POWER ELECTRONICS

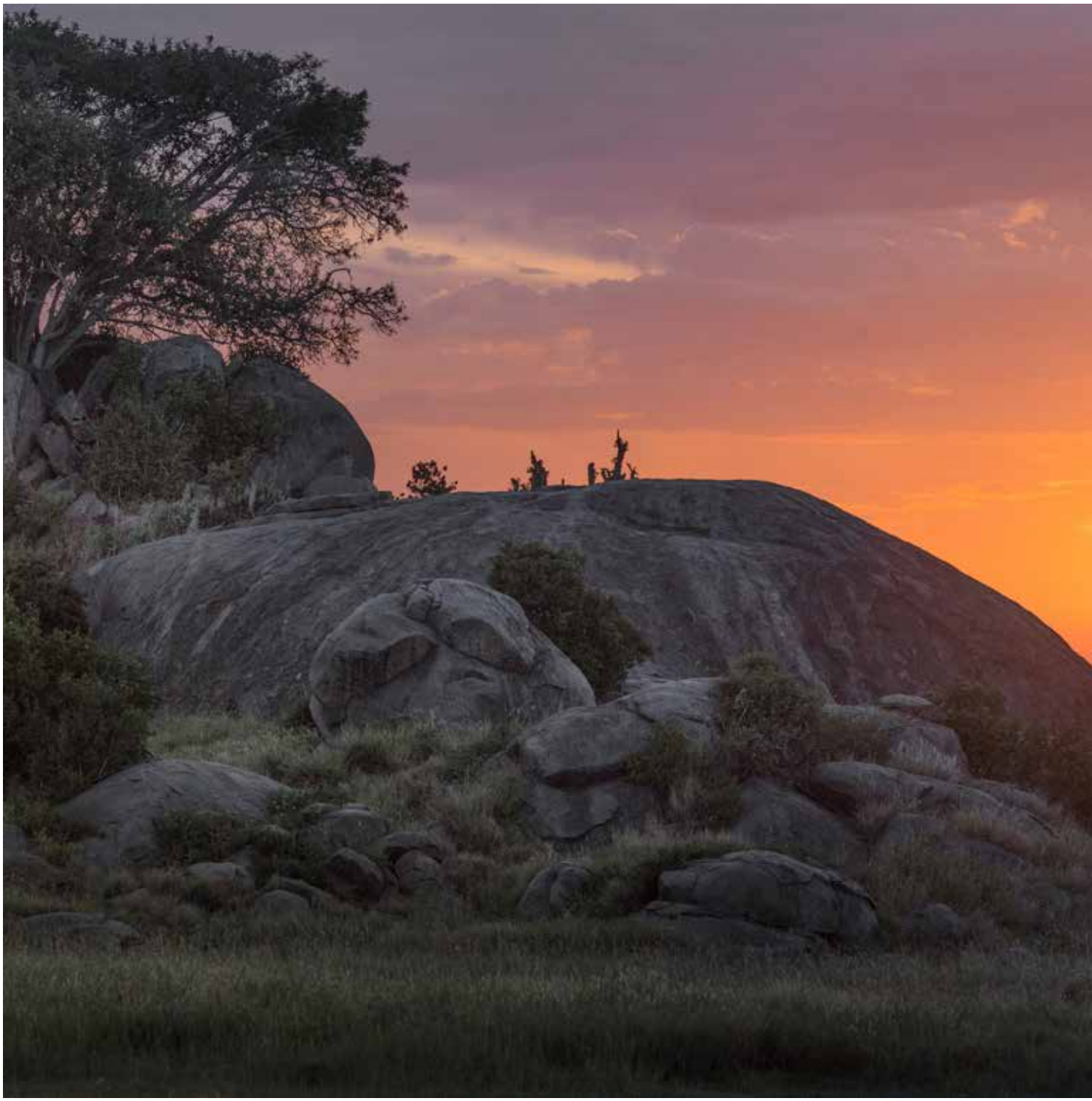
PURE ENERGY

SOLAR SOLUTIONS

INVERTERS | STATIONS

PURE ENERGY

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.



CONTENTS


CAUTION
PRÉCAUTION
RSIZE

Since 1987, Power Electronics has been producing high-power soft starters and variable speed drives for low and medium voltage AC motor applications, as well as solar inverters for photovoltaic power generation. Today, it also manufactures equipment for the charging of all types of electric vehicles, as a result of the company's commitment to electric mobility. All this experience has enabled Power Electronics to position itself as a leading manufacturer of power electronics thanks to the unique characteristics of its products, its design patents and the fastest delivery time in the market, as well as unique customer service and reference in the sector, Power On Support 24/7.

30 YEARS OF PRODUCT EXCELLENCE

24/7 POWER ON SUPPORT

INTERNATIONAL PRESENCE

FINANCIAL STABILITY AND STRENGTH

INDEPENDENT REPORTS AND CERTIFICATIONS

SUSTAINABLE GROWTH

ENGINEERING & CONSULTING

Energy projects often require customer specific solutions, for this reason our clients also have our Engineering and Consulting department at their disposal, which is comprised of 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.

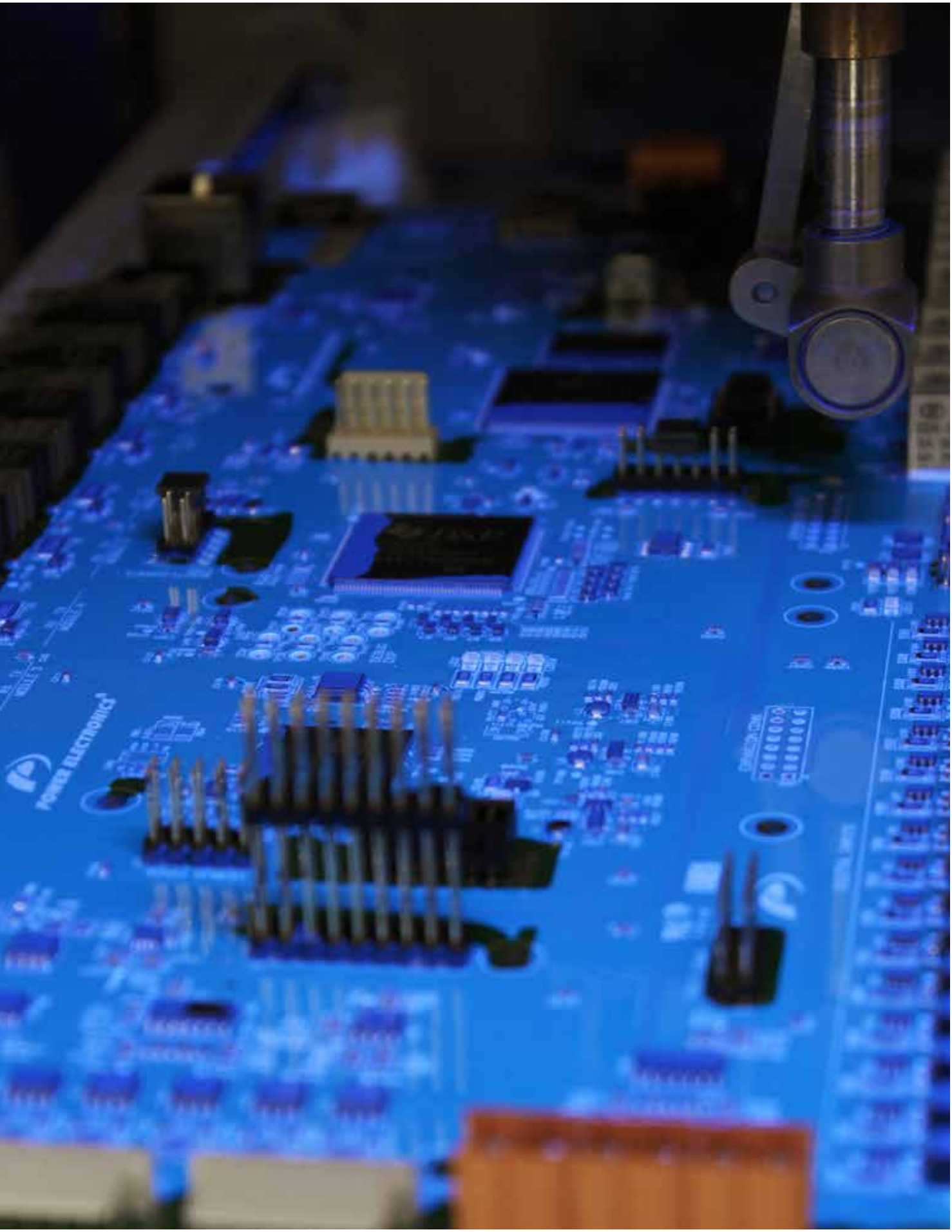
TECHNICAL ADVICE
ENGINEERING
CUSTOMIZED SOLUTIONS
PROJECT MANAGEMENT
COMMISSIONING
24/7 SERVICE

VERTICAL INTEGRATION

Flexibility and specialization play a key role in the manufacture of standard products, but even more so in personalized products. We integrate the mechanics of our equipment into our design and manufacturing. Vertical integration gives us the flexibility to adapt to customer requirements and still provide very short delivery times.

INNOVATION & DESIGN FLEXIBILITY
HIGH QUALITY COMPONENTS
RELIABLE ENGINEERING
FACTORY TESTED
VALUE CHAIN SUPERVISION
IMMEDIATE DELIVERY

"We design, manufacture and test the electronic boards of all our products"




SPORT
POWER ELECTRONICS

- **AVAILABILITY**
- **COMMISSIONING**
- **CUSTOMER SUPPORT**
- **ONSITE ASSISTANCE**
- **SPARE PARTS WARRANTY**
- **TRAINING SEMINARS**
- **WARRANTY**

POWER ON SUPPORT

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 for a signed O&M contract.

Customer Oriented Strategy.

WORLDWIDE PRESENCE

From the beginning, customer service and internationalization have been key elements for the development of the company. Thanks to the global expansion in the five continents, today we have presence and provide technical service throughout the world.

HEADQUARTERS

+28
DELEGATIONS

+100
SALES COUNTRIES

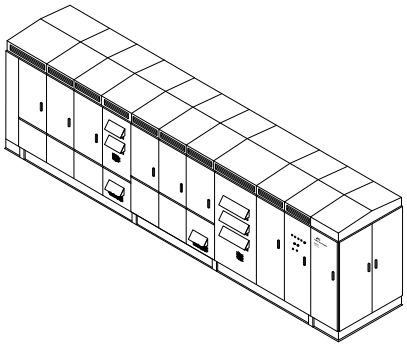
+22 GW
INVERTERS INSTALLED

+14 GW
ANNUAL CAPACITY PRODUCTION

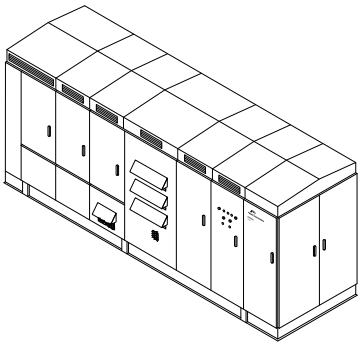

UNITED KINGDOM
GERMANY
FRANCE
ITALY
SPAIN
JAPAN
S. KOREA
CHINA
UNITED ARAB EMIRATES
INDIA
MALAYSIA
SOUTH AFRICA
AUSTRALIA
NEW ZEALAND

PRODUCT RANGE

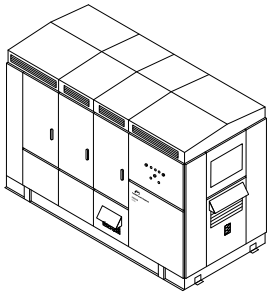
SOLAR INVERTERS



HEM HYBRID NEW
3300 kVA - 3630 kVA
34.5 kV
1000 kW - 3000 kW (DC/DC)
1500 Vdc
P. 15



HEM
3190 kVA - 3630 kVA
34.5 kV
1500 Vdc
P. 31



HEMK
2120 kVA - 3800 kVA
600 Vac - 690 Vac
1500 Vdc
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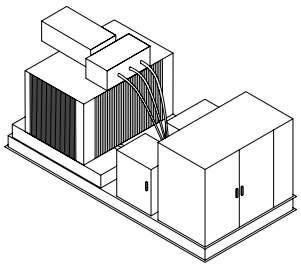
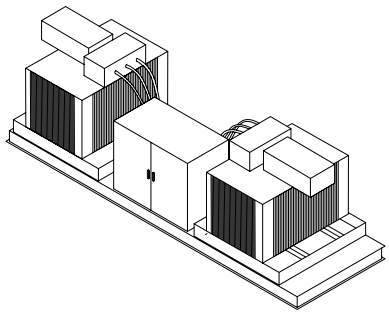
SOLAR STATIONS



MV SKID
1050 kVA - 3800 kVA
12 kV - 36 kV
Oil Transformer
2L+P/V Switchgear
P. 61



TWIN SKID
3000 kVA - 7600 kVA
12 kV - 36 kV
Oil Transformer
2L+ 2P/2V Switchgear
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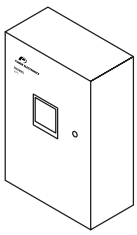
CONTROL AND MONITORING SOLUTIONS



FREESUN PPC
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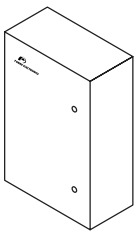

FREESUN EMS
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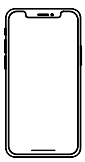


FREESUN APP
P. 77

SOLAR INVERTERS

UTILITY SCALE
OUTDOOR INVERTERS

HEM Solar inverter

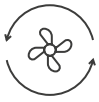
HEM HYBRID

SOLAR-PLUS-STORAGE TURN-KEY SOLUTION

DC/DC BUILT-IN

CLIPPING RECOVERY

FIELD REPLACEABLE UNITS



ICOOL 3

ECON MODE

3 LEVEL TOPOLOGY

OUTDOOR DURABILITY

THE ALL IN ONE INVERTER FOR SOLAR+STORAGE POWER PLANTS

The Power Electronics HEM HYBRID is designed for utility scale solar-plus-storage applications. It can reach up to 3.6 MVA of nominal power and include up to six Freemaq DC/DC converters of 500 kW each one all integrated in the same enclosure. Following the Freesun HEM and HEMK family philosophy, the HEM HYBRID includes the advantages of a central inverter solution but also the modularity of a string architecture. It is the lowest LCOE solution in the market for solar+storage applications. It also has the added advantage of having an integrated medium voltage transformer and switchgear. Its architecture, composed of six field replaceable units (FRU) for DC/AC conversion and up to six FRUs for DC/DC conversion, is designed to provide the highest availability and optimize yield production. Its use in utility scale PV plants provides considerable savings in CAPEX, since the integration of the DC/DC converters, MV transformer and switchgear reduces the need of additional connections.

Thanks to the Power Electronics iCOOL3 cooling system, the HEM HYBRID is able to provide NEMA 3R degree of protection with an air cooling system, and as a result reducing OPEX costs.

ROBUST DESIGN

Polymeric Painting

Closed-Cell Insulation

Galvanized Steel | Stainless Steel (Optional)

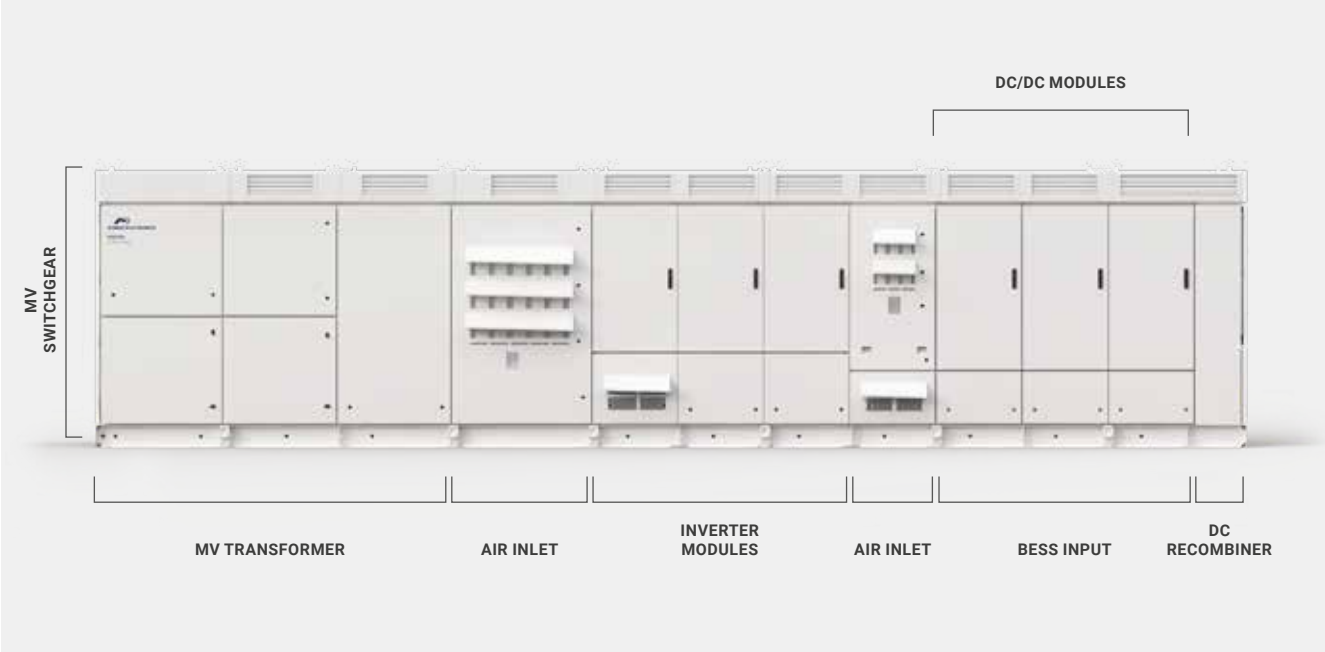
HEM HYBRID modules have a design life of greater than 30 years of operation in harsh environments and extreme weather conditions. HEM HYBRID units are tested and ready to withstand conditions from the frozen Siberian tundra to the Californian Death Valley, featuring:

Totally sealed electronics cabinet protects 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.
C4 degree of protection according to ISO 12944. Up to C5-M optional.
Closed-Cell insulation 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 HEM HYBRID structure avoids the need of additional external structures.
Random units selected to pass a Factory Water Tightness Test ensuring product quality.
NEMA 3R.

