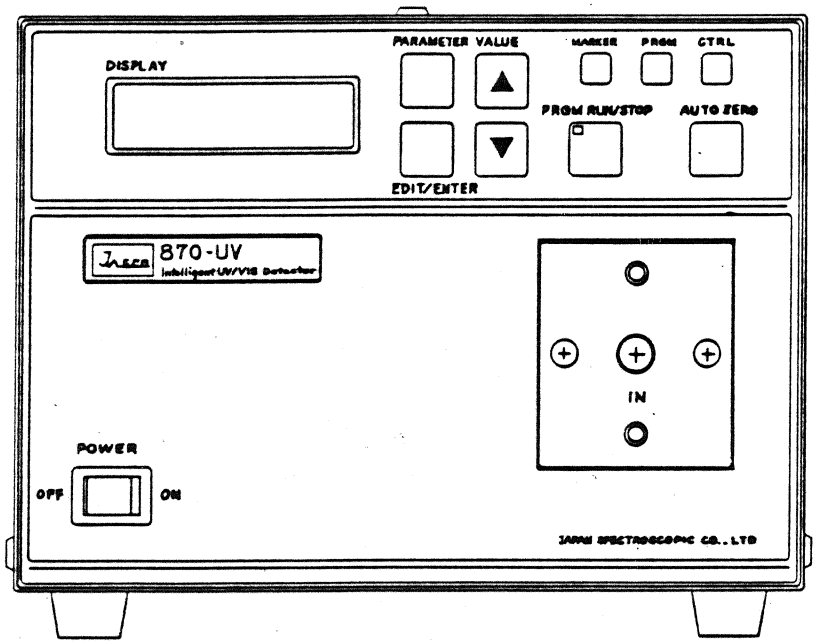
JASCO MODEL 870-UV/875-UV
INTELLIGENT UV SPECTROPHOTOMETRIC DETECTOR
INSTRUCTION MANUAL
(ROM VERSION 2.0)



JASCO, JAPAN SPECTROSCOPIC CO., LTD.
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TOKYO 192, JAPAN

Dec., 1988

WARRANTY

Products sold by Jasco, unless otherwise specified, are warranted for a period of one year to be free of defects in materials and workmanship. If any defects should occur in the products during this period of warranty, Jasco will repair or replace the defective parts free of charge. However, this warranty does not cover following cases;

1) Defects caused by misoperation.
2) Repair or modification done by other than Jasco or authorized agent.
3) Use of fittings or other spare parts supplied by other than Jasco.
4) Accident beyond our responsibility.
5) Disaster
6) Corrosion due to use of improper solvent or sample.

This warranty does not cover parts listed below.

1) Deuterium lamp, tungsten lamp and other light source.
2) Mirrors of the light source unit, and cell window.
3) Fuse, battery, glass ware, recorder chart and ink.
4) Plunger seal, needle seal, cell window gasket, valve seal, disk seal and other seal materials.
5) Fittings such as ferrule and nut, filters such as inlet filter, line filter and other solvent filters.
6) Pre-column and guard column.

For any inquiry or request for repair service, contact your JASCO agent after confirming the model and serial number of your instrument.

INTRODUCTION

This instruction manual provides the user with necessary information to properly operate the JASCO Model 870-UV or 875-UV INTELLIGENT UV SPECTROMETRIC DETECTOR. In order to obtain the best performance from the detector free from troubles over a long period of time, read this instruction manual for sufficient understanding before operation. Most of the descriptions in this manual are common for both models, those excusively for the 870-UV or 875-UV are given separatetly.

Special considerations and precautions for safe and efficient use are also described in the manual. These appear in the form of [WARNINGs], <CAUTIONs> and (NOTEs) as shown below.

[WARNING]

Warns you to potentially hazardous situations that may cause personal injury, and how to avoid these situations.

<CAUTION>

Alerts you to situations that may cause instrument failure or damage, and how to avoid these situations.

(NOTE)

Information to aid you in obtaining best performance from your instrument.

Pressurized solvents, which are potentially hazardous, are used in high performance liquid chromatography. Pay ample care for safety, the operator must wear a face protector, when injecting samples, opening valves, etc..

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1. UNPACKING AND INSTALLATION

1-1 Unpacking and Verification

1-1-1 Main Unit

Take out the main unit from the box, holding the bottom of the cabinet. Do not hold knobs, terminals etc.. Then, confirm that the number printed on the number plate on the rear panel of the main unit is identical to the number in the inspection certificate. And also confirm that the line voltage and frequency specified on the number plate are compatible with those of the power line to be used. If you find any difference, contact your Jasco agent.

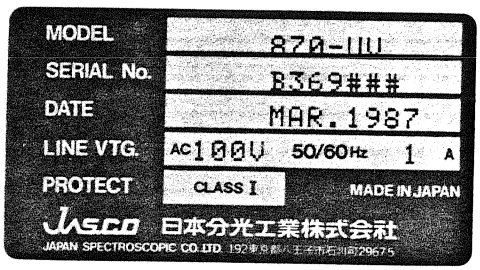


Fig. 1-1 Number Plate

1-1-2 Standard Accessories

Take out accessories and verify that each part agrees with the item in the standard accessory list. If you find any missing or damaged part, contact your JASCO agent.

1-2 Installation

1-2-1 Requirements on installation site

Since the high performance liquid chromatograph requires a large quantity of solvents as compared with general analytical instruments, its installation should be selected with consideration on the possibility of solvents to be spilt or vaporized. The installation site should satisfy the following requirements;

1) **Good ventilation**
Since most solvent used for liquid chromatography are harmful to your health and also inflammable, attention must be paid on ventilation.

2) **Safety for fire**
Any use of fire heat should be avoided near the instrument. In addition, operation of any instrument which contains a spark-generating part should be avoided. Fire extinguishers must be provided in case of an emergency.

3) **Provision of emergency shower, eye-washer, sink, etc**
For first aid treatment in case of an emergency, these must be provided nearby the instrument.

4) **No exposure to direct sunlight**

5) **Slight temperature variation**
Temperature is preferable within the range of 15 - 25^{o} C.

6) **Avoid the direct air flow from an air-conditioner**

7) **Absence of any appreciable vibration**

8) **Slight variation of power line voltage**
Tolerable line voltage variation is specified voltage $\pm$10%, however, variation less than $\pm$5% is preferable.

9) **Avoid strong magnetic, electromagnetic or electric field**
Those kinds of strong fields can result in malfunction of the instrument.

10) **Secure ground terminal**
The instrument must be securely grounded to a proper ground terminal such as one on a power distributor panel to avoid an electric-shock.

1-2-2 Installation

A bench of approximately 120cm (or wider) x 75cm, which bears 80kg is required for the system comprising a pump model 880-PU, UV detector model 875-UV, a column oven model 860-CO, and a graphic integrator model 805-G1. Figure 1-2 shows an example of installation.

<CAUTION>

Such an installation as disturbs heat dissipation of the instrument should be avoided. Especially, when the instrument is mounted in a rack, provide spaces of more than 10cm between the cabinet and the walls. Layout of the pump, injector, column, etc. also needs to be taken into account in selecting the installation site.

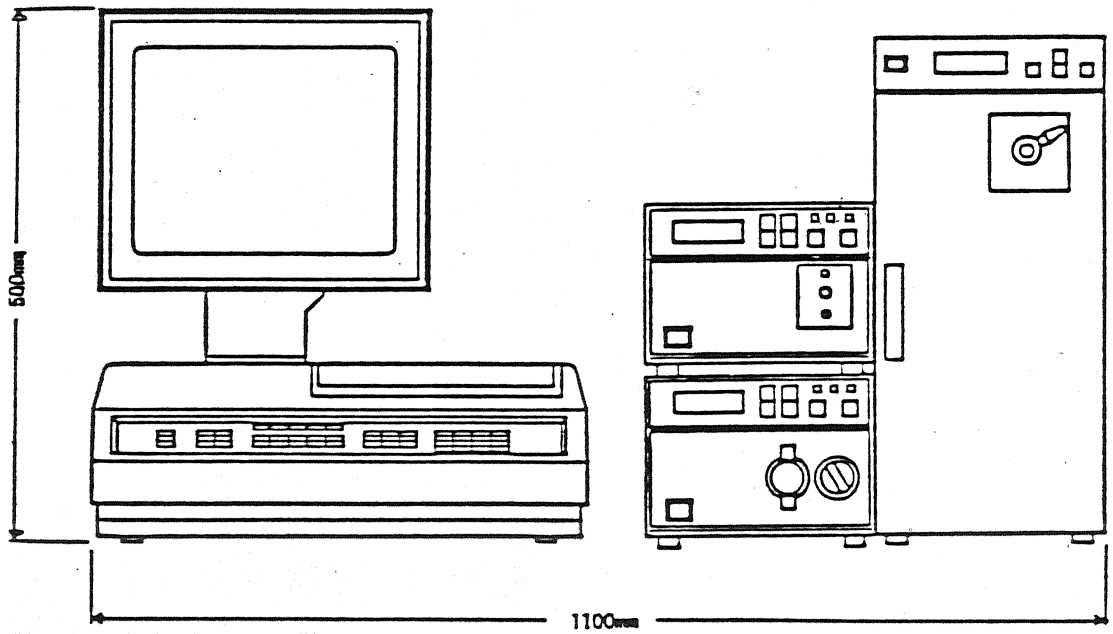


Fig. 1-2 Example of Installation

1-2-3 Connection to recorder

Connect the "REC OUT" terminal (+REC, -REC, GND) on the rear panel of the detector and the input terminal of the recorder with the provided recorder cable. Set the recorder full-scale to 10mV. Refer to the instruction manual for the recorder as to connection of the recorder cord.

Figure 1-3 shows an example of connecting the JASCO RECORDER MODEL RC-150 to the detector.

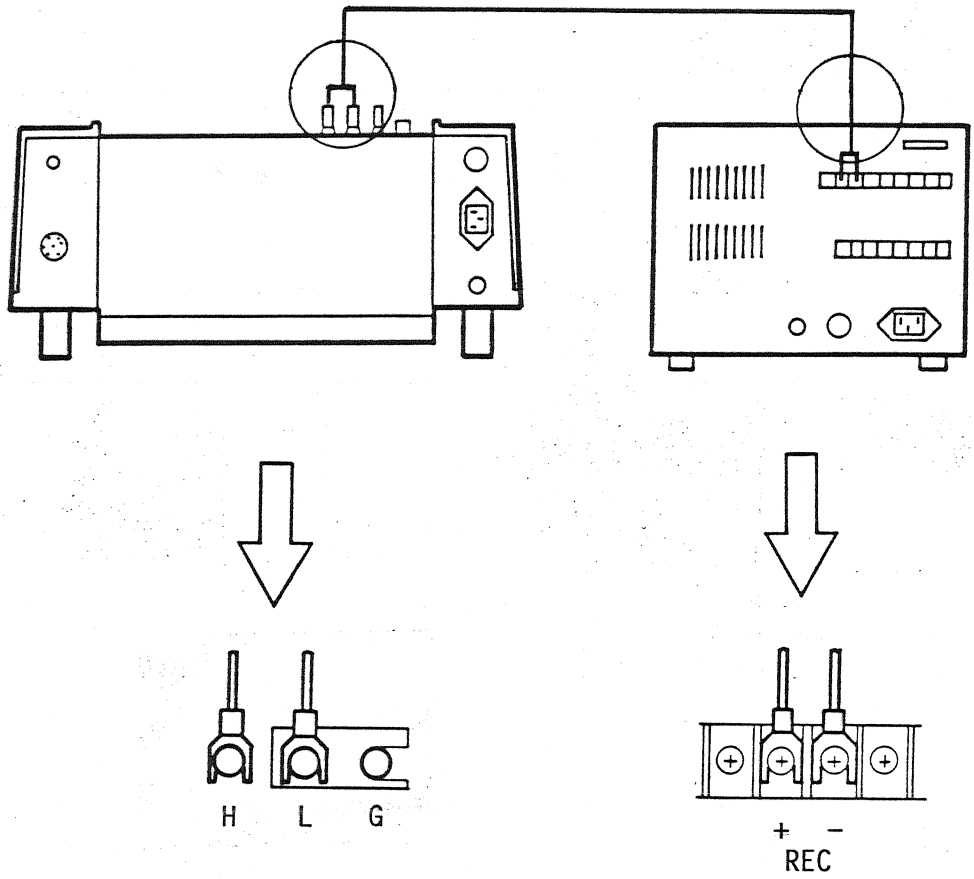


Fig. 1-3 Connection between the Detector and the Recorder

1-2-4 Connection to integrator

Connect the "INTE OUT" terminal (+INTE 1,-INTE, GND or +INTE 2, -INTE, GND) on the rear panel of the detector and the input terminal of the integrator with the signal cable, not provided. An analog signal proportional to the absorbance detected is outputted to the "INTE OUT", regardless of the "RANGE" setting of the UV detector. Outputs from "INTE 1" and "INTE 2" are 1 V/1 ABU and 0.5V/1 ABU, respectively. Normally, the output signal level from the +INTE 2 is suitable for most integrators, because the linear dynamic range of the detector matches that of common integrators. Figure 1-4 shows an example of connection between the detector and the JASCO 805-GI graphic integrator.

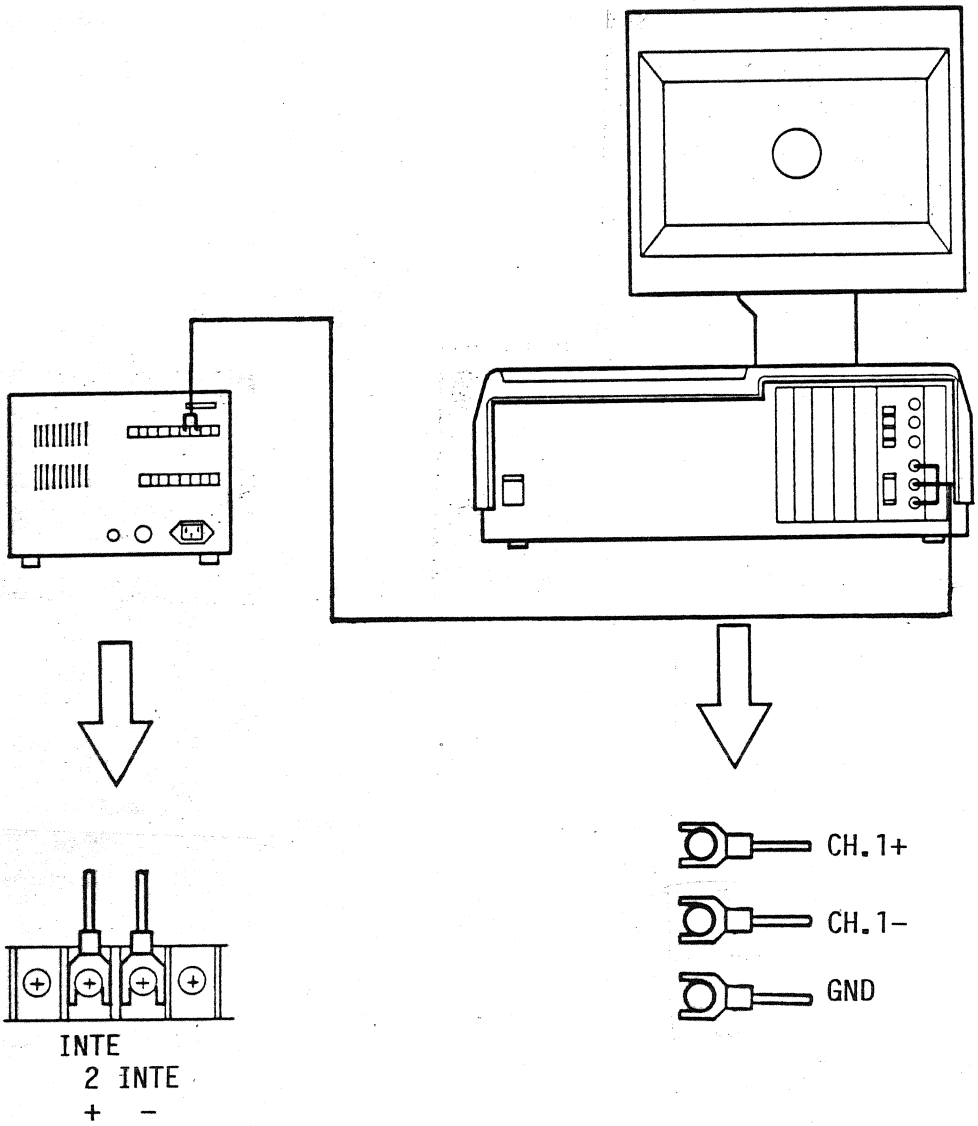


Fig. 1-4 Connection of the detector UV to the Integrator

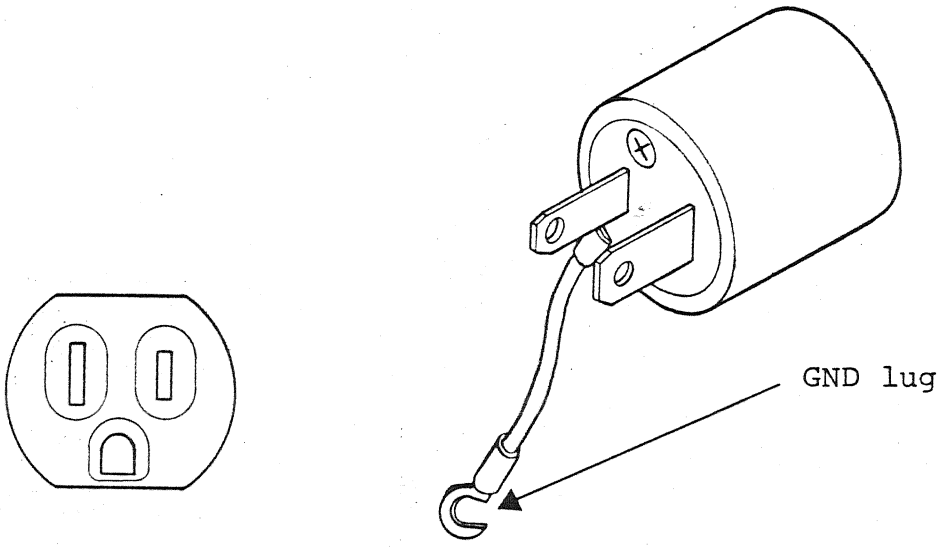
(NOTE)

The integrator ouput is limited up to 1.28 ABU in terms of absorbance.

1-2-5 Connection of power cable

Before connecting the power cable, confirm that "POWER" switch on the front panel is OFF. Plug the power cable to the power input on the rear panel of the detector, then insert the power cable plug into a power outlet.

The line frequency may be either 50 or 60 Hz. It is recommended to use a 3-P outlet with ground as shown in Figure 1-5. This type of outlet, capable of providing grounding automatically, is simple and safe to use. If such grounded outlet is not available, use the provided 3P-2P adaptor shown at the right side in Figure 1-5 and make a ground connection securely at the ground terminal of the adaptor or the ground terminal on the rear panel of the unit, the ground terminal is indicated by "⏚".



3-P outlet with ground 3P-2P adaptor

Fig. 1-5 Power Outlet

[WARNING 1]

Remember that HPLC uses lots of solvents including buffer solutions which is electrically conductive. If such a solvent should spill over the instrument, electrical leakage could occur. So be sure to ground the instrument to protect the operator from electrical accident.

[WARNING 2]

Ground the instrument also to prevent malfunction of the instrument due to noise that may come from the power line. If the instrument is not grounded, you may feel a little electric shock when you touch the metal part depending on the installation condition. This is due to a small capacitance between the instrument chassis and the power line.

[WARNING 3]

Do not use the water line for grounding because it is often made of non-metal material. For safety, do not use the gas line for grounding, either. Correctly ground the instrument using the ground terminal on the power distribution board or equivalent.

2. GENERAL DESCRIPTION

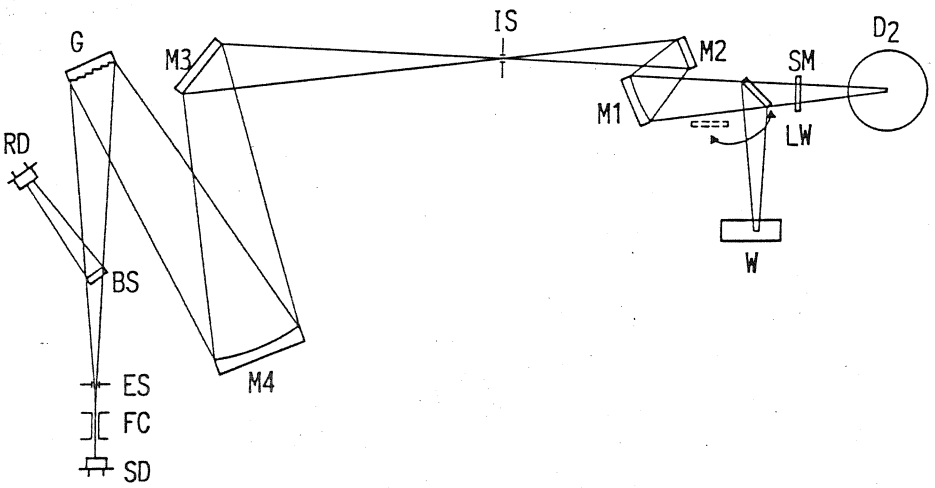
2-1 General Description

The JASCO MODEL 875-UV/875-UV is an intelligent UV spectrophotometric detector dedicated to liquid chromatography. It includes following features;

1) Time program capability of wavelength and sensitivity range without an external controller.
2) Excellent baseline stability due to highly efficient monochromator and symmetrical photometer.
3) High stability and reliability due to microprocessor based digital processing not only for the control section but also for the signal processing section to completely eliminate analog processing except for light-to-current conversion.
4) Availability of various options such as easy-to-install front loading cassette cells for wide range of applications to semi-micro, preparative, supercritical fluid chromatography (with high pressure cell), etc..
5) Use of LCD (liquid crystal display) panel for displaying messages for operation status and self-diagnostic results.
6) Simple operation by increment/decrement key.
7) Built-in self-diagnosis for automated performance check includes memories (ROMs, RAMs), DC power supplies, lamp ON/OFF operation, lamp emission energy, range over, solvent leak etc..
8) Wider auto zero range (2 ABU) and high resolution (1×10^{-5}) achieved only by the use of the microprocessor.
9) Built-in auto lamp OFF by timer function.
10) Built-in maintenance program for wavelength re-calibration, lamp emission energy check through keypad.
11) Time program of wavelength, range auto-zero, response, etc. using the model 801-SC system controller through the LC-NET® without additional interface board. Solvent leak sensor protect the detector from corrosion due to leaked solvent by sending stop signal to the pump through the LC-Net®.

2-2 Principle of Operation

The detector consists functionally of an optical section and a control section. The radiation from the light source (D_2 or tangsten lamp) is focused on the entrance slit of the monochromator by means of the spherical and plane mirrors. The light beam passing through the entrance slit enters the monochromator, where a grating (1200 lines/mm) is utilized in a highly efficient Monk-Gillieson mount optical system, and dispersed to a monochromatic beam, then focused on the exit slit. The beam from the exit slit passes through the flow cell, where UV absorption takes place, then the intensity is converted to electrical signal by means of a sample side photodiode. A part of the light from the monochromator is directed to a reference side photodiode to obtain reference signal for compensation for intensity fluctuation of the light source. Wavelength selection is made by rotating the grating, which is driven directly by a stepping motor and an arc. This configuration allows quick change of the wavelength. Figure 2-1 shows the optical diagram.



D_2 = Deuterium lamp
W = Tangsten lamp
LW = Lamp house window
SM = Light source switching mirror
M1 = Spherical mirror, light source
M2 = Plane mirror, light source
IS = Entrance slit
M3 = Plane mirror, monochromator
M4 = Spherical mirror, monochromator

G = Diffraction grating
BS = Beam splitter
ES = Exit slit
FC = Flow cell
SD = Sample-side photodiode
RD = Reference-side photodiode

Fig. 2-1 Optical Diagram

The control section consists of a microprocessor and memories. Output signals from pre-amplifiers are immediately converted into digital signal, then subjected to logarithmic conversion, auto-zero, etc. which are all digitally processed. Figure 2-2 shows the schematic diagram of the detector.

