# Machine Automation Controller NJ Series
## NJ Robotics CPU Unit
**NJ501-4□□□**

- Parallel link and Cartesian robot control functionality
- Increase machine control speed and precision
- Reduce machine development time
- Minimize machine footprint and maximize efficiency

**sysmac**
always in control

# Robot control technology adds flexibility to manufacturing processes

## Increase control speed and precision

- One machine control to ensure high precision synchronization between conveyor and robot
- High-speed control, from sensor inputs to robot control
- Control of even manipulators synchronized with robot motion via EtherCAT
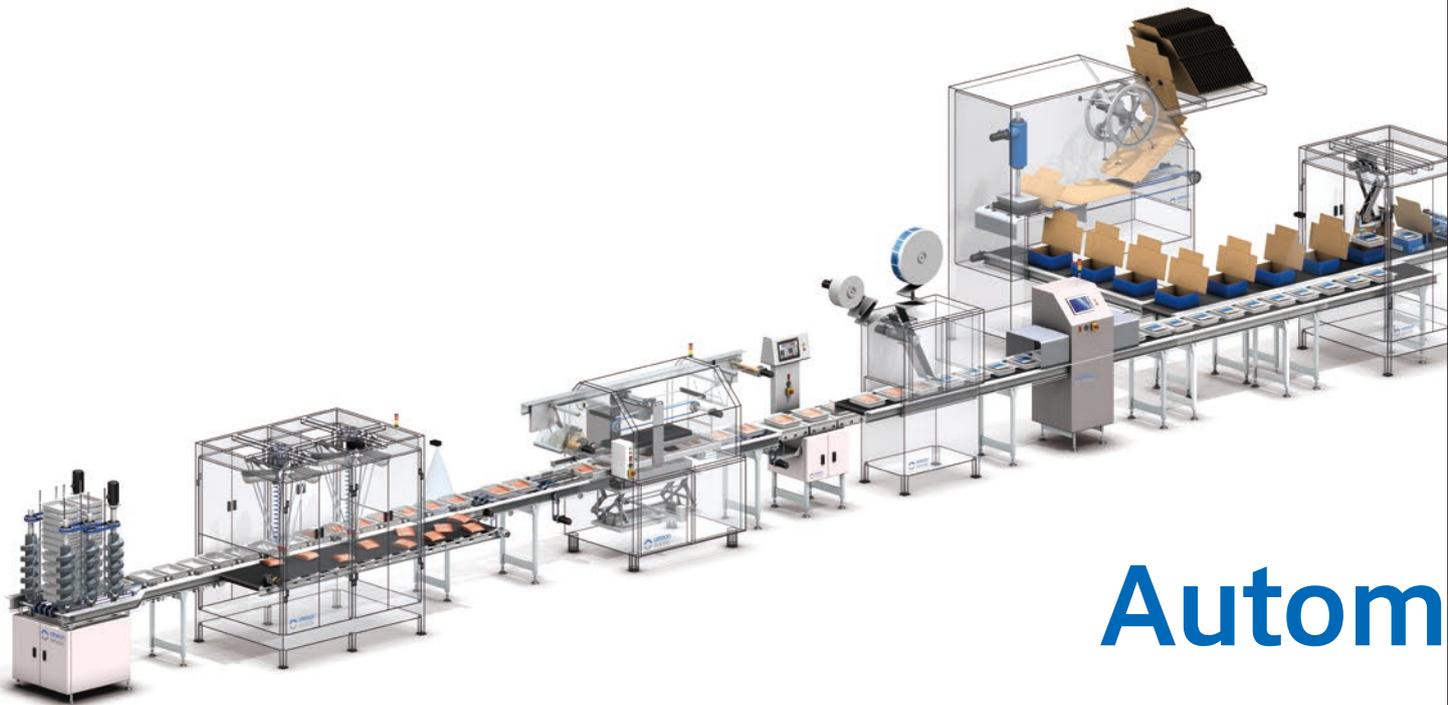
**Autom**

