OMRON

Machine Automation Controller

NJ/NX Series

sysmac
always in control

A fully integrated platform

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). 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.

N-Smart Fiber/
Laser/Contact
Sensor

ZW-7000
Displacement
Sensor

FH
Vision System

One Machine Controller

▌ Complete integration of motion and logic

A large selection of CPU Units for up to 256 axes

▌ Safety integration

Flexible system lets you integrate safety into machine automation through the use of Safety over EtherCAT (FSoE).

SQL-
Database

One Connection
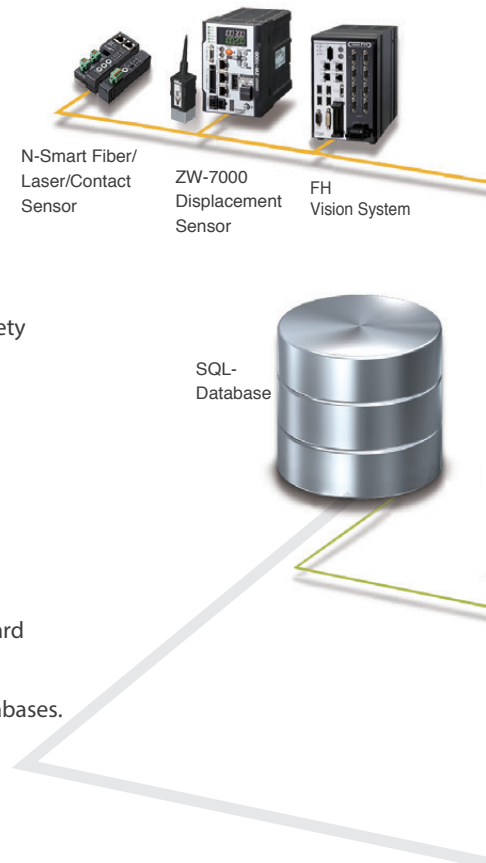
▌ Integration of machine control and Information

· Built-in EtherCAT and EtherNet/IP™ ports : Global standard networks

· NX701-1□□□/NX102-□□□□/NJ501-1□00 CPU Unit with built-in international standard (IEC 62541) OPC UA communication functionality

· Database connection: Logs real-time data from production lines directly into SQL Databases. This enables preventive maintenance and quality traceability.
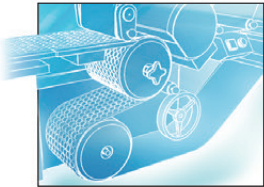
One Software

