1. Product Description

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

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

The NX2001 is a 24 Vdc transistor output module. NX2001 offers 16 protected source type outputs for general purpose use and uses only one slot of the Nexto Series Backplane Rack. Finally, Nexto Series has some innovative features for diagnosis and maintenance, such as Electronic Tag on Display, Easy Plug System and One Touch Diag.

Its main features are:

- High density, with 16 outputs in single width module
- Two isolated output groups
- Diagnostics and short circuit protection for outputs
- Protection against external power supply polarity inversion
- External power supply low voltage diagnostic
- Display for module diagnostics and output state indication
- Easy Plug System
- One Touch Diag
- Electronic Tag on Display

2. Ordering Information

2.1. Included Items

The product package contains the following items:

- NX2001 module
- 20-terminals connector with wire holder

2.2. Product Code

The following code should be used to purchase the product:

Code	Description
NX2001	24 Vdc 16 DO Transistor Module

Table 1: Product Code

3. Related Products

The following product must be purchased separately when necessary:

Code	Description
NX9403	20-terminal connector with cable guides

Table 2: Related Products

4. Innovative Features

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

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

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

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

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..

5. Product Features

5.1. General Features

	NX2001
Backplane rack occupation	1 slot
Output type	Transistor source type
Number of outputs	16
Maximum output current	1 A @ 30 Vdc per output 4 A @ 30 Vdc per group
Leakage current	30 μA
On state resistance	0.25 Ω
External power supply	19.2 to 30 Vdc
Switching time	100 μs – off-to-on transition 400 μs – on-to-off transition
Maximum switching frequency	500 Hz
Output update time	1 ms
Output state indication	Yes
One Touch Diag (OTD)	Yes
Electronic Tag on Display (ETD)	Yes
Status and diagnostic indication	Display, web pages and CPU's internal memory
Hot swap capability	Yes
Module protections	Yes, power supply polarity inversion protection, protection against surge voltages and short circuit
Wire gauge	0,5 mm^2 (20 AWG)
Minimum wire temperature rating	75 °C
Wire material	Copper only
Isolation	
Outputs to logic	500 Vac / 1 minute
Outputs to protective earth ⏚	1250 Vac / 1 minute
Logic to protective earth ⏚	1250 Vac / 1 minute
Output group to output group	500 Vac / 1 minute
Current consumption from rack PSU	140 mA
Maximum power dissipation	3 W
IP level	IP 20
Operating temperature	0 to 60 °C
Storage temperature	-25 to 70 °C
Operating and storage relative humidity	5% to 96%, non-condensing
Conformal coating	Yes
Module dimensions (W x H x D)	18.00 x 114.62 x 117.46 mm
Package dimensions (W x H x D)	25.00 x 122.00 x 147.00 mm
Weight	200 g
Weight with package	250 g

Table 3: General Features

Notes:

Maximum output current: When required higher current value, it's possible to use more than one output connected on the same load. In this case the maximum current is the sum of individual currents where up to 4 outputs can be used

together. For example: It's possible to drive a given load with 1.5 A using 2 outputs. All outputs used on a given load must be enabled/disabled at the same time.

External power supply: The terminals 9, 10, 19 and 20 are used to supply voltage only to the outputs. NX2001 is supplied by the Power Supply Module placed on the Nexto Backplane Rack.

ATTENTION

If the external power supply is below the 19.2 V limit, the outputs are turned off. However, since the display only shows the outputs' logical state, its indication may not match the physical state of outputs.

Switching time: It's the required time to turn off one specific output, but it depends on the output load. A lower resistance load results in a shorter time to disable the output. The given time refers to the maximum time to disable an output connected to a 12.5 kΩ resistive load, which is the maximum allowable resistance defined by IEC 61131 for digital input modules.

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

Wire gauge: Crimp terminals for 0.5 mm^2 wire in each way respecting as described at Nexto Series User Manual - MU214600.

5.2. Standards and Certifications

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

Table 4: Standards and Certifications

5.3. Compatibility with Other Products

The following table provides information regarding the compatibility of the module NX2001 and Nexto Series programming tool MasterTool IEC XE.

