

CRYSTALLINE

In-line Mastering for the
3rd Generation Format

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SINGULUS MASTERING, the global market leader in mastering equipment for optical discs, presents the **CRYSTALLINE**: The in-line solution for mastering of pre-recorded Blu-ray Disc (BD25, BD50, 3D BD).

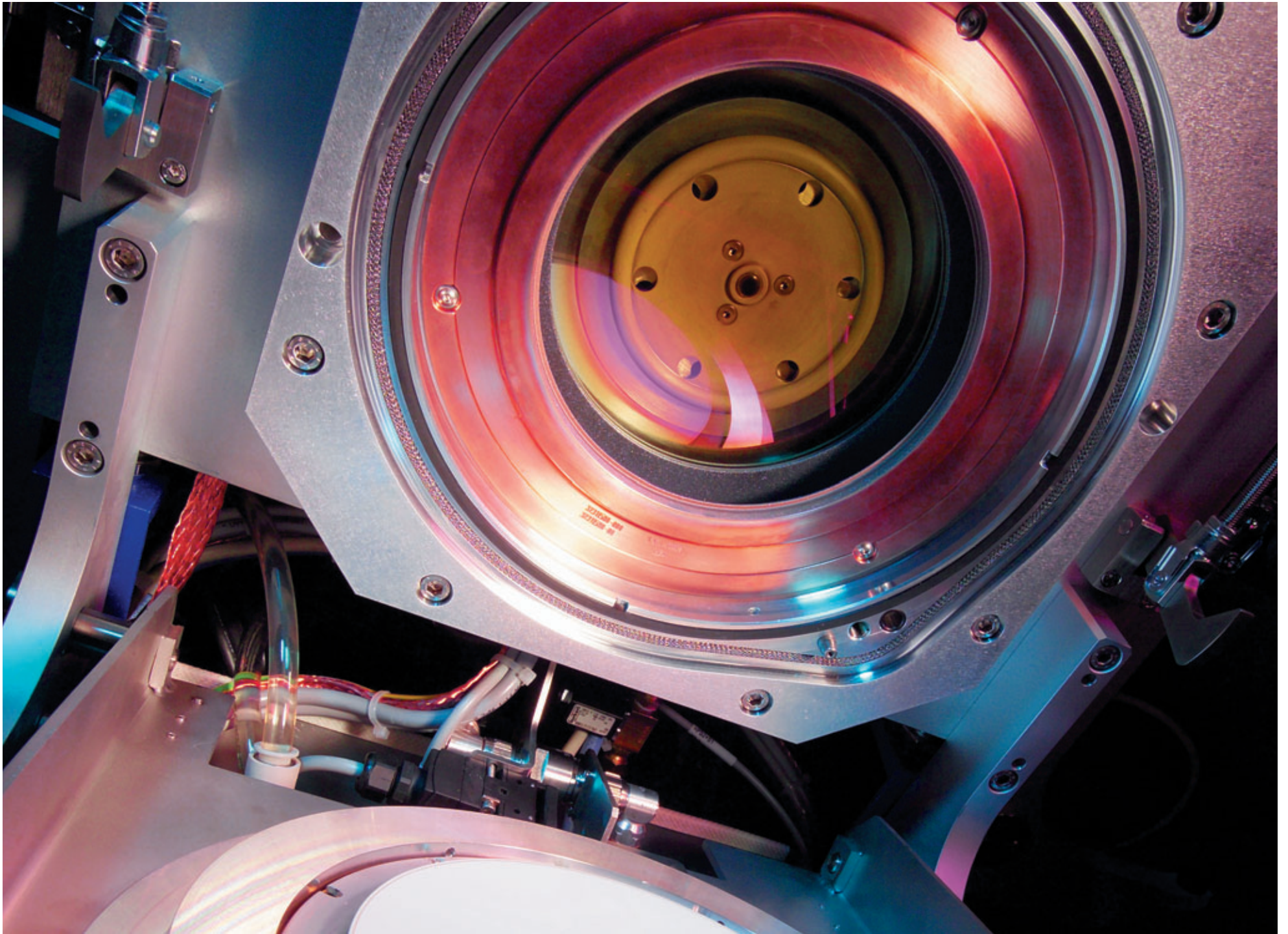
Based on the “Glass substrates in – Finished Masters out” principle, the system incorporates the SINGULUS’ proprietary PTM process. The **CRYSTALLINE** is designed for maximum unattended operation, and offers the lowest Cost of Ownership, ensuring maximum return on investment. By offering all specific technologies, from BD mastering to BD replication, SINGULUS is in the unique position to deliver complete and fully optimized solutions for BD manufacturing.

The **CRYSTALLINE** system incorporates a wet station for cleaning, developing and DOM measurements, a “single chamber – three target” sputtering unit for application of the PTM recording and nickel layers and an innovative Laser Beam Recorder performing the recording process. The use of the Phase Transition Mastering (PTM) process, combined with advanced waveshaping technologies enables the use of the proven 405 nm Solid State Laser on the new LBR. The signal encoder incorporates advanced waveshaping technology feeding the laser. The central substrate “warehouse”, combined with innovative, patented, scheduling algorithms ensures the shortest production cycle possible in the machine.

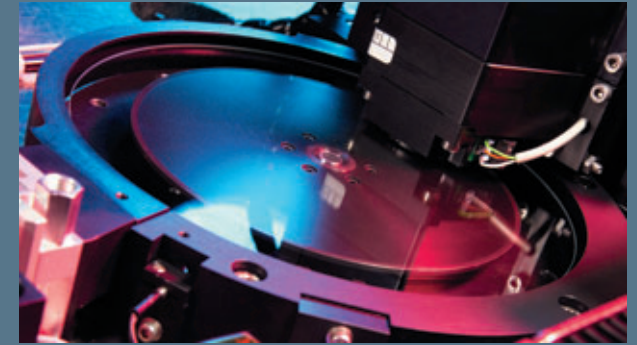
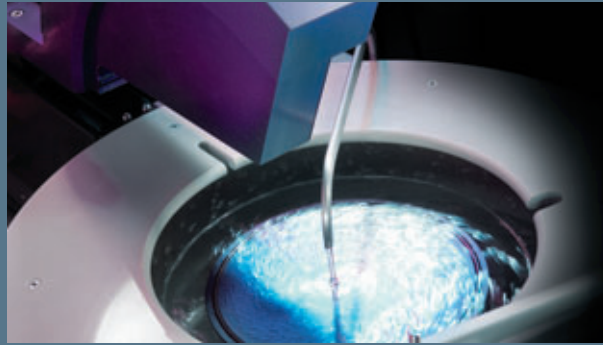
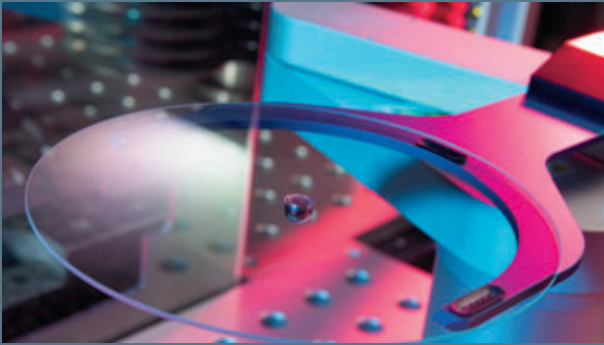
The experience gained in building mastering systems for first and second generation optical formats, combined with a newly designed Laser Beam Recorder and Sputtering Unit incorporating the SINGULUS Smart Cathode® technology has resulted in a reliable machine for in-line mastering of the Blu-ray Disc format.

With its worldwide sales and service network, SINGULUS MASTERING is able to provide exceptional support together with technological synergies to benefit our customers.





Concept



Concept

The mastering process of the **CRYSTALLINE** machine is based on the proprietary Phase Transition Mastering (PTM) technology. The PTM recording process enhanced with customized waveshaping allows the creation of the desired pit geometries after development and the subsequent galvanic step. Waveshaping is an integral part of the encoder and is strongly linked to the 405 nm

solid state laser. The encoder is used to encode the data for Blu-ray Disc, with the required protections such as AACS and ROMMark.

It is also used to generate the signal for graphics bands on the disc. A novel and intuitive user interface gives immediate status overview on the machine also accessible remotely, and the orders being processed. Data generated by each station,

which is linked to the order by DiscTag, can be viewed at the machine in the form of reports, or be made available for further analysis as exported XML files.

XML is also the structuring language that describes each individual station and recipes, covering all process steps, used for creating the master.

The Stations and Logistics

1 The Laser Beam Recorder has been designed to meet the stringent requirements posed by BD in particular. Modern modelling technologies and innovative design have resulted in an exceptionally stable LBR. All movements in the LBR support mastering at high speeds (up to 3R) when encoders become available. Especially the newly developed Learning Feed Forward Control (LFFC) makes this possible.

2 The Sputtering Unit was specially designed to perform two tasks; preparing the substrate for recording and finishing the substrate after development, so it can subsequently be used in galvanics.

The first step consists of sputtering a base silicon layer, followed by the PTM layer. The layer thickness variation is less than 2 nm over the program area of the disc.

3 The wet station combines the functions of cleaning, development and reflection/diffraction (DOM) measurement. After recording of the disc, the wet station develops the substrate based on order criterion.

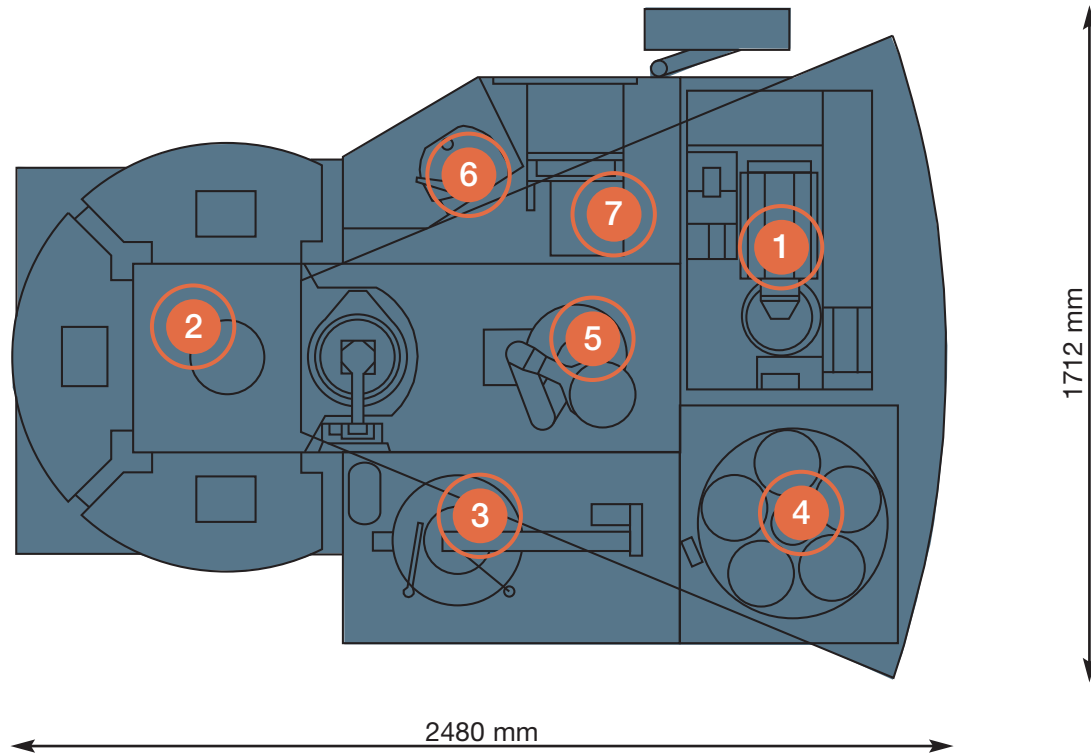
4 The Warehouse, having 100 storage locations for substrates, plays a vital role in having the CRYSTALLINE achieve its maximum throughput. The warehouse also makes it possible to run unattended mastering for 24 hours or more.

5 The Handler, selected for reliability and speed, can reach all process locations in a short time. Handling time between process steps is no longer a delaying factor in the throughput of the machine.

6 The Intake accepts cartridges holding 20 substrates.

7 The Unload delivers the finished masters each in a dedicated box. It also offers the possibility to load a single substrate for processing or measuring in the **CRYSTALLINE**.

8 The substrate used in the machine has an industry-wide accepted diameter of 180 mm. The polished glass disc, combined with a hub, guarantees optimum quality while maintaining easy handling and fixation on the stations throughout the machine.

**Mastering Formats:**

Pre-recorded Blu-ray Disc at 1R (1.5R optionally available).
All mastering data to be delivered through Gigabit Ethernet link. Support for AACS and BD ROMMark

Production Capacity:

Blu-ray Disc 21 per 24 hours (at 1.5R)

General Details:

- Width: 1.7 m
- Length: 2.5 m
- Height: 2.3 m
- Weight: 2.100 kg
- Room Conditions: Temperature 18 - 24 °C
Humidity 40 - 70 % RH

Laser Beam Recorder:

- Type of Laser: Directly modulated twin input – quad level solid state laser diode (405 nm)
- Expected Laser Life Time: > 10,000 hours
- Focus: Using recording beam. Learning Feed Forward Control (LFFC)
- Translation: Linear motor attached at centre of gravity
- Rotation: Brushless DC motor, with embedded tachometer
- Substrate: Ø 180 mm glass (1.6 mm thick) with hub delivered in cassette for 20 substrates

Utility Requirements:

- Electrical Supply 230/400 V 50/60 Hz
- Power Consumption 10 kVA
- Di Water: 2.6 l / disc
- Argon Gas: 80 Nml/min (= 80 sccm)
- Compressed Air: 250 Nl/min at > 8 bar

Sputtering Target Lifetimes:

- Si: > 10,000 shots
- PTM: > 10,000 shots
- Ni: > 5,000 shots

Technical alterations reserved



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