Technical Specifications

multipower

120 kW MODULAR THREE PHASE IN/OUT

ON LINE Double Conversion Technology (VFI)

riello ups

CONTENTS

1. OBJECTIVE

These specifications define the technical characteristics of the **Multi Power2 – M2X** uninterruptible power supply (UPS), M2X 120 CBC 6 and M2X 120 PCS. The UPS is designed to provide a clean and stable electrical supply, irrespective of the condition of the mains or an alternative power supply.
The **Multi Power2** series of UPS is designed and manufactured by Riello UPS, a leader in this field with a range of products from 350 VA to 1600 kVA and over 30 years of experience in power protection.
For more information, please visit our website at: www.riello-ups.com

2. REFERENCE STANDARDS

Riello UPS operates a Quality Management System certified to ISO 9001/2015 (Certification No. CERT-04674-99-AQ-VEN-SINCERT) covering all company functions from design and manufacture to after sales services.

This certification is a guarantee for the customer with regard to the following aspects:

- use of quality materials;
- meticulousness in the production and testing phases;
- continued customer support.

In addition, the UPS meets the stringent standards according to IEC EN 62040-3 (VFI-SS-11) and complies with the following specific standards for UPS:

- **IEC EN 62040-1:** Static uninterruptible power supplies (UPS): general and safety provisions;
- **IEC EN 62040-2:** Electromagnetic compatibility (EMC) requirements category C3;
- **IEC EN 62040-3:** Methods of specification of performances and test provisions;

The **Multi Power2** series also satisfies the following general standards, where applicable:

- **IEC 60529:** Degree of protection provided by enclosures;
- **IEC 60664:** Insulation for low-voltage equipment;
- **IEC 60755:** General Requirements for Residual Current Operated Protective Devices;
- **IEC 62477-1:** Safety requirements for power electronic converter systems and equipment
- **IEC 61000-4-2:** Electrostatic discharge immunity test;
- **IEC 61000-4-3:** Radio frequencies, electromagnetic immunity test;
- **IEC 61000-4-4:** Transitory overvoltage immunity test;
- **IEC 61000-4-5:** Overvoltage immunity test;
- **IEC 61000-4-6** Immunity to conducted disturbances, induced by radio-frequency fields
- **IEC 61000-4-8** Power frequency magnetic field immunity test

European Directives:

LVD directive 2014/35/EU
The LVD covers all health and safety risks of electrical equipment operating with a voltage between 50 and 1000 V for alternating current and between 75 and 1500 V for direct current.

EMC directive 2014/30/EU
The EMC Directive limits electromagnetic emissions from equipment; the Directive also governs the immunity of such equipment to interferences.

3. SYSTEM MAIN FEATURES

The M2X is an online double conversion technology UPS, scalable up to 120 kW (in a single unit). According to the demands of the business, systems can be parallelized to increase the rated power up to 720 kW.
Thanks to its innovative technology, the UPS is able to reach outstanding efficiency while working in online double conversion, providing a sustainable and cost oriented solution.
The product has been designed to protect the load even during system extension or maintenance operations.

Multi Power2 key features:

- Sustainable and with brilliant performances:
  - Efficiency up to **98.1%** in ONLINE mode (BLUE module)
  - Very low operational expenses
  - Full power up to 40°C

- Safe, reliable and flexible:
  - **Modular design**, with totally independent and **hot swap** power modules
  - Quick and safe upgrade of the system
  - Adaptable to installation requirements

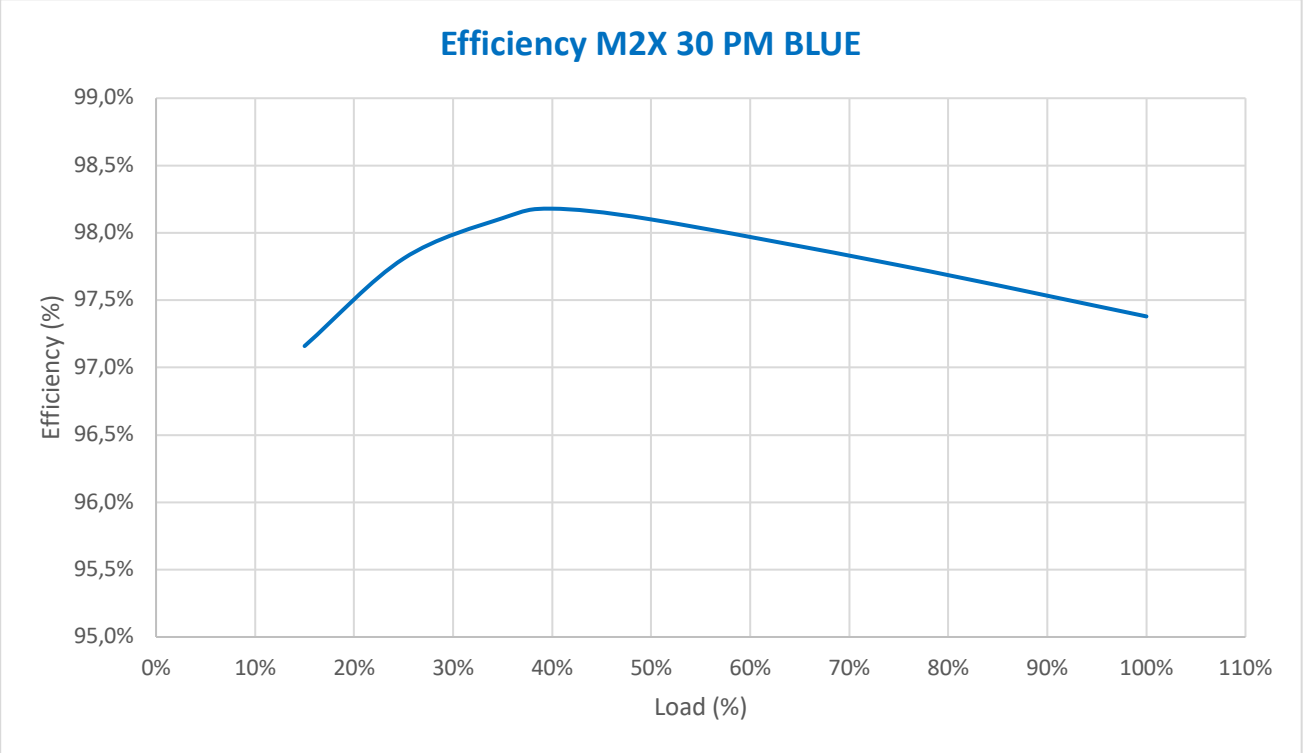
- User friendly interface:
  - 10” touchscreen colour display
  - Easy access to all system information

- Smart features
  - Constant monitoring (temperature and fans status)
  - Easy and secure remote connection
  - Riello Connect Ready

4. INNOVATIVE TECHNOLOGY

4.1 SiC – SILICON CARBIDE

M2X, with the new M2X 30 PM BLUE, increases our portfolio of products able to reach an outstanding efficiency of 98.2% in double conversion (at module level), helping to minimize the overall operational expenses and the cooling requirements of all the installations.
Lower losses mean not only higher efficiency, but also less stress for the other electronic components within the power module, providing a more compact, reliable and robust solution.



4.2 INTERLEAVING

In most electronic devices, the DC current signal applied to a circuit has an AC portion (referred as the ripple current).
The ripple current raises the internal temperature of the capacitors reducing their lifespan and increasing their failure rate, impacting the overall reliability of electronic devices.
To minimize the ripple current, M2X manages the converters by properly synchronizing the PWM signals used to drive each converter stage while the unit is working in battery mode. This behaviour enhances the lifespan of both batteries and DC capacitors.

5. SYSTEM CONFIGURATIONS

Several cabinet frames are available to provide the best solution according to the project specifications.
The UPS Power Modules are 'hot swappable', allowing non-intrusive scaling up or down, and replacement (if it is required), without the need to power down and interrupt the critical loads.
Multi Power2 M2X units are fully compatible with conventional battery block batteries housed in a free-standing framework following the 40 blocks, **3 wires architecture (with neutral point).**

5.1 POWER CABINET

The Power Cabinet is one of the main cabinets of the Multi Power2 – M2X modular solution granting continuous and high-quality power supply. All the relevant building blocks that make up the cabinet are swappable to ensure easy, safe, non-intrusive and quick maintenance operations.
M2X 120 PCS Power Cabinet can accommodate up to 4+1 M2X 30 PM BLUE (one is redundant) or 5x M2X 15 PM (either standard or BLUE version) Power Modules according to the level of efficiency needed for the specific project.
Up to six complete cabinets can be connected in parallel (please refer to your pre-sales reference for further details).
The internal communication architecture and the parallel logic are based on two high-speed fully redundant buses which ensure continuous and secure UPS operations if one communication link fails (or even if there is a short circuit in one of the two buses). If this condition does occur, a warning is immediately raised to the user, so that all corrective actions can be taken to restore the full communication link.

The available UPS power and redundancy level can expand vertically using the M2X 30 PM BLUE from:

- 30 to 120 kW (4 modules 30 kW + 1 redundant) in one single Power Cabinet and up to 720 kW with six cabinets in parallel.

The available UPS power and redundancy level can expand vertically using the M2X 15 PM BLUE or M2X 15 PM modules from:

- 15 to 75 kW (5 modules 15 kW) in one single Power Cabinet and up to 450 kW with six cabinets in parallel

The Cabinet is provided with SWIN, SWBYP, SWOUT and SWMB and frontal connection.
For further details on the cabinet configurations check the Summary Table in chapter 17 at the end of the document.

5.2 COMBO CABINET

Combo Cabinet is the combined solution to offer power quality and battery backup, two models available:

- M2X 120 CBC 6 can accommodate up to 4+1 M2X 30 PM BLUE (one redundant) or 5 M2X 15 PM and six battery shelves capable of housing up to six strings of batteries.
  M2X 120 CBC 6 is provided with SWMB and battery switch.

Power Modules are hot swappable to ensure easy, non-intrusive and quick maintenance operations.
Battery units can be replaced while the unit is working in online double conversion (ensure that the system is not in battery mode while performing the operation and make sure you only replace one battery string at a time).
As per Power cabinets, also Combo Cabinets can be connected in parallel (max 6 units), increasing the capacity including redundancy, and the parallel logic and communication architecture are based on two high-speed fully redundant buses ensuring continuous and secure UPS operations if one communication link fails.

The available UPS power and redundancy level can expand vertically using the M2X 30 PM BLUE power module from:
• 30 to 120 kW in one single Combo Cabinet (M2X 120 CBC 6) and up to 720 kW with six cabinets in parallel.

The available UPS power and redundancy level can expand vertically using the M2X 15 PM BLUE or M2X 15 PM power module from:
• 15 to 75 kW in one single Combo Cabinet (M2X 120 CBC 6) and up to 450 kW with six cabinets in parallel.

The M2X 120 CBC 6 with a full battery arrangement (24xBU) can back up a 120 kW load (4x M2X 30 PM BLUE) maximum or a 75 kW load (5x M2X 15 PM BLUE).
For further details on the cabinet configurations check the Summary Table in chapter 17 at the end of the document.

Notes:
1. It is not possible to increase back up time by combining a conventional battery cabinet with either a Multi Power modular Battery Cabinet or a M2X Combo Cabinet which is populated with BUs.

