OMRON

Machine Automation Controller

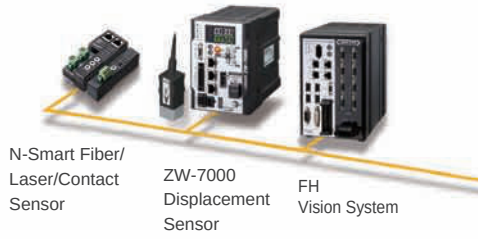
NJ/NX Series



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.



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).



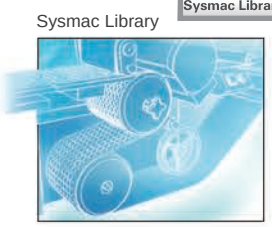
One Connection

- 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.

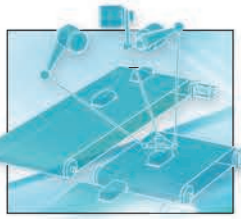
Sysmac Library



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

EtherNet/IP Ethernet

Information technologies

IT devices

Smart factory

Sales force

Offices HQ

Advanced machine control and integrated production /

Motion Control

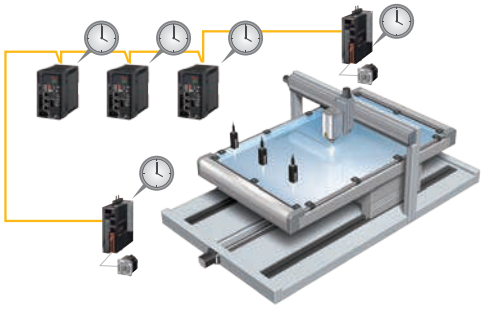
Complete integration of motion and logic

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.



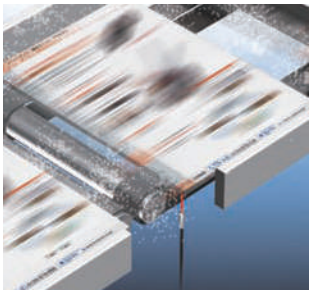
Preventive maintenance

Preventive maintenance of EtherCAT sensor

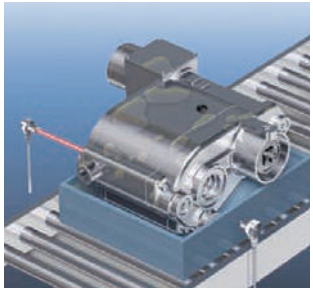
Monitoring the sensor status allows you to maintain before sensors malfunction due to dirt or aged deterioration.* The sensor settings can be saved and loaded, which minimizes downtime when troubles occur.

FROM

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.



* 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.

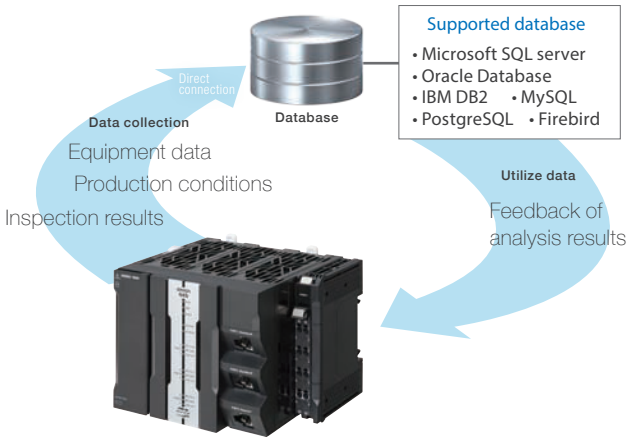
machine data management for a variety of applications

Information

NX701-1□20/NX502-1□00/NX102-□□20/NJ101-□020/NJ501-□□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.



NX701-1□□□/NX502-□□□□/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.