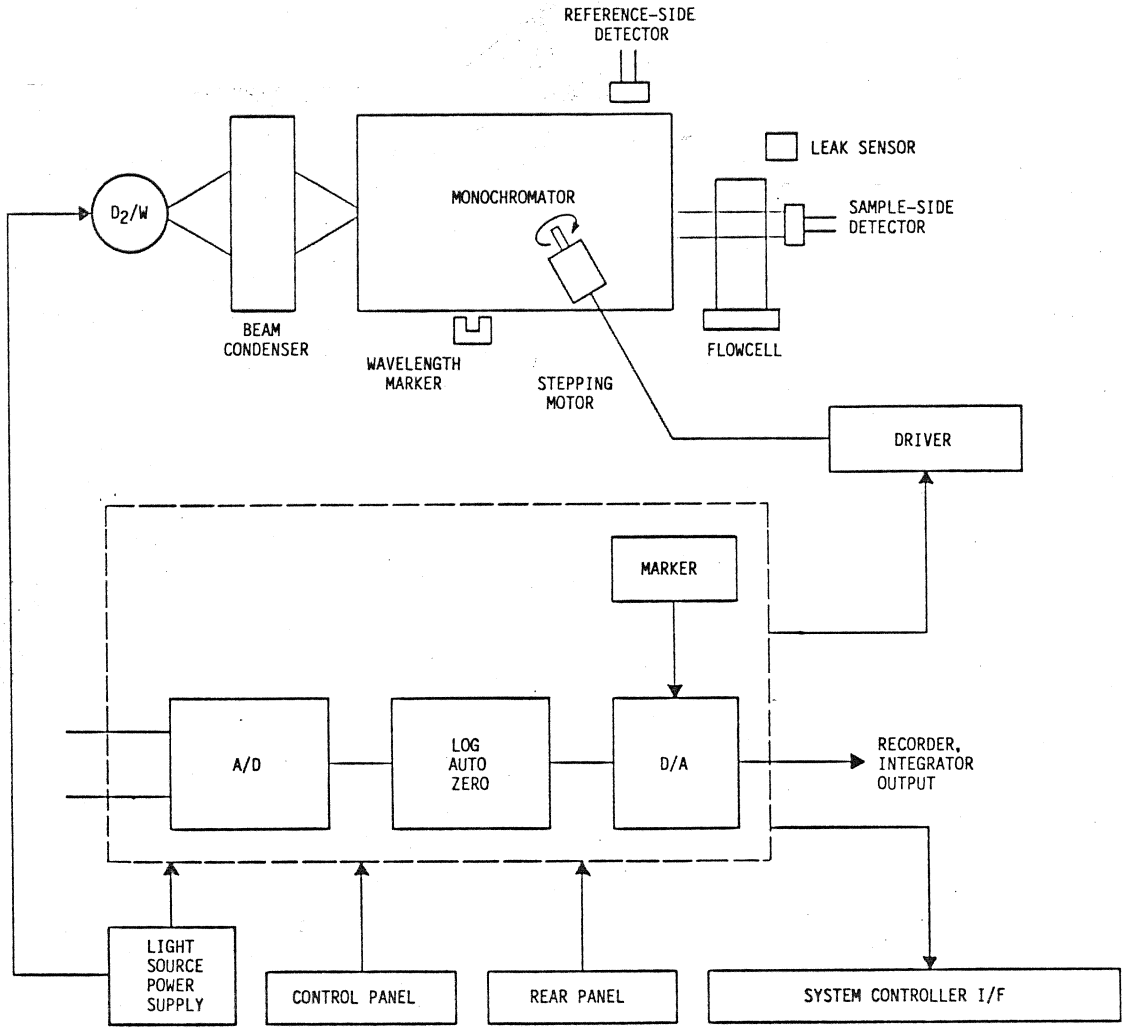


Fig. 2-2 Schematic Diagram of the Detector

3. SPECIFICATIONS

Model Name	:	870-UV/875-UV INTELLIGENT UV SPECTROPHOTOMETRIC DETECTOR
Optical System		
Monochromator	:	Monk-Gillieson mount monochromator
Diffraction grating	:	1200 lines/mm
Spectral Bandwidth	:	8 nm
Wavelength accuracy	:	$\pm$2 nm
Wavelength reproducibility	:	$\pm$0.3 nm
Light source	:	870-UV; D_2 lamp (190 - 400 nm), tangsten lamp (400 - 700nm). 875-UV; D_2 lamp (190 - 600 nm).
Wavelength range	:	870-UV; 190 - 700 nm, (Light source is automatically switched. Both D_2 and tungsten lamp must be on, in oder to vary the wavelength across 400 nm.) 875-UV; 190 - 600 nm, (UV cut filter is automatically inserted in longer wavelengths than 400nm.)

Photometric System

Type	: Dual-beam photometer
Noise level	: $\pm 1.5 \times 10^{-5}$ ABU at 250nm wavelength and STD time constant with empty cell per ASTM.
Drift	: 5×10^{-4} ABU/H at constant room temperature after warming up, empty cell and 250nm wavelength. (870-UV; tangsten lamp is off).
Photometric scale	: 0.001, 0.0025, 0.005, 0.01, 0.02, 0.04, 0.08, 0.16, 0.32, 0.64, 1.28, 2.56, ABU/10mV, S (short)
Auto-zero	: range; 2 ABU resolution ; 1×10^{-5} ABU
Time constant	: FAST (approx. 0.05sec) STD (approx. 1sec) SLOW (approx. 3sec)

Flow Cell Section

Type	: Front loading cassette cell
Standard cell	: 8 µl x 10 mm pathlength
Optional items	: Preparative cell; 21 µl x 1 mm pathlength (0.1, 0.2, 1mm*) Semi-micro cell ; 1 µl x 5 mm pathlength High pressure cell; 4 µl x 5 mm pathlength, 300 kg/cm^2

* 1mm path gasket has been Factory installed.

Input/Output

Program ext.	
RESET/START	: 1 (600msec contact closure)
Marker input	: 1 (600msec contact closure)
Auto-zero input	: 1 (600msec contact closure)
Recorder output	: 10 mV/full scale output impedance; 1kΩ or less
Integrator output	: 0.5V, 1V / ABU output impedance; 2kΩ or less
Marker output	: 1 (600msec contact closure)

Self-Diagnostic

Check Items	: Memories (ROMs, RAMs), DC power supplies, lamp ON, lamp emission energy, range over and solvent leak in cell section.
Maintenance program	: Wavelength re-calibration* (can be performed with reference to 0th order, 486 nm and 656 nm from a D_2 lamp or 0th-order light, 254 nm, 313 nm, 365 nm, 436 nm and 546 nm from a Hg lamp)

*Wavelength calibration kit is neede for precise re-calibration.

Time Program

Step and time	: 5 step including initial step, max. 999.9 min in 0.1 min increment
Parameters	: Wavelength and range
Auto lamp OFF	: 0 - 9999 min (in 1 min increment)

Miscellaneous

Materials in contact with solvent	: qualtz, PTFE, ss-316 stainless steel
Dimensions	: 210(W) x 450(D) x 160(H)mm,

4. PARTS NAMES and FUNCTIONS

4-1 Front Panel

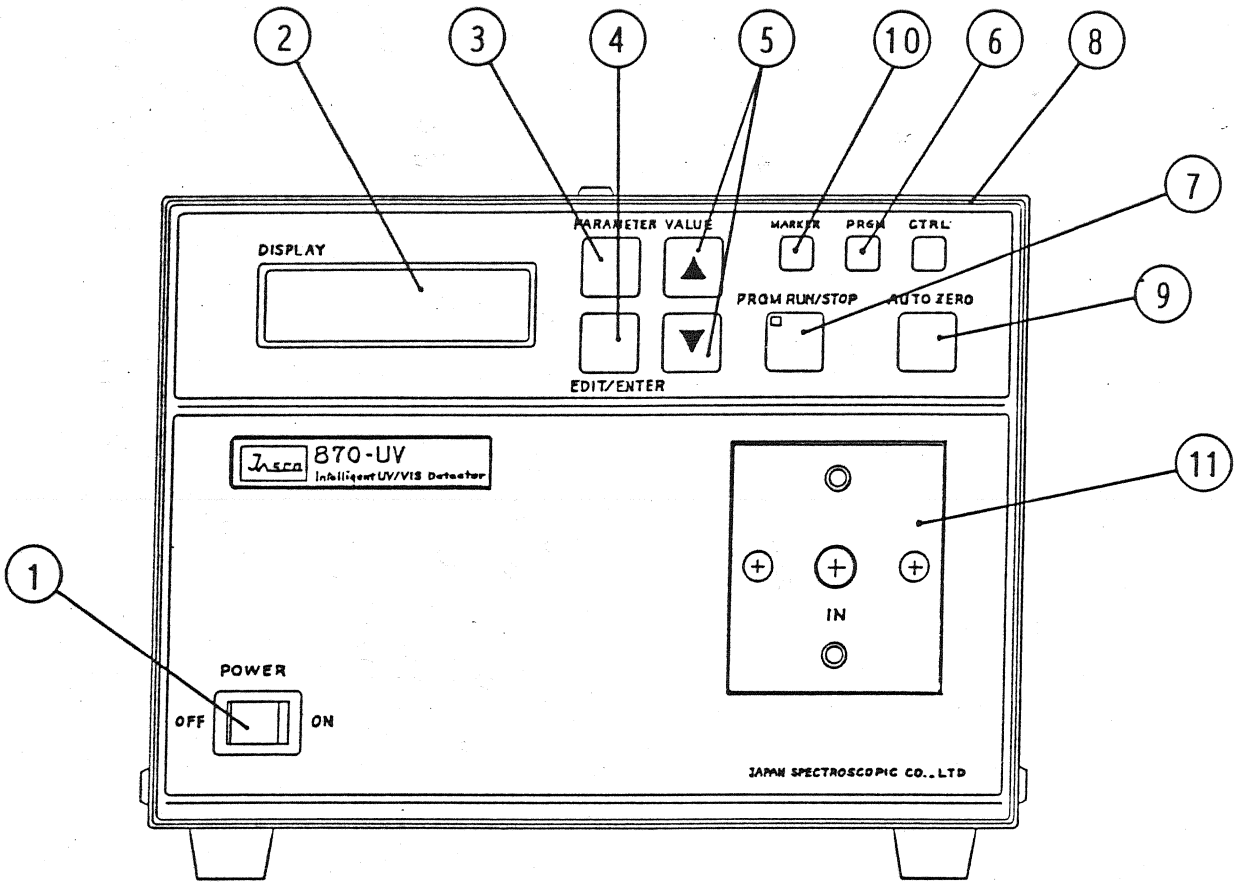


Fig. 4-1 Front Panel

Control/Indicator	Function
(1) Power switch	is used for turning the power ON or OFF by pressing the right or left side of the switch. Turning ON the power will display the model name and the ROM version on the LCD multi-display (2) and then starts the self-diagnosis.

Control/Indicator	Function
② LCD multi-display	will display results of self-diagnosis, parameters (range, wavelength, response, type of lamps, etc.) and absorbance values.
③ **[PARAMETER]** Key	is used for changing a parameter to be displayed on the LCD multi-display. A hit on the key will sequentially change parameters (range, wavelength, response, lamp ON/OFF).
④ **[EDIT/ENTER]** Key	is used for editing or entering new values for range, wavelength, response, etc, or to switch the lamps ($D_2 \longleftrightarrow W$) (only for the 870-UV). Display a parameter to be edited by pressing the **[PARAMETER]** Key, then press the **[EDIT/ENTER]** key. The displayed parameter then blinks to prompt entry. Therefore, press the **[▲]/[▼]** key to obtain the desired value. Finally, press the **[EDIT/ENTER]** key again to get it entered. See Section 6.
⑤ **[▲]/[▼]** key	is used for increasing or decreasing parameter values. A hit on the key will increase or decrease in a minimum acceptable value, pressing for more than a second will continue increment or decrement.

(NOTE) When the parameter reaches the maximum (or minimum) value, no further change occurs even if the **[▲]/[▼]** Key is kept depressed.

Control/Indicator	Function
⑥ **[PRGM]** key	changes the mode from normal to time program, vice versa.
⑦ **[PRGM RUN/STOP]** key	runs or stops the time program. First press on the key start the time program and the second press will reset the program time clock to "0 min".
⑧ **[CTRL]** Key	is used for performing double-key operations. See Section 6.
⑨ **[AUTO ZERO]** Key	is used for zeroeing the baseline. This is effective for both the recorder and integrator outputs.
⑩ **[MARKER]** Key	is used for making a spike on the detector baseline on the recorder output as an event marker. Amplitude of the marker signal is about +3mV with reference to GND level and is equivalent to about 30% of the recorder full scale.
⑪ Flow cell cassette	This is a removable cassette cell. See 4-3.

4-2 Rear Panel

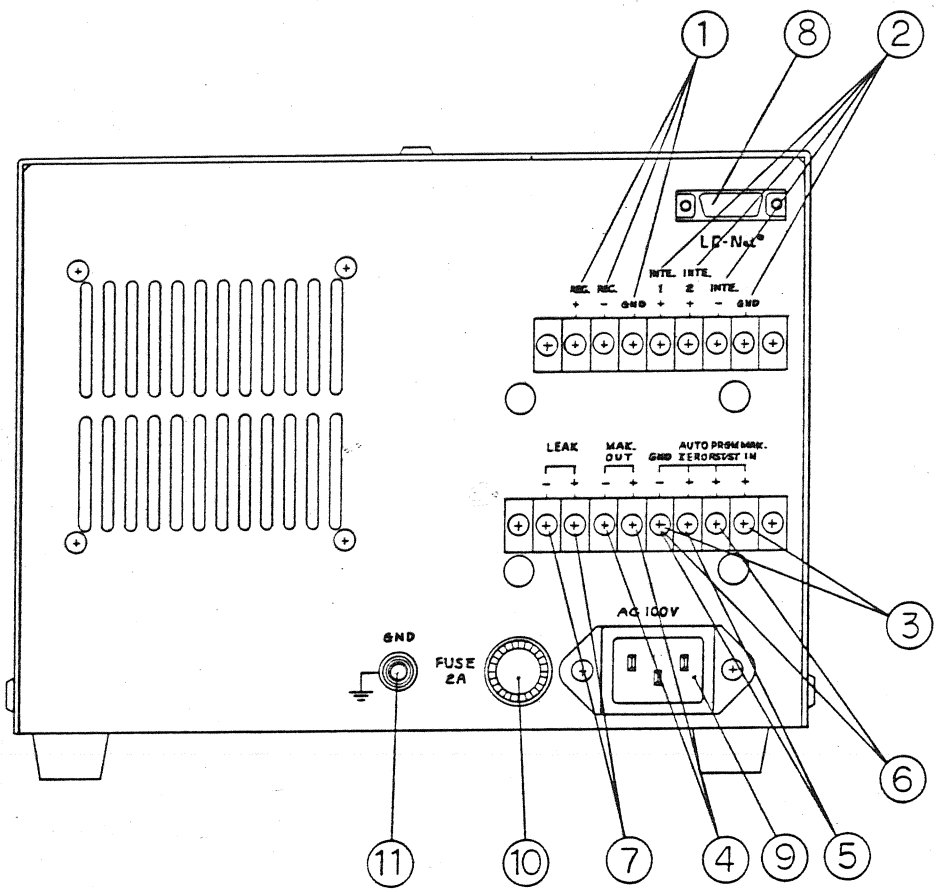


Fig. 4-2 Rear Panel

Control/Indicator	Function
① "REC +"/"-"/"GND"	output chromatogram signal to a recorder. The recorder input terminals are to be connected to these terminals by using the provided recorder cable. The output full scale is 10mV for the designated ABU range.
② "INTE 1+"/"INTE -"/"GND" "INTE 2+"/"INTE -"/"GND"	output chromatogram signal to an integrator. The integrator input terminals are to be connected to these terminals. Output levels on "+INTE 1" and "+INTE 2" are 1V/1ABU and 0.5V/1ABU, respectively.

Control/Indicator	Function
③ "MAK. IN +"/"GND -"	accept a marker input signal (600 msec contact closure) from an external instrument (ex. injector, auto sampler, etc.) and output marker signal on 4 "MARKER OUT". Closing these terminals for a moment is functionally equal to pressing the **[MARKER]** key on the front panel. See Section 7.
④ "MAK. OUT +"/"-"	output a marker signal, when the **[MARKER]** key is pressed or a marker signal is inputted to the "MARKER IN". See Section 7.
⑤ "AUTO ZERO +"/"GND -"	accept an auto zero input signal (600 msec contact closure) from an external instrument (e.g. injector, auto sampler, etc.) and zero the recorder and integrator outputs. Closing these terminals for a moment is functionally equal to pressing the **[AUTO ZERO]** key on the front panel. See Section 7.
⑥ "PRGM RST/ST +"/"GND -"	accept a signal (600 msec contact closure) for reset/ start of the time program from an external instrument (ex. injector, auto sampler, etc.). When these terminals are closed momentarily, the program time clock is reset to "0 min", and immediately start the time program again. Closing these terminals for a moment is functionally similar to pressing the **[PRGM RUN/STOP]** key on the front panel. However, it can not STOP the time program at the time "0 min". See Section 7.

Control/Indicator	Function
⑦ "LEAK +"/"-"	output a contact closure signal (600 msec) on these terminals, when an electrically conductive solvent leak from the flow cell. Solvent delivery of the 880-PU pump can be stopped by this signal by connecting these terminals with "STOP IN" on the rear panel of the pump.
⑧ "LC-NET® " receptacle	is used for connecting the LC-Net cable for automated operation with the 801-SC system controller. The system controller allows to program initial conditions of wavelength, range and response and time program of wavelength, range and auto zero.
⑨ "AC xxxV"	is a power inlet to which the power cable is connected.
⑩ "FUSE"	is a fuse. Use only the specified type and rating.
⑪ "GND"	is a ground terminal for grounding the instrument chassis. Do not use this terminal as a signal ground.

(NOTE) When the detector is under control of the 801-SC, time program entered to the detector becomes disabled, and only the time program in the 801-SC is valid.

[WARNING]

In replacing fuse;
DISCONNECT THE POWER CABLE FROM THE INSTRUMENT.
Replace with a fuse of the SAME TYPE AND RATING.
Using an incorrect fuse could result in not only fatal damage to the instrument, but also damage to the power source used.

4-3 Flow cell section

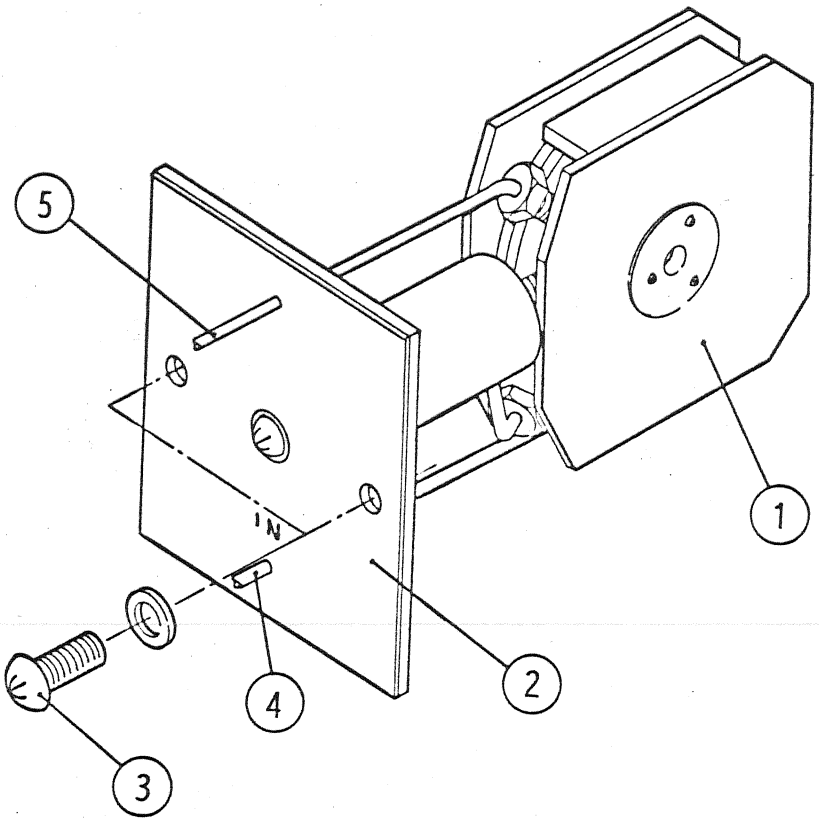


Fig. 4-3 Flow Cell Cassette

Control/Indicator	Function
(1) Cell body	is a main body of the flow cell, consisting of a stainless steel block with a cell hole, 1 mmID x 10 mml, and a pair of windows which sandwich the block with PTFE gaskets.
(2) Cell panel	is a panel of the flow cell cassette which faces the front panel of the instrument. Mount the panel with the "IN"-mark side down.

Control/Indicator	Function
③ Lock screws	fasten the flow cell cassette securely to the optical module inside the cabinet. To insert the flow cell cassette, press it cassette in until it seat neatly on the bottom by holding the cell panel ② , while applying downward force. Then, tighten lock screws evenly.
<CAUTION> Inserting the lock screws may often	cell cassette by rotating the fail to mount it in right position.
④ Inlet tubing	is to be connected to the outlet of the column and effluent flows into the flow cell through this tubing.
⑤ Outlet tubing	is to be led to a waste reservoir or to a next detector.

5. INITIAL SET-UP

[WARNING]

Wear face protecter while performing the initial set-up to protect your eyes from solvents.

<CAUTION>

The instrument should not be operated before the initial set-up is completed.

5-1 Plumbing

5-1-1 Connection between column and flow cell

Connect the inlet tubing of the flow cell to the outlet of the column. If the other end, ie. outlet, be connected, it may cause larger noise or solvent leakage in the flow cell section at high flow rates (5 ml/min or higher).

<CAUTION 1>

Read the instruction manual for the column to be used before connecting it to the detector. Note that some columns could be seriously damaged if a wrong solvent is used.

<CAUTION 2>

In case of connecting any column supplied by other than JASCO, connect it using a dead-volumeless union and extension tubing of a minimum length. Use a suitable compression screw and a ferrule to eliminate dead volume and make secure connection.

5-1-2 Series connection of detectors

In case of connecting detectors in series, connect this detector upstream of the others. Because this detector has generally smaller cell volume and higher pressure rating than other detectors such as fluorescence detector, differential refractometer, etc..

5-1-3 Precautions in the use of restrictor

When an additional tube or a restrictor is connected to the oulet tubing in order to suppress air bubbles in the cell, the following points should be noted.

1) Noise may increase if additional tubing is connected.
2) If a 0.25 mmID x 1 m long stainless steel tube is connected, do not set the flow rate to more than 5 ml/min with aqueous solvent. Observe the pressure

across the flow cell, if necessary, it must not exceed 35 kg/cm^2. Never use a tube having narrower more than 0.25 mm, ex. 0.1 mm, it can be easily blocked, resulting in the fatal damage to the cell gaskets and windows.

5-2 Flowing Solvent

(NOTE)

This instruction manual does not include descriptions for operating a pump, read the instruction manual for the pump to be used and be familiar with your pump before proceeding.

5-2-1 Flowing solvent

After completing the connection of the flow system, start flowing an appropriate solvent. Unless otherwise specified, the flow cell has been purged with a methanol-water mixture. When an immiscible solvent with the above mixture such as hexane is to be used, replace with isopropanol or similar solvent which is inter-miscible with both hexane and the methanol-water mixture, first, then use hexane. When a buffer solution is to be used, replace the mixture with water in advance.

<CAUTION>

Prior to replacing the solvent in the cell, remove the column, if necessary, then connect the detector directly to the pump. Some columns could be fatally damaged if a wrong solvent is used.

5-2-2 Flow cell leak check

After flowing a solvent for a few minutes, remove the two lock screws and draw out the cell cassette from the main unit by pulling both tubing. Then, check every part of the cell cassette carefully for solvent leak. If any leak be found, repair it with referring to Section 8. It is recommended to perform this check procedure once in a few months.

5-2-3 Re-installing flow cell cassette

To re-install the flow cell cassette, press it until it seat neatly on the bottom by holding the cell panel, while applying downward force. Then fasten it securely by tightening the two lock screws evenly. Tighten the screws to until the gasket of the cell panel is sufficiently

pressed and there should not be any gap between the panel and the gasket.

5-3 Turning Power ON

When the power switch is turned ON, the model name (either 875-UV or 870-UV) and the ROM version will be displayed on the LCD multi-display. Then, the self-diagnosis will be performed automatically on every check items; ROMs, RAMs lamp emission energy, DC power supply, etc., and the results will also be displayed sequentially. On completion of the self-diagnosis on all check items without error, previously entered parameters are automatically loaded, and the detector becomes ready for measurement.

If any item fail, it would be displayed as an error message. Refer to Section 8.

5-4 Simple Key Operations for Measurement

If the self-diagnosis is completed without fail, the detector is ready for accepting key operations. In this section, simple operating procedure is given, for the detailed key operation refer to Section 6.

(NOTE)

This section describes how to operate the instrument when you inject a sample but it does mean how to analize your sample.

1) Now, absorbance value and sensitivity range are displayed on the LCD multi-display. Pressing the **[EDIT/ENTER]** key will blink the range value, prompting the operator to enter the new value for the range. Use the **[▲]/[▼]** key to display desired value. Then, press the **[EDIT/ENTER]** key again to get the value entered. The range start from 0.001 and increases in the binary increment from 0.0025 to 2.56ABU and S (zero output) in 13 steps.
2) Press the **[PARAMETER]** key, then, the parameters wavelength and response will be displayed.
3) Edit and enter the value for wavelength by the same key operation described in step 1). Wavelength can be selected in the range from 190 to 600 nm (875-UV) or 190 to 700 nm (870-UV) in 1nm increment.

(NOTE)

When the 870-UV is to be used in the longer wavelength region than 400 nm, the tungsten lamp must be selected. See Section 6.

4) After entering the value for the wavelength, edit and enter the desired response. There are three responses, SLOW, STD and FAST. A hit on the [▲] key will change the response sequentially from SLOW, STD to FAST, and a hit on the [▼] key key will change it from FAST, STD to SLOW.

5) Press the **[PARAMETER]** key to display the absorbance and the newly entered range. If it is desired to change parameters again, press the **[PARAMETER]** key again, and follow the steps described above.

(NOTE)

For editing other parameters, refer to Section 6.

6) After confirming that the solvent is flowing without leakage in the system, then start a strip chart recorder or a recording integrator with a chart speed at 5 - 10 mm/min.

7) Wait until the baseline becomes stable, press the **[AUTO ZERO]** key, then the baseline will be shifted to recorder zero position. If the baseline position is not proper, change the baseline position to the desired postion by rotating the zero adjustment knob on the recorder.

8) Inject a sample and press the **[MARKER]** key, a chromatogram will be recorded on chart paper.

5-5 After Measurement

The materials of the flow cell could be corroded by some solvents such as; strong acids, bases, salts, halogenated solvent, etc., if they are left for a long period of time. Especially, the quartz cell window is easily corroded by strong bases. Purge the flow cell with an inert solvent, such as methanol, isopropanol. Do not use water, it is of course inert but microbiotics will grow in water and results in problem. Flush whole the system including detector flow cell with enough water after using such solvents. Then, turn the power OFF.

6. DISPLAY AND KEY OPERATIONS

The 870-UV/875-UV INTELLIGENT UV SPECTROPHOTOMETRIC DETECTOR can be easily operated through the simple key pad and the LCD multi-display. The logical key operation system and interactive messages appear on the LCD facilitate the operator to use the instrument to its full capability.

6-1 General Flow Chart of Key Operation and Display

The general flow chart of the key operation and display system is shown in Fig. 6-1.

