1. Product Description

NX-ERA Series is a powerful and complete Programmable Logic Controller (PLC) with unique and innovative features. Due to its flexibility, smart design, enhanced diagnostics capabilities and modular architecture, NX-ERA 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 NX-ERA Series to be applied in small automation systems with high performance requirements, such as manufacturing applications and industrial machines.

The Series has a wide variety of CPUs, I/O and communication modules with features to fit requirements in different kinds of applications. The options available cover from standard automation systems, high-availability applications where redundancy is a major requirement, distributed applications to functional safety systems.

The NX5100 and NX5101 modules are devices of slave head type for MODBUS TCP networks, allowing the user to use all I/O modules of NX-ERA Series. Finally, NX-ERA Series has some innovative features for diagnostics and maintenance, such as Electronic Tag on Display, Easy Plug System and One Touch Diag.

Its main features are:

- MODBUS TCP protocol for communication of I/O data
- Ethernet interface 10/100 Mbps with auto crossover
- Integrated power supply
- Integrated Digital Inputs and Outputs (only in NX5101)
- Configurable IP Address through LCD or web page
- Ability to use up to 22 I/O modules in a single rack (only in NX5100)
- Support NX-ERA Series (NX) I/O modules
- Support NX-ERA Jet Series (NJ) I/O modules
- Support hot swap I/O modules (only in NX5100)
- Integrated web page for diagnostics, IP address configuration and firmware update
- Diagnostics and states of local operation via LEDs (only in NX5100)
- Diagnostics and states of local operation via display
- Diagnostics and states of remote operation via web page and MODBUS TCP protocol
- One Touch Diag
- Free of moving parts (fans, coolers, etc.)

2. Ordering Information

2.1. Included Items

The NX5100 product package contains the following items:

- NX5100 module
- 6-terminal connector

The NX5101 product package contains the following items:

- NX5101 module
- 12-terminal connector
- 18-terminal connector

2.2. Product Code

The following products must be purchased separately when necessary:

Code	Description
NX5100	MODBUS TCP Head
NX5101	MODBUS TCP Head without hot swap, with 14 digital inputs and 10 digital outputs

Table 1: Product Code

3. Related Products

The following products must be purchased separately when necessary:

Code	Description
NX9000	8-Slot Backplane Rack
NX9001	12-Slot Backplane Rack
NX9002	16-Slot Backplane Rack
NX9003	24-Slot Backplane Rack
NX9010	8-Slot Backplane Rack (No Hot Swap)
NX9020	2-Slot base for panel assembly
NX9404	6-terminal connector with fixing
NX9405	12-terminal connector with fixing
NX9406	18-terminal connector with fixing
NX9202	RJ45-RJ45 2 m Cable
NX9205	RJ45-RJ45 5 m Cable
NX9210	RJ45-RJ45 10 m Cable
MT8500	MasterTool IEC XE

Table 2: Related products

Notes:

NX9010: NX9010 rack model doesn't support IO module's hot swap. It neither supports double width modules, as NX2020.

NX9020: The NX9020 accessory is only compatible with the NX5101.

MT8500: MasterTool IEC XE is available in four different versions: LITE, BASIC, PROFESSIONAL and ADVANCED. For more details, please check MasterTool IEC XE User Manual – MU299609.

4. Innovative Features

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

One Touch Diag: One Touch Diag is an exclusive feature that NX-ERA Series brings to PLCs. With this new concept, the user can check diagnostic information of any module present in the system directly on CPU's graphic display with one single press in the diagnostic switch of the respective module. OTD is a powerful diagnostic tool that can be used offline (without supervisor or programmer), re- ducing maintenance and commissioning times.

ETD – Electronic Tag on Display: Another exclusive feature that NX-ERA Series brings to PLCs is the Electronic Tag on Display. This new functionality brings the process of checking the tag names of any I/O pin or module used in the system directly to the CPU's graphic display. Along with this information, the user can check the description, as well. This feature is extremely useful during maintenance and troubleshooting procedures.

DHW – Double Hardware Width: NX-ERA Series modules were designed to save space in user cabi- nets or machines. For this reason, NX-ERA Series delivers two different module widths: Double Width (two backplane rack slots are required) and Single Width (only one backplane rack slot is required). This concept allows the use of compact I/O modules with a high-density of I/O points along with complex modules, like CPUs, fieldbus masters and power supply modules.

iF Product Design Award 2012: NX-ERA Series was the winner of iF Product Design Award 2012 in industry + skilled trades group. This award is recognized internationally as a seal of quality and excellence, considered the Oscars of the design in Europe..

5. Product Features

5.1. General Features

	NX5100	NX5101
Backplane Rack Occupation	2 Sequential Positions	
One Touch Diag (OTD)		
Electronic Tag on Display (ETD)		
Status and diagnostic indication	Graphic display, LEDs, web pages, Head internal memory and MODBUS TCP protocol	
Hot Swap Support		
Maximum I/O modules	22	10
Isolation Logic to Earth Protection Logic to Ethernet interface Ethernet Interface to Earth Protection	 1750 Vdc / 1 minute (1250 Vac / 1 minute) 2000 Vdc / 1 minute (1500 Vac / 1 minute) 1750 Vdc / 1 minute (1250 Vac / 1 minute)	 2000 Vdc / 1 minute (1500 Vac / 1 minute) 2000 Vdc / 1 minute (1500 Vac / 1 minute) 2000 Vdc / 1 minute (1500 Vac / 1 minute)
Maximum Dissipation	4 W	
IP Level	IP 20	
Operating Temperature	0 to 60 °C	
Storage Temperature	-25 to 75 °C	
Operation and Storage Relative Humidity	5% to 96%, non-condensing	
Conformal Coating	✓	✓
Module dimensions (W x H x D)	36.00 x 114.63 x 115.30 mm	
Package dimensions (W x H x D)	44.00 x 122.00 x 147.00 mm	
Weight	350 g	
Weight with Package	400 g	

Table 3: General Features

Note:

Conformal Coating: Conformal coating protects the electronic components inside the product from moisture, dust and other harsh elements to electronic circuits.

5.2. Standards and Certifications

Standards and Certifications NX5100 / NX5101	
IEC	61131-2: Industrial-process measurement and control - Programmable controllers - Part 2: Equipment requirements and tests
	DNV Type Approval – DNV-CG-0339 (TAA000013D) (Except NX5101)
	2014/30/EU (EMC) 2014/35/EU (LVD) 2011/65/EU and 2015/863/EU (ROHS)
	S.I. 2016 No. 1091 (EMC) S.I. 2016 No. 1101 (Safety) S.I. 2012 No. 3032 (ROHS)
	UL/cUL Listed – UL 61010-1 UL 61010-2-201 (file E473496)
	TR 004/2011 (LVD) CU TR 020/2011 (EMC)

Table 4: Standards and Certifications

5.3. NET 1

	NX5100, NX5101
Connector	Shielded female RJ45
Auto crossover	Yes
Maximum cable length	100 m
Cable type	UTP or ScTP, category 5
Baud rate	10/100 Mbps
Physical layer	10/100 BASE-TX
Data link layer	LLC (logical link control)
Network layer	IP (internet protocol)
Transport layer	TCP (Transmission Control Protocol) UDP (User Datagram Protocol)
Application layer	MODBUS TCP Server HTTP Server
Diagnostics	LEDs – green (speed), yellow (link/activity)

Table 5: NET1 Features

5.4. Power Supply

	NX5100
Nominal Input Voltage	24 Vdc
Maximum Output Power	15W @ 60 °C 20W @ 50 °C
Maximum Output Current	3 A
Input Voltage	19.2 to 30 Vdc
Maximum Input Current (in-rush)	30 A
Maximum Input Current	1.4 A
Maximum input voltage interruption	10 ms @ 24 Vdc
Isolation Input to Output Input to Earth Protection ⏚ Input to Functional Earth ▬	 1500 Vdc / 1 minute (1000 Vac / 1 minute) 2000 Vdc / 1 minute (1500 Vac / 1 minute) 1500 Vdc / 1 minute (1000 Vac / 1 minute)
Wire Gauge	0.5 mm^2
Reverse polarity protection	Yes
Internal Resettable fuse	Yes
Short-circuit protection on the output	Yes
Over Current Protection	Yes

Table 6: Power Supply Features (NX5100)

Note:

Maximum output power: To use the extended maximum output power, some conditions must be respected: use of NX-ERA Jet I/O modules only; reduction of maximum operating temperature; do not perform a hot swap of I/O modules, at the risk of affecting the system operation; modules NJ6000, NJ6010 and NJ6100 need to have revision AB or greater.

	NX5101
Nominal Input Voltage	24 Vdc
Maximum Output Power	10 W
Maximum Output Current	2 A
Input Voltage	19.2 to 30 Vdc
Maximum Input Current (in-rush)	40 A
Maximum Input Current	1 A
Maximum input voltage interruption	1 ms @ 24 Vdc
Isolation Input to Output Input to Earth Protection ⏚	 1500 Vdc / 1 minute (1000 Vac / 1 minute) 1500 Vdc / 1 minute (1000 Vac / 1 minute()
Wire Gauge	0.5 mm^2
Reverse polarity protection	Yes
Internal Resettable fuse	No
Short-circuit protection on the output	No
Over Current Protection	No

Table 7: Power Supply Features (NX5101)

5.5. Digital Inputs

	NX5101
Input type	Type 1 sink
Inputs number	14
Connector configuration	I0, I1, I2, I3, I4, I5, I6, I7, I8, I9, I10, I11, I12 and I13
Input Voltage	24 Vdc 15 to 30 Vdc for logic level 1 0 to 5 Vdc for logic level 0
Input impedance	1.85 kΩ for I0 to I3 4.95 kΩ for I4 to I13
Maximum Input Current	6.2 mA @ 30 Vdc
Input status indication	Yes
Input update time	1 ms
Input filter	100 µs – by hardware 2 ms to 255 ms – by software
Isolation	
Input to Logic	2000 Vdc / 1 minute (1500 Vac / 1 minute)
Input to Outputs	1500 Vdc / 1 minute (1000 Vac / 1 minute)
Input to Ethernet	2000 Vdc / 1 minute (1500 Vac / 1 minute)
Inputs I0 for I3 to power supply	It has not
Inputs I4 for I13 to power supply	1500 Vdc / 1 minute (1000 Vac / 1 minute)
Input to protection Earth ⏚	1500 Vdc / 1 minute (1000 Vac / 1 minute)

Table 8: Digital Inputs Features

Note:

Input filter: Filter sampling is performed in the MainTask (or update function), so it is recommended to use multiple values of the task interval.

5.6. Transistor Digital Output

	NX5101
Outputs number	10
Connector configuration	Q0, Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8 and Q9
Maximum current	0.5 A @ 30 Vdc per output Q0 to Q3 2 A @ 30 Vdc total for Q0 to Q3
	1.5 A @ 30 Vdc per output Q4 to Q9 4 A @ 30 Vdc total for Q4 to Q9
Output type	Transistor source
Switching time	200 µs - transition off to on @ 30 Vdc 500 µs - transition on to off @ 30 Vdc
Maximum switching frequency	250 Hz
Status indication	Yes, can be seen at the product's standard screen
Protection	Yes, TVS diode at all transistored outputs.
Operation voltage	19.2 to 30 Vdc

	NX5101
Output impedance	700 mΩ for Q0 to Q3 500 mΩ for Q4 to Q9
Isolation Output to Logic Output to Inputs Output to Ethernet Outputs Q0 for Q3 to power supply Outputs Q4 for Q9 to power supply Output to protection Earth ⏚	 2000 Vdc / 1 minute (1500 Vac / 1 minute) 1500 Vdc / 1 minute (1000 Vac / 1 minute) 2000 Vdc / 1 minute (1500 Vac / 1 minute) It has not. 1500 Vdc / 1 minute (1000 Vac / 1 minute) 1500 Vdc / 1 minute (1000 Vac / 1 minute)

Table 9: Transistor Digital Output Features

Note:

Switching time: Time required to switch off an output, but it depends on the load. A load with low resistance results in a shorter switching time. The informed time refers to the maximum time required to deactivate an output connected to a resistive load of 12.5 kΩ witch is the maximum admissive resistance to digital input modules according to IEC 61131.

