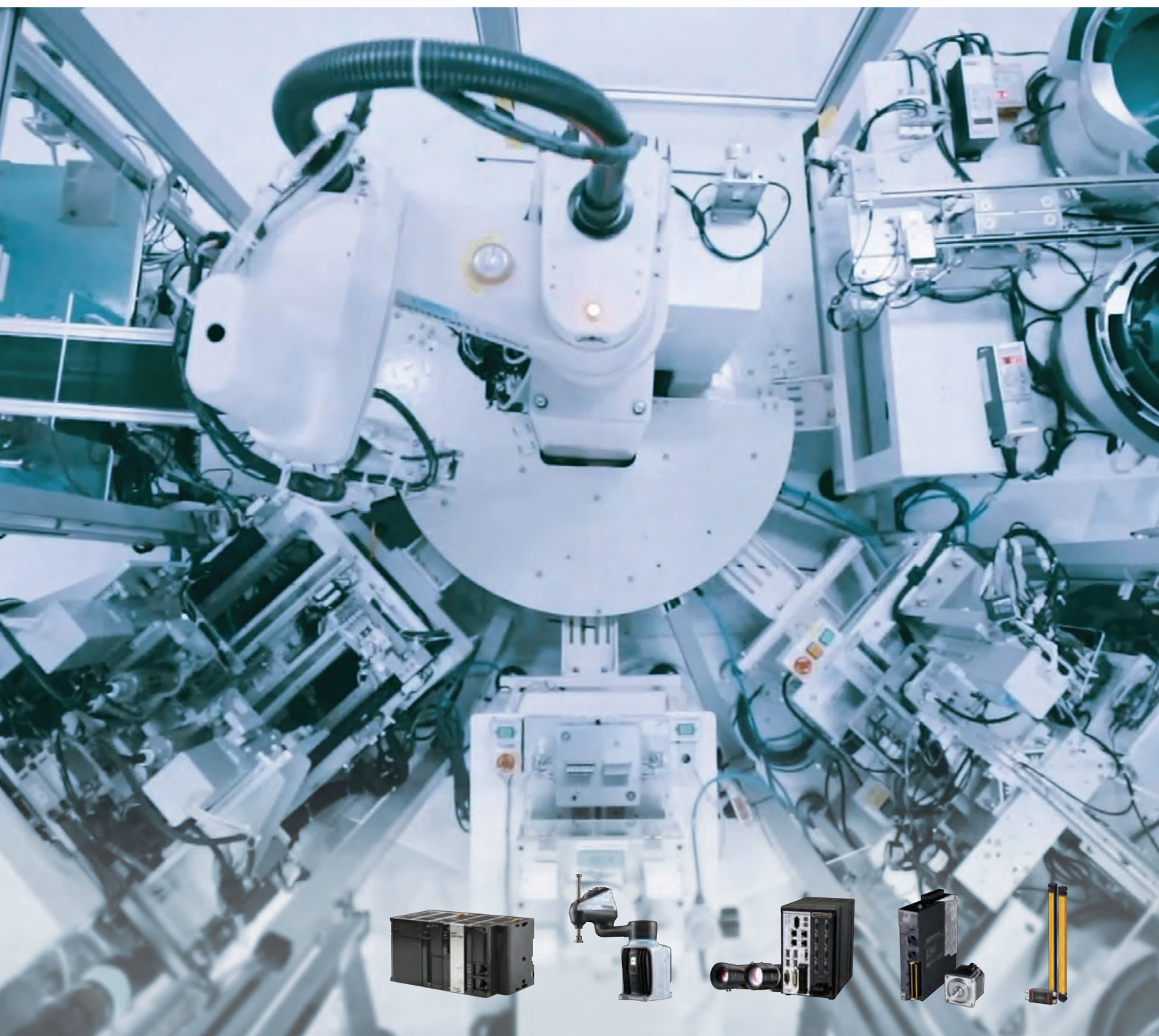


Revolutionizing manufacturing through integrated control of robots, machines, vision sensors, and safety components



Revolutionizing manufacturing that only an automation provider can offer

Revolutionizing manufacturing by integrating control of robots, machines, vision sensors, and safety components to One Controller
to Revolutionize automation applications through smooth and advanced control of unprecedented levels
and Revolutionize the system building process
by seamlessly melding the virtual and actual

Faced with issues such as labor shortage, which has long been a problem, and new ways of working such as remote working, the manufacturing industry is now at a critical turning point.

This has led to rising demand for automation that can bolster production resilience, and for the innovation of engineering environments through digital technologies.



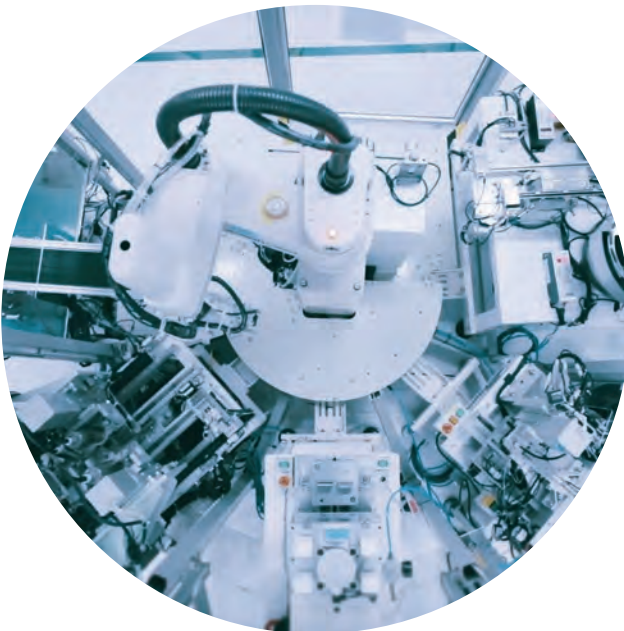
A highly automated manufacturing site

- A manufacturing site where many highly manual tasks are automated
- A manufacturing site where the robots and equipment are controlled and fully synchronized in real-time
- A manufacturing site where fuses the virtual and the real, unconstrained by the limitations of time and place

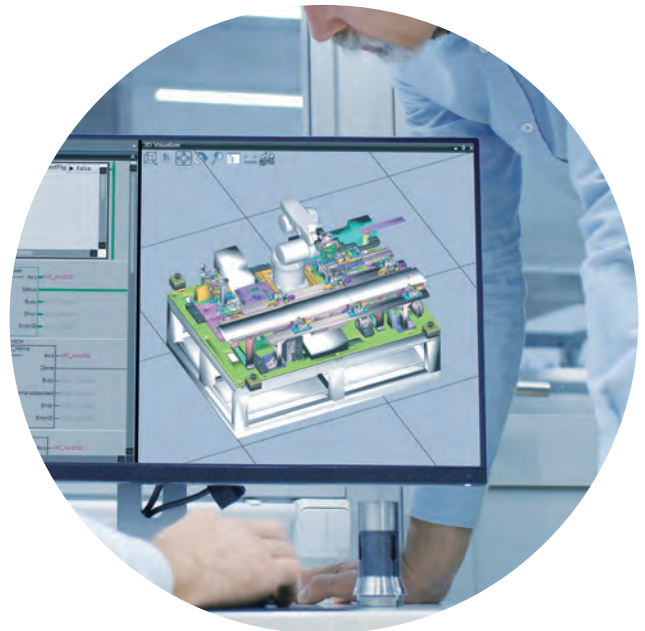
Control integration enables unique and innovative automation applications tailored to each production site by positioning robots as one of the elements required to implement such applications and closely coordinating them with other devices.

Integration of the Construction Process simplifies the process of implementing automation so that users can automate their sites exactly to their needs.

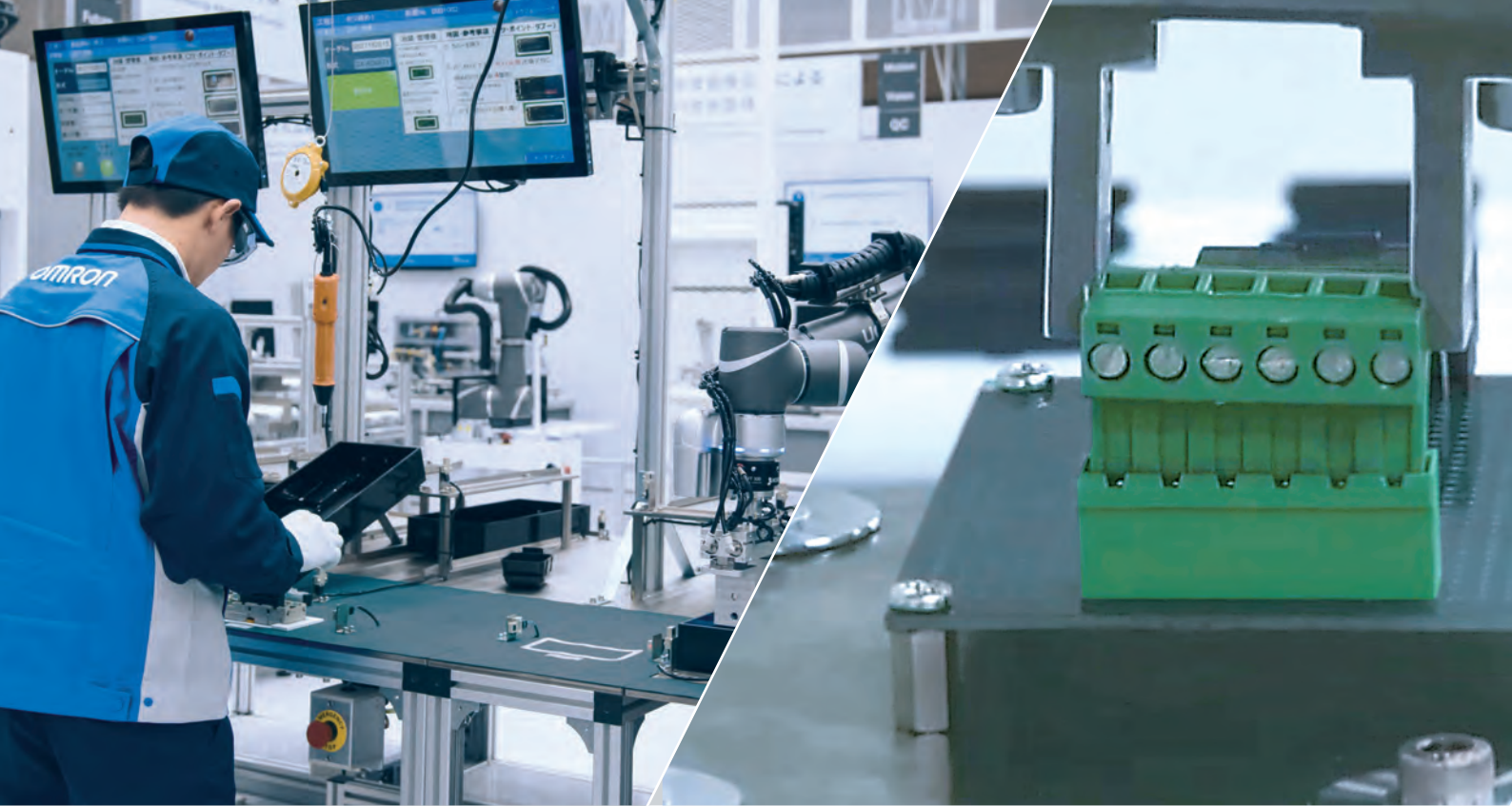
Together, these two “integrations” make a highly automated manufacturing site possible.



