

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

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

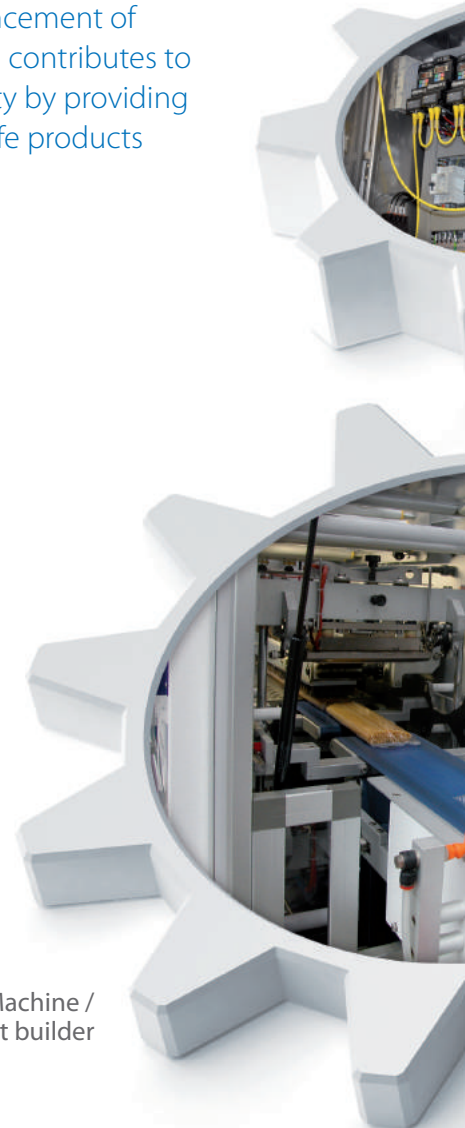
- Non-stop processes, 24/7 operation
- Extended product lifecycle



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

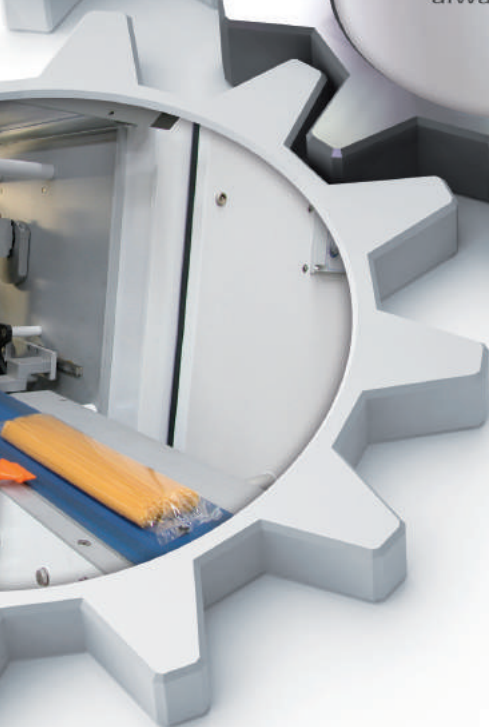
Panel builder /
System integrator



Manufacturer



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.

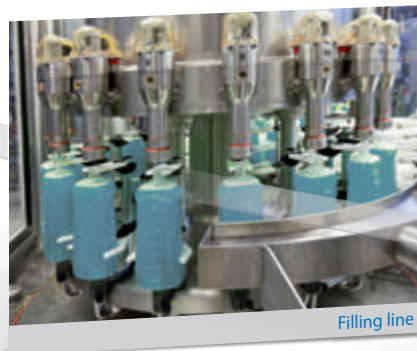


Machine Automation Controller

FACTORY
AUTOMATION

MACHINE
CONTROL

Motion



Filling line

- 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

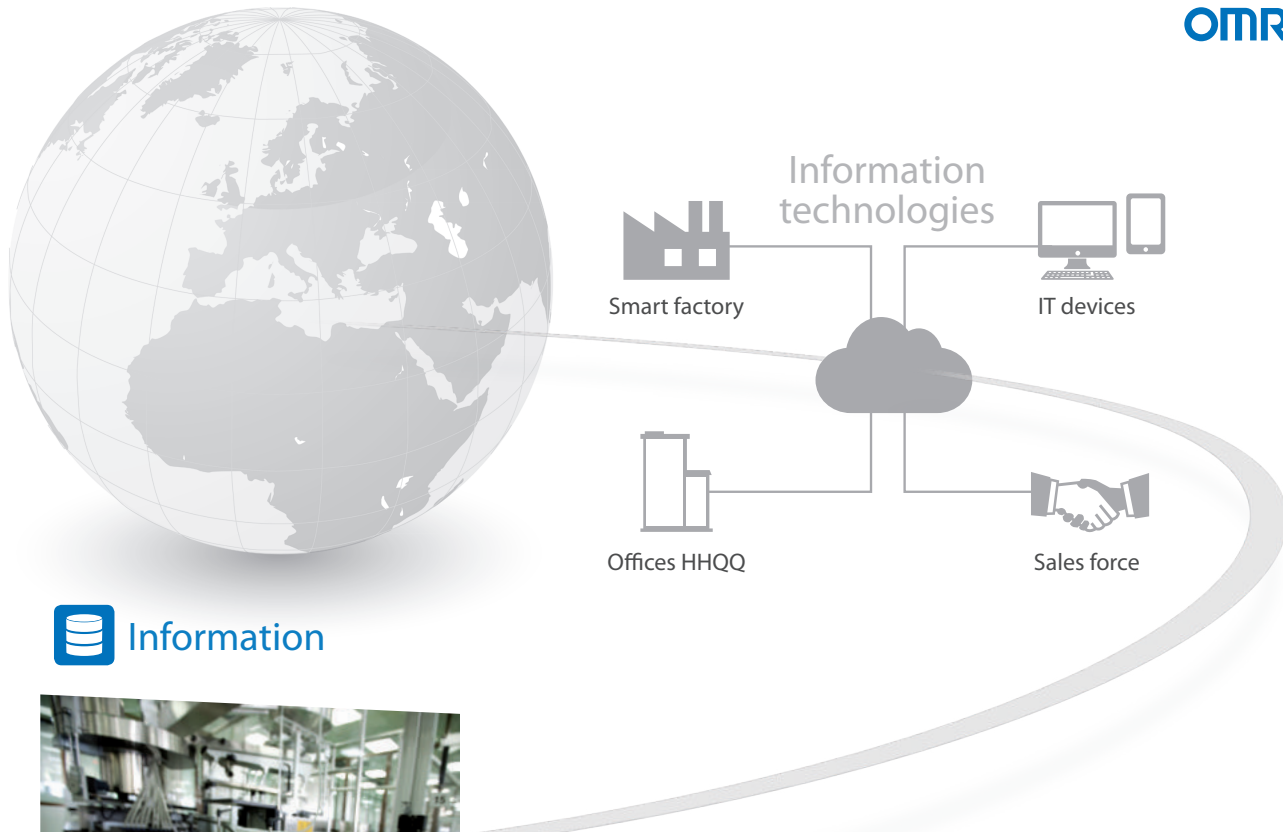
Safety



Assembly

- 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.

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



 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

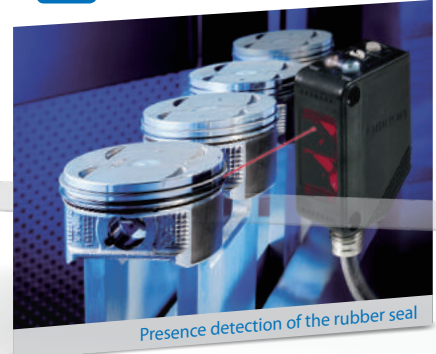
 Robotics



Pick & Place

- Up to 8 Delta robots with one controller
- Time-based Robotic Function Blocks make programming easier

