifications

Applicable fiber	SM
Optical connector	FC
Wavelength range[1)]	1270 to 1650nm (182 to 236THz)

Wavelength accuracy

1.3 Configuration

As a standard, this device is configured of the main body and the accessories shown in the standard accessories list

Standard accessories list

Part name	Qty.	Remarks
Power cord	1 pc.	Approx. 3m
Instruction manual	1 copy	

Chapter2

2.1 Unpacking and acceptance inspection

This device has undergone inspections before shipment from the factory, and the correct operation is guaranteed.
When the device arrives, unpack it immediately and check for any damage that may have occurred during transportation. When unpacking, take care not to damage the materials other than the outer paper, such as the interior cardboard box and cushioning material. Save these materials for future repacking.

Mechanical inspection

Check the appearance of the device, switch operations and connectors for any damage or faults that may have occurred during transportation. Check the types and quantities of accessories with the enclosed part list.

2.2 When damage or abnormality is found

If any damage is found on the device during the acceptance inspection or if any abnormality is found when using the device, notify Ando Electric (headquarters, sales office) of the details immediately.

2.3 Preparation and general precautions

Power voltage

Use a power supply with a voltage of 100 to 240VAC and power frequency within 48 to 63Hz. Prepare a cable with a rating voltage that satisfies the working voltage.

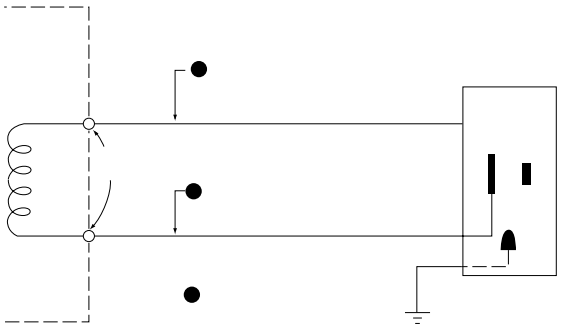
Power cable

The power cable is a 3-pin plug type, and the round pin at the center is the ground. Use a 3-pin socket when possible.

Fuse

When using with a power voltage of 100 to 120V/200 to 240V, use a 3.15A (quick action type) fuse.

Power voltage	Fuse
AC100 to 120V AC200 to 240V	F3.15A



Protective grounding

Grounding with 3-pole power socket

When the 3-pole (grounding type 2-pole) socket is used, the polarity of the 3-core power cord plugs and power supply will match. Thus, when this device's power cord is connected to the socket it is grounded to the ground.

Replacing the fuse

A "F3.15A 250V" fuse is mounted as a standard.

If the fuse needs to be replaced because of any trouble, pinpoint and remove the cause of the trouble, and then replace the fuse.

⚠WARNING

Before replacing the fuse, turn OFF the device's power switch, and disconnect the power plug from the socket. Replacing the fuse with the power ON could lead to personal injuries from electric shocks.

Before turning ON the power after replacing the fuse, carry out the protective grounding, and confirm that the AC power voltage is adequate. Then turn the power switch ON. Turning ON the power without protective grounding could lead to personal injuries from electric shocks. If the AC power voltage is inadequate, the inside of the device could be damaged by an abnormal voltage.

2.5 Precautions for storage

Precautions to be observed when storing this device for a long time are described below.

Precautions before storage

(1) Wipe off any dust, contamination (fingerprints) and stains, etc., on the device.

(2) Confirm that the device operates normally.

(3) Avoid storing the device for a long time in the following places:

- Where the device will be subject to direct sunlight, and where there are high levels of dust
- Highly humid places where water drops could adhere or form
- Places with active gases, or where the device could oxidize.
- Places with the following temperature and humidity levels

  Temperature: >60℃, <−20℃

  Humidity: >90%

Recommended storage places

In addition to satisfying the "Precautions before storage", it is recommended that the device be stored in the following environmental conditions when storing for a long time.

- Temperature 5 to 30℃
- Humidity 40～70%
- Where the daily temperature and humidity fluctuation is low.

When reusing the device after storage, check the operation and confirm that the device operates normally.

2.6 Repacking and transportation

The methods for repacking and transporting the device for transportation or repairs are explained in this section.

Repacking

Use the packing materials provided with the initial shipment. If those packing material has been lost or damaged, pack the device with the following method.

(1) Prepare a box with 10 to 15cm or more of space larger than the outline dimensions of this device.

(2) Place protective cushions on the projecting sections of the device's front panel and back panel.

(3) Wrap the device in vinyl, etc.

(4) Fill the clearance between the device and box with cushioning material to prevent shock such as vibration.

(5) Securely fix the outside of the box with adhesive tape or packing bands, etc.

Reusing the packing material initially delivered will make repacking simple, so save the packing material.

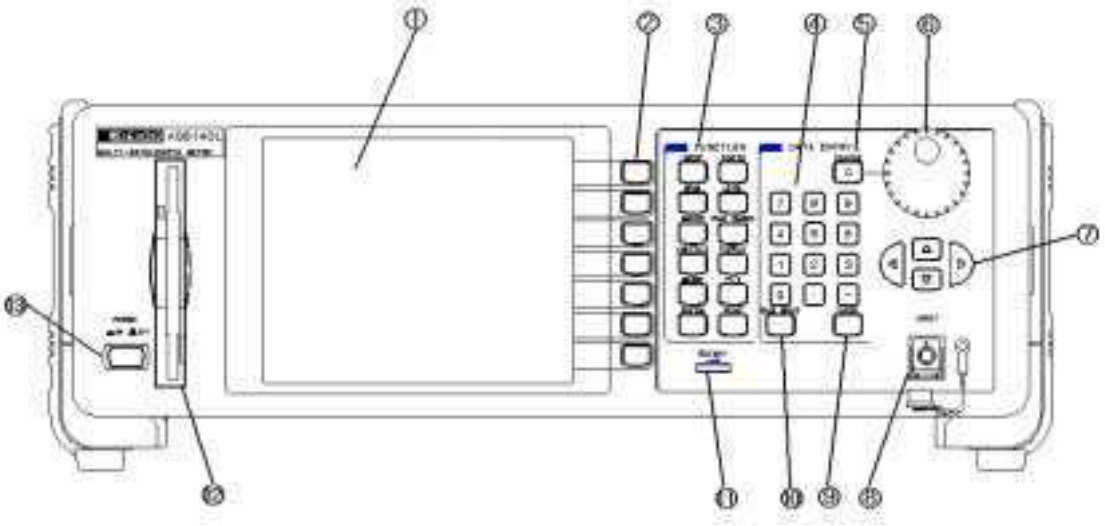
Transportation

Avoid vibration, and satisfy the "Recommended packing" conditions when transporting the device.

Chapter3

3.1 Names and functions of panels

The names and explanations of this device's panels are shown in Fig. 3-1 and 3-2.



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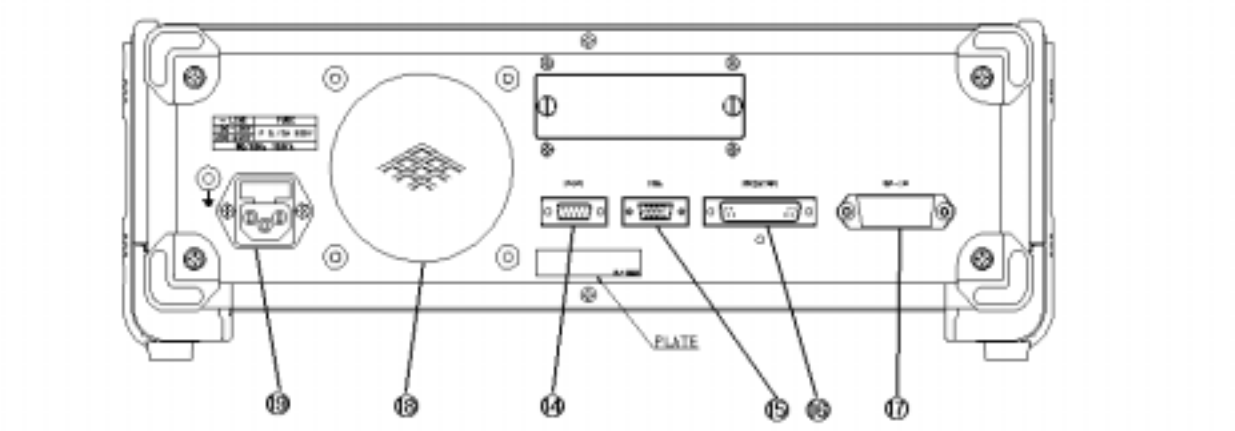

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3.2 Turning the power ON and OFF

Preparing to turn the power ON

Check the following items before inserting the device's power cord into the power socket.

(1) Confirm that the power switch (POWER) is OFF.

(2) Confirm that the power socket's voltage matches the device specification power voltage.

(3) Always ground the grounding terminal on the rear panel or the power cord grounding terminal to avoid electrical shock.

⚠ Note

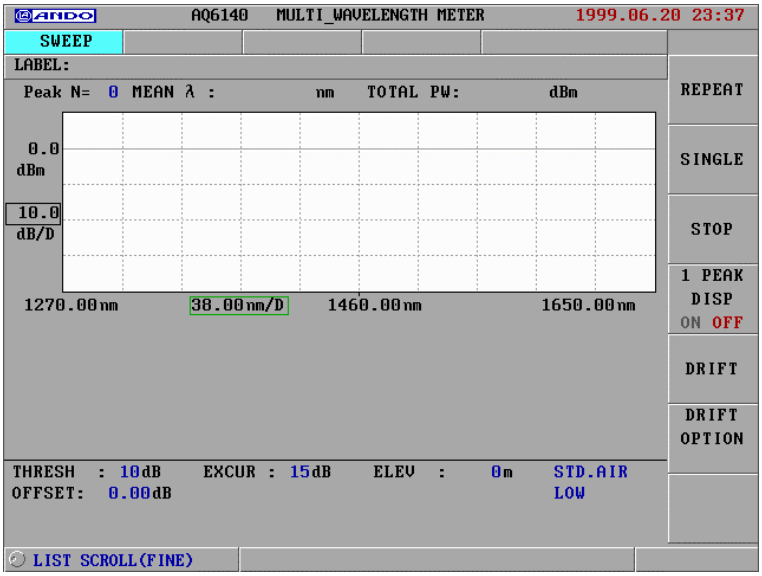
Before replacing the fuse, always turn the power switch OFF, and disconnect the power cord from the power socket. Then, replace the fuse.

Avoid use in places with great vibration, high levels of humidity or dust, places subject to direct sunlight or active gases, or inclined places where the device could tilt over.

(4) Connecting with other devices
Before connecting a printer, CRT display, RS-232-C or GP-IB device to this device, turn the OFF power switches for this device and the device to be connected, and check the wiring. Connecting devices with the power ON could damage the device.

Turning the power ON

Press the "POWER" switch to turn the power ON.
This device automatically checks the internal memory and initializes the device. The screen will appear when these are completed.
Turn the power switch for the external device ON after the screen appears.



⚠CAUTION

After the power switch is turned ON, if the waveform display screen does not appear on the LCD display even after two minutes have passed, turn the power switch OFF, and contact Ando Electric (headquarters, sales office, branch office).

Refe rence

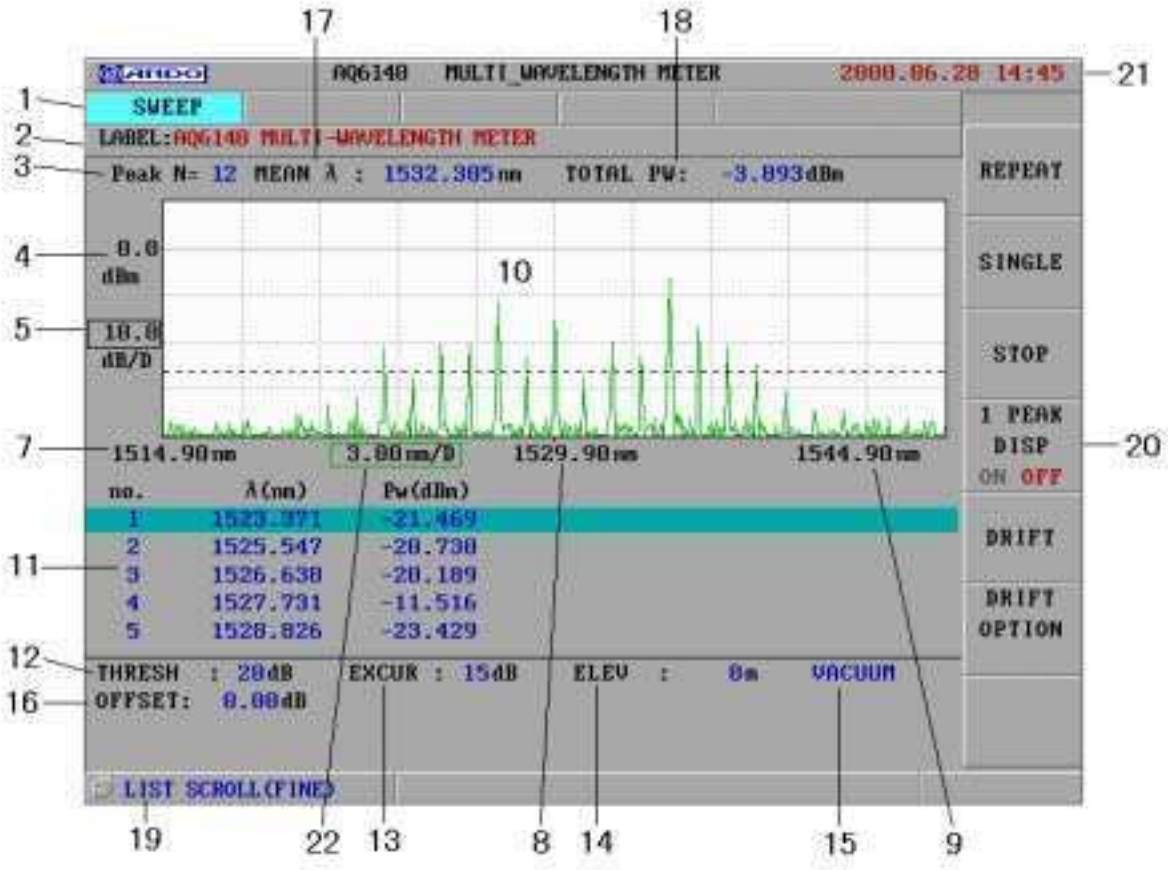
The measurement conditions and selection status of the soft keys are saved in an involute memory, so the state when the power was turned OFF previously will appear when the power is turned ON.

