1. Product Description

NJ Line is a powerful and complete Programmable Logic Controller (PLC) Series with unique and innovative features. Due to its flexibility, smart design, enhanced diagnostics capabilities and modular architecture, NJ Line is suitable for control systems ranging from medium to high-end large applications. Finally, its compact size, high density of points per module and superior performance, allow NJ Line to be applied in small automation systems with high performance requirements, such as manufacturing applications and industrial machines.

In this context, NJ Line is a selection of I/O modules that uses the existing CPUs and modules from NJ Line to provide the best solution for applications in verticals like infrastructure, building, water, wastewater, food, machines and several OEM projects. NJ Line is ideal for systems with no hot-swapping requirements.

Finally, the module NJ1001 is a module that offers 16 isolated inputs of source/sink type for general use and it is a module that uses one rack position.



Its main features are:

- High density, with 16 inputs in single width module
- Four independent input groups which can be used as sink or source inputs
- Isolated inputs
- Display for module diagnostics and input state indication
- Easy Plug System

ATTENTION

Starting from product revision AI, it was included the connector frontal cover (which was previously exclusive of NX models), thus adding the Easy Plug System feature to this product.

2. Ordering Information

2.1. Included Items

The product package contains the following items:

- NJ1001 module
- 20-terminals connector with wire holder

2.2. Product Code

The following code should be used to purchase the product:

Code	Description
NJ1001	24 Vdc 16 DI Module
NJ1001-C	24 Vdc 16 DI Module with Conformal Coating

Table 1: Product Code

3. Related Products

The following product must be purchased separately when necessary:

Code	Description
NX9403	20-terminal connector with cable guides

Table 2: Related Products

4. Innovative Features

This product brings to the user many innovations regarding utilization, supervision and system maintenance. These features were developed focusing a new concept in industrial automation.



Easy Plug System: This product has an exclusive method to plug and unplug I/O terminal blocks. The terminal blocks can be easily removed with a single movement and with no special tools. In order to plug the terminal block back to the module, the frontal cover assists the installation procedure, fitting the terminal block to the module.

5. Product Features

5.1. General Features

	NJ1001
Backplane rack occupation	1 slot
Input type	Sink or source type 1
Number of inputs	16
Input voltage	24 Vdc 15 to 30 Vdc for level logic 1 0 to 5 Vdc for level logic 0
Input impedance	4.95 kΩ
Maximum input current	6.2 mA @ 30 Vdc
Input filter	2 to 255 ms – per software
Transaction time	90 µs - transaction off to on @ 30 Vdc 110 µs - transaction on to off @ 30 Vdc
Input update time	1 ms
Input state indication	Yes
One Touch Diag (OTD)	No
Electronic Tag on Display (ETD)	No
Status and diagnostic indication	Display, web pages and CPU's internal memory
Hot swap capability	No
Wire gauge	0,5 mm^2 (20 AWG)
Minimum wire temperature rating	75 °C
Wire material	Copper only
Isolation	
Input group to others input groups	1000 Vac / 1 minute
Inputs to logic	2500 Vac / 1 minute
Inputs to protective earth ⏚	2500 Vac / 1 minute
Logic to protective earth ⏚	1500 Vac / 1 minute

	NJ1001
Current consumption from rack	160 mA
Maximum power dissipation	3.8 W
IP Level	IP 20
Operating temperature	0 to 60 °C
Storage temperature	-25 to 75 °C
Operating and storage relative humidity	5% to 96%, non-condensing
Conformal coating	Optional, ordering code NJ1001-C
Module dimensions (W x H x D)	18.00 x 114.62 x 117.46 mm
Package dimensions (W x H x D)	25.00 x 122.00 x 147.00 mm
Weight	200 g
Weight with package	250 g

Table 3: General Features

Notes:

Input Type: NJ1001's inputs are divided in four input groups: 00 to 03, 04 to 07, 10 to 13 and 14 to 17. Each group can be used as source input as well as sink inputs independently of the type used in the other groups. To use an input group as source inputs, the respective common terminal must be connected to 24 Vdc. To use an input group as sink inputs, the respective common terminal must be connected to 0 Vdc. For more information please check the section Installation.

Input filter: The usage of digital input filter is indicated for environments susceptible to high electromagnetic interference levels to the defined in the standard IEC 61131-2 or due to special features of used sensor.

Conformal coating: The conformal coating protects the electronics inside the product from moisture, dust and other harsh elements in electronic circuits.

5.2. Standards and Certifications

Standards and Certifications	
IEC	61131-2: Industrial-process measurement and control - Programmable controllers - Part 2: Equipment requirements and tests
CE	2014/30/EU (EMC) 2014/35/EU (LVD) 2011/65/EU and 2015/863/EU (ROHS)
UKCA	S.I. 2016 No. 1091 (EMC) S.I. 2016 No. 1101 (Safety) S.I. 2012 No. 3032 (ROHS)
c UL us LISTED	UL/cUL Listed – UL 61010-1 UL 61010-2-201 (file E473496)
EAC	TR 004/2011 (LVD) CU TR 020/2011 (EMC)

Table 4: Standards and Certifications

5.3. Compatibility with Other Products

The following table provides information regarding the compatibility of the module and programming tool Mastertool.

