

Photodiode Array UV-Vis Detector
For Shimadzu Ultra High Performance Liquid Chromatograph

SPD-M40

Instruction Manual

Read this manual thoroughly before you use the product.
Keep this manual for future reference.

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Introduction

Read this Instruction Manual thoroughly before using the product.

Thank you for purchasing this product.

This instruction manual describes the basic operation, and accessories and options for this product. Read this manual thoroughly before using the product and operate the product in accordance with the instructions in this manual.

The following instruction manuals are included with the product in booklet form or in PDF format. The PDF documentation is on the instruction manual CD-ROM (Part No. S228-92350-41).

Document Name	Document No.	Description
Instruction Manual (PDF)	228-92358	This instruction manual.
System Guide (PDF)	228-92352	This manual provides details on how to use the system: system performance optimization, analysis procedure, troubleshooting, validation, installation, etc.
Safety Guideline (Booklet/PDF)	228-92326	Describes the precaution instructions to ensure safe operation.

Read "Safety Guideline" thoroughly before using the product.

"Safety Guideline" describes the information about the warranty, after-sales service, safety instructions and precautions to ensure safe operation of the instrument. Keep this manual for future reference.

Important

- If the user or usage location changes, ensure that the manuals are always kept together with the product.
- If the manual or a product warning label is lost or damaged, immediately contact your Shimadzu representative to request a replacement.
- To ensure safe operation, read the accompanying booklet "Safety Guideline" before using the product.
- To ensure safe operation, contact your Shimadzu representative if product installation, adjustment, re-installation (after the product is moved), or repair is required.

Notice

- Information in this manual is subject to change without notice and does not represent a commitment on the part of the vendor.
- Any errors or omissions which may have occurred in this manual despite the utmost care taken in its production will be corrected as soon as possible, although not necessarily immediately after detection.
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Indications Used in This Manual

Precaution symbols are indicated using the following conventions:

Indication	Meaning
 WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or possibly death.
 CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor to moderate injury or equipment damage.
 NOTE	Emphasizes additional information that is provided to ensure the proper use of this product.

The following symbols are used in this manual:

Indication	Meaning
 Prohibition	Indicates an action that must not be performed.
 Instruction	Indicates an action that must be performed.
 Hint	Indicates information provided to improve product performance.
 Reference	Indicates the location of related reference information.

Electromagnetic Compatibility

Descriptions in this section apply only to the following model:

- 228-65302-58 SPD-M40

This product complies with European standard EN61326, class B for electromagnetic interference (Emissions) and industrial electromagnetic environment (Immunity).

■ EN55011 Emissions (Electromagnetic Interference)

This is a class B product. When this product causes an electromagnetic disturbance to devices being used near this product, create an appropriate distance between those devices and this product in order to eliminate the disturbance.

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1 Overview

The SPD-M40 is a photodiode array, UV-Vis detector designed for use with a Shimadzu ultra high performance liquid chromatograph system (HPLC), and was developed to satisfy demands for greater accuracy and sensitivity in analysis.

The instrument is controlled through a system controller or personal computer (hereinafter referred to as "PC").

The LC workstation software (LabSolutions or LCsolution) can be used to control a Shimadzu LC system controller, as well as to manage or process data.

1.1 Features

■ High sensitivity measurement can be obtained over the entire wavelength range of 190 nm to 800 nm

A photodiode array continuously monitors spectra over the entire wavelength range. The instrument uses a D2 (deuterium) lamp and W (tungsten) lamp as light sources, which enables obtaining chromatograms and absorbance spectra with high sensitivity over the wide measurement wavelength range of 190 nm to 800 nm.

- Continuous monitoring of the absorbance spectra of eluted components can improve analysis reliability.
 - Identification of components from absorbance spectra
The combined use of retention time with absorbance spectra provides greater accuracy in identification.
 - Impurities check
Eluted peaks can be checked to determine if they are generated from a single component or mixed with impurities.

■ Wide linearity range can reduce the time for analysis preparation

Improved optical system has accomplished both wide linearity range and superb signal-to-noise ratio performance at the same time.

The wide linearity range makes it possible to measure main components and trace components simultaneously, thereby allowing for reducing the time to dilute thick samples.

Use of variable slits allows for achieving higher sensitivity in accordance with the analysis objective.

■ Improved stability in analysis through flow cell/polychromator/lamp compartment temperature control

Mobile phases have higher absorbances in shorter wavelengths than in longer ones, which allows variation in the ambient temperature to affect the absorbance of the mobile phase in the cell and leads to change in the baseline or peak areas. The instrument stabilizes analysis by controlling the temperature of the flow cell, polychromator, and lamp compartment.

■ **Decomposition of samples due to ultraviolet light can be prevented for improving data reliability**

The ultraviolet light cut-off filter can prevent samples from being decomposed by ultraviolet light

This can suppress the variations in absorbance due to the decomposition of samples to improve data reliability.

■ **Easy maintenance and part replacement**

When replacing the lamp, troublesome optical axis adjustment is unnecessary. Furthermore, the total lamp usage time is monitored, so just a quick glance lets you know when to replace the lamp.

The photodiode array exposure time setting can be automatically optimized for easy maintenance.

Wavelength accuracy is checked automatically from the ultraviolet to visible wavelength range using the built-in holmium oxide filter absorbance spectrum and deuterium emission line spectrum, providing easy performance verification.

■ **Multi wavelength UV detector functionality**

Chromatograms can be output to an external integrator via the analog output terminal on the rear panel. Up to 4 wavelengths (4 channels) can be output, allowing the SPD-M40 to be used as a multi wavelength UV detector.

■ **Cell memory and lamp memory functions**

A cell memory in which the type of the cell is stored is embedded in the flow cell for automatic recording the type of the cell used for analysis in the analysis data, achieving improved traceability of analysis. Likewise, the memory embedded in the lamp can control the lighting time properly. The lighting time and serial number of the lamp used for analysis are automatically recorded in the analysis data, improving the traceability of analysis.

■ **Network support**

This instrument can be connected to a PC network via a standard Ethernet terminal.

If using a LAN environment, a remote PC can be used to configure instrument settings and monitor instrument operation.

The user can access the instrument through a web browser (Internet Explorer, etc.) on the PC to configure analysis conditions or start analysis.

1.2 Component Parts

This instrument comprises the parts listed below. After unpacking, verify that the correct types and quantity of parts have been provided.

1

Part Name	Part No.	Q'ty	Remark
SPD-M40	-	1	
Safety Guideline(Booklet)	228-92326	1	Contains cautions for use regarding the instrument.
CD-ROM for SPD-M40	228-73155-41	1	SPD-M40 Utility The bound version of utility help (228-92655) will be provided for a fee.
Instruction Manual/System Guide (CD-ROM)	228-92350-41	1	A paper based (this) manual (228-92358) and System Guide (228-92352) are available at a fee.
Syringe needle	228-57027	1	
Syringe,1 ML	228-57028	1	
Male nuts PEEK	228-18565	4	
ETFE tube	228-18495-06	1	ETFE (creamy white) $\phi 1.6 \times \phi 0.25 \times 2,000$ mm
Drain tube	228-25162-03	1	
Cap, hinge bracket	228-70057	1	
Remote cable	228-28253-91	1	White/black cable
Drain adapter	228-42204	1	
Drain OUT, STD	228-42205	1	
Drain OUT, CTO	228-42206	1	
Straight tubing connector	228-28163	1	
Coupling 1.6-0.8C	228-40998-10	1	
Male nut 0.8MN-PEEK	228-46363	1	
Ethernet cable, 2 m	228-61083-41	1	Please purchase a cable separately when a cable length other than 2 meters is required. ▶ Reference "5.4 Items Required for Operation" P.93

1.3 Optional Parts

Optional units available for this instrument are listed below.

For information about other optional units not listed below, contact your Shimadzu representative. For features of each optional flow cell part, refer to "1.3.1 Optional Flow Cell" P.4.

Part Name	Part No.	Remark
UHPLC cell	228-64724-41	A flow cell for high speed analysis.
Semi-micro cell	228-64725-41	A flow cell for semi-micro analysis.
Inert cell	228-64728-41	A flow cell with the wetted part of inert (non-metal) materials.
UHPLC Inert cell	228-74221-41	A flow cell with the wetted part of inert (non-metal) materials used for high speed analysis.
Low Dispersion Inert cell	228-74222-41	A flow cell with the wetted part of inert (non-metal) materials, which reduces sample dispersion, used for semi-micro analysis.
Preparative cell (variable path length)	228-64727-41	A flow cell for fractionation. Users can change the path length by replacing the provided spacer with another.
Micro cell	228-64737-41	A flow cell for micro analysis.
High-pressure resistant cell	228-64726-41	A flow cell with a high pressure resistance (40 MPa). The cell can also be used for SFC analysis.
Conventional cell	228-68250-41	It is a flow cell used for conventional analysis.
Signal cable	228-39306-91	It is necessary to output an analog signal.

1.3.1 Optional Flow Cell

For details on the specifications, refer to the instruction manual of each optional flow cell.

■ Flow cell (Standard flow cell for SPD-M40) 228-62156-41

Item	Specifications
Cell path length	10 mm
Cell volume	12 μ L
Inlet tubing	14 μ L : I.D. 0.13mm, length 1040 mm (The length out of the cell is 315~340 mm.)
Outlet tubing	8 μ L : I.D. 0.25 mm, length 160 mm
Cell materials in contact with liquid	SUS316L, quartz, PFA, PEEK
Cell pressure tolerance	12 MPa
Cell temperature control	Able

■ UHPLC cell 228-64724-41

Item	Specifications
Cell path length	10 mm
Cell volume	8 μL
Inlet tubing	4.3 μL : I.D. 0.1mm, length 550 mm (The length out of the cell is 315~340 mm.)
Outlet tubing	2.1 μL : I.D. 0.13 mm, length 160 mm
Cell materials in contact with liquid	SUS316L, quartz, PFA, PEEK
Cell pressure tolerance	12 MPa
Cell temperature control	Able

■ Semi-micro cell 228-64725-41

Item	Specifications
Cell path length	5 mm
Cell volume	2.5 μL
Inlet tubing	4.3 μL : I.D. 0.1 mm, length 550 mm (The length out of the cell is 315~340 mm.)
Outlet tubing	2.1 μL : I.D. 0.13 mm, length 160 mm
Cell materials in contact with liquid	SUS316L, quartz, PFA, PEEK
Cell pressure tolerance	12 MPa
Cell temperature control	Able

■ Inert cell 228-64728-41

Item	Specifications
Cell path length	10 mm
Cell volume	12 μL
Inlet tubing	32 μL : I.D. 0.25 mm, length 650 mm (The length out of the cell is 280~320 mm.)
Outlet tubing	8 μL : I.D. 0.25 mm, length 160 mm
Cell materials in contact with liquid	PEEK, quartz, PFA
Cell pressure tolerance	8 MPa
Cell temperature control	Able

■ UHPLC Inert cell 228-74221-41

Item	Specifications
Cell path length	10 mm
Cell volume	8 μL
Inlet tubing	3.9 μL : I.D. 0.1 mm, length 500 mm (The length out of the cell is 315~340 mm.)
Outlet tubing	2.0 μL : I.D. 0.125 mm, length 160 mm
Cell materials in contact with liquid	PEEK, quartz, PFA
Cell pressure tolerance	8 MPa
Cell temperature control	Able

■ Low Dispersion Inert cell 228-74222-41

6.7.

Item	Specifications
Cell path length	5 mm
Cell volume	2.5 μL
Inlet tubing	3.9 μL : I.D. 0.1 mm, length 500 mm (The length out of the cell is 315~340 mm.)
Outlet tubing	2.0 μL : I.D. 0.125 mm, length 160 mm
Cell materials in contact with liquid	PEEK, quartz, PFA
Cell pressure tolerance	8 MPa
Cell temperature control	Able

■ Preparative cell (variable path length) 228-64727-41

Item	Specifications		
Cell path length (variable)	0.1 mm	0.2 mm	0.5 mm
Cell volume (variable depending on the path length)	0.8 μL	1.6 μL	4.0 μL
Inlet tubing	201 μL : I.D. 0.8 mm, length 400 mm (The length out of the cell is 315~340 mm.)		
Outlet tubing	80 μL : I.D. 0.8 mm, length 160 mm		
Cell materials in contact with liquid	SUS316L, quartz, PTFE, PCTFE, PEEK		
Cell pressure tolerance	3 MPa		
Cell temperature control	Disable		

■ Micro cell 228-64737-41

Item	Specifications
Cell path length	3 mm
Cell volume	0.21 μ L
Inlet tubing	1.3 μ L : I.D. 0.064 mm, length 400 mm (The length out of the cell is 315~340 mm.)
Outlet tubing	2.1 μ L : I.D. 0.13 mm, length 160 mm
Cell materials in contact with liquid	SUS316L, quartz, PTFE, PEEK
Cell pressure tolerance	8 MPa
Cell temperature control	Disable

■ High-pressure resistant cell 228-64726-41

Item	Specifications
Cell path length	10 mm
Cell volume	12 μ L
Inlet tubing	6.8 μ L : I.D. 0.1 mm, length 870 mm (The length out of the cell is 315~340 mm.)
Outlet tubing	8 μ L : I.D. 0.25 mm, length 160 mm
Cell materials in contact with liquid	SUS316L, quartz, PCTFE, PEEK
Cell pressure tolerance	40 MPa
Cell temperature control	Disable

■ Conventional cell 228-68250-41

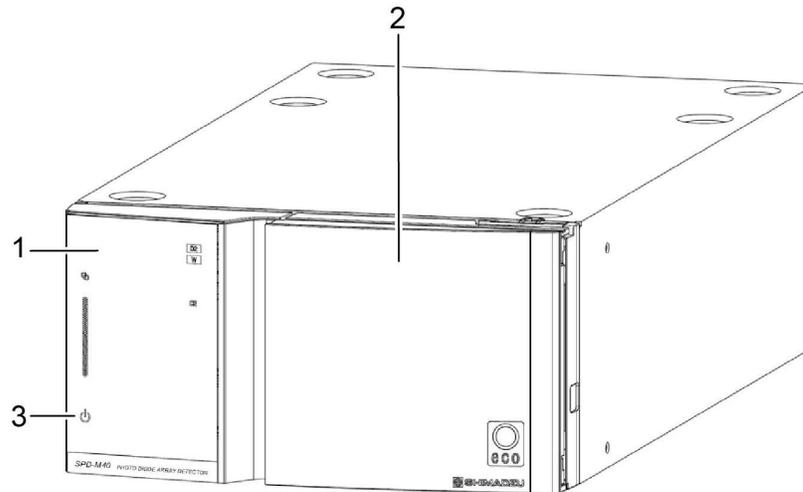
Item	Specifications
Cell path length	10 mm
Cell volume	12 μ L
Inlet tubing	43 μ L : I.D. 0.25 mm, length 870 mm (The length out of the cell is 315~340 mm.)
Outlet tubing	8 μ L : I.D. 0.25 mm, length 160 mm
Cell materials in contact with liquid	SUS316L, quartz, PFA, PEEK
Cell pressure tolerance	12 MPa
Cell temperature control	Able

■ Selection of option cells

▶▶ Reference "Cell Selection" in the System Guide (228-92352)

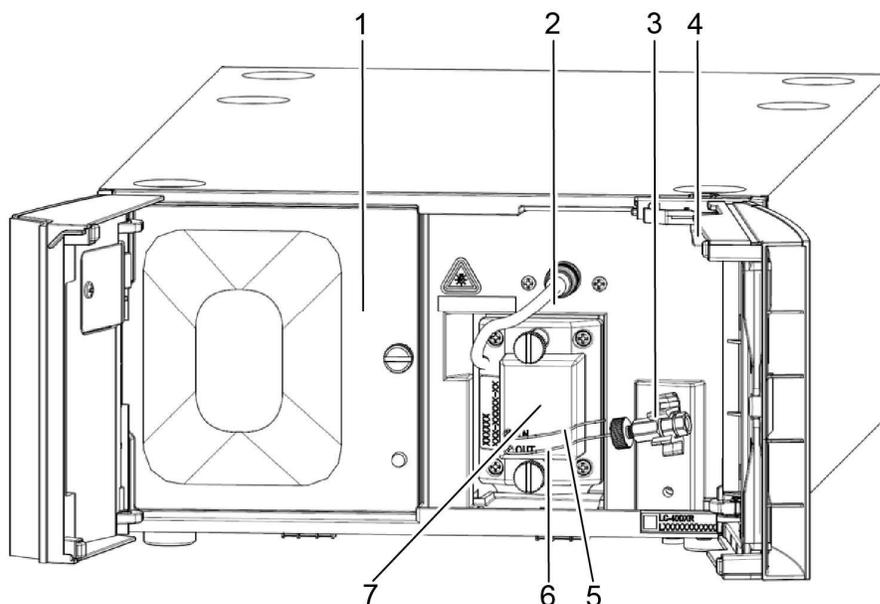
2 Part Names and Functions

2.1 Front



No.	Name	Description
1	Operation panel	To display lamp statuses or clear errors.
2	Front cover	Opens when opening / closing the flow cell. Please close the cover during measurement.
3	 (Power button)	To switch the power ON/OFF. Press the switch in to turn power ON. Press again to turn power OFF. The switch is enabled only when the main power switch on the back is on by default setting. Note that, with a system controller SCL-40 or CBM-40 connected, the switch does not illuminate and the operation to the switch is ignored by default setting. "Power Button(Sets the power button)" P.22

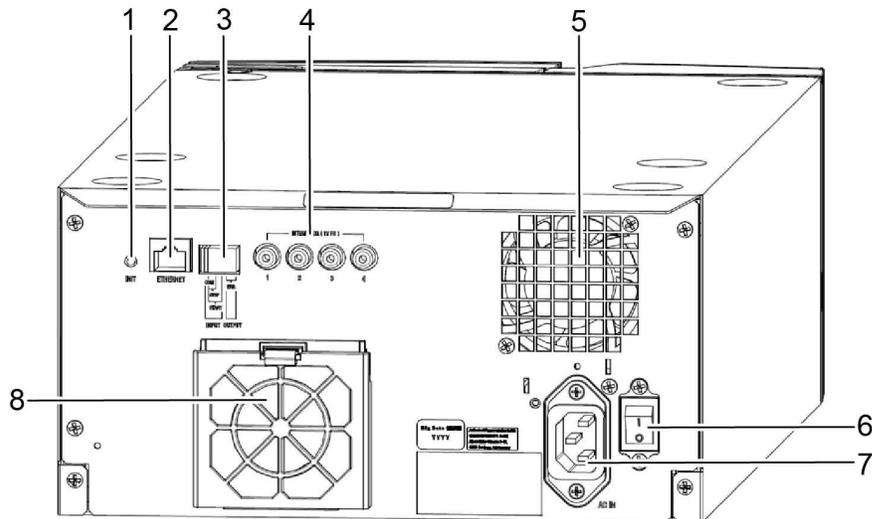
2.2 Internal View of the Front Cover



2

No.	Name	Description
1	Lamp cover	Remove the lamp cover to replace the D2 lamp or W lamp inside. For the replacement procedure, see " 4.7 Replacing the Lamp " P.78. When the lamp cover is removed, the lamp is automatically turned off to ensure safety.
2	Temperature-controlled flow cell connector	Connects to the temperature-controlled flow cell. NOTE Be sure to turn off the power of the equipment when plugging or unplugging the flow cell cable connector.
3	Coupling holder	Fix the coupling of the cell outlet tube.
4	Tubing holder	This secures the tubing.
5	Cell inlet tubing(Red tube)	Connect to the column. The length out of the cell is 315~340 mm.
6	Cell outlet tubing	Connect to the tube that discharges mobile phase solvent after analysis.
7	Flow cell	Flow cell body. The long tubing with a colored tube is the inlet of the cell. (The tube color differs depending on the type of cell. The standard cell has a red tube.)

