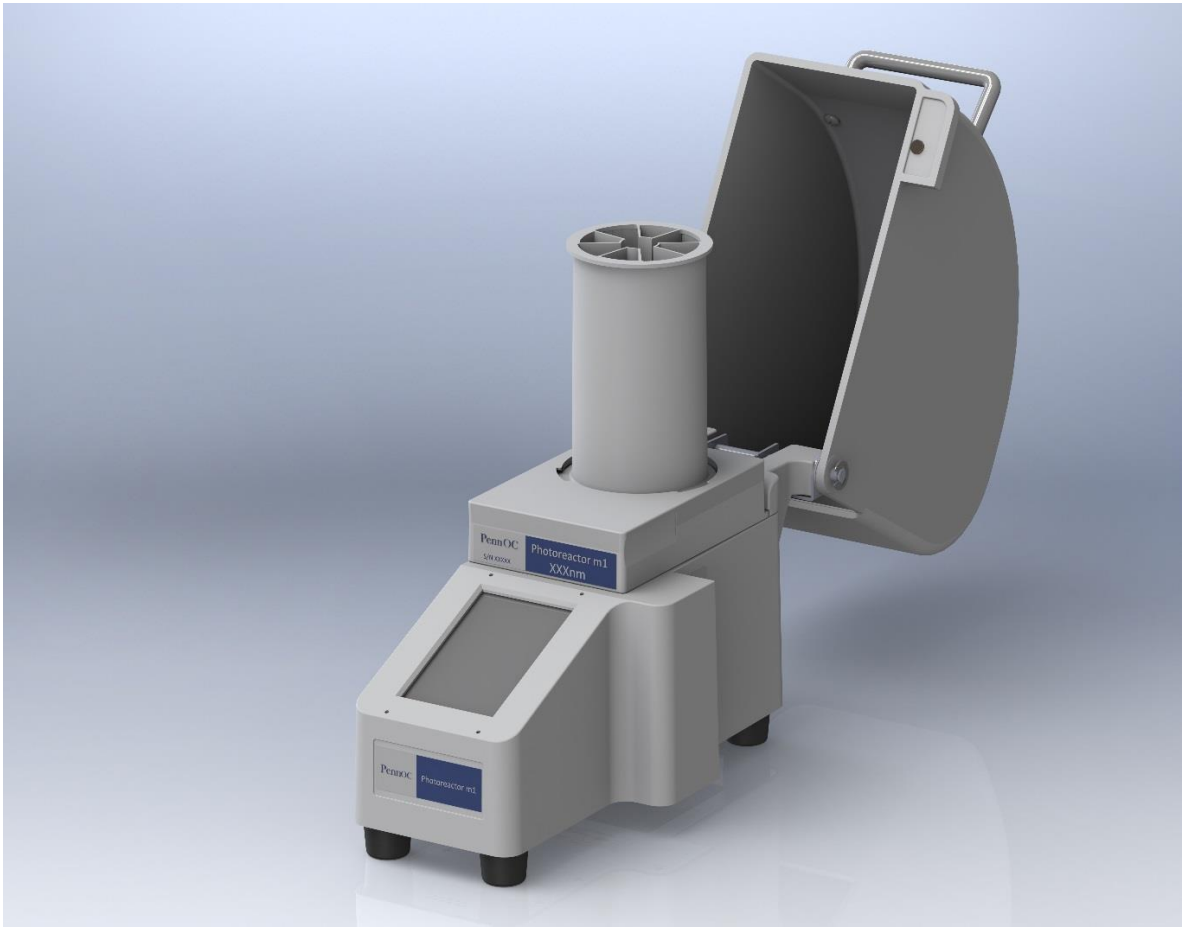
Penn PhD Photoreactor m2



User Manual

Rev C

Penn Photon Devices

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1 Introduction

The Photoreactor m2 is a benchtop instrument designed for chemists and researchers to accelerate chemical reactions using photoredox catalysis. The Photoreactor m2 combines LED illumination, mechanical stirring and cooling in one device. The user defined parameters of temperature, intensity, stir rate and time, creates a valuable tool for repeatability, traceability, efficiency and consistency of results. The Photoreactor m2 addresses the potential to streamline synthetic sequences, and create valuable strategies for addressing some of the challenges of molecule construction in drug discovery.

