

INSTRUCTION MANUAL

LS - 601A

Tunable LD Light Source

Koshin Kogaku Co., Ltd.

Safety Summary

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

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

• Warning Labels

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

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

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

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

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

• Basic Precautions

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

- Use a power cable rated for the voltage in question. Be sure however to use a power cable conforming to safety standards of your nation when using a product overseas.
- When inserting the plug into the electrical outlet, first turn the power switch OFF and then insert the plug as far as it will go.
- When removing the plug from the electrical outlet, first turn the power switch OFF and then pull it out by gripping the plug. Do not pull on the power cable itself. Make sure your hands are dry at this time.

- Before turning on the power, be sure to check that the supply voltage matches the voltage requirements of the product.
- Be sure to plug the power cable into an electrical outlet which has a safety ground terminal. Grounding will be defeated if you use an extension cord which does not include a safety ground terminal.
- Be sure to use fuses rated for the voltage in question.
- Do not use this product with the case open.
- Do not place objects on top of this product. Also, do not place flower pots or other containers containing liquid such as chemicals near this product.
- When the product has ventilation outlets, do not stick or drop metal or easily flammable objects into the ventilation outlets.
- When using the product on a cart, fix it with belts to avoid its drop.
- Which connecting the product to peripheral equipment, turn the power off.

• **Caution Symbols Used Within this Manual**

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

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

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

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

• **Safety Marks on the Product**

The following Safety marks can be found on KOSHIN KOGAKU products.



Caution - Refer to manual



PROTECTIVE CONDUCTOR TERMINAL



Earth(ground) TERMINAL

• **Precautions when Disposing of this Product**

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

Harmful substances : (1) PCB (polycarbon biphenyl)
(2) Mercury
(3) Ni-Cd (nickel cadmium)
(4) Other

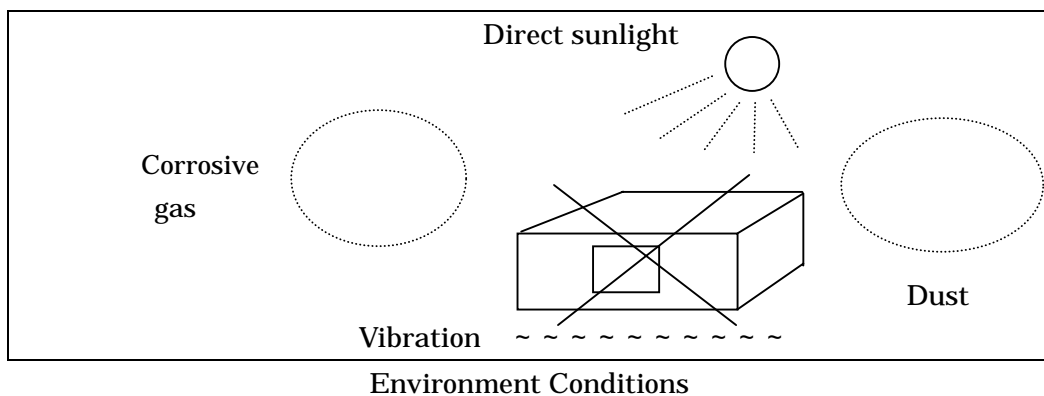
Items possessing cyan, organic phosphorous and hexadic chromium and items which may leak cadmium or arsenic (excluding lead in solder) .

Example : fluorescent tubes, batteries

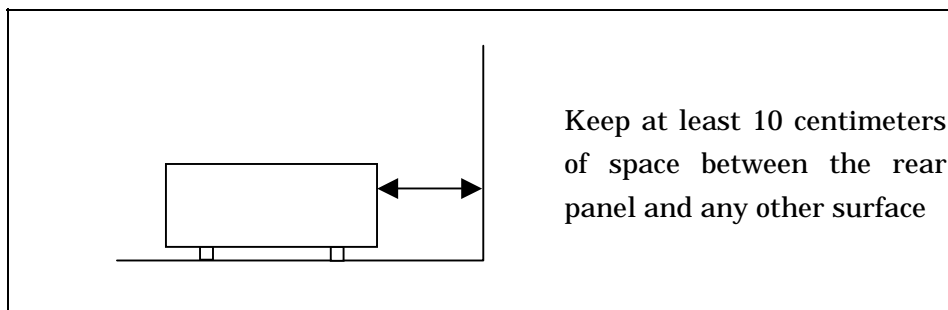
Environmental Conditions

This product should only be used in an area which satisfies the following condition:

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



- Product Placement



This product can be used safely under the following conditions:

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

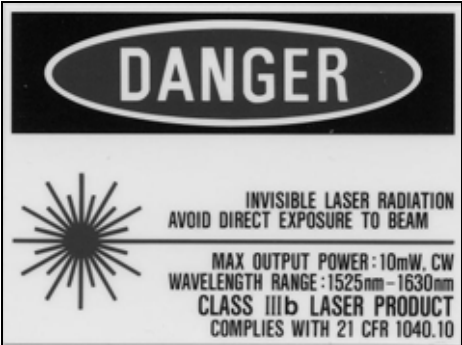
CAUTIONS ON USING THE LS-601A

1. Information for the Safety of Laser Used in the LS-601A


Laser Type	Fabry Perot-Laser	
Laser Class	b : 21CFR 1040.10 (USA) 3A : IEC 825+A1(Non-USA)	
Permissible Output Power	< 10mW	
Beam Diameter	9 μm	
Numerical Aperture	0.1	
Wavelength	LS-601A-15	1520 ~ 1590nm
	LS-601A-16	1580 ~ 1650nm
	LS-601A-56	1525 ~ 1630nm

2. Laser Warning Labels

The following laser warning labels are used on this instrument.




Affixed on top of the instrument
(see 'a' on top the instrument).




Affixed on top of the instrument
(see 'c' on top the instrument).

Class b laser product label : For the U.S.A. only



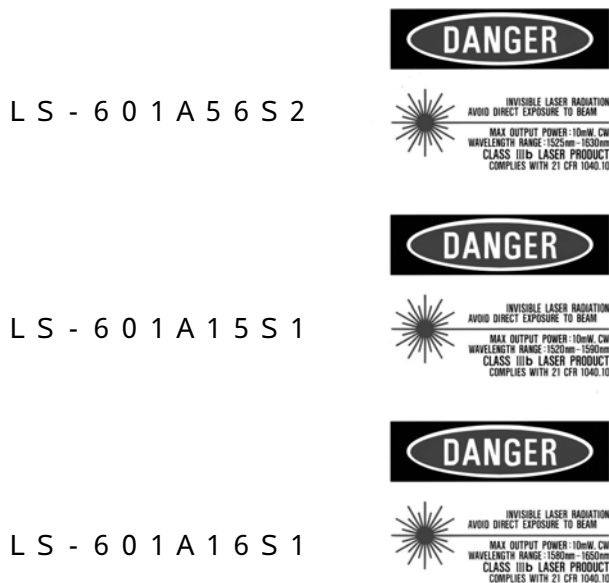
Affixed on front of the instrument
(see 'b' on top the instrument).



Affixed on front of the instrument
(see 'd' on top the instrument).