ALL IN ONE

With the HEM HYBRID, Power Electronics offers a real turnkey solution, including the MV transformer, switchgear and up to six DC/DC converters to allow the BESS connection. Everything fully assembled and tested at the factory.

The HEM HYBRID is an all in one inverter that will reduce site design, installation and connection costs, and therefore will minimize the LCOE. By providing full front access the HEM HYBRID series simplifies the maintenance tasks, reducing the MTTR (and achieving a lower OPEX). The total access allows a fast swap of the FRUs without the need of qualified technical personnel.



STRING CONCEPT POWER STAGES

The HEM HYBRID combines the advantages of a central inverter with the modularity of the string inverters. Its power stages are designed to be easily replaceable on the field without the need of advanced technical service personnel, providing a safe, reliable and fast Plug&Play assembly system.

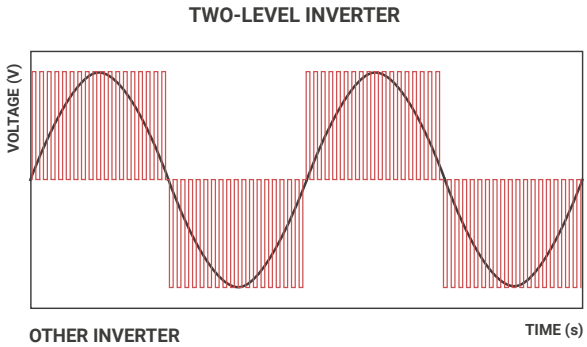
Following the modular philosophy of the Freesun series, the HEM HYBRID is composed of 6 FRUs (field replaceable units) for DC/AC conversion and up to 6 FRUs for DC/DC conversion. DC/AC power stages are physically joined in the DC side and therefore, in the event of a fault, the faulty module is taken off-line and its power is distributed evenly among the remaining functioning FRUs.

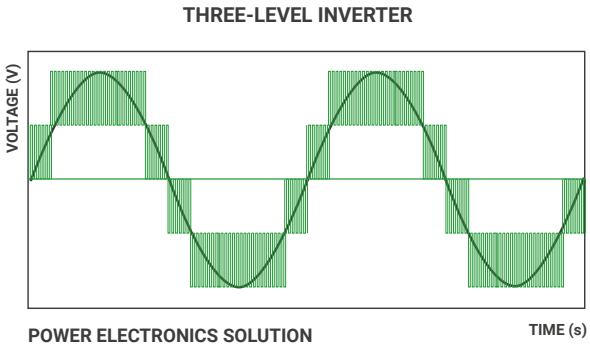
INNOVATIVE COOLING SYSTEM

Based on more than 3 years of experience with our MV Variable Speed Drive and the HEM inverter, the iCOOL3 is the first air-cooling system allowing NEMA 3R degree of protection in an outdoor solar inverter. iCOOL3 delivers a constant stream of clean air to the FRUs and the MV transformer, being the most effective way of reaching up NEMA 3R degree of protection, without having to maintain cumbersome dust filters or having to use liquid-cooling systems, avoiding the commonly known inconveniences of it (complex maintenance, risk of leaks, higher number of components…), therefore resulting in an OPEX cost reduction.

MULTILEVEL TOPOLOGY

The multilevel IGBT topology is the most efficient approach to manage high DC link voltages and makes the difference in the 1,500 Vdc design. Power Electronics has many years of power design in both inverters and MV drives and the HEM HYBRID design is the result of our experience with 3 level topologies. The 3 level IGBT topology reduces stage losses, increases inverter efficiency and minimizes total harmonic distortion. High efficiency to deliver the lowest LCOE.





ACTIVE HEATING

At night, when the unit is not actively exporting power, the inverter can import a small amount of power 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**

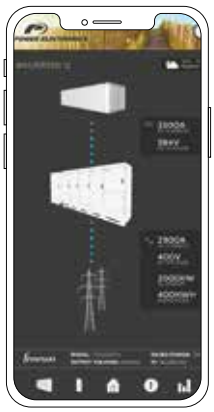
ECON MODE

This innovative control mode allows increasing the efficiency of the MV transformer up to 25%, reducing the power consumption of the plant and therefore providing considerable savings. Available as an optional kit, this feature has a payback time of less than a few years, therefore resulting in the increase of the plant lifetime overall revenue.

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.

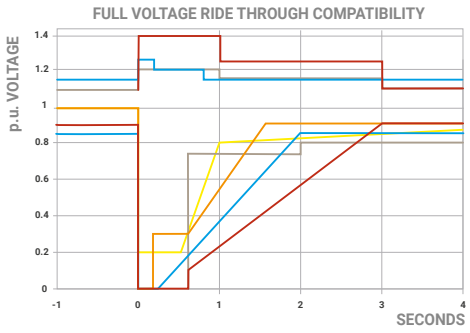
The app user-friendly interface allows quick and easy access to critical information (energy registers, production and events).



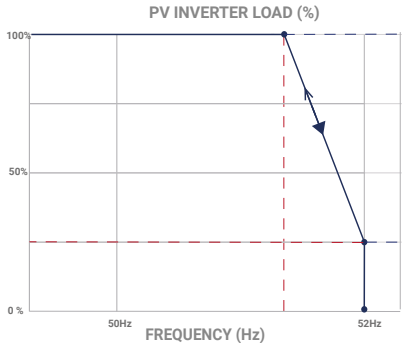
AVAILABLE INFORMATION	Grid and PV field data. Inverter and Power module data (Voltages, currents, power, temperatures, I/O status...). Weather conditions. Alarms and warnings events. Energy registers. Others.
FEATURES	Easy Wireless connection. Comprehensive interface. Real time data. Save and copy settings.
LANGUAGE	English, Spanish.
SYSTEM REQUIREMENTS	iOS or Android devices.
SETTINGS CONTROL	Yes.

DYNAMIC GRID SUPPORT

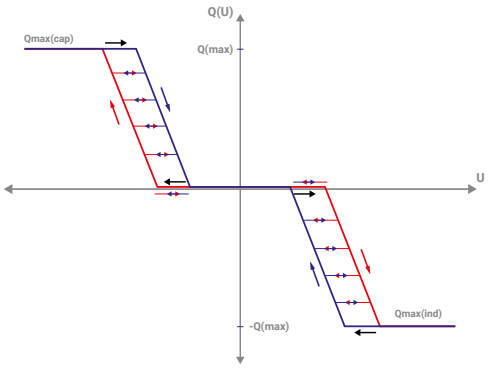
HEM HYBRID firmware includes the latest utility interactive features (LVRT, OVRT, FRS, FRT, Anti-islanding, active and reactive power curtailment…), and can be configured to meet specific utility requirements.

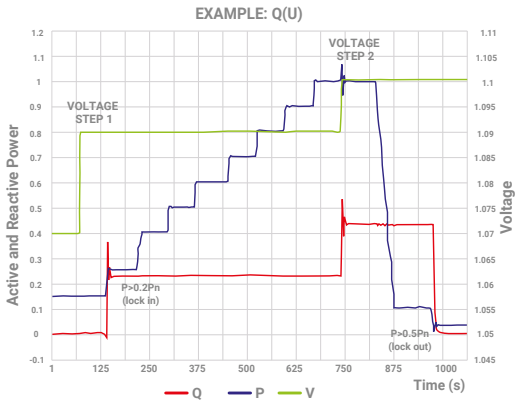


Low Voltage Ride Through (LVRT or ZVRT). Inverters can withstand any voltage dip or profile required by the local utility. In this situation, the inverter can inject current up to the nominal value.

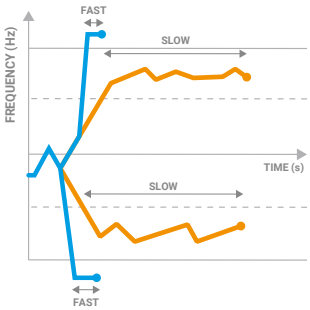


Frequency Response (FR). Active power can be adjusted automatically along a preset characteristic curve in response to high or low frequency events for grid stabilization.

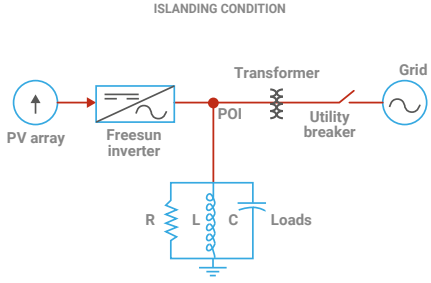




Q(V) curve. It is a dynamic voltage control function which provides reactive power in order to maintain the voltage as close as possible to its nominal value.



Frequency Ride Through (FRT). Freesun solar inverters have flexible frequency protection settings and can be easily adjusted to comply with future requirements.

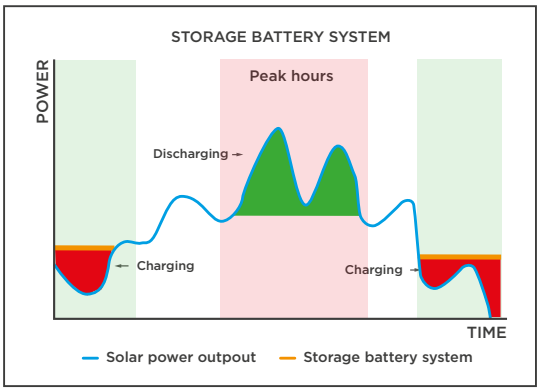


Anti-islanding. This protection combines passive and active detection methods that eliminate nuisance tripping and allow to comply with IEC 62116 and IEEE 1547 standards.

ENERGY STORAGE APPLICATIONS

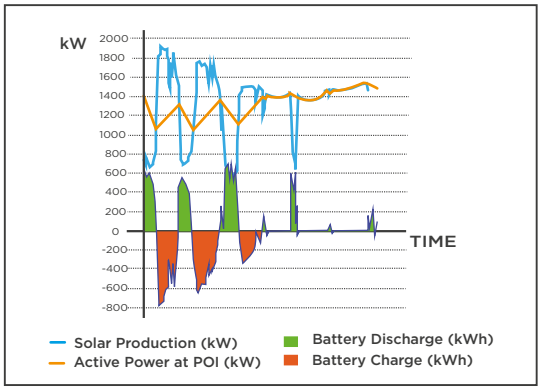
LOAD LEVELING

The HEM HYBRID series allow 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.



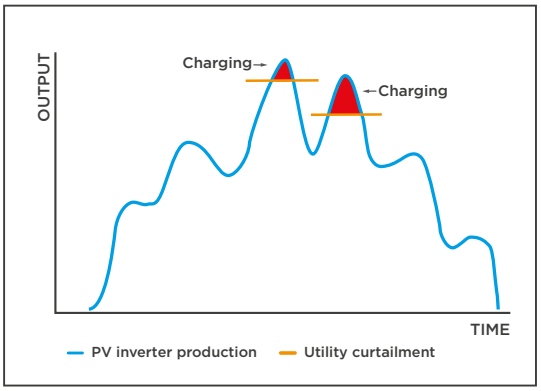
RENEWABLE INTEGRATION

The HEM HYBRID series allow to attenuate the intermittent nature of renewable energy sources, to provide a smoother power output. The HEM 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.



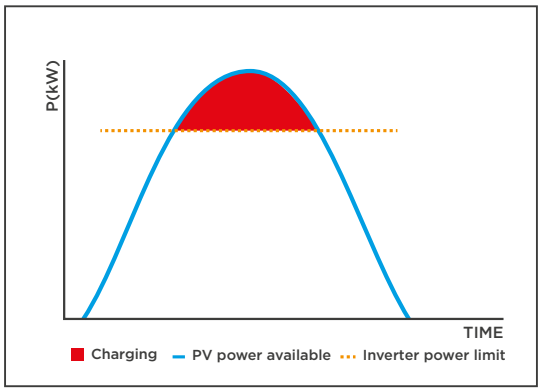
UTILITY CURTAILMENT RECOVERY

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 DC-coupled energy storage system, the excess energy from the PV field can be stored in the Battery Energy Storage System (BESS) and then delivered when needed.



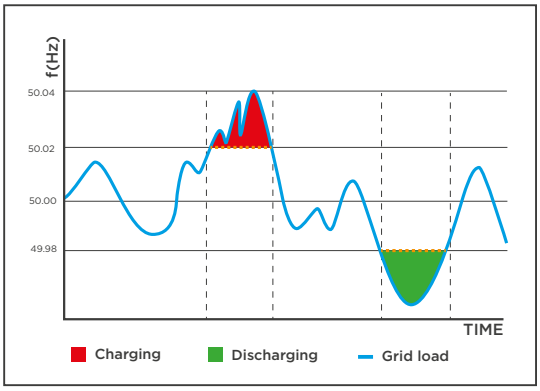
CLIPPING RECOVERY

The Power Electronics HEM HYBRID 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 RESPONSE

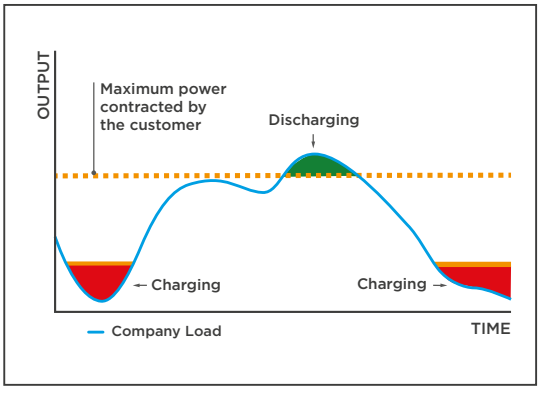
The HEM HYBRID provides ability to regulate grid frequency in both directions. When there is a grid overfrequency (generation>demand) inverter power output is curtailed and this energy is stored. When there is a grid under-frequency (generation<demand) inverter power output is increased by discharging 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.