 Sensing



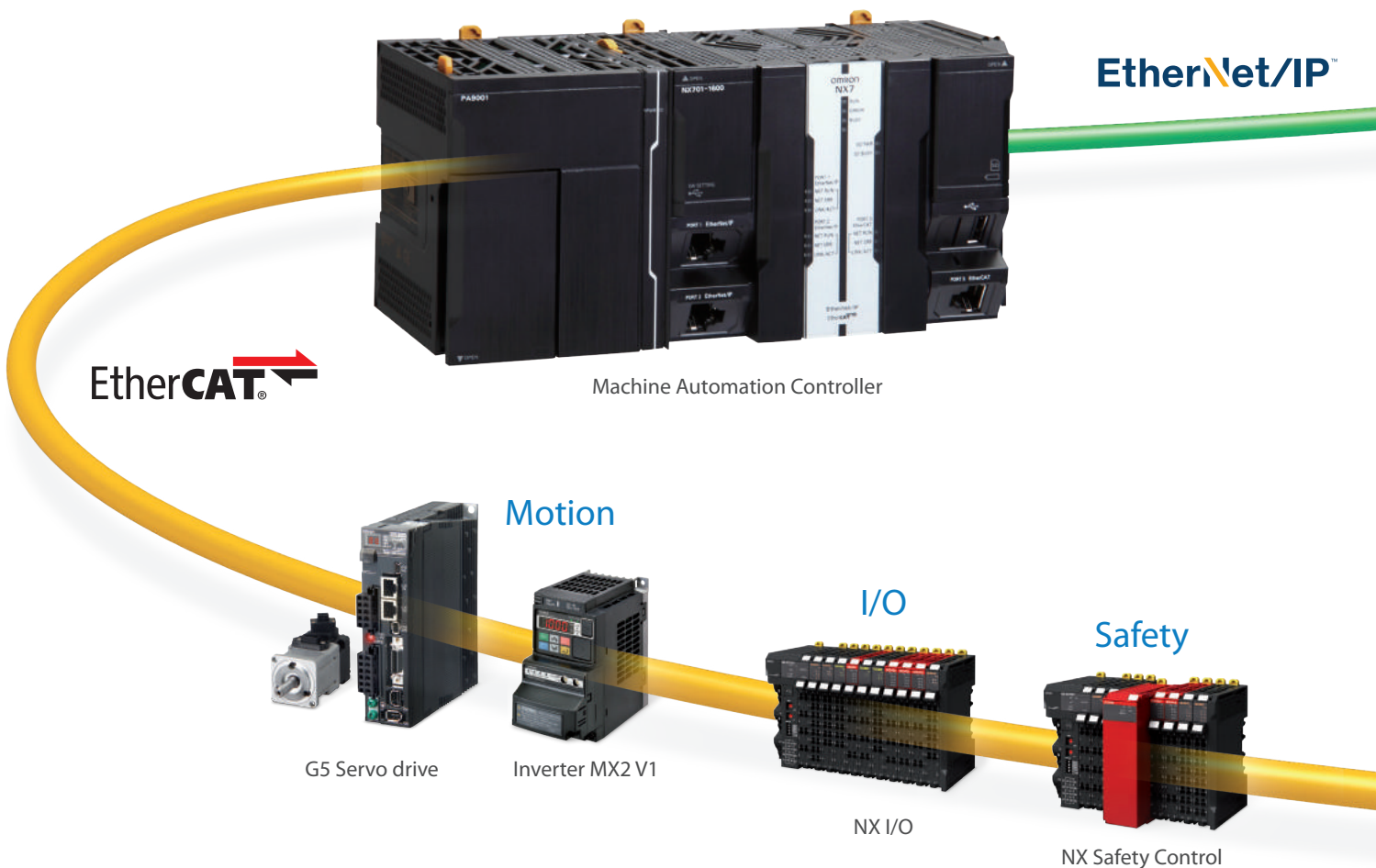
Presence detection of the rubber seal

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

One Connection

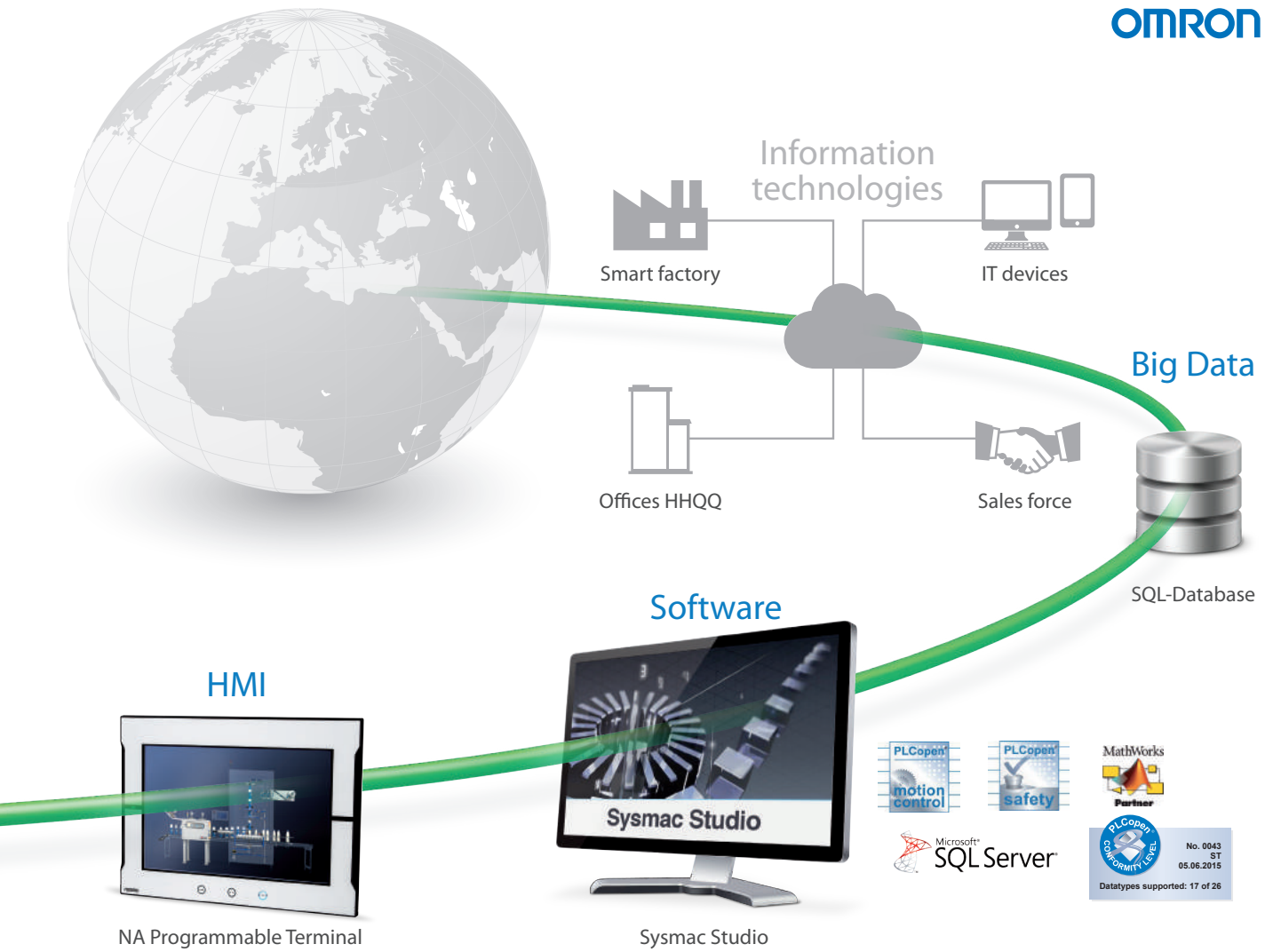
Seamless machine control and factory automation

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.



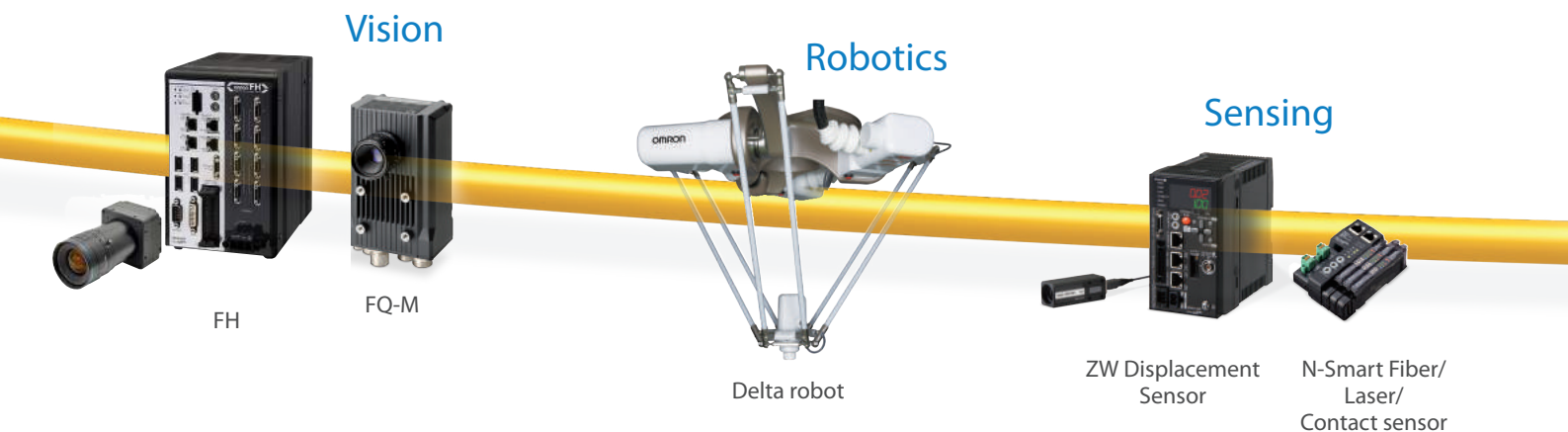
EtherCAT - Machine Control

- Fastest cycle time: 125 μ s
- Up to 256 synchronized axes
- 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



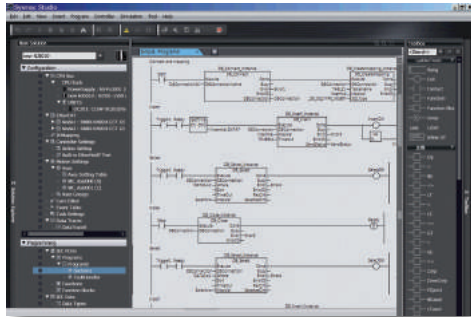
Ethernet - Factory Automation

- 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



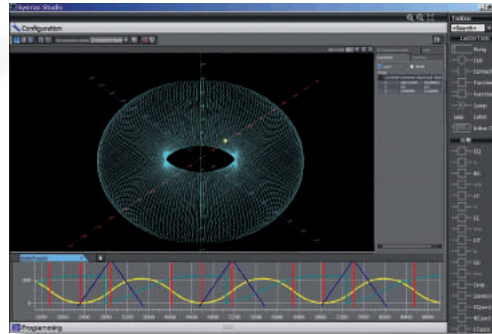
Information

Projects can generate a huge volume of data, but thanks to the Sysmac Database Connectivity FB library, this data can be analyzed and acted on in real-time.



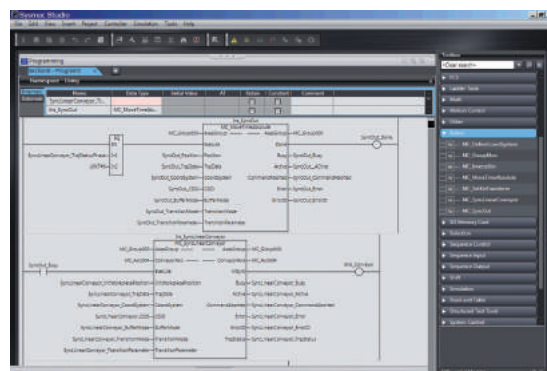
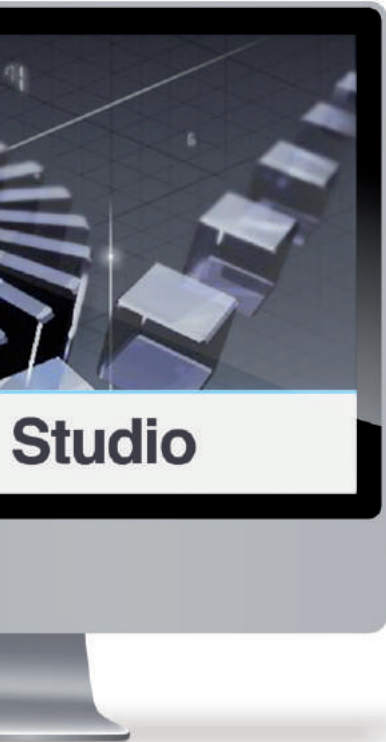
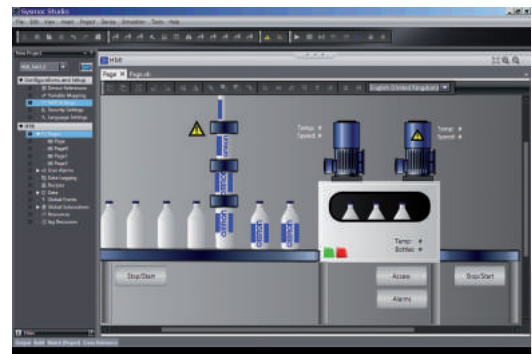
Simulation

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.



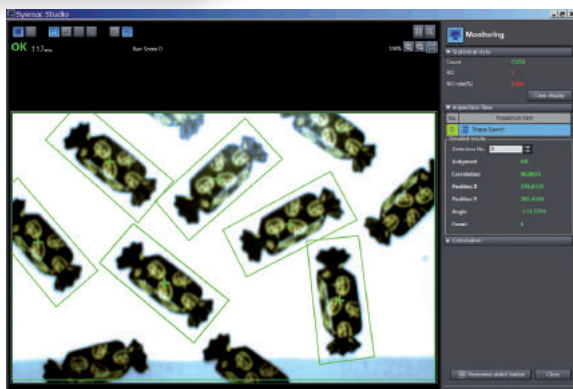
HMI

Design your own IAG's (Intelligent Application Gadgets) using the machine parts collection. It is also possible to embed code within an IAG using Visual Basic standard functionality. The Simulator in the Sysmac Studio allows you to test the NA application with the Machine Controller program.



