AS-61460

INSTRUCTION MANUAL

TYPE AQ-4304

PROGRAMMABLE LIGHT SOURCE

ANDO ELECTRIC CO., LTD.

Tokyo, Japan

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SECTION 1

GENERAL INFORMATION

1.1 INTRODUCTION

This instruction manual contains information required for proper operation and maintenance of Type AQ-4304 Programmable Light Source (which will be referred to as the apparatus or AQ-4304 in this manual).

1.2 GENERAL

This apparatus is used as the light source in various spectrophotometric operations. It has a built-in monochromator which uses a diffraction grating as a dispersion element. The apparatus permits settings to be made either manually from its front panel or by program using an external controller connected to it via a GP-IB. When used in combination with an optical power meter, it enables measurement of optical loss wavelength characteristics on optical fiber cables and other optical devices. Either an appropriate optical power meter in your possession or the one listed in Table 1-2 may be used.

1.3 SPECIFICATIONS

The specifications and performance characteristics of this apparatus are listed in Table 1-1. The procedures for performance tests to be made to check whether the apparatus performs according to specifications are described in Section 5.

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1.4 COMPOSITION

This apparatus is supplied with the standard accessories listed in the table at the end of this manual.

Table 1-1 Specifications

Wavelength range	:	600-1600 nm in 1 nm steps
Resolution	:	1-15 nm in 1 nm steps
Wavelength accuracy	:	±5nm
Output level	:	-45 dBm or more [for input via GI50/125 fiber cable at the wavelength (700 - 1500nm) with a resolution of 15nm and CW light]
Luminous element	:	Tungsten helogen lamp
Optical connector	:	Via FC type optical connector
Power requirements	:	*** V±10% AC, about 180 VA
Dimensions and weight:		
Dimensions	:	About 132.5 (H) x 425 (W) x 300 (D) mm
Weight	:	About 13 kg

Table 1-2 Devices for combined use

Name	Rating	Qty	Ando's model
Optical power meter	Wavelength range: 400-1700 nm Optical power measuring range: -90 to +10 dBm (Ratings vary with the sensor type.)	1	Type AQ-1135E Optical Power Meter
GP-IB card	For AQ-1135E (Factory option)	1	Type AQ-1964E GP-IB Card
Optical sensor	Wavelength range: 700-1600 nm Receivable optical power range: -80 to 0 dBm (at 1300 nm)	1	Type AQ-1965 Sensor
	Wavelength range: 400-1100 nm Receivable optical power range: -90 to 0 dBm (at 850 nm)	1	Type AQ-1966 Sensor

NOTE: The optical connector of this apparatus can be changed as an option at the factory. To connect an optical fiber cable attached with a plug other than FC type, use a J-J converter.

SECTION 2

PREPARATION FOR USE

2.1 INTRODUCTION

This section deals with the procedures for unpacking, acceptance inspection and repacking.

2.2 UNPACKING AND ACCEPTANCE INSPECTION

This apparatus has been factory inspected, mechanically and electrically, prior to shipment to insure that it gives satisfactory performance. When it is received, promptly unpack and check it for damage sustained in transit.

When unpacking the apparatus, save the wooden box, corrugated cardboard box, cushions, and other packing materials except consumables like steel bands and wrapping paper where possible so that they may be reused when the apparatus is to be packed again for shipment.

2.2.1 Mecahnical Inspection

Visually inspect the apparatus for damage or deformation. Check the switches, knobs, and other parts exposed to view for looseness, rough movement or other faults. Check the types and quantities of accessories and spares against the packing list.

2.2.2 Performance Test

If the apparatus is found by the mechanical inspection to be in good order externally, then test it according to the procedures described in Section 5 to check its performance for compliance with the specifications set forth in Table 1-1.

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2.3 DAMAGE OR FAULT

If the apparatus is found damaged or faulty in the acceptance inspection, immediately report the damage or fault to the nearest dealer.

2.4 REPACKING

When repacking the apparatus, use the packing materials, if saved for later use. If they have not been saved, repack the apparatus exercising care as suggested below.

(1) Wrap the apparatus in strong paper like tarpaulin paper or vinyl sheeting. Protect all the protrusions with cushions against damage.

(2) Place the wrapped apparatus in a wooden or cardboard box which is larger by about 10 cm than the apparatus on all sides.

(3) Fill all open spaces between the apparatus and the box with polyurethane foam or any other suitable cushioning material.

The apparatus may rattle and be damaged in transit, if cushioning is insufficient.

(4) Cover the wooden box and brace it up with steel bands.

If a corrugated cardboard box is used, seal it with adhesive tape.

(5) Indicate the contents and shipping marks in a legible and durable way.

SECTION 3

OPERATION

3.1 INTRODUCTION

This section contains the procedures for operation of the apparatus.

3.2 NAMES AND FUNCTIONS OF PANEL CONTROLS

Figures 3-1-1 and 3-1-2 show the arrangements of the front and rear panel controls, respectively. The control names and functions are given in Tables 3-1-1 and 3-1-2. It is recommended that the operator familiarize himself with the names of panel controls indicated therein, as they will be used throughout this manual.

The letters or symbols in brackets indicate the markings (operation and setting indicators, etc.) of controls located on the front and rear panels of the apparatus.

