

# FL 6500/FL 8500 FLUORESCENCE SPECTROMETERS



## Hardware Guide

## Release History

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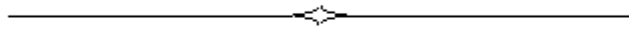
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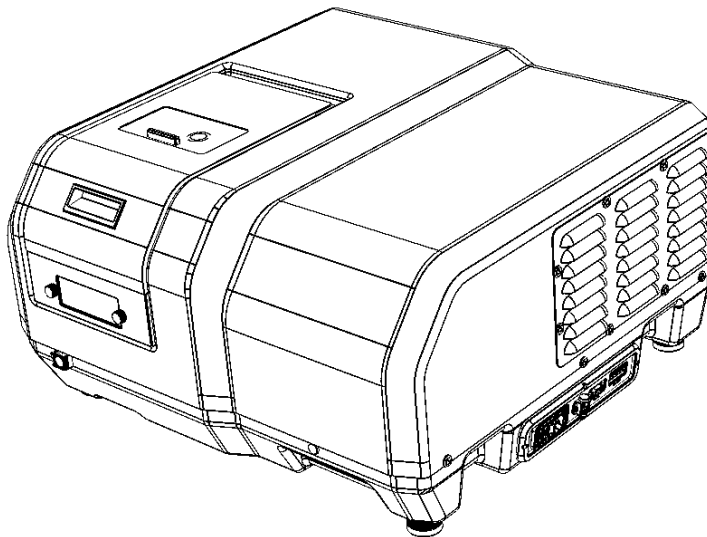


# ***Introduction***

## ***Overview***

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This hardware guide describes the operating procedures for the FL 6500 and FL 8500 fluorescence spectrometers, plus those maintenance routines that do not necessarily require a PerkinElmer Service Engineer.



**FL Series Fluorescence Spectrometer**

## ***About This Manual***

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This hardware guide is divided into following chapters:

### ***Chapter 1 Introduction***

This chapter contains a brief introduction on the instrument, the conventions and warnings used in the manual.

### ***Chapter 2 Safety Practices***

Important safety information is provided in this chapter.

### ***Chapter 3 System Description***

This chapter contains information on the components of the instrument, how it works and instrument specifications.

### ***Chapter 4 Installation***

Information on installing and re-installing your instrument should you ever need to move your system is provided.

### ***Chapter 5 Replacement***

Lamp replacement procedures of your instrument are provided.

### ***Chapter 6 Recalibration***

Wavelength recalibration procedures are provided.

### ***Chapter 7 Troubleshooting***

Performance checks, troubleshooting information, software and system error messages are provided for the instrument.

## ***Conventions Used in this Manual***

---

Normal text is used to provide information and instructions.

**Bold** text refers to text that is displayed on the screen.

UPPERCASE text, for example ENTER or ALT, refers to keys on the PC keyboard. '+' is used to show that you have to press two keys at the same time, for example, ALT+F.

All eight digit numbers are PerkinElmer part numbers unless stated otherwise.

Unless stated otherwise, FL series fluorescence spectrometer refers to the FL 6500, 8500 spectrometer as applicable.

### ***Notes, cautions and warnings***

Three terms, in the following standard formats, are also used to highlight special circumstances and warnings.

**NOTE:** *A note indicates additional, significant information that is provided with some procedures.*



**CAUTION**

We use the term **CAUTION** to inform you about situations that could result in **serious damage to the instrument** or other equipment. Details about these circumstances are in a box like this one.

**D****Caution (Achtung)**

Bedeutet, daß die genannte Anleitung genau befolgt werden muß, um einen **Geräteschaden** zu vermeiden.

**DK****Caution (Bemærk)**

Dette betyder, at den nævnte vejledningskaloverholdes nøje for at undgåen **beskadigelse af apparatet**.

**E****Caution (Advertencia)**

Utilizamos el término **CAUTION (ADVERTENCIA)** para advertir sobre situaciones que pueden provocar **averías graves en este equipo** o en otros. En recuadros éste se proporciona información sobre este tipo de circunstancias.

**F****Caution (Attention)**

Nous utilisons le terme **CAUTION (ATTENTION)** pour signaler les situations susceptibles de provoquer de **graves détériorations de l'instrument** ou d'autre matériel. Les détails sur ces circonstances figurent dans un encadré semblable à celui-ci.

**I****Caution (Attenzione)**

Con il termine **CAUTION (ATTENZIONE)** vengono segnalate situazioni che potrebbero arrecare **gravi danni allo strumento** o ad altra apparecchiatura. Troverete informazioni su tali circostanze in un riquadro come questo.

**NL****Caution (Opgelet)**

Betekent dat de genoemde handleiding nauwkeurig moet worden opgevolgd, om **beschadiging van het instrument** te voorkomen.

**P****Caution (Atenção)**

Significa que a instrução referida tem de ser respeitada para evitar a **danificação do aparelho**.



**WARNING**

We use the term **WARNING** to inform you about situations that could result in **personal injury** to yourself or other persons. Details about these circumstances are in a box like this one.

**D**

**Warning (Warnung)**

Bedeutet, daß es bei Nichtbeachten der genannten Anweisung zu einer **Verletzung** des Benutzers kommen kann.

**DK**

**Warning (Advarsel)**

Betyder, at brugeren kan blive **kvæstet**, hvis anvisningerne ikke overholdes.

**E**

**Warning (Peligro)**

Utilizamos el término **WARNING (PELIGRO)** para informarle sobre situaciones que pueden provocar **daños personales** a usted o a otras personas. En los recuadros como éste se proporciona información sobre este tipo de circunstancias.

**F**

**Warning (Danger)**

Nous utilisons la formule **WARNING (DANGER)** pour avertir des situations pouvant occasionner des **dommages corporels** à l'utilisateur ou à d'autres personnes. Les détails sur ces circonstances sont données dans un encadré semblable à celui-ci.

**I**

**Warning (Pericolo)**

Con il termine **WARNING (PERICOLO)** vengono segnalate situazioni che potrebbero provocare **incidenti alle persone**. Troverete informazioni su tali circostanze in un riquadro come questo.

**NL**

**Warning (Waarschuwing)**



Betekent dat, wanneer de genoemde aanwijzing niet in acht wordt genomen, dit kan leiden tot **verwondingen** van de gebruiker.

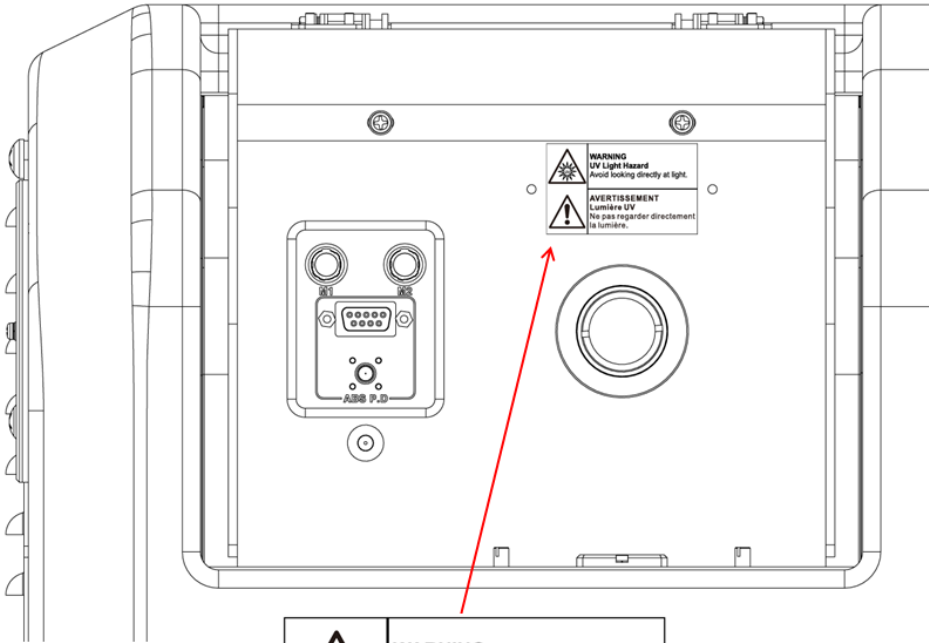
**P**

**Warning (Aviso)**

Significa que a não observância da instrução referida poderá causar um **ferimento** ao usuário.





# Warning Labels

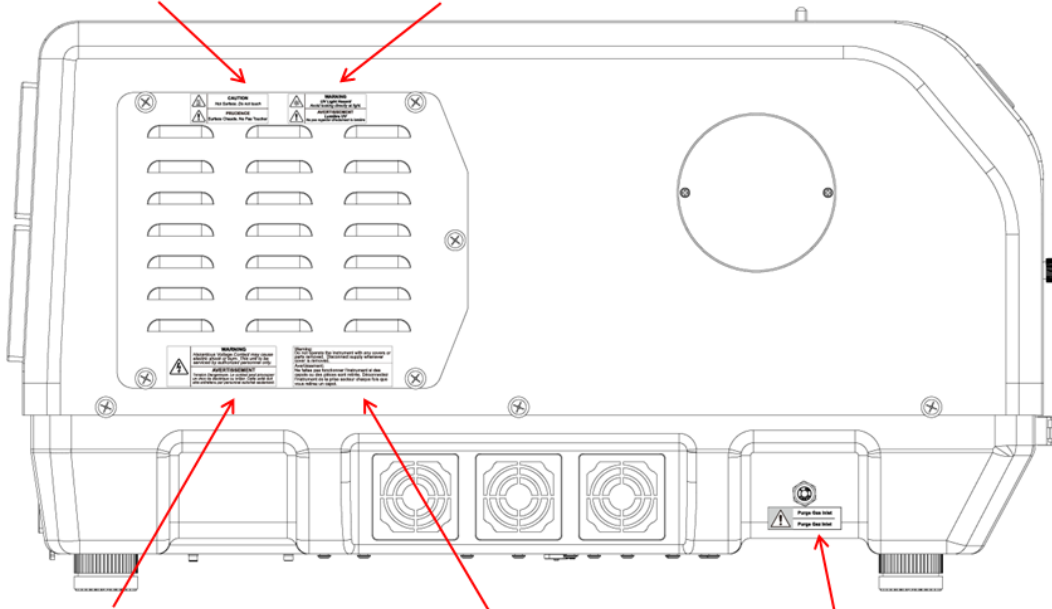
 <b>WARNING</b>	<p>When this label is attached to an instrument it means refer to the manual.</p>
 <b>AVERTISSEMENT</b>	<p>Lorsque cette étiquette est attachée à un instrument, cela signifie se référer au manuel.</p>



	<b>WARNING</b> <b>UV Light Hazard</b> Avoid looking directly at light.
	<b>AVERTISSEMENT</b> <b>Lumière UV</b> Ne pas regarder directement la lumière.

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	<b>CAUTION</b> Hot Surface. Do not touch		<b>WARNING</b> UV Light Hazard Avoid looking directly at light.
	<b>PRUDENCE</b> Surface Chaude. Ne Pas Toucher		<b>AVERTISSEMENT</b> Lumière UV Ne pas regarder directement la lumière

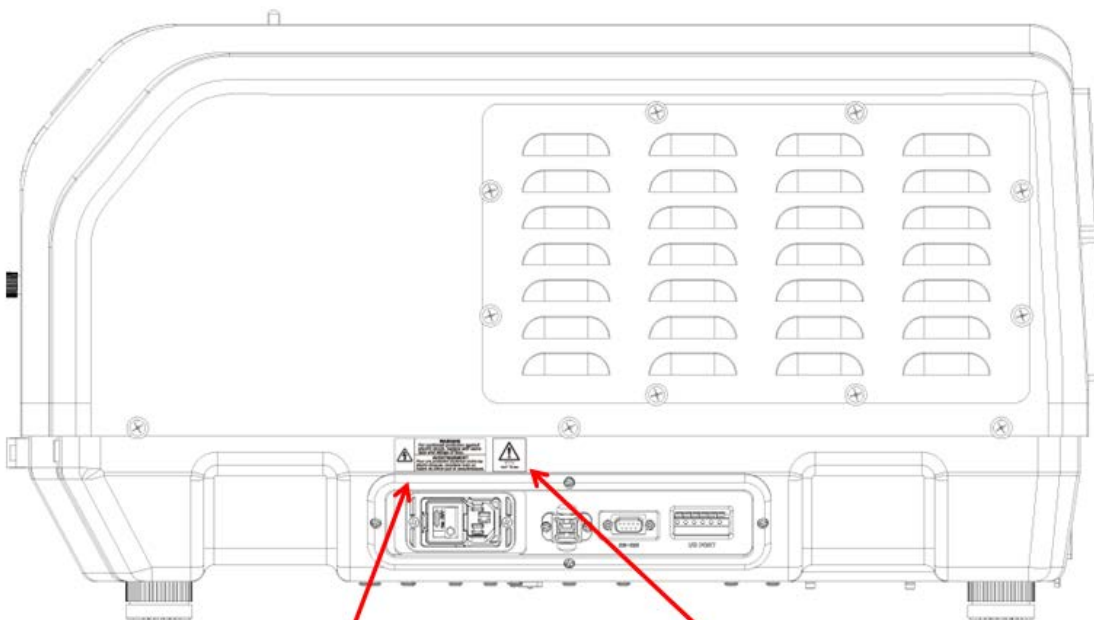


	<b>WARNING</b> Hazardous Voltage. Contact may cause electric shock or burn. This unit to be serviced by authorized personnel only.
	<b>AVERTISSEMENT</b> Tension Dangereuse. Le contact peut provoquer un choc de électrique ou brûler. Cette unité doit être entretenue par personnel autorisé seulement.

**Warning:**  
Do not operate the instrument with any covers or parts removed. Disconnect supply whenever cover is removed.

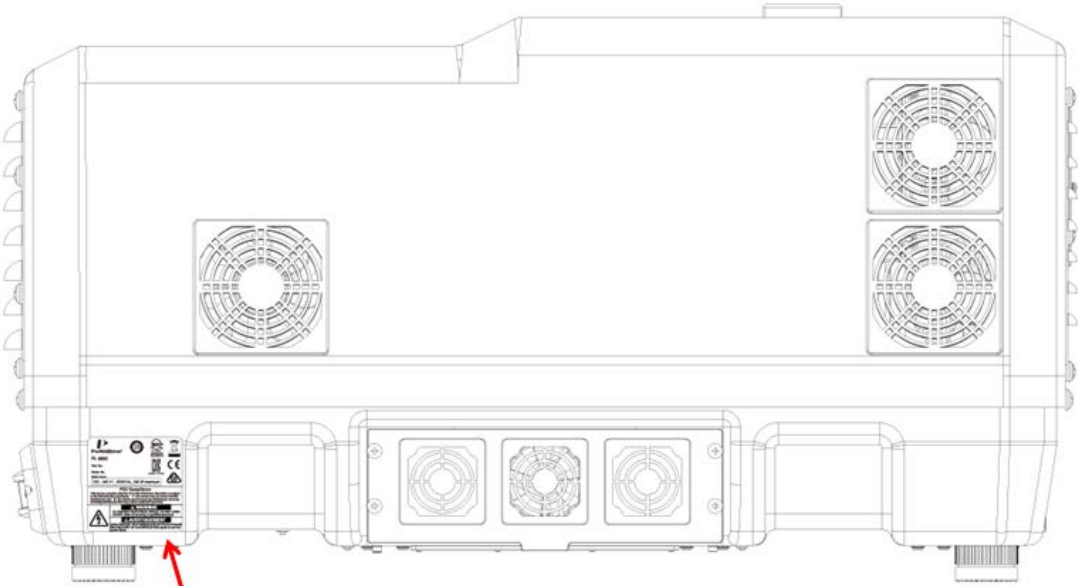
**Avvertissement:**  
Ne faites pas fonctionner l'instrument si des capots ou des pièces sont retirés. Déconnectez l'instrument de la prise secteur chaque fois que vous retirez un capot.

	<b>Purge Gas Inlet</b> <b>Purge Gaz Inlet</b>
---	--





	<b>WARNING</b> For continued protection against electric shock, replace with same type and ratings of fuse.
	<b>AVERTISSEMENT</b> Pour une protection soutenue contre les électro chocs, remplacer avec un fusible de même type et caractéristiques.


250V~ T3.15AL



### Warning Signs on the Instrument

	Caution, hot surface. Attention surface chaude.
---	--

	Caution, risk of electric shock. Attention, risqué d'électrocution.
---	--

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### Caution

Documentation must be consulted to determine the nature of the potential hazard and any actions which have to be taken.

### Attention

La documentation doit être consultée pour déterminer la nature du risque potentiel et des actions qui doivent être prises.

The following additional graphic symbols used on the instrument:

	Indicates the primary protective grounding terminal
	Indicates the <i>off</i> position of the main power switch
	Indicates the <i>on</i> position of the main power switch

# ***Safety Practices***

## *Overview*

---

This chapter describes the general safety practices and precautions that must be observed when operating the FL 6500/8500.



This advice is intended to supplement, not supersede, the normal safety codes in the user's country. It is also a supplement to the PerkinElmer standard Safety and Health Policy. The information provided does not cover every safety procedure that should be practiced. Ultimately, maintenance of a safe laboratory environment is the responsibility of the analyst and the analyst's organization.

Please consult all manuals supplied with the FL 6500/8500 and accessories before you start working with the instrument. Carefully read the safety information in this chapter and in the other manuals supplied. When setting up the instrument or performing analyses or maintenance procedures, strictly follow the instructions provided.



## Precautions

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 <p><b>WARNING</b></p>  <p><b>AVERTISSEMENT</b></p>	<p><i>Be sure that all instrument operators read and understand the precautions listed below. It is advisable to post a copy of the precautions near or on the instrument shelf.</i></p> <p><i>Assurez-vous que tous les opérateurs d'instruments lisent et comprennent les précautions indiquées ci-dessous. Il est conseillé de poster une copie des précautions à proximité ou à l'étagère de l'instrument.</i></p>
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The following precautions must be observed when using the FL 6500/8500:

- Be sure that the voltage of the FL 6500/8500 corresponds to the voltage used in your laboratory.
- Never remove the side panels of the FL 6500/8500 without shutting down the instrument and disconnecting the instrument power cord from line power.
- Do not immerse the purge gas exit line in a liquid, as the liquid may be drawn back into the sample holder.
- Only high quality purge gases should be used with the FL 6500/8500. Minimum purity of 99.9% is recommended. A high quality filter-dryer accessory is recommended for the removal of any moisture from the purge gases.
- Always encapsulate indium, tin, lead, and zinc standards in aluminum or graphite pans, as these metals will alloy with gold, copper or platinum pans.
- It is very important that nothing fall down into the cavity surrounding the sample holders. If anything does fall down, **IMMEDIATELY** turn off the power switch of the FL 6500 / 8500 and call your PerkinElmer Service Representative immediately.

## ***General Operating Conditions***

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The FL 6500/8500 has been designed and tested in accordance with PerkinElmer specifications and in accordance with the safety requirements of the International Electrotechnical Commission (IEC). The FL 6500/8500 conforms to IEC61010-1 (Safety Requirements for electrical equipment for measurement, control and laboratory use) as it applies to IEC Class 1 (earthed) appliances and therefore meet the requirements of EC directive 73/23/EEC.

Only use the FL 6500/8500 indoors and under the following conditions:

Temperature                      5°C to 40°C

Relative Humidity              20 - 80%, non-condensing

If possible, avoid any adjustment, maintenance and repair of the opened, operating instrument. If any adjustment, maintenance and repair of the opened instrument is necessary, this must be done by a skilled person who is aware of the hazard involved.

Whenever it is likely that the FL 6500/8500 is unsafe, make it inoperative. The FL 6500/8500 may be unsafe if it:

- shows visible damage
- fails to perform the intended measurement
- has been subjected to prolonged storage in unfavourable conditions
- has been subjected to sever transport stresses.

## ***Environmental Conditions***

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The instrument has been designed to be safe under the following conditions:

- Indoor use
- Altitude up to 2000 m
- Ambient temperatures of 5°C to 40°C
- A maximum relative humidity of 80% for temperatures up to 31 °C, decreasing linearly to 50% relative humidity at 40 °C
- Main supply voltage fluctuations up to  $\pm 10\%$  of the nominal voltage.



**WARNING**



**AVERTISSEMENT**

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

*Si l'équipement est utilisé d'une manière non spécifiée ici, la protection fournie par l'équipement peut être altérée.*

## Electrical Safety

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The instrument has been designed to protect the operator from potential electrical hazards. This section describes some recommended electrical safety practices.

