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REHLKO *MF* Series

Centralised Bypass

Modular high power three-phase uninterruptible power supply

(250 – 2000 kVA/kW)
Scalable to 4500 kVA/kW

Technical Specification

Document Control

ISSUE	DATE	REVISION SUMMARY
TS_766_01	20/11/2023	Rebranded International version
TS_766_02	13/05/2024	Input and output currents changed to ‘per module’
TS_766_03	18/03/2025	Standards Added
TS_766_04	16/12/2025	1000kVA frame, CSB module, batteries, heat dissipation added
TS_766_05	06/05/2026	Rebranding to Rehlko

Useful Contacts

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IRELAND

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Contents

REHLKO MF SERIES DESCRIPTION

Three phase double conversion uninterruptible power supply for critical environments that have high power demands. The UPS is specially designed for modern data storage infrastructures such as enterprises, colocation, cloud, internet, media, and telecommunications data centres.

The Rehlko MF Series provides a continuous flow of clean, sustainable power. The UPS is based on 250 kW power modules with scalable power up to 2000 kW or 1750 N+1 for redundancy in a single system and up to 4 units can be connected to provide a total of 6 MW capacity.

The Rehlko MF Series UPS incorporates the latest technological developments in power engineering. Representing a completely new generation of high power three phase UPS systems, its advanced double conversion VFI (Voltage and Frequency Independent) topology is optimised to provide the highest availability and energy efficiency for a UPS system of this type. The Rehlko MF Series UPS is compliant with the IEC 62040-3 (VFI-SS-111) standards.

Rehlko Ltd. specialises in the installation and maintenance of Uninterruptible Power Systems, emergency lighting inverters and standby generators. This powerful UPS is just one example of our wide range of state-of-the-art power protection devices that will provide your critical equipment with a steady and reliable power supply for many years.

Model Range

The Rehlko MF Series is a truly expandable system, based on a number of plug-in 250 kW UPS modules installed in a purpose-designed cabinet. Up to eight 250 kW modules can be fitted in the 2000 kW Frame, up to 6 250 kW modules in the 1500 kW frame and up to four 250 kW modules can be fitted in the 1000 kW Frame, thanks to the advanced Rehlko MF Series system design, if a cabinet is not fully populated it is possible to add further UPS modules to increase the system capacity without having to power-down the system or in any way disrupt the load. Using the 1000 kW frame as an example, if a system is initially purchased with only two UPS modules fitted, an additional four modules can be installed later as and when required. Depending on the system redundancy and existing load demand, this ‘hot-swappable’ design also allows individual modules to be exchanged while the equipment remains fully operational without having to transfer the load to the unprotected bypass supply.

Key Features

Uninterruptible power – power capacity and redundancy on demand

Up to 2000 kW power protection in a single UPS by paralleling power modules of 250 kW. Power modules can be slid in, adding power capacity, or providing internal redundancy (N+1).

Readiness for parallel redundant system configurations (2N, 2(N+1), 3N/2) securing uptime and reliability

Maximized availability and resiliency

Proven technology and maximized availability based on power modules of 250 kW that include all necessary functional parts, such as rectifier, inverter, battery converter, static bypass, and back-feed protection. The UPS architecture provides fully redundant critical components and shares the load equally among the power modules.

Concurrently maintainable power modules for continuous uptime. The power module is online swappable while the load is secured in double conversion mode. Insertion or removal of the power module is smooth and simple thanks to wheels and guide rails. Further, the power module plug-in concept supports easy and safe power connection, thus eliminating electrical hazards.

Fail-safe startup of the system without human intervention by testing of power modules before applying to the critical load.

Fault-tolerant UPS operation. If one power module fails, the others take up the load - without impacting the power supply.

Minimized energy losses, heat dissipation and electricity cost while the critical load is protected by the UPS in double conversion or ECO modes. The UPS achieves an efficiency of up to 97.4% in double conversion mode and 99 % in ECO mode.

Flexible operation optimizes UPS efficiency and reduces power loss when the load is low compared to the UPS total capacity. Rehlko Xtra VFI mode can improve system efficiency by optimizing the number of power modules used in double conversion mode to feed the load.

Simply and safe installation. The UPS is provided with pre-engineered power frames consisting of metal busbars – which eliminate wiring entirely – and slide-in power modules with safe, plug-in connections that remove any hazard.

Ease to operate and manage real-time monitoring is provided by the local system display or in the control room via the web application.

Design life of up to 15 years reduces the cost of systems replacements over the infrastructure lifespan

Control and monitoring features, I/O dry ports, dry inputs for remote shutdown, generator, operational and external switchgear, castell interlock function, preconfigured battery temperature senor input

Power Exchanger - Grid-support option and Demand response functionality is an energy management function available on the MF Series family enabling the UPS to interact with the grid and supply (upon external request) ancillary grid services.

AI Load profile optimization: MF Series UPS family has been assessed and confronted with design developing an **outstanding proven AI Ready performance**.

Through this **Frequency Regulation Function** (FRF) UPS can reduce/increase the input power flowing from grid to the UPS or even to reverse the flow and inject power back into the grid (back-feed), while maintaining constant the output power.

Sustainable Self-Test functionalities, even with NO-LOAD situation. UPS modules can be powered from input grid supply or from Battery storage energy to execute the full-load self-test. This functionality support commissioning, site implementation and thermal on-site loses simulation test for cooling systems.

Flexible to integrate several back-up power sources, including traditional valve-regulated lead acid (VRLA), Lithium-Ion solutions and new energy storage chemistries, as Nickel-Zinc (NiZn) ready.

MF SERIES WITH CENTRALISED BYPASS

The MF Series double conversion online modular UPS with centralised bypass benefits from all the advantage of ABB's innovative DPA. The key features of this UPS are:

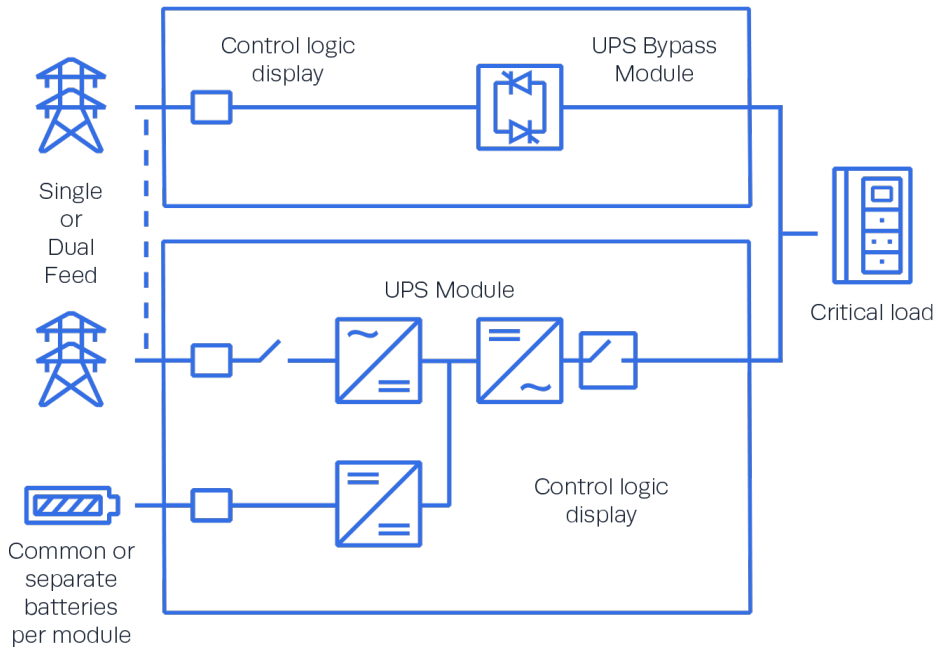
- Centralised static bypass switch
- Each UPS module can operate autonomously
- Redundant critical components and paths serving the load; no single points of failure
- UPS modules can be online-swapped without impacting the load
- Redundant power configuration (N+1) with common or separate batteries
- Smart load sharing between the active UPS modules
- Continuous and redundant control and monitoring on module and system level

The MF Series with Centralised Bypass can be tailored to suit up to 4500 kW power protection available in a single system by placing MF Frames in parallel and adding power modules of 250 kW. Additional power modules can be slid in, adding power capacity or providing internal redundancy (N+1).

The MF Series with Centralised Bypass uses multiple thyristor blocks as a central static bypass, which is sized for the total combined UPS module capacity. The bypass switching devices use N+1 thyristors, which means the bypass itself has redundancy and the higher MTBF allows the UPS to function when one of the thyristors has failed, whereas conventional bypasses do not have this feature. Equal current sharing between the thyristor elements is achieved using a unique, patented magnetic coupling system (externally certified).

