

Bring Innovation to Manufacturing Sites

Factory Automation in the IoT Era



Bring innovation to manufacturing sites

Manufacturers are facing challenges in the IoT era. Omron believes we can find solutions in "manufacturing sites".

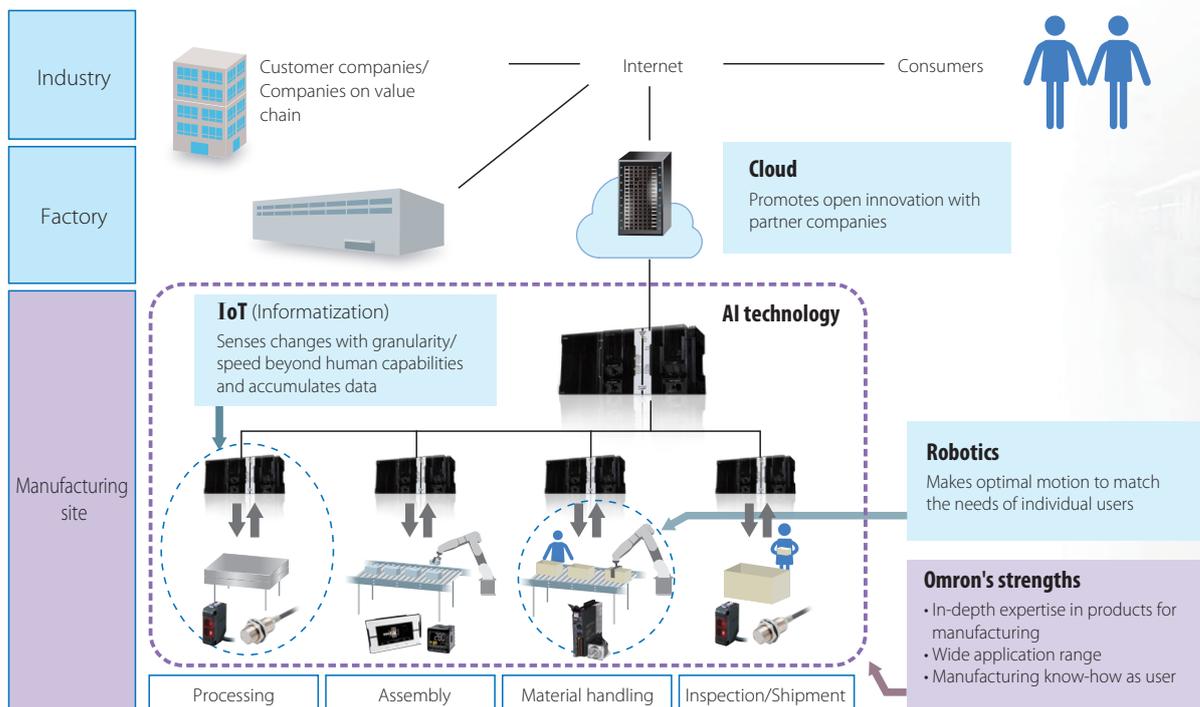
Manufacturers pursue high value-added manufacturing, quality, and stable operation. What should they do now while responding to global competition and changes in technology? Having manufacturing knowledge and offering a wide range of products to manufacturers, Omron believes that the solutions exist in manufacturing sites. We can find powerful manufacturing capabilities, such as expert know-how and improvements, and clues to solve business problems at manufacturing sites.

In today's manufacturing environment, there is a growing movement for technological innovation to transform manufacturing sites: rapid advancement of IoT (Internet of Things) - Industrie 4.0 in Germany and Industrial Internet Consortium in United States, robotics, and AI (Artificial Intelligence). Manufacturers also need to respond to significant changes: diverse demands, complex production management by utilizing data, global production system, and increasing automation needs due to shortage of skilled workers and high labor costs. To keep up with the advancement of manufacturing and meet the changing market needs, it is crucial to utilize the ever-evolving modern technology.

Manufacturing site innovation with information technology for high value-added manufacturing

