Synventive molding solutions
A business of BARNES GROUP INC

Rozwój Nowych Technologii
Optymalizacja i Kontrola Procesu

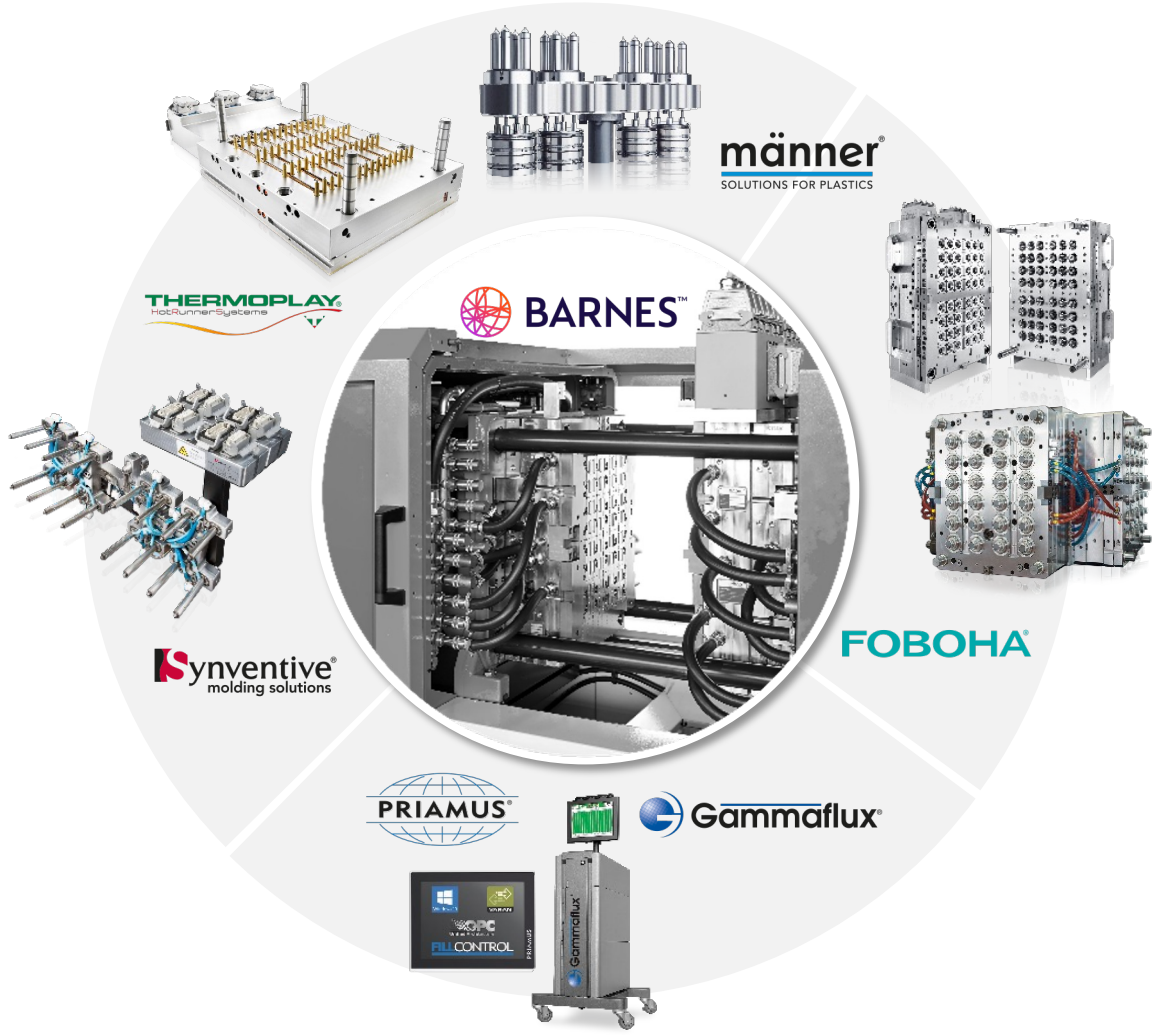
Robert Redzisz
5th of October 2023

Barnes GROUP INC

Barnes Molding Solutions

Synventive molding solutions
A business of BARNES GROUP INC

- Reliable complete Solutions
- Combined Know-How and Technologies
- Global Capacities & Capabilities



Increase Production Efficiency

Synventive molding solutions
A business of BARNES GROUP INC

Through Process Control - Integrative - Mold and Hot Runner Technology

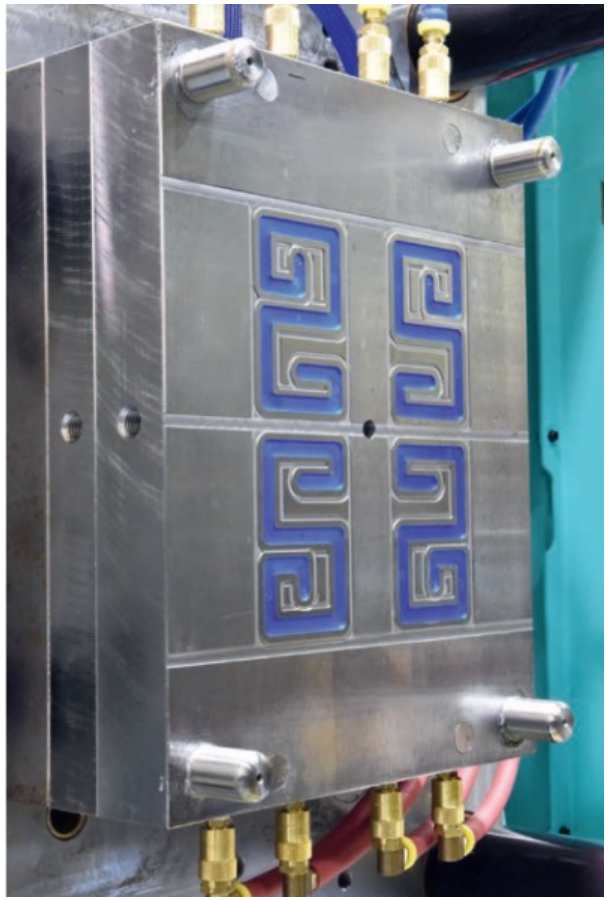
- Sensor-Based Process Control in the Mold
- Online process monitoring and process control (Flow Control)
- Fully automated balancing

Goal

- Avoidance of permanent fluctuations in the injection molding process
- Optimally balanced components

Solution

- Process control where the quality originates in the mold
- Automatization of balancing of Valve Gate Hot Runner systems
  - With wall temperature / pressure sensors
  - With pin position monitoring and control (sequential injection)