5.7. Diagnostics LEDs

MODBUS TCP head (NX5100) of NX-ERA Series have one LED to indicate diagnostics (DG LED) and one LED to indicate watchdog occurrence (WD LED). More information about diagnostics LEDs can be found at Diagnostics through LEDs section.

5.8. Graphic Display

The graphical display of the MODBUS TCP Head is an important tool for process control, as it is possible to recognize possible error conditions, presence of components or active diagnostics through it. In addition, it is through the graphic display that all diagnostics, including the I/O modules, are displayed to the user using the OTD - One Touch Diag functionality.

The image below describes all available fields on the graphic display's main screen, including their meanings.

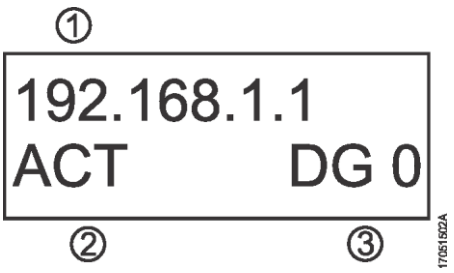


Figure 1: Graphic Display

Legend:

1. IP Address
2. Operational State (check the Operation States section for further information)
3. Active diagnostics quantity indication. In case the display shows a number is different from 0 (zero) there are active diagnostics. Those may be checked by the diagnostic button OTD or through other ways described in this document.

The graphic display can also be used to configure the IP Address of the MODBUS TCP Head. For further information about the IP configuration check the section Informative and configuration Menu.

5.9. I/O Capacity

A MODBUS TCP Head has its capacity limited by the following values:

- Used rack model
- Consumption of each I/O module

It's important to remember that MODBUS TCP Head doesn't support bus expansion.

5.10. Software Features

The NX-ERA Series brings to the user the MasterTool IEC XE, a powerful tool that provides a complete interface for programming of all modules of NX-ERA Series. This means that there is no need for other software to perform the configuration of the MODBUS TCP Head. All configurations are done in the same software used for programming the NX-ERA Series CPUs.

The MODBUS TCP Head's configuration is sent by MasterTool through the Ethernet network.

5.11. Compatibility with Other Products

The following table provides information regarding compatibility with other NX-ERA Series products.

NX5100		NX5101		Compatible Software Version
Version	Revision	Version	Revision	MasterTool IEC XE
1.0.0.5 or higher	AC or higher	-	-	3.03 to 3.05
1.7.17.0 or higher	AC or higher	-	-	3.10 or higher
1.8.11.0 or higher	AC or higher	1.7.40.0 or higher	AA or higher	3.18 or higher
1.9.12.0 or higher	AC or higher	1.9.12.0 or higher	AA or higher	3.30 or higher
1.12.18.0 or higher	AC or higher	1.12.18.0 or higher	AA or higher	3.51 or higher

Table 10: Compatibility with Other Products

Note:

Product Revision: If the firmware is updated at field, the product revision indicated on tag will no longer match the real product version.

6. Installation

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

6.1. Product Identification

Both products have some parts that must be observed before installation and use. The following figures identify each of these parts.

6.1.1. NX5100

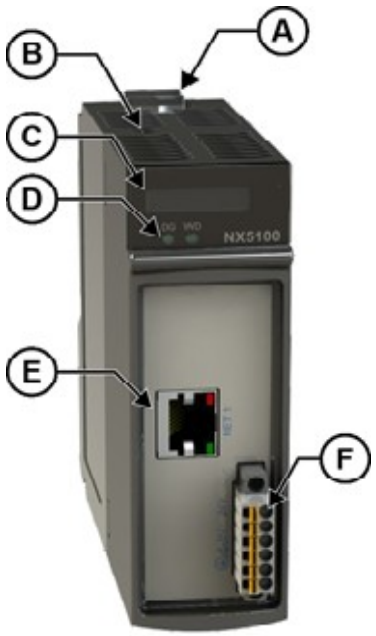


Figure 2: NX5100

Ⓐ Fixing lock.
Ⓑ Diagnostic switch.
Ⓒ Status and diagnostic display.
Ⓓ Diagnostic and watchdog LEDs.
Ⓔ RJ45 connector for Ethernet communication.
Ⓕ Connector for power supply.

6.1.2. NX5101

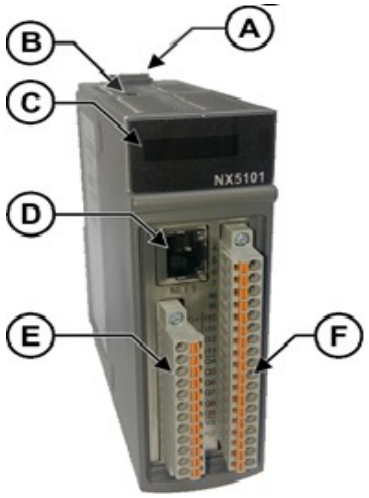


Figure 3: NX5101

Ⓐ Fixing lock.
Ⓑ Diagnostic switch.
Ⓒ Status and diagnostic display.
Ⓓ RJ45 connector for Ethernet communication.
Ⓔ Power supply connector, I/O and RS-485.
Ⓕ I/O connector.

The products have in their mechanics a label that identifies them 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 Assembly

The figures below show the NX5100 and NX5101 module's electrical diagram installed on a NX-ERA Series Rack. The connectors' disposition is merely illustrative in the figure.

6.2.1. NX5100

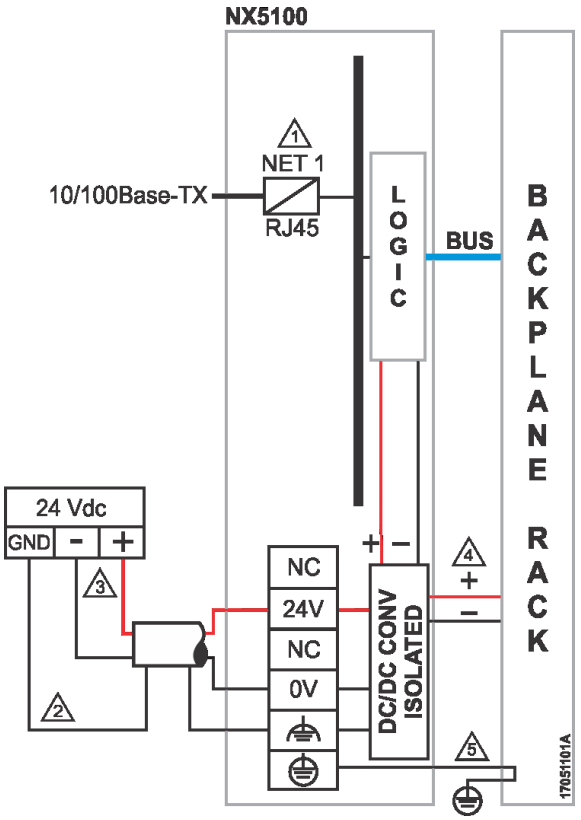


Figure 4: Electrical Diagram of the NX5100

Diagram Notes:

1 Standard Ethernet interface 10/100Base-TX.

2 Shielding from the external power supply connection can be connected to terminal ■. If the grounding of the external source is the same as that of the rack, connect the terminal ■ only to the terminal ⏚. Use 0.5 mm^2 cables.

3 The power supply is connected to the terminals 24 V and 0 V. Use 0.5 mm^2.

4 The module feeds the other modules of the NX-ERA Series through rack connection

5 The grounding of the module is done via the NX-ERA Series rack.

⏚ Protection earth terminal.

Functional earth terminal.

6.2.2. NX5101

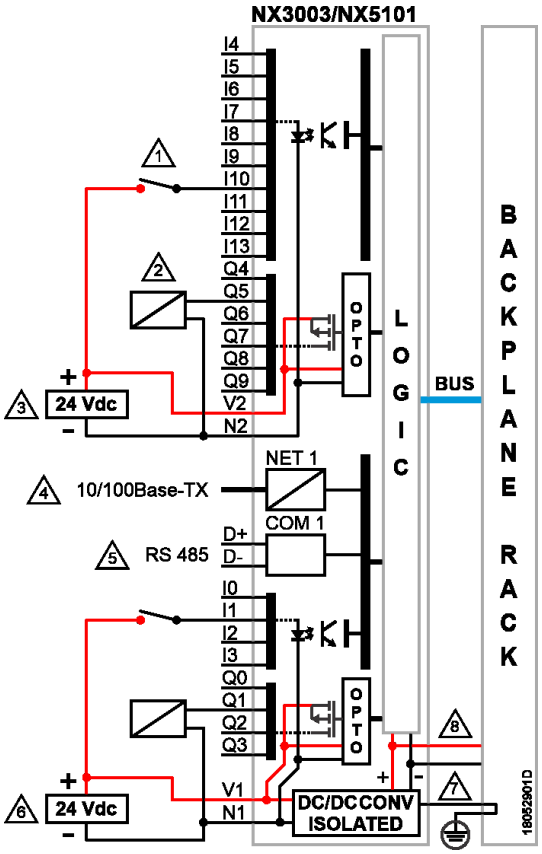


Figure 5: Electrical Diagram of the NX5101

Diagram Notes:

1. Typical usage of sink digital inputs, N2 is the 0 Vdc common to input I4 to I13.
2. Typical usage of source digital outputs.
3. External power supply to supply the outputs Q4 to Q9, V2 is connected to +24 Vdc and N2 is connected to 0 Vdc.
4. Ethernet 10/100Base-TX standard interface.
5. Serial RS-485 interface (available only on NX3003). D+ and D- pins
6. External power supply to supply the module and outputs Q0 to Q3, V1 is connected to +24 Vdc and N1 is connected to 0 Vdc. N1 is the common 0 Vdc input group I0 to I3.
7. The module is grounded through the NX-ERA Series backplane racks.
8. The module supplies the other modules through the connection to the backplane rack.

Protection earth terminal.

6.3. Connector Pinout

6.3.1. NX5101

The following table shows descriptions for each connector terminal:

Panel Identification	Description
D+	Pin D+
D-	Pin D-
I0	Input 00
I1	Input 01
I2	Input 02
I3	Input 03
Q0	Output 00
Q1	Output 01
Q2	Output 02
Q3	Output 03
V1	Power for Outputs 00 to 03
N1	Common for Inputs 00 to 03

Table 11: Connector pinout - 12 positions

Panel Identification	Description
4	Input 04
5	Input 05
6	Input 06
7	Input 07
I8	Input 08
I9	Input 09
I10	Input 10
I11	Input 11
I12	Input 12
I13	Input 13
Q4	Output 04
Q5	Output 05
Q6	Output 06
Q7	Output 07
Q8	Output 08
Q9	Output 09
V2	Power for Outputs 04 to 09
N2	Common for Inputs 04 to 13

Table 12: Connector pinout - 18 positions

6.4. Protection Circuit

For further information, consult the "Lightining Protection" section of the NX-ERA Series User Manual - MU214600.

ATTENTION

Atmospheric discharges (thunders) may cause damages to the product although its protections. Additional protections should be used if the product's power comes from a power supply located outside the panel where it is installed because it could be vulnerable to this kind of discharges. If the field wiring of the output points is susceptible to this kind of discharge, surge suppressors should be used.

