OMRON

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
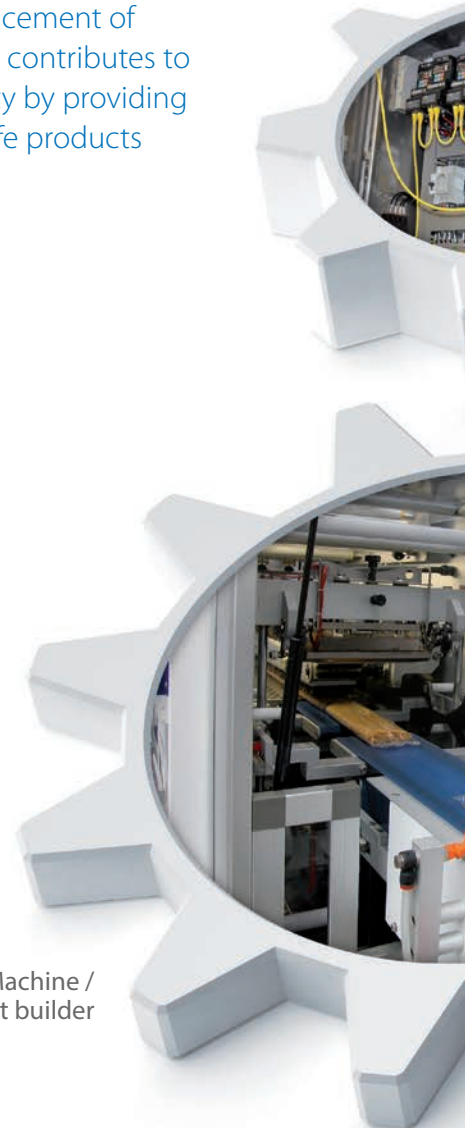
Machine /
Equipment builder

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

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

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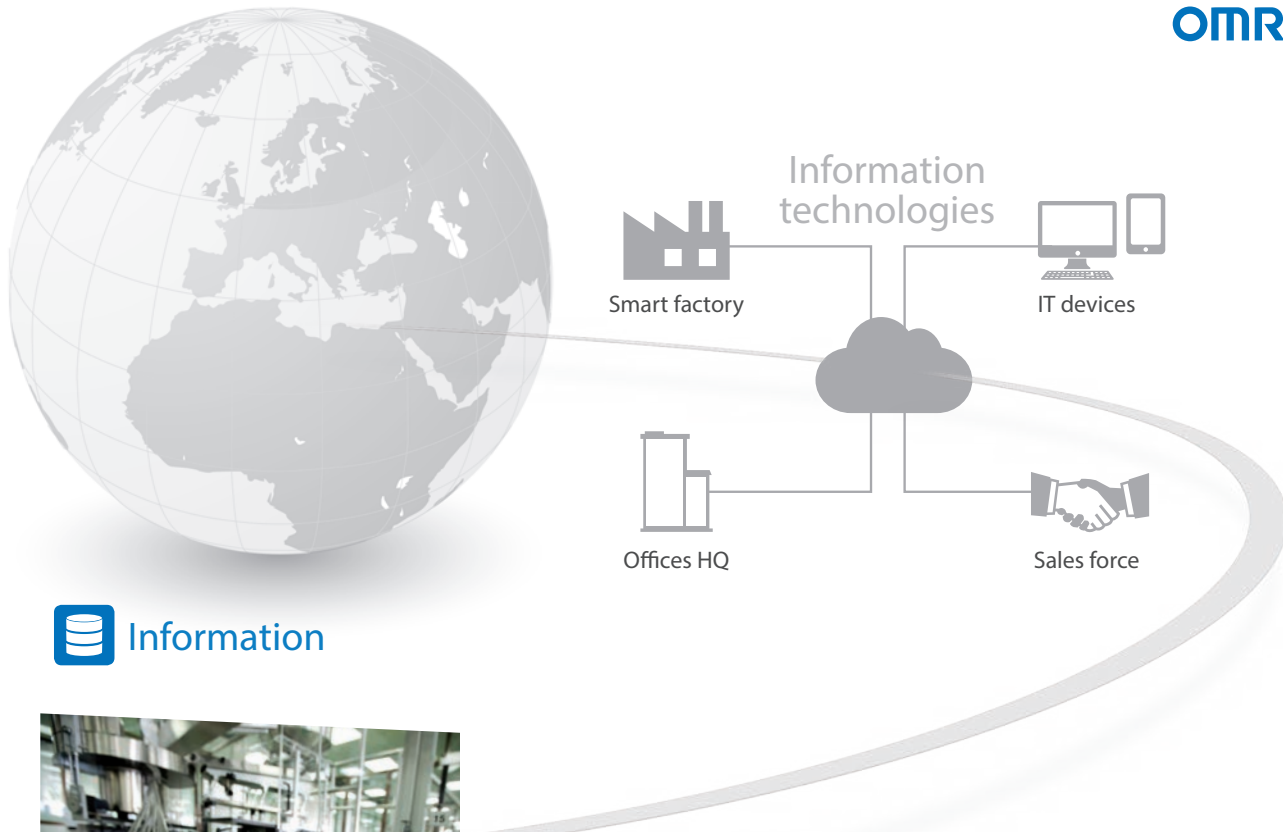· Direct Synchronous control for Position, Speed and Torque

· All safety related data is synchronized with the whole network
· The PLCopen® FBD simplifies and accelerates the development process through structuring safety circuits and enhancing reuse.

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
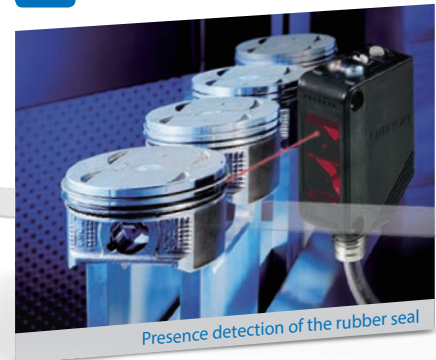
Robot

© ETR 300
Pick & Place

- Function Blocks in Adept Robot Control Library enable robot control from the NJ/NX/NY Controller using Ladder and Structured Text
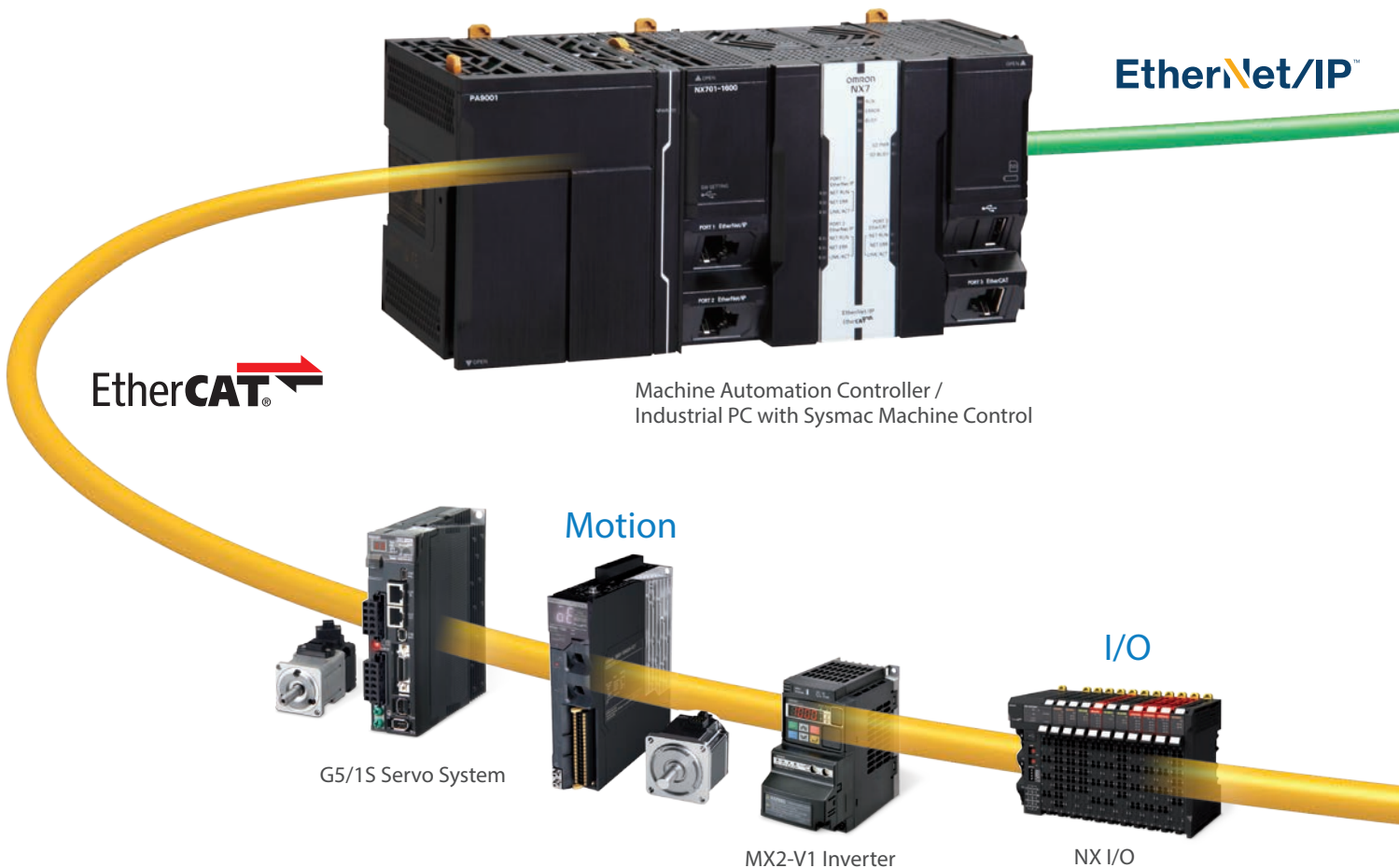
Sensing

