TECHNICAL GUIDE

EN

MODULYS XM

50 to 500kW Modular Unit
for parallel architecture up to 2,0 MW

ULTIMATE
Fault tolerant power
without compromise

1 000 000 HOURS MTBF

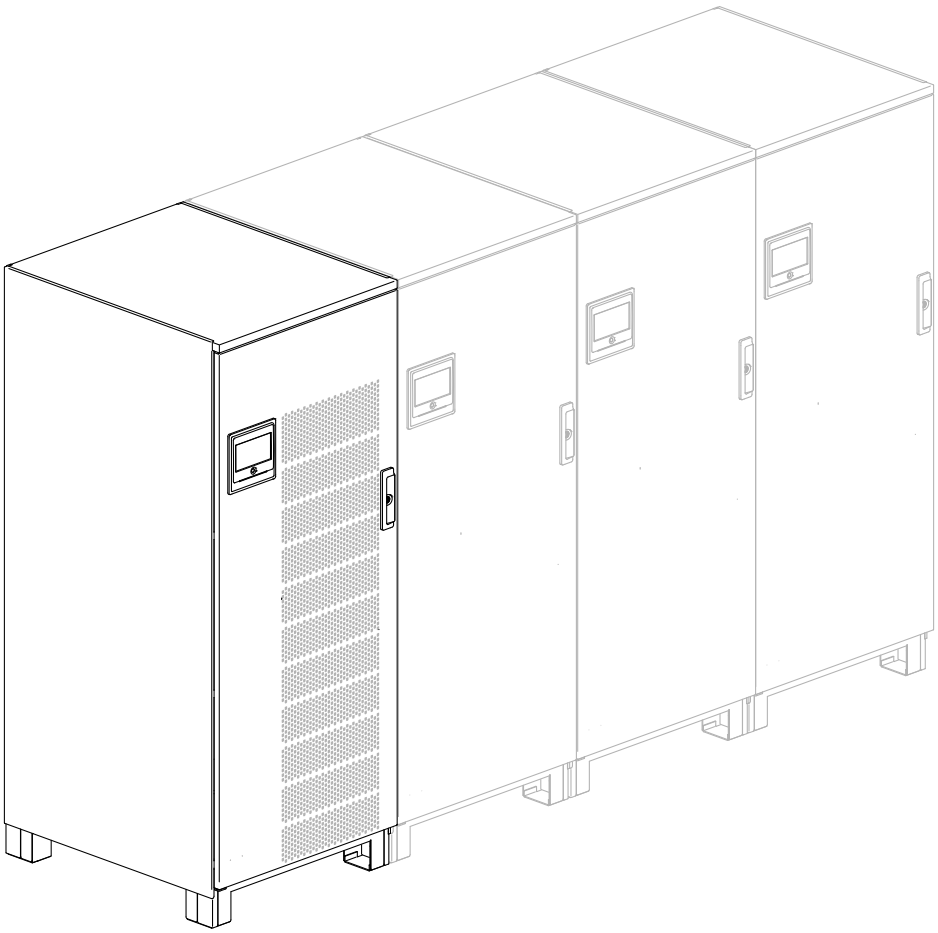
automatic firmware alignment

HOT-SWAP

FLEXIBILITY

20+ YEARS

Li-Ion



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1. OBJECTIVES

The purpose of these specifications is to provide the information required to prepare the system and installation site.

The specifications are intended for:

- installation engineers.
- design engineers.
- engineering consultants.

For detailed information, see the installation and operating manual.

2. ARCHITECTURE

2.1. Range and Flexibility

Modulys XM is a modular, scalable, and redundant UPS system based on plug-in, hot-swap power modules.

Its modular design enables power scalability by simply adding one or more additional modules to the existing unit (up to six modules per unit).

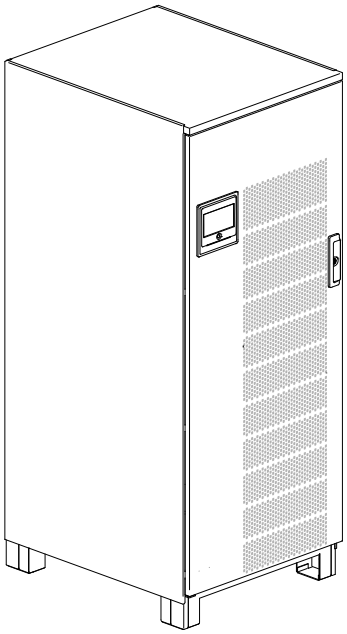
This modularity also allows for redundancy, an essential feature to ensure the fault tolerance of the UPS system. Redundant configurations of the power modules can be set, ranging from N+1 to N+R.

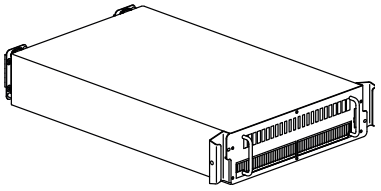
Modulys XM Units can be connected in parallel (up to 4) to increase overall power capacity to meet higher power requirements and increase the flexibility of the system.

Modulys XM is highly flexible, and this flexibility is further leveraged in its parallel architecture, providing exceptional versatility that encompasses all aspects of parallel architectures, configurations and design.

2.1.1. THE BRICKS

Modulys XM is built on a flexible brick concept. The UPS can be built by associating the bricks according to the requirements.

