Sysmac: A fully integrated platform

One connection - One software - One machine controller

FACTORY AUTOMATION
HMI · Programming · DB connection · IT systems

MACHINE CONTROL
Servo · Inverter · I/O · Safety · Vision · Robotics · Sensing

sysmac
always in control

Omron provides tailored solutions

Flexible and integrated production business models

In today's globalized manufacturing environment, diverse and complex challenges arise and need to be overcome. The global market rapidly changes, and manufacturing companies are under increasing pressure to supply products in a timely manner that satisfy a wide variety of consumer needs. Omron industrial automation makes efficient, flexible and cost effective manufacturing possible.

Innovation
- New technology for smart manufacturing
- Collaboration between humans and machines
- Environmentally safe products

Productivity
- Integrated systems for optimized manufacturing
- Production data available in real-time
- In-line quality inspection: zero defects

Flexibility
- Quick product changeovers
- Openness and third party connectivity
- Scalable systems for optimum solutions

Reliability
- Non-stop processes, 24/7 operation
- Extended product lifecycle

Globalization
- Products meet global standards
- Local support for training, repairs and spare-parts supply
- Engineering environment compliance with global standards

✓ Through automation, **Omron** supports the advancement of manufacturing and contributes to a sustainable society by providing environmentally safe products
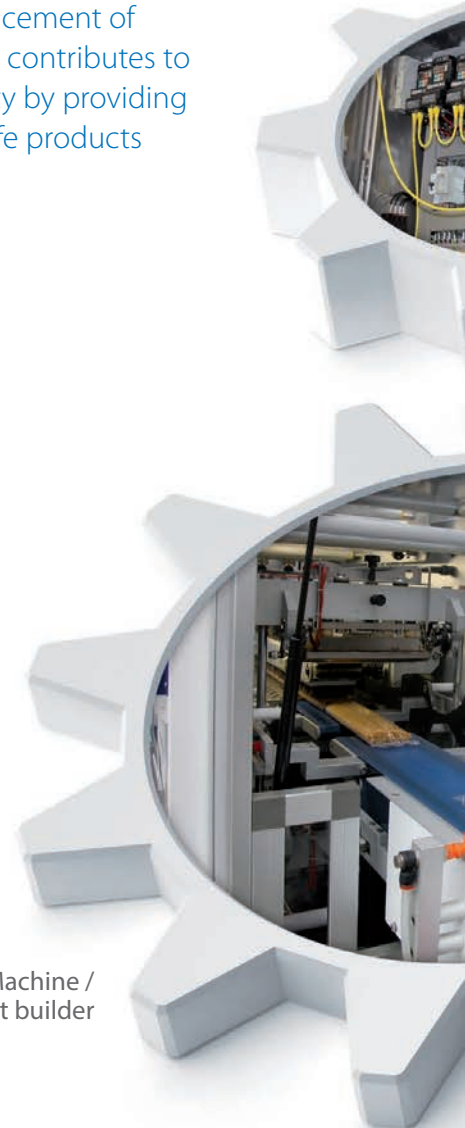
Machine /
Equipment builder

The **Sysmac** technology platform ensures a flexible and integrated production business model

Manufacturer

Panel builder / System integrator

sysmac
always in control

Parts manufacturer

Sysmac: A fully integrated platform

Integration and Functionality

Sysmac is an integrated automation platform dedicated to providing complete control and management of your automation plant. At the core of this platform, the Machine Controller series offers synchronous control of all machine devices and advanced functionality such as motion, robotics and database connectivity. This multidisciplinary concept allows you to simplify solution architecture, reduce programming and optimize productivity.

☑ One Machine Controller

Complete integration of motion and logic sequence

FACTORY AUTOMATION

MACHINE CONTROL

Machine Automation Controller /
Industrial PC with Sysmac Machine Control

⚙ Motion

Filling line

⚠ Safety

Assembly

- Motion Control: Integrated within the IDE, and operating in real-time
- Standard PLCopen Function Blocks plus Omron generated motion FB's
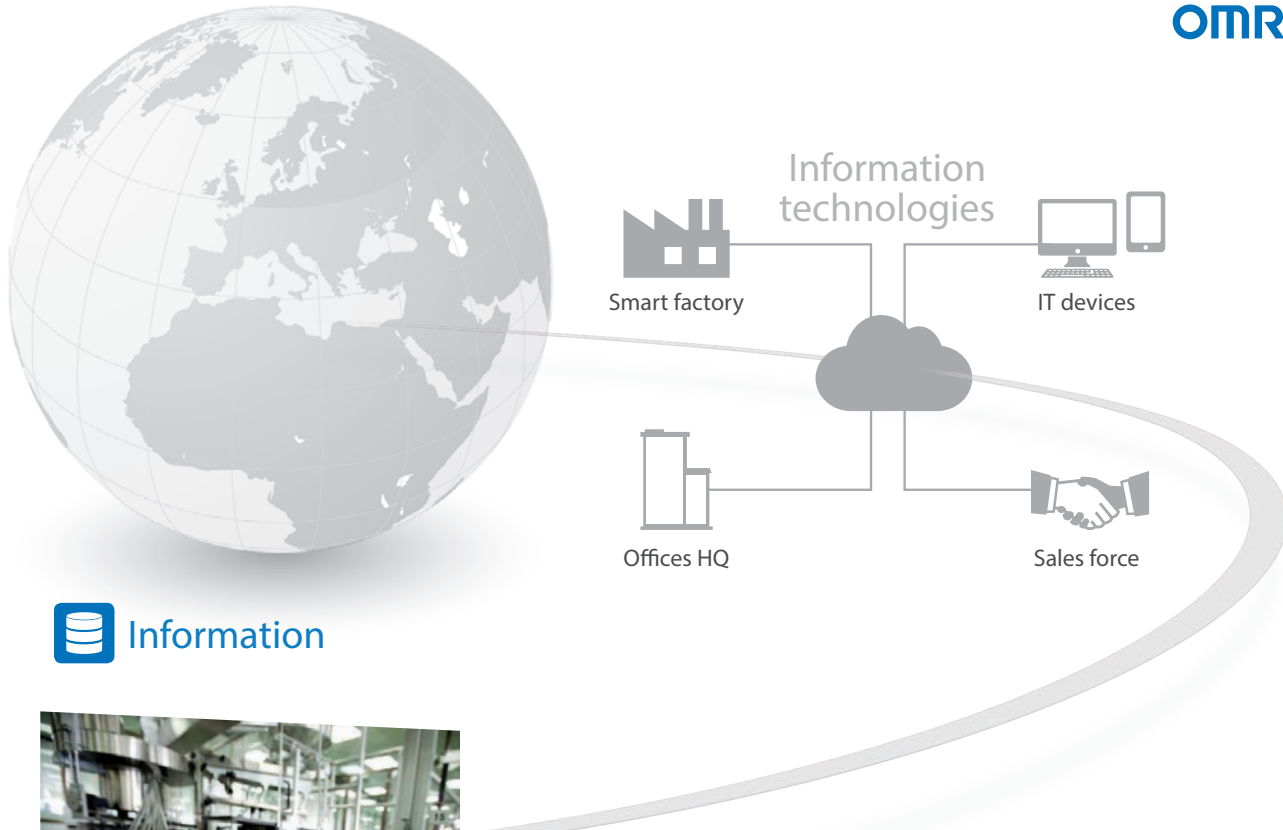- Direct Synchronous control for Position, Speed and Torque

- The simplest way to integrate safety improves productivity and safety
- The PLCopen® safety FB's simplify and accelerate the development process

☑ One Integrated Development Environment software for Configuration, Programming, Simulation and Monitoring

Information technologies

Smart factory

IT devices

Offices HQ

Sales force

Information

Pills blister packing

· Sysmac communicates in real-time with Databases such as SQL
· Secure Data: In the event of a server going down or losing communications, data is automatically stored in internal memory
· Sysmac operates with Databases at high speed [1000 table element/ 100 ms] ensuring realistic Big Data Processing to improve productivity and aid predictive maintenance etc.

☑ **Integrated Automation Control:**
The Sysmac platform is scalable and provides the performance and functionality for a wide range of solutions from simple machines through to manufacturing cells
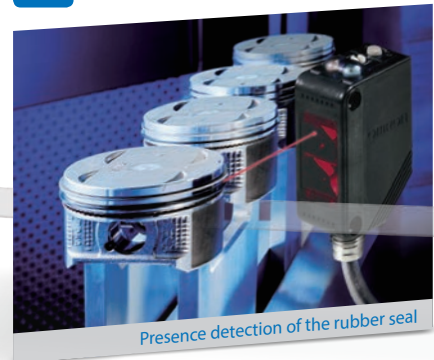
Vision

Quality inspection

· Higher resolution images available without increasing the vision processing time
· Shape search technology: Provides more stable and accurate object detection for Pick & Place projects

Robot

Pick & Place

· One controller integrates two different types of engines, one based on cyclic scanning (PLC feature) and another based on procedural programming (robot feature), providing direct control of robots
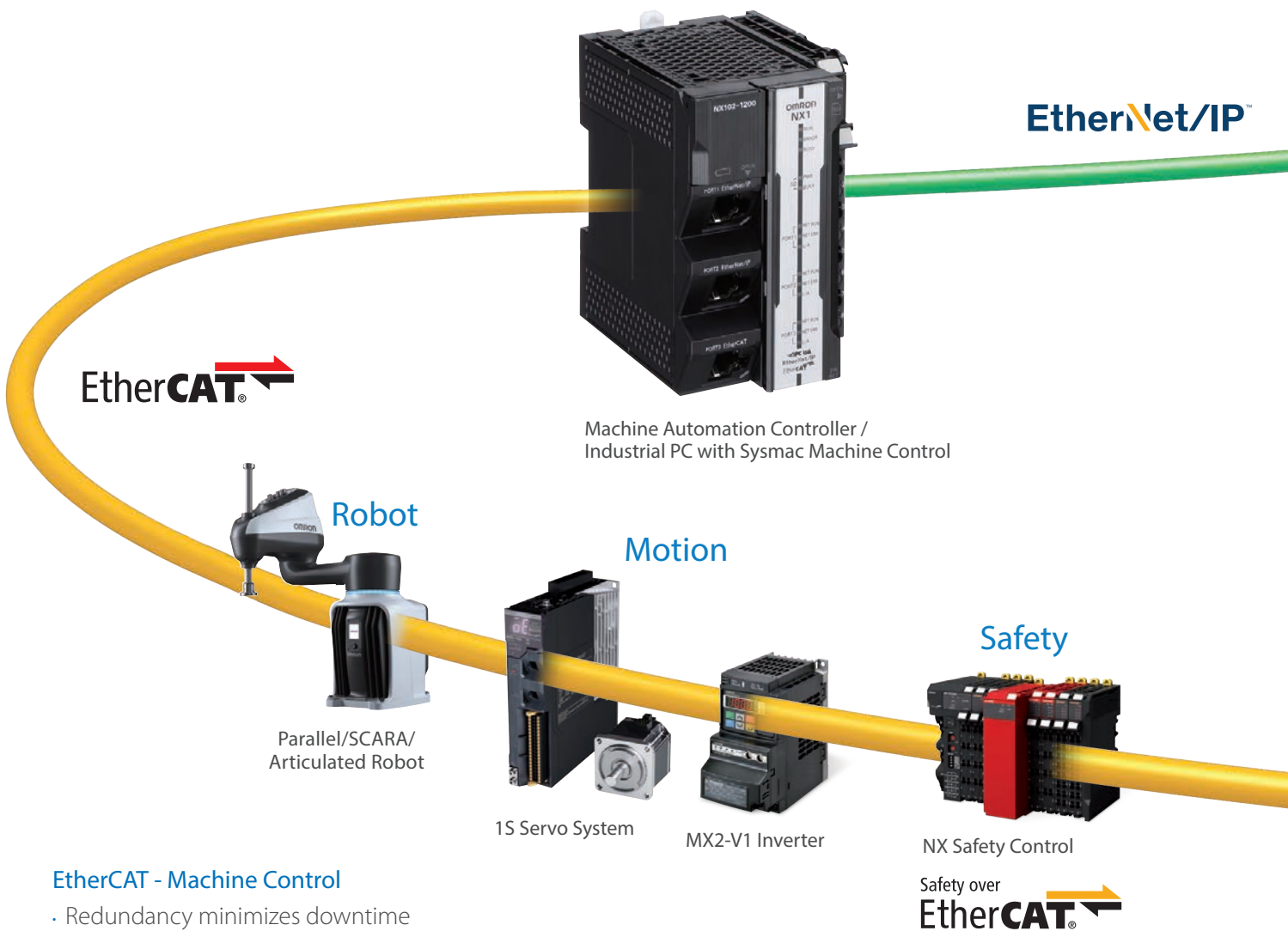
Sensing