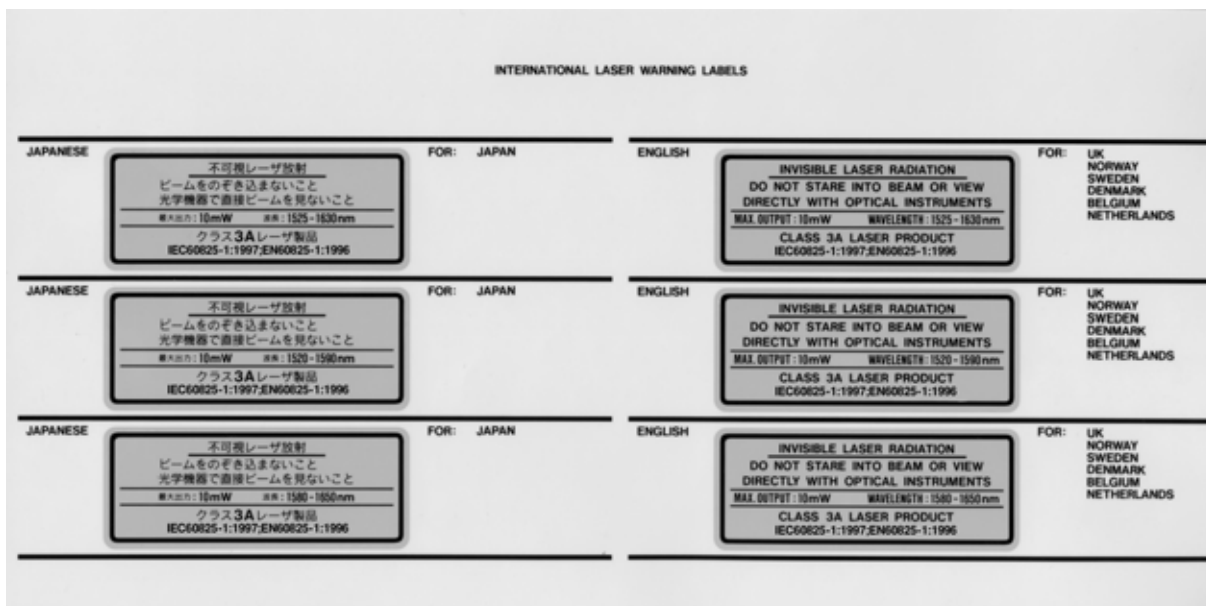
Class 3A laser product label : For all countries except the U.S.A.

Class 3A laser product label is provided as a standard accessory.
Please attach the label that was in the following specification when LS-601A is used in U.S. to the position of 'a' of the upper part panel.



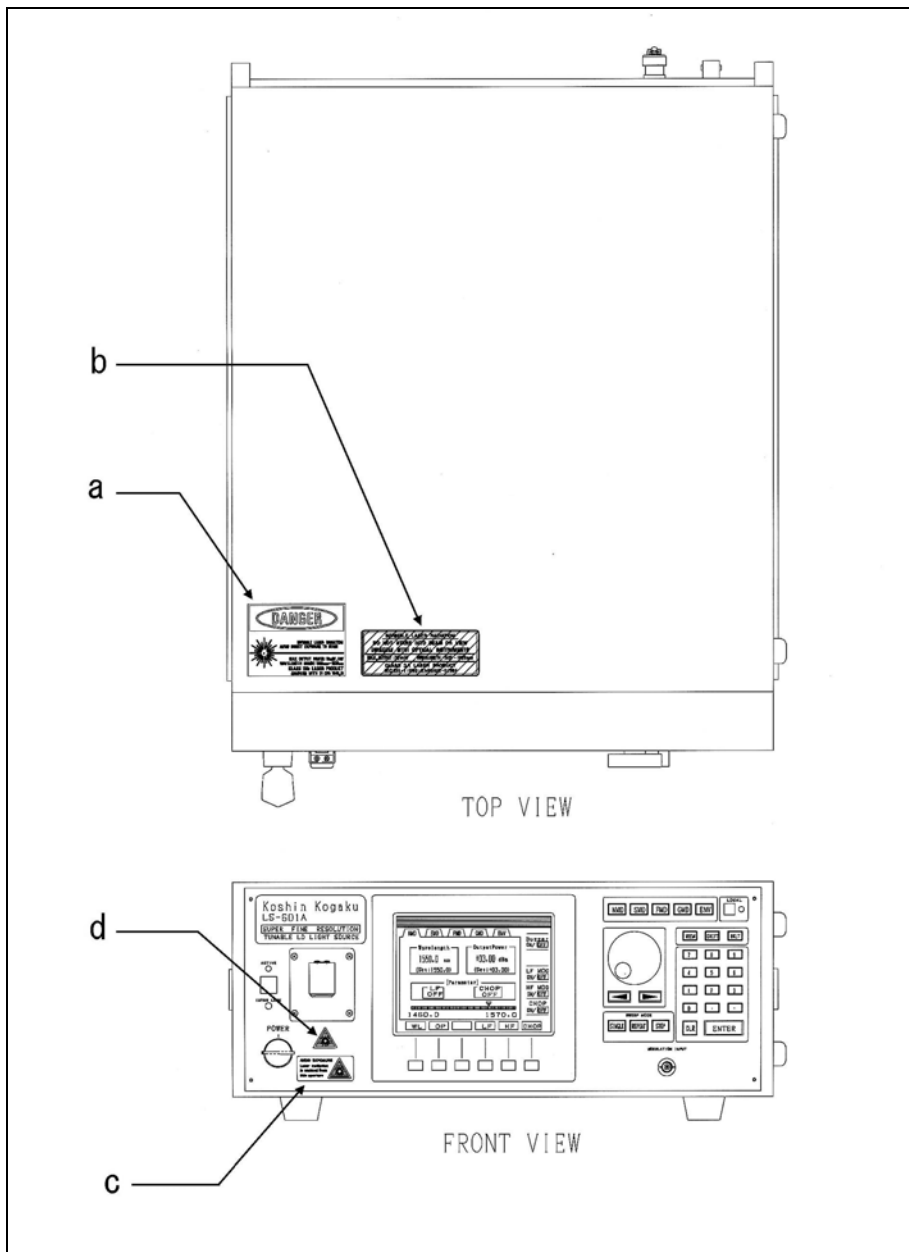
Class 3B laser product label

Also, Class 3A laser product label is provided as a standard accessory.
A class 3A laser product label which corresponds to the country where this instrument is used must be affixed on top of the instrument as marked with 'b'.



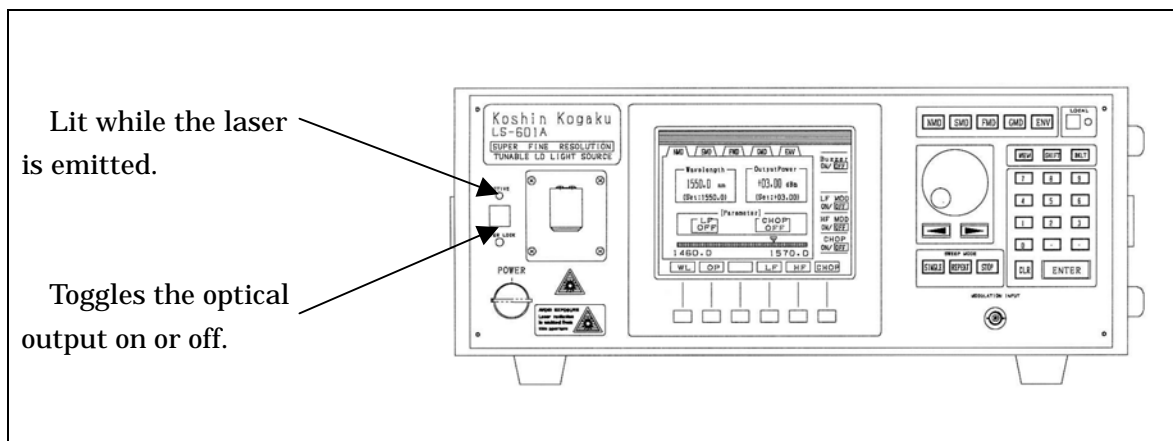
Class 3A laser product label

The position, which pastes each label on the product, is as follows.