2.3 Back

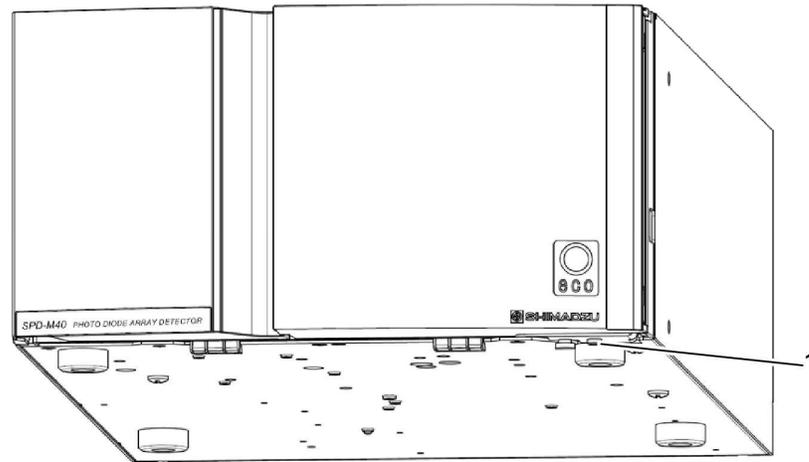


No.	Name	Description
1	[INIT] button	Used to initialize the instrument. ▶▶ Reference "3.4 Initializing Network Settings, User IDs, and Passwords" P.33
2	[ETHERNET] connector	Used for the interface of control signals and analysis data through the network. ▶▶ Reference 40-series System Guide
3	External input/output terminals	Used for the input/output of analysis start and stop signals, and event signals when an error occurs. The rated value of the relay contact is 30 VDC, 0.2 A. ▶▶ Reference 40-series System Guide
4	[INTEGRATOR] connectors	Used to connect an integrator, allowing output of up to 4 channels of analog signals. ▶▶ Reference "3.6.1 Analog Output Usage and Settings" P.49
5	Cooling fan	Fan for internal cooling.
6	Main power switch	Turn the power supply of the instrument ON/OFF. Normally it should always be turned ON. *1
7	Power cord connector (Built-in fuse holder)	Used for connection of the power cable and has a built-in fuse holder. ▶▶ Reference 40-series System Guide
8	Vent	A vent for air to cool the instrument. (Allow a clearance of at least 100 mm between the wall and the back of the instrument.)

*1 Usually, the power of the instrument is turned ON/OFF using  (power button on the operation panel or the power button of the system controller). The power can be turned ON/OFF from the front side of the instrument using  (power button) of the system controller if the main power

switch is turned ON. When the instrument will not be used for a long period of time, turn OFF the main power switch.

2.4 Base Panel

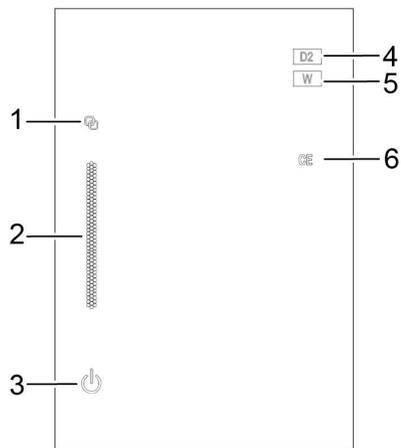


2

No.	Name	Description
1	Leakage drain outlet	The outlet funnels any leakage from the instrument to a unit under the instrument. ▶▶ Reference 40-series System Guide

2.5 Name and Functions of the Operation Panel

The operation panel consists of LED lamps and status indicators.



No.	Name	Function
1	Link LED	Illuminates while the instrument is controlled through a PC or system controller. Blinks during start-up.
2	Status LED	<ul style="list-style-type: none"> • Turns green when the power is ON. • Turns red after an error occurs. • Turns blue during analysis. • Turns yellow during preparation for analysis. • Turns orange in sleep mode. • Blinks yellow when an IP address conflict error occurs. • Blinking blue when memory initialization / version up • Blinking green when notification of safety check
3	 (Power Button)	<p>Switches ON/OFF the power.</p> <ul style="list-style-type: none"> • To turn the power ON: Press and hold the power button for at least 3 seconds. • To turn the power OFF: Holding down the power button 3 seconds or more blinks the status LED. Holding it down again 1 second turns off the power. Press [CE] to cancel the operation while the LED is blinking. <p>The button cannot be used if the instrument is linked with the system controller by default setting. "Power Button(Sets the power button)" P.22</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>NOTE If SCL-40 is connected, pressing the power button of SCL-40 turns off the power of the entire system.</p> </div>
4	D2 (D2 lamp)	Illuminates when the D2 lamp is turned ON. The LED blinks while the lamp is warming up.
5	W (W lamp)	Illuminates when the W lamp is turned ON. The LED blinks while the lamp is warming up.

No.	Name	Function
6	CE Key	Clear errors.



3 Operation

3.1 Precautions on Operation

■ Preparation Prior to Operation

After starting up the instrument or turning on the lamp, it takes some time to stabilize the baseline.

When high sensitivity is required for analysis, turn on the lamp in advance while taking into account the time required for baseline stabilization. As a guide, stabilization takes about 1.5 hours following startup.

■ Precautions During Operation

Be sure to close the cover during measurement.

During high sensitive analysis, opening and closing the cover or leaving it open may cause baseline fluctuation or noise increase.

■ Precautions After Operation

The failures most likely to happen to the instrument are dirt in the flow cell and clogging of the flow cell tubing. After analyzing a high concentration of sample, let the mobile phase flow for a sufficient time to ensure that no sample is left in the flow cell. If a buffer solution was used for the mobile phase, purge the mobile phase in the flow cell with water after analysis. Remaining buffer solution dries and crystallizes, resulting in clogging.

3.2 Turning the Power ON/OFF

■ Turning the Power ON

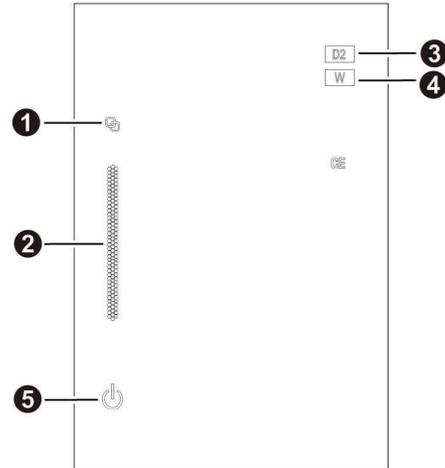
1

Press and hold  (power button) for at least 3 seconds.

Power is supplied.

 **Hint** When power to the instrument is turned ON, the following initialization sequence occurs.

- 1 All the LEDs ① to ④ CE key, and the power button ⑤ illuminate temporarily.
- 2 The W lamp ④ illuminates.
- 3 The Link LED ① blinks.
- 4 According to the method settings, the D2 lamp ③ and W lamp LEDs ④ illuminate.



3

-  **NOTE**
- The settings for the lamp that illuminates are the same as the previously set method.
 - If an error occurs, the status LED ② will illuminate red.

■ Turning the Power OFF

1

Press and hold  (power button) for at least 3 seconds.

The status LED ② blinks.

2

Press and hold the power button for another 1 second.

Power to the instrument is turned OFF.

3.3 Operation Using a Web Browser

The following operations can be performed on this instrument using a web browser. This section is summarized in the table below. For general use information on web browsers, consult the documentation that accompanies your web browser and PC.

❶	Configuring network settings
❷	Configuring user IDs and passwords
❸	Displaying various instrument logs
❹	Displaying system check reports
❺	Displaying the condition of consumable parts

3.3.1 User Rights

There are two levels of user rights at login.

User ID	Permitted Operations	Default User ID	Default Password
Administrator	<ul style="list-style-type: none"> • Configure network settings and user rights/passwords and reference the instrument's various logs using a web browser. • Perform instrument performance checks, calibration, and configure analog output settings using SPD-M40 Utility. 	Admin	Admin
Operator	<ul style="list-style-type: none"> • Perform instrument performance checks, reference calibration parameters, and configure analog output settings using SPD-M40 Utility. 	Operator	None

3.3.2 Configuring Network Settings (Web Browser)

■ IP Address and Subnet Mask Settings on the PC

1

Enter an IP address that allows SPD-M40 connection as well as the subnet mask.
Configure the following settings when connecting to a factory default SPD-M40.

Item	Setting Value
IP address	192.168.200.xxx* ¹
Subnet mask	255.255.255.0

*1 Up to three digits can be entered for "xxx".

- ▶▶ **Reference** See the following section when restoring the network settings of the SPD-M40 to the factory defaults.
["3.4 Initializing Network Settings, User IDs, and Passwords" P.33](#)

■ **NOTE** If a PC or other device in the existing LAN environment has an IP address of "192.168.200.99" or "192.168.200.98", configuration cannot be performed because an IP address conflict will occur when attempting to connect to a factory default SPD-M40 or system controller. In this case, only connect the SPD-M40 and PC and configure the IP address settings before connecting to an existing LAN. In addition, connecting two or more factory default SPD-M40 instruments to a LAN at the same time will result in an IP address conflict. For this reason, connect each instrument one at a time when configuring each IP address.

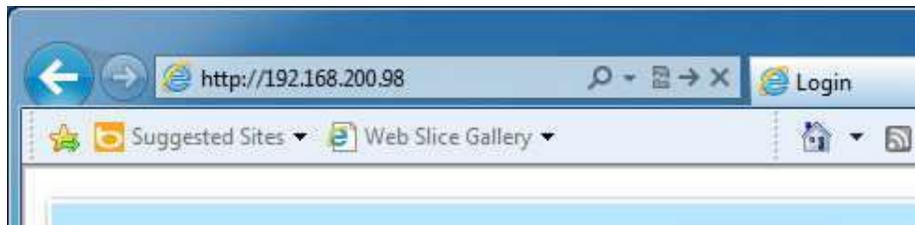
3

■ **Launching the Web Browser and Connecting to the Instrument**

- 1** Turn ON the PC used for controlling the instrument.
- 2** Launch the web browser on the PC.
- 3** Enter the IP address of the instrument in the [Address] field of the browser. (http://<IP address>/)

Default IP address: 192.168.200.98

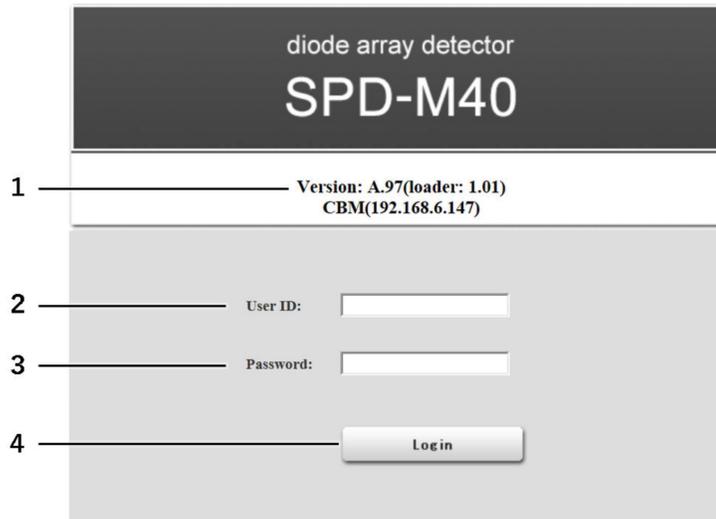
▶▶ Reference "3.4 Initializing Network Settings, User IDs, and Passwords" P.33



- 4** Enter a user ID and password, and click [Login].

Default user ID: Admin

Default password: Admin



No.	Name	Function
1	Version display	Displays the firmware version.
2	User ID	Enter the user ID for connection
3	Password	Enter the corresponding password.
4	[Login] button	Executes user login.

The administrator screen is displayed.

3

No.	Name	Function
1	Instrument status	Displays the [READY] or [ERROR] state.
2	[CE] button	Clear the instrument error state. (The button is displayed when an error occurs.)
3	Logout button	Log out of the administrator screen.
4	Log tab	Display log information stored on the instrument.
5	User Management tab	Configure user information.
6	Configuration tab	Configure network information. (This tab is selected when a user logs in.)

■ SPD-M40 Network Settings

1

Click on the [Configuration] tab after logging in.

Configure the information under [Network Configuration] and [System Configuration].

NOTE Settings are stored on the instrument when the [Register] button is clicked.

The screenshot shows the Configuration tab of the SPD-M40 web interface. It is divided into two main sections: Network Configuration and System Configuration. The Network Configuration section includes fields for IP Address (192.168.200.98), Subnet Mask (255.255.255.0), Default Gateway (0.0.0.0), Ethernet Mode (Auto Detect), Power Button (CBM), and Dark Skip (OFF). The System Configuration section includes fields for Group Name (HPLC1), System Name (M40-1), and Master Server Name (CBM1). Both sections have a Register button. Numbered callouts 1 through 9 point to specific fields in the interface.

2

Enter the information under [Network Configuration] and click [Register].

NOTE Changing any field in network settings and clicking the [Register] button causes the settings on the instrument to be changed and the connection to be lost. In order to continue configuring settings other than the network settings, enter the newly set IP address into the web browser and log in again.

No.	Name	Function
1	IP Address	Set the IP address of the instrument. (Default: 192.168.200.98)
2	Subnet Mask	Set the subnet mask. (Default: 255.255.255.0)
3	Default Gateway	Set the default gateway. (Default: 0.0.0.0)
4	Ethernet Mode	Set the Ethernet communication speed. (Default: Auto Detect)
5	Power Button	Set the power button. (Default: CBM)

No.	Name	Function
6	Dark Skip	Set the timing of the dark current measurement. (Default: OFF) Use to start an analysis from an external input/output terminal.

IP Address and Subnet Mask

An IP address must be set to allow the instrument to connect to the network.

- The IP address consists of a network part and a host part. Take the previous figure for example. The subnet mask is 255.255.255.0 and therefore 192.168.200 in the IP address is the network part, which identifies the network to access. The value 98 is the host part and identifies the instrument or PC within the network. The subnet mask value, as stated previously, specifies the boundary between the network part and host part in IP addresses.
- The network part of the address is set to be the same as that of the LAN environment to which the instrument is to be connected. Be sure to set the subnet mask and LAN environment appropriately. If they are not set appropriately, the instrument will not be able to connect to the network.
- Set the host part so that it does not conflict with any other PCs or instruments on the network. If the address is set to be the same as another PC, the instrument will not be able to connect to the PC and it will not be able to connect to other devices with conflicting addresses.

Default Gateway

The router IP address must be set when connecting a PC and instrument via a router.

NOTE When the network related parameters are not set appropriately, it becomes impossible for the instrument to connect to a PC as well as other equipment. When connecting to an existing LAN environment and setting parameters, consultation with the network administrator will be required.

Ethernet Mode Settings

While the Ethernet mode should normally be set to "Auto Detect", it can be changed to the following modes if necessary.

Mode Name	Description
Auto Detect	Automatic speed setting (default)
10 Mbps/Half Duplex	Half duplex at 10 Mbps
10 Mbps/Full Duplex	Full duplex at 10 Mbps
100 Mbps/Half Duplex	Half duplex at 100 Mbps
100 Mbps/Full Duplex	Full duplex at 100 Mbps

Power Button(Sets the power button)

Sets the power button on the front of the instrument.

Set Value	Function
CBM	Operation of the power button from the instrument is disabled according to the control of the system controller only. (Initial value)
MODULE	In addition to being controlled by the system controller, it is also possible to turn off the power individually from the instrument.

 **Hint** When the instrument is connected to the system controller SCL-40/CBM-40, the power control of the instrument follows the system controller, and the shutdown and startup functions operate from the system controller throughout the system.

-  **NOTE**
- If you turn off the power to the instrument individually with the setting [MODULE], the connection to the system controller will also be lost. Therefore, the system startup function does not turn on the instrument. you need to turn the power on again by pressing and holding the power button on the instrument. The system shutdown function is still enabled with setting [MODULE]. However, if the power is turned off by the shutdown function, turning on the power by pressing the power button of the instrument is disabled, and the system must be started up from the system controller.
 - Connected as SPD-M20A, the power control function by the system controller is not available. Therefore, you can always operate the power button of the instrument regardless of the setting of this function.

3

Enter the information under [System Configuration] and click [Register].

No.	Name	Function
7	Group Name	Set the group name. (Default: ShimadzuHPLC)
8	System Name	Set the system name. (Default: Instrument serial number)
9	Master Server Name	Set the master server name. (Default: ShimadzuPDA)

The system configuration information is used so that system controllers can distinguish between instruments. Set the information when establishing a system by connecting the instrument to the system controller. Refer to the system controller's instruction manual for details.

-  **NOTE** Only use one-byte alphanumeric characters for [Group Name], [System Name], and [Master Server Name].