6.5. Mechanical Assembly

Instructions on mechanical assembly and the procedures for inserting/removing modules in the rack are described in the NX-ERA Series User Manual - MU214600. The NX510X module must be installed in position 0 of the NX-ERA Series backplane.

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

NX-ERA Series 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.

6.6. Software Installation

Programming software installation instructions are described in MasterTool IEC XE Utilization Manual MU299609.

6.7. Physical Dimensions

6.7.1. NX5100

Dimensions in mm.

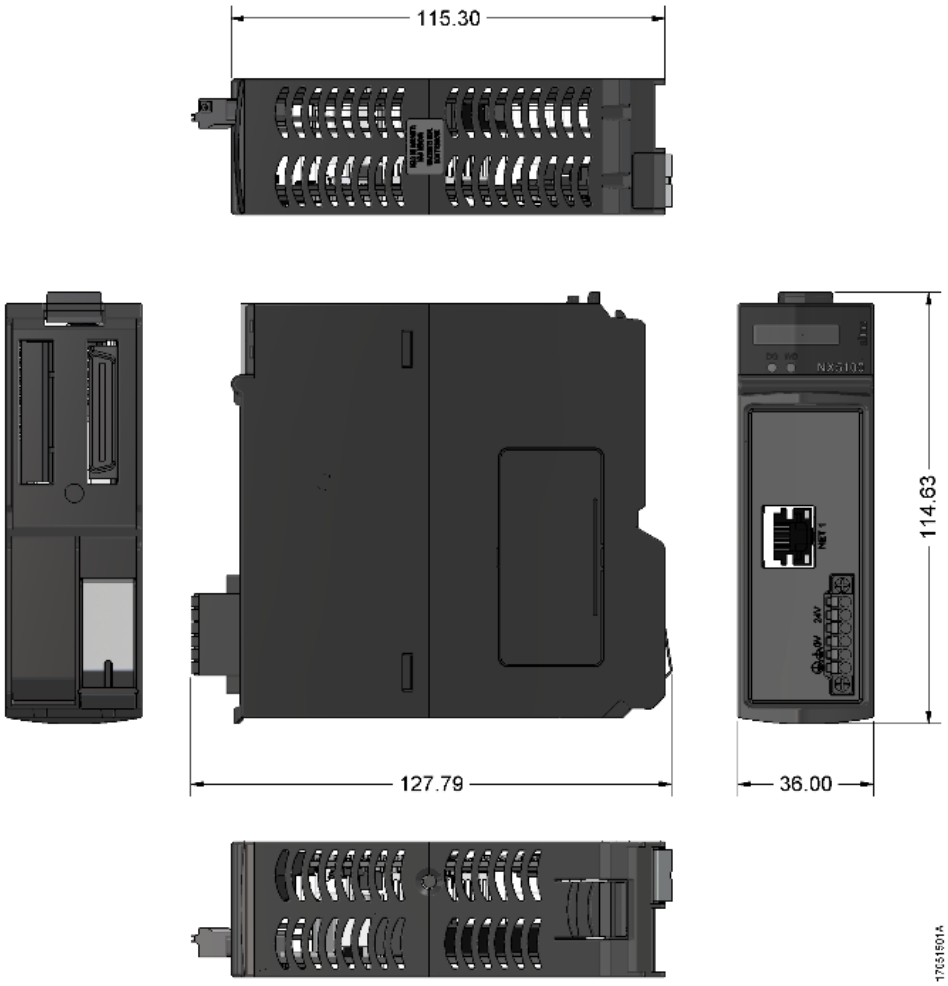


Figure 6: Physical Dimensions of the NX5100

6.7.2. NX5101

Dimensions in mm.

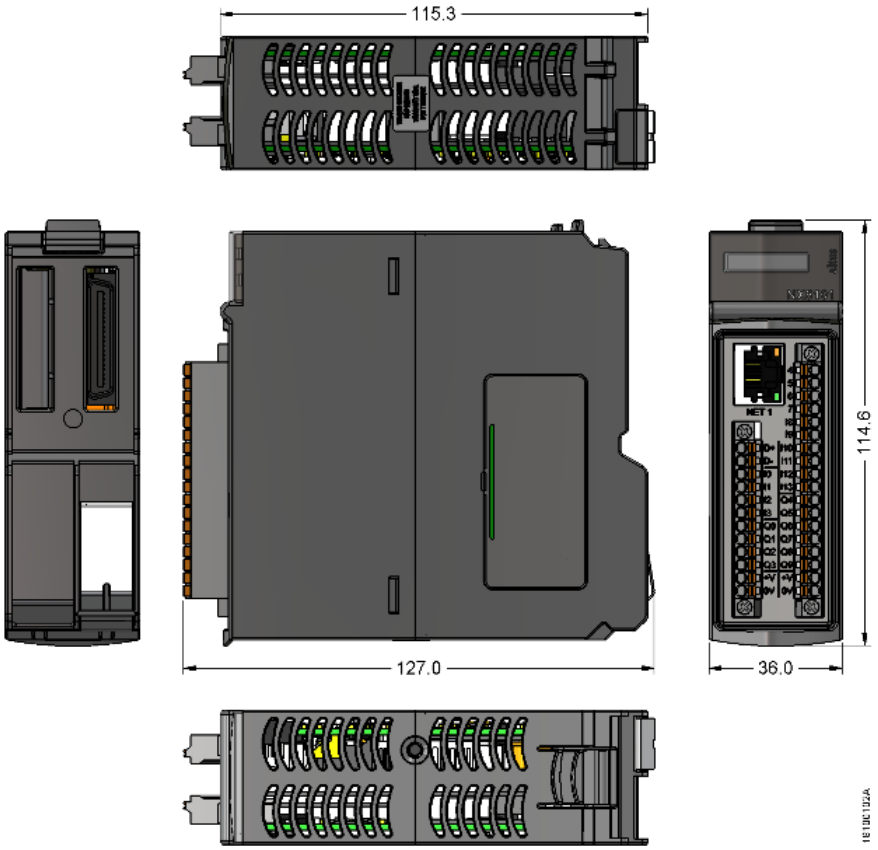


Figure 7: Physical Dimensions of the NX5101

7. Configuration

The configuration of the MODBUS TCP Head and its I/O modules is done by the tool MasterTool IEC XE. The network parameters of the head's Ethernet port can be either configured via web page or through the graphic display with the help of OTD button, located on the head's upside part. The procedure to configure the network parameters through the web page is described on Diagnostics through WEB section. Further configuration procedures are described on the following sections.

7.1. Informative and configuration Menu

The MODBUS TCP Head's Informative and Configuration Menu is accessed by a long touch on the diagnostic button from the initial status screen showed on the display. The information are organized through levels, and to access and edit a menu item it is enough to do a long touch, while a short touch allows to navigate through same level items.

The table below shows the menu levels and each item type:

Level 1	Level 2	Level 3	Type
HARDWARE	TEMPERATURE	-	Informative
	CONTRAST	CONTRAST LEVEL	Configurable
	INPUTS	STATUS OF DIGITAL INPUTS	Informative
	OUTPUTS	STATUS OF DIGITAL OUTPUTS	Informative
	BACK	-	Returns Level
LANGUAGES	ENGLISH	>ENGLISH	Configurable
	PORTUGUES	>PORTUGUES	Configurable
	ESPANOL	>ESPANOL	Configurable
	BACK	-	Returns Level
NETWORK	NET 1 IP ADDR.	IP ADDRESS	Configurable
	NET 1 MASK	MASK	Configurable
	NET 1 GATEWAY	GATEWAY	Configurable
	BACK	-	Returns Level
SOFTWARE	FIRMWARE	-	Informative
	BOOTLOADER		Informative
	BACK		Returns Level
BACK	-	-	Returns Level

Table 13: Information Menu and Configuration Levels

Note:

Temperature: The item "TEMPERATURE" is not available on the NX5101 head.

Inputs and Outputs: The hardware submenus "INPUTS" and "OUTPUTS" are only available on the NX5101 head that supports integrated I/O.

As described on the table above, among the available options for visualization and change, it is found the main required information for product utilization, like:

- Hardware resources information::
  - TEMPERATURE – MODBUS TCP Head internal temperature (Ex.: 36°C 97°F)
  - CONTRAST – MODBUS TCP Head frontal display contrast adjust
  - INPUTS – State of the inputs integrated in the NX5101 head
  - OUTPUTS – State of the outputs integrated in the head NX5101
- MODBUS TCP Head menu language changeP:
  - PORTUGUES – Change the language to Portuguese

- ENGLISH – Change the language to English
- ESPANOL – Change the language to Spanish

- Visualization and configuration of the device network information:
  - NET 1 IP ADDR. – IP Address (Ex.: 192.168.0.1)
  - NET 1 MASK – Network mask (Ex.: 255.255.255.0)
  - NET 1 GATEWAY – Gateway Address (Ex.: 192.168.0.100)
- Software versions information:
  - FIRMWARE – MODBUS Head software version (Ex.: 1.0.0.0)
  - BOOTLOADER – MODBUS Head Bootloader version (Ex.: 1.0.0.0)

The figure below describes an example of how to operate the MODBUS TCP Head's menu, performing the contrast adjustment procedure from the Status screen. Besides making the configuration easier, it's possible to identify the main levels and the touch time to navigate between them. The short touch shows that the contrast is being increased (brighter), and the next touch after the maximum value returns it to the minimum value (darker). The long touch confirms the desired contrast and returns to previous level.

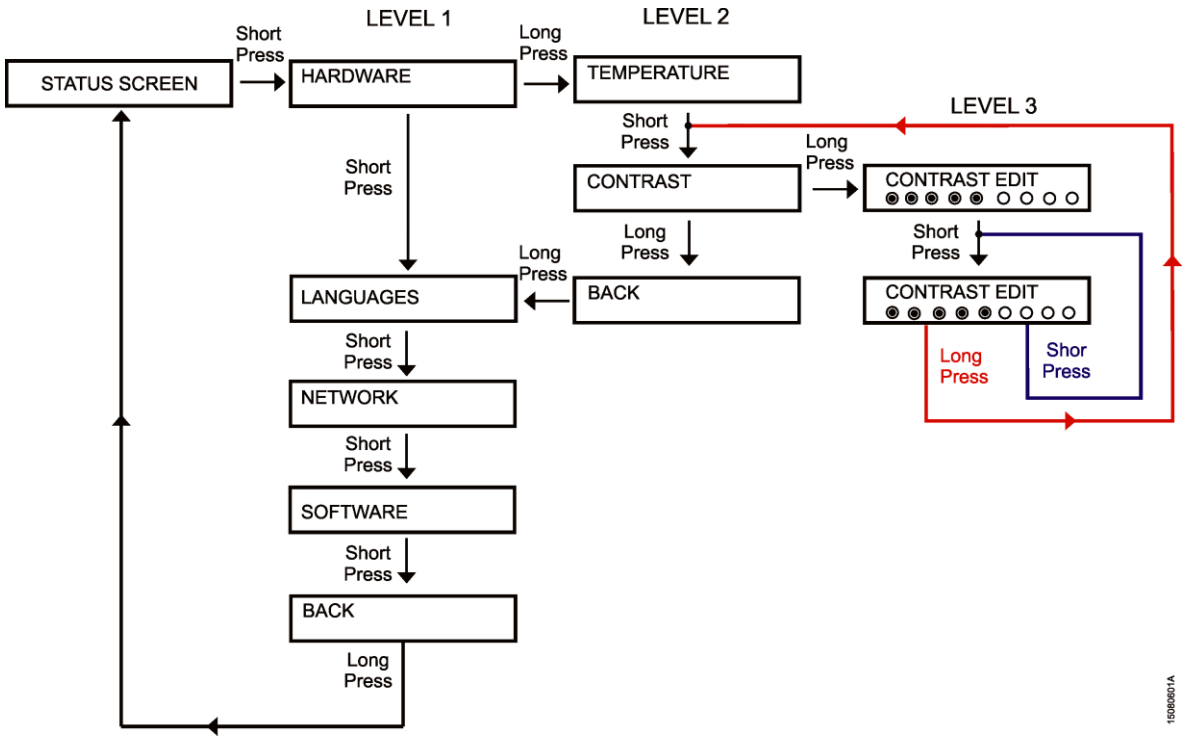


Figure 8: Example of menu operation on the NX5100

Additionally to finish the edition of MODBUS TCP Head's menu through a long press on the diagnostic button in level 1 BACK screen, there are either another exit conditions, which are described below:

- A short touch, at any moment, on the modules present at the bus, makes the head exit the menu and show the desired module diagnostics.
- Inactivity time, at any level, longer than 5s. (except monitoring the status of inputs and outputs)

7.2. Configuration Tool

The configuration tool MasterTool IEC XE, used to configure and program the NX-ERA Series CPUs, is also used to configure the MODBUS TCP Head. This section describes the Head configuration procedure, without repeating all information that is already on the MasterTool IEC XE utilization Manual - MU299609.

