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.

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 diagnostic 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
MT8500	MasterTool IEC XE
HD8500	MasterTool Xtorm
AL-2600	RS-485 network branch and terminator
AL-2306	RS-485 cable for MODBUS or CAN network
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 2 m Cable
NX9205	RJ45-RJ45 5 m Cable
NX9101	32 GB microSD memory card with miniSD and SD adapters
HX9405	04-terminal Connector
HX9102	Backplane Connector Cover

Table 2: Related Products

Notes:

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

MT8500: MasterTool IEC XE is available in four different versions: LITE, BASIC, PROFESSIONAL and ADVANCED. For more details, please check MasterTool IEC XE User Manual - MU299609.

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-2306: Two shielded twisted pairs cable without connectors, used for networks based on RS-485 or CAN.

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/NX9210: Cables used for Ethernet communication and to interconnect the bus expansion modules.

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

HX9405: The 4-terminal connector, HX9405, is exclusively used for the IRIG-B channel of the HX3040 CPU.

HX9102: It is a cover to protect the Hadron Xtorm Series rack connectors. This cover was designed to provide high protection for the unused connectors of the rack. It is recommended that the user protect all unused positions with the HX9102 product, which supports temperatures from -5°C to 70°C.

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.

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6.   Product Features

6.1.   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)
Maximum number of tasks	32
Maximum number of expansion racks	15
Ethernet TCP/IP local interface	6
Ethernet TCP/IP interfaces redundancy support	Yes
CPU redundancy support (same rack)	Yes
Real time clock (RTC)	Yes Resolution of 1 ms and maximum variance of 2 s per day
Clock synchronization (IRIG-B, SNTP and PTP)	Yes

Event queue
    Size
    Overflow policy
    Retentivity
	
	4.500 events
	Keeps the latest
	Yes

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

Isolation
    Logic to protective earth ⏚
    Logic to Ethernet interfaces
    Logic to serial port (COM 2)
    Logic to IRIG-B port
    Ethernet interfaces to protective earth ⏚
    Ethernet Interface to serial port (COM 2)
    Ethernet Interface to Ethernet Interface
    Serial Port (COM 2) to protective earth ⏚
	
	2500 Vac/ 1 minute
	1500 Vac/ 1 minute
	2000 Vac/ 1 minute
	2500 Vac/ 1 minute
	1500 Vac/ 1 minute
	2500 Vac/ 1 minute
	1500 Vac/ 1 minute
	2500 Vac/ 1 minute

Current consumption from backplane rack	1500 mA

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	HX3040
Dissipation	7.5 W
Operation temperature	-5 to 60°C
Storage temperature	-25 to 75°C
Operating and storage relative humidity	5 to 96 %, no condensation
Eletronic circuit coating	Yes
Protection Leve	IP 20
Module dimensions (L x A x P)	38,0 x 235,3 x 184,2 mm
Module dimensions (L x A x P)	55,0 x 308,0 x 266,0 mm
Weight	1000 g
Weight with package	1300 g

Table 3: Main Features

Notes:

Types of tasks: Task is an object used to call POUs. A Task can be triggered 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.

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

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

Eletronic circuit coating: The eletronic circuit coating protects the electronic components inside the product from humidity, dust and other harsh elements to electronic circuits.

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6.2. 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 4: Standards and Certifications

6.3. Memory

	HX3040
Addressable input variables memory (%I)	96 Kbytes
Addressable output variables memory (%Q)	96 Kbytes
Symbolic variable memory	6 Mbytes
Retain symbolic variables memory	8 Kbytes
Persistent symbolic variables memory	4 Kbytes
Redundant variable memory	512 Kbytes
Program memory	12 Mbytes
Source code memory (backup)	100 Mbytes
User files memory	32 Mbytes

Table 5: Memory

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Notes:

Addressable input variables memory (%I): It is the area where all the direct addressable input variables are assigned. An addressable variable means that the variable can be accessed directly in the memory using the desired address. For example: %IB0, %IW100. Addressable input variables 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 area of addressable input variables memory (%I) as redundant variables, which means that the user does not need to select this area.

