1. Product Description

The automation of electric power systems is characterized by using robust, reliable, and high-tech equipment and devices that can operate in hostile environments with 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.

its main features are:

- CPU redundancy support in the same rack
- Ethernet ports redundancy support
- 6 Ethernet ports with RJ45 connector
- 1 RS-232/485 port
- 1 RS-485/RS-422 isolated port
- SD Card Interface
- Time synchronization via IRIG-B, SNTP, PTP and control center
- IEC 61850 Server protocol (MMS Server and GOOSE Publisher/Subscriber)
- IEC 60870-5-104 Client and Server protocol
- DNP3 Client and Server protocol
- MODBUS RTU, MODBUS TCP and MODBUS RTU via TCP protocol
- High-speed 32-bit processor
- Web server resources
- Enhanced diagnosis services
- Messages log system
- Automation features with 6 languages (IEC 61131-3)
- One Touch Diag
- Real Time Clock
- Hot swap
- Robust design
- Easy insertion and removal
- Fan less design (no moving parts and internal batteries)

2. Ordering Information

2.1. Included Items

The product package contains the following items:

- HX3040 module
- 01 terminal connector HX9405

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3. Product Code

The following codes should be used to purchase the product:

Code	Description
HX3040	High-speed CPU, 6 Ethernet ports, 2 serial channels, memory card interface, and redundancy support

Table 1: Product Code

4. Related Products

The following product must be purchased separately when needed:

Code	Description
HD8500	MasterTool Xtorm
AL-2600	RS-485 net derivatior and terminatior
AL-2301	RS-485 Net cable (up to 1000 m)
AL-2306	RS-485 Net cable (up to 500 m)
AL-1729	RJ45-CMDB9 cable
AL-1748	CMDB9-CFDB9 cable
AL-1752	CMDB9-CMDB9 cable
AL-1753	CMDB9-CMDB25 cable
AL-1754	CMDB9-CFDB9 cable
AL-1762	CMDB9-CMDB9 cable
AL-1763	CMDB9 terminal block cable
NX9202	RJ45-RJ45 2m cable
NX9205	RJ45-RJ45 5m cable
NX9210	RJ45-RJ45 10m cable
NX9101	32 GB MicroSD CARD with SD adaptors and miniSD
HX9405	4-terminal connector
HX9102	Rack Connector Cover

Table 2: Related Products

Notes:

HD8500: MasterTool Xtorm is the configuration and programming tool used for the Hadron Xtorm Series.

AL-2600: This module is used for derivation and termination of RS-422/485 networks. For each network node must exist an AL-2600. The AL-2600 modules that are in the ends of the network must be configured as termination, except when there is a device with active internal termination. The other modules must be configured as derivation.

AL-2301 and AL-2306: Shielded cable with two twisted pairs, with no connectors, used for RS-485 and RS-422 networks, with 1000 m and 500 m of maximum length respectively.

AL-1729: RS-232C standard cable with one RJ45 connector and one DB9 male connector for communication between CPUs of Hadron Xtorm Series and the other Altus products (DUO, Piccolo and Ponto Series).

AL-1748: RS-232C standard cable with one DB9 male connector and 1 DB9 female connector for communication between CPUs of Hadron Xtorm Series and other products of the Altus Cimrex Series.

AL-1752: RS-232C standard cable with one DB9 male connector for communication between CPUs of Hadron Xtorm Series and the Altus products of the H Series and IX Series HMIs.

AL-1753: RS-232C standard cable with one DB9 male connector and one DB25 male connector for communication between CPUs of Hadron Xtorm Series and the Altus H Series products.

AL-1754: RS-232C standard cable with one DB9 male connector and one DB9 female connector for communication between CPUs of Hadron Xtorm Series and the Altus Exter Series products or a microcomputer serial port, RS-232C standard.

AL-1762: RS-232C standard cable with two DB9 male connectors for communication between CPUs of Hadron Xtorm Series and also for communication between CPUs of Nexto Series.

AL-1763: Cable with one DB9 male connector and terminal blocks for communication between CPUs of Hadron Xtorm Series and the products with RS-485/RS-422 standard terminal blocks.

