1. Product Description

The automation of electric power systems is characterized by the use of robust, reliable, and high-tech equipment and devices with the ability to operate in hostile environments, where there are significant levels of electromagnetic interference and exposure to higher operating temperatures. This is the reality of applications in hydroelectric power plants (HPPs), electricity substations, and wind farms, among others.

In this context, the Hadron Xtorm Series is an innovative Remote Terminal Unit (RTU), perfect for applications in electricity generation, transmission, and distribution. The Series has an ideal set of features with high performance and facilities for the various stages in the life cycle of an application, to reduce engineering, installation, and commissioning costs and minimize downtime and system maintenance when in operation. With intuitive and user-friendly interfaces, precise and intelligent diagnostics, a modern and robust design, and several innovative features, Hadron Xtorm exceeds the requirements of applications in this market.

The Series has an intelligent and versatile architecture, offering modularity in input and output (I/O) points, redundancy options, hot-swapping of modules, high-speed communication protocols such as IEC 61850 and DNP3, implementation of logic in compliance with the IEC 61131-3 standard and time synchronization.

The HX6000 module of the Hadron Xtorm Series offers 16 analog inputs that can be individually configured as voltage or current inputs with different operating scales configured by software.

Its main features are:

- 16 analog voltage/current input points
- Independent inputs configuration in different scales by software
- Filters configurable by software
- Galvanic isolation between inputs and internal logic
- Protection against surge voltages
- Display for input status and diagnostics indication
- Hot swap support
- Mechanical design with high robustness and extended operating temperature
- High electromagnetic noise immunity (EMC/EMI)
- Smart diagnostics such as One Touch Diag and Electronic Tag on Display

2. Ordering Information

2.1. Included Items

The product package contains the following items:

- HX6000 Module
- Four 10-terminal connector HX9402

2.2. Product Code

The following codes should be used to purchase the product:

Code	Description
HX6000	16 AI Voltage/Current Module

Table 1: Product Code

3. Related Products

The following products must be purchased separately when necessary:

Code	Description
HX9402	10-terminal Connector

Table 2: Related Products

4. Innovative Features

Hadron Xtorm Series brings to the user several innovations in utilization, supervision and system maintenance. These features were developed focusing a new concept in automation of hydropower plants, substations and other applications of the segment.The list below shows some new features that the user will find in Hadron Xtorm Series:

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.

5. Product Features

5.1. General Features

	HX6000
Module type	16 analog inputs
Input type	Voltage or current Input individually configurable
Data format	16 bits in two's complement, justified to the left
Converter resolution	24 bits monotonicity guaranteed, no missing codes
Input status indication	Yes
One Touch Diag (OTD)	Yes
Electronic Tag on Display (ETD)	Yes
Status and diagnostic indication	Display, web page and CPU's internal memory
Hot swap support	Yes
Module protections	Yes, against surge voltage
Isolation **Input to logic** **Input to protective earth** ⏚ **Logic for protective earth** ⏚	 2500 Vac / 1 minute 2500 Vac / 1 minute 2500 Vac / 1 minute
Current consumption from backplane	280 mA
Maximum power dissipation	3 W
Wire size	0.5 to 1.5 mm²
IP level	IP 20
Operating temperature	-5 to 70 °C
Storage temperature	-25 to 75 °C
Operation and storage relative humidity	5 to 96 %, non-condensing
Conformal coating	Yes
Module dimensions (W x H x D)	38.0 x 235.3 x 187.2 mm
Package dimensions (W x H x D)	55.0 x 308.0 x 266.0 mm
Weight	900 g
Weight with package	1200 g

Table 3: General Features

Notes:

One Touch Diag (OTD): This option is available only when the module is in operating mode.

