

Project coordinator:



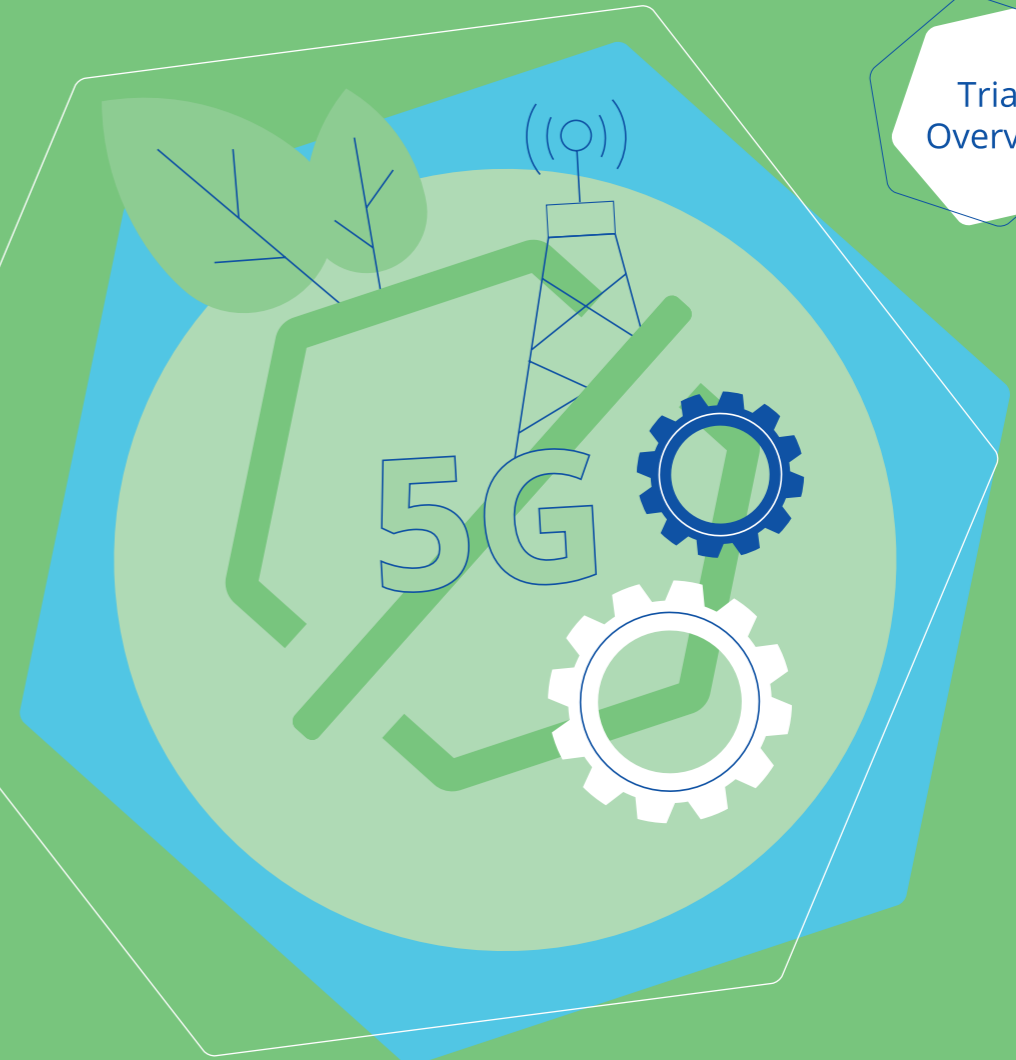
Technical coordinator:



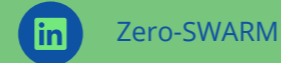
ZEROSWARM

Zero-SWARM: Bridging the Gap Between Innovation and Sustainable Manufacturing

Trials Overview



www.zero-swarm.eu



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 This work has received funding from the European Union's Horizon Europe Innovation Action under Grant Agreement no. 101057083 (Project Zero-SWARM)

NN01.