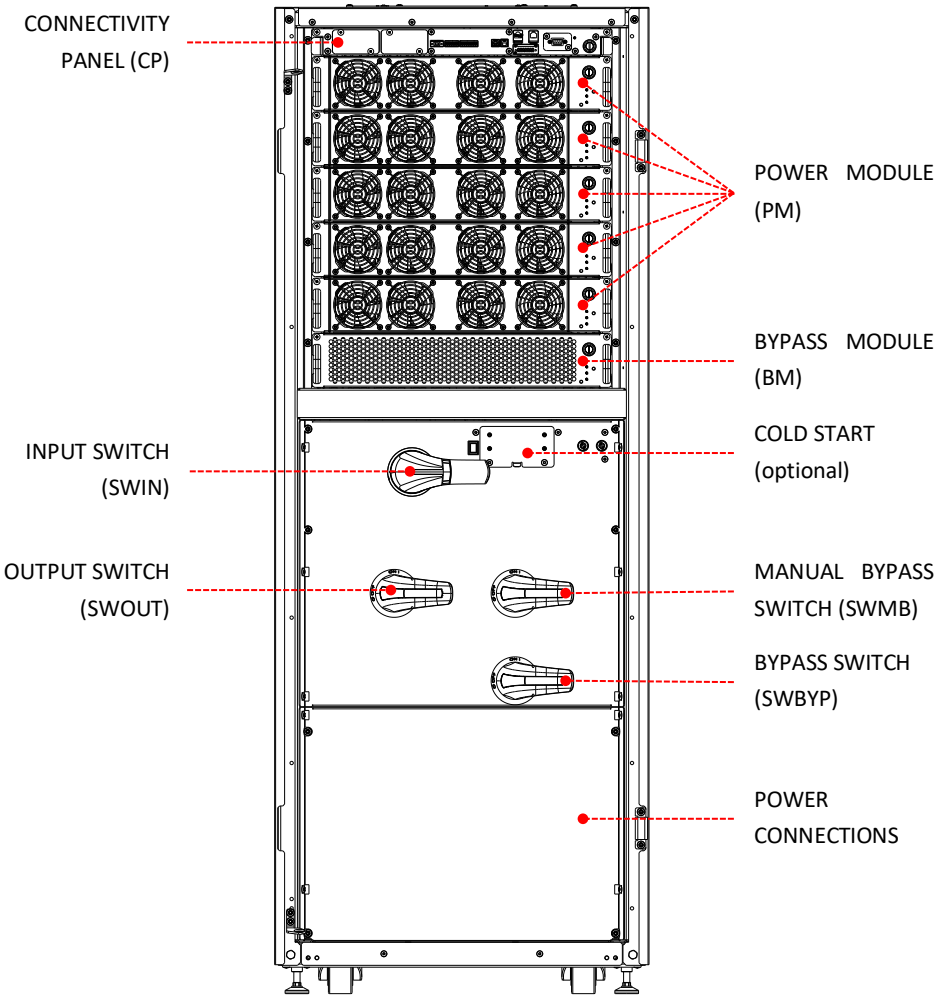
2. For the nature of this design as a modular UPS, M2X (both Power and Combo Version) should not be sized to work with the n modules at full capacity, but at design stage with at least one PM running as redundant unit within each of the cabinet.

5.3 SYSTEM DESCRIPTION

The models described above are realized using the same major building blocks in all frames.
The major parts listed below are designed to provide quick and safe operation during replacement or upgrading, therefore granting business continuity. In the exceptional event of “bypass module” replacement the opening of the bypass a manual bypass operation is mandatory to ensure a safe operation for the site engineer.

ITEM	ACRONYM	DESCRIPTION
Power Module	PM	Acronym used to indicate M2X 30 PM BLUE, M2X 15 PM BLUE or M2X 15 PM
Power Module 30 BLUE	M2X 30 PM BLUE	30 kW Power Module unit, 2U, high efficiency, full SiC technology
Power Module 15 BLUE	M2X 15 PM BLUE	15 kW Power Module unit, 2U, high efficiency, full SiC technology
Power Module 15	M2X 15 PM	15 kW Power Module unit, 2U, IGBT technology
Bypass Module	BM	Acronym used to indicate the Bypass Module
Battery Unit	BU	Battery back-up intelligent Unit
Battery Unit Array	BUA	Battery Unit Array (4x BU with batteries)
Connectivity Panel	CP	User and service system interface panel, with embedded I/O signals and network card
System Monitoring Unit	SMU	Monitoring device
Main communication Unit	MCU	Display of the unit
Parallel Interface board	PIB	Parallel interface board

5.4 M2X 120 PCS OVERVIEW



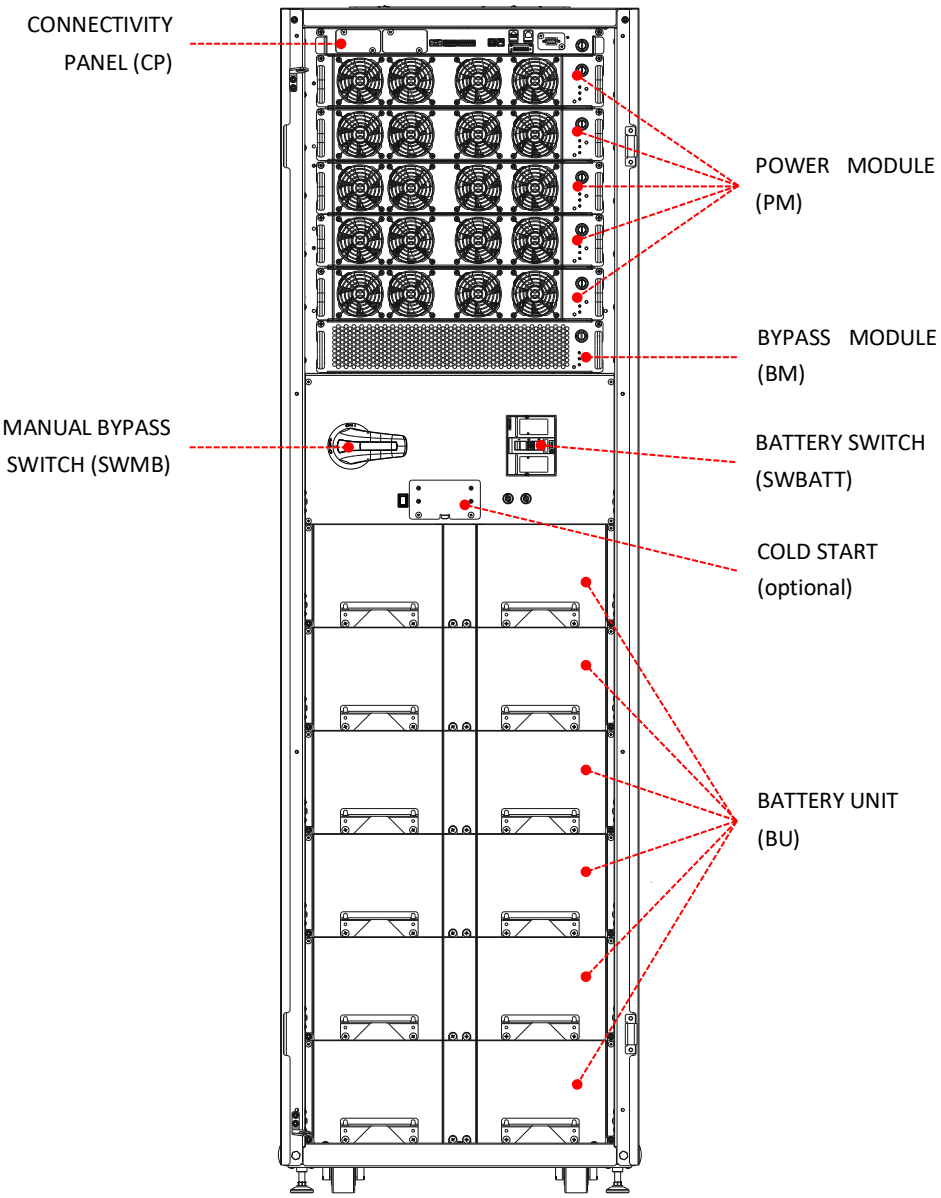
M2X 120 PCS

(120 kW frame with mains input, bypass, manual bypass and output switches)

	PMs TO REACH MAX POWER OF THE CABINET	POWER SLOTS AVAILABLE	EXTRA FREE SLOTS AVAILABLE*
M2X 120 PCS with 30 kW PM (max power 120 kW)	4	5	1
M2X 120 PCS with 15 kW PM (max power 75 kW)	5	5	0

** Only for redundancy*

5.5 M2X 120 CBC 6 OVERVIEW



M2X 120 CBC 6

(120 kW frame with battery, battery switch and manual bypass switch)

	PMs TO REACH MAX POWER OF THE CABINET	POWER SLOTS AVAILABLE	EXTRA FREE SLOTS AVAILABLE*
M2X 120 CBC 6 with 30 kW PM (max power 120 kW)	4	5	1
M2X 120 CBC 6 with 15 kW PM (max power 75 kW)	5	5	0

** Only for redundancy*

5.6 OPERATING CONFIGURATION

Multi Power2 architecture can operate in the following different main operating modes: ON LINE, FREQUENCY CONVERTER, ECO, SMART ACTIVE, STANDBY OFF and in their main variants described in the following paragraph.

In ON LINE mode Multi Power2 M2X grants an overall efficiency up to 98.1%, in case the unit is working in frequency converter the overall efficiency could decrease by 0.1 or 0.2% according to the operating conditions.

Mode: ON LINE

Normal Operation: The rectifier, drawing power from the mains power supply, supplies the Inverter and charges the batteries; the load is powered by the Inverter which provides a clean and secure supply, synchronised to the bypass supply.

Emergency Operation: if the mains power supply wanders outside the permitted input range (voltage and frequency), the rectifier shuts down and the Inverter is automatically powered by the battery for the preset backup time, without any disruption to the load. When the mains power supply returns, the rectifier gradually starts, charging the batteries and eventually powers the Inverter.

Operation from By-pass: if an Inverter overload exceeds permitted limits (or it stops due to a fault), the load automatically transfers to the emergency bypass supply via the static switch, without disruption to the load.

Mode: FREQUENCY CONVERTER

The UPS can be configured as a frequency converter (with “Service SW”), therefore when the input frequency is 50 Hz the output frequency can be 60 Hz and vice versa. During this mode of operation, the automatic bypass is disabled. The UPS can work in frequency converter mode with or without the batteries (must be set up with “Service SW”). Please contact your pre-sales reference for further details about performance, operating conditions and expected lifetime in this operating mode.

Mode: ECO

If the user determines that the load conditions are not so critical to accept lower protection (voltage fluctuations and/or harmonic distortions within certain limits), the UPS can be set in this operating mode to increase the lifespan for those components subjected to wear such as capacitors and fans that are not energized in this operating selection.
In order to optimize the overall efficiency of the UPS, in ECO mode, the load is normally powered via bypass (any disturbances that occur in the network can have effects on the load). In the event of a mains power supply failure or if the power supply is not within the pre-set tolerances, the UPS will switch to normal ON LINE operation with double conversion. Approximately five minutes after the power supply returns within tolerance, the load is switched back to bypass.
ECO activation as well as sensitivity adjustment is granted to authorized personnel only (via “Service SW”).

Mode: SMART ACTIVE

When the UPS is configured to operate in SMART ACTIVE mode, it automatically selects whether to operate in ON LINE or ECO mode.
The decision is made based on statistical calculations performed by the UPS and based on the quality of the mains and bypass supplies: if the latter remains suitable for a certain period, the unit selects ECO mode, otherwise it remains in ON LINE mode. This mode is useful when powering loads that do not require the regulated no-break supply from the Inverter and allows the system to achieve an efficiency up to 99%.

