

SINGULUS  
MOLDING

SMART SOLUTIONS TO DRIVE THE FUTURE.



**MOLDPRO**

All-Electric Molding Machine

# MOLDPRO

ONE SYSTEM FOR ALL OPTICAL DISC FORMATS

SINGULUS MOLDING, with its manufacturing facility in Schaffhausen, Switzerland, was established in 2005 to develop and manufacture next generation molding machines. SINGULUS MOLDING has now completed development of the new MOLDPRO injection molding technology. This new technology provides unique opportunities and is ready for mass production.

The design concept and development along with maximum process experience make the MOLDPRO a state-of-the-art molding machine.

The MOLDPRO is designed exclusively for molding optical discs. All components are laid out using FEM-analysis methods to ensure the highest accuracy, best substrate quality and a long lifespan.

In conjunction with SINGULUS TECHNOLOGIES' superior replication and mastering technology, SINGULUS MOLDING offers optimized and stable molding processes with the highest precision and repeatability at the shortest cycle times.

With the SINGULUS TECHNOLOGIES worldwide sales and service network in its corner, SINGULUS MOLDING is able to offer exceptional customer support and technological synergism to benefit our customers.

The MOLDPRO all-electric molding machine is designed for the economic production of any optical disc format. Its direct drive concept guarantees highest precision and repeatability to ensure disc quality according to the specifications issued by the Philips Intellectual Property & Standards Organization.



The MOLDPRO performance is based on the following main features in conjunction with dedicated process know-how for each format:

## DIRECT DRIVE SYSTEM

Three hollow axis AC-servo motors combined with high precision roller gears are used to drive the clamping unit and two hollow axis AC-servo motors are used for the injection unit. These five motors are water cooled and permit high acceleration and high torque. Each motor is equipped with a high resolution encoder to achieve precise positioning. The patented E-clamp system is free of clearance to ensure the best repeatability. Together with the PLC-controlled servo amplifiers, which allow simultaneous movements, the all-electric molding machine guarantees high reliability.

## CLAMPING UNIT

The complete system, particularly the clamping unit, was designed by Finite Elements Analysis. Quick opening and closing speeds shorten the cycle times considerably. The direct drive system offers precise positioning and high replication rate due to high acceleration movements. Due to the patented E-clamp system, the parallelism of the mold mounting plates can be influenced. Offset values for each single clamp motor allow adjustments of the substrate thickness variation during operation.

## PLASTICIZING UNIT

The entire unit has been especially designed by SINGULUS MOLDING for optical media applications. Inside the hardened barrel, there is a 28 mm screw with the non-return valve. Each part is surface coated with TiN against wear and corrosion. The barrel is divided into six individually controlled heating zones, with special synchronization software for careful and simultaneous heating to avoid overheating of single zones.

The nozzle of the plasticizing unit is actively opened and closed by a pneumatic driven needle shut-off nozzle system. This design ensures a "soft cut" process for best sprue stiffness and high melt quality. Even at high speed cycles the plasticizing time has no influence on cycle time. The permanent contact of the nozzle tip to the sprue bushing leads to very low wear. In addition, melt homogeneity and minimized shot weight variations are achieved by high precision metering control.

## MULTI FORMAT MOLD

SINGULUS MOLDING has designed a multi format mold which allows the production of substrate thicknesses between 0.2 and 1.5 mm. In combination with the E-clamp system the changeover time from CD with 1.2 mm to DVD with 0.6 mm is no more than the time required for stamper change and readjustment of temperatures. Due to the high precision assembly of the clamp unit and precision ball bearings to guide the tie bars, the mold does not require separate centering.

## MOLD TEMPERATURE

The temperature control unit consists of a buffer tank, a primary and a secondary circuit. The primary circuit supplies cooling water to the high torque servo motors, the mold mounting platen, the tie bars and the feeding zone of the barrel.

The secondary circuit is divided into four mold circuits. Each of these circuits can be precisely adjusted between 20° C and 140° C. All components are specially selected to ensure long lifespan and durability. Magnetically coupled pumps are used for all mold circuits; all other parts, which are in contact with water, are made of either stainless steel or brass to eliminate corrosion.

The buffer tank separates the machine from the factory water and is filled with DEMI-water plus an anti-corrosive agent.