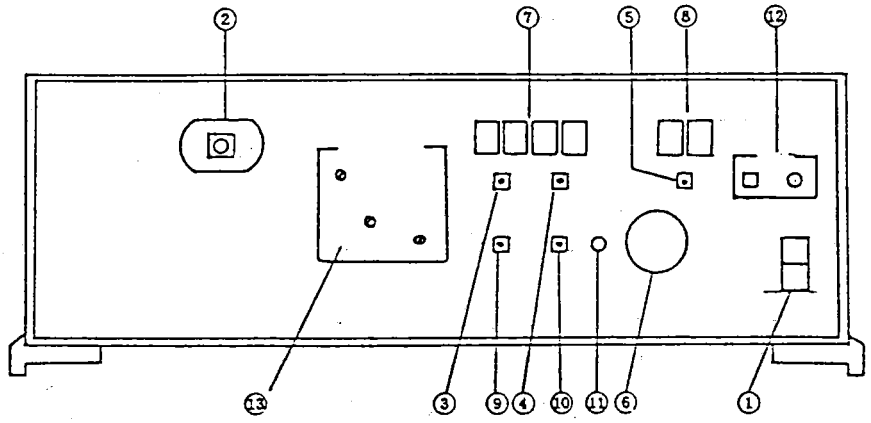

Fig. 3-1-1 Control arrangement of front panel

Table 3-1-1 Front panel controls

No.	Marking	Name	Function	
①	[POWER] [ON], [OFF]	Power switch	Setting this switch to [ON] and [OFF] turns on and off the power to the apparatus.	
②	[OPTICAL OUTPUT] [(600 ∿ 1600nm)]	Optical connector	The light of the set wavelength is output through this connector.	
③	[ENTRY]	Wavelength setting switch 1	This switch enables the top two digits of a 4-digit wavelength value to be set using the rotary encoder ⑥.	Of these three switches, only the pressed one with its LED on is effective.
④		Wavelength setting switch 2	This switch enables the last two digits of a 4-digit wavelength value to be set using the rotary encoder ⑥.	
⑤		Resolution setting switch	This switch enables a 2-digit resolution value to be set using the rotary encoder ⑥.	
⑥		Rotary encoder	Turning this rotary encoder changes the wavelength or resolution setting whichever corresponding to the one with LED on among the three switches ③ - ⑤. (Turn this switch clockwise to increase, or counterclockwise to decrease, the setting.)	
⑦	[WAVELENGTH] [nm]	Wavelength indicator LED	LEDs to indicate the wavelength setting in nm.	
⑧	[RESOLUTION] [nm]	Resolution indicator LED	LEDs to indicate the resolution setting in nm.	
⑨	[OUTPUT] [ON/OFF]	Output switch	Setting this switch to [ON] (LED lights) causes the light of the set wavelength to be output to the optical connector. Setting it to [OFF] shuts off the light output.	
⑩	[CW/270Hz]	CW-chop selection switch	This switch with its LED on indicates that CW light has been selected. When its LED is off, it indicates that the light chopped at 270-Hz has been selected.	

No.	Marking	Name	Function
⑪	[READY]	Ready lamp	This lamp remains off until the indicated wavelength has been internally set. This lamp being on indicates that the apparatus is ready for measurement.
⑫	[GP-IB] [LOCAL] [REMOTE]	GP-IB	While the [REMOTE] lamp is on, panel operations are not performable. Local control is enabled when the REMOTE status is reset by pressing the [LOCAL] switch. The [LOCAL] switch does not function in the LOCAL LOCK OUT status.
⑬	[LAMP ADJ]	Fine adjustment knobs	These fine adjustment knobs are used to maximize the optical output by adjusting the light source with respect to the X, Y and Z axes.

