

## Using automated guided vehicles (AGVs) to create a more flexible and efficient production environment

Addressing multiple platform assemblies is no small challenge. To address the growing demand for vehicles in a cost effective manner, a number of automakers are looking to Mexico for production. One such state of the art facility, which opened in 2013, uses smaller and more modular conveyors and transfer system as well as an array of automation technologies to address these production challenges. Coupled with the plant unique environmental sustainable design, the plant is a unique mix of automated processes with an eye to the future. These advantages enable workers to assemble one brand new vehicle on average every 55 seconds. Even so, the plant's staff are always looking for ways to increase efficiency and improve product quality.

"The plant is truly state of the art – even when compared to automotive vehicle assembly plants outside Mexico," said Eliseo Rafael Barajas, Field Application Engineer for Omron Automation and Safety. "But we knew the operation could be made even more efficient by improving part fulfillment."

Barajas' team began talking to the plant's engineers about using Omron technology in combination with their existing automated guided vehicles (AGVs) to address bottlenecks that tended to manifest themselves in the body, trim, and powertrain shops. AGV path planning in a dynamic environment is a key factor in enabling flexible assembly deployment success. In order to do this communications, traceability, and safety are key.

Barajas saw that by improving parts delivery and making the AGVs more flexible, the plant would save on overhead costs and further streamline inventory requirements. While the engineers were interested in Barajas' idea, they had reservations about monitoring the AGVs in such a large environment and modifying

the programming of individual AGVs as production requirements changed.

### Omron delivers an integrated solution that ramps up quickly

Barajas worked with his team to create a demonstration version of the proposed solution. "We needed only four hours to design and program a working system," he said. Omron manufactures a large portfolio of controllers, drives, motors, relays, sensors, switches, safety, and wireless networking devices. Integrating these components is a simple process for automation technicians and engineers.

Omron's Sysmac is an integrated automation platform dedicated to providing complete control and management of automation. At the core of this platform, the NJ series offers synchronous control of all machine devices and advanced functionality such as logic, safety, vision, motion, robotics, and database connectivity. This multidisciplinary concept allows one to simplify solution architecture, reduce programming and optimize productivity.

Selecting the right controller for this application was critical to address the plant's concerns about using AGVs. Barajas and his team decided to use the Omron Sysmac NJ machine automation controller (MAC) with SQL is designed to work with Microsoft SQL Server, Oracle, IBM DB2, MySQL, and Firebird databases. The SQL feature allows customers to integrate automation directly with their existing SQL database applications and their business applications without having a separate industrial PC middle layer. The NJ SQL MAC includes an industrially hardened Intel® Atom™ processor and a solid-state drive to log data and simultaneously access up to three relational database systems. This allows for real-time data logging and communication, which is critical in a dynamic environment. In addition, the NJ SQL platform's industrial-grade

### ■ Business Need

Automated guided vehicles (AGVs) are a key component of a flexible manufacturing system (FMS) and are a proven technology to improve efficiency, safety, and quality in an automotive manufacturing environment. Reliable, configurable, easily programmable, and real-time communication capabilities are critical to successful implementation.

### ■ Unique Solution

Omron's Sysmac NJ SQL machine automation controller combined with our WE70 wireless LAN and Sysmac Studio software suite creates a real-time, traceable, and scalable platform for AGV communication and control that is easy to implement and modify, affordable to deploy. Connecting our OS32C safety scanners and V680 series RFID solutions allow for additional functionality.

### ■ Customer Benefits

Omron's automation solutions enable AGVs that can be quickly reprogrammed to change path, task, or operation, eliminating the need for expensive station retrofitting or wired pathways while offering a safe and predictable method of delivery. Coupled with Omron's suite of logic, vision, safety, motion, and robotics solutions, each AGV can be customized or new AGVs added easily in an efficient manner to meet the challenges of the automotive factory of today.



components provide a robust platform capable of monitoring last as long as the AGV is in operation.

The NJ comes standard with built-in EtherCAT and EtherNet/IP. The two networks with one connection purpose is the perfect match between fast real time machine control and data plant management. However, tethering an NJ to an AGV using a cable was not a practical option for the plant's complex production environment. Barajas's team addressed this issue by including an Omron WE70 wireless local area network communication unit as part of the solution package. The WE70 is affordable and provides a communication link for remotely monitoring and programming the AGVs. Compliance with IEEE 802.11 a/b/g standards ensured the wireless connection would deliver high data rates, security, and coverage throughout the production environment.

### Sysmac makes AGV control simple and reliable

The NJ integrates logic, motion, safety, robotics, vision, information, visualization and networking under one software: Sysmac Studio. This one software provides a true Integrated Development Environment (IDE) that also includes a custom 3D motion simulation tool. The Omron Sysmac Studio software suite provided a perfect platform for programming all the AGV capabilities. During the demonstration, Barajas used the software's graphics-oriented interface and library of motion control function blocks to operate and track the AGVs.

"It is very easy and intuitive to create complex motion profiles with the PLCopen function blocks," Barajas said. "Sysmac allows engineering to pretest motion trajectories and guide paths using 3D simulations."

Sysmac Studio provides a true integrated development environment (IDE) for writing and inserting structured text directly into ladder programs. It also offers advanced functions such as name confirmation, serial ID matching,

administrator access rights, controller write protections, and 32-digit security passwords to help prevent unauthorized connections to the system.

In addition, the function block library includes over 46 safety FB/FN function blocks – perfect for upgrading the AGVs to use safety laser scan technology, such as Omron OS32C. Vision and RFID type capability can easily be added in the future using the same software platform and program to expand capability and simplify the task of managing AGVs in complex environments. With a wired or wireless connection to an AGV, the plant's engineers can use the function blocks to remotely build or modify the vehicle's programming in one environment. Omron also includes a Smart Editor that helps with program debugging.

### Tight automation integration with AGVs enhances production

Flexible manufacturing is defined by having highly automated manufacturing process with rigorous computerized monitoring and management of quality and productivity that is scalable, reconfigurable, and provides plant management with the detailed and timely information to make real-time decisions. AGVs are a key component of a flexible manufacturing system (FMS).

Plant engineers were amazed at ease and speed of implementation as well as the ease of re-programming on demand. By delivering more real-time visibility into vehicle production, inventory, and order management, plant engineers were able to significantly improve cycle time in key areas while increasing quality. They are now looking to new ways to incorporate functionality into each AGVs in the hopes of expanding operational footprint.

"The Omron Sysmac software, wireless connectivity with the NJ controller combined with an AGV platform gives the plant lots of flexibility going forward," Barajas said. "The plant will have the tools it needs to continue improving material-handling without retooling its fixed-conveyor system."

Omron Automation and Safety is a leading global provider of machine safety and automation solutions, with more than 80 years of service experience in the controls and sensing business. Our customers can rest assured the automation strategy developed will meet the needs of today and include pathways for practical expansion and modification to address the many challenges of the future.

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