FRONT VIEW

BACK VIEW

TECHNICAL CHARACTERISTICS HEM HYBRID

REFERENCE		FS3510M2	FS3510M4	FS3510M6
OUTPUT	AC Output Power (kVA/kW) @50°C [1]	3510		
	AC Output Power (kVA/kW) @40°C [1]	3630		
	Operating Grid Voltage	34.5 kV ±10 %		
	Operating Grid Frequency	60Hz		
	Current Harmonic Distortion (THDi)	< 3% per IEEE 519		
	Power Factor (cosine phi) [2]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night		
INPUT	MPPt @full power	934V - 1310V		
	Maximum DC voltage	1500V		
	Number of PV inputs [3]	Up to 36		
	Number of Freemaq DC/DC	2	4	6
	Freemaq DC/DC Power (kW) @50ºC	1000	2000	3000
	DC ESS Voltage range [4]	700V - 1500V		
	Max. DC continuous current (A) [5]	6200		
	Max. DC short circuit current (A) [5]	12000		
EFFICIENCY & AUXILIARY SUPPLY	Max. PV Inverter Efficiency PAC, nom (η)	97.80% including MV transformer (preliminary)		
	CEC PV Inverter Efficiency (η)	97.51% including MV transformer (preliminary)		
	Max. Power Consumption (kVA)	30		
CABINET	Dimensions [WxDxH] (ft)	30.38 x 7 x 7 (preliminary)		
	Dimensions [WxDxH] (m)	9.26 x 2.2 x 2.2 (preliminary)		
	Weight (lb)	< 41888		
	Weight (kg)	< 19000		
	Type of ventilation	Forced air cooling		
ENVIRONMENT	Degree of protection	NEMA 3R		
	Permissible Ambient Temperature	-35°C to +60°C / > 50°C Active Power derating		
	Relative Humidity	4 % to 100 % non condensing		
	Max. Altitude (above sea level) [6]	2000 m		
	Noise level [7]	< 79 dBA		
CONTROL INTERFACE	Communication protocol	Modbus TCP		
	Plant Controller Communication	Optional		
	Keyed ON/OFF switch	Standard		
PROTECTIONS	Ground Fault Protection	GFDI and isolation monitoring device		
	General AC Protection	MV switchgear (configurable)		
	General DC Protection	Fuses		
	Overvoltage Protection	Type 2		
CERTIFICATIONS	Safety	UL 1741, CSA 22.2 No.107.1-16		
	Compliance	NEC 2017		
	Utility interconnect	IEEE 1547.1-2005 / UL 1741 SA - Feb. 2018		

[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] Consult Power Electronics for derating curves.
[5] Consult Power Electronics for higher currents.
[6] Consult Power Electronics for other altitudes.
[7] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEM HYBRID

REFERENCE		FS3430M2	FS3430M4	FS3430M6
OUTPUT	AC Output Power (kVA/kW) @50°C [1]		3430	
	AC Output Power (kVA/kW) @40°C [1]		3550	
	Operating Grid Voltage		34.5 kV ±10 %	
	Operating Grid Frequency		60Hz	
	Current Harmonic Distortion (THDi)		< 3% per IEEE 519	
	Power Factor (cosine phi) [2]		0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power		913V - 1310V	
	Maximum DC voltage		1500V	
	Number of PV inputs [3]		Up to 36	
	Number of Freemaq DC/DC	2	4	6
	Freemaq DC/DC Power (kW) @50ºC	1000	2000	3000
	DC ESS Voltage range [4]		700V - 1500V	
	Max. DC continuous current (A) [5]		6200	
	Max. DC short circuit current (A) [5]		12000	
EFFICIENCY & AUXILIARY SUPPLY	Max. PV Inverter Efficiency PAC, nom (η)		97.76% including MV transformer (preliminary)	
	CEC PV Inverter Efficiency (η)		97.50% including MV transformer (preliminary)	
	Max. Power Consumption (kVA)		30	
CABINET	Dimensions [WxDxH] (ft)		30.38 x 7 x 7 (preliminary)	
	Dimensions [WxDxH] (m)		9.26 x 2.2 x 2.2 (preliminary)	
	Weight (lb)		< 41888	
	Weight (kg)		< 19000	
	Type of ventilation		Forced air cooling	
ENVIRONMENT	Degree of protection		NEMA 3R	
	Permissible Ambient Temperature		-35°C to +60°C / > 50°C Active Power derating	
	Relative Humidity		4 % to 100 % non condensing	
	Max. Altitude (above sea level) [6]		2000 m	
	Noise level [7]		< 79 dBA	
CONTROL INTERFACE	Communication protocol		Modbus TCP	
	Plant Controller Communication		Optional	
	Keyed ON/OFF switch		Standard	
PROTECTIONS	Ground Fault Protection		GFDI and isolation monitoring device	
	General AC Protection		MV switchgear (configurable)	
	General DC Protection		Fuses	
	Overvoltage Protection		Type 2	
CERTIFICATIONS	Safety		UL 1741, CSA 22.2 No.107.1-16	
	Compliance		NEC 2017	
	Utility interconnect		IEEE 1547.1-2005 / UL 1741 SA - Feb. 2018	

[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] Consult Power Electronics for derating curves.
[5] Consult Power Electronics for higher currents.
[6] Consult Power Electronics for other altitudes.
[7] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEM HYBRID

REFERENCE		FS3350M2	FS3350M4	FS3350M6
OUTPUT	AC Output Power (kVA/kW) @50°C [1]		3350	
	AC Output Power (kVA/kW) @40°C [1]		3465	
	Operating Grid Voltage		34.5 kV ±10 %	
	Operating Grid Frequency		60Hz	
	Current Harmonic Distortion (THDi)		< 3% per IEEE 519	
	Power Factor (cosine phi) [2]		0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power		891V - 1310V	
	Maximum DC voltage		1500V	
	Number of PV inputs [3]		Up to 36	
	Number of Freemaq DC/DC	2	4	6
	Freemaq DC/DC Power (kW) @50ºC	1000	2000	3000
	DC ESS Voltage range [4]		700V - 1500V	
	Max. DC continuous current (A) [5]		6200	
	Max. DC short circuit current (A) [5]		12000	
EFFICIENCY & AUXILIARY SUPPLY	Max. PV Inverter Efficiency PAC, nom (η)		97.75% including MV transformer (preliminary)	
	CEC PV Inverter Efficiency (η)		97.48% including MV transformer (preliminary)	
	Max. Power Consumption (kVA)		30	
CABINET	Dimensions [WxDxH] (ft)		30.38 x 7 x 7 (preliminary)	
	Dimensions [WxDxH] (m)		9.26 x 2.2 x 2.2 (preliminary)	
	Weight (lb)		< 41888	
	Weight (kg)		< 19000	
	Type of ventilation		Forced air cooling	
ENVIRONMENT	Degree of protection		NEMA 3R	
	Permissible Ambient Temperature		-35°C to +60°C / > 50°C Active Power derating	
	Relative Humidity		4 % to 100 % non condensing	
	Max. Altitude (above sea level) [6]		2000 m	
	Noise level [7]		< 79 dBA	
CONTROL INTERFACE	Communication protocol		Modbus TCP	
	Plant Controller Communication		Optional	
	Keyed ON/OFF switch		Standard	
PROTECTIONS	Ground Fault Protection		GFDI and isolation monitoring device	
	General AC Protection		MV switchgear (configurable)	
	General DC Protection		Fuses	
	Overvoltage Protection		Type 2	
CERTIFICATIONS	Safety		UL 1741, CSA 22.2 No.107.1-16	
	Compliance		NEC 2017	
	Utility interconnect		IEEE 1547.1-2005 / UL 1741 SA - Feb. 2018	

[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] Consult Power Electronics for derating curves.
[5] Consult Power Electronics for higher currents.
[6] Consult Power Electronics for other altitudes.
[7] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEM HYBRID

REFERENCE		FS3270M2	FS3270M4	FS3270M6
OUTPUT	AC Output Power (kVA/kW) @50°C [1]		3270	
	AC Output Power (kVA/kW) @40°C [1]		3380	
	Operating Grid Voltage		34.5 kV ±10 %	
	Operating Grid Frequency		60Hz	
	Current Harmonic Distortion (THDi)		< 3% per IEEE 519	
	Power Factor (cosine phi) [2]		0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power		870V - 1310V	
	Maximum DC voltage		1500V	
	Number of PV inputs [3]		Up to 36	
	Number of Freemaq DC/DC	2	4	6
	Freemaq DC/DC Power (kW) @50ºC	1000	2000	3000
	DC ESS Voltage range [4]		700V - 1500V	
	Max. DC continuous current (A) [5]		6200	
	Max. DC short circuit current (A) [5]		12000	
EFFICIENCY & AUXILIARY SUPPLY	Max. PV Inverter Efficiency PAC, nom (η)		97.71% including MV transformer (preliminary)	
	CEC PV Inverter Efficiency (η)		97.47% including MV transformer (preliminary)	
	Max. Power Consumption (kVA)		30	
CABINET	Dimensions [WxDxH] (ft)		30.38 x 7 x 7 (preliminary)	
	Dimensions [WxDxH] (m)		9.26 x 2.2 x 2.2 (preliminary)	
	Weight (lb)		< 41888	
	Weight (kg)		< 19000	
	Type of ventilation		Forced air cooling	
ENVIRONMENT	Degree of protection		NEMA 3R	
	Permissible Ambient Temperature		-35°C to +60°C / > 50°C Active Power derating	
	Relative Humidity		4 % to 100 % non condensing	
	Max. Altitude (above sea level) [6]		2000 m	
	Noise level [7]		< 79 dBA	
CONTROL INTERFACE	Communication protocol		Modbus TCP	
	Plant Controller Communication		Optional	
	Keyed ON/OFF switch		Standard	
PROTECTIONS	Ground Fault Protection		GFDI and isolation monitoring device	
	General AC Protection		MV switchgear (configurable)	
	General DC Protection		Fuses	
	Overvoltage Protection		Type 2	
CERTIFICATIONS	Safety		UL 1741, CSA 22.2 No.107.1-16	
	Compliance		NEC 2017	
	Utility interconnect		IEEE 1547.1-2005 / UL 1741 SA - Feb. 2018	

[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] Consult Power Electronics for derating curves.
[5] Consult Power Electronics for higher currents.
[6] Consult Power Electronics for other altitudes.
[7] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEM HYBRID

REFERENCE		FS3190M2	FS3190M4	FS3190M6
OUTPUT	AC Output Power (kVA/kW) @50°C [1]	3190		
	AC Output Power (kVA/kW) @40°C [1]	3300		
	Operating Grid Voltage	34.5 kV ±10 %		
	Operating Grid Frequency	60Hz		
	Current Harmonic Distortion (THDi)	< 3% per IEEE 519		
	Power Factor (cosine phi) [2]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night		
INPUT	MPPt @full power	849V - 1310V		
	Maximum DC voltage	1500V		
	Number of PV inputs [3]	Up to 36		
	Number of Freemaq DC/DC	2	4	6
	Freemaq DC/DC Power (kW) @50ºC	1000	2000	3000
	DC ESS Voltage range [4]	700V - 1500V		
	Max. DC continuous current (A) [5]	6200		
	Max. DC short circuit current (A) [5]	12000		
EFFICIENCY & AUXILIARY SUPPLY	Max. PV Inverter Efficiency PAC, nom (η)	97.68% including MV transformer (preliminary)		
	CEC PV Inverter Efficiency (η)	97.47% including MV transformer (preliminary)		
	Max. Power Consumption (kVA)	30		
CABINET	Dimensions [WxDxH] (ft)	30.38 x 7 x 7 (preliminary)		
	Dimensions [WxDxH] (m)	9.26 x 2.2 x 2.2 (preliminary)		
	Weight (lb)	< 41888		
	Weight (kg)	< 19000		
	Type of ventilation	Forced air cooling		
ENVIRONMENT	Degree of protection	NEMA 3R		
	Permissible Ambient Temperature	-35°C to +60°C / > 50°C Active Power derating		
	Relative Humidity	4 % to 100 % non condensing		
	Max. Altitude (above sea level) [6]	2000 m		
	Noise level [7]	< 79 dBA		
CONTROL INTERFACE	Communication protocol	Modbus TCP		
	Plant Controller Communication	Optional		
	Keyed ON/OFF switch	Standard		
PROTECTIONS	Ground Fault Protection	GFDI and isolation monitoring device		
	General AC Protection	MV switchgear (configurable)		
	General DC Protection	Fuses		
	Overvoltage Protection	Type 2		
CERTIFICATIONS	Safety	UL 1741, CSA 22.2 No.107.1-16		
	Compliance	NEC 2017		
	Utility interconnect	IEEE 1547.1-2005 / UL 1741 SA - Feb. 2018		

[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] Consult Power Electronics for derating curves.
[5] Consult Power Electronics for higher currents.
[6] Consult Power Electronics for other altitudes.
[7] Readings taken 1 meter from the back of the unit.

HEM

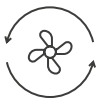
UTILITY SCALE MV CENTRAL STRING INVERTER

FIELD REPLACEABLE UNITS

OUTDOOR DURABILITY

BUS PLUS SOLAR + STORAGE

NEMA 3R



ICOOL 3

ACTIVE HEATING

3 LEVEL TOPOLOGY

ECON MODE

THE INNOVATIVE MEDIUM VOLTAGE CENTRAL STRING INVERTER

The Power Electronics HEM medium voltage inverter is designed for utility scale solar applications, that require the advantages of a central inverter solution but also the modularity of a string architecture. The HEM can reach up to a nominal power of 3.6 MVA, and offers a wide MPPT window. It also has the added advantage of having an integrated medium voltage transformer and switchgear.

The Bus Plus ready feature allows the connection of up to six Freemaq DC/DC converters. It is the most cost competitive solution for solar-plus-storage retrofits.

Its architecture, composed of six field replaceable units (FRU), is designed to provide the highest availability and optimize yield production. Its use in Utility Scale PV plants provides considerable savings in CAPEX, since having an integrated MV transformer and switchgear reduces the need of additional connections between the LV and MV sides.

Thanks to the Power Electronics iCOOL3 cooling system, the HEM is able to provide NEMA 3R degree of protection with an air cooling system, and as a result reducing OPEX costs. This product has been designed to be the lowest LCOE solution in the market for solar applications.

ROBUST DESIGN

Polymeric Painting

Closed-Cell Insulation

Galvanized Steel | Stainless Steel (Optional)

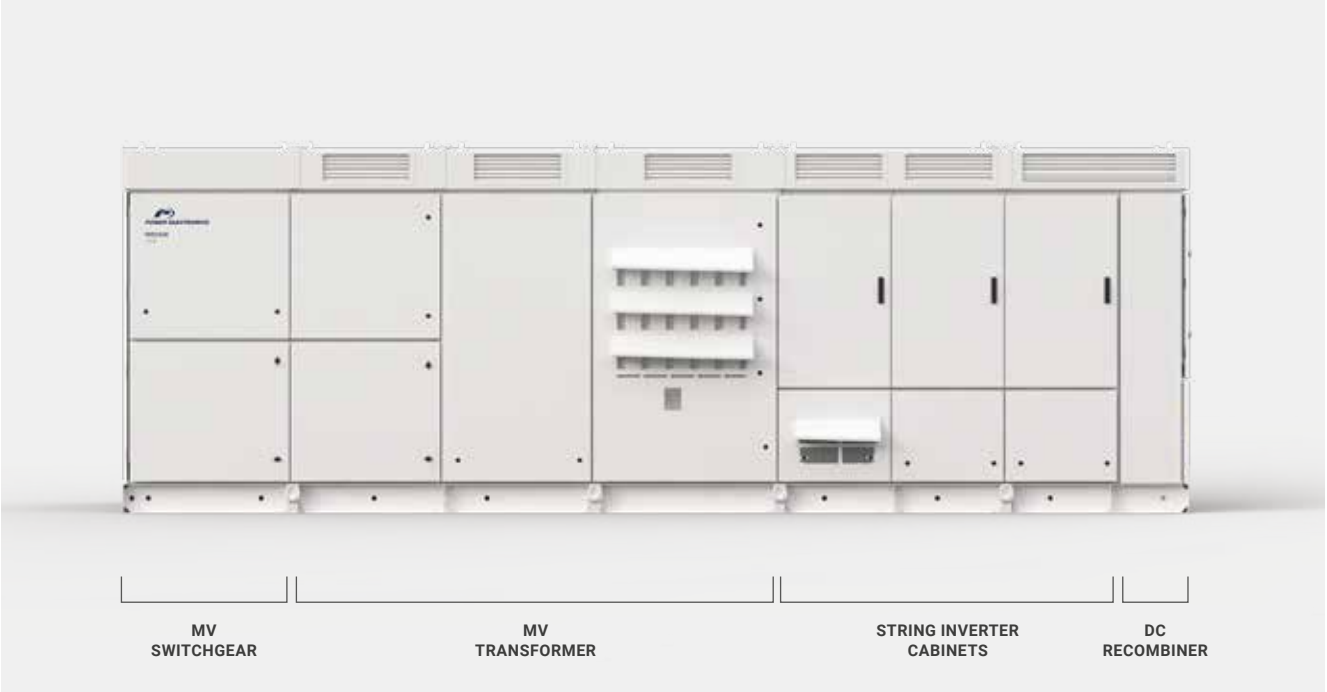
HEM inverter modules have a design life of greater than 30 years of operation in harsh environments and extreme weather conditions. HEM units are tested and ready to withstand conditions from the frozen Siberian tundra to the Californian Death Valley, featuring:

- Totally sealed electronics cabinet protects 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.
- C4 degree of protection according to ISO 12944.
  Up to C5-M optional.
- Closed-Cell insulation 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 HEM structure avoids the need of additional external structures.
- Random units selected to pass a Factory Water Tightness Test ensuring product quality.
- NEMA 3R.

REAL TURN-KEY SOLUTION - EASY TO SERVICE

With the HEM, Power Electronics offers a real turn-key solution, including the MV transformer and switchgear fully assembled and tested at the factory. The HEM is a compact turn-key solution that will reduce site design, installation and connection costs, and therefore will minimize the LCOE.

By providing full front access the HEM series simplifies the maintenance tasks, reducing the MTTR (and achieving a lower OPEX). The total access allows a fast swap of the FRUs without the need of qualified technical personnel.



STRING CONCEPT POWER STAGES

The HEM combines the advantages of a central inverter with the modularity of the string inverters. Its power stages are designed to be easily replaceable on the field without the need of advanced technical service personnel, providing a safe, reliable and fast Plug&Play assembly system.