The MODBUS TCP Head configuration procedure starts by creating a new project (File > New Project...) or by opening a project created previously (File > Open Project...). When creating a new standard project, the project name and the path where its going to be stored will be asked:

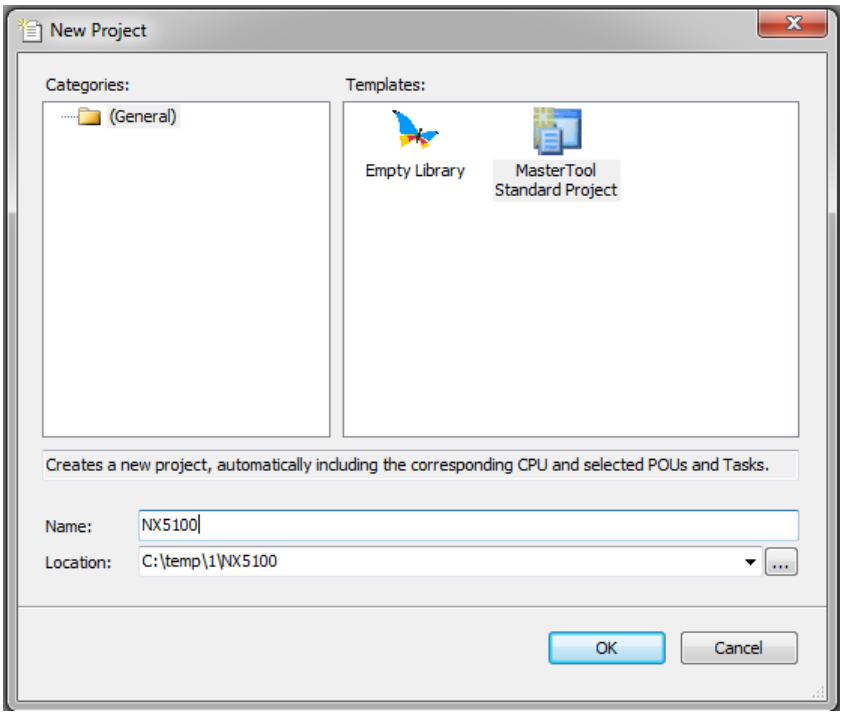


Figure 9: New Project

After confirming the information, the CPU/Head model for which the project is being developed, in this example it's the MODBUS TCP Head model NX5100, and also the rack model:

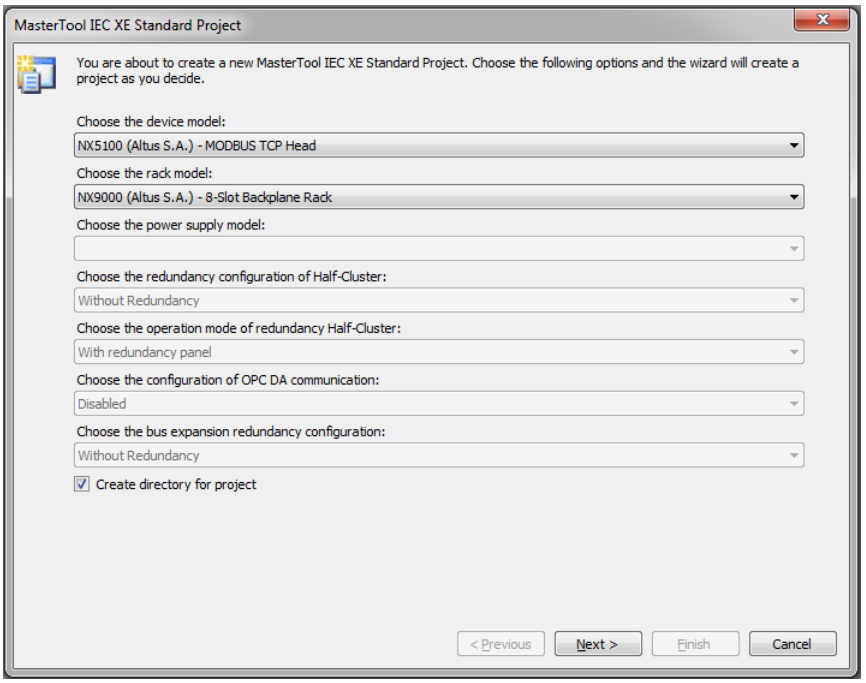


Figure 10: Device Model

On the next step the I/O modules type can be selected, NX-ERA (NX) or NX-ERA Jet (NJ), and the quantity of each type of I/O points' (digital input, digital output, Voltage/Current Input, etc...). The head doesn't support expansion racks, therefore the project is limited to a single rack. In this example we're going to define some I/O points during the project creation step, according to the following figure. After the conclusion of this step, the tool will create a project with the rack, the MODBUS head and the I/O modules according to the quantity of the selected points', according to the second figure.

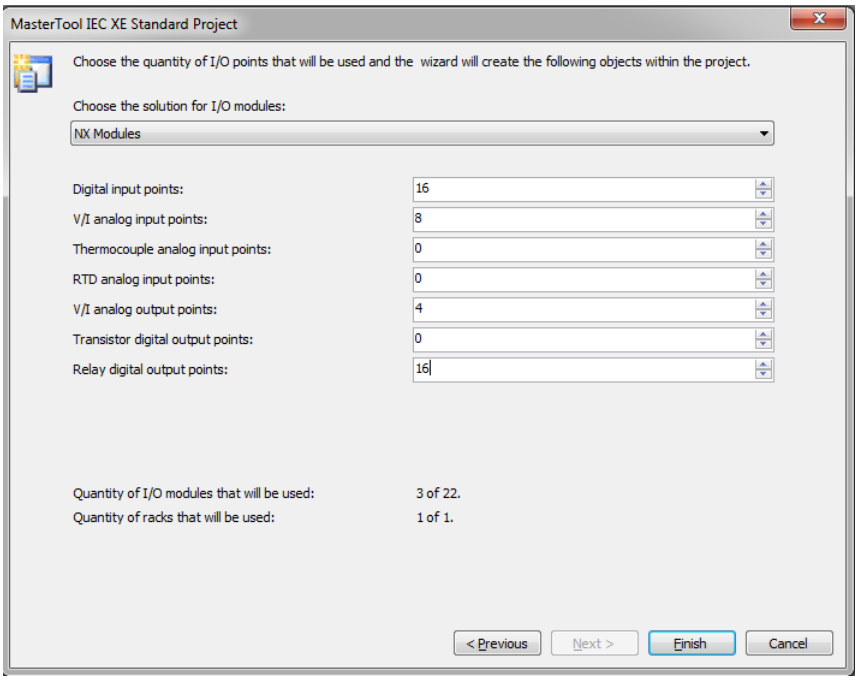


Figure 11: Solution for I/O Modules

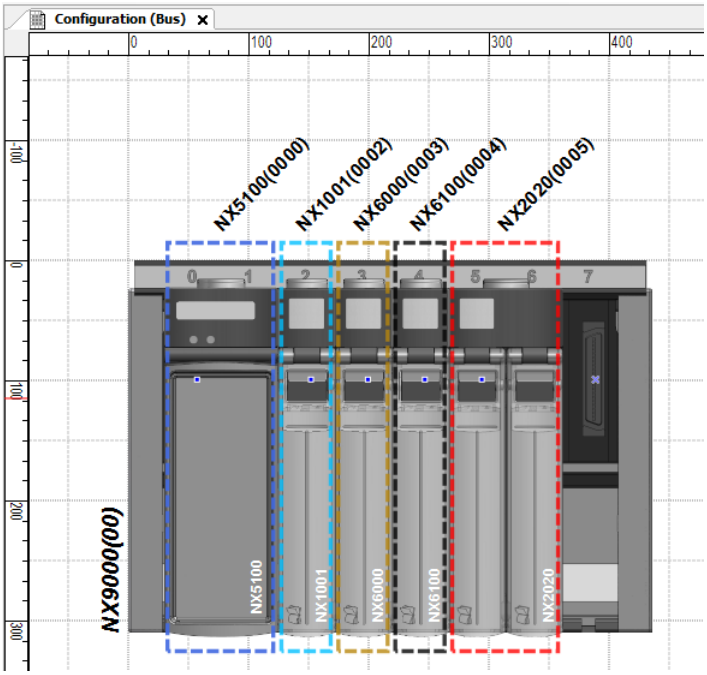


Figure 12: Configuration Bus

The "Add Modules" section of MU299609 can be consulted if is desired to insert more I/O modules on the Head bus after the project is already created. The procedure to be followed is the same as inserting I/O modules on the NX-ERA Series CPU's bus. It also is applicable to I/O modules parameters edition, the section "Module Parameters" of chapter "Editors" of MU299609 must be consulted.

After inserting the I/O modules on the bus, it is necessary to compile the project, to the project device structure be updated and to go on with the project configuration. After the compilation is finished, the GVLs and the MODBUS Symbol Server driver will be updated.

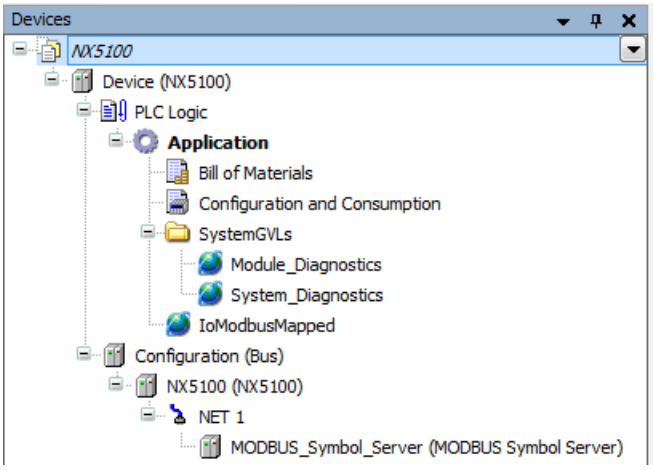


Figure 13: Devices Tree

A double click with the left mouse button over NX5100 components, on the device tree window, will open the Head parameters configuration tab, showing the following figure. On the second tab, the current consumption can be seen.

