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Anritsu

MG9637A/MG9638A

Tunable Laser Source

Operation Manual

MG9638A

■ Read this manual before using the equipment. Keep this manual with the equipment.

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MG9637A/MG9638A
Tunable Laser Source
Operation Manual

Sixth Edition

Read this manual before using the equipment.
Keep this manual with the equipment.

Measuring Instruments Division
Measurement Group
ANRITSU CORPORATION

Document No.: M-W1213AE-6.0

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Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Insure that you clearly understand the meanings of the symbols BEFORE using the equipment.
Some or all of the symbols may not be used on this equipment. In addition, when drawings are included in this manual, labels on the equipment may not be shown on them.

Safety Symbols Used in Manual

DANGER ⚠ This indicates a very dangerous procedure that could result in death or serious injury if not performed properly.

WARNING ⚠ This indicates a hazardous procedure that could result in death or serious injury if not performed properly.

CAUTION ⚠ This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and/or in Manual

The following safety symbols are used inside or on the equipment near operation locations, and/or in manual to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.



This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.



This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.



This indicates warning or caution. The contents are indicated symbolically in or near the triangle.



This indicates a note. The contents are described in the box.



These indicate that the marked part should be recycled.

MG9637A/MG9638A
Tunable Laser Source
Operation Manual

27 January 1997 (First Edition)
26 May 2000 (Sixth Edition)

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For Safety

WARNING ⚠



1. ALWAYS refer to the operation manual when working near locations at which the alert mark shown on the left is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.
   Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.



2. When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, before supplying power to the equipment, use a conversion adapter and ground the green wire, or connect the frame ground on the rear panel of the equipment to ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

Repair

WARNING ⚠

3. This equipment cannot be repaired by the user. DO NOT attempt to open the cabinet or to disassemble internal parts. Only Anritsu-trained service personnel or staff from your sales representative with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision parts.

Falling Over

4. This equipment should be used in the correct position. If the cabinet is turned on its side, etc., it will be unstable and may be damaged if it falls over as a result of receiving a slight mechanical shock.

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For Safety

WARNING ⚠

5. DO NOT short the battery terminals and never attempt to disassemble it or dispose of it in a fire. If the battery is damaged by any of these actions, the battery fluid may leak.
   This fluid is poisonous.

Battery Fluid

   DO NOT touch it, ingest it, or get in your eyes. If it is accidentally ingested, spit it out immediately, rinse your mouth with water and seek medical help. If it enters your eyes accidentally, do not rub your eyes, irrigate them with clean running water and seek medical help. If the liquid gets on your skin or clothes, wash it off carefully and thoroughly.

6. This instrument uses a Liquid Crystal Display (LCD); DO NOT subject the instrument to excessive force or drop it. If the LCD is subjected to strong mechanical shock, it may break and liquid may leak.
   This liquid is very caustic and poisonous.

LCD

   DO NOT touch it, ingest it, or get in your eyes. If it is ingested accidentally, spit it out immediately, rinse your mouth with water and seek medical help. If it enters your eyes accidentally, do not rub your eyes, irrigate them with clean running water and seek medical help. If the liquid gets on your skin or clothes, wash it off carefully and thoroughly.

CAUTION ⚠

1. Before changing the fuses, ALWAYS remove the power cord from the poweroutlet and replace the blown fuses. There is risk of receiving a fatal electric shock if the fuses are replaced with the power cord connected.

Changing Fuse

CAUTION ⚠

   ALWAYS use new fuses of the type and rating specified on the fuse marking on the rear panel of the cabinet or mentioned in this manual.

   T5A indicates a time-lag fuse.
   5A of time-lag fuses are used for this measuring instrument.

2. Keep the power supply and cooling fan free of dust.
   - Clean the power inlet regularly. If dust accumulates around the power pins, there is a risk of fire.
   - Keep the cooling fan clean so that the ventilation holes are not obstructed. If the ventilation is obstructed, the cabinet may overheat and catch fire.

Cleaning

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For Safety

WARNING ⚠

To ensure safety when using laser light, this instrument has a laser On/Off key, a mechanical shutter to block the laser beam, and an interlock connector. However, since there is a small chance that these three safety devices might malfunction, NEVER look directly into the laser output connector, nor into the end of a fiber connected to the laser output, even if the laser has been switched off.

Laser Radiation Markings

The product name and the danger classification specified by IEC825-1 and FDA21-CER are explained below.

	MG9637A	MG9638A
IEC825-1	Class3A	Class3A
FDA21-CFR	Class1	Class1

Class 1 and Class 3 indicates the degree of danger of the laser radiation outlined below as defined by IEC825-1 and FDA21-CER.

Class 1 Safe laser presenting no danger when used according to design specifications.

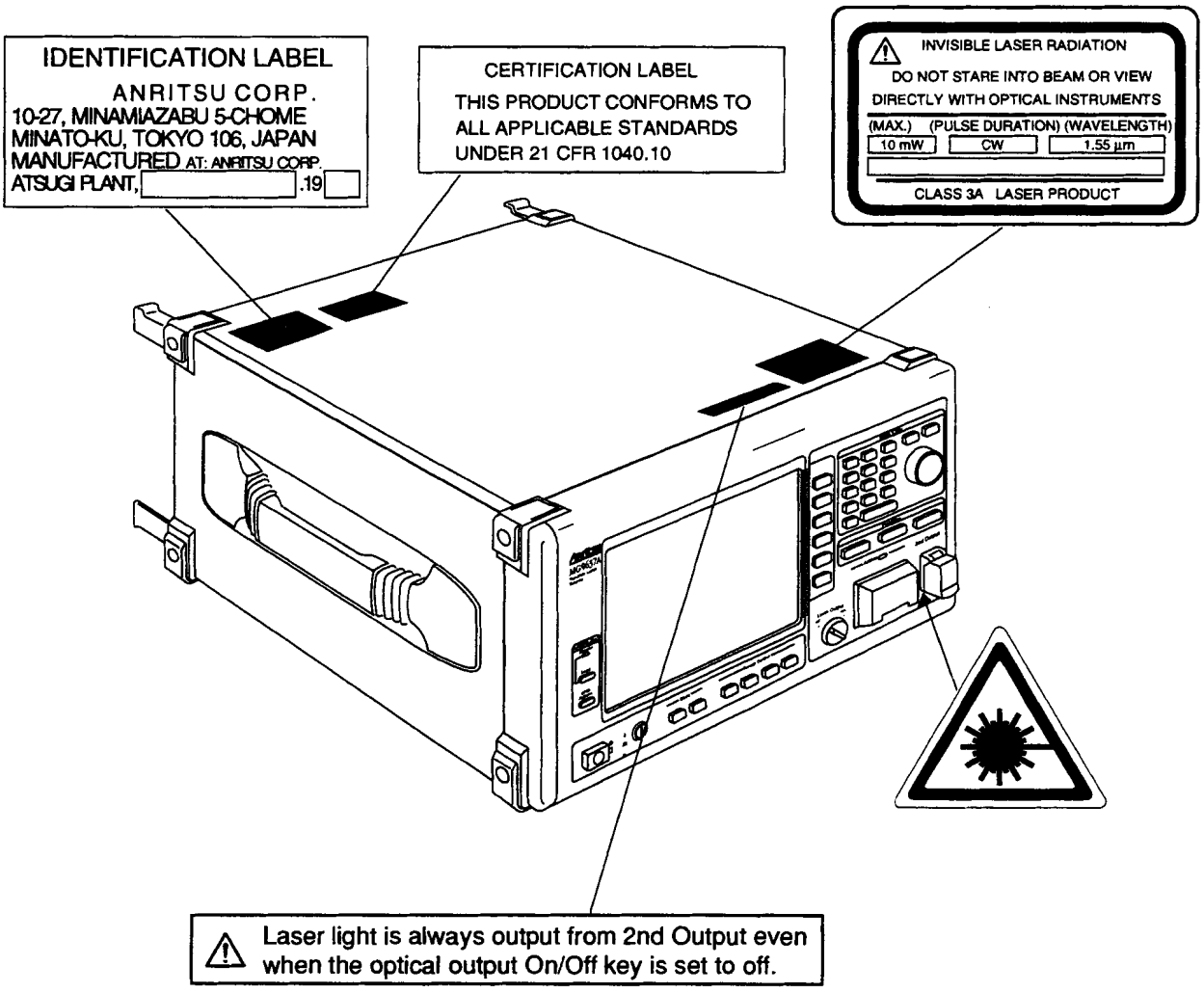
Class 3A Precautions are only required to prevent continuous viewing of the direct beam; a momentary (0.25 s) exposure as would occur in accidental viewing situations is not considered hazardous. However, the laser beam should not be intentionally aimed at people. The use of optical viewing aids (e.g. binoculars) is hazardous.

To ensure safe operation of the laser optical output, this instrument has an optical output ON/OFF key, a mechanical shutter, and an interlock connector. However, although it is very unlikely that these safety devices would all fail simultaneously, as an added precaution, take care NEVER to look directly into the laser light even when the laser optical output is off.

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For Safety

Laser Radiation Markings



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For Safety

CAUTION ⚠

Changing memory back-up battery

This equipment uses a lithium battery to back-up the memory. This battery must be replaced by a service engineer when it has reached the end of its useful life; contact the Anritsu sales section or your nearest representative.

Note: The battery used in this equipment has a maximum useful life of 7 years. It should be changed before this period has elapsed.

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Equipment Certificate

Anritsu Corporation certifies that this equipment was tested before shipment using calibrated measuring instruments with direct traceability to public testing organizations recognized by national research laboratories including the Electrotechnical Laboratory, the National Research Laboratory and the Communication Research laboratory, and was found to meet the published specifications.

Anritsu Warranty

Anritsu Corporation will repair this equipment free-of-charge if a malfunction occurs within 1 year after shipment due to a manufacturing fault, provided that this warranty is rendered void under any or all of the following conditions.

- The fault is outside the scope of the warranty conditions described in the operation manual.
- The fault is due to mishandling, misuse, or unauthorized modification or repair of the equipment by the customer.
- The fault is due to severe usage clearly exceeding normal usage.
- The fault is due to improper or insufficient maintenance by the customer.
- The fault is due to natural disaster including fire, flooding, earthquake, etc.
- The fault is due to use of non-specified peripheral equipment, peripheral parts, consumables, etc.
- The fault is due to use of a non-specified power supply or in a non-specified installation location.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation will not accept liability for equipment faults due to unforeseen and unusual circumstances, nor for faults due to mishandling by the customer.

Anritsu Corporation Contact

If this equipment develops a fault, contact Anritsu Corporation or its representatives at the address in this manual.

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CE Marking

Anritsu affix the CE Conformity Marking on the following product(s) accordance with the Council Directive 93/68/EEC to indicate that they conform with the EMC directive of the European Union (EU).

CE Conformity Marking

CE

1. Product Name/Model Name

Product Name: Tunable Laser Source
Model Name: MG9637A, MG9638A

2. Applied Directive

EMC : Council Directive 89/336/EEC
Safety: Council Directive 73/23/EEC

3. Applied Standards

EMC:

Electromagnetic radiation:

EN55011(ISM, Group 1, Class A equipment)

Immunity: EN50082-1

		Performance Criteria*
IEC801-2 (ESD)	4 kVCD, 8 kVAD	B
IEC801-3 (Rad.)	3 V/m	A
IEC801-4 (EFT)	1 kV	B

*: Performance Criteria

A: No performance degradation or function loss

B: Self-recovered temporary degradation of performance or temporary loss of function

Harmonic current emissions:

EN61000-3-2 (Class A equipment)

Safety: EN61010-1 (Instration Category II, Pollution Degree 2)

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Anritsu affix the C-tick marking on the following product(s) accordance with the regulation to indicate that they conform with the EMC framework of Australia/New Zealand

C-tick marking



1. Product Name/Model Name

Product Name: Tunable Laser Source
Model Name: MG9637A, MG9638A

2. Applied Standards

EMC:

Emission:

AS/NZS 2064.1/2 (ISM, Group 1, Class A equipment)

Immunity:

AS/NZS 4252.1

		*Performance Criteria
IEC801-2 (ESD)	8 kVAD	B
IEC801-3 (Rad.)	3 V/m	A
IEC801-4 (EFT)	1 kV(peak)	B

* Performance Criteria

A: No performance degradation or function loss

B: Self-recovered temporary degradation of performance or temporary loss of function

x

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About This Manual

This manual explains how to operate, calibrate, and maintain the MG9637A and MG9638A wavelength tunable laser sources (TLSs).

First-time users should first read Chapter 1, "Outline", to understand the basic functions and for a summary of operations of this unit.

Detailed explanations are provided in the subsequent chapters in an easy-to-reference arrangement. Use this information together with the index at the end of this manual.

☞ indicates a reference item number including a detailed explanation and related description.

Notes on operation and useful contents are described as "Hint:"

Note:
This unit can be set to either a wavelength or frequency display; however, in this manual, there are many portions explained assuming the wavelength display. Users applying the frequency display should read "wavelength" instead of "frequency."

This unit provides a GPIB and RS-232C serial interfaces so that users can perform remote operation by connecting a computer. For details on these interfaces and remote commands, refer to the manual below.

MG9637A/MG9638A Remote Control Instructions Manual (M-W1214AE)

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Section 1 Outline

This chapter outlines the basic functions and operations of this unit. For details on performance and function specifications, see Appendix A.

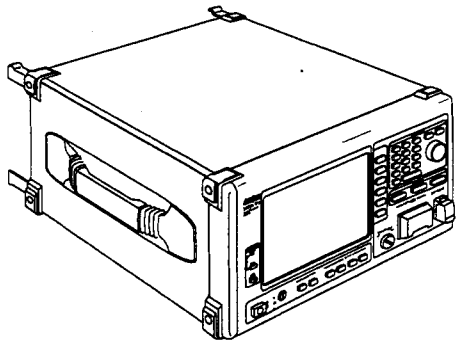
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1.1 MG9637A and MG9638A Wavelength Tunable Laser Sources

The MG9637A and MG9638A wavelength tunable laser sources enable the output of any wavelength. They can also sweep out an output wavelength in a specific range. In addition, they enable you to specify a laser output level and select a successive laser output or modulation laser output (internal or external modulation). These laser sources are applicable to measure wavelength characteristics of an optical device and perform experiments with specific wavelengths.

The MG9637A and MG9638A wavelength tunable laser sources provide the GPIB and RS-232C as remote interfaces. Combining them with a computer and other measuring instruments (optical spectrum analyzer, optical power meter, etc.) enables automatic measurement and synchronous measurement.

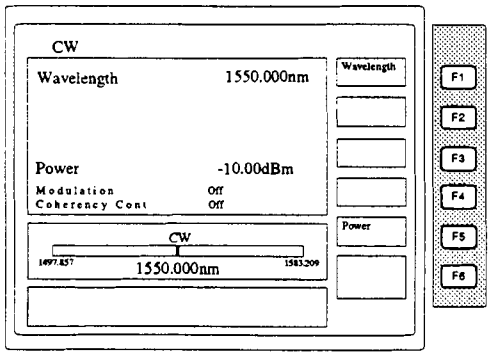


1.2 Major Functions and Operations

1.2.1 Successively outputting any wavelength ... CW mode

To successively output any wavelength, press the CW key; the screen below appears. Then, press the F1 (wavelength) key and use the ten-key pad to key in "1560." "1560nm" appears on the right of "Input Wavelength" at the bottom of the screen. After confirming the input value, finally press the ENTER key. The specification of the wavelength is then completed. The laser output wavelength is 1560 nm.

In this explanation, the wavelength is used, but you may set a frequency instead of the wavelength. **For details, see Section 4.9.1.**

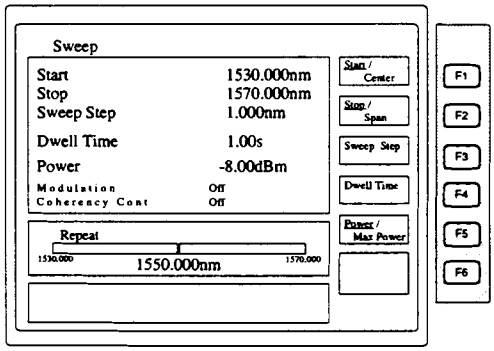


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1.2.2 Sweeping out a set wavelength ... Sweep mode

The MG9637A/MG9638A can sweep out a wavelength by specifying a sweep starting wavelength, sweep ending wavelength, and step wavelength. First press the SWEEP key; the screen below appears. Then, press the F1 key to highlight "Start" in "Start/ Center." Use the ten-key pad to key in 1540; "1540 nm" appears on the "Input Start Wavelength" line at the bottom of the screen. Press the ENTER key to adopt the input value. The sweep starting wavelength is then set to 1540 nm. To specify the sweep ending wavelength, press the F2 key to highlight "Stop" in "Stop/span" and use the ten-key pad to key in an input value. To specify the sweep step wavelength, in the same way as above, press the F3 key to highlight "Sweep Step" and use the ten-key pad to key in an input value.

In this explanation, the wavelength is used, but you may set a frequency instead of the wavelength. **For details, see Section 4.9.1.**



1.2.3 Setting an output level ... Power/Max Power

To specify a laser output level in the CW mode, press the CW key to place the unit in the CW mode. Then, press the F5 (Power) key and use the ten-key pad and enter keys or rotary knob to specify a level in the input limit range.

1.3 Standard Configuration

Standard accessories

- AC power cord
- 5-A fuse × 2
- Instructions manual (this manual)
- Remote Control Instructions Manual
- Laser output control key × 2

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1.4 Options

Optical connectors

	MG9637A	MG9638A
• E2000 (DIAMOND) connector	MG9637A-27	MG9638A-27
• EC (RADIAL) connector	MG9637A-31	MG9638A-31
• FC connector	MG9637A-37	MG9638A-37
• ST connector	MG9637A-38	MG9638A-38
• DIN (47256) connector	MG9637A-39	MG9638A-39
• SC connector	MG9637A-40	MG9638A-40
• HMS-10/A (DIAMOND) connector	MG9637A-43	MG9638A-43

1.5 Application Parts

RS-232C cable (9P-9P) J0654A

RS-232C cable (9P-25P) J0655A

GPIB cable (1-m)

Replaceable optical connectors

- FC connector
- ST connector
- DIN (47256) connector
- HMS-10/A (DIAMOND) connector
- SC connector

Optical fiber cable (2-m)

Ferrule cleaner

Ferrule cleaner refill tape (6 units/set)

Adapter cleaner (stick type, 200 units/set)

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Section 2 Name and Function of each Part

This chapter describes the name and function of each part on the front and rear panels of this unit and explains how to use it.

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2.2 Name and Function of each Part 2-2
2.3 Front Panel 2-4
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2.1 Unpacking

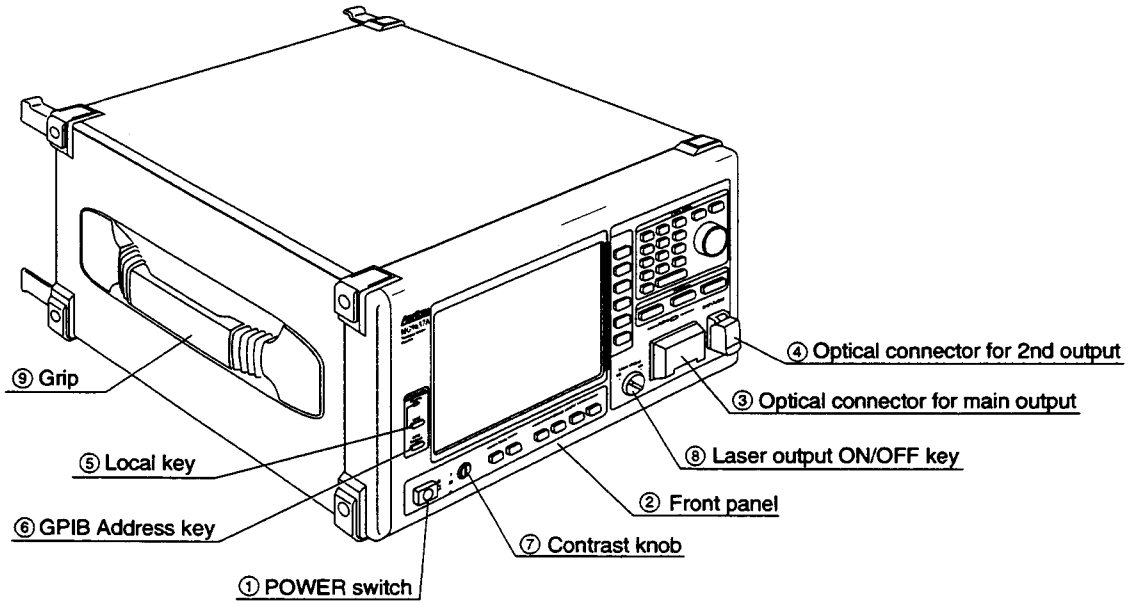
Take out this unit and its accessories from the package box and confirm that the parts shown in the component list are all provided. If there is a missing or damaged part, contact Anritsu or an Anritsu dealer.

Component list

Component name	Q'ty	Model type or ordering No.
Main unit	1	
Wavelength tunable laser source		MG9637A or MG9638A
Standard accessories		
AC power cord	1	J0017
5-A fuse	2	T5A250V
Instructions manual (This manual)	1	W1213AW
Remote Control Instructions Manual	1	W1214AW
Laser output control key	2	S0001
Front Cover	1	B0329G

2.2 Name and Function of each Part

Confirm the name and function of each part.



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1 POWER switch	Turns the power on or and off.
2 Front panel	☞ See Section 2.3, "Front Panel."
3 Optical connector for output 1	Optical connector for main output
4 Optical connector for output 2	Optical connector for 2nd output
5 Local key	Releases the GPIB remote state.
6 GPIB Address key	Sets a GPIB address.
7 Contrast knob	Adjusts a display contrast.
8 Laser output ON/OFF key	Switches main output to ON and OFF.
9 Grip	Provided on the left and right of this unit.

Caution ⚠

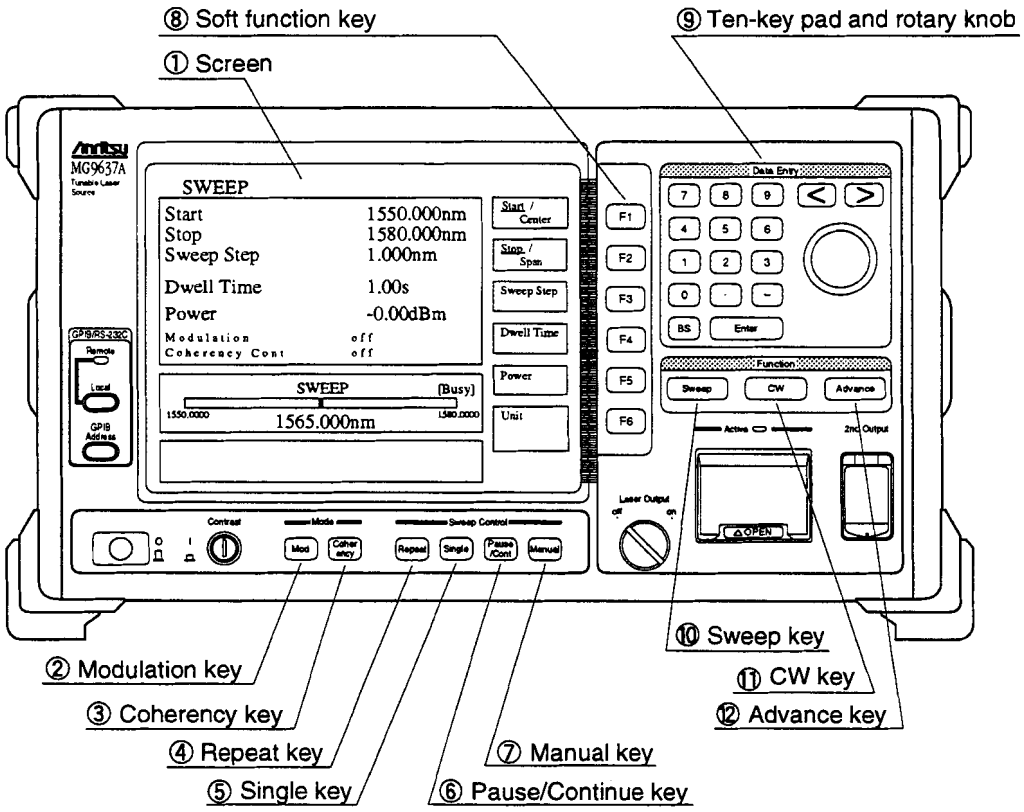
To carry this unit, be sure to hold the grips on the left and right so that this unit is as level as possible. If you carry this unit while holding only one of the grips (as when hanging this unit), an unreasonable force applies to the internal precision parts, and they may be damaged.