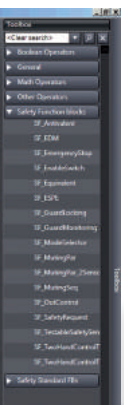
Robotics

Integrated robotics Function Block library for Delta 2 and Delta 3 control. A 3D simulator is also integrated in the Sysmac Studio, visualizing and reproducing the Delta robot trajectory.



Vision

Just drag & drop any processing items to build a program for image processing.



One Machine Controller

Complete and robust machine automation

The Machine Automation Controller is at the heart of the Sysmac platform. One integrated machine controller that offers speed, flexibility and scalability of software centric architecture without compromising on the traditional reliability and robustness that you have come to expect from Omron PLCs. The Machine Controller is designed to meet extreme machine control requirements in terms of motion control speed and accuracy, communication, security and robust system. You just create...



Application libraries

- FB library option for packaging engineering (Rotary Knife, Winder/Unwinder, Temperature Control...)

System robustness

- One event log for controller, field devices and networks
- Standard PLC system check: Watch-Dog Timer, memory check, network topology check, etc.

Machine automation controller features

- Fastest system cycle: 125 μ s
- 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
- Built-in EtherCAT and EtherNet/IP ports
- CE and cULus global standards



Hardware design

- Architecture based on new Intel® CPU
- The most compact controller in its class
- Built-in USB port and SD card slot

✓ Scalability, performance, robustness... Choose the most suitable CPU for your application!



	NX7	NJ5	NJ3	NJ1
Fastest Cycle Time	125 μ s	500 μ s	500 μ s	1 ms
Real axes	256, 128 axes	64, 32, 16 axes	8, 4 axes	2, 0 axes
EtherCAT slaves	512	192	192	64
Motion Core	Two synchronized Motion Cores	Synchronized Motion Core	Synchronized Motion Core	Synchronized Motion Core



EtherNet/IP™

Standard Factory network

- Programming
- Other Machine controllers
- HMI / SCADA
- IT systems
- Standard Protocols and Services: TCP/IP, FTP, NTP, SNMP
- CIP protocol
- Database connection FB's for Microsoft SQL Server, Oracle, IBM DB2, MySQL and Firebird
- Built-in SECS/GEM communications functionality

EtherCAT®

Standard Machine network

- Servos
- Inverters
- Robotics
- Vision systems
- Distributed I/O
- Integrated Safety
- Sensing

Standard programming

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



NA Programmable Terminal

The next generation of machine interface

An HMI that is dynamic, intuitive and predictive makes industrial machines more attractive and competitive. The new Omron HMI enables faster, more efficient control and monitoring - and a more natural, proactive relationship between operator and machine. The design has been based on real applications and customer requirements, a future-proofed, scalable platform that will evolve with their ever-changing needs, allowing real time reaction to events. As part of the system family, the NA Series is fully aware of the total machine.

Hardware design

- Fan-less cooling
- Water and dust proof design – IP65
- SD card slot for transfer/store projects and data logging

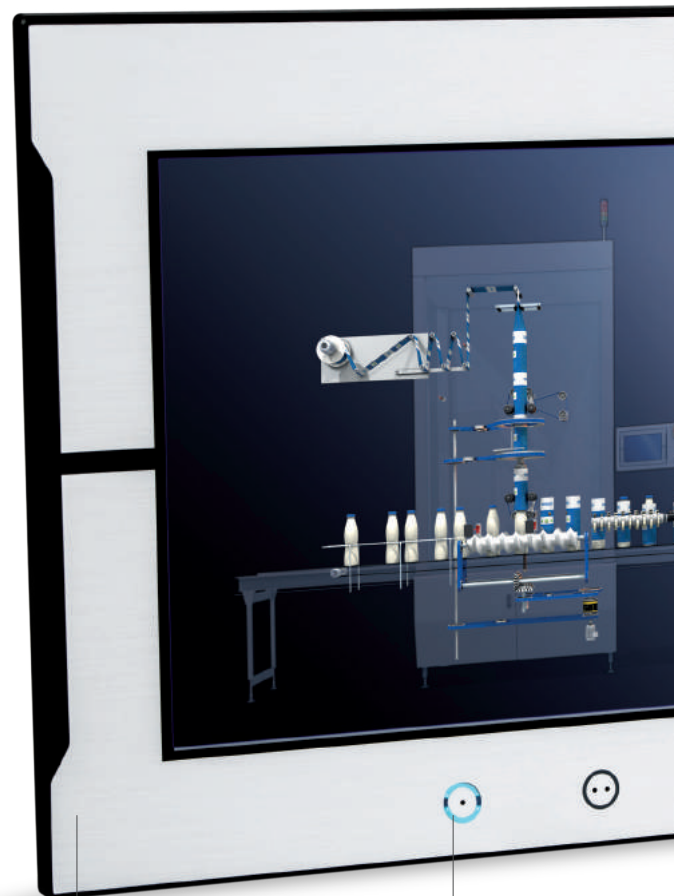


Connectivity

- 3 x USB ports: USB memory and programming
- 2 x Ethernet ports: for machine network / IT systems and programming

NA machine interface features

- Widescreen models: 7, 9, 12 and 15 inches
- 1280 x 800 high resolution display (12 and 15 inches)
- One integrated project in the Sysmac Studio: NJ/NX
- Controller, Safety, Vision and HMI



Black and Silver frame color

Programmable Function Keys

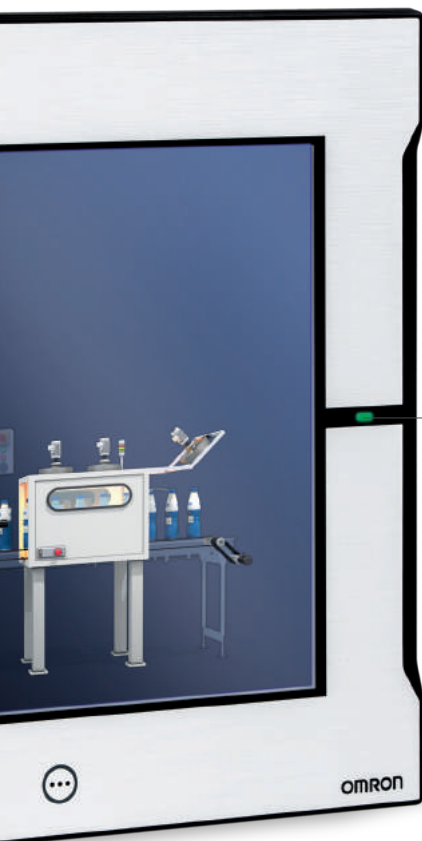


Machine interface

- Touch screen
- 3 x Programmable Function Keys
- Multimedia including PDF files and video

Scalable solution

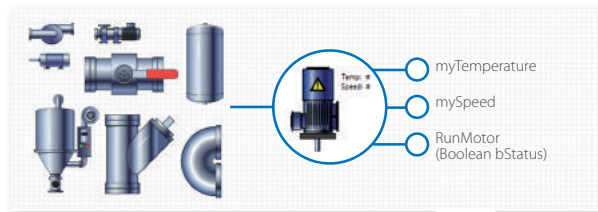
- Display size from 7-inch up to 15-inch
- Widescreen in all models
- 1280 x 800 resolution for the 12-inch and 15-inch models
- 800 x 480 resolution for the 7-inch and 9-inch models
- Available in black and silver frame colors



RUN led indicator

IAG – Intelligent Application Gadgets

- Graphics collection from the machine parts
- Embedded code within an IAG with the Visual Basic standard functionality
- Make your own IAG collection and share them between projects, like a Function Block



Sysmac Studio

- NA HMI programming as a device in the Sysmac Studio
- NJ/NX controller variables (Tags) in the NA project
- Multiple-access level security with password protection
- Visual Basic programming with Visual Basic
- NA application testing with the NJ/NX program via the Simulator in the Sysmac Studio

NX I/O

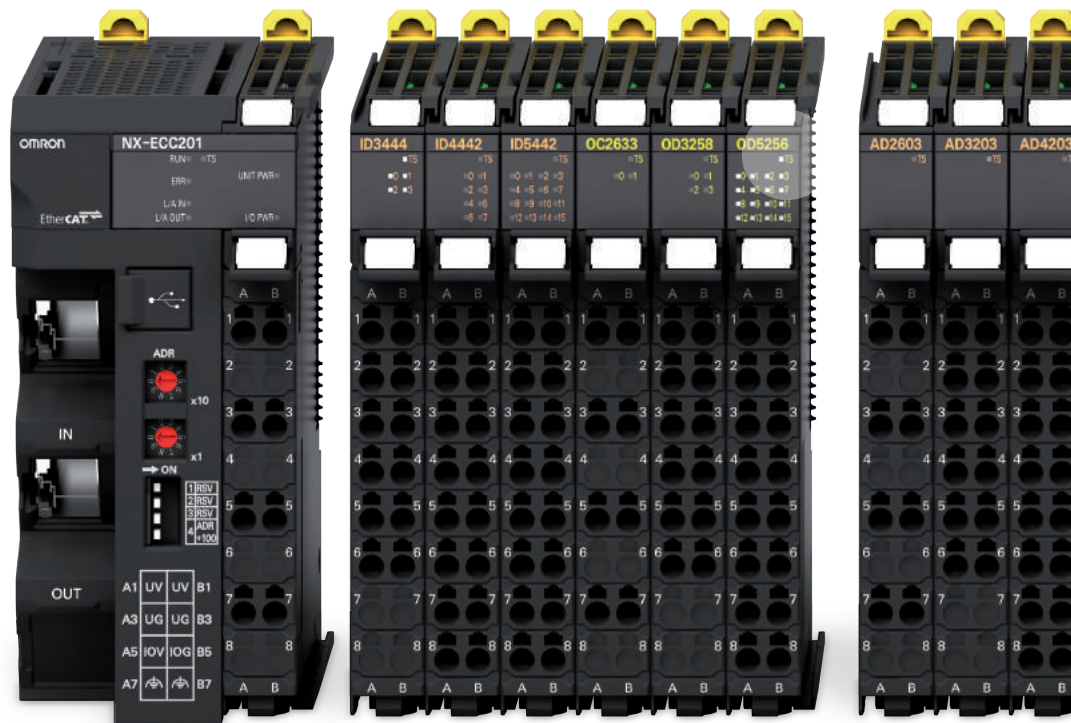
Speed and accuracy for machine performance

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 90 models including position control, temperature inputs and integrated safety.