UNIT		
Max Unit Power (kW)	500	
Parallelability	Ready for parallel up to 4	
Height (mm)	1990	
Width (mm)	800	
Depth (mm)	950	
Weight (without modules)	400	
Cabling	Top	
Access for installation/cabling, operation and maintenability	Front access, for all the parts composing the Unit: rear and lateral access are never necessary	
Grounding system	Flexibility to work on any grounding system: TN-C – TN-S – IT – TT	
Maintenability	Fast and safe maintenance based on parts (like power modules, static bypass, electronic boards, mimic panel) that can be all hot-swapped in inverter mode (double conversion mode) without the need of moving in maintenance bypass or static bypass	
	Electronic-free cabinet: all the electronics parts are plug-in (not fixed to the Unit enclosure) and can be hot-swapped	
Number of Power Modules	2 → 10	
Power Module Size (kW)	50	
Number of Static Bypass Modules	1	
Bypass Module Size (kW)	500	

POWER MODULES		
Power (kW)	50	
Architecture and reliability	Double conversion	
	Completely independent: Rectifier, Inverter, Battery Charger, Internal Control, Control for internal Parallel	
	Segregation at input and output stages for complete isolation of electronic: embedded upstream and downstream galvanic separation and fast fuses	
	Selective disconnection: any potential fault is isolated inside the affected power module, without affecting the remaining modules	
	Heavy duty connectors > 500 mating cycles (certified)	
	MTBF > 1.000.000 h (certified)	
Hot-swap and Module addition for scalability	Hot swap and hot plg-in: safe (EN 62040-1 and EN 50110-1) and completely automatic (certified)	
	Automatic power module self-configuration and testing (certified)	
	Automatic firmware alignment without any intervention of the operator (certified)	
	MTTR < 2 min	
Parallelability	Totally independent power modules with distributed parallel control (no single point of failure: no centralised control)	
Weight (kg)	36	
Cabling	Plug-in	

OPTIONS / EXTENSIONS	
N-PE connection kit for TN-C gounding system	Ready for on-site installation
Input / Auxiliary mains connection kit for common mains	Ready for on-site installation
Remote mimic panel	Ready for on-site installation
Programmable relay card 3 inputs / 4 outputs + insulated RS485 serial link	Ready for on-site installation
Net vision card web/SNMP interface	Ready for on-site installation
Environment temperature and humidity sensor and 2 inputs	Ready for on-site installation
External Battery temperature sensor	Ready for on-site installation
Cold-start kit	Ready for on-site installation
Automatic cross-synchronisation card	Ready for on-site installation (*)
Seismic kit	(*)

(*) consult us

2.1.2. FLEXIBLE RATED POWER

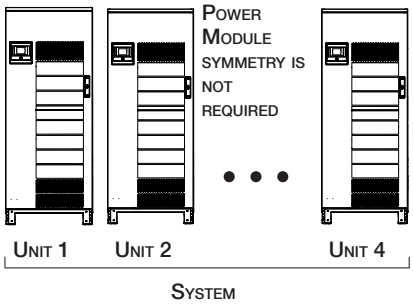
MAXIMUM POWER OF THE PARALLEL SYSTEMS				
Number of Units	1	2	3	4
Configuration w/o redundancy (kW) (1)	500	1000	1500	2000
N+1 redundant power module configuration (kW) (2)	450+50	950+50	1450+50	1950+50
1 redundant Unit configuration (kW)	/	500+500	1000+500	1500+500
1+1 configuration (kW)	/	500+500	/	/
Stand-alone configuration (kW) (3)	500 450+50 (4)	/	/	/

(1) configuring the system without redundancy is not advisable in a high-reliability modular setup, unless the redundancy is at the infrastructure level (2N, 3N2, Catcher, etc.).
(2) power module redundancy can generally be configured as N+R.
(3) stand-alone configuration is possible, enabling operation with a single unit while retaining the flexibility to add additional units in the future.
(4) it is recommended that the standalone configuration includes internal redundancy.

2.1.3. FLEXIBLE ARCHITECTURE

Flexible Distribution of Power Modules:

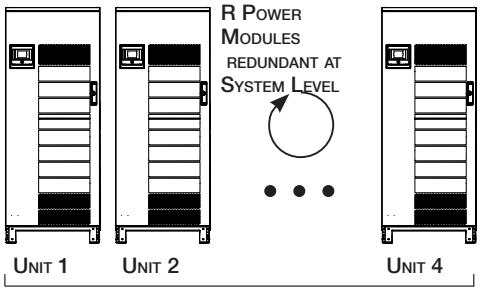
- Symmetry across units is not required.
- Units may contain different numbers of power modules.
- Units are not required to have the same power capacity



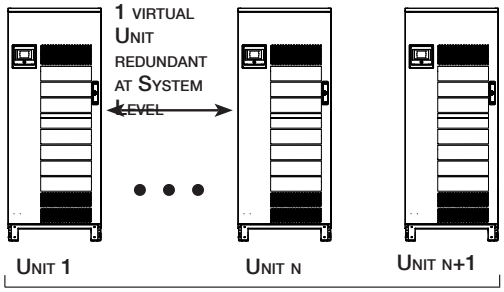
Flexible Scalability:

- A power module can be added to any available slot in the system, regardless of which unit it is in.
- There is no requirement to add one power module to each unit to maintain the same power capacity; symmetry is not necessary

Flexible Redundancy management



System with distributed power module redundancy



System with distrbuted unit redundancy

Power Module redundancy:

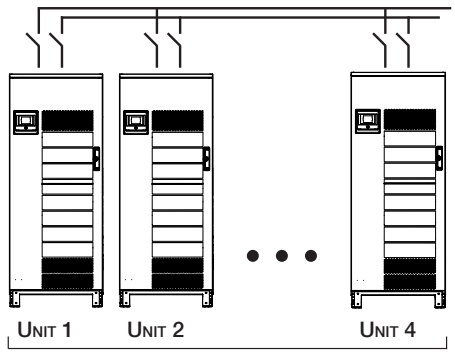
"R" virtual redundant modules (R=1, 2, 3, …) are distributed across the entire system, eliminating the need for identical power module redundancy in each individual unit.

Unit redundancy:

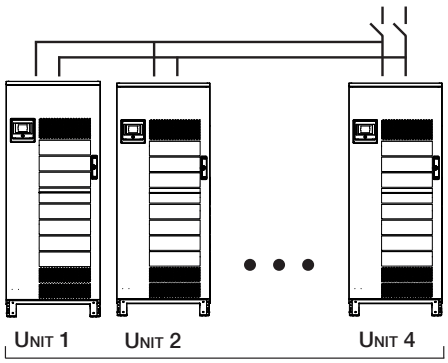
A single virtual redundant unit is designated across the system, with all redundant modules virtually allocated to this unit, though they remain physically distributed across the entire system.

Distributed redundancy across the global system allows for the avoidance of unnecessary duplication of system components, resulting in a cost-effective architecture, redundancy, scalability and maintenance.