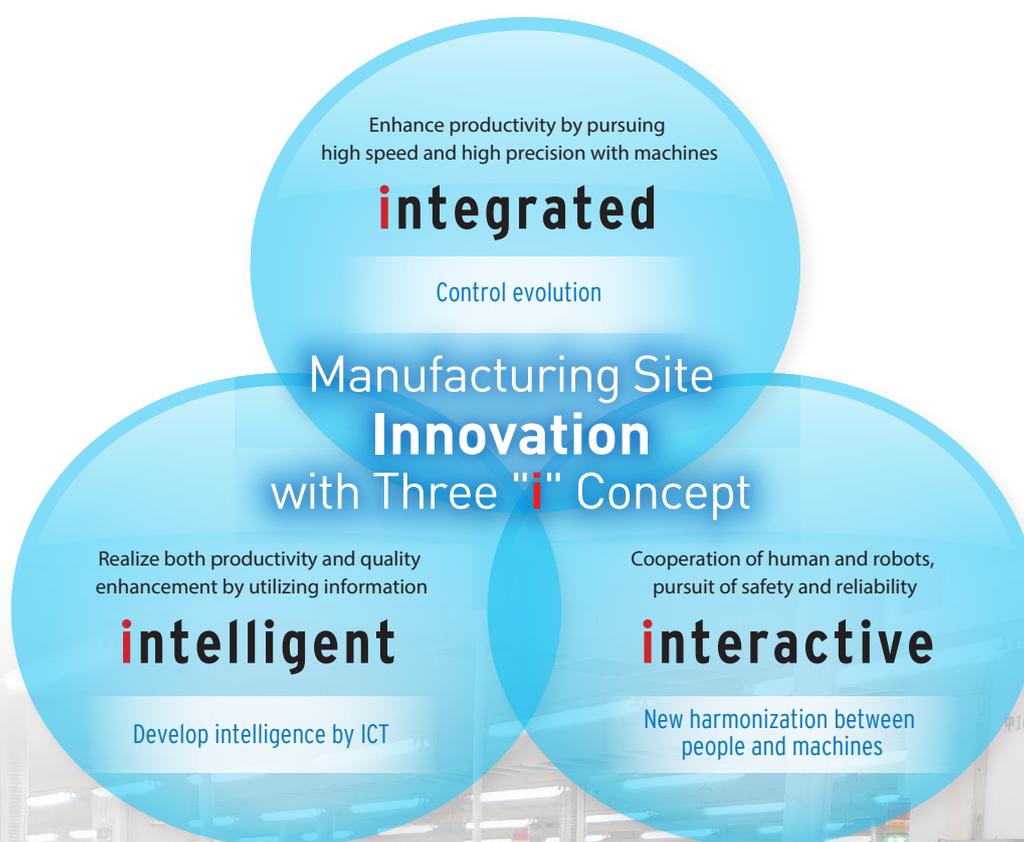
Omron has been committed to the development of manufacturing industry over many years by developing and providing automation devices used at production sites. More than 100,000 different specifications of devices are provided. In order to quickly respond to the ever-evolving technology, we continue to deliver benefits of information technology using standard open networks to customers. We further strive to meet the changes in technology including IoT, AI, and robotics and support customers to produce high value-added and competitive products through manufacturing site innovation.

< Omron's efforts >



Automation evolving with the latest technology takes you into a new dimension of manufacturing

Omron brings innovation to your manufacturing sites by combining control evolution and harmonious manufacturing sites with the latest information technology.



Attaining the Factory of the Future in which human intention and equipment converge makes manufacturing more enjoyable!

integrated

Enhance productivity by pursuing high speed and high precision with machines

Advancing industry's fastest class* of automation technology

New automation achieved by integrating control and robots

High control performance and capabilities of collecting and analyzing enormous amounts of data. A controller must meet both requirements to produce attractive, high-quality products. The NX7 Machine Automation Controller with the PLC and Motion engines performs high-speed, high-precision, reliable motion control and large-volume data processing thanks to the Intel® Core™ i7 processor (quad-core). This makes smooth cam motion, high-precision interpolation control, phase adjustment, and data analysis possible, which will contribute to your high value-added manufacturing. By combining ultra-high-speed, high-precision control technologies from US-based Delta Tau Data Systems (DT) and robot control technologies from Omron Adept Technologies (OAT) with Omron products, we are committed to increasing speed and accuracy for manufacturing site innovation.

