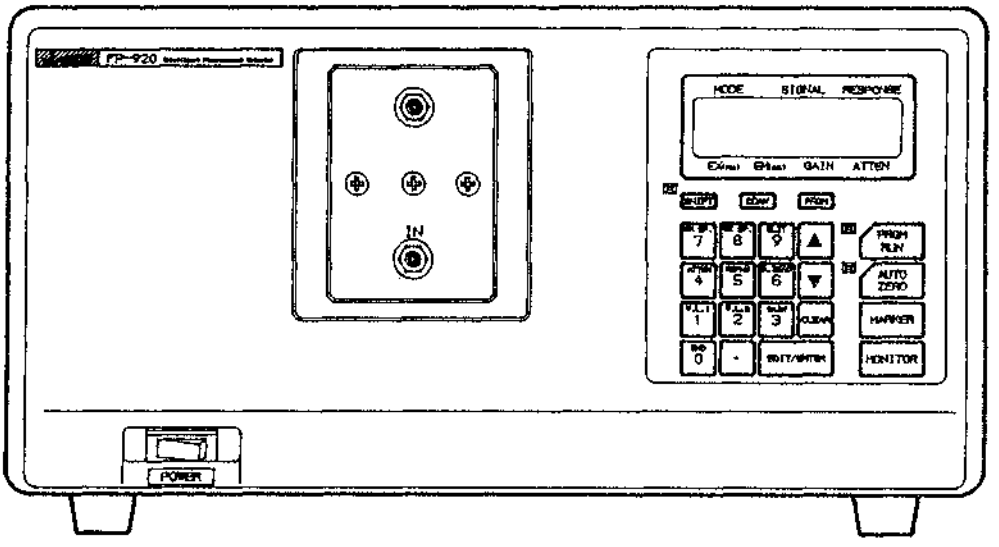
MODEL FP-920

Intelligent Fluorescence Detector

Operation Manual



JASCO

Part No. 0302-0205B

Rev. 1995.02
1994.01

WARRANTY

Products sold by JASCO, unless otherwise specified, are warranted for a period of one year from the date of shipment to be free of defects in materials and workmanship. If any defects should occur in the product during this period of warranty, JASCO will repair or replace the defective part(s) or product free of charge.

Products and parts may not be returned which are contaminated and may constitute health hazards to JASCO employees.

This warranty does not apply to defects resulting from the following:

1) Improper or inadequate operation, maintenance, adjustment or calibration.
2) Unauthorized modification or misuse.
3) Use of consumable parts that are not supplied by JASCO.
4) Accident beyond JASCO's control.
5) Disaster.
6) Corrosion due to the use of improper solvents or samples.

This warranty does not cover the consumable parts listed below:

1) Deuterium lamp, tungsten lamp, xenon lamp and other light sources.
2) Mirrors in the light source section, and cell windows.
3) Fuses, batteries, glassware, chart paper and ink.
4) Plunger seals, needle seals, cell window gaskets, valve seals, disk seals and other seal materials.
5) Tubing and fittings such as ferrules and nuts, filters such as inlet filters, line filters and other solvent filters.
6) Pre-columns and guard columns.

The warranty period for all parts and repairs supplied under this warranty expires with the warranty period of the original product. For inquiries concerning repair service, contact your JASCO agent after confirming the model name and serial number of your instrument.

INTRODUCTION

This instruction manual describes the operation of the JASCO Model FP-920 Intelligent Spectrofluorometer. Carefully read this manual to obtain a thorough understanding of the software before using it in conjunction with the MD-910 Detector.

Special considerations and precautions for safe and efficient use are also described throughout the manual. These appear in the following forms:

WARNING! Warns of potentially hazardous situations and outlines the correct procedures or practices required to prevent personal injury.

CAUTION: Alerts the operator to the correct operating or maintenance procedures required to prevent instrument failure or damage.

Note: Provides additional information to aid the operator in obtaining optimal instrument performance.

Pressurized, hazardous solvents are used in high performance liquid chromatography. Take care to follow proper laboratory procedures to ensure operator safety. Always wear eye, skin and clothing protection when operating the instrument, especially during sample injection, valve opening, etc.

NOTICE

This instruction manual is believed to be complete and accurate at the time of publication. In no event shall JASCO be liable for incidental or consequential damages in connection with, or arising from, the use of this manual.

The contents of this manual are subject to change without notice in accordance with product improvements.

Table of Contents

1. Unpacking and Installation

This section describes the proper procedure for unpacking and installing the instrument.

1-1 Unpacking and instrument self-check

This section describes the unpacking and self-check procedures of the instrument.

1-1-1 Main body

Open the cardboard box and carefully remove the instrument. Confirm that the serial number on the plate on the side of the main body is the same as the serial number in the inspection table, and that the power voltage is as designated (See Fig. 1-1).

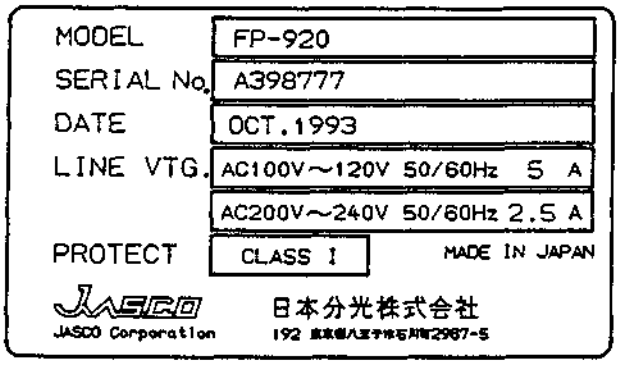


Figure 1-1 Serial Number Plate

1-1-2 Standard Accessories

Take out the accessories and check each part against the detailed list of standard accessories. If there is a missing or damaged part, contact your nearest Jasco representative.

1-2 Installation

This section describes the installation of the instrument.

1-2-1 Installation conditions

Since the high speed liquid chromatograph uses a large quantity of solvent compared to most analytical instruments, its installation location must be selected with consideration for possible solvent spills and solvent evaporation. Pay particular attention to the points listed below.

1) Install the instrument in a well ventilated area
2) Be aware of fire hazards
3) Have a sink nearby
4) Shield the instrument from direct sunlight
5) Choose a location with little temperature fluctuation
6) Prevent air conditioning and heating from directly hitting the instrument
7) Use a location with little vibration
8) Use a power voltage within ±10% of the designated voltage (±5% is preferable)
9) Use a location with no strong magnetic fields or high frequency waves
10) Use a location with little dust
11) Be sure a firm grounding is maintained

1-2-2 Installation

Install the instrument on a base that can withstand its weight, and that is matched to the width and depth of the unit. Fig. 1-2 shows an example of an appropriate arrangement.

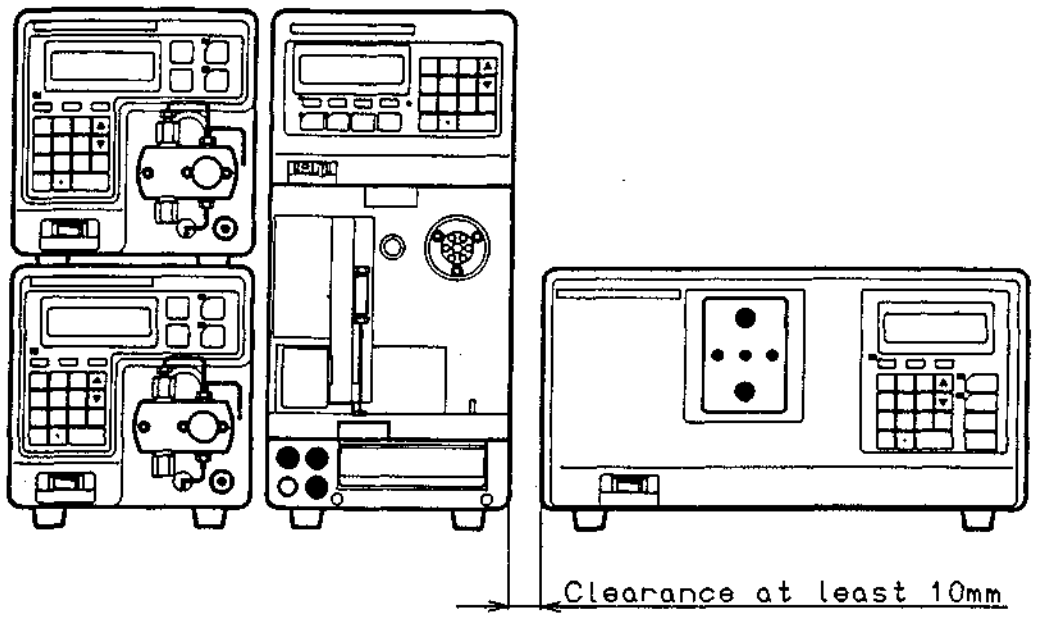


Figure 1-2 Arrangement Example

Note: Since the FP-920 gives off heat, do not place other devices on either side of the instrument. In particular, be sure to maintain a clearance of at least 10mm on the left side.

1-3 Turning on the power

CAUTION: Before connecting the power cable, confirm that the main power switch is OFF, and that the power voltage selector located on the rear panel of the instrument is set in accordance with the voltage supplied by the power source.

Turn the power on using the sequence shown below:

1) Turn the "POWER" switch to "OFF".

2) Insert the receptacle end of the power cable into the power input terminal (see Fig. 2-4) on the rear of the instrument.

3) Insert the plug end of the power cable into the power socket.

4) Turn the "POWER" switch to "ON".

WARNING!

(1) Use either a three-pronged grounded socket, or a two-pronged socket in connection with a ground adaptor. Securely ground the wire on the adaptor. If it is not possible to ground the insturment in either of these ways, use the "GND" ground terminal on the rear of the instrument to ground the unit.

(2) Do not attempt to ground the unit to water piping, since the piping used is often made of a non-conducting material (vinyl chloride).

(3) For safety reasons, do not use gas pipes as a ground.

If the instrument is not grounded, there is the possibility of an electric shock in the unlikely event of a break in the unit's insulation.

Note: The voltage measured by a voltage meter with high input impedance between the ground terminal "GND" on the rear of the instrument and the earth may be close to the power voltage without a ground.

This phenomenon is caused by the noise filter connected between the ground terminal and the power line and is not an electrical short circuit. The current flowing through the noise filter is 1mA or less and is not dangerous to the human body.

1-4 Operation check

When the FP-920 power is turned on, the message shown below will be displayed on the LCD for about 1 second, after which the instrument will begin a self-check procedure.

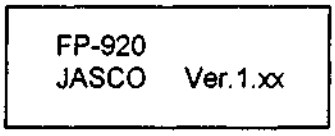


Figure 1-1 Screen when Power is Turned On

The items covered in the self-check are listed below:

(1) ROM, RAM, BACK UP (Memory check)

(2) +/- 15V, +5V, (DC power check)

(3) LAMP (Light source lamp check)

(4) G, DRIVE (Wavelength drive section check)

If the self-check for a given item reveals no abnormality, "OK!" will be displayed for 0.5 seconds and the instrument will continue to the next item. If an error is detected, a message will be displayed corresponding to the item in which the error occurred.

Press [SHIFT][▽] to move from the item where the error occurred to the next item. The instrument will proceed with the next self-check. At the end of the self-check, the monochromator spectrum bandwidth and the lamp use time will be displayed.

If the self-check ends normally, the monitor screen for the normal operation mode will be displayed. The setting values such as wavelength and sensitivity will be the same as those set when the power was last turned off.

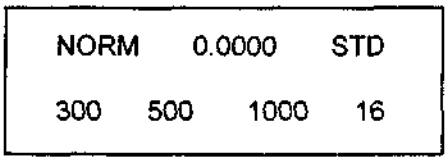


Figure 1-2 Monitor Screen for the Normal Operation Mode

1-5 About safety

This section contains information regarding the safe operation of the instrument.

1-5-1 Installation

Compared to other analytical instruments, the high speed liquid chromatograph uses a large quantity of solvent. Some of these solvents are volatile, toxic or flammable. While care should be taken to find a well ventilated location for the instrument, it is also necessary to be prepared for possible solvent spills or leaks from piping joints.

1-5-2 Grounding

Because solutions normally flow through the internal parts of the high speed liquid chromatograph, there is the danger of an electrical short circuit in the unlikely event of a fluid leak within the instrument.
For the safety of the operator, even in the event of an electrical short circuit, be sure to ground the instrument before use. Refer to section 1-3 for details about grounding the unit.

1-5-3 Light source cooling fan

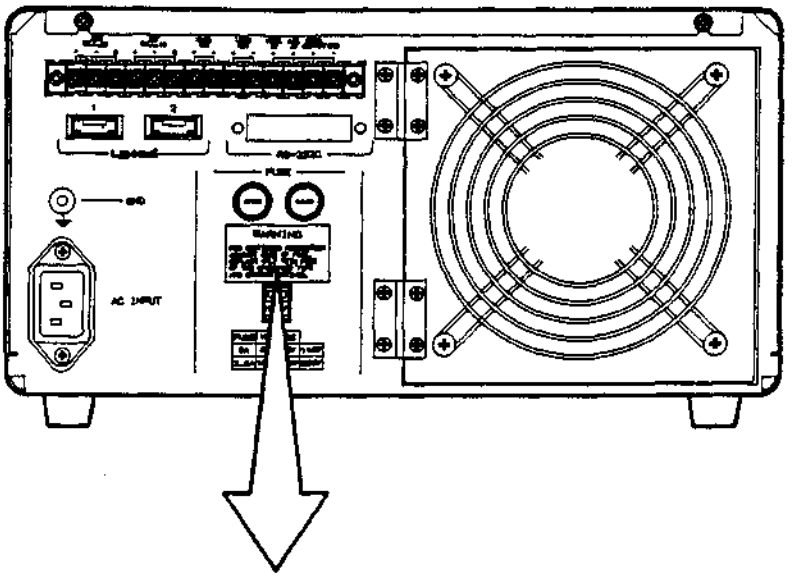
Check that the light source cooling fan on the back of the instrument (see Fig. 2-4) is turning properly when the power is turned on. If the lamp is on when the fan has stopped, the glass portion of the lamp will fatigue rapidly.

1-5-4 Fuse

The following warning label is attached to the instrument. Do not remove or obscure the label.

Note: If it is not possible to read the label, contact your nearest Jasco representative.

For protection from dangers such as fire, use fuses of the designated current value.



WARNING

FOR CONTINUED PROTECTION
AGAINST RISK OF FIRE,
REPLACE ONLY WITH FUSE
OF THE SPECIFIED TYPE
AND CURRENT RATINGS.

Figure 1-5 Warning Label on the Back Panel

Warning: ***To protect people and the instrument from dangers such as fire, use only fuses of the designated current value. Also, to prevent electric shocks, be sure to turn the "POWER" switch to "OFF" and unplug the power cable before replacing fuses.***

2. Names and Functions of Parts

This chapter contains the names and functions of the unit's parts.

2-1 Front panel

This section describes the front panel of the unit.

2-1-1 Switches and keys

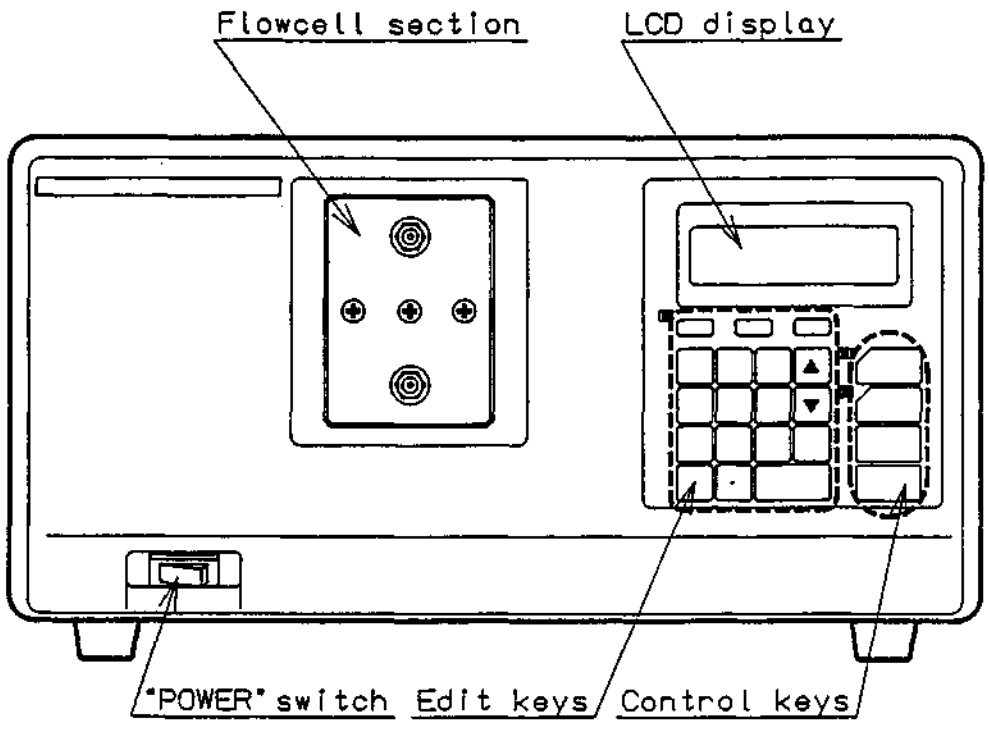


Figure 2-1 Front Panel

Part Name	Description
LCD Display	Displays operating conditions, fluorescent intensity, parameters, setting values, and various messages.
"POWER" switch	Used to turn the instrument on or off.
Flowcell section	This is the cassette type flowcell section.
Edit keys	Used to select parameters, set numerical values and create programs
Control keys	Used to operate detector fuctions such as autozero, marker and time program

2-1-2 Keypad

The keypad is illustrated in Fig. 2-2.

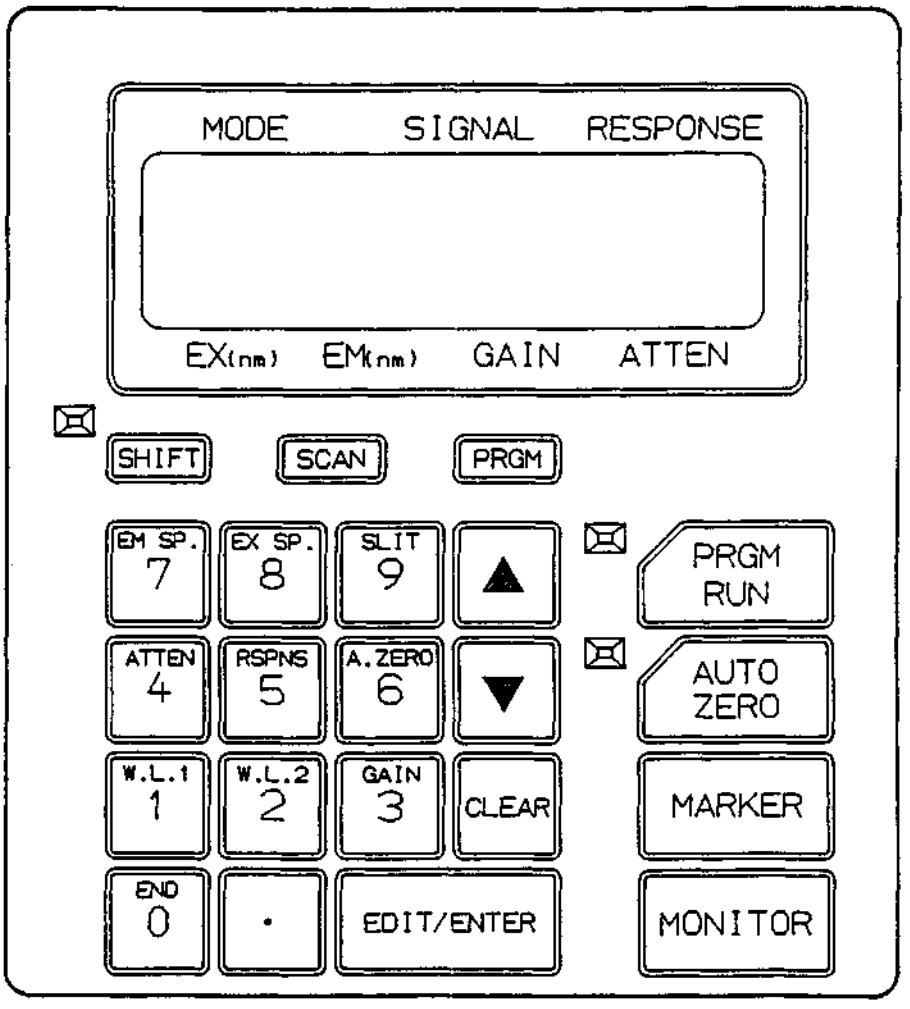


Figure 2-2 Keypad

Key	Function
[PRGM RUN]	- Used to start and stop the time program. If pressed when the upper left lamp is off, the time program will start and the lamp will light. If pressed again the time program will stop and the lamp will go out. - Used for spectrum measurement and output.
[AUTOZERO]	- Sets the integrator and recorder outputs to zero.
[MARKER]	- A marker will be added to the recorder output (about +3mV).
[MONITOR]	- Used to return to or change the monitor screen. *Note: [MONITOR] displays the instrument operation conditions such as wavelength, fluorescent intensity and program running time.*
[PRGM]	- Used to switch between the normal operation mode and time program mode.
[SCAN]	- Used to switch to the wavelength scan mode (press [MONITOR] to return to the original mode).
[SHIFT]	- Used in combination with the numeric keys to set parameters that are not frequently changed.
[END/0][•]-[SLIT/9]	- Numeric keys

Key	Function
[W.L1/1]	- Numeric "1" key - Wavelength change key in the normal operation mode - Used for "EX, EM, W.L" (W.L is short for wavelength) functions in time program mode
[W.L2/2]	- Numeric "2" key
[GAIN/3]	- Numeric "3" Key - Gain change key in the normal operation mode - Used for the "GAIN" function in time program mode
[ATTEN/4]	- Numeric "4" key - Attenuation change key in the normal operation mode - Used for the "ATTEN" (attenuation) function in time program mode
[RSPNS/5]	- Numeric "5" key - Response (equivalent speed) change key in the normal operation mode - Used for the "RSPNS" (response) function in time program mode
[A.ZERO/ 6]	- Numeric "6" key - Used for the "A.Z" (autozero) function in time program mode
[EMSP./7]	- Numeric "7" key - Used for the "EM SP" (emission spectrum) function in time program mode

Key	Function
[EXSP./8]	- Numeric "8" key - Used for the "EX SP" (excitation spectrum) function in time program mode
[SLIT/9]	- Numeric "9" key - Used for the "SLIT" (fluorescence spectral bandwidth) functions in time program mode
[Δ] [∇]	- Used to select setting values (ATTEN for example) - Used to increase or decrease step numbers in the time program.
[EDIT/ENTER]	- Used to check or change setting values.
[CLEAR]	- Used to cancel input values - Used to clear problems (LEAK IN CELL for example).