Rear panel

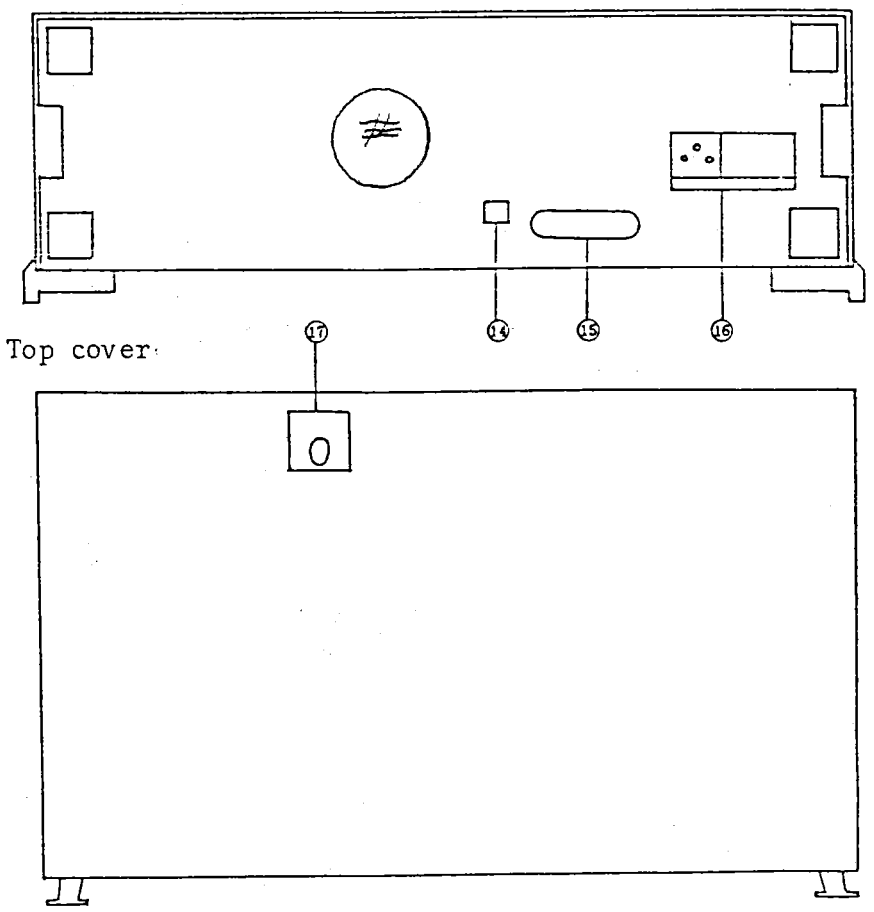

Fig. 3-1-2 Control arrangement on rear panel, and top cover

Table 3-1-2 Rear panel controls, and top cover

No.	Marking	Name	Function
⑭	[ADDRESS] [54321] [$^{1}_{0}$]	Address switch	Used to set the GP-IB address.
⑮	[GP-IB]	GP-IB connector	Used to connect an external controller to the apparatus via the GP-IB.
⑯	[LINE]	Power connector	Used to connect the power cord.
⑰		Cover	This cover can be opened when replacing the lamp.

3.3 PREPARATION

3.3.1 Power Supply

Before connecting the apparatus to the power outlet, make sure that the line voltage agrees, as indicated in Table 3-2, with the operating voltage indication visible through the opening in the power connector ⑯.

Also, ascertain that a fuse of the corresponding capacity has been set.

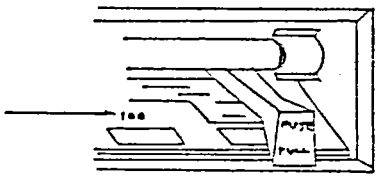

Fig. 3-2 Operating voltage indication

Table 3-2 Line voltage and fuse

Operating voltage indication	Suitable line voltage	Fuse capacity
100 V	100 V	3.15 A
120 V	115 to 120 V	3.15 A
220 V	220 V	2 A
240 V	230 to 240 V	2 A

If the line voltage does not agree with the operating voltage indication, change the operating voltage using the procedure described in Fig. 3-3.

Operating voltage changing procedure:

1. Slide the cover door to the left and, pulling the [FUSE PULL] lever, turn it counterclockwise to take out the fuse.
2. Pull out the voltage selection card and firmly push it back in the position with the desired voltage indication facing up on its left-hand side.
3. Push back the [FUSE PULL] lever, set an appropriate fuse and close the cover.

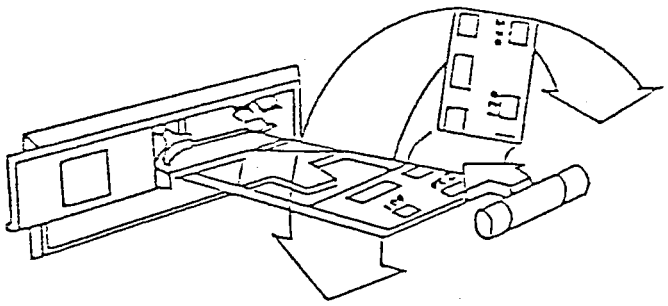

Fig. 3-3 Changing the operating voltage setting

3.3.2 Power Cord Connection

Connect the power cord to the power connector (16) on the rear panel in the correct position as shown in Figure 3-4; then plug the other end of the power cord into the power outlet.

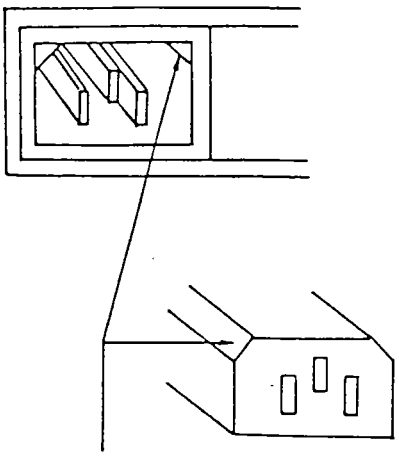

Fig. 3-4 Power cord connection

3.3.3 Switching On

Setting the power switch (1) on the front panel to [ON] causes the [CW/270Hz] switch to light and the indicator LEDs to indicate [WAVELENGTH] 850 [nm] and [RESOLUTION] 15 [nm]. When the initial settings have been made, the [READY] lamp (11) lights to indicate that the apparatus is ready for measurement.

3.4 OPERATING PROCEDURES

3.4.1 Fine Adjustment

Replacing the lamp causes the optical axis to be shifted and the optical output level to lower. To maximize the optical output, correctly adjust the optical axis using the fine adjustment knobs (13). To adjust the optical axis, connect this apparatus and an optical power meter (short wavelength sensor) with an appropriate optical fiber cable, and set the [POWER] switch to [ON]. After the [READY] lamp has lit, set the [OUTPUT] switch to [ON] and adjust the optical axis.

