NJ-Series NJ501 CPU Units

NJ501-□□□□

CSM_NJ501_DS_E_1_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

NJ501-1500

Features

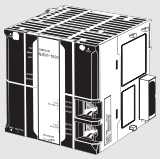
- Architecture Based on new Intel® Atom™ Processor
  - The user program including the double precision floating point arithmetic instruction that is necessary for the coordinates correction, ST language and Function Blocks is executed fast, as well as the basic instructions and the special instructions.
- 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.

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	1.90A	–	**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.

Item			Recommended manufacturer	Cable length (m) ✻1	Model
For EtherCAT	Wire Gauge and Number of Pairs: AWG22, 2-pair Cable	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
		Cable with Connectors on Both Ends (M12/RJ45) 	OMRON	2	XS5W-T421-DMC-K
				5	XS5W-T421-GMC-K
				10	XS5W-T421-JMC-K
For EtherCAT and EtherNet/IP	Wire Gauge and Number of Pairs: AWG24, 4-pair Cable	Cables	Tonichi Kyosan Cable, Ltd.		NETSTAR-C5E SAB 0.5 × 4P
			Kuramo Electric Co.		KETH-SB
			SWCC Showa Cable Systems Co.		FAE-5004
		RJ45 Connectors	Panduit Corporation		MPS588
	Wire Gauge and Number of Pairs: AWG22, 2-pair Cable	Cables	Kuramo Electric Co.		KETH-PSB-OMR ✻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
		RJ45 Connectors	Panduit Corporation		MPS588

✻1. The cable length 0.3, 0.5, 1, 2, 3, 5, 10 and 15 m are available. For details, refer to Cat.No.G019.
✻2. We recommend you to use above cable and connector 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		NJ501-1300	NJ501-1400	NJ501-1500
Enclosure		Mounted in a panel		
Grounding		Less than 100 Ω		
CPU Unit Dimensions (H × D × W)		90 mm × 90 mm × 90 mm		
Weight		550 g (including 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 IEC60068-2-6. 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 IEC60068-2-27. 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			NJ501-1300	NJ501-1400	NJ501-1500
Processing Speed	Execution Time		Ladder Diagram Instructions (LD/AND/OR/OUT): 1.9 ns min		
			Math Instructions (LREAL): 2.6 ns min		
Programming	Program capacity		20 MB (execution objects and variable tables (including variables))		
	Memory capacity for variables	Variables with Retain attribute (Does not include Holding, DM, and EM Area memory for CJ-series Units.)	2 MB		
		Variables without Retain attribute (Does not include CIO and Work Area memory for CJ-series Units.)	4 MB		
	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		
	Number of Expansion Racks		3 max.		
	I/O capacity		2,560 points max. plus EtherCAT slave I/O capacity		
	Power Supply to CPU Rack and Expansion Racks		NJ-P□3001 Power Supply Unit		
Motion control	Controllable Servo Drives		OMRON G5-series Servo Drives with Built-in EtherCAT Communications		
		Recommended Unit Version	Version 2.1 or higher		
	Controllable encoder input terminals		OMRON GX-series GX-EC0211/EC0241 EtherCAT Remote I/O Terminals		
		Recommended Unit Version	Version 1.1 or higher		
	Control method		Control commands using EtherCAT communications		
	Control modes		Position control (Cyclic Synchronous Position Control Mode) Velocity control (Cyclic Synchronous Velocity Control Mode) Torque control (Cyclic Synchronous Torque Control Mode)		
	Number of controlled axes	Maximum number of controlled axes	16 axes	32 axes	64 axes
		Single-axis control	16 axes max.	32 axes max.	64 axes max.
		Linear interpolation control	4 axes max. per axes group		
		Circular interpolation control	2 axes per axes group		
	Number of axes groups		32 axes groups max.		
	Display unit		Pulses, millimeters, micrometers, nanometers, inches, or degrees		
	Electronic gear ratio		Command pulses per motor rotation divided by work travel distance per motor rotation		
	Positions that can be managed		Command positions and actual positions		
	Position command values		Negative, positive, or 0 long real data (LREAL) (command units ✻) ✻ Positions can be set within a 40-bit signed integer range when converted to pulses.		
	Velocity command values		Negative, positive, or 0 long real data (LREAL) (command units/s)		
	Acceleration command values and deceleration command values		Positive or 0 long real data (LREAL) (command units/s^2)		
	Jerk command values		Positive or 0 long real data (LREAL) (command units/s^3)		
	Override factors		0.00% or 0.01% to 500.00%		
	Axis types		Servo axes, virtual servo axes, encoder axes, and virtual encoder axes		
	Motion control period		Same as process data communications period of EtherCAT communications		
	Cams	Number of cam data points	65,535 points max. per cam table 1,048,560 points max. for all cam tables		
		Number of cam tables	640 tables max.		

