 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

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.

Through automation, Omron supports the advancement of manufacturing and contributes to a sustainable society by providing environmentally safe products.

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

- 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.

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

- 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.

**Vision**

- 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**

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

**Sensing**

- 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 μs
- 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
Information technologies

Smart factory

IT devices

Offices HHQQ

Sales force

Big Data

SQL-Database

Software

HMI

NA Programmable Terminal

Sysmac Studio

Software

Sysmac Studio

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

Vision

FH

FQ-M

Robotics

Delta robot

Sensing

ZW 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.

Programming
Multi-tasking and fully compliant with IEC 61131-3 standard. The program editor includes smart support functions such as syntax error check and clear color segregation of variables and symbols. ST instructions can be directly written in Ladder programs thanks to in-line ST function.

Motion control
The graphical CAM editor allows quick implementation of complex motion profiles. CAM tables can be modified on the fly. A PLCopen Function Blocks for the Motion Control library are available to implement general purpose motion control.

Safety
The Function Block Diagram editor includes 46 safety FB/FN. Conforms with IEC 61131-3 standard programming and PLCopen Function Blocks for Safety.
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.
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 µs
- 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
Standard programming
- Fully conforms with IEC 61131-3 standards
- PLCopen Function Blocks for Motion Control

EtherCAT

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

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

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

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

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 µs 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

**Serial communication**
- Units for RS232C or RS422A/485 serial communication interface
- High signal density; up to 16 I/O points in 12 mm width

**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 µs 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
**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 < 1 µs)

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**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

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**End Cover**

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

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**Time Stamp sequence example**

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<tr>
<th>NJ Controller</th>
<th>EtherCAT cycle</th>
<th>I/O Refresh</th>
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<td>NX I/O</td>
<td></td>
<td>I/O Refresh</td>
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<tr>
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<td>52371800 ns</td>
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</table>

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

**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

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**EtherCAT telegram**

**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

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

<table>
<thead>
<tr>
<th>Load</th>
<th>MX2 V1 inverter</th>
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<tbody>
<tr>
<td>Speed</td>
<td>Conventional inverter</td>
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<tr>
<td>Time</td>
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</tbody>
</table>

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)
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)

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)
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

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

Varying material i.e. shiny
Overlapping products
Product detection: 10 pcs with rotation < 200 ms
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

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

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

Dimension check
Character and code reading
Focal shift
Contrast
Chips
Hidden
Overlapping
Thinning and thickening

Omron
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

ZW Measurement Sensor

No electronic parts in the sensor head.

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

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

Inter-Unit Network
DS-Bus*1

- Max 30 Sensors *2
- Max 10 Sensors
- Max 10 Sensors
- Max 8 DS Units

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

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. Make use of our Tsunagi (connectivity) laboratory 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.
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

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<tr>
<td>Description</td>
<td>Ideal for large-scale, fast, and highly-accurate control with up to 256 axes.</td>
<td>NJS series Machine Controller with Sequence and Motion functionality</td>
<td>NJS series Machine Controller with Sequence, Motion and Robotics functionality</td>
<td>NJS series Machine Controller with Sequence, Motion and DB connection functionality</td>
<td>NJS series Machine Controller with Sequence, Motion and SECS/GEM functionality</td>
<td>Ideal for simple machines</td>
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<td>236, 328</td>
<td>64, 32, 16</td>
<td>64, 32, 16</td>
<td>64, 32, 16</td>
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<tr>
<td>Motion control</td>
<td>Axes groups interpolation and single axis moves</td>
<td>Electronic cams and gearboxes</td>
<td>Direct position control for axis and groups</td>
<td>Axes groups interpolation and single axis moves</td>
<td>Electronic cams and gearboxes</td>
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<tr>
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<td>Axes groups interpolation and single axis moves</td>
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<td>Axes groups interpolation and single axis moves</td>
<td>Electronic cams and gearboxes</td>
<td>Direct position control for axis and groups</td>
<td></td>
</tr>
</tbody>
</table>

