Nexto PROFIBUS-DP Head User Manual

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Summary

1.Introduction

This manual aims to guide the user during products selecting stages for certain application, as well as at installation, programming and maintenance related to the product PROFIBUS-DP Head NX5x10, which is part of the Nexto Series of programmable controllers.

Nexto Series

Nexto Series is a powerful and complete series of Programmable Controllers (PLC) directed to satisfy the necessities of small and middle-sized applications, as well as high level applications. The series has many features and brings the best cost-benefit both for great process automations and machinery automations. Nexto Series is based in a modular system which allows flexibility between performance and cost.

Nexto Series architecture has a great variety of input and output modules. These modules combined with a powerful 32 bits processor and a high speed bus based on Ethernet, fit to several application kinds as high speed control for small machines, complex distributed processes, redundant applications and systems with a great number of I/O as building automation. Furthermore, Nexto Series has modules for motion control, communication modules encompassing the most popular field networks among other features.

Nexto Series uses an advanced technology in its bus, which is based on a high speed Ethernet interface, allowing input and output information and data to be shared between several controllers inside the same system. The system can be easily divided and distributed throughout the whole field, allowing the use of bus expansion with the same performance of a local module, turning possible the use of every module in the local frame or in the expansion frames with no restrictions. For interconnection between frames expansions a simple standard Ethernet cable is used.

Figure 1-1. Nexto Series - Overview

Innovative Features

Nexto Series brings to the user several innovations in utilization, supervision and system maintenance. These features were developed focusing a new experience in industrial automation. The list below shows some new features that users will find in the NX5110 and NX5210 modules:

One Touch Diag: One Touch Diag is an exclusive feature that Nexto Series brings to PLCs and PROFIBUS Heads. With this new concept, the user can check diagnostic information of any module present in the system directly on CPU's graphic display, or on the Head's 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), reducing maintenance and commissioning times.

ETD – Electronic Tag on Display: Another exclusive feature that Nexto Series brings to PLCs and Profibus Heads 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 graphic display from CPU or Profibus Head. 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: Nexto Series modules were designed to save space in user cabinets or machines. For this reason, Nexto 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, such as CPUs, fieldbus masters, fieldbus heads and power supply modules.

iF Product Design Award 2012: Nexto 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

PROFIBUS

Fieldbus networks usage as communication link between Central Processing Units of automation and field devices grow popular every day. Experience has shown that usage of network technologies brings many benefits to installation, configuration and maintenance of wirings in comparison with previous technology. In field networks, only one pair of wires is needed to transmit information, such as input or output data, parameters, diagnostics, programs or power for field devices.

Field networks have been used for quite some time, however the first ones were proprietary and incompatible with each other, with high costs for configuration or interfacing between equipments of different manufacturers. New networks offer open standards, which dismisses projects of complex interfaces. Open systems allow the end user to freely choose the best solution for his application between a wide range of products.

PROFIBUS is the leading fieldbus network in Europe, with great acceptance in the rest of the world. Its application areas include manufacturing, process control and building automation.

PROFIBUS is an open fieldbus, standardized in Europe as EN50170, and internationally recognized as IEC61158 e IEC61784. The most important world manufacturers of automation technology offer PROFIBUS interface for its devices.

NX5110 and NX5210

The PROFIBUS Fieldbus Heads NX5110 and NX5210 are modular slave type network devices of the Nexto Series. They enable the access of remote I/O modules through the PROFIBUS-DP fieldbus.

Both have the same physical features, differing only externally through the information in the front panel, and their information tags at the bottom.

The fundamental difference between the two heads is NX5210's capacity for head redundancy, which works together with the second NX5210 in the bus to increase availability.

Figure 1-2. NX5110 and NX5210 Modules

Redundancy

There are two types of redundancies that can be configured for NX5110 and NX5210 module:

- Network redundancy, only available for NX5210.
- Master redundancy

Network Redundancy

In redundant networks, each slave device has two redundant interfaces, NX5210, forming a double network, connected to two modules masters, NX5001.

Fieldbus network redundancy is a vital feature where high reliability is required. NX5001 network interface is the solution for this type of application, being used in pairs. In this type of redundancy, the slave device, by having two connections, chooses through which network it will receive and transmit its data. Examples of redundant devices are Altus' PROFIBUS network heads NX5210, PO5063V5 and PO5065.

Each pair of redundant heads controls a bus of Nexto or Ponto Series I/O modules, alternately. One of the redundant heads is communicating through the network (active) and the other one is in stand-by. The stand-by head can take control of the bus if there is a failure in the network of the active head or in its hardware. This change is automatic and transparent to users, keeping the system in operation in case of failure in one of the networks.

At the CPU that controls the network, the NX5001 interfaces manage incoming data from the network, so only the inputs from the active head are copied to the CPU's variables, while inputs of the stand-by head are ignored. The outputs are sent to the two heads (active and stand-by), but only the active head writes in the output modules.

The CPUs are informed through NX5001 interfaces which head is active on each network node, and if there is any defective device. In this type of network, hot reconfiguration is allowed, reconfiguring one network while the other remains in operation and vice-versa.

It should be noted that the network can continue operating normally when there are defects in some heads connected to PROFIBUS A network, as well as defects in other heads connected to PROFIBUS B network, as long as both heads from the same group of remote I/O have not failed. In this case, communication with the system of remote I/O is partly distributed between network A and network B.

Master Redundancy

Master redundancy is characterized by the existence of two PROFIBUS DP NX5001 masters on the same network, where one NX5001 acts as active master and the other as passive master.

PROFIBUS masters in active mode establish connection with the slaves. Its network operation status is OPERATE.

Enabled PROFIBUS masters in passive mode are used to test the PROFIBUS transmission and reception circuits, in order to avoid failures. Passive masters communicate only with active masters. Its operation state is STOP.

Further details regarding the master states can be found in the PROFIBUS Network Utilization - MU299026.

Regarding its configuration, both masters receive the same bus configuration and the PROFIBUS slaves' configuration.

The active network master has the address configured by the user in the MasterTool IEC XE programmer. The passive master connects to the network through another address. The passive master's address is active master's address subtracted by one. In case the active master's address is zero, the passive master's address will be set to 125.

The passive network master's address is transparent to the user, so there's no specific configuration needed. The NX5001 module calculates and takes this address when it becomes the PROFIBUS network passive master.

It's up to the Nexto Series CPU to define if the PROFIBUS DP NX5001 master acts as passive or active master.

For further details regarding the PROFIBUS DP NX5001 insertion in the series redundancy context, see Nexto Series CPU Utilization manual (MU214605), chapter Redundancy with NX3030 CPU.

Information for Purchase

Integral Items

The product package contains the following items:

- NX5110 or NX5210 module
- 6-terminal block with fixing
- Installation guide

Product Code

The following codes shall be used for product purchase:

Code	Description
NX5110	PROFIBUS-DP Head
NX5210	PROFIBUS-DP Redundant Head

Table 1-1. Module Names

Related Products

The following products must be acquired separately whenever necessary:

Code	Description
NX9010	08-Slot Backplane Rack (No Hot Swap)
NX9000	08-Slot Backplane Rack
NX9001	12-Slot Backplane Rack
NX9002	16-Slot Backplane Rack
NX9003	24-Slot Backplane Rack
NX3004	CPU with 1 Ethernet port, 1 serial channel, support for expansion bus and integrated power supply
NX3010	High speed CPU, 1 Ethernet port, 2 serial channels, memory card interface and support for bus expansion
NX3020	High speed CPU, 2 Ethernet ports, 2 serial channels, memory card interface and support for bus expansion
NX3030	High speed CPU, 2 Ethernet ports, 2 serial channels, memory card interface, support the expansion bus and support for redundancy
NX9404	6 Terminal Connector Fixation
AL-2601	PROFIBUS-DP Connector
AL-2602	PROFIBUS-DP Termination Connector
AL-2605	Terminator With Supply Diagnostic
AL-2303	PROFIBUS Network Cable A Type
AL-2431	Optical Repeater FOCOS/PROFIBUS
AL-2432	Optical Repeater FOCOS/PROFIBUS with Two Optical Ports
AL-2433	PROFISwitch – Coupler for Redundant Profibus Network
NX5001	PROFIBUS-DP Master Interface
PO4053	PROFIBUS-DP Master Interface
AL3406	PROFIBUS-DP Master Interface
MT8500	MasterTool IEC XE

Table 1-2. Related Products

Notes:

AL-2601: the connector for PROFIBUS-DP network is a connector type DB9 with standardized pinout according to EN 50170 and without termination. It is suitable for connection to PROFIBUS-DP devices mounted on intermediate positions in the PROFIBUS-DP network, i.e. physically not

mounted at the ends of the network. This connector has input and output connection of the cable network, enabling disconnection be done without disrupting the continuity of the physical network.

AL-2602: PROFIBUS-DP terminator connector is a connector type DB9 with standardized pinout according to EN 50170 and termination. It is suitable for connection to PROFIBUS-DP devices mounted on the ends of the physical network (beginning and end).

AL-2605: the terminator with diagnosis of font is used in the extremes of redundant networks, where is needed to make the exchange of devices without losing the endings.

AL-2303: cable for data communication on PROFIBUS-DP network.

AL-2431 e AL-2432: optical repeaters for interconnection between any PROFIBUS-DP equipment through optical fiber. The module AL-2432 has redundancy of optical transmission by adding increased availability to the system.

AL-2433: The AL-2433 adapter enables the interconnection between non-redundant PROFIBUS-DP slave devices in a redundant PROFIBUS-DP network with AL-3406, PO4053 or NX5001 masters.

NX5001: PROFIBUS-DP Master – Nexto Series.

PO4053: PROFIBUS-DP Master – Ponto Series.

AL3406: PROFIBUS-DP Master – AL Series.

MT8500: MasterTool IEC XE is available in four different versions: LITE, BASIC, PROFESSIONAL and ADVANCED. For more information, please consult the MasterTool IEC XE User Manual - MU299609.

Documents Related to this Manual

For additional information about Nexto Series, you can consult other documents (manuals and technical data) beyond this one. These documents are available in its last review on www.altus.com.br.

Each product has a document called Technical Characteristics (CE), with the list of features of the product in question. Additionally, the product may have User Manuals (manuals' codes are mentioned at CEs of each product).

It is recommended to consult the following documents as a source of additional information:

- Technical Characteristics of each product.
- Nexto Series User Manuals
- MasterTool Programming Manual for the Nexto Series
- PROFIBUS-DP Master NX5001 User Manual

Visual Inspection

Before installing the product, we recommend a careful visual inspection of equipment, checking if there is any damage caused by shipping. Make sure all components of your order are in perfect condition. In case of defects, inform the transportation company and the nearest Altus representative or distributor.

CAUTION:
Before removing modules from the package, it is important to discharge eventual static potentials accumulated in your body. Touch (with bare hands) a metallic grounded surface before handling the modules. Such procedure ensures that the levels of static electricity supported by the module will not be exceeded.

It is important to write down the serial number of each received item, as well as its software revisions, if any. This information will be necessary if you need to contact Altus Technical Support.

Technical Support

To contact Altus Technical Support in São Leopoldo, RS, call +55 51 3589-9500. To find the centers of Altus Technical Support in other locations, check our website (www.altus.com.br) or send an email to altus@altus.com.br.

If the equipment is already installed, please have the following information when requesting assistance:

- Models of equipment used and the configuration of installed system
- Serial number of the PROFIBUS-DP Head
- Equipment review and executive software version, listed on the label affixed to the product side
- Information about the Head's operation mode, obtained through MasterTool IEC XE programmer and graphical display from the Head
- Contents of the application program, obtained through MasterTool IEC XE programmer
- Version of the programmer used

Warning Messages Used in this Manual

In this manual, warning messages will present the following formats and meanings:

DANGER:
Relates potential causes that, if not noted, *will generate* damages to physical integrity and health, property, environment and production loss.

CAUTION:
Relates configuration details, application and installation that *must* be followed to avoid conditions that could lead to system failure, and its related consequences.

ATTENTION:
Indicate important details of configuration, application or installation to obtain the maximum operation performance from the system.

2. Technical Description

Features

General Features

	NX5110	NX5210
Module Type	PROFIBUS-DP Fieldbus Head	PROFIBUS-DP Fieldbus Redundant Head
Communication Protocol	PROFIBUS-DP, standard EN 50170	
Sync/Freeze Support	Yes	
Backplane Rack Occupation	2 Sequential Positions	
Maximum Number of Modules	22	20
Input Capacity	240 input bytes	238 data bytes + 2 bytes regarding the head status
Output Capacity	240 data bytes	238 data bytes + 2 bytes of User Commands
Baud rate	Automatic Baud rate detection from 9,6 to 12.000 Kbit/s	
Ethernet Port Baud Rate	10/100 Mbps	
Status and Diagnostics Indication	Display, web page and LEDs	
Network Redundancy Support	No	Yes
GSD File	ALT_0EDD.GSD ALNJ0EDD.GSD	ALT_0EDE.GSD
Hot Swap Support	Yes	
One Touch Diag (OTD)	Yes	
Electronic Tag on Display (ETD)	Yes	
Attended Standards	- PROFIBUS European norm EN 50170 - IEC 61131-2:2003, chapters 8 and 11 - CE, Electromagnetic compatibility directives (EMC) and Low Voltage Devices directive (LVD). CE RoHS See general features of the series.	
Isolation		
PROFIBUS Interface to Logic	1000 Vac / 1 minute	
PROFIBUS Interface to Earth Protection ⏚	1000 Vac / 1 minute	
Logic to Earth Protection ⏚	1250 Vac / 1 minute	
Input Voltage	19,2 a 30 Vdc	
Max Input Current (in-rush)	30 A	
Max Input Current	1.4 A	
Max Current Provided to the Bus	3 A	
Dissipation	5 W	
IP Level	IP 20	
Operating Temperature	0 a 60 °C	
Storage Temperature	-25 a 75 °C	
Operation and Storage Relative Humidity	5 a 96 %, non-condensing	
Conformal Coating	Yes	
Standards	IEC 61131-2	
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	200 g	

Weight with Package	250 g

Table 2-1. General Features

Notes:

Maximum Number of Modules: The maximum number of modules is related to greater backplane rack available in Series Nexto, with 24 positions, two positions are occupied by the NX5110 module, allowing the use of a maximum of 22 modules, in this backplane, or 20 modules if used a redundant system with two NX5210. There are still other limits that are to be taken into consideration, such as the consumption of each I/O module and also the number of bytes of input and output that each module has. In this way, this limit may be reduced in the light of these other requirements.

Input Capacity: Each PROFIBUS-DP remote's ability to convey the master module the limit of 240 bytes of input, thus it is necessary to consult section Nexto Bus Limits to check the number of bytes of each module entry consumes. For example, the HSC NX1001 module (module NX1001 counter mode enabled) has 16 bytes of input.

Output Capacity: Each PROFIBUS-DP remote has the ability to receive the master module the limit of 240 bytes of output, thus it is necessary to consult section Nexto Bus Limits to check the number of bytes of each module output consumes. For example, the HSC NX1001 module (module NX1001 counter modes enabled) has 11 bytes of output.

Baud rate: The baud rate is detected in the following communication speeds: 9.6 Kbits/s, 19.2 Kbit/s, 93.75 Kbit/s, 187.5 Kbit/s, 500 Kbit/s, 1500, 3000 Kbit/s Kbit/s Kbit/s 6000 and 12000 Kbit/s.

Network redundancy support: This implementation is described in the Redundant Network section.

Isolation: In order to identify the different circuits and component sets that have isolation on the product, the term logic is the name given the internal interfaces as memories, and interfaces with the rack.

Max Current Provided to the Bus: The modules NX5110 and NX5210 have an integrated power supply that can provide to the bus 3 A of current to power the I/O modules.

Conformal Coating: The coating of electronic circuitry protects the internal parts of the product against humidity, dust and other harsh elements to electronic circuits.

ATENTION: NX5110 and NX5210 modules don’t have network terminations, therefore external terminator modules are necessary.

Power Supply

	NX5110, NX5210
Nominal Input Voltage	24 Vdc
Maximum Output Power	15 W
Maximum Output Current	3 A
Input Voltage	19.2 to 30 Vdc
Maximum Input Current	30 A
Maximum input voltage interruption	10 ms
Isolation	
Input to Output	1000 Vac / 1 minute
Input to Earth Protection	1500 Vac / 1 minute
Input to Functional Earth	1500 Vac / 1 minute
Wire Gauge	0.5 mm²
Reverse polarity protection	Yes
Internal Resettable fuse	Yes
Short-circuit protection on the output	Yes
Over Current Protection	Yes

Table 2-2. Power Supply features

Physical Dimensions

Dimensions in mm.