## SERVO TAKE-OUT ROBOT

The direct driven servo take-out robot is located at the rear side of the machine and is fixed to the stationary machine platen. It takes the substrate out of the mold and hands it over to the drop-off position for the downstream equipment.

The mechanical components and the drive concept of the take-out robot guarantee short cycle times due to fast disc take-out and short mold opening stroke. Other main features are:

- Precise positioning and high reliability
- Long lifespan and mechanical robustness
- Easy teach function
- Reliable sprue detection
- Soft and symmetric sprue gripping by vacuum

## TOUCH SCREEN

The 10-inch colored LC-display gives easy access to the machine operation. The menu is clearly arranged and so far English and German can be selected for a simpler parameter adjustment. Additionally, all important parameters can be monitored, either within one cycle to observe the process behavior, or over 500 shots to judge process stability. Every parameter change is saved in a log-file showing date, time and the old and new parameter values.

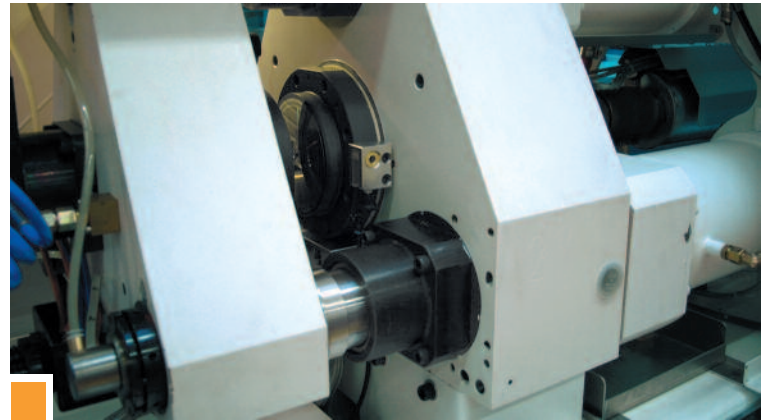
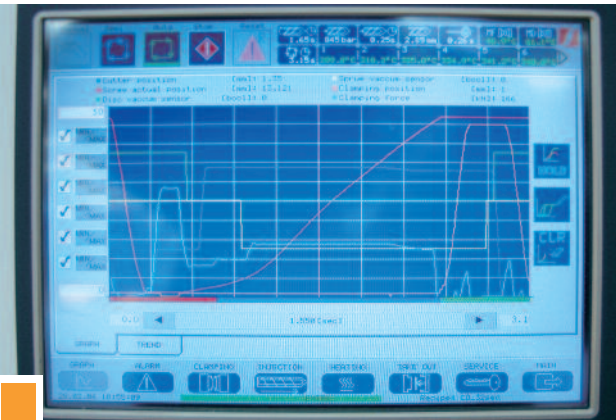
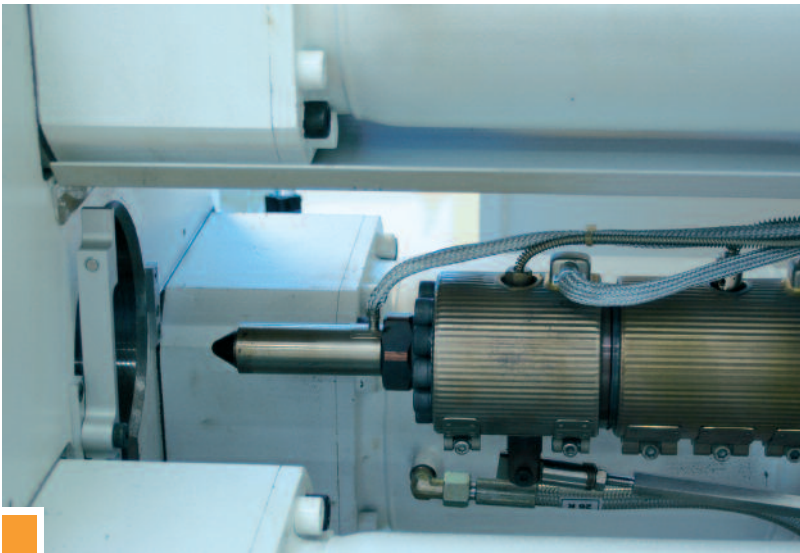