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
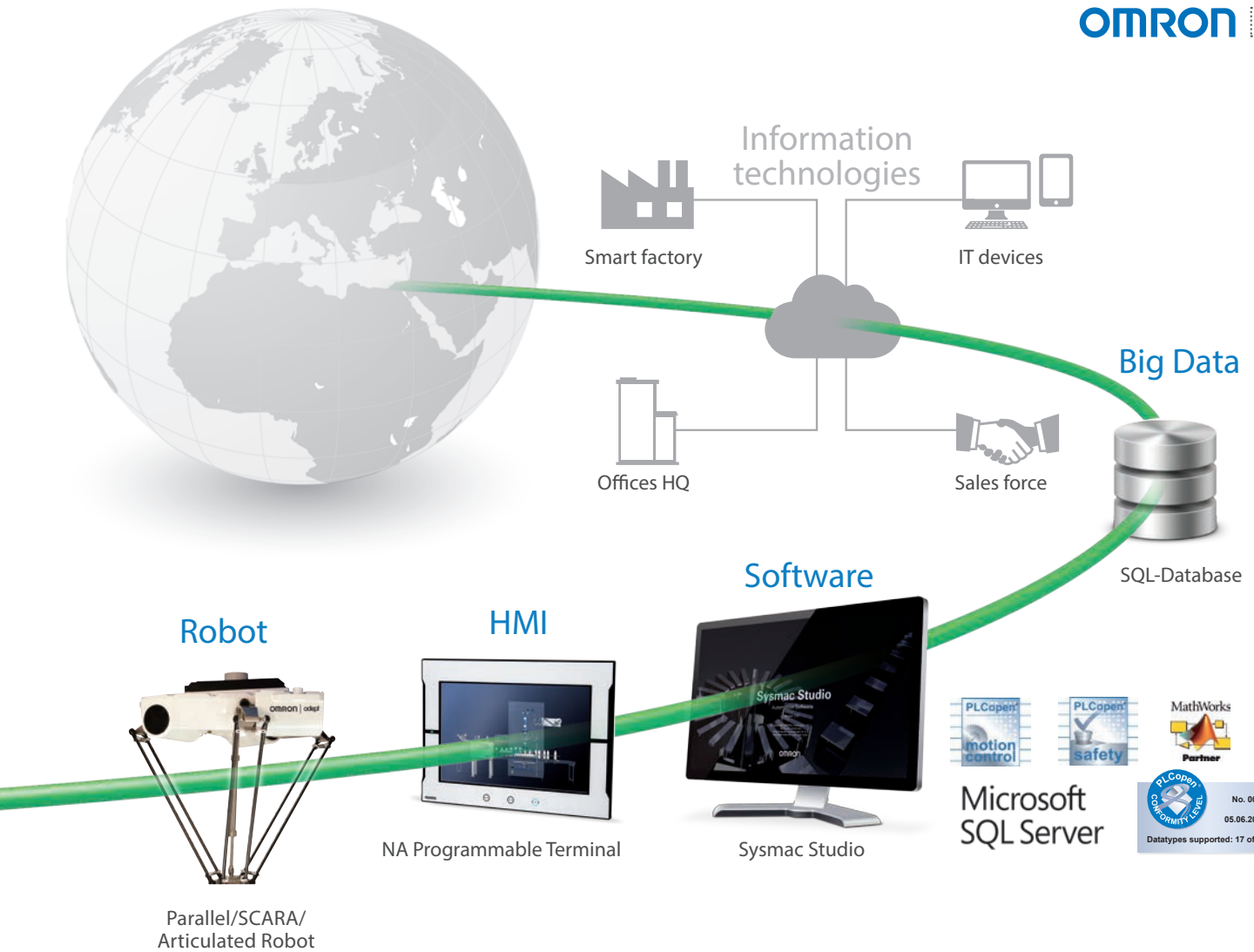
One Connection

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 is the perfect match between fast real time machine control and data plant management.
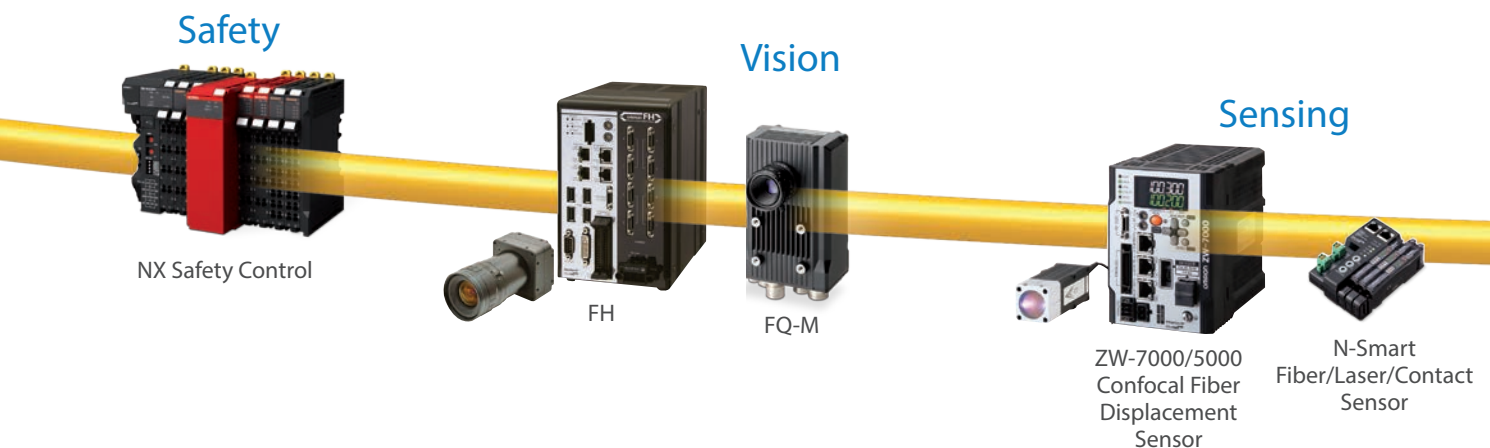
EtherNet/IP

EtherCAT

Machine Automation Controller /
Industrial PC with Sysmac Machine Control

Motion

I/O

G5/1S Servo System

MX2-V1 Inverter

NX I/O

EtherCAT - Machine Control

· 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

Information technologies

Smart factory

IT devices

Offices HQ

Sales force

Big Data

SQL-Database

Robot

Parallel/SCARA/
Articulated Robot

HMI

NA Programmable Terminal

Software

Sysmac Studio

PLCopen motion control

PLCopen safety

MathWorks Partner

Microsoft SQL Server

PLCopen CONFORMITY LEVEL
No. 0043
ST
05.06.2015
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

NX Safety Control

Vision

FH

FQ-M

Sensing

ZW-7000/5000
Confocal Fiber
Displacement
Sensor

N-Smart
Fiber/Laser/Contact
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 and motion programming based on IEC standard and PLCopen Function Blocks for Motion Control 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.

Design

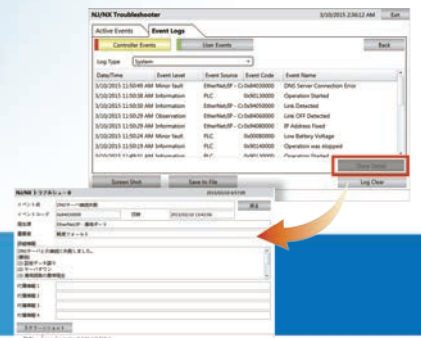### Reusable programs

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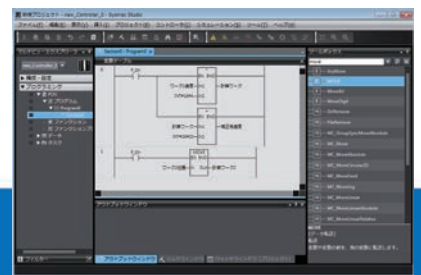
One Integrated Development Environment software Sysmac Studio is fully compliant with the open standard IEC 61131-3. Programming with variables eliminates the need to learn the internal memory map of the PLC and allows the programs to be reused.

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.