Control Integration



Integration of the
Construction Process



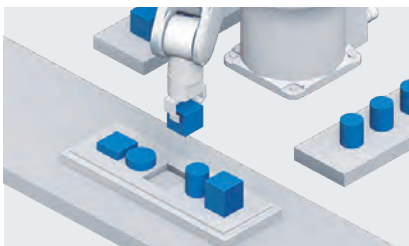
Control Integration

Revolutionizing automation applications through the “One Controller” approach

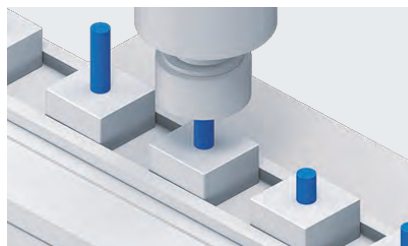
Automating “virtuoso craftsmanship”

The “One Controller” approach integrates the control of robots and machines—traditionally performed by separate controllers—to a single controller, enabling intimate coordination between peripheral devices and robots to deliver automation systems that can achieve unprecedented levels of intricacy and dexterity. For instance, robots can be optimally controlled to operate in

complete synchrony with image processors and other sensing devices to enable advanced automation that covers even the most complex machining and assembly procedures, such as inserting and press-fitting, that could previously only be performed by humans. Automation of such “virtuoso craftsmanship” provides a possible solution to the talent shortage issue.



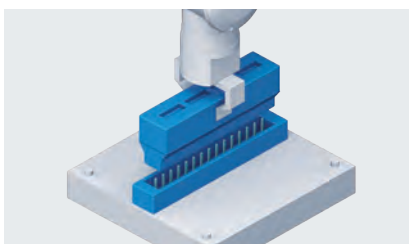
Handling of a wide range of workpieces



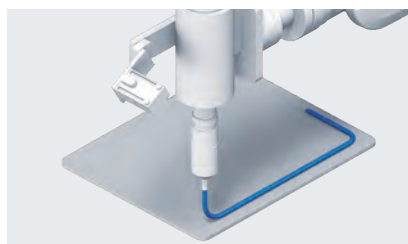
Insertions/press-fitting involving tricky alignment



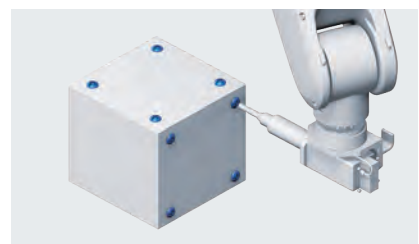
Mating requiring trial and error, including in amount of force



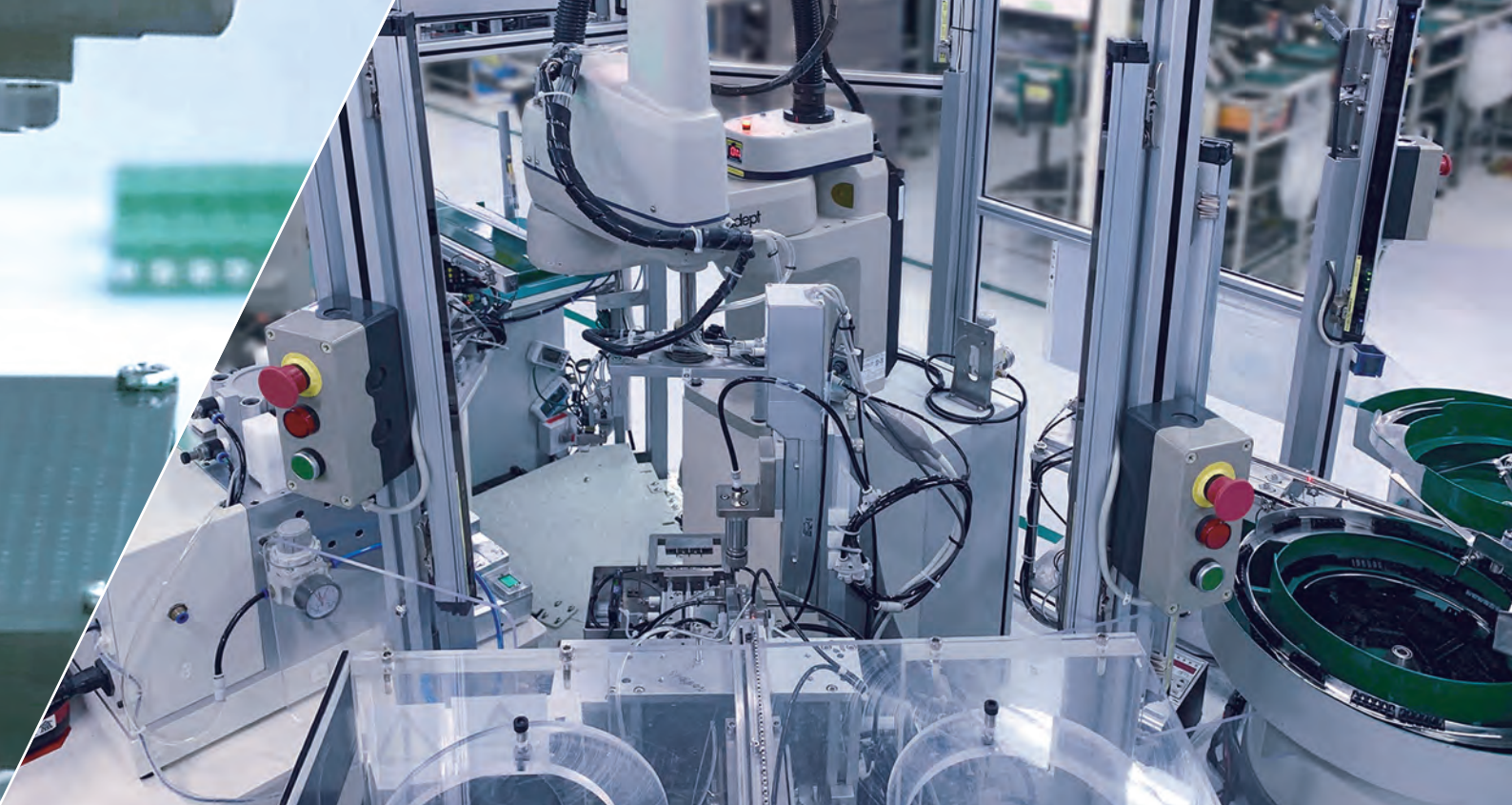
Mating connectors by searching to find the right position



Even coating along entire path



Screwing from multiple directions



Maximizing equipment throughput

Omron's One Controller approach enables the full synchronization of sensing (e.g. image processing), motion control, and robots. It allows for devices to work in real-time synchronization, effectively maximizing equipment throughput to deliver the highest level*1 of automation performance.

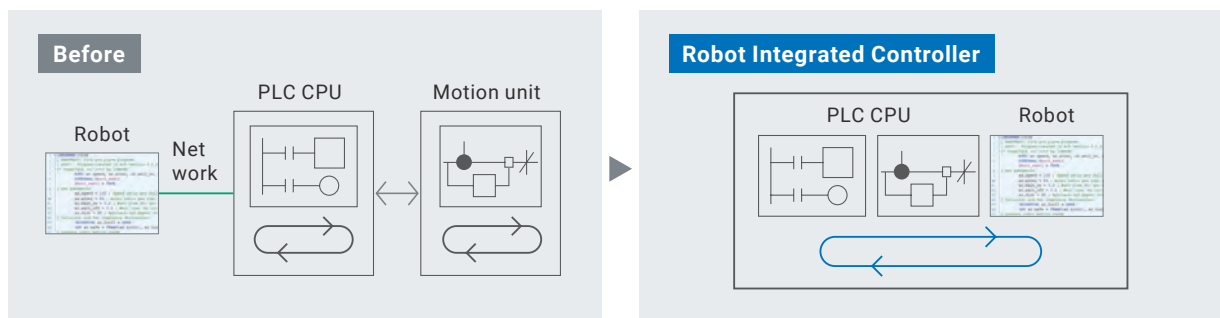


Omron's technologies that make control integration possible

Industry first ^{*1}

PATENT PENDING ^{*2}

PLC programs use control engines based on cyclic scanning, while robots use those based on procedural programming. The two types of control engines are very different and have developed completely independently of each other. Omron is the first in the world*1 to develop a technology that can integrate and synchronize the program tasks and I/O refreshing of these two engine types on a single controller so that they can work in coordination with each other. This unique technology is one that only Omron, with its assortment of control devices essential for manufacturing, could achieve.