Flexible upstream protection architecture

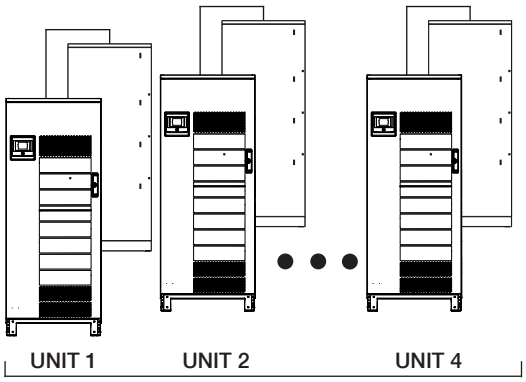


System with distributed upstream architecture

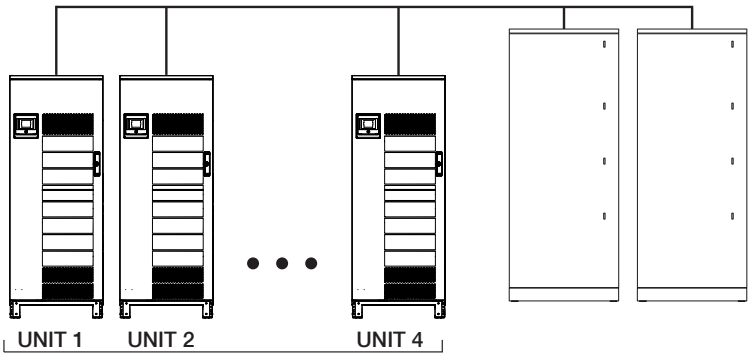


System with common upstream architecture

Flexible battery architecture



System with distributed battery



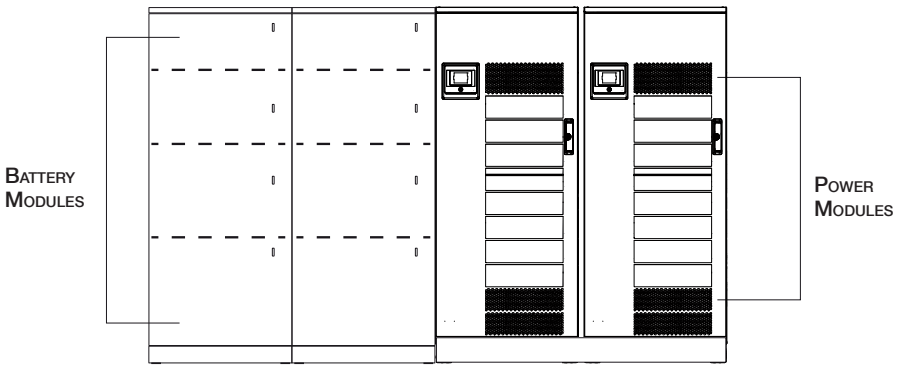
System with shared battery

2.1.4. FLEXIBLE GROUNDING COMPATIBILITY

Compatible with any grounding system: TN-S, TN-C, IT and TT.

2.2. Flexible back-up time

2.2.1. Modular battery cabinet - high capacity



DIMENSIONS AND WEIGHT		
Number of Strings	0	1
Height (mm)	1990	
Depth (mm)	890	
Width (mm)	810	
Weight (kg)	220	1792

High-capacity modular battery cabinets are designed for long back-up times (BUT) with higher power.

A standard temperature sensor optimizes the battery recharging parameters according to the ambient operating temperature to extend battery life.

2.2.2. Modular Lithium Battery Cabinet

Consult us.