Item				NJ501-1300	NJ501-1400	NJ501-1500
Communications	Peripheral USB port	Supported services		Sysmac Studio connection		
		Physical layer		USB 2.0-compliant B-type connector		
		Transmission distance		5 m max.		
	Built-in EtherNet/IP port	Communications protocol		TCP/IP, UDP/IP, and BOOTP client		
		Supported services		Sysmac Studio connection, tag data link, CIP message communications, socket service, FTP server, automatic clock adjustment (NTP client), SNMP agent, DNS client.		
		Physical layer		10Base-T or 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 (100BASE-TX) or higher		
		Transmission distance		100 m max. (distance between ethernet switch and node)		
		Number of cascade connections		There are no restrictions if an ethernet switch is used.		
		CIP service: Tag data links (cyclic communications)		–		
			Number of connections	32		
			Packet interval	10 to 10,000 ms in 1.0 ms increments Can be set for each connection. (Data will be refreshed at the set interval, regardless of the number of nodes.)		
			Permissible communications band	1,000 pps ✻1 including heartbeat		
			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 (Seven 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 (Note: Data concurrency is maintained within each connection.)		
			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.)		
			Changing tag data link parameters when Controller is in RUN mode	Supported. ✻2		
			Multi-cast packet filter ✻3	Supported.		
		CIP message service: Explicit messages		–		
			Class 3 (number of connections)	32 (clients plus server)		
			UCMM (non-connection type)	Number of clients that can communicate at one time: 32 max. Number of servers that can communicate at one time: 32 max.		
			CIP routing	Supported. Units through which CIP routing is supported: CS1W-EIP21, CJ1W-EIP21, CJ2H-CPU□□-EIP, and CJ2M-CPU3□		

✻1. Means packets per second, i.e., the number of communications packets that can be sent or received in one second.
✻2. However, if port parameters are changed, the relevant EtherNet/IP port is restarted.
Communications for the nodes that were communicating with that port will time out, and then they will be automatically restored.
✻3. 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.

Item			NJ501-1300	NJ501-1400	NJ501-1500
Communications	Built-in EtherCAT port	Communications standard	IEC 61158, Type 12		
		EtherCAT master specifications	Class B (Feature Pack Motion Control compliant)		
		Communications protocol	Special protocol for EtherCAT		
		Supported services	CoE (PDO communications and SDO communications)		
		Synchronized communications	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	Twisted-pair cable of category 5 or higher (double-shielded straight cable with aluminum tape and braiding)		
		Transmission distance	Distance between nodes: 100 m max.		
		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		
		Communications period	500, 1,000, 2,000, or 4,000 μs		
		Minimum communications period	500 μs		
		Maximum communications period	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		