2-1-3 Flowcell section

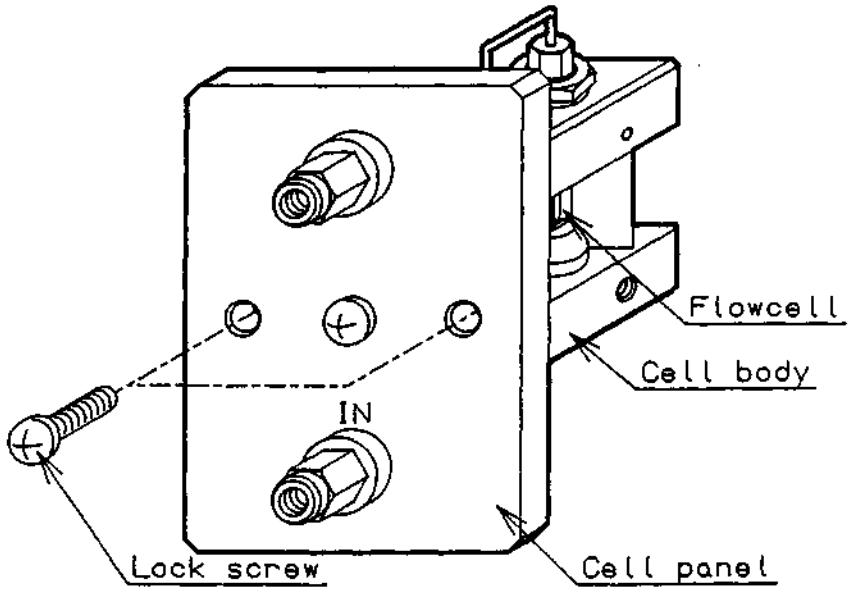


Figure 2-3 Flowcell Cassette (Standard)

Name	Explanation
Cell body	Flowcell support body
Flowcell	Silica glass flowcell
Cell panel	
Lock screw	Cell panel attachment screw

Caution: When attaching the flowcell section, press the cell panel in by hand so that the guide pins go through the back holes. Next, alternately tighten the lock screws to attach the panel. If the panel is inserted with the lock screws tightened down from the beginning, the panel may not be positioned properly.

2-2 Back panel

The external appearance of the back panel is shown in Fig. 2-4.

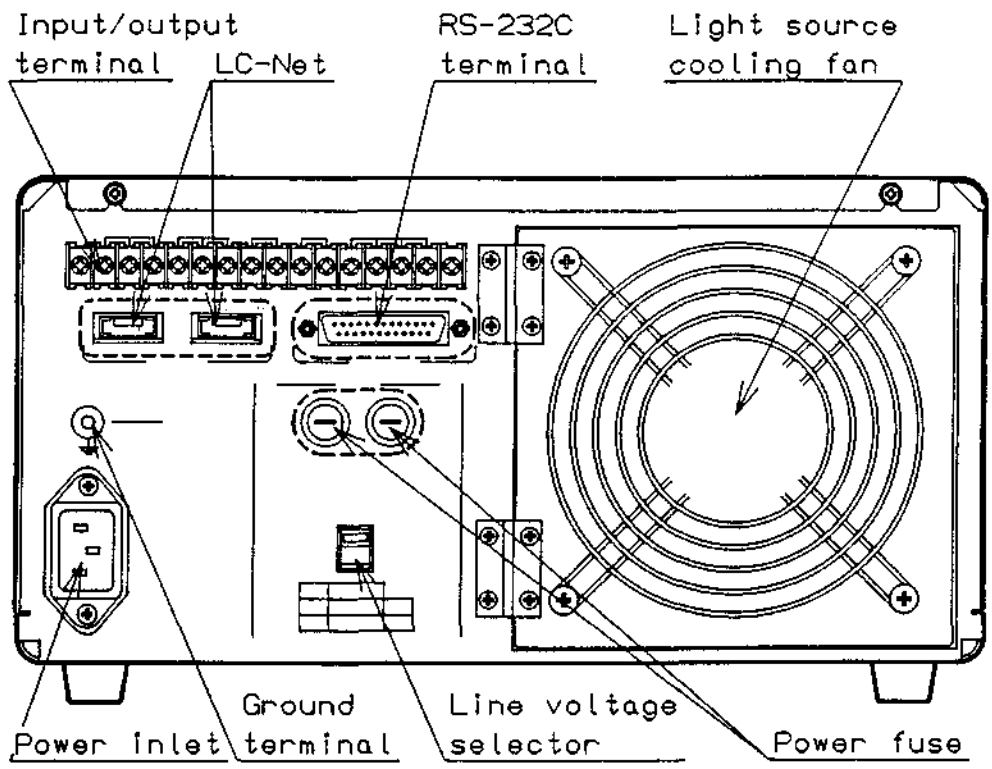


Figure 2-4 Back Panel

Name		Description
Input/output terminal		
Signal output terminal		
REC	± G(GND)	Recorder output terminal (The output level or sensitivity is determined by the ATTEN setting)
INT	± G(GND)	Integrator output terminal
MARK OUT	+ -	Marker output terminal (Normally "OPEN", the point of contact is "CLOSED" if the [MARK] key is pressed or if "MARK IN" is input.)
LEAK OUT	+ -	Fluid leak warning output terminal (Normally "OPEN", the point of contact is "CLOSED" if a fluid leak occurs in the flowcell.)
		Note: Only the buffer solution fluid leaks can be detected.
Signal input terminal		
MARK IN GND	+ -	Marker input terminal (A marker input signal is added to the recorder output if the point of contact signal is "CLOSED"). Refer to section 4-4 for details
A/Z IN IN	+ -	Autozero input terminal (The recorder output and integrator output are zeroed if the point of connection signal is "CLOSED").
PRGM RST/ST GND	+ -	Time program input terminal (If the point of contact is "CLOSED", the program starts immediately after time program is reset (return to initial conditions)

Name	Description
Light source cooling fan	Fan for cooling the xenon lamp
Power inlet	Power cable connection.
Power fuse	***Warning: For continued protection against the risk of fire, replace old fuses with fuses of the specified type and current ratings only.***
Ground terminal	This is the ground terminal for the power line. This is not a ground terminal for the input/output signal. (Do not use this in place of the input/output terminal ground.)
Line voltage selector	Switches the line voltage between 115V and 230V 115V: 85V - 132V 230V: 187V - 264V
RS-232C terminal	Instrument control and digital output of signals is possible through the RS-232C channel.

3. Key Operations in Normal Operation Mode

In the normal operation mode, chromatograms are taken at a fixed wavelength and range.

3-1 Parameter settings

The screen shown in Fig. 3-1 will appear after turning the power on, when the self-check is complete.

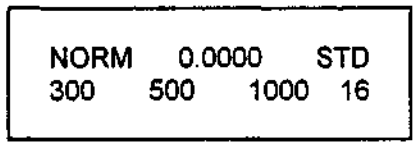


Figure 3-1 LCD Screen after Completion of Self-check

The setting values for range, wavelength, and response time will be the same as those set when the power was last turned off.

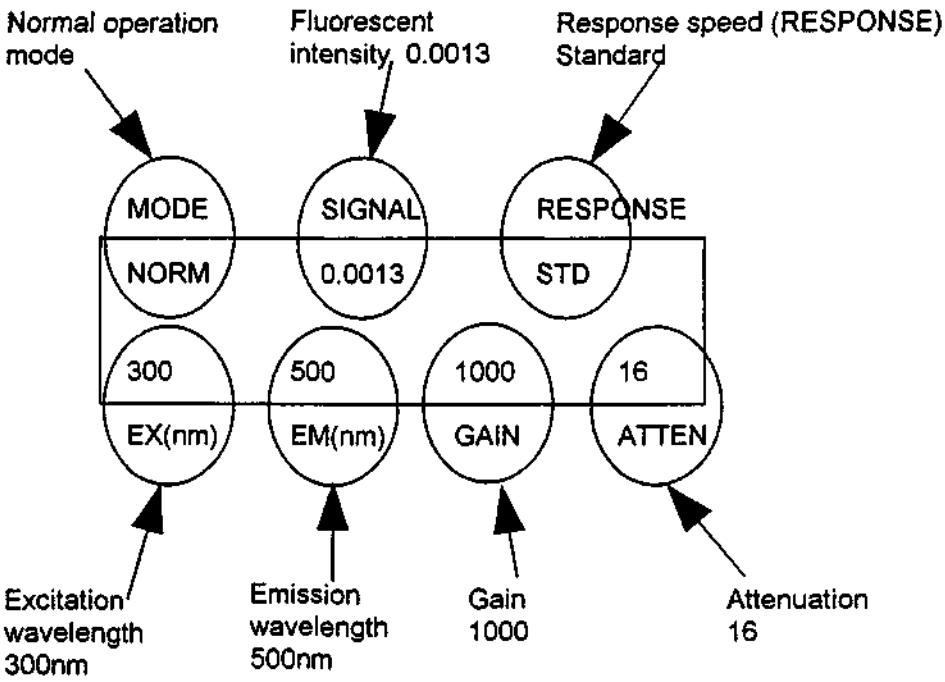


Figure 3-2 Description of the Normal Operation Mode Screen

The method for setting parameters is shown below:

1) When the key designating the parameter to be changed is pressed, the set value will flash.

2) Input the settings using the [Δ]/[∇] keys or the numeric keys. If an incorrect value is input, press [CLEAR] and input the value again.

3) Press [EDIT/ENTER] and the flashing will stop.

A list of key operations for setting parameters is shown in Table 3-1.
Sections 3-1-1 to 3-1-4 show actual examples.

Table 3-1. Key Operations for Setting Parameters

Parameter	Setting key	Change method	Setting range
Wavelength (EX, EM)	[W.L1/1]	Numeric keys	200 - 900 (nm)
Gain	[GAIN/3]	Numeric or [Δ]/[∇] keys	1, 10, 100, 1000
Attenuation	[ATTEN/4]	Numeric or [Δ]/[∇] keys	S, 256, 128, ...4, 2, 1
Response	[RSPNS/5]	[Δ]/[∇] keys	FST, STD, SLW, or 3S, 5S, 10S, 20S, 40S

3-1-1 Wavelength setting

Set the excitation wavelength to 230nm and the emission wavelength to 350nm

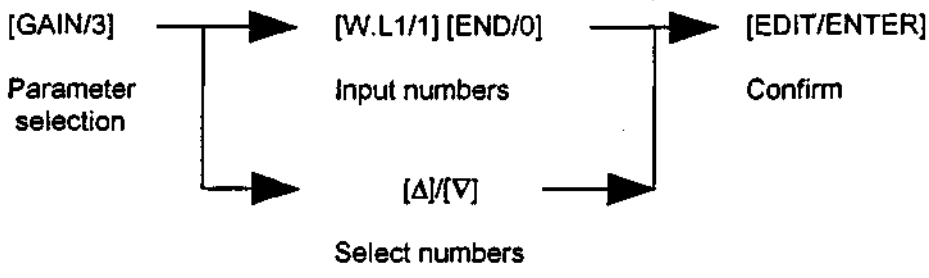
[W.L1/1]	→	[W.L2/2][GAIN/3][END/0]	→	[EDIT/ENTER]
Parameter selection		Input numbers		Confirm
	→	[GAIN/3][RSPNS/5][END/0]	→	[EDIT/ENTER]
		Input numbers		Confirm

Note 1: When [SHIFT][W.L1/1] is pressed, the screen will change to the preamp. output screen. When [MONITOR] is pressed, the screen will return to the screen shown in Fig. 3-1.

Note 2: The wavelength setting range can be broadened using special settings (refer to section 4-10).

3-1-2 Gain setting

Change the gain to 10

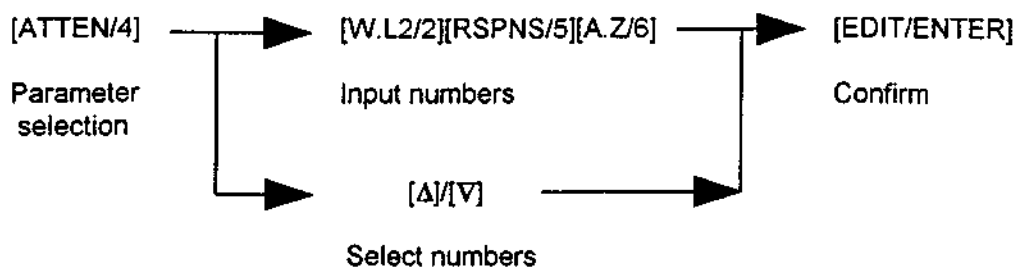


Note: When [SHIFT][GAIN/3] is pressed, the screen will change to the signal filter setting screen.

When [MONITOR] is pressed the screen will return to the screen shown in Fig. 3-1.

3-1-3 Attenuation setting

Set the attenuation to 256



Note: When [SHIFT][ATTEN/4] is pressed, the screen will change to the autozero operation screen.

When [MONITOR] is pressed, the screen will return to the screen shown in Fig. 3-1.

The difference between GAIN and ATTEN:

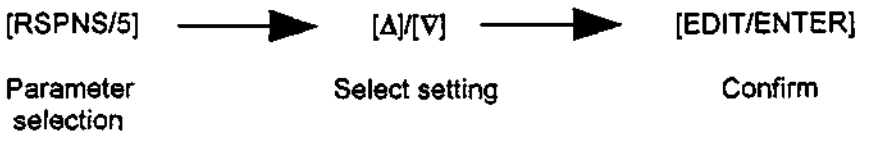
The magnitude of the voltage added to the fluorescence detector photomultiplier tube is called gain. Larger gain values mean that a larger voltage is added, and higher sensitivity is obtained. Adjustment using gain affords a wide dynamic range.

On the other hand, a decrease in the recorder output is called attenuation. Smaller attenuation values produce smaller decreases and higher sensitivity. Adjustment using attenuation enables the decrease in recorder output to be finely and accurately set.

Note: Attenuation has no influence on integrator output. Integrator output can be considered as recorder output with the attenuation fixed at 1. Recorder output is zero when attenuation is set to "S".

3-1-4 Response setting

Change the response setting to SLOW



Note 1: When [SHIFT][RSPNS/5] is pressed, the screen will change to the zero-point shift screen. When [MONITOR] is pressed, the screen will return to the screen shown in Fig. 3-1.

Note 2: Only values can be set here. The response method (single filter method) is set in the screen shown in Fig. 4-3 (see section 4-3).

3-2 Special parameter settings

Function parameters that are not frequently used, and parameters that are rarely changed once set, cannot be set in the screen shown in Fig. 3-1.

The special parameter settings screens can be accessed from the screen shown in Fig. 3-1 by pressing [SHIFT] and a numeric key. After setting in the special screen, press [MONITOR] to return to the screen shown in Fig. 3-1 (refer to chapter 4 for a more detailed explanation).

4. Special Key Operations ([SHIFT][n] operations)

The functions described in this chapter can be executed from the screens displayed by pressing the [SHIFT] key together with a numeric key from the monitor screen. (These screens will be framed with double lines in the figures of this manual)

After making the settings, press the [MONITOR] key to return to the monitor screen.

Note: There are also functions that use keys other than the numeric keys.

4-1 Preamplified output ([SHIFT][1] setting)

The preamplified output will be displayed on this screen. This is used to check for deterioration of the lamp or light source mirror and for the existence of bubbles in the cell. The output is also used for re-alignment after replacing the Xe lamp.

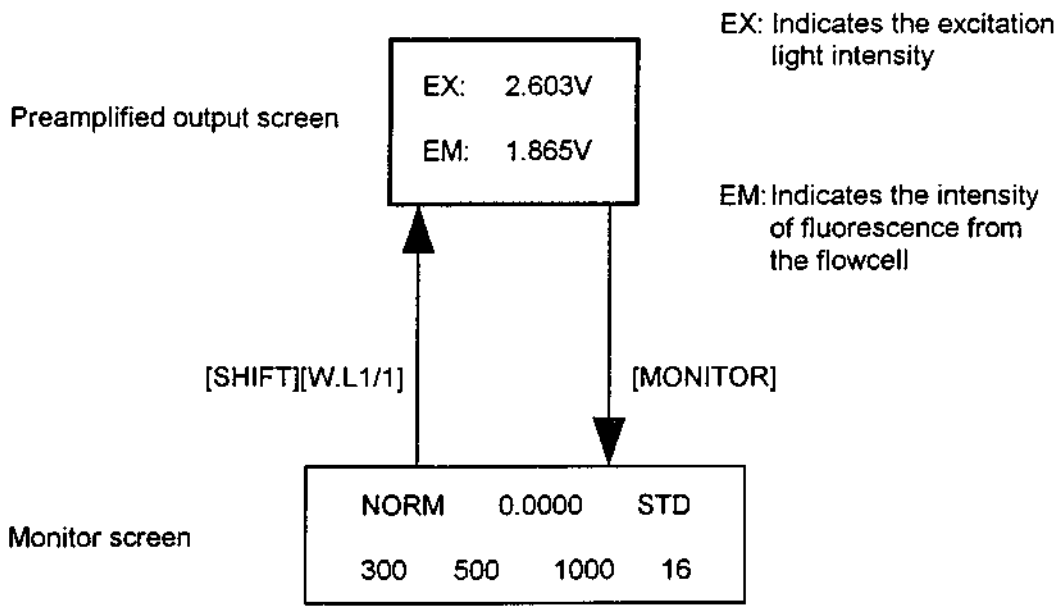


Figure 4-1 Displaying the Preamplified Output

4-2 Lamp off timer ([SHIFT][2] setting)

This section outlines the use of the lamp off timer

4-2-1 Timer set

The lamp will be turned off after the time set on this screen has elapsed.

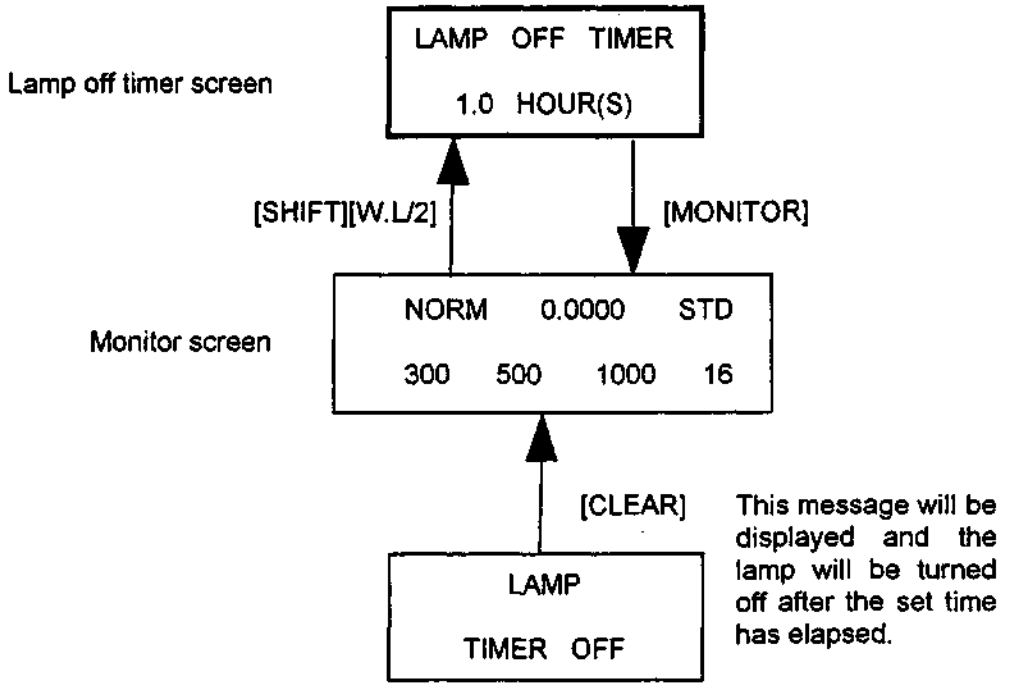


Figure 4-2 Operation of Lamp Off Timer

The method for setting the timer is shown below:

1) Press [EDIT/ENTER] and the number will flash.

{Example} OFF (flashing)

2) Input a numeric value. If an incorrect numeric value is entered, press [CLEAR] and re-enter the input.

{Example} Change to [1] → 1.0 HOUR(S) (Flashing)

3) Press [EDIT/ENTER] and the number will stop flashing.

{Example} 1.0 HOUR(S)

Note: The setting range for the lamp off timer is from 0 (OFF) to 99.9 H (in 0.1 H increments).

The lamp off timer is automatically set to "OFF" when the power is turned on.

4-2-2 Relighting the lamp

Turn the power off then on again.

Note: It is sometimes difficult to relight the lamp immediately after the lamp has been turned off. If the lamp will not light, wait for at least one minute, and turn the power on again.

4-3 Signal Filter Method ([SHIFT][3] setting)

This section describes the signal filter method.

4-3-1 Setting method

The noise reduction method (Note) for the fluorescence signal is set on this screen.

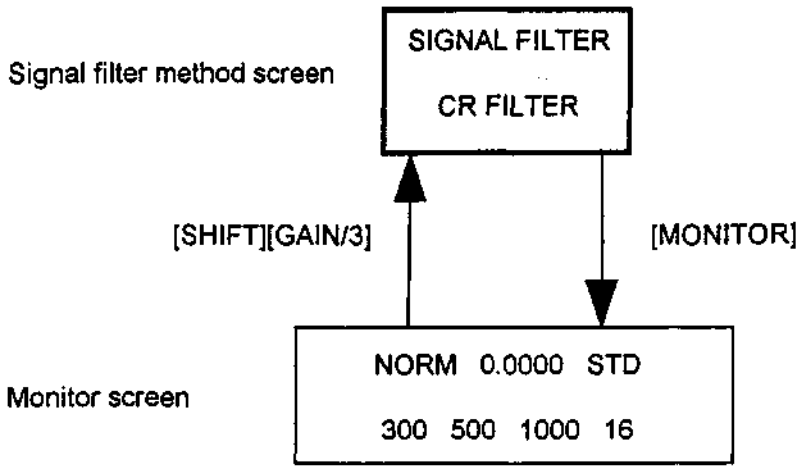


Figure 4-3. Signal Filter Method Display

Note: Only the signal filter method can be set in this display. Values are set in the monitor screen (screen displayed in Fig. 3-1) (refer to section 3-1-4).

The setting method is described below:

1) Press [EDIT/ENTER] and the selected method will flash.

   {Example} CR FILTER (flashing)

2) Use the [Δ]/[∇] keys to select the desired method.

   {Example} CR FILTER (flashing) → DIGITAL FILTER (flashing)

3) Press [EDIT/ENTER] and the selected method will stop flashing, indicating that it has been entered.

   {Example} DIGITAL FILTER

4-3-2 Method of use

The signal filter method is normally set at "CR FILTER"; FST, STD, and SLW can be selected depending on the peak width and degree of noise.

If a high noise level makes analysis using the "CR FILTER" method difficult, switch to the "DIGITAL FILTER" method.

The DIGITAL FILTER method reduces baseline noise more than the CR FILTER method.

The CR FILTER response speed when set at STD is approximately equivalent to the speed of the DIGITAL FILTER set at 3S; and the CR FILTER response speed when set at SLW is approximately equivalent to that of the DIGITAL FILTER set at 5S.

Caution:

(1) **A period of approximately three times the set value is required before the effect of the digital filter is seen. For example, when the setting value is 5S, about 15 seconds are required to process the signal.**
If a parameter were changed (i.e. wavelength or gain) no effect would be seen for about 15 seconds in the above example.
It is therefore advisable to avoid changing parameters immediately before a peak.

(2) **Due to the operating principle of the digital filter, signals are delayed by approximately 1.5 times the setting value. For example, when the setting value is 5S, the peak elution time will be delayed by about 8 seconds. When detecting peaks using the integrator, it is therefore necessary to keep the setting values constant.**

Setting value	Approximate signal processing time (seconds)	Approximate delay time (seconds)
3S	8	4
5S	15	8
10S	30	15
20S	60	30
40S	120	60

4-4 Autozero operation ([SHIFT][4] setting)

This section describes the use of the autozero function

4-4-1 Operation method

When the parameters shown below are changed, this screen can be used to select whether or not to autozero the fluorescence signal.

When set to "AUTO", the autozero will occur immediately after the parameter change.

When set to "MANUAL", no autozero will occur.

-When changing wavelength (EX, EM)
-When changing gain
-When MARKER IN (on the back panel) is input
-When changing spectrum bandwidth (see section 4-8)

Note: The [MARKER] key function on the front panel adds a marker regardless of this setting.

4-4-2 Setting method

The autozero operation method is set on this screen.