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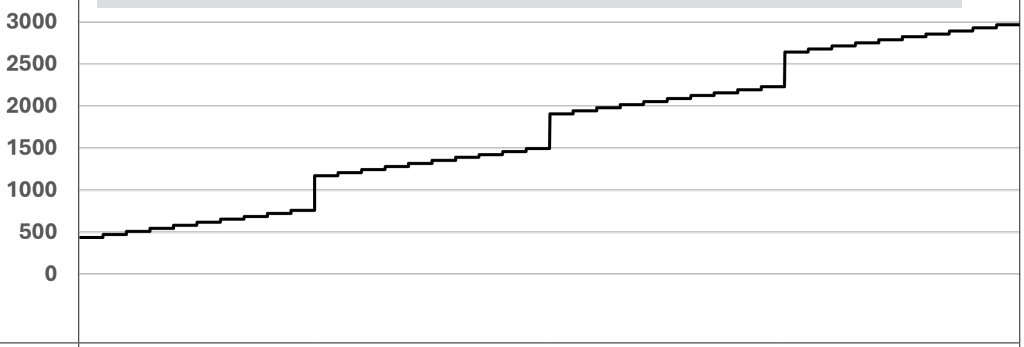
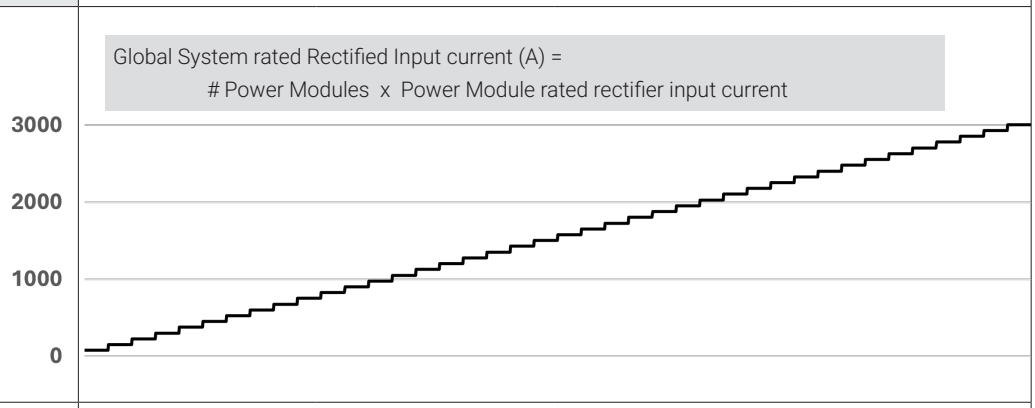
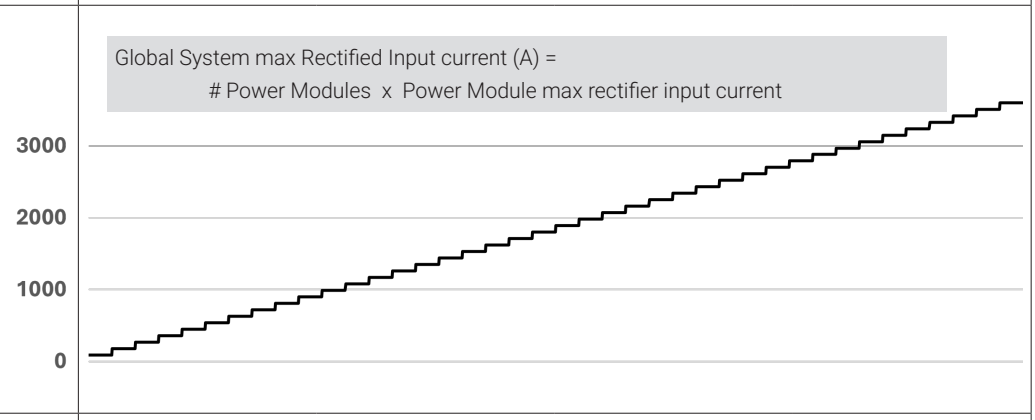
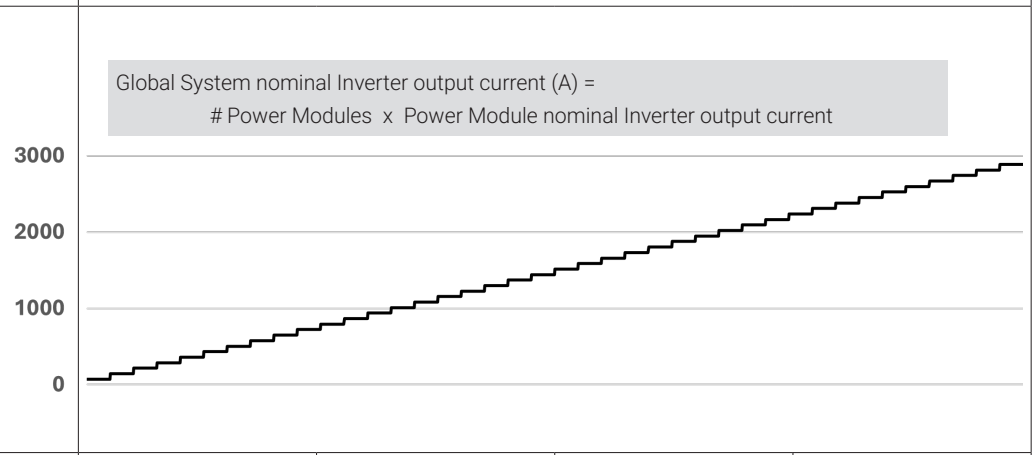
3. SPECIFICATIONS

3.1. Installation parameters

GLOBAL PARALLEL SYSYEM DIMENSIONS AND WEIGHT				
Number of Units	1	2	3	4
Width (mm)	800	1600	2400	3200
Height (mm)	1990			
Depth (mm)	950			
Number of Modules	01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40			
Weight (kg)	Global System Weight = # Units x Empty Unit Weight + # Power Modules x Module Weight 			
Single Empty Unit weight (kg)	400			
Single Power Module weight (kg)	36			

RATED CURRENT AND MAX CURRENT (SINGLE POWER MODULE)	
Rated rectifier input current (EN 62040-1) (A)	75
Max rectifier input current (EN 62040-3) (A)	90
Nominal Inverter output current (A)	72
Max battery current (A)	114

RATED CURRENT AND MAX CURRENT (GLOBAL PARALLEL SYSTEM)				
Number of Modules	01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40			
Rated rectifier input current (A) (EN 62040-1)				
Max rectifier input current (A) (EN 62040-3)				
Nominal Inverter output current (A)				
Maximum bypass input current (A) (EN 62040-3)	797	1594	2391	3198

COOLING (SINGLE POWER MODULE)		
Maximum air flow	(m3/h)	600
Power Dissipation under nominal conditions (1)	(W)	2240
	(kcal/h)	1920
	(BTU/h)	7640
Power Dissipation (maximum) under worst-case conditions (2)	(W)	2580
	(kcal/h)	2220
	(BTU/h)	8810

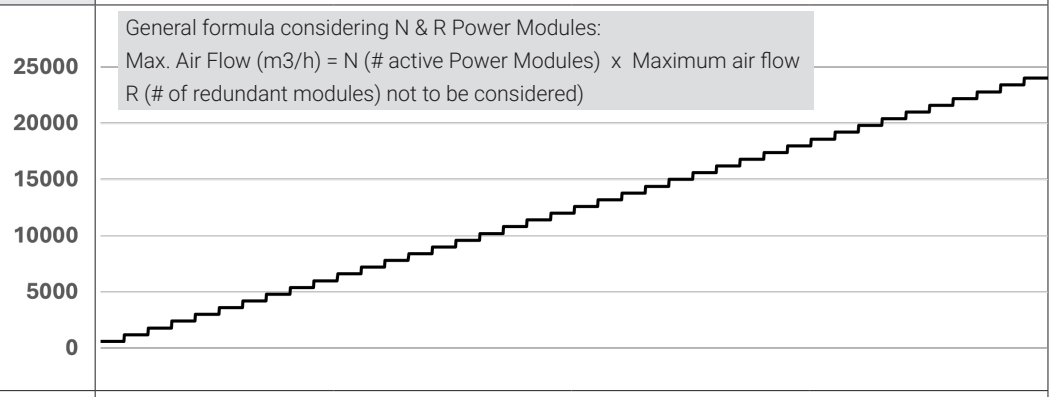
(1) worst-case: R (# redundant modules) = 0
(2) nominal input voltage and rated output active power (PF=1)

COOLING (GLOBAL PARALLEL SYSTEM)

