thermo scientific

UV Visible

Evolution Pro Spectrophotometer

User Guide

269-350000 Revision A • August 2021

ThermoFisher SCIENTIFIC

For technical support, please contact: www.thermofisher.com

For Research Use Only. This instrument or accessory is not a medical device and is not intended to be usedfor the prevention, diagnosis, treatment, or cure of disease.

WARNING Avoid an explosion or fire hazard. This instrument or accessory is not designed for use in an explosive atmosphere.

Evolution Pro Spectrophotometer

Considerations

DANGER Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE Follow instructions with this label to avoid damaging the system hardware or losing data.

Note Contains helpful supplementary information.

Site Preparation and Safety

Before using the system, read the site preparation and safety manual on the documentation media provided. Always follow the safety precautions in that manual and in this document when using the system.

Operating Precautions

WARNING

- Do not operate this system without following the safety precautions described in this manual and the documentation that came with your system.
- n'utilisez le système qu'en suivant les consignes de sécurité qui figurent dans ce manuel et dans la documentation accompagnant le système.
- Betreiben Sie dieses System nur unter Beachtung der Sicherheitshinweise in diesem Handbuch und in der im Lieferumfang des Systems enthaltenen Dokumentation
- Non utilizzare questo sistema senza seguire le norme di sicurezza descritte in questo manuale e nella documentazione di accompagnamento del sistema.
- No opere este sistema sin sequir las precauciones de seguridad descritas en este manual y en la documentación proporcionada con el sistema.

The spectrophotometer contains precise optical components. Handle it carefully and follow these precautions.

- Do not allow moisture to leak into the instrument interior
- Wipe off spilled chemicals immediately
- Do not drop the instrument
- Protect the instrument from mechanical shock
- Protect the instrument from dust

Spectrophotometer Basics

Sample Compartment Lid

Lift the blue tab at the front of the sample compartment to raise the entire lid.

Slide the door in the lid to the back to provide easy access to the sample position to insert or remove a cuvette.

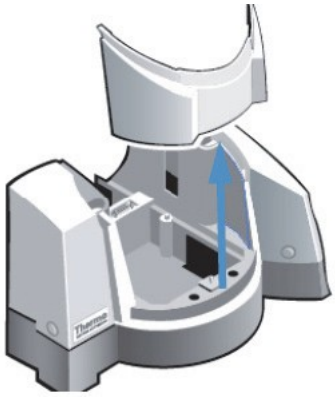
Stainless steel plate to place the samples to be tested.

Front Cover

Remove the hold-down screw on the front panel. Pull upwards to remove it

Align the tabs on the sides with the grooves in the instrument cover and slide the panel into place to replace it.

The hold-down screw is generally only required when tubing or hoses are being brought into the sample compartment under the flaps at the bottom of the front cover.



Installing and Removing Accessories

Standard Cell Holder

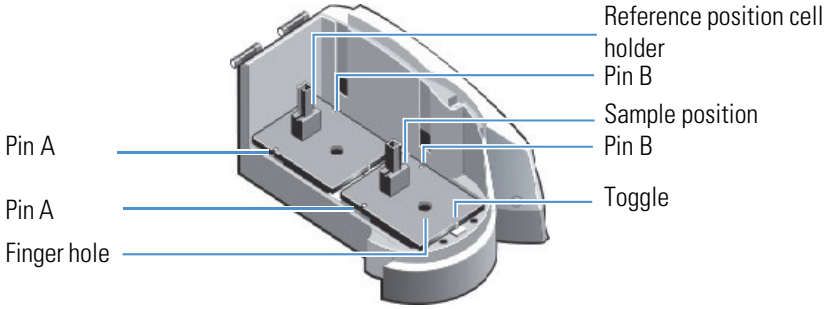
The standard cell holder included with the instrument accommodates 10 mm pathlength cells.

Note The Z-height (distance from the bottom of the cell to the center of the light beam) for the spectrophotometer is 8.5 mm. This is true for all cuvette holder accessories. If purchasing microcuvettes be sure to specify 8.5 mm as the Z-height for the window.

Accessories that are not electrically connected are called manual accessories. It is not necessary to power off the instrument while installing or removing a manual accessory.

