Advanced UV-LED Light Engine ONE C

ALE/1C – Photolithography UV-LED Exposure Systems

Key Applications
- Mask aligner systems
- Stepper systems (i.a., advanced packaging)
- Wafer edge exposure
- Other applications that require highest UV-radiation output in manufacturing equipment (e.g., adhesive curing, broadband exposure)

ALE/1C Solution Highlights
- Built-in solution for maximum efficiency and performance
- Up to 50 Watts of broadband exposure (UV-LED 350-450 nm)
- Closed-loop controlled output for maximum process stability
- Future-proof mercury-free light source with significant Cost of Ownership advantages
- Quality Made in Germany
Multispectral Modularity for Highest Intensities

Illumination power of 1 kW and 2 kW mercury arc lamps

**Standard Lithography Setup**

3 NUV-LEDs (365, 405, and 435 nm)

Broad band lithography applications using i-, h-, and g-line in the semiconductor industry

**Radiation output in Watts**

<table>
<thead>
<tr>
<th>Primelite’s ALE/1C²</th>
<th>Broadband (350-470 nm)</th>
<th>i-line (350-385 nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALE/1C± (w/ external cooling) Optics: Ø8.0 mm HEX AR</td>
<td>50</td>
<td>21</td>
</tr>
<tr>
<td>ALE/1C± (standard) Optics: Ø8.0 mm HEX AR</td>
<td>40</td>
<td>17</td>
</tr>
<tr>
<td>ALE/1C± (standard) Optics: Ø6.5 mm RND AR</td>
<td>35</td>
<td>14</td>
</tr>
</tbody>
</table>

Mercury arc lamp

<table>
<thead>
<tr>
<th>1000 W type</th>
<th>500 W type</th>
</tr>
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<tbody>
<tr>
<td>37</td>
<td>19</td>
</tr>
<tr>
<td>17</td>
<td>9</td>
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</table>

ALE/1C units follow a distributed design approach, typically made up of a Control Subsystem (CSS) and a single or multiple separate Exposure Subsystems (ESS).

Very compact, yet extremely powerful: This design principle of our UV-LED exposure head allows for easy integration directly into your equipment. The light exit of our Exposure Subsystem may be combined with a variety of available light pipes, light guides and additional (also customized) optics.

**Distributed Setup for Optimal OEM-integration**

Control Subsystem (CSS)

- Available as stand-alone unit and as 4U 19” rack mount system
- Includes power supply, cooling system, and external interfaces

Exposure Subsystem (ESS)

- Compact design to be directly integrated into exposure equipment
- Includes emitters for i-, h-, and g-line, as well as LED-drivers

1. CRI of emitters: 367.5±2.5 nm, 387.5±2.5 nm, 402.5±2.5 nm, and 435.0±2.5 nm
2. Full spectrum measured; deviation of ±10% possible;
# Modular Technology Platform

## System Properties and Specifications

<table>
<thead>
<tr>
<th>Included emitters</th>
<th>Up to 3 LEDs ranging from 365 nm to 970 nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total radiation output¹</td>
<td>Up to 40 W (50 W with additional external cooling)</td>
</tr>
<tr>
<td>Output intensity¹</td>
<td>Up to 100,000 mW/cm²</td>
</tr>
<tr>
<td>Numerical aperture</td>
<td>Variable, depending on condenser optics</td>
</tr>
</tbody>
</table>

### Control configurations
- Individual LED power management and presets
- High-resolution intensity adjustment (20-100%)
- LED rise time approx. 1 millisecond
- Continuous monitoring of optical output and feedback control via internal or external signal

### Communication interfaces
- USB: ALE/remote (ALE PC-Software)
- PLC: Discrete interface
- Fieldbus: As per customer requirement (e.g. CANopen, PROFINET)

### Heat management
- Internal liquid cooling
- External cooling (optional), for elevated output level

### Dimensions (W H D)
- ESS: 20 cm X 13 cm X 20.5 cm (7.9” X 5.1” X 8.1”)
- CSS: 20 cm X 15 cm X 45 cm (7.9” X 5.9” X 17.7”)
- CSS (Rack): 44 cm X 18 cm X 37 cm (17.3” X 7.1” X 14.6”)

### Weight
- ESS: 5 kg (11 lbs)
- CSS: 9 kg (20 lbs)
- CSS (Rack): 10 kg (22 lbs)

### Power supply input
110-240 VAC / 50-60 Hz / 1,000 W

### Light Guide Options
- Hex, square and round light pipes (i.a., Ø6.5 mm and Ø8.0 mm)
- Customized condenser or focusing optics

¹ Full spectrum measured at end of light pipe (Ø8.0 mm, HEX AR-coated); deviation of ±10%
Accessories for the ALE/1C

Primelite Performance Optics

Very much like the Advanced Light Engines, our standard UV-LED optics product portfolio also follows a modular design principle. You may opt to use a flexible light guide or one of our light pipes/homogenizers with our ALE/1C light sources. In many cases it makes sense to take a closer look at our condensing optics, too.

As the output aperture from our flexible light guides and light pipes/homogenizers is around 0.6 (α~ ±30-35°), our lens systems can be an efficient addition to reduce divergence. Our light pipes and homogenizers are available in a selection of round, hexagonal, and square shapes. Primelite Performance Optics exclusively use UV-grade material.

Homogenizing and Condensing Optics

<table>
<thead>
<tr>
<th>Light Pipes / Homogenizers</th>
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<tbody>
<tr>
<td>Available types:</td>
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<tr>
<td>Numerical aperture:</td>
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<td>AR-coating:</td>
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<th>Condensing Optics</th>
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About Primelite

History and Guiding Principles

**History**

- Primelite GmbH was founded in Munich, Germany, in 2016 by a team of experienced engineers and managers.
- A prototype of our first high-power UV-LED light engine, the versatile, fiber-coupled ALE/1, was presented at the SEMICON Japan end of 2016. Series production started in 2017.
- In 2018, we added the ALE/1C to our product portfolio: A UV-LED exposure solution with standard-setting output performance, which you can directly integrate into semiconductor manufacturing equipment.
- Providing superior value, we can now call some of the biggest names in the semiconductor, pharma, and automotive industries our customers.

**Guiding Principles**

- We have committed ourselves to develop advanced UV-LED light sources which are best-in-class solutions for our customers.
- Perfect quality is our aspiration: We design and manufacture our UV-LED systems in Munich, Germany. To achieve industry-leading product reliability, we rely on carefully selected suppliers of critical components. These include made-to-spec optics from semiconductor-grade Japanese glass and superior LED emitter technology.
- To stay way ahead of our competition, we continually advance our core know-how on optical and mechanical design. Additionally, improving our electronic hardware and software architecture is just as essential.
- We enable product innovation as well as fast-track development and product rollout by having a lean organization, deep market insight, customer-focus, and dynamic business culture at Primelite.