Number of Units	1	2	3	4
Number of Modules	01 02 03 04 05 06 07 08 09 10	11 12 13 14 15 16 17 18 19 20	21 22 23 24 25 26 27 28 29 30	31 32 33 34 35 36 37 38 39 40

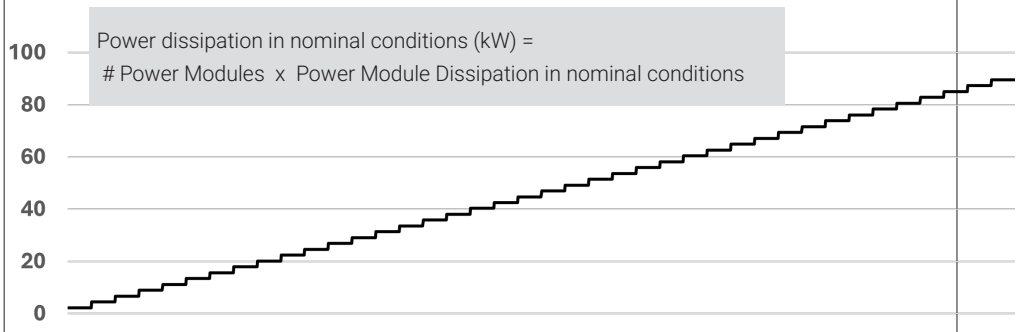
Maximum air flow [1] (m^3/h)

General formula considering N & R Power Modules:
Max. Air Flow (m3/h) = N (# active Power Modules) x Maximum air flow
R (# of redundant modules) not to be considered)



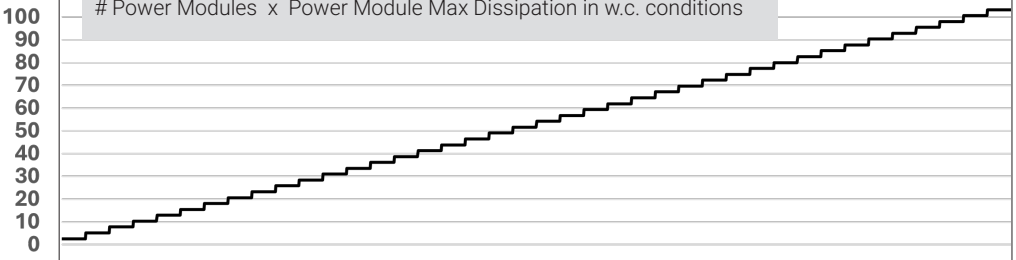
Power Dissipation in nominal conditions [1] [2] (kW)

Power dissipation in nominal conditions (kW) =
Power Modules x Power Module Dissipation in nominal conditions



Power Dissipation in worst-case conditions [1] [2] [3] (kW)

Power dissipation in w.c. conditions (kW) =
Power Modules x Power Module Max Dissipation in w.c. conditions

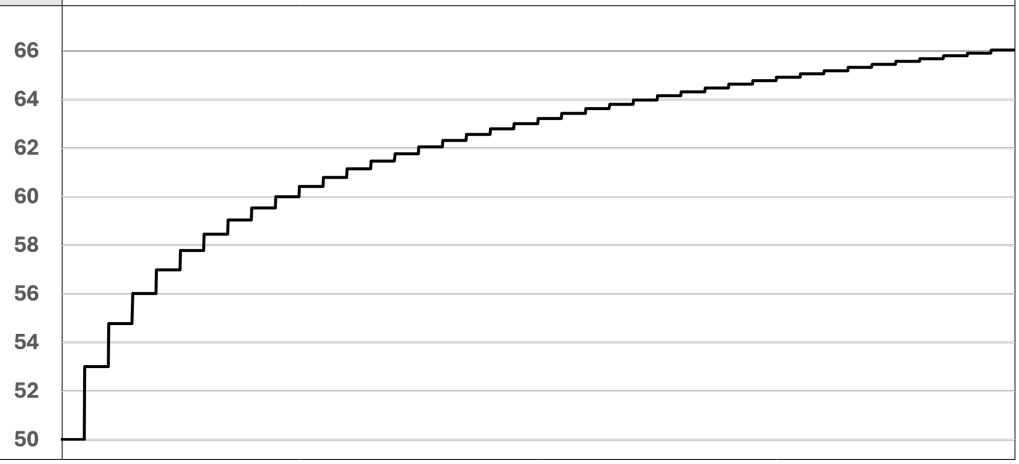


(1) worst-case: R (# redundant modules) = 0
(2) nominal input voltage and rated output active power (PF=1)
(3) low input voltage, battery recharge and rated output active power (PF=1)

ACOUSTIC NOISE

Number of Units	1	2	3	4
Number of Modules	01 02 03 04 05 06 07 08 09 10	11 12 13 14 15 16 17 18 19 20	21 22 23 24 25 26 27 28 29 30	31 32 33 34 35 36 37 38 39 40

Acoustic noise at 1m [1] (dBA)



(1) at 70% nominal load.

3.2. Electrical characteristics

3.2.1. Electrical characteristics independent OF the number of modules and units

ELECTRICAL CHARACTERISTICS - INPUT	
Rated mains supply voltage (V)	400 V 3-phase+N
Voltage tolerance at full load	340 V to 480 V (+20 / -15%)
Voltage tolerance at derated load	up to 240 V @ 50% of nominal load (linear decrease)
Rated frequency (Hz)	40 - 70 Hz
Power factor	> 0.99 (1)
Total harmonic input current distortion (THDi)	≤ 3% (@: Pn, Resistive load, Mains THDv ≤ 1%)
Max inrush current at start-up	Power walk-in / Soft-start (selectable parameters)

(2) Pout ≥ 50% of nominal Power.

