

# Machine Automation Controller

NJ/NX Series



# 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.

## One Machine Controller

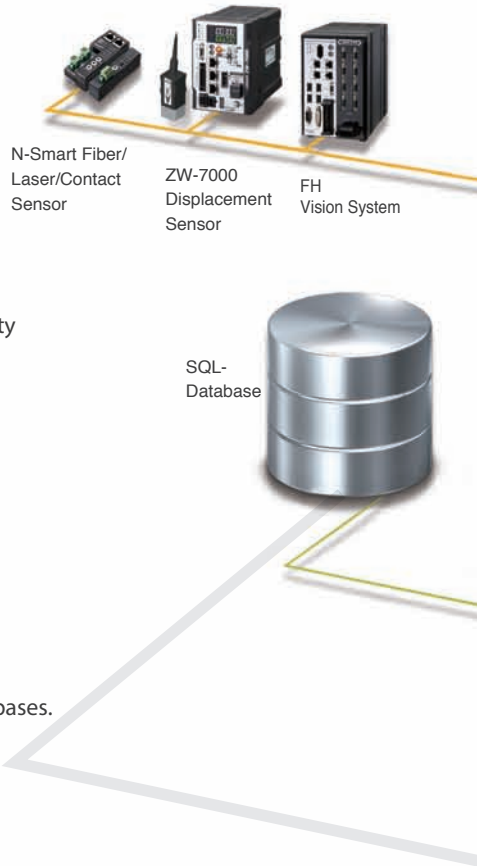
- Complete integration of motion and logic
  - A large selection of CPU Units for up to 256 axes
- Safety integration
  - Flexible system lets you integrate safety into machine automation through the use of Safety over EtherCAT (FSoE).

## One Connection

- Integration of machine control and Information
  - Built-in EtherCAT and EtherNet/IP™ ports : Global standard networks
  - Built-in international standard (IEC 62541) OPC UA communication functionality (NX701-1□□□/NX502-□□□□/NX102-□□□□/ NJ501-1□□00 CPU Unit)
  - 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 /

## Motion Control

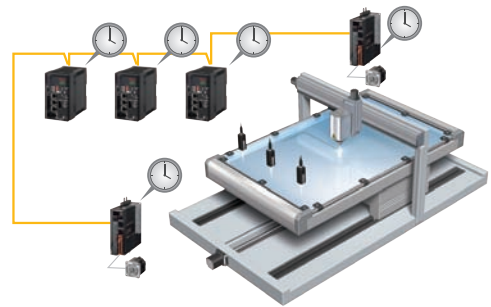
### Complete integration of motion and logic

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.



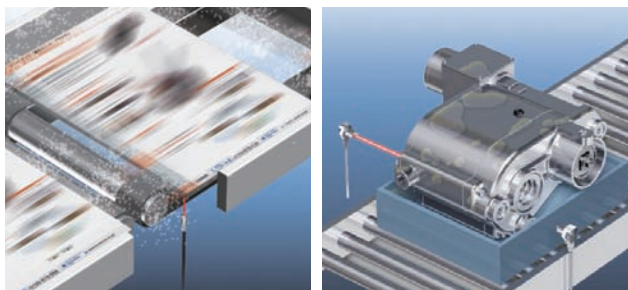
## Preventive maintenance

### 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

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



Detection in dusty environment

Detection in oily environment

#### TO

Decreases in light intensity can be detected by monitoring sensors.



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.



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.



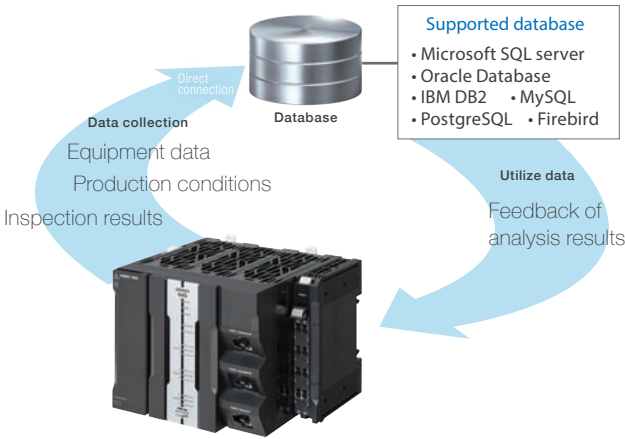
# machine data management for a variety of applications