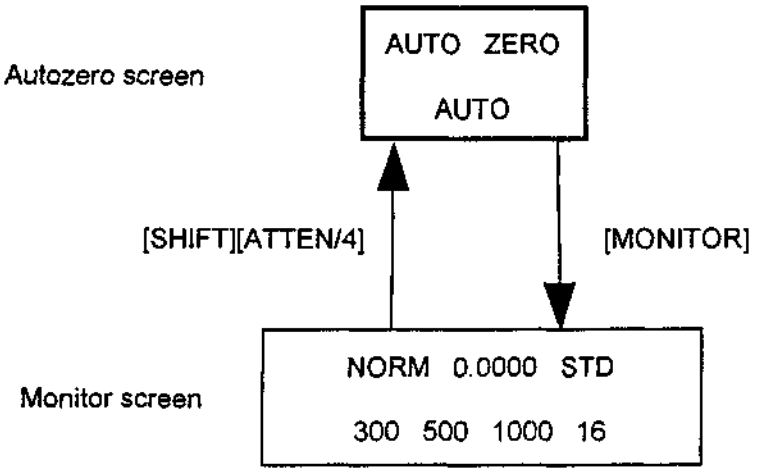


Figure 4-4 Setting the Autozero Operation Method

The setting method is shown below:

1) Press [EDIT/ENTER] and the selected operation method will flash

{Example} MANUAL (flashing)

2) Select using the [Δ]/[∇] keys

{Example} MANUAL (flashing) -> AUTO (flashing)

3) Press [EDIT/ENTER] and the selected method will stop flashing, indicating that it has been entered

{Example} AUTO

4-4-3 Method of use

It is convenient to use the AUTO setting for analysis and the MANUAL setting for separation.

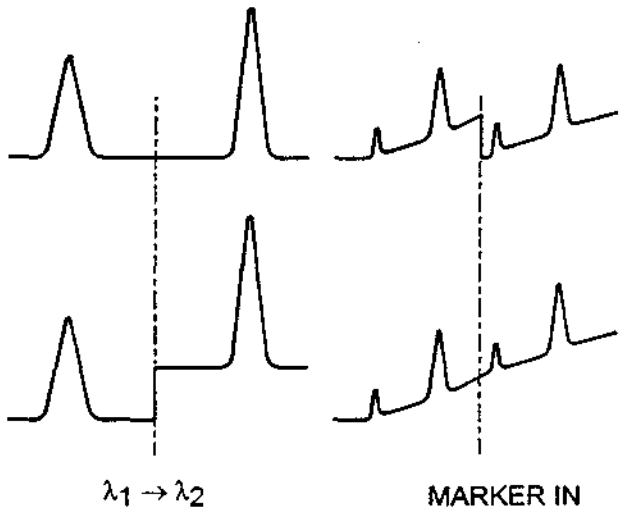
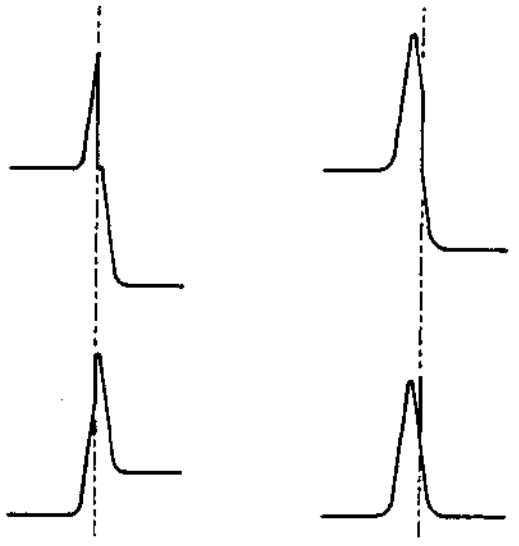
<AUTO setting>

- Autozero is automatically executed when the wavelength or gain is changed either manually or via a time program.
- When performing repeated analyses using the autosampler, autozero is automatically executed with the addition of a marker when the MARKER IN signal is input.

<MANUAL setting>

- Since no autozero is executed when the wavelength or gain is changed as a peak is being detected, the signal does not return to zero, and therefore, gives a more natural chromatogram.
- Since no autozero is executed with the addition of a marker when the MARKER IN signal is input as a peak is being detected, the signal does not return to zero causing the chromatogram to have no steps.
- When searching for the wavelength corresponding to a peak maximum during peak detection, the wavelength is easy to find since autozero is not executed.

Table 4-1 Autozero Operation Example

Chromatogram change / Setting	Wavelength change	MARKER IN input
AUTO		
MANUAL		
	$\lambda_1 \rightarrow \lambda_2$	MARKER IN
AUTO		
MANUAL		
	$\lambda_1 \rightarrow \lambda_2$	MARKER IN

4-5 Integrator output zero point shift ([SHIFT][5] setting)

This section describes the procedure for shifting the integrator output zero point.

4-5-1 Setting method

The approved input voltage for the integrator is in the range of -10mV to +1V. In other words, the dynamic range on the minus side is small compared to that on the plus side. With the zero point shift function, the voltage is shifted beforehand to the plus side, thereby preventing the integrator output from falling below -10mV.

Shift quantity can be set at 0, 5, 10, 50, or 100mV.

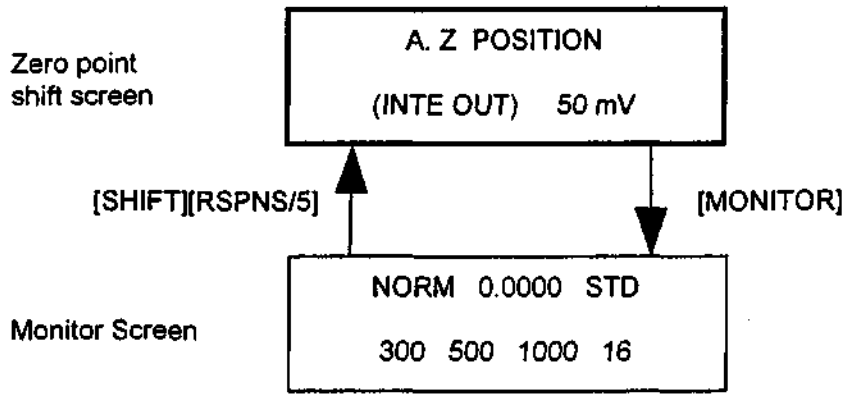


Figure 4-5 Setting the Zero Point Shift

The setting method is shown below:

1) Press [EDIT/ENTER] and the selected number will flash.

{Example} 0 mV (flashing)

2) Select using the [Δ]/[∇] keys.

{Example} 0 mV (flashing) -> 50 mV (flashing)

3) Press [EDIT/ENTER] and the number will stop flashing.

{Example} 50 mV

Note 1: Zero point shift does not apply to recorder output.

Note 2: The extent of integrator output noise is not changed by the zero point shift setting. However, as the input voltage becomes larger, the signal resolution of the integrator becomes smaller and the visible baseline noise becomes larger. Therefore, do not set values that are larger than necessary.

4-5-2 Method of use

{Example 1} The baseline has a negative drift over a long time period.

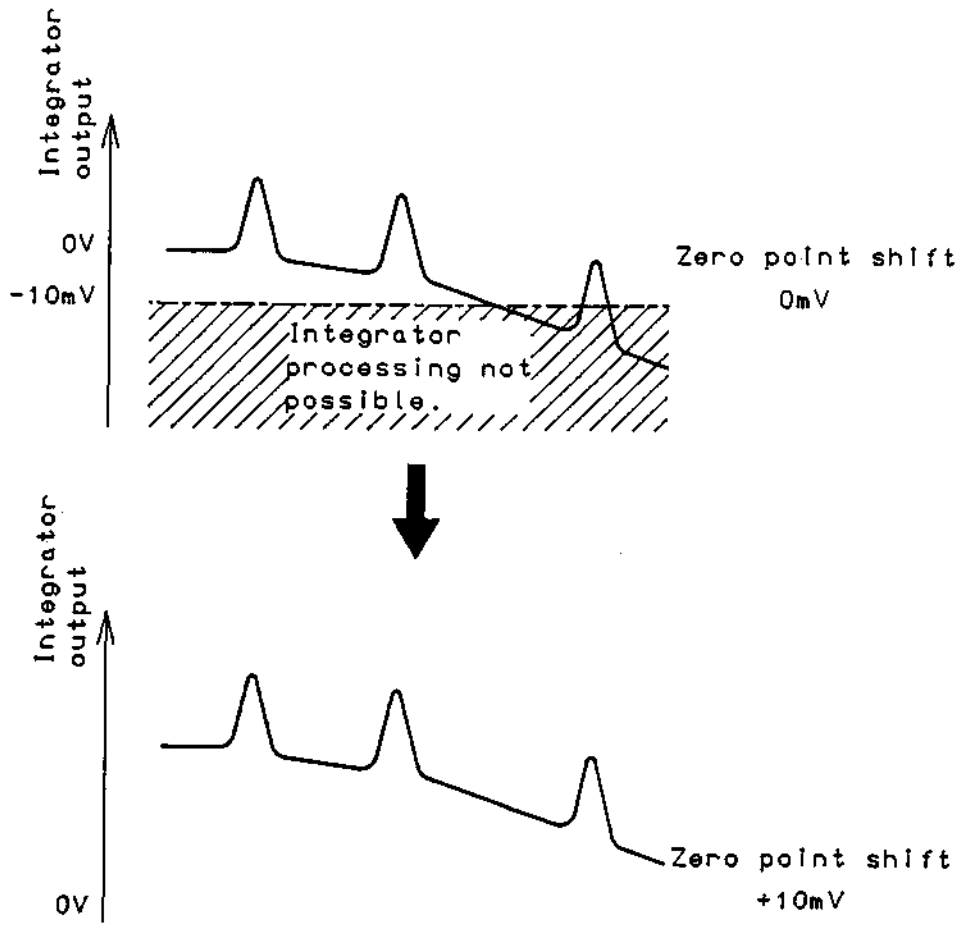


Figure 4-6 Method of Using Zero Point Shift

4-6 Recorder output polarity ([SHIFT][6] setting)

This section outlines the recorder output polarity.

4-6-1 Setting method

The polarity of the recorder output (Note) is set on this screen.

Note: The output polarity change is not applied to integrator output.

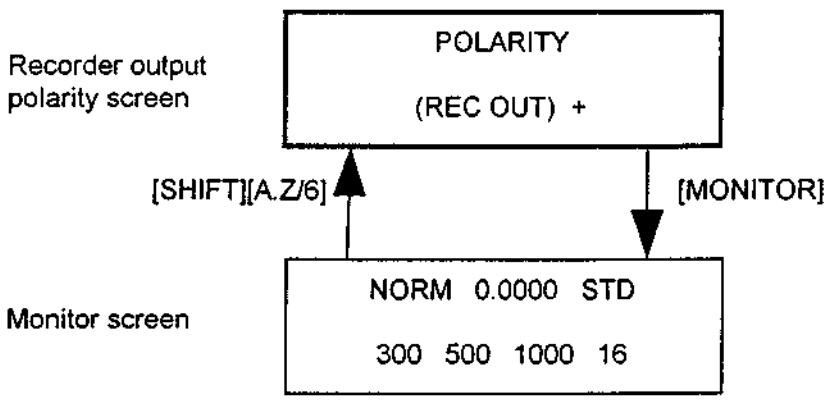


Figure 4-8 Setting of Recorder Output Polarity

The setting method is shown below:

1) Press [EDIT/ENTER] and the polarity will flash.
   {Example} + (flashing)

2) Select the desired polarity using the [Δ]/[∇] keys.
   {Example} + (flashing) → - (flashing)

3) Press [EDIT/ENTER] and the polarity will stop flashing, indicating that it has been entered.
   {Example} -

4-6-2 Method of use

{Example} Recording in parallel with another detector

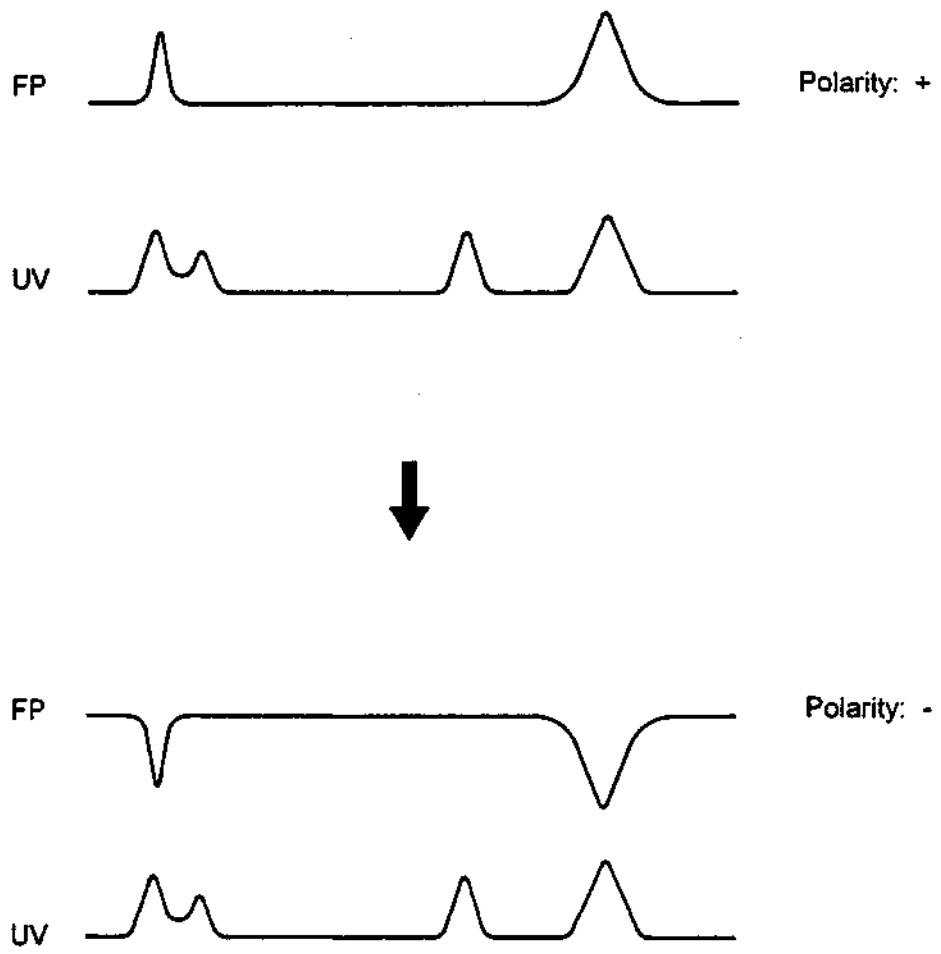


Figure 4-9 Method of Using Recorder Output Polarity

4-7 Xenon lamp use time ([SHIFT][7] setting)

The total time the lamp has been lit will be displayed on this screen, and is used to determine when to replace the lamp.

The life of a xenon lamp is about 1,000 hours; and even though their emission may still be good, lamps that have accumulated 1,000 hours of use should be replaced, since the glass portion of the lamp is fatigued and mechanically weak.

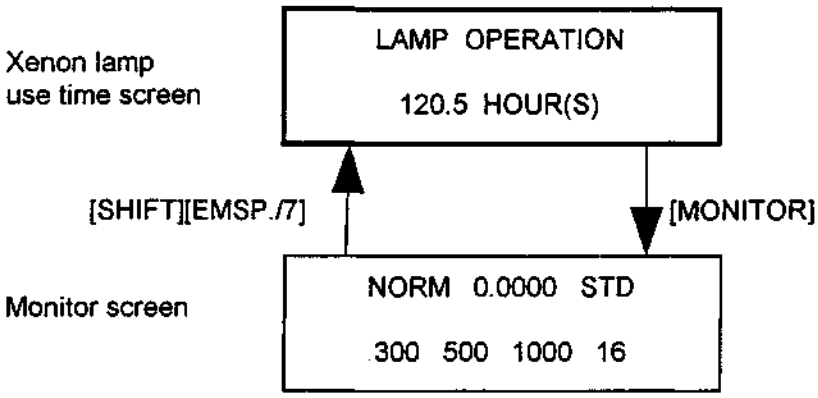


Figure 4-10 Displaying the Lamp Use Time

4-8 Spectrum bandwidth ([SHIFT][9] setting)

This section outlines the procedures for the setting and use of the spectrum bandwidth.

4-8-1 Setting method

The fluorescence spectrum bandwidth is set on this screen.

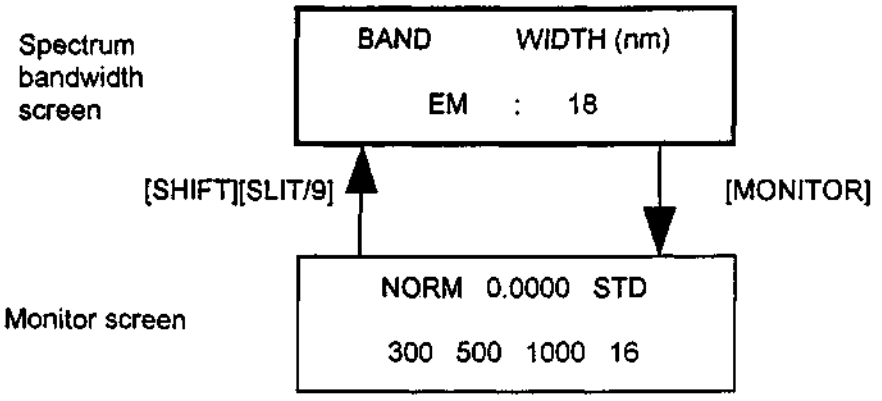


Figure 4-11 Setting the Spectrum Bandwidth

The setting method is explained below:

1) Press [EDIT/ENTER] and the selected spectral bandwidth will flash.

   {Example} 18 (flashing)

2) Select the desired value using the [Δ]/[∇] keys.

   {Example} [40] (flashing) → 40 (flashing)

3) Press [EDIT/ENTER] and the selected spectral bandwidth will stop flashing, indicating that it has been entered.

   {Example} 40

4) Slit switching will begin immediately and the message below will be displayed until the operation is finished (16 seconds at most).

   NOW SETTING

Note: While the NOW SETTING message is displayed, the integrator output and recorder output will be maintained at the values set immediately prior to the slit switching operation. When switching is complete, operation will continue according to the autozero operation method settings (see section 4-4).

4-8-2 Method of use

Sensitivity and wavelength selectivity can be improved by changing the spectrum bandwidth.

Example 1: By narrowing the spectrum bandwidth when the emission wavelength is close to the excitation wavelength, the excitation light and scattered light can be decreased, thereby improving sensitivity.

Example 2: When a single component is sufficiently separated from other peaks, fluorescence can be strengthened and sensitivity increased by widening the spectrum bandwidth.

Table 4-2 Using the Spectrum Bandwidth Settings

Setting (nm)	Use
10	Used to improve wavelength selectivity
18	Standard setting value
40	Used to enlarge the fluorescence signal

4-9 Program number ([SHIFT][PRGM] setting)

The program number (0 - 9) is set on this screen. Set the program number when operating in the program mode.

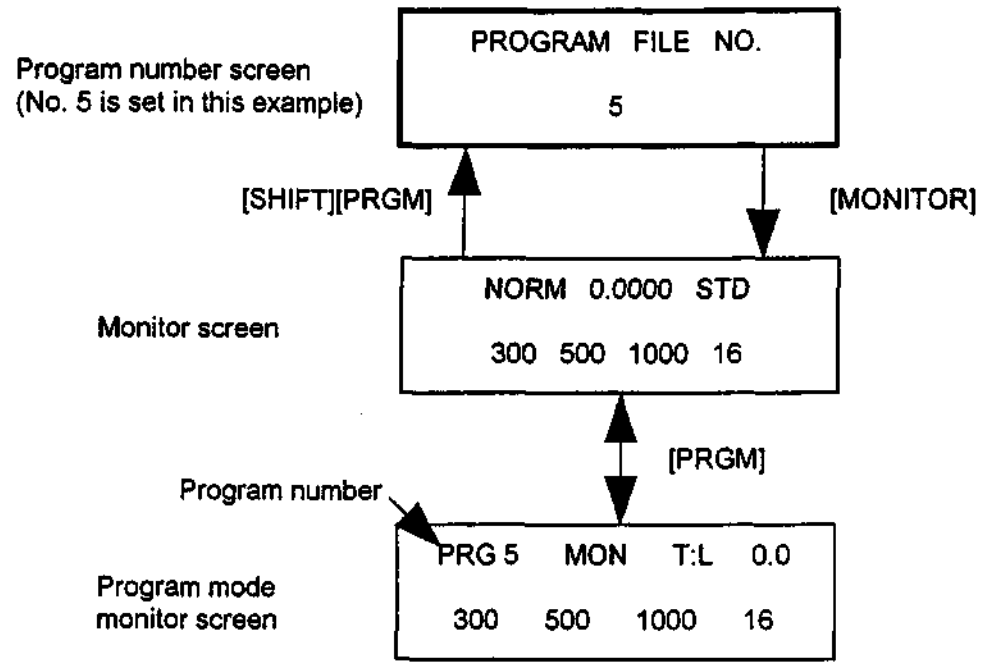


Figure 4-12 Setting the Program Number

The method for setting the program number is shown below:

1) Press [EDIT/ENTER] and the selected program number will flash.

   {Example} 0 (flashing)

2) Input the desired value using the numeric keys, or select it using the [Δ]/[∇] keys.

   {Example} [5] becomes → 5 (flashing)

3) Press [EDIT/ENTER] and the number will stop flashing, indicating that it has been selected.

   {Example} 5

4-10 *Wavelength range* ([SHIFT][CLEAR] *setting*)

The EX and EM wavelength range is set on this screen.

Setting	Wavelength range
EM > EX + 10	200nm ≤EX, EM ≤ 900nm and EX + 10(nm) ≤EM
NOT RESTRICTED	0nm ≤EX, EM ≤ 900nm

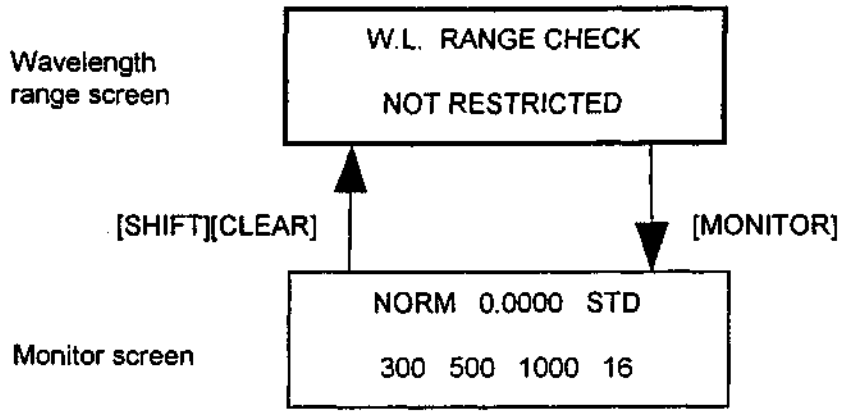


Figure 4-13 Setting the Wavelength Range

The method for setting the wavelength range is shown below:

1) Press [EDIT/ENTER] and the selected wavelength range will flash.

   {Example} NOT RESTRICTED (flashing)

2) Select the desired wavelength range using the [Δ]/[∇] keys.

   {Example} NOT RESTRICTED (flashing) → EM > EX + 100 (flashing)

3) Press [EDIT/ENTER] and the selected value will stop flashing, indicating that it has been selected.

   {Example} EM > EX + 100

Caution: **When the wavelength range is set to NOT RESTRICTED, a setting of EX = EM is possible. In this situation scattered light stronger than the fluorescent light is incident on the light detector photomultiplier tube. To prevent deterioration of the photomultiplier tube caused by the strong light, preset the gain to a small value (1 or 10).**

4-11 Temperature correction ([SHIFT][MARKER] setting)

The internal temperature of the instrument is displayed on this screen.

Note: This fluorescence detector senses the temperature inside the instrument and suppresses temperature drift.