＊ 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.
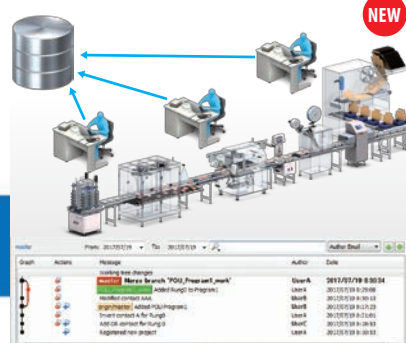
Collection of software functional components
Sysmac Library

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

Project version control function *

NEW

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.
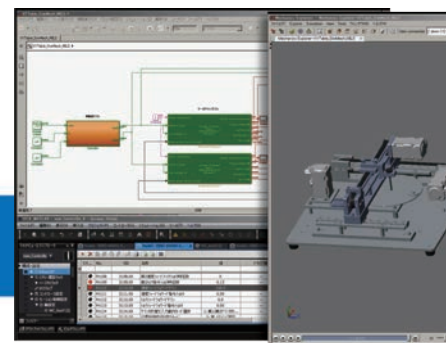
Motion programming
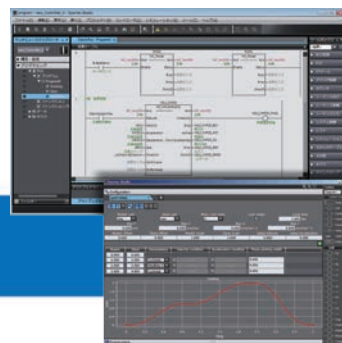
Advanced motion control applications can be created quickly just by combining PLCopen® Function Blocks for Motion Control.

Model-Based design

Complex feedback control that is designed with MATLAB®/Simulink® can be imported into programs.

MathWorks
Partner
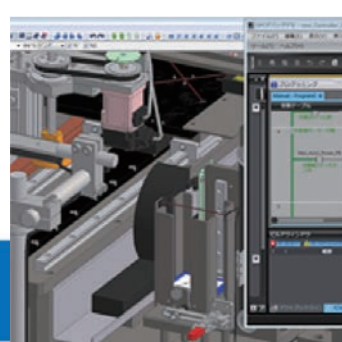
Verifification

Fast system debugging

Remote maintenance

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.

Virtual mechanical debugging

Before the mechanical prototype is completed, motion can be checked and the program can be debugged. This cuts design time.

LATTICE TECHNOLOGY
VMECH
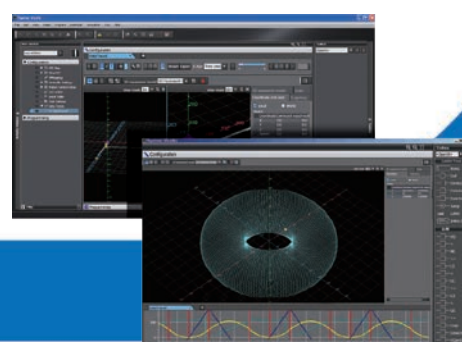
3D simulation

Motion trajectories in 3D can be pre-tested with advanced simulation of sequence and motion control. Simulation of single Function Blocks, POU's (Program Organization Unit) or the entire program can be performed. In addition all standard features such as Break & Step are available. Easy tuning and debugging reduce the set-up times of machines and production lines.

One Machine Controller
NJ/NX/NY Machine Automation Controller

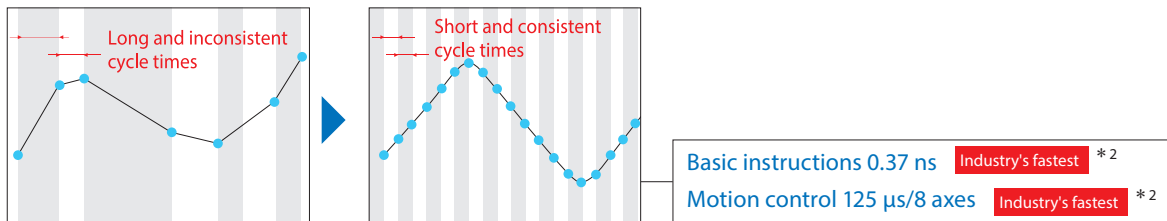### Powerful, yet easy to configure

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™ i7 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.

Machine automation controller features
· Up to 256 synchronized axes
· Synchronized control of all machine network devices
· Multi-tasking programs
· In-line ST, Structured Text and Ladder mixed in the same program
· Full control of Axes Group Position
· System Backup and Restore
· CE and cULus global standards

* 1. Performance of NX701-1□00

* 2. Based on Omron investigation in February 2015.

* 3. Database connection CPU unit:
     NJ501-1□20/NJ101-□□20

Fast machine data storage in database *3

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.

Supported database
- Microsoft SQL server
- Oracle Database
- IBM DB2
- MySQL
- PostgreSQL
- Firebird
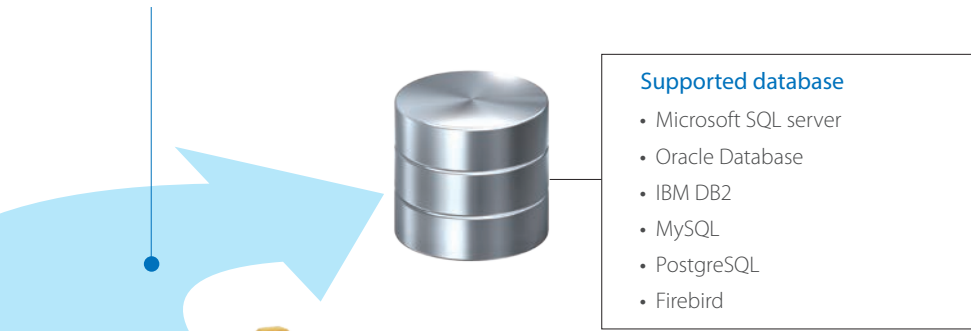
Standard programming
- Fully conforms with IEC 61131-3 standards
- PLCopen Function Blocks for Motion Control

PLCopen motion control

PLCopen CONFORMITY LEVEL

No. 0043
ST
05.06.2015

Datatypes supported: 17 of 26

Global standard networks

EtherCAT.
Standard Machine Network

EtherNet/IP
Standard Factory Network

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

Case studies of machine innovation by increasing speed and precision

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

Problems

1. Stacking many sheets precisely increases cycle time because position correction and stop are repeated.

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

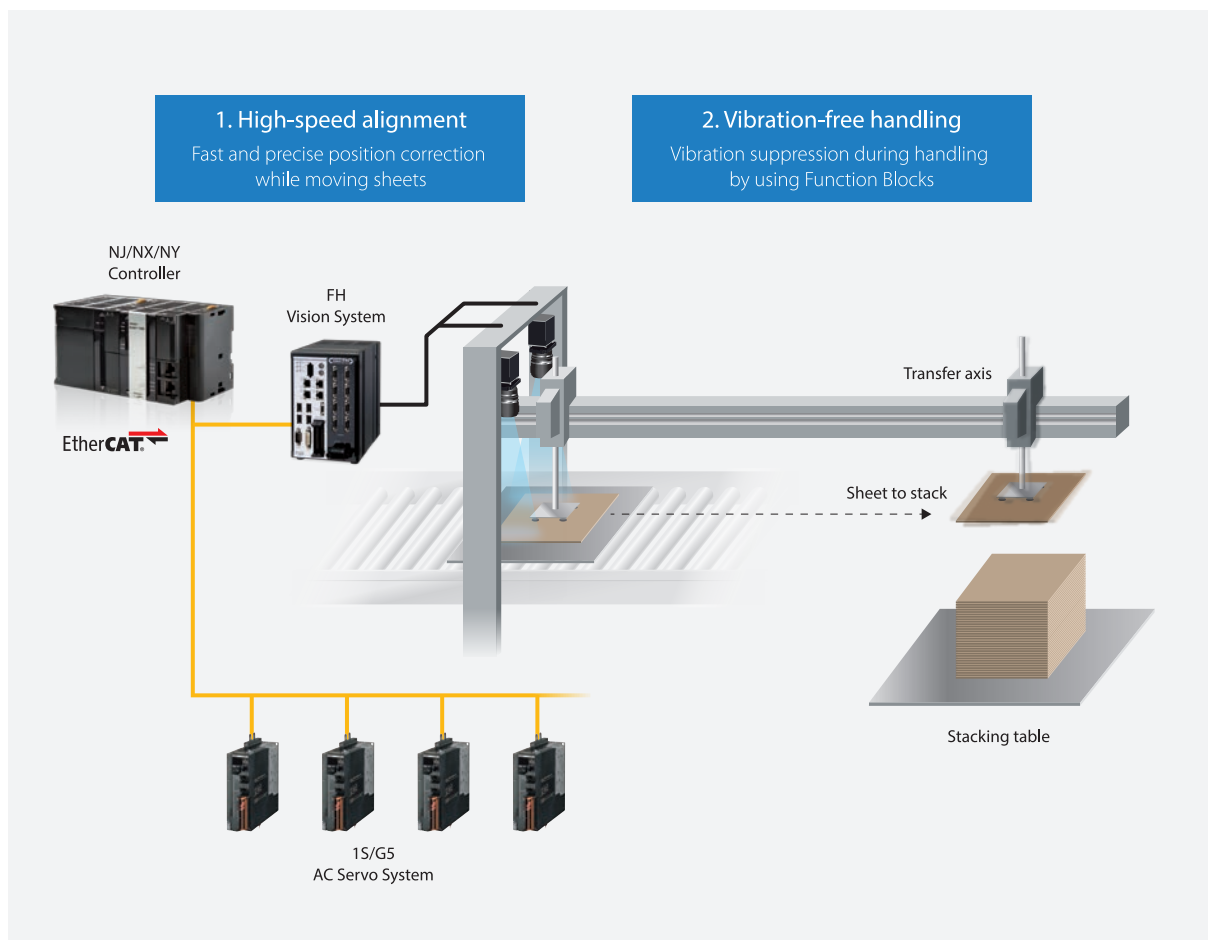### 1. High-speed, high-precision alignment system
The FH Vision System provides the Shape Search function for fast and accurate shape recognition and the Continuous Alignment function for continuous position correction while moving objects. These functions increase alignment speed without sacrificing accuracy.