3. Warning on the Laser

1. Never attempt to emit a laser beam when no fiber is connected to the optical output connector on the front panel.



2. Never attempt to look into the optical output connector to observe the emitted laser beam. While the laser beam is emitted, never attempt to look into the optical fiber cord at the end, because an invisible light is emitted. The invisible light may seriously damage your eyesight.
3. Never attempt to look into the optical output connector or the end of optical fiber cord to observe the emitted laser beam using an optical instrument. Your eyesight may be seriously damaged.
4. Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
5. Do not attempt to open the unit. The unit should be serviced only by KOSHIN KOGAKU representatives. KOSHIN KOGAKU assumes no responsibility for any damage caused by unauthorized service.

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1 INTRODUCTION

1.1 SUMMARY

This equipment is composed of external-cavity tunable semiconductor laser consist of a Fabry-Perot LD as gain media and a highly efficient interference band pass filter as a wavelength selector.

This equipment is characterized by the following features:

- High output power
- Wide tunable range
- Sufficient suppression of spontaneous emission
- Light and compact
- Output power and wavelength stability
- Low price

NOTE: In order to bring out the potential of this equipment (resolution of wavelength: 0.0001nm) sufficiently, the optical reflection through the measurement system have to be kept quite low.

Therefore, an angle-polished optical fiber cable is attached to this equipment and the use of it as a terminal is recommended, for example, in case the output power is monitored by an optical power meter.

1.2 ACCESSORIES

Please checking quantity and norm about accessories according to table 1-1.

Table 1-1. Standard accessories

Items		Quantity	Note
Power cable		1	
Fuse	TDU-5A (T-5A, 250V)	2	It uses only in Japan and U.S.A.
	TDI-5A (T-5A, 250V)	2	It uses in all countries except for Japan and U.S.A.
Angle-polished optical fiber cable		1	<u>Angle-polished (one side only)</u> <u>(Green connector: angle-polished)</u>
Instruction manual		1	

1.3 POWER SUPPLY

- (1) Turn off the power switch, when connect the plug of the power cord with the power outlet.
- (2) In case the fuse has blown, find the cause. If the fuse itself is the cause, replace it

as follows:

1. Turn off the power switch.
2. Pull the plug of the power cord from the AC LINE connector.
3. Remove the fuse holder under the AC LINE connector on the rear panel using a portable - screwdriver.
4. Confirm the fuse has been cut by the extra-flow of current, and change a new fuse which satisfy the requirement as follows:

Table 1-2 Fuse

Model	Voltage rating	Ampere rating	Note
TDU-5A	250V	T5A	It uses only in Japan and U.S.A.
TDI-5A	250V	T5A	It uses in all countries except for Japan and U.S.A.

WARNING: The protective earth grounding on this equipment must be maintained to provide protection from electric shock.

1.4 ENVIRONMENTAL CONDITIONS

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

- Ambient temperature: +10 ~ +35 (Operating temperature)
- Relative humidity: 85% or less (without condensation)
- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibration
- A low noise area(When ambient noise is unavoidable, use a noise cut filter.)
- An area allowing unobstructed air flow
- An area allowing unobstructed air flow

Also, the equipment can be used safely under the following conditions:

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

1.5 PRECAUTION FOR USE

- (1) This equipment has cooling fan in rear panel for adjust the inside temperature.

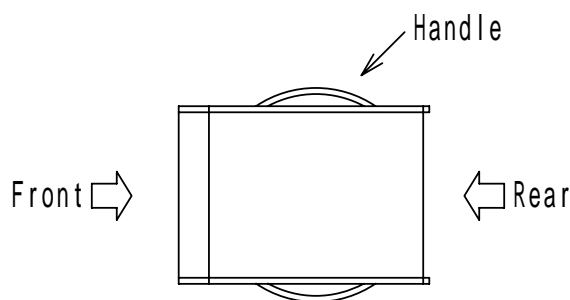
Give care to surrounding ventilation and these openings must not be

blocked or covered.

- (2) This equipment builds in a precision mechanism. So horizontal use only is available. And do not put anything on this equipment.
- (3) Age the equipment for more than 60 minutes until the operation becomes stable. And further in the cold region, press the power switch after checking this equipment is warmed at room temperature(10-30).
- (4) In case of transport, use packing materials when this equipment is delivered.

If there is no packing materials, prepare the box that has about 10cm space against this equipment dimensions and pack with sufficient cushion.

- (5) In case of carrying this equipment, hold both side handles.



- (6) If the optical connector is dirty, the optical loss will increase and the optical reflection will occur.

Connect the optical connector after cleaning.

And further clean the optical connector inside this equipment in case the optical loss becomes large or the optical power stability becomes bad.

< CLEANING PROCEDURES >

Loosen screws and remove them.



Pulling out optical output parts about 5cm. Take notice of not be broken the inside optical fiber.



Removing an adapter and cleaning the cross section of the inside optical connector.

Fix the optical connector to the adapter and put back slowly.

Tighten up screws and fix them.

1.6 SPECIFICATIONS

The following is specifications of this equipment.

Table 1-3. Specifications

Wavelength range	LS-601A-15	70nm (1520-1590nm)
	LS-601A-16	70nm (1580-1650nm)
	LS-601A-56	105nm (1525-1630nm)
Wavelength accuracy		< ±10pm (typ. : <±5pm)
Wavelength resolution		0.1pm
Wavelength repeatability		< ±5pm
Sidemode suppression ratio (typ.)		> 50dB
Optical power	LS-601A-15	> +4.0dBm
	LS-601A-16	> +4.0dBm
	LS-601A-56	> +2.0dBm (1540-1620nm) > 0.0dBm (1525-1630nm)
Linewidth (typ.)		< 100kHz
RIN (typ.)		< - 160dB/Hz
Optical power flatness (typ.)		< ± 0.2dB (1525-1630nm,APS works)
Optical power stability*		< ± 0.03dB (60min)
Frequency stability*		< ± 100MHz (60min)
Wavelength/Frequency sweep function		Possess
APS function		Possess
Optical power monitor		Possess
Optical variable attenuator		to -30dBm
External high frequency modulation		10-120MHz (front panel) Input level <+10dBm (50)
Internal low frequency modulation		200Hz-300kHz
Optical beam shutter		Possess
Interface		GP-IB
Power requirements		100-240V, 48-66Hz 200VA MAX
Operating environment		Temperature range : 10-35 (Accuracy guarantee 15-30) Relative humidity : 85% or less. (without condensation)
Dimensions & mass		345(W) × 445(D) × 147.5(H)mm, 16kg

*Note: Constant environmental conditions

Specifications are subject to change without notice.