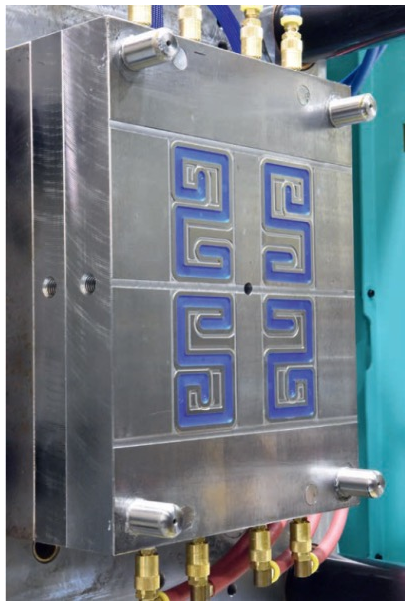


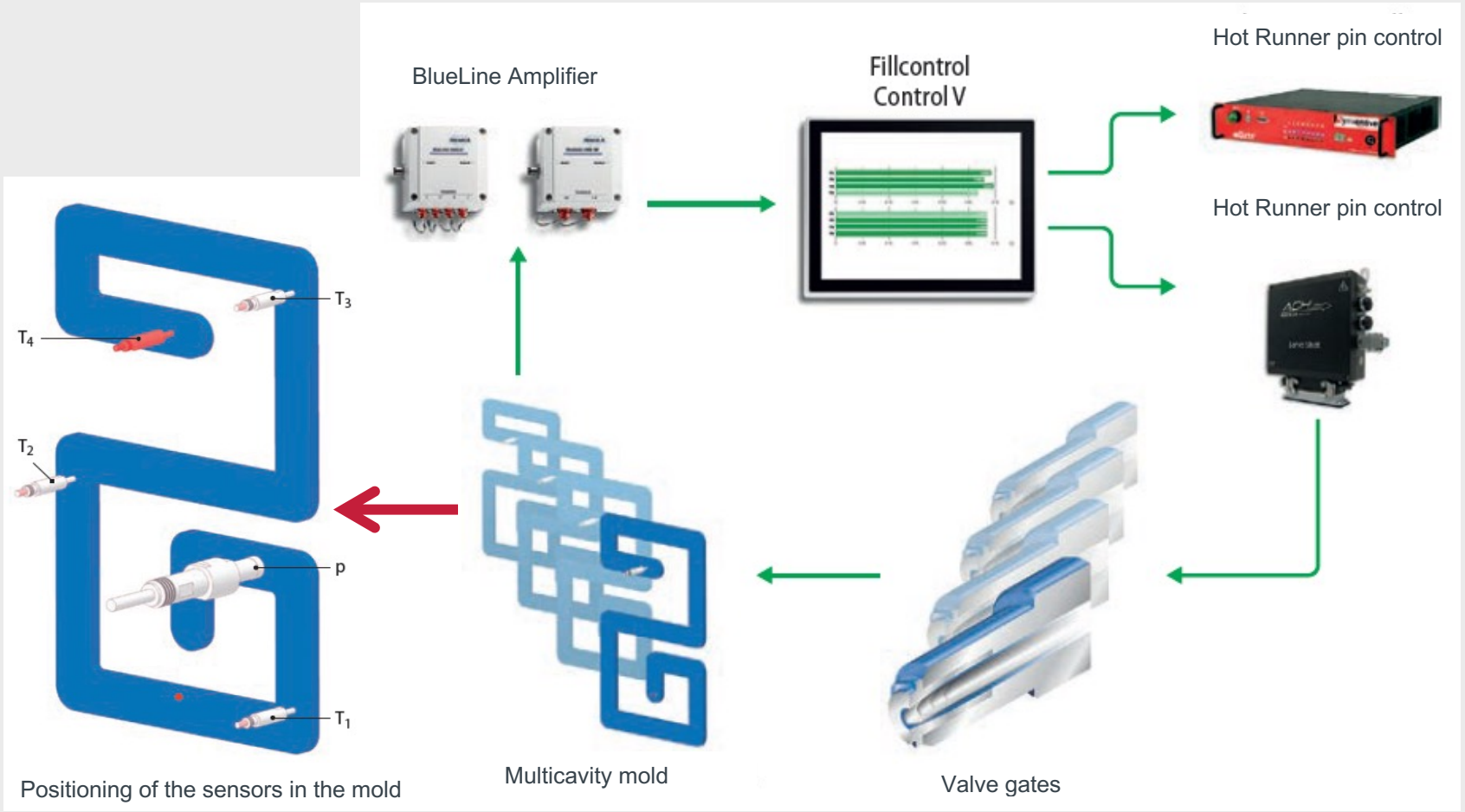
Sensor-Based Process Control in the Mold

Synventive molding solutions
A business of BARNES GROUP INC

Principle:

Temperature / Pressure sensors (Priamus) monitors the filling difference cycle by cycle and uses it to calculate the optimum pin stroke for a balanced filling.