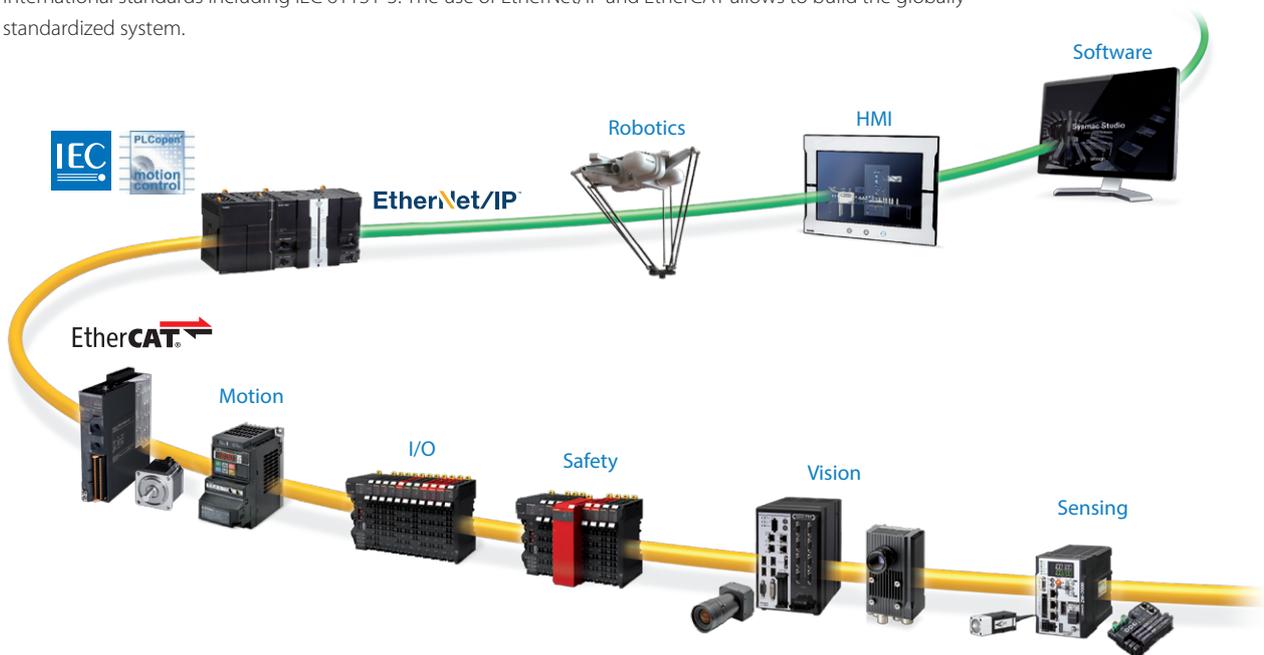
* Omron survey as of November 2016

SYSMAC
always in control

High performance and high reliability		 NX Machine Automation Controller
General-purpose MPU	PLC software	
Motion function	Sequence function	
Ultra fast, accurate control		 CK3E IPC Programmable Multi-Axis Controller NY51-A IPC Programmable Multi-Axis Controller
Omron technology	DT technology	
Robot control		 SCARA robot Articulated robot Parallel robot
Omron technology	OAT technology	

Omron helps you increase productivity and added value by optimizing a variety of devices

By integrating and optimizing input, logic, output, robotics, and safety, Omron makes it easier to achieve fast and accurate control. The Sysmac automation platform is a PC architecture based platform that conforms to international standards including IEC 61131-3. The use of EtherNet/IP and EtherCAT allows to build the globally standardized system.

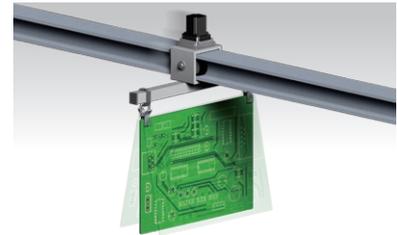


Know-how to significantly increase machine accuracy



High-speed, high-precision Sysmac hardware allows your production knowledge and know-how to be accumulated as assets. This increases the added value of machines and ensures continuous evolution. Omron is developing control applications to solve your problems and providing the Sysmac Library, which is a collection of Function Blocks that is packed with Omron's technical know-how on control, to reduce your work.

Advanced control applications include vibration suppression for high-speed material handling, and libraries include Function Blocks to monitor devices that can cause intermittent stoppages. Omron accelerates innovation by solving a variety of challenges through our product range and manufacturing know-how.



Example: Vibration suppression
 Benefit: Reduced vibration settling time for suspending conveyance

Omron continues to develop more advanced automation

Maximize machine performance with cyber-physical technology

Verification using physical devices is an effective way to maximize machine performance. However, it is difficult to check interference only with human eyes, and verification must wait until the machine is completed. That's why Omron collaborates with other companies so that you can perform simulation and tuning by loading real data into virtual (cyber) space, verifying on a PC, and feeding back the best results to the real machine. This helps you maximize your machine performance and start up the equipment immediately. We provide a development environment linked with MATLAB®/Simulink® for control software design, such as Model-Based Design, and a physical simulator using 3D CAD models for mechanical design. 2D and 3D CAD libraries* for electrical engineering CAD software that integrates and manages design data are also available and will reduce the time required to set up and start up equipment. Integration of virtual and real worlds brings further advancements to manufacturing.