<p>Laser class b : 21CFR 1040.10 3A : IEC 825+A1.</p>
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1.7 ABOUT SETTING OF THE WAVELENGTH AT HIGH SPEED

This equipment has the performance to change the setting speed of a wavelength gradually into high speed with the combination of such functions as the "APS" and the "Indication Control", while the "High Speed Mode" is ON.

In case the manual operation, it needs to set the "High Speed Mode" ON and "APS" function OFF at one time, in order to make the setting speed faster than the normal use. In case the GP-IB operation, by the "Indication Control" function is OFF, in addition (the above procedure), the setting speed of a wavelength is faster than the above use [fastest operation among every use].

< Reference >

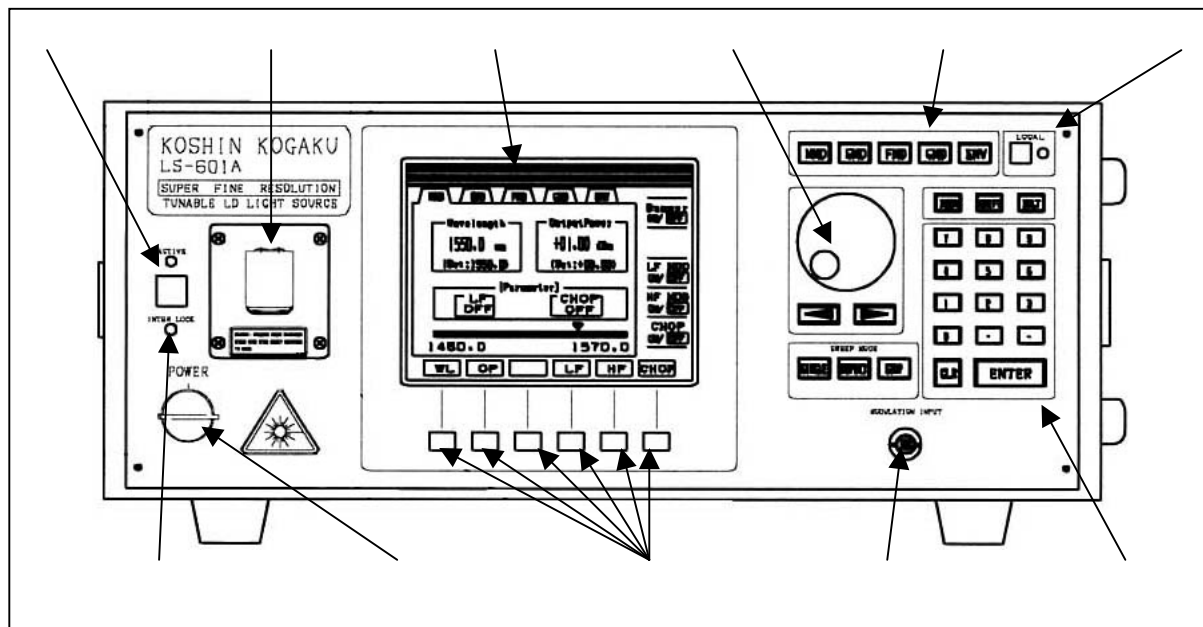
In shows the setting time of a wavelength against arbitrary wavelength tunable step (typical), in case the GP-IB operation.

GP-IB command setting : HS1 : "High Speed Mode" ON
 MON0 : "Indication Control" function OFF
 APS0 : "APS" function OFF

Wavelength tunable step (nm)	Wavelength setting time (ms)
0.0001	40
0.001	48
0.01	55
0.1	160
1.0	600
10.0	800

2 PANELS AND OPERATING PROCEDURES

2.1 FRONT PANEL EXPLANATION

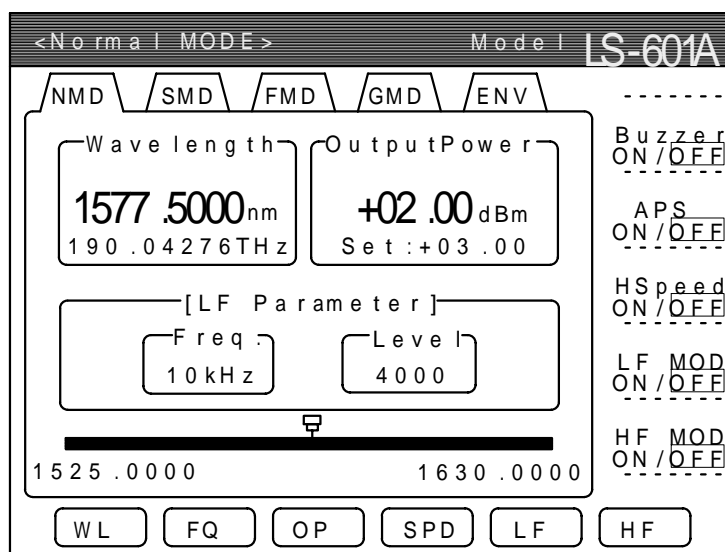


LCD unit display

There are five modes on LCD unit display.

(1) Normal Mode

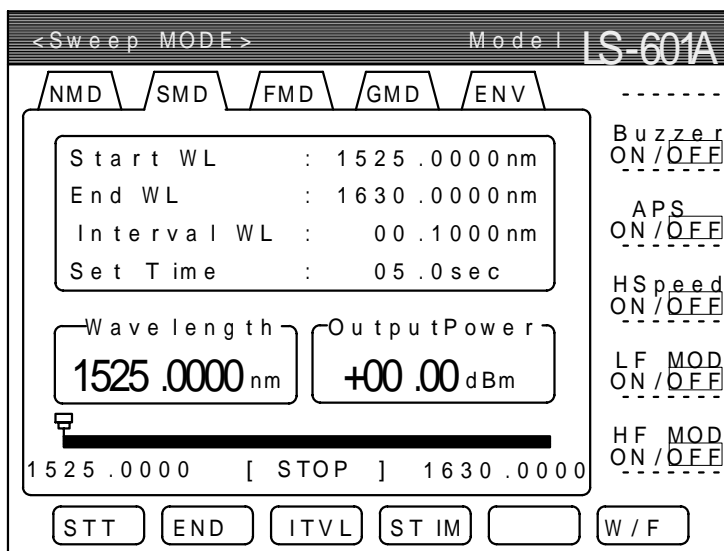
This is an ordinary mode. This mode is for the use of setting of a wavelength and an output power. This mode is set after power on sequence.



(2) Sweep Mode

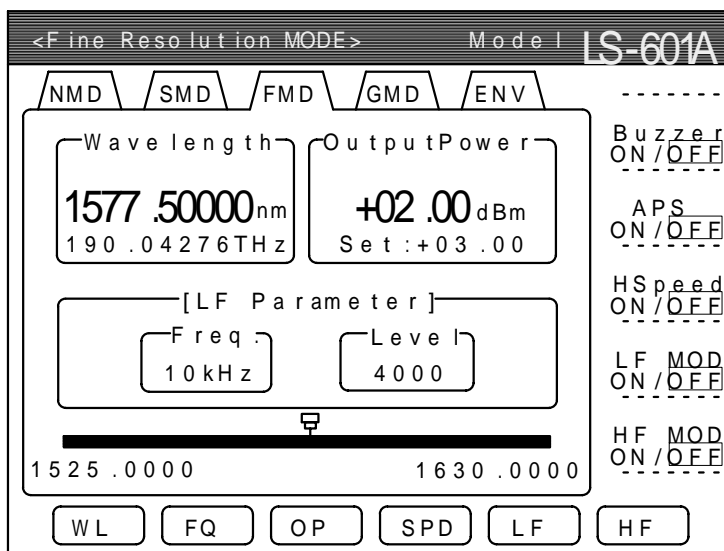
This mode is for the use of automatically sweeping after the start/end wavelength, interval wavelength and time have been set.