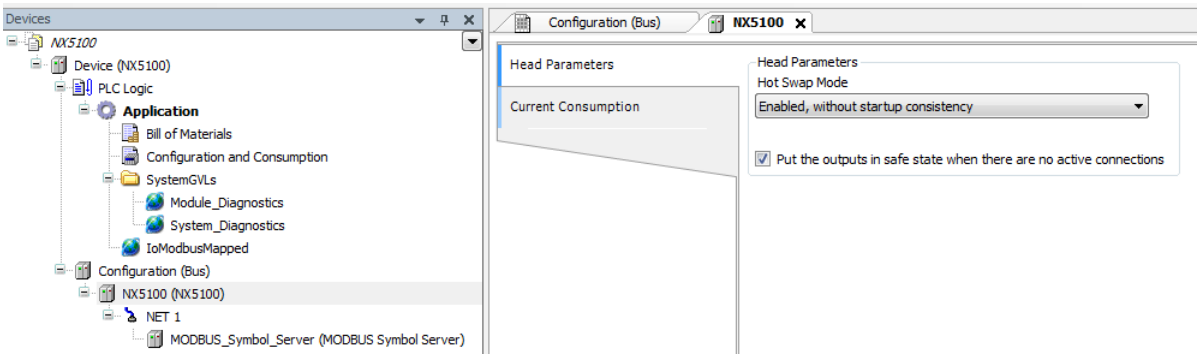


Figure 14: Parameters of the NX5100

The parameters related below are part of the Head configuration. Each item must be rightly reviewed by the user for the project correct working.

Configuration	Description	Factory Default	Possibilities
Hot Swap	Modules hot swap mode.	Enable, without start consistency.	Disable, for declared modules only Disabled Disabled, without consistency in the start Enable, with consistency in the start only for declared modules Enable, with consistency in the start Enabled, without consistency in the start
Outputs State	Set the outputs to safe state when there is no active connections.	Enable	Enable Disable

Table 14: Parameters of NX5100 Head

Configuration	Description	Factory Default	Possibilities
Hot Swap	I/O modules hot swap mode.	Disable, for declared modules only	Disable, for declared modules only Disabled Disabled, without consistency in the start
Outputs State	Set the outputs to safe state when there is no active connections.	Enable	Habilitado Desabilitado

Table 15: Parameters of NX5101 Head

The MODBUS TCP Head hot swap modes are the same supported by the NX-ERA Series CPUs. To working details, check
Hot Swap section on NX-ERA Series CPUs Utilization Manual - MU214605.

When enabled, the parameter that set the outputs to safe state when there is no active connections, will change the Head to STOP and turn off all digital and analog modules outputs when no MODBUS client is connected to it. This condition can be quickly detected by the Head when the client closes the connection or in a slower way when it detects communication time-out with the connected MODBUS clients. This communication time-out value can be changed by the user in MODBUS Symbol Server Advanced parameters.

The next adjustments to be done in Head configuration are about the MODBUS Symbol Server communication protocol inserted under the NET 1. Among the parameters are the TCP port address, connection mode (TCP or RTU over TCP), IP filter to data write/read and the two advanced parameters which define the task interval and the connection inactivity time-out. These general parameters are common to NX-ERA CPUs and their description can be found at section MODBUS Server Protocol General Parameters – Configuration via Symbolic Mapping of NX-ERA Series CPUs Utilization Manual - MU214605.

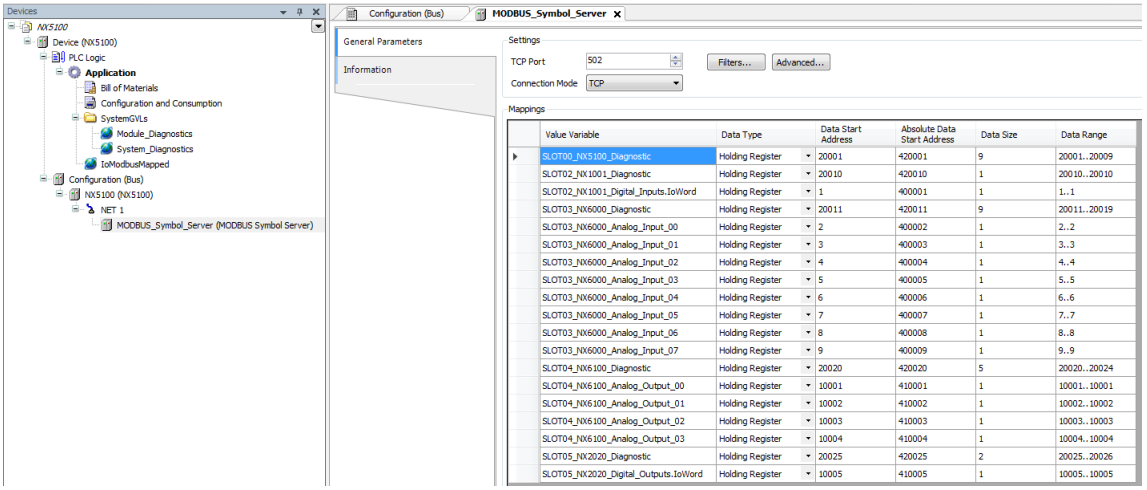


Figure 15: MODBUS Mapping

ATTENTION

The following TCP ports of Ethernet interface are used by another Head services and therefore, are reserved and must not being used by the user to configure the MODBUS TCP protocol: 80, 1217 and 11740.

MODBUS Server Head maximum protocol limits:

- Quantity of connections with clients = 64
- Quantity of simultaneous requests = 64

The MODBUS mappings showed on the previous figure can't be changed by the user. They are automatically generated by the MasterTool according to the declared modules, when the user compiles the project. Therefore every time the user add or remove an I/O module, the project must be compiled again to update the MODBUS mappings.

The MODBUS mappings must be used as reference by the user that will develop the MODBUS Client application, which will communicate with the Head. It might be observed that all data types (digital inputs, analog inputs, digital outputs, etc...) are mapped sequentially in MODBUS objects of Holding Register type:

- Inputs: from the Holding Register of address 1
- Outputs: from the Holding Register of address 10001
- Diagnostics: from the Holding Register of address 20001

By the fact that all Head mappings are always done in Holding Register type MODBUS objects, the Head supports only Holding Register reading/write MODBUS functions, according to the table presented below.

Function Code		MODBUS Function Description
DEC	HEX	
3	0x03	Holding Register Reading
6	0x06	Holding Register Writing
16	0x10	Multiple Holding Registers Writing
22	0x16	Holding Register Masked Writing
23	0x17	Multiple Holding Registers Reading/Writing

Table 16: Function Code

The order of the mappings follows the same order that the modules were declared on the bus, starting by the diagnostics, then the inputs and at last each module outputs (when they exists). Observe that the NX5100 Head only have mappings related to its diagnostics, while the NX5101 Head has three mappings, one for its diagnostics, one for its inputs and one for its outputs. A mixed module like NX1005 would have three mappings: its diagnostics (two Holding Registers), its inputs (one Holding Register) and its outputs (one Holding Register). Also, taking the NX1005 as example, it has only eight digital inputs and

eight digital outputs, being necessary only one input byte and one output byte, thus the most significant byte of each Holding Register is not used.

The NX5101 Head diagnostics format, stored in Holding Registers, can be checked at Diagnostics through MODBUS TCP protocol section. In the other hand, the modules diagnostics format follows each module's diagnostic structure pattern, the same used at the modules diagnostics GVL (Module_Diagnostics) of NX-ERA CPUs applications.

The last configuration to be done by the user, before compiling again and downloading the application to the Head, is the NET 1 Ethernet network parameters. They are IP Address, Subnetwork Mask and Gateway Address. It's not possible to use DHCP on the Head, because MasterTool use this IP address to establish communication and download the application.

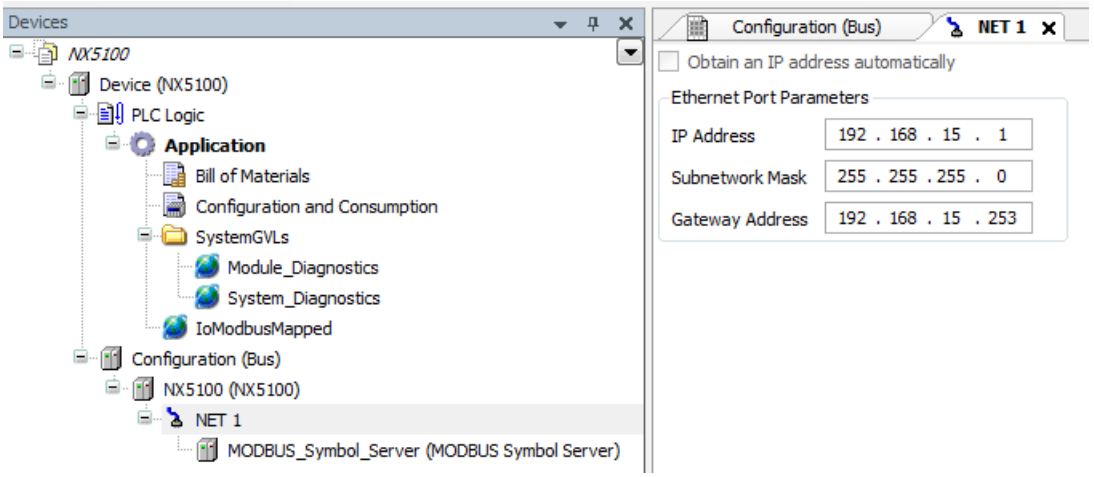


Figure 16: NET1 Configuration

IP Address parameter must be edited by the user with the same value configured on the device, because this parameter defines where MasterTool will download the application when asked for. Observe that the download procedure is slightly different from the one done on NX-ERA CPUs, where the user need to previously select a CPU, from the gateway list, to download the project. For the MODBUS TCP Head, the user don't need to configure any communication Gateway.

In case the user need to change Head's IP Address, it must be done through the web page first or through front display + OTD button, and then change the IP Address on the project to be downloaded. In case the user configures an IP address which doesn't match any device on the network, MasterTool won't be able to download the application and an error message will be shown.

After finishing the configuration, it will be need to compile again the project before downloading it, and this is done automatically by the MasterTool if the Login command is executed.

After the login, it is not possible to change its state from STOP to RUN (neither it's necessary), it will automatically go to RUN when a client connects to it. The user can also choose to download the source code of the project to the Head.

It is possible to keep logged in on the Head with MasterTool to watch the system diagnostics (NX5100 diagnostics) and of its I/O modules, as well as Input/output values. It is not allowed the write or forcing of values through MasterTool on the Head.

ATTENTION

In case of doubts about MasterTool IEC XE, MasterTool IEC XE utilization Manual (MU299609) must be consulted. In case of doubts about MODBUS TCP Head communication parameters or MODBUS Symbol Server communication driver, NX-ERA Series CPUs' Utilization Manual (MU214605) can be consulted.

7.3. Programming

Messung recommends the use of NX-ERA and Xtorm Series controllers to communicate with the NX510x MODBUS TCP Heads, due to programming an integration ease provided by MasterTool.

This section shows some programming details of NX-ERA Series CPU NX3030, used as a NX5100's MODBUS Client, configured on the previous section.

The first step is to create a GVL (NX5100_example) in CPU's project, based on the Head's MODBUS mapping, whose variables are declared on Head's IoModBusMapped GVL. The suggestion is to copy the content of hat GVL and paste it on the GVL created on CPU's project, to then do the following changes:

- Change the AT direct variables address from %Q to %M, which are linked to the I/O modules and Head diagnostics. Later these variables are going to be mapped CPU's Client MODBUS driver.
- Create a structured diagnostic variable to each module, repeating the same previous AT %M address. These variables of type structure will make easy to interpret and treat the diagnostics on CPU's application. It's necessary to duplicate the diagnostics, because MasterTool doesn't accept the mapping of structure types linked to Holding Register objects on MODBUS Client driver.
- Change the digital input and output modules value variables type to WORD. Each WORD variable can store up to 16 bits of digital data and as the NX1001 and NX2020 modules owns exactly 16 bits of data, one WORD variable is enough to access all their digital inputs or outputs. Later these variables will also be mapped on CPU's MODBUS Client driver.