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

5.2. Standards and Certifications

Standards and Certifications	
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)
UKCA	S.I. 2016 No. 1091 (EMC) S.I. 2016 No. 1101 (Safety) S.I. 2012 No. 1101 (ROHS)
EAC	TR 004/2011 (LVD) CU TR 020/2011 (EMC)

Table 4: Standards and Certifications

5.3. Voltage Mode Features

	Voltage Mode	
	Range	**Resolution**
Input ranges	0 to 1 Vdc 0 to 5 Vdc 0 to 10 Vdc -1 to 1 Vdc -5 to 5 Vdc -10 to 10 Vdc	16.7 uV with 50/60 Hz filter 83.3 uV 166.7 uV 33.3 uV with 50/60 Hz filter 166.7 uV 333.3 uV
Precision	±0.1 % of full scale rating @ 25 °C ± 0.005 % / °C of full scale rating	
Over scale	± 4.5 % of full scale rating for all voltage scales	
Maximum input voltage	30 Vdc	
Update time	1 ms with one channel enabled 16 ms with all channels enabled	
Input impedance	5 MΩ	

	Voltage Mode
Configurable parameters	Input type per point Measuring range per point Filters Alarms
Noise suppression filter	50, 60 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: Voltage Mode Features

5.4. Current Mode Features

	Current Mode	
	Range	**Resolution**
Input ranges	-1 to 1 mA	33.3 nA with 50/60 Hz filter
	-5 to +5 mA	166.7 nA
	-20 mA to 20 mA	666.7 nA
	0 to 10 mA	166.7 nA
	0 to 20 mA	333.3 nA
	4 to 20 mA	333.3 nA
Precision	±0.1 % of full scale rating @ 25 °C ± 0.006 % / °C of full scale rating	
Over scale	± 4.5 % of full scale rating for all current ranges	
Maximum input voltage	30 Vdc	
Update time	1 ms with one channel enabled 16 ms with all channels enabled	
Input impedance	150 Ω	
Configurable parameters	Input type per point Measuring range per point Filters Alarms	
Noise suppression filter	50, 60 Hz or disabled	
Low pass filter	1st order digital filter	
Low pass filter time constant	100 ms, 1 s, 10 s or disabled	

Table 6: Current Mode Features

Notes:

Noise suppression filter: The filter value selected in this parameter will be applied to all module inputs.

Voltage mode input impedance: Input impedance value when module is configured for voltage mode or no configuration.

Current mode input impedance: Input impedance value when module is configured for current mode or de-energized.

Over scale: In the range of 4 to 20 mA input, depending on the configuration used for the scale in engineering units, the limit of ±32.700 can be achieved before reaching the 4.5% of full scale.

6. Physical Dimensions

Dimensions in mm.