NX9202, NX9205 and NX9210: Ethernet CAT5 cable, shielded, twisted pair, with RJ45 male connectors in the ends, supports temperature of -5 ºC to 70 ºC, used for Ethernet networks with 2, 5 and 10 m of maximum length respectively.

NX9101: Kit with a 32 Gbytes microSD card, one adaptor for the SD standard and other adaptor for the miniSD standard.

HX9405: 4-terminal connector with wiring fixing through a spring pressure system, and with a connector fixing system in the module through screws.

HX9102: It is a cover to protect the Hadron Xtorm Series rack connectors.

5.   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:

Battery Free Operation: Hadron Xtorm Series does not require any kind of battery for memory maintenance and real time clock operation. This feature is extremely important because it reduces the system maintenance needs and allows the use in remote locations where maintenance can be difficult to be performed. Besides, this feature is environmentally friendly.

Multiple Block Storage: Several kinds of memories are available to the user in Hadron Xtorm Series CPUs, offering the best option for any user needs. These memories are divided in volatile memories and non-volatile memories. For volatile memories, Hadron Xtorm Series CPUs offer addressable input (%I), addressable output (%Q), addressable memory (%M), data memory and redundant data memory. For applications that require non-volatile functionality, Hadron Xtorm Series CPUs bring retain addressable memory (%Q), retain data memory, persistent addressable memory (%Q), persistent data memory, program memory, source code memory, CPU file system (doc, PDF, data) and memory card interface.

One Touch Diag: One Touch Diag is an exclusive feature that Hadron Xtorm 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.

OFD – On Board Full Documentation: Hadron Xtorm Series CPUs are capable of storing the complete project documentation in its own memory. This feature can be very convenient for backup purposes and maintenance, since the complete information is stored in a single and reliable place.

ETD – Electronic Tag on Display: Another exclusive feature that Hadron Xtorm 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.

6. Product Features

6.1. Basic Features

	HX3040
Direct representation input variables memory (%I)	96 Kbytes
Direct representation output variables memory (%Q)	96 Kbytes
Addressable variables memory (%M)	64 Kbytes
Symbolic variables memory	6 Mbytes
Retain symbolic variables memory	8 Kbytes
Persistent symbolic variables memory	4 Kbytes
Redundant variables memory	512 Kbytes
Program memory	12 Mbytes
Source code memory (backup)	100 Mbytes
User files memory	32 Mbytes
Maximum number of tasks	32
Maximum number of expansion racks	8
Ethernet TCP/IP local interface	6
Ethernet TCP/IP interfaces redundancy support	Yes
CPU redundancy support (same rack)	Yes
Clock synchronization (IRIG-B, SNTP and PTP)	Yes

Table 3: Basic Features

Notes:

Direct representation input variable memory (%I): It is the area where all the direct representation variables for the input type are assigned. A direct representation variable means that the variable can be accessed directly in the memory using the desired address. For example: %IB0, %IW100. Direct representation input variable can be used for mapping analogic or digital input points. As a reference, 8 digital input points can be represented by one byte and 1 analogic input point can be represented by two bytes. The Hadron Xtorm Series HX3040 CPU defines all the direct representation input variables memory (%I) as redundant variables, which means that the user does not need to select this area.

Direct representation output variable memory (%Q): It is the area where all the direct representation variables for the output type are assigned. A direct representation variable means that the variable can be accessed directly in the memory using the desired address. For example: %QB0, %QW100. Direct representation output variable can be used for mapping analogic or digital output points. As a reference, 8 digital output points can be represented by one byte and 1 analogic output point can be represented by two bytes. The Hadron Xtorm Series HX3040 CPU defines all the direct representation output variables memory (%Q) as redundant variables, which means that the user does not need to select this area.

Symbolic variables memory: It is the area where the symbolic variables are assigned. Symbolic variables are IEC variables created in POUs and GVLs during application development, not addressed directly in memory. Symbolic variables can be defined as retain or persistent. In this case the retain symbolic variables memory or the persistent symbolic variables memory area will be used, respectively. The RTU system allocates system variables in this area, so that the available space for the allocation of variables user-created is lower than those reported in the table. The amount of memory occupied by these system variables depends on the project characteristics (number of modules, drivers, etc. ...), so it is recommended to observe the available space in the MasterTool Xtorm compilation messages.