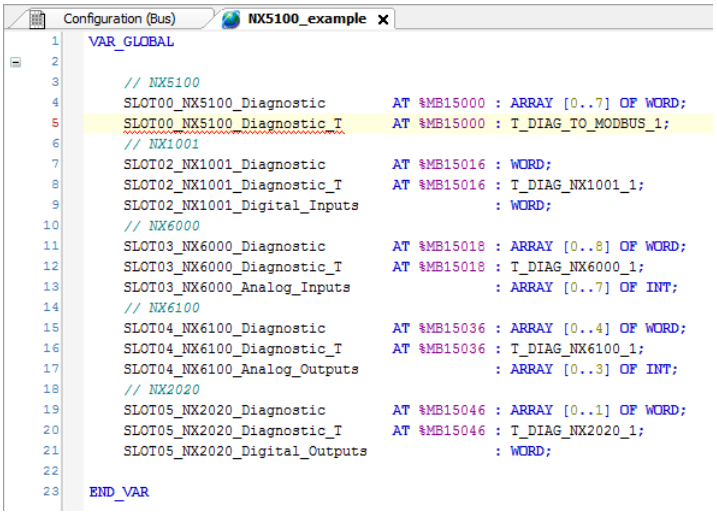


Figure 17: NX5100 Example

Observe that the diagnostic variable SLOT00_NX5100_Diagnostic_T created to NX51000 Head isn't of a known type to MasterTool. So as second step, it's needed to add the "NX5100 Diagnostic Structs" library to the project. The library version (1.0.0.1) might change according to MasterTool version.

The Head diagnostic structure mapped at MODBUS protocol can be consulted at section Diagnostics through MODBUS TCP protocol.

As third step it must be configured the MODBUS Server device (NX5100 Head), inserted under the CPU's MODBUS Client driver. There will be needed to map the diagnostic variables and Head's input and output value variables.

Define the inputs and diagnostics read and outputs write requests. As well as adjust the general parameters as Head's IP address, connection port, and simultaneous request maximum number and communication time-out.

On the following figures are present the mapping, request and general parameters to be adjusted.

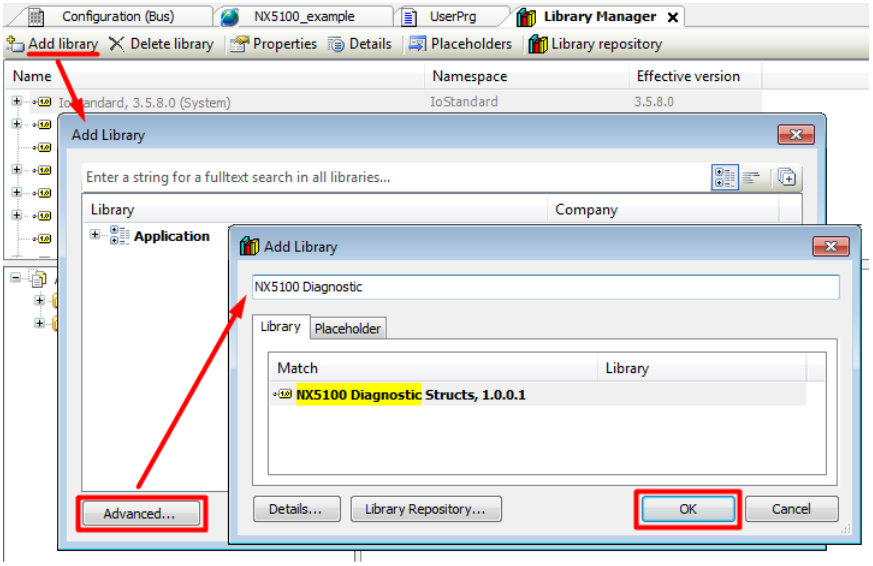
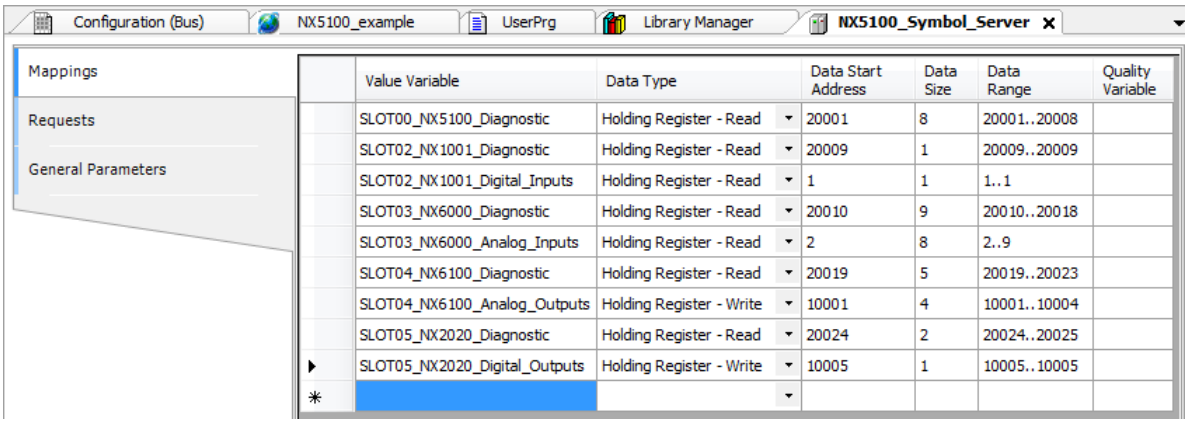


Figure 18: Adding Library to the Project

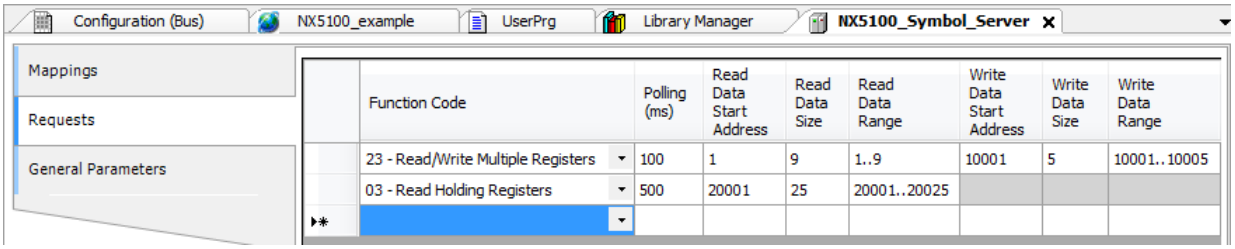
The NX5100 MODBUS Head mappings in the CPU's MODBUS Client are very similar to those created automatically by MasterTool in the Head's project, must being used the same initial addresses and total quantities. The diagnostics and input variables must be of read type (Holding Register - Read), while the output variables must be of write type (Holding Register - Write).



Value Variable	Data Type	Data Start Address	Data Size	Data Range	Quality Variable
SLOT00_NX5100_Diagnostic	Holding Register - Read	20001	8	20001..20008	
SLOT02_NX1001_Diagnostic	Holding Register - Read	20009	1	20009..20009	
SLOT02_NX1001_Digital_Inputs	Holding Register - Read	1	1	1..1	
SLOT03_NX6000_Diagnostic	Holding Register - Read	20010	9	20010..20018	
SLOT03_NX6000_Analog_Inputs	Holding Register - Read	2	8	2..9	
SLOT04_NX6100_Diagnostic	Holding Register - Read	20019	5	20019..20023	
SLOT04_NX6100_Analog_Outputs	Holding Register - Write	10001	4	10001..10004	
SLOT05_NX2020_Diagnostic	Holding Register - Read	20024	2	20024..20025	
SLOT05_NX2020_Digital_Outputs	Holding Register - Write	10005	1	10005..10005	

Figure 19: MODBUS Mappings

Using the MODBUS function 22, it can write the output registers and read the input registers with a single command, improving system performance. Such advantage is only possible, because both devices, Head and NX-ERA CPU, support MODBUS function 22. Observe that, Head and its modules diagnostics registers, obtained through MODBUS function 3, were configures to be updated in a lower frequency.



Function Code	Polling (ms)	Read Data Start Address	Read Data Size	Read Data Range	Write Data Start Address	Write Data Size	Write Data Range
23 - Read/Write Multiple Registers	100	1	9	1..9	10001	5	10001..10005
03 - Read Holding Registers	500	20001	25	20001..20025			

Figure 20: MODBUS Requests

To ensure that both MODBUS request are going to be executed by the MODBUS Client in the configured frequency (polling parameter), it's convenient to adjust the MODBUS Server device advanced parameter to the maximum value of two simultaneous requests.

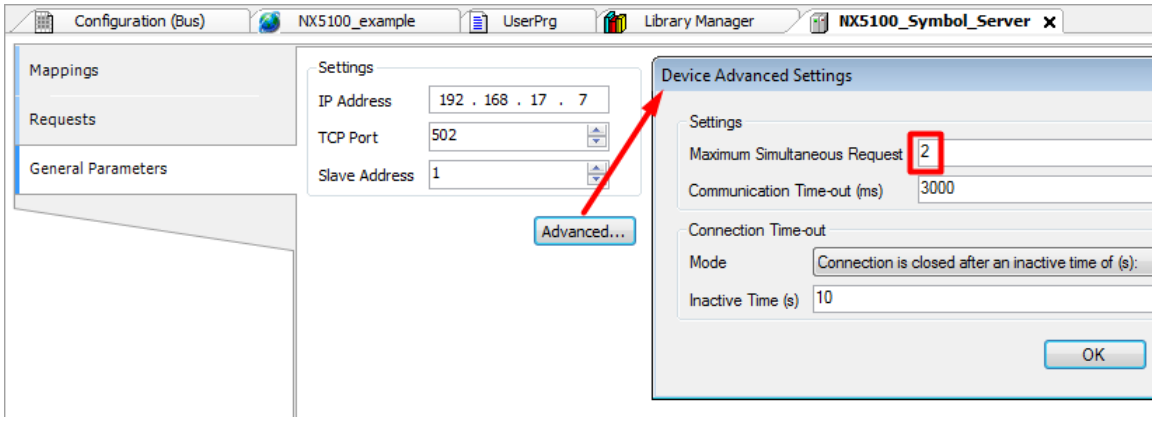


Figure 21: MODBUS General Parameters

After finished the configuration, the user just need to program the control logics according to its needs, based on the involved devices diagnostics structures, as shown below.