▌ One integrated development environment software

· Fully conforms with IEC 61131-3 standards

· PLCopen function blocks for motion control

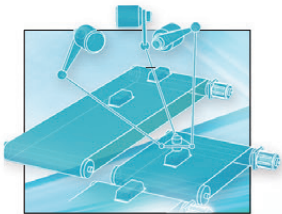· Packed with Omron's rich technical know-how. Various software components help reduce programming time.
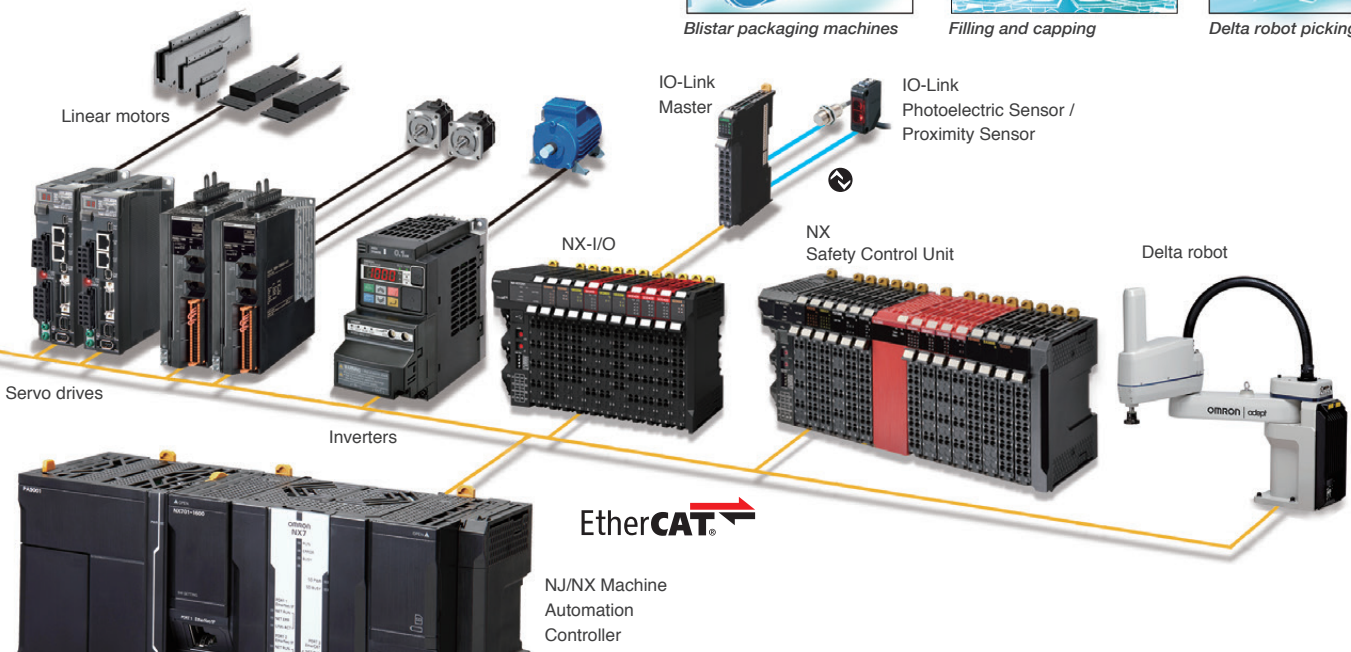
Sysmac Library

Blistar packaging machines

Filling and capping

Delta robot picking system

Linear motors

IO-Link Master

IO-Link Photoelectric Sensor / Proximity Sensor

NX-I/O

NX Safety Control Unit

Delta robot

Servo drives

Inverters

EtherCAT®

NJ/NX Machine Automation Controller

NA Programmable Terminal

PLCopen motion control

EtherNet/IP Ethernet

Information technologies

IT devices

Smart factory

Sales force

Offices HQ
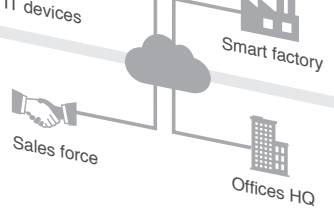
# Advanced machine control and integrated production /

Motion Control

Complete integration of motion and logic

One controller integrates logic, motion, vision and information for complete control and management of machines. Position, displacement, and tension information collected from sensors can be quickly and easily fed back to the motion control.
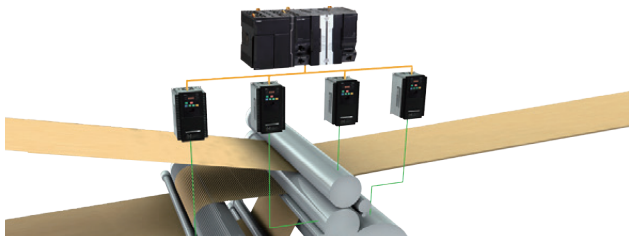
Accurate feedback control with less than 1 µs jitter