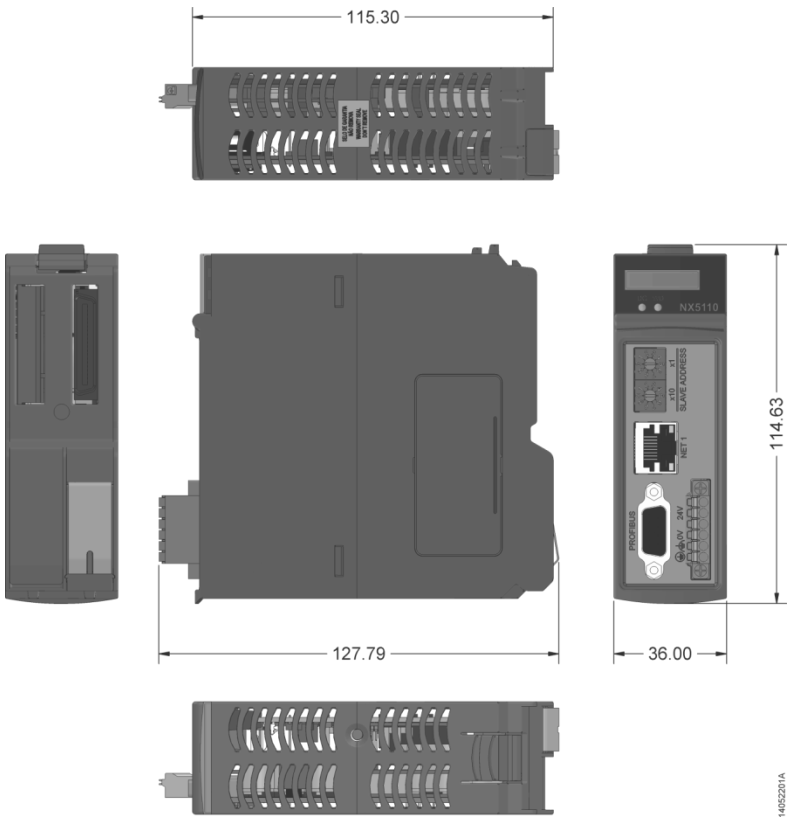

Figure 2-1. NX5X10 Physical Dimensions

Compatibility with Other Products

NX5110

The following table provides information concerning the compatibility between the NX5110 module with the programming tool IEC MasterTool XE and other Nexto Series Modules.

	Software Version	Software Version
NX5001	1.2.0.0 or above	AG
MT8500	2.01	AQ

Table 2-3. NX5110 Compatibility

NX5210

The following table provides information concerning the compatibility between the NX5210 module with the programming tool IEC MasterTool XE and other Nexto Series Modules.

	Software Version	Software Version
NX5001	1.2.0.0 or above	AG
MT8500	2.01	AQ

Table 2-4. NX5210 Compatibility

AL-3406

When using AL-3406 on PROFIBUS networks composed exclusively by Nexto Series slaves, the parameter *Watchdog Control* must be configured with a minimum value of 2000 ms (2 seconds).

Performance

PROFIBUS- DP Head Response Time

Response time is the time between the detection of an input variation and the change of the corresponding output. NX5110 and NX5210 heads have the same response time.

The response time of a remote I/O system depends on internal delays, on the network that connects it to the master and on the network control program's processing time.

To calculate the maximum response time, the following formula is recommended.

$$Maximum\ Response\ Time\ for\ Input\ Reading = Input\ Module\ Update\ Time + PROFIBUS\ Head\ Cycle\ Time + PROFIBUS\ Network\ Scan$$

$$Maximum\ Response\ Time\ for\ Output\ Writing = Output\ Module\ Update\ Time + PROFIBUS\ Head\ Cycle\ Time + PROFIBUS\ Network\ Scan$$

Components' analysis:

Input and Output Modules' Update Time: this time depends on the I/O module and it is specified in its Technical Characteristics document.

PROFIBUS Head Cycle Time: PROFIBUS Head cycle time is 6 ms, which is the necessary time to perform the read and write of I/O modules.

PROFIBUS Network Scan: PROFIBUS network scan time must be evaluated at the network's Master. The scan time depends on the quantity of octets configured in the network. The Master's

program processing time must be considered, including the application execution time and its operational system, and the time it takes for the data to reach the CPU. For instance, when the Baud Rate is 12 Mbps, the scan time is 1 ms.

Example

A remote bus with one 16 digital inputs (NX1001) module and one 16 digital outputs module (NX2001). In these conditions, let's consider an application that operates an output point (NX2001) and it is connected to an input in the module NX1001, we will observe the following maximum time to detect an alteration of the input in the main CPU, considering also the PROFIBUS-DP network at 12 Mbps.

PROFIBUS-DP Network Scan: 1 ms

NX1001 Update = 2 ms

NX2001 Update = 2 ms

PROFIBUS Head Cycle = 6 ms

Application Program Cycle Time = 20 ms

$$\begin{aligned} &Maximum\ Response\ Time \\ &= Digital\ Input\ Update\ Time + PROFIBUS\ Head\ Cycle \\ &+ PROFIBUS\ Network\ Scan\ + Application\ Program\ Cycle\ Time \\ &+\ PROFIBUS\ Network\ Scan\ + PROFIBUS\ Head\ Cycle \\ &+ Digital\ Output\ Update\ Time \end{aligned}$$

$$Maximum\ Response\ Time = 2\ ms\ + 6\ ms\ + 1ms\ + 20\ ms + \ 1ms + 6\ ms + 2ms$$

Application Program Cycle Time: Defined by the interval time of the application program running in the Master bus CPU. In Nexto Series' case, it's the *MainTask Interval*.

PROFIBUS-DP Head States

It is important to know the states in which NX5110 and NX5210 heads operate so the user can understand how it works. Each state is activated distinctly and has unique features, allowing the head's operation.

NX5110 Module States

NX5110 head operates in one of these three states:

- Off-Line (OFF)
- Active (ACT)
- Error (ERR)

Off-Line

In this state, the head doesn't Exchange data with the Master, nor does it act upon I/Os or monitors Nexto bus. The state happens since the head is powered until it receives proper configuration and parameters from the Master, or when there's no communication with the Master. It can change to Active when the head is properly configured and parameterized by the Master, or to Error when some problem is detected.

Active

In this state, the head exchanges data with the Master, acts upon I/O modules and monitors Nexto bus. It can change to Off-Line when it loses communication with the Master, or to Error when some problem is detected.

Error

In this state, the head loses read and write access to Nexto bus and it doesn't update I/Os sent by the Master. The head gets into this state when the hot swap is disabled and some inconsistency is detected on the bus (absent modules, etc.), showing further details of the error in the diagnostics area (see chapter Diagnostics). To leave this state, it is necessary to restart the head (power reset or a hot swap).

NX5210 Module States

NX5210 head operates in one of these four states:

- Off-Line (OFF)
- Active (ACT)
- Standby (SBY)
- Error (ERR)

Off-Line

In this state, the head doesn't Exchange data with the Master, nor does it act upon I/Os or monitors Nexto bus. The state happens since the head is powered until it receives proper configuration and parameters from the Master, or when there redundant slave has no communication with the Master. It can change to Active or Standby, considering that the first head that is configured will either go to Active or Error when some problem is detected.

Active

In this state, the head has exclusive access to the bus, where it exchanges data with the Master, acts upon I/O modules and monitors Nexto bus. This is the head that exchanges valid data with the Master. It can change to Standby in case of a Switchover or to Error when some problem is detected. If the redundant slave loses its communication with the Master, it goes to Off-Line.

Standby

In this state, the head doesn't have bus read and write access. Even so, it is receiving and sending data to the PROFIBUS network Master and monitoring failures in the Active head. Through virtual redundancy module NX9900, the Standby head indicates that the data should not be considered valid by the application. It can change to Active state in case of a Switchover, to Off-Line state if the redundant slave loses communication with the Master or to Error when some problem is detected.

Error

In this state, the head loses read and write access to Nexto bus and it doesn't update I/Os sent by the Master. The head gets into this state in two situations:

- When the hot swap is disabled and some inconsistency is detected on the bus (absent modules, etc.)
- When the PROFIBUS address (set by the front panel switches) is different from the one set for the Active head.

In these situations, further details on the error are presented in the diagnostics area (see chapter Diagnostics). To leave this state, it is necessary to restart the head (power reset or a hot swap).

Hot Swap

This feature enables the replacement of modules while the bus is energized, making maintenance in case of module failure easier.

I/O Modules Hot Swap

Both NX5110 and NX5210 allow Hot Swap of its I/O modules. It is recommended consulting Nexto Series CPUs User Manual (MU214600).

NX5110 Hot Swap

It is not possible to hot swap NX5110, because it will consequently remove the bus power supply, making the I/O modules shut down.

ATTENTION: If the NX5110 module is removed, the last input information sent to the Master will be frozen.

NX5210 Hot Swap

It is possible to hot swap the redundant Head NX5210 when there's a redundant slave. For it to be possible, the remaining head must be in Primary Online State. This way, there's no need to shut down the power source and the replacement of the head won't influence I/O devices.

ATTENTION: If Both NX5210 heads are removed, the last input information sent to the Master will be frozen.

GSD File

All PROFIBUS-DB devices have a file that defines its limits and configuration possibilities. NX5110 and NX5210 heads use different files, being ALT_0EDD.GSD and ALNJ0EDD.GSD for NX5110 and ALT_0EDE.GSD for NX5210. ALNJ0EDD.GSD is to be used with Nexto Jet series' modules and head NX5110. Altus provides definition these files so that the modules can be added in a PROFIBUS-DB network. These files are in English. Also related to the GSD files are three image files (DIB extension) that help identifying the correct head during PROFIBUS network assembly in the Master's configurator tool.

Files ALT_0EDD.GSD, ALNJ0EDD.GSD, NX5110_S.DIB, NX5110_R.DIB and NX5110_D.DIB, and ALT_0EDE.GSD, NX5210_S.DIB, NX5210_R.DIB and NX5210_D.DIB are available at the webpage http://www.altus.com.br and also are available in MasterTool IEC XE.

These files facilitate interoperability in the PROFIBUS network of devices from different vendors, and also contain device features and other information such as quantity and types of modules, diagnostic messages, bus parameterization, communication rate and sustenance.

GSD files must be used in the network Master's configuration through a special program that imports such files and require that the user picks his modules options, as shown in Figure 2-2.

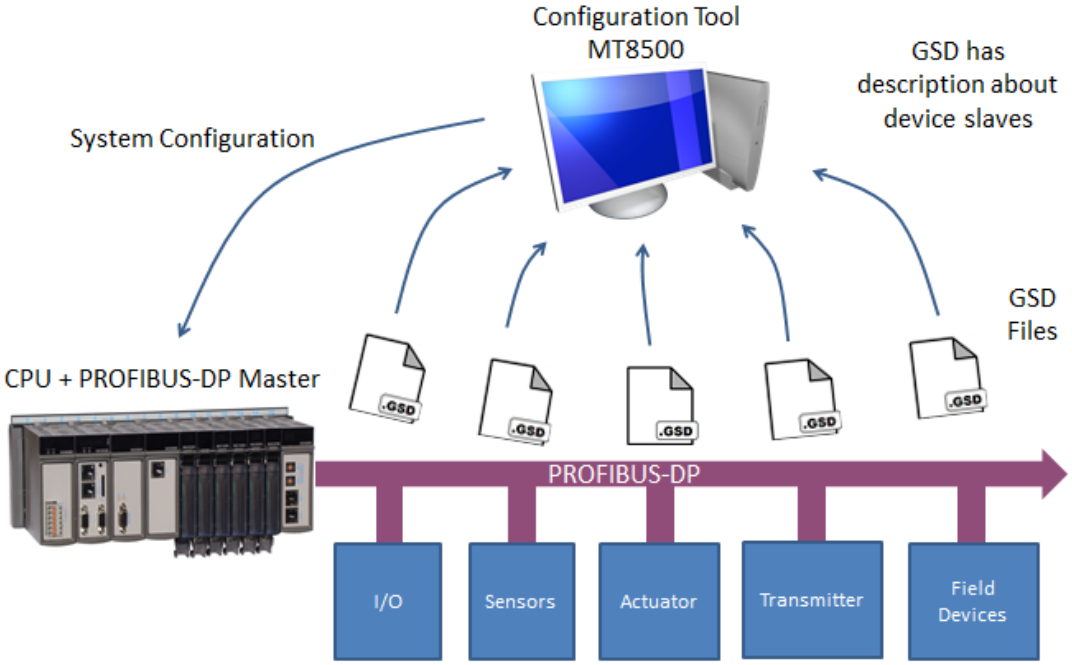

Figure 2-2. Configuration through GSD Files

Supported Architectures

Nexto Series brings to the user MasterTool IEC XE software, a powerful tool that presents a complete interface to program all modules of the series

.ATTENTION: No additional software is required to parameterize the PROFIBUS network's modules. No extra cable is necessary as well. All configuration and parameters are made in MasterTool IEC XE and sent to the PROFIBUS-DB Master NX5001 through Nexto CPU.

The PROFIBUS network configuration is made in MasterTool IEC XE, where all device configuration files (.GSD) connected to the Master NX5001 are required.

ATTENTION: NX5001 GSD file, as well as Nexto Series' and Ponto Series' remotes are already installed in MasterTool IEC XE, ready to be used.

This chapter presents the possible PROFIBUS network architectures, using Nexto Series NX5001 (Master), NX5110 and NX5210 (heads).

Architecture A: Simple PROFIBUS-DP Network

The PROFIBUS-DP network configuration allows simple connection between a master and slave devices through a single network. The following figure illustrates this connection by using Nexto Series PROFIBUS-DP Master NX5001, however, this same link can be applied with other PROFIBUS-DP master.

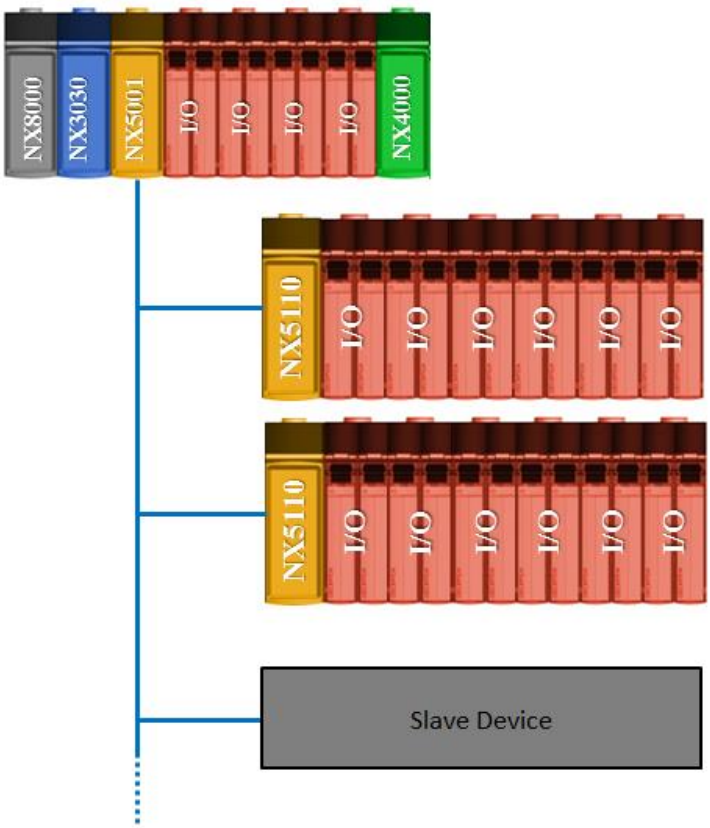

Figure 2-3. Simple PROFIBUS-DP Architecture

Architecture B: Redundant PROFIBUS-DP Network

The redundant PROFIBUS-DP network configuration allows maintaining the redundant system operating even occurring a failure in a redundant slave's head, interruption in data transmission or line failure in one of the Master Interfaces. This type of configuration consists of a CPU connected to two PROFIBUS-DP Master Interfaces (NX5001). These interfaces make up networks A and B, each with their heads NX5210. In the example below the bus consists of a CPU NX3030 and two Nexto PROFIBUS-DP NX5001 Masters.