| Ordering information | P072 Sysmac Catalog |

---

**Sysmac**: A fully integrated platform

**MACHINE CONTROLLERS**

**Product name**
- NX701
- NJ501
- NJ501 Robotics
- NJ501 DB connection
- NJ501 SECS/GEM
- NJ301
- NJ701

**Description**
- NX701: Ideal for large-scale, fast, and highly-accurate control with up to 256 axes.
- NJ501: NJS series Machine Controller with Sequence and Motion functionality.
- NJ501 Robotics: NJS series Machine Controller with Sequence, Motion and Robotics functionality.
- NJ501 DB connection: NJS series Machine Controller with Sequence, Motion and DB connection functionality.
- NJ501 SECS/GEM: NJS series Machine Controller with Sequence, Motion and SECS/GEM functionality.
- NJ301: NJS series Machine Controller with Sequence and Motion functionality.
- NJ701: Ideal for simple machines.

**Software**
- NX701: Sysmac Studio
- NJ501: Sysmac Studio
- NJ501 Robotics: Sysmac Studio
- NJ501 DB connection: Sysmac Studio
- NJ501 SECS/GEM: Sysmac Studio SECS/GEM Configurator
- NJ301: Sysmac Studio
- NJ701: Sysmac Studio

**Programming**
- NX701: Ladder (within In-line ST), Structured Text, In-line ST
- NJ501: Ladder (within In-line ST), Structured Text, In-line ST
- NJ501 Robotics: Ladder (within In-line ST), Structured Text, In-line ST
- NJ501 DB connection: Ladder (within In-line ST), Structured Text, In-line ST
- NJ501 SECS/GEM: Ladder (within In-line ST), Structured Text, In-line ST
- NJ301: Ladder (within In-line ST), Structured Text, In-line ST
- NJ701: Ladder (within In-line ST), Structured Text, In-line ST

**Standard programming**
- NX701: IEC 61131-3, PLCopen Function Blocks for Motion Control
- NJ501: IEC 61131-3, PLCopen Function Blocks for Motion Control
- NJ501 Robotics: IEC 61131-3, PLCopen Function Blocks for Motion Control
- NJ501 DB connection: IEC 61131-3, PLCopen Function Blocks for Motion Control
- NJ501 SECS/GEM: IEC 61131-3, PLCopen Function Blocks for Motion Control
- NJ301: IEC 61131-3, PLCopen Function Blocks for Motion Control
- NJ701: IEC 61131-3, PLCopen Function Blocks for Motion Control

**Program capacity**
- NX701: 80 MB
- NJ501: 20 MB
- NJ501 Robotics: 20 MB
- NJ501 DB connection: 20 MB
- NJ501 SECS/GEM: 5 MB
- NJ301: 3 MB
- NJ701: 3 MB

**Memory card**
- NX701: SD/SDHC memory card
- NJ501: SD/SDHC memory card
- NJ501 Robotics: SD/SDHC memory card
- NJ501 DB connection: SD/SDHC memory card
- NJ501 SECS/GEM: SD/SDHC memory card
- NJ301: SD/SDHC memory card
- NJ701: SD/SDHC memory card

**Built-in ports**
- NX701: EtherCAT/1P, EtherCAT, USB 2.0
- NJ501: EtherCAT/1P, EtherCAT, USB 2.0
- NJ501 Robotics: EtherCAT/1P, EtherCAT, USB 2.0
- NJ501 DB connection: EtherCAT/1P, EtherCAT, USB 2.0
- NJ501 SECS/GEM: EtherCAT/1P, EtherCAT, USB 2.0
- NJ301: EtherCAT/1P, EtherCAT, USB 2.0
- NJ701: EtherCAT/1P, EtherCAT, USB 2.0