Installing a Manual Accessory

1. Open the sample compartment door.
2. Remove any accessory from the location where you plan to install the new accessory (see the instructions below).



3. Position the accessory so the two alignment holes on its baseplate fit over pins A and B in the sample compartment.
4. Gently push down on the front edge of the baseplate until it snaps in place under the toggle.
5. Close the sample compartment door.

For operating instructions and installation details, see the user guide for the accessory.

Removing a Manual Accessory

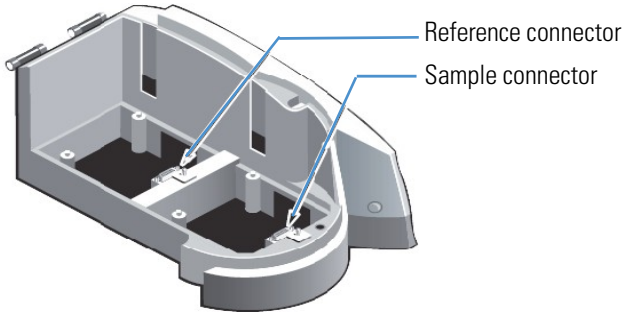
1. Use the handle or finger hole on the accessory baseplate to release the plate from the toggle.
2. Lift the plate off the alignment pins and remove the accessory from the sample compartment.

Smart Accessories

Smart Accessories include cell changers and sample holders that feature:

- Auto recognition
- Smart alignment
- Serial number reporting

A connector under the accessory baseplate provides data communication and power. Smart accessories are hot swappable. It is not necessary to power off the instrument while installing or removing a Smart Accessory.



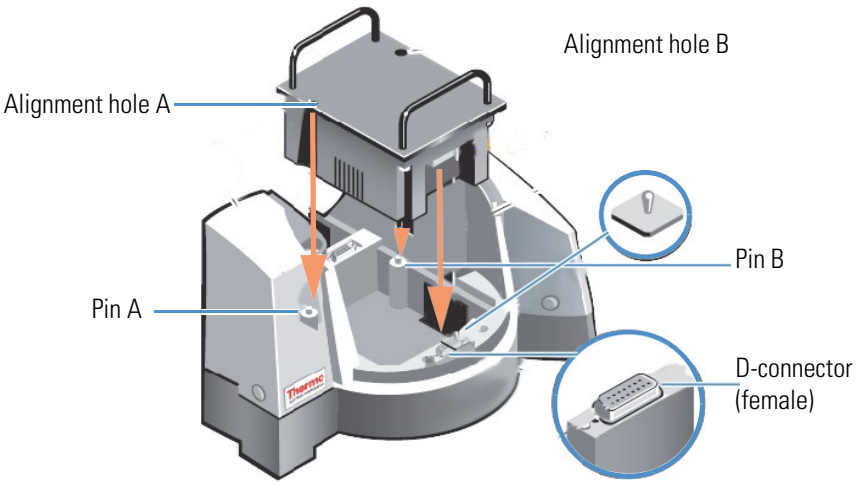
These accessories are supported in the sample position:

- Smart 7-cell rotary changer
  - Also supports CVC accessory
- Smart 8-cell linear changer
  - Also supports 8-cell Peltier accessory
- Smart sipper

Only the Smart 7-cell rotary changer is supported in the reference position. With this 7 x 7 configuration each cell in the sample position is measured against a unique reference cuvette in the reference position. This configuration is useful when the different concentrations/dilutions of matrix, such as buffer solution, are present in a single batch of samples.

Installing a Smart Accessory

1. Open the sample compartment and remove any cell holder or accessory.
2. Insert the accessory.
   a. Grasp the accessory by the handles and lower it into the sample compartment, aligning the connector under the baseplate with the connector in the sample compartment floor.
   b. Line up the two holes at the back of the accessory with pins A and B in the sample compartment.



   c. Press down on the front of the accessory to secure the connection.

      The software displays a prompt to initialize the accessory.

CAUTION

- Avoid pinch hazard. Keep hands and objects clear of the accessory during initialization.
- Évitez tout risque de pincement. Gardez vos mains, ainsi que tout objet, à l'écart de l'accessoire pendant l'initialisation.
- Quetschungen sind zu vermeiden. Hände und Objekte sind während der Initialisierung vom Zubehör fern zu halten.
- Evitare il rischio di pizzicamento. Tenere mani e oggetti lontano dall'accessorio durante l'inizializzazione.
- Evite riesgos de atrapamiento. Mantenga manos y objetos lejos del alcance del accesorio durante la inicialización.