Addressable output variables memory (%Q): : It is the area where all the addressable output variables are assigned. An addressable variable means that the variable can be accessed directly in the memory using the desired address. For example: %QB0, %QW100. Addressable output variables 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 addressable 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 the 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.

ATTENTION

The declaration and use of persistent variables should be performed exclusively through the Persistent Vars object, which may be included in the project through the treeview in Application -> Add Object -> Persistent Variables. Do not use the expression VAR PERSISTENT in the declaration field of POUs variables.

In addition to the persistent area size given in the table above, these 44 bytes are reserved for storing information about the persistent variables (not available for use). The complete list of when persistent variables keep their values and when the value is lost can be found in the following table.

The table shows the behavior of the symbolic, retentive and persistent variables for different situations, where "-" means that the value is lost and "X" means that the value is kept.

Command	Symbolic Variable	Retain Variable	Persistent Variable
Reset Warm / Power on Cycle	-	X	X
Reset Cold	-	-	X
Reset Origin	-	-	-
Remove CPU or Power Supply from Rack when powered	-	-	-
Download	-	-	X
Online change	X	X	X
Reboot CPU	-	X	X
Clean All	-	-	X
Reset Process (IEC 60870-5-104	-	X	X

Table 6: Non-volatile Variables Behavior

In the case of the Clean All command, if the application has been modified in such a way that persistent variables have been removed, inserted at the beginning of the list or have had their type changed, the value of these variables will be lost (alerted by the MasterTool when downloading). It is therefore recommended that changes in the GVL of persistent variables only involve adding new variables at the end of the list.

Memory of redundant variables: Only applied to designs with CPU redundancy. These are the variables synchronized between redundant CPUs, which includes direct representation variables (%I e %Q), used by I/O modules, and user program symbolic variables declared in redundant GVLs or POUs.

Program memory: Memory area that corresponds to the maximum size allowed for the user application. This area is shared with source code memory, with the total area being the sum of "program memory" and "source code memory".

Source code memory (backup): Memory area used as a backup of the project, that is, if the user wants to import its project, the MasterTool Xtorm software will find the necessary information in this area. It is important to make sure that the project saved as a backup is up to date to avoid losing critical information. This area is shared with the program memory with the total area being the sum of "program memory" and "source code memory".

User files memory: This area of the memory is destined to the storage of files, such as: doc, pdf, images, among others, that is, it allows the recording of data as if it were a memory card.

Redundancy support (same rack): The HX3040 CPU supports redundancy of CPUs placed in the same rack.

6.4. Protocols

	HX3040	Interface
Communication with programming software	Yes	NET 1 .. NET 2
Open Protocol	Yes	COM 1 / COM 2
MODBUS RTU Master	Yes	COM 1 / COM 2
MODBUS RTU Slave	Yes	COM 1 / COM 2
MODBUS TCP Client	Yes	NET 1 .. NET 6
MODBUS TCP Server	Yes	NET 1 .. NET 6
MODBUS RTU over TCP Client	Yes	NET 1 .. NET 6
MODBUS RTU over TCP Server	Yes	NET 1 .. NET 6
IEC 60870-5-104 Client	Yes	NET 1 .. NET 6
IEC 60870-5-104 Server	Yes	NET 1 .. NET 6
DNP3 Client	Yes	NET 1 .. NET 6
DNP3 Server	Yes	NET 1 .. NET 6
IEC 61850 MMS Server	Yes	NET 1 .. NET 6
IEC 61850 GOOSE Publisher	Yes	NET 1 .. NET 6
IEC 61850 GOOSE Subscriber	Yes	NET 1 .. NET 6
OPC DA Server	Yes	NET 1 .. NET 6
OPC UA Server	Yes	NET 1 .. NET 6
EtherCAT Master	No	-
SNMP Agent	No	-
EtherNet/IP Scanner	No	-
EtherNet/IP Adapter	No	-
MQTT Client	Yes	NET 1 .. NET 6
SNTP Client (for clock synchronism)	Yes	NET 1 .. NET 6
PTP (Precision Time Protocol) Slave	Yes	NET 1 .. NET 6
PROFINET Controller	Yes	NET 1 .. NET 6
PROFINET Device	No	-
OpenVPN Client	No	-
OpenVPN Server	No	-
FTP Server	Yes	NET 1 .. NET 6
MRP	No	-

Table 7: Protocols

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Notes:

PROFINET Controller: Enabled for use without CPU redundancy and in a simple network (without a ring) with up to 8 devices. For larger applications, consult technical support.