ELECTRICAL CHARACTERISTICS - BYPASS	
Bypass rated voltage (V)	Nominal output voltage ±15% (±20% if GENSET is used)
Bypass rated frequency (Hz)	50 / 60
Bypass frequency tolerance	±2% selectable (±8% if GENSET is used)
Bypass frequency variation speed	50 / 60 ±10%

ELECTRICAL CHARACTERISTICS - INVERTER	
Rated output voltage (V)	(3ph + N) 400 380 / 400 / 415 selectable
Output voltage tolerance (V)	±1%
Rated output frequency (Hz)	50 / 60 (selectable)
Output frequency tolerance	±0.05% (on battery mode)
Load crest factor	≥ 2.7 :1
Total output voltage distortion (THDv)	≤ 1% (Ph / Ph); ≤ 2% (Ph / N) (@: Pn, Resistive load)

ELECTRICAL CHARACTERISTICS - STORED ENERGY OPERATING MODE	
Number of battery blocks (VRLA)	From 18+18 to 24+24 (1)

(3) Consult us

ELECTRICAL CHARACTERISTICS - EFFICIENCY	
Efficiency (on-line mode)	up to 96.5%
Efficiency (eco-mode)	up to 99.3%

ELECTRICAL CHARACTERISTICS - BYPASS OVERLOAD AND SHORTCIRCUIT PERFORMANCE					
Number of Units		1	2	3	4
Number of Power Modules		2 → 10	11 → 20	21 → 30	31 → 40
Bypass overload (A)	Nominal	725	1449	2174	2899
	Continuous	797	1594	2391	3188
	10'	906	1812	2717	3623
	1'	1087	2174	3261	4348
	1"	1268	2536	3804	5072
Bypass Max short-circuit current I_{TSM} (A_{pk}) (1)	20 ms	21000	34000	50000	67000
Bypass I^2t (A^2s) (1)		2200000	5600000	12700000	22600000

ELECTRICAL CHARACTERISTICS - SINGLE UNIT SHORT CIRCUIT SAFETY PERFORMANCE		
	Number of Power Modules	1 → 10
Conditional short circuit current Icc (A_{RMS}) (2) (3)		100 kA
Short-circuit current withstand Icw (A_{RMS}) (4)	High short-circuit (Standard Unit) (5) (7)	35 kA
	Extra-high short-circuit (Optional Unit) (6) (7)	65 kA

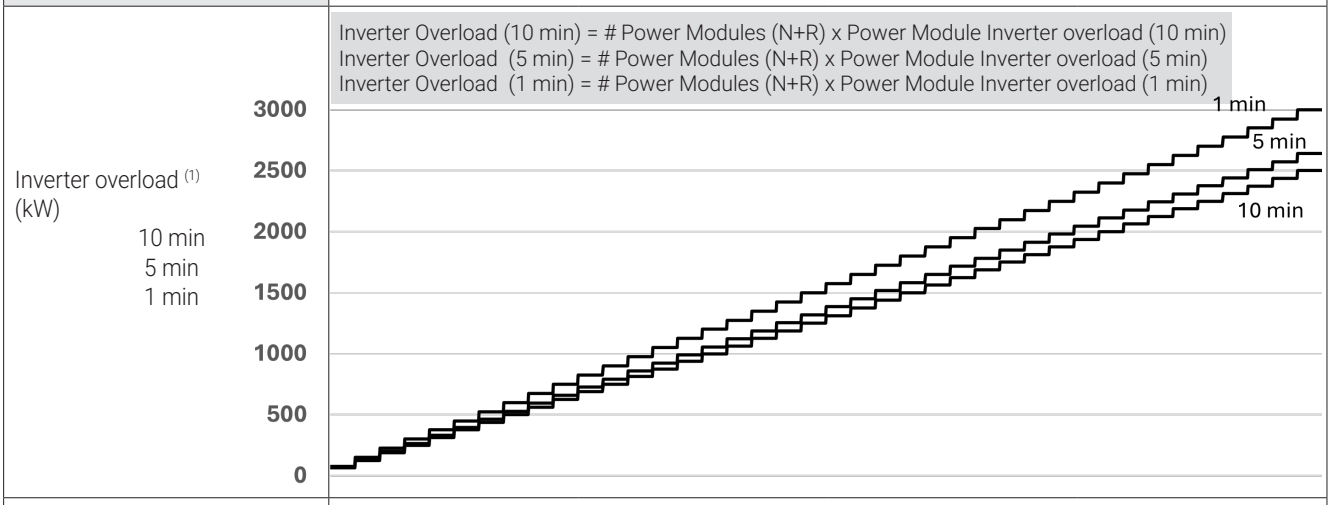
(1) Ta = 25°C
(2) short-circuit safety withstanding Icw (IEC/EN 62040-1 requirement without upstream protection)
(3) with Standard Unit (high short-circuit Icw = 35 kW) and each Unit with defined upstream protection (consult us)
(4) short-circuit safety withstanding Icc (IEC/EN 62040-1 requirement with upstream protection)
(5) standard Unit Icw = 35 kA for enhanced short-circuit safety withstanding (above IEC/EN 62040-1 requirements: Icw = 17 kA)
(6) extra rugged Unit Icw = 65 kA for enhanced short-circuit safety withstanding (above IEC/EN 62040-1 requirements: Icw = 17 kA)
(7) third party certified

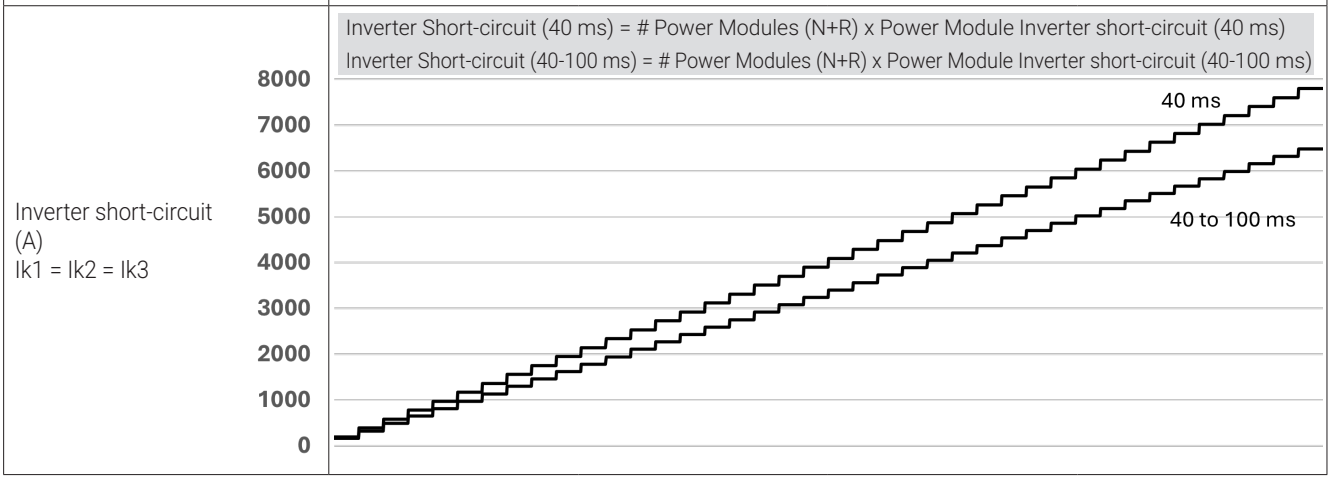
3.2.2. Electrical characteristics dependent on the number of modules AND UNITS