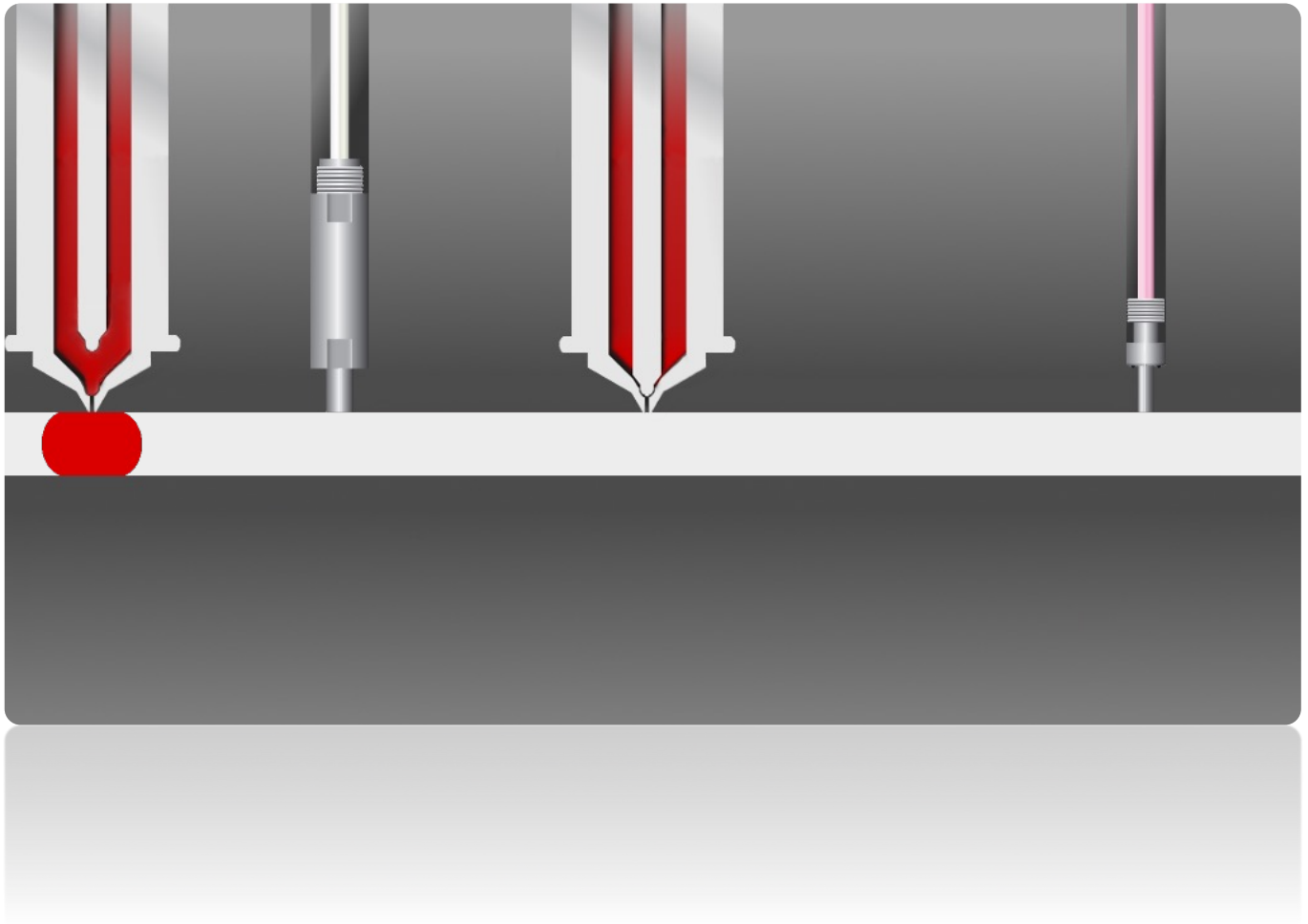




Background

Synventive molding solutions
A business of BARNES GROUP INC

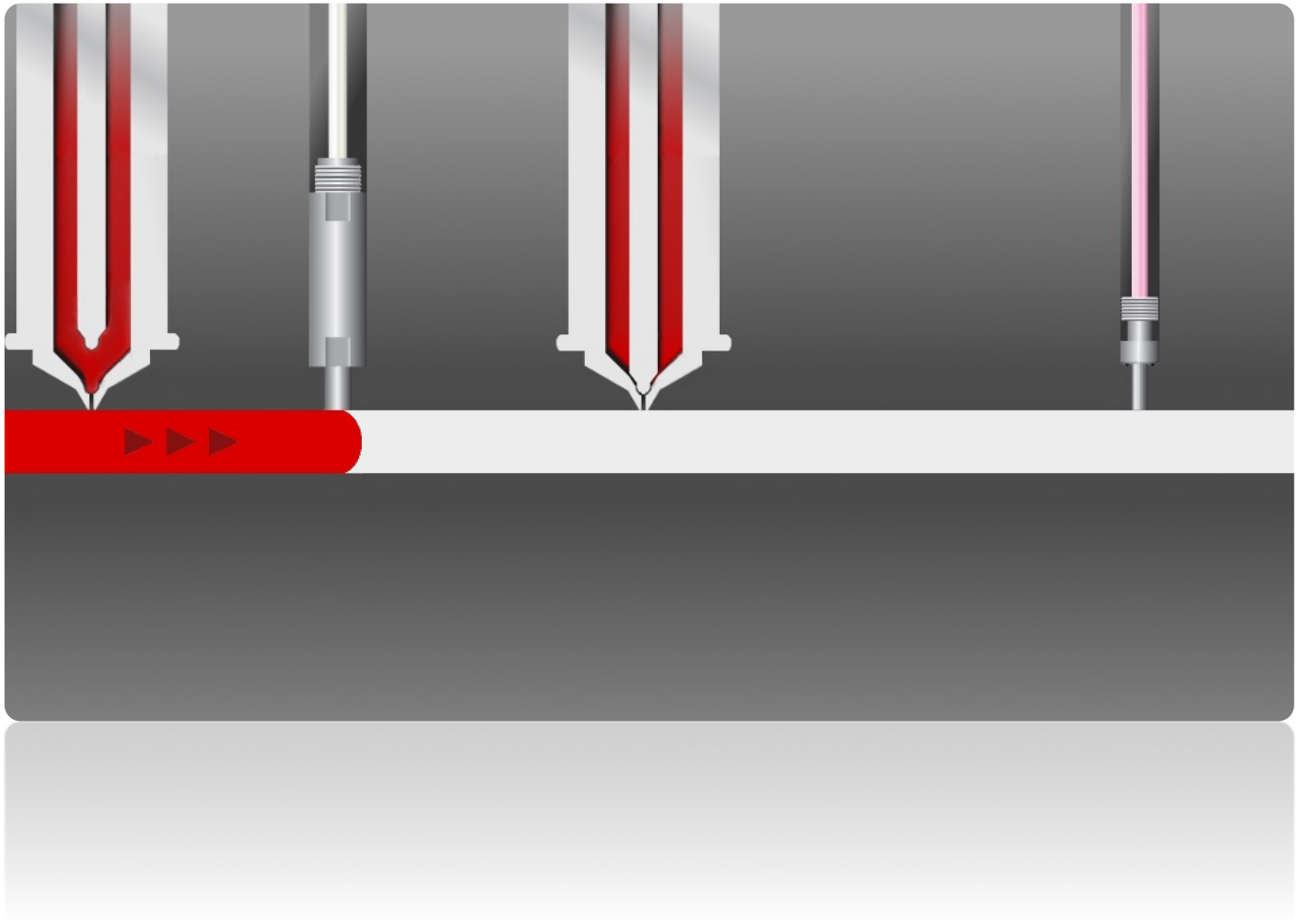
- Open first valve gate on cycle start



Background

Synventive molding solutions
A business of BARNES GROUP INC

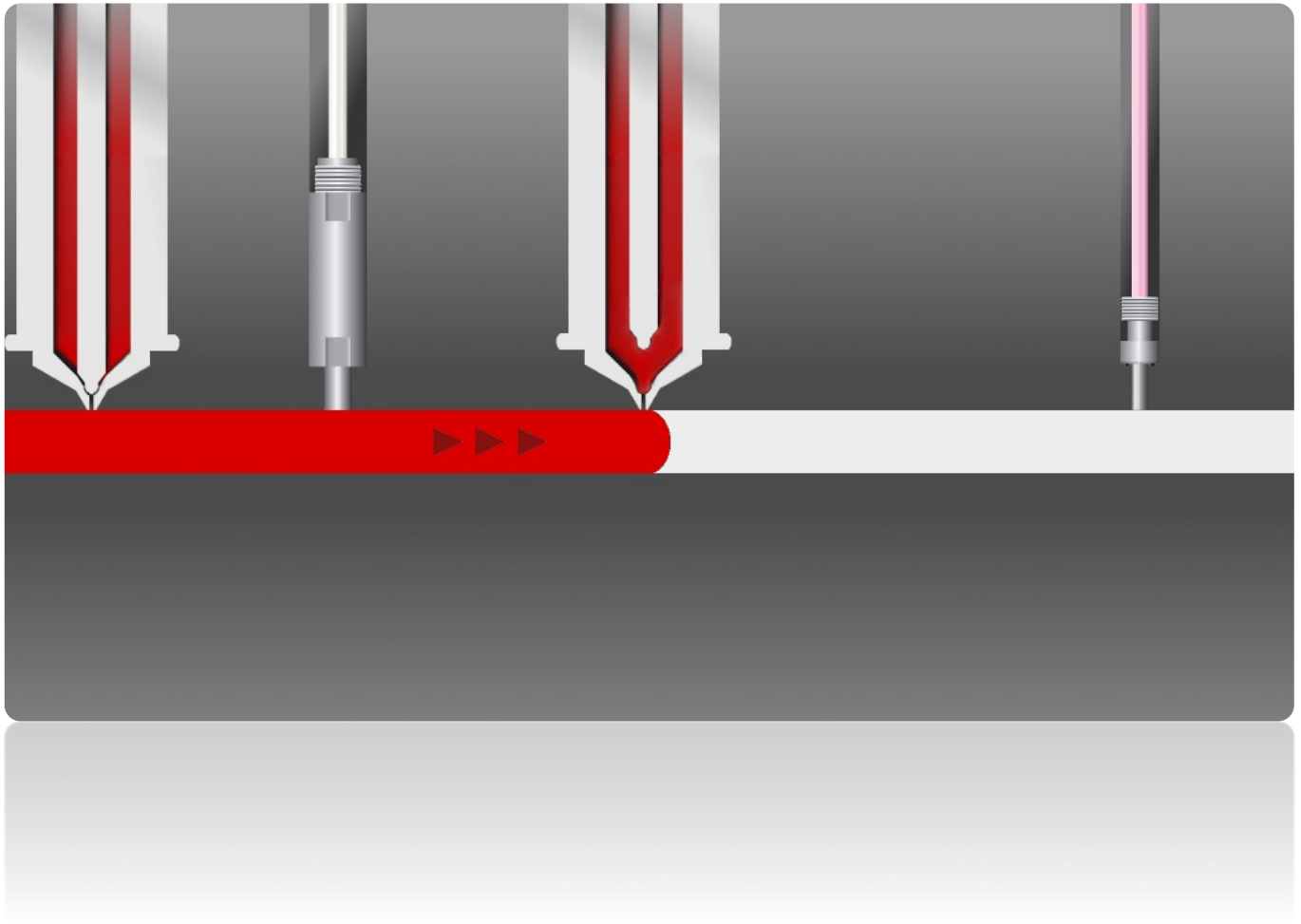
- Detect melt front at first sensor



Background

Synventive molding solutions
A business of BARNES GROUP INC

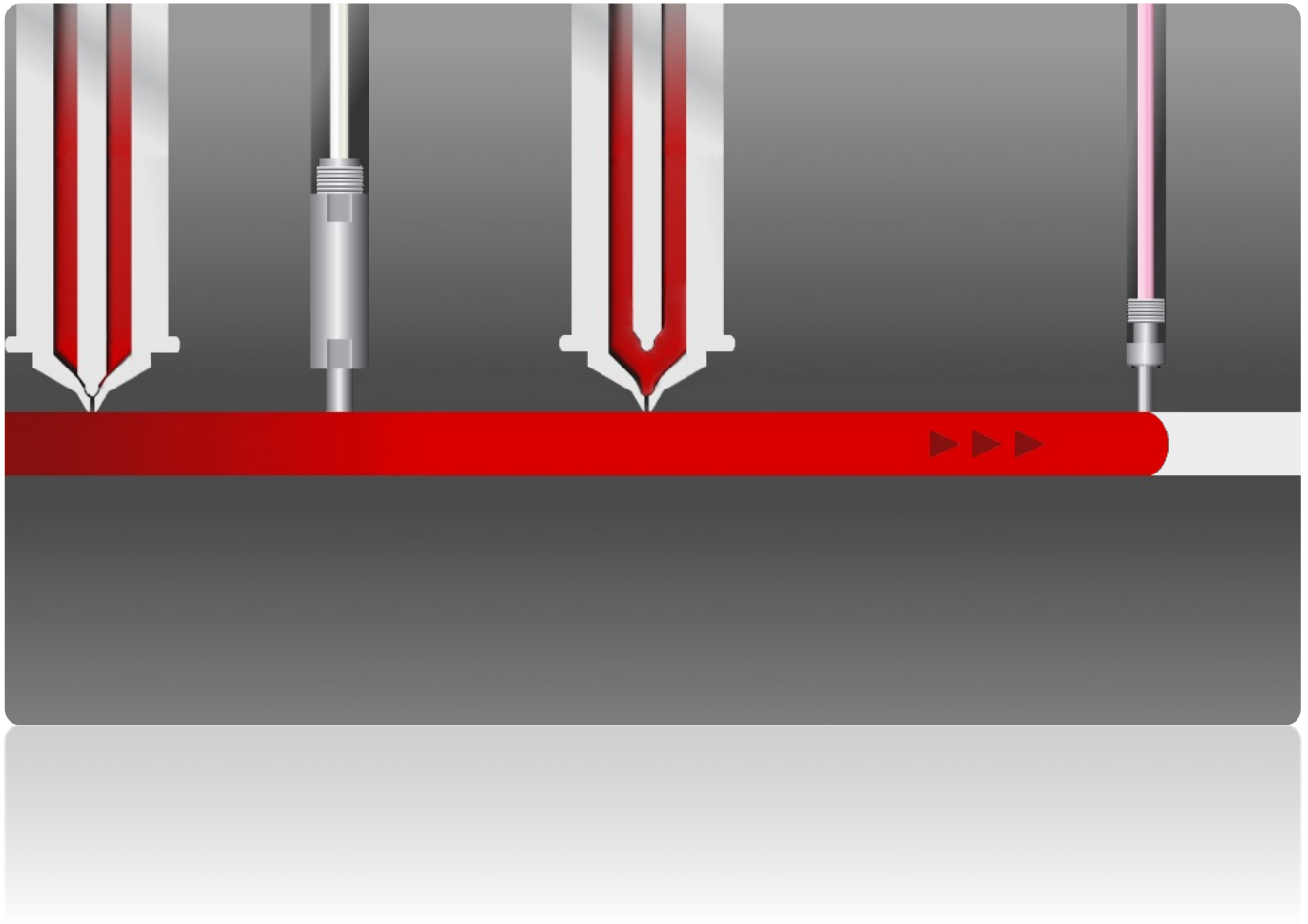
- Close valve 1, open valve 2 after additional delay to melt front detection