0 Rear panel	☞ See 2.4, "Rear Panel."

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2.3 Front Panel

Confirm the name and function of each part on the front panel.



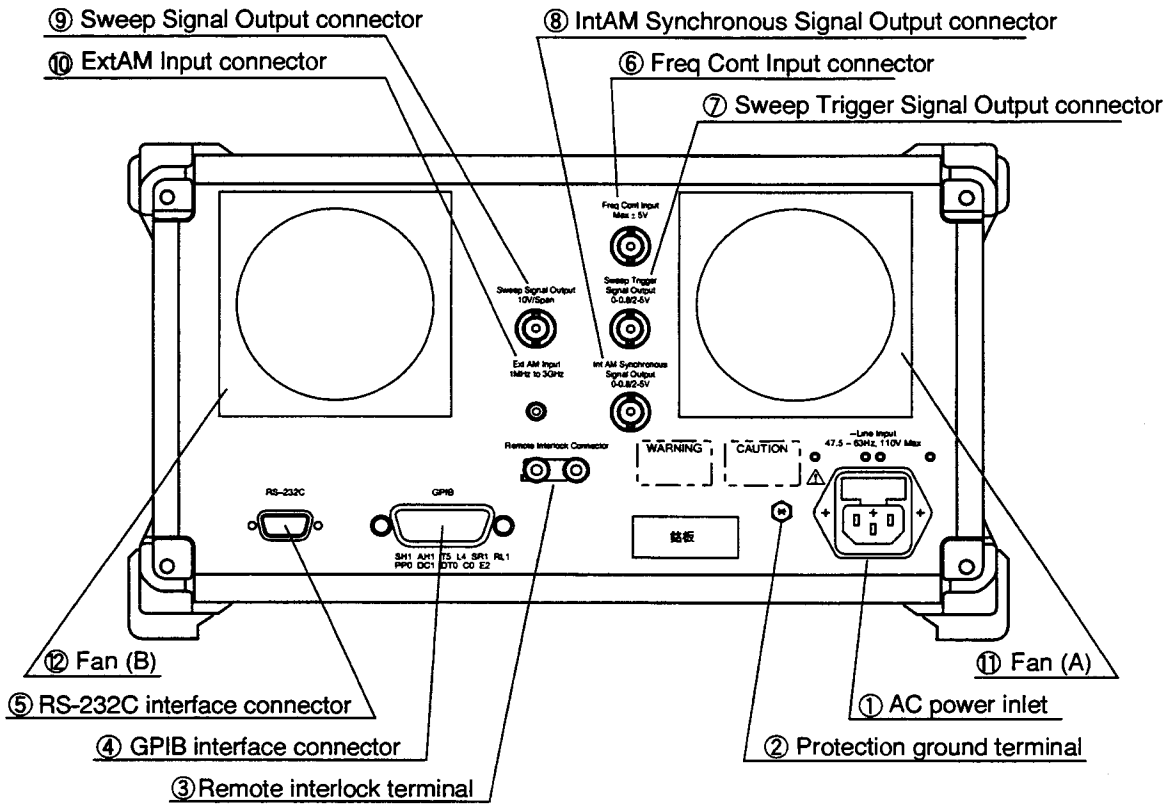
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①Screen	Displays the set wavelength and power parameters on the screen. **See Section 2.5.**
②Modulation key	Allocates a determined modulation to the soft function key. **See Section 4.11.**
③Coherency key	Switches the coherency control to ON and OFF. **See Section 4.12.**
④Repeat key	Repeatedly performs sweeping in the sweep mode. **See Section 4.10.2.**
⑤Single key	Performs only one sweeping in the sweep mode. **See Section 4.10.1.**
⑥Pause/Continue key	Stops or restarts the sweeping in the sweep mode. **See Section 4.10.4.**
⑦Manual key	Manually switches a wavelength in the sweep mode. **See Section 4.10.3.**
⑧Soft function key	Sets an item displayed on the screen.
⑨Ten-key pad and rotary knob	Used to enter a numeric value and select an optional item. See Section 4.4.
⑩Sweep key	Changes the wavelength output mode to the sweep mode. **See Section 4.5.2.**
⑪CW key	Changes the wavelength output mode to the CW mode. **See Section 4.5.1.**
⑫Advance key	Allocates an item used rarely of the set items to the soft function key. **See Section 4.9.**

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2.4 Rear Panel

Confirm the name and function of each part on the rear panel.
A handling note label is printed on the rear panel. For detailed information on how to safely use laser related equipment, see page VI at the beginning of this manual.



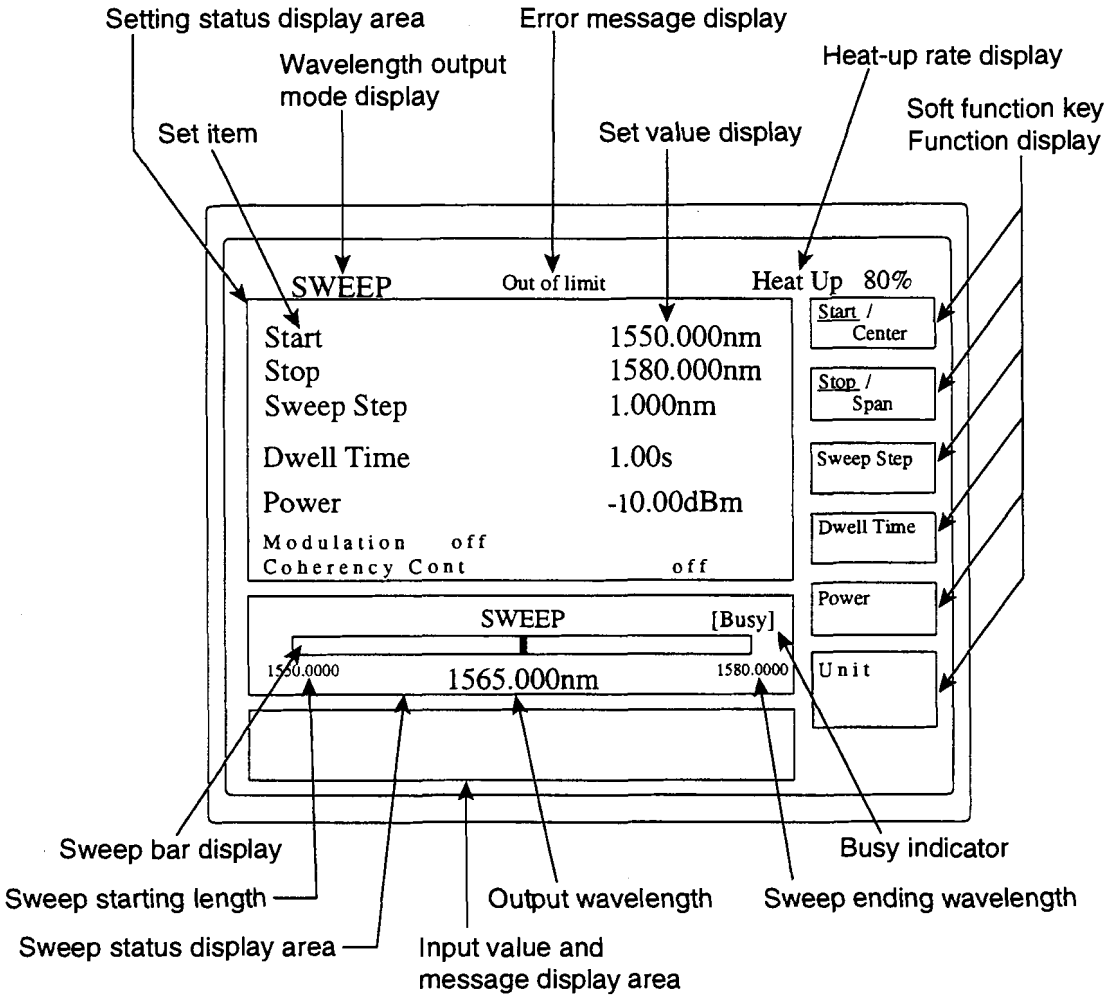
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①AC power inlet	Fuse holder one-body type connector used to connect the AC power cord. ☞ See Section 3.2.
②Protection ground terminal	Connected to a ground line for safety grounding. ☞ See Section 3.2.
③Remote interlock terminal	Provides an external switch to turn the laser output on and off. ☞ See Section 4.2.
④GPIB interface connector	Controls this unit in the remote mode.
⑤RS-232C interface connector	Controls this unit in the remote mode.
⑥Freq Cont Input connector	Inputs a signal for shifting an output wavelength. ☞ See Section 4.14.1.
⑦Sweep Trigger Signal Output connector	Outputs a sweep starting signal. ☞ See Section 4.14.2.
⑧Int AM Synchronous Signal Output connector	Outputs a signal synchronous with the internal modulation frequency. ☞ See Section 4.14.3.
⑨Sweep Signal Output connector	Outputs a voltage in proportion to the sweep wavelength. ☞ See Section.4.14.4.
⑩ExtAM Input connector	Inputs an external modulation signal. ☞ See Section 4.14.5.
⑪Fan (A)	An air cooling fan that exhausts the air in this unit. ☞ See Section 3.1.3.
⑪Fan (B)	An air cooling fan that exhausts the air in this unit. ☞ See Section 3.1.3.

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2.5 Screen Display

The information below is displayed on the screen.



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Section 3 Before Using this Unit

This chapter summarizes items you should know before using this unit. It also describes notes to maintain safety and prevent faults during operation of this unit. Be sure to read through this chapter at least once.

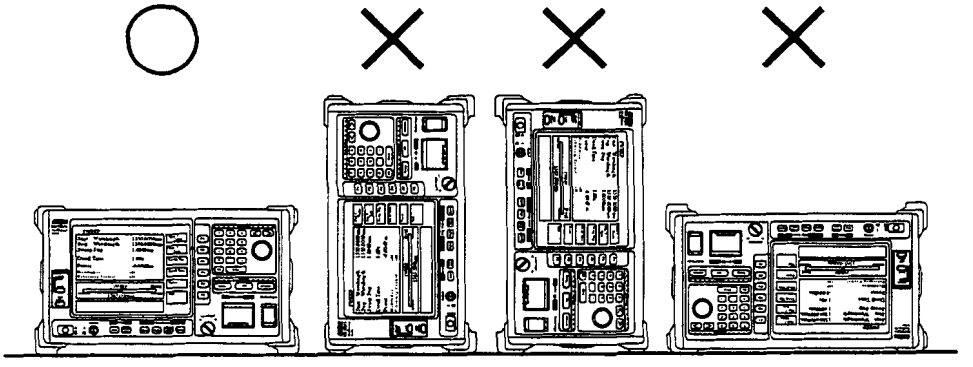
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3.1 Installation

3.1.1 Installation conditions

Install this unit horizontally.



3.1.2 Installation environment

This unit operates at 15 to 35°C; however, a fault will occur in the following environment:

- Location where vibrations are present
- Wet and dusty locations
- Inclined locations
- Locations exposed to the direct rays of the sun
- Locations exposed to active gases
- Locations where the temperature changes extremely

After this unit is used at a low-temperature location for a long time, if it is moved to a place where the temperature is high, dew condensation may occur inside this unit. If this unit is then powered on, a fault will be caused by a circuit short. In this case, completely dry this unit and turn the POWER switch on.

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3.1.3 Distance from fan

Two cooling fans are provided on the rear of this unit. Normally, only Fan A (rear right) operates. However, if the temperature becomes too high, Fan B also begins to operate automatically as required. This unit must be placed at least 10 cm away from walls and peripherals so as not to impede the air flow. Also, cleaning must be performed periodically to remove dusts on the protection net using a vacuum cleaner.

WARNING ⚠

Do not insert a foreign object in an opening in the protection net to stop the rotating fan. Precise optical parts, whose temperature is controlled, are used in the optical unit that is the core of this unit. Stopping the fan may cause motor damage due to fire and reduce the performance of those precise optical parts, or cause permanent damage.

3.1.4 Power voltage and frequency

Supply power in the voltage range of 85 to 132 Vac or 170 to 265 Vac and the frequency range of 47.5 to 63 Hz. 100V/200V switching is not required.

WARNING ⚠

Before replacing a fuse, disconnect the power cord from the power outlet. If the fuse is replaced without disconnecting the power cord from the power outlet, you may receive an electric shock.

The fuse to be replaced must be the same as the one described in this manual or have the same rating and characteristics as the fuse indicated on the rear of the cabinet. If illegal fuses are used, fuse burnout may occur repeatedly, and or fire may occur.

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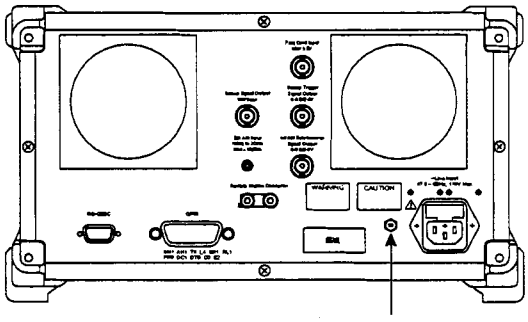
3.2 Connecting Power Cable and Ground Line

To supply the power to this unit, connect the distributed 3-core cable to the ground-type power outlet so that this unit is connected.

If ground-type power outlet is not provided, use distributed conversion adapter to convert to two poles. Before connecting the power cord to the outlet, be sure to connect the terminal of the green cable (ground line) from the conversion adapter or protection ground terminal on the rear panel.

WARNING ⚠

Turning on the power without grounding this unit it may result in electric shock causing injury or death. Be sure to connect the 3-core power cord to the ground-type two-pole power outlet or protection grounding terminal on the rear panel to the ground.



Protection grounding terminal

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3.3 Laser Safety

This unit includes parts that radiate a Class 1 or Class 3A laser beam based on JIS, IEC825, and FDA21-CFR. ☞ **See "To Use This Unit with Safety."**

To prevent this laser beam from being radiated unexpectedly, the optical connector for output 1 in this unit has the following three safety units. ☞ **See Section 4.2.**

1. Optical fiber cable connection detection
   No laser beam is output unless an optical fiber cable is connected to the optical connector for output 1.
2. Key switch
   No laser beam is output unless the switch is turned on using the removable key.
3. Remote interlock connector
   No laser beam is output unless the remote interlock connector terminal is in the short state. ☞ **See Section 3.4.**

While a laser beam is output, the indicator lamp on the optical connector for output 1 lights on.

Caution ⚠

Do not peep into the optical fiber cable connection side of the optical connector in this unit and end-face of the optical fiber cable connected to this unit. You may sustain injury to the eye due to output of an invisible laser beam.

If you use a procedure other than the one described in this manual, you may suffer from bombardment by an invisible laser beam.

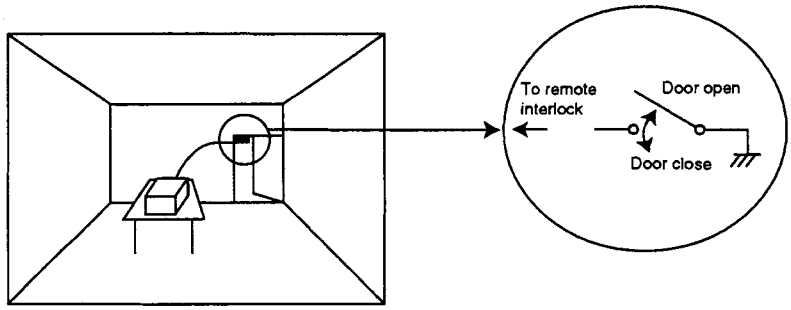
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3.4 Connecting Remote Interlock Connector

This unit has a remote interlock connector as a safety unit. When the terminal on the rear panel is not in the short state, no laser beam is output from the optical output connector.

Ordinarily use this unit as the short fixtures attached to the terminal are connected.

To output the output beam radiated from this unit into a chamber as a space beam, connect the connector as shown below so that no beam leaks when the chamber door or window is opened suddenly.

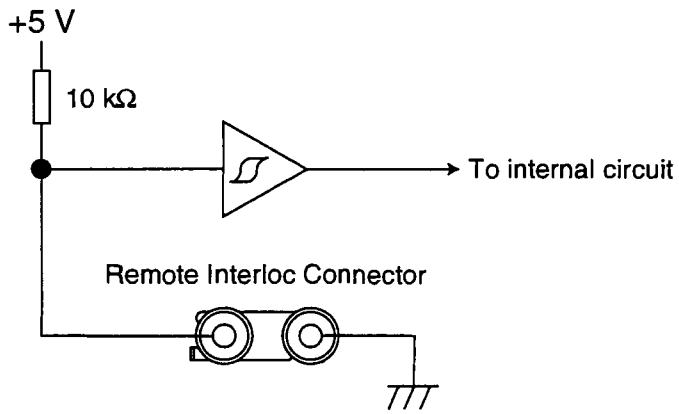


Then, prepare a switch that is opened when the chamber door or window is opened or shorted when it is closed synchronously with the movement of the chamber door.

Remove the short fixtures attached to the remote interlock connector. In this case, take care not to lose the removed short fixtures.

Connect the switch to the opened remote interlock connector.

The polarity is not especially specified at connection; the internal equivalent circuit is configured as shown below.



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Caution ⚠

Before connecting the switch to the remote interlock connector, disconnect the power cord from the power outlet. If the power cord is not disconnected from the power outlet, you may receive an electric shock.

Never connect other than the short fixtures or short switch to the remote interlock connector. This will result in a circuit fault or burn damage.

3.5 Notes on Vibration and Shock

Precise mechanical parts of the order of a few É m are used for the optical unit that is the core of this unit. When using, store, and carrying this unit, do not subject it to strong vibration or shocks.

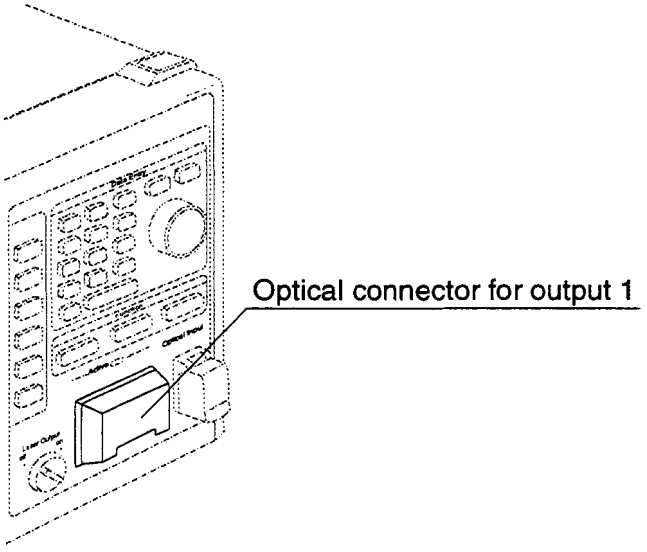
Caution ⚠

To carry this unit, be sure to hold the grips on the left and right so that this unit is as level as possible. If you carry this unit while holding only one of the grips (as if this unit were hung), unreasonable force will be applied to the internal precision parts, and they may get damaged.

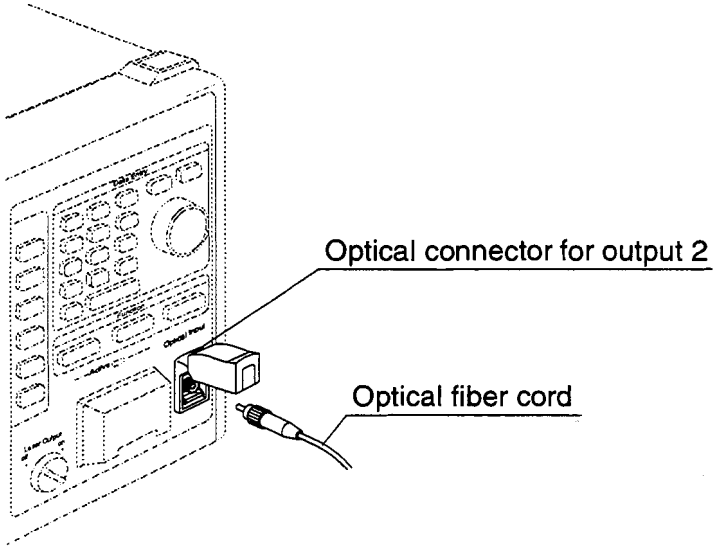
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3.6 Connecting Optical Fiber Cable

Open the cover of the optical output connector on the front panel and connect the optical fiber cable. When the optical fiber cable is not connected correctly, the safety unit functions and no laser beam is output.



To use the optical connector for output 2, open the cover of the optical connector for output 2 and connect the optical fiber cable.



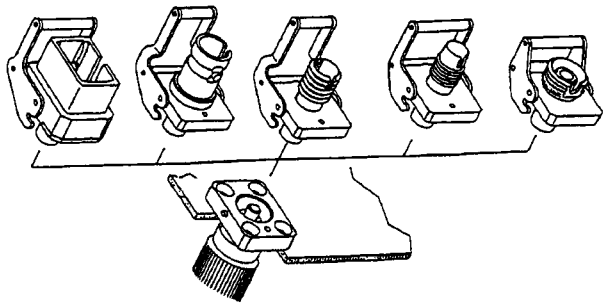
Caution ⚠

Before connecting the optical fiber cable, be sure to clean the end-face of the optical fiber cable used. Confirm that the receptacle of this unit is cleaned completely. If a strong force is output as the receptacle is dirty, the parts may be damaged by fire. For details on cleaning, see Section 6.1.

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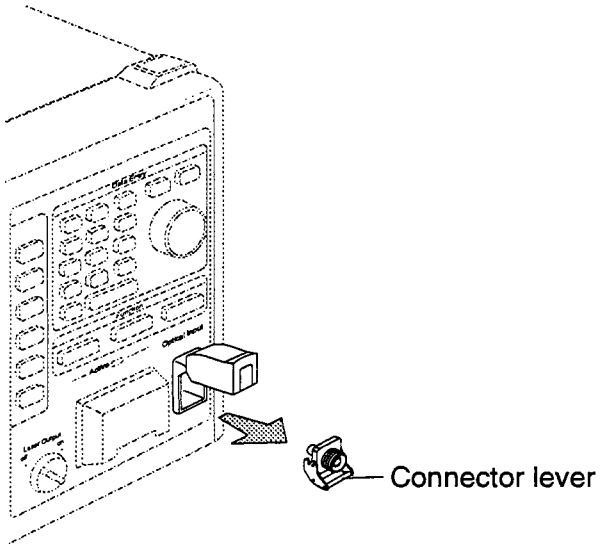
3.7 Replacing Optical Connector

You can remove the optical connector of this unit to replace it with a differently shaped connector (sold separately) and clean the inside.



Follow the procedure below to replace the optical connector. For details on cleaning, see Section 6.1.

1. Open the connector cover.
2. Pull up the connector lever toward you and confirm that the latch is disconnected, then carefully and pull out the connector straight toward you.



3. To attach the connector, perform the procedure in the reverse order. In this case, be careful not to damage the end-face of the ferrule with the connector.

Unless specified, the FC-PC connector (MG9637A-37 or MG9638A-37) is attached to the optical connector. You can replace the connector with one of the following connectors:

Product name	Model type
SC connector	MG9637A-40(orMG9638A-40)
ST connector	MG9637A-38(orMG9638A-38)
DIN connector	MG9637A-39(orMG9638A-39)
HMS-10A (DIAMOND) connector	MG9637A-43(orMG9638A-43)
EC (RADIAL) connector	MG9637A-31(orMG9638A-31)
E2000 (DIAMOND) connector	MG9637A-27(orMG9638A-27)

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3.8 Replacing Fuse

When the fuse is cut off, correct the cause and replace it with a new one following the procedure below.

Caution ⚠

Before replacing the fuse, disconnect the power cord from the power outlet. If the fuse is replaced without disconnecting the power cord from the power outlet, you may receive an electric shock.

The fuse to be replaced must be equivalent to the one described in this manual or have the same rating and characteristics asthe fuse indicated on the rear of the cabinet. If an illegal fuse is used, fuse burnout may occur repeatedly, and burn damage or fire may occur.