Function Specifications

Item				NJ501
Tasks	Function			I/O refresh and the user program are executed in units that are called tasks. Tasks are executed periodically. • Primary periodic task: This task has the highest priority. It is always executed in the specified period. There is only one primary periodic task. • Periodic tasks: Periodic tasks are executed during the unused time between executions of the primary periodic task. There can be three periodic tasks.
	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).
		I/O refresh settings		EtherCAT Slaves: Axes assigned to Servo Drives and encoder input slaves: Assigned to the primary periodic task. Other Slaves: Assigned as required to the primary periodic task or a priority-16 periodic task. CJ-series Units: I/O refreshing is set as required for each Unit in the primary periodic task or a priority-16 periodic task.
	Monitoring	Task execution times		The average, maximum, and minimum execution times are displayed for each task.
Programming	POUs (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 (see note) and structured text (ST) **Note:** Inline ST is supported. (Inline ST is ST that is written as an element in a ladder diagram.)
	Variables	Type of variables	User-defined variables	Variables that are defined by the user.
			Semi-user-defined variables	Variables for which only some of the attributes can be changed.
			System-defined variables	Variables that are defined by the system. None of the attributes of these variables can be changed.
		External access of variables		Network variables (This is set as an attribute of the variable.)
		Initial values	Variables without Retain attribute	Initial values are set when the user program is transferred.
			Variables with Retain attribute	Whether to set initial values can be selected when the user program is transferred.
	Array attribute	Array variables	Function	An array groups data with the same attributes so that it can be handled as a single unit of data. Number of dimensions: 3 max. Maximum number of elements: 65,535
			Array specifications for FB instances	Supported. (Execution of multiple instances is possible by using a variable to indirectly specify an array element number.)
			Protective functions	During programming and program execution, exceeding the number of elements that was defined for the array is detected.
	Data types	Basic data types		BOOL, BYTE, WORD, DWORD, LWORD, INT, SINT, DINT, LINT UINT, USINT, UDINT, ULINT, REAL, LREAL, TIME (durations), DATE, TIME_OF_DAY, DATE_AND_TIME, and STRING (text strings)
		Derivative data types		Structures, unions, and enumerations
		Structures	Function	A derivative data type that groups together data with different variable types. Number of members: 2,048 max. Nesting levels: 8 max.
			Member data types	Basic data types, structures, enumerations, unions, or array variables
		Unions	Function	A derivative data type that enables access to the same data with different data types. Number of members: 4 max.
			Member data types	BOOL, BYTE, WORD, DWORD, or LWORD
	Data types	Enumerations	Function	A derivative data type that uses text strings called enumerators to express variable values.
		Data type attributes	Array specifications	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. You can specify arrays for both basic data types and derivative data types.
			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. You can specify a range for any integer basic data type.
		Program checks		Programming is checked offline with the Sysmac Studio and when instructions are executed.
		Programming support		Rung numbers (ladder diagrams) and line numbers (ST) are displayed. Guidance is provided when inputting instructions. (Item names and data types are displayed for input variables.)

Item				NJ501
Motion control functions ✻4	Single axes	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 position 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.
		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.
			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.

✻4. When connected to an OMRON G5-series Servo Drive with built-in EtherCAT communications.

Item				NJ501
Motion control functions ✻5	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.
		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.
	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 Mode		You can set the Stop Mode to determine when the immediate stop input signal or limit input signal is valid.
		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	Software limits are set for each axis.
			Following error	The error between the command current value and the actual current value is monitored for each axis.
			Velocity, acceleration rate, deceleration rate, torque, interpolation velocity, interpolation acceleration rate, and interpolation deceleration rate	The warning value is monitored for each axis and each axes group.
		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 following Servo Drive input signals are used. Home signal, home proximity signal, positive limit signal, negative limit signal, immediate stop signal, and interrupt input signal

✻5. When connected to an OMRON G5-series Servo Drive with built-in EtherCAT communications.

Item				NJ501
Unit (I/O) management	CJ-series Units	I/O allocations		Use one of the following procedures. • Creating the Unit configuration offline with Sysmac Studio • Creating the Unit configuration online by reading the actual Unit configuration with the Sysmac Studio
		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.
		Special Units	Restarting	Units can be restarted from instructions, system-defined variables, and the Sysmac Studio.
			Special Unit Setup	Special Units can be set up with Unit settings from the Sysmac Studio or by setting device variables.
	EtherCAT slaves	Basic I/O	Chattering and noise countermeasures	Input response times are set.
		Special I/O	Restarting	Restarting is possible from the Sysmac Studio.
Communications	Peripheral USB port			A port for communications with various kinds of Support Software running on a personal computer.
	EtherNet/IP port	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.
			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	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. The following application protocol is supported. CoE (CANopen over EtherCAT)
		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 between all EtherCAT devices (including the master). To implement the distributed clock, propagation delay compensation, drift compensation, and offset compensation are performed.
	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.
System management functions	Log management	Event logs		The following events are recorded. • Events for the operation of the NJ-series system itself • Communications events • Security events • Events for the operation of user-designed device applications