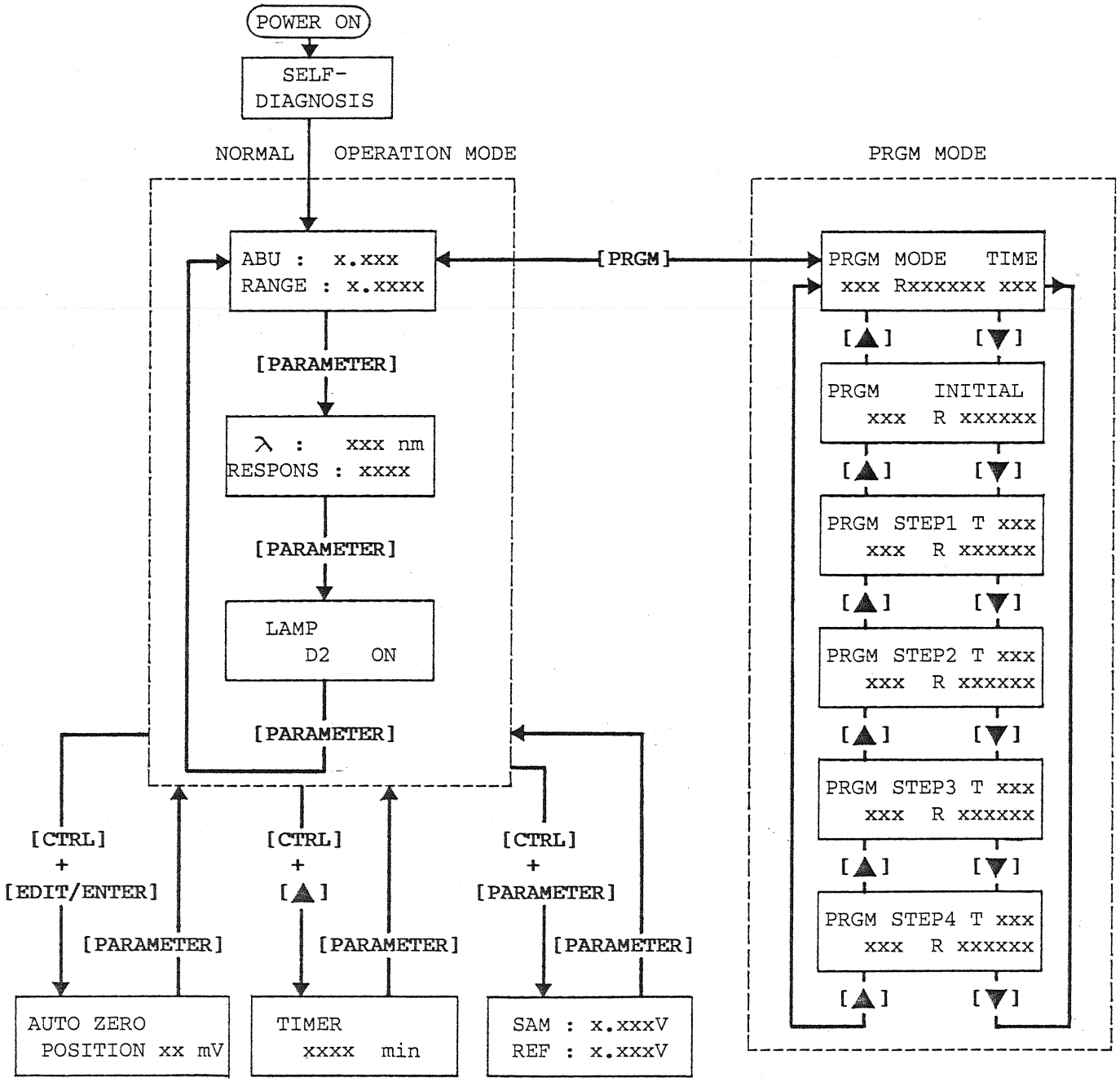


Fig. 6-1 General Flow Chart of Key Operation and Display

The key operation consists of following 5 modes;

1) NORMAL OPERATION MODE includes setting of sensitivity range, wavelength, response time and lamp selection.
2) TIME PROGRAM MODE includes program of wavelength and sensitivity range.
3) TIMER MODE includes the auto-lamp-off timer.
4) MAINTENANCE MODE includes re-calibration of wavelength.
5) SELF-DIAGNOSTIC MODE includes the checking of memories, RAM back-up, lamp emission energy, DC power supply, etc., and the messages of the results.

Each mode can be selected by a simple key stroke as shown in Fig. 6-1.

6-2 Key Operation in Normal Operation Mode

The normal operation mode is the most commonly used for measurement, where the user can change the sensitivity range, wavelength, response, light source and auto-zero position. In addition to above items, output levels of sample-side and reference-side amplifiers can conveniently be read out for diagnostic purpose without entering the maintenance mode.

On completion of the self-diagnostic run, the normal operation mode is automatically selected, and the following NORMAL MODE MONITOR DISPLAY will appear on the LCD.

```
ABU:  x.xxx
RANGE: x.xxxx
```

Present absorption in the flow cell in terms of absorbance unit is shown on ABU, and previously entered sensitivity range is also shown on RANGE.

6-2-1 Entering sensitivity range

When the above display is shown on the LCD, RANGE can be entered by the following procedure.

[EDIT/ENTER] : RANGE value will blink (shown as x.xxxx).

```
ABU:  x.xxx
RANGE: x.xxxx
```

[▲]/[▼] : Change to desired RANGE.

[EDIT/ENTER] : New value has been entered, and shown on RANGE without blinking.

(NOTE)

The RANGE value start from 0.001 and increases in the binary step from 0.0025 to 2.56 ABU and S (zero output) in 13 steps.

6-2-2 Entering wavelength and response

When the following NORMAL MODE MONITOR DISPLAY is shown on the LCD, WAVELENGTH and RESPONSE can be entered.

```
ABU:  x.xxx
RANGE: x.xxxx
```

[PARAMETER] : WAVELENGTH and RESPONSE will be shown.

```
λ :   xxx nm
RESPONS: xxxx
```

[EDIT/ENTER] : WAVELENGTH value will blink (shown as x.xxxx).

```
λ :   xxx nm
RESPONS: xxxx
```

[▲]/[▼] : Change to desired WAVELENGTH.

[EDIT/ENTER] : New value has been entered, and shown on λ without blinking. Now a word on RESPONS value is blinking.

```
λ :   xxx nm
RESPONS: xxxx
```

[▲]/[▼] : Change to desired REPONS; FAST, STD or SLOW.

[EDIT/ENTER] : New RESPONS has been entered, and shown on RESPONS without blinking.

(NOTE)

The WAVELENGTH ranges are 190 - 700 nm (870-UV) and 190 - 700 nm (875-UV), and it can be changed in 1 nm step. When a wavelength longer than 400 nm is to be entered to 870-UV, W (tangsten) lamp must be ON. See next section.

6-2-3 Selecting light source

When the following display is shown on the LCD, light source selection is allowed.

```
λ :   xxx nm
RESPONS: xxxx
```

[PARAMETER] : Present LAMP(s), D2, W or D2&W will be shown.

```
LAMP
cccc     ON
```

[EDIT/ENTER] : Present LAMP(s) will link (shown as cccc).

```
LAMP
cccc     ON
```

[▲]/[▼] : Select desired LAMP(s).

[EDIT/ENTER] : New LAMP(s) has (have) been selected, and shown without blinking.

[PARAMETER] : Returns to NORMAL MODE MONITOR DISPLAY as shown below.

```
ABU:  x.xxx
RANGE: x.xxxx
```

(NOTE)

If simultaneous lighting of the deuterium and tangsten lamps (D2&W) are selected, the baseline drift may be greater.

6-2-4 Entering auto-zero position

When an integrator is used, a baseline level is sometimes needed to be off-setted above the true zero level for monitoring negative peaks, for instance, peaks in indirect ion chromatography. The 870-UV/875-UV has capability to bias the integrator output by entering AUTO ZERO POSITION for such a case. When the following NORMAL MODE MONITOR DISPLAY is shown on the LCD, AUTO ZERO POSITION can be entered, by the procedure shown below;

```
ABU:  x.xxx
RANGE: x.xxxx
```

[CTRL] : Keep the key depressed.

\+

[EDIT/ENTER] : Present AUTO ZERO POSITION will be shown in mV.

```
 AUTO ZERO
POSITION xxmV
```

[EDIT/ENTER] : AUTO ZERO POSITION in mV will blink (shown as xx).

```
 AUTO ZERO
POSITION xxmV
```

[▲]/[▼] : Change to desired AUTO ZERO POSITION.

[EDIT/ENTER] : New AUTO ZERO POSITION has been entered, and shown without blinking.

[PARAMETER] : Returns to NORMAL MODE MONITOR DISPLAY as shown below.

```
ABU:  x.xxx
RANGE: x.xxxx
```

(NOTE 1)

AUTO ZERO POSITION can be 0.10 or 50 mV.

(NOTE 2)

AUTO ZERO POSITION is valid only for integrator output.

6-2-5 Checking sample and reference pre-amp outputs

The 870-UV/875-UV is equipped with the micro-processor controlled auto-zero which has very wide dynamic range and high resolution. Therefore, even with a high-absorption mobile phase or dirty cell windows, auto-zero can be performed. In such a case, "OUT OF RANGE" warning may occur when the background level or transmittance of the cell windows become marginal. In order to determine if the cell windows are dirty or the mobile phase has too high absorption, sample and reference pre-amplifier outputs can be directly read on the LCD. When the following display is shown on the LCD, SAM and REF outputs can be read, by the procedure shown below;

```
ABU:  x.xxx
RANGE: x.xxxx
```

[CTRL] : Keep the key depressed.

\+

[PARAMETER] : Present SAM and REF output will be shown in V.

```
SAM:  x.xxxV
REF:  x.xxxV
```

[PARAMETER] : Returns to NORMAL MODE MONITOR DISPLAY as shown below.

```
ABU:  x.xxx
RANGE: x.xxxx
```

(NOTE)

When the REF output is below 1/5th of SAM output with a solvent having no absortption at the wavelength, cell windows are probably dirty. See Section 8.

6-2-6 General notes and precautions on key operation

(NOTE 1)

Just press the **[EDIT/ENTER]** key to skip the parameter not to be changed.

(NOTE 2)

While a parameter is being edited with blinking, only **[▲]/[▼]** and **[EDIT/ENTER]** keys are accepted and **[MARKER]** and **[AUTO ZERO]** keys are disabled.

(NOTE 3)

While parameters are being edited, the detector operates with the previously entered values. The new parameters activate on pressing the **[EDIT/ENTER]** key.

6-2-7 Summary for key operations in normal operation mode

Table 6-1 Summary for Key Operation in Normal Operation Mode

FUNCTION	STATUS		KEY OPERATION
	DISPLAY	LED	
Entering RANGE	ABU : x.xxx RANGE : x.xxxx	on/off	**[EDIT/ENTER]** **[▲]/[▼]** **[EDIT/ENTER]** (RANGE entry)
Entering WAVELENGTH and RESPONSE	ABU : x.xxx RANGE : x.xxxx	on/off	**[PARAMETER]** → λ : xxx nm RESPONS : xxxx **[EDIT/ENTER]** **[▲]/[▼]** **[EDIT/ENTER]** (WAVELENGTH entry) **[▲]/[▼]** **[EDIT/ENTER]** (REAPONSE entry)
Selecting LAMP	ABU : x.xxx RANGE : x.xxxx	on/off	**[PARAMETER]** **[PARAMETER]** → LAMP D2 ON **[EDIT/ENTER]** **[▲]/[▼]** **[EDIT/ENTER]** (LAMP entry)

Table 6-1 Continued

FUNCTION	STATUS		KEY OPERATION
	DISPLAY	LED	
Entering AUTO ZERO POSITION	ABU : x.xxx RANGE : x.xxxxx	on/off	[CTRL] + [EDIT/ENTER] → AUTO ZERO POSITION xx mV [EDIT/ENTER] [▲]/[▼] [EDIT/ENTER] (AUTO ZERO POSITION entry) [PARAMETER] → ABU : x.xxx RANGE : x.xxxxx
Checking SAMPLE and REFERENCE output levels	ABU : x.xxx RANGE : x.xxxx	on/off	[CTRL] + [PARAMETER] → SAM : x.xxxV REF : x.xxxV [PARAMETER] → ABU : x.xxx RANGE : x.xxxxx

(NOTE)

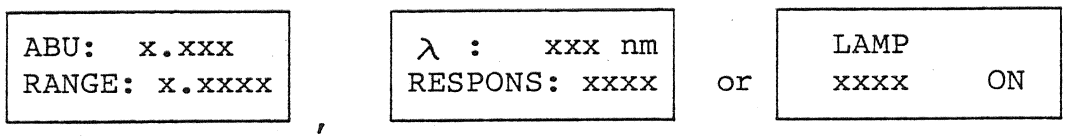
AUTO ZERO POSITION is valid only for integrator output.

6-3 Time Program Mode

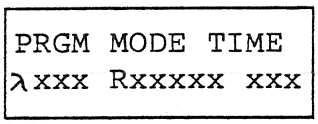
In TIME PROGRAM MODE, the wavelength and sensitivity RANGE can be programmed with time.

6-3-1 Change mode to time program

When any one of following displays is shown on the LCD, the mode can be changed from NORMAL OPERATION MODE to TIME PROGRAM MODE, by the procedure shown below.



[PRGM] : Changes to TIME PROGRAM MODE, and the TIME PROGRAM MODE MONITOR DISPLAY will be as shown.



(NOTE 1)

The RANGE is a parameter which is not time-programmable, the RANGE entered to NORMAL OPERATION MODE is valid in the TIME PROGRAM MODE.

(NOTE 2)

Even though the time program mode is selected and the TIME PROGRAM MODE MONITOR DISPLAY is shown on the LCD, the detector is operated with parameters, wavelength, sensitivity range and response, entered to the NORMAL OPERATION MODE, unless the **[PRGM RUN/STOP]** is pressed. See Section 6-3-4.

6-3-2 Entering wavelength and range to initial step

The time program consists of 5 steps including the initial step and steps #1 through #4. The inital step is a step at "0 min" time, WAVELENGTH and RANGE at desired time can be entered to steps #1 through #4. When the following TIME PROGRAM MODE MONITOR DISPLAY is shown on the LCD, initial WAVELENGTH and RANGE can be entered, by the procedure shown below.

```
PRGM MODE TIME
λxxx Rxxxxx xxx
```

[▲] : The initial step display will be shown.

```
 PRGM   INITIAL
λ xxx   Rxxxxxx
```

[EDIT/ENTER] : Previously entered WAVELENGTH value will blink (shown as xxx).

```
 PRGM   INITIAL
λ xxx   Rxxxxxx
```

[▲]/[▼] : Change to desired WAVELENGTH.

[EDIT/ENTER] : New value has been entered, and shown on λ without blinking. Now RANGE value is blinking.

```
 PRGM   INITIAL
λ xxx   Rxxxxxx
```

[▲]/[▼] : Change to desired RANGE.

[EDIT/ENTER] : New value has been entered, and shown on R without blinking.

```
 PRGM   INITIAL
λ xxx   Rxxxxxx
```

6-3-3 Entering wavelength and range to steps #1 through #4

After entering parameters, WAVELENGTH and RANGE, to the initial step, the parameters can be entered to steps #1 through #4 together with times when these to be changed. When the following display is shown on the LCD, entering is allowed by the procedure shown below.

```
 PRGM  INITIAL
λ xxx  Rxxxxxx
```

[▲] : The step #1 display will be shown.

```
PRGM STEP1 Txxx
λ xxx  Rxxxxxx
```

[EDIT/ENTER] : Previously entered TIME value will blink (shown as xxx).

```
PRGM STEP1 Txxx
λ xxx  Rxxxxxx
```

[▲]/[▼] : Change to desired TIME.

[EDIT/ENTER] : New value has been entered, and shown on T without blinking. Now WAVELENGTH value is blinking.

```
PRGM STEP1 Txxx
λ xxx  Rxxxxxx
```

[▲]/[▼] : Change to desired WAVELENGTH.

[EDIT/ENTER] : New value has been entered, and shown on λ without blinking. Now RANGE value is blinking.

```
 PRGM  INITIAL
λ xxx  Rxxxxxx
```

[▲]/[▼] : Change to desired RANGE.

[EDIT/ENTER] : New value has been entered, and shown on R without blinking.

[▲] : The step #2 display will be shown.

```
PRGM STEP2 Txxx
↗xxx  Rxxxxxx
```

To enter parameters steps #2 through #4, repeat the same procedure as for step #1.

(NOTE)

When the detector is conected to the 801-SC system controller, the above time program will not be activated.

6-3-4 Running time program

(NOTE)

When the detector is connected to the 801-SC system controller, the above time program will not be activated.

When the following TIME PROGRAM MODE MINITOR DISPLAY is shown on the LCD, running of the time program is accepted.

```
PRGM MODE TIME
↗xxx Rxxxxx xxx
```

[PRGM RUN/STOP]: Starts the time program with performing auto-zero and turning the key LED on.

[PRGM RUN/STOP]: Stops the time program, reset the program time clock to "0 min", with turning the key LED off. Now, the detector is operated with the parameters in the initial step.

[PRGM RUN/STOP]: Re-starts the time program with performing auto-zero and turning the key LED on.

(NOTE)

The detector continues to operate with the parameters in the last step until the **[PRGM RUN/STOP]** key is pressed.

6-3-5 Returning to normal operation mode

When the following TIME PROGRAM MODE MINITOR DISPLAY is shown on the LCD, the mode can be changed to NORMAL OPERATION MODE, by the procedure shown below.

```
PRGM MODE TIME
λxxx Rxxxxx xxx
```

[PRGM] : Returns to the NORMAL OPERATION MODE, and the display will be changed to the NORMAL OPERATION MODE MONITOR DISPLAY, as shown.

```
ABU:  x.xxx
RANGE: x.xxxx
```

6-3-6 Summary for key operations in time program mode

Table 6-2 List of Key Operations for Editing Time Program

FUNCTION	STATUS		KEY OPERATION
	DISPLAY	LED	
Changing to PRGM MODE	ABU : x.xxx RANGE : x.xxxx or λ : xxx nm RESPONS : xxxx or LAMP D2 ON	on/off	[PRGM] → PRGM MODE TIME λxxx Rxxxxxx xxx
Entering PRGM MODE INITIAL STEP	PRGM MODE TIME λxxx Rxxxxxx xxx	on/off	[▲] → PRGM INITIAL λ xxx R xxxxxx [EDIT/ENTER] [▲]/[▼] [EDIT/ENTER] (WAVELENGTH entry) [▲]/[▼] [EDIT/ENTER] (RANGE entry)
Entering PRGM MODE STEP 1-4	PRGM MODE TIME λxxx Rxxxxxx xxx	on/off	[▲] → PRGM STEPn T xxx λ xxx R xxxxxx [EDIT/ENTER] [▲]/[▼] [EDIT/ENTER] (TIME entry) [▲]/[▼] [EDIT/ENTER] (WAVELENGTH entry) [▲]/[▼] [EDIT/ENTER] (RANGE entry) [▲] (Next step)

Table 6-3 List of Key Operations for Running Time Program

FUNCTION	STATUS		KEY OPERATION
	DISPLAY	LED	
PRGM MODE PRGM RUN	PRGM MODE TIME λxxx Rxxxxxx xxx	off	**[PRGM RUN/STOP]** → LED on (Parameters are set to INITIAL values.)
PRGM MODE PRGM STOP,RESET	PRGM MODE TIME λxxx Rxxxxxx xxx	on	**[PRGM RUN/STOP]** → LED off (Time program is over and reset.)

(NOTE)

When the detector is connected to the 801-SC, only the time program in the 801-SC will be valid.

6-4 Entering Time for AUTO-LAMP-OFF

When the NORMAL OPERATION MODE DISPLAY is shown on the LCD, the entry of AUTO-LAMP-OFF time is accepted by the following procedre.

```
ABU:  x.xxx
RANGE: x.xxxx
```

[CTRL] : Keep depressed;
+
[▲] : Change display to AUTO-LAMP-OFF mode;

```
TIMER
  xxxx min
```

[EDIT/ENTER] : TIME value will blink (shown as x.xxxx).

```
TIMER
  xxxx min
```

[▲]/[▼] : Change to desired TIME.

(NOTE)
If AUTO-LAMP-OFF setting is not required, enter "OFF". Entering "OFF" is carried out by pressing [▼], decreasing the value below 1 min, and pressing [EDIT/ENTER] key.

[EDIT/ENTER] : New value has been entered, and shown on TIME without blinking, and the time starts decrement.

[PARAMETER] : Return to the NORMAL OPERATION MODE,

```
ABU:  x.xxx
RANGE: x.xxxx
```

When the time is up, the lamp(s) is (are) automatically turned off, the display will be as shown.

```
TIMER OFF !!
```

[PARAMETER] : Return to NORMAL OPERATION MODE.

(NOTE)

Once the lamp(s) is (are) turn off by the AUTO-LAMP-OFF function, the entered time is cleared. Re-entering of the time is required to activate the function again.

6-4-1 Summary for Key Operations in AUTO-LAMP-OFF mode

Table 6-4 List of Key Operations for Entering AUTO-LAMP-OFF

FUNCTION	STATUS		KEY OPERATION
	DISPLAY	LED	
Entering TIMER	ABU : x.xxx RANGE : x.xxxx or λ : xxx nm RESPONS : xxxx or LAMP D2 ON	on/off	[CTRL] + [▲] → TIMER xxxx min [EDIT/ENTER] [▲]/[▼] [EDIT/ENTER] (TIME entry) [PARAMETER] (→ Monitor Display)
Restoring NORMAL OPERATION MODE	TIMER OFF !! or WARNING !! OUT OF RANGE	on/off	[PARAMETER] (→ Monitor Display)

6-5 Clearing Error message and returning to NORMAL OPERATION MODE

When an error message has appeared as shown below, the NORMAL OPERATION MODE can be restored by the following procedure.

```
 WARNING !!
OUT OF RANGE
```

[PARAMETER] : Restore the NORMAL OPERATION MODE.

```
ABU:  x.xxx
RANGE: x.xxxx
```

(NOTE)

The above procedure restores the NORMAL OPERATION MODE, however, it does not solve the problem. Refer to Section 8.

7. OPERATION IN CONNECTION WITH OTHER INSTRUMENTS

The MODEL 870-UV/875-UV INTELLIGENT SPECTROPHOTOMETRIC DETECTOR is equipped with terminals for accepting control signals from external instruments and for controlling external instruments by contact closure signals. Further, it is equipped with the LC-Net® terminal, through which intelligent communication with the 801-SC system controller is permitted.

7-1 Activating Marker Out by External Instruments

By applying a contact closure signal to the "MAK. IN" terminal on the rear panel of the instrument, an event marker will outputted (600 msec) on "MAK. OUT" terminal as well as the recorder output. External instruments such as a manual injector with a marker output, autosampler, etc. can conveniently activate this function without pressing the **[MARKER]** key on the front panel by making connection described below.

7-1-1 Activating marker out by manual injector

This section describes how to activate an injection marker by the 7125 injector built in the MODEL 860-CO COLUMN OVEN. Connect the "MAK. IN" terminal on the rear panel of the detector to the "INJ. MARKER" terminal on the rear panel on the 860-CO column oven, referring to Fig. 7-1. This connection allows to provide the marker signal to the detector and to output injection marker whenever the injector lever is shifted from the load to inject position without pressing the **[MARKER]** key.

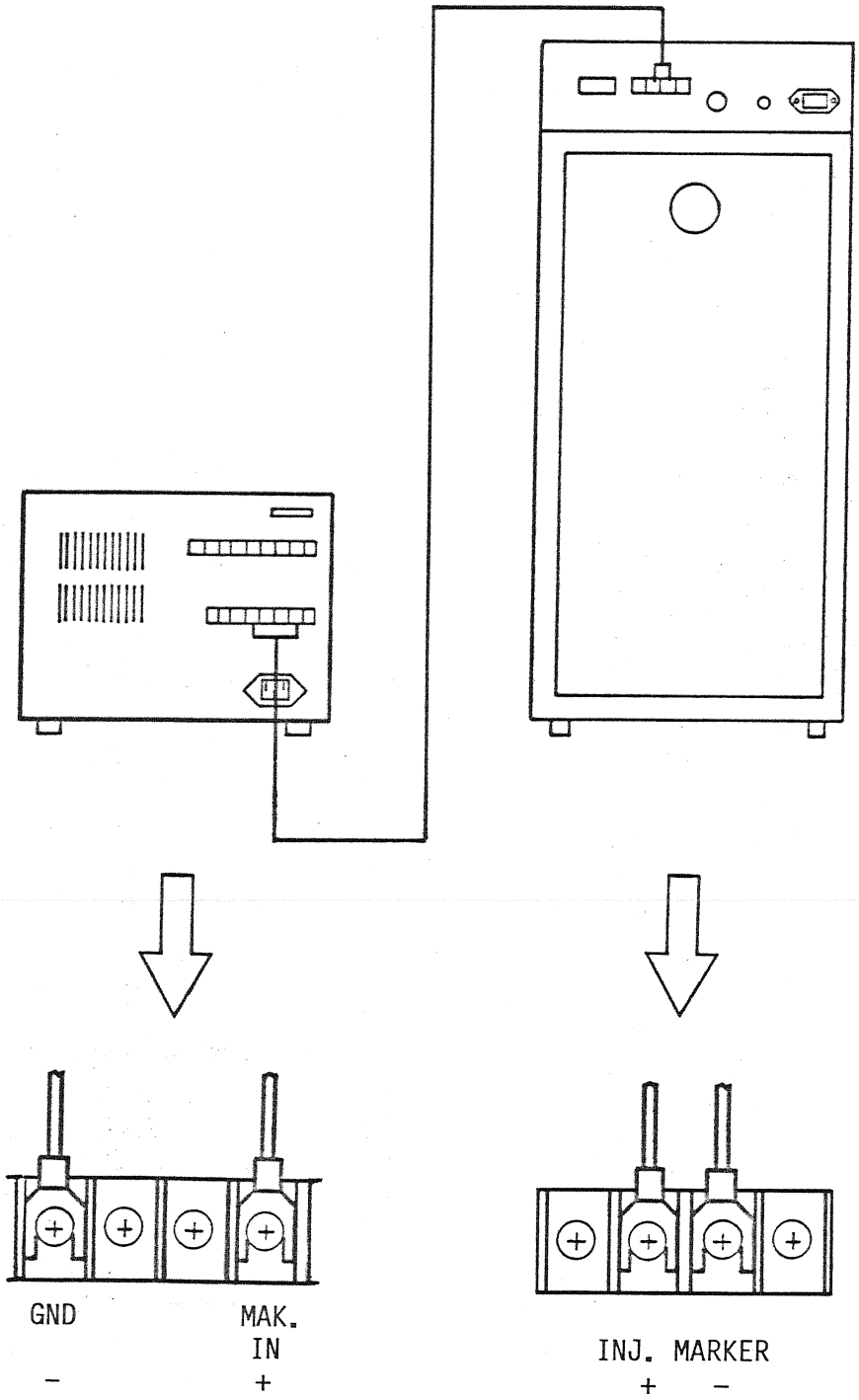


Fig. 7-1 Connection for Activating "MAK. OUT" (1)

7-1-2 Activating marker out by autosampler

This section describes how to activate an injection marker by the MODEL 855-AS INTELLIGENT SAMPLER or a similar one equipped with an "Injection Marker Output" as a contact closure.

