



# SAIC-GM

Shanghai Automotive Industry Corporation (SAIC) and GM — Designed for success



# SAIC-GM Taps GE and CIMPLICITY® to Drive Turnkey Automation Solution at New Plant

When the Chinese government named the automotive industry a pillar industry for development, it seemed only natural that the Shanghai Automotive Industry Corporation (SAIC), China's largest passenger automobile manufacturer, and General Motors (GM), the world's largest full-line vehicle manufacturer, would team up to form SAIC-GM.

SAIC-GM's production facility in the Pudong area of Shanghai is a \$1.5 billion, 5,920,200-square-foot (550,000-square-meter) plant that includes a press shop, body shop, paint shop, general assembly shop, and powertrain shop. Considered the largest and most innovative automobile complex in China, SAIC-GM primarily supplies China's businesses and government, producing Buick mid-size sedans, the Buick GL, wagons, and luxury compact sedans.

Before the first Buick rolled off the line, SAIC-GM selected the diversified services, technology and manufacturing company



— the General Electric Company — to unlock a \$65 million turnkey communication and control and power distribution system, as well as provide process equipment and support, that would actively support GM's production practices. With GE's automation team in the driver's seat, GE Electrical Distribution & Control was soon riding shotgun, together

designing a state-of-the-art communication and control and power distribution system to operate within GE's overall communication plan.

For its part, GE's automation and MES team developed a \$15 million communication and control system guided by its renowned CIMPLICITY, manufacturing enterprise-wide software and supported by Microsoft® Windows®, and Intel-based server and workstation computers. Four subsystems — the Process Monitoring & Control (PMC) system, the Target Control System (TCS), the Automatic Vehicle Identification (AVI) system, and the ANDON system — are connected by a GE provided network to monitor and control SAIC-GM's five shops. With thousands of machines and miles of conveyor systems, GE's turnkey automation solution effectively minimizes idle equipment and personnel, maximizes uptime and productivity, and operates seamlessly within the broader scope of the GE framework.

## Results

- Maximum uptime and productivity
- Real-time data reporting
- Lower inventory and reduced material consumption
- Greater quality, less rework

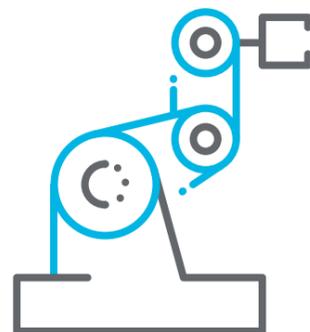


# Auto Assurance: SAIC-GM's Production Monitoring and Control System

## Process Monitoring & Control (PMC) System

Working to maximize equipment uptime and process productivity, SAIC-GM's PMC system employs over 400 PLCs collecting data from 60,000 I/O points. CIMPLICITY HMI/SCADA software monitors production equipment conditions, generates and logs alarms, and communicates process status in rich graphic displays. The user-friendly but powerful CIMPLICITY software allows operators to generate nearly 4000 different reports and trending charts, including production counts, WIP totals, and process cycle times. Control functions are also provided by the system to allow authorized operators to start and stop production lines.

To support troubleshooting and repair efforts, CIMPLICITY quickly detects equipment and production problems, immediately notifies the appropriate maintenance team, production manager, or process support engineer, and provides diagnostic data for speedy repair efforts. Essential to a facility of this size, SAIC-GM's PMC system minimizes production downtime that can result from mechanical or production-related problems.



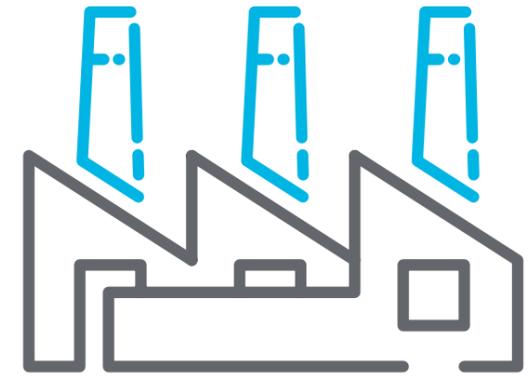
## Target Control System (TCS)

SAIC-GM's TCS controls the movement of vehicle bodies into and out of the body distribution center using several modes of operation from fully automatic to fully manual. Like the PMC system, the TCS also employs CIMPLICITY software, but with the added feature of Tracker — a comprehensive CIMPLICITY option that provides tracking and routing control of the serialized vehicle bodies as they move through the production process.