3.4.2 Wavelength Setting

For wavelength setting, use the two switches (3) and (4), and the rotary encoder (6). First, press the switch (3); its LED lights to indicate that the first two digits of a desired wavelength value may be set using the rotary encoder (6). After setting the first two digits, press the switch (4) and set the last two digits. The wavelength setting range is from 600 to 1600 [nm].

3.4.3 Resolution Setting

For resolution setting, press the switch (5) and set a desired value in the range of 1 to 15 [nm] using the rotary encoder (6).

3.4.4 Other Settings

To output light, set the [OUTPUT] switch to [ON]. Also, select either CW or 270 Hz depending on the types of the optical power meter and optical sensor to be used in combination with this apparatus.

3.4.5 Remote Control

Connect an appropriate external controller, which is capable of performing control functions via a GP-IB, to the [GP-IB] connector (15) located on the rear panel of this apparatus via the GP-IB cable. The [ADDRESS] switch for GP-IB address setting is also located on the rear panel. It has been factory set to 5 (switches 1 and 3 set to ON).

1) Control format with this apparatus designated as listener

Wavelength

Wxxxx: For example, wavelength of 600 nm = W0600 or W␣600

Resolution

Rxx : For example, resolution of 5 nm = R05 or R␣5

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Output

ON : OUTPUT ON

OFF: OUTPUT OFF

CW/270Hz selection

CW : CW

CP : 270 Hz

SRQ request

E : SRQ enabled

D : SRQ diseabled

Continuous reception

For example: 800nm, RES10nm, 270Hz

W⌐800, R10 CP

Commas may be omitted to directly connect adjoining data, or they may be replaced with other codes.

2) Control format with this apparatus designated as talker

For example: W1200, R15, ON, CW, RDY

RDY is for the [READY] lamp (11) being on. If the lamp is off, BSY is output instead of RDY.

NOTE: "␣" represents a blank.

3.4.6 Sample Application System

Figure 3-5 shows an optical loss characteristics measurement system incorporating this apparatus. The other devices included in the system are those listed in Table 1-2 presented in Section 1.

To measure the optical loss characteristic of an optical fiber cable, first connect a reference fiber cable between this apparatus and the Type AQ-1135E Optical Power Meter

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and measure its wavelength characteristic. Next, connect the optical fiber cable to be tested and measure its wavelength characteristic; then record the difference between the two measurements.

When measuring the wavelength characteristic of the reference fiber cable, use dummy fibers and mode cutters as required to eliminite the clad mode.

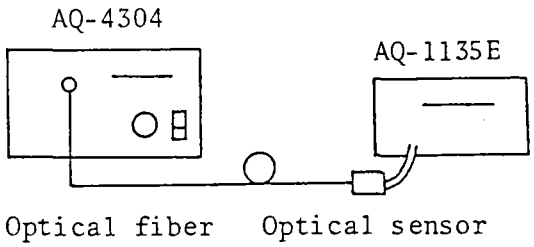

Fig. 3-5 Optical loss characteristics measurement system

CAUTION

(1) When the [POWER] switch is set to [ON], the tungsten halogen lamp lights. Do not directly look at it; directly looking at such a dazzling light is bad for the eyes.

(2) The tungsten halogen lamp becomes very hot. When replacing the lamp, set the [POWER] switch to [OFF] and allow the lamp to cool down.

(3) This apparatus is usable for measurement only with its READY lamp on.

SECTION 4

CIRCUITRY AND CONSTRUCTION

4.1 INTRODUCTION

This section contains general information on the circuitry and construction of this apparatus.

4.2 CIRCUITRY

The schematic circuit diagram of this apparatus is shown in Drawing K-61460. Figure 4-1 shows the circuit construction. The CPU controls the motor operations according to the settings made on the front panel.

The optical filter, slit and grating are driven by the corresponding motors that receive pulse signals equal to the numbers stored in memory based on the corresponding settings.

The optical chopper driving motor runs at the speed determined to switch the optical output on and off at 270 Hz.

The optical filter to eliminate higher-frequency light is automatically selected according to the optical wavelength as follows:

600-900 nm: Filter to cut off light of wavelength shorter than 600 nm is used.

900-1600 nm: Filter to cut off light of wavelength shorter than 900 nm is used.

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4.3 CONSTRUCTION

The external view and shape of the apparatus are shown in Drawing ASD-61460. Figure 4-2 shows the internal layout of the apparatus.

