NJ501-□□□□

CSM_NJ501_DS_E_5_1

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
Ideal for large-scale, fast, and high-accurate control with up to 64 axes

NJ501-□□□□

Features

- Architecture Based on new Intel® Atom™ Processor
  - The user program including the double precision floating point arithmetic instruction that is necessary for the coordinates correction, ST language and Function Blocks is executed fast, as well as the basic instructions and the special instructions.
- Integration of Logic and Motion in one CPU
- Synchronous control of all machine network devices : vision sensors, servo drives and field devices with the machine control network, EtherCAT. Synchronize the PLC Engine and the Motion Engine with the EtherCAT control period. Fast and highly-accurate control is possible.
- Standard programming : Conforms IEC 61131-3 standards, variable-based instructions including the PLCopen Motion function blocks
- Complete and robust machine automation: fast control performance and basic functions and reliability of industrial controllers
  - Fan-free operation in ambient temperature between 0 to 55°C
  - Complete RAS functions: Transmission frame error check, timeout, bus diagnosis, Watchdog (WDT), memory check, and topology check, etc.

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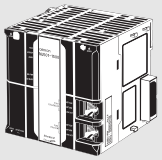
Ordering Information

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, and CE: EC Directives.
- Contact your OMRON representative for further details and applicable conditions for these standards.

NJ501 CPU Units

Product Name	Specifications				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		
NJ501 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	16	1.90	–	**NJ501-1300**	UC1, N, L, CE
				32			**NJ501-1400**	
				64			**NJ501-1500**	

Recommended EtherCAT and EtherNet/IP Communications Cables

Use Straight STP (shielded twisted-pair) cable of category 5 or higher with double shielding (braiding and aluminum foil tape) for EtherCAT.
Use Straight or cross STP (shielded twisted-pair) cable of category 5 or higher for EtherNet/IP.

Cabel with Connectors

Item			Recommended manufacturer	Cable length (m) *1	Model
For EtherCAT	Wire Gauge and Number of Pairs: AWG27, 4-pair Cable Cable Sheath material: LSZH *2 Cable color: Yellow *3	Standard type Cable with Connectors on Both Ends (RJ45/RJ45)	OMRON	0.3	XS6W-6LSZH8SS30CM-Y
				0.5	XS6W-6LSZH8SS50CM-Y
				1	XS6W-6LSZH8SS100CM-Y
				2	XS6W-6LSZH8SS200CM-Y
				3	XS6W-6LSZH8SS300CM-Y
				5	XS6W-6LSZH8SS500CM-Y
	Wire Gauge and Number of Pairs: AWG22, 2-pair Cable	Rugged type Cable with Connectors on Both Ends (RJ45/RJ45)	OMRON	0.3	XS5W-T421-AMD-K
				0.5	XS5W-T421-BMD-K
				1	XS5W-T421-CMD-K
				2	XS5W-T421-DMD-K
				5	XS5W-T421-GMD-K
				10	XS5W-T421-JMD-K
		Rugged type Cable with Connectors on Both Ends (M12/RJ45)	OMRON	0.3	XS5W-T421-AMC-K
				0.5	XS5W-T421-BMC-K
				1	XS5W-T421-CMC-K
				2	XS5W-T421-DMC-K
				5	XS5W-T421-GMC-K
				10	XS5W-T421-JMC-K
		Rugged type Cable with Connectors on Both Ends (M12 L/RJ45)	OMRON	0.3	XS5W-T422-AMC-K
				0.5	XS5W-T422-BMC-K
				1	XS5W-T422-CMC-K
				2	XS5W-T422-DMC-K
				5	XS5W-T422-GMC-K
				10	XS5W-T422-JMC-K

✻1. Standard type cables length 0.2, 0.3, 0.5, 1, 1.5, 2, 3, 5, 7.5, 10, 15 and 20m are available.
Rugged type cables length 0.3, 0.5, 1, 2, 3, 5, 10 and 15m are available.
✻2. The lineup features Low Smoke Zero Halogen cables for in-cabinet use and PUR cables for out-of-cabinet use.
✻3. Cables colors are available in blue, yellow, or Green
Note: For details, refer to Cat.No.G019.

Cables / Connectors

Item			Recommended manufacturer	Model
For EtherCAT and EtherNet/IP	Wire Gauge and Number of Pairs: AWG24, 4-pair Cable	Cables	Hitachi Cable, Ltd.	NETSTAR-C5E SAB 0.5 × 4P *1
			Kuramo Electric Co.	KETH-SB *1
			SWCC Showa Cable Systems Co.	FAE-5004 *1
		RJ45 Connectors	Panduit Corporation	MPS588-C *1
	Wire Gauge and Number of Pairs: AWG22, 2-pair Cable	Cables	Kuramo Electric Co.	KETH-PSB-OMR *2
			Nihon Electric Wire&Cable Co.,Ltd.	PNET/B *2
		RJ45 Assembly Connector	OMRON	XS6G-T421-1 *2
For EtherNet/IP	Wire Gauge and Number of Pairs: 0.5 mm, 4-pair Cable	Cables	Fujikura Ltd.	F-LINK-E 0.5mm × 4P *3
		RJ45 Connectors	Panduit Corporation	MPS588 *3

✻1. We recommend you to use above cable for EtherCAT and EtherNet/IP, and RJ45 Connector together.
✻2. We recommend you to use above cable for EtherCAT and EtherNet/IP, and RJ45 Assembly Connector together.
✻3. We recommend you to use above cable For EtherNet/IP and RJ45 Connectors together.
Note: Please be careful while cable processing, for EtherCAT, connectors on both ends should be shield connected and for EtherNet/IP, connectors on only one end should be shield connected.