EtherCAT connectivity

- Distributed clock to ensure I/O response with less than 1 μ s jitter
- Safety over EtherCAT (FSoE)



EtherCAT coupler

- Up to 1024 byte input / 1024 byte output
- Automatic backup/restore of all I/O unit parameters. Except Safety Control unit and Safety I/O units

Digital I/O

- Units for 4, 8 or 16 points
- Standard, high-speed and time-stamp models
- Relay outputs, NO only or NO+NC
- 240 V AC inputs
- 16- and 32-point units with MIL/M3 Screw/FCN connector

NX I/O features

- NsynX technology provides deterministic I/O response with nanosecond resolution
- Digital I/O: high-speed and time-stamp models (NsynX)
- Analogue I/O: high performance models offer 10 μ s conversion time per channel and 1:30000 resolution
- Detachable front connector with push-in type screwless terminals on all NX I/O units
- On/Offline configuration, simulation, and unified troubleshooting in the Sysmac Studio software

Serial communication

- Units for RS232C or RS422A/485 serial communication interface

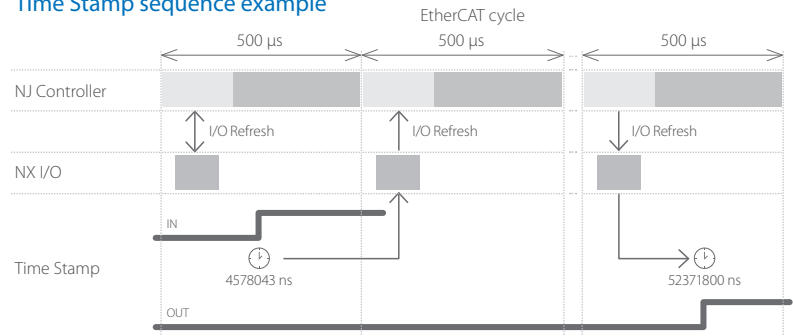
- High signal density; up to 16 I/O points in 12 mm width



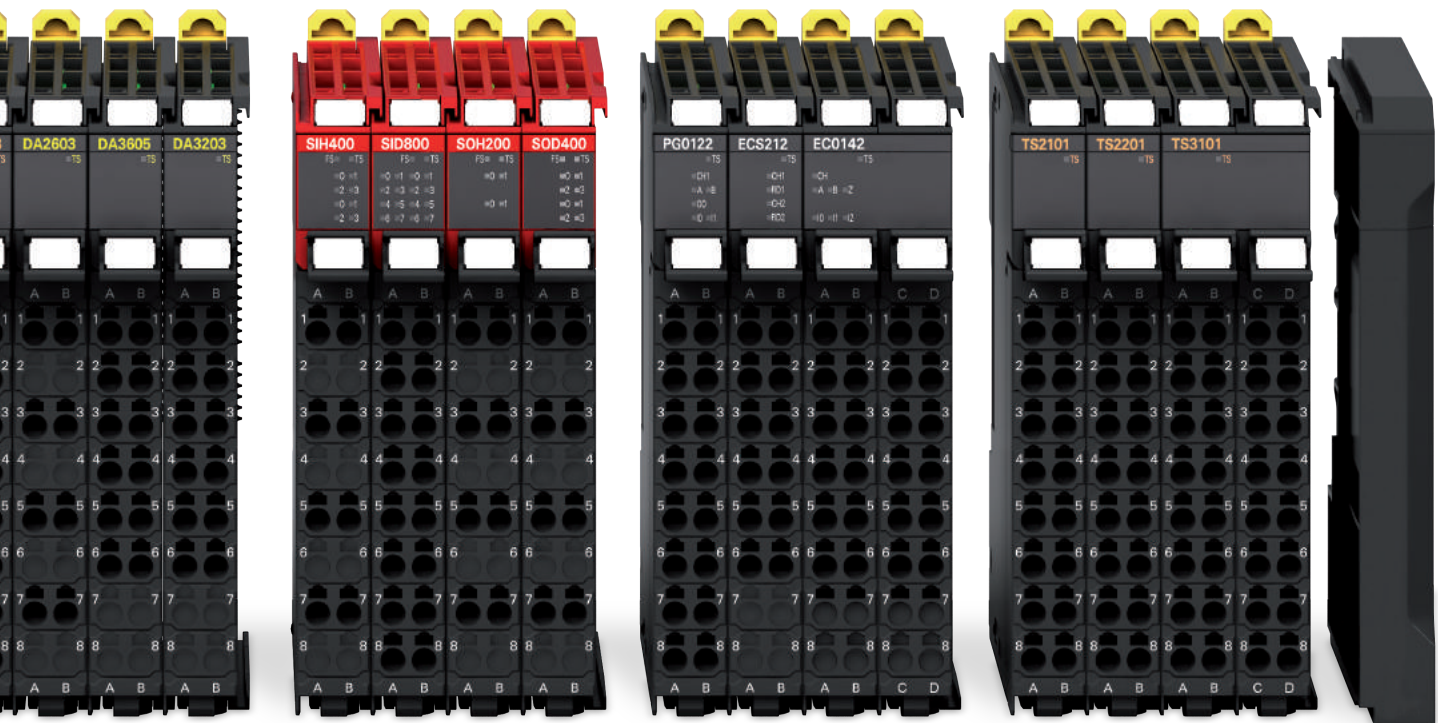
NsynX technology

- The NsynX technology is provided by the internal high-speed bus synchronized with the EtherCAT network. This technology is designed for machine control and includes:
 - I/O units with distributed clock
 - High-speed I/O units synchronized with the EtherCAT cycle
 - I/O units with Time-Stamp function (accuracy <math>< 1 \mu\text{s}</math>)

Time Stamp sequence example



Accurate control of input events and perfect control of output with nanosecond resolution



Analogue 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

Safety I/O

- Up to 8 safety input points per unit
- Free allocation of the Safety I/O units on the internal high speed bus.

Position interface

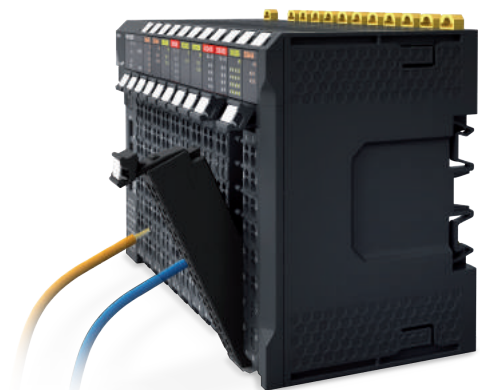
- Encoder input units for connection of external axes to the Sysmac system
- Incremental and absolute encoder support
- Positioning control unit with pulse train output

Temperature Inputs

- Thermocouple or RTD inputs, 2 or 4 per unit

End Cover

- Fast and secure screwless push-in connections
- Removable I/O connectors for easy pre-wiring, testing and system maintenance



NX Safety Control

Integrated safety into machine automation

The Sysmac platform integrates a safety solution within our one connection and one software concept. One connection is realized through the use of Safety over EtherCAT -FSoE- protocol. The One software is achieved by using the Sysmac Studio for configuration, programming and maintenance. The NX safety system consists of safety controller and safety I/O units. Both the safety controller and safety I/O can be freely distributed in an I/O rack throughout the network, mixing them in any combination with standard NX I/O.

EtherCAT®



EtherCAT telegram



NX Safety controller

- The safety controller variables are part of the NJ/NX controller project
- Flexibility and reusability of the programming code

NX Safety features

- 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



ISO 13849-1, PLe

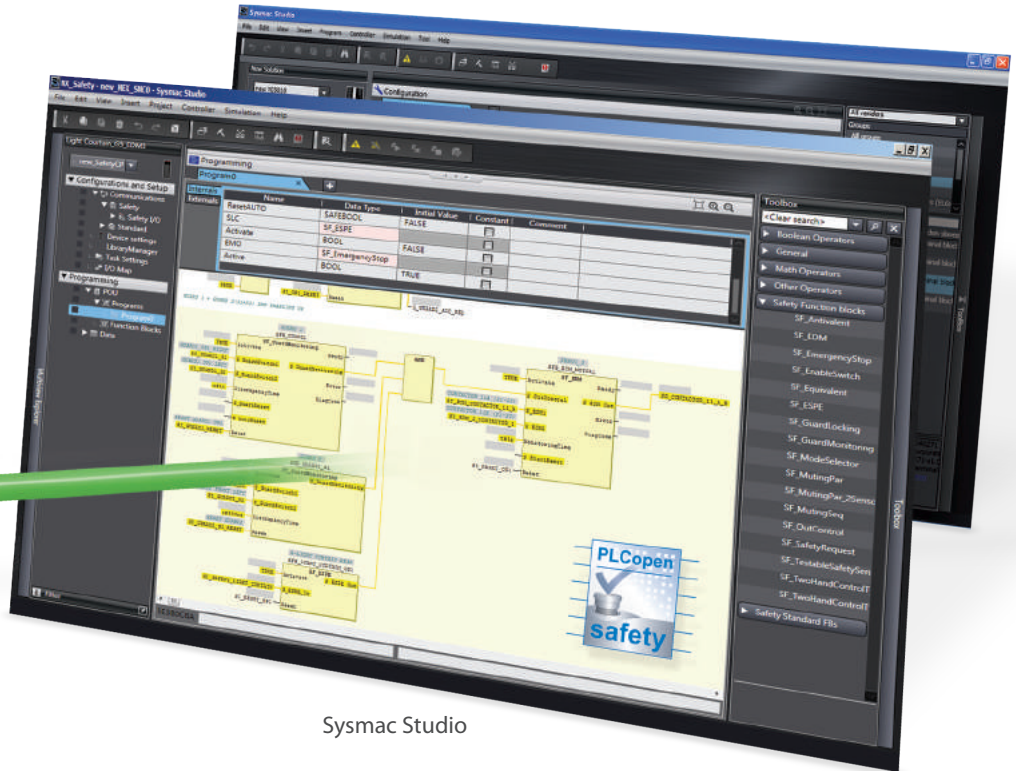
IEC 61508, SIL3

Safety integration in One software

- Integrated Development Environment in Sysmac Studio provides one common software for hardware configuration, programming and maintenance of the Sysmac platform
- 46 safety FB/FN conforming with IEC 61131-3 standard programming
- PLCopen Function Blocks for safety



Machine Automation Controller



Sysmac Studio

Safety over EtherCAT frame



NX Safety I/O

- Up to 8 safety input points per unit
- High connectivity I/O units for direct connection to a variety of devices
- I/O data monitoring in the NJ/NX controller project

G5 Servo system

At the heart of every great machine

Great machines are born from a perfect match between control and mechanics. G5 gives you that extra edge to build more accurate, faster, smaller and safer machines.



