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 architecture is the perfect match of real time machine control and plant data management.
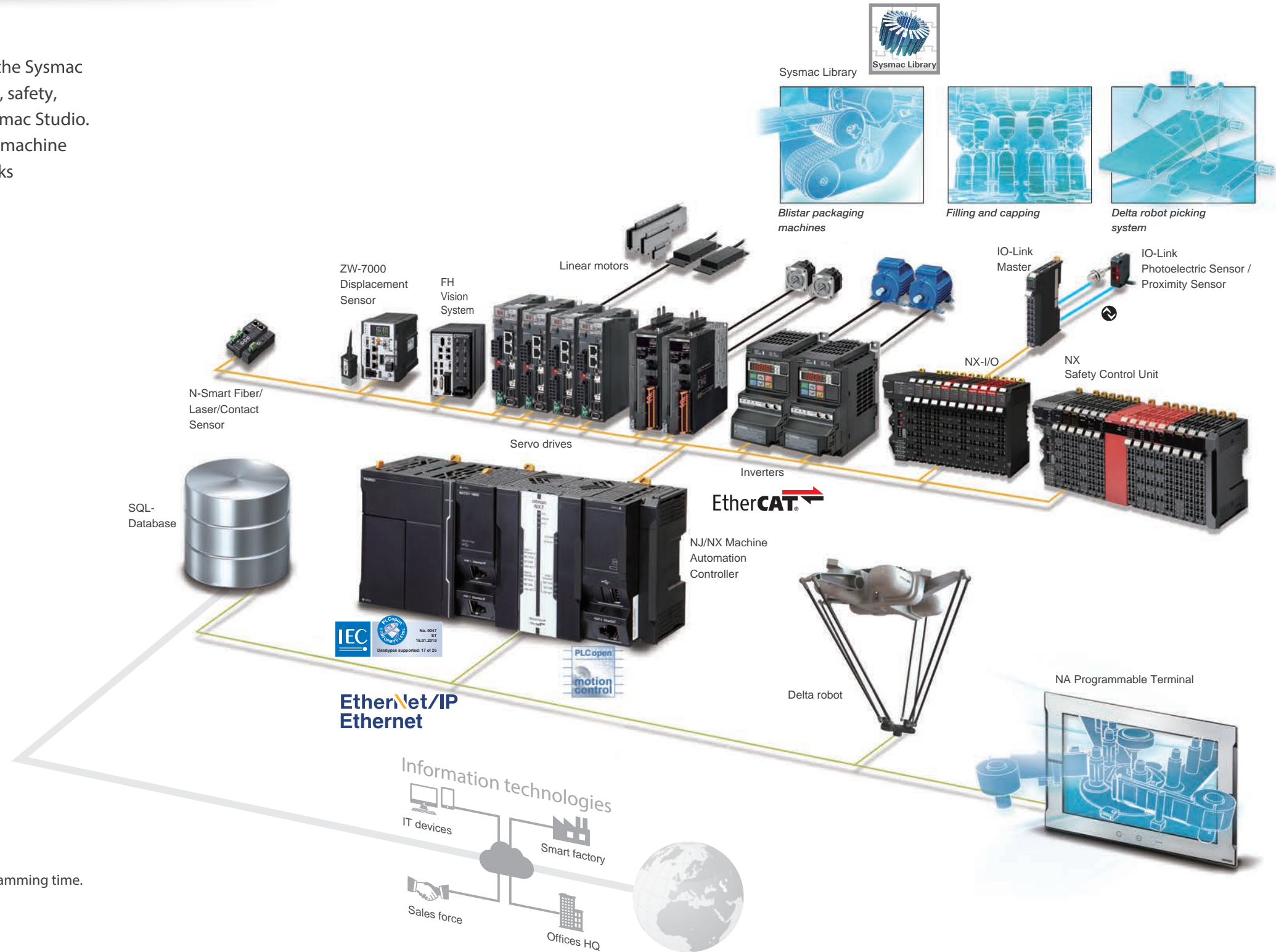
One Machine Controller

❚ 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).