Set the group name and master server name as shown below to allow SPD-M40 Utility to start data collection in synchronization with the start of analysis using the system controller(P.91).

- Set the group name to the same group name as for the system controller(P.91).
- Set the master server name to the system name of the system controller(P.91).

Configuration Example

	System controller(P.91) Settings	SPD-M40 Settings
Group Name	HPLC1	HPLC1
System Name	CBM1	M401
Master Server Name	-	CBM1

-  **NOTE** When moving the PDA detector to another system, change the device setting of the SPD - M40 according to the system controller of the target system.

3.3.3 Configuring User IDs and Passwords

Set the user rights, user ID, and password for accessing the SPD-M40 from a web browser, and for launching SPD-M40 Utility from a PC without LabSolutions installed.

NOTE To define the user rights, user ID, and password for launching SPD-M40 Utility from a PC with LabSolutions installed, configure them on LabSolutions.

1

Click the [User Management] tab after logging in.

The screenshot shows the 'User Management' tab in a web interface. It contains two sections: 'Administrator' and 'Operator'. Each section has three input fields: 'Administrator ID' (with 'Admin' as a default value), 'New Password', and 'Password (Confirmation)'. A 'Register' button is located to the right of each section. Numbered callouts 1 through 6 point to the following fields:

- 1: Administrator ID
- 2: New Password
- 3: Password (Confirmation)
- 4: Operator ID
- 5: New Password
- 6: Password (Confirmation)

2

Set the [Administrator ID] and two password fields for the administrator and click [Register].

Set the user information for displaying this administrator screen and for opening SPD-M40 Utility as an administrator.

No.	Name	Function
①	Administrator ID	Set the administrator ID. (Default: Admin)
②	New Password	Set the password. (Default: Admin)
③	Password (Confirmation)	Enter the same password as [New Password] for confirmation.

3 Set the [Operator ID] and two password fields for the operator and click [Register].

Set the user information for operating the instrument using SPD-M40 Utility.

No.	Name	Function
4	Operator ID	Set the operator ID. (Default: Operator)
5	New Password	Set the password. (Default: None)
6	Password (Confirmation)	Enter the same password as [New Password] for confirmation.

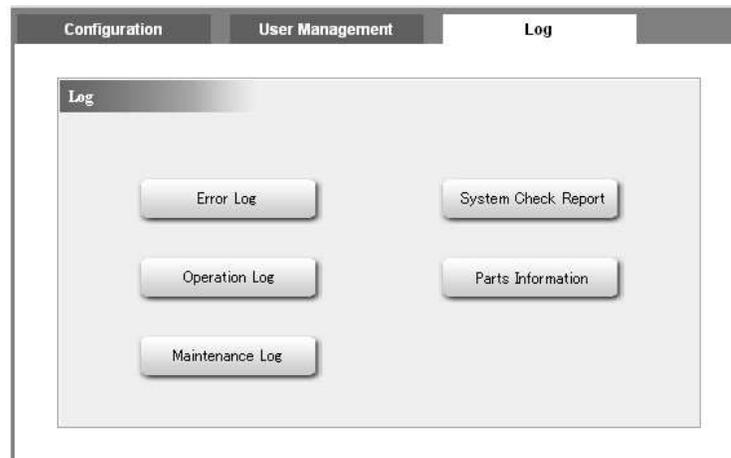
3.3.4 Displaying the Error Log

1 Launch the web browser and log onto the instrument.

▶▶ Reference ["3.3.2 Configuring Network Settings \(Web Browser\)" P.17](#)

2 Click the [Log] tab after logging in.

The options on the [Log] tab are displayed.



3

Click [Error Log].

The log history of generated errors is displayed.

No.	Date	Code	Message
1	2018/06/28 15:18:12	0x5a51	SNTP too delayed
2	2018/06/28 15:18:12	0x5a51	SNTP too delayed
3	2018/06/18 15:09:13	0x5a45	PDA saturated
4	2018/06/08 15:00:04	0x5a54	CBMLAN timeout
5	2018/05/30 11:08:54	0x5a45	PDA saturated
6	2018/05/30 10:43:19	0x5a45	PDA saturated
7	2018/05/30 10:42:25	0x5a45	PDA saturated

Item	Description	Remarks
No.	Displays the number of the entry in the error log.	
Date	Displays the date and time that each error occurred.	Date and time display/power ON time display
Code / Message	Displays the error message.	

NOTE Date display :
The date for each log is displayed in one of the following two formats.

Item	Format	Example	Remarks
Date and time display	Year/month/day hr:min:sec	2018/03/28 15:32:40	When the actual time that event occurred is known.
Power ON time display	Total number of hours that power has been supplied to the instrument when the event occurred.	T00165 (total power ON time of 165 hours)	When the actual time that event occurred is unknown.

When an error or some other event occurs, the time of the occurrence is recorded as described below:

- When the SPD-M40 is controlled via the system controller or computer
➔The time is recorded as shown in the table above.
- When the SPD-M40 is not controlled via either of these devices and is running in stand-alone mode
➔The instrument's total power ON time (total number of hours that power has been supplied to the instrument since its manufacture) is displayed.
* The instrument receives time information from a PC or system controller.

3.3.5 Displaying the Operation Log

1 Launch the web browser and log onto the instrument.

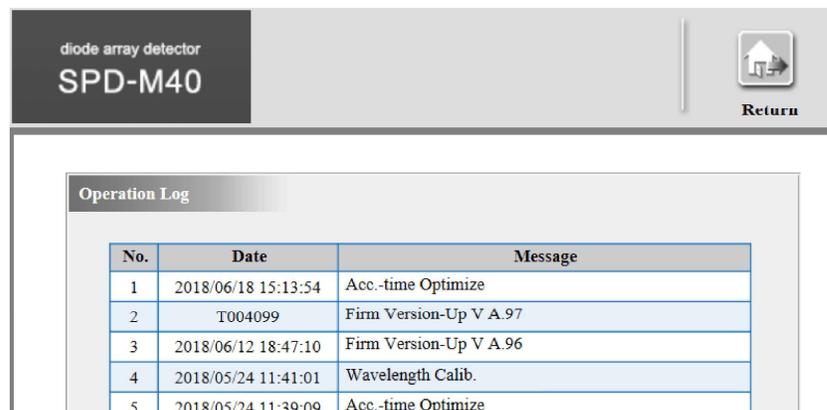
▶▶ Reference "3.3.2 Configuring Network Settings (Web Browser)" P.17

2 Click the [Log] tab after logging in.

The options on the [Log] tab are displayed.

3 Click [Operation Log].

The log history of operations is displayed.



No.	Date	Message
1	2018/06/18 15:13:54	Acc.-time Optimize
2	T004099	Firm Version-Up V A.97
3	2018/06/12 18:47:10	Firm Version-Up V A.96
4	2018/05/24 11:41:01	Wavelength Calib.
5	2018/05/24 11:39:09	Acc.-time Optimize

Item	Description	Remarks
No.	Displays the number of the entry in the operation log.	
Date	Displays the date and time the operation was executed.	Date and time display/power ON time display ▶▶ Reference "3.3.4 Displaying the Error Log" P.25
Message	Displays the type of operation performed.	

The table below shows the list of contents displayed in the operation log.

Representation	Contents	Reference
Change Password	Password changed.	AFTER
Firm Version-Up	Upgraded the firmware.	-
Initialize Param	EEPROM was initialized.	-
Wavelength Calib	Wavelength calibration was executed.	AFTER
Acc.-time Optimize	Changed the accumulation time.	AFTER
Leak-sensor Calib	Leak sensor calibration or liquid leak threshold was changed.	AFTER
Change UserID	User ID changed.	AFTER

3.3.6 Displaying the Maintenance Log

1 Launch the web browser and log onto the instrument.

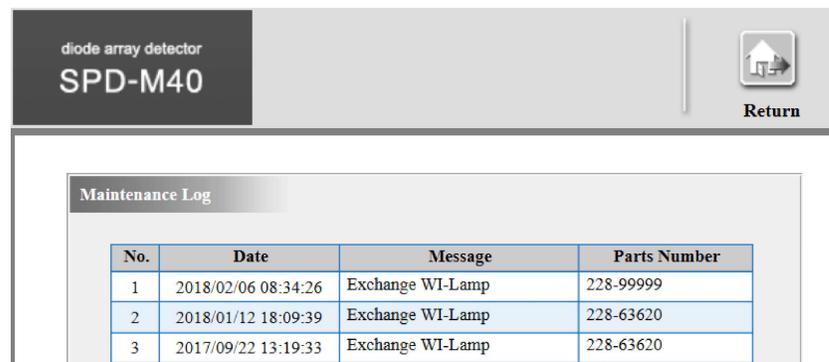
▶▶ Reference "3.3.2 Configuring Network Settings (Web Browser)" P.17

2 Click the [Log] tab after logging in.

The options on the [Log] tab are displayed.

3 Click [Maintenance Log].

The log history of part replacement is displayed.



No.	Date	Message	Parts Number
1	2018/02/06 08:34:26	Exchange WI-Lamp	228-99999
2	2018/01/12 18:09:39	Exchange WI-Lamp	228-63620
3	2017/09/22 13:19:33	Exchange WI-Lamp	228-63620

Item	Description	Remarks
No.	Displays the number of the entry in the maintenance log.	
Date	Displays date and time the maintenance was performed.	Date and time display/power ON time display ▶▶ Reference "3.3.4 Displaying the Error Log" P.25
Message	Displays the type of maintenance performed.	
Parts Number	Displays the part number of the replaced part.	

The table below lists the contents displayed in the maintenance log.

Representation	Contents	Reference
Exchange D2-Lamp	Replaced D2 lamp.	-
Exchange W-Lamp	Replaced W lamp.	AFTER
Change W OP Time	Changed the lighting time of the W lamp.	AFTER
Exchange Parts	Replaced the parts.	-

3.3.7 Displaying the System Check Report

System checks on this instrument can be performed and result reports displayed in a web browser. As an exception, "lamp intensity check" and "wavelength accuracy check" will not be conducted.

NOTE System checks including "lamp intensity check" and "wavelength accuracy check" can be performed from the LC workstation LabSolutions.

1

Launch the web browser and log onto the instrument.

▶▶ Reference ["3.3.2 Configuring Network Settings \(Web Browser\)" P.17](#)

2

Click the [Log] tab after logging in.

The options on the [Log] tab are displayed.

3**Click [System Check Report].**

The system check report is displayed.

System Check Report				
TOTAL OP TIME (hr)	201807121003		4670	
D2 OP TIME (hr)	201807121003	OK	674	2000
D2 EN. NAR(230nm)	201805291637	OK	5679	5000
D2 EN. WID(230nm)	201805291637	OK	5560	5000
W OP TIME (hr)	201807121003	OK	1533	2000
W EN. NAR(600nm)	201805291637	OK	5269	3000
W EN. WID(600nm)	201805291637	OK	5261	3000
WAVE CALIB	201805241141	OK		
SLIT CHECK		***		
SLIT SWITCH TIMES	201807121003		436	
ABS COMP FACTOR	T000000		1.000	
STRAY.L ENERGY NAR	201802161625		2	
STRAY.L BACKGND NAR	201802161625		2507	
STRAY.L ENERGY WID	201802161625		2	
STRAY.L BACKGND WID	201802161625		2568	

3

The report shows one item per line and information is displayed according to the position of the line, as described below.

No.	Item	Description	Remarks
1	Parameters	Displays items and parameter names.	
2	Date	Displays the date and time the check was executed.	If not connected to the system controller, the instrument's total power ON time is displayed.
3	Result	Displays the result of pass/fail judgment, if performed.	
4	Values (1)	Displays settings, such as the leak sensor threshold value and the D2 lamp illumination time, and values that represent the state of the instrument.	
5	Values (2)	Displays the system check judgment criterion or values related to Values (1).	

3.3.8 Displaying the Condition of Consumable Parts

1

Launch the web browser and log onto the instrument.

▶▶ Reference "3.3.2 Configuring Network Settings (Web Browser)" P.17

2

Click the [Log] tab after logging in.

The options on the [Log] tab are displayed.

3

Click [Parts Information].

The usage time and replacement date of consumable parts managed according to the duration of usage are displayed.

The screenshot shows the web interface for the SPD-M40 diode array detector. The page title is 'diode array detector SPD-M40'. There is a 'Return' button with a home icon. The main content area is titled 'Parts Information' and contains a table with the following data:

Item	Life Time	Used Time	Exchange Date
D2Lamp	2000(hrs)	674(hrs)	201802060832
WLamp	2000(hrs)	1533(hrs)	201802060834
PDA	-	3369340(hrs)	-
Slit	-	436(times moved)	-
System	-	4670(hrs)	-

Item	Description	Remarks
D2Lamp	Total usage time of the D2 lamp	
WLamp	Total usage time of the W lamp	
PDA	Total exposure time of the PDA to UV light	Only when the D2 lamp is on.
Slit	Number of times variable slit has switched	
System	Total amount of time that power has been supplied to the instrument	

3.4 Initializing Network Settings, User IDs, and Passwords

If the instrument's network settings, administrator ID or password, operator ID or password are forgotten, initialize the instrument's parameters according to the following procedure.

1

While holding down the [INIT] button on the rear panel, turn on the main power switch and press and hold the [INIT] button for 4 seconds or more.

NOTE If you press and hold for less than 4 seconds, no initialization is performed and normal operation is started.

▶▶ Reference "2.3 Back" P.10

The instrument's parameters are initialized as follows.

▶▶ Reference "3.3.2 Configuring Network Settings (Web Browser)" P.17

Item	Settings
IP address	192.168.200.98
Subnet mask	255.255.255.0
Default gateway	0.0.0.0
Administrator user ID	Admin
Administrator password	Admin
Operator user ID	Operator
Operator password	None

3

3.5 Operation Using SPD-M40 Utility

SPD-M40 Utility software has the following functions:

- Calibration of wavelength, exposure time, etc.
- Check of wavelength, absorbance linearity, etc.
- Check and registration of PDA detector information

For how to operate SPD-M40 Utility, refer to SPD-M40 Utility Help (228-92655).

3.5.1 SPD-M40 Utility

This section explains how to use SPD-M40 Utility.

■ Launching SPD-M40 Utility (PC with LabSolutions Installed)

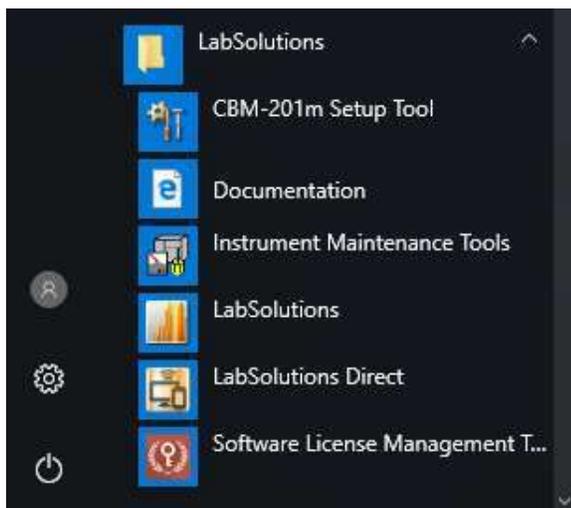
1

Exit LabSolutions analysis.

If the LabSolutions analysis program is running, exit the analysis program.

2

Click the  (Start) menu and click [LabSolutions] - [Instrument Maintenance Tools].

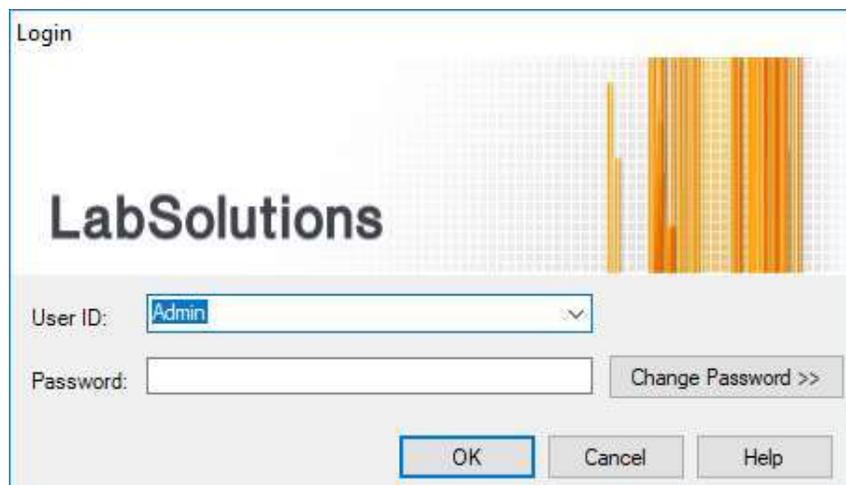


NOTE The procedure above is for Windows 10.

For Windows 7, click the  (Start) menu and click [All Programs] - [LabSolutions] - [Instrument Maintenance Tools] - [Instrument Maintenance Tools].

3 Select the desired options in the [Tool Launcher] window.

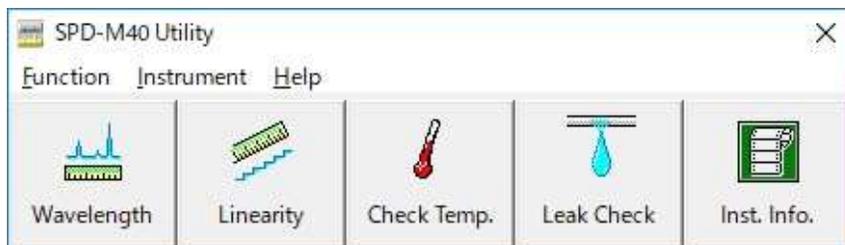
- 1 Select [SPD-M40 Utility] for [Application].
- 2 Select the analysis instrument that is connected to SPD-M40 for maintenance for [Detector Name].
- 3 Click [Run].

4 Select a username in the [User ID], enter the password, and click [OK].

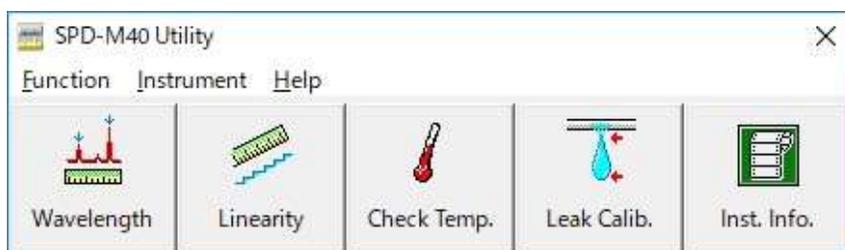
5

SPD-M40 Utility (launcher window) is launched.

