

BLULINE II

The Platform for
High-Quality Blu-ray Discs

BLULINE II

Reliable Replication System for Single Layer Discs with 25 GB as well as Dual Layer Discs with 50 GB and with 66 GB Storage Capacity

The dual layer Blu-ray format has definitively established itself as a standard in the market. High definition television combined with Blu-ray Disc, is the standard technology of the media sector. 4K TV is coming soon and will open even a better quality.

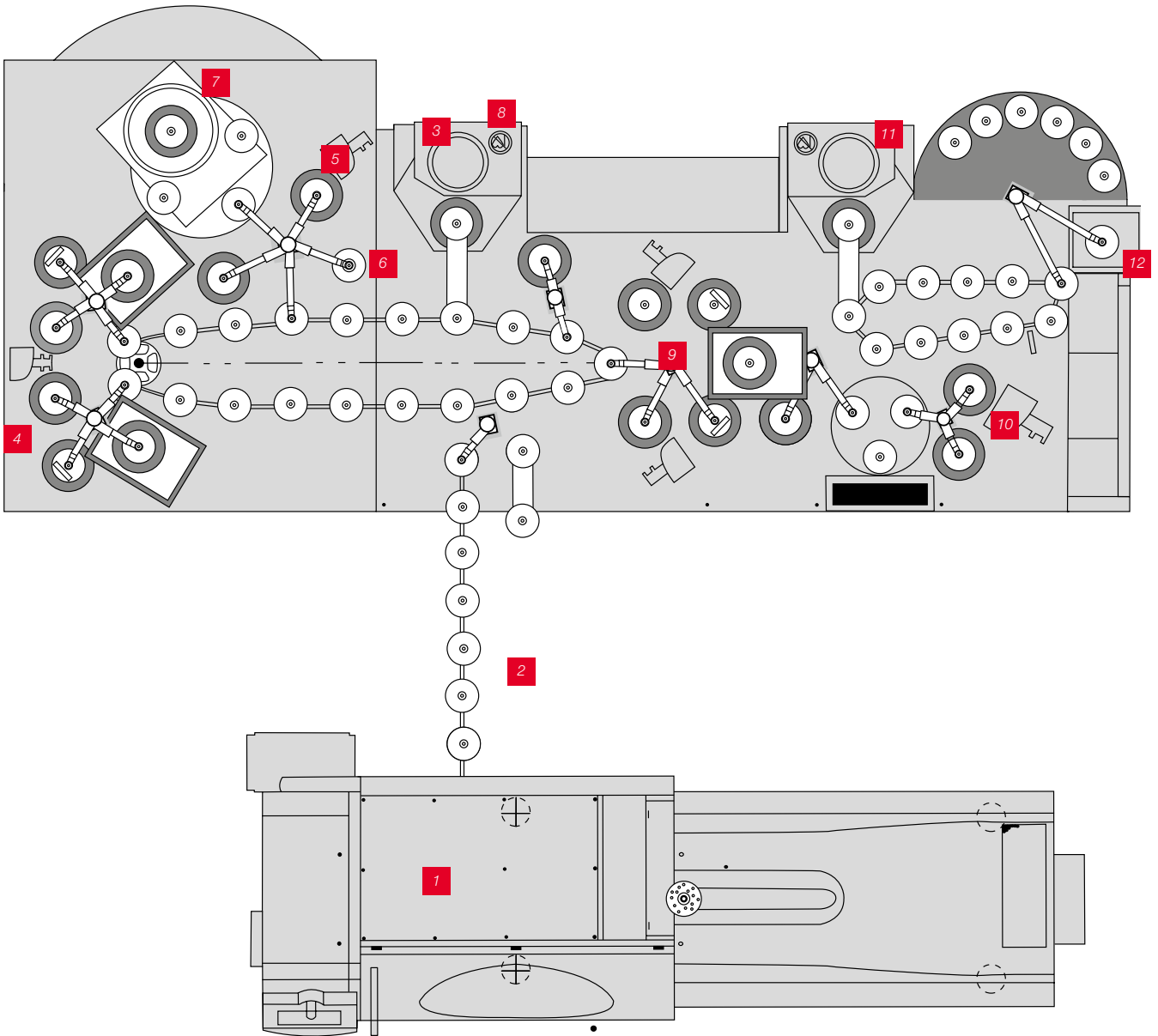
SINGULUS TECHNOLOGIES has already installed a large number of production lines all around the globe. The SINGULUS Blu-ray Disc production system BLULINE II is designed for the economical production of Blu-ray Discs (BD ROM Single Layer and Dual Layer Discs for 50 & 66 GB), according to the specifications issued by the BDA. All production steps from molding, cooling, metallizing, wet-embossing, lacquering and UV-curing to quality inspection are incorporated in the BLULINE II. Its functionality, speed and design will have again set a new benchmark for the industry. The BLULINE II