Background

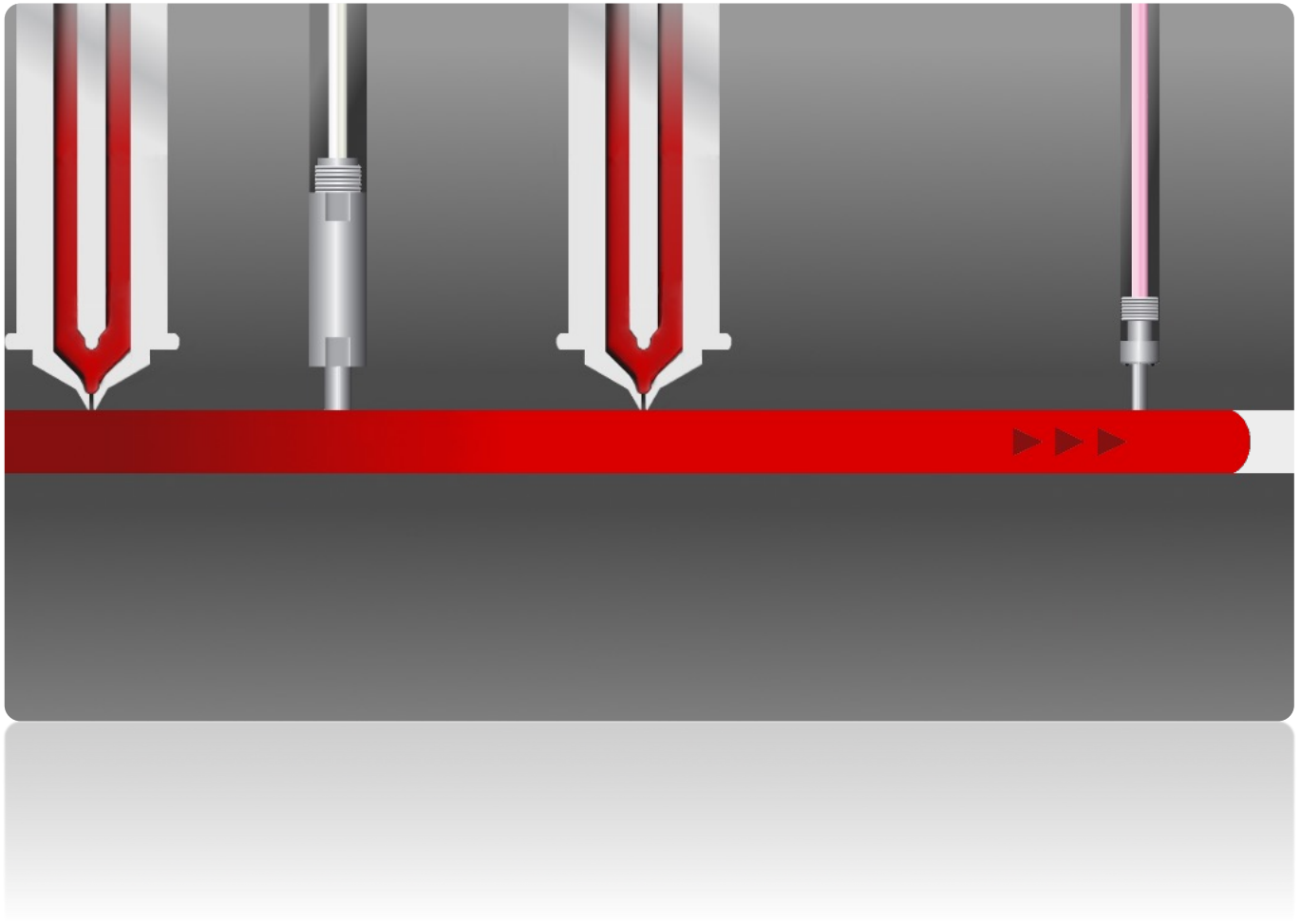
Synventive molding solutions
A business of BARNES GROUP INC

- Detect melt front at second sensor



Background

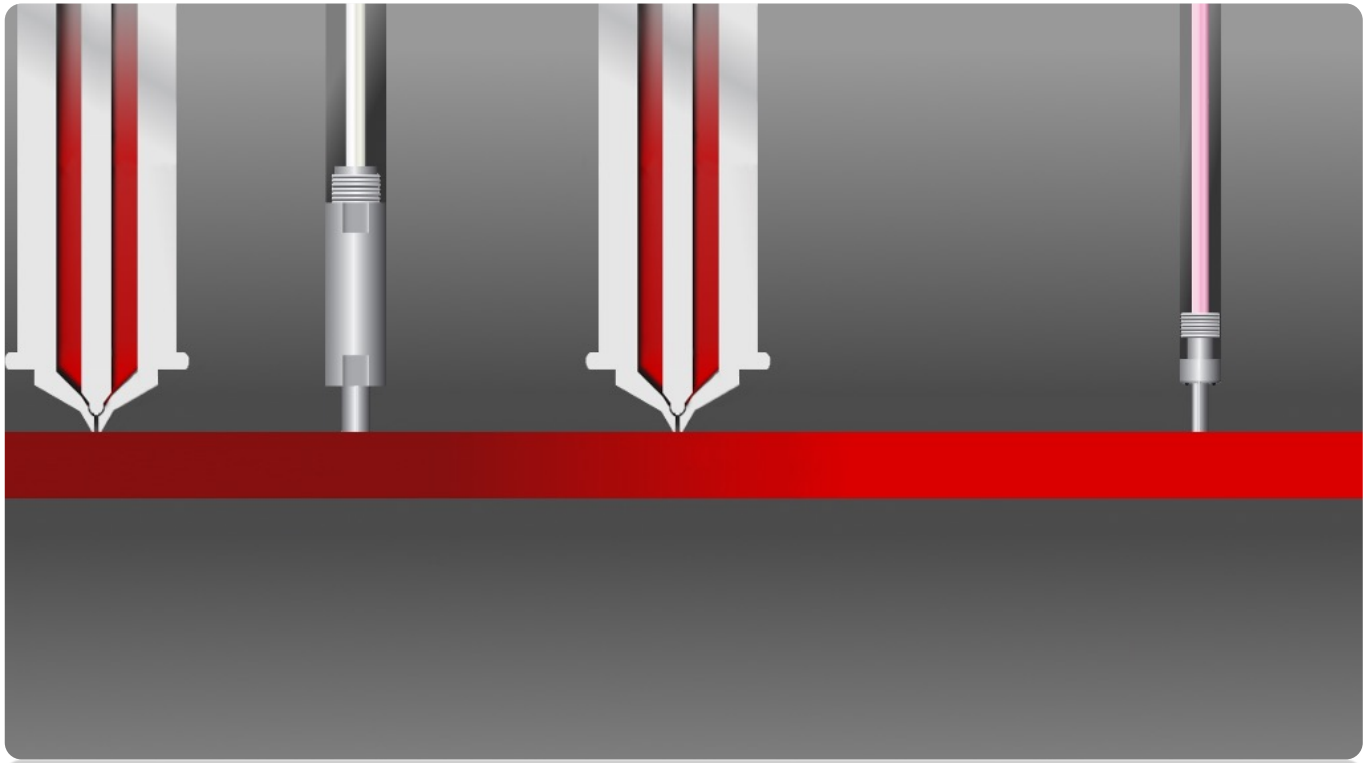
- Open first valve again, keep second valve open for holding pressure