Following the modular philosophy of the Freesun series, the HEM is composed of 6 FRUs (field replaceable units), where all the power stages are physically joined in the DC side and therefore, in the event of a fault, the faulty module is taken off-line and its power is distributed evenly among the remaining functioning FRUs.

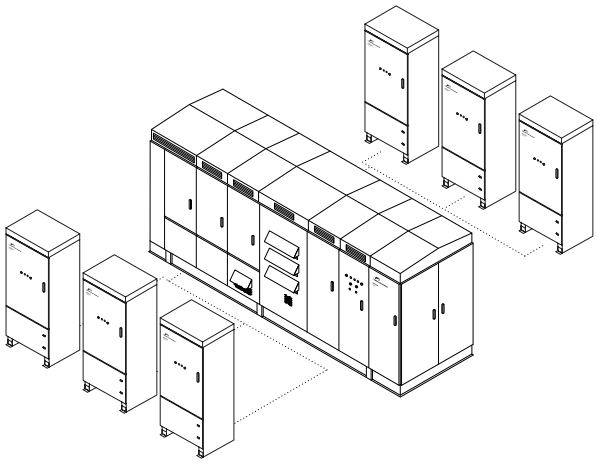
INNOVATIVE COOLING SYSTEM

Based on more than 3 years of experience with our MV Variable Speed Drive, the iCOOL3 system allows to get NEMA 3R degree of protection in an outdoor solar inverter. iCOOL3 delivers a constant stream of clean air to the FRUs and the MV transformer, being the most effective way of reaching up to NEMA 3R degree of protection, without having to maintain cumbersome dust filters or having to use liquid-cooling systems, avoiding the commonly known inconveniences of it (complex maintenance, risk of leaks, higher number of components…), therefore resulting in an OPEX cost reduction and a LCOE improvement.

BUS PLUS READY - SOLAR + STORAGE

The Bus Plus feature allows the connection of up to six Freemaq DC/DC converters. It is the most cost competitive solution for solar-plus-storage retrofits. It prevents from additional connections out of the inverter between the DC/DC converters and the PV field. This solution provides considerable savings in CAPEX.

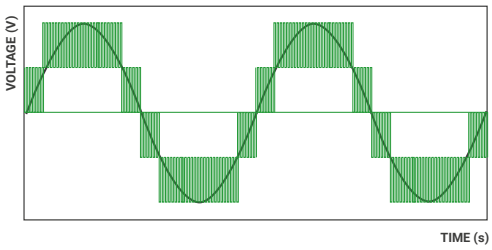
Power Electronics Freemaq DC/DC is a modular outdoor solution available from 500 kW to 3000 kW, fully compatible with different battery technologies and manufacturers. Freemaq DC/DC converter allows clipping energy recovery that will boost customer revenues and avoids the installation of additional station with a dedicated MV transformer.



MULTILEVEL TOPOLOGY

The multilevel IGBT topology is the most efficient approach to manage high DC link voltages and makes the difference in the 1,500 Vdc design. Power Electronics has many years of power design in both inverters and MV drives and the HEM design is the result of our experience with 3 level topologies. The 3 level IGBT topology reduces stage losses, increases inverter efficiency and minimizes total harmonic distortion. High efficiency to deliver the lowest LCOE.

THREE-LEVEL INVERTER



VAR AT NIGHT

At night, in case of solar applications, the HEM inverter can shift to reactive power compensation mode. The inverter can respond to an external dynamic signal, a Power Plant Controller command or pre-set reactive power level (kVAr).

ACTIVE HEATING

At night, when the unit is not actively exporting power, the inverter can import a small amount of power 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**

ECON MODE

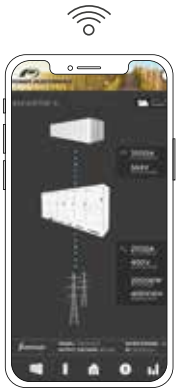
This innovative control mode allows increasing the efficiency of the MV transformer up to 25%, reducing the power consumption of the plant and therefore providing considerable savings. Available as an optional kit, this feature has a payback time of less than a few years, therefore resulting in the increase of the plant lifetime overall revenue.

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.

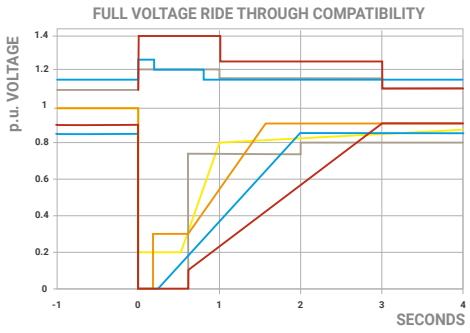
The app user-friendly interface allows quick and easy access to critical information (energy registers, production and events).

AVAILABLE INFORMATION	Grid and PV field data, inverter and power module data (voltages, currents, power, temperatures, I/O status...), weather conditions, alarms and warnings events, energy registers. Others.
FEATURES	Easy Wireless connection. Comprehensive interface. Real time data. Save and copy settings.
LANGUAGE	English, Spanish.
SYSTEM REQUIREMENTS	iOS or Android devices.
SETTINGS CONTROL	Yes.

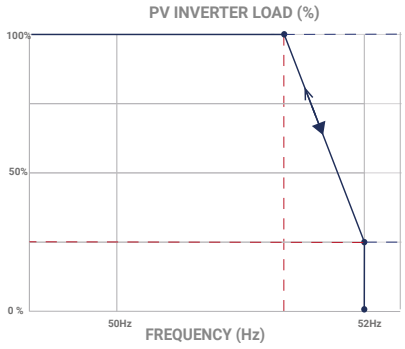


DYNAMIC GRID SUPPORT

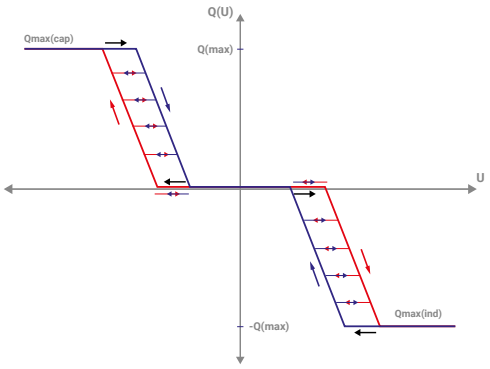
HEM firmware includes the latest utility interactive features (LVRT, OVRT, FRS, FRT, Anti-islanding, active and reactive power curtailment…), and can be configured to meet specific utility requirements.

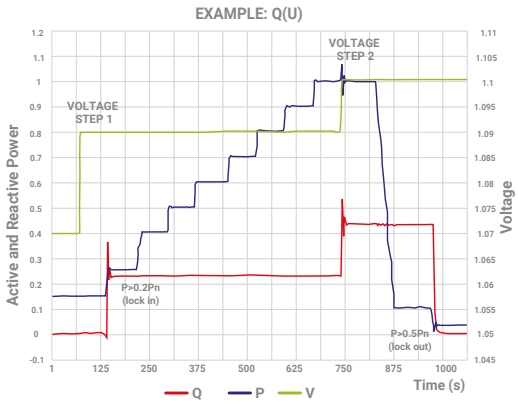


Low Voltage Ride Through (LVRT or ZVRT). Inverters can withstand any voltage dip or profile required by the local utility. In this situation, the inverter can inject current up to the nominal value.

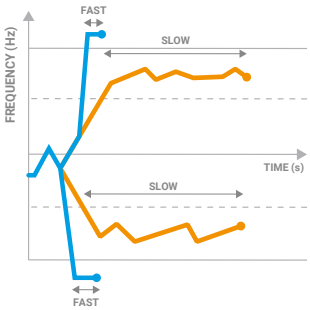


Frequency Regulation System (FRS). Frequency droop algorithm curtails the active power along a preset characteristic curve supporting grid stabilization.

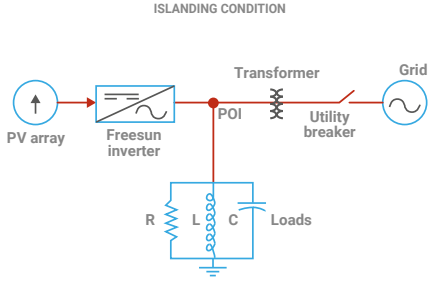




Q(V) curve. It is a dynamic voltage control function which provides reactive power in order to maintain the voltage as close as possible to its nominal value.



Frequency Ride Through (FRT). Freesun solar inverters have flexible frequency protection settings and can be easily adjusted to comply with future requirements.



Anti-islanding. This protection combines passive and active detection methods that eliminate nuisance tripping and allow to comply with the IEC 62116 and IEEE 1547 standards.

FRONT VIEW

BACK VIEW

TECHNICAL CHARACTERISTICS HEM

REFERENCE		FS3510M
OUTPUT	AC Output Power (kVA/kW) @50°C [1]	3510
	AC Output Power (kVA/kW) @40°C [1]	3630
	Operating Grid Voltage (VAC)	34.5kV ±10%
	Operating Grid Frequency (Hz)	60Hz
	Current Harmonic Distortion (THDi)	< 3% per IEEE519
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night
INPUT	MPPt @full power (VDC)	934V-1310V
	Maximum DC voltage	1500V
	Number of PV inputs [2]	Up to 36
	Number of Freemaq DC/DC inputs [4]	Up to 6
	Max. DC continuous current (A) [4]	3970
	Max. DC short circuit current (A) [4]	6000
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	97.80% including MV transformer
	CEC (η)	97.51% including MV transformer
	Max. Power Consumption (KVA)	20
CABINET	Dimensions [WxDxH] (ft)	21.7 x 7 x 7
	Dimensions [WxDxH] (m)	6.6 x 2.2 x 2.2
	Weight (lb)	30865
	Weight (kg)	14000
	Type of ventilation	Forced air cooling
ENVIRONMENT	Degree of protection	NEMA 3R
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating
	Relative Humidity	4% to 100% non condensing
	Max. Altitude (above sea level) [5]	2000m
	Noise level [6]	< 79 dBA
CONTROL INTERFACE	Communication protocol	Modbus TCP
	Plant Controller Communication	Optional
	Keyed ON/OFF switch	Standard
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device
	General AC Protection	MV Switchgear (configurable)
	General DC Protection	Fuses
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2
CERTIFICATIONS	Safety	UL 1741, CSA 22.2 No.107.1-16
	Compliance	NEC 2017
	Utility interconnect	IEEE 1547.1-2005 / UL 1741 SA-Feb. 2018

[1] Values at 1.00•Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Consult Power Electronics for altitudes above 1000m.
[6] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEM

REFERENCE		FS3430M
OUTPUT	AC Output Power (kVA/kW) @50°C [1]	3430
	AC Output Power (kVA/kW) @40°C [1]	3550
	Operating Grid Voltage (VAC)	34.5kV ±10%
	Operating Grid Frequency (Hz)	60Hz
	Current Harmonic Distortion (THDi)	< 3% per IEEE519
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night
INPUT	MPPt @full power (VDC)	913V-1310V
	Maximum DC voltage	1500V
	Number of PV inputs [2]	Up to 36
	Number of Freemaq DC/DC inputs [4]	Up to 6
	Max. DC continuous current (A) [4]	3970
	Max. DC short circuit current (A) [4]	6000
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	97.76% including MV transformer
	CEC (η)	97.50% including MV transformer
	Max. Power Consumption (KVA)	20
CABINET	Dimensions [WxDxH] (ft)	21.7 x 7 x 7
	Dimensions [WxDxH] (m)	6.6 x 2.2 x 2.2
	Weight (lb)	30865
	Weight (kg)	14000
	Type of ventilation	Forced air cooling
ENVIRONMENT	Degree of protection	NEMA 3R
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating
	Relative Humidity	4% to 100% non condensing
	Max. Altitude (above sea level) [5]	2000m
	Noise level [6]	< 79 dBA
CONTROL INTERFACE	Communication protocol	Modbus TCP
	Plant Controller Communication	Optional
	Keyed ON/OFF switch	Standard
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device
	General AC Protection	MV Switchgear (configurable)
	General DC Protection	Fuses
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2
CERTIFICATIONS	Safety	UL 1741, CSA 22.2 No.107.1-16
	Compliance	NEC 2017
	Utility interconnect	IEEE 1547.1-2005 / UL 1741 SA-Feb. 2018

[1] Values at 1.00•Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Consult Power Electronics for altitudes above 1000m.
[6] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEM

REFERENCE		FS3350M
OUTPUT	AC Output Power (kVA/kW) @50°C [1]	3350
	AC Output Power (kVA/kW) @40°C [1]	3465
	Operating Grid Voltage (VAC)	34.5kV ±10%
	Operating Grid Frequency (Hz)	60Hz
	Current Harmonic Distortion (THDi)	< 3% per IEEE519
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night
INPUT	MPPt @full power (VDC)	891V-1310V
	Maximum DC voltage	1500V
	Number of PV inputs [2]	Up to 36
	Number of Freemaq DC/DC inputs [4]	Up to 6
	Max. DC continuous current (A) [4]	3970
	Max. DC short circuit current (A) [4]	6000
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	97.75% including MV transformer
	CEC (η)	97.48% including MV transformer
	Max. Power Consumption (KVA)	20
CABINET	Dimensions [WxDxH] (ft)	21.7 x 7 x 7
	Dimensions [WxDxH] (m)	6.6 x 2.2 x 2.2
	Weight (lb)	30865
	Weight (kg)	14000
	Type of ventilation	Forced air cooling
ENVIRONMENT	Degree of protection	NEMA 3R
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating
	Relative Humidity	4% to 100% non condensing
	Max. Altitude (above sea level) [5]	2000m
	Noise level [6]	< 79 dBA
CONTROL INTERFACE	Communication protocol	Modbus TCP
	Plant Controller Communication	Optional
	Keyed ON/OFF switch	Standard
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device
	General AC Protection	MV Switchgear (configurable)
	General DC Protection	Fuses
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2
CERTIFICATIONS	Safety	UL 1741, CSA 22.2 No.107.1-16
	Compliance	NEC 2017
	Utility interconnect	IEEE 1547.1-2005 / UL 1741 SA-Feb. 2018

[1] Values at 1.00•Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Consult Power Electronics for altitudes above 1000m.
[6] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEM

REFERENCE		FS3270M
OUTPUT	AC Output Power (kVA/kW) @50°C [1]	3270
	AC Output Power (kVA/kW) @40°C [1]	3380
	Operating Grid Voltage (VAC)	34.5kV ±10%
	Operating Grid Frequency (Hz)	60Hz
	Current Harmonic Distortion (THDi)	< 3% per IEEE519
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night
INPUT	MPPt @full power (VDC)	870V-1310V
	Maximum DC voltage	1500V
	Number of PV inputs [2]	Up to 36
	Number of Freemaq DC/DC inputs [4]	Up to 6
	Max. DC continuous current (A) [4]	3970
	Max. DC short circuit current (A) [4]	6000
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	97.71% including MV transformer
	CEC (η)	97.47% including MV transformer
	Max. Power Consumption (KVA)	20
CABINET	Dimensions [WxDxH] (ft)	21.7 x 7 x 7
	Dimensions [WxDxH] (m)	6.6 x 2.2 x 2.2
	Weight (lb)	30865
	Weight (kg)	14000
	Type of ventilation	Forced air cooling
ENVIRONMENT	Degree of protection	NEMA 3R
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating
	Relative Humidity	4% to 100% non condensing
	Max. Altitude (above sea level) [5]	2000m
	Noise level [6]	< 79 dBA
CONTROL INTERFACE	Communication protocol	Modbus TCP
	Plant Controller Communication	Optional
	Keyed ON/OFF switch	Standard
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device
	General AC Protection	MV Switchgear (configurable)
	General DC Protection	Fuses
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2
CERTIFICATIONS	Safety	UL 1741, CSA 22.2 No.107.1-16
	Compliance	NEC 2017
	Utility interconnect	IEEE 1547.1-2005 / UL 1741 SA-Feb. 2018

[1] Values at 1.00•Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Consult Power Electronics for altitudes above 1000m.
[6] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEM

REFERENCE		FS3190M
OUTPUT	AC Output Power (kVA/kW) @50°C [1]	3190
	AC Output Power (kVA/kW) @40°C [1]	3300
	Operating Grid Voltage (VAC)	34.5kV ±10%
	Operating Grid Frequency (Hz)	60Hz
	Current Harmonic Distortion (THDi)	< 3% per IEEE519
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night
INPUT	MPPt @full power (VDC)	849V-1310V
	Maximum DC voltage	1500V
	Number of PV inputs [2]	Up to 36
	Number of Freemaq DC/DC inputs [4]	Up to 6
	Max. DC continuous current (A) [4]	3970
	Max. DC short circuit current (A) [4]	6000
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	97.68% including MV transformer
	CEC (η)	97.47% including MV transformer
	Max. Power Consumption (KVA)	20
CABINET	Dimensions [WxDxH] (ft)	21.7 x 7 x 7
	Dimensions [WxDxH] (m)	6.6 x 2.2 x 2.2
	Weight (lb)	30865
	Weight (kg)	14000
	Type of ventilation	Forced air cooling
ENVIRONMENT	Degree of protection	NEMA 3R
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating
	Relative Humidity	4% to 100% non condensing
	Max. Altitude (above sea level) [5]	2000m
	Noise level [6]	< 79 dBA
CONTROL INTERFACE	Communication protocol	Modbus TCP
	Plant Controller Communication	Optional
	Keyed ON/OFF switch	Standard
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device
	General AC Protection	MV Switchgear (configurable)
	General DC Protection	Fuses
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2
CERTIFICATIONS	Safety	UL 1741, CSA 22.2 No.107.1-16
	Compliance	NEC 2017
	Utility interconnect	IEEE 1547.1-2005 / UL 1741 SA-Feb. 2018

[1] Values at 1.00•Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Consult Power Electronics for altitudes above 1000m.
[6] Readings taken 1 meter from the back of the unit.

