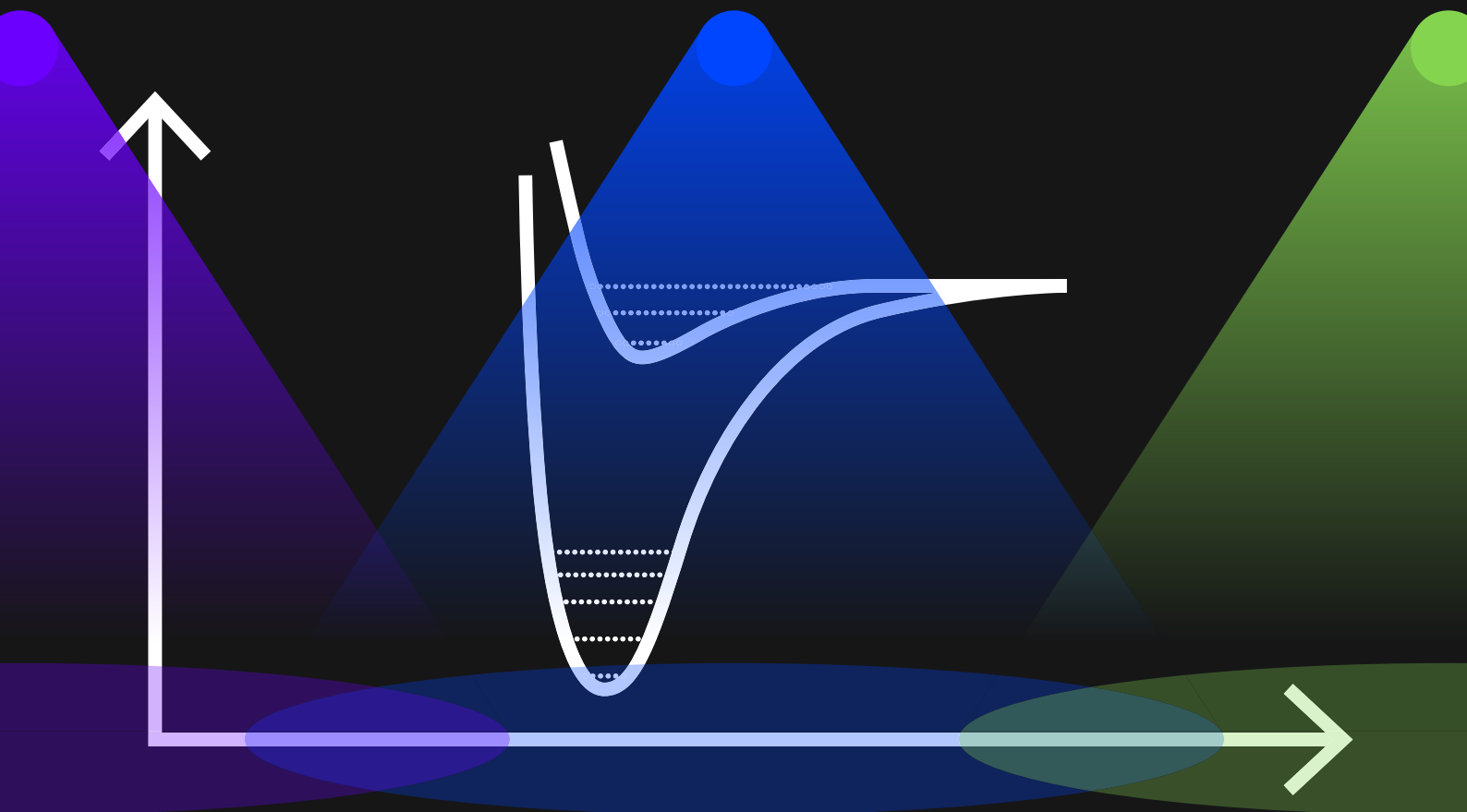


ASIA PHOTOCHEMISTRY REACTOR DATASHEET



Contents

1	Introduction	3
2	Specifications	4
	2.1 LED modules	4
	2.2 LED wavelengths	5
3	Control module	8
4	Temperature control	9
5	Safety interlock	11

1 Introduction

The Asia Photochemistry Reactor enables continuous photochemistry applications to be performed on the Asia flow chemistry system. Due to its modular nature, the Asia Photochemistry Reactor can also be used as a stand-alone module to increase your flow chemistry capability. This easy-to-use reactor makes modern photochemistry techniques accessible without the limitations of traditional batch photochemistry.

