



POWER ELECTRONICS®

**ENERGY STORAGE
& POWER QUALITY**

PURE ENERGY

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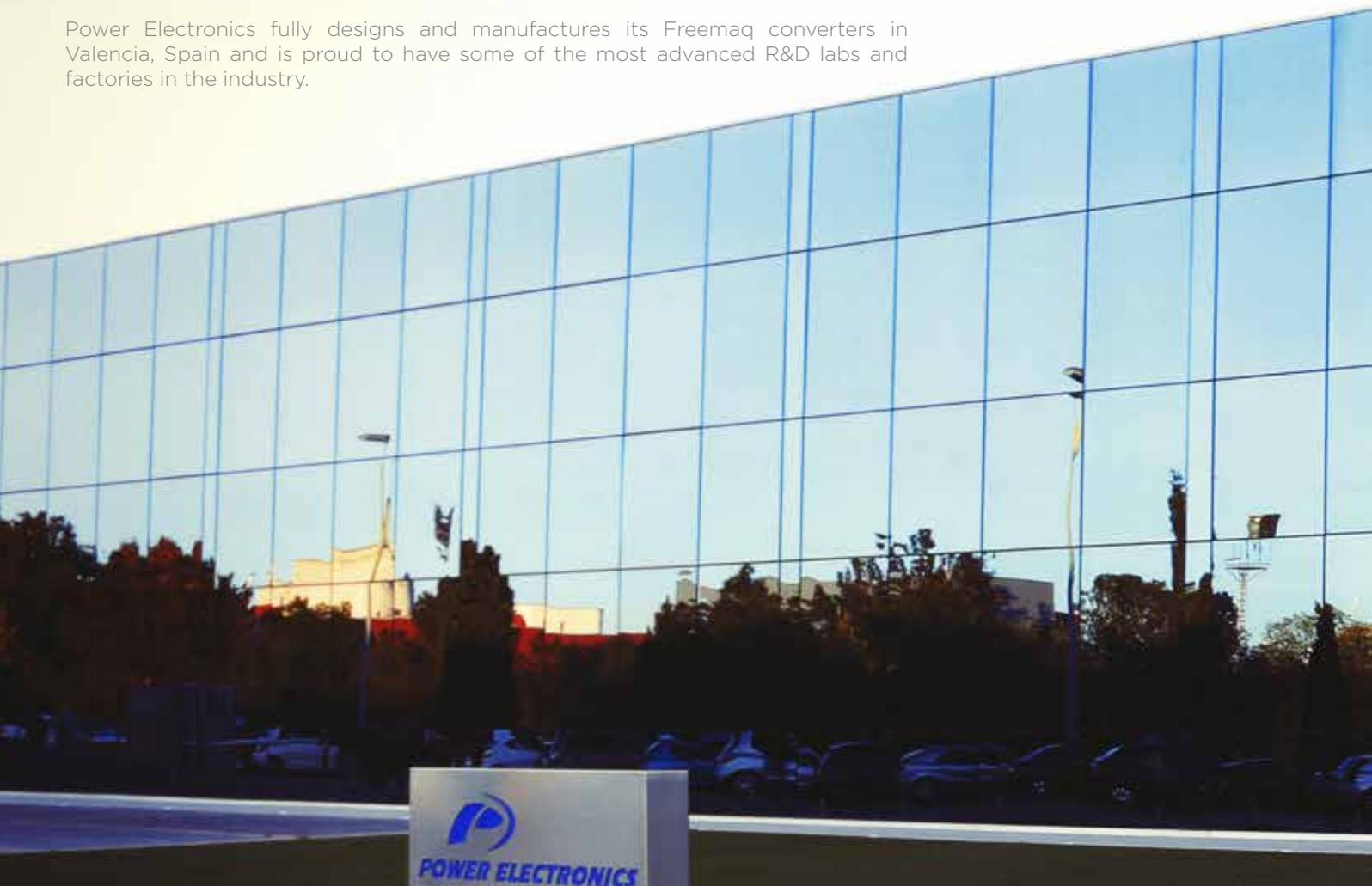
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ABOUT US

Since 1987 Power Electronics Industrial division has been producing high power variable speed drives and soft starters for low and medium voltage AC motor applications. This experience has allowed Power Electronics to position itself as the leading manufacturer of utility scale solar inverters thanks to our unique product features, patented designs, fastest global delivery times and unbeatable 24/7 Power on Support.

Power Electronics fully designs and manufactures its Freemaq converters in Valencia, Spain and is proud to have some of the most advanced R&D labs and factories in the industry.



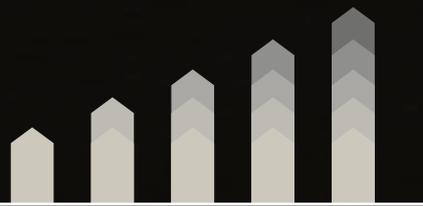
+45
countries

Financial stability and strength



+30 years

of product
excellence and
diversification



5GW
annual capacity

+6GW Solar Inverters Installed



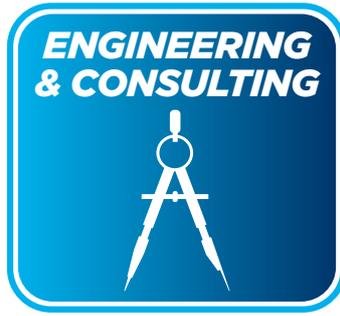
Product and Factory independent
Reports and Certifications



25 years EOL design

3 years
warranty

25 years
extension
warranty



Energy experts

Energy projects often require customer specific solutions, for this reason our clients also have our Engineering and Consulting department at their disposal, which comprise a wide number of highly skilled and experienced engineers that are available to modify our standard product to suit customer demands and ensure our clients get the product they need.





Vertical integration for customer satisfaction

Flexibility and specialization play a key role in standard product manufacturing but even more in customized products. Vertical integration gives us the flexibility to be able to adapt to customer requirements and still provide very short lead times.

RELIABLE ENGINEERING

DESIGN FLEXIBILITY

HIGH QUALITY COMPONENTS

VALUE CHAIN SUPERVISION

FACTORY TESTED

IMMEDIATE DELIVERY





Power on Support customer oriented strategy

Power on Support is the concept of a customer oriented strategy implemented by Power Electronics since its origins more than 30 years ago with 24/7 after sales service available for all our customers and end users without the need of signing an O&M contract.

COMMISSIONING ASSISTANCE

3 YEAR WARRANTY

24/7 CUSTOMER SUPPORT

24/7 ONSITE ASSISTANCE

TRAINING SEMINARS

SPARE PARTS WARRANTY



COMMISSIONING



START

WARRANTY

3
YEARS

CUSTOMER SUPPORT



ON SITE
TECHNICAL SERVICE



TRAINING SEMINARS



SPARE PARTS
WARRANTY



AVAILABILITY





UNITED STATES

UNITED KINGDOM

SPAIN

MEXICO

PANAMA

COLOMBIA

MOROCCO

CHILE

PERU

BRAZIL

SOUTH AFRICA

power-electronics.com

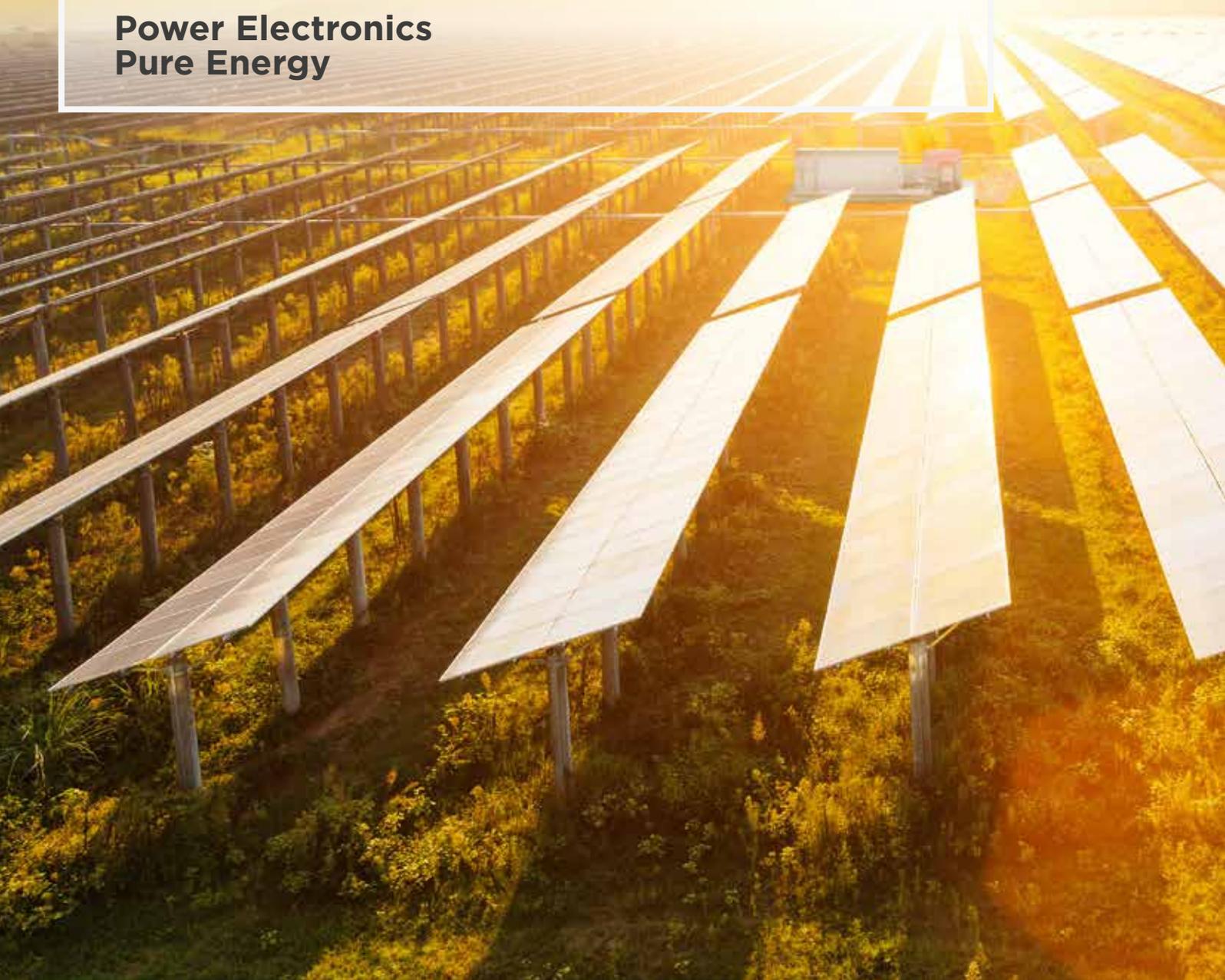
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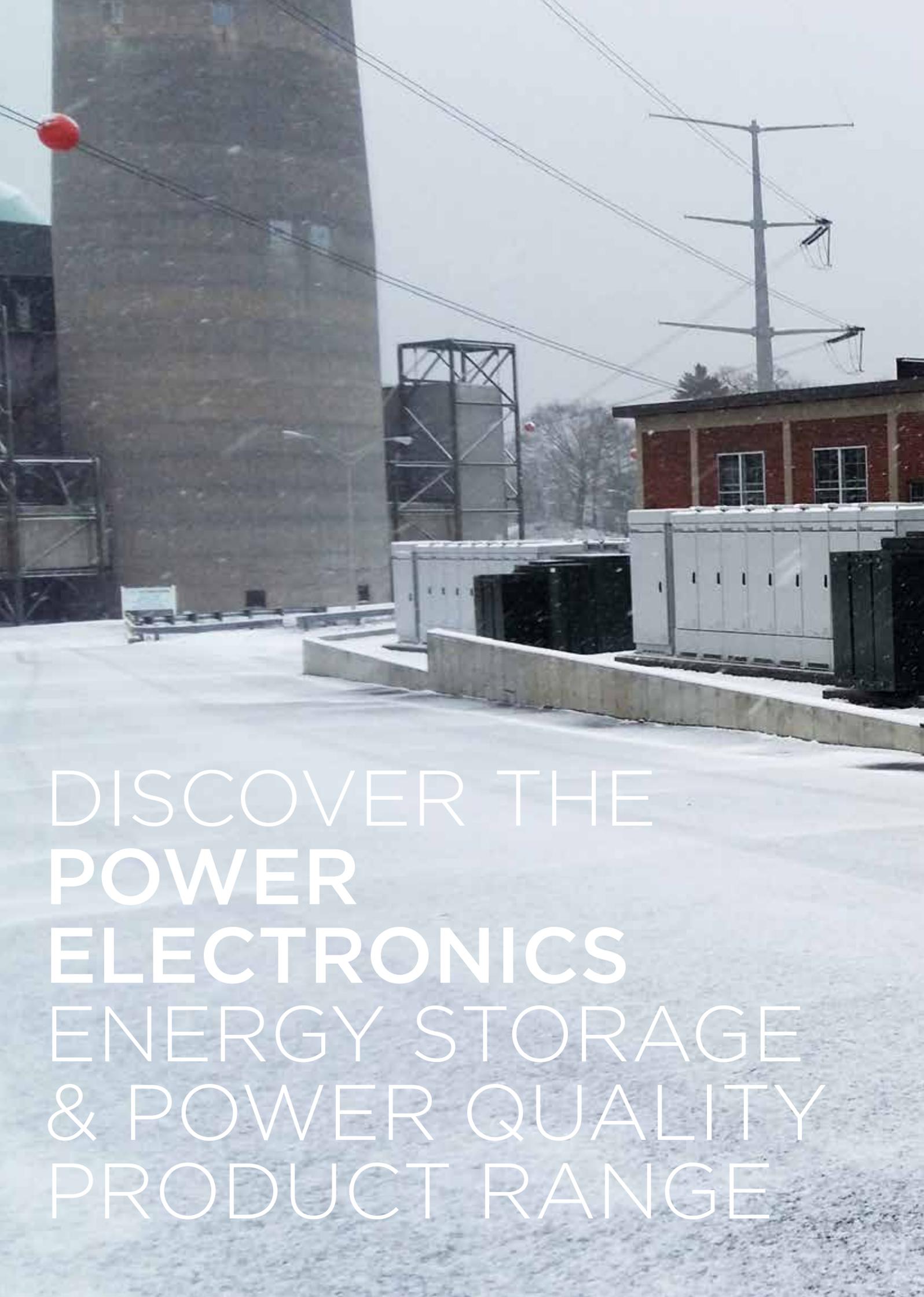
PURE ENERGY

is our motivation for leading the renewable energy generation, it is the search for product and service perfection, it is our vision of a world, clean and sustainable for our children and future generations.

**Power Electronics
Pure Energy**





A photograph of an industrial facility in winter. The ground is covered in snow. In the foreground, there are several large, white, rectangular power cabinets or transformers arranged in a row. Behind them is a brick building with several windows. To the left, a tall, dark, cylindrical structure, possibly a chimney or cooling tower, is visible. Power lines and a utility pole are also present in the scene. The overall atmosphere is cold and industrial.

DISCOVER THE
POWER
ELECTRONICS
ENERGY STORAGE
& POWER QUALITY
PRODUCT RANGE

UNITED STATES
CASCO BAY, 18MW
Freemaq PCS





Freemaq DC/DC

BIDIRECTIONAL OUTDOOR
DC/DC CONVERTER

350kW - 500kW

p. 16



Freemaq PCS

OUTDOOR BATTERY INVERTER

690kVA - 2815kVA

370Vac - 690Vac

p. 22

Freemaq Hybrid

OUTDOOR HYBRID INVERTER

990kVA - 3000kVA

530Vac - 690Vac

p. 38



Freemaq STATCOM

OUTDOOR STATIC COMPENSATOR

1275kVA - 3000kVA

690Vac

p. 50



PPC

POWER PLANT CONTROLLER

p. 58

UNITED STATES
PIMA, 11MW
Freemaq PCS



*RELIABLE AND ROBUST
OUTDOOR TECHNOLOGY*

Freemaq DC/DC

BI-DIRECTIONAL DC/DC CONVERTER



Freemaq DC/DC

The new Power Electronics Freemaq DC/DC is a bi-directional DC converter designed to maximize the benefits of the large-scale solar plants with a solar-plus-storage approach, offering a cutting-edge technology product that is able to reduce the CAPEX of PV installations coupled with energy storage systems, avoiding the installation of an additional station with a dedicated MV transformer.

Following the Power Electronics philosophy, the Freemaq DC/DC is a modular outdoor solution available from 375kW to 3500kW, fully compatible with different battery technologies and manufacturers, with a voltage range up to 1500Vdc and the highest efficiency in the market.

This product has been designed to be easily integrated with a Freesun HEC V1500 inverter in new or already installed PV power plants, being the most cost-competitive solution for battery storage systems paired with PV installations.

By coupling the Power Electronics Freemaq DC/DC converter with a HEC V1500 solar inverter, it is possible to perform functions such as: energy shifting, ramp control rate, frequency response, and most importantly, clipping energy recovery, that will boost customer revenues.