NX2001		Compatible Software Version
Version	**Revision**	**MasterTool IEC XE**
1.0.0.0	AA	1.22 or higher
1.0.1.1 or higher	AB or higher	1.29 or higher

Table 5: Compatibility with Other Products

Note:

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

5.4. Physical Dimensions

Dimensions in mm.

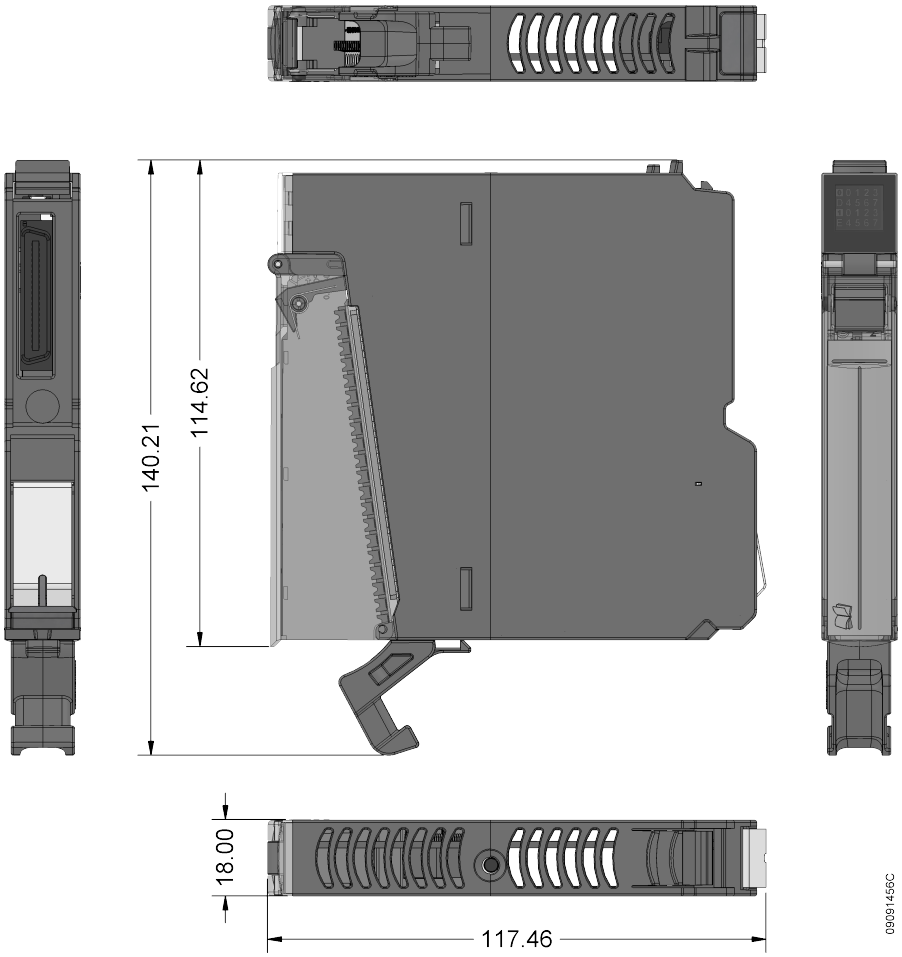

Figure 1: Physical Dimensions

6. Installation

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

6.1. Product Identification

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

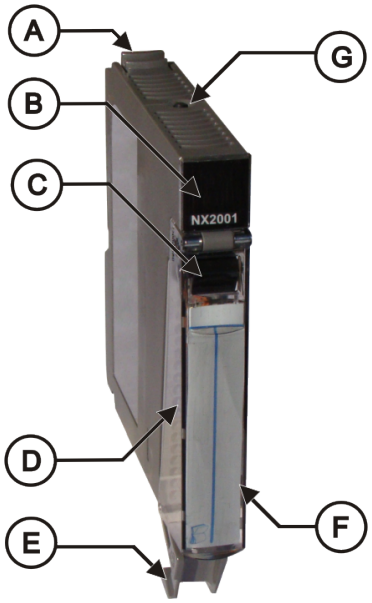

Figure 2: NX2001

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

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

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

⎓ Direct Current.