Item				NJ501	
Debugging	Online editing			Programs, function blocks, functions, and global variables can be changed online. Individual POUs can be changed by more than one worker working across a network.	
	Forced refreshing			The user can force specific variables to TRUE or FALSE. Device variables for CJ-series Units and variables with AT specifications: 64 variables max. Device variables for EtherCAT slaves: 64 variables max. **Note:** Forced refreshing values are overwritten by program execution. Refreshing of external outputs uses the forced refreshing values, not the program values.	
	Motion Control Test Mode			Motor operation and wiring can be checked from the Sysmac Studio.	
	Synchronization			The project file in the Sysmac Studio and the data in the CPU Unit can be made the same when online.	
	Data tracing			The specified variables are sampled and stored in trace memory when the specified conditions are met. No programming is required. Maximum number of records: 10,000 records 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.	
		Starting tracing		When specified from the Sysmac Studio or automatically at startup	
		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: The percentage of sampling before and after the trigger condition is set. (Example: 20%/80%)	
		Continuous tracing		Data tracing is executed continuously and the trace data is collected by the Sysmac Studio.	
	Simulation			The operation of the CPU Unit is emulated in the Sysmac Studio. The following can be emulated: user program execution (including partial emulation), debugging (including step execution and breakpoints), monitoring, tracing, estimating execution times, and Servo Drive signals.	
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	
		Remote programming and monitoring		Connection is possible through the peripheral USB port to other nodes that are connected to the built-in EtherNet/IP port.	
	ID information	Production information		Individual identifiers, lot numbers, and other information is accessed from the Sysmac Studio.	
Reliability functions	Self-diagnosis	Controller errors		• Major faults: Internal bus check errors, main memory check errors, etc. • Partial faults: Motion control period exceeded, slave initialization error, etc. • Minor faults: Battery-backed-up memory check errors, clock oscillation stopped, etc.	
		User-defined errors		User-defined errors are registered in advance and then generated by executing an instruction. Error registration, error resetting, error information registration	
		User-defined error messages		User-defined error messages can be specified in up to nine languages, including Japanese and English.	
	Power supply management	Allowable power supply interruption time		AC power supply: 30 to 45 ms DC power supply: 22 to 25 ms	
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	Protection for online operations from the Sysmac Studio	User program transfers with no restoration information	Prevents reading data in the CPU Unit from the Sysmac Studio.
				CPU Unit write-protection	Prevents writing data to the CPU Unit from the Sysmac Studio.
			Protection for offline operations from the Sysmac Studio	Protection of all project files	Prohibits opening or copying project files on the Sysmac Studio without a password.
		Verification of operation authority		Online operations are restricted by operation rights to prevent damage to equipment or injuries that may be caused by operating mistakes.	
		Hardware identification (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).	

Item			NJ501
SD Memory Card functions	Storage type		SD Memory Card (2 GB max.)
	Application	SD Memory Card operation instructions	You can access SD Memory Cards from instructions in the user program.
		FTP server	You can use FTP commands from an FTP client on an intranet to read and write large files in the SD Memory Card through EtherNet/IP.
		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 system-defined variable and event log.