Turning the power OFF

Turn OFF the "POWER" switch, and then turn the power switch for the external device OFF.
Disconnect the optical fiber cable connected tho this device's optical connector, and attach a cap. Disconnect this device's power cord from the power socket.

3.3 Explanation of screen displays

The names and explanation of this device's screen are shown in Fig. 3-3.



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3.4 Basic operations

The basic operations of this device are explained in this section.

Function operations

The function is changed with the function key.

When the function is changed, the functions corresponding to the changed function key will appear on the screen.

Soft key operation

The functions that can be used with the current function are displayed on the right side of the screen.
The function is changed with the soft keys at the side of the function display.
When the soft key is pressed, the current selected display will change to "red", and the display that is not selected will change to "dark gray". The displays will be reversed when the soft key is pressed again.

Changing the parameters

Depending on the function and the soft key function, the color of the input target value at the top of the screen will change. The value with the changed color can be changed.
The parameters can be input with the numeric keys, rotary encoder or cursor keys.

1 Inputting with the numeric keys

（1） Input the value with the numeric keys, and set the value by pressing the [ENTER] key.

2 Inputting with the rotary encoder

（1） When the rotary encoder knob is turned clockwise, the value will increment, and when turned counterclockwise, will decrement. If the "COARSE" key is ON (when the lamp is lit), the value increment/decrement width will increase when the knob is turned.

3 Inputting with the cursor keys

（1） The digit of the input target parameter can be changed with the "←" and "→" (left/right) cursor keys. The value can be incremented and decremented with the " ↑ " and " ↓ " (up/down) cursor keys. This is the same operation as the rotary encoder.

Chapter4

This device's functions have the following menu configuration.

Function name	Details	Reference secti
SWEEP	Sweep	4.1
CENTER	Center waveform (horizontal axis)	4.2
SPAN	Sweep span (horizontal axis)	4.3
LEVEL	Level (vertical axis)	4.4
MARKER	Marker	4.5
PEAK SEARCH	Peak search	4.6
ANALYSIS	Analysis	4.7
DISPLAY	Display	4.8
MEMORY	Memory	4.9
FILE	File	4.10
SYSTEM	System	4.11
PRINT	Print	

The soft key functions assigned to each function are displayed on the LCD screen and explained.
The soft key functions of some functions are hierarchical.
Refer to this chapter if there are any questions about the currently displayed screen.

The hierarchy of the menu is displayed at the position shown in the figure below.

4.1 SWEEP

This screen is used to carry out sweeping.

REPEAT

The sweep is repeated.
Press the "REPEAT" key to execute the repeat sweep.

Refe rence To stop the sweep execution, press the "STOP" key.

SINGLE

A single sweep is carried out from the left side to right side of the screen.

Note Note that the measurement cannot be stopped midway.

STOP

When executing repeated sweeping, the sweep will stop.

1 PEAK DISP ON／OFF

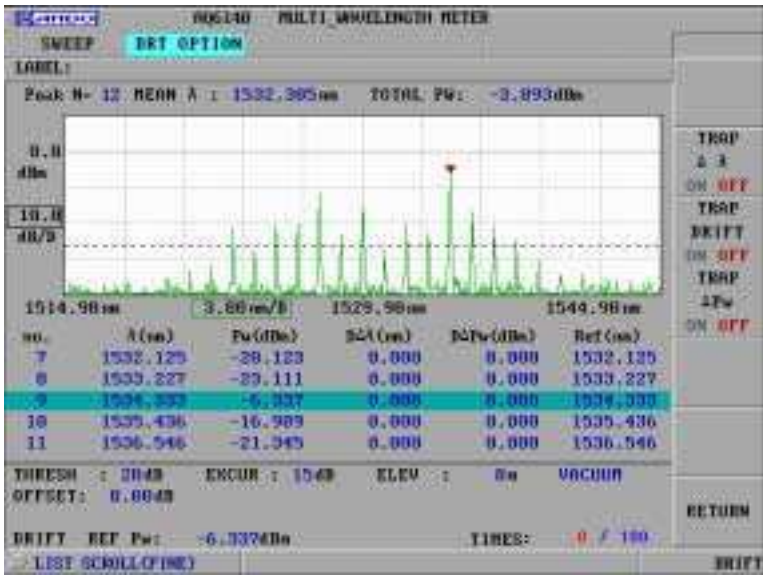
The cursor line in the peak table will be enlarged and displayed.
The current cursor line will be enlarged and displayed at "1 PEAK DISP ON".

DRIFT

This key is used to set the drift measurement. The following screen will appear when this key is pressed.

DRIFT OPTION

This key is used to set the drift options. The following screen will appear when this key is pressed.



1. TRAP Δλ ON OFF

This turns the trap function1 ON or OFF. When set to ON, the current setting value will appear in the window. Change the setting value with the rotary knob or numeric keys.

If the peak interval of one or more peaks in all of the peaks exceeds $m, a message will appear, and the measurement will stop.

2. TRAP DRIFT ON OFF

This turns the trap function2 ON or OFF. When set to ON, the current setting value will appear in the window. Change the setting value with the rotary knob or numeric keys.

Of all of the peak wavelengths λ, if the deviation of one or more peak wavelengths (difference with drift reference value from start of measurement) exceeds Δλ, a message will appear, and the measurement will stop.

3. TRAP ΔPw ON OFF

This turns the trap function3 ON or OFF. When set to ON, the current setting value will appear in the window. Change the setting value with the rotary knob or numeric keys.

Of all of the peak power levels, if the deviation of one or more power level (difference with drift reference value from start of measurement) exceeds ΔW, a message will appear, and the measurement will stop.

Refe rence

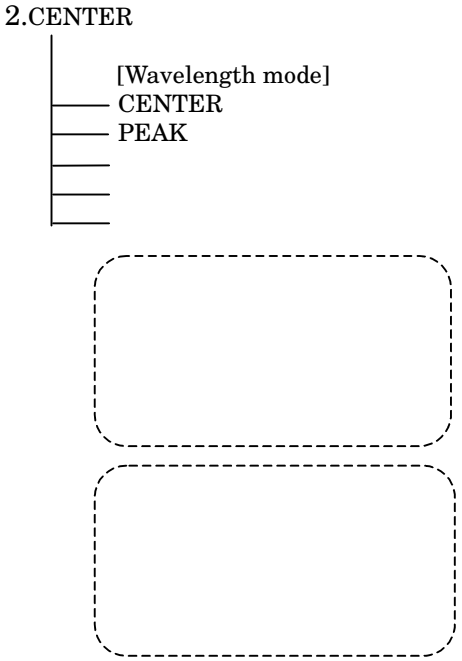
The original soft key menu will appear when the "RETURN" soft key is pressed.

Refe rence

If a peak exists beyond the allowable range of the trap function, measurement is stopped and "#" marking will be displayed at the right side of the peak No. in the peak table.

4.2 CENTER

This screen is used to set the center wavelength. The display unit will change according to the selected mode (wavelength, frequency, Wave number). The screen for the wavelength mode is shown below.



CENTER

The center wavelength is set. When this key is pressed, the current setting value will appear in the window. Input the setting value with the rotary knob or numeric keys.

Parameter range:

For wavelength mode ····· 1270.3 to 1649.7nm (0.1nm step)

For frequency mode ····· 181.71 to 236.04THz (0.01THz step)

For cm-1 (Wave number) mode ··· 6063 to 7872cm-1 (1 step)

PEAK→CENTER

The peak wavelength is searched for and the peak wavelength is set for the center wavelength. When this key is pressed, the set value will appear in the window. The setting can be changed with the rotary knob or numeric keys.

AUTO CENTER ON OFF

Set whether to turn the PEAK ∃ CENTER function ON or OFF for each sweep. If latched, when the sweep ends, the peak wavelength will be searched for, and the peak wavelength will be set for the center wavelength.

CENTER 1 ****.***nm

The displayed setting value will be set as center wavelength 1.
The set value will appear in the window.

CENTER 2 ****.***nm

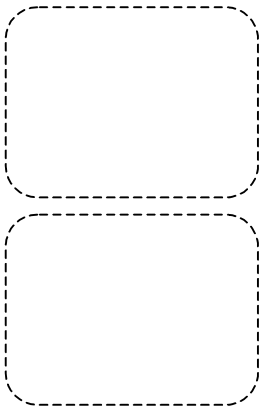
The displayed setting value will be set as center wavelength 2.
The set value will appear in the window.

4.3 SPAN

This screen is used to set the horizontal axis' sweep span.

3.SPAN

- [Wavelength mode]
- FULL SPAN
- SPAN
- START



FULL SPAN

The sweep span is set to the 1270 to 1650nm (for wavelength mode) full range.

Parameter range:

For wavelength mode ····· 1270.0 to 1650.0nm

For frequency mode ····· 181.68 to 236.07THz

For cm-1 (Wave number) mode ··· 6060 to 7875cm-1

SPAN

The speed span is set. When this soft key is pressed, the current setting value will appear in the window. Change the setting value with the rotary knob or numeric keys.

Parameter range:

For wavelength mode ····· 0.5 to 380.0nm (0.1nm step)

For frequency mode ····· 0.05 to 54.39THz (0.01THz step)

For cm-1 (Wave number) mode ··· 5 to 1815cm-1 (1 step)

START

The measurement starting frequency is set. When this soft key is pressed, the current setting value will appear in the window. Change the setting value with the rotary knob or numeric keys.

Parameter range:

For wavelength mode ····· 1270.0 to 1649.5nm (0.1nm step)

For frequency mode ····· 181.68 to 236.02THz (0.01THz step)

For cm-1 (Wave number) mode ··· 6060 to 7870cm-1 (1 step)

STOP

The measurement end frequency is set. When this soft key is pressed, the current setting value will appear in the window. Change the setting value with the rotary knob or numeric keys.

Parameter range:

For wavelength mode ····· 1270.5 to 1650.0nm (0.1nm step)

For frequency mode ····· 181.73 to 236.07THz (0.01THz step)

For cm-1 (Wave number) mode ····· 6065 to 7875cm-1 (1 step)

UNIT

The X axis unit is selected.

The "nm", "THz" and "cm-1" windows will appear, so select the required units.

4.4 LEVEL

This screen is used to set the reference level of the vertical axis, etc.

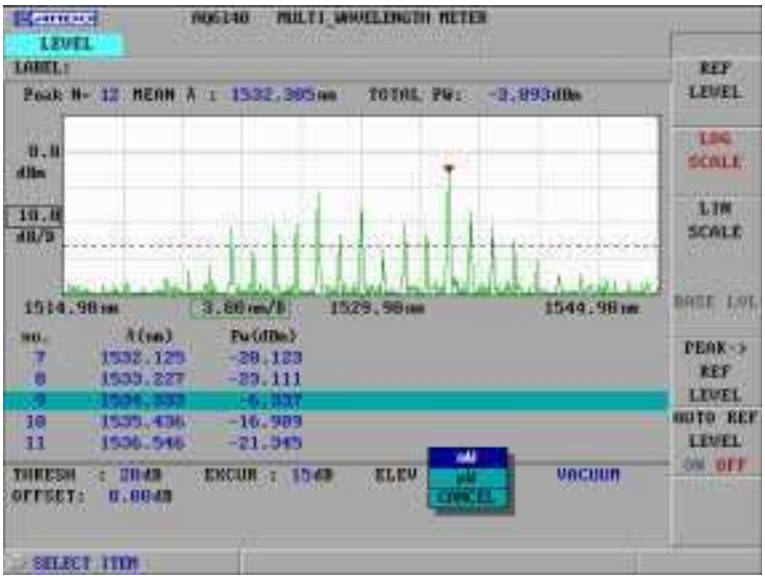
4.LEVEL

REF LEVEL
LOG SCALE
LIN SCALE
BASE LVL
PEAK

LIN SCALE

The level axis scale is set in LIN SCALE.

Used to select mW or uW for the unit.



Refe rence

Only the LOG SCALE or LIN SCALE can be selected.

BASE LVL

When the level axis scale is the LIN SCALE, the lower end value of the level scale is set. Note that this cannot be set for the LOG SCALE.
(The upper limit is REF level×0.9)

Parameter range: ····· 0.001 to 100.000mW (0.001 step)

PEAK→REF LEVEL

The peak level is searched for, and the obtained value is set as the reference level. The waveform is then redrawn.
When this soft key is pressed, the set value will appear in the window. The setting value can be changed with the rotary knob or numeric keys.

AUTO REF LEVEL ON OFF

Set whether to turn the PEAK→REFLEVEL function ON or OFF for each sweep. If latched, when the sweep ends, the peak level will be searched for, and the peak level will be set for the reference level.

4.5 MARKER

The marker is valid for the active trace.

MARKER→CENTER

The wavelength of the movement marker is set at the center wavelength, and the waveform is redrawn. After execution, the movement marker will move to above the waveform at the center of the screen.
When this soft key is pressed, the set value will appear in the window. The setting value can be changed with the rotary knob or numeric keys.

SET MKR

The movement marker is set as a fixed marker. The marker value will appear in the data area.
Even after fixing, the movement marker can be moved with the rotary knob.

ALL MKR CLEAR

When this soft key is pressed, the movement marker and fixed mark and line marker will be erased, and the marker values in the data area will be erased.

MORE

The remaining soft key menus will appear.

1. LINE MARKER 1

   When the wavelength marker 1 is not displayed on the screen, it will appear at a position one-quarter from the left edge of the screen. When this soft key is pressed, the marker can be moved with the rotary knob.

2. LINE MARKER 2

   When the wavelength marker 2 is not displayed on the screen, it will appear at a position one-quarter from the right edge of the screen. When this soft key is pressed, the marker can be moved with the rotary knob.