NX502-□□□□/NX102-□□□□/NX1P2-□□□□

Easy and secure data collection in the cloud

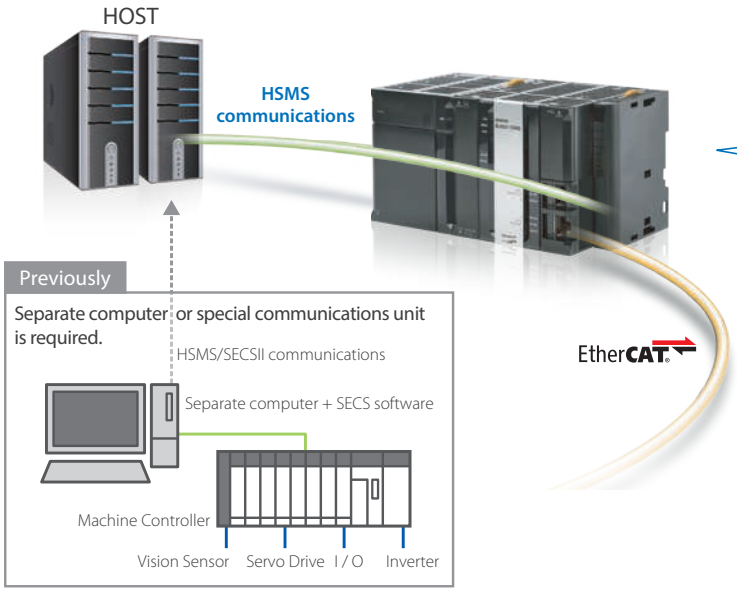
The controllers supports MQTT (S) communication using MQTT Communication Library. It can easily connect to the cloud without a gateway PC and securely collect manufacturing site data.

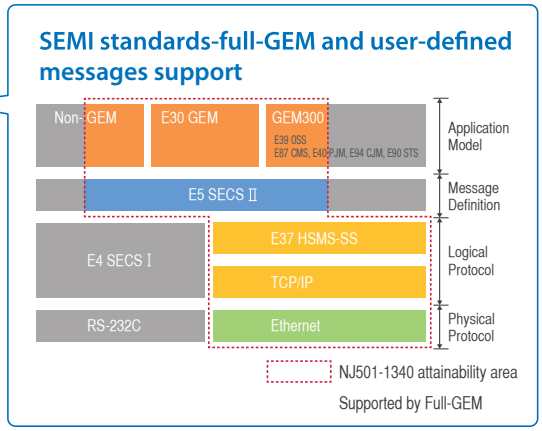


NJ501-1340

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.





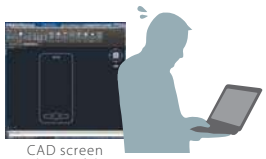
Processing NJ501-5300

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



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
① Parameters are set using CAD/CAM software

Automatic generation
② NC program in G-Code is generated

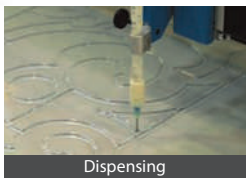
Transferred
③ Program is transferred to NC integrated controller



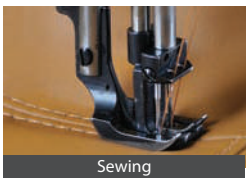
Milling



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□□□

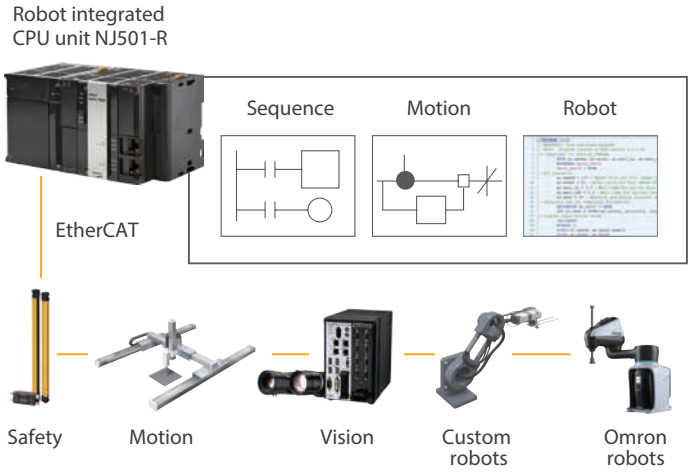
Integration of logic, motion, Omron Robot and kinematics makes automation more advanced and flexible

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.



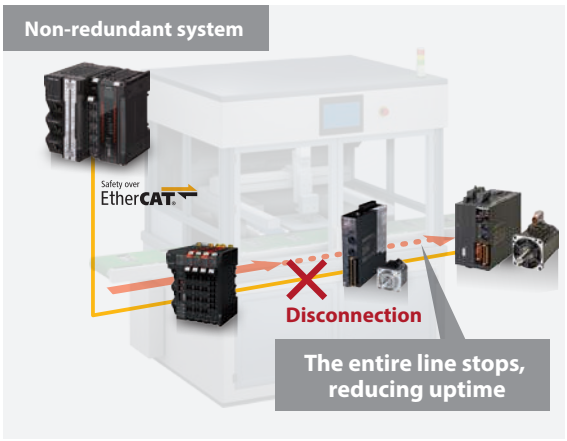
*Based on Omron investigation in November 2019

