



Applied SmartFactory® Run-To-Run

As an integral part of the Applied Materials process quality systems, SmartFactory Run-to-Run Solution optimizes tool recipe parameters from batch-to-batch, lot-to-lot and wafer-to-wafer based on knowledge of material context and metrology data to achieve process targets

INDUSTRIES

- Front-end semiconductor wafer manufacturing
- Semiconductor assembly and test
- Display manufacturing

FEATURES

- Out-of-box solution or pre-configured models for each module (e.g. Run-to-Run CMP)
- Advanced features for each control module
- Multiple inputs and multiple outputs
- State space model
- Model predictive control with constraints
- Linked control threads
- High-mix and low-volume support

BENEFITS

- Increases Speed-To-Value
- Provides quicker deployment time
- Minimizes the excursion risks during development
- Improves process capability
- Minimizes scrapped wafers
- Reduces number of send-ahead wafers
- Gets rid of manual tuning

CHALLENGES

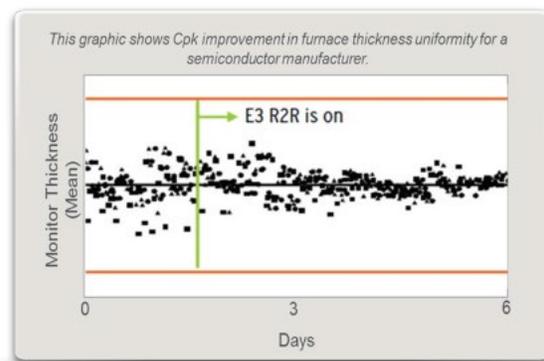
Increased manufacturing complexity in today's semiconductor, assembly and test, display factories requires better control of advanced processes. Manufacturing processes may be disrupted due to a variety of factors such as wear and tear on equipment, process drifts, inconsistent operation, maintenance events and product changes. Process disruptions can result in lots that are out-of-spec or off target. For example, pad wear in a chemical mechanical polish process that results in wafer thickness variances may require recipe adjustments by engineers to ensure proper process targeting. Other variances due to tool age, if not corrected, may also lead to scrapped wafers.

Factories are investing in more automated information handling, equipment integration and advanced process control (APC) tools such as Run-to-Run to reduce process variance. However, one manufacturing challenge is that many of these systems lack a unified platform with a shared data repository or common algorithms. Because many of these systems are homegrown or highly customized, heavy IT investment is required to maintain and update manufacturing needs.

SOLUTION DESCRIPTION

The Applied SmartFactory Run-to-Run solution improves processing performance and reduces process variability by optimizing recipe parameters from lot-to-lot or wafer-to-wafer based on feedback from process models, incoming variations and metrology. The solution enables lower cost of ownership (CoO) by reducing model management activities through a unified modeling structure approach and advanced patented technology. Finally, the solution is designed to support high-mix and low-volume manufacturing operations, which have always posed a challenge in the industry.

Process variance reduced by Run-to-Run control



SMARTFACTORY SOLUTIONS WITH ENGINEEREDWORKS™

EngineeredWorks is Applied's pre-built automation logic that executes on a proven Applied platform. EngineeredWorks increases speed-to-value for customers and provides quicker deployment times. When deploying SmartFactory Run-to-Run solution with EngineeredWorks, customers can cut deployment times by as much as **75%** compared to custom deployments.

SmartFactory Run-to-Run Solution Capabilities

✓	Improve Quality	Improves process capabilities (Cpk) through optimizing tool recipe parameters automatically from batch-to-batch, lot-to-lot or wafer-to-wafer based material context and metrology data. Reduces out of spec (OOS) & scrap events through compensating the drifts from equipment and process, including the feed-forward disturbances.
✓	Improve Yield	Reduces process variation and enables better decision making during the development and ramp phases as well as reducing yield killing process variation during the HVM phase.
✓	Lower Cost	Improves the throughput by reducing pilot wafers and eliminating the manual adjustments for tunable parameters during production.

Tackling Process Variations In Manufacturing

CUSTOMER RESULTS

Measurable results from SmartFactory Run-to-Run Solution implementations include:

- Reduce OOS & scrap events 10%–30%
- Improve Cpk ~30% on average
- Reduce time to achieve mature yield
- Increase mature yield 2%–4%
- Eliminate manual tuning up to 100% reduction
- Reduce send-ahead wafers up to 100%

PACKAGE CONTENTS

R2R solutions are designed around best-known control methods for process optimization and run on proven technology in one package.

SOFTWARE

- SmartFactory Solution installation package for Furnace, CMP, CVD, Photolithography, and Etch.
 - Applied E3 R2R license
- Server hardware and installation services sold separately.*

SERVICES, TRAINING AND SUPPORT

- Onsite controller integration service
- Run-to-Run modeling guide
- User workshops and trainings
- Solution upgrade services