Connect the "MAK. IN" terminal on the rear panel of the detector to the "INJ. MARKER" terminal on the rear panel on the 855-AS autosampler, referring to Fig. 7-2. This connection allows to provide the marker signal to the detector and to output injection marker on the "MAK. OUT" whenever the autosampler injects a sample without pressing the **[MARKER]** key.

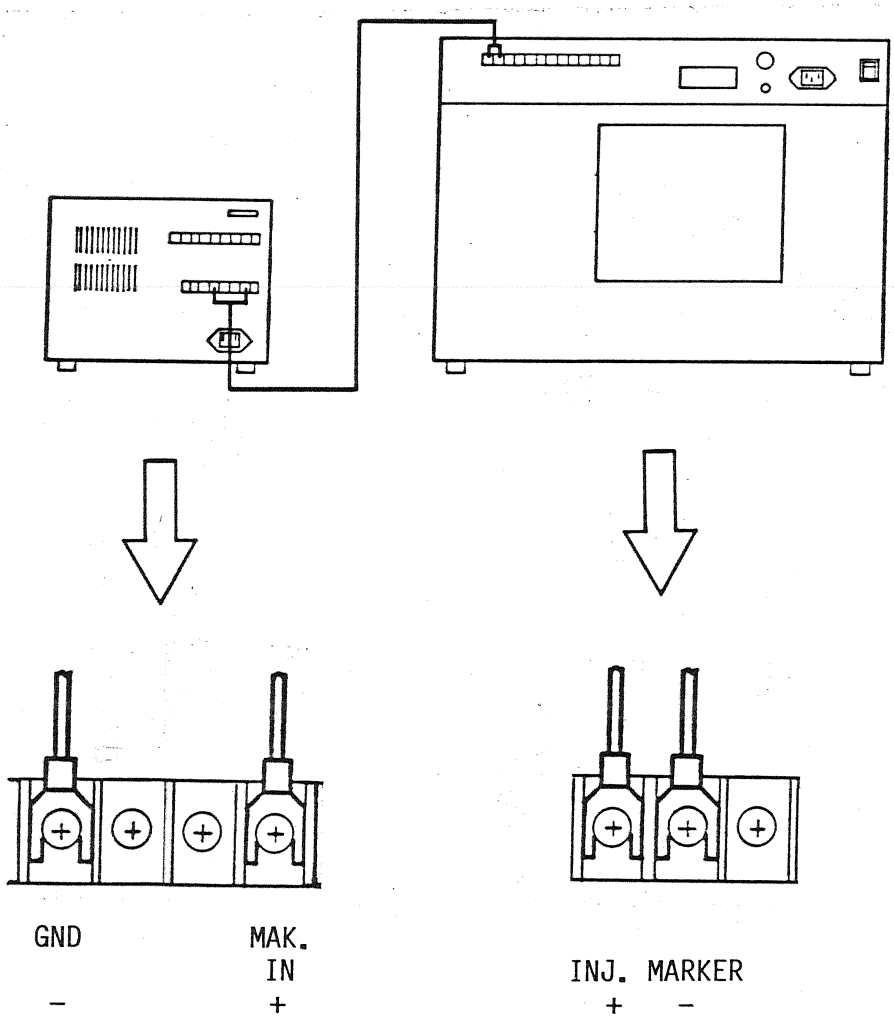


Fig. 7-2 Connection for Activating "MAK. OUT" (2)

7-1-3 Note and cautions in using "MAK. IN/OUT" terminals

(NOTE)

Input to "MAK. IN" must be done as a momentary closing of the terminals "MAK. IN +" and "GND -". Keeping the terminals closed does not function properly.

<CAUTION 1>

Input to the "MAK. IN" terminal is made by a contact closure signal (contact capacity of at least 5V and 10mA). When the "MAK. IN" are momentarily closed for 600 msec, the "MAK. OUT +"/"-" terminals are closed for the same period of time.

<CAUTION 2>

Parallel connection of "MAK.IN" with other control input terminals on the detector such as "AUTO ZERO" and "PRGM RST/ST" is allowed for simultaneously accepting a control signal from the same contact closure, however, parallel connection with input terminals of an external instrument is not allowed.

<CAUTION 3>

Never apply voltage or current to the "MAK. IN" terminal.

7-2 Activating Auto-zero by External Instruments

By applying a contact closure signal (600 msec) to the "AUTO ZERO" terminal on the rear panel of the instrument, detector outputs both on the "REC" and "INTE 1, 2" are automatically zeroed. External instruments such as a manual injector with a marker output, autosampler, etc. can conveniently activate this function without pressing the **[MARKER]** key on the front panel by making connection described below.

7-2-1 Activating auto-zero by marker out

This section describes how to activate an auto-zero by the marker output on "MAK. OUT".

Connect the "MAK. OUT" terminal to the "AUTO ZERO" terminal, both on the 870-UV/875-UV rear panel, referring to Fig. 7-3. This connection allows to autozero the detector outputs when never a contact closure signal is inputted to the "MAK. IN" on the detector rear panel. Input to the "MAK. IN" can be done by connections described in Sections 7-1-1 and 7-1-2. By the above connection and that in Section 7-1-1, the detector outputs are zeroed whenever the injector lever is shifted from the load to inject position. And by the

connctions here and Section 7-1-2, the outputs are zeroed whenever the autosampler injects a sample.

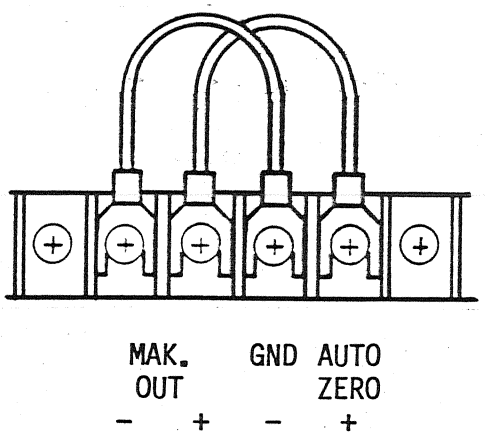


Fig. 7-3 Connection for Activating Auto-zero (1)

7-2-2 Activating auto-zero by autosampler

This section describes how to activate an auto-zero by an autosampler, the 855-AS INTELLIGENT SAMPLER or a similar one equipped with an "Injection Marker Output" as a contact closure.

Connect one of the "MARKER. OUT" terminals on the sampler rear panel to the "AUTO ZERO" terminal on the detector rear panel, referring to Fig. 7-4. This connection allows to autozero the detector outputs whenever the sampler injects a sample.

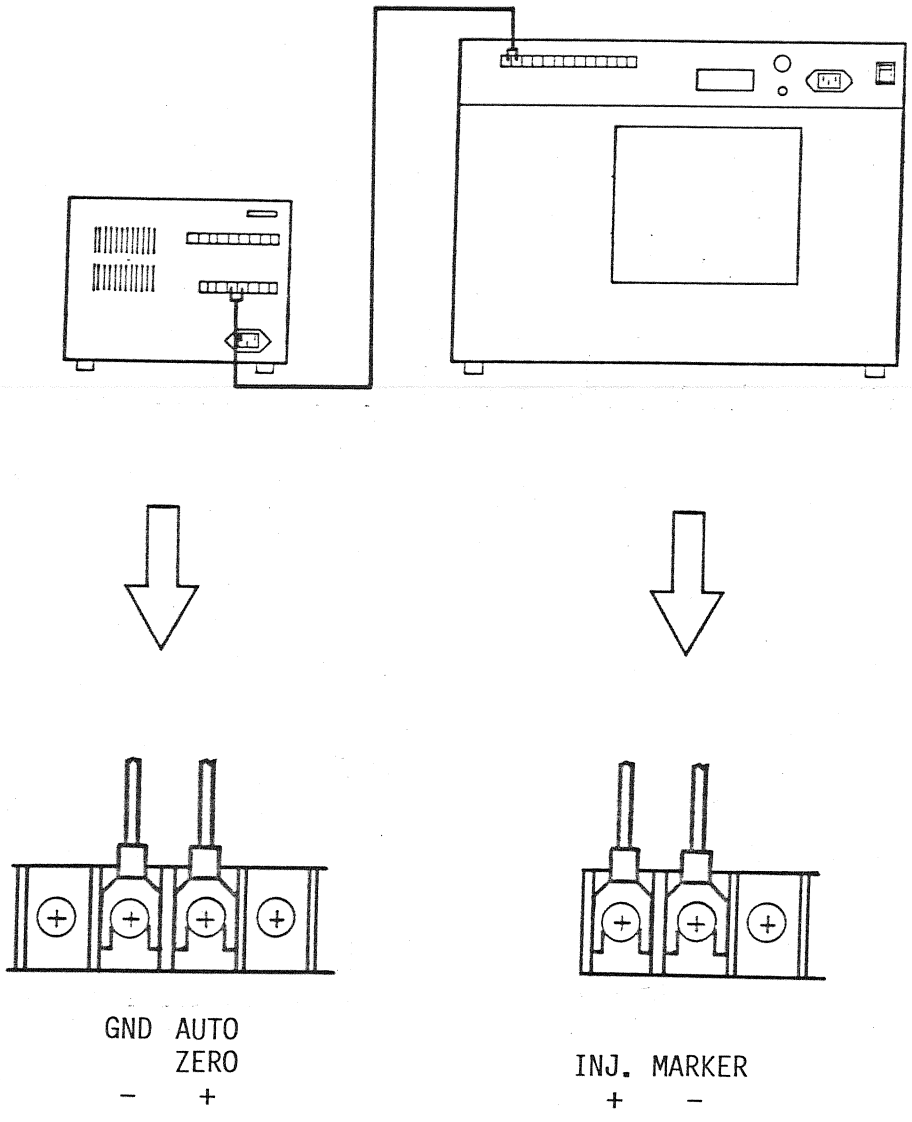


Fig. 7-4 Connection for Activating Auto-zero (2)

7-2-3 Notes and cautions in using "AUTO ZERO" terminal

(NOTE 1)

The sampler can activate auto-zero by both connections described in Sections 7-2-1 and 7-2-2.

(NOTE 2)

Input to "AUTO ZERO" must be done as a momentary closing of the terminals "MAK. IN +" and "GND -". Keeping the terminals closed does not function properly, it locks out the **[AUTO ZERO]** key.

(NOTE 3)

"AUTO ZERO" is activated whenever the time program starts, ie., the "PRGM RST/ST" is closed or the **[PRGAM RUN/STOP]** key is pressed for starting the program.

<CAUTION 1>

Auto-zero is activated when the "AUTO ZERO +"/"-" terminals are closed for 600 msec. A contact closure device must have capacity of at least 5V and 10mA.

<CAUTION 2>

Parallel connection of "AUTO ZERO" with other control input terminals on the detector such as "MAK. IN" is allowed for simultaneouly accepting a control signal from the same contact closure, however, parallel connection with input terminals of an external instrument is not allowed.

<CAUTION 3>

Never apply voltage or current to the "AUTO ZERO" terminal.

7-3 Starting External Instruments by Marker Out

When a contact closure signal (600 msec) is inputted from an external instrument to the "MAK. IN" terminal on the rear panel of the instrument, an event marker will be outputted on "MAK. OUT" terminal as well as the recorder output. External instruments such as an integrator, a recorder, etc. with "Ext. START" terminal compatible with a contact closure of 600 msec can conveniently be started by this output without using **[START]** key on each instrument panel by making connection described below.

7-3-1 Starting integrator by manual injector

This section describes how to start an integrator, the 805-GI GRAPHIC INTEGRATOR or similar one equipped with an "EXT. START" terminal, by the marker out signal on the "MAK. OUT" on the detector.

Connect the "MAK. OUT" on the rear panel of the detector to the "EXT. START" input terminal of the integrator, referring to Fig. 7-5. Also perform connection between the "MAK. IN" of the detector and the "INJ. MARKER." the 860-CO column oven as described in Section 7-1-1. These connections allow to start the integrator without pressing the **[START/STOP]** on the integrator key pad, whenever the injector lever is shifted from the load to inject position.

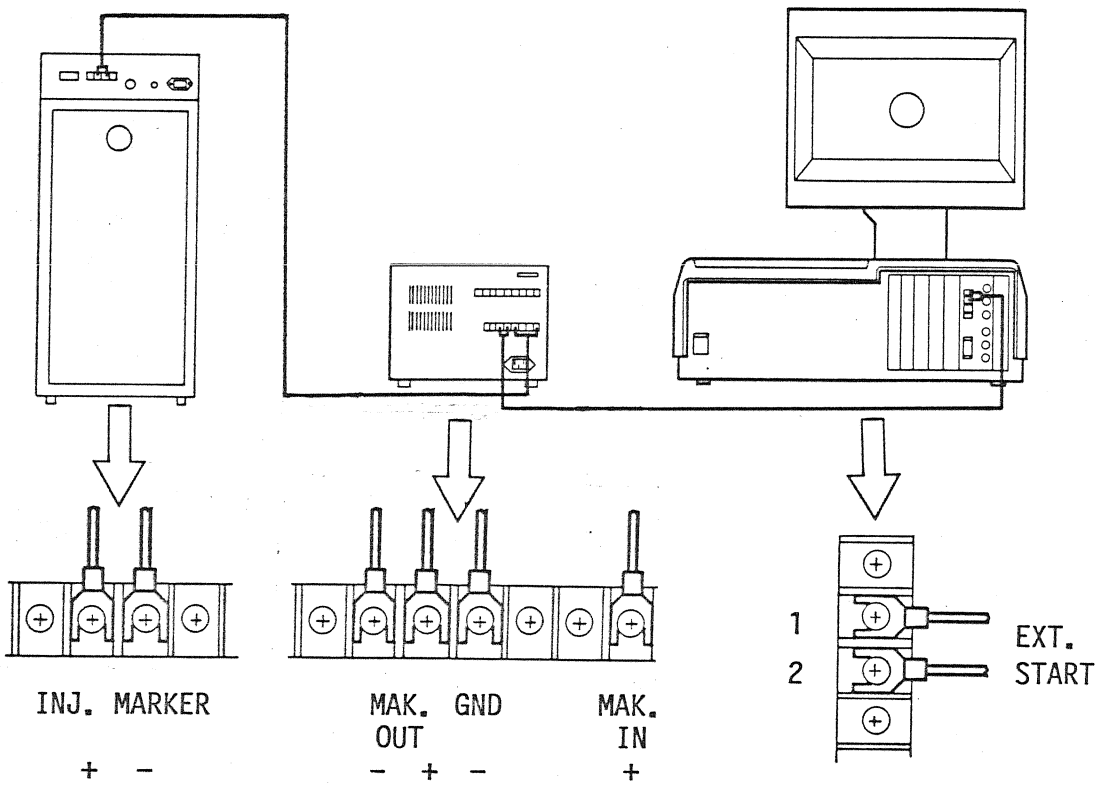


Fig. 7-5 Connection for Starting Integrator

7-3-2 Starting integrator by autosampler

Connection for starting an integrator by an autosamper is a simple modification of the connection described in Section 7-3-1 by that in Section 7-1-2.

Perform conncetion between the detector and the sampler as described in Section 7-1-2. Then, connect the "MAK. OUT" on the rear panel of the detector to the "EXT. START" input terminal of the integrator, referring to Fig. 7-5. These connections allow to automatically start the integrator without pressing the **[START/STOP]** on the integrator key pad, whenever the sampler injects a sample.

7-3-3 Note and cautions in using "MAK. OUT" terminal

(NOTE)

These connections do not stop the integrator, the enter stop time to the integrator or press the **[START/STOP]** in order to stop it.

<CAUTION 1>

Output to the "MAK. OUT" terminal is as a contact closure (contact capacity of 15V and 50 mA). The "MAK. OUT +"/"-" terminals are closed for 600 msec, when an input is applied to "MAK. IN".

<CAUTION 2>

Never apply voltage or current to the "MAK. IN" terminal.

7-4 Starting Time Program by External instruments

The 870-UV/875-UV has built-in time program of the wavelength and the sensitivity range. Time program can be started by inputting a contact closure signal to the "PRGM RST/ST" terminal on the detector as well as pressing the **[PRGM RUN/STOP]** key. External instruments such as a manual injector with a marker output, autosampler, etc. can conveniently activate this function without pressing the **[PRGM RUN/STOP]** key.

Effect of the "PRGM RST/ST" terminal is a little different from that of the **[PRGM RUN/STOP]**; closing the terminal will reset the program time clock to "0 min", ie., to the initial step, perform auto-zero and immediately start the program again. On the other hand, first press on the key will auto-zero and start the program and the second press will stop the program and reset the time to "0 min", but will not start the program again until the next press is applied on the key.

7-4-1 Starting time program by manual injector

Perform connections described in Section 7-1-1, then connect "MAK. OUT" to "PRGM RST/ST" as shown in Fig. 7-6. This connection allows to reset and start the time program whenever the injector lever is shifted from the load to inject position without pressing the **[PRGM RUN/STOP]** key.

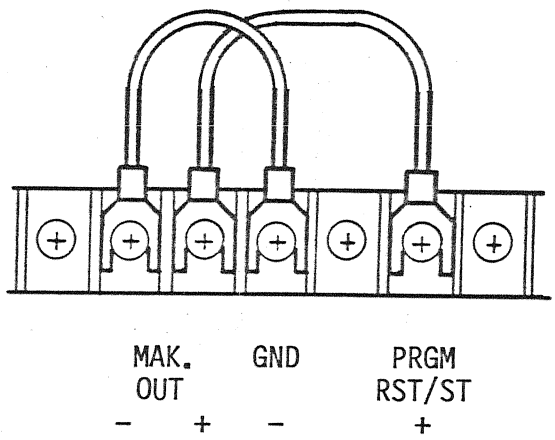


Fig. 7-6 Connection for Starting Time Program

7-4-2 Starting time program by autosampler

Perform connections described in Section 7-1-2, then connect "MAK. OUT" to "PRGM RST/ST" as shown in Fig. 7-6. This connection allows to reset and start the time program whenever the injector lever is shifted from the load to inject position without pressing the **[PRGM RUN/STOP]** key.

If the autosamper has more than one "INJECT. MARKER" output, as the 855-AS, "PRGM RST/ST" can be connected to one of these "INJECT. MARKER" output terminals of the autosampler.

7-4-3 Notes and cautions in using "PRGM RST/ST" terminal

(NOTE 1)

Closing the "PRGM RST/ST" terminal activates auto-zero as well as starting the time program. Therefore, the connection of "AUTO ZERO" is not necessry, if the "PRGM RST/ST" connection was made.

(NOTE 2)

Input to "PRGM RST/ST" must be done as a momentary closing of the terminals "MAK. IN +" and "GND -". Keeping the terminals closed does not function properly, it locks out the **[PRGM RUN/STOP]** key.

<CAUTION 1>

The time program starts when the "PRGM RST/ST+"/"GND-" terminals are closed for 600 msec. A contact closure device must have capacity of at least 5V and 10mA.

<CAUTION 2>

Parallel connection of "PRGM RST/ST" with other control input terminals on the detector such as "MAK. IN" is allowed for simultaneouly accepting a control signal from the same contact closure, however, parallel connection with input terminals of an external instrument is not allowed.

<CAUTION 3>

Never apply voltage or current to the "PRGM RST/ST" terminal.

7-5 Stopping solvent delivery by leak out signal

The 870-UV/875-UV has a built-in solvent leak sensor in the flow cell section. If an electrically conductive solvent such as a buffer solution leak from the flow cell, a contact closure signal is outputted on the "LEAK OUT" terminal. By applying this signal to the "STOP IN" terminal of the 880-PU INTELLIGENT PUMP, or similar one equipped with such a input terminal, solvent delivery can be stopped. This function protects the detector from the fatal damage when solvent leak should occur.

<CAUTION>

The leak out signal is never outputted by the leakage of non-conductive solvents, such as pure organic solvents.

Connect the "LEAK OUT" terminal on the rear panel of the detector to the "STOP IN" on the rear panel of the 880-PU pump, referring to Fig. 7-7.

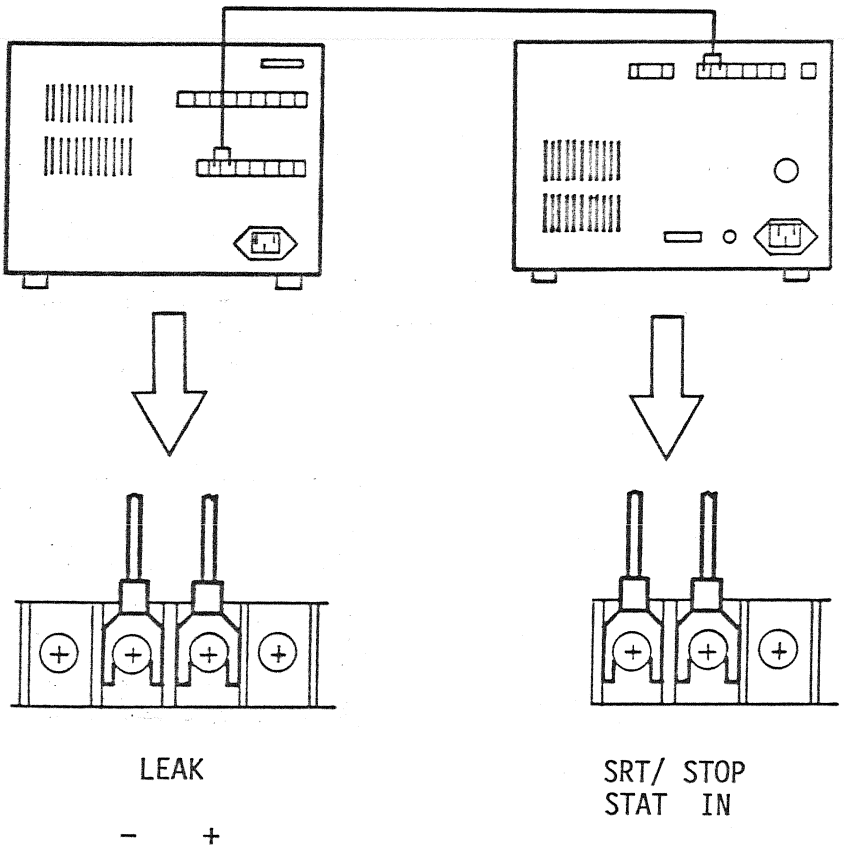


Fig. 7-7 Connection for stopping solvent delivery on leak

7-6 Operation with 801-SC SYSTEM CONTROLLER through LC-Net®

The MODEL 870-UV/875-UV INTELLIGENT SPECTROPHOTOMETRIC DETECTOR can be controlled by the MODEL 801-SC SYSTEM CONTROLLER through LC-Net® communication system. When the 870-UV/875-UV is included in the LC-Net® system, function of the system widely extended as follows;

1) initial conditions for wavelegnth, sensitivity range and response;
2) time program of wavelength, sensitivity range, auto-zero and power supply on/off;
3) maximum program step number of 200;
4) 10 different programs can be stored as files;
5) maximum 99 analyses with 10 different detector programs can be performed by using the 850-AS INTELLIGENT SAMPLER.

The functions of the system includes sophisticated post-column derivatization analysis, fully automated sequential analyses with different elution conditions, system protect program, etc., as well as detector capability mentioned above. All controls of the detector, pump(s), autosampler, etc. can be performed by using a key pad and CRT display of the 801-SC. The operator is prompted conveniently by help message for key operation.

7-6-1 Connection with 801-SC System Controller

LC-Net® communication system is made by connection of each module generally in series with one another by using LC-Net® cable A and C. When the model 850-AS INTELLIGENT SAMPLER is to be included, connection must be started with the 801-SC, then 850-AS should be second as shown in Fig. 7-1, the order of connection for other modules can be disregarded.

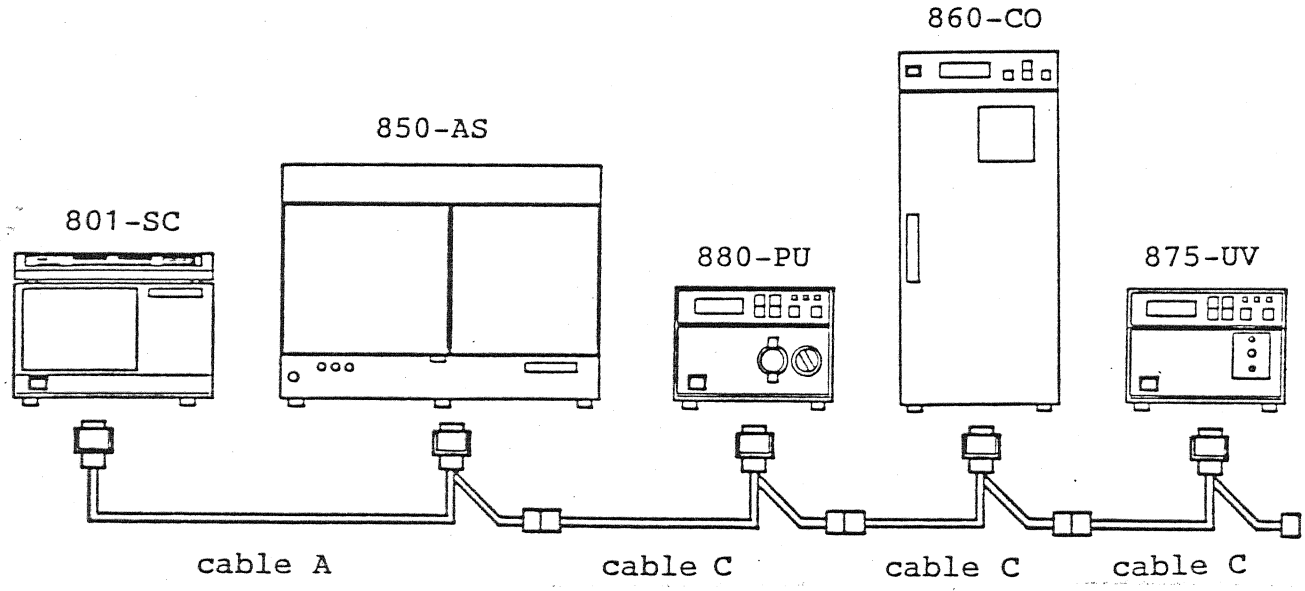


Fig. 7-8 Connection Including 850-AS

When the 850-AS is not included, the order of connection can be disregarded as long as the connection is started with the 801-SC as shown in Fig. 7-2. An LC-Net® cable A, which is included in the 801-SC accessory kit, is used for connection between the 801-SC and the next module, an LC-Net® C, which is an optional item, is used for connection with modules after second one.