3. LINE MARKER 3

   When the wavelength marker 3 is not displayed on the screen, it will appear at a position one-quarter from the top edge of the screen. When this soft key is pressed, the marker can be moved with the rotary knob.

4. LINE MARKER 4

   When the wavelength marker 4 is not displayed on the screen, it will appear at a position one-quarter from the bottom edge of the screen. When this soft key is pressed, the marker can be moved with the rotary knob.

5. LINE MKR CLEAR

   All of the line markers and line marker values displayed on the screen will be erased.

6. MKR L1-L2 SPAN

   The span between the wavelength line markers 1 and 2 is set as the sweep span. When this soft key is pressed, the set value will appear in the window. The value can be changed with the rotary knob or numeric keys.

4.6 PEAK SEARCH

Peak search is valid for the active trace.

PEAK SEARCH

The peak search is executed and the movement marker is set. The marker value appears in the data area. If the peak level exceeds the screen's upper edge or lower edge, the movement marker will appear at the upper or lower edge, but the marker value will be the correct value.

NEXT SEARCH

When this soft key is pressed, the movement marker will be set at the peak following the position where the movement marker is set. Note that the marker will not move if there is no next peak.

PREVIOUS SEARCH

When this soft key is pressed, the movement marker will be set at the peak before the position where the movement marker is set. Note that the marker will not move if there is no previous peak.

PEAK THRESH

The threshold for the peak search is set.

When this soft key is pressed, a window will appear. Input the threshold with the rotary knob or numeric keys.

Parameter range: 0 to 40dB (1 step)

Default value: 10dB

The threshold level is indicated with a solid dotted line.

PEAK EXCUR

The crest/root difference for the peak search is set.

When this soft key is pressed, a window will appear. Input the crest/root difference with the rotary knob or numeric keys.

Parameter range: 1 to 30dB (1 step)

Default value: 15dB

AUTO SEARCH ON OFF

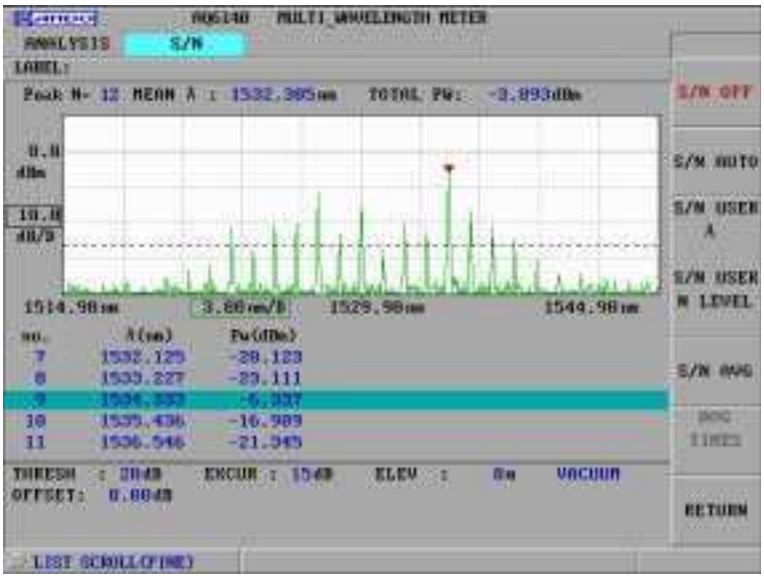
Set whether to turn the peak search function ON or OFF for each sweep. If set to ON and latched, when the sweep ends, the peak will be automatically searched for, and the movement marker will be set.

4.7 ANALYSIS

Analysis is valid for the active trace. When this key is pressed, the latched algorithm will be executed.

S/N

The S/N ratio is analyzed. When this soft key is pressed, the following window will appear.



1. S/N OFF

   The S/N ratio analysis function is turned OFF.

2. S/N AUTO

   The S/N ratio analysis is obtained with automatic interpolation.

3. S/N USER *

   The S/N ratio analysis is obtained with the user-input wavelength.
   Signal-Noise ratio is requested according to the noise level of the input wavelength.
   When this soft key is pressed, a window will appear. Set the user-input waveform (****.***nm, ****.****THz or ****cm-1) with the rotary knob or numeric keys.

Refe rence

** indicates the " λ ", "THz" or "cm-1" unit.

4. S/N USER N LEVEL

   S/N ratio is determined based on the user input noise power volume.
   You can select the user input noise power volume from the rotary knob or numerical keypad.

   Parameter range: -40 to -99dBm

5. AVG TIMES

The No. of averages is set with the rotary knob or numeric keys.

6. AVG TIMES

The No. of averages is set with the rotary knob or numeric keys.

This is valid when the S/N AVG is selected.

Refe rence

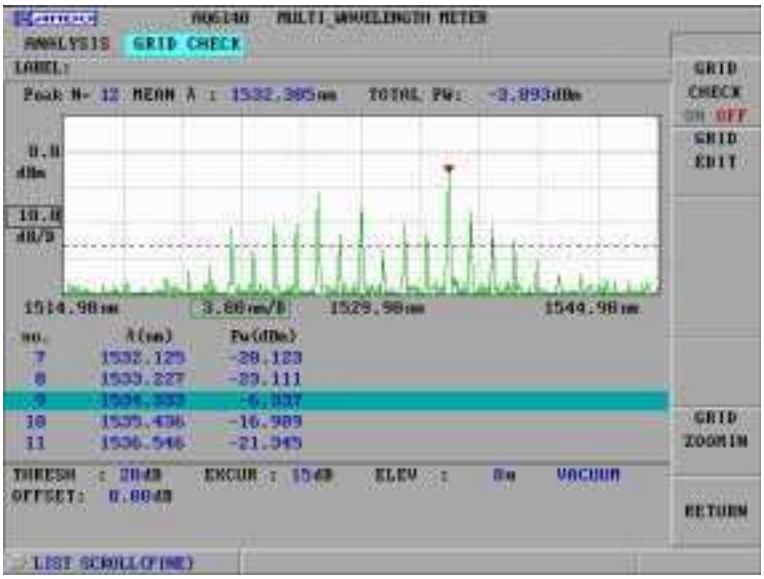
Select one of the above items and analyze the S/N ratio. Note that you cannot carry out the S/N AVG and drift measurement at the same time.

FABRY-PEROT ON OFF

Set whether to turn the Fabry-Perot analysis function ON or OFF for each sweep.

GRID CHECK

Used to turn on the GRID analysis. When this soft key is pressed, the following window will appear.



1. GRID CHECK ON OFF

Used to turn ON or OFF the GRID analysis function.

2. GRID EDIT

The GRID edit window is displayed.

2.1 GRID SPAN

Used to specify a GRID span. All GRID spans are specified with the CENTER frequency being set at the center.

Parameter range:

For wavelength mode…0.05～380.00nm

For frequency mode…0.01～54.39THz

For cm^{-1}(wave number) mode…0.4～181.5cm^{-1}

2.2 CENTER EDIT

A center frequency of the GRID is selected. You can enter a center frequency for GRIDs No. 1 to 256. A center frequency must be selected in the ascending order of the GRID No (in the descending order when selecting a frequency or wave number).

2.2.1 CLEAR

The CENTER frequency at the current cursor position is cleared.

2.2.2 ALL CLEAR

All center frequencies are cleared.

2.3 CHK EDIT

Used to select a GRID on which the GRID analysis is to take place. The analysis is performed on the GRIDs indicated with "*" marking.

2.3.1 CLEAR

Used to clear CHK mark at the current cursor position.

2.3.2 ALL CLEAR

Used to clear all CHK marks.

2.3.3 START CHK

Used to select a GRID No. from which the CHK is started.

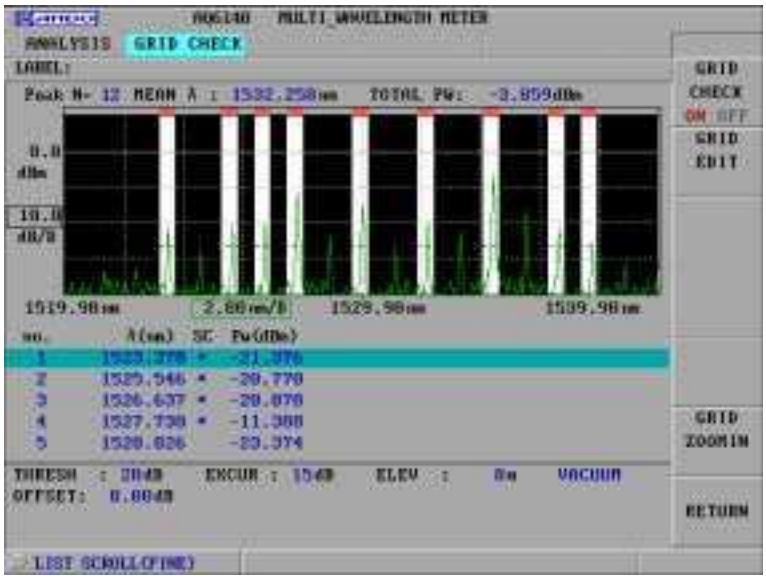
2.3.4 STOP CHK

Used to select an ending GRID No. at which the CHK mark is ended.

2.4 ITU-T EDIT

Used to set an ITU-U specification-conformed center wavelength.

An example of the screen displayed during the analysis:



3. GRID ZOOMIN

The GRID at the cursor line is zoomed up.

ELEV

The altitude value is set. When this soft key is pressed, a window will appear. Set the altitude with the rotary knob or numeric keys.
Parameter range: 0 to 5000m (1 step)

CAL

When this soft key is pressed, a window will appear. Select either "STD AIR (in standard air)" or "VACUUM (in vacuum)".
Default value: VACUUM (in vacuum)

Pw OFFSET

When this soft key is pressed, a window for setting the power offset value will appear. Input the setting value with the rotary knob or numeric keys.
Parameter range: -20.00 to 20.00dB (0.01 step)

4.8 DISPLAY

8.DISPLAY

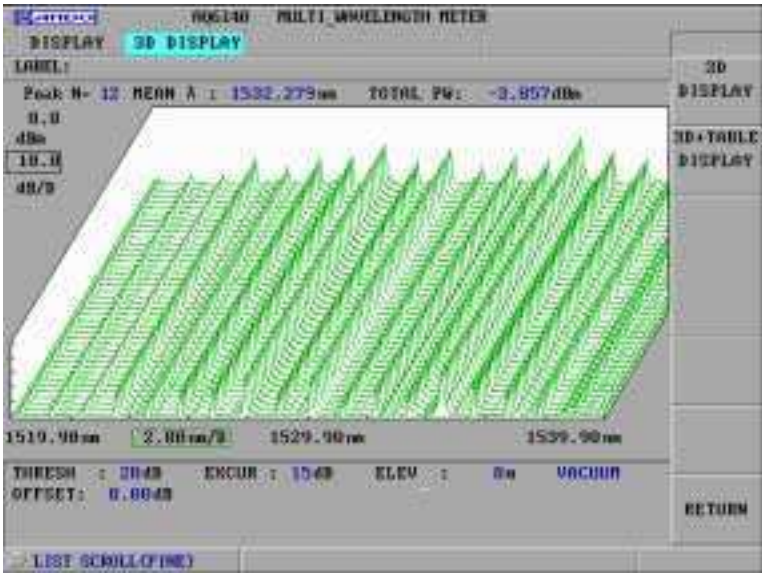
NORMAL DISPLAY
TABLE ONLY
3D DISPLAY

TABLE ONLY

The screen is set to the mode for displaying only the table.

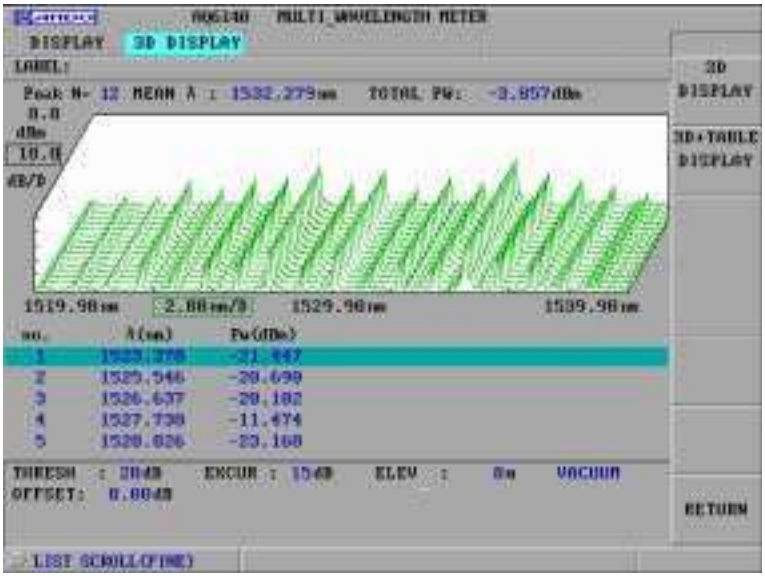
3D DISPLAY

When this soft key is pressed, the three-dimensional graph display mode will be set.



3D+TABLE DISPLAY

The screen is set to the three-dimensional graphic and table display mode.



Note

Virious set changes cannot be done at “3D” screen and “3D+TABLE” screen.

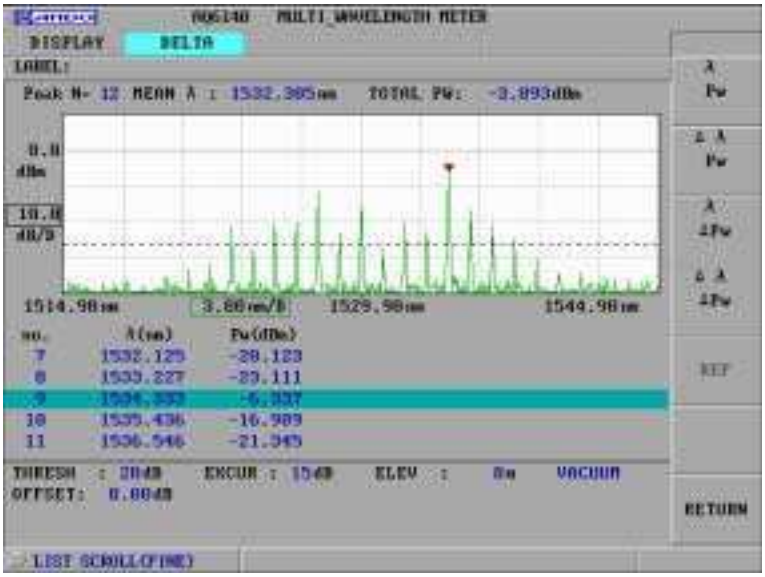
DRIFT DISPLAY

Used to turn on the DRIFT display mode for the screen.
DRIFT DISPLAY can be displayed at the following conditions.