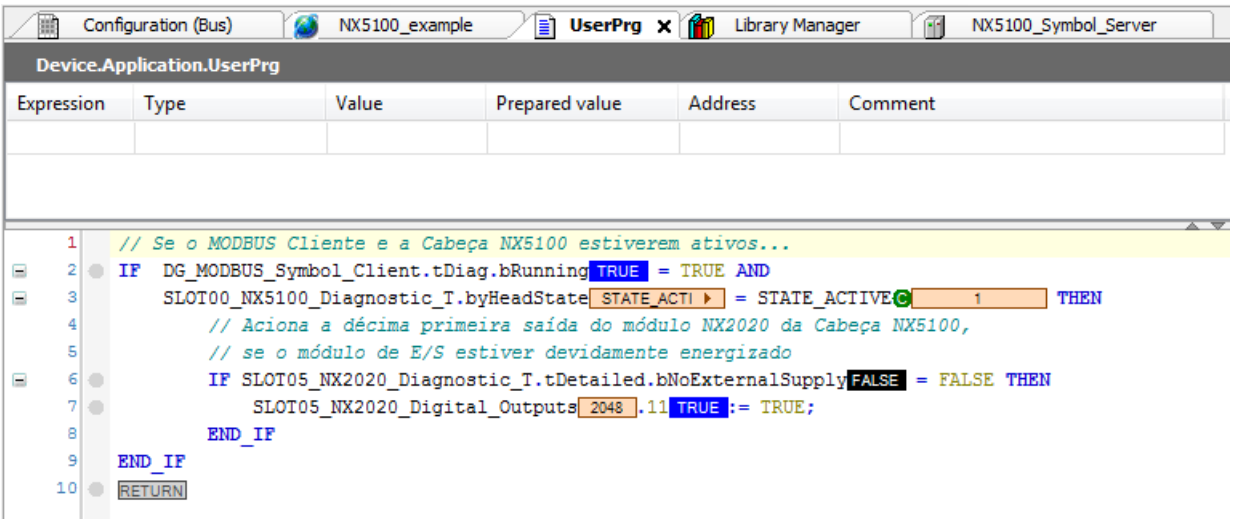


Figure 22: Control Logics

8. Maintenance

Messung recommends that all modules connections be checked and the dust and any kind of dirt located at the module's compartment be removed at least each 6 months.

The MODBUS TCP Head offers a series of features to help the user during the maintenance, according to the following descriptions.

8.1. One Touch Diag

The One Touch Diagnostics, or single touch, is an exclusive feature the NX-ERA Series brings for the programmable con- trollers. With this new concept the user can verify the diagnostics of any module connected to the system straight on the Head graphic display with a single touch on the module Diagnostic Switch. This is a powerful diagnostic tool which can be used off-line (with no need of supervisory or programming software) making easier to find and solve quickly possible problems.

The diagnostics key is placed on the Head upper part, in an easy access place and, besides giving active diagnostics, allows the access to the navigation menu, described in the Configuration section.

For further information about the OTD feature, NX-ERA Series Utilization Manual (MU214600) must be consulted.

8.2. Operation States

MOBUS TCP Head operation states are:

- **Off-Line (OFF):** In this state, the Head doesn't exchange data with the master, doesn't act on input and output devices and doesn't sweep the local I/O bus. Occurs since the moment in what the Head energized until communication establishment with master, or when there is no communication with the master.
- **Ativo (ACT):** In this state the Head exchanges data with the master, act on input and output devices and sweeps the local I/O bus. Can change to Offline state when lose communication with the master or to Error state when a failure is detected.
- **Erro (ERR):** In this state the Head doesn't update the I/O. The Head goes to this state when the hot swap is disabled and an inconsistency is found on the bus (missing modules, etc.), showing the occurred error through diagnostics. To move on from that state it's needed to reset the system (by power interruption or hot swap).
- **Not-Configured (NCF):** In this state the Head don't update the I/O. The Head only enter in this state when there is no configuration loaded in its memory. To move on from this state, it's needed to download a configuration on it through MasterTool.
- **WRONG SLOT**: In this state the head is not present on the bus, as configured in the project.

8.3. Diagnostics through LEDs

MODBUS TCP Head (Only NX5100) has one LED to diagnostic indication (DG LED) and one LED o watchdog indication (WD LED). The following tables explain each state of those LEDs.

8.3.1. DG (Diagnostic)

Green	Red	Description	Causes	Priority
On	Off	MODBUS Client connected and bus operational	Normal operation	4 (Lowest)
Blinking 2x	Off	MODBUS Client connected and some module with diagnostic	Some modules on the rack (including the head) have an active diagnostic	3
Off	On	MODBUS Client disconnected	There is no MODBUS client connected in the Head	2
Off	Blinking 1x	Configuration error or hardware rack error	Configuration/ Parameterization error. (check diagnostics)	1
Off	Blinking 4x	Installation or hardware error	Head inserted on the wrong slot. Rack or Head hardware failure	0 (Higher)
Off	Off	Without external power or head hardware error	External power fault. Head hardware failure.	-

Table 17: Diagnostic LED Status Description

8.4. WD (Watchdog)

Green	Red	Description	Causes	Priority
Off	Off	Without watchdog indication	Normal operation	2 (Lowest)
Off	Blinking 1x	Software watchdog	Internal software execution time overpassed 1s	1
Off	On	Hardware watchdog	Module damaged	0 (Higher)

Table 18: Watchdog LED Status Description

Note:

Software/hardware watchdog: To remove a watchdog indication it's necessary to reboot the device. In case that error occurs frequently, Messung technical support must be contacted.

8.5. Diagnostics through WEB

Besides the previously presented features, NX-ERA Series brings an innovative diagnostics and system operation states access tool, through WEB page. The utilization, besides dynamic, is much intuitive and eases the user operation. In other words, it can replace supervision systems usage when it is restricted to system status verification.

To access the MODBUS TCP Head WEB page, it's just need to use a common web browser (Internet Explores 7 or higher, Mozilla Firefox 3.0 or higher or Google Chrome 8 or higher) and type the Head IP address on the address bar (Ex.: http://192.168.15.1).

Initially, there will be presented the General Information tab which brings the MODBUS TCP Head's information.

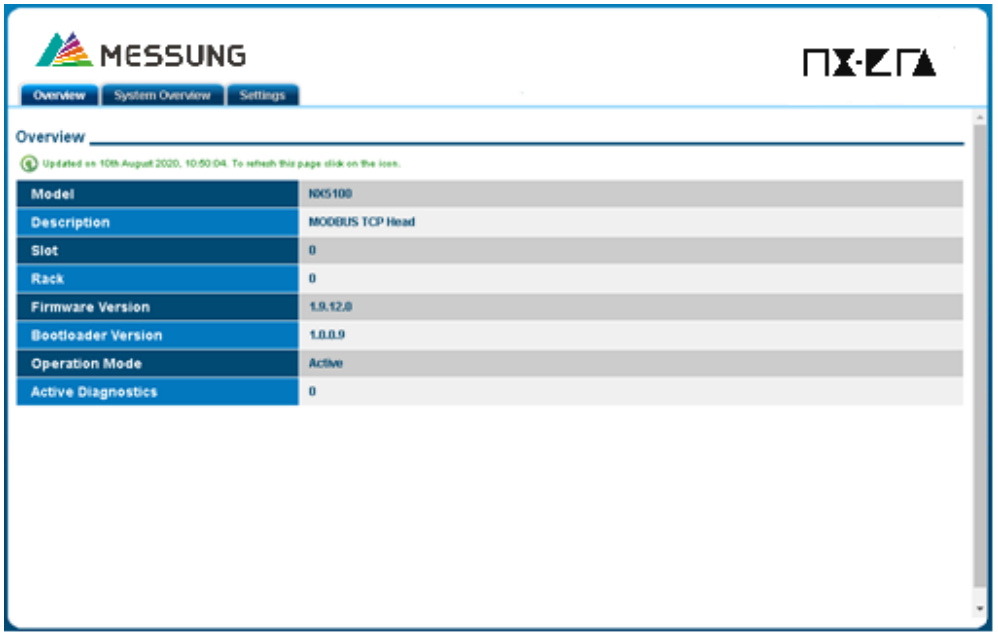


Figure 23: Overview via WEB

There is the System Overview tab, which can be visualized through Diagnostics or Status list. When to click on Diagnostics, in the same instant it is shown the MODBUS TCP Head active diagnostics.

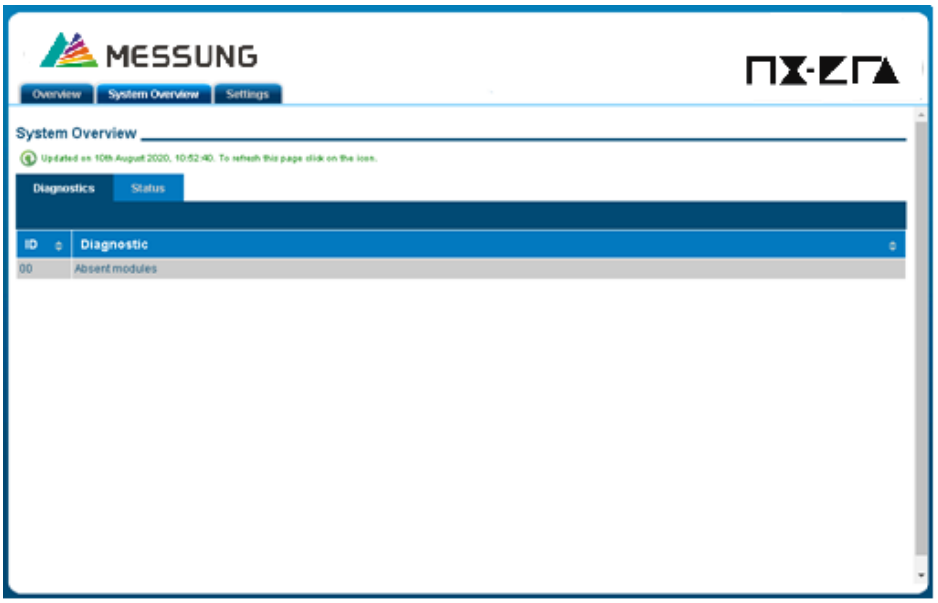


Figure 24: Diagnostics via WEB

In case the Status tab is selected, all detailed diagnostics states are shown on the screen.

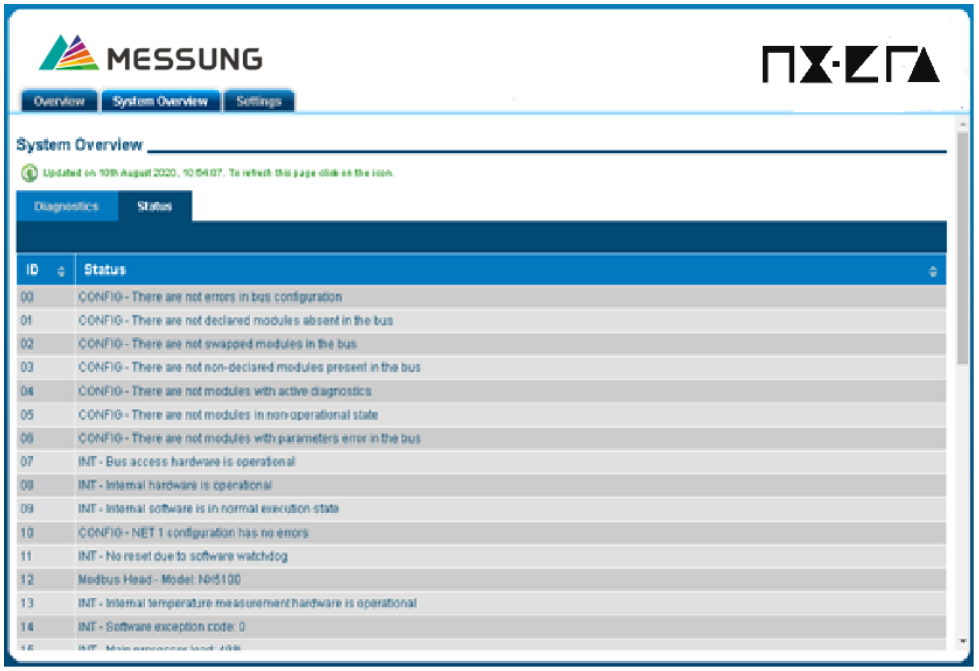


Figure 25: Status via WEB

Besides this, the user can chose between three language options: English. It's just need to select on the upper right menu the desired language.

Settings tab allows the user to configure the IP address, through the Network Configuration, where can be seen the actual configuration and a button to reset these parameters.