Mode: EFFICIENCY CONTROL

In very low load operation, EFFICIENCY CONTROL mode improves overall system efficiency while preserving ON LINE mode and set redundancy. PMs that are not needed to support the applied load are placed in a low-power state. In the event of a mains power failure or if the power supply is outside the specified conditions, all PMs switch to normal ON LINE operation with double conversion. In the event of a sudden and significant increase in load, the system may temporarily switch to the bypass line.

The ECM algorithm is designed to ensure that active modules operate close to their maximum efficiency point (between 30 and 50% of load rate), monitors load variation and equalizes the operating hours of each PM to ensure that all electronic components age evenly.

EFFICIENCY CONTROL mode can be activated via HMI.

The operating mode set for the UPS system, ON LINE, ECO, SMART ACTIVE, FREQUENCY CONVERTER or EFFICIENCY CONTROL, is displayed on the home page of the "System Status" LCD screen.

Note: The above listed operating modes are available whether a single unit, or parallel system configuration.

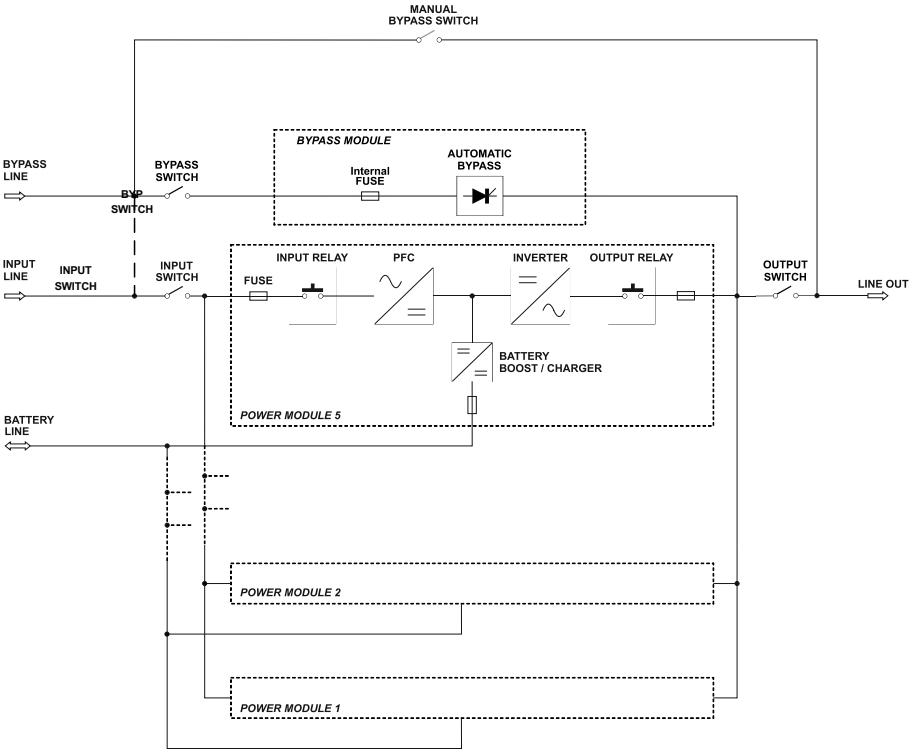
Note: ON LINE operating mode is the factory default setting. Any other operating mode selection is licensed to authorised service personnel only.

6. MULTI POWER PARTS DESCRIPTION

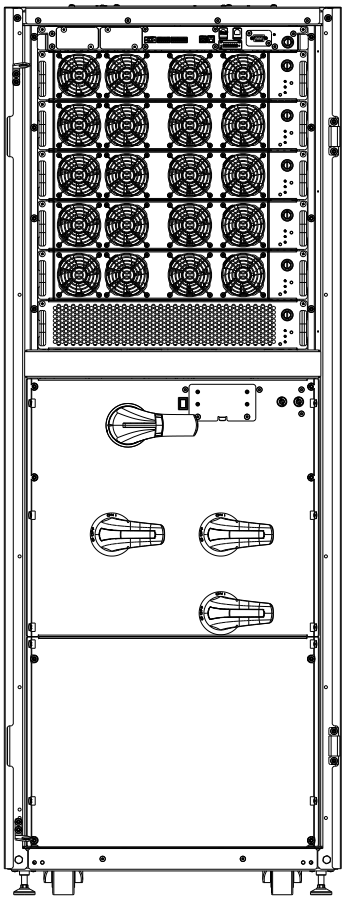
MULTI POWER2 – M2X block diagram is as follows:

M2X 120 PCS units are provided with main input, bypass, manual bypass and output switch, single input connection (dual input is available just removing the connections between the two inputs), and front-bottom cable entry.
Maximum power of the unit: 120 kW working with 30 kW power modules (4 + 1 redundant)
75 kW working with 15 kW power modules (5).

Power Cabinet layout:



M2X 120 PCS

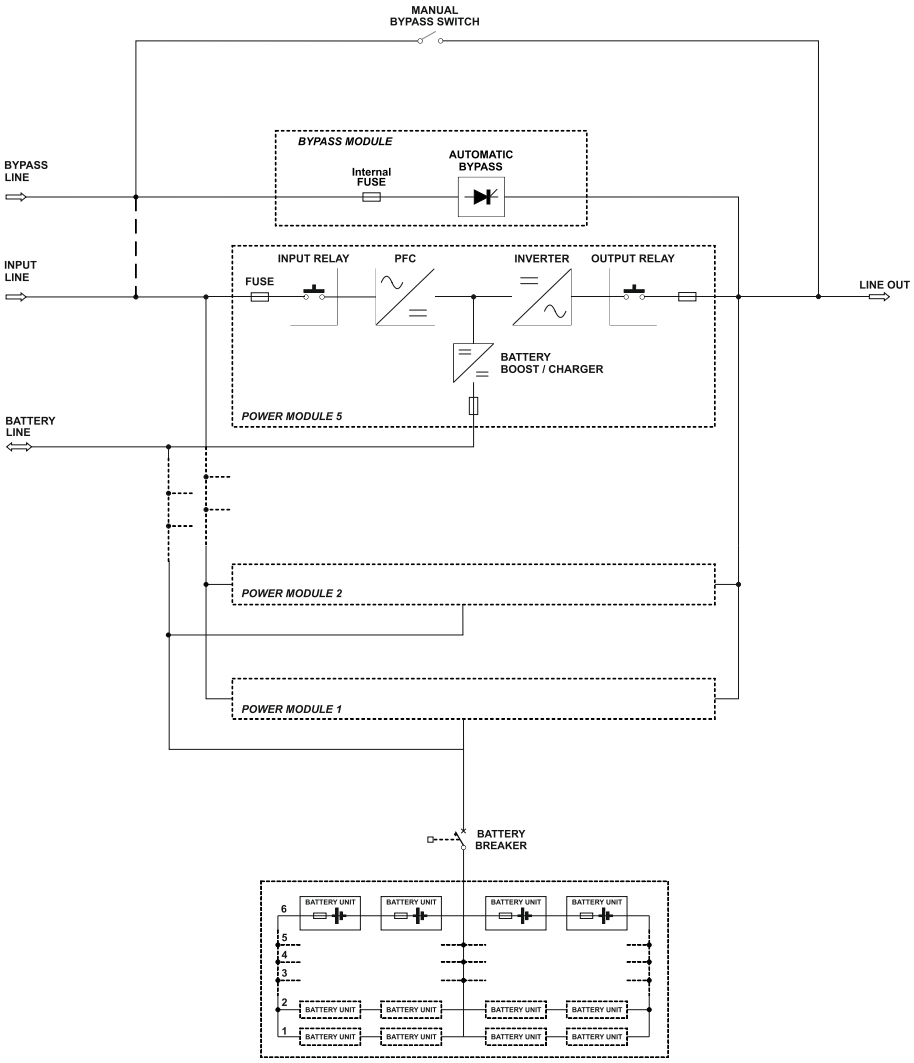


Note: the configuration shown is the maximum. The number of PM can be different according to system power and redundancy.

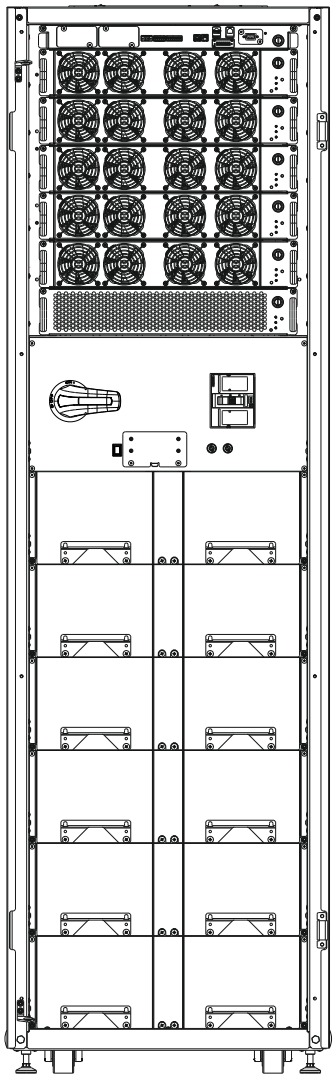
M2X 120 CBC 6 units are provided by default with manual bypass and battery switch (for internal batteries), single input connection (dual input is available just removing the connections between the two inputs) and top or bottom cable entry, on the rear.

Max power of the unit: 120 kW working with 30 kW power modules (4 + 1 redundant)
75 kW working with 15 kW power modules (5)

Combo Cabinet layout:



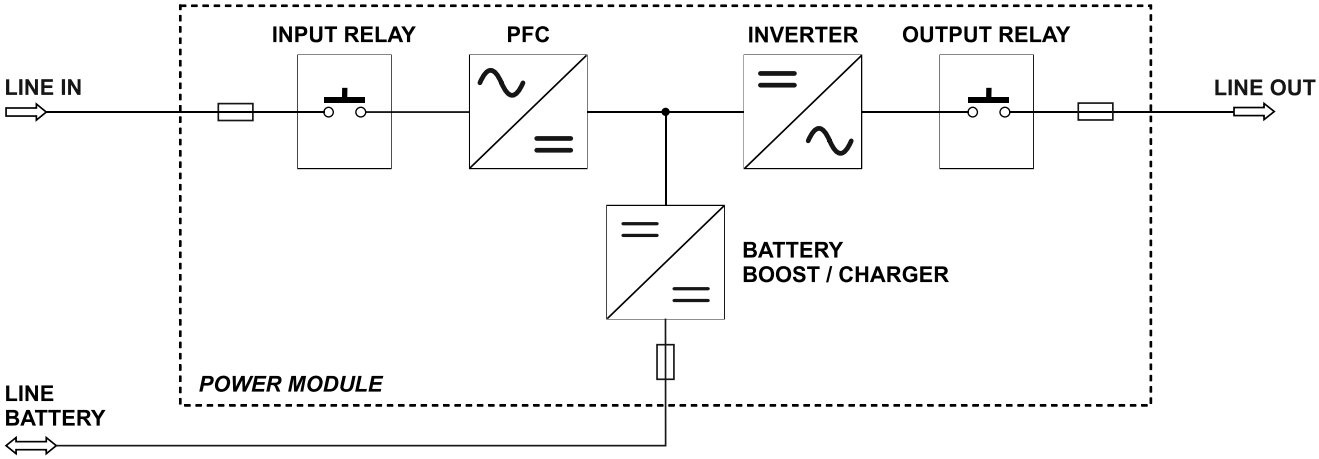
M2X 120 CBC 6



Note: the configuration shown is the maximum. The number of PM and BU can be different according to system power, redundancy and autonomy.

6.1 POWER MODULE (PM)

All the performance details as described below are referenced to M2X 30 PM BLUE, M2X 15 PM BLUE and M2X 15 PM (here in after identified as PM) unless otherwise stated.