If the login to LabSolutions and the connection is successful, the launcher window for SPD-M40 Utility is displayed.



Launcher Window for Operator Rights



Launcher Window for Administrator Rights

NOTE While the power is down or the instrument is starting up, "Power Down" is shown next to the window title.

LabSolutions supports multiple user rights and combinations of these rights can be set for each user. SPD-M40 user rights (operation rights for SPD-M40 Utility) are determined in the following manner according to the combination of the LabSolutions user rights of "system check execution", "modification of system check settings" and "instrument adjustment". The required privileges are ticked (✓) in the following table.

NOTE Users without the "instrument adjustment" privilege cannot launch SPD-M40 Utility.

LabSolutions User Right			Instrument User Right (Operation Privileges for SPD-M40 Utility)
System Check Execution	Modification of System Check Settings	Instrument Adjustment	
✓	-	-	Operator rights
✓	✓	✓	Administrator rights

If failed to login to LabSolutions, retry to login to LabSolutions. If the connection failed, check the usage status of the instrument and the connection status, and select the instrument for connection in the [Tool Launcher] window.

Login to LabSolutions/Connection Result	Message	Action
Login to LabSolutions failed	User ID or password is not correct.	Retry to login to LabSolutions
Connection failed	A SPD-M40 detector is not added to the selected instrument.	Check the LabSolutions settings for the instrument that the SPD-M40 detector is added to for analysis. SPD-M40 Utility can only be used for adjusting M40 instruments.
	Cannot connect to the PDA. It is already in use by another application or is not turned on. Please select another PDA.	Check the usage status of the instrument and the connection status.

■ Launching SPD-M40 Utility (PC without LabSolutions Installed)

1

Insert the CD provided with the instrument into the PC's optical drive and launch SPD-M40 Utility.

By double clicking on the SPD-M40PDA Utility shortcut located in the provided CD, the SPDM40 Utility application "SPDM40PDAUtility.exe" is launched.

Name	Date modified	Type	Size
SPD-M40PDAUtility	10/25/2017 4:44 AM	File folder	
Tools	10/25/2017 4:18 AM	File folder	
SPD-M40PDA Utility	4/16/2017 8:26 PM	Shortcut	4 KB

After the application is launched, the [SPD-M40 User Authentication] window is displayed for selecting the instrument to connect.

- NOTE**
- SPD-M40 Utility is dedicated adjustment software for the SPD-M40 instrument. Other models than M40 are not displayed.
 - SPD-M40 Utility is also used for the adjustment and checking of SPD-M40 instruments that are operating in M20A compatibility mode. In this case, launching SPD-M40 Utility and connecting to such instruments temporarily disables M20A compatibility mode and adjustment and checking is performed in M40 mode. When SPD-M40 Utility is exited, these instruments will return to M20A compatibility mode. When the utility is connected or disconnected, the unit reboots automatically in M20A compatibility mode.

2

Enter an IP address in [IP Address], user ID in [User ID], and password in [Password] under [Instrument to connect] and click [OK].

SPD-M40 User Rights	User ID (Default)	Password (Default)
Administrator	Admin	Admin
Operator	Operator	None

NOTE When connecting with operator rights, functions for changing adjustment values and setting values cannot be executed (the relevant functions are not displayed or are disabled).

Searching for Connectable Instruments (SPD-M40)

Select [IP Target List] to display a list of powered-on SPD-M40 instruments on the network.

NOTE Only SPD-M40 instruments are displayed in the instrument list. Other models than M40 are not displayed. Note that SPD-M40 instruments operating in M20A compatibility mode are displayed in the instrument list and "SPD-M20A" appears in the server type information field.

3

SPD-M40 Utility (launcher window) is launched.

If the connection and user authentication is successful, the launcher window of SPD-M40 Utility is displayed. If instrument connection or user authentication fails, a message appears and the launcher window of SPD-M40 Utility is displayed in offline mode ([Offline] is shown on the title bar). In this case, select the instrument for connection again.

Connection/Authentication Result	Message	Action
Connection and user authentication successful	(The launcher window for SPD-M40 Utility is displayed.)	-
Connection failed	Cannot connect to the PDA. It is already in use by another application or is not turned on. Please select another PDA.	Check the usage status of the instrument and the connection status. SPD-M40 Utility can be used only for adjusting M40 instruments. Try connecting again or changing the instrument for connection by selecting [Select Instrument to Connect] on the [Instrument] menu in the launcher window.
User ID authentication failed	Failed to authenticate for SPD-M40.	Check the user ID and password. Try connecting again or changing the instrument for connection by selecting [Select Instrument to Connect] on the [Instrument] menu in the launcher window.

3

3.6 Setting Parameters

The parameters that must be set prior to performing analysis are shown in the table below, each along with its setting range, step (minimum interval), and default value. All instrument parameters are set using LC workstation software on a PC. For details on setting procedures, refer to the instruction manual of the LC workstation software.

Parameter	Range	Step	Default Value
Exposure time	5 ms to 640 ms	0.1 ms	Adjusted for each instrument before shipment.
Bandwidth	0 nm to 500 nm	1 nm	4 nm
Slit width	1.2 nm, 8 nm	Switch	8 nm
Wavelength	190 nm to 800 nm	1 nm	254 nm (analog output default setting)
Sampling time	10, 25, 80, 160, 240, 320, 640, 1280, 2000 ms	Switch	640 ms
Time constant (response)	0 (OFF), 10, 25, 80, 160, 240, 320, 640, 1280, 2000 ms	The setting automatically switches between the values on the left.	1280 ms
Lamp ON/OFF	D2, W, D2+W, OFF	Switch	D2
Cell temperature	0 (OFF), 19 to 50 °C	1 °C	40 °C
UV Cut-Off Filter	OFF, ON	Switch	OFF

■ Exposure Time

Exposure time is the length of time during which the light-detecting photodiode array (PDA) is exposed to light.

As exposure time increases, the amount of light received by the PDA also increases while noise decreases. However, if the exposure time is too long, the PDA elements will saturate preventing measurement.

The optimal value* is automatically set on this instrument by automatically setting the exposure time.

▶▶ **Reference** 40-series System Guide

(*Optimal value: the optimal value is an exposure time when the output voltage from the PDA elements reaches the standard value. Separate values are set for the 1.2 nm and 8 nm slits.)

 **Hint** Note that if a sampling time shorter than the exposure time is set, the exposure time automatically changes to equal the sampling time.

■ Bandwidth

Bandwidth expresses the width of the wavelength region for averaging absorbance values.

Example: Measurement wavelength: 250 nm, bandwidth: ± 4 nm

➔ Average of measurement values over wavelengths from 246 to 254 nm

While noise decreases as the bandwidth increases, spectral resolution decreases with increased bandwidth.

Normally, set this value to 4 nm.

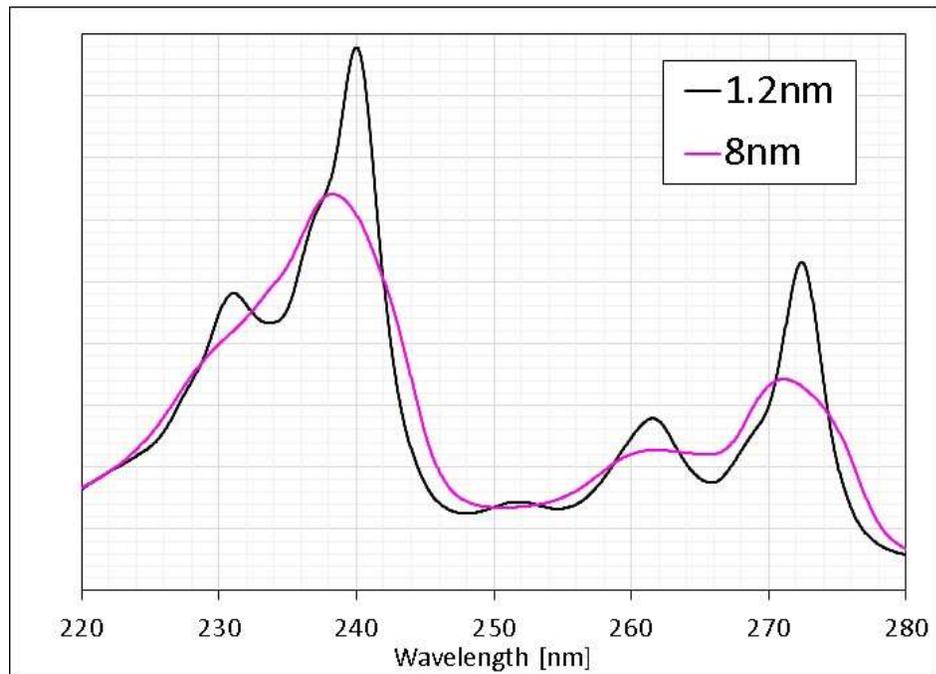
■ Slit Width

This instrument allows selection between two levels of slit width, 1.2 nm and 8 nm, depending on the analysis requirements.

Use of an 8 nm slit slightly reduces spectral resolution but increases light intensity and improves S/N.

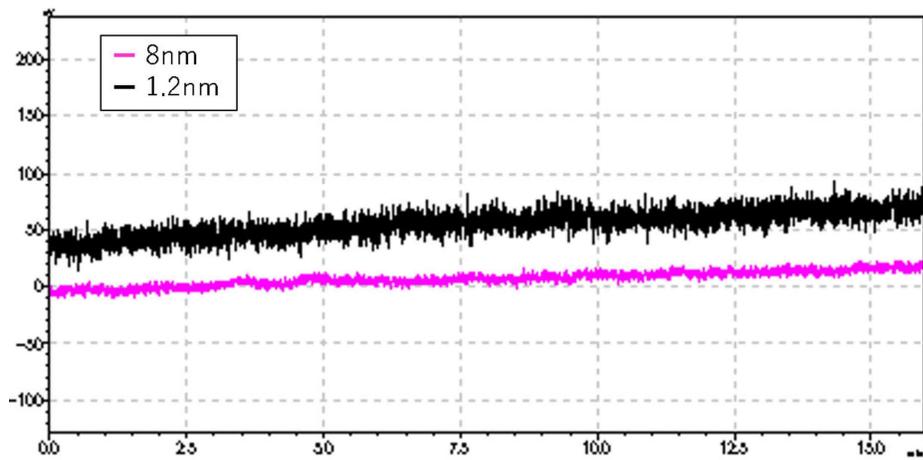
On the other hand, use the 1.2 nm slit to prioritize spectral resolution over S/N.

Comparison of the spectral resolution between 1.2 nm and 8 nm is shown below.



Comparison of spectral resolution (pyrene spectrum).

Comparison of noise between 1.2 nm and 8 nm is shown below.



Noise comparison (sampling time is 80 ms, time constant is 160 ms)

■ Wavelength

This parameter sets the wavelength of the chromatogram to be displayed.

In the case of a PDA detector, since three-dimensional data can be recorded, it is possible to monitor other wavelengths as long as they are within the recording wavelength range.

This instrument is equipped with 4 channels of analog output terminals, which enables it to be used as a multi channel UV detector.

For details on setting the wavelength, see "[3.6.1 Analog Output Usage and Settings](#)" P.49.

Reference Wavelength

If a reference wavelength is set, the absorbance of the reference wavelength is subtracted from that of the measurement wavelength. This reduces noise caused by fluctuations in the light intensity of the lamp. The default value is 350 ±20 nm.

Set the reference wavelength range to a wavelength at least 20 nm away from the measurement wavelength at which samples do not absorb.

Example: Reference wavelength: 350 ±20 nm

➔ Measurement wavelength should be $(350 - 20 - 20 =)$ 310 nm or less.

Measurement wavelength = Reference Wavelength ±20 nm

NOTE Normally set the reference wavelength to a wavelength at which the sample does not absorb. If the sample absorbs at the reference wavelength, use caution when handling the data.

Recording Wavelength Range

This is used to set the wavelength range over which recording will be conducted. The instrument can measure the wavelength range of 190 nm to 800 nm and record only the desired wavelengths to reduce the data size. If a reference wavelength is used, it is necessary to record up to the upper limit of the reference wavelength.

Example:

	Wavelength	Bandwidth
Measurement wavelength channel 1	210 nm	±4 nm
Measurement wavelength channel 2	250 nm	±4 nm
Reference wavelength	350 nm	±20 nm

In this case, set the recording wavelength range as 206 nm to 370 nm.

Spectral Resolution

Spectral resolution is equivalent to the wavelength interval of the spectrum for acquisition and can be set to the 3 levels of 1024, 512, and 256. The relationship between spectral resolution, wavelength interval, and data volume is shown below.

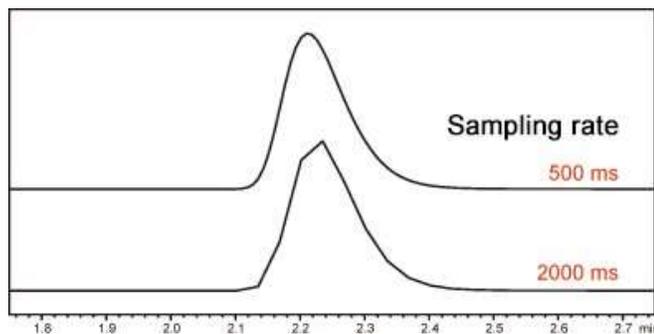
Decreasing the spectral resolution reduces the data volume. Excessively decreasing the spectral resolution decreases the wavelength resolution, which results in poor repeatability of measurement wavelength.

Spectral Resolution	Wavelength Resolution	Data Volume
1024	Approx. 0.5 nm	-
512	Approx. 1 nm	Half of the spectral resolution of 1024
256	Approx. 2 nm	Quarter of the spectral resolution of 1024

■ Sampling Time

This is the cycle at which data is output. Normally, there should be approximately 20 sampling points in the full width at half maximum of the target peak.

Too long a sampling period causes few signal changes to be tracked, which results in a distorted peak shape. Too short a sampling period makes the data file size larger than needed.



NOTE A shorter sampling time leads to a larger data size and therefore a shorter maximum analysis time. The chromatogram plot time that LabSolutions can display is the shorter of either 1 hour or the maximum analysis time calculated as described later. See the calculation described later and set an appropriate sampling time, recording wavelength range, and spectral resolution.

HINT For monitoring a chromatogram for a longer time than usual to check the stability after power-on, make the sampling time value larger for a longer analysis time.

How to Calculate

Calculations for the data volume per analysis and maximum analysis time are performed using the following formulae.

Data volume (MB)

$$= 4.5 \times 10^{-4} \times \text{analysis time (min)} \times \{\text{end wavelength} - \text{start wavelength} + 1 \text{ (nm)}\} \times \text{spectral resolution} / \text{sampling time (ms)}$$

Maximum analysis time (min)

$$= 2.237 \times 10^{-3} \times \text{Upper limit of memory for storing PDA data (MB)} \times \text{sampling time (ms)} / (\text{end wavelength} - \text{start wavelength} + 1 \text{ nm}) / \text{spectral resolution}$$

The upper limit of data volume (upper limit of memory for storing PDA data) for each analysis can be set on the SPD-M40. The setting range for the upper limit of memory for storing PDA data is 32 to 128 MB (in 1 MB steps) or unlimited. (The default is 128 MB. Set the value to 128 MB or less. The setting for the upper limit of memory for storing PDA data is accessible by clicking [Detail Option] located on the [PDA] tab on the [Advanced] view of the [Instrument Parameters View] window in LabSolutions. Please set it to 0 if it is unlimited.)

Example: A data volume of 69 MB and data collection time of 18 minutes below are examples given by the formulas above.

Measurement Wavelength Range	Sampling Time	Spectral Resolution	Data Volume	Data Collection Time
200 nm to 300 nm	10 ms	1024	Approx. 69 MB	10 minutes
200 nm to 300 nm	10 ms	1024	128 MB (upper limit)	Data collection of 18 minutes max.

■ Time Constant (Response)

A time constant is used when filtering data to reduce noise.

An increase in the time constant will increase the reduction in noise. However, if the time constant is excessively increased, the peak height decreases. Normally, the constant is automatically set to double the sampling time value.

■ Lamp ON/OFF

This instrument uses a D2 lamp and a W lamp as the light source that provides a 190 to 800 nm wavelength range absorption spectrum.

To measure only the ultraviolet region, turn on the D2 lamp only.

Lamp	Recommended Analysis Wavelength Range
D2 ON	190 nm to 500 nm
W ON	500 nm to 800 nm
D2 and W ON	190 nm to 800 nm

The D2 lamp and a W lamp are turned off after a sequence of analysis ends to prevent premature lamp burnout.

■ Polarity

Setting the polarity to "-" inverts the positive or negative sign of absorbance. Normally use "+" for polarity. If the absorbance of the mobile phase is higher than the absorbance of the component targeted for analysis (using the indirect absorbance detection method), set the polarity to "-".

■ Controlled Cell Temperature

This instrument can control the temperature of the flow cell to reduce the influence of variations in the ambient temperature to the baseline. This is particularly effective when the light absorbance in the mobile phase is large or when temperature dependency of the absorbance of the sample is large.

Set the temperature at the ambient temperature +15 °C min. The range from 40 to 50 °C can be always used, however, irrespective of the ambient temperature.

NOTE When the temperature setting is 40 °C or lower, the ambient temperature has to be so controlled that the temperature setting becomes the ambient temperature +15 °C min. If cell temperature has to be controlled below the ambient temperature +15 °C, please contact our sales office or dealer.

If the temperature of the column is higher than the set temperature of the flow cell, the heat of the mobile phase is transferred and the temperature of the flow cell may not drop to the set temperature. In this case, increase the set temperature of the flow cell.

If the flow cell temperature exceeds the upper limit of 50 °C, turn off the cell temperature control.

■ UV Cut-Off Filter

The filter prevents samples from deteriorating and decomposing by blocking UV rays with short wavelengths.

The cutoff wavelength (the transmittance is almost 0%) is less than 220 nm.

Conditions for Use

NOTE Measure at 240 nm or more. Noise and drift may be worse, which may interfere with analysis.