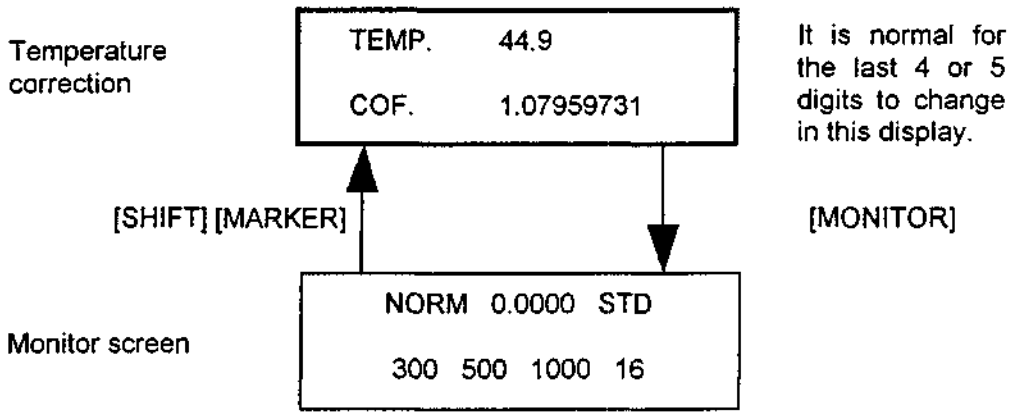


Figure 4-14 Displaying the Temperature

5. Key Operations in the Program Mode

This section outlines the key operations in the program mode.

5-1 Outline

The program mode is used to change the detection wavelength depending on the elution time and to use the autozero function during an analysis. The following parameters can be programmed in the program mode.

-Wavelength (EX and EM)
-Sensitivity (GAIN and ATTEN)
-Response speed (RESPONSE)
-Autozero
-Wavelength scan (EX and EM spectrum measurement)
-Spectrum bandwidth (EM)

There are 10 program files, each of which can contain a 64 step program. Set the program number (see section 4-9), and then proceed to use the operations described in this chapter.

5-2 Switch to program mode

When the [PRGM] key is pressed while in the normal operation mode screen, the mode will change to the program mode. To return to the normal operation mode from the program mode screen, press the [PRGM] key again.

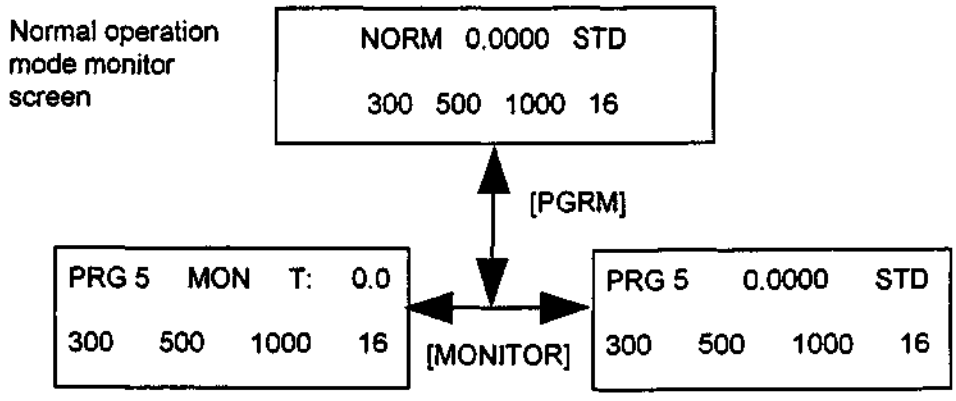


Figure 5-1 Switch between Normal Operation Mode and Program Mode

5-3 Program mode monitor screen

There are 2 types of monitor screens in the program mode.
Use the [MONITOR] key to change between screens 1 and 2.

1 A screen displaying the time, etc.

2 A screen displaying the range, wavelength, and fluorescent intensity.

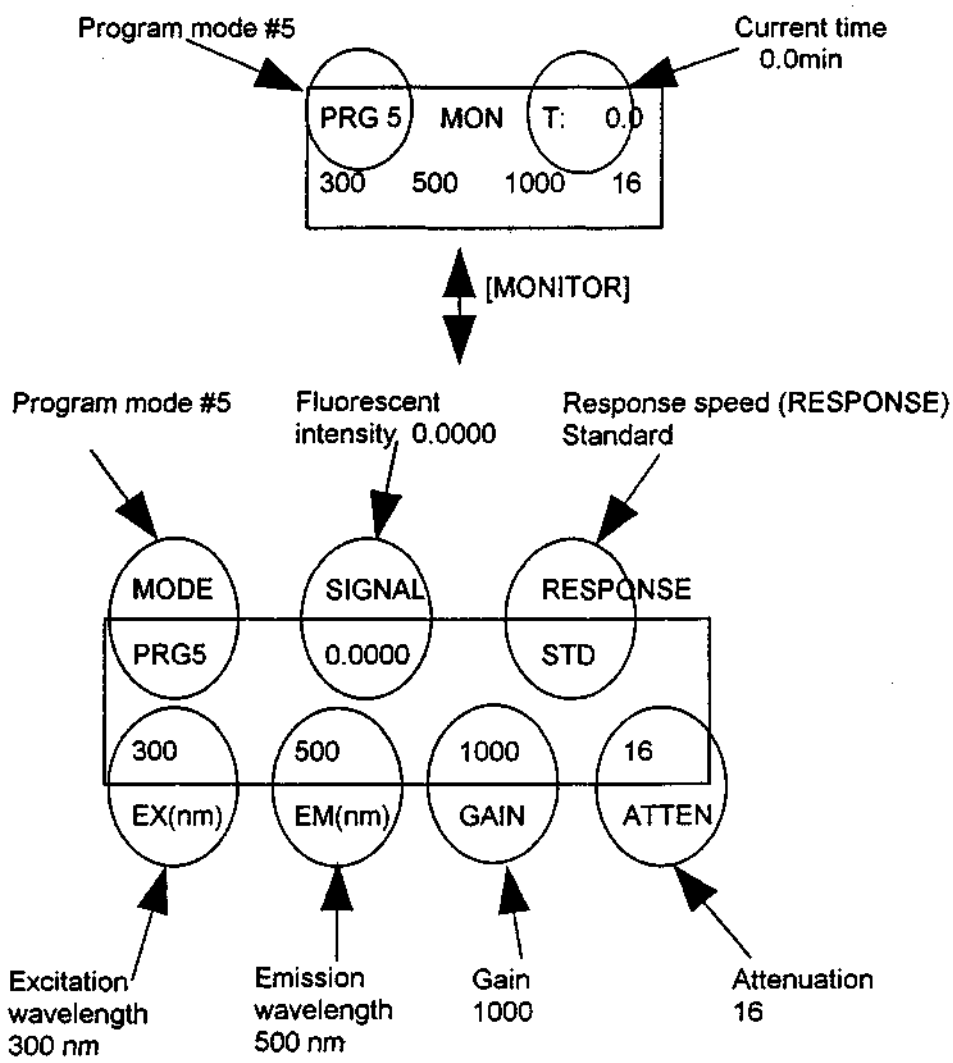
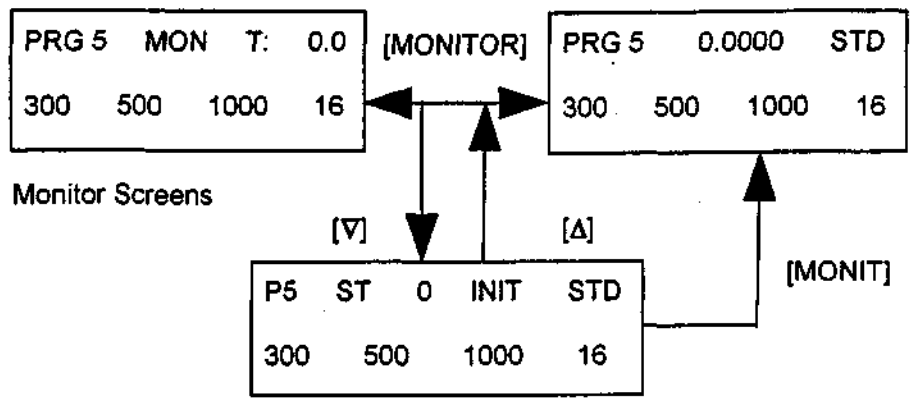


Figure 5-2 Explanation of the Program Monitor Screens

5-4 Input method for initial program parameters

When the monitor screen is displayed, press the [▽] key to enter the initial parameter settings screen.



Initial parameter settings screen

Figure 5-3 Initial Parameter Settings Screen

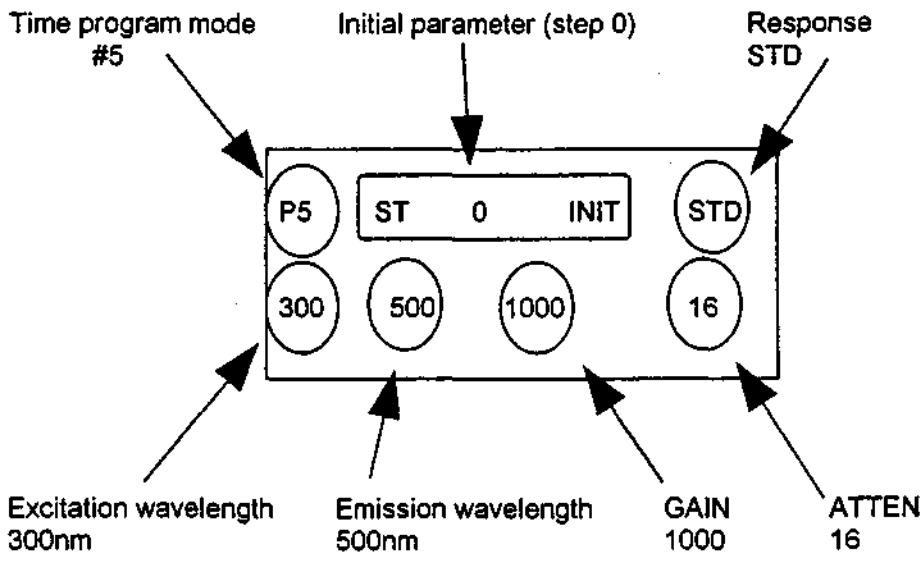
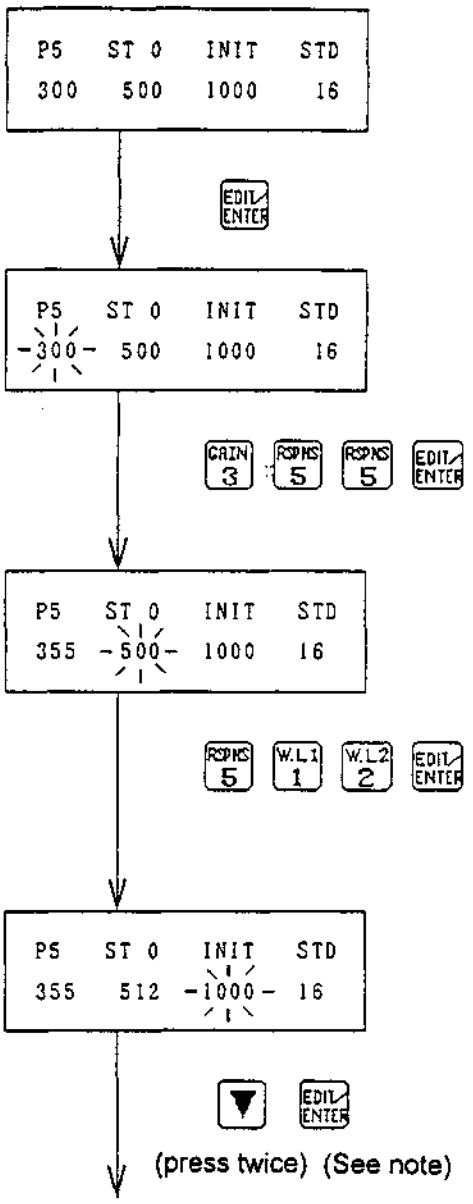


Figure 5-4 Explanation of the Initial Parameter Settings Screen

The parameters are set as shown below:

Screen

Explanation of key operation



Sets the excitation wavelength

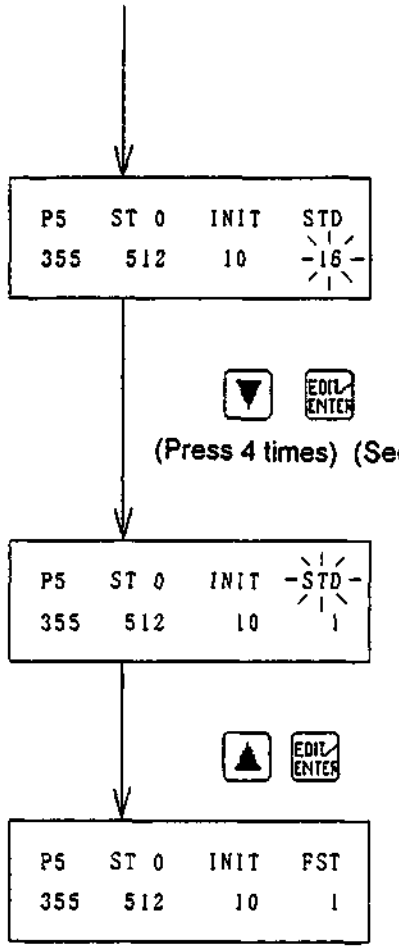
Input 355nm
Once the excitation wavelength is set, the instrument automatically proceeds to the emission wavelength setting

Input 512nm
Once the emission wavelength is set, the instrument automatically proceeds to GAIN setting

Input 10

Continued on next page

From previous page



Once the GAIN is set, the instrument automatically proceeds to ATTEN setting

Input 1

Once the ATTEN is set, the instrument automatically proceeds to the response setting

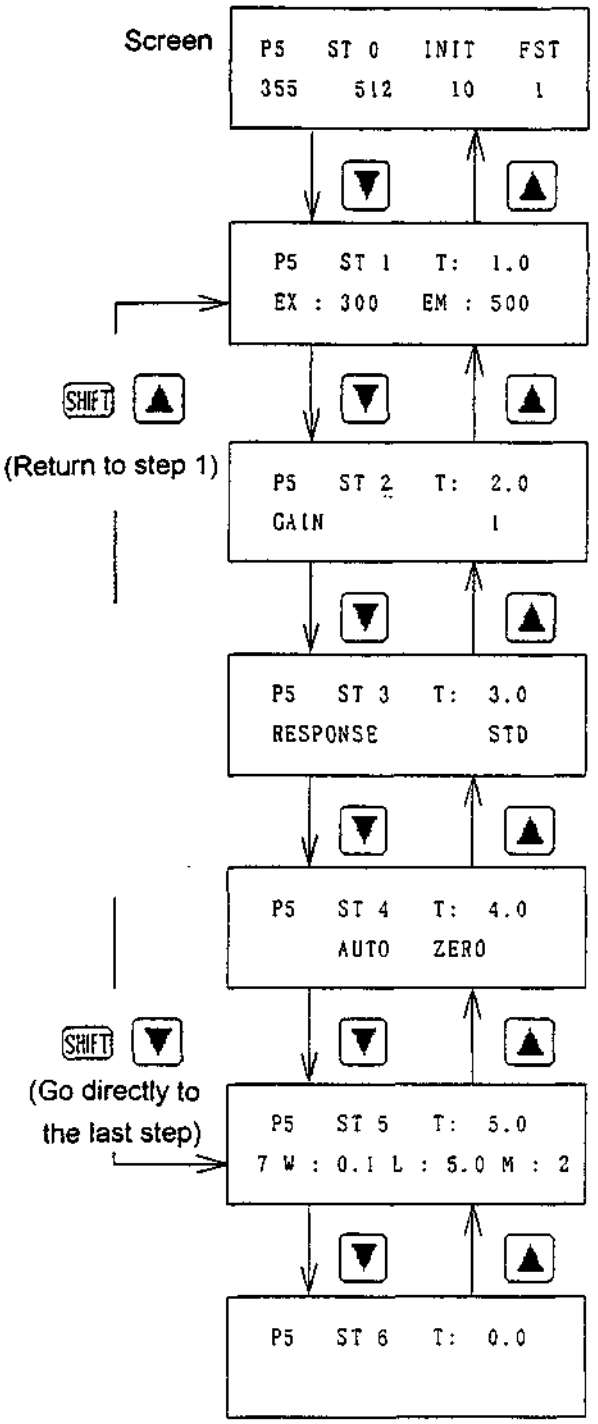
Input FST

Figure 5-5 Initial Parameters Input Method

Note: The numeric keys can be used as well as the [Δ]/[∇] keys.

5-5 Input method for program step 1 and after

An input example is shown in Fig. 5-6. The input procedure is described in sections 5-5-1 through 5-5-3.



Explanation

Initial parameter setting screen

After 1 minute, the excitation wavelength is set to 300nm and the emission wavelength to 500nm

After 2 minutes the GAIN is set to 1

After 3 minutes, the response is set to STD

After 4 minutes, the autozero operation is performed

After 5 minutes, the fluorescence spectrum is measured

Refer to section 5-8 for details

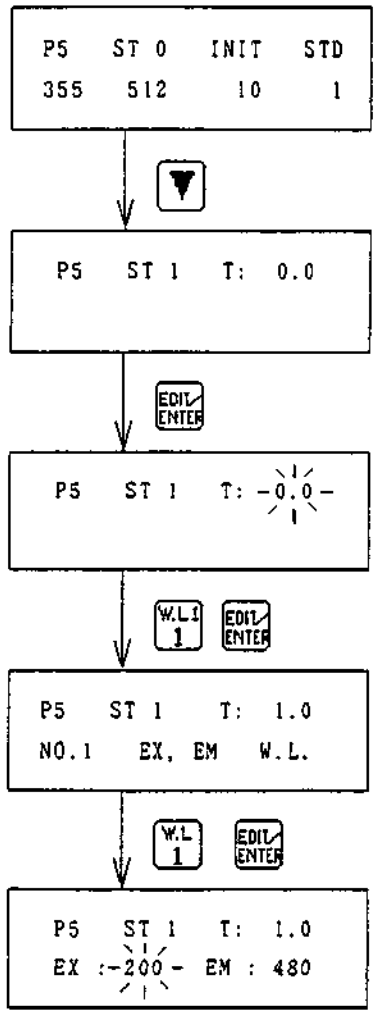
Figure 5-6 An Example of Input

5-5-1 New input (used if step is left blank)

The input described here follows the sequence used when there is no input in step 1 (ST 1) or later steps. A summary of the sequence is illustrated below.

1) Time setting
2) Function setting
3) Value setting
4) Proceed to the next step
5) Return to monitor screen after input is complete

Screen



Explanation of key operation

Move from step 0 (ST 0) to step 1 (ST 1)

Input number value (1 is input in this example)

Display time

Waiting for time input

Input number value (1 is input in this example)

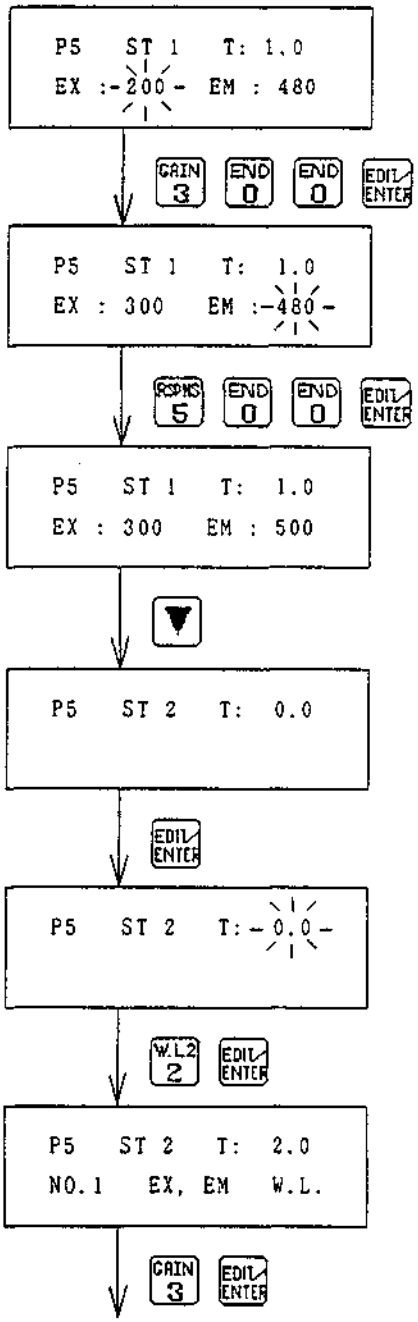
Waiting for function input

Display wavelength

Waiting for excitation wavelength input

Continued on next page

From previous page



Waiting for excitation wavelength input

Input number value (300nm is input in this example)

Waiting for emission wavelength input

Input number value (500nm is input in this example)

Move from step 1 (ST 1) to step 2 (ST 2)

Display time

Waiting for time input

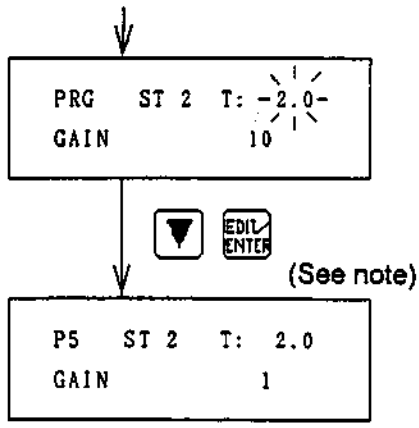
Input number value (2 minutes is input in this example)

Waiting for function input

Display GAIN

Continued on next page

From previous page



Waiting for GAIN input

Input number value
(1 is input in this example)

Note: The numeric keys can be used instead of the [∇]/[Δ] keys.

Figure 5-7 Input Method

Repeat the same key operations for input in step 3 and later.

The method for selecting a setting value differs depending on the parameter. Refer to Table 5-1 for a list of these differences.

Once input is complete, press the [MONITOR] key to return to the monitor screen. The program will be arranged chronologically at this point.

Table 5-1 Functions in the Program Mode Function

Function	Setting key	Keys used to change	Setting range
Wavelength Excitation (EX) Emission (EM)	[W.L1/1]	Numeric keys	200 - 900 (nm)
GAIN	[GAIN/3]	Numeric or [Δ]/[∇] keys	1, 10, 100, 1000
ATTEN	[ATTEN/4]	Numeric or [Δ]/[∇] keys	S, 256, 128, ... 2, 1
Response	[RSPNS/5]	[Δ]/[∇] keys	FST, STD, SLW 3S, 5S,... 40S
Autozero	[A.Z/6]	/	/
EM spectrum measurement (see note)	[EMSP./7]	Numeric keys	W: 0.0 - 9.9 (min) L: 0.0 - 99.9 (%) M: 0 - 9
EX spectrum measurement (%) (see note)	[EXSP. /8]	Numeric keys	W: 0.0 - 9.9 (min) L: 0.0 - 99.9 (%) M: 0 - 9
Spectrum bandwidth	[SLIT/9]	Numeric or [Δ]/[∇] keys	10, 18, 40 (nm)

Note: For more detailed information refer to section 5-8, Spectrum Measurement in the Program Mode.

5-5-2 Edit method (for changing time and parameters)

The input sequence used when a program has already been input is described here. In this example, the desired correspondence between time and parameter settings differs from that already set. In the example in section 5-5-3, the desired correspondence is the same and only the values are changed.