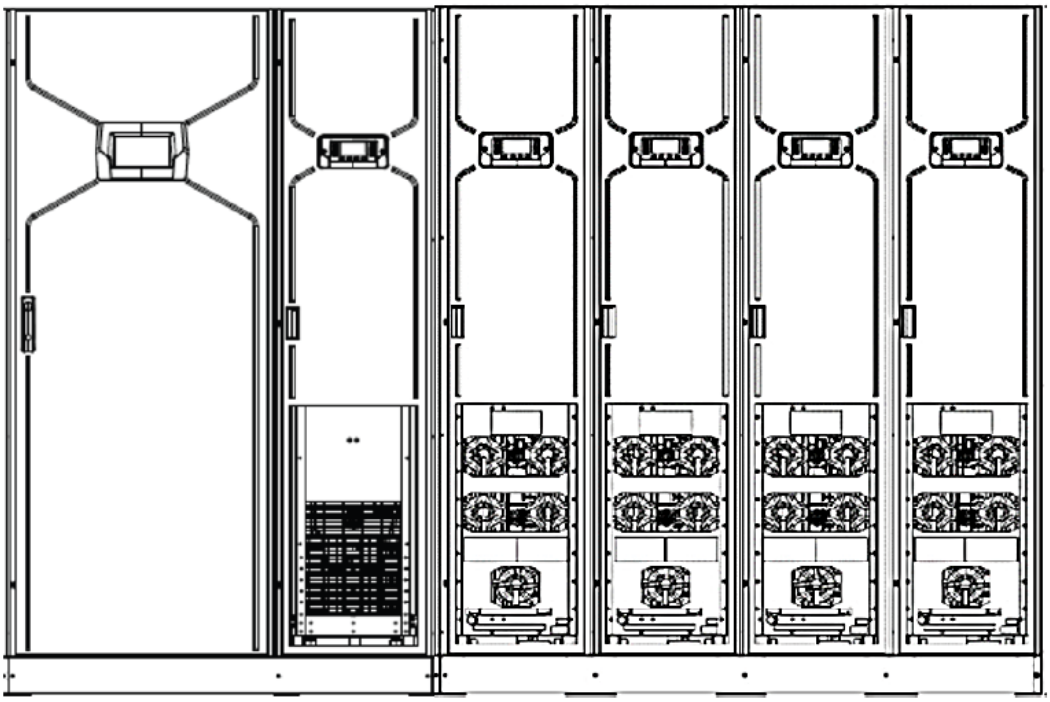
The MF Series with Centralised Bypass has a higher I2t energy let through capability.

The MF Series with Centralised Bypass can be installed with separate or common input feeds to the rectifier and static bypass.



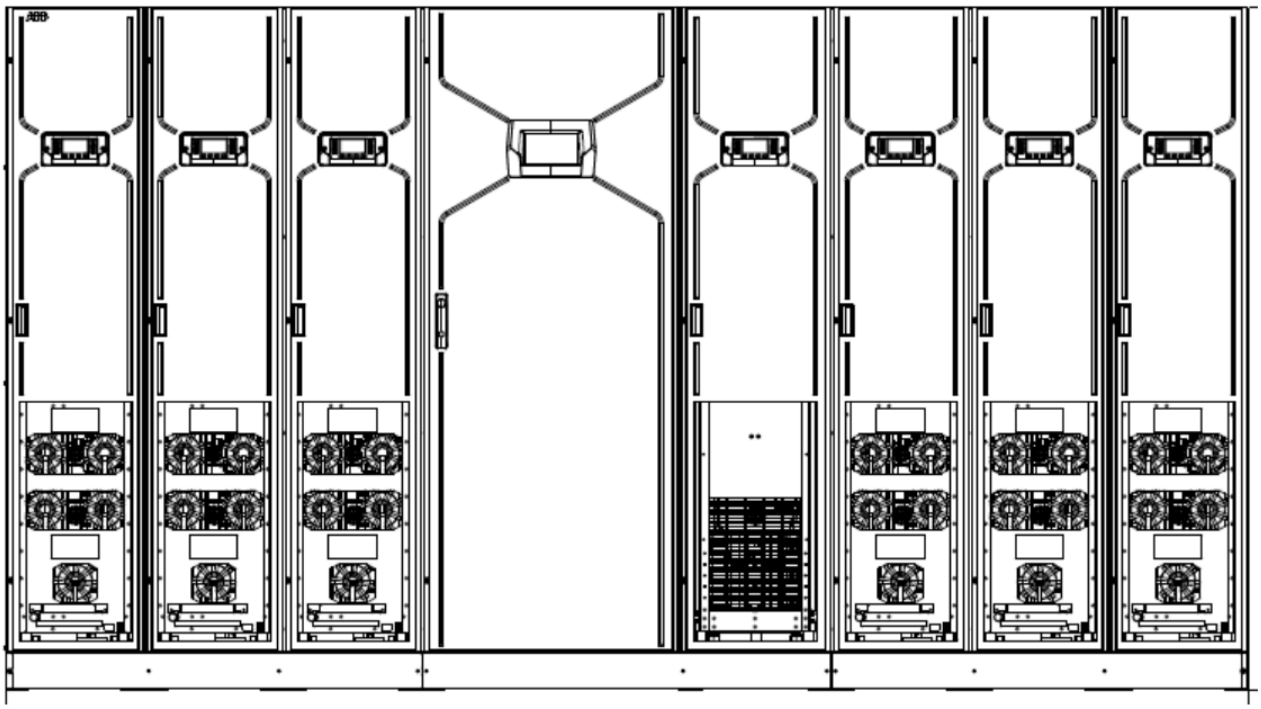
Mechanical Characteristics MF Series with Centralised Bypass

Rehlko MF1500 DPA – 1000 CSB Frame



1000 kVA / 1000 kW Frame with Centralised Bypass	1 Module	2 Module	3 Module	4 Module
System power rating (per cabinet) (kVA/kW)	250	500	750	1000
Maximum cabinet rating	1000 kVA / 1000 kW (up to 4 power modules)			
UPS type	On-Line, transformerless, Modular, DPA			
Parallel capability	Up to 4.0 MVA / 4.0 MW			
Battery	Housed external to the UPS. Dimensions/weight/design is specific to application			
Performance specification	VFI-SS-111			
Backfeed Protection	Standard			
UPS Frame Dimensions (W x D x H) mm	2835 x 1000 x 2000			
Weight (without power modules) kg	1022			
Weight (with power modules) kg	1718	2068	2418	2768
UPS cabinet colour	RAL 9005 (Black)			
Ingress protection	IP 20			
Cable entry	Top or Bottom (To be defined at Order)			
Ventilation	Front to Top			
Service access	Front			
Installation clearances mm	Front 1500mm, Top 500mm, Rear 0mm			

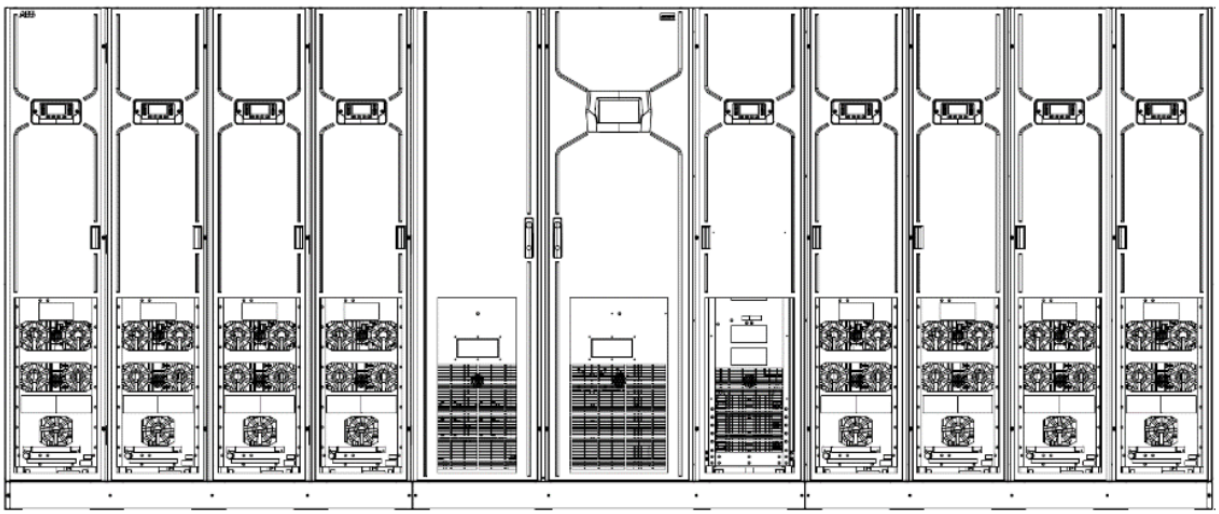
Rehlko MF1500 DPA – 1500 kVA CSB Frame



1500 kVA / 1500 kW Frame with Centralised Bypass	1 Module	2 Module	3 Module	4 Module	5 Module	6 Module
System power rating (per cabinet) (kVA/kW)	250	500	750	1000	1250	1500
Maximum cabinet rating	1500 kVA / 1500 kW (up to 6 power modules)					
UPS type	On-Line, transformerless, Modular, DPA					
Parallel capability	Up to 4.5 MVA / 4.5 MW					
Battery	Housed external to the UPS. Dimensions/weight/design is specific to application					
Performance specification	VFI-SS-111					
Backfeed Protection	Standard					
UPS Frame Dimensions (W x D x H) mm	3645 x 1000 x 2000					
Weight (without power modules) kg	1200					
Weight (with power modules) kg	1816	2166	2516	2866	3216	3566
UPS cabinet colour	RAL 9005 (Black)					
Ingress protection	IP 20					
Cable entry	Top or Bottom (To be defined at Order)					
Ventilation	Front to Top					
Service access	Front					
Installation clearances mm	Front 1500mm, Top 500mm, Rear 0mm *					

*During delivery and positioning access may be required to sides and rear for assembly of the frame.