Wavelength Range	Conditions
Measurement wavelength < 240 nm	Noise increase > double (Transmittance < 20 %) * The shorter the wavelength, the worse the noise.
240 nm ≤ measurement wavelength ≤ 250 nm	Noise increase is approx. double (Transmittance: Approx. 25 %)
250 nm < measurement wavelength < 260 nm	Noise increase is approx. 1.5 times (Transmittance: Approx. 40 %)
260 nm ≤ measurement wavelength	Noise increase < 1.5 times (Transmittance > 60 %)

■ Ready Check

The ready check ensures that analysis starts after heat balance is established at temperature-controlled locations.

The ready check is available for the flow cell and polychromator.

3.6.1 Analog Output Usage and Settings

■ Analog Output Overview

The back of the instrument is equipped with 4 channels of analog output terminals, allowing it to be used as a multi wavelength UV detector.

The absorbance signals from the detector can be output to recorders, data processors, and instruments that require analog input for control.

Output settings can be configured using the following software.

1. LabSolutions

2. SPD-M40 Utility

▶▶ [Reference SPD-M40 Utility Help \(228-92655\)](#) "Check / set analysis parameters"

Analog Output Specifications

Anlog output range : 0.5, 1, 1.25, 2, 2.5, 4 AU/V (selectable and configurable)

Polarity : +, - (selectable and configurable)

Voltage output range : -0.1 to +1.0 (V)

■ Configuring Analog Output Using LabSolutions

1

Launch LabSolutions.

▶▶ Reference For details on LabSolutions operation, refer to the LabSolutions instruction manual.

2

Start the [Instrument Parameters View] and select [Advanced].

Instrument Parameters View Normal **Advanced** End Time : 60.00 min

Data Acquisition PDA

Model: SPD-M30A

Lamp: D2

Polarity: +

Wavelength

Start Wavelength: 190 nm

End Wavelength: 700 nm

Spectrum Resolution: 1024

Maximum Acquisition: 350.21 min

Slit Width: 8 nm

Reference Correction

Ref. Wavelength: 350 nm

Ref. Bandwidth: .20 nm

Apply to Data Processing Parameters

Obtain from Data Processing Parameters

Analog Output

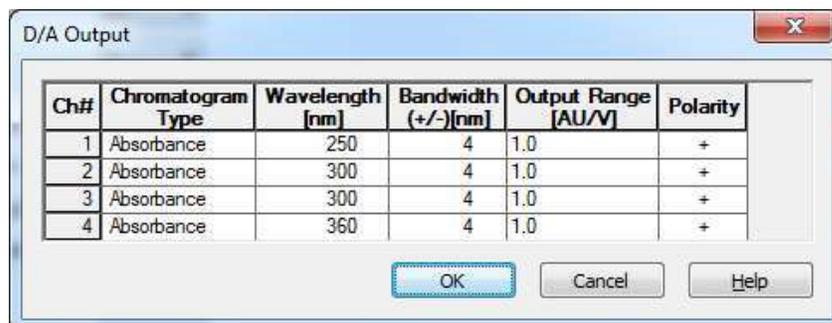
Detail Option

Data Acquisi...

3

Select the [PDA] tab and click the [Analog Output] button.

The [D/A Output] window is displayed.



Name	Function
Chromatogram Type	Select [Absorbance], [Max. Plot], or [Average]. <ul style="list-style-type: none"> As well as in the normal measurement, [Absorbance] outputs the integrated average spectra in the bandwidth. [Max. Plot] outputs the maximum absorbance for each retention time within the set wavelength range. [Average] outputs the average absorbance within the set wavelength range.
Wavelength	The wavelength for analog output can be set for up to 4 channels.
Bandwidth	The analog output signal is the average of absorbance data \pm the configured bandwidth around the set wavelength.
Output Range	Set the range of the analog signal output voltage.
Polarity	Set the polarity (positive/reversed voltage) that increases the absorbance level.

3

3.7 Calibration

In the SPD-M40, the following items can be calibrated.

Item	Description	Reference
Exposure time/W lamp voltage settings	Sets the exposure time appropriate for the D2 lamp (deuterium lamp) and W lamp and the voltage of the W lamp for the slit width (1.2 nm/8 nm).	SPD-M40 Utility Help (228-92655) "Setting accumulation time"

Item	Description	Reference
Wavelength accuracy calibration	Calibrates the deviation between the wavelength setting and the wavelength measured. The emission line of the D2 lamp (deuterium lamp) and the absorption line of the embedded filter (holmium filter) are used to measure the wavelength accuracy. After the measurements, the wavelength accuracy is automatically calibrated based on those results.	SPD-M 40 Utility Help (228 - 92655) "Calibration of wavelength"

▼ **NOTE** Settings of exposure time/W lamp voltage and calibration of wavelength accuracy are performed from PDA Utility. For the details of the operation, refer to SPD-M40 Utility Help.

3.8 Preparation before using option cell (Registration / Calibration)

SPD-M40 reads out the cell ID memory information recorded in the flow cell mounted and applies calibration information stored in the main unit automatically according to that cell ID memory (cell ID memory function). The calibration information that can be stored for each cell ID memory is as follows.

▼ **NOTE** Turn off the temperature control of the flow cell before exchanging the flow cell.

Calibration Information	Description	Calibration for Each Cell
Exposure time information	Perform exposure time configuration and store the optimal exposure time on the installed cell.	Required
Wavelength calibration information	Perform automatic wavelength calibration and store the wavelength calibration information (element wavelength conversion table) on the installed cell.	Required

The cell bundled with this instrument when shipped has been factory-calibrated. Before using a cell other than the one bundled prior to shipment, register the cell and calibrate it as follows. The number of cells that can be registered in an SPD-M40 is five. Perform the following tasks to utilize the cell ID function.

- 1 Register a cell.
▶▶ Reference SPD-M 40 Utility Help (228 - 92655) "Cell Registration"
- 2 Calibrate the registered cell.
▶▶ Reference SPD-M 40 Utility Help (228 - 92655) "Cell Registration"

3.9 Validation

3.9.1 Check Term

Check terms for the rack changer validation are listed below.

Check Term	Description
"3.9.2 Light Source Usage Time Check"	Checks the amount of time the light source has been used.
"3.9.3 Wavelength Accuracy Check"	Checks the wavelength accuracy using the mercury/deuterium lamp emission line and lambda maximum of the holmium oxide (Ho) filter.
"3.9.4 Lamp Intensity Check"	Checks the intensity of the light source in use.

3

3.9.2 Light Source Usage Time Check

■ Objective

To check the amount of time the light source has been used.

■ Check Procedure

1

Launch SPD-M40 Utility.

▶▶ Reference "3.5.1 SPD-M40 Utility" P.34

2

Click the  (instrument information).

3

Check the value of [D2 Lamp Time] and [W Lamp Time].

CRITERIA	D2 lamp maximum usage time: Approximately 2,000 hours W lamp maximum usage time: Approximately 2,000 hours
----------	---

3.9.3 Wavelength Accuracy Check

■ Objective

The wavelength accuracy check verifies that the difference between the set wavelength and actual wavelength satisfies the CRITERIA (acceptance criteria). This check is performed automatically and the results are displayed on screen.

The wavelength accuracy check can be performed using the following methods.

- D2/Ho
Perform the wavelength accuracy check using the emission line of the D2 lamp and lambda maximum of the holmium oxide (Ho) filter. This method is easier since it uses the integrated Ho filter.
- Caffeine
Wavelength accuracy is checked with the absorption spectrum of caffeine.

NOTE The wavelength accuracy check can also be done with theophylline. For details, please contact our sales office, agent or service representative.

Check Mode	Wavelengths Used for Checking Wavelength Accuracy	
	Lambda Maximum of the Holmium Oxide Filter	D2 Lamp Emission Line
D2/Ho	241.5 nm, 360.8 nm	486.0 nm, *656.1 nm

Check Mode	Wavelengths Used for Checking Wavelength Accuracy
Caffeine	Absorption maximum : *205.0 nm *273.0 nm Absorption minimum : *245.0 nm

The wavelengths shown in the table are for the 1.2 nm slit. If the 8 nm slit is used, perform the wavelength accuracy check at the wavelengths with an asterisk (*).

Criteria: D2/Ho error \leq 1.0 nm

Caffeine error \leq 2.0 nm

The check is performed while automatically switching between the 1.2 nm and 8 nm slits.

■ Wavelength Accuracy Check Using the D2 Lamp and Holmium Oxide Filter

Check Procedure

1

Flush the flow cell with pure water, methanol, or acetonitrile from the pump.

NOTE Make sure that air bubbles are purged from the detector cell to ensure accurate measurements.

2

Launch SPD-M40 Utility.

▶▶ Reference "3.5.1 SPD-M40 Utility" P.34

3

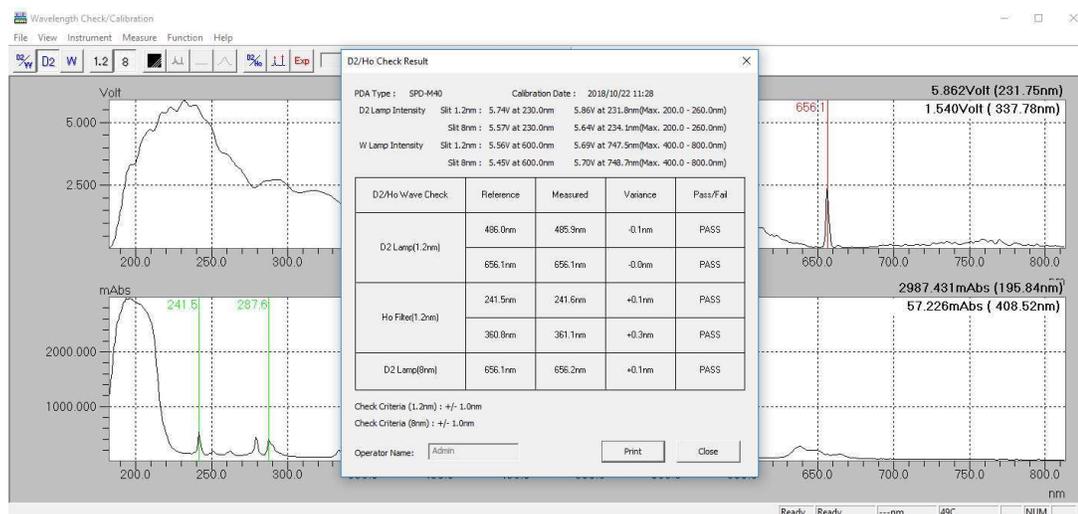
Click the  (wavelength check) or  (wavelength check/calibration).

The [Wavelength Check] or [Wavelength Check/Calibration] window is displayed.

4

Click  (wavelength check) or [Wavelength Check] - [Execute] on the [Function] menu.

The wavelength accuracy check is performed and the results are displayed on screen.



Hint The spectrum displayed after the wavelength accuracy check completes is the wavelength check spectrum for the 1.2 nm slit. Select [Wavelength Check Result (8 nm)] from the selection box on the tool bar to display the wavelength check spectrum for the 8 nm slit.

5

Confirm the results of the wavelength accuracy check and click [OK].

Confirm that the results of the wavelength accuracy check satisfy the CRITERIA. The results can be printed by clicking the [Print] button.

CRITERIA	All the judgments show [PASS].
----------	--------------------------------

▶▶ Reference If the check fails, refer to "[Corrective Action When Wavelength Accuracy Does Not Satisfy CRITERIA](#)" P.58



Hint The execution results of wavelength accuracy checks performed after SPD-M40 Utility startup can be displayed until SPD-M40 Utility is exited by clicking [Wavelength Check] - [Check Result] on the [Function] menu. However, if wavelength calibration is performed or the connected instrument is changed, the check results are cleared and cannot be displayed again.

■ Wavelength Accuracy Check Using the Caffeine

Procedure "1" Perform with SPD-M40 utility

1

Launch SPD-M40 Utility.

▶▶ Reference "3.5.1 SPD-M40 Utility" P.34

2

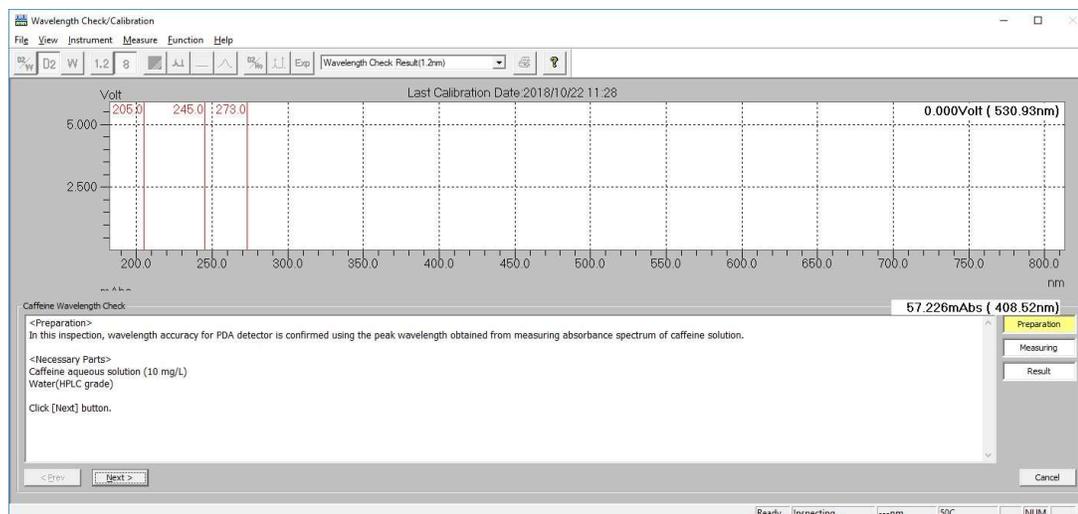
Click the  (wavelength check) or  (wavelength check/calibration).

The [Wavelength Check] or [Wavelength Check/Calibration] window is displayed.

3

Click [Caffeine Wavelength Check] - [Execute] on the [Function] menu.

The light intensity spectrum is displayed in the upper part of the screen and the wizard is displayed in the lower part of the screen. Follow the wizard to check the wavelength accuracy.



4

Fill the flow cell with pure water using a syringe and click [Next].

Clicking [Next] here displays the spectrum to be monitored.

5

Check that the light intensity has become stable on the screen and click [Next].

The absorbance when [Next] is clicked is memorized as the background absorbance and absorbance measurement starts.

6

Fill the flow cell with caffeine solution using a syringe.

- 7** Check that the absorbance has become stable on the screen and click [Next].
The absorbance when [Next] is clicked is memorized as the absorbance of caffeine solution and the caffeine wavelength check result is displayed with the background absorbance.

- 8** Check the caffeine wavelength check result.

CRITERIA	[Passed] is displayed for all the judgment results of slits and measured wavelengths.
----------	---

Procedure "2" Perform with Work station

- 1** Prepare the following items.

Part Name	Description
Data Processing Unit	LabSolutions
Flow Restrictor	SUS 4 m × 0.1 mm I.D. and 2 m × 0.5 mm I.D. or PEEK 3 m × 0.13 mm I.D. and 2 m × 0.5 mm I.D. (In case of using UHPLC Inert cell or Low Dispersion Inert cell)
Mobile Phase	Purified water (HPLC grade or equivalent)
Aqueous Caffeine Solution	228-73475 (10 mg/L) or 228-73475-05 (20 mg/L) or 228-67619-41 20 mg/L caffeine samples (for set of 5 concentrations)

*1 The flow restrictor is removed for system configurations that result in abnormal pump pressures at the specified flowrate.

*2 Be sure to use a degassing unit to degas mobile phases.

- 2** Specify instrument parameter settings as indicated below.

Item	Value
Flow Speed	0.5 mL/min
Oven Temperature	40 °C
Analysis Time	2 minutes (can be changed as necessary)
Wavelength	190 to 280 nm
Injection Volume	10 uL (base injection volume, which can vary depending on loop volume)

- 3** After the baseline stabilizes, inject mobile phase to confirm that no peaks appear in the chromatogram.

NOTE For manual injectors, inject five times more mobile phase than the loop volume.

4 Inject a caffeine sample.

▼ **NOTE** For manual injectors, inject five times more caffeine solution than the loop volume.

5 In the results shown in the [Chromatogram View], identify the local minimum and maximum absorbance values near the setting value and record their deviation from the setting value.

Absorbance maxima near 205 and 273 nm

Absorbance minimum near 245 nm

Control Criteria	Within ± 2 nm of all three wavelengths
------------------	--

■ Corrective Action When Wavelength Accuracy Does Not Satisfy CRITERIA

If the check fails, any of the following causes is likely.

Cause	Corrective Action
Air bubbles stay in the flow cell/optical plate	Perform corrective action for bubbles. ▶▶ Reference "Corrective Action for Bubbles" of "5.3 Periodic Inspection and Maintenance" in the Nexera Series System Guide
The solvent in the flow cell absorbs light.	Replace the solvent in the flow cell with distilled water, methanol, or acetonitrile.
The flow cell window is dirty.	Clean the flow cell. ▶▶ Reference "4.3 Flow Cell Inspection/Cleaning"
Wavelength accuracy calibration has not been performed properly.	Perform wavelength accuracy calibration. ▶▶ Reference "4.3 Flow Cell Inspection/Cleaning"
Problems in the optical system (deteriorated mirror or optical plate etc.).	Perform maintenance on the optical system (contact your Shimadzu representative).

■ Measurement Method for Wavelength Accuracy

Wavelength calibration is performed on the SPD-M40 using the 241.5 nm lambda maximum of the Ho filter and the 656.1 nm emission line of the D2 lamp. Wavelength accuracy is achieved through adjustment using these wavelengths as references.

3.9.4 Lamp Intensity Check

■ Objective

To check the intensity of the D2 lamp and W lamp.

■ Check Procedure

1

Fill the cell with distilled water, acetonitrile or methanol.

2

Launch SPD-M40 Utility.