Presence detection of the rubber seal

· Full control of the process parameter setting and predictive maintenance functions
· High precision detection and positioning data synchronized on the network
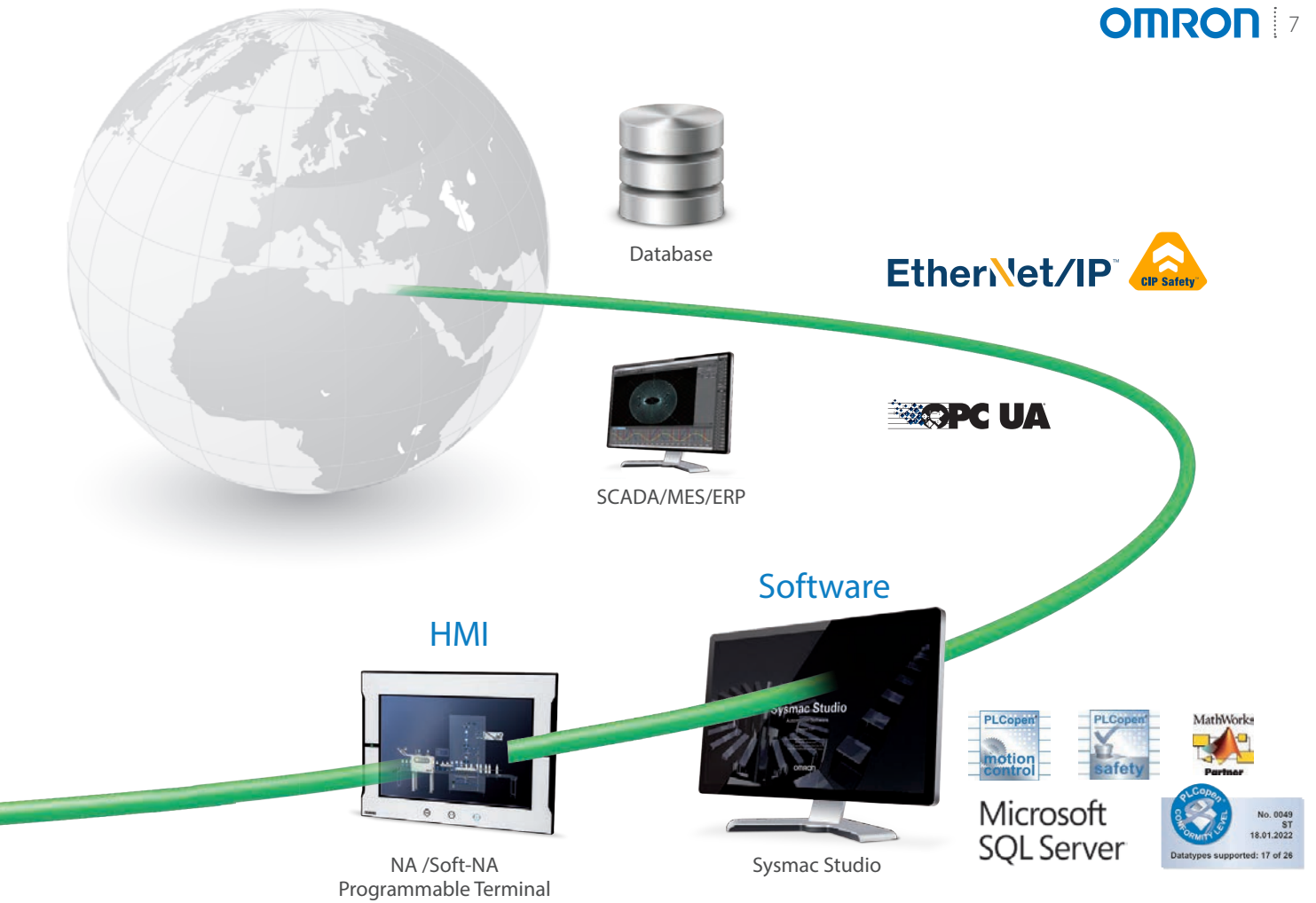
One Connection

Seamless machine control and factory automation

One machine control through one connection and one software is how we define the Sysmac automation platform. The Machine Automation Controller 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 machine controller comes standard with built-in EtherCAT and EtherNet/IP. The two networks with one connection purpose and integrated safety are the perfect match between fast real time machine control and data plant management.

EtherNet/IP™

EtherCAT.

Machine Automation Controller /
Industrial PC with Sysmac Machine Control

Robot

Motion

Safety

Parallel/SCARA/
Articulated Robot

1S Servo System

MX2-V1 Inverter

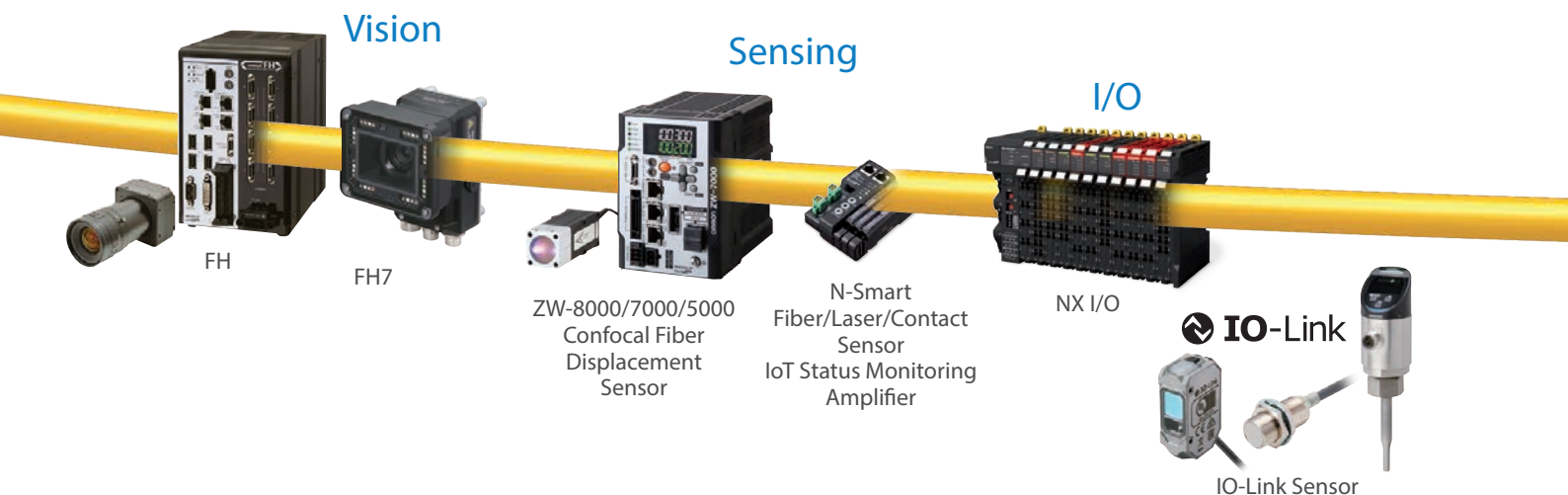NX Safety Control

Safety over
EtherCAT.

EtherCAT - Machine Control

- Redundancy minimizes downtime
- Flexible system configuration using a variety of slaves
- Fast and precise: Fastest cycle time of 125 μs, synchronization with 1 μs jitter
- 512 slaves
- Embedded in Omron servo drive, inverter, I/O, Safety, Vision and Sensing
- Uses standard STP Ethernet cable with RJ45 connectors
- One connection using Safety over EtherCAT (FSoE) protocol

Database

EtherNet/IP CIP Safety

SCADA/MES/ERP

OPC UA

Software

HMI

NA /Soft-NA
Programmable Terminal

Sysmac Studio

PLCopen motion control

PLCopen safety

MathWorks Partner

Microsoft SQL Server

No. 0049 ST 18.01.2022
Datatypes supported: 17 of 26

Ethernet - Factory Automation
- Peer-to-Peer controller communication
- Interface with Sysmac Studio , NA HMI or SCADA software
- Database connection for Microsoft SQL Server, Oracle, IBM DB2, MySQL and Firebird
- FTP server
- Safety integrated via CIP Safety
- Secure cloud connection by MQTTS communication

Vision

Sensing

I/O

FH

FH7

ZW-8000/7000/5000
Confocal Fiber
Displacement
Sensor

N-Smart
Fiber/Laser/Contact
Sensor
IoT Status Monitoring
Amplifier

NX I/O

IO-Link

IO-Link Sensor

One Software
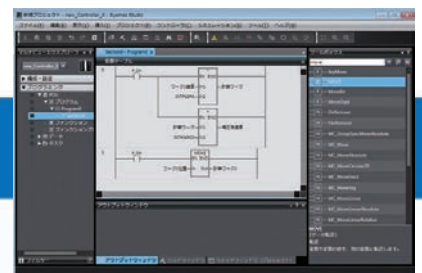
One Integrated Development Environment Software

Created to give you complete control over your automation system, Sysmac Studio integrates configuration, programming and monitoring. Graphics-oriented configuration allows quick set-up of the controller, field devices and networks while machine, motion, and safety programming based on IEC standard and PLCopen® Function Blocks for Motion Control and Safety cuts programming time. Smart Editor with On-line debugging helps quick and error free programming. Advanced simulation of sequence and motion control, and data trace reduce machine tuning and set-up.