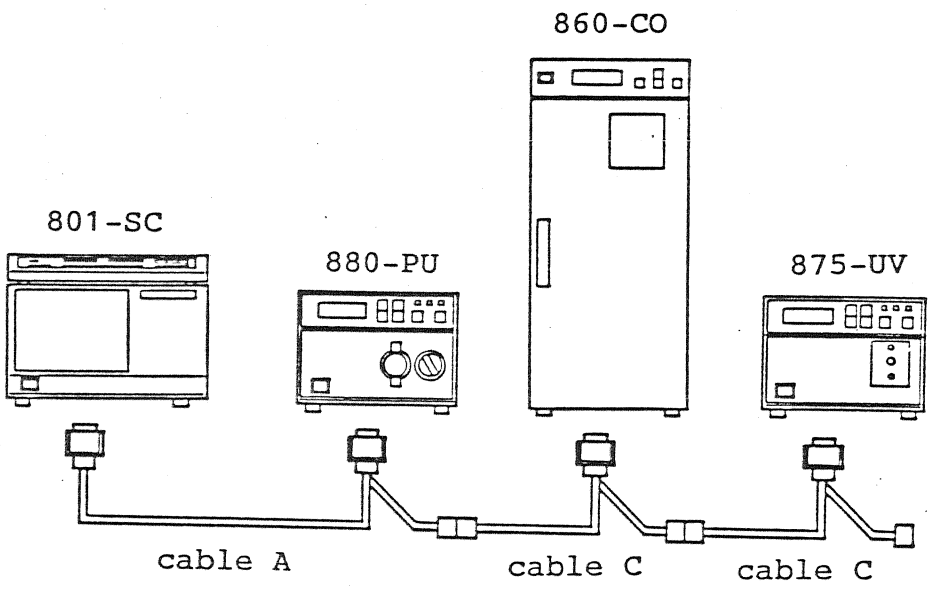


Fig. 7-9 Connection Excluding 850-AS

8. SELF-DIAGNOSTICS AND TROUBLESHOOTING

This chapter provides the user with instructions necessary to isolate the cause of the 870/875-UV ULTRAVIOLET HPLC DETECTOR problem. The 870/875-UV is equipped with a self-diagnostic program, which automatically check electrical function and operation status. The results are shown on the panel LCD display as error and trouble messages.

8-1 Power on Self-Diagnostics

On turning the power on to the 870/875-UV, the self-diagnostic program runs automatically, checks following items.

1) ROM check sum
2) RAM read/write
3) RAM back up
4) Lamp emission energy
5) +/- 15V DC power supply output voltage

If there should be any problem with above items, error messages will be displayed on the panel LCD (liquid crystal display). Error messages, symptom, probable cause and recommended action are listed in Table 8-1.

Table 8-1 Error Messages in SELF DIAGNOSIS

Item	Message	Symptom	Probable cause/ Recommended Action
1	ROM CHECK ERROR	ROM malfunction	Turn off power, then turn on again after 30 sec. Note that too short on/off interval may result in ROM/RAM error. If "ERROR" is displayed again, replace ROM/RAM (P/N 6572-H501B/ 6572-H502B).
2	RAM CHECK ERROR	RAM malfunction	
3	BACK UP ERROR	RAM back up malfunction	Replace back up battery.
4	LAMP EM POOR	Lamp emission at 250nm became 1/4 of original emission.	Replace lamp or light source mirror(s), for highly sensitive measurement or with high absorption back-ground. Ordinary measurements can be done without problem, the error message will dis-appear in a few seconds.
5	+-15V ERROR	+/-15V POWER SUPPLY PCB malfunction	Replace +/-15V POWER SUPPLY PCB.

(NOTE)

If "BACK UP ERROR" be shown, re-entering of wavelength calibration coefficients is required. See Section 9.

8-2 Self-diagnosis in Operation

Following items are continuously checked, even the detector is in operation.

1) Leak in cell assembly
2) Lamp burnt out
3) Wavelength driver position
4) AUTO LAMP OFF timer
5) AUTO ZERO background

If above items should occur, messages will be displayed on the panel LCD. Error and other messages, symptom, probable cause and recommended action are listed in Table 8-2.

Table 8-2 Error and other Messages in Operation

Item	Message	Symptom	Probable cause and Recommended Action
1	TROUBLE !! LEAK IN CELL	Solvent leak in cell assy.	Turn power off. Pull out the cell and repair.
2	TROUBLE !! LAMP OFF	Lamp burnt out.	Turn power off, then turn on again after 30 sec. Note that too short on/off interval may result in lamp off. If "LAMP OFF" is displayed again, replace lamp or +/- 15V POWER SUPPLY PCB.
3	TROUBLE !! λLIMIT	Wavelength driver malfunction	Turn power off, then turn on again after 30 sec. If "LIMIT" is displayed again, call JASCO agent.
4	TIMER OFF !!	Lamp is turned off by built-in timer.	Press "PARAMETER" key to clear timer and restore normal operation. Re-entry of time is necessary for next timer operation.
5	WARNING !! OUT OF RANGE	Absorption background is too high to auto zero.	Press "PARAMETER" key to clear message. Auto-zero cannot activate for absorption background more than 2 ABU, remove cause of too high background, such as too short wavelength, contamination, etc.

8-3 General Problems

This section describes general problems which are not covered by the self-diagnostic program. These problems usually appear as symptoms on baseline. Observe baseline on a strip chart recorder and consult the table shown below.

8-3-1 Baseline problems

Table 8-3 Baseline Problems

Symptom	Probable Cause	Recommended Action
Baseline noises shown in Fig. 8-1	1. D_2 lamp out of life	Replace lamp.
Other types of noises shown in Fig. 8-2	1. Air bubbles in flow cell	Flush with degassed solvent.
	2. Contaminated cell windows	Disassemble and clean or repair.
	3. Foreign particles in cell	
	4. Solvent leak from cell	
	5. Electrical noise	Ground or remove cause.
	6. Air bubbles in pump head	Remove.
	7. Pump pulsation	Reduce pulse.
	8. Detector response too FAST	Change to STD or SLOW.
Too high background	1. Air bubbles trapped in flow cell	Flush with degassed solvent.
	2. Contaminated cell windows	Disassemble and clean.
	3. Immiscible solvent in flow cell	Flush with inter-miscible solvent.
	4. Contaminated mobile phase	Replace mobile phase solvent.
	5. Mobile phase with UV absorption	Change mobile phase or wavelength.
Drift	1. Contaminants eluted from column	Clean column.
	2. Degassing level changing	Re-degas or use in-line-degasser.
	3. Solvent composition changing	Keep on mixing.
	4. Room temperature changing	Stabilize.
	5. Leaks from cell	Disassemble and repair.
	6. Bad optical alignment	Re-align.

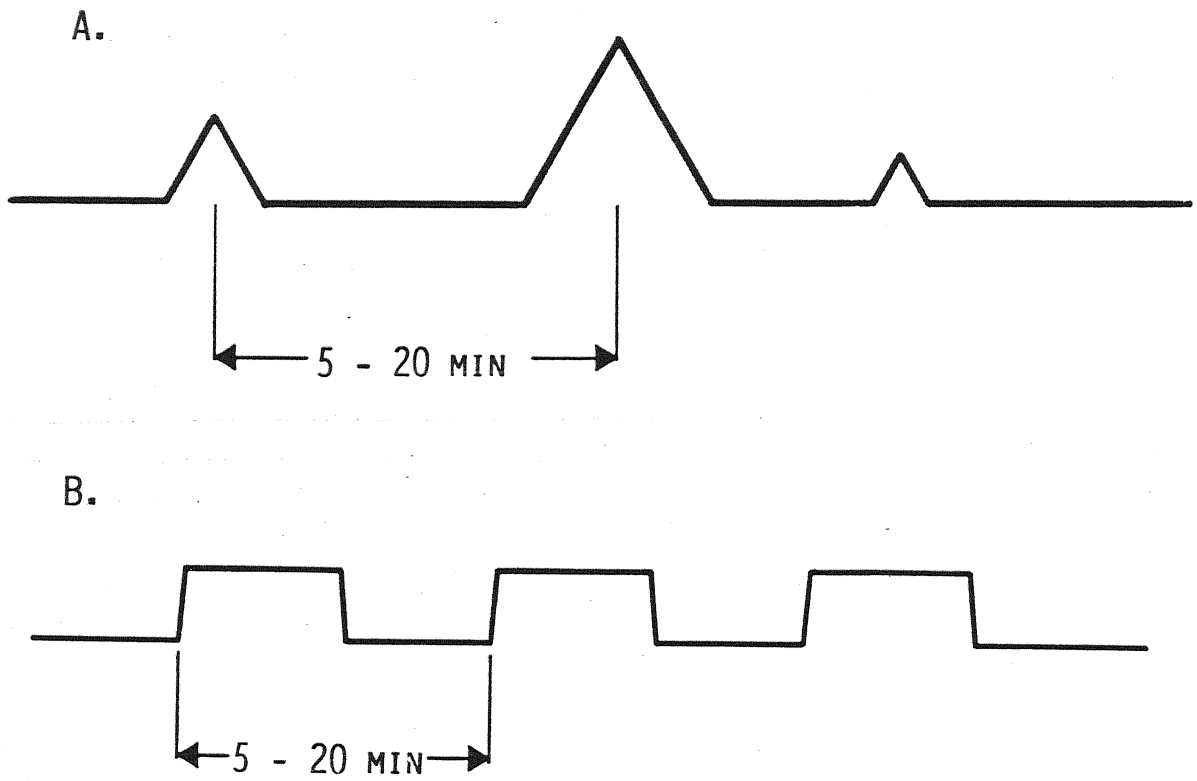


Fig. 8-1 Noises on Baselines (1)

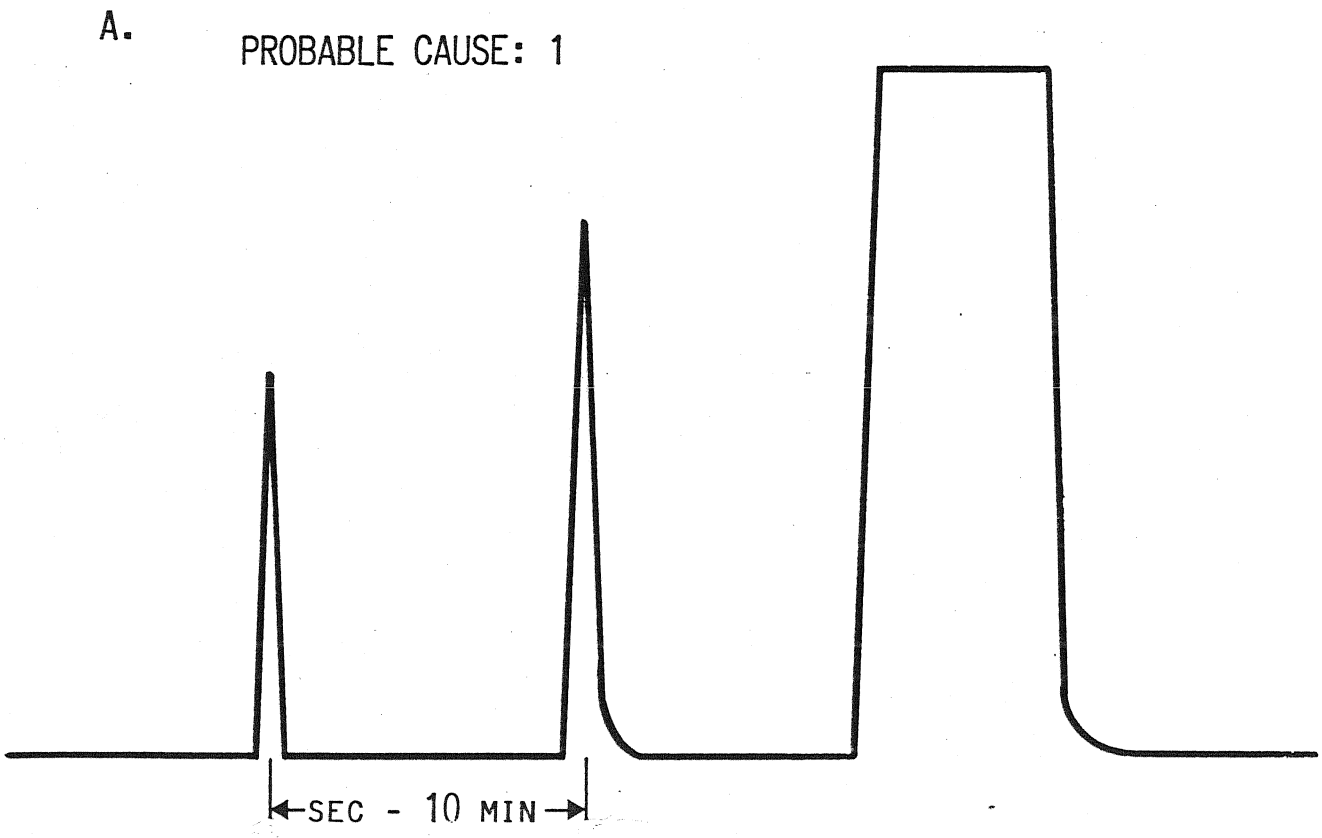
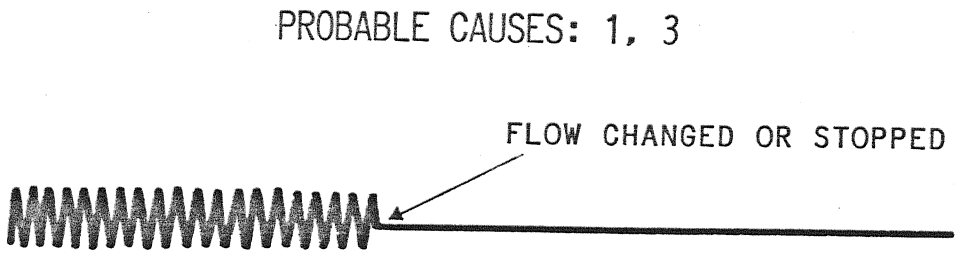


Fig. 8-2 Different types of Noises on Baselines (1)

B.



C.

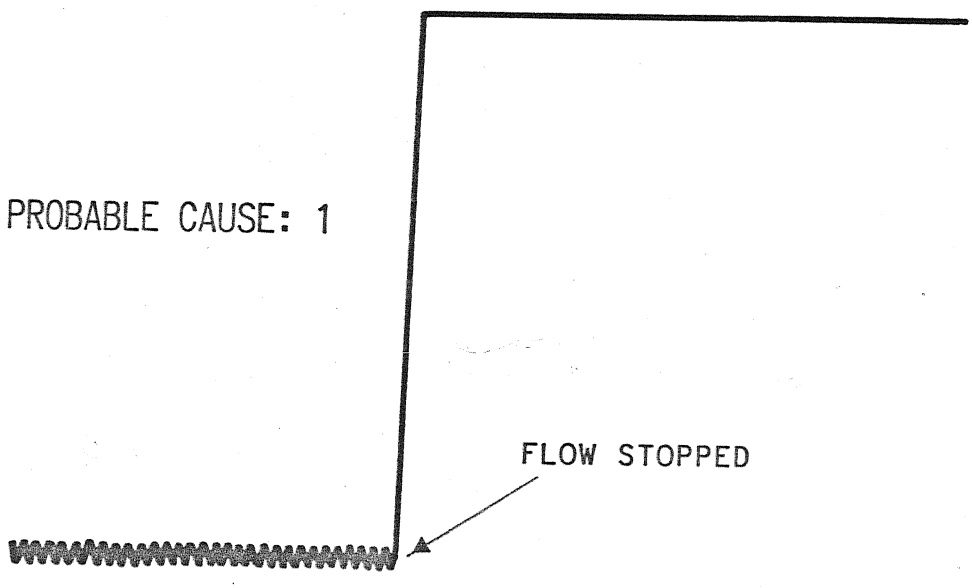
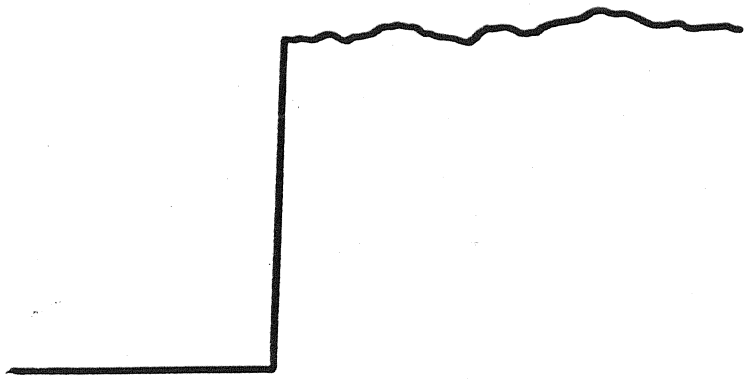


Fig. 8-2 Different types of Noises on Baselines (2)

D. PROBABLE CAUSE: 2



E. PROBABLE CAUSE: 4

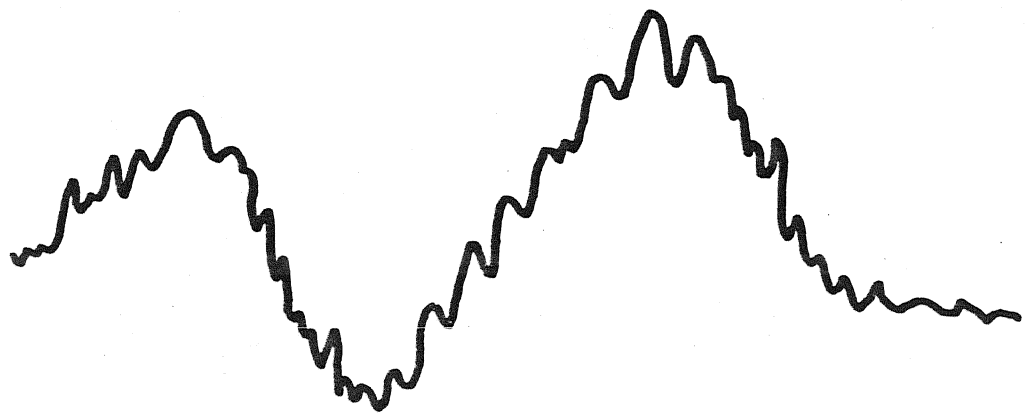
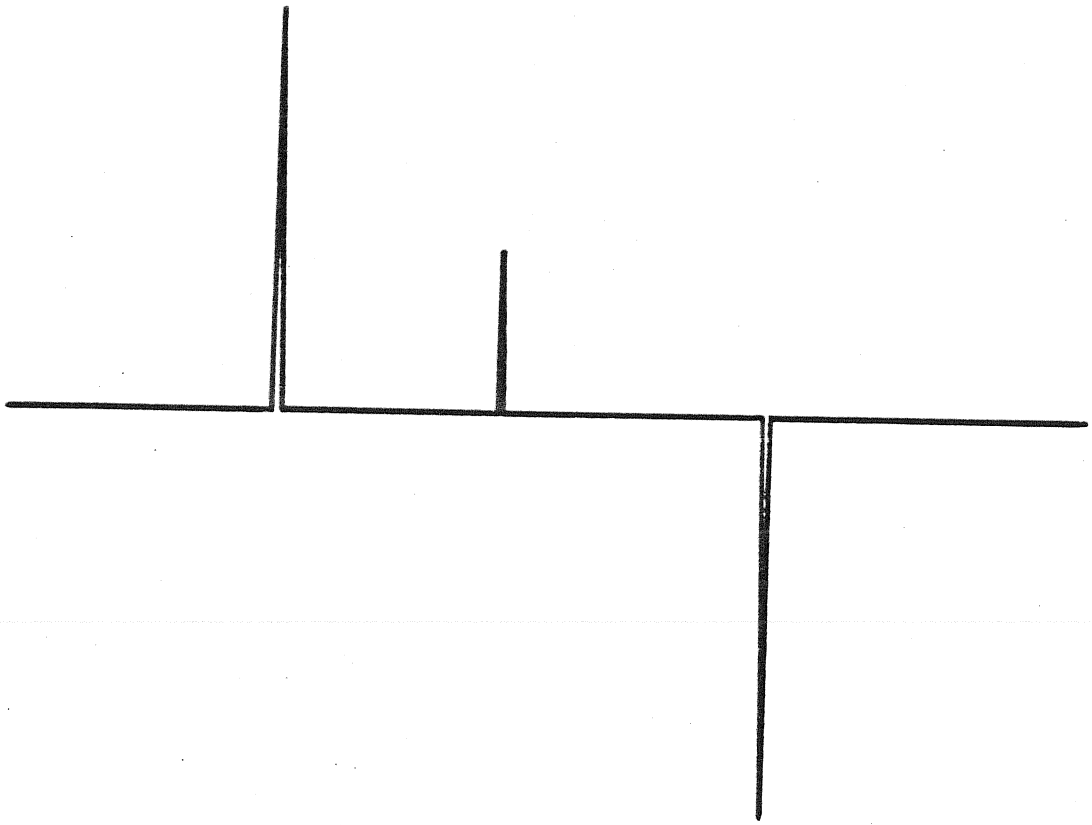


Fig. 8-2 Different types of Noises on Baselines (3)

F.

PROBABLE CAUSE: 5



G.

PROBABLE CAUSES: 6, 7

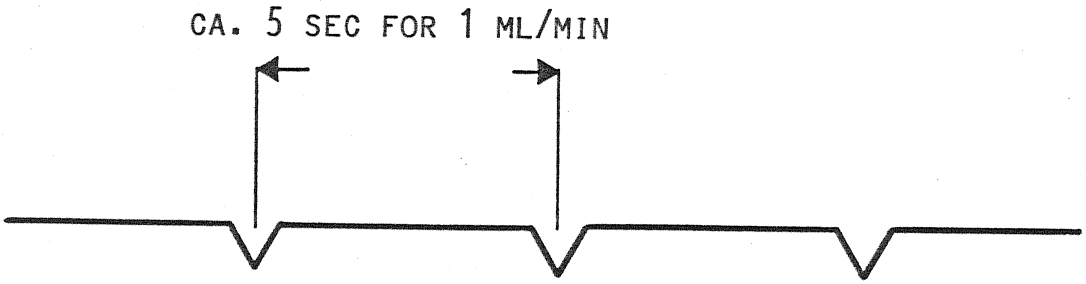
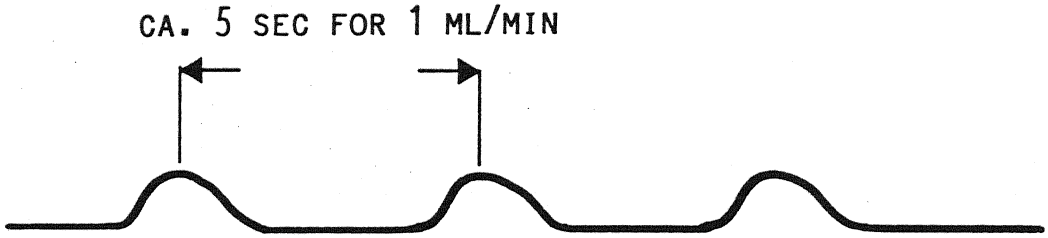


Fig. 8-2 Different types of Noises on Baselines (4)

H.

PROBABLE CAUSES: 6, 7



I.

PROBABLE CAUSES: 5, 8

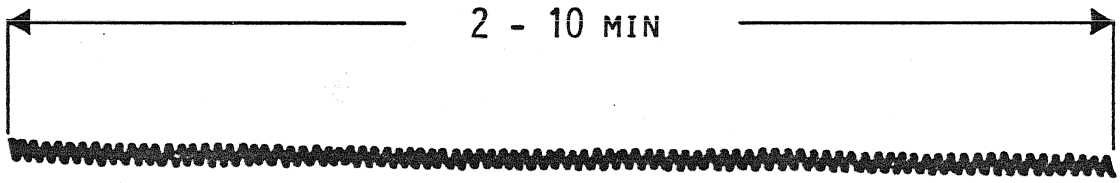


Fig. 8-2 Different types of Noises on Baselines (5)

8-4 Routine Maintenance Procedures

There is a few routine maintenance for the user to carry on the 875/870-UV detector. However, there may some problems caused by air bubbles, contaminants in mobile phase solvents. This section decribes the maintenance procedures for solving such problems.

8-4-1 Cleaning the flow cell by flushing

Baseline noise and drift are often caused by leakage and contamination of the cell window. In addition to those baseline problems, solvent leaked from the cell might result in serious damage to the optical unit.

<CAUTION>

Cell leakage is electrically detected, therefore, it is valid only for aqueous solvent. Be reminded that leakage of an organic solvent cannot be detected by the build-in leak detector.

Remove the flow cell cassette from the main unit, referring to Section 5-2-2, and flush it with an appropriate solvent by using a syringe. The best flushing solvent is dependent on the solvents used and samples injected, several different solvents should be tried. Once a suitable flushing solvent is found, it is more efficient to flush by using the pump. Connect the flow cell directly to the pump, and flow the solvent at a higher flow rate than usual, for instance 10ml/min.

<CAUTION 1>

Turn the "POWER" off before removing the flow cell cassette.

<CAUTION 2>

Solvents must be inter-miscible with each other.