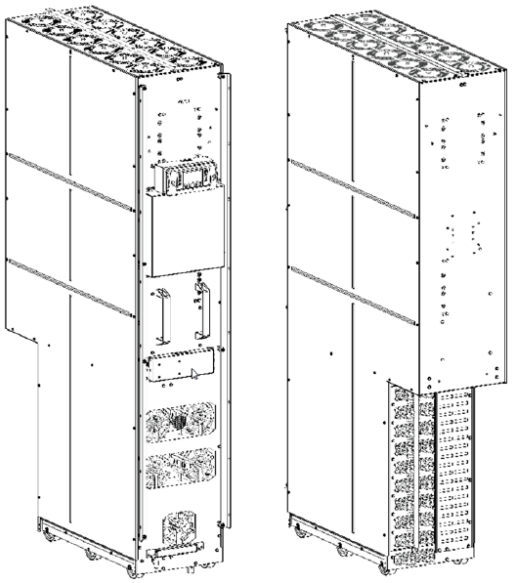
Rehlko MF1500 DPA – 2000 kVA CSB Frame



2000 kVA / 2000 kW Frame with Centralised Bypass	1 Mod	2 Mod	3 Mod	4 Mod	5 Mod	6 Mod	7 Mod	8 Mod
System power rating (per cabinet) (kVA/kW)	250	500	750	1000	1250	1500	1750	2000
Maximum cabinet rating	1500 kVA / 1500 kW (up to 6 power modules)							
UPS type	On-Line, transformerless, Modular, DPA							
Parallel capability	Up to 4.0 MW / 4.5MVA							
Battery	Housed external to the UPS. Dimensions/weight/design is specific to application							
Performance specification	VFI-SS-111							
Backfeed Protection	Standard							
UPS Frame Dimensions (W x D x H) mm	4830 x 1000 x 2000							
Weight (without power modules) kg	1494							
Weight (with power modules) kg	2150	2500	2850	3200	3550	3900	4250	4600
UPS cabinet colour	RAL 9005 (Black)							
Ingress protection	IP 20							
Cable entry	Top or Bottom (To be defined at Order)							
Ventilation	Front to Top							
Service access	Front							
Installation clearances mm	Front 1500mm, Top 500mm, Rear 0mm *							

*During delivery and positioning access may be required to sides and rear for assembly of the frame.

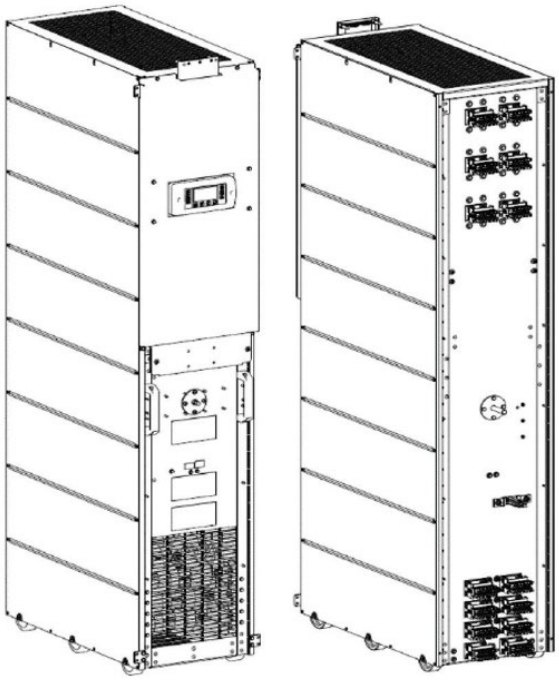
Rehlko MF1500 DPA – 250 kVA Power Module



250 KVA / 250 kW Power Module	1 Module
Module Input Fuse (Type gRL/gS)	500A
Dimensions (W x D x H) mm	356 x 1015 x 1825
Weight kg	344
Ventilation	Forced ventilation with fan failure detection and fan speed regulation. N+1 fan redundancy
Service Access	Removable power modules with 360° access*

*see UPS FOOTPRINT AND for further information.

Rehlko MF1500 DPA - Central static Bypass Power Module



Power Rating kW	1500	2000
Dimensions (W x D x H) mm	396 x 831 x 1854	396 x 831 x1854
Weight kg	370	386
Ventilation	Forced ventilation with fan failure detection and fan speed regulation. N+1 fan redundancy	
Service Access	Removable power modules with 360º access*	

GENERAL SPECIFICATIONS

Environment & Electromagnetic Compatibility	
Environmental service conditions	Indoor unconditioned
Climatic class	3K2
Conformal coating	Conf. coating for PCBs available as option
Pollution degree	2
UV resistance	N.A
Ambient operating temperature range	0-40ºC
Ambient storage temperature range (see note)	-25-70ºC
Relative humidity range	<95% (non-condensing)
Altitude without derating	up to 1000m
Altitude with derating	up to 5000m
Vibration	according to EN60721-3-2

Note: Elevated storage temperatures may impact useful life, specifically for the UPS capacitors. Ideal storage temperature is between +5 and +35°C and at relative humidity of up to 75%. Long term storage in an environment with high humidity should be avoided. Likewise, one should avoid storage in environments that contain halogenated gases (and other hazardous gases), spray or oil as well as exposure to any radiation.

Electromagnetic Compatibility	
Emission	C3
Immunity	C3

Standards	
1. Safety	1. IEC/EN 62040-1
2. EMC	2. IEC/EN 62040-2; Class C3
3. Performance	3. VFI SS 111 - IEC/EN 62040-3
4. Environmental	4. IEC 62040-4
5. Manufacturing	5. ISO 9001:2015, ISO 14001:2015, OHSAS18001
6. Energy Efficient	6. SEAI- Triple E Product Registered & ACA Approval
7. PEP Eco Passport	7. PEP-PCR-ed3-EN-2015 04 02 Product Environmental Profile certification in compliance with ISO 14025:2010 «Environmental labels and declarations. Type III environmental declarations».
8. CE Mark	8. According to with EU Directives 2006 95 2004 108 and through compliance with standards IEC/EN 62040-1: General rules for electric safety; IEC/EN 62040-2: Electromagnetic compatibility and immunity (EMC); IEC/EN 62040-3: Performances and testing rules.

INPUT CHARACTERISTICS

Input AC Power Distribution	
Input AC power distribution system compatibility (earthing system)	TN-S, TN-C, TN-C-S
Input AC power distribution system wiring	3 Phase + Neutral + PE
Overvoltage category to be mandatory included (or inside UPS by factory UPS frame installed Options or External to UPS, located on mains incoming protection panel)	Category II 2500VAC as standard Category III 4500VAC optional To be mandatory included (or inside UPS by factory UPS frame installed Options or External to UPS, located on mains incoming protection panel)
Input rated conditional short circuit current (Icc)	120 kA
Additional information	Single or Dual input for Rectifier and Bypass. Factory standard is Dual Input Feed (DIF) configuration. Optional: Single Input Deed (SIF) kit as available as frame options.
Input Voltage & Frequency	
Input rated voltage	380, 400 or 415 VAC (Phase to Phase) 220, 230 or 240 VAC (Phase to Neutral)
Input voltage tolerance 40°C @ 400VAC	Load <100% (-10%, + 15%) Load <80% (-20%, + 15%) Load <60% (-30%, + 15%)
Input rated frequency	50Hz or 60Hz
Input frequency tolerance	40Hz or 70Hz*(nominal Frequency +_10Hz)
Slew rate	1Hz/second
Input Current and Overload Characteristics	
Maximum input rated current - 400V - (batteries charged) *	378A Per 250 kVA module
Maximum input rated current - 400V - (batteries charging)	420A Per 250 kVA module
Total harmonic distortion (THDi), 100 % load - normal mode - linear load (at 400V input voltage; input THDU < 2%; tolerance of ±0.3% may apply)	<3%
Total harmonic distortion (THDi), 100 % load - normal mode - non-linear load (at 400V input voltage; input THDU < 2%; tolerance of ±0.3% may apply)	<3%
Rectifier input in-rush (% of rated current against time)	<100%
Rectifier input power factor (rated linear load; rated non-linear load)	100% load

*Maximum input rated current – 380V and 415V please contact Rehlko ** An external bypass is required – housed in external switchgear separate to the UPS frame.

EFFICIENCY CHARACTERISTICS

Efficiency	
Double conversion efficiency - 100% rated load	96.5%
Double conversion efficiency - 75% rated load	97.0%
Double conversion efficiency - 50% rated load	97.4%
Double conversion efficiency - 25% rated load	97.2%

According to IEC 62040-3 (UPS performance standard): Efficiency tolerance +/-0.2 %

All AC/AC efficiency VFI declared at system level, data refers without battery charging current, @nominal input conditions with nominal frequency and with resistive load. At 25ºC Ambient temperature.

The 97.4% @400V efficiency point is declared at 25ºC Ambient temperature with nominal frequency and with resistive load

OUTPUT CHARACTERISTICS

Output AC Power Distribution	
Output AC power distribution system compatibility (earthing system)	TN-S, TN-C, TN-C-S, TT
Output AC power distribution system wiring	3 Phase + Neutral + PE
Output Voltage	
Output rated voltage	380, 400 or 415 VAC (Phase to Phase) 220, 230 or 240 VAC (Phase to Neutral)
Output voltage variation - normal mode	+/- 1%
Output voltage variation - battery mode	+/- 1%
Total harmonic distortion (THDU), 100 % load - normal mode - linear load	<2%
Total harmonic distortion (THDU), 100 % load - normal mode - non-linear load	<4%
Total harmonic distortion (THDU), 100 % load - battery mode - linear load	<2%
Total harmonic distortion (THDU), 100 % load - battery mode - non-linear load	<4%
Voltage transient and recovery time - 100 % step load - linear	<4%, (<200ms)
Voltage transient and recovery time - 100 % step load - non- linear	<4%, (<200ms)
Voltage transient and recovery time - transfer normal mode / battery mode	<1%, (<200ms)
Output Frequency	
Output rated frequency	50Hz or 60Hz
Output frequency variation - normal mode	+/- 2% or 4% selectable (Synchronised with mains, allowing for transfer to static bypass)
Output frequency variation - battery mode	+/- 0.1%
Output frequency variation - free-running	+/- 0.1%
Synchronization (max ± % range of rated frequency)	+/- 2% or 4% selectable
Max synch. phase error (referred to a 360° cycle)	2°
Output Current	
Output rated current - 400V*	362A Per 250 kVA module
Inverter overload capability	110% load: 60 minutes 125% load : 10 minutes 150% load : 1 minute
Output overload – Battery mode Worst scenario with battery close to end of discharge (Measured at 400Vdc)	120%: 1 min 110%: 5 min 105%: 10 min
Output current limitation, "short circuit current" (% or rated current / time duration, Ph- N)	2.8 x In, 40ms (default) 2.5 x In, 100ms 2.1 x In, 300ms
Fault clearing capability (normal mode / stored energy mode, 400V rated voltage)	1014.5A Per 250 kVA module
Output Power Factor	
Load power factor - rated	1.0
Load power factor - displacement (permissible lead-lag range)	0.6 lag to 0.8 lead