3. Click **OK** to initialize the accessory.

   Initialization reads information about the accessory and, for cell changers, moves it to position 1.

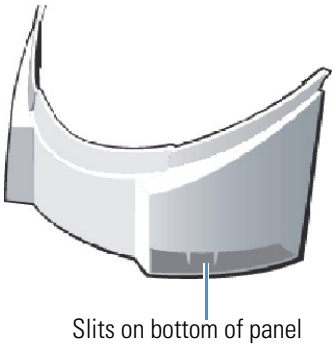
   Refer to the user guide for the accessory for detailed operating instructions.

Removing a Smart Accessory

1. Grasp the handles or the cell holder (if handles are not present) and lift the front of the accessory to release the baseplate from the toggle.
2. Lift the plate off the alignment pins and remove the accessory from the sample compartment.
3. The software confirms the accessory has been removed.

Routing Tubing or Cables into the Sample Compartment

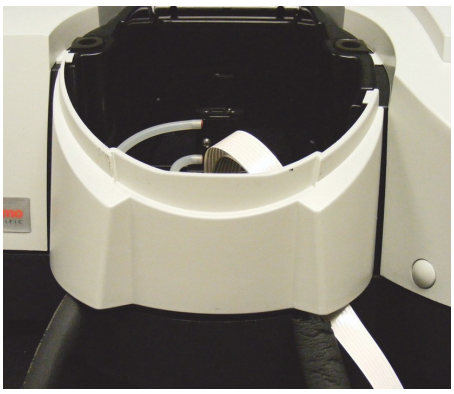
The front cover of the sample compartment has two openings to allow passage of tubing or cables into the sample compartment. These openings are covered by a layer of black foam to exclude light. Slits cut into the foam allow you to create an opening without allowing excess light into the sample compartment.

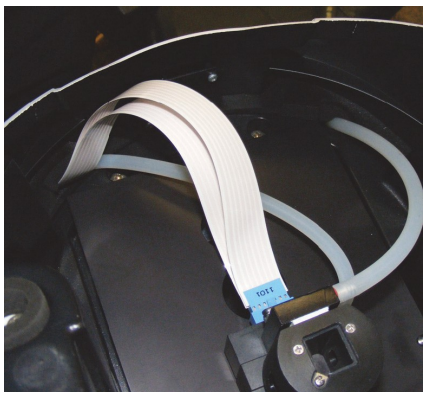


Ensure that the water flows freely through the circuit (hoses are not pinched) and that the tubes do not obstruct the light beam or movement of a cell changer accessory. If the tubing used has insulation around it, cut the insulation off at a suitable point to allow the section of tubing that will reside in the opening to be uninsulated.

- For the PCCU1 accessory, allow the portion of the tubing that will be inside the sample compartment to remain uninsulated. This will not impact performance. See photographs below.
- For the TPS-1500W or any similar thermostatted recirculator using insulated tubing, replace the insulation around the tubing inside the sample compartment.

The hold-down screw at the center of the sample compartment front cover should be secured to hold the cover firmly in place when tubing or cables are present.



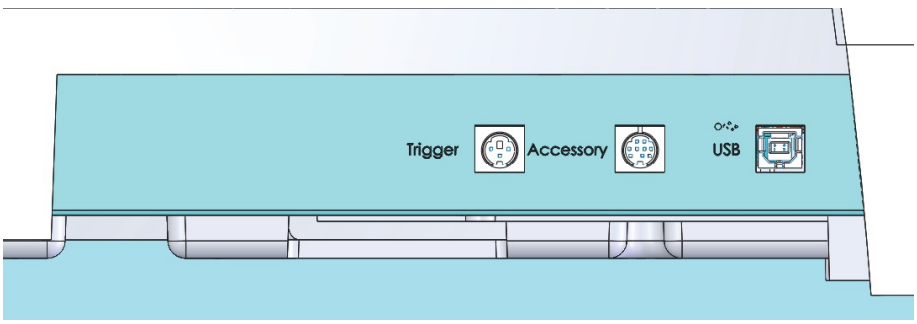


Reference Cell Holder

For measurements with a reference sample, install a cuvette containing a suitable reference solution in the reference position. The reference position can accommodate all manual cell holders and the Smart Rotary 7-Cell Changer. It cannot accommodate the Linear 8-Cell Changers or the Smart Sipper.

