Asynt
By chemists, for chemists



PhotoSyn

High Power LED Photoreactor for Continuous Flow Chemistry

www.asynt.com
enquiries@asynt.com
+44 (0)1638 781709

PhotoSyn LED Photoreactor

Variable, high power LED lamp unit for flow photochemistry



(Note: PhotoSyn shown fitted to Asynt Cold Coil MkII)

- **High intensity LED light source for continuous flow photochemistry**
- **Hemi-spherical LED arrays concentrate light towards the reactor core**
- **Wide range of available wavelengths**
- **Independent control of coil reactor temperature**
- **Compatible with Cold Coil II and Polar Bear *Plus* Flow reactor modules**
- **Variable intensity, programmable power supply (RS232, ethernet, USB)**
- **Class leading safety features (interlocks, zero light leakage)**

The Asynt PhotoSyn is a high power LED lamp unit for continuous flow photochemistry applications.

The unit contains a set of hemispherical LED arrays composed of several hundred high quality individual diodes that maximise photon flux by concentrating the light inwards towards a central coil reactor. Chromed coil reactors are available to maximise reflective light.
Standard units are available with the following configurations in total power outputs up to a maximum of 700W:

- **Single, dual & triple wavelength combination options**
- **365nm, 385nm, 420nm, 455nm, 530nm and white light LED options**
- **Customised LED arrays (e.g. 420nm, 385nm)**

The high power LED arrays require liquid cooling and incorporate thermal cut-outs which prevent any potential damage associated with over-heating.



To avoid the possibility of exposure to high intensity and/or UV light sources, the unit is constructed such that there is no extraneous light leakage in operation. Safety interlocks immediately switch off the LEDs should any attempt be made to remove the lamp enclosure from the reactor. module

The PhotoSyn™ LED light unit is supplied with a matching high voltage power supply that 'recognises' the configuration of the lamp unit connected and modulates the current output accordingly to protect and maximise the lifetime of the LEDs. The same power supply may therefore be connected to any lamp unit.

Where available, different wavelengths, or combinations of wavelengths, can be selected using the keypad and the output can be varied from 10 to 100%.

The power supply displays the temperatures and current consumption of each LED array and has both serial (RS232) and ethernet sockets (TCP/IP) to enable external comms connectivity.



The PhotoSyn may be fitted to either the Asynt Cold Coil Mk II standalone coil/chip reactor module (as shown above), or the Polar Bear *Plus* Flow.

In the latter case, it is necessary to fit an adaptor ring which both prevents the lamp unit being removed whilst powered and prevents the possibility of inadvertent exposure to high intensity light.





PhotoSyn is compatible with all existing Asynt PFA coil reactors constructed from either 1/16" or 1/8" OD PFA tubing.

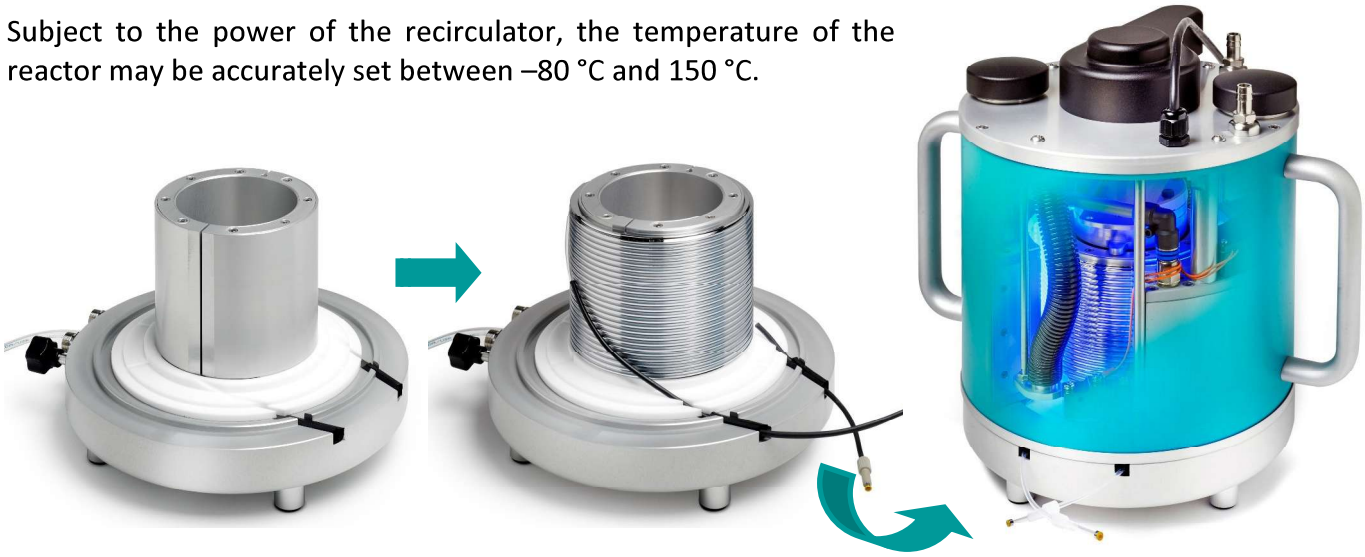
Chromed coil reactors that maximise reflected light inside the lamp unit, are also available.