Model-Based Design

MathWorks
Partner

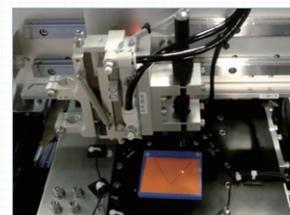
Offline tuning using physical simulator

3D model

iCAD
LATTICE TECHNOLOGY
VMECH

Program debugging using virtual machine

Cyber domain



Automated tuning

Physical domain

* EPLAN Software&Service GmbH & Co.KG; EPLAN, Zuken Inc.; E3. series

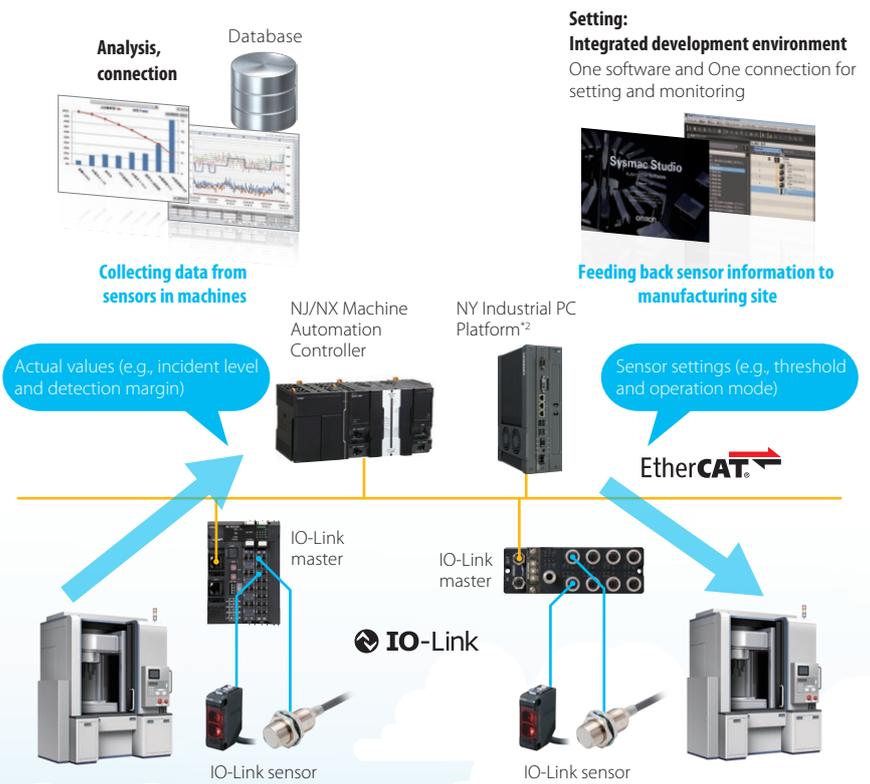
intelligent

Realize both productivity and quality enhancement by utilizing information

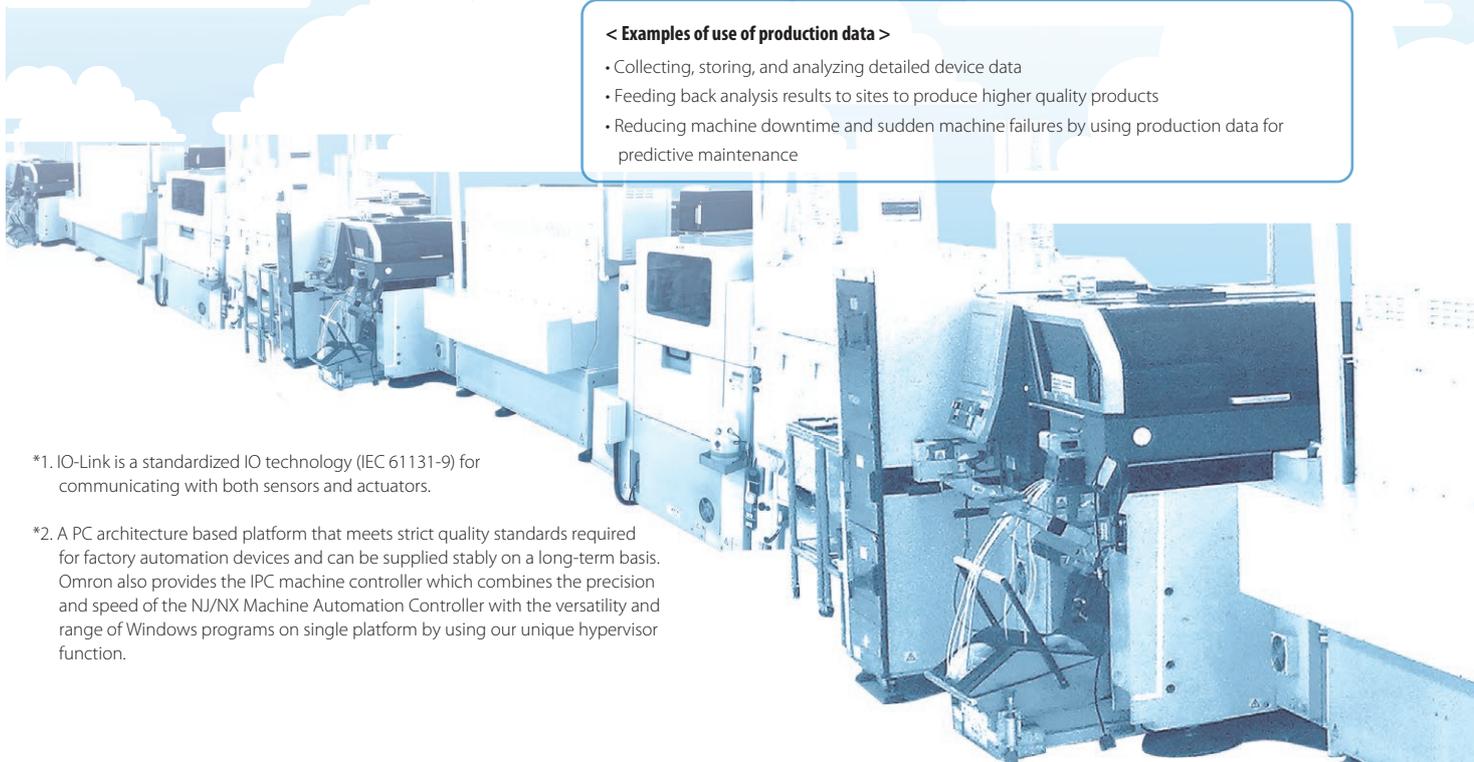
High value-added manufacturing by leveraging production data

