Machine Automation Controller NJ Series
## NJ Robotics CPU Unit

NJ501-4□□□

- Parallel, Cartesian and serial 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: reconfigurable

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
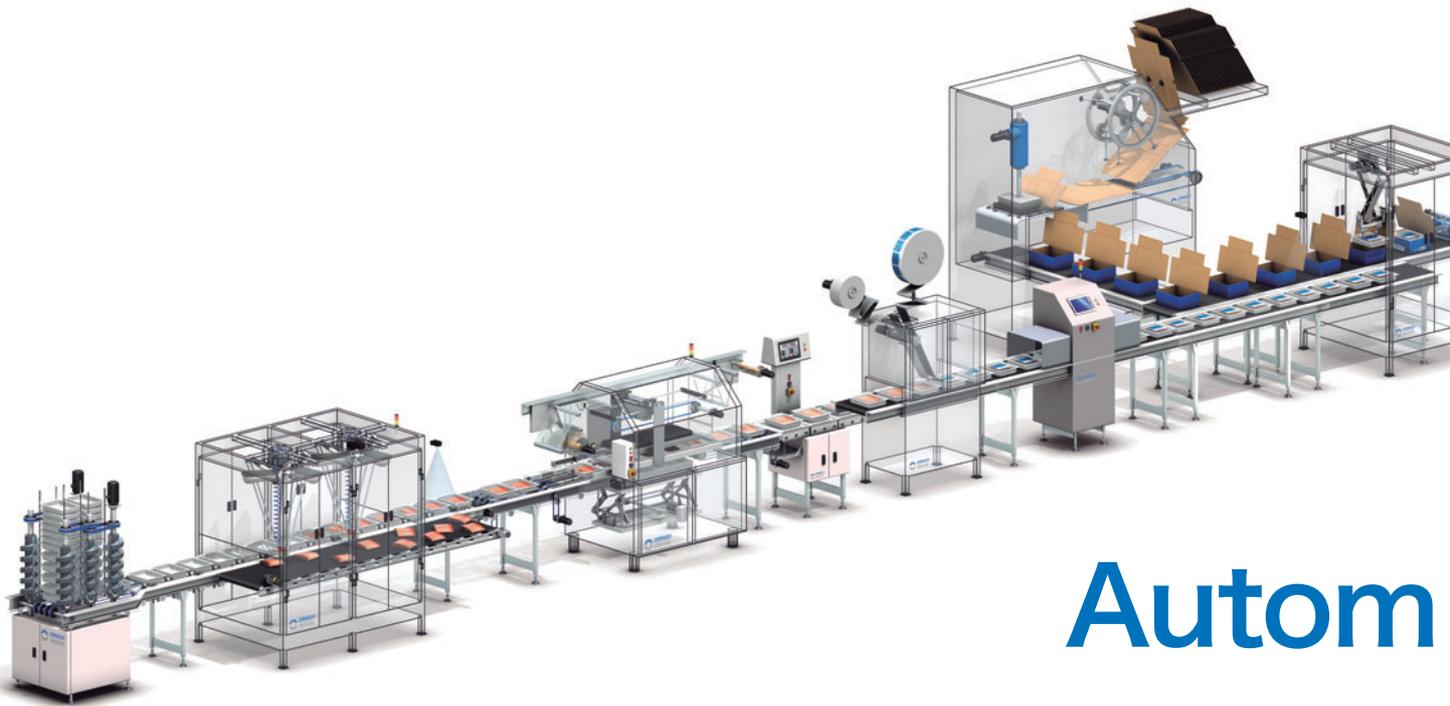
Autom

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
- Easy conveyor tracking by using parallel/Cartesian/SCARA robots

