# 1. Product Description

NX-ERA 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, NX-ERA Series can be used for control systems from medium to high-end large applications. Due to its compact size, high density of points per module and superior performance capacity, NX-ERA can also be used for small automation systems with high performance requirements, as industrial machinery and manufacture applications.

Bus technology used in the series is based on high speed deterministic Ethernet which allows the inputs, outputs and processed information to be shared among modules of the system. The I/O modules can be easily distributed in the field and can be used for both local I/O (located at the same rack of CPU module) and as remote without any loss in performance through the NX4000 bus expansion module. Besides allowing the bus expansion without loss of performance, the module NX4000 allows the use of two kinds of redundancy, characteristic which increases I/O system availability.



Its main features are:

- Bus expansion with loopback support (cable redundancy)
- Bus expansion module redundancy support
- One Touch Diag
- Electronic Tag on Display
- Display for diagnostics indication

# 2. Ordering Information

## 2.1. Included Items

The product package contains the following items:

- NX4000 module
- Installation guide

## 2.2. Product Code

The following code should be used to purchase the product:

| Code | Description |
|---|---|
| NX4000 | Bus Expansion Module |

Table 1: Product Code

## 2.3. Related Products

The following products must be purchased separately when necessary:

| Code | Description |
|---|---|
| NX9202 | RJ45-RJ45 2 m Cable |
| NX9205 | RJ45-RJ45 5 m Cable |
| NX9210 | RJ45-RJ45 10 m Cable |

Table 2: Related Products

Note:

NX9202, NX9205 and NX9210: These cables that may be used to interconnect the bus expansion modules are available in lengths described in the table above.

# 3. Innovative Features

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

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

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

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

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

# 4.  Product Features

## 4.1.  General Features

| | NX4000 |
|---|---|
| Backplane rack occupation | 2 sequential slots |
| Bus expansion with loopback support (redundant cabling) | Yes |
| Redundancy support of bus expansion | Yes |
| Maximum number of expansion racks | NX3003: 0 rack<br>NX3004: 1 rack<br>NX3005: 4 racks<br>NX3010: 8 racks<br>NX3020: 24 racks<br>NX3030: 24 racks |
| Maximum number of I/O modules | 128 |
| Hot swap support | Yes |
| Status and diagnostic indication | Display, web page and CPU's internal memory |
| One Touch Diag (OTD) | Yes |
| Electronic Tag on Display (ETD) | Yes |
| Isolation<br>   Logic to bus expansion interfaces<br>   Logic to protective earth ⏚<br>   Bus expansion interfaces to protective earth | <br>1500 Vac / 1 minute<br>1250 Vac / 1 minute<br><br>1500 Vac / 1 minute |
| Current consumption from backplane rack power supply | 360 mA |
| Dissipation | 1.8 W |
| IP Level | IP 20 |
| Operating temperature | 0 to 60 °C |
| Storage temperature | -25 to 75 °C |
| Operating and storage relative humidity | 5% to 96%, no condensing |
| Conformal coating | Yes |
| Module dimensions (W x H x D) | 36.00 x 114.63 x 117.07 mm |
| Package dimensions (W x H x D) | 42.00 x 122.00 x 147.00 mm |
| Weight | 200 g |
| Weight with package | 250 g |

Table 3: General Features

**Notes:**

**Status and diagnostic indication**:  More information about diagnostic and status indication can be found on the topic Maintenance.

**Logic:** Logic is the name for the internal interfaces like processors, memories and backplane rack interfaces.

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

## 4.2. Standards and Certifications

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

Table 4: Standards and Certifications

## 4.3. System Configurations

Suggested configurations using NX4000 are shown below:

### 4.3.1. Configuration A: Bus Expansion without Loopback

These architectures are based on a base rack (where the CPU is placed) and remote racks. The communication between the base rack and the remote racks is done via NX4000 modules. Each remote rack needs its own power supply module and a Bus Expansion module. The Bus Expansions has two RJ45 ports, where one port is for incoming data and another one for outgoing data.