The NJ/NX controller offers synchronous control of all machine devices, from input through to output. Distributed clock-based clock synchronization incorporated into EtherCAT slaves enables the I/O refresh cycle to be synchronized between units such as the FH Vision System, ZW Displacement Sensor, NX I/O, and G5/1S Servo Drive.
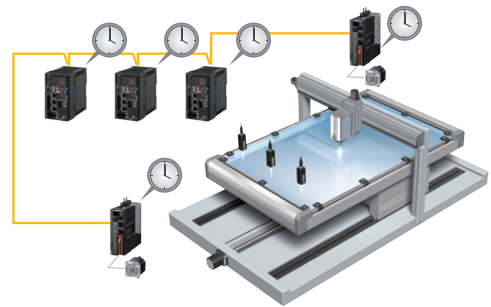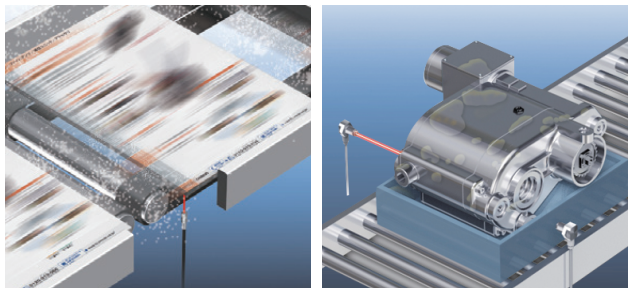
Preventive maintenance

Preventive maintenance of EtherCAT sensor

Monitoring the sensor status allows you to maintain before sensors malfunction due to dirt or aged deterioration.* The sensor settings can be saved and loaded, which minimizes downtime when troubles occur.

FROM	TO
In harsh environments, sensors can become dirty, resulting in malfunctions.	Decreases in light intensity can be detected by monitoring sensors.

Detection in dusty environment   Detection in oily environment

Initial display   Trend graph

Preventive maintenance of actuator devices

The NJ/NX controller that integrates EtherCAT and motion control can constantly monitor actuator devices with a fast cycle time.

Fully integrated and synchronized

EtherCAT®

* When combining the NJ/NX controller with the E3NW EtherCAT Sensor communications unit and creating the programmable terminal screens.
The sample program for Omron NS/NA Programmable Terminal is available. Contact your Omron sales representative for details.
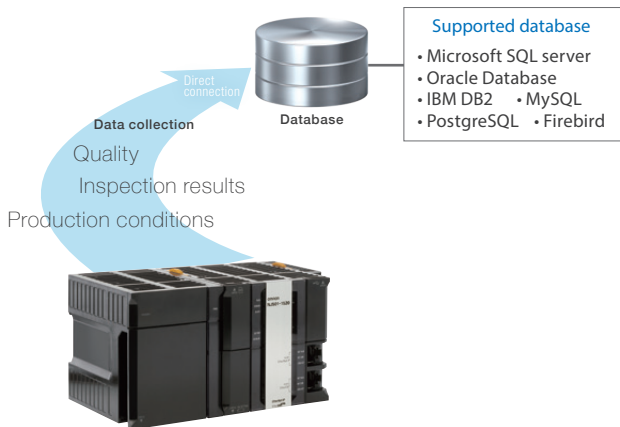
machine data management for a variety of applications

Information

NX102-□□20/NJ101-□020/NJ501-□□20/NX701-1□20

Fast machine data storage in database

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

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

Database

Direct connection

Data collection

Quality

Inspection results

Production conditions

NX701-1□□□□/NX102-□□□□□/NJ501-1□00

International standard communication protocol OPC UA directly connects automation and IT

OPC UA with strong security features (e.g., authentication and encryption) is widely used across the world and adopted for Industrie 4.0 and PackML communications. The host system can access production data directly without connecting a gateway computer.