EtherNet/IP

EtherCAT

Sysmac Studio

Design

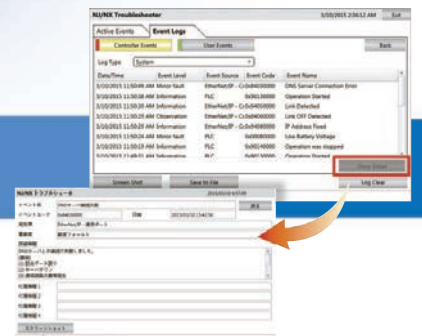### Reusable programs

Programming with variables

One Integrated Development Environment software Sysmac Studio is fully compliant with the open standard IEC 61131-3. Programming with variables eliminates the need to learn the internal memory map of the PLC and allows the programs to be reused.

Maintenance

Highly efficient maintenance

Troubleshooting

Troubleshooting in the Sysmac Studio and NA Programmable Terminal can manage errors across the entire system including the controller. You can check details of errors and solutions without reading manuals.

*1. This function can be used by applying the Team Development Option to Sysmac Studio version 1.20 or higher.
    Project version control function is supported by CPU Unit version 1.16 or later.
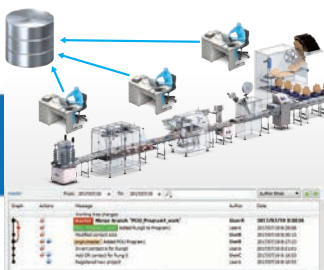*2. Available with the Sysmac Studio 64-bit version. 3D CAD data supports STEP/IGES.

Collection of software functional components
Sysmac Library

Packed with Omron's rich technical know-how, the Function Blocks in the Sysmac Library for advanced applications and motion control cut programming time.

Development by multiple developers

For advanced machine control

Efficient designing linked to electrical CAD

| Project version control function*1

| Motion programming

| Model-Based design

| AutomationML import function   *NEW*

Electrical CAD

Data link

When you develop a project at the same time as your colleagues, the Sysmac Studio combined with the version control system (Git™) merges changes automatically and resolves conflicting changes. This makes merging easier and faster. You can even revert to the previous revision after graphically comparing the current project with a previous one.
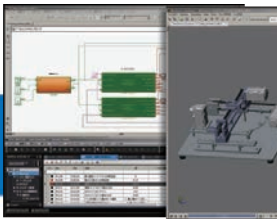
Advanced motion control applications can be created quickly just by combining PLCopen® Function Blocks for Motion Control.
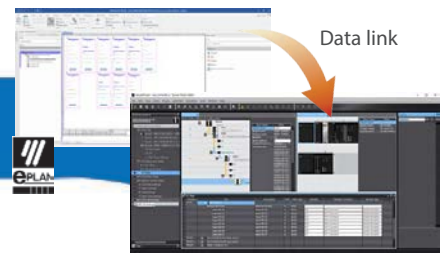
Complex feedback control that is designed with MATLAB®/Simulink® can be imported into programs.

MathWorks
Partner

Circuit diagrams designed using electrical CAD data (e.g., unit configurations and signal lines) can be imported to the Sysmac Studio and automatically reflected in unit configurations and settings and allocated variables. Seamless and accurate setup using electrical CAD design data speeds up the engineering process and improves design efficiency.
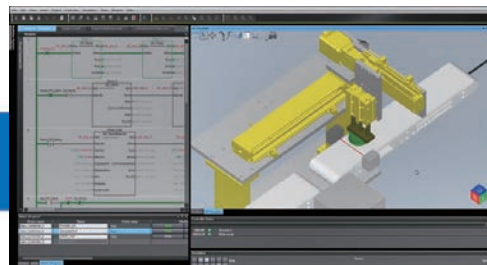
ePLAN

Verifification

Fast system debugging

| Remote maintenance

| Virtual mechanical debugging

Enhanced by 3D simulation option*2

Movement of the machine connected online can be displayed on the CAD in real time, and movement can also be reproduced from the trace data. Maintenance and troubleshooting can be performed in remote locations.

Use only the Sysmac Studio with loaded 3D CAD data*2 for 3D simulations.Operation of a control program can be verified in a virtual environment, improving program accuracy during design and reducing rework during verification using physical devices.

For more information, see the video:
www.fa.omron.co.jp/3d-simulation_e

Debugging in conjunction with a third-party simulator is possible.
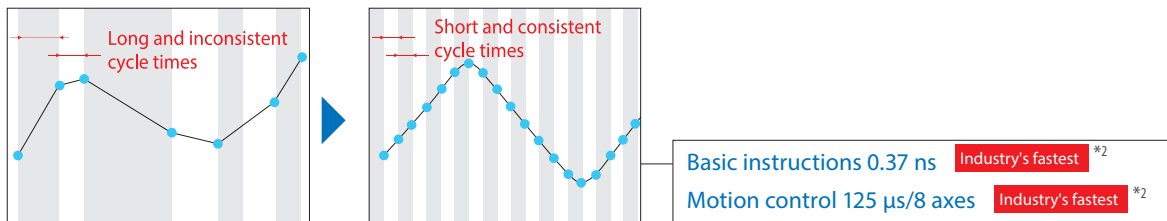
LATTICE TECHNOLOGY
VMECH

One Machine Controller
NJ/NX/NY Machine Automation Controller

Powerful, yet easy to configure

The NJ/NX/NY Controller is at the heart of the Sysmac platform. One integrated controller is designed to meet extreme requirements in terms of logic sequence and motion control speed and accuracy. Standard programming and open networks make it easy to build your automation system.

High-speed, high-precision control[*1]

Architecture based on Intel® Core™ processor significantly speeds up the execution of instructions (basic instructions 0.37 ns, math instructions for Long Real Data 3.2 ns). Command values to send to servomotors and stepper motors can be updated as fast as every 125 μs. This enables smooth cam motion and high-precision interpolation and phase adjustment between axes.

Long and inconsistent cycle times

Short and consistent cycle times

Basic instructions 0.37 ns   Industry's fastest [*2]

Motion control 125 μs/8 axes   Industry's fastest [*2]

Complete integration of motion and logic

One controller integrates logic, motion, vision and information for complete control and management of machines. Position, displacement, and tension information collected from sensors can be quickly and easily fed back to the motion control.
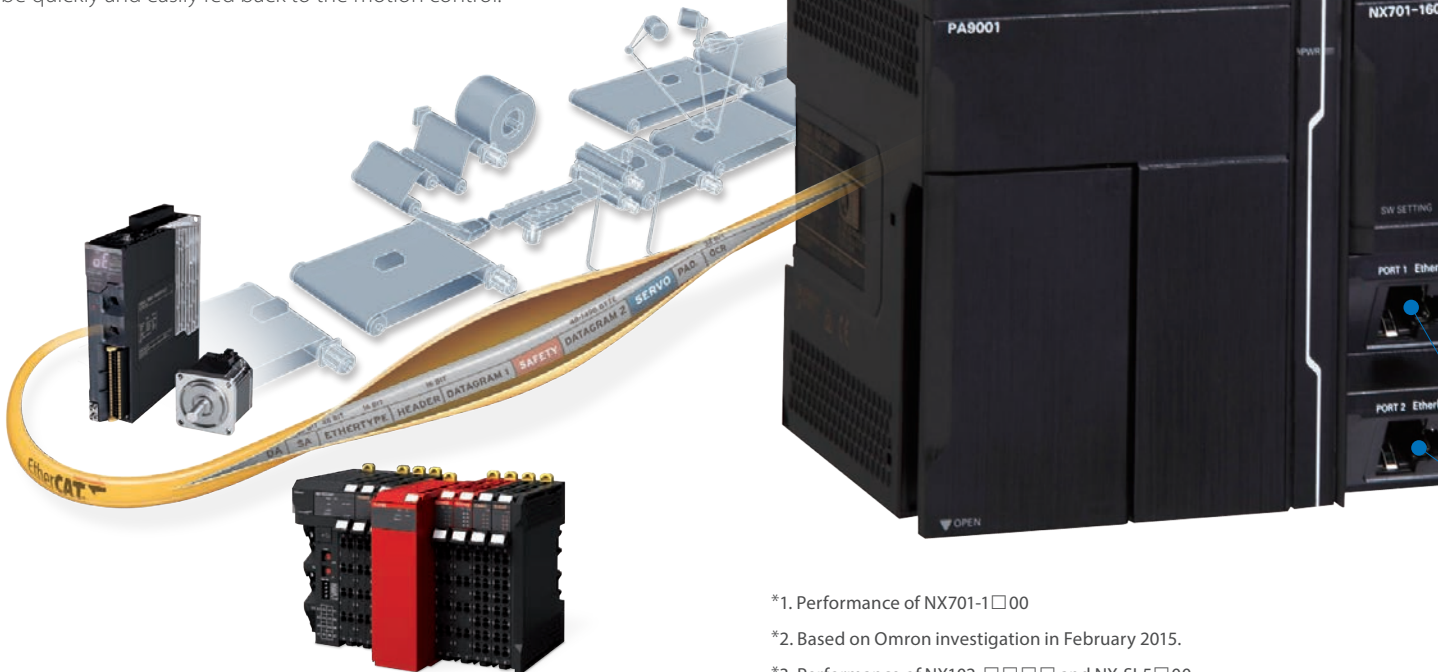
Integrated safety into machine control[*3]

The controller integrates safety control into machine control in lines that require fast cycle times. It also integrates two different open networks: EtherNet/IP for safety control in production lines and EtherCAT for safety control in machines.

*1. Performance of NX701-1☐00

*2. Based on Omron investigation in February 2015.

*3. Performance of NX102-☐☐☐☐ and NX-SL5☐00

*4. Database connection CPU unit:
    NX102-☐☐20/NJ☐01-☐☐20

*5. Performance of NX701-1☐☐☐/NX102-☐☐☐☐/NJ501-1☐00

*6. Performance of NX102-☐☐☐☐/NX1P2-☐☐☐☐

*7. Performance of NX102-☐☐☐☐

Fast machine data storage in database*4

The controller connects directly to a database without the need for a gateway. The special instructions allow easy access to the database.
Real-time data collection enables productivity improvement, predictive maintenance, and quality traceability.

