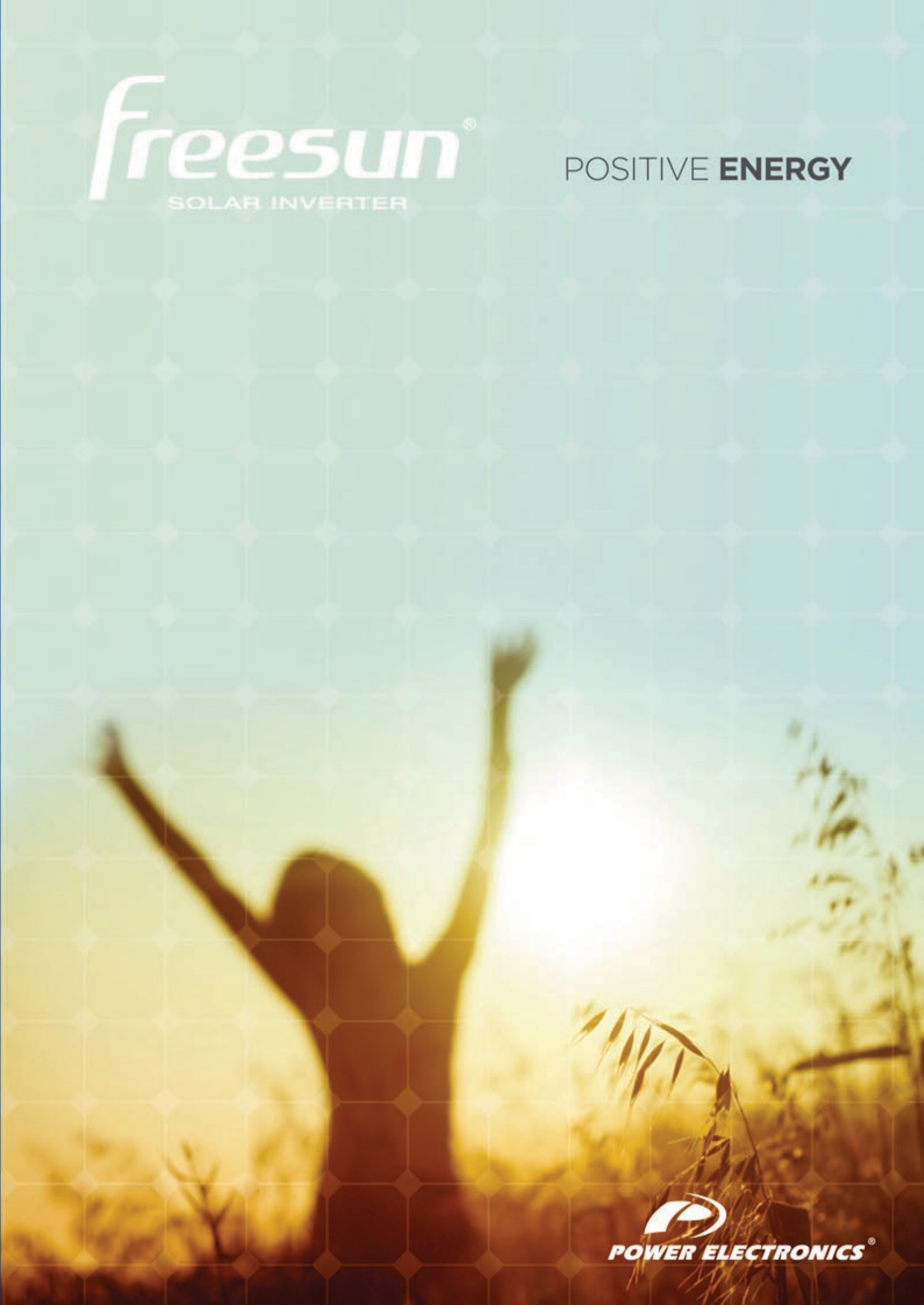
freesun®

SOLAR INVERTER

POSITIVE **ENERGY**



POWER ELECTRONICS®

POWER ELECTRONICS®

Freesun®
SOLAR INVERTER

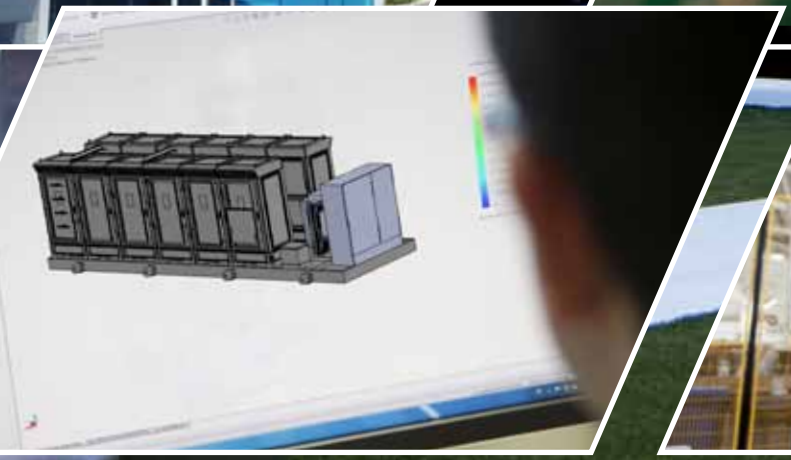
THE MOST ADVANCED SOLAR INVERTER

Our experience in developing and manufacturing high power Variable Speed Drives and Softstarters, in the control of diverse applications and the integration of all types of grid topologies, have allowed us to make the most robust, reliable and efficient solar inverter of the market.

POWER ELECTRONICS
THE COMPANY

In Power Electronics we believe we are a SERVICE and MANUFACTURING company of power electronics. We help you along the whole product life cycle, from plant lay-out the after sales technical service, by providing close, flexible and customer oriented assistance that ensures we keep long-term relationships with our clients and partners of the INDUSTRIAL and SOLAR PHOTOVOLTAIC sectors.

Our HEAD OFFICE in Valencia (Spain) houses our high technology R&D centre as well as the electronics manufacturing. Additionally, two FACTORIES with a net area of more than 20.000 sqm with an available area of 80.000 sqm can produce annually 1GW of solar and 5GW of industrial equipment. All under the perspective of a vertical integration that enhances the production quality and flexibility.



POWER ELECTRONICS®

INDUSTRIAL DIVISION - SOLAR DIVISION

VARIABLE SPEED DRIVES
ELECTRONIC SOFT STARTERS

SOLAR INVERTERS
SOLAR POWER STATIONS

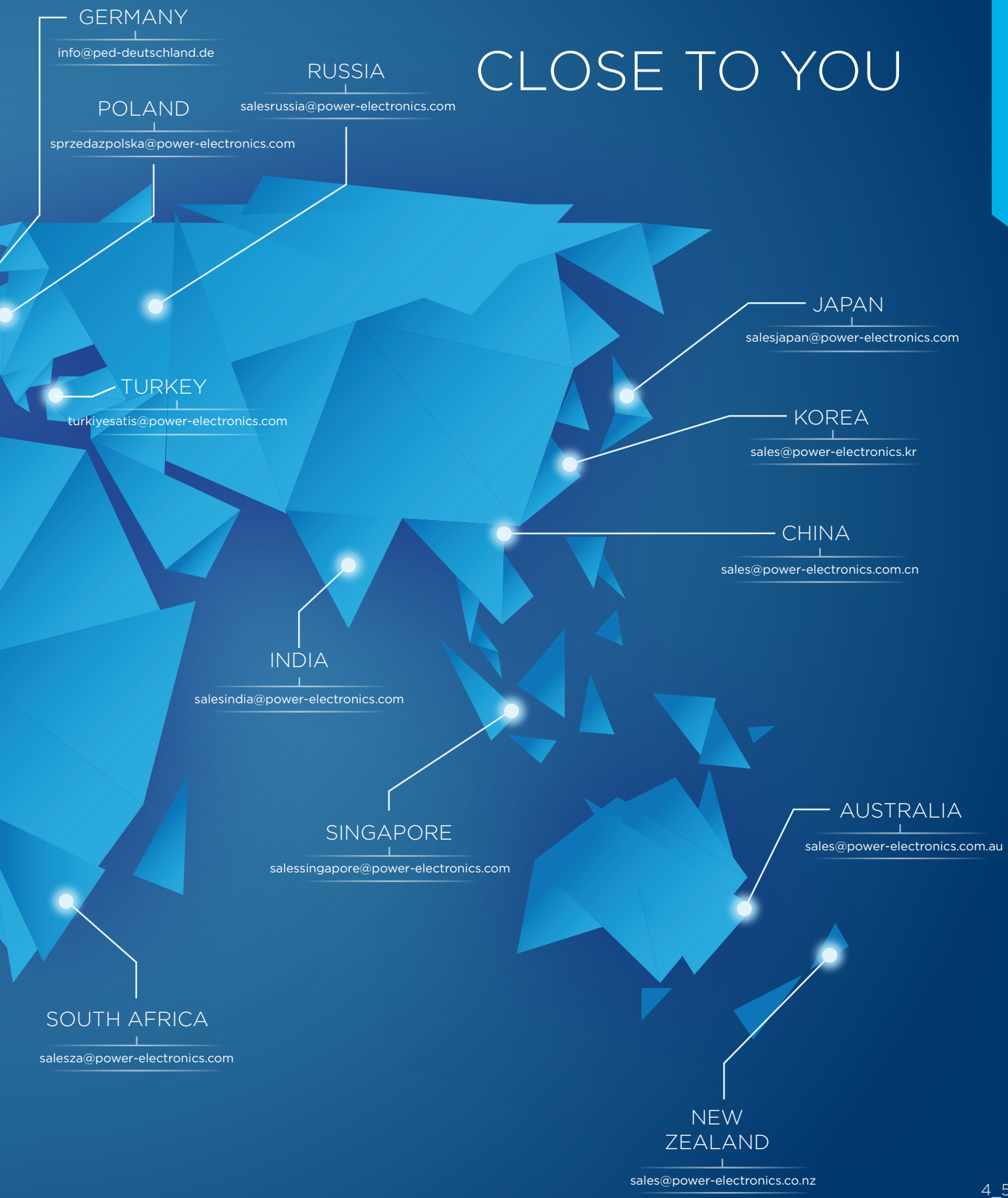
POWER ELECTRONICS WORLDWIDE

www.power-electronics.com

Power Electronics is a family-owned multinational who began manufacturing and selling variable speed drives and soft starters 25 years ago.

INTERNATIONAL PRESENCE in over 20 countries with more than 500 worldwide employees. Our branches do not only have a sales presence, we deliver on-site local technical assistance and updated spare parts stock that ensures our unique service response commitment.

CLOSE TO YOU



Freesun product range covers any possible requirement for your solar installation

Our expertise is divided into two main fields, the industrial one where we manufacture VSD (variable speed drives) and soft starters, both in low and medium voltage, and the other is the solar business, where we manufacture Solar Inverters, our Freesun product range covers any possible requirement for your solar installation.

Since our birth back in 1987 we haven't ceased to grow and compete against worldwide corporations, however our philosophy of giving service where others fail to do so, has brought us to where we are now. We continue to grow at great speed every year, and we hope that the near future will be of growth and expansion, consolidating more than 40 markets where we already are and adding some new horizons to our future.

SAVING ENERGY FOR THINGS THAT MATTER

In Power Electronics we know that the modern world is getting faster and more complicated by the day and that often our priorities in life can get confused. When we design and create our products, we don't only think about numbers and graphics, we think about our clients, their companies and the surrounding environment, like we would think about our own.

And that is exactly why we understand that there are more things in life, not only work. We don't want our clients to worry about our products, we want to save their energy so that they can invest it in the things that really matter, their families, their friends, their hobbies...

We will take care of the rest: we will set up free technical seminars and courses so that our clients and their technicians can get to know the products as well as we do, we will assist with the commissioning with no additional cost because we believe in work well done, we will offer you a 24h phone line so that you can always ask what you want to know no matter the time of day or night, and we will never let our clients down if they have a problem... We will take care of all these things so that you can save your energy for things that really matter...

Power on Support customer oriented strategy

POWER ON SUPPORT 24h

POWER ON SUPPORT is the concept which explains the customer oriented strategy implemented by Power Electronics since its origins more than 25 years ago. We do not simply consider ourselves an advanced power electronics manufacturer, but a services company in the market to take care of all our customers' needs and adapt to their requirements.

Therefore, flexibility and specialisation play a key role. We are flexible to be able to supply advanced products delivered in very short lead times, service our product ranges in any market where we have a branch within 24 hours, commission our devices worldwide, offer a worldwide hotline 24/7...

We are ready to give technical advice and support about our products and the applications in which they are installed. Our clients also have at their disposal our engineering and consulting department, which comprise a wide number of highly skilled and experienced engineers in the development of tailor-made solutions.

ENGINEERING SUPPPORT

FREE COMISSIONING

5 YEAR WARRANTY

24/7 CUSTOMER SUPPORT

24/7 ONSITE ASSISTANCE

MAINTENANCE CONTRACT

SPARE PARTS WARRANTY

99% AVAILABILITY

Vertical integration for customers satisfaction

Vertical integration of the whole production process allows us to offer a fully flexibility, outstanding quality and immediate delivery time, thanks to complete production supervision and scheduling of the electronics, frames and cabins, assembly and testing.

RELIABLE ENGINEERING

DESIGN FLEXIBILITY

HIGH QUALITY COMPONENTS

VALUE CHAIN SUPERVISION

FACTORY TESTED

IMMEDIATE DELIVERY

Index

Freesun®
SOLAR INVERTER

Freesun means experience, service, flexibility, reliability and commitment with your investment. The ultimate Freesun series and accessories provide a solution for medium and high power solar plants. Freesun's design and topology bring together the engineering expertise in industrial power electronics development and the solar plants economic and technical requirements.

INDOOR UTILITY SCALE
Solar inverters

FREESUN HE
200kVA to 1390kVA
270, 300, 330, 360Vac
1000Vdc, 10 MPPt, Extended MPPt range

FREESUN HES
200kVA-1250kVA
6kV-36kVac
1000Vdc
Oil transformer, 2L+P switchgear

OUTDOOR UTILITY SCALE
Solar inverters

FREESUN HEC
600kVA - 1700kVA
360, 380, 400Vac
1000Vdc, Extended MPPt range

FREESUN MV STATION
400kVA – 2000kVA
6kV-36kVac
Oil transformer, 2L+P switchgear

FREESUN HEC-UL
160kVA-1200kVA
208, 330, 360, 390Vac
600Vdc - 1000Vdc, 4 MPPt

FREESUN HEK
200kVA-2500kVA
4.16kV- 34.5kV
600Vdc - 1000Vdc,
4 MPPt / Open Skid Station

COMMERCIAL SCALE
Solar inverters

FREESUN LVT
20kW-100kW
400Vac, Built-in transformer
1000Vdc, 1 MPPt
Outdoor and Indoor Inverter

ENERGY STORAGE
Solar solutions

FREESUN PCS
125kVA- 1800kVA
360Vac – 440VAc
1000Vdc
Up to 4 independent battery strings
Outdoor Battery Inverter

FREESUN PCS-Skid Station
200kVA-3000kVA
4.16kV- 34.5kV
1000Vdc,
Up to 8 independent battery strings
Open Skid Station

FREESUN HET
200kVA-2000kVA
6kV-36kVac
1000Vdc
Dry transformer, 2L+P switchgear

FREESUN MV OUTDOOR SET
400kVA – 2000kVA
6kV-36kVac
Outdoor transformer &
2L+P Switchgear Station

FREESUN ESS
100kWh- 2MWh
600Vdc-800Vdc
1C to 4.2C
Discharge capacity
Powered by Kokam

ACCESSORIES

STRING SUPERVISORS
·SFS16, 24 Wall mounted
·SFS08 Wall mounted

DC DISCONNECTION & PROTECTION
·Built-in module
·Outdoor wall-mounted
·Outdoor stand-alone

AC DISCONNECTION & PROTECTION
·Built-in AC circuit breaker
·Built-in AC fuses and disconnector
·Stand-alone Indoor AC cabinet

PLANT MANAGEMENT
· Freesun PPC Power Plant Controller
· Freesun PCI Power Control Interface
· Freesun PIK Power Independence Kit

MONITORING AND REMOTE O&M
·Freesun Portal
·Freesun Web Display
·Freesun App Display

WEATHER ACCESSORIES
·Irradiance sensor
·Pyranometer
·Weather Station
·Security cameras
·Optical Probe

CONFIGURATION
·Freesun Smart Configurator

INDOOR UTILITY SCALE
Solar Inverters

HE
Solar Inverter

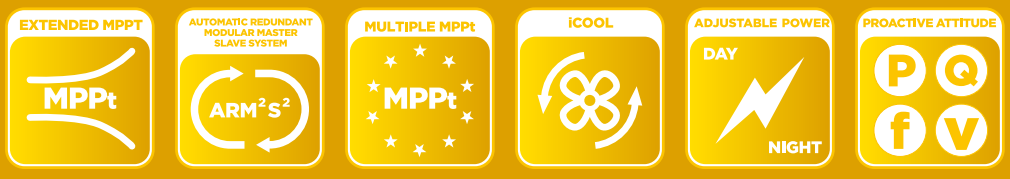
Freesun®
SOLAR INVERTER

POWER ELECTRONICS´ HE solar inverter is the best choice in quality and reliability. It is available in four output voltages from 270Vac to 360Vac, covering a power range from 200kVA to 1390kVA.