▶▶ Reference "3.5.1 SPD-M40 Utility" P.34

3

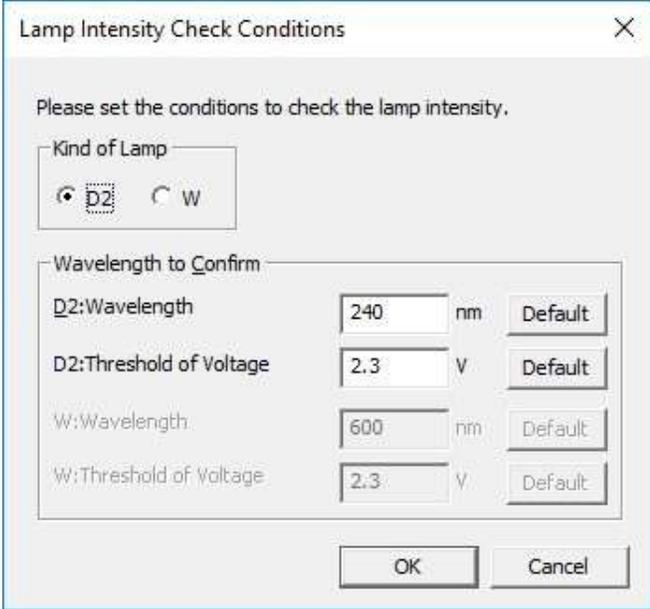
Click the  (wavelength check) or  (wavelength check/calibration).

The [Wavelength Check] or [Wavelength Check/Calibration] window is displayed.

4

Click [Check Lamp Intensity] on the [Function] menu.

The [Lamp Intensity Check Conditions] window is displayed.



Lamp Intensity Check Conditions

Please set the conditions to check the lamp intensity.

Kind of Lamp

D2 W

Wavelength to Confirm

D2:Wavelength	240	nm	Default
D2:Threshold of Voltage	2.3	V	Default
W:Wavelength	600	nm	Default
W:Threshold of Voltage	2.3	V	Default

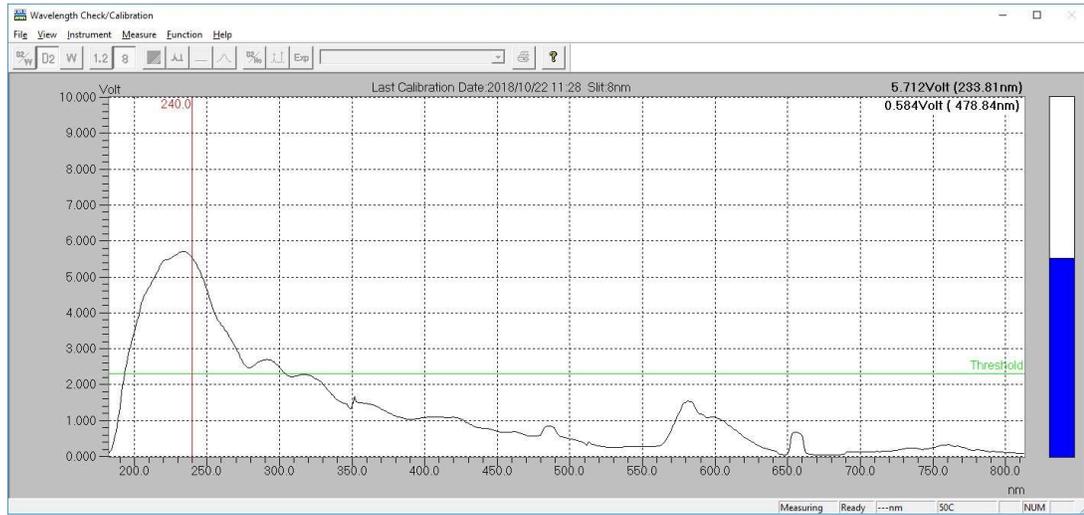
OK Cancel

3

5

Enter the wavelength used for checking the lamp intensity and voltage threshold (reference value), and then click [OK].

Set the wavelength used for checking the lamp intensity and voltage threshold based on the CRITERIA. Clicking [OK] displays the [Wavelength Check/Calibration & Optical Adjustment] window and starts lamp intensity measurement.



6**See the light intensity spectrum on the screen and check that the maximum light intensity in the specific wavelength range is exceeding the threshold.**

In the case of the D2 lamp, confirm that the maximum light value at 200 nm to 260 nm exceeds the threshold. In the case of the W lamp, confirm that the maximum light value at 400 nm to 800 nm exceeds the threshold. Click or [Check Lamp Intensity] on the [Function] menu again to end the lamp intensity check.

CRITERIA	D2 lamp: Maximum light value at 200 nm to 260 nm \geq 2.3 V
	W lamp: Maximum light value at 400 nm to 800 nm \geq 2.3 V

The check wavelength intensity bar to the right of the spectrum is displayed blue when the lamp intensity at the check wavelength exceeds the threshold, and red when the lamp intensity does not exceed the threshold.

Setting the CRITERIA During Periodic Maintenance After Instrument Delivery

- The lamp intensity gradually decreases and the baseline becomes noisier over the service life of the lamps.
- In case of the lamps, it is possible to keep using the same lamp even if the lamp intensity underruns the lamp intensity threshold as long as the S/N ratio is large enough. Therefore the acceptance value for lamp intensity should be set based on the required level of sensitivity for each analysis.
In other words, even if the lamp intensity value is low, such an intensity can be used for analyses other than high sensitivity analysis.
However, note that noise increases with lower lamp intensity values. Set the acceptance value for lamp intensity while taking into account any reduction of the S/N ratio of the target peak for analysis.

6.6. If using a lamp that has exceeded its service life of 2000 hours, the lamp may flicker leading to noise or become difficult to turn on. If the cumulative operating time of the lamp has exceeded the lamp's service life rating, replace the lamp with a new one .

3

■ Corrective Action When Lamp Intensity Does Not Satisfy CRITERIA

Cause	Corrective Action
Air bubbles stay in the flow cell.	Perform corrective action for bubbles. ▶▶ Reference "Corrective Action for Bubbles" of "5.3 Periodic Inspection and Maintenance" in the Nexera Series System Guide
The solvent in the flow cell absorbs light.	Replace the solvent in the flow cell with distilled water or acetonitrile.
The flow cell window is dirty.	Clean the flow cell. ▶▶ Reference "4.3 Flow Cell Inspection/Cleaning"
Lamp has reached the end of its service life.	Check the operating time of the D2 lamp and replace it if the operating time exceeds the CRITERIA. ▶▶ Reference "3.9.2 Light Source Usage Time Check" "4.7 Replacing the Lamp"
Exposure time is too short.	Set the exposure time. ▶▶ Reference "Corrective Action for Bubbles" of "4.2 Setting the Exposure Time" in the SPD-M40PDA Utility HELP
A mirror or lens has deteriorated.	Perform maintenance on the optical system (contact your Shimadzu representative).

4 Maintenance

4.1 Periodic Inspection and Maintenance

Periodic inspections of this instrument must be performed to ensure safety during use. It is possible to have these periodic inspections performed by Shimadzu service personnel on a contractual basis.

For information regarding a maintenance inspection contract, contact your Shimadzu representative.

WARNING



Instruction

Turn off the main power switch on the back of the instrument and unplug the power cable prior to performing inspections and maintenance when instructed.

Failing to do so may result in fire, electric shock, or malfunction.

CAUTION



Prohibition

Never remove the main cover.

This may cause injury or malfunction of the instrument. Contact your Shimadzu representative if the main cover must be removed.



Instruction

When replacing parts, only use the parts listed in "1.2 Component Parts" P.3 and "5.2 Consumable Parts" P.92.

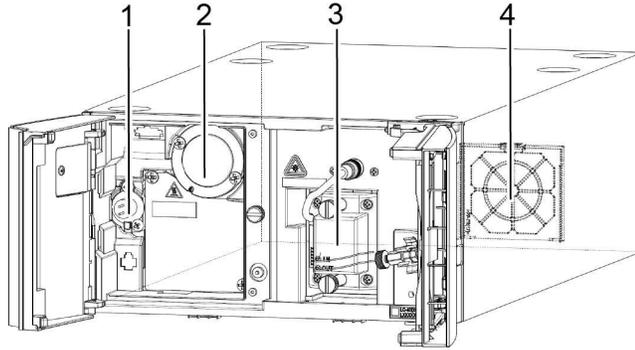
If any other parts are used, they may be damaged, resulting in injury or malfunction.

4.1.1 Prior to Inspection and Maintenance

- Purge the mobile phase in the flow lines with water.
- Wipe away any dirt from the front cover and the operation panel.
- If the operation panel is soiled, wipe away any dirt from the display with tissue paper or a soft cloth moistened with water.

4.1.2 Periodic Inspection and Maintenance List

The replacement and maintenance periods listed in this table are presented only as guidelines. These are not guaranteed periods and will vary depending on the conditions of use.



No.	Inspection/Maintenance Item	1 Year	2 Years	3 Years	Remarks	See
1	D2 lamp replacement	✓	✓	✓	Replace at about 2000 hours of total illumination time.	P.80
2	W lamp replacement			✓	Replace at about 2000 hours of total illumination time.	P.84
3	Flow cell replacement		✓		Replace the flow cell if it is unclean and light intensity is low even after cleaning it.	P.67
	Flow cell gasket replacement		✓		Replace the gaskets after disassembling and cleaning the flow cell.	P.74
	Flow cell lens replacement		✓		Replace the lenses when some dirt remains after disassembling and cleaning the flow cell.	
4	Dust filter replacement		✓	✓	Replace the filter when it becomes discolored from the original white color.	P.87

6.6.
6.6.

4.1.3 Check After Inspection and Maintenance

After inspection and maintenance, check for any leakage during pumping.

- ▶▶ Reference For details, refer to System Guide "5.3 Fault Diagnosis and Measures"
 System Guide "5.2.4.Baseline Does Not Stabilize"
 System Guide "5.25 Noise Appears in Baseline"

4.2 Removing/Installing the Flow Cell

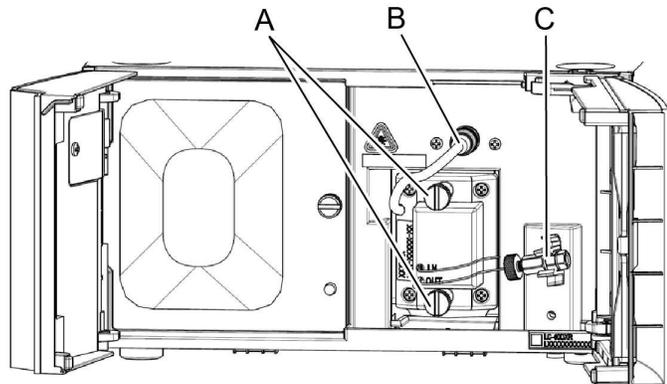
NOTE Be sure to turn off the power of the equipment when plugging or unplugging the flow cell cable connector.

4.2.1 Removing the Flow Cell

- 1 Open the front cover.
- 2 Remove the coupling from the coupling holder (C).
- 3 Disconnect the connector (B).

NOTE Turn off the equipment before unplugging the connector.

- 4 Loosen the 2 cell mounting screws (A) and remove the cell.



4

4.2.2 Installing the Flow Cell

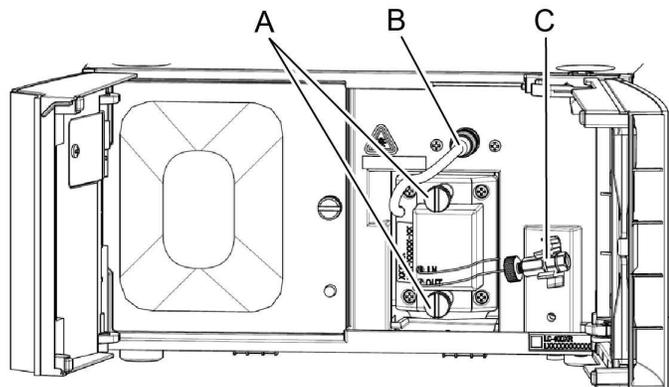
- 1 Turn up the connector side and then install the flow cell to the instrument.
- 2 While holding the flow cell fitted to the installation surface, tighten the two cell mounting screws (A) alternately.
- 3 Insert the connector (B) into the instrument. With the coupling holder (C), fix the coupling to the instrument.

NOTE Make sure that the equipment is turned off before plugging the connector.

- 4 Connect the inlet tubing of the flow cell directly to the column. Via the coupling, connect the outlet tubing of the flow cell to the drain tubing.

NOTE When performing the above operation, do not let any air enter the flow lines.

- 5 Close the front cover.



4.3 Flow Cell Inspection/Cleaning

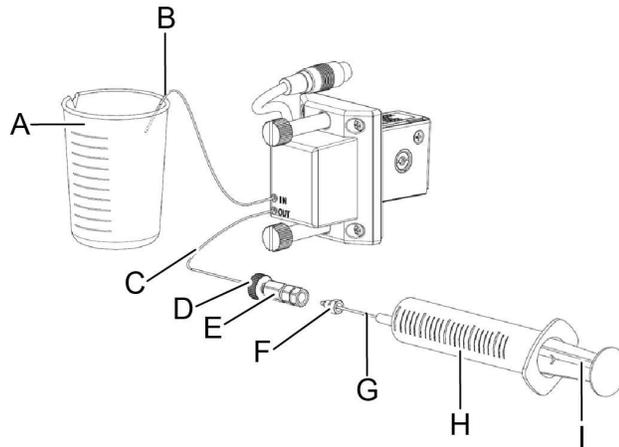
If the baseline shows excessive noise or a large drift, check the flow cell. If the check finds some bubbles or dirt, try a simple cleaning procedure. After cleaning the flow cell with the syringe according to the following procedure, if the light intensity is not improved, replace the column with the coupling and pump a rinsing solution (2-propanol) into the flow cell assembly for 2 hours.

NOTE • If the light intensity is not improved after cleaning, replace the flow cell assembly with a new one.

Necessary Parts

Part Name	Type	Part No.
Syringe, 1ML	Standard accessory	228-57028
Syringe needle	Standard accessory	228-57027
Coupling 1.6-0.8C *1	Standard accessory	228-40998-10
Male nuts 0.8MN-PEEK	Standard accessory	228-46363
Male nuts ETFE	Standard accessory	228-56759
2-propanol		

*1 When using Inert cell, UHPLC Inert cell or Low Dispersion Inert cell, use the supplied coupling 1.6-0.8C PEEK.



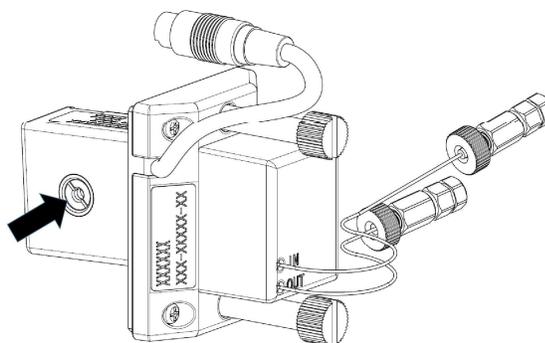
Sign	Name	Sign	Name
A	Waste container	F	Male nut 0.8MN-PEEK
B	Cell inlet tubing	G	Syringe needle
C	Cell outlet tubing	H	Syringe
D	Male nut ETFE	I	Plunger
E	Coupling 1.6-0.8C		

1 Remove the flow cell.

▶▶ Reference "4.2.1 Removing the Flow Cell" P.65

2 Set the flow rate to 1 mL/min and then start pumping.

3 While the mobile phase is flowing, look at the inside of the flow cell in the direction of the arrow to check that no bubble or dirt is in the cell.



If some bubbles or dirt is in the cell, proceed to the simple cleaning.

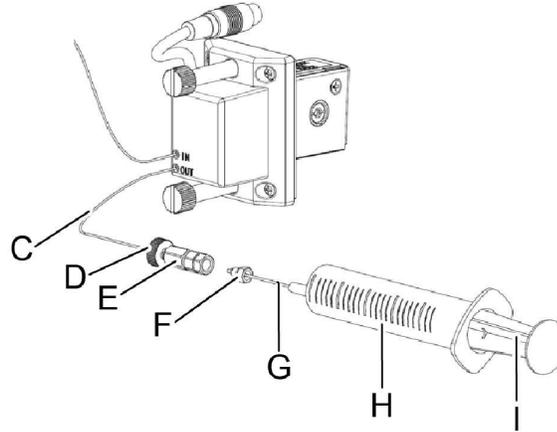
NOTE No simple cleaning is needed if no bubble or dirt is in the cell.

4 Insert the syringe needle (G) on the tip of the syringe (H) and turn it clockwise to fix it in place.

5 Remove the tubing from the cell outlet coupling.

6

Connect the syringe (H) to the cell outlet tubing (C). Attach the male nut 0.8MN-PEEK (F) to the syringe needle and connect the coupling 1.6-0.8C (E). Connect the cell inlet tubing to the drain.



NOTE When using Inert cell, UHPLC Inert cell or Low Dispersion Inert cell, connect the coupling to the cell inlet tubing.

7

Gently push in the syringe's plunger (I).

The liquid will be injected into the cell interior and clean the cell.

CAUTION



Instruction

If an aqueous solvent (especially a solvent containing buffer salts) is used as the mobile phase, purge the solvent in the cell with water before flushing with 2-propanol.

If an organic solvent is mixed with salts, crystals will form and clog the tubing.

8

Flush the flow cell with distilled water or deionized water using a syringe to purge the rinsing solution (2-propanol).

9

Perform step 3 to check for bubbles and dirt.

4

4.4 Disassembling and Cleaning the Flow Cell

If dirt and air bubbles cannot be removed by performing a simple cleaning, disassemble and clean the flow cell. Also, disassembling and cleaning the flow cell is recommended every 2 years.

Necessary tools

- Flathead screwdriver (Part No.: 086-10504-18)
- Plastic tweezers (with no dirt on the end)
- Air blower (for the lens) (Part No.: 086-78801-02)

▣ **NOTE** If plastic tweezers are not available, use some kind of alternative item such as a toothpick for removal. In this case, use something soft so that it does not scratch the lens or cell window.

Necessary parts

Part Name	Part Type	Part No.	Remarks
Gaskets	Maintenance part	228-35097-95 (2 pieces)	Be sure to replace when disassembling and cleaning the flow cell.
2-Propanol	NA		
(Mobile Phase Solution Used for Analysis)	NA		

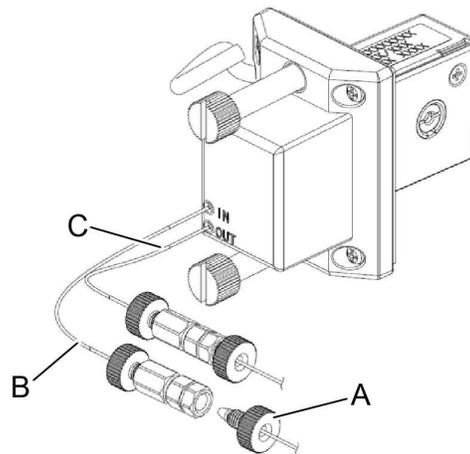
▣ **NOTE** If use of the original gaskets is continued without replacements, fluid may begin to leak.

