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 is suitable for control systems ranging from medium to high-end large applications. Finally, its compact size, high density of points per module and superior performance, allow NX-ERA Series to be applied in small automation systems with high performance requirements, such as manufacturing applications and industrial machines.

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

The NX6014 module offers 8 analog current inputs with individually configurable HART, occupying only one position in the rack. In addition to enabling the reading of signals from field instruments (pressure, temperature, etc...) through the conventional 0-20 mA signal, these inputs also allow HART communication with the instruments to be carried out via the CPU's Ethernet port using a asset management with support for DTM technology. The NX-ERA Series DTM is available for download on the website.

Its main features are:

- 08 inputs in a single width module
- Different current scales support: 0 to 20 mA and 4 to 20 mA
- HART Protocol (4-20mA)
- Individual configuration per input
- Software configurable filters
- Galvanic isolation between inputs and internal logic
- Protection against surge voltage
- Open loop diagnostics
- Under range and over range diagnostics
- Display for module diagnostics and input 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:

- NX6014 module
- 20-terminals connector with wire holder

2.2.   Product Code

The following code should be used to purchase the product:

Code	Description
NX6014	8 AI Current Module with HART

Table 1: Product Code

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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

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.

Easy Plug System: NX-ERA 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 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.

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

5. Product Features

5.1. General Features

	NX6014
Backplane rack occupation	1 slot
Number of inputs	8 analog inputs
Input type	Current input, single ended, individually configured
Data format	16 bits in two's complement, justified to the left
Converter resolution	24 bits monotonicity guaranteed, no missing codes
Input 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, protection against surge voltages (maximum permanent voltage without damage: 30 Vdc)
Wire gauge	0,5 mm^2 (20 AWG)
Minimum wire temperature rating	75 °C
Wire material	Copper only

Isolation
    Input to logic
    Input to protective earth ⏚
    Logic to protective earth ⏚
	
	1500 Vdc / 1 minute (1000 Vac / 1 minute)
	1500 Vdc / 1 minute (1000 Vac / 1 minute)
	1500 Vdc / 1 minute (1000 Vac / 1 minute)

Current consumption from backplane rack power supply	300 mA
Maximum power dissipation	3 W
IP level	IP 20
Operating temperature	0 to 60 °C
Storage temperature	-25 to 75 °C
Operating and storage relative humidity	5% to 96%, non-condensing
Conformal coating	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

Note:

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 NX-ERA 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
CE	2014/30/EU (EMC) 2014/35/EU (LVD) 2011/65/EU and 2015/863/EU (ROHS)
cULus LISTED	UL/cUL Listed – UL 61010-1 UL 61010-2-201 (file E473496)
EAC	TR 004/2011 (LVD) CU TR 020/2011 (EMC)

Table 4: Standards and Certifications

5.3. Analog Inputs

Scale	Current Mode	
	Range	Resolution
	0 to 20 mA	333 nA
	4 to 20 mA	266 nA
Precision	± 0.1 % of full scale rating@ 25 °C	
	± 0.01 % of full scale rating / °C	
Influence of HART signal on input measurement	± 0.1 % of full scale rating	
Over scale	3 % of full scale rating	
Maximum input current	30 mA	
Update time		
Disabled	10 ms with one channel enabled 80 ms with all channels enabled	
50 Hz	25 ms with one channel enabled 200 ms with all channels enabled	
60 Hz	21 ms with one channel enabled 168 ms com with all channels enabled	
Settling time	40 ms for 95% of final value	
Input impedance	250 to 300 Ω	
Configurable parameters	Signal type per input Measurement range per input Filters Open loop value	
Noise suppression filter	60 Hz, 50 Hz or disabled	
Low pass filter	1st order digital filter	
Low pass filter time constant	100 ms, 1 s, 10 s or disabled	

Table 5: Analog Input Features

Notes:

Resolution: The presented resolutions are the optimal delivered by the hardware.

Update time: The update time depends on the configuration of Noise Suppression Filter.

Settling time: It is related to the 1st order low-pass filter present on the hardware of each input.

Noise Suppression Filter: When this parameter is configured, the filter value is applied to all analog inputs.