## Reduce development time

- One language used for programming, from sequence control to robot control
- One software Sysmac Studio to start devices including vision sensors and robots
- Standard IEC 61131-3 based instructions for motion and robot control
- Codes used during integrated simulation can be reused for the real machine

## Minimize footprint and maximize efficiency

- One controller to control up to 8* parallel rink and Cartesian robots in total
- One network EtherCAT to connect all machine network devices
- One controller system to improve maintenance efficiency
  * The number of controlled robots varies according to the number of axes used for the system.
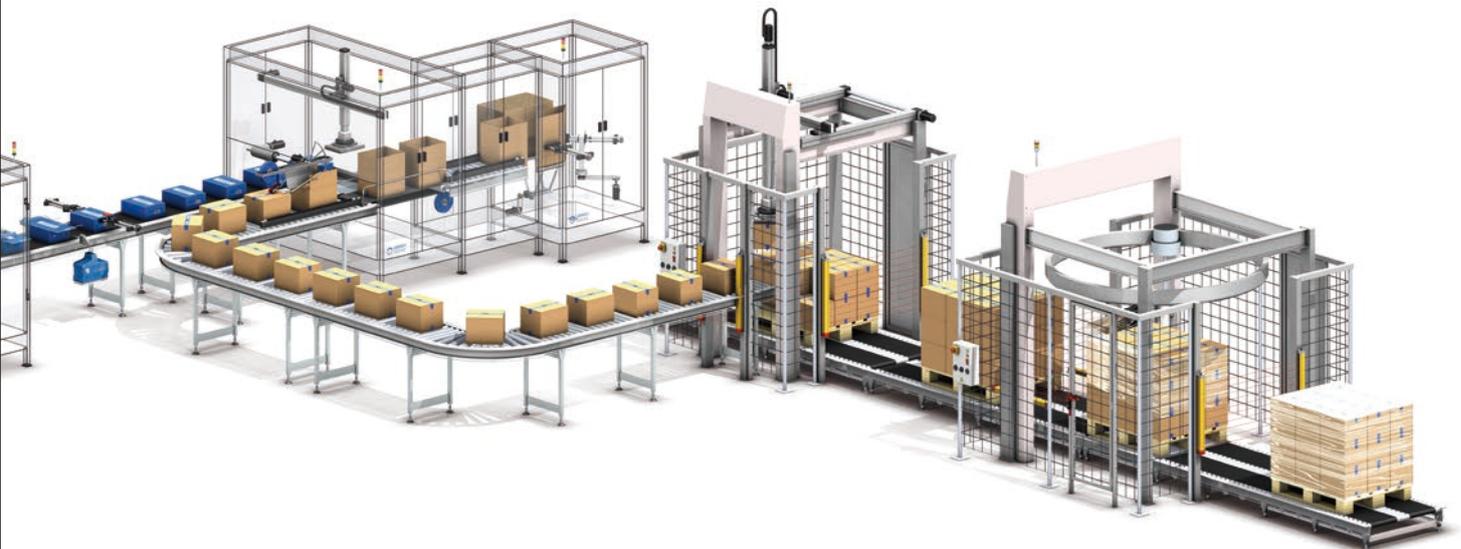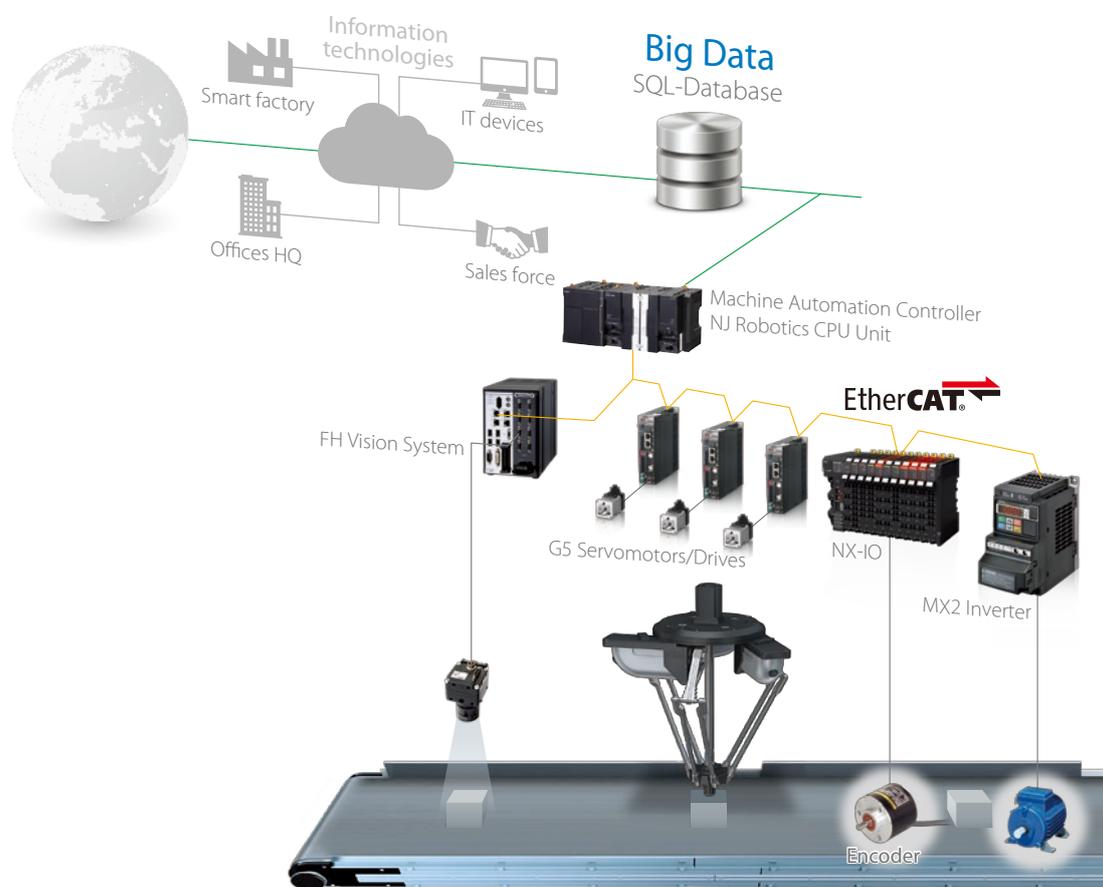
# ation Solution