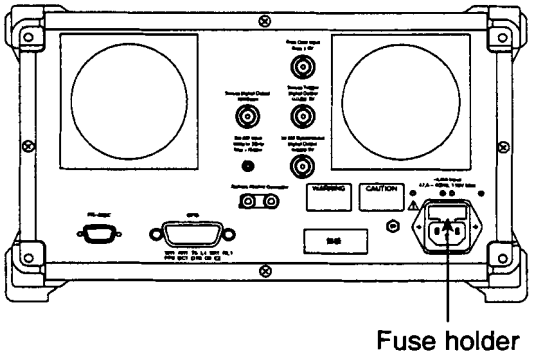
TxxxA indicates a fuse of the time lag type. This unit uses 5 A for the time lag type.

Fuse replacement procedure

1. A fuse holder is provided at the top of the AC inlet on the rear panel of this unit. Apply the end of a standard screwdriver to the bottom edge of the fuse holder and pull out the fuse holder.
2. Two fuses are attached to the fuse holder.
   Remove these fuses from the fuse holder and attach new ones. In this case, you may replace only a burnedout fuse, but one that may cause it to burnout easily. Therefore, you should replace the two fuses together.
   When replacing fuses to change the power voltage, be sure to replace the two fuses together.

   Model type: T5A250V

3. Attach the fuse holder at the top of the AC inlet.



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Section 4 Operation

TThis chapter explains how to operate this unit in the main states. For details on the name of each part, see "Before Using This Unit." For details on installing this unit, see Section 3.1, "Installation."

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4.1 Power-on and Heat-up

This unit controls the temperature of the optical unit to maintain stable performance. About one hour is required to heat up this unit until its internal temperature is stabilized after the power is turned on.

The heat-up status is displayed in the heat-up rate field with a rate (%) on the upper right of the screen. When the heat-up rate reaches 100%, the heat-up is assumed to be completed, and the heat-up rate display disappears.

Hint: This heat-up time is a typical value. It varies depending on the unit and peripheral temperatures at power-on.

1 When attaching the conversion adapter to the supplied 3-core power cord, confirm that the terminal at the end of the green line from the conversion adapter or protection ground terminal on the rear panel of this unit is grounded.

2 Confirm that the POWER switch on the front panel is OFF and connect the power inlet on the rear panel with the commercial power receptacle the power cord.

3 Press the POWER switch to turn the power on.

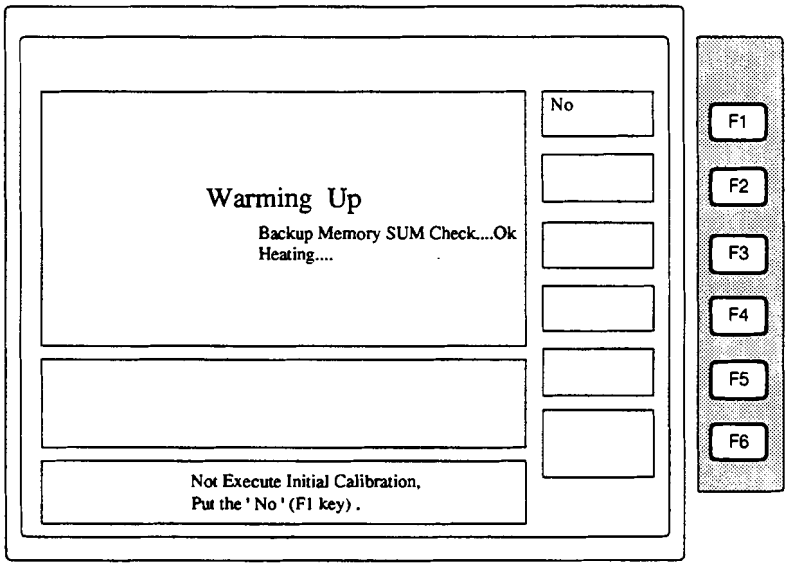
4 The screen shown in the figure appears and "Heating ..." keeps blinking.
After a while, when the internal temperature of this unit reaches the predetermined value, the self-check is executed.

☞ **See Section 6.4, "If an Error Message Appears by Self-Diagnosis."**

Hint: When the outside air temperature is high or the power is turned on just after the POWER switch was set to OFF, the inside of this unit already reaches the predetermined temperature. In this case, "Heating ..." is not displayed and the self-check is executed immediately.

During the above procedure operation, message "Not Execute Initial Calibration, Put the "No" (F1 key")" appears at the bottom of the screen to ask the operator if calibration is to be automatically performed at completion of heat-up. To perform calibration, you need take no action; To not perform calibration, press the F1 key (No).

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Hint: When the calibration is performed at completion of heat-up, the laser output is intercepted once to calibrate internal data.

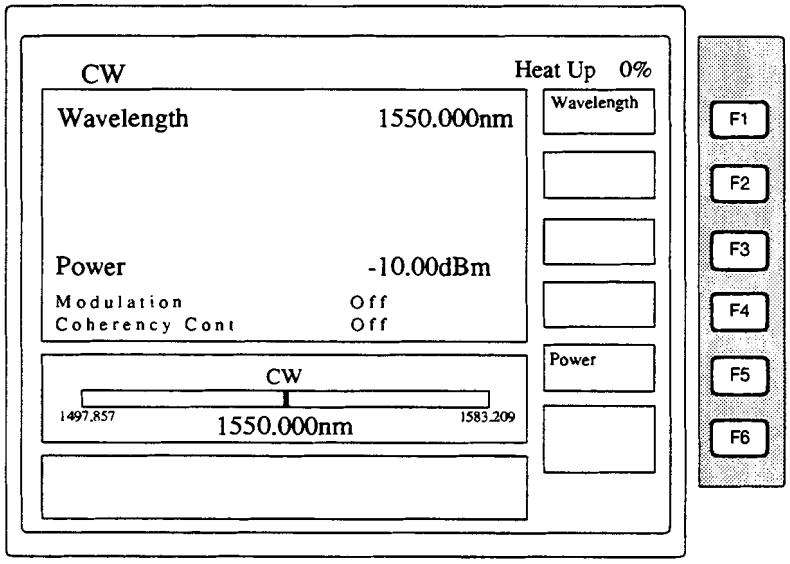
This processing is necessary to maintain the typical values and wavelength repeatability of this unit. For applications that do not especially require the wavelength repeatability, however, the following problems occur and it may be best not to perform the calibration.

- The measurement is stopped.
- The wavelength changes after processing is stopped.

In these cases, press the F1 key (No) not to perform calibration.

Message "Not Execute Initial Calibration, Put the No (F1) key" and F1 (No) key are displayed only while the self-check screen appears. After the self-check is completed, you cannot cancel the calibration.

5 When the self-check screen disappears and the screen below appears, the system is ready for operation.



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4.2 Turning Laser Output ON

The laser output of this unit is not turned on unless the following three conditions are satisfied. To use this unit with safety, exactly perform these operations.

1 Open the front panel cover and connect the optical fiber cable.

Hint: This unit detects that the optical fiber cable is connected using a photointerrupter.

WARNING ⚠

Do not open the optical output connector cover and do not insert a foreign object in this unit except when connecting the optical fiber cable. The photointerrupter erroneously recognizes the foreign object and outputs an invisible laser beam in some cases; you may suffer from laser bombardment or sustain injury to the eye.

Hint: While connecting the optical fiber cable to the optical output connector, do not approach a lighting instrument or do not emit a strong stroboscope beam so that the light goes inside. The photointerrupter would erroneously recognize it and the laser output may be cut off temporarily.

Caution ⚠

Before connecting the optical fiber cable, be sure to clean the end section of the optical fiber cable. Also confirm that the connector (ferrule) of this unit is cleaned at periodical intervals. If this unit is used while dirty, the end section of the ferrule and that of the optical fiber cable may be damaged. If the laser output level of this unit is raised in that state, the parts may be damaged by a fire.

2 Short the remote interlock connector.
Refer to Section 3.4, "Connecting Remote Interlock Connector."

3 Turn the laser output ON/OFF key up to the ON position.

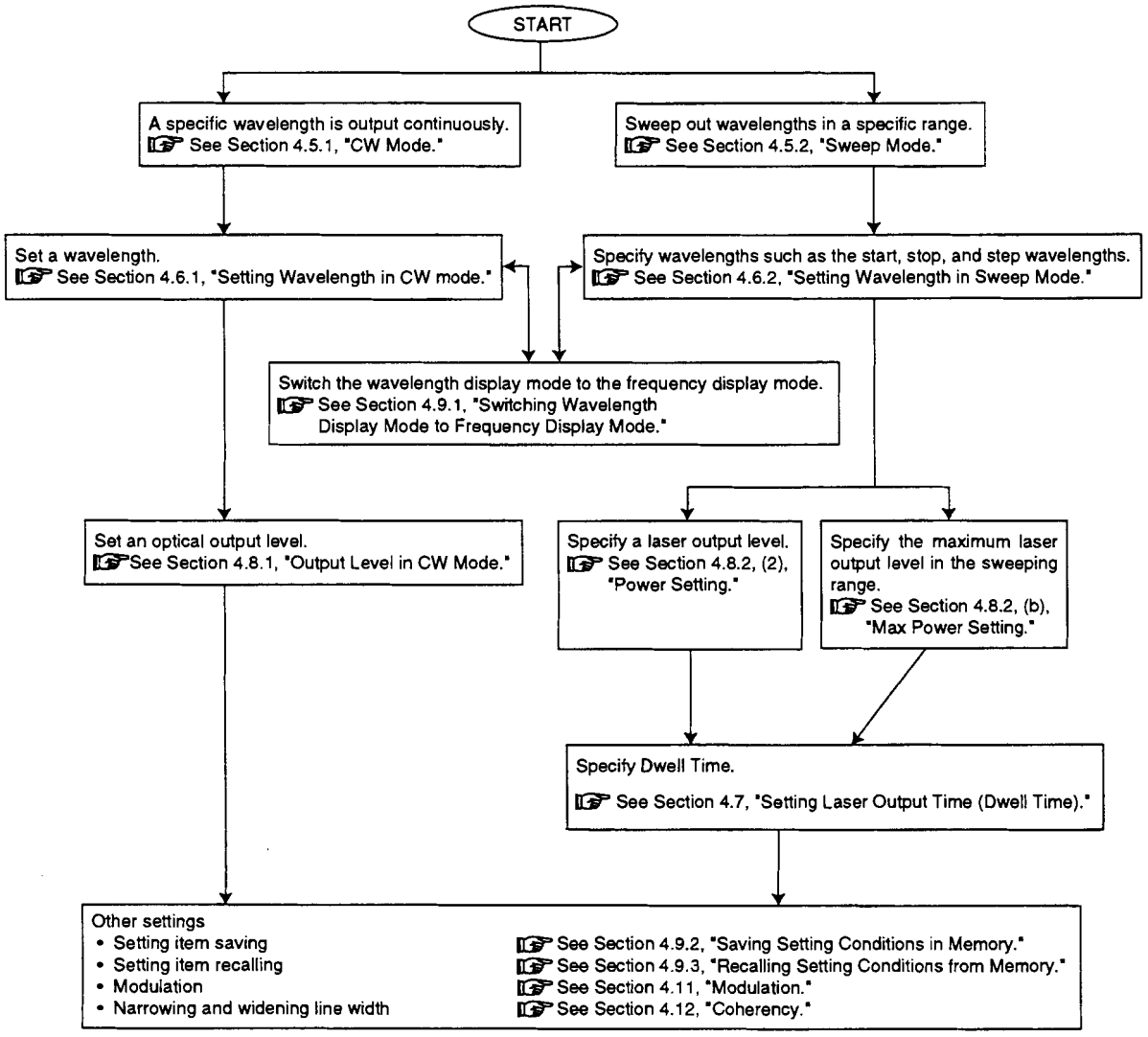
WARNING ⚠

Do not peep into the optical fiber cable connection side of the optical connector in this unit and end section of the optical fiber cable connected to this unit. You may sustain injury for the eye by the output invisible laser beam.
If you use a procedure other than one described in this manual, you may suffer from bombarding by an invisible laser beam.

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4.3 Operation Map

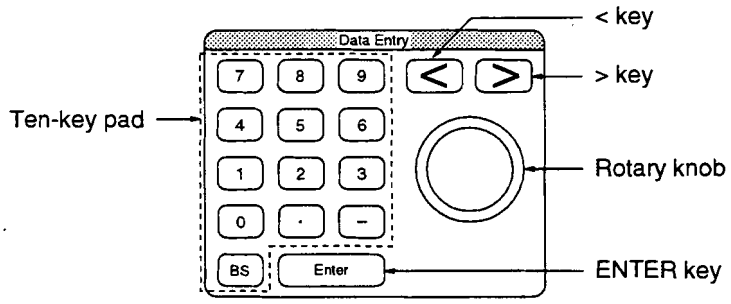
The basic setting procedure of this unit is as follows:



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4.4 Entering Set Values (Parameters)

There are two methods of entering set values such as a wavelength and output level: using the ten-key pad and turning the rotary knob. Selecting a set item highlights the current set value. You can specify a digit or item highlighted in that set value. The highlighted digit can be changed using the < or > key above the rotary knob. Pressing the < or > key changes the entry range to an upper or lower digit,respectively. When the highest-level digit in the specifiable range is highlighted, if the < key is pressed, all digits are highlighted (you can change all digits). When all digits are highlighted, if the > key is pressed, all the digits are highlighted. When all the digits are highlighted, if the < key is pressed, the lowest-level digit in the specifiable range is highlighted. If the > key is pressed, the highest-level digit in the specifiable range is highlighted.



You may use both the ten-key pad and rotary knob or only one of the two depending on set items. For details, see the explanation of each set item.

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4.4.1 Using ten-key pad

The ten-key pad is convenient to directly specify a target value and make a large change in a set value.

Select a set item to be changed, for example, start wavelength, then use the < or > key to select a digit to be entered.

When all-digit entry is selected, the entry area appears at the bottom of the screen. Use the ten-key pad to key in 1550; "1550nm" appears in the entry area. To change this value, press the BS key to delete the numeric value in the entry area, then specify the correct value. Each time the BS key is pressed, the character on the rightmost side lowest digit) is deleted. If the value displayed in the entry area is correct, press the ENTER key to select the value. The numeric value of "Start" at the top of the screen changes to 1550.000nm, and the setting is completed.

When digit entry is selected, the keyed-in numeric value is entered immediately. To correct that value, continuously key in the correct number. After keying in the numeric value, you need not press the ENTER key. However, if the ENTER key is pressed, the entry processing ends. To continue the entry processing, select a set item once more and perform the procedure again.

4.4.2 Using Rotary Knob

The rotary knob is convenient to determine a set value while shifting it by degrees and change a set value slightly.

Select a set item to be changed, for example, start wavelength, then use the < or > key to select a digit to be entered. Turn the rotary knob rightward or leftward. Turning the rotary knob rightward increases the digit highlighted in the numeric value in "Center" at the top of the screen. Turning it leftward reduces the digit.

Unlike the ten-key pad, the rotary knob enables to carry up and down a digit. The entered value is select when the rotary knob was turned; you need not press the ENTER key. However, if the ENTER key is pressed, the entry processing ends.

Hint: After all-digit entry is selected, if the rotary knob is turned, the set value is entered into the lowest digit.

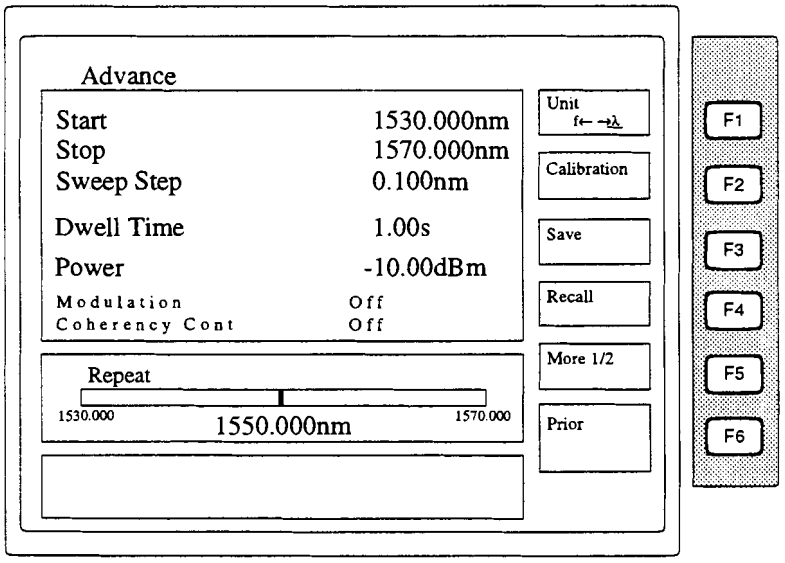
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4.4.3 Returning setting conditions to delivery status

This unit has a function for saving the set conditions. When the power is turned on, therefore, the previously set values are displayed. This section explains the procedure for returning setting conditions to the deliver status.
See Appendix B.

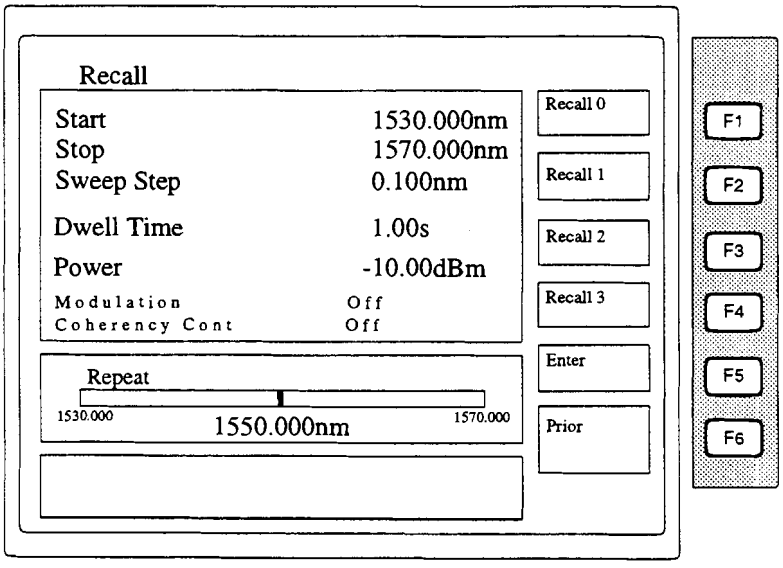
1 Press the Advance key.

2 Confirm that More1/2 is set for F5 as shown below. If not so, press the F5 key until More1/2 is set.



3 Press the F4 (Recall) key.

4 As shown below, Recall0 to Recall3 appear for the F1 to F4 keys respectively. Press the F1 (Recall0) key.



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5 The delivery setting conditions are displayed in the setting status display area. Confirm them and press the F5 (ENTER) key.

Hint: The delivery setting conditions are written to memory 0. Executing Recall0 returns the setting conditions to the delivery status. ☞ **See Section 4.9.3.**

4.5 Setting Wavelength Output Mode

This unit has two modes: outputting only a specific wavelength (CW mode) and sweeping a wavelength (sweep mode).

Hint: The specified parameter is held for each mode. If the CW mode is returned after it was changed to the sweep mode, the previous set value in the CW mode is called.

4.5.1 CW mode

To specify the CW mode, press the CW key. In this mode, the output is continued with the determined center wavelength. For details on specifying a wavelength, see Section 4.6.

4.5.2 Sweep mode

To specify the sweep mode, press the Sweep key. In this mode, the range from the start wavelength to the stop wavelength is swept out for each step wavelength.

When the sweep mode is set, the repeat sweeping also starts. To perform sweeping only once, press the Single key. To stop and restart sweeping, press the Pause/Cont key. For details, see Section 4.10.

For details on specifying a wavelength, also see Section 4.6.

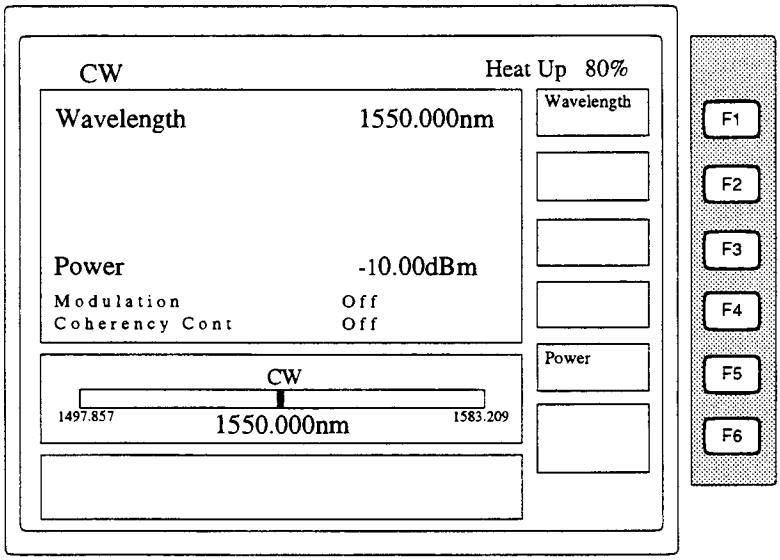
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4.6 Setting Wavelength

4.6.1 Setting wavelength in CW Mode

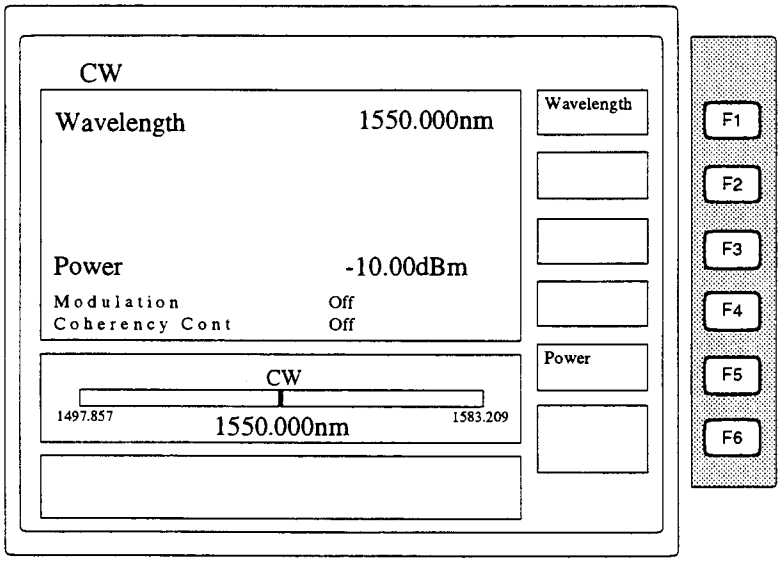
In the CW mode, the display below appears, and only the required wavelength is set as a continuous wave output. Follow the procedure below to set the output wavelength. The input wavelength can be entered in either the wavelength display mode or frequency display mode.

For details on switching the wavelength and frequency display modes, see Section



(1) Wavelength display mode

1 Confirm that the screen is displayed as shown below.



2 Press the F1 (Wavelength) key. The numerical value in the Wavelength item is highlighted.

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3 Use the < or > key to select a digit to be entered. If all-digit entry is selected, the "Input Wavelength" entry area appears at the bottom of the screen.
(In this example, the units digit is assumed to be selected.)

4 Use the ten-key pad to key in 5.

5 The numeric value in the Wavelength field changes to 1555.000nm.

6 In step 4, you can use the rotary knob instead of the ten-key pad.

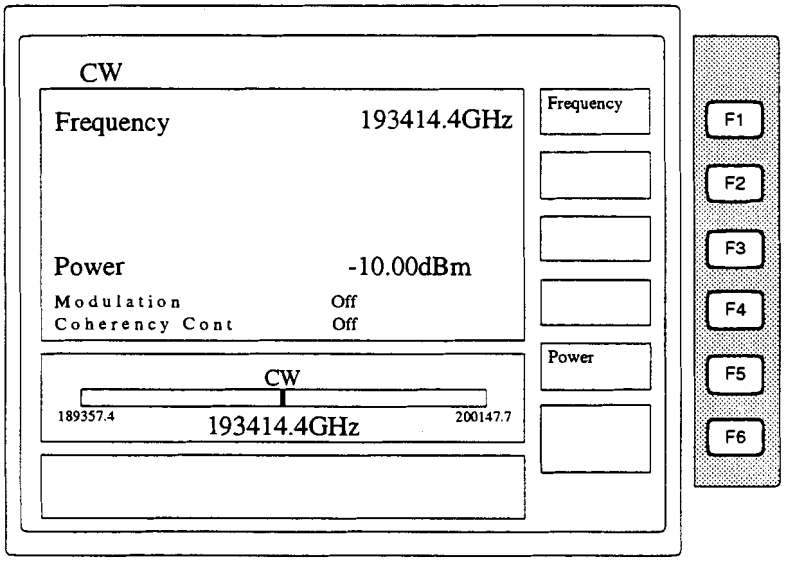
7 To select all-digit entry, key in 1555 in the entry area in step 4 and press the ENTER key.