- DRIFT MODE : ON
- DRIFT TIMES : Excluding 0(Endless)

DELTA

The soft keys for the relative display will appear.



1. λ Pw

   When this soft key is pressed, the absolute wavelength and absolute power will appear.

2. Δ λ Pw

   When this soft key is pressed, the relative wavelength and absolute power will appear.

3. λ Δ Pw

   When this soft key is pressed, the absolute wavelength and relative power will appear.

4. Δ λ Δ Pw

   When this soft key is pressed, the relative wavelength and relative power will appear.

5. REF

   The reference value for the relative display is set.

   The current cursor position in the peak table is the reference.
   The reference peak is indicated with "R" marking on its right side.

SORT

Press this software key to select the peak table sort screen.

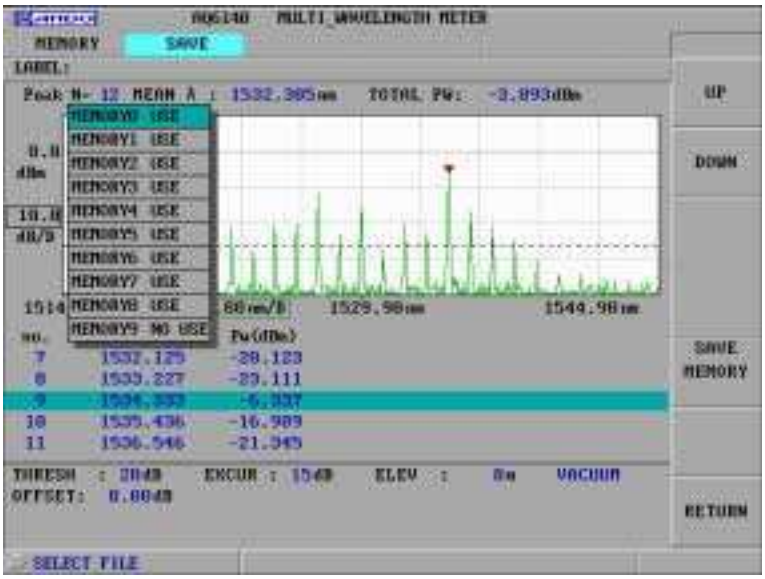
4.9 MEMORY

9.MEMORY

- SAVE
  - UP
  - DOWN
  - SAVE MEMORY
  - RETURN
- RECALL
  - UP
  - DOWN
  - RECALL MEMORY
  - RETURN
- LABEL

SAVE

The measurement conditions and results are saved in the memory. When this soft key is pressed, a window will appear. The data can be saved in ten memories (0 to 9).



1. UP

The memory No. to save is selected. When this soft key is pressed, the highlight will move upward. When held down, the highlight will move from the bottom toward the top.

2. DOWN

The memory No. to save is selected. When this soft key is pressed, the highlight will move downward. When held down, the highlight will move from the top toward the bottom.

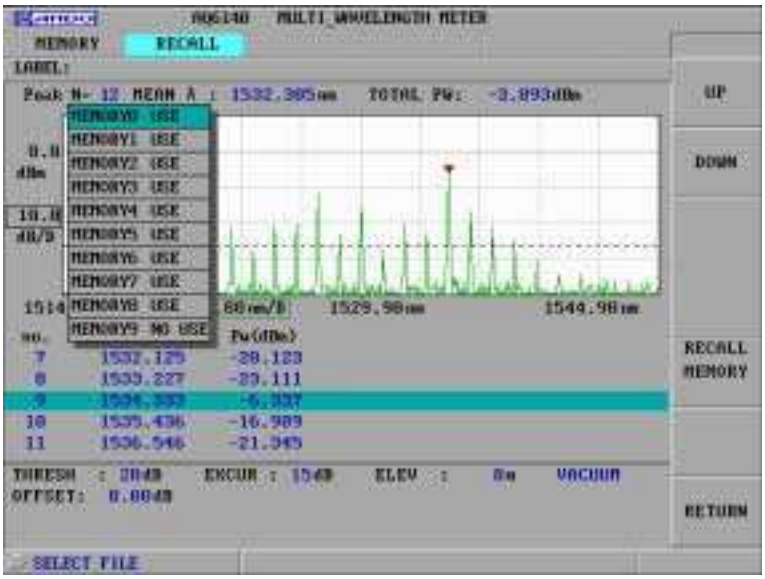
3. SAVE MEMORY

When this soft key is pressed, the measurement conditions and results will be saved in the selected memory No.

When the saving is completed, the original soft key menu will appear.

RECALL

The contents saved in the ten memories are.
When this soft key is pressed, the following type of window will appear.



1. UP

   The memory No. to be read out is selected. When this soft key is pressed, the highlight will move upward. When held down, the highlight will move from the bottom toward the top.

2. DOWN

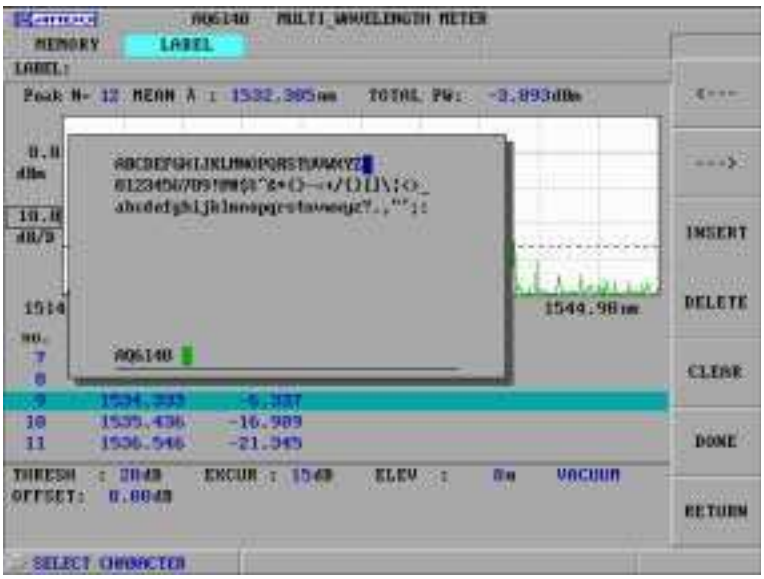
   The memory No. to be read out is selected. When this soft key is pressed, the highlight will move downward. When held down, the highlight will move from the top toward the bottom.

3. RECALL MEMORY

   When this soft key is pressed, the contents of the selected memory No. will be read. When the reading is completed, the original soft key menu will appear.

LABEL

When this soft key is pressed, the window for inputting a label will appear.



1. ←

   The cursor in the label input area (underline section at cursor) will move one character to the left. When held down, the cursor will successively move to the left. If the cursor is at the left edge, it will not move.

2. →

   The cursor in the label input area will move one character to the right. When held down, the cursor will successively move to the right. If the cursor is at the right edge, it will not move.

3. INSERT

   A blank space will be inserted one character the cursor position in the label input area, and the character string to the right of the cursor will be shifted to the right.

4. DELETE

   The character at the cursor position in the label input area will be deleted one character. The character string to the right of the cursor will be shifted to the left.

5. CLEAR

   All of the characters input in the label input area will be erased.

6. DONE

   The character string in the label input area will be copied to the right of "LABEL:" at the top of the screen.

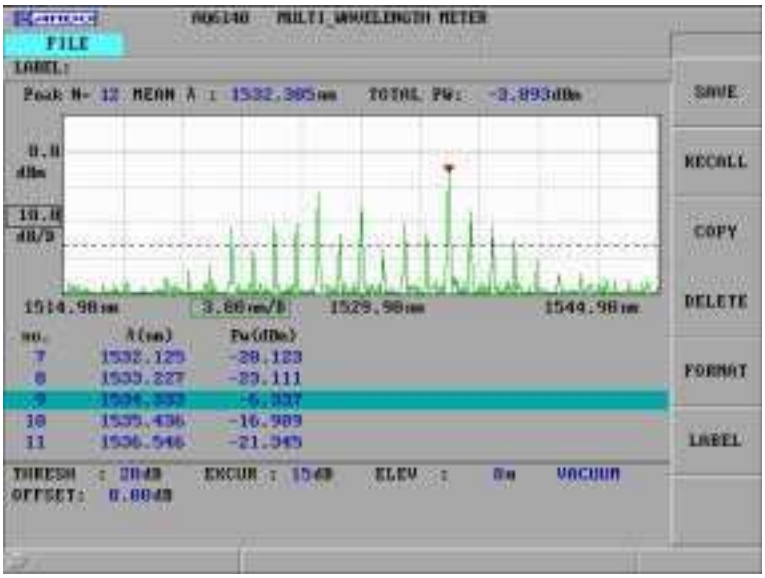
   When the copying is completed, the soft key menu will appear.

4.10 FILE

On this screen, data on a floppy disk or hard disk can be read, written, copied, deleted or formatted.

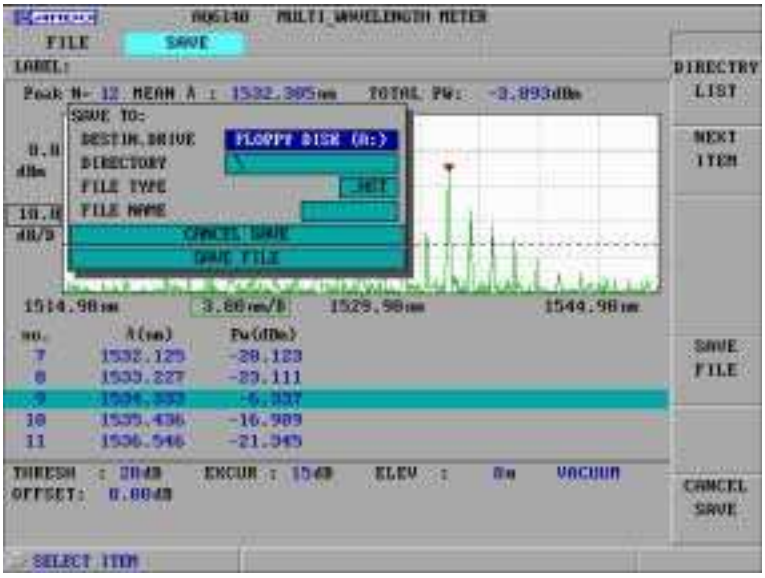
10.FILE

- SAVE
  - DIRECTORY LIST
  - NEXT ITEM
  - SAVE FILE
  - CANCEL SAVE
- RECALL
  - NEXT ITEM
  - RECALL FILE
  - PAGE UP
  - PAGE DOWN
  - MORE
    - SORT BY
    - PRINT LIST
- COPY
  - UP
  - DOWN
  - SELECT FILE
  - COPY FILE
  - RETURN
- DELETE
  - NEXT ITEM
  - SORT BY
  - SELECT FILE
  - RETURN
- FORMAT
  - SELECT DRIVE
  - FORMAT DRIVE
  - CREATIVE/DELETE DIRECTORY
  - RETURN
- LABEL



SAVE

When this soft key is pressed, the window required to save data on a floppy disk or hard disk will appear.



1. DIRCTRY LIST

The files in the current directory are displayed in a list. The original menu screen will appear when the "RETURN" key is pressed.

When the list is displayed, the soft keys will change as follows.

1.1 UP

The previous file will appear. If there is no previous file, the cursor will move to the very bottom of the list.

1.2 DOWN

The next file will appear.

1.3 PAGE UP

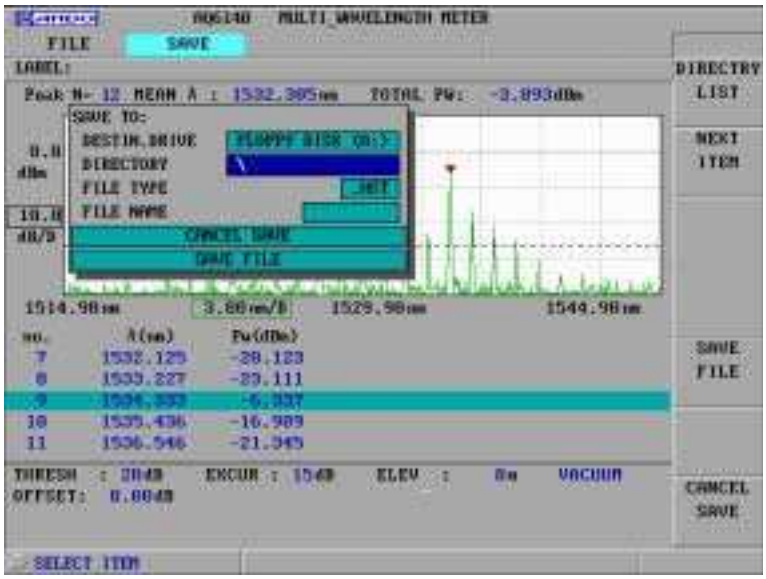
The files on the previous page will appear.

1.4 PAGE DOWN

The files on the next page will appear.

2. NEXT ITEM

The cursor in the window will move to the next item, and the section where the cursor moved to will be highlighted.



When the "ENTER" key is pressed, the item where the cursor is at will open, and the following type of window will appear.

2.1 DESTIN. DRIVE (Function drive)

The drives connected to this device and this device's drive will appear in the window.。
To select the drive to save, press the soft keys "UP" and "DOWN" to select the drive. When the "ENTER" key is pressed to set the selection, the drive No. (A, C, ...) in the window will change. The screen will change to the original soft key menu.