6.2. Electrical Installation

The figure below shows an example where each NX2001's output is connected to a different load. The outputs 00 to 07 are supplied by one power supply and the outputs 10 to 17 are supplied by a different one.

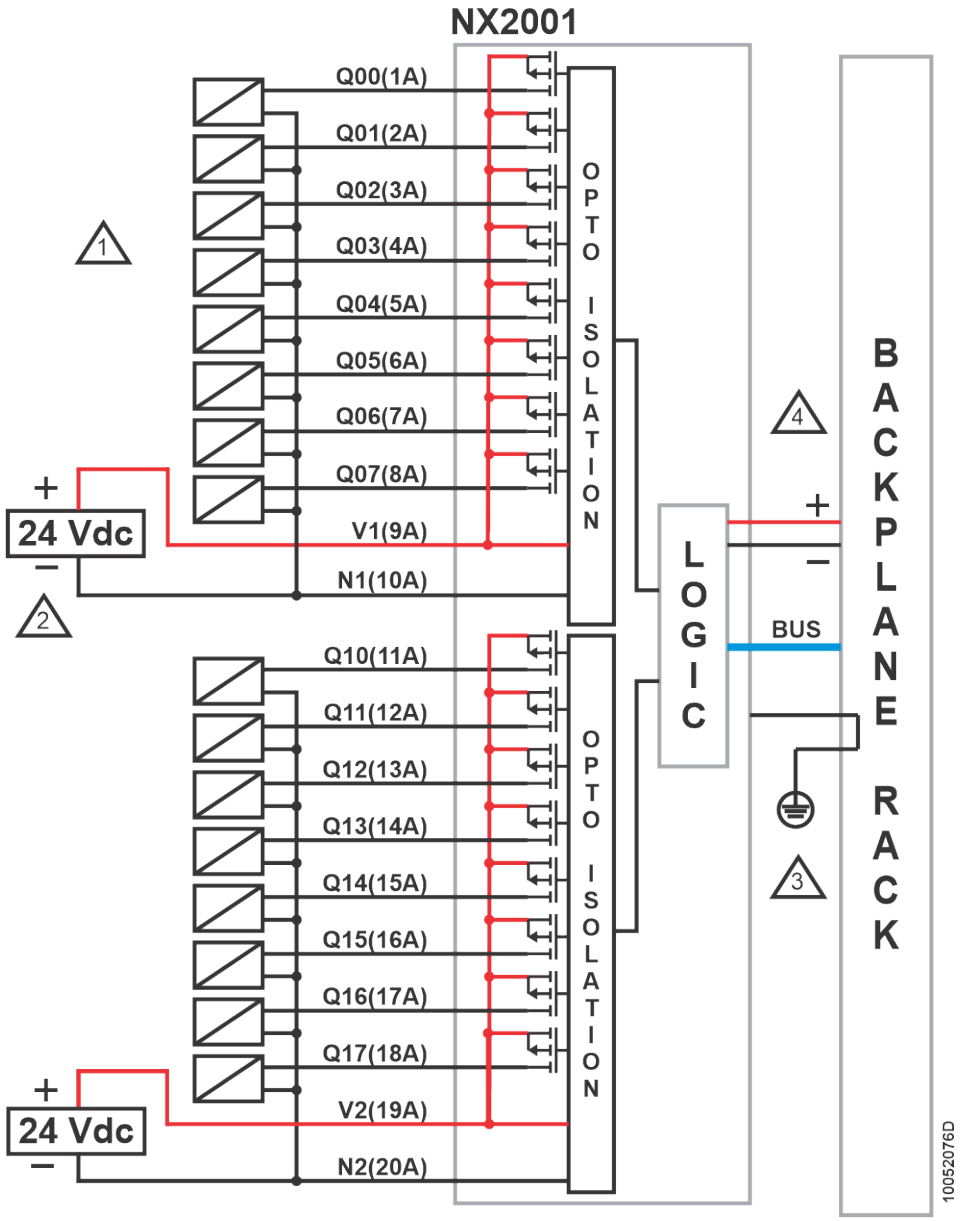

Figure 3: Electric Diagram

Diagram Notes:

1 Typical usage of source digital outputs.

2 External power supply to supply the outputs, V1 and V2 are connected to +24 Vdc, N1 and N2 are connected to 0 Vdc.

3 The module is grounded through the Nexto Series backplane rack.

4 The module power supply is derived from the connection to the backplane rack, not requiring external connections.

Protective conductor terminal.