NJ1001		Compatible Software Version			
Version	**Revision**	**NX3004**	**NX30x0**	**NX5110**	**Mastertool**
1.2.0.4 or higher	AA or higher	1.5.1.0 or higher	1.5.1.0 or higher	1.1.1.0 or higher	2.03 or higher

Table 5: Compatibility with Other Products

Note:

Revision: If the software is upgraded in the field the product revision indicated on the label will no longer match the actual revision of the product.

ATTENTION

The CPUs, racks and the PROFIBUS remote head of NX Line support the use of Nexto Jet Modules. The Nexto Jet is formed by I/Os modules and when used in configuration with CPUs or PROFIBUS remote head of NX Line, no other I/O type of NX Line can be used in the same bus.

5.4. Physical Dimensions

Dimensions in mm.

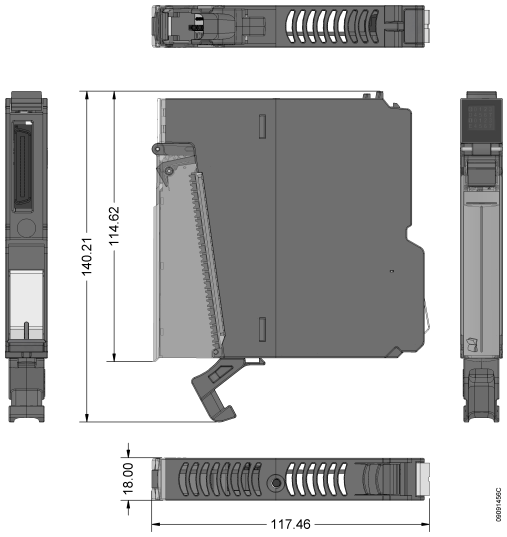


Figure 1: 18 mm I/O Module

6. Installation

For the correct installation of this product, it is necessary to use a backplane rack and it must be carried out according to the mechanical and electrical installation instructions that follow.

6.1. Product Identification

This product has some parts that must be observed before installation and use. The following figure identifies each of these parts.

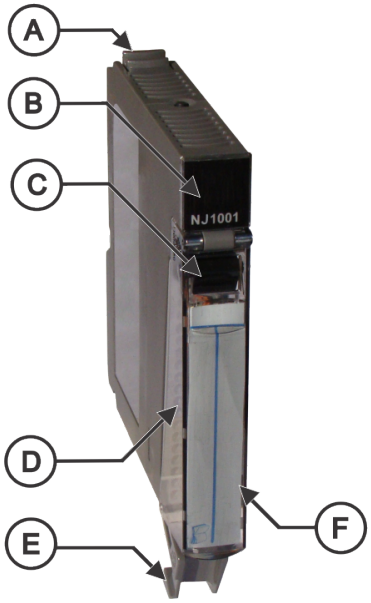


Figure 2: NJ1001

Ⓐ Fixing lock.
Ⓑ Status and diagnostic display.
Ⓒ Terminal block extraction lever.
Ⓓ Front cover.
Ⓔ 20 pin terminal block with wire holder.
Ⓕ Label for module identification.

The product has in its mechanics a label that identifies it and in it are presented some symbols whose meaning is described below:

⚠ Attention! Before using the equipment and installing, read the documentation.

⎓ Direct Current.

6.2. Electrical Installation

The figure below shows an example where NJ1001 is used as sink or source inputs. The inputs 00 to 03 and 10 to 13 are used as sink inputs while inputs 04 to 07 and 14 to 17 are used as source inputs. Each input group is isolated.

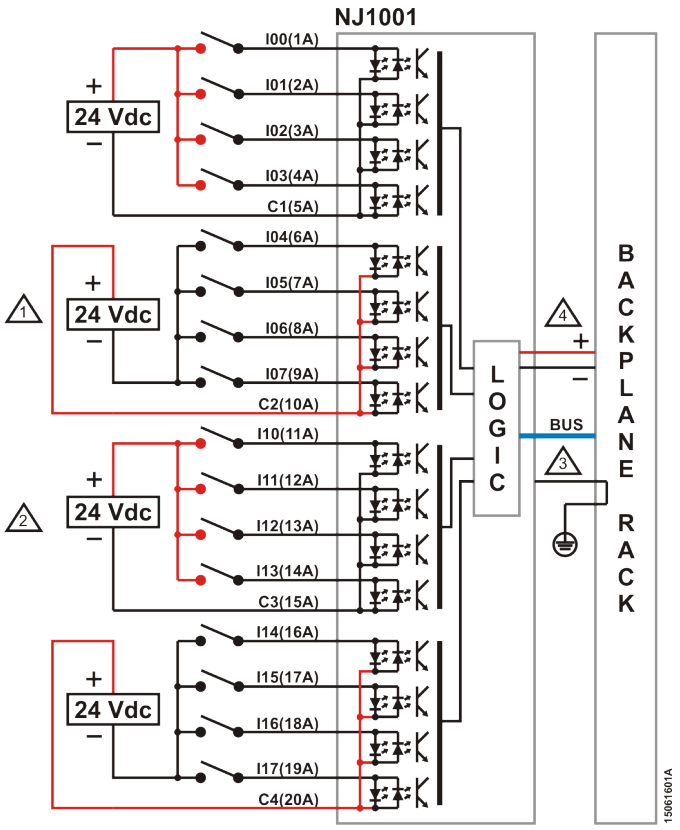


Figure 3: Electric Diagram

Diagram Notes:

1. Typical usage of source digital inputs, C2 is the +24 Vdc common to input group I04 to I07.
2. Typical usage of sink digital inputs, C3 is the 0 Vdc common to input group I10 to I13.
3. The module is grounded through the backplane racks.
4. The module power supply is derived from the connection to the backplane rack, not requiring external connections.

Protection earth terminal.

6.3. Connector Pinout

The following table shows the description of each connector terminal:

Terminal Number	Description
1	Input 00
2	Input 01
3	Input 02
4	Input 03
5	Common for inputs 00 to 03
6	Input 04
7	Input 05
8	Input 06
9	Input 07
10	Common for inputs 04 to 07
11	Input 10
12	Input 11
13	Input 12
14	Input 13
15	Common for inputs 10 to 13
16	Input 14
17	Input 15
18	Input 16
19	Input 17
20	Common for inputs 14 to 17

Table 6: Connector Pinout

6.4. Mechanical Assembly

ATTENTION

Products with broken warranty seal are not covered in warranty.

CAUTION

The device is sensitive to static electricity (ESD). Always touch in a metallic grounded object before handling it.

DANGER

Nexto System can operate with voltage up to 250 Vac. Special care must be taken during the installation, which should only be done by qualified technical personnel. Do not touch on the wiring field when in operation.

6.4.1. Module Insertion

The following example shows a generic module, this procedure must be followed for any module.

First the module lower part, which is used as a guide for the correct insertion, must be fit in the backplane rack, and then the guide pins are correctly placed in the right rack keyways for a specified position. Modules that use only one position in the rack has only one guide pin. The figure below shows how the module lower part must be positioned in relation to the rack for the correct insertion.

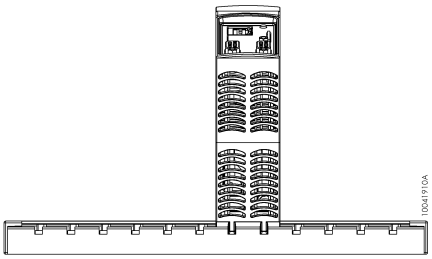


Figure 4: Module and Backplane Rack

After fitting the module lower part as described above, a rotation movement must be executed in order to fit the fixation lock in the rack upper part, as shown on figure below.

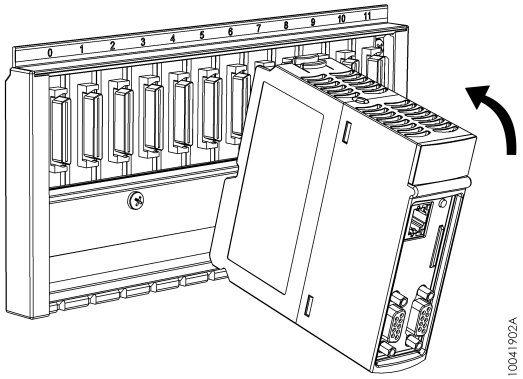


Figure 5: Backplane Rack Fitting Movement

If the user follows the described procedures correctly, the module will have been perfectly connected to the bus, as presented on figure below.

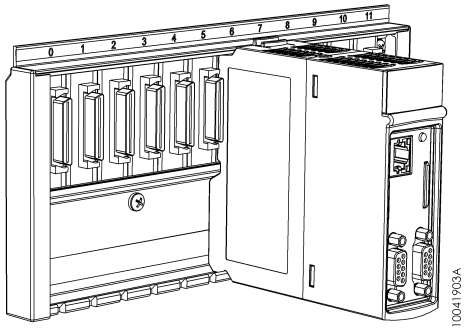


Figure 6: Module Correctly Placed in the Backplane Rack

The module mustn't be connected to the rack any other way. Wrong insertion of the module may cause irreversible damage to it. The figure below show how to NOT connect the modules to the rack.

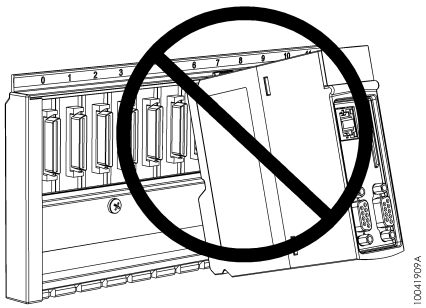


Figure 7: Wrong Insertion Way

6.4.2. Modules Removal

The following example shows a generic module, this procedure must be followed for any module.

First the fixation lock must be pressed (1), in order to unlock the module from the bus, then it must be rotate as shown on figure below(2).