*1. Based on Omron investigation in November 2019 *2. As of October 2024



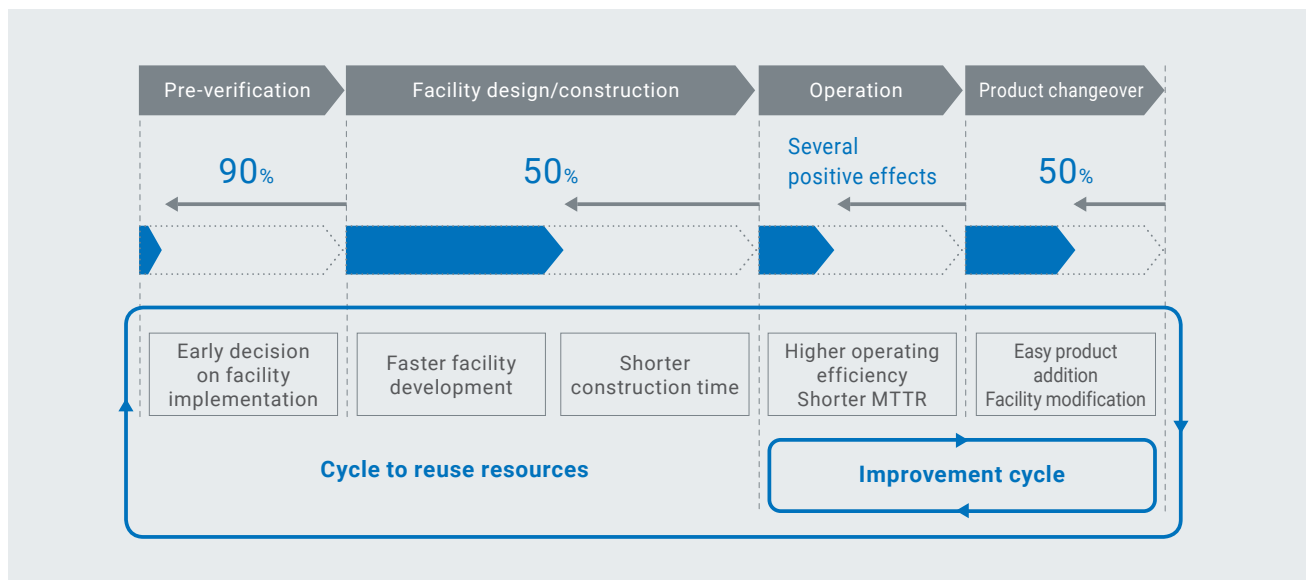
Integration of the Construction Process

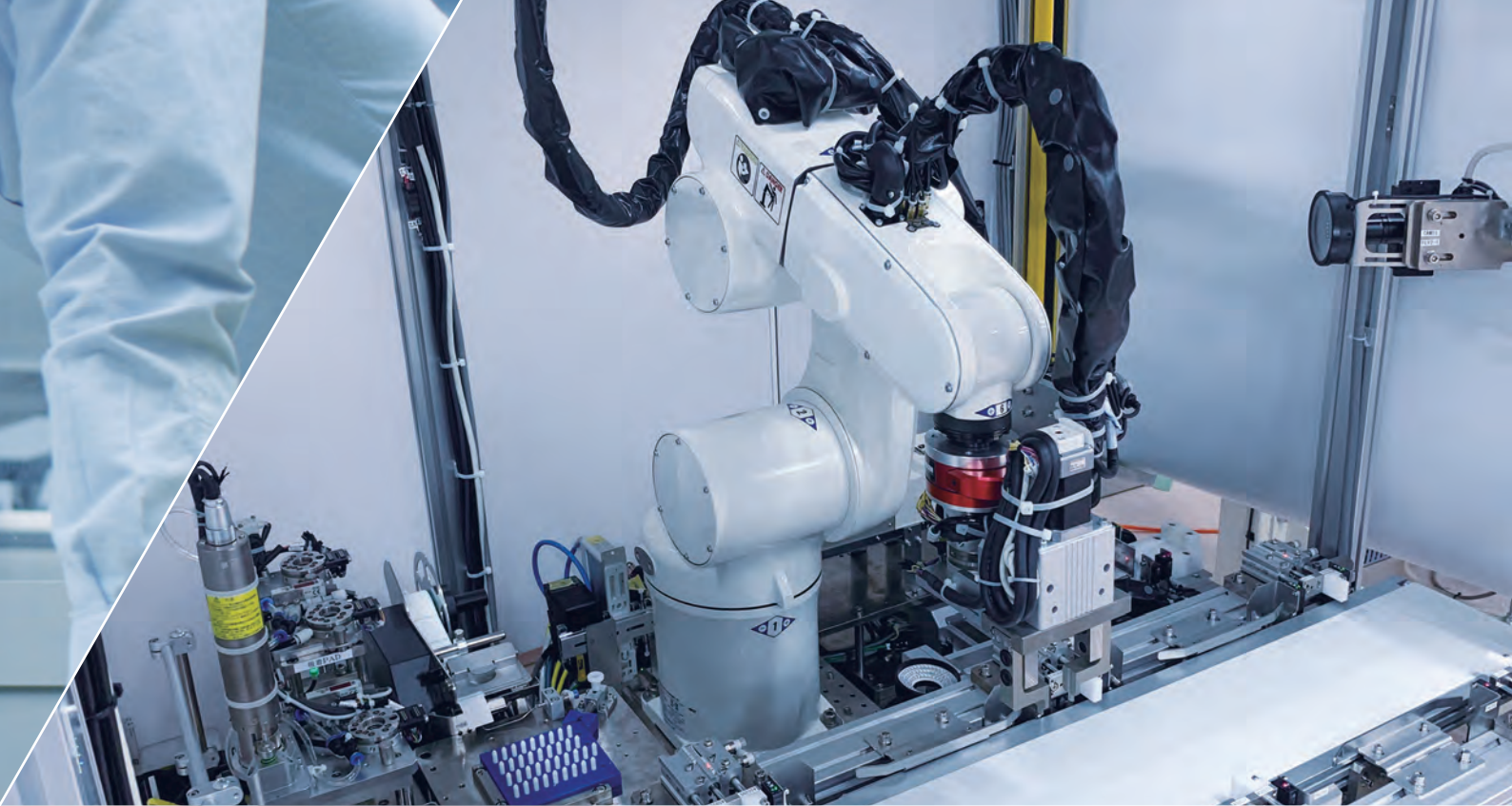
Revolutionizing the system building process by seamlessly melding the virtual and actual

Revolutionizing the engineering chain of automation

Robots were traditionally controlled using languages that were separate from those used to control other devices. Omron is the first in the industry*¹ to integrate and simplify these languages to control all equipment—including robots—from the PLC. We also established the technology for 3D simulation of not only robots but also input and output devices, with all their devices synchronized, dramatically streamlining process design

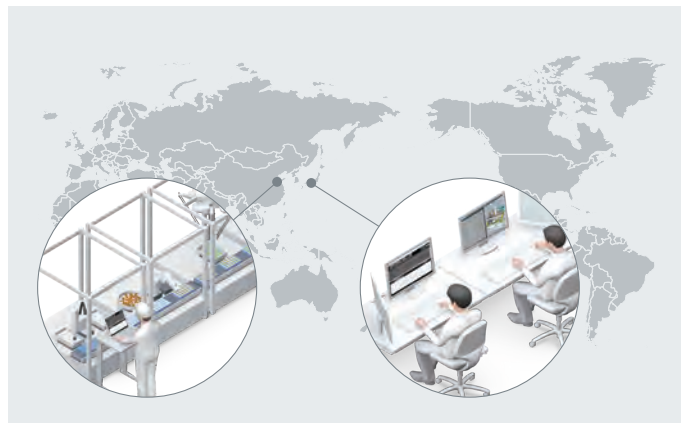
and operation verification by allowing users to visualize equipment takt time before commissioning. These technologies seamlessly integrate the entire process, from building the whole system all the way to its maintenance, and enable the reuse of software and CAD assets from past development projects to resolve personnel shortage issues in both facility development and implementation and accelerate time to market.





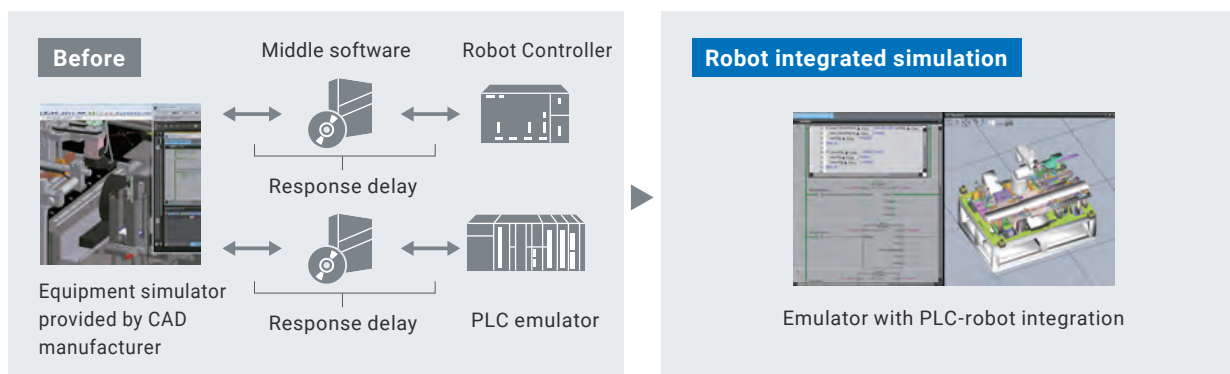
Revolutionizing commissioning and maintenance through remote operation

Seamless integration of simulations and actual devices offers new ways to commission and maintain facilities. For example, it enables offline simulation, which in turn allows facilities already in operation to swiftly respond to sudden changes, such as product type additions and specification modifications, with no line downtime. It also allows manufacturers to implement such response measures and maintain facilities from remote locations.



