ACSI has over 600 installations worldwide with systems operating in over 20 different countries. ACSI customers are serviced from the headquarters in Toledo, Ohio, USA, and from out European office in Oxford, England.

Our application knowledge covers both batch and continuous processes. We have extensive knowledge of glass manufacturing and have provided solutions to all segments of the industry. We are also emerging as a leader in the integration of systems for the food and material handling industries.

ACSI process knowledge covers a wide area of basic manufacturing processes:

Advanced Control Strategies
Model Based Control
Glass Batching
Material Handling
Pneumatic and Mechanical material transport
Temperature Control
Combustion Control
Multi-variable Control

ACSI

8750 Resource Park Drive Sylvania, Ohio 43560

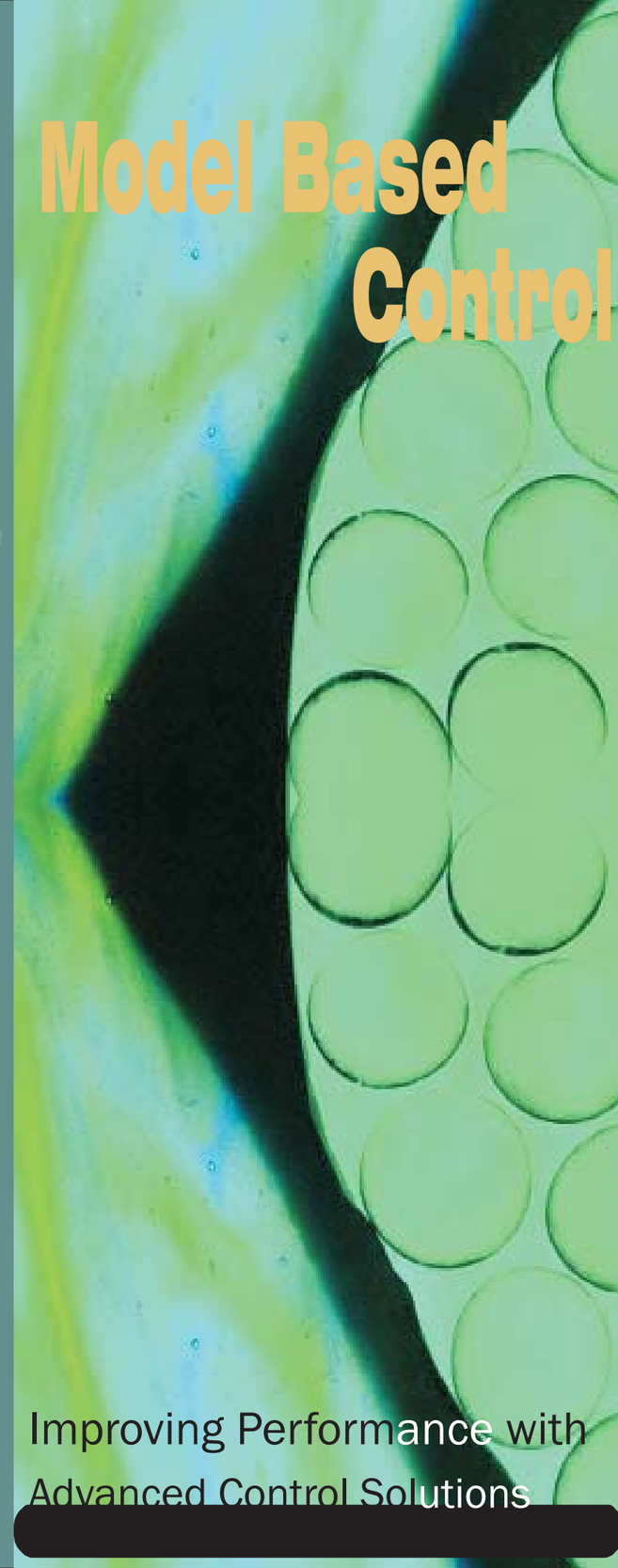
PHONE: (+1) 419.843.4820

FAX: (+1) 419.843.4821

We're on the Web!

See us at www.acsitoledo.com

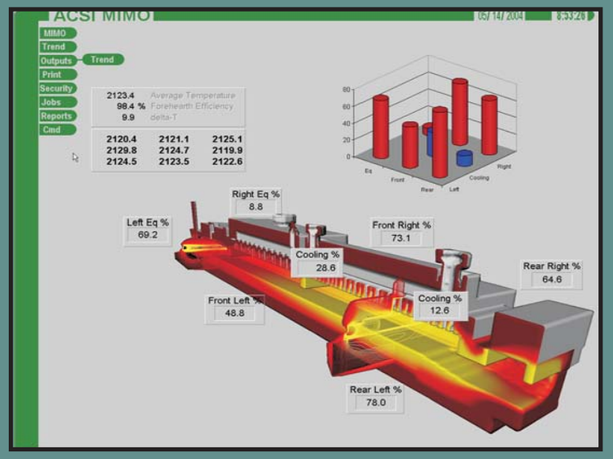
Advanced Control Solutions



Model Based Control

Improving Performance with Advanced Control Solutions

ACSI combines process knowledge with innovative technology in its new model based control. The combination of ACSI's process expertise and BrainWave®'s software capability enables this integrated process controller to greatly outperform PID by reacting quickly to stabilize temperature variations in **all types of glass manufacturing processes***.



maximize performance with model based control

The ACSI model based controller creates models for each control/process variable and feedforward input. The ideal model then anticipates changes needed to maintain consistent glass temperature.