One Connection

❚ Integration of machine control and Information Systems
   • Built-in EtherCAT and EtherNet/IP™ ports : Global standard networks
   • 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

ZW-7000 Displacement Sensor

FH Vision System

Linear motors

IO-Link Master

IO-Link Photoelectric Sensor / Proximity Sensor

NX-I/O

NX Safety Control Unit

N-Smart Fiber/ Laser/Contact Sensor

Servo drives

Inverters

SQL-Database

EtherCAT

NJ/NX Machine Automation Controller

EtherNet/IP Ethernet

Delta robot

NA Programmable Terminal

Information technologies

IT devices

Smart factory

Sales force

Offices HQ

Advanced machine control and integrated production / machine data management for a variety of applications

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.
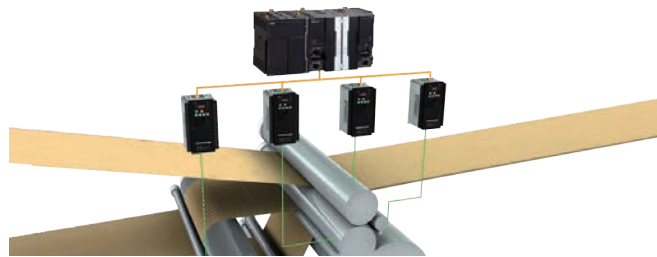
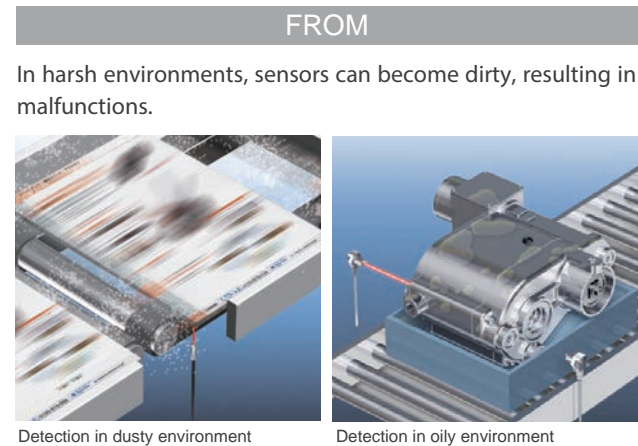### Accurate feedback control with less than 1 μs jitter

The NJ/NX controller offers synchronous control of all machine devices, from input to output. Distributed clock-based 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.
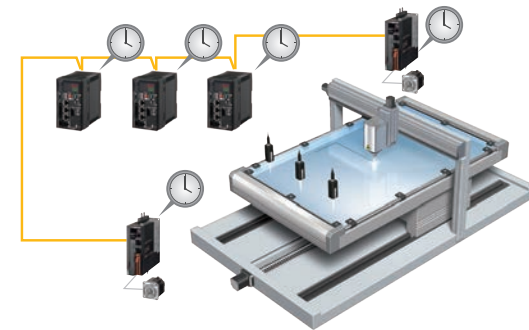
Preventive maintenance

Preventive maintenance with EtherCAT sensors.

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

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

Initial display Trend graph

Detection in dusty environment Detection in oily environment

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.

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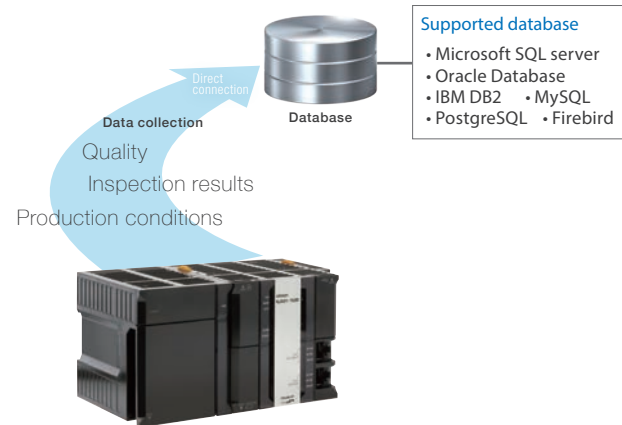
Supported database
- Microsoft SQL server
- Oracle Database
- IBM DB2   • MySQL
- PostgreSQL • Firebird

Database

Direct connection

Data collection

Quality

Inspection results

Production conditions

NX102-□□□□/NJ501-1□00

International standard communication protocol OPC UA directly connects the plant floor to enterprise systems.