Key Features:

- Photoreactor m2 is a complete benchtop instrument to accelerate photoredox catalysis
- Modular design allows for use with a variety of wavelengths from 365nm to 450nm
- 360 degree reflective environment maximizes surface area photon capture
- Light shield interlock prevents user exposure to harmful light rays
- Interactive touch screen controls reaction parameters
- Intertek ETL, CE, and CB approved
- User defined parameters including temperature, light intensity, fan speed and stirring
- Auto stop, pause and reset options
- Supports vial sizes gc, 4, 8, 20, 40 ml
- Temp feedback using a k-type thermocouple

2 Safety

Prior to use, the operator should thoroughly read the instructions for use. Using this device without reading and understanding the instructions for use may result in operator injury or damage to the equipment.

The device contains a powerful LED that produces extremely bright light. Do not look into the back end of the device when the LED is activated as this may result in eye damage.

Only use the device with approved accessories. Proper care must be taken during setup and operation to prevent injury to operators and other personnel or damage to the unit.

The unit is equipped with multiple safety features including an interlock device that will not permit LED emission when the light shield is not in place. Keep magnets away from the device to prevent accidental interlock activation.

	***No modification of this equipment is allowed.***

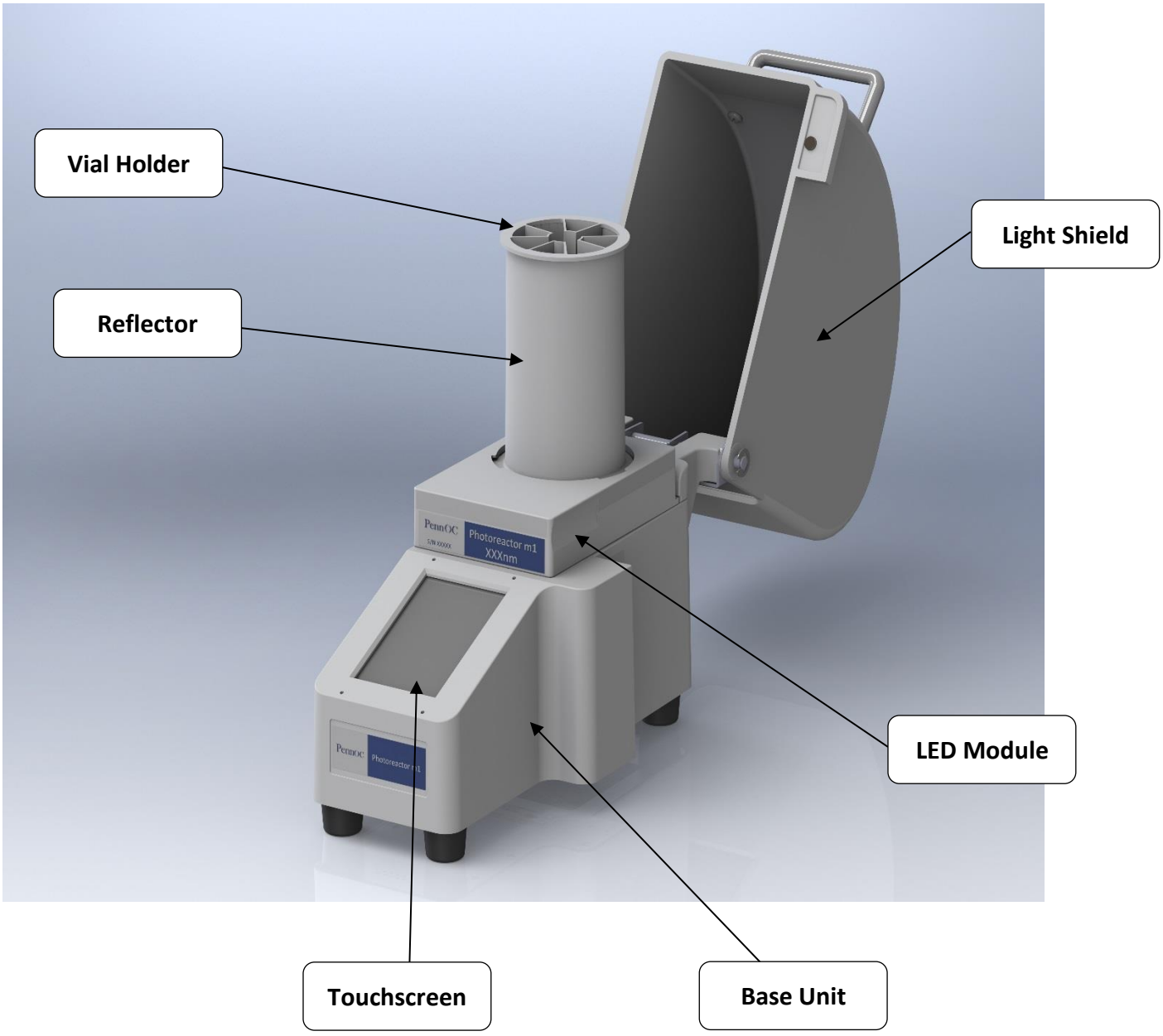
	***Never open or remove the bottom cover. Qualified personnel must perform all maintenance.***