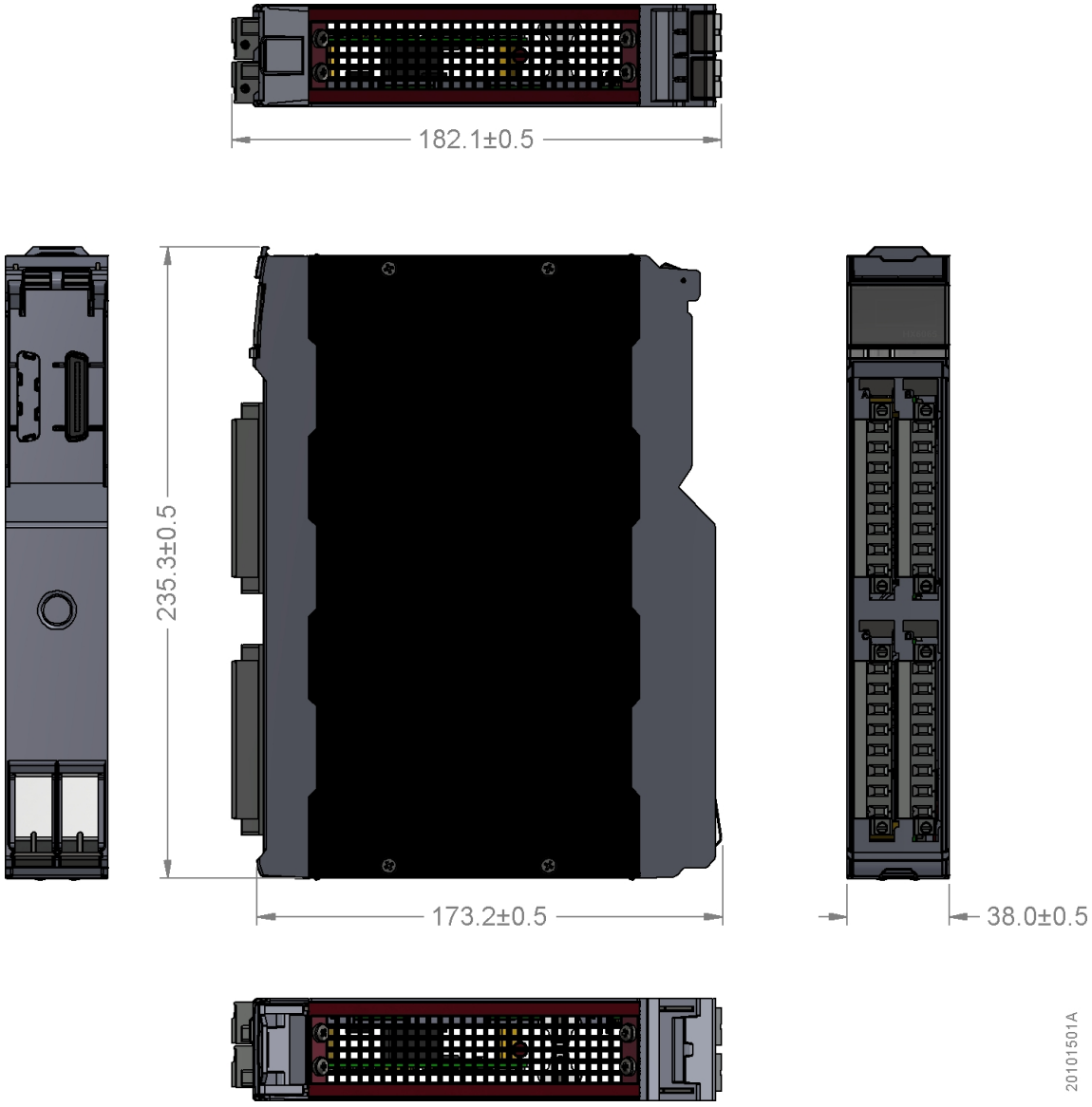

Figure 1: Physical Dimensions

7. 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.

7.1. Product Identification

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

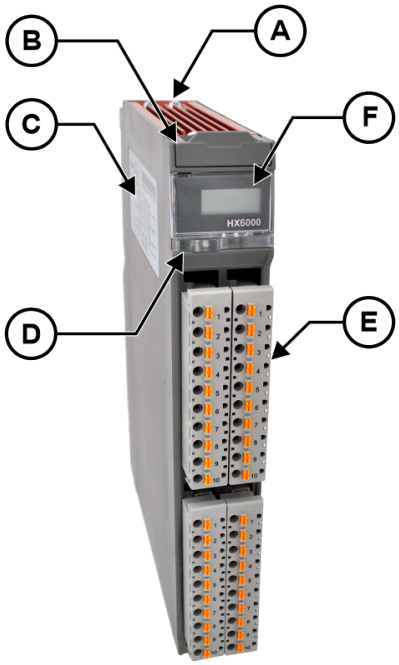

Figure 2: HX6000

Ⓐ Fixing lock.
Ⓑ Module Slot locking slider.
Ⓒ Label for module identification.
Ⓓ Diagnostic LED and switch.
Ⓔ 10 pin terminal blocks.
Ⓕ Status and diagnostic display.

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.

7.2. Electrical Installation

The figure below shows an example where some of the HX6000 inputs are being used: input 00, input 02, input 03, input 05, input 10, input 12, input 13 and input 15. Each of these inputs has a different type of connection as shown below.