## Information

**NX701-1□□□/NX502-1□□□/NX102-□□□□/NJ101-□□□□/NJ501-□□□□**

### 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.



**NX701-1□□□/NX502-□□□□/NX102-□□□□/NJ501-1□□□**

### 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.



**NX502-□□□□/NX102-□□□□/NX1P2-□□□□**

### Easy and secure data collection in the cloud

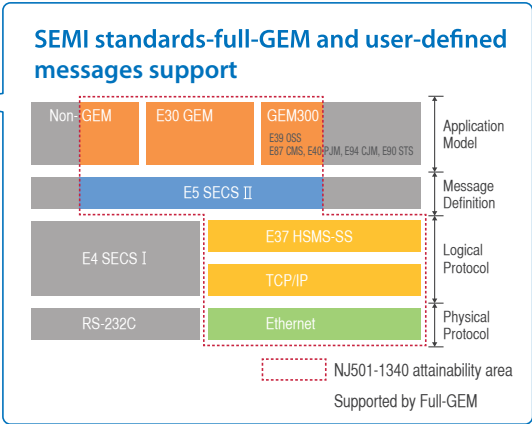
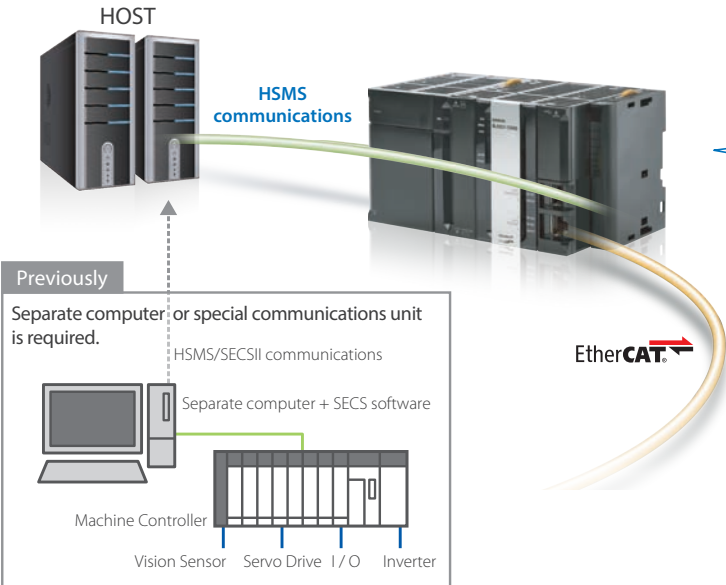
The controllers supports MQTT (S) communication using MQTT Communication Library. It can easily connect to the cloud without a gateway PC and securely collect manufacturing site data.



**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.



**Processing** **NJ501-5300**

**Versatile NC functions**

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

**Conventional controller**

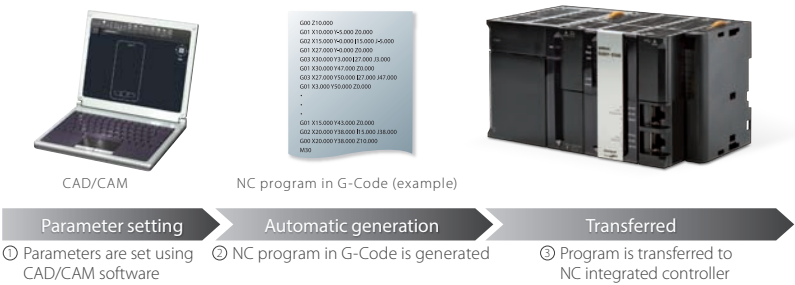
Processing programs are designed based on CAD data. Programming using PLC instructions and debugging are required for each figure



- 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



**NC functions for complex profiling applications**

<p><b>G-Code</b> G-Code NC programming language allows manual programming on operation software and use in combination with any CAD/CAM software</p>	<p><b>High-speed control</b> Logic sequence, motion control and NC functionality with the fastest cycle time of 500 μs</p>	<p><b>Cutter compensation 2D</b> Tool diameter and shape compensation, matching the cutting point exactly as specified in G-Code</p>
<p><b>Lookahead</b> Future instructions are analyzed in advance, movements are blended and optimized in speed and acceleration for a better performance</p>	<p><b>3D interpolation</b> Helical, spiral and conical interpolation for 3D profiling</p>	<p><b>Coordinate systems</b> Various profiling using machine coordinate system, workpiece coordinate system, and local coordinate system</p>