Background

Synventive molding solutions
A business of BARNES GROUP INC

- Close both valves, when holding pressure ends



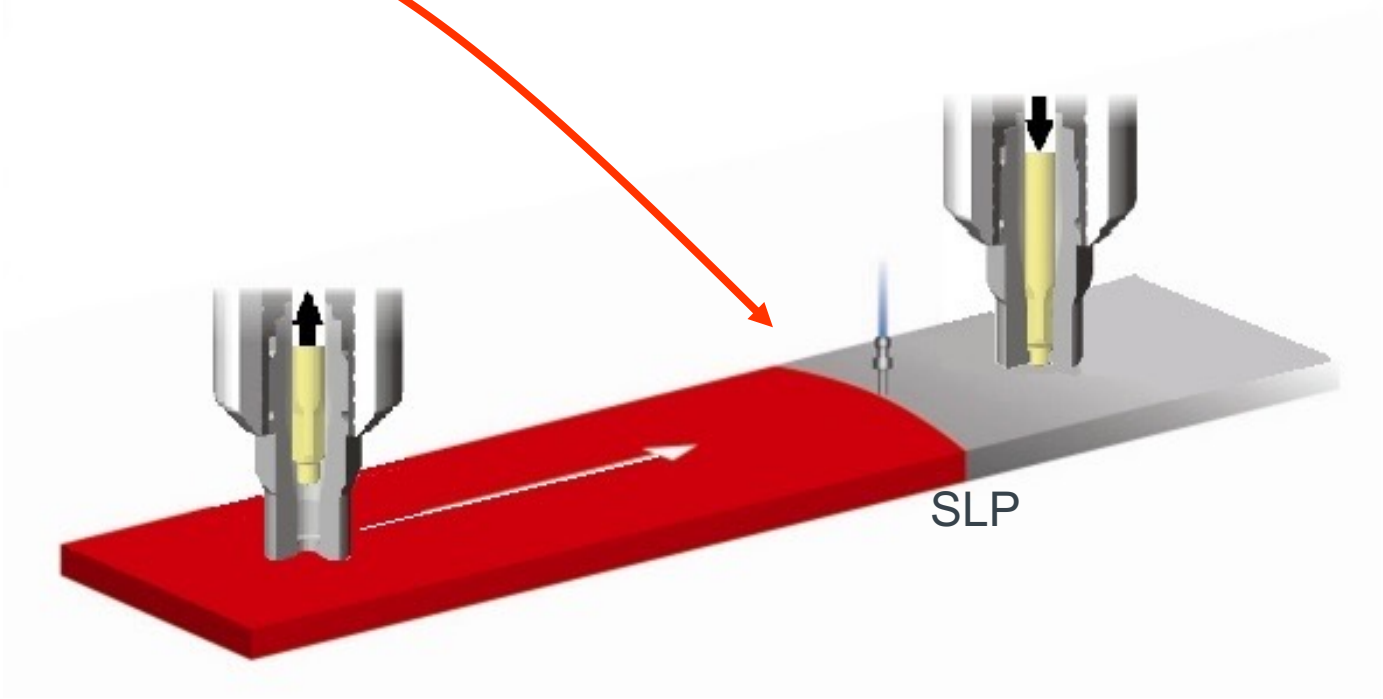
Sequential Applications

Synventive molding solutions
A business of BARNES GROUP INC

Automatic Sequential Control - Basics

Melt front always detected
at sensor position!

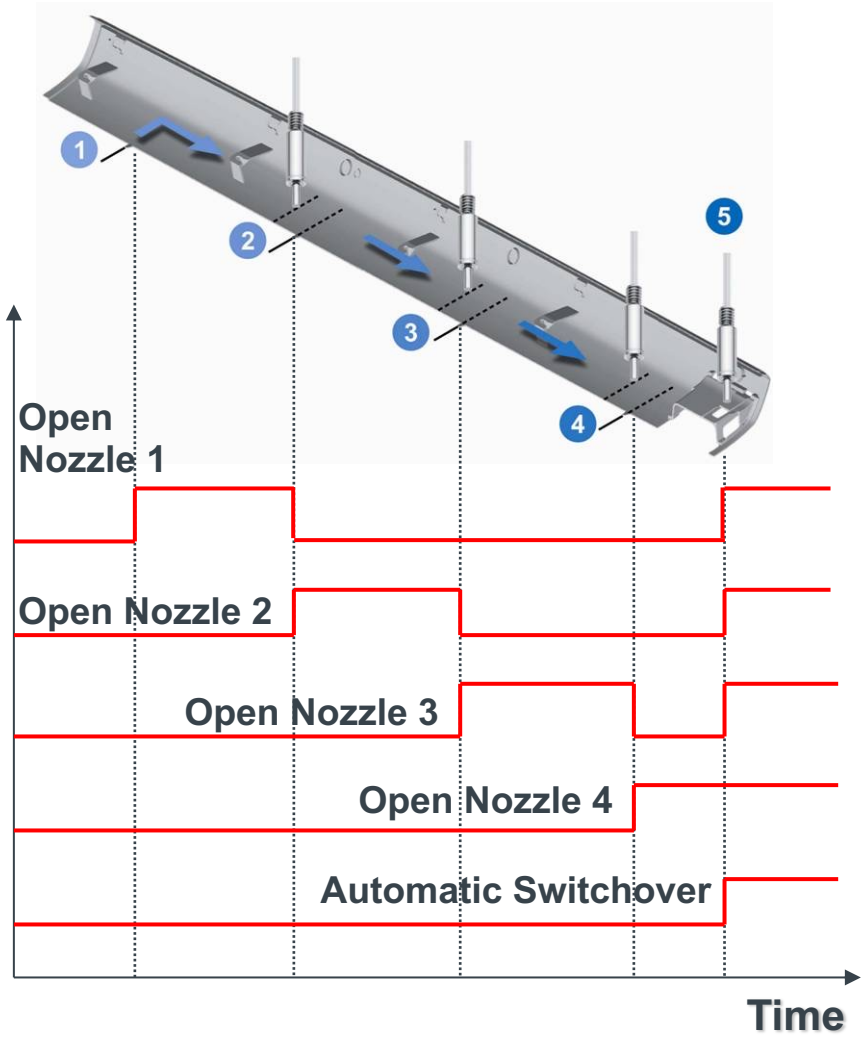
Optimized by delay times



Sequential Applications

Synventive molding solutions
A business of BARNES GROUP INC

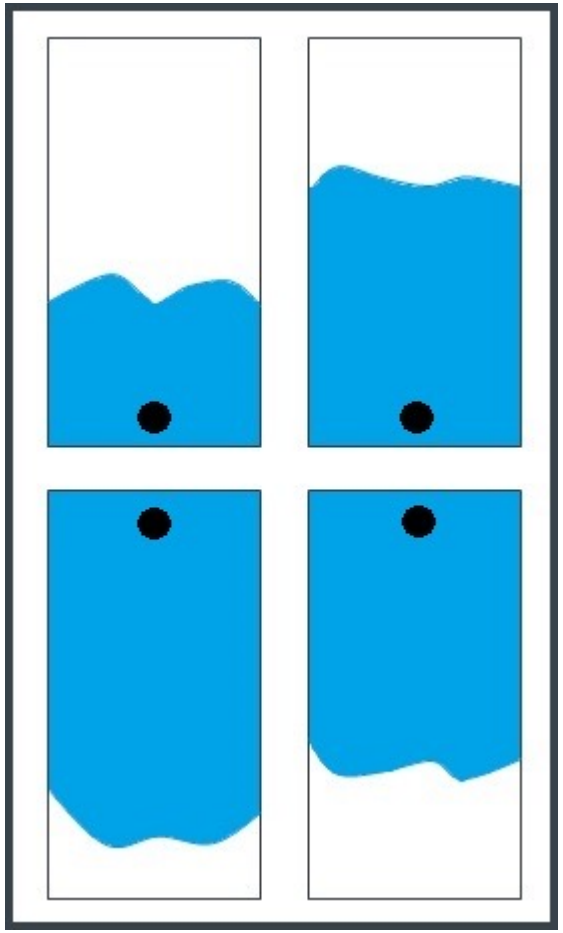
Automatic Sequential Control - Basics



1. Open nozzle 1
2. •Optimize delay time
   •Automatic control of nozzle 2
3. •Optimize delay time
   •Automatic control of nozzle 3
4. •Optimize delay time
   •Automatic control of nozzle 4
5. •Automatic Switchover

Why do we have unequal filling of the parts?