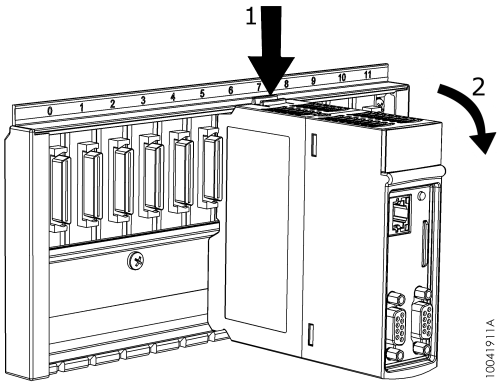


Figure 8: Bus Unlock

If the user follows the described procedures correctly, the module will have been perfectly disconnected from the bus and it can be taken off as presented on figure below.

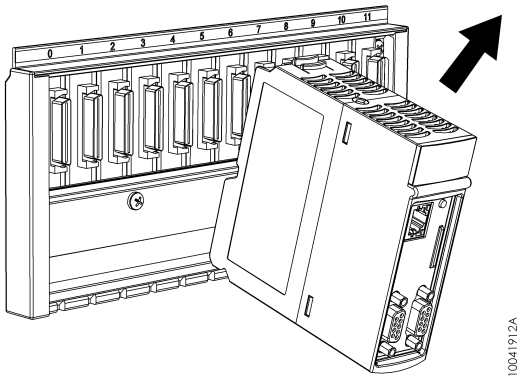


Figure 9: Module being Removed from the Backplane Rack

6.4.3. I/O Modules

6.4.3.1. Frontal cover

I/O modules have a frontal cover which has as main objective to protect the I/O connectors. Besides, the frontal cover has other functions which are described throughout the I/O Modules item.

To access the I/O connector the frontal cover must be opened pulling its lower extremity. The figure below indicated how it must be done.

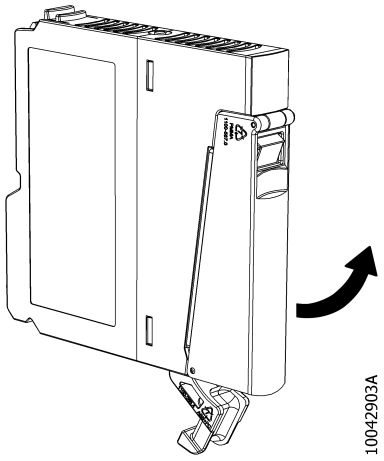


Figure 10: Opening the Frontal Cover

The figure below shows an I/O module with its frontal cover opened.

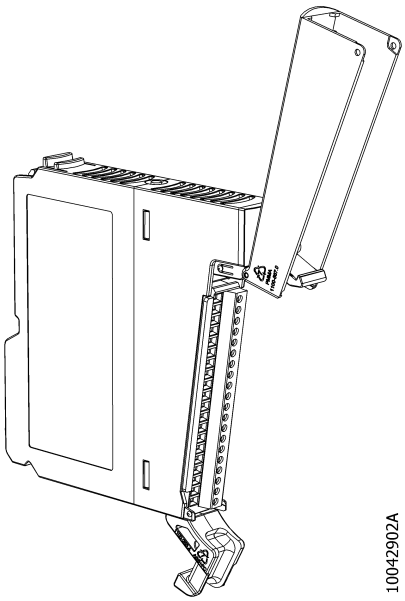


Figure 11: Frontal Cover Opened

6.4.3.2. I/O Connector Insertion

The simple width modules have an extra feature which helps the I/O terminal block insertion, described below. In case of double width module the insertion must be executed manually.

With the frontal cover opened, the terminal block must be inserted partially in the module, taking care to insert it in the right position. Then the frontal cover must be closed as indicated on figure below. Observe the connector partially connected.

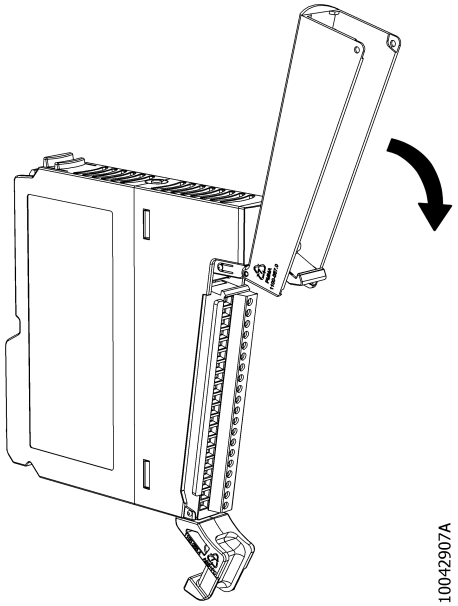


Figure 12: Closing the Frontal Cover

At closing the frontal cover the I/O connector block is inserted in the module. The movement must be done all the way down until the cover is in the final position, as presented on figure below.