**Number of EtherCAT slaves**
- NX701: 312
- NJ501: 192
- NJ501 Robotics: 192
- NJ501 DB connection: 192
- NJ501 SECS/GEM: 192
- NJ301: 64
- NJ701: 64

**Number of axes**
- NX701: 236, 328
- NJ501: 64, 32, 16
- NJ501 Robotics: 64, 32, 16
- NJ501 DB connection: 64, 32, 16
- NJ501 SECS/GEM: 16
- NJ301: 8, 4
- NJ701: 2, 0

**Motion control**
- NX701: Axes groups interpolation and single axis moves, Electronic cams and gearboxes, Direct position control for axis and groups
- NJ501: Axes groups interpolation and single axis moves, Electronic cams and gearboxes, Direct position control for axis and groups
- NJ501 Robotics: Axes groups interpolation and single axis moves, Electronic cams and gearboxes, Direct position control for axis and groups
- NJ501 DB connection: Axes groups interpolation and single axis moves, Electronic cams and gearboxes, Direct position control for axis and groups
- NJ501 SECS/GEM: Axes groups interpolation and single axis moves, Electronic cams and gearboxes, Direct position control for axis and groups
- NJ301: Axes groups interpolation and single axis moves, Electronic cams and gearboxes, Direct position control for axis and groups
- NJ701: 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

<table>
<thead>
<tr>
<th>Model</th>
<th>NA5-15W</th>
<th>NA5-12W</th>
<th>NA5-9W</th>
<th>NA5-7W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display device</td>
<td>TFT LCD</td>
<td>TFT LCD</td>
<td>TFT LCD</td>
<td>TFT LCD</td>
</tr>
<tr>
<td>Screen size</td>
<td>15.4-inch widescreen</td>
<td>12.1-inch widescreen</td>
<td>9.0-inch widescreen</td>
<td>7.0-inch widescreen</td>
</tr>
<tr>
<td>Resolution</td>
<td>1280 x 800 dots (horizontal x vertical)</td>
<td>1280 x 800 dots (horizontal x vertical)</td>
<td>800 x 680 dots (horizontal x vertical)</td>
<td>800 x 680 dots (horizontal x vertical)</td>
</tr>
<tr>
<td>Colors</td>
<td>16,770,000 colors (24 bit full colors)</td>
<td>16,770,000 colors (24 bit full colors)</td>
<td>16,770,000 colors (24 bit full colors)</td>
<td>16,770,000 colors (24 bit full colors)</td>
</tr>
<tr>
<td>Operation</td>
<td>• Touch panel: analog resistance membrane (pressure sensitive) Function keys: 3 inputs (capacitance inputs)</td>
<td>• Touch panel: analog resistance membrane (pressure sensitive) Function keys: 3 inputs (capacitance inputs)</td>
<td>• Touch panel: analog resistance membrane (pressure sensitive) Function keys: 3 inputs (capacitance inputs)</td>
<td>• Touch panel: analog resistance membrane (pressure sensitive) Function keys: 3 inputs (capacitance inputs)</td>
</tr>
<tr>
<td>Built-in ports</td>
<td>• 2 Ethernet ports • 2 USB host ports • 1 USB slave port</td>
<td>• 2 Ethernet ports • 2 USB host ports • 1 USB slave port</td>
<td>• 2 Ethernet ports • 2 USB host ports • 1 USB slave port</td>
<td>• 2 Ethernet ports • 2 USB host ports • 1 USB slave port</td>
</tr>
<tr>
<td>Allowable power supply voltage range</td>
<td>19.2 to 28.8 VDC</td>
<td>19.2 to 28.8 VDC</td>
<td>19.2 to 28.8 VDC</td>
<td>19.2 to 28.8 VDC</td>
</tr>
<tr>
<td>Programming software</td>
<td>Sysmac Studio</td>
<td>Sysmac Studio</td>
<td>Sysmac Studio</td>
<td>Sysmac Studio</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>Front-panel controls: IP65 oil-proof type</td>
<td>Front-panel controls: IP65 oil-proof type</td>
<td>Front-panel controls: IP65 oil-proof type</td>
<td>Front-panel controls: IP65 oil-proof type</td>
</tr>
<tr>
<td>Memory card</td>
<td>SD/SDHC memory card</td>
<td>SD/SDHC memory card</td>
<td>SD/SDHC memory card</td>
<td>SD/SDHC memory card</td>
</tr>
<tr>
<td>Features</td>
<td>• 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</td>
<td>• 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</td>
<td>• 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</td>
<td>• 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</td>
</tr>
<tr>
<td>Frame colors</td>
<td>Black, silver</td>
<td>Black, silver</td>
<td>Black, silver</td>
<td>Black, silver</td>
</tr>
<tr>
<td>Ordering information</td>
<td>P072 Sysmac Catalog</td>
<td>P072 Sysmac Catalog</td>
<td>P072 Sysmac Catalog</td>
<td>P072 Sysmac Catalog</td>
</tr>
</tbody>
</table>
### I/O