5.4. HART

	NX6014
Operation mode	Master/Slave (point to point)
Allows secondary master	Yes

Table 6: HART Features

5.5. Compatibility with Other Products

The following table provides information regarding the compatibility of the module NX6014 and other NX-ERA Series prod- ucts.

NX6014			Software Version Compatible	
Version	Revision	Feature	MasterTool IEC XE	NX-ERA CPU's
1.0.0.0	AA	-	3.20 or higher	1.8.0.0 or higher

Table 7: Compatibility with Other Products

Note:

Revision: If the software is upgraded in the field the product reviewing indicated on the label will no longer match the actual review of the product.
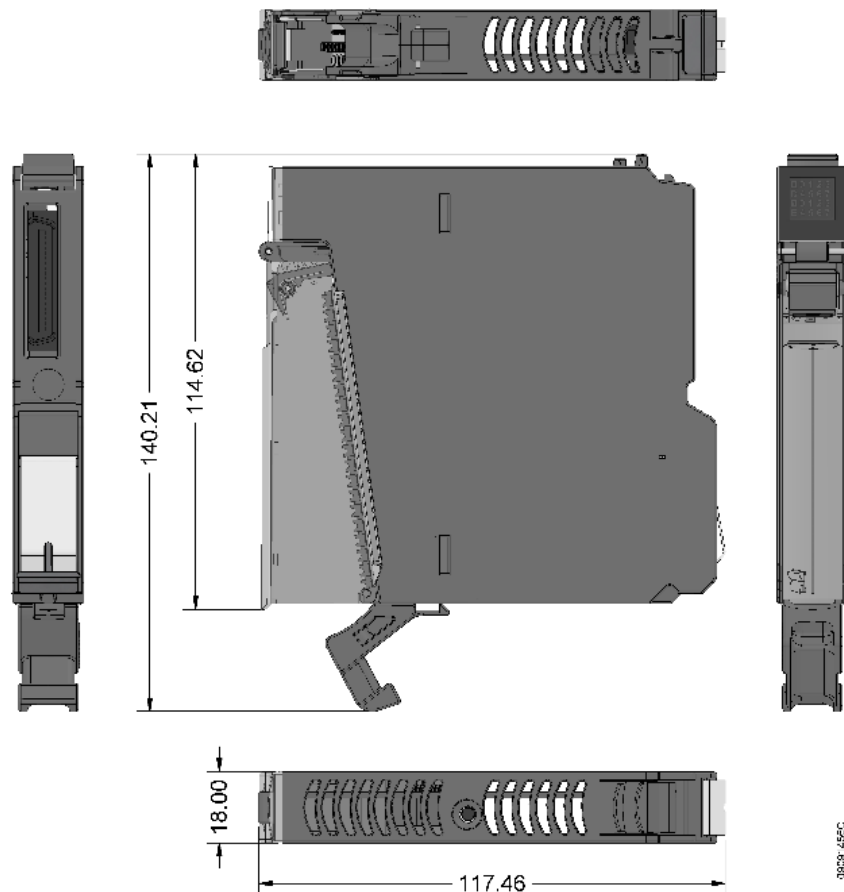
5.6.   Physical Dimensions

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.
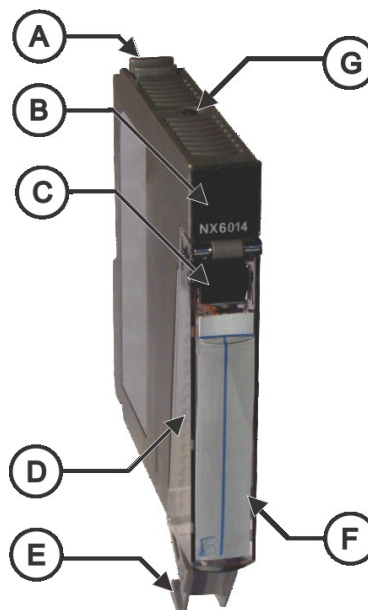