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 while moving sheets

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

# Case 2: Packaging machine using electric cam

Problems

1. The PLC and mechanical cam control cannot accurately synchronize axes.
   In addition, low precision, vibration, and noise caused by mechanical cam limit high-speed and high-precision packaging.

2. It takes time to adjust mechanical cam to different packaging materials and settings every time a different type of product is packaged.

Electronic cam optimizes packaging speed and precision

Electronic cam motion control realizes machine cam motion. Electronic cam enables 3 axes - "film feeding", "product feeding", and "rotary knife" - to be synchronized at high speed. This eliminates following errors between axes even during high-speed operation, leading to higher-speed and higher-quality packaging. Registering settings as a recipe reduces changeover time.

Software functional components for electronic cam control

The Rotary Knife Function Block in the Packaging Machine Library increases the speed and precision of horizontal flow packaging and enables mechanical cam motion without electronic cam table.

Sysmac Library

Packaging Machine Library
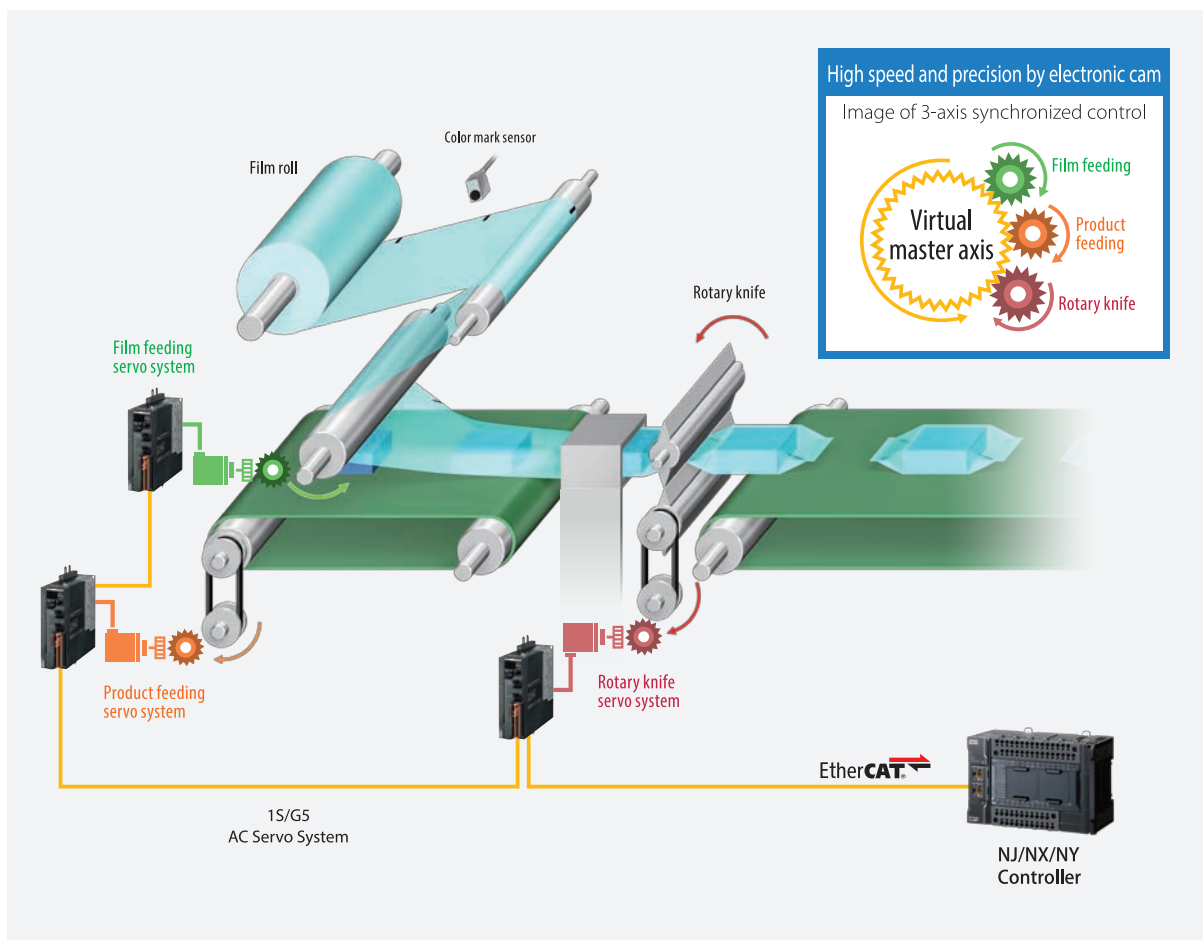
Sysmac Family
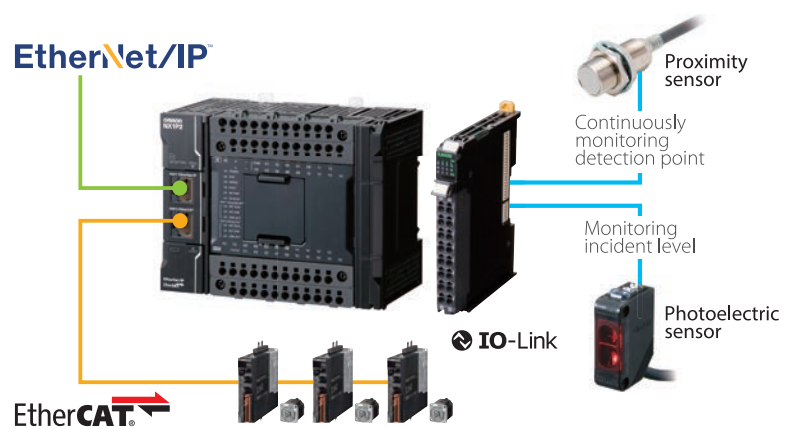## Controller

NX1P
Machine Automation Controller

Motion control and networks for IoT in a Sysmac entry model

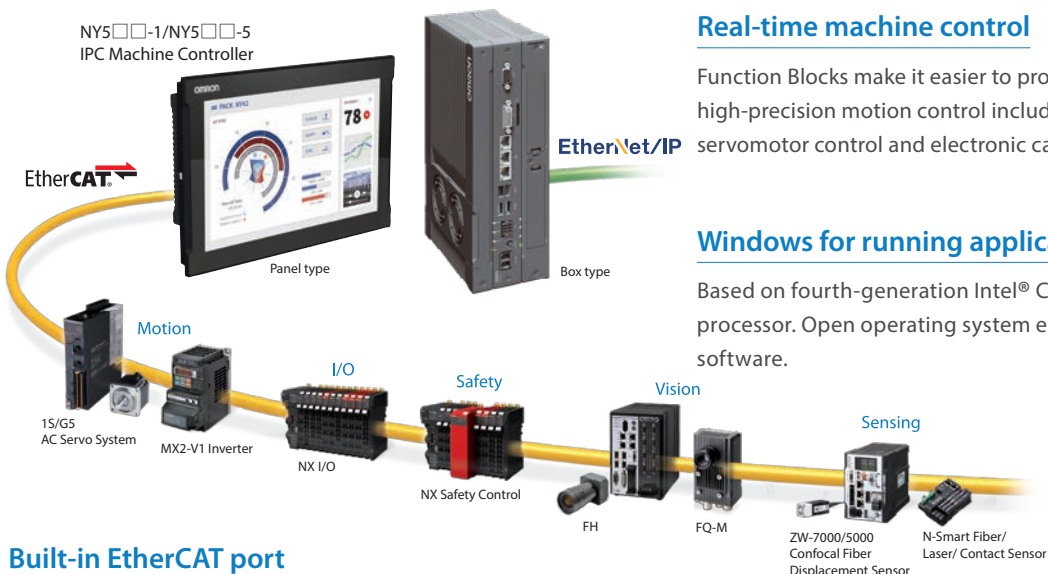### Networks for onsite IoT

IO-Link brings IoT to the sensor level.

Advanced motion control

The built-in EtherCAT port and advanced motion control make machines faster and more precise.