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)

General Specification

Item		NJ501-□□□□
Enclosure		Mounted in a panel
Grounding Method		Ground to less than 100 Ω
Dimensions (height×depth×width)		90 mm × 90 mm × 90 mm
Weight		550 g (including the End Cover)
Current Consumption		5 VDC, 1.90 A (including SD Memory Card and End Cover)
Operation Environment	**Ambient Operating Temperature**	0 to 55°C
	Ambient Operating Humidity	10% to 90% (with no condensation)
	Atmosphere	Must be free from corrosive gases.
	Ambient Storage Temperature	-20 to 75°C (excluding battery)
	Altitude	2,000 m or less
	Pollution Degree	2 or less: Conforms to JIS B3502 and IEC 61131-2.
	Noise Immunity	2 kV on power supply line (Conforms to IEC 61000-4-4.)
	Overvoltage Category	Category II: Conforms to JIS B3502 and IEC 61131-2.
	EMC Immunity Level	Zone B
	Vibration Resistance	Conforms to IEC 60068-2-6. 5 to 8.4 Hz with 3.5-mm amplitude, 8.4 to 150 Hz Acceleration of 9.8 m/s^2 for 100 min in X, Y, and Z directions (10 sweeps of 10 min each = 100 min total)
	Shock Resistance	Conforms to IEC 60068-2-27. 147 m/s^2, 3 times in X, Y, and Z directions (100 m/s^2 for Relay Output Units)
Battery	**Life**	5 years at 25°C
	Model	CJ1W-BAT01
Applicable Standards		Conforms to cULus, NK, LR and EC Directives.

Performance Specifications

Item				NJ501-		
				1500	1400	1300
Processing Time	Instruction Execution Times	Ladder Diagram Instructions (LD, AND, OR, and OUT)		1.9 ns or more		
		Math Instructions (for Long Real Data)		26 ns or more		
Programming	Program capacity*1	Size		20 MB		
		Number	POU definition	3000		
			POU instance	6000		
	Variables capacity	No Retain Attribute*2	Size	4 MB		
			Number	90,000		
		Retain Attribute*3	Size	2 MB		
			Number	10,000		
	Data type	Number		2,000		
	Memory for CJ-Series Units (Can be Specified with AT Specifications for Variables.)	CIO Area		6,144 words (CIO 0 to CIO 6143)		
		Work Area		512 words (W0 to W511)		
		Holding Area		1,536 words (H0 to H1535)		
		DM Area		32,768 words (D0 to D32767)		
		EM Area		32,768 words × 25 banks (E0_00000 to E18_32767)		
Unit Configuration	Maximum Number of Connectable Units	Maximum per CPU Rack or Expansion Rack		10 Units		
		Entire Controller		40 Units		
	Maximum number of Expansion Racks			3 max.		
	I/O Capacity	Maximum number of I/O Points on CJ-series Units		2,560 points max.		
	Power Supply Unit for CPU Rack and Expansion Racks	Model		NJ-P□3001		
		Power OFF Detection Time	AC Power Supply	30 to 45 ms		
			DC Power Supply	22 to 25 ms		
Motion Control	Number of Controlled Axes	Maximum Number of Controlled Axes		64 axes	32 axes	16 axes
		Maximum Number of Axes for Single-axis Control		64 axes max.	32 axes max.	16 axes max.
		Maximum Number of Axes for Linear Interpolation Axis Control		4 axes per axes group		
		Number of Axes for Circular Interpolation Axis Control		2 axes per axes group		
	Maximum Number of Axes Groups			32 groups		
	Motion Control Period			The same control period as that is used for the process data communications cycle for EtherCAT.		
	Cams	Number of Cam Data Points	Maximum Points per Cam Table	65,535 points		
			Maximum Points for All Cam Tables	1,048,560 points		
		Maximum Number of Cam Tables		640 tables		
	Position Units			Pulses, millimeters, micrometers, nanometers, degrees or inches		
	Override Factors			0.00% or 0.01% to 500.00%		
Peripheral USB Port	Supported Services			Sysmac Studio connection		
	Physical Layer			USB 2.0-compliant B-type connector		
	Transmission Distance between Hub and Node			5 m max.		
Built-in EtherNet/IP Port	Physical Layer			10Base-T or 100Base-TX		
	Media Access Method			CSMA/CD		
	Modulation			Baseband		
	Topology			Star		
	Baud Rate			100 Mbps (100Base-TX)		
	Transmission Media			STP (shielded, twisted-pair) cable of Ethernet category 5, 5e or higher		
	Maximum Transmission Distance between Ethernet Switch and Node			100m		
	Maximum Number of Cascade Connections			There are no restrictions if Ethernet switch is used.		

✻1. This is the capacity for the execution objects and variable tables (including variable names).
✻2. Words for CJ-series Units in the CIO and Work Areas are not included.
✻3. Words for CJ-series Units in the Holding, DM, and EM Areas are not included.