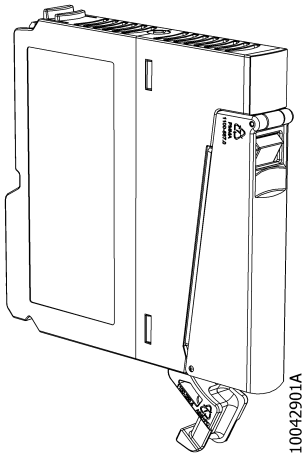


Figure 13: Module with the Frontal Cover Closed

6.4.3.3. I/O Connector Removal

The I/O modules have a feature to help the connector block removal, which is described below.

As described previously, to open the frontal cover, it's necessary to pull it by its lower part. When the I/O connector block must be removed, it's necessary to execute the same opening movement besides pressing the connector block extraction lever as shown on figure below. It's important to keep the extraction lever pressed during the whole movement since the beginning.

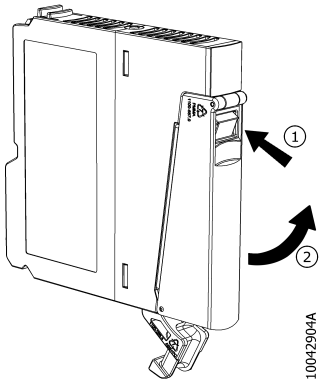


Figure 14: Movement to Remove the I/O Connector Block Modules

After the described movement, the I/O connector block is partially removed, simplifying the rest of its extraction. Such functionality is available both for the simple width modules as for the double width modules. In case of double width modules, each I/O connector has its own extraction lever. Therefore each connector must be removed individually.

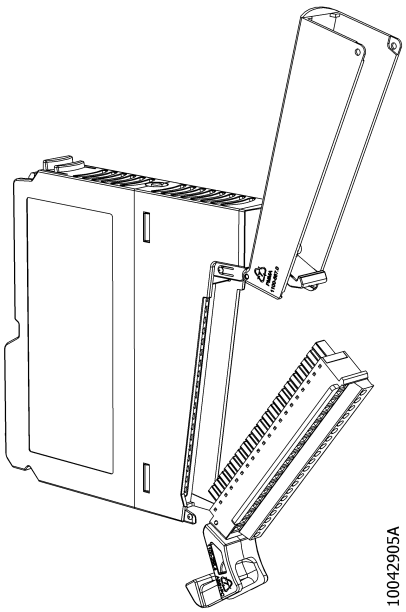


Figure 15: I/O Connector Block Removal Modules

6.4.3.4. I/O connector block

The connectors block from the I/O modules use the spring-connection for cable fixation, not needing screws for cable holding.

6.4.3.4.1. Identification

All I/O connector block pins are numbered. The 10 pins connectors are numbered from 1 to 10 and the 20 pins connectors block are numbered from 1 to 20. The relation between the pin number and its function is defined in the Connector Pinout section.

6.4.3.5. I/O module labels

6.4.3.5.1. Identification number and description

The modules have a frontal label, which has two functions: allow the user to identify and describe each module and indicate on a short way its installation diagram.

When the I/O modules frontal cover is closed, its identification number and description is visible, as shown on figure below. In this example the identification number is indicated by “XXXX” and the module description by “Description Altus S/A”.

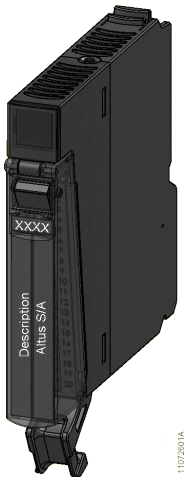


Figure 16: Module Identification

6.4.3.5.2. Installation Diagram

At opening the I/O frontal covers, the module installation diagram becomes visible, as presented on figure below.

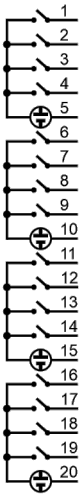


Figure 17: Installation Diagram

On table below are described all symbols used in the installation diagram.

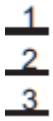
Symbol	Meaning
	The numbers on the left indicate the connector block pin number, e.g. on the figure on the left the pins 1, 2 and 3 are indicated.
	This symbol indicates a contact responsible for activate or deactivate a specific module input point. This contact can be replaced by any output circuit compatible with the input module.
	This symbol indicates a direct current power supply source. On this symbol the power supply polarity isn't specified. This means the user can choose the polarity according to his demands. The voltage must be compatible with the module characteristics.

Table 7: Installation Diagram Symbols

6.4.3.5.3. Label insertion and removal

To add the identification number and module description it's necessary to remove the I/O module frontal label as shown on figure below. This figure shows an I/O module frontal cover which uses one slot in the rack. The same procedure must be executed for modules that use two slots.