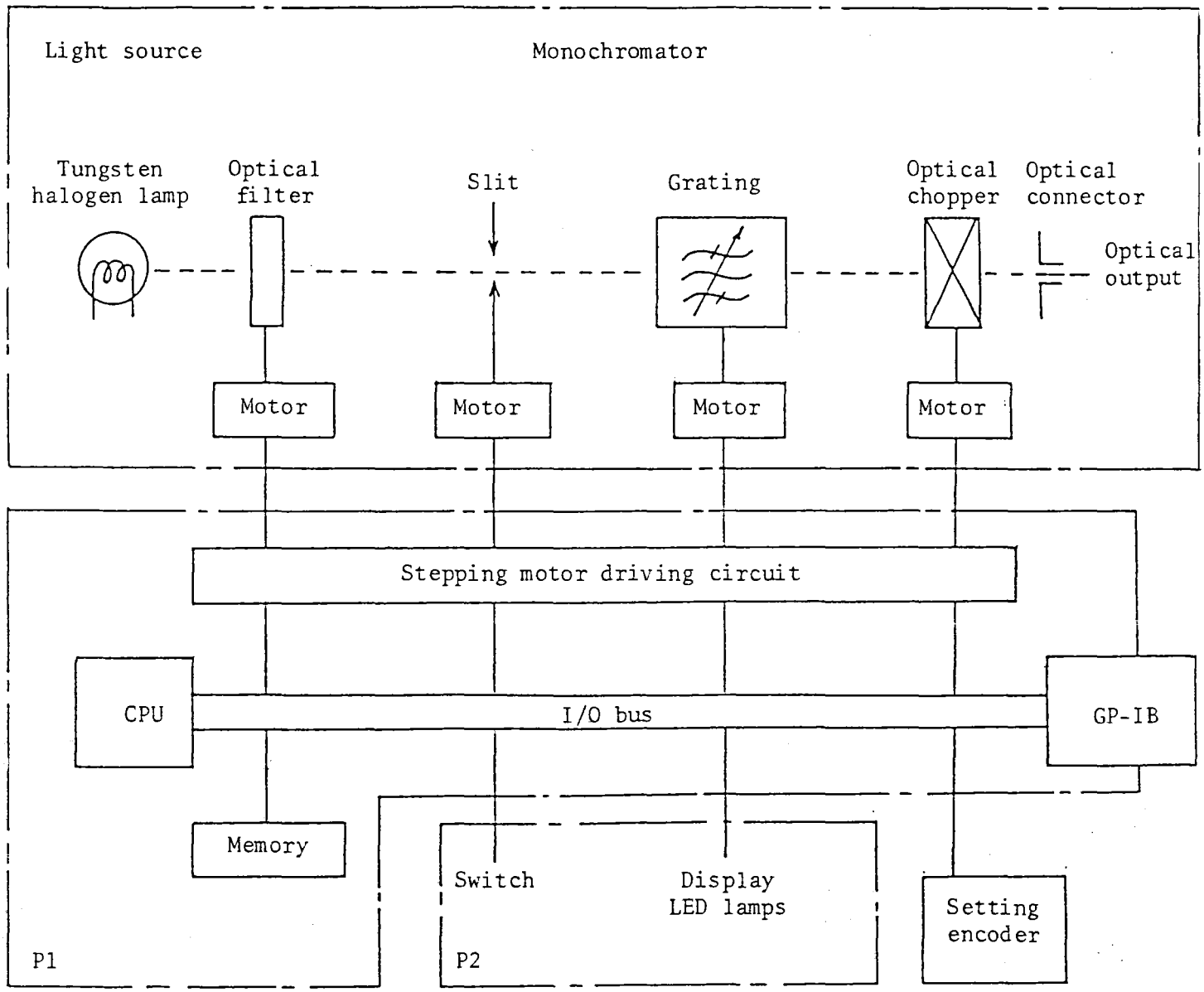


Fig. 4-1 Circuit construction

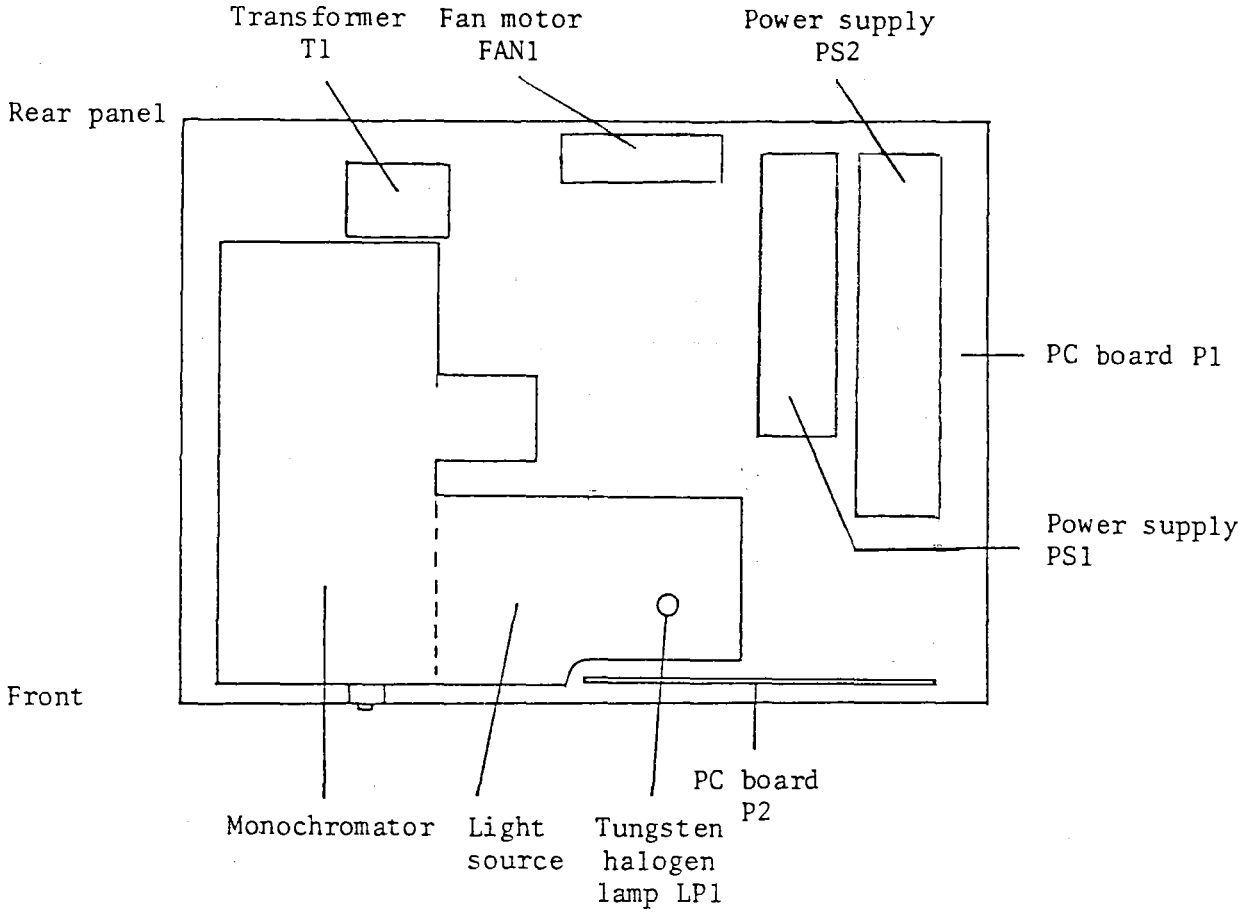


Fig. 4-2 Internal layout

SECTION 5

MAINTENANCE

5.1 INTRODUCTION

This section deals with the procedures for periodical inspection, performance test, and simple repairs required to obtain optimum performance from this apparatus.

5.2 TESTING INSTRUMENTS

The testing instruments required for the testing, maintenance and repairs of the apparatus are listed in Table 5-1. The performance characteristics listed in Table 5-1 represent the minimum requirements with which the testing instruments are expected to comply. Two or more instruments may be used together to cover the measurement range, if it cannot be entirely covered by any one instrument on hand.

5.3 PERIODICAL INSPECTION

The apparatus is designed to give stable and reliable service. Perform periodical inspection about once a year (complying with Section 5.5 "Performance Test").

5.4 LAMP REPLACEMENT

The life of the high-intensity halogen lamp is about 50 hours; it burns out after about 50 hours in use. It can be replaced by opening the top cover of the apparatus. Before replacing it, switch off the apparatus and make sure that the lamp has

2/