<table>
<thead>
<tr>
<th>Series</th>
<th>NX</th>
<th>GX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Modular I/O</td>
<td>Block I/O</td>
</tr>
<tr>
<td>Communications interface</td>
<td>EtherCAT</td>
<td>EtherCAT</td>
</tr>
<tr>
<td>Number of connectable units</td>
<td>63 units max.</td>
<td>One expansion unit can be connected with one digital I/O terminal (16 inputs + 16 outputs)</td>
</tr>
<tr>
<td>Input bytes max.</td>
<td>1,024 bytes</td>
<td>1,024 bytes</td>
</tr>
<tr>
<td>Output bytes max.</td>
<td>1,024 bytes</td>
<td>1,024 bytes</td>
</tr>
<tr>
<td>I/O types</td>
<td>Digital I/O, Pulse output</td>
<td>Digital I/O, Encoder input, Expansion unit</td>
</tr>
<tr>
<td>Analog I/O, Temperature input</td>
<td>Analog I/O, Safety</td>
<td>Analog I/O</td>
</tr>
<tr>
<td>Encoder input</td>
<td>Safety</td>
<td>Safety</td>
</tr>
<tr>
<td>Features</td>
<td>Over 70 models of I/O units including position interface, temperature inputs and integrated safety</td>
<td>Wide variety of lineup: digital I/O, analog I/O, and encoder input units</td>
</tr>
<tr>
<td>High-speed I/O units synchronized with the EtherCAT cycle</td>
<td>Easy maintenance: removable I/O terminal</td>
<td></td>
</tr>
<tr>
<td>NynX technology provides deterministic I/O response with nanosecond resolution</td>
<td>Easy set-up: automatic and manual address setting</td>
<td></td>
</tr>
<tr>
<td>Detachable front connector with push-in type screw-less terminals in all NX I/O units</td>
<td>Up to 32 digital inputs or outputs</td>
<td></td>
</tr>
<tr>
<td>Mounting</td>
<td>DIN track</td>
<td>DIN track</td>
</tr>
<tr>
<td>Ordering information</td>
<td>P072 Sysmac Catalog</td>
<td></td>
</tr>
</tbody>
</table>
## SAFETY