In this application example, only the NX4000 local module outgoing port is connected. The incoming data port is open. The last remote rack has the outgoing data port open. The remote racks in between, will have both ports connected: one port connected to previous rack and the other to the next rack. Each Bus Expansion has a switch for selecting the rack address. Each rack must have a unique address.

This architecture is intended for medium to large applications, where the number of I/O points is high.
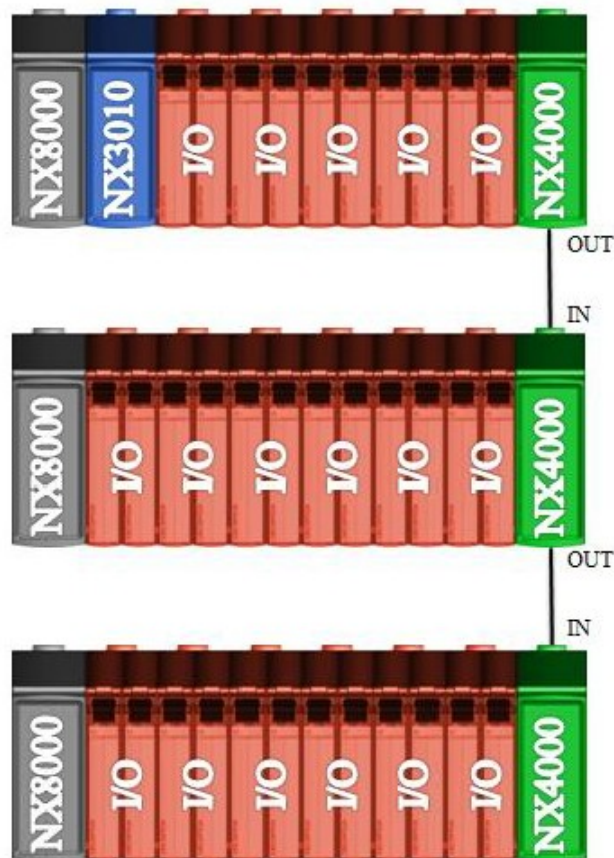
Figure 1: Configuration A

> **ATTENTION**
>
> This module executes the bus expansion function, because it, can not install additional and non-declared NX4000 modules on the bus.

### 4.3.2.  Configuration B: Bus Expansion with Loopback

This architecture is based on the previous one with a base rack (where the CPU is placed) and remote racks. The communication between the base rack and remote racks is done via the Bus Expansion modules. The only difference is that the outgoing data port in the last NX4000 module is connected to the NX4000 base rack incoming data port.

This architecture allows the system to keep the I/O access even in the case of a single failure on extension cables. The CPU will detect the damaged cable, re-route the internal data paths to override this failure and generate user diagnostics. This feature is interesting for fast maintenance with the system powered on and it increases the overall system availability.

This architecture is intended for medium to large applications, where the number of I/O points is high and there is the need of higher availability.
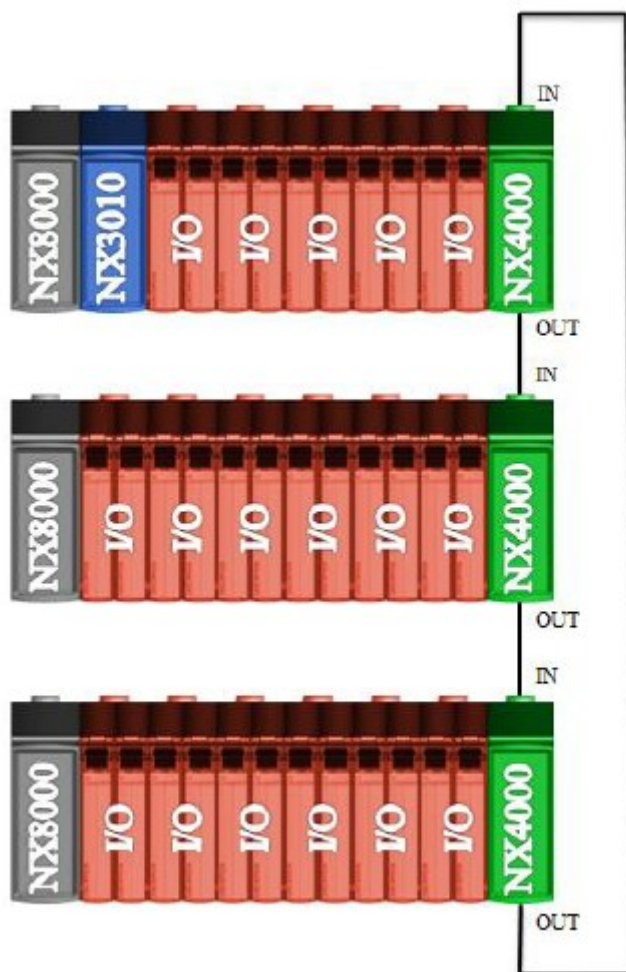
MESSUNG