Figure 2: NX6014

Ⓐ   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 using two inputs: input I0 and input I2. Each entry has a different connection, as explained below.
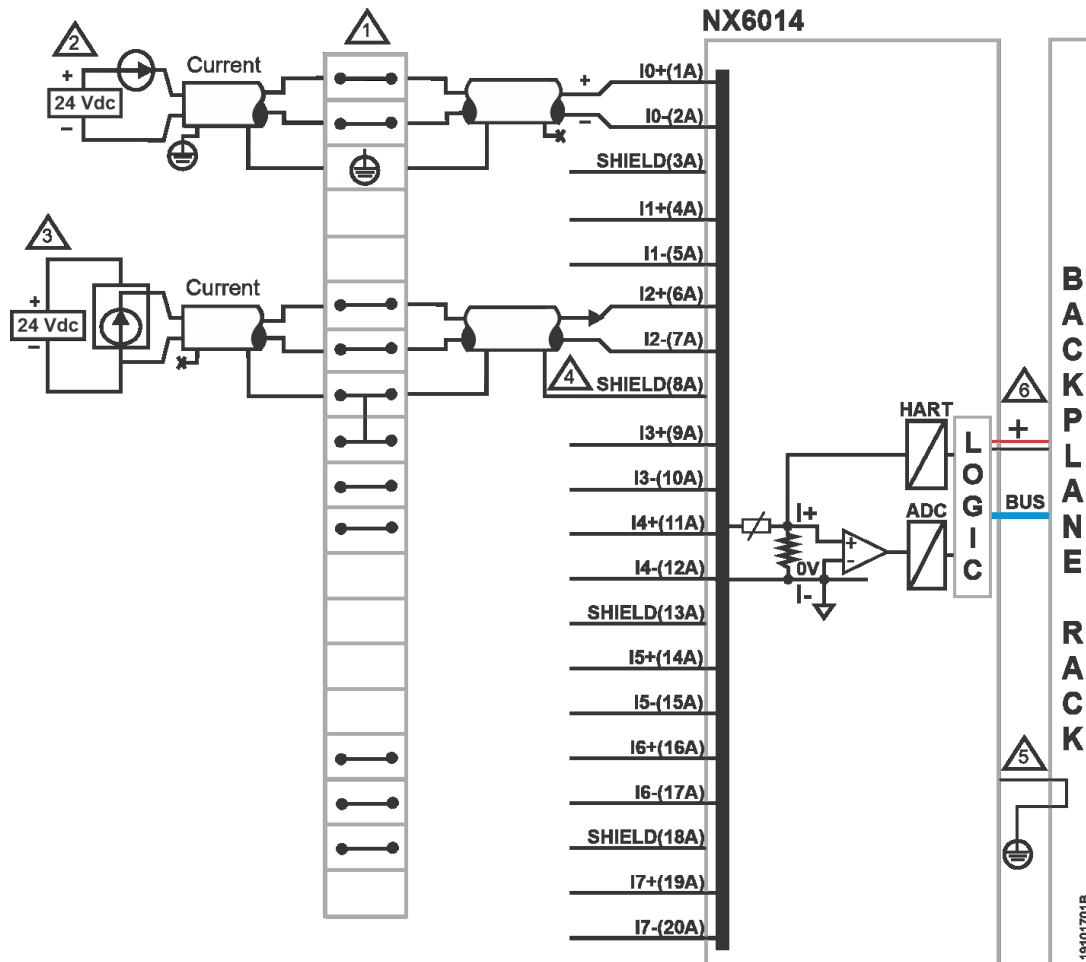
Figure 3: Electrical Installation

Diagram Notes

⚠️1 The diagram above has the representation a set of terminal blocks where each symbol represents a different kind of terminal block: ▭ represents a standard feed-through terminal block, ⏚ represents a grounding terminal block and ▭ represents a feed'-through terminal block with connection to other terminal block.

⚠️2 Input I0 is connected to a current output module, usually a transducer. This type of transducer, unlike the example above, uses the same pins for power supply and current output. In this case, only a 4 to 20 mA scale is possible.

⚠️3 Input I2 is connected to a current output module, usually a transducer. This type of transducer has different pins for power supply and current output.

⚠️4 There is a shield pin for each pair of analog inputs.

⚠️5 The NX6014 is connected to protective earth ⏚ through the backplane rack.