	<p><b>Lethal voltages are present at certain areas within the instrument. Installation and internal maintenance of the instrument should only be performed by a PerkinElmer service engineer or similarly authorized and trained person.</b></p>
<p><b>WARNING</b></p>	<p><i>When the instrument is connected to line power, opening the instrument covers is likely to expose live parts. Even when the power switch is off, high voltages can still be present. Capacitors inside the instrument may still be charged even if the instrument has been disconnected from all voltage sources.</i></p>
	<p><b>Des tensions létales sont présentes dans certaines zones de l'instrument. L'installation et la maintenance interne de l'instrument ne doivent être effectuées que par un ingénieur de service PerkinElmer ou une personne autorisée et formée de manière similaire.</b></p>
<p><b>AVERTISSEMENT</b></p>	<p><i>Lorsque l'instrument est connecté à la ligne, l'ouverture des capots de l'instrument risque d'exposer les pièces en direct. Même lorsque l'interrupteur d'alimentation est éteint, des tensions élevées peuvent encore être présentes. Les condensateurs à l'intérieur de l'instrument peuvent toujours être chargés même si l'instrument a été déconnecté de toutes les sources de tension.</i></p>

The instrument must be correctly connected to a suitable electrical supply. The supply must have a correctly installed protective conductor (earth ground) and must be installed or checked by a qualified electrician before connecting the instrument.

	<p><b>Any interruption of the protective conductor (earth ground) inside or outside the instrument or disconnection of the protective conductor terminal is likely to make the instrument dangerous. Intentional interruption is prohibited.</b></p>
<p><b>WARNING</b></p>	
	<p><b>Toute interruption du conducteur de protection (terreuse) à l'intérieur ou à l'extérieur de l'instrument ou la déconnexion de la borne du conducteur de protection risque de rendre l'instrument dangereux.</b></p>
<p><b>AVERTISSEMENT</b></p>	<p><i>L'interruption intentionnelle est interdite.</i></p>

When working with the instrument observe the following:

Always turn off the GC SNFR Olfactory Port and disconnect the power cord from the electrical outlet before you remove any covers. Do not operate the instrument with any covers or internal parts removed.

- Disconnect the instrument from all voltage sources before opening it for any adjustment, replacement, maintenance, or repair. If afterwards, the opened instrument must be operated for further adjustment, maintenance, or repair, this must only be

done by a PerkinElmer Service engineer or a similarly trained and authorized person. Use only fuses of the specified type and with the required current rating for replacement.

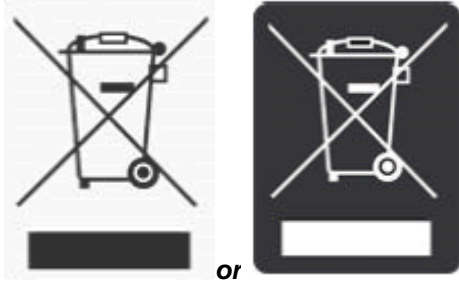
- The instrument is to be positioned in a clean area free of dust, smoke, vibration, and corrosive fumes, out of direct sunlight, and away from heating or cooling units or ducts.
- Do not attempt to make adjustments, replacements or repairs to this instrument except as described in the accompanying User Documentation. Only a PerkinElmer service representative or similarly trained and authorized person should be permitted to service the instrument.
- Whenever it is possible that the instrument is no longer electrically safe for use, make the instrument inoperative and secure it against any unauthorized or unintentional operation. The electrical safety of the instrument is likely to be impaired if, for example, the instrument shows visible damage; has been subjected to prolonged storage under unfavorable conditions; or has been subjected to severe stress during transportation.
- Be sure the power cord is the correct one for your laboratory. The line cord used must meet the national safety agency's guidelines for the particular country of use. Some power cords available from PerkinElmer are illustrated below:

 <p>North America NEMA-5-15 09988986</p>	 <p>Old British Standard BS 546 India 09991423</p>
 <p>Europe CEE 7 "Schuko" 09991415</p>	 <p>British Standard BS 1363 United Kingdom 09991414</p>
 <p>Europe Switzerland 09991413</p>	 <p>Australia ETSA S/86 09991417</p>
 <p>Europe Italy 09991422</p>	 <p>Israel 09991424</p>
 <p>Denmark 09991416</p>	 <p>Japan 09991425</p>
 <p>Brazil 09290996 10A Brazil 09290996 16A</p>	 <p>China 09290346</p>

#### AC Line Cords

**NOTE:** Do not replace the supplied detachable power cord with a cord from an unqualified supplier or a cord that has inadequate ratings.

## ***WEEE Instructions for PerkinElmer Products***



A label with a crossed-out wheeled bin symbol and a rectangular bar indicates that the product is covered by the Waste Electrical and Electronic Equipment (WEEE) Directive and is not to be disposed of as unsorted municipal waste. Any products marked with this symbol must be collected separately, according to the regulatory guidelines in your area.

The objectives of this program are to preserve, protect and improve the quality of the environment, protect human health, and utilize natural resources prudently and rationally. Specific treatment of WEEE is indispensable in order to avoid the dispersion of pollutants into the recycled material or waste stream. Such treatment is the most effective means of protecting the customer's environment.

Requirements for waste collection, reuse, recycling, and recovery programs vary by regulatory authority at your location. Contact your local responsible body (e.g., your laboratory manager) or authorized representative for information regarding applicable disposal regulations. Contact PerkinElmer at the web site listed below for information specific to PerkinElmer products.

Web address:

[www.perkinelmer.com/WEEE](http://www.perkinelmer.com/WEEE)

For Customer Care telephone numbers select "Contact us" on the web page.

Products from other manufacturers may also form a part of your PerkinElmer system. These other producers are directly responsible for the collection and processing of their own waste products under the terms of the WEEE Directive. Please contact these producers directly before discarding any of their products.

Consult the PerkinElmer web site (above) for producer names and web addresses.

## ***Decontamination and Cleaning***

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Before using any cleaning or decontamination methods except those specified by PerkinElmer, you should check with PerkinElmer that the proposed method will not damage the equipment.

### ***Decontamination***

Before using any cleaning or decontamination methods except those specified by PerkinElmer, users should check with PerkinElmer that the proposed method will not damage the equipment.

**Customers wishing to return instrumentation and/or associated materials to PerkinElmer for repair, maintenance, warranty or trade-in purposes are advised that all returned goods must be certified as clean and free from contamination.**

The customer's responsible body is required to follow the "Equipment Decontamination Procedure" and complete the "Certificate of Decontamination". These documents are available on the PerkinElmer public website:

[http://www.perkinelmer.com/Content/technicalinfo/dts\\_instrumentdeconprocedure.pdf](http://www.perkinelmer.com/Content/technicalinfo/dts_instrumentdeconprocedure.pdf)

If you do not have access to the internet contact Customer Care:

Customer Care USA: (8:30 a.m. – 7 p.m. EST)	<b>1-800-762-4000</b> <b>(+ 1) 203-925-4602</b>	<b>(inside the USA)</b> <b>(outside the USA)</b>
Customer Care Canada:	<b>800-561-4646</b>	
Customer Care EU:	<b>0800 40 858</b> <b>0800 90 66 42</b>	<b>(Brussels)</b> <b>(Monza)</b>

If you are located outside of these regions, please call your local PerkinElmer sales office for more information.

### ***Cleaning the Instrument***

Exterior surfaces may be cleaned with a soft cloth, dampened with a mild detergent and water solution. **Do not** use abrasive cleaners or solvents.

### ***General Laboratory Safety***

Your laboratory should have all equipment ordinarily required for the safety of individuals working with chemicals (fire extinguishers, first-aid equipment, safety shower and eye-wash fountain, spill cleanup equipment, etc.).

## ***ElectroMagnetic Compatibility (EMC)***

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### ***Europe***

All information concerning EMC standards is in the Declaration of Conformity, and these standards may change as the European Union adds new requirements.

PerkinElmer instruments have been designed and manufactured, having regard to the state of the art, to ensure that:

- the electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended;
- it has a level of immunity to the electromagnetic disturbance to be expected in its intended use which allows it to operate without unacceptable degradation of its intended use.

### ***South Korea***

This device complies with MSIP (Ministry Of Science, ICT, and Future Planning) EMC Registration requirements. This instrument is registered as a Class A instrument for business use only. Product seller and user should notice that this equipment is not for house hold use.

A급기기 (업무용방송통신기자재)

이기는업무용(A급) 전자파적합기기로서판매자또는사용자는이점을주의하시기바라며, 가정외의지역에서사용하는것을목적으로합니다.

## ***United States (FCC)***

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United States (FCC) This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a business/industrial/commercial environment is likely to cause harmful interference in which the user will be required to correct the interference at your own expense. Changes or modifications not expressly approved by the manufacturer could void your authority to operate the equipment in compliance with FCC rules.

**Note:** *Changes or modifications not expressly approved by PerkinElmer could cause the instrument to violate FCC (U.S. Federal Communications Commission) emission regulations, and because of this violation could void the user's authority to operate this equipment.*



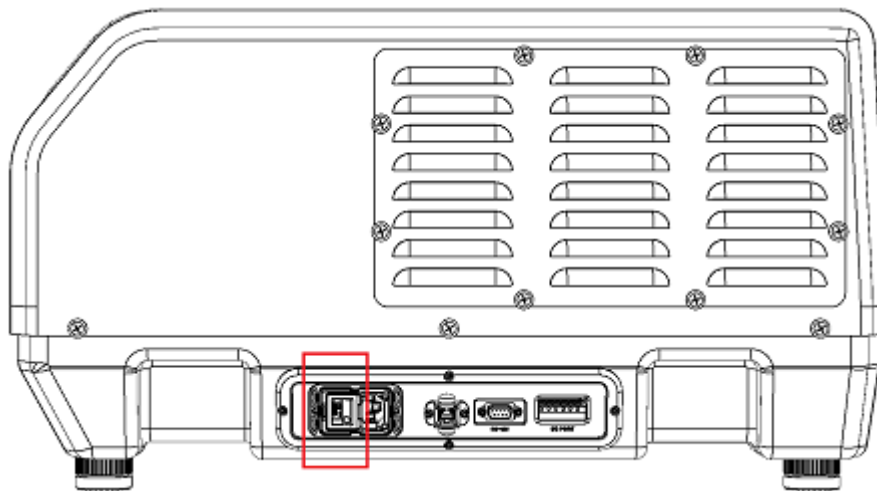
## Fuses

The following is the OPERATOR replaceable fuse.

	<p><b>Caution</b> These are NOT IEC fuses, but are CSA approved fuses.</p>
	<p><b>Attention</b> Ce ne sont PAS des fusibles CEI, mais des fusibles approuvés CSA.</p>

Fuse	Location	Current rating	Voltage rating	Type	PerkinElmer part number
Mains Input	Mains input panel	3.15A	250V	CSA: Time lag	N4202037

The fuses are located in a power code noise filter at the side of the instrument as shown in Figure



**Location of the fuses**

To change the fuses:

1. Switch off the instrument and remove the line power code from the electrical supply.
2. Squeeze In a flat-headed screwdriver and gently pull out the fuse holder as shown in the figure below.



**Removing the fuse holder**

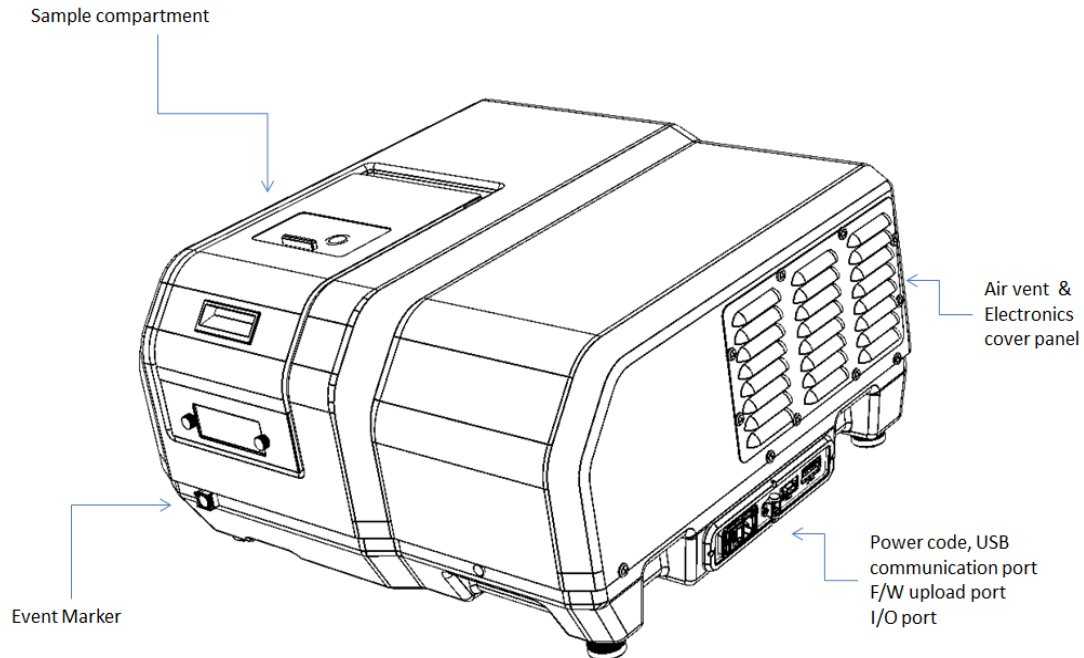
3. Replace the fuses with new ones of the same type and rating.
4. Replace the fuse holder by aligning the lug at the bottom of the fuse holder with the slot in the socket and then pushing the holder into place.

# *System Description*

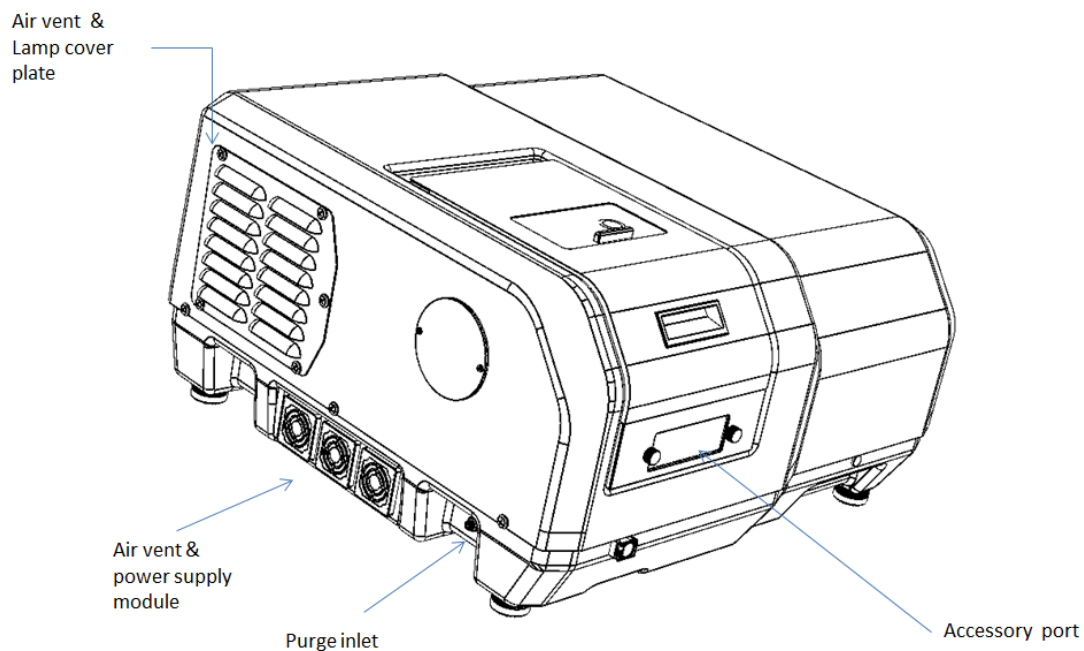
## Overview

The FL 6500, 8500 spectrometers are versatile instruments operating in the ultraviolet and visible spectral range. The spectrometer features light source, excitation monochromator, emission monochromator, optical system and detectors.

These instruments are usable in a wide range of applications, as indicated by their performance specifications.



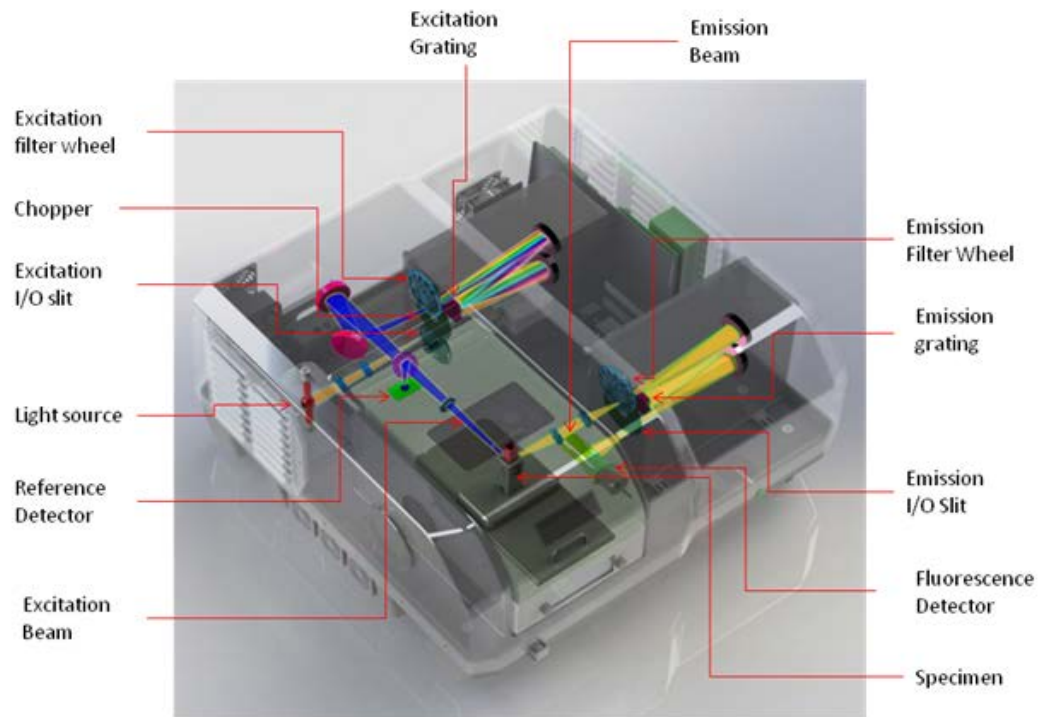
### Main features of the FL series fluorescence spectrometer



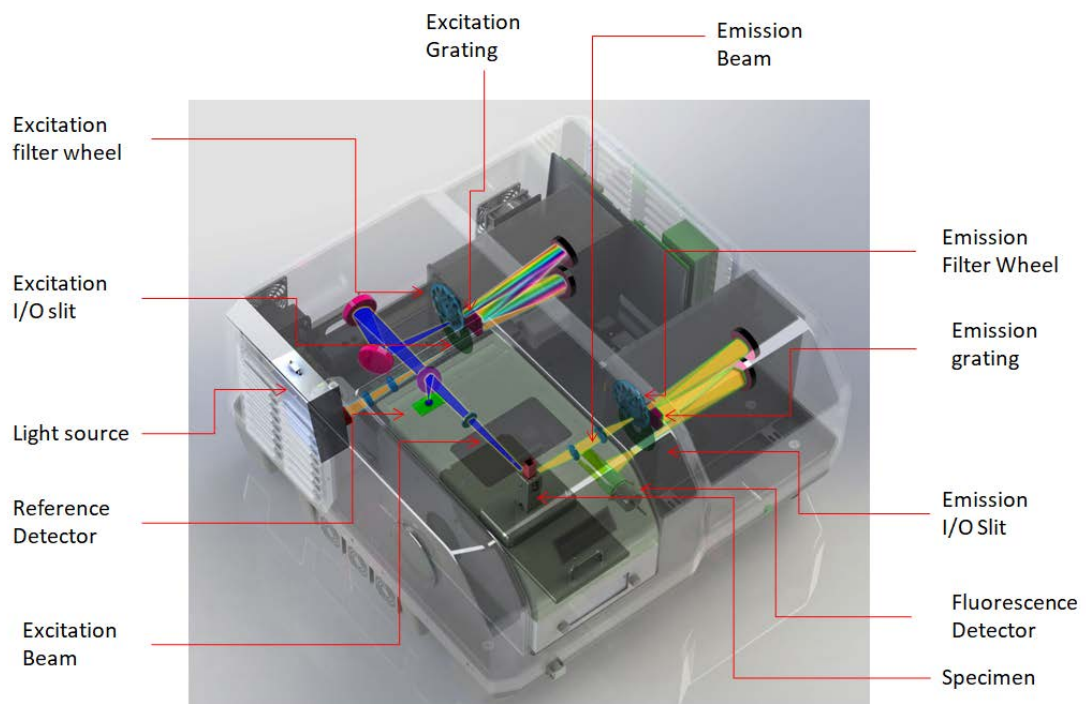
### Main features of the FL series fluorescence spectrometer

## Major Components

Figure shows that the optical components of the FL series fluorescence spectrometer.