## MOLDPRO

Best Performance for  
CD • DVD • HD DVD • Blu-ray Disc

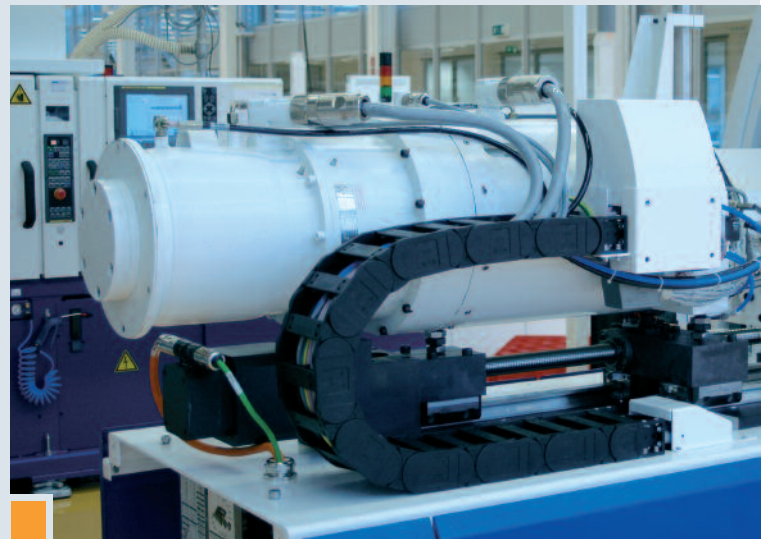
- 1 SKYLINE II Inline Replication system for CD/DVD 5
- 2 SPACELINE II Inline Replication system for all DVD formats as well as HD DVD
- 3 BLU-LINE Inline Replication system for the production of Blu-ray Discs





## MAIN CHARACTERISTICS

- Direct drive technology ensures highest precision and repeatability
- Multi format mold for quick format change (e.g. CD to DVD or BD)
- Low energy consumption
- Shortest cycle times guarantee highest productivity
- Extremely quiet operation
- Minimum footprint
- Easy to operate and maintain
- Water cooled clamp unit for fast stabilization and low reject rates after start up
- Independent temperature control unit - no influence of factory water on the process
- Worldwide customer support



# MOLDPRO

## Technical Data

### General data:

- Suitable for clean room classification: class 10.000 (US Fed. Standard 209 D) (class 1.000)
- Installation dimension: L 2.93 x W 0.94 x H 1.79 m
- Required floor space: 2.75 m<sup>2</sup>
- Net weight: approx. 2.5 t
- Floor load (static load, vertical direction): ~ 1.000 kg/m<sup>2</sup>
- Dynamic force: 1 kN
- Atmosphere: no corrosive gases allowed

### Mold temperature controller:

- Model: SINGULUS
- Type: TCU 1
- Max. temperature: 140 °C
- Cooling methode: indirect by cooling liquid

### Injection unit:

- Adjustable barrel heating zones: 6 incl. Nozzle heating
- Total heater capacity: 9.4 kW

### Motor rated power:

- Clamping unit: 54 kW (3 x 18 kW)
- Injection unit: 11 kW

### Media consumption:

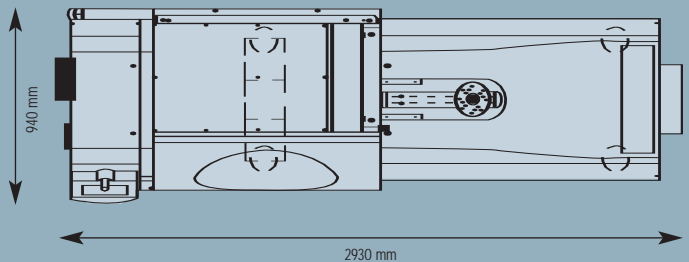
- Water: < 25 l/min
- Compressed air: < 150 l/min (cycle time 2.2 s)
- Electricity: During production < 10 kW
- Heat loss to the environment:
  - Cooling water: ~ 5 kW
  - Atmosphere: ~ 5 kW

### Cycle times:

- CD-Audio/ROM: 3.2 s
- DVD-5/9/10: 2.3 s
- HD DVD: 3.5 s
- BD: 4.0 s

### Electrical power:

- Voltage: 3 x 400 V, PE, +/- 5%- Type TCU 1
- Frequency: 50 Hz / 60 Hz
- Total connected power: < 35 kW
- Power consumption: < 10 kW
- Main circuit breaker: 63 A CE
- Connection: L1, L2, L3, PE



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