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

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

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

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

NJ501-1340 attainability area
Supported by Full-GEM

Previously

Separate computer or special communications unit is required.

HSMS/SECSII communications

Separate computer + SECS software

Machine Controller

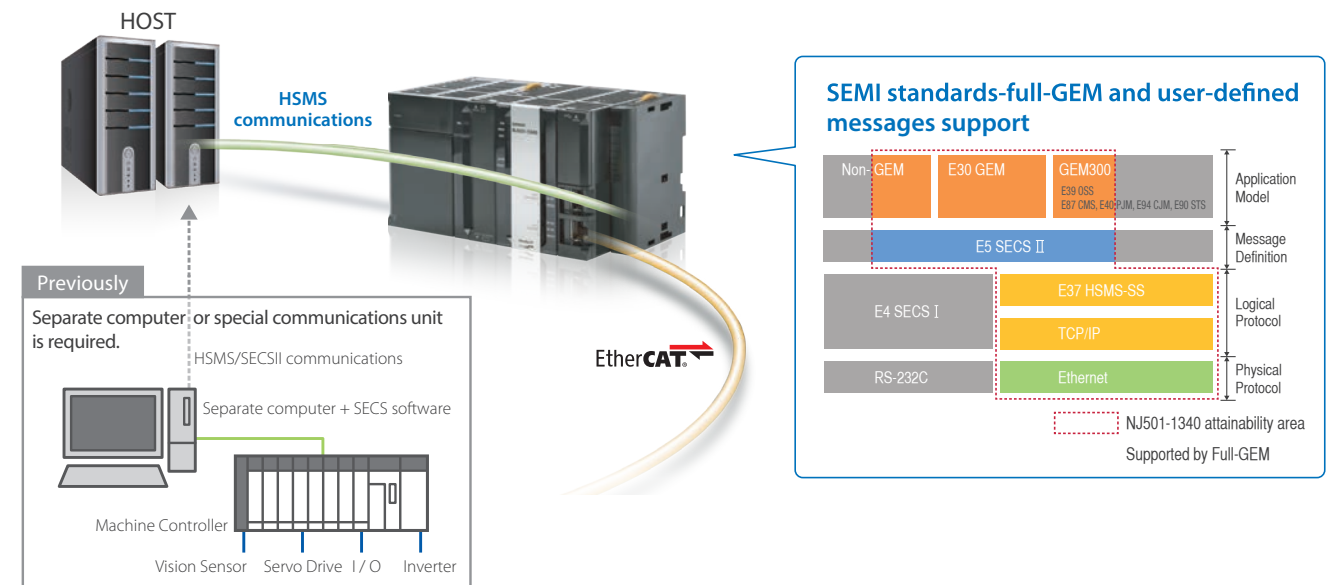Vision Sensor Servo Drive I/O Inverter

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.

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
- Interpret CAD file into a series of motion commands
  - Linear Interpolation
  - Circular Interpolation
- Evaluate blending of movements
  - Velocities
  - Acceleration/ Deceleration
- Interpret movements between profiles
- Adjust tool offsets to modify motion commands.