2.2 DIRECTORY

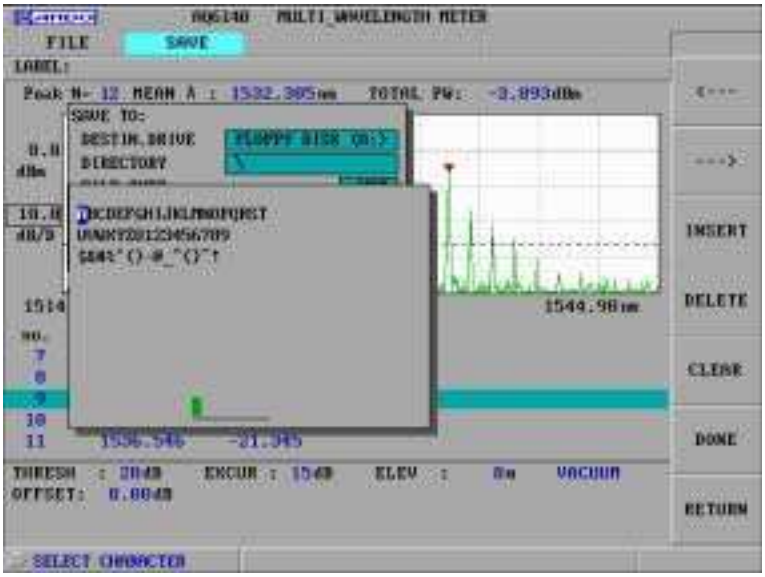
When the cursor is moved, "DIRECTORY" is highlighted and the "ENTER" key is pressed, the contents of the selected drive will appear as a list on the window.
To select the directory to save, press the soft keys "UP" and "DOWN" to select the directory. When the "ENTER" key is pressed to set the selection, the directory display contents will change. The screen will change to the original soft key menu.

2.3 FILE TYPE

Move the cursor to highlight "FILE TYPE", and then press the "ENTER" key. A window, with the file type that can be saved with this device, will appear. Using the soft keys "UP" and "DOWN", select the file type to be saved. When the "ENTER" key is pressed to set the selection, the file type display contents will change. The screen will change to the original soft key menu.

2.4 FILE NAME

Move the cursor to highlight "FILE NAME", and then press the "ENTER" key. A window for inputting characters will appear. Up to "eight characters" can be input.
Input the file name using the soft keys "(" ← "→", "INSERT", "DELETE", "CLEAR", "DONE" and "RETURN".



「←」 The cursor in the file input area will move one character to the left.

「→」 The cursor in the file input area will move one character to the right.

「INSERT」 A blank space character will be inserted one character at the cursor position in the file input area, and the character string to the right of the cursor will shift to the right.

「DELETE」 The character at the cursor position in the file input area will be deleted one character, and the character string to the right of the cursor will shift to the left.

「CLEAR」 The entire character string currently being input will be deleted.

「DONE」 The character string in the file name input area is set as the file name.

「RETURN」 The file input will be canceled, and the original soft key menu will appear.

3. SAVE FILE

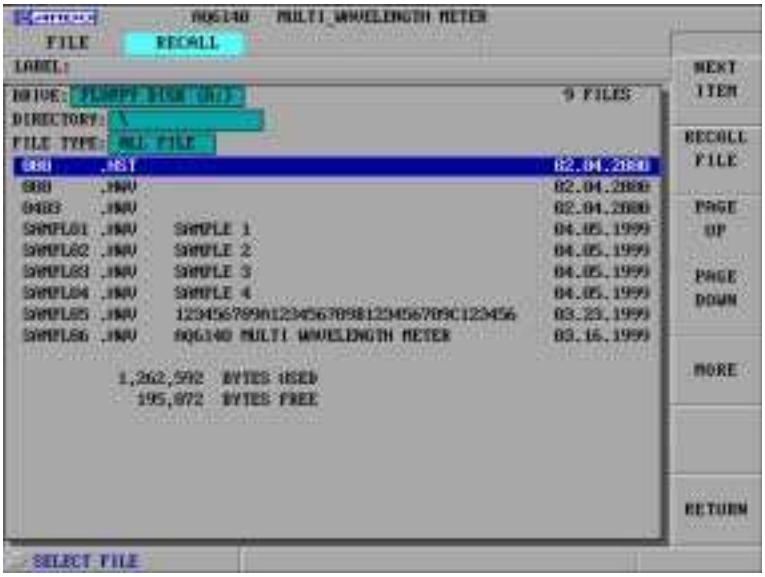
The file will be saved with the selected details, and the original soft key menu will appear

4. CANCEL SAVE

Saving of the file with the selected details will be canceled, and the original soft key menu will appear.

RECALL

The window required for reading data saved on a floppy disk or hard disk will appear.



1. NEXT ITEM

The DRIVE, DIRECTORY and FILE TYPE are selected. Refer to the explanation on "NEXT ITEM" in "FILE SAVE".

2. RECALL FILE

When this soft key is pressed, the file will be read in, and the original soft key menu will appear.

3. PAGE UP

A list of the files on the previous page will appear. If there is no previous page, the current screen will remain displayed.

4. PAGE DOWN

A list of the files on the next page will appear. If there is no next page, the current screen will remain displayed.

5. MORE

When this soft key is pressed, the next menu will appear.

5.1 SORT BY

When this soft key is pressed, a window for selecting which file format to use for sorting will appear.

Press the soft keys "UP" and "DOWN" to select the file format to be sorted, and then press the "ENTER" key. The original soft key menu will appear.

5.2 PRINT LIST

When this soft key is pressed, a list of the files in the printer connected to this device will be printed.

COPY

When this soft key is pressed, the copy function window will appear.

1. UP

When this soft key is pressed, the highlight of the item currently selected in the window will move up one.

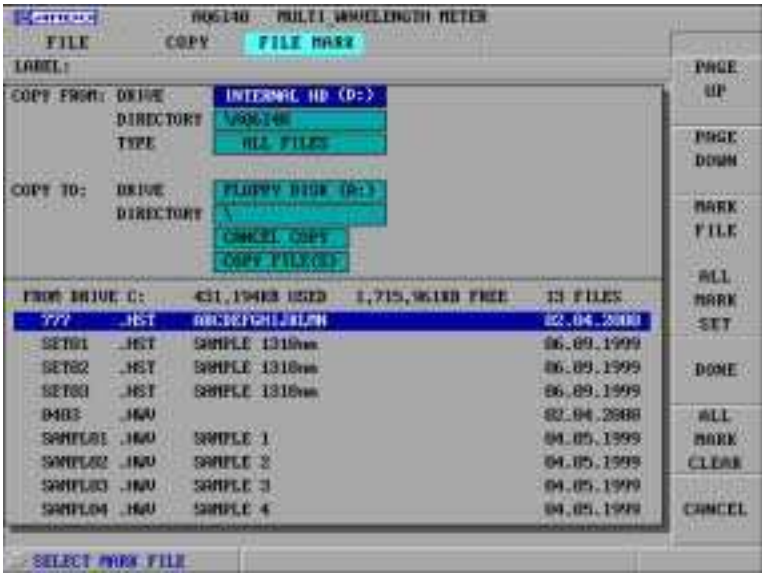
2. DOWN

When this soft key is pressed, the highlight of the item currently selected in the window will move to the next item.

To change the selected details, highlight the item to be changed and press the "ENTER" key. A window for changing the details will appear, so select the item with the "UP" or "DOWN" soft key, and then press the "ENTER" key to set the item.

3. SELECT FILE

The file to be copied is selected.



3.1 PAGE UP

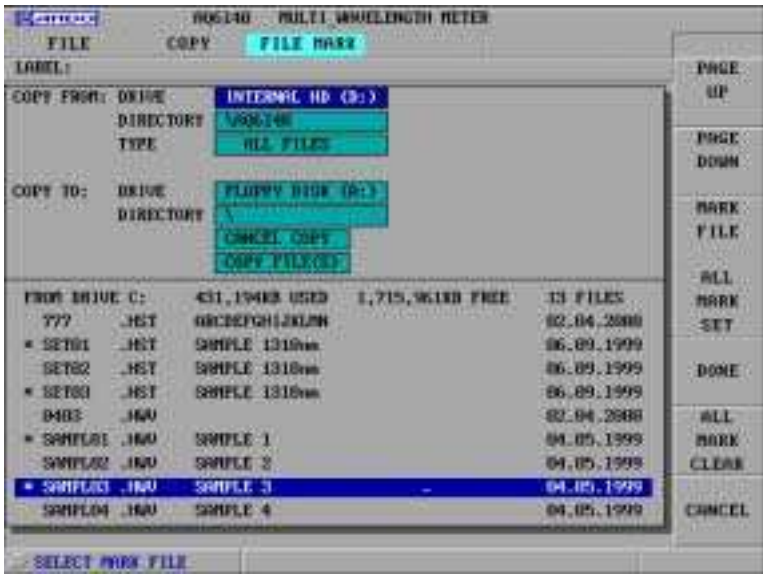
The previous page's file list will appear.

3.2 PAGE DOWN

The next page's file list will appear.

3.3 MARK FILE

The file where the cursor is at is marked as the file to be copied. A "*" mark will appear in front of the marked file. If this key is pressed again, the "*" mark will disappear, and the file will be removed from the copy target.



3.4 ALL MARK FILE

All of the files currently displayed are set as the copy target in a batch. All of the files with the currently selected conditions are the copy target.

3.5 ALL MARK CLEAR

All currently selected copy target files are cleared.

4. COPY FILE

When this soft key is pressed, the selected files will be copied. When the copying is completed, the "FILE" soft key menu will appear.

DELETE

The selected file is deleted.
Note that the deleted file data cannot be recovered.

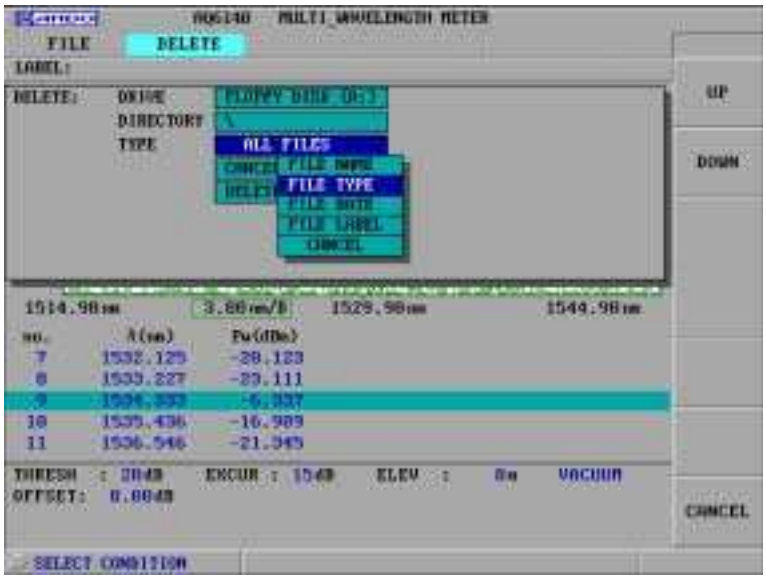
1. NEXT ITEM

The "DRIVE", "DIRECTORY" and "FILE TYPE" of the file to be deleted are set.

When this soft key is pressed, the windows will sequentially appear.Press the "UP" or "DOWN" soft key to select the drive, directory and file type of the file to be deleted. Set each selection by pressing the "ENTER" key.

2. SORT BY

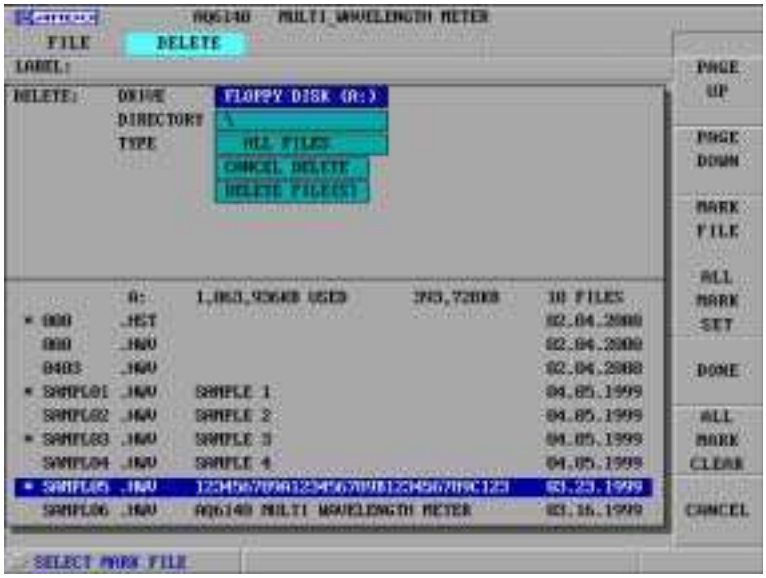
When this soft key is pressed, a window for setting the type to sort the files will appear.



Press the "UP" and "DOWN" soft keys to select the sort type, and press the "ENTER" key to set the selection. When the sorting is completed, the original soft menu key will appear.

3. SELECT FILE

When this soft key is pressed, a list window for selecting the files to be deleted will appear.



3.1 PAGE UP

The previous page's file list will appear.

3.2 PAGE DOWN

The next page's file list will appear.

3.3 MARK FILE

The file where the cursor is at is marked as the file to be deleted. A "*" mark will appear in front of the marked file. When a file with a "*" mark is selected and this soft key is pressed, the "*" mark will disappear, and the file will be removed from the deletion target.

3.4 ALL MARK SET

All files with the currently selected conditions are deleted.