Omron's technologies that make integration of the Construction Process possible **Industry first** ^{*1} **Patented**

Omron's simulation technology synchronizes the control periods of devices controlled by the PLC and those of the robot emulator to deliver virtual verification that is fully consistent with actual machine operation. We are the first in the world^{*1} to deliver an all-in-one emulator that integrates the robot controller and PLC emulator to PLC programming software.



^{*1}Based on Omron investigation in November 2019

Unique robot applications only Omron—a company founded on control technology—can provide

Industry first^{*1}: A robot integrated controller that merges the control of robots and that of control devices

The robot integrated controller delivers innovative applications that incorporate robots through two kinds of integrations: control integration, which seamlessly coordinates robots and peripheral devices to enable advanced automation of complex tasks that previously could only be performed by humans; and building process integration, which streamlines the entire process from building the automation system to its maintenance through accurate simulation technologies for both actual and virtual environments. Omron combines its assortment of control devices essential for manufacturing with its wealth of technology and extensive knowledge on applications amassed over the years to create applications for non-stop inspection and alignment and those for the advanced automation of “virtuoso craftsmanship.”

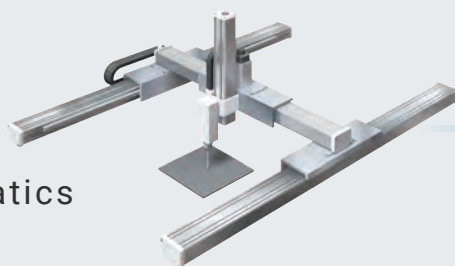
Robotics

>P.14

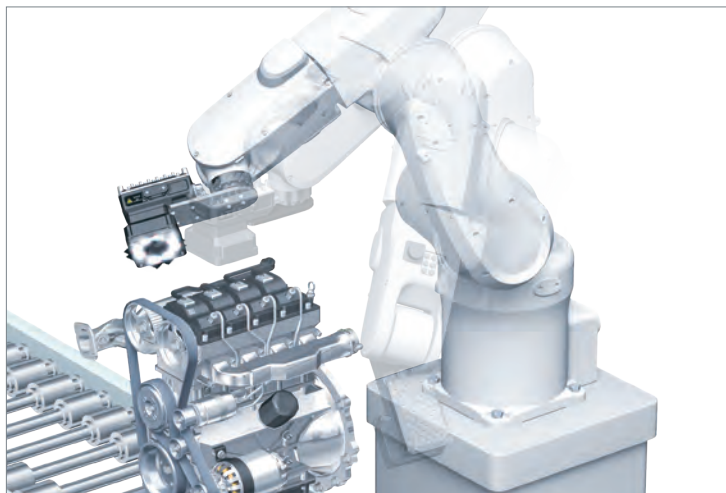


Kinematics

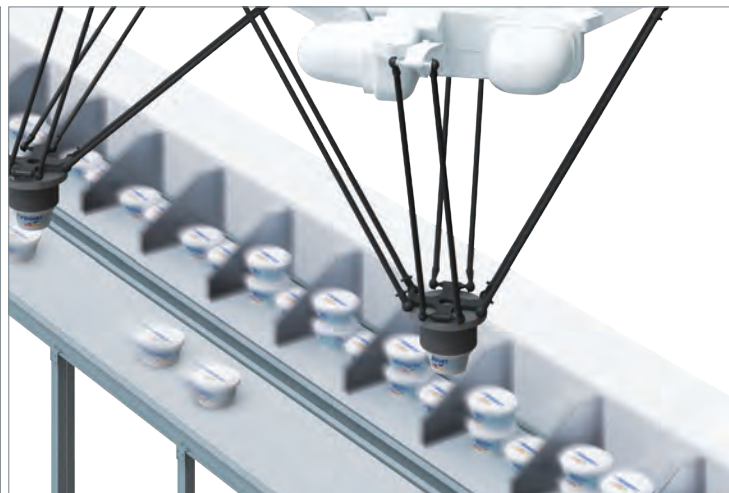
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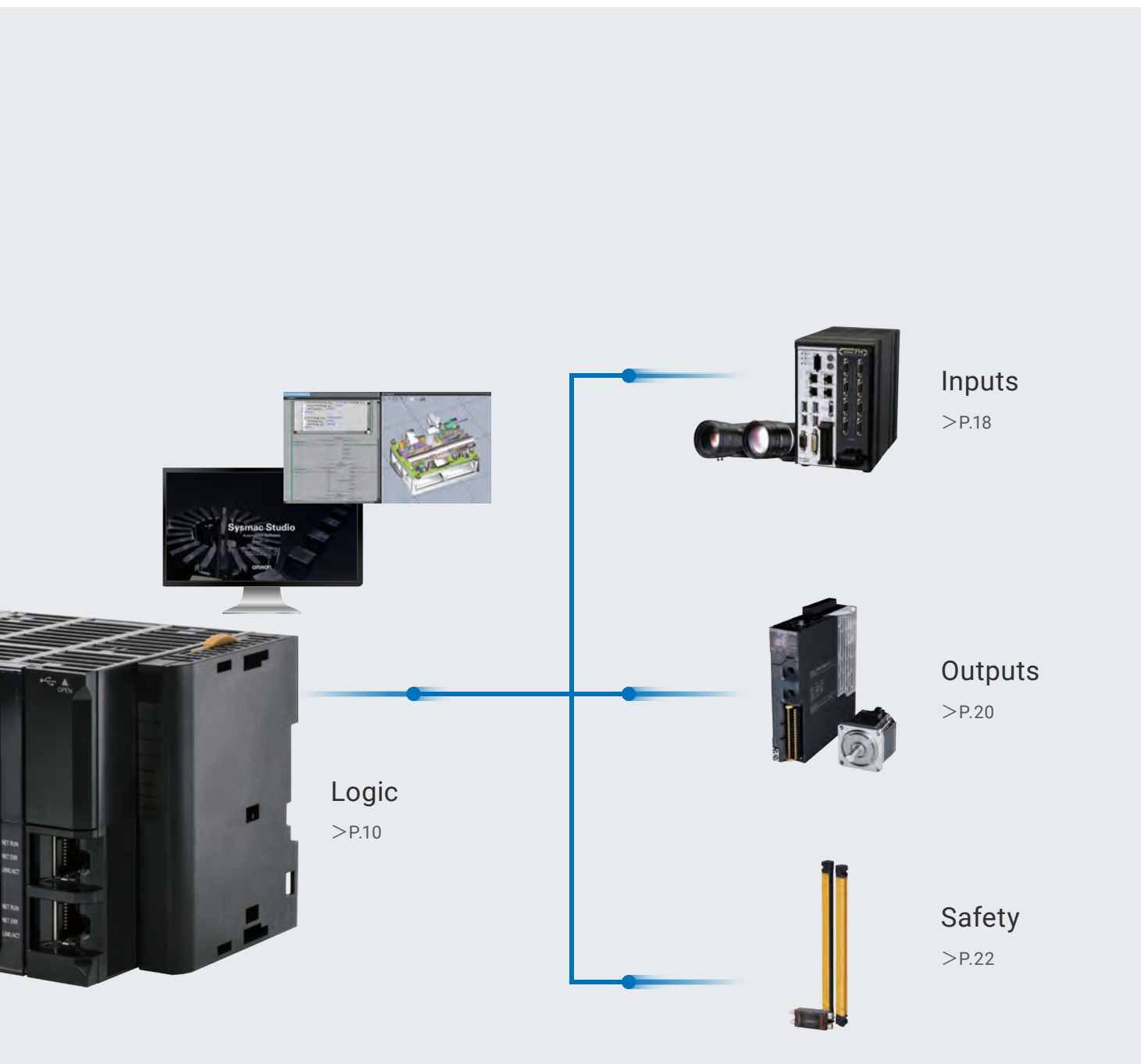