Create additional value by collecting, visualizing, and analyzing data

Omron helps customers innovate manufacturing by combining factory automation with ICT - connecting a wide variety of Omron products to networks. 100,000 different specifications of automation devices such as sensors and relays will meet the information and communication needs including IO-Link^{*1} by 2020. Collecting ON/OFF signals and other production process data makes tacit production knowledge explicit. This knowledge can be used to achieve the same quality production across the world and extract improvement margins, which can improve productivity. We further develop autonomous devices that monitor their own status and notify an error if it occurs. We are also committed to realizing an evolving factory - high value-added final products are produced using more advanced manufacturing technology, and information is fed back to production sites to avoid production line stoppages due to machine or device failure.



- < Examples of use of production data >**
- Collecting, storing, and analyzing detailed device data
 - Feeding back analysis results to sites to produce higher quality products
 - Reducing machine downtime and sudden machine failures by using production data for predictive maintenance

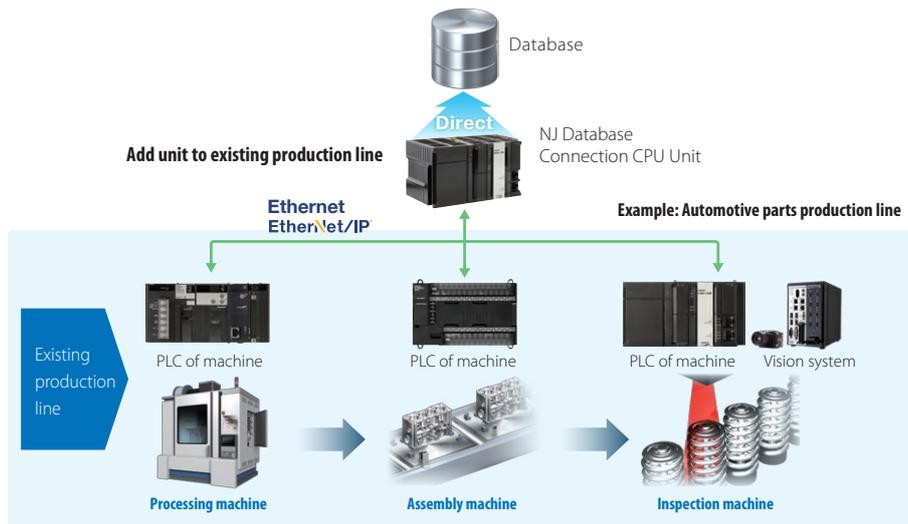


*1. IO-Link is a standardized IO technology (IEC 61131-9) for communicating with both sensors and actuators.

*2. A PC architecture based platform that meets strict quality standards required for factory automation devices and can be supplied stably on a long-term basis. Omron also provides the IPC machine controller which combines the precision and speed of the NJ/NX Machine Automation Controller with the versatility and range of Windows programs on single platform by using our unique hypervisor function.