1**Remove the flow cell.**

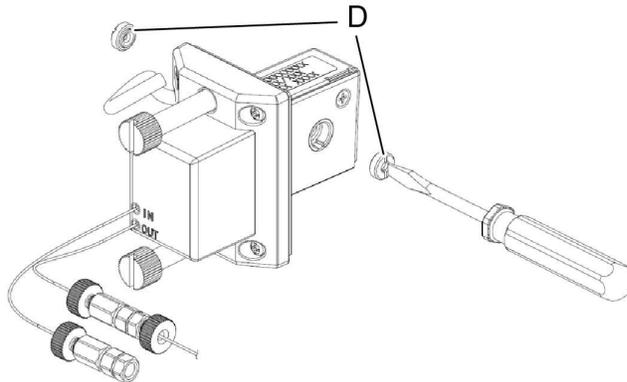
▶▶ Reference "4.2.1 Removing the Flow Cell" P.65

2**Remove the lenses and cell gaskets.**

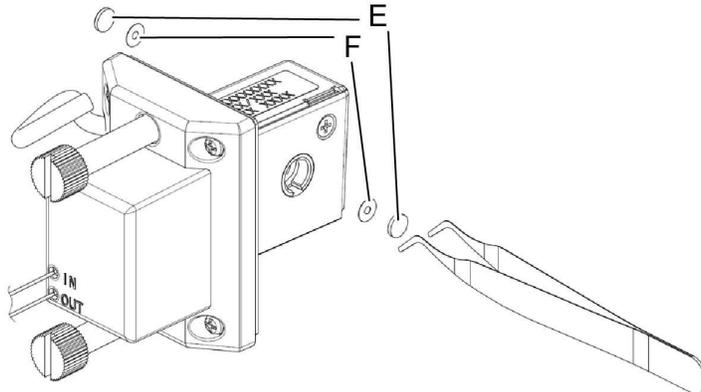
- 1 Loosen the male nut (A) on the column side, and remove the flow cell inlet tubing (B).
Remove the flow cell outlet tubing (C) in the same way.



- 2 Remove the left and right setscrews (D) using a flathead screwdriver.

**4**

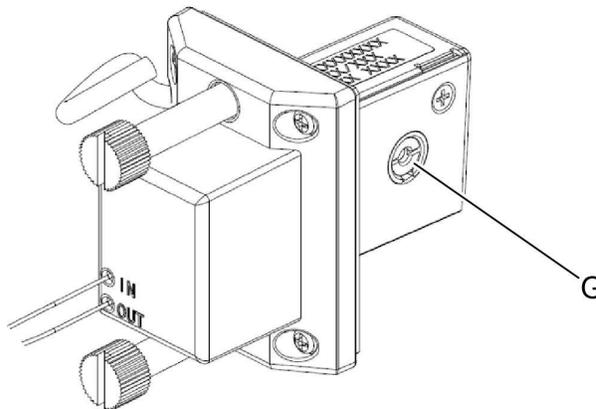
- 3 Remove the lens (E) and gasket (F) using plastic tweezers.



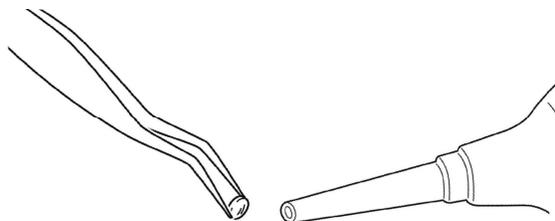
- 3 Put the removed lenses in 2-propanol and clean them with an ultrasonic bath for 5 minutes.

- 4 Attach the cleaned lenses and two new cell gaskets to the cell.

- 1 Use a paper towel soaked in 2-propanol to remove dirt inside the cell housing (G).

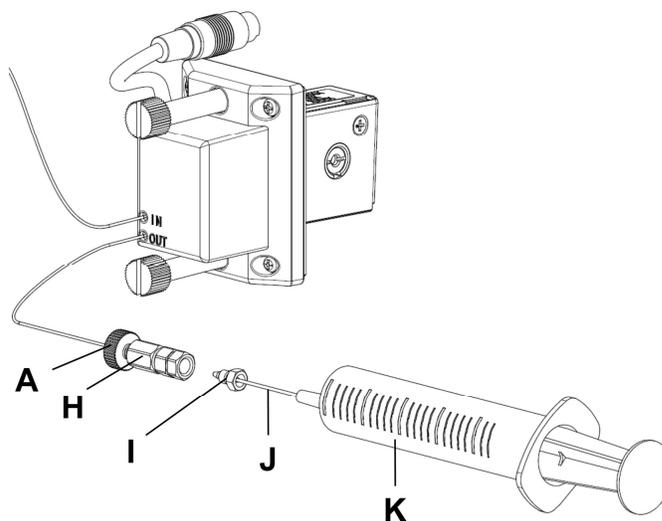


- 2 If dust or droplets is attached to the lenses or gaskets, remove it using an airblower (for the lens) while securing the lenses or gaskets with plastic tweezers so as not to be blown away by the air.



Hint If an air blower (for the lens) is not available, use a piece of wiping paper soaked in 2-propanol to remove the dust. If the deposit can not be removed with an air blower (for lens), use a piece of wiping paper soaked in 2-propanol to remove the dust.

- 3 Attach the new gaskets and lenses in that order using plastic tweezers, and attach the setscrews using a flathead screwdriver.
- 4 Connect the syringe needle to the flow cell outlet tubing (attach the male nut 0.8MN-PEEK (I) to the syringe side and use a coupling 1.6-0.8C (H)). Connect the flow cell inlet tubing to the tube to the drain.



NOTE When using Inert cell, UHPLC Inert cell or Low Dispersion Inert cell, use the supplied coupling 1.6-0.8C PEEK. In this case, connect the coupling to the cell inlet tubing.

- 5 Attach the syringe (K), in which the mobile phase solvent used for analysis has been set, to the syringe needle (J) and press the plunger slowly to check for any leakage.

NOTE If there is a fluid leak, rinse the lenses again, and then tighten the setscrews again so that they are not loose.

6 Loosen the male nut (A), and remove the syringe needle.

5

Attach the flow cell.

▶▶ Reference "4.2.2 Installing the Flow Cell" P.66

4.5 Replacing a Flow Cell Part

It is necessary to replace the lens or cell window if dirt on the lens or cell window cannot be removed after disassembling and cleaning the flow cell. The gaskets should be replaced at the same time. Also, it is recommended to replace the lenses or cell window every 2 years.

Necessary tools

- Flathead screwdriver (Part No.: 086-10504-18)
- Plastic tweezers (with no dirt on the end)
- Air blower (for the lens) (Part No.: 086-78801-02)



Hint If plastic tweezers are not available, use some kind of alternative item such as a toothpick for removal. In this case, use something soft so that it does not scratch the lens or cell window.

Necessary parts

Part Name	Part Type	Part No.	Remarks
Gaskets	Maintenance part	228-35097-95 (2 pieces)	Be sure to replace when disassembling and cleaning the flow cell.
Lens	Maintenance part	228-73281-41(2 pieces) 228-14572(1 piece)	-
2-propanol	-	-	-

▣ **NOTE** If use of the original gaskets is continued without replacements, fluid may begin to leak.

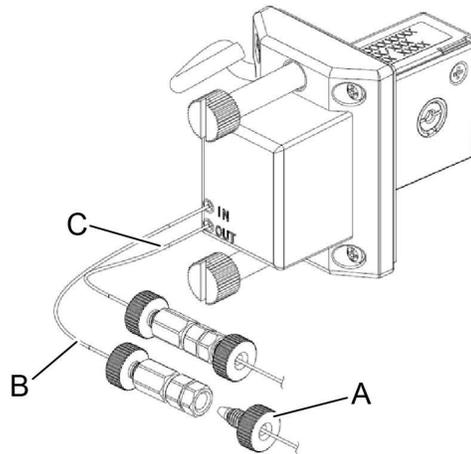
1

Remove the flow cell.

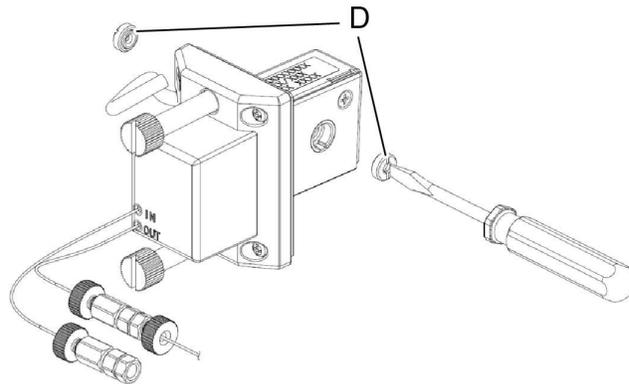
▶▶ Reference "4.2.1 Removing the Flow Cell" P.65

2**Remove the lenses and cell gaskets.**

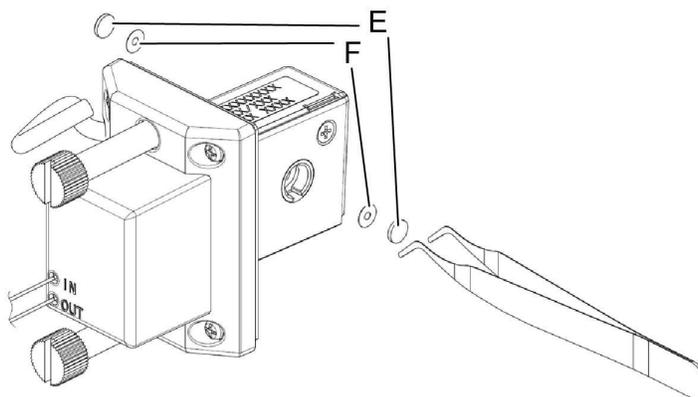
- 1 Loosen the male nut (A) on the column side, and remove the flow cell inlet tubing (B). Remove the flow cell outlet tubing (C) in the same way.



- 2 Remove the left and right setscrews (D) using a flathead screwdriver.

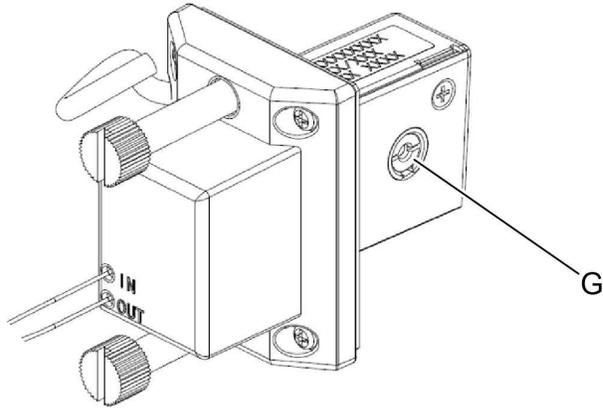


- 3 Remove the lens (E) and gasket (F) using plastic tweezers.

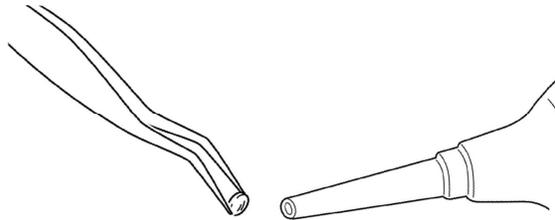


3 Attach the new lenses and 2 new cell gaskets.

- 1 Use a piece of wiping paper soaked in 2-propanol to remove dirt inside the cell housing (G).



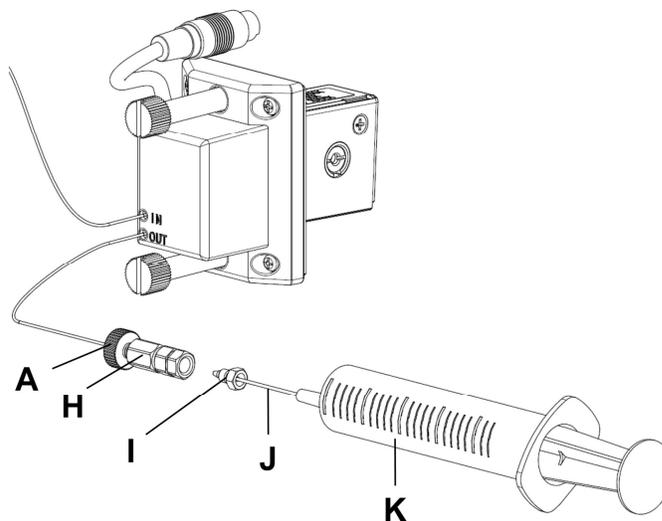
- 2 If dust is attached to the lenses, cell window or new gaskets, remove it using an air blower (for the lens) while securing the lenses or new gaskets with plastic tweezers so as not to be blown away by the air.



Hint If an air blower (for the lens) is not available, use a piece of wiping paper soaked in 2-propanol to remove the dust.

- 3 Attach the new gaskets and lenses in that order using plastic tweezers, and attach the setscrews using a flathead screwdriver.

- 4 Connect the syringe needle to the flow cell inlet tubing (attach the male nut 0.8MN-PEEK (I) to the syringe side and use the coupling 1.6-0.8C (H)). Connect the flow cell outlet tubing (C) to the tube to the drain.



NOTE When using Inert cell, UHPLC Inert cell or Low Dispersion Inert cell, use the supplied coupling 1.6-0.8C PEEK. In this case, connect the coupling to the cell inlet tubing.

- 5 Attach the syringe (K), in which the mobile phase solvent used for analysis has been set, to the syringe needle (J) and press the plunger slowly to check for any leakage.

NOTE If there is a fluid leak, rinse the lenses again, and then tighten the setscrews again so that they are not loose.

- 6 Loosen the male nut (A), and remove the syringe needle.

4

Attach the flow cell.

▶▶ Reference "4.2.2 Installing the Flow Cell" P.66

4.6 Storing the Flow Cell

Before storing the flow cell, pump methanol into it. Then, drain the methanol with the syringe and dry the inside of the flow cell or fill the flow cell with methanol and seal the cell before storing it.

4.7 Replacing the Lamp

A D2 lamp and a W lamp are the light sources used in this instrument. As the D2 lamp used in this instrument approaches the end of its service life, the light intensity of the lamp begins to decrease and baseline noise starts to increase. When approaching the end of the lamp's service life, as listed below, replace the lamp with a new one.

■ Lamp Service Life Ratings and Guarantee

D2 lamp service life rating: Approx. 2000 hours

The guaranteed service life of the D2 lamp is 2000 hours of use or 1 year from the date of purchase, whichever is shorter.

W lamp service life rating: Approx. 2000 hours

The guaranteed service life of the W lamp is 2000 hours of use or 1 year from the date of purchase, whichever is shorter.

WARNING



Instruction

Before replacing the lamp, turn the instrument power switch OFF.

Failing to do so may result in fire, electric shock, or malfunction.



Instruction

Allow the instrument to cool down adequately before performing the lamp replacement procedure.

The lamp compartment is extremely hot just after turning off the lamp.

⚠ CAUTION

Instruction

When replacing the lamp, be careful not to touch the glass portion of the lamp directly with your fingers.

If the lamp becomes dirty, wipe it with an ethanol-moistened lens cleaner.



Instruction

Be careful not to break the lamp.

Do not impart shocks or vibrations to the lamp.



Instruction

Be sure to install the lamp cover before switching on the lamp.

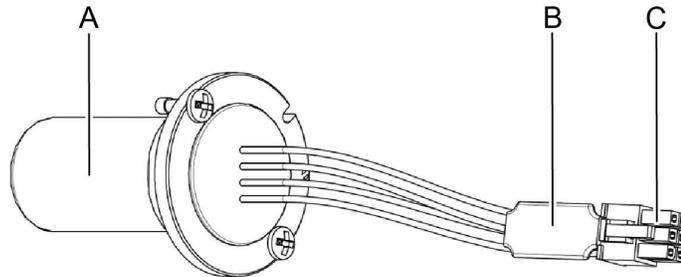
The lamp cannot be switched on while the lamp cover is removed.

If the lamp cover is removed without switching off the lamp, the lamp is extinguished automatically.

4.7.1 Replacing the D2 Lamp

Necessary Parts

Part Name	Part Type	Part No.
D2 lamp	Consumable part	228-63621-02



Sign	Name
A	Tube
B	Lamp memory
C	Connector

Shimadzu recommends 228-54515-02 for the D2 lamp.

The lamp memory (B) stores the following information, which contributes to traceability for parts information.

Stored Information Name	Example
Serial number	L14578-02
Part number	2286362102
Tube number	Ex.ample : LL2350
Date of manufacture	Ex.ample :April 1, 2017
Usage time [hour]	Ex.ample :500 hours
Date of replacement	Ex.ample :April 01, 2018
Threshold for replacement	Ex.ample :2000 hours

1

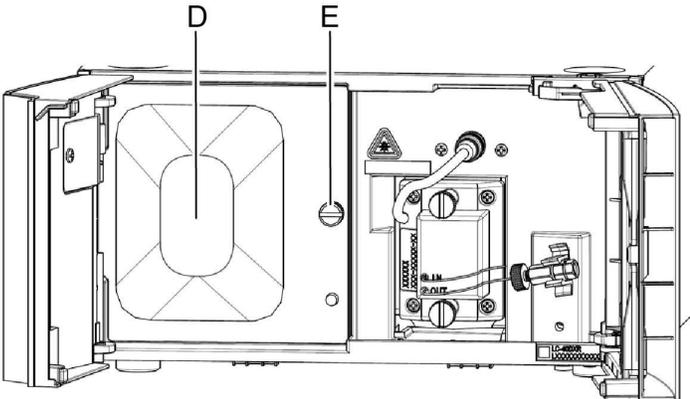
Turn OFF power to the instrument.

▶▶ Reference ["Turning the Power OFF" P.15](#)

2

Open the front cover and operation panel.