THE MOST COST
COMPETITIVE SOLUTION
FOR SOLAR + STORAGE
INSTALLATIONS



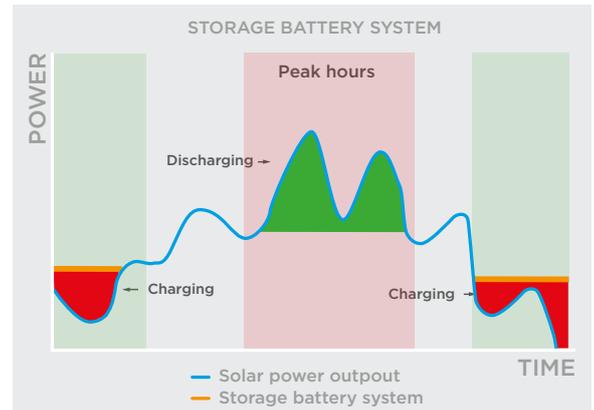
ENERGY STORAGE APPLICATIONS

Following the instructions of a plant control system, the Freemaq DC/DC can perform multiple power and dynamic grid support functions such as:



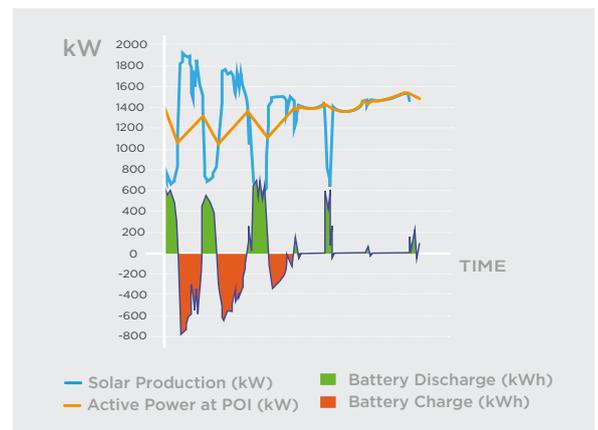
LOAD LEVELING

Freemaq DC/DC series are able to store energy during periods of low demand from the grid, in order to later supply this energy when there is a higher demand. This has the benefit of selling the energy at a higher market price during peak periods. It also allows grid operators to supply electricity with a higher renewable origin. Since PV generation may not be at the same time as peak demand, this facilitates the flexibility and integration of renewable generation into the grid.



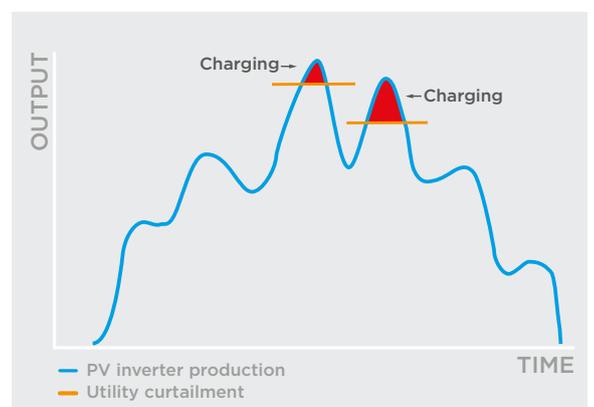
RENEWABLE INTEGRATION

The Power Electronics Freemaq DC/DC series attenuates the intermittent nature of renewable energy sources, to provide a smoother power output. The Freemaq DC/DC controls the ramp rate at which power is injected into the grid, and thus reduces the impact of rapid power fluctuations due to sudden or transient conditions experienced by the PV array.



UTILITY CURTAILMENT RECOVERY

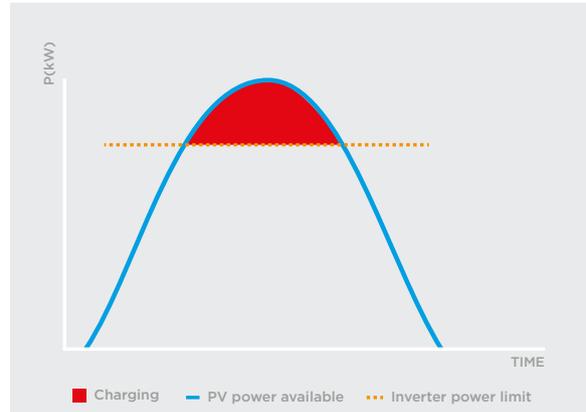
Utility scale inverter production can be curtailed by the grid operator, due to the high energy sources penetration in the grid during certain periods. With this AC-coupled energy storage system, the excess energy from the PV field can be stored in the BESS and then delivered when needed.





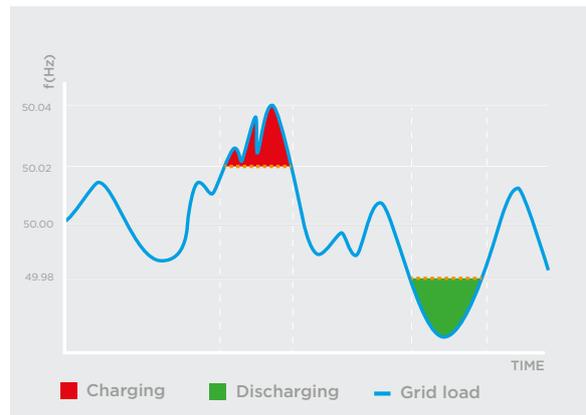
CLIPPING RECOVERY

The Power Electronics Freemaq DC/DC gets the maximum revenues from the PV generator, by charging the battery storage system when the PV inverter is clipping the output power, due to the high DC/AC power ratios. This stored energy can be exported to the utility grid when the price per KWh is high.



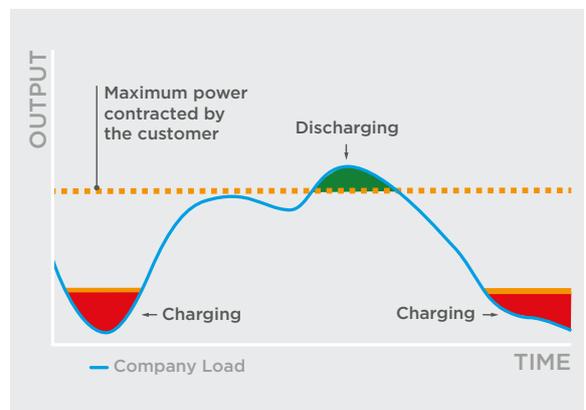
FREQUENCY REGULATION SYSTEM

Freemaq DC/DC provides ability to regulate grid frequency in both directions. When there is a grid over-frequency (generation > demand) inverter power output is curtailed and this energy is stored. When there is a grid under-frequency (generation < demand) inverter power output is increased by discharging the batteries and injecting more power to the grid.



PEAK POWER SHAVING

By delivering stored energy to the grid during periods of high demand, it reduces the burden on the distribution network and increases significantly its efficiency. Energy is stored during periods of low demand increasing the load on the grid. During peak periods this stored energy is then injected into the grid reducing the demand at this time. The result is a more flattened demand curve which means the grid can avoid switching on more expensive and polluting generators.



Freemaq DC/DC

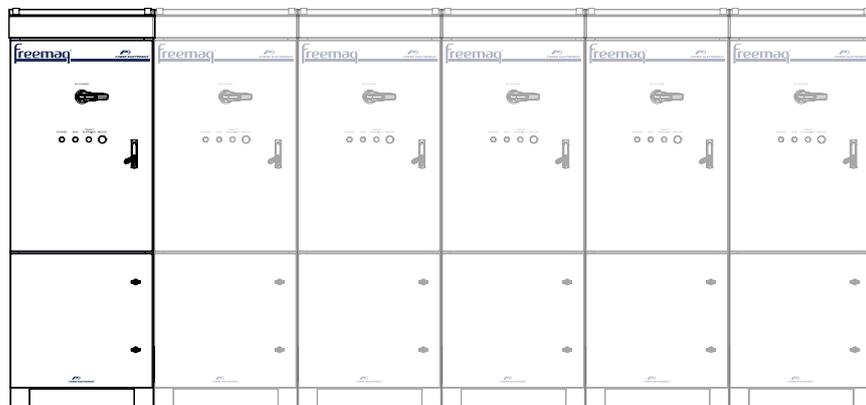
TECHNICAL CHARACTERISTICS

REFERENCE		Freemaq DC/DC	
		FD0375	FD0500
DC INPUT & OUTPUT	DC Rated Power (kW) @50°C	375	500
	DC PV Voltage Range (Vdc) ^[1]	800 to 1310	
	DC ESS Voltage Range (Vdc)	700 to 1310	
	Maximum DC PV Input Voltage (Vdc)	1500	
	DC Voltage Ripple	<3%	
	Maximum DC Output Current (A)	542	722
	Battery Technology	Compatible with all battery technologies	
EFFICIENCY	Efficiency (Max)	99% (target)	
	Max. Standby Consumption	< approx. 50W	
CABINET	Dimensions (WxDxH)	550 x 947 x 2200 (21.6" x 37.3" x 86.6")	
	Cooling	Forced air	
	Enclosure Rating	NEMA 3R / IP54	
CONNECTIONS	Number of connections	3 positive / 3 negative	
	Terminals	Lugs Rated 90°C	
	Max. positive and negative input wire size	750 kcmil / 380mm ²	
ENVIRONMENTAL	Operating Temperature range ^[2]	-35°C to 60°C	
	Relative Humidity	4% to 95% non condensing	
	Max. Altitude	4000m; >2000m power derating	
	Audible Noise level	< 79 dBA	
CONTROL INTERFACE	Interfaces	Graphic display (HEC V1500 cabinet) Emergency pushbutton and indicator lights USB, RJ45 and RS 485 Freesun App	
	Communications Protocol	Modbus TCP, Modbus RTU	
PROTECTIONS	Ground Fault Detection	Insulation monitoring device	
	DC disconnection & protection (PV)	Built-in	
	DC disconnection (ESS)	Optional	
	Battery overvoltage protection	Optional	
CERTIFICATIONS	Safety Certification	UL-1741 (pending)	

NOTES [1] For other range consult Power Electronics.
[2] Heating resistors kit option below -20°C.

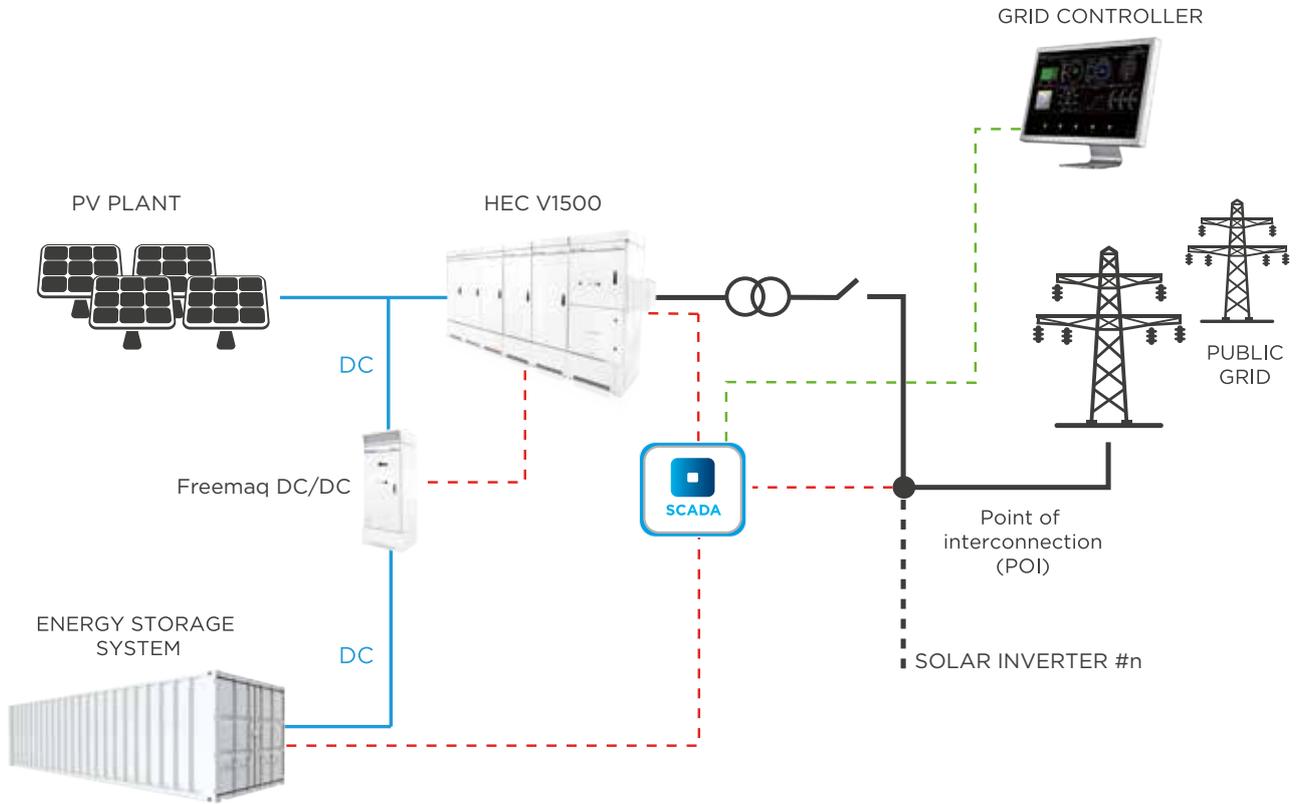
MODULAR DESIGN

Its unique modular design provides the flexibility needed to design your project, choosing the amount of storage power to be dispatched, according to the specific grid requirements.



from 375kW to 3MW

CONFIGURATION

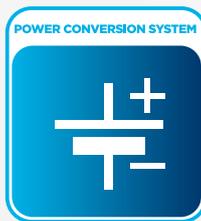


READY FOR THE
MOST DEMANDING
CONDITIONS



Freemaq PCS

UTILITY SCALE BATTERY INVERTER



Freemaq PCS

The Freemaq PCS is a modular solution from 690kW to 2815kW with configurable DC and AC voltages making it compatible with all battery technology and manufacturers. Power Electronics is a proven partner in the solar and energy storage market. The Power Electronics Freemaq PCS offers proven hardware to meet storage and grid support challenges.

The energy production industry is embracing renewable energy sources. However, high penetration creates power transmission instability challenges, thus Grid Operators require stringent dynamic and static grid support features for solar inverters and Power Conversion Systems (PCS).

The Freemaq PCS can perform grid support functions such as: Peak Shaving, Ramp Rate Control, Frequency Regulation, Load Leveling and Voltage Regulation, controlled by a Power Plant Controller or SCADA.

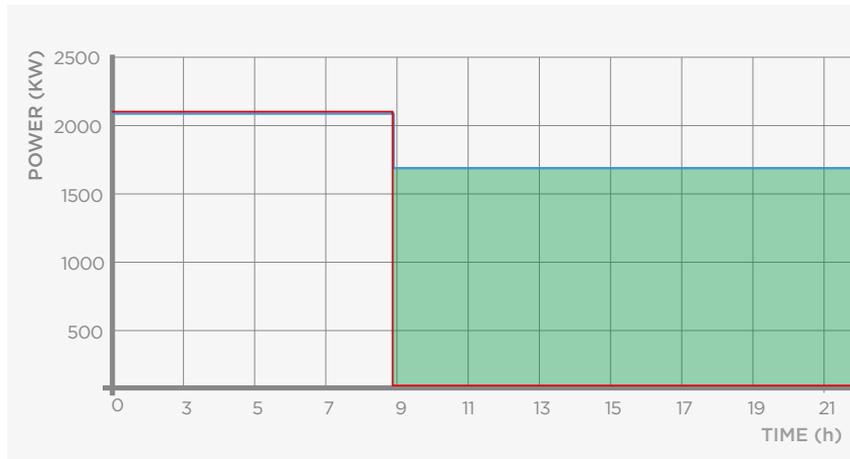
The Freemaq PCS stations are turn-key solutions ready for connection to the battery container and MV power distribution wiring. Units are designed for concrete pads, open skids or integrated into full container solutions.

PROVEN HARDWARE
AND ROBUST OUTDOOR
DESIGN FEATURED WITH
THE LATEST CONTROL



AUTOMATIC REDUNDANT POWER MODULE SYSTEM (ARPMS)

Freemaq PCS is a modular central battery inverter based on an Automatic Redundant Power Module (up to 400kVA per stage). If there is a fault in one power module, it is taken off-line and its output power is distributed evenly among the remaining functioning modules. All power modules work in parallel controlled by a dual redundant main control. As the main governor of the system it is responsible for the battery charge / discharge, synchronization sequence and overall protection. The automatic redundant capability based on our industrial systems is able to shift the main control in the event of a fault, restoring the backup control and restarting the station to guarantee high availability.