Item				NJ501-		
				1500	1400	1300
Built-in EtherNet/IP Port	CIP service: Tag Data Links (Cyclic Communications)	Maximum Number of Connections		32		
		Packet interval ✻4		1 to 10,000 ms in 1.0-ms increments ✻5 Can be set for each connection. (Data will be refreshed at the set interval, regardless of the number of nodes.)		
		Permissible Communications Band		3,000 pps ✻6 ✻7 (including heartbeat)		
		Maximum Number of Tag Sets		32		
		Tag types		Network variables, CIO, Work, Holding, DM, and EM Areas		
		Number of tags per connection (i.e., per tag set)		8 (7 tags if Controller status is included in the tag set.)		
		Maximum Link Data Size per Node (total size for all tags)		19,200 bytes		
		Maximum Data Size per Connection		600 bytes		
		Maximum Number of Registrable Tag Sets		32 (1 connection = 1 tag set)		
		Maximum Tag Set Size		600 bytes (Two bytes are used if Controller status is included in the tag set.)		
		Multi-cast Packet Filter ✻8		Supported.		
	Cip Message Service: Explicit Messages	Class 3 (number of connections)		32 (clients plus server)		
		UCMM (non-connection type)	Maximum Number of Clients that Can Communicate at One Time	32		
			Maximum Number of Servers that Can Communicate at One Time	32		
Built-in EtherCAT Port	Maximum number of TCP socket service			30 ✻9		
	Communications Standard			IEC 61158 Type12		
	EtherCAT Master Specifications			Class B (Feature Pack Motion Control compliant)		
	Physical Layer			100BASE-TX		
	Modulation			Baseband		
	Baud Rate			100 Mbps (100Base-TX)		
	Duplex mode			Auto		
	Topology			Line, daisy chain, and branching		
	Transmission Media			Twisted-pair cable of category 5 or higher (double-shielded straight cable with aluminum tape and braiding)		
	Maximum Transmission Distance between Nodes			100m		
	Maximum Number of Slaves			192		
	Maximum Process Data Size			Inputs: 5,736 bytes Outputs: 5,736 bytes (However, the maximum number of process data frames is 4.)		
	Maximum Process Data Size per Slave			Inputs: 1,434 bytes Outputs: 1,434 bytes		
	Maximum Communications Cycle			500/1,000/2,000/4,000 μs		
	Sync Jitter			1 μs max.		
Internal Clock				At ambient temperature of 55°C: -3.5 to +0.5 min error per month At ambient temperature of 25°C: -1.5 to +1.5 min error per month At ambient temperature of 0°C: -3 to +1 min error per month		

✻4. Data is updated on the line in the specified interval regardless of the number of nodes.
✻5. The Packet interval of the CPU Unit version 1.02 or earlier is 10 to 10,000 ms in 1.0-ms increments.
✻6. Means packets per second, i.e., the number of communications packets that can be sent or received in one second.
✻7. The Permissible Communications Band of the CPU Unit version 1.02 or earlier is 1,000 pps.
✻8. An IGMP client is mounted for the EtherNet/IP port. If an ethernet switch that supports IGMP snooping is used, filtering of unnecessary multicast packets is performed.
✻9. The Maximum number of TCP socket service of the CPU Unit version 1.02 or earlier is 16.

Function Specifications

Item				NJ501-□□□□
Tasks	Function			I/O refreshing and the user program are executed in units that are called tasks. Tasks are used to specify execution conditions and execution priority.
		Periodically Executed Tasks	Maximum Number of Primary Periodic Tasks	1
			Maximum Number of Periodic Tasks	3
		Conditionally executed tasks ✻1	Maximum number of event tasks	32
	Setup	System Service Monitoring Settings		The execution interval and the percentage of the total user program execution time are monitored for the system services (processes that are executed by the CPU Unit separate from task execution).
Programming	POU (program organization units)	Programs		POUs that are assigned to tasks.
		Function Blocks		POUs that are used to create objects with specific conditions.
		Functions		POUs that are used to create an object that determine unique outputs for the inputs, such as for data processing.
	Programming Languages	Types		Ladder diagrams ✻2 and structured text (ST)
	Namespaces*3			A concept that is used to group identifiers for POU definitions.
	Variables	External Access of Variables	Network Variables	The function which allows access from the HMI, host computers, or other Controllers
	Data Types	Basic Data Types	Boolean	BOOL
			Bit Strings	BYTE, WORD, DWORD, LWORD
			Integers	INT, SINT, DINT,LINT, UINT, USINT, UDINT, ULINT
			Real Numbers	REAL, LREAL
			Durations	TIME
			Dates	DATE
			Times of Day	TIME_OF_DAY
			Date and Time	DATE_AND_TIME
			Text Strings	STRING
		Derivative Data Types		Structures, unions, enumerations
		Structures	Function	A derivative data type that groups together data with different variable types.
			Maximum Number of Members	2048
			Nesting Maximum Levels	8
			Member Data Types	Basic data types, structures, unions, enumerations, array variables
			Specifying Member Offsets	You can use member offsets to place structure members at any memory locations. ✻3
		Unions	Function	A derivative data type that groups together data with different variable types.
			Maximum Number of Members	4
			Member Data Types	BOOL, BYTE, WORD, DWORD, LWORD
		Enumerations	Function	A derivative data type that uses text strings called enumerators to express variable values.
	Data Type Attributes	Array Specifications	Function	An array is a group of elements with the same data type. You specify the number (subscript) of the element from the first element to specify the element.
			Maximum Number of Dimensions	3
			Maximum Number of Elements	65535
			Array Specifications for FB Instances	Supported.
		Range Specifications		You can specify a range for a data type in advance. The data type can take only values that are in the specified range.
	Libraries			User libraries

✻1. Supported only by the CPU Units with unit version 1.03 or later.
✻2. Inline ST is supported. (Inline ST is ST that is written as an element in a ladder diagram.)
✻3. Supported only by the CPU Units with unit version 1.01 or later.