PM 30 and PM 15 shares the same dimensions and internal architecture:

PM 30 BLUE and PM 15 BLUE: are three phase double conversion modules equipped with:

- **Full SiC technology for Rectifier and Inverter**;
- Battery charger;
- Three level Inverter topology;
- Dedicated protections to prevent major failures and isolate the faulty module in case of an internal fault.

Thanks to its full SiC architecture, the module is able to reach very high efficiency in double conversion, reducing switching and operational losses compared to state-of-the-art IGBT solutions available in the market.

PM 15: is a three phase double conversion UPS equipped with:

- IGBT technology for Rectifier and Inverter;
- Battery charger;
- Three level Inverter topology;
- Dedicated protections to prevent major failures and isolate the faulty module in case of an internal fault.

6.1.1 Overall Module Control

The PM has been developed with the most reliable and innovative technologies using power components at the cutting edge of technology and multi microprocessor architecture to ensure utmost system control, reliability and power density providing 15/30 kW at unity power factor with no de-rating up to 40°C operating temperature.
Two microprocessors oversee all the PM operations, each having different and dedicated tasks.
Furthermore, all major power components are continually temperature monitored with up to eleven temperature points.
It means that all devices are working in the most optimized conditions granting STEADY and EFFICIENT operations.
The PM is equipped with three fans which are speed controlled, therefore there is no waste of energy to supply them if the load level does not require high ventilation.
At the same time each fan is equipped with a fourth 'control' wire which immediately warns the microcontroller in case of a fault; subsequently the user is immediately informed so that necessary actions can be taken to restore the complete system to correct operations.

6.1.2 Embedded Intelligence and Firmware Alignment

Each power module has its own intelligence ensuring the optimization of the resources of each single unit, while communication between each PMs is provided by two redundant buses, providing a resilient and high-speed connection.
The integration of the state-of-the-art hardware together with last firmware releases introduces several new features especially during the insertion and start-up of the power modules.
To ensure that the introduction of a new module won't affect the power quality supplied to the critical loads or the integrity of the system, a series of automatic health-checks are performed during the plug-in of each module to verify its status and avoid defective components.
If a new module has a different firmware version, the system, after confirmation by the user, aligns it to the one of the other modules already in operation.
The operation enables the technician to increase the power or redundancy of the system while the UPS is protecting the load.

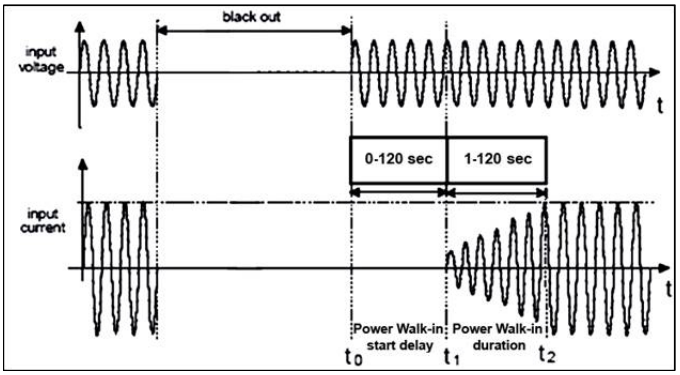
6.1.3 PFC Input Converter

The PFC Converter (AC/DC) converts the AC voltage into a DC supply to power the Inverter; if the mains or alternative power supply fails, the converter will raise the battery voltage to a value suitable to power the inverter.
The input converter is a three phase plus neutral type; if utility supply phase rotation is not correct, the converter will continue to operate but warn the user of the error via a dedicated alarm.
In addition, if one or two of the supply input phases are missing the system may continue taking power from the mains (not absorbing energy from the batteries) depending on the load level (refer to the technical table).
The rectifier is based on silicon Carbide components (PM BLUE versions) or IGBT components (standard PM).
The PFC control technology benefits from Digital Signal Processor (DSP) microprocessor, advanced Programmed Logic Device (PLD) and latest generation of power semiconductors to achieve a low impact on the power supply source, low harmonic distortion and high input power factor.
The UPS negligible input harmonic distortion of 3% and high input power factor (> 0.99) make it possible to reduce the size of a possible generator and/or a distribution transformer MT/BT placed upstream.

A very low impact on the supply source is ensured, due to the following configurable operational control parameters:

- **Power Walk in-start Delay (t1-t0):** when the mains power supply returns, this parameter delays the input stage start up for a period of time that can be set between 0 and 120 seconds. This function is particularly useful when the mains power supply returns after an interruption (or when the generator set is started) and the source is required to supply various UPS or, more typically, multiple loads.

- **Power Walk-in duration (t2-t1):** when the mains power supply returns, absorption of the mains power supply progressively reaches the nominal value within a time period that can be set from 1 to 120 seconds. This function is normally disabled but whether active or not the UPS maximum input current (Inrush) is always limited and never greater than the nominal current.



6.1.4 Inverter

The DC/AC Converter (Inverter) is a three-level type (NPC) and converts the DC voltage into a stabilized sinusoidal AC voltage to power the load. When the UPS is in ON LINE mode, the load is always powered by the Inverter.
As for the rectifier, also the inverter is based on SiC components (PM BLUE versions) or on IGBT components (standard PM).
Like IGBT devices, Silicon Carbide devices work at a switching frequency of 18 kHz but granting less operational and switching losses compared to IGBT solution, bringing a sensitive increase of the overall efficiency of the system.
Whatever module is used (30 or 15 kW), DSP microprocessor controls guarantee static and dynamic excellent performances under any operating condition:

Voltage adjustment
The output voltage can be adjusted using the independent phase control and DSP microprocessor; this enables a better static and dynamic response. In detail:

a) **static condition:** the Inverter output voltage remains within ±1% for all variations of the input voltage within the accepted limits;
b) **dynamic condition:** for load variations from 0 to 100%, the output voltage remains within the most stringent limits defined by class 1 of the EN 62040-3 standard.

Frequency adjustment

The Inverter output frequency is generated autonomously by an internal oscillator, in synchronisation with the bypass supply. Frequency stability is operating condition dependent:

c) **Frequency stability**
With mains power present: the internal oscillator follows any frequency variations in the bypass supply and in relation to the preset value - normally ±5% (configurable from ±0.25% to ±10%).
With no supply present: the Inverter autonomously generates the frequency of the output voltage with a stability of ± 0.01%.

d) **Frequency variation speed**
The maximum Inverter output frequency variation (to lock to that of the bypass supply) is 1 Hz/s (adjustable from 0.5 to 2 Hz/s).

Distortion of the output voltage

Inverter output waveform distortion with a linear load is maintained ≤ 1%. Within a non-linear load, as defined by the EN 62040-3 standard, output voltage distortion does not exceed ±3%.

Overload and Short circuit current

If an overcurrent occurs whilst the UPS is operating, the Inverter will carefully analyse the output voltage and current to distinguish if the short circuit is genuine or an overload.
As for the overload limits refer to the technical data table. If the UPS detects a short circuit (VOUT <100 Volt and overload status):

- During battery operation (bypass power supply failure), the Inverter can supply a fault current (current limited) up to 250% for 100 ms and after that, (if the short circuit has not been cleared) an additional 150% for 400 ms.
- When the mains power supply is present, the Inverter will switch to bypass; the UPS will continue to feed the fault according to a specific current-related function (see technical data for further details).

The table below recommends the sizing of the various protection devices located downstream of the UPS to guarantee their selectivity even in the event of a power failure:

Output protections (values recommended for selectivity)	
Rapid fuses (GI / gG)	In (Nominal current)/4
Magneto thermal switches (Curve C)	In (Nominal current)/4

Output voltage symmetry

Under all conditions, output voltage symmetry is maintained within ±1% for balanced loads and ±2% for unbalanced loads of 100% (e.g. one phase with nominal load and the other two with no load).

Phase shift angle

The three-phase Inverter output voltages have a guaranteed phase shift angle of 120° ± 1° for balanced loads and for 100% unbalanced loads.

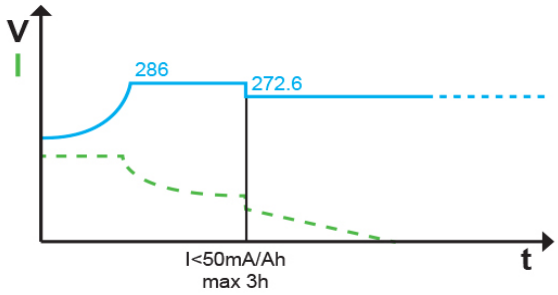
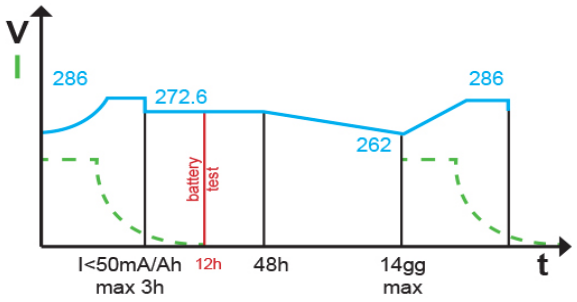
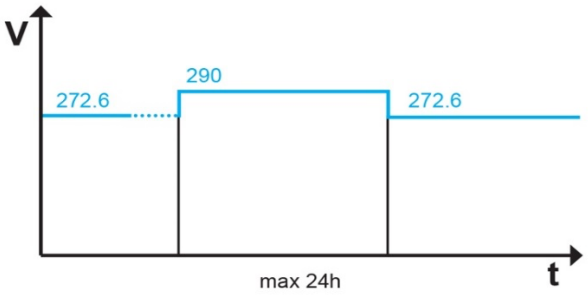
Output power

The Inverter is sized to supply 100% of active power with a nominal load PF of 1 within the operational temperature range without any downgrading. Multi Power2 can supply capacitive (or inductive) loads with a PF from 1 to 0.7 without any power derating.

6.1.5 Battery Charger (Battery Care System)

The "Battery Care System" is a set of functions arranged to help extend the working life of the battery set and optimize its performance. Each Power Module is equipped with a battery charger able to provide up to 20 A (PM 30 BLUE; 12 A for the PM 15 and PM 15 BLUE). All chargers combine to recharge the UPS batteries.

Battery recharging: the UPS can be used with sealed lead batteries (VRLA), AGM and open vented batteries. In case of a request for Li-Ion batteries, please contact your pre-sales contact.
According to the type of battery used several recharge methods are available (the below data are referred to a semi-string with 20 batteries):

Recharging modes (selectable by "Service SW")	M2X configurations
	Floating: the charge state of the battery is continuously monitored; when the mains power supply is present, the batteries are charged at a pre-set voltage level and limited current relative to the recharge time required and the capacity of the connected battery.
	Two-level recharge (standard): this recharge is at limited current with two levels of voltage. In the first instance, the process uses a quick charge voltage, whilst in the second stage a float charge. This type of charging is mainly used with open-vented batteries or other types when an accelerated recharge time is required.
	Cyclical recharge: this recharge is sometimes recommended by battery manufacturers to prolong the battery life. It consists of battery charge and discharge cycles as indicated in the diagram.
	"Commissioning Charge": this charge method is useful every time new batteries are installed in the UPS. By increasing the voltage to 290 (adjustable value) Volts for a maximum of 24 hours, perfect equalization of the battery charge is assured, thus guaranteeing a uniform discharge and wear of the individual battery blocks.