	***The Illuminator unit requires adequate airflow to maintain proper cooling. Ensure the ventilation holes and bottom of the unit are unobstructed and a minimum of 4" clearance is provided in rear of unit.***
	***If the Illuminator is used in a manner not specified within this manual, the protection provided by the equipment might be impaired. It is the responsibility of the user to follow all applicable safety guidelines in prevention of injury or damage to the unit.***
	***Use of the equipment with an unapproved power supply may cause damage to the device and/or power supply and may result in injury.***
	***It is the responsibility of the user to assess and mitigate any hazards that may result from a mixing interruption.***
	***It is the responsibility of the user to assess and mitigate any hazards that may result from mixing volatile or flammable materials. Users shall comply with all applicable safety and accident-prevention procedures for laboratory work.***
	***Device intended for a variety of chemical reactions; Device to be used by trained operator in a laboratory setting.***
	***Operation of multiple devices simultaneously in a single enclosed area may require ear protection***

2.1 Explanation of labels

	***Manufacturer.***
	***Caution – Read User Manual.***

3 System Overview



4 Setup

4.1 System Components

The Photoreactor m2 is comprised of the following components:

- Base Unit
- 450nm LED Module*
- 8ml Reflector
- 40ml Reflector
- gc Vial Holder
- 4ml Vial Holder
- 8ml Vial Holder
- 20ml/40ml Vial Holder
- Power Supply
- Power Cable