The truly modular and redundant inverter, all systems are repeated in each module, control board, power stage, cooling system and disconnectors. All being coupled by the DC and AC buses so that the system provides redundancy in case of the failure of a module. FREESUN HE frames can be featured with up to 10 modules that are able to perform the MPPt tracking and act as a Master. Large power stations equipped with two TWIN Freesun HE inverters can be synchronized and connected to one step-up transformer with a single winding.

Best in class topology and unique after-sales service in the market represents the best guarantee for your investment.

The truly modular inverter, all systems are repeated in each module



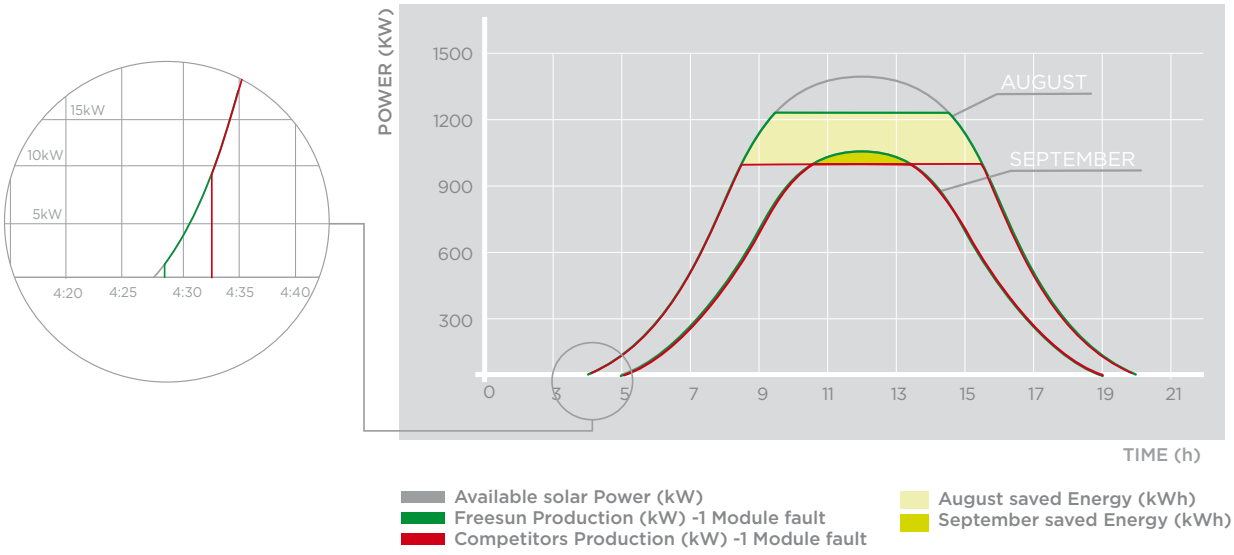
AUTOMATIC REDUNDANT MODULAR MASTER SLAVE SYSTEM

ARM²S²

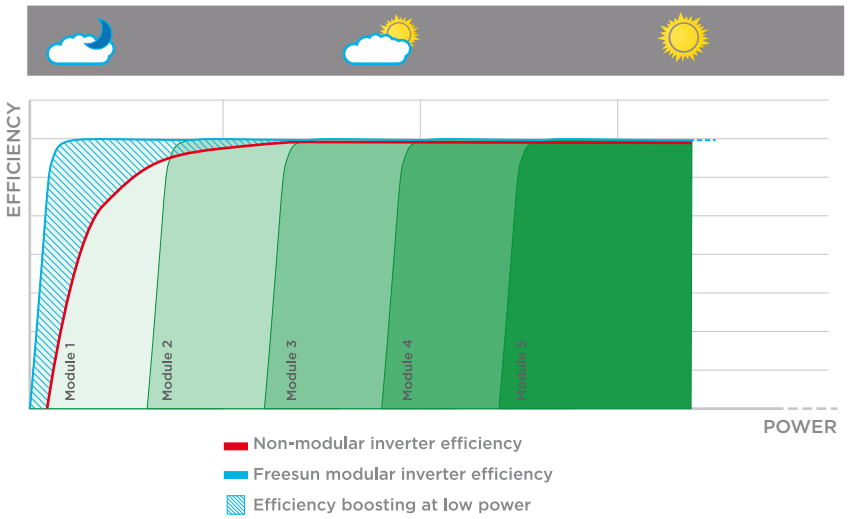
Automatic Redundant Modular Master Slave System

Freesun HE topology gets the competiveness of central inverters and the availability of string inverters. It is constructed with independent modules from 100 to 139kVA, each module includes its own control board, power stage and cooling system, being coupled by the DC and AC buses. In the end, an issue only affects to one of the units and never the entire system. At the same time, the power of the faulty module is sent to an adjoining operative module, so that it only reduces the injected power when the maximum rated power is reached. If not, you won't lose a kWh and you might probably never realize that a module is not operative.

All the units work in parallel together commanded by the master. This master is the main governor of the system and is responsible of the MPPt tracking, synchronization sequence, overall protection.... Freesun HE is smartly designed to last. The automatic mode shifts every night the master role by comparing the register of energy production of every module. The one with less energy produced (kWh) will act as a master next early morning with the first sunbeams. This feature enables a homogeneous wear and tear of all the components in the modules, extends the product lifetime and MTBF ratio.



When addressing the selection of a solar inverter manufacturer, there are crucial points that should be considered first and inverter's efficiency is one of the most important. On low radiation conditions, a modular inverter operates at higher efficiency levels than a similarly sized central inverter. By shutting off unneeded power modules, modules load increases to get the maximum available efficiency. At the same time, a lower power rating of the inverter units allow to start feed-in earlier in the morning and to stop later in the afternoon. As a result, throughout the entire service life of the PV plant, HE will generate higher yields than central or string inverters.



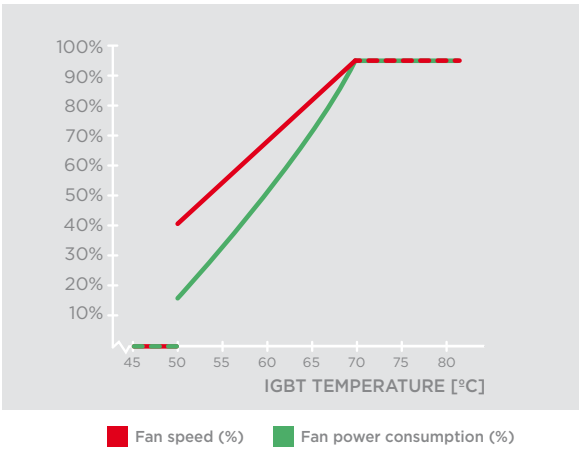
A MODULAR AND REDUNDANT INVERTER GENERATES HIGHER YIELDS

Efficient Cooling System

Independent cooling in each module reduces the fan power consumption. The inverter reduces to the maximum the Stand-by consumption at low capacity. Each hot zone of the module has 3 independent fans smartly located and controlled through its own control board and temperature sensors.

Power Electronics´experience in VSD has been implemented in the main power fans to reduce the energy consumption to the minimum and to boost the cooling capacity for PV installation situated higher than 3000 meters above sea level. Energy saving with greater cooling features.

No power derating until 50°C due its oversized IGBT's, its mechanical design and efficient cooling system.



Totally Sealed

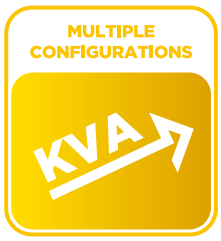
The internal fan moves the clean air through the dissipation surface that allows HE Series to be totally isolated. This mechanical design offers maximum protection for the electronics without the risk of dust filters clogging which require regular maintenance.

Easy to install

Its modular design allows to isolate and replace all the components with no effort, saving time and money during routine inspections. Each module is equipped with guided wheels that enable an easy frontal extraction only with the aid of the delivered trolley.

Maximum DC bus flexibility that allows up to 10 independent MPPt per inverter

Furthermore, design each MPPt's rated power as you wish, neither mechanical, hardware or software restriction to fit all the customer's requirements.



Configurable Rating

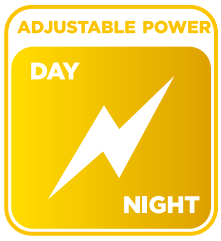
AC Power configurable rating and MPPt DC voltage range, the customer could adjust the limits of the inverter to increase the module power from 100kVA to 139kVA. Power electronics provides you competitiveness tools.

	MPPt Window (VDC)[2]				
# MODULES	382V-900V	425V-900V	467V-900V	510V-900V	
2	200kVA	230kVA	250kVA	280kVA	Nominal AC Output Power (kVA)[1]
3	300kVA	340kVA	380kVA	420kVA	
4	400kVA	460kVA	500kVA	560kVA	
5	500kVA	570kVA	630kVA	700kVA	
6	600kVA	680kVA	750kVA	830kVA	
7	700kVA	800kVA	880kVA	970kVA	
8	800kVA	910kVA	1000kVA	1110kVA	
9	900kVA	1030kVA	1130kVA	1250kVA	
10	1000kVA	1140kVA	1250kVA	1390kVA	
AC Output Voltage	270VAC	300VAC	330Vac	360Vac	

[1] Values at 50°C, 50Hz [2] Values at 1.00Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.

Extended MPPt

Using the latest modulation techniques, inspired by the most accurate and powerful motor control applications, has lead to the widest MPPt full power window in the solar market. Update your OND files as soon as possible to check how the most advanced control software and our unique topology boost your PV plant performance rates.



Accurate and flexible reactive capability

Freesun HE inverter is limited by the output current at 50°C, no matter whether it is active or reactive current. Just an appropriate selection of the units considering the reactive capability curves allow the user to install Freesun HE with any power factor conditions.

During the night Freesun HE inverter can shift to reactive power compensation mode. The inverter will work either following an external dynamic signal from a power analyzer, or injecting a pre-set reactive power (kVAr).

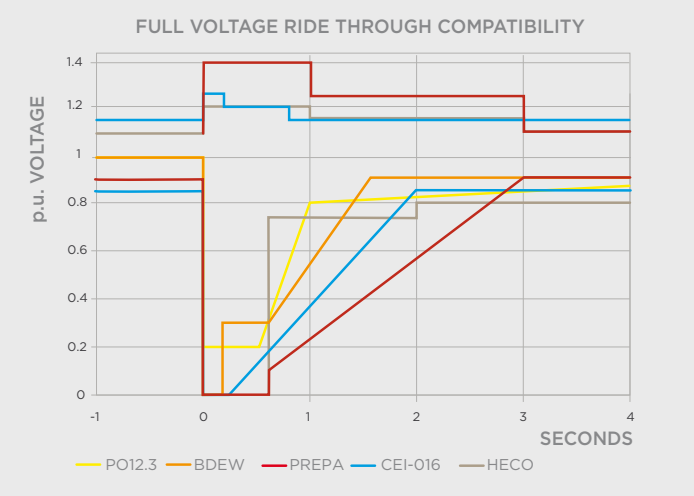
PROACTIVE ATTITUDE

P Q f V

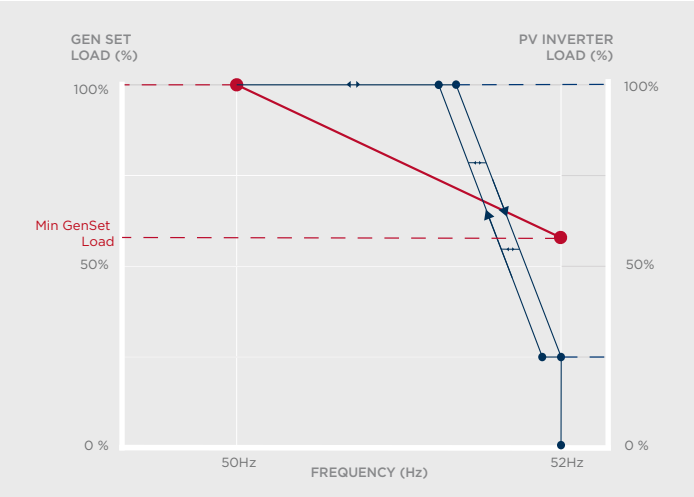
Dynamic grid support

Freesun HE firmware includes the latest utility interactive features (LVRT, OVRT, FRS, FRT, Anti-islanding, active and reactive power curtailment...), being compatible with all the specific requirements of the utilities in any country (France, Germany, Italy, Israel, Japan, Mexico, Puerto Rico, Rumania, South Africa, Spain, UK, U.S.A...)

LVRT or ZVRT (Low Voltage Ride Through): Our inverter withstand any voltage dip profile required by the local interconnection code, it will immediately feed the fault with full reactive power, as long as the protection limits are exceeded.



FRS: The Frequency Regulation Systems algorithm curtails the active power along a preset characteristic curve supporting the grid stabilization. This functionality, together with a Freesun PPC; will control the PV active power injection in electric grids powered by diesel Generators.



Freesun HE can perform simultaneously two anti-islanding protection methods: Passive and Active method. Both certified according to IEC 62116 and IEEE1547.

The advance control allows the inverter to support the grid through reactive power injection or phase shift control by selecting: a fixed cos φ, dynamic cos φ, preset cos φ(P) continuous curve, preset Q(V) step or continuous curve.

freesun
SOLAR INVERTER

HE | Technical Characteristics 360VAC

		360VAC - MPPt Window 510Vdc-900Vdc								
		FRAME 1 - FS		FRAME 2 - FS			FRAME 3 - FS			
	NUMBER OF MODULES	2	3	4	5	6	7	8	9	10
	FREESUN HE	FS0280IH	FS0420IH	FS0560IH	FS0701IH	FS0830IH	FS0970IH	FS1110IH	FS1250IH	FS1390IH
OUTPUT	Nominal AC Power(kVA) at 50°C	280	420	560	700	830	970	1110	1250	1390
	Nominal AC Current (A) at 50°C	444	667	889	1111	1333	1555	1778	2000	2222
	Operating Grid Voltage(V_{AC})	360Vac								
	Operating Range, Grid Frequency	50Hz - 60Hz								
	Voltage Ripple, PV Voltage	< 3%								
	Current Harmonic Distortion (THDi)	< 3% at nominal power								
	Power Factor (cosi phi)[1]	0.0 leading...0.0 lagging / Reactive power injection at night								
	Number AC connections per pole	4x240mm²xM12		4x240mm²xM12			8x240mm²xM12			
INPUT	MPPt Voltage Window (VDC)[2]	510V-900V								
	MPPt window @full power (VDC)[3]	568V-820V								
	Max. permissible DC voltage (V_{AC})	1000V								
	Rated DC current (A)	500A	750A	1000A	1250A	1500A	1750A	2000A	2250A	2500A
EFFICIENCY & AUX. SUPPLY	Maximum Efficiency $P_{AC, nom}$ (η)	98.6%		98.6%			98.6%			
	Euroeta (η)	98.2%		98.3%			98.4%			
	Maximum Standby Consumption (Pnight)	< approx. 120W		< approx. 240W			< approx. 400W			
	Control Power Supply	3 x 400V, 50/60Hz, (VRT compatible inverters equipped with internal UPS)								
CABINET	Dimensions [WxHxD] mm	2100x2080x1020		3372 x 2080 x 1020			5260 x 2080 x 1020			
	Weight (kg)	1650		2900			4500			
	Air flow	Intake through rear lower part blown out through upper side								
	Type of ventilation	VSD temperature controlled, Air-cooled								
ENVIRON-MENT	Degree of protection	Indoor IP21								
	Permissible Ambient Temperature	-20°C ...+50°C								
	Relative Humidity	10% to 95% Non condensing								
	Max. Altitude (above sea level)	1000m; >1000m power derating 1% Sn (kVA) per 100m								
	Noise level[4]	< 79 dBA								
CONTROL INTERFACE	Interface	Alphanumeric Display / Optional Freesun App Display or Freesun Web Display								
	Communication	RS232 / RS485 / USB / Ethernet, (Modbus RTU Protocol, Modbus TCP/IP) Optional GSM/GPRS								
	Analogue Inputs	1 programmable and differential inputs; (0-20mA or ± 10mV to ± 10V) and PT100								
	String Supervisor Communication	RS485 /Modbus RTU								
	Plant Controller Interface	Ethernet / Modbus / TCP/IP								
	Digital Outputs	2 electrically-isolated programmable switched relays (250V_{AC}, 8A or 30 V_{DC}, 8A)								
PROTECTIONS	Ground Fault Monitoring[5]	Standard built in								
	Humidity Control	Active Heating / Optional Heating Resistors								
	Emergency Stop	Optional								
	General AC Protection & Disconn.	Circuit Breaker / Optional AC fuses & disconnectors								
	General DC Protection & Disconn.	Optional: Integrated in empty modules or external								
	Module AC Protection & Disconn.	AC circuit breaker & contactor								
	Module DC Protection & Disconn.	Motorized MCCB								
	Overvoltage Protection	AC, DC Inverter and Auxiliary Supply type 2 - Internal Standard								
	Lightning Protections	Optional (Integrated in the inverter)								

NOTES [1] [1] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$
[2] Values at 1.00Vac nom and cos Φ = 1.
Consult Power Electronics for derating curves.
[3] Values at 1.00Vac nom and cos Φ = 1 and T_{amb}=50°C.
[4] Sound pressure level at a distance of 1m from the rear part.
[5] In cases where the installation has the positive pole or the negative pole earth connected, this protection will be disconnected.