8 To change the entry unit including the displayed value, press the F6 (Unit) key. "nm" and "μm" are switched each time the F6 key is pressed.

Hint: The F6 (Unit) key appears only when the F1 (Wavelength) is pressed.

(2) Frequency display mode

1 Confirm that the screen is displayed as shown below.



2 Press the F1 (Frequency) key. The numerical value in the Frequency field is highlighted.

3 Use the < or > key to select a digit to be entered. If all-digit entry is selected, the "Input Frequency" entry area appears at the bottom of the screen.
(In this example, the units digit is assumed to be selected.)

4 Use the ten-key pad to key in 8.

5 The numeric value in the Frequency field changes to 193414.8 GHz.

6 In step 4, you can use the rotary knob instead of the ten-key pad.

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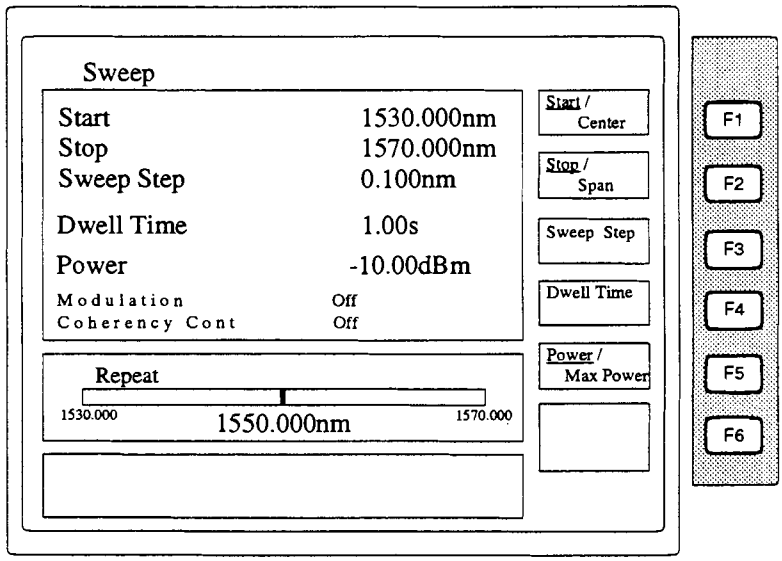
7 To select all-digit entry, key in 193414.8 in the entry area in step 4 and press the ENTER key.

When all digits are entered using the ten-key pad, the entered value is selected by pressing the ENTER key. In other cases, you need not press the ENTER key. However, you can end the wavelength setting status by pressing the ENTER key, so the ENTER key the set value from being changed erroneously.

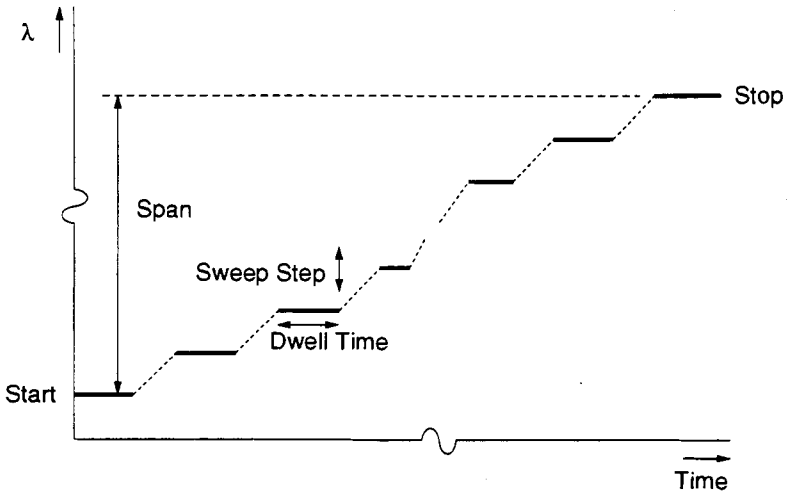
The specifiable value is displayed as "Input Limit" at the bottom of the screen. You cannot enter a value outside the displayed range.

4.6.2 Setting wavelength in sweep mode

In the sweep mode, the screen is displayed as shown below. In this mode, the sweeping range is determined by a combination of the start wavelength with the stop wavelength or that of the center wavelength with the sweeping width (span). The sweeping wavelength interval is set as a sweep step.



For the items to be set in the sweep mode, see the figure below.



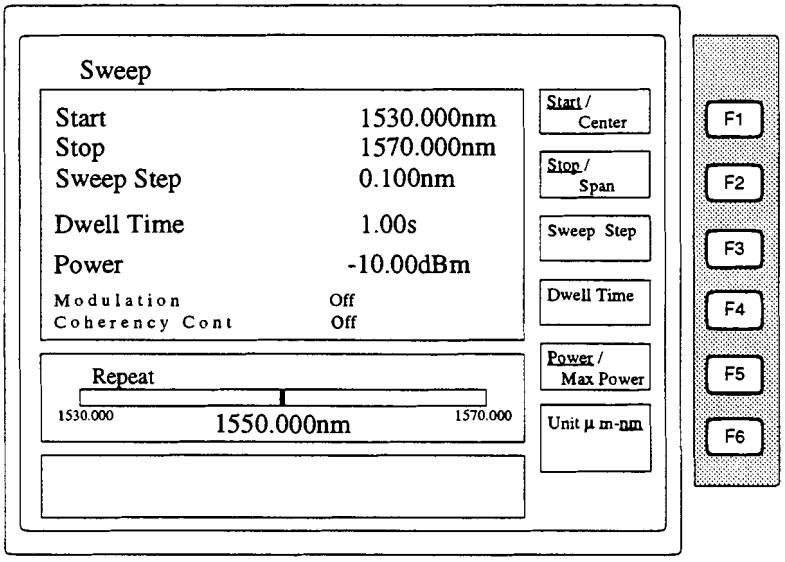
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(1) Setting start wavelength

The start wavelength can be set in either the wavelength or frequency display mode. For details on switching the wavelength and frequency display modes, see Section 4.9.1.

(a) Wavelength display mode

1 Confirm that the screen is displayed with a combination of Start with Stop as shown below. If the screen is displayed with a combination of Center and Span, it is switched by the operation described in step 2.



2 Press the F1 (Start/Center) key until "Start" is highlighted.

3 Use the < or > key to select a digit to be entered. If all-digit entry is selected, the "Input Start Wavelength" entry area appears at the bottom of the screen. (In this example, the units digit is assumed to be selected.)

4 Use the ten-key pad to key in 3.

5 The numeric value in the Start field changes to 1530.300nm.

6 In step 4, you can use the rotary knob instead of the ten-key pad.

7 To select all-digit entry, key in 1530.3 in the entry area in step 4 and press the ENTER key.

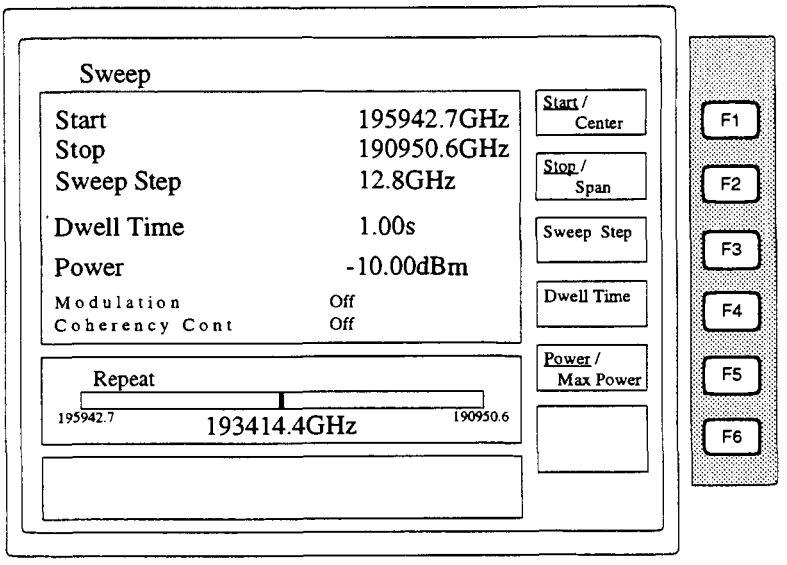
8 To change the entry unit including the displayed value, press the F6 (Unit) key. "nm" and "μm" are switched each time the F6 key is pressed.

Hint: The F6 (Unit) key appears only when the F1 (Start/Center) or F2 (Stop/Span) key is pressed.

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(b) Frequency display mode

1 Confirm that the screen is displayed with a combination of Start with Stop as shown below. Though the screen shows the Center and Span combination, the indication can be changed by the operation in step 2.



2 Press the F1 (Start/Center) key until "Start" is highlighted. Input Start Frequency appears at the bottom of the screen.

3 Use the < or > key to select a digit to be entered. If all-digit entry is selected, the "Input Start Frequency" entry area appears at the bottom of the screen.
(In this example, the tens digit is assumed to be selected.)

4 Use the ten-key pad to key in 9.

5 The numeric value in the Start Frequency field changes to 195992.7 GHz.

6 In step 4, you can use the rotary knob instead of the ten-key pad.

7 To select all-digit entry, key in 195992.7 in the entry area in step 4 and press the ENTER key.

When all digits are entered using the ten-key pad, the entered value is selected by pressing the ENTER key. In other cases, you need not press the ENTER key. However, you can end the start wavelength setting status by pressing the ENTER key, so the ENTER key prevents the set value from being changed erroneously.

The specifiable value is displayed as "Input Limit" at, if the F1 key is pressed, the underlined one is highlighted. When either one is already highlighted, another one is highlighted instead. You can enter the highlighted item.

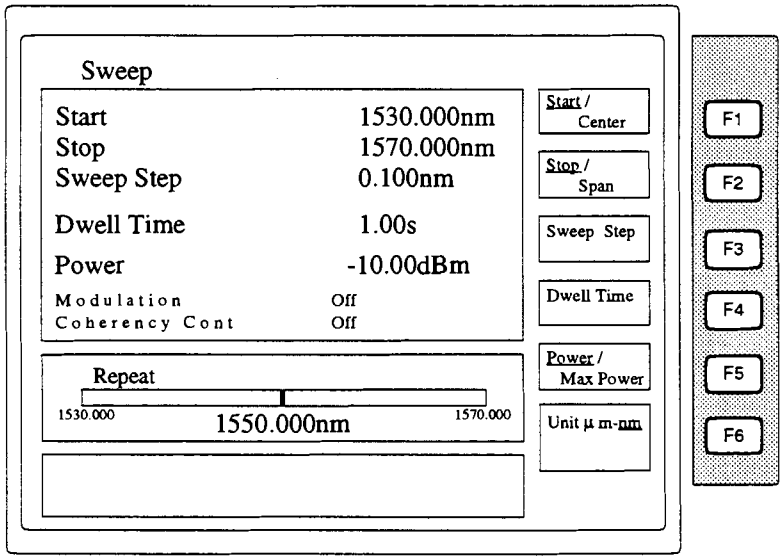
Hint: When neither Start nor Center is highlighted, if the F2 key is pressed, the underlined one is highlighted. When either one is already highlighted, another one is highlighted instead. You can enter the highlighted item.

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(2) Setting stop wavelength

(a) Wavelength display mode

1 Confirm that the screen is displayed with a combination of Start with Stop as shown below. If the screen is displayed with a combination of Center and Span, it is switched by the operation described in step 2.



2 Press the F2 (Stop/Span) key until "Stop" is highlighted.

3 Use the < or > key to select a digit to be entered. If all-digit entry is selected, the "Input Stop Wavelength" entry area appears at the bottom of the screen.
(In this example, the units digit is assumed to be selected.)

4 Use the ten-key pad to key in 4.

5 The numeric value in the Start field changes to 1570.400nm.

6 In step 4, you can use the rotary knob instead of the ten-key pad.

7 To select all-digit entry, key in 1570.4 in the entry area in step 4 and press the ENTER key.

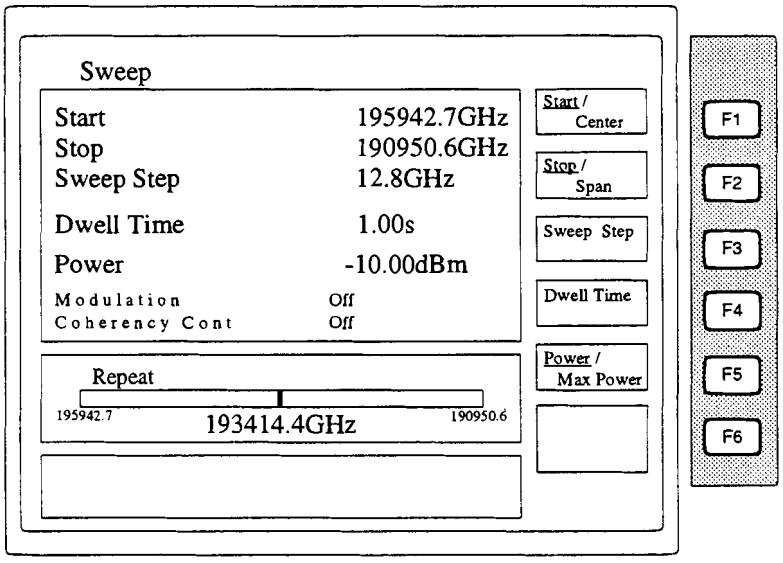
8 To change the entry unit including the displayed value, press the F6 (Unit) key. "nm" and "μm" are switched each time the F6 key is pressed.

Hint: The F6 (Unit) key appears only when the F1 (Start/Center) or F2 (Stop/Span) key is pressed.

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(b) Frequency display mode

1 Confirm that the screen is displayed with a combination of Start with Stop as shown below. If the screen is displayed with a combination of Center and Span, it is switched by the operation described in step 2.



2 Press the F2 (Stop/Span) key until "Stop" is highlighted.

3 Use the < or > key to select a digit to be entered. If all-digit entry is selected, the "Input Stop Frequency" entry area appears at the bottom of the screen. (In this example, the hundreds digit is assumed to be selected.)

4 Use the ten-key pad to key in 8.

5 The numeric value in the Stop Frequency field changes to 190850.6 GHz.

6 In step 4, you can use the rotary knob instead of the ten-key pad.

7 To select all-digit entry, key in 190850.6 in the entry area in step 4 and press the ENTER key.

When all digits are entered using the ten-key pad, the entered value is selected by pressing the ENTER key. In other cases, you need not press the ENTER key. However, you can end the start wavelength setting status by pressing the ENTER key, so the ENTER key prevents the set value from being changed erroneously.

The specifiable value is displayed as "Input Limit" at the bottom of the screen. You cannot enter a value outside the displayed range.

Hint: When neither Stop nor Span is highlighted, if the F2 key is pressed, the underlined one is highlighted. When either one is already highlighted, another one is highlighted instead. You can enter the highlighted item.

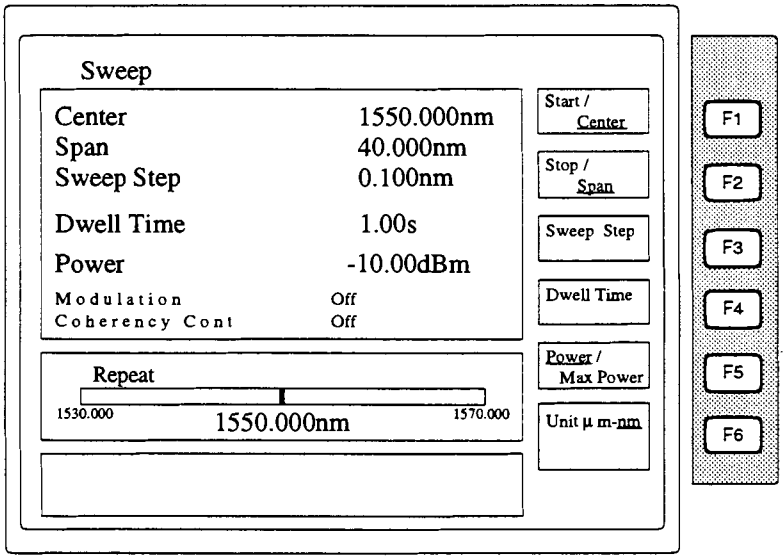
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(3) Setting center wavelength

The center wavelength can be set in both the wavelength and frequency display modes. For details on switching the wavelength and frequency display modes, see Section 4.9.1.

(a) Wavelength display mode

1 Confirm that the screen is displayed with a combination of Center and Span as shown below. If the screen is displayed with a combination of Start and Stop, it is switched by the operation described in step 2.



2 Press the F1 (Start/Center) key until "Center" is highlighted.

3 Use the < or > key to select a digit to be entered. If all-digit entry is selected, the "Input Center Wavelength" entry area appears at the bottom of the screen. (In this example, the tens digit is assumed to be selected.)

4 Use the ten-key pad to key in 6.

5 The numeric value in the Center Wavelength field changes to 1560.000nm.

6 In step 4, you can use the rotary knob instead of the ten-key pad.

7 To select all-digit entry, key in 1560.000 in the entry area in step 4 and press the ENTER key.

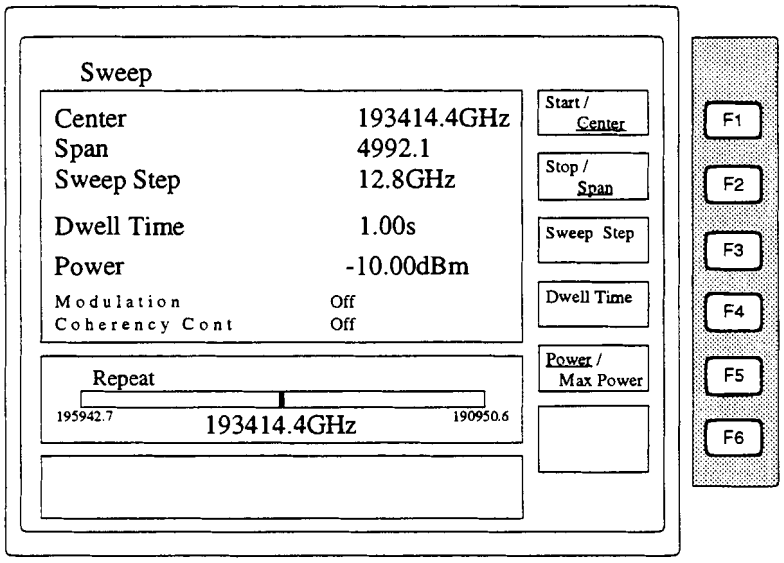
8 To change the entry unit including the displayed value, press the F6 (Unit) key. "nm" and "µm" are switched each time the F6 key is pressed.

Hint: The F6 (Unit) key appears only when the F1 (Start/Center) or F2 (Stop/Span) key is pressed.

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(b) Frequency display mode

1 Confirm that the screen is displayed with a combination of Center and Span as shown below. If the screen is displayed with a combination of Start and Stop, it is switched by the operation described in step 2.



2 Press the F1 (Start/Stop) key until "Center" is highlighted.

3 Use the < or > key to select a digit to be entered. If all-digit entry is selected, the "Input Center Frequency" entry area appears at the bottom of the screen. (In this example, the tens digit is assumed to be selected.)

4 Use the ten-key pad to key in 3.

5 The numeric value in the Center Frequency field changes to 193434.4GHz.

6 In step 4, you can use the rotary knob instead of the ten-key pad.

7 To select all-digit entry, key in 193434.4 in the entry area in step 4 and press the ENTER key.

When all digits are entered using the ten-key pad, the entered value is selected by pressing the ENTER key. In other cases, you need not press the ENTER key. However, you can end the start wavelength setting status by pressing the ENTER key, so the ENTER key prevents the set value from being changed erroneously.

The specifiable value is displayed as "Input Limit" at the bottom of the screen. You cannot enter a value outside the displayed range.

Hint: When neither Stop nor Center is highlighted, if the F1 key is pressed, the underlined one is highlighted. When either one is already highlighted, another one is highlighted instead. You can enter the highlighted item.

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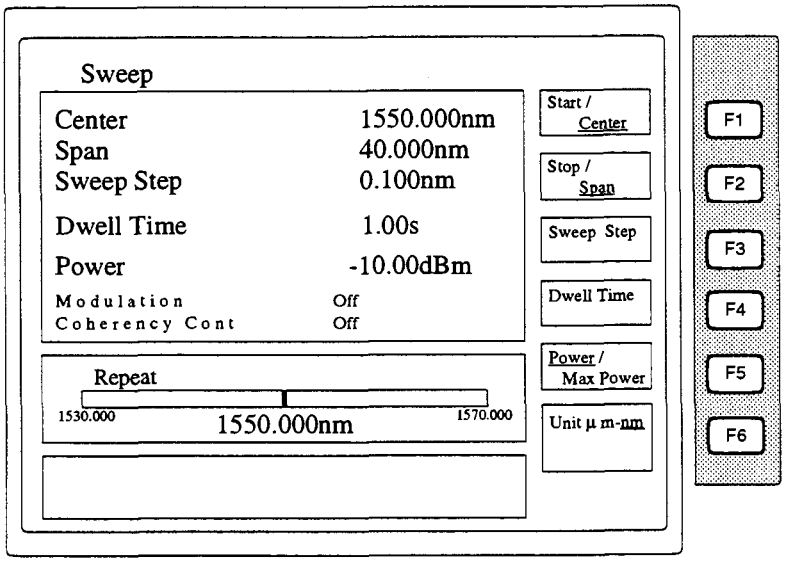
(4) Setting sweep width (span)

The sweep width (span) can be set in both the wavelength and frequency display modes.

For details on switching the wavelength and frequency display modes, see Section 4.9.1.

(a) Wavelength display mode

1 Confirm that the screen is displayed with a combination of Center and Span as shown below. If the screen is displayed with a combination of Start and Stop, it is switched by the operation described in step 2.



2 Press the F2 (Stop/Span) key until "Span" is highlighted.

3 Use the < or > key to select a digit to be entered. If all-digit entry is selected, the "Input Span" entry area appears at the bottom of the screen.
(In this example, the tens digit is assumed to be selected.)

4 Use the ten-key pad to key in 5.

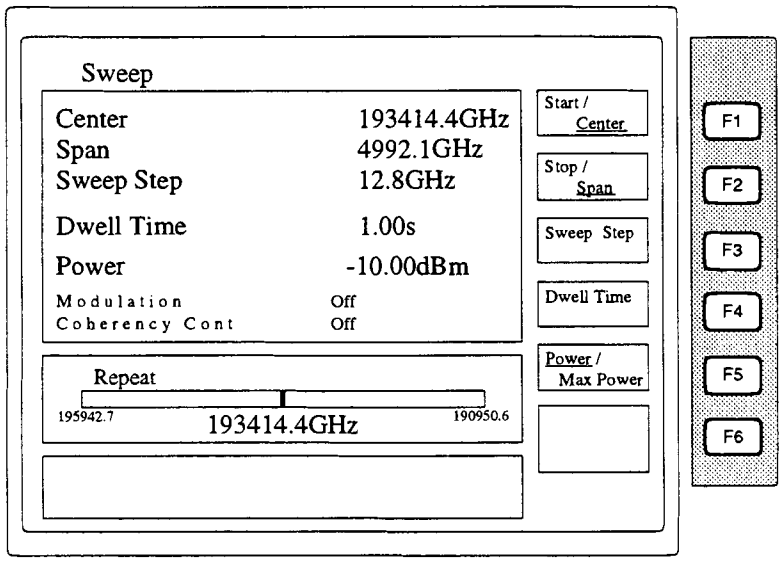
5 The numeric value in the Span field changes to 50.000nm.

6 In step 4, you can use the rotary knob instead of the ten-key pad.

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(b) Frequency display mode

1 Confirm that the screen is displayed with a combination of Center with Span as shown below. If the screen is displayed with a combination with Start with Stop, it is switched by the operation described in step 2.



2 Press the F1 (Stop/Span) key until "Span" is highlighted.

3 Use the < or > key to select a digit to be entered. If all-digit entry is selected, the "Input Span" entry area appears at the bottom of the screen.
(In this example, the tens digit is assumed to be selected.)