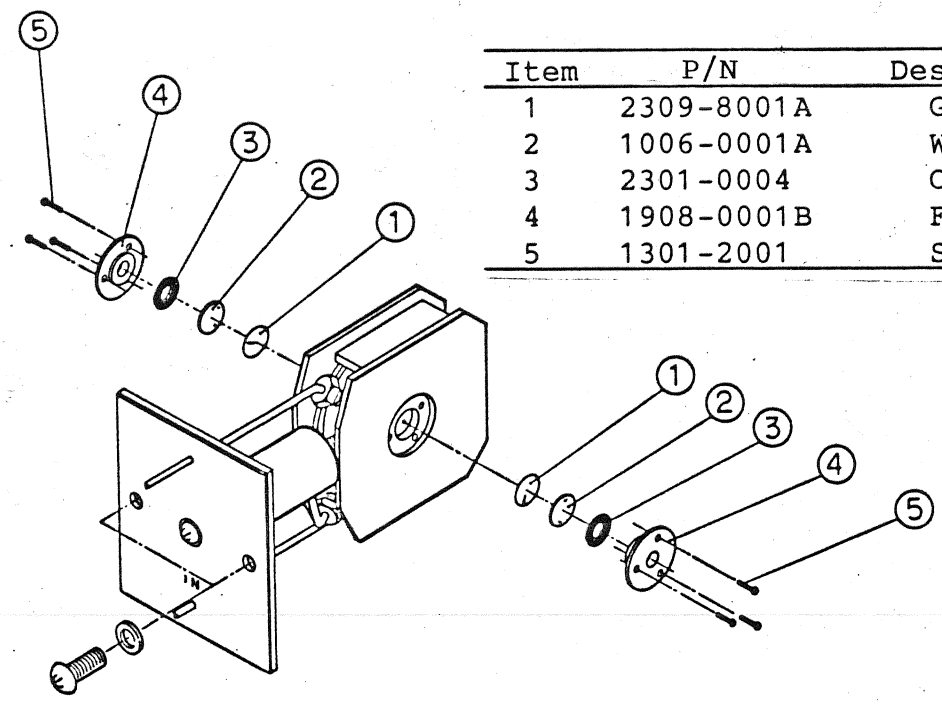
<CAUTION 3>

Dry the cell completely before re-install it, do not leave even a single droplet of solvent, wet outer surface of the window causes great loss in incident light due to light scattering, and will result in malfunction.

8-4-2 Disassembling and re-assembling the flow cell

Figure 8-3 shows the exploded view for the flow cell cassette.

Exploded View of Flow Cell Cassette



Item	P/N	Description
1	2309-8001A	Gasket
2	1006-0001A	Window
3	2301-0004	O-ring
4	1908-0001B	Flange
5	1301-2001	Screw

Fig. 8-3 Exploded View of Flow Cell Cassette

To disassemble and clean the cell proceed as follows;

1) Unscrew, evenly and gradually, three screws which secure the flange using a small phillips screw-driver.
2) Remove the window, flange and O-ring one by one.
3) Put a piece of adhesive tape on each window, and remove the window by lifting it with the tape. Do not use tweezers, pin, any hard tool, they will easily scratch the surface of the window.
4) Remove PTFE gaskets using a pin and tweezers.
5) Repeat steps 1) through 4) for the window on the other side.
6) Pour isopropanol into the cell hole and wipe it with a piece of lint-free cloth. If the solvent which has been used is not miscible with isopropanol, then, use inter-miscible solvents as described in Section 5-2. Be careful not to leave any lint, it will cause leakage and noise.
7) Clean the windows in ethanol or methanol by an ultra-sonic cleaner for several minutes, then, pick them up with tweezers by the edge and wipe them to dry with a piece of lint-free cloth. Repeat this procedure until

any stain or cloud are removed. When a pair of tweezers is used, be careful not to touch the polished surfaces of the window with its tips. If it should fail to clean them, use new windows.

8) Clean the new PTFE gaskets in ethanol or methanol.

(NOTE)

Once a gasket has been compressed, do not use it again, a used gasket causes leakage.

9) To re-assemble the flow cell cassette, hold it horizontally and place the PTFE gasket in position. Make sure that both the large and small cell holes appear through the slot of the gasket.

10) Place the window on the gasket.

11) Place the O-ring on the window, then, the flange with three screws.

12) Tighten the screws evenly until the part of the black O-ring can be slightly seen through the hole of the flange.

13) Repeat steps from 9) through 12) for the window on the other side.

14) Confirm that the slot of each gasket clears the cell holes, if not, perform procedures from 7) to 12) again.

8-4-3 Testing for leakage

Remove the flow cell cassette from the main unit, and connect the outlet tubing of the flow cell directly to the pump, then, flow an appropriate solvent at 10 ml/min. After several minutes check the cell visually. When aromatic solvent has been used, it is a good idea to smell it for leak check, as it is very sensitive. If it is necessary to check it for higher pressure, put an appropriate stainless steel tubing which can build a necessary back-pressure.

<CAUTION>

Maximum pressure is 35Kg/cm^2, do not apply higher back pressure than that.

8-4-4 Blocked stainless steel tubing

Tubing is sometimes blocked by samples, salts, dirt, etc.. To clear a blocked tubing, back flush it with an appropriate solvent. It is important to estimate the cause of clogging in order to select a flushing solvent. A flushing solvent should be able to dissolve the material caused the blockage. Select such a solvent and follow the procedure as;

1) Remove the flow cell cassette from the main unit, and

connect the outlet tubing to the outlet of the pump.

2) Set the pressure limit of the pump to 35 Kg/cm^2.
3) Start the pump with a low flow rate, for instance, 0.1 ml/min, then, gradually increase the flow rate until the back pressure becomes 35 Kg/cm^2.
4) If the pump should be stopped, before blockage is removed, start the pump again. Repeat this procedure several times.
5) If the above procedure should fail to clear the tubing, then, remove the windows of the flow cell with referring to Section 8-4-2.
6) Connect the blocked side of tubing to the outlet of the pump.
7) Set the pressure limit of the pump to its maximum.
8) Start the pump with a low flow rate, for instance, 0.1 ml/min, then, gradually increase the flow rate until the back pressure becomes maximum.
9) If the pump should be stopped, before the blockage is removed, start the pump again. Repeat this procedure several times.
10) If it should fail, insert a piece of thin wire, 0.15 mm OD, and push the blockage out.
11) If it should fail, then, cut off the blocked portion of the tubing.

9. RE-CALIBRATION PROCEDURE

The 870-UV/875-UV is equipped with a maintenance program which allows the operator to re-calibrate the wavelength by key operation.

9-1 Wavelength Re-calibration*

Each detector has been factory-calibrated by using line emissions from a low pressure mercury lamp; 0th order, 254, 313, 365, 436, 546 nm to comply with the wavelength accuracy of ±2 nm.

As described in Section 2-2, the diffraction grating in the optical module is rotated by a stepping motor and an arc which is fastened to the grating shaft. The wavelength of the light beam from the grating is not proportional to the angle of the incident beam to the grating, but it is sinuosoidally proportional to the angle. Therefore, in order to obtain the wavelength selected, the built-in microprocessor calculate the correponding number of pulses to be fed to the stepping motor. In the calculation, two calibration points are used, these are the 0th order and 546 nm as a function of pulse number from the starting point on the sinuosoidal function. The starting point as a postion on the arc is given by the timing when the photodiode-LED coupler is interrupted in the power-on initilization. These two pulse numbers are defined as wavelength calibration coefficients; one for the pulse number for 0th order and the other for the pulse number for 546 nm.

* Japanese and other patents pending.

9-1-1 Re-entering calibration coefficients after changing back-up battery

The wavelength calibration coefficients are stored in the memory which is battery back-upped. If the back-up battery be dead and the "BACK UP ERROR" be shown in the power-on self-diagnostics, see Section 8-1. The battery must be replaced with a new one and the coefficients must be re-entered by the following procedure.

(NOTE)

The back-up battery normally lasts about 5 years.

The calibration coefficients are printed on a label stuck on the left side of the optical module as shown in Fig. 9-1.

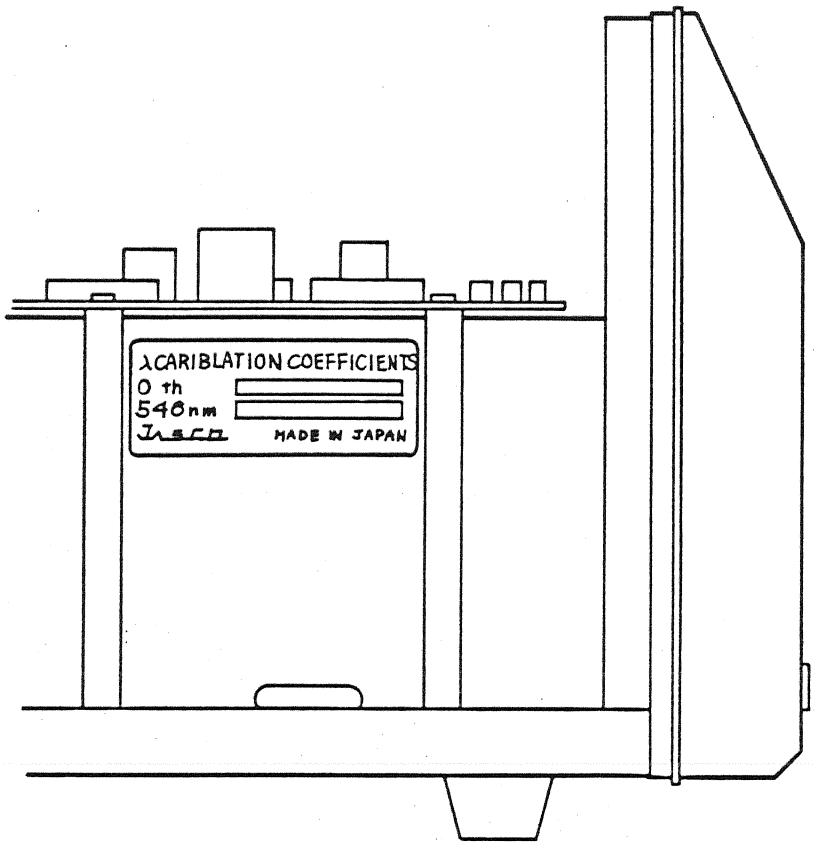


Fig. 9-1 Wavelength Calibration Coefficient label

Turn the power switch on with keeping the **[MARKER]** key depressed, then, the following display will appear on the LCD;

```
D2  ON
 x.xxxV
```

[CTRL] : Keeping the key repressed;
+
[AUTO ZERO] : The 0th order coefficient is to be entered;

```
   xx Pulse
```

[▲]/[▼] : Change to the 0th order coefficient shown on the label;

[EDIT/ENTER] : The 0th order coefficient has been entered, and the display will be changed as shown;

```
λ 546 EMPTY
  xxxx Pulse
```

[▲]/[▼] : Change to the 546nm coefficient shown on the label;

[EDIT/ENTER] : The 546nm coefficient has been entered, and the display will be as shown;

```
λ 546 FULL
  xxxx Pulse
```

[MARKER] : Return to the power-on self-diagnosis.

9-1-2 Re-calibration by using 0th order beam

By using the 0th order beam, the wavelength re-calibration can be performed.

1) Draw the flow cell cassette out, and stick a piece of plane white paper with adhesive tape on the cell hole as shown in Fig. 9-2.

(NOTE)
The piece of paper is used as an optical intensity reducing filter.

2) Re-install the flow cell cassette.

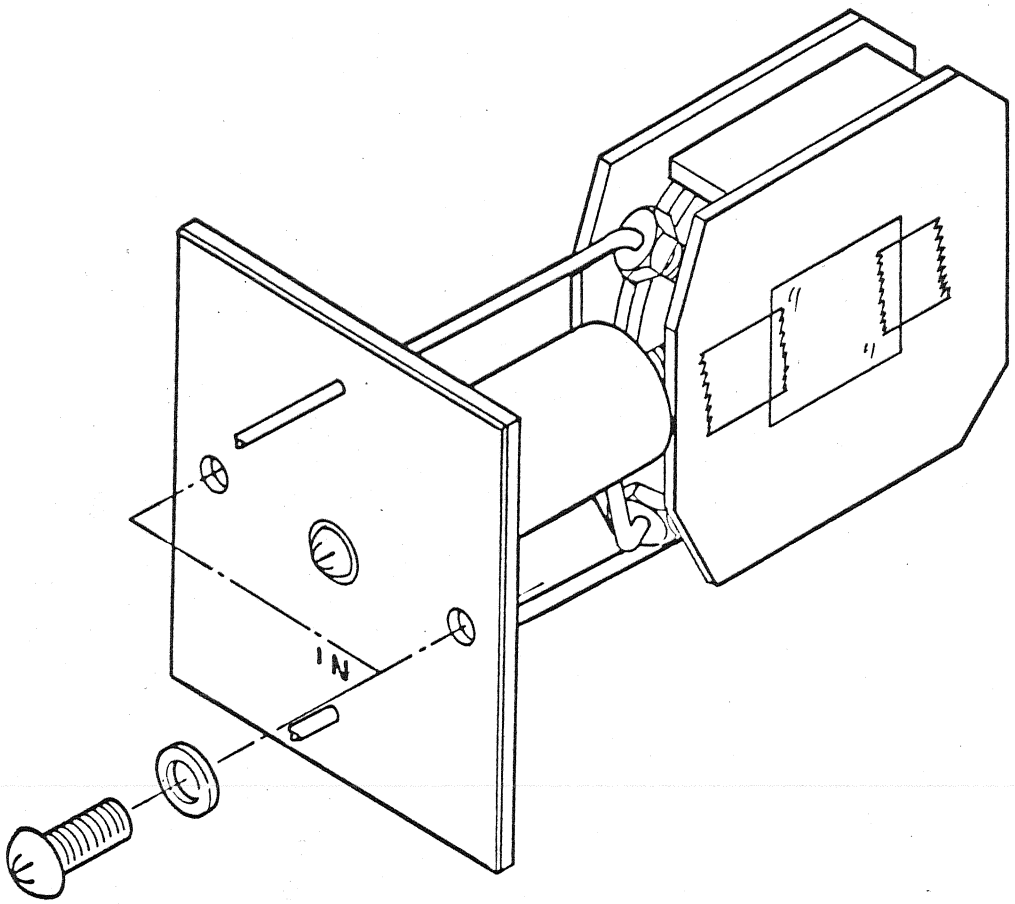


Fig. 9-2 Sticking a piece of Paper on Cell Hole

3) Turn the power switch on with keeping the **[MARKER]** key depressed, then, the following display will appear on the LCD;

```
D2  ON
 x.xxxV
```

[▲]/[▼] : Get the maximum voltage reading;

(NOTE)

If the reading exceed 10V, then add another piece of paper on the previous one. If the maximum reading is below 1V, then use thinner paper.

[EDIT/ENTER] : The new 0th order coefficient has been determined.

[CTRL] : Keeping the key depressed;
+
[AUTO ZERO] : The new 0th order coefficient is shown in terms of pulse number as;

xx Pulse

Write the new coefficient on the label;

(NOTE)

The coefficent must be within 50±10 pulses, if the reading is out of this rang, the optical alignment of the diffraction grating and/or mirror M4 may be off-alignment. In such a case, contact your JASCO agent.

[EDIT/ENTER] : The new 0th order coefficient has been entered, and the display will be changed as shown;

λ 546 EMPTY xxxx Pulse

[▲]/[▼] : Change to the 546nm coefficient shown on the label;

[EDIT/ENTER] : The 546nm coefficient has been entered, and the display will be as shown;

λ 546 FULL xxxx Pulse

[MARKER] : Return to the power-on self-diagnosis.

10. PARTS REPLACEMENT PROCEDURES

There is few routine maintenance for the user to carry on the 875/870-UV detector. However, there are some parts which could deteriorate as the instrument is used, such as deuterium and tungsten lamps, light source mirrors, cell windows and gaskets, etc. Replacement of such parts and other repairs could be needed from time to time.

10-1 Deuterium Lamp Replacement

If the D_2 (deuterium) lamp has been burnt out or the lamp emission has become too low and noisy, the lamp is needed to be replaced with a new one. In such a case, replace the lamp with referring to the following procedure.

10-1-1 Removing used lamp

[WARNING]

To remove the used lamp, the outer cover of the detector cabinet, lamp house cover etc. must be removed. There is DANGEROUS VOLTAGE in the cabinet, respect the instructions given below.

1) Turn the power off, and unplug the power cable.
2) Remove the flow cell cassette, referring to Section 5-2-2.
3) Remove the outer cover from the cabinet, referring to Fig. 10-1.
4) Turn the printed circuit boards up and place them upright by inserting their lower edges into slots on the top of the optical module as shown in Fig. 10-1.

<CAUTION>

Never disconnect any cable from the printed circuit boards. Removing the back-up battery cable results in deletion of previously entered parameters not only for the NORMAL OPERATION MODE and TIME PROGRAM MODE but also for wavelength calibration coefficients. If the cable be removed, the wavelength calibration coefficients must be re-entered. See Section 9.

5) Unplug the the lamp lead connector from the cable.

[WARNING]

If the instrument has been in operation, the LAMP MAY BE HOT. If so, wait for 5 - 10 min until it cools.

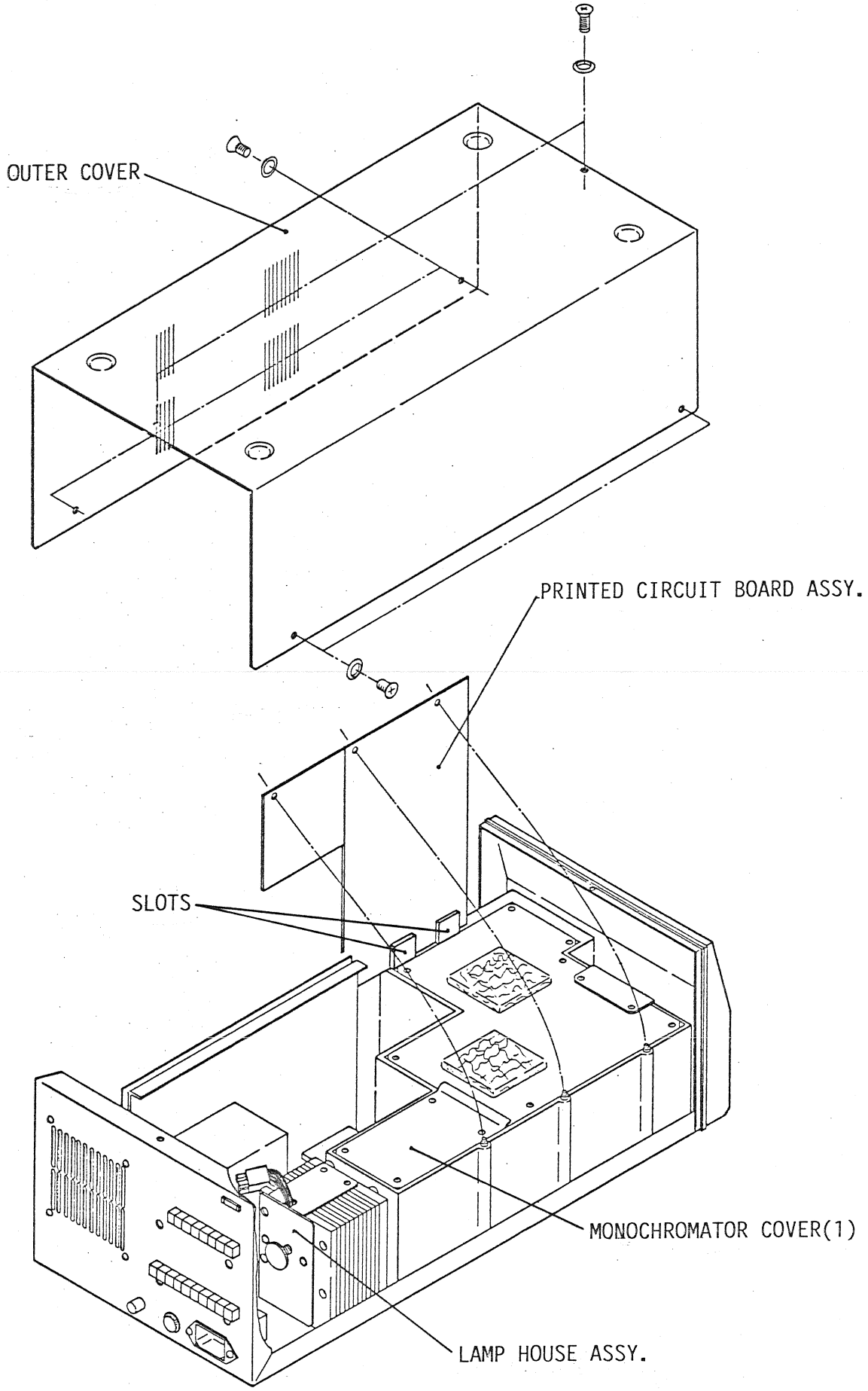


Fig. 10-1 Inside Cabinet View

6) Remove the D_2 lamp house cover, referring to Fig. 10-2.
7) Loosen the lamp lock screw until the lamp becomes loose enough to be moved.
8) Remove the lamp by pulling the lead wire.

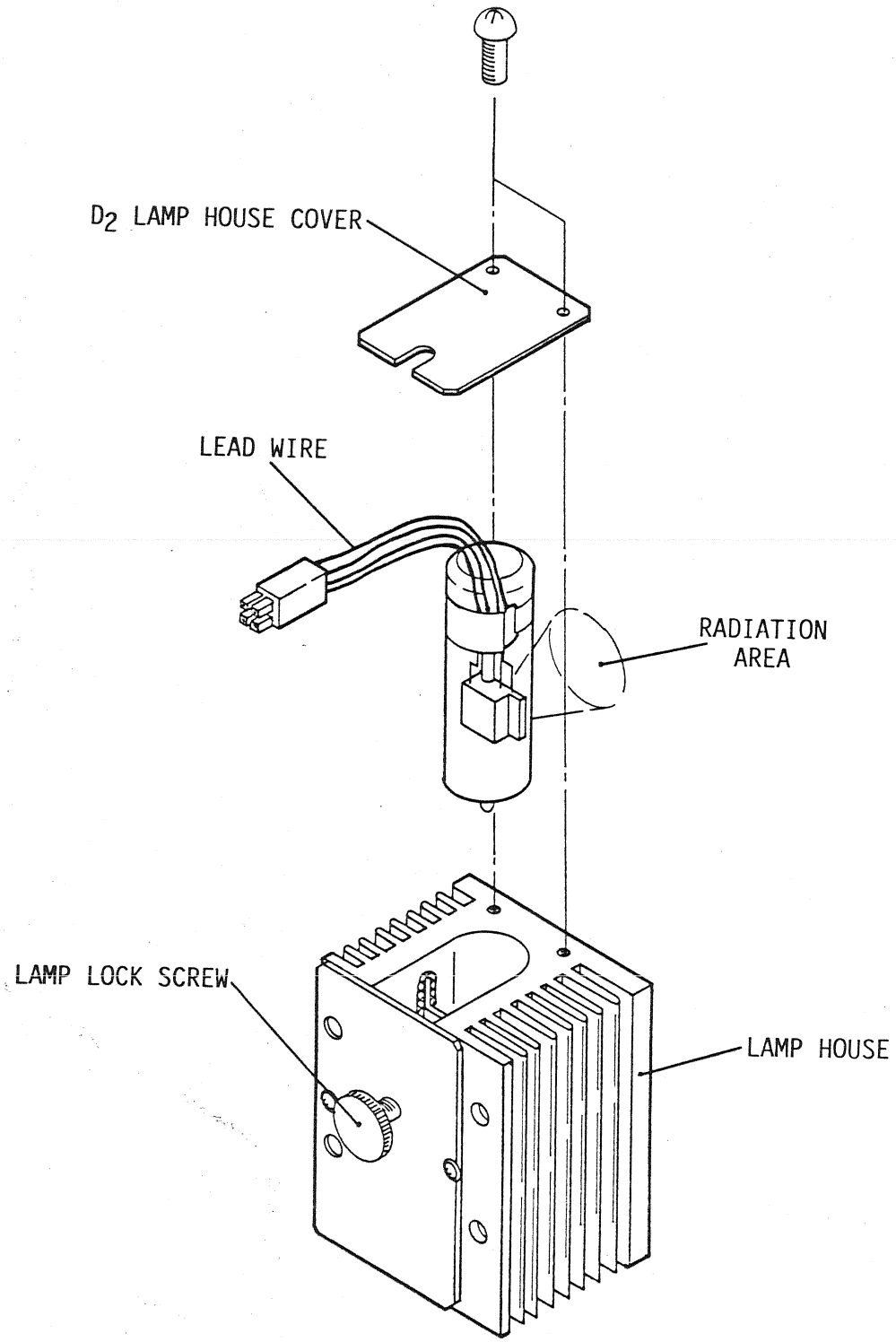


Fig. 10-2 Partially Exploded View of D_2 Lamp House Assembly

10-1-2 Replacing lamp

1) Take the new lamp carefully out from the box.
2) Clean the lamp tube with a piece of clean cloth and alcohol.

<CAUTION>
Don't touch the radiation area of the lamp tube.

3) Put the lamp into the lamp house with its radiation area in the opposite direction to the lock screw, by holding the lead wire, referring to Fig. 10-2.
4) Tighten the lamp lock screw a little so that it does not fall down, but it can be moved.
5) Connect the lamp lead wire to the lamp cable by plug the connector into the receptacle of the cable.

10-1-3 Deuterium lamp alignment

[WARNING]
Be sure to put on a pair of safety or sun glasses. Since the deuterium lamp emits intense untraviolet light, it is dangerous to perform optical alignment with naked eyes. Be careful not to expose your eyes directly to the light coming from the lamp.

1) Remove the monochromator cover (1), referring to Fig.10-1.
2) Install the flow cell cassette, referring to Section 5-2-3.
3) Plug the power cable to the power source.

[WARNING]
Dangerous voltage is present in the cabinet, though it is covered and insulated, DO NOT TOUCH PARTS unless they are specified in the procedure.

4) Turn the power switch on, self-diagnostic program will start, and the following message could be shown;

LAMP EM POOR

5) Disregard the message because it is due to non-aligned lamp. In a few seconds, the message will disappear, and the NORMAL OPERATION MODE MONITOR DISPLAY will be shown on the LCD.
6) Set wavelength to 250 nm.