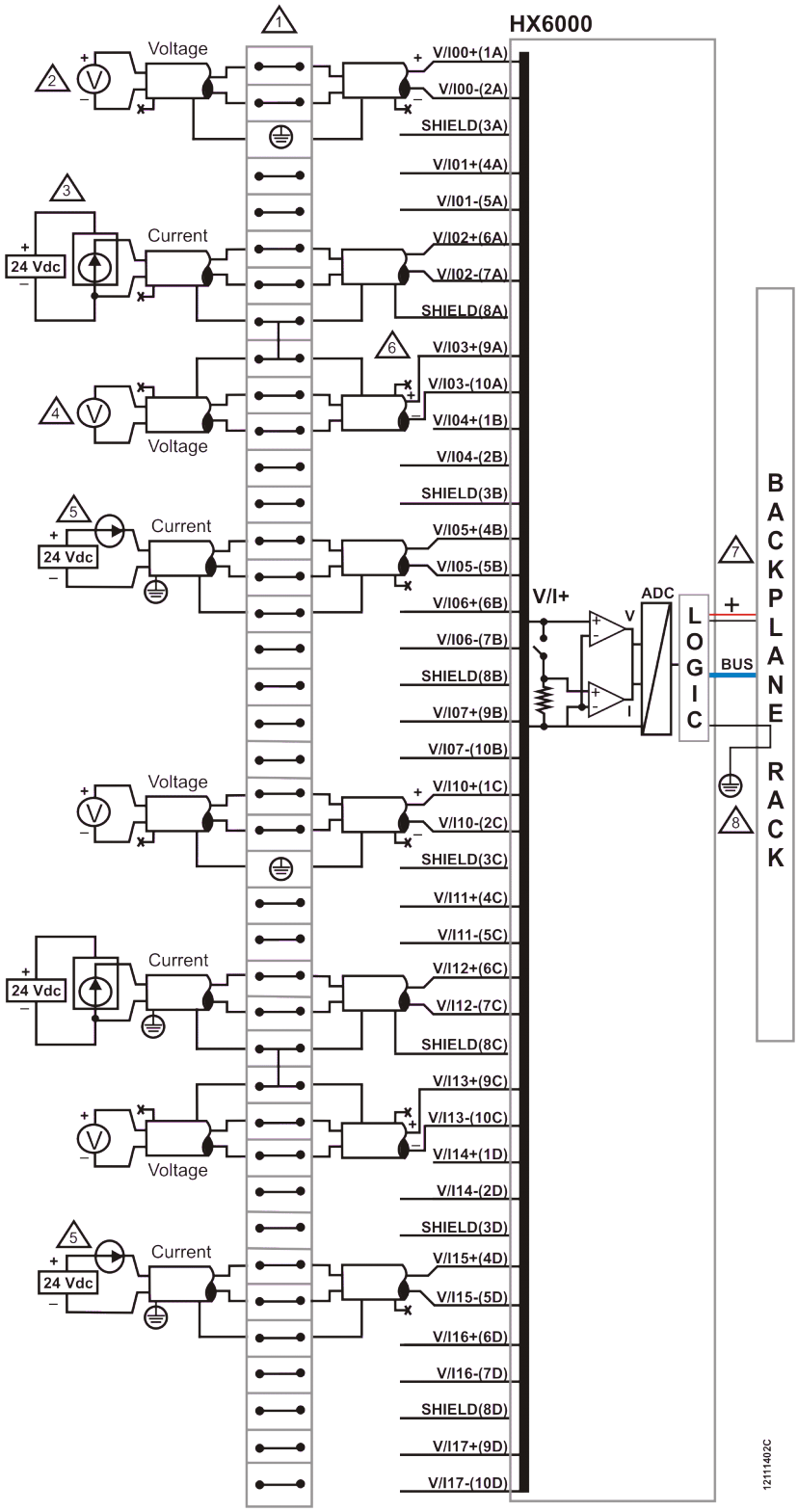

Figure 3: Diagram for connecting analog inputs

Notes:

1. Terminal group.
2. Typical usage of analog input 00 in voltage mode.
3. Typical usage of analog input 02 in current mode with field device power supply independent from analog signal.
4. Typical usage of the analog input 03 voltage mode where the shielded cable is shared between two inputs.
5. Typical usage of analog input 05 in current mode with field device supplied by analog signal.
6. There is a pin shield for each pair of analog inputs.
7. The module power supply is derived from the connection to the backplane rack, not requiring external connections.
8. The HX6000 is connected to the protective earth ⏚ through the backplane rack.

7.2.1. Connector Pinout

The figure below indicates the position of the connectors A, B, C and D:

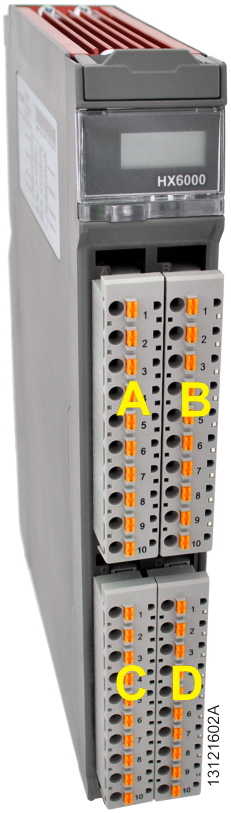

Figure 4: Connector Positions

The following table shows the description of each terminal:

A	Terminal number	B
Description		**Description**
Input 00 (Voltage / Current)	1	Input 04 (Voltage / Current)
Input 00 (Common)	2	Input 04 (Common)
Grounding	3	Grounding
Input 01 (Voltage / Current)	4	Input 05 (Voltage / Current)
Input 01 (Common)	5	Input 05 (Common)
Input 02 (Voltage / Current)	6	Input 06 (Voltage / Current)
Input 02 (Common)	7	Input 06 (Common)
Grounding	8	Grounding
Input 03 (Voltage / Current)	9	Input 07 (Voltage / Current)
Input 03 (Common)	10	Input 07 (Common)
C	**Terminal number**	**D**
Description		**Description**
Input 10 (Voltage / Current)	1	Input 14 (Voltage / Current)
Input 10 (Common)	2	Input 14 (Common)
Grounding	3	Grounding
Input 11 (Voltage / Current)	4	Input 15 (Voltage / Current)
Input 11 (Common)	5	Input 15 (Common)
Input 12 (Voltage / Current)	6	Input 16 (Voltage / Current)
Input 12 (Common)	7	Input 16 (Common)
Grounding	8	Grounding
Input 13 (Voltage / Current)	9	Input 17 (Voltage / Current)
Input 13 (Common)	10	Input 17 (Common)

Table 7: Connector Pinout

7.3. Mechanical Assembly

Information and orientations about correct mechanical installation can be found at Hadron Xtorm Utilization Manual - MU223600.

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

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

8. Configuration

HX6000 was developed to be used with Hadron Xtorm series products. All configuration data of a given module can be accessed through a double click in the desired module in the Graphical Editor.

8.1. Process Data

The process data, when available, are the variables used to access and control the module. The table below shows all the variables delivered by HX6000 module. Besides this data, the module also provides a set of variables containing information related to diagnostics which are also described in this document.

Process Data	Description	Type
AI 00	Analog Input 00	Input (Read)
AI 01	Analog Input 01	Input (Read)
AI 02	Analog Input 02	Input (Read)
AI 03	Analog Input 03	Input (Read)
AI 04	Analog Input 04	Input (Read)
AI 05	Analog Input 05	Input (Read)
AI 06	Analog Input 06	Input (Read)
AI 07	Analog Input 07	Input (Read)
AI 08	Analog Input 08	Input (Read)
AI 09	Analog Input 09	Input (Read)
AI 10	Analog Input 10	Input (Read)
AI 11	Analog Input 11	Input (Read)
AI 12	Analog Input 12	Input (Read)
AI 13	Analog Input 13	Input (Read)
AI 14	Analog Input 14	Input (Read)
AI 15	Analog Input 15	Input (Read)
AI 16	Analog Input 16	Input (Read)
AI 17	Analog Input 17	Input (Read)

Table 8: Process Data

8.2. Module Parameters

Name	Description	Default Value	Options	Configuration
Noise Suppression Filter	Enables or Disables the noise suppression filter features in the frequencies of 50 Hz or 60 Hz	Disabled	50 Hz 60 Hz Disabled	Per module
Type	Reading mode and scale setting	0 to 10 Vdc	Not Configured Voltage 0 to 10 Vdc Voltage ± 10 Vdc Voltage 0 to 5 Vdc Voltage ± 5 Vdc Voltage 0 to 1 Vdc Voltage ± 1 Vdc Current ± 1 mA Current ± 5 mA Current ± 20 mA Current 0 to 10 mA Current 0 to 20 mA Current 4 to 20 mA	Per channel
Minimum value	Minimum value for engineering scale	0	-	Per channel
Maximum value	Maximum value for engineering scale	30000	-	Per channel
Digital filter	Low pass filter time constant	Disabled	Disabled 100 ms 1 s 10 s	Per channel
Open circuit value	Configures the value in open circuit condition	Min Value	0 Min Value Max Value Keep last value	Per channel
Alarms	Enable or disable alarms triggering feature	Disabled	Disabled Enabled	Per channel
Alarm - HH	Alarm – High-High Setpoint	0	-	Per channel
Alarm - H	Alarm – High Setpoint	0	-	Per channel
Alarm - L	Alarm – Low Setpoint	0	-	Per channel
Alarm - LL	Alarm – Low-Low Setpoint	0	-	Per channel

Table 9: Module 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).