Retain symbolic variables memory: It is the area where the retain symbolic variables are assigned. Retain data keep their respective values even after a power on/power off cycle of the CPU. The complete list of when retain variables keep their values and when the value is lost can be found on the table below.

Persistent symbolic variable memory: It is the area where the persistent symbolic variables are assigned. Persistent data keep their respective values even after a download of a new application into CPU. The complete list of when persistent variables keep their values and when the value is lost can be found on the table below.

Redundant variables memory: It is the area where the redundant variables are assigned (selected on Redundancy Configuration object).

Program memory: It is memory area that corresponds to the maximum size that can be used to store the user application. This area is shared with the source code memory, thus the total area is the sum of the *"program memory"* plus the *"source*

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code memory".

Source code memory (backup): It is the memory area available to store a backup from the project. In case the user decides to import the project, the MasterTool Xtorm software will search the required information in this area. It is important to ensure that the backup project is updated to avoid the loss of critical information. This area is shared with the program memory, thus the total area is the sum of the *"program memory"* plus the *"source code memory"*.

User files memory: It is the memory area available to store files such as doc, pdf, images, and more. This function allows saving data like a memory card. More information can be found at Hadron Xtorm Utilization Manual – MU223600.

Maximum number of tasks: Maximum number of tasks can be found at Hadron Xtorm Utilization Manual – MU223600.

Redundancy support (same rack): The HX3040 supports CPU redundancy when placed ate the same rack. More information can be found at Hadron Xtorm Utilization Manual – MU223600.

6.2.   General Features

	HX3040
Programming languages	Instruction list (IL)
	Structured text (ST)
	Ladder diagram (LD)
	Sequential function chart (SFC)
	Function block diagram (FBD)
	Continuous function chart (CFC)
Types of tasks	Cyclic (periodic)
	Event (software interruption)
	External event (hardware interruption)
	Continuous (free run)
	Status (software interruption)
Online changes	Yes
Hot swap support	Yes
Bus expansion redundancy support	Yes
Serial interfaces	1 x RS-232C / RS-485 (COM 1)
	1 x RS-485 / RS-422 (COM 2)
MODBUS Protocol	RTU Master and slave (COM 1 and COM 2)
	TCP Client and server (NET 1 .. NET 6)
	RTU via TCP Client and server (NET 1 .. NET 6)
DNP3 Protocol	TCP Client and Server (NET 1 .. NET 6)
IEC 60870-5-104 Protocol	TCP Client and Server (NET 1 .. NET 6)
IEC 61850 MMS Protocol	TCP Server (NET 1 .. NET 6)
IEC 61850 GOOSE Protocol	Publisher and Subscriber (NET 1 .. NET 6)
SNTP Protocol	Client
PTP Protocol	Precision Time Protocol (Slave)

Event queue
    Size
    Overflow policy
    Retentivity
	
	4.500 events
	Keep most recente
	Yes

Real time clock (RTC)	Yes Resolution of 1 ms and maximum variance of 2 s per day
Watchdog	Yes
Status and diagnostic indication	Display, LED, web page and CPU's internal memory
One Touch Diag (OTD)	Yes
Eletronic Tag on Display (ETD)	Yes

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	HX3040
Isolation	
Logic to protective earth ⏚	2500 Vac/ 1 minute
Logic to Ethernet interfaces	1500 Vac/ 1 minute
Logic to serial port (COM 2)	2000 Vac/ 1 minute
Logic to IRIG-B port	2500 Vac/ 1 minute
Ethernet interfaces to protective earth ⏚	1500 Vac/ 1 minute
Ethernet Interfaces to serial port (COM 2)	2500 Vac/ 1 minute
Ethernet interface to Ethernet interface	1500 Vac/ 1 minute
Serial port (COM 2) to protective earth ⏚	2500 Vac/ 1 minute
Current consumption from backplane rack	1500 mA
Dissipation	7,5 W
Operating temperature	-5 to 60°C
Storage temperature	-25 to 75°C
Operating and storage relative humidity	5 to 96 %, no condensation
Conformal coating	Yes
Protection Level	IP 20
Module dimensions (W x H x D)	38,0 x 235,3 x 184,2 mm
Package dimensions (W x H x D)	55,0 x 308,0 x 266,0 mm
Weight	1000 g
Weight with package	1300 g

Table 4: General Features

Notes:

Types of tasks: Task is an object used to call POUs. A Task can be achieved by period, events or can run in freewheeling mode. Each task can call one or more POUs.