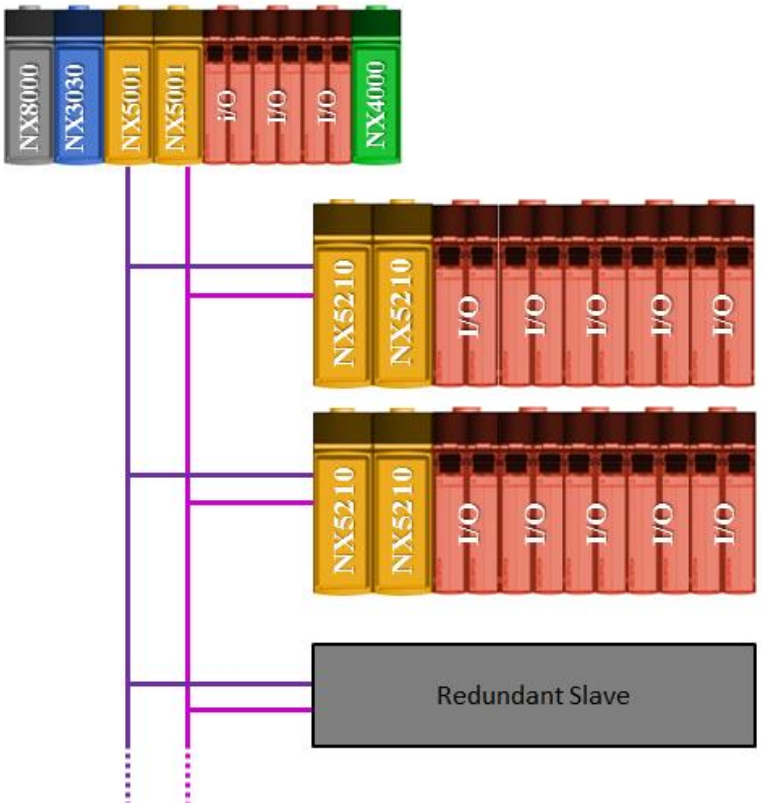

Figure 2-4. Redundant PROFIBUS-DP Architecture

Architecture C: Redundant PROFIBUS-DP Network with Master's Redundancy

This architecture keeps the operation of the system even in a failure in of a redundant slave's head, a disruption of data transmission lines, in one of the Interfaces or in one of the masters. This type of configuration consists of two Master's PLCs, each connected to two Master PROFIBUS-DP Interfaces. In the example presented each CPU is composed of a NX3030 and two Nexto PROFIBUS-DP NX5001 Masters.

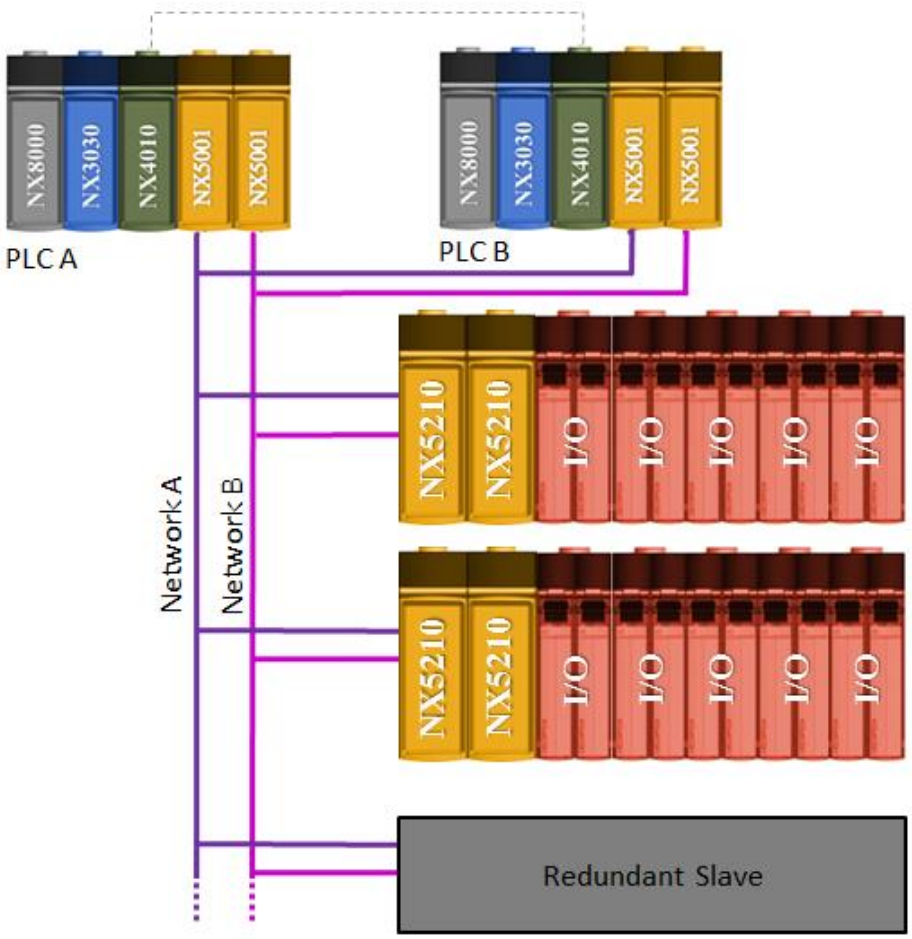

Figure 2-5. Redundant PROFIBUS-DP Architecture with Half-Cluster Redundancy

3. Installation

This chapter presents the steps to install the PROFIBUS fieldbus head NX5x10.

Mechanical Assembly

The mechanical assembly of this module is described in Nexto Series User Manual - MU214600. The NX5110 module must be installed at the slot 0. The NX5210 module must be placed side by side at the slot 0 and 2. The modules must be added at the device tree below a PROFIBUS-DP Master.

Electrical Installation

DANGER:
When performing any installation of an electrical panel, make sure that its power source is TURNED OFF.

The backplane rack installation can be seen on the figure below.

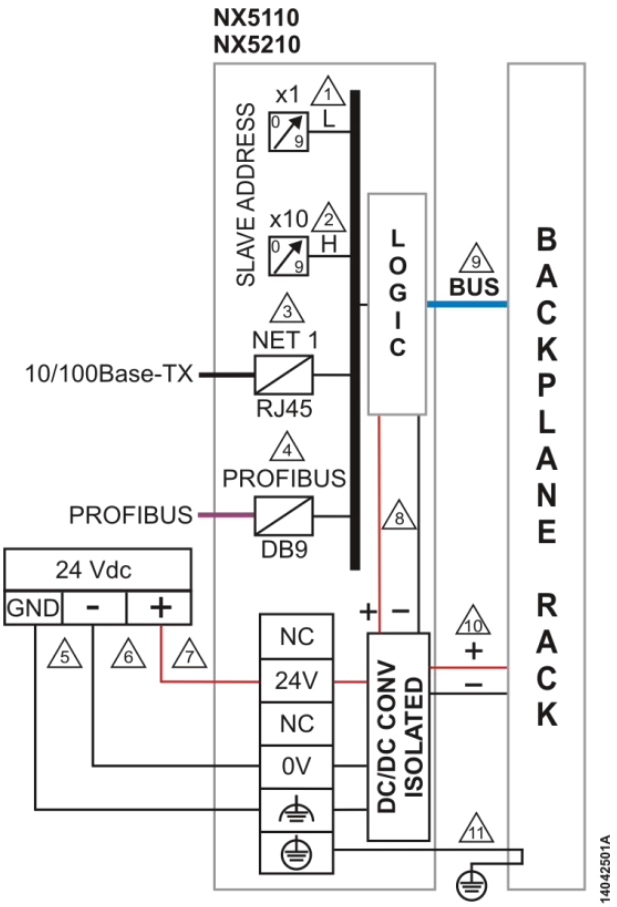

Figure 3-1. Electrical Diagram from PROFIBUS-DP Head NX5X10

Diagram Notes

1, 2- The address of the PROFIBUS-DP Slave is set by key x 1 and x 10 so that the unit is set in the key x 1 and the ten is set in the key x 10. As an example, the rack with address 15 must have 5 in x 1 and 1 in x 10

3- Standard Ethernet interface 10/100Base-TX to access the Diagnostics and Firmware update through Web page

4- Use the cable AL-2303 for PROFIBUS-DP fieldbus network and one of the following connectors:

- AL-2601 is a connector for PROFIBUS-DP fieldbus network without internal termination. It can be used to connect any PROFIBUS-DP equipment in a position in which the termination is not required.
- AL-2602 is a connector for PROFIBUS-DP fieldbus network with internal termination. It should be used on PROFIBUS-DP equipment located at the ends of the fieldbus network. Altus also offers a second option for requirements where reliability and availability are key requirements. For these cases a connector AL-2605 should be used at each end of the field network and all modules PROFIBUS-DP without internal termination connectors should be used with AL-2601. More information about the AL-2605 module can be found in document CE104705.

The use of two network PROFIBUS-DP terminations is obligatory. Each termination should be positioned at each end of the network fieldbus.

5- The grounding from the external power source is connected to the terminal. Use cables from 0.5 mm² up to 1 mm².

6- The power supply is connected to terminal 0 V. Use 0.5 mm² cables. For further information on the connector's usage, please refer to the Nexto Series User Manual- MU214600.

7- The power supply is connected to terminal 24 V. Use 0.5 mm² cables. For further information on the connector's usage, please refer to the Nexto Series User Manual- MU214600.

8- The power supply feeds the internal circuit directly

9- Local data bus

10- The module feeds the other modules of the Nexto Series through rack connection

11- The grounding of the module is done via the Nexto Series rack.

PROFIBUS-DP Network Installation

The PROFIBUS-DP network installation is described at the PROFIBUS-DP Master User Manual - NX5001 – MU214601.

4. Configuration

This chapter means to establish the necessary products to assemble a remote I/O system using PROFIBUS-DP protocol.

The configuration steps use MT8500 MasterTool IEC XE software, which ensures all configuration specifications are fulfilled and provides a complete bill of materials for the assembly.

Architecture Definition

The first step do configure a PROFIBUS network is to determine the architecture, either simple or redundant (check Supported Architectures for further information on architectures). Along with the architecture, the Master must be defined. For further information, consult PROFIBUS-DP Master NX5001 User Manual (MU214601).

Bus Configuration

Depending on the defined architecture, it is necessary to come up with a module distribution in each Nexto Series bus. In the following sections we'll see how to assemble PROFIBUS remotes for both simple and redundant networks.

It is important to note that Nexto Series' modules inserted in the bus must be placed in the same order that they are inserted in MT8500's project. Figure 4-1 illustrates such situation.

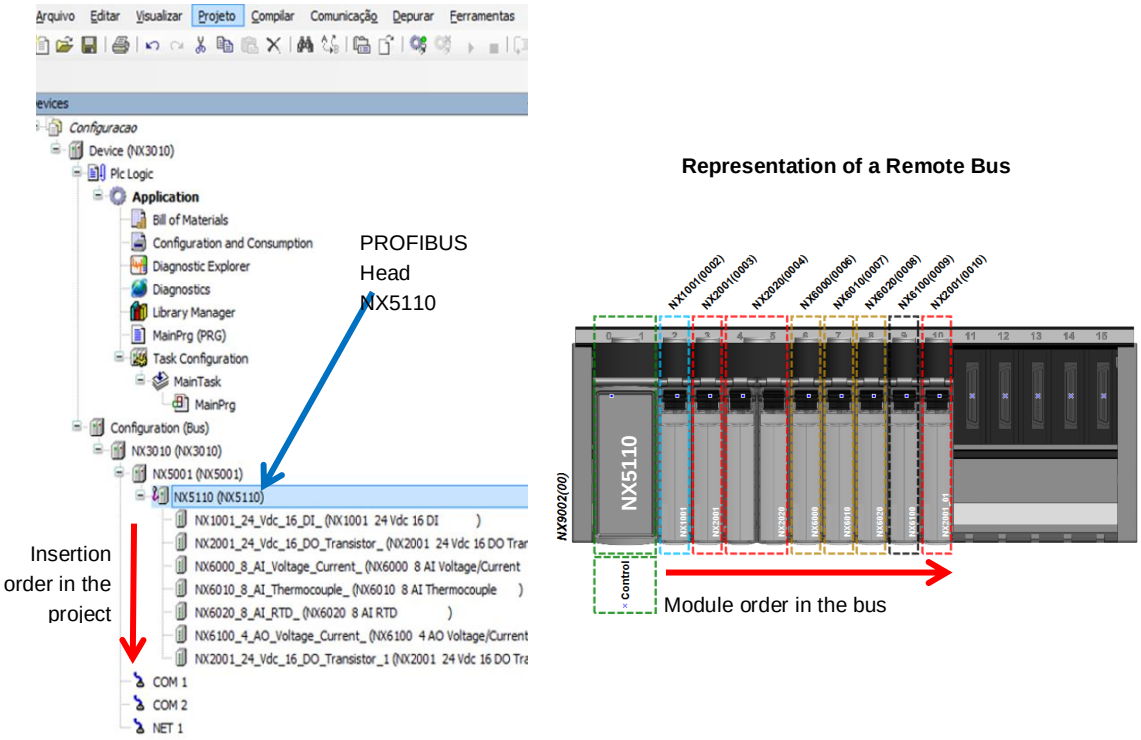

Figure 4-1. Graphical Representation of Module Placement in the Bus

Nexto Bus Limits

Nexto bus, when used as a PROFIBUS Remote, has some limitations that must be observed, along with some PROFIBUS Head limitations.

- The maximum bus current due to the PROFIBUS Head power supply is 3 A

- Maximum number of input data bytes: 240 bytes (when NX5210 is used, the limit is 238 + 2 redundancy control bytes)
- Maximum number of output data bytes: 240 bytes (when NX5210 is used, the limit is 238 + 2 redundancy control bytes)
- Maximum number of diagnostics bytes: 240 bytes
- Maximum number of modules using an NX9003 rack:
    - NX5110: 22 I/O modules
    - NX5210: 20 I/O modules

Therefore, the Datasheet document must be consulted of each product (CE) in order to identify the characteristics of consumption and data memory organization of each module. Following Table 4-1, which shows an example of some modules supported by the PROFIBUS Head.

Module	Description	Consumption	Bytes Quantity of Input Data	Bytes Quantity of Output Data
NX1001	24 Vdc 16 DI Module	160 mA	2	
NX1001 HSC	24 Vdc 16 DI Module	160 mA	16	11
NX1005	24 Vdc 8 DO Transistor / 8 DI Mixed Module	160 mA	1	1
NX1005 HSC	24 Vdc 8 DO Transistor / 8 DI Mixed Module	160 mA	15	12
NX6000	8 AI Voltage/Current Module	270 mA	16	
NX6010	8 AI Thermocouple Module	270 mA	16	
NX6020	8 AI RTD Module	300 mA	16	
NX2001	24 Vdc 16 DO Transistor Module	140 mA		2
NX2020	16 DO Relay Module	140 mA		2
NX6100	4 AO Voltage/Current Module	130 mA		8
NJ1001	24 Vdc 16 DI Module	160 mA	2	
NJ6000	8 AI Voltage/Current Module	270 mA	16	
NJ6010	8 AI Thermocouple Module	270 mA	16	
NJ6020	8 AI RTD Module	300 mA	16	
NJ2001	24 Vdc 16 DO Transistor Module	165 mA		2
NJ6100	4 AO Voltage/Current Module	130 mA		8

Table 4-1. I/O Modules Information

Simple Network

In order to configure a simple network using the Nexto Series, first it is necessary to define the main bus with CPU and PROFIBUS-DP master NX5001, followed by the PROFIBUS network remotes. Figure 4-2 shows the *Add Device* window, which is opened by right-clicking the NX5001 master. Here the NX5110 must be added.