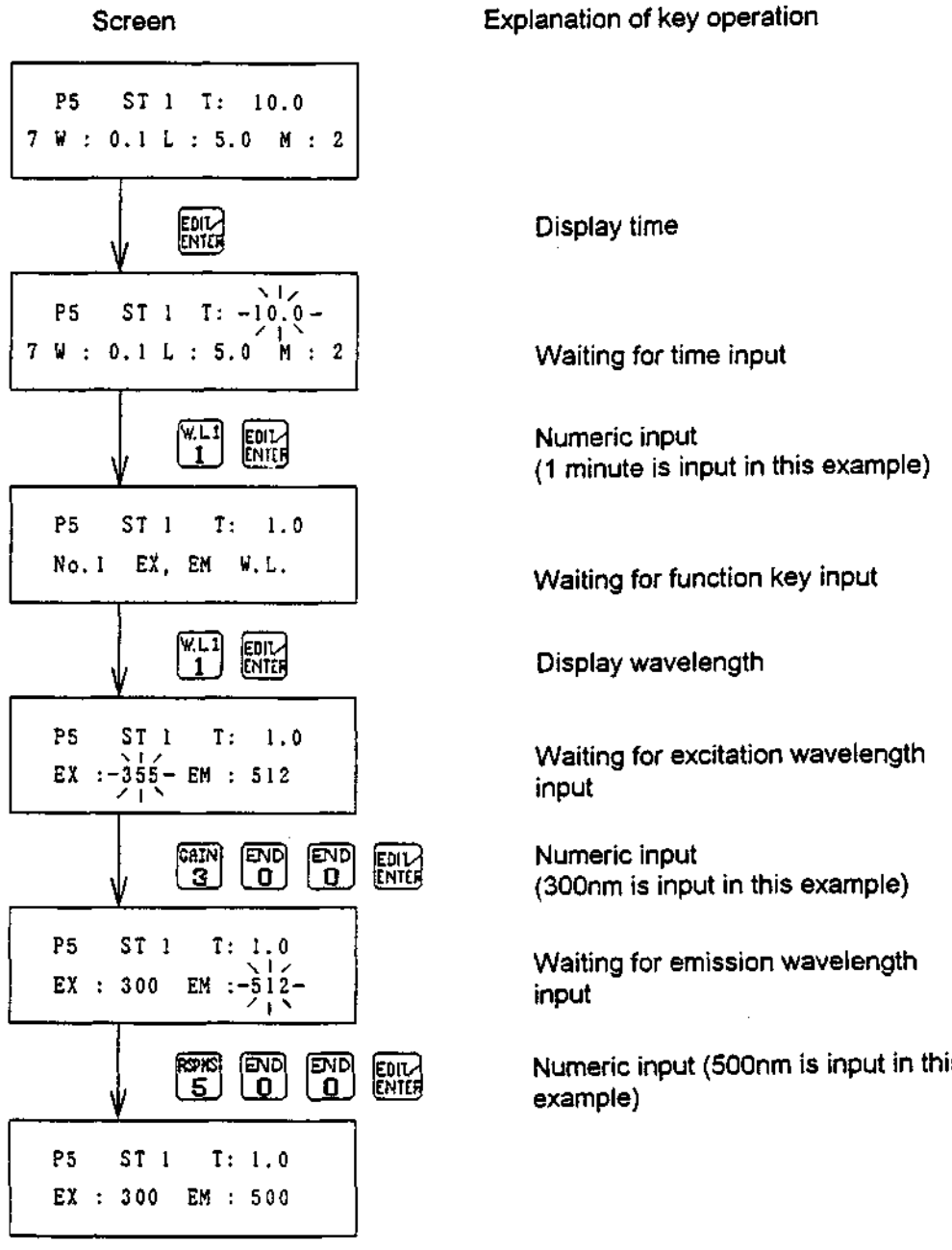


Figure 5-8 Edit Method

5-5-3 Edit method (for changing only values)

The input sequence when a program has already been input is described here. In this example, the desired correspondence between time and parameter settings remains the same and only the values are changed. In section 5-5-2, the desired correspondence also differs from that already set.

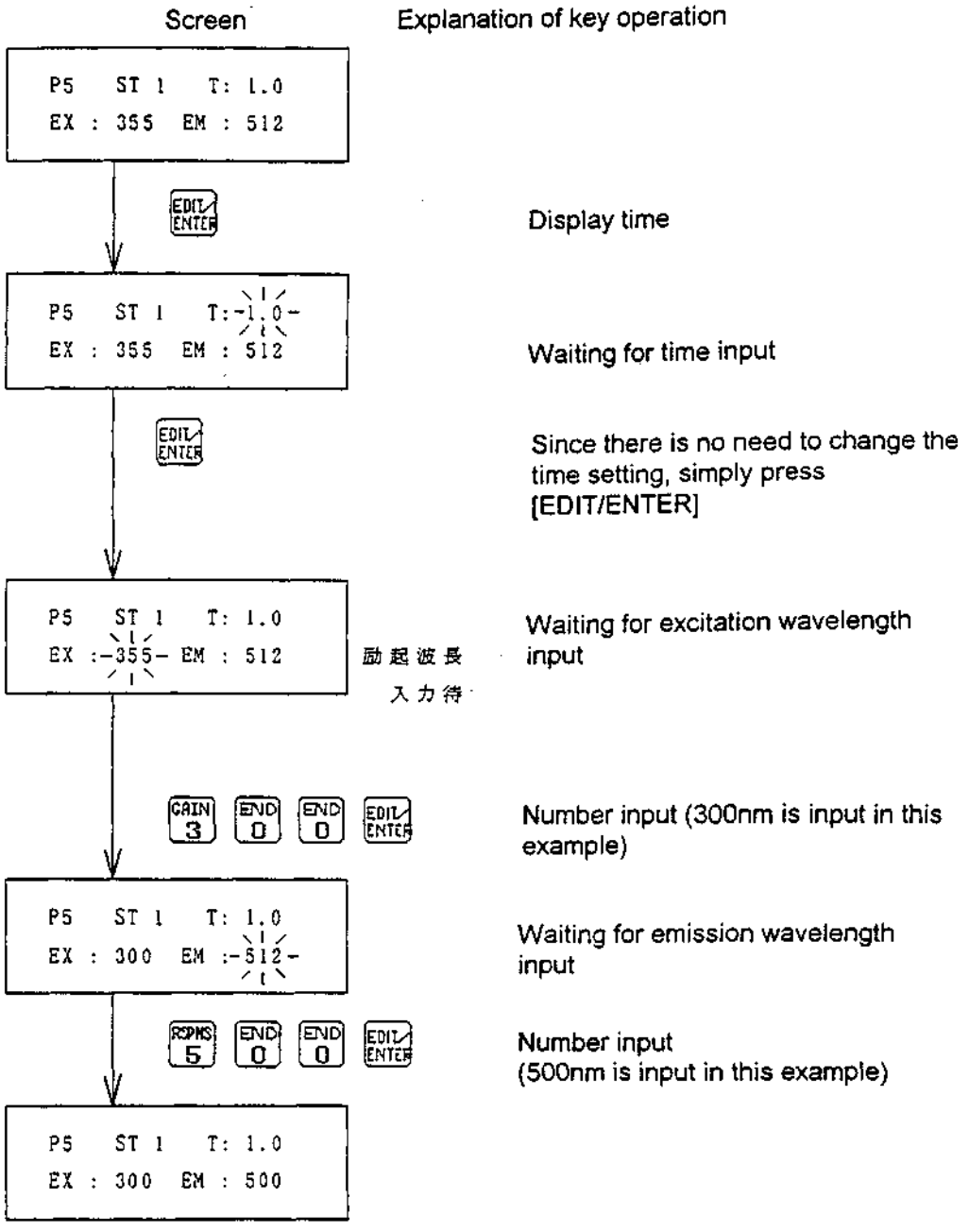


Figure 5-9 Edit Method

5-6 Program editing method

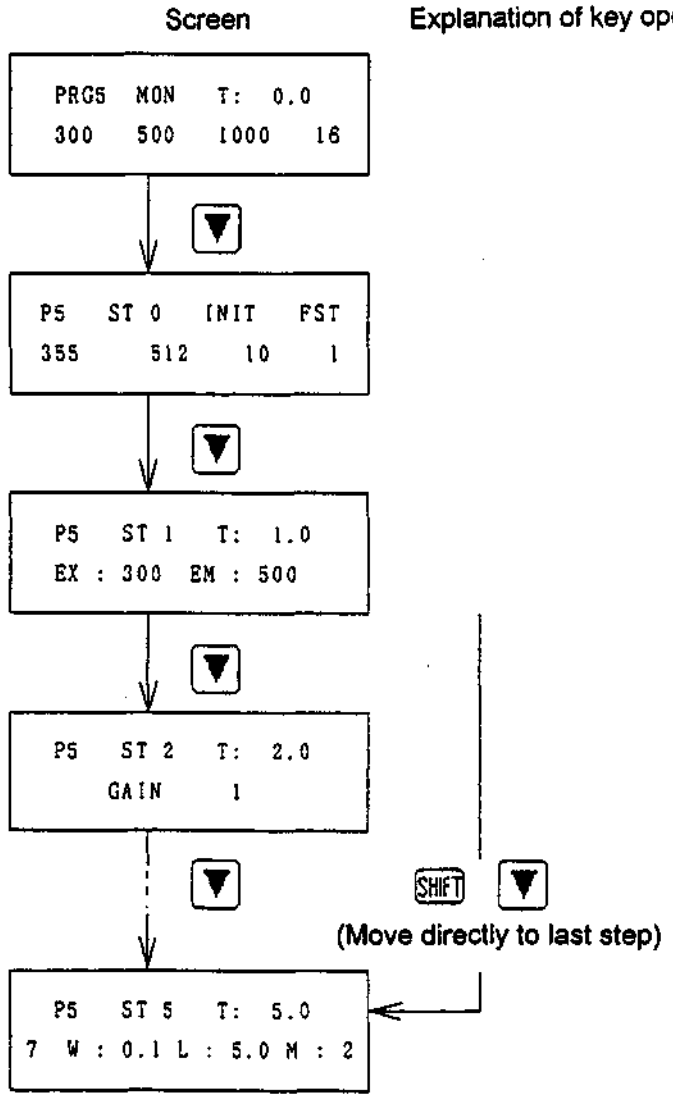
This section describes the program editing method.

5-6-1 Step insertion

A new step can be added to the program. The program will be arranged chronologically when returning to the monitor screen after input.

1) Display a step with no parameter input

2) Refer to section 5-5-1 and input parameters



Continued on next page

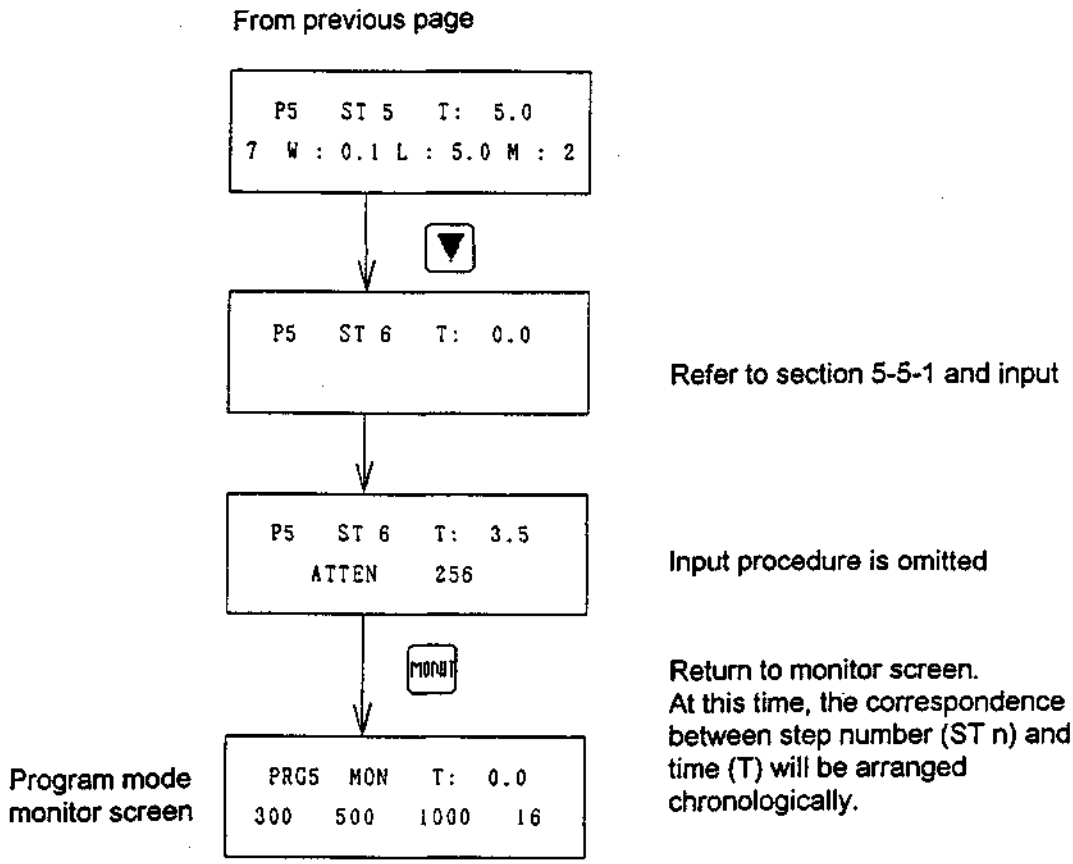


Figure 5-10 Step Insertion Method

Table 5-2 Arrangement after Step Insertion

ST n	Arrangement at time of addition	Arrangement when returning to monitor screen
1	1	1
2	2	2
3	3	3
4	4	3.5
5	5	4
6	3.5	5

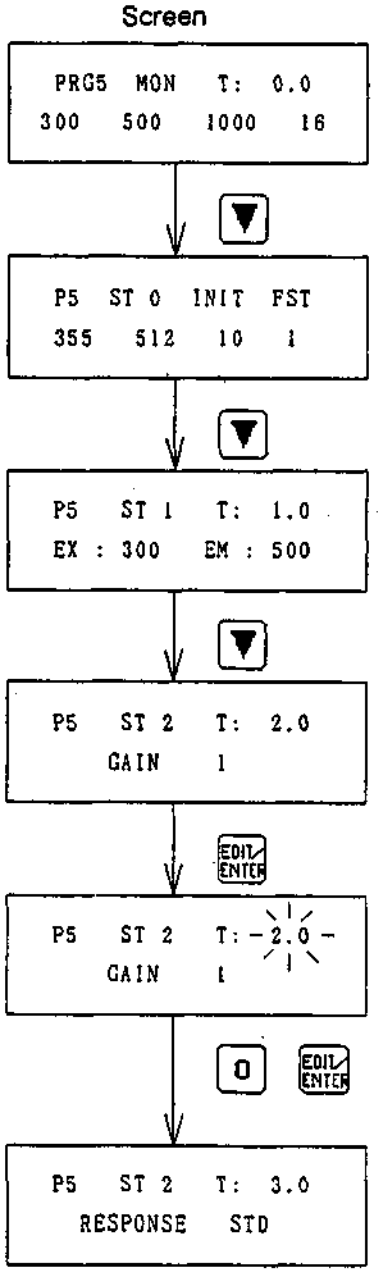
Table arranged chronologically.

5-6-2 Step deletion

When 0 is input for time (T), the step will be deleted.

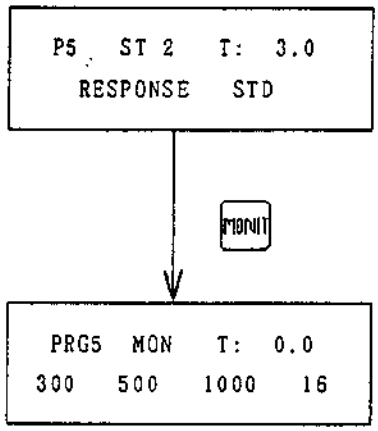
1) Display the step to be deleted

2) Input 0 as the time of that step



Continued on next page

From previous page



Return to monitor screen

Program mode monitor screen

Figure 5-11 Step Deletion Method

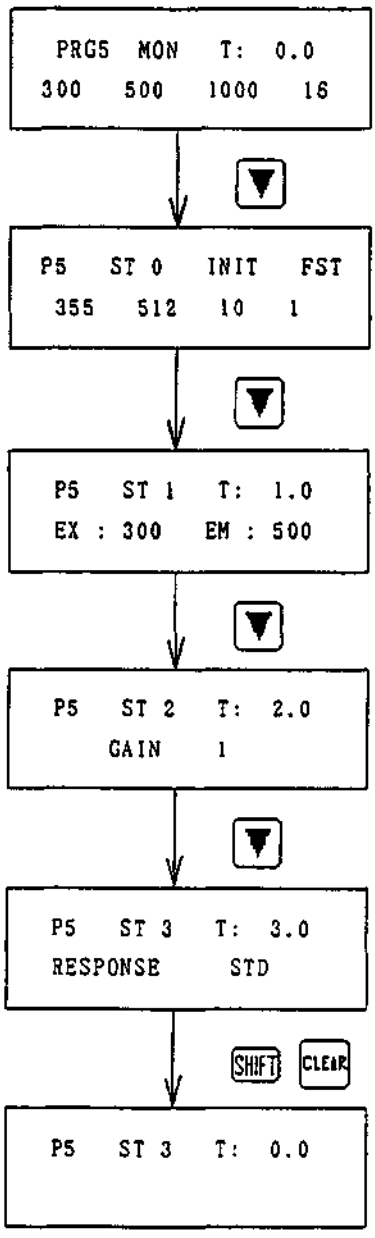
Table 5-3 Arrangement after Step Deletion

ST n	Arrangement before deletion	Arrangement when returning to monitor screen
1	1	1
2	2→0	3
3	3	4
4	4	3.5
4	4	5
5	5	Unnecessary step is deleted.

5-6-3 Section deletion (delete the designated step and all steps thereafter)

1) Display the first step of the series to be deleted
2) Input [SHIFT][CLEAR]

Screen



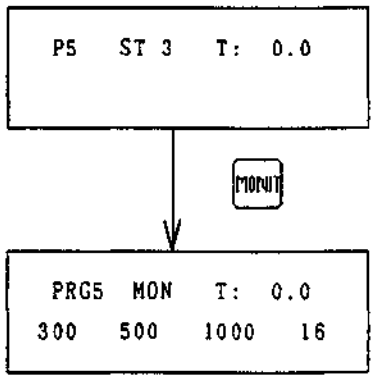
Explanation of key operation

Display the first step of the series to be deleted (In this example step 3 and after will be deleted.)

Steps 3 and after are deleted

Continued on next page

From previous page



Steps 3 and above are deleted

Return to monitor screen

Figure 5-12 Section Deletion Method

5-7 Program example

A chromatogram to help explain the time program is shown in Fig. 5-13. The 5 peaks are detected under the conditions shown in Table 5-4. An example of a time program under these same conditions is then shown in Fig. 5-14.

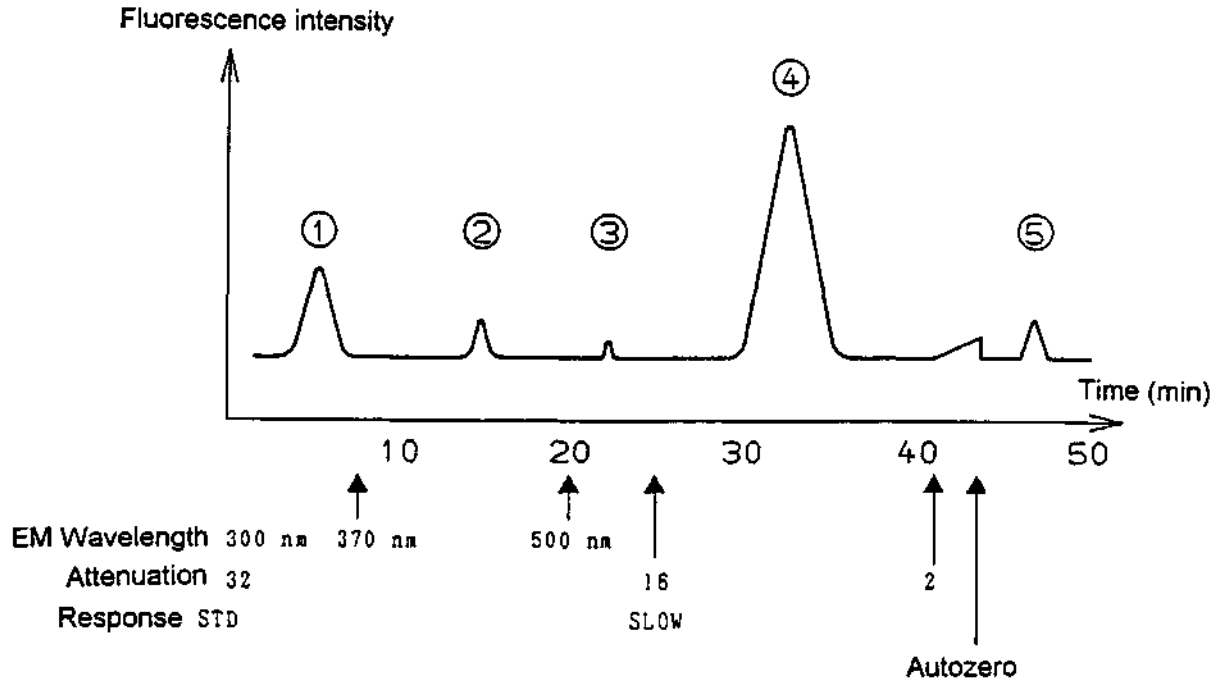


Figure 5-13 Chromatogram for Time Program Explanation

Table 5-4 Detection Conditions for Each Peak

Condition / Peak number	EM Wavelength (nm)	Attenuation	Response	Comments
1	300	32	STD	
2	370	same	same	
3	500	same	same	
4	same	16	SLOW	
5	same	2	same	Autozero just before peak

```
P3   ST 0  INIT  STD
250   300   10   32
```

Initial conditions
EX : 250nm
EM : 300nm
GAIN : 10
ATTE : 32
RESPONSE: STD

```
P3   ST 1    T:  8.0
EX:   250    EM: 370
```

Change EM wavelength to 370nm after 8 minutes

```
P3   ST 2    T: 20.0
EX:   250    EM: 500
```

Change EM wavelength to 500nm after 20 minutes

```
P3   ST 3   T: 27.0
     ATTEN    16
```

Change Attenuation to 16 after 27 minutes

```
P3   ST 4   T: 27.0
  RESPONSE   SLW
```

Change response to SLOW after 27 minutes

```
P3   ST 5   T: 41.0
     ATTEN     2
```

Change Attenuation to 2 after 41 minutes

```
P3   ST 6   T: 44.0
     AUTO  ZERO
```

Perform an autozero after 44 minutes

Figure 5-14 Program Example

5-8 Spectrum measurement in the program mode

This section describes spectrum measurement in the program mode.

5-8-1 Outline

A wave length scan can be executed when the fluorescent intensity exceeds the set level within a set time period during a time program execution. The spectrum obtained by the wavelength scan can be saved in memory and then output in the wavelength scan mode.

Note: Scan range and Scan speed are automatically set in the program mode; refer to section 7-7-2.

5-8-2 Setting method

The following 4 parameters are set for spectrum measurement.

1 Time ("T" on the screen)
2 Allowed time interval ("W" on the setting screen)
3 Threshold value for fluorescent intensity ("L" on the setting screen)
4 Memory number where spectrum is saved ("M" on the screen)

The setting method is explained here using the chromatogram shown in Fig. 5-16 as an example.

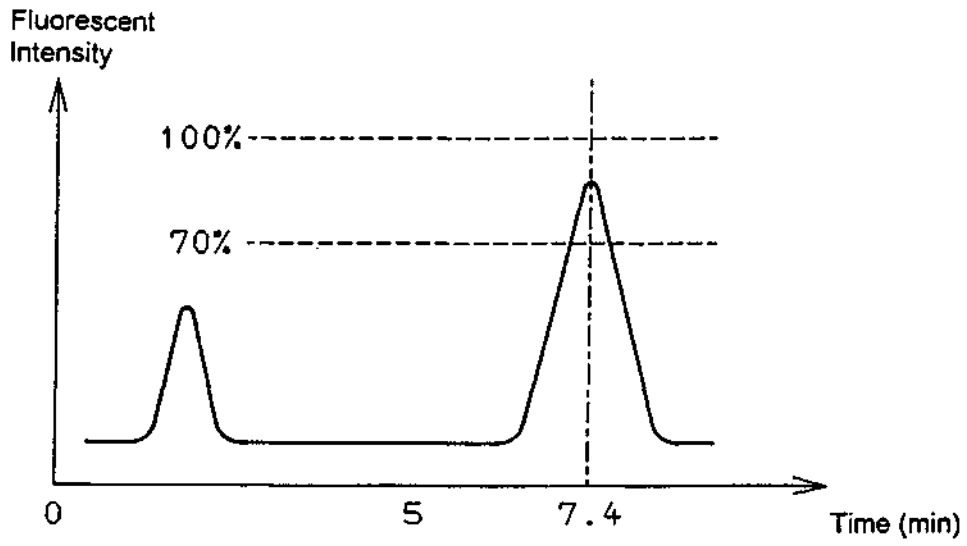


Figure 5-16 Chromatogram for Spectrum Measurement Explanation

The peak elution time for the spectrum to be measured is 7.4 minutes and the peak height is 90% of the maximum fluorescent intensity.