Optical components of the FL 8500 fluorescence spectrometer



Optical components of the FL 6500 fluorescence spectrometer

## Light Sources

FL 6500 uses the flash xenon lamp. The details of lamp are as follow.

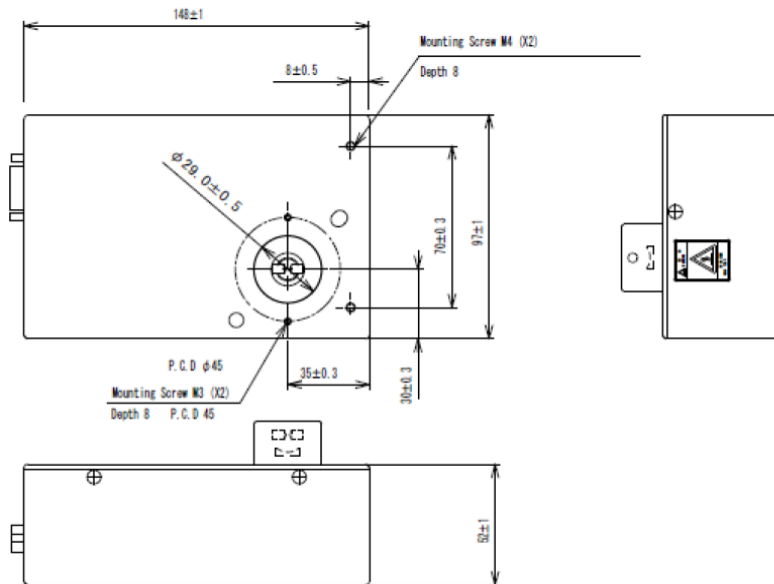
Arc size	1.5	mm
Window material	UV glass	—
Spectral distribution	185 to 2000	nm
Main discharge voltage range *1	400 to 1000	V
Maximum input energy (per flash) *2	See operation conditions.	—
Maximum average input (continuous) *3	20	W
Light output stability (Max.) *4	2.0	% CV
Guaranteed life *5	$1 \times 10^9$	flashes
Input voltage	21.6 to 26.4	V
Input current	1.5	A
Inrush current	3	A
Trigger input	Rectangular wave 2.5 V to 10 V: pulse width must be 10 $\mu$ s or more. *6	—
Trigger input impedance	330	$\Omega$
Cooling method	Not required *7	—
Operating temperature range	0 to 40	$^{\circ}$ C
Storage temperature range	-40 to +90	$^{\circ}$ C
Operating humidity range	Below 85 (no condensation)	% RH
Storage humidity range	Below 95 (no condensation)	% RH
EMC standards	IEC61326-1: 2012 Group1, ClassA	—
Safety standards	IEC61010-1: 2010 IEC62471: 2006 Risk Group3	—

**NOTE:**

- \*1 Internal: Adjustable with variable trimmer.  
External: Variable with control voltage from 1.9 V to 4.76 V.
- \*2 Maximum input energy (per flash)  
 $E=1/2 CV^2$   
E: Maximum input energy (J)  
V: Main discharge capacitor (V)  
C: Main discharge capacitance (F)
- \*3 Maximum average input (continuous):  
 $W=E \times f$   
f: Repetition Rate (Hz)
- \*4 Light output stability is given by:  
Light output stability (% CV) =  
light output standard deviation /  
average light output  $\times 100$
- \*5 At 20 W operation
- \*6 Only for external control;  
synchronized with rising edge.
- \*7 Cooling is required when the  
package temperature exceeds 50  
 $^{\circ}$ C during operation.

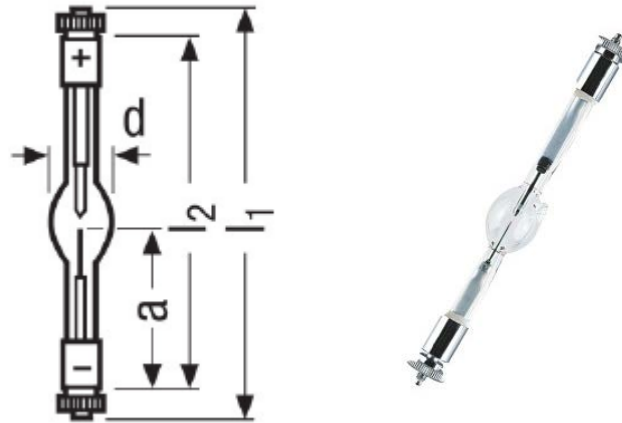
### ■ Operating Condition

Type No.	Main Discharge Capacitor ( $\mu$ F)	Main Discharge Voltage (V)	Repetition Rate Max (Hz)	Main Average Input Energy (mJ)	Max Average Input (W)
L12745-01S	0.64	400	391	51.2	20
		700	128	156.8	20
		1000	63	320.0	20



Unit : mm

FL 8500 uses the continuous xenon arc lamp. The details of lamp are as follow.



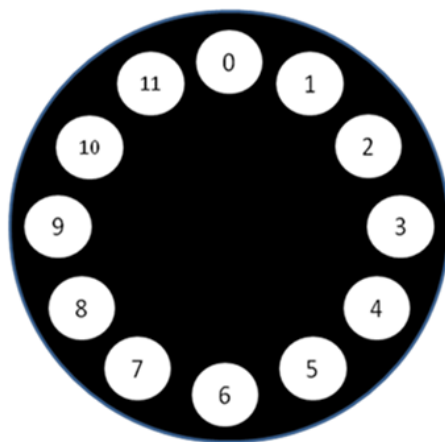
Lamp Wattage	Lamp Voltage	Lamp Current	Type of Current
130 ~ 175W	17 ~21 V	7.5A	DC

Luminescence	LifeSpan	Operating Temp.	
15000 cd/cm <sup>2</sup>	1200 h	230°C	

Length (l1)	Mounting Length (l2)	Light Center Length (a)	Product Weight
150.0mm	127.0mm	57.0mm	100.0g

### Excitation Filter Wheel

In excitation filter wheel, there are 12 holes to attach the filters. The default setting is as follow.



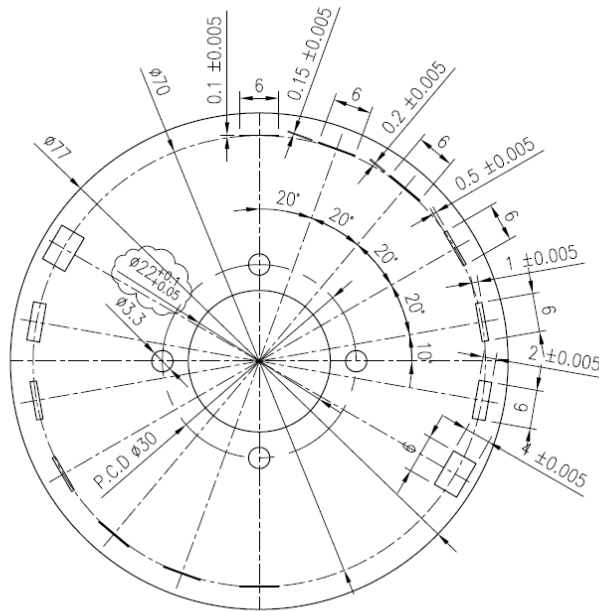
- 0: Air
- 1: 290nm
- 2: 370nm
- 3: 530nm
- 4: Air (User select)
- 5: Air (User select)
- 6: Air (User select)
- 7: Air (User select)
- 8: UV-Vis Polarizer Vertical(↕)
- 9: UV-Vis Polarizer Horizontal (↔)
- 10: Visible Polarizer Vertical (↕)
- 11: Visible Polarizer Horizontal (↔)

Step Motor :TS3214 N13(TAMAGAWA SEIKI)

## Excitation / Emission Slit

In FL series fluorescence spectrometer, excitation slit and emission slit has same dimensions. The physical widths and spectral bandwidths are paired as follow.

Physical Width	Spectral Bandwidth	Comment
100um	0.5nm	Used for only alignment
150um	0.75nm	Not used in software
200um	1.0nm	Wavelength calibration, High sensitive sample
500um	2.5nm	commonly used in fluorescence
1000um	5nm	Most commonly used in fluorescence
2000um	10nm	Water Raman Test
4000um	20nm	It is for low sensitive sample

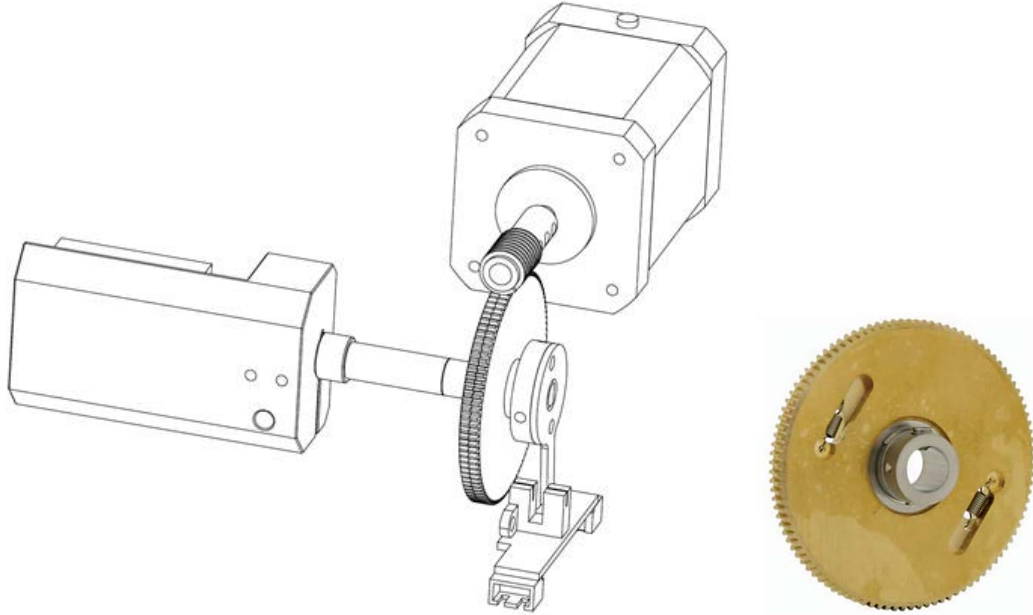


Step Motor for the slit: TS3214 N13(TAMAGAWA SEIKI)



## Excitation/Emission Grating Module

To get the high resolution and high speed, high torque step motor is used. And the back rash can be minimized using the anti backlash gear.



The grating scan speed is related to the motor's pulse width. The following table shows that the grating scan speed and the step motor's pulse width.

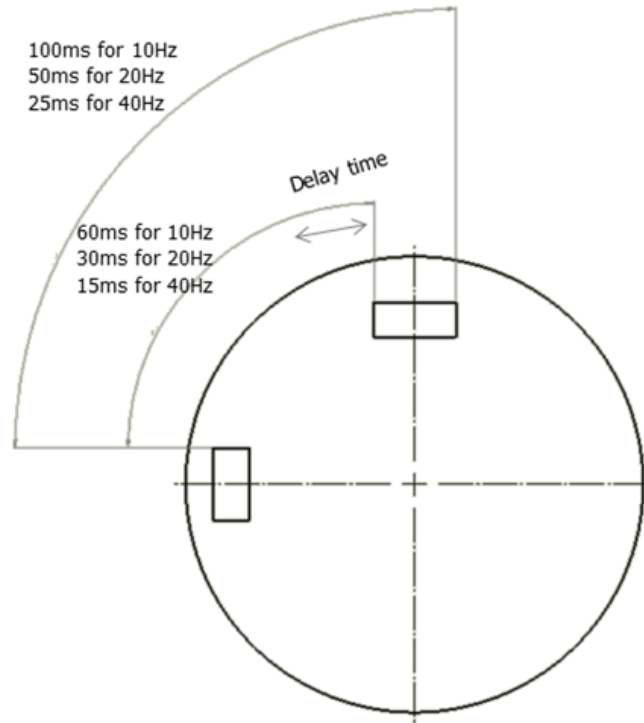
Scan speed (nm/min)	Scan speed (nm/Sec)	Pulse/Sec	Pulse Width (ms)
60,000	1,000	5,000	0
24,000	400	2,000	1
12,000	200	1,000	1
2,400	40	200	5
1,200	20	100	10
240	4	20	50
60	1	5	200
30	1	3	400

Grating specification is as follow.

Side	Grating	Blaze	Size (mm)	Groove
EX	Blazed Holographic Grating	250nm	34 X 34 X 9.5	1200gr/mm
EM	Holographic Grating	Visible	30 X 30 X 9.5	1200gr/mm

## Excitation Chopper (For FL 8500)

Chopper is used to block the beam when measuring luminescence or phosphorescence in FL 8500. The chopper speed range is 10 ~ 40 Hz and the blocking time of the light in phosphorescence is as follow.



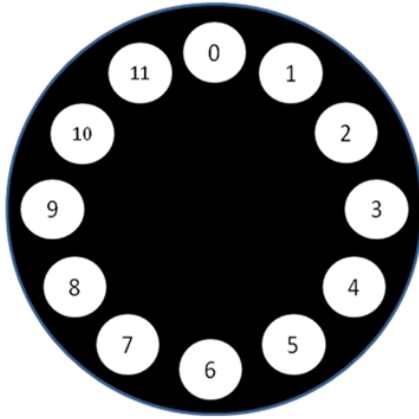
Phosphorescence Lifetime (Short)		
Chopper speed	Gate time + Delay time	Delay time
10Hz	60ms	0 ~ 5000us
20Hz	30ms	0 ~ 5000us
40Hz	15ms	0 ~ 3000us

## Reference Photo Diode

For maximum stability and minimum maintenance, observe the following requirements when choosing where to site the instruments:

## Emission Filter Wheel

In excitation filter wheel, there are 12 holes to attach the filters like the excitation filter wheel. The default setting is as follow.



- 0: Air
- 1: 320nm
- 2: 430nm
- 3: 515nm
- 4: Air (User select)
- 5: Air (User select)
- 6: Air (User select)
- 7: Air (User select)
- 8: UV-Vis Polarizer Vertical(↕)
- 9: UV-Vis Polarizer Horizontal(⇔)
- 10: Visible Polarizer Vertical(↕)
- 11: Visible Polarizer Horizontal(⇔)

## R928 PMT

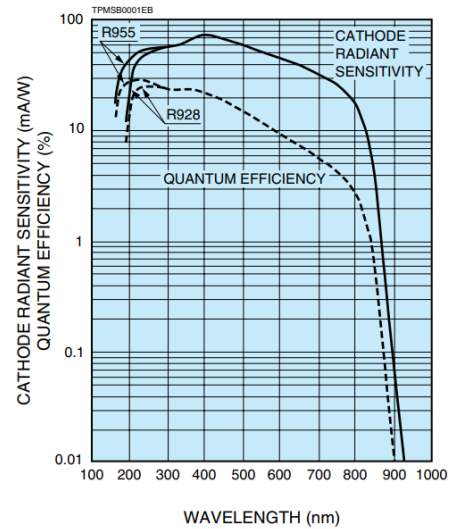
R928 PMT is widely used in UV-Vis spectrometers and fluorescence spectrometers. The typical efficiency curve and specifications of R928 PMT are as follow.

### SPECIFICATIONS

#### GENERAL

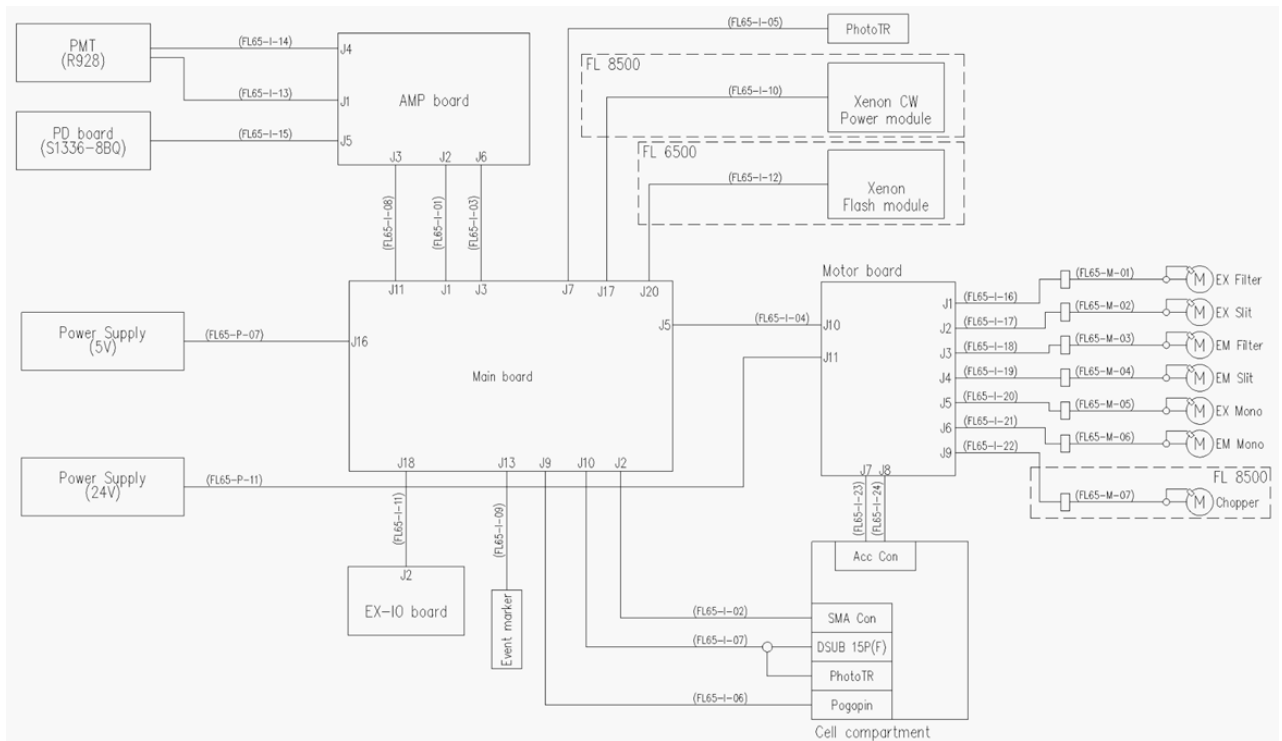
Parameter	Description / Value	Unit	
Spectral response	R928	185 to 900	nm
	R955	160 to 900	nm
Wavelength of maximum response	400	nm	
Photocathode	Material	Multialkali	—
	Minimum effective area	8 × 24	mm
Window material	R928	UV glass	—
	R955	Quartz	—
Dynode	Structure	Circular-cage	—
	Number of stages	9	—
Direct interelectrode capacitances	Anode to last dynode	Approx. 4	pF
	Anode to all other electrodes	Approx. 6	pF
Base	11-pin base	—	
Weight	Approx. 45	g	
Operating ambient temperature	-30 to +50	°C	
Storage temperature	-30 to +50	°C	
Suitable socket	E678-11A (sold separately)	—	
Suitable socket assembly	E717-63 (sold separately)	—	
	E717-74 (sold separately)	—	

Figure 1: Typical spectral response



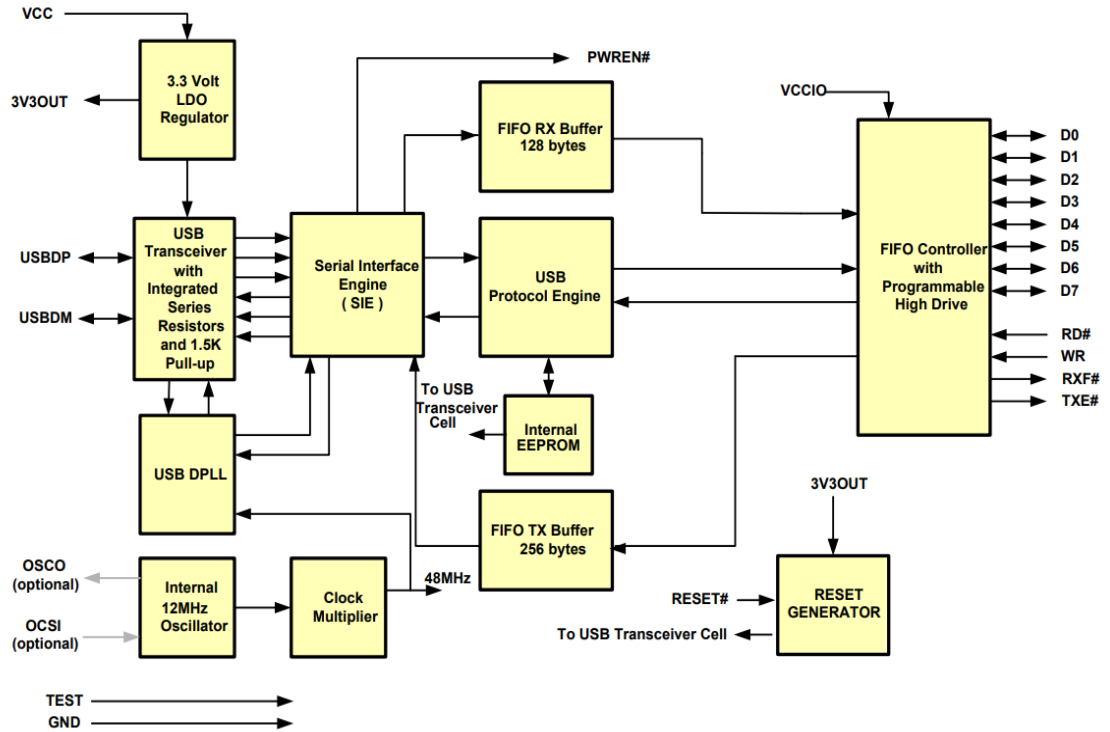
## Electronics Signal Process Block Diagram

FL series fluorescence spectrometer's electronics signal process is as follow.