*420nm and 365nm wavelength LED modules are separately available

4.2 Choosing a Location

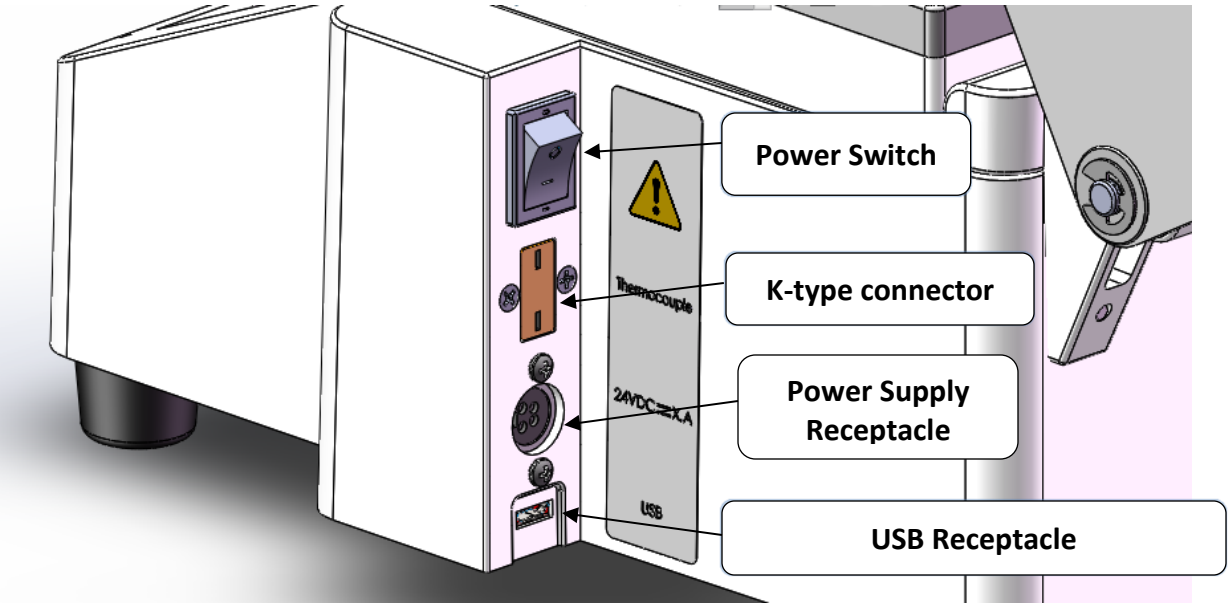
Set the Photoreactor m2 horizontally on its four neoprene feet on a flat surface in a place that allows for adequate air ventilation on the back and bottom. Do not place the Photoreactor m2 on top of paper or loose material that may be drawn into any ventilation port. Do not position the unit so that the back of the unit is obstructed. The Photoreactor m2 should only be transported in the horizontal position.

NOTE:	***For adequate ventilation, maintain at least 4" of clearance around all sides of the unit in an unenclosed space.***

4.3 Connecting the Power Cord

Insert the power supply receptacle-end into the receptacle on the side of the unit. Insert the power cord plug into a standard AC outlet.

	*Warning: To avoid risk of electric shock, this equipment must only be connected to a supply mains with a protective earth.*



The unit must be powered with the supplied power supply (85-264V, 50/60 Hz, Full Range).