Connections on the Side of the Instrument

There are three communications cable connections on the right side panel of the instrument.



- Trigger port – connect a contact closure trigger device here
  - Used with the rapid mix kinetics accessory
  - Used with third party remote triggering devices
- Accessory Port – provides support for planned future accessories
- USB-B Port – connect the computer running the instrument control software here

Using the Spectrophotometer

Connecting and Powering the Spectrophotometer

Refer to the Getting Started guide supplied with the instrument (printed copy) and also on the same media as this user guide.

Tip

The power light flashes slowly when the spectrophotometer is starting up. When the start-up sequence is complete the light will be steady. If the power light starts to flash rapidly this indicates an error condition. Check INSIGHT software for any error reports. If INSIGHT it not running or shows no error

1. Power the spectrophotometer OFF.
2. Perform basic checks and prepare to collect fault information:
   a. Check that both sample and reference beams are clear of obstacles.
   b. Close the sample compartment doors.
   c. Start INSIGHT software on the attached computer.
   d. Power the spectrophotometer ON.
   e. Watch the progress of the startup routine.
3. If the error repeats, note the stage (bottom left corner of the window) where the error occurred and contact us.

Making a Measurement

Refer to the INSIGHT software help system, included with your installation of INSIGHT software. INSIGHT software help includes quick-start guides for each application mode. These are available with one click from the help system home screen.

The beam direction in the sample compartment is from right to left.

The beam direction in the reference compartment is from front to back.

Most cuvettes have two frosted walls and two polished walls. Try not to touch the polished walls. Wipe the polished walls with a lint-free cloth to remove dust, droplets of liquid or fingerprints before making a measurement.

Inserting and Removing Cuvettes

Always insert cuvettes so that the beam passes through the polished walls. Plastic cuvettes generally have a "V" or other mark at the top of one polished wall. Ideally, you should always orient this "V" in a consistent direction relative to the beam. Generally, this is towards the beam.

Using the Reference Beam

For simple measurements it is not generally necessary to put a reference cuvette containing blank solution in the reference beam. There is no need to "balance the beams" in an Evolution Pro spectrophotometer. A cuvette in the reference beam is only necessary if:

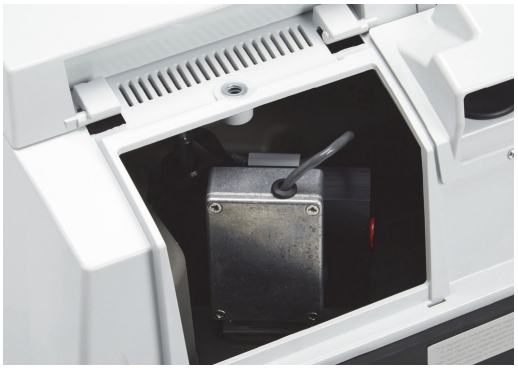
- You expect the matrix (for example, a buffer solution) to change absorbance during the course of the measurement. This typically only applies to kinetics (Rate) experiments that last several minutes or longer.
- Where the method calls for placing a reagent blank in the reference beam as part of the protocol that will effectively subtract out the absorbance of the reagent blank.
- Where an existing SOP or protocol developed for an older instrument has been validated and cannot be deviated from. It will do no harm to place a cuvette with blank solution in the reference beam.

Note A question commonly asked of our technical support specialists is "I have a cuvette with blank solution in the reference beam. Why do I still need to place a cuvette with blank solution in the sample position and record a blank or baseline? Why can't I just measure my sample directly?

The short answer is "That is not how the reference channel works." A "blank" measurement is required so that the instrument knows what "100%T" looks like on the sample detector. The 100%T value is required in order to calculate %T for the sample. That value is required in order to calculate absorbance.