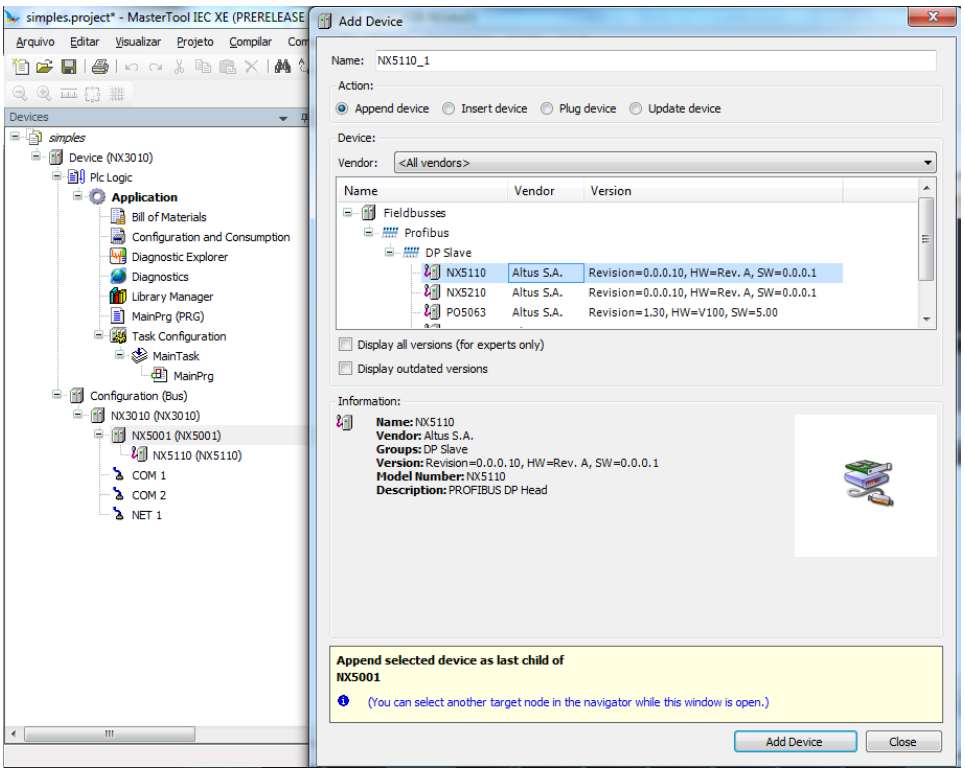

Figure 4-2. Adding a PROFIBUS-DP Head in a Simple Network

After inserting the NX5110 PROFIBUS head, it must be configured in its tab, as shown in Figure 4-3. These parameters are described in section PROFIBUS-DP Head Parameters.

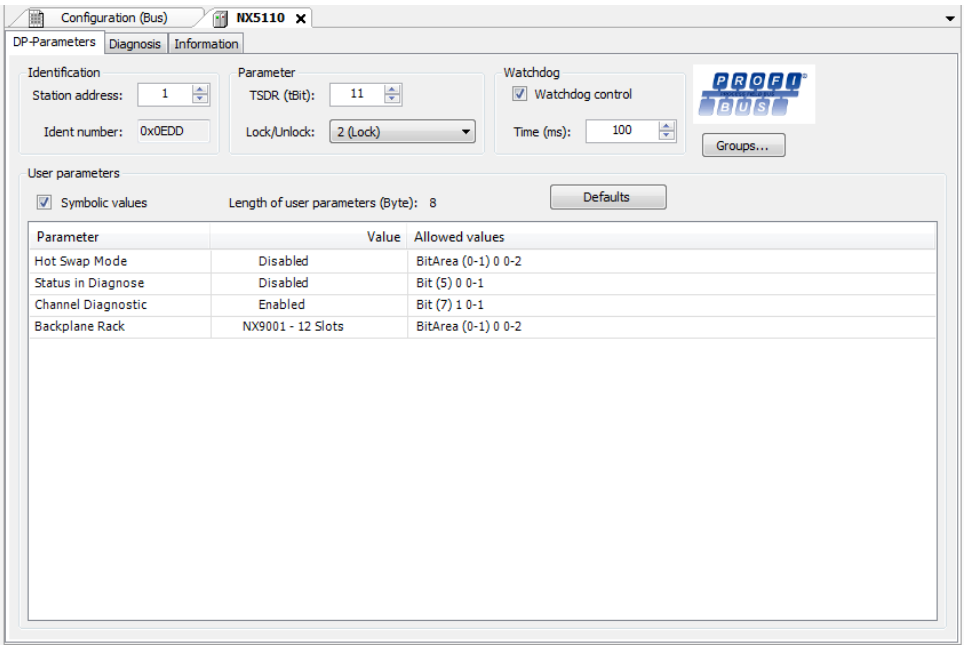

Figure 4-3. PROFIBUS-DP Head NX5110 Configuration

After configuring the PROFIBUS head, the I/O modules can be added. It is important to note that the order in the bus is given by the order of insertion, as shown in Figure 4-1.

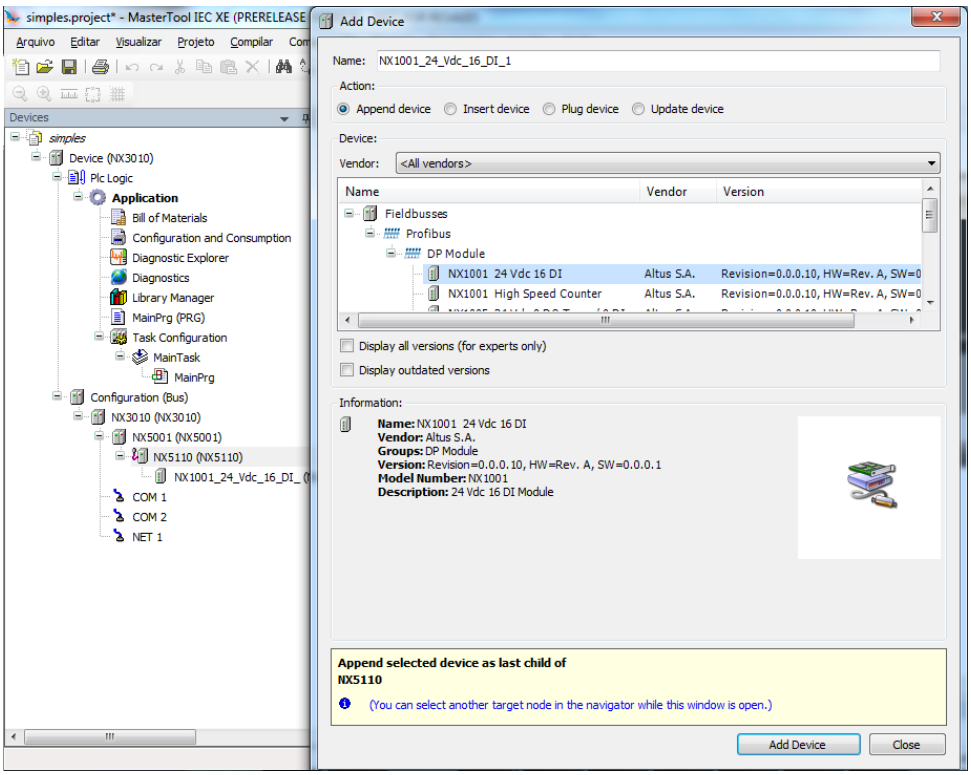

Figure 4-4. Adding I/O Modules to the Bus

I/O module configuration is made through the graphical interface, as shown in Figure 4-5, which presents the configuration of an NX1001.

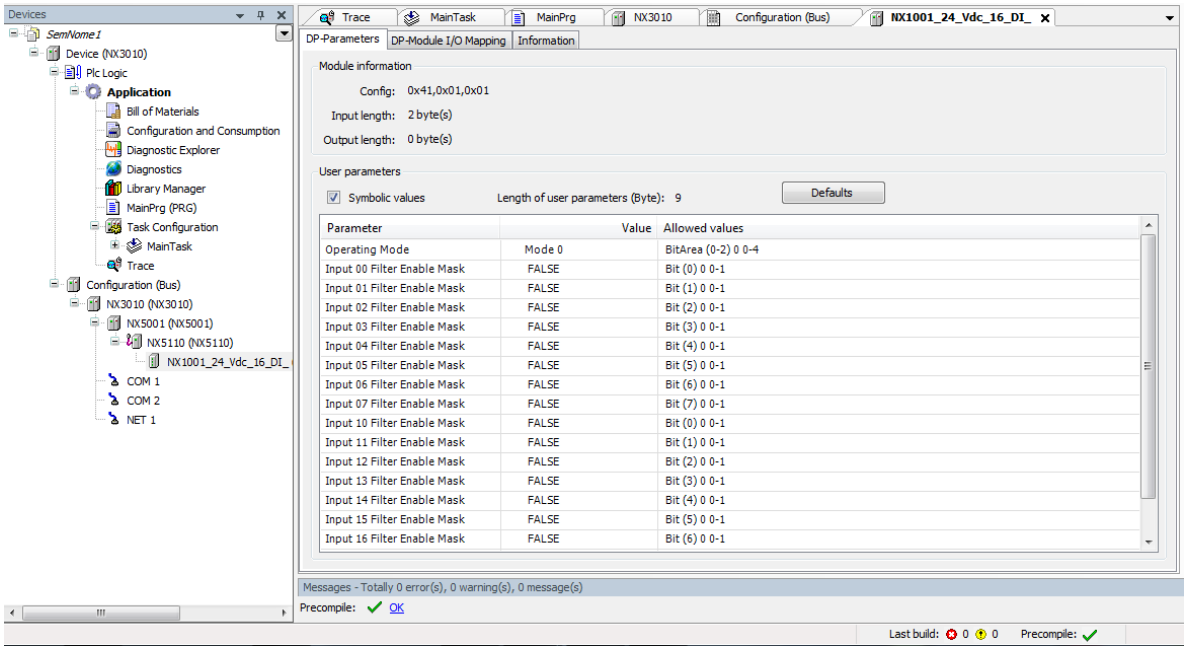

Figure 4-5. NX1001 Module Configuration Example

Redundant Network

The configuration of a redundant network is similar to the simple one, however in this case, it must be inserted an NX5210 instead of an NX5110, and after inserting all the I/O modules, the Redundant virtual module NX9900 must be inserted, which is used to provide information to the NX5001 PROFIBUS-DP Master. Figure 4-6 illustrates the insertion of the module.

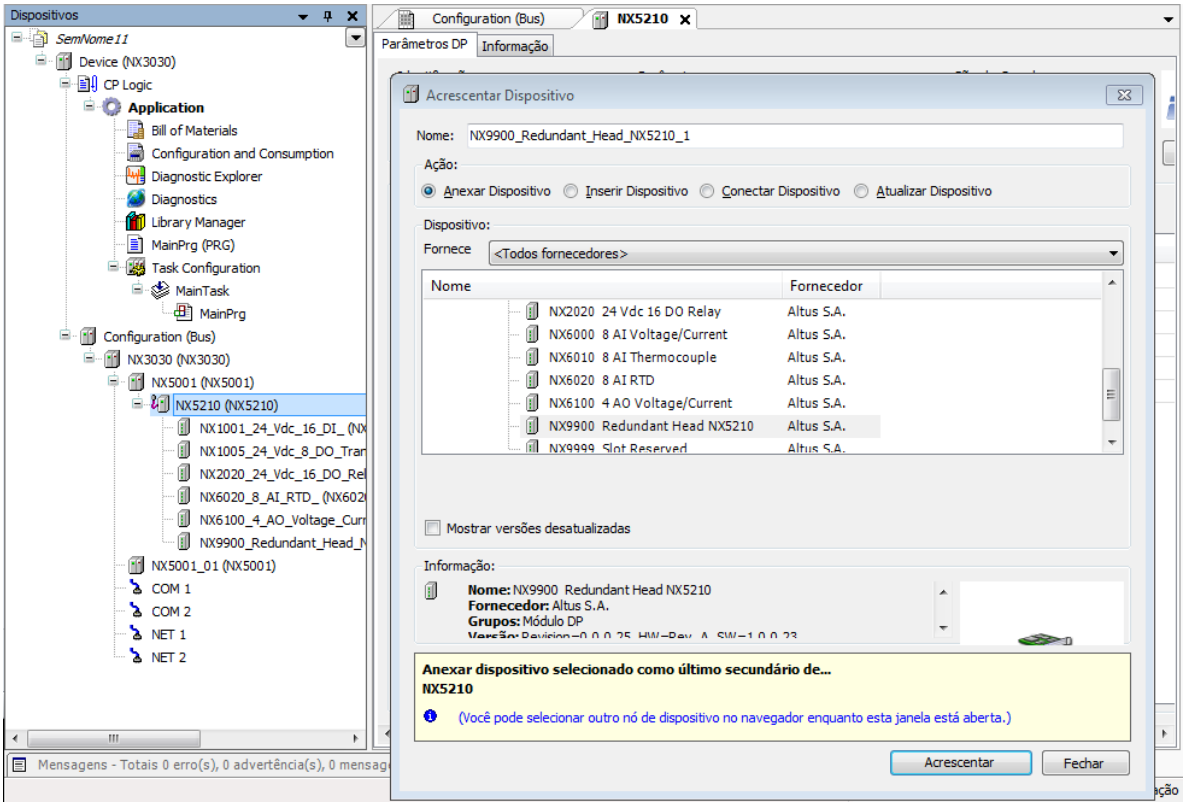

Figure 4-6. Insertion of Redundant Virtual Head NX9900

MasterTool's tree view will end up as shown in Figure 4-7.

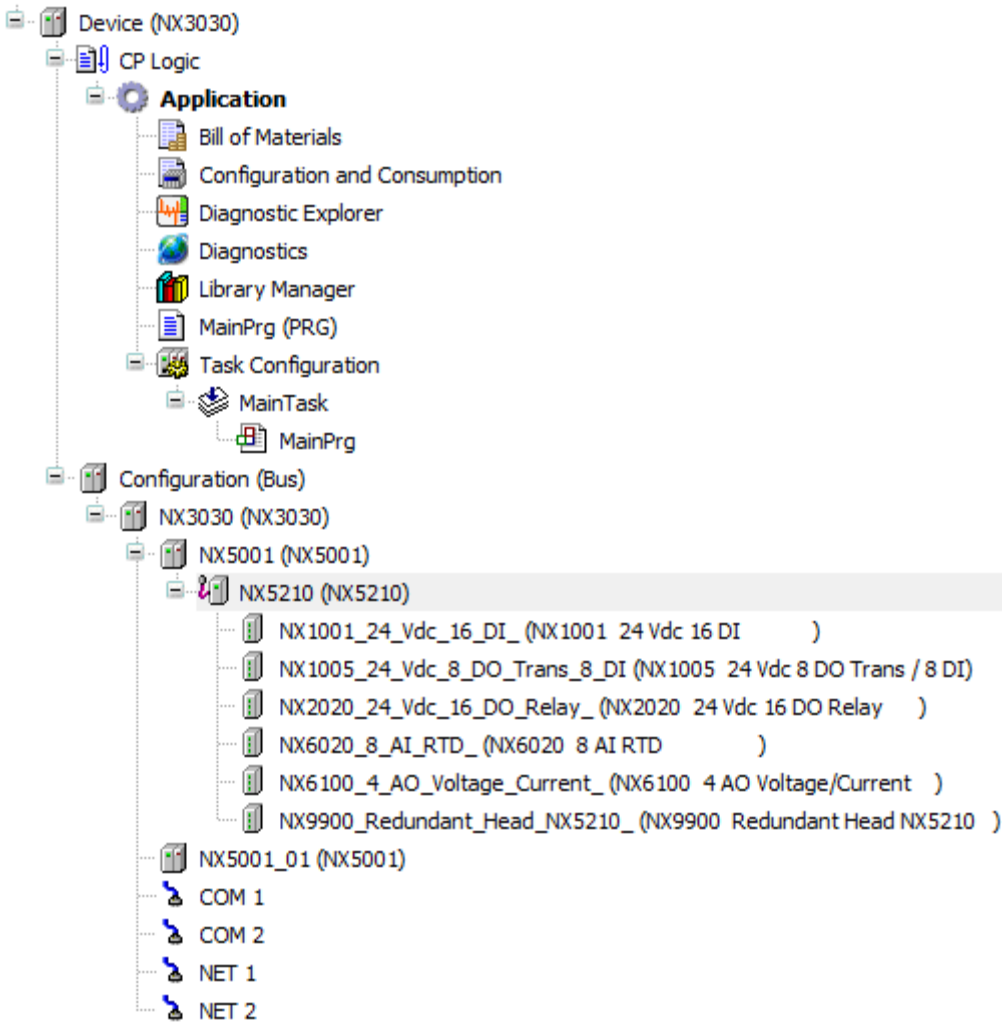

Figure 4-7. Tree view of a Slave with Redundant Network

ATTENTION: It's not necessary to insert two PROFIBUS-DP NX5210 redundant heads in the project, even though a second one should be physically placed in the bus second position.

The PROFIBUS-DP redundant head's parameterization can be seen in section Modules Parameters.

Module Parametrization

Nexto Series' modules may require that the user configure its parameters so it may work properly. Both the PROFIBUS heads and I/O modules have parameters that must be configured.

NX5110 and NX5210 parameters are basically identical, except for the *Manual Switchover* parameter. The parameters are set in the Master's configurator.

ATTENTION: The parameterization is made in a friendly environment through menus. This is the case of most PROFIBUS Master Configuration softwares.