HE | Technical Characteristics

330VAC

		330VAC - MPPt Window 467Vdc-900Vdc								
		FRAME 1 - FS		FRAME 2 - FS			FRAME 3 - FS			
	NUMBER OF MODULES	2	3	4	5	6	7	8	9	10
	FREESUN HE	FS0250IH	FS0380IH	FS0501IH	FS0630IH	FS0750IH	FS0880IH	FS1001IH	FS1130IH	FS1251IH
OUTPUT	Nominal AC Power(kVA) at 50°C	250	380	500	630	750	880	1000	1130	1251
	Nominal AC Current (A) at 50°C	438	657	876	1095	1314	1533	1752	1971	2190
	Operating Grid Voltage(V_{AC})	330Vac								
	Operating Range, Grid Frequency	50Hz - 60Hz								
	Voltage Ripple, PV Voltage	< 3%								
	Current Harmonic Distortion (THDi)	< 3% at nominal power								
	Power Factor (cosi phi)[1]	0.0 leading...0.0 lagging / Reactive power injection at night								
	Number AC connections per pole	4x240mm²xM12		4x240mm²xM12			8x240mm²xM12			
INPUT	MPPt Voltage Window (VDC)[2]	467V-900V								
	MPPt window @full power (VDC)[3]	511V-820V								
	Max. permissible DC voltage (V_{AC})	1000V								
	Rated DC current (A)	500A	750A	1000A	1250A	1500A	1750A	2000A	2250A	2500A
EFFICIENCY & AUX. SUPPLY	Max. Efficiency PAC, nom (η)	98.6%		98.6%			98.6%			
	Euroeta (η)	98.2%		98.3%			98.4%			
	Max. Standby Consumption (Pnight)	< approx. 120W		< approx. 240W			< approx. 400W			
	Control Power Supply	3 x 400V, 50 / 60Hz, (VRT compatible inverters equipped with internal UPS)								
CABINET	Dimensions [WxHxD] mm	2100x2080x1020		3372 x 2080 x 1020			5260 x 2080 x 1020			
	Weight (kg)	1650		2900			4500			
	Air Flow	Intake through rear lower part blown out through upper side								
	Type of ventilation	VSD temperature controlled Air-cooled								
ENVIRON-MENT	Degree of protection	Indoor IP21								
	Permissible Ambient Temperature	-20°C ...+50°C								
	Relative Humidity	10% to 95% Non condensing								
	Max. Altitude (above sea level)	1000m; >1000m power derating 1% Sn (kVA) per 100m								
	Noise level[4]	< 79 dBA								
CONTROL INTERFACE	Interface	Alphanumeric Display / Optional Freesun App Display or Freesun Web Display								
	Communication	RS232 / RS485 / USB / Ethernet, (Modbus RTU Protocol, Modbus TCP/IP) Optional GSM/GPRS								
	Analogue Inputs	1 programmable and differential inputs; (0-20mA or ± 10mV to ± 10V) and PT100								
	String Supervisor Communication	RS485 /Modbus RTU								
	Plant Controller Interface	Ethernet / Modbus / TCP/IP								
	Digital Outputs	2 electrically-isolated programmable switched relays (250V_{AC}, 8A or 30 V_{DC}, 8A)								
PROTECTIONS	Ground Fault Monitoring[5]	Standard built in								
	Humidity Control	Active Heating / Optional Heating Resistors								
	Emergency Stop	Optional								
	General AC Protection & Disconn.	Circuit Breaker / Optional AC fuses & disconnectors								
	General DC Protection & Disconn.	Optional: Integrated in empty modules or external								
	Module AC Protection & Disconn.	AC circuit breaker & contactor								
	Module DC Protection & Disconn.	Motorized MCCB								
	Overvoltage Protection	AC, DC Inverter and Auxiliary Supply type 2 - Internal Standard								
	Lightning Protections	Optional (Integrated in the inverter)								

NOTES [1] [1] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$
[2] Values at 1.00Vac nom and cos Φ = 1.
Consult Power Electronics for derating curves.
[3] Values at 1.00Vac nom and cos Φ = 1 and T_{amb}=50°C.
[4] Sound pressure level at a distance of 1m from the rear part.
[5] In cases where the installation has the positive pole or the negative pole earth connected, this protection will be disconnected.

freesun
SOLAR INVERTER

HE | Technical Characteristics 300VAC

		300VAC - MPPt Window 425Vdc-900Vdc								
		FRAME 1 - FS		FRAME 2 - FS			FRAME 3 - FS			
NUMBER OF MODULES		2	3	4	5	6	7	8	9	10
FREESUN HE		FS0230IH	FS0340IH	FS0460IH	FS0570IH	FS0680IH	FS0801IH	FS0910IH	FS1030IH	FS1140IH
OUTPUT	Nominal AC Power(kVA) at 50°C	230	340	460	570	680	800	910	1030	1140
	Nominal AC Current (A) at 50°C	438	657	876	1095	1314	1533	1752	1971	2190
	Operating Grid Voltage(V_{AC})	300Vac								
	Operating Range, Grid Frequency	50Hz - 60Hz								
	Voltage Ripple, PV Voltage	< 3%								
	Current Harmonic Distortion (THDi)	< 3% at nominal power								
	Power Factor (cosi phi)[1]	0.0 leading...0.0 lagging / Reactive power injection at night								
	Number AC connections per pole	4x240mm²xM12		4x240mm²xM12			8x240mm²xM12			
INPUT	MPPt Voltage Window (VDC)[2]	425V-900V								
	MPPt window @full power (VDC)[3]	466V-820V								
	Max. permissible DC voltage (V_{AC})	1000V								
	Rated DC current (A)	500A	750A	1000A	1250A	1500A	1750A	2000A	2250A	2500A
EFFICIENCY & AUX. SUPPLY	Max. Efficiency PAC, nom (η)	98.6%		98.6%			98.6%			
	Euroeta (η)	98.2%		98.3%			98.4%			
	Max. Standby Consumption (Pnight)	< approx. 120W		< approx. 240W			< approx. 400W			
	Control Power Supply	3 x 400V, 50 / 60Hz, (VRT compatible inverters equipped with internal UPS)								
CABINET	Dimensions [WxHxD] mm	2100x2080x1020		3372 x 2080 x 1020			5260 x 2080 x 1020			
	Weight (kg)	1650		2900			4500			
	Air Flow	Intake through rear lower part blown out through upper side								
	Type of ventilation	VSD temperature controlled Air-cooled								
ENVIRON-MENT	Degree of protection	Indoor IP21								
	Permissible Ambient Temperature[3]	-20°C ...+50°C								
	Relative Humidity	10% to 95% Non condensing								
	Max. Altitude (above sea level)[3]	1000m; >1000m power derating 1% Sn (kVA) per 100m								
	Noise level[4]	< 79 dBA								
CONTROL INTERFACE	Interface	Alphanumeric Display / Optional Freesun App Display or Freesun Web Display								
	Communication	RS232 / RS485 / USB / Ethernet, (Modbus RTU Protocol, Modbus TCP/IP) Optional GSM/GPRS								
	Analogue Inputs	1 programmable and differential inputs; (0-20mA or ± 10mV to ± 10V) and PT100								
	String Supervisor Communication	RS485 /Modbus RTU								
	Plant Controller Interface	Ethernet / Modbus / TCP/IP								
	Digital Outputs	2 electrically-isolated programmable switched relays (250V_{AC}, 8A or 30 V_{DC}, 8A)								
PROTECTIONS	Ground Fault Monitoring[5]	Standard built in								
	Humidity Control	Active Heating / Optional Heating Resistors								
	Emergency Stop	Optional								
	General AC Protection & Disconn.	Circuit Breaker / Optional AC fuses & disconnectors								
	General DC Protection & Disconn.	Optional: Integrated in empty modules or external								
	Module AC Protection & Disconn.	AC circuit breaker & contactor								
	Module DC Protection & Disconn.	Motorized MCCB								
	Overvoltage Protection	AC, DC Inverter and Auxiliary Supply type 2 - Internal Standard								
	Lightning Protections	Optional (Integrated in the inverter)								

NOTES [1] [1] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$
[2] Values at 1.00Vac nom and cos Φ = 1.
Consult Power Electronics for derating curves.
[3] Values at 1.00Vac nom and cos Φ = 1 and T_{amb}=50°C.
[4] Sound pressure level at a distance of 1m from the rear part.
[5] In cases where the installation has the positive pole or the negative pole earth connected, this protection will be disconnected.

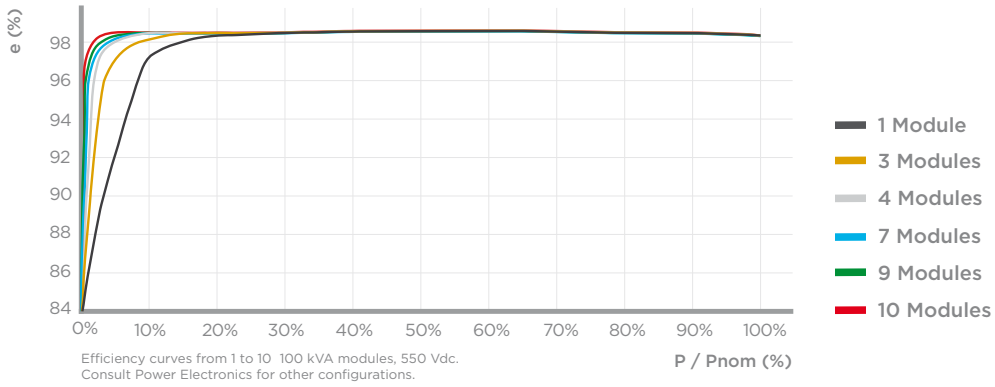
HE | Technical Characteristics 270VAC

		270VAC - MPPt Window 382Vdc-900Vdc								
		FRAME 1 - FS		FRAME 2 - FS			FRAME 3 - FS			
	NUMBER OF MODULES	2	3	4	5	6	7	8	9	10
	FREESUN HE	FS0200IH	FS0300IH	FS0400IH	FS0500IH	FS0600IH	FS0700IH	FS0800IH	FS0900IH	FS1000IH
OUTPUT	Nominal AC Power(kVA) at 50°C	200	300	400	500	600	700	800	900	1000
	Nominal AC Current (A) at 50°C	428	642	856	1070	1284	1485	1712	1926	2140
	Operating Grid Voltage(V_{AC})	270Vac								
	Operating Range, Grid Frequency	50Hz - 60Hz								
	Voltage Ripple, PV Voltage	< 3%								
	Current Harmonic Distortion (THDi)	< 3% at nominal power								
	Power Factor (cosi phi)[1]	0.0 leading...0.0 lagging / Reactive power injection at night								
	Number AC connections per pole	4x240mm²xM12		4x240mm²xM12			8x240mm²xM12			
INPUT	MPPt Voltage Window (VDC)[2]	382V-900V								
	MPPt window @full power (VDC)[3]	410V-820V								
	Max. permissible DC voltage (V_{AC})	900V, 1000V (Optional)								
	Rated DC current (A)	480A	720A	960A	1200A	1440A	1680A	1920A	2160A	2400A
EFFICIENCY & AUX. SUPPLY	Max. Efficiency PAC, nom (η)	98.6%		98.6%			98.6%			
	Euroeta (η)	98.2%		98.3%			98.4%			
	Max. Standby Consumption (Pnight)	< approx. 120W		< approx. 240W			< approx. 400W			
	Control Power Supply	3 x 400V, 50 / 60Hz, (VRT compatible inverters equipped with internal UPS)								
CABINET	Dimensions [WxHxD] mm	2100x2080x1020		3372 x 2080 x 1020			5260 x 2080 x 1020			
	Weight (kg)	1650		2900			4500			
	Air Flow	Intake through rear lower part blown out through upper side								
	Type of ventilation	VSD temperature controlled Air-cooled								
ENVIRON-MENT	Degree of protection	Indoor IP21								
	Permissible Ambient Temperature[3]	-20°C ...+50°C								
	Relative Humidity	10% to 95% Non condensing								
	Max. Altitude (above sea level)[3]	1000m; >1000m power derating 1% Sn (kVA) per 100m								
	Noise level[4]	< 79 dBA								
CONTROL INTERFACE	Interface	Alphanumeric Display / Optional Freesun App Display or Freesun Web Display								
	Communication	RS232 / RS485 / USB / Ethernet, (Modbus RTU Protocol, Modbus TCP/IP) Optional GSM/GPRS								
	Analogue Inputs	1 programmable and differential inputs; (0-20mA or ± 10mV to ± 10V) and PT100								
	String Supervisor Communication	RS485 /Modbus RTU								
	Plant Controller Interface	Ethernet / Modbus / TCP/IP								
	Digital Outputs	2 electrically-isolated programmable switched relays (250V_{AC}, 8A or 30 V_{DC}, 8A)								
PROTECTIONS	Ground Fault Monitoring[5]	Standard built in								
	Humidity Control	Active Heating / Optional Heating Resistors								
	Emergency Stop	Optional								
	General AC Protection & Disconn.	Circuit Breaker / Optional AC fuses & disconnectors								
	General DC Protection & Disconn.	Optional: Integrated in empty modules or external								
	Module AC Protection & Disconn.	AC circuit breaker & contactor								
	Module DC Protection & Disconn.	Motorized MCCB								
	Overvoltage Protection	AC, DC Inverter and Auxiliary Supply type 2 - Internal Standard								
	Lightning Protections	Optional (Integrated in the inverter)								

NOTES [1] [1] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$
[2] Values at 1.00Vac nom and cos Φ = 1.
Consult Power Electronics for derating curves.
[3] Values at 1.00Vac nom and cos Φ = 1 and T_{amb}=50°C.
[4] Sound pressure level at a distance of 1m from the rear part.
[5] In cases where the installation has the positive pole or the negative pole earth connected, this protection will be disconnected.

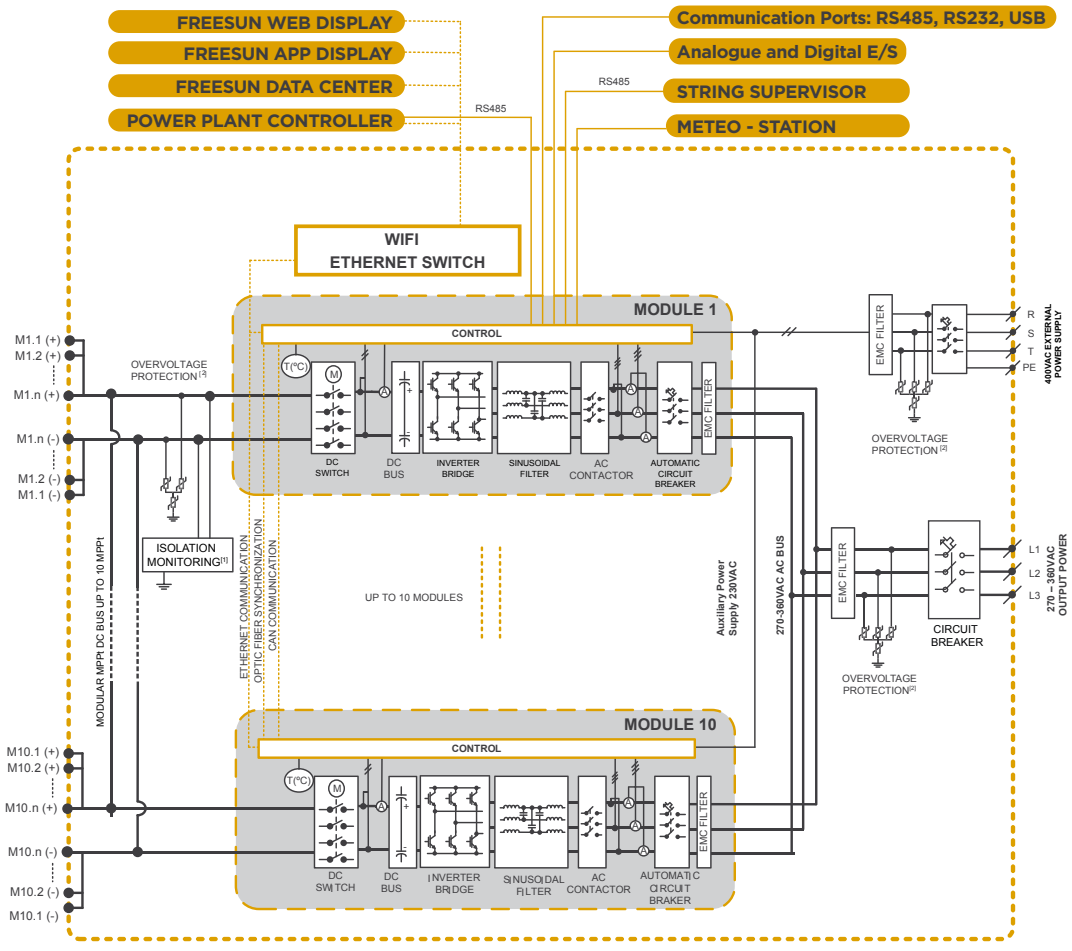
HE | Efficiency Curves Operational Diagram

EFFICIENCY CURVES



Efficiency curves from 1 to 10 100 kVA modules, 550 Vdc.
Consult Power Electronics for other configurations.