— Freemaq PCS Production (kW) - 1 Module fault ■ Freemaq PCS extra energy production (kWh)
— Central inverter Production (kW) - Fault



EASY TO SERVICE

By providing full front and rear access the Freemaq PCS series simplifies the maintenance tasks improving the MTTR (achieving a lower OPEX). The frontal access allows the checking of the whole electronic cabinet (electronics boards, semiconductors, power supply, contactors...) while the rear access permits the revision of AC fuses and LCL filter.

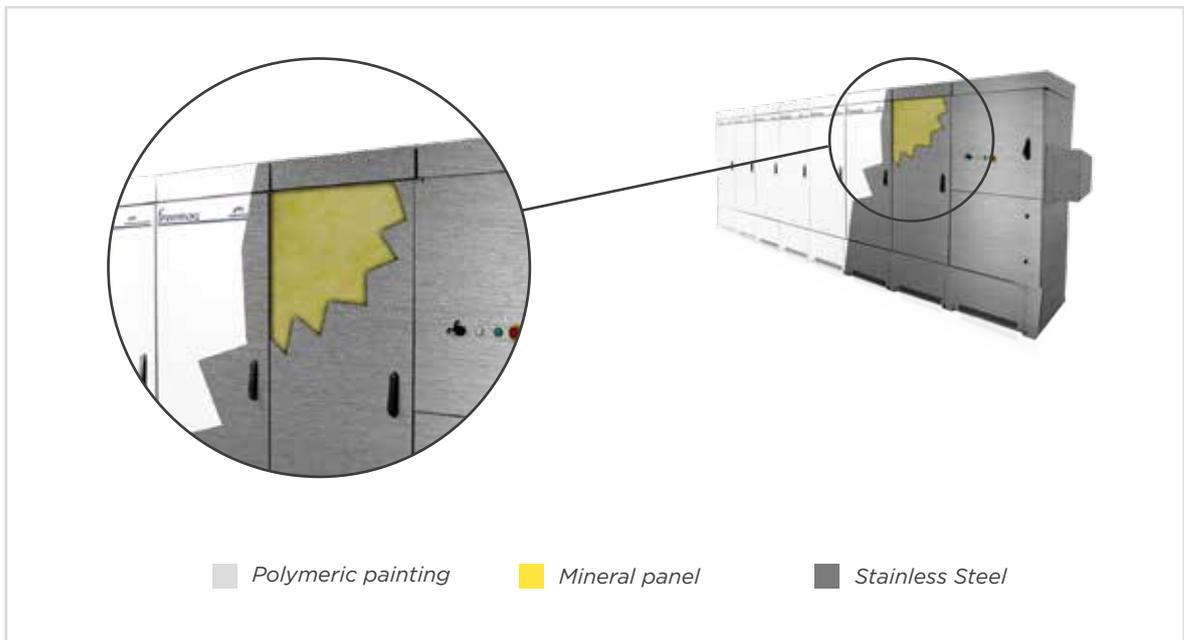




ROBUST DESIGN

Freemaq PCS inverters have been designed to last for more than 20 years of operation in harsh environments and extreme weather conditions. Freemaq PCS units are tested and ready to withstand conditions from the frozen siberian tundra to the californian Death Valley, featuring:

- Totally sealed cabin for protecting electronics against dust and moisture.
- Conformal coating on electronic boards shields PCBs from harsh atmospheres.
- Temperature and humidity controlled active heating prevents internal water condensation.
- Stainless Steel construction with 2mm thickness for maximum enclosure longevity.
- The Freemaq PCS has a C5-M degree of protection according to ISO 12944.
- 50mm mineral panel isolates the cabinet from solar heat gains.
- Roof cover designed to dissipate solar radiation, reduce heat build-up and avoid water leakages. The solid Freemaq PCS structure avoids the need of additional external structures.
- Random units selected to pass a Factory Water Tightness Test ensuring product quality.



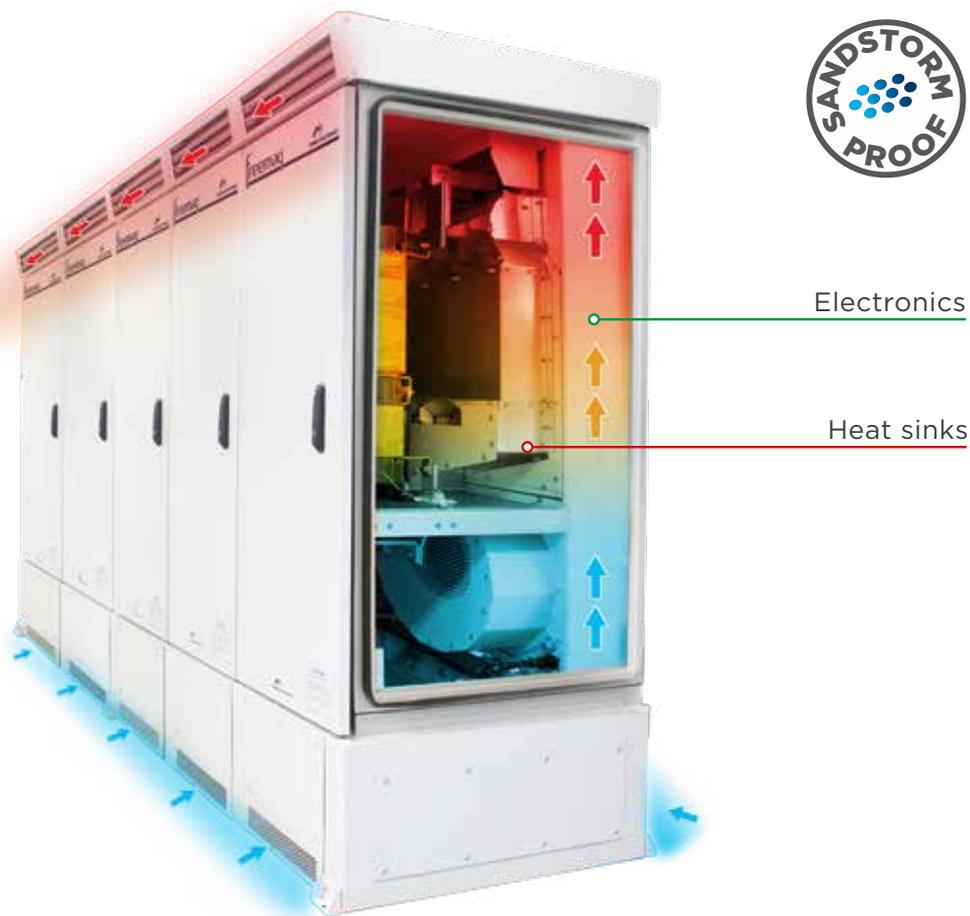


REVOLUTIONARY COOLING SYSTEM

The Power Electronics Freemaq PCS series includes the innovative and sophisticated iCOOL V performance that allows Freemaq PCS to work up to 50°C at nominal power. The cooling system iCOOL V smartly cools the inverter, regulating the cooling system capacity depending on the data from the temperature sensors.

Freemaq PCS modules are divided into two main areas: clean area (electronics) and hot area (heat sink). The electronics are totally sealed and use a temperature control low flow cooling system that reduces filters clogging and maintenance intervals. The hot area integrates a speed controlled fan for each module, simplifying the cooling system and reducing the maintenance tasks.

Furthermore, due to the modular topology, the iCOOL V reduces the Stand-by consumption at low capacity to the maximum, boosting the cooling capacity for the installations situated up to 4000 meters above sea level. (patent pending)



VAR SUPPORT

The Freemaq PCS inverter can provide reactive power at any time in order to stabilize the grid conditions. The inverter can respond to an external dynamic signal, a Power Plant Controller command or a pre-set reactive power level (kVar).



EASY TO MONITOR

The Freesun app is the easiest way to monitor the status of our inverters. All our inverters come with built-in wifi, allowing remote connectivity to any smart device for detailed updates and information without the need to open cabinet doors. The app user friendly interface allows quick and easy access to critical information (energy registers, production and events).



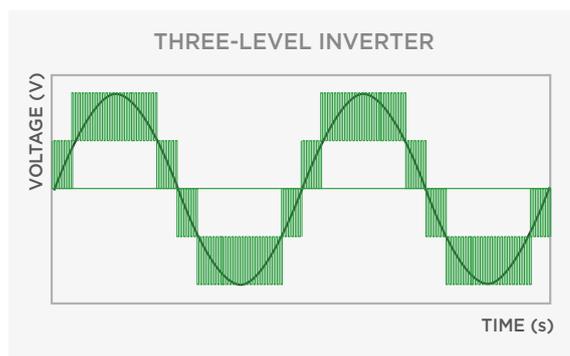
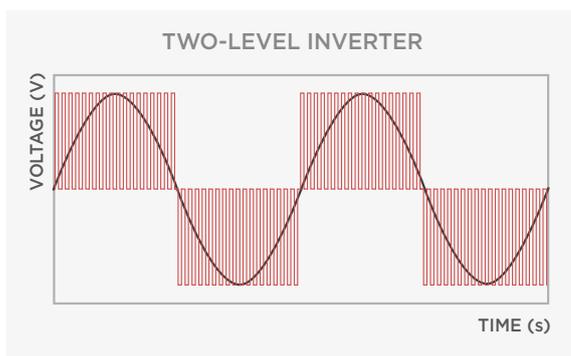
ACTIVE HEATING

In cold conditions, and when the unit is not working, the inverter can import a small amount of power from the grid to keep the inverter internal ambient temperature above -20°C , without using external resistors. This autonomous heating system is the most efficient and homogeneous way to prevent condensation, increasing the inverters availability and reducing maintenance. (patented)



MULTILEVEL TOPOLOGY

The multilevel IGBT topology makes the difference when the DC voltage is above 1000V, being the most efficient way to manage high DC link voltages. Based in our long IGBT experience components used in our Solar and Industrial division, the Freemaq PCS takes profit of the three level IGBT topology reducing the power stage losses, increasing the efficiency and offering a very low total harmonic distortion.

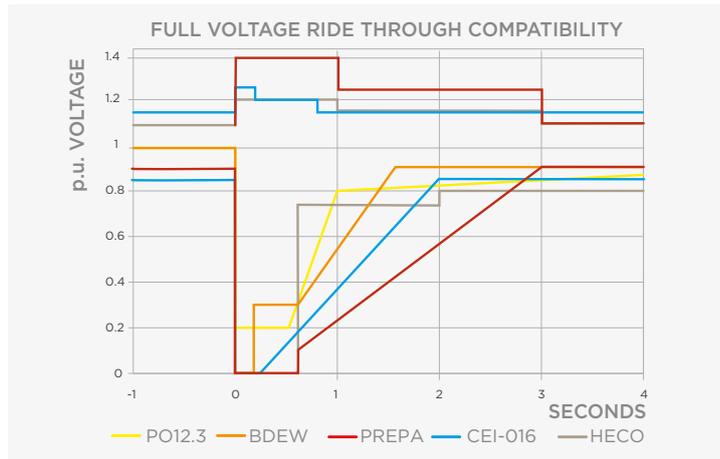




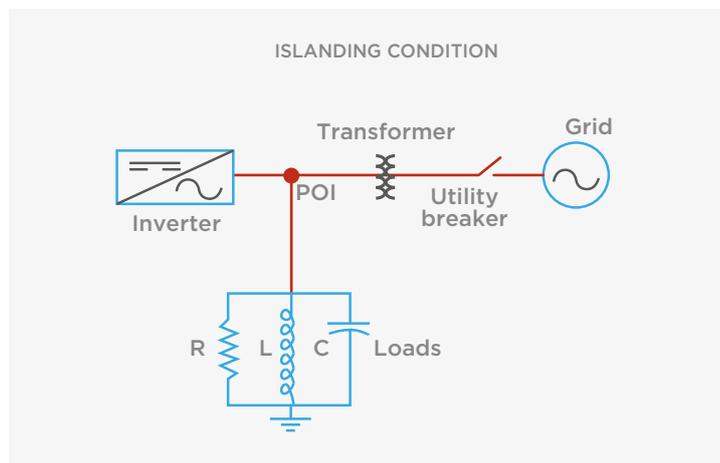
DYNAMIC GRID SUPPORT

Freemaq PCS firmware includes the latest utility interactive features (LVRT, OVRT, FRS, FRT, Anti-islanding, active and reactive power curtailment...), and is compatible with all the specific requirements of the utilities.

▲ **LVRT or ZVRT (Low Voltage Ride Through).** Inverters can withstand any voltage dip or profile required by the local utility. The inverter can immediately feed the fault with full reactive power, as long as the protection limits are not exceeded.



▲ **Anti-islanding:** This protection combines passive and active methods that eliminates nuisance tripping and reduces grid distortion according to IEC 62116 and IEEE1547.

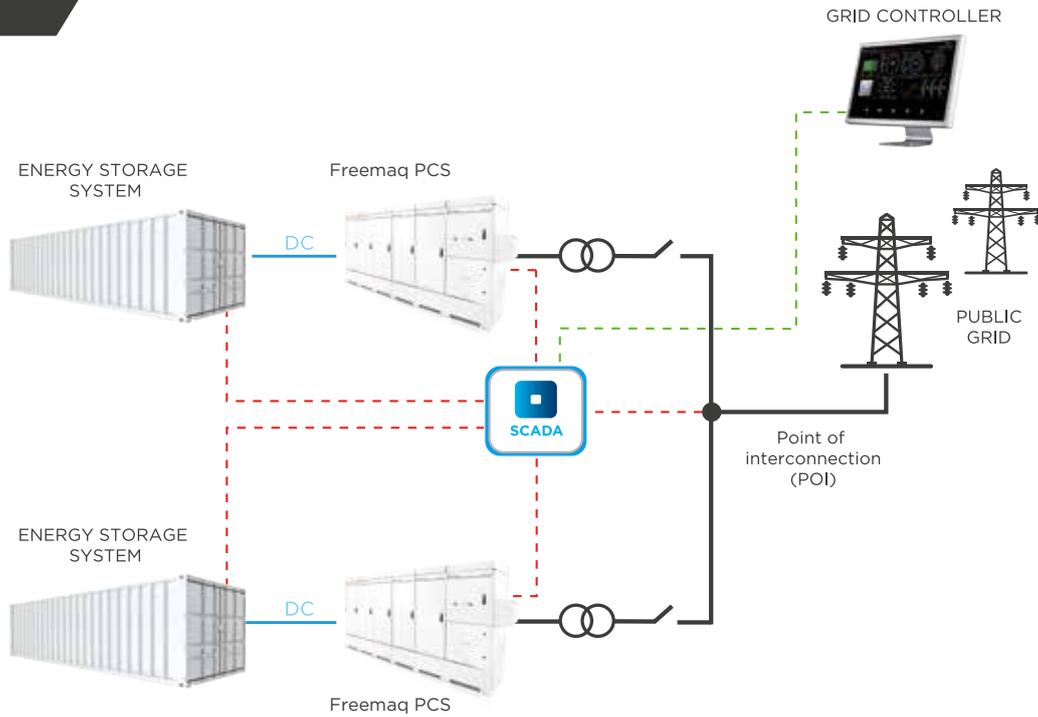




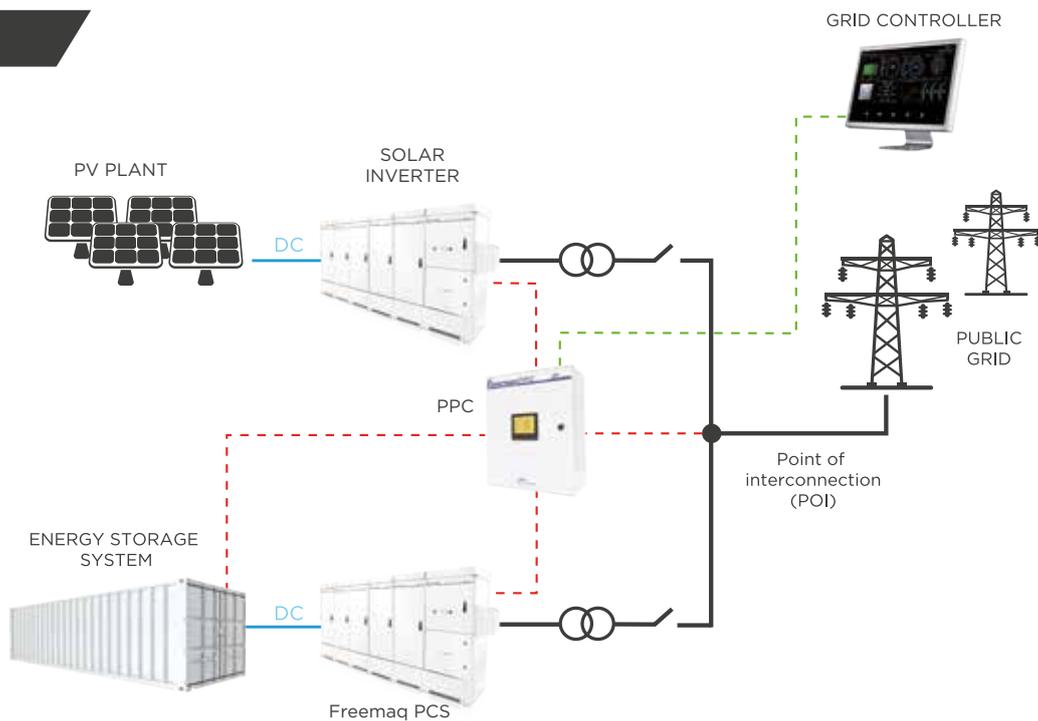
BATTERY ENERGY STORAGE SYSTEM

A BESS comprises a battery container connected to a Freemaq PCS (Power Conversion System) that follows the instruction of the main governor of the plant, the PPC (Power Plant Controller) or SCADA.