Real Time Clock (RTC): The retention time, which is the time that the real time clock keeps updating the date and time after the CPU goes off, is 15 days considering environments with temperature of 25 °C. Up to the maximum product operation temperature, retain time is reduced to 10 days.

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

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

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6.3. Standards and Certifications

Standards and Certifications	
IEC	61131-2: Industrial-process measurement and control - Programmable controllers - Part 2: Equipment requirements and tests 61131-3: Programmable controllers - Part 3: Programming languages 61850: International standard defining communication protocols for intelligent electronic devices at electrical substations.
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 5: Standards and Certifications

6.4.   COM 1

	HX3040
Connector	DB9 shielded female
Physical interface	RS-232C or RS-485 (depending on the connected cable)
Communication direction	RS-232C: full duplex RS-485: half duplex
Maximum number of transceivers RS-485	32
RS-485 termination	No (allows the use of external active termination)
Modem signals	RTS, CTS, DCD
Baud rate	600, 1.200, 1.800, 2.400, 4.800, 9.600, 19.200, 38.400, 57.600, 115.200 bps
Protocols	MODBUS RTU (Master/ Slave) Open protocol

Table 6: COM 1

6.5.   COM 2

	HX3040
Connector	DB9 shielded female
Physical interface	RS-422 or RS-485 (depending on the selected cable)
Communication direction	RS-422: full duplex RS-485: half duplex
Maximum number of RS-422 transceivers	11 (1 sender and 10 receivers)
Maximum number of RS-485 transceivers	32
Termination	Yes (optional via cable selection)
Baud rate	600, 1.200, 1.800, 2.400, 4.800, 9.600, 19.200, 38.400, 57.600, 115.200 bps
Protocols	MODBUS RTU (Master/ Slave) Open protocol

Table 7: COM 2

Notes:

Physical interface: Depending on the cable configuration it is possible to choose the type of physical interface: RS-232C or RS-485 to COM1, and RS-422 or RS-485 to COM2.

Maximum number of RS-422 transceivers: The maximum number of RS-422 interfaces that can be used on the same bus.

Maximum number of RS-485 transceivers: The maximum number of RS-485 interfaces that can be used on the same bus.

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6.6. NET1 to NET6

	HX3040
Connector	RJ45 shielded female
Auto Crossover	Yes
Maximum cable length	100 m
Cable type	UTP or ScTP, category 5
Baud rate	10/100 Mbps
Physical layer	10/100 BASE-TX
Data link layer	LLC (logic link control)
Network layer	IP (internet protocol)
Transport layer	TCP (transmission control protocol) UDP (user datagram protocol)
Application layer	MODBUS TCP Client / Server MODBUS RTU via TCP Client / Server DNP3 Client / Server IEC 60870-5-104 Client / Server GOOSE Protocol (sending and receiving messages) MMS Serve HTTP (web server) Mastertool Xtorm programming protocol (only NET 1) SNTP (Clock synchronism)

Table 8: NETs

Note:

Mastertool Xtorm Programming protocol: In the cases where NET 1 is configured as redundant, NET 2 can also be used to the Mastertool Xtorm programming protocol.

6.7. IRIG-B

	HX3040
Connector type	Removable terminal connector with 4 terminals (HX9405)
Maximum cable length	5 m
Wire gauge	0,5 mm²
Input and output level	TTL
Input impedance	> 100 kΩ
Delay between input and output	< 10 ns
Maximum output current	10 mA
Maximum output load	500 Ω
Protection against short circuit	Yes
Voltage levels	0 to 1.5 Vdc to logic level 0 3.5 to 5 Vdc to logic level 1

Table 9: IRIG-B

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Note:

Maximum output load: The resulting total load of all devices connected to the output should not exceed this value. There is no maximum predefined limit of devices. The value should be calculated regarding the minimum input impedance of each device connected to the IRIG-B Xtorm output.