3.5 DELETE FILE

When this soft key is pressed, all marked files will be deleted.
Note that the deleted file cannot be recovered.。

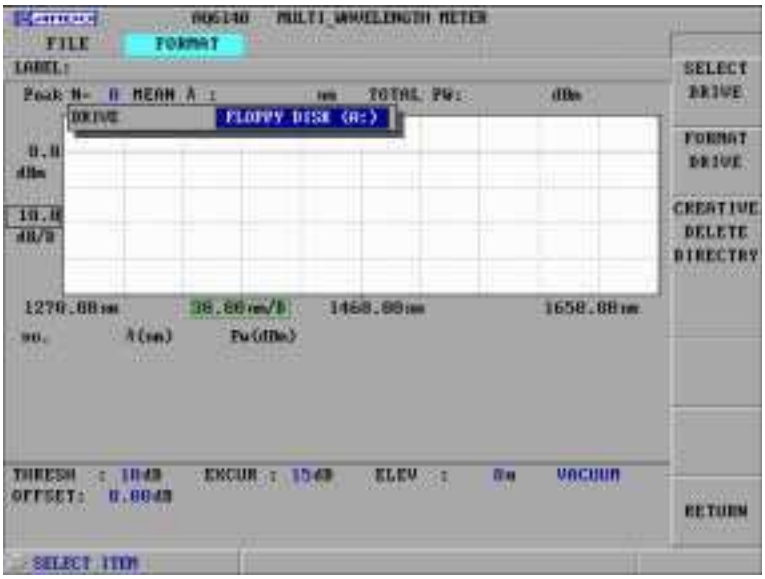
3.6 ALL MARK CLEAR

All currently selected delete target files are cleared.

FORMAT

The floppy disk or hard disk is formatted (initialized).

Refe rence All contents of the floppy disk or hard disk will be erased with the format, so take care when using this function.



1. SELECT DRIVE

The drive to be formatted is selected.

When this soft key is pressed, a window will appear. Press the "UP" or "DOWN" key to select the drive to be formatted.

2. FORMAT DRIVE

The selected drive is formatted (initialized).

When the formatting is completed, the original soft key screen will appear.

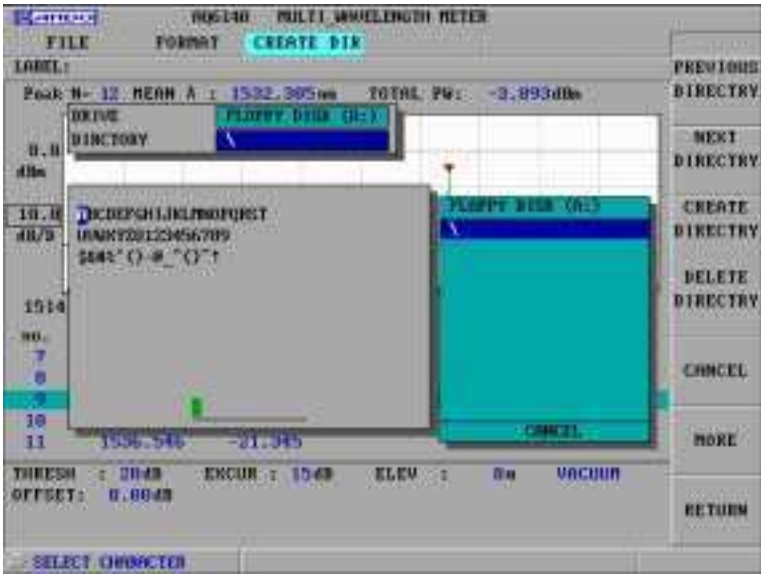
Note All data will be erased when formatting (initialization) is executed, so take care.

Note The format of FD corresponds to 2HD,2DD.

However, the FD format of a remote communication corrsponds only to 2HD.

3. CREATIVE /DELETE DIRECTORY

A directory is created or deleted.



3.1 PREVIOUS DIRECTORY

The cursor is moved to the previous directory.

3.2 NEXT DIRECTORY

The cursor is moved to the next directory.

3.3 CLEATE DIRECTRY

A directory with the input name is created.

3.4 DELETE DIRECTRY

The directory at the cursor is deleted.

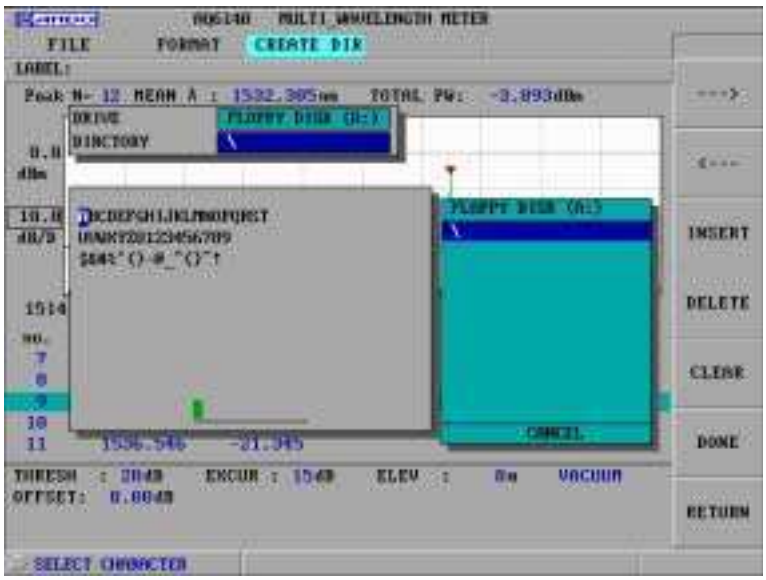
※Note that the deleted directory cannot be recovered.

3.5 CANCEL

Returns to the screen of the original soft key menu.

3.6 MORE

A window for creating the directory name will appear.



3.6.1 →

The cursor at the directory name input area will move one character to the left.

3.6.2

LABEL

The window for inputting the label will appear.

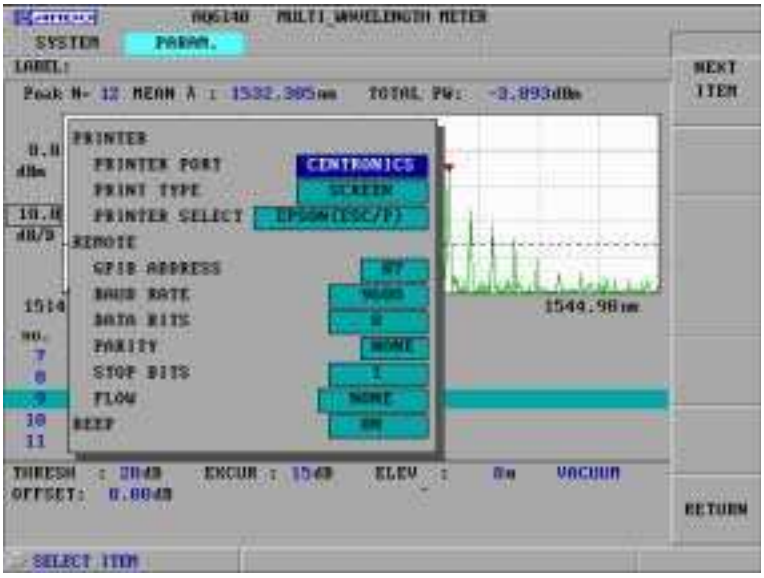
The operations are the same as "LABEL" in "MEMORY" so refer to that section.

4.11 SYSTEM

The settings for initialization, the internal clock are made on this screen.

PARAM.

The various setting windows and soft keys will appear.



1. NEXT ITEM

The cursor will move to the next item.

INITIAL

All of the currently set measurement conditions will be returned to the default values.

Save important measurement conditions in the memory or on a floppy disk.

SET CLOCK

A window for setting the internal clock will appear.

1. CALENDAR SET

A window for setting the date will appear.

2. TIME SET

The time for the internal clock is set as a 24-hour display.

2.1 CURSOR →

When this soft key is pressed, the cursor will move from "hour" to "minute". When pressed again, the cursor will move from "minute" to "hour".

Set the hour and minute with the rotary knob or numeric keys.

3. CALENDAR TYPE

Show to display the date on the screen is set.

The date can be displayed with the following methods

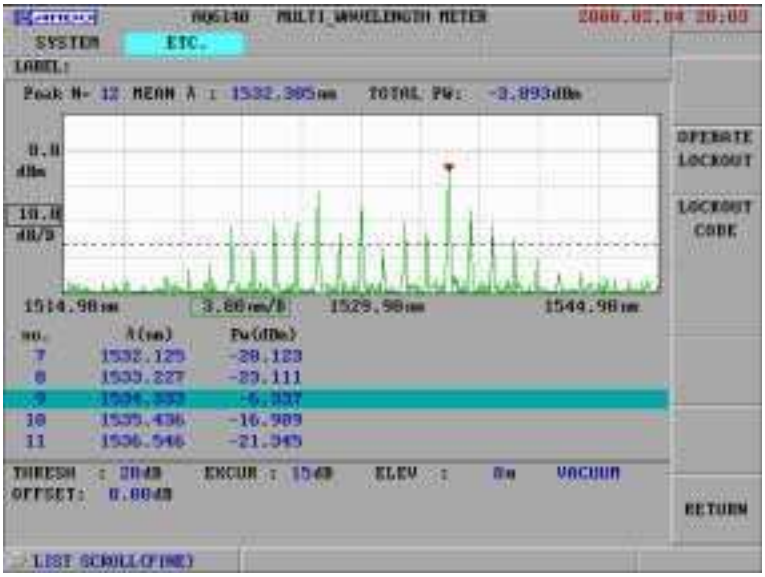
MMM.DD.YYYY	Month.Date.Year
DD.MMM.YYYY	Date.Month.Year
YYYY.MM.DD	Year.Month.Date

SOFT Ver

Used to display software version.

ETC.

The screen for making the other settings will appear.



1. OPERATE LOCKOUT

A window for turning the operation lock out "ON" or "OFF" will appear.

2. LOCKOUT CODE

A window for inputting the 4-digit operation lock out code will appear.

Input four random digits with numeric keys.

Refe rence This function is valid only when "OPERATE LOCKOUT" is set to "ON".

Chapter5

5.1 Measurement

Measurement

● Wavelength range

This device is compatible with ranges from 1270 to 1650nm.

The initial range is 1270 to 1650nm.

Refer to the section "5.2 Measurement range" for details on changing the measurement range.

● Calibration

Set the medium and altitude value to make accurate measurements.

● Minimum separation resolution characteristics

The minimum separation resolution characteristecs is 10GHz.

● Input power

This device is compatible with an input power of up to 10dBm.

⚠ CAUTION
The input power for the entire device can be up to 10dBm. If a power exceeding 10dBm is input, the device's input circuit could be damaged. When using a power exceeding 10dBm, use an attenuator to reduce the input power to 10dBm or less. In this case, a power exceeding 10dBm can be accurately measured by using the power offset function and inputting the attenuator's attenuation amount.

1 Carrying out repeated measurement

(1)

Calibration

● Medium (in vacuum, in standard air)

As the light wavelength varies according to the medium through which the light passes, the measurement must be calibrated to obtain an accurate wavelength measurement.

● Altitude value

As the measurement with this device is carried out in air, the air density according to altitude will affect the measurement results. Calibration is carried out by inputting the altitude value.

The input range is 0 to 5000m (1 step, 1m), and the default value is 0m.

4 Setting the altitude value

（1）

Definition of standard air

Barometric pressure: 760torr

Temperature: 15℃

Relative humidity: 0%

6 Setting the power offset value

(1)

Reset items (INITIAL)

Item	Reset value	
Label	Clear	
Sweep state	Stop	
Center wavelength	1460nm	
Sweep span	380nm	
Starting wavelength	1270nm	
Ending wavelength	1650nm	
X axis unit	Wavelength	
Reference level	0dB	
Log scale	10dB/div	
Base level	0	
Power unit	dBm	
Automatic peak	CENTER OFF REF LEVEL OFF AUTO SEARCH OFF	
S/N	Function OFF Seletion AUTO User wavelength not affected User Noise Level not affected No. of averages 100	
Medium	Vacuum	
Elevation	not affected	
Peak search threshold	10dB	
Peak search Excursion	15dB	
Offset value for power measurement	0dB	
Fabry-Perot	OFF	
Display screen type	NORMAL	
Move Marker,Line Marker	OFF	
Relative display	λ,Pw	
Sort direction	Forward with wavelength	
REF cursor position	Invalid	
1 peak display	OFF	
GRID	Function OFF GRID SPAN:0.10nm GRID CENTER:ITU-T GRID GRID CHK:ALL ON	
Drift	Function OFF Display △ Repeat Interval FAST Num of Drift 0(Endless)	
	Trap (wavelength span)	Function OFF Value 50nm
	Trap (peak wavelength)	Function OFF Value 10nm
	Trap (peak power)	Function OFF Value 0.001dBm

5.2 Measurement range

The measurement range will be explained for the wavelength mode.
For the frequency or Wave number mode, substitute the respective terms for wavelength.

1 Setting the center wavelength

(1)

4 Setting the center wavelength 1 and 2

(1)

◇ Wavelength mode
Setting range: 1270.0 to 1649.5nm (0.1nm step)
Default value: 1270.0nm

◇ Frequency mode
Setting range: 181.68 to 236.02THz (0.01THz step)
Default value: 181.68THz

◇ Wave number mode
Setting range: 6060 to 7870cm-1(1cm-1 step)
Default value: 6060cm-1

7 Setting the measurement starting wavelength

(1)

5.3 Unit

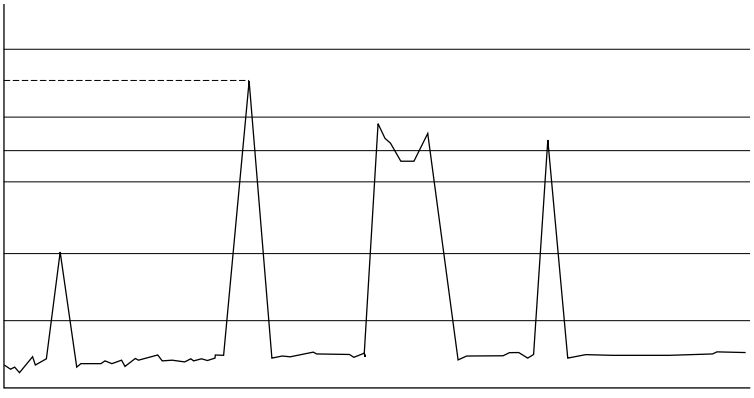
1 Setting the reference level

◇LOG scale

（1）

3 Setting the peak level as the reference level

(1)



1 Searching for the peak

(1)

4 Setting the peak search threshold

(1)

5.5 Screen display

1 Setting to the normal display mode (waveform + table)

（1）

Displaying relatively

1 Displaying the absolute wavelength and absolute power (1)

Sorting the table

1 Sorting the table with wavelengths (ascending order, descending order)

(1)

◇ Label input soft keys

<←>: The cursor in the label input area will move one character to the left.