A setting example for spectrum measurement with regard to this chromatogram is shown in Fig. 5-17, the input method is shown in Fig. 5-18.

Note: The numeric value shown on the "SIGNAL" column of the LCD indicates the fluorescent intensity, and has a maximun value of (+)1.0000.

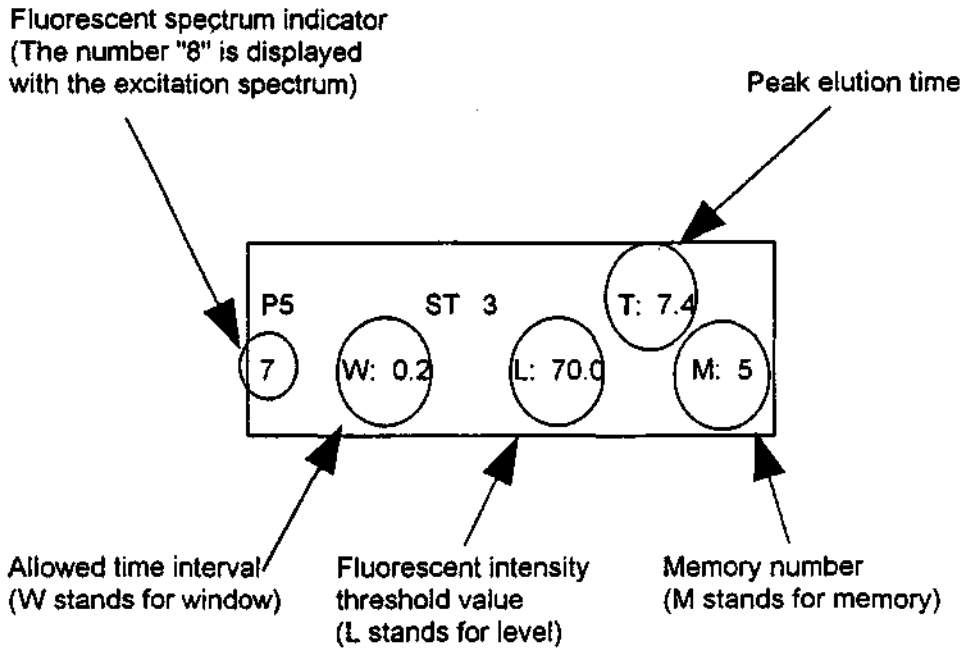


Figure 5-17 Example of Fluorescent Spectrum Measurement Settings

Explanations of the example settings in Fig. 5-17 are provided below:

Minimum fluorescent intensity for measuring spectrum : 70% of maximum value (Threshold value "L" of fluorescent inensity)

The setting range of "L" is from 0 to 99.9. This value shows the minimum fluorescent intensity at which spectrum measurement will be performed, as a proportion of the maximum fluorescent intensity. In Fig. 5-17 for example, the setting (L: 70.0) means that spectrum measurement will occur only at fluorescent intensities of (+)0.7000 and above.

Time for measuring spectrum ("T"): 7.4 minutes
Allowed time interval ("W"): 0.2 minutes (±0.1 minute)

The setting range of "W" is from 0.0 to 9.9 (min). This is the interval with regard to time T over which the spectrum is measured. In other words, the spectrum will only be measured between T - W/2 and T + W/2.

Memory number where spectrum is saved ("M"): 5

The setting range of "M" is from 0 to 9.

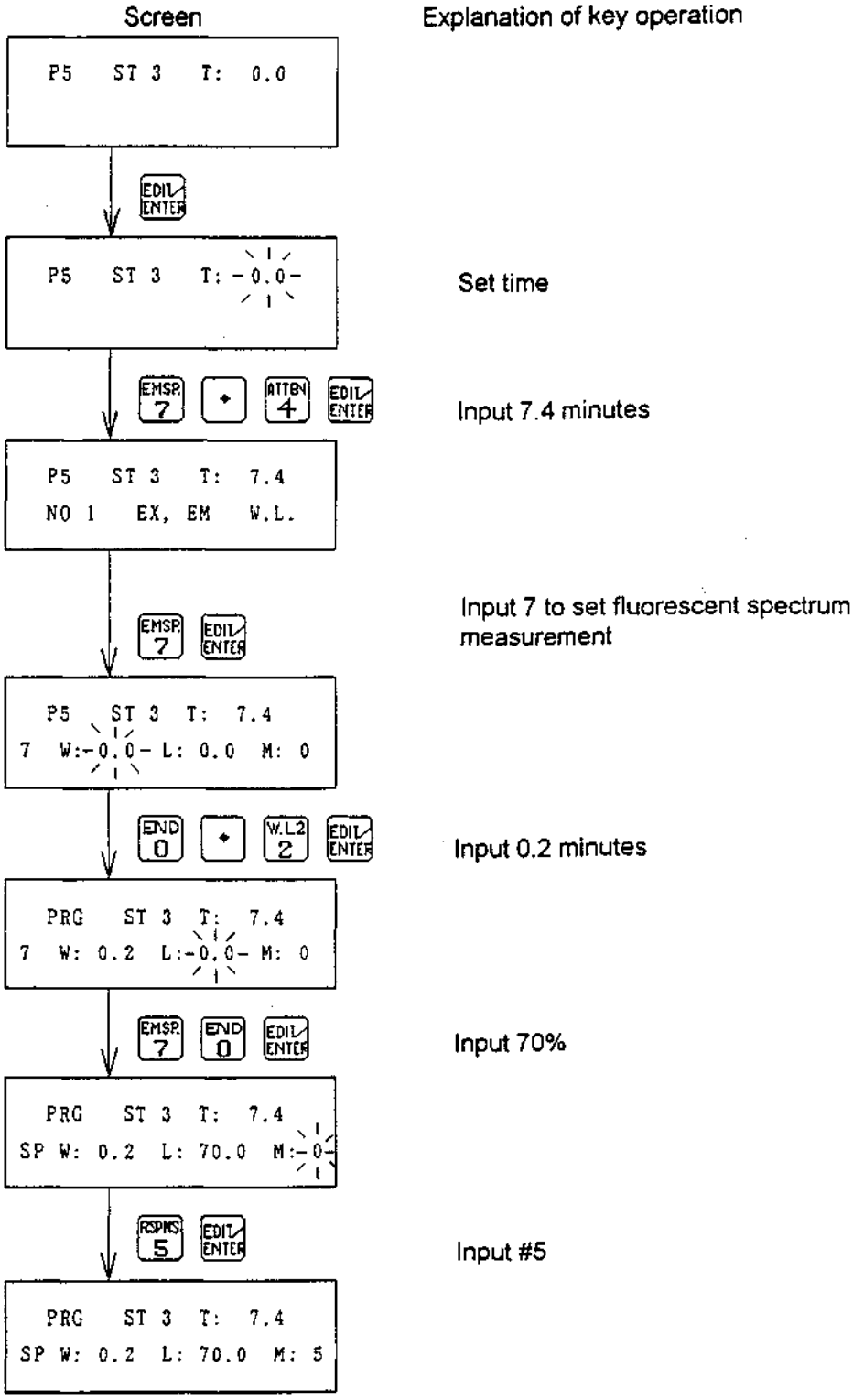
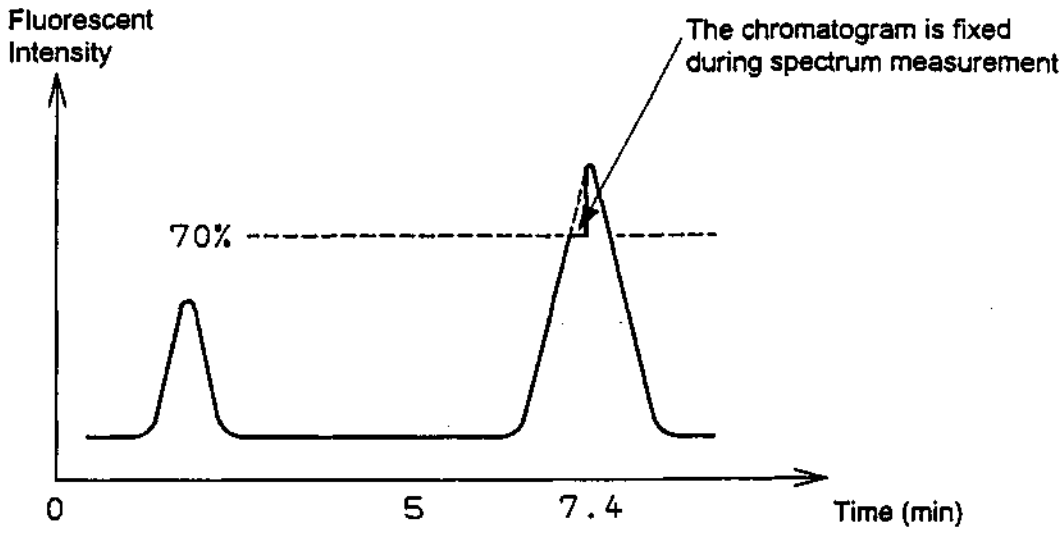


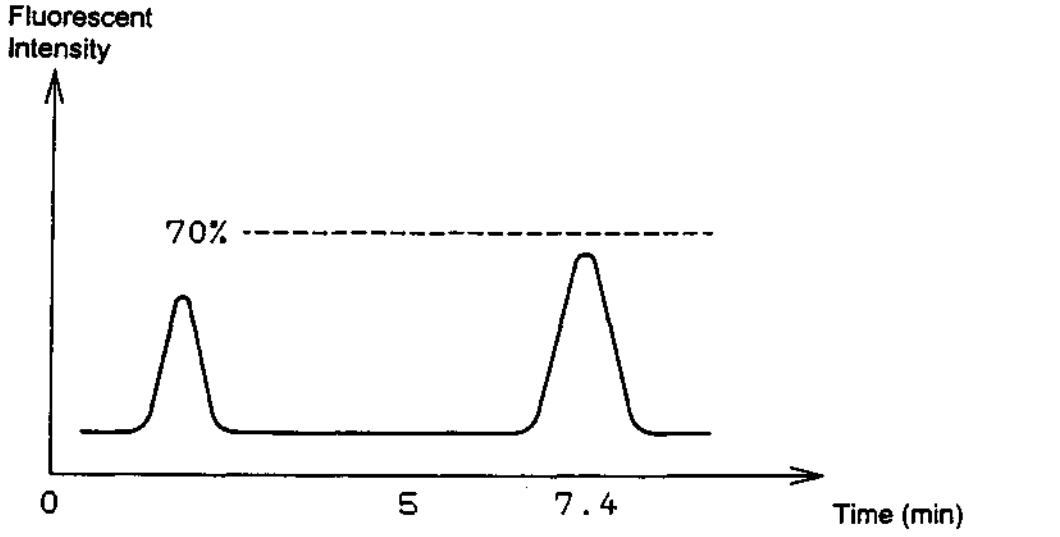
Figure 5-18 Input for Fluorescent Spectrum Measurement

5-8-3 Execution example

With the example settings shown in Fig. 5-17, when the fluorescent intensity is 70% or more of the maximum value between 7.3 and 7.5 minutes, the spectrum will be measured and saved in memory number 5. The spectrum will not be measured if any of the conditions is not met.



With spectrum measurement



Without spectrum measurement

Figure 5-19 Chromatogram with and without Spectrum Measurement

5-8-4 Spectrum output

The spectrum is output from the wavelength scan mode. Refer to section 7-5 for the detailed operation procedure.

6. Operation

This chapter outlines the operating procedures.

6-1 Operation in normal operation mode

This section describes operation in the normal operation mode.

6-1-1 Parameter settings.

Refer to section 3-1 for an explanation of the parameter settings.

6-1-2 Error messages

The error messages that may appear during operation are shown in Fig. 6-1. LAMP TIMER OFF however, is not an error (see section 4-2).

When an error message appears, press [CLEAR] to return to the monitor screen. If the lamp has been turned off by the LAMP OFF timer, the power must be turned off then on again.

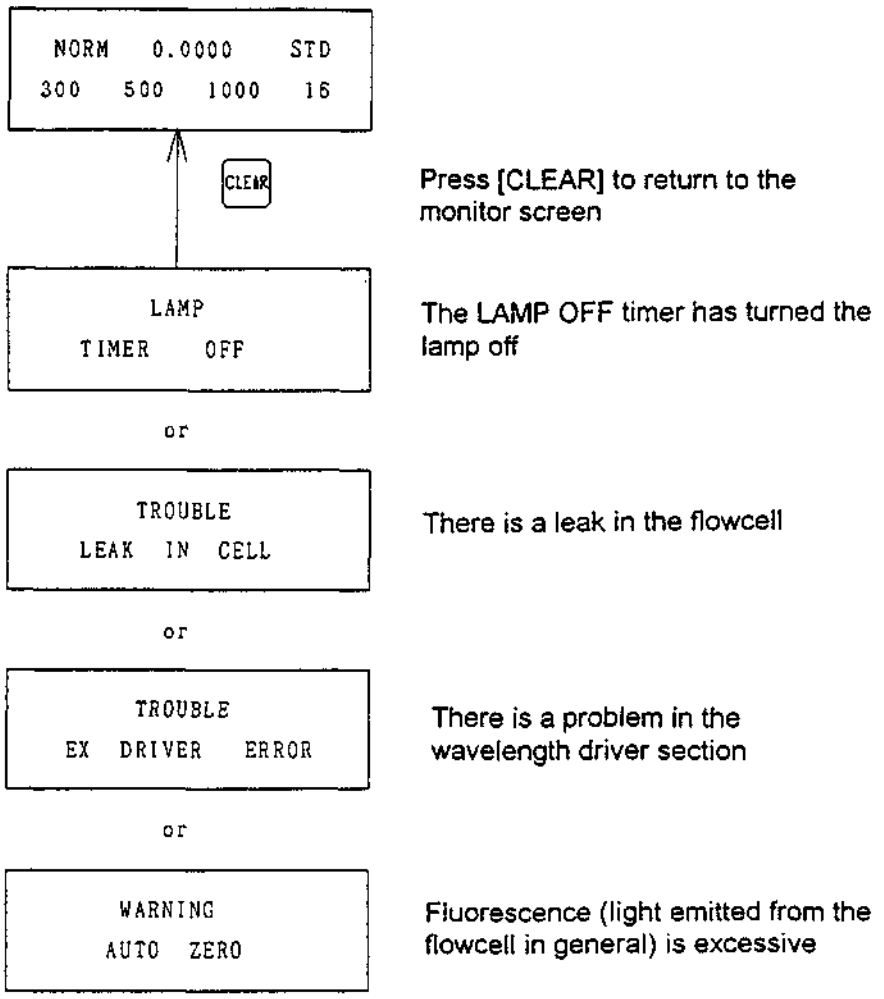


Figure 6-1 Possible Error Messages Displayed During Operation

6-1-3 Measures to take if the [AUTOZERO] key lamp is flashing or if the "WARNING AUTOZERO" message is displayed.

When the intensity of light emitted from the flowcell is excessive, "WARNING AUTOZERO" will be displayed on the LCD, or the [AUTOZERO] key lamp will flash.

In addition to high fluorescent intensity, causes of excessive light emission from the flowcell include excessive scattered light from the solvent, sample or from air bubbles in the flowcell. Countermeasures are shown in Table 6-1.

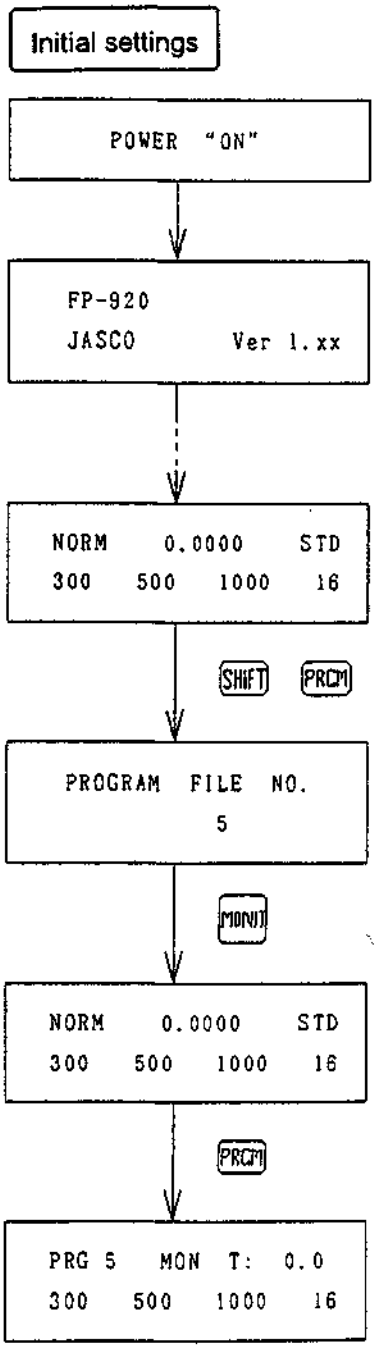
Table 6-1 Countermeasures for Excessive Light Emitted from the Flowcell

Cause	Countermeasure
Fluorescent intensity is high	Decrease the "GAIN"
Scattered light from the solvent or sample	Check solvent Check detected Wavelength
Scattered light caused by air bubbles	Remove the air bubbles

6-2 Operation in the program mode

This section describes operating procedures in the program mode

6-2-1 Initial settings



Begin self-check

End self-check

Select program number
(Only necessary when using a number different from the program number last set when the power was turned "OFF")

To program mode

Continued on next page

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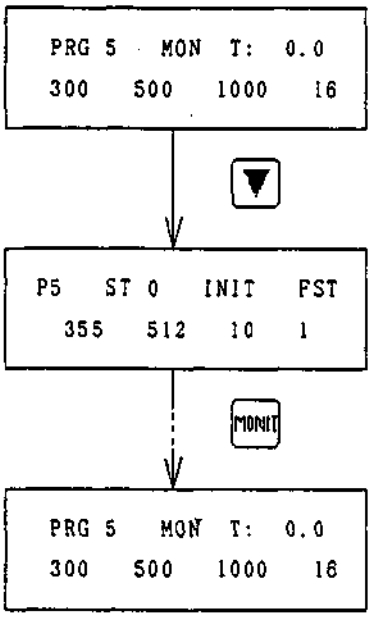


Program creation

To program monitor screen

Note: When [PRGM] is pressed, the status of the instrument does not change even though the mode displayed on the screen has changed. For example, when the mode is changed from NORMAL OPERATION to TIME PROGRAM, the sensitivity and wavelength values set in the NORMAL OPERATION mode are still in effect. (i.e., the initial conditions set in the TIME PROGRAM are not recognized). Use the following steps to change the instrument settings to the initial conditions.

(1) Set the sensitivity and wavelength parameters using the TIME PROGRAM mode MONITOR display.

(2) Press [PRGM/RUN] once to advance the program proceed, then press it again to stop the program.

6-2-2 Starting the program

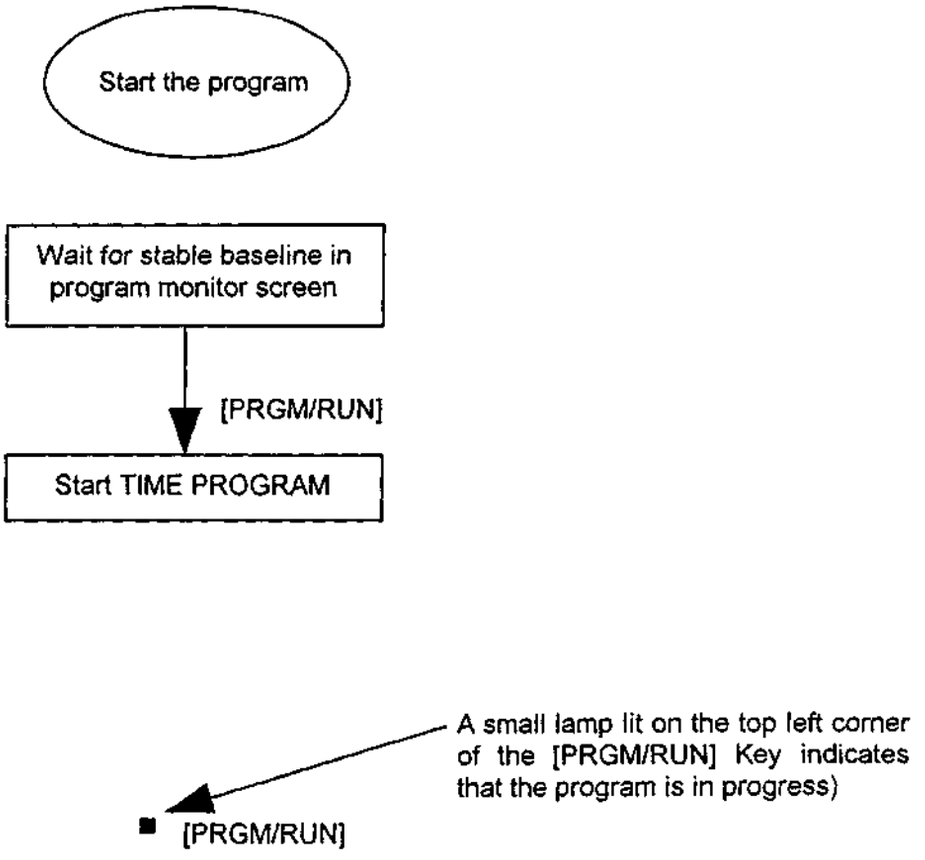


Figure 6-3 Procedure for Starting a Time Program

6-2-3 Changing parameters during a program run

The values set for attenuation, gain, response, wavelength, and lamp off timer can be changed during program excecution. These changes can be made in the display screens shown boxed with double lines. The old settings are valid until the program progresses and new values are incorporated.