6.3. Connector Pinout

The following table shows the description of each connector terminal:

Terminal Number	Description
1	Output 00
2	Output 01
3	Output 02
4	Output 03
5	Output 04
6	Output 05
7	Output 06
8	Output 07
9	(V1) +24 Vdc for outputs 00 to 07
10	(N1) 0 Vdc for outputs 00 to 07
11	Output 10
12	Output 11
13	Output 12
14	Output 13
15	Output 14
16	Output 15
17	Output 16
18	Output 17
19	(V2) +24 Vdc for outputs 10 to 17
20	(N2) 0 Vdc for outputs 10 to 17

Table 6: Connector Pinout

6.4. Protection Circuit

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

ATTENTION

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

6.5. Mechanical and Electrical Assembly

The mechanical and electrical mounting and the connector insertion and removing for single hardware width I/O modules are described at Nexto Series User Manual – MU214600.

ATTENTION

Products with broken warranty seal are not covered in warranty.

CAUTION

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

DANGER

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

7. Configuration

This module was developed to be used with Nexto Series products. All Nexto Series products are configured in MasterTool IEC XE. All configuration data of a given module can be accessed through a double click in it on the Graphical Editor.

7.1. Process Data

Process Data, when available, are the variables that are used to access and control the module. The list below describes all variables delivered by NX2001.

The process data of the module, when inserted in a PROFIBUS network, can be accessed through variables. The table below presents the variables organizational structure in the CPU memory.

Besides this data, NX2001 also provides a set of variables containing information related to diagnostics which are also described in this document.

Variable	Size	Process Data	Description	Type	Update
%QB(n)	BYTE	Digital Outputs - Byte 0	Output value of output 00 to 07	Output (Read/Write)	Always
%QB(n+1)	BYTE	Digital Outputs - Byte 1	Output value of output 10 to 17	Output (Read/Write)	Always

Table 7: Process Data

Note:

Update: The field Update indicates if, by default, the respective process data is updated by CPU and NX2001. When defined as Always, it means that the process data is always updated. When defined as Selectable, means that the user can select if the respective process data will be updated or not. All these process data are exchanged between CPU and NX2001 through the bus. To improve CPU performance, it's recommended to update only the process data that will be used in the application.

7.2. Module Parameters

Name	Description	Standard value	Options	Configuration
Outputs Behavior when CPU is in Stop	Defines output behavior when CPU is in Stop.	Disabled	Disabled Off On Last Value	Per Output
%Q Start Address of Module Diagnostics Area	Defines the starting address of the module diagnostics.	-	-	Per Module

Table 8: Module parameters

Notes:

Outputs Behavior when CPU is in Stop: This parameter allows to define the state of the module outputs when the execution of the application on the CPU is interrupted, both on the local bus and on remote PROFIBUS (when there is no CPU redundancy), which can typically occur in two situations:

- Execution of Stop command through MasterTool
- Failure in one or more I/O module (absent), when Hot Swap is disabled

When the system has CPU redundancy, it is not recommended to execute a Stop command on the active CPU, since it is controlling the system. If this command is executed, just like the other two situations described above, the execution of the application is not interrupted, since the Reserve PC assumes control. However, if these situations are triggered when the other CPU is not in the Reserve state, application execution will be interrupted and the PROFIBUS bus outputs will go into the Disabled state.

The "CPU in Stop" state also occurs at the end of Download, Reset Warm and Reset Cold. During the execution of these commands, the behavior of the outputs may vary depending on the type of architecture used:

- **Local Bus:** he output temporarily assumes the Disabled state, going to the value set by the parameter at the end of the operation. However, specifically in the case configured as Last Value, due to the application restart that occurs in these commands, the output does not return to the last value written, but to its minimum value.
- **PROFIBUS Remote Bus:** The behavior depends on whether the system uses CPU redundancy. In non-redundant systems, the behavior is the same as described for the local bus. In redundant systems, however, the output state will be Disabled in all three cases.