machines and quick changeovers

Minimize footprint and maximize efficiency

- One controller to control up to 8* parallel, Cartesian, and serial 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.
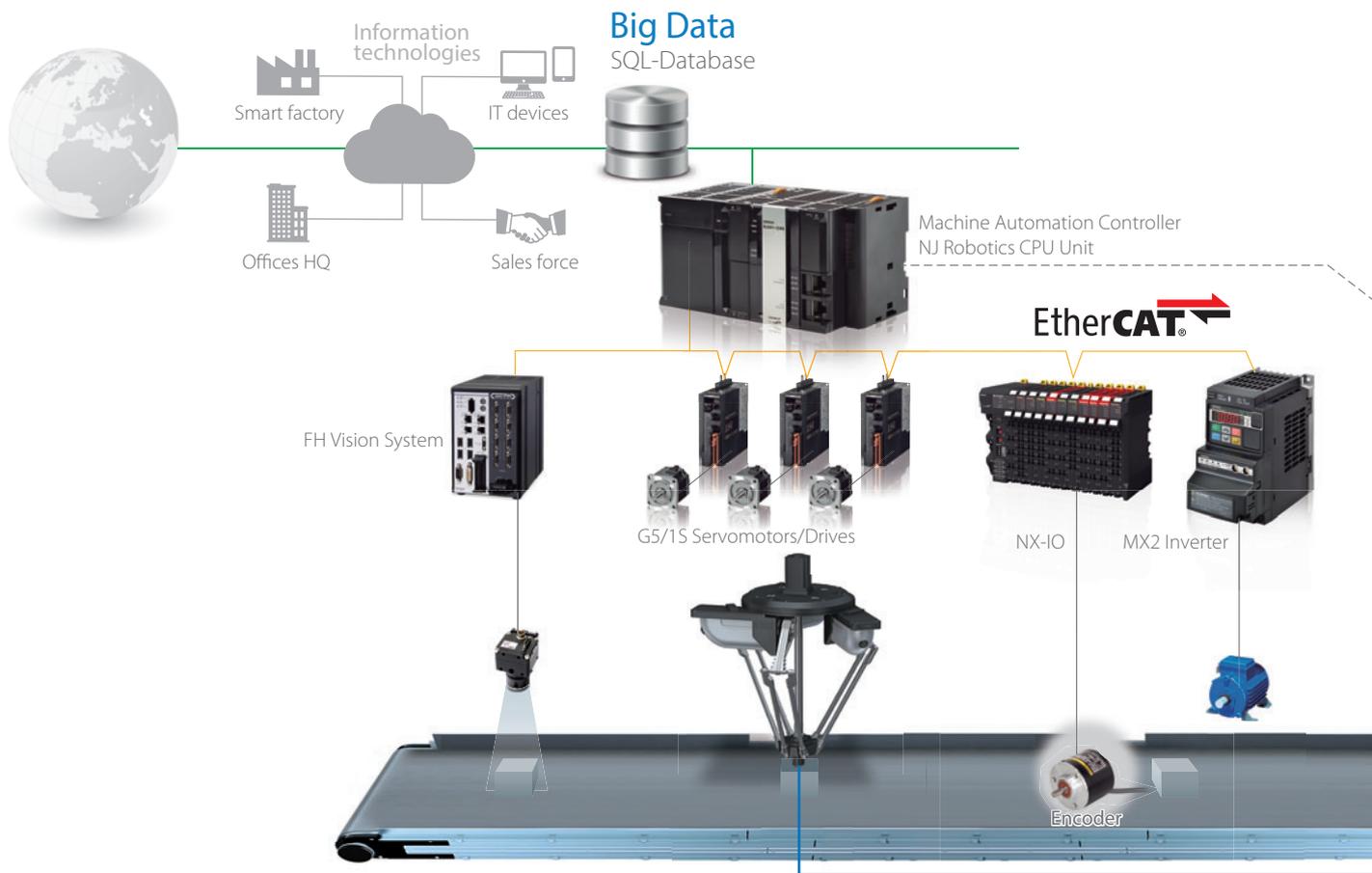
ation Solution

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

Big Data
SQL-Database

Smart factory

IT devices

Offices HQ

Sales force

Machine Automation Controller
NJ Robotics CPU Unit

EtherCAT®

FH Vision System

G5/1S Servomotors/Drives

NX-IO   MX2 Inverter

Encoder

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
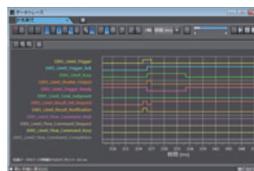robots makes complex operation verification easy.

NEW   **Integrated simulation***
Machine movement can be simulated based on measurement results of vision systems.
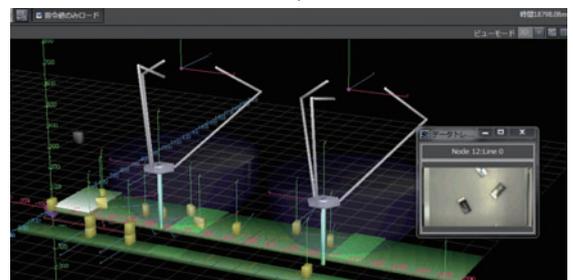
Vision system simulation
Inspection and measurement by vision systems can be simulated from the Sysmac Studio.

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

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

control and robot control,

Scalable and easy programming of any type of robots

When building conveyor tracking applications, you can program Pick & Place control systems by using the same program structure in the same programming manner regardless of the robot type: parallel, Cartesian , or SCARA robot.
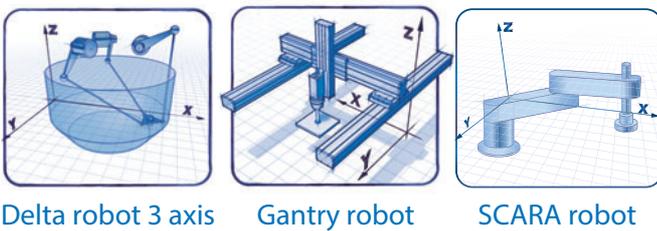
Delta robot 3 axis   **Gantry robot**   **SCARA robot**

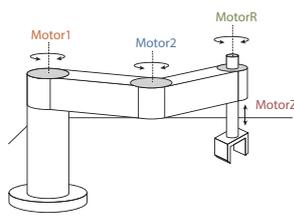### Pick & Place control
Robot instructions common to all robots

- Set Kinematics Transformation
- Group Monitor
- Inverse Kinematics
- Define Coordinate System

Parallel	Delta-3	
	Delta-3R	
	Delta-2	
Cartesian	Cartesian 3D	
	Cartesian 3D Gantry	
	Cartesian 2D (XY)	
	Cartesian 2D (XZ)	
	Cartesian 2D (YZ)	
	Cartesian 2D Gantry	
	H-Bot XY	
Serial **NEW**	SCARA RRP+R	
	SCARA PRR+R	
	3-AXES	

Multi-axis setup and tuning

NEW Multi - drive window

Adjusting, monitoring parameters of the robot's drives is done easily in a single view.