OPERATIONAL DIAGRAM

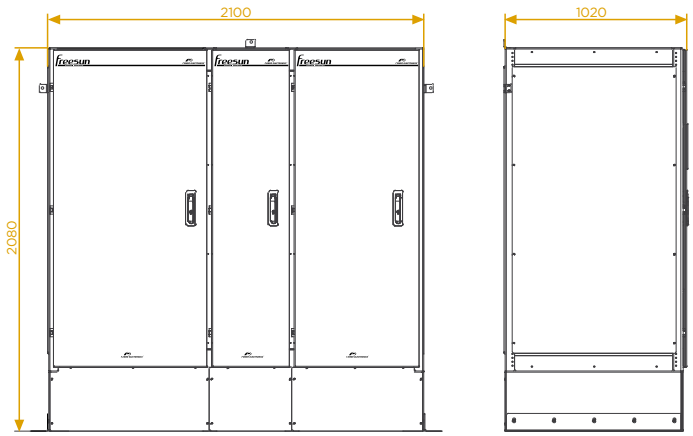


[1] In positive pole or negative pole earth connected installations, the protection must be disconnected.
[2] Optional AC and DC lightning protection.

HE | Dimensions and weights

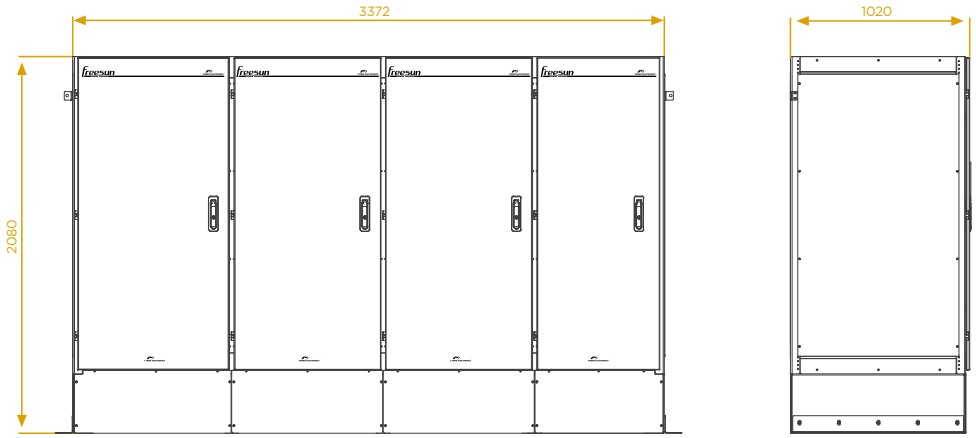
FRAME 1

FRAME	WEIGHT (kg)
1	1650



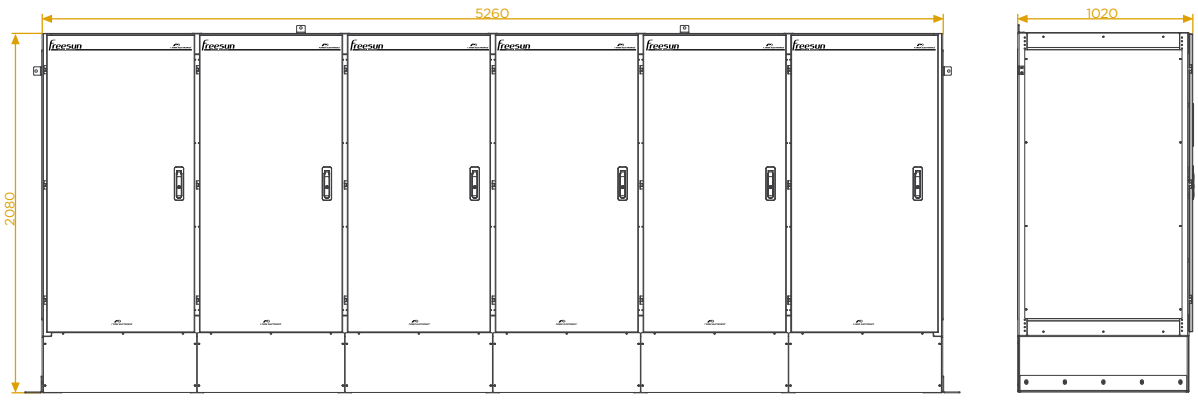
FRAME 2

FRAME	WEIGHT (kg)
2	2900



FRAME 3

FRAME	WEIGHT (kg)
3	4500



HES
Solar Inverter

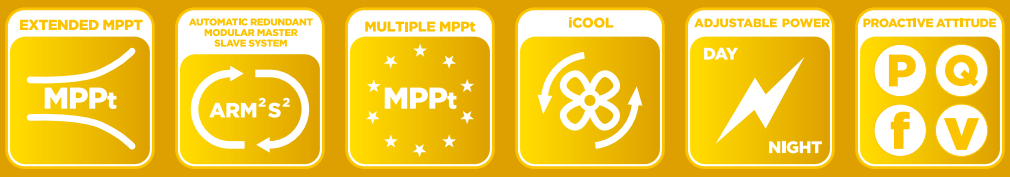
Freesun®
SOLAR INVERTER

HES by POWER ELECTRONICS is a prefabricated concrete station easy to install and totally protected from harsh conditions, the HES represents a cost-effective turnkey solution for large installations.

We offer a wide portfolio of Solar Power Stations from 250kVA to 1250kVA. They are featured with oil-immersed step-up transformer, SF6 air insulated MV switchgear, DC and AC disconnection and protection, tailored to comply with any client requirements. The Freesun HES station is easy to connect and to install in field, reducing the transportation, installation and commissioning costs.

Maximize the life and availability of your PV plant relying on Freesun HE inverters and Power Electronics conditions.

Freesun HES-R is the most compact, reliable and cost effective 1.25MW concrete solar power station



freesun
SOLAR INVERTER

HES | Technical Characteristics

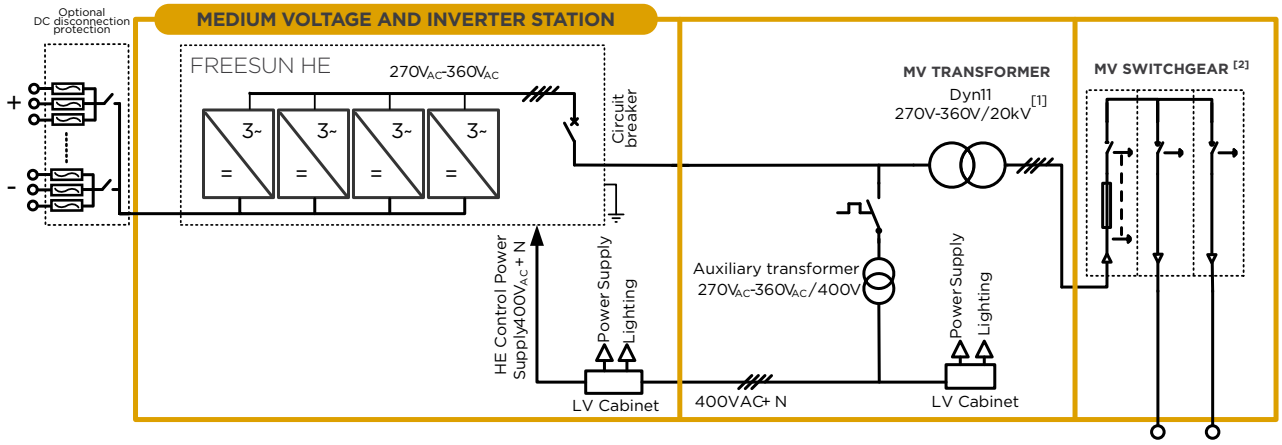
		FRAME 1 - FS	FRAME 2 - FS	FRAME 3 - FS	
MEDIUM VOLTAGE	Inverter AC Voltage	270Vac / 300Vac / 330Vac / 360Vac			
	Output Voltage	10kV-36kV			
	MV Transformer	250 - 400kVA	400 - 800kVA	800 - 1250kVA	
	Transformer vector Configuration and type	Dyn11, Oil/Dry (optional)			
	Frequency	50Hz / 60Hz			
	MV Transformer Efficiency	Standard or High Efficiency			
	MV Switchgear [1]	2L1P scheme, SF6 insulated switchgear			
STANDARD STATION[2]	Concrete Station Dimensions [WxHxD] mm	6080x3200x2530	6950x3200x2530	Inverter ST	6080x3200x2530
				Transf. ST	4600x3200x2530
	Total Weight (Inverter + Concrete)	20t	25t	Inverter ST	20t
				Transf. ST	15t
REDUCED STATION[2] [3]	Concrete Station Dimensions [WxHxD] mm	6080x2400x2400	6800x2400x2400	8400x2400x2400	
	Total Weight (Inverter + Concrete)	16t	24t	28t	
AUXILIARY SUPPLY	Auxiliary Inverter Power Supply	3 x 400V, 50 / 60Hz, (LVRT compatible inverters equipped with internal UPS)			
	Auxiliary transformer[4]	10kVA, Yyn0			
		Optional upstream fuse protection			
	Auxiliary services Station[4]	General control panel with auxiliary breakers, prepared with four outputs: Lighting, power supply, inverter power supply and auxiliary MCB			
ENVIRON-MENTAL RATINGS	Protection Rating as per EN 60529	Outdoor IP54			
	Permissible Ambient Temperature	-20°C ...+50°C			
	Relative Humidity	5% to 95% Non condensing			
	Max. Altitude (above sea level)	1000m			
	Power Altitude derating	>1000m, 1% Sn (kVA) per 100m			
	Noise Level[5]	< 79 dBA			
	UV Exposure	Yes			
	Humidity control	Active heating, Optional heating resistor			
CABINET FEATURES	Station material	Prefabricated Concrete			
	Concrete (exterior walls) colour	RAL 7047			
	Metal parts (grills, doors) and cover colour	RAL 7016			
	Internal earth grid	✔			
	Interior lighting	✔			
	Floor plate and grilles for HE Inverter	✔			
	Mural type extractor fan with thermostat	✔			
	Security features: gloves, bench and first aid information	✔			
	Module rack trolley for modules replacement	✔			
CONNECTIONS	Station Access[4]	Input and output holes for underground cabling			
	High Voltage AC Wiring	MV Bridge between transformer and protection switchgear with plug-in terminals at one side and interior terminals in the other			
	DC Wiring	Customised DC fuse protected inputs and disconnectors			
	AC Auxiliary Services wiring	LV Bridge between the transformer and low voltage switchboard included			
		LV auxiliary services wiring (including those connected to the inverter) included			
MV SPECIFIC STANDARDS	Medium Voltage Safety	EN 62271 - 202, EN 62271 - 200			

NOTES

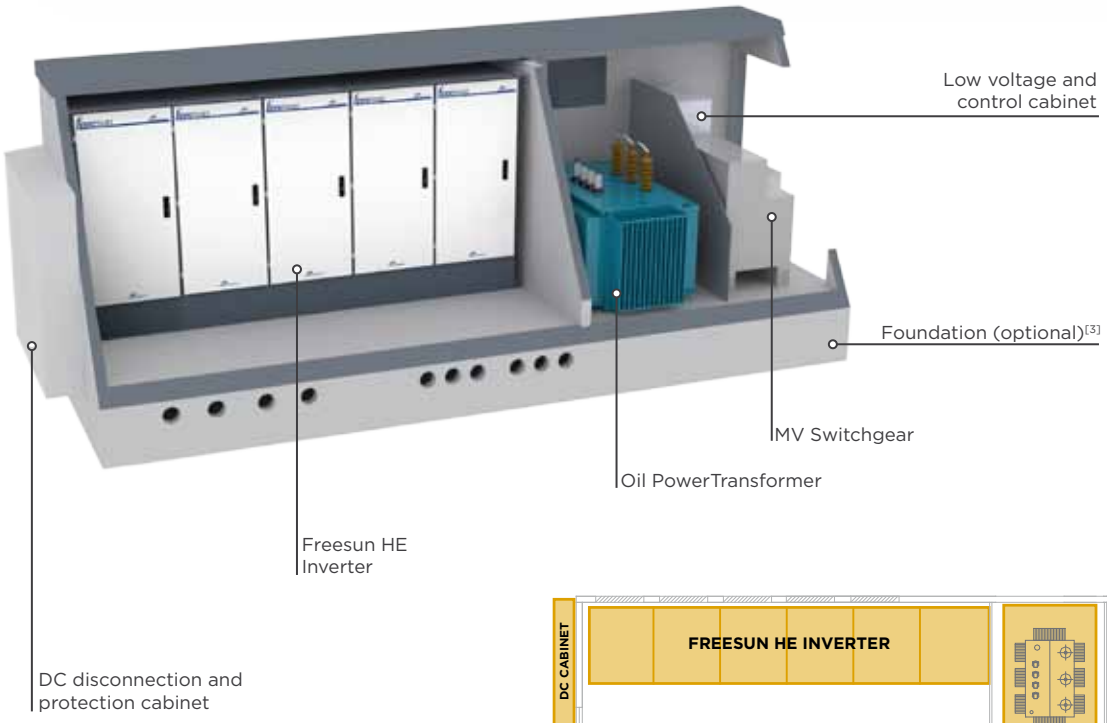
[1] Two line cells and one protection cell.
[2] Dimensions and weight will depend on the final system configuration, please consult Power Electronics.
[3] Reduced station frame 3 requires dedicated fundation for underground cabling and transformer oil collection.
[4] Other configuration, please consult Power Electronics.
[5] Sound pressure level at a distance of 1m from the rear part.
1t=1000kg

HES | Technical Characteristics

OPERATIONAL DIAGRAM



REDUCED STATION SECTION



NOTES

[1] It is also available for other Operating Grid Voltage (11kV, 15 kV, 22kV, 24kV, 30kV, 36kV)
[2] Other configurations, please consult Power Electronics. Some Freesun HES units may differ from the concept shown in the images.
[3] Reduced station require dedicated fundation for underground cabling and transformer oil collection.

HET
Solar Inverter

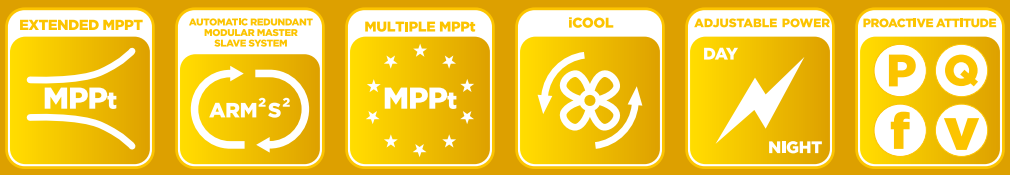
Freesun®
SOLAR INVERTER

Freesun HET is a turnkey solution designed for large solar photovoltaic plants under the most demanding environments. It includes a Freesun HE inverter and all the LV and MV electrical equipment ready for fast commissioning.

The unique features of the Freesun HE cooling system in combination with an isolated steel container, optional dust filters or back up air conditioning, make Freesun HET inverter the most suitable solution for worldwide projects under the most demanding operation conditions.

Freesun HET has no boundaries. A standard container eliminates maritime transport barriers and increase competitiveness and reliability to your projects all over the world.