4 Use the ten-key pad to key in 4.

5 The numeric value in the Span field changes to 4942.1GHz.

6 In step 4, you can use the rotary knob instead of the ten-key pad.

7 To select all-digit entry, key in 4942.1 in the entry area in step 4 and press the ENTER key.

When all digits are entered using the ten-key pad, the entered value is selected by pressing the ENTER key. In other cases, you need not press the ENTER key. However, you can end the start wavelength setting status by pressing the ENTER key, so the ENTER key prevents the set value from being changed erroneously.

The specifiable value is displayed as "Input Limit" at the bottom of the screen. You cannot enter a value outside the displayed range.

Hint: When neither Stop nor Span is highlighted, if the F2 key is pressed, the underlined one is highlighted. When either one is already highlighted, another one is highlighted instead. You can enter the highlighted item.

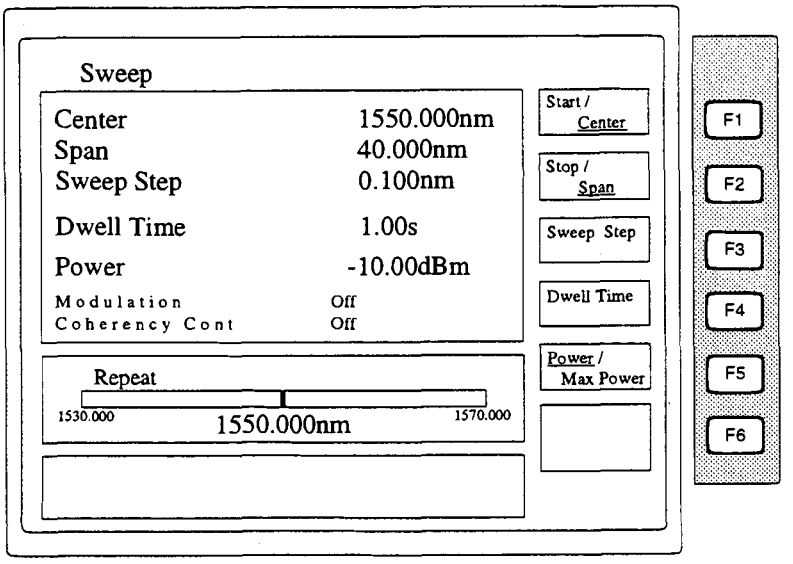
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(5) Setting sweep step

The sweep step can be set in both the wavelength and frequency display modes.
For details on switching the wavelength and frequency display modes, see Section 4.9.1.

(a) Wavelength display mode

1 Confirm that the screen is displayed as shown below.



2 Press the F3 key; "Sweep Step" is highlighted.

3 Use the < or > key to select a digit to be entered. If all-digit entry is selected, the "Input Sweep Step" entry area appears at the bottom of the screen.
(In this example, the units digit is assumed to be selected.)

4 Use the ten-key pad to key in 9.

5 Press the ENTER key; the numeric value in the Sweep Step field at the top of the screen changes to 0.900nm.

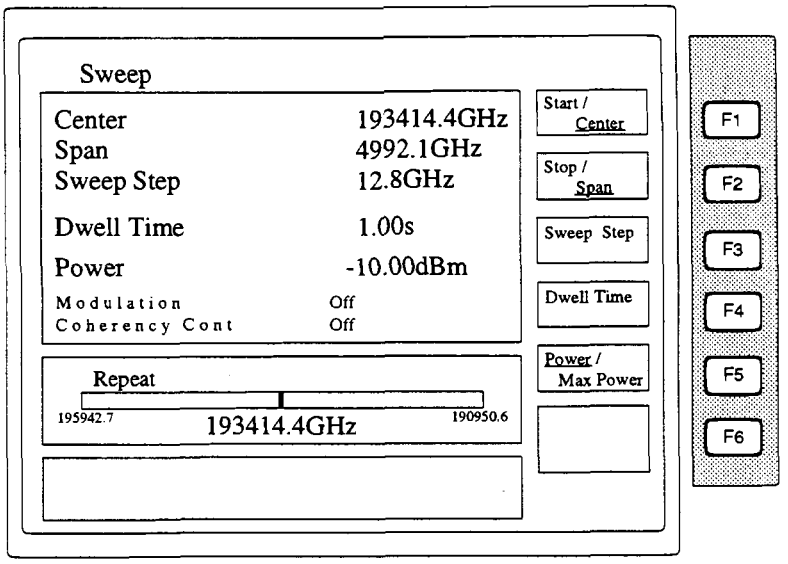
6 In step 4, you can use the rotary knob instead of the ten-key pad.

7 To select all-digit entry, key in 0.9 in the entry area in step 4 and press the ENTER key.

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(b) Frequency display mode

1 Confirm that the screen is displayed as shown below.



2 Press the F3 key; "Sweep Step" is highlighted.

3 Use the < or > key to select a digit to be entered. If all-digit entry is selected, the "Input Sweep Step" entry area appears at the bottom of the screen.
(In this example, the units digit is assumed to be selected.)

4 Use the ten-key pad to key in 3.

5 The numeric value in the Sweep Step field at the top of the screen changes to 13.8 GHz.

6 In step 4, you can use the rotary knob instead of the ten-key pad.

7 To select all-digit entry, key in 13.8 in the entry area in step 4 and press the ENTER key.

When all digits are entered using the ten-key pad, the entered value is selected by pressing the ENTER key. In other cases, you need not press the ENTER key. However, you can end the start wavelength setting status by pressing the ENTER key, so the ENTER key prevents the set value from being changed erroneously.

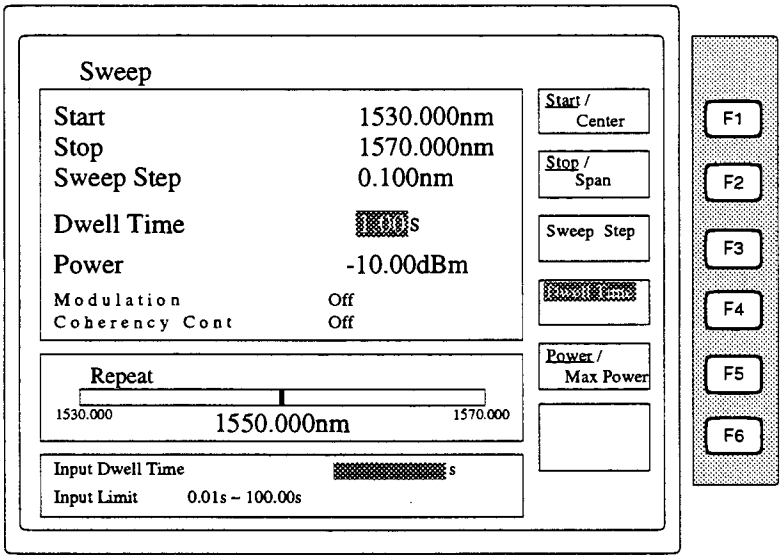
The specifiable value is displayed as "Input Limit" at the bottom of the screen. You cannot enter a value outside the displayed range.

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4.7 Setting Laser Output Time (Dwell Time)

Set a laser output time with each wavelength output in the sweep mode.

1 Press the F4 key; "Dwell Time" is highlighted and "Input Dwell Time" appears at the bottom of the screen.



2 Use the ten-key pad to key in 1.25.

3 Press the ENTER key; the numeric value in the Dwell Time field at the top of the screen changes to 1.25s.

4 In steps 2 and 3, you can use the rotary knob instead of the ten-key pad.

The entry value range is 0.01 to 100.

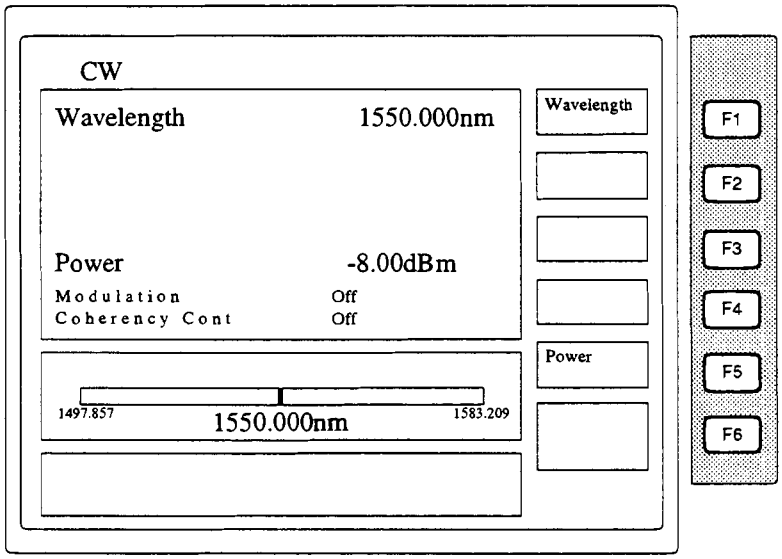
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4.8 Setting Laser Output Level

The laser output level can be set in both the CW and sweep modes. The setting method varies depending on the mode. The entry unit can also be specified.

4.8.1 Output level in CW mode

In the CW mode, the screen below is displayed. Follow the procedure below to set an output level.



1 Press the F5 (Power) key and confirm that "Power" is highlighted.
2 Use the < or > key to select a digit to be entered. If all-digit entry is selected, the "Input Power" entry area appears at the bottom of the screen.
(In this example, the units digit is assumed to be selected.)
3 Use the ten-key pad to key in 5.
4 The numeric value in the Power field at the top of the screen changes to -5dBm.
5 In step 3, you can use the rotary knob instead of the ten-key pad.

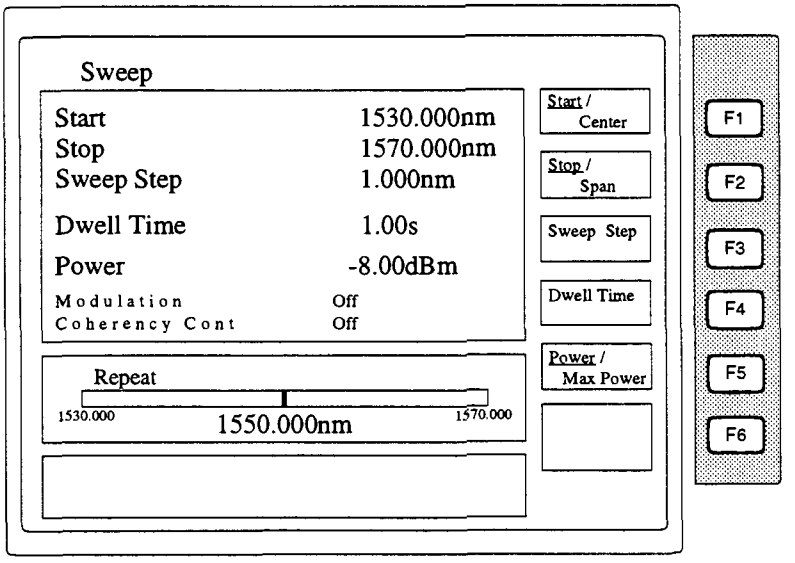
When all digits are entered using the ten-key pad, the entered value is selected by pressing the ENTER key. In other cases, you need not press the ENTER key. However, you can end the start wavelength setting status by pressing the ENTER key, so the ENTER key prevents the set value from being changed erroneously.

The specifiable value is displayed as "Input Limit" at the bottom of the screen. You cannot enter a value outside the displayed range.

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4.8.2 Output level in sweep mode

In the sweep mode, the screen below is displayed. There are two methods of setting Power: specifying a specific laser output level in the sweeping wavelength range and specifying the maximum laser output level in the sweeping wavelength range. Follow the procedure below to set a laser output level.



(a) Power setting

1 Press the F5 (Power/Max Power) key until "Power" is highlighted.

2 Use the < or > key to select a digit to be entered. If all-digit entry is selected, the "Input Power" entry area appears at the bottom of the screen. (In this example, the units digit is assumed to be selected.)

3 Use the ten-key pad to key in 5.

4 The numeric value in the Power field at the top of the screen changes to -5dBm.

5 In step 3, you can use the rotary knob instead of the ten-key pad.

6 To select all-digit entry, key in -5 in the entry area in step 3 and press the ENTER key.

When all digits are entered using the ten-key pad, the entered value is decided after the ENTER key was pressed. In other cases, you need not press the ENTER key. However, you can end the start wavelength setting status by pressing the ENTER key, so the ENTER key prevents a happening, e.g., a set value is changed erroneously.

The specifiable value is displayed as "Input Limit" at the bottom of the screen. You cannot enter a value outside the displayed range.

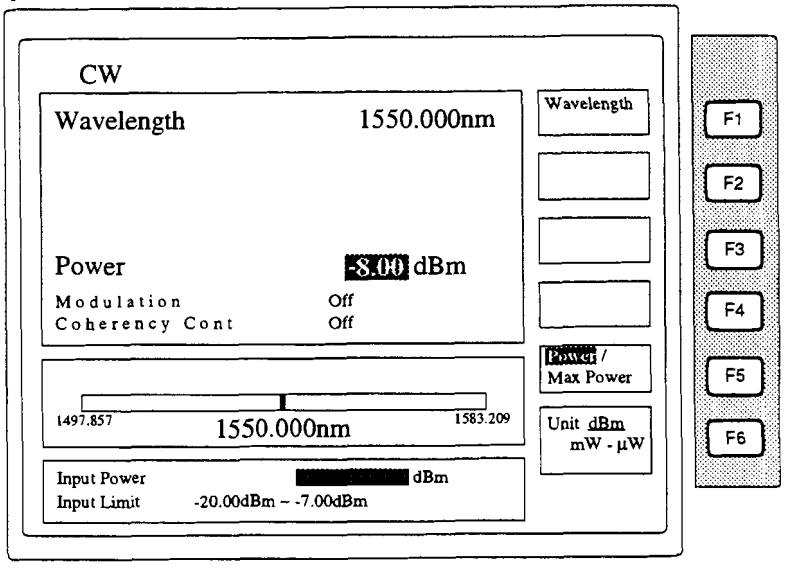
(b) Max Power setting

Press the F5 (Power/Max Power) key until "Power" is highlighted. The Power value is set at the maximum laser output level in the sweeping wavelength range.

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4.8.3 Entry unit

Pressing the F5 (Power or Power/Max Power) key displays the F6 (Unit dBm/mW-μW) key as shown below.



(a) dBm setting

Press the F6 (Unit dBm/mW-μW) key until "dBm" is underlined.

Each time the F6 key is pressed, the unit changes in the order of dBm -> mW -> μW -> dBm.

The currently selected entry unit is underlined.

(b) W (mW or μW) setting

Press the F6 (Unit dBm/mW-μW) key until "mW" or "μW" is underlined.

Each time the F6 key is pressed, the unit changes in the order of dBm -> mW -> μW -> dBm.

The currently selected entry unit is underlined.

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4.9 Setting Advance Mode

This unit collectively provides various extension functions (e.g., switching between the wavelength and frequency display modes, saving setting conditions in memory) as an Advance mode. Each function is allocated to a function key and divided into two screens. Which screen is displayed is indicated by a fraction following More. Each screen changes to 1/2 and 2/2 each time the F5 (More) key is pressed. To exit the Advance mode, press the F6 (Prior) key. The mode set before the Advance mode, that is, CW mode or sweep mode is set.

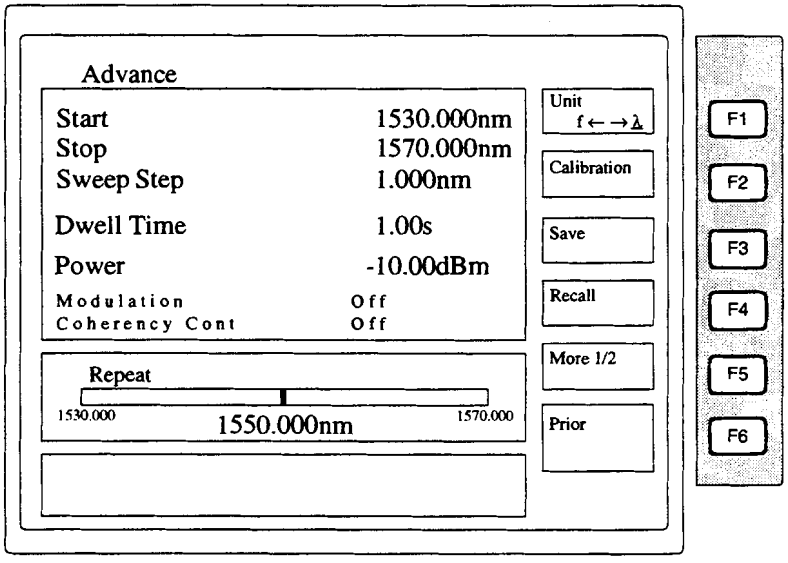
4.9.1 Switching wavelength display mode to frequency display mode

The output wavelength can be entered in the wavelength display mode (e.g., 1550.000nm) and frequency display mode (e.g., 199861.6 GHz).

The actual wavelength is entered in the mode specified by this function. In advance, follow the procedure below to specify the wavelength or frequency display mode.

1 Press the Advance key.

2 Confirm that More1/2 is displayed for the F5 key as shown below. If not so, repeatedly press the F5 key until More1/2 appears.



3 Confirm that either f (frequency display mode) or λ (wavelength display mode) is underlined for the F1 (Unit) key. The underline mode is set currently.
(This figure indicates that the wavelength display mode is set.)

4 Press the F1 key until the required mode is underlined.

5 Press "CW", "Sweep", or F6 (Prior) key to terminate the switching between the wavelength and frequency display modes (setting the Advance mode).

6 To set another Advance mode continuously after step 4, perform this procedure from step 2 in each function setting mode.

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4.9.2 Saving Setting Conditions in Memory

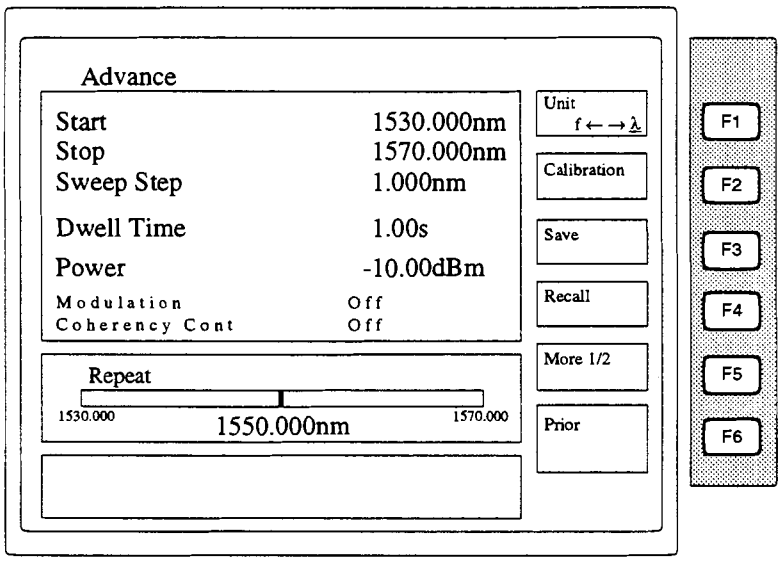
This unit records setting conditions in internal memory and calls them as required. This section explains how to record their contents in memory.

For details on calling the recorded memory contents, see Section 4.9.3, "Recalling Setting Conditions from Memory."

This unit has three internal memory units to save setting conditions. For details on the saved items, see Appendix B.

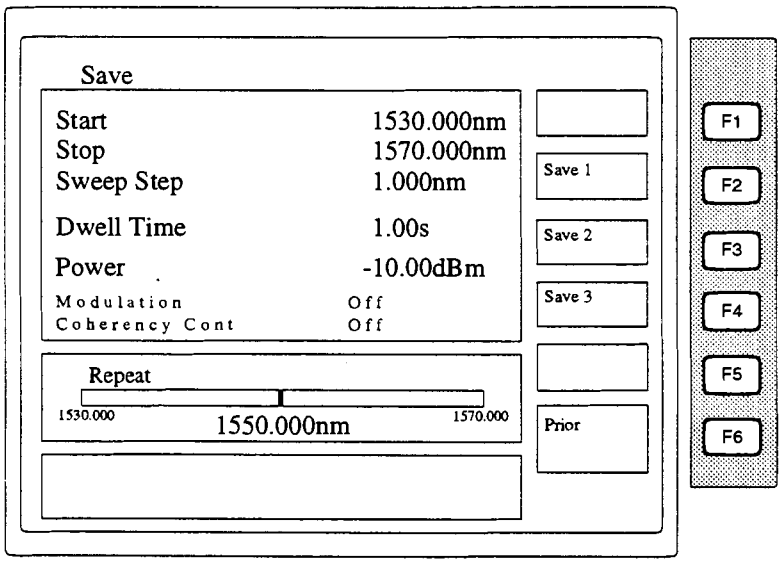
1 Press the Advance key.

2 Confirm that More1/2 is displayed for the F5 key as shown below. If not so, repeatedly press the F5 key until More1/2 appears.



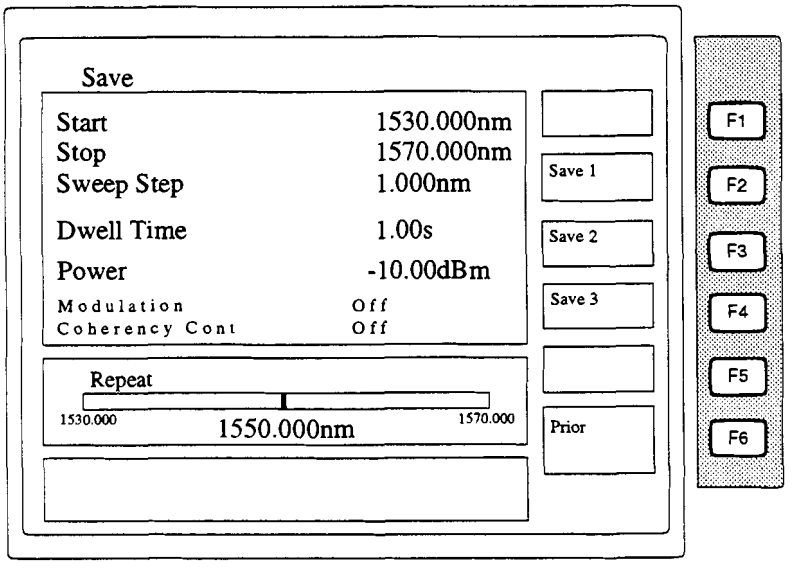
3 Press the F3 (Save) key.

4 As shown above, Save1 to Save3 appear for the F2 to F4 keys. Press the function key (e.g., F3) matching the number of the memory you want to save setting conditions into.



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5 If no data is written to the memory to be saved, this item is not necessary. When saved information is already saved, this system asks you if new data may be overwritten to the memory. If it may be overwritten, press the F1 (OverwriteYes) key. To stop the memory overwriting, press the F2 (OverwriteNo) key.



Hint: In this figure, the underlined number in the "Over write Save2 (Yes/No)?" field of the message area is a number of the memory to be saved. To confirm the already written memory contents (setting conditions), stop the memory save operation once and confirm the setting conditions using the memory recall function. For details on the memory recall function, see Section 4.9.3, "Recalling Setting Conditions from Memory."

6 Saving the setting conditions in memory (setting the Advance mode) ends with step 4 or 5. To stop the setting, press "CW", "Sweep", "Advance", or F6 (Prior) key.

Hint: The conditions that were set at power-off are recorded separately from the memories used for saving and recalling. At the next power-on, the setting conditions that were set at the previous power-on appear on the screen. To initialize the previous setting conditions, see Section 4.4.3, "Returning Setting Conditions to Delivery Status."