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 NJ501-4□□□

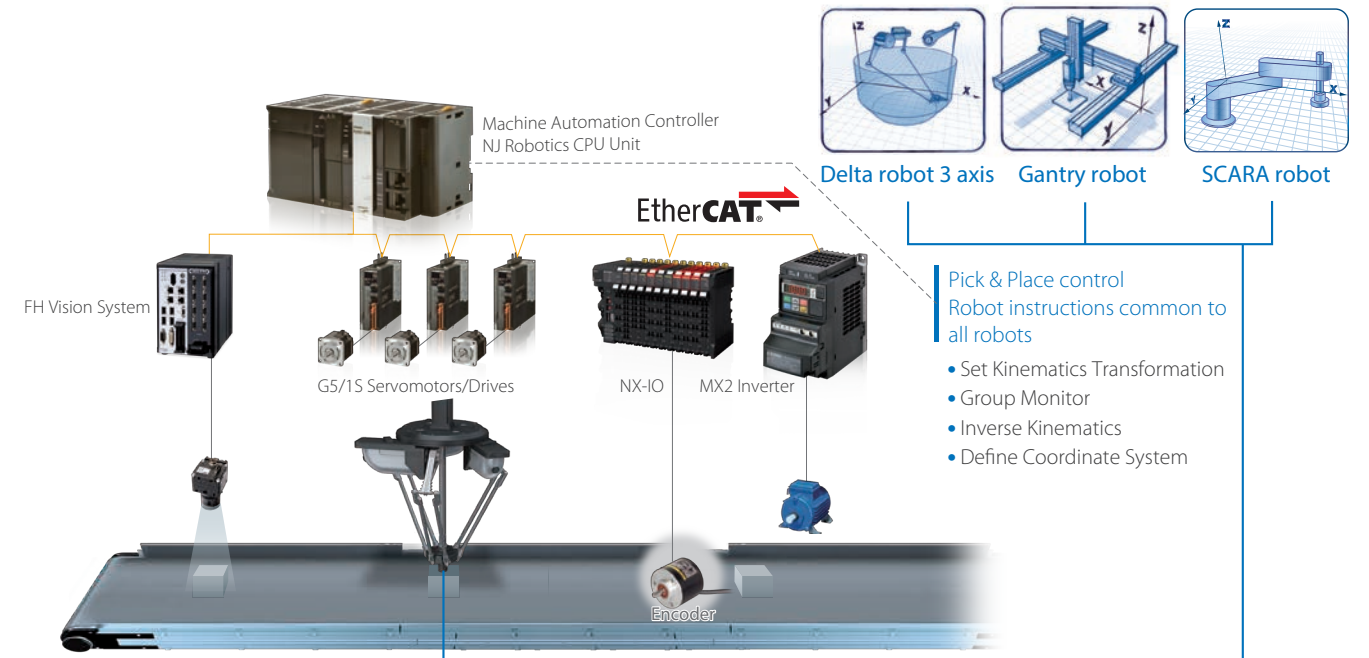### Integrated machine and robot control brings flexibility to build machines

Integrating machine control and robot control, allows you to build a conveyor tracking application where robots are precisely synchronized with conveyors.
One controller can control up to 64 axes including 8 parallel, Cartesian, or serial robots.
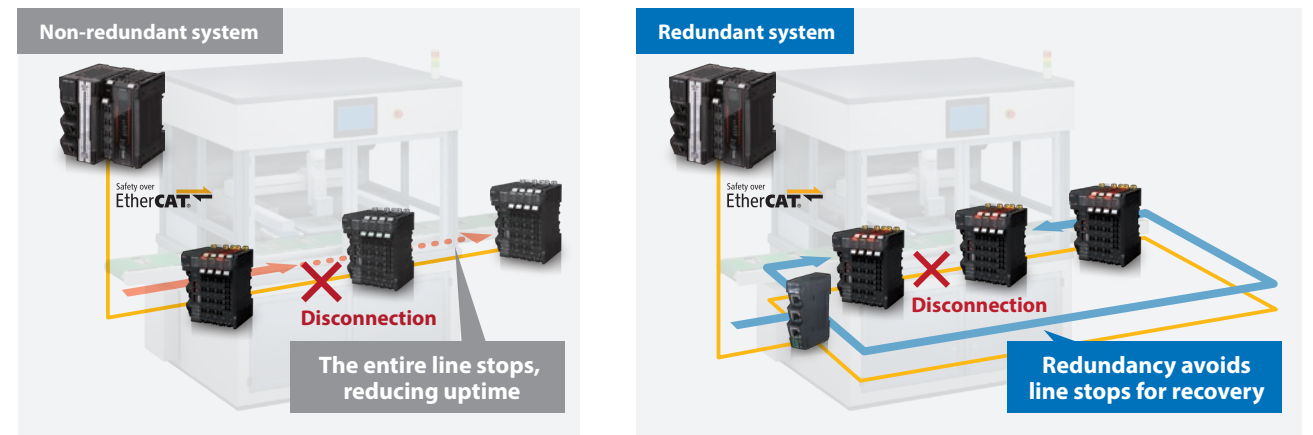Standard IEC 61131-3 based instructions for motion and robot control reduce programming time.