Freesun HET has no boundaries. It eliminates maritime transport barriers and includes all the electrical equipment ready for fast comissioning



freesun
SOLAR INVERTER

HET | Technical Characteristics

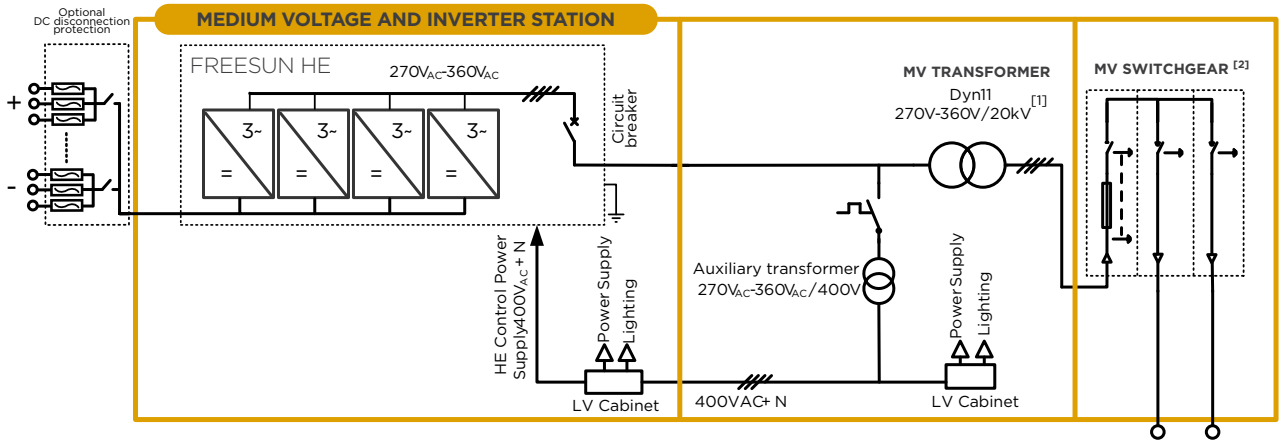
		FRAME 3 - FS	FRAME 2 TWIN - FS
MEDIUM VOLTAGE	Inverter Output Voltage	270Vac / 300Vac / 330Vac / 360Vac	
	Output Voltage [1]	10kV-36kV	
	Inverter	1 x HE Frame 3	2 x HE Frame 2 (TWIN)
	MV Transformer	800kVA - 1250kVA	1300kVA - 2000kVA
	Transformer vector Configuration	Dyn11	
	Transformer Type	Dry type - Optional Oil immersed	
	Frequency	50Hz / 60Hz	
	MV Transformer Efficiency	Standard or High Efficiency	
	MV Switchgear [1]	2L1P scheme, SF6 insulated switchgear	
STATION	Container	40' High Cube ISO Container	
	Container Dimensions [WxDxH] mm [2]	12192x2438x2896, 40 feet	
	Total Weight [2]	18t	
AUXILIARY SUPPLY	Auxiliary Inverter Power Supply	3 x 400V, 50 / 60Hz, (LVRT compatible inverters equipped with internal UPS)	
	Auxiliary transformer[3]	10kVA, Yyn0, 270Vac-360Vac / 400Vac	
	Auxiliary services Station	LV panel, Internal earth grid, Interior lighting, Floor plate and grilles for HE inverter, Wall and ceiling insulation, Mural type extractor fan with thermostat, Gloves, bench and first aid information, Module rack trolley for modules replacement	
	Optional Auxiliary services	Door with internal insulation, Door safety opening, Dustproof Filters,Air conditioning	
ENVIRON-MENTAL RATINGS	Protection Rating as per EN 60529	Outdoor IP54	
	Permissible Ambient Temperature	-20°C ...+50°C	
	Relative Humidity, non condensing	5% to 95% Non condensing	
	Max. Altitude (above sea level)	1000m	
	Power Altitude derating	>1000m, 1% Sn (kVA) per 100m	
	Noise Level [4]	< 79 dBA	
	UV Exposure	Yes	
	Painting coating	C3 (ISO 12944), C5 (Optional)	
	Heating resistors	Optional	
CABINET FEATURES	Station material	20/10 thick corrugated sheet with load bearing structure and Internal Insulation	
	Exterior walls colour	RAL 7047	
	Metal parts (grills and doors) and cover colour	RAL 7016	
	Internal earth grid	✔	
	Interior lighting	✔	
	Floor plate and grilles for HE Inverter	✔	
	Wall and ceiling insulation	✔	
	Door with internal insulation	Optional	
	Door safety opening	Optional	
	Mural type extractor fan with thermostat	✔	
	Dustproof Filters	Optional	
	Air conditioning	Optional	
	Security features:gloves, bench and first aid information	✔	
	Module rack trolley for modules replacement	✔	
CONNECTIONS	Station Access	Input and output holes for underground cabling	
	High Voltage AC Wiring	MV Bridge between transformer and protection switchgear with plug-in terminals at one side and interior terminals in the other	
	Low Voltage AC Wiring	Maximum cable section 8x240mm² M12 per phase 4x240mm² M12 neutral	
	DC Wiring	Customised DC fuse protected inputs and disconnectors	
	AC Auxiliary Services wiring	LV Bridge between the transformer and low voltage switchboard included	
		LV auxiliary services wiring (including those connected to the inverter) included	
SPECIFIC STANDARDS	Medium Voltage Safety	EN 62271 - 202, EN 62271 - 200	
	Transportation	CSC Safety approval	

NOTES

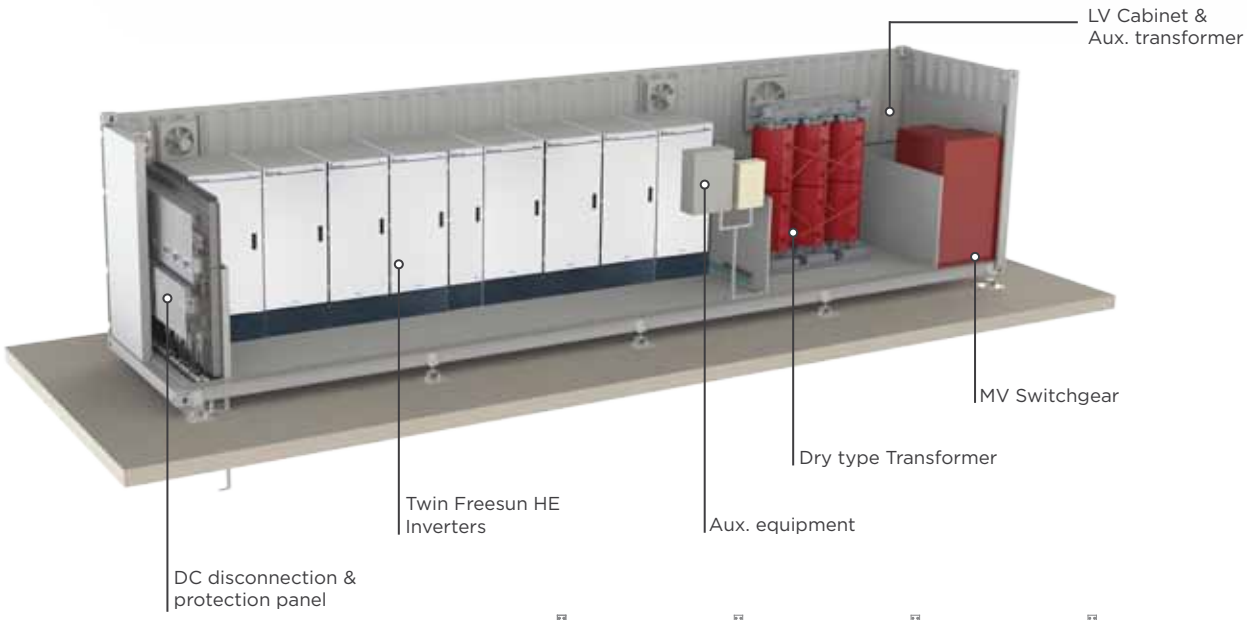
[1] Two line cells and one protection cell.
[2] Dimensions and weight will depend on the final system configuration, please consult Power Electronics.
[3] Other configuration, please consult Power Electronics.
[4] Sound pressure level at a distance of 1m from the rear part.
1t=1000kg

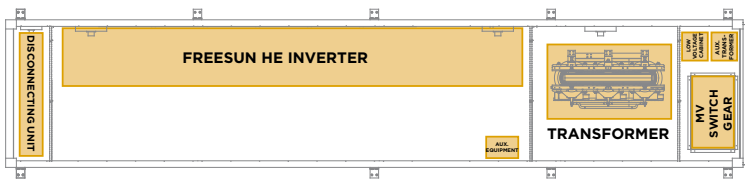
HET | Technical Characteristics

OPERATIONAL DIAGRAM



SECTION





NOTES [1] It is also available for other Operating Grid Voltage (15 kV, 22kV, 24kV, 30kV, 33kV)

Other configurations, please consult Power Electronics. Some Freesun HET units may differ from the concept shown in the images.

OUTDOOR UTILITY SCALE
Solar Inverters

HEC
Solar Inverter

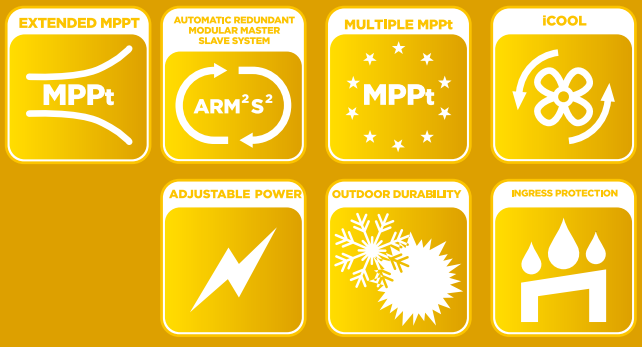
Freesun®
SOLAR INVERTER

Power Electronics' Freesun HEC and HEC+ 2nd generation of outdoor modular and redundant inverters are the most powerful and reliable air cooled Utility Scale PV Inverters in the market. 1000Vdc class upgraded inverters offer extended MPPt voltage range and maximum efficiency in three different AC output voltages 360Vac, 380Vac and 400Vac, covering all commercial and utility-scale PV facilities.

Freesun HEC and HEC+ are based on a modular & redundant topology with up to 10 modules ranging from 150kVA to 170kVA that provides the competiveness of central inverters and the availability of string inverters. The Freesun HEC and HEC+ are featured with an outdoor IP54 stainless steel enclosure, 50mm rockwool isolation panel and the most advance iCOOL filter-less system that makes it suitable for the most demanding conditions.

Freesun HEC can be equipped with customized internal (HEC+) or external DC disconnection and protection subsystem that makes it compatible with any PV plant configuration and the highest DC:AC ratios.

Freesun Gen II - The most powerful and reliable air cooled utility-scale PV inverter in the market



AUTOMATIC REDUNDANT MODULAR MASTER SLAVE SYSTEM

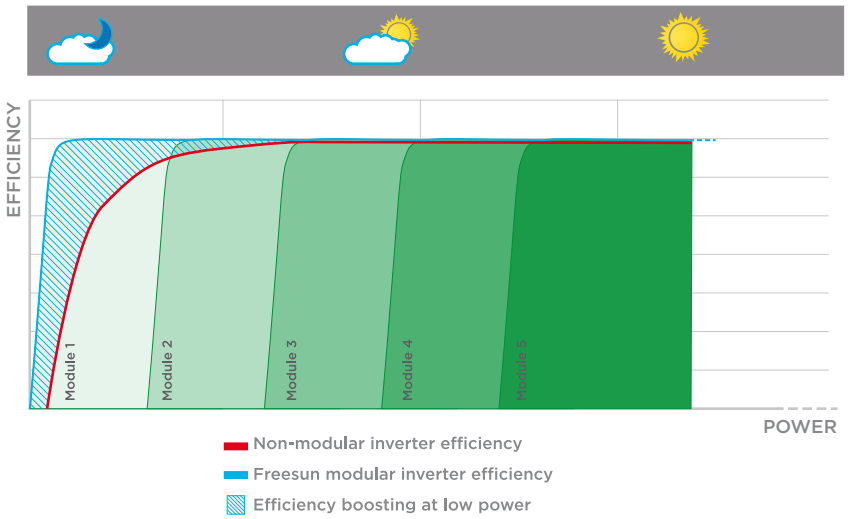
ARM²S²

Automatic Redundant Modular Master Slave System

Freesun HEC topology gets the competiveness of central inverters and the availability of string inverters. It is constructed with independent modules from 150 to 170kVA, each module includes its own control board, power stage and cooling system, being coupled by the DC and AC buses. In the end, an issue only affects to one of the units and never the entire system. At the same time, the power of the faulty module is sent to an adjoining operative module, so that it only reduces the injected power when the maximum rated power is reached. If not, you won't lose a kWh and you might probably never realize that a module is not operative.

All the units work in parallel together commanded by the master. This master is the main governor of the system and is responsible of the MPPt tracking, synchronization sequence, overall protection.... Freesun HEC is smartly designed to last. The automatic mode shifts every night the master role by comparing the register of energy production of every module. The one with less energy produced (kWh) will act as a master next early morning with the first sunbeams. This feature enables a homogeneous wear and tear of all the components in the modules, extends the product lifetime and MTBF ratio.

When addressing the selection of a solar inverter manufacturer, there are crucial points that should be considered first and inverter's efficiency is one of the most important. On low radiation conditions, a modular inverter operates at higher efficiency levels than a similarly sized central inverter. By shutting off unneeded power modules, modules load increases to get the maximum available efficiency. At the same time, a lower power rating of the inverter units allow to start feed-in earlier in the morning and to stop later in the afternoon. As a result, throughout the entire service life of the PV plant, HEC will generate higher yields than central or string inverters.



A MODULAR AND REDUNDANT INVERTER GENERATES HIGHER YIELDS

Rugged design

Freesun HEC inverters have been designed to last over 20 years of operation under harsh environments and extreme weather conditions. HEC units are ready and tested to withstand from the frozen Canadian landfills to the extreme African dessert conditions featuring:

• Totally sealed area protects electronics from dust and moisture.
• Conformal coating on electronic board shields PCBs from aggressive atmospheres.
• Temperature and humidity controlled active heating prevents from internal water condensation.
• Stainless Steel construction with 2mm thickness for maximum enclosure longevity
• Corrosion proved polymeric painting C3 according to ISO 9223 used in the most demanding environments
• 50mm rockwool panel isolates the cabinet from solar heat gains.
• Roof cover design dissipates solar radiation, reduces heat build-up and avoids water leakages. Additionally you will be able to protect your O&M team from rain or sun by installing our corrugated iron roof or retractable awning kit. The solid HEC structure avoids the need of additional external structures.
• Random units from a lot pass Factory Water Tightness Test ensuring product quality.

Polymeric painting *Rockwool panel* *Stainless Steel*

DC Disconnection & Protection

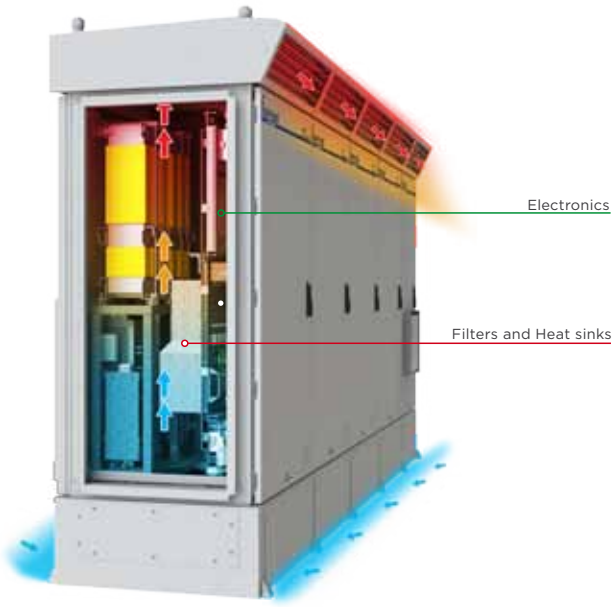
Freesun HEC is available with internal DC disconnection and protection subsystem (HEC+) or with an external DC disconnection and protection unit (DU unit) that will be coupled together with the inverter by a mounting kit. The DC subsystems are fully customizable and can be featured with up to 6 DC on-load disconnectors, 36 fuses and 24 independent monitoring channels.

The disconnecting unit goes one step further by improving the PV plant safety and operation for those who apply the best engineering.

iCool

In Power Electronics we don't believe in cost cutting when it affects the quality of the product and that's why we oversize sensitive components and improve the sophisticated iCOOL performance that allow HEC to work at 50°C with no power derating. Our know how in mining, water treatment plants, CSP facilities in the most demanding locations all over the world have given us the necessary experience to develop the perfect technical solution for our outdoor solar inverters.

Freesun HEC modules are divided into two main areas: clean area (electronics) and hot area (filters and heat sink). The electronics are totally sealed and use a temperature control low flow cooling system that reduces filters clogging and maintenance intervals. The hot area integrates independent and speed controlled fans per each module, reducing to the maximum the Stand-by consumption at low capacity and boosting the cooling capacity for PV installation situated at higher altitudes than 3000 meters above sea level.