5 Operation

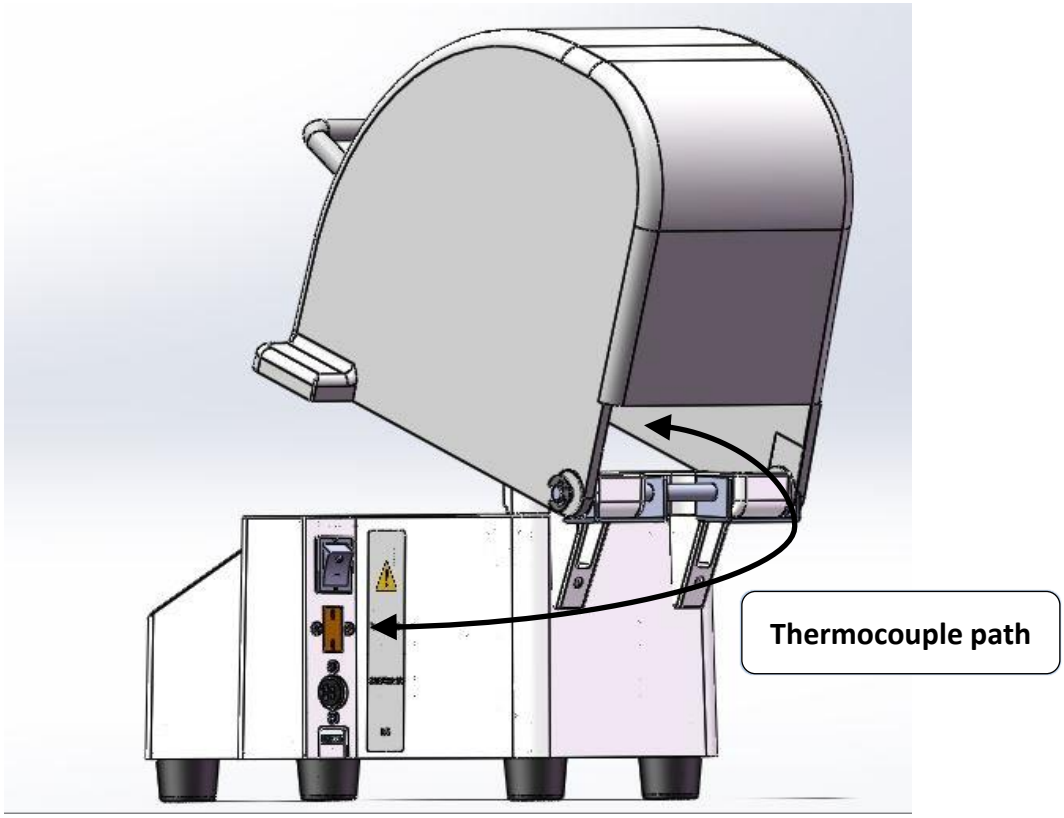
5.1 Setup

Once the power cord is connected set the ON/OFF (I/O) switch to the ON (I) position.
Add the contents to vial with appropriately sized stir bar (if required) and insert into the vial holder. (Note: select the vial holder that corresponds to the correct vial size and ensure that it is fully seated).
Insert the vial holder into the corresponding reflector and ensure that the vial is still fully seated and is roughly concentric to the reflector.
With the light shield in the open position, select the desired LED module and insert it into the base unit, being careful to properly align the connector pins.
Insert the reflector into the LED module by aligning the tabs with the slots and turning the reflector until it stops.
If temperature monitoring or control is desired, connect a K-type thermocouple to the K-type connector. Pass the thermocouple through the opening at the rear of the light shield (see below) and place the distal end within the vial or at the desired location.
Lower the light shield and verify that the interlock is engaged by ensuring that the “Interlock” indicator is green on the touch screen.

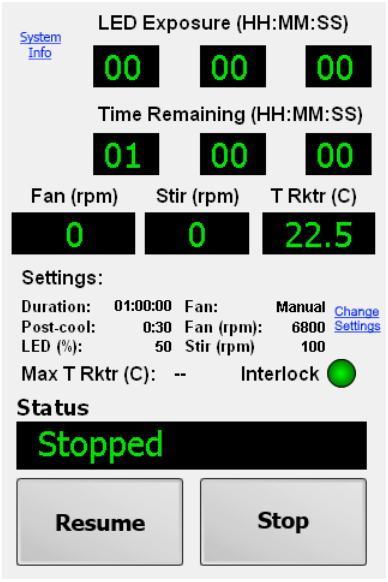
NOTE:	***Please note that the viscosity of the stirred material will affect the ability of the stir bar to remain coupled to the rotating magnet. Materials of high viscosity must be stirred at slower speed settings.***

⚠	*Warning: Magnetic stirring cannot be achieved with all combinations of stir bars, reflectors, vial holders, and vials. It is recommended that the user select the reflector (8ml or 40ml), which minimizes the distance from the bottom of the vial to the LED module. The user must determine the appropriate combination of stir bar, reflector, vial holder and vial to optimize magnetic stirring.*

	Warning: To avoid damage to the device, ensure the thermocouple does not come into contact with any moving parts, i.e. stir magnet, motor or fan



5.2 Performing a Photoredox Cycle



The user interface (GUI) initiates on the main display (shown left). The device is configured with the following default settings.