*Maximum input rated current – 380V and 415V please contact Rehlko

STATIC BYPASS CHARACTERISTICS

Static Bypass Switch	1500 kVA	2000kVA
Rated Current - 400V*	2174A	2899A
Static Bypass Architecture	Centralised fault tolerance pluggable static bypass	
VFD Efficiency at 100% rated load	99%	
Bypass Overload (% of rated current / time duration)	110% load: continuous 140% load: 10 minutes 190% load: 2 minutes	
Bypass voltage tolerance (% of rated voltage @ 400V)	-20% + 15%	
Bypass fault clearing capability (% of rated current/ time duration @ 400V)	35 In / 10ms	30 In / 10ms

*Maximum Input Rated Current – 380V and 415V please contact Rehlko

BATTERY AND ENERGY STORAGE CHARACTERISTICS

Battery charger	
Max. Charge current	187.5A (d.c) per module
Max. Charge power	75 kW (d.c) per module
Max. Fault current rating	100kA (d.c)
Battery ripple current max.	400mA RMS
Nominal voltage (total)	480 VDC - 600 VDC
Stored energy time (back-up time at 100 % rated load)	Extended autonomy times without derating. Refer to battery autonomy calculators for correct sizing
Ambient reference temperature (To secure maximal service life)	Battery type dependent: Lithium ion: 25°C, VRLA: 20°C, NiCd: Refer to manufacturer provided information

Additional Battery Information	
End of discharge voltage (EOD)	3.20 V/Cell Samsung 2.80V/cell Vision 1.65 V/Cell VLRA 1.05 V/Cell Ni-Cd
Cable voltage drop recommendation	1%
Battery temperature compensation	Supported by standard UPS. Temperature sensor available as option
Battery test	Automatic battery test performed by UPS. Could run by Power Module (250kW) or at frame UPS full capacity power level

VRLA	
Design life	Ref to battery manufacturer provided information
Quantity of cells per string	VRLA 12 V: 40-50 blocks/ 240-300 cells
Nominal voltage (total)	480 VDC - 600 VDC
Max. discharge current @EOD 240cells	649.5A per 250kW module
Stored energy time (back-up time at 100 % rated load)	Extended autonomy times without derating. Refer to battery autonomy calculators for correct sizing
Restored energy time (re-charge time to 90 % capacity)	10 hours (varies on amount and size of used batteries
Ambient reference temperature (To secure maximal service life)	20°C
Charge voltage (float)	2.23 V/Cell
End of discharge voltage	1.65 V/Cell
Battery temperature compensation	Supported by standard UPS. Temperature sensor available as option

Nickel Zinc - ZincFive	
Battery Cab	BC2
Number of Cabinets	1
Design Life	15
Quantity of cells per string	8 cells; 38 modules
Nominal range	383 VDC - 585 VDC
Nominal Capacity	80
Stored Energy time	Suitable for short autonomies
Ambient reference temperature (To secure maximum service life)	20-35ºC
Restored energy time (re-charge time to 90 % capacity)	4hrs @22A charge current
Max. discharge current @EOD	687A per 250kW module

Lithium-Ion Samsung and Vision							
Battery Configuration	Samsung	Vision					
	136S	TP100	TP110	TP120	TP200	TP220	TP240
Minimum No. Of Cabinets	1	2			1		
Energy storage type	No integrated batteries, external energy needed						
Design life	15 years						
Quantity of cells per string	136 Cells 17 mods	160S1P cells 10 mods	176S1P cells 11 mods	192S1P cells 12 mods	160S2P cells 10 mods	176S1P cells 11 mods	192S1P cells 12 mods
Nominal voltage (total) Vdc	516.8	512	563.2	614.4	512	563.2	614.4
Nominal Capacity Ah	67	50	50	50	100	100	100
Stored energy time (back-up time at 100 % rated load)	Extended autonomy times without derating. Refer to battery autonomy calculators for correct sizing						
Max. discharge current @EOD 240cells	649.5A per 250kW module						
Restored energy time (re-charge time to 90 % capacity) Hrs	3 @22A charge	2.7 @25A Charge			2.7 @50A Charge		
Ambient reference temperature (To secure maximal service life)	18-28ºC	20-25ºC					
Maximum discharge current @EOD	1000kW 2406A 1250kW 3008A 1500kW 3609A 1750kW 4211A 2000kW 4812A	1000kW 2337A 1250kW 2922A 1500kW 3506A 1750kW 4091A 2000kW 4676	1000kW 2125A 1250kW 2656A 1500kW 3187A 1750kW 3718A 2000kW 4250	1000kW 1948A 1250kW 2435A 1500kW 2922A 1750kW 3409A 2000kW 3896	1000kW 2337A 1250kW 2922A 1500kW 3506A 1750kW 4091A 2000kW 4674	1000kW 2125A 1250kW 2656A 1500kW 3187A 1750kW 3718A 2000A 4250	1000kW 1948A 1250kW 2435A 1500kW 2922A 1750kW 3409A 2000kW 3896A

Lithium-Ion Ampace P100					
Battery Configuration		Ampace P100			
		6C 12 Modules	6C 11 Modules	6C 10 Modules	6C 9 Modules
Minimum No. Of Cabinets		1	1	1	1
Design life		15 years			
Quantity of cells per string		192S2P	176S2P	160S2P	144S2P
Nominal voltage (total) Vdc		614.4	563.2	512	460.8
Minimum voltage Vdc		537.6	492.8	448	403.2
Nominal Capacity Ah		104	104	104	104
Restored time to 90% SOC		1H@104A			
Ambient reference temperature (To secure maximal service life)		20-30ºC			
Maximum discharge current @EOD	1000kW 1250kW 1500kW 1750kW 2000kW	1948A 2448A 2937A 3427A 3916A	2136A 2670A 3204A 3738A 4272A	2350A 2937A 3524A 4111A 4700A	2611A 3263A 3916A 4568A 5222A

Ampace PU-100 Sizing basic guide

Common battery configuration (Optional «Common Battery connection kit» installed at UPS Frame)

Note: Dedicated per-frame-size Optional - Common Battery connection kit should be added on the MF Series UPS cabinet.

Battery cabinets are connected in common configuration to the frame.

MF Series Family - Common battery config. - Ampace Sizing for 5 min EOL							
Power Rating		500	750	1000	1250	1500	2000
PU-100 cabinet		2	3	4	4	5	7
Nº Battery Modules per cabinet		10	10	10	12	12	12
Master Kit required		1	1	1	1	1	1
EOL 10 years	[min]	8.7	8.7	9.68	9.29	9.68	9.32
Voltage range	[Vdc]	400 - 576	400 - 576	400 - 576	480 - 691	480 - 691	440 - 634
Max current	[kAdc]	1.3	2.0	2.6	3.0	3.3	4.7

MF Series Family - Common battery config. - Ampace Sizing for 10 min EOL							
Power Rating		500	750	1000	1250	1500	2000
PU-100 cabinet		2	3	4	5	6	7
Nº Battery Modules per cabinet		12	12	11	11	11	12
Master Kit required		1	1	1	1	1	1
EOL 10 years	[min]	10.4	10.4	10.65	10.65	10.65	10.17
Voltage range	[Vdc]	480 - 691	480 - 691	440 - 634	440 - 634	440 - 634	480 - 691
Max current	[kAdc]	1.1	1.6	2.2	2.7	3.2	4.4

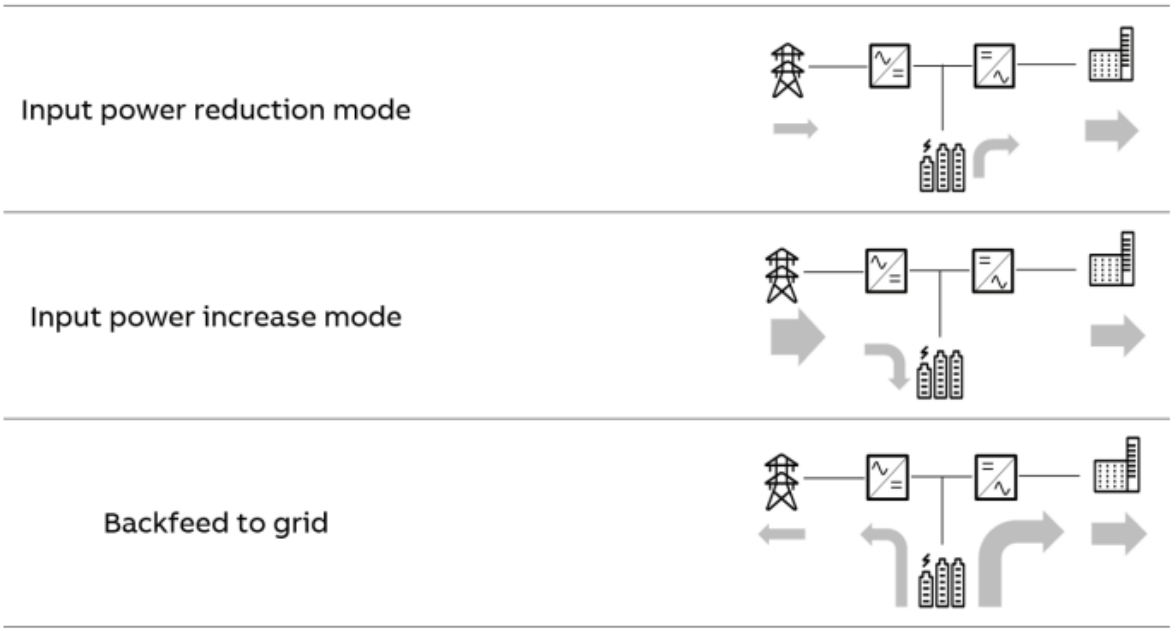
Separate battery configuration (Standard from factory - Separate battery per each UPS Module)

Ampace Sizing for 5 min EOL		
Power Rating		250kW
PU-100 cabinet		1
Nº Battery Modules per cabinet		10
Master Kit required		1
EOL 10 years	[min]	8.7
Voltage range	[Vdc]	400-576
Max current	[kAdc]	0.7

Ampace Sizing for 10 min EOL		
Power Rating		250kW
PU-100 cabinet		1
Nº Battery Modules per cabinet		12
Master Kit required		1
EOL 10 years	[min]	8.4
Voltage range	[Vdc]	480-691
Max current	[kAdc]	0.6

POWER EXCHANGER

PowerExchanger is a function enabling the UPS to interact with the grid and supply (upon external request) ancillary grid services. Through this function the UPS is able to reduce/increase the input power absorbed from the grid or even to inject power into the grid (backfeed), while maintaining constant the output power.