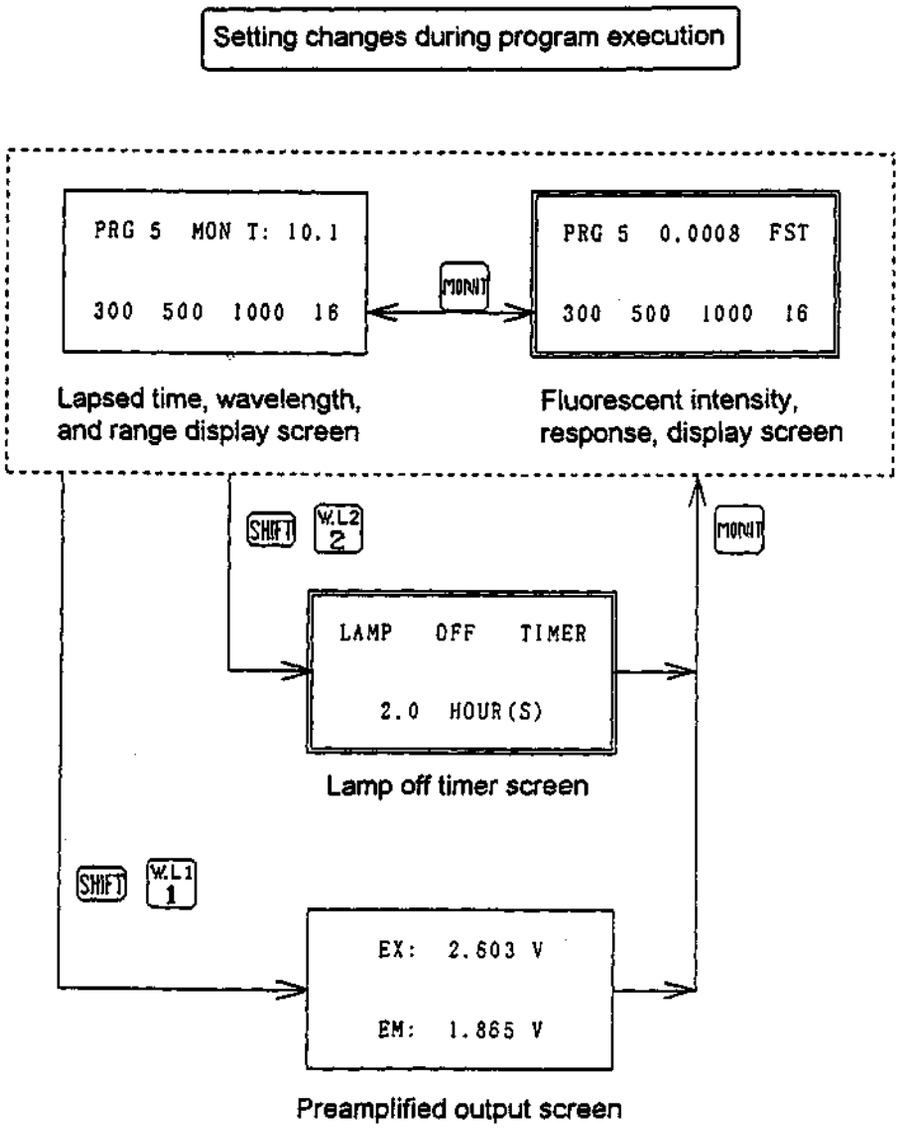


Figure 6-4 Changing Parameters During Program Execution

6-2-4 Stopping the program

The program can be stopped at any time during execution by pressing [PRGM RUN]. Once a time program has reached the final step, the detector will continue to operate under the conditions of that step while time lapse alone progresses, until [PRGM RUN] is pressed.

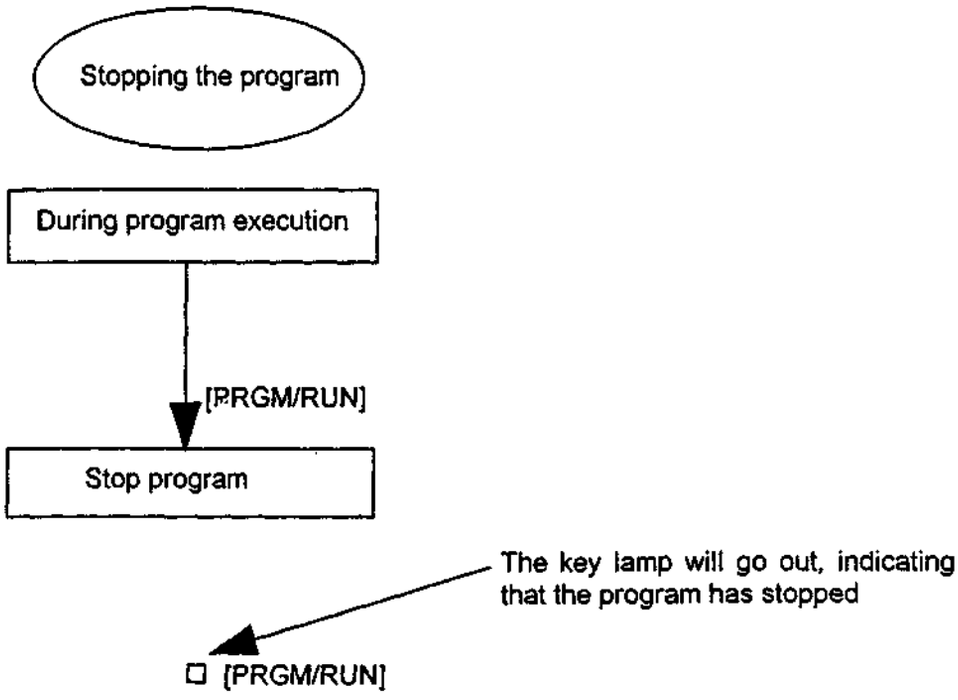


Figure 6-5 Stopping a Time Program

7. Wavelength Scan Mode

This chapter outlines the use of the wavelength scan mode.

7-1 Outline of functions

The functions of the wavelength scan mode are listed below:

-Spectrum measurement
-Spectrum measurement parameter settings
-Spectrum output
-Spectrum difference output

When a spectrum is measured, the results are stored in memory. There are 10 memory locations for storing EX and EM spectra. The wavelength range over which the spectrum will be measured and other parameters can be set in detail, and the measured spectrum can be output to the integrator and recorder. The spectrum differences can be output in addition to the EX and EM spectra.

7-2 Outline of operation

When entering the wavelength scan mode, the EM spectrum measurement will first be displayed as a menu. Display the functions to be executed using the [Δ]/[∇] keys or directly using the numeric keys. To execute the displayed functions, press the [EDIT/ENTER] key and perform the key operations according to the guide messages.

Table 7-1 Wavelength Scanning Menu

Number	Display	Function
1	EM SPECT	EM spectrum measurement
2	EX SPECT	EX spectrum measurement
3	EM D.OUT	EM spectrum output
4	EX D.OUT	EX spectrum output
5	DIFFER EM	EM spectrum difference output
6	DIFFER EX	EX spectrum difference output
0	SCAN PARAM	Spectrum measurement conditions

7-3 Notes for use

(1) Press the [MONITOR] key repeatedly to exit the wavelength scan mode.

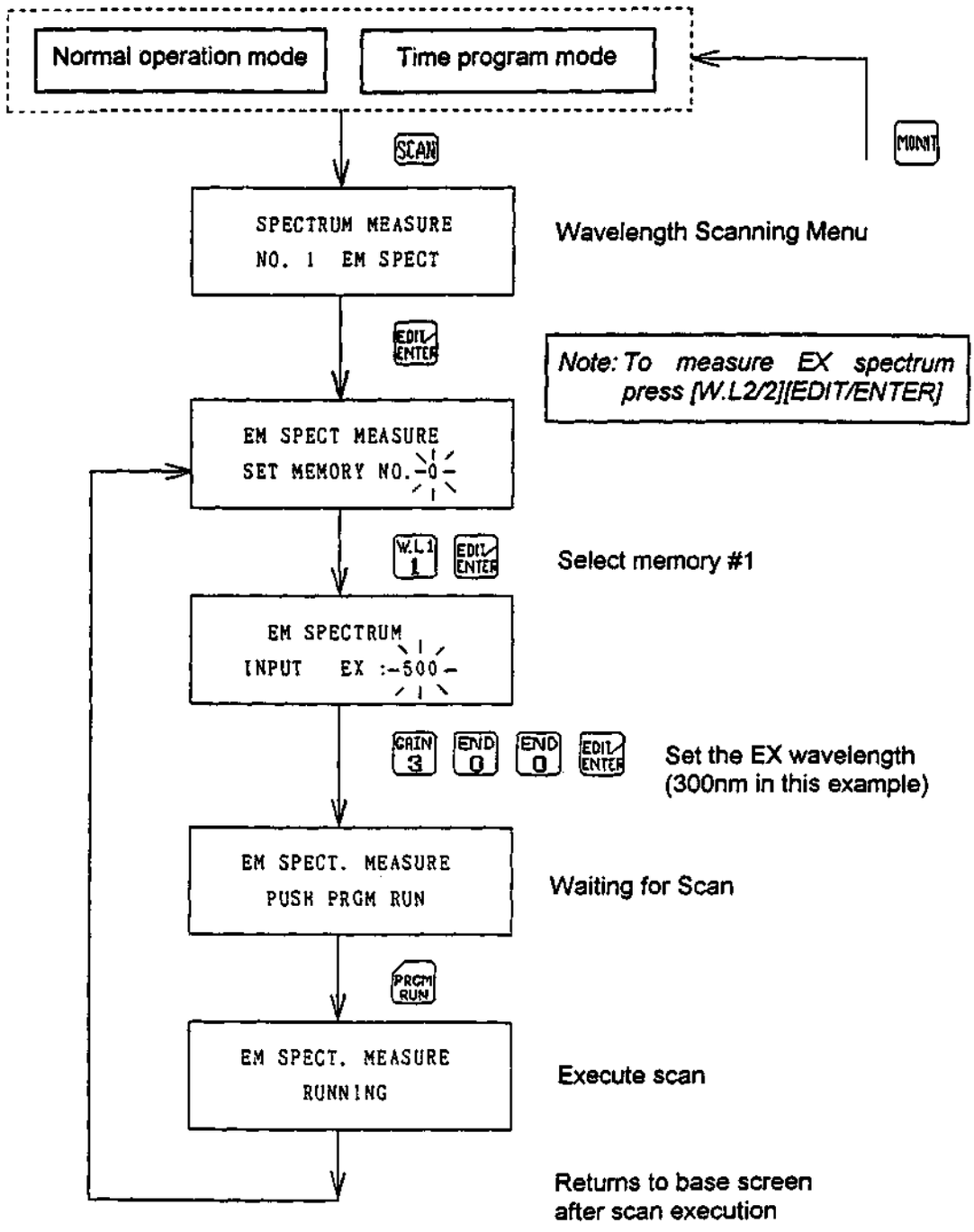
(2) Spectrum measurements can be performed using the wavelength scan mode described in this chapter, or using the time program. The wavelength scan mode has the ability to measure a spectrum under specified measurement conditions, whereas the time program offers the advantage of automatically measuring multiple spectra.

(3) Spectrum output is performed in the wavelength scan mode regardless of whether the spectrum was measured in the wavelength scan mode or the time program.

(4) Storage memory numbers 0 to 9 can be designated when measuring emission spectra or excitation spectra, thereby allowing 10 spectra to be saved. Be aware that when choosing memory numbers two types of spectra can be saved using the same number. For example, the emission spectrum output #5 and the excitation spectrum output #5 are completely different even though their numbers are identical.

7-4 Spectrum measurement

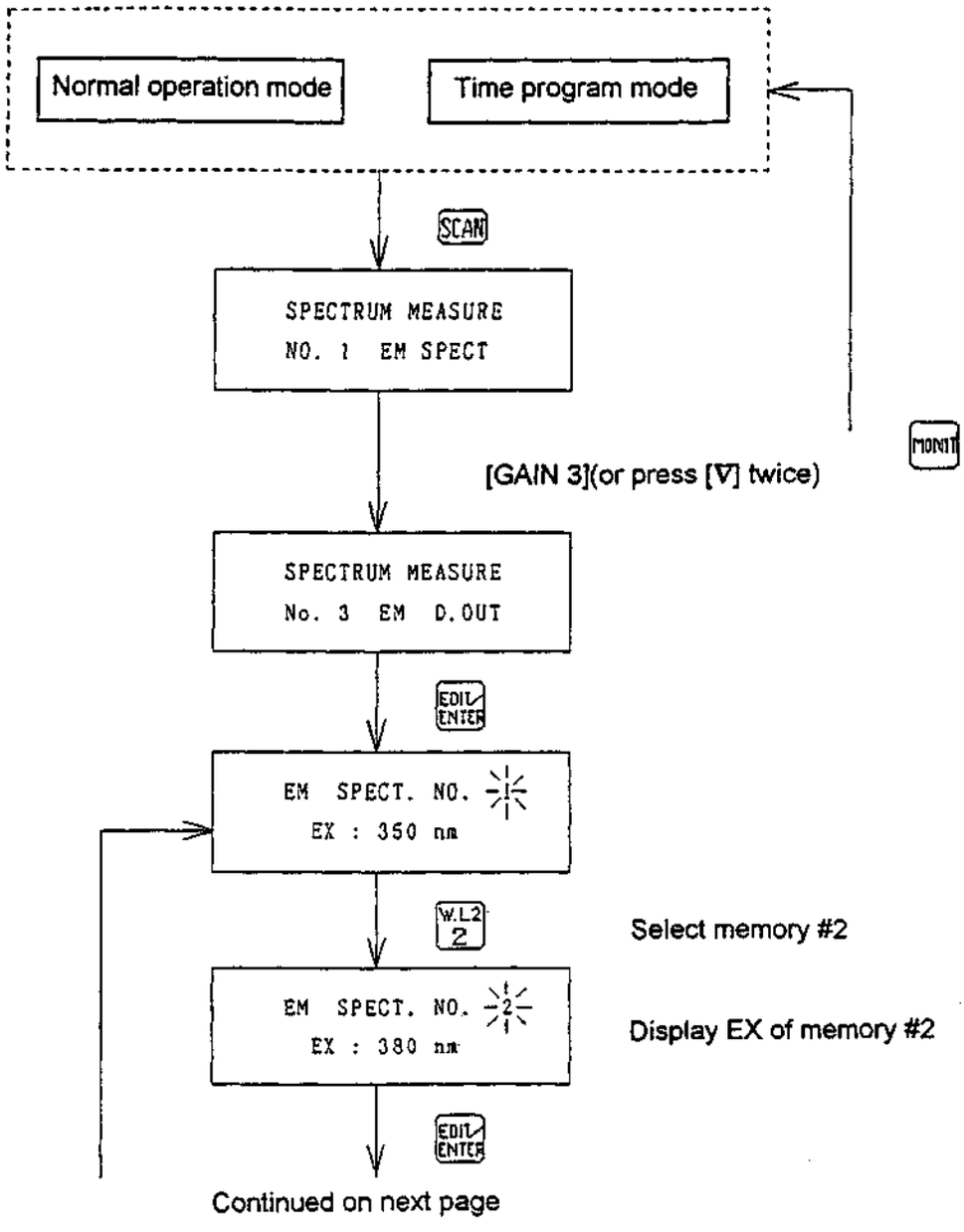
The procedures for spectrum measurement are explained in this section.
Since the procedures for both the EM and EX methods are the same, only EM spectrum measurement is used as an example.



7-5 Spectrum output

Spectrum output is described in this section. Since the procedures for both the EM and EX methods are the same, only EM spectrum output is used as an example.

7-5-1 Key operations



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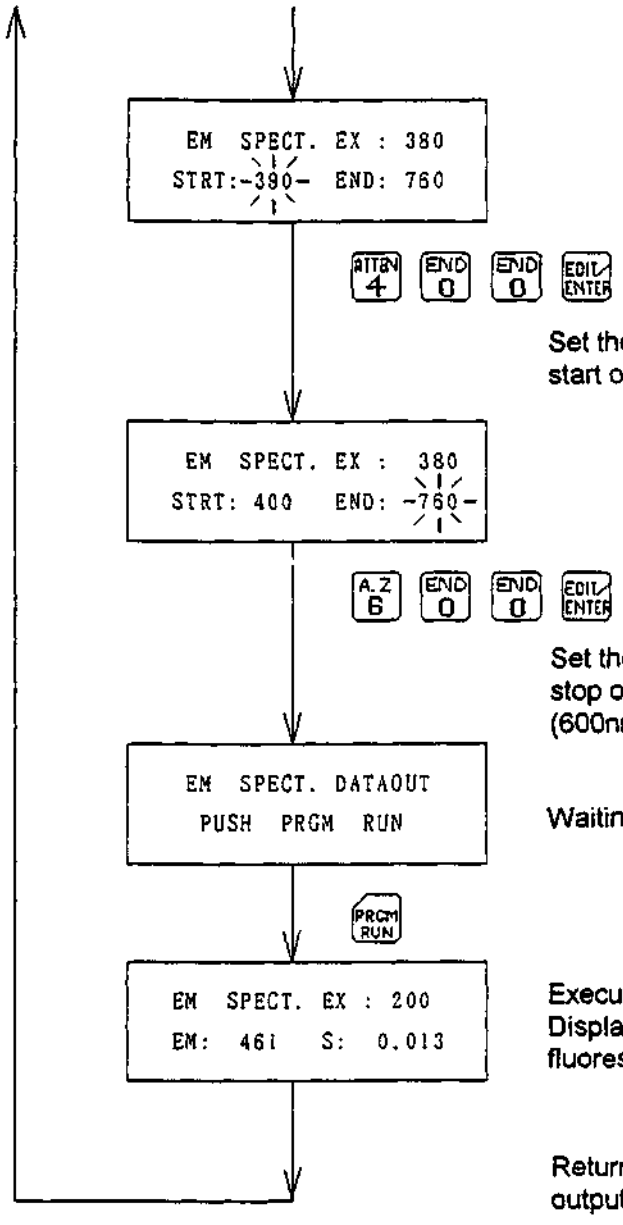


Set the EM wavelength at which to start output (400nm in this example)

Set the EM wavelength at which to stop output (600nm in this example)

Waiting for output

Execute output
Display EM wavelength and fluorescent intensity

Returns to base screen after output has finished

7-5-2 Output form

The spectrum is sent to the integrator output and recorder output. The recorder output intensity can be set using "ATTEN" (see "Normal Operation" for setting procedure). Wavelength markers will be added to the recorder output at 100nm intervals (ie: 200, 300..., 700, 800nm).

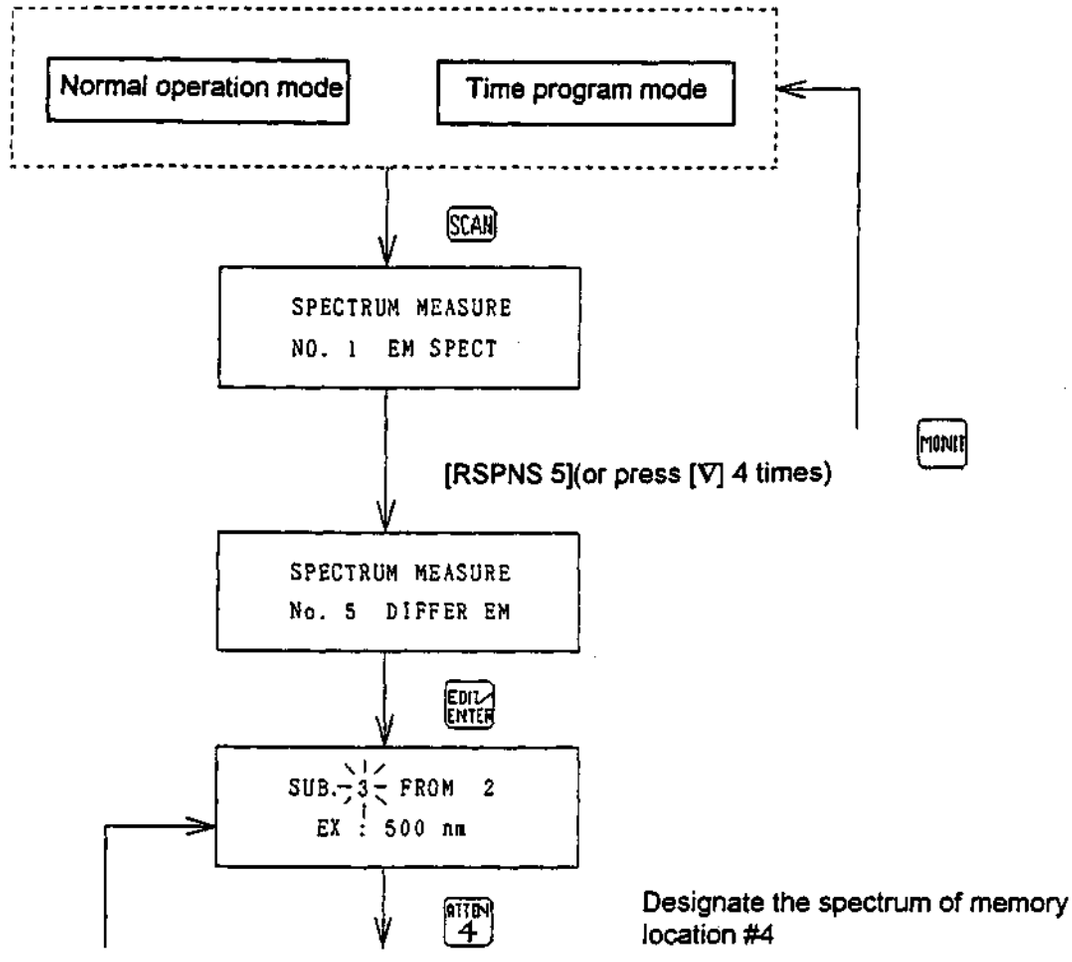
The speed of the spectrum output is 100nm/30sec (about 3.3nm/sec), therefore with a chart speed of 100mm/min, a 100nm spectrum will yield a chart 50mm long.

7-6 Difference spectrum output

Difference spectrum output is described in this section. Since the procedures in both the EM and EX methods are the same, only EM spectrum output is outlined.

Note: As illustrated in the following example, the EX wavelength of both spectra must be the same in order to output a difference spectrum. An error message appears if the EX of the spectra differ. Similarly, the EM of the spectra must also be the same upon EX spectrum output.

7-6-1 Key operations



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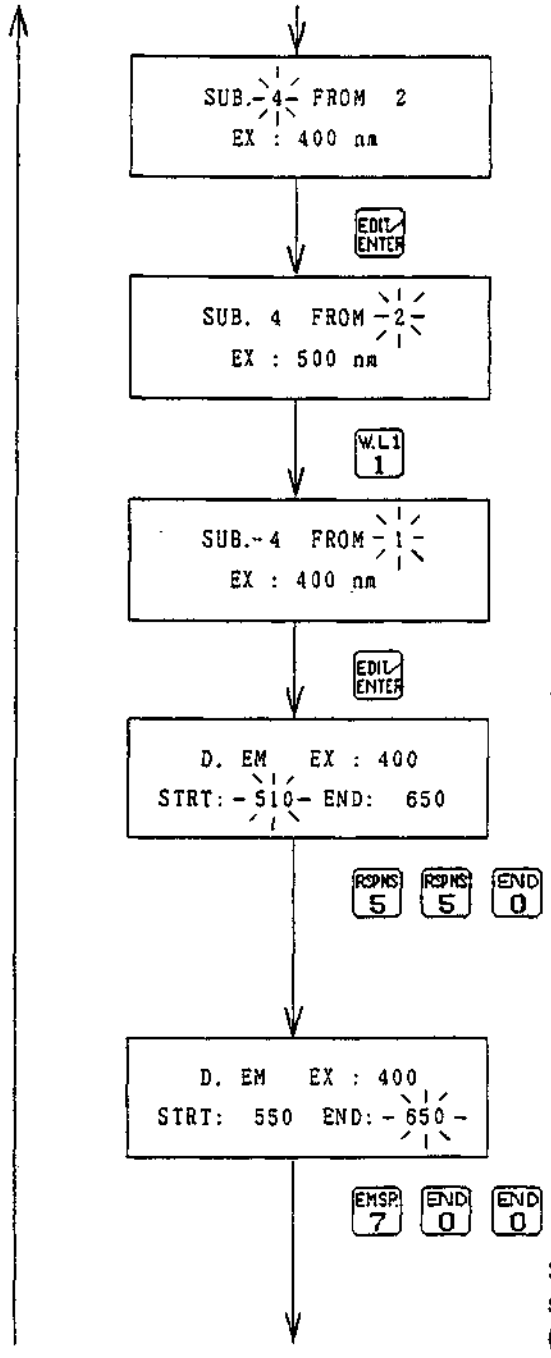

The EX wavelength when the EM spectrum of memory location #4 was measured will be displayed on the lower part of the LCD.

Designate the spectrum of memory location #1

The EX wavelength when the EM spectrum of memory location #1 was measured will be displayed on the lower part of the LCD.

In this example, "Spectrum #1" - "Spectrum #4" will be output

Set the EM wavelength at which to start output
(550nm in this example)

Set the EM wavelength at which to stop output
(700nm in this example)

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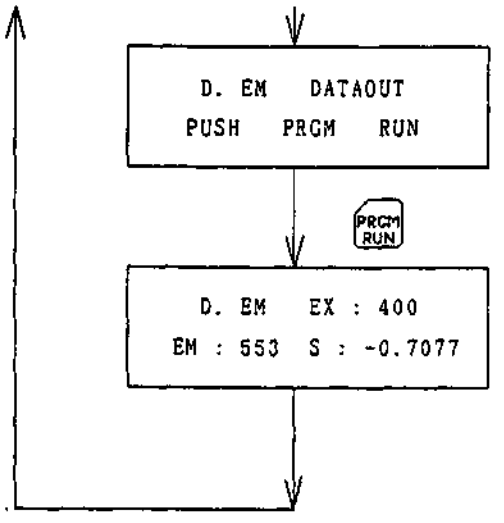


Waiting for output

Execute output
Display EM wavelength and the difference in EM spectra intensites

Returns to base screen after output has finished

7-6-2 Output form

Since the output form is exactly the same as the spectrum output, refer to section 7-5-2.