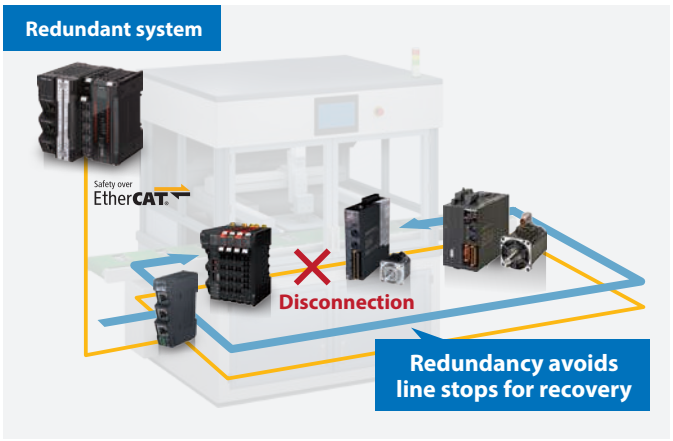
Maximized uptime

NX502-□□□□/NX102-□□□□/NX1P2-□□□□/NJ501-□□□□/NJ301-□□□□/NJ101-□□□□

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.



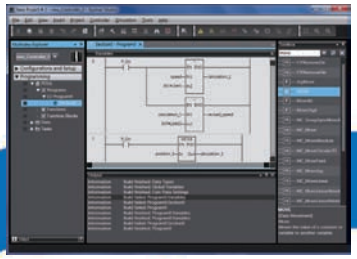


Creative development environment for globalized

Design

Reusable programs

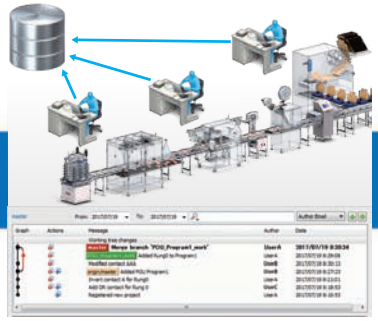
Programming with variables



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



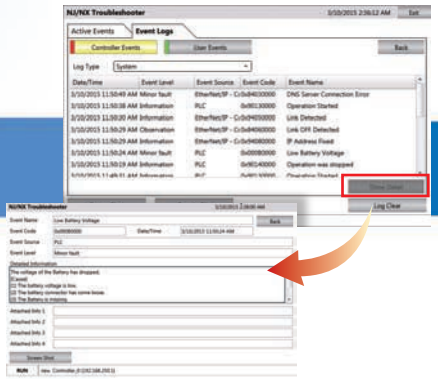
When you develop a project at the same time as your colleagues, the Sysmac Studio combined with the version control system (Git™*) merges changes automatically and resolves conflicting changes. This makes merging easier and faster. You can even revert to the previous revision after graphically comparing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

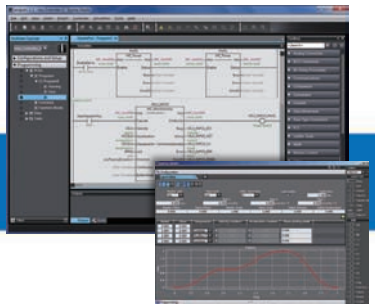
manufacturing

Collection of software functional components Sysmac Library

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

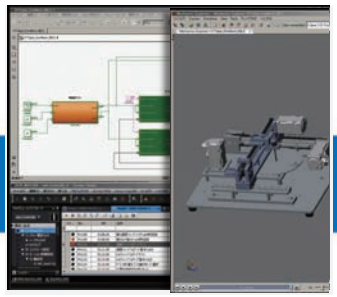
For advanced machine control

Motion programming



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

Model-Based design

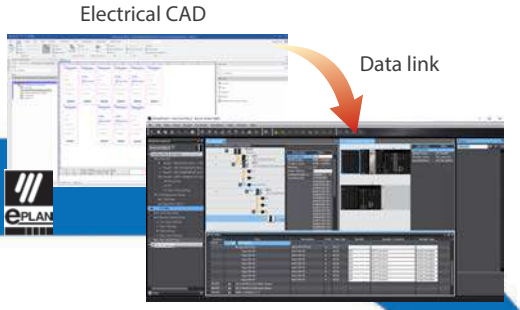


Complex feedback control that is designed with MATLAB®/Simulink® can be imported into programs.