PROFIBUS-DP Head Parameters

NX5110 and NX5210 PROFIBUS heads have the following parameters:

- Station Address

- Watchdog
- Hot Swap Mode
- Only Consists Declared Modules
- Status in Diagnose
- Channel Diagnostic
- Backplane Rack
- Manual Switchover

Station Address

This parameter defines the PROFIBUS head's address in the network. The value set in this field is compared to the one set in the Slave Address rotatory switches x1 and x10 found in the module's front. If the configured address differs from the one set in the switches, the device will indicate such issue in a diagnostic (see chapter Diagnostics). The range of valid values is from 1 to 99.

Watchdog

This parameter defines the head's behavior when it loses communication with the Master. It can have the following values:

- Disabled: After the loss of communication with the Master, the head keeps its operating state and the outputs remain in the last received value.
- Enabled: After the loss of communication with the Master, the head starts the defined watchdog timer. During this time, the outputs remain frozen in the last received value. If the communication is not reestablished by the end of this timer, the head enters Off-Line State and brings the outputs to safe state.

The configured watchdog time will depend on the application. If it is a redundant PLC system, this time should be larger than the PLC Switchover time.

Hot Swap Mode

It is considered "startup" the first time the PROFIBUS head enters in On-Line state after being powered. If there's a pair of NX5210 working as a redundant slave, it is considered "startup" when one of them enters in Primary On-Line.

The PROFIBUS head can start in three different configurations: hot swap disabled, hot swap enabled with startup consistency and hot swap enabled without startup consistency.

- Hot swap Disabled

All modules must be present in the bus all the time.

The PROFIBUS head goes to Error State when it detects that a module:

  - Is absent
  - Is defective

- Hot Swap Enabled, startup consistency

The head verifies if all declared modules are present in the bus during startup.

The PROFIBUS head goes to Error State when it detects during startup that a module:

  - Is absent
  - Is defective

After the startup, if a module falls into one of the previously mentioned situations, the system will carry on working and warn the problem through diagnostics.

When there's a power failure, even if it's temporary, and there's an absent module, the head will go to Error since it is considered a startup situation.

This option is the most recommended, since it ensures the system's integrity at startup, but afterwards it allows the hot swap of modules.

For a pair of NX5210 working as a redundant slave, the consistency test will only happen at startup, i.e. it won't happen again after a Switchover.

- Hot Swap Enabled, no startup consistency

It allows the system to operate even if a module:

  - Is absent.
  - Is placed in the wrong slot
  - Is not configured for the slot it is in
  - Is not declared in that bus
  - Is defective

All these situations are reported through diagnostics. This option is recommended during the system's development, since it enables module changes and power resets without all modules being in place.

Only Consists Declared Modules

This parameter allows the user to choose if the rules applied in the Hot Swap Mode parameter are valid only for declared modules. For now, this parameter only supports declared modules.

Status in Diagnose

The PROFIBUS head may present in its PROFIBUS diagnostics some information related to problems in modules and system status.

This parameter defines the behavior of diagnostics generation:

- Disabled: The diagnostics generation only happens when there's a variation in the data from modules
- Enabled: The diagnostics generation happens either when there's a variation in the data from modules or in the system status

The need for enabling or not the sending of status in diagnose exists because some Master devices consider the presence of diagnostics as an error.

By disabling this option, the Mater won't indicate when the head has an error. An example where it is recommended to disable this option is the Siemens PROFIBUS Master.

Channel Diagnostic

This parameter controls the sending of Channel diagnostics within a diagnostics frame of the Nexto PROFIBUS slave:

- Disabled: If there are Channel diagnostics in the modules, they will be suppressed, so only the device's and the module's diagnostics will be circulating the network
- Enabled: The Channel diagnostics will always be sent in the extended diagnostics frame

The format of the PROFIBUS diagnostics can be seen in Figure 6-1 and in section PROFIBUS Diagnostics of Chapter 6.

Backplane Rack

This parameter defines the size of the rack being used in the remote. There are five models available in the Nexto series:

- 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, only available for NX5110)

Manual Switchover (only NX5210)

This parameter allows the redundant head to accept a Switchover request by the PROFIBUS Master and change its operating state:

- Disabled: The redundant head will refuse a Switchover request by the Master and keep its operating state
- Enabled: The redundant head will accept a Switchover request by the Master and change its operating state

Modules Parameters

The modules parameters are specified in their datasheet document.

If there's more than one module of a given type, it is necessary to configure them independently.

ATTENTION: The parameterization is made in a friendly environment through menus. This is the case of most PROFIBUS Master configuration softwares.

The quantity of parameters in each module varies. The module's datasheet may present some byte or bit values as constants – they should be precisely copied to ensure the correct parameterization.

Example:

Figure 4-8 presents module NX6000's parameter in a sample configuration. In MasterTool IEC XE window, we can see the module's parameters, where the first of them (noise suppression filter) applies to the whole model, and the other are individual to each channel, grouped in threes (type, digital filter and open loop value). Other NX6000 parameters found in the datasheet and are not displayed in this screen receive default values. They are not present because the PROFIBUS norm establishes a limit of parameters in the parameterization frame.

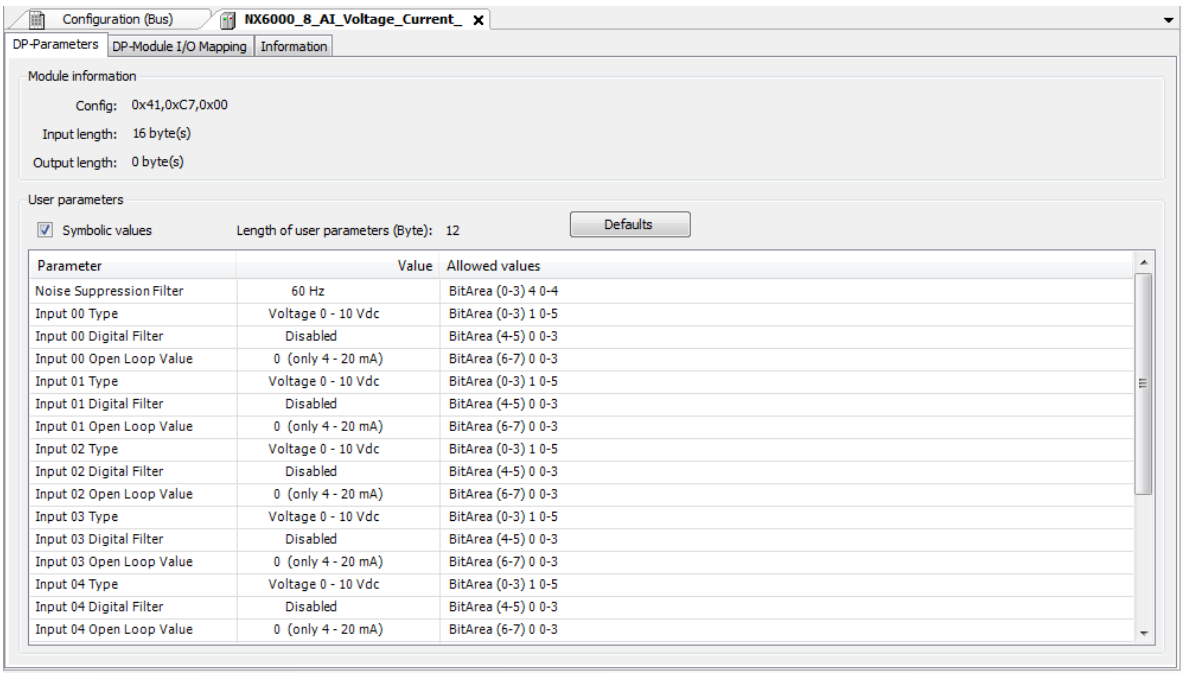

Figure 4-8. NX6000 Module Parameters

Figure 4-9 shows the editing of a Type parameter in channel 0.

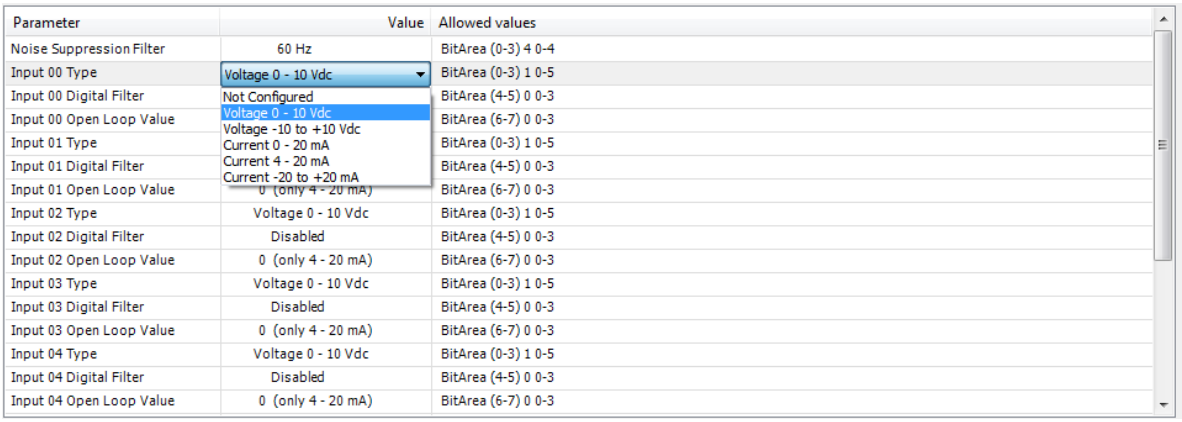

Figure 4-9. NX6000 Module Parameter Selection

ATTENTION:
The concepts of the NX6000 parameters are not the object of this manual. If necessary, consult the module's datasheet.

ATTENTION:
The usage of MasterTool IEC XE programmer is not the object of this manual. If necessary, consult MasterTool IEC XE User Manual (MU299609).

PROFIBUS-DP Head's Informative and Configuration Menu

The access to the Nexto PROFIBUS-DP Head's Informative and Configuration Menu, just as the access do detailed diagnostics, are available in levels. To access the menu's information, browse the levels and change configurations, a long press in the OTD switch is required. To browse items in the same level, a short press in the OTD switch is required. Consult the section One Touch Diag to learn the operation and differences between pressings in the diagnostic switch.

Table 4-2 shows the menu levels available in the PROFIBUS-DP Heads. It also shows the type of the field – whether it is informative or configurable.

Level 1	Level 2	Level 3	Type
HARDWARE	TEMPERATURE	-	Informative
	CONTRAST	CONTRAST LEVEL	Configurable
	BACK	-	Level Return
LANGUAGE	ENGLISH	>ENGLISH	Configurable
	PORTUGUESE	>PORTUGUESE	Configurable
	SPANISH	>SPANISH	Configurable
	BACK	-	Level Return
NETWORK	ADDR.. IP NET 1	-	Informative
	MASC. NET 1		Informative
	BACK		Level Return
SOFTWARE	FIRMWARE	-	Informative
	BOOTLOADER		Informative
	BACK		Level Return
BACK	-	-	Level Return

Table 4-2. PROFIBUS-DP Head Menu Levels

As already shown in Table 4-2, among the options are helpful information to the user, such as:

- Information on hardware resources:
    - TEMPERATURE – Internal Temperature of the PROFIBUS Head (e.g. 36 C 97 F)
    - CONTRAST – POFIBUS Head's LCD contrast adjustment
- Change in PROFIBUS-DP Head menu language:
    - PORTUGUESE – Changes language to Portuguese
    - ENGLISH – Changes language to English
    - SPANISH – Changes language to Spanish
- Information on the device's configured network:
    - ADDR. IP NET 1 – IP Address (e.g. 192.168.0.1)
    - MASC. NET 1 – Subnet Mask (e.g. 255.255.255.0)
- Information on software versions:
    - FIRMWARE –Software version of the PROFIBUS-DP Head (e.g. 1.0.0.0)
    - BOOTLOADER – Bootloader version of the PROFIBUS-DP Head (e.g. 1.0.0.0)

Figure 4-10 brings an example of how to operate the menu of the Nexto PROFIBUS-DP Heads through the adjustment of the contrast from the Status screen. Not only does it facilitate configuration, it's also easy to identify all other levels and the type of pressing to navigate it. A short press increments contrast (brighter), being that the next pressing after the full value sets it to its lowest (darker). A long press confirms the setting of the contrast and returns to the previous level.

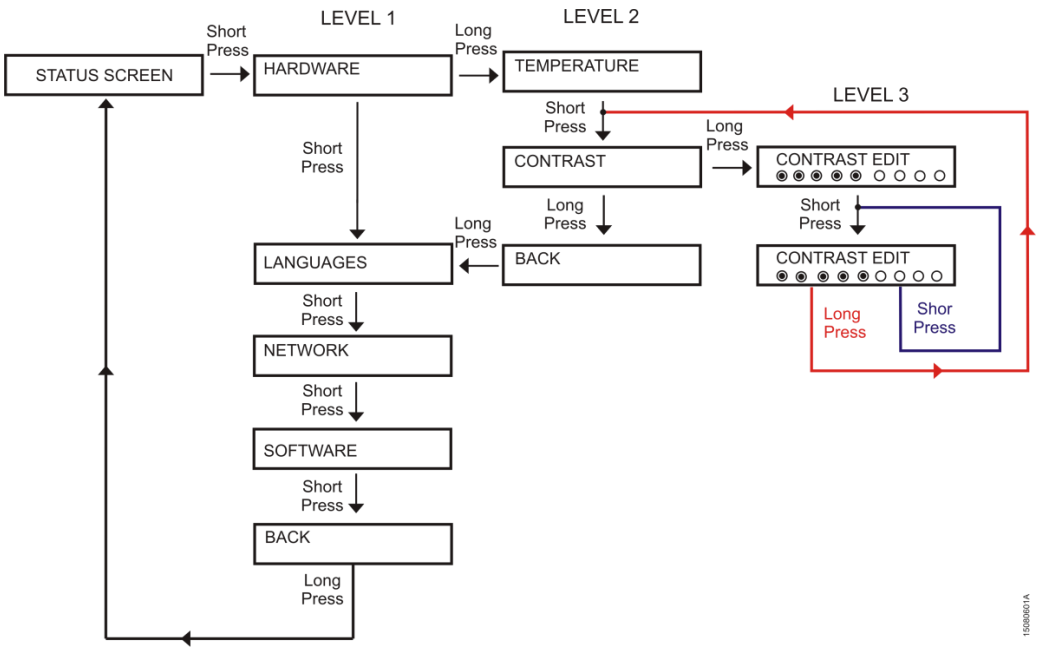

Figure 4-10. Contrast Adjustment

There are other ways to exit the menu than a long press in the first level's BACK:

- A short press, at any moment, in another module of the bus will make the Head exit its menu and show the pressed module's diagnostics
- More than 5 seconds of inactivity at any level

5. Operation

Sync/Freeze Mode

Sync/Freeze operation is described at PROFIBUS-DP Master User Manual – MU214601.

NX5210 Redundancy

This section covers the redundancy mechanism of the NX5210 head.

General Features

A redundant PROFIBUS-DP slave is composed of two NX5210 redundant heads mounted side by side and sharing the same I/O modules. The redundancy uses a proprietary algorithm which makes it compatible only with Masters from Altus product series (AL Series, Ponto Series or Nexto Series).

There's no order or precedence that determines which head will be Active or Standby, such state allocation is random. However, the head's software ensures that two heads in the same bus won't be Active at the same time.

They operate independently. The Active head commands the input and output devices while the Standby head is waiting for a command to make it Active.

The redundancy of the NX5210 heads is possible thanks to the Switchover command. It executes the state change between the heads of the redundant slave when there's a failure in the Active head. This state change between the heads is made autonomously, so it doesn't require any manual operation, however it is still possible to enable the manual execution of Switchovers.

To use the NX5210 redundant heads, it is necessary to declare the redundant virtual module NX9900 at the last position of the bus. This is not an actual physical module, but merely a logical device declared at the Master's configurator. If the master is Nexto's NX5001, then MasterTool IEC XE will be used, other Altus Masters will require the ProfiTool software.

Both NX5210 redundant heads in the same bus must have the same address.

Switchover

In a redundant system, the state change between Active and Standby is named Switchover.

The Switchover may happen automatically if the redundant device detects a failure in the active head's network or any other internal failure. In this case, the device performs the Switchover to the working network and the NX5001 displays in its diagnostics which network is currently Active. The redundant heads have the autonomy to make a Switchover in case of failure, and the application can execute such command as well.

As said, the Switchover may be commanded by the PLC. In this case, it might be necessary that all devices of a given network (A or B) be Active, so that any sort of operation or maintenance is performed in the Standby network.

Table 5-1 lists the events that trigger a Switchover, the action sequence and the state of the heads afterwards.