cooled down. After replacing the lamp, readjust the optical axis with the fine adjustment knobs before starting measurement again.

5.5 PERFORMANCE TEST

The performance test is carried out to check the performance of the apparatus against the specifications. It should be performed at the time of acceptance inspection, periodical inspection or inspection after repair or lamp replacement.

5.5.1 Wavelength Accuracy

Connect this apparatus and an optical spectrum analyzer with an optical fiber cable. Changing the wavelength setting on this apparatus from 600 nm to 1600 nm in 20 nm steps, read the peak wavelength indicated by the optical spectrum analyzer at each step. Check the readings against the wavelength accuracy specification of this apparatus.

5.5.2 Output Level

Connect this apparatus and an optical power meter via an optical fiber cable and an optical sensor, and set the resolution to 15 nm. Changing the wavelength setting on this apparatus from 700 nm to 1500 nm in 20 nm steps, measure the optical power at each step. Check the measurements against the specifications of this apparatus.

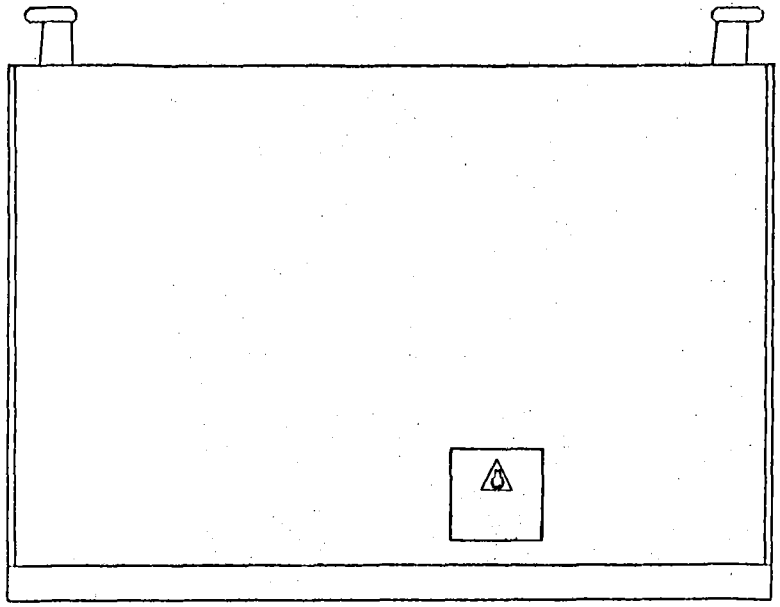
5.5.3 If the performance test results do not meet the specifications, contact your dealer immediately.