IT system
SCADA/HMI/MES/ERP

OPC UA

Manufacturing site
Machine control

NX102-□□□□/NX1P2-□□□□

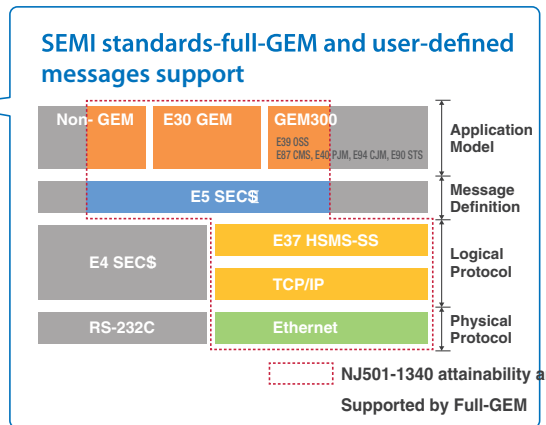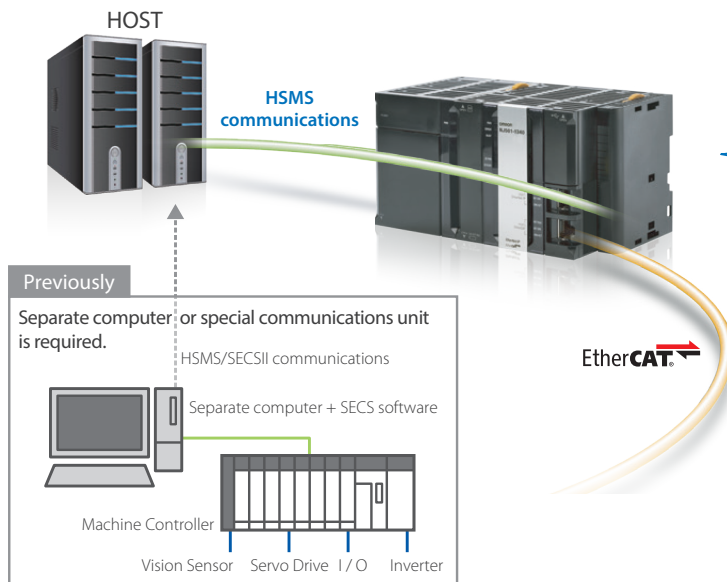#### Easy and secure data collection in the cloud

The controllers supports MQTT (S) communication using MQTT Communication Library. It can easily connect to the cloud without a gateway PC and securely collect manufacturing site data.

MQTT(S)

NJ501-1340

Semiconductor industry standard SECS/GEM communications functionality

The SECS/GEM CPU Unit integrates machine control and host communications, reducing time, cost, and complexity to establish SECS/GEM communications.

HOST

HSMS communications

EtherCAT

Previously

Separate computer or special communications unit is required.

HSMS/SECSII communications

Separate computer + SECS software

Machine Controller

Vision Sensor Servo Drive I / O Inverter

SEMI standards-full-GEM and user-defined messages support

Non- GEM	E30 GEM	GEM300 E39 OSS E87 CMS, E40 PJM, E94 CJM, E90 STS	Application Model
	E5 SECS		Message Definition
E4 SECS	E37 HSMS-SS		Logical Protocol
	TCP/IP		
RS-232C	Ethernet		Physical Protocol

NJ501-1340 attainability area

Supported by Full-GEM

Processing   NJ501-5300

Versatile NC functions

G-Code reduces time required to design and program complex profiling.
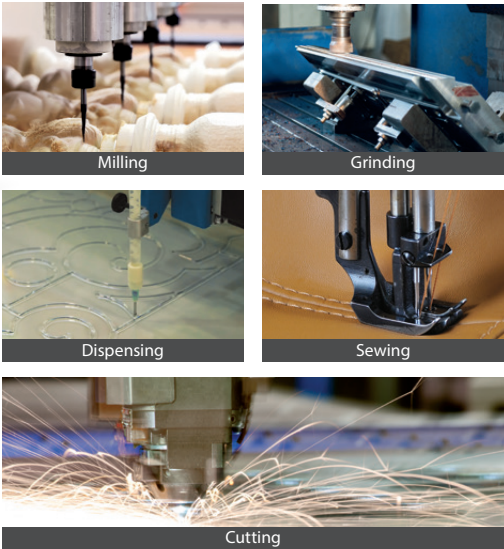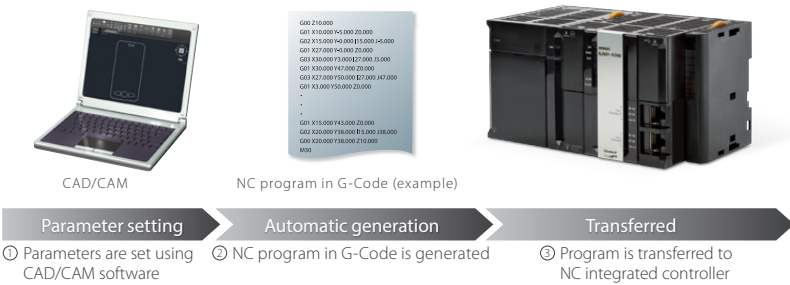
Conventional controller