HEMK

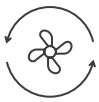
UTILITY SCALE CENTRAL STRING INVERTER

FIELD REPLACEABLE UNITS

OUTDOOR DURABILITY

BUS PLUS READY SOLAR + STORAGE

NEMA 3R / IP54



ICOOL 3

ACTIVE HEATING

3 LEVEL TOPOLOGY

COMBINING THE BENEFITS OF CENTRAL AND STRING INVERTERS

The HEMK is the second generation 1500V inverter, based on the more than proven HEC V1500. This modular solar inverter offers the advantages of both central and string inverters. Reaching a very high power density, and an output power of 3.8 MW at 40ºC, it is available in 6 different AC voltages, providing the flexibility to choose the best solution for each PV plant. The power stage architecture, composed of six field replaceable units (FRU), is designed to provide the highest availability and optimize yield production.

The Bus Plus ready feature allows the connection of up to six Freemaq DC/DC converters. It is the most cost competitive solution for solar-plus-storage retrofits.

The innovative iCOOL3 cooling system allows the HEMK to be installed in the harshest environments, thanks to a degree of protection of up to IP54. This advanced air-cooling system, reduces the OPEX cost compared to other cooling solutions, that need the use of complex liquid-cooling systems.

The HEMK has been designed to be the lowest LCOE solution in the market in solar applications.

ROBUST DESIGN

Polymeric Painting

Closed-Cell Insulation

Galvanized Steel | Stainless Steel (Optional)

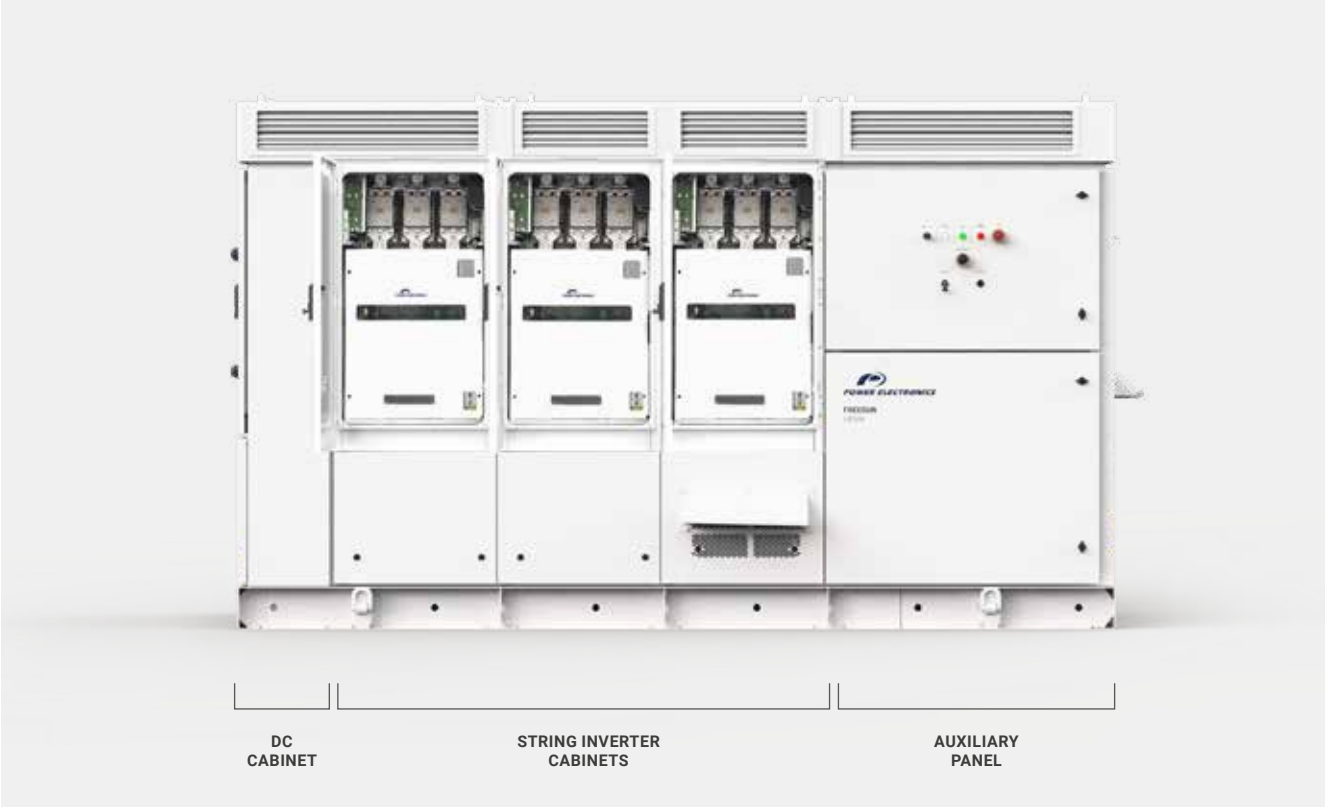
HEMK inverter modules have a design life of greater than 30 years of operation in harsh environments and extreme weather conditions. HEMK units are tested and ready to withstand conditions from the frozen Siberian tundra to the Californian Death Valley, featuring:

- Totally sealed electronics cabinet protects 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.
- C4 degree of protection according to ISO 12944.
  Up to C5-M optional.
- Closed-Cell insulation 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 HEMK structure avoids the need of additional external structures.
- Random units selected to pass a Factory Water Tightness Test ensuring product quality.
- NEMA 3R / IP54.

COMPACT DESIGN - EASY TO SERVICE

By providing full front access the HEMK series simplifies the maintenance tasks, reducing the MTTR (and achieving a lower OPEX). The total access allows a fast swap of the FRUs without the need of qualified technical personnel.

With the HEMK, Power Electronics offers its most compact solution, achieving 3.8 MW in just 12ft long, reducing installation costs and labor time, and therefore will minimize the LCOE.



STRING CONCEPT POWER STAGES

The HEMK combines the advantages of a central inverter with the modularity of the string inverters. Its power stages are designed to be easily replaceable on the field without the need of advanced technical service personnel, providing a safe, reliable and fast Plug&Play assembly system.

Following the modular philosophy of the Freesun series, the HEMK is composed of 6 FRUs (field replaceable units), where all the power stages are physically joined in the DC side and therefore, in the event of a fault, the faulty module is taken off-line and its power is distributed evenly among the remaining functioning FRUs.

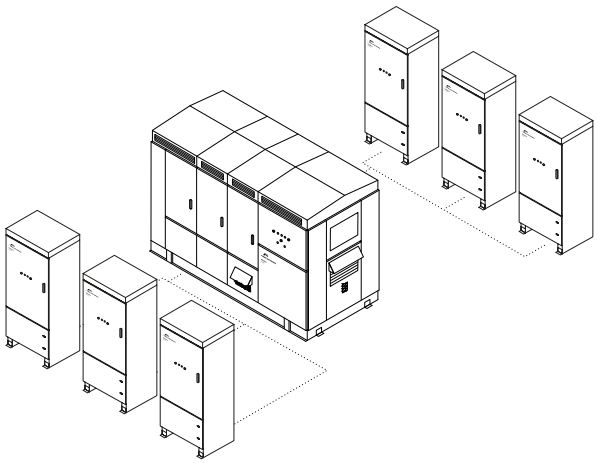
INNOVATIVE COOLING SYSTEM

Based on more than 3 years of experience with our MV Variable Speed Drive, the iCOOL3 system allows to get IP54 degree of protection in an outdoor solar inverter. iCOOL3 delivers a constant stream of clean air to the FRUs, being the most effective way of reaching up to IP54 degree of protection, without having to maintain cumbersome dust filters or having to use liquid-cooling systems, avoiding the commonly known inconveniences of it (complex maintenance, risk of leaks, higher number of components…), therefore resulting in an OPEX cost reduction and a LCOE improvement.

BUS PLUS READY - SOLAR + STORAGE

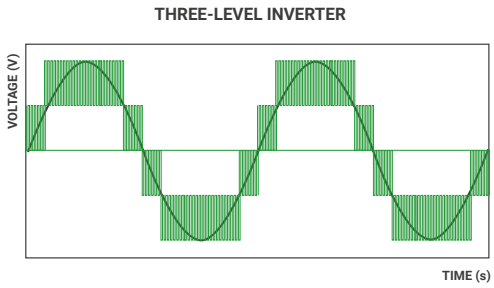
The Bus Plus feature allows the connection of up to six Freemaq DC/DC converters. It is the most cost competitive solution for solar-plus-storage retrofits. It prevents from additional connections out of the inverter between the DC/DC converters and the PV field. This solution provides considerable savings in CAPEX.

Power Electronics Freemaq DC/DC is a modular outdoor solution available from 500 kW to 3000 kW, fully compatible with different battery technologies and manufacturers. Freemaq DC/DC converter allows clipping energy recovery that will boost customer revenues and avoids the installation of additional station with a dedicated MV transformer.



MULTILEVEL TOPOLOGY

The multilevel IGBT topology is the most efficient approach to manage high DC link voltages and makes the difference in the 1,500 Vdc design. Power Electronics has many years of power design in both inverters and MV drives and the HEMK design is the result of our experience with 3 level topologies. The 3 level IGBT topology reduces stage losses, increases inverter efficiency and minimizes total harmonic distortion. High efciency to deliver the lowest LCOE.



VAR AT NIGHT

At night, in case of solar applications, the HEMK inverter can shift to reactive power compensation mode. The inverter can respond to an external dynamic signal, a Power Plant Controller command or pre-set reactive power level (kVAr).

ACTIVE HEATING

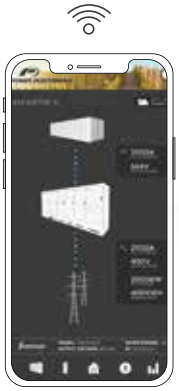
At night, when the unit is not actively exporting power, the inverter can import a small amount of power to keep the inverter internal ambient temperature above -20°C, without using external resistors.

This autonomous heating system is the most efficient and homogeneous way to prevent condensation, increasing the inverters availability and reducing maintenance. **PATENTED**

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.

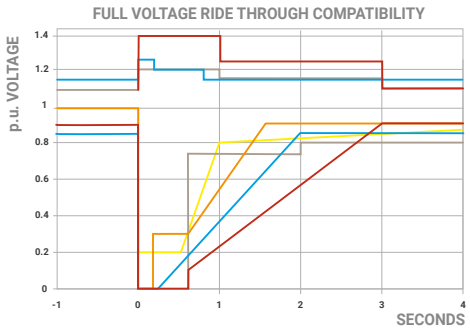
The app user-friendly interface allows quick and easy access to critical information (energy registers, production and events).



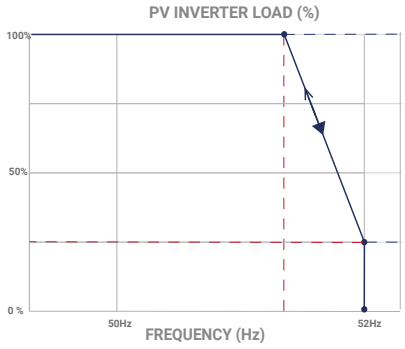
AVAILABLE INFORMATION	Grid and PV field data, inverter and power module data (voltages, currents, power, temperatures, I/O status...), weather conditions, alarms and warnings events, energy registers. Others.
FEATURES	Easy Wireless connection. Comprehensive interface. Real time data. Save and copy settings.
LANGUAGE	English, Spanish.
SYSTEM REQUIREMENTS	iOS or Android devices.
SETTINGS CONTROL	Yes.

DYNAMIC GRID SUPPORT

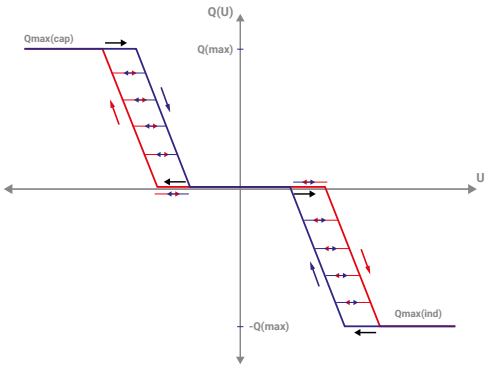
HEMK firmware includes the latest utility interactive features (LVRT, OVRT, FRS, FRT, Anti-islanding, active and reactive power curtailment…), and can be configured to meet specific utility requirements.

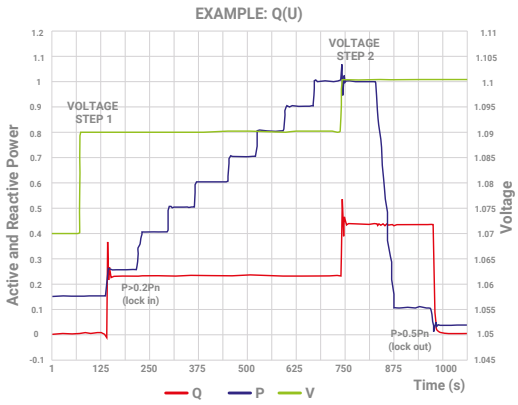


Low Voltage Ride Through (LVRT or ZVRT). Inverters can withstand any voltage dip or profile required by the local utility. In this situation, the inverter can inject current up to the nominal value.

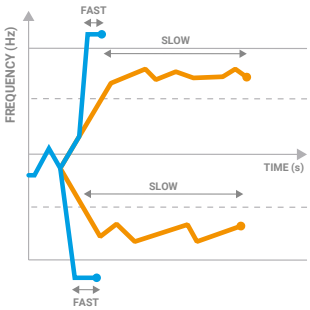


Frequency Regulation System (FRS). Frequency droop algorithm curtails the active power along a preset characteristic curve supporting grid stabilization.

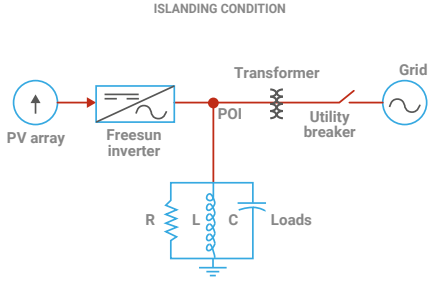




Q(V) curve. It is a dynamic voltage control function which provides reactive power in order to maintain the voltage as close as possible to its nominal value.



Frequency Ride Through (FRT). Freesun solar inverters have flexible frequency protection settings and can be easily adjusted to comply with future requirements.



Anti-islanding. This protection combines passive and active detection methods that eliminate nuisance tripping and allow to comply with the IEC 62116 and IEEE 1547 standards.