Furthermore this mode is changeable between the "wavelength sweep" and the "frequency sweep".



(3) Fine Resolution Mode

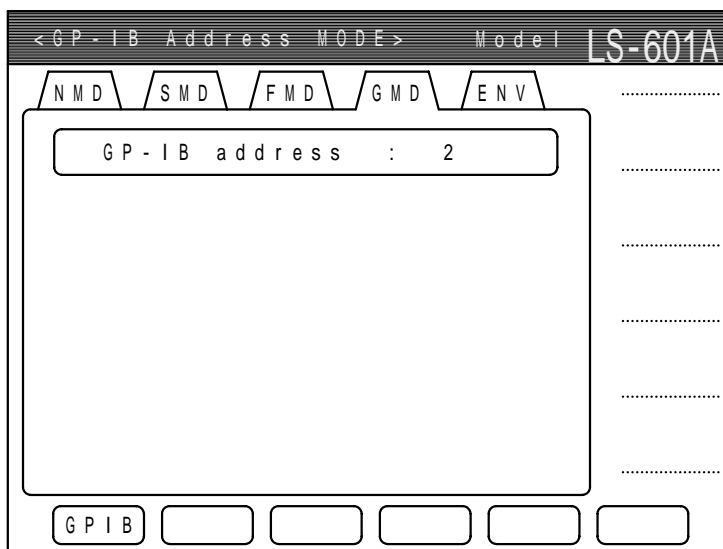
This mode is for the use of further fine setting of the wavelength than normal mode.



Notes: It is also able to adjust an arbitrary wavelength with confirming the wavelength, for example, by an optical wavelength counter.

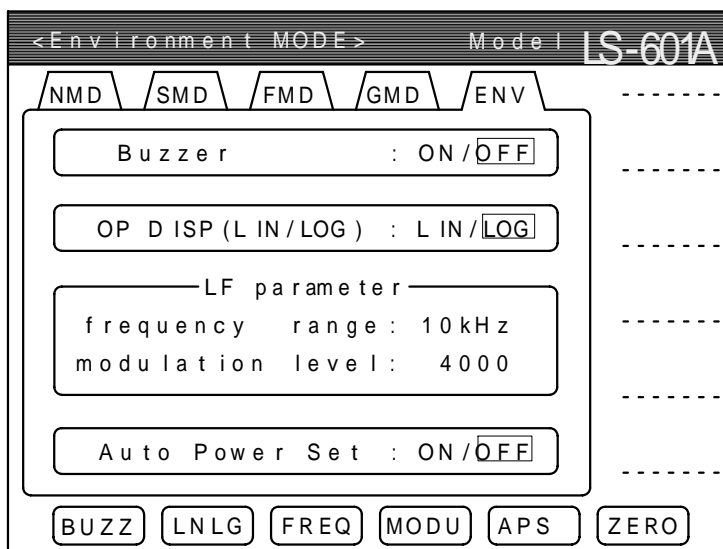
(4) GP-IB Address Mode

This mode is for the use of a GP-IB address setting



(5) Environment Mode

This mode is for the use of an environmental setting. Parameters which can be set are the [ON]/[OFF] buzzer, the unit indication mode of optical power, the parameter of the "internal low frequency modulation" and the "APS" function and so on.



Rotary knob (dial)

The knob for adjusting wavelength or optical power continuously.

Function key for the mode select

Keys for selecting of an operational mode.

Local switch & remote LED

The switch for changing the remote state into the local state.

The LED indicates that this equipment is on the remote state.

Ten key

Keys for setting of a numerical data.

Soft function key

Keys for various functions which are indicated on the LCD unit display.

Power switch

The switch for the power ON/OFF.

To operate this switch, the key of the exclusive use must be inserted.

Beam shutter switch & active LED

The switch for the beam shutter ON/OFF. When opening the shutter, the beam is produced 3 seconds later. The shutter is open during the LED is light.

Optical output (FC connector)

An optical connector for optical output.

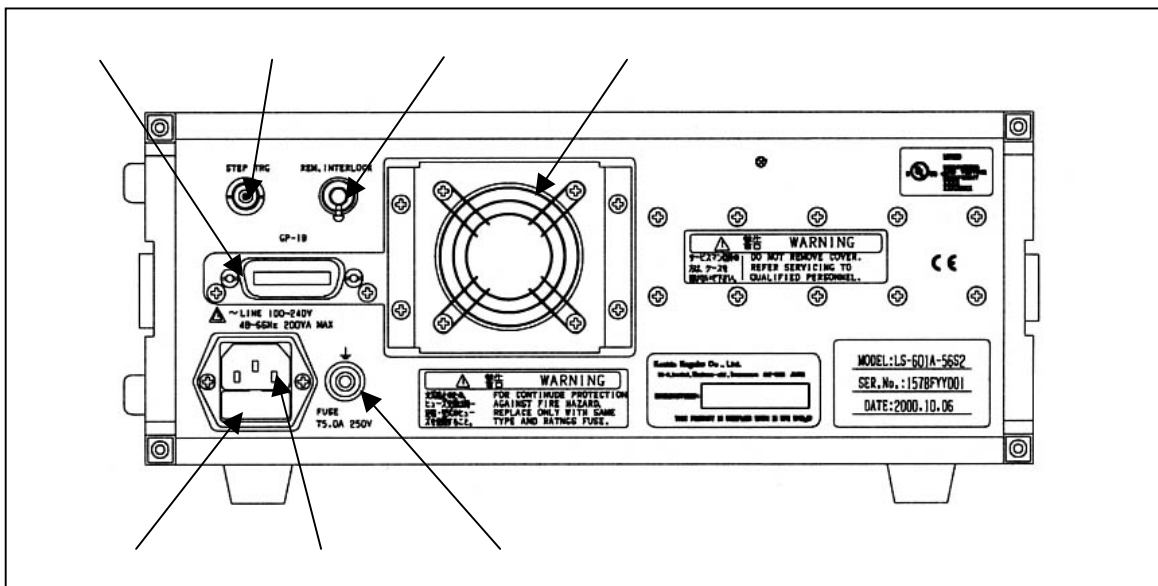
Modulation input (BNC 50)

An input connector for an external high frequency modulation.

Inter lock LED

This LED lights up when the feature of the interlock is working.

2.2 REAR PANEL EXPLANATION



GP-IB connector

A connector for GP-IB interface cables.

Step trigger signal output (BNC TTL level)

An output connector for the pulsed signal, which occur every step operation during the sweep function, works.

Remote Interlock connector

This is to protect a user from the damage when using a class b laser source. The use of this system is specified with class b laser sources by 21CFR 1040.10 (USA). If the short circuit at this BNC connector is opened, the laser is switched off immediately and cannot be switched on until it is closed again.

Cooling fan

This equipment has one low noise fan.

Fuse holder

Be sure to use the Fuse, which suit the requirement. (See " 1.3 POWER SUPPLY" for details)

AC line input

AC input (Refer to 1.3 clauses "about the power supply").

Ground connecting terminal

A terminal for the connection of a ground wire.