Processing programs are designed based on CAD data. Programming using PLC instructions and debugging are required for each figure

CAD screen
(example)

Program design
- Exploding components into lines
- Types of lines: straight line, arc, free curve
- Target positions of lines
- Travel velocities
- Transition path between figures, etc.

NC Integrated Controller

CAD/CAM software makes design easy

CAD/CAM

NC program in G-Code (example)

Parameter setting	Automatic generation	Transferred
① Parameters are set using CAD/CAM software	② NC program in G-Code is generated	③ Program is transferred to NC integrated controller

Milling

Grinding

Dispensing

Sewing

Cutting

NC functions for complex profiling applications

G-Code
G-Code NC programming language allows manual programming on operation software and use in combination with any CAD/CAM software

High-speed control
Logic sequence, motion control and NC functionality with the fastest cycle time of 500 μs

Cutter compensation 2D
Tool diameter and shape compensation, matching the cutting point exactly as specified in G-Code

Lookahead
Future instructions are analyzed in advance, movements are blended and optimized in speed and acceleration for a better performance

3D interpolation
Helical, spiral and conical interpolation for 3D profiling

Coordinate systems
Various profiling using machine coordinate system, workpiece coordinate system, and local coordinate system
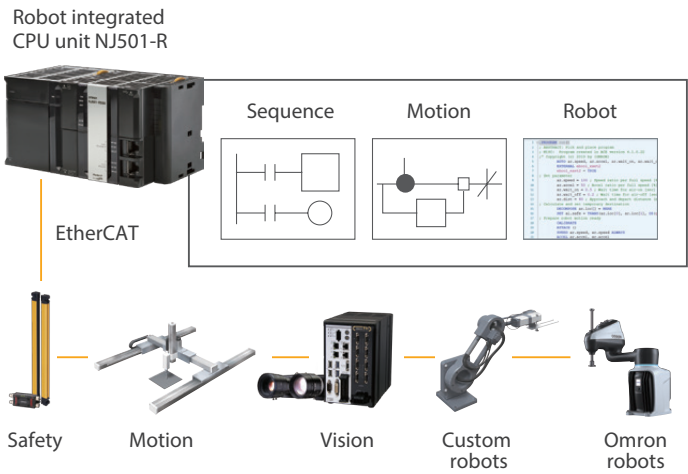
Robotics   NJ501-R□□□

Integration of logic, motion, Omron Robot and kinematics makes automation more advanced and flexible

Industry first*:
Integrated control of different engines

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

Collection of truly useful data

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

Robot integrated
CPU unit NJ501-R

EtherCAT

Sequence   Motion   Robot

Safety   Motion   Vision   Custom robots   Omron robots

*Based on Omron investigation in November 2019

Maximized uptime   NX102-□□00/NX1P2-□□□□/NJ501-1□00/NJ301-1□00/NJ101-□□00

Redundancy minimizes downtime

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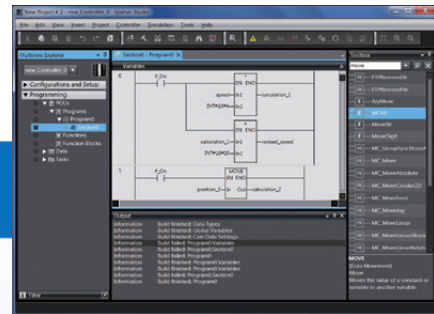
Non-redundant system