Figure 2: Configuration B

### 4.3.3. Configuration C: Bus Expansion Redundant with Loopback

This architecture is based on using two modules NX4000 per rack. With two bus expansion modules, the system has a high availability because supports fault in the NX4000 module or in a cable.

As the previous architecture, this architecture is intended to systems where the maintenance system is critical and must be available for long periods. In this architecture, the racks must be mounted according to the diagram below, with modules NX4000 located side by side in the last positions.

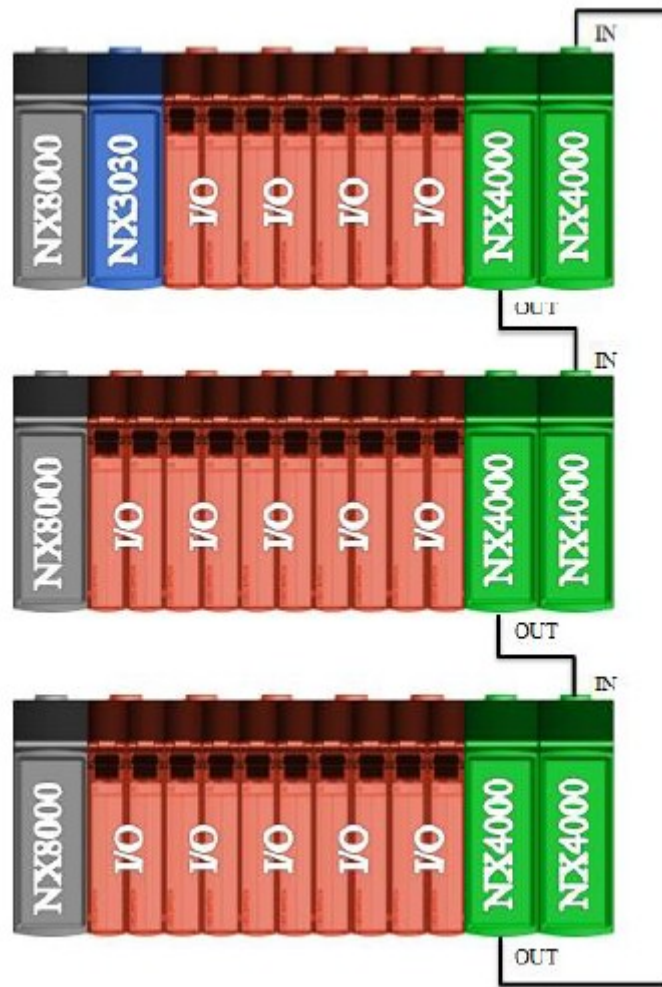Note that there are ports for bus expansion modules not used, which should be left disconnected.

Figure 3: Configuration C

## 4.4.  Compatibility with Other Products

All NX-ERA series CPUs allow support of bus expansion, performed by NX4000 module.

The fieldbus interface modules such as NX5000, NX5001 and NX4010 cannot be installed on expansion bus. They can only be installed on the main bus, along with the CPU.

According to the  System Configurations section, expanding bus with the NX4000 can be configured in three different ways: without loopback, with loopback and redundancy of the NX4000 with loopback. The configuration with redundancy is only available from the revision AD of NX4000 (version 1.1.0.0 or higher).