NJ Robotics CPU Unit
NJ501-4☐☐☐

# The NJ Robotics controller integrates machine bringing new flexibility to build machines

## NJ Robotics controller at the heart of the system

- One controller can connect up to 64 axes including robots
- The control system integrates vision sensors, I/O, safety controllers, and robots within one EtherCAT network
- The database connection model can upload system information to host

Information technologies

Smart factory

IT devices

Offices HQ

Sales force

**Big Data**
SQL-Database

Machine Automation Controller
NJ Robotics CPU Unit

EtherCAT.

FH Vision System

G5 Servomotors/Drives

NX-IO

MX2 Inverter

Encoder

Solutions for a wide variety of applications in food and beverage, automotive, and digital industries
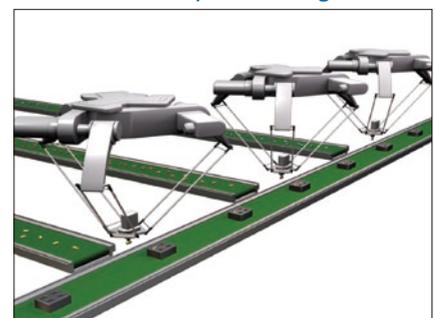
• Packing process (F&B)

• Post-press process (Automotive)

• Parts insertion process (Digital)

# control and robot control,

## Coordinate systems simplify mechanical control

Function Blocks for robot control (e.g. SynLinearConveyor, SyncOut, and RobotJoG instructions) can be used for Cartesian robots as well as parallel link robots.