Non-stop multipoint inspections using robots



Automating “virtuoso craftsmanship” by robots and motion control





Pick & Place with position correction



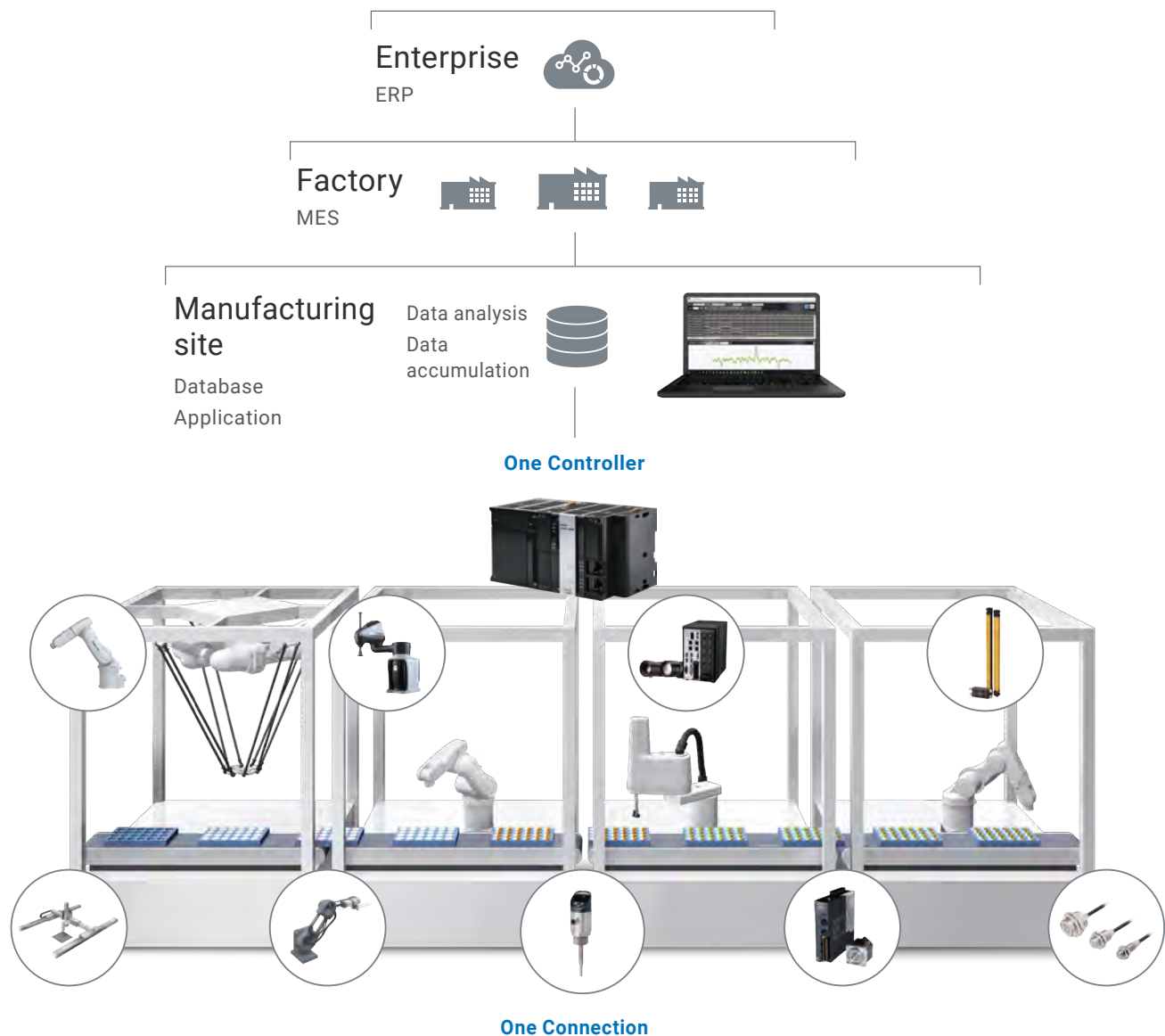
Screwing in horizontal direction



Logic

Omron's "One Controller" approach: Seamless, smooth integration of sequence, motion, and robot control

Omron's One Controller approach integrates robot control, in addition to sequence and motion control, to a single controller. This enables synchronized control of robots as well as other devices. It also enables users to collect information on devices that is aligned to a common timeline and therefore of practical use.



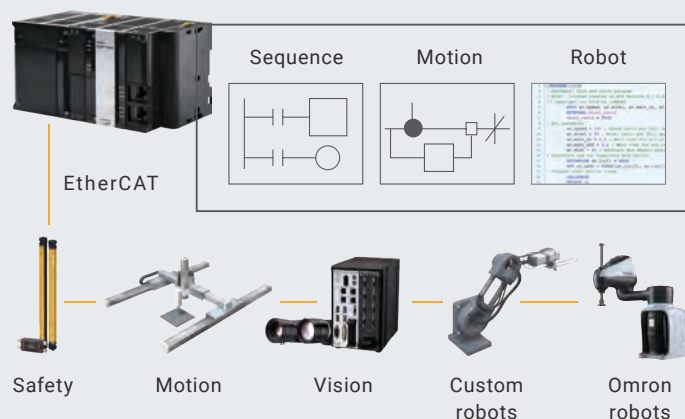
Products	Robot Integrated CPU Unit NJ501-R 
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Industry first^{*1}: Integrated control of different engines

Industry first^{*1} PATENT PENDING^{*2}

We are the first in the industry^{*1} to provide a controller that integrates two very different types of engines—one that works in program scan cycles (PLC feature) and another based on procedural programming (robot feature)—and synchronizes their program tasks and I/O refreshing.

Robot integrated CPU unit
NJ501-R



Information accuracy (concurrency)

Devices such as robots and motion/vision sensors can be connected to an EtherCAT network for synchronized control. This synchronization ensures that the data collected on these devices is concurrent and therefore truly useful for visualizing facility operation.

Because sensor information can be linked to the robot's TCP coordinates, it enables highly reproducible control as well.



Easy facility condition visualization enabled by database connection

The controller can be directly connected to a database without a gateway to easily collect data using a specialized set of instructions. This real-time data collection enables better on-site productivity, predictive maintenance, and quality traceability.



Logic

Omron's "One Software" approach: Revolutionizing the engineering chain through 3D simulation and programming that integrate robot and machine control

We have established a technology that unifies the programming languages for robotics and machine control, which have until now been different, and allows easy simulation on a single software integration development environment. This makes it possible to connect virtual and real-world production facilities to enable remote facility commissioning and maintenance.



Virtual

Real



One Software

Products

Sysmac Studio 3D Simulation



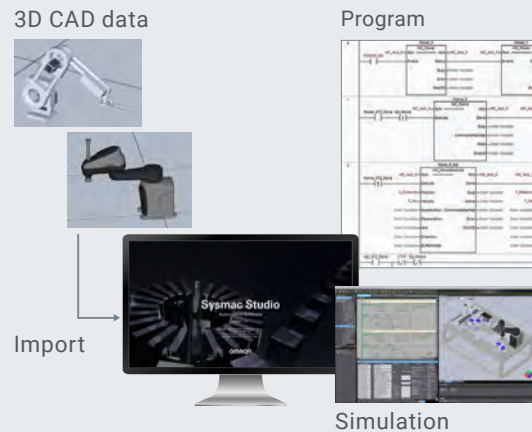
Omron's solutions enable manufacturing in virtual and remote environments through 3D simulations that are seamless extensions of actual equipment.

Industry first^{*1}: Simulations with PLC-robot integration

Industry first ^{*1}

Facilities can be verified using 3D simulation that includes not only robots but also input and output devices. These simulations can be created from CAD data and control programs for structures designed using 3D CAD, with only a PLC programming tool—no 3D CAD software required. The simulations can also be easily configured via a wizard-style interface.

3D simulations of mechanical components, including custom mechanical components (e.g., serial mechanisms and parallel mechanisms) and electric cylinders from partner manufacturers, are now available.

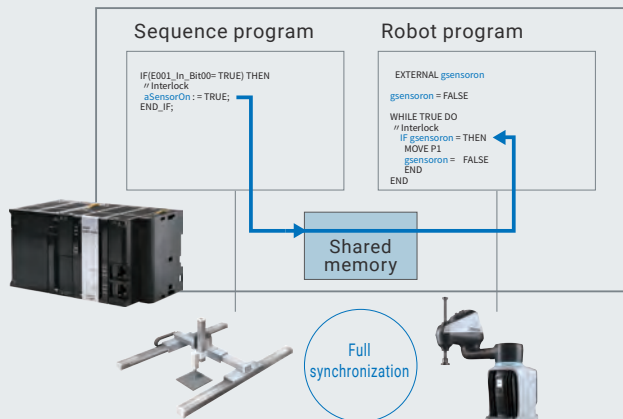


Easy programming

PLC sequences and robots can be programmed using One Software and a single language, allowing the tasks of these programs to be run synchronously within One Controller.

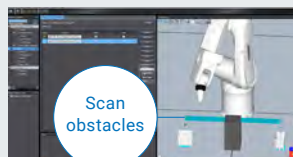
This eliminates the need for programs for connecting robots, which were required in previous systems, and allows for easy programming of interlocks for both robots and other devices controlled by the PLC.

Furthermore, Omron's robots connected via EtherCAT can be directly controlled from sequence programs as well.



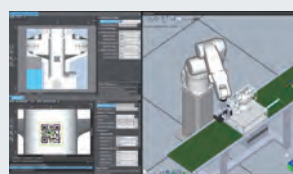
Even more advanced offline operations

3D simulation in an offline environment allows you to easily prepare various tasks using robots in your office. There are plenty of useful functions: Robot Path Planning that automatically generates the path to avoid obstacles during robot teaching for Pick & Place, Visualizer Capture Device that automatically creates images captured by the camera for inspection using a robot, and Snap that easily and precisely moves the robot TCP to the target position. Offline operations have reached a high degree of perfection, greatly speeding up commissioning on sites.



Robot Path Planning

The path of a picked workpiece to avoid obstacles can be automatically generated simply by specifying the start (pick) point and end (place) point.



Visualizer Capture Device

Workpiece images can be produced as if they came from a physical camera.