Item				NJ501-□□□□
Motion Control	Control Modes			position control, velocity control, torque control
	Axis Types			Servo axes, virtual servo axes, encoder axes, and virtual encoder axes
	Positions that can be managed			Command positions and actual positions
	Single-axis	Single-axis Position Control	Absolute Positioning	Positioning is performed for a target position that is specified with an absolute value.
			Relative Positioning	Positioning is performed for a specified travel distance from the command current position.
			Interrupt Feeding	Positioning is performed for a specified travel distance from the position where an interrupt input was received from an external input.
			Cyclic synchronous absolute positioning ∗1	A positioning command is output each control period in Position Control Mode.
		Single-axis Velocity Control	Velocity Control	Velocity control is performed in Position Control Mode.
			Cyclic Synchronous Velocity Control	A velocity command is output each control period in Velocity Control Mode.
		Single-axis Torque Control	Torque Control	The torque of the motor is controlled.
		Single-axis Synchronized Control	Starting Cam Operation	A cam motion is performed using the specified cam table.
			Ending Cam Operation	The cam motion for the axis that is specified with the input parameter is ended.
			Starting Gear Operation	A gear motion with the specified gear ratio is performed between a master axis and slave axis.
			Positioning Gear Operation	A gear motion with the specified gear ratio and sync position is performed between a master axis and slave axis.
			Ending Gear Operation	The specified gear motion or positioning gear motion is ended.
			Synchronous Positioning	Positioning is performed in sync with a specified master axis.
			Master Axis Phase Shift	The phase of a master axis in synchronized control is shifted.
			Combining Axes	The command positions of two axes are added or subtracted and the result is output as the command position.
		Single-axis Manual Operation	Powering the Servo	The Servo in the Servo Drive is turned ON to enable axis motion.
			Jogging	An axis is jogged at a specified target velocity.
		Auxiliary Functions for Single-axis Control	Resetting Axis Errors	Axes errors are cleared.
			Homing	A motor is operated and the limit signals, home proximity signal, and home signal are used to define home.
			Homing with parameter ∗1	Specifying the parameter, a motor is operated and the limit signals, home proximity signal, and home signal are used to define home.
			High-speed Homing	Positioning is performed for an absolute target position of 0 to return to home.
			Stopping	An axis is decelerated to a stop.
			Immediately Stopping	An axis is stopped immediately.
			Setting Override Factors	The target velocity of an axis can be changed.
			Changing the Current Position	The command current position or actual current position of an axis can be changed to any position.
			Enabling External Latches	The position of an axis is recorded when a trigger occurs.
			Disabling External Latches	The current latch is disabled.
			Zone Monitoring	You can monitor the command position or actual position of an axis to see when it is within a specified range (zone).
			Monitoring Axis Following Error	You can monitor whether the difference between the command positions or actual positions of two specified axes exceeds a threshold value.
			Resetting the Following Error	The error between the command current position and actual current position is set to 0.
			Torque Limit	The torque control function of the Servo Drive can be enabled or disabled and the torque limits can be set to control the output torque.

∗1. Supported only by the CPU Units with unit version 1.03 or later.

Item				NJ501-□□□□
Motion Control	Axes Groups	Multi-axes Coordinated Control	Absolute Linear Interpolation	Linear interpolation is performed to a specified absolute position.
			Relative Linear Interpolation	Linear interpolation is performed to a specified relative position.
			Circular 2D Interpolation	Circular interpolation is performed for two axes.
			Axes Group Cyclic Synchronous Absolute Positioning	A positioning command is output each control period in Position Control Mode. ✻3
		Auxiliary Functions for Multi-axes Coordinated Control	Resetting Axes Group Errors	Axes group errors and axis errors are cleared.
			Enabling Axes Groups	Motion of an axes group is enabled.
			Disabling Axes Groups	Motion of an axes group is disabled.
			Stopping Axes Groups	All axes in interpolated motion are decelerated to a stop.
			Immediately Stopping Axes Groups	All axes in interpolated motion are stopped immediately.
			Setting Axes Group Override Factors	The blended target velocity is changed during interpolated motion.
			Reading Axes Group Positions	The command current positions and actual current positions of an axes group can be read. ✻3
			Changing the Axes in an Axes Group	The Composition Axes parameter in the axes group parameters can be overwritten temporarily. ✻3
	Common Items	Cams	Setting Cam Table Properties	The end point index of the cam table that is specified in the input parameter is changed.
			Saving Cam Tables	The cam table that is specified with the input parameter is saved in non-volatile memory in the CPU Unit.
		Parameters	Writing MC Settings	Some of the axis parameters or axes group parameters are overwritten temporarily.
	Auxiliary Functions	Count Modes		You can select either Linear Mode (finite length) or Rotary Mode (infinite length).
		Unit Conversions		You can set the display unit for each axis according to the machine.
		Acceleration/ Deceleration Control	Automatic Acceleration/ Deceleration Control	Jerk is set for the acceleration/deceleration curve for an axis motion or axes group motion.
			Changing the Acceleration and Deceleration Rates	You can change the acceleration or deceleration rate even during acceleration or deceleration.
		In-position Check		You can set an in-position range and in-position check time to confirm when positioning is completed.
		Stop Method		You can set the stop method to the immediate stop input signal or limit input signal.
		Re-execution of Motion Control Instructions		You can change the input variables for a motion control instruction during execution and execute the instruction again to change the target values during operation.
		Multi-execution of Motion Control Instructions (Buffer Mode)		You can specify when to start execution and how to connect the velocities between operations when another motion control instruction is executed during operation.
		Continuous Axes Group Motions (Transition Mode)		You can specify the Transition Mode for multi-execution of instructions for axes group operation.
		Monitoring Functions	Software Limits	The movement range of an axis is monitored.
			Following Error	The error between the command current value and the actual current value is monitored for an axis.
			Velocity, Acceleration Rate, Deceleration Rate, Torque, Interpolation Velocity, Interpolation Acceleration Rate, And Interpolation Deceleration Rate	You can set warning values for each axis and each axes group to monitor them.
		Absolute Encoder Support		You can use an OMRON G5-Series Servomotor with an Absolute Encoder to eliminate the need to perform homing at startup.
	External Interface Signals			The Servo Drive input signals listed on the right are used. Home signal, home proximity signal, positive limit signal, negative limit signal, immediate stop signal, and interrupt input signal

✻3. Supported only by the CPU Units with unit version 1.01 or later.