EXAMPLE 1



EXAMPLE 2





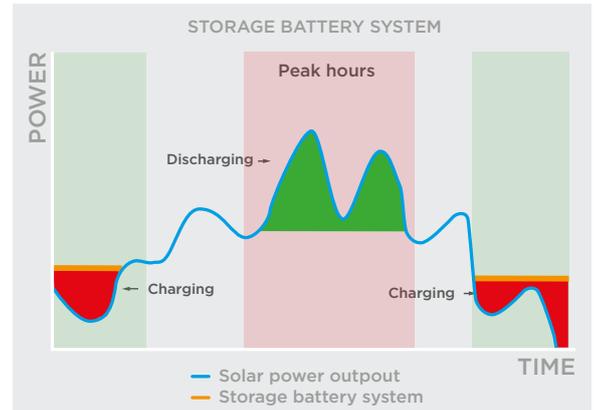
ENERGY STORAGE APPLICATIONS

Following the instructions of a plant control system, the Freemaq PCS can perform multiple power and dynamic grid support functions such as:



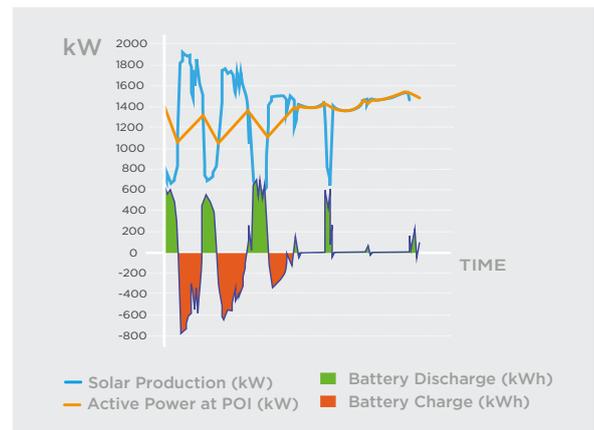
LOAD LEVELING

Freemaq PCS series are able to store energy during periods of low demand from the grid, in order to later supply this energy when there is a higher demand. This has the benefit of selling the energy at a higher market price during peak periods. It also allows grid operators to supply electricity with a higher renewable origin. Since PV generation may not be at the same time as peak demand, this facilitates the flexibility and integration of renewable generation into the grid.



RENEWABLE INTEGRATION

The Power Electronics Freemaq PCS series attenuates the intermittent nature of renewable energy sources, to provide a smoother power output. The Freemaq PCS controls the ramp rate at which power is injected into the grid, and thus reduces the impact of rapid power fluctuations due to sudden or transient conditions experienced by the PV array.

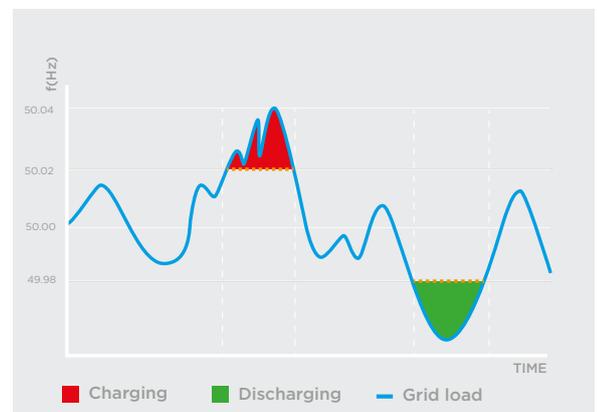


The system monitors the PV inverter output to inject or consume power accordingly to ensure the output remains within the ramp requirements.



FREQUENCY REGULATION SYSTEM

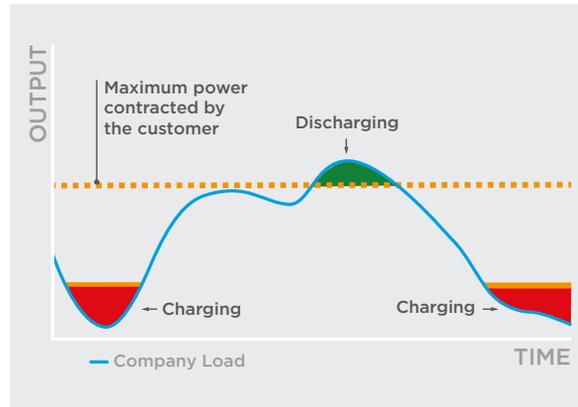
Freemaq PCS provides ability to regulate grid frequency in both directions. When there is a grid over-frequency (generation > demand) inverter power output is curtailed and this energy is stored. When there is a grid under-frequency (generation < demand) inverter power output is increased by discharging the batteries and injecting more power to the grid.





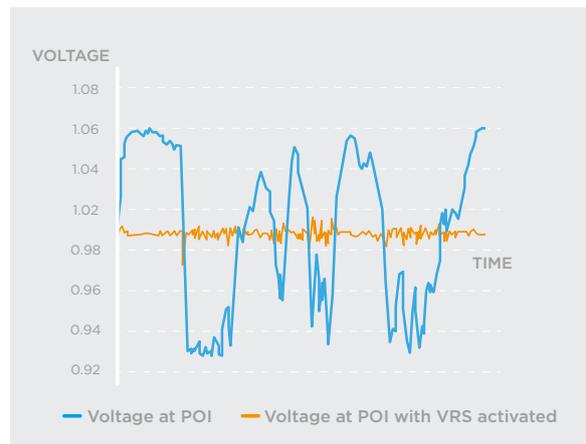
PEAK POWER SHAVING

By delivering stored energy to the grid during periods of high demand, it reduces the burden on the distribution network and increases significantly its efficiency. Energy is stored instead of injected into the grid during periods of low demand, which as a result increases the load on the grid. However, during peak periods this stored energy is then injected into the grid, which reduces the demand at this time. The result is a more flattened demand curve which means the grid can avoid switching on more expensive and polluting generators.



GRID SUPPORT

Freemaq PCS series helps the integration of renewable sources, by helping to maintain grid stability and power quality. It can help support the grid voltage by generating capacitive or inductive current. Other features include Voltage Control, Reactive Power Control and Fault Ride Through Support.



Freemaq PCS

TECHNICAL CHARACTERISTICS

		690V				
		FRAME 3	FRAME 4	FRAME 5	FRAME 6	FRAME 7
NUMBER OF MODULES		3	4	5	6	7
REFERENCES		FP1290	FP1720	FP2150	FP2580	FP3000
AC	AC Output Power (kVA/kW) @50°C ^[1]	1290	1720	2150	2580	3000
	Max. AC Output Current (A)	1080	1440	1800	2160	2520
	Overload capacity ^[2]	120% (depending on preload conditions)				
	Operating Grid Voltage (VAC)	690V ±10% ^[3]				
	Operating Grid Frequency (Hz)	50/60 Hz				
	Current Harmonic Distortion (THDi)	< 3% per IEEE519				
	Power Factor (cosine phi) ^[2]	0.0 leading ... 0.0 lagging				
Reactive power compensation	Four quadrant operation					
DC	DC Voltage Range (full power)	976V-1310V				
	Maximum DC voltage	1500V				
	DC Voltage Ripple	< 3%				
	Max. DC continuous current (A)	1350	1800	2250	2700	3145
	Battery Technology	all type of batteries (BMS required)				
	Number of separate DC inputs	1 DC input per inverter ^[3]				
Battery Connections	FSDK style battery cabinet with 8 positive and 8 negative connections. Larger FSDK cabinets optional					
EFFICIENCY & AUX. SUPPLY	Efficiency (Max) (η)	98%				
	Max. Standby Consumption	< approx. 50W/per module				
	Max. Power Consumption (VA) (W)	2400	3200	4000	4800	5600
CABINET	Dimensions [WxDxH] (inches)	119.6"x37.2"x86.5"	147.6"x37.2"x86.5"	175.7"x37.2"x86.5"	203.8"x37.2"x86.5"	231.9"x37.2"x86.5"
	Dimensions [WxDxH] (mm)	3038x945x2198	3751x945x2198	4464x945x2198	5177x945x2198	5890x945x2198
	Weight (lbs)	5809	7253	8697	10141	11585
	Weight (kg)	2635	3290	3945	4600	5255
	Air Flow	Bottom intake. Exhaust top rear vent				
Type of ventilation	Forced air cooling					
ENVIRONMENT	Degree of protection	NEMA 3R / IP54				
	Permissible Ambient Temperature	-35°C ^[4] to +60°C, >50°C / Active Power derating (>50°C)				
	Relative Humidity	4% to 100% Condensing				
	Max. Altitude (above sea level)	2000m / >2000m power derating (Max. 4000m)				
Noise level ^[5]	< 79 dBA					
CONTROL INTERFACE	Interface	Graphic Display (inside cabinet) / Optional Freesun App display				
	Communication protocol	Modbus TCP				
	Power Plant Controller	Optional. Third party SCADA systems supported				
	Keyed ON/OFF switch	Standard				
	Digital I/O	Optional ^[3]				
Analog I/O	Optional ^[3]					
PROTECTIONS	Ground Fault Protection	Insulation monitoring device				
	Humidity control	Active Heating				
	General AC Protection & Disconn.	Circuit Breaker				
	General DC Protection & Disconn.	External Disconnecting Unit Cabinet				
Overvoltage Protection	AC and DC protection (type 2)					
CERTIFICATIONS	Safety	UL-1741 (pending) / IEC 62109-1 and IEC 62109-2				
	Utility interconnect	IEEE 1547 with Utility Interactive Control functions				

NOTES [1] Values at 1.00•Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.

[2] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA))^2-P(kW)^2}$.

[3] Consult Power Electronics for other configurations.

[4] Heating resistors kit option below -20°C.

[5] Readings taken 1 meter from the back of the unit.

Freemaq PCS

TECHNICAL CHARACTERISTICS

		645V				
		FRAME 3	FRAME 4	FRAME 5	FRAME 6	FRAME 7
NUMBER OF MODULES		3	4	5	6	7
REFERENCES		FP1200	FP1600	FP2000	FP2400	FP2800
AC	AC Output Power (kVA/kW) @50°C ^[1]	1200	1600	2000	2400	2800
	Max. AC Output Current (A)	1080	1440	1800	2160	2520
	Overload capacity ^[2]	120% (depending on preload conditions)				
	Operating Grid Voltage (VAC)	645V ±10% ^[3]				
	Operating Grid Frequency (Hz)	50/60 Hz				
	Current Harmonic Distortion (THDI)	< 3% per IEEEE519				
	Power Factor (cosine phi) ^[2]	0.0 leading ... 0.0 lagging				
Reactive power compensation	Four quadrant operation					
DC	DC Voltage Range (full power)	913V-1310V				
	Maximum DC voltage	1500V				
	DC Voltage Ripple	< 3%				
	Max. DC continuous current (A)	1350	1800	2250	2700	3150
	Battery Technology	all type of batteries (BMS required)				
	Number of separate DC inputs	1 DC input per inverter ^[3]				
Battery Connections	FSDK style battery cabinet with 8 positive and 8 negative connections. Larger FSDK cabinets optional					
EFFICIENCY & AUX. SUPPLY	Efficiency (Max) (η)	98%				
	Max. Standby Consumption	< approx. 50W/per module				
	Max. Power Consumption (VA) (W)	2400	3200	4000	4800	5600
CABINET	Dimensions [WxDxH] (inches)	119.6"x37.2"x86.5"	147.6"x37.2"x86.5"	175.7"x37.2"x86.5"	203.8"x37.2"x86.5"	231.9"x37.2"x86.5"
	Dimensions [WxDxH] (mm)	3038x945x2198	3751x945x2198	4464x945x2198	5177x945x2198	5890x945x2198
	Weight (lbs)	5809	7253	8697	10141	11585
	Weight (kg)	2635	3290	3945	4600	5255
	Air Flow	Bottom intake. Exhaust top rear vent				
Type of ventilation	Forced air cooling					
ENVIRONMENT	Degree of protection	NEMA 3R / IP54				
	Permissible Ambient Temperature	-35°C ^[4] to +60°C, >50°C / Active Power derating (>50°C)				
	Relative Humidity	4% to 100% Condensing				
	Max. Altitude (above sea level)	2000m / >2000m power derating (Max. 4000m)				
Noise level ^[5]	< 79 dBA					
CONTROL INTERFACE	Interface	Graphic Display (inside cabinet) / Optional Freesun App display				
	Communication protocol	Modbus TCP				
	Power Plant Controller	Optional. Third party SCADA systems supported				
	Keyed ON/OFF switch	Standard				
	Digital I/O	Optional ^[3]				
Analog I/O	Optional ^[3]					
PROTECTIONS	Ground Fault Protection	Insulation monitoring device				
	Humidity control	Active Heating				
	General AC Protection & Disconn.	Circuit Breaker				
	General DC Protection & Disconn.	External Disconnecting Unit Cabinet				
Overvoltage Protection	AC and DC protection (type 2)					
CERTIFICATIONS	Safety	UL-1741 (pending) / IEC 62109-1 and IEC 62109-2				
	Utility interconnect	IEEE 1547 with Utility Interactive Control functions				

NOTES [1] Values at 1.00•Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.

[2] Consult P-Q charts available: $Q(kVAR)=\sqrt{(S(kVA))^2-P(kW)^2}$.

[3] Consult Power Electronics for other configurations.

[4] Heating resistors kit option below -20°C.

[5] Readings taken 1 meter from the back of the unit.

Freemaq PCS

TECHNICAL CHARACTERISTICS

		530V				
		FRAME 3	FRAME 4	FRAME 5	FRAME 6	FRAME 7
NUMBER OF MODULES		3	4	5	6	7
REFERENCES		FP0990	FP1320	FP1650	FP1980	FP2310
AC	AC Output Power (kVA/kW) @50°C ^[1]	990	1320	1650	1980	2310
	Max. AC Output Current (A)	1080	1440	1800	2160	2520
	Overload capacity ^[2]	120% (depending on preload conditions)				
	Operating Grid Voltage (VAC)	530V ±10% ^[3]				
	Operating Grid Frequency (Hz)	50/60 Hz				
	Current Harmonic Distortion (THDi)	< 3% per IEEE519				
	Power Factor (cosine phi) ^[2]	0.0 leading ... 0.0 lagging				
Reactive power compensation	Four quadrant operation					
DC	DC Voltage Range (full power)	750V-1310V				
	Maximum DC voltage	1500V				
	DC Voltage Ripple	< 3%				
	Max. DC continuous current (A)	1350	1795	2245	2695	3145
	Battery Technology	all type of batteries (BMS required)				
	Number of separate DC inputs	1 DC input per inverter ^[3]				
Battery Connections	FSDK style battery cabinet with 8 positive and 8 negative connections. Larger FSDK cabinets optional					
EFFICIENCY & AUX. SUPPLY	Efficiency (Max) (η)	98%				
	Max. Standby Consumption	< approx. 50W/per module				
	Max. Power Consumption (VA) (W)	2400	3200	4000	4800	5600
CABINET	Dimensions [WxDxH] (inches)	119.6"x37.2"x86.5"	147.6"x37.2"x86.5"	175.7"x37.2"x86.5"	203.8"x37.2"x86.5"	231.9"x37.2"x86.5"
	Dimensions [WxDxH] (mm)	3038x945x2198	3751x945x2198	4464x945x2198	5177x945x2198	5890x945x2198
	Weight (lbs)	5809	7253	8697	10141	11585
	Weight (kg)	2635	3290	3945	4600	5255
	Air Flow	Bottom intake. Exhaust top rear vent				
Type of ventilation	Forced air cooling					
ENVIRONMENT	Degree of protection	NEMA 3R / IP54				
	Permissible Ambient Temperature	-35°C ^[4] to +60°C, >50°C / Active Power derating (>50°C)				
	Relative Humidity	4% to 100% Condensing				
	Max. Altitude (above sea level)	2000m / >2000m power derating (Max. 4000m)				
	Noise level ^[5]	< 79 dBA				
CONTROL INTERFACE	Interface	Graphic Display (inside cabinet) / Optional Freesun App display				
	Communication protocol	Modbus TCP				
	Power Plant Controller	Optional. Third party SCADA systems supported				
	Keyed ON/OFF switch	Standard				
	Digital I/O	Optional ^[3]				
Analog I/O	Optional ^[3]					
PROTECTIONS	Ground Fault Protection	Insulation monitoring device				
	Humidity control	Active Heating				
	General AC Protection & Disconn.	Circuit Breaker				
	General DC Protection & Disconn.	External Disconnecting Unit Cabinet				
	Overvoltage Protection	AC and DC protection (type 2)				
CERTIFICATIONS	Safety	UL-1741 (pending) / IEC 62109-1 and IEC 62109-2				
	Utility interconnect	IEEE 1547 with Utility Interactive Control functions				

NOTES [1] Values at 1.00•Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.