<→>: The cursor in the label input area will move one character to the right.

<INSERT>: A blank space will be inserted one character at the cursor position in the label input area, and the character string to the right of the cursor will shift to the right.

<DELETE>: The character at the cursor position in the label input area will be deleted, and the character string to the right of the cursor will shift to the left.

<ENTER>: The characters at the cursor potion in the label window will be set at the cursor position in the label area.

<DONE>: The character string in the label input area will be copied to the label area at the top of the screen. The window will close, and the soft key menu will appear.

<RETURN>: The label input will be canceled, and the original soft key menu will appear.

5.6 Drift

Drift measurement

Drift measurement

Drift measurement refers to measuring the time-passage changes in the laser beam wavelength and power.
With this device, up to 256 wavelengths can be simultaneously drift measured.
The items that are drift measured include the difference with the reference of the measurements from the start to present measurements, the maximum variation width, maximum value and minimum value.

1 Carrying out measurement

(1)

5 Using the TRAP function

(1)

6 Setting the DRIFT interval

(1)

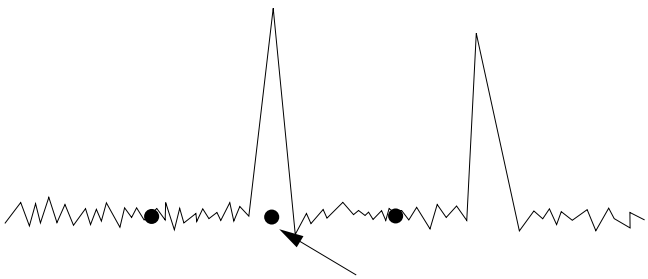
DRIFT display function

2 Setting the DRIFT times

(1)

5 changing an ending count of the DRIFT display screen

(1)



S/N ratio measurement with average

With S/N ratio measurement with average, the noise floor is lowered with averaging. The noise power is obtained with automatic interpolation from this noise floor lowered with averaging, so the S/N ratio can be improved.
Generally with a modulated laser beam, the noise floor rises, so by using averaging, the noise floor can be lowered to the real noise level and the accurate S/N ratio can be measured.

1 Using the SN ratio analysis function

(1)

5.8 Recalling and saving the results

1 Saving the measurement condition and results in the memory

(1)

4 Recalling the measurement conditions or measurement conditions and results from an FD (1)

5 Copying the files

(1)

◇ Changing the file list page

Display the next and previous pages of the file list by pressing the <PAGE UP> and <PAGE DOWN> keys.

7 Formatting

(1)

Conditions required when saving measurement conditions into a file

Item	Note
Label	
Center wavelength	
Sweep span	
Starting wavelength	
Ending wavelength	
X axis unit	
Reference level	
Log scale	
Base level	As for LIN scale
Power unit	
AUTO Function AUTO CENTER Function ON/OFF AUTO REF LEVEL Function ON/OFF AUTO SEARCH Function ON/OFF	
S/NFunction ON/OFF S/N ratio analysis approach User wavelength User noise level Num of averages	
Medium	
Elevation	
Peak search threshold	
Peak search Excursion	
Offset value for power measurement	
Fabry-Perot ON/OFF	
Display screen type	Not available from the DRIFT screen
Move marker, Line marker	
Relative display	
Sort direction	
REF cursor position	When the relative display ON is selected
1 peak display	
GRID function OFF GRID SPAN GRID CENTER GRID CHK	Turning on the GRID function does not save the measurement conditions
DRIFT function OFF Display type DRIFT times TRAP △* function ON/OFF Setting value of TRAP △* TRAP DRIFT function ON/OFF Seting value of TRAP DRIFT TRAP △Pw function ON/OFF Setting value of TRAP △Pw	Turning on the DRIFT function does not save the measurement conditions

5.9 Printing the results

1 Setting the printer

(1)

5.10 Remote

Setting the remote
The GP-IB or RS-232-C is set.

1 Setting GP-IB address

(1)

4 Setting the RS-232-C parity bit

(1)

5.11 Analysis

The marker is valid for the active trace.

1 Displaying the movement marker.

(1)

5 Setting the wavelength line marker

(1)

Fabry-Perot Analysis

When Fabry-Perot analysis is turned ON, the following items will appear on the screen.

* Peak Amplitude (Maximum peak value):Ppeak
* Peak Wavelength (Wavelength with maximum peak): λ peak
* Total Power (Total peak):Ptotal
* Mode Spacing (Peak spacing): Δ λ mode
* Mean Wavelength (Average wavelength): λ mean
* Full width at half Maximum(FWHM): λ FWHM
* Sigma(Σ): Δ λ

The above items are obtained with the following calculation expressions.

◇ Ppeak

The peak values in the peak table are sorted in order of large No., and the highest (largest) data＝Ppeak

◇ λ peak

Wavelength having Ppeak＝ λ peak

◇Ptotal

$$Ptotal = \sum_{i=1}^{n} Pi$$

◇ Δ λ mode(SPACE λ)

$$\Delta\lambda mode = \frac{\sum_{i=1}^{n-1}(\lambda i+1 - \lambda i)}{n-1} = \frac{\lambda n - \lambda 1}{n-1}$$

◇ λ mean

$$\lambda mean = \frac{\sum_{i=1}^{n}(Pi \times \lambda i)}{\sum_{i=1}^{n} Pi}$$

◇

GRID analysis function

1 Using the GRID analysis function

(1)

4 Setting the GRID center

(1)

7 Selecting a GRID on which the GRID analysis it be performed(1)

If you select CHK mark ("*"), presence or absence of a peak within the specified GRID will be checked.

（1）

9 Deleting CHK mark from a GRID

(1)

ITU-T specification-conformed wavelengths (nm) 1/4

GRID No.	CENTER	CHK	START	STOP
1	1524.11			

ITU-T specification-conformed wavelengths (nm) 2/4

GRID No.	CENTER	CHK	START	STOP
56	1545.72			

ITU-T specification-conformed wavelengths (nm) 3/4

GRID No.	CENTER	CHK	START	STOP
111	1567.95			

ITU-T specification-conformed wavelengths (nm) 4/4

GRID No.	CENTER	CHK	START	STOP
166	1590.83			

ITU-T specification-conformed frequency(THz) 1/4

GRID No.	CENTER	CHK	START	STOP
1	196.70			

ITU-T specification-conformed frequency(THz) 2/4

GRID No.	CENTER	CHK	START	STOP
56	193.95			

ITU-T specification-conformed frequency(THz) 3/4

GRID No.	CENTER	CHK	START	STOP
111	191.20			

ITU-T specification-conformed frequency(THz) 4/4

GRID No.	CENTER	CHK	START	STOP
166	188.45			

ITU-T specification-conformed wave number (cm^{-1}) 1/4

GRID No.	CENTER	CHK	START	STOP
1	6561.21			

ITU-T specification-conformed wave number (cm^{-1}) 2/4

GRID No.	CENTER	CHK	START	STOP
56	6469.48			

ITU-T specification-conformed wave number (cm^{-1}) 3/4

GRID No.	CENTER	CHK	START	STOP
111	6377.75			

ITU-T specification-conformed wave number (cm^{-1}) 4/4

GRID No.	CENTER	CHK	START	STOP
166	6286.02			

5.12 Others

1 Setting the internal clock

(1)

5 Using the operation lock out function

(1)

Chapter6

6.1 Remote measurement using GP-IB

Remote control with GP-IB (IEEE-488.2 compliant) is possible with this device. A GP-IB port (connector) is provided on the back of this device.

Connecting the GP-IB connector

Turn OFF the power for this device and for all of the devices connected to this device. Connect the GP-IB bus cable to the GP-IB connector on the back of the device. Securely tighten the connector's fixing screws at this time.

CAUTION
Always turn OFF the power of all devices connected to the bus cable before connecting or disconnecting the GP-IB bus cable. Connecting/disconnecting the bus cable while the power is ON could lead to device malfunctioning and trouble.

Setting the GP-IB address

（1）

Interface functions

Of the GP-IB interface functions specified in IEEE488.1, this device has the subset functions shown in Table 6.1.

Table 6-1 Interface functions

Code	Interface functions
SH1	All transmission functions
AH1	All reception functions
T6	Basic talker and serial poll function
L4	Basic listener functions
SR1	All service request functions
RL1	Local lock out functions
PPO	No parallel poll function
DC1	All device clear functions (The send and receive buffers is cleared.)
DT1	All device trigger functions (When the GET command is received, it executes the single-measurement.)
C0	No controller functions

Remote/local function

REN and ATN are set to "True" by the controller, and the listen address is set to this device. This device will then enter the remote state.

In the remote state, all panel switches and soft keys other than the <LOCAL> soft keys are invalid.

When the <LOCAL> soft key is pressed, this device will return to the local state, and the panel switches will be accepted.

This device will also return to the local state when the GTL (Go To Local) message is sent from the controller or when REN is set to "False".

This device will enter the local lock out state when the LLO (Local Lock Out) message is sent from the controller. In this state, the local state will not be returned to even when the <LOCAL> soft key is pressed. To cancel the local lock out state, set RED to "False" with the controller.

Remote commands

The remote commands comply with IEEE-488.2.

Character strings used

The character strings used with this function are not case-sensitive.

Terminator

The following message terminator can be used with this device.

(1) Program message terminator

^END,LF+^END,LF

CRLF+^END,CR+^END,CRLF

LF is a single JIS code 0x0A

(2) Response message terminator

This device uses CRLF+^END as the message terminator.

Send and Receive Buffers

The AQ6140 has the 512-byte(to store CR.LF and other control codes and commas",") receive buffers.

The AQ6140 has the 1024-byte(to store CR.LF and other control codes and commas",") send buffers.

Command reference

(1) Inputting commands

The minimum character string required for this device to recognize commands is described in uppercase. Always input this uppercase section when sending a command. The section described in lowercase can be omitted.

The input character string is input with half-byte character in either upper or lowercase.

(2) Symbols rule table

Symbol	Explanation
< >	Designate the parameter according to the details defined in <>. Insert a half-byte space between the command and parameter, and separate the parameters with "," (commas).
|	This divides several elements in a list. (One of the elements is selected.)
[ ]	This selects an option. (Does not need to be described.)
{ }	One of the elements enclosed in { } must be selected.
<integer>	Integer Follows the IEEE488.2 <NR1> description method. <NR1>: Integer (no decimal point) ASCII. Example: "10"
<real>	Real number Follows the IEEE488.2 <NR2>, <NRf> description method. <NR2>: Decimal point description ASCII Example: "1.01" <NRf>: Floating point description ASCII Example: -5.1E+001"

(3) Expressing values

NR1 type: Value unconditionally expressed with a decimal point. The decimal point is always placed at the right end of the number string.
Example) 123, -9999

NR2 type: Value expressed with decimal point.
Example) 123.00, -9999.99

NR3 type: Value with decimal point having exponential.
Example) 1.23e2, -9.99999E3

NRf type: Values can be expressed with the NR1, 2 or 3 method.
Example) 123, 123.00, 1.23e2

(4) Unit table

Multiplier (floating point description)	Multiplier character	Name	Wave length (m)	Frequency (Hz)	m-1 (None)	Linear (W)	dBm (None)
1E18	EX	exa	—	—	—	—	—
1E15	PE	peta	—	—	—	—	—
1E12	T	tera	—	○	—	—	—
1E9	G	giga	—	○	—	—	—
1E6	MA	mega	—	○	—	—	—
1E3	K	kilo	—	○	—	—	—
1E-3	M	milli	○	—	—	○	—
1E-6	U	micro	○	—	—	○	—
1E-9	N	nano	○	—	—	○	—
1E-12	P	pico	○	—	—	○	—
1E-15	F	femto	—	—	—	—	—

An example of parameter input

（1）

Status data configuration

IEEE-488.2 Standard status data structure

Command reference

Reset items (*RST)

Item	Reset value	
Label	Clear	
Sweep state	Stop	
Center wavelength	1460nm	
Sweep span	380nm	
Starting wavelength	1270nm	
Ending wavelength	1650nm	
X axis unit	Wavelength	
Reference level	0dB	
Log scale	10dB/div	
Base level	0	
Power unit	dBm	
Automatic peak	CENTER OFF REF LEVEL OFF AUTO SEARCH OFF	
S/N	Function OFF Seletion AUTO User wavelength not affected User Noise Level not affected No. of averages 100	
Medium	Vacuum	
Elevation	not affected	
Peak search threshold	10dB	
Peak search Excursion	15dB	
Offset value for power measurement	0dB	
Fabry-Perot	OFF	
Display screen type	NORMAL	
Move,Line Marker	OFF	
Relative display	λ,Pw	
Sort direction	Forward with wavelength	
REF cursor position	Invalid	
1 peak display	OFF	
GRID	Function OFF GRID SPAN:0.10nm GRID CENTER:ITU-T GRID GRID CHK:ALL ON	
Drift	Function OFF Display △ Repeat Interval FAST Num of Drift 0(Endless)	
	Trap (wavelength span)	Function OFF Value 50nm
	Trap (peak wavelength)	Function OFF Value 10nm
	Trap (peak power)	Function OFF Value 0.001dBm

Common commands 2/2

No.	Type	Format	Explanation
8	C	*SAV<integer>	Saves the device status. <integer>

MEASurement instructions

No.	Type	Command hierarchy	Explanation
1		:MEASure	MEAS command: Command that sets the device conditions, newly measures and returns the measurement results.
		:ARRay	
	Q	:POWer[?]	:MEAS:ARR:POW ?

FETCh instructions			
No.	Type	Command hierarchy	Explanation
3			FETC command: Command that returns current measurement results. (Does not measure)
	Q	:FETCh[?]	:FETC?
		:ARRay	
	Q	:POWer[?]	:FETC:ARR:POW ?