Using the PhotoSyn Light Unit with the Asynt Cold Coil

The Cold Coil Mk II is a standalone coil reactor module that is compatible with all Asynt coil reactors. It has a proprietary clamping mechanism that ensures coil reactors can be securely clamped in place to ensure optimal heat transfer, but easily removed and interchanged when required.

The Cold Coil has no internal electrical components and is designed to be connected to a suitable recirculating heater/chiller.

Subject to the power of the recirculator, the temperature of the reactor may be accurately set between –80 °C and 150 °C.



As shown in the sequence above, assembly of the photoreactor is straightforward.

The Cold Cold II is the perfect partner for the PhotoSyn and, as shown above, these units can be seamlessly combined without the need for any adaptor plates. Moreover, the coil reactor may be quickly removed and interchanged.

For safety, interlock switches ensure that the LEDs are only powered when the PhotoSyn engages with the baseplate of the Cold Coil. No leakage of light occurs when the unit is in place.

When fitted with the optional Cold Coil Chip Holder (UQ1053-001), small Asynt Glass Static Mixer blocks may also be utilised.





Temperature control of the reactor module can be achieved by connection to either a suitable water supply (this may be the same as that used to cool the backplates of the LED arrays) or, optimally, an independent recirculating heater/chiller.

A nitrogen purge fitted to the Cold Coil II minimises condensation inside the unit when operating under sub-ambient conditions.

Using the PhotoSyn Lamp unit with the Polar Bear Plus Flow

The Polar Bear *Plus* Flow is a compact cryostatic reactor module for continuous flow applications. It is compatible with all Unqsis coil reactors. When the optional Chip Adaptor Plate (UQ1053-001) is fitted (as shown below) small Asynt Glass Static Mixer blocks (e.g. UQ5102) can also be accommodated.

The Polar Bear *Plus* Flow is a self-contained plug-and-play module that does not require an external refrigerant such as card-ice or liquid nitrogen to achieve sub-ambient temperatures.



Step 1: Fit the Polar Bear Plus Flow Adaptor Ring (UQ1080) and secure in place using the two red locking clamps, as shown opposite.



Step 2: Fit a suitable coil reactor (e.g. UQ2508-C) and route the tubing through the black foam inserts that prevent light escaping from the hood.

Note: It is recommended that the inlet and outlet tubes are 'sleeved' to prevent light transmission along the tubing itself.

Step 3: Fit the temperature probe and lower the PhotoSyn LED lamp unit into place.

Note: The lamp unit will not disable the interlock safety switches unless the red locking clamps are rotated such that they lock the adaptor plate in position.

Step 4: Connect and switch on power supply, set the temperature and allow the unit to equilibrate. Select the wavelength (if applicable), switch on the LEDs and set the intensity.



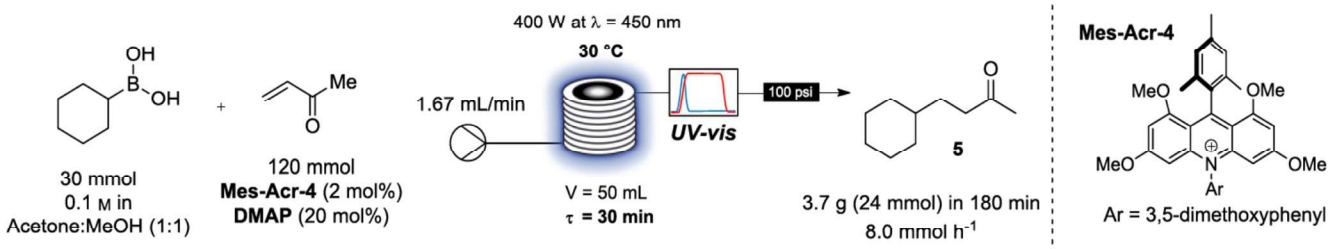
PhotoSyn Application Note:

Organic photocatalysis for the radical couplings of boronic acid derivatives in flow

F. Lima, L. Grunenberg, H. B. A. Rahman, R. Labes, J. Sedelmeier and S. V. Ley*

Chem. Commun., **2018**, 54, 5606.