OPC UA Server: Enabled for use without CPU redundancy and in a simple network (without a ring).

6.5. Serial Interfaces

6.5.1. COM 1

	COM 1
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 RS-485 transceivers	32
RS-485 termination	No (allows the use of external active termination)
Modem signals	RTS, CTS, DCD
Baud rate	600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps

Table 8: Serial Interface COM 1

6.5.2. COM 2

	COM 2
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 driver e 10 receivers)
Maximum number of RS-485 transceivers	32
Termination	Yes (optional via cable selection)
Baud rate	600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps

Table 9: Serial Interface 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. Ethernet Interfaces

6.6.1. NET 1 .. NET 6

	NET 1 .. NET 6
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)

Table 10: Ethernet Interfaces NET 1 .. NET 6

6.7. IRIG-B

	IRIG-B
Connector type	Removable terminal connector with 4 terminals (HX9405)
Maximum cable length	5 m
Wire gauge	$0,5\ mm^2$
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	Sim
Voltage levels	0 a 1,5 Vdc to logic level 0 3,5 a 5 Vdc to logic level 1

Table 11: IRIG-B Interface

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.

6.8. Graphic Display

The Hadron Xtorm Series CPUs have a graphic display used to show the status and diagnostics of the entire system, including the specific diagnostics of each additional module. The display also offers a user-friendly menu that gives the user a quick path to read or set some parameters such as: internal temperature (read-only); graphic display contrast and IP address for each NET interface (read-only).

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6.9. Memory Card Interface

Memory cards can be used for different types of data storage such as: user logs, web pages, project documentation, and source files.

	Memory Card
Maximum capacity	32 Gbytes
Minimum capacity	2 Gbytes
Type	SD
File system	FAT32
Remove card safely	Yes, through specific menu for this function.

Table 12: Memory Card Interface Features

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.

Maximum 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.

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7. 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.

7.1. 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.
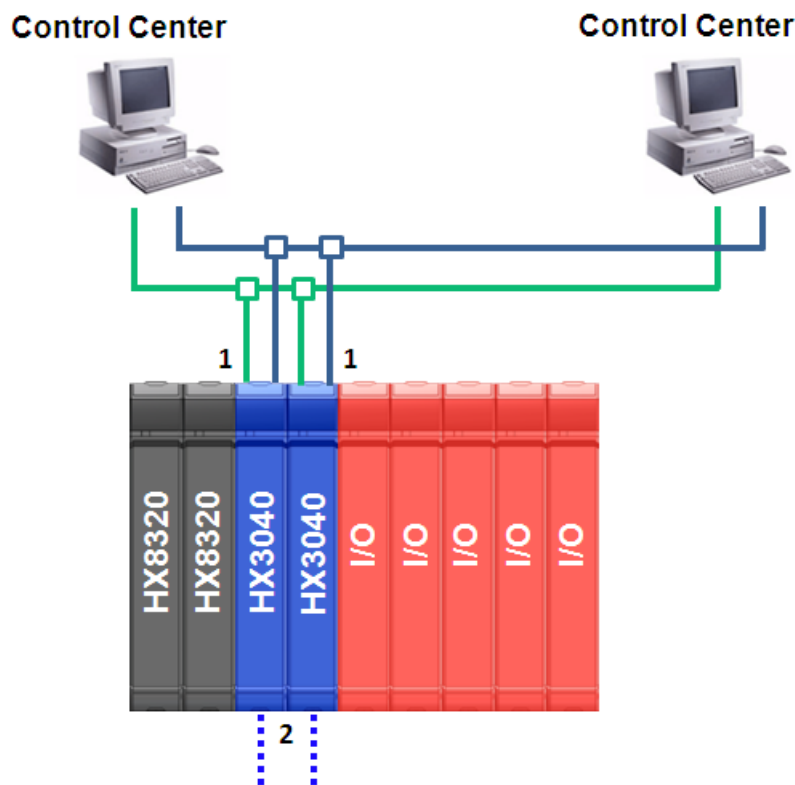