Motor1   Motor2   MotorR   MotorZ

NEW Multi axis tuning wizard

Several 1S servo drives can be tuned simultaneously in a short amount of time.

Step 1	Step 2	Step 3
Setup and criteria	Auto tune process	Data trace and result

Build a vision-guided robots in 5 steps

Since the beginning, our main goal for this new development was very clear: Making Pick & Place machine programming easier.

Far from the old and rigid top-down programming manner our solution is based on Wizards that guide the user through the main steps using a graphical interface to operate with an unique software tool capable to manage Robotics and Vision seamlessly at the same time.

≪ VIRTUAL

Import the pictures into Sysmac Studio wizard

- Using the Sysmac Studio wizard you can define the layout of the Pick & Place machine, selecting how many robots and conveyors you have and choose between the most typical layout templates.

2

PATENTED

PATENTED

3
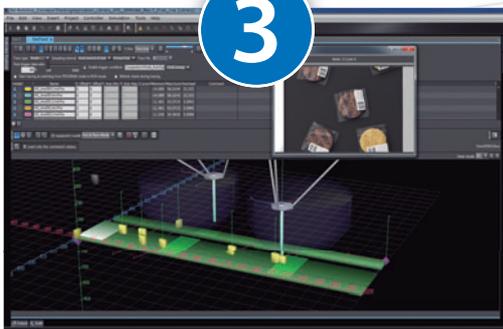
3D Simulation

- Sysmac Studio generates the 3D simulation environment according to the parameters defined in the previous steps.
- The integrated graphical environment enables visualizing the Pick & Place machine and the Vision simulation at the same time.
- Moreover, the images captured in the Step 1 are automatically converted into the corresponding virtual products that run over the picking conveyor.

4

Reuse of codes

- The 3D simulation is very reliable since it is based on the real system cores so you can reuse the whole programming to control the real machine by significantly shortening the commissioning time.

☑ Virtualize your Pick & Place machine into the integrated 3D Simulator and make it Real in 5 simple steps, guided by intuitive wizards.

REAL >

①

Image capturing

- The first step is to take the pictures of the products to handle. Yes just as easy as it sounds!
- The wide portfolio of our FH cameras allows to optimize your choice.
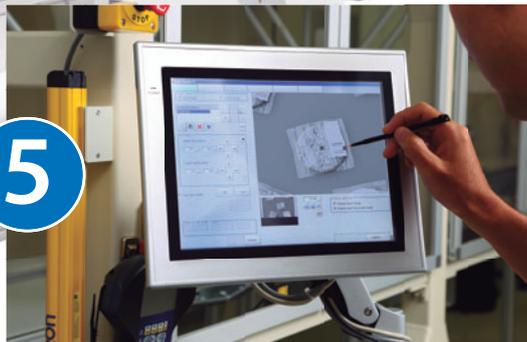
⑤

Easy tuning on site P&P and FH Vision

- The finalization of your project is guided by a Vision system wizard that calibrates the Virtual machine against the Real machine.
- It take just few minutes to place a matrix calibration sheet into the machine and follow the wizard that will align the robots and the vision systems to minimize any kind of measurement error.

Benefits include **time optimization** and reduction for the complete project

Project proposal and Concept	Design, Engineering and Test run	Commissioning and Maintenance
30%	**50%**	**60%**
SAVE 70%	SAVE 50%	SAVE 40%

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 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, Cartesian, and serial 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, Cartesian, and serial 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.
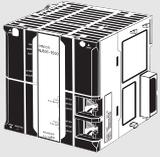
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Ordering Information

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: Regulatory Compliance 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 CPU Units, NY-series Industrial PC, EtherCat Slave, and the HMI. Sysmac Studio runs on the following OS. 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)	– (Media only)	DVD	SYSMAC-SE200D	–
	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).	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/1S 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
1.14	1.04	1.18
1.13		1.17
1.12	1.03	1.16
1.11		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		1.08
1.06		1.07
1.05	1.00	1.06
1.04		1.05
1.03		1.04
1.02		

Note: If you use a lower version of the Sysmac Studio, you can use only the functions of the unit version of the CPU Unit that corresponds to the Sysmac Studio version.
If you use a CPU Unit with an earlier version, select the unit version of the connected CPU Unit or an earlier unit version in the Select Device Area of the Project Properties Dialog Box on the Sysmac Studio. You can use only the functions that are supported by the unit version of the connected CPU Unit.

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.

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External Interface

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

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 the Sysmac Studio.	Describes the operating procedures of the 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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