Min and Max Value: These parameters can be configured in any value from -30,000 to 30,000, as long as the Max Value is larger than the Min Value.

Open Circuit Value: Valid only for the current range of 4 to 20 mA.

Alarm Setpoints: These parameters must be within the range configured in the Min and Max Value fields, described above.

8.3. Noise Suppression Filter

This parameter enables or disables the filter in each one of the HX6000 modules. This filter rejects a particular frequency in the analog signal measurements. The available frequencies are 50 Hz and 60 Hz. This rejection includes a delay in reading each one of the analog reading channels in modules where the filter is enabled, according to the selected frequency. It is important to consider the delays presented in the table below while developing an application.

Noise Suppression Frequency	Conversion Time
Disabled	1 ms
50 Hz	40 ms
60 Hz	35 ms

Table 10: Noise Suppression Filter

Note:

Conversion time: The conversion time shown in the table above refers to each one of the inputs enabled in the module, and the total conversion time of the module is obtained by summing the times according to the quantity of channels enabled.

9. Usage

9.1. General Purpose Input Reading

HX6000 module 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.

10. Maintenance

Altus 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.

10.1. Electronic Tag on Display and One Touch Diag

Electronic Tag on Display and One Touch Diag are important features that provides to the user the chance to check the tag, description and diagnostics related to a given module directly on the CPU 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 can be found at Hadron Xtorm Utilization Manual - MU223600.

10.2. Status and Diagnostic Indicators

HX6000 module Hadron Xtorm Series has a display and a bi-color LED to indicate the diagnostics. The display has the following symbols: D, E, 0, 1 and numerical characters. States of D and E symbols are common for all modules of Hadron

Xtorm Series slaves. These states can be found in the following table. The same D and E symbol states are indicated by the color of the LED in module front panel.

The meaning of the numerical characters may be different for specific modules.

10.2.1. D, E and Diagnostics LED (DL) States

Symbol D	Symbol E	DL (Color)	Description	Cause	Solution	Priority
Off	Off	Off	Display fail, module off or OTD fail	Disconnected module, no external supply, hardware fail or OTD button fail	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	On (Blue)	Normal use	-	-	7 (Lower)
Blinking 1x	Off	Blinking 1x (Blue)	Active Diagnostics	There is at least one active diagnostic related to this module	Check what the active diagnosis is. More information can be found in the Maintenance section of this document	6
Blinking 2x	Off	Blinking 2x (Blue)	CPU in STOP mode	CPU in STOP mode	Check if CPU is in RUN mode. More information can be found on CPU's documentation	5
Blinking 4x	Off	Blinking 4x (Blue)	Hardware non-fatal error	Hardware fault	The module remains with its main functionality, but in order to correct the fault, Altus support team must be contacted	4
Off	Blinking 1x	Blinking 1x (Red)	Parameterization Error	The module isn't parameterized or received an invalid parameter	Check if the module parameterization is correct	2
Off	Blinking 2x	Blinking 2x (Red)	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 4x	Blinking 4x (Red)	Hardware fatal error	Hardware fault	Contact Altus support team in case of hardware fatal error	1 (Higher)

Table 11: D, E and Diagnostics LED (DL) States

Note:

Any signaling pattern different from those listed above indicates that the module should be forwarded to Altus Support.

10.2.2. 0, 1 and Numeral Characters

The segments 0 , 1 are used to group the numerical characters used for the 16 analog inputs. The characters that are placed to the right side of the character 0 represent inputs from 00 to 07, where the character 0 represents the input 00 and character 7 represents the input 07. The characters that are placed to the right of the character 1 represent inputs from 10 to 17, where the character 0 represents the input 10 and the character 7 represents the input 17. The figure below shows the relation between numerical characters and the respective input.