Input power reduction mode

Activation power (input reduction)	From actual load down to 0%
Response time from activation request	< 1 Second
Input power reduction duration	Modbus RTU: until minimum state of charge is reached dry contact: 0-200, selectable
Deactivation ramp	Modbus RTU: instantaneous control, dynamic setpoint dry contact: 0-100%, selectable
Battery minimum state of charge*	0-100%, selectable
Battery type compatibility	VRLA, Li-Ion**, NiCd
Communication with external gateways	Modbus RTU or dry contact***
Activation	Dedicated Module 1 license

*defines the minimum level beyond which the input power reduction mode is inhibited

** valid for Li-Ion batteries officially compatible with this UPS, lithium iron phosphate battery is recommended.

*** if dry contact communication is selected, the activation power is a predefined setpoint (programmable)

Input power increase mode

Input power increase	Max 75Kw/UPS module, on top of actual load. (limitations may apply depending on initial battery state of charge)
Response time from activation request	< 1 Second
Input power increase duration	Modbus RTU: until minimum state of charge is reached dry contact: 0-200, selectable
Deactivation ramp	Modbus RTU: instantaneous control, dynamic setpoint dry contact: 0-100%, selectable
Battery maximum charge status*	0-100%, selectable
Battery type compatibility	Li-Ion**
Communication with external gateways	Modbus RTU or dry contact***
Activation	Dedicated Module 1 license

* during input power increase mode the battery is charged, therefore to enable this mode the battery should be normally kept in a partial state of charge; this parameter specifies the maximum charge allowed (100% equals then to disabling the function). The initial state of charge and the amount of battery capacity installed influences the amount of power increase.

** valid for Li-Ion batteries officially compatible with this UPS, lithium iron phosphate battery is recommended.

*** if dry contact communication is selected, the activation power is a predefined setpoint (programmable).

Backfeed to Grid

Activation power (backfeed to grid)	Up to 175kW/UPS module exported towards the grid
Response time from activation request	< 1 Second
Backfeed to grid duration	Modbus RTU: until minimum state of charge is reached dry contact: 0-200, selectable
Deactivation ramp	Modbus RTU: instantaneous control, dynamic setpoint dry contact: 0-100%, selectable
Battery maximum charge status*	0-100%, selectable
Battery type compatibility	VRLA, Li-Ion**, NiCd
Communication with external gateways	Modbus RTU or dry contact***
Activation	Dedicated Module 1 license

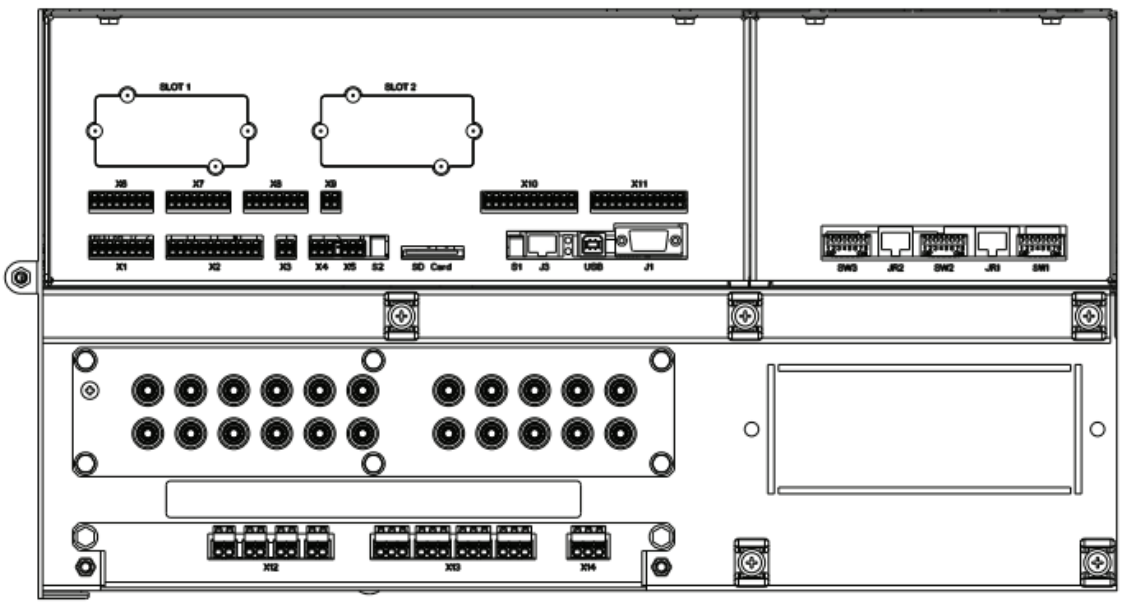
* defines the minimum level beyond which the back feed reduction mode is inhibited

** valid for Li-Ion batteries officially compatible with this UPS, lithium iron phosphate battery is recommended.

*** if dry contact communication is selected, the activation power is a predefined setpoint (programmable)

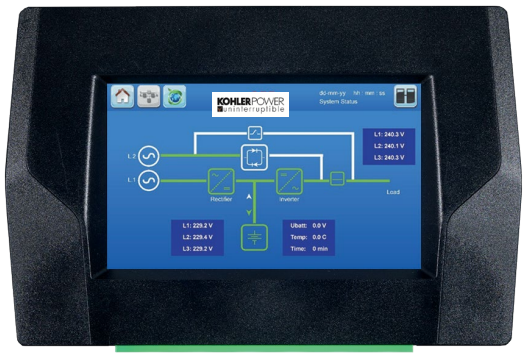
REMOTE CONTROL AND MONITORING

Communications - Hard Wired (fitted as standard)	
Inputs dry ports X1, X7, X8	X1 / X7 / X8 can hold Cable from 0.2mm2 – 1.5mm^2 All X1 / X7 / X8 are inputs, cable max. R 50Ω at 10mA X1 (4 inputs): Generator operation ON, External output breaker, external manual bypass, remote shut down X7-X8 (8 inputs) are programmable inputs
High voltage input port X12	X12 terminals can hold Cable from 0.2mm2 – 1.5mm^2 X12 are inputs rated: Min. 87 Vac – Max. 277 Vac 50Hz/60Hz X12 are programmable inputs
Input analog port X6	X6 can hold Cable from 0.2mm2 – 1.5mm^2 All X6 are analogue inputs, designed for sensors with standard industry output 1-24Vdc or 4-20mA
Input battery temperature sensor X3	X3 can hold Cable from 0.2mm2 – 1.5mm^2
Modbus communication power X4	X4 terminals can hold Cable from 0.2mm2 – 1.5mm^2 X4 are differential 5V RS485 signals
CAN bus communication port X5	X5 terminals can hold Cable from 0.2mm2 – 1.5mm^2 X5 are differential 5V RS485 signals
Output dry port X2,X10, X11	X2, X10 and X11 terminals can hold Cable from 0.2mm2 – 1.5mm^2 X2, X10 and X11 are potential free contacts and are rated: Max 30Vac/1A; 60Vdc/0.5A. X2 (4 outputs) : common alarm, battery low, load on inverter, main failure X10,X11 (8 outputs) are programmable outputs
High voltage output power X13	X13 terminals can hold Cable from 0.2mm2 – 1.5mm2 X13 are output rated: Max. 5A @ 277 Vac or 5A @ 30VDC X13 are programmable outputs
Output + 24dc X9	X9 can hold Cable from 0.2mm2 – 1.5mm2 X9 is an output port rated: 24Vdc @ 100mA Max
Synchronization input port X14	X14 terminals can hold Cable from 0.2mm2 – 1.5mm^2 X14 are inputs and are rated: Max. 415 Vac
Communications - Network Card Options	
Slot 1	SNMP Card or Modbus TCP/IP or Modbus RS-485
Slot 2	SNMP Card or Modbus TCP/IP or Modbus RS-485



UPS CONTROL AND MONITORING

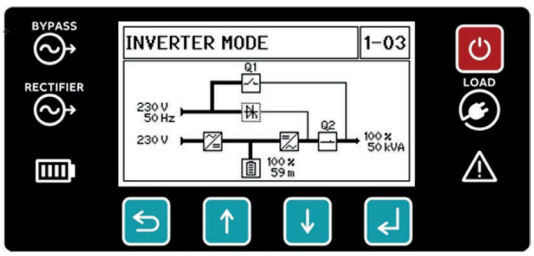
System Control Panel



Each UPS system has a system graphical display. It is a 7” touchscreen display enabling the operator to perform:

- Monitoring and measuring of the power flow through the UPS system, individual power modules and batteries
- Monitoring of UPS operational status, events, and alarm history
- If the system control panel fails each module can still be operated using their own panel
- UPS setting configuration
- UPS Data

Module Control Panel



The power module has its own control panel consisting of an LCD display, control and navigation buttons and led status indicators. The LCD display shall display:

- Mimic diagram of the power module showing the rectifier, battery, static bypass, inverter status and the input, bypass, battery, and output measurements: voltage, frequency, power
- Power module status: off, disconnected, inverter mode, bypass mode, battery mode, stand-by mode
- Power module location: Power frame and power module number

The control and navigation buttons shall allow the user to perform settings and adjustments, monitor the voltages, currents, frequencies, power measurements and scroll the main and sub-menus in the UPS module.