Event	Action	Next State of the Active Head	Next State of the Standby Head
Disconnection between active head and Master interface	Switchover command by the Standby head	Off-Line	On-Line
Standby head receives the Switchover command	Switchover command by the Standby head	Standby	On-Line
Active Head receives the	Switchover command by the Active	Standby	On-Line

Switchover command	head		
Active head detects a failure that might harm the system's operation	Switchover command by the Active head	Error	On-Line
Active head loses power due to a failure in its internal or external power source unit	Standby head detects bus inactivity and executes the Switchover	Shut Down	On-Line
Active head is removed for a hot-swap	Standby head detects bus inactivity and executes the Switchover	Absent	On-Line.
Active head enters Watchdog	Standby head detects bus inactivity and executes the Switchover	Watchdog	On-Line

Table 5-1. Switchover Events

NX9900 Virtual Module

The NX9900 virtual redundant module's purpose is to inform the Master about the state of the redundant head and transmit Switchover commands.

This module must always be placed in the last position when configuring the bus at the Master's configuration software. Since it's a virtual module, it doesn't occupy a physical slot in Nexto's bus.

This module has 2 input bytes and 2 output bytes. The input bytes carry information on the state of the head, while the output bytes have the Switchover commands. PLC commanded Switchovers must be first enabled in the head's parameters – consult section Manual Switchover (only NX5210) for further information.

PLC commanded Switchovers are made by forcing the corresponding variable, as shown in Figure 5-1.

By writing TRUE in one of the first two bits, a Switchover is forced to the chosen network (where Network A is the one connected to the left head). The bits named "Reserved" are not used. If both bits are TRUE at the same time, bit 0 (Network A) will prevail.

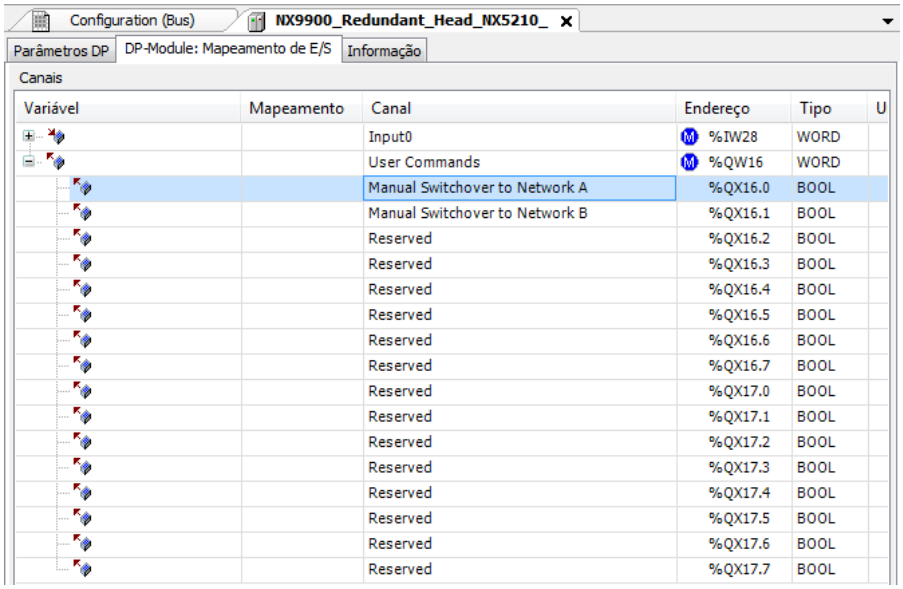

Figure 5-1. Manual Switchover Command

ATTENTION:
To ensure the necessary time for the Switchover, the redundancy diagnostics must be consulted before sending a new command to make sure that the previous Switchover has been performed.

6. Diagnostics

PROFIBUS Diagnostics

This chapter presents the PROFIBUS diagnostics format, according to norm EN 50170.

If the PROFIBUS Master programmer is MasterTool IEC XE, section Nexto PROFIBUS Diagnostic must be consulted.

The reading of this section is only recommended in the following situations:

- Users whose PROFIBUS Master's programmer is not capable of interpreting diagnostics messages through the GSD.
- The application program uses the diagnostics (in case the CPU has access to these bits).

If the PROFIBUS Master programmer can interpret diagnostics messages, the reading of this section is not necessary.

The diagnostics frame's general format must have no more than 240 bytes, distributed a follows:

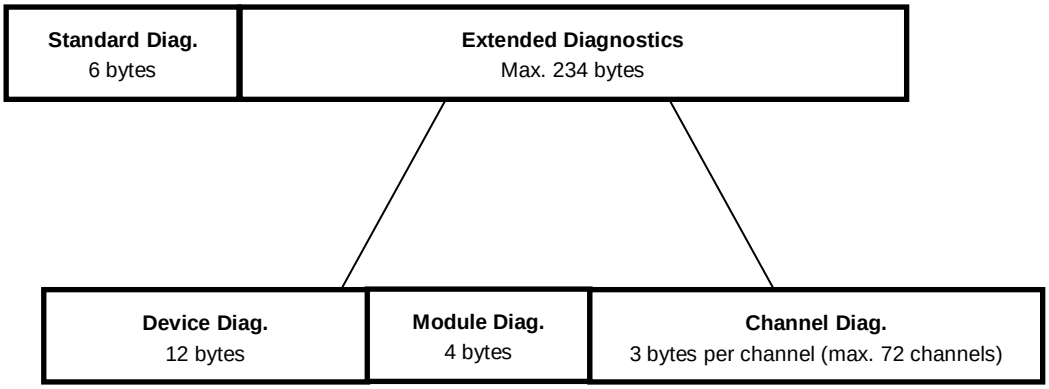

Figure 6-1. PROFIBUS Diagnostics Frame Format

The next sections will explore each of the previous figure's blocks in detail.

Standard Diagnostics

The standard diagnostics defined by the norm is made of 6 bytes.

The table below shows the description of each bit:

Byte								Description
7	6	5	4	3	2	1	0	
Byte 0 – Status 1								
							1	Station_non_Existent: slave not found in the network.
						1		Station_Not_Ready: slave not ready for communication.
					1			Cfg_Fault: indicates that the slave configuration is different than the Master's
				1				Ext_diag: indicates that the slave has an extended diagnostics message to be read by the Master.
			1					Not_Supported: indicates that the slave has received an unsupported command.
		1						Invalid_Slave_Response: indicates that the slave's response to the master was not recognized.
	1							Prm_fault: indicates that there has been an error in the sending of parameters to the slave.
1								Master_Lock: indicates that the module has been parameterized by another master,

Byte 1 – Status 2								
1								Deactivated: the slave was declared inactive in the parameterization.
	x							Reserved.
		1						Sync_Mode: Set by the slave when receiving the Sync command.
			1					Freeze_mode: Set by the slave when receiving the Freeze command.
				1				WD_On: Set by the slave when its Watchdog is activated.
					1			Always TRUE by the slave.
						1		Stat_Diag: Se by the slave to warn that the diagnostics must be read by the master.
							1	Prm_Req: Set by the slave to warn that it must be parameterized and configured.
Byte 2 – Status 3								
1								Ext_Diag_Overflow: Set if the extended diagnostics information is beyond the slave's capacity as defined in the Ext_Diag_Data of the GSD file.
	x	x	x	x	x	x	x	Reserved.
Byte 3 – Status 4 - Master_Add								Address of the master that parameterized the slave.If no master has parameterized it, the value is 255.
Byte 4 e 5 – Status 5/6 - Ident_Number								Slave device identifier (device number, as registered at the PROFIBUS committee).

Table 6-1. PROFIBUS Diagnostics Frame Fields

Extended Diagnostics

The next bytes of the standard diagnostics describe in detail the slave situation. If the slave send the extended diagnostics, the Ext_Diag bit is set.

The extended diagnostics is composed of three categories:

- Device related diagnostics
- Module related diagnostics
- Channel related diagnostics

Device Diagnostics

The following table presents the device's diagnostics format.

Size: block's size in bytes, including the overhead.

For the PROFIBUS heads NX5110 and NX5210, 12 bytes are allocated for diagnostics, thus distributed:

Byte								Description
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
Byte 0 - Overhead								Number of bytes in the head's diagnostics.
0	0	0	0	1	1	0	0	Fixed in 12,
Byte 1 - Reserved								Reserved.
Byte 2 - Reserved								Reserved.
Byte 3 - Reserved								Head's summarized diagnostics.
							1	There's a bus configuration problem
						1		One or more declared modules are absent.
					1			Two modules are swapped in the bus.
				1				One or more modules present in the bus are not declared.
			1					One or more modules in the bus have active diagnostics.
		1						One or more modules in the bus are in a non-functional state.
	1							One or more modules in the bus have parameterization error.

1								Indicates that it has exceeded the maximum number of input or output bytes.
Byte 4 - Summarized								Head's summarized diagnostics.
							1	Indicates that it has exceeded the maximum number of modules.
						1		There are configuration errors in NET1 interface.
					1			Indication that there is a failure in the local bus.
				1				Indicates that there's a hardware failure in the device.
			1					Indicates that there is a failure in the LCD.
		1						The switch is stuck for more than 20 seconds at least once while the CPU was powered. This diagnostics is only reset at the system's restart.
	1							Indicates that the PROFIBUS slave address has been altered.
1								Indicates failure in the internal thermometer.
Byte 5 - Summarized								Head's summarized diagnostics.
							1	High temperature alarm.
						1		Low temperature alarm
					1			Indicates that the device has been restarted due to a power failure.
				1				Indicates that the device has been restarted due to a watchdog.
x	x	x	x					Reserved.
Byte 6 - Summarized								Head's summarized diagnostics.
x	x	x	x	x	x	x	x	Reserved.
Bytes 7 .. 10 – Absent Modules								Indicate absent modules in the respective bus positions.
Byte 11 – Network Address								PROFIBUS head's address, defined by keys x1 and x10.

Table 6-2. Device's Diagnostics Table

Module Diagnostics

The table below presents the module's diagnostics format, indicating its situation.

Byte								**Description**
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
Byte 12 - Overhead								
0	1	Size						Size of the device's diagnostics
Byte 13 – Module with Diag.								
Module 7	Module 6	Module 5	Module 4	Module 3	Module 2			Modules 2 to 7 with diagnostics
Byte 14 - Module with Diag.								
Module 15	Module 14	Module 13	Module 12	Module 11	Module 10	Module 9	Module 8	Modules 8 to 15 with diagnostics
Byte 15 - Module with Diag.								
Module 23	Module 22	Module 21	Module 20	Module 19	Module 18	Module 17	Module 16	Modules 16 to 23 with diagnostics

Table 6-3. Module's Situation Bytes

ATTENTION:
NX5210 PROFIBUS Redundant Head uses positions 0, 1, 2 and 3 of the bus, while NX5110 PROFIBUS Head uses positions 0 and 1. I/O modules that use two bus slots are identified by the smaller slot number.

Channel Diagnostics

Each channel has its identification and error cause, where each active diagnostics will use 3 bytes, even when each channel has two or more active diagnostics. Table 6-4 presents the format of the channel diagnostics.

Byte								Description
Byte 0 - Identifier								
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
1	0	Ident						Bus position of the module with diagnostics
Byte 1 - Channel								
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
0	0	Channel						Channel number
Byte 2 - Type of Diagnostics								
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
0	0	0	Type of Diagnostics					Described at the module's datasheet document.

Table 6-4. Channel Diagnostics Format

For further details on the device's diagnostics, consult Norm EN 50170.

Nexto PROFIBUS Diagnostics

The NX5001 PROFIBUS Master receives the diagnostics data in the PROFIBUS format and decodes them in a structured variable form, making the access and understanding of them easier, and enabling their usage by the user application.

The table below presents the diagnostics structure of the Nexto PROFIBUS Head. This structure is only available when using Nexto PROFIBUS Master NX5001.

Direct Representation Variable		Diagnostics Message	Symbolic Variable DG_modulename.	Description
Variable	**Size**			
%QB(n)	BYTE	-	byStationAddress	Address.
%QB(n+1)	0	-	tPbusHeadA.tStatus1. bStation_Non_Existent	Nonexistent or non-responsive slave.
	1	-	tPbusHeadA.tStatus1. bStation_Not_Ready	The slave is not ready for data exchange cycle.
	2	-	tPbusHeadA.tStatus1.bCfg_Fault	Configuration error. The configuration is different than the one sent by the master.
	3	-	tPbusHeadA.tStatus1.bExt_Diag	Indicates that the extended diagnostics area is used.
	4	-	tPbusHeadA.tStatus1.bNot_Supported	Command not supported.
	5	-	tPbusHeadA.tStatus1. bInvalid_Slave_Response	Invalid slave response.
	6	-	tPbusHeadA.tStatus1.bPrm_Fault	Last parameter received is incorrect.
	7	-	tPbusHeadA.tStatus1.bMaster_Lock	Slave parameterized by another master.
%QB(n+2)	0	-	tPbusHeadA.tStatus2. bPrm_Req	Slave requires new parameterization and configuration.
	1	-	tPbusHeadA.tStatus2. bStat_Diag	Master needs to reach information from the slave.
	2	-	tPbusHeadA.tStatus2. bFixed_1	Value fixed in 1.

Direct Representation Variable		Diagnostics Message	Symbolic Variable DG_modulename.	Description
Variable	Size			
	3	-	tPbusHeadA.tStatus2. bWD_On	Indication that the watchdog supervisory mechanism is active.
	4	-	tPbusHeadA.tStatus2. bFreeze_Mode	Indicates that the slave received a Freeze command.
	5	-	tPbusHeadA.tStatus2. bSync_Mode	Indicates that the slave received a Sync command.
	6	-	tPbusHeadA.tStatus2. bReserved_06	Reserved.
	7	-	tPbusHeadA.tStatus2. bDeactivated	Slave was not designed.
%QB(n+3)	0	-	tPbusHeadA.tStatus3. bReserved_00	Reserved.
	1	-	tPbusHeadA.tStatus3. bReserved_01	Reserved.
	2	-	tPbusHeadA.tStatus3. bReserved_02	Reserved.
	3	-	tPbusHeadA.tStatus3. bReserved_03	Reserved.
	4	-	tPbusHeadA.tStatus3. bReserved_04	Reserved.
	5	-	tPbusHeadA.tStatus3. bReserved_05	Reserved.
	6	-	tPbusHeadA.tStatus3. bReserved_06	Reserved.
	7	-	tPbusHeadA.tStatus3. bExt_Diag_Overflow	Indicates that the quantity of active diagnostics exceeds the data capacity that the slave can send (defined by Ext_Diag_Data parameter of GSD).
%QB(n+4)	BYTE	-	tPbusHeadA.byMasterAddress	Indicates PROFIBUS-DP master address.
%QB(n+5)	WORD	-	tPbusHeadA.wIdentNumber	Identification number.
%QB(n+7)	BYTE	-	tPbusHeadA.byReserved_06	Reserved.
%QB(n+8)	BYTE	-	tPbusHeadA.byReserved_07	Reserved.
%QB(n+9)	0	CONFIG. MISMATCH	tSummarized.bConfigMismatch (1)	There is a configuration problem in the bus, such as a module in the wrong slot..
	1	ABSENT MODULES	tPbusHeadA.tSummarized. AbsentModules (1)	One or more declared modules are absent.
	2	SWAPPED MODULES	tPbusHeadA.tSummarized. bSwappedModules (1)	Two modules are swapped in the bus.
	3	NON-DECLARED MODULES	tPbusHeadA.tSummarized. bNonDeclaredModules (1)	One or more modules present in the bus are not declared.
	4	MODULES W/ DIAGNOSTIC	tPbusHeadA.tSummarized. bModulesWithDiagnostic (1)	One or more modules in the bus have active diagnostics.
	5	MODULES W/ FATAL ERROR	tPbusHeadA.tSummarized. bModuleFatalError (1)	One or more modules present in the bus are not functional.
	6	MODULES W/ PARAM. ERROR	tPbusHeadA.tSummarized. bModuleParameterError (1)	One or more modules present in the bus are with parameterization error.
	7	EXCEEDED NUM BYTES	tPbusHeadA.tSummarized. bExceededNumInOutBytes	Indicates that the maximum number of I/O bytes has been exceeded.
	8	EXCEEDED MAX NUM MODULES	tPbusHeadA.tSummarized. bExceededMaxModules	Indicates that the maximum number of modules has been exceeded.
	9	-	bReserved_9	Reserved.
	10	BUS ERROR	tPbusHeadA.tSummarized. bLocalBusError	Indicates that there is a failure in the local bus.
	11	HARDWARE FAILURE	tPbusHeadA.tSummarized. bHardwareFailure	Indicates that there is a hardware failure in the device.
	12	-	bReserved_12	Reserved.
	13	OTD SWITCH ERROR	tPbusHeadA.tSummarized. bOTDSwitchError	The OTD switch was stuck for more than 20 seconds at least once while the slave was powered. This diagnostics is only cleared when the system is restarted.
	14	ADDRESS MODIFIED	tPbusHeadA.tSummarized. bPbAddrSwitchChanged	Indicates that the slave's PROFIBUS-DP address has been altered.
	15	-	tPbusHeadA.tSummarized. bThermometerFailure	Indicates failure in the internal thermometer.
	16	-	tPbusHeadA.tSummarized.	Indicates the high temperature alarm.