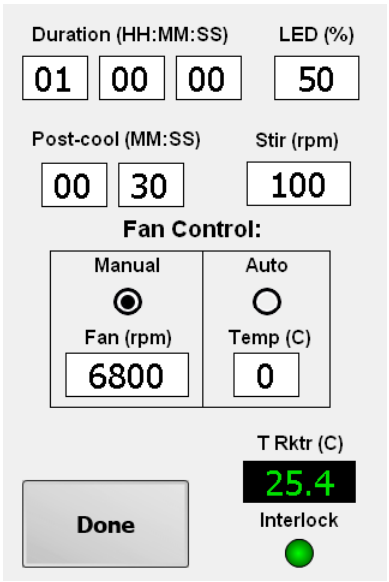
- Duration (HH:MM:SS) is 01:00:00
- Post-cool duration (MM:SS) is 00:30
- LED intensity (%) is 50
- Fan Control is set to Manual
- Fan (rpm) is set to 6800 (Max)
- Stir(rpm) is 100 (Min)

To operate the device with the default settings, simply press “Start”.

To customize set points press “Change Settings” on the main display.
The user interface opens the settings screen (shown left)
The following set points can be customized.

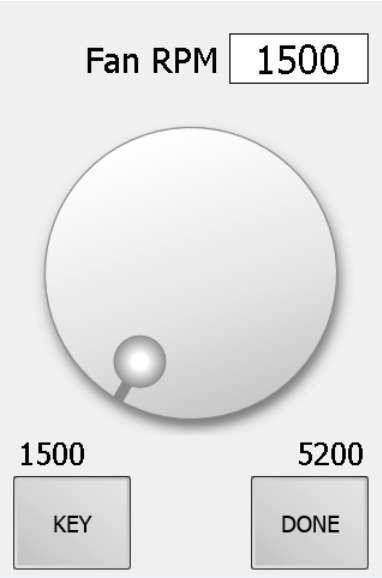
- Duration (HH:MM:SS) up to 99:99:99
- LED intensity (%) – 1% to 100%
- Post-cool duration (MM:SS) - 00:00 to 59:59
- Stir(rpm) – 100 to 2000
- Fan Control – Manual / Auto
- Manual Fan (rpm) – 2800 to 6800*
- Auto Fan/Temperature Control (Temp (C) – 0 to 50

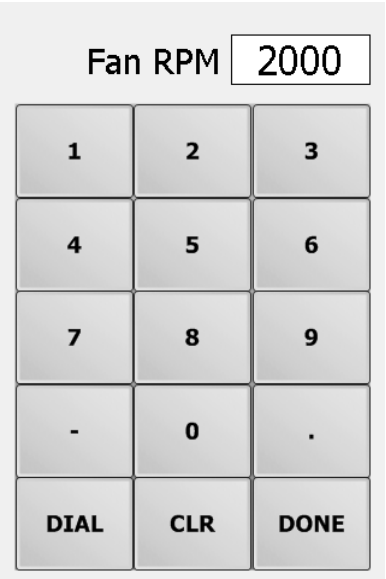
When the Fan Control is set to Auto, the Fan (rpm) will dynamically change to maintain the target temperature set point.



	*Ensure Thermocouple is in vial while operating in auto fan mode*

To change the set point of a given parameter select it on the touch screen. This will provide a display corresponding to the parameter you have chosen as shown on the right. The dial may be rotated to select the desired setting. Alternatively, pressing the “KEY” button will allow the user to enter an exact value. Pressing the “DONE” button will accept the value.





Once the parameters have been set, press “Done” on the Change Settings screen to return to the main display.
Press “Start” to begin.
All values may be edited at any time during operation.

The unit will begin a 10 second precooling cycle as indicated by the Status field. The reported time will show the countdown from 10 seconds. The fan and stir motor will start and the actual RPMs will be displayed. RPM values are expected to deviate slightly from the set values. At this point, all values can still be edited by changing the parameters as described above. Changes in set-points will take effect as soon as the “DONE” button is pressed on the dial or keypad screens, with the exception of the LED as it will not be emitting at this point.