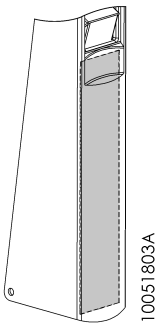


Figure 18: Label (1)

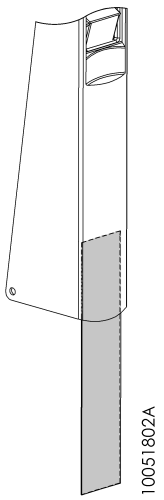


Figure 19: Label (2)

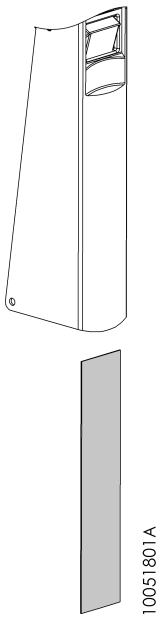


Figure 20: Label (3)

Care must be taken for a little lock existent in the frontal cover inner part. The label removal is only possible when it is directed over the lock. Besides, at inserting it again, the label must be placed over the frontal cover side locks in order to remain fixed. The figure below indicates the side lock position where 3 locks can be observed on each side.

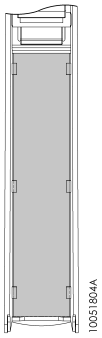


Figure 21: Label Fixation Locks

6.4.4. Spring-Connectors

This type of connector has a fixation system based on a high reliability spring even under vibration subjected environment. For its assembly it's recommended the use of a 3.5 mm wide screwdriver with isolated handle. The advantage of using this connector is the quick and easy electric cable assembly.

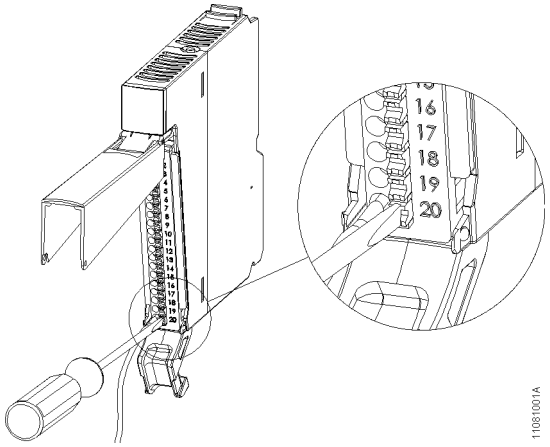


Figure 22: Spring Connection I/O Module

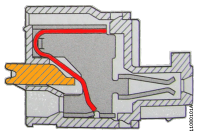


Figure 23: Spring Terminal Block

To assembly the cable in the connector:

- Insert the screwdriver in the terminal lever to open the spring
- Insert the cable terminal in the connector
- Remove the screwdriver to close the connector

6.4.4.1. Cable Insertion

In order to obtain an equal length in all cables connected to a same I/O connector block, it's recommended the following definition regarding the length difference which each cable beside another must obey before installation. It's important to stress that the biggest cable must be always the cable connected to the I/O connector pin 1.

6.4.4.2. 20-Pin Connector Block - NX9403

It's recommended the use of 0.5 mm^2 cables. Each cable must be cut with a difference of 4 mm as indicated on Figure 24. Each pin must have 0.5 mm^2 terminals crimped.

ATTENTION

Use single terminal with length A = 8 mm to guarantee the effective contact (see Figure 25).

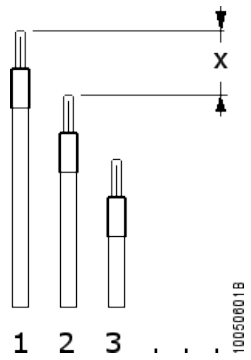


Figure 24: Wire Cutting

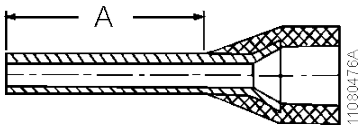


Figure 25: Terminal

6.4.4.3. Cable assembly

Insert the terminals in the connector block starting by pin 10, for the 10-pin connector block, or by pin 20, for 20-pin connector block. Certify that the terminals are completely inserted in the connector and correctly connected.

6.4.4.4. Cable fixation and Identification

It is recommended to use numbered wiring or cables with numbered conductors for wiring identification and Conexel identifier WKM 8/30 (PN: 1631910000) for cable identification. Turn the cables to place then under the I/O module frontal cover. Then, tie them together using plastic tie fixing in the wire holder placed on the connector lower part (see figure below).

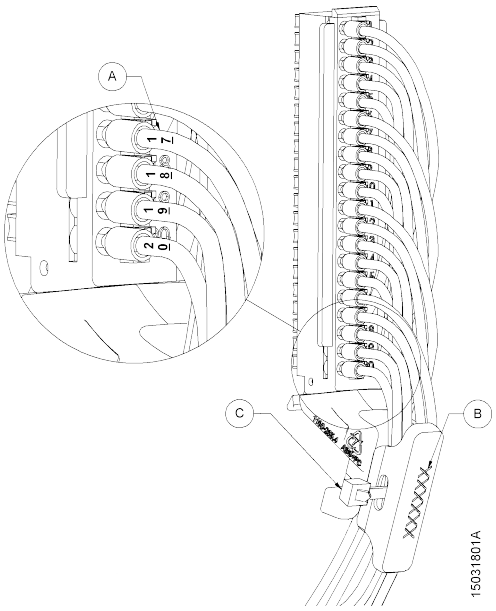


Figure 26: Cabling ID and Fixation

To identify the wiring:

- (A) Use numbered wiring or cables with numbered conductors
- (B) Use Conexel identifier WKM 8/30 (PN: 1631910000) for cable identification
- (C) Fix with plastic tie the identifier of the wires on the support (wire holder) located at the bottom of the connector

6.4.4.5. Cable removal

To remove the cables from the connector block it's recommended the use of a 3.5 mm wide screwdriver with isolated handle. It must be inserted in the lever beside the cable while the cable is pulled off.