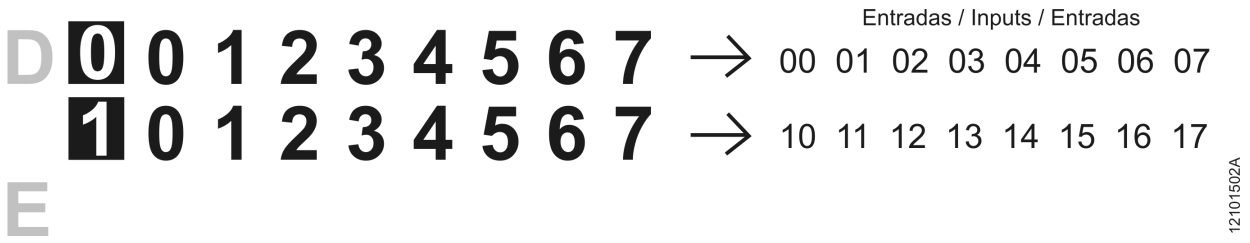

Figure 5: Display

10.3. Web Page with Complete Status and Diagnostics List

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

More information about web page with complete status and diagnostic list can be found at Hadron Xtorm Utilization Manual - MU223600.

10.4. Diagnostics Mapped through Variables

All HX6000's diagnostics can be accessed through variables that can be handled by the user application or even forwarded to a supervisory using a communication channel. The table below shows all available diagnostics for HX6000 and their respective symbolic variables, description and string that will be shown on the CPU Graphical Display and Web.

10.4.1. General Diagnostics

Diagnostic Message	Symbolic Variable DG_modulename.tGeneral.	Description
UNKNOWN DIAGNOSTIC	bReserved_08..15	Reserved
MODULE W/ DIAGNOSIS	bActiveDiagnostics	**TRUE –** Module has active diagnostics **FALSE –** Module doesn't have active diagnostics
NO DIAG		
MODULE W/ FATAL ERROR	bFatalError	**TRUE –** Fatal error **FALSE –** No fatal error
CONFIG. MISMATCH	bConfigMismatch	**TRUE –** Parameterization error **FALSE –** Parameterization ok
WATCHDOG ERROR	bWatchdogError	**TRUE –** Watchdog has been detected **FALSE –** No watchdog detected
OTD SWITCH ERROR	bOTDSwitchError	**TRUE –** Failure on the diagnostic switch **FALSE –** No failure on the diagnostic switch
UNKNOWN DIAGNOSTIC	bReserved_05..06	Reserved
BUS COM. ERROR	bCommunicationError	**TRUE –** Failure in module communication with the bus **FALSE –** Module communication with the bus is OK

Table 12: General Diagnostics

10.4.2. Specific Diagnostics

Diagnostic Message	Symbolic Variable DG_modulename.tSpecific.	Description
INPUT 00 W/ DIAG	bActiveDiagnosticsInput00	**TRUE –** Input 00 has active diagnostics **FALSE –** Input 00 doesn't have active diagnostics
INPUT 01 W/ DIAG	bActiveDiagnosticsInput01	**TRUE –** Input 01 has active diagnostics **FALSE –** Input 01 doesn't have active diagnostics
INPUT 02 W/ DIAG	bActiveDiagnosticsInput02	**TRUE –** Input 02 has active diagnostics **FALSE –** Input 02 doesn't have active diagnostics
INPUT 03 W/ DIAG	bActiveDiagnosticsInput03	**TRUE –** Input 03 has active diagnostics **FALSE –** Input 03 doesn't have active diagnostics
INPUT 04 W/ DIAG	bActiveDiagnosticsInput04	**TRUE –** Input 04 has active diagnostics **FALSE –** Input 04 doesn't have active diagnostics