Machine Automation Controller NJ Robotics CPU Unit

EtherCAT

FH Vision System

G5/1S Servomotors/Drives

NX-IO

MX2 Inverter

Encoder

Delta robot 3 axis Gantry robot SCARA robot

Pick & Place control
Robot instructions common to all robots
- Set Kinematics Transformation
- Group Monitor
- Inverse Kinematics
- Define Coordinate System

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

Redundancy minimizes downtime

Cable Redundancy provides continuous connectivity even if a part of the EtherCAT network is disconnected.
This function allows you to fix disconnection without stopping production.

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 manufacturing

Design

Reusable programs

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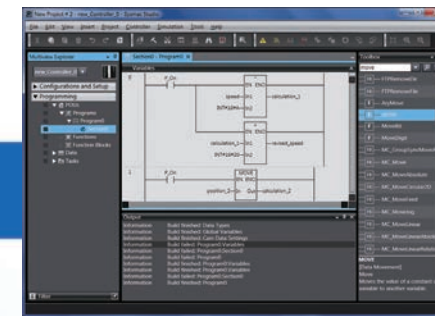
One Integrated Development Environment software Sysmac Studio is fully compliant with the open standard IEC 61131-3. Programming with variables eliminates the need to learn the internal memory map of the PLC and allows the programs to be reused.

Development by multiple developers

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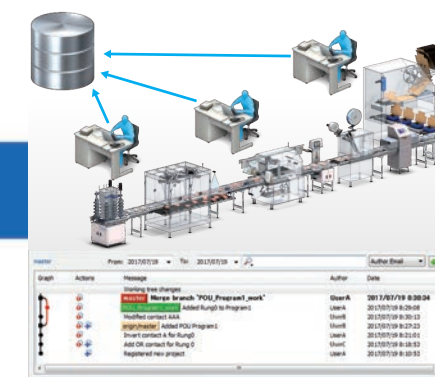
When you develop a project at the same time as your colleagues, the Sysmac Studio combined with the version control system (Git™*) merges changes automatically and resolves conflicting changes. This makes merging easier and faster. You can even revert to the previous revision after graphically comparing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

For advanced machine control

▌Motion programming
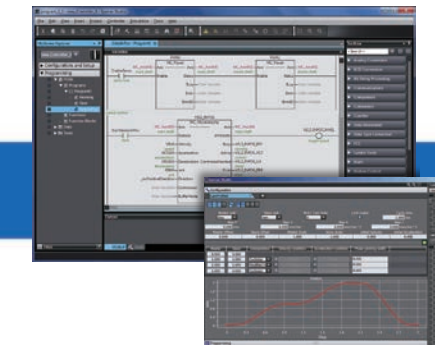
Advanced motion control applications can be created quickly just by combining PLCopen® Function Blocks for Motion Control.
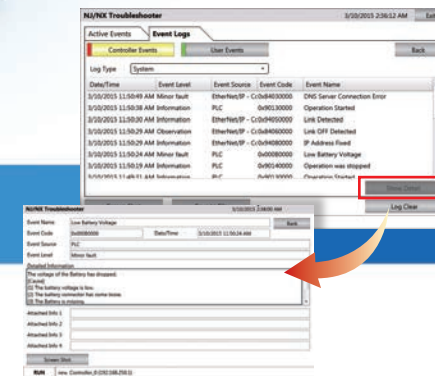
▌Model-Based design
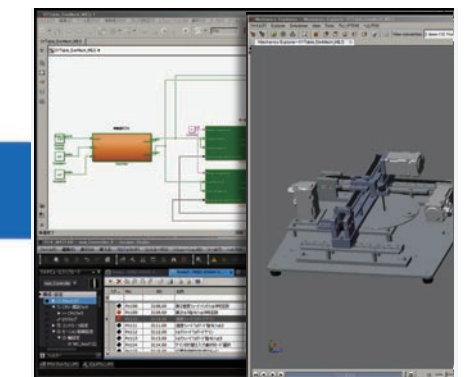
Complex feedback control that is designed with MATLAB®/Simulink® can be imported into programs.
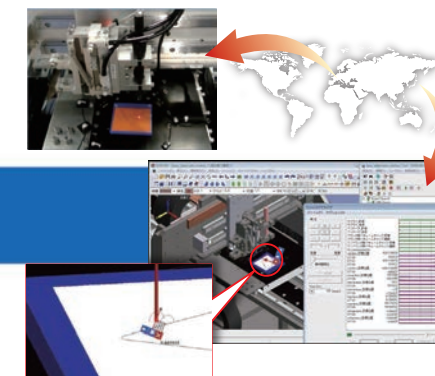
MathWorks
Partner