An acridium-based organic photocatalyst is reported to be an efficient replacement for iridium-based photocatalysts to oxidise boronic acid derivatives by a single electron process. This was exemplified by the synthesis of four active pharmaceutical ingredients (APIs). A straightforward scale up approach using continuous flow photoreactors is also reported affording gram an hour throughput.
The Asynt **Flow-UV** inline spectrometer was utilised to conveniently monitor steady state.



METHOD:

A 500 mL conical-shaped flask equipped with a magnetic stir bar was charged with cyclohexyl boronic acid (3.84 g, 30 mmol, 1.0 equiv.), **Mes-Acr-4** (384 mg, 0.6 mmol, 2 mol%) and DMAP (732 mg, 6.0 mmol, 20 mol%) as Lewis base catalyst.

The flask was then sealed with a rubber septum and evacuated/backfilled with argon three times. Methyl vinyl ketone (6.0 mL, 120 mmol, 4.0 equiv.) was then added followed by 300 mL of a degassed acetone/methanol (1:1) mixture to lead a clear yellow transparent 0.1 M solution.

The clear solution was then pumped at 1.66 mL/min through the Uniqsis PhotoSyn™ (52 mL, PFA; 3.25mm OD x 2.4mm ID) held at 30°C. followed by acetone:methanol (1:1) solvent to flush the reactor. The reaction plug monitored by UV-vis detection (Uniqsis Flow-UV™), the totality of the plug was collected and then concentrated *in vacuo* and immobilised on ISOLUTE® HM-N. This immobilised crude was extracted on a pad of silica gel with 5% Et_2O in PE (3 L) to yield the pure product **5** (3.72 g, 24.1 mmol) as a colourless oil in 81% yield.

PhotoSyn Options & Accessories:

Part No.	Description
UQ1074	PhotoSyn™ HP LED Photoreactor, BLUE (455nm); 220/110V, 50/60Hz
UQ1075	PhotoSyn™ HP LED Photoreactor, UVA/BLUE (365nm/455nm); 220/110V, 50/60Hz
UQ1076	PhotoSyn™ HP LED Photoreactor, BLUE/GREEN/WHITE (455nm/525nm/3000K)
UQ1077	PhotoSyn™ HP LED Photoreactor, BLUE/VIOLET (420nm/455nm); 220/110V, 50/60Hz
UQ1078	PhotoSyn™ HP LED Photoreactor, UVA (365nm); 220/110V, 50/60Hz
UQ1074-001	PhotoSyn™ HP LED Photoreactor, BLUE (455nm); LIGHT HOOD ONLY
UQ1075-001	PhotoSyn™ HP LED Photoreactor, UVA/BLUE (365nm/455nm); LIGHT HOOD ONLY
UQ1076-001	PhotoSyn™ HP LED Photoreactor, BLUE/GREEN/WHITE; LIGHT HOOD ONLY
UQ1077-001	PhotoSyn™ HP LED Photoreactor, BLUE/VIOLET (420nm/455nm); LIGHT HOOD ONLY
UQ1079-001	PhotoSyn™ VIOLET HP LED photoreactor 395nm; LIGHT HOOD ONLY
UQ1079	PhotoSyn™ Power Supply ONLY
UQ1050-M2	Cold Coil MkII standalone coil reactor module (requires recirculator)
UQ1080	Polar Bear Plus Flow Adaptor Ring for PhotoSyn™
UQ1081	Replacement tubing seals, sponge rubber, black (10 pack)
UQ2501-C	Coil Reactor, chromed, PFA, 2.5ml, 1.57mm OD x 1.00mm ID
UQ2503-C	Coil Reactor, chromed, PFA, 10ml, 1.57mm OD x 1.00mm ID
UQ2509-C	Coil Reactor, chromed, PFA, 20ml, 1.57mm OD x 1.00mm ID
UQ2508-C	Coil Reactor, chromed, PFA, 52ml, 3.25mm OD x 2.62mm ID
UQ2507-C	Coil Reactor, chromed, PFA, 5.0ml, 1.57mm OD x 1.00mm ID