The various recharge methods and the preset voltage values are defined using the service software ("Service SW").
The presence of the external temperature sensor option will activate compensation of the voltage depending on the temperature (the sensor shall be enabled through UPS System configuration).

a) **Battery test:** during normal operation the battery is automatically tested at regular intervals. The battery test can also be manually activated. The test is performed to ensure a limited battery discharge and impact on overall life expectancy. If the test returns a negative result a warning is displayed on the UPS panel (or remote panel, if installed).

b) **Protection against slow discharges:** for long runtimes and low load discharges, the end of discharge voltage is raised to approximately 1.8 V/el as recommended by the battery manufacturers to avoid a deep discharge state.

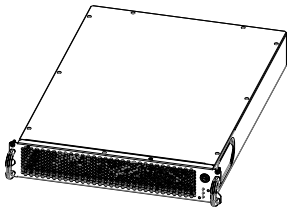
c) **Ripple current:** recharge ripple current (residual AC component) is one of the most important causes of poor battery reliability and reduced operating life. The UPS battery charger is a high-frequency design with a negligible level of ripple current.

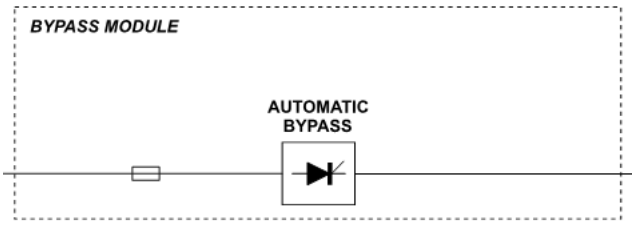
d) **Battery recharge limit current:** The battery recharge current is configurable and prefixed at a value of Cnom/8 (i.e. 12.5% Cnom).

e) **Cold-Start:** This feature allows the UPS to be switched on and the load to be powered by the battery when the mains power supply is not present.

f) **UPS without batteries:** the UPS must always operate with the batteries connected; if they are not connected alarms will be generated and the UPS will not be able to perform to specification ensuring business continuity. However, if the system operates as a frequency converter or voltage stabilizer a battery is not mandatory, the system must be properly set.

6.2 BYPASS MODULE (BM)





The bypass static switch is a high-speed, solid-state transfer device rated for continuous duty operation. Transfer operations will be provided by the electronic static switch which takes place automatically in the event of:

- Output voltage outside the limits
- PMs overload limits exceeded
- DC voltage goes outside the permitted range

As soon as the mains supplies the load (via bypass) all the disturbances such as voltage and frequency variations affect the load (VFD).

The uninterrupted automatic transfer may be inhibited in the following situations:

- If at the time of switchover, the Inverter voltage is not synchronized with that of the bypass line power supply. The transfer will take place with a delay of around 20 ms; in consideration of the various types of loads, this delay can be set with “Service SW” (10-100 ms) or the switchover can be inhibited if there is no synchronization.
- Manual switching to bypass supply via the maintenance bypass switch.
- If the system operates as a frequency converter.

Each Multi Power2 – M2X comes with its own replaceable Bypass Modules sized for 200A, unlike PM, BM is always included as part of the UPS system.
(Refer to the technical table for details).

Fuse protection
Each bypass module has embedded input fast fuses to meet the following Icc values:

M2X 120 PCS and M2X 120 CBC 6:
- *65 kA in case the manual bypass is excluded*
- *65 kA with the use of manual bypass (SWMB) and external protection fuses (200 A gG)*
- *10 kA with the use of manual bypass*

Backfeed protection

The UPS has internal protection against backfeed. This protection acts by means of a sensing circuit which turns the inverter off if a fault within the static switch is detected. During this condition, to avoid interrupting the supply to the connected load, the UPS switches to the bypass line.

If this fault occurs during battery operation, the inverter is stopped.

A volt-free contact is available to drive a disconnecting device to be installed upstream of the bypass input to the UPS, in this case when a backfeed fault occurs, the system commands the opening of the external disconnecting device, hence avoiding the requirement to stop the inverter (refer to the advanced configuration manual to configure this option).

Bypass power supply limits

Transfer to the bypass line takes place if the voltage and/or the frequency are considered 'suitable' for the load and the limits for transfer can be set on-site by the UPS user.

Voltage range: configurable from -22% to +15 %;
Frequency range: configurable from ±0.25% to ±10%

Overload

The UPS static switch is sized to support the following overload periods; above these limits the UPS is automatically turned Off:

- > 101% ÷ ≤110% for 60 minutes
- > 111% ÷ ≤125% for 10 minutes
- > 125% ÷ ≤150% for 1 minute

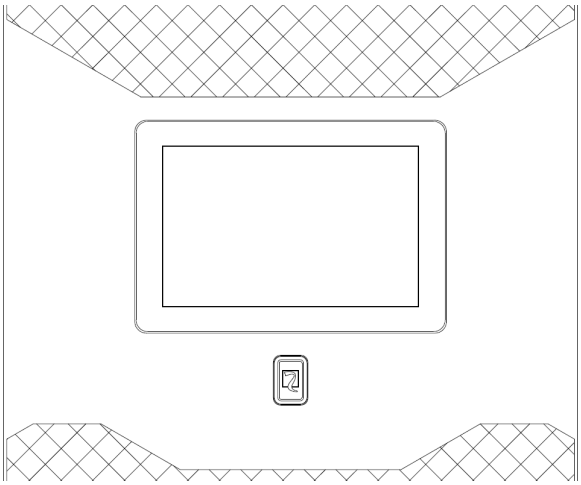
Note: for further overload limit details, clearing I^2t energy and rated conditional short circuit current (Icc), refer to the technical data table.

Dedicated Power Supply for the BM

BM unit is equipped with a dedicated power supply to allow the automatic bypass to operate independently from other system power supplies, granting a higher bypass system reliability and system operation.

7. DISPLAY AND STATUS LED

The control panel consists of a 10" touchscreen graphic display and a multicolour status LED placed below the display which delivers immediate and clear information regarding the overall status of the UPS by changing the color (light blue, dark blue, orange and red) according to the operating mode and condition.

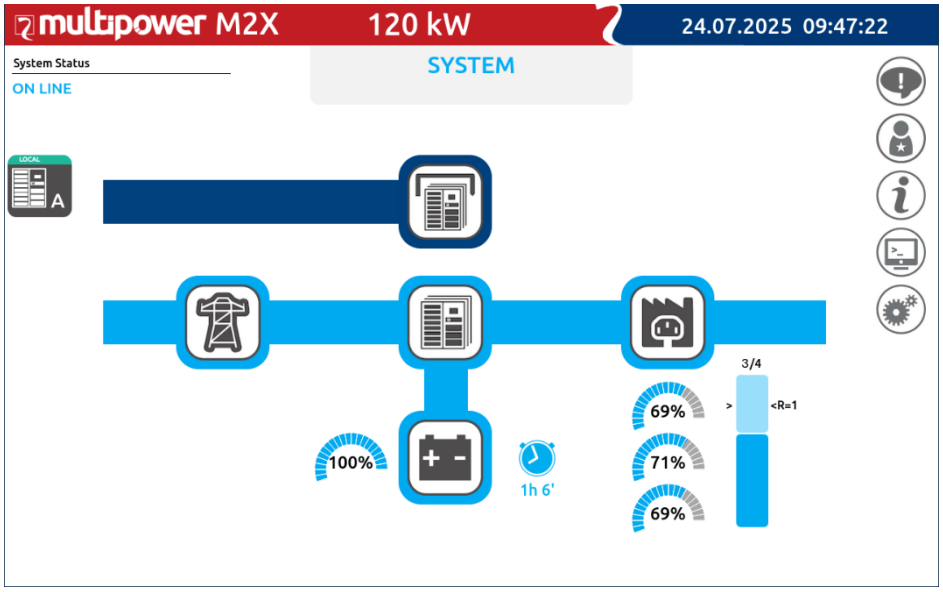


The 10” touchscreen display is installed in the front door of the UPS and it’s replaceable in case of need, while the unit is working in ON LINE mode.
It allows the user (according to access profile) to easily:

- Identify the energy path through the UPS;
- Monitor the overall system status and single module status (PM, BU, BM);
- Send start /stop, battery test, bypass commands;
- Set up the system: parameter configuration, operating functions, web and mail services, access levels.

Graphic display provides UPS information, measurements, operating states, alarms and configuration in different languages.
Multilevel access menu grants easy, intuitive and secure access to information, measurements, and configurations, for both service personnel and users according to the profile.

7.1 DISPLAY



As M2X is a modular UPS, the information is structured in such a way that the user can see both the detailed data and parameters of each module and, also, a more general view of the entire system, to see, at a glance, the operating mode and the status of the unit.

The home page provides a graphic bar showing the load level and the system redundancy:

Load level: The bar is a comprehensive representation of the number of PM set including their status in terms of load level and operational conditions.

Redundancy: To increase the system reliability the customer can add a number of additional PM (redundant PM) rather than just fit those strictly necessary to supply the load.
All PM, including the redundant units operate together sharing the load.
It is highly recommended to set one or more redundant PM according to the power needed and the installation type; hence with any Cabinet fully equipped at least one unit should be set as a redundant unit.

The load percentage is referred to the power of the unit configured during the start-up.

7.1.1 Display Icons, Symbols and Texts

The main active icons present in the diagram are:

				
Mains input	Output	Battery	Automatic static bypass	System status

Tapping each icon, it is possible to collect the UPS measurements and particularly:
System input/mains icon: Input voltage plus input current and frequency;
System output icon: Output voltage, rms and peak current, power (kW/kVA/pf);
Bypass icon: Input voltage phase to phase and phase to neutral plus frequency;
Battery icon: Battery voltage and current, charging level and autonomy time.

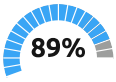
The icons can be highlighted by several colours, according to the status of the UPS:

				
Grey: communication lost (Com-Lost)	Light blue: on line mode	Blue: load on bypass	Orange: anomaly	Red: alarm

Coloured bars indicate the route that power is following in the system:

	Normal mode. The power goes from input to load through UPS that loads battery if they are connected.
	Working on Bypass. Power flows through static bypass or manual bypass.
	Battery working. Power flows from battery to load through UPS. Pay attention to back-up time and charge percentage of the battery.
	Manual bypass.

In addition to the main diagram, there are additional information icons:

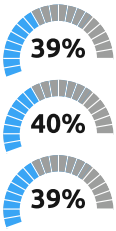


% Battery charge gauge

it represents charge percentage of the battery

Back-up time estimate

The calculus of back-up time is function of applied load and the battery charge status



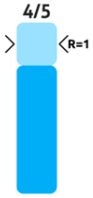
L1

L2

L3

% Load gauge phase 1, 2, 3

referred to the system power



Redundancy bar

see user manual for more info

7.1.2 Active Text Areas

At the top left of the display, active area which reports the current state of the SYSTEM.

At the top centre of the display, active area showing the name and possibly the address (A, B, C, D) of the SYSTEM, UPS or Module being viewed.

At the top right of the display, active area which reports the current status of the selected UPS or Module (present only when the UPS or Module tabs are displayed.

7.1.3 UPSs List

Address list of all UPSs of the SYSTEM. Every UPS that composes the system has a unique address (identified to a letter from A to D). The written LOCAL informs that this display belongs to this specific SYSTEM.

These symbols may appear inside the icon, which identify a particular state of the related UPS:

▲	Anomaly present	■	Alarm present

7.1.4 Menu:

On the right side of the Home page there are a series of icons that allow you to set commands, configurations or view various information relating to the SYSTEM.

NOTE: the menu may change depending on the pre-set access level.