Start a small-scale IoT by connecting a controller directly to database

Production data utilization starts by collecting data from PLC of individual machines to a database. The NJ Database Connection CPU Unit can now directly access databases without previously required PC, software, or middleware. Adding the unit to your existing system allows you to implement a small-scale IoT in manufacturing and use the collected data for productivity improvements, predictive maintenance, and quality traceability.

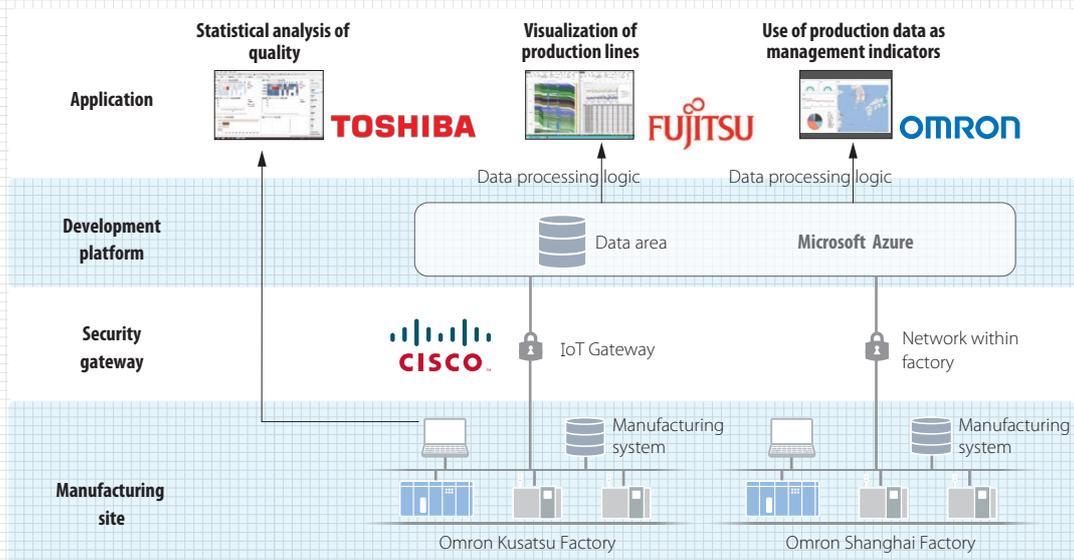


Omron continues to develop more advanced automation

Site-led manufacturing innovation

Omron collaborates with IT partner companies for information innovation for manufacturing sites. Specialized applications and advanced security solutions using partners' strengths are adopted to accelerate IoT implementation in manufacturing.

< Example of Omron factories >



Since the data collected through IO-Link can be used as management indicators, improvements are made to increase the productivity of the factory. Our aim is to achieve site-led manufacturing.

interactive

Cooperation of human and robots, pursuit of safety and reliability

Pursuing flexible, safe, and secured technology

Collaborative manufacturing between people and robots

By combining robotics technology to enable collaborative work between people and machines and ICT technology to apply big data to production, Omron offers one stop solutions to manufacturing challenges, such as improving productivity and reducing labor and skills shortages. Robotics technology from Omron Adept Technologies (OAT) allows you to use robots in the fields where previously only people could do, which leads to advanced automation and harmony between people and machines.

Flexible material handling with easy-to-deploy mobile robots

Omron mobile robots* use on-board lasers to scan the environment, generate a map used for navigation, and identify their current location. They avoid fixed and moving obstacles in their path and go wherever needed via the best route. Using mobile robots to move goods between separate processes which were previously strung into one production line, you can easily reconfigure production line layouts. This reduces the buffer space and changeover time.

* Available soon

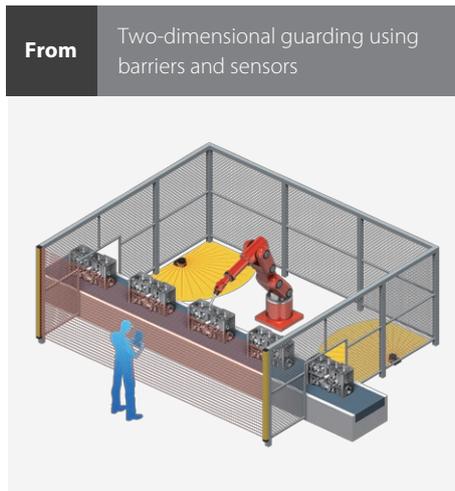
Autonomous mobile robot



* Image for illustration purposes only.

3D Safety Vision System*1 for the first step of harmony

Omron provides safety components and consulting services that are essential for people to work with machines safely. We are developing the 3D Safety Vision System*1 that meets the new safety requirements*2 to realize harmony between people and machines. Free access to machines and robots without protective barriers will improve productivity and reduce downtime caused by collisions of forklift. We continue to address the challenge to maximize human productivity in harmony with robots.