The user shall be able to identify the status of the bypass, rectifier, battery and UPS output and the alarm by reading the LED indicators. The LEDs are always active even if the display is in screensaver mode. Please refer to the OPM for more information.

INSTALLATION AND PLANNING

INSTALLATION PLANNING

The following *guidelines* should be considered when planning a suitable UPS location and working environment.

Location considerations summary

- The UPS equipment must be installed and transported in an upright position.
- The floor at the installed location and en-route from the off-loading point must be able to safely take the weight of the UPS and battery equipment.
- The floor material where the UPS is to be located should be non-flammable.
- Local fire protection standards must be respected.
- The appropriate power supplies must be accessible so that the UPS cabling can be performed easily.

Environmental considerations summary

- Avoid high ambient temperature, moisture, and humidity. The prescribed limits are humidity (<90% non-condensing) and temperature (0°C to +40°C and ideally 18°C to 25°C).
- A battery temperature of 20°C is recommended for VRLA to achieve a long battery life.
- Any prescribed air-cooling flow must be available. Ensure the air conditioning system can provide enough air cooling to keep the room at, or below, the maximum desired temperature.
- No dust or corrosive/explosive gases should be present.
- The location must be vibration-free.

UPS Cabinet Installation

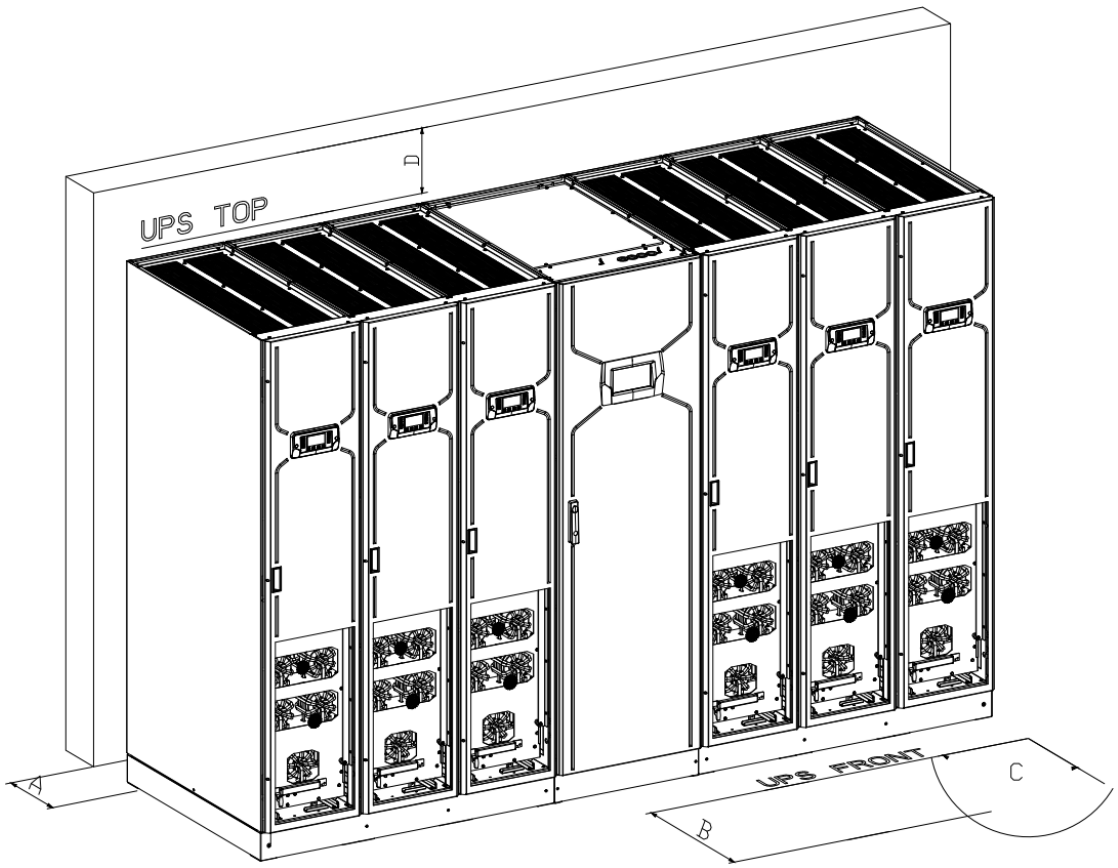
Before moving the UPS to its final position, carry out any necessary pre-installation cabling (power and control cables) to ensure that full cable access is available once the UPS is placed in-situ. Top or bottom cable access is possible, or a combination of the two.

Battery Installation

The battery system should be contained in a purpose-designed cabinet or mounted on a suitable open or closed battery rack. The battery cabinet can be positioned on either side of the UPS cabinet and they can also be in a separate room or location. If the batteries are to be mounted on external battery racks, rather than cabinet mounted, the battery must be sized to consider the voltage drop between the battery installation and UPS. Contact Rehlko Ltd. For installation advice and support if necessary.

UPS FOOTPRINT AND CLEARANCES

The minimum needed clearances to allow sufficient airflow on the UPS system and to allow proper services and maintenance shall be respected as reported below



UPS Clearances	
A - Rear clearance for ventilation	0 mm (Can be positioned against a wall)
B - Front clearance to allow door to open	1500 mm *
C - Maximum door opening angle	95 °
D - Top clearance	500 mm

*Front clearance of 1,200mm can be accepted if the power module is removed by 2 service engineers.

SINGLE LINE DIAGRAM

The MegaFlex DPA CSB UPS frames (4-slots / 6-slots / 8-slots) can support different type of installation and wiring schemes. Single/common input feed or Dual/separate (Rect./Byp.) input feed, as well as common or separate battery configurations

The configuration should be selected according to project requirements, site installation needs and possible restrictions. In this section several configurations are presented with recommended AC (In/Out) and DC cable and protection selections for each possible configuration.

The information provided in this section should assist in the planning and preparation of the UPS power cabling.

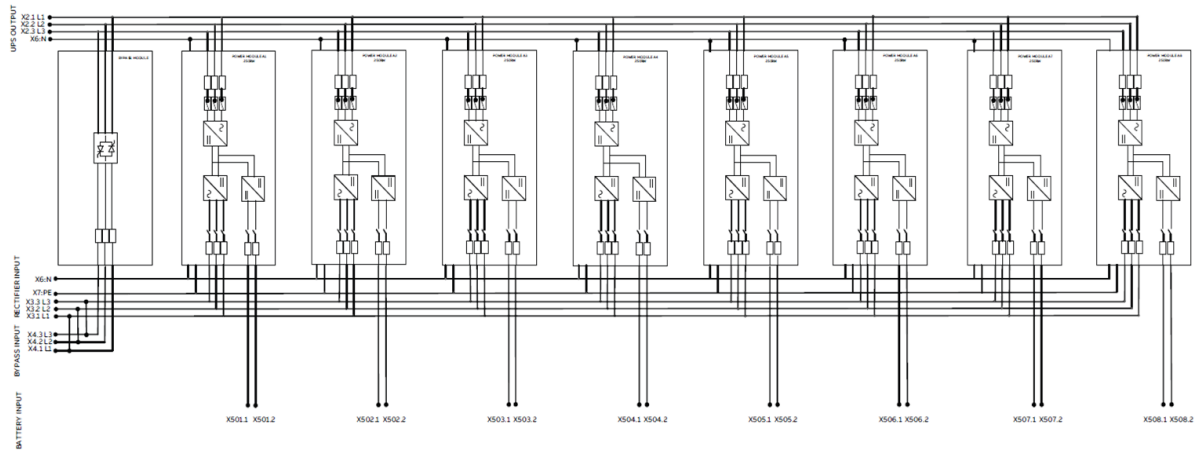
As shown below, the UPS input mains should be connected to the UPS system via a circuit breaker or fused device. The input device provides a means of isolating the UPS from the utility mains supply and must be suitably rated to provide overload protection for the UPS. Similarly, the UPS output should be connected to the load equipment via a suitably protected UPS system output panel.

The tables below shows the maximum UPS input and output current for each set of cables together with the cable termination details. This is provided to assist the customer in selecting appropriately rated power cables and external switchgear.