TECHNICAL CHARACTERISTICS HEMK 690V

		FRAME 1	FRAME 2
REFERENCE		**FS2445K**	**FS3670K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2445	3670
	AC Output Power(kVA/kW) @40°C [1]	2530	3800
	Max. AC Output Current (A) @40°C	2117	3175
	Operating Grid Voltage(VAC) [2]	690V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	976V-1310V	
	Maximum DC voltage	1500V	
	Number of PV inputs [2]	Up to 36	
	Number of Freemaq DC/DC inputs [4]	Up to 6	
	Max. DC continuous current (A) [4]	2645	3970
	Max. DC short circuit current (A) [4]	4000	6000
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	98.87%	98.93%
	Euroeta (η)	98.48%	98.65%
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	12 x 7 x 7	
	Dimensions [WxDxH] (m)	3.7 x 2.2 x 2.2	
	Weight (lb)	12125	12677
	Weight (kg)	5500	5750
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA 3R - IP54	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [5]	< 79 dBA	
CONTROL INTERFACE	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-16, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2017 / IEC	
	Utility interconnect	EEE 1547.1-2005 / UL1741SA-Feb. 2018 / IEC62116:2014	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS

HEMK 660V

		FRAME 1	FRAME 2
REFERENCE		**FS2340K**	**FS3510K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2340	3510
	AC Output Power(kVA/kW) @40°C [1]	2420	3630
	Max. AC Output Current (A) @40°C	2117	3175
	Operating Grid Voltage(VAC) [2]	660V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	934V-1310V	
	Maximum DC voltage	1500V	
	Number of PV inputs [2]	Up to 36	
	Number of Freemaq DC/DC inputs [4]	Up to 6	
	Max. DC continuous current (A) [4]	2645	3970
	Max. DC short circuit current (A) [4]	4000	6000
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	98.84%	98.90%
	Euroeta (η)	98.48%	98.65%
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	12 x 7 x 7	
	Dimensions [WxDxH] (m)	3.7 x 2.2 x 2.2	
	Weight (lb)	12125	12677
	Weight (kg)	5500	5750
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA 3R - IP54	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [5]	< 79 dBA	
CONTROL INTERFACE	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-16, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2017 / IEC	
	Utility interconnect	EEE 1547.1-2005 / UL1741SA-Feb. 2018 / IEC62116:2014	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEMK 645V

		FRAME 1	FRAME 2
REFERENCE		**FS2285K**	**FS3430K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2285	3430
	AC Output Power(kVA/kW) @40°C [1]	2365	3550
	Max. AC Output Current (A) @40°C	2117	3175
	Operating Grid Voltage(VAC) [2]	645V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	913V-1310V	
	Maximum DC voltage	1500V	
	Number of PV inputs [2]	Up to 36	
	Number of Freemaq DC/DC inputs [4]	Up to 6	
	Max. DC continuous current (A) [4]	2645	3970
	Max. DC short circuit current (A) [4]	4000	6000
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	98.81%	98.87%
	Euroeta (η)	98.43%	98.60%
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	12 x 7 x 7	
	Dimensions [WxDxH] (m)	3.7 x 2.2 x 2.2	
	Weight (lb)	12125	12677
	Weight (kg)	5500	5750
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA 3R - IP54	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [5]	< 79 dBA	
CONTROL INTERFACE	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-16, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2017 / IEC	
	Utility interconnect	EEE 1547.1-2005 / UL1741SA-Feb. 2018 / IEC62116:2014	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS

HEMK 630V

		FRAME 1	FRAME 2
REFERENCE		**FS2235K**	**FS3350K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2235	3350
	AC Output Power(kVA/kW) @40°C [1]	2310	3465
	Max. AC Output Current (A) @40°C	2117	3175
	Operating Grid Voltage(VAC) [2]	630V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	891V-1310V	
	Maximum DC voltage	1500V	
	Number of PV inputs [2]	Up to 36	
	Number of Freemaq DC/DC inputs [4]	Up to 6	
	Max. DC continuous current (A) [4]	2645	3970
	Max. DC short circuit current (A) [4]	4000	6000
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	98.79%	98.85%
	Euroeta (η)	98.42%	98.59%
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	12 x 7 x 7	
	Dimensions [WxDxH] (m)	3.7 x 2.2 x 2.2	
	Weight (lb)	12125	12677
	Weight (kg)	5500	5750
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA 3R - IP54	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [5]	< 79 dBA	
CONTROL INTERFACE	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-16, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2017 / IEC	
	Utility interconnect	EEE 1547.1-2005 / UL1741SA-Feb. 2018 / IEC62116:2014	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEMK 615V

		FRAME 1	FRAME 2
REFERENCE		**FS2180K**	**FS3270K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2180	3270
	AC Output Power(kVA/kW) @40°C [1]	2255	3380
	Max. AC Output Current (A) @40°C	2117	3175
	Operating Grid Voltage(VAC) [2]	615V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	870V-1310V	
	Maximum DC voltage	1500V	
	Number of PV inputs [2]	Up to 36	
	Number of Freemaq DC/DC inputs [4]	Up to 6	
	Max. DC continuous current (A) [4]	2645	3970
	Max. DC short circuit current (A) [4]	4000	6000
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	98.79%	98.84
	Euroeta (η)	98.41%	98.57%
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	12 x 7 x 7	
	Dimensions [WxDxH] (m)	3.7 x 2.2 x 2.2	
	Weight (lb)	12125	12677
	Weight (kg)	5500	5750
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA 3R - IP54	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [5]	< 79 dBA	
CONTROL INTERFACE	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-16, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2017 / IEC	
	Utility interconnect	EEE 1547.1-2005 / UL1741SA-Feb. 2018 / IEC62116:2014	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS

HEMK 600V

		FRAME 1	FRAME 2
REFERENCE		**FS2125K**	**FS3190K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2125	3190
	AC Output Power(kVA/kW) @40°C [1]	2200	3300
	Max. AC Output Current (A) @40°C	2117	3175
	Operating Grid Voltage(VAC) [2]	600V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	849V-1310V	
	Maximum DC voltage	1500V	
	Number of PV inputs [2]	Up to 36	
	Number of Freemaq DC/DC inputs [4]	Up to 6	
	Max. DC continuous current (A) [4]	2645	3970
	Max. DC short circuit current (A) [4]	4000	6000
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	98.78%	98.84%
	Euroeta (η)	98.39%	98.56%
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	12 x 7 x 7	
	Dimensions [WxDxH] (m)	3.7 x 2.2 x 2.2	
	Weight (lb)	12125	12677
	Weight (kg)	5500	5750
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA 3R - IP54	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [5]	< 79 dBA	
CONTROL INTERFACE	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-16, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2017 / IEC	
	Utility interconnect	EEE 1547.1-2005 / UL1741SA-Feb. 2018 / IEC62116:2014	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Readings taken 1 meter from the back of the unit.

SOLAR STATIONS

UTILITY SCALE
OUTDOOR INVERTERS

HEMK + TWIN SKID
Egypt - Alcazar PV plant (283MW)

MV SKID

UTILITY SCALE SOLAR STATION

TURN-KEY SOLUTION

HIGH RELIABILITY

EASY TO INSTALL

OUTDOOR DURABILITY

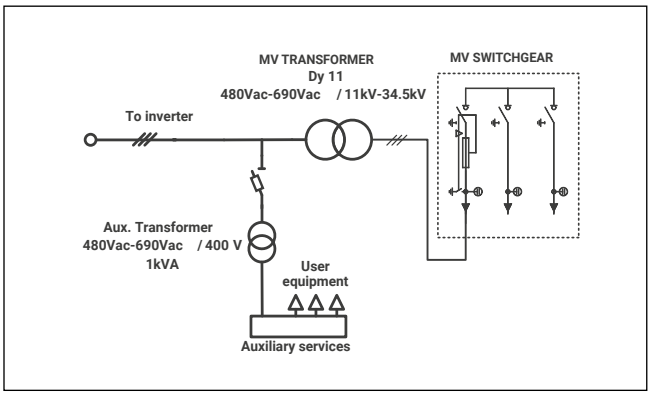
SIMPLIFY YOUR COMMISSIONING WITH THE MOST COMPETITIVE SOLUTION INTEGRATED WITH ALL THE MEDIUM VOLTAGE EQUIPMENT

The MV Skid is a compact turnkey outdoor platform made from high resistance galvanized steel with all the medium voltage equipment integrated, including an outdoor power transformer, MV switchgear, oil tank, filter and built in fast power connection to any HEMK solar inverter. With between 480 V - 690 V in the low voltage range and 12 kV to 36 kV in the high voltage range, this compact platform achieves power outputs between 1050 kVA and 3800 kVA.

This compact solution also allows the installation of a low voltage cabinet that is fully configurable to the customer needs as well as different types of cells and even an enclosure fence among other options. The MV SKID simplifies the project design of the PV plant, reducing installation costs and the amount of resources needed. The benefits of the MV Skid and the fact that it is also easier to transport and deliver into remote sites makes it the optimal solution for EPC`s (engineering, procurement and construction).

MODEL NUMBERS AND OPERATIONAL DIAGRAM

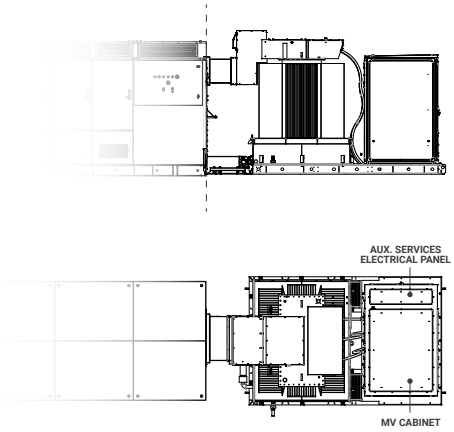
	REFERENCE	RATED POWER (kVA)
FRAME 1 AND 2 [1]	MVS1050[ ]	1050
	MVS1100[ ]	1110
	MVS1220[ ]	1220
	MVS1335[ ]	1335
	MVS1440[ ]	1440
	MVS1550[ ]	1550
	MVS1630[ ]	1630
	MVS1710[ ]	1710
	MVS1800[ ]	1800
	MVS1900[ ]	1900
	MVS2000[ ]	2000
	MVS2110[ ]	2110
FRAME 2	MVS2225[L]	2225
	MVS2330[L]	2330
	MVS2440[L]	2440
	MVS2550[L]	2550
	MVS2660[L]	2660
	MVS2860[L]	2860
	MVS3000[L]	3000
	MVS3110[L]	3110
	MVS3345[L]	3345
	MVS3500[L]	3500
	MVS3630[L]	3630
	MVS3800[L]	3800



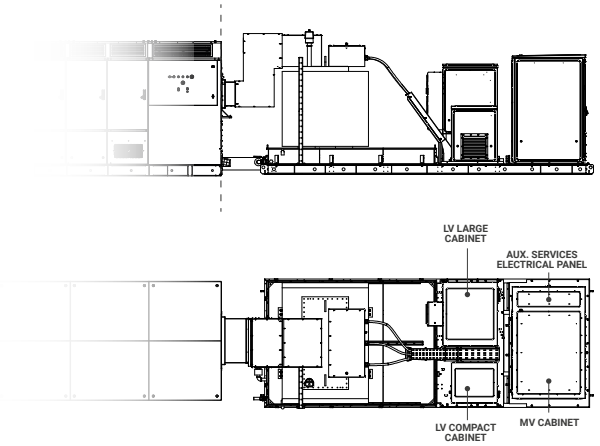
[1] Example: MVS1050S for Frame 1 / MVS10050L for Frame 2.

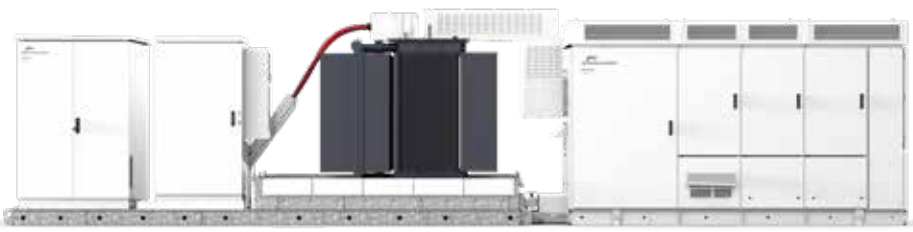
SECTIONS

FRAME 1



FRAME 2





For customized solutions, contact Power Electronics.

TECHNICAL CHARACTERISTICS MV SKID

		FRAME 1	
		FRAME 2	
MEDIUM VOLTAGE EQUIPMENT	Rated Power range	1050kVA - 2110kVA	2220kVA - 3800kVA
	MV Voltage range	11kV / 20kV / 22kV / 23kV / 33kV / 34.5kV	
	LV Voltage range	480 / 500 / 530/ 600V / 615V / 630V / 645V / 660V / 690V	
	Type of tank	Oil-sealed	
	Cooling	ONAN (KNAN optional)	
	Vector Group	Dy11	
	Transformer protection	DGPT-2 (PT100 optional)	
	Oil tank	Integrated with valve and filter	
	Transformer protection rate	IP54	
	Switchgear configuration	Single feeder (L) or Double feeder (2L)	
	Switchgear protection [1]	Fuses (P) / Automatic circuit breaker (V)	
CONNECTIONS	Inverter AC connection	Close couple solution (Plug & Play)	
	LV protection	Circuit breaker included in the inverter	
	HV AC wiring	MV Bridge between transformer and protection switchgear prewired	
ENVIROMENT	Ambient Temperature	-20°C...+50°C (t>50°C power derating)	
	Extended Temperature [2] [3]	-35°C...+50°C (t>50°C power derating)	
	Max. Altitude (above sea level)	>2000m power derating	
	Relative Humidity	4% to 95% Non condensing	
MECHANICAL CHARACTERISTICS	Skid Dimensions (WxHxD) mm	3690x2340x2235	5640x2340x2235
	Skid weight with MV equipmen t[1]	< 8 Tn	
	Oil tank material	Galvanized Steel	
	Skid Body material	Galvanized Steel	
	Cabinet type	Outdoor	
	Anti-rodent protection	✔	
AUXILIARY SERVICES ELECTRICAL PANEL	Auxiliary supply	3x400V, 50/60Hz	
	User power supply available	1kVA or 6kVA	
	Additional auxiliary transformer [4]	10kVA / 15kVA / 25kVA	
	Cooling	Air	
	Auxiliary supply protection	✔	
	Communication [4]	Ethernet (Fiber optic or RJ45)	
	UPS system for monitoring [4]	1kVA / 3kVA, 10 minutes	
AUXILIARY OUTDOOR TRANSFORMER	Rated Power (Voltage)	-	30kVA / 40kVA / 50kVA (3x400V)
	Cooling	-	Air
	Protection	-	Circuit breaker
	Cabinet type	-	Outdoor
LV COMPACT CABINET	Additional indoor auxiliary transf. [4]	-	10kVA / 25kVA / 40kVA / 50kVA (3x400V)
	UPS system for monitoring[4]	-	1kVA / 3kVA, 10 minutes
	Cooling	-	Air forced
	Auxiliary supply protection	-	✔
	Cabinet type	-	Outdoor
LV LARGE CABINET	Additional indoor auxiliary transf. [4]	-	25kVA / 40kVA / 50kVA (3x400V)
	UPS for trackers [4]	-	20kVA / 40kVA, 10 minutes
	Cooling	-	Air forced
	Auxiliary supply protection	-	✔
	Cabinet type	-	Outdoor
OTHER EQUIPMENT	Safety mechanism	Trapped key safety interlock	
	Safety perimeter	Transformer access protection fence	
	Cabinet heating	Heating resistors	
	Interior lighting	Fluorescent lamp	
	Emergency lighting	Electronic supplier for emergency lighting (1h autonomy)	
	Air conditioner	UPS batteries cooling	
	Communication [4]	Splice box / MV Switchgear monitoring	
STANDARDS	Medium Voltage	IEC 62271-212, IEC 62271-200, IEC 60076, IEC 61439-1	

[1] Depending on customer configuration.
[2] Optional. For additional information or available configurations, please consult Power Electronics.
[3] Other temperature range, consult Power Electronics.
[4] By demand.

TWIN SKID

UTILITY SCALE SOLAR STATION

TURN-KEY SOLUTION

HIGH RELIABILITY

EASY TO INSTALL

OUTDOOR DURABILITY

THE MOST POWER DENSE TURN-KEY STATION FOR LARGE SCALE PV PLANTS

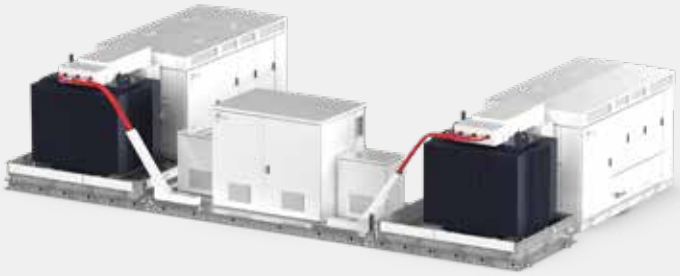
The Twin Skid has been designed to meet the requirements of large scale PV power plants. The station is a compact outdoor skid made of high resistance galvanized steel with all the medium voltage equipment integrated and acco panied by a inverter: protection cell, outdoor power transformer, oil tank and filter. This turnkey solution achieves power outputs between 3000 kVA and 7600 kVA.

The Twin Skid simplifies the project design of the PV plant, reducing the cost of installation and the amount of resources needed thanks to its extra high power density.

CUSTOMIZED SOLUTIONS

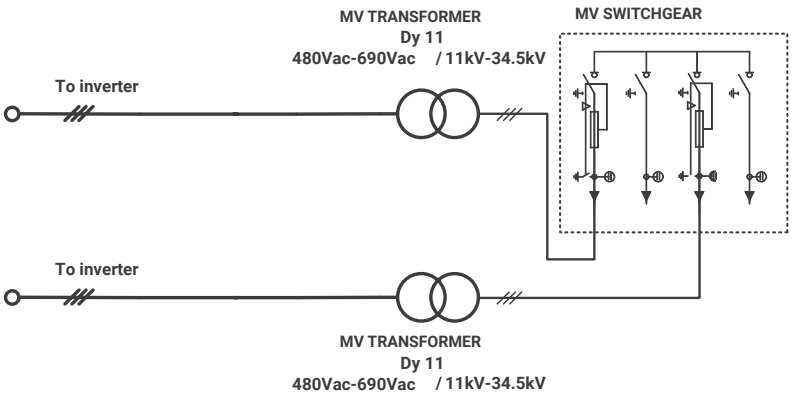
High value power plant projects often require customer specific solutions. Our team of highly experienced engineers are available to modify our standard solution to suit your specific demands to ensure you get the product you need.