Snap

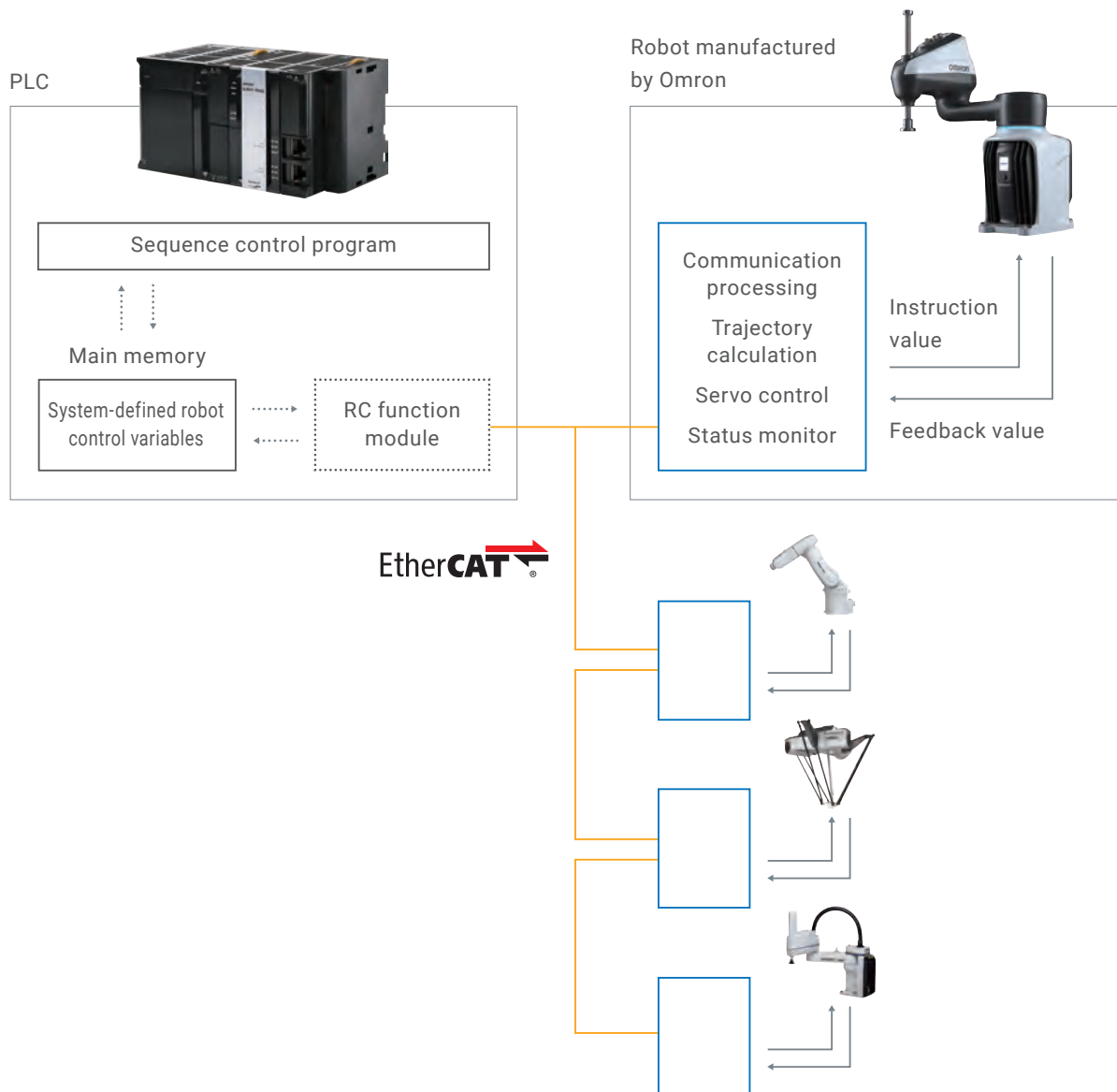
The offset of the robot TCP can be easily determined just by clicking on the target position.

^{*1}Based on Omron investigation in November 2019

Robotics

Programming robots easily the same way other devices are programmed from the PLC

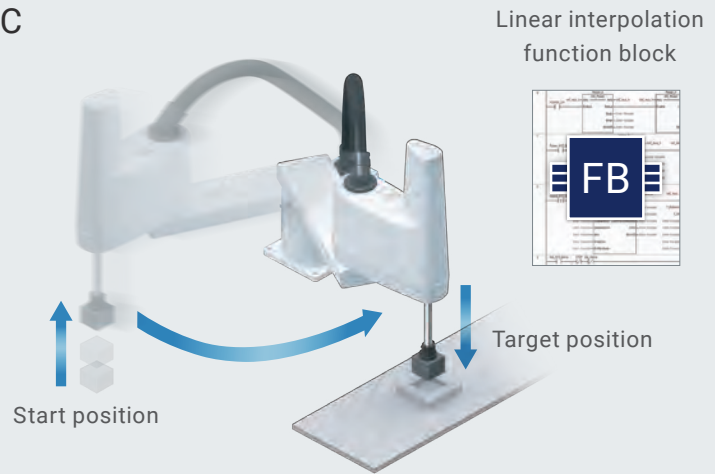
Because robot control is integrated to the PLC, robots, like other devices, can be controlled from the PLC via EtherCAT with their high speed and precision intact —allowing for PLC engineers to control robots as well.



Products	 SCARA Robots i4L/i4H	 SCARA Robots eCobra	 Parallel Robots ix3/ix4	 Articulated Robots Viper
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Direct control of robots from PLC

Omron provides a set of commands with which robots can be controlled directly from sequence programs. These commands were developed based on the same approach used in PLC motion control, allowing users to program SCARA robots and other robots in much the same way as PLC motion control traditionally used in facility development.



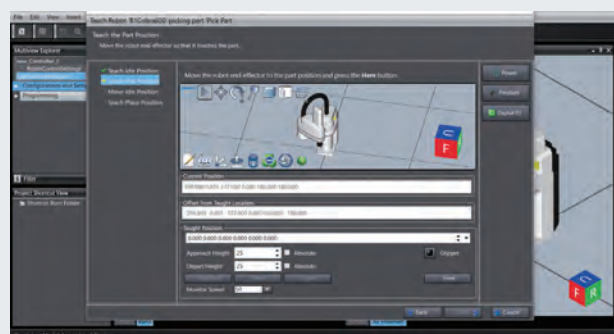
Control methodology that covers all robots

Different robots—including our 4-axis parallel robot (the only*1 and fastest*1 of its kind in the industry)—deployed for their respective purpose in automation can all be controlled from the PLC using a common style of programming.



Application building made easy with application manager

An application manager with vision sensor (the “eyes” of the robot) capabilities allows users to develop robot applications using an automatic wizard-style program generator, enabling easy programming of advanced applications.



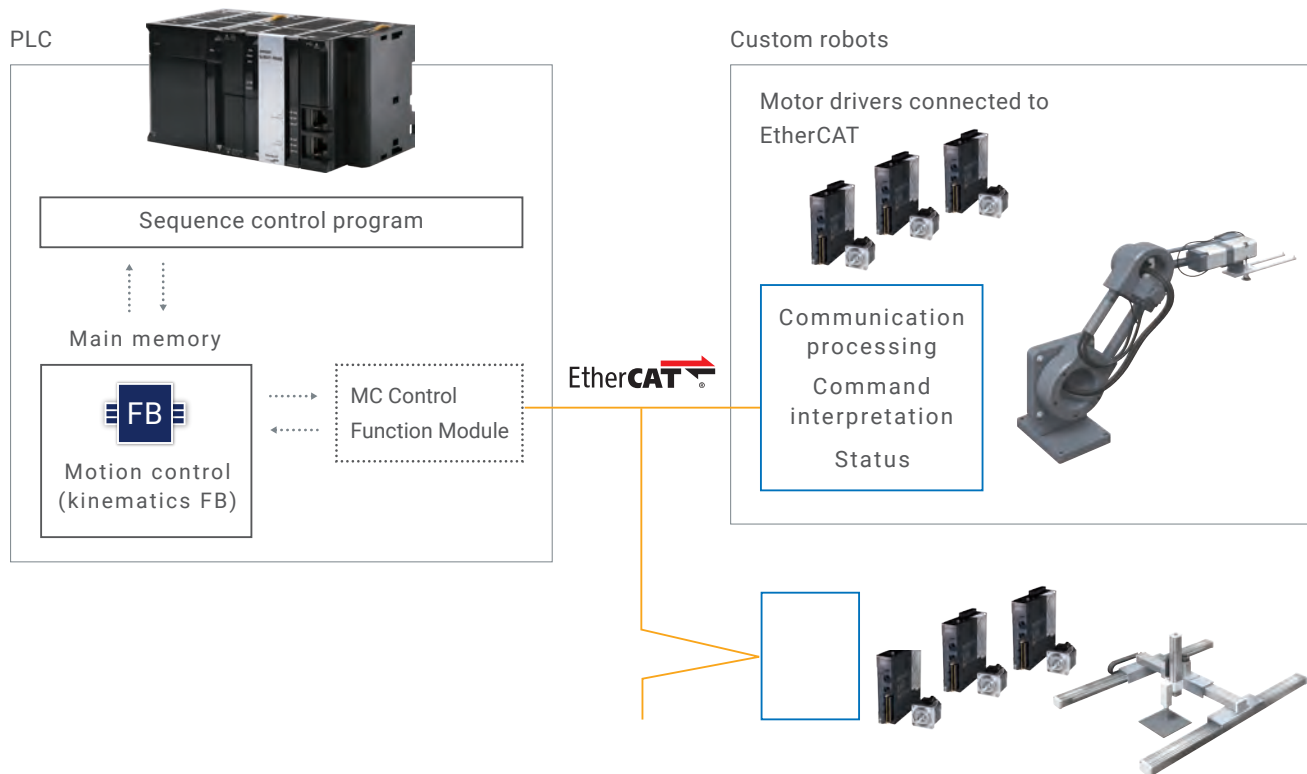
Wizard-style configuration software

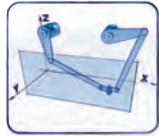
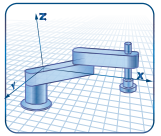
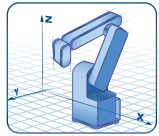
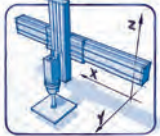
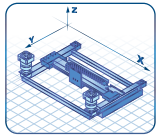
*1. Based on Omron investigation in November 2019

Kinematics

Creating unique, flexible machines through “One Controller” control of custom (in-house-built) robots tailored to your machine size

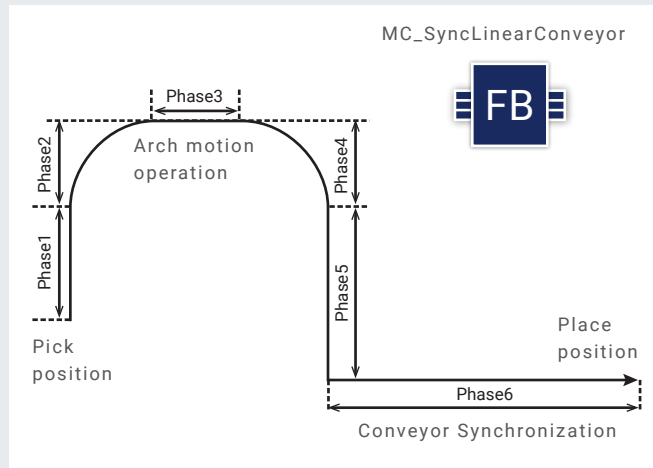
Omron's One Controller approach enables high-speed synchronized control of in-Machine motion and your custom robots, using IEC 61131-3 function blocks.