The status of machines and production lines can be defined as coordinate systems - machine coordinate system (MCS), user coordinate system (UCS), and tool coordinate system (TCS). This simplifies the programming for automation systems.

**Robot control functions are now available for Cartesian systems**

| | |
|---|---|
| Parallel link | Delta-3 |
| | Delta-3R |
| | Delta-2 |
| NEW Cartesian | Cartesian 3D |
| | Cartesian 3D Gantry |
| | Cartesian 2D (XY) |
| | Cartesian 2D (XZ) |
| | Cartesian 2D (YZ) |
| | Cartesian 2D Gantry |
| | H-Bot XY |

Delta robot 3 axis    Delta robot 2 axis    Gantry robot    Cartesian robot
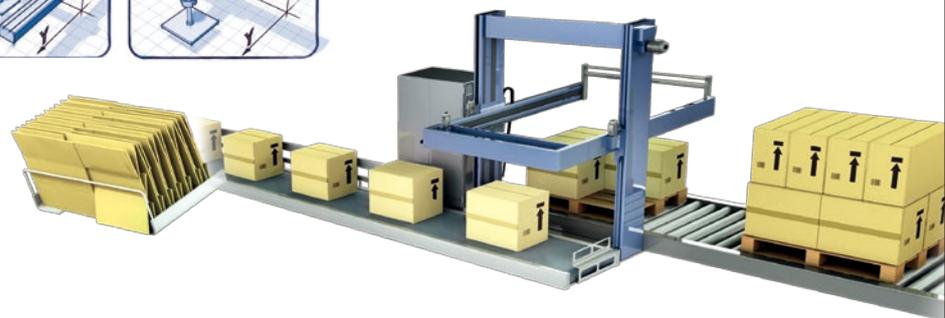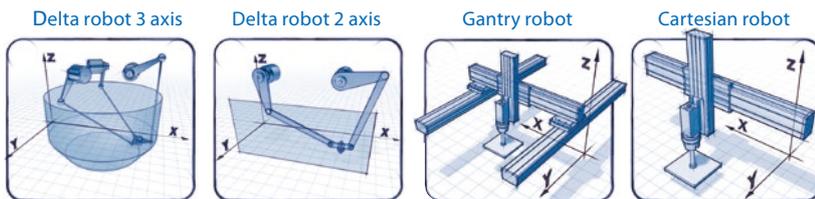
## Efficient preliminary verification with integrated simulation

You can perform integrated simulations linked to motion control for robots and inspection and measurement by vision systems.
The virtual environment allows to visualize the machine motion.
The simulation of the synchronization between robots makes complex operation verification easy.
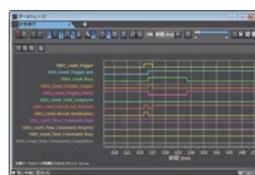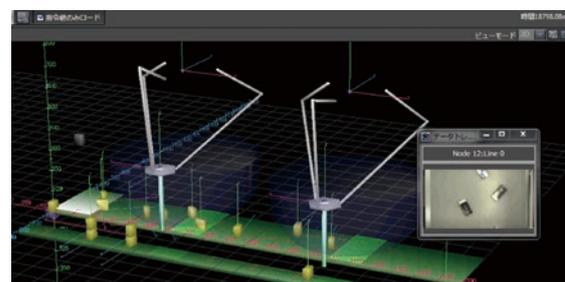
**Vision system simulation**
Inspection and measurement by vision systems can be s imulated from the Sysmac Studio.