Secure host connection

OPC UA is an IEC communication protocol which is listed as a recommendation for Industrie 4.0 and PackML. The controller comes equipped with an OPC UA server interface and provides a secure connection to IT systems such as MES and ERP.*5
The controllers provides a easily and secure connection to the cloud by using MQTT Communications Library.*6

Supported database
- Microsoft SQL server
- Oracle Database
- IBM DB2
- MySQL
- PostgreSQL
- Firebird

Standard programming
· Fully conforms with IEC 61131-3 standards
· PLCopen Function Blocks for Motion Control

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18.01.2022
Datatypes supported: 17 of 26

Global standard networks

EtherCAT
Standard Machine Network

Safety over EtherCAT

EtherNet/IP
Standard Factory Network

CIP Safety *7

Collection of software functional components
Sysmac Library
- FB library option for advanced applications
  (vibration suppression, temperature control, motion control...)
- High quality products with reliable global support

Sysmac Library

Drive machine innovation by increasing speed

Case 1: High-speed alignment and vibration-free handling

Problems

1. Precisely stacking many sheets increases cycle time because retries caused by mechanical errors increase positioning time.

2. Vibration settling time is required when high-speed handling is stopped. Speed must be reduced to suppress vibration.

1. High-speed, high-precision alignment system

The FH Vision System provides the Shape Search function for fast and accurate shape recognition and Visual Feedback that feeds back the current position to control the motor in every measurement cycle. These increase alignment speed without sacrificing accuracy.
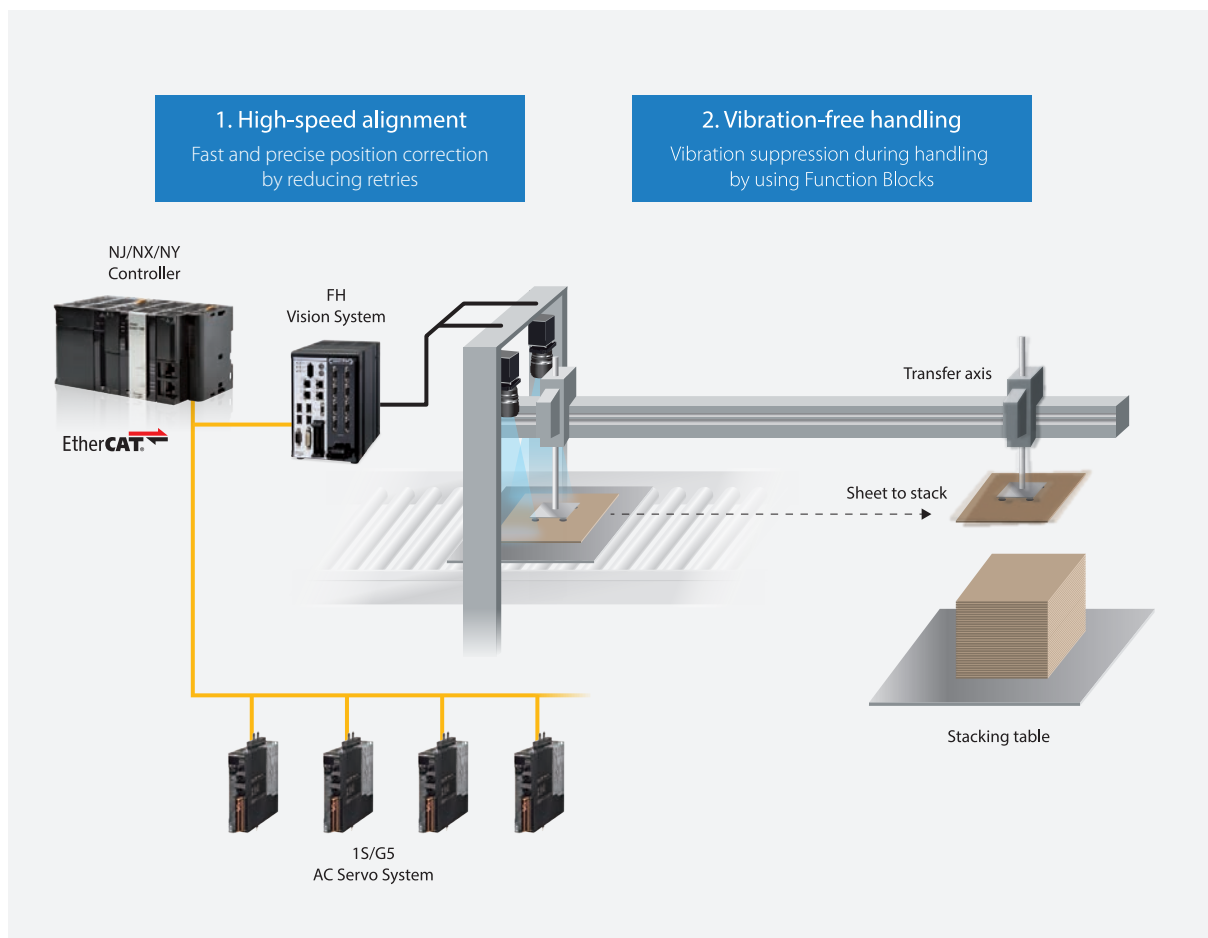
Visual Feedback Alignment Library

2. Software functional components for vibration suppression

The Vibration Suppression Library facilitate programming for high-speed handling while suppressing vibration. Waiting time is reduced, and positional accuracy is increased.

Vibration Suppression Library

1. High-speed alignment
Fast and precise position correction by reducing retries

2. Vibration-free handling
Vibration suppression during handling by using Function Blocks

NJ/NX/NY Controller

FH Vision System

EtherCAT

Transfer axis

Sheet to stack

Stacking table

1S/G5 AC Servo System

and precision and maximizing uptime

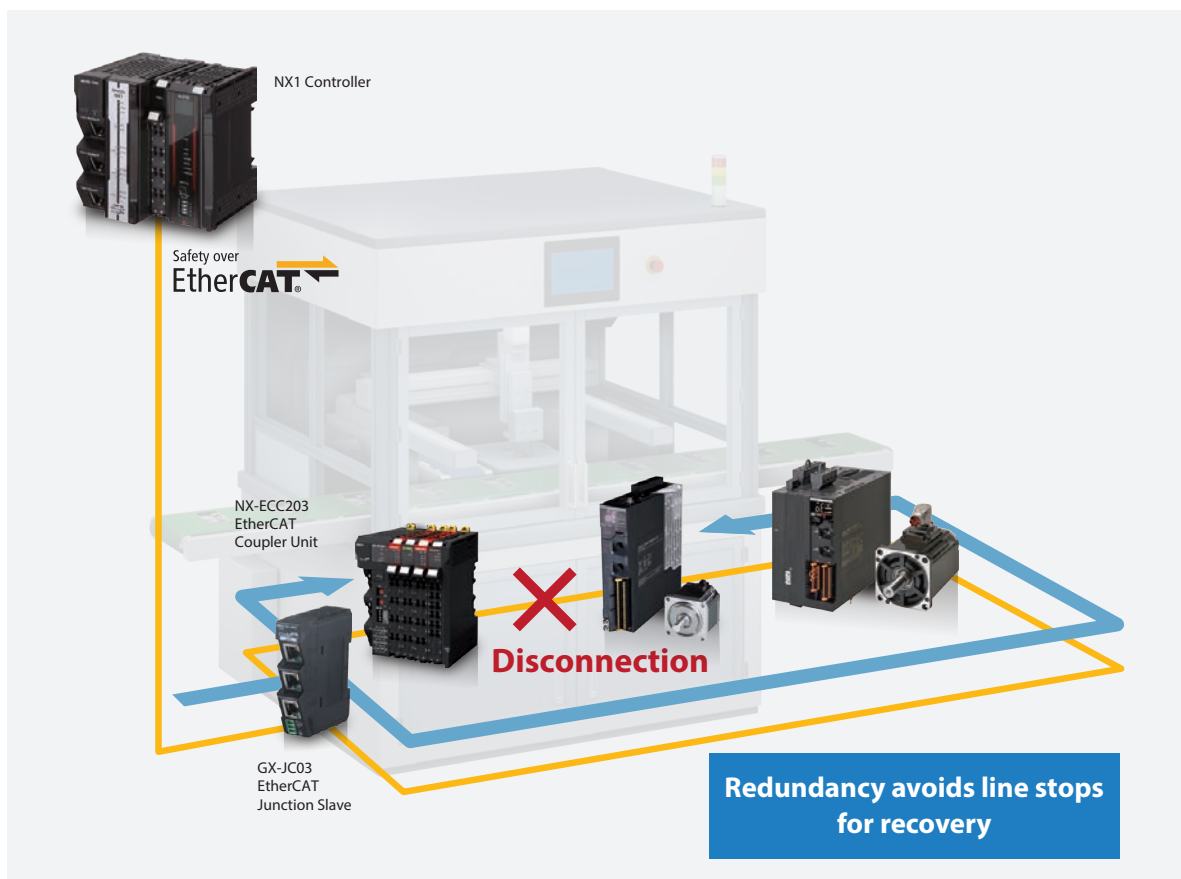## Case 2 : Redundancy minimizes downtime

Problems

1. It takes time to recover from an unexpected production line stop, significantly reducing uptime.
2. The safety system stops the entire line due to disconnection or other causes even when there is no danger.

Cable Redundancy

Even if a part of the EtherCAT network is disconnected, Cable Redundancy provides continuous connectivity. This function allows you to fix disconnection without stopping the machines and production line where one controller provides both machine and safety control.

The line stops only when operators are in danger, which ensures safety.

NX1 Controller

Safety over
EtherCAT.

NX-ECC203
EtherCAT
Coupler Unit

✕
Disconnection

GX-JC03
EtherCAT
Junction Slave

Redundancy avoids line stops for recovery

Sysmac Family
Controller

NX1
Machine Automation Controller CPU Unit

Compact size controller integrates production line and IT systems

Improve productivity, improve your business

The NX1 can utilize information, take safety measures, and control quality while at the same time improving production efficiency through high-speed, high-precision control.