Synventive molding solutions
A business of BARNES GROUP INC

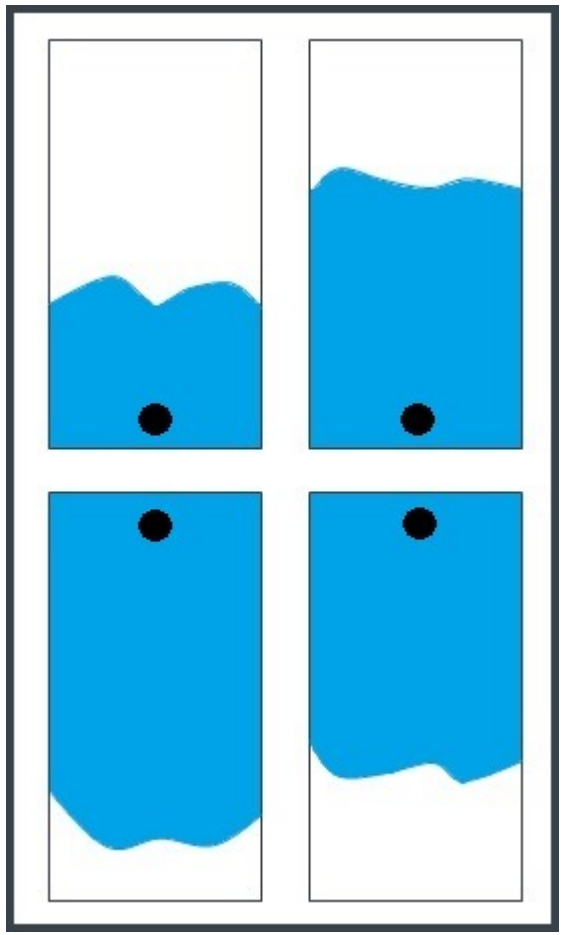


Reasons for variations:

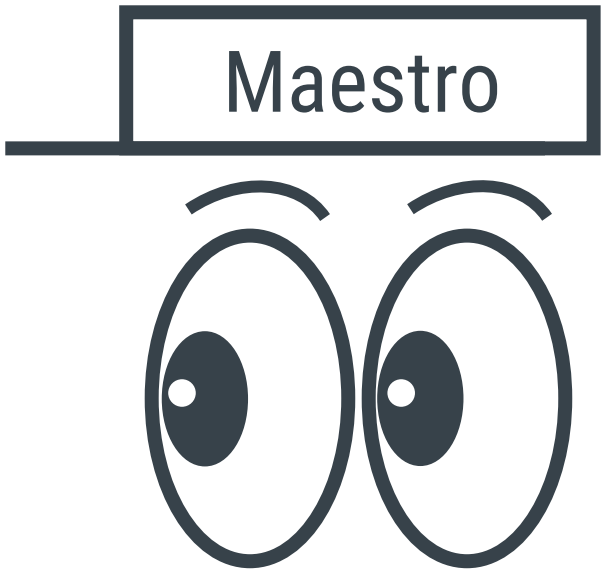
- Different position of thermocouples (HR)
- Different response times of heating (HR)
- Non-symmetrical geometry of cooling channels (Mold)
- Differences in gate size (Mold when thermal gate)
- Part geometry itself and/or differences between each cavity (Part)
- Variation in viscosity of the resin (Material)

Classical way

Synventive molding solutions
A business of BARNES GROUP INC



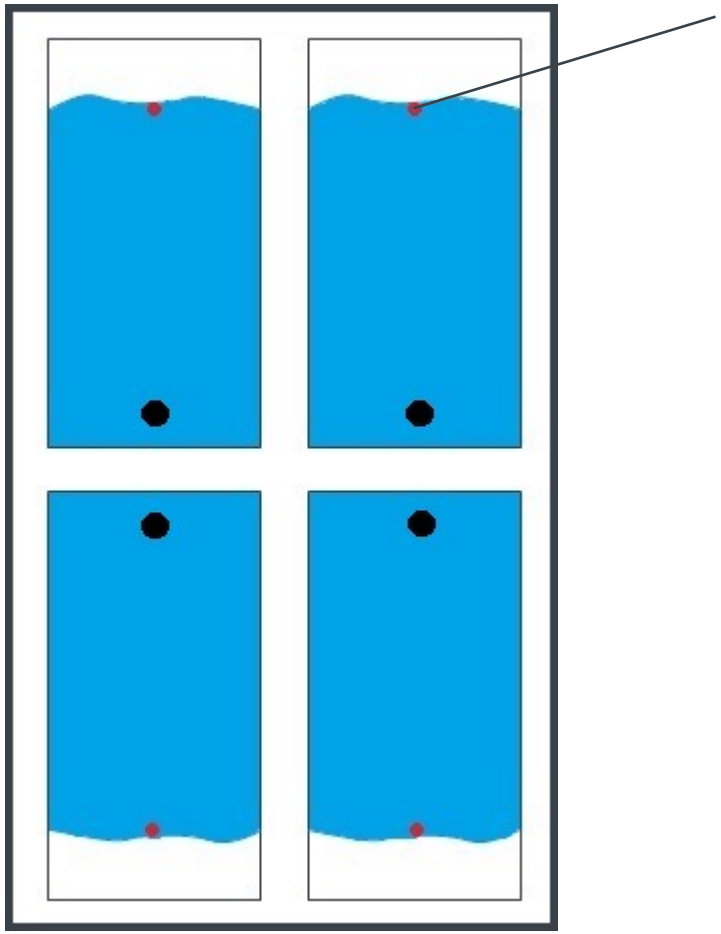
Conventional balancing



- Same for thermal gate solution (open system)
- Same for valve gate solution (needle closing)
- Same for valve gate solution (sequential needle closing)

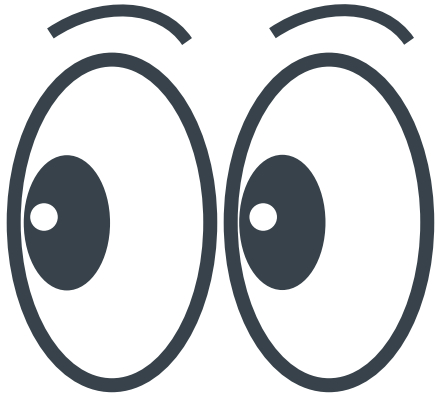
Automatic balancing with Temperature Sensors

Synventive molding solutions
A business of BARNES GROUP INC



Temperature Sensor in the cavity
(at approx. 85-90% filling)

PRIAMUS FILLCONTROL
Measure • Monitor • Switch • Control



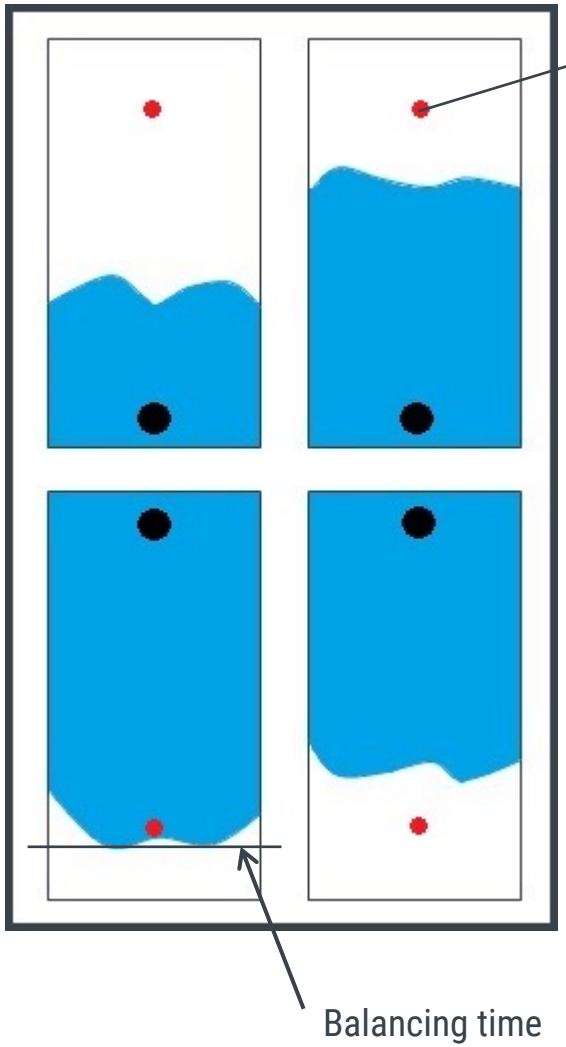
Balancing with FILLCONTROL

- Same for thermal gate solution (open system)
- Same for valve gate solution (needle closing)
- Same for valve gate sequential solution (needle closing)