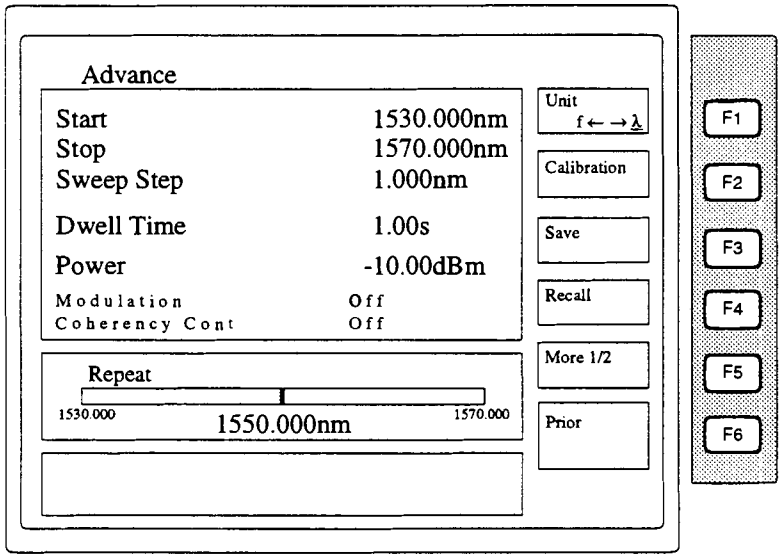
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4.9.3 Recalling setting conditions from memory

This function calls the setting conditions recorded in the internal memory saving with the procedure described in Section 4.9.2, and newly set them. This function cannot be used unless data is saved in memory. You can only confirm the recorded contents without setting conditions.

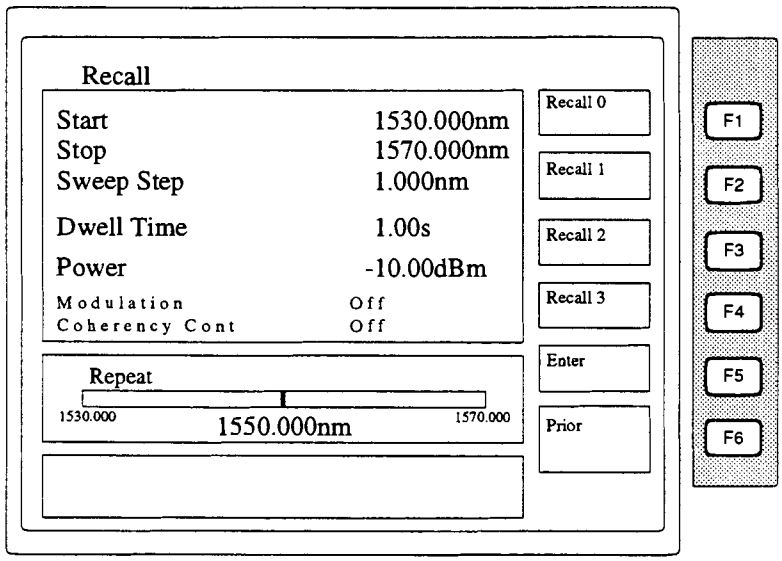
1 Press the Advance key.

2 Confirm that More1/2 is displayed for the F5 key as shown below. If not so, repeatedly press the F5 key until More1/2 appears.



3 Press the F4 (Recall) key.

4 As shown above, Recall0 to Recall3 appear for the F1 to F4 keys. Press the function key (e.g., F3) matching the number of the memory you want to recall.



Hint: The setting conditions at delivery are saved in memory 0 called by the F1 (Recall0) key. **See Section 4.4.3 and Appendix B.**

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5 The memory contents appears in the setting status display area. If the displayed contents are correct, press the F5 (ENTER) key; otherwise, press a function key (e.g., F2) of another memory number to display the required setting contents.

Hint: The setting of the contents called from memory is completed by pressing the F5 (ENTER) key. In other words, the setting contents are not selected until the F5 (ENTER) key is pressed; therefore, you can confirm the setting contents while selecting each of the F1 to F4 (Recall0 to Recall3) keys.

6 To stop the setting, press "CW", "Sweep", "Advance", or F6 (Prior) key.

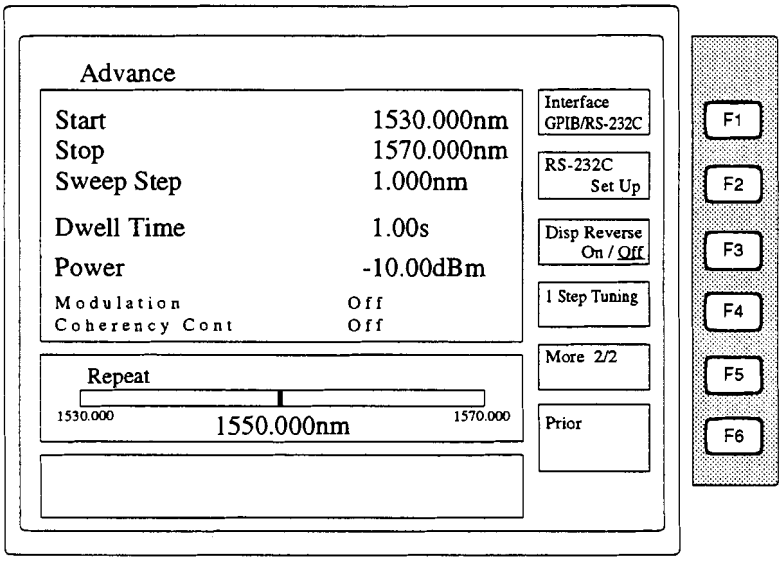
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4.9.4 One-step sweeping

This function successively sweeps the range from the start wavelength to the stop wavelength at high speed. An ordinary sweeping function requires a lot of time because the sweeping is performed while stopping for each wavelength. Using this function, you can measure an outline of the wavelength characteristics at high speed.

1 Press the Advance key.

2 Press the F5 (More1/2) key and confirm that More2/2 is displayed for the F5 key as shown below. If not so, repeatedly press the F5 key until More2/2 appears.



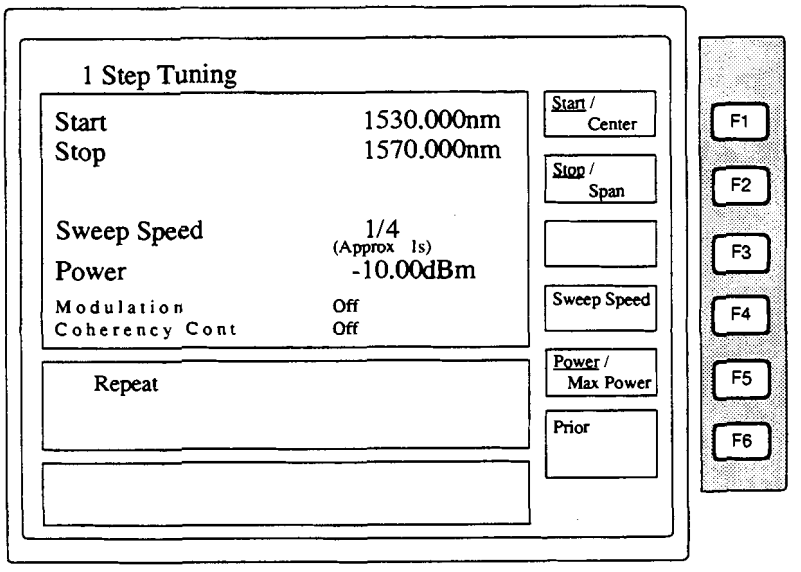
3 Press the F4 (1 step tuning) key.

4 The screen changes to the one shown in the figure. In this case, each value remains set in the sweep mode before the Advance mode. Specify the required start and stop wavelengths (or center wavelength or sweep width) in addition to the output level.

For details on setting the start and stop wavelengths (or center wavelength and sweep width), see Section 4.6.2, "Setting Wavelength in Sweep Mode."

For details on setting the output level, see Section 4.8, "Setting Laser Output Level."

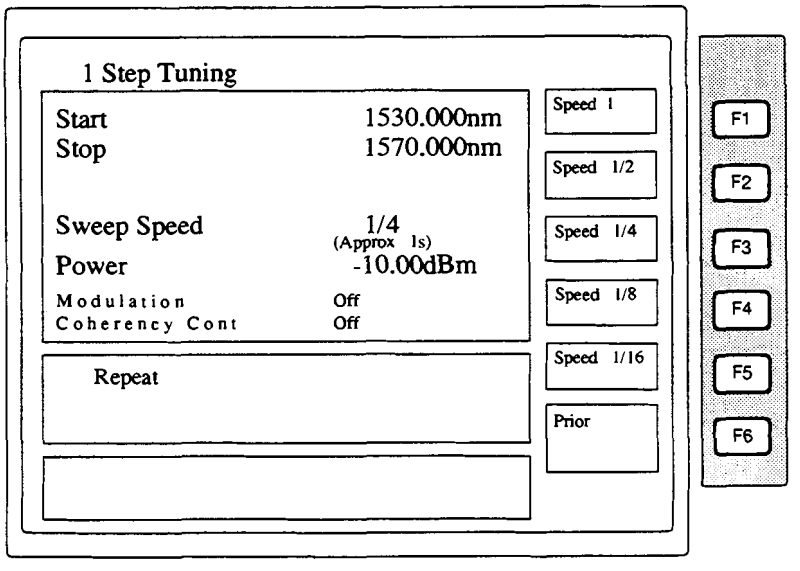
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5 Press the F4 (SweepSpeed) key.

6 As shown above, Speed1 to Speed1/16 are displayed for the F1 to F5 keys. Speed1 is set to the highest speed; Speed1/2 to about half of Speed1 and the required time is double. In the same way, Speed1/4 is about 1/4 of Speed1; Speed1/8 is about 1/8 of Speed1; Speed1/16 is about 1/16 of Speed1. Press the required sweeping speed key.

Note: If the sweep time is 1 second or less, it is not changed.



7 Use the Single, Repeat, or Pause/Continue key for sweeping.
For details on these keys, see Section 4.10, "Sweeping."

8 To stop the setting, press "CW", "Sweep", "Advance", or F6 (Prior) key.

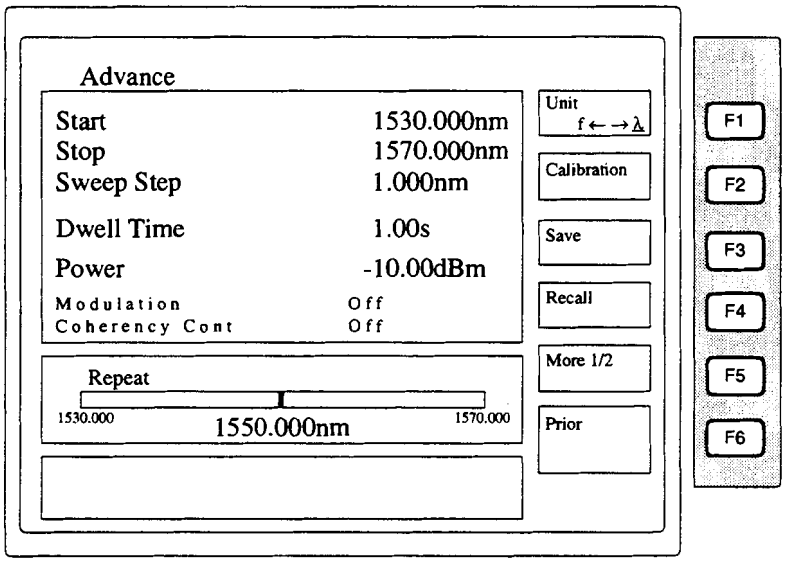
9 To set another Advance mode after this procedure, perform the relevant function setting procedure from step 1.

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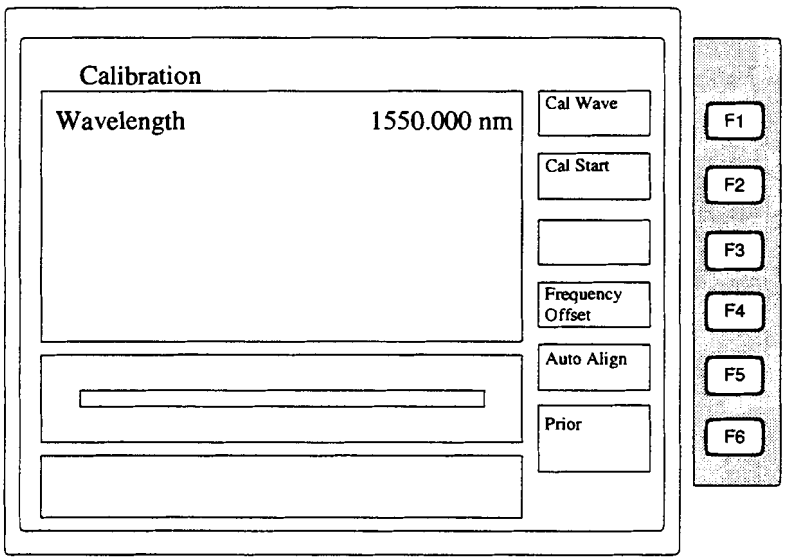
4.9.5 Calibration

1 Press the Advance key.

2 As shown below, confirm that More1/2 is displayed for the F5 key. If not so, repeatedly press the F5 key until More1/2 appears.



3 Press the F2 (Calibration) key.



a) Cal Wave/Cal Start

Improves the wavelength reappearance in the specified wavelength ± 3 mm to the typical value ± 7 pm or less.

(1) Press the F1 (Cal Wave) key and enter the center wavelength in the wavelength band of which the wavelength reappearance is to be improved.
For details on the entry method, see Section 4.6.

☞**See Section 4.6, "Setting Wavelength."**

(2) Press the F2 (Cal Start) key to execute the calibration.
The calibration is completed in about 1 minute, and the system returns to the state set before the Advance key is pressed.

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(3) To stop the calibration, press the F1 (Cancel) key. The calibration is not executed, and the system returns to the state set before the Advance key is pressed.

Hint: The wavelength calibration differs from the contents described in Section 5.2, "Calibration."

b) Frequency Offset

Shifts the wavelength (frequency) of an output beam by the specified frequency offset.

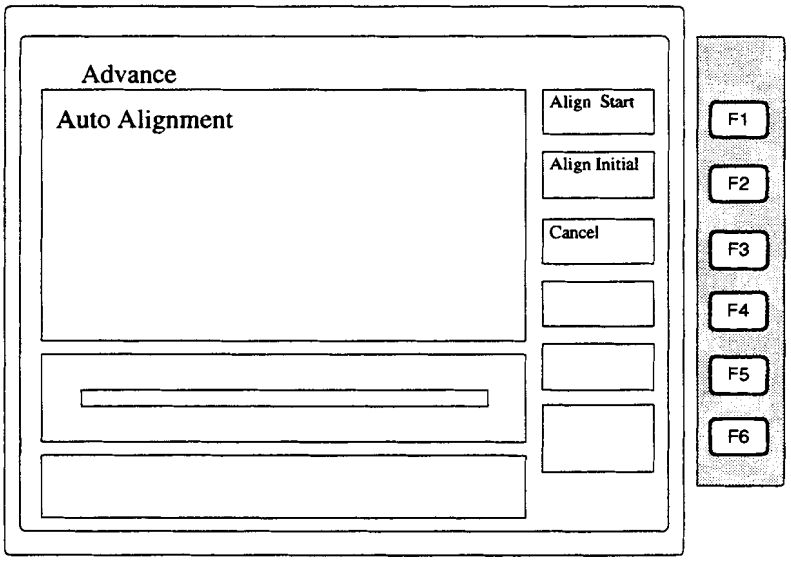
(1) Press the F4 (Frequency Offset) key to enter the frequency to be shifted. You can enter up to ± 50 GHz using the ten-key pad and ENTER key or rotary knob.

c) Auto Align

Aligns the built-in optical modules. Available when the ambient temperature changes extremely.

This function is already implemented at power-on. When this unit is used in an ordinary environment, this function is not necessary.

(1) Press the F5 (Auto Align) key.



(2) Press the F1 (Align Start) key to align the optical modules.

(3) To stop the alignment, press the F3 (Cancel) key.

(4) To return the alignment to the delivery status, press the F2 (Align Initial) key.

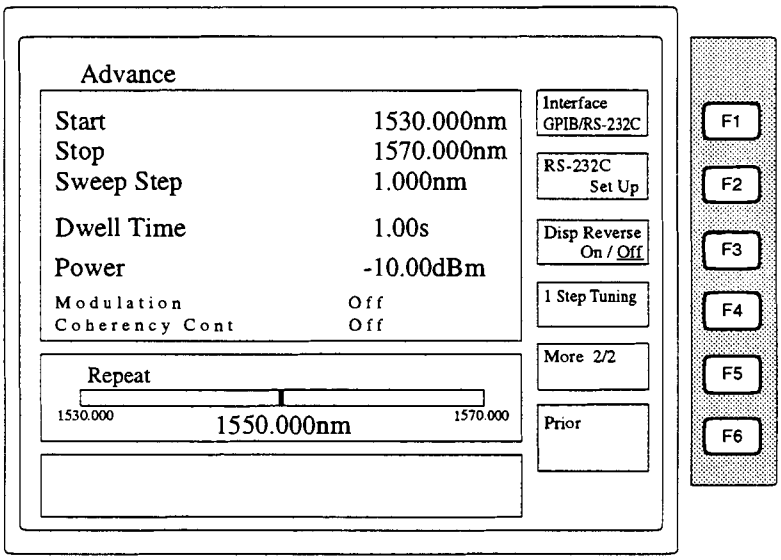
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4.9.6 Screen white-black reverse display (DispReverse)

This unit ordinarily displays white characters on the black background; however, if necessary, it can display black characters on the white background.

1 Press the Advance key.

2 Confirm that More2/2 is displayed for the F5 key as shown below. If not so, repeatedly press the F5 key until More2/2 appears.



3 Press the F3 (DispReverse) key.

4 For the F3 key, "Off" in the On/Off field is underlined as the current set value. When "Off" is underlined, white characters are displayed on the black background. When "On" is underlined, black characters are displayed on the white background. (In the figure above, black characters are displayed on the white background.)

5 On and Off alternately change each time the F3 key is pressed.

6 To stop the setting, press "CW", "Sweep", "Advance", and F6 (Prior) key.

7 To set another Advance mode continuously after step 5, execute the relevant function setting procedure from step 2.

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4.9.7 GPIB/RS-232C switching

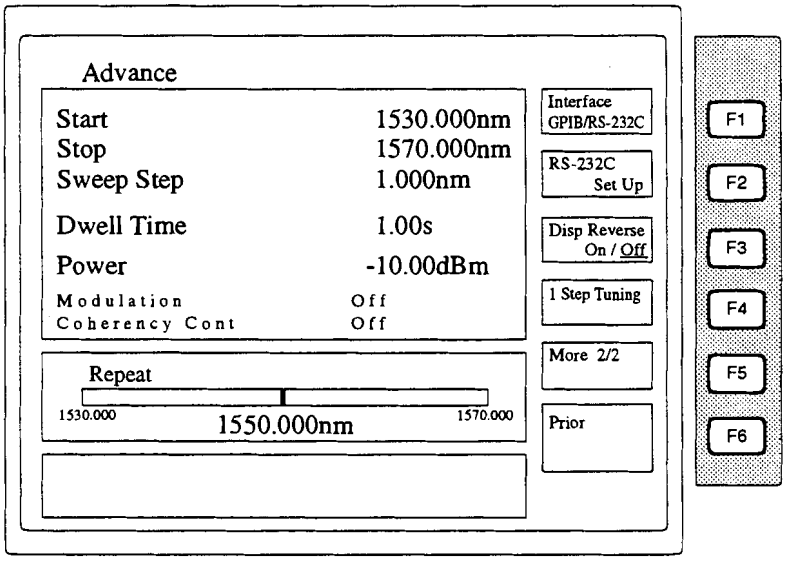
This unit provides a GPIB and RS-232C as the remote interfaces; either one can be used by switching them.

After the power is turned on, an interface to which a command was sent first is selected automatically.

To switch the current interface to another one during operation, perform the procedure below.

1 Press the Advance key. If the Remote lamp on the front panel lights on, press the Local key on the front panel to release the remote state, then press the Advance key.

2 Confirm that More2/2 is displayed for the F5 key. If not so, repeatedly press the F5 key until More2/2 appears.



3 Press the F1 (Interface GPIB/RS-232C) key. GPIB and RS-232C are alternately switched each time the F1 key is pressed. The underlined item is a selected interface.

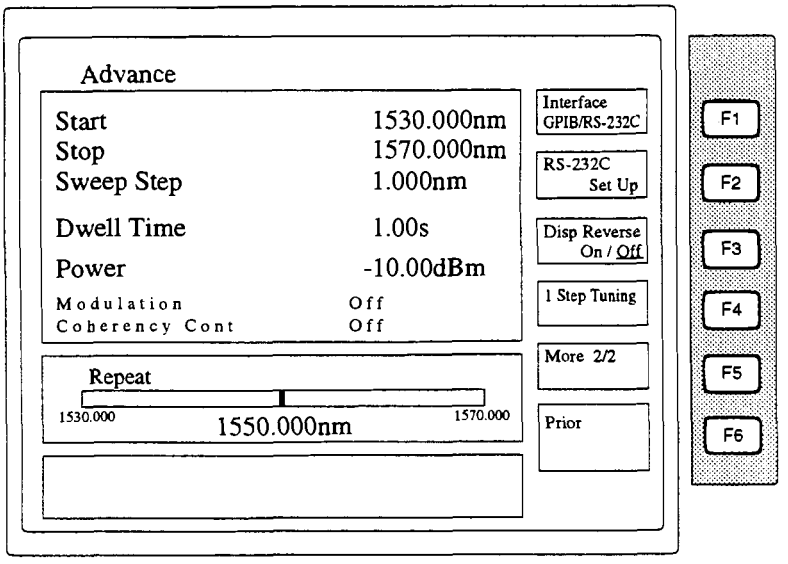
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4.9.8 RS-232C setting

Specify the RS-232C interface communication conditions.

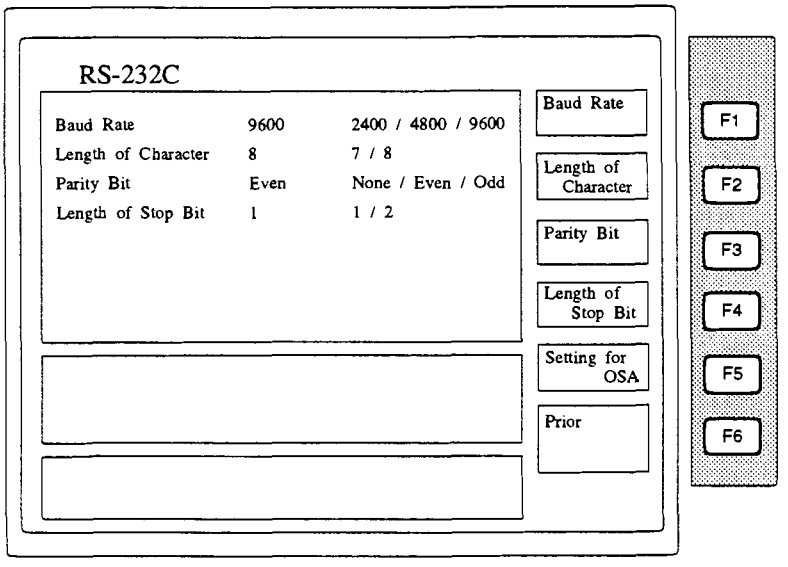
1 Press the Advance key.

2 Confirm that More2/2 is displayed for the F5 key. If not so, repeatedly press the F5 key until More2/2 appears.



3 Press the F2 (RS-232C SetUp) key. As shown above, the set items and current values are displayed in sequence.

Hint: In this figure, the options for each item are displayed on the right of the current value together. Actually, they are displayed only for the set item selected in step 4 below.



4 Use a function key to select a set item. Then, use the -> and <- keys or rotary knob to select its set value.

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Item	Meaning	
Baud Rate	Select the communication speed from 9600, 4800, and 2400 bps.	
Length of Character	Select a character length.	
	7	7 bits
	8	8 bits
Parity Bit	Select a parity bit.	
	None	Without parity bit
	Even	With even parity bit
	Odd	With odd parity bit
Length of Stop Bit	Select a stop bit length.	
	1	Adds a 1-bit stop bit.
	2	Adds a 2-bit stop bit.
Setting for OSA	Specify the interlocking with the MS9710A optical spectrum analyzer.	

For details on each item, refer to the Remote Control Instructions Manual.