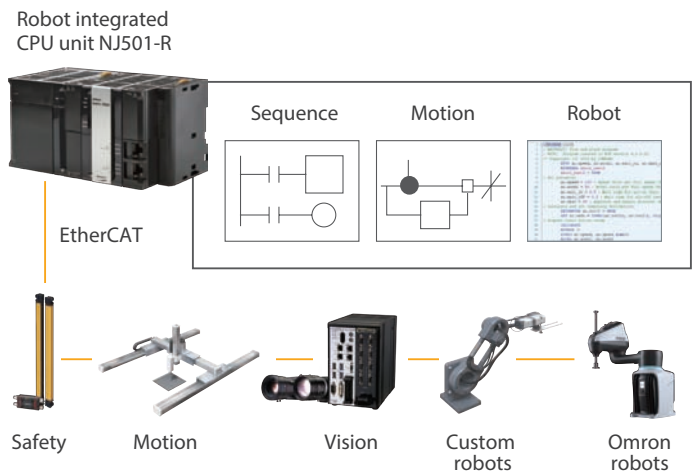
**Robotics**

**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.



\*Based on Omron investigation in November 2019

**Collection of truly useful data**

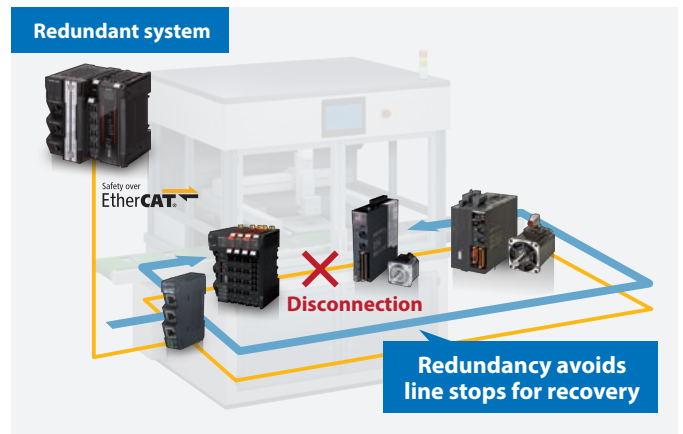
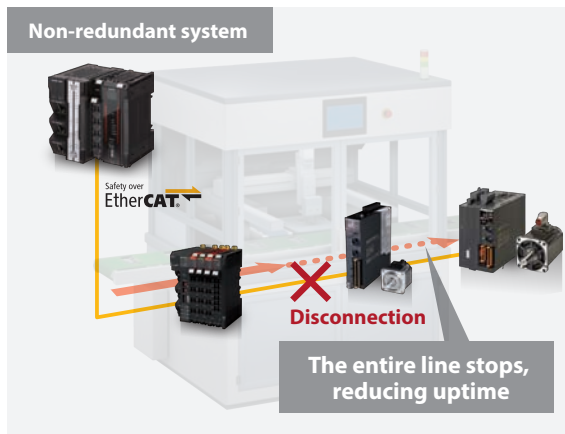
Devices such as robots and motion/vision sensors can be connected to an EtherCAT network for synchronized control. This synchronization ensures that the data collected on these devices is concurrent and therefore truly useful for visualizing facility operation.

**Maximized uptime**

**NX502-□□□□/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.

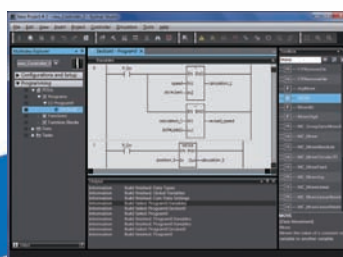


# Creative development environment for globalized

## Design

### Reusable programs

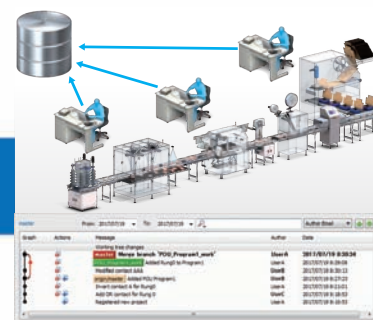
Programming with variables



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.

### Development by multiple developers

Project version control function\*1

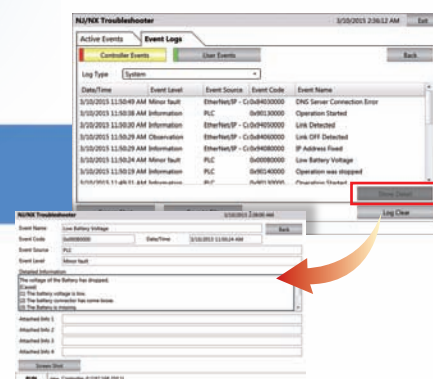


When you develop a project at the same time as your colleagues, the Sysmac Studio combined with the version control system (Git™\*) merges changes automatically and resolves conflicting changes. This makes merging easier and faster. You can even revert to the previous revision after graphically comparing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