Automatic Balancing Filling

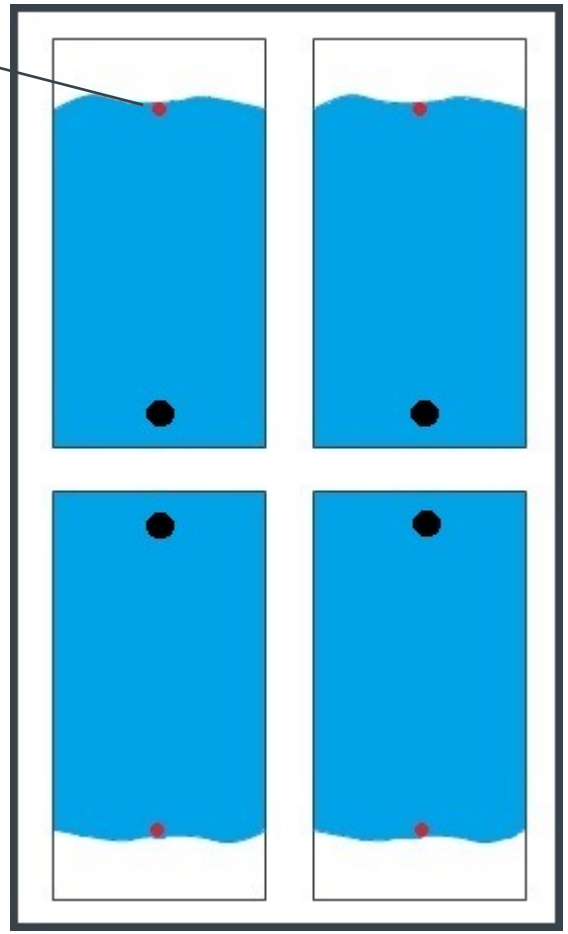
VALVE GATE (SEQUENTIAL)

Synventive molding solutions
A business of BARNES GROUP INC



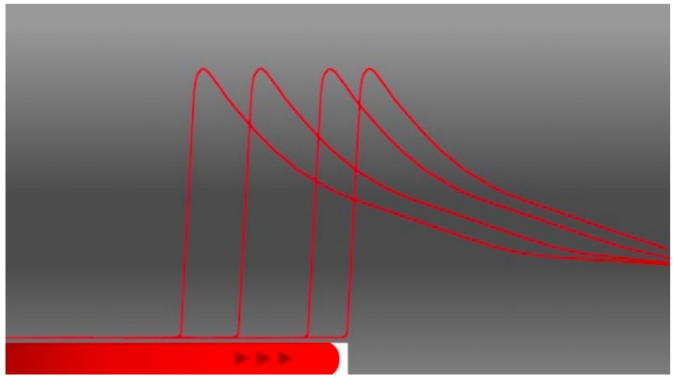
Automatic Balancing Filling

- Temperature sensors detect the melt front in real-time
- Balancing times are converted into changes of the nozzle sequence opening via signal from sensor
- Automatic adjustment of the flow front from shot to shot until the desired filling balance is reached

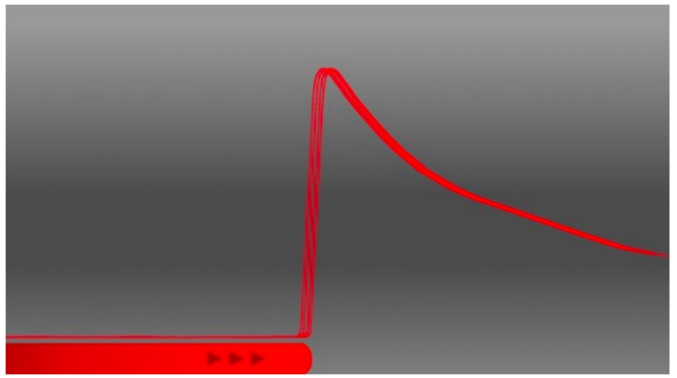


Balancing of a 4-cavity mold

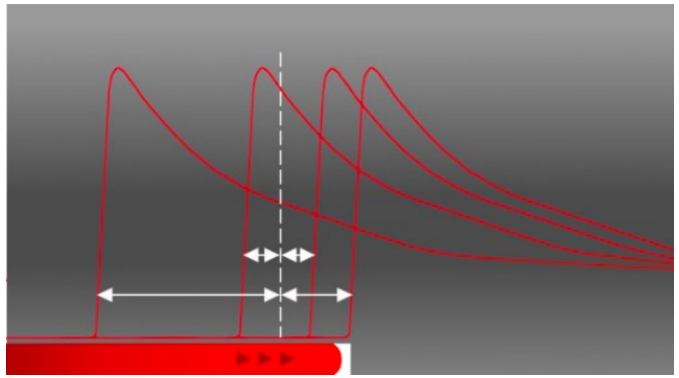
Synventive molding solutions
A business of BARNES GROUP INC



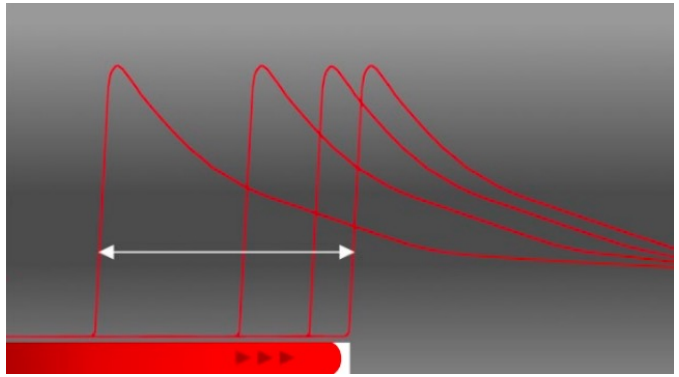
The temperature signals are displaced in time.
The cavities are filled differently.



After balancing all cavities are filled at the same time.



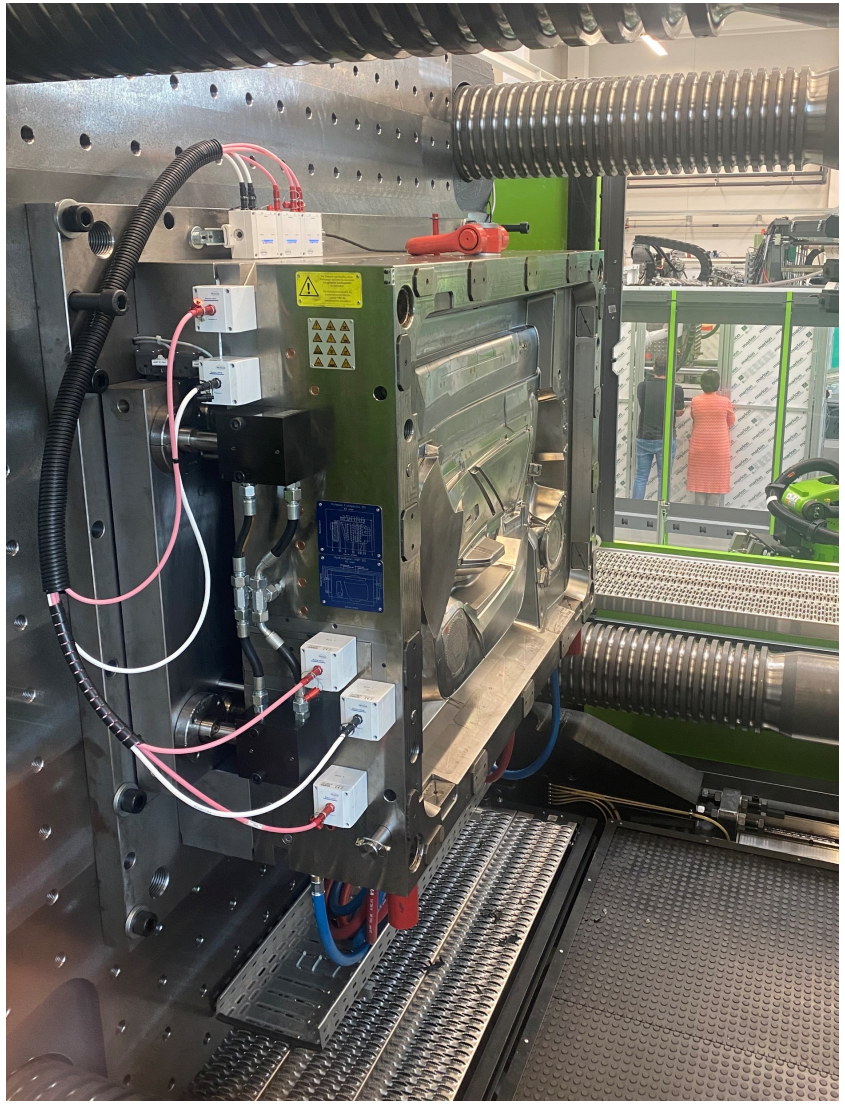
Fill time deviation is the highest time deviation of a signal from the mean fill time.