Fulfilling functions in compact size

Three industrial Ethernet ports and a power supply are housed in a compact design with a width of 66 mm.The multicore microprocessor and OPC UA connectivity enable information utilization without compromising control performance.
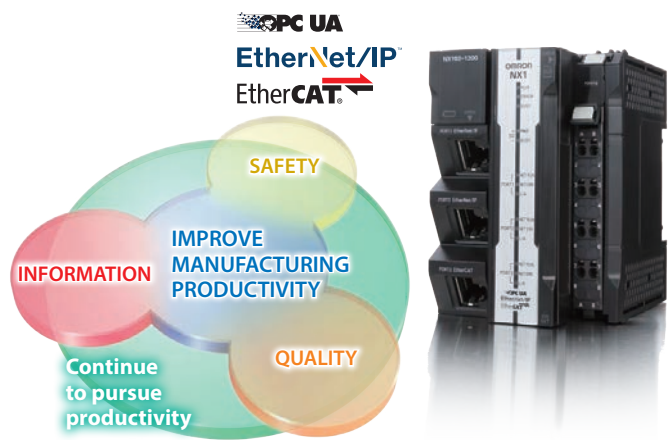
Robot Integrated CPU Unit
NJ501-R@@@

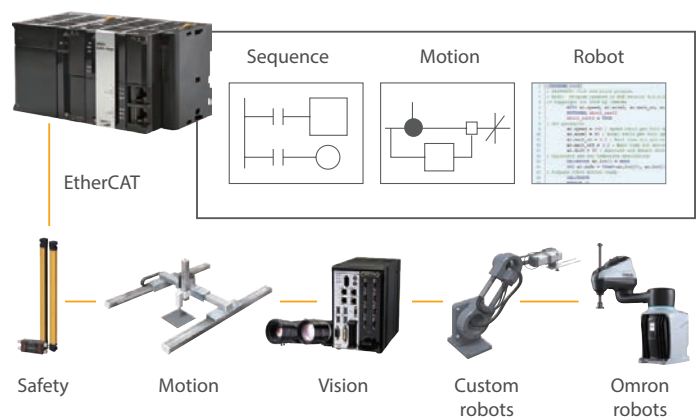Integration of logic, motion, Omron Robot and kinematics in one CPU

Industry first*:

Integrated control of different engines

Omron is the first in the industry* 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.

Collection of truly useful data

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.

Robot integrated
CPU unit NJ501-R

EtherCAT

Sequence   Motion   Robot

Safety   Motion   Vision   Custom robots   Omron robots

* Based on Omron investigation in November 2019

Lineup

Series	NX Series			NJ Series			
Model	NX1P2-□□□□	NX102-□□□□	NX701-□□□□	NJ101-□□□□	NJ101-□□20	NJ301-□□□□	NJ501-□□□□
Feature	Motion control and built-in I/O	Compact controller with up to 8 axes motion control	For large-scale control with up to 256 axes	For simple machines		For small-scale control with up to 8 axes	For large-scale control with up to 64 axes
Appearance							
Instruction execution times (LD instruction)	3.3 ns	3.3 ns	0.37ns	3.0 ns		1.6 ns	1.1 ns
Program capacity	1.5 MB	5 MB	80MB	3 MB		5 MB	20 MB
Variables capacity (No retain attribute)	2 MB	32 MB	256MB	2 MB		2 MB	4 MB
I/O capacity	40 points	—	—	2,560 points		2,560 points	2,560 points
Number of EtherCAT slaves	16	64	512	64		192	192
Number of motion axes	0, 2, 4	0, 2, 4, 8	128, 256	0, 2		4, 8	16, 32, 64
Functions	—	Database connection (NX102-□□20)	Database connection (NX701-1□20)	—	Database connection	—	—
Detailed specification Catalog	P116	P130	P141	P140			

Series	NJ Series					NY Series	
Model	NJ501-R□□□	NJ501-4□□□	NJ501-1□20	NJ501-1340	NJ501-5300	NY51□-1	NY53□-1
Feature	For large-scale control with up to 64 axes					Perfect integration: Sysmac machine control and ICT	
Appearance							
Instruction execution times (LD instruction)	1.1 ns					0.33 ns	
Program capacity	20 MB					40 MB	
Variables capacity (No retain attribute)	4 MB					64 MB	
I/O capacity	2,560 points					—	
Number of EtherCAT slaves	192					192	
Number of motion axes	16, 32, 64			16		16, 32, 64	
Functions	Kinematics control	Kinematics control	Database connection	SECS/GEM communication	Numerical control (NC)	—	—
Detailed specification Catalog	P140					P118	

Sysmac Family
Software

SYSMAC-SE2□□□
Automation Software Sysmac Studio

One software for programming, configuration, simulation and monitoring

· One software for motion, logic sequence, safety,
  motion, vision and visualization
· Fully compliant with open standard IEC 61131-3
· Supports Ladder, Structured Text, and Function
  Block programming with a rich instruction set
· Advanced security function with 32 digit security
  password

SYSMAC-XR□□□
Sysmac Library

Omron's control expertise changes programming

· Advanced control such as vibration suppression
  and temperature control
· High-precision control of packaging machines
  and actuators for servo presses
· Productivity improvement by monitoring device
  operations and restoring parameters
· Reduction in programming time

Lineup

Series	Automation Software Sysmac Studio	Collection of software functional components Sysmac Library
Model	SYSMAC-SE2☐☐	SYSMAC-XR☐☐☐
Appearance		
DVD	32-bit DVD [Supporting OS] Windows 7 (32/64-bit)/8.1 (32/64-bit)/10 (32/64-bit)/11 (64-bit) 64-bit DVD [Supporting OS] Windows 10 (64-bit)/11 (64-bit)	Download from http://www.ia.omron.com/sysmac_library/
License type / Library type	[Licenses for Editions] Standard Edition Vision Edition Measurement Sensor Edition NX-I/O Edition Drive Edition Safety Edition [Licenses for Options] Team Development Option 3D Simulation Option	MC Test Run Library MC Command Table Library MC Tool Box Library EtherCAT G5 Series Library EtherCAT N-Smart Series Library Vibration Suppression Library Temperature Control Library Device Operation Monitor Library Adept Robot Control Library Weighing Control Library EtherCAT 1S Series Library Packaging Machine Library Servo Press Library Dimension Measurement Library Safety System Monitor Library High-Speed Analog Inspection Library SLMP Communications Library Visual Feedback Alignment Library MQTT Communications Library
Detailed specification	Refer to your OMRON website.	

Sysmac Family
HMI

NA
Programmable Terminal

Make industrial machines more attractive and competitive by bringing technology to life

As part of the Sysmac automation platform, NA transforms machine data into information, shows information and controls devices based on requirements at FA manufacturing sites.

· One connection: Connectable with Sysmac products
· One software: The machine interface brings you a clear view in one integrated project.
· Rich media provide an intuitive and proactive machine management tool
· More than 16 million display colors (24-bit full color)

NX-I/O
NX Safety

FH
Vision System

1S
AC Servo System

NJ/NX/NY
Controller

IAG – Intelligent Application Gadgets
The graphics collection accelerates the development process.
You can make your own collections and share them between projects.

Lineup

Series	NA Series			
Feature	More than 16 million color (24 bit full color) and wide screen for all models			
Appearance				
Display device	TFT LCD			
Screen size	15.4-inch widescreen	12.1-inch widescreen	9.0-inch widescreen	7.0-inch widescreen
Number of dots (horizontal × vertical)	WXGA 1,280×800 dots		WVGA 800×480 dots	
Colors	16,770,000 colors (24 bit full colors)			
Built-in ports	2 Ethernet ports, 2 USB host ports, 1 USB slave port			
Allowable power supply voltage range	19.2 to 28.8 VDC			
Degree of protection	Front-panel controls: IP65 oil-proof type			
Memory card	SD/SDHC memory card			
Flame colors	Black, silver			
Detailed specification — Catalog	V457			

Series	Soft-NA
Feature	NA functions work on Windows
OS	Windows 10 Pro Version 1903 or later 64 bit
Processor	Intel Atom® x5-E3940 equivalent or higher processor
RAM	4 GB or more
Optical disk drive	DVD-ROM drive
Detailed specification — Catalog	V457

Sysmac Family
Motion

1S Series with Safety Functionality
R88M-1A□/R88D-1SAN□-ECT

Higher Productivity and Safer Environment

Quick Installation : One Cable
· Power, encoder and brake in one pre-assembled cable with IP67 connector
· Pluggable connectors for easy pre-wiring and system maintenance
· Fast and secure screw-less push-in in all connectors

20 bit high resolution encoder
· No battery, no maintenance and compact size

Time Reduction: Integrated Programming and Testing
· Auto definition of I/F variables
· Motion safety function blocks
· Graphical GUI
· Integrated Data Trace

High adaptability for machine safety
· 8 safety functions according to SIL3/PLe
(STO, SS1, SS2,SOS, SLS, SLP, SDI, SBC)
· Safety-over-EtherCAT (FsoE)

EtherCAT.   Safety over EtherCAT.

R88M-1□/R88D-1SN□-ECT
1S AC Servo System

Improved machine design. Increased machine productivity

Optimized installation and commissioning tasks
· Cabinet size reduction: Compact servo drive with same height
  throughout the whole power range
· Fast and secure screw-less push-in in control I/O connector and
  brake interlock connector

23 bit high resolution encoder
· No battery, no maintenance and compact size

Multi-axis setup and tuning
· Configure and monitor multiple axes in one view
· Easy & fast parameter transfer among axes in the machine
  (up to 256 axes)
· Comprehensive gain tuning

Safety control via EtherCAT
· EN ISO 13849-1(Cat.3 PLd)
· EN61508(SIL2), EN62061(SIL2)
· EN61800-5-2(STO)

EtherCAT.   Safety over EtherCAT.

Lineup

Series	1S Series with Safety Functionality	1S Series	
Model	R88M-1A□/R88D-1SAN□-ECT	R88M-1A□/R88D-1SAN□-ECT	
Appearance			
Type	Built-in EtherCAT Communications	Built-in EtherCAT Communications	
Linear Type	No	No	
100 VAC Applicable motor capacity/force	No	50 W to 400 W	
200 VAC Applicable motor capacity/force	200 W to 2.7 kW	50 W to 15 kW	
400 VAC Applicable motor capacity/force	750 W to 3 kW	600 W to 15 kW	
Applicable servomotor	1S with Safety Functionality Servomotor	1S Servomotor	
Control mode	Position, speed and torque control	Position, speed and torque control	
Safety approvals	· EN ISO 13849-1 (PLe/Cat.3) · EN 61508(SIL3) · EN 62061(SIL CL3) · EN 61800-5-2(SIL3) (STO/SS1/SS2/SOS/SLS/SLP/SDI/SBC)	· ISO 13849-1 (PL-e/PL-d) · EN61508 (SIL3/SIL2) · EN62061 (SIL3/SIL2) · IEC 61800-5-2 (STO)	
Full closed loop	—	—	
Appearance			
Rated rotation speed	3,000 r/min	3,000 r/min	2,000 r/min
Momentary maximum rotation speed	5,000 to 6,000 r/min	5,000 to 6,000 r/min	3,000 r/min
Rated torque	0.637 to 9.55 N·m	0.318 to 9.55 N·m	4.77 to 14.3 N·m
Capacity	200 W to 3 kW *1	50 W to 5 kW *3	400 W to 3 kW
Applicable servo drive	1S with Safety Functionality Drive	1S Servo Drive	
Encoder resolution	20-bit absolute	23-bit absolute	23-bit absolute
Protective structure	IP67	IP67	
Appearance			
Rated rotation speed	1,500 r/min	1,500 r/min	1,000 r/min
Momentary maximum rotation speed	3,000 r/min	2,000 to 3,000 r/min	2,000 r/min
Rated torque	9.55 to 19.1 N·m	25.5 to 95.5 N·m	8.59 to 28.7 N·m
Capacity	1.5 kW to 3 kW *2	4 to 15 kW	900 W to 3 kW
Applicable servo drive	1S with Safety Functionality Drive	1S Servo Drive	
Encoder resolution	20-bit absolute	23-bit absolute	23-bit absolute
Protective structure	IP67	IP67	
Detailed specification	Catalog	I838/I842	I821	

*1. The maximum capacity of the 200 V model is 2.6 kW. *2. The maximum capacity of the 200 V model is 2.7 kW. *3. The maximum capacity of the 200 V model is 4.7 kW.