Cable Terminations

Terminals Description	Label	Cable Size	Torque (Nm)
Input Line L1	X3.1: L1	M12 Bolt Terminal	42
Input Line L2	X3.1: L2	M12 Bolt Terminal	42
Input Line L3	X3.1: L3	M12 Bolt Terminal	42
Bypass (Separate)	X4.1: L1	M12 Bolt Terminal	42
Bypass (Separate)	X4.2: L1	M12 Bolt Terminal	42
Bypass (Separate)	X4.3: L1	M12 Bolt Terminal	42
Neutral Bar (Common Neutral)	X6: N	M12 Bolt Terminal	42
Earth Bar (Common Earth)	X7 : PE	M12 Bolt Terminal	42
Output Line L1	X2.1: L1	M12 Bolt Terminal	42
Output Line L2	X2.1: L2	M12 Bolt Terminal	42
Output Line L3	X2.1: L3	M12 Bolt Terminal	42
Battery Terminal + (Common battery)	X51.1: +	M12 Bolt Terminal	42
Battery Terminal - (Common battery)	X51.2: -	M12 Bolt Terminal	42
Battery Terminal + (Separate batteries)	X501.1: +	M12 Bolt Terminal	42
Battery Terminal - (Separate batteries)	X502.2: -	M12 Bolt Terminal	42

Single input feed and separate batteries with centralised static bypass



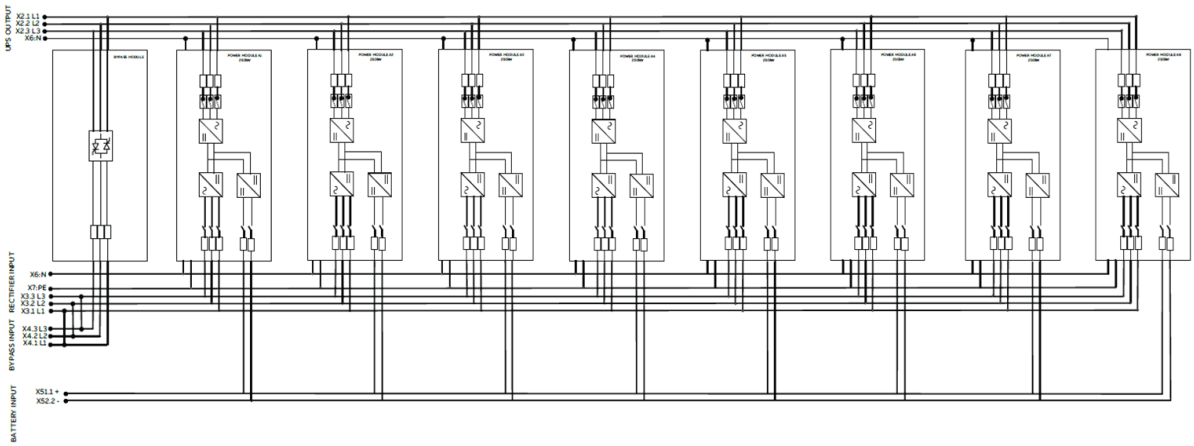
In a 'Separate battery' installation the UPS battery busbars are removed, and the individual battery positive and negative cables are connected directly to the modules' battery circuit breaker (F3)

Input /output protection values calculated at 380V

Recommended external protection & Cables	1000kVA	1250kVA	1500 kVA	1750 kVA	20000 kVA
Rectifier input fuse gL or MCCB	1600A	2000A	2500A	3200A (x0.9 In)	3200A
Rectifier input cable section (L1,L2,L3,N)	4 x (4 x 300mm^2)	4 x (5 x 300mm^2)	4 x (6 x 300mm^2)	4 x (7 x 300mm^2)	4 x (8 x 300mm^2)
UPS output fuse gL or MCCB, 3P or 4P	1600A	2000A	2500A	3200A (x0.9 In)	3200A
Output cable section (L1,L2,L3,N)	4 x (4 x 300mm^2)	4 x (5 x 300mm^2)	4 x (6 x 300mm^2)	4 x (7 x 300mm^2)	4 x (8 x 300mm^2)
Separate Battery					
Battery input fuse gR or MCCB (Separate to each module)	2x630A per module				
Battery Cable section (+,-) (Separate to each module)	4x185mm^2 per module				
Earth cable section (PE)	1 x 185mm^2 Per module				

Single Input feed kit should be installed on UPS frame, provided as option.

Single input feed and common batteries with centralised static bypass

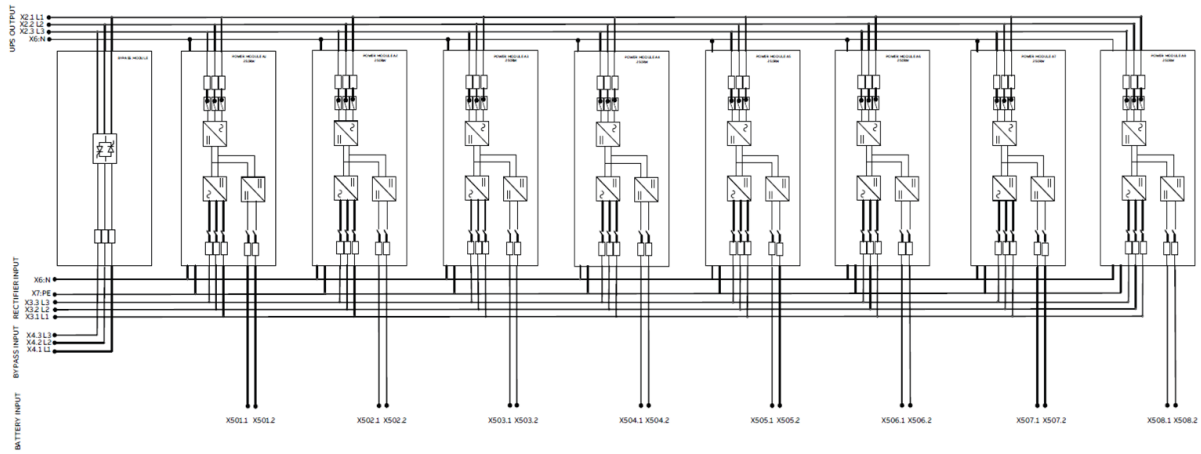


Input /output protection values calculated at 380V

Recommended external protection & Cables	1000kVA	1250kVA	1500 kVA	1750 kVA	20000 kVA
Rectifier input fuse gL or MCCB	1600A	2000A	2500A	3200A (x0.9 In)	3200A
Rectifier input cable section (L1,L2,L3,N)	4 x (4 x 300mm^2)	4 x (5 x 300mm^2)	4 x (6 x 300mm^2)	4 x (7 x 300mm^2)	4 x (8 x 300mm^2)
UPS output fuse gL or MCCB, 3P or 4P	1600A	2000A	2500A	3200A (x0.9 In)	3200A
Output cable section (L1,L2,L3,N)	4 x (4 x 300mm^2)	4 x (5 x 300mm^2)	4 x (6 x 300mm^2)	4 x (7 x 300mm^2)	4 x (8 x 300mm^2)
Common Battery					
Common connection Battery input fuse gR or MCCB. (1 input for full frame common battery)	2500A	3200A	4000A	5000 (x0.8In)	5000A
Battery cable section, 2 poles, cable section (+) & (-)	2x (4x 185^{2}mm)	2x (5x 185^{2}mm)	2x (6x 185^{2}mm)	2x (7x 185^{2}mm)	2x (8x 185^{2}mm)
Earth cable section (PE)	4 x 185mm2	5 x 185mm2	6 x 185mm2	7 x 185mm2	8 x 185mm2

Single Input feed & Common battery busbar kits should be installed on UPS frame, provided option.

Dual input feed and separate batteries with centralised static bypass

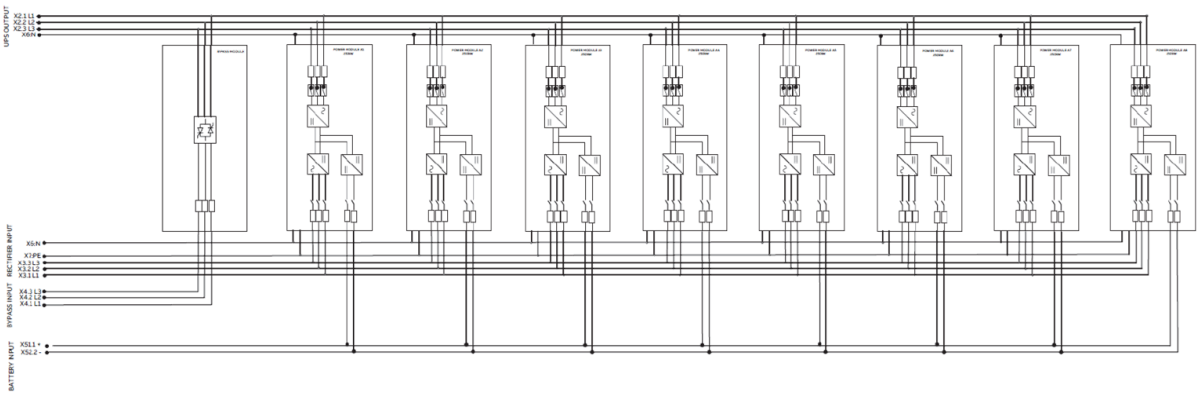


In a 'Separate battery' installation the UPS battery busbars are removed, and the individual battery positive and negative cables are connected directly to the modules' battery circuit breaker (F3)

Input /output protection values calculated at 380V

Recommended external protection & Cables	1000kVA	1250kVA	1500 kVA	1750 kVA	20000 kVA
Rectifier input fuse gL or MCCB	1600A	2000A	2500A	3200A (x0.9 In)	3200A
Rectifier input cable section (L1,L2,L3,N)	4 x (4 x 300mm^2)	4 x (5 x 300mm^2)	4 x (6 x 300mm^2)	4 x (7 x 300mm^2)	4 x (8 x 300mm^2)
Bypass (separate) fuse gL or MCCB	1600A	2000A	2500A	3200A (x0.9 In)	3200A
Bypass (separate) cable section (L1,L2,L3,N)	4 x (4 x 300mm^2)	4 x (5 x 300mm^2)	4 x (6 x 300mm^2)	4 x (7 x 300mm^2)	4 x (8 x 300mm^2)
UPS output fuse gL or MCCB, 3P or 4P	1600A	2000A	2500A	3200A (x0.9 In)	3200A
Output cable section (L1,L2,L3,N)	4 x (4 x 300mm^2)	4 x (5 x 300mm^2)	4 x (6 x 300mm^2)	4 x (7 x 300mm^2)	4 x (8 x 300mm^2)
Separate Battery					
Battery input fuse gR or MCCB (Separate to each module)	2x630A per module				
Battery Cable section (+,-) (Separate to each module)	4x185mm^2 per module				
Earth cable section (PE)	1 x 185mm^2 Per module				