EtherNet/IP™

Proximity sensor

Continuously monitoring detection point

Monitoring incident level

IO-Link

Photoelectric sensor

EtherCAT®

NY5□□-1/NY5□□-5
IPC Machine Controller

An IPC machine controller combines machine control and IT technology

NY5□□-1/NY5□□-5
IPC Machine Controller

EtherCAT®

Panel type

Box type

EtherNet/IP™

Motion

I/O

Safety

Vision

Sensing

1S/G5
AC Servo System

MX2-V1 Inverter

NX I/O

NX Safety Control

FH

FQ-M

ZW-7000/5000
Confocal Fiber
Displacement Sensor

N-Smart Fiber/
Laser/ Contact Sensor

Real-time machine control

Function Blocks make it easier to program high-speed, high-precision motion control including synchronized servomotor control and electronic cams.

Windows for running applications

Based on fourth-generation Intel® Core™ i7-4700EQ processor. Open operating system enables use of own software.

Built-in EtherCAT port

EtherCAT connectivity simplifies installation of FA devices and safety devices: up to 192 synchronized slaves, up to 64 axes of motion control, and Safety over EtherCAT.
Fully conforms to IEC 61131-3 standard programming.

Lineup

Standard Type

Series	NX Series	NJ Series			NX Series
Model	NX1P2-□□□□	NJ101-□□□□	NJ301-□□□□	NJ501-□□□□	NX701-□□□□
Feature	Motion control and built-in I/O	For simple machines	For small-scale control with up to 8 axes	For large-scale control with up to 64 axes	For large-scale control with up to 256 axes
Appearance					
Instruction execution times (LD instruction)	3.3 ns	3.3 ns	2.0 ns	1.1 ns	0.37 ns
Program capacity	1.5 MB	3 MB	5 MB	20 MB	80 MB
Variables capacity (No retain attribute)	2 MB	2 MB	2 MB	4 MB	256 MB
I/O capacity	40 points	2,560 points	2,560 points	2,560 points	—
Number of EtherCAT slaves	16	64	192	192	512
Number of motion axes	0, 2, 4	0, 2	4, 8	16, 32, 64	128, 256
Detailed specification — Catalog	P116	P089			

Application Type

Series	NJ/NY Series				
Model	NJ501-4□□□	NJ501-1□20 NJ101-□□20	NJ501-1340	NY5□□-1	NY53□-5400 NJ501-5300
Feature	Robotics in addition to machine control	Database connection	SECS/GEM communications	Perfect integration: Sysmac machine control and ICT	Numerical control (NC) functionality
Appearance					
Instruction execution times (LD instruction)	1.1 ns	1.1 ns/3.3 ns	1.1 ns	0.33 ns	0.33 ns/1.1 ns
Program capacity	20 MB	20 MB/3 MB	20 MB	40 MB	40 MB/20 MB
Variables capacity (No retain attribute)	4 MB	4 MB/2 MB	4 MB	64 MB	64 MB/4 MB
I/O capacity	2,560 points	2,560 points	2,560 points	—	—/2,560 points
Number of EtherCAT slaves	192	192	192	192	192
Number of motion axes	16, 32, 64	16, 32, 64/0, 2	16	16, 32, 64	32/16
Detailed specification — Catalog	P089			P118	P118/P089

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

Sysmac Library

Displacement Sensor
FH Vision System
Linear motors
Servo motors
N-Smart
NX Safety Control Unit
NX-I/O
Servo drives
Inverters
EtherCAT
SQL-Database
NJ/NX/NY Controller
Robot
NA Programmable Terminal
EtherNet/IP
Ethernet
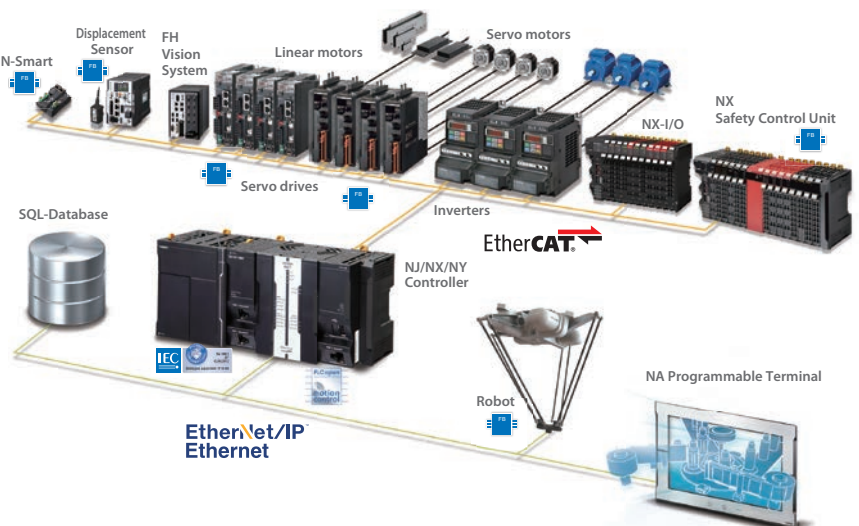
Lineup

Series	Automation Software Sysmac Studio	Collection of software functional components Sysmac Library
Model	SYSMAC-SE2□□	SYSMAC-XR□□□
Appearance		
System requirements	[Operating system (OS)] Windows 7 (32-bit/64-bit version), Windows 8 (32-bit/64-bit version), Windows 8.1 (32-bit/64-bit version), Windows 10 (32-bit/64-bit version) [CPU] Windows computers with Intel® Celeron™ processor 540 (1.8 GHz) or faster CPU. Intel® Core™ i5 M520 processor (2.4 GHz) or equivalent or faster recommended.	[Applicable models] For details, refer to the catalog of Sysmac Library.
Included software/Libraries	CX-Designer CX-Integrator CX-Protocol Network Configurator SECS/GEM Configurator Adept Robot IP Address Setting Tool CX-ConfiguratorFDT IODD DTM Configurator	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
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

Palletiser
○ Side View
○ Top View
○ Animation

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	V413			

Sysmac Family
Motion

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)

R88M-K/R88D-KN□-ECT□R88L-EC/R88D-KN□-ECT-L
G5 AC Servomotor/Linear Motor/Servo Drive

At the heart of every great machine

Rotary motors

· Motors with IP67
· Large range of motors from 0.16 Nm up to
  96 Nm nominal torque (224 Nm peak)

Ironless linear motors

· Excellent force-to-weight ratio
· No latching force

Iron-core linear motors

· Optimum ratio between force and volume
· Weight-optimized magnetic track

Safety conformance

· ISO13849-1(PLc,d)
· EN61508(SIL2)
· IEC61800-5-2(STO)

Lineup

Series	1S Series		G5 Series	
Model	R88M-1☐/R88D-1SN☐-ECT		R88M-K/R88D-KN☐-ECT・R88L-EC/ R88D-KN☐-ECT-L	
Appearance				
Type	Built-in EtherCAT Communications		Built-in EtherCAT Communications	
Linear Type	No		Yes. Refer to the G5 Series Catalogs (Cat. No. I815 and I816) for details.	
100 VAC Applicable motor capacity/force	100 W to 400 W		50 W to 400 W	
200 VAC Applicable motor capacity/force	100 W to 3 kW		50 W to 15 kW	
400 VAC Applicable motor capacity/force	600 W to 3 kW		400 W to 15 kW	
Applicable servomotor	1S servomotor		G5 rotary servomotor	
Control mode	Position, speed and torque control		Position, speed and torque control	
Safety approvals	· ISO 13849-1 (PL-e/PL-d) · EN61508 (SIL3/SIL2) · EN62061 (SIL3/SIL2) · IEC 61800-5-2 (STO)		· ISO 13849-1 (PL-c,d) · EN61508 (SIL2) · EN62061 (SIL2) · IEC 61800-5-2 (STO)	
Full closed loop	—		Built-in	
Appearance				
Rated rotation speed	3,000 r/min	2,000 r/min	3,000 r/min	2,000 r/min
Momentary maximum rotation speed	5,000 to 6,000 r/min	3,000 r/min	4,500 to 6,000 r/min	3,000 r/min
Rated torque	0.318 to 9.55 N·m	4.77 to 14.3 N·m	0.16 to 15.9 N·m	1.91 to 23.9 N·m
Capacity	100 W to 3 kW	400 W to 3 kW	50 W to 5 kW	400 W to 5 kW
Applicable servo drive	1S Servo Drive		G5 Servo Drive (for rotary servomotor)	
Encoder resolution	23-bit absolute	23-bit absolute	20-bit incremental/ 17-bit absolute	20-bit incremental/ 17-bit absolute
Protective structure	IP67			
Appearance				
Rated rotation speed	1,000 r/min		1,500 r/min	1,000 r/min
Momentary maximum rotation speed	2,000 r/min		2,000 to 3,000 r/min	2,000 r/min
Rated torque	8.59 to 28.7 N·m		47.8 to 95.5 N·m	8.59 to 57.3 N·m
Capacity	900 W to 3 kW		7.5 to 15 kW	900 W to 6 kW
Applicable servo drive	1S Servo Drive		G5 Servo Drive (for rotary servomotor)	
Encoder resolution	23-bit absolute		17-bit absolute	20-bit incremental/ 17-bit absolute
Protective structure	IP67			
Detailed specification — **Catalog**	I821		I815 and I816	