operates with one molding machine and comprises all the advanced features required for production of high end Dual Layer Blu-ray Discs.

The most common technology for creating an additional information layer on a substrate surface is the wet-embossing process. The benefit of the wet-embossing process is that it provides a fine pit geometry and therefore generates a flawless electrical signal. The dual layer process requires an excellent uniformity of the space layer between the two information layers (approx. 25 ± 1 micron). This space layer is created by our field proven spin coating process and uses IR heating and UV-curing to achieve the required uniformity.

Finally the Dual Layer Discs disc requires a precise $75\ \mu\text{m}$ layer of cover layer and protective hard coating.





1 Injection Molding

SINGULUS TECHNOLOGIES has qualified the MOLDPRO/2 all-electric molding machine for Blu-ray Disc production. Other qualified molding machines can be integrated on request.

2 Cooling Conveyor

A linear cooling conveyor transports the discs in horizontal position through a separate conveyor belt to the downstream. This additional cooling of the substrates during transportation provides a uniform temperature distribution over the disc surface.

3 Layer 0 Metallization

A high-rate SINGULUS V sputter module with the patented SMART Cathode® is used for the metallization of the molded Blu-ray Disc substrates with Layer 0 full-reflective material. Silver Alloy is sputtered with a layer thickness of approx. 35 nm.

4 Base Resin

Lacquering takes place on a double track module for high throughput. Both tracks are connected to one lacquer dispense system, two spin bowls and one IR lamp. One Xenon pulsed UV lamp is used for each track. The combination of a spin bowl and the UV station creates a uniform shape and outer edge on the disc.

5 Pit Transfer Resin

This unit consists of one lacquer dispense systems and two spin bowls. The discs are transported by one handling system. Once the metallized and base resin-coated disc reaches the first position, a highly accurate circular ring of lacquering agent is applied onto the disc and spin off to achieve a uniform pit transfer resin layer of approx. 3 µm.

6 Pre-Curing

A one-position turntable to pre-cure the center of the lacquered Blu-ray Discs is positioned just prior the wet-embossing station.

7 Wet-Embossing Station

The Layer 1 wet-embossing station is the key unit of the dual-layer application. This unit is built with a 4-position turntable and one embossing head. The Layer 1 stamper is mounted onto the top side of the embossing head. It is supported by vacuum

and a mechanical stamper holder. The disc is loaded onto a quartz glass underneath the embossing head and the L1 Nickel stamper structures are embossed into the pit transfer resin and cured with UV light.

8 Layer 1 Metallization

For the second metallization of the wet-embossed disc with Layer 1 semi-reflective material, the same sputter station is used as for Layer 0. Silver alloy is sputtered with a thickness of approx. 30 nm.

9 Cover Layer

Lacquering the cover layer takes place on a double track module for high throughput. With the feedback from the final inspection system a closed loop cover layer control is generated to ensure constant thickness and uniformity.