7.   Graphic Display

The Hadron Xtorm Series CPUs have a graphic display used to show status and diagnostics of the entire system including specific diagnostics of each additional module. The display also offers an easy-to-use menu that brings to the user a fast way to read or set some parameters like: internal temperature (read only); graphic display contrast and IP address for each NET interface (read only). More information about how to use the graphic display can be found at Hadron Xtorm Utilization Manual – MU223600.

8.   Memory Card Interface

The memory cards can be used for different kinds of data storage like user's logs, webpages, project documentation and source files. More information about how to use memory card interface can be found at Hadron Xtorm Utilization Manual – MU223600.

	HX3040
Maximum capacity	32 Gbytes
Minimum capacity	2 Gbytes
Type	SD
File system	FAT32
Remove card safely	Yes, via the CPU menu option

Table 10: Memory Card

Notes:

Maximum capacity: The memory card capacity should be equal or below this limit for the Hadron Xtorm CPU correct functioning. The CPU may not recognize the card or data loss may occur during the transfer processes.

Minimum capacity: The memory card capacity should be equal or above this limit for the Hadron Xtorm CPU correct functioning. The CPU may not recognize the card or data loss may occur during the transfer processes.

File system: It is recommended to format the memory using the Hadron Xtorm CPU itself, otherwise performance loss may occur when accessing the memory card interface.

9.   CPU Redundancy

Hadron Xtorm Series offers CPU redundancy. The redundant CPUs must be located in the same rack. In the redundant architecture, the system will have one CPU running (active CPU) and another one acting as the standby CPU, The standby CPU is capable of automatic switchover and assume the control of the application in the event of a primary controller failure. This means that critical processes are not affected by control system hardware failures. The result is increased productivity and minimized downtime.

The communication between the CPUs is done at the end of each cycle across two high-speed redundancy links located at the position 2 and 3 of the rack.

The example below demonstrates the redundant mode provided by Hadron Xtorm Series. More information about how to configure and use CPU's redundant features can be found at Hadron Xtorm Utilization Manual – MU223600.

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9.1. CPU Redundancy on the Same Rack

This Series provides the redundancy feature using two CPUs connected on the same rack. Each CPU may contain one or more net protocols configured to communicate with the control center. When an error with the active CPU occurs, standby CPU automatically takes over the connections control. This application is easy to configure and dismisses the user to create a special programming or parameterization. In this redundant mode, CPUs must be placed side by side. The figure below demonstrates an example of a rack with a CPU redundant topology.
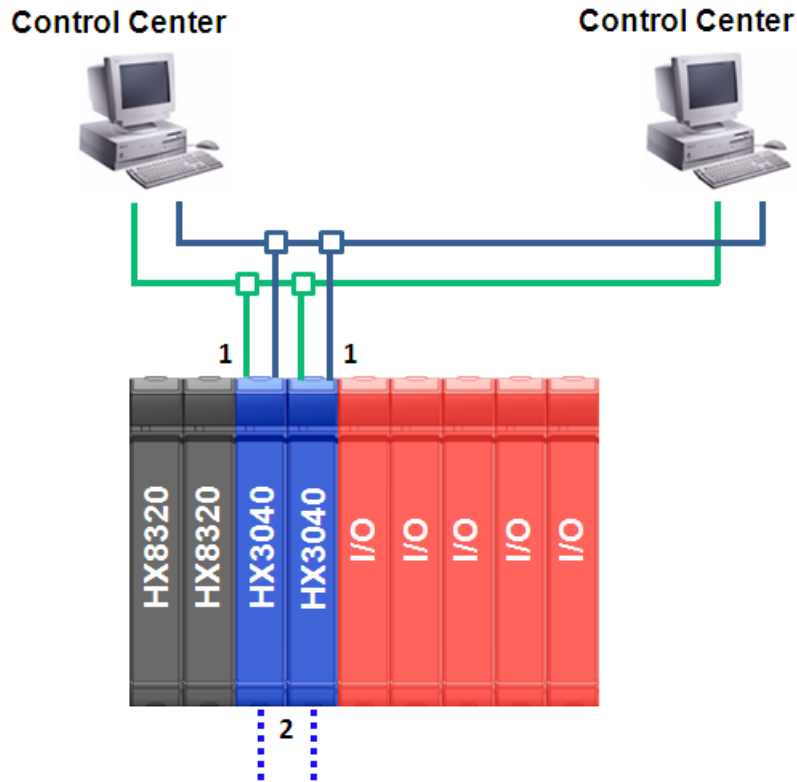
Figure 1: CPU Redundancy on the Same Rack

Notes:

1- Ethernet net topology.