Sysmac Family
▌Motion

## 3G3MX2-A□□□□-V1
MX2-V1 Multi-function Compact Inverter

Born to drive machines

EtherCAT.

Torque control in open loop

· Ideal for low to medium torque applications
· Can replace a flux vector inverter or servo
  drive in suitable systems

Quick response to load fluctuation

· Stable control without decreasing
  machine speed improves quality
  and productivity

Load

Speed

MX2 V1 inverter

Conventional inverter

Time
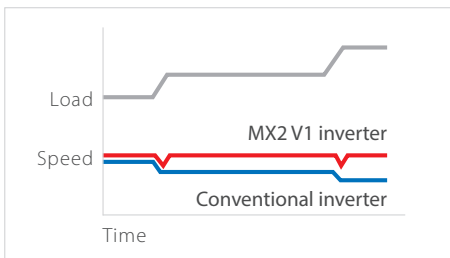
Safety inside

· Conforms to safety
  norm ISO 1384901 Cat. 3
  performance level PLd
· 2 Safety inputs
· External device monitoring
  (EDM)

Other Features

· Maximum applicable motor
  capacity: 15 kW
· Double rating (CT: Heavy
  load/VT: Light load)
· Permanent magnet motors
· Drive Programming
· Built-in brake control function

3G3RX2-□□□□□
RX2 High-function General-purpose Inverters

Save energy and maximize performance
with versatile inverter

EtherCAT.

· Triple rating: Normal Duty (ND), Low Duty (LD), and Very Low Duty (VLD)
· PM motor control helps save energy
· Safety function IEC 61800-5-2 "Safe Torque Off (STO)" Conforms to machinery
  directive with ISO13849-1 (Category 4/PLe)
· DriveProgramming allows simple sequence control without a PLC
· EtherCAT communication using an optional communication unit provides high-
  speed communication for running and stopping, monitoring operating status,
  and changing various settings

Lineup

Series		MX2 Series V1 type	RX2 Series
Model		**3G3MX2-V1**	**3G3RX2**
Appearance			
Power supply and capacity	Three-phase 200 V	0.1 to 15 kW(CT)	0.4 to 55 kW(ND)
	Three-phase 400 V	0.4 to 15 kW(CT)	0.4 to 132 kW(ND)
	Single-phase/three-phase 200 V	No	No
	Single-phase 200 V	0.1 to 2.2 kW(CT)	No
Control methods		· V/F control · Sensorless vector control	· V/F control · Sensorless vector control · Vector control with a PG
Input/ output	No. of multi-function I/O points	· 7 inputs · 2 transistor outputs · 1 relay output	· 11 inputs · 5 transistor outputs · 2 relay outputs

	Analog I/O	· 2 inputs
		  (0 to 10 V, 4 to 20 mA)
		· 1 output
		  (0 to 10 V)
			· 3 inputs
			  (1)/(2) 0 to 10 V or 0 to 20 mA
			  (3) -10 to 10 V
			· 2 outputs
			  0 to 10 V or 0 to 20 mA
			· 1 PWM voltage output

Braking		· Braking resistor connection
		· Regenerative Braking Unit connection
		· Regenerative Braking Unit
		  + braking resistor connection
			· Braking resistor connection
			  200V (22 kW max.)
			  400V (37 kW max.)
			· Regenerative Braking Unit connection
			· Regenerative Braking Unit
			  + braking resistor connection

Frequency	Frequency setting range	0.1 to 400 Hz	0.1 to 400 Hz
	Frequency output method	Line-to-line sine wave PWM	Line-to-line sine wave PWM
Installation and wiring	Side-by-side mounting	Yes	No
	Removable terminal block	No	Yes
	Power supply and motor wiring	Bottom wiring	Bottom wiring
Main functions	Multistep speed control	16 steps + jog	16 steps + jog
	Carrier frequency setting	2 to 15 kHz (default setting: 5 kHz)	2 to 15 kHz (default setting: 5 kHz)
	Torque assist function	Auto/manual torque assist	Auto/manual torque assist
	PID function	Yes	Yes
	Absolute value positioning	No	Yes
	Emergency shutoff	Yes	Yes
	0-Hz domain sensorless vector control	No	Yes
	Tripless function	Yes	Yes
	Momentary power interruption restart	Yes	Yes
	Multiple rating	Double ratings	Triple ratings
	Permanent magnet motor control	Yes	—
	Starting torque	200% at 0.5 Hz	· 200% at 0.3 Hz in open loop · Full torque at 0 Hz in closed loop
	PLC functionality (Drive Programming)	Provided	Provided
Communications		Optional EtherCAT communication unit	Optional EtherCAT communication unit
Safety approvals		· ISO 13849-1 (Cat.3/PLd) · IEC 60204-1 Stop Category 0	· ISO13849-1 (Cat.4/PLe) · IEC 61800-5-2
Detailed specification	Catalog	I920	I921

Sysmac Family
I/O

NX
I/O-System

Speed and accuracy for machine performance

Based on an internal high-speed bus running in synchronization with the EtherCAT network and using the time-stamp function, the NX I/O can be controlled with microsecond accuracy and with nanosecond resolution.
The I/O range consists of over 100 models including position control, temperature inputs and integrated safety.

Communications coupler
· EtherCAT®
· EtherNet/IP™

IO-Link master
· Up to 4 IO-Link devices with one master

Serial communications
· RS-232C or RS-422A/485 interface

RFID
· Direct connection to V680 RFID System
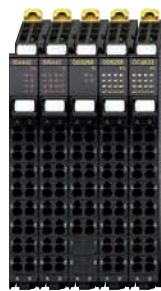
Digital I/O
· 4, 8, 16, or 32 channels per input unit
· 2, 4, 8, 16, or 32 channels per output unit (8 channels per relay output unit)
· 16 channels per mixed I/O unit
· Standard, high-speed, and time-stamp models
· Units with Push-In Plus/MIL/Fujitsu/M3 Screw connector

Analog I/O
· +/-10V voltage and 4-20 mA current signals
· 2, 4 or 8 channels per input unit
· 2 or 4 channels per output unit
· Standard and high-performance models
· Single-ended input and differential input models

High-speed analog input
· 4 channels per input unit
· Differential input
· Sampling as fast as every 5 μs

Load cell inputs
· One load cell with one unit
· Fastest conversion cycle of 125 μs

Safety CPU
· EN ISO13849-1 (PLe/Safety Category 4), IEC 61508 (SIL3) certified

Safety I/O
· 4 or 8 safety input points per unit
· 2 or 4 safety output points per unit
· Free allocation of the safety I/O units on the internal high speed bus

Temperature inputs
· Thermocouple or RTD inputs, 2 or 4 per unit
· Conversion time of 10 ms, 60 ms or 250 ms

Heater burnout detection
· 4 CT sensor inputs and 4 trigger outputs to drive SSRs

Temperature control
· 2 or 4 multi-input (thermocouple and resistance thermometer) channels per unit
· Conversion time of 50 ms
· Voltage output (for driving SSR) or linear current output
· 1 CT input per channel

Position interface
· Incremental and absolute encoder support
· Pulse output unit (line driver output model)

Lineup

Series	NX Series
Features	· Over 100 models including digital I/O, analog I/O, position interface, temperature inputs, temperature control, RFID, safety CPU, and safety I/O · NsynX technology provides I/O response with less than 1 μs jitter · Screwless terminal block, connector, and M3 screw types · Up to 32 channels per digital input unit or output unit
Appearance	
Type	Modular I/O
Communications interface	EtherCAT
Number of connectable units	· 63 units max. · Input: 1,024 bytes max., output: 1,024 bytes max.
Unit types	Communications coupler, IO-Link master, serial communication, RFID, digital I/O, analog I/O, high-speed analog input, load cell input, safety I/O, safety CPU, temperature input, heater burnout detection, temperature control, position interface
Mounting	DIN track
Detailed specification Catalog	R183

* See page 27 for more information on safety I/O.

Series	GX Series
Features	· Detachable screw terminal block and e-CON connector types · Easy set-up: automatic and manual address setting
Appearance	
Type	Block I/O
Communications interface	EtherCAT
Number of connectable units	One expansion unit can be connected with one digital I/O terminal (16 inputs + 16 outputs)
I/O types	Digital I/O, analog I/O, encoder input, IO-Link master, expansion unit
Mounting	DIN track
Detailed specification	Refer to your OMRON website.

Sysmac Family
█ Safety

NX-SL5/SL3/SI/SO
Safety Control Unit

Integrated safety into machine automation

Modular machines with individual CPU units

Safety is integrated via EtherNet/IP for safety communication between machines and EtherCAT for high-speed, high-precision fieldbus communication in a machine.
It is easy to set up motion or a robot, which are the key to quality and productivity enhancement, via one cable.

Simple and flexible integration of safety

Flexible system lets you freely mix safety I/O units with standard NX I/O.

Integration in One software, Sysmac Studio

Safety I/O wiring diagrams, safety circuit programs, and user-defined Function Blocks can be automatically generated, minimizing safety design errors.
Simple Automatic Test using Offline Simulation is available.
Online Functional Test ensures and maintains safety during machine commissioning and operation.

Lineup

Safety Controller

Product name	Safety CPU Unit	
Model	**NX-SL5500/5700**	**NX-SL3300/3500**
Features	Two different networks, Safety over EtherCAT (FSoE) and EtherNet/IP (CIP Safety), in a single system	Integrated safety into machine automation through the use of Safety over EtherCAT (FSoE) protocol.
Appearance		
Network	Safety over EtherCAT (FSoE), EtherNet/IP (CIP Safety)	Safety over EtherCAT (FSoE)
Applicable standards	EN ISO 13849-1 (PLe/Safety Category 4), IEC 61508(SIL3), IEC/EN 62061(SIL CL3), IEC/EN 61131-2 , IEC 6132-3-1, IEC 61131-6	EN ISO 13849-1 (PLe/Safety Category 4), IEC 61508 (SIL3), EN 62061 (SIL CL3), IEC/EN 61131-2, IEC 6132-3-1
Programming	· IEC 61131-3 standard · PLCopen Function Blocks for Safety	
Program capacity	2048 KB, 4096 KB	512 KB, 2048 KB
Safety I/O connection	128/254	32/128
Maximum number of safety I/O points	1024, 2032	256, 1024
Units that can connect	NX102 CPU Unit, Communication Control Unit	NX102 CPU Unit, EtherCAT Coupler Unit, EtherNet/IP Coupler Unit
Detailed specification	Catalog : F104	Refer to your OMRON website.