2.3 PANEL OPERATING PROCEDURES

(1) Introduction to operation

"<< SELF TEST IN PROGRESS >>" is indicated on LCD unit display when the power switch is depressed. Then, after a moment, any mode which has been set is first displayed and ready to work (In the beginning, the normal mode, which has been already set at factory side is first indicated. And this modification of starting mode and any parameter can be changed freely by rewriting of the system memory).

This equipment has five modes, which is mentioned below.

Normal Mode : This is a basic mode.

Sweep Mode : This mode for the use of automatically sweeping.

Fine Resolution Mode : This mode for the use of further fine tuning than normal mode.

GP-IB Address Mode : This mode for the use of setting GP-IB address.

Environment Mode : This mode for the use of setting the environmental parameters.

(2) Explanation for each mode operations

Normal Mode

1) Setting for an wavelength/frequency

First, press the '[WL] / [FQ]' key. Secondly, set a ten key or rotary knob or [◀] / [▶] key. And finally, press the '[ENT]' key.

2) Setting an optical output power

First, press the '[OP]' key. Secondly, set a ten key or rotary knob or [◀] / [▶] key. And finally, press the '[ENT]' key.

3) Setting the "High Speed Mode" (ON/OFF)

Press the '[SPD]' key, every time changing ON and OFF.

While "High Speed Mode" is on, the line width is widened into about 10MHz.

4) Setting for the internal low frequency modulation (ON/OFF)

Press the '[LF]' key, every time changing ON and OFF.

5) Setting for the external high frequency modulation (ON/OFF)

Press the '[HF]' key, every time changing ON and OFF.

6) Changing into another mode

Change into Sweep Mode : Press the '[SMD]' key

- Change into Fine resolution Mode : Press the '[FMD]' key
 Change into GP-IB Address Mode : Press the '[GMD]' key
 Change into Environment Mode : Press the '[ENV]' key

Sweep Mode

1) Setting parameters

First, press the '[W/F]' to select the sweep mode (wavelength or frequency). Secondly, press the '[STT]', '[END]', '[ITVL]' and '[STIM]' key for setting the "start", "end", "interval" wavelength and "sweep time", respectively (see below explanation). And finally, press the '[SINGLE]' or '[REPEAT]' key for sweeping automatically.

And besides, press the '[SHIFT]' + '[SINGLE]' keys to perform the "single step" operation.

To cancel a sweep operation, press '[STOP]' key until the '[STOP]' message is indicated on LCD unit display.

[STT]: the start wavelength of sweeping

[END]: the end wavelength of sweeping

[ITVL]: the interval wavelength of sweeping

[STIM]: the time of keeping the each wavelength

[W / F]: changing the sweep mode. (wavelength / frequency)

2) Changing into another mode

- Change into Normal Mode : Press the '[NMD]' key
 Change into Fine Resolution Mode : Press the '[FMD]' key
 Change into GP-IB Address Mode : Press the '[GMD]' key
 Change into Environment Mode : Press the '[ENV]' key

Fine Resolution Mode

1) Setting for an wavelength/frequency

First, press the '[WL] / [FQ]' key. Secondly, set a ten key or rotary knob or [◀] / [▶] key. And finally, press the [ENT] key.

2) Setting for an optical output power

First, press the '[OP]' key. Secondly, set a ten key or rotary knob or [◀] / [▶] key.

And finally, press the '[ENT]' key.

3) Setting the "High Speed Mode" (ON/OFF)

Press the '[SPD]' key, every time changing ON and OFF.

While "High Speed Mode" is on, the line width is widened into about 10MHz.

- 4) Setting for the internal low frequency modulation (ON/OFF)
Press the '[LF]' key, every time changing ON and OFF.
- 5) Setting for the external high frequency modulation (ON/OFF)
Press the '[HF]' key, every time changing ON and OFF.
- 6) Changing into another mode

Change into Normal Mode	: Press the '[NMD]' key
Change into Sweep Mode	: Press the '[SMD]' key
Change into GP-IB Mode	: Press the '[GMD]' key
Change into Environment Mode	: Press the '[ENV]' key

GP-IB Address Mode

- 1) Setting for GP-IB Address
First, press the '[GP-IB]' key. Secondly, set a ten key or the rotary knob.
And finally, press the '[ENT]' key.
Note: The address is memorized permanently.
- 2) Changing into another mode

Change into Normal Mode	: Press the '[NMD]' key
Change into Sweep Mode	: Press the '[SMD]' key
Change into Fine Resolution Mode	: Press the '[FMD]' key
Change into Environment Mode	: Press the '[ENV]' key

Environment Mode

- 1) Setting for Buzzer
First, Press the '[BUZZ]' key. Secondly, choice the '[ON] / [OFF]' key.
And finally, Press the '[ENT]' key.
- 2) Setting for optical output indication
First, Press the '[LNLG]' key. Secondly, choice the '[LIN] / [LOG]' key.
And finally, Press the '[ENT]' key.
Note : LIN : The optical output is indicated by [μ W] unit.
LOG: The optical output is indicated by [dBm] unit.
- 3) Setting for the parameter of the internal low frequency modulation
<frequency>
First, press the '[FREQ]' key. Secondly, set the rotary knob or [◀] / [▶]
key. And finally, press the '[ENT]' key.
<modulation level>

First, press the '[MODU]' key. Secondly, set the rotary knob or [◀] / [▶] key. And finally, press the '[ENT]' key.

4) Setting for the APS function

First, Press the '[APS]' key. Secondly, choice the [ON] / [OFF] key.
And finally, Press the '[ENT]' key.

[APS function]

"APS", which means of Auto Power Set, has the function to keep the level of optical power constant each setting of wavelength in any region.

But because it takes a little more time to set an wavelength than this function does not work, please do not use it when the speed of setting have to be kept fast.

5) Zero offset of the optical power level

Press the '[ZERO]' key, then adjust zero offset automatically.

6) Changing into another mode

Change into Normal Mode : Press the '[NMD]' key

Change into Sweep Mode : Press the '[SMD]' key

Change into Fine Resolution Mode : Press the '[FMD]' key

Change into GP-IB Mode : Press the '[GMD]' key

2.4 STARTING PARAMETER MODIFICATION/PRESET

(1) Starting parameter modification

The operational mode, which is indicated first on LCD display unit when the instrument is turn on, and many kinds of parameters are easy to modified. The new state and parameters, which has been changed according to below procedure, work from next start up and are valid until "preset of parameter" is performed.

<<Modification Procedure>>

Change various parameters after the operational mode, which you want to first indicate when the equipment turn on, has been indicated.

Press '[MEM]' key.

<< Change Memory >> is indicated bottom on LCD display unit.

Press '[YES]' or '[NO]'.

When '[YES]' is pressed, current parameters are memorized as new starting parameters.

(2) Starting parameter preset

The operational mode, which is indicated first on LCD display unit when the instrument is turn on, and many kinds of parameters are easy to return the default value.

<<Preset Procedure>>

Press '[SHIFT]' + '[CLR]' keys

<< Inst Preset! >> is indicated bottom on LCD display unit.

Press '[YES]' or '[NO]'.

When '[YES]' is pressed, the instrument is initialized and restart.

3 GP-IB CONTROL

3.1 INTRODUCTION TO GP-IB OPERATION

This GP-IB interface is able to control the "SRQ" interruption, wavelength (set/read), optical power (set/read), internal low frequency modulation, external high frequency modulation, beam shutter, LCD back light, buzzer and so on.