Unit Versions

Unit	Model	Unit version
NJ501 CPU Units	**NJ501-□□□□**	Unit version 1.00

Unit Versions and Programming Devices

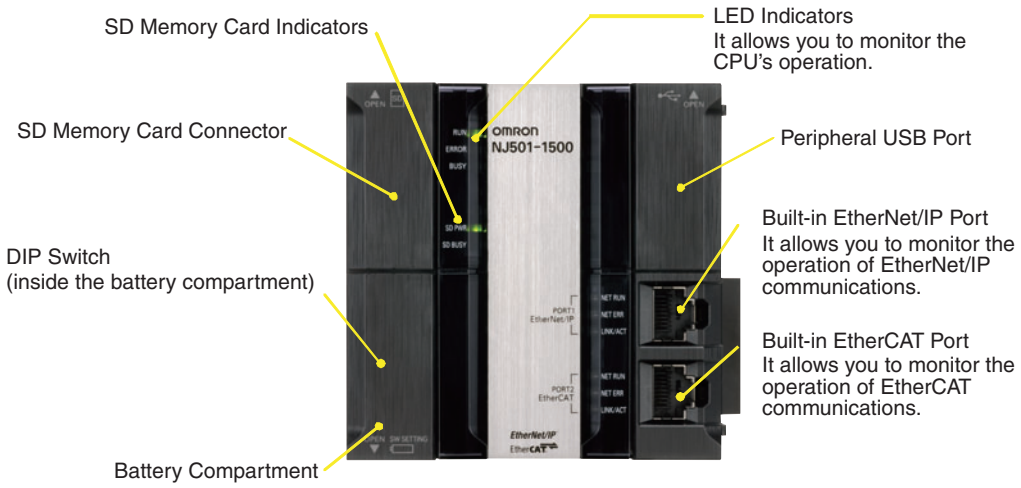
The following tables show the relationship between unit versions and Sysmac Studio versions.

Unit Versions and Programming Devices

CPU Unit	Functions	Required Programming Device
		Sysmac Studio
		Ver.1.00
NJ501-□□□□ Unit version 1.00	Functions for unit version 1.00	OK

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.

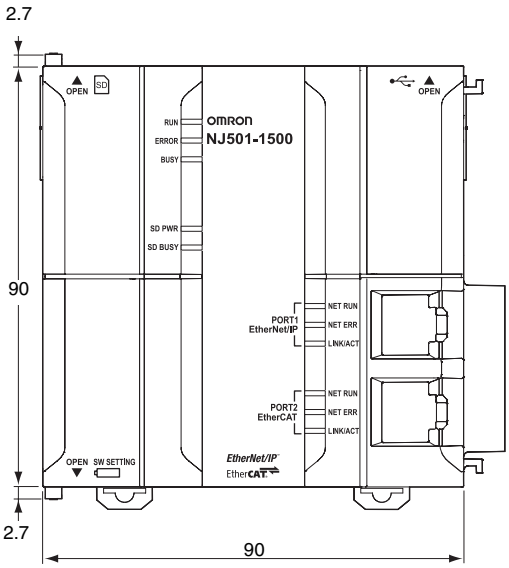
Built-in EtherCAT Port

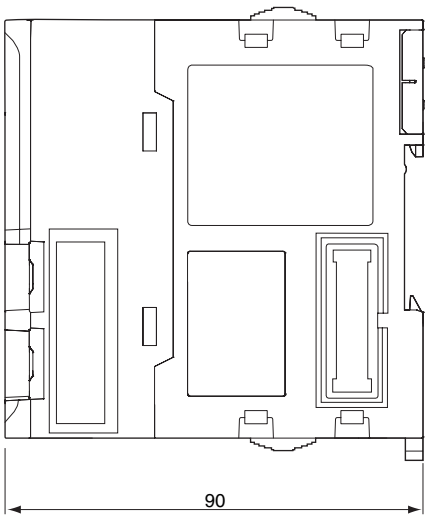
Item	Specification
Synchronization	DC (distributed clock)
Physical layer	100BASE-TX
Modulation	Baseband
Baud rate	100 Mbps (100BASE-TX).
Duplex mode	Automatic
Topology	Line, daisy chain and branching
Transmission media	Shielded twisted-pair (STP); Category 5 or higher straight cable with double shielding (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
W500	NJ501-□□□□	NJ-series CPU Unit Hardware User's Manual	Learning the basic specifications of the NJ501 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 NJ501 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-□□□□	NJ-series CPU Unit Software User's Manual	Learning how to program and set up an NJ501 CPU Unit Mainly software information is provided.	The following information is provided on a Controller built with an NJ501 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-□□□□	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-□□□□	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-□□□□	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 Z310 W492 W494 W497	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 NJ501 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 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-□□□□	NJ-series CPU Unit Built-in EtherCAT Port User's Manual	Using the built-in EtherCAT port on an NJ501 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-□□□□	NJ-series CPU Unit Built-in EtherNet/IP Port User's Manual	Using the built-in EtherNet/IP port on an NJ501 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-□□□□	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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