Smart assembly in cabinet production

Trial ensures secure data flow in smart manufacturing. Digital twin, following industry standards, is vital for AI and AR. Private 5G ensures adaptable production. Reliability and digitization align with Zero policies. Paperless, server-based production with 3D models. 5G test network aids live guidance. Digital twins boost automation. Cellular 5G enables wireless tools, enhancing tracking and productivity for quality improvement, satisfaction, and multi-site support.

Trial aims to validate 5G for real-time data collection from rotating machinery. It paves the way for wireless closed-loop automation in shop floors, enabling continuous monitoring and automatic actions. Ultra-low latency and high reliability are crucial for secure operations. Edge computing will handle large data volumes. The trial assesses radio interference impact and aims to enhance end-to-end 5G performance. Security, trusted connectivity, and AI/ML tools for data collection are also studied.

NN02.

Sustainable powertrains

NN03.

Improved resilience with remote operation in mass customized production

The shift to reconfigurable production islands enhances flexibility. Reconfigurable Manufacturing Systems rapidly adapt to market changes. Key RMS characteristics include modularity, integrability, flexibility, scalability, convertibility, and diagnosability. This trial validates Zero-SWARM tech in mass customization, emphasizing dynamic reconfiguration and 5G-enabled shop floors.

Challenges in securing low-latency communication in industrial automation led to this trial. It employs 5G-powered PLCs for measuring latency and security KPIs. Interoperability with protocols like OPC UA, MQTT, and IEC 61499 will be analyzed. The trial extends IEC 61499 with dynamic agent discovery for plug-and-play capabilities. Secure communication via NPT messages will be explored. Targets include an I4.0 framework, carbon footprint tracking, performance indicators, dynamic CPSoS models, and robust cybersecurity measures.

NN04.

5G powered PLCs for real time communications in distributed control systems

CN01.

Safe and autonomous transport of goods in the factory shop floors using 5G

AGVs on flexible shop floors navigate autonomously. Current safety measures, using special sensors, lead to speed restrictions for efficiency. Lack of coordination and communication limits productivity. This use case aims to enhance transparency and efficiency in critical areas. By combining sensor data with AGV movements, actions can be deduced, requiring low latency and data availability. Accurate data could lead to better traffic coordination, allowing AGVs to continue without stopping in most cases.

CN02.

5G enabled process aware AGVs

The trial features an AGV with a robotic arm for pick & place tasks. Control software is distributed, with basic tasks on the mobile manipulator and complex functions in a cloud service. The setup includes marker-based localization and environment modeling. A stationary robot workstation and magazine holder are added, along with a magazine warehouse. 5G infrastructure is in place, spanning a cloud-edge continuum between Fraunhofer IPK and Fraunhofer HHI.

CN03.

Plug & connect 5G industrial network setups for industrial operations

Industrial 5G meets manufacturing needs with high data rates, security, and low latency. Companies in Germany can operate private networks, creating versatile campus setups. SMS digital implements this in their subsidiaries. 5G supports Industry 4.0 with high bandwidth and improved availability. Slicing allows tailored network configurations.

Trials were merged and involve a compact packaging line, integrating AGVs with mobile agents for re-configurability. The Adaptable Dispatching Algorithm dynamically schedules AGV tasks. The layout is dynamic, and AGVs prioritize specific jobs. Traffic and charge level are considered. Scenario 2 focuses on integrating ReeNEXT edge platform and developing new modules for AI-based decision-making in production and maintenance planning.

SN01.

Mobile intelligent agents for integrated re-configurability of the zero plastic waste production line

SN02.

Edge-cloud continuum to support smart maintenance and optimization

SN03.

5G enabled remote quality control for zero defect resilient manufacturing

The trial leverages 5G and Industrie 4.0 in Additive Manufacturing and Quality Control. It introduces agile 5G-powered AM cells for flexible factory movement and seamless cloud communication. This showcases synergy with protocols like OPC-UA. Additionally, it establishes a secure data-sharing ecosystem, optimizing resource capacity and quality. Lastly, it enhances quality control with 5G technology, promising quicker, robust results, accounting for environment and machine conditions.