The following table provides information regarding the compatibility of the module NX4000, CPUs models and NX-ERA Series programming tool MasterTool IEC XE.

| NX4000 | | Compatible  Software  Version | |
|---|---|---|---|
| Version | Revision | MasterTool  IEC  XE | NX-ERA Series |
| 1.0.0.1 | up to AC | 1.25 or higher | 1.2.0.5 or higher |
| 1.1.0.0 or higher | AD or higher | 1.29 or higher | 1.2.0.5 or higher |

Table 5: Compatibility with Other Products

Note:

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

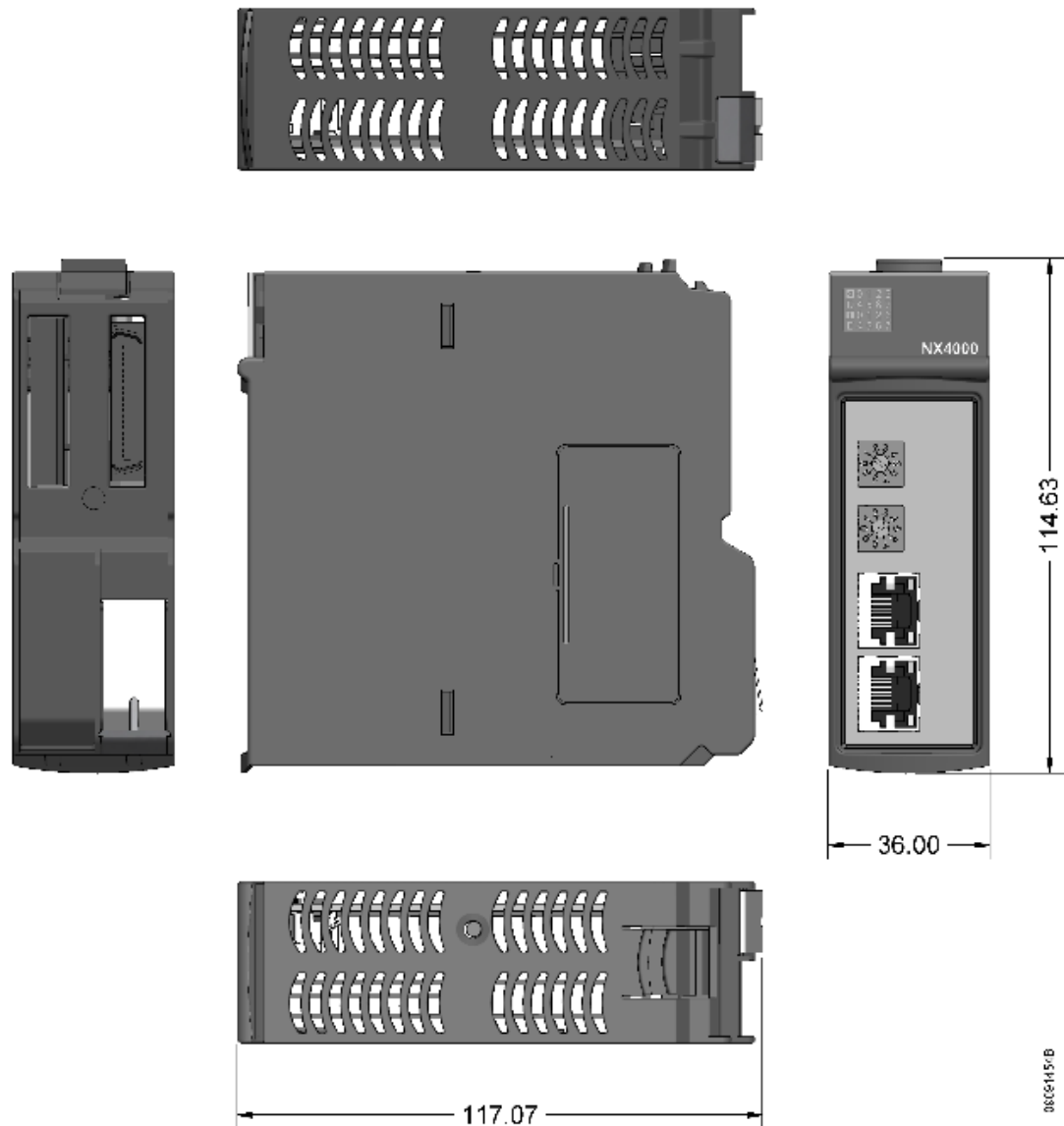## 4.5. Physical Dimensions

Dimensions in mm.