**Data tracing**
Inputs and outputs of vision systems can be traced as a time series.

**NEW Integrated simulation***
Machine movement can be simulated based on measurement results of vision systems.

* Only Delta3 and Delta3R robots can be used for integrated simulation.

## Machine Automation Controller
## NJ series

New controller that covers functions and high-speed processing required for machine control and safety, reliability and maintainability that are the features of industrial controllers provides parallel link robot control function.
In addition to robot control, general motion control with up to 64 axes can be also performed.

NJ501-4□□□

## Features

- Special instructions for kinematics of parallel link robots
- Faster and more high precision machine control
    - One machine control to ensure accurate synchronization between conveyor and robot
    - High-speed control, from sensor inputs to robot control
- Faster machine development
    - One language used for programming, from sequence control to robot control
    - One software, Sysmac Studio, to start devices including vision sensors and robots
    - Standard IEC 61131-3 based instructions for motion and robot control
- Smaller machine footprint
    - One Controller to control up to 8✱ parallel rink robots
- One network, EtherCAT, to connect all machine network devices: vision sensors, servo drives and field devices.

✱ The number of controlled robots varies according to the number of axes used for the system.
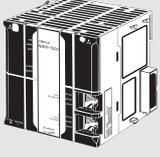
# Ordering Information

**International Standards**
- The standards are abbreviated as follows: U: UL, U1: UL(Class I Division 2 Products for Hazardous Locations), C: CSA, UC: cULus, UC1: cULus (Class I Division 2 Products for Hazardous Locations), CU: cUL, N: NK, L: Lloyd, CE: EU Directives, RCM: RCM mark and KC: KC Registration.
- Contact your OMRON representative for further details and applicable conditions for these standards.

**Use for robot systems**
Contact your OMRON represenrive for further details and conditions for robot systems.

## NJ-series CPU Units

| Product Name | Specifications | | | | Number of controlled robots | Database Connection function | Current consumption (A) | | Model | Standards |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | I/O capacity / maximum number of configuration Units (Expansion Racks) | Program capacity | Memory capacity for variables | Number of motion axes | | | 5 VDC | 24 VDC | | |
| **NJ-series CPU Units** | 2,560 points / 40 Units (3 Expansion Racks) | 20 MB | 2 MB: Retained during power interruption 4 MB: Not retained during power interruption | 64 | 8 max. * | No | 1.90 | – | **NJ501-4500** | UC1, N, L, CE, RCM, KC |
| | | | | 32 | | | | | **NJ501-4400** | |
| | | | | 16 | | | | | **NJ501-4300** | |
| | | | | 16 | 1 | | | | **NJ501-4310** | |
| | | | | 16 | 8 max. * | Yes | | | **NJ501-4320** | |

✻ The number of controlled robots varies according to the number of axes used for the system.

## Automation Software Sysmac Studio

Please purchase a DVD and required number of licenses the first time you purchase the Sysmac Studio. DVDs and licenses are available individually. Each model of licenses does not include any DVD.
The license number for a robot is required to use this CPU Unit. Please contact your OMRON sales representative for details.

| Product name | Specifications | Number of licenses | Media | Model | Standards |
| --- | --- | --- | --- | --- | --- |
| **Sysmac Studio Standard Edition Ver.1.□□** | The Sysmac Studio is the software that provides an integrated environment for setting, programming, debugging and maintenance of machine automation controllers including the NJ/NX Series, EtherCat Slave, and the HMI. Sysmac Studio runs on the following OS. Windows XP (Service Pack 3 or higher, 32-bit version)/Windows Vista(32-bit version)/Windows 7(32-bit/64-bit version)/Windows 8(32-bit/64-bit version)/Windows 8.1(32-bit/64-bit version)/Windows 10(32-bit/64-bit version) The Sysmac Studio Standard Edition DVD includes Support Software to set up EtherNet/IP Units, DeviceNet slaves, Serial Communications Units, and Support Software for creating screens on HMIs (CX-Designer). For details, refer to the Sysmac Integrated Catalogue (P072). | – (Media only) | DVD | **SYSMAC-SE200D** | – |
| | | 1 license *1 | – | **SYSMAC-SE201L** | – |
| **Sysmac Studio Robot Additional Option *2** | Sysmac Studio Robot Additional Option is a license to enable the Vision & Robot integrated simulation. | 1 license | – | **SYSMAC-RA401L** | – |