2- The configuration of each CPU must be identical.

10. Physical Dimensions
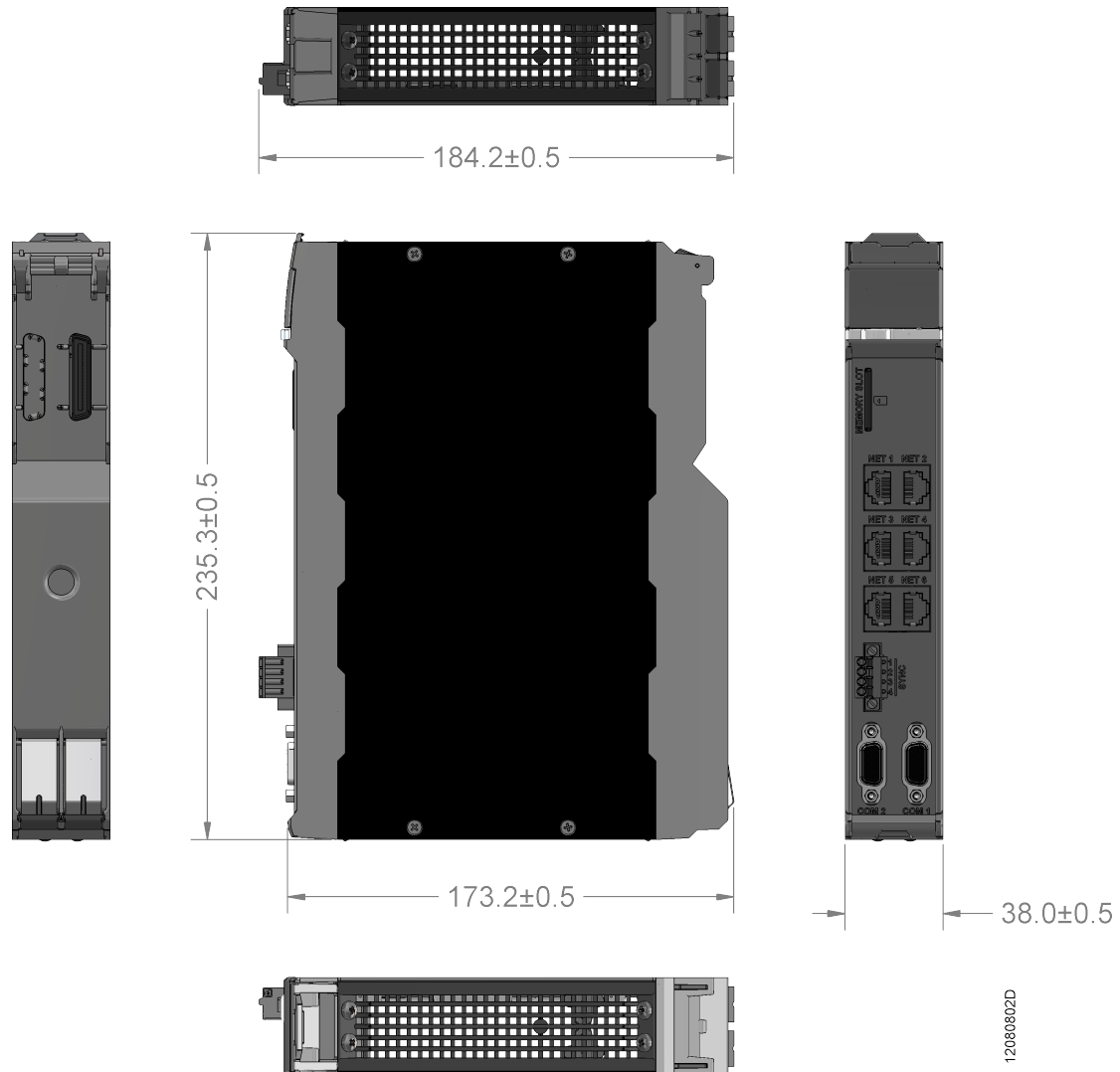
Dimensions in mm.

Figure 2: Physical Dimensions

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11.   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.