I-TWIN SKID



U-TWIN SKID

OPERATIONAL DIAGRAM



TECHNICAL CHARACTERISTICS

TWIN SKID

MEDIUM VOLTAGE EQUIPMENT	Rated Power range [1]	3000kVA - 7600kVA
	MV Voltage range	11kV / 20kV / 22kV / 23kV / 33kV / 34.5kV
	LV Voltage range	480 / 500 / 530 / 600V / 615V / 630V / 645V / 660V / 690V
	Type of tank	Oil-sealed
	Cooling	ONAN (KNAN optional)
	Vector Group	Dy11
	Transformer protection	DGPT-2 (PT100 optional)
	Oil tank	Integrated with valve and filter
	Transformer protection rate	IP54
	Switchgear configuration	Single feeder (L) or Double feeder (2L)
	Switchgear protection [1]	Fuses (2P) / Automatic circuit breaker (2V)
CONNECTIONS	Inverter AC connection	Close couple solution (Plug & Play)
	LV protection	Circuit breaker included in the inverter
	HV AC wiring	MV Bridge between transformer and protection switchgear prewired
ENVIROMENT	Ambient Temperature	-20°C…+50°C (t>50°C power derating)
	Extended Temperature [2] [3]	-35°C…+50°C (t>50°C power derating)
	Max. Altitude (above sea level)	>2000m power derating
	Relative Humidity	4% to 95% Non condensing
MECHANICAL CHARACTERISTICS	Skid Dimensions (WxHxD) mm [1]	8000 x 2340 x 2235 / 11000 x 2340 x 2235
	Skid weight with MV equipment [1]	< 21 Tn
	Oil tank material	Galvanized steel
	Skid Body material	Galvanized steel
	Cabinet type	Outdoor
	Anti-rodent protection	✔
AUXILIARY SERVICES ELECTRICAL PANEL	Rated Power (Voltage)	30kVA / 40kVA / 50kVA (3x400V)
	Cooling	Air
	Protection	Circuit breaker
	Cabinet type	Outdoor
AUXILIARY OUTDOOR TRANSFORMER	Rated Power (Voltage)	30kVA / 40kVA / 50kVA (3x400V)
	Cooling	Air
	Protection	Circuit breaker
	Cabinet type	Outdoor
LV COMPACT CABINET	Additional indoor auxiliary transf. [4]	10kVA / 25kVA / 40kVA / 50kVA (3x400V)
	UPS system for monitoring [4]	1kVA / 3kVA, 10 minutes
	Cooling	Air forced
	Auxiliary supply protection	✔
	Cabinet type	Outdoor
LV LARGE CABINET	Additional indoor auxiliary transf. [4]	25kVA / 40kVA / 50kVA (3x400V)
	UPS for trackers [4]	20kVA / 40kVA, 10 minutes
	Cooling	Air forced
	Auxiliary supply protection	✔
	Cabinet type	Outdoor
OTHER EQUIPMENT	Safety mechanism	Trapped key safety interlock
	Safety perimeter	Transformer access protection fence
	Cabinet heating	Heating resistors
	Interior lighting	Fluorescent lamp
	Emergency lighting	Electronic supplier for emergency lighting (1h autonomy)
	Air conditioner	UPS batteries cooling
	Communication [4]	Splice box / MV Switchgear monitoring
STANDARDS	Medium Voltage	IEC 62271-212, IEC 62271-200, IEC 60076, IEC 61439-1

[1] Depending on customer configuration.
[2] Optional. For additional information or available configurations, please consult Power Electronics.
[3] Other temperature range, consult Power Electronics.
[4] By demand.

CONTROL AND MONITORING SOLUTIONS

FREESUN PPC
FREESUN EMS
FREESUN APP

FREESUN PPC

UTILITY SCALE POWER PLANT CONTROLLER

With over 22 GW inverters installed worldwide, Power Electronics has acquired the necessary know-how and expertise for the development of advanced, reliable and precise control algorithms to meet the most demanding grid codes in the world. Power Electronics Power Plant Controller offers smart and flexible solutions for utility PV and storage power plants.

TECHNICAL CHARACTERISTICS

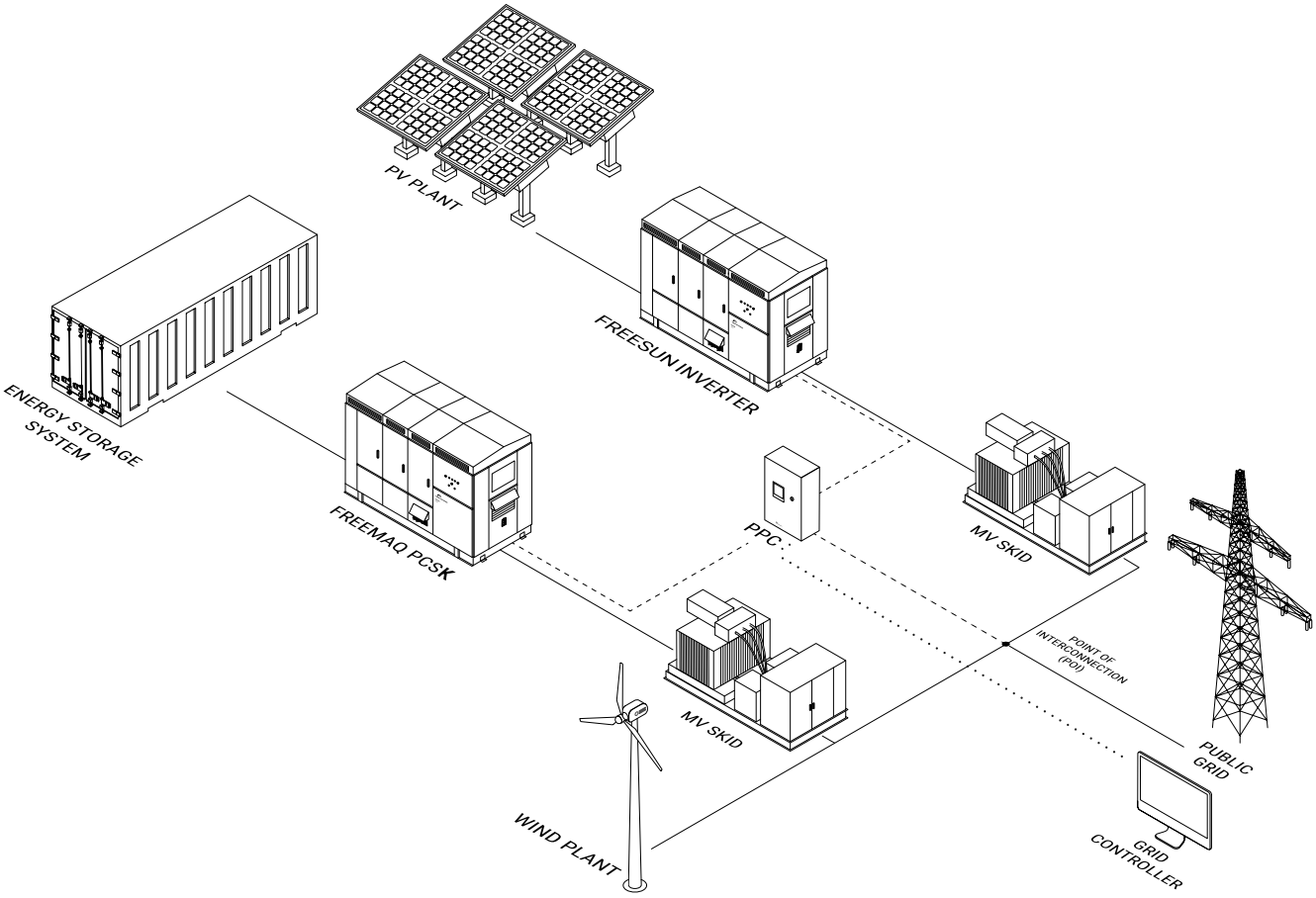
GENERAL DATA	Dimensions (WxDxH) mm	415 x 230 x 515
	Weight (kg)	10
	Mounting system	Wall mounted
	Compatible inverters	Freesun inverters, Freemaq PCS and Freemaq statcoms
	Power supply	250W
I/O and COMMUNICATIONS [1]	4 x Digital inputs	Programmable inputs and active high (24Vdc). Optically isolated.
	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)
	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.

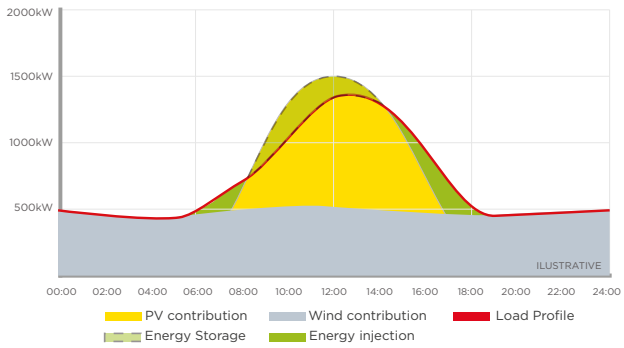
POWER PLANT CONTROLLER

The Power Plant Controller (PPC) can be the main governor of the most complex power plants, 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.



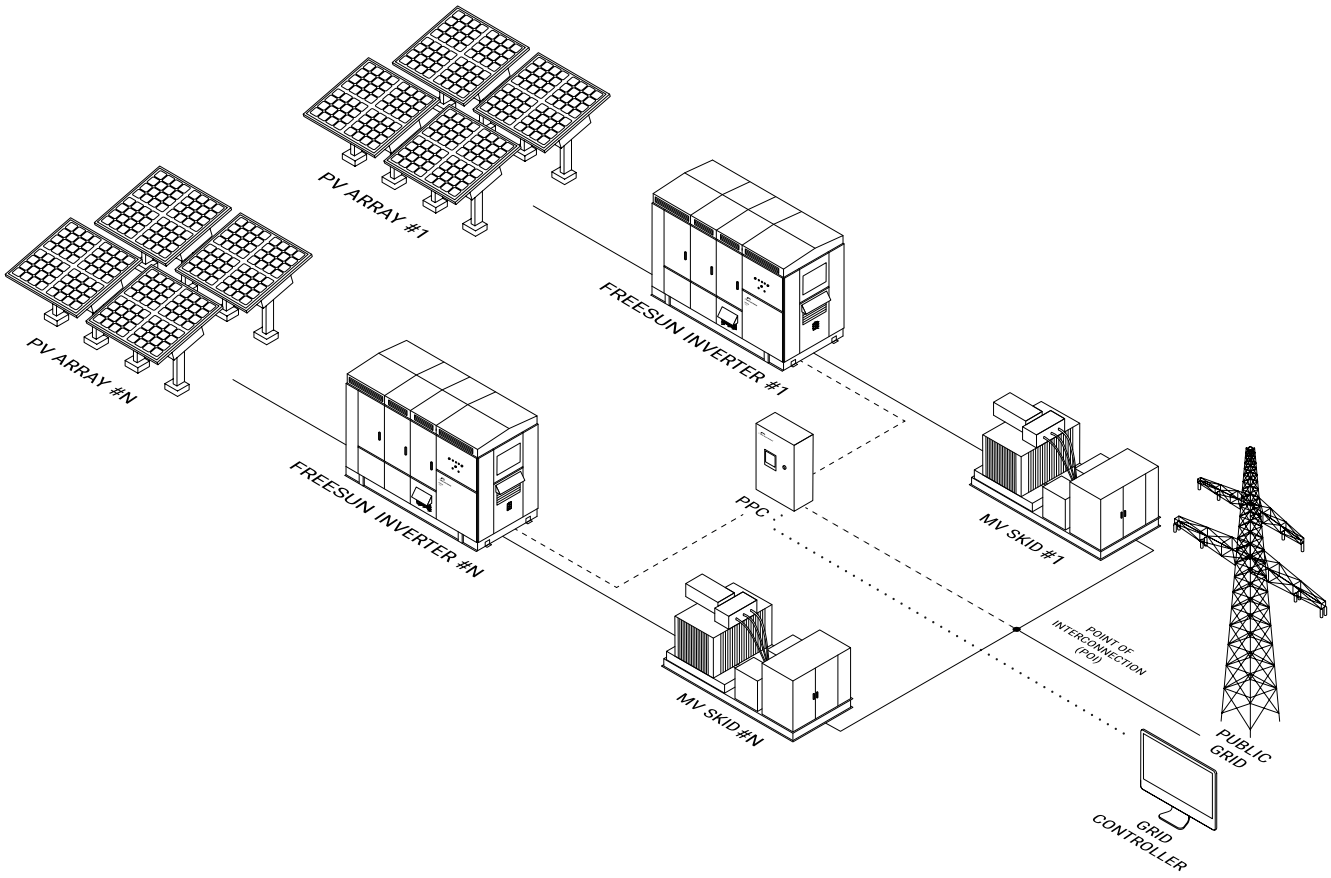
- PPC main governor and interface of the system.
- Multiple renewable power sources: solar, wind, etc.
- Centralized dynamic grid support at POI.
- Power smoothing – Enable ramp rate control.
- Storage equipment control.

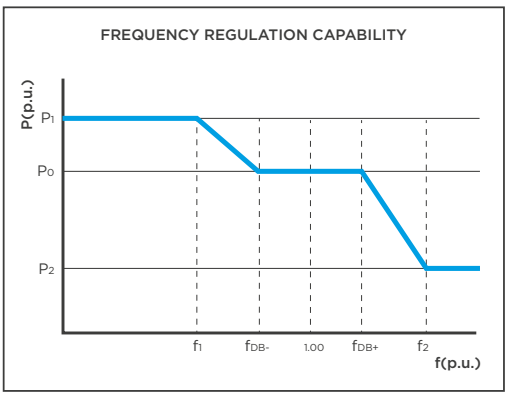


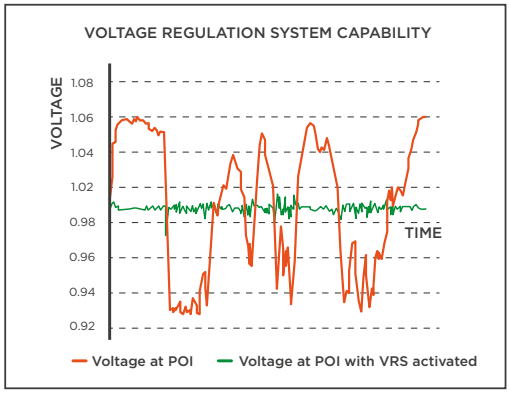
DYNAMIC GRID SUPPORT

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 ELECTRONICS
FREESUN
PPC

FREESUN EMS

ENERGY MANAGEMENT SYSTEM

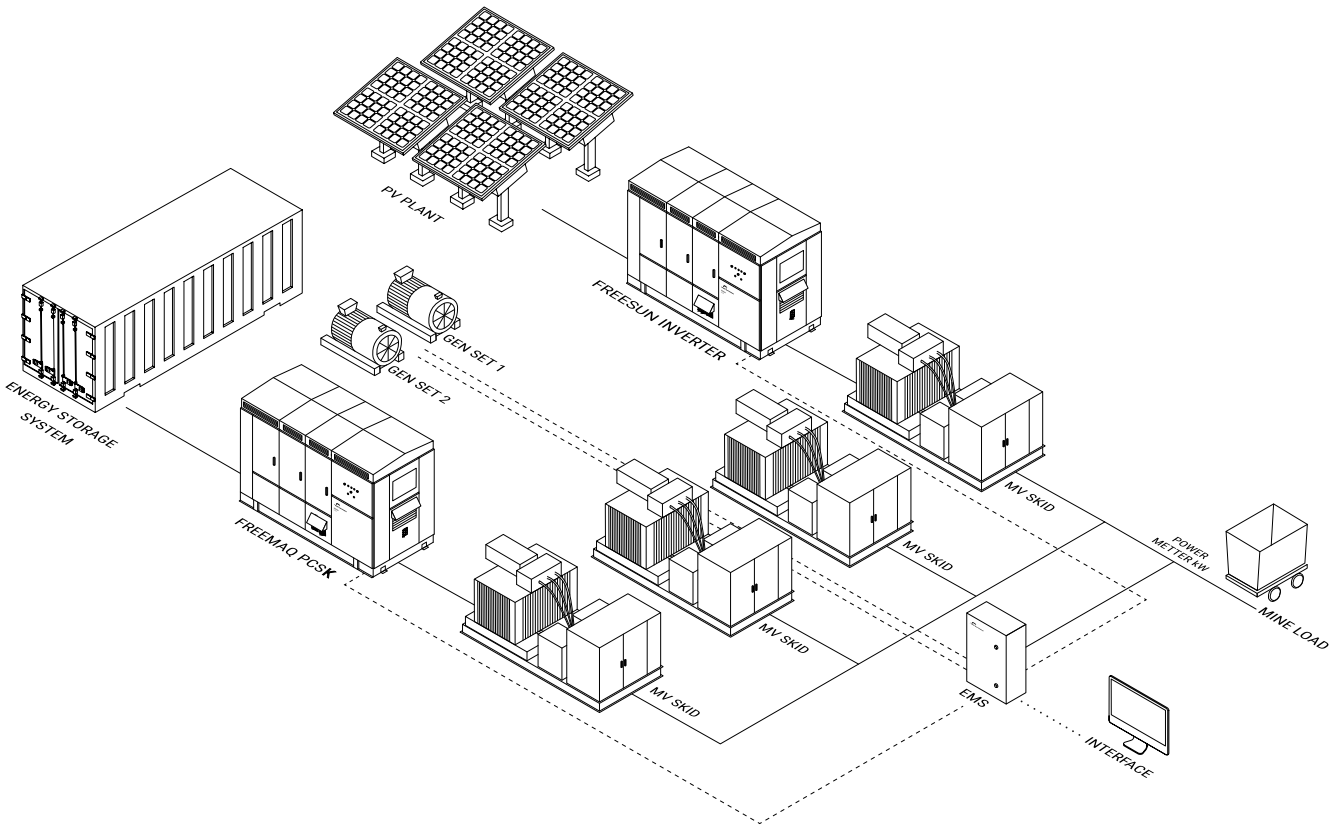
Power Electronics Energy Management System is the best solution for self-consumption applications due to its advanced, reliable and precise control algorithms. The Power Electronics EMS is designed to match energy production and consumption. It provides smart and flexible solutions for self-consumption applications such as zero grid injection systems.