There are also other situations that involve stopping the CPU, such as:

- Reset Origin
- CPU failure (no power, or removed from the bus)
- Software exception
- Firmware update

In these scenarios, where there is an interruption or complete removal of the application, the output temporarily switch to the state defined by this parameter. However, at the end of the process, the state of the output will be Disabled. In the case of a firmware update, at the end of the process, if the CPU has an application, the output will assume the value set in the application.

The support for this functionality was introduced on MasterTool version 3.75 and firmware 1.2.0.10, where the default value is Disabled, thus keeping the module original behavior. If used with an earlier firmware version, the module will work normally, only ignoring the value set for this parameter, also keeping its original behavior.

8. Usage

8.1. General Purpose Output Write

NX2001 has two variables to control its outputs (Digital Outputs - Byte 0 and Digital Outputs - Byte 1). These variables have eight bits where each bit represents the logical state of each output channel. The relationship between each bit and its respective output can be found on the Bus I/O Mapping tab.

9. Maintenance

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

This module offers five important features to assist users during maintenance: Electronic Tag on Display, One Touch Diag, Status and Diagnostics Indicators, Web Page with Complete Status and Diagnostics List, and Diagnostics through Variables.

9.1. Electronic Tag on Display and One Touch Diag

Electronic Tag on Display and One Touch Diag are important features that provide to the user the option to check the tag, description and diagnostics related to a given module directly on the CPU display.

Electronic Tag on Display and One Touch Diag are easy-to-use features. To check the tag and diagnostics of a given module, it's required only one short press (shorter than 1 s) on its diagnostic switch. After pressing once, CPU will start to scroll tag information and diagnostic information of the module. To access the respective module description just long press (longer than 1 s) the diagnostics switch of the respective module.

More information about Electronic Tag on Display and One Touch Diag can be found at User Manual of each respective CPU (listed at manual of Nexto Series - MU214600).

9.2. Status and Diagnostics Indicators

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

9.2.1. State of D and E Symbols

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

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

Table 9: Status of Symbols D and E

Notes:

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

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

9.2.2. 0, 1 and Numerical Characters

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

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

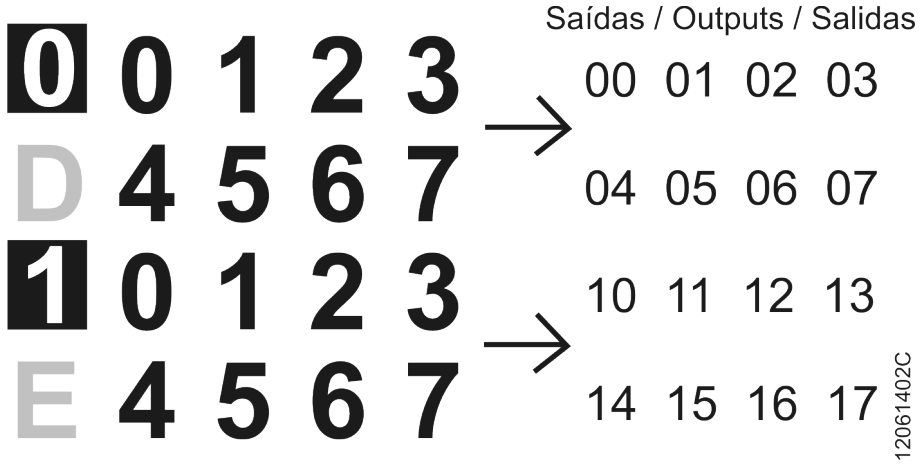

Figure 4: Display

9.3. Web Page with Complete Status and Diagnostics List

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

More information about web page with complete status and diagnostics list can be found at User Manual of each respective CPU (listed at Nexto Series User Manual - MU214600).

9.4. Diagnostics Through Variables

All diagnostics in this module can be accessed through variables that can be handled by the user application or even forwarded to a supervisory system using a communication channel. There are two different ways to access diagnostics in the user application: using symbolic variables with AT directive or addressing memory. Altus recommends use symbolic variables for diagnostic accessing. The table below shows all available diagnostics for this module and their respective memory address, description, symbolic variable and string that will be shown on the CPU graphical display and web.