You can find a selection of photochemical application on the Photochemistry Applications document (available on request) or at www.syrris.com.



2 Specifications

Reactor volume	4 mL or 16 mL using standard Asia Tube Reactors
Reactor temperature	From -40 °C to +80 °C (dependent upon using the Asia Heater or Asia Cryo Controller module)
Temperature settings	Set to 1 °C and displayed to 0.1 °C
Number of LED modules	Can house up to 8 x LED modules at fixed or mixed wavelengths
LED module wavelength	Monochromatic lights at 365, 385, 405, 420, 450 and 525 nm
Control module display	Control module displays light intensity and radiant flux
Power	Variable power from 10 to 100 %
Output power	Radiant flux from 3 W to 108 W (dependent on wavelength)
Safety	Full safety interlocks to ensure user will never be exposed to light
Compatibility	Compatible with the Asia flow chemistry system or as a stand-alone module

2.1 LED modules

A wide range of monochromatic, high-powered LED modules are available that can be interchanged in seconds to allow rapid screening of different wavelengths to optimize your photochemistry conditions.

The LED module wavelengths have been selected to offer the widest range of modern photochemical applications.

The reactor enables any combination of wavelengths to be used offering the ability to run reactions with multiple wavelengths. This allows chemists to explore new and exciting photocatalyzed applications.

Figure 1.

Asia Photochemistry LED Module



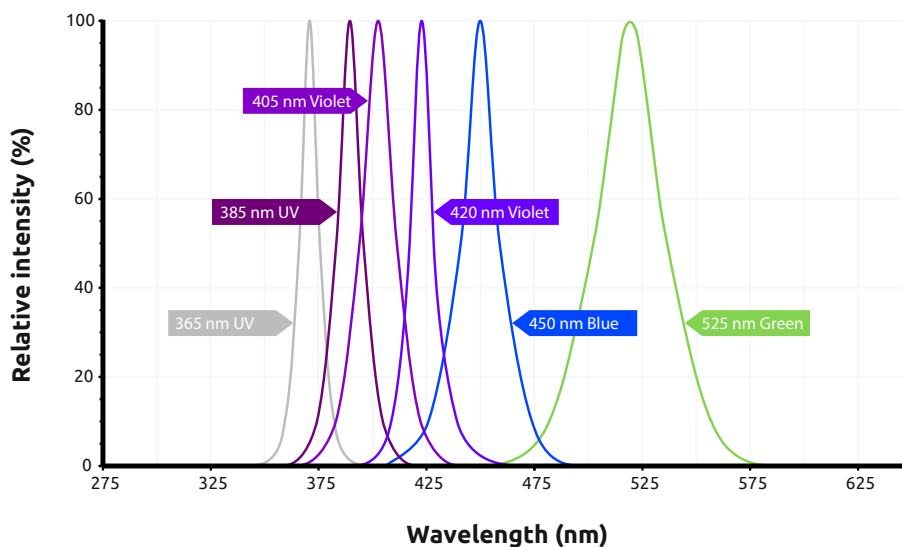
2.2 LED wavelengths

Available wavelengths

The range of monochromatic wavelength have been selected to offer the greatest range of modern photochemical reactions. Wavelengths of 365, 385, 405, 420, 450 and 525 nm are available as standard.

Figure 2.

The spectral output for each LED module available for the Asia Photochemistry Reactor.



Reaction scalability

The design of the Asia Photochemistry reactor allows any number and combination of LED modules to be selected and added to the reactor assembly.

This allows the options of optimizing reaction conditions with a single wavelength and then adding up to eight LED modules to increase light intensity. Adding extra LED modules will increase reactions rates and increase reaction throughput for direct scalability of your reaction.

The table below shows how the Asia Photochemistry Reactor can directly scale the radiant flux (W) from one module to eight modules to deliver high intensity light to your reaction for each LED wavelength.