CALCulate2 Subsystem
1/4

No.	Type	Command hierarchy	Explanation
5		:CALCulate2 :DATA?	:CALC2:DATA? {POWer | FREQuency | WAVelength | WNUMber} : Returns peak table data.
	Q		:CALC2:DATA? POWer

CALCulate2 Subsystem
2/4

No.	Type	Command hierarchy	Explanation
		:CALCulate2	
		:WLIMit	
	CQ	[:STATe]	:CALC2:WLIM [:STATe] {? | { ON | OFF | 1 | 0 }}

CALCulate2 Subsystem
3/4

No.	Type	Command hierarchy	Explanation
		:CALCulate2	
		:WLIMit	
		:CENTer	
	CQ	:FREQuency	:CALC2:WLIM:CENT:FREQ {? | {<real> | MAXimum | MINimum}} : Sets the center frequency.(Hz) <real> : 181.71

CALCulate2 Subsystem
4/4

No.	Type	Command hierarchy	Explanation
		:CALCulate2	
		:VERTical	
	Q	:REF	:CALC2:VERT:REF ? :Returns the reference level. Query response <real>
	C	:DBM	:CALC2:VERT:REF:DBM <real> :Sets the reference level.(Only dBm scale) <real> : -40.0

CALCulate3 Subsystem 1/8

No.	Type	Command hierarchy	Explanation
6		:CALCulate3 :DATA?	Returns the relative,drift,SN ratio and SN ratio AUTO results. :CALC3:DATA? {POWer | FREQuency | WAVelength | WNUMber}
	Q		:CALC3:DATA? POW

CALCulate3 Subsystem 2/8

No.	Type	Command hierarchy	Explanation
		:CALCulate3	
		:SNR	SN ratio operation
	CQ	[:STATe]	:CALC3:SNR[:STATe]{? |{ ON | OFF| 1 | 0 }}

CALCulate3 Subsystem 3/8

No.	Type	Command hierarchy	Explanation
		:CALCulate3	
		:DRIFt	Drift operation
	C	:PRESet	:CALC3:DRIF:PRES : Drift state (DIFF, MAX, MIN, REF) all OFF. In this state, REF is returned if ":CALC3:DATA?" is established.

CALCulate3 Subsystem 4/8

No.	Type	Command hierarchy	Explanation
		:CALCulate3 :DRIFt :TRAP2	
	CQ	[:STATe]	:CALC3:DRIF:TRAP2[:STATe] {?|{ON|OFF|1|0}} :Trap function2 ON/OFF Query response 1:ON 0:OFF
	CQ	:FREQuency	:CALC3:DRIF:TRAP2:FREQ {?|<real>} <real> : 0.0001

CALCulate3 Subsystem 5/8

No.	Type	Command hierarchy	Explanation
		:CALCulate3 :DELTa	Relative operation
	C	:PRESet	:CALC3:DELT:PRES

CALCulate3 Subsystem 6/8

No.	Type	Command hierarchy	Explanation
		:CALCulate3	
		:FPERot	
	CQ	[:STATe]	:CALC3:FPER[:STSTe] {?|{ON|OFF|1|0}} :Fabry-perot analysis ON/OFF Query response 1:ON 0:OFF
		:FWHM?	
	Q	:FREQuency	:CALC3:FPER:FWHM{:FREQ|[:WAV]|:WNUM} ?
		[:WAVelength]	:Returns the FWHM
		:WNUMber	Query response <NRf>
		:MEAN?	
	Q	:FREQuency	:CALC3:FPER:MEAN{:FREQ|[:WAV]|:WNUM} ?
		[:WAVelength]	:Returns the mean data.
		:WNUMber	Query response <NRf>
		:MODE:SPACing?	
	Q	:FREQuency	:CALC3:FPER:MODE:SPAC{:FREQ|[:WAV]|:WNUM} ?
		[:WAVelength]	:Returns the mode spacing data
		:WNUMber	Query response <NRf>
		:PEAK?	
	Q	:FREQuency	:CALC3:FPER:PEAK{:FREQ|[:WAV]|:WNUM} ?
		[:WAVelength]	:Returns the peak data.
		:WNUMber	Query response <NRf>
		:POWer?	
	Q	[:DBM]	:CALC3:FPER:POW{ [:DBM]|:WATTs} ?
		:WATTs	:Returns the peak power data. Query response <NRf>
		:SIGMa?	
	Q	:FREQuency	:CALC3:FPER:SIGM{:FREQ|[:WAV]|:WNUM} ?
		[:WAVelength]	:Returns the sigma data.
		:WNUMber	Query response <NRf>

CALCulate3 Subsystem 7/8

No.	Type	Command hierarchy	Explanation
		:CALCulate3	
		:GRID	
	CQ	[:STATe]	:CALC3:GRID[:STATe] {?|{ON|OFF|1|0}} :Grid analysis function ON/OFF Query response 1:ON 0:OFF
		:SPAN	
	CQ	:FREQuency	:CALC3:GRID:SPAN:FREQ {?|<real>|MINimum|MAXimum} :Sets the grid span(Hz) <real> : 0.01

CALCulate3 Subsystem 8/8

No.	Type	Command hierarchy	Explanation
	CQ	:CALCulate3 :GRID :CHK	:CALC3:GRID:CHK {? <integer> | <integer>,{ON|OFF|1|0}} : Sets the GRID CHK (analysis is turned on with ON or "1"). <integer> : GRID No.1

DISPlay Subsystem			
No.	Type	Command hierarchy	Explanation
7		:DISPlay :MARKer	
	C	:MAXimum	:DISP:MARK :MAX

STATus Subsystem			
No.	Type	Command hierarchy	Explanation
10		:STATus	
	C	:PRESet	:STAT:PRES

SYSTem Subsystem			
No.	Type	Command hierarchy	Explanation
11	Q	:SYSTem :HELP :HEADera?	:SYST:HELP:HEAD? :Output the remote command list Query response #<integer> <string> <string> <string>… Output example) #45678 :ABORt /nquery/ :CALCulate2:DATA? /qonly/ : "#45678" indicates that total number of characters used in the command list is 5678 bytes long. And, "4" at the head indicates that "5678" is a four-digit number.
	C	:PRESet	:SYST:PRESet

TRIGger Subsystem			
No.	Type	Command hierarchy	Explanation
12	C	:ABORt	:ABORt :Stop the measurement.
		:INITiate	:INIT:CONT {? |{ON | OFF | 1 | 0}} : Selects single or continuous measurement, and retrieves status.
	C	:CONTinuous	:INIT:CONT {ON | 1}

FILE Subsystem
1/3

No.	Type	Command hierarchy	Explanation
14		:FILE	
	CQ	:DRIVe	:FILE:DRIV {?|<integer>} :Sets the drive <integer> 0|2 0:FDD 2:HDD Query response <integer>
	CQ	:NAMe	:FILE:NAM {?|<string>} :Sets the file name <string> file name (a character string consisted of up to 8 characters) Query response <string>
	CQ	:DIRectory	:FILE:DIR {?|<string>} : <string> directory name (MAX 12chara) Full-path specification is required a hierarchical file structure is employed. Note, however, that you must specify the directory after specifying the drive. Query response <string>
	C	:MAKe	:FILE:DIR:MAK <integer>,<string> :Make the directory <integer> 0|2 0:FDD 2:HDD <string> directory name (MAX 12chara) Full-path specification is required a hierarchical file structure is employed.
	C	:DELete	:FILE:DIR:DEL <integer>,<string> :Delete the directory <integer> 0|2 0:FDD 2:HDD <string> directory name (MAX 12chara) Full-path specification is required a hierarchical file structure is employed.
	CQ	:TYPe	:FILE:TYP {?|<integer} : <integer> 0

FILE Subsystem
2/3

No.	Type	Command hierarchy	Explanation
		:FILE	
	C	:SAVe	:FILE:SAV :Record the file File is written in the specified address. (Every file must be specified with DRIV, DIR, NAME and TYP). When another file with the same name is already present at the address, the succeeding file won't be overwritten on the preceding file.
	C	:OVERwrite	:FILE:SAV:OVER :Overwrite the file A file is overwritten at the specified address. (Every file must be specified with DRIV, DIR, NAME and TYP). If no file is present at the specified address, no action is taken.
	Q	:BYTe?	:FILE:SAV:BYT? <integer> : Recorded capacity at the specified drive is returned. This capacity is output in number of bytes. <integer> 0|2 0:FDD 2:HDD Query response <integer>(Byte)
	Q	:LIST?	:FILE:SAV:LIST? <integer1>,<string1>,<integer2> : Names of recorded files are returned. <integer1> Drive 0|2 0:FDD 2:HDD <string1> Directory name (MAX 12chara)

FILE Subsystem
3/3

No.	Type	Command hierarchy	Explanation
		:FILE	
	C	:COPY	:FILE:COPY : Taking a copy (Specify a file with SOUR and DEST).
	CQ	:SOURce	:FILE:COPY:SOUR {?|<integer1>,<string1>,<integer2>,<string2>} : Sets the information of a copied-from- file <integer1> Drive 0|2 0:FDD 2:HDD <string1> Directory name (MAX 12chara)

PRINT Subsystem			
No.	Type	Command hierarchy	Explanation
15	CQ	:PRINt :OUT	:PRIN:OUT {?|<integer>} : Sets the destination of print out <integer> 1

6.2 Remote measurement using RS-232C

This device has an RS-232C interface mounted as a standard. This allows remote measurements to be carried out by connecting this device with a personal computer (controller).

Connecting the RS-232C connector

Turn OFF the power for this device and for all of the devices connected to this device.
Connect the cable to the RS-232C connector on the back of the device.

CAUTION
Always turn OFF the power of all devices connected to the cable before connecting or disconnecting the cable. Connecting/disconnecting the cable while the power is ON could lead to device malfunctioning and trouble. Use a cross cable for the RS-232C cable.

Setting the interface

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Status data structure

The structure is the same as the GP-IB remote measurement. Note that a service request cannot be generated to confirm the status. If a command error occurs, the standard event status register will be set, so the register can be read out with the "*ESR?" command.

Remote command

Command reference

The control command and request commands are the same as the GP-IB remote measurement.

Delimiter

"CRLF" is used for the delimiter.

Send and Receive Buffers

The AQ6140 has the 512-byte(to store CR.LF and other control codes and commas”,”) receive buffers.

The AQ6140 has the 1024-byte(to store CR.LF and other control codes and commas”,”) send buffers.

Sample Program

The following programs measure the DFB laser. Measured wavelength and power are displayed on the screen.
The program language is N88BASIC.

```
1000 '
1010 '    AQ6140 MULTI-WAVELENGTH METER
1020 '              SAMPLE PROGRAM
1030 '              (DFB LASER)
1040 '
1050 CLS
1060 ISET IFC
1070 ISET REN
1080 ADRS=7
1090 '
1100 PRINT @ ADRS;"*RST"
1110 '
1120 PRINT @ ADRS;":MEAS:SCAL:POW:WAV?"          :Measurement of wavelength
1130 INPUT @ ADRS;WAV$
1140 '
1150 PRINT @ ADRS;":FETC:SCAL:POW?"              :Measurement of power
1160 INPUT @ ADRS;POW$
1170 '
1180 GOSUB *ERRCHK                               :Error check
1190 '
1200     WAV#=VAL(WAV$)*1000000000#              :Display of measurement value
1210     WAV#=INT(WAV#*1000#+.5#)/1000#
1220     POW=VAL(POW$)
1230     POW#=INT(POW*1000#+.5#)/1000#
1240     PRINT "WAVLENGTH=",WAV#,"nm"
1250     PRINT "POWER      =",POW#,"dBm"
1260 '
1270 IRESET REN
1280 END
1290 '
1300 *ERRCHK
1310     PRINT @ ADRS;":SYST:ERR?"               :Judgment of error
1320     INPUT @ ADRS;N$,E$
1330     IF N$="+0" THEN RETURN
1340     PRINT "ERROR",N$,E$
1350     IRESET REN
1360 END
```

Chapter7

7.1 Mechanical inspections

Inspect the appearance of the operation section and the mechanical operation from outside the device.
For the appearance, visually check for damage and deformation, and confirm that the switches, connectors and other assembly parts are not loose and move smoothly.
If any abnormality is found, notify Ando Electric of the details immediately.

7.2 Cleaning the device

This device must be cleaned daily to ensure long usage, and to prevent trouble and accidents. The methods for cleaning the device, floppy disk drive, optical connector and optical adaptor are described below.

Device

If the device's case or LCD surface is contaminated, wipe it off with a soft cloth, soaked in water or lukewarm water, and then dry off with a dry cloth.

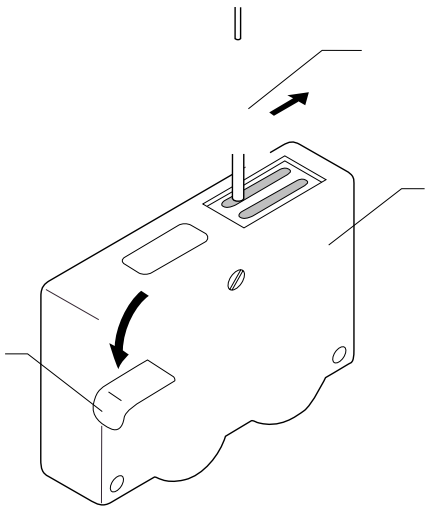
⚠ CAUTION
Do not use thinner, benzene or alcohol, etc., as the surface could be damaged.

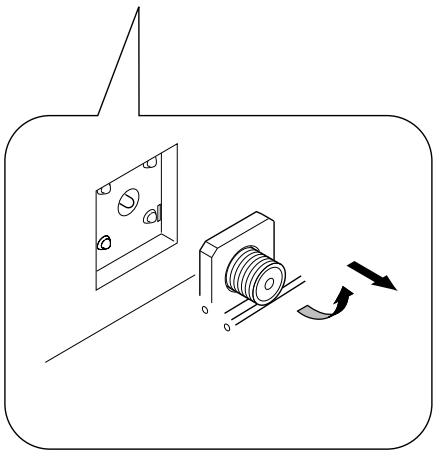
Floppy disk drive

Contamination of the floppy disk drive's magnetic head will lead to writing and reading errors. Using a commercially available "floppy head cleaner (for double-sided drive), clean the head once every three months.

Wet and dry type head cleaners are available. The wet type is effective in removing contamination from the head surface, and thus is recommended.

Follow the instructions provided by the cleaner maker when using the cleaner.





2 Install a new front shell.

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