EtherCAT connectivity

- Compliant with CoE -CiA402 Drive profile-
- Cyclic Synchronous Position, Velocity and Torque modes
- Embedded Gear Ratio, Homing and Profile Position mode
- Distributed clock to ensure high precision synchronization



Safety conformance

- PL-d according ISO 13849-1
- STO: IEC61800-5-2
- SIL2 according to EN61508

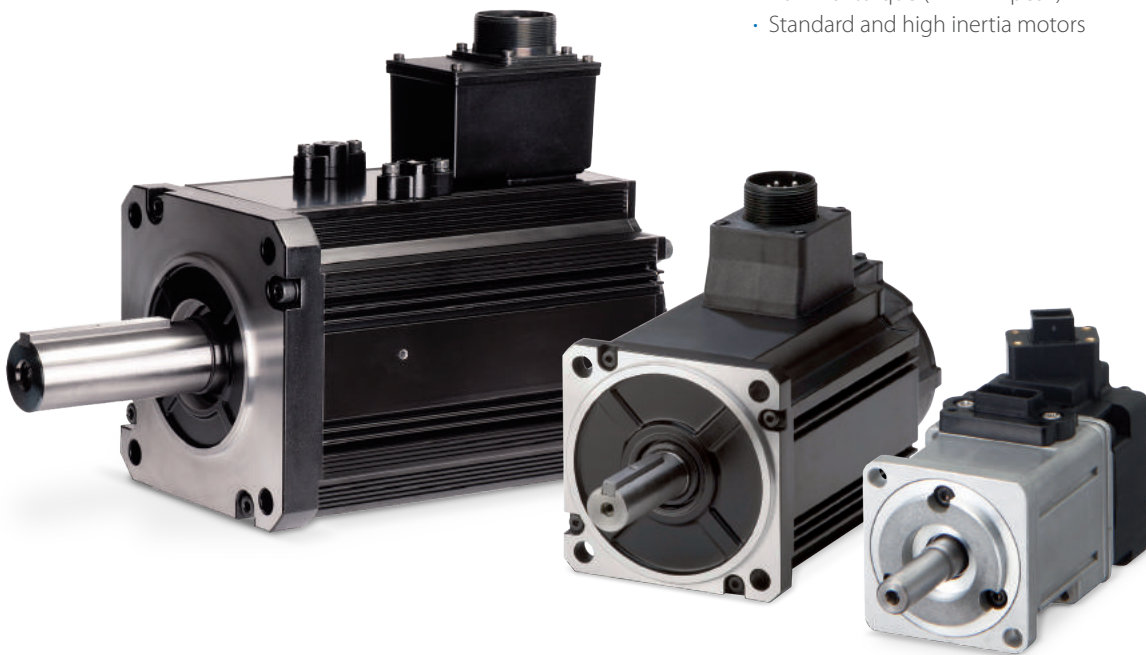
G5 servo system features

- Compact size servo drives with EtherCAT connectivity built-in
- High-response frequency of 2 kHz
- Load vibration suppression
- Embedded Safety conforming ISO 13849-1 Performance Level d
- Advanced tuning algorithms (Anti-vibration function, torque feedforward, disturbance observer)
- Wide range of linear and rotary servo motors



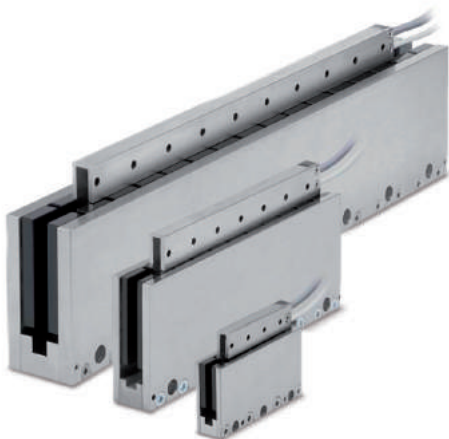
Improved rotary motors

- Low cogging torque servo motors
- High accuracy provided by 20 bit encoder
- Motors and connectors with IP67
- Large range of motors from 0.16 Nm up to 96 Nm nominal torque (224 Nm peak)
- Standard and high inertia motors



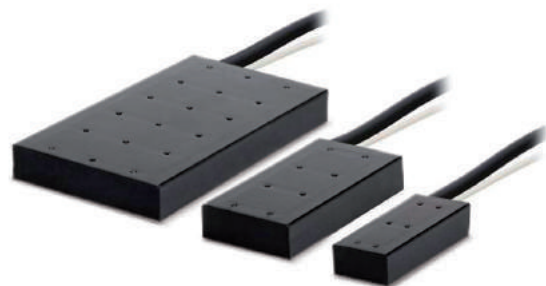
Ironless linear motors

- Compact, efficient design
- Excellent force-to-weight ratio
- No latching force



Iron-core linear motors

- Compact, flat design
- Optimum ratio between force and volume
- Weight-optimized magnetic track



MX2 V1 and RX V1 Inverter series

Drive solution for machine automation

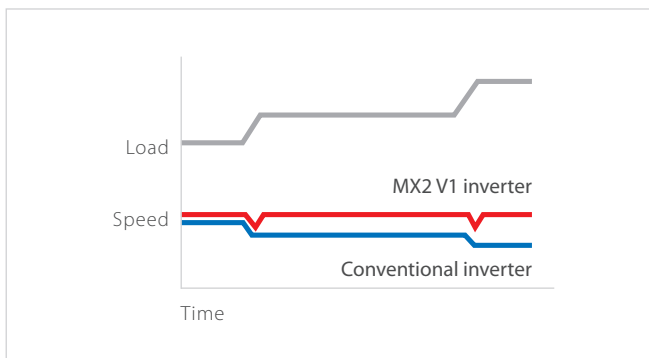
Thanks to its advanced design and algorithms, the MX2 V1 inverter provides smooth control down to zero speed, plus precise operation for cyclic operations and torque control capability in open loop. The RX V1 combines high performance, application functionality and customisation to match the precise requirements. Both, the MX2 V1 and RX V1 inverter series are fully integrated within the Omron Sysmac automation platform.

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



EtherCAT

MX2 V1

MX2 V1 features

- Power range up to 15 kW
- Torque control in open loop, ideal for low to medium torque applications
- 200% starting torque near stand-still operation (0.5 Hz)
- Double rating VT 120%/1 min and CT 150%/1 min
- IM and PM motor control
- Drive Programming software tool
- Built-in application functionality (i.e. Brake control)



EtherCAT

RX V1

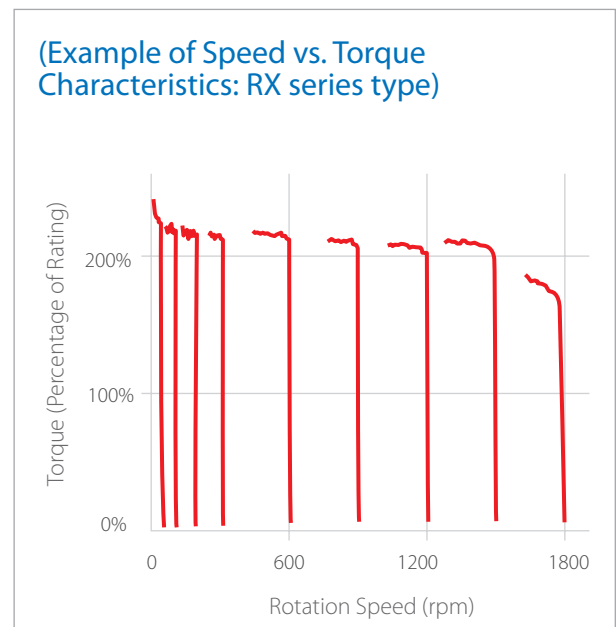
Motor efficiency control

- Double rating VT 120%/1 min and CT 150%/1 min
- Energy saving function

200% starting torque

- Near stand-still operation
- High starting torque in open loop
- Control of fast cyclic loads

(Example of Speed vs. Torque Characteristics: RX series type)



RX V1 features

- Power range up to 132 kW
- Sensor-less and closed-loop vector control
- High starting torque in open-loop (200% at 0.3 Hz)
- Full torque at 0 Hz in closed-loop
- Double rating VT 120%/1 min and CT 150%/1 min
- Drive Programming software tool
- Built-in application functionality (i.e. ELS - Electronic Line Shaft-)

FQ-M Vision sensor

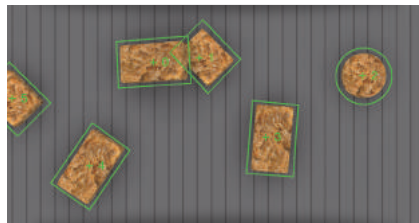
Designed for object tracking

The FQ-M series is a vision sensor designed specifically for pick and place applications. It comes with EtherCAT embedded and can be configured and monitored from Sysmac Studio software. The FQ-M series is compact, fast and includes an incremental encoder input for easy tracking and calibration.

Advanced shape search technology



Varying material ie. shiny



Overlapping products



Product detection:
10 pcs with rotation < 200 ms

Detection

- Up to 5000 pieces per minute with 360 degree rotation
- Stable and robust detection under changeable environmental conditions

Design

- Camera and image processing in one
- Standard C-mount lenses; choose the field of view and focus distance you need
- Variety of industrial connector types (angled, straight) for correct mounting
- EtherCAT port for object tracking
- Ethernet port for advanced configuration and monitoring
- Vision sensor with encoder input for tracking function

Software tool

- Fully integrated within the Sysmac Studio software tool
- Intuitive and icon driven set-up and configuration
- Trending and logging function



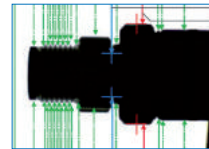
FH Vision system

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.

Flexible machine vision

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



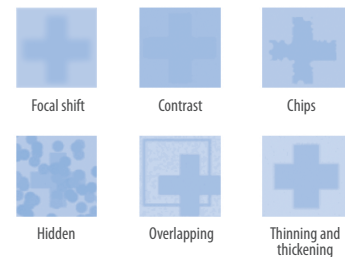
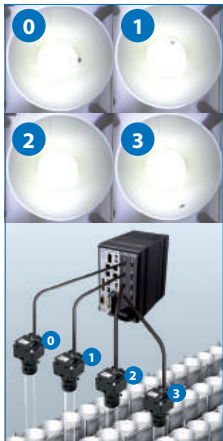
Dimension check