**Note:** The license number for a robot is required to use this CPU Unit with the Sysmac Studio version 1.13 or lower. Please contact your OMRON sales representative for details.
The Sysmac Studio version 1.14 or higher does not require the license number for a robot.
✻**1.** Multi licenses are available for the Sysmac Studio (3, 10, 30, or 50 licenses).
✻**2.** Sysmac Studio Standard Edition is required to use this option.

## Recommended EtherCAT and EtherNet/IP Communications Cables

For the Recommended EtherCAT and EtherNet/IP Communications Cables, refer to the Machine Automation Controller NJ/NX-Series Datasheet.

# Accessories

The following accessories come with the CPU Unit.

| Item | Specification |
| --- | --- |
| **Battery** | CJ1W-BAT01 |
| **End Cover** | CJ1W-TER01 (necessary to be connected to the right end of the CPU Rack.) |
| **End Plate** | PFP-M (2 pcs) |

## NJ501-4□□□

## General Specification

For the common specifications of the NJ-series NJ501, refer to the Machine Automation Controller NJ/NX-Series Datasheet.

## Performance Specifications

- For robot control, use the G5 series AC Servo Drive with built-in EtherCAT communications, absolute encoder, and brake.
- The EtherCAT communications cycle for robot control is 1 ms or less.

Furthermore, for the common specifications of the NJ-series NJ501, refer to the Machine Automation Controller NJ/NX-Series Datasheet.

Refer to the specifications of the NJ501-□5□0 for those of the NJ501-45□□, the NJ501-□4□0 for the NJ501-44□□, and the NJ501-□3□0 for the NJ501-43□□.

## Function Specifications

For the common specifications of the NJ-series NJ501, refer to the Machine Automation Controller NJ/NX-Series Datasheet.

## Functions Supported by NJ501-4□□□

Besides functions of the NJ501-1□00, functions supported by the NJ501-4□□□ are as follows.

| Item | | | | NJ501- | | | | |
|------|--|--|--|------|--|--|--|--|
| | | | | 4500 | 4400 | 4300 | 4310 | 4320 |
| Robot control functions | Axes groups | Multi-axes coordinated control | Conveyer tracking | The robot is moved in synchronization with the conveyor during the conveyor tracking operation. | | | | |
| | | Auxiliary functions for multi-axes coordinated control | Kinematics Setting | Set parameters for robot operation, such as arm length of Delta3 robot. | | | | |
| | Auxiliary functions | Monitoring functions | Work space function | Set the coordinate values for workspace check and check the workspace during operation. | | | | |

## DB Connection Functions Supported by NJ501-4320

For the DB connection functoins supported by the NJ501-4320, refer to to the Machine Automation Controller NJ/NX-Series Datasheet.

## Unit Versions and Robot Versions

| Units | Models | Unit Version | Robot Version |
|-------|--------|--------------|---------------|
| NJ-series CPU Units | NJ501-4□□□ | Unit version 1.02 or later | Robot version 1.00 or later |

## Unit Versions, Robot Versions and Programming Devices

The following table gives the relationship between unit versions of CPU Units and the corresponding Sysmac Studio versions.

| Unit version of CPU Unit | Robot version of CPU Unit | Corresponding version of Sysmac Studio |
|--------------------------|---------------------------|----------------------------------------|
| 1.11 | 1.03 | 1.15 |
| 1.10 | 1.02 | 1.14 |
| 1.09 | 1.02 | 1.13 |
| 1.08 | 1.02 | 1.12 / 1.11 |
| | 1.01 | 1.10 |
| 1.07 | 1.00 | 1.08 |
| 1.06 | | 1.07 |
| 1.05 | | 1.06 |
| 1.04 | | 1.05 |
| 1.03 | | 1.04 |
| 1.02 | | |

## Functions That Were Added or Changed for Each Unit Version and Sysmac Studio version

For the common specifications of the NJ-series NJ501, refer to the Machine Automation Controller NJ/NX-Series Datasheet.