<table>
<thead>
<tr>
<th>Product name</th>
<th>NX Safety CPU Unit</th>
<th>NX Safety Input Unit</th>
<th>NX Safety Output Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network</td>
<td>FSoE – Safety over EtherCAT</td>
<td>FSoE – Safety over EtherCAT</td>
<td>FSoE – Safety over EtherCAT</td>
</tr>
<tr>
<td>Programming</td>
<td>IEC 61131-3 standard</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>PLCopen-Function Blocks for Safety</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Number of master connections</td>
<td>32/128</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Number of input/output points</td>
<td>---</td>
<td>• 4 points</td>
<td>• 2 points</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 8 points</td>
<td>• 4 points</td>
</tr>
<tr>
<td>Number of test output points</td>
<td>---</td>
<td>2 points</td>
<td>---</td>
</tr>
<tr>
<td>Terminal block</td>
<td>---</td>
<td>Screwless clamping terminal block</td>
<td>Screwless clamping terminal block</td>
</tr>
<tr>
<td>Features</td>
<td>Freely mixing with standard NX I/O</td>
<td>Freely mixing with standard NX I/O</td>
<td>Freely mixing with standard NX I/O</td>
</tr>
<tr>
<td></td>
<td>Reusable certified programs</td>
<td>The 4-point unit can be directly connected with OMRON non-contact switches and singlebeam sensors</td>
<td>The 2-point unit is characterized by large output breaking current of 2.0 A</td>
</tr>
<tr>
<td></td>
<td>NX variables sharing in the NJ controller project</td>
<td>I/O data monitoring in the NJ controller project</td>
<td>I/O data monitoring in the NJ controller project</td>
</tr>
<tr>
<td>Mounting</td>
<td>DIN track</td>
<td>DIN track</td>
<td>DIN track</td>
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<td>Ordering information</td>
<td>P072 Sysmac Catalog</td>
<td>P072 Sysmac Catalog</td>
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</table>
### Linear Motors

<table>
<thead>
<tr>
<th>Product name</th>
<th>Type</th>
<th>Continuous force</th>
<th>Momentary maximum force</th>
<th>Maximum speed</th>
<th>Magnetic attractive force</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Iron-core</td>
<td>48 to 760 N</td>
<td>96 to 1,730 N</td>
<td>1.2 to 16 m/s</td>
<td>300 to 4,440 N</td>
</tr>
<tr>
<td></td>
<td>Ironless</td>
<td>26.5 to 348 N</td>
<td>26.5 to 760 N</td>
<td>1</td>
<td>0</td>
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</table>

### GS Servomotors

<table>
<thead>
<tr>
<th>Product name</th>
<th>Rated rotation speed</th>
<th>Momentary maximum rotation speed</th>
<th>Rated torque</th>
<th>Capacity</th>
<th>Applicable servo drive</th>
<th>Encoder resolution</th>
<th>Protective structure</th>
<th>Protective structure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3,000 r/min</td>
<td>4,500 to 6,000 r/min</td>
<td>0.16 to 15.9 Nm</td>
<td>50 W to 5 kW</td>
<td>GS Servo Drive (for rotary servomotor)</td>
<td>20-bit incremental/17-bit absolute</td>
<td>IP67</td>
<td>IP67</td>
</tr>
<tr>
<td></td>
<td>2,000 r/min</td>
<td>3,000 r/min</td>
<td>1.91 to 23.9 Nm</td>
<td>400 W to 5 kW</td>
<td>N/A</td>
<td>20-bit incremental/17-bit absolute</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>1,500 r/min</td>
<td>2,000 to 3,000 r/min</td>
<td>47.8 to 95.5 Nm</td>
<td>7.5 to 15 kW</td>
<td>N/A</td>
<td>17-bit absolute</td>
<td>IP67</td>
<td>IP67</td>
</tr>
<tr>
<td></td>
<td>1,000 r/min</td>
<td>2,000 r/min</td>
<td>8.59 to 57.3 Nm</td>
<td>900 W to 6 kW</td>
<td>N/A</td>
<td>20-bit incremental/17-bit absolute</td>
<td>N/A</td>
<td>N/A</td>
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</tbody>
</table>