ELECTRICAL CHARACTERSTICS (SINGLE POWER MODULE) – INVERTER OVERLOAD AND SHORT-CIRCUIT		
Inverter overload [1] (kW)	10 min	62.5
	5 min	66
	1 min	75
Inverter short-circuit (A) Ik1 = Ik2 = Ik3	40 ms	195
	40 to 100 ms	162

ELECTRICAL CHARACTERSTICS (GLOBAL PARALLEL SYSTEM) – INVERTER OVERLOAD AND SHORT-CIRCUIT

Number of Units	1	2	3	4
Number of Modules	01 02 03 04 05 06 07 08 09 10	11 12 13 14 15 16 17 18 19 20	21 22 23 24 25 26 27 28 29 30	31 32 33 34 35 36 37 38 39 40

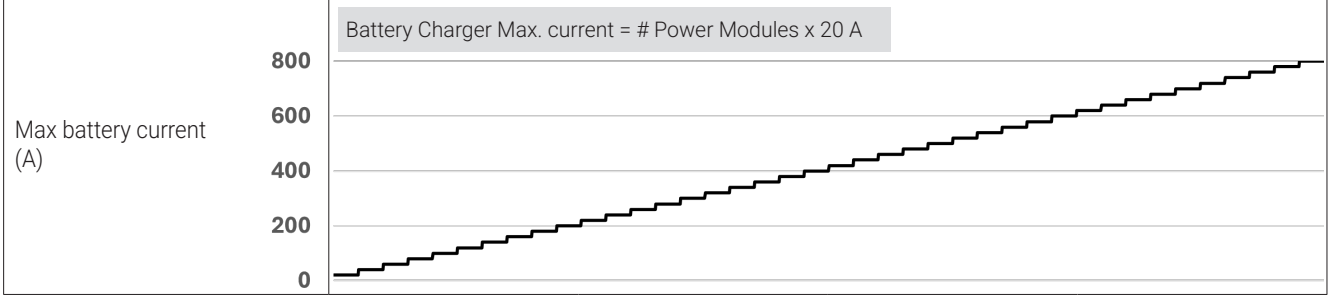




(1) Conditions: Initial Pout ≤ 80% Pn, Vin nominal

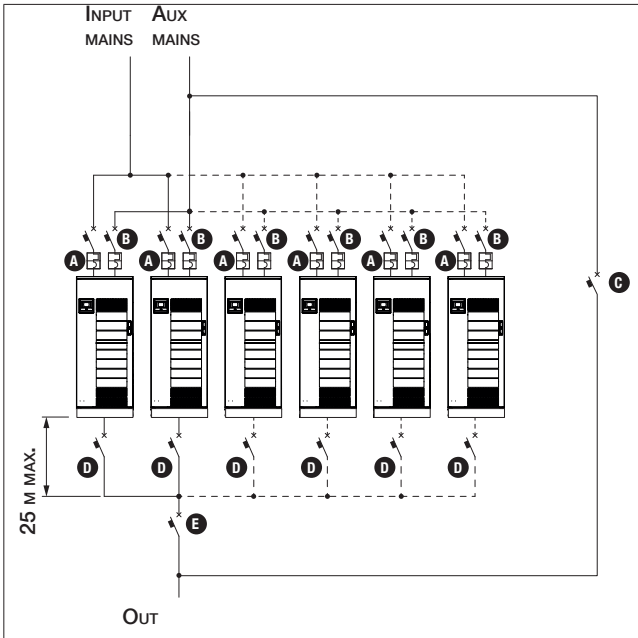
ELECTRICAL CHARACTERSTICS - BATTERY CHARGER MAX CURRENT

Number of Units	1	2	3	4
Number of Modules	01 02 03 04 05 06 07 08 09 10	11 12 13 14 15 16 17 18 19 20	21 22 23 24 25 26 27 28 29 30	31 32 33 34 35 36 37 38 39 40



3.3. Recommended protection

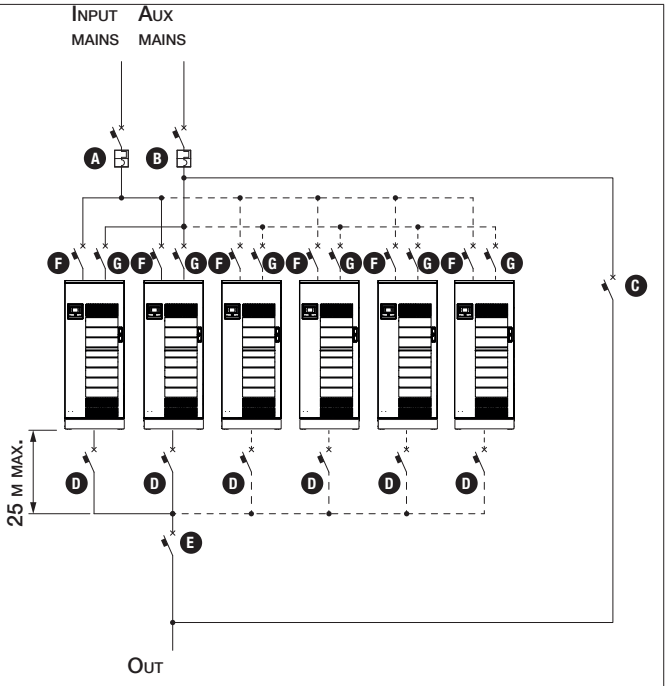
3.3.1. Architectures of Parallel System up to 2 MW based on 50→500 kW Units