Character and code reading

Multiple inspection

- Powerful 4-core i7 parallel processor
- Up to 8 camera by one controller



Advanced shape search technology

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



Wide camera range

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

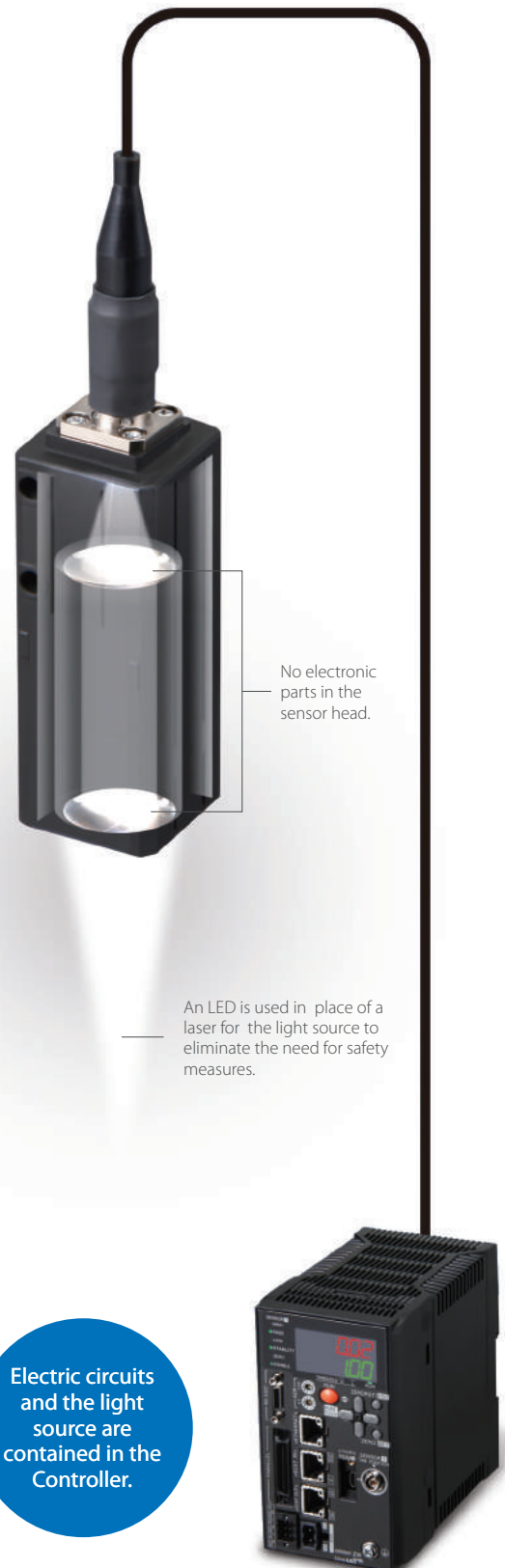
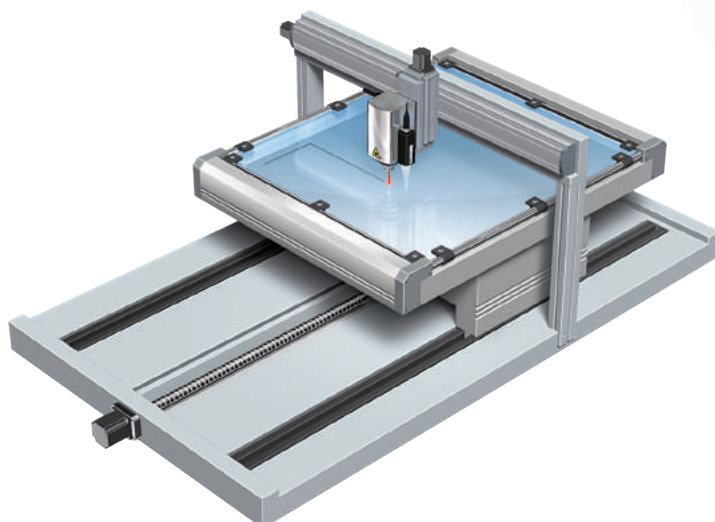


ZW Measurement Sensor

Ultra-compact, Lightweight sensor measures any material

The ZW confocal fiber displacement sensor delivers stable, non-contact in-line measurements of height, thickness and other dimensions. It solves the problems of traditional laser triangulation sensors: deviation between different material with inclination tolerance. The compact sensing head has no electronic parts to eliminate problems of installation space and mutual interference, electrical/magnetic noise, temperature rise and mechanical positioning. The EtherCAT interfaces integrates height and position coordinates for profile mapping.

- Ultra-compact sensing head: 24x24mm weighs only 105g
- High flexibility fiber optic cable from sensor to controller - up to 32m
- Mount sensing head one time - no need to re-tune for changing materials
- Separate amplifier provides white LED light source, spectroscope and processor to convert reflected color light to distance
- Stable measurements for any material - glass, stainless steel, mirror, white ceramic and PCB substrates



No electronic parts in the sensor head.

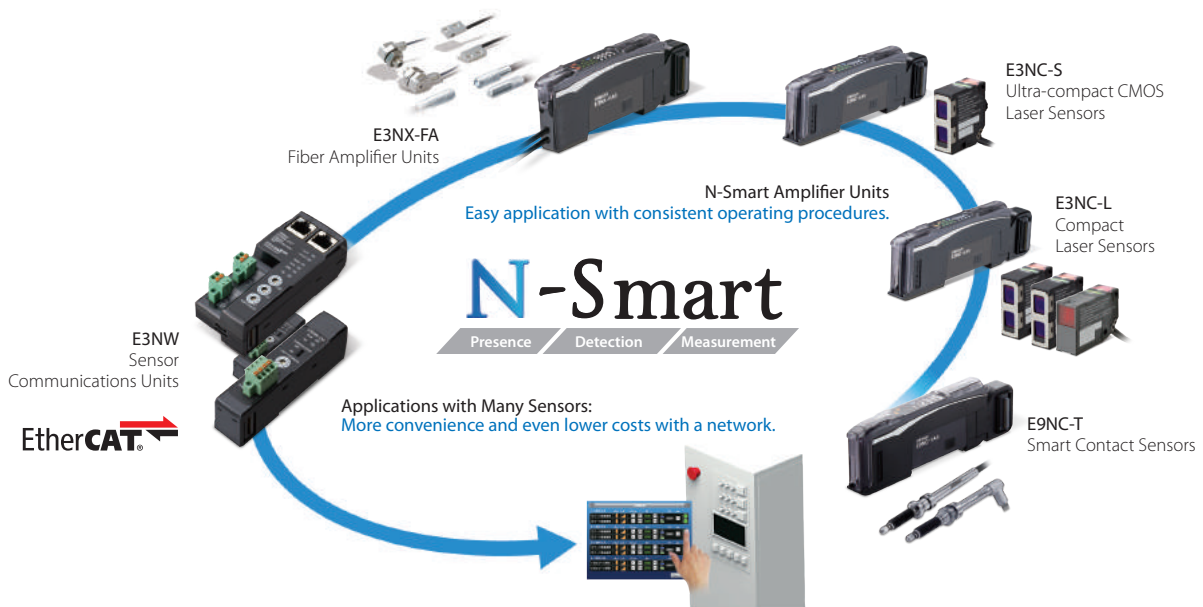
An LED is used in place of a laser for the light source to eliminate the need for safety measures.

Electric circuits and the light source are contained in the Controller.

N-Smart Series

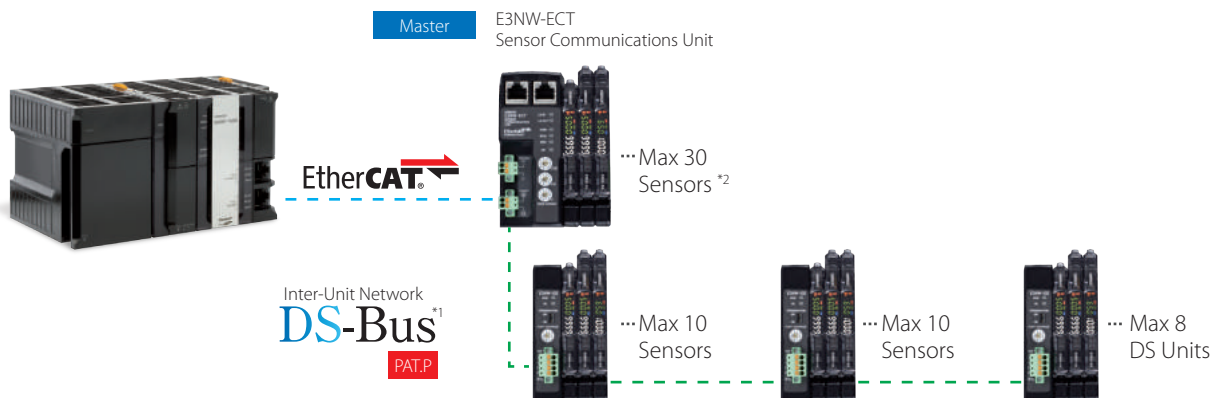
Various Sensors Connected over EtherCAT

The N-Smart Lineup of Next-generation Fiber Sensors, Laser Sensors and Contact Sensors will quickly solve your problems and therefore increase equipment operation rates and minimize downtime with optimum cost performance.



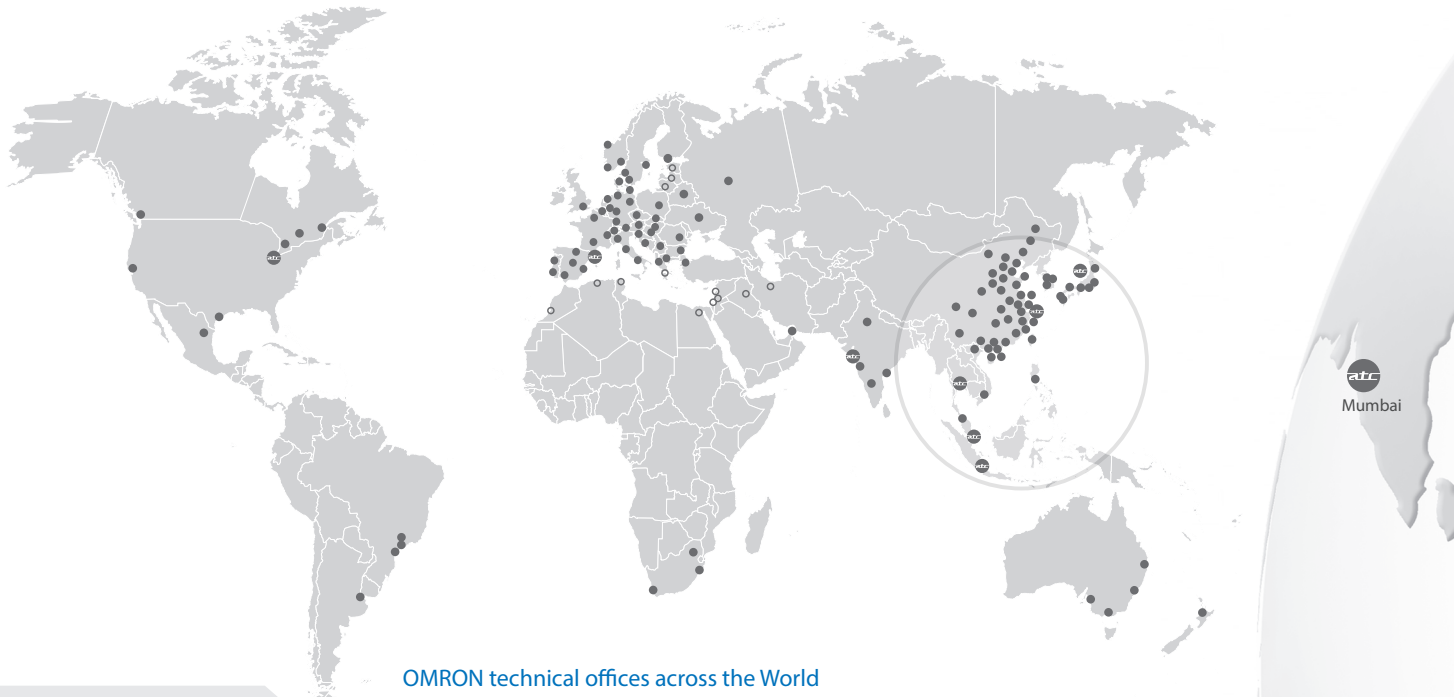
Features

- 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



^{*1} The DS-Bus is an OMRON inter-Unit network communications protocol, that connects the E3NW-ECT Sensor Communications Unit and E3NW-D5 Distributed Sensor Units.
^{*2} Each E3NW Node supports a maximum of 30 total sensors, including DS-Bus sensors.