### GS Servo Drives

<table>
<thead>
<tr>
<th>Product name</th>
<th>Type</th>
<th>Applicable motor capacity/force</th>
<th>Applicable servomotor</th>
<th>Control mode</th>
<th>Safety approvals</th>
<th>Full closed loop</th>
<th>Ordering information</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Built-in EtherCAT Communications</td>
<td>50 to 400 W</td>
<td>GS rotary servomotor</td>
<td>Position, speed and torque control</td>
<td>ISO13849-1 (PLc, d)</td>
<td>Built-in</td>
<td>P072 Sysmac Catalog</td>
</tr>
<tr>
<td></td>
<td>Built-in EtherCAT Communications Linear Motor Type</td>
<td>200 VAC Applicable motor capacity/force</td>
<td>200 W to 1.5 kW</td>
<td>Position, speed and torque control</td>
<td>ISO13849-1 (PLc, d)</td>
<td>N/A</td>
<td>P072 Sysmac Catalog</td>
</tr>
<tr>
<td></td>
<td>Built-in EtherCAT Communications Linear Motor Type</td>
<td>400 VAC Applicable motor capacity/force</td>
<td>400 W to 15 kW</td>
<td>Position, speed and torque control</td>
<td>ISO13849-1 (PLc, d)</td>
<td>N/A</td>
<td>P072 Sysmac Catalog</td>
</tr>
</tbody>
</table>

### GS Servo Drives (for linear motor)

<table>
<thead>
<tr>
<th>Product name</th>
<th>Type</th>
<th>Applicable motor capacity/force</th>
<th>Applicable servomotor</th>
<th>Control mode</th>
<th>Safety approvals</th>
<th>Full closed loop</th>
<th>Ordering information</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Built-in EtherCAT Communications</td>
<td>50 to 400 W</td>
<td>Linear motor</td>
<td>Position, speed and torque control</td>
<td>ISO13849-1 (PLc, d)</td>
<td>Built-in</td>
<td>P072 Sysmac Catalog</td>
</tr>
<tr>
<td></td>
<td>Built-in EtherCAT Communications Linear Motor Type</td>
<td>200 VAC Applicable motor capacity/force</td>
<td>200 W to 1.5 kW</td>
<td>Position, speed and torque control</td>
<td>ISO13849-1 (PLc, d)</td>
<td>N/A</td>
<td>P072 Sysmac Catalog</td>
</tr>
<tr>
<td></td>
<td>Built-in EtherCAT Communications Linear Motor Type</td>
<td>400 VAC Applicable motor capacity/force</td>
<td>400 W to 15 kW</td>
<td>Position, speed and torque control</td>
<td>ISO13849-1 (PLc, d)</td>
<td>N/A</td>
<td>P072 Sysmac Catalog</td>
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## INVERTERS

<table>
<thead>
<tr>
<th>Series</th>
<th>RX-V1</th>
<th>MX2-V1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three-phase 400 V</td>
<td>0.4 to 152 kW</td>
<td>0.4 to 15 kW</td>
</tr>
<tr>
<td>Three-phase 200 V</td>
<td>0.4 to 55 kW</td>
<td>0.1 to 15 kW</td>
</tr>
<tr>
<td>Single-phase 200 V</td>
<td>—</td>
<td>0.1 to 2.2 kW</td>
</tr>
<tr>
<td>Control methods</td>
<td>• V/F control</td>
<td>• V/F control</td>
</tr>
<tr>
<td></td>
<td>• Sensorless vector control</td>
<td>• Sensorless vector control</td>
</tr>
<tr>
<td></td>
<td>• Vector control with a PG</td>
<td></td>
</tr>
<tr>
<td>Starting torque</td>
<td>• 200% at 0.3 Hz in open loop</td>
<td>200% at 0.5 Hz</td>
</tr>
<tr>
<td></td>
<td>• Full torque at 0 Hz in closed loop</td>
<td></td>
</tr>
<tr>
<td>Communications</td>
<td>Optional EtherCAT communication unit</td>
<td>Optional EtherCAT communication unit</td>
</tr>
<tr>
<td>PLC functionality</td>
<td>Provided as standard</td>
<td>Provided as standard</td>
</tr>
<tr>
<td>PLC functionalty (Drive Programming)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ordering information</td>
<td></td>
<td>P072 Sysmac Catalog</td>
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</tbody>
</table>