3.2 HANDLING GP-IB CABLES

Be sure to disconnect the power cable from the socket before handling GP-IB cables, otherwise any circuits in each instrument would be damaged by AC leak voltage.

3.3 SET GP-IB ADDRESS AND CONFIRMATION

Set a GP-IB address at GP-IB Address Mode ('GMD'). The address is set as "02h" initially at factory side, and this address is memorized permanently until next setting.

3.4 GP-IB INTERFACE FUNCTIONS

The following is shown interface functions of this equipment.

Table 3-1. interface functions

CODE	FUNCTION	
SH1, AH1	All hand-shake functions	
T6	Talker function	
L4	Listener function	
SR1	Service request function	
RL1	Remote local function	
PP0	Parallel poll function	×
DC1	Device clear function	
DT0	Device trigger function	×
C0	Controller function	×
E2	Tri-state driver	-

Note: · · · possible
 × · · · impossible

3.5 DEVICE MESSAGE

The following is shown device messages and codes of this equipment.

Table 3-2. device messages and codes

《Device message which are valid all operational mode》

CONTROL ITEM	CONTROL CODE	FUNCTION																																				
Initialize (prearranged)	RST	Initialize with resetting all parameter																																				
Initialize (normal)	INIT	Initialize with remaining all parameter																																				
Parameter memorize	MEM	Rewrite all default parameter																																				
Delimiter	DL0	Set delimiter as '[CR]'+'[LF]'																																				
	DL1	Set delimiter as '[CR]'+'[LF]'(with '[EOI]')																																				
	DL2	Set delimiter as '[LF]'																																				
	DL3	Set delimiter as '[EOI]'																																				
Operational mode	MD0	Set operational mode as 'NMD'																																				
	MD1	Set operational mode as 'SMD'																																				
	MD2	Set operational mode as 'FMD'																																				
	MD3	Set operational mode as 'GMD'																																				
	MD4	Set operational mode as 'ENV'																																				
	MD?	Receive operational mode(Mdn : n=mode No.)																																				
Active state	AC?	Receive active state (ACn : n=1 ACTIVE)																																				
Service request	SQ0	Not send the 'SRQ'																																				
	SQ1	Send the 'SRQ'																																				
Optical output power	PD0	Indicate optical power as 'dBm' unit																																				
	PD1	Indicate optical power as ' μ W' unit																																				
Modulatory frequency	FQn	Set a frequency of the internal low frequency modulation n=201-304 (200Hz-300kHz)																																				
Modulatory level	MLn	Set a internal low frequency modulation level <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>n</th> <th>GAINS</th> <th>n</th> <th>GAINS</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> <td>8</td> <td>100</td> </tr> <tr> <td>1</td> <td>2</td> <td>9</td> <td>200</td> </tr> <tr> <td>2</td> <td>4</td> <td>10</td> <td>400</td> </tr> <tr> <td>3</td> <td>8</td> <td>11</td> <td>800</td> </tr> <tr> <td>4</td> <td>10</td> <td>12</td> <td>1000</td> </tr> <tr> <td>5</td> <td>20</td> <td>13</td> <td>2000</td> </tr> <tr> <td>6</td> <td>40</td> <td>15</td> <td>4000</td> </tr> <tr> <td>7</td> <td>80</td> <td>15</td> <td>8000</td> </tr> </tbody> </table>	n	GAINS	n	GAINS	0	1	8	100	1	2	9	200	2	4	10	400	3	8	11	800	4	10	12	1000	5	20	13	2000	6	40	15	4000	7	80	15	8000
n	GAINS	n	GAINS																																			
0	1	8	100																																			
1	2	9	200																																			
2	4	10	400																																			
3	8	11	800																																			
4	10	12	1000																																			
5	20	13	2000																																			
6	40	15	4000																																			
7	80	15	8000																																			
Internal low frequency modulation	LF0	Internal low frequency modulation OFF																																				
	LF1	Internal low frequency modulation ON																																				
External high frequency modulation	HF0	External high frequency modulation OFF																																				
	HF1	External high frequency modulation ON																																				
Beam shutter	ST0	Beam shutter CLOSE																																				
	ST1	Beam shutter OPEN																																				

LCD back light	BL0	LCD back light OFF
	BL1	LCD back light ON
Buzzer	BZ0	Buzzer OFF
	BZ1	Buzzer ON
Optical output power flatness	APS0	APS ON
	APS1	APS OFF
Wavelength position	SET	Proofread an wavelength once when determine a wavelength position
Monitor display	MON0	Wavelength/Frequency and Optical output power display ON
	MON1	Wavelength/Frequency and Optical output power display OFF
High speed mode	HS0	High speed mode ON
	HS1	High speed mode OFF

《Device message which are valid NMD mode》

CONTROL ITEM	CONTROL CODE	FUNCTION
Wavelength	WLnnnn.nnnn	Set wavelength (unit: nm)
	WL?	Receive wavelength (WLnnnn.nnnn)
Frequency	WFnnn.nnnnn	Set Frequency (unit: THz)
	WF?	Receive Frequency (WFnnn.nnnnn)
Optical output power	PWnnn.nn	Set optical power (unit: dBm)
	PW?	Receive optical power(PW:nn.nn)
	PUnnnn.n	Set optical power(unit : μ W)
	PU?	Receive optical power (PUnnnn.n)
	PS?	Receive optical power (set by user)

《Device message which are valid SMD mode》

CONTROL ITEM	CONTROL CODE	FUNCTION
SINGLE	SNG	Sweep operation (single)
REPEAT	REP	Sweep operation (repeat)
TRIGGER	TRG	One-step operation (trigger mode: ON)
STOP	STP	Stop sweep operation
Start wavelength	SWnnnn.nnnn	Set a start wavelength (unit: nm)
Start frequency	SFnnn.nnnnn	Set a start frequency (unit : THz)
End wavelength	EWnnnn.nnnn	Set an end wavelength (unit: nm)
End frequency	EFnnn.nnnnn	Set an end frequency (unit: THz)
Interval wavelength	IWnn.nnnn	Set an interval wavelength (unit: nm)
Interval frequency	IFn.nnnnn	Set an interval frequency (unit: THz)

Set Time	TWnn.n	Set the time of keeping the each wavelength (unit's)
Wavelength/frequency change	DOM0	Wavelength sweep operation
	DOM1	Frequency sweep operation

《Device message which are valid FMD mode》

CONTROL ITEM	CONTROL CODE	FUNCTION
Wavelength	WLnnnn.nnnnn	Set a wavelength (unit: nm)
	WL?	Receive wavelength (WLnnnn.nnnn)
Frequency	WFnnn.nnnnn	Set a frequency (unit: THz)
	WF?	Receive Frequency (WFnnn.nnnnn)
Optical power	PWnnn.nn	Set an optical power (unit: dBm)
	PW?	Receive optical power (PW±nn.nn)
	PUnnnn.n	Set an optical power (unit : μW)
	PU?	Receive optical power (PUnnnn.n)
	PS?	Receive optical power (set by user)

《Device message which are valid ENV mode》

CONTROL ITEM	CONTROL CODE	FUNCTION
ZERO Modification	PZ	Offset modification of photo detector