Figure 4: Physical Dimensions

# 5. Installation

## 5.1. Electrical Installation

The NX4000 module must be placed in the last two positions of the rack. When using bus expansion module redundancy, both modules must be positioned in the last four positions of the rack. The figure below demonstrates the connection diagram of each bus expansion module.
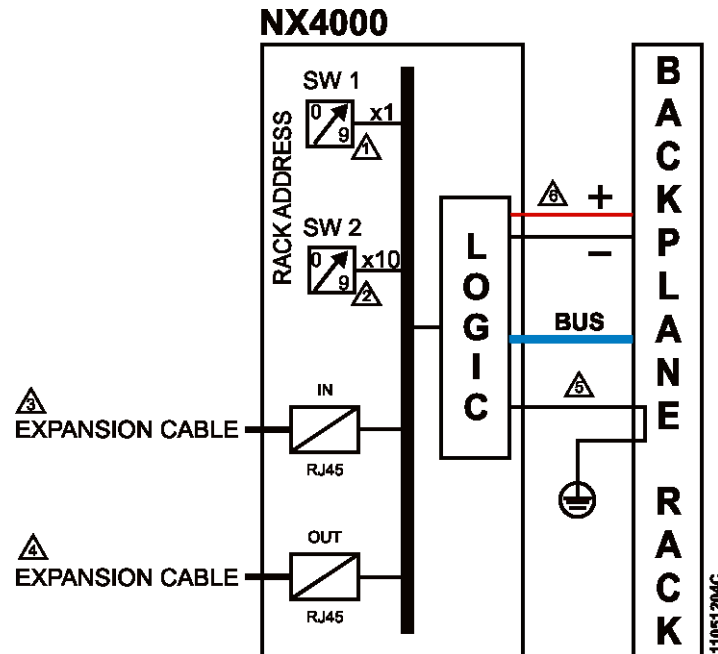
Figure 5: Electric Diagram

Diagram Notes:

⚠1 The address of the remote rack is defined by SW1 and SW2 switches so that the unit is set in the key SW1 and the decade is set in the switch SW2. As an example, the rack with address "15" must have "5" in SW1 and "1" in SW2.

⚠3 Bus expansion interface IN. When used, must be connected to another rack expansion interface OUT.

⚠4 Bus expansion interface OUT. When used, must be connected to another rack expansion interface IN.

⚠5 The module is grounded through the NX-ERA Series backplane racks.

⚠6 The module is powered through the connection with the rack.

> **ATTENTION**
>
> Bus expansion interfaces IN and OUT must be connected only to other bus expansion modules (NX4000) and/or converters for optical fiber network. The connection of these interfaces in switches or other equipment may result in system malfunction.

## 5.2.  Mechanical Assembly

Information and orientations about correct mechanical installation can be found at NX-ERA Series User Manual - MU214600.

# 6.  Configuration

The NX-ERA Series CPUs User Manual - MU214605 should be consulted for information on module configuration.

## 6.1.  Process Data

The process data, when available, are the variables used for access and module control.  The table below shows all the variables delivered by NX4000.

| Process Data | Description | Type | Update |
|---|---|---|---|
| Reserved | Reserved | %IB (Read) | Always |

Table 6: Process Data

Note:

Update:  The field Update indicates if the respective process data is updated by CPU and NX4000.  When it is set as Always, it means that the process data is always updated.

## 6.2.  Module Parameters

| Name | Description | Standard Value |
|---|---|---|
| Rack Number | Sets rack number | 0 |
| Expansion Cable Type | Expansion cable type connected to port IN of NX4000 module | Not Connected |
| %Q Start Address of Module Diagnostics Area | Defines the start address of the module diagnostics | – |

Table 7: Module Parameters

**Notes:**

**Standard value:**  MasterTool IEC XE programmer fills it automatically, but allows the user to edit its initial offset. The limit depends on the CPU supported model (details at NX-ERA Series CPUs User Manual – MU214605).