Fill time difference is the time difference of the cavity filled first to the cavity filled last

Mold & Controller

Synventive molding solutions
A business of BARNES GROUP INC



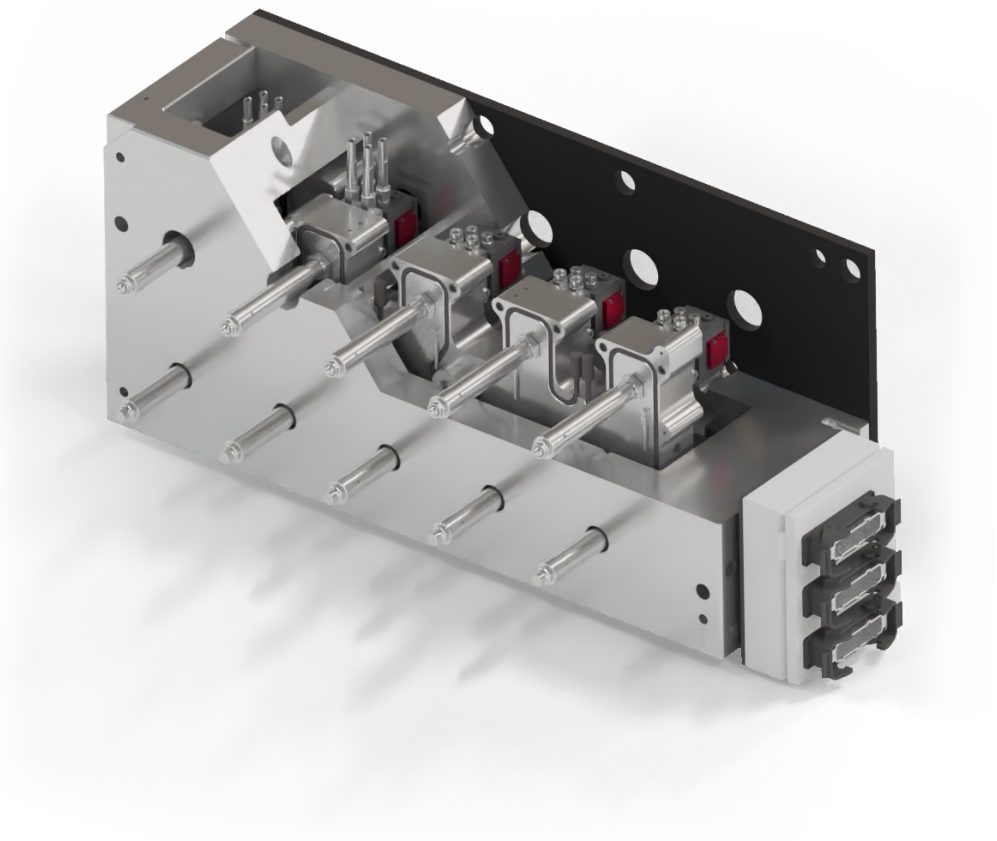
Part pictures – automatic filling control

Synventive molding solutions
A business of BARNES GROUP INC

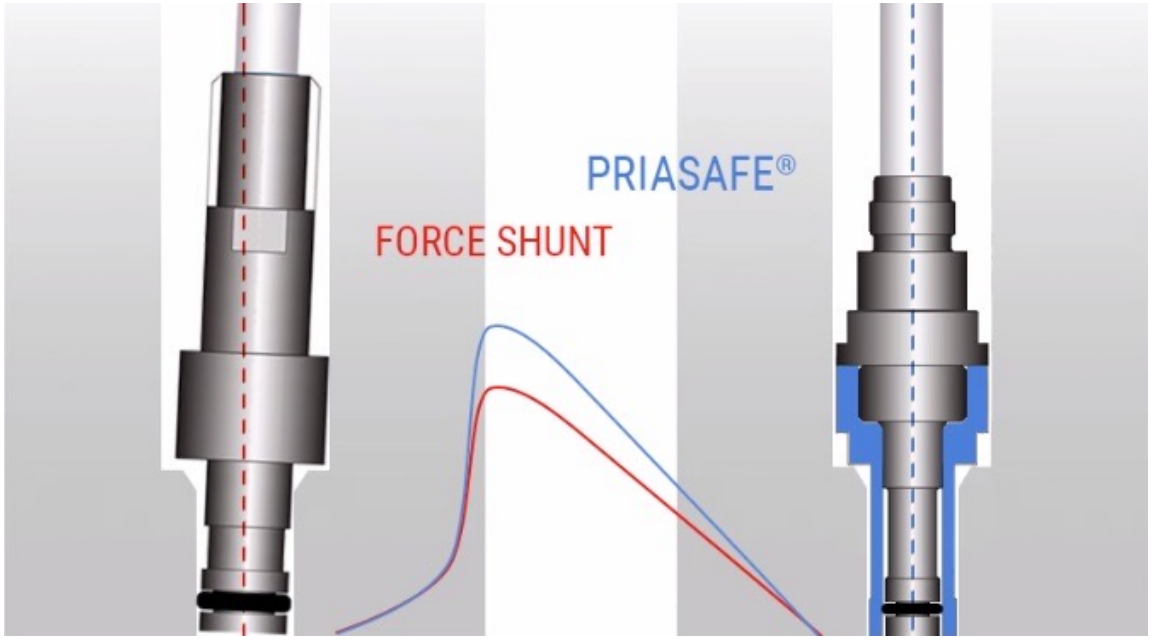
Using

Synventive molding solutions
A business of BARNES GROUP INC

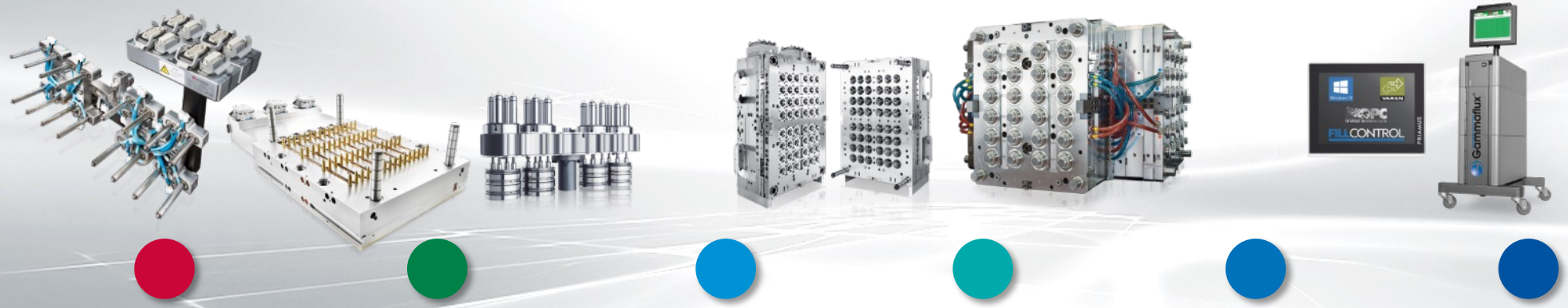
- ✓ Valve gate switching for cascade controls
- ✓ Realtime triggering of outputs
- ✓ Controlling every shot (shot by shot)
- ✓ Switch on/off each valve two times per cycle
- ✓ Various switching options and combinations
  - Switch on/off with digital input/output signals
  - Switch on/off with melt front detection or level
  - Switch on/off at specified time
- ✓ Single – and dual solenoid valves supported



Limitations



- Needed installation of pressure/temperature sensors in specific area of the mold/cavity
- Needs additional cutouts in the mold
- Needs precise maintenance and very good positioning
- Should be decided during mold construction
- We need external Controller



Synventive molding solutions
A business of BARNES GROUP INC
www.synventive.com

THERMOPLAY HotRunnerSystems
A business of BARNES GROUP INC
www.thermoplay.com

männer SOLUTIONS FOR PLASTICS
A business of BARNES GROUP INC
www.maenner-group.com

FOBOHA
A business of BARNES GROUP INC
www.foboha.com

PRIAMUS
A business of BARNES GROUP INC
www.priamus.com

Gammaflux®
A business of BARNES GROUP INC
www.gammaflux.com

Connected Brands – Complete Solutions

Barnes GROUP INC