## 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

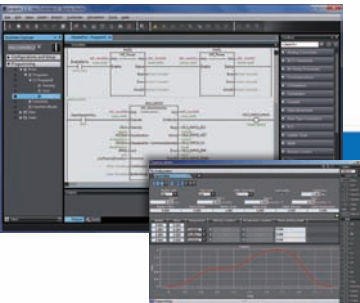


## Collection of software functional components Sysmac Library

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

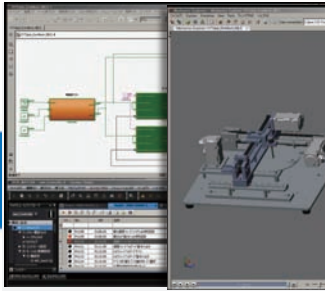
### For advanced machine control

#### ■ Motion programming



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

#### ■ Model-Based design



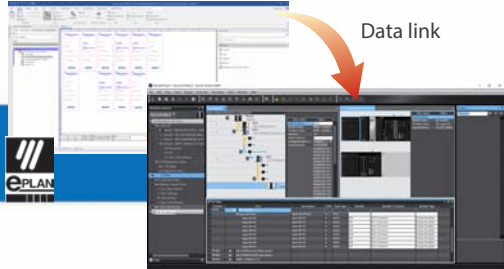
Complex feedback control that is designed with MATLAB®/Simulink® can be imported into programs.



### Efficient designing linked to electrical CAD

#### ■ AutomationML import function **NEW**

Electrical CAD



Circuit diagrams designed using electrical CAD data (e.g., unit configurations and signal lines) can be imported to the Sysmac Studio and automatically reflected in unit configurations and settings and allocated variables.

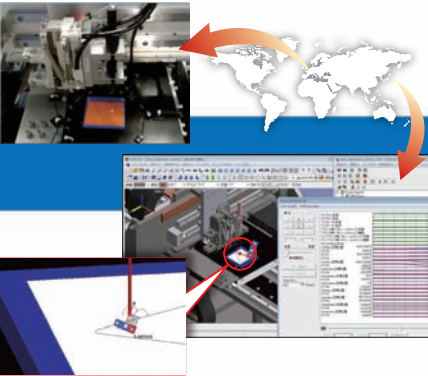
Seamless and accurate setup using electrical CAD design data speeds up the engineering process and improves design efficiency.



## Verification

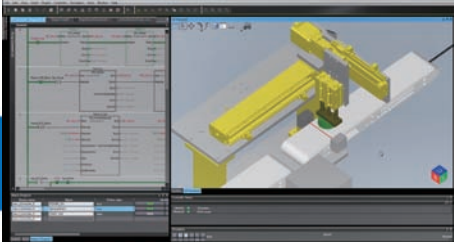
### Fast system debugging

#### ■ 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.

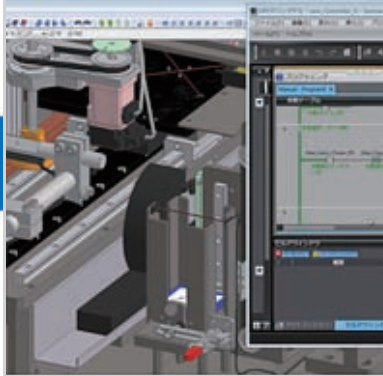
#### ■ Virtual mechanical debugging



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](http://www.fa.omron.co.jp/3d-simulation_e)



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



# NJ/NX-series Lineup

Series		NX Series				
Product name		NX701 CPU Units	NX502 CPU Units	NX102 CPU Units	NX1P2 CPU Units	
Model		NX701-□□□□	NX502-□□□□	NX102-□□□□	NX1P2-□□□□	
Appearance						
Specifications	CPU Unit features	Ideal for large-scale, fast, and highly-accurate control with up to 256 axes.	Ideal for large-scale, fast, and highly-accurate control with up to 64 axes. Used with NX-EIP201 to configure up to 10 EtherNet/IP networks.	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	0.53 ns or more	3.3 ns	3.3 ns
		Math instructions (for long real data)	3.2 ns or more	3.3 ns or more	70 ns or more	70 ns or more
	Program capacity	80 MB	80 MB	5 MB	1.5 MB	
	Variable capacity	4 MB: Retained during power interruptions 256 MB: Not retained during power interruptions	4 MB: Retain attributes 256 MB: No Retain attributes	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 63 NX I/O Units connectable	— 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	16, 32, 64	0, 2, 4, 8 *1	0, 2, 4 *1	
	EtherCAT slaves	512	256	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	Memory Cards	
Detailed specification (Datasheet)		P141	P159	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

NX502  
P158



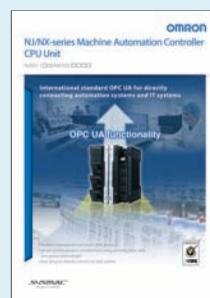
NX1  
P129



NX1P  
P115






OPC UA  
P123



Robot Integrated Controller  
I856



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
								
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



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This product includes cryptographic software written by Eric Young ([ey@cryptsoft.com](mailto:ey@cryptsoft.com)).  
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**Cat. No. P089-E1-26** 0523(0415)