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)

● Technical office

○ Premium Partner

PRESENCE

COMPETENCE

OMRON



Design

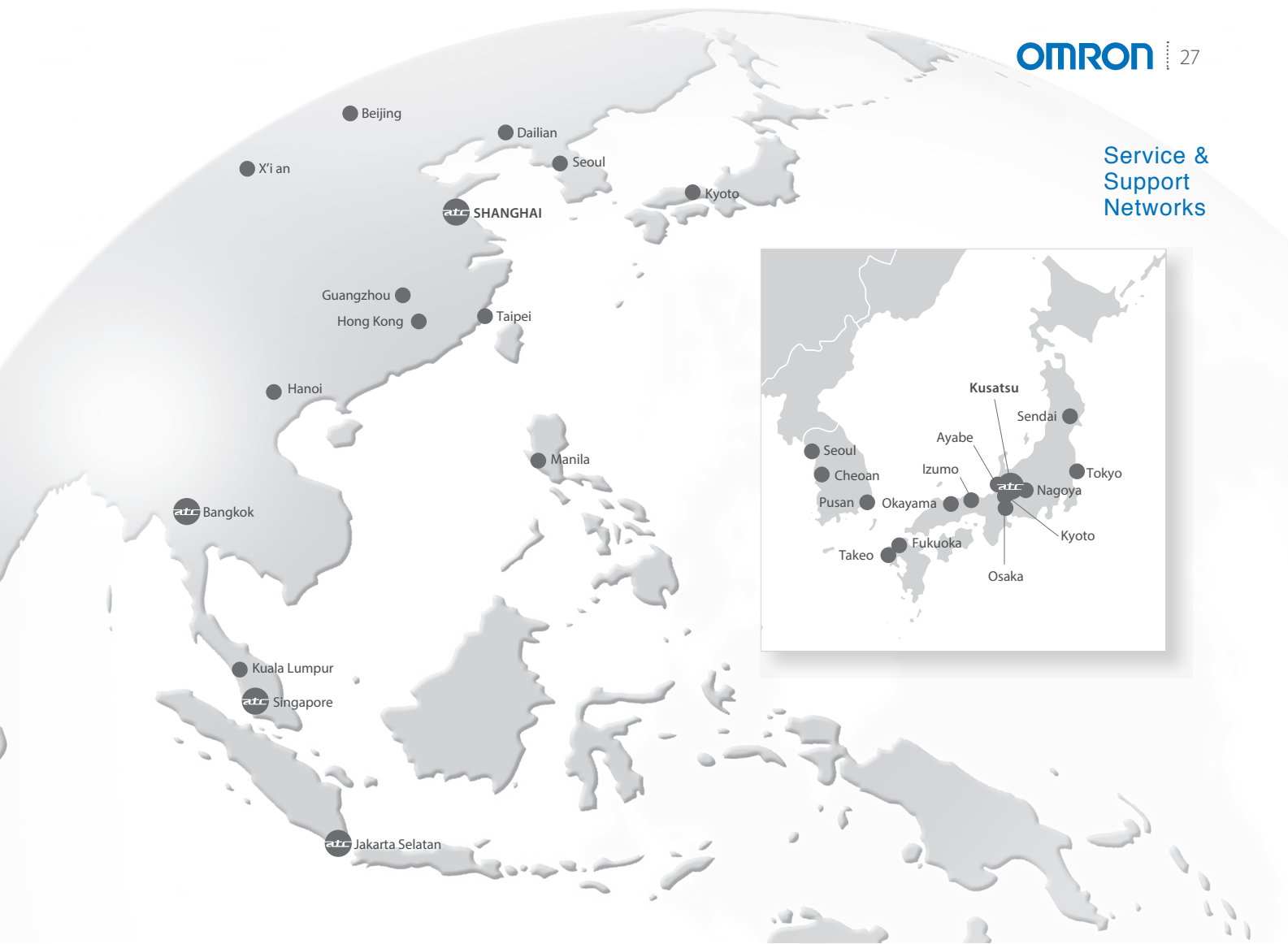
Our wide network of machine automation specialists will help you to select the right automation architecture and products to meet your requirements. Our flat structure based on expert-to-expert contact ensures that you will have ONE accountable and responsible expert to deal with on your complete project.

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.

Service & Support Networks



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 -

Sysmac family

MACHINE CONTROLLERS				
				
Product name	NX701	NJ501	NJ301	NJ101
Description	Ideal for large-scale, fast, and highly-accurate control with up to 256 axes.	NJ5 series Machine Controller with Sequence and Motion functionality	NJ3 series Machine Controller with Sequence and Motion functionality	Ideal for simple machines
Software	Sysmac Studio	Sysmac Studio	Sysmac Studio	Sysmac Studio
Programming	<ul style="list-style-type: none"> Ladder (within In-line ST) Structured Text In-line ST 	<ul style="list-style-type: none"> Ladder (within In-line ST) Structured Text In-line ST 	<ul style="list-style-type: none"> Ladder (within In-line ST) Structured Text In-line ST 	<ul style="list-style-type: none"> Ladder (within In-line ST) Structured Text In-line ST
Standard programming	<ul style="list-style-type: none"> IEC 61131-3 PLCopen Function Blocks for Motion Control 	<ul style="list-style-type: none"> IEC 61131-3 PLCopen Function Blocks for Motion Control 	<ul style="list-style-type: none"> IEC 61131-3 PLCopen Function Blocks for Motion Control 	<ul style="list-style-type: none"> IEC 61131-3 PLCopen Function Blocks for Motion Control
Program capacity	80MB	20 MB	5 MB	3MB
Variables capacity	No Retain attribute	256MB	4MB	2MB
	Retain attribute	4MB	2MB	0.5MB
Memory card	SD/SDHC memory card	SD/SDHC memory card	SD/SDHC memory card	SD/SDHC memory card
Built-in ports	<ul style="list-style-type: none"> EtherNet/IP EtherCAT USB 2.0 	<ul style="list-style-type: none"> EtherNet/IP EtherCAT USB 2.0 	<ul style="list-style-type: none"> EtherNet/IP EtherCAT USB 2.0 	<ul style="list-style-type: none"> EtherNet/IP EtherCAT USB 2.0
Number of EtherCAT slaves	512	192	192	64
Number of axes	256, 128	64, 32, 16	8, 4	2, 0
Motion control	<ul style="list-style-type: none"> Axes groups interpolation and single axis moves Electronic cams and gearboxes Direct position control for axis and groups 	<ul style="list-style-type: none"> Axes groups interpolation and single axis moves Electronic cams and gearboxes Direct position control for axis and groups 	<ul style="list-style-type: none"> Axes groups interpolation and single axis moves Electronic cams and gearboxes Direct position control for axis and groups 	<ul style="list-style-type: none"> Axes groups interpolation and single axis moves Electronic cams and gearboxes Direct position control for axis and groups
Ordering information	P072 Sysmac Catalog			

MACHINE CONTROLLERS



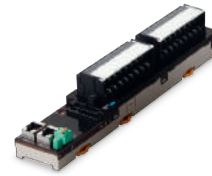
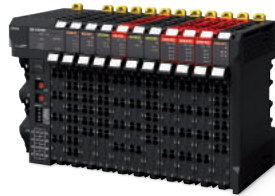
Product name		NJ- series Robotics	NJ- series DB connection		NJ- series SECS/GEM
		NJ501	NJ501	NJ101	NJ501
Description		Machine Controller with Sequence, Motion and Robotics functionality	Machine Controller with Sequence, Motion and DB connection functionality		Machine Controller with Sequence, Motion and SECS/GEM functionality
Software		Sysmac Studio	Sysmac Studio	Sysmac Studio	Sysmac Studio SECS/GEM Configurator
Programming		<ul style="list-style-type: none"> Ladder (within In-line ST) Structured Text In-line ST 	<ul style="list-style-type: none"> Ladder (within In-line ST) Structured Text In-line ST 	<ul style="list-style-type: none"> Ladder (within In-line ST) Structured Text In-line ST 	<ul style="list-style-type: none"> Ladder (within In-line ST) Structured Text In-line ST
Standard programming		<ul style="list-style-type: none"> IEC 61131-3 PLCopen Function Blocks for Motion Control 	<ul style="list-style-type: none"> IEC 61131-3 PLCopen Function Blocks for Motion Control 	<ul style="list-style-type: none"> IEC 61131-3 PLCopen Function Blocks for Motion Control 	<ul style="list-style-type: none"> IEC 61131-3 PLCopen Function Blocks for Motion Control SEMI standards
Program capacity		20 MB	20 MB	3 MB	20 MB
Variables capacity	No Retain attribute	4MB	4MB	2MB	4MB
	Retain attribute	2MB	2MB	0.5MB	2MB
Memory card		SD/SDHC memory card	SD/SDHC memory card	SD/SDHC memory card	SD/SDHC memory card
Built-in ports		<ul style="list-style-type: none"> EtherNet/IP EtherCAT USB 2.0 	<ul style="list-style-type: none"> EtherNet/IP EtherCAT USB 2.0 	<ul style="list-style-type: none"> EtherNet/IP EtherCAT USB 2.0 	<ul style="list-style-type: none"> EtherNet/IP EtherCAT USB 2.0
Number of EtherCAT slaves		192	192	64	192
Number of axes		64, 32, 16	64, 32, 16	2, 0	16
Motion control		<ul style="list-style-type: none"> Axes groups interpolation and single axis moves Electronic cams and gearboxes Direct position control for axis and groups Up to 8 Delta Robot control 	<ul style="list-style-type: none"> Axes groups interpolation and single axis moves Electronic cams and gearboxes Direct position control for axis and groups 	<ul style="list-style-type: none"> Axes groups interpolation and single axis moves Electronic cams and gearboxes Direct position control for axis and groups 	<ul style="list-style-type: none"> Axes groups interpolation and single axis moves Electronic cams and gearboxes Direct position control for axis and groups
Ordering information		P072 Sysmac Catalog			