*1. Now being developed.

*2. IEC TS 61496-4-3:2015
 Particular requirements for equipment using vision based protective devices (VBPD)
 - Additional requirements when using stereo vision techniques (VBPDST)

Omron continues to develop more advanced automation

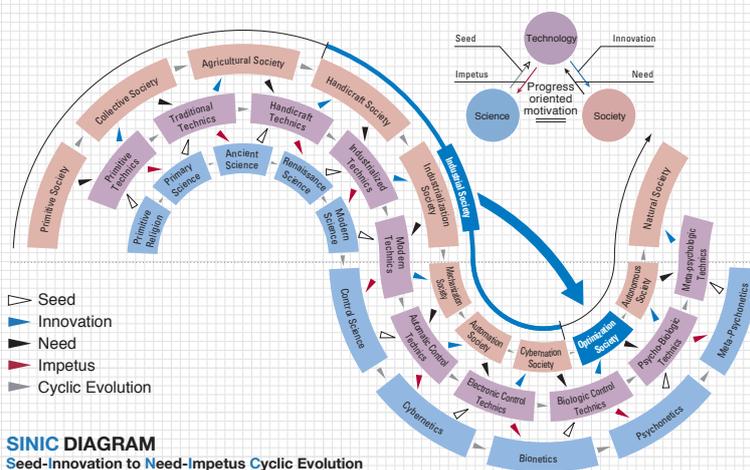
Manufacturing site innovation aiming for harmony between people and machines

SINIC theory

In 1970 Omron presented a future prediction method, the SINIC theory - science, technology and society share a cyclical relationship and evolve together. The SINIC theory still serves as a compass for guiding Omron's management. According to the SINIC theory, the present period is part of the Optimization Society where people and machines will find an ideal level of harmony. Omron aims to realize the manufacturing sites where robots/machines and people work in complete harmony.

Machines adapt to human needs

Omron's ping-pong robot shows a place before returning a ball to the place that is easy for the human opponent to hit back. Combining robotics technology with Omron's unique control technology, Omron pursues the ideal way of more advanced, efficient automation in which robots not only avoid collisions with humans but also provide suitable support for individual operations.

