

FACTORY AUTOMATION

Customer Reference

Robotics and force sensing for intelligent testing of automotive components

How MELFA robots and MELSOT Gemini helped to increase efficiency and precision in demanding testing

Key points

- 60% reduction in engineering development time through intelligent robotics and virtual commissioning.
- Adaptive testing processes enabled by AI-assisted force sensing and real-time motion correction.
- Improved process reliability through digital twin validation, integrated data acquisition and full test traceability.

Minebea AccessSolutions designs intelligent solutions ranging from door handles to keyless systems for vehicle access and security. To ensure high-quality standards and increase production efficiency, Minebea AccessSolutions chose to automate a critical testing phase by implementing Mitsubishi Electric industrial robots equipped with an AI-powered force sensor.

The Challenge: Manufacturers of automotive door handles, locking systems and smart access solutions are faced with increasingly stringent quality requirements. Testing procedures must verify not only dimensional accuracy but also the functional characteristics of moving mechanical components operating under variable load conditions. Minebea AccessSolutions required an automated testing system capable of reproducing complex human interactions while accurately measuring force, displacement, velocity and acceleration. The solution needed to compensate for part-to-part variations, maintain testing repeatability and support future product developments without extensive re-engineering.

The Solution: The solution combined a MELFA industrial robot with integrated force sensing, AI-assisted control and a digital twin environment based on MELSOFT Gemini to create an advanced automated testing cell capable of both executing test procedures and collecting

measurement data within a single platform. The robot was used not only as a handling device but also as a precision testing actuator, operating in a closed-loop control architecture that continuously compared commanded and measured force values.



By processing real-time feedback from the force sensor, the system dynamically adjusted robot trajectories and motion parameters to compensate for component tolerances and variations between test samples, ensuring highly repeatable and accurate results.

The results: The implementation of MELFA robotics, integrated force sensing and virtual commissioning technology enabled Minebea AccessSolutions to reduce application development time by up to 60% while significantly shortening commissioning activities. The automated testing process delivers highly repeatable results independent of operator influence, automatically compensates for component tolerances and improves measurement accuracy through real-time force monitoring and adaptive motion control. Comprehensive collection of force and position data also supports greater process stability while helping to reduce scrap, rework and quality-related costs.

Technical solution: The solution combined MELFA industrial robotics with the MELSOFT Gemini simulation and digital twin environment to create a highly integrated automated testing platform. The robot was deployed as a servo-controlled testing actuator, leveraging integrated force-sensing capabilities and AI-assisted control algorithms to execute force-dependent test routines and dynamically compensate for variations in component behaviour. Operating within a closed-loop control architecture, the system continuously processed force and position feedback to maintain precise interaction with the test specimen and ensure repeatable measurement conditions. Prior to deployment, the complete cell was modelled and validated in MELSOFT Gemini, enabling offline verification of robot kinematics, trajectory planning, collision zones and process sequences. This virtual engineering workflow reduced commissioning risk while providing a reliable framework for performance optimisation, process validation and future scalability.

Why it matters: By combining robot control, measurement, diagnostics and data acquisition within a single environment, the solution provides a scalable platform for future product developments and automation projects. The integration of digital twin technology through MELSOFT Gemini allows engineering teams to validate and optimise testing processes before deployment, accelerating the introduction of new product variants while ensuring consistent quality, full traceability and long-term operational efficiency.



"The technical team has successfully supported the Minebea Mitsumi group, perfectly interpreting our process needs and proposing innovative, concrete solutions that exceed expectations"
Vittorio Giaccone, Head of Divisions – Purchasing."

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