[2] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA))^2-P(kW)^2}$.

[3] Consult Power Electronics for other configurations.

[4] Heating resistors kit option below -20°C.

[5] Readings taken 1 meter from the back of the unit.

Freemaq PCS

TECHNICAL CHARACTERISTICS

		500V				
		FRAME 3	FRAME 4	FRAME 5	FRAME 6	FRAME 7
NUMBER OF MODULES		3	4	5	6	7
REFERENCES		FP0935	FP1245	FP1560	FP1870	FP2180
AC	AC Output Power (kVA/kW) @50°C ^[1]	935	1245	1560	1870	2180
	Max. AC Output Current (A)	1080	1440	1800	2160	2520
	Overload capacity ^[2]	120% (depending on preload conditions)				
	Operating Grid Voltage (VAC)	500V ±10% ^[3]				
	Operating Grid Frequency (Hz)	50/60 Hz				
	Current Harmonic Distortion (THDI)	< 3% per IEEEE519				
	Power Factor (cosine phi) ^[2]	0.0 leading ... 0.0 lagging				
Reactive power compensation	Four quadrant operation					
DC	DC Voltage Range (full power)	708V-1310V				
	Maximum DC voltage	1500V				
	DC Voltage Ripple	< 3%				
	Max. DC continuous current (A)	1350	1795	2250	2700	3145
	Battery Technology	all type of batteries (BMS required)				
	Number of separate DC inputs	1 DC input per inverter ^[3]				
Battery Connections	FSDK style battery cabinet with 8 positive and 8 negative connections. Larger FSDK cabinets optional					
EFFICIENCY & AUX. SUPPLY	Efficiency (Max) (η)	98%				
	Max. Standby Consumption	< approx. 50W/per module				
	Max. Power Consumption (VA) (W)	2400	3200	4000	4800	5600
CABINET	Dimensions [WxDxH] (inches)	119.6"x37.2"x86.5"	147.6"x37.2"x86.5"	175.7"x37.2"x86.5"	203.8"x37.2"x86.5"	231.9"x37.2"x86.5"
	Dimensions [WxDxH] (mm)	3038x945x2198	3751x945x2198	4464x945x2198	5177x945x2198	5890x945x2198
	Weight (lbs)	5809	7253	8697	10141	11585
	Weight (kg)	2635	3290	3945	4600	5255
	Air Flow	Bottom intake. Exhaust top rear vent				
Type of ventilation	Forced air cooling					
ENVIRONMENT	Degree of protection	NEMA 3R / IP54				
	Permissible Ambient Temperature	-35°C ^[4] to +60°C, >50°C / Active Power derating (>50°C)				
	Relative Humidity	4% to 100% Condensing				
	Max. Altitude (above sea level)	2000m / >2000m power derating (Max. 4000m)				
Noise level ^[5]	< 79 dBA					
CONTROL INTERFACE	Interface	Graphic Display (inside cabinet) / Optional Freesun App display				
	Communication protocol	Modbus TCP				
	Power Plant Controller	Optional. Third party SCADA systems supported				
	Keyed ON/OFF switch	Standard				
	Digital I/O	Optional ^[3]				
Analog I/O	Optional ^[3]					
PROTECTIONS	Ground Fault Protection	Insulation monitoring device				
	Humidity control	Active Heating				
	General AC Protection & Disconn.	Circuit Breaker				
	General DC Protection & Disconn.	External Disconnecting Unit Cabinet				
Overvoltage Protection	AC and DC protection (type 2)					
CERTIFICATIONS	Safety	UL-1741 (pending) / IEC 62109-1 and IEC 62109-2				
	Utility interconnect	IEEE 1547 with Utility Interactive Control functions				

NOTES [1] Values at 1.00•Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.

[2] Consult P-Q charts available: $Q(kVAR)=\sqrt{(S(kVA))^2-P(kW)^2}$.

[3] Consult Power Electronics for other configurations.

[4] Heating resistors kit option below -20°C.

[5] Readings taken 1 meter from the back of the unit.

Freemaq PCS

TECHNICAL CHARACTERISTICS

		480V				
		FRAME 3	FRAME 4	FRAME 5	FRAME 6	FRAME 7
NUMBER OF MODULES		3	4	5	6	7
REFERENCES		FP0900	FP1200	FP1500	FP1800	FP2100
AC	AC Output Power (kVA/kW) @50°C ^[1]	900	1200	1500	1800	2100
	Max. AC Output Current (A)	1080	1440	1800	2160	2520
	Overload capacity ^[2]	120% (depending on preload conditions)				
	Operating Grid Voltage (VAC)	480V ±10% ^[3]				
	Operating Grid Frequency (Hz)	50/60 Hz				
	Current Harmonic Distortion (THDi)	< 3% per IEEE519				
	Power Factor (cosine phi) ^[2]	0.0 leading ... 0.0 lagging				
Reactive power compensation	Four quadrant operation					
DC	DC Voltage Range (full power)	679V-1310V				
	Maximum DC voltage	1500V				
	DC Voltage Ripple	< 3%				
	Max. DC continuous current (A)	1355	1805	2255	2705	3155
	Battery Technology	all type of batteries (BMS required)				
	Number of separate DC inputs	1 DC input per inverter ^[3]				
Battery Connections	FSDK style battery cabinet with 8 positive and 8 negative connections. Larger FSDK cabinets optional					
EFFICIENCY & AUX. SUPPLY	Efficiency (Max) (η)	98%				
	Max. Standby Consumption	< approx. 50W/per module				
	Max. Power Consumption (VA) (W)	2400	3200	4000	4800	5600
CABINET	Dimensions [WxDxH] (inches)	119.6"x37.2"x86.5"	147.6"x37.2"x86.5"	175.7"x37.2"x86.5"	203.8"x37.2"x86.5"	231.9"x37.2"x86.5"
	Dimensions [WxDxH] (mm)	3038x945x2198	3751x945x2198	4464x945x2198	5177x945x2198	5890x945x2198
	Weight (lbs)	5809	7253	8697	10141	11585
	Weight (kg)	2635	3290	3945	4600	5255
	Air Flow	Bottom intake. Exhaust top rear vent				
Type of ventilation	Forced air cooling					
ENVIRONMENT	Degree of protection	NEMA 3R / IP54				
	Permissible Ambient Temperature	-35°C ^[4] to +60°C, >50°C / Active Power derating (>50°C)				
	Relative Humidity	4% to 100% Condensing				
	Max. Altitude (above sea level)	2000m / >2000m power derating (Max. 4000m)				
Noise level ^[5]	< 79 dBA					
CONTROL INTERFACE	Interface	Graphic Display (inside cabinet) / Optional Freesun App display				
	Communication protocol	Modbus TCP				
	Power Plant Controller	Optional. Third party SCADA systems supported				
	Keyed ON/OFF switch	Standard				
	Digital I/O	Optional ^[3]				
Analog I/O	Optional ^[3]					
PROTECTIONS	Ground Fault Protection	Insulation monitoring device				
	Humidity control	Active Heating				
	General AC Protection & Disconn.	Circuit Breaker				
	General DC Protection & Disconn.	External Disconnecting Unit Cabinet				
Overvoltage Protection	AC and DC protection (type 2)					
CERTIFICATIONS	Safety	UL-1741 (pending) / IEC 62109-1 and IEC 62109-2				
	Utility interconnect	IEEE 1547 with Utility Interactive Control functions				

NOTES [1] Values at 1.00•Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.

[2] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA))^2-P(kW)^2}$.

[3] Consult Power Electronics for other configurations.

[4] Heating resistors kit option below -20°C.

[5] Readings taken 1 meter from the back of the unit.

Freemaq PCS

TECHNICAL CHARACTERISTICS

		370V				
		FRAME 3	FRAME 4	FRAME 5	FRAME 6	FRAME 7
NUMBER OF MODULES		3	4	5	6	7
REFERENCES		FP0690	FP0925	FP1155	FP1385	FP1615
AC	AC Output Power (kVA/kW) @50°C ^[1]	690	925	1155	1385	1615
	Max. AC Output Current (A)	1080	1440	1800	2160	2520
	Overload capacity ^[2]	120% (depending on preload conditions)				
	Operating Grid Voltage (VAC)	370V ±10% ^[3]				
	Operating Grid Frequency (Hz)	50/60 Hz				
	Current Harmonic Distortion (THDI)	< 3% per IEEE519				
	Power Factor (cosine phi) ^[2]	0.0 leading ... 0.0 lagging				
Reactive power compensation	Four quadrant operation					
DC	DC Voltage Range (full power)	524V-1310V				
	Maximum DC voltage	1500V				
	DC Voltage Ripple	< 3%				
	Max. DC continuous current (A)	1345	1805	2250	2700	3150
	Battery Technology	all type of batteries (BMS required)				
	Number of separate DC inputs	1 DC input per inverter ^[3]				
Battery Connections	FSDK style battery cabinet with 8 positive and 8 negative connections. Larger FSDK cabinets optional					
EFFICIENCY & AUX. SUPPLY	Efficiency (Max) (η)	98%				
	Max. Standby Consumption	< approx. 50W/per module				
	Max. Power Consumption (VA) (W)	2400	3200	4000	4800	5600
CABINET	Dimensions [WxDxH] (inches)	119.6"x37.2"x86.5"	147.6"x37.2"x86.5"	175.7"x37.2"x86.5"	203.8"x37.2"x86.5"	231.9"x37.2"x86.5"
	Dimensions [WxDxH] (mm)	3038x945x2198	3751x945x2198	4464x945x2198	5177x945x2198	5890x945x2198
	Weight (lbs)	5809	7253	8697	10141	11585
	Weight (kg)	2635	3290	3945	4600	5255
	Air Flow	Bottom intake. Exhaust top rear vent				
Type of ventilation	Forced air cooling					
ENVIRONMENT	Degree of protection	NEMA 3R / IP54				
	Permissible Ambient Temperature	-35°C ^[4] to +60°C, >50°C / Active Power derating (>50°C)				
	Relative Humidity	4% to 100% Condensing				
	Max. Altitude (above sea level)	2000m / >2000m power derating (Max. 4000m)				
Noise level ^[5]	< 79 dBA					
CONTROL INTERFACE	Interface	Graphic Display (inside cabinet) / Optional Freesun App display				
	Communication protocol	Modbus TCP				
	Power Plant Controller	Optional. Third party SCADA systems supported				
	Keyed ON/OFF switch	Standard				
	Digital I/O	Optional ^[3]				
Analog I/O	Optional ^[3]					
PROTECTIONS	Ground Fault Protection	Insulation monitoring device				
	Humidity control	Active Heating				
	General AC Protection & Disconn.	Circuit Breaker				
	General DC Protection & Disconn.	External Disconnecting Unit Cabinet				
Overvoltage Protection	AC and DC protection (type 2)					
CERTIFICATIONS	Safety	UL-1741 (pending) / IEC 62109-1 and IEC 62109-2				
	Utility interconnect	IEEE 1547 with Utility Interactive Control functions				

NOTES [1] Values at 1.00•Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.

[2] Consult P-Q charts available: $Q(kVAR)=\sqrt{(S(kVA))^2-P(kW)^2}$.

[3] Consult Power Electronics for other configurations.

[4] Heating resistors kit option below -20°C.

[5] Readings taken 1 meter from the back of the unit.

Freemaq Hybrid

UTILITY SCALE HYBRID INVERTER



Freemaq Hybrid

The Power Electronics Freemaq Hybrid modular inverter architecture can be designed to support solar generation and energy storage in a single inverter, or even having individual battery systems. Each power module can be designated as either a power module to export PV power or as a bi-directional power module designed to support energy storage.

The Freemaq Hybrid is the perfect solution for having a solar inverter with storage capabilities integrated, such as Peak Shaving, Ramp Rate control, Frequency Regulation and Load Leveling, without the need of an additional transformer.

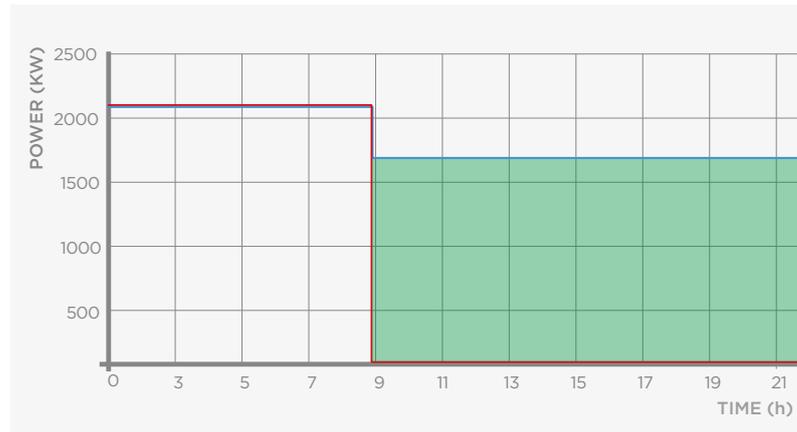
Within this architecture, the AC bus is designed to match the minimum DC voltage on either the solar or battery system. In the DC side, the inputs for each power module are independent. The Power Electronics Hybrid Inverter is available with 1 to 7 power modules dedicated to energy storage.

TAKING ADVANTAGE OF
THE MOST FLEXIBLE 1500V
INVERTER PLATFORM



AUTOMATIC REDUNDANT POWER MODULE SYSTEM (ARPMS)

Freemaq Hybrid is a modular central battery inverter based on an Automatic Redundant Power Module (up to 400kVA per stage). If there is a fault in one power module, it is taken off-line and its output power is distributed evenly among the remaining functioning modules. All power modules work in parallel controlled by a dual redundant main control. As the main governor of the system it is responsible for the battery charge / discharge, synchronization sequence and overall protection. The automatic redundant capability based on our industrial systems is able to shift the main control in the event of a fault, restoring the backup control and restarting the station to guarantee high availability.



— Freemaq Hybrid Production (kW) - 1 Module fault ■ Freemaq Hybrid extra energy production (kWh)
— Central inverter Production (kW) - Fault



EASY TO SERVICE

By providing full front and rear access the Freemaq Hybrid series simplifies the maintenance tasks improving the MTTR (achieving a lower OPEX). The frontal access allows the checking of the whole electronic cabinet (electronics boards, semiconductors, power supply, contactors...) while the rear access permits the revision of AC fuses and LCL filter.

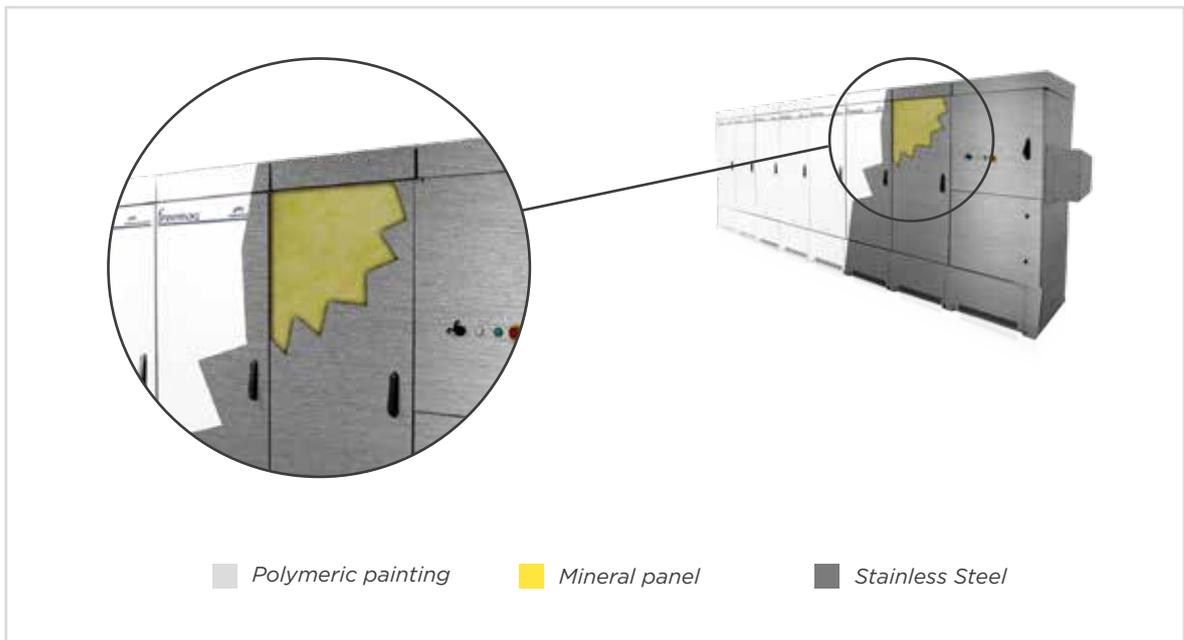




ROBUST DESIGN

Freemaq Hybrid inverters have been designed to last for more than 20 years of operation in harsh environments and extreme weather conditions. Freemaq Hybrid units are tested and ready to withstand conditions from the frozen siberian tundra to the californian Death Valley, featuring:

- Totally sealed cabin for protecting electronics against dust and moisture.
- Conformal coating on electronic boards shields PCBs from harsh atmospheres.
- Temperature and humidity controlled active heating prevents internal water condensation.
- Stainless Steel construction with 2mm thickness for maximum enclosure longevity.
- The Freemaq Hybrid has a C5-M degree of protection according to ISO 12944.
- 50mm mineral panel isolates the cabinet from solar heat gains.
- Roof cover designed to dissipate solar radiation, reduce heat build-up and avoid water leakages. The solid Freemaq Hybrid structure avoids the need of additional external structures.
- Random units selected to pass a Factory Water Tightness Test ensuring product quality.