With Tracker, SAIC-GM can dynamically collect and store a variety of vehicle body data, including process parameters, time stamps, and quality measurements. Operators can easily determine the location of a tracked vehicle body, display its data, and provide control commands to production equipment to process and route the body. Communication to

Automatic Vehicle Identification system and Conveyor controls is supported over the plant Ethernet network.

In addition to tracking vehicle bodies, CIMPLICITY determines where to store vehicle bodies arriving from the body shop, sequences vehicle bodies into the paint shop, decides where to store vehicle bodies returning from the paint shop, and again sequences vehicle bodies into general assembly. The TCS and similar routing control systems are used extensively in automotive facilities to efficiently and effectively control vehicle flow based on parameters such as production schedule, optimum color blocking, consistent load balancing, and material availability. For SAIC-GM, the TCS effectively optimizes production flow and productivity and, due to its efficiency, minimizes paint costs and reduces paint emissions.

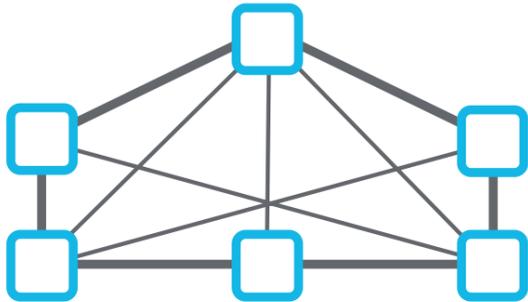


### Automatic Vehicle Identification (AVI) System

The plant's Automatic Vehicle Identification (AVI) System identifies and tracks vehicles in the body shop, paint shop, and general assembly shop. Vehicles are identified by writing vehicle identification and configuration data to radio frequency (RF) tags mounted on each vehicle carrier. Vehicles are tracked by reading the vehicle data from the RF tags as they move through the production process.

There are two independent AVI systems; one is for the body shop and body distribution center (BDC), and the other is for the paint shop. The body shop/BDC system consists of one PLC networked with eight tag read/write stations located in the body shop, body distribution center and paint shop exit. Two of the stations in the body shop have automatic bar code scanners that read data from a label affixed to the body so that it can be uniquely identified by the AVI system when it enters the production stream. The paint shop AVI system also uses a PLC with 14 tag read/write stations. Each system controller interfaces with its own CIMPLICITY HMI-based operator station mounted adjacent to the associated system controller. The stations are available for system monitoring, maintenance, and supervisory control functions.

Each AVI system also communicates directly with the TCS and SGM's FLEX system via the network, reporting vehicle locations and vehicle data to both. The AVI system also receives data from the FLEX system for storage on the RF tags. This data is read from the tags by other systems and is used for controlling the production process.



## ANDON System

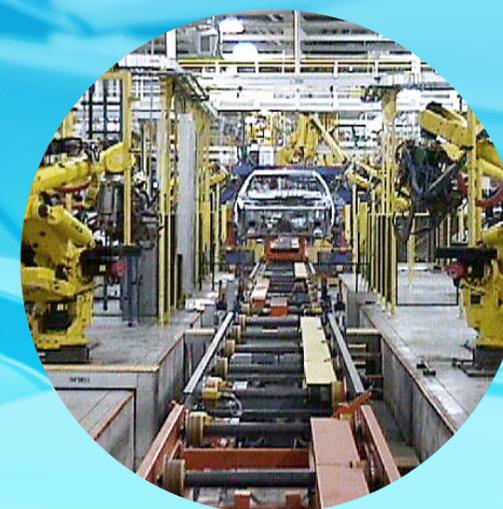
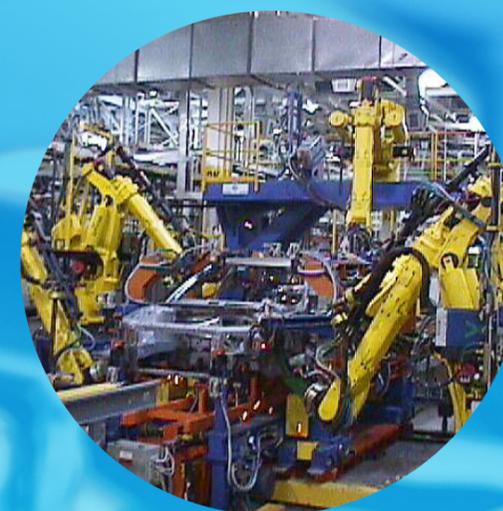
The Quality and Material ANDON System consists of two similar but separate subsystems. The Quality ANDON subsystem enables factory personnel to request help when a product or process quality problem is identified. Help is requested by pulling cords located along the production line. The action of pulling a cord sends a signal back to the operator interface, illuminating a section of a large display called an ANDON board that indicates where the problem exists along the production line. The Quality ANDON subsystem supports the synchronous manufacturing principles of producing quality products utilizing in-station repair rather than final process repair.