Wavelength	Radiant Flux 1 module (W)	Radiant Flux 4 modules (W)	Radiant Flux 8 modules (W)	Max current (mA)
365nm UV	12.1	48.5	96.9	760
385nm UV	13.5	54.2	108.3	760
405nm Violet	12.8	51.3	102.6	760
420nm Violet	8.9	35.7	71.4	665
450nm Blue	10.5	41.8	83.6	665
525nm Green	3.2	12.7	25.5	950

Table 1. Asia Photochemistry LED Module radiant flux outputs

Variable light intensity

The power intensity can be set to all LED wavelengths from 10 % to 100 %.

The graphs below show the relationship between the set Power Intensity and the output Radiant Flux to the reactor for combinations of one, four and eight LED modules of the same wavelength.

Figure 3.
Radiant flux vs
Power Intensity for
1 x LED Module
across all available
wavelengths

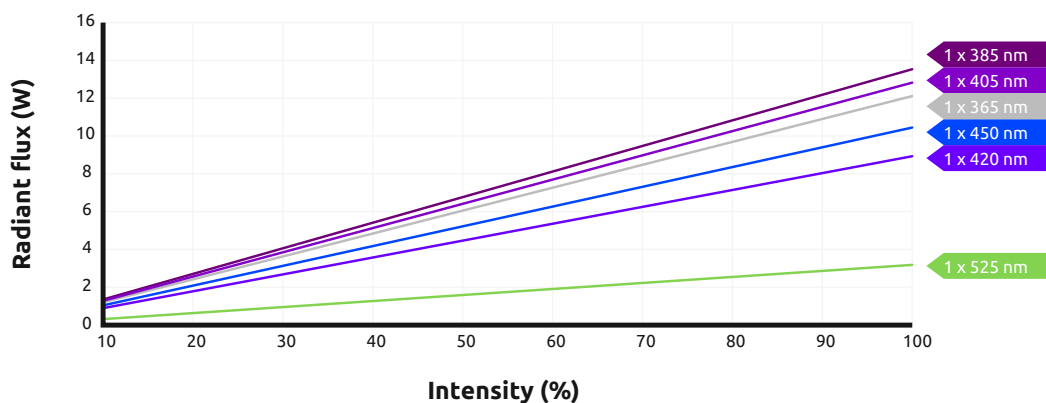


Figure 4.
Radiant flux vs
Power Intensity for
4 x LED Module
across all available
wavelengths

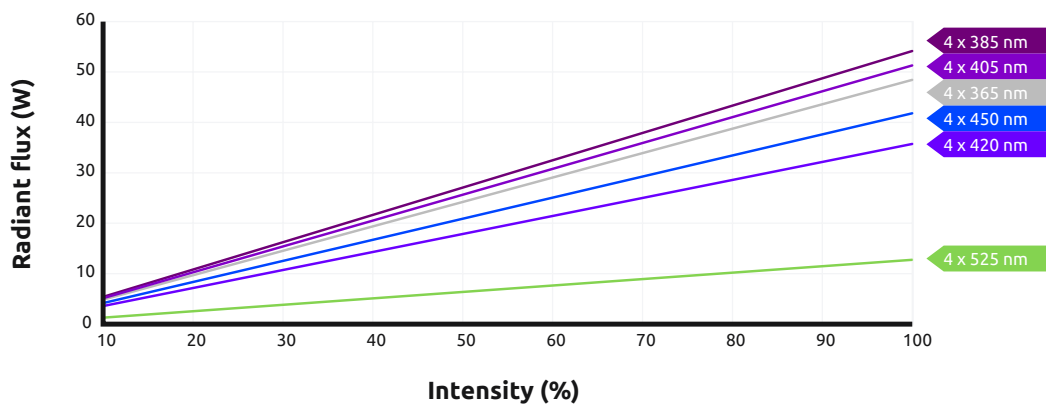
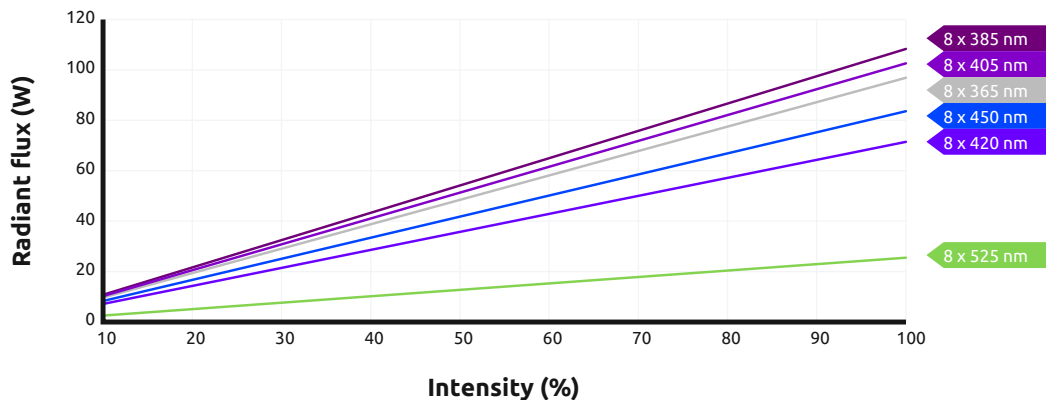