Figure 1: CPU Redundancy on the Same Rack

Notes:

1- Ethernet net topology.

2- The configuration of each CPU must be identical.

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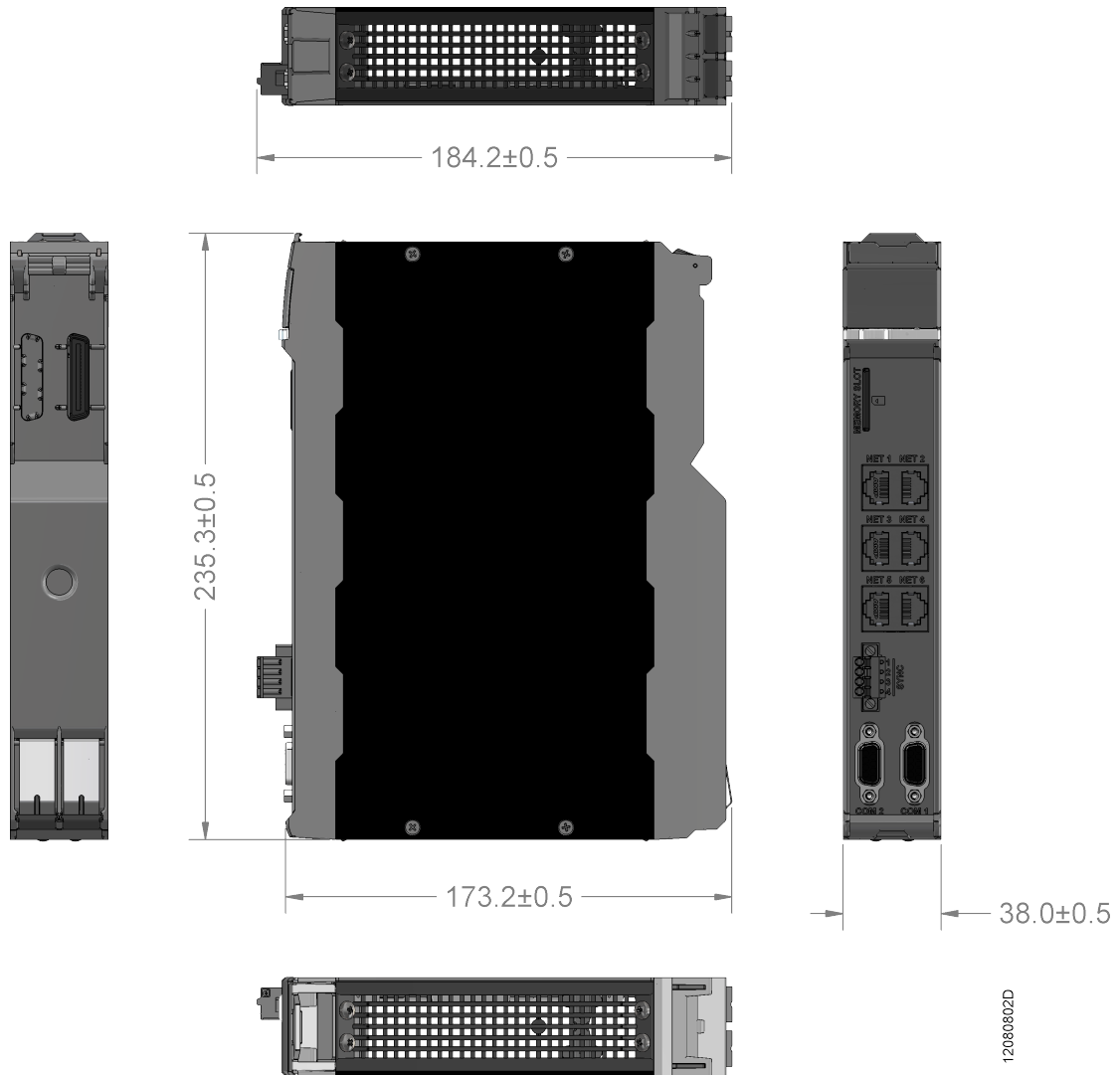
8. Physical Dimensions