10 Hard Coating

The hard coat is performed with a spin process, ensuring a very thin and uniform distribution of the hard coat material. Afterwards, the disc will be UV-cured and positioned on the conveyor. A flip-over handling arm brings the print side of the disc facing up.

11 Barrier Layer

A SINGULUS V module is used for sputtering the label side of the disc with a moisture barrier. SiN is sputtered with a layer thickness of approx. 10 nm.

12 Final Inspection

The unique layer thickness measuring system controls the layer thickness and layer uniformity of each layer automatically.

The following features characterize the BLULINE II concept:

- Dedicated to production of BD ROM Single Layer 25 GB, Dual Layer 50 & 66 GB
- Cycle time Single Layer 25 GB, Dual Layer 50 & 66 GB less than 4.0 s
- Highly integrated design
- All production steps included inline
- Thickness Measurement Device (TMD) for metallized layers with close loop control for the cathode
- Inline-Scanner for spacer-layer and cover-layer measuring with close loop control for spin process
- High productivity, high uptime
- Clear structured disc flow
- Automated handling of BD through all production steps
- Minimum space required

Main Features

Format	Blu-ray Discs Single Layer 25 GB, Dual Layer 50 & 66 GB
Cycle time	DL < 4.0 s SL < 4.0 s
Space layer BD DL	25 µm (23 µm base resin + 2 µm pit transfer resin)
Cover layer BD DL	72 µm + 3 µm hardcoat
Cover layer BD SL	97 µm + 3 µm hardcoat

Metallization

Fully reflective layer	Ag+ (approx. 35 nm)
Semi reflective layer	Ag+ (approx. 30 nm)
Barrier layer	SiN (approx. 10 nm)

Available Options

Adaption of BCA module	
------------------------	--

Dimensions BLULINE II (with MOLDPRO/2 Injection Molding Machine)

Length	4500 mm
Width	3700 mm
Height	2080 mm



Headquarters



Subsidiaries
Offices



SINGULUS TECHNOLOGIES AG

Hanauer Landstrasse 103
D - 63796 Kahl, Germany
Tel. +49 6188 440-0
Fax +49 6188 440-110
sales@singulus.de
www.singulus.de

China

**SINGULUS TECHNOLOGIES
SHANGHAI**
Tel. +86 13918298537
greens.pan@singulus.com.cn

France

**SINGULUS TECHNOLOGIES
FRANCE S.A.R.L.**
Tel. +33 3 893111-29
singulus@club-internet.fr

Germany

**SINGULUS TECHNOLOGIES AG
Niederlassung Fürstenfeldbruck**
Tel. +49 8141 3600-0
sales@singulus.de

Latin America

**SINGULUS TECHNOLOGIES
LATIN AMERICA LTDA.**
Tel. +55 1121 6524-10
rodolfo.mignone@singulus.com.br

Singapore

**SINGULUS TECHNOLOGIES
ASIA PACIFIC PTE LTD.**
Tel. +65 674 119-12
sales@singulus.com.sg

Taiwan

**SINGULUS TECHNOLOGIES
TAIWAN LTD.**
Tel. +886 2 2748-3366
sales@singulus.com.tw

United States and Canada

SINGULUS TECHNOLOGIES INC.
Tel. +1 860 68380-00
sales@singulus.com



THIN FILM
DEPOSITION

SURFACE
ENGINEERING

THERMAL
PROCESSING

WET
CHEMICAL

SINGULUS TECHNOLOGIES – Innovations for New Technologies

SINGULUS TECHNOLOGIES develops innovative technologies for economic and resource-efficient production processes. SINGULUS TECHNOLOGIES' strategy targets the use and expansion of its existing core competencies. This includes process technology and scientific solutions combined with mechanical and plant engineering. The core competence of SINGULUS TECHNOLOGIES rests on vacuum thin-film and plasma technology, wet-chemical processing as well as thermal process technology.

SINGULUS TECHNOLOGIES is expanding this expertise in its core segments and is transferring the know-how to new application areas: consumer goods, entertainment, energy, mobility and semiconductors.