9.4.1. General Diagnostics

Direct Variable		Diagnostic Message	Symbolic Variable DG_NX2001.tGeneral.*	Description	PROFIBUS Message Code
Variable	**Bit**				
%QB(n)	0..7	Reserved			
%QB(n+1)	0	MODULE W/ DIAGNOSTIC	bActiveDiagnostics	TRUE – Module has active diagnostics	-
		NO DIAG		FALSE – Module doesn't have active diagnostics	
	1	MODULE W/ FATAL ERROR	bFatalError	TRUE – Fatal error	25
		-		FALSE – No fatal error	
	2	CONFIG. MISMATCH	bConfigMismatch	TRUE – Parameterization error	26
		-		FALSE – Parameterization ok	
	3	WATCHDOG ERROR	bWatchdogError	TRUE – Watchdog has been detected	27
		-		FALSE – No watchdog	
	4	OTD SWITCH ERROR	bOTDSwitchError	TRUE – Module has switch failure	28
		-		FALSE – Diagnostics switch ok	
	5..7	Reserved			

Table 10: General Diagnostics

9.4.2. Detailed Diagnostics

Direct Variable		Diagnostic Message	Symbolic Variable DG_NX2001.tDetailed.*	Description	PROFIBUS Message Code
Variable	**Bit**				
%QB(n+2)	0	OUTPUT SHORT CIRCUIT G0	bOutputShortCircuitGroup_0	TRUE – Short circuit at outputs 00 to 07. Short circuit in any output with diagnostic enabled.	16
		-		FALSE – No short circuit at outputs 00 to 07.	
	1	OUTPUT SHORT CIRCUIT G1	bOutputShortCircuitGroup_1	TRUE – Short circuit at outputs 10 to 17. Short circuit in any output with diagnostic enabled.	17
		-		FALSE – No short circuit at outputs 10 to 17.	
	2..7	Reserved			
%QB(n+3)	0	NO EXTERNAL SUPPLY G0	bNoExternalSupplyGroup_0	TRUE – No external power supply at outputs 00 to 07 (terminal 9 and 10 of the connector).	24
		-		FALSE – Power supply ok for outputs 00 to 07.	
	1	NO EXTERNAL SUPPLY G1	bNoExternalSupplyGroup_1	TRUE – No external power supply at outputs 10 to 17 (terminal 19 and 20 of the connector).	25
		-		FALSE – Power supply ok for outputs 10 to 17.	
	2..7	Reserved			

Table 11: Detailed Diagnostics

Notes:

Direct Representation Variable: "n" is the address defined in the field %Q Start Address of Module Diagnostics Area on the NX2001 configuration screen – Module Parameters tab in MasterTool IEC XE.

Symbolic Variable: Some symbolic variables serve to access diagnostics. These diagnostics are stored in the direct representation variable, then the AT directive is used to map the symbolic variables in the direct representation variable. The AT directive is a reserved word in the MasterTool IEC XE, that uses this directive to declare the diagnostics automatically on a symbolic variables. All symbolic variables declared automatically can be found in the diagnostics object.

9.5. Hot Swap

This product supports hot swap. For further information about how to correctly perform a hot swap, consult Nexto Series User Manual - MU214600.

10. Manuals

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

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

Code	Description	Language
CE114000	Nexto Series – Technical Characteristics	English
CT114000	Série Nexto – Características Técnicas	Portuguese
MU214600	Nexto Series User Manual	English
MU214000	Manual de Utilização Série Nexto	Portuguese
MU299609	MasterTool IEC XE User Manual	English
MU299048	Manual de Utilização MasterTool IEC XE	Portuguese
MP399609	MasterTool IEC XE Programming Manual	English
MP399048	Manual de Programação MasterTool IEC XE	Portuguese
MU214608	Nexto PROFIBUS-DP Head Utilization Manual	English
MU214108	Manual de Utilização da Cabeça PROFIBUS-DP Nexto	Portuguese

Table 12: Related Documents