Figure 5.
Radiant flux vs
Power Intensity for
8 x LED Module
across all available
wavelengths



Photocalculator

A photocalculator is available allowing you to precisely determine either the Power Intensity or the Radiant Flux you want to control your photochemistry with.

Intensity calculator

Select wavelength	365nm UV
Enter target radiant flux (W)	25
Enter number of modules	8
Set % intensity	26%

Radiant flux calculator

Select wavelength	420nm Violet
Enter target % intensity	50
Enter number of modules	4
Set radiant flux (W)	18

The LED modules each have been set to be driven by a maximum current to prolong the lifetime of the individual LEDs and modules. For applications where multiple wavelengths are required the output radiant flux is adjusted to the maximum power of the lowest rated LED module. The mixed wavelength calculator below allows you to select any combination of wavelength (LED modules) and blank modules and delivers the Total Radiant Flux (W) available to the photochemical reaction.

Mixed wavelength calculator

	Choose wavelength	Radiant flux (W)	Intensity (%)
Position 1	420nm Violet	8	90
Position 2	Blank	0.0	
Position 3	450nm Blue	9.4	
Position 4	Blank	0.0	
Position 5	420nm Violet	8.0	
Position 6	Blank	0.0	
Position 7	450nm Blue	9.4	
Position 8	Blank	0.0	
Total Radiant flux (W)		34.7	

3 Control module

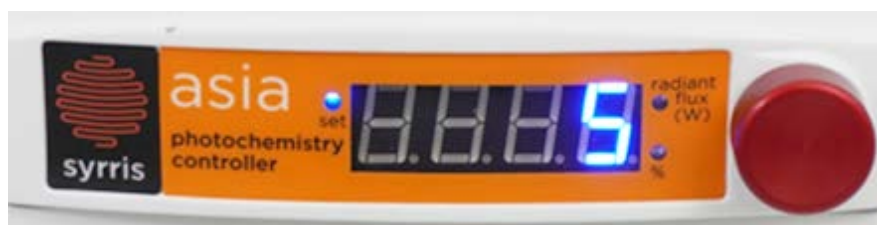
The Asia Photochemistry Control module provides the power to control the LED modules and enables the photochemistry parameters to be set manually (automated control is made possible using Asia Manager software).

The control module allows the number of LED modules connected to the Photochemistry Reactor to be set and calculates the available radiant flux.

Operation is intuitive and easy-to-use and in a few short settings the Photochemistry Reactor can be ready to use.



After initializing, the control module will allow you to set the **number of modules** connected to the reactor



The control module enables the **power intensity** to be set to power the LED modules



Alternatively, the control module enables the **radiant flux** to be set. The radiant flux is dependent on the number of LED modules selected



4 Temperature control

The Asia Photochemistry Reactor allows precise temperature control from $-40\text{ }^{\circ}\text{C}$ to $+80\text{ }^{\circ}\text{C}$ to enable selectivity and control of photochemical reactions.