PARALLEL SYSTEM WITH DISTRIBUTED UPSTREAM ARCHITECTURE

KEY

A	Unit input mains thermal-magnetic circuit breaker.
B	Unit auxiliary mains thermal-magnetic circuit breaker.
C	System external maintenance by pass switch (connect signal status to the parallel board)
D	Unit output switch
E	System shutdown switch



PARALLEL SYSTEM WITH COMMON UPSTREAM ARCHITECTURE

KEY

A	System input mains thermal-magnetic circuit breaker.
B	System auxiliary mains thermal-magnetic circuit breaker.
C	System external maintenance by pass switch (connect signal status to the parallel board)
D	Unit output switch
E	System shutdown switch
F	Unit input mains switch
G	Unit auxiliary mains switch

The installation and system should comply with national plant regulations.

The electrical distribution panel should have a sectioning and protection system installed for input and auxiliary mains.

SINGLE UNIT CABLE - MAX SECTION		
Rectifier terminals (mm^2)	Flexible	3 x 240
	Rigid	3 x 240
Bypass terminals (mm^2)	Flexible	3 x 240
	Rigid	3 x 240
Battery terminals (mm^2)	Flexible	3 x 240
	Rigid	3 x 240
Output terminals (mm^2)	Flexible	3 x 240
	Rigid	3 x 240

M10 terminals

Tightening torque 20 Nm

Maximum cross-section is determined by the size of the terminals.

As specified in EN 62040-3 Appendix 3 (Non-Linear Load Reference), in the event of three-phase non-linear loads connected downstream of the UPS, the neutral current on the load can be 1.5 - 2 times higher than the phase current. This should be taken into account when estimating the correct size of output and auxiliary neutral cables.

The Unit is designed for bottom connections. A specific option is available for top connection.

RECOMMENDED PROTECTION DEVICES - INPUT MAINS						
Architecture		Distributed protections (1 rectifier protection for each Unit)	Common protections (1 rectifier protection for all the Units)			
Number of Units		1 → 4	1	2	3	4
Circuit breaker (A)	Minimum	1000	For a common protection architecture, the sizing of the upstream protection system must consider the rated and maximum rectifier current of the parallel system (§ 2.1), the protection of connection cables based on their size (§ 2.3), and compliance with local standards and regulations.			
	Maximum					

A circuit breaker switch with a magnetic intervention threshold of ≥10 In is recommended.

When an optional external transformer is used, a circuit breaker with Im ≤ 20 x In (A) and selective breaker capabilities is necessary.

The minimum value depends on the size of the power cables in the installation, while the maximum value is constrained by the UPS cabinet.

The system can accommodate the maximum size of protection, regardless of the number of modules installed, to allow for future scalability.

A protection value lower than the maximum must be used when the mains network structure or cables cannot support the full power load. This value should be selected accordingly.

When the auxiliary mains and input are connected together, the general input protection rating must be higher than that of either the auxiliary mains or the rectifier.

RECOMMENDED PROTECTION DEVICES - AUXILIARY MAINS						
Architecture		Distributed protections (1 rectifier protection for each Unit)	Common protections (1 rectifier protection for all the Units)			
Number of Units		1 → 4	1	2	3	4
Circuit breaker (A)	Minimum	800	For a common protection architecture, the sizing of the upstream protection system must consider the rated and maximum rectifier current of the parallel system (§ 2.1), the protection of connection cables based on their size (§ 2.3), and compliance with local standards and regulations.			
	Maximum					

A circuit breaker switch with a magnetic intervention threshold of ≥10 In is recommended.

If an optional external transformer is used, a circuit breaker with Im ≤ 20 x In (A) and selective breaker capabilities is required.

The minimum value depends on the size of the power cables in the installation, while the maximum value is limited by the UPS cabinet.

The conditional short-circuit current (Icc) in compliance with IEC 62040-1 is 65 kArms (§ 2.2.1), provided that the UPS is protected by an MCCB with adequate breaking capability and current-limiting capacity under short-circuit conditions.

For detailed information, please contact us.

RECOMMENDED PROTECTION DEVICES - UPSTREAM RESIDUAL DETECTION CIRCUIT BREAKER						
Architecture		Distributed protections (1 rectifier and aux. mains protection for each Unit)	Common protections (1 rectifier and aux. mains protection for the global parallel system)			
Number of Units		1 → 4	1	2	3	4
Differential input (A)	Minimum	RCD devices cannot be used on parallel system with distributed protections	0,5A (1)			

(1) RCD devices are not recommended as upstream common protection in a parallel system.
RCD devices are unnecessary when the UPS is installed in a TN-S system.
RCD devices are not permitted in TN-C systems.

4. REFERENCE STANDARDS AND DIRECTIVES

4.1. Overview

REFERENCE	TITLE
2014/35/EU	Directive of the European Parliament and of the council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits.
2014/30/EU	Directive of the European Parliament and of the council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility.
2011/65/EU	Directive of the European Parliament and of the council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

4.2. Standards

STANDARD	
Safety	EN / IEC 62040-1 - AS 62040-1
EMC	EN / IEC 62040-2 - AS 62040-2
Product certification	IECEE CB Scheme
Performance	EN / IEC 62040-3 - AS 62040-3
Product marks	CE - RCM(1) - CMIM(1) - UKCA (1)
Protective class	Protective Class I
Protection level	IP20

(1) depends on the production site. Consult the data plate on the equipment.

ELITE UPS: a mark of efficiency

Socomec, as CEMEP UPS manufacturer member, has signed a Code of Conduct put forward by the Joint Research Centre of the European Commission (JRC), to ensure the protection of critical applications and processes ensuring 24/7 continuous high quality supply. The JRC commits to mitigating energy losses and gas emissions caused by UPS equipment, therefore maximising UPS efficiency.

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