Dimensions in mm.

Figure 2: Physical Dimensions

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9.   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.

9.1.   Product Identification

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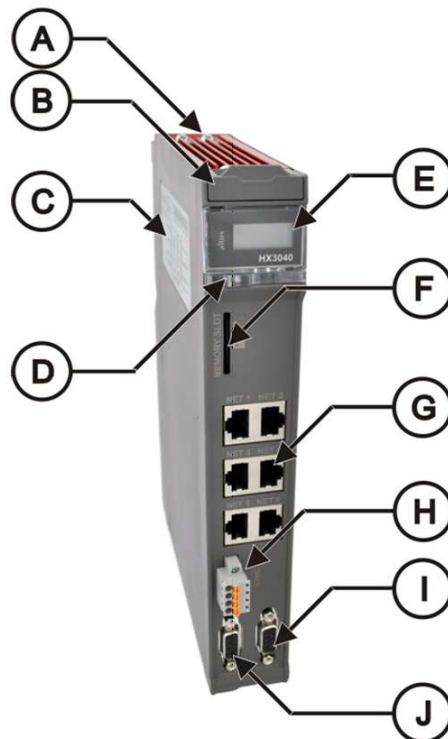
Figure 3: HX3040

Ⓐ   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.

9.2. 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.
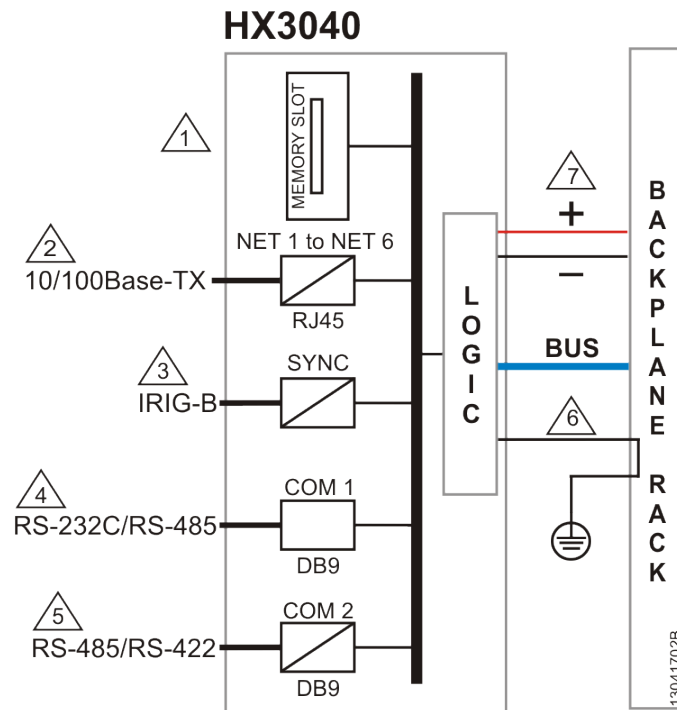

Figure 4: Electrical Diagram

Diagram Notes:

⚠1   SD card interface.

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

⚠3   Standard IRIG-B interface for connection to the time synchronization signal. It is recommended to use cables with a cross-section of 1.5 mm².

⚠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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9.3. 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.

10. 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.

11. 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.

12. 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.

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13. 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.

14. 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 13: 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.

15. 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.

16. Diagnostics Mapped through Variables

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

17. 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 14: Related Documents