Sysmac Family
Motion

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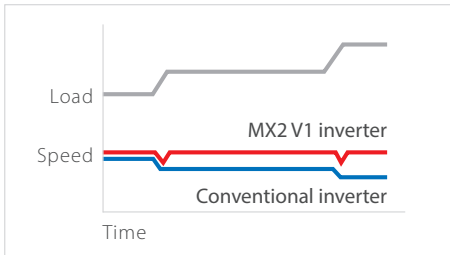## MX2-V1 Multi-function Compact Inverter

Born to drive machines

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

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

3G3RX-□□□□□-V1
RX-V1 High-function General-purpose Inverter

Versatile for a wide range of applications

· Maximum applicable motor capacity: 132 kW
· Double rating (CT: Heavy load/VT: Light load)
· Sensorless vector control, Vector control with a PG
· Drive Programming
· Built-in Electronic gear

Lineup

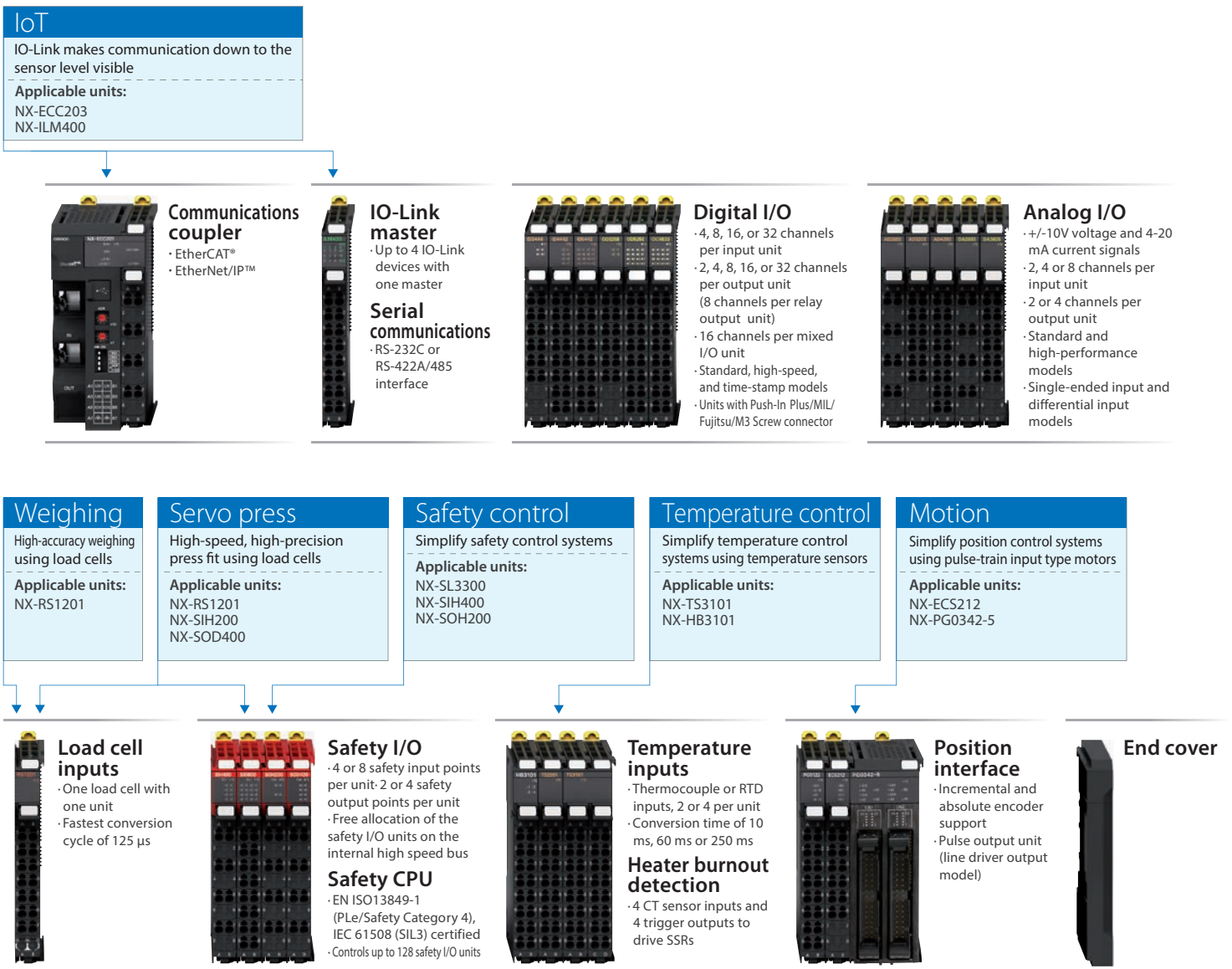| Series		MX2 Series V1 type	RX Series V1 type
Model		**3G3MX2-V1**	**3G3RX-V1**
Appearance			
Power supply and capacity	Three-phase 200 V	0.1 kW to 15 kW(CT)	0.4 to 55 kW(CT)
	Three-phase 400 V	0.4 kW to 15 kW(CT)	0.4 to 132 kW(CT)
	Single-phase/three-phase 200 V	No	—
	Single-phase 200 V	0.1 kW to 2.2 kW(CT)	—
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	· 9 inputs (1 RUN (FWD) input + 8 multi-function inputs) · 5 transistor outputs · 1 relay output

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

Braking		· Braking resistor connection
		· Regenerative Braking Unit connection
		· Regenerative Braking Unit
		  + braking resistor connection
			· Braking resistor connection (22 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
	Double Rating	Yes	Yes
	MOTOR CONTROL Permanent magnet motors	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	—
Detailed specification	Catalog	I920	I919

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.

IoT
IO-Link makes communication down to the sensor level visible

Applicable units:
NX-ECC203
NX-ILM400

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

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

Weighing
High-accuracy weighing using load cells

Applicable units:
NX-RS1201

Servo press
High-speed, high-precision press fit using load cells

Applicable units:
NX-RS1201
NX-SIH200
NX-SOD400

Safety control
Simplify safety control systems

Applicable units:
NX-SL3300
NX-SIH400
NX-SOH200

Temperature control
Simplify temperature control systems using temperature sensors

Applicable units:
NX-TS3101
NX-HB3101

Motion
Simplify position control systems using pulse-train input type motors

Applicable units:
NX-ECS212
NX-PG0342-5

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

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

Safety CPU
· EN ISO13849-1 (PLe/Safety Category 4), IEC 61508 (SIL3) certified
· Controls up to 128 safety I/O units

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

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

End cover

Lineup

Series	NX Series
Features	· Over 100 models including digital I/O, analog I/O, position interface, temperature inputs, 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.
I/O types	Digital I/O, analog I/O, load cell input, encoder input, pulse output, temperature input, heater burnout detection, communications interface, IO-Link master, safety
Mounting	DIN track
Detailed specification Catalog	R183

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

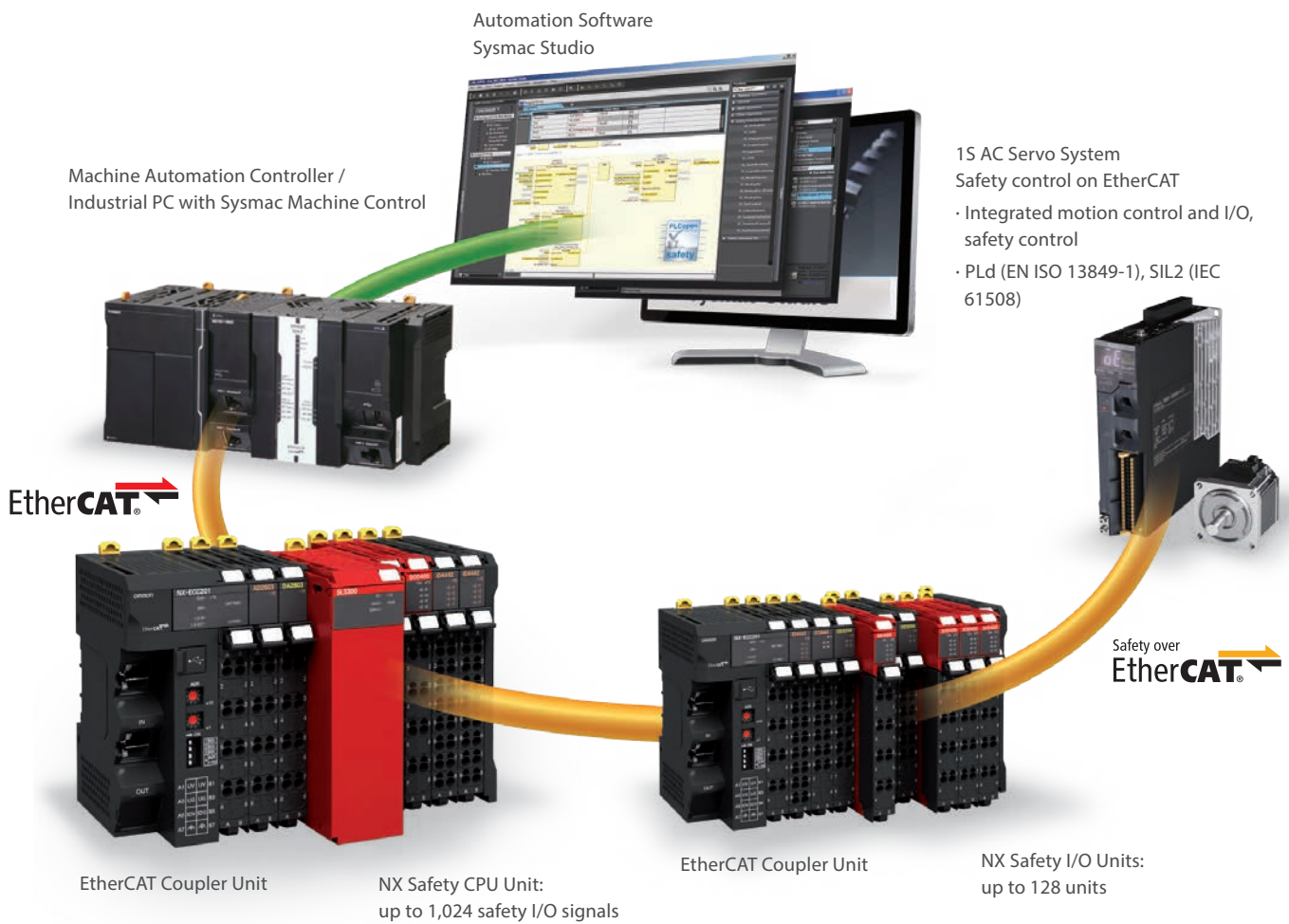| Series	GX Series
Features	· Detachable screw terminal block and e-CON connector types · Easy set-up: automatic and manual address setting
Appearance	
Type	Block I/O
Communications interface	EtherCAT
Number of connectable units	One expansion unit can be connected with one digital I/O terminal (16 inputs + 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-SL/SI/SO
NX Safety Controller