Item				NJ501-□□□□
Unit (I/O) Management	EtherCAT Slaves	Maximum Number of Slaves		192
		Basic I/O Units	Chattering and Noise Countermeasures	Input response times are set.
	CJ-Series Units	Maximum number of Units		40
		Basic I/O Units	Chattering and Noise Countermeasures	Input response times are set.
			Load Short-circuit Protection and I/O Disconnection Detection	Alarm information for Basic I/O Units is read.
Communications	Peripheral USB Port			A port for communications with various kinds of Support Software running on a personal computer.
	EtherNet/IP Port	Communications protocol		TCP/IP, UDP/IP
		CIP Communications Service	Tag Data Links	Programless cyclic data exchange is performed with the devices on the EtherNet/IP network.
			Message Communications	CIP commands are sent to or received from the devices on the EtherNet/IP network.
		TCP/IP Applications	Socket Services	Data is sent to and received from any node on Ethernet using the UDP or TCP protocol. Socket communications instructions are used.
			FTP Server	Files can be read from or written to the SD Memory Card in the CPU Unit from computers at other Ethernet nodes.
			Automatic Clock Adjustment	Clock information is read from the NTP server at the specified time or at a specified interval after the power supply to the CPU Unit is turned ON. The internal clock time in the CPU Unit is updated with the read time.
			SNMP Agent	Built-in EtherNet/IP port internal status information is provided to network management software that uses an SNMP manager.
	EtherCAT Port	Supported Services	Process Data Communications	Control information is exchanged in cyclic communications between the EtherCAT master and slaves.
			SDO Communications	Control information is exchanged in noncyclic event communications between the EtherCAT master and slaves. SDO communications that are defined in the CANopen standard are used.
		Network Scanning		Information is read from connected slave devices and the slave configuration is automatically generated.
		DC (Distributed Clock)		Time is synchronized by sharing the EtherCAT system time among all EtherCAT devices (including the master).
		Packet Monitoring		The frames that are sent by the master and the frames that are received by the master can be saved.The data that is saved can be viewed with WireShark or other applications.
		Enable/disable Settings for Slaves		The slaves can be enabled or disabled as communications targets.
		Disconnecting/Connecting Slaves		Temporarily disconnects a slave from the EtherCAT network for maintenance, such as for replacement of the slave, and then connects the slave again.
		Supported Application Protocol	CoE	SDO messages that conform to the CANopen standard can be sent to slaves via EtherCAT.
	Communications Instructions			The following instructions are supported. CIP communications instructions, socket communications instructions, SDO message instructions, no-protocol communications instructions, and protocol macro instructions
Operation Management	RUN Output Contacts			The output on the NJ-P□3001 Power Supply Unit turns ON in RUN mode.

Item				NJ501-□□□□
System Management	Event Logs	Categories		Events are recorded in the following logs. System event log Access event log User-defined event log
		Maximum Number of Events per Event Log		1,024
Debugging	Online Editing	Single		Programs, function blocks, functions, and global variables can be changed online. Different operators can change different POUs across a network.
	Forced Refreshing			The user can force specific variables to TRUE or FALSE.
		Maximum Number of Forced Variables	Device Variables for EtherCAT Slaves	64
			Device Variables for CJ-series Units and Variables with AT Specifications	64
	MC Test Run			Motor operation and wiring can be checked from the Sysmac Studio.
	Synchronizing			The project file in the Sysmac Studio and the data in the CPU Unit can be made the same when online.
	Differentiation monitoring ✻1			Rising/falling edge of contacts can be monitored.
		Maximum number of contacts ✻1		8
	Data Tracing	Types	Single Triggered Trace	When the trigger condition is met, the specified number of samples are taken and then tracing stops automatically.
			Continuous Trace	Data tracing is executed continuously and the trace data is collected by the Sysmac Studio.
		Maximum Number of Simultaneous Data Trace		4
		Maximum Number of Records		10,000
		Sampling	Maximum Number of Sampled Variables	192 variables
		Timing of Sampling		Sampling is performed for the specified task period, at the specified time, or when a sampling instruction is executed.
		Triggered Traces		Trigger conditions are set to record data before and after an event.
			Trigger Conditions	When BOOL variable changes to TRUE or FALSE Comparison of non-BOOL variable with a constant Comparison Method: Equals (=), Greater than (>), Greater than or equals (≥), Less Than (<), Less than or equals (≤), Not equal (≠)
			Delay	Trigger position setting: A slider is used to set the percentage of sampling before and after the trigger condition is met.
	Simulation			The operation of the CPU Unit is emulated in the Sysmac Studio.
Maintenance	Connections to HMIs	Connected Port		Built-in EtherNet/IP port
	Sysmac Studio Connection	Connected Port		Peripheral USB port or built-in EtherNet/IP port
Reliability Functions	Self-diagnosis	Controller Errors	Levels	Major fault, partial fault, minor fault, observation, and information
			Maximum ✻5 Number of Message Languages	2
		User-defined errors		User-defined errors are registered in advance and then records are created by executing instructions.
			Levels	8 levels
			Maximum number of message languages	9

✻1. Supported only by the CPU Units with unit version 1.03 or later.
✻5. Maximum number of message languages that the NS-series PT can display.