Safety over EtherCAT

Disconnection

The entire line stops, reducing uptime

Redundant system

Safety over EtherCAT

Disconnection

Redundancy avoids line stops for recovery
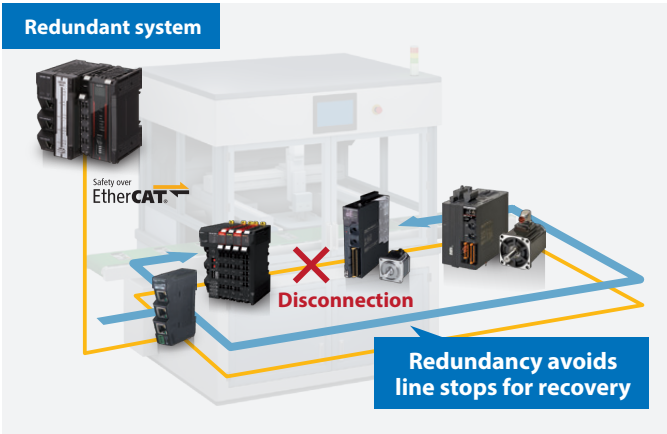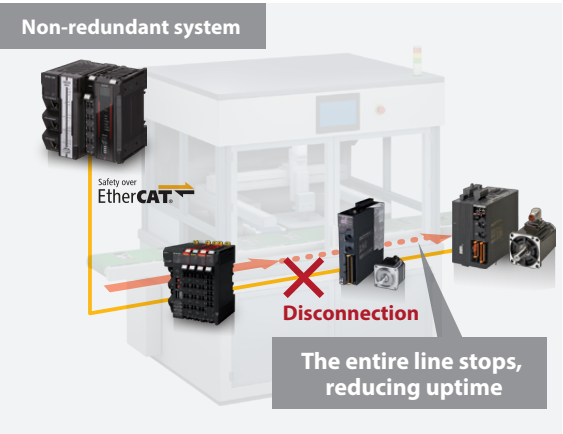
Creative development environment for globalized

Design

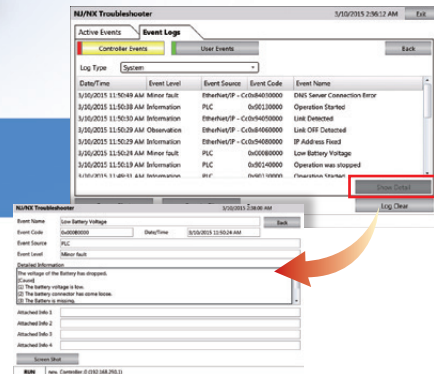### Reusable programs

▍Programming with variables

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

Maintenance

Highly efficient maintenance

▍Troubleshooting

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

*1. This function can be used by applying the Team Development Option to Sysmac Studio version 1.20 or higher.
   Project version control function is supported by CPU Unit version 1.16 or later.
   Git and the Git logo are either registered trademarks or trademarks of Software Freedom Conservancy, Inc., corporate home of the Git Project, in the United States and/or other countries.

*2. Available with the Sysmac Studio 64-bit version. 3D CAD data supports STEP/IGES.

manufacturing

**Collection of software functional components
Sysmac Library**

Packed with Omron's rich technical know-how.
Various software components help reduce programming time.

## Development by multiple developers

Project version control function*1
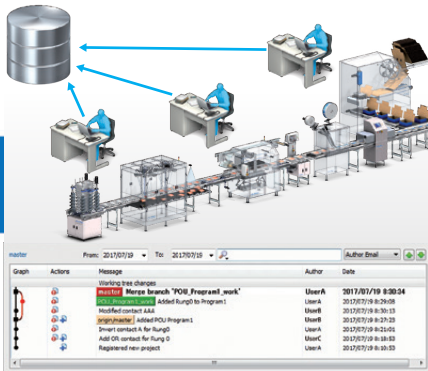
When you develop a project at the same time as your colleagues, the Sysmac Studio combined with the version control system (Git™*) merges changes automatically and resolves conflicting changes. This makes merging easier and faster. You can even revert to the previous revision after graphically comparing the current project with a previous one.