- The construction of the LED modules allows the use of high intensity light with no external cooling to maintain optimum performance even at their maximum power. This translates to longer lifetimes of your LED modules and efficient temperature control of your reactions.
- The Asia Photochemistry Reactor can be assembled on the Asia Cryo Controller module which runs continuously from $-40\text{ }^{\circ}\text{C}$ to $25\text{ }^{\circ}\text{C}$ and the Asia Heater from $25\text{ }^{\circ}\text{C}$ to $80\text{ }^{\circ}\text{C}$.
- When no temperature control is set, the maximum temperature reached, due to heat generation by LED modules is $\sim 50\text{ }^{\circ}\text{C}$ (8 x LED modules at 100% power). The ability to maintain good reaction temperatures at a maximum power allows the Photochemistry Reactor to be used as a standalone option without the need for circulators or cryogenic cooling.

**Photochemistry Reactor
on the Heater**



**Photochemistry Reactor
on the Cryo Controller**



**Photochemistry Reactor
on the Standalone Module**



Efficient control with no external cooling

The maximum temperature of the reactor without any active cooling or heating is shown in Figure 6 and Figure 7.

These are results obtained by measuring the reactor temperature without external temperature control (from the Asia Heater or Asia Cryo Controller). It can be seen that the maximum temperature when 8 x LED modules are active at 100 % is ~50 °C. The temperature is dependent on the wavelength and power chosen. For example, when 4 x 525 nm LED modules are used in the reaction at maximum power, the temperature of the reactor is only 33 °C (only 8 °C above ambient temperature).

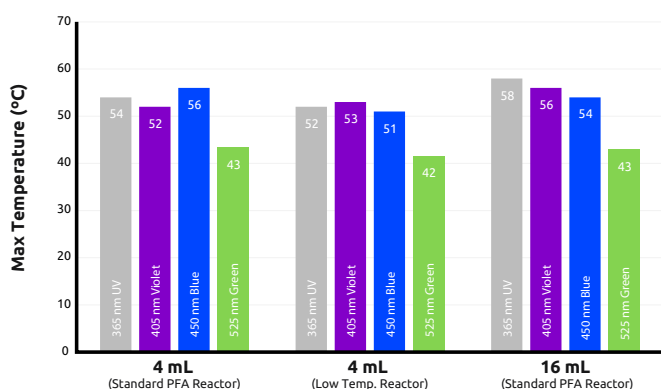


Figure 6
Maximum temperature of reactor, without any active cooling, using 8 x LED Module and power at 100 %

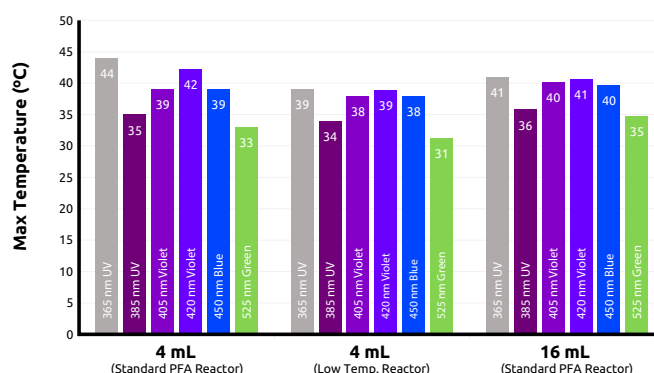


Figure 7
Maximum temperature of reactor, without any active cooling, using 4 x LED Module and power at 100 %

Figure 8 and Figure 9 show the maximum temperatures obtained when the Standalone module was fitted with, respectively, 8 and 4 LED modules.

It can be seen that the maximum temperature when 8 x LED modules are active at 100 % is ~47 °C. The temperature is dependent on the wavelength and power chosen. For example, when 4 x 525 nm LED modules are used in the reaction at maximum power, the temperature of the reactor is only 31 °C (only 6 °C above ambient temperature).