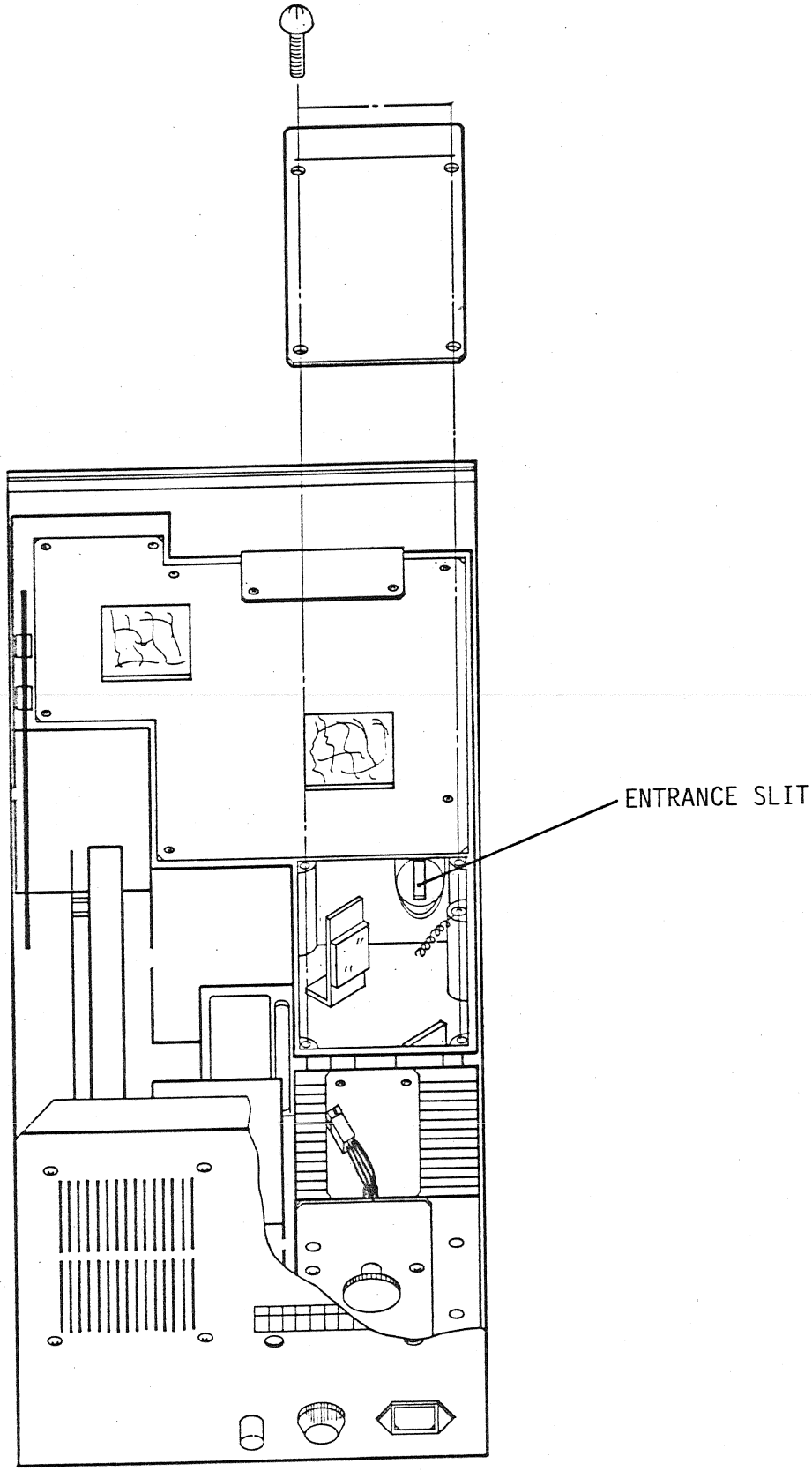


Fig. 10-3 Position of Entrance Slit

(NOTE)

The deuterium lamp must be selected by the key operation described in Section 6-2-3 for the aligment.

7) Press the **[PARAMETER]** while keeping the **[CTRL]** key depressed, then the following display will appear;

```
SAM: x.xxxV
REF: x.xxxV
```

. See Section 6-2-5.

8) Hold the lamp lead wire and loosen the lamp lock screw so that the lamp can be rotated or pulled up or pushed down freely.

9) Observe the lamp image on the entrance slit, referring to Fig. 10-3, and move the lamp up and down and rotate so that the image covers over the slit properly as shown in Fig. 10-4.

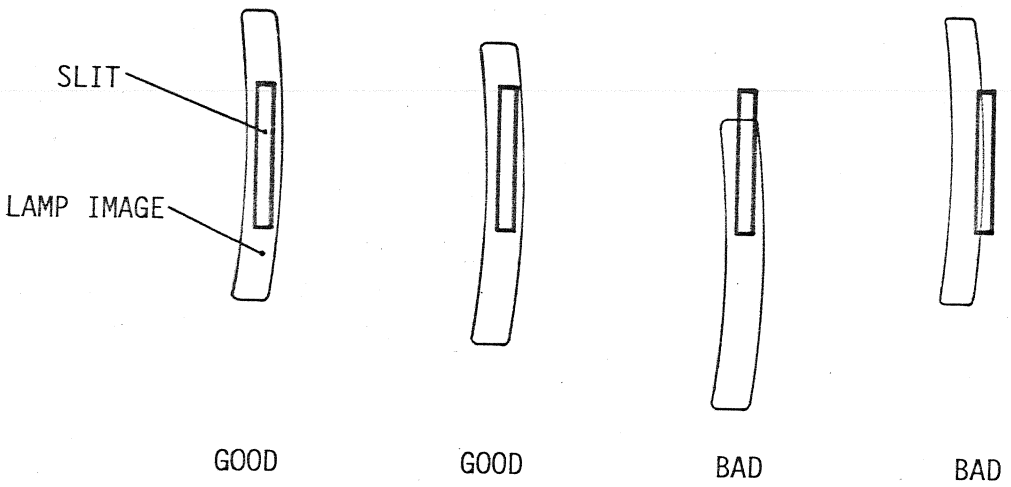


Fig. 10-4 Various Lamp Images on Entrance Slit

10) Move the lamp up and down little by little until the REF output reads maximum, then rotate the lamp right and left little by little until the REF output reads maximum.

11) Tighten the lamp lock screw until the lamp is securely fastened.

(NOTE 1)

The lamp image position on the slit goes down as the lamp is lowered, vice versa.

(NOTE 2)

If there be a UV absorving solvent or air bubbles in the cell, an error message "OUT OF RANGE", see Section 8-2, will be shown. In such a case, clear the message by pressing the **[PARAMETER]** key and flow degassed water or methanol. Then, perform the procedure from 7).

12) Observe the lamp image on the slit again, and confirm that the image covers over the slit properly.
13) Turn the power switch off, and unplug the power cable.
14) Re-place the monochromator cover (1) and the lamp house cover, referring to Fig. 10-2.
15) Re-place the printed circuit boards in position, referring to Fig. 10-1.

<CAUTION>

Place cables around the lamp house, the printed circuit boards and the fan neatly in position. Fan blades must be free from cables.

16) Re-place the outer cover of the cabinet, referring to Fig. 10-1.

<CAUTION>

Do not leave anything in the cabinet. Even a piece of metal can cause fatal problem.

17) Plug the power cable and turn the power switch on.
18) Check that the power-on self-diagnosis completes without fail.

<CAUTION>

Check the fan is rotating without interference.

10-2 Tangsten Lamp Replacement

If the W (tangsten) lamp has been burnt out, the lamp is needed to be replaced with a new one. In such a case, replace the lamp with referring to the following procedure.

10-2-1 Removing used lamp

[WARNING]

To remove the used lamp, the outer cover of the detector cabinet, lamp house cover etc. must be removed. There is DANGEROUS VOLTAGE in the cabinet, respect the instructions given below.

1) Turn the power off, and unplug the power cable.
2) Remove the flow cell cassette, referring to Section 5-2-2.
3) Remove the outer cover from the cabinet, referring to Fig. 10-1.
4) Turn the printed circuit boards up and place them upright by inserting their lower edges into slots on the top of the optical module as shown in Fig. 10-1.

<CAUTION>

Never disconnect any cable from the printed circuit boards. Removing the back-up battery cable results in deletion of previously entered parameters not only for the NORMAL OPERATION MODE and TIME PROGRAM MODE but also for wavelength calibration coefficients. If the cable be removed, the wavelength calibration coefficients must be re-entered. See Section 9.

5) Unplug the the lamp lead connector from the cable.

[WARNING]

If the instrument has been in operation, the LAMP MAY BE HOT. If so, wait for 5 - 10 min until it cools.

6) Remove the W lamp house cover, referring to Fig. 10-5.
7) Unplug the lamp by pulling it.

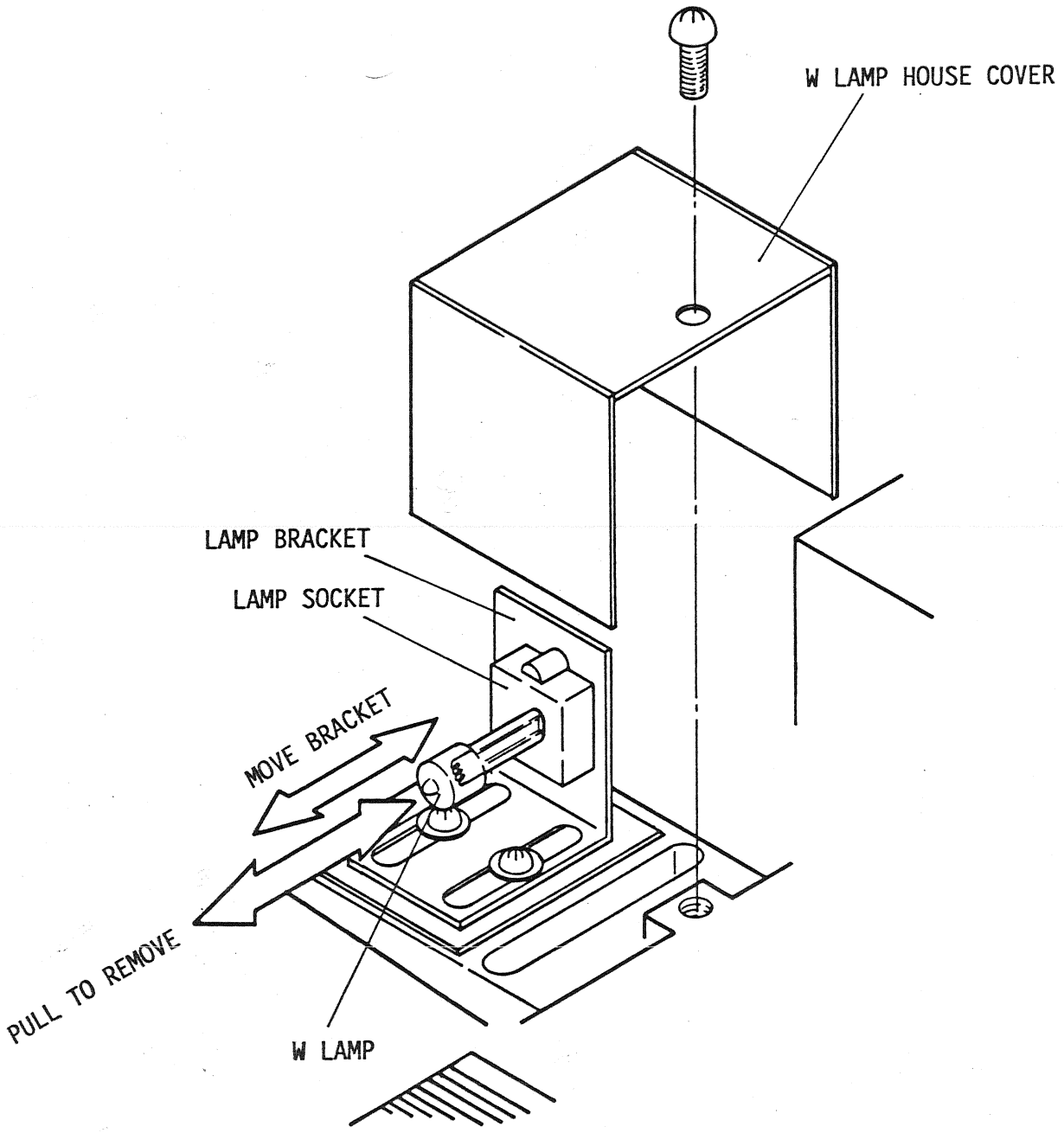


Fig. 10-5 Partially Exploded View of W Lamp House Assembly

10-2-2 Replacing lamp

1) Take the new lamp carefully out from the box.
2) Clean the lamp tube with a piece of clean cloth and alcohol.

<CAUTION>
Don't touch the lamp tube with naked hand. Use clean cloth or thin rubber gloves.

3) Plug the lamp into the lamp socket firmly by holding it with a gloved hand, referring to Fig. 10-5.

10-2-3 Tangsten lamp alignment

[WARNING]
Be sure to put on a pair of safety or sun glasses. Since the tangsten lamp emits intense visible and even untraviolet light, it is dangerous to perform optical alignment with naked eyes. Be careful not to expose your eyes directly to the light coming from the lamp.

1) Remove the monochromator cover (1), referring to Fig.10-1.
2) Install the flow cell cassette, referring to Section 5-2-3.
3) Plug the power cable to the power source.

[WARNING]
Dangerous voltage is present in the cabinet, though it is covered and insulated, DO NOT TOUCH PARTS unless they are specified in the procedure.

4) Turn the power switch on, self-diagnostic program will start, and the following message could be shown;

LAMP EM POOR

.

(NOTE)
The tangsten lamp must be selected by the key operation described in Section 6-2-3 for the aligment.

5) Disregard the message because it is due to non-aligned lamp. In a few seconds, the message will disappear, and the NORMAL OPERATION MODE MONITOR DISPLAY will be shown on the LCD.
6) Set wavelength to 550 nm.
7) Press the **[PARAMETER]** while keeping the **[CTRL]** key depressed, then the following display will appear;

```
SAM: x.xxxV
REF: x.xxxV
```

. See Section 6-2-5.

8) Loosen the two screws which fasten the W lamp bracket a little so that the bracket can move as shown by the arrow.
9) Observe the lamp image on the entrance slit, referring to Fig. 10-3, and move the bracket right and left so that the image covers over the slit properly as shown in Fig. 10-4.
10) Move the lamp right and left little by little until the REF output reads maximum.
11) Fasten the bracket firmly by tightening the two screw until the lamp.

[WARNING]

Never touch the lighting lamp, IT IS VERY HOT.

(NOTE)

If there be a light absorving solvent or air bubbles in the cell, an error message "OUT OF RANGE", see Section 8-2, will be shown. In such a case, clear the message by pressing the **[PARAMETER]** key and flow degassed water or methanol. Then, perform the procedure from 7).

12) Observe the lamp image on the slit again, and confirm that the image covers over the slit properly.
13) Turn the power switch off, and unplug the power cable.
14) Re-place the monochromator cover (1) and the W lamp house cover, referring to Figs. 10-2 and 10-5.
15) Re-place the printed circuit boards in position, referring to Fig. 10-1.

<CAUTION>

Place cables around the lamp house, the printed circuit boards and the fan neatly in position. Fan blades must be free from cables.

16) Re-place the outer cover of the cabinet, referring to Fig. 10-1.

<CAUTION>

Do not leave anything in the cabinet. Even a piece of metal can cause fatal problem.

17) Plug the power cable and turn the power switch on.
18) Check that the power-on self-diagnosis completes without fail.

<CAUTION>

Check the fan is rotating without interference.

10-3 Replacement of Mirrors

If the "LAMP EMISSION POOR" message be shown, see Section 8-1, even after the lamp has been replaced, it is suspected that the light source mirrors M1 and M2 shown in Fig. 10-6 became deteriorated. Confirm it by reading the reference pre-amplifier output with referring to Section 6-2-5. If the output is below 1.0 V at 200 nm with a new deuterium lamp, it is recommended to replace the mirrors M1 and M2.

<CAUTIONs>

(1) The mirrors are not glasses, do not touch the surface of mirrors, wipe with cloth, nor even blow with mouth.

(2) Mirrors must be replaced one by one, in case both mirrors have been removed at a time, optical alignment becomes extremly difficult. First, replace the M1 mirror, then M2.

(3) Mirrors have been factory adjusted so that the optical axis of the mirrors match the axis of the optical module, do not apply too much stress before installation.

(4) Before proceeding, review all the WARNINGs, CAUTIONs and NOTEs in Section 10-1.

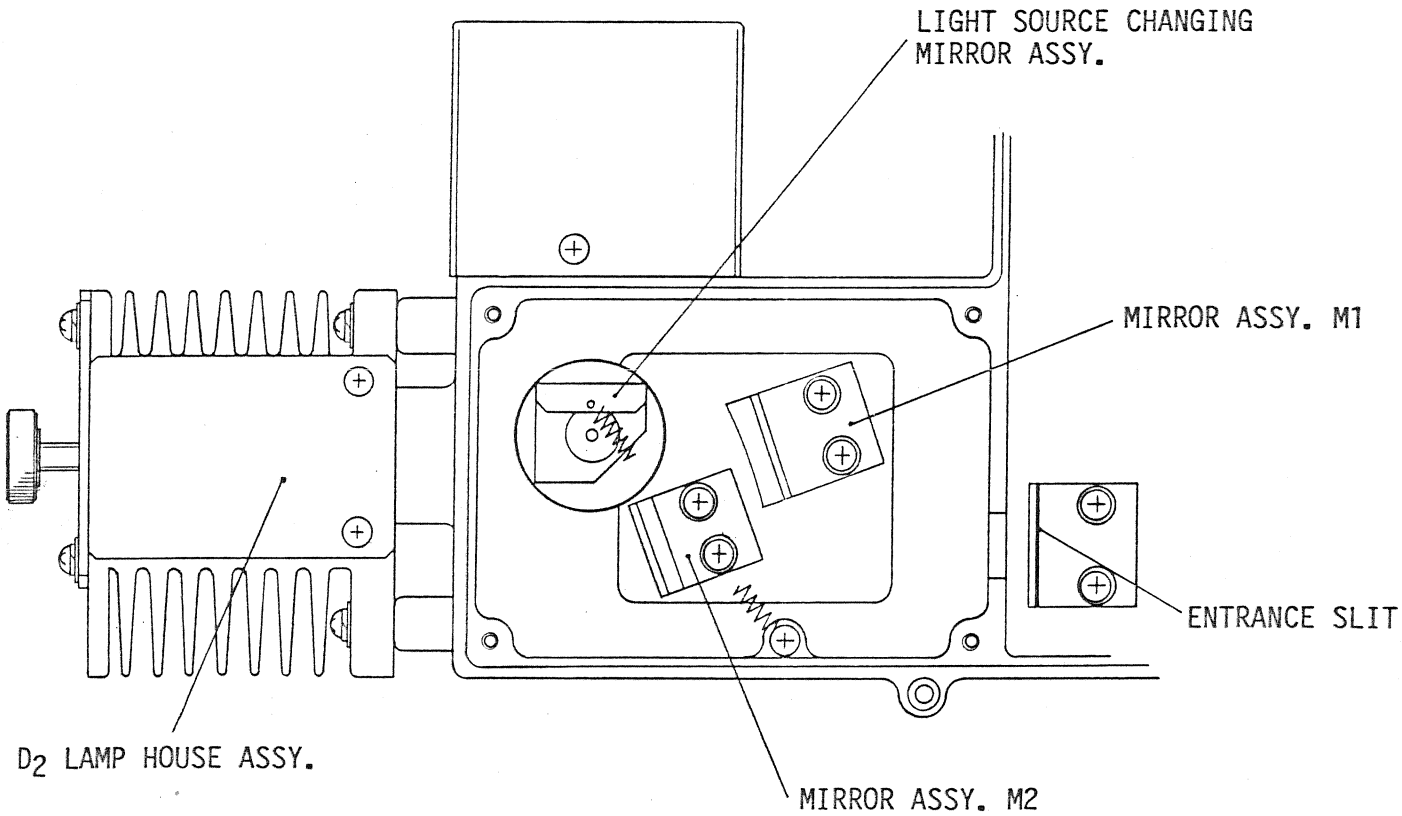


Fig. 10-6 Light Source Mirrors M1 and M2

10-3-1 Preparation for replacing mirrors M1 and M2

1) Remove the monochromator cover (1) with referring to Section 10-1.

<CAUTION>

To keep the monochromator free from dust, put the cover on, whenever possible.

2) Turn the "POWER" switch ON.

[WARNING]

Dangerous voltage is present in the cabinet, though it is covered and insulated, DO NOT TOUCH PARTS unless they are specified in the procedure.

3) Observe the lamp image on the entrance slit, referring to Figs. 10-3 and 10-4, and memorize how the image covers over the slit.

10-3-2 Replacing mirrors M1 and M2

1) Unscrew and remove the screws on the M1 mirror holder, and take the old M1 mirror out.
2) Place the new M1 mirror in position.
3) Tighten the screws a little and adjust direction and position of the mirror in such a way that the lamp image on the slit becomes similar to the image before changing. Note that the screws should be positioned at the centers of the slots of the mirror holder, when the mirror is aligned correctly.
4) Tighten the screws firmly, keeping the lamp image covering correctly over the entrance slit.
5) Unscrew and remove the screws on the M2 mirror holder, and take the old M2 mirror out.
6) Place the new M2 mirror in position.
7) Tighten the screws a little and adjust direction and position of the mirror in such a way that the lamp image on the slit becomes similar to the image before changing. Note that the screws should be positioned at the centers of the slots of the mirror holder, when the mirror is aligned correctly.
8) Tighten the screws firmly, keeping the lamp image covering correctly over the entrance slit.
9) Re-place the monochromator cover (1).
10) For a fine the light source section perform, the deuterium lamp alignment with referring to Section 10-1-3.

10-4 Back-Up Battery Replacement

Entered parameters such as; wavelength, sensitivity range, response, the parameter for time program and the wavelength calibration coefficients are stored in the memory which is battery back-upped. Normally, the back-up battery will last about 5 years. If the back-up battery be dead and the "BACK UP ERROR" be shown in the power-on self-diagnostics, see Section 8-1. The battery must be replaced with a new one.

<CAUTION>

When the battery has been changed, the wavelength calibration coefficients must be re-entered. See Section 9-1-1. Without re-entering the coefficients the detector never functions correctly.

[WARNING]

To replace the battery, the outer cover of the detector cabinet must be removed. There is DANGEROUS VOLTAGE in the cabinet, respect the instructions given below.

1) Turn the power off, and unplug the power cable.
2) Remove the outer cover from the cabinet, referring to Fig. 10-1.
3) Unplug the battery cable from the connect J3 on the S-MAIN board with referring to the general assembly drawing in APPENDIX I.
4) Remove the dead battery from the clamp by unscrewing the lock screw.
5) Clamp the new battery by tightening the lock screw, then plug the cable into the connector J3 on the S-MAIN board.
6) Re-place the outer cover of the cabinet, referring to Fig. 10-1.

<CAUTION>

Do not leave anything in the cabinet. Even a piece of metal can cause fatal problem.

7) Plug the power cable and turn the power switch on.
8) Check that the power-on self-diagnosis completes without fail.

<CAUTION>

Check the fan is rotating without interference.

9) Re-enter the wavelength calibration coefficients, referring to Section 9-1-1.