MathWorks Partner

Efficient designing linked to electrical CAD

AutomationML import function NEW

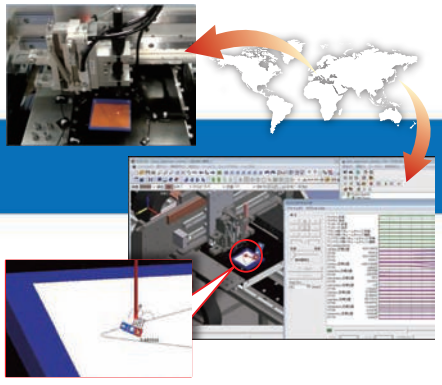


Circuit diagrams designed using electrical CAD data (e.g., unit configurations and signal lines) can be imported to the Sysmac Studio and automatically reflected in unit configurations and settings and allocated variables.
Seamless and accurate setup using electrical CAD design data speeds up the engineering process and improves design efficiency.

Verification

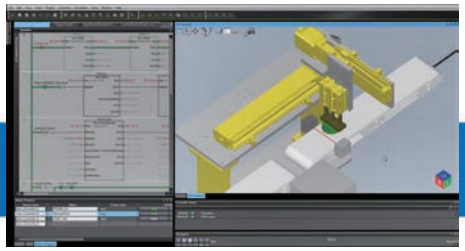
Fast system debugging

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.

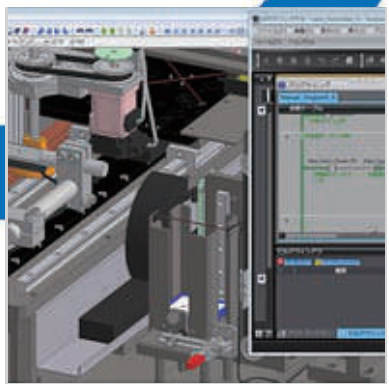
Virtual mechanical debugging



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



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			OPC UA (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.	Ideal for large-scale, fast, and highly-accurate control with up to 256 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-axiscontrol, 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 Zuring 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, 128, 256	0, 2, 4, 8 *1	0, 2, 4 *1
	Number of CNC axes		–	–	–	–
	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. With a combination of a CPU Unit with CNC version 1.03 or higher and Sysmac Studio version 1.60 or higher, up to 32 axes can be controlled. For a CPU Unit with CNC version 1.02 or lower, the maximum number of motion axes and CNC axes total is 16 axes.

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
	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	
	–					16 *3	–	–	
	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



Sysmac is a trademark or registered trademark of OMRON Corporation in Japan and other countries for OMRON factory automation products.
Intel and Intel Core are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.
Microsoft, Windows, Windows Vista and SQL Server are registered trademarks of Microsoft Corporation in the United States and other countries.
Oracle and Oracle Database are trademarks or registered trademarks of Oracle Corporation and/or its affiliates in the United States and other countries.
IBM and DB2 are trademarks or registered trademarks of International Business Machines Corp., registered in the United States and other countries.
SEMI® is a trademark or registered trademark of Semiconductor Equipment and Materials International in the United States and other countries.
EtherCAT® is a registered trademark of Beckhoff Automation GmbH for their patented technology.
EtherNet/IP™ and DeviceNet™ are trademarks of ODVA.
This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (http://www.openssl.org/)
This product includes cryptographic software written by Eric Young (eay@cryptsoft.com).
The CAD data in inCAD Library is used with permission from MISUMI Corporation. Copyright of any of information in CAD data belongs to MISUMI Corporation or its respective manufacturer.
MISUMI Corporation may not offer all parts in each application design. Available parts can only be purchased separately not as a unit shown in each application design.
MISUMI Corporation does not guarantee quality, accuracy, functionality, safety or reliability for the combination of the parts in each application example.
Microsoft product screen shot(s) used with permission from Microsoft.
MATLAB® and Simulink® are registered trademarks of The MathWorks® Inc.
Safety over EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.
Other company names and product names in this document are the trademarks or registered trademarks of their respective companies.

Note: Do not use this document to operate the Unit.

OMRON Corporation Industrial Automation Company

Kyoto, JAPAN **Contact : www.ia.omron.com**

Regional Headquarters

OMRON EUROPE B.V.
Wegalaan 67-69, 2132 JD Hoofddorp
The Netherlands
Tel: (31) 2356-81-300 Fax: (31) 2356-81-388

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.
438B Alexandra Road, #08-01/02 Alexandra
Technopark, Singapore 119968
Tel: (65) 6835-3011 Fax: (65) 6835-3011

OMRON (CHINA) CO., LTD.
Room 2211, Bank of China Tower,
200 Yin Cheng Zhong Road,
PuDong New Area, Shanghai, 200120, China
Tel: (86) 21-6023-0333 Fax: (86) 21-5037-2388

Authorized Distributor:

©OMRON Corporation 2015-2025 All Rights Reserved.
In the interest of product improvement,
specifications are subject to change without notice.

CSM_14_2
Cat. No. P089-E1-29 0225(0415)