MAXIMUM YIELD AND RELIABILITY

Using the latest modulation techniques, inspired by the most accurate and powerful motor control applications, has lead to the widest MPPt full power window in the solar market. Update your OND files as soon as possible to check how the most advanced control software and our unique topology boost your PV plant performance rates.

freesun
SOLAR INVERTER

HEC | Technical Characteristics 400VAC

		400VAC - MPPt Window 566V-900V							
		FRAME 1 - FS		FRAME 2 - FS		FRAME 3 - FS		FRAME 4 - FS	
NUMBER OF MODULES		3	4	5	6	7	8	9	10
REFERENCE		FS0450CH	FS0601CH	FS0751CH	FS0901CH	FS1050CH	FS1200CH	FS1350CH	FS1500CH
OUTPUT	AC Output Power(kVA) @ 50°C	450	600	750	900	1050	1200	1350	1500
	AC Output Power(kVA) @ 40°C	510	680	850	1020	1190	1360	1530	1700
	Rated AC Output Current (A) @40°C	736	981	1227	1472	1718	1963	2208	2454
	Operating Grid Voltage(VAC)	400Vac							
	Operating Range, Grid Frequency	50Hz/60Hz							
	Current Harmonic Distortion (THDi)	< 3% at any load condition							
	Power Factor (cosine phi)[1]	0.00 leading ... 0.00 lagging adjustable/ Reactive Power injection at night							
	Power Curtailment (kVA)	0...100%/0.1% Steps							
INPUT	MPPt Voltage Window (VDC)[2]	566V - 900V							
	MPPt window @full power (VDC)[3]	580V – 820V							
	Maximum DC and Starting voltage	1000V							
	Maximum DC current (A)	900	1200	1500	1800	2100	2400	2700	3000
EFFICIENCY & AUXILIARY SUPPLY	Max. Efficiency PAC, nom (η)	98.6%		98.6%		98.6%		98.6%	
	Euroeta (η)	98.2%		98.3%		98.4%		98.4%	
	Max. Standby Consumption (Pnight)	< approx. 40W/per module							
	Control Power Supply	10kVA Built-in Internal transformer as standard 220VAC–5kVA user power supply available							
	UPS backup system	Optional 400V- 700VAh Internal UPS-(LVRT compatible units are equipped as standard)							
	Avg. Power Consumption	1380W	1840W	2300W	2760W	3220W	3680W	4140W	4600W
CABINET	Dimensions [WxDxH] [4] [mm]	2900x1050x2400		3900x1050x2400		4900x1050x2400		5900x1050x2400	
	Weight (kg) [5]	2470	2780	3540	3850	4590	4900	5640	5950
	Air Flow	Intake through lower part blown out through upper side							
	Type of ventilation	Forced air cooling							
ENVIRON-MENT	Degree of protection	IP54							
	Permissible Ambient Temperature	-20°C to +50°C							
	Relative Humidity	4% to 100% Condensing							
	Max. Altitude (above sea level)	1000m; >1000m power derating 1% Sn (kVA) per 100m							
	Noise level[6]	< 70 dBA							
CONTROL INTERFACE	Interface	Alphanumeric Display / Optional Freesun App display or Web display							
	Communication	RS232 / RS485 / USB / Ethernet, (Modbus RTU Protocol, Modbus TCP/IP)							
	Analogue Inputs	1 programmable and differential inputs; (0-20mA or ± 10mV to ± 10V) and PT100							
	String Supervisor Communication	RS485 / Modbus RTU							
	Plant Controller Communication	Ethernet / Modbus TCP/IP							
	Digital Outputs	2 electrically-isolated programmable switched relays (250VAC, 8A or 30VDC, 8A)							
PROTECTIONS	Ground Fault Protection	Floating PV array: Isolation Monitoring per MPP Grounded PV array (Positive pole and negative pole): GFDI protection per MPP							
	Humidity control	Active Heating / Optional Heating Resistors							
	Emergency Stop	Optional							
	General AC Protection & Disconn.	Circuit Breaker / Optional AC switch and fuses							
	General DC Protection & Disconn.	Optional External Disconnecting Unit Cabinet (DC fuse protection and on-load disconnector with external operating handle)							
	Module AC Protection & Disconn.	AC circuit breaker & contactor							
	Module DC Protection & Disconn.	DC contactor & DC fuses							
	Overvoltage Protection	DC and AC Inverter sides (Type 4) and Auxiliary Supply type 2 - Internal Standard							
	Protection class	Class I							
	Lightning Protections	Optional (Integrated in the inverter)							

NOTES
[1] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$
[2] Values at 1.00•Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.
[3] Values at 1.00•Vac nom, cos Φ= 1, T_{AMB} = 40°C
[4] Units with integrated DU subsystem (HEC+) will increase 1000mm in width.
[5] Preliminary, consult Power Electronics.
[6] Sound pressure level at a distance of 1m from the rear part.

HEC | Technical Characteristics

380VAC

		380VAC - MPPt Window 538V-900V							
		FRAME 1 - FS		FRAME 2 - FS		FRAME 3 - FS		FRAME 4 - FS	
	NUMBER OF MODULES	3	4	5	6	7	8	9	10
	REFERENCE	FS0435CH	FS0580CH	FS0725CH	FS0870CH	FS1015CH	FS1160CH	FS1305CH	FS1450CH
OUTPUT	AC Output Power(kVA) @ 50°C	435	580	725	870	1015	1160	1305	1450
	AC Output Power(kVA) @ 40°C	480	640	800	960	1120	1280	1440	1600
	Rated AC Output Current (A) @40°C	729	972	1215	1459	1702	1945	2188	2431
	Operating Grid Voltage(VAC)	380Vac							
	Operating Range, Grid Frequency	50Hz/60Hz							
	Current Harmonic Distortion (THDi)	< 3% at any load condition							
	Power Factor (cosine phi)[1]	0.00 leading ... 0.00 lagging adjustable/ Reactive Power injection at night							
	Power Curtailment (kVA)	0...100%/0.1% Steps							
INPUT	MPPt Voltage Window (VDC)[2]	538V - 900V							
	MPPt window @full power (VDC)[3]	544V – 820V							
	Maximum DC and Starting voltage	1000V							
	Maximum DC current (A)	900	1200	1500	1800	2100	2400	2700	3000
EFFICIENCY & AUXILIARY SUPPLY	Max. Efficiency PAC, nom (η)	98.6%		98.6%		98.6%		98.6%	
	Euroeta (η)	98.2%		98.3%		98.4%		98.4%	
	Max. Standby Consumption (Pnight)	< approx. 40W/per module							
	Control Power Supply	10kVA Built-in Internal transformer as standard 220VAC-5kVA user power supply available							
	UPS backup system	Optional 400V- 700VAh Internal UPS-(LVRT compatible units are equipped as standard)							
	Avg. Power Consumption	1380W	1840W	2300W	2760W	3220W	3680W	4140W	4600W
CABINET	Dimensions [WxDxH] [4] [mm]	2900x1050x2400		3900x1050x2400		4900x1050x2400		5900x1050x2400	
	Weight (kg) [5]	2470	2780	3540	3850	4590	4900	5640	5950
	Air Flow	Intake through lower part blown out through upper side							
	Type of ventilation	Forced air cooling							
ENVIRON-MENT	Degree of protection	IP54							
	Permissible Ambient Temperature	-20°C to +50°C							
	Relative Humidity	4% to 100% Condensing							
	Max. Altitude (above sea level)	1000m; >1000m power derating 1% Sn (kVA) per 100m							
	Noise level[6]	< 70 dBA							
CONTROL INTERFACE	Interface	Alphanumeric Display / Optional Freesun App display or Web display							
	Communication	RS232 / RS485 / USB / Ethernet, (Modbus RTU Protocol, Modbus TCP/IP)							
	Analogue Inputs	1 programmable and differential inputs; (0-20mA or ± 10mV to ± 10V) and PT100							
	String Supervisor Communication	RS485 / Modbus RTU							
	Plant Controller Communication	Ethernet / Modbus TCP/IP							
	Digital Outputs	2 electrically-isolated programmable switched relays (250VAC, 8A or 30VDC, 8A)							
PROTECTIONS	Ground Fault Protection	Floating PV array: Isolation Monitoring per MPP Grounded PV array (Positive pole and negative pole): GFDI protection per MPP							
	Humidity control	Active Heating / Optional Heating Resistors							
	Emergency Stop	Optional							
	General AC Protection & Disconn.	Circuit Breaker / Optional AC switch and fuses							
	General DC Protection & Disconn.	Optional External Disconnecting Unit Cabinet (DC fuse protection and on-load disconnector with external operating handle)							
	Module AC Protection & Disconn.	AC circuit breaker & contactor							
	Module DC Protection & Disconn.	DC contactor & DC fuses							
	Overvoltage Protection	DC and AC Inverter sides (Type 4) and Auxiliary Supply type 2 - Internal Standard							
	Protection class	Class I							
	Lightning Protections	Optional (Integrated in the inverter)							

NOTES
[1] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$
[2] Values at 1.00•Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.
[3] Values at 1.00•Vac nom, cos Φ= 1, T_{AMB} = 40°C
[4] Units with integrated DU subsystem (HEC+) will increase 1000mm in width.
[5] Preliminary, consult Power Electronics.
[6] Sound pressure level at a distance of 1m from the rear part.

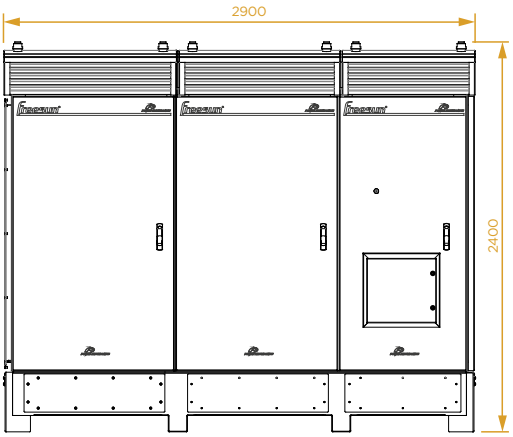
HEC | Technical Characteristics 360VAC

		360VAC - MPPt Window 510V-900V							
		FRAME 1 - FS		FRAME 2 - FS		FRAME 3 - FS		FRAME 4 - FS	
	NUMBER OF MODULES	3	4	5	6	7	8	9	10
	REFERENCE	FS0420CH	FS0560CH	FS0702CH	FS0840CH	FS0980CH	FS1120CH	FS1260CH	FS1400CH
OUTPUT	AC Output Power(kVA) @ 50°C	420	560	700	840	980	1120	1260	1400
	AC Output Power(kVA) @ 40°C	450	600	750	900	1050	1200	1350	1500
	Rated AC Output Current (A) @40°C	722	962	1203	1443	1684	1925	2165	2406
	Operating Grid Voltage(VAC)	360Vac							
	Operating Range, Grid Frequency	50Hz/60Hz							
	Current Harmonic Distortion (THDi)	< 3% at any load condition							
	Power Factor (cosine phi)[1]	0.00 leading ... 0.00 lagging adjustable/ Reactive Power injection at night							
	Power Curtailment (kVA)	0...100%/0.1% Steps							
INPUT	MPPt Voltage Window (VDC)[2]	510V - 900V							
	MPPt window @full power (VDC)[3]	510V – 820V							
	Maximum DC and Starting voltage	1000V							
	Maximum DC current (A)	900	1200	1500	1800	2100	2400	2700	3000
EFFICIENCY & AUXILIARY SUPPLY	Max. Efficiency PAC, nom (η)	98.6%		98.6%		98.6%		98.6%	
	Euroeta (η)	98.2%		98.3%		98.4%		98.4%	
	Max. Standby Consumption (Pnight)	< approx. 40W/per module							
	Control Power Supply	10kVA Built-in Internal transformer as standard 220VAC–5kVA user power supply available							
	UPS backup system	Optional 400V- 700VAh Internal UPS-(LVRT compatible units are equipped as standard)							
	Avg. Power Consumption	1380W	1840W	2300W	2760W	3220W	3680W	4140W	4600W
CABINET	Dimensions [WxDxH] [4] [mm]	2900x1050x2400		3900x1050x2400		4900x1050x2400		5900x1050x2400	
	Weight (kg) [5]	2470	2780	3540	3850	4590	4900	5640	5950
	Air Flow	Intake through lower part blown out through upper side							
	Type of ventilation	Forced air cooling							
ENVIRON-MENT	Degree of protection	IP54							
	Permissible Ambient Temperature	-20°C to +50°C							
	Relative Humidity	4% to 100% Condensing							
	Max. Altitude (above sea level)	1000m; >1000m power derating 1% Sn (kVA) per 100m							
	Noise level[6]	< 70dBA							
CONTROL INTERFACE	Interface	Alphanumeric Display / Optional Freesun App display or Web display							
	Communication	RS232 / RS485 / USB / Ethernet, (Modbus RTU Protocol, Modbus TCP/IP)							
	Analogue Inputs	1 programmable and differential inputs; (0-20mA or ± 10mV to ± 10V) and PT100							
	String Supervisor Communication	RS485 / Modbus RTU							
	Plant Controller Communication	Ethernet / Modbus TCP/IP							
	Digital Outputs	2 electrically-isolated programmable switched relays (250VAC, 8A or 30VDC, 8A)							
PROTECTIONS	Ground Fault Protection	Floating PV array: Isolation Monitoring per MPP Grounded PV array (Positive pole and negative pole): GFDI protection per MPP							
	Humidity control	Active Heating / Optional Heating Resistors							
	Emergency Stop	Optional							
	General AC Protection & Disconn.	Circuit Breaker / Optional AC switch and fuses							
	General DC Protection & Disconn.	Optional External Disconnecting Unit Cabinet (DC fuse protection and on-load disconnector with external operating handle)							
	Module AC Protection & Disconn.	AC circuit breaker & contactor							
	Module DC Protection & Disconn.	DC contactor & DC fuses							
	Overvoltage Protection	DC and AC Inverter sides (Type 4) and Auxiliary Supply type 2 - Internal Standard							
	Protection class	Class I							
	Lightning Protections	Optional (Integrated in the inverter)							

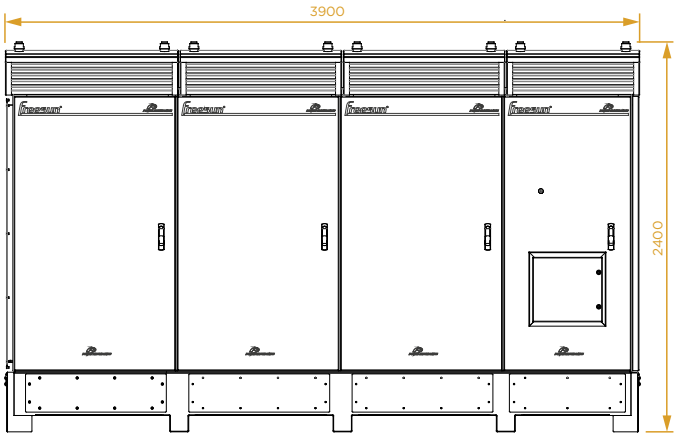
NOTES
[1] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$
[2] Values at 1.00•Vac nom and cos Φ= 1. Consult Power Electronics for derating curves.
[3] Values at 1.00•Vac nom, cos Φ= 1, T_{AMB} = 40°C
[4] Units with integrated DU subsystem (HEC+) will increase 1000mm in width.
[5] Preliminary, consult Power Electronics.
[6] Sound pressure level at a distance of 1m from the rear part.