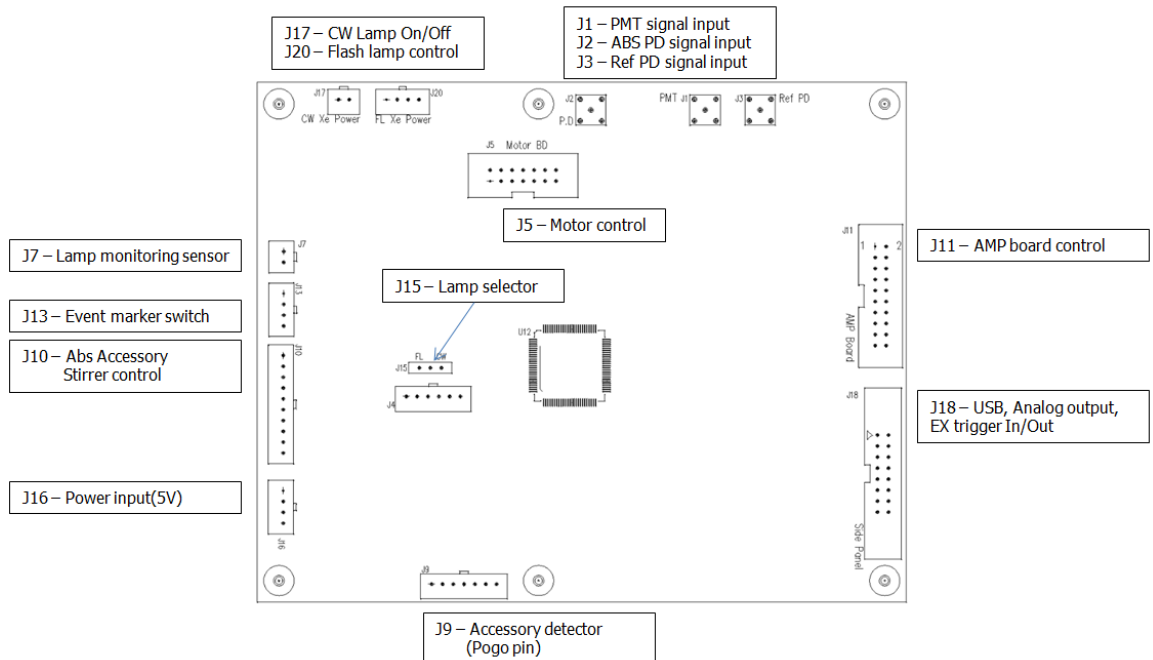
## USB Communication Block Diagram

FL series fluorescence spectrometer's USB communication's block diagram is as follow.



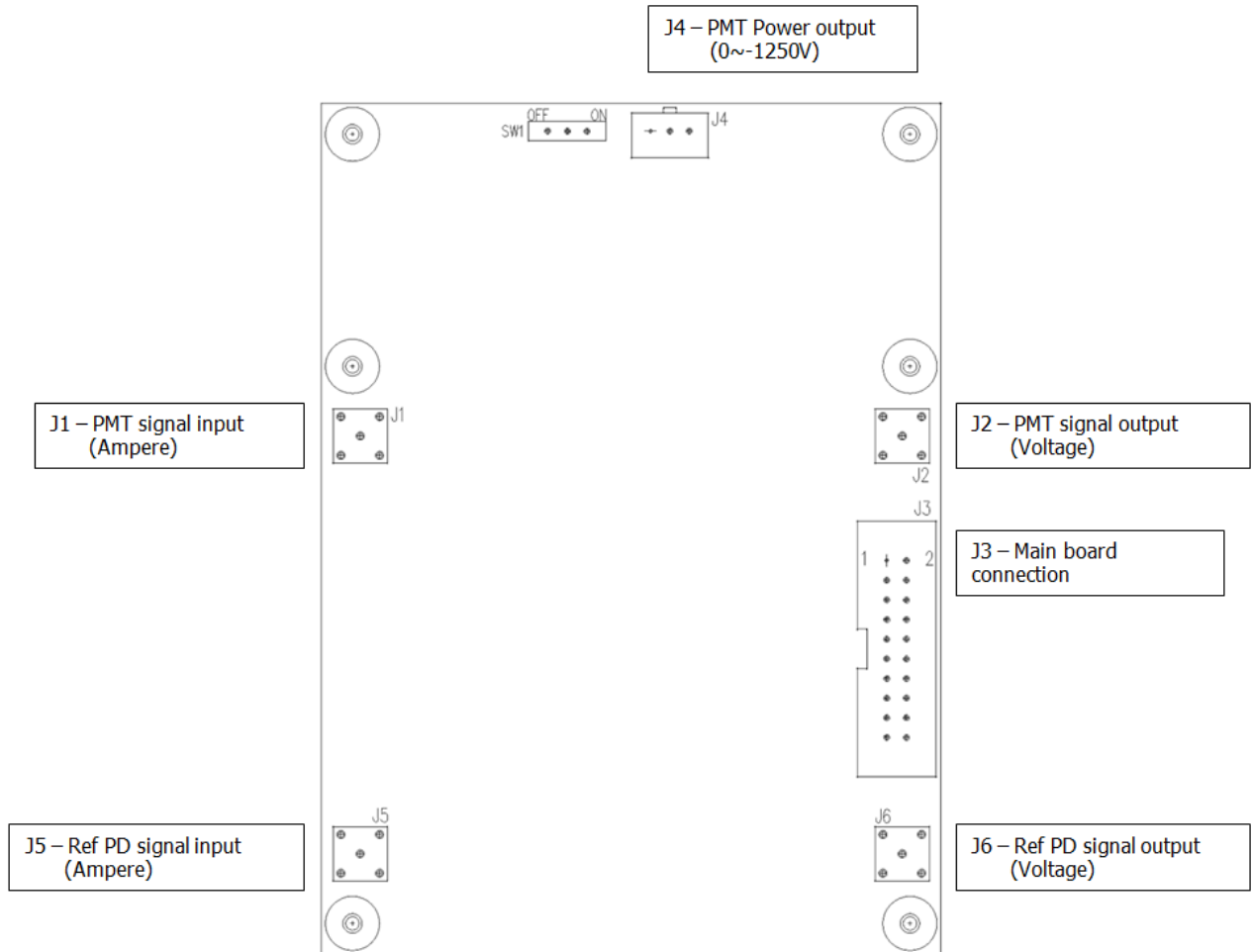
## Main Board

Main board is mainly used for the data communication, saving the information of the instrument and controlling each parts of the system.



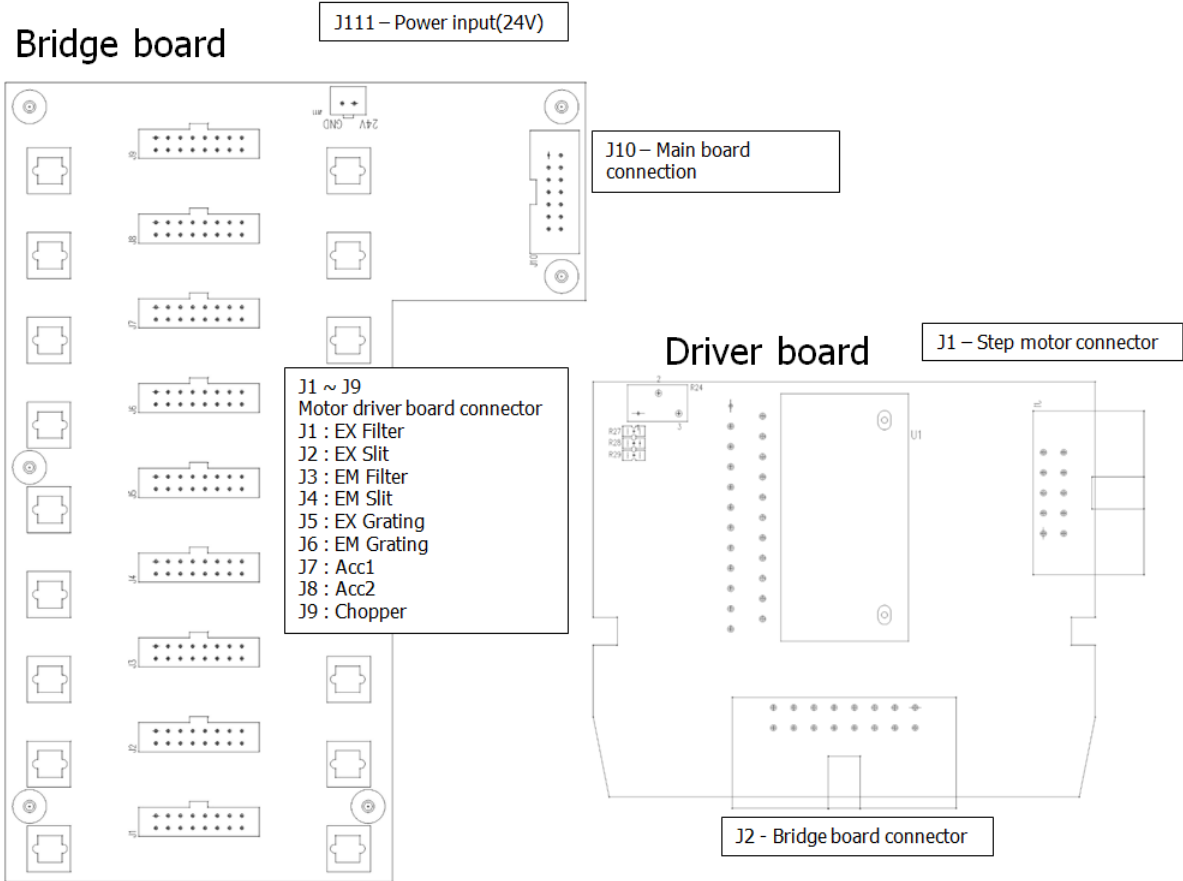
## Analog Board (Amp Board)

To digitize the data from analogue data of photo diode and PMT, the amplification board is used. See the following detailed schematic.



### Motor Boards and Bridge Board

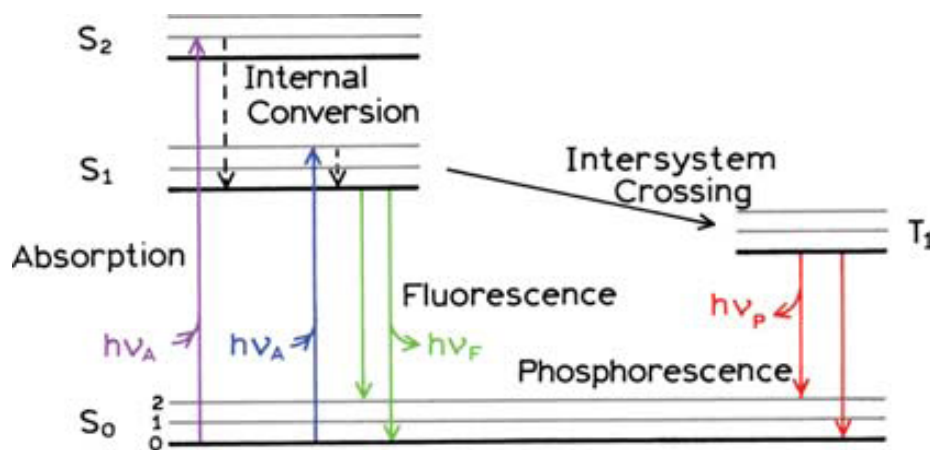
There are six motor boards in the FL 6500 and seven motor boards in the FL 8500. These boards are used for driving the motor of slit, filter, grating and chopper. The bridge board is used to connect all motor boards to one board to facilitate service and assembly.



## Theory

Luminescence is the emission of light from any substance, and occurs from electronically excited states. Luminescence is formally divided into two categories—fluorescence and phosphorescence—depending on the nature of the excited state. In excited singlet states, the electron in the excited orbital is paired (by opposite spin) to the second electron in the ground-state orbital. Consequently, return to the ground state is spin allowed and occurs rapidly by emission of a photon. The emission rates of fluorescence are typically  $10^8$  s, so that a typical fluorescence lifetime is near 10 ns ( $10 \times 10^{-9}$  s). The lifetime ( $\tau$ ) of a fluorophore is the average time between its excitation and return to the ground state. Many fluorophores display sub-nanosecond lifetimes. Because of the short timescale of fluorescence, measurement of the time-resolved emission requires sophisticated optics and electronics.

Phosphorescence is emission of light from triplet excited states, in which the electron in the excited orbital has the same spin orientation as the ground-state electron. Transitions to the ground state are forbidden and the emission rates are slow ( $10^3$  to  $100$  s $^{-1}$ ), so that phosphorescence lifetimes are typically milliseconds to seconds. Even longer lifetimes are possible, as is seen from "glow-in-the-dark" toys. Following exposure to light, the phosphorescence substances glow for several minutes while the excited phosphors slowly return to the ground state. Phosphorescence is usually not seen in fluid solutions at room temperature. This is because there exist many deactivation processes that compete with emission, such as non-radiative decay and quenching processes.

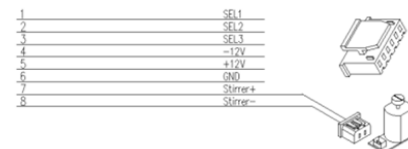
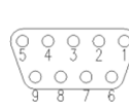
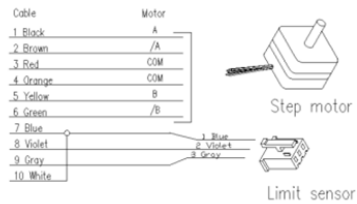
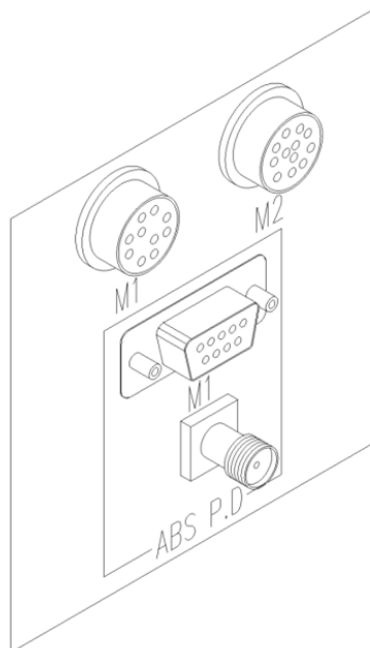
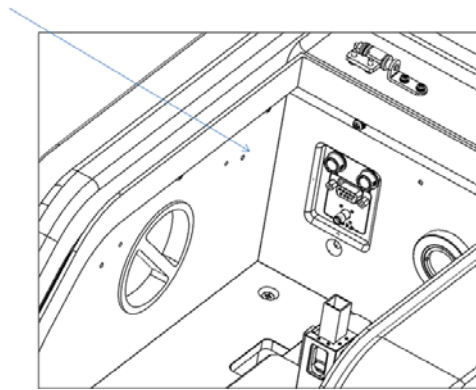
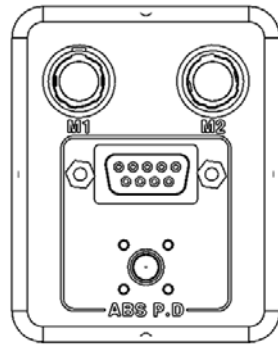


One form of a Jablonski diagram



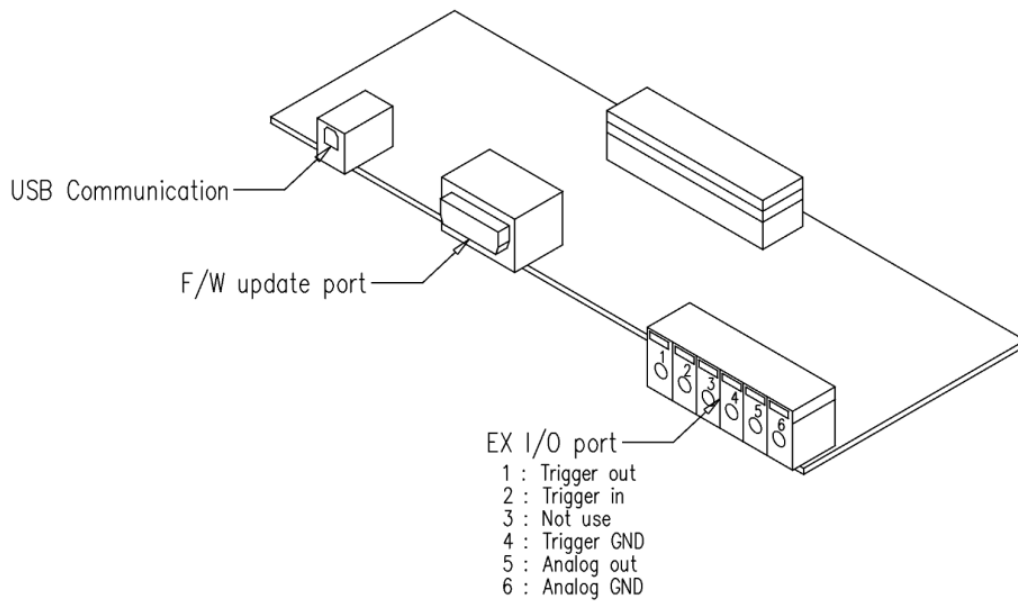
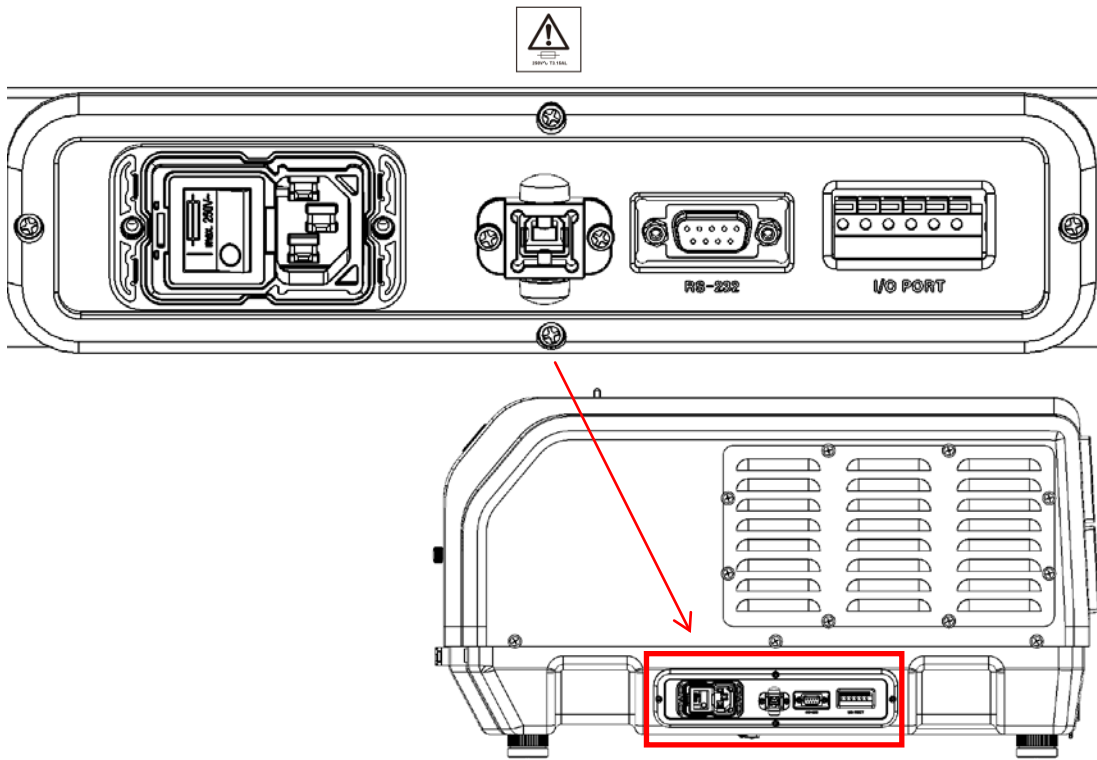
## Connections

There are several ports inside of the sample compartment as shown in the following figure. Multi-cell holder accessories are connected with the M1 connector. The fast filter and Microplate reader are connected with M1, M2 connectors. A nine pin DIP subconnector is used for connecting with the absorbance module or connecting with the stirrer. The SMA connector (ABS P.D) is used for connecting with the Absorbance Module. The configuration of each connector is shown below.