7. Configuration

This module was developed to be used with NJ Line products. All Nexto System products are configured in Mastertool. All configuration data of a given module can be accessed through a double click in it on the Graphical Editor.

7.1. Process Data

Process Data, when available, are the variables that are used to access and control the module. The list below describes all variables delivered by NJ1001.

The process data of the module, when inserted in a PROFIBUS network, can be accessed through variables. The NJ1001 module has two bytes to access the input data.

Besides this data, NJ1001 also provides a set of variables containing information related to diagnostics which are also described in this document.

Variable	Size	Process Data	Description	Type	Update
%IB(n)	BYTE	Digital Inputs - Byte 0	Input value of channel 00 to 07	Input (Read)	Always
%IB(n+1)	BYTE	Digital Inputs - Byte 1	Input value of channel 10 to 17	Input (Read)	Always

Table 8: Process Data

Note:

Update: The field Update indicates if the respective process data is updated by CPU and NJ1001. When defined as Always, it means that the process data is always updated. When defined as Selectable, means that the user can select if the respective process data will be updated or not. All these process data are exchanged between CPU and NJ1001 through the bus, to improve CPU performance, it's recommended to update only the process data that will be used in the application.

7.2. Module Parameters

Name	Description	Options	Standard value
Input Filter Enable Mask	Enables or disables input filter feature per channel	False True	False
Input Filter Time Constant	Sets input filter time constant (ms)	2 - 255	7
%Q Start Address of Module Diagnostics Area	Defines the start address of the module diagnostics	-	-

Table 9: Module Parameters

Notes:

Input Filter Enable Mask: The field can be selected by the user to enable the input filter feature in a specific channel. If the input filter is enabled in a channel, the module will reject pulses smaller than the time configured in the Input Filter Time Constant.

Input Filter Time Constant: The field determines the time to apply in the filter and this parameter can be set from 2 to 255 ms.

8. Usage

8.1. General Purpose Input Read

NJ1001 has two variables to access its inputs (Digital Inputs - Byte 0 and Digital Inputs - Byte 1). Both variables have eight bits where each bit represents the physical input state of a given input channel. The relationship between each bit and its respective input can be found on the Bus I/O Mapping tab.

9. Maintenance

Altus recommends that all modules' connections should be checked and any dust or any kind of dirt located in the module's enclosure should be removed at least every 6 months.

This module offers important features to assist users during the maintenance: Status and Diagnostics Indicators, Web Page with Complete Status and Diagnostics List, and Diagnostics Mapped to Variables.

9.1. Status and Diagnostics Indicators

All I/O modules have a display with the following symbols: D, E, 0, 1 and numerical characters. The states of the symbols D, E, 0 and 1 are common for all this line of I/O modules. These states can be consulted in the table below.

9.1.1. D and E States

D	E	Description	Cause	Solution	Priority
Off	Off	Display failure or module off	- Module disconnected; - External power supply failure; - Hardware failure.	Check: - If the module is completely connected to the rack; - If the rack is powered by an external source; - If the module has external power.	-
On	Off	Normal use	-	-	9 (Lower)
Blinking 1x	Off	Active diagnostics	There is at least one active diagnostic related to the module.	Check what the active diagnostic is. More information can be found at section Diagnostics Through Variables.	8
Blinking 2x	Off	No I/O data update	- CPU in STOP mode; - Head/Remote in non-ACTIVE state.	Check: - If the CPU is in operation; - If the Fieldbus Master is in operation; - The integrity of the network between the MODBUS Client and the Head/Remote.	7
Blinking 3x	Off	Reserved	-	-	6
Blinking 4x	Off	Non-fatal fault	Failure in some hardware or software component, which does not have impact on the basic functionality of the product.	Check the module's diagnostic information. If it is a hardware failure, have the part replaced. If it's software, contact Technical Support.	5
Off	Blinking 2x	Loss of bus master	Loss of communication between: - The module and the CPU; - The module and the Head/Remote; - The Head/Remote and the Field Network Master.	Check: - If the module is completely connected to the rack; - If the CPU is in RUN mode; - If the Fieldbus Master is in operation; - Network integrity between PROFIBUS Master and Head/Remote.	4
Off	Blinking 3x	Module without calibration	- The module is not calibrated; - There was an error with the calibration value.	The module must return to the manufacturer.	3

D	E	Description	Cause	Solution	Priority
Off	Blinking 1x	Missing or parameterization error	The module isn't parameterized.	Check: - If the module parameterization is correct; - Network integrity between PROFIBUS Master and Head/Remote; - Network integrity between PROFINET Controller and Head/Remote.	2
Off	Blinking 4x	Fatal hardware fault	Hardware fault.	The module must return to the manufacturer.	1 (Higher)

Table 10: Status of Symbols D and E

Notes:

Field net master: There are different field net solutions, using different nomenclatures to refer to the net master. Examples: PROFIBUS Master, MODBUS Client, PROFINET Controller, etc.