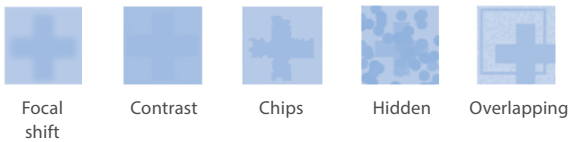| Product name	Safety Input Unit	Safety Output Unit
Model	**NX-SIH400/SID800**	**NX-SOH200/SOD400**
Appearance		
Applicable standards	EN ISO 13849-1 (PLe/Safety Category 4), IEC 61508(SIL3), IEC/EN 62061(SIL CL3), IEC/EN 61131-2, IEC 6132-3-1	
Number of safety input/ output points	4, 8	2, 4
Detailed specification	Refer to your OMRON website.	

Sysmac Family
Vision

FH
Vision System

Flexible solution for machine vision

The FH Vision System is optimized to detect the position and orientation of any object at high speed and with high accuracy. The built-in EtherCAT communications enable reliable and easy networking with motion control, increasing the overall machine performance. A flexible machine vision tailored for quality inspection.

Advanced shape search technology

High-precision and robust positioning is possible even under the adverse conditions, such as changes in environments and materials.

| Focal shift | Contrast | Chips | Hidden | Overlapping |

Unique lineup

· The camera lineup includes up to 20.4 Mpix camera
· The MDMC light flexibly changes illumination colors and angles according to items to inspect

Multiple inspection

· Powerful 4-core i7 parallel processor
· Up to 8 cameras per controller
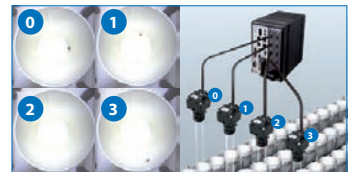
AI Scratch Detect Filter (Software sold separately)

The AI Scratch Defect Filter learns by means of images in which human inspectors noticed defects.Where as previous inspection methods found the unexpected size, shape or color of a particular defect to be a barrier to automation, AI successfully extracts abnormalities.

Captured image   Extracted scratch (internal image)

FHV7 Smart Camera
Designed for pre-alignment and appearance inspection

The FHV7 Smart Camera is an all-in-one camera with the functionalities of the high-spec FH Vision System packed in its compact, robust body that is easy to deploy.
It offers the same operability as the FH Series, allowing for easy integration into even processes where it was previously difficult to install advanced vision systems.

IP67 waterproof structure

IP67 protection allows use in wet conditions, such as regular wash-downs at the sites where the cameras are installed.

Advanced shape search technology

The shape search technology that provides the same level of performance as the FH Series has been implemented.

Robust all-in-one camera for easy integration into machines
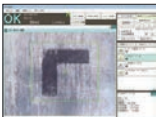
Lights

Controller

Lens

EtherNet/IP

Autofocus lens

The autofocus lens covers a focal length range from 59 to 2,000 mm*. Even when products in different sizes are produced, the focus range can be changed easily by parameters. This feature eliminates mechanical operation for changeover during product replacement, leading to a simpler system with higher productivity.

Working distance
90 mm→100 mm

Water ▶ Water
Natural mineral water

* Differs depending on the lens type.

Lineup

Product name		Vision System		Smart Camera	
Series		**FH Series**		**FHV7 Series**	
Appearance					
Hardware	**Processing speed** *1	★★★		★★	
	No. of connectable cameras	8 max.		1	
	Resolution	0.4 million-pixel/2 million-pixel/4 million-pixel/5 million-pixel/12 million-pixel	5 million-pixel/20.4 million-pixel	0.4 million-pixel/1.6 million-pixel/3.2 million-pixel/5 million-pixel	6.3 million-pixel/12 million-pixel
	Shutter method	Global shutter	Rolling shutter	Global shutter	Rolling shutter
	Lens	Interchangeable (C mount, M42 mount)		Interchangeable (C mount)/autofocus (mechanical, liquid lens)	
	Light	External light connectivity/special light connectivity (MDMC *2, PS *3)		Built-in light (white, red, infrared, multi-color)/external light connectivity/special light connectivity (MDMC *2)	
Software	**User interface**	Flexible interface	Main screen	Measurement flow setting screen	Measurement condition setting screen
Detailed specification	**Catalog**	Q197		Q264	

*1. The more starts, the higher the performance.

*2. Multi-Direction Multi-Color. The MDMC light can be adjusted to defects by freely combining the illumination directions, colors, and light intensities.

*3. Photometric Stereo.

Sysmac Family
Sensing

ZW-8000/7000
Confocal Fiber Displacement Sensor

Measure anything from anywhere The most reliable in-line measurements

The ZW-8000 Series provides high-precision in-line measurements of rattling or inclined shiny, thin, or minute parts.The ZW-7000 Series provides ultra-high-speed, stable measurements of diffuse reflective objects during movement.These sensors help increase quality inspection accuracy and reduce inspection time.

Reliable measurements for any material and surface types

The white light confocal principle allows a continuous measurement of object in any mixed conditions such as mirror, coarse, transparent, curved, or narrow areas without stopping the sensor head.

· Angle characteristic: ±25° for shiny surfaces
· Linearity for different materials: ±0.3 μm
· Minimum sampling period: 20 μs
· Minimum spot diameter: 4 μm

Note: Specifications differ among models. Please ask Omron sales representative for details.

E3NX/E3NC/E9NC Series
N-Smart Series

Various sensors connected over EtherCAT

The N-Smart lineup of next-generation fiber sensors, laser sensors and contact sensors will quickly solve your problems and therefore maximize uptime and minimize downtime with optimum cost performance.

E3NX-CA
Color Fiber Amplifier Units

E3NX-FA
Fiber Amplifier
Units

E3NC
Smart Laser
Sensors

E9NC-T
Contact-Type
Smart Sensor

E3NX-MA
Smart Fiber
Amplifier Units
(2-channel
models)

N-Smart Amplifier Units
Easy application with
consistent operating procedures

N-Smart
Presence / Detection / Measurement

E3NW
Sensor
Communications
Units

Applications with many sensors
More convenience and even lower
costs with a network

E2NC
Smart Proximity
Sensor

E9NC-AA/VA
IoT Status Monitoring
Amplifier

EtherCAT

Features

- Ultra-easy Advanced Smart Tuning with the push of a button
- More stable detection of high-speed workpieces
- Predictive maintenance to reduce downtime
- Highly visible white LED display
- E3NX-FA has 1.5x the sensing distance of conventional amplifiers *

＊ Compared with E3X-HD

Lineup

Product name	Confocal Fiber Displacement Sensor		
Series	**ZW-8000 Series**	**ZW-7000 Series**	**ZW-5000 Series**
Feature	For measurements of rattling or inclined "transparent objects or mirror surfaces" such as thin film sheets or glass	For accurate shape measurements of "coarse surfaces" while the sensor head is moving	Bring the benefits of the white light confocal principle to production lines
Appearance			
Measurement method	White light confocal principle		
Measuring range	Min : 7±0.3 mm, Max : 30±2 mm		
Static resolution	0.002 to 0.016 µm		
Linearity	±0.3 to ±3.0 µm		
Spot diameter	4 to 11 µm	50 to 190 µm	9 to 20 µm
Measurement cycle	60 to 7500 µs	20 to 400 µs	80 to 1600 µs
Detailed specification — Catalog	Q250		
Detailed specification — Web	Refer to your OMRON website.		

Product name	Fiber Sensor/Laser Sensor/Proximity Sensor/Contact Sensor	
Series	**N-Smart Series**	**E3X**
Feature	Connect fiber, laser and contact sensors to EtherCAT at low initial cost	Easily connect fiber sensors to EtherCAT
Appearance		
Network specification	EtherCAT communication unit	EtherCAT communication unit
Sensor Communications Units	E3NW-ECT/DS	E3X-ECT

Connectable sensor amplifier units	Fiber Sensor
	  E3NX-FA0
	  E3NX-CA0
	Laser Sensor
	  E3NC-LA0
	  E3NC-SA0
	Contact Sensor
	  E9NC-TA0
	IoT Status Monitoring Amplifier
	  E9NC-AA0/VA0
		Fiber Sensor
		  E3X-HD0

Maximum number of connectable sensors	30	30
Detailed specification — Catalog	E3NW: E418 E3NX-FA: E418 E3NX-CA: Y216 E9NC-T: E434 E9NC-AA/VA: E474	—
Detailed specification — Web	Refer to your OMRON website.	

Sysmac Family
Robot

iX3/iX4, eCobra/i4H, Viper
Parallel Robot, SCARA Robot, Articulated Robot with EtherCAT (Connectable to NJ501-R)

Robots for flexible production lines

Omron's parallel, SCARA, and articulated robots are designed to be directly controlled by the NJ501-R Robot Integrated Controller that is connected to the robots via EtherCAT.

Parallel robots

The Hornet and Quattro are parallel robots ideal for use in the food and beverage, pharmaceutical, and healthcare industries.
The iX4 that is a four-axis parallel robot with a high payload capacity achieves high speed and high precision.

· Fast and high-precision conveyance and assembly
· Supports fast Pick & Place on a fast conveyor
· Maximum working range: 1130, 1300, and 1600 mm models

iX3
iX4

SCARA robots

High-performance four-axis SCARA robots are ideal for mechanical assembly, material handling, packaging, machine tending, and screw driving.
Table/floor or Inverted mounting models are available.

· High repeatability suitable for material handling and
   precision assembly
· Reach: i4H: 650, 750, and 850 mm models
          eCobra: 600 and 800 mm models

eCobra
i4H

Articulated robots

Six-axis articulated robots are ideal for mechanical assembly, material handling, packaging, and palletizing.