Diagnostic Message	Symbolic Variable DG_modulename.tSpecific.	Description
INPUT 05 W/ DIAG	bActiveDiagnosticsInput05	**TRUE –** Input 05 has active diagnostics **FALSE –** Input 05 doesn't have active diagnostics
INPUT 06 W/ DIAG	bActiveDiagnosticsInput06	**TRUE –** Input 06 has active diagnostics **FALSE –** Input 06 doesn't have active diagnostics
INPUT 07 W/ DIAG	bActiveDiagnosticsInput07	**TRUE –** Input 07 has active diagnostics **FALSE –** Input 07 doesn't have active diagnostics
INPUT 10 W/ DIAG	bActiveDiagnosticsInput10	**TRUE –** Input 10 has active diagnostics **FALSE –** Input 10 doesn't have active diagnostics
INPUT 11 W/ DIAG	bActiveDiagnosticsInput11	**TRUE –** Input 11 has active diagnostics **FALSE –** Input 11 doesn't have active diagnostics
INPUT 12 W/ DIAG	bActiveDiagnosticsInput12	**TRUE –** Input 12 has active diagnostics **FALSE –** Input 12 doesn't have active diagnostics
INPUT 13 W/ DIAG	bActiveDiagnosticsInput13	**TRUE –** Input 13 has active diagnostics **FALSE –** Input 13 doesn't have active diagnostics
INPUT 14 W/ DIAG	bActiveDiagnosticsInput14	**TRUE –** Input 14 has active diagnostics **FALSE –** Input 14 doesn't have active diagnostics
INPUT 15 W/ DIAG	bActiveDiagnosticsInput15	**TRUE –** Input 15 has active diagnostics **FALSE –** Input 15 doesn't have active diagnostics
INPUT 16 W/ DIAG	bActiveDiagnosticsInput16	**TRUE –** Input 16 has active diagnostics **FALSE –** Input 16 doesn't have active diagnostics
INPUT 17 W/ DIAG	bActiveDiagnosticsInput17	**TRUE –** Input 17 has active diagnostics **FALSE –** Input 17 doesn't have active diagnostics

Table 13: Specific Diagnostics

10.4.3. Detailed Diagnostics

Diagnostic Message	Symbolic Variable DG_modulename.tDetailed. tAnalogInput_XX.	Description
UNKNOWN DIAGNOSTIC	bReserved_08..15	Reserved
OVER RANGE	bOverRange	**TRUE –** Over range condition at the input **FALSE –** No over range condition at the input
UNDER RANGE	bUnderRange	**TRUE –** Under range condition at the input **FALSE –** No under range condition at the input
OPEN LOOP	bOpenLoop	**TRUE –** Open loop condition at the input **FALSE –** No open loop condition at the input
-	bInputNotEnable	**TRUE –** Input is not enabled **FALSE –** Input is enabled
-	bHHAlarm	**TRUE –** High-High Alarm is active **FALSE –** High-High Alarm is not active
-	bHAlarm	**TRUE –** High Alarm is active **FALSE –** High Alarm is not active
-	bLLAlarm	**TRUE –** Low-Low Alarm is active **FALSE –** Low-Low Alarm is not active
-	bLAlarm	**TRUE –** Low Alarm is active **FALSE –** Low Alarm is not active

Table 14: Detailed Diagnostics

Notes:

Open Loop Diagnostic: This diagnosis only applies to channels configured as 4 to 20 mA current input type, and is set when the input current is lower than 3.5 mA. In the case of open loop diagnosis, this will have the highest priority, making the module assumes the value set for this option.

Under Range: This diagnosis becomes active when the value of the analog input is less than the minimum value of the range configured for this channel subtracted from 1% of the full scale value. E.g. for the 0 to 10 Vdc voltage scale, under range diagnostics turns true for measurements below -0.1 Vdc. For the 4 to 20mA current scale, under range diagnostics turns true for measurements below 3.8 mA.

Over Range: This diagnosis becomes active when the analog input value exceeds the maximum value of the scale configured for this channel, plus 1% of the full-scale value.. E.g. for the 0 to 10 Vdc scale, over range diagnostics turns true for measurements above 10.1 Vdc. In the case of Under Range or Over Range diagnostic in engineering scale values, it must be considered the ratio value of 1% (amplitude of the engineering scale and amplitude of the selected input type). E.g. for the 0 to 10 Vdc voltage range and 0 to 30000 engineering scale, the Over Range diagnostic variable will be switched on when the measured value is greater than or equal to 30300. For the 0 to 10 Vdc voltage range and -30000 to 30000 engineering scale, the Over Range diagnostic variable will be switched on when the measured value is greater than or equal to 30600.

10.5. Hot Swap

These products support hot swapping. For more information on how to carry out a hot swap correctly, please consult the Hadron Xtorm Utilization Manual – MU223600.

11. 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
CE123000	Hadron Xtorm Series Technical Characteristics	English
CT123000	Características Técnicas Série Hadron Xtorm	Portuguese
MU223600	Hadron Xtorm Utilization Manual	English
MU223000	Manual de Utilização Hadron Xtorm	Portuguese

Table 15: Related Documents