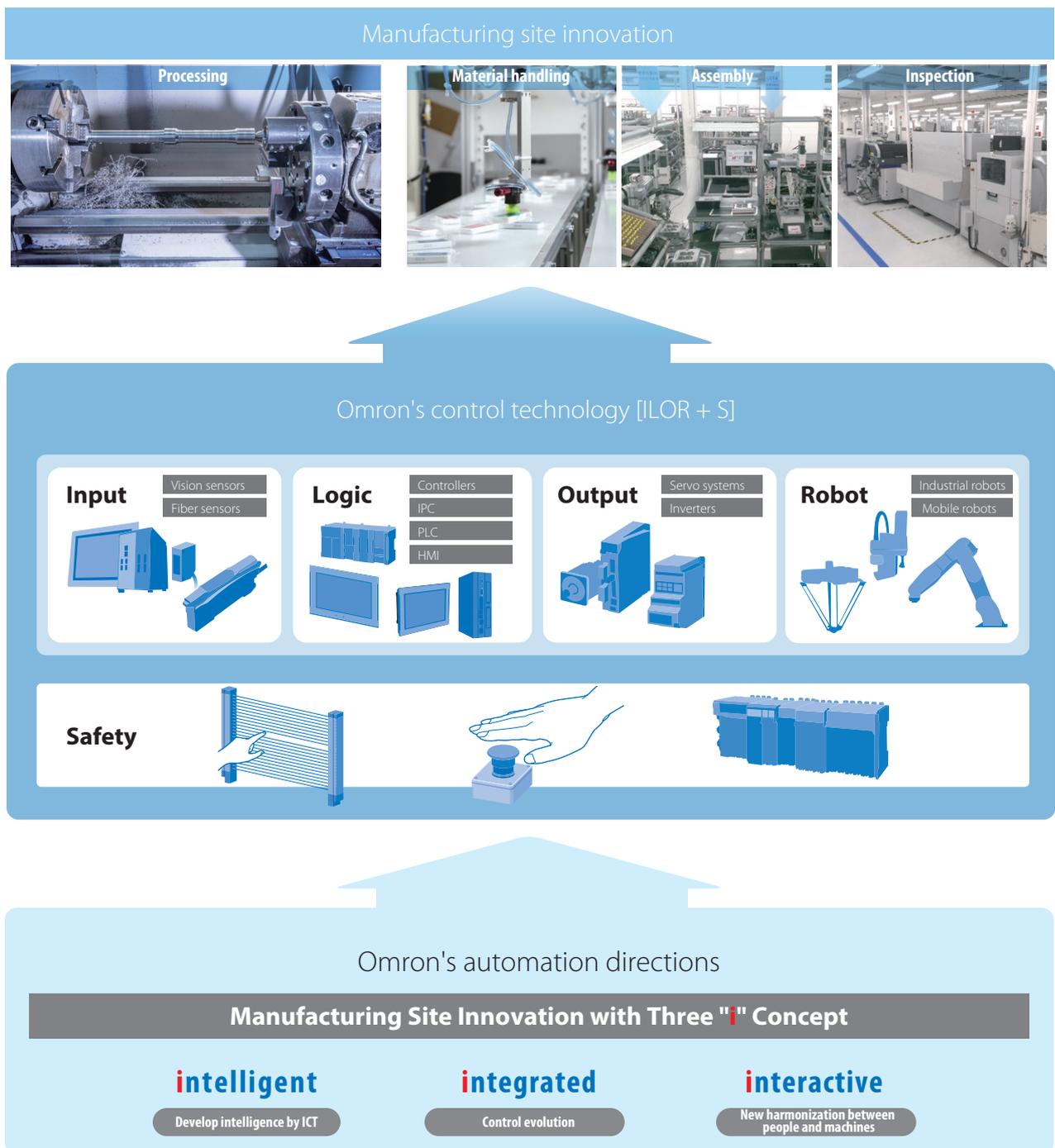


The ping-pong robot FORPHEUS brings out human ability by using the AI technology "time-series deep learning" to control its robot hand according to the characteristics of the player's actions.

Products and solutions for manufacturing site innovation

Offering Omron's unique automation by combining ILOR+S

By adding robotics technology to our world leading control technology and incorporating the latest information technology, Omron is committed to evolving automation and bringing innovation to manufacturing sites together with manufacturers around the world.



Examples of Omron factories that leverage IoT

Direction of leveraging IoT (1)

Global Operations

- Omron Kusatsu Factory
- Omron Shanghai Factory

Improving operating efficiency thanks to high-speed data collection

The system to visualize the productivity of the PCB surface mounting line in time series was built in Kusatsu Factory, and overseas factories are now using this system. The systems in each factory are connected via the cloud to share the data. This will help share the know-how between factories and improve productivity and quality.

Omron Kusatsu Factory

Omron Shanghai Factory

Benefits

- ▮ 6 times faster to identify improvement points*
- ▮ Increased productivity by 30%*

Direction of leveraging IoT (2)

Quality Innovation

- Omron Kusatsu Factory

Analyzing causes of failure by linking object data with inspection data

The system implemented in the PCB surface mounting line obtains the inspection data in addition to the object passing time and analyzes the correlation between the process and causes of failure. This system will obtain more data and increase the analysis accuracy, aiming for further quality innovation.

Benefits

- ▮ Collected about 6 times the amount of data*
- ▮ Failure rate of 1 ppm*

Direction of leveraging IoT (3)

Predictive Maintenance

- Omron Ayabe Factory

Improving maintenance by leveraging big data

The system to collect machine data and visualize operating status was built for the high-efficiency coupling element alignment machines. The workflow where the vacuum nozzle is washed when a measured value exceeds the specified threshold is achieved by collecting the data from the process and analyzing it. Efficient and timely, not periodic, checks will lead to improvement of operating efficiency.

Benefits

- ▮ 6 times faster to identify causes of failure*
- ▮ Reduced parts replacement frequency to 1/4*

* In-house comparison.

SINIC stands for Seed-Innovation to Need-Impetus Cyclic Evolution.

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OMRON Corporation Industrial Automation Company
Kyoto, JAPAN

Contact: www.ia.omron.com

Regional Headquarters

OMRON EUROPE B.V.

Wegalaan 67-69, 2132 JD Hoofddorp
The Netherlands
Tel: (31)2356-81-300/Fax: (31)2356-81-388

OMRON ELECTRONICS LLC

2895 Greenspoint Parkway, Suite 200
Hoffman Estates, IL 60169 U.S.A.
Tel: (1) 847-843-7900/Fax: (1) 847-843-7787

OMRON ASIA PACIFIC PTE. LTD.

No. 438A Alexandra Road # 05-05/08 (Lobby 2),
Alexandra Technopark,
Singapore 119967
Tel: (65) 6835-3011/Fax: (65) 6835-2711

OMRON (CHINA) CO., LTD.

Room 2211, Bank of China Tower,
200 Yin Cheng Zhong Road,
PuDong New Area, Shanghai, 200120, China
Tel: (86) 21-5037-2222/Fax: (86) 21-5037-2200

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