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.
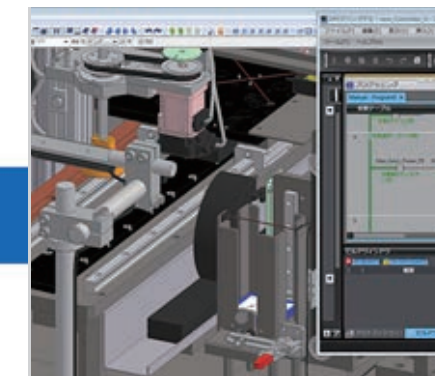
▌Remote maintenance

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.
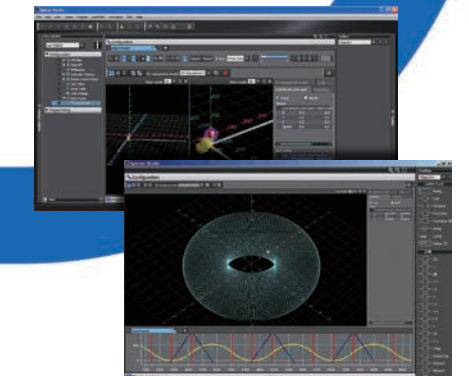
Verification

### Fast system debugging

▌Virtual mechanical debugging

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

LATTICE TECHNOLOGY
VMECH

▌3D simulation

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

EtherNet/IP

EtherCAT.
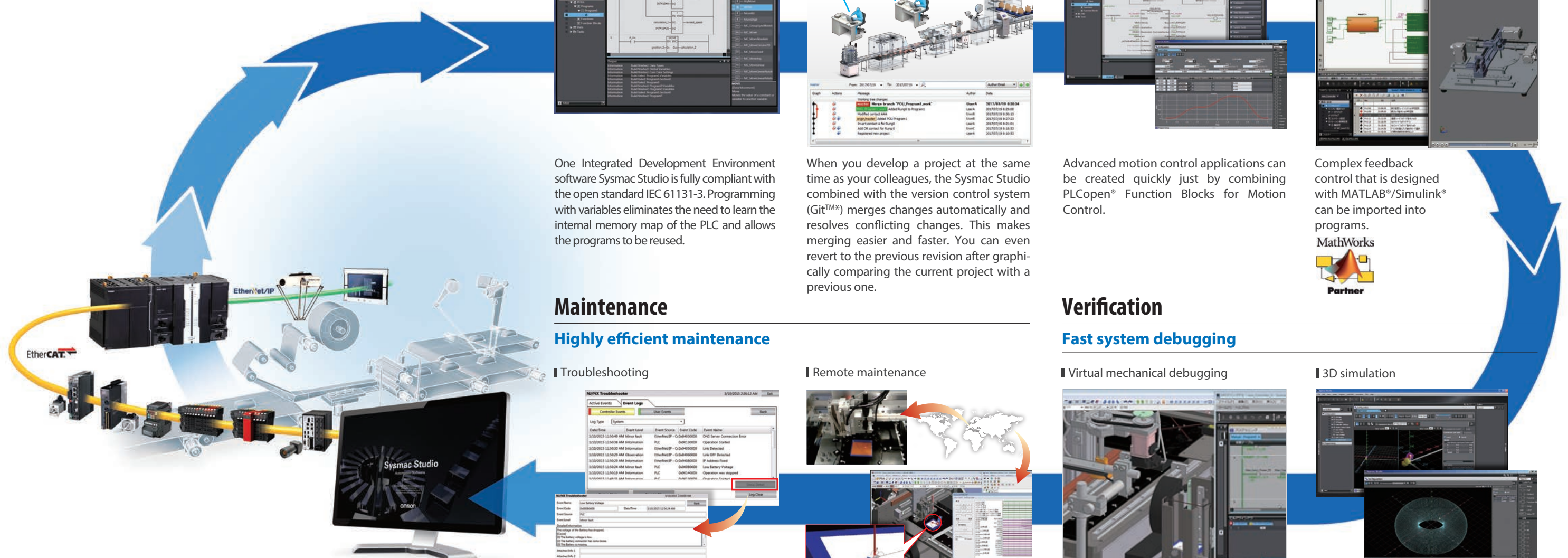
Sysmac Studio

* 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.

OMRON

NJ/NX-series Lineup

Specifications		NX Series			NJ Series							
Series		NX Series			NJ Series							
Product name		NX701 CPU Units	NX102 CPU Units	NX1P2 CPU Units	NJ501 CPU Units					NJ301 CPU Units	NJ101 CPU Units	
Model		NX701-□□□□	NX102-□□□□	NX1P2-□□□□	NJ501-1□00	NJ501-4□□□	NJ501-1□20	NJ501-1340	NJ501-5300	NJ301-1□00	NJ101-□□00	NJ101-□□20
Appearance			OPC UA		OPC UA (NJ501-1□00)							
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.	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.	
Instruction execution times	LD instructions	0.37 ns or more	3.3 ns	3.3 ns	1.1 ns (1.7 ns or less)					1.6 ns (2.5 ns or less)	3.0 ns (4.5 ns or less)	
	Math instructions (for long real data)	3.2 ns or more	70 ns or more	70 ns or more	24 ns or more					35 ns or more	63 ns or more	
Program capacity		80 MB	5 MB	1.5 MB	20 MB					5 MB	3 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	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	
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	2,560 points/40 Units (3 Expansion Racks)					2,560 points/40 Units (3 Expansion Racks)	2,560 points/40 Units (3 Expansion Racks)	
Number of motion axes		128, 256	0, 2, 4, 8 *1	0, 2, 4 *1	16, 32, 64			16	16 *3	4, 8	0, 2	