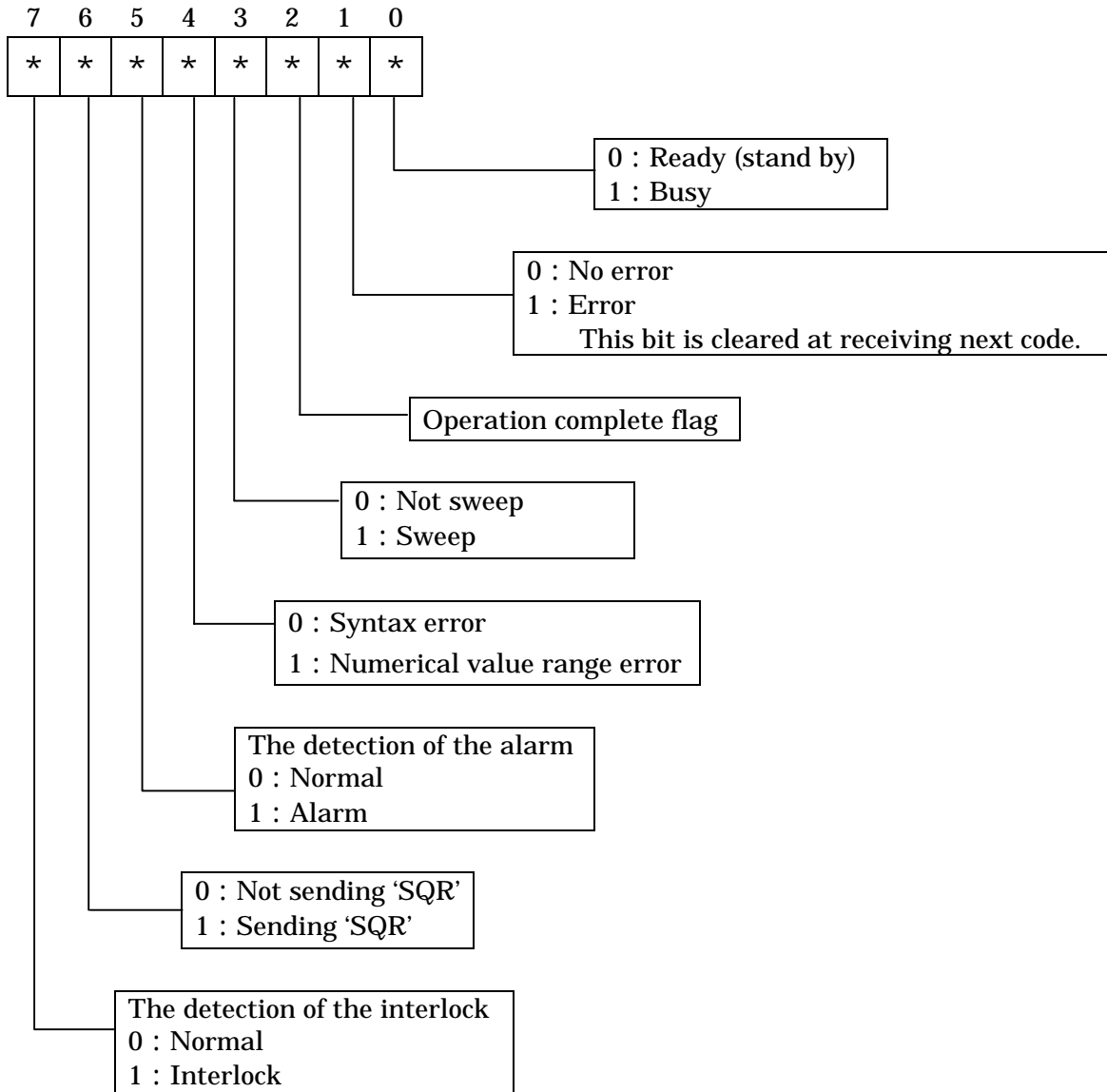
《ATTENTION》

- Only 64characters/10 commands can be dictated in a line and each command have to be separated with ", (comma)" ("INIT","RST","MEM","SNG","REP","TRG" and "STP" should be used alone each other).
- signed command send the service request of an operation have been completed or not when [SRQ] declared.
- signed command should not be used without it is necessary.

3.6 STATUS MESSAGE

The following is status messages of this equipment.

<< STATUS MESSAGE >>



3.7 SERVICE REQUEST (SRQ)

This equipment can send service request to controller when satisfy such condition as follows.

- (1) Service request when operation terminate.

This equipment can send service request simultaneously with "operation termination bit (bit2)" of status message when an operation executed by such commands as "RST", "INIT", "MEM", "WL", "WF", "SNG", "PW" and "PU" has been completed normally.

- (2) Service request when error occur.

This equipment can send service request simultaneously with the error information of "error state bit (bit1)" and "error type bit (bit4)" when receive the command which has not been defined or designated numerical value is out of range.

3.8 DELIMITER

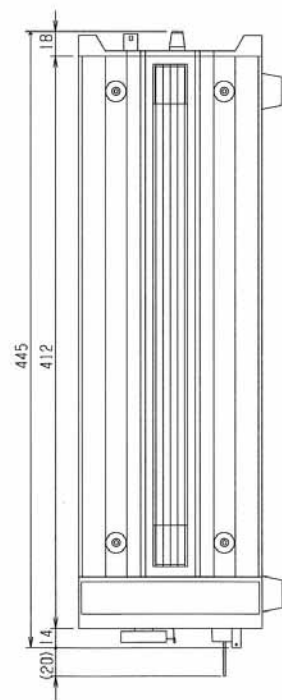
This equipment can receive the following 4 kinds delimiter.

- (1) CR+LF
- (2) CR+LF (with EOI)
- (3) LF
- (4) EOI

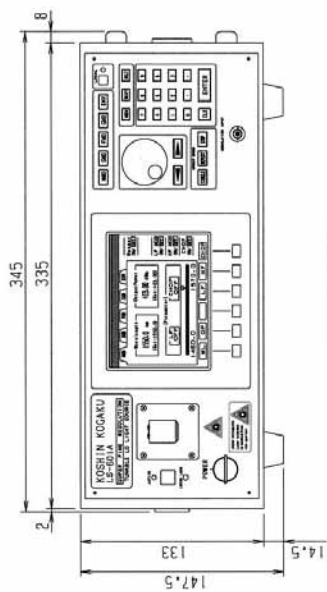
Besides the delimiter, when this equipment works as talker, is designated by "DL" command.

4 THE OUTLINE THIS EQUIPMENT

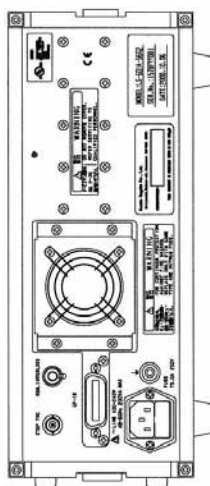
4.1 The outline of this equipment



SIDE VIEW



FRONT VIEW



REAR VIEW

5 STORAGE / WARRANTY / SERVICE

5.1 RECOMMENDABLE STORAGE CONDITIONS

Temperature : - 10 ~ +50

Relative humidity : 80%

5.2 WARRANTY

This equipment is guaranteed to be free from defects in workmanship and materials for a year from date of shipment.

5.3 SERVICE

Reference to maintenance : **Koshin Kogaku Co., Ltd.**

Sales Department

69-3 Bodai Hadano-shi, Kanagawa

259-1302 Japan

Tel. +81-463-75-5196

Fax. +81-463-75-3535

E-mail : sales@koshin-kogaku.co.jp