Integrated safety into machine automation

· The safety controller meets PLe according to the ISO 13849-1 and SIL3 according to IEC 61508
· Flexible system lets you freely mix safety controller and safety I/O units with standard NX I/O
· Integration in One software, Sysmac Studio
· Certified programs can be reused, which reduces the amount of verification work

Automation Software
Sysmac Studio

Machine Automation Controller /
Industrial PC with Sysmac Machine Control

1S AC Servo System
Safety control on EtherCAT
· Integrated motion control and I/O, safety control
· PLd (EN ISO 13849-1), SIL2 (IEC 61508)

EtherCAT

Safety over
EtherCAT

EtherCAT Coupler Unit

NX Safety CPU Unit:
up to 1,024 safety I/O signals

EtherCAT Coupler Unit

NX Safety I/O Units:
up to 128 units

Lineup

Safety Controller

Product name	Safety CPU Unit	Safety Input Unit	Safety Output Unit
Model	NX-SL3300/3500	NX-SIH400/SID800	NX-SOH200/SOD400
Features	· Integrated safety into machine automation through the use of Safety over EtherCAT -FSoE- protocol*. Freely mixing with standard NX I/O · Sysmac Studio version 1.07 or higher for hardware configuration and programming		
	· Flexible Safety system building	· Optimal I/O building	
Appearance			
Network	FSoE – Safety over EtherCAT		
Applicable standards	EN ISO 13849-1 (PLe/Safety Category 4), IEC 61508 (SIL3), EN 62061 (SIL3), EN 61131-2		
Programming	· IEC 61131-3 standard · PLCopen Function Blocks for Safety		
Program capacity	512 KB, 2048 KB	—	—
Number of safety master connections	32/128	—	—
Maximum number of safety I/O points	256, 1024	—	—
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.

Wide camera range

· Up to 12 Mpixel
· High speed CMOS camera
· Use different fields of vision and at any angle

Advanced shape search technology

· Differences of the work piece
· Dust and dirt conditions
· Detection of overlapping objects
· Changing ambient environment

Focal shift   Contrast   Chips

Hidden   Overlapping   Thinning and thickening
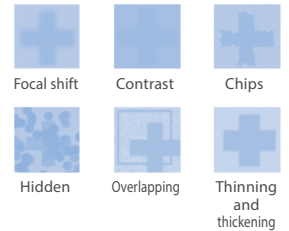
Flexible machine vision

· Over 100 processing items including 1D code, 2D code and OCR
· Inspection of scratches and defects

Multiple inspection

· Powerful 4-core i7 parallel processor
· Up to 8 camera by one controller
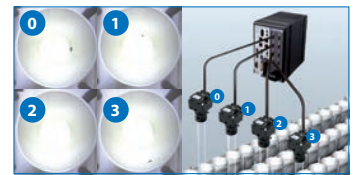
FQ-M
Vision Sensor

Designed for object tracking

The FQ-M Series is a vision sensor designed specifically for pick and place applications. Up to 5,000 pieces per minute with 360 degree rotation can be detected. The FQ-M series include an incremental encoder input for easy tracking and calibration.

EtherCAT

Compact design

Camera and image processing in one

Standard C-mount lenses; choose the field of view and focus distance you need

· Flexible cables
· Vision sensor with encoder input for tracking function

75 mm
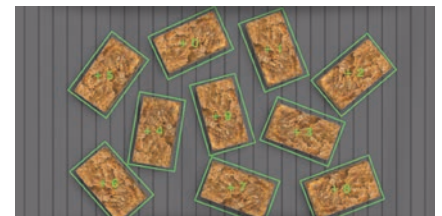
110 mm

Advanced shape search technology

Varying material ie. shiny

Overlapping products

Product detection:
10 pcs with rotation < 200 ms

Lineup

Product name		Smart Camera	Vision System
Series		FQ-M Series	FH Series
Appearance			
Hardware features		· Camera and image processing in one · Easy to installation	Flexible configuration of cameras and controller to suit your applications
Software feature		Communication wizard for easy setting	Flexible setting with flowchart
Processing items		Processing items for Pick & Place applications	Processing items covering general applications
Processing resolution	0.30 Mpix	752 (H)×480 (V)	640 (H)×480 (V)
	2 Mpix	—	2040 (H)×1088 (V)
	4 Mpix	—	2040 (H)×2048 (V)
	12 Mpix	—	4084 (H)×3072 (V)
Communications interfaces		EtherCAT, Ethernet, Parallel I/O, encoder input	
Detailed specification	Catalog	Q183	Q197

Sysmac Family
Sensing

ZW-7000/5000
Confocal Fiber Displacement Sensor

Micron-level moving measurement

The ZW-7000/5000 Series measures different material types and shapes with micron-level accuracy while moving the sensor head, increasing quality inspection accuracy and reducing 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: ±0.5 μm or less
· Minimum sampling period: 20 μs
· Minimum spot diameter: 10 μm or less

Notes. Specifications 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-FA
Fiber Amplifier Units

E3NX-CA
Color Fiber Amplifier Units

E3NC-S
Ultra-compact CMOS Laser Sensors

N-Smart Amplifier Units
Easy application with consistent operating procedures

EtherCAT

N-Smart
Presence / Detection / Measurement

E3NC-L
Compact Laser Sensors

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

E3NW
Sensor Communications Units

E9NC-T
Smart Contact Sensors

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		Fiber Sensor/Laser Sensor/Proximity Sensor/ Contact Sensor	
Series	ZW-7000 Series	ZW-5000 Series	N-Smart Series	E3X/E3C/E2C
Feature	Sampling rate as fast as 20 µs - for moving measurements	Small spot diameter of 10 µm or less - for minute measurements	Connect fiber, laser and contact sensors to EtherCAT at low initial cost	Easily connect fiber, laser photoelectric and proximity sensors to EtherCAT
Appearance				
Measurement method	White light confocal principle		—	—
Measuring range	Min : 10±0.5 mm, Max : 30±2 mm		—	—
Static resolution	0.004 to 0.016 µm		—	—
Linearity	±0.45 to ±2.0 µm		—	—
Spot diameter	50 to 100 µm dia.	9 to 18 µm dia.	—	—
Measurement cycle	20 to 400 µs	80 to 1600 µs	—	—
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	Fiber Sensor E3X-HD0 E3X-MDA0 Laser Sensor E3C-LDA0 Proximity Sensor E2C-EDA0
Maximum number of connectable sensors	—	—	30	30
Detailed specification	Catalog	Q250	E3NW: E418 E3NX-FA: E418 E3NX-CA: Y216 E9NC-T: E434	—
	Web	Refer to your OMRON website.		

Sysmac Family
Robot

Hornet/Quattro, Cobra/eCobra, Viper
Parallel Robot, SCARA Robot, Articulated Robot

Robots for flexible production lines

Parallel, SCARA, and articulated robots are designed to be programmed using familiar programming languages (IEC 61131-3) through the NJ/NX/NY Controller that is connected to the robots via EtherNet/IP.