Item				NJ501-□□□□
Security	Protecting Software Assets and Preventing Operating Mistakes	CPU Unit Names and Serial IDs		When going online to a CPU Unit from the Sysmac Studio, the CPU Unit name in the project is compared to the name of the CPU Unit being connected to.
		Protection	User Program Transfer with No Restoration Information	You can prevent reading data in the CPU Unit from the Sysmac Studio.
			CPU Unit Write Protection	You can prevent writing data to the CPU Unit from the Sysmac Studio or SD Memory Card.
			Overall Project File Protection	You can use passwords to protect .smc files from unauthorized opening on the Sysmac Studio.
			Data Protection	You can use passwords to protect POUs on the Sysmac Studio. ✻3
		Verification of Operation Authority		Online operations can be restricted by operation rights to prevent damage to equipment or injuries that may be caused by operating mistakes.
			Number of Groups	5 ✻4
		Verification of User Program Execution ID		The user program cannot be executed without entering a user program execution ID from the Sysmac Studio for the specific hardware (CPU Unit).
SD Memory Card Functions	Storage Type			SD Memory Card (2 GB max.), SDHC Memory Card
	Application	Automatic transfer from SD Memory Card ✻1		The data in the autoload folder on an SD Memory Card is automatically loaded when the power supply to the Controller is turned ON.
		SD Memory Card Operation Instructions		You can access SD Memory Cards from instructions in the user program.
		File Operations from the Sysmac Studio		You can perform file operations for Controller files in the SD Memory Card and read/write standard document files on the computer.
		SD Memory Card Life Expiration Detection		Notification of the expiration of the life of the SD Memory Card is provided in a systemdefined variable and event log.
Backup functions ✻1	SD Memory Card backup functions	Opetation	Using front switch	You can use front switch to backup, compare, or restore data.
			Using system-defined variables	You can use system-defined variables to backup or compare data.
			Memory Card Operations Dialog Box on Sysmac Studio	Backup and verification operations can be performed from the SD Memory Card Operations Dialog Box on the Sysmac Studio.
		Protection	Prohibiting backing up data to the SD Memory Card	Prohibit SD Memory Card backup functions.
	Sysmac Studio Controller backup functions			Backup, restore, and verification operations for Units can be performed from the Sysmac Studio.

✻1. Supported only by the CPU Units with unit version 1.03 or later.
✻3. Supported only by the CPU Units with unit version 1.01 or later.
✻4. When the NJ501 CPU Units with unit version 1.00 is used, this value becomes two.

Unit Versions

Units	Models	Unit Version
NJ501 CPU Units	NJ501-□□□□	Unit version 1.04 Unit version 1.03 Unit version 1.02 Unit version 1.01 Unit version 1.00

Unit Versions and Programming Devices

The following tables show the relationship between unit versions and Sysmac Studio versions.

Unit Versions and Programming Devices

CPU Unit model	Unit Version	Sysmac Studio version					
		1.00	1.01	1.02	1.03	1.04	1.05
NJ501-□□□□	1.04	Not supported.	Not supported.	Supported. *1	Supported. *2	Supported. *3	Supported.
	1.03	Not supported.	Not supported.	Supported. *1	Supported. *2	Supported.	Supported. *4
	1.02	Not supported.	Not supported.	Supported. *1	Supported.	Supported. *4	Supported. *4
	1.01	Not supported.	Supported. *5	Supported.	Supported. *4	Supported. *4	Supported. *4
	1.00	Supported.	Supported.	Supported. *4	Supported. *4	Supported. *4	Supported. *4

***1.** You cannot use functionality that was added for unit version 1.02 or later of the CPU Unit.
***2.** You cannot use functionality that was added for unit version 1.03 or later of the CPU Unit.
***3.** You cannot use functionality that was added for unit version 1.04 or later of the CPU Unit.
***4.** You can use only projects for which the unit version of the CPU Unit or an earlier unit version is selected for the project device.
***5.** You cannot use functionality that was added for unit version 1.01 or later of the CPU Unit. You cannot use projects that were created on Sysmac Studio version 1.02 or higher with unit version 1.01 or later selected for the project device.

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

Additions and Changes to Functional Specifications

The following table gives the unit version of the CPU Units and the Sysmac Studio version for each addition or change to the functional specifications.

Function				Addition/ change	Unit version	Sysmac Studio version
Tasks	Function	Conditionally executed tasks		Addition	1.03	1.04
Programming	Namespaces			Addition	1.01	1.02
	Data types	Structure data types	Specifying member offsets *1	Addition	1.01	1.02
				Change		1.03 *2
	Libraries			Addition	1.01	1.02
Motion control	Single axes	Single-axis position control	Cyclic synchronous absolute positioning	Addition	1.03	1.04
		Auxiliary function for singleaxis control	Homing with specified parameters	Addition	1.03	1.04
	Axes groups	Multi-axes coordinated control	Axes group cyclic synchronous absolute positioning	Addition	1.01	1.02
		Auxiliary functions for multiaxes coordinated control	Reading axes group positions	Addition	1.01	1.02
			Changing the axes in a group	Addition	1.01	1.02
Debugging function	Differential monitoring			Addition	1.03	1.04
Reliability functions	Self diagnosis	Controller errors	Changing levels	Addition	1.03	1.04
Security	Asset protection and preventing incorrect operation	Protection	Data protection	Addition	1.01	1.02
		Operation authority verification	Number of groups	Change	1.01	1.02
SD Memory Cards	Application	Automatic transfer from SD Memory Card		Addition	1.03	1.04
Backup functions	SD Memory Card backups	Operating methods	SD Memory Card Dialog Box in Sysmac Studio	Addition	1.03	1.04
			Specification with systemdefined variables	Addition	1.03	1.04
			CPU Unit front-panel switch	Addition	1.03	1.04
		Protection functions	Disabling backups to SD Memory Cards	Addition	1.03	1.04
	Sysmac Studio Controller backups			Addition	1.03	1.04
Configuration Units *3	CJ1W-EIP21 with unit version 2.1 or later selected			Addition	1.01	1.02
	CJ1W-CRM21			Addition	1.01	1.02

***1.** The following table gives the unit version of the CPU Units and the Sysmac Studio version that are required to specify member offsets.