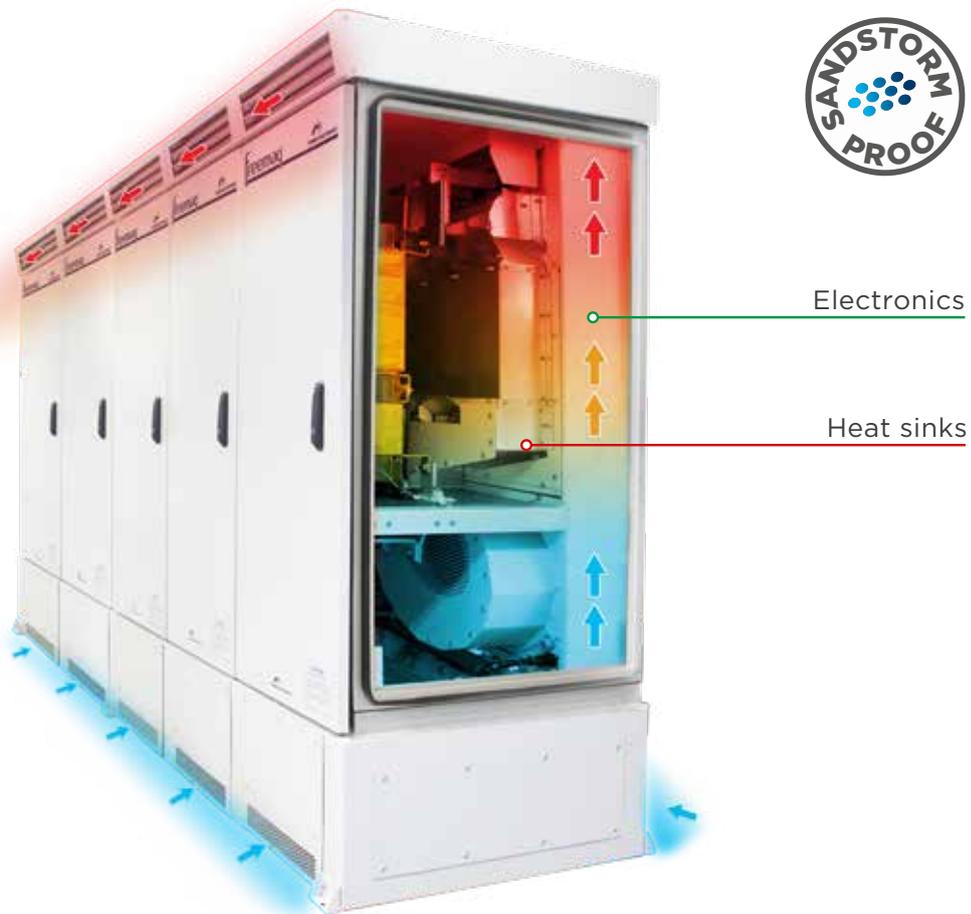


REVOLUTIONARY COOLING SYSTEM

The Power Electronics Freemaq Hybrid series includes the innovative and sophisticated iCOOL V performance that allows Freemaq Hybrid to work up to 50°C at nominal power. The cooling system iCOOL V smartly cools the inverter, regulating the cooling system capacity depending on the data from the temperature sensors.

Freemaq Hybrid modules are divided into two main areas: clean area (electronics) and hot area (heat sink). The electronics are totally sealed and use a temperature control low flow cooling system that reduces filters clogging and maintenance intervals. The hot area integrates a speed controlled fan for each module, simplifying the cooling system and reducing the maintenance tasks.

Furthermore, due to the modular topology, the iCOOL V reduces the Stand-by consumption at low capacity to the maximum, boosting the cooling capacity for the installations situated up to 4000 meters above sea level. (patent pending)



Electronics

Heat sinks



VAR SUPPORT

The Freemaq Hybrid inverter can provide reactive power at any time in order to stabilize the grid conditions. The inverter can respond to an external dynamic signal, a Power Plant Controller command or a pre-set reactive power level (kVAr).



EASY TO MONITOR

The Freesun app is the easiest way to monitor the status of our inverters. All our inverters come with built-in wifi, allowing remote connectivity to any smart device for detailed updates and information without the need to open cabinet doors. The app user friendly interface allows quick and easy access to critical information (energy registers, production and events).



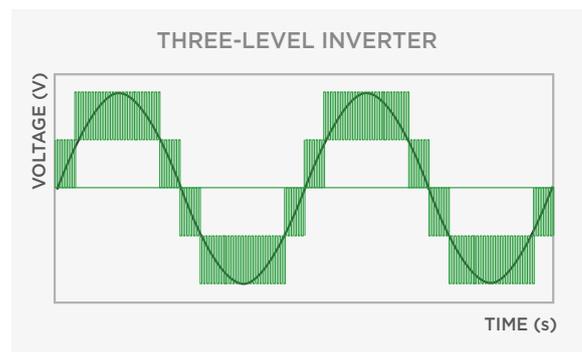
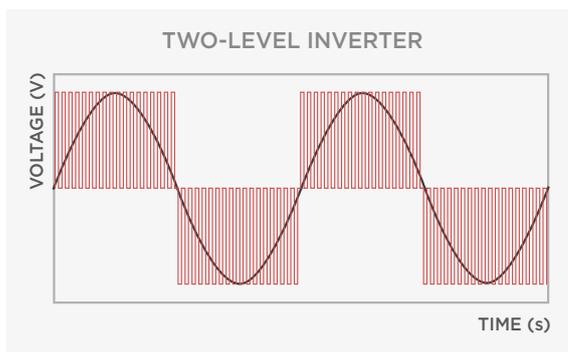
ACTIVE HEATING

In cold conditions, and when the unit is not working, the inverter can import a small amount of power from the grid to keep the inverter internal ambient temperature above -20°C, without using external resistors. This autonomous heating system is the most efficient and homogeneous way to prevent condensation, increasing the inverters availability and reducing maintenance. (patented)



MULTILEVEL TOPOLOGY

The multilevel IGBT topology makes the difference in the 1500V technology, being the most efficient way to manage high DC link voltages. Based in our long IGBT experience components used in our Solar and Industrial division, the Freemaq Hybrid takes profit of the three level IGBT topology reducing the power stage losses, increasing the efficiency and offering a very low total harmonic distortion.

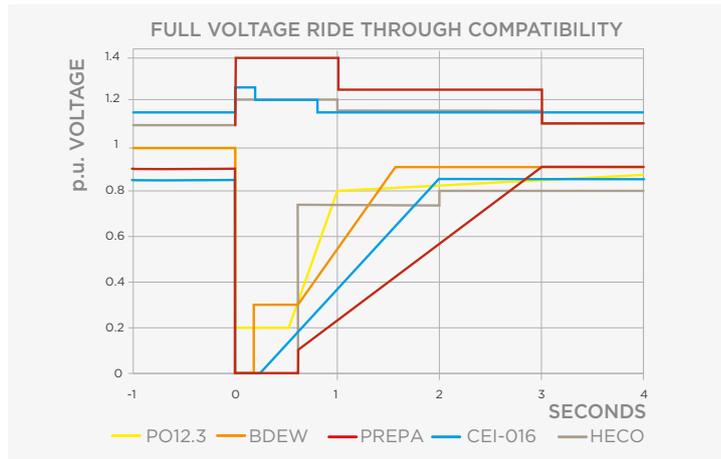




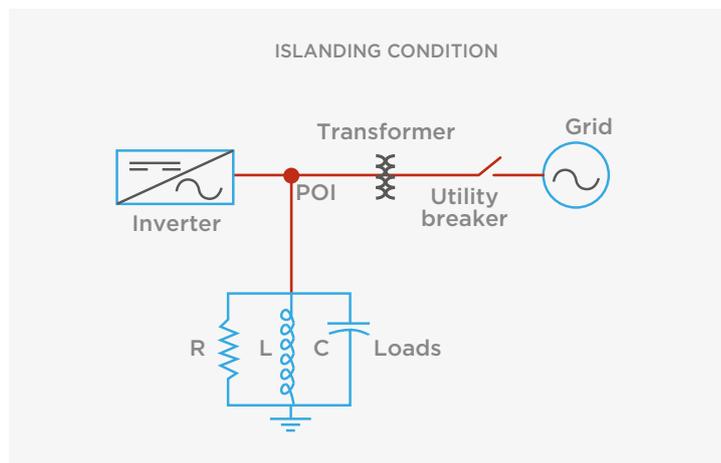
DYNAMIC GRID SUPPORT

Freemaq Hybrid firmware includes the latest utility interactive features (LVRT, OVRT, FRS, FRT, Anti-islanding, active and reactive power curtailment...), and is compatible with all the specific requirements of the utilities.

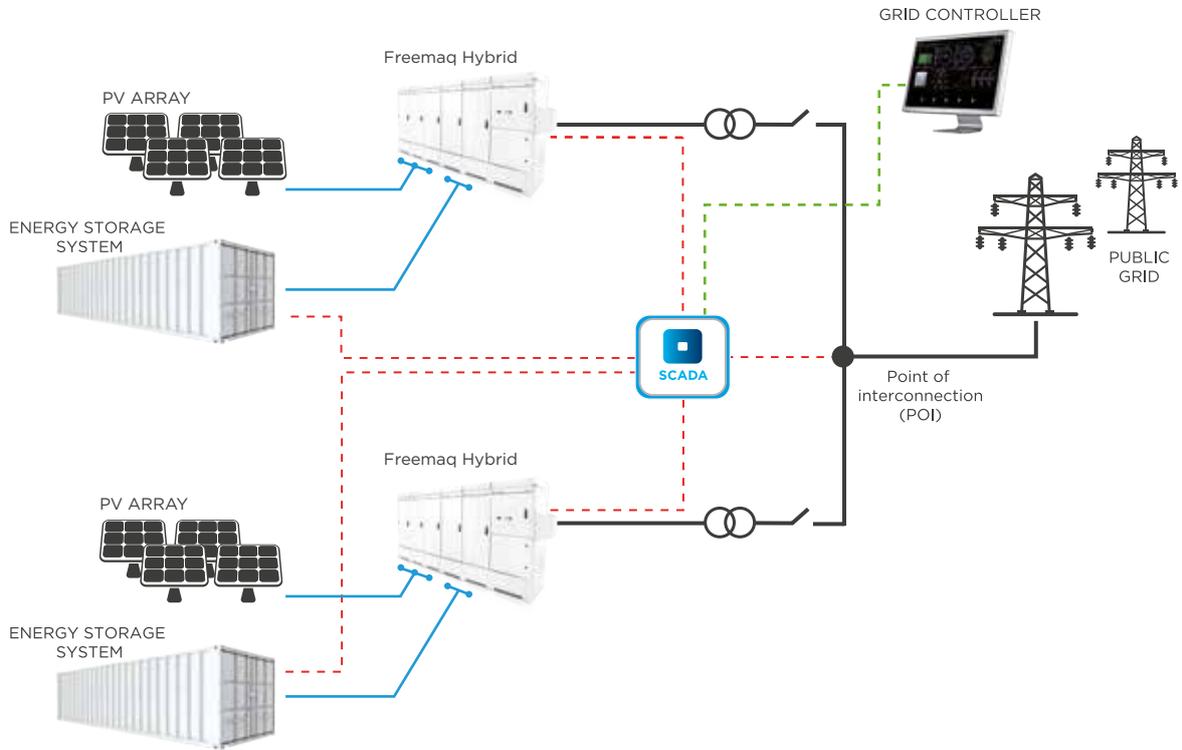
▲ **LVRT or ZVRT (Low Voltage Ride Through).** Inverters can withstand any voltage dip or profile required by the local utility. The inverter can immediately feed the fault with full reactive power, as long as the protection limits are not exceeded.



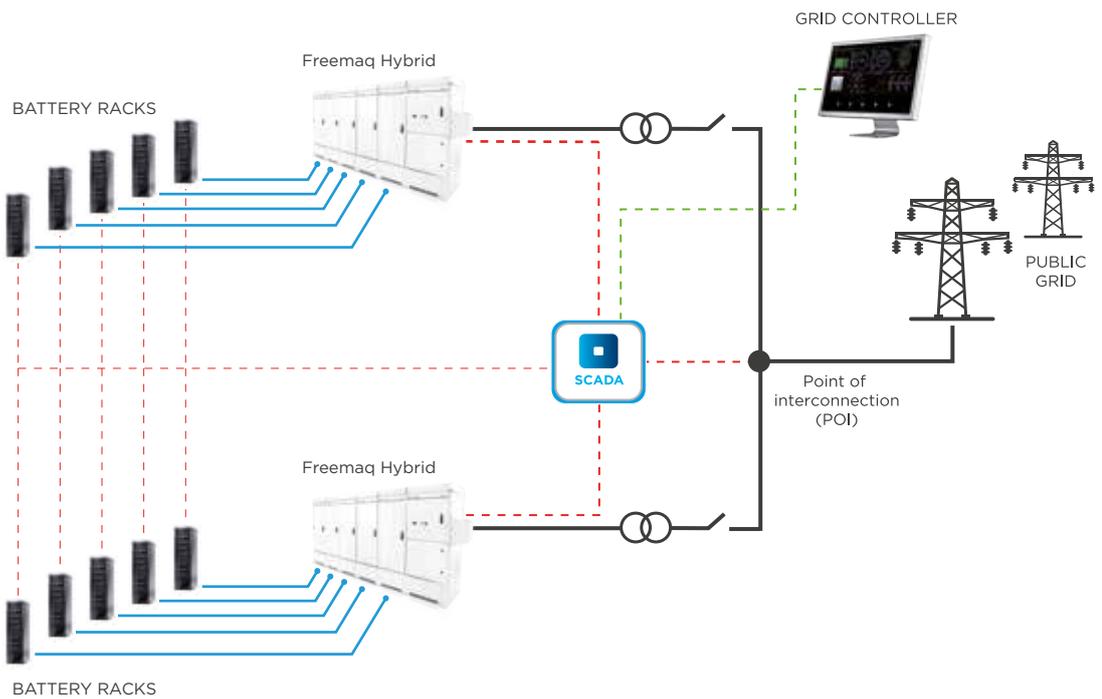
▲ **Anti-islanding:** This protection combines passive and active methods that eliminates nuisance tripping and reduces grid distortion according to IEC 62116 and IEEE1547.



EXAMPLE 1



EXAMPLE 2





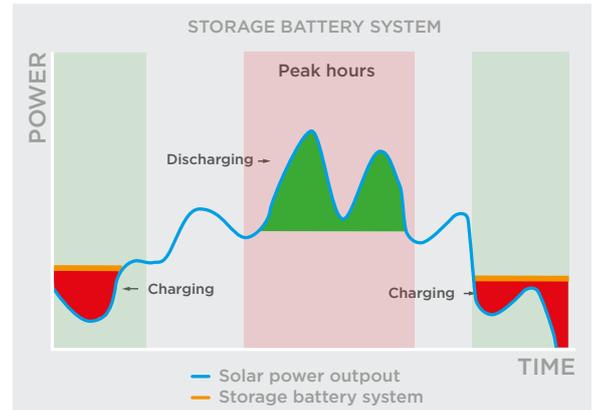
ENERGY STORAGE APPLICATIONS

Following the instructions of a plant control system, the Freemaq Hybrid can perform multiple power and dynamic grid support functions such as:



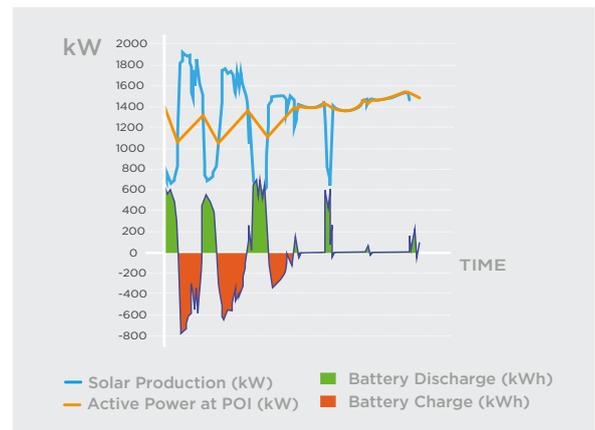
LOAD LEVELING

Freemaq Hybrid series are able to store energy during periods of low demand from the grid, in order to later supply this energy when there is a higher demand. This has the benefit of selling the energy at a higher market price during peak periods. It also allows grid operators to supply electricity with a higher renewable origin. Since PV generation may not be at the same time as peak demand, this facilitates the flexibility and integration of renewable generation into the grid.