Notifications/alarm

Access level selection

NOTE: the icon changes depending on the preset access level (see *"Access level selection"* paragraph in the user manual)

Global System information

Command panel

NOTE: available only with "Power User" or "Expert" access level

Settings menu

NOTE: available only with "Power User" or "Expert" access level

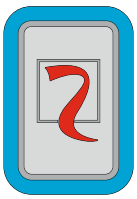
in the various pop-up screens, on the right side at least one of these icons will always be present:

⊗	button to exit the active pop-up screen (any changes will not be saved)
✓	button to confirm any insertion and/or modification operations

Note: For more information about the display menu and operations refer to the UPS user manual.

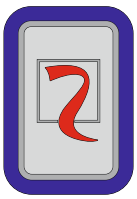
7.2 .STATUS LED

Below the touchscreen display, an illuminated Riello UPS logo will inform the user at a glance, about the status of the UPS. The operational conditions are indicated via the various colors as follows. For further details refer to UPS user manual.



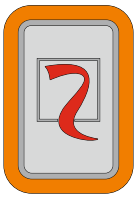
Light blue (pulsing): Normal operation

No anomalies are present, and the system is working in the selected mode.



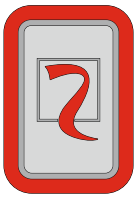
Dark blue: Bypass operation

The system is working from a temporary bypass.



Orange: Anomaly

The system is working from battery, forced to bypass or an anomaly or warning has occurred.



Blinking red: Fault condition

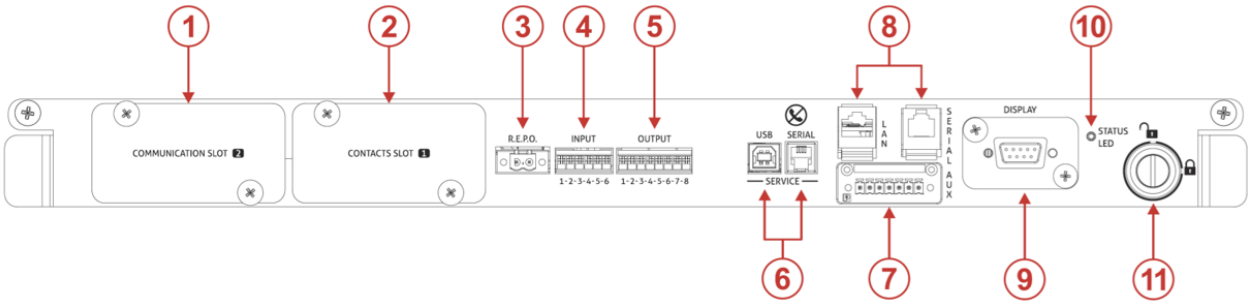
A fault or lock occurred, or the load is not powered due to an unexpected condition (e.g. Emergency Power Off).

8. CONNECTIVITY PANEL

The Connectivity Panel encompasses all the communication interfaces. Thanks to this component M2X is aware of the information coming from the installation and is able to provide data and other operational information to the Customer.
The Connectivity Panel includes the system monitoring unit (SMU), a microprocessor-controlled board dedicated to the management of input and output signals, such as temperature sensors, status of external switches (if any), communication boards and it is also responsible of the operation of the display.
Even for this item, in case of a fault,-the replacement procedure can be performed easily while the UPS is running in online double conversion.

It is provided with:

- 1 NETWORK communication port (a Netman 208 card is installed inside the CP).
- 1 slot for communication boards (refer to paragraph 8.4).
- 1 slot suitable to host relay card (refer to paragraph 8.4).
- 5 input and 4 output signals, configurable.
- Auxiliary output terminals to manage backfeed and battery disconnection commands and an input signal for the temperature sensor (“AUX” section)



1 Communication Slot (SLOT 2)

2 Contact Slot (SLOT 1)

3 R.E.P.O.

4 Signal input

5 Signal output

6 Service ports

7 Signal AUX

8 NETMAN port

9 Display port

10 SMU status LEDs

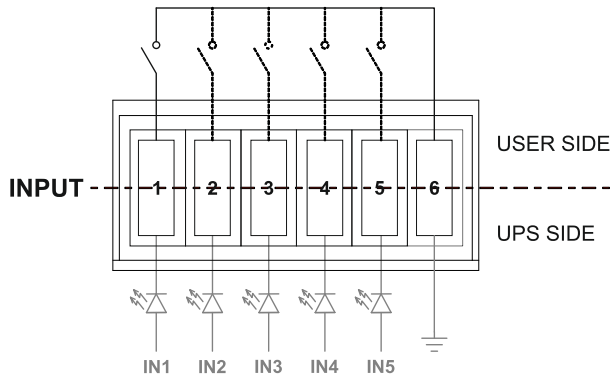
11 Switch Lock

8.1 R.E.P.O

This insulated input is used to switch off the UPS in an emergency. The UPS is supplied from the factory with a “remote Emergency Power Off” (R.E.P.O.) terminals short-circuited.
When activated from a remote push-button or other device in an emergency, the R.E.P.O connection will open and the UPS will shutdown. The UPS no longer powers the load.
The R.E.P.O circuit is supplied with SELV type circuits. No external supply voltage is required. When it is closed (normal condition), a maximum current of 10 mA flows.
After an emergency shutdown, the UPS will only return to ON LINE operating mode once it receives a start-up command from the mimic panel (provided that the Remote Emergency Power Off device is not still active).

8.2 PROGRAMMABLE IN–OUT SIGNALS

All input signals can be programmed using the service configuration software (reserved to service personnel only);



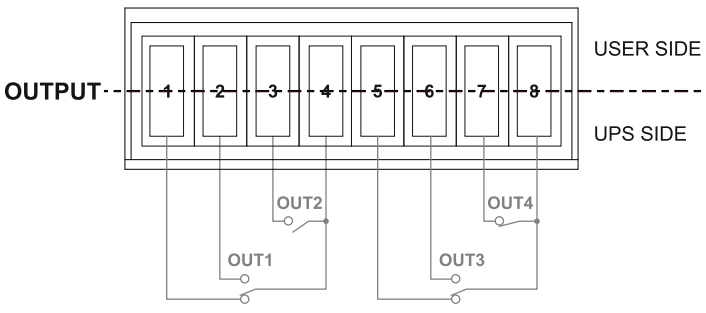
FACTORY DEFAULT SETTING

INPUT	FUNCTION
IN 1 #	-
IN 2 #	CB OFF
IN 3 #	Battery test
IN 4 #	Position of the External SWBAT
IN 5	Position of the External SWMB

These inputs must be enabled from the display panel

Although all the output signals can be programmed using the service configuration software (reserved to service personnel only), they have a standard factory configuration:

DRY CONTACTS OUTPUT

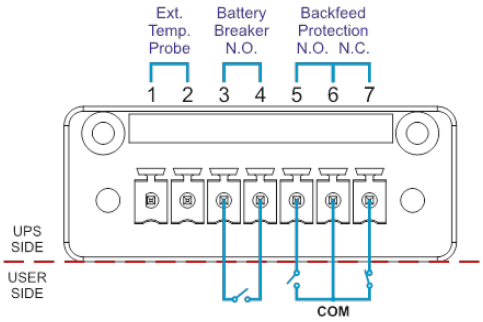


FACTORY DEFAULT SETTING

OUTPUT	FUNCTION
OUT 1	Load on Bypass
OUT 2	Battery Working
OUT 3	Battery Low
OUT 4	Fault or Lock (F+L)

The output dry contacts are rated to:
1A @ 24Vdc or 1A @ 30Vac

8.3 AUXILIARY SIGNALS



EXTERNAL TEMPERATURE PROBE

Input to connect the external probe to measure the battery temperature. Please refer to the optional kit.

EXTERNAL BATTERY BREAKER OPENING COMMAND

Output (default N.O.) to manage the opening of the external battery disconnector switch. The contact closes if EPO is activated. This dry contact is rated to: 1A @ 24Vdc or 1A @ 30Vac.

EXTERNAL BACKFEED PROTECTION OPENING COMMAND

Output (N.O. or N.C.) to manage the opening of an external disconnector switch in case of a backfeed fault occurs. This dry contact is rated to: 1A @ 24Vdc or 1A @ 30Vac.

For further information please refer to the installation manual.

8.4 COMMUNICATION SLOTS

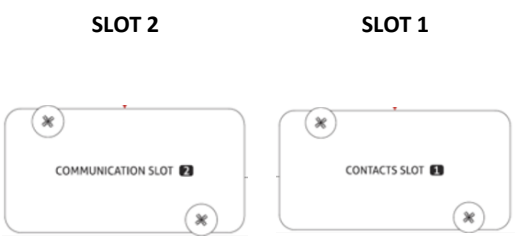
The UPS is provided with two communication slots which can be used to host optional communications cards. The slots are not interchangeable.

SLOT 1 – Contacts Slot

Slot to accommodate the relay cards (no communication cards).

SLOT 2 - Communication Slot

Slot to host communication cards (no relay cards).



Please refer to the related manual for further information.

8.4.1 Communication and Relay Cards

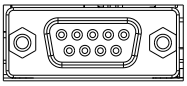
The communication slot (slot 2) is compatible with a variety of communications options, including:

- Additional RS232 port
- Ethernet network agent with TCP/IP protocol, HTTP and SNMP
- RS232 + RS485 port with MODBUS protocol
- EnergyManager 2 card to be used for Li-Ion batteries

The contacts slot (slot 1) is suitable to host the relay cards MULTICOM 392 (**three** opto-insulated inputs and **eight** programmable volt free output contacts 25 Vac / 30 Vdc, 1 Amp)
In order to carry out card installation and configuration refer to the specific cards dedicated user manual.
For further accessory information and compatibility with the product please visit our website.

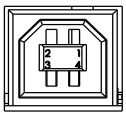
8.5 DISPLAY PORT

Port providing data and power supply to display.

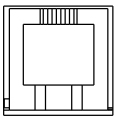


DISPLAY

8.6 SERVICE PORT USB AND SERIAL



USB



SERIAL RS 232

This port is dedicated to service personnel to connect the UPS to PC for service configuration or firmware update.

9. STANDARD FEATURES

9.1 REDUNDANT COMMUNICATION BUSES

The internal communication is done by two separate, fully redundant and high-speed buses. In case one of the branches stops working, the other will provide all the information to the system without any delay. Through this new architecture, all data is shared between the modules at faster speed and ensuring the highest availability and the best operational continuity.

9.2 SINGLE INPUT

The unit is provided with single input as standard configuration; it can be adapted to dual input directly on site, just removing the jumpers between the rectifier and static bypass power supplies.
If the UPS is changed from single Input to “Dual Input” version, UPS protections should be sized accordingly (refer to UPS installation manual).

9.3 EXTERNAL SYNCHRONISATION

This insulated input can be used to synchronise the Inverter output to a suitable signal from an external source. It is essential when the Multi Power2 M2X is used in combination with Static Switch Transfer Systems.
During installation, it is important to:

- provide in input 230 Vac signal (no need for external insulation transformer)
- use double-insulation cable with a cross-sectional area of 1.5 mm^2.

The external synchronisation must be configured via the Configuration Software assigned to authorised personnel.
External synchronisation terminals (identified as “EXT SYNC”) are close to power terminal connections to facilitate the installation phase (refer to Installation manual).

9.4 FIRE DETECTION CABLE

The units have a certified fire detection cable going through all the rear parts of the cabinet. This cable monitors the DC connections of the unit in order to detect the presence of abnormal temperatures, caused for example by an electrical arc, and promptly provides a contact to trigger the battery protections and minimizing the consequences if such a condition persists.