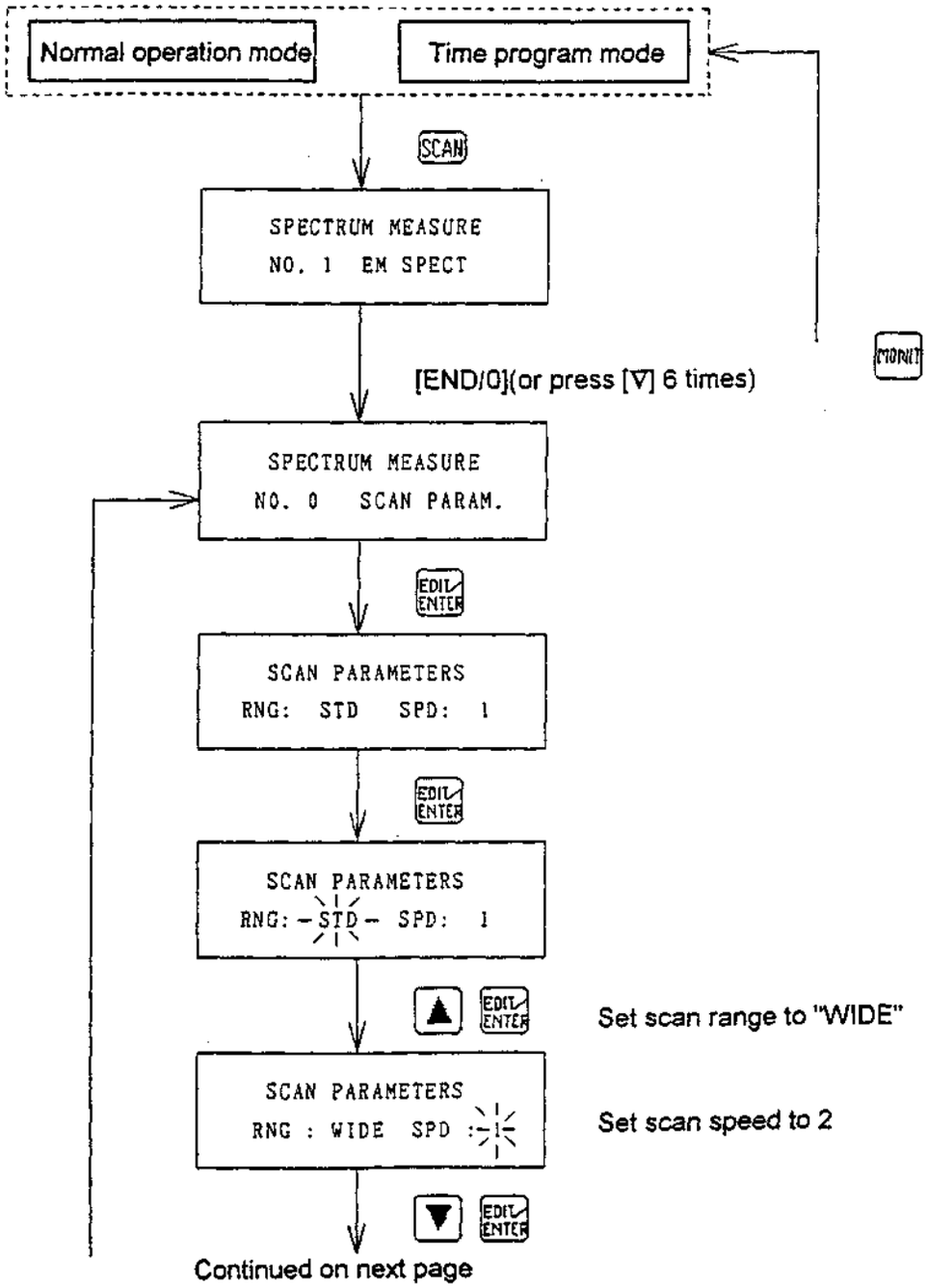
7-6-3 Method of use

In addition to obtaining difference spectra for different samples, the difference spectrum is also used to eliminate the influence of emission and scattering from the mobile phase solvent itself.

7-7 Spectrum measurement parameter settings

Both the wavelength scan range and the speed for spectrum measurement can be set.

7-7-1 Key operations



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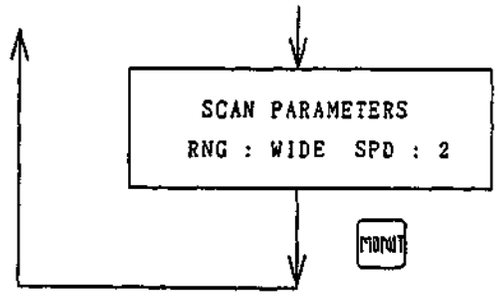


Returns to base screen

7-7-2 Settings

Settings and their corresponding descriptions are listed in the tables below.

Table 7-1 EM Wavelength Scan Range

Setting	Wavelength scan range
WIDE STD NARROW	0nm -> 900nm EX + 10nm -> 900nm EX + 10nm ->2X EXnm (or 650 nm, whichever is shorter)

For example, the EM wavelength scan range is 260nm -> 500nm for the NARROW setting at EX 250nm.

Table 7-2 EX Wavelength Scan Range

Setting	Wavelength scan range
WIDE STD NARROW	0nm -> 900nm 200nm -> EM - 10nm EM/2 -> EM - 10 (or 220nm, whichever is longer)

Table 7-3 Wavelength Scan Speed

Setting	Wavelength scan range
1 2	100nm/sec 30nm/sec

Note: Scan range and speed are automatically set to NARROW and 1, respectively, when using the time program spectrum measurement.

8. Specifications and Options

This section outlines the specifications and options of the instrument.

8-1 Specifications

Model name:	Model FP-920 Intelligent Fluorescence Detector
Optical system:	
Monochromator:	Holographic concave diffraction grating (for Ex and Em)
Light source:	150W xenon lamp (mounted horizontally)
Wavelength range:	220nm - 650nm (for EX and EM) (Setting range: 0nm - 900nm)
Spectrum bandwidth:	Excitation monochromator: 18nm Emission monochromator: 10, 18, 40nm (can be switched by keypad input)
Wavelength accuracy:	±2nm
Wavelength repeatability:	±0.3nm
Detectors:	Excitation monochromator: Photodiode, Emission monochromator: Photomultiplier
Flowcell Capacity:	16µl (standard)
Solvent wetted materials:	Synthetic silica, fluororesin, PEEK, stainless steel SUS-316
Control system:	
Sensitivity:	S/N for the RAMAN peak of water is 200 or greater; where Ex = 350nm and the time constant is 1.5 seconds
Measurement range:	10 steps in total: 1, 2, 4, 8, 16, 32, 64, 128, 256, and S
Gain:	x 1000, x 100, x 10, x 1
Response:	FAST, STANDARD, SLOW, and digital filter method

Signal processing:	Digital processing by A/D and D/A converters (with ambient temperature compensation circuits)
Output:	Recorder output: 10mV/FS (polarity change is possible) Integrator output: 1V/FS One circuit each for marker and leak output
Input:	One circuit each for marker and autozero input Program reset run input
Program functions:	Time program possible with Ex wavelength, EM wavelength, gain, attenuation, wavelength scan, etc.
Wavelength scan functions:	Excitation spectrum and emission spectrum measurement (Manual and time program) Spectrum storage (10 excitation and 10 emission spectra) and spectrum (difference spectrum) output
Self-check function:	Memory (ROM and RAM), DC power, Ex energy decrease, leak in cell, lamp use time
Lamp off timer:	99.9 hour maximum (0.1 hour increments).
Lamp use time calculation function:	Internal timer for recording the total number of hours that the Xe lamp has been used.
Others:	
Dimensions and weight:	300(W) x 150(H) x 460mm(D), about 19kg
Required power:	115 V AC 230 V AC selectable 50/60Hz, maximum 300 W
Ambient Temperature:	+10 to 35°C for operation - 30 to 60°C for storage

8-2 Options (Optional accessories)

Photomultiplier:	High Sensitivity (200 - 700nm) Long wavelength (220 - 900nm)
Flowcell:	High capacity (50μl) Micro-capacity (5μl)
Square cell holder:	For 10mm square cells
Secondary light filter:	For excitation or emission

9. Optional Accessories

This section describes optional accessories for the unit.

9-1 Filter types and uses

The Model FP-920 Fluorescence Detector is equipped with high efficiency dual monochrometer optics which make it unnecessary to use filters during normal measurement. However, when measuring emission at wavelengths close to 2 or 3 times the excitation wavelength, a filter is necessary to remove the second and third order light from the excitation wavelength. If the emission wavelength is set at 2 or 3 times the excitation wavelength, the second and third order light of the excitation light will stray into the emission monochrometer and become incident on the detector along with the light emission of the sample. This creates a high background and noise, making good analytical results impossible to obtain.
For example, with an excitation wavelength of 250nm, if the emission wavelength is set at 500nm, the secondary light of the 250nm excitation wavelength (500nm) that has been scattered by the cell will also be contained in the 500nm emission wavelength. To remove this secondary light, a UV-32, UV-36, L-39 or similar filter (the filter shape depends on the shape of the flow cell cassette) (see fig 9-4 and table 9-2), which cuts 250nm light and allows 500nm light to pass, should be attached at the emission outlet of the flowcell cassette.

Table 9-1 Characteristics of Filters for the Model FP-920 Fluorescence Detector

Type	Use	Characteristics
UV-D36C	Excitation	Band pass filter transmits light near 360nm
C-39B	Excitation	Band pass filter transmits light near 390nm
B-460	Excitation	Band pass filter transmits light near 460nm
UV-32	Emission	Sharp cut low pass filter, 50% transmittance near 320nm
UV-36	Emission	Sharp cut low pass filter, 50% transmittance near 360nm
L-39	Emission	Sharp cut low pass filter, 50% transmittance near 390nm
Y-46	Emission	Sharp cut low pass filter, 50% transmittance near 460nm

The spectral characteristics of the filters above are shown in Figs. 9-1 and 9-2.

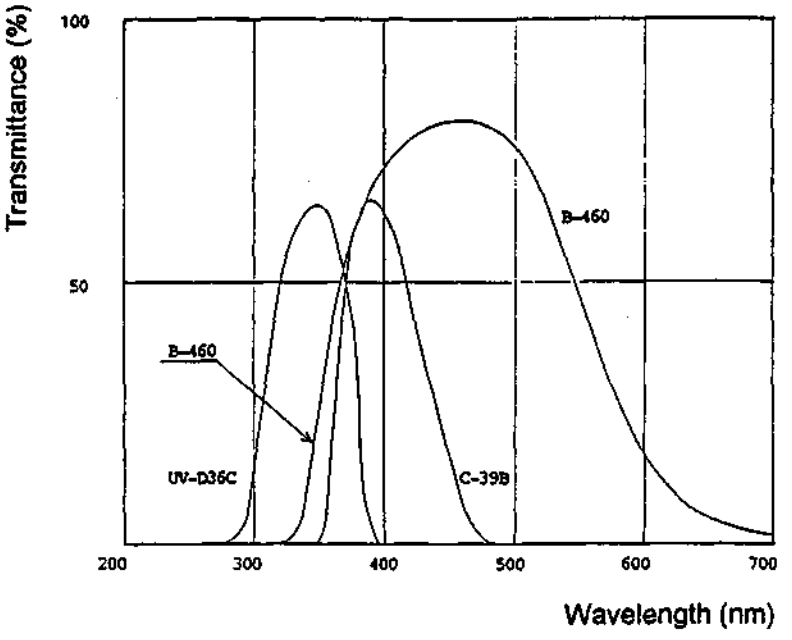


Figure 9-1 Characteristics of Excitation Filters

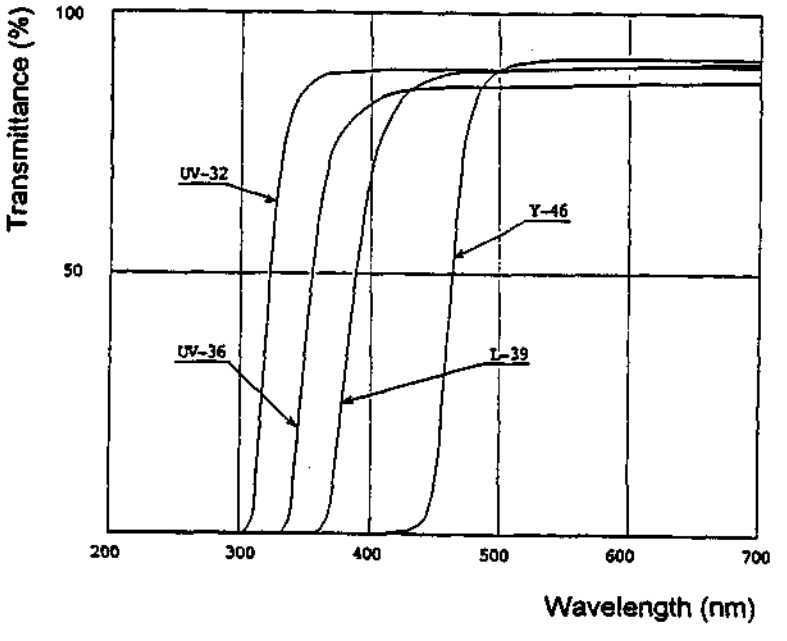


Figure 9-2 Characteristics of Emission Filters

9-2 Square cell holder

A 10mm square cell holder is designed to permit the Model FP-920 Fluorescence Detector to perform intensity measurements using the 10mm square cells commonly used with the fluorescent spectrophotometer. Using these cells, the Model FP-920 Fluorescence Detector functions as a fluorescent spectrophotometer. The capability of the FP-920 to output difference spectra can be used to output spectra with the solvent background removed as well as to output the difference spectra between samples.

9-3 High-sensitivity flowcell

A high-sensitivity flowcell for detecting trace-level analytes is designed for the Model FP-920 Fluorescence Detector. This high-sensitivity flowcell has a volume of approximately 50µl, and can be used to detect relatively broad peaks with increased sensitivity.

9-4 Micro-flowcell

A micro-flowcell with a volume of approximately 5µl is made for the Model FP-920 Fluorescence Detector. This micro-flowcell can be used to detect narrow peaks without band-broadening.

9-5 Fluorescent photomultiplier types

There are 2 additional types of photomultipliers in addition to the standard type made for the Model FP-920 Fluorescence Detector. One of the photomultipliers is for high sensitivity and is about twice as sensitive as the standard photomultiplier. The other photomultiplier is for long wavelengths, and has a maximum wavelength of 900nm, compared to the standard photomultiplier's 650nm. The sensitivity characteristics of the standard photomultiplier, as well as the two additional photomultipliers, are shown in Fig. 9-3. The characteristics of the standard, high sensitivity, and long wavelength photomultipliers are listed in fig. 9-3 as 1P28(01), R3788-01, and R928-23, respectively. These are typical, but not guaranteed values. The sensitivity of the fluorescence detector also depends on factors other than the photomultiplier characteristics, such as stray light from the monochromator and background noise. Replacing the photomultiplier may therefore not always provide the improvement indicated in figure 9-3.

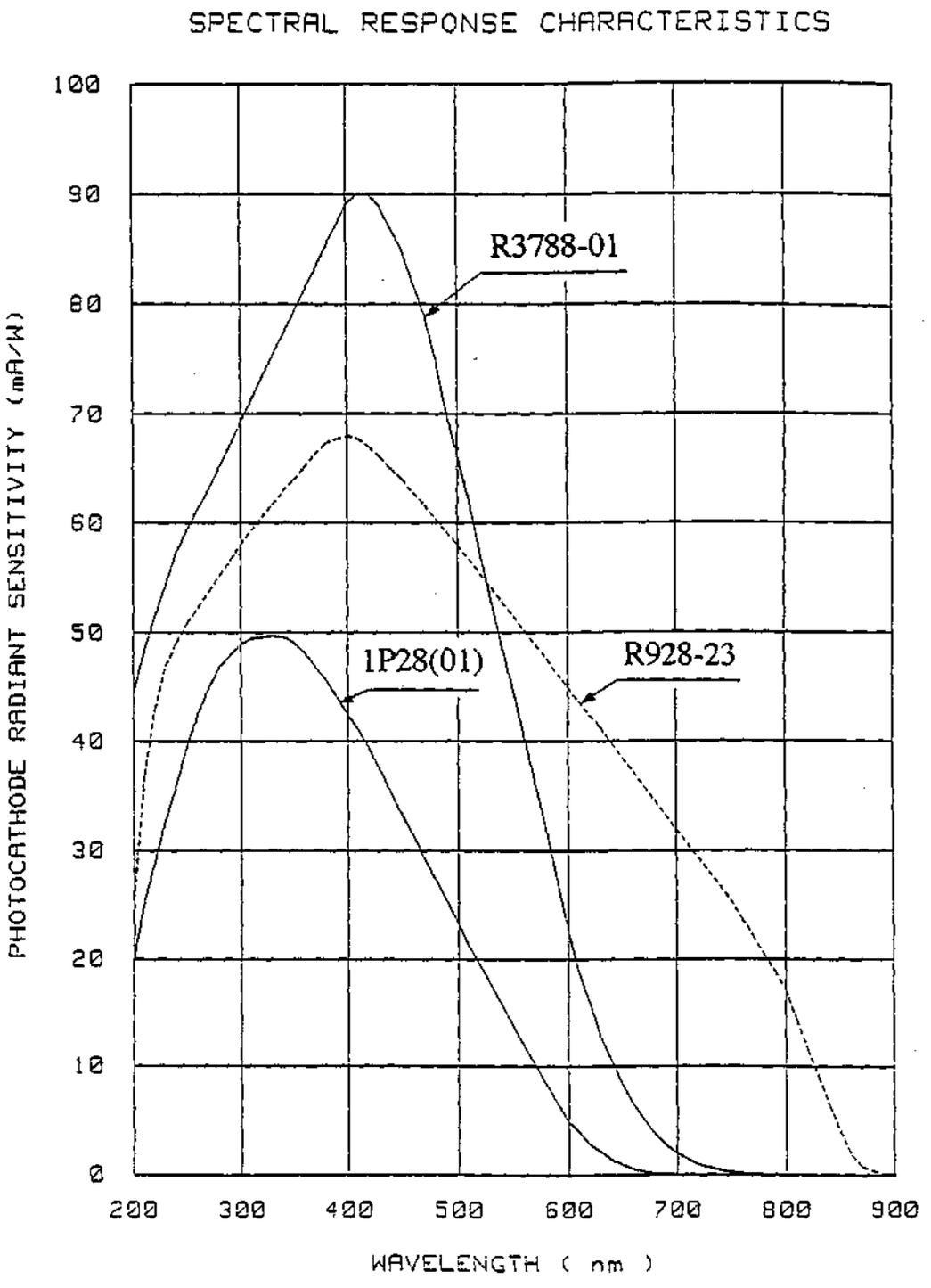
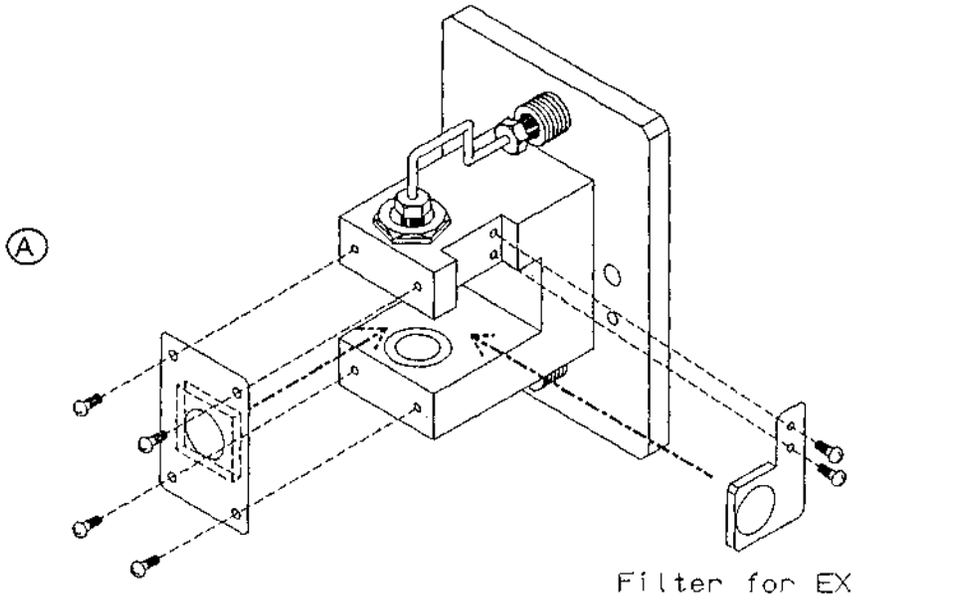


Figure 9-3 Photomultiplier sensitivity



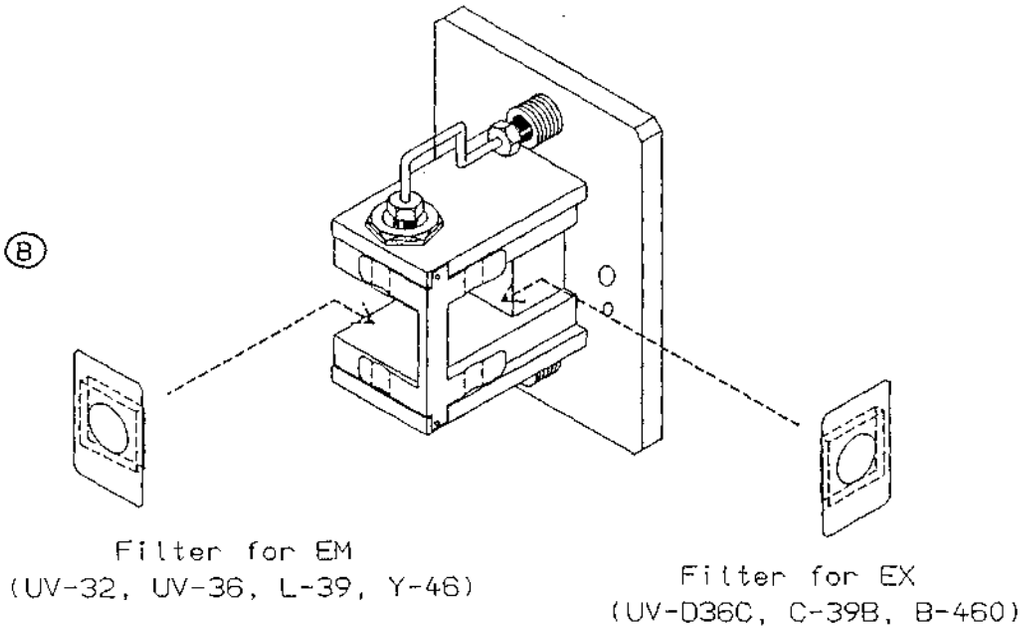


Figure 9-4 Flow cell cassette configuration

Table 9-2 Filter part number reference list

Type	Part Number (Configuration A)	Part Number (Configuration B)
UV-D36C	6604-H107A	6715-H335A
C-39B	6604-H108A	6715-H336A
B-460	6604-H109A	6715-H337A
UV-32	6604-H110A	6715-H335A
UV-36	6604-H111A	6715-H332A
L-39	6604-H112A	6715-H333A
Y-46	6604-H113A	6715-H334A
Filter kit (all types included)	6604-H101A	6715-H338A

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Printed in Japan