**Expansion cable type**:  Presents cable options that can be connected to the IN port, cables NX9202, NX9205 and NX9210 are described in the section Related Products. The **Custom** option now includes the option of using a standard ETHERNET cable (100 BASE TX) maximum length 100 meters, not provided by Messung.

# 7. Maintenance

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

NX4000 offers five important features to assist the user during maintenance: Electronic Tag on Display, One Touch Diag, Status and Diagnostics Indicators, Web Page with Complete Status and Diagnostics List, and Diagnostics Mapped through Variables.

## 7.1. 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 chance to check the tag, description and diagnostics related to a given module directly on the CPU's display.

To check the module tag and diagnostics of a given module, it's required only one short press on its diagnostic switch. After press once, CPU will start to scroll tag information and diagnostic information of the module. To access the respective description for the module just long press the diagnostic switch of the respective module.

More information about Electronic Tag on Display and One Touch Diag can be found at NX-ERA Series CPUs User Manual – MU214605.

## 7.2. Status and Diagnostics Indicators

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

The meaning of the numerical characters can be different for specific modules. NX4000 doesn't use these segments.

### 7.2.1. D and E States

| D | E | Description | Cause | Solution | Priority |
|---|---|---|---|---|---|
| Off | Off | Display failure or module off | Module off, external power supply failure or hardware failure | Check if the module is completely connected to the backplane rack and if the backplane rack is supplied by an external power supply. | - |
| 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 Diagnostics Mapped through Variables section of this document. | 8 |
| Blinking 2x | Off | CPU in STOP mode | CPU in STOP mode | Check if CPU is in RUN mode. More information can be found on CPU's documentation. | 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 diagnostic information. If it is a hardware fault, provide the replacement of this part. If it is a software fault, please contact the Technical Support. | 5 |

| D | E | Description | Cause | Solution | Priority |
|---|---|---|---|---|---|
| Off | Blinking 1x | Parameterization error | The module isn't parameterized or didn't receive the new parameterization | Check if the module parameterization is ok. | 4 |
| Off | Blinking 2x | Loss of master | Loss of communication between module and CPU | Check if the module is completely connected to the backplane rack. Check if CPU is in RUN mode. | 3 |
| Off | Blinking 3x | Reserved | - | - | 2 |
| Off | Blinking 4x | Fatal hardware fault | Hardware fault | In this case, the module should return to the manufacturer. | 1 (Higher) |

Table 8: D and E States

### 7.2.2. 0, 1 and Numerical Characters

The segments ⓪ and ① should be normally off. These two segments will start to blink when the module is on the Diagnostic Mode (Electronic Tag on Display and One Touch Diag).

The numerical characters aren't used in this module.

> **ATTENTION**
>
> When a bus expansion interface is missing in your rack the CPU will diagnose that all modules that rack are missing, even though they are physically connected in the rack.

## 7.3. RJ45 Connector LEDs

There are two LEDs placed in the RJ45 connectors, but only one is functional and helps the user in the installed physical network problem detection, indicating the existence of interface communication traffic. The LED meaning is presented in the table below.

| Green | Meaning |
|---|---|
| Off | Network LINK is absent |
| On | Active network LINK |
| Blinking | Transmission or reception occurrence |

Table 9: RJ45 Connector LED

## 7.4. Web Page with Complete Status and Diagnostics List

Another way to access diagnostic information on NX-ERA Series is via web pages. NX-ERA Series CPUs have an embedded web pages server that provides all NX-ERA status and diagnostic information, which can be accessed using a browser.

More information about web page with complete status and diagnostics list can be found at NX-ERA Series CPUs User Manual – MU214605.