Table 5-1 Testing instruments

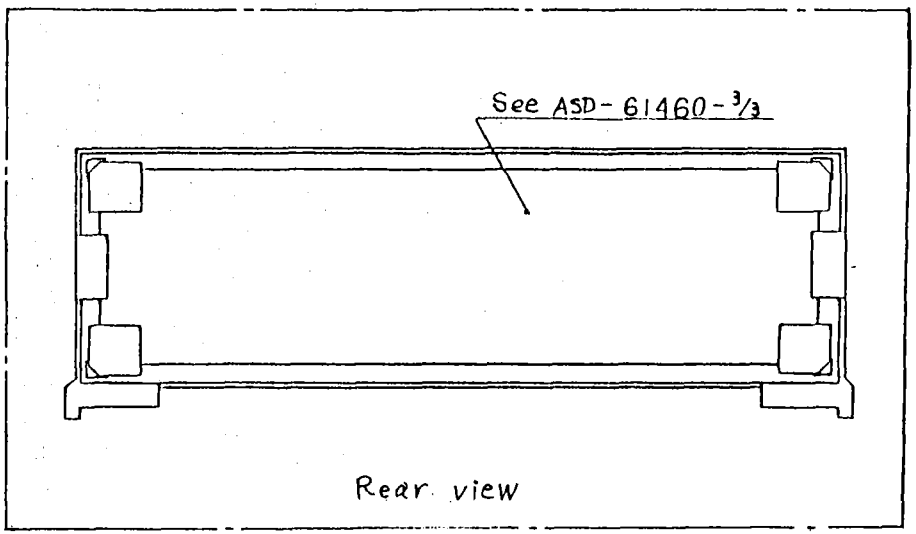
Name	Performance requirement	Ando's model
Optical spectrum analyzer	Wavelength range and accuracy: 400-1600 nm, ±1 nm Input level: -55 dBm or more	Type AQ-1425 Optical Spectrum Analyzer
Optical Power meter and optical sensor	Wavelength range: 400-1600 nm Input level: -60 dBm or more	Type AQ-1135E Optical Power Meter Type AQ-1965 Sensor Type AQ-1966 Sensor

Standard accessories

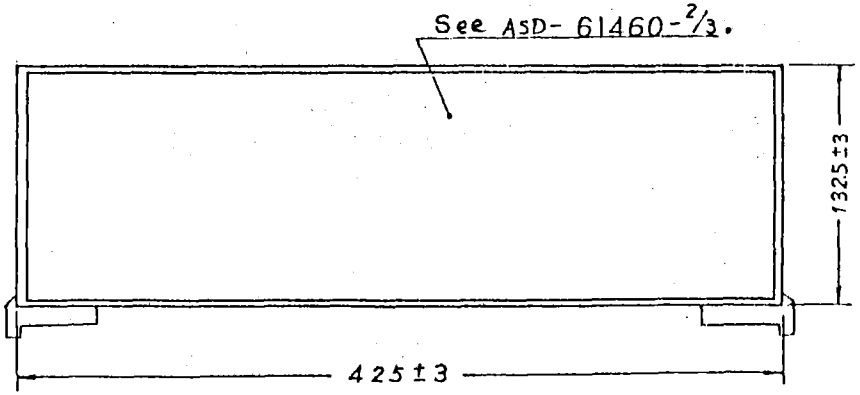
Accessory name	Qty	Remarks
Power cord	1	3 m long
Tungsten halogen lamp	6	12 V, 50 W. 1 for use + 5 spares
Fuse	2	1 for use + 1 spare
Instruction manual	1	