Unit version of CPU Unit	Sysmac Studio version		
	1.01 or lower	1.02	1.03 or higher
1.01 or later	Not possible.	Possible. *	Possible.
1.00	Not possible.	Not possible.	Not possible.

***** You cannot select the memory configuration type. You can set member offsets.

***2.** You can select *NJ*, *CJ*, or *User* as the memory configuration type for structure members.
***3.** For the Unit that can be connected, refer to "Unit Configuration" of "Machine Automation Controller NJ-Series" of System Design Guide on the Sysmac Catalogue (Cat. No. P072).

Performance Improvements for Unit Version Upgrades

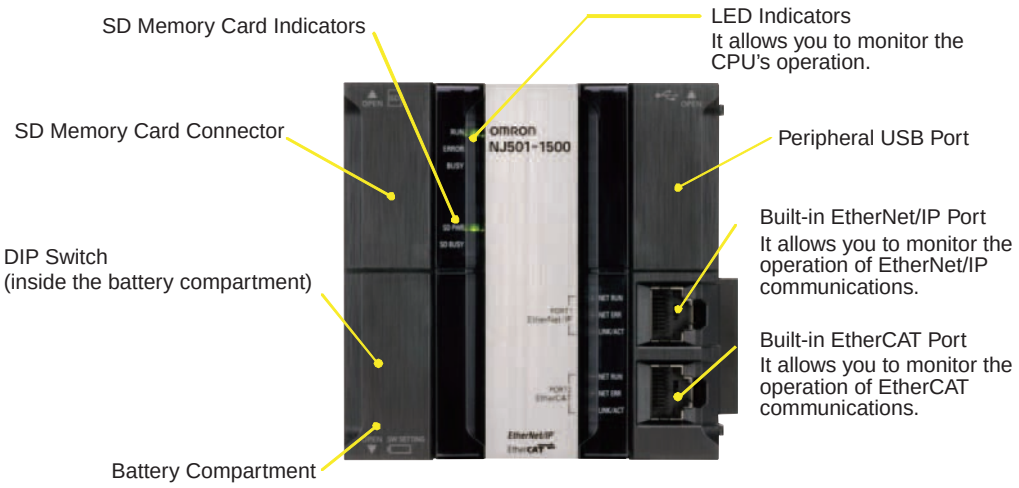
This section introduces the functions for which performance was improved for each unit version of the CPU Unit.

Function			Performance value	Unit version
Built-in EtherNet/IP port	CIP service: Tag data links (cyclic communications)	Packet interval	Can be set for each connection. 1 to 10,000 ms in 1-ms increments	1.03 or higher
			Can be set for each connection. 10 to 10,000 ms in 1-ms increments	1.02 or lower
		Permissible communications band	3,000 pps* (including heartbeat)	1.03 or higher
			1,000 pps (including heartbeat)	1.02 or lower
	Number of TCP sockets		30	1.03 or higher
			16	1.02 or lower

***** Here, pps means “packets per second” and indicates the number of packets that can be processed in one second.

External Interface

An NJ501 CPU Unit (NJ501-□□□□) provides three communications ports for external interfaces: a peripheral USB port, a built-in EtherNet/IP port and a built-in EtherCAT port.



Peripheral USB Port

Item	Specification
Physical layer	USB 2.0-compliant B-type connector
Transmission distance	5 m max.

Use commercially available USB cables.
Specification: USB 2.0 (or 1.1) cable (A connector - B connector), 5.0 m max.

Built-in EtherNet/IP Port

Item	Specification
Physical layer	10BASE-T/100BASE-TX
Media access method	CSMA/CD
Modulation	Baseband
Topology	Star
Baud rate	100 Mbps (100Base-TX)
Transmission media	Straight or cross STP (shielded twisted-pair) cable of category 5 or higher.
Transmission distance	100 m max. (distance between ethernet switch and node)

You can connect Sysmac Studio with built-in EtherNet/IP port.

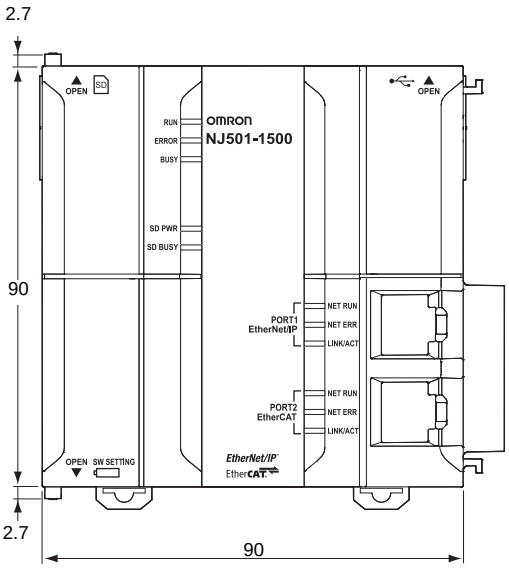
Built-in EtherCAT Port

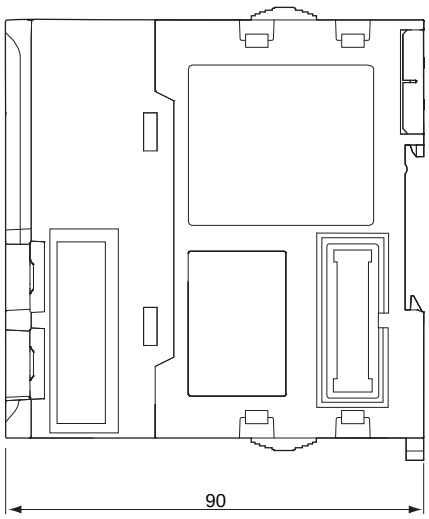
Item	Specification
Synchronization	DC (distributed clock)
Physical layer	100BASE-TX
Modulation	Baseband
Baud rate	100 Mbps (100BASE-TX).
Duplex mode	Automatic
Topology	Line, daisy chain and branching
Transmission media	Shielded twisted-pair (STP); Category 5 or higher straight cable with double shielding (braiding and aluminum foil tape)
Transmission distance	100 m max. between nodes

