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 N/J501-1 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.
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 G5/15 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.

In harsh environments, sensors can become dirty, resulting in malfunctions.

<table>
<thead>
<tr>
<th>FROM</th>
<th>TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detection in dusty environment</td>
<td>Detection in oil environment</td>
</tr>
</tbody>
</table>

Decreases in light intensity can be detected by monitoring sensors.

**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.

**Information**

**NX102-20/NJ101-20/NJ501-20/NX701-20**

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.

**NX102-1D0/NJ501-1D0**

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 Industry 4.0 and PackML communications. The host system can access production data directly without connecting a gateway computer.

**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.

**SEMII standards-full GEM and user-defined messages support**

Application Model

* 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.
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.

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

Parameter setting
- Automatic generation
- Transferred

NC functions for complex profiling applications

- G-Code
- High-speed control
- Lookahead
- 3D interpolation
- Coordinate systems

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.

Standard IEC 61131-3 based instructions for motion and robot control reduce programming time.

Maximized uptime

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.
Design

Reusable programs
- Programming with variables

Development by multiple developers
- Project version control function*

For advanced machine control
- Motion programming
- Model-Based design

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.

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.

Verification

Fast system debugging
- Virtual mechanical debugging
- 3D simulation

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

Maintenance

Highly efficient maintenance
- Troubleshooting

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.

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

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.

Maintenance 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.

Packing and 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.

Pre-written Function Blocks

- Sysmac Library

Various software components help reduce programming time.

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

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

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

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.

* 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.
### NJ/NX-series Lineup

<table>
<thead>
<tr>
<th>Series</th>
<th>NX Series</th>
<th>NJ Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>NX701 CPU Units</td>
<td>NX302 CPU Units</td>
</tr>
<tr>
<td>Appearance</td>
<td><img src="image1" alt="Image" /></td>
<td><img src="image2" alt="Image" /></td>
</tr>
<tr>
<td>CPU Unit features</td>
<td>Ideal for large-scale, fast, and highly-accurate control with up to 256 axes.</td>
<td>Compact controller with up to 8 axes motion control.</td>
</tr>
<tr>
<td>Instruction execution times</td>
<td>0.27 ns or more</td>
<td>3.3 ns</td>
</tr>
<tr>
<td>Program capacity</td>
<td>20 MB</td>
<td>5 MB</td>
</tr>
<tr>
<td>Specifications</td>
<td><strong>CPU Unit features</strong>&lt;br&gt;LD instructions</td>
<td>3.2 ns or more</td>
</tr>
<tr>
<td>Instruction execution times</td>
<td><strong>Basic instructions (for long real data)</strong></td>
<td></td>
</tr>
<tr>
<td>Program capacity</td>
<td><strong>Variable capacity</strong>&lt;br&gt;4 MB: Retained during power interruptions</td>
<td>256 MB: Not retained during power interruptions</td>
</tr>
<tr>
<td>I/O capacity (maximum number of configuration Units (Expansion Racks))</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Number of motion axes</td>
<td>128, 256</td>
<td>0, 2, 4, 8 *1</td>
</tr>
<tr>
<td>EtherCAT slaves</td>
<td>512</td>
<td>64</td>
</tr>
<tr>
<td>Number of controlled robots</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Functions</td>
<td>Database connection</td>
<td>● NX701-CX20</td>
</tr>
<tr>
<td>Communications functions</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Numerical Control (NC) functions</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>External memory</td>
<td>Memory Cards</td>
<td>Memory Cards</td>
</tr>
<tr>
<td>Detailed specification (Datasheet)</td>
<td>P141</td>
<td>P130</td>
</tr>
</tbody>
</table>

*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**

<table>
<thead>
<tr>
<th>NX1</th>
<th>NX1P</th>
<th>OPC UA</th>
<th>Robotics</th>
<th>Database Connection</th>
<th>SECS/GEM</th>
<th>NC Integrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>P129</td>
<td>P115</td>
<td>P123</td>
<td>P085</td>
<td>P088</td>
<td>P086</td>
<td>P086</td>
</tr>
</tbody>
</table>

---

**Machine Automation Controller**
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