Dual input feed and common batteries with centralised static bypass



Input /output protection values calculated at 380V

Recommended external protection & Cables	1000kVA	1250kVA	1500 kVA	1750 kVA	20000 kVA
Rectifier input fuse gL or MCCB	1600A	2000A	2500A	3200A (x0.9 In)	3200A
Rectifier input cable section (L1,L2,L3,N)	4 x (4 x 300mm^2)	4 x (5 x 300mm^2)	4 x (6 x 300mm^2)	4 x (7 x 300mm^2)	4 x (8 x 300mm^2)
Bypass (separate) fuse gL or MCCB	1600A	2000A	2500A	3200A (x0.9 In)	3200A
Bypass (separate) cable section (L1,L2,L3,N)	4 x (4 x 300mm^2)	4 x (5 x 300mm^2)	4 x (6 x 300mm^2)	4 x (7 x 300mm^2)	4 x (8 x 300mm^2)
UPS output fuse gL or MCCB, 3P or 4P	1600A	2000A	2500A	3200A (x0.9 In)	3200A
Output cable section (L1,L2,L3,N)	4 x (4 x 300mm^2)	4 x (5 x 300mm^2)	4 x (6 x 300mm^2)	4 x (7 x 300mm^2)	4 x (8 x 300mm^2)
Common Battery					
Common connection Battery input fuse gR or MCCB. (1 input for full frame common battery)	2500A	3200A	4000A	5000 (x0.8In)	5000A
Battery cable section, 2 poles, cable section (+) & (-)	2x (4x 185^{2}mm)	2x (5x 185^{2}mm)	2x (6x 185^{2}mm)	2x (7x 185^{2}mm)	2x (8x 185^{2}mm)
Earth cable section (PE)	4 x 185mm2	5 x 185mm2	6 x 185mm2	7 x 185mm2	8 x 185mm2

Heat Dissipation

UPS Power Rating		1000kW	1250kW	1500 kW	1750 kW	20000 kW
Maximum Airflow EN62040-1	M3/h	7576	9470	11364	13258	15152
	CFM	4459	5574	6688	7803	8918
Heat Dissipation 25% Load	W	7175	8969	10763	12556	14350
	BTU/h	24482	30603	36725	42844	48964
Heat Dissipation 40% Load	W	10467	13084	15700	18317	20934
	BTU/h	35715	44644	53570	62501	71430
Heat Dissipation 50% Load	W	13347	16684	20021	23357	26694
	BTU/h	45541	56928	68314	79697	91082
Heat Dissipation 75% Load	W	22877	28596	34316	40035	45754
	BTU/h	78060	97573	117091	136605	156120
Heat Dissipation 100% Load	W	36699	45874	55049	64223	73398
	BTU/h	125222	156528	187835	219139	250444
Heat Dissipation No Load	W	4000	5000	6000	7000	8000
	BTU/h	13647	17059	20471	23882	27294

STANDARD FEATURES

Cold Start

The cold start function allows starting a UPS (or UPS module) without the input mains present during the status UPS total off.

The start-up could then be performed directly sourcing from the battery to feed the inverter to supply the relevant load during a limited time (battery charge and load dependable).

UPS power walk-in when transferring back from batteries to utility

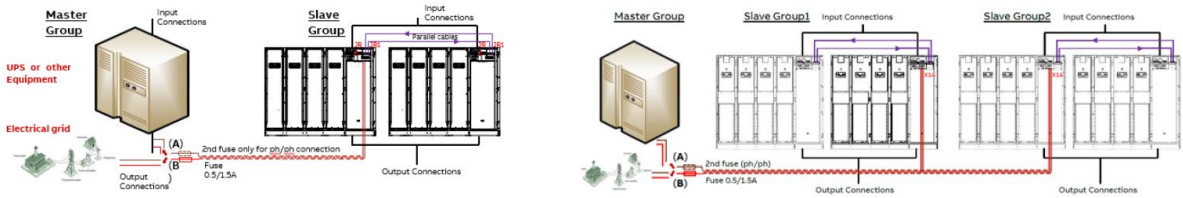
It's possible to set a ramp-up on modules (rectifier walk-in activation) and a delay on connecting each system module to facilitate returns after mains failure without impacting on full power demand-in.

When system detects input mains (utility) restored to nominal values, the first module ramp-up will start after a configurable delay. Rectifier automatically starts with the walk -in as soon as the input mains is within tolerance. Meanwhile load is supported from Battery-Inverter operation. Every additional module will start (also ramp-up) after previous module, with configurable delay.

UPS power walk-in	
First module ramp-up configurable delay	1-20 Seconds
After first module full loaded, every additional module step-activation	3 – 60 (set in 3 second steps)
Example MF Series 1000kVA frame 4x250kW modules	
"Fastest" configurable TOTAL walk-in for (4 x M250) example	First module starting after 1 sec.; Last one module starting after 10 sec. Total sequence: (1 + 3 + 3 + 3 = 10 sec)
"Slowest" configurable TOTAL walk-in for (4 x M250) example	First module starting after 20 sec.; Last one module starting after 200 sec. Total sequence: (20 + 60 + 60 + 60 = 200 sec)

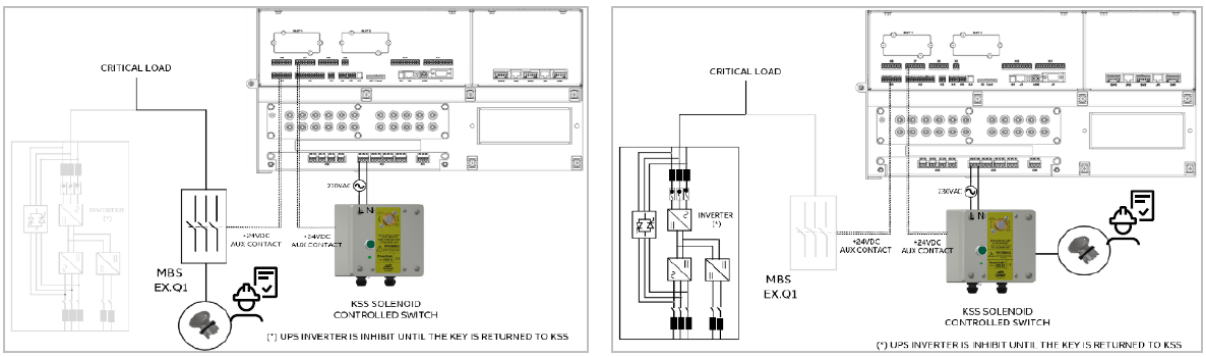
Synchronization Feature

The MF Series Synchronization Feature enables to synchronize the output voltage of one or more UPS Slave-group/s (single UPS frame or a parallel system composed of multiple UPS frames) with any AC electrical line. For more information on the procedure and configuration, refer to the User/Installation product Manual.



Castell Key Interlock

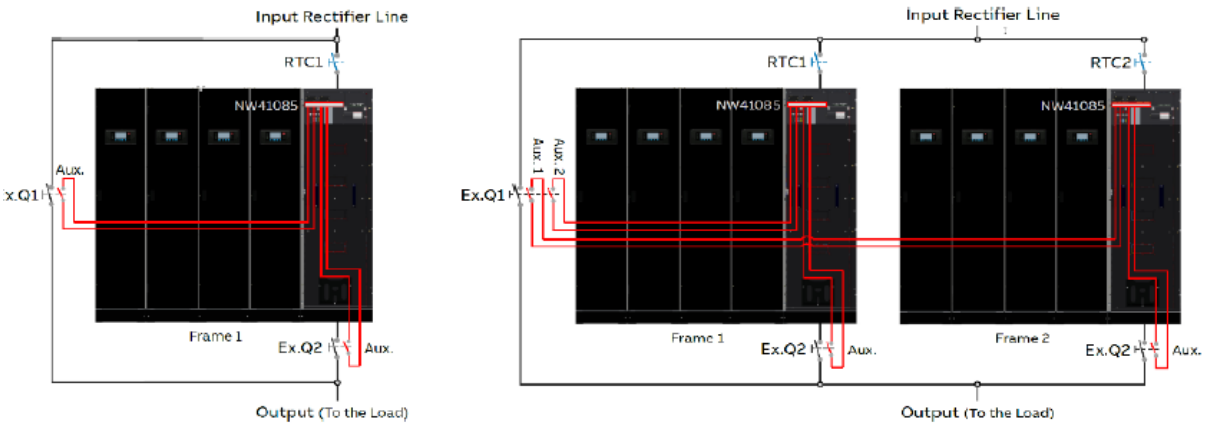
Castell key interlock functionality can be applied between UPS and the external manual bypass switch to avoid unnecessary switching between Modes of Operation producing an interruption of power supply for the critical load. The Castell key interlock is usually consisting of two locks (MBS & KSS Solenoid Switch) and one key.



The KSS interlock device is an external piece of hardware, not provided by Rehlko. Additional external wiring connections to interface unit and UPS secured power supply are required for the KSS interlock device. **See User Manual to see connections and more information**.

External Maintenance Bypass Switch and Output Switch connections

The monitoring of the external maintenance bypass switch (EXT Q1) and the external output switch (EXT Q2) is mandatory for the UPS operation.



Therefore, the auxiliary contacts of EXTQ1 and EXT Q2 should be connected to the to the input dry port X1 in the communication interface.

For more information on the procedure and configuration, refer to the User Manual.