· Diagnostics display enables faster trouble shooting
· High accuracy, superior slow-speed following, and easy
   calibration
· Reach: 653 and 855 mm models

Viper

Lineup

Series	iX3	iX4	eCobra
Feature	Parallel robot ideal for use in the food and beverage, pharmaceutical, and healthcare industries	Four-axis parallel robot achieves high speed and high precision	Mid-size/large SCARA robot for precision machining, assembly, and material handling
Appearance			
Robot type	Parallel robot	Parallel robot	SCARA robot
Number of axes	3, 4	4	4
Mounting	Inverted	Inverted	Table/Floor
Payload capacity	3 kg (8 kg: without rotation axis)	· Quattro 650 6 kg (No rotation: 15 kg) · Quattro 800 4 kg (No rotation: 10 kg)	5.5 kg
Working volume (radius)	565 mm	650 to 800 mm	—
Reach	—	—	600 to 800 mm
Position repeatability	±0.10 mm	±0.10 mm	±0.017 mm
Protection/ Cleanroom classes — Specifications	IP67: arms and platform IP65: underside of robot IP20: topside of robot	· H type IP67: arms and platform IP65: underside of robot IP20: topside of robot · HS type IP67: arms and platform IP66: robot base	IP20
Protection/ Cleanroom classes — Option	IP65: topside of robot (with optional cover)	H type IP65: topside of robot (with optional cover)	· eCobra 600 Class10 Cleanroom model · eCobra 800 IP65, Class10 Cleanroom model
Detailed specification — Catalog	I822		

Series	i4H	i4H Inverted	Viper
Feature	Mid-size/large SCARA robot for precision machining, assembly, and material handling	Overhead-mount mid-size/large SCARA robot for precision machining, assembly, and material handling	Articulated robot for machining, assembly, and material handling
Appearance			
Robot type	SCARA robot	SCARA robot	Articulated robot
Number of axes	4	4	6
Mounting	Table/Floor	Inverted	Table/Floor/Inverted
Payload capacity	15 kg	15 kg	5 kg
Working volume (radius)	—	—	—
Reach	650 to 850 mm	650 to 850 mm	635 to 855 mm
Position repeatability	XY: i4H 650 ±0.015 mm, i4H 750/850 ±0.025 mm Z: ±0.015 mm θ: ±0.005°		±0.02 to 0.03 mm
Protection/ Cleanroom classes — Specifications	IP20	IP20	IP40
Protection/ Cleanroom classes — Option	ISO4, IP65, Class10 Cleanroom model	ISO4, IP65, Class10 Cleanroom model	IP54: robot main body IP65: robot joints (J4, J5, J6) Class10 Cleanroom model
Detailed specification — Catalog	I822		

Service and support
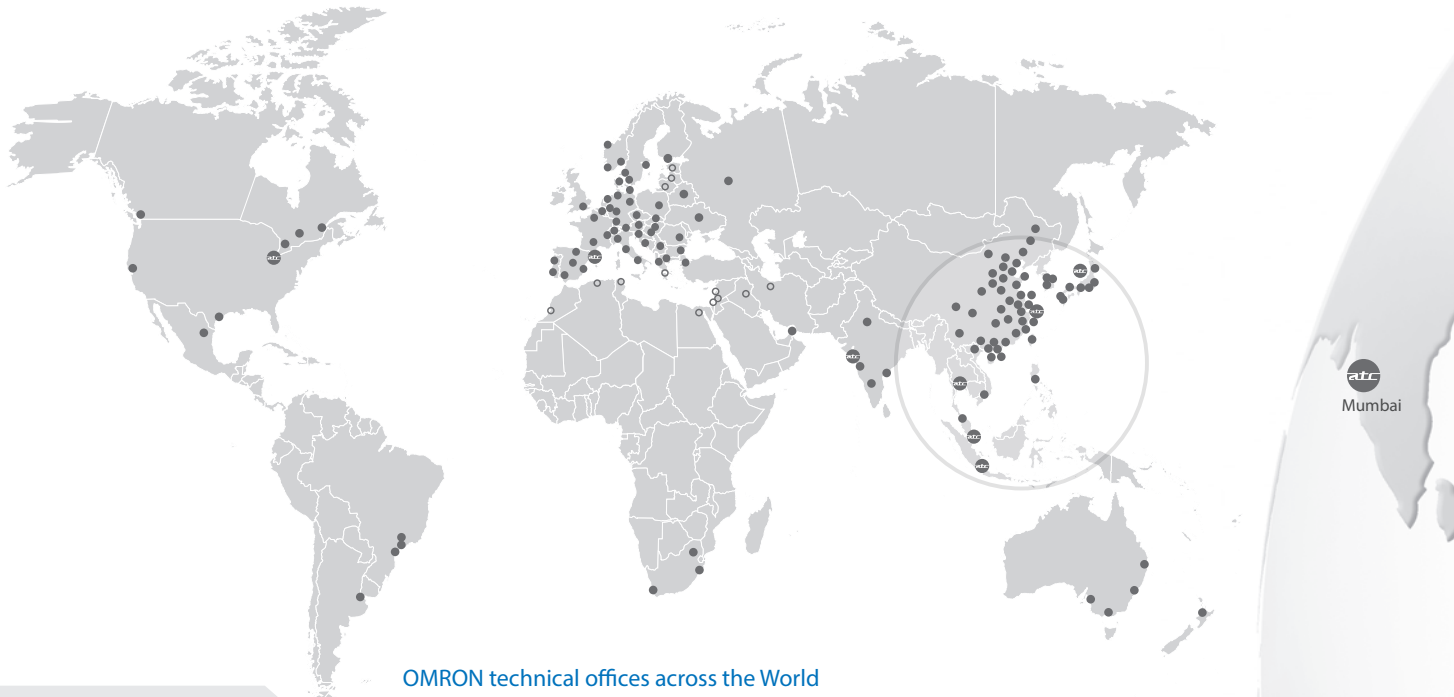
OMRON technical offices across the World

 Automation Center
Kusatsu (JPN), Kariya (JPN), Shanghai (CHN), Barcelona (ESP), Jakarta (IDN), Mumbai (IND), Hoffman Estates IL (USA), Bangkok(THA), Singapore(SGP), Seoul(KOR)

● Technical office   ○ Premium Partner

PRESENCE

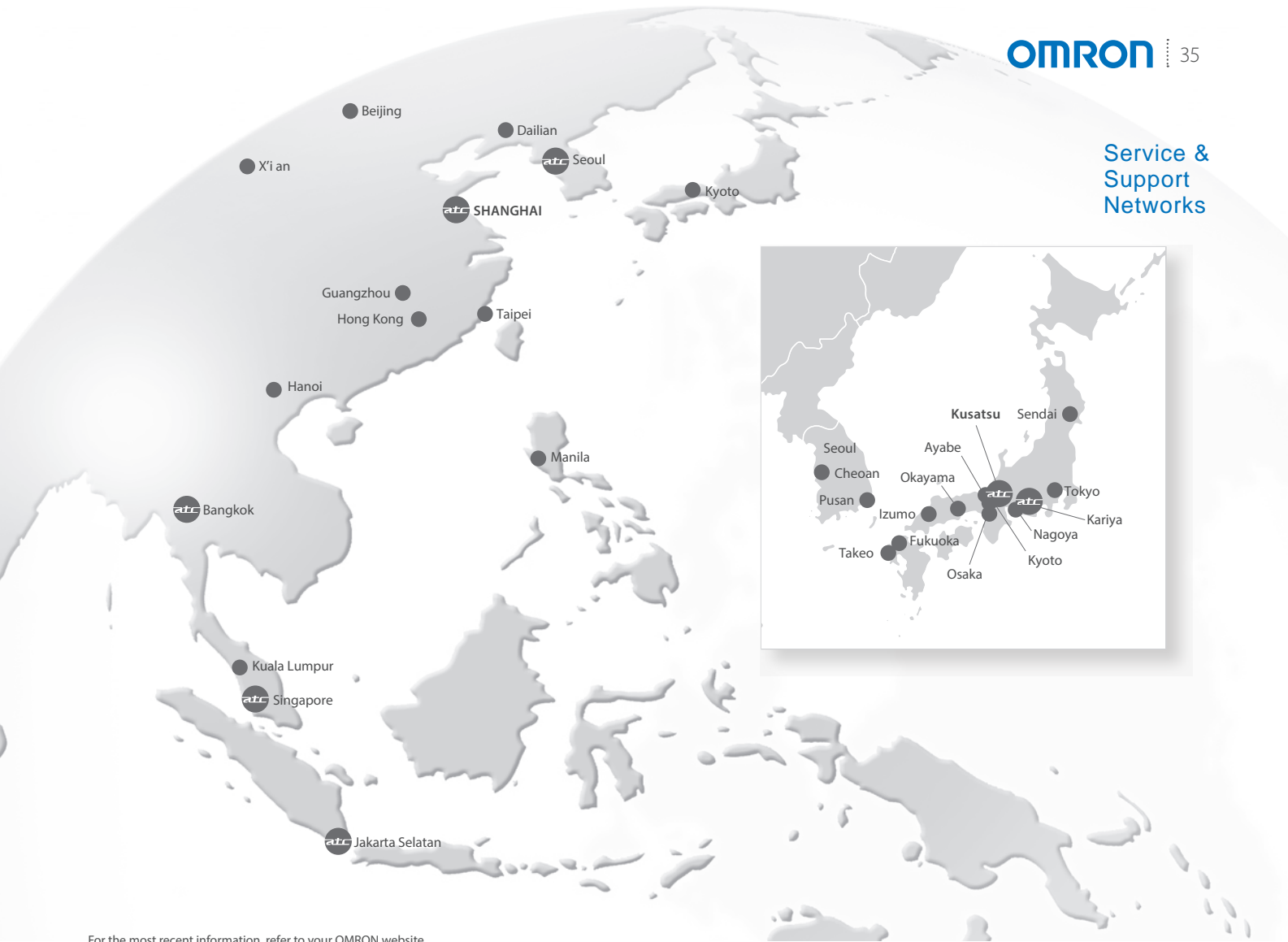**COMPETENCE**

OMRON

Design

Our wi de net work of machine automation specialists will help you to select the right automation architecture and products to meet your requirements. Our flat structure based on expert-to-expert contact ensures that you will have ONE accountable and responsible expert to deal with on your complete project.

Proof of concept

As your project matures make use of our Automation centers to test and catch-up with technology trends in motion, robotics, networking, safety, quality control etc. and to interface, test and validate your complete system with our new machine network (EtherCAT) and factory network (EtherNet/IP).

We will assign a dedicated application engineer to assist with initial programming and proof testing of the critical aspects of your automation system. Our application engineers have in-depth expertise in and knowledge of networks, PLCs, motion, safety and HMIs when applied to machine automation.

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Manila

atc Bangkok

Kuala Lumpur

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Ayabe

Cheoan

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Pusan

Tokyo

Izumo

atc atc

Kariya

Nagoya

Takeo

Fukuoka

Kyoto

Osaka

For the most recent information, refer to your OMRON website.

CONFIDENCE

ASSURANCE

Development

During your prototyping phase you will need flexibility in technical support, product supply and exchange. We will assign an inside sales contact to help you source the correct products fast during your prototyping phase.

Commissioning

With our world-wide network for service and support the export of your product is made simple, we will support you on-site with your customer, anywhere in the world. We can arrange a liaison sales engineer to facilitate training, spare parts supply or even machine commissioning. All this in a localised language with localised documentation - giving you complete peace of mind.

Serial production

As your production increases we will engage in supplying you within 24hrs and repairing within 3 days. All our products are global products meeting global standards - CE, cULus, NK, LR -

Note: Do not use this document to operate the Unit.

OMRON Corporation Industrial Automation Company

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