Once the precooling countdown reaches 0, the LED will activate at the set intensity. The Status will update to running. The count will start from the duration set value.

Note: If the duration set value is edited during operation to a value less than the elapsed time, the device will begin a post cooling cycle.
It is recommended to pause operation prior to changing the duration set value.

Once the cycle has completed, the unit will begin post cooling as indicated by the status field. The LEDs will stop emitting, however the fan and stir bar will continue to rotate until the countdown has reached 0.
During the operation the cycle can be “Paused”. The LED will stop emitting and the fan and stir bar will stop rotating. The LED exposure (HH:MM:SS) and Time Remaining (HH:MM:SS) will pause.

The Status field will indicate “Paused” and the Pause button will change to “Resume”. Press “Resume” to restart the device. The LED exposure and Time Remaining count will continue from the point in the cycle when it was paused.
Opening the light shield during a cycle will also pause the device.

Upon completion of a cycle, the unit will display status “Complete”. Before initiating another reaction or changing parameters, the device must be “Reset”. The “reset” button will reset the device to the parameters set for the last cycle. Parameters may be changed as described previously and another reaction may be initiated.

During a cycle, the Stop button will immediately halt all operations. Similar to a completed cycle, the device must be reset from the stopped condition before initiating another reaction or changing parameters.

5.3 Termination, Turning the Unit “Off”

Unplugging the unit or switching off the unit while it is running will cause no harm to the system, nor will it cause an unsafe condition.

All of the following methods can be used to turn off the unit, safely:

- Side Panel Power Switch.
- Disconnecting Mains Power.

6 System Information

To display the system information press the “System Info” button on the main display.
The user interface opens the system information screen.

The GUI FW and Control FW version display the latest FW version on the device.
The S/N is set by manufacturer during assembly and matches the control label S/N on the base of the device.

7 Proper Care and Handling

Remove Photoreactor m2 and accessories from packaging and observe all labeling. Immediately notify the manufacturer of any defects.

7.1 Cleaning, Disinfection, and Disposal

- Clean and disinfect the external housing of the Photoreactor m2 with a mild detergent.
- Wipe with mild detergent, do not spray.
- Never clean any internal electronics with liquid cleaners. If necessary, remove all dust from external surfaces with dry compressed air.
- Photoreactor m2 units shall be disposed of via local and applicable regulations based on the intended use.

8 Maintenance

The Photoreactor m2 is designed to operate for many years without any maintenance required.
No user-changeable fuses are included. Consult manufacturer.

	***All maintenance is to be performed by qualified personnel only. Do not attempt internal maintenance or repair. Consult the manufacturer for further instructions.***

Contact Information:
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9 Technical Data

Cover closed

- Width: 12.2 cm (4.8 inches)
- Height: 27.2 cm (10.7 inches)
- Depth: 28.2 cm (11.1 inches)

Cover open

- Width: 12.2 cm (4.8 inches)
- Height: 33.8 cm (13.3 inches)
- Depth: 42.67 cm (16.8 inches)

- Weight: Approximately 2 kg (4.4 lbs.)
- Operating mode: Continuous
- Main cable: 10 A/250 V
- Power supply: 85-264V, 50/60 Hz, 120VA
- Expected Service Life: 5 years
- Cleaning: Surface cleaning with mild detergent

Ambient conditions for operation

- Temperature: 5° to 40°C (41° to 104°F)
- Rel. humidity: 0% to 80% non-condensing for temperatures up to 31°C (88°F) decreasing linearly to 50% at 40°C (104°F)
- Air pressure: 700 hPa to 1060 hPa

Ambient conditions for storage (in shipping packaging)

- Temperature: -20° to +50°C (-4° to 122°F)
- Rel. humidity: 0% to 100%, non-condensing

10 Product Ratings

CE

For all CE compliance questions, EU customers may contact;
Necsel IP, Inc., an Ushio Group company
101 Panton Road,
Vergennes, VT 05491, USA
Tel: (011) 802 877 2182