The Material ANDON subsystem allows each production area to automatically or manually request material before inventory is completely consumed. Factory personnel manually request more material by pressing a button. Material can also be requested automatically by sensors that detect a minimum inventory level. The manual or automatic request sends a signal back to the Material ANDON System, which displays the request in the material storage area. Fork truck drivers then deliver the requested material to the location, again supporting the synchronous manufacturing principles of just-in-time delivery.

Both the Quality and Material ANDON systems feature built-in tracking and reporting capability that compiles the number of ANDON calls, the number of line stops, and the resulting downtime. Problems are detected and resolved quickly and inventory is minimized. As with the PMC and TCS, the ANDON system avoids the high cost of idle equipment and people due to production problems and drastically reduces the opportunity for poor quality and rework.

## Driving It Home

Fitting nicely into the framework of GE's master communication and control plan, GE's automation and MES team successfully integrated a comprehensive production monitoring and control system that will allow SAIC-GM to continue breaking new ground in auto manufacturing.



# A Look Inside SAIC-GM

## Press Shop

The 139,931-square-foot (13,000-square-meter) press shop features two 180-inch press lines with automatic pick-and-place panel transfer systems. Each line has five fully automated presses. SAIC-GM stamps 26 external metal parts at a rate of 500 parts per hour.

## Body Shop

In the 265,868-square-foot (24,700-square-meter) body shop, heavy parts are lifted and moved by manipulators while 44 robots perform quality-sensitive tasks such as welding and sealing. The shop has agile tooling and a programmable design in the framing station that allows it to produce bodies for two completely different vehicles. An Electrified Monorail System (EMS) in the underbody sub-assembly and body side sub-assembly areas maximizes the flexibility of model mixing in the production schedule.

## Paint Shop

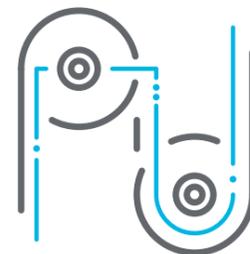
The 548,958-square-foot (51,000-square-meter) paint shop is a state-of-the-art, environmentally friendly facility. Here, for the first time in China, provisions were made for the future use of waterborne primer and paint, which will effectively reduce exhaust emissions. Also for the first time in China, color-specific primer, which improves paint quality, is applied to all vehicles.

## General Assembly Shop

The 452,084-square-foot (42,000-square-meter) general assembly shop features a unique T-shape layout pioneered by General Motors. A prerequisite for just-in-time production, the building shape offers three distinct advantages: docking stations permitting line-side direct delivery of parts; a centralized nerve center; and options for future expansion without interrupting production. Three automated conveyor systems complete the efficient assembly process.

## Powertrain Shop

The 409,028-square-foot (38,000-square-meter) powertrain shop manufactures five major engine components for 4 and 6-cylinder engines that are used on its engine assembly line. This state-of-the-art engine assembly line can produce the mix of 4 and 6-cylinder engines required for the vehicles SAIC-GM produces, as well as for other vehicle manufacturers in China. It also produces 5 major components for, and assembles, the first automatic transmission used on a production car built in China.





## About GE

GE (NYSE: GE) is the world's Digital Industrial Company, transforming industry with software-defined machines and solutions that are connected, responsive and predictive. GE is organized around a global exchange of knowledge, the "GE Store," through which each business shares and accesses the same technology, markets, structure and intellect. Each invention further fuels innovation and application across our industrial sectors. With people, services, technology and scale, GE delivers better outcomes for customers by speaking the language of industry.

## Contact Information

[www.ge.com/digital](http://www.ge.com/digital)