For advanced machine control

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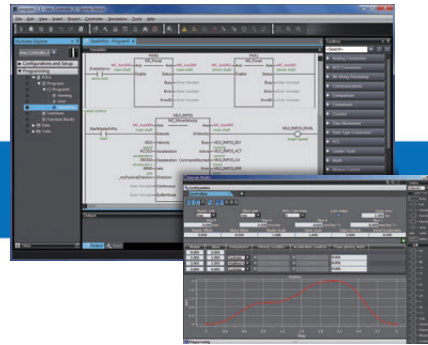
Advanced motion control applications can be created quickly just by combining PLCopen® Function Blocks for Motion Control.

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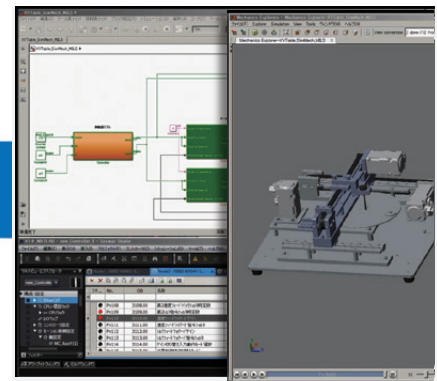
Complex feedback control that is designed with MATLAB®/Simulink® can be imported into programs.

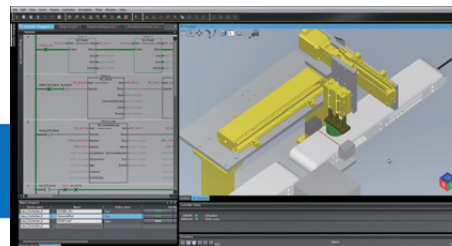MathWorks
Partner

Verification

Fast system debugging

Remote maintenance

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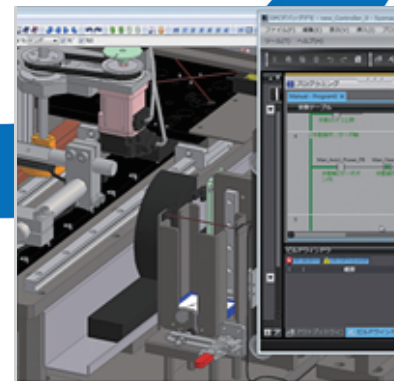
Virtual mechanical debugging

NEW Enhanced by 3D simulation option *2

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

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

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

LATTICE
TECHNOLOGY
VMECH

NJ/NX-series Lineup

Series		NX Series		
Product name		**NX701 CPU Units**	**NX102 CPU Units**	**NX1P2 CPU Units**
Model		**NX701-□□□□**	**NX102-□□□□**	**NX1P2-□□□□**
Appearance		(NX701-1□00) OPC UA	OPC UA	
Specifications	CPU Unit features	Ideal for large-scale, fast, and highly-accurate control with up to 256 axes.	Compact controller with up to 8 axes motion control.	Compact controller with up to 4 axes motion control, up to 4 axes single-axis control, and built-in I/O.
	Instruction execution times — LD instructions	0.37 ns or more	3.3 ns	3.3 ns
	Instruction execution times — Math instructions (for long real data)	3.2 ns or more	70 ns or more	70 ns or more
	Program capacity	80 MB	5 MB	1.5 MB
	Variable capacity	4 MB : Retained during power interruptions 256 MB: Not retained during power interruptions	1.5 MB: Retained during power interruptions 32 MB : Not retained during power interruptions	32 KB: Retained during power interruptions 2 MB : Not retained during power interruptions
	I/O capacity/maximum number of configuration Units (Expansion Racks)	—	— Up to 32 NX I/O Units connectable	Built-in I/O: 40 points max. Up to eight NX I/O Units connectable
	Number of motion axes	128, 256	0, 2, 4, 8 *1	0, 2, 4 *1
	EtherCAT slaves	512	64	16
	Number of controlled robots	—	—	—
	Number of controlled OMRON robots	—	—	—
Functions	Database connection	● NX701-1□20	● NX102-□□20	—
	SECS/GEM communications functions	—	—	—
	Numerical Control (NC) functions	—	—	—
External memory		Memory Cards	Memory Cards	Memory Cards
Detailed specification (Datasheet)		P141	P130	P116

*1. Motion control axes and 4 single-axis position control axes.
*2. The number of robots that can be controlled depends on the number of axes used in the system.
*3. The number of controlled axes of the MC Control Function Module is included.