RENEWABLE INTEGRATION

The Power Electronics Freemaq Hybrid series attenuates the intermittent nature of renewable energy sources, to provide a smoother power output. The Freemaq Hybrid controls the ramp rate at which power is injected into the grid, and thus reduces the impact of rapid power fluctuations due to sudden or transient conditions experienced by the PV array.

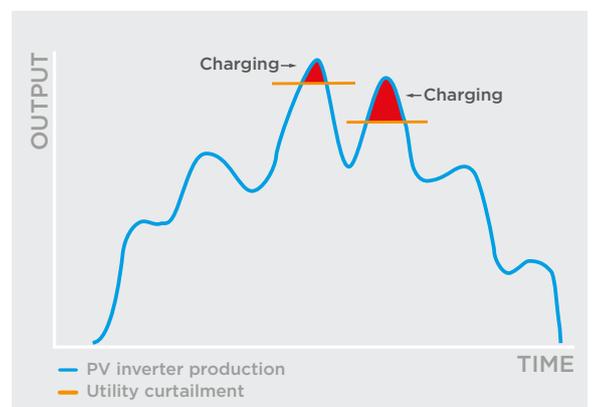


The system monitors the PV inverter output to inject or consume power accordingly to ensure the output remains within the ramp requirements.



UTILITY CURTAILMENT RECOVERY

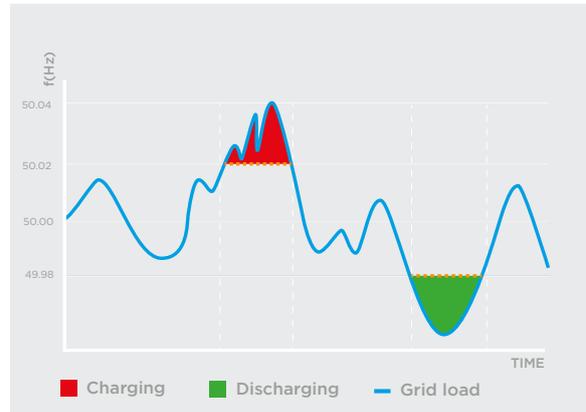
Utility scale inverter production can be curtailed by the grid operator, due to the high energy sources penetration in the grid during certain periods. With this AC-coupled energy storage system, the excess energy from the PV field can be stored in the BESS and then delivered when needed.





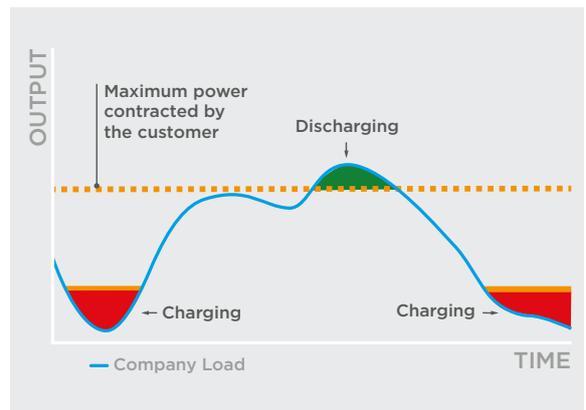
FREQUENCY REGULATION SYSTEM

Freemaq Hybrid provides ability to regulate grid frequency in both directions. When there is a grid over-frequency (generation > demand) inverter power output is curtailed and this energy is stored. When there is a grid under-frequency (generation < demand) inverter power output is increased by discharging the batteries and injecting more power to the grid.



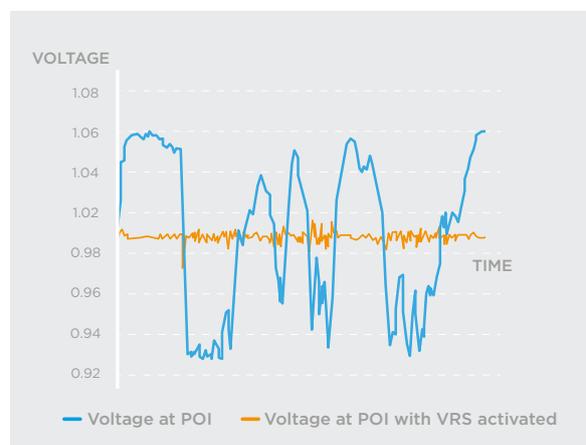
PEAK POWER SHAVING

By delivering stored energy to the grid during periods of high demand, it reduces the burden on the distribution network and increases significantly its efficiency. Energy is stored instead of injected into the grid during periods of low demand, which as a result increases the load on the grid. However, during peak periods this stored energy is then injected into the grid, which reduces the demand at this time. The result is a more flattened demand curve which means the grid can avoid switching on more expensive and polluting generators.



GRID SUPPORT

Freemaq Hybrid series helps the integration of renewable sources, by helping to maintain grid stability and power quality. It can help support the grid voltage by generating capacitive or inductive current. Other features include Voltage Control, Reactive Power Control and Fault Ride Through Support.



Freemaq Hybrid

TECHNICAL CHARACTERISTICS

		Freemaq Hybrid				
		530V	565V	600V	645V	690V
AC	AC Output Power (kVA/kW) @50°C ^[1]	980-2300	1050-2450	1100-2600	1200-2800	1275-3000
	Max. AC Output Current (A)	1070-2500				
	Operating Grid Frequency (Hz)	50/60 Hz				
	Current Harmonic Distortion (THDI)	< 3% per IEEE519				
	Power Factor (cosine phi) ^[2]	0.0 leading ... 0.0 lagging				
	Reactive power compensation	Four quadrant operation				
DC	DC Voltage Range	750-1310V	800-1310V	849-1310V	913-1310V	976-1310V
	DC Voltage Ripple	<3%				
	Max. DC continuous current (A)	1340 - 3130 (depending on the PCS configuration)				
	Battery Technology	all type of batteries (BMS required)				
	Number of separate DC inputs	Up to 7 ^[3]				
EFFICIENCY & AUX. SUPPLY	Efficiency (Max) (η)	97% (preliminary)				
	Max. Standby Consumption	< approx. 50W/per module				
	Max. Power Consumption (VA) (W)	2400 - 5600 (depending on the PCS configuration)				
	External Auxiliary Supply	Optional				
CABINET	Dimensions [WxDxH] (inches/mm)	Frame 3	119.6"x37.2"x86.5" / 3038x945x2198			
		Frame 4	147.6"x37.2"x86.5" / 3751x945x2198			
		Frame 5	175.7"x37.2"x86.5" / 4464x945x2198			
		Frame 6	203.8"x37.2"x86.5" / 5177x945x2198			
		Frame 7	231.9"x37.2"x86.5" / 5890x945x2198			
	Weight (lbs/kg)	Frame 3	5809 / 2635			
		Frame 4	7253 / 3290			
		Frame 5	8697 / 3945			
		Frame 6	1014 / 4600			
		Frame 7	11585 / 5255			
Air Flow	Bottom intake. Exhaust top rear vent					
Type of ventilation	Forced air cooling					
ENVIRONMENT	Degree of protection	IP54 / NEMA3R				
	Permissible Ambient Temperature	-35°C ^[4] to +60°C / >50°C Active Power derating				
	Relative Humidity	0% to 100% Non condensing				
	Max. Altitude (above sea level)	2000m / >2000m power derating (Max. 4000m)				
	Noise level ^[5]	< 79 dBA				
CONTROL INTERFACE	Interface	Graphic Display (inside cabinet) / Optional Freesun App				
	Communication protocol	Modbus TCP				
	Power Plant Controller	Optional. Third party SCADA systems supported				
	Keyed ON/OFF switch	Standard				
	Digital I/O	Optional ^[3]				
	Analog I/O	Optional ^[3]				
PROTECTIONS	Ground Fault Protection	Insulation monitoring device				
	Humidity control	Active Heating				
	General AC Protection & Disconn.	Circuit Breaker				
	General DC Protection & Disconn.	Contactor + Fuses				
	Overvoltage Protection	AC and DC protection (type 2)				

NOTES [1] Values at 1.00•Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.
 [2] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA))^2-P(kW)^2}$.
 [3] Each input can be defined as PV or STORAGE.
 [4] Heating resistors kit option below -20°C.
 [5] Readings taken 1 meter from the back of the unit.



Freemaq STATCOM

UTILITY SCALE STATIC COMPENSATOR



Freemaq STATCOM

Freemaq STATCOM is a high power, utility scale, modular static compensator. It is ideal for dynamic reactive response, VAR support and grid voltage stabilization in either industrial locations or distributed generators such as renewable energy plants.

Its modular design and redundant topology make it the perfect solution for the most demanding installations. As an outdoor solution, it doesn't need to be installed in a technical room and neither does it need additional cooling thanks to its revolutionary iCOOL V system.

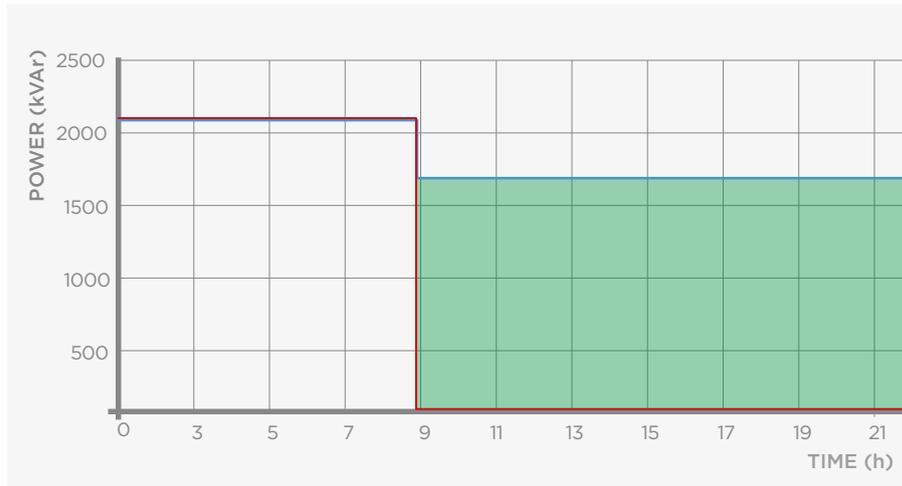
It is available in 5 different frames ranging from 1275kVAr to 3000kVAr.

INCREASE NETWORK
STABILITY WITH THE MOST
RELIABLE TECHNOLOGY



AUTOMATIC REDUNDANT POWER MODULE SYSTEM (ARPMS)

Freemaq STATCOM is a modular static compensator based on an Automatic Redundant Power Module (up to 500kVA per stage). If there is a fault in one power module, it is taken off-line and the system is still able to operate with the remaining modules. All power modules work in parallel controlled by a dual redundant main control. As the main governor of the system it is responsible for the VAR support, synchronization sequence and overall protection. The automatic redundant capability based on our industrial systems is able to shift the main control in the event of a fault, restoring the backup control and restarting the station to guarantee high availability.



— Freemaq STATCOM compensation (kVar) - 1 Module fault ■ Freemaq STATCOM extra kVar compensated (kVarh)
— Competitors STATCOM (kVar) - Fault



EASY TO SERVICE

By providing full front and rear access the Freemaq STATCOM series simplifies the maintenance tasks improving the MTTR (achieving a lower OPEX). The frontal access allows the checking of the whole electronic cabinet (electronics boards, semiconductors, power supply, contactors...) while the rear access permits the revision of AC fuses and LCL filter.

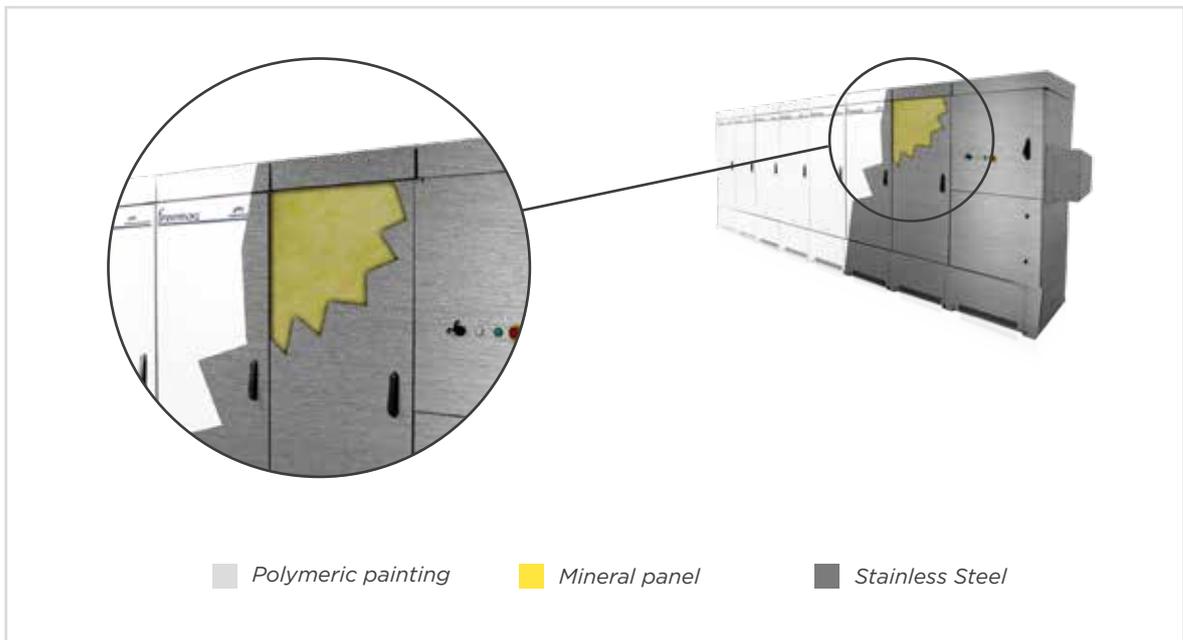




ROBUST DESIGN

Freemaq STATCOM inverters have been designed to last for more than 20 years of operation in harsh environments and extreme weather conditions. Freemaq STATCOM units are tested and ready to withstand conditions from the frozen siberian tundra to the californian Death Valley, featuring:

- Totally sealed cabin for protecting electronics against dust and moisture.
- Conformal coating on electronic boards shields PCBs from harsh atmospheres.
- Temperature and humidity controlled active heating prevents internal water condensation.
- Stainless Steel construction with 2mm thickness for maximum enclosure longevity.
- The Freemaq STATCOM has a C5-M degree of protection according to ISO 12944.
- 50mm mineral panel isolates the cabinet from solar heat gains.
- Roof cover designed to dissipate solar radiation, reduce heat build-up and avoid water leakages. The solid Freemaq STATCOM structure avoids the need of additional external structures.
- Random units selected to pass a Factory Water Tightness Test ensuring product quality.





REVOLUTIONARY COOLING SYSTEM

The Power Electronics Freemaq STATCOM series includes the innovative and sophisticated iCOOL V performance that allows Freemaq STATCOM to work up to 50°C at nominal power. The cooling system iCOOL V smartly cools the inverter, regulating the cooling system capacity depending on the data from the temperature sensors.

Freemaq STATCOM modules are divided into two main areas: clean area (electronics) and hot area (heat sink). The electronics are totally sealed and use a temperature control low flow cooling system that reduces filters clogging and maintenance intervals. The hot area integrates a speed controlled fan for each module, simplifying the cooling system and reducing the maintenance tasks.

Furthermore, due to the modular topology, the iCOOL V reduces the Stand-by consumption at low capacity to the maximum, boosting the cooling capacity for the installations situated up to 4000 meters above sea level. (patent pending)



Electronics

Heat sinks



VAR SUPPORT

The Freemaq STATCOM inverter can provide reactive power at any time in order to stabilize the grid conditions. The inverter can respond to an external dynamic signal, a Power Plant Controller command or a pre-set reactive power level (kVar).



EASY TO MONITOR

The Freesun app is the easiest way to monitor the status of our inverters. All our inverters come with built-in wifi, allowing remote connectivity to any smart device for detailed updates and information without the need to open cabinet doors. The app user friendly interface allows quick and easy access to critical information (energy registers, production and events).