## 42. Fluorescence Spectrometer Hardware Guide

There are also various connectors on the side of the spectrometer. In this connector panel, from the left, there is power connector, a USB communication port, a F/W upload port, a I/O port. The rapid mixing accessory or external trigger can be connected via the I/O port.



## Specifications

List the specifications for the different components of the instrument

	FL 6500	FL 8500
<b>Illumination Source</b>	Pulse Xe lamp 4 Peak Power options: (a) 20Kw (b) 40Kw (c) 80Kw (d) 120Kw Variable peak power obtained through controlling the voltage. Base Specs: 20W ,<2 usec pulse width. Lamp connector to lamp holder will be unique and exclusive to PKI.	Xe Arc (150W) Lamp Source Lamp connector to lamp holder will be unique and available exclusively to PKI.
<b>Wavelength accuracy</b>	0.5 nm	0.5 nm
<b>Wavelength reproducibility</b>	0.2 nm	0.2 nm
<b>Wavelength scan speed</b>	24,000 nm/min	60,000 nm/min
<b>Response</b>	≥0.002, seconds	≥0.002, seconds
<b>Communication</b>	USB 2.0	USB 2.0
<b>Display range</b>	0 ~ 260000	0 ~ 260000
<b>Weight</b>	46 Kg	47 Kg
<b>Detector</b>	PMT R928	PMT R928
<b>Monochromator</b>	1200 grooves/mm, 250nm, 20cm focal length	1200 grooves/mm, 450nm, 20cm focal length
<b>Sensitivity (S/N ratio)</b>	Min 750 :1 (RMS);	4000:1 (RMS); 1000:1 (Peak to Peak)
<b>Wavelength range</b>	200 - 900 nm	200 - 900 nm
<b>Slit width</b>	1,2.5,5,10,20 nm	1,2.5,5,10,20 nm
<b>Display range</b>	0 ~ 260000	0 ~ 260000
<b>Power Supply</b>	100-240V at 50-60Hz	100-240V at 50-60Hz
<b>Filter Wheel</b>	12 slots that accept 12.5 mm round filters.	12 slots that accept 12.5 mm round filters.
<b>Filter Wheel</b>	Filter wheel will be included within the instrument	Filter wheel will be included within the instrument
<b>Standard Excitation Filters (wavelengths) included with instrument</b>	Excitation: 290, 370, 530 cut off filters, plus an open position for white light excitation and total fluorescence	Excitation: 290, 370, 530 cut off filters, plus an open position for white light excitation and total fluorescence
<b>Standard Emission Filters (wavelengths) included with instrument</b>	Emission: 320, 430, 515 nm, plus an open position for white light excitation and total fluorescence	Emission: 320, 430, 515 nm, plus an open position for white light excitation and total fluorescence



# **Installation**

## Overview

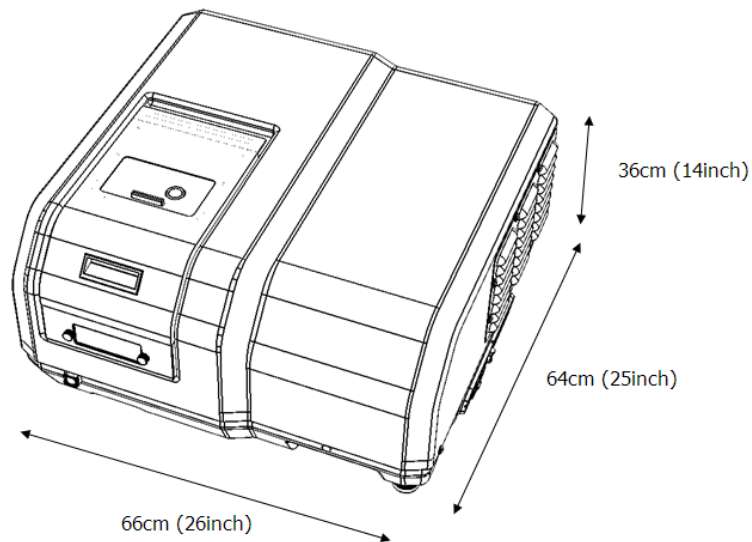
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Note: The first-time installation of your instrument will be carried out by a PerkinElmer Service Engineer. The following information is for reference only.

### Site Requirement

For maximum stability and minimum maintenance, observe the following requirements when choosing where to site the instruments:

- A firm base, free from vibration;
- Enough space around and underneath the instrument for efficient air circulation, as shown in Figure;
- A recommended temperature: 10°C to 35°C
- A constant relative humidity of between 20% and 80%
- An atmosphere free from dust and corrosive fumes;
- Keep out of direct sunlight, Illumination with diffuse lighting is ideal;
- A suitable source of electrical power should be located in the vicinity of the instrument, in this case a proper earth-grounded 3-wire electrical outlet. The power requirements are 100 VAC-240VAC, 50/60Hz;
- The instrument has drain hole in it to run off spilled liquids to the benchtop underneath the instrument. If required, place a sheet of thick filter paper under the instrument.



**Physical dimension of FL series fluorescence spectrometer**

## ***Installation Summary***

---

The installation of the system is divided into the following steps:

- Unpacking
- Shipping List
- Moving the instrument
- Connecting the System Components.
- Installing the instrument
- Software Installation
- Instrument Start-up
- Accessories Installation

## Unpacking

**CAUTION** *Take great care when installing your FL series Fluorescence spectrometer, and follow the procedures described in this manual. If you require assistance, contact your local PerkinElmer Service Engineer.*

**ATTENTION** *Faites attention lorsque vous installez votre NOM DE L'INSTRUMENT et suivez les procédures décrites dans ce manuel. Si vous avez besoin d'aide, contactez votre ingénieur de service local PerkinElmer.*

## Introduction

**Carefully read these instructions before unpacking the Fluorescence spectrometers to avoid damage to the instrument.** The fluorescence spectrometer is packed in a cardboard box with pallet that has been designed to safely move and unload the instrument.



**WARNING**

*The FL series Fluorescence spectrometer, in the box, can weigh as much as 47kg (103lbs). Carefully move the instrument between the unloading area and the installation site. If using a hand truck carefully position the box on the hand truck.*



**AVERTISSEMENT**

*Le spectromètre à fluorescence de la série FL, dans la boîte, peut peser jusqu'à 47 kg (103 lb). Déplacez soigneusement l'instrument entre la zone de déchargement et le site d'installation. Si vous utilisez un chariot manuel, placez la boîte sur le chariot.*

*The shipping platform used to pack the instrument is returnable for reuse within the U.S.A. only.*

## Inspecting the Shipment

Upon receipt of the instrument, the exterior of all the shipping cartons should be inspected. All cartons should arrive unopened and undamaged. If the examination reveals that damage has occurred in shipment, notify the carrier and PerkinElmer immediately. A representative of the shipping carrier must be present for insurance purposes.

## Unpacking the FL Series Fluorescence Spectrometer

The instrument (along with the single cell holder, documents on a USB, power cables, USB communication cable, extra fuses and software USB) is shipped in one carton. Boxes containing the accessories are shipped separately.



## Tools You'll Need

- Snipers for removing the banding and tie wraps
- Scissors for removing tape and opening the box



## ***Banding on of the Box***

Use snipers or scissors to remove any banding maybe around the box.

	<i>Wear safety glasses when cutting the banding to prevent injury.</i>
<b>WARNING</b>	
	<i>Porter des lunettes de sécurité lors de la coupe du baguage pour prévenir les blessures.</i>
<b>AVERTISSEMENT</b>	

- Record any visible damage on the waybill before accepting the shipment. Notify your local PerkinElmer customer support engineer immediately.

## ***How to Unpack the Instrument***

1. Place the instrument carton on the floor in front of the bench on to which the instrument will be placed.



2. Cut the bands that hold the carton together, open the top of the shipping carton.



3. Open the box and pull out the foam piece.



4. Take out the small carton box that includes the single cell holder, documents, power cables, extra fuses and software USB.



5. Pull out all the foam that secure the instrument in the box.



**WARNING**

*The instrument can weigh as much as 47 kg (103lbs). Use proper lifting posture when lifting the instrument out of the carton. You will need two people to lift the instrument out of the carton and position the instrument on the bench.*



**AVERTISSEMENT**

*L'instrument peut peser jusqu'à 47 kg (103lbs). Utilisez une posture de levage appropriée lorsque vous sortez l'instrument du carton. Vous aurez besoin de deux personnes pour sortir l'instrument du carton et positionner l'instrument sur le banc.*

6. Prepare to lift the instrument out of the carton. You will need two people to do this. The bench should be nearby and if the bench has wheels make sure that the wheels are locked.



7. Squat down and securely grip the sides of the instrument.

8. With knees bent, simultaneously lift the instrument up as you end up in a standing position. Carefully place the instrument on the bench.



9. Remove the polyethylene bag covering the instrument.



10. Remove any adhesive tape on instrument.

11. Open the small carton box.



12. Check if there are power cables, USB communication cable, Software & document USB, Teflon block, extra fuses and documents.

## ***Recycling the Instrument Box***

If you plan on moving your Fluorescence spectrometer instrument you may want to keep the cardboard box that the instrument was shipped in. If you need to dispose of the cardboard box please do so in accordance with local environmental regulations

SUPPLIES, ACCESSORIES, AND REPLACEMENT PARTS can be ordered directly from PerkinElmer. For further information visit our website at [www.perkinelmer.com](http://www.perkinelmer.com) or contact your local PerkinElmer representative.

## ***Shipping List***

---

### ***Installation Kit***

The instrument ships with an installation kit (Part No. N4202000).

### ***Instruments***

Part No.	Description
N4200011	FL 6500 Analyzer
N4200031	FL 8500 Analyzer

### ***USB Drives***

Part No.	Description
N4208001	USB drive for Spectrum FL software and documents.
N4208011	USB drive for Spectrum ES FL software and documents.

### ***Spare Parts***

Part No.	Description
N4202037	Fuse
N4202033	Teflon Block

### ***Power Cords***

The instrument ships with a US, European and United Kingdom power cord. All other power cords will need to be ordered separately.

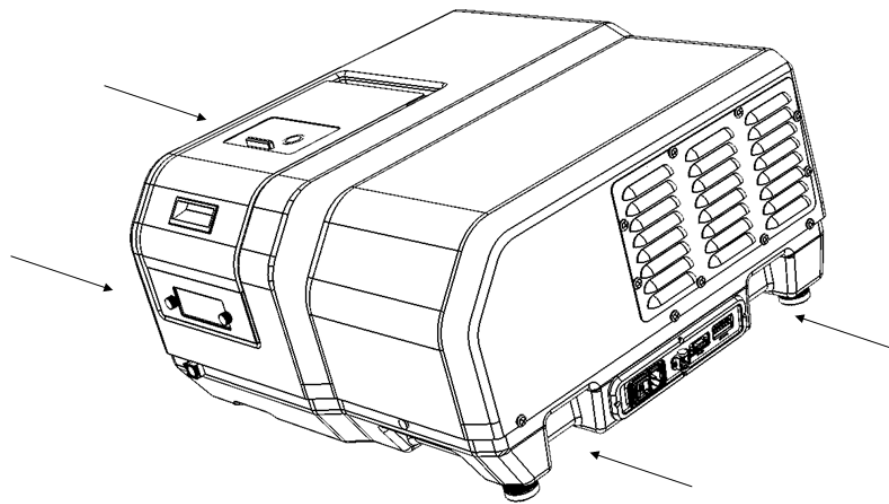
## ***Moving the Instrument***

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If you must move the instrument any great distance, especially if the instrument may be subject to vibrations or jolts **contact a PerkinElmer service engineer to assist you in moving your system.**

If you are only moving the instrument within the laboratory or to a nearby laboratory use the following procedure.

1. Turn the system off and unplug the power line.
2. Disconnect all cables connected to the outside of the instrument.
3. The instrument weighs about 46kg. Two people are needed to lift the instrument.
4. Lift the instrument using the handholds as shown below figure.



**L Series handholds position**

## ***Connecting the Gases***

---

After the instrument has been placed into position, it can be connected to the various services in the laboratory.

### ***Connecting the Purge Gas***

To connect the gases to the instrument follow these steps.

1. Place the equipment and gas bombe in a safe position and fix the gas bombe not to fall.
2. Connect the tube to the purge gas inlet of the instrument. (Recommended Tube Outer Diameter : 4 mm , Inner Diameter : 2.5 mm)

Working Pressure of Fitting: Max. 20 Bar





## Connecting the System Components



**WARNING**

### **Electrical Hazard**

*To prevent potential injury to yourself and damage to the instrument, switch **OFF** all instruments in the system and disconnect them from the line power supply before you alter, or make any new electrical connections.*



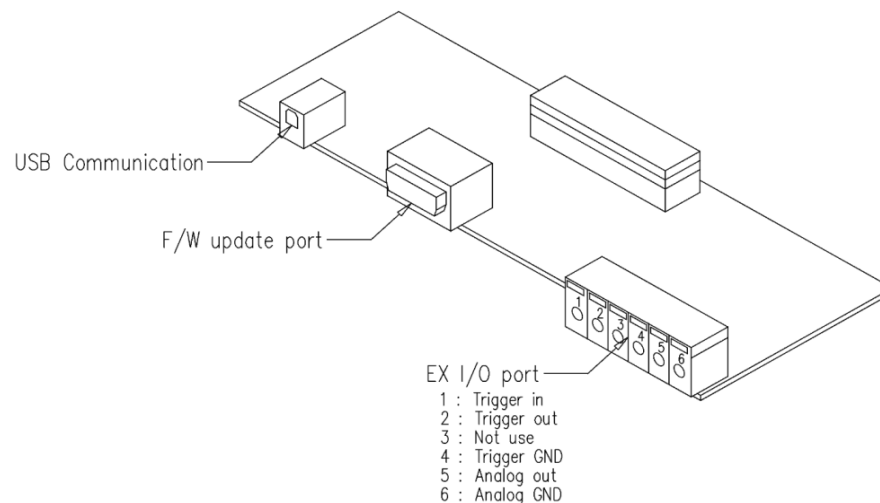
**AVERTISSEMENT**

### **Danger électrique**

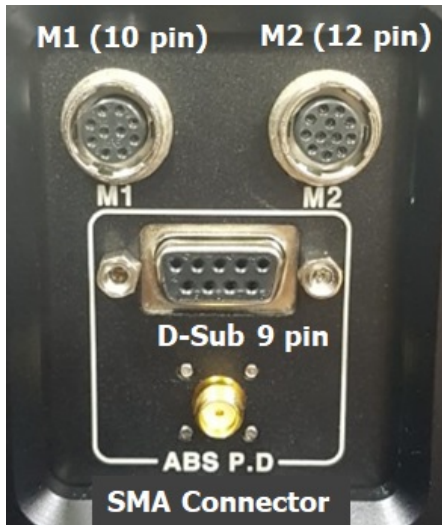
*Pour éviter toute blessure potentielle et endommager l'instrument, éteignez tous les instruments du système et débranchez-les de l'alimentation secteur avant de modifier ou de créer de nouvelles connexions électriques.*

The system component connections are as follows (see the following figure):

- USB communication Cable
- F/W upload cable (RS-232)
- I/O connection cable for external trigger.



- Accessory Connection



Port	Accessory list
M1	4-Position Multi-Cell Holder, Water Jacketed 4-Position Multi-Cell Holder, Water Jacketed 4-Position Multi-Cell Holder w/Stirrer, Fast Filter, Micro Plate Reader
M2	Micro Plate Reader, Fast Filter
D-Sub 9 pin	Absorbance Module, Water Jacketed Single Cell Holder w/Stirrer, Water Jacketed Micro Cell Holder w/Stirrer, Water Jacketed 4-Position Multi-Cell Holder w/Stirrer
SMA Connector	Absorbance Module

## *Installing the Instrument*

---

To install the instrument follow these steps.

1. Carefully remove the instrument and all of its components from the shipping container.

Verify that all of the components received match the packing list.

- FL 6500 (or FL 8500) Fluorescence Spectrometer
- Interface cable
- Power Cords (US, UK, EU)
- USB Flash Drive for Software and Document Pack
- Teflon Block

2. Place the instrument in a location that is compatible with the required environmental conditions for operation.



3. Connect the power cord to the right side of the instrument. The power plug **must** be grounded.



4. Connect the Interface cable (USB) between the computer and the instrument.

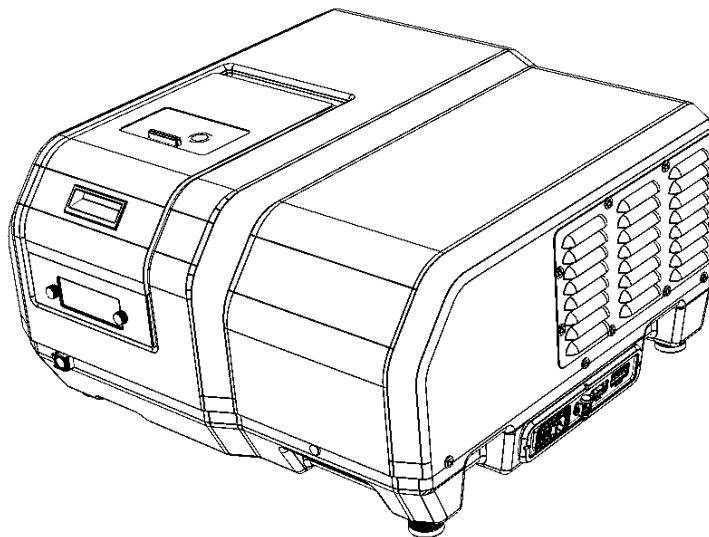


- A suitable source of electrical power should be located in the vicinity of the instrument, in this case a proper earth-grounded 3-wire electrical outlet. The power requirements are 100 VAC-240VAC, 50/60Hz.

## ***Software Installation***

---

This software installation guide describes how to install the software for FL 6500 and FL 8500 fluorescence spectrometers.



**FL series fluorescence spectrometer**

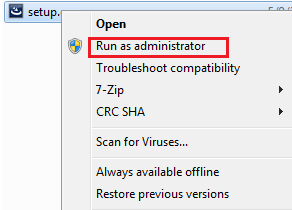
## Installing Software for the Instrument

To install the software follow these steps.