Lamp Compartment Access Panel

A mercury lamp accessory is available for the Evolution Pro either as a factory-installed option or as a user (or Field Service Engineer) installed accessory. To access the lamp compartment, turn the locking screw 90 degrees counterclockwise and lift the panel upwards.



Corrosion Protection

The spectrophotometer contains precise optical components that may be damaged by a corrosive environment.

- Quartz windows on the monochromator cover protect the monochromator from corrosive gases in the sample compartment to some extent. However, the monochromator is not sealed and corrosive gases from the sample compartment can still make their way into the monochromator through other routes.
- There are no windows between the detector compartment and the sample compartment.

If your samples will produce corrosive vapors you should purge the sample compartment with a continuous flow of draw gas such as dried air or nitrogen.

NOTICE The warranty does not cover damage to internal optics or electronics caused by failure to use sample compartment windows or to adequately purge the sample compartment.

Purging the Sample Compartment

Purging the sample compartment removes moisture from the sampling area for subambient temperature-controlled measurements. It also serves to flush potentially harmful vapors from volatile samples out of the sample compartment.

WARNING

- Do Not use a flammable gas to purge the instrument
- N'utilisez jamais de gaz inflammable pour purger l'instrument
- Verwenden Sie niecontact us
- mals entflammbares Gas zum Spülen des Instruments
- Non utilizzare mai un gas infiammabile per spurgare lo strumento
- Nunca use un gas inflamable para purgar el instrumento

Use dry air or dry nitrogen to reduce or eliminate condensation. The purge gas must be free of moisture, oil and other reactive materials. To remove particulate matter and oil, install a 10-micrometer filter. Connect the flow of purge gas to the 1/4-inch internal diameter tubing purge fitting on the back of the spectrophotometer.

The Evolution Pro does not feature a dedicated purge port. Route the tubing for the purge gas into the sample compartment through one of the openings in the baseplate in the well beneath the reference position. A flow rate of 17 liters per minute is recommended to completely replace and exclude room air from the sample compartment.

Installing a Liquid Thermostatted Accessory

Liquid thermostatted accessories have ports to attach hoses from an external thermostatted recirculator. The heated or cooled liquid flows through internal chambers within the metal block where the cells are held, bringing that block to the same temperature as the liquid. The cuvettes then come to the same temperature as the block.

❖ To install a thermostatted accessory

1. Install the accessory in the sample compartment.
2. Route the tubing from the recirculator through the two openings at the base of the sample compartment front cover.

   See "Routing Tubing or Cables into the Sample Compartment" on page 7.
3. Use additional tubing and adapters (not included), if necessary, to size the tubing from the recirculator to match to the ports on the accessory.

For a cell changer, set the changer to position 1 before connecting the tubing to the ports on the accessory. Allow just enough tubing inside the sampling compartment to permit the cell changer to move through all possible positions

Note Ensure the tubing does not obstruct the light beam or prevent the sample compartment door from closing. If necessary, secure the tubing using cable clips or ties.

Cleaning the Instrument

Clean the instrument regularly using approved methods (wipe off spilled chemicals immediately).

NOTICE Do not allow moisture to leak into the instrument interior.

1. Use a lint-free cloth dampened with a weak solution of detergent and water to wipe the surface as necessary.
2. Repeat using a cloth dampened with plain water.
3. Dry the surface with another cloth.

Lamp Replacement

The xenon flash lamps used in Evolution spectrophotometers are extremely long lived. Each is rated for service equivalent to continuous flashing for a period of three years and is covered under warranty by us for three years. Under typical operating conditions the lamp will not require replacement within ten years.

INSIGHT software tracks lamp use and reports remaining lamp life on the **Lamp** tab in the **System Settings**.

Re-alignment of the instrument optics is required following replacement of the lamp. This means that the process must be completed by a trained and equipped service engineer, either in the field or at one of our service depots.

Live Readings

In spectrophotometers with traditional, short lived, tungsten or deuterium/tungsten sources the lamp is always on. It is common for the software running these instruments to display a value for the absorbance even when the instrument is not actively running an experiment. The xenon flash lamp is only on when actively making a measurement, so no such display is present in our software. If you wish to monitor live absorbance readings you can do this using the Live Display mode in INSIGHT software. Refer to the INSIGHT software user guide or the Help system within the INSIGHT software for details.