Custom robot mechanisms	Parallel	• Delta-3 • Delta-3R 	• Delta-2 
	Serial	• SCARA RRP+R • SCARA PRR+R 	• 3-arms 
	Cartesian	• Cartesian 3D • Cartesian 3D Gantry 	• Cartesian 2D (XY) • Cartesian 2D (XZ) • Cartesian 2D (YZ) • Cartesian 2D Gantry • H-Bot XY  

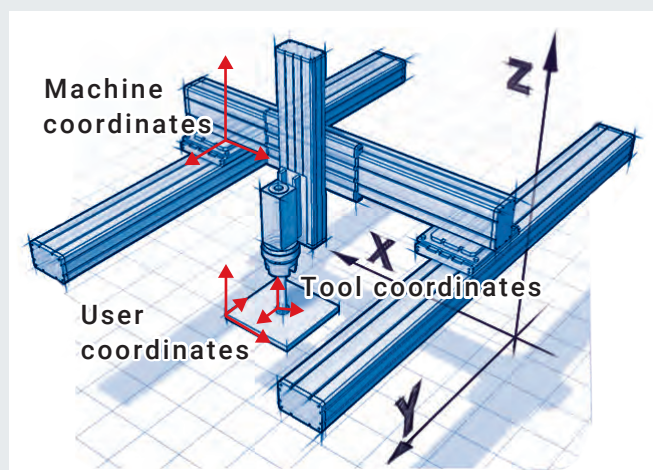
Easy, scalable programming

You can program Pick & Place control systems by using the same program structure in the same programming manner regardless of the robot type: parallel, Cartesian, or SCARA robot. You can also set arch motion settings for Pick & Place with a single command, and make time adjustments and adjustments for vibration suppression. Conveyor tracking is supported as well.



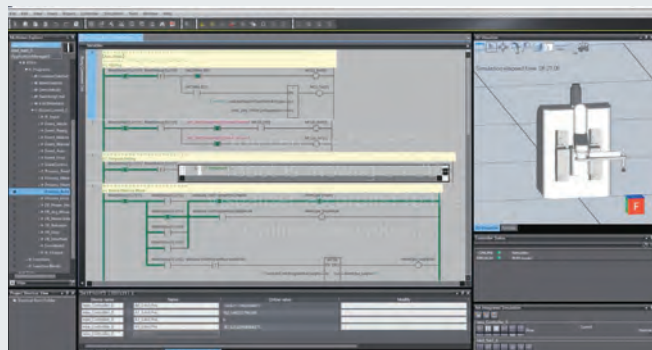
Easy coordinate-based control

The Kinematics function block enables control using coordinate system commonly used in robot control. It automatically converts machine-side motion according to user coordinates, allowing users to easily create readily understandable programs with instructions that directly address workpiece positions.



Integrated simulation for efficient testing

Sysmac Studio's 3D simulations visualize custom robot control in a virtual space. The simulations can be executed in parallel with in-Machine motion control, allowing for efficient debugging of programs for interlocked operation of multiple devices.



Inputs

Maximizing inspection throughput through non-stop inspection

Omron's One Controller approach maximizes inspection throughput by integrating the control of vision sensors and robots. This allows for inspections to be conducted while conveyors are still on the move and enables non-stop multipoint inspections using vision sensors mounted on robots.



Products

Vision System
FH



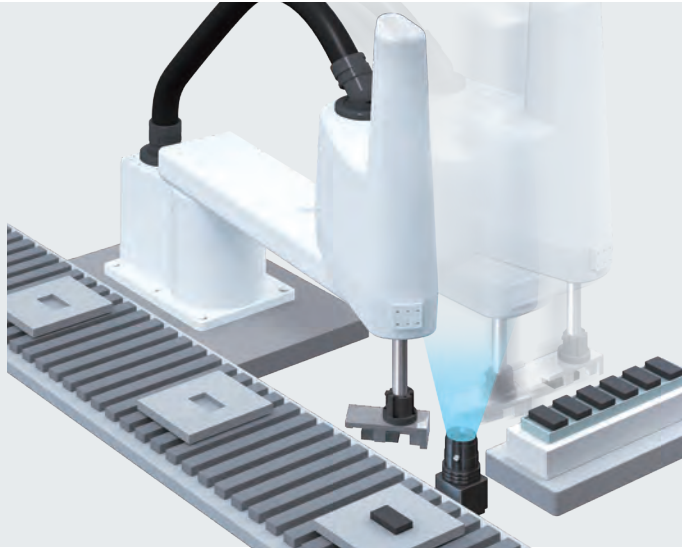
Smart Camera
FHV7



Inspect without stopping (flying trigger technology)

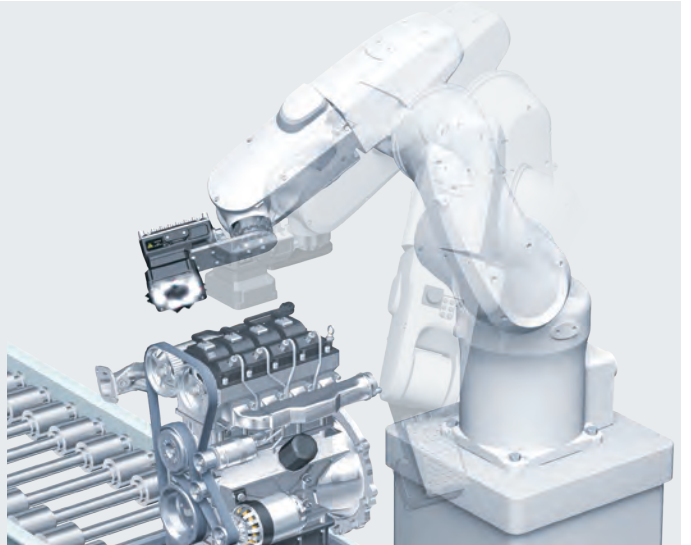
With previous workpiece inspection methods, workpieces had to be paused at the vision sensor position.

Omron's One Controller approach integrates control over the robots' handling of workpieces, image capture by vision sensors, and result judgment to a single controller. This allows for workpieces to be inspected and judged while they are on the move, dramatically reducing inspection time.



Multipoint inspections using robots

The One Controller approach uses EtherCAT to integrate robot location information and vision sensor shutter control to the controller. This enables multipoint inspections to be conducted using a robot mounted with a camera: the robot's location information is used to move its camera to points of inspection, where the shutter of its vision sensor is then released. The robot can keep moving throughout the automated inspection process, without having to pause at points of inspection. This is a big improvement from conventional methods where multiple vision sensors were required and workpieces had to be moved around for inspection, which was much more time and space consuming.



Pick & Place with position correction (high-speed alignment)

Using workpiece position/height information collected via EtherCAT from image and displacement sensors, the controller can send commands to robots in real time to flexibly respond to changes in the positions and heights of workpieces and conveyors.

This framework can be applied to enable accurate Pick & Place operation: vision sensors detect the position where the workpiece was picked up by the robot, and the controller uses this information to correct positioning as needed, without ever having to halt robot operation.



Outputs

Maximizing assembly/machining throughput through high-speed robot-motion control synchronization

Omron's systems deliver streamlined, smooth, and dexterous operation and maximize assembly/machining throughput through advanced, high-speed synchronization and coordination enabled by the integration of robot and motion control.



High-speed
synchronization



Products

AC Servo System
1S



Inverter
MX2-V2



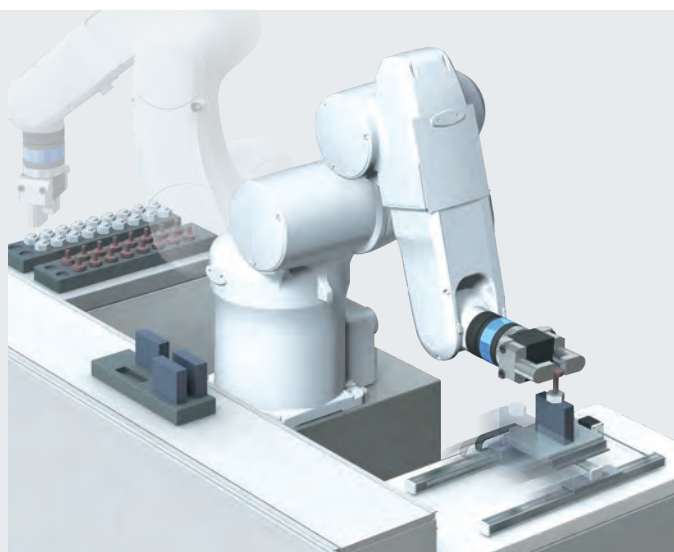
Advanced robot-conveyor synchronization (tracking)

By synchronizing robot control with motion control of peripheral structures, Omron's technology expands the range of robot-conveyor applications beyond conveyor tracking, where workpieces are Picked & Placed while conveyors are in motion, to include more complex schemes, like synchronizing robots with conveyors that accelerate and decelerate for intermittent feeding.



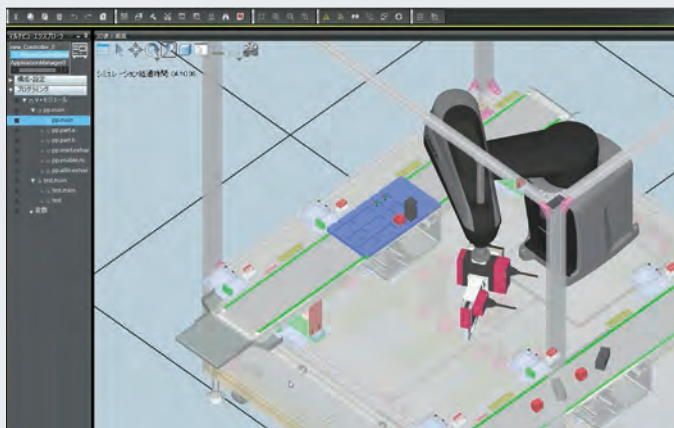
Coordinating robots with peripheral structures

The controller monitors the status of all devices, including peripheral structures and robots, enabling facilities where different machines can work in smooth and streamlined coordination. For example, workpieces may be moved to locations where robots can handle them more easily, and peripheral operations may be predicted to minimize robot idle time.