11.1.   Product Identification

This product has some parts that must be observed before installation and use. The following figure identifies each of these parts.
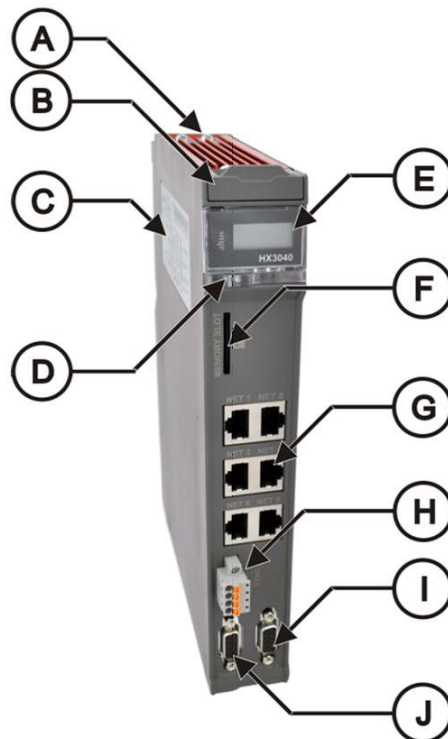
Figure 3: HX3040

Ⓐ   Fixing lock.

Ⓑ   Module Slot locking slider

Ⓒ   Label for module identification.

Ⓓ   Diagnostic LED and switch.

Ⓔ   Status and diagnostic display.

Ⓕ   MicroSD card connector.

Ⓖ   RJ45 connectors for Ethernet communication.

Ⓗ   4-pin terminal block for IRIG-B.

Ⓘ   Female DB9 connector RS-232C/RS-485.

Ⓙ   Female DB9 connector for RS-485/RS-422.

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.

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11.2. Electrical Installation

> **DANGER**
>
> When executing any installation in an electric panel, certify that the main energy supply is OFF.

The power supply for the Hadron Xtorm Series CPU comes from the Power Supply Module, which supplies voltage to the CPUs via the connection to the rack, without the need for external connections. The module is grounded through contact between the module's ground spring and the rack.
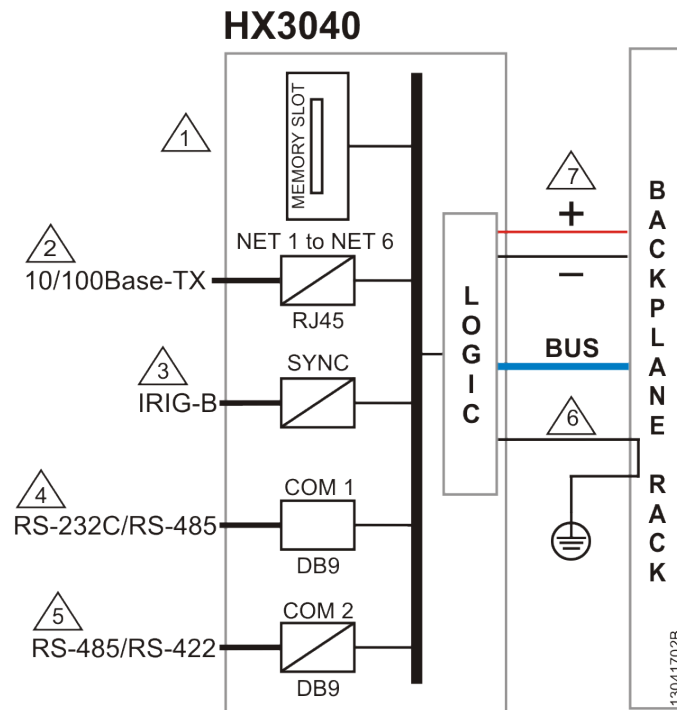

Figure 4: Electrical Diagram

Diagram Notes:

△1   SD card interface.