Direct Representation Variable		Diagnostics Message	Symbolic Variable DG_modulename.	Description
Variable	Size			
			bOverTemperatureAlarm	
	17	-	tPbusHeadA.tSummarized. bUnderTemperatureAlarm	Indicates the low temperature alarm.
	18	-	tPbusHeadA.tSummarized. bBrownOutReset	Indicates that the device has been restarted due to a power failure.
	19	-	tPbusHeadA.tSummarized. bWatchdogReset	Indicates that the device has been restarted due to a watchdog.
	20	HOT SWAP MODE ERROR	tPbusHeadA.tSummarized. bHotSwapModeError (1)	Informs that there has been an unusual situation in the bus and that the hot swap logic (parameterized by the user) has acted, taking the slave to an Error state.
	21	WRONG SLOT	tPbusHeadA.tSummarized.bWrongSlot	Indicates that the PROFIBUS-DP Head is powered and placed in the wrong bus slot.
	22 .. 31	-	tPbusHeadA.tSummarized. bReserved_nn	Reserved.
%QB(n+13)	DWORD	-	tPbusHeadA.dwModuleNotPresent (1)	Indicates module presence in the respective bus positions.
%QB(n+17)	0	-	tPbusHeadB.tStatus1. bStation_Non_Existent	Nonexistent or non-responsive slave.
	1	-	tPbusHeadB.tStatus1. bStation_Not_Ready	Slave not ready for data exchange cycle.
	2	-	tPbusHeadB.tStatus1.bCfg_Fault	Configuration error, configuration different than sent by master.
	3	-	tPbusHeadB.tStatus1.bExt_Diag	Indicates usage of extended diagnostics.
	4	-	tPbusHeadB.tStatus1.bNot_Supported	Command not supported.
	5	-	tPbusHeadB.tStatus1. bInvalid_Slave_Response	Invalid slave response.
	6	-	tPbusHeadB.tStatus1.bPrm_Fault	Last received parameter is incorrect.
	7	-	tPbusHeadB.tStatus1.bMaster_Lock	Slave parameterized by another master.
%QB(n+18)	0	-	tPbusHeadB.tStatus2. bPrm_Req	Slave requires new parameterization and configuration.
	1	-	tPbusHeadB.tStatus2. bStat_Diag	Master needs to reach information from the slave.
	2	-	tPbusHeadB.tStatus2. bFixed_1	Value fixed in 1.
	3	-	tPbusHeadB.tStatus2. bWD_On	Indication that the watchdog supervisory mechanism is active.
	4	-	tPbusHeadB.tStatus2. bFreeze_Mode	Indicates that the slave received a Freeze command..
	5	-	tPbusHeadB.tStatus2. bSync_Mode	Indicates that the slave received a Sync command.
	6	-	tPbusHeadB.tStatus2. bReserved_06	Reserved.
	7	-	tPbusHeadB.tStatus2. bDeactivated	Slave was not designed.
%QB(n+19)	0	-	tPbusHeadB.tStatus3. bReserved_00	Reserved.
	1	-	tPbusHeadB.tStatus3. bReserved_01	Reserved.
	2	-	tPbusHeadB.tStatus3. bReserved_02	Reserved.
	3	-	tPbusHeadB.tStatus3. bReserved_03	Reserved.
	4	-	tPbusHeadB.tStatus3. bReserved_04	Reserved.
	5	-	tPbusHeadB.tStatus3. bReserved_05	Reserved.
	6	-	tPbusHeadB.tStatus3. bReserved_06	Reserved.
	7	-	tPbusHeadB.tStatus3. bExt_Diag_Overflow	Indicates that the quantity of active diagnostics exceeds the data capacity that the slave can send (defined by Ext_Diag_Data parameter of GSD).
%QB(n+20)	BYTE	-	tPbusHeadB.byMasterAddress	Indicates PROFIBUS-DP master address.
%QB(n+21)	WORD	-	tPbusHeadB.wIdentNumber	Identification number.
%QB(n+23)	BYTE	-	tPbusHeadB.byReserved_06	Reserved.

Direct Representation Variable		Diagnostics Message	Symbolic Variable DG_modulename.	Description
Variable	Size			
%QB(n+24)	BYTE	-	tPbusHeadB.byReserved_07	Reserved.
%QB(n+25)	0	CONFIG. MISMATCH	tSummarized. bConfigMismatch (1)	There is a configuration problem in the bus, such as a module in the wrong slot..
	1	ABSENT MODULES	tPbusHeadB.tSummarized. AbsentModules (1)	One or more declared modules are absent.
	2	SWAPPED MODULES	tPbusHeadB.tSummarized. bSwappedModules (1)	Two modules are swapped in the bus.
	3	NON-DECLARED MODULES	tPbusHeadB.tSummarized. bNonDeclaredModules (1)	One or more modules present in the bus are not declared.
	4	MODULES W/ DIAGNOSTIC	tPbusHeadB.tSummarized. bModulesWithDiagnostic (1)	One or more modules in the bus have active diagnostics.
	5	MODULES W/ FATAL ERROR	tPbusHeadB.tSummarized. bModuleFatalError (1)	One or more modules present in the bus are not functional.
	6	MODULES W/ PARAM. ERROR	tPbusHeadB.tSummarized. bModuleParameterError (1)	One or more modules present in the bus are with parameterization error.
	7	EXCEEDED NUM BYTES	tPbusHeadB.tSummarized. bExceededNumInOutBytes	Indicates that the maximum number of I/O bytes has been exceeded.
	8	EXCEEDED MAX NUM MODULES	tPbusHeadB.tSummarized. bExceededMaxModules	Indicates that the maximum number of modules has been exceeded.
	9	-	bReserved_9	Reserved.
	10	BUS ERROR	tPbusHeadB.tSummarized. bLocalBusError	Indicates that there is a failure in the local bus.
	11	HARDWARE FAILURE	tPbusHeadB.tSummarized. bHardwareFailure	Indicates that there is a hardware failure in the device.
	12	-	bReserved_12	Reserved.
	13	OTD SWITCH ERROR	tPbusHeadB.tSummarized. bOTDSwitchError	The OTD switch was stuck for more than 20 seconds at least once while the slave was powered. This diagnostics is only cleared when the system is restarted.
	14	ADDRESS MODIFIED	tPbusHeadB.tSummarized. bPbAddrSwitchChanged	Indicates that the slave's PROFIBUS-DP address has been altered.
	15	-	tPbusHeadB.tSummarized. bThermometerFailure	Indicates failure in the internal thermometer.
	16		tPbusHeadB.tSummarized. bOverTemperatureAlarm	Indicates the high temperature alarm.
	17	-	tPbusHeadB.tSummarized. bUnderTemperatureAlarm	Indicates the low temperature alarm.
	18	-	tPbusHeadB.tSummarized. bBrownOutReset	Indicates that the device has been restarted due to a power failure.
	19	-	tPbusHeadB.tSummarized. bWatchdogReset	Indicates that the device has been restarted due to a watchdog.
	20	HOT SWAP MODE ERROR	tPbusHeadB.tSummarized. bHotSwapModeError (1)	Informs that there has been an unusual situation in the bus and that the hot swap logic (parameterized by the user) has acted, taking the slave to an Error state.
	21	WRONG SLOT	tPbusHeadB.tSummarized.bWrongSlot	Indicates that the PROFIBUS-DP Head is powered and placed in the wrong bus slot.
	22 .. 31	-	tPbusHeadB.tSummarized. bReserved_nn	Reserved.
%QB(n+29)	DWORD	-	tPbusHeadB.dwModuleNotPresent (1)	Indicates module presence in the respective bus positions.

Table 6-5. Table of Diagnostics Mapped to Variables

(1) The state of these diagnostics is duplicated between tPbusHeadA and tPbusHeadB structures of each PROFIBUS-DP redundant head because they concern the bus. Other diagnostics are specific to each head.

Notes:

Direct Representation Variable: "n" is the address defined in the field *%Q Start Address of Diagnostic Area* at the NX5001 configuration screen – tab *Module Parameters*, at MasterTool IEC XE.

Symbolic Variable: Some symbolic variables are used to access diagnostics. These diagnostics are stored in direct representation variables, so the AT directive is used to map the symbolic variables to them. The AT directive is a reserved word at MasterTool IEC XE that declares diagnostics automatically in symbolic variables. All diagnostics mapped automatically to symbolic variables are found at the *Diagnostics* object.

7.Maintenance

Module Diagnostics

One of the features of the Nexto Series is the generation of irregularities diagnostics such as failures, errors or operating modes, enabling the operator to easily identify and solve problems that may happen to the system.

NX5110 and NX5210 modules have an LCD with status and other useful information such as: Operation Mode with network redundancy enabled, IP address of the Ethernet interface, Sync/Freeze mode indication. There's also the DG LED to provide diagnostics about the interface and the PROFIBUS network and the WD LED to signal the occurrence of a watchdog event.

One Touch Diag

The One Touch Diagnostics (OTD) is an exclusive feature the Nexto Series brings to its programmable controllers. With this new concept, the user can verify the diagnostics of any module connected to the system straight on the CPU or PROFIBUS head (NX5110 or NX5210) graphic display with a single touch on the module's 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 problems quickly.
The diagnostics switch is placed on the CPU's upper part, in an easily accessible place and, besides providing active diagnostics, it allows access to the navigation menu described in chapter Configuration, section PROFIBUS-DP Head's Informative and Configuration Menu.

Figure 7-1 shows the PROFIBUS-DP Head switch placement:

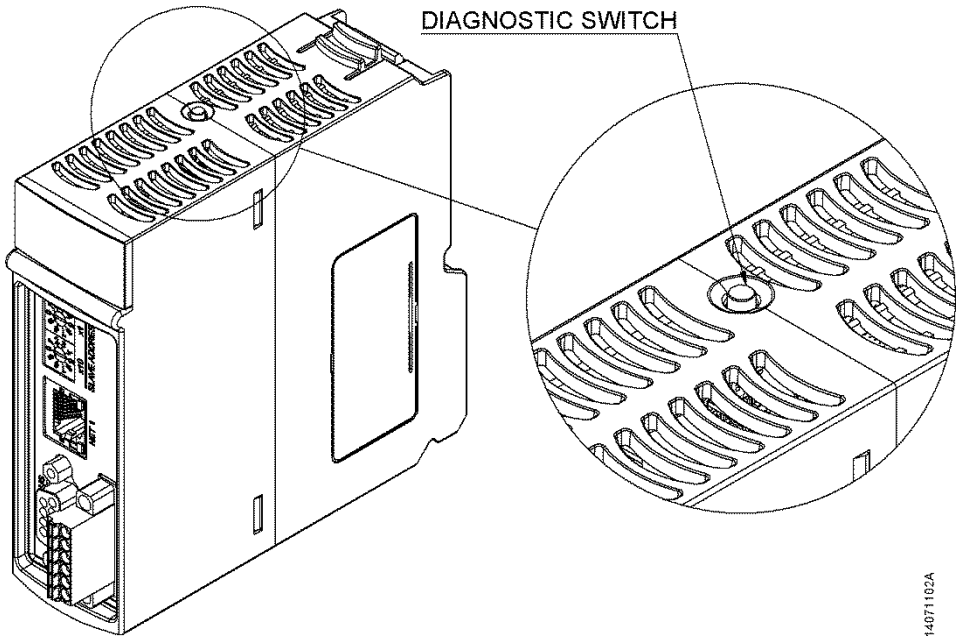

Figure 7-1. Diagnostic Switch

With a single short press, the module starts showing the bus diagnostics (when active, otherwise it shows the "NO DIAG" message). All diagnostics will be shown through messages at the Head's LCD. This process is executed twice and it is automatic, so the user only has to execute the first short press and the Head is responsible for showing the diagnostics. The diagnostics of other modules present in the bus are also shown on the Head's LCD by a short press in their diagnostics switch, in the same presentation model of the Head diagnostics.

Figure 7-2 shows the process starting with the short press, with the conditions and the times presented in smaller rectangles. It is important to stress a single diagnostic may use more than one screen to present the whole message, so the specified time in the flowchart below is valid for each screen.

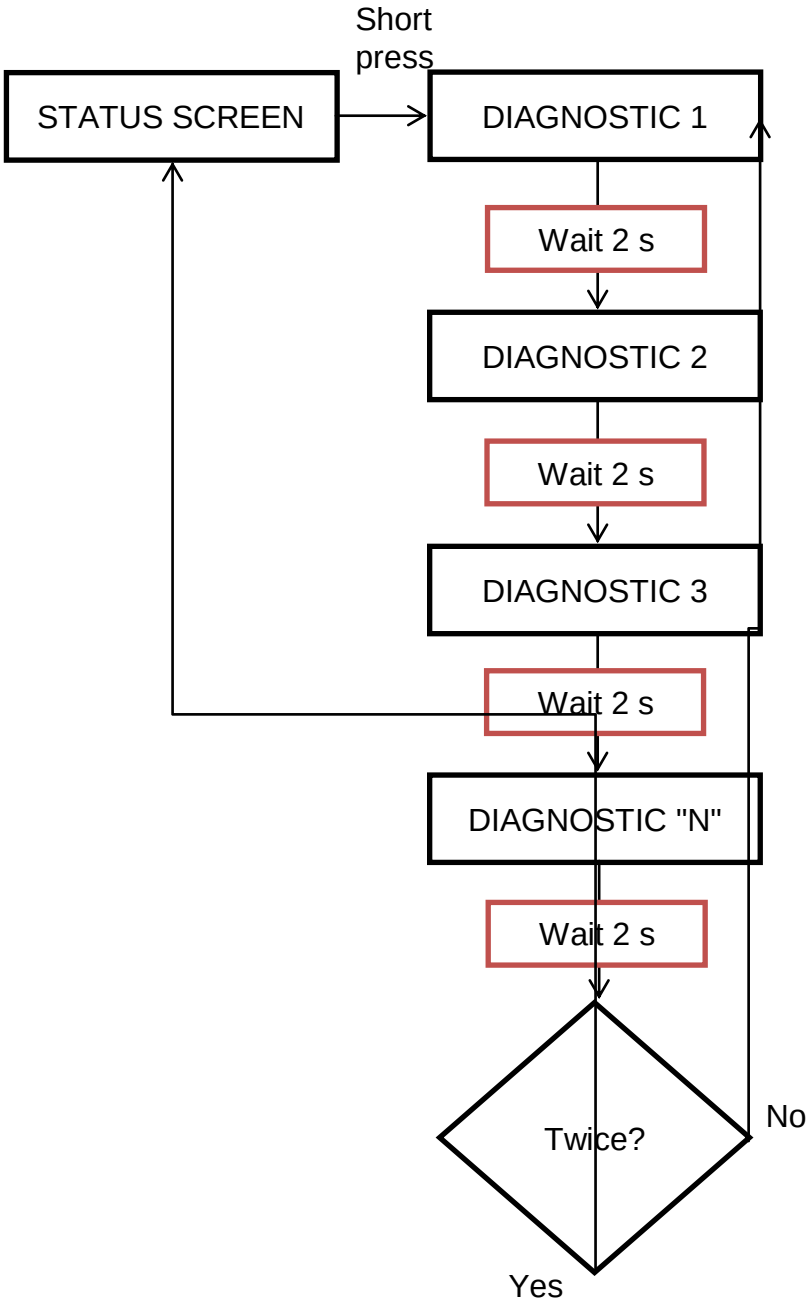

Figure 7-2. Diagnostics Visualization

Diagnostics LEDs

PROFIBUS Heads NX5110 and NX5210 have an LED for diagnostics indication (LED DG) and an LED for watchdog event indication (LED WD). Table 7-1 and Table 7-2 describe each LED's state:

DG (Diagnostic)

Green	Red	Description	Causes	Priority
ON	OFF	Cyclic data are exchanged with the master.	Communication with PROFIBUS-DP master has been established	5 (Low)
Blink 2x	OFF	Modules in the bus with diagnostics	Some module, including the Head, has an active diagnostic	4
Blink 4x	OFF	No configuration	PROFIBUS-DP master still hasn't sent the parameterization and configuration	3
OFF	Blink 1x	Configuration Error or Hardware Error	Configuration/Parameterization Error. See the diagnostics structure	2
OFF	ON	No activity in the PROFIBUS network	- Defective PROFIBUS-DP network cable - Disconnected PROFIBUS-DP network cable - Error in PROFIBUS-DP termination	1
OFF	OFF	Hardware Error in the Head	- Fatal hardware fault - Memory error in PROFIBUS-DP coprocessor	0 (High)

Table 7-1. DG LED Diagnostics

WD (Watchdog)

Green	Red	Description	Causes	Priority
OFF	OFF	No watchdog indication	Normal operation	3 (Low)
OFF	Blink 1x	Software watchdog	Software watchdog	2
OFF	ON	Hardware watchdog	Damaged Module	1 (High)

Table 7-2. WD LED Diagnostics

Notes:

Software Watchdog: To remove the watchdog application, the device must be reset. This watchdog happens when the PROFIBUS-DP execution time is larger than the watchdog configured time.