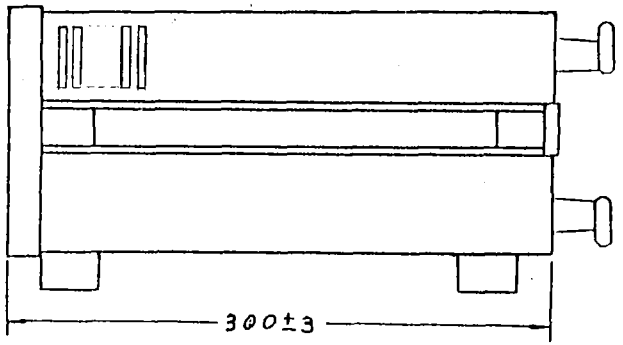
Top view



Rear view

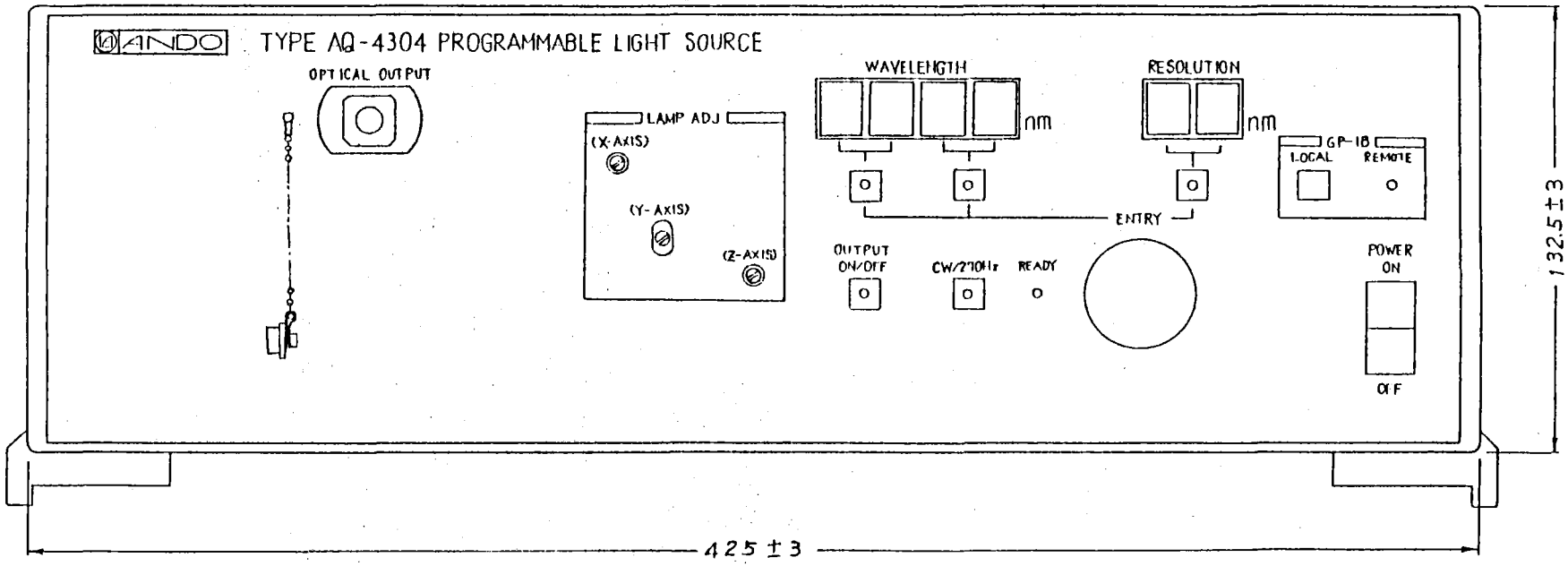


Front view



Side view

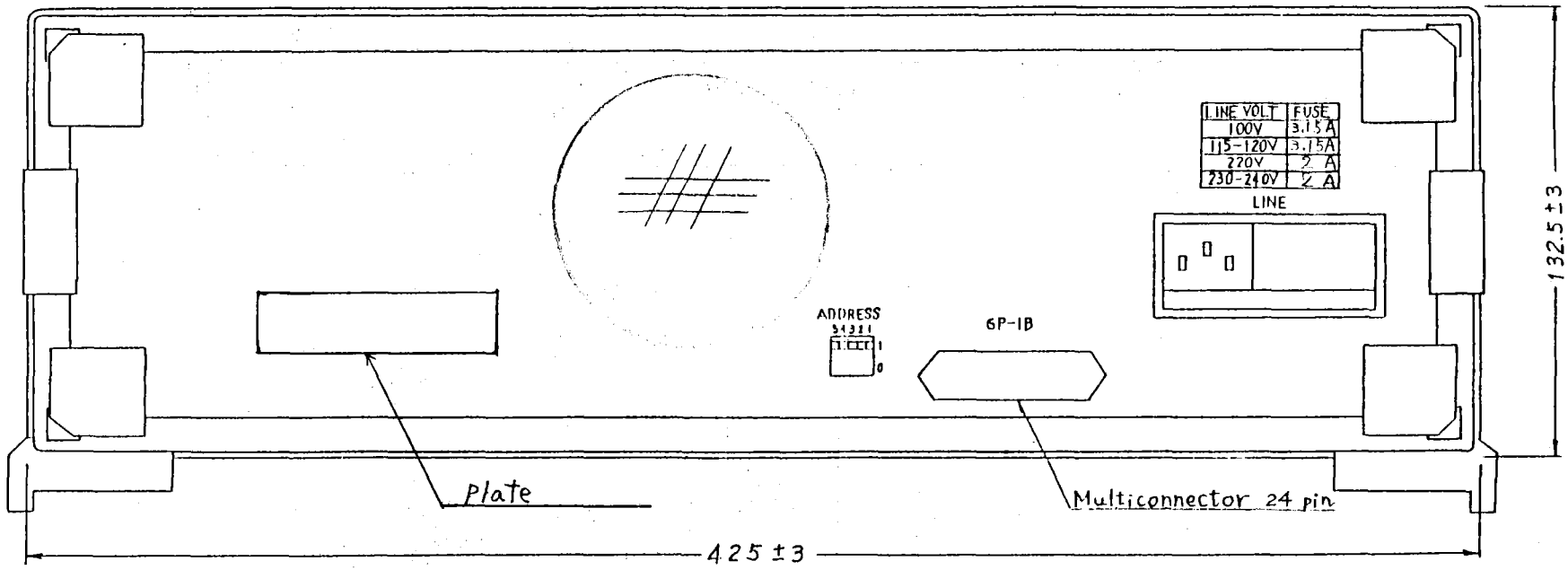
EXTERNAL VIEW ASD-61460-1/3



Depth 300±3

FRONT PANEL VIEW

ASD-61460-2/3



REAR PANEL VIEW