⚠️6 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	Current Input 00
2	Reference input 00
3	Shield
4	Current Input 01
5	Reference input 01
6	Current Input 02
7	Reference input 02
8	Shield
9	Current Input 03
10	Reference input 03
11	Current Input 04
12	Reference input 04
13	Shield
14	Current Input 05
15	Reference input 05
16	Current Input 06
17	Reference input 06
18	Shield
19	Current Input 07
20	Reference input 07

Table 8: Connector Pinout

6.4. Mechanical and Electrical Assembly

The mechanical and electrical mounting and the connector pin insertion and removing for single hardware width I/O modules are described at NX-ERA 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

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

7.   Configuration

This module was developed to be used with NX-ERA Series products. All NX-ERA 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 are the variables used to access the module. The table below describes all the variables made available by this module when declared on the CPU or MODBUS Head bus.

In addition to the data in the table, this product 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
%IW(n)	WORD	AI 00	Analog Input 00	Input (Read)	Always
%IW(n+2)	WORD	AI 01	Analog Input 01	Input (Read)	Always
%IW(n+4)	WORD	AI 02	Analog Input 02	Input (Read)	Always
%IW(n+6)	WORD	AI 03	Analog Input 03	Input (Read)	Always
%IW(n+8)	WORD	AI 04	Analog Input 04	Input (Read)	Always
%IW(n+10)	WORD	AI 05	Analog Input 05	Input (Read)	Always
%IW(n+12)	WORD	AI 06	Analog Input 06	Input (Read)	Always
%IW(n+14)	WORD	AI 07	Analog Input 07	Input (Read)	Always

Table 9: Process Data

Note:

Update: The field "Update" indicates if the respective process data is updated by CPU and NX6014 by default. When defined as "Always", it means that the process data is always updated. When defined as "Selectable", it 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 NX6014 through the bus, to improve CPU performance, it's recommended to update only the process data that will be used in the application.

7.1.1.   PROFIBUS Data

When the module is inserted on the bus of a PROFIBUS Head, the variable type will be WORD. In this case, we recommend using symbolic variables of type INT, declared with the AT directive at the same addresses as the direct variables. Example, considering the direct variable %IW(n) from the previous table:

```
iChannel_0 AT %IW(n): INT;
```

The values sent by PROFIBUS are of the integer type and are fixedly configured in the -30,000 to +30,000 range. For example, on a channel configured as current 0 to 20 mA, the current value of 0 mA will be converted to -30,000, while the current value of 20 mA will be converted to +30,000.

7.2. Module Parameters

Name	Description	Standard Value	Options	Configuration
Noise Suppression Filter	Frequency of the noise filter	60 Hz	Disabled 50 Hz 60 Hz	Per module
Type	Type and scale of a given input	Current 4 - 20 mA with HART	Not Configured Current 0 - 20 mA Current 4 - 20 mA Current 4 - 20 mA with HART	Per input
Min Value	Minimum value for engineering scale	0	(see note)	Per input
Max Value	Maximum value for engineering scale	30000	(see note)	Per input
Digital Filter	First order digital filter time constant (ms)	Disabled	Disabled 100 ms 1 s 10 s	Per input
Open Loop Value	Value when in open loop condition (only valid for 4 – 20 mA scale)	Min Value	0 Min Value Max Value Disabled	Per input
%Q Start Address of Module Diagnostics Area	Defines the start address of the module diagnostics area	-	-	Per module

Table 10: Modules Parameters

Notes:

Noise Suppression Filter: For further information about this parameter, consult Noise Suppression Filter section. If a signal is present on a channel with filter enabled and a hot-swap is performed in the module, the channel will start with a value of zero to dynamically, according to the selected time constant, reach the present value at the input.

Configuration: Configuration indicates if the parameter is related to the entire module (per module) or if the parameter is related to a single input (per input). In case of input wise parameters, all parameters will be repeated for each available input.

Min and Max Value: These parameters can be configured in any value from -30000 to 30000, as long as the Max Value is larger than the Min Value. In PROFIBUS-DP remotes, the minimum and maximum values are fixed at -30000 and 30000, respectively.

7.3. Noise Suppression Filter

This parameter enables or disables a filter that rejects a particular frequency in the measurements, but this rejection includes a delay per enabled input for data acquisition, which depends on the selected frequency as informed on Analog Input Features table. It is important to consider these delays while developing an application.