Individual Pamphlets

NX1
P129

OMRON
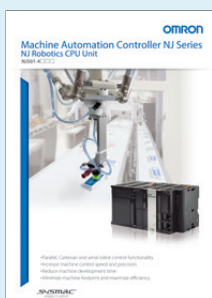NX1 Machine Automation Controller
Continue to pursue productivity

The solution in your hand

NX1P
P115

OMRON
Machine Automation Controller
NX1P

OPC UA
P123

OMRON
NJ/NX-series Machine Automation Controller CPU Unit
International standard OPC UA for directly connecting automation systems and IT systems
OPC UA functionality

Robot Integrated Controller
I856

OMRON
Robot Integrated Controller
Revolutionizing manufacturing through integrated control of robots, machines, vision sensors, and safety components

NJ Series								
NJ501 CPU Units						**NJ301 CPU Units**	**NJ101 CPU Units**	
NJ501-1□00	NJ501-R□□□	NJ501-4□□□	NJ501-1□20	NJ501-1340	NJ501-5300	NJ301-1□00	NJ101-□□00	NJ101-□□20
OPC UA (NJ501-1□00)								
Ideal for large-scale, fast, and highly-accurate control with up to 64 axes.						Ideal for small control with up to 8 axes.	Ideal for simple machines.	
1.1 ns (1.7 ns or less)						1.6 ns (2.5 ns or less)	3.0 ns (4.5 ns or less)	
24 ns or more						35 ns or more	63 ns or more	
20 MB						5 MB	3 MB	
2 MB: Retained during power interruptions 4 MB: Not retained during power interruptions						0.5 MB: Retained during power interruptions 2 MB: Not retained during power interruptions	0.5 MB: Retained during power interruptions 2 MB: Not retained during power interruptions	
2,560 points/40 Units (3 Expansion Racks)						2,560 points/40 Units (3 Expansion Racks)	2,560 points/40 Units (3 Expansion Racks)	
16, 32, 64				16	16 *3	4, 8	0, 2	
192						192	64	
—	8 robots max. *2	8 robots max. *2	—			—	—	
—	8 robots max.	—	—			—	—	
—	● NJ501-R□20	● NJ501-4320	●	—		—	—	●
—				●	—	—	—	
—					●	—	—	
Memory Cards						Memory Cards	Memory Cards	
P140								

Robotics
P085

Database Connection
P088
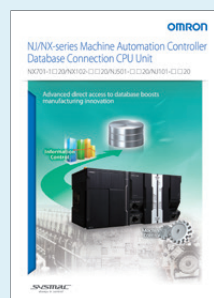
SECS/GEM
P086

NC integrated
R190

OMRON Corporation   **Industrial Automation Company**
  Kyoto, JAPAN

           Contact: www.ia.omron.com

Regional Headquarters
OMRON EUROPE B.V.
Sensor Business Unit
Carl-Benz-Str. 4, D-71154 Nufringen, Germany
Tel: (49) 7032-811-0/Fax: (49) 7032-811-199

OMRON ELECTRONICS LLC
2895 Greenspoint Parkway, Suite 200
Hoffman Estates, IL 60169 U.S.A.
Tel: (1) 847-843-7900/Fax: (1) 847-843-7787

OMRON ASIA PACIFIC PTE. LTD.
No. 438A Alexandra Road # 05-05/08 (Lobby 2),
Alexandra Technopark,
Singapore 119967
Tel: (65) 6835-3011/Fax: (65) 6835-2711

OMRON (CHINA) CO., LTD.
Room 2211, Bank of China Tower,
200 Yin Cheng Zhong Road,
PuDong New Area, Shanghai, 200120, China
Tel: (86) 21-5037-2222/Fax: (86) 21-5037-2200

Authorized Distributor: