

SUNLINE AND THE PROCESS IS UNDER CONTROL

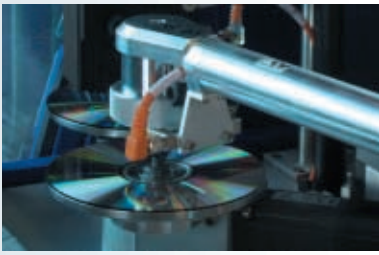
THE PROVEN PRODUCTION LINE
FOR ALL REWRITABLE FORMATS AS WELL AS BLUE RAY DISC

The SUNLINE embraces all the advanced features required for production of high end optical discs. Within a very compact footprint many process steps are integrated under a cleanroom 100 environment. Due to the comparable high production costs of ReWritable Media high emphasis was put on the inspection and control of disc properties. This helps to keep the yield at high level and the disc characteristics within a small bandwidth. Three disc scanners are integrated. Results and parameters are nicely displayed and easy to edit. Automatic process control is achieved by online measurement and closed loop control of the thin film layer stack.

SINGULUS process experience is collected in the CD-RW and DVD±RW process packages and layer stack design, which reflect the influence of the relevant steps on the specific disc characteristics. The SUNLINE runs with two molding machines either both for CD-RW or in case of DVD one for data and one for dummy side. As an option also a hardcoat module can be integrated to deposit a protecting lacquer on the data disc. The multilayer sputter system MODULUS operates with the SMART CATHODE® ensuring excellent layer uniformities on the disc. Then the disc returns back to the SUNLINE to be lacquer coated or bonded by SINGULUS proven technologies

Customer responses confirm the high process stability as anticipated in the design of the line.





SUNLINE: The Universal Replication Line for all ReWritable Formats

After two year development SINGULUS has completed its inline manufacturing solution SUNLINE in 2001. The line can manufacture all ReWritable optical disc formats as CD-RW, DVD±RW, DVD-RAM and also the next generation discs for blue laser.

Our SUNLINE includes all production steps from molding, sputtering, lacquering/bonding to UV-curing and testing. Functionality, speed and design set a new low cost benchmark for the industry. As sputtering is the key production step for ReWritable optical disc formats, the multichamber sputter system MODULUS played the dominant role in the design of the manufacturing line.



MODULUS: The Heart of our SUNLINE

A thin sputtered active layer composed of a very special metal alloy is sandwiched between other thin films, which serve for the correct optical and thermal properties of the thin film layer stack during the laser beam writing and reading. The SUNLINE integrated multi-cathode metallizer MODULUS deposits four to seven different layers on the substrate. Equipped with the well field proven SMART CATHODE® and an unique cooling technology, MODULUS is an unbeatable sputter system for temperature sensitive DVD substrates. MODULUS forms a family of multilayer sputtering machines with up to 15 process stations particularly dedicated to the manufacturing of ReWritable phase change discs at high throughput. In this machine all modern sputtering technologies including DC-, pulsed DC- and RF-sputtering are employed. Accordingly the 13 station MODULUS got today a popular product covering all present ReWritable CD and DVD formats. MODULUS installations are running at several manufacturers in full production.



Advanced SUNLINE Disc Transport System

The SUNLINE marks a significant jump in disc transport technology. Wherever possible, servo motors are employed for motion control.

While in previous manufacturing lines the sequence of movements was designed into the mechanical gear as hardware, now motion became part of the machine software. This has tremendous advantages for optimizing the production line performance achieved by a delicate programming work for smooth mechanical movements. Equipped with state of the art disc inspection tools SUNLINE provides all manufacturing steps and the performance required to make the replication of ReWritable CD and DVD formats a profitable business. The effort was rewarded by reliable, fast, smooth and intelligent line operation.

Hardware backed by SINGULUS Process Certified for DVD±RW

SINGULUS offers the full package of process support coming with the SINGULUS products molding, line and sputtering. Each hardware is under constant observation and development by process engineers for improvement and transfer to customers. In addition there is a high crosslinking between the different line types for the delicate processes e. g. DVD bonding, curing to achieve stable and reliable operation. As a result of the SINGULUS process development on November 7th, 2002, SINGULUS TECHNOLOGIES, as the first optical disc equipment manufacturer, has successfully passed the DVD+RW verification test with discs produced on its new SUNLINE manufacturing system. The DVD+RW verification marks an important milestone for the SINGULUS RW team and gives final proof to a customer, that SINGULUS RW equipment with process technology on top is ready for the disc production. The first SUNLINE was delivered to the company SENTINEL, Belgium, as a turnkey installation, with SINGULUS EMOULD injection molding, a 13-station MODULUS multilayer sputtering and together with SINGULUS CD-RW as well as DVD+RW process technology. Other complete Production Systems are operating in Far East.

Main Characteristics

Top Product Quality

- Superior layer uniformity by SMART CATHODE® sputtering
- Constant product performance by automatic compensation of deposition rate over target lifetime
- Low stress and temperature on the disc by dedicated cooling stations
- Field proven bonding technology
- Cleanroom class 100 condition from molding to bonding

Top Productivity/Lowest Cycle Time

- Up to 15 process stations for sputter deposition / cooling
- High substrate transportation speed
- High sputter rates
- Efficient disc cooling stations

High System Uptime

- Robust construction of the machine and all handling systems
- Minimum chance of disc jams by reliable disc transport system employing gripper fingers
- Automated disc mask exchange during machine operation without production stop
- Easy shield and target change
- Easy service and maintenance by open mechanical design

High Production Yield

- Tight control of layer uniformity and thickness within one disc and from disc to disc by closed loop thickness control
- Low disc tilt after sputtering for large climate test window
- Reduced particle contamination by excellent shield cooling
- Disc cleaning before and after sputtering

Low Cost per Disc

- Efficient use of target material
- High throughput



SUNLINE
designed for ReWritable DVD Production



SUNLINE

Technical Data

Formats: CD-RW, DVD-RW/DVD+RW, and DVD-RAM finished discs (single sided DVD formats) or lacquer protected halvesides of these format

Substrates: CD and DVD ø120 or 80 mm

- Processes:**
- Molding
 - Sputter Deposition & Cooling on 5-15 Process Stations
 - Disc cleaning
 - Lacquering / Bonding
 - Inspection
 - Serial number disc marking
 - Spindle storage

- Options:**
- Thin Film Layer Stack Monitoring
 - Hardcoating
 - Inline Initialization

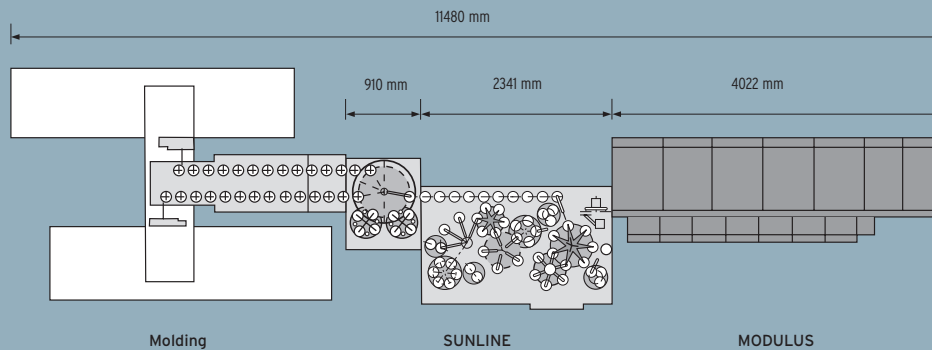
Performance: typ. < 4.5s Cycle time
typ. ≥ 90% Uptime
typ. ≥ 85% Yield
(depending on the particular format)

Footprint: < 40 m²
(11 x 3,5 m for base model including 2 molding machines)

Consumables: Granular polycarbonat, sputter targets, lacquer / bonding resin, marker ink, process gases

Required Supplies: Electrical power, cooling water, compressed air

Environmental conditions: Class 100 cleanroom
18-22°C stable ambient temperature



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SUNLINE:
For CD-RW / DVD±RW / DVD-RAM
Production