Automating "virtuoso craftsmanship" through robot and motion control

Motion control and robot control can be integrated and synchronized to enable advanced automation of even complex tasks that require high levels of dexterity. For example, the task of placing workpieces at an optimal angle, something that previously could only be performed by humans, can be automated by adding a motion axis to the end of a robot arm and coordinating its movement with that of the robot.



Safety

Making your robot system both safe and productive

Productivity and safety are essential elements to reliable robot system operation. Omron helps you secure these elements by providing both product and service support.



Products

Safety Light Curtain
F3SG-SR/PG



Safety Control Unit
NX-CSG/SL5/SI/S0



Robust global support for safety standard compliance

Our safety experts, certified by third-party organizations for their knowledge and skill in machine safety based on international standards is stationed at our locations to help you build the applications you need. Please contact your local Omron sales office for details.

Qualification certification example in Japan :



Safety Assessor Qualification Card
Photo provided by Japan
Certification Corporation

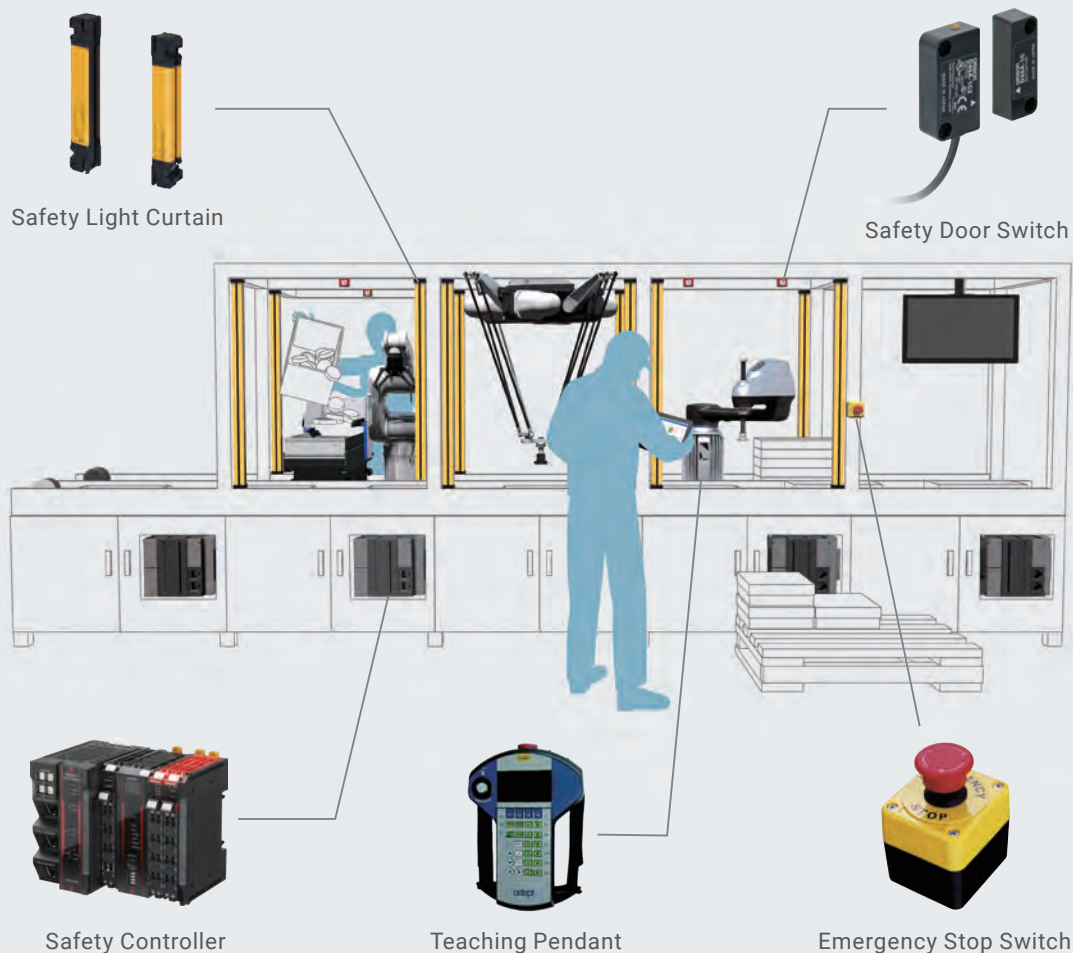


Robot Safety Assessor Qualification Card
Photo provided by Japan
Certification Corporation

Note: The Safety Assessor Qualification System was established by Nippon Electric Control Equipment Industries Association (NECA); and the Robot Safety Assessor Qualification System was established by The Institute of Global Safety Promotion (IGSAP). They are managed by Japan Certification Corporation (JC).

Safety measures to ensure secure, reliable production lines

We offer a wide range of products that help ensure the safety and reliability of your product lines, such as safety controllers for building safety control circuits, and safety light curtains and door switches for securing openings.



Global Support Network

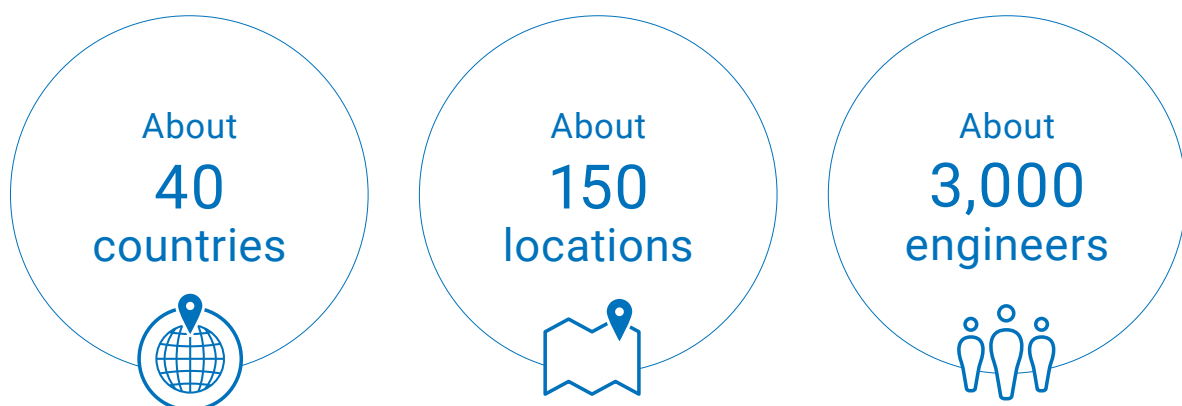
Our AUTOMATION CENTERS help revolutionize your manufacturing

Our AUTOMATION CENTERS allow us to experience, prove, and verify with our customers solutions based on their actual production process and equipment to resolve issues surrounding their manufacturing sites.

We have 35 AUTOMATION CENTER locations across the globe, helping revolutionize manufacturing from locations close to our customers.



Providing you support from locations across the globe





AUTOMATION CENTER

Experience, prove, and verify your solution

Our POC LABs are joint labs where customers can verify and prove solutions to their issues together with Omron in a hands-on environment, and smoothly acquire technical skills required for on-site implementation.

In each lab is a space where customers can bring their workpieces and equipment in for testing. They can work with our technically savvy engineers to conduct demonstration tests, verify different scenarios, and engage in technical implementation training.



POC LAB

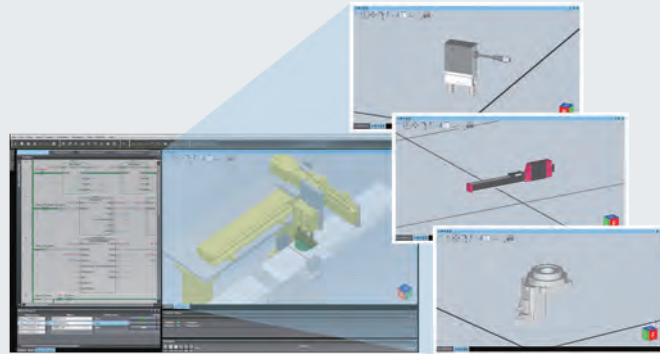
Support Service

A range of support and services

Omron offers 3D simulation samples, videos that demonstrate the advantages of 3D simulations, and other support and services to help you use its robot integrated controllers.

3D simulation samples

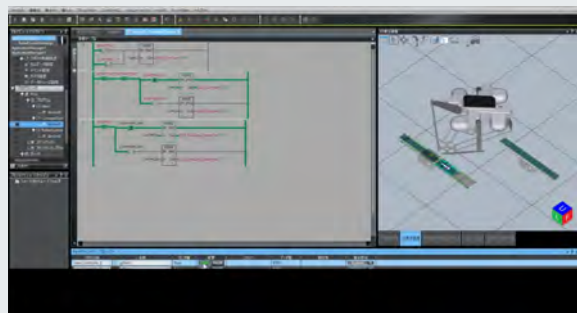
As Sysmac Studio 3D simulation samples, we provide sample mechanical component projects using devices from our partner manufacturers.



https://www.fa.omron.co.jp/product/robotics/lineup/integratedcontroller/featured-products/download/list_e/

Videos demonstrating the advantages of 3D simulation

Omron's 3D simulations deliver faster development and better design quality without the need for CAD software or specialized programs. We offer videos that demonstrate these and other advantages of 3D simulation.



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CSM_3_5

Cat. No. I856-E1-07 1124 (0820)