△2   Ethernet 10/100 Base-TX standard interface.

△3   IRIG-B interface.

△4   Serial RS-232C/RS-485 standard interface.

△5   Serial RS-485/RS-422 standard interface.

△6   The HX3040 is grounded ⏚ through the backplane racks.

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

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11.3. Mechanical and Electrical 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.

12. Configuration

Hadron Xtorm Series CPUs were developed to be used with Hadron Xtorm Series products. All the products of the Series are configured with MasterTool Xtorm. Information about the right procedure to add/remove modules from the system can be found at Hadron Xtorm Utilization Manual - MU223600.

13. Programming

Hadron Xtorm Series CPUs use the IEC 61131-3 standard languages, which are IL, ST, LD, SFC and FBD. IL and ST are textual languages and they are similar to Assembly and C languages, respectively while LD, SFC and FBD languages are graphical. LD uses the representation of relays and blocks and is similar to relay diagrams. SFC uses an arrangement of sequence diagram, allowing a clear view of functions performed on each action. Series CPUs also offer a sixth language – CFC.

The programming is performed on the MasterTool Xtorm interface. The Mastertool Xtorm enables the use of six languages in the same project, thus providing the best features that each language can offer to the user, resulting in efficient application developments, allowing easy documentation and future maintenance.

Additional information about programming can be found at Hadron Xtorm Utilization Manual - MU223600.

14. Maintenance

Altus 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.

Hadron Xtorm Series CPUs offer 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 status and diagnostics mapped through internal memory.

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15. 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.

Electronic Tag on Display and Onde Touch Diag are easy to use features. To check the tag and diagnostics of a given module, it's required only one short press (less than 1 sec) on its diagnostic switch. After press once, CPU will show the tag information and the diagnostic information of the module. To access the respective description just long press (more than 1 second) the diagnostic switch of the respective module.

More information about Electronic Tag on Display can be found at Hadron Xtorm Utilization Manual - MU223600.

16. Status and Diagnostics Indicators

The Hadron Xtorm Series CPUs present a graphic display containing the status and some useful information to the user, such as: application states (Run and Stop), SD card status, activity on the serial interfaces (RX and TX) and others. Additionally, the Hadron Xtorm Series CPUs also provides a bicolor LED used to indicate the status and diagnostics. The table below shows the meaning of each LED status.

DL (Color)	Description	Cause	Priority
Off	Display failure or module off	No external supply or hardware failure	-
On (Blue)	Applications in Run Mode	-	4 (Lowest)
Blinking 2x (Blue)	Bus modules or CPU with diagnosis	There is at least one bus module with some active diagnostic (including the CPU)	2
Blinking 3x (Blue)	Data forcing	Some memory area is being forced by the user through MasterTool Xtorm	3
On (Red)	Applications on Stop Mode	-	4 (Lowest)
Blinking 1x (Red)	Software watchdog	Watchdog of the user application	1
Blinking 4x (Red)	Configuration error or Hardware in the bus	The bus is damaged or it is not properly configured	0 (Highest)

Table 11: Diagnostic LED status (DL)

Note:

Software watchdog: To clear any watchdog indication an application reset must be performed or the CPU must be turned off and on again.The watchdog happens when the user application time is higher than the configured watchdog.

17. Web Page with Complete Status and Diagnostics List

Another way to access diagnostic information on Hadron Xtorm Series is via web pages. Hadron Xtorm Series CPUs has an embedded web pages server that provides all status and diagnostic information, which can be accessed using a simple browser in a computer, tablet or smartphone.

18. Diagnostics Mapped through Variables

The list of all CPUs status and diagnostics can be found at Hadron Xtorm Utilization Manual - MU223600.

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19. Manuals

For technical details, configuration, installation and programming of Hadron Xtorm Series, see the documents in the table below.

The table below is only a guide of some relevant documents that can be useful during the use and maintenance of HX3040. The complete and updated table containing all documents of Hadron Xtorm Series can be found at Hadron Xtorm Utilization Manual – MU223600.

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 12: Related Documents

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