PROGRAMMABLE TERMINALS



Model	NA5-15W	NA5-12W	NA5-9W	NA5-7W
Display device	TFT LCD	TFT LCD	TFT LCD	TFT LCD
Screen size	15.4-inch widescreen	12.1-inch widescreen	9.0-inch widescreen	7.0-inch widescreen
Resolution	1280 x 800 dots (horizontal x vertical)	1280 x 800 dots (horizontal x vertical)	800 x 480 dots (horizontal x vertical)	800 x 480 dots (horizontal x vertical)
Colors	16,770,000 colors (24 bit full colors)	16,770,000 colors (24 bit full colors)	16,770,000 colors (24 bit full colors)	16,770,000 colors (24 bit full colors)
Operation	<ul style="list-style-type: none"> • Touch panel: analog resistance membrane (pressure sensitive) • Function keys: 3 inputs (capacitance inputs) 	<ul style="list-style-type: none"> • Touch panel: analog resistance membrane (pressure sensitive) • Function keys: 3 inputs (capacitance inputs) 	<ul style="list-style-type: none"> • Touch panel: analog resistance membrane (pressure sensitive) • Function keys: 3 inputs (capacitance inputs) 	<ul style="list-style-type: none"> • Touch panel: analog resistance membrane (pressure sensitive) • Function keys: 3 inputs (capacitance inputs)
Built-in ports	<ul style="list-style-type: none"> • 2 Ethernet ports • 2 USB host ports • 1 USB slave port 	<ul style="list-style-type: none"> • 2 Ethernet ports • 2 USB host ports • 1 USB slave port 	<ul style="list-style-type: none"> • 2 Ethernet ports • 2 USB host ports • 1 USB slave port 	<ul style="list-style-type: none"> • 2 Ethernet ports • 2 USB host ports • 1 USB slave port
Allowable power supply voltage range	19.2 to 28.8 VDC	19.2 to 28.8 VDC	19.2 to 28.8 VDC	19.2 to 28.8 VDC
Programming software	Sysmac Studio	Sysmac Studio	Sysmac Studio	Sysmac Studio
Degree of protection	Front-panel controls: IP65 oil-proof type	Front-panel controls: IP65 oil-proof type	Front-panel controls: IP65 oil-proof type	Front-panel controls: IP65 oil-proof type
Memory card	SD/SDHC memory card	SD/SDHC memory card	SD/SDHC memory card	SD/SDHC memory card
Features	<ul style="list-style-type: none"> • Sharing NJ controller variables in the NA project • Increased security with password protection • Visual Basic programming • Testing NA with the NJ control program via Simulator in Sysmac Studio 	<ul style="list-style-type: none"> • Sharing NJ controller variables in the NA project • Increased security with password protection • Visual Basic programming • Testing NA with the NJ control program via Simulator in Sysmac Studio 	<ul style="list-style-type: none"> • Sharing NJ controller variables in the NA project • Increased security with password protection • Visual Basic programming • Testing NA with the NJ control program via Simulator in Sysmac Studio 	<ul style="list-style-type: none"> • Sharing NJ controller variables in the NA project • Increased security with password protection • Visual Basic programming • Testing NA with the NJ control program via Simulator in Sysmac Studio
Frame colors	Black, silver	Black, silver	Black, silver	Black, silver
Ordering information	P072 Sysmac Catalog			

I/O



Series		NX			GX	
Type	Modular I/O			Block I/O		
Communications interface	EtherCAT			EtherCAT		
Number of connectable units	<ul style="list-style-type: none"> • 63 units max. • Input: 1,024 bytes max., output: 1,024 bytes max. 			One expansion unit can be connected with one digital I/O terminal (16 inputs + 16 outputs)		
I/O types	<ul style="list-style-type: none"> • Digital I/O • Pulse output 	<ul style="list-style-type: none"> • Analog I/O • Temperature input 	<ul style="list-style-type: none"> • Encoder input • Safety 	<ul style="list-style-type: none"> • Digital I/O • Encoder input 	<ul style="list-style-type: none"> • Analog I/O • Expansion unit 	
Features	<ul style="list-style-type: none"> • Over 100 models of I/O units including position interface, temperature inputs and integrated safety • High-speed I/O units synchronized with the EtherCAT cycle • NsynX technology provides deterministic I/O response with nanosecond resolution • Detachable front connector with push-in type screw-less terminals in all NX I/O units • Up to 32 digital inputs or outputs 			<ul style="list-style-type: none"> • Wide variety of lineup: digital I/O, analog I/O, and encoder input units • Easy maintenance: removable I/O terminal • Easy set-up: automatic and manual address setting 		
Mounting	DIN track			DIN track		
Ordering information	P072 Sysmac Catalog					

SAFETY



Product name	NX Safety CPU Unit	NX Safety Input Unit	NX Safety Output Unit
Network	FSoE – Safety over EtherCAT	FSoE – Safety over EtherCAT	FSoE – Safety over EtherCAT
Applicable Standards	EN ISO 13849-1, 2 (PLe/Safety Category 4), IEC 61508 (SIL3), EN 62061 (SIL CL3), EN 61131-2	EN ISO 13849-1, 2 (PLe/Safety Category 4), IEC 61508 (SIL3), EN 62061 (SIL CL3), EN 61131-2	EN ISO 13849-1, 2 (PLe/Safety Category 4), IEC 61508 (SIL3), EN 62061 (SIL CL3), EN 61131-2
Programming	<ul style="list-style-type: none"> IEC 61131-3 standard PLCopen Function Blocks for Safety 	---	---
Number of safety master connections	32/128	---	---
Number of safety input/output points	---	<ul style="list-style-type: none"> 4 points 8 points 	<ul style="list-style-type: none"> 2 points 4 points
Number of test output points	---	2 points	---
Terminal block	---	Screwless clamping terminal block	Screwless clamping terminal block
Features	<ul style="list-style-type: none"> Freely mixing with standard NX I/O Reusable certified programs NX variables sharing in the NJ controller project 	<ul style="list-style-type: none"> Freely mixing with standard NX I/O The 4-point unit can be directly connected with OMRON non-contact switches and singlebeam sensors I/O data monitoring in the NJ controller project 	<ul style="list-style-type: none"> Freely mixing with standard NX I/O The 2-point unit is characterized by large output breaking current of 2.0 A I/O data monitoring in the NJ controller project
Mounting	DIN track	DIN track	DIN track
Ordering information	P072 Sysmac Catalog		

SERVOMOTORS/LINEAR MOTORS/DRIVES



Product name		
Type	Built-in EtherCAT Communications	Built-in EtherCAT Communications Linear Motor Type
100 VAC Applicable motor capacity/force	50 to 400 W	26.5 to 232 N
200 VAC Applicable motor capacity/force	50 W to 1.5 kW	26.5 to 760 N
400 VAC Applicable motor capacity/force	400 W to 15 kW	48 to 760 N
Applicable servomotor	G5 rotary servomotor	Linear motor
Control mode	Position, speed and torque control	Position, speed and torque control
Safety approvals	<ul style="list-style-type: none"> ISO13849-1 (PLC, d) STO: IEC61800-5-2 EN61508 (SIL2) 	<ul style="list-style-type: none"> ISO13849-1 (PLC, d) STO: IEC61800-5-2 EN61508 (SIL2)
Full closed loop	Built-in	N/A
Ordering information	P072 Sysmac Catalog	



Product name				
Rated rotation speed	3,000 r/min	2,000 r/min	1,500 r/min	1,000 r/min
Momentary maximum rotation speed	4,500 to 6,000 r/min	3,000 r/min	2,000 to 3,000 r/min	2,000 r/min
Rated torque	0.16 to 15.9 Nm	1.91 to 23.9 Nm	47.8 to 95.5 Nm	8.59 to 57.3 Nm
Capacity	50 W to 5 kW	400 W to 5 kW	7.5 to 15 kW	900 W to 6 kW
Applicable servo drive	G5 Servo Drive (for rotary servomotor)			
Encoder resolution	20-bit incremental/ 17-bit absolute	20-bit incremental/ 17-bit absolute	17-bit absolute	20-bit incremental/ 17-bit absolute
Protective structure	IP67	IP67	IP67	IP67
Ordering information	P072 Sysmac Catalog			



Product name		
Type	Iron-core	Ironless
Continuous force	48 to 760 N	26.5 to 348 N
Momentary maximum force	105 to 2,000 N	96 to 1,730 N
Maximum speed	2 to 10 m/s	1.2 to 16 m/s
Magnetic attractive force	300 to 4,440 N	0
Applicable servo drive	G5 Servo Drive (for linear motor)	
Ordering information	P072 Sysmac Catalog	

INVERTERS






Series	RX-V1	MX2-V1
Three-phase 400 V	0.4 to 132 kW	0.4 to 15 kW
Three-phase 200 V	0.4 to 55 kW	0.1 to 15 kW
Single-phase 200 V	---	0.1 to 2.2 kW
Control methods	<ul style="list-style-type: none"> V/F control Sensorless vector control Vector control with a PG 	<ul style="list-style-type: none"> V/F control Sensorless vector control
Starting torque	<ul style="list-style-type: none"> 200% at 0.3 Hz in open loop Full torque at 0 Hz in closed loop 	200% at 0.5 Hz
Communications	Optional EtherCAT communication unit	Optional EtherCAT communication unit
PLC functionality (Drive Programming)	Provided as standard	Provided as standard
Ordering information	P072 Sysmac Catalog	

VISION SENSORS



Series	FQ-M	FH
Product name	Smart Camera	Vision System
Hardware features	<ul style="list-style-type: none"> 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	300,000 pixels	752 (H) x 480 (V)
	2 million pixels	---
	4 million pixels	---
	12 million pixels	---
Communications interfaces	EtherCAT, Ethernet, parallel I/O, encoder input	
Ordering information	P072 Sysmac Catalog	

DISPLACEMENT/FIBER/LASER/CONTACT/PROXIMITY SENSORS

			
	Displacement Sensor	Fiber/Laser/Contact Sensors	Fiber/Laser/Proximity Sensors
Series	ZW	N-Smart	E3X/E3C/E2C
Measurement method	White light confocal principle	---	---
Applications	Height, thickness	---	---
Measuring range	Min: 7 ± 0.3 mm, Max: 40 ± 6 mm	---	---
Static resolution	0.25 μm	---	---
Linearity	±0.8 to 9.3 μm	---	---
Features	<ul style="list-style-type: none"> • Ultra-compact sensing head • Easy to install and high resolution • Synchronous control and setting of multiple sensors via Ethernet • Wide variety of interfaces (EtherCAT/Ethernet/RS-232C/Analog voltage and current) 	Connect fiber, laser and contact sensors to EtherCAT at low initial cost	Easily connect fiber, laser photoelectric and proximity sensors to EtherCAT
Network specification	---	EtherCAT communication unit	EtherCAT communication unit
Maximum connectable sensors	---	30	30
Connectable sensor amplifier units	---	<ul style="list-style-type: none"> • E3NX-FA0 • E3NC-LA0 • E3NC-SA0 • E9NC-TA0 	<ul style="list-style-type: none"> • E3X-HD0 • E3X-MDA0 • E3C-LDA0 • E2C-EDA0
Mounting	DIN track (controller)	DIN track	DIN track
Ordering information	P072 Sysmac Catalog		

SOFTWARE



Model	Sysmac Studio
	<p>The Sysmac Studio provides one design and operation environment for configuration, programming, simulation and monitoring</p> <ul style="list-style-type: none"> • One software for motion, logic sequencing, safety, drives, vision and HMI • Fully compliant with open standard IEC 61131-3 • Supports Ladder, Structured Text and Function Block programming with a rich instruction set • CAM editor for easy programming of complex motion profiles • One simulation tool for sequence and motion in a 3D environment • Advanced security function with 32 digit security password • IEC standard and PLCopen Function Blocks for Motion Control and Safety
Ordering information	P072 Sysmac Catalogue

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Memo

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

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