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8. Module Usage

8.1. General Purpose Input Read

NX6014 has one variable for each input. The parameters Min Value and Max Value are used by the module to convert the analog input value to the corresponding engineering value.

9. Maintenance

Messung recommends that all modules' 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 mapped to internal memory.

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 NX-ERA Series - MU214600).

9.2. Status and Diagnostics Indicators

NX-ERA 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 NX-ERA Series I/O modules. These states can be consulted in the table below.

9.2.1. D and E States

D	E	Description	Cause	Solution	Priority
Off	Off	Display failure or module off	- Module disconnected; - External power supply failure; - Hardware failure.	Check: - If the module is completely connected to the rack; - If the rack is powered by an external source; - If the module has external power.	-
On	Off	Normal use	-	-	9 (Lower)
Blinking 1x	Off	Active diagnostics	There is at least one active diagnostic related to the module.	Check what the active diagnostic is. More information can be found at section Diagnostics Through Variables.	8

D	E	Description	Cause	Solution	Priority
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
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	2
Off	Blinking 4x	Fatal hardware fault	Hardware fault.	The module must return to the manufacturer.	1 (Higher)

Table 11: 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.

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9.2.2. 0, 1 and Numerical Characters

The meaning of the numerical characters can be different for specific modules. In case of analog modules, the numerical characters show the respective state of each input. When the numerical character is on, the respective input is configured and enabled, and if the numerical character is off, the respective input is disabled. The relationship between the input number and its respective numerical character can be found on the following figure.

The segments 0 and 1 are used to group the numerical characters used for the first 8 I/O and the numerical characters used for the last 8 I/O. In case of NX6014 only the character 0 is on. The figure below shows the relation between numerical characters and the respective input.
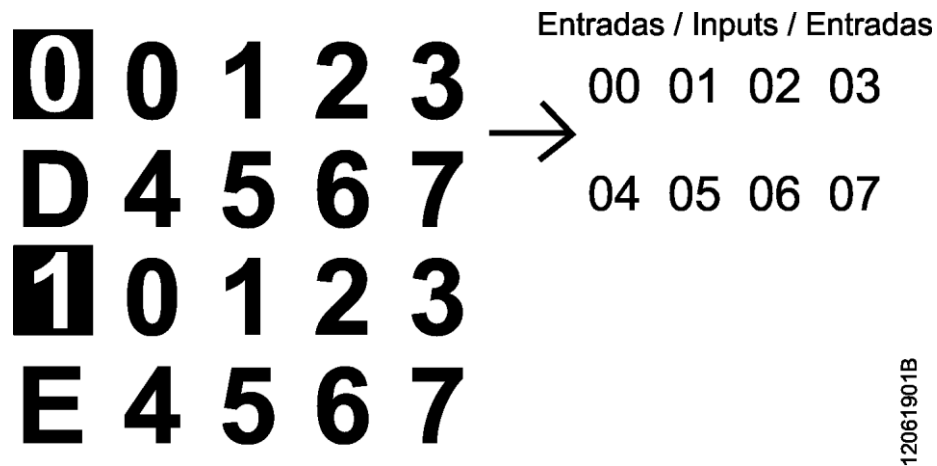
Figure 4: Numerical Character