## 7.5. Diagnostics Mapped through Variables

All NX4000's diagnostics can be accessed through variables that can be handled by the user application or even forwarded to a supervisor using a communication channel. There are two different ways to access diagnostics in the user application:

using symbolic variables with AT directive or direct representation variables. Messung recommends the use of symbolic variables. The table below shows all available diagnostics for NX4000 and their respective memory addresses, description, symbolic variable and string that will be shown on the CPU's Graphical Display and Web.

| Direct Representation Variable | | Diagnostic Message | Symbolic Variable DG_NX4000.* | Description |
|---|---|---|---|---|
| Variable | Bit | | | |
| %QB(n) | 0..7 | Reserved | | |
| %QB(n+1) | 0 | MODULE W/ DIAGNOSIS | tGeneral.bActiveDiagnostics | TRUE – Module has active diagnostics |
| | | NO DIAG | | FALSE – Module doesn't have active diagnostic |
| | 1 | MODULE W/ FATAL ERROR | tGeneral.bFatalError | TRUE – Fatal error |
| | | - | | FALSE – No fatal error |
| | 2 | CONFIG. MISMATCH | tGeneral.bConfigMismatch | TRUE – Parameterization error |
| | | - | | FALSE – Parameterization success |
| | 3 | WATCHDOG ERROR | tGeneral.bWatchdogError | TRUE – Watchdog has been detected |
| | | - | | FALSE – No watchdog detected |
| | 4 | OTD SWITCH ERROR | tGeneral.bOTDSwitchError | TRUE – Failure on the diagnostic switch |
| | | - | | FALSE – No failure on the diagnostic switch |
| | 5..7 | Reserved | | |
| %QB(n+2) | 0..7 | Reserved | | |
| %QB(n+3) | 0 | RACK ADDRESS CHANGED | tDetailed.bRackAddrChanged | TRUE – There was change in the address of the rack after module power-up |
| | | - | | FALSE – There was not change in the address of the rack after module power-up |
| | 1 | Reserved | | |
| | 2 | BUS IN LINK DOWN | tDetailed.bLinkDownIn | TRUE – IN interface isn't properly connected |
| | | - | | FALSE – IN interface is connected |
| | 3 | BUS OUT LINK DOWN | tDetailed.bLinkDownOut | TRUE – OUT interface isn't properly connected |
| | | - | | FALSE – OUT interface is connected |
| | 4 | BUS IN INVALID LINK | tDetailed.bInvalidLinkIn | TRUE – IN interface with invalid connection |
| | | - | | FALSE – IN interface with valid connection |
| | 5 | BUS OUT INVALID LINK | tDetailed.bInvalidLinkOut | TRUE – OUT interface with invalid connection |
| | | - | | FALSE – OUT interface with valid connection |
| | 6..7 | Reserved | | |

| Direct Representation Variable | | Diagnostic Message | Symbolic Variable DG_NX4000.* | Description |
|---|---|---|---|---|
| Variable | Bit | | | |
| %QW(n+4) | | Reserved | | |
| %QW(n+6) | | Reserved | | |
| %QW(n+8) | | Reserved | | |
| %QW(n+10) | | Reserved | | |

Table 10: Diagnostics

**Notes:**

**Direct Representation Variable**: "n" is the address defined in the field %Q Start Address of Module Diagnostics Area on the NX4000's configuration screen – Module Parameters tab in the MasterTool IEC XE.

**Symbolic Variables**: Some symbolic variables serve to access diagnostics. These diagnostics are stored in the direct representation variable, so 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 symbolic variables. All symbolic variables declared automatically can be found inside of the diagnostics object.

## 7.6. Hot Swap

This product supports hot swap, by the way it's important to view that the availability of the system will depend of the configuration selected: with or without loopback or with expansion redundant. For further technical details, the System Configurations section should be consulted.

# 8. Manuals

For further technical details, configuration, installation and programming of NX-ERA Series the table below should be consulted.

The table below is only a guide of some relevant documents that can be useful during the use and maintenance of NX-ERA Series modules. The complete and updated table containing all documents of NX-ERA Series can be found at NX-ERA Series User Manual – MU214600.

| Code | Description | Language |
|---|---|---|
| CE114000 | NX-ERA Series – Technical Characteristics | English |
| MU214600 | NX-ERA Series User Manual | English |
| MU214605 | NX-ERA Series CPUs User Manual | English |
| MU299609 | MasterTool IEC XE User Manual | English |

Table 11: Related Documents