Dimensions

(Unit: mm)

NJ501 CPU Units (NJ501-□□□□)





Related Manuals

Cat. No.	Model number	Manual	Application	Description
W513	NJ501-□□□□ NJ301-□□□□	NJ Series Startup Guide (CPU Unit)	Using the NJ-series CPU Unit for the first time	The startup procedures for using an NJ-series CPU Unit and the basic operating instructions for the Sysmac Studio are described with a simple sequence control example.
W514	NJ501-□□□□ NJ301-□□□□	NJ Series Startup Guide (Motion Control)	Using the motion control function module of the NJ series for the first time	The startup procedures for setting axis parameters and performing simple one-axis positioning and two-axis linear interpolation with an NJ-series CPU Unit and the operating instructions for the Sysmac Studio are described.
W500	NJ501-□□□□ NJ301-□□□□	NJ-series CPU Unit Hardware User's Manual	Learning the basic specifications of the NJ-series CPU Units, including introductory information, designing, installation, and maintenance Mainly hardware information is provided.	An introduction to the entire NJ-series system is provided along with the following information on a Controller built with an CPU Unit. • Features and system configuration • Introduction • Part names and functions • General specifications • Installation and wiring • Maintenance and inspection Use this manual together with the *NJ-series CPU Unit Software User's Manual* (Cat. No. W501).
W501	NJ501-□□□□ NJ301-□□□□	NJ-series CPU Unit Software User's Manual	Learning how to program and set up an NJ-series CPU Unit Mainly software information is provided.	The following information is provided on a Controller built with an NJ-series CPU Unit. • CPU Unit operation • CPU Unit features • Initial settings • Programming language specifications and programming with the IEC 61131-3 standard. Use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500).
W507	NJ501-□□□□ NJ301-□□□□	NJ-series CPU Unit Motion Control User's Manual	Learning about motion control settings and programming concepts	The settings and operation of the CPU Unit and programming concepts for motion control are described. Use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500) and *NJ-series CPU Unit Software User's Manual* (Cat. No. W501).
W502	NJ501-□□□□ NJ301-□□□□	NJ-series Instructions Reference Manual	Learning about the specifications of the instruction set that is provided by OMRON	The instructions in the instruction set (IEC 61131-3 specifications) are described. Use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500) and *NJ-series CPU Unit Software User's Manual* (Cat. No. W501).
W508	NJ501-□□□□ NJ301-□□□□	NJ-series Motion Control Instructions Reference Manual	Learning about the specifications of the motion control instructions that are provided by OMRON	The motion control instructions are described. Use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500), *NJ-series CPU Unit Software User's Manual* (Cat. No. W501) and *NJ-series CPU Unit Motion Control User's Manual* (Cat. No. W507).

Cat. No.	Model number	Manual	Application	Description
W490 W498 W491 Z317 W492 W494 W497 W495 W493	CJ1W-□□□□	CJ-series Special Unit Manuals for NJ-series CPU Unit	Leaning how to connect CJ-series Units	The methods and precautions for using CJ-series Units with an NJ-series CPU Unit are described, including access methods and programming interfaces. Manuals are available for the following Units. Analog I/O Units, Insulated-type Analog I/O Units, Temperature Control Units, ID Sensor Units, High-speed Counter Units, and DeviceNet Units, EtherNet/IP Units, CompoNet Master Units Use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500) and *NJ-series CPU Unit Software User's Manual* (Cat. No. W501).
W505	NJ501-□□□□ NJ301-□□□□	NJ-series CPU Unit Built-in EtherCAT Port User's Manual	Using the built-in EtherCAT port on an NJ-series CPU Unit	Information on the built-in EtherCAT port is provided. This manual provides an introduction and provides information on the configuration, features, and setup. Use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500) and *NJ-series CPU Unit Software User's Manual* (Cat. No. W501).
W506	NJ501-□□□□ NJ301-□□□□	NJ-series CPU Unit Built-in EtherNet/IP Port User's Manual	Using the built-in EtherNet/IP port on an NJ-series CPU Unit	Information on the built-in EtherNet/IP port is provided. Information is provided on the basic setup, tag data links, FINS communications (non-disclosure), and other features. Use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500) and *NJ-series CPU Unit Software User's Manual* (Cat. No. W501).
W503	NJ501-□□□□ NJ301-□□□□	NJ-series Troubleshooting Manual	Learning about the errors that may be detected in an NJ-series Controller.	Concepts on managing errors that may be detected in an NJ-series Controller and information on individual errors are described. Use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500) and *NJ-series CPU Unit Software User's Manual* (Cat. No. W501).
W504	SYSMAC-SE2□□□	Sysmac Studio Version 1 Operation Manual	Leaning about the NJseries Supports Software and how to use it	An introduction to the Support Software is provided along with information on the installation procedure, basic operations, connection procedures, and procedures for the main features.

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