☞ **See the Remote Control Instructions Manual.**

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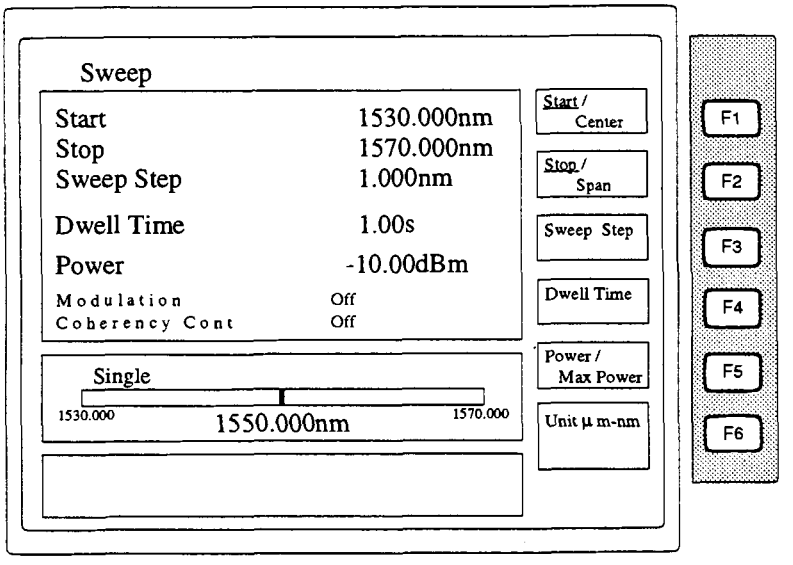
4.10 Sweeping

The sweeping function controls the sweeping in the sweep or 1-step turning mode. It is classified into four types: Single (only one sweeping), Repeat (repetitive sweeping), Pause (stop), and Cont (restart).

4.10.1 Single sweeping

The single sweeping function performs only one sweeping in the range from the start wavelength to the stop wavelength in the sweep or 1 step tuning mode.

During single sweeping, "Single" is displayed above the sweep bar as shown below.



1 Press the Single key of Sweep Control.

2 To resweep from the start wavelength, repress the Single key.

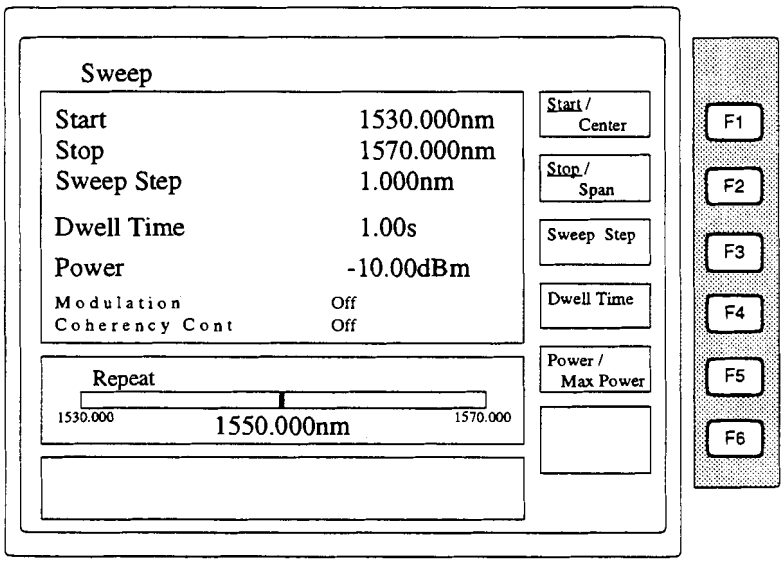
Hint: When the wavelength is set with Start/Stop, even if the Start numeric value is greater than the Stop numeric value, the sweeping is performed from Start to Stop. (When the wavelength is set with Center/Span, the Start numeric value is less than the Stop numeric value.)

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4.10.2 Repeat sweeping

The repeat sweeping function repeatedly sweeps the range from the start wavelength to the stop wavelength in the sweep or 1 step tuning mode.

During repeat sweeping, "Repeat" is displayed above the sweep bar as shown below.



1 Press the Repeat key of Sweep Control.

2 To stop the repeat sweeping, repress the Repeat key.

See Section 4.10.4, "Pause/Continue."

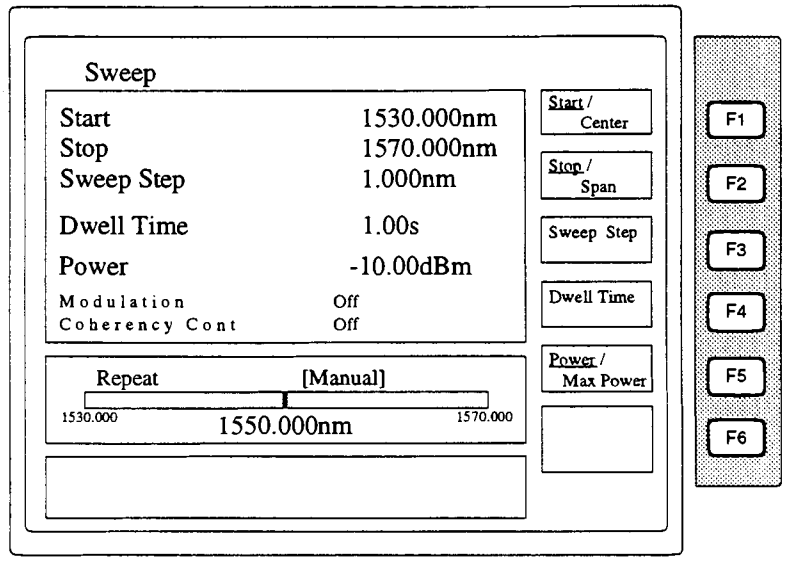
3 To resweep from the start wavelength, repess the Repeat key.

Hint: When the wavelength is set with Start/Stop, even if the Start numeric value is greater than the Stop numeric value, the sweeping is performed from Start to Stop. (When the wavelength is set with Center/Span, the Start numeric value is less than the Stop numeric value.)

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4.10.3 Manual sweeping

The manual sweeping function switches a wavelength by turning the rotary knob. When the manual sweeping is activated, "Manual" is displayed above the sweep bar as shown below.



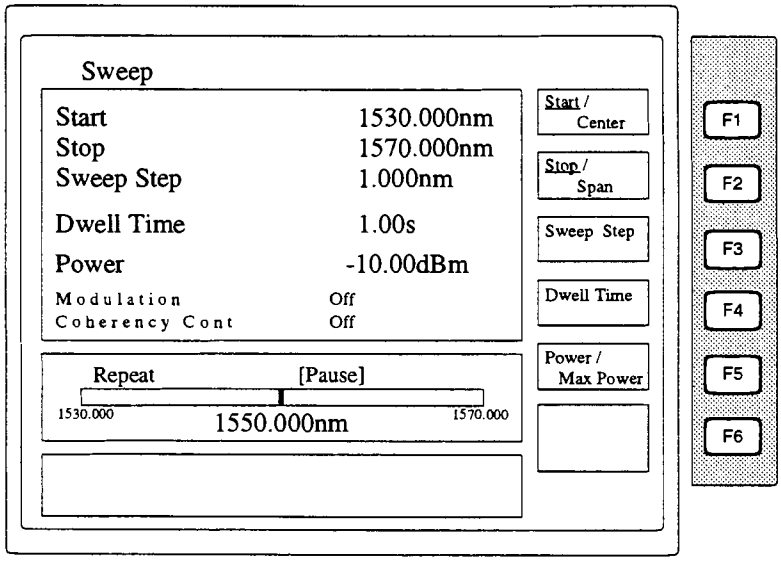
1 Press the Manual key of Sweep Control.

2 Turn the rotary knob to change the current wavelength. The wavelength changes by the set sweep step each time the rotary knob is clicked. Turning the rotary knob clockwise changes the wavelength in the stop wavelength direction. Turning it counterclockwise changes the wavelength in the start wavelength direction.

4.10.4 Pause/Continue

This function stops the Single or Repeat sweeping and releases the stop state to restart the sweeping.

When the sweeping stops, "Pause" is displayed above the sweep bar as shown below.



1 To stop the sweeping, press the Pause/Continue key of Sweep Control.

2 To release the stop state and restart the sweeping, press the Pause/Continue key.

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4.11 Modulation

This unit has a function that modulates laser output using an internal or external signal.

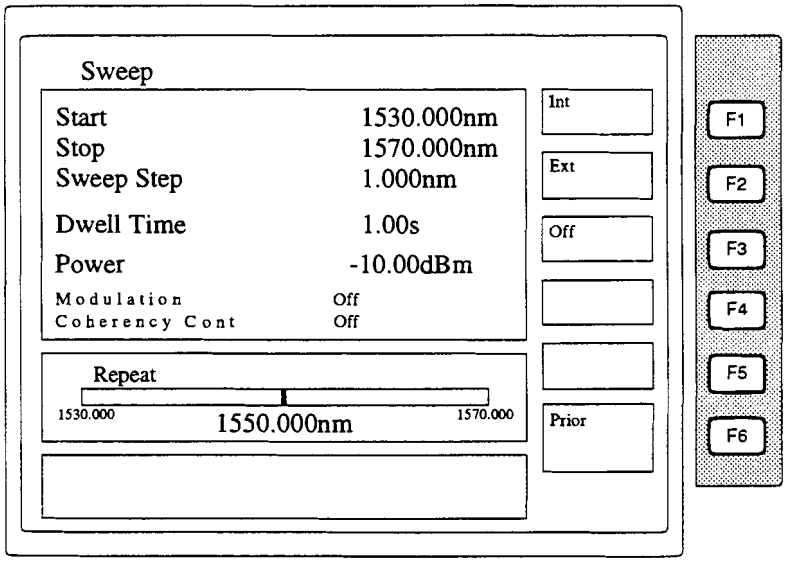
When the internal signal is used, the laser output is modulated in the range from 0.2 kHz to 20 kHz. When the external signal is used, the laser output is modulated in the range from 1 MHz to 3 GHz for MG9637A and 1 MHz to 300 MHz for MG9638A.

4.11.1 Internal modulation setting

This function sets the modulation frequency in 0.1 kHz units from the range from 0.2 kHz to 20 kHz. This section explains how to set 10.0 kHz.

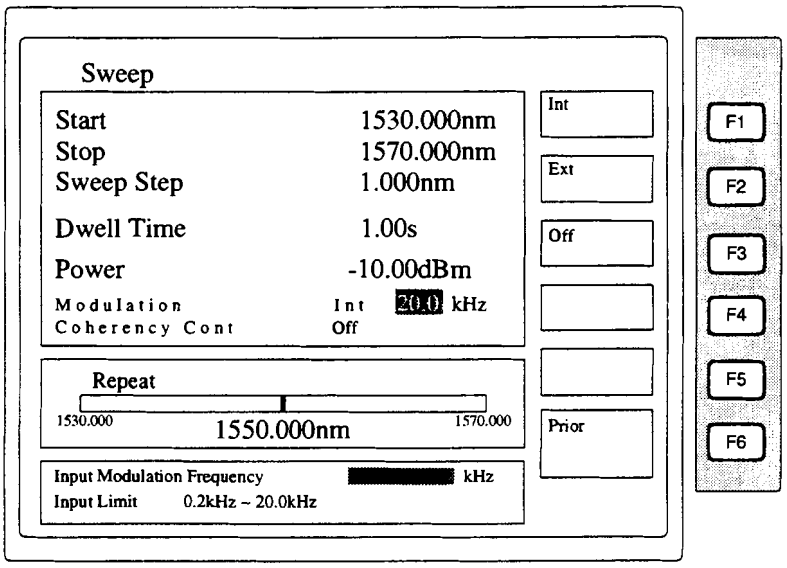
1 Press the Modulation key on the front panel.

2 As shown below, F1 (Int), F2 (Ext), F3 (Off), and F6 (Prior) are displayed as soft keys.



3 Press the F1 (Int) key. The modulation mode on the top of the screen changes to Int, and the modulation frequency set on the right is displayed. The modulation frequency entry area, "Input Modulation Frequency", appears at the bottom of the screen. The specifiable modulation frequency range is also displayed as Input Limit.

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4 Use the ten-key pad to key in 10.

5 Press the ENTER key; the entered value is decided and the modulation frequency at the top of the screen changes to 10.0 kHz.

6 In steps 4 and 5, you can use the rotary knob instead of the ten-key pad.

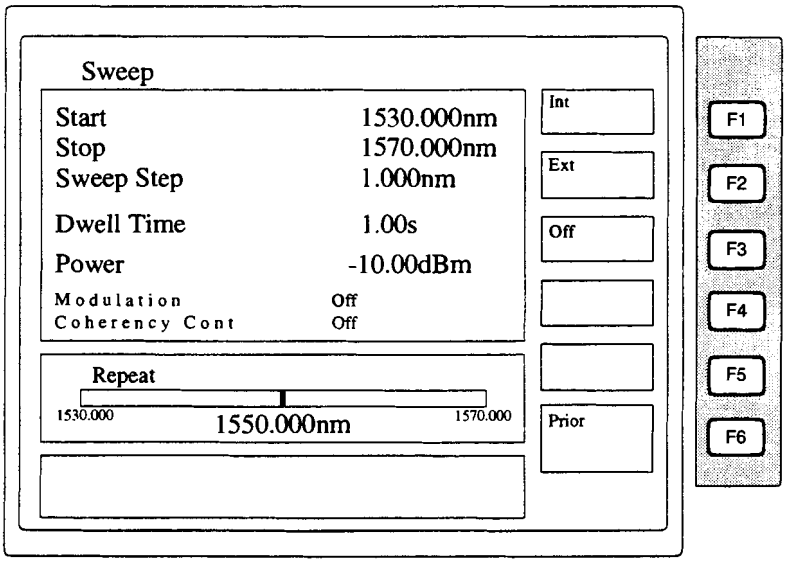
7 To stop the modulation output, press the Modulation key and F3 (Off) key. The modulation mode at the top of the screen changes to Off.

4.11.2 External modulation setting

This function modulates the laser output with a signal sent from the Ext AM Input connector (Section 4.14.5).

1 Press the Modulation key on the front panel.

2 As shown below, F1 (Int), F2 (Ext), F3 (Off), and F6 (Prior) are displayed as soft keys.



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3 Press the F2 (Ext) key. The modulation mode on the top of the screen changes to Ext, and the external modulation is set.

4 To stop the modulation output, press the Modulation key and F3 (Off) key. The modulation mode on the top of the screen changes to Off.

4.12 Coherency

This function controls the line width of output beam. Setting Off narrows the line width of output beam (typ. 700 kHz). Setting on widens the line width of output beam (typ. 50 MHz). Which mode (on or off) is set is displayed in the setting status display area.

1 Press the Coherency key.

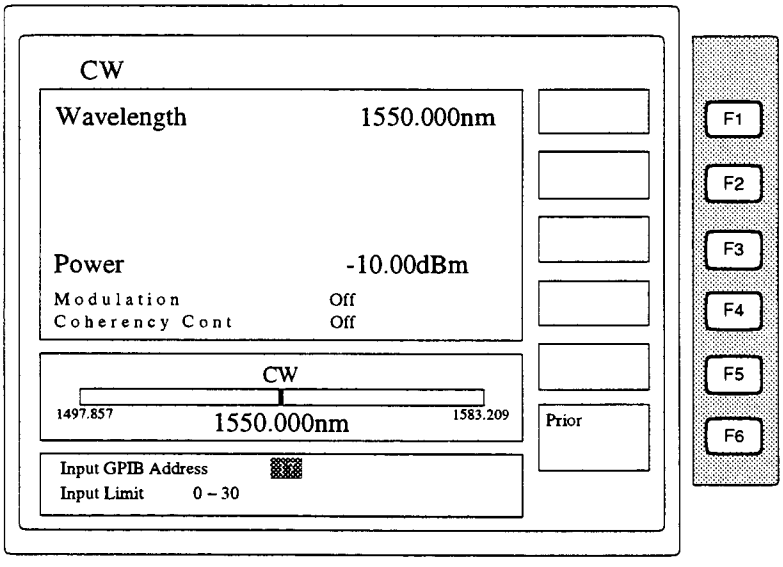
2 The mode reverse with one displayed in the setting status display is set each time the Coherency key is pressed. In other words, when On is displayed in the setting status display area, if the Coherency key is pressed, the setting changes to Off. When Off is displayed in the setting status display area, if the Coherency key is pressed, the setting changes to On.

Hint: Turning the coherency function on widens the line width of output beam; however, a level variation caused by interference is eliminated, and a high-level measurement is possible.

4.13 GPIB Address

This function sets a GPIB address in the range from 0 to 30.
It is unavailable in the remote mode. If the remote mode is set, return it to the local mode before setting the GPIB address.

1 Press the Address key on the front panel. As shown below, the GPIB address entry area appears on the bottom of the screen.



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2 Use the ten-key pad to specify a numeric value (0 to 30).

3 Press the ENTER key to decide the numeric value. The screen remains unchanged, but the change of the address is completed by this operation. If this processing is terminated without pressing the ENTER key, the previous address is held.

4.14 Rear Connectors

This section explains how to use five types of connectors other than the remote connectors of the rear connectors.

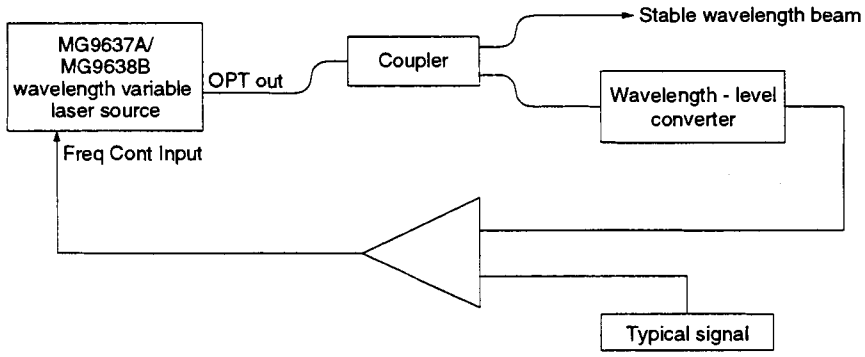
4.14.1 Freq Cont Input connector

The laser output wavelength can be shifted by inputting 0 to ± 5V voltage to the Freq Cont Input connector.

The input voltage range is 0 to ± 5V.

The wavelength shift value varies depending on output wavelengths. The wavelength shifts by +200 MHz or more at +5V input and -200 MHz or more at -5V input.

As shown below, the feedback system using a wavelength - level converter for detecting an absorption line is available to rise the output wavelength stability of this unit.



Hint: To shift the laser output wavelength using the Freq Cont Input connector, perform the calibration with the wavelength used in advance.

See Section 4.9.6.

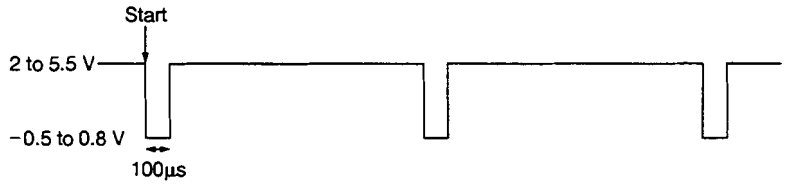
If the laser output wavelength is shifted without calibration, a wavelength variation of approx. 3 GHz (mode hop) occurs in the reverse direction of the shift direction.

The wavelength shift value does not linearly change for the input voltage. As shown in this example, be sure to configure a feedback system.

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4.14.2 Sweep Trigger Signal Output connector

When the wavelength output mode is the sweep mode and beams having the start wavelength are output, a low pulse of approx. 100 µs is output as a sweep trigger signal.



4.14.3 Int AM Synchronous Signal Output Connector

This connector outputs a signal synchronous with the modulation frequency (0.2 to 20 kHz) described in **Section 4.11.1**, "Internal Modulation Setting."

4.14.4 Sweep Signal Output connector

The voltage is output in proportion to the Span wavelength during sweeping in the sweep mode. When the start wavelength is output, the 0 V voltage is output. When the center wavelength is output, the 10 V voltage is output. The Seep Signal Output connector is available for axis X signal of the X-Y recorder.

Hint: When the wavelength shifts by one sweep step, the voltage variation is 10V x [sweep step/sweep width]. If the value set for [sweep step/sweep width] is extremely small or great, the voltage output does almost not change or changes extremely.

4.14.5 Ext AM Input connector

This connector inputs an external modulation signal used to set the external modulation (☞ **see Section 4.11.2**). The following signals can be input:

Frequency: 1 MHz to 3 GHz, Sine wave (MG9637A)
1 MHz to 300 MHz, Sine wave (MG9638A)

Maximum input intensity: +5 dBm

Input impedance: 50 Ω

Caution ⚠

Do not input a signal outside the input enabled range described above to the Ext AM Input

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Section 5 Performance Test and Calibration

This chapter explains how to confirm the performance of this unit.

To maintain the performance of this unit and correctly measure each value, you should execute the performance test at least once six months to confirm the performance of this unit.

When the standard conditions are not assumed to be satisfied by the performance test described in this chapter, repair or calibration is required. In this case, contact our branch office or agency listed in this book.

Before requesting the repair or calibration, check the items below.

(1) Device name and machine number indicated on rear panel
(2) Fault status
(3) Name and phone number of the person in charge we confirm the fault con tents and contact at completion of the repair

5.1 Performance Test 5-2
5.1.1 Wavelength accuracy 5-3
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(1) Setup 5-4
(2) Test procedure 5-4
5.2 Calibration 5-4

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5.1 Performance Test

Test the following parameters to confirm performance of this unit:

- Wavelength accuracy
- Side mode suppression rate
- Maximum output level
- Monitor laser output level

Before testing performance, clean the optical connector. The measurement must be performed after the power is turned on and the heat-up and calibration are completed.

☞ **See Section 4.1, "Power-On and Heat-Up."**

The table below lists the typical value of each test parameter and measuring instrument required for its test.

Typical value of each test parameter

	MG9637A	MG9638A
Wavelength accuracy	±0.1 nm or less	±0.1 nm or less
Side mode suppression rate	45 dB or more (1520 ~ 1570 nm) 40 dB or more (1500 ~ 1580 nm)	40 dB or more (1520 ~ 1570 nm) 35 dB or more (1500 ~ 1580 nm)
Maximum output level (Output 1)	−10 dBm or more (1520 ~ 1570 nm) −13 dBm or more (1500 ~ 1580 nm)	+4 dBm or more (1520 ~ 1570 nm) 0 dBm or more (1510 ~ 1580 nm) −5 dBm or more (1500 ~ 1580 nm)
Output level 2	−10 dBm or more	−10 dBm or more

Measuring instrument required for each test

- Wavelength accuracy — Optical wavelength meter
  MF9630A
  Wavelength: 0.6 to 1.6 μm
  Measurement accuracy: ±0.5 ppm
  Resolution: 0.1 ppm or less
- Side mode suppression rate — Optical spectrum analyzer
  MS9710A
  Wavelength: 0.6 to 1.75 μm
  Resolution: 0.1 nm
  Dynamic range: 58 dB
- Maximum output level and monitor laser output level — Optical power meter
  ML9001A + MA9712A
  Wavelength: 0.75 to 1.8 μm
  Level: +10 dB

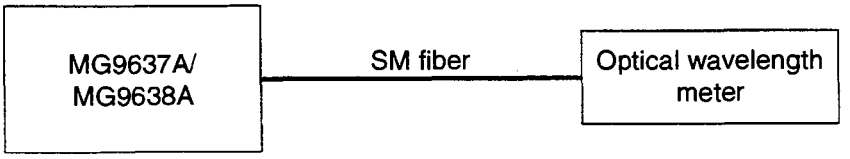
Hint: To record the test result, copy the performance test result record sheet shown in Appendix D or prepare a similar table.

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5.1.1 Wavelength accuracy

(1) Setup

Connect the device as shown below.



(2) Test procedure

1 Set the CW mode as the MG9637A/MG9638A wavelength output mode and specify the wavelengths below in sequence:

1500 nm, 1540 nm, 1550 nm, 1580 nm

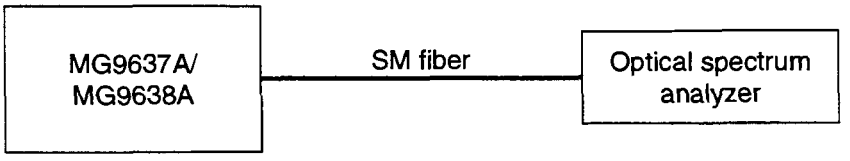
2 Use the optical wavelength meter to measure the output wavelength for each wavelength set in step 1.

3 Confirm that the difference between the set and measured values is within the standard.

5.1.2 Side mode suppression rate

(1) Setup

Connect the device as shown below.