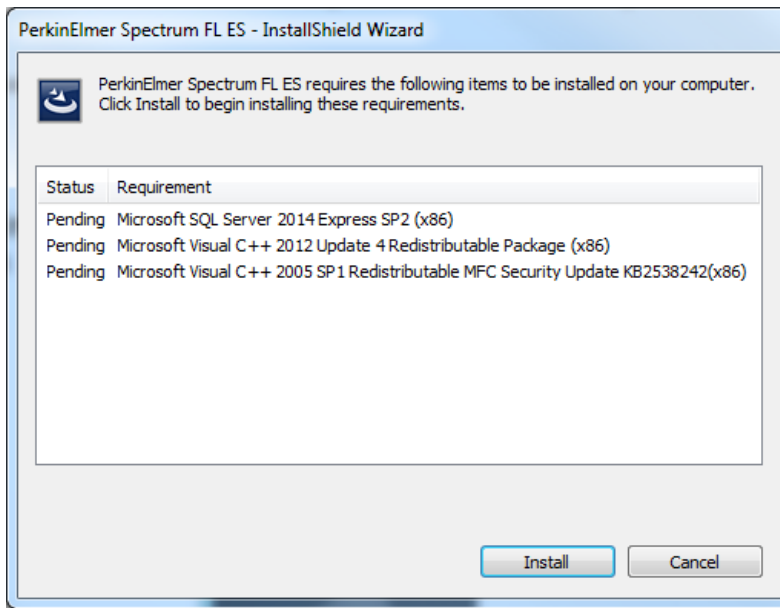
1. Copy the software installation **setup.exe** file to the local computer.

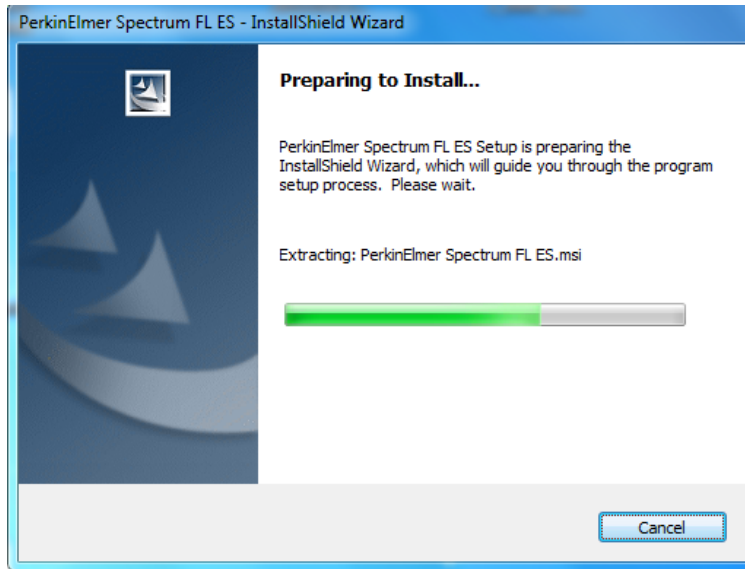


2. Select the installation file, right click to select **Run as administrator** to start installation.

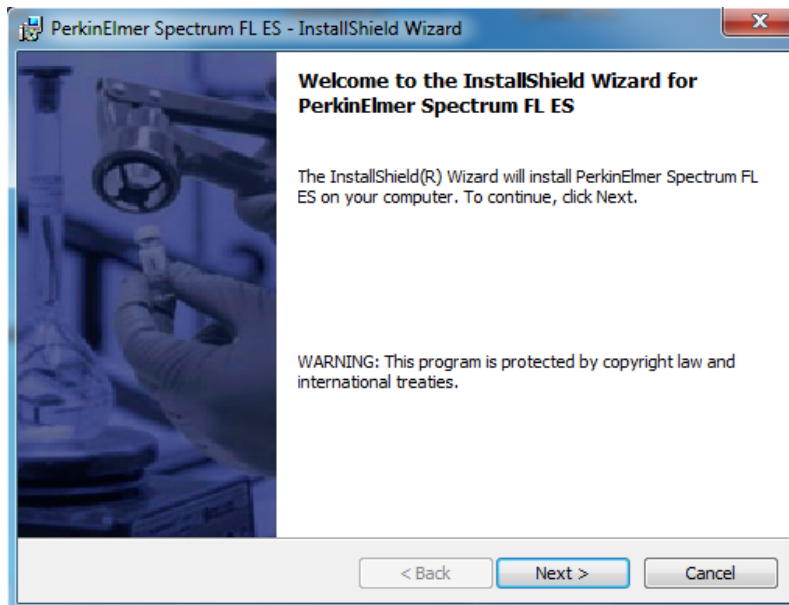


3. Click **Install** to install the required components.

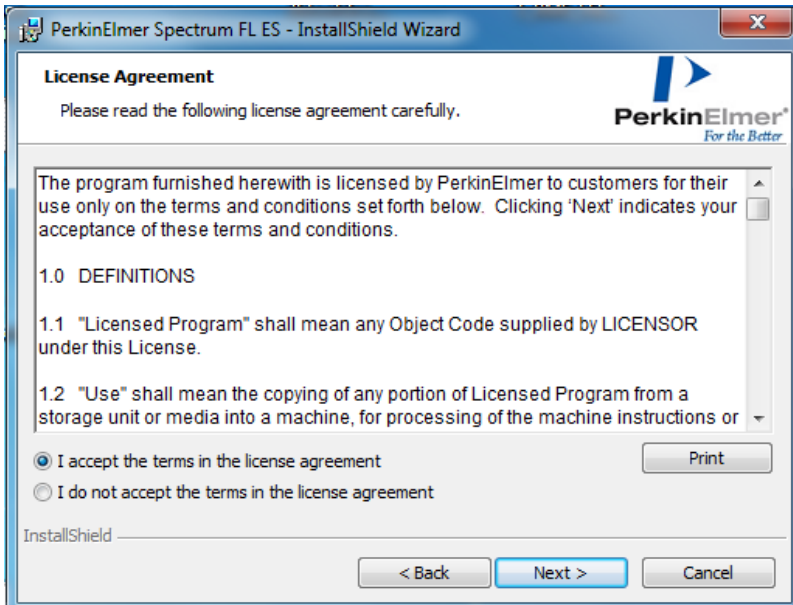




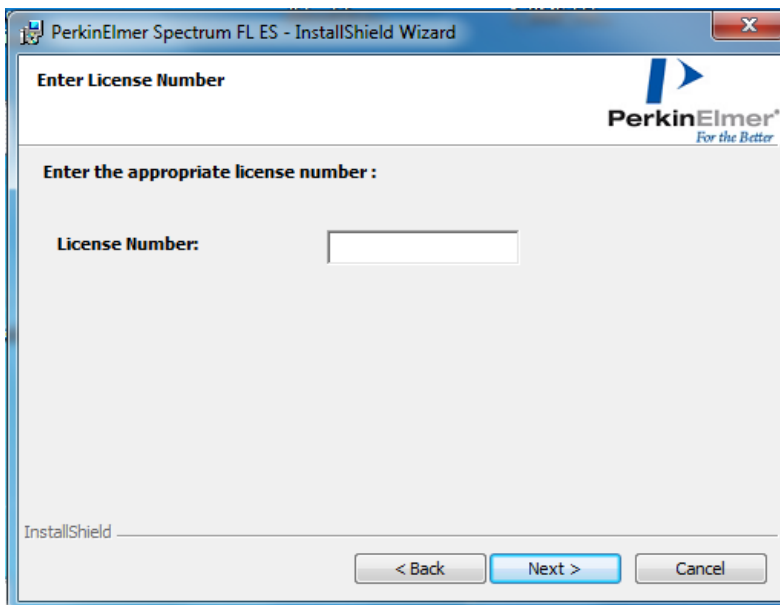
4. Click **Next** to open the license agreement.



5. Select **I accept the terms in the license agreement**, then click the **Next** button.

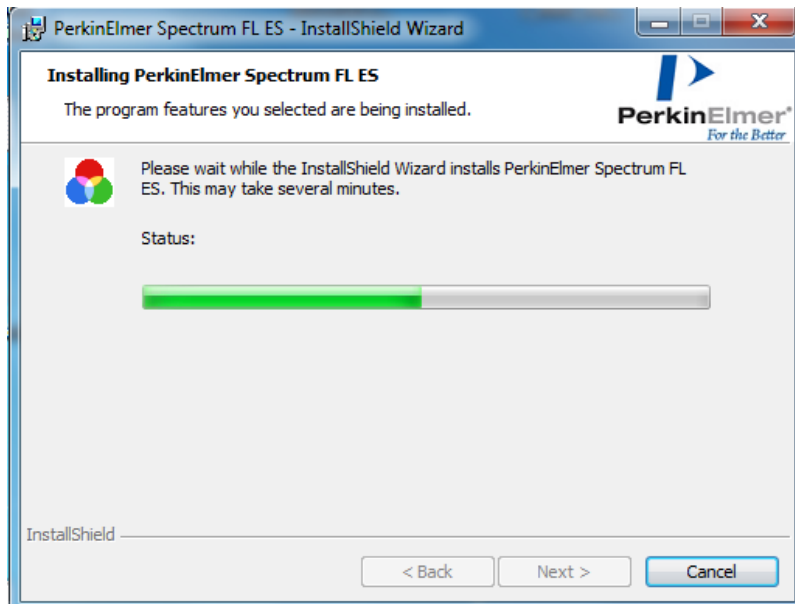
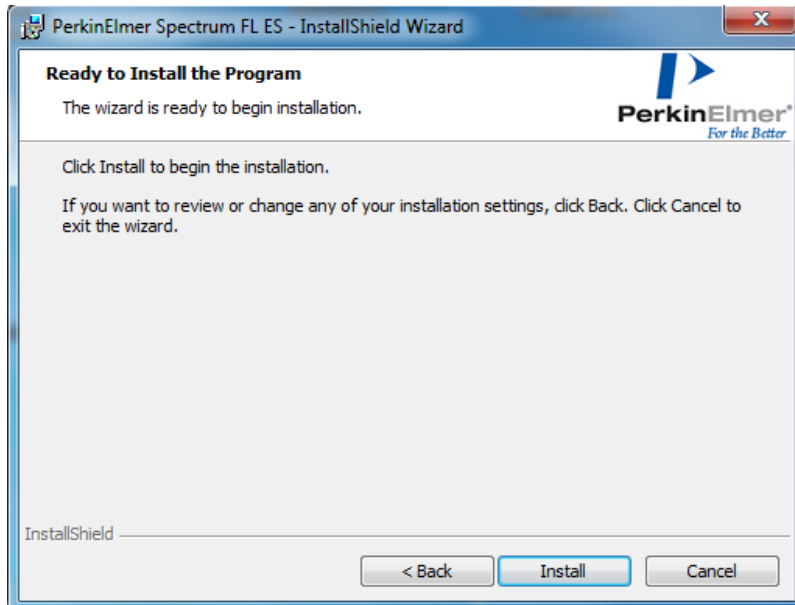


6. Enter the appropriate license number, click the **Next** button.

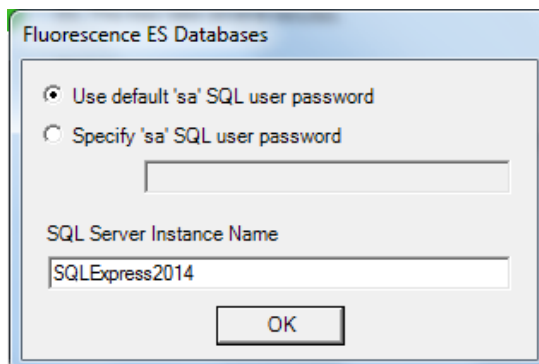




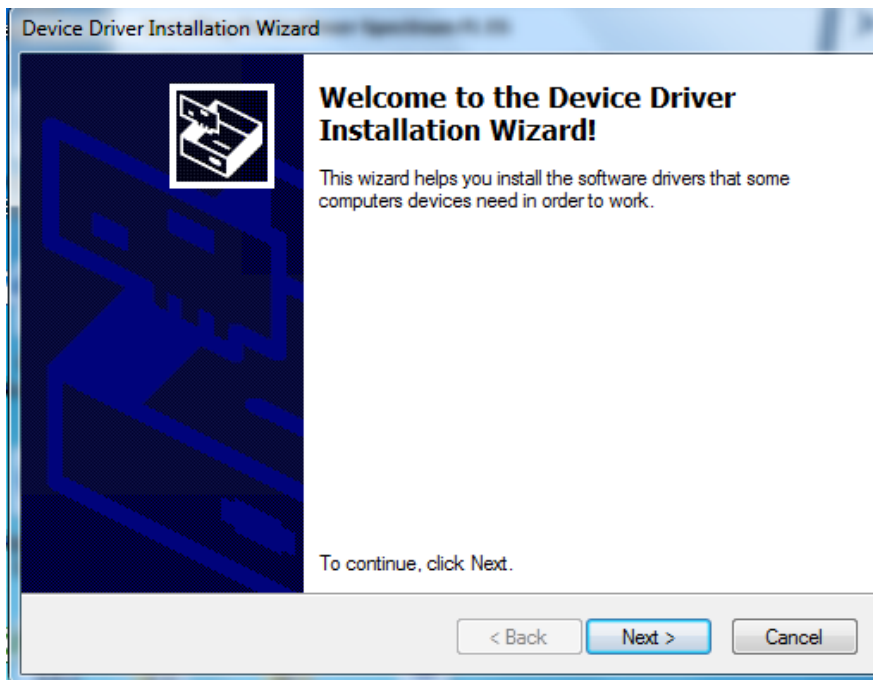
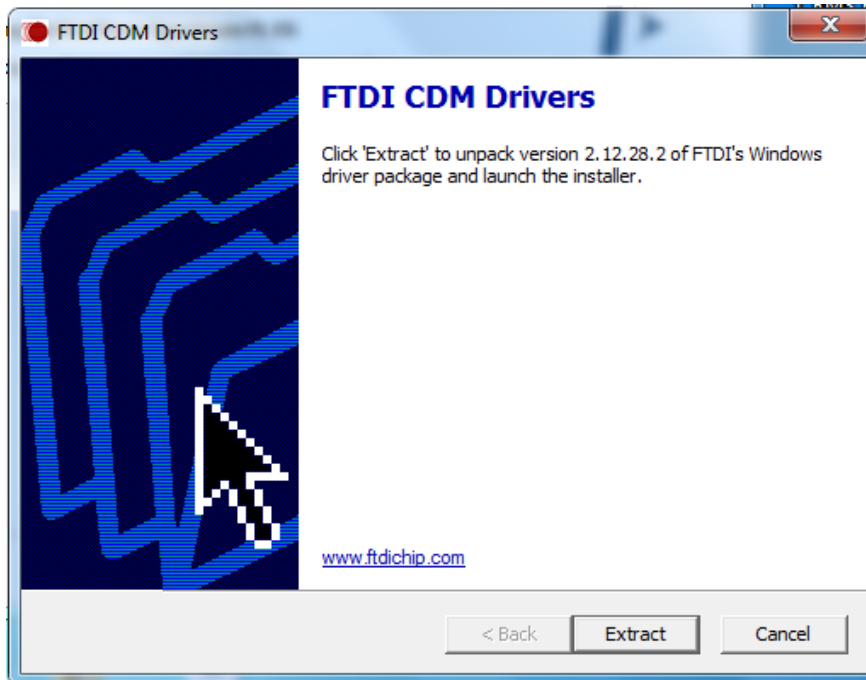
- Click the **Install** button on the **Ready to Install the Program** page.

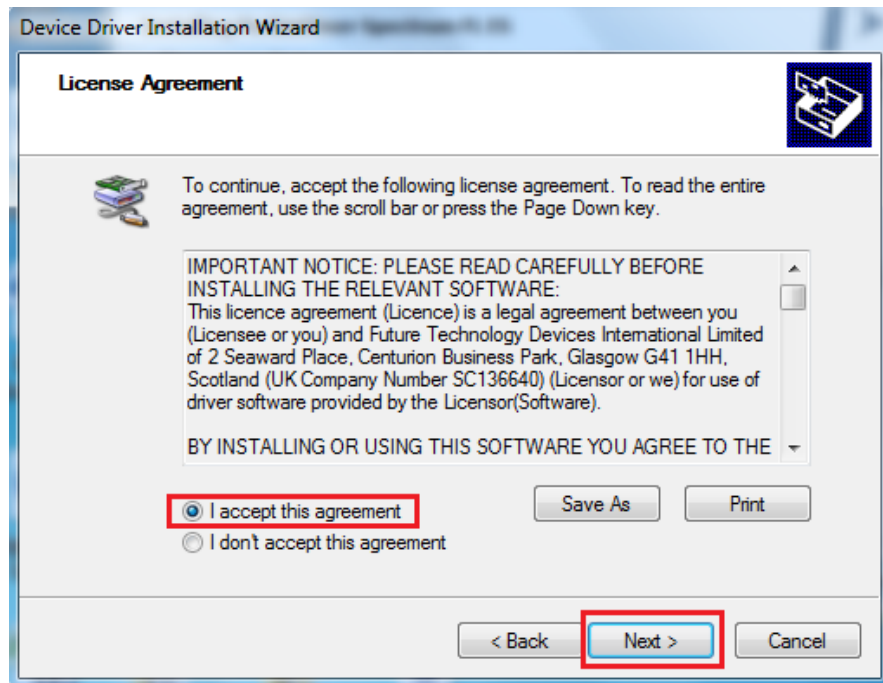


- Click **OK** once the following dialog appears.

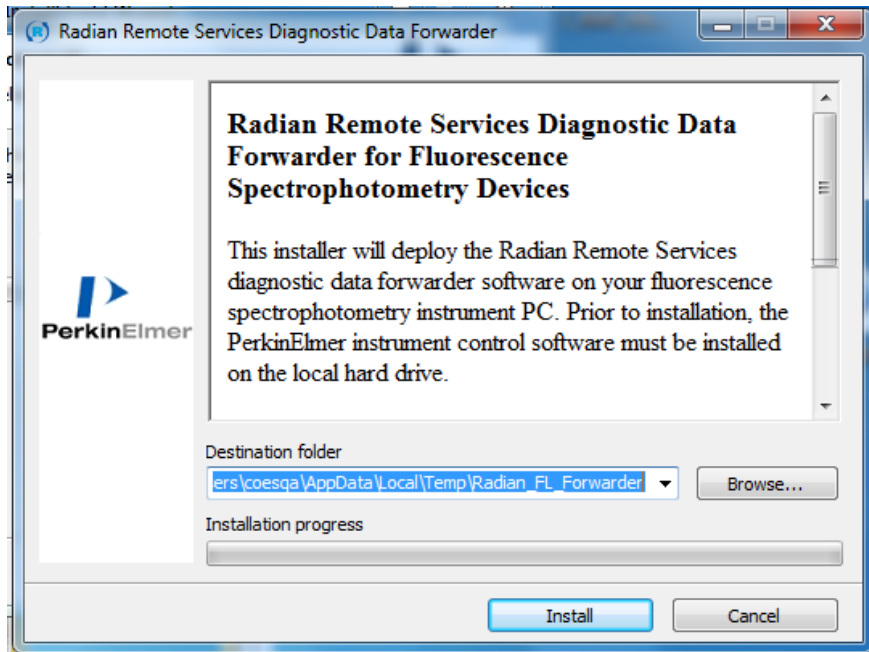
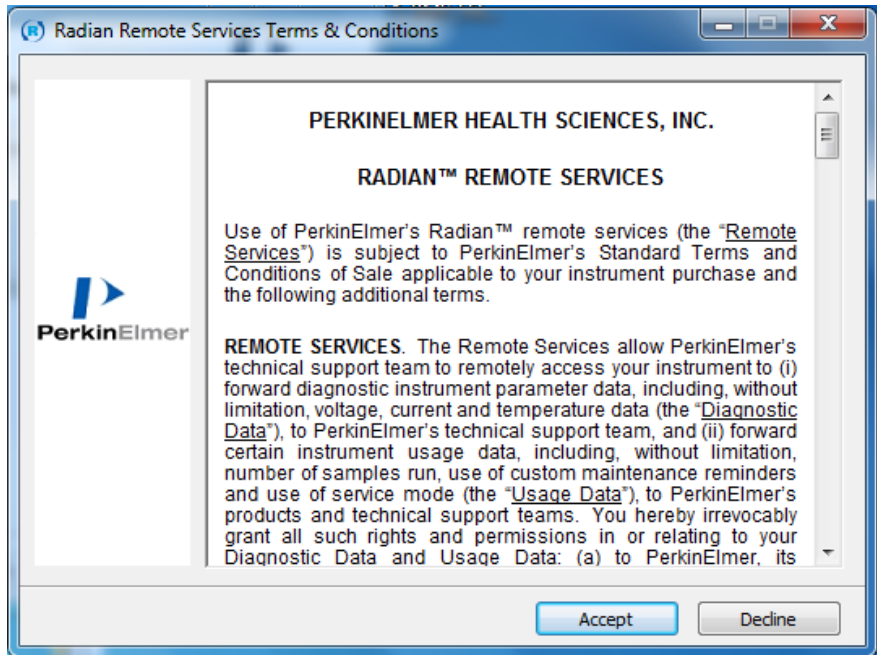


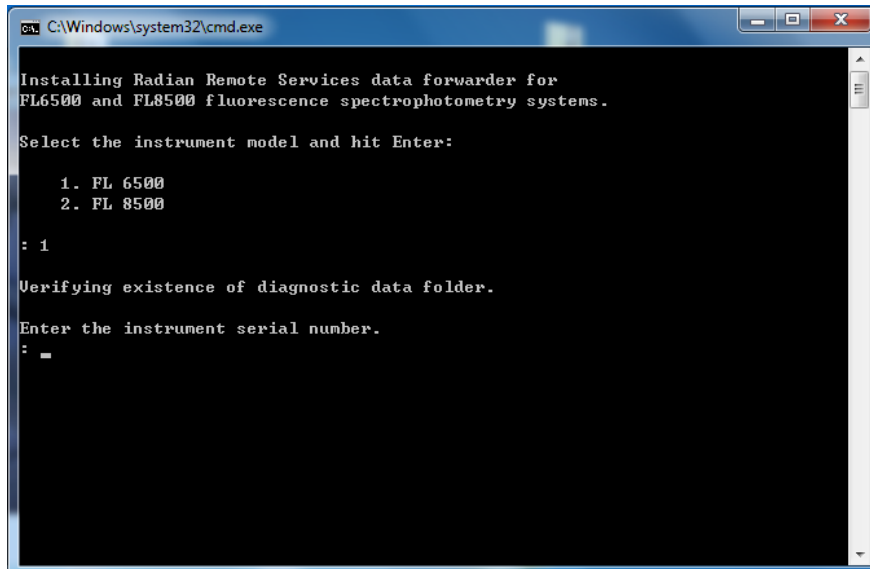
9. Click **Extract** to install the FTDI CDM Driver, when FTDI CDM Driver dialog displays.