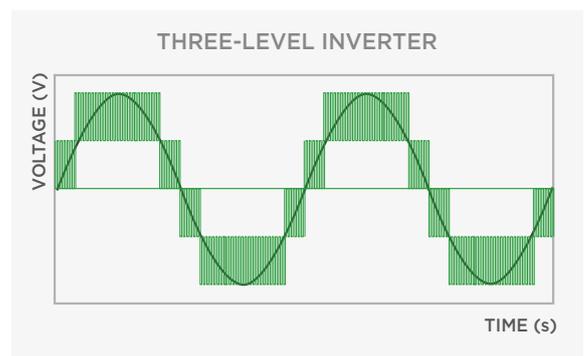
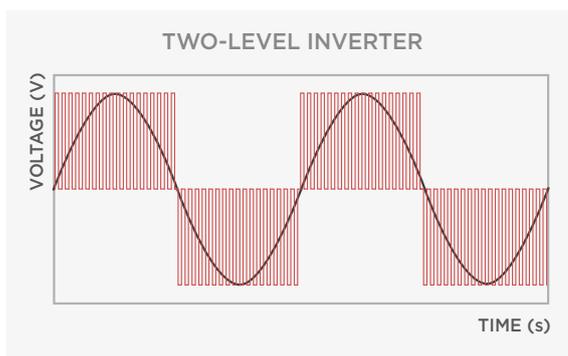
ACTIVE HEATING

In cold conditions, and when the unit is not working, the inverter can import a small amount of power from the grid to keep the inverter internal ambient temperature above -20°C , without using external resistors. This autonomous heating system is the most efficient and homogeneous way to prevent condensation, increasing the inverters availability and reducing maintenance. (patented)



MULTILEVEL TOPOLOGY

The multilevel IGBT topology makes the difference in the 1500Vdc technology, being the most efficient way to manage high DC link voltages. Based in our long IGBT experience components used in the HEC PLUS series, the Freemaq STATCOM takes profit of the three level IGBT topology reducing the power stage losses, increasing the efficiency and offering a very low total harmonic distortion.



Freemaq STATCOM

TECHNICAL CHARACTERISTICS

		Freemaq STATCOM				
		FRAME 3	FRAME 4	FRAME 5	FRAME 6	FRAME 7
NUMBER OF MODULES		3	4	5	6	7
REFERENCE		FT1275	FT1700	FT2125	FT2550	FT3000
OUTPUT	AC Output Power (kVAr) @50°C ^[1]	1275	1700	2125	2550	3000
	Max. AC Output Current (A)	1080	1440	1800	2160	2520
	Operating Grid Voltage (VAC)	690V ±10%				
	Operating Grid Frequency (Hz)	50Hz/60Hz				
	Current Harmonic Distortion (THDi)	< 3% per IEEE519				
Power Curtailment		0...100% / 0.1% Steps				
CONSUMPTION & AUX. SUPPLY	Maximum total power consumption	< 2%				
	Maximum standby consumption	< approx. 50W/per module				
	Control Power Supply	400V/230VAC (208V/120VAC) 6kVA available for external equipment (optional)				
CABINET	Dimensions [WxDxH] [inches]	119.6"x37.2"x86.5"	147.6"x37.2"x86.5"	175.7"x37.2"x86.5"	203.8"x37.2"x86.5"	231.9"x37.2"x86.5"
	Dimensions [WxDxH] [mm]	3038x945x2198	3751x945x2198	4464x945x2198	5177x945x2198	5890x945x2198
	Weight (lbs)	5809	7253	8697	10141	11585
	Weight (kg)	2635	3290	3945	4600	5255
	Air Flow	Bottom intake. Exhaust top rear vent.				
ENVIRONMENT	Type of ventilation	Forced air cooling				
	Degree of protection	NEMA 3R / IP54				
	Permissible Ambient Temperature	-35°C ^[2] to 60°C / Active Power derating >50°C				
	Relative Humidity	0% to 100% non condensing				
	Max. Altitude (above sea level)	2000m / >2000m power derating (Max. 4000m)				
CONTROL INTERFACE	Noise level ^[3]	< 79 dBA				
	Interface	Graphic Display (inside cabinet) / Optional Freesun App				
	Communication protocol	Modbus TCP				
	Power Plant Controller	Optional				
	Keyed ON/OFF switch	Standard				
PROTECTIONS	Digital I/O	User configurable				
	Analog I/O	User configurable				
	Humidity control	Active Heating				
PROTECTIONS	General AC Protection & Disconn.	Circuit Breaker				
	Module AC Protection & Disconn.	AC contactor & fuses				
	Overvoltage Protection	Type 2				

NOTES [1] Values at 1.00•Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.
 [2] Heating kit option required below -20°C.
 [3] Sound pressure level at a distance of 1m from the rear part.



PPC

UTILITY SCALE POWER PLANT CONTROLLER



POWER PLANT CONTROLLER

Power Electronics experience in integrating its products into different global electrical networks enables us to offer a set of solutions that can be customized to your requirements to control different sources of energy into the same grid.

The integration of an alternative power source creates an unprecedented opportunity to reduce operational costs to off grid industrial and commercial facilities.

ENHANCE THE DYNAMIC
GRID SUPPORT OF
YOUR PV PLANT

PPC

TECHNICAL CHARACTERISTICS

GENERAL DATA	Dimensions (WxDxH) mm	415 x 230 x 515
	Weight (kg)	10
	Mounting system	Wall mounted
	Compatible Inverters	HE, HEC and PCS by Power Electronics
	Power Supply	250W
I/O and COMMUNICATIONS [1]	4 x Digital Inputs	Programmable inputs and active high (24Vdc). Optically isolated.
	1 x RS485 Port	3 wires (GND,A,B), Modbus RTU
	1 x USB Port	PC connectable using a master Modbus configurator (ModScan or similar). Reserved for TS.
	1 x CAN Port	3 wires (LO, GND, HI), Modbus RTU
	1 x Ethernet Port (RJ45)	Modbus TCP/IP
ENVIRONMENTAL CONDITIONS	Operation Temperature	0-50°C (32°-122°F)
	Altitude	< 2000m above sea level
	Storage temperature	-20-80°C (-4°-176°F)
	Humidity	5-95% non-condensing
	Degree of protection	IP42
CERTIFICATIONS	CE	
OTHERS	Web interface for local and remote monitoring	
	Customized solution	

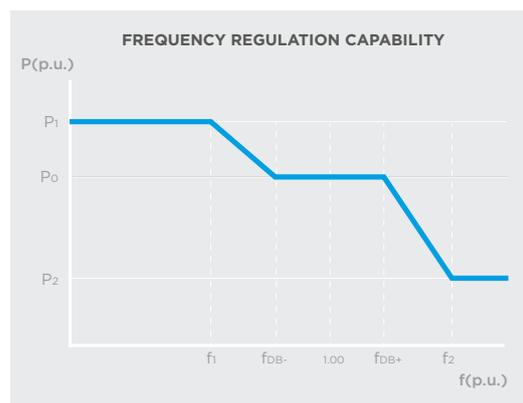
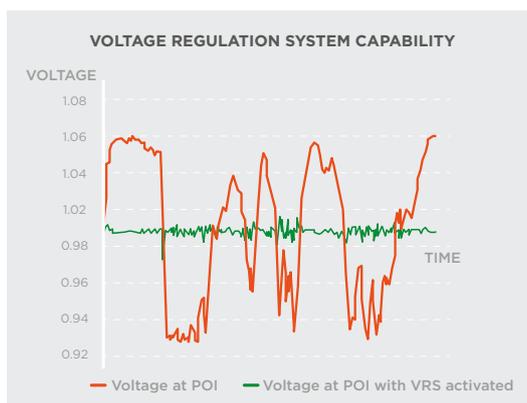
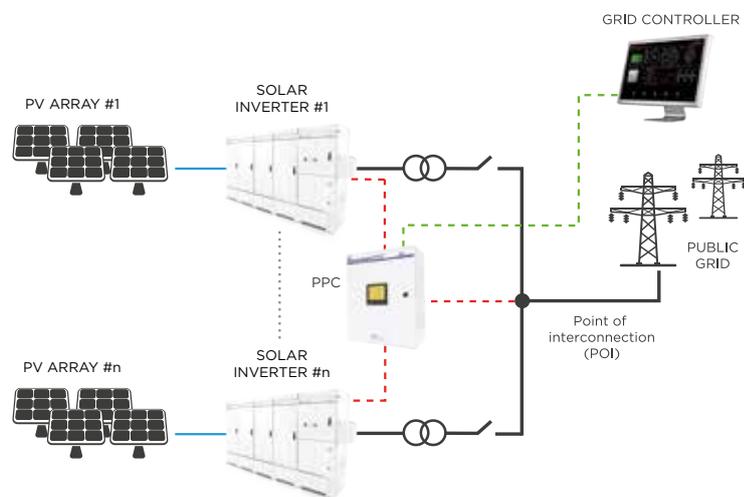
[1] Communication ports can be customised depending on PV plant design without prior notice.

DYNAMIC GRID SUPPORT

The Power Electronics Power Plant Controller is a device used to manage PV plants in order to comply with all the utility and customer requirements, thanks to its fast and flexible control algorithms.

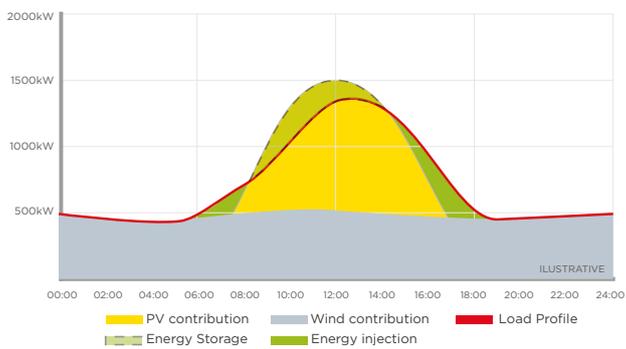
The PPC helps the grid controller to manage the performance of the PV plant, guaranteeing grid quality requirements.

The PPC includes the latest utility interactive specifications to support the grid, by controlling the reactive and active power at the POI with a fast response time. This flexible plant control device allows the user to customize the unit, in order to comply with any grid code standards and regulations.

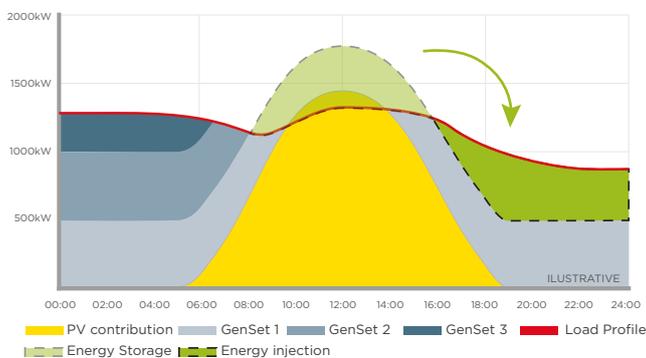
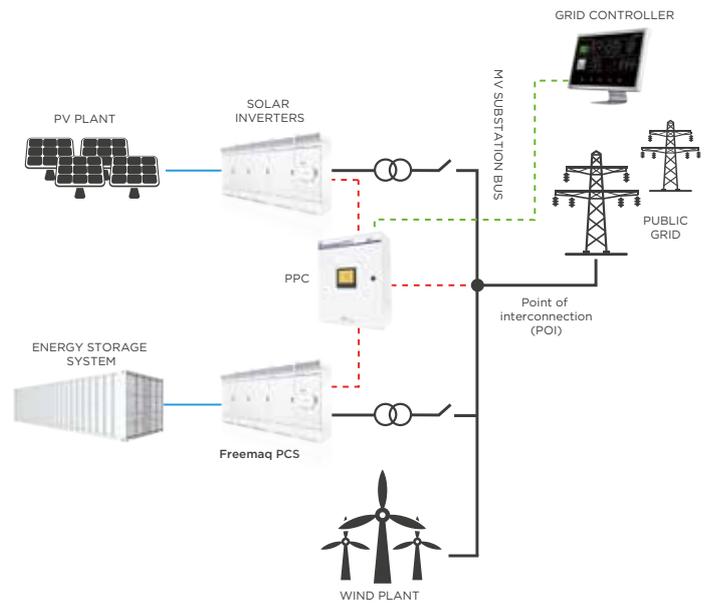


POWER PLANT CONTROLLER

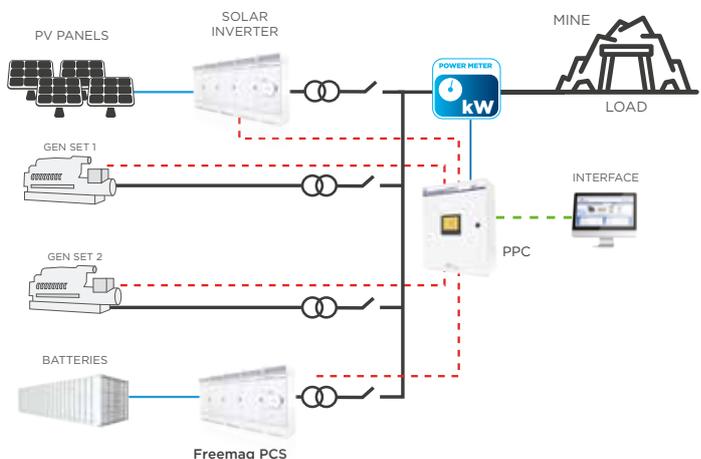
The Power Plant Controller (PPC) can be the main governor of the most complex hybrid systems by monitoring the point of interconnection (POI) and at the same time controlling the power generation and storage equipment. The PPC is equipped with the latest PLC based microprocessor that interacts through the programmable digital/analogue signals and communication ports (Modbus TCP). The PPC together with the Freesun solar inverter or the Freemaq series can be customized for those countries (Puerto Rico, Hawaii,...) that require full compliance to stringent dynamic grid support response at POI.



- PPC main governor and interface of the system.
- Multiple renewable power sources: solar, wind, etc.
- Centralized dynamic grid support at POI.
- Power smoothing - Enable ramp rate control.
- Storage equipment control.



- PPC main governor and interface of the system.
- Multiple GenSets and storage equipment control.
- Centralized dynamic grid support at POI.
- Power shaping - Enhanced broad implementation of decentralized PV.
- Power smoothing - Enable ramp rate control.



Warranty

Power Electronics (the Seller) warrants that their ENERGY STORAGE AND POWER QUALITY Products are free of faults and defects for a period of 3 years, valid from the date of delivery to the Buyer. It shall be understood that a product is free of faults and defects when its condition and performance is in compliance with its specification.



The warranty shall not extend to any Products whose defects are due to (i) careless or improper use, (ii) failure to observe the Seller's instructions regarding the transport, installation, functioning, maintenance and the storage of the Products, (iii) repairs or modifications made by the Buyer or third party without prior written authorization of the Seller, (iv) negligence during the implementation of authorized repairs or modifications, (v) if serial numbers are modified or illegible, (vi) anomalies caused by, or connected to, the elements coupled directly by the Buyer or by the final customer, (vii) accidents or events that place the Product outside its storage and operational specification, (viii) continued use of the Products after identification of a fault or defect.

The warranty excludes components that must be replaced periodically such as fuses, lamps & air filters or consumable materials subject to normal wear and tear.

The warranty excludes external parts that are not manufactured by the Seller under the brand of Power Electronics.

The Seller undertakes to replace or to repair, himself, at their discretion, any Product or its part that demonstrates a fault or defect, which is in conformance with the aforementioned terms of the warranty. Reasonable costs associated with the disassembly/assembly, transport and customs of equipment will also be undertaken by the Seller except in cases of approved intervention by the Buyer and/or their representative where cost allocation has been previously agreed.

In case of fault or defect, the Buyer shall notify the Seller in writing by using the following contact email: quality@power-electronics.com, of the presence of any fault or defect within 15 days of the fault or defect event. The serial number of the defective product plus a brief description of the fault must be included in the email. Failure to notify the Seller of fault or defect within this time period may result in the warranty becoming invalid.

In the event of replacement of defective Product or part thereof, the property of the Product or part shall be transferred to the Seller.

The Seller shall bear no liability for damages to property or third persons, even as manufacturer of the Products, other than that expressly provided by virtue of applicable mandatory law provisions. In any case, the Seller shall not be liable for indirect or consequential damages of whatsoever nature as, by way of example, production losses or unearned profits.

The Seller shall, at their discretion, forfeit all warranty rights of the Buyer if the total sum of the contract and payment has not been reached in accordance with the agreed conditions of the contract.

No other warranties, express or implied, are made with respect to the Products including, but not limited to, any implied warranty of merchantability or fitness for a particular purpose.

In any case, the Buyer's right to damages shall be limited to a maximum amount equal to no more than the price obtained by the Seller of the faulty or defective Products.

These conditions shall apply to any repaired or replacement products. Notwithstanding the above, the replacement of a Product does not imply an extension of the term of warranty outside that of the original term.

Optional additional Warranties

Power Electronics stands by the quality and durability of our inverters. That is why we offer a comprehensive 3 year warranty on our equipment. As the inverter is the critical component of the installation, it must not shutdown. This is why we have made it our top priority to create a robust and reliable product and give the best service and warranty along with it. To boost your confidence further in our products, Extended Warranty packages up to 20 years are also available.



Contact

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