(2) Test procedure

1 Set the CW mode as the MG9637A/MG9638A wavelength output mode and specify the wavelengths below in sequence:

1500 nm, 1520 nm, 1550 nm, 1570 nm, 1580 nm

2 Use the optical spectrum analyzer to measure the side mode suppression rate for each wavelength set in step 1.

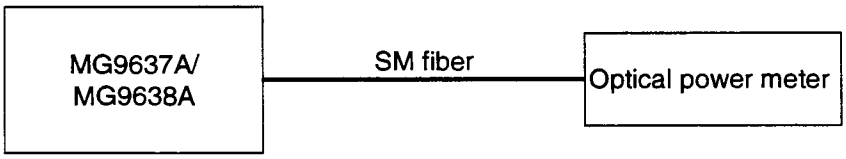
3 Confirm that the measured value is within the standard.

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5.1.3 Maximum output level (Output 1)

(1) Setup

Connect the device as shown below.



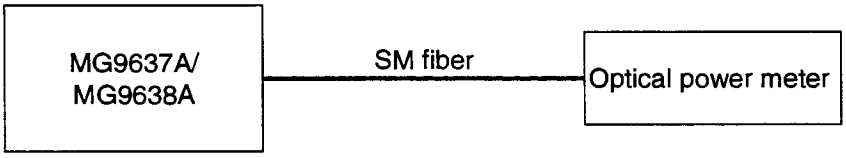
(2) Test procedure

1 Set the CW mode as the MG9637A/MG9638A wavelength output mode and specify the wavelengths below in sequence:
MG9637A: 1500 nm, 1520 nm, 1570 nm, 1580 nm
MG9638A: 1500 nm, 1510 nm, 1520 nm, 1570 nm, 1580 nm
2 Use the spectrum power meter to measure the maximum output level for each wavelength set in step 1.
3 Confirm that the measured value is within the standard.

5.1.4 Output level 2

(1) Setup

Connect the device as shown below.



(2) Test procedure

1 Set the CW mode as the MG9637A/MG9638A wavelength output mode and specify the wavelengths below in sequence:
1500 nm, 1520 nm, 1580 nm
2 Use the optical power meter to measure the monitor laser output level for each wavelength set in step 1.
3 Confirm that the measured value is within the standard.

5.2 Calibration

You cannot calibrate this unit manually. When the standard conditions are not assumed to be satisfied by the performance test described in Section 5.1, repair and calibration are required. In this case, contact one of the branch offices or leaders listed in this manual.

Hint: The calibration described in Section 4.9.6 is a function that raises the wavelength accuracy in a specific wavelength range. It differs from the calibration described in this section.

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Section 6 Maintenance and Retransportation

TThis chapter describes the notes on the daily maintenance and retransportation.

6.1 Daily Maintenance 6-2
6.2 Notes on Storage 6-3
6.3 Retransportation 6-4
6.4 If an Error is Displayed by Self-Check 6-4
6.5 If a Fault Occurs 6-5

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6.1 Daily Maintenance

Dirty appearance

When the appearance is extremely dirty; this unit is used in a dusty place; or before storing this unit, slightly wipe off the dirt using a cloth moistened with a soap-and-water solution. Thinner and benzine may damage the coating of this unit.

Dirty screen

When the screen is dirty, wipe off it with a soft cloth. If the screen is extremely dirty, slightly wipe off it using a cloth moistened with a soap-and-water solution.

Caution ⚠

Before wiping off the dirt using a cloth moistened with soap-and-water solution, disconnect the power cord from the power outlet. If this processing is performed without disconnecting the power cord, you may receive an electric shock.

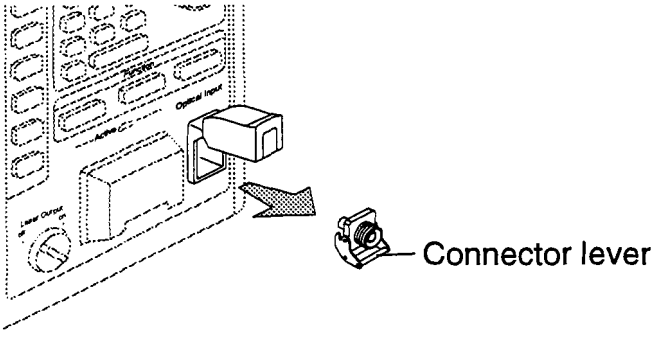
Do not disassemble and lubricate this unit. Precision parts on the order of a few É m are used in this unit. If this unit is disassembled or lubricated, it may not operate normally.

Cleaning the ferrule in this unit

Before cleaning the ferrule in the optical output connector, follow the procedure below to remove the optical connector. The ferrule must be cleaned periodically.

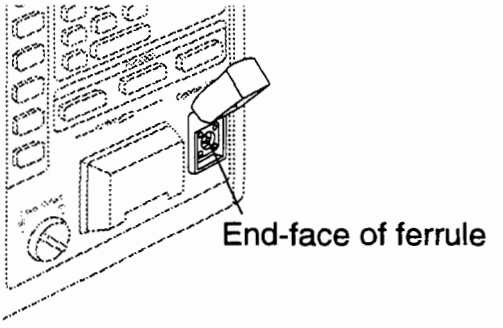
1 Open the connector cover.

2 Pull out the connector level toward you and confirm that the latch is released. Then, pull out the connector carefully straight toward you.



3 Use the adapter cleaner to wipe off the dirt of the end-face of the ferrule.

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4 Attach the optical connector in the reverse order. In this case, do not damage the end-face of the ferrule with a connector.

Cleaning the ferrule of the optical fiber cable

To clean the ferrule at the end of the cable, use the ferrule cleaner (Z0282) that is a product related to this unit.

Caution ⚠

If the end section of the optical fiber is cleaned using an applicator moistened with a solvent (e.g., alcohol), dusts may remain on the end section after the solvent evaporates. To clean the optical fiber, use the ferrule cleaner (Z0282) that you need not moisten with solvent such as alcohol.

6.2 Notes on Storage

Do not store this unit in the following locations.

- Location where the temperature reaches 60°C or higher or –20°C or lower
- Location exposed to the direct rays of the sun
- Dusty location
- High-humidity location where water drops form
- Location exposed to active gases

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6.3 Retransportation

To retransport this unit, note the following items:

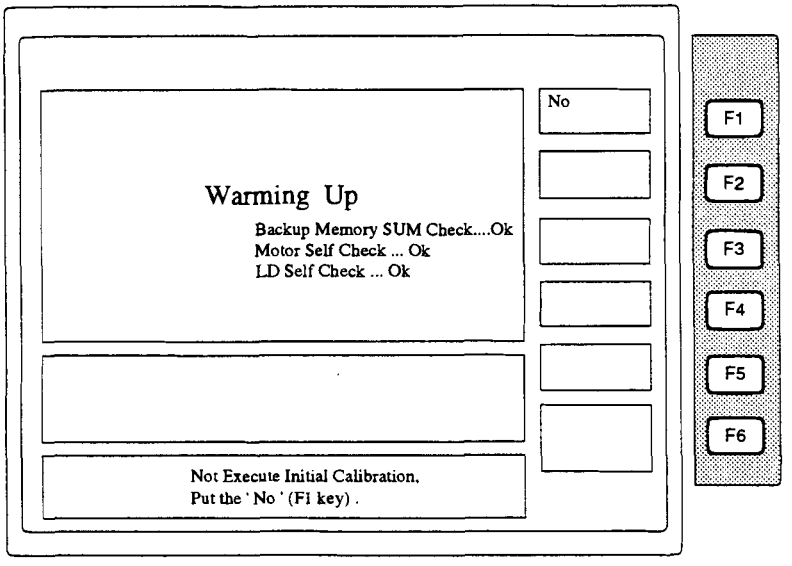
- Use the package materials used at purchase.
- Since this unit is a super-precise optical device, instruct a transporter to transport this unit horizontally as much as possible.

If you lose the package materials used at purchase, perform the procedure below.

1 Attach a separately sold protection cover to the front and rear panels.
2 Cover the entire unit with a vinyl bag.
3 Prepare a solid package box made of a corrugated board, wood, or aluminum with a 10 to 15 cm space in all directions. Then, pad cushioning materials of thickness 10 to 15 cm on the bottom of the box.
4 Put the unit covered with a vinyl bag in the box and pad cushioning materials around this unit.
5 Securely fix the box with a cord, tape, or belt.

6.4 If an Error is Displayed by Self-Check

The self-check program automatically tests this unit at power-on and displays the result on the screen. **See Section 4.1, "Power-On and Heat-Up."**



When OK is displayed for each test parameter, this unit is assumed to be normal. If Wrong is displayed, an error occurs, In this case, turn the power on again. If the same error recurs, memo the invalid item and contact an Anritsu service center.

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6.5 If a Fault Occurs

Phenomenon	Probable cause	Action
The power is not turned on.	The POWER switch is not pressed securely.	Securely press the POWER switch.
	The AC power input connector is not exactly connected to the power cord or the power cord is not exactly connected to the power receptacle.	
	Correctly connect the AC power input connector to the power cord or power receptacle.	
	A fuse is burnt out.	Replace the fuse. ☞See Section 3.8, "Replacing Fuse."
When 2 minutes or more lapsed after the power was turned on, the initialization screen does not appear.		Turn the power off once and turn it on again. If the same error recurs, turn the power off and contact an Anritsu service center.
When 2 hours or more lapse after the power was turned on, the heat-up rate does not reach 100%.	The ambient temperature is too low.	The temperature must be within 10 to 35°C. ☞See Appendix A, "Standard."
	The heater is defective.	Turn the power off and contact an Anritsu service center.
No data appears on the screen after the power was turned on.	The position of the Contrast knob is incorrect.	Adjust the Contrast knob.
	The display circuit is defective.	Turn the power off once and turn it on again. If the same error recurs, turn the power off and contact an Anritsu service center.
The optical fiber cord cannot be connected.	The shape of the optical fiber cord is different from that of the connector.	Use a connector of the correct shape. ☞See Section 3.7, "Replacing Optical Connector."
	The optical fiber cord insertion direction is different from the connector insertion direction (e.g., claw position).	Confirm the claw position and direction.

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Phenomenon	Assumed cause	Action
No laser is output.	The interlock connector is opened.	Short the interlock connector. ☞ See Section 3.4, "Connecting Remote Interlock Connector."
	The laser output ON/OFF key is off.	Turn the laser output ON/OFF key to ON.
	The optical fiber cord is not connected.	Connect the optical fiber cord.
	The laser output is set to off by remote control.	Set the laser output to on by remote control.
Wavelength Cal cannot be executed.	The heat-up rate does not reach 100%.	Wait until the heat-up rate reaches 100%.
The output power is too low.	The end section of the fiber cord or connector is dirty.	Clean the end section of the fiber cord and connector. ☞ See Section 6.1, "Daily Maintenance."
	The fiber cord is not securely connected to the connector.	Securely connect the fiber cord to the connector.
The optical level is unstable.	The end section of the fiber cord or connector is dirty.	Clean the end section of the fiber cord and connector. ☞ See Section 6.1, "Daily Maintenance."
	The reflection loss of the fiber cord is low.	Use a fiber cord of which reflection loss of the fiber output terminal is 45 dB or more. Turn the coherency control on; a stabler level is obtained.
The wavelength stability is low.	The coherency control is turned on.	To obtain high wavelength stability, turn the coherency control off.
	Modulated	Turn the modulation (Mod) off.
	This unit is used in an oscillating place.	Install this unit in a stable place. ☞ See Section 3.1.1, "Installation Environment."
	The ambient temperature changes.	Install this unit in a location where the ambient temperature is constant.
Not modulated.	Mod Int or Mod Ext is not set.	Set Mod Int or Mod Ext.
	An external modulation signal is not input.	Input an external modulation signal.

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Phenomenon	Probable cause	Action
Mode hop occurs.	Wavelength Cal is not executed near the wavelength to be measured ± 3 nm.	Execute wavelength Cal near the wavelength to be measured ± 3 nm.
Fan B does not rotate.		Fan B does not rotate unless the ambient temperature reaches about 35°C. ☞ See Section 3.1.3, "Distance from Fan."
GPIB or RS-232C does not function.	The GPIB or RS-232C cable is not connected securely.	Correctly connect the GPIB or RS-232C cable.
	An invalid type of RS-232C cable is used.	Use a cross cable for the RS-232C. ☞ Refer to the Remote Control Instructions Manual.
	The GPIB or RS-232C interface is not set (selected) correctly.	Correctly set the GPIB or RS-232C interface.
	An invalid GPIB address is set.	Set the correct GPIB address.
	An invalid RS-232C setting condition is specified.	Specify the correct RS-232C setting condition.
Backup Memory SUM Check Wrong occurred.	When the initialization was performed at power-on, an error occurred in the backup RAM.	Turn the power off once and turn it on again. If the same error recurs, turn the power off and contact an Anritsu service center.
Motor Self Check Wrong occurred.	When the initialization was performed at power-on, an error occurred in the mirror motor.	
LD Self Check Wrong occurred.	When the initialization was performed at power-on, an error occurred in an optical module.	
MCIC error occurred.	An error occurred in the mirror motor.	

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A.1 MG9637A Wavelength Variable Laser Source

A.1.1 Standard

Item	Standard	Conditions
Wavelength range	1500 nm to 1580 nm	
Wavelength setting resolution	1pm	
Wavelength accuracy	±0.1 nm or less	
Wavelength stability	±100 MHz or less	Within 1 hour at the predetermined temperature *
Wavelength repeatability	±35pm or less	
	Typical value ± 7 pm or less	± 3 nm range of CAL wavelength after execution of wavelength CAL At predetermined temperature
Line width	700k Hz(typical value)	Coherency control OFF
	50 MHz(typical value)	Coherency control ON
Wavelength switching time	100ms/1 nm(typical value)	Dwell Time < 1s
	150ms/10 nm(typical value)	
	500ms/80 nm(typical value)	
Side mode suppression rate	45 dB or morer(1520 to 1570 nm)	
	40 dB or morer(1500 to 1580 nm)	
Maximum output level (main output)	–10 dBm or morer(1520 to 1570 nm)	
	–13 dBm or more(1500 to 1580 nm)	
Minimum output level (main output)	–20 dBm	
Level stability (main output)	Within ±0.01 dB	Within 1 hour at the predetermined temperature *
Level flatness (main output)	±0.1 dB or less	At steady temperature
Polarized wave quenching rate	18 dB or morer	Guaranteed at fiber end FC, SC, ST, DIN, or nmS-10/A only for connector
2nd output level	–10 dBm or more	
Internal modulation	200 Hz to 20k Hz	Square wave, duty 50%
External modulation	1 MHz to 3 GHz	Sine wave

* The predetermined temperature means the temperature variation ± 3 degrees or less.

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A.1.2 Functions

Wavelength calibration function	
1 step sweep function	
Input-output function	
GPIB	SH1,AH1,T5,L4,SR1,RL1,PP0,DC1,DT0,C0,E1
RS-232C	Conforms to ITU-T V28. Max. 9600 bps
Freq Cont input	Max. ± 5V
Sweep signal output	(10V± 0.5 V)/Span
Sweep trigger	0/5 V(L:– 0.5 to 0.8 V,H:2 to 5.5 V)
AM synchronous signal output	0/5 V(L:– 0.5 to 0.8 V,H:2 to 5.5 V)

A.1.3 Environment performance

Power	Operating voltage	AC85 to 132V/170 to 265 V
	Frequency	47.5 to 63 Hz
	Power capacity	11. 190VA or less
Temperature and humidity	Operating temperature	10 to +35°C
	Storage temperature	–20 to+60°C
Warming-up time	1 hour or less	
Laser safety	Class 3A	(IEC825-1)
	Class 1	(FDA 21 CFR)

A.1.4 Dimensions and Weight

Dimensions	319(W)×177(H)×450(D)
Weight	16 kg or less

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A.2 MG9638A Wavelength Variable Laser Source

A.2.1 Standard

Item	Standard	Conditions
Wavelength range	1500 nm to 1580 nm	
Wavelength setting resolution	1pm	
Wavelength accuracy	±0.1 nm or less	
Wavelength stability	±100 MHz or less	Within 1 hour at the predetermined temperature *
Wavelength repeatability	±35pm or less	
	Typical value ± 7 pm or less	± 3 nm range of CAL wavelength after execution of wavelength CAL At predetermined temperature
Line width	700k Hz(typical value)	Coherency control OFF
	50 MHz(typical value)	Coherency control ON
Wavelength switching time	100ms/1 nm(typical value)	Dwell Time < 1s
	150ms/10 nm(typical value)	
	500ms/80 nm(typical value)	
Side mode suppression rate	40 dB or more(1520 to 1570 nm)	
	35 dB or more(1500 to 1580 nm)	
Maximum output level (main output)	+4 dBm or morer(1520 to 1570 nm)	
	0 dBm or more(1500 to 1580 nm)	
	–5 dBm or more(1500 to 1580 nm)	
Minimum output level (main output)	–20 dBm	
Level stability (main output)	Within ±0.02 dB	Within 1 hour at the predetermined temperature *
Level flatness (main output)	±0.2 dB or less	At steady temperature
Polarized wave quenching rate	18 dB or morer	Guaranteed at fiber end FC, SC, ST, DIN, or nmS-10/A only for connector
2nd output level	–10 dBm or more	
Internal modulation	200 Hz to 20k Hz	Square wave, duty 50%
External modulation	1 MHz to 300 Hz	Sine wave

* The predetermined temperature means the temperature variation ± 3 degrees or less.

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A.2.2 Functions

Wavelength calibration function	
1 step sweep function	
Input-output function	
GPIB	SH1,AH1,T5,L4,SR1,RL1,PP0,DC1,DT0,C0,E1
RS-232C	Conforms to ITU-T V28. Max. 9600 bps
Freq Cont input	Max. ± 5V
Sweep signal output	(10V± 0.5 V)/Span
Sweep trigger	0/5 V(L:– 0.5 to 0.8 V,H:2 to 5.5 V)
AM synchronous signal output	0/5 V(L:– 0.5 to 0.8 V,H:2 to 5.5 V)

A.2.3 Environment performance

Power	Operating voltage	AC85 to 132V/170 to 265 V
	Frequency	47.5 to 63 Hz
	Power capacity	11. 190VA or less
Temperature and humidity	Operating temperature	10 to +35°C
	Storage temperature	–20 to+60°C
Warming-up time	1 hour or less	
Laser safety	Class 3A	(IEC825-1)
	Class 1	(FDA 21 CFR)

A.2.4 Dimensions and Weight

Dimensions	319(W)×177(H)×450(D)
Weight	16 kg or less

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Appendix B Initial Set Values

At delivery, the set values are fixed as shown below. A changed set value can be returned to the original by calling memory 0 with Recall0 (see Section 4.9.3).

Measurement mode	Item	Set value
CW mode	Wavelength	1550.000 nm
	Frequency	193414.4 GHz
	Power	– 10 dBm
Sweep mode	Start Wavelength	1530.000 nm
	Stop Wavelength	1570.000 nm
	Center Wavelength	1550.000 nm
	Span Wavelength	40 nm
	Start Frequency	195942.7 GHz
	Stop Frequency	190950.6 GHz
	Center Frequency	193414.4 GHz
	Span Frequency	4992.1 GHz
	Sweep Step Wavelength	0.100 nm
	Sweep Step Frequency	12.8 GHz
	Dwell Time	1.00s
	Power	– 10 dBm
ÇPStep Tuning	Sweep Speed	1/4
Measurement mode common	f←→λ	λ
	Modulation	Off
	Modulation Int Freq	20.0k Hz
	Coherency	Off
	Reverse On/off	Off
	Calibration Wavelength	1550.000 nm
	Calibration Frequency	193414.4 GHzSave/Recall

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Appendix C Error Codes

C.1 Operation Errors

No.	Error message	Status	Factor
1001	Span or Step Limit		Span is lower than the sweep step.
1002	Power Limit		In the wavelength mode, the output level was higher than the output level of this unit.
1003	Power Limit		In the frequency mode, the output level was higher than the output level of this unit.
1004	Out of Limit		An illegal set value was specified.
1005	Can't Find Recall Data		Recall data is not found.

C.2 Remote Control Errors

No.	Error message	Status	Factor
2001	Invalid Command	ESE-CME	Remote command error
2002	Invalid Parameter of Command	ESE-EXE	Remote command parameter error
2003	Can't Execute Command	ESE-DDE	A request command is not accepted in the current mode.
2004	Can't Execute Command	ESE-DDE	A set command is not accepted in the current mode.
2005	Out of Cal Temperature	ESE-DDE	Since the heat-up rate of the LD module does not reach 100%, this processing cannot be executed currently.

C.3 System Errors

No.	Error message	Status	Factor
4001	Out of Order (4001)		Motion control origin detection erro
4002	Out of Order (4002)		Motion control operation error
4003	Out of Order (4003)		Backup memory sum check erro
4004	Out of Order (4004)		ND filter origin detection error

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C.4 Other Hardware Errors

No.	Error message	Status	Factor
	Backup Memory SUM Check ? Wrong		An error was detected in backup memory during initialization.
	Motor Self Check ? Wrong		An error occurred in the mirror motor during initialization.
	LD Self Check ? Wrong		An error occurred in an optical module during initialization.
	MCIC Error		An error occurred in the mirror motor.
	Error of APC		An error occurred in APC.

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Performance Test Result Record Sheet

Model type MG9637A

Manufacture No.

Tested on Month, day, year , ,

Temperature ˚C

Humidity %

Air pressure hPa

Person in charge

◎ Wavelength accuracy Standard ± 0.1nm or less

Set wavelength	Measured wavelength	Error	Decision
1500. 000 nm	. nm	. nm	Passed, Rejected
1540. 000 nm	. nm	. nm	Passed, Rejected
1550. 000 nm	. nm	. nm	Passed, Rejected
1580. 000 nm	. nm	. nm	Passed, Rejected

◎ Side mode suppression rate

Set wavelength	Standard	Side mode suppression rate	Decision
1500. 000 nm	40 dB or more	. dB	Passed, Rejected
1520. 000 nm	45 dB or more	. dB	Passed, Rejected
1550. 000 nm	45 dB or more	. dB	Passed, Rejected
1570. 000 nm	45 dB or more	. dB	Passed, Rejected
1580. 000 nm	40 dB or more	. dB	Passed, Rejected

◎ Maximum output level

Set wavelength	Standard	Maximum output level	Decision
1500. 000 nm	−13 dB or more	. dBm	Passed, Rejected
1520. 000 nm	−10 dB or more	. dBm	Passed, Rejected
1570. 000 nm	−10 dB or more	. dBm	Passed, Rejected
1580. 000 nm	−13 dB or more	. dBm	Passed, Rejected

◎ Monitor laser output level

Set wavelength	Standard	Monitor laser output level	Decision
1500. 000 nm	−10 dB or more	. dBm	Passed, Rejected
1550. 000 nm	−10 dB or more	. dBm	Passed, Rejected
1580. 000 nm	−10 dB or more	. dBm	Passed, Rejected

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Performance Test Result Record Sheet

Model type MG9638A

Manufacture No.

Tested on Month, day, year , ,

Temperature °C

Humidity %

Air pressure hPa

Person in charge

◎ Wavelength accuracy Standard ± 0.1nm or less

Set wavelength	Measured wavelength	Error	Decision
1500. 000 nm	. nm	. nm	Passed, Rejected
1540. 000 nm	. nm	. nm	Passed, Rejected
1550. 000 nm	. nm	. nm	Passed, Rejected
1580. 000 nm	. nm	. nm	Passed, Rejected

◎ Side mode suppression rate

Set wavelength	Standard	Side mode suppression rate	Decision
1500. 000 nm	35 dB or more	. dB	Passed, Rejected
1520. 000 nm	40 dB or more	. dB	Passed, Rejected
1550. 000 nm	40 dB or more	. dB	Passed, Rejected
1570. 000 nm	40 dB or more	. dB	Passed, Rejected
1580. 000 nm	35 dB or more	. dB	Passed, Rejected

◎ Maximum output level

Set wavelength	Standard	Maximum output level	Decision
1500. 000 nm	− 5 dB or more	. dBm	Passed, Rejected
1510. 000 nm	0 dB or more	. dBm	Passed, Rejected
1520. 000 nm	+4 dB or more	. dBm	Passed, Rejected
1570. 000 nm	+4 dB or more	. dBm	Passed, Rejected
1580. 000 nm	−5 dB or more	. dBm	Passed, Rejected

◎ Monitor laser output level

Set wavelength	Standard	Monitor laser output level	Decision
1500. 000 nm	−10 dB or more	. dBm	Passed, Rejected
1550. 000 nm	−10 dB or more	. dBm	Passed, Rejected
1580. 000 nm	−10 dB or more	. dBm	Passed, Rejected

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