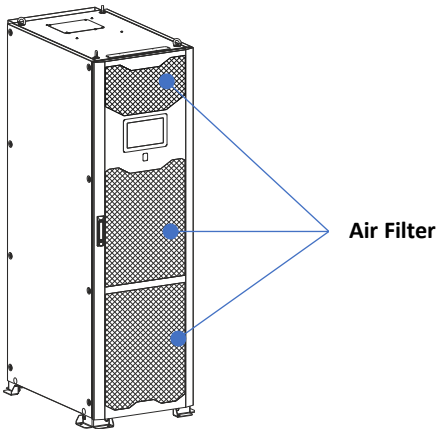
9.5 MONITORING AND CONTROL SOFTWARE

The PowerShield^3 software guarantees effective, intuitive UPS management, displaying all the most important information such as input voltage, applied load and battery capacity.
It is also able to perform shutdown operations, send e-mails and network messages automatically when certain events (selected by the user) occur.

10. OPTIONS AND ACCESSORIES

10.1 FRONT DOOR AIR FILTER

A dedicated air filter can be installed in the front door in correspondence of power modules and bypass modules.



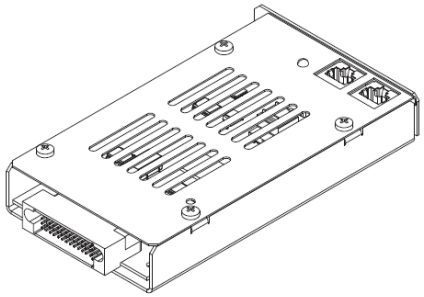
M2X 120 CBC 6 + air filter

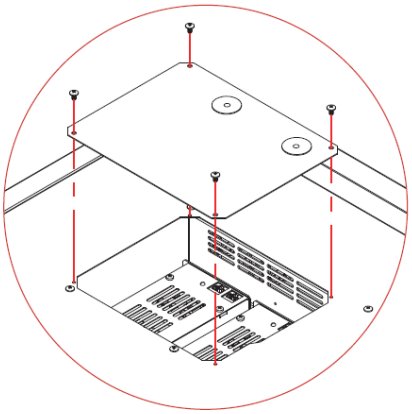
10.2 PARALLEL

All M2X units can be paralleled with other units of the same kind through optional parallel boards, inserted in a dedicated compartment accessible via the roof of the unit.
In order to parallel two or more Power cabinets (cabinet types cannot be mixed), a parallel kit must be ordered per each unit, and each one consists of 2 parallel boards and also n.2 ethernet cables for the connections between the units (10 meters).

This kit is not compatible with Optical Fiber Bus Kit.

For further information about the parallel feature, please refer to the “Parallel kit” manual.

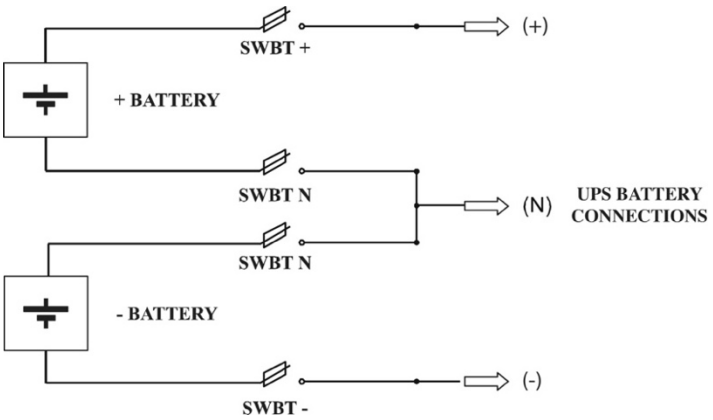




10.3 CONVENTIONAL BATTERY CABINET

The battery cabinet should be used to provide suitable power backup time during the failure of the incoming mains power supply.
The UPS can monitor the status of the battery switch located within the cabinet via an auxiliary switch contact (if available) connected to programmable input terminal strip.
If one or more Battery Cabinets are installed, the UPS must be configured to update the rated capacity value (Ah of all external battery cabinets). This operation can only be performed via the Configuration Software.

The Riello UPS Battery Cabinet configuration is shown below.

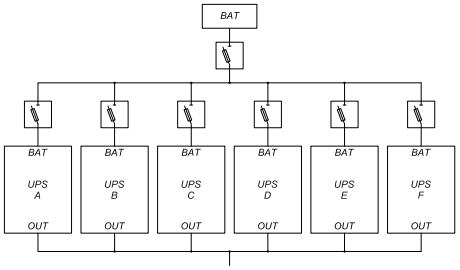


Other solutions may be developed on site, bearing in mind that:
- The structure of the battery enclosure must respect that described above.
- The standard number of batteries is: 20+20 12 Volt blocks and multiple strings in parallel if required.
- The battery capacity (expressed in Ah) must fall within the range of 4 and 20 times the available recharging current (see the “Technical Specifications Table”).

The battery cabinets can be connected in parallel to achieve the required autonomy; in case of 2 or more cabinets in parallel, it is advisable to add a single battery switch cabinet where the paralleling of the cables can be connected.

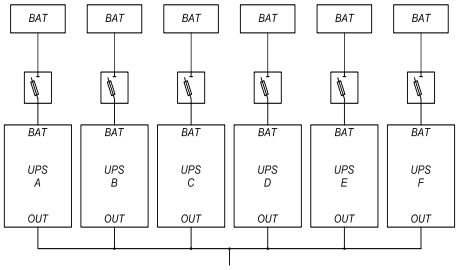
If more UPS are connected in parallel (from two to six) the user may decide to have a common battery bank for the parallel system (if all the units are working only with external battery cabinets) or a dedicated battery bank assigned to each of the units.
During the installation and commissioning the authorized engineer can select and configure the system to operate with a Common or Separated battery in addition to any related settings (refer to the advanced configuration manual).

Common Battery Configuration



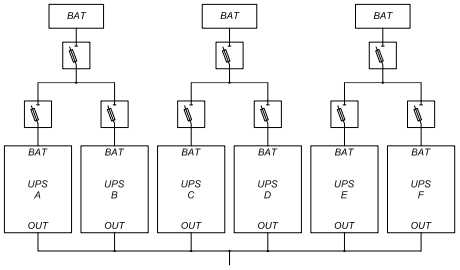
- Default configuration
- Compatible with Conventional Battery cabinets
- Applicable from 1 to 6 Cabinets

Separated Battery Configuration



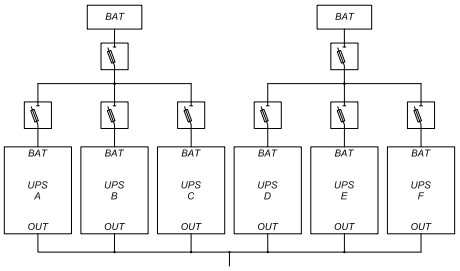
- Service configuration
- Compatible with Conventional Battery cabinets
- Applicable from 2 to 6 Cabinets

Paired Battery Configuration



- Service configuration
- Compatible with Conventional Battery cabinets
- Applicable with 4 and 6 Cabinets

Three by Three Battery configuration



- Service configuration
- Compatible with Conventional Battery cabinets
- Applicable with 6 Cabinets

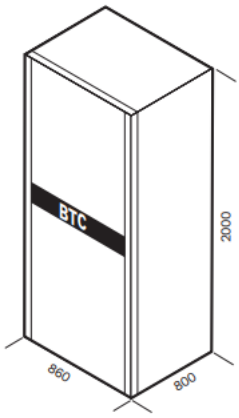
The above battery arrangements must be properly configured via the dedicated display menu in accordance with the instructions listed within the Advanced Configuration Manual.

M2X units are compatible with:

MODELS BATTERY CABINETS	BTC 2000 480V BB V6 3T / BTC 2000 480V BB V7 3T BTC 2000 480V BB V8 3T / BTC 2000 480V BB V9 3T BTC 2000 480V AB V9 3T (CONVENTIONAL BATTERY CABINET)

DIMENSIONS (mm)

W x D x H



For further details on Battery Cabinet installation refer to the UPS user manual.

10.4 EXTERNAL BATTERY TEMPERATURE SENSOR

The UPS has a specific connection point for measuring the temperature inside an external Battery Cabinet and indicating the temperature on the UPS display.
The specific kit supplied by the manufacturer includes a bipolar double insulated cable measuring 10 meters. The use of a bipolar cable without insulation exposes the UPS and the user to risks resulting from a lack of insulation as the reading refers directly to the UPS neutral earthing.
Once installed, it is necessary to enable the temperature display information and activate the voltage compensation. Both operations can be performed using the Configuration Software (by service personnel).
The kit enables the connection of a temperature probe for a Battery Cabinet placed adjacent to the UPS or 10 meters away. If it is not enough it is possible to extend it up to 25 meters (sensor cable length shall be arranged by the user).
For further details refer to the dedicated option installation manual.

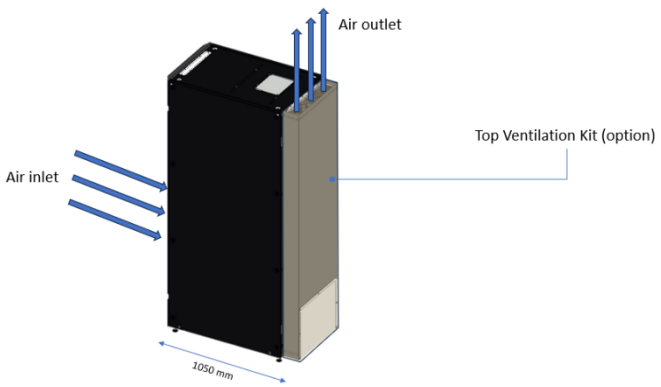
10.5 TOP VENTILATION KIT COMBO UNIT

For the specific request of front-top air ventilation, M2X Combo units will be provided with a dedicated top ventilation kit. The kit consists of a specific rear carter applied to the unit.

The top ventilation kit for the combo unit is designed to avoid any impact on the overall efficiency of the unit**.**

With this kit the cable entry is only from the bottom.

For further details about operating conditions and performance of the unit, please contact your pre-sales reference.



10.6 COLD START

This feature allows the unit to be switched on allowing then the load to be powered by the battery, when the mains power supply is not present. The cold start function can be installed as retrofit on M2X models. The cold start button is located at the front of the unit; for details refer to the UPS installation manual.

10.7 COMMUNICATION CARDS

The connectivity panel provides two extra expansion slots for accessory communication cards that make it possible to communicate with the UPS using different communication protocols.

MultiCom 302: a Modbus/Jbus protocol converter through an RS232 or RS485 output for monitoring the UPS, for example, from a BMS (Building Management System). It also provides a second independent RS232 serial line that can be used by other devices such as a NetMan or PC.

MultiCom 411: it is an external accessory with which you can connect a UPS to a Profibus DP network. With this device management and monitoring of the UPS can be integrated in a control system based on one of the field buses most widely used in industry for communication between control/automation systems and distributed I/O.

MultiCom 421: MultiCom 421 connects the UPS to a PROFINET Network. In industrial environments, the Gateway integrates the UPS management and monitoring into a control system. The Gateway uses the PROFINET control system – one of the most popular used for communicating between devices such as automation control systems and distributed I/O hardware.

MultiCom 372: MultiCom 372 provides a UPS with an additional RS232 serial interface port. The card has Emergency Power Off (EPO) and Remote Shutdown (RSD) inputs with terminal connections.

MultiCom 392: Multi Power range includes a specific relay card (MultiCom 392) having 8 programmable relay alarms (25 Volt, 1 Amp) and 3 programmable inputs.
Input/output configurations might be adjusted through the advanced configuration software available for authorised engineers (Service SW).

In order to carry out card installation and configuration refer to the dedicated manual.