EtherCAT slaves		512	64	16	192					192	64	
Number of controlled robots		—	—	—	—	8 robots max. *2	—			—	—	
Functions	Database connection	● NX701-1□20	● NX102-□□20	—	—	● NJ501-4320	●	—		—	—	●
	SECS/GEM communications functions	—	—	—	—	—	—	●	—	—	—	
	Numerical Control (NC) functions	—	—	—	—	—	—		●	—	—	
External memory		Memory Cards	Memory Cards	Memory Cards	Memory Cards					Memory Cards	Memory Cards	
Detailed specification (Datasheet)		P141	P130	P116	P140							

*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	NX1P	OPC UA	Robotics	Database Connection	SECS/GEM	NC integrated
P129	P115	P123	P085	P088	P086	R190

OMRON

Authorized Distributor:

Controllers & I/O
• Machine Automation Controllers (MAC) • Motion Controllers
• Programmable Logic Controllers (PLC) • Temperature Controllers • Remote I/O

Robotics
• Industrial Robots • Mobile Robots

Operator Interfaces
• Human Machine Interface (HMI)

Motion & Drives
• Machine Automation Controllers (MAC) • Motion Controllers • Servo Systems
• Frequency Inverters

Vision, Measurement & Identification
• Vision Sensors & Systems • Measurement Sensors • Auto Identification Systems

Sensing
• Photoelectric Sensors • Fiber-Optic Sensors • Proximity Sensors
• Rotary Encoders • Ultrasonic Sensors

Safety
• Safety Light Curtains • Safety Laser Scanners • Programmable Safety Systems
• Safety Mats and Edges • Safety Door Switches • Emergency Stop Devices
• Safety Switches & Operator Controls • Safety Monitoring/Force-guided Relays

Control Components
• Power Supplies • Timers • Counters • Programmable Relays
• Digital Panel Meters • Monitoring Products

Switches & Relays
• Limit Switches • Pushbutton Switches • Electromechanical Relays
• Solid State Relays

Software
• Programming & Configuration • Runtime