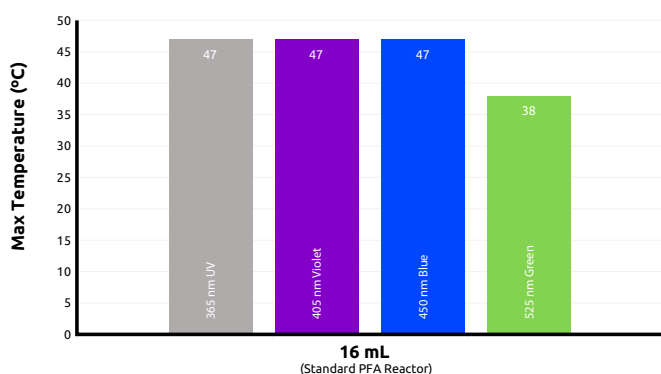


Figure 8
Maximum temperature of reactor, using the standalone module fitted with 8 x LED Module and power at 100 %

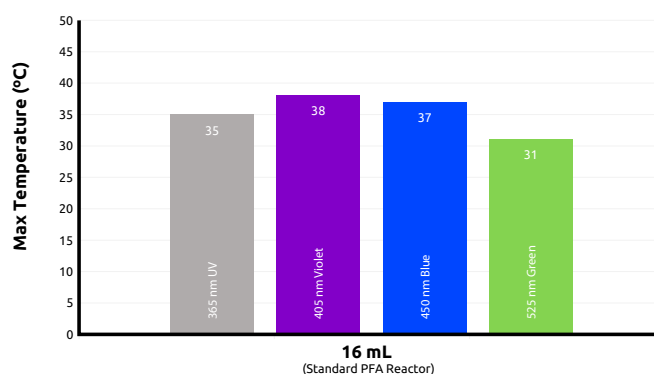
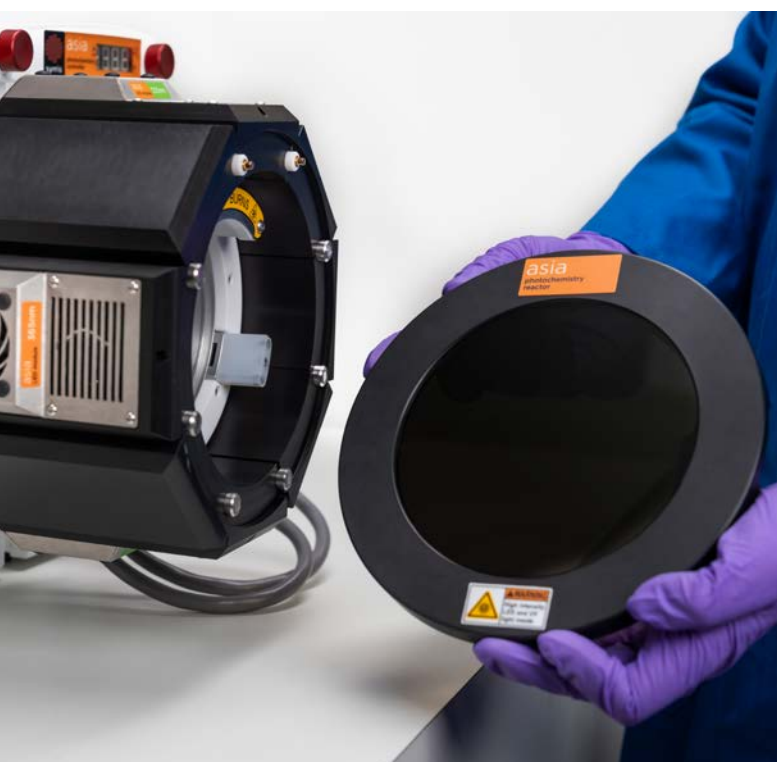


Figure 9
Maximum temperature of reactor, using the standalone module fitted with 4 x LED Module and power at 100 %

5 Safety interlock

The Asia Photochemistry Reactor is designed with safety in mind. The reactor has all the safety features expected of modern chemistry laboratories.

- The front panel and LED modules are fitted with an interlocking feature which means that if they are removed during operation, the system power will shut down. This means that the user will **never** be exposed to high intensity UV or visible light.
- These features allow the Asia Photochemistry Reactor to be used safely within standard fume hoods with peace of mind.
- The front panel shield prevents any exposure to high intensity light to the user. This is attached firmly in place by a strong magnetic connection.
- If the front panel or LED module is disconnected during operation, the safety interlocks shut down the system preventing light exposure.



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