TECHNICAL CHARACTERISTICS

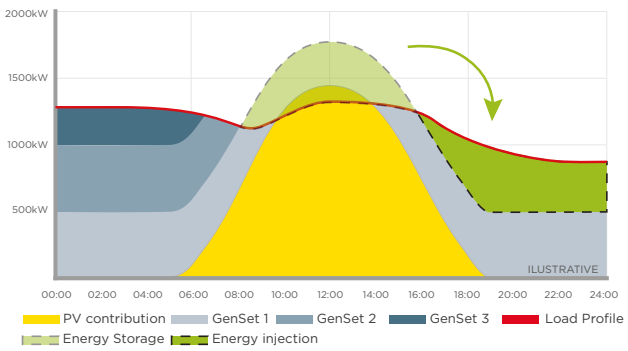
GENERAL DATA	Dimensions (WxDxH) mm	809 x 600 x 300
	Weight (kg) 10	10
	Mounting system Wall mounted	Wall mounted
	Compatible inverters	Freesun inverters, Freemaq PCS and Freemaq statcoms
	Power supply 250W	250W
I/O and COMMUNICATIONS [1]	2 x RS232/RS422/RS485 Port	3 wires (GND, A, B), Modbus RTU
	4 x USB Port	PC connectable using a master.Modbus configurator (ModScan or similar). Reserved for TS.
	2 x Ethernet Port (RJ45)	Modbus TCP/IP, Profinet, EtherCAT, Ethernet I/P
	1 x DVI	Digital Video output interface
	Digital/Analog I/O	Optional
ENVIRONMENTAL CONDITIONS	Operation temperature	0~50°C (32°~122°F)
	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	

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

EMS SELF-CONSUMPTION APPLICATION



- 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.



FREESUN APP

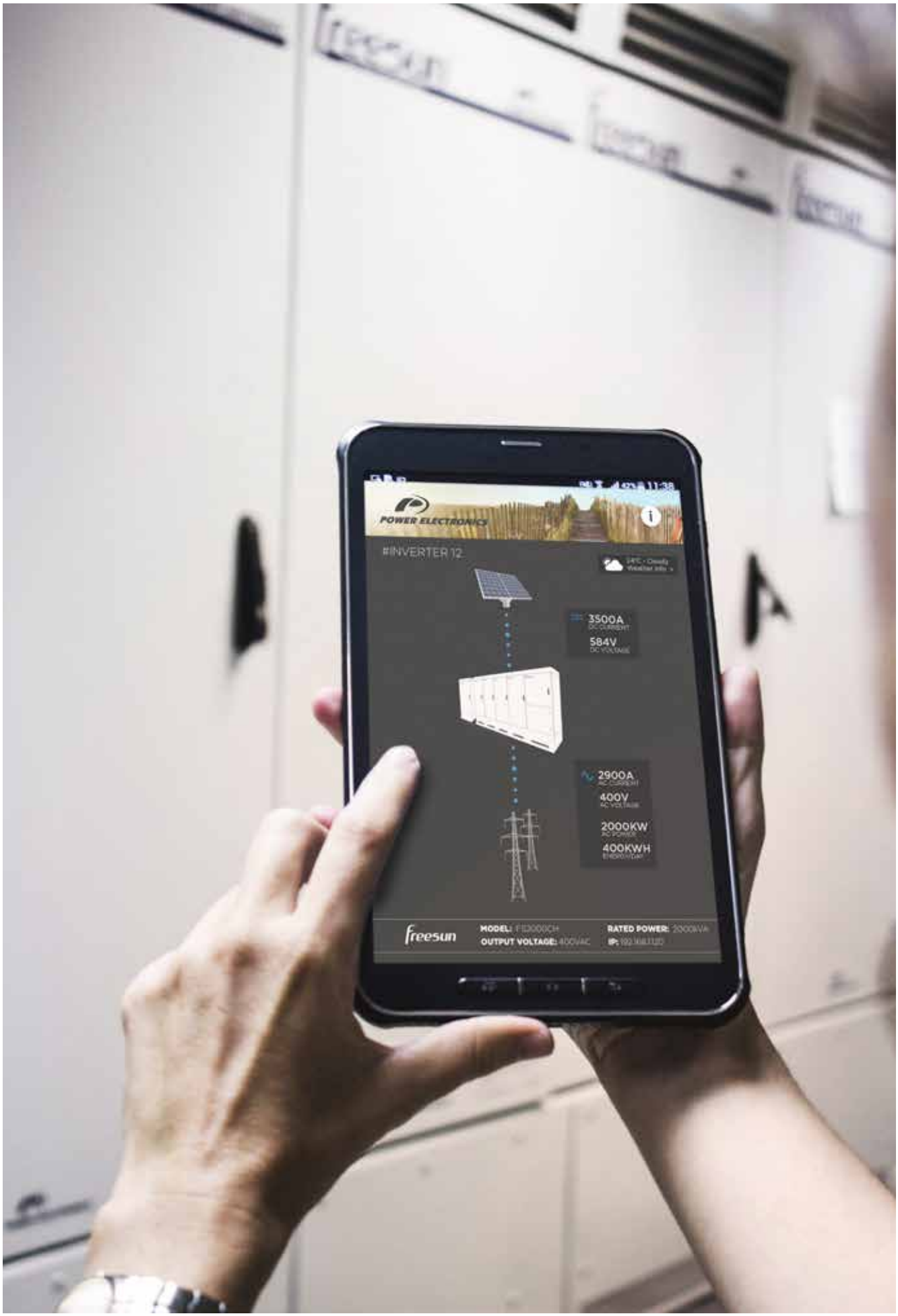
GO WIRELESS

The ultimate APP display application will play a key role in your Plant Service and Management. Any Android or iOS device can easily wirelessly connect to the inverter for a comprehensive and user friendly interface. Forget about using built-in displays with tiny screens or tedious menus, and allow your field technicians to service outdoor units in rain, snow or sun scorching conditions, without opening or standing in front of the unit. In its bid to create an application for mobile devices Power Electronics presents our Freesun app for monitoring our solar inverters. It is available on Android and iOS operating systems and can be used on both smartphones and tablets.

The Freesun application makes it easy to connect to our modular solar inverters via wifi. It is possible to perform the following tasks: monitor the key performance parameters of equipment, monitor operating statuses of diagnostics, module comparisons, values of incidents and many more.

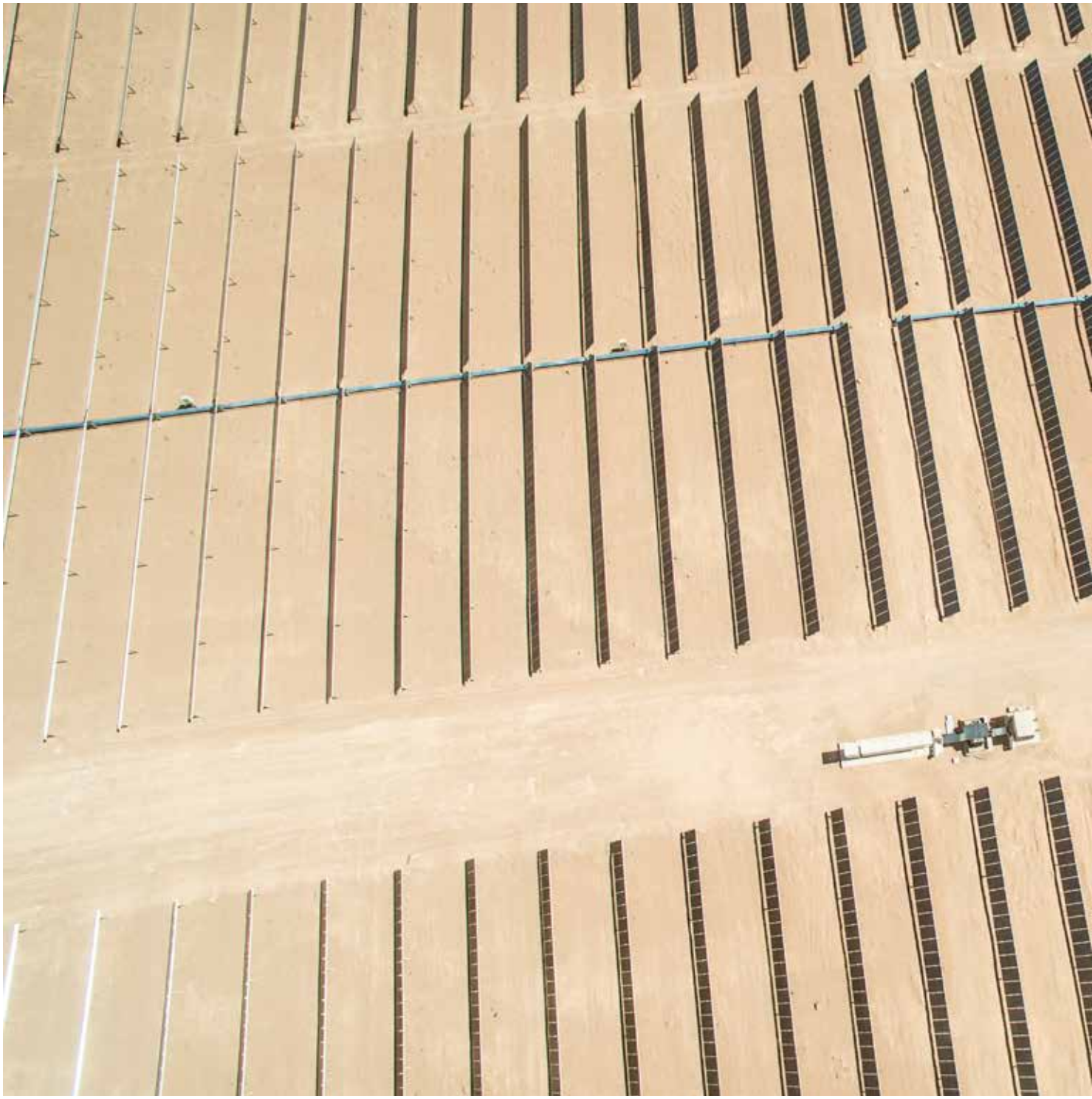
The application, through a careful and simple interface, displays data graphically and numerically. It also provides comparative information at the level of modules as well as showing detailed information of the entire system. Easy and intuitive to use; with this application you can automatically identify Freesun solar inverters available on the local network and store information from inverters to communicate with them at any time.

AVAILABLE INFORMATION	Grid and PV field data. Inverter and Power module data (Voltages, currents, power, temperatures, I/O status...). Weather conditions. Alarms and warnings events. Energy registers. Others.
FEATURES	Easy Wireless connection. Comprehensive interface. Real time data. Save and copy settings.
LANGUAGE	English, Spanish.
SYSTEM REQUIREMENTS	iOS or Android devices.
SETTINGS CONTROL	Yes


POWER ELECTRONICS
#INVERTER 12
3500A
584V
2900A
400V
2000KW
400KWH
freesun
MODEL:
OUTPUT VOLTAGE:
RATED POWER:

REFERENCES

More than 22 GW installed around the world.



SPAIN

Alcázar, 168 MW

HEMK+ TWIN SKID

UNITED STATES

Phoebe, 250 MW

HEM

UNITED STATES

Willow Springs, 108 MW

HEM

UNITED STATES

Grange Hall, 71,5 MW

HEM

CANADA

Barlow, 10 MW

HEMK

SPAIN

Los Limonetes, 46 MW

HEMK + MV SKID

UNITED STATES

Calflats, 310 MW

HEM

SPAIN

Guillena, 105 MW

HEMK+ TWIN SKID

SPAIN

Bonete, 142 MW

HEMK+ TWIN SKID

UNITED STATES

Antelope 2, 121 MW

HEM

MEXICO

Guajiro, 221 MW

HEMK

JAPAN

Ishikawa, 10 MW

HEC-JP PLUS

UNITED STATES

Pecan, 90 MW

HEMK

AUSTRALIA

Rugby Run, 83 MW

HEC V1500 + MV SKID

SPAIN

La Nava, 46 MW

HEMK + TWIN SKID

UNITED STATES

Payne, 105 MW

HEM

UNITED STATES

Shaw Creek, 88 MW

HEM

JAPAN

Tano Ike, 2.5 MW

HEC V1500

JAPAN 1ST 1500V INVERTER

UNITED STATES

Rosamond, 175 MW

HEM

PANAMA

Chiriqui, 10.5 MW

HEC PLUS

EGYPT

Alcazar, 283 MW

HEMK+ TWIN SKID

BRAZIL

BRAZIL´S 1ST 1500V INVERTER

Sobral and Sertao, 30+30 MW

HEC V1500 + MV SKID

ARGENTINA

ARGENTINA'S 1ST 1500V INVERTER

Nonogasta, 42 MW

HEC V1500 + TWIN SKID

CHILE

Santiago Solar, 115 MW

HEC PLUS + MV SKID

UNITED STATES

Midway III, 24 MW

HEC-US V1500

UNITED STATES

Maverick, 8.5 MW

HEC-US V1500

UNITED STATES

Roserock, 157 MW

HEC-US

MEXICO

Santiago & Hermosillo, 170+100 MW

HEC V1500 + MV SKID

IRELAND

Dale Farm, 4 MW

HEV 1500 + MV SKID

UNITED KINGDOM

Eveley, 49 MW

HEC PLUS

JORDAN

Al Mafraq, 61 MW

HEC V1500 + MV SKID

JORDAN´S 1ST 1500V INVERTER

CHILE

Uribe, 50 MW

HEC PLUS + MV SKID

UNITED STATES

San Bernardino, 30 MW

HEK

UNITED KINGDOM

West Raynham, 44 MW

HEC PLUS

PORTUGAL

Ourique, 46 MW

HEC V1500

PORTUGAL'S 1ST 1500V INVERTER

BOLIVIA

Uyuni & Yunchara, 60+5 MW

HEC V1500 + MV SKID

BOLIVIA 1ST 1500V INVERTER

CHILE

Los Andes, 24 MW

HEC PLUS

URUGUAY

Alto Cielo, 26 MW

HEC PLUS

BARBADOS

St. Lucy, 9 MW

HEC PLUS

UNITED STATES

Gala, 56 MW

HEC-US V1500

UNITED KINGDOM

Lyneham, 51 MW

HEC PLUS

MEXICO

Solem I & II, 175 + 165 MW

HEC V1500 + MV SKID

UNITED STATES

Oak Solar, 180 MW

HEC-US V1500

AUSTRALIA

Barcaldine, 20 MW

HEC PLUS + MV SKID

UNITED STATES

Portal Ridge, 32 MW

HEC-US V1500

WARRANTY

Power Electronics (the Seller) warrants that their SOLAR INVERTER Products are free of faults and defects for a period of 5 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@powerelectronics. 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. Not withstanding the above, the replacement of a Product does not imply an extension of the term of warranty outside that of the original term.

ADDITIONAL WARRANTY

Power Electronics stands by the quality and durability of our inverters. That is why we offer a comprehensive 5 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 25 years are also available.

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