Module without calibration: Only valid for modules that have calibration, typically analog modules. Modules that do not have calibration will never show such an indication through the symbols D and E.

9.1.2. 0, 1 and Numerical Characters

The meaning of the numerical characters can be different for specific modules. In case of digital input modules, the numerical characters represent its physical state as well. When the numerical character is on, the respective input is also on, and if the numerical character is off, the respective input is also off. The relationship between the input number and its respective numerical character can be found on the following figure.

The segments 0 and 1 are used to group the numerical characters used for the 16 inputs. The numerical characters that are placed at the right side of character 0 represent the inputs from 00 to 07, where character 0 is related to input 00 and character 7 is related to input 07. In the same way the numerical characters that are placed at the right side of character 1 represent the inputs from 10 to 17, where character 0 is related to input 10 and the character 7 is related to input 17. The figure below shows the relation between numerical characters and the respective inputs.

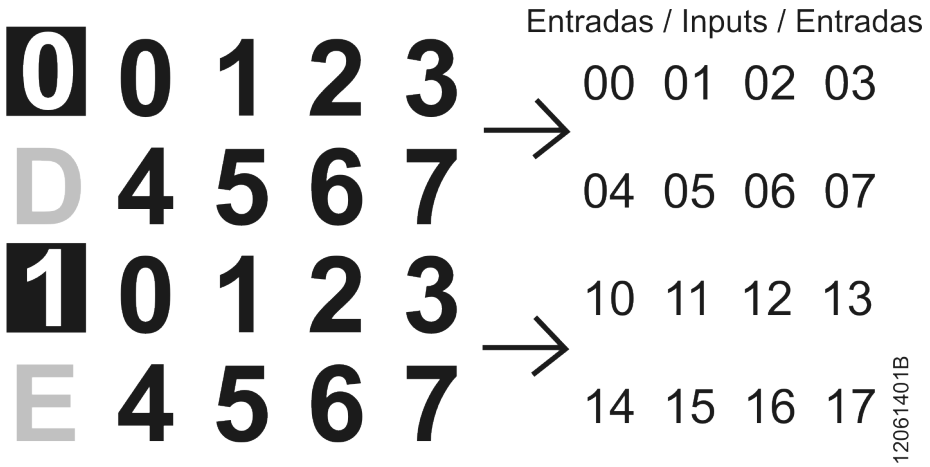


Figure 27: Display

9.2. Web Page with Complete Status and Diagnostics List

Another way to access diagnostics information is via web pages. The CPU's has an embedded web page server that provides all status and diagnostics information, which can be accessed using a simple browser.

More information about web page with complete status and diagnostics list can be found at User Manual of each respective CPU.

9.3. Diagnostics Through Variables

All diagnostics can be accessed through symbolic variables that can be handled by the user application or even forwarded to a supervisory system using a communication channel. The tables below show all available diagnostics and their respective symbolic variables, description and string that will be shown on the CPU graphical display and web.

9.3.1. General Diagnostics

Diagnostic Message	Symbolic Variable DG_NJ1001.tGeneral.*	Description	PROFIBUS Message Code
MODULE W/ DIAGNOSTIC	bActiveDiagnostics	TRUE – Module has active diagnostics	-
NO DIAG		FALSE – Module doesn't have active diagnostic	
MODULE W/ FATAL ERROR	bFatalError	TRUE – Fatal error	25
-		FALSE – No fatal error	
CONFIG. MISMATCH	bConfigMismatch	TRUE – Parameterization error	26
-		FALSE – Parameterization ok	
WATCHDOG ERROR	bWatchdogError	TRUE – Watchdog has been detected	27
-		FALSE – No watchdog	

Table 11: General Diagnostics

Note:

Symbolic Variable: Diagnostics are accessed through the symbolic variables listed in the table above. Mastertool declares them automatically, and all of them can be found in the diagnostics object.

10. Manuals

For further technical details, configuration, installation and programming, the table below should be consulted.

The table below is only a guide of some relevant documents that can be useful during the use, maintenance, and programming of this product.

Code	Description	Language
CE114000	Technical Characteristics of the NX and NJ Lines	English
CT114000	Características Técnicas das Linhas NX e NJ	Portuguese
MU299611	Mastertool X User Manual	English
MU299049	Manual de Utilização Mastertool X	Portuguese
MU299609	MasterTool IEC XE User Manual	English
MU299048	Manual de Utilização MasterTool IEC XE	Portuguese
MP399609	IEC 61131 Programming Manual	English
MP399048	Manual de Programação IEC 61131	Portuguese
MU214608	Nexto NX NX5110, NX5210 User Manual	English
MU214108	Manual de Utilização Nexto NX NX5110, NX5210	Portuguese

Table 12: Related Documents