11. ENVIRONMENTAL DATA

	Combo Cabinet M2X 120	Power Cabinet M2X 120
Operating temperature [°C]	0 ÷ 40	
Recommended working temperature for optimum battery performance [°C]	20 ÷ 25	
Storage temperature [°C]	- 25 up to +60 (UPS) - 15 up to +40 (UPS with batteries)	
Relative humidity range [%]	5-95 (without condensation)	
Maximum Operating Altitude (according with IEC/EN 62040-3)	Full power up to 1000 m a.s.l. (power derating of 0.5% for each 100 m between 1000 and 4000 m)	
Pollution degree	PD2	
Acoustic noise level at one meter and 50% load [dBA±2] in full configuration	< 60	

12. TECHNICAL DATA

Power modules:

Main features	**M2X 30 PM BLUE**	**M2X 15 PM BLUE**	**M2X 15 PM**
			
Technology	SiC	SiC	IGBT
Power [kW]	30	15	15
Efficiency [%]	Up to 98.2	Up to 97.7	Up to 96.8
Weight [kg]	21	18.5	18.5
Dimensions WxDxH [mm]	480 (444 body width for 19") x 678 (w handles) x 86.5(2U)		
Ventilation	Forced		
Cabinet IP rating	IP20 finger proof (either with cabinet doors open or closed)		
Electrical connection	Rear plug-in connectors		
Coating treatment	Available as option		
Colour	RAL 9005 + Blue band		RAL 9005 + Grey band

UPS overview:

Main features	M2X 120 CBC 6	M2X 120 PCS
		
Nominal Maximum Power(1)	120 kW	120 kW
Bypass Power	120 kW	120 kW
Module slots available	5	5
Cabinet layout description	4+1 x M2X 30 PM BLUE (max 120 kW) or 5 x M2X 15 PM or M2X 15 PM BLUE (max 75 kW)	4+1 x M2X 30 PM BLUE (max 120 kW) or 5 x M2X 15 PM or M2X 15 PM BLUE (max 75 kW)
Parallelable up to	Up to 6 units	
Max power expandability	720 kW	720 kW
Dimensions WxDxH [mm] & weight [kg] PCS(2) Type	-	600x940x1590 301
Dimensions WxDxH [mm] & weight [kg] CBC(3) Type	600 x 985 x 1995 1148	-
Moving UPS cabinet types	Castors (cabinets shipped without PM)	
Ventilation	Forced	
Air Inlet	Front	
Air outlet	Rear (Top as optional)	Rear
Cabinet IP rating	IP20	
Cable input	Rear side either top or bottom	Front access - bottom
Rated Conditional Short Circuit Current “Icc” [kA]	65	
Standards	Safety: IEC EN 62040-1 EMC: IEC EN 62040-2 Electromagnetic compatibility (EMC) requirements category C3;	
Colour	RAL 9005	

(1) *Power rating can be settled with a selected number of power modules.*

(2) *With SWIN, SWBYP, SWMB, SWOUT, weight considering fully populated configuration with PMs.*

(3) *Combo cabinet, weight considering fully populated configuration with PMs and battery shelves.*

NOTE: for parallel configuration please contact your presales reference

13. ELECTRICAL DATA

Input electric data are calculated considering the worst case and single unit.

INPUT	M2X 120 PCS	M2X 120 CBC 6
Nominal voltage	380 – 400 - 415 Vac Three-Phase plus neutral	
Voltage tolerance	320 to 480 V at 100% of the load 240 to 480 V at 50% of the load	
Maximum load applicable with ONE input phase missing (4)	66%	
Maximum load applicable with TWO input phases missing (4)	33%	
Nominal frequency	50 or 60 Hz	
Input frequency tolerance	40 to 72 Hz	
Maximum Input Current (6)	240 A	240 A
Total Harmonic distortion (THDi) with full load and source THDv <1%	< 3%	
Power factor (from 50% to 100% load)	0.99	
Rectifier progressive start-up (Power Walk-in duration)	Programmable from 1 to 120 seconds in steps of 1 second (standard disabled)	
Adjustable delay for the rectifier start up (Power Walk-in start delay)	Programmable from 1 to 120 seconds in steps of 1 second (3 seconds by default)	

(4) *From system OFF it will only start up if phases L1 and L2 are present.*

(5) *The input current is stated at 364V with 10A battery charging current*

DC CIRCUIT	M2X 120 PCS	M2X 120 CBC 6
Battery arrangement	Separate or common batteries at UPS level	
Number of poles	3 wires (+/N/-)	
Number of 12 V battery blocks	20 + 20	
Battery block range per string – VRLA	15+15 to 22+22 20+20 – 22+22 @ 100% power 19+19 @ 95% nominal power 18+18 @ 90% nominal power 17+17 @ 85% nominal power 16+16 @ 80% nominal power 15+15 @ 75% nominal power	
Rated standard battery voltage	240+240 V_{DC}	
Float voltage (2.27 V/el. Adjustable) - VRLA	273 + 273 V_{DC} (6)	
Boost voltage (2.38 V/el. Adjustable) - VRLA	286 + 286 V_{DC} (6)	
End of discharge voltage – load dependent (1.6 V/el. Adjustable) – VRLA	192 + 192 V_{DC} (6)	
Compatible with	VRLA batteries, Ni-Cd, Li-Ion, Supercaps	
Battery recharging current (7) M2X 30 PM BLUE	20 A per each power module installed up to 85% load 14 A per each power module installed @ 96% load 10 A per each power module installed @ 103% load	
Battery recharging current (7) M2X 15 PM or M2X 15 PM BLUE	12 A per each power module installed up to 78% load 8 A per each power module installed @ 92% load 5 A per each power module installed @ 103% load	
Maximum current drawn from batteries with UPS working at nominal power (8)	312 A	312 A
Voltage compensation (if temperature sensor active)	20 mv/°C (12 Volt block)	

(6) *This value refers to 20+20 blocks; refer to service documents for customised setting according with a different number of batteries.*

(7) *The currents refer to input voltages ≥ 364 Volt*

(8) *The power and current shown are the maximum values according with Cabinet type; the real value is associated to the number and rated power of PM installed.*

INVERTER	M2X 120 PCS	M2X 120 CBC 6
Max system nominal power	120 kVA	
Max system nominal active power	120 kW	
Power range	30 - 120 kW (max 4 PM 30 kW + 1 redundant) 15 - 75 kW (max 5 PM 15 kW)	
Power module size	30 kW or 15 kW	
Nominal voltage	380/400/415 Vac Three-Phase plus neutral	
Downgrading for output voltage different set-up	220 V_{LN}: -4% 208 V_{LN}: -10% 200 V_{LN}: -13%	
Nominal frequency	50 or 60 Hz	
Static stability	± 1%	
Dynamic stability	Resistive load and non-linear load: EN62040-3 class performance 1	
Voltage distortion (EN 62040-3)	< 1% with linear resistive load < 3% with 100% non-linear load	
Inverter frequency stability without bypass supply synchronisation	0.01 %	
Rate of Frequency variation	1 Hz/sec (adjustable from 0.5 to 2)	
Inverter Overload (@ 25°C)	> 103% and ≤ 125% 10 min > 125% and ≤ 150% 1 min > 150% 0.5 sec	
Short circuit current (Ph-N)	2.5 In for 100 ms + 1.5 In for 400 ms	
Efficiency on battery operation – for a **PM 30 BLUE**	97.2% @ 25% load 97.5% @ 50% load 97.4% @ 75% load 97.1% @ 100% load	
Efficiency on battery operation – for a **PM 15 BLUE**	96.3% @ 25% load 97.0% @ 50% load 97.0% @ 75% load 96.7% @ 100% load	
Efficiency on battery operation – for a **PM 15**	95.6% @ 25% load 96.4% @ 50% load 96.4% @ 75% load 96.3% @ 100% load	

BYPASS	M2X 120 PCS	M2X 120 CBC 6
Nominal current	200 A	
Nominal Voltage	380-400-415 Vac Three-Phase plus neutral	
Output maximum current[9]	180 A	
Bypass voltage range	from 180 V (adjustable 180-200) to 264 V (adjustable 250-264 V)	
Nominal frequency	50 or 60 Hz	
Bypass input frequency range	± 5% (adjustable from 0.25 to 10%)	
Transfer time bypass to Inverter (UPS in "ECO mode")	2 ms typical	
Internal fuse pre-arc energy value	12000 A^2s	
Max current in short circuit for 20 ms	1700 A[10]	
Overload capability on bypass line (@ 30 °C – 400V) [11]	> 101% and ≤ 110% 60 min > 111% and ≤ 125% 10 min > 125% and ≤ 150% 1 min > 150% 1 sec	

(9) *The power and current shown are the maximum values according with the Cabinet Type; the real value is associated to the number and rated power of PM installed*

(10) *Limited by fuse*

(11) *Percentage referred to the nominal power of cabinet*

System Efficiency AC/AC @400V according to the installed PM model[12]	M2X 30 PM BLUE (30 kW)	M2X 15 PM BLUE (15 kW)	M2X 15 PM (15 kW)
AC/AC Efficiency @ Full load	97.2 %	97.2 %	96.4 %
AC/AC Efficiency @ 75%	97.6 %	97.4 %	96.5 %
AC/AC Efficiency @ 50%	98.0 %	97.5 %	96.6 %
AC/AC Efficiency @ 25%	97.8 %	96.7 %	95.3 %
Power dissipated with resistive full load (pf=1) @ 400 V*	864 W 743 kcal/h 2948 BTU/h	432 W 371 kcal/h 1474 BTU/h	560 W 482 kcal/h 1911 BTU/h

(12) *Without redundancy (4x M2X PM 30 BLUE, 5x M2X 15 PM / PM BLUE)*

**3.97 B.T.U = 1 kcal*

ON LINE Mode Auto-consumption w/o load @400 V[13]	M2X 120 CBC6	M2X 120 PCS
M2X 30 PM BLUE (30 kW)	419 W	
M2X 15 PM BLUE (15 kW)	368 W	
M2X 15 PM (15 kW)	526 W	

(13) *Cabinet populated with 5 PM*

ECO Mode efficiency	M2X 120 CBC6	M2X 120 PCS
Efficiency: UPS System ECO Mode at 50% load rate [%]	99.2 %	
Efficiency: UPS System ECO Mode at 100% load rate [%]	99.2 %	
Auto-consumption: ECO mode w/o load	233	

14. SUMMARY TABLE

SUMMARY	M2X 120 CBC 6	M2X 120 PCS
Max N° of PM	4+1 x M2X 30 PM BLUE or 5 x M2X 15 PM / PM BLUE	
Switches	SWMB, SWBAT	SWIN, SWBY, SWOUT, SWMB
Standard backfeed protection	Std	
Backfeed Protection Device	N/A	
Front To Rear Ventilation	Std	
Front To Top Ventilation (VE)		N/A
Bottom Cable Entry	Std	
Top Cable Entry	Std	N/A
Single Input	Std	
Dual Input	Std(14)	
Air Filter		
Cold Start		
Coating Treatment		
Castors	Std	
Parallel (Lan/Optical Fiber)(17)	 (15)	
External Sync	Std	
Connectivity Panel	5 In, 4 Out 2 Com. Slots	
Network Card	Std(16)	
Pressure Sensor	N/A	
Battery Temperature Sensor		
Fire Detection Cable	Std	

 *Optional, onsite kit installation*

 *Optional, factory installation*

(14) *Just removing the connections between the two inputs*

(15) *Only Lan cables*

(16) *Embedded within Connectivity Panel*

(17) *1 kit per each unit*

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SPTM2XM3T26BREN Ver. Feb. 2026 - **Subject to change without notice and inaccuracies**