## External Interface

For the External Interface, refer to the Machine Automation Controller NJ/NX-Series Datasheet.

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# Dimensions

For the Dimensions, refer to the Machine Automation Controller NJ/NX-Series Datasheet.

# Related Manuals

The following manuals are related to the DB Connection Service. Use these manuals for reference.

| Manual name | Cat. No. | Model numbers | Application | Description |
|---|---|---|---|---|
| NJ-series NJ Robotics CPU Units User's Manual | W539 | NJ501-4□□□ | Using the robot control with NJ-series Controllers. | Describes the robot control. Use this manual together with the NJ/NX-series CPU Unit Motion Control User's Manual (Cat. No. W507) and the NJ/NX-series Motion Control Instructions Reference Manual (Cat. No. W508). |
| NJ-series Database Connection CPU Units User's Manual | W527 | NJ501-1□20 NJ101-1□20 NJ101-9□20 | Learning about the functions and application procedures of the NJ-series DB Connection function. | Describes the functions and application procedures of the NJ-series DB Connection function. |
| Sysmac Studio Version 1 Operation Manual | W504 | SYSMAC -SE2□□□ | Learning about the operating procedures and functions of Sysmac Studio. | Describes the operating procedures of Sysmac Studio. |
| Vision & Robot Integrated Simulation Startup Guide | Y128 | SYSMAC-SE20□□ SYSMAC-RA401L NJ501-4□□□ R88D-KN□-ECT FH-1□□□ FH-3□□□ | Learning about the operating procedures of Vision & Robot integrated simulation. | Describes the operating procedures of Vision & Robot integrated simulation. |
| Vision & Robot Integrated Simulation Technology Introduction Guide (Calibration Parameter) | Y213 | | Learning about the calibration parameters created using the 3D Equipment Model Creation Wizard for the Vision & Robot integrated simulation. | Describes calibration parameters created using the 3D Equipment Model Creation Wizard for the Vision & Robot integrated simulation. |
| Vision Sensor FH Series Conveyor Tracking Application Programming Guide | Z368 | | Learning about the setup procedure of the wizard style calibration for cameras, robots, or conveyors. | Describes how to configure and operate Conveyor Tracking Calibration Wizard on Sysmac Studio on FH Sensor Controllers. |
| Vision Sensor FH Series Operation Manual Sysmac Studio Calibration Plate Print Tool | Z369 | | Learning about the setup procedure for printing the Pattern on a Calibration Plate used for calibration for cameras and robots on Sysmac Studio. | Describes how to configure and operate Calibration Plate Print Tool on Sysmac Studio on FH Sensor Controllers. |
| Vision Sensor FH Series Operation Manual Sysmac Studio Conveyor Tracking Calibration Wizard Tool | Z370 | | Learning about the setting procedure of sample macros for conveyor tracking. | Describes the setting procedure of sample macros used for applications of conveyor tracking on FH Sensor Controllers. |
| Vision Sensor FH Series Operation Manual Sysmac Studio Conveyor Panorama Display Tool | Z371 | | Learning about the setup procedure of panorama display for image capture of targets on conveyors. | Describes how to configure and operate the Conveyor Panorama Dis-play tool on Sysmac Studio on FH Sensor Con-trollers. |

For the Related Manuals about the common specifications of the NJ-series NJ501, refer to the Machine Automation Controller NJ/NX-Series Datasheet.

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