HEC | Dimensions

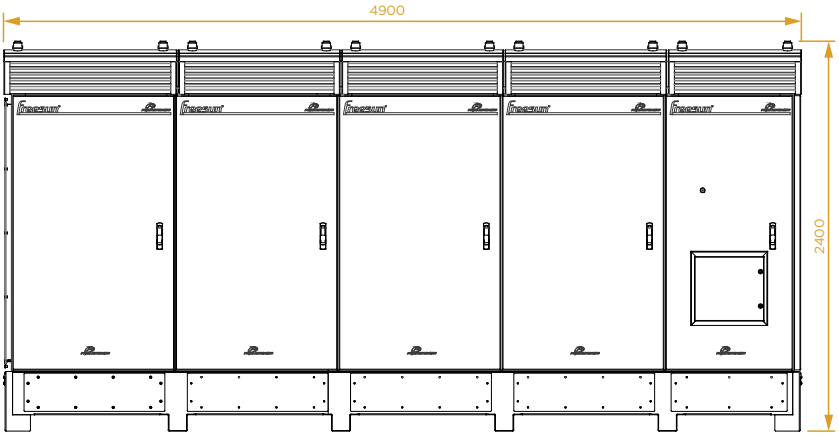
FRAME 1



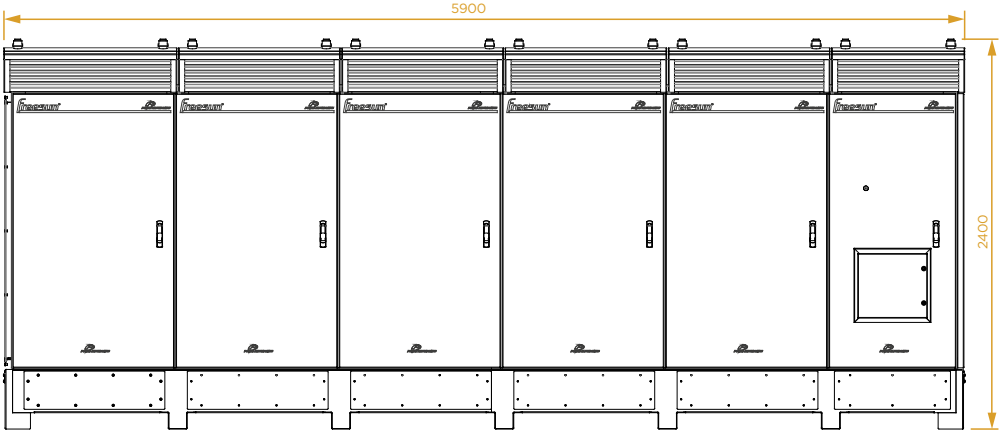
FRAME 2



FRAME 3

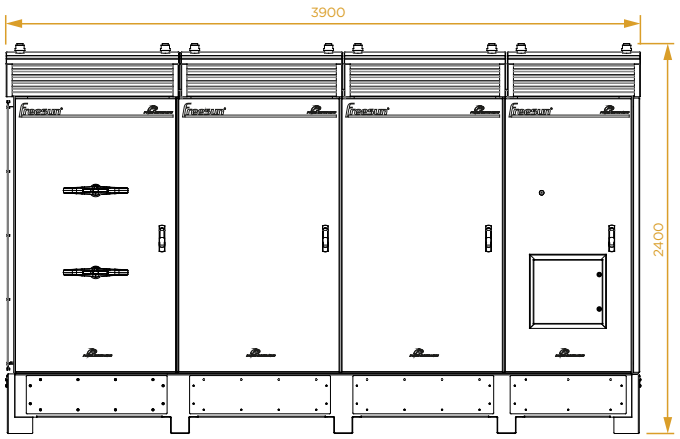


FRAME 4

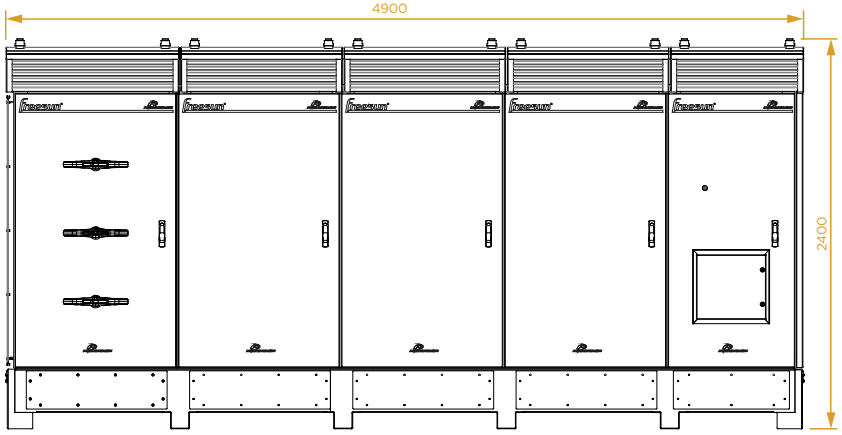


HEC+ | Dimensions

FRAME 1



FRAME 2



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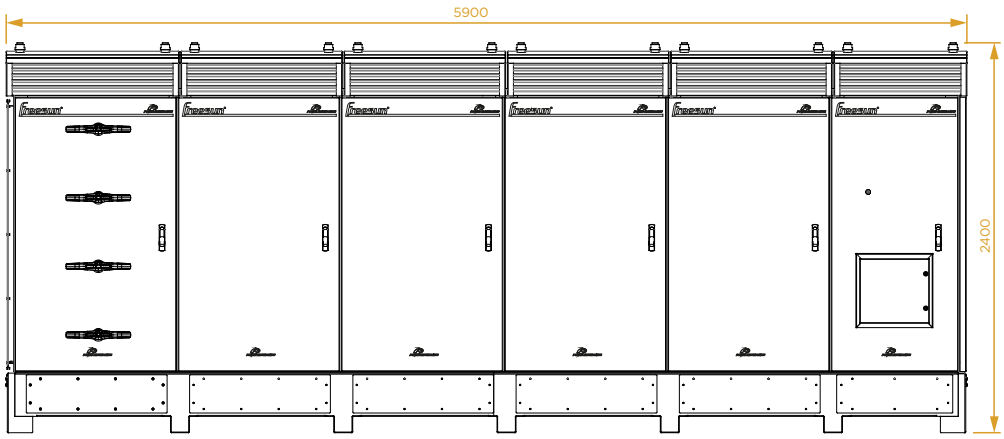
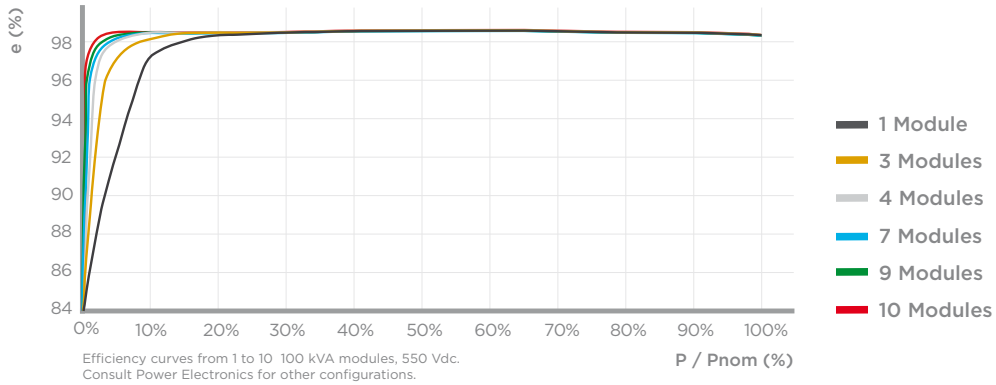


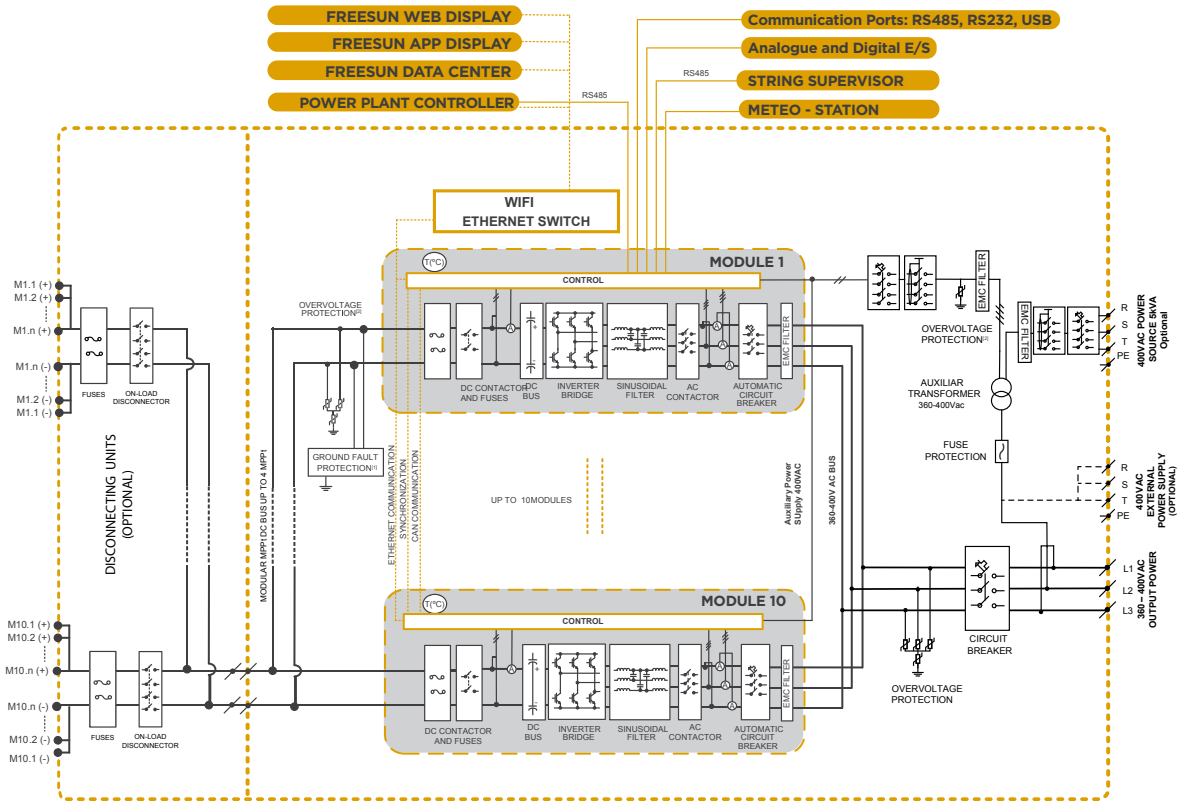
HEC | Efficiency curves Operational Diagram

EFFICIENCY CURVES



Efficiency curves from 1 to 10 100 kVA modules, 550 Vdc.
Consult Power Electronics for other configurations.

OPERATIONAL DIAGRAM



[1] In positive pole or negative pole earth connected installations, the protection must be disconnected.
[2] Optional AC and DC lightning protection.

MV COMPACT STATION

Solar Station

Freesun®
SOLAR INVERTER

The Freesun MV compact station is turnkey concrete compartment for large installation ready to connect up to two Freesun HEC inverters and the MV cables. It can house inside an oil-immersed step-up transformer and SFS6 gas insulated switchgear, nevertheless it can be customized to fit client's indoor special equipment. Reduce the LCOE by installing new cost-effective solutions that ensures the maximum yield and availability.

The Freesun MV compact station is your right choice to house indoor equipment

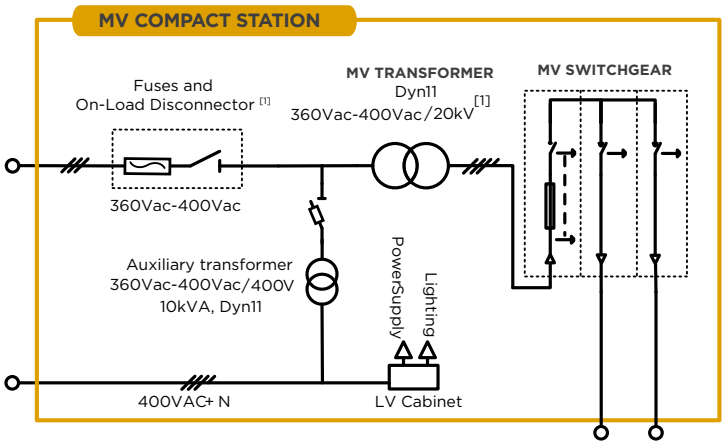
MV COMPACT STATION

Technical Characteristics

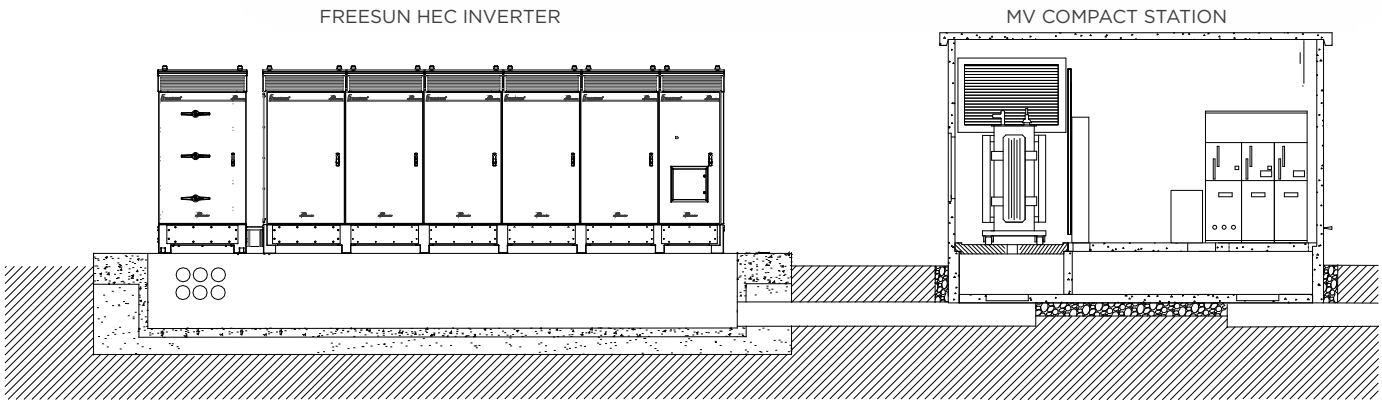
		MV COMPACT STATION
MEDIUM VOLTAGE	Input Voltage	360Vac / 380Vac / 400Vac
	Number of Inverters connected	Max. 2 Freesun units - Double or Triple winding transformer available[1]
	Output Voltage	10kV – 36kV
	MV Transformer	250kVA - 2000kVA
	Transformer vector Configuration	Dyn11 oil/dry (optional)
	Frequency	50Hz / 60Hz
	MV Transformer efficiency	Standard or High efficiency
	MV Switchgear	2L1P scheme, SF6 insulated switchgear
STATION DATA	Concrete Cabinet Dimensions [WxHxD] mm[2]	4600x3200x2530
	Total Weight[2]	15t
AUXILIARY SUPPLY	Auxiliary Station transformer [3]	360Vac-380Vac-400Vac / 400V, 50/60Hz
		10kVA – 30kVA, Yyn0
		Optional upstream fuse and downstream circuit breaker protection
	Auxiliary services Cabinet	General control panel with auxiliary breakers, prepared with four outputs: Lighting, power supply, inverter power supply and auxiliary MCB Optional UPS systems (Low Voltage Ride Through option)
ENVIRON-MENTAL RATINGS	Protection Rating as per EN 60529	Outdoor IP54
	Permissible Ambient Temperature	-20°C ...+50°C
	Relative Humidity, non-condensing	5% to 95% Non condensing
	Max. Altitude (above sea level) [3]	1000m
	Power Altitude derating	>1000m, 1% Sn (kVA) per 100m
	UV Exposure	Yes
	Heating Resistors	Optional
CABINET FEATURES	Cabinet material	Prefabricated Concrete
	Concrete (exterior walls) colour [3]	RAL 7047
	Metal parts (grills and doors) and cover colour [3]	RAL 7016
	Internal earth grid	✔
	Interior lighting	✔
	Mural type extractor fan with thermostat	✔
	Security features: gloves, bench and first aid information	✔
CONNECTIONS	Cabinet Access	Input and output holes for underground cabling
	High Voltage AC Wiring	MV Bridge between transformer and protection switchgear with plug-in terminals at one side and interior terminals in the other
	Low Voltage AC Wiring[3]	LV Bridge between the inverter and MV Compact Station not included Maximum cable section: 8x240mm² M12 per phase; 4x240mm² M12 neutral
	Auxiliary Power Supply [3]	LV auxiliary services wiring within the station included
		LV bridge between MV Compact station's auxiliary services cabinet and the Inverter not included
MV SPECIFIC STANDARDS	Medium Voltage Safety	EN 62271 – 202, EN 62271 – 200

NOTES
[1] Consult Power Electronics for additional information.
[2] Dimensions and weight will depend on the final system configuration, please consult Power Electronics.
[3] Other configuration available, please consult Power Electronics.

OPERATIONAL DIAGRAM



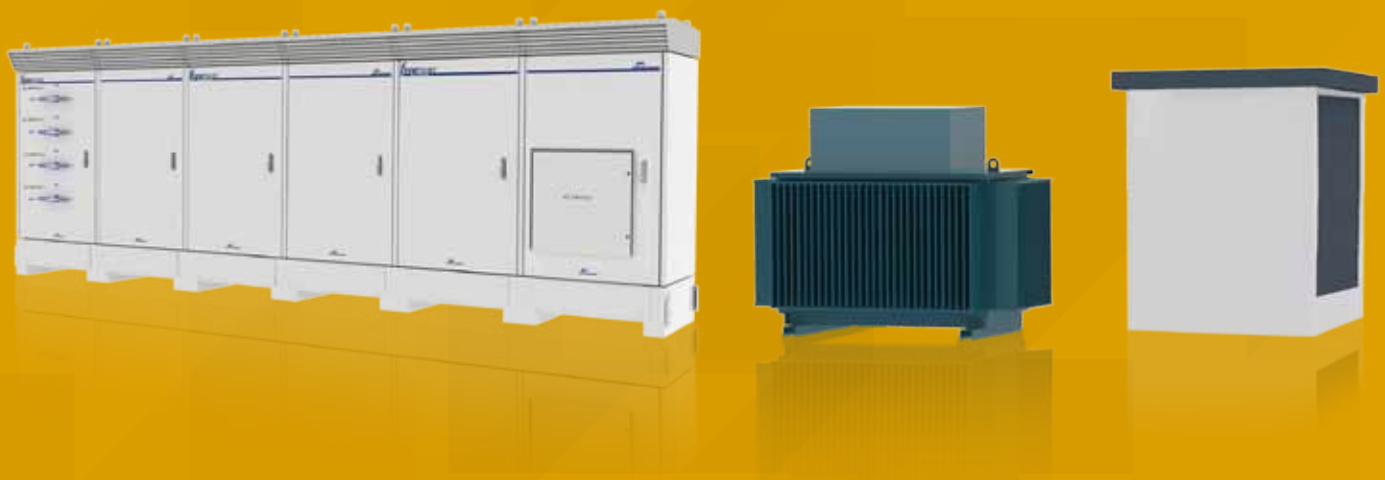
FULL SET SECTION



NOTES
[1] It is also available for other Operating Grid Voltage (11kV, 15 kV, 22kV, 24kV, 30kV, 36kV)
[2] Other configurations, please consult Power Electronics. Some MV Compact stations may differ from the concept shown in the images.