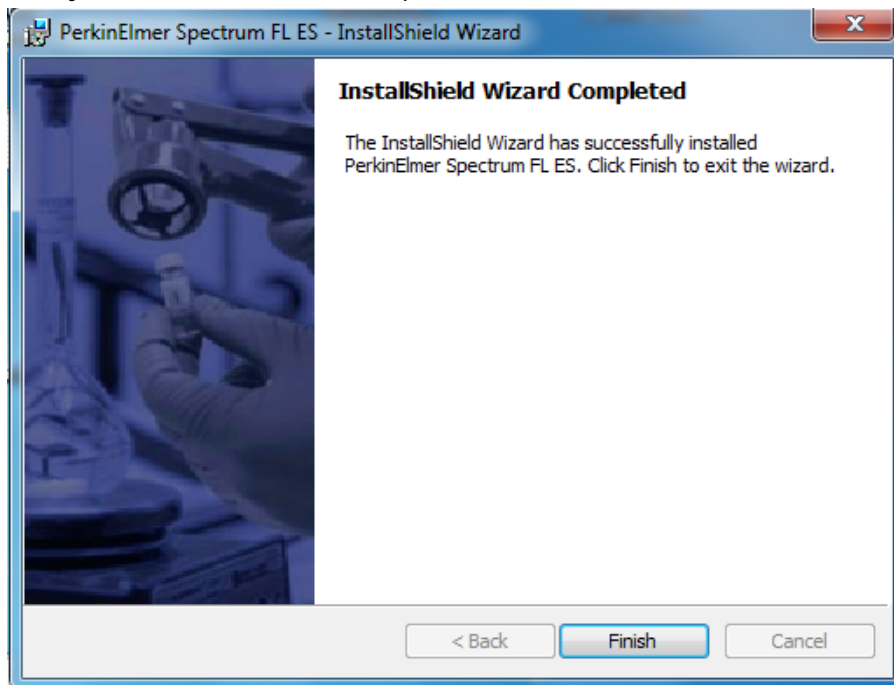


10. Finch standard software installation will continue with the installation of the Radian remote service components as shown in the following screenshots.





11. Finally click **Finish** button to complete the installation, then restart the computer.



## *Instrument Start-up*

---

### *Operating Procedure*

1. Turn on the power switch. In case of FL 8500, allow the instrument to warm-up for at least 10 minutes.
2. Execute **Spectrum FL** software and select a measurement mode.
3. In case of FL 8500, allow the instrument to warm-up for at least 10 minutes.
4. Check the recognition of accessory.
5. Set up the measurement parameters.
6. Click **Save** to save the method after setting up the parameters.
7. Input the sample name and click **OK**.
8. The results are shown the result window.
9. Save or print the data as required.

### *Diagnostics & Wavelength Calibration*

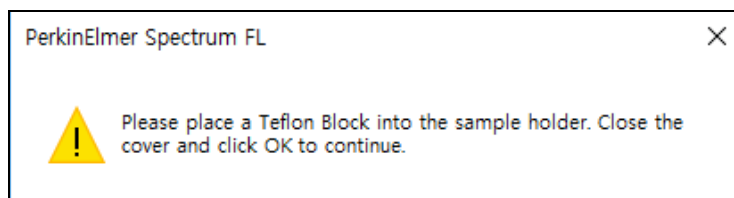
Once the instrument is installed you will need to check the wavelength

1. Power on the system and run the **Spectrum FL** software.
2. From the **Options** panel in the software Spectrum FL software, click **Diagnostics**.



3. Click **Run** to check the system operates well.

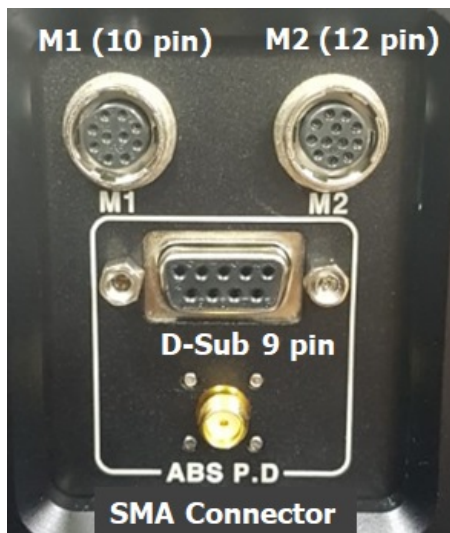
4. Place a teflon block into the cell holder. Click **OK**.



5. If the system check results are all **PASS** you do not have to recalibrate the system.
6. In case the wavelength test result is **Failed**, recalibrate wavelengths referring to the **Recalibration** section.

## Accessories Installation

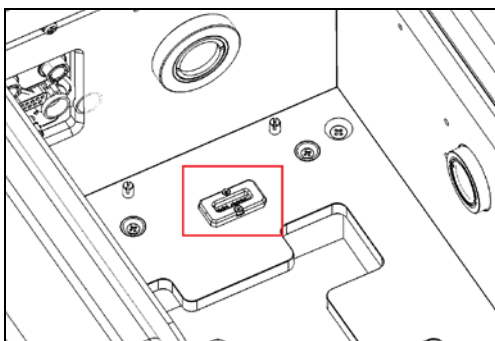
When you use the cell holders with stirrer, Multi-cell Holder, Micro Plate Reader, Absorbance Module and Fast Filter, the electronic cables should be connected to the several ports inside of the sample compartment. The table shows that which accessories should be connected to each connectors. In this section, there will be brief instruction of accessories to be connected with accessory connection panel.



Port	Accessory list
M1	4-Position Multi-Cell Holder, Water Jacketed 4-Position Multi-Cell Holder, Water Jacketed 4-Position Multi-Cell Holder w/Stirrer, Fast Filter, Micro Plate Reader
M2	Micro Plate Reader, Fast Filter
D-Sub 9 pin	Absorbance Module, Water Jacketed Single Cell Holder w/Stirrer, Water Jacketed Micro Cell Holder w/Stirrer, Water Jacketed 4-Position Multi-Cell Holder w/Stirrer
SMA Connector	Absorbance Module

## Accessories Recognition Pogo Pin

When using accessories The FL series fluorescence spectrophotometer can automatically recognize which accessories have been installed using pogo pins.





***Pogopin ID and accessories LUT***

ID	Accessory	#1	#2	#3	#4	#5	#6	#7
0	None	Open	Open	Open	Open	Open	Open	Open
1	Single Cell Holder	Close	Open	Open	Open	Open	Open	Close
2	Water Jacketed Single cell Holder	Open	Close	Open	Open	Open	Open	Close
3	Water Jacketed Single Cell Holder w/Stirrer	Close	Close	Open	Open	Open	Open	Close
4	4-Position Multi Cell Holder	Open	Open	Close	Open	Open	Open	Close
5	Water Jacketed 4-Position Multi-Cell Holder	Close	Open	Close	Open	Open	Open	Close
6	Water Jacketed 4-Position Multi-Cell Holder w/Stirrer	Open	Close	Close	Open	Open	Open	Close
7	Micro Cell Holder	Close	Close	Close	Open	Open	Open	Close
8	Water jacketed Micro Cell Holder w/Stirrer	Open	Open	Open	Close	Open	Open	Close
9	Solid Sample Holder	Close	Open	Open	Close	Open	Open	Close
10	Variable Angle Solid Sample Holder	Open	Close	Open	Close	Open	Open	Close
11	Manual Polarizer Holder	Close	Close	Open	Close	Open	Open	Close
12	Manual Polarizer Holder w/Stirrer	Open	Open	Close	Close	Open	Open	Close

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13	Single Cell Peltier Holder	Close	Open	Close	Close	Open	Open	Close
14	4-Position Multi-Cell Peltier Holder	Open	Close	Close	Close	Open	Open	Close
15	Peltier Powder Sampling Holder(Liquid Cooling)	Close	Close	Close	Close	Open	Open	Close
16	Absorbance Module	Open	Open	Open	Open	Close	Open	Close
17		Close	Open	Open	Open	Close	Open	Close
18	Low Temp. Cell Holder	Open	Close	Open	Open	Close	Open	Close
19	Fast Filter	Close	Close	Open	Open	Close	Open	Close
20	Fiber Optic Probe	Open	Open	Close	Open	Close	Open	Close
21	LC flow cell	Close	Open	Close	Open	Close	Open	Close
22	Micro Plate Reader	Open	Close	Close	Open	Close	Open	Close
23	Integrating Sphere	Close	Close	Close	Open	Close	Open	Close

# *Replacement*

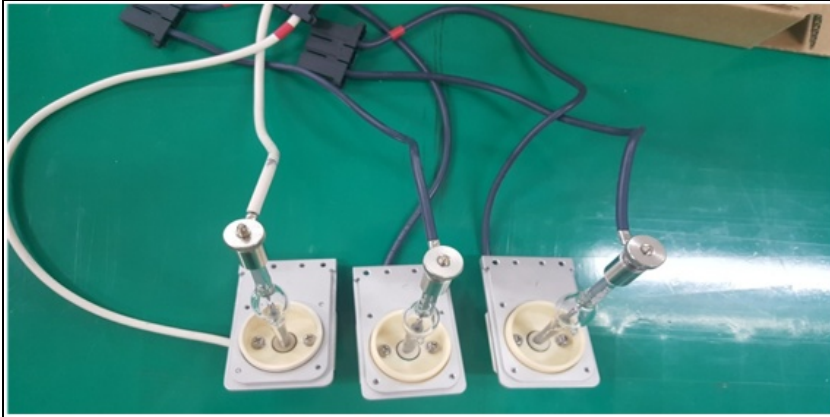
## ***Light Source***

---

### ***Replacing the lamp (FL 8500)***

If the lamp usage is over the lifespan, you need to change the lamp following the steps.

1. Turn off the main power and unplug the power code from the equipment.
2. Prepare the new lamp module.



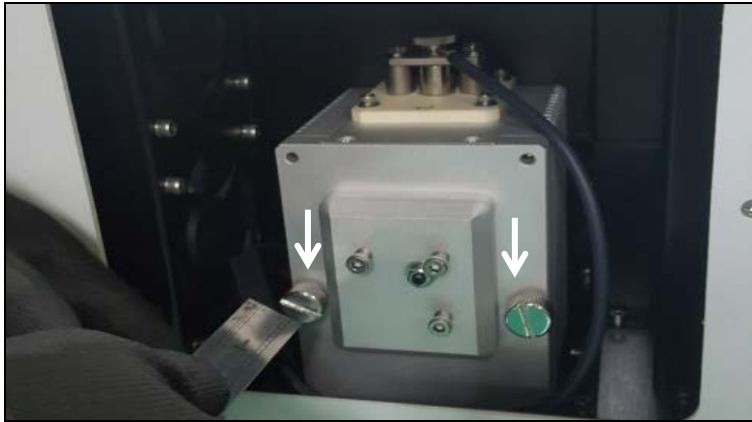
3. Open the side panel.



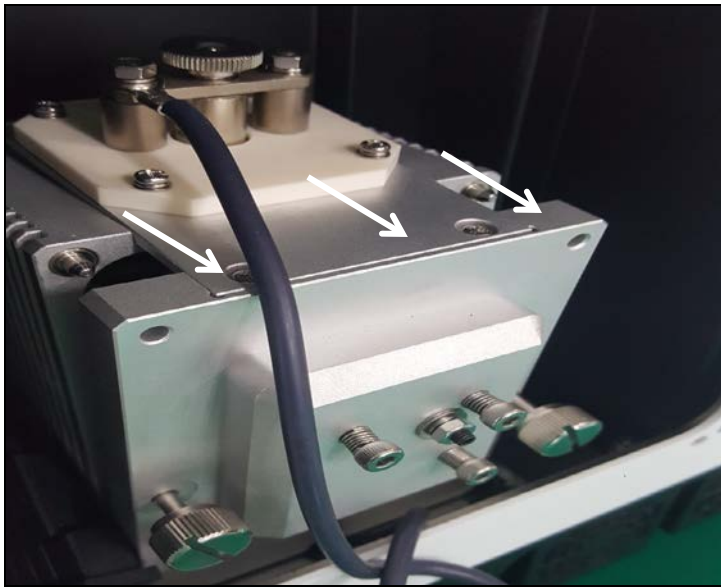
4. Separate the power from the lamp by disconnecting the connectors.



5. Loosen the screws.



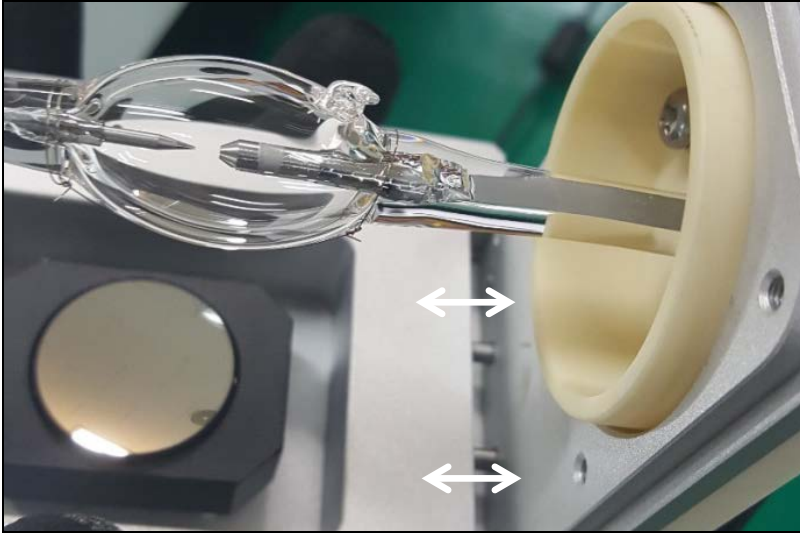
6. Remove the lamp module by pulling it in the direction of the arrows.



7. Loosen the top screws of the separated lamp holder.



8. Disconnect the lamp bracket as follows. (To disconnect them easily, the lamp module should be cooled down.)



9. The order of replace a new lamp module is the reverse of the disassembly procedure.

### ***Replacing the lamp (FL 6500)***

If the lamp usage is over the lifespan, you need to change the lamp following the steps.

1. Turn off the main power and unplug the power code from the equipment.
2. Prepare the new lamp.



3. Open the side panel.



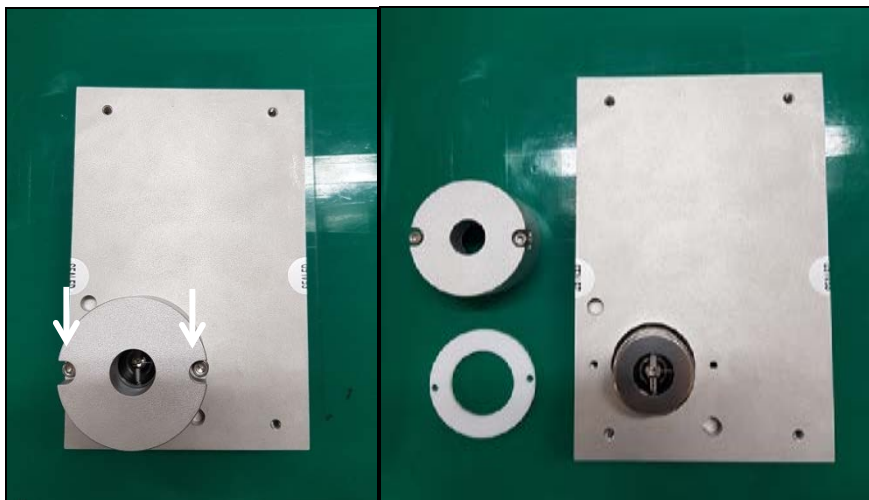
4. Loosen the screws at the bottom of the lamp.



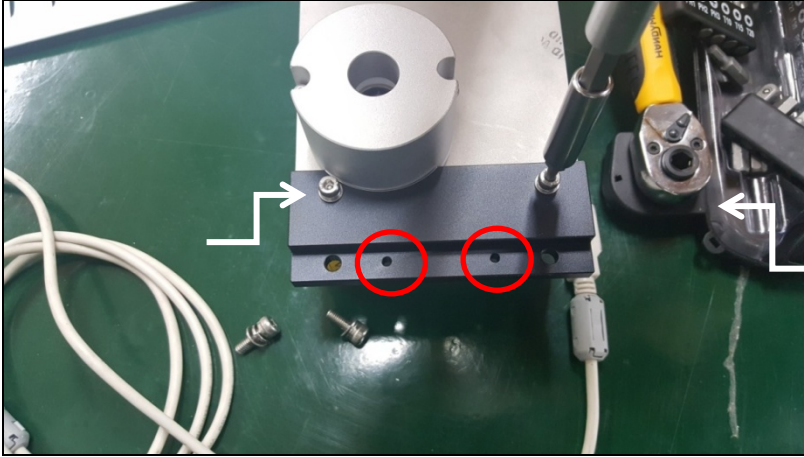
5. Pull out the lamp and separate the power by unscrew the screws.



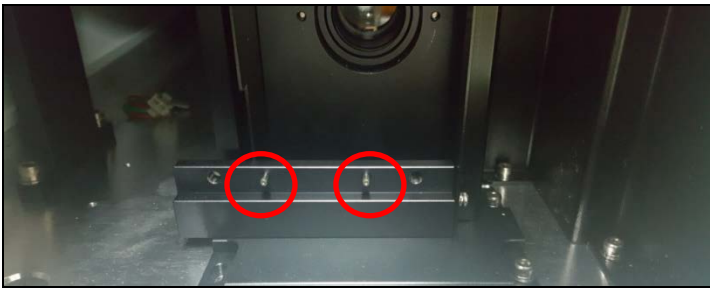
6. Separate the silencer from the existing lamp and install it onto new lamp.



7. Remove the cradle from the existing lamp and attach it to the new lamp.



8. After connecting power, assemble by aligning hole of cradle (see the following figure, red circles) and pin of equipment.