Once the optimum process is modeled, the ACSI model-based controller

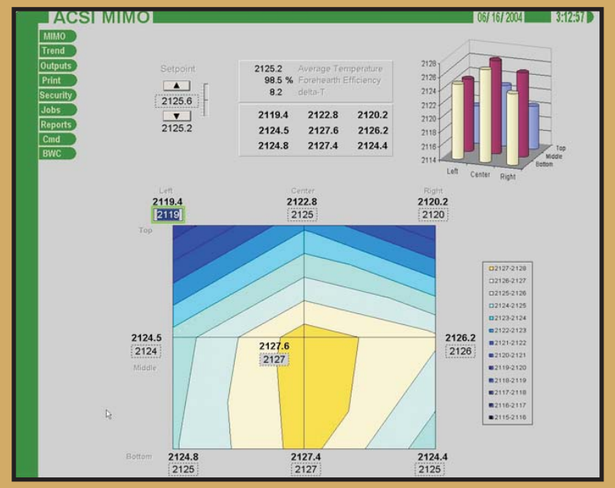
- **Predicts** control actions required to drive the glass temperature to setpoint quickly without overshoot.
- Continuously **adapts** to process and production changes automatically for better control without loop tuning.
- Models **feed forward** inputs and updates control actions to quickly stabilize temperature variation.

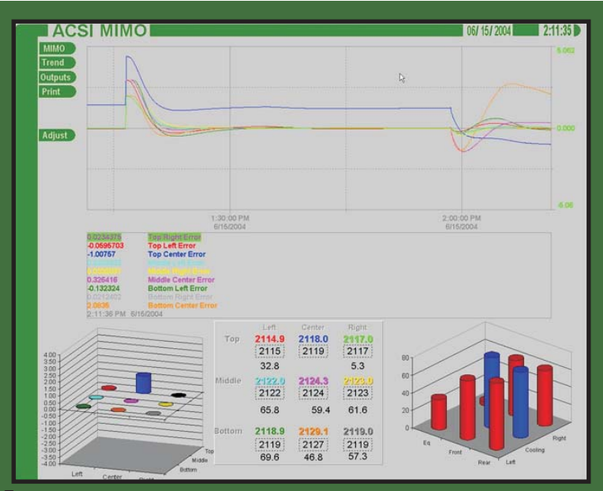
Controlling glass temperature is key to achieving optimum glass viscosity and gob weight. Even the slightest temperature variations can affect the quality of the finished product and result in lost production time. Job change time and zone temperature modeling offer opportunities for tighter control.

minimize job change times in forehearth applications

Historically, the **9-point grid** is used to achieve desired temperature and maintain stability and homogeneity. Now the grid temperatures are controlled using the model based system. This system understands the interrelationships among zones; therefore, it removes the complications that would normally be difficult for operators to resolve. The model based controller

- Thinks of the forehearth as a unit, not individual zones
- Prioritizes temperature readings to determine the most important
- Knows which temperatures may be sacrificed and which are most important and adjusts accordingly
- Allows zones to work together rather than fight each other





improve temperature stability in float plants

New glass temperature setpoints must be achieved as quickly as possible with minimum overshoot. When attempting to achieve both objectives simultaneously with PID, one of two scenarios is likely to occur. Either glass temperature is raised quickly and overshoots the optimum setpoint or temperature is slowly achieved with gradual rise in temperature. Either scenario typically requires several hours to stabilize glass temperatures during which productivity suffers.

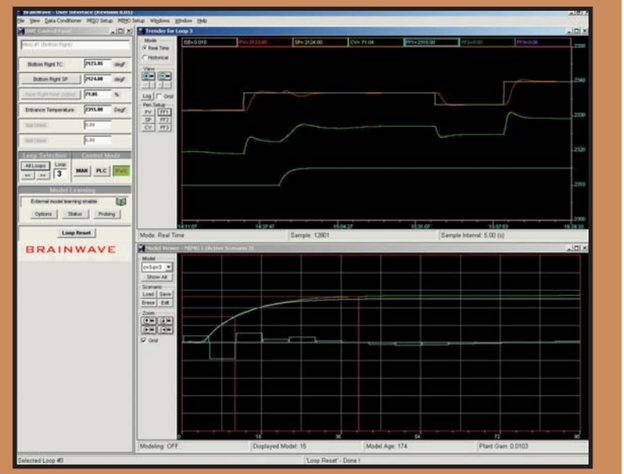
The model-based controller provides responsive control for **dead time** intensive loops without overshoot. The model does not have to wait to see the effect of a change before taking action. Instead, it knows what change is needed to prevent a deviation.

Over time, your process changes. Model based control systems **continuously learn the process and fine-tune the model**; therefore, the model is refined as equipment ages, and it is as effective at the end of a campaign as it was at the beginning.

reduce fiberglass breakout

Because bushings are directly affected by temperature swings in the glass, stable glass temperature is a necessity. It is essential to maintain the desired glass temperature through the melter and forehearth as well as at the bushings in order to control the amount of heat sent to the bushings.

Model based control uses feedforward inputs to stabilize the temperature . Using inputs from the melter and forehearth allow the model based system to prepare for upsets or undesired temperatures before a problem occurs. By the time the glass reaches the bushings, the temperature is stable and there is less chance for a bushing breakout.



In addition to delivering consistent glass to bushings, model based control feeds forehearth temperatures forward to allow bushings to be prepared for incoming temperatures and adapt to them more effectively than PID loops. This helps bushings overcome deficiencies in forehearth temperature.

*ACSI is BrainWave®'s process application partner for the glass manufacturing industry.