## VISION SENSORS

<table>
<thead>
<tr>
<th>Series</th>
<th>FQ-M</th>
<th>FH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product name</td>
<td>Smart Camera</td>
<td>Vision System</td>
</tr>
<tr>
<td>Hardware features</td>
<td>• Camera and image processing in one</td>
<td>Flexible configuration of cameras and controller to suit your applications</td>
</tr>
<tr>
<td></td>
<td>• Easy to installation</td>
<td></td>
</tr>
<tr>
<td>Software FEATURE</td>
<td>Communication wizard for easy setting</td>
<td>Flexible setting with flowchart</td>
</tr>
<tr>
<td>Processing items</td>
<td>Processing items for Pick &amp; Place applications</td>
<td>Processing items covering general applications</td>
</tr>
<tr>
<td>Processing resolution</td>
<td>300,000 pixels</td>
<td>640 (H) x 480 (V)</td>
</tr>
<tr>
<td></td>
<td>752 (H) x 480 (V)</td>
<td>2040 (H) x 1088 (V)</td>
</tr>
<tr>
<td></td>
<td>2 million pixels</td>
<td>2040 (H) x 2048 (V)</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>4084(H)x 3072(V)</td>
</tr>
<tr>
<td>Communications interfaces</td>
<td>EtherCAT, Ethernet, parallel I/O, encoder input</td>
<td></td>
</tr>
<tr>
<td>Ordering information</td>
<td></td>
<td>P072 Sysmac Catalog</td>
</tr>
</tbody>
</table>
**DISPLACEMENT/FIBER/LASER/CONTACT/PROXIMITY SENSORS**

<table>
<thead>
<tr>
<th>Series</th>
<th>Displacement Sensor</th>
<th>Fiber/Laser/Contact Sensors</th>
<th>Fiber/Laser/Proximity Sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measurement method</strong></td>
<td>White light confocal principle</td>
<td>N-Smart</td>
<td>E3X/E3C/E2C</td>
</tr>
<tr>
<td><strong>Applications</strong></td>
<td>Height, thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Measuring range</strong></td>
<td>Min: 7 ± 0.3 mm, Max: 40 ± 6 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Static resolution</strong></td>
<td>0.25 µm</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Linearity</strong></td>
<td>±0.8 to 9.3 µm</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td>Ultra-compact sensing head</td>
<td>Easy to install and high resolution</td>
<td>Connect fibre, laser and contact sensors to EtherCAT at low initial cost</td>
</tr>
<tr>
<td></td>
<td>Synchronous control and setting of multiple sensors via Ethernet</td>
<td></td>
<td>Easily connect fibre, laser photoelectric and proximity sensors to EtherCAT</td>
</tr>
<tr>
<td></td>
<td>Wide variety of interfaces (EtherCAT/Ethernet/RS-232C/Analog voltage and current)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Network specification</strong></td>
<td>EtherCAT communication unit</td>
<td>EtherCAT communication unit</td>
<td></td>
</tr>
<tr>
<td><strong>Maximum connectable sensors</strong></td>
<td>30</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td><strong>Connectable sensor amplifier units</strong></td>
<td>E9NX-FA0</td>
<td>E9X-HD0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E9NC-LA0</td>
<td>E9X-MD40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E9NC-SA0</td>
<td>E9X-DA0-S</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E9NC-TA0</td>
<td>E9X-LDA0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>E9X-EDA0</td>
<td></td>
</tr>
<tr>
<td><strong>Mounting</strong></td>
<td>DIN track (controller)</td>
<td>DIN track</td>
<td>DIN track</td>
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The Sysmac Studio provides one design and operation environment for configuration, programming, simulation and monitoring.

- 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 12 digit security password
- IEC standard and PLCopen Function Blocks for Motion Control and Safety

**Ordering information**

P072 Sysmac Catalogue - www.industrial.omron.eu

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**Model | Sysmac Studio**

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