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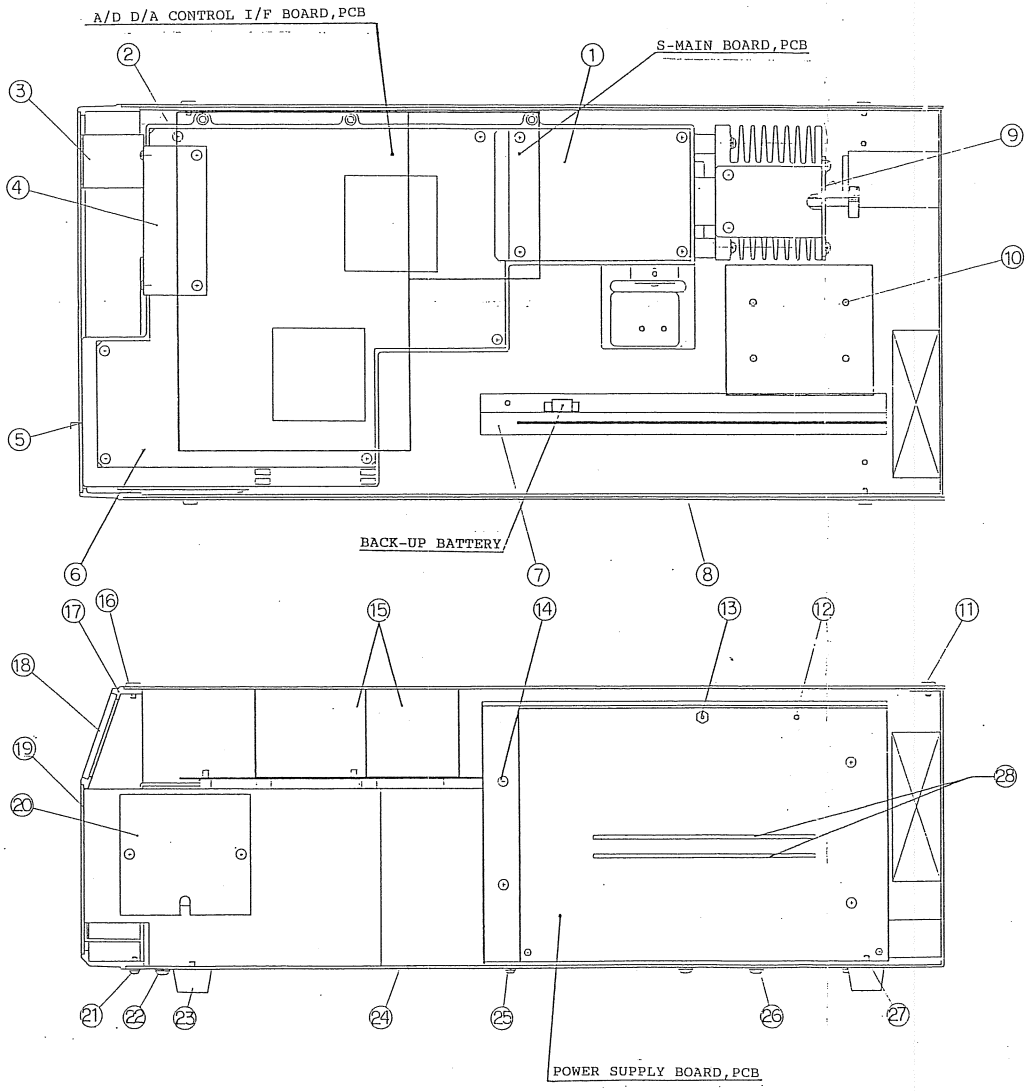


870/875-UV GENERAL ASSEMBLY
PART LIST

DESCRIPTION: 870/875-UV GENERAL ASSEMBLY

Item	JASCO P/N	Description	Qty
1	6572-1203A	Cover, monochrometor(1)	1 pc
2	1301-1009	Screw and washer assy.	12 pcs
3	6572-1104A	Panel, switch	1 pc
4	6572-1206A	Cover, pre-amp, reference	1 pc
5	6572-A102B	Optical module, assy.	1 pc
6	6572-1202A	Cover, monochrometor(2)	1 pc
7	6572-1103A	Support, PCB	1 pc
8	6560-0103A	Cover, outer	1 pc
9	6572-A104B	Lamp house, assy.	1 pc
10	1301-1016	Screw, philips, M4 x L6	4 pcs
11	1314-0001	Washer, nylon	6 pcs
12	1301-1010	Screw, philips, M3 x L10	1 pc
13	5810-0014	Screw, tapping	1 pc
14	1301-1009	Screw, philips, M3 x L8	4 pcs
15	6572-1106A	Cushion, PCB	2 pcs
16	1303-1001	Screw, flat, M3 x L5	6 pcs
17	6560-0101B	Bezel	1 pc
18	3890-0042	Key pad, assy.	1 pc
19	6572-1101A	Panel, front	1 pc
20	6572-1205A	Cover, pre-amp, sample	1 pc
21	1301-1009	Screw and washer assy.	2 pcs
22	1301-1016	Screw and washer assy.	2 pcs
23	2003-1001A	Foot, rubber	4 pcs
24	6572-1102A	Chassi	1 pc
25	1301-1009	Screw and washer assy.	3 pcs
26	1301-1016	Screw and washer assy.	4 pcs
27	1301-1009	Screw and washer assy.	4 pcs
28	6572-1105A	Heat sink	2 pcs

(JIS B 0404)

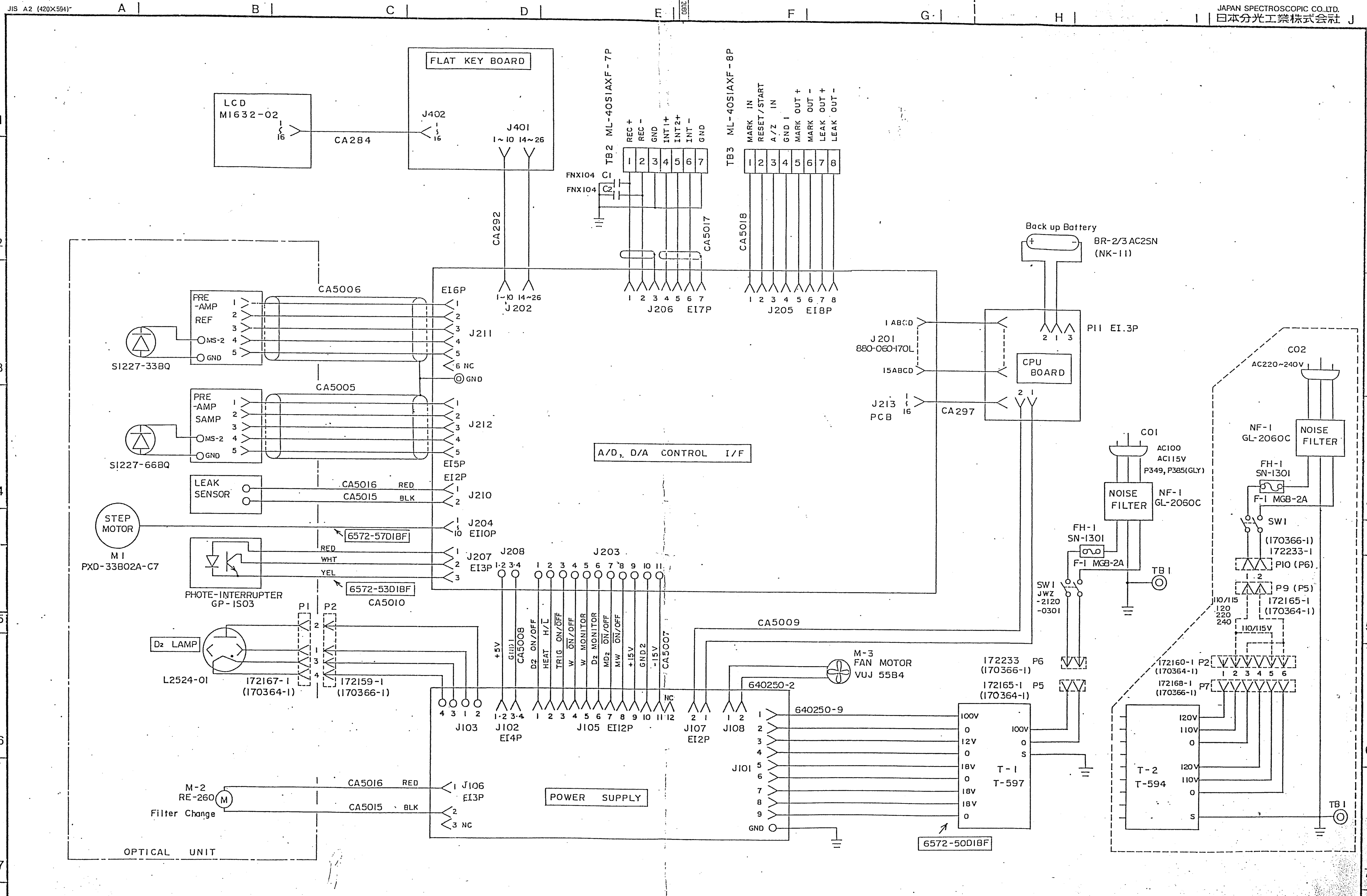
普通許容差 TOLERANCES													
0.5~3	±0.07	3~6	±0.09	6~10	±0.11	10~18	±0.14	18~30	±0.16	30~50	±0.2	50~80	±0.22	80~120	±0.28
120~180	±0.3	180~250	±0.35	250~315	±0.4	315~400	±0.45	400~500	±0.5	500~630	±0.55	630~800	±0.6	800~1000	±0.7

変更No MODIFICATION	日付 DATE	記号 SYMBOL	号数 SERIAL NO	発行者 ISSUER	承認 APP	共用機種 CUSHION USE	ユニット UNIT	担当 CHARGE
19 . . .			~					
19 . . .			~					
19 . . .			~					
19 . . .			~					
19 . . .			~					

備考 NOTES

尺度 SCALE 1/ × %	作成 DRAWN 大村	技術 ENGR	数 QTY
単位mm 第3角法 DIMENSIONS IN mm 3RD ANGLE PROJECTION	検討 CHECKED	承認 APPROVED	材質 MATERIAL
JASCO 日本分光	日付 DATE 1987. 1. 26.		処理 FINISH

区分 ZONE 870/875-UV	ユニット UNIT
品名 DESCRIPTION 870/875-UV GENERAL ASSY.	
部品番号 PART NUMBER 6572-01A2A	
図面番号 DWG NUMBER	



19 . . .	E		~	日付 DATE	機種名 NAME	回路名 DESCRIPTION
19 . . .	D		~	19 87 · 1 · 28 ·	875-UV for VARIAN	MAIN FRAME SCHEMATIC DIAGRAM
19 . . .	C		~	JASCO	作成 DRAWN / 技術 ENGR / 検討 CHECKED / 承認 APPROVED	
19 . . .	B		~			

1. WAVELENGTH RE-CALIBRATION BY USING LINE EMISSIONS FROM LOW-PRESSURE MERCURY LAMP

The 870-UV/875-UV INTELLIGENT UV SPECTROPHOTOMETRIC DETECTOR is equipped with a maintenance program including a wavelength re-calibration. Using the program, precise wavelength calibration can be carried out with reference to the line emissions from a low-pressure mercury lamp.

(NOTE)

An optional wavelength re-calibration kit and a digital voltmeter are necessary to perform the procedure described in this section.

1-1 Removing Deuterium Lamp

Remove the deuterium lamp with referring to Section 10-1-1 in the INSTRUCTION MANUAL (ROM VERSION 2.0).

1-2 Installing Low-Pressure Mercury Lamp

Install the Hg-lamp assembly in place of the deuterium lamp, refering to Fig. 1-1.

1-3 Calibration at 0th Order Beam

Prepare the flow cell cassette according to the procedure described in Section 9-1-2 in the INSTRUCTION MANUAL as;

1) Draw the flow cell cassette out, and stick a piece of plane white paper with adhesive tape on the cell hole as shown in Fig. 9-2.

(NOTE)

The piece of paper is used as an optical intensity reducing filter.

2) Re-install the flow cell cassette.

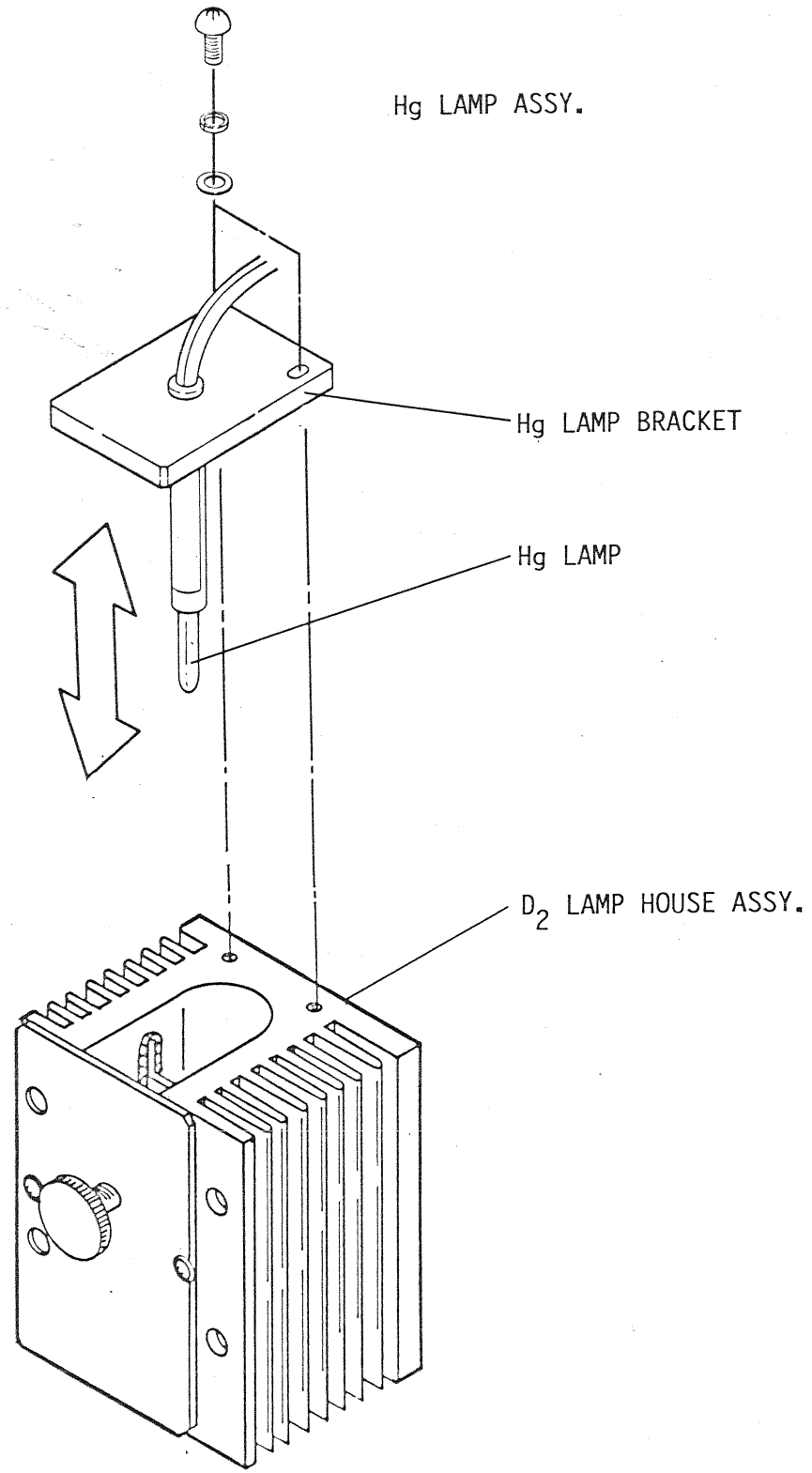


Fig. 1-1 Installing Hg-Lamp Assembly

3) Turn the power switch on with keeping the **[MARKER]** key depressed, then, the following display will appear on the LCD;

```
D2  ON
 x.xxxV
```

[▲]/[▼] : Get the maximum voltage reading;

(NOTE)

If the reading exceed 10V, then add another piece of paper on the previous one. If the maximum reading is below 1V, then use thinner paper.

[EDIT/ENTER] : The new 0th order coefficient has been determined.

[CTRL] : Keeping the key depressed;

\+

[AUTO ZERO] : The new 0th order coefficient is shown in terms of pulse number as;

```
   xx Pulse
```

Write the new coefficient on the label;

(NOTE)

The coefficent must be within 50±10 pulses, if the reading is out of this range, the optical alignment of the diffraction grating and/or mirror M4 may be performed.

[EDIT/ENTER] : The new 0th order coefficient has been entered, and the display will be changed as shown;

```
λ 546 EMPTY
  xxxx Pulse
```

1-4 Calibration at 546nm

After completing the calibration at 0th order, the following display is on the LCD.

```
λ 546 EMPTY
  xxxx Pulse
```

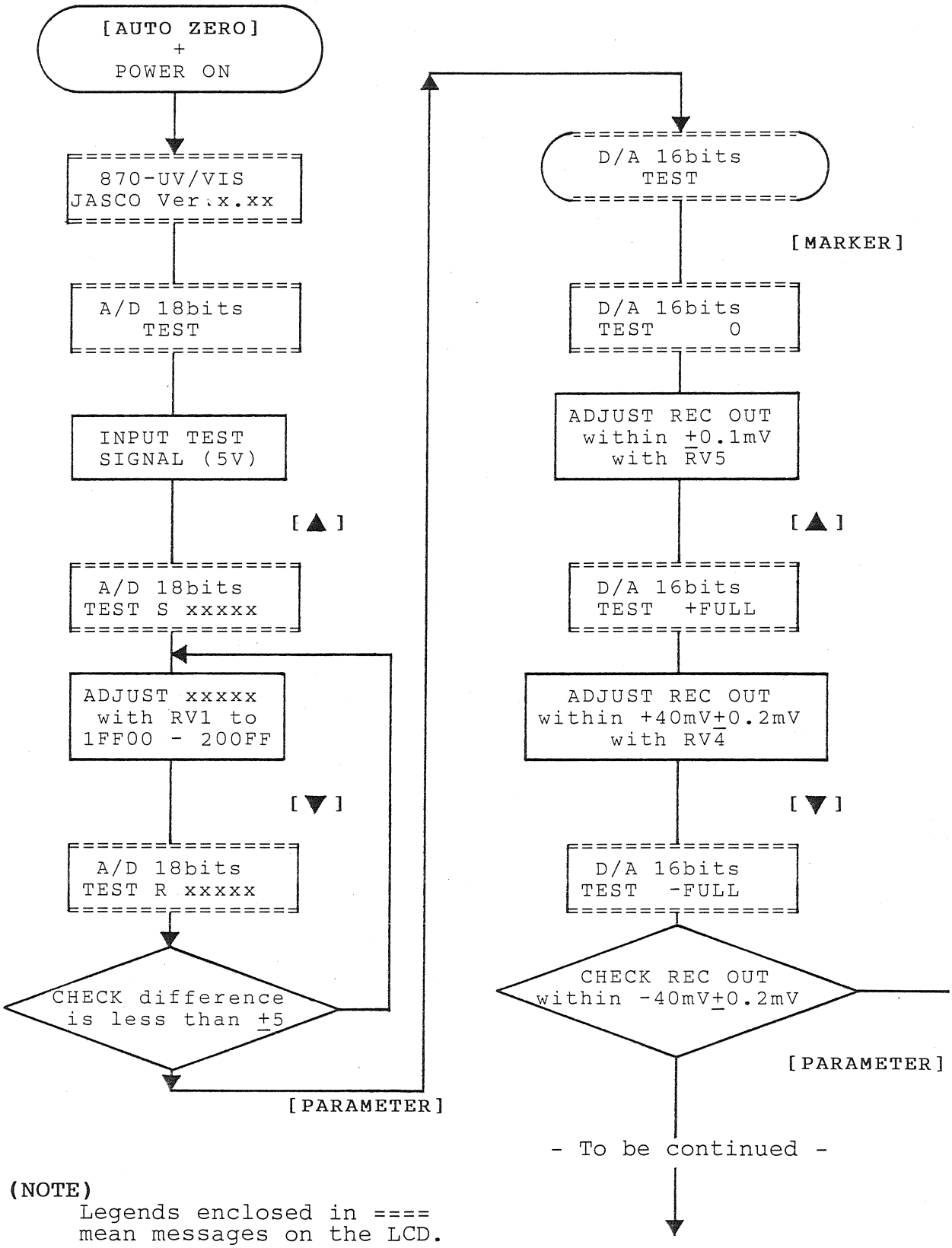
Draw out the flow cell cassette and remove the paper stuck on the cell hole, re-install the cell and then proceed as follows.

1) Connect the probe of the digital voltmeter to Pin NO. 4 (+) and No. 2 (-) of J212 on the A/D, D/A CONTROL I/F PCB. Set the range of the voltmeter to 10V full scale.
2) Press the **[▲]/[▼]** key so that the reading on the digital voltmeter becomes maximum.
3) Press the **[EDIT/ENTER]** key when the meter reads the maximum. Then, the new wavelength calibration coefficient for 546 nm has been entered, and the display will be as shown;

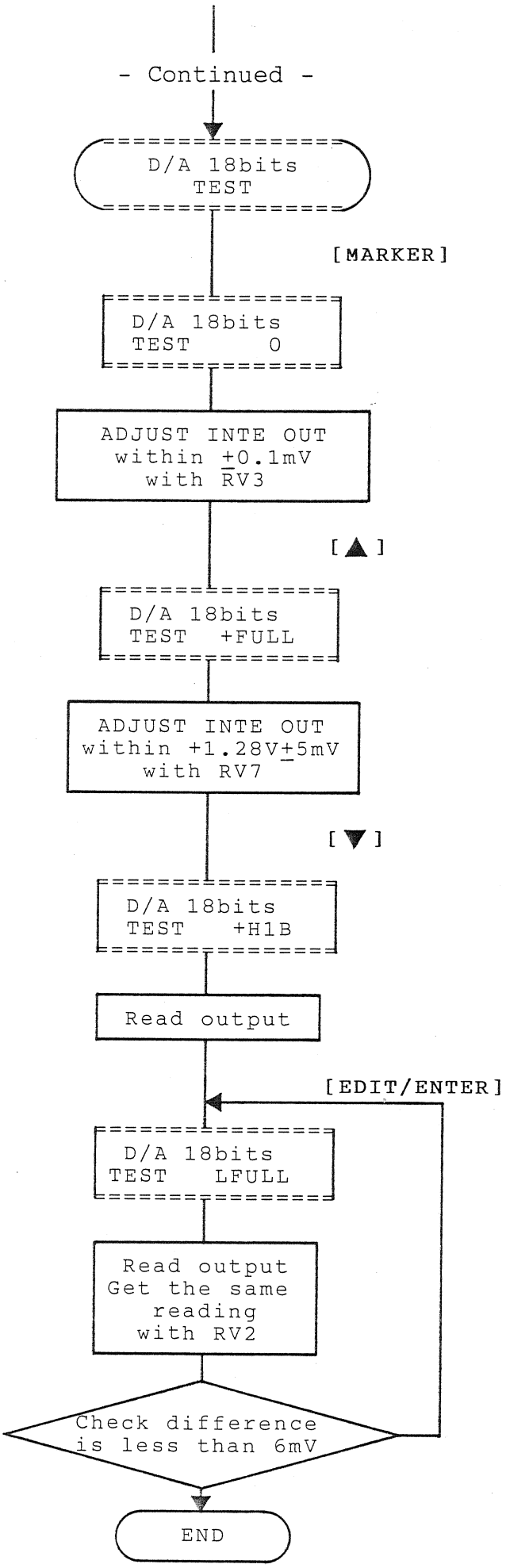
```
λ 546 FULL
  xxxx Pulse
```

4) Write the new pulse number on the coefficient label.
5) Pressing the **[MARKER]** key will leave the wavelength re-calibration program and return to the power-on self-diagnostics.

1-1-3 Summary for Key Operation and Display as flow chart



(NOTE)
Legends enclosed in ====
mean messages on the LCD.


- Continued -
D/A 18bits TEST
[MARKER]
D/A 18bits TEST 0
ADJUST INTE OUT within ±0.1mV with RV3
[▲]
D/A 18bits TEST +FULL
ADJUST INTE OUT within +1.28V±5mV with RV7
[▼]
D/A 18bits TEST +H1B
Read output
[EDIT/ENTER]
D/A 18bits TEST LFULL
Read output Get the same reading with RV2
Check difference is less than 6mV
END

1. ADJUSTMENT AND CALIBRATION OF PRINTED CIRCUIT BOARD

The 870-UV/875-UV INTELLIGENT UV SPECTROPHOTOMETRIC DETECTOR is equipped with a maintenance program including a calibration program for printed circuit boards. Using the program delicate calibration and adjustment for A/D and D/A convertors can be carried out through simple key operation.

(NOTE)

The procedure described in this section requires some skill on electronic and equipments: a test signal generator and a ditital voltmeter having 0.1mV resolution.

1-1 A/D, D/A Control I/F Printed Circuit Board

In the 870-UV/875-UV, an 18-bit A/D (analog-to-digital) convertor and 16-bit and 18-bit D/A (digital-to-analog) convertors are utilized. The 18-bit A/D convertor accepts outputs from sample and reference pre-amps and convert them into 18-bit digital data, then the data is subjected to LOG conversion and auto-zero processing. The processed digital data is again converted to analog signal by means of the 16-bit and 18-bit D/A convertors to be compatible with an analog recorder and an analog input integrator, respectively.

Turn the power switch on with keeping the **[AUTO ZERO]** depressed, the A/D, D/A CONTROL I/F PCB test program will run, and the following display will be shown on the LCD as;

```
870-UV/VIS
JASCO Ver x.xx
```

, After a few seconds, the display will be as shown;

```
A/D 18bits
TEST
```

1-1-1 18-bit A/D convertor adjustment

1) Disconnect the cables from both sample and reference pre-amplifiers, and connect the test signal generator in place of the pre-amps.
2) Adjust the test signal level to "+5.00V" by the trimmer on the test signal generator.

3) Press keys as shown below;

[▲] : The display will be changed as shown;

```
A/D 18bits
TEST S xxxxx
```

4) Adjust the value xxxxx to within 1FF00 and 200FF by rotating the trimmer RV1 on the A/D, D/A CONTROL I/F PCB. By the following procedure. While rotating the trimmer, hit the [▲] key a few times and check the value. Note that the value is read and shown when the key is pressed.

5) Press keys as shown below;

[▼] : The display will be changed as shown;

```
A/D 18bits
TEST R xxxxx
```

6) Hit the [▼] key several times and check if the reading is the same as the reading in step 4), and also check the stability of the reading, a fluctuation of ±5 may be allowed. If not, go back to 4) and re-adjust RV1 until value in 4) equals the value in (7).

1-1-2 16-bit D/A convertor adjustment

After adjusting the 18-bit A/D convertor, the 16-bit D/A convertor adjustment can be followed.

1) Press the **[PARAMETER]** key, then the display will be changed as shown;

```
D/A 16bits
TEST
```

2) Press keys as shown below;

[MARKER] : The display will be changed as shown;

```
D/A 16bits
TEST     0
```

3) Adjust the recorder output (Voltage between REC + and REC - terminals on the rear panel of the detector) to ±0.1mV by rotating the trimmer RV5 on the A/D, D/A CONTROL I/F PCB.

4) Pressing the [▲] key will change the display as shown;

```
 D/A 16bits
TEST  +FULL
```

5) Adjust the output to +39.8 - +40.2mV by rotating the trimmer RV4 on the A/D, D/A CONTROL I/F PCB.

6) Pressing the [▼] key will change the display as shown;

```
 D/A 16bits
TEST  -FULL
```

7) Then, check the ouput is now within -39.8 - -40.2mV.

1-1-3 18-bit D/A convertor adjustment

After adjusting the 16-bit D/A convertor, the 18-bit D/A convertor adjustment can be followed.

1) Press the **[PARAMETER]** key, then the display will be changed as shown;

```
 D/A 18bits
TEST
```

2) Press keys as shown below;

[MARKER] : The display will be changed as shown;

```
 D/A 18bits
TEST     0
```

3) Adjust the intergrator output (Voltage between INTE 1+ and INTE - terminals on the rear panel of the detector) to ±0.1mV by rotating the trimmer RV3 on the A/D, D/A CONTROL I/F PCB.

4) Pressing the [▲] key will change the display as shown;

```
D/A 18bits
TEST  +FULL
```

5) Adjust the output to +1.28V ±5mV by rotating the trimmer RV7 on the A/D, D/A CONTROL I/F PCB.

6) Pressing the [▼] key will change the display as shown;

```
D/A 18bits
TEST   +H1B
```

7) Read the ouput, then press the **[EDIT/ENTER]** key, now the display will be changed as shown;

```
D/A 18bits
TEST   LFULL
```

8) Read the ouput, and compare the present reading with the previous one in step 8).

9) Rotate the trimmer RV2 so that the present reading is equal to the reading in step 8).

10) Repeat step 7) through 10), and confirm that the difference of both outputs is less than 0.1mV.