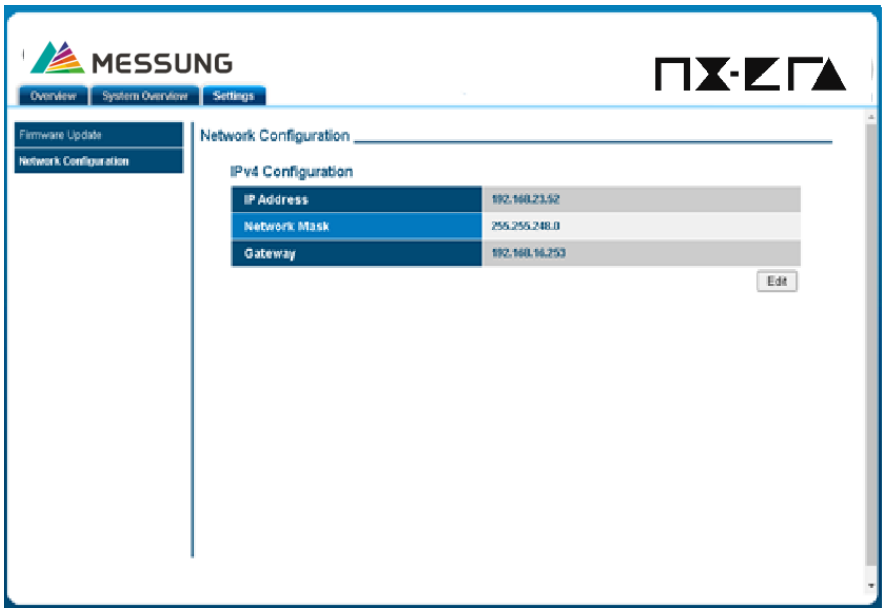


Figure 26: Network Configuration via WEB

The Firmware Update menu must only be used under Technical Support guidance.

8.6. Diagnostics through Variables

MODBUS TCP Head has a diagnostic structure, stored in internal memory variables, and accessible on fullness through MasterTool IEC XE, and partially available through MODBUS protocol to its clients.

The diagnostics stored in Head's internal memory are splitted in three structures:

> **ATTENTION**
>
> The name of the structure will depend on the model used. If a NX5100 is used, it starts with DG_NX5100. If using a NX5101, start with DG_NX5101.

In the structures shown below, it is being shown only from the NX5100.

- Summarized: DG_NX5100.tSummarized structure
- Detailed: DG_NX5100.tDetailed structure
- Mapped on MODBUS: DG_NX5100.tMappedToMODBUS structure

All three structures can be accessed and visualized through MasterTool IEC XE, while logged in the Head, but only the third structure is accessible to its Clients through MODBUS protocol. This diagnostics structure mapped on MODBUS, repeats the main summarized and detailed diagnostics of the Head and it is presented at the following section.

8.7. Diagnostics through MODBUS TCP protocol

The Head diagnostics mapped on MODBUS protocol, are available from address 20001 of Holding Register and they fill 9 sequential address at total, as shown on the following table.

Holding Register Addresses	Data Type	Symbolic Variable DG_NX5100. tMappedToMODBUS	Description
20001..20002	ARRAY[0..3] OF BYTE	abyFirmware_Version	Firmware Version
20003	T_DIAG_SUMMARIZED_ MODBUS_1	tSummarized	Summarized Diagnostics
20004	ENUM_APP_STATE	byAppState	Operation State
	EN_HOT_SWAP	byHotSwapAndStartupStatus	Hot Swap and Start Up state
20005..20006	DWORD	dwRackIoErrorStatus	I/O modules Errors
20007..20008	DWORD	dwModulePresenceStatus	Presence on bus of declared I/O modules
20009	ENUM_HEAD_STATE	byHeadState	Head State
	BYTE	ByReserved0	Reserved

Table 19: Head Diagnostics via MODBUS

Notes:

Firmware version: Heads Firmware Version. The first Holding Register stores bytes 0 and 1, while the second stores bytes 2 and 3 of the array. The byte 0 corresponds to the most significant version value. Example to firmware version 1.0.0.5:

Holding Register	Hexadecimal Value	Decimal Value
20001	0x0100	256
20002	0x0005	5

Table 20: Firmware Version Example

Summarized Diagnostics: The summarized diagnostics also can be visualized through Head's OTD.

HR's Bit	Diagnostic Message	Variable DG_Module.tSummarized.*	Description
0	HARDWARE FAILURE	bHardwareFailure	TRUE – Head's hardware failure.
			FALSE – Hardware working fine.
1	SOFTWARE EXCEPTION	bSoftwareException	TRUE – One or more exceptions generated by software.
			FALSE – No exception generated by software.
2	NET 1 CONFIG ERROR	bNET1ConfigError	TRUE – Some error occurred during or after configuring NET 1 Ethernet interface.
			FALSE – NET 1 interface's configuration is correct.
3	RUNTIME RESET	bRTSReset	TRUE – The Runtime was reset at least once. This diagnostic is clean on system reboot.
			FALSE – Runtime is working fine.

HR's Bit	Diagnostic Message	Variable DG_Module.tSummarized.*	Description
4	OTD SWITCH ERROR	bOTDSwitchError	TRUE – OTD switch got stuck for more than 20 seconds since the last power up.
			FALSE – OTD switch isn't nor was stuck.
5	DUPLICATED SLOT	bDuplicatedSlots	TRUE – There are some slot addresses duplicated.
			FALSE – There aren't duplicated slot addresses.
6	-	bReserved_14	Reserved.
7	-	bReserved_15	Reserved.
8	CONFIG MISMATCH	bConfigMismatch	TRUE – There are some configurations problems on the bus. As modules on the wrong position.
			FALSE – The bus is configured correctly.
9	ABSENT MODULES	bAbsentModules	TRUE – One or more declared modules are absent.
			FALSE – All declared modules are present.
10	SWAPED MODULES	bSwappedModules	TRUE – Two I/O modules are swapped between them on the bus.
			FALSE – There are no swapped modules.
11	NON DECLARED MODULES	bNonDeclaredModules	TRUE – One or more I/O modules, present on the bus, aren't declared at the project.
			FALSE – All present modules are declared.
12	MODULES WITH DIAGNOSTICS	bModulesWithDiagnostic	TRUE – One or more I/O modules present on the bus have active diagnostics.
			FALSE – There is no module with active diagnostic.
13	MODULES W/ FATAL ERROR	bModuleFatalError	TRUE – One or more I/O module, present on the bus, are in non functional state.
			FALSE – All present modules are functional.
14	MMODULES W/ PARAM. ERROR	bModuleParameterError	TRUE – One or more I/O modules have parameterization error.
			FALSE – All modules are parameterized.
15	RACK ERROR	bWHSBBusError	TRUE – Master indication that there is WHSB bus failure.
			FALSE – WHSB bus working fine.

Table 21: Summarized Diagnostics

Operation State: The operation state corresponds to the forth Holding Register (20004) most significant byte.

ENUM_APP_STATE	Enumerable	Description
1	RUN	Input and output modules being used.
3	STOP	Frozen inputs and outputs in safe state.

Table 22: Diagnosis Operating Status

Hot swap and starting state: Hot swap and starting state corresponds to the forth Holding Register (20004) less significant byte.

EN_HOT_SWAP	Enumerable	Description
00	INITIALIZING	Initializing, preparing to next state.
01	RESET_WATCHDOG	Not used.
02	ABSENT_MODULES_HOT_SWAP_ DISABLED	STOP state due to Absent Modules diagnostic activation, when hot swap is configured as disable or disable only to declared modules.
03	CFG_MISMATCH_HOT_SWAP_ DISABLED	STOP state due to Config Mismatch diagnostic activation, when hot swap is configured as disable or disable only to declared modules.
04	ABSENT_MODULES_HOT_SWAP_ STARTUP_CONSISTENCY	STOP state due to Absent Modules diagnostic activation, when hot swap is configured as enable with startup consistency or enable with startup consistency only to declared modules.
05	CFG_MISMATCH_HOT_SWAP_ STARTUP_CONSISTENCY	STOP state due to Config Mismatch diagnostic activation, when hot swap is configured as enable with startup consistency or enable with startup consistency only to declared modules.
06	APPL_STOP_ALLOWED_TO_RUN	STOP state and all consistency done with success. Enable to go to RUN when a MODBUS Client connects.
07	APPL_STOP_MODULES_NOT_READY	STOP state and all consistency done with success. But the I/O modules are not ready to system's start. Not enable to go to RUN.
08	APPL_STOP_MODULES_GETTING_ READY_TO_RUN	STOP state and all consistency done with success. But the I/O modules are being prepared to system's start. Not enable to go to RUN.
09	NORMAL_OPERATING_STATE	RUN state, in normal operation.
10	MODULE_CONSISTENCY_OK	Internal use.
11	APPL_STOP_DUE_TO_EXCEPTION	STOP state because an exception occurred.
12	DUPLICATED_SLOT_HOT_SWAP_ DISABLED	STOP state due to Duplicated Slot diagnostic activation, when hot swap is configured as disable or disable only to declared modules.
13	DUPLICATED_SLOT_HOT_SWAP_ STARTUP_CONSISTENCY	STOP state due to Duplicated Slot diagnostic activation, when hot swap is configured as enable with startup consistency or enable with startup consistency only to declared modules.
14	DUPLICATED_SLOT_HOT_SWAP_ ENABLED	STOP state due to Duplicated Slot diagnostic activation, when hot swap is configured as enable.
15	NON_DECLARED_MODULE_HOT_ SWAP_STARTUP_CONSISTENCY	STOP state due to Non Declared Modules diagnostic activation, when hot swap is configured as enable with startup consistency.
16	NON_DECLARED_MODULE_HOT_ SWAP_DISABLED	STOP state due to Non Declared Modules diagnostic activation, when hot swap is configured as disabled.

Table 23: Situation Codes That Stop Application

I/O modules Errors: Each DWORD bit corresponds to a rack position.

DWORD's bit 0 corresponds to sixth Holding Register (20006) bit 0 and to rack's position zero.

DWORD's bit 16 corresponds to fifth Holding Register (20005) bit 0 and to rack's position sixteen.

Each one of the bits is an OR logic operation result between Config Mismatch (bConfigMismatch), absent modules (bAbsentModules), swapped modules (bSwappedModules), modules with fatal error (bModuleFataError) and the respective position module operational state.

I/O modules declared on bus presence Each DWORD's bit corresponds to a rack position.

DWORD's bit 0 corresponds to eighth Holding Register (20008) bit 0 and to rack's position zero.

DWORD's bit 16 corresponds to seventh Holding Register (20005) bit 0 and to rack's position sixteen.

If the respective module is present, this bit will be TRUE. It's important to remark that this diagnostic is valid to all modules except to Heads an not declared I/O modules, that is, they bus presence is not present on their respective position (bit remains FALSE).

Head State: The Head state corresponds to the ninth Holding Register (20009) most significant byte.

ENUM_HEAD_STATE	Enumerable	Description
00	STATE_OFFLINE	SWithout MODBUS connections.
01	STATE_ACTIVE	In normal operation.
02	STATE_ERROR	Software exception or hot swap error.
03	STATE_NON_CONFIGURED	Without loaded project.

Table 24: Head Condition Diagnosis

Reserved: The ninth Holding Register (20009) less significant byte is reserved for future use.

9. 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	NX-ERA Series – Technical Characteristics	English
MU214600	NX-ERA Series User Manual	English
MU214605	NX-ERA Series CPUs User Manual	English
MU299609	MasterTool IEC XE User Manual	English
MP399609	MasterTool IEC XE Programming Manual	English

Table 25: Related Documents