Parallel robots

The Hornet and Quattro are parallel robots ideal for use in the food and beverage, pharmaceutical, and healthcare industries. The Quattro 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

Hornet 565
Quattro 650/800

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: 350, 600, and 800 mm models

Cobra 350
eCobra 600/800
eCobra 800 Inverted

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 650/850

Lineup

Series	Hornet 565	Quattro 650/800	Cobra 350
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	Small 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 kg
Working volume (radius)	565 mm	650 to 800 mm	—
Reach	—	—	350 mm
Position repeatability	±0.10 mm	±0.10 mm	±0.015 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)	Class10 Cleanroom model
Detailed specification — Catalog	I822		

Series	eCobra 600/800	eCobra 800 Inverted	Viper 650/850
Feature	Mid-size/large SCARA robot for precision machining, assembly, and material handling	Overhead-mount 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	5.5 kg	5.5 kg	5 kg
Working volume (radius)	—	—	—
Reach	600 to 800 mm	800 mm	635 to 855 mm
Position repeatability	±0.017 mm	±0.017 mm	±0.02 to 0.03 mm
Protection/Cleanroom classes — Specifications	IP20	IP20	IP40
Protection/Cleanroom classes — Option	· eCobra 600 Class10 Cleanroom model · eCobra 800 IP65, Class10 Cleanroom model	IP65, Class10 Cleanroom model	IP54: robot main body IP65: robot joints (J4, J5, J6) Class10 Cleanroom model
Detailed specification — Catalog	I822		

Service and support
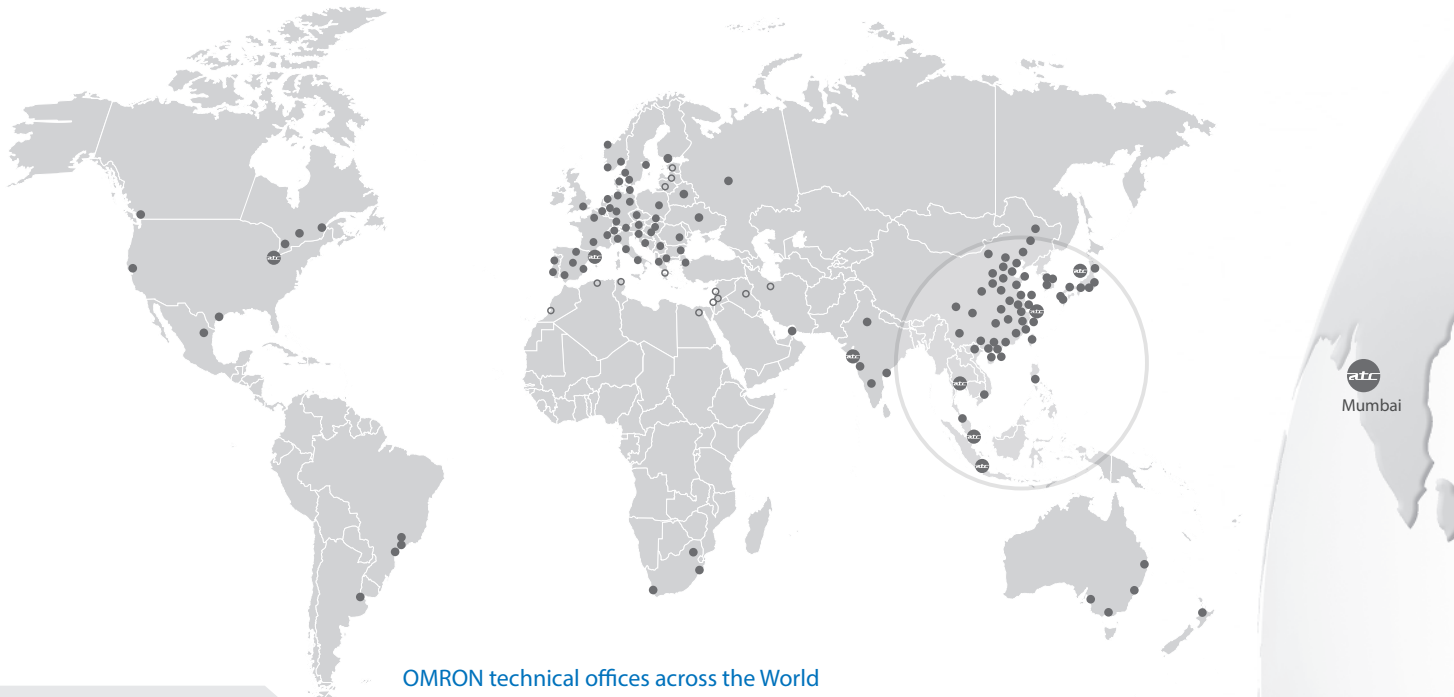
OMRON technical offices across the World

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

⚫ Technical office   ⭕ Premium Partner
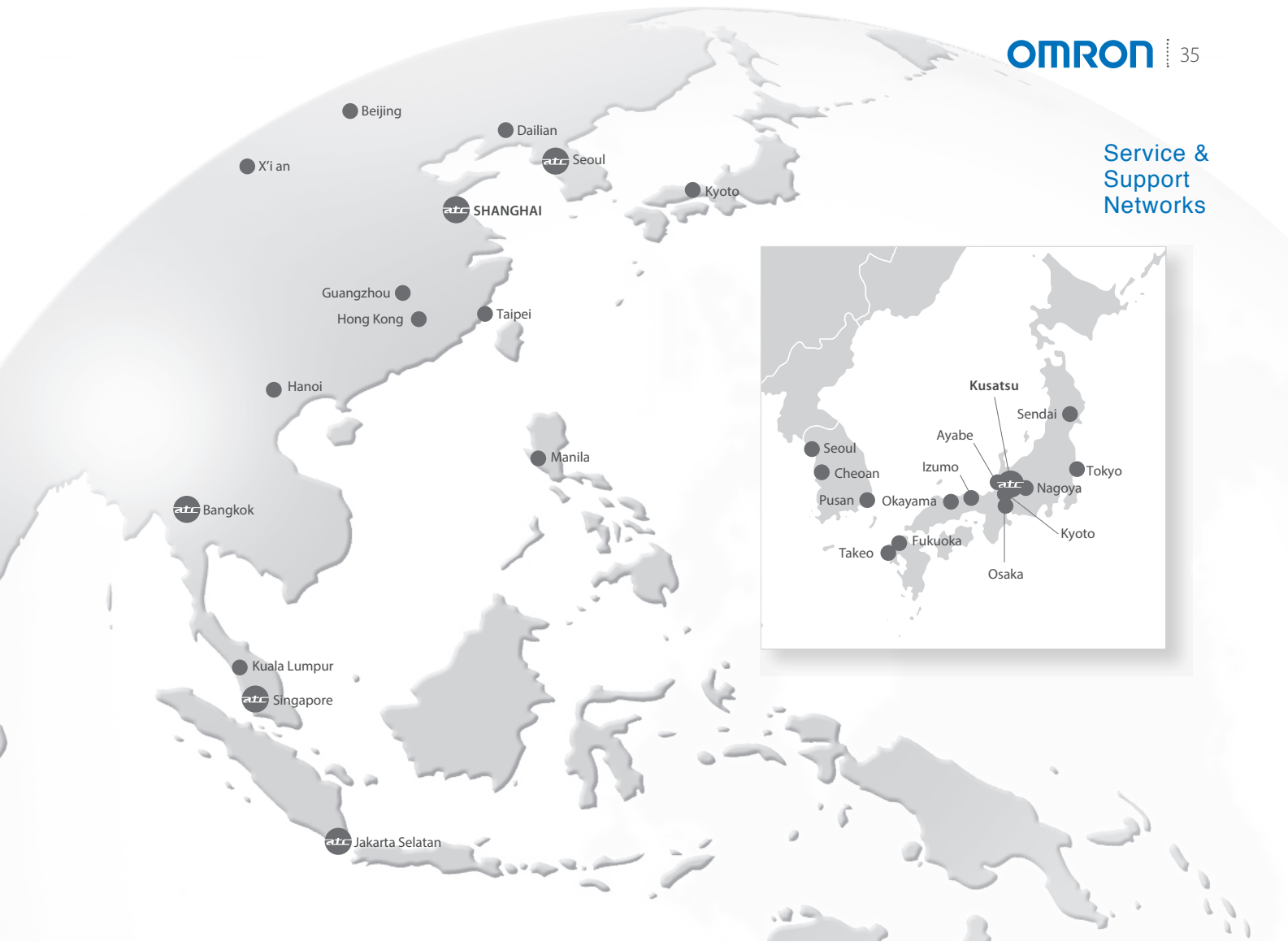
PRESENCE

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.

Map labels: Beijing, Dailian, X'i an, Seoul, SHANGHAI, Kyoto, Guangzhou, Hong Kong, Taipei, Hanoi, Manila, Bangkok, Kuala Lumpur, Singapore, Jakarta Selatan

Inset map labels: Kusatsu, Sendai, Ayabe, Seoul, Izumo, Tokyo, Cheoan, Nagoya, Pusan, Okayama, Kyoto, Takeo, Fukuoka, Osaka

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 -

OMRON Corporation   **Industrial Automation Company**

   Tokyo, JAPAN

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