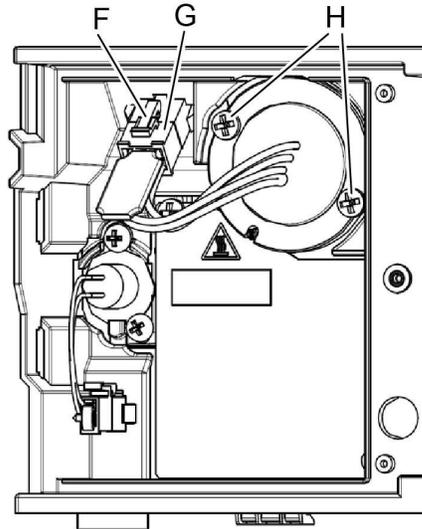
3 Loosen the lamp cover mounting screw (E) and remove the lamp cover (D).



4 With the fastening (F) detached, unplug the connector (G).

4

- 5** Loosen the two D2 lamp mounting screws (H) and pull the lamp out of the instrument.



! WARNING



Instruction

Turn off the power supply before replacing the lamp.

It may cause a fire, electric shock, or malfunction.



Instruction

Cool the instrument before replacing the lamp.

The lamp compartment is very hot immediately after use.

! CAUTION



Instruction

When replacing the lamp, be careful not to touch the glass portion of the lamp directly with your fingers.

If the lamp becomes dirty, wipe it with an ethanol-moistened lens cleaner.



Instruction

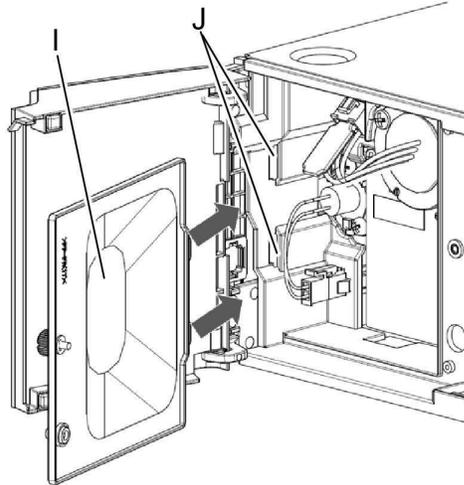
Be careful not to break the lamp.

Do not impart shocks or vibrations to the lamp.

- 6** Install the new lamp in the same orientation as the old one and then tighten the D2 lamp mounting screws alternately.

7**Install the lamp cover (I) to its original position on the instrument.**

Install the lamp cover (I) by inserting its edge into the slit (J) in the panel and secure it by tightening the lamp cover mounting screw.

**8****After replacing the D2 lamp, set the exposure time.**

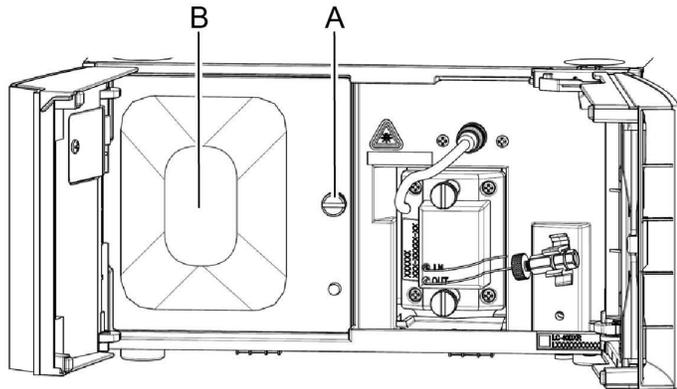
▶▶ Reference SPD-M40 Utility Help (228-92655) "Setting accumulation time"

4

4.7.2 Replacing the W Lamp

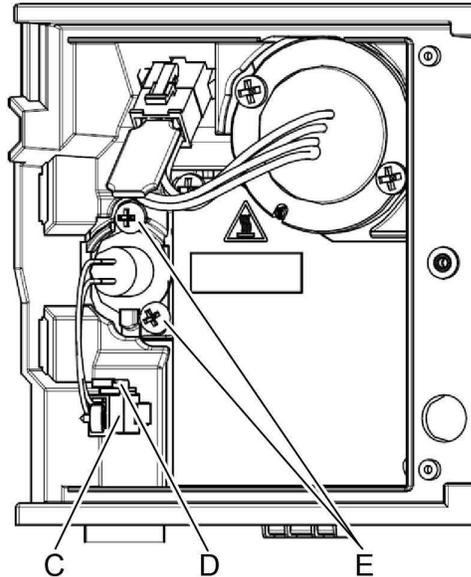
Necessary parts

Part Name	Part Type	Part No.	Remarks
W Lamp	Consumable part	228-73309	-

1**Turn OFF power to the instrument.**▶▶ Reference ["Turning the Power OFF" P.15](#)**2****Open the front cover and operation panel.****3****Loosen the lamp cover mounting screw (A) and then remove the lamp cover (B).**

4 With the fastening (D) detached, unplug the connector (C).

5 Loosen the W lamp mounting screws (E) and then pull the lamp out of the instrument.



4

⚠ WARNING



Instruction

Turn off the power supply before replacing the lamp.
It may cause a fire, electric shock, or malfunction.



Instruction

Cool the instrument before replacing the lamp.
The lamp compartment is very hot immediately after use.

⚠ CAUTION



Instruction

When replacing the lamp, be careful not to touch the glass portion of the lamp directly with your fingers.
If the lamp becomes dirty, wipe it with an ethanol-moistened lens cleaner.



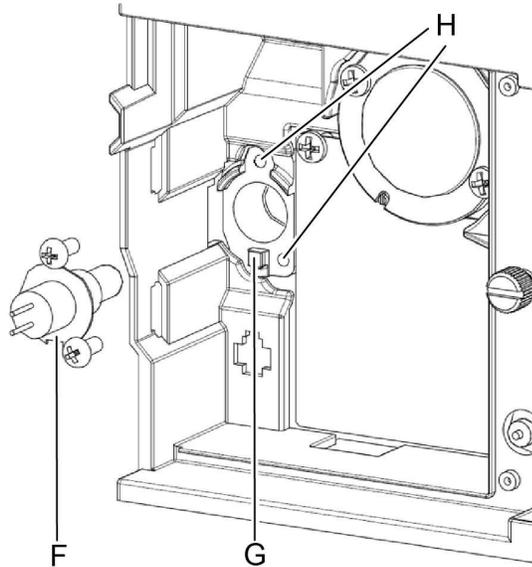
Instruction

Be careful not to break the lamp.
Do not impart shocks or vibrations to the lamp.

6

Install the new lamp in the same orientation as the old one.

Align the notch (F) of the W lamp with the projection (G) and then tighten the screws of the W lamp (H) alternately.

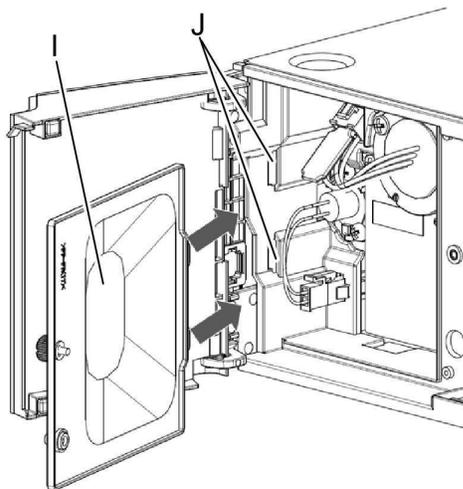


Hint When the mounting screws are loose, the W lamp can be installed with the mounting screws still in place.

7

Install the lamp cover (I) to its original position on the instrument.

Install the lamp cover (I) by inserting its edge into the slits (J) in the panel and secure it by tightening the lamp cover mounting screw.



8

After replacing the W lamp, enter the parts information of the W lamp and calibrate the exposure time.

▶▶ Reference SPD-M40 Utility Help (228-92655) "Setting accumulation time"

4.8 Replacing the Dust Filter

This instrument has a dust filter fitted on the rear side. If the dust filter becomes clogged, the performance of the instrument will deteriorate and may even cause instrument failure. If the dust filter becomes discolored from its original gray color, replace it with a new one.

NOTE Be sure to turn OFF power to the instrument before replacing the filter.

Necessary Parts

Part Name	Type	Part No.
Dust filter	Replacement part	228-53924-05

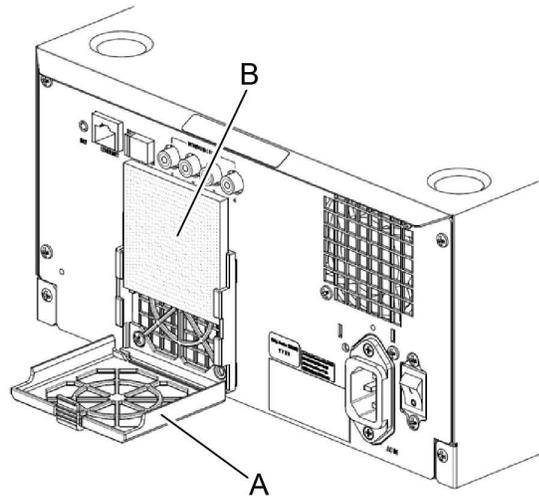
1

Turn OFF power to the instrument.

▶▶ Reference ["Turning the Power OFF" P.15](#)

2

Open the filter cover (A) and then remove the filter (B).


3

Replace the filter (B) and return the filter cover (A) to its original position.

4

4.9 Accumulation time / W lamp voltage setting

The accumulation time and voltage setting of the W lamp are set from the PDA Utility.

▶▶ Reference SPD-M40 Utility Help (228-92654) "4.2 Setting accumulation time"

4.10 Calibrate wavelength accuracy

Calibration of wavelength accuracy is performed from the PDA Utility.

▶▶ Reference SPD-M40 UTILITY HELP (228 - 92654) "4.3 Calibration of wavelength"

4.11 Adjustment of leak sensor

Adjustment of leak sensor is done from PDA Utility.

▶▶ Reference SPD-M40 Utility Help (228 - 92654) "Adjustment of Leak Sensor"

5 Technical Information

5.1 Specifications

5.1.1 Performance Specifications

Item	Specifications
Photodiode array elements	1024
Light source	D2 lamp, W lamp
Measurement wavelength range	190 nm to 800 nm
Wavelength accuracy	±1 nm (Emission line of the D2 lamp 656.1 nm)
Wavelength reproducibility	±0.1 nm (When measured on the same day Emission line of the D2 lamp 656.1 nm)
Element resolution	0.6 nm/element
Slit width	1.2 nm, 8 nm, slit switching possible
Spectral bandwidth	1.4 nm max. (using 253.7 nm low voltage Hg (mercury) lamp emission line, 1.2 nm slit)
Noise level	4.5×10^{-6} AU max.* ¹ 6.3.
Drift	0.4×10^{-3} AU/hour max.* ¹
Linearity	2.5 AU (Caffeine 273 nm, 1.2 nm slit) 6.5.
Temperature coefficient	0.3×10^{-3} AU/°C max.* ¹
Sampling time	10, 25, 80, 160, 240, 320, 640, 1280, 2000 ms 6.8.
Time constant (response)	The value is automatically set according to the sampling time. For manual setting, the user can choose from the following. No filtering, 10, 25, 50, 80, 100, 160, 240, 320, 480, 640, 960, 1280, 2000 ms

*1 Measurement conditions of drift/noise/temperature coefficient
 Measurement wavelength: 250 nm, reference wavelength: 350 nm,
 reference wavelength bandwidth: ±20 nm, cell: methanol solvent delivery at 1 ml/min,
 time constant: 2 s, slit width: 8 nm, noise measurement: ASTM method (ASTM E1657-98),
 ambient temperature constant (Drift), maximum ambient temperature fluctuation 2 °C (Noise,
 Temperature coefficient)

5.1.2 Standard Flow Cell

Item	Specifications
Cell length	10 mm
Cell volume	12 μ L
Cell pressure resistance	12 MPa
Liquid contact part materials	SUS316L, Quartz, PFA (fluorine resin), PEEK
pH range	1 to 13 (Using some mobile phases with pH 10 or above for long periods may damage the flow cell quartz and change its transmission property.)
Cell inlet tubing diameter	14 μ L : I.D. 0.13mm, length 1040 mm (The length out of the cell is 315~340 mm.)
Cell outlet tubing diameter	8 μ L : I.D. 0.25 mm, length 160 mm
Cell temperature input range	0 (OFF), 19 to 50 $^{\circ}$ C, 1 $^{\circ}$ C step 6.9

5.1.3 Detector Unit

Item		Specifications				
Interface		Ethernet				
Corresponding system controller		CBM-40, SCL-40, CBM-40 Lite, CBM-20A (In compatibility mode) , CBM-20A lite (In compatibility mode)				
Analog output		4 channels				
Analog output range		0.5, 1, 1.25, 2, 2.5, 4 AU/V (selectable and configurable)				
Voltage output range		-0.1 to +1.0 (V)				
Safety measures	Temperature sensor	60 °C (polychromator), 70 °C (lamp housing), 95 °C (flow cell)				
	Temperature fuse	98 °C (thermal protection for the polychromator), 98 °C (thermal protection for the lamp housing), 123 °C (thermal protection for the flow cell)				
	Leak sensor	Leak detection at flow cell and tubing joints				
	Lamp cover sensor	Lamp automatically extinguished if cover is removed. (UV light protection, high voltage protection)				
Ambient temperature/humidity range		4 to 35 °C/20 % to 85 %, no condensation*1				
Dimensions		260 mm (W) ×140 mm (H) × 500 mm (D)				
Mass		10 kg (main unit only)				
Power supply		Part No.	Power Supply Voltage*2 (indicated on the instrument)	Power Consumption	Frequency	Rated Breaking Capacity*3
		228-65302-46	100 to 240 VAC	180 VA	50/60 HZ	50 A
		228-65302-58				
Installation Environment (IEC)		Installation Category II, Pollution Degree 2, Altitude 2000 m or lower Install inside a lab.				

*1 Take note that the ambient temperature and humidity range for the entire system may be limited by the specifications of the PC and printer.

*2 Mains supply voltage fluctuations are not to exceed 10 % of the nominal supply voltage.

*3 Connect the instrument to a power outlet that is equipped with a circuit breaker that shuts off the current at the described value or less.

5.2 Consumable Parts

- NOTE
- When replacing a part, be sure to use one listed here.
 - For how to replace a part, see "4 Maintenance" P.63.

5.2.1 Consumable Parts

Part Name	Part No.	Remarks
D2 lamp	228-63621-02	Light source
W lamp	228-73309	Light source
Dust filter	228-53924-05	

5.2.2 Maintenance Parts

Part Name	Part No.	Remarks
Gasket	228-35097-95	Cell gasket : 2PC
Lens	228-14572 228-73281-41	Cell lens 228-14572 : 1PC 228-73281-41 : 2PC

5.3 Technical Information Regarding Networks

Item	Description	Remarks								
[ETHERNET] connector	RJ-45									
Communication speed	10 BASE-T (Full Duplex/Half Duplex) 100 BASE-TX (Full Duplex/Half Duplex)	Automatic recognition, manual configuration possible*1								
Default IP address	192.168.200.98	Configuration possible using a web browser*1								
Ports	<table border="1"> <thead> <tr> <th>Port No.</th> <th>Use</th> </tr> </thead> <tbody> <tr> <td>80</td> <td>Web browser configuration screen</td> </tr> <tr> <td>5006</td> <td>Communications with the PC (LabSolutions)</td> </tr> <tr> <td>5007</td> <td>Communications with the system controller</td> </tr> </tbody> </table>	Port No.	Use	80	Web browser configuration screen	5006	Communications with the PC (LabSolutions)	5007	Communications with the system controller	
	Port No.	Use								
	80	Web browser configuration screen								
5006	Communications with the PC (LabSolutions)									
5007	Communications with the system controller									

*1 Refer to "3.3.2 Configuring Network Settings (Web Browser)" P.17 for changes to communication speed and IP address.

5.4 Items Required for Operation

A PC and network environment are required to operate the instrument.

Option	Part No.	Remark
LC workstation LabSolutions Multi-PDA	-	-
LC workstation LCsolution Multi-PDA	-	-
Hub	- (Commercially available)*1	100 M switching hub
Ethernet cable	- (Commercially available)*1	Category 5 UTP Ethernet network cable (straight-through cable)*1
PC system	-	Should meet our recommended PC specifications ▶▶ Reference "Recommended PC Specifications" P.94

*1 For details on hubs and Ethernet cables that can be used, contact your Shimadzu representative.

■ Recommended PC Specifications

A PC and optional devices that Shimadzu recommends are required.
The amount of memory changes depending on the system configuration. For details, contact your Shimadzu representative.

Item	32-bit Edition	64-bit Edition
OS	Japanese edition: Windows 7 Professional 32-bit Japanese edition (and SP1)	Japanese edition: <ul style="list-style-type: none"> • Windows 10 Pro 64-bit Japanese edition • Windows 7 Professional 64-bit Japanese edition (and SP1)
	English edition: Windows 7 Professional 32-bit English edition (and SP1)	English edition: <ul style="list-style-type: none"> • Windows 10 Pro 64-bit English edition • Windows 7 Professional 64-bit English edition (and SP1)
CPU	A processor equivalent to Intel Core or Core2 with a clock speed of at least 2 GHz Or A processor equivalent to Intel Pentium4 or Pentium D with a clock speed of at least 3 GHz	A processor equivalent to Intel Core i5 with a clock speed of at least 2.5 GHz
RAM	2 GB min.	4 GB min.
Hard disk capacity	10 GB min.	40 GB min.
LAN	100BASE-TX compliant	
Serial port	An RS-232C (D-sub, 9 pin) is included as standard or can be added (for connecting LC or GC through RS-232C)	
SCSI Board	<ul style="list-style-type: none"> • A PCI card with a 50-pin connector for external connection • A driver compatible with the OS to be used (for when SPD-M10Avp is connected or for when MO is needed) 	For Windows 10 and Windows 7 64-bit, LabSolutions LC/GC is incompatible with SCSI devices.
USB	USB 2.0 compliant	
Mouse	PS/2 mouse or USB mouse	
Display	SXGA (1,280 × 1,024) or better resolution, with high color (65,536 colors) or better	
Printer	Printer and drivers that are compatible with the installed version of Windows. (a functionally verified printer is recommended)	
Other required peripherals	Installed with an optical drive that can read CD-ROM and DVD-ROM optical discs.	

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