9.3. Web Page with Complete Status and Diagnostics List

Another way to access diagnostics information on NX-ERA Series is via web pages. NX-ERA Series CPU's has an embedded web page server that provides all NX-ERA 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 NX-ERA 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. Messung 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 Represent.		Diagnostic Message	Variable DG_Module.tGeneral.*	Description
Variable	Bit			
%QB(n)	0	INPUT 00 W/ DIAG	bActiveDiagnosticsInput00	TRUE – Input 00 has active diagnostics
		-		FALSE – Input 00 doesn't have active diagnostics
	1	INPUT 01 W/ DIAG	bActiveDiagnosticsInput01	TRUE – Input 01 has active diagnostics
		-		FALSE – Input 01 doesn't have active diagnostics
	2	INPUT 02 W/ DIAG	bActiveDiagnosticsInput02	TRUE – Input 02 has active diagnostics
		-		FALSE – Input 02 doesn't have active diagnostics
	3	INPUT 03 W/ DIAG	bActiveDiagnosticsInput03	TRUE – Input 03 has active diagnostics
		-		FALSE – Input 03 doesn't have active diagnostics
	4	INPUT 04 W/ DIAG	bActiveDiagnosticsInput04	TRUE – Input 04 has active diagnostics
		-		FALSE – Input 04 doesn't have active diagnostics
	5	INPUT 05 W/ DIAG	bActiveDiagnosticsInput05	TRUE – Input 05 has active diagnostics
		-		FALSE – Input 05 doesn't have active diagnostics
	6	INPUT 06 W/ DIAG	bActiveDiagnosticsInput06	TRUE – Input 06 has active diagnostics
		-		FALSE – Input 06 doesn't have active diagnostics
	7	INPUT 07 W/ DIAG	bActiveDiagnosticsInput07	TRUE – Input 07 has active diagnostics
		-		FALSE – Input 07 doesn't have active diagnostics
%QB(n+1)	0	MODULE W/ DIAGNOSTIC	bActiveDiagnostics	TRUE – Module has active diagnostics
		NO DIAG		FALSE – Module doesn't have active diagnostic
	1	MODULE W/ FATAL ERROR	bFatalError	TRUE – Fatal error
		-		FALSE – No fatal error
	2	CONFIG. MISMATCH	bConfigMismatch	TRUE – Parameterization error
		-		FALSE – Parameterization ok
	3	WATCHDOG ERROR	bWatchdogError	TRUE – Watchdog has been detected

Direct Represent.		Diagnostic Message	Variable DG_Module.tGeneral.*	Description
Variable	Bit			
		-		FALSE – No watchdog
	4	OTD SWITCH ERROR	bOTDSwitchError	TRUE – Module has switch failure
		-		FALSE – Diagnostics switch ok
	5..7	Reservado		

Table 12: General Diagnostics

9.4.2. Detailed Diagnostics

Direct Represent.		Diagnostic Message	Variable DG_Module.tDetailed.*	Description
Variable	Bit			
%QB(n+2 +XX*2)	0..7	Reserved		
%QB(n+2+ 2*XX+1)	0	OVER RANGE	bOverRange	TRUE – Input data is over range
		-		FALSE – Input data is ok
	1	UNDER RANGE	bUnderRange	TRUE – Input data is under range
		-		FALSE – Input data is ok
	2	OPEN LOOP	bOpenLoop	TRUE – Input is open
		-		FALSE – Input is ok
	3	-	bInputNotEnable[1]	TRUE – Input is not enable
		-		FALSE – Input is enable
	4..7	Reserved		

Table 13: Detailed Diagnostics

Notes:

[1]: This diagnosis does not apply to the module when declared on the Profibus Heads or PROFINET Heads bus. It is valid only when the module is declared on the UCPs or MODBUS Heads bus.

Open Loop Diagnostic: This diagnostics only applies to channels configured as 4 – 20 mA input current, and is set when the input current is lower than 3 mA.

Under Range: This diagnosis is true when the input value is 1% of the full scale below the scale, being applicable only for 4 to 20 mA scales. Therefore, it will be true for measurements below 3.8 mA.

Over Range: This diagnosis is true when the input value is 1% of the full scale above the scale. Therefore, it will be true for measurements above 20.2 mA.

Direct Represent.: "n" is the address defined in the field %Q Start Address of Diagnostic Area on the module configuration screen – Modules Parameters tab in the MasterTool IEC XE, "XX" is the channel of analog input.

Symbolic Variable: Some symbolic variables serve to access diagnostics. These diagnostics are stored into the addressing memory, then the AT directive is used to map the symbolic variables in the addressing memory. The directive AT is a reserved word in the MasterTool IEC XE, that uses this directive to declares the diagnostics automatically on a symbolic variables. All symbolic variables declared automatically can be found inside of Diagnostics object.

9.5. Hot Swap

This product supports hot swap. For further information about how to correctly perform a hot swap, consult NX-ERA 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	NX-ERA Series – Technical Characteristics	English
MU214600	NX-ERA Series User Manual	English
MU299609	MasterTool IEC XE User Manual Manual	English
MP399609	MasterTool IEC XE Programming Manual Manual	English
MU214608	NX-ERA PROFIBUS-DP Head Utilization Manual	English

Table 14: Related Documents