9. Assemble the new lamp w/2 screws.



10. Close the side panel.

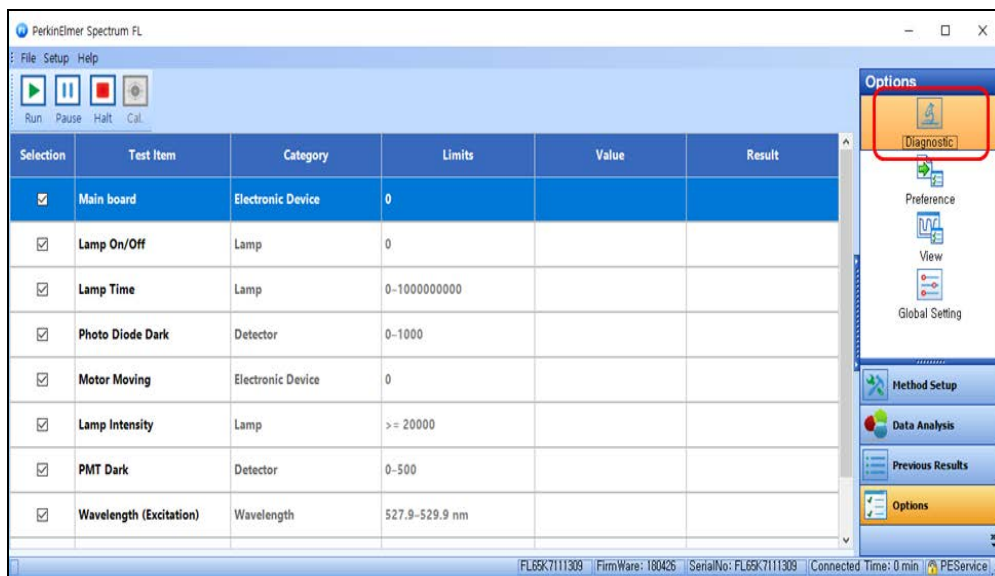


# **Recalibration**

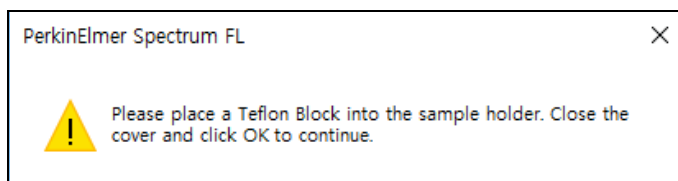
## Recalibration

If the wavelength does not match, proceed to the next step.

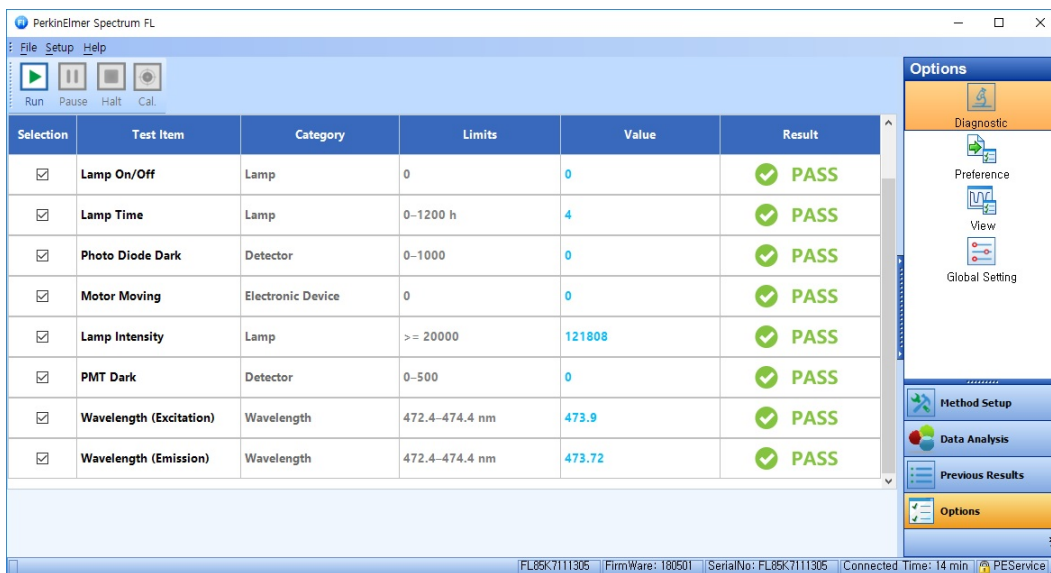
1. Power on the system and run the **Spectrum FL** software.
2. From the Options panel in the software Spectrum FL software, click **Diagnostics**.



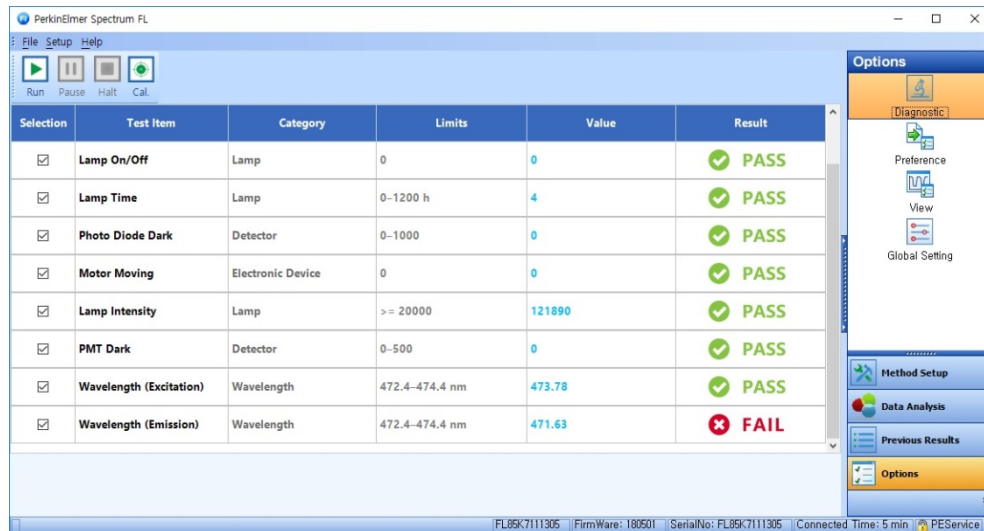
3. Click **Run** to check the system operates well.
4. Place a teflon block into the cell holder. Click **OK**.



5. If the system check results are all **PASS** you do not have to recalibrate the system.

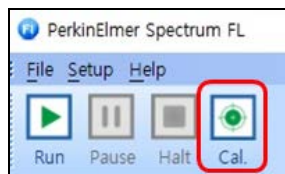


6. In case the wavelength test result is **Failed**, recalibrate wavelengths.



Selection	Test Item	Category	Limits	Value	Result
<input checked="" type="checkbox"/>	Lamp On/Off	Lamp	0	0	✓ PASS
<input checked="" type="checkbox"/>	Lamp Time	Lamp	0-1200 h	4	✓ PASS
<input checked="" type="checkbox"/>	Photo Diode Dark	Detector	0-1000	0	✓ PASS
<input checked="" type="checkbox"/>	Motor Moving	Electronic Device	0	0	✓ PASS
<input checked="" type="checkbox"/>	Lamp Intensity	Lamp	>= 20000	121890	✓ PASS
<input checked="" type="checkbox"/>	PMT Dark	Detector	0-500	0	✓ PASS
<input checked="" type="checkbox"/>	Wavelength (Excitation)	Wavelength	472.4-474.4 nm	473.78	✓ PASS
<input checked="" type="checkbox"/>	Wavelength (Emission)	Wavelength	472.4-474.4 nm	471.63	✗ FAIL

7. Click **Cal.** to calibrate wavelengths.



8. To proceed the wavelength calibration, the Teflon block should be inserted into the cell holder.

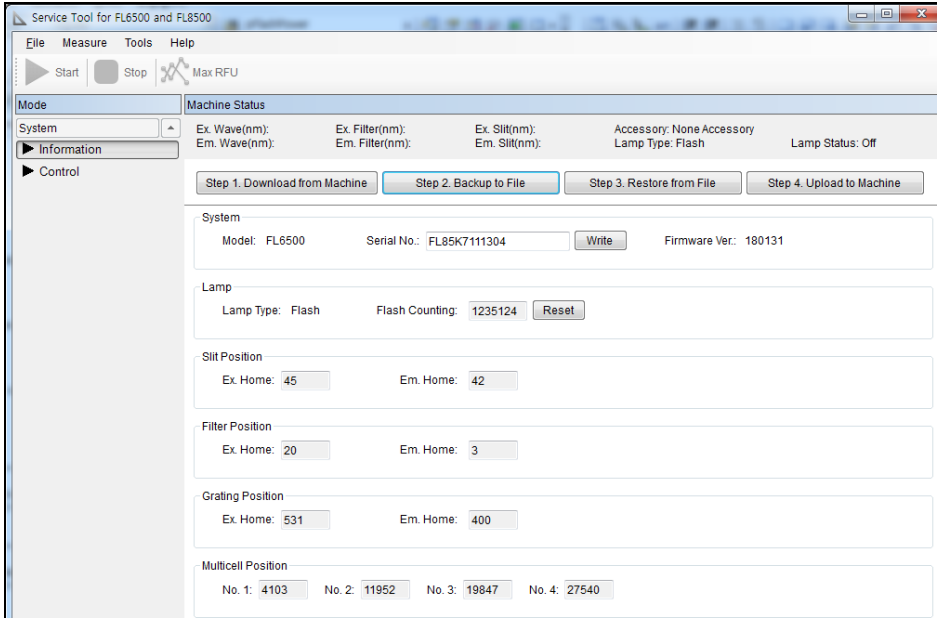


9. When the recalibration is finished, the Cal. icon is activated.
10. Run the Diagnostics again.
11. After conforming the system work well, close the Spectrum FL software.
12. Run **Service Tool.exe** software to back up the system information. Click **This PC > Local Disk(C) > Program Files (x86) > PerkinElmer > ServiceFL > FLService Tool.**

- Click **Information** and click **Step 1. Download from Machine**.

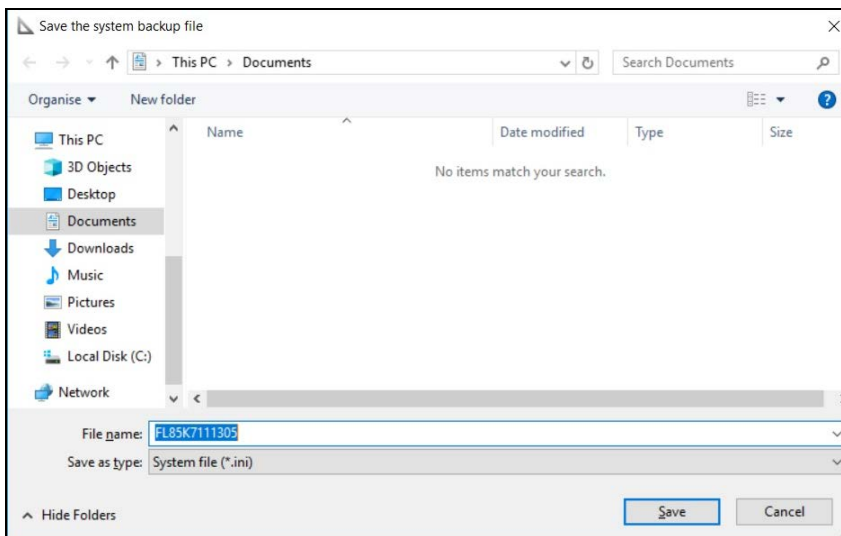


- You can see that the information is downloaded from the instrument.



- Click **Step 2. Backup to File**, then you have to save the information to the specified file. Enter the file name and click **Save**.

**NOTE:** Save and keep this file in case you need to replace the main board. When replacing the main board, this file should be opened and the information should be uploaded to the instrument.



# *Troubleshooting*

## ***Overview***

---

FL series fluorescence spectrometer system was designed to operate reliably and predictably. If the instrument has a problem, take measures by referring to the table below. When a symptom in question is not found in the table, contact your local Perkin Elmer service engineer or sales representatives.

## Intoduction

The following tables list the most common instrument performance problems and software error messages for the FL series fluorescence spectrometer.

Problem	Possible Causes	Corrective Action
1. The instrument is not powered though the power switch is in the ON position.	The power cable is not securely connected.	Securely insert the plugs at both ends of the cable into the inlet on the instrument and the outlet at the site.
	Power fuse is blown.	Replace the fuse with a new one.
	Other causes.	Contact Perkin Elmer or sales representative.
2. Software can't be communicated to the Hardware.	USB cable is not securely connected.	Reconnect the USB Cable.
	The mainboard cable is loose.	Reconnect the main board Cable.
	Mainboard is out of order.	Replace the main board.
3. Light is not reaching the sample.	Slit does not move to the right position.	Check the slit motor in the Diagnostic. If slit motor passes the diagnostics, there is a need to calibrate the slit position. If slit motor fails in the diagnostics, there is a need to replace the cable or board. For both cases, contact Perkin Elmer or sales representative.
	Chopper does not open. (FL 8500)	Check the chopper motor in the Diagnostic. If chopper motor passes the diagnostics, the mechanical adjustment will be needed. If chopper motor fails in the diagnostics, there is a need to replace the cable or board. For both cases, contact Perkin Elmer or sales representative.
	The lamp is not lit. (FL 8500)	Go to Item 4
	The lamp is not lit. (FL 6500)	Go to Item 4
	The monochromator is incorrectly calibrated.	Calibrate the Wavelength. If the problem is not solved after the Wavelength Calibration, Contact Perkin Elmer or sales representative.

	The accessory is not a right position.	Relocate the position.
4. The lamp is not turned on.	Wiring is disconnected or oxidized.	Check the connection of the high-voltage lead on the positive (+) electrode side of the lamp. Before opening the cover of the lamp house, be sure to disconnect the power cable from the outlet. Inadvertently powering ON of the instrument with the cover open is extremely dangerous. When the lamp is oxidized, replace the lamp.
	Lamp temperature is high even though it is not turned on.	Replace the lamp.
	Lamp Usage Time is over 1200 hours (FL 8500) Lamp Flash Number is over $10^9$	Replace the lamp.
	No sound of ignition of the lamp.	Replace the lamp.(CW/Flash) Replace the igniter.
	SMPS-24V is out of order. (FL 6500)	Replace the SMPS-24V.
5. S/N ratio does not satisfy the guaranteed value	The xenon lamp is not stably lit.	After turning on the power of the instrument, wait for at least 30 minutes until the Xenon lamp is stably lit.
	The xenon lamp is aged.	Replace Xenon lamp.
	Distilled water is contaminated.	Contaminated distilled water or dirty cuvette cell will result in the increased background noise owing to scattered light or impurity-induced fluorescence, eventually decreasing the S/N ratio. Rinse the cuvette cell thoroughly. Use clean distilled water only.
6. The signal does not come out	The Xenon lamp is misaligned.	Position lamp correctly.
	Wrong acquisition parameters.	Correctly specify the wavelength, slit width, filter etc.
	Lamp is unlit.	Replace the lamp.
	Data is saturated.	Reduce slit setting or adjust PMT voltage setting properly.
	Data is zero.	Adjust PMT voltage or replace the PMT and Amp board.



	Data is low.	Adjust PMT voltage or replace the lamp.
7. Diagnostics Fail (Wavelength)	Wavelength is shifted.	Calibrate the Excitation and Emission monochromator.
8. Diagnostics Fail (Motor Moving)	Photo Interrupter (IR sensor) is out of order	Replace the Photo Interrupter. (Contact to Perkin Elmer Service Engineer)
	Motors Board is out of order.	Replace the Motor board. (Contact to Perkin Elmer Service Engineer)
9. Diagnostics Fail (PMT Dark)	PMT is out of order.	Replace the PMT.
	PMT amp board is out of order.	Replace the PMT amp board.
10. Diagnostics Fail (Photo Diode Dark)	The photodiode is out of order.	Replace the photodiode.
	Photodiode amp board is out of order.	Replace the photodiode amp board.
11. Diagnostics Fail (Lamp intensity)	The photodiode is out of order.	Replace the photodiode.
	Photodiode amp board is out of order.	Replace the photodiode amp board.
	Lamp usage is over the lifespan.	Replace the lamp.
12. The sound of an electric spark in the lamp. (FL 6500)	The xenon lamp is not stably lit.	Replace the lamp.
13. The accessory is not recognized.	Pogo pin is not securely connected.	Reconnect the Pogo pin cable.
	Pogo pin is broken.	Replace the Pogo pin and cable.

## Diagnosics

The following tables list the method to check the system in diagnostic. You can define the cause of the issue when the system does not work improperly.

Check List	Test Method	Return Parameter	Permitted Value
Mainboard	Use the dedicated protocol to check if the return is as expected	0	Pass
		1	Fail
		2	Software error
Lamp On/Off	1. Check the lamp status after turning on the lamp 2. Check the lamp status after turning off the lamp	0	Pass
		1	Fail
		2	Software error
Lamp Time	Check the flash count in FL 6500. Check the lamp time in FL 8500	FL 6500 : Flash Count	Should be less than 10 <sup>9</sup>
		FL 8500 : Lamp Time	Should be less than 1200
		1	Hardware error
		2	Software error
Photo Diode Dark	1. Turn off the lamp 2. Chopper Close(FL 8500) 3. EX. Slit - 0.5 nm, EX. Filter - Air 4. EM. Slit - 0.5 nm, EM. Filter - Air 5. PD Amp Level –x1 6. Gather 1000 data every 1ms 7. Calculate the Max-Min 8. Turn on the lamp (FL 8500)	Dark Intensity	Should be less than 1000
		1	Hardware error
		2	Software error
Motor Moving	Move the motors to limit position and move them to home position again. Open and close the chopper (FL 8500)	0	Pass
		1~7	Motor number in trouble
		10	Software error
Lamp Intensity	1. EX. Slit - 5 nm, EX. Filter - Air 2. EM. Slit - 5 nm, EM Filter - Air 3. EX. Grating - 550 nm 4. Flash Lamp Power - 80Kw (FL 6500 ) 5. PMT Amp Level - X1 6. Chopper Open(FL 8500) 7. Gather 1000 data every 1 ms and calculate the average 8. Chopper Close(FL 8500)	Lamp Intensity	Should be over 20000
		1	Hardware error
		2	Software error
PMT Dark	1. Turn off the lamp 2. Chopper Close(FL 8500)	PMT Intensity	Should be less than 500

	3. EX. Slit - 0.5 nm, EX. Filter - Air 4. EM.Slit - 0.5 nm, EM. Filter - Air 5. PMT Voltage - 300V 6. PMT Amp Level - X1 7. Gather 1000 data every 1ms 8. Calculate the Max-Min 9. Turn on the lamp (FL 8500)		
		1	Hardware error
		2	Software error
Wavelength (Ex.)	1. EX. Slit - 1 nm, EX. Filter - Air 2. EM. Slit - 1 nm, EM. Filter - Air 3. EX. Grating - Move to start wavelength: FL 6500 - 526.9 nm FL 8500 - 471.4 nm 3. Flash Lamp Power - 80Kw (FL 6500 ) 4. PD Amp Level -X5 5. Scan Speed - 30 nm / min 6. Scan 526.9 nm ~ 530.9 nm (FL 6500) Scan 471.4 nm ~ 475.4 nm (FL 8500) 7. Find the peak	Peak Wavelength	FL 6500 - 528.9 nm ± 1.0nm  FL 8500 - 473.4 nm ± 1.0nm
		1	Hardware error
		2	Software error
Wavelength (Em.)	1. EX. Slit - 1 nm, EX. Filter - Air 2. EM. Slit - 1 nm, EM. Filter - Air 3. Move the EX. grating to fixed wavelength FL 6500 - 528.9 nm FL 8500 - 473.4 nm 4. Move the EM. grating - Start wavelength : FL 6500 - 526.9 nm FL 8500 - 471.4 nm 5. PMT Voltage - 220 6. Flash Lamp Power - 80Kw (FL 6500) 7. PMT Amp Level - X1 8. Scan Speed - 30 nm / min 9. Scan 526.9 nm ~ 530.9 nm (FL 6500) Scan 471.4 nm ~ 475.4 nm (FL 8500) 10.Find the peak.	Peak Wavelength	FL 6500 - 528.9 nm ± 1.0nm FL 8500 - 473.4 nm ± 1.0nm
		1	Hardware error
		2	Software error



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