Hardware Watchdog: In order to reset any watchdog indication, as in the WD LED or in the tDetailed.Reset.bWatchdogReset variable, the module must be disconnected from the power supply

WEB Diagnostics

Besides the previously presented features, Nexto Series brings to the user an innovating access tool to the system diagnostics and operation states through a WEB page. The utilization and dynamics is very intuitive and facilitates user operation. The use of a supervisory system can be replaced when it is restricted to system status verification.

To access the desired PROFIBUS-DB Head WEB page, just use a standard browser (Internet Explorer 7 or above, Mozilla Firefox 3.0 or above and Google Chrome 8 or above) and type the Head's IP address at the address bar (e.g. 192.168.1.1). First, the PROFIBUS-DP Head information is presented, as in Figure 7-3:

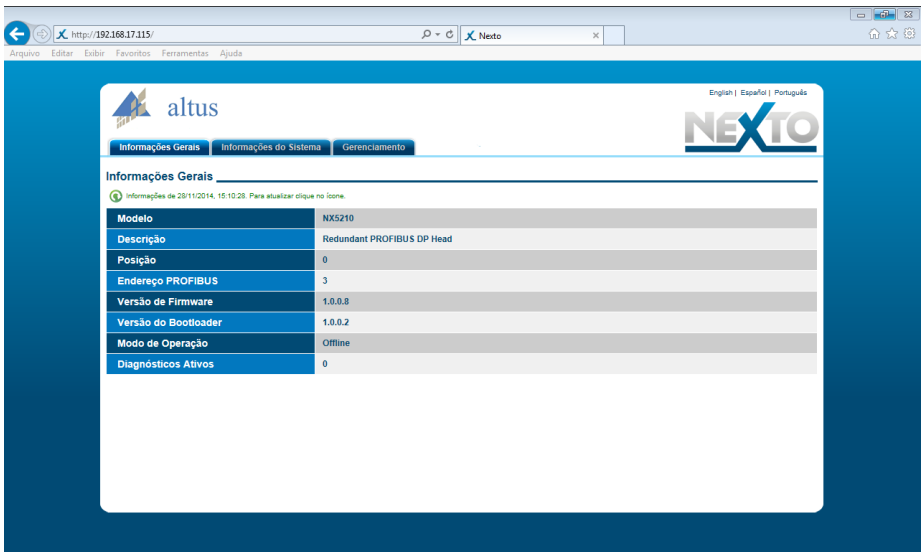

Figure 7-3. Start Screen

There's also the *System Overview* tab, where he user can see Diagnostics and Status information on the PROFIBUS-DP Head.

The Diagnostics section shows the active Diagnostics of the PROFIBUS-DP Head, as shown in Figure 7-4.

ATTENTION: When a PROFIBUS Head is restarted and an application exception happens at the startup, the diagnostics are not valid. It is necessary to fix the problem that generates the application exception for the diagnostics to be updated.

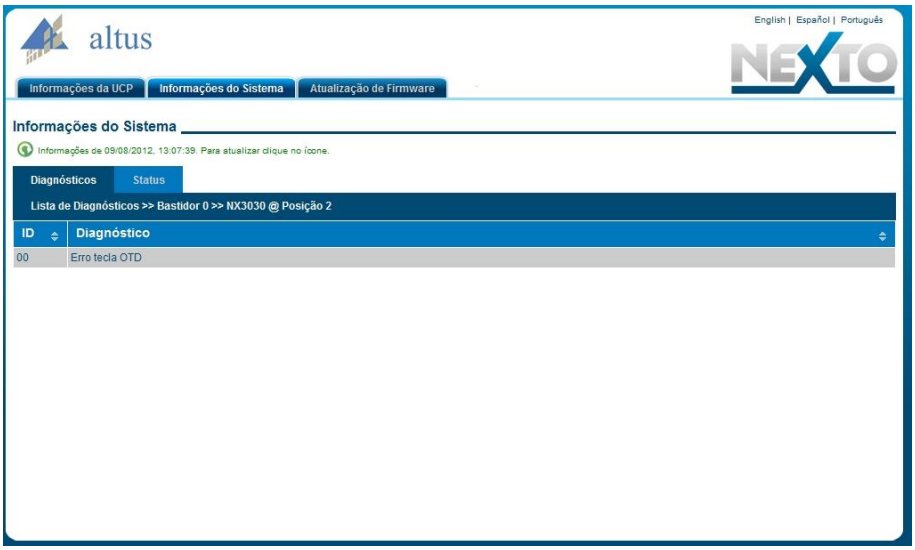

Figure 7-4. System Diagnostics

The Status section shows the state of all detailed diagnostics, as shown in Figure 7-5:

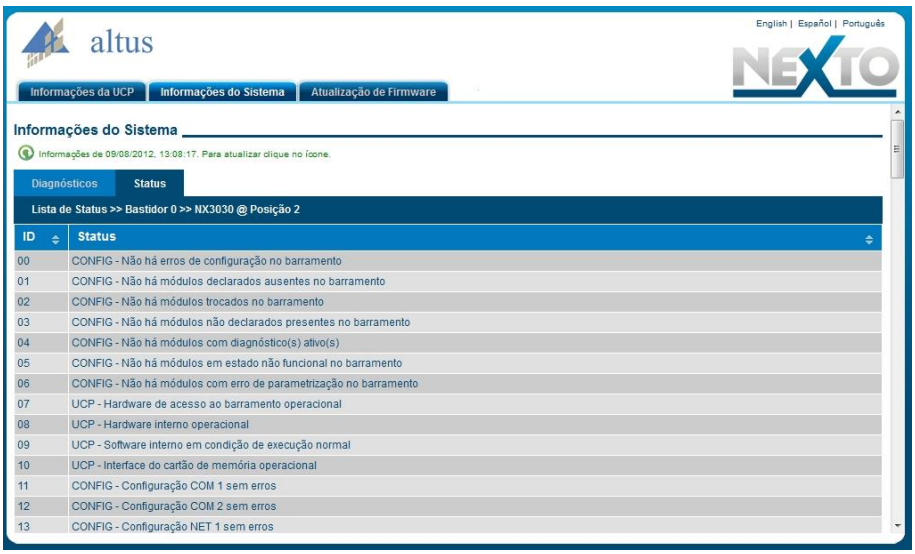

Figure 7-5. System Status

The user can also choose between three language options: Portuguese, English and Spanish. The options are in upper right menu.

The *Management* tab allows the IP address configuration at the Network Configuration section, where the current configuration is seen, and also a button to enable its editing, as shown in Figure 7-6.

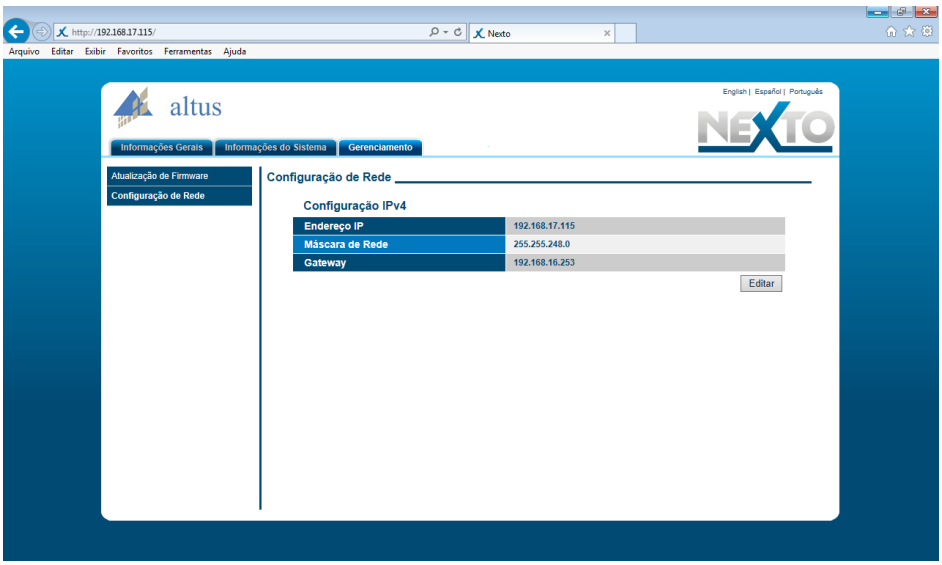

Figure 7-6. Network Configuration

The *Firmware Update* section is restricted to Altus' internal usage.

Preventive Maintenance

- It must be verified, each year, if the interconnection cables are connected firmly, without dust accumulation, mainly the protection devices
- In environments subjected to excessive contamination, the equipment must be periodically cleaned from dust, debris, etc.

The TVS diodes used for transient protection caused by atmospheric discharges must be periodically inspected, as they might be damaged or destroyed in case the absorbed energy is above limit. In

many cases, the failure may not be visual. In critical applications, is recommendable the periodic replacement of the TVS diodes, even if they do not show visual signals of failure.

8. Glossary

Autoclear	In PROFIBUS networks, it's the parameter that, when activated, changes the State of the master to Clear when an error occurs on the network.
Bus	Set of electrical signals that are part of a logic group with the function of transferring data and control between different elements of a subsystem.
Remote bus	Set of interconnected I/O modules to a head of network field.
Bit	Basic information unit, it may be at 1 or 0 logic level.
Byte	Information unit composed by eight bits.
Field network head	Slave module of a field network. Is responsible for the exchange of data between your modules and a master of the field network.
Field network cable	Cable that connects the nodes of a field network, e.g. the field network interface and the field network head.
Serial channel	Interface for an equipment that transfers data in serial mode.
Watchdog	Electronic circuit that checks the equipment operation integrity.
Cluster	Group formed by the controllers (half-clusters) PLCA and PLCB.
Programmable Controller	Also known as PLC. Equipment controlling a system under the command of an application program. It is composed of a CPU, a power supply and I/O modules.
PLC	See Programmable Controller.
Redundant PLC	Group formed by a cluster (PLCA and PLCB), PX2612 control panel and remote I/O systems.
Stand-by PLC	Half-cluster (PLCA or PLCB) who is momentarily in a stand-by state.
PLCA	Designation of one of the two controllers that form a redundant PLC. The other is called PLCB.
PLCB	Designation of one of the two controllers that form a redundant PLC. The other is called PLCA.
Default	Preset value for a variable, used in case there is no definition.
Diagnosis	Procedure used to detect and isolate faults. It is also the set of data used for this determination, which serves for the analysis and remediation.
Dword	Double Word.
EN50170	In PROFIBUS networks, is the standard that defines the field network.
Address of head of field network	Is the address of a node on the network, set at the base of the field network head module.
I/O	See input/output.
Input/output	Also called I/O. I/O devices on a system. In the case of PLCs typically correspond to modules digital or analogue output or input monitoring or driving the controlled device.
ER	Acronym used to indicate error in LEDs.
Slave	Equipment connected to a communications network that transmits data only if it is requested by other equipment called master.
Frame	A unit of information transmitted on the network.
Freeze	In PROFIBUS networks, is the State of the network when the data entries are frozen.
Gateway	Equipment for connecting two communication networks with different protocols.
Half-cluster	Alternative name for each of the two controllers (PLCA and PLCB) that form a cluster.
Hardware	Physical equipment used in data processing which normally run programs (software).
HSA	Acronym for Highest Station Address.
IEC 61131	Generic standard for operation and use of PLCs. Former IEC1131.
Interface	Adapts electric and/or logically the transfer of signals between two devices.
Field Network Interface	Field networks master module located in local bus and intended to make communication with field network heads.
LED	Acronym for Light Emitting Diode. Is a type of semiconductor diode that emits light when stimulated by electricity. Used as an indicator light.
Menu	Set of options available and displayed by a program in the video and that can be selected by the user to activate or to perform a particular task.
Master	Equipment connected to a communications network where originate command requests to other network equipment.
Active PROFIBUS Master	The master NX5001 in Active mode establishes communication with the remote (slave) PROFIBUS.
Passive PROFIBUS Master	Passive mode serves to test the circuits of transmission and reception PROFIBUS and physical medium to prevent the occurrence of a hidden flaw. The master NX5001 in passive mode performs only the master fault monitoring NX5001 active.
Module (hardware)	Basic element of a system with very specific functionality. It's normally connected to the system by connectors and may be easily replaced.

Node	Any station of a network with communication skills using an established protocol.
NX5001	Refers to the PROFIBUS DP master module NX5001.
Octet	Set of eight bits numbered from 0 to 7.
PROFIBUS DP	Means PROFIBUS Protocol (Decentralized Periphery).
Application program	Is the program loaded into a PLC, which determines the operation of a machine or process.
Project	PLC project as a whole, formed by the project archive (source code) and by the project application (executable code).
Protocol	Procedural rules and conventional formats which, upon control signals, allow the establishment of a data transmission and error recovery between equipment.
Communication network	Set of equipment (nodes) interconnected by communication channels.
Master-slave communication network	Communication network where information transfers are initiated only from a single node (master of network) connected to the data bus. The other network nodes (slave) only respond when requested.
Multimaster communication network	Communication network where information transfers are initiated by any node connected to the data bus.
Master redundancy (referring to PROFIBUS Master)	System used in PLC redundant, where two masters NX5001 are used in the same network. A master on the PLCA and the other on the PLCB. A NX5001 will act as Active Master and the other as Passive Master liability (see Passive PROFIBUS Master and Active PROFIBUS Master).
Network redundancy (referring to PROFIBUS network)	Each PROFIBUS slave device has two network connections, forming a double network, connected to two NX5001 modules.
Software	Computer programs, procedures and rules related to the operation of a data processing system.
Bus termination	Component that should be connected in the last module of a bus.
Timeout	Maximum preset time to a communication to take place. When exceeded, then retry procedures are started or diagnostics are activated.
Token	Is a tag that indicates who is the master of the bus at the time.
Hot swap	Procedure of replacement of modules in a system without the need of turning off. Normally used in trading of I/O modules.
CPU	Central Processing Unit. It controls the data flow, interprets and executes the program instructions as well as monitors the system devices.
Varistor	Voltage surge protection device
WD	Acronym for watchdog. See watchdog circuit.
Word	Information unit composed by 16 bits.
Autoclear	In PROFIBUS networks, it's the parameter that, when activated, changes the State of the master to Clear when an error occurs on the network.
Bus	Set of electrical signals that are part of a logic group with the function of transferring data and control between different elements of a subsystem.
Remote bus	Set of interconnected I/O modules to a head of network field.
Bit	Basic information unit, it may be at 1 or 0 logic level.
Byte	Information unit composed by eight bits.
Field network head	Slave module of a field network. Is responsible for the exchange of data between your modules and a master of the field network.
Field network cable	Cabo que conecta os nós de uma rede de campo, como a interface de rede de campo e a cabeça de rede de campo.
Serial channel	Interface for an equipment that transfers data in serial mode.
Watchdog	Electronic circuit that checks the equipment operation integrity.
Cluster	Group formed by the controllers (half-clusters) PLCA and PLCB.
Programmable Controller	Also know as PLC. Equipment controlling a system under the command of an application program. It is composed of a CPU, a power supply and I/O modules.
PLC	See Programmable Controller.
Redundant PLC	Group formed by a cluster (PLCA and PLCB), PX2612 control panel and remote I/O systems.
Stand-by PLC	Half-cluster (PLCA or PLCB) who is momentarily in a stand-by state.
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Default	Preset value for a variable, used in case there is no definition.
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Input/output Also called I/O. I/O devices on a system. In the case of PLCs typically correspond to modules digital or analogue output or input monitoring or driving the controlled device.