MV OUTDOOR SET

Solar Set



Freesun®
SOLAR INVERTER

The Freesun MV Outdoor kit is a cost effective solution for Freesun HEC, that comprises an outdoor MV step-up oil-immersed transformer and an indoor SF6 gas insulated MV switchgear fitted in an outdoor concrete cubicle. Three outdoor items offers the most competitive solution.

Freesun MV outdoor kit offer flexibility and competiveness to reduce your investment

freesun
SOLAR INVERTER

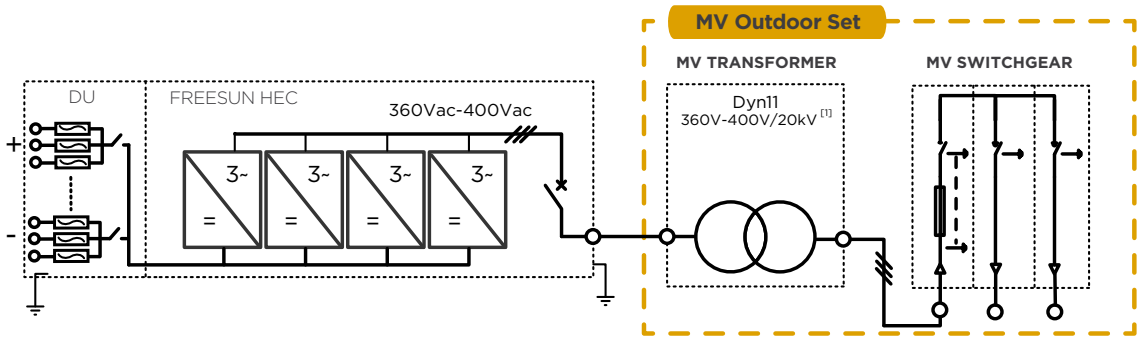
MV OUTDOOR SET

Technical Characteristics

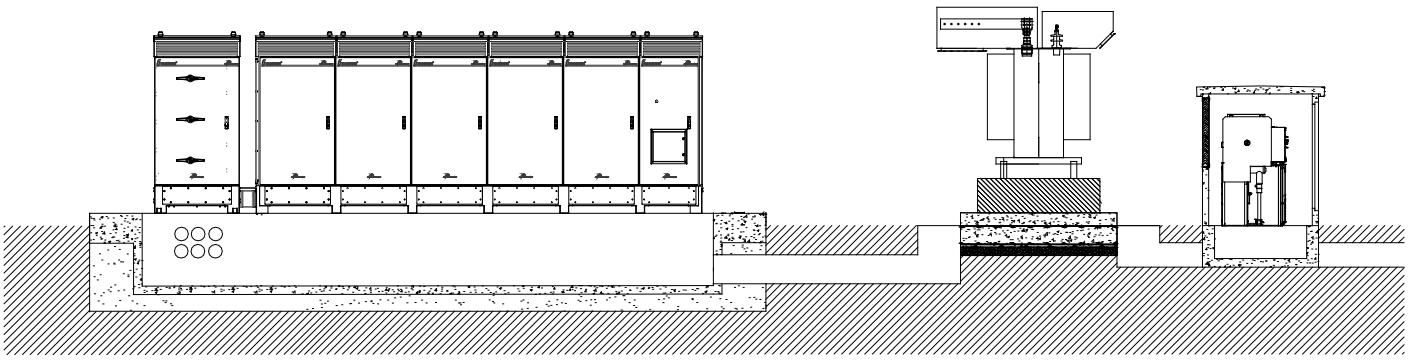
		MV OUTDOOR SET		
POWER TRANSFORMER	Input Voltage	360Vac / 380Vac / 400Vac		
	Output Voltage	10kV - 36kV		
	MV Transformer	250kVA -2000kVA		
	Transformer vector Configuration	Dyn11 biodegradable oil (optional)		
	Frequency	50Hz / 60Hz		
	MV Transformer efficiency	Standard or High efficiency		
	I/O connections water protection	✔		
	Transformer cabling	Customized connections busbar and cable glands		
MEDIUM VOLTAGE SWITCHBOARD	Configuration	2L1P	2L2P,	1L2P
	Max Power Transformers Connection	1	2	2
	Type	SF6 insulated switchgear		
	Insulation Level	28 / 75 kV; 38 / 95 kV; 50 / 125 kV; 70 / 170 kV		
	Rated Current	630 / 1250 A		
	Short time withstand current	16 kA / 3 s; 20 kA / 1 s		
	Cabinet Dimensions [WxHxD] mm	2290x2080x1340		
	Total Weight [1]	4.5t		
	Station material	Prefabricated Concrete		
	Concrete (exterior walls) colour[2]	RAL 7047		
	Security features: gloves, bench and first aid information	✔		
	Cabinet cabling	Input and output holes for underground cabling		
ENVIRON-MENTAL RATINGS	Protection Rating as per EN 60529	Outdoor IP54		
	Permissible Ambient Temperature	-20°C ...+50°C		
	Relative Humidity, non-condensing	4% to 95% Non condensing		
	Max. Altitude (above sea level) [2]	1000m		
	Power Altitude derating	>1000m, 1% Sn (kVA) per 100m		
	UV Exposure	Yes		
OTHER	LV and MV Cabling	Optional		
	LV AC overcurrent protection	Circuit breaker built-in in HEC		
MV SPECIFIC STANDARDS	Medium Voltage Safety	EN 62271 – 202, EN 62271 – 200		

NOTES [1] Weight will depend on the final system configuration, please consult Power Electronics.
[2] Other configuration available, please consult Power Electronics.

OPERATIONAL DIAGRAM



FULL SET SECTION



NOTES
[1] It is also available for other Operating Grid Voltage (11kV, 15 kV, 22kV, 24kV, 30kV, 36kV)
[2] Other configurations, please consult Power Electronics. Some MV Compact stations may differ from the concept shown in the images.

HEC-UL
Solar Inverter

C US

Freesun®
SOLAR INVERTER

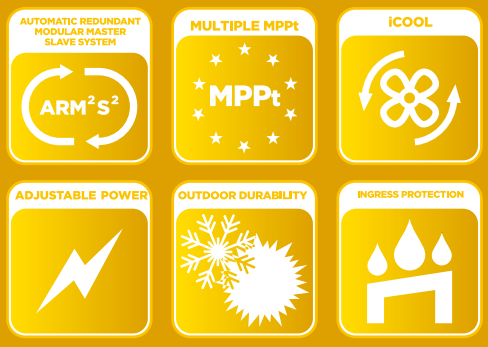
Freesun HEC–UL is the unique outdoor modular central inverter in North America's market. It integrates built-in as standard the unique ARM²S², iCOOL – filterless and Multi MPPt systems that maximize plant's availability and performance.

Freesun HEC–UL MW inverter has been designed for utility scale PV plants with the most demanding environments. The Disconnecting Unit makes HEC-UL to comply with UL1741, IEEE1547 and NEC2011 installation requirements.

It includes Freesun's proven dynamic grid support features such as Low and High Voltage Ridethrough and regulation (LVRT & OVRT, VRS), Frequency Ridethrough and regulation (FRT, FRS), Power factor and Reactive power injection control, Ramp Rate Control (RRC), that enhance grid quality and PV plant management.

Freesun HEC–UL is available in a turnkey MW platform Freesun HEK. Delivered with factory tested Inverter, MV Pad-mount transformer and auxiliary equipment that reduce installing and commissioning time and cost.

A modular and redundat system maximizes plant's availability and performance



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HEC-UL | Technical Characteristics 390VAC

			390VAC - MPPt range 585Vdc-820Vdc						
			FRAME 0 - FS	FRAME 1 - FS		FRAME 2 - FS		FRAME 3 - FS	
	NUMBER OF MODULES		2	3	4	5	6	7	8
	FREESUN MODEL NUMBER		FS0300CU	FS0450CU	FS0600CU	FS0751CU	FS0900CU	FS1050CU	FS1200CU
OUTPUT	Continuous AC Output Power (kVA) [1]		300	450	600	750	900	1050	1200
	Max. apparent Power (+10%) (kVA) [2]		330	495	660	825	990	1155	1320
	Continuous Output AC Current(A)		444	666	888	1110	1332	1554	1776
	Operating Grid Voltage(VAC)		390Vac						
	Operating Range, Grid Frequency		60Hz						
	Voltage Ripple, PV Voltage		< 3%						
	Current Harmonic Distortion (THDi)		< 3% at nominal power						
	Power Factor (cos phi)/@max. power		0.0 leading...0.0 lagging / 0.90 leading ... 0.90 lagging (adjustable)						
	Power Curtailment (kVA)		0...110%/0.1% Steps						
INPUT	MPPt Range (VDC)[3]		585V-820V						
	Max. permissible DC voltage		1000V						
	Max. continuous DC current (A)		500A	750A	1000A	1250A	1500A	1750A	2000A
	Max. short circuit DC current (A)		650A	975A	1300A	1625A	1950A	2275A	2600A
EFFICIENCY & AUX. SUPPLY	Max. Efficiency PAC, nom (η)		98.6%	98.6%		98.6%		98.6%	
	Weighted CEC Efficiency (η)		98.0%	98.0%		98.0%		98.0%	
	Max. Standby Consumption (Pnight)		< approx. 40W/per module						
	Control Power Supply		Built-in Internal transformer as standard (Optional external 3x208VAC power supply and UPS backup system)						
	Avg. Power Consumption		920W	1380W	1840W	2300W	2760W	3220W	3680W
CABINET	Dimensions [WxDxH] mm	mm[4]	1900x1020x2400	2900x1020x2400		3900x1020x2400		4900x1020x2400	
		inches[4]	74.8 x 40.2 x 94.5	114.2x 40.2 x 94.5		153.5 x 40.2 x 94.5		192.9 x 40.2 x 94.5	
	Weight[5]	kg	1720	2780		3850		4900	
		lbs	3800	6130		8500		10800	
	Air Flow		Intake through lower part blown out through upper side						
	Type of ventilation		Forced						
ENVIRON-MENT	Degree of protection		NEMA 3R						
	Permissible Ambient Temperature[6]		-4° F to +122° F / -20°C ...+50°C						
	Relative Humidity		4% to 100%						
	Max. Altitude (above sea level)[6]		1000m; >1000m power derating 1% Sn (kVA) per 100m						
	Noise level[7]		< 70 dBA						
CONTROL INTERFACE	Interface		Alphanumeric display						
	Communication		RS232 / RS485 / USB / Ethernet, (Modbus RTU Protocol, Modbus TCP/IP)						
	Analogue Inputs		1 programmable and differential inputs; (0-20mA or ± 10mV to ± 10V) and PT100						
	Digital Outputs		2 electrically-isolated programmable switched relays (250VAC, 8A or 30 VDC, 8A)						
PROTECTIONS	Ground Fault Protection		Floating PV array: Isolation Monitoring per MPP Grounded PV array (Positive pole and negative pole): GFDI protection per MPP						
	Heating Resistors		Standard						
	Emergency Stop		Optional						
	General AC Circuit Breaker		Standard; External Operation						
	AC contactor		Standard in each module						
	AC Circuit Breaker		Standard in each module						
	DC Contactor		Standard in each module						
	DC Fuses		Standard in each module						
	General DC protection		Optional Disconnecting Unit Cabinet (DC fuse protection and on-load disconnector with external operating handle)						
	Overvoltage Protection		DC and AC Inverter sides (Type 4) and Auxiliary Supply type 2- Internal Standard						
	Lightning Protections		Optional (Integrated in the inverter)						

NOTES [[1] Values at 50°C.
[2] Maximum ambient temperature 40°C.
[3] Values at 1.00·Vac nom and cos Φ = 1.
[4] Units with integrated DU subsystem (HEC+) will increase 1000mm in width.
[5] Preliminary. Consult Power Electronics.
[6] Other characteristics consult with Power Electronics.
[7] Sound pressure level at a distance of 1m from the rear part.

HEC-UL | Technical Characteristics 360VAC

			360VAC - MPPt range 540Vdc-820Vdc						
			FRAME 0 - FS	FRAME 1 - FS		FRAME 2 - FS		FRAME 3 - FS	
	NUMBER OF MODULES		2	3	4	5	6	7	8
	FREESUN MODEL NUMBER		FS0280CU	FS0420CU	FS0560CU	FS0701CU	FS0830CU	FS0970CU	FS1110CU
OUTPUT	Continuous AC Output Power (kVA)[1]		280	420	560	700	830	970	1110
	Max. apparent Power (+10%) (kVA)[2]		310	460	610	760	920	1070	1220
	Continuous Output AC Current(A)		444	667	889	1111	1333	1555	1778
	Operating Grid Voltage(VAC)		360Vac						
	Operating Range, Grid Frequency		60Hz						
	Voltage Ripple, PV Voltage		< 3%						
	Current Harmonic Distortion (THDi)		< 3% at nominal power						
	Power Factor (cos phi)/@max. power		0.0 leading...0.0 lagging / 0.90 leading ... 0.90 lagging (adjustable)						
	Power Curtailment (kVA)		0...110%/0.1% Steps						
INPUT	MPPt Range (VDC)[3]		540V-820V						
	Max. permissible DC voltage		1000V						
	Max. continuous DC current (A)		500A	750A	1000A	1250A	1500A	1750A	2000A
	Max. short circuit DC current (A)		650A	975A	1300A	1625A	1950A	2275A	2600A
EFFICIENCY & AUX. SUPPLY	Max. Efficiency PAC, nom (η)		98.6%	98.6%		98.6%		98.6%	
	Weighted CEC Efficiency (η)		98.0%	98.0%		98.0%		98.0%	
	Max. Standby Consumption (Pnight)		< approx. 40W/per module						
	Control Power Supply		Built-in Internal transformer as standard (Optional external 3x208VAC power supply and UPS backup system)						
	Avg. Power Consumption		920W	1380W	1840W	2300W	2760W	3220W	3680W
CABINET	Dimensions [WxDxH] mm	mm[4]	1900x1020x2400	2900x1020x2400		3900x1020x2400		4900x1020x2400	
		inches[4]	74.8 x 40.2 x 94.5	114.2x 40.2 x 94.5		153.5 x 40.2 x 94.5		192.9 x 40.2 x 94.5	
	Weight[5]	kg	1720	2780		3850		4900	
		lbs	3800	6130		8500		10800	
	Air Flow		Intake through lower part blown out through upper side						
	Type of ventilation		Forced						
ENVIRON-MENT	Degree of protection		NEMA 3R						
	Permissible Ambient Temperature[6]		-4° F to +122° F /-20°C ...+50°C						
	Relative Humidity		4% to 100%						
	Max. Altitude (above sea level)[6]		1000m; >1000m power derating 1% Sn (kVA) per 100m						
	Noise level[7]		< 70 dBA						
CONTROL INTERFACE	Interface		Alphanumeric display						
	Communication		RS232 / RS485 / USB / Ethernet, (Modbus RTU Protocol, Modbus TCP/IP)						
	Analogue Inputs		1 programmable and differential inputs; (0-20mA or ± 10mV to ± 10V) and PT100						
	Digital Outputs		2 electrically-isolated programmable switched relays (250VAC, 8A or 30 VDC, 8A)						
PROTECTIONS	Ground Fault Protection		Floating PV array: Isolation Monitoring per MPP Grounded PV array (Positive pole and negative pole): GFDI protection per MPP						
	Heating Resistors		Standard						
	Emergency Stop		Optional						
	General AC Circuit Breaker		Standard; External Operation						
	AC contactor		Standard in each module						
	AC Circuit Breaker		Standard in each module						
	DC Contactor		Standard in each module						
	DC Fuses		Standard in each module						
	General DC protection		Optional Disconnecting Unit Cabinet (DC fuse protection and on-load disconnector with external operating handle)						
	Overvoltage Protection		DC and AC Inverter sides (Type 4) and Auxiliary Supply type 2- Internal Standard						
	Lightning Protections		Optional (Integrated in the inverter)						

NOTES [[1] Values at 50°C.
[2] Maximum ambient temperature 40°C.
[3] Values at 1.00·Vac nom and cos Φ = 1.
[4] Units with integrated DU subsystem (HEC+) will increase 1000mm in width.
[5] Preliminary. Consult Power Electronics.
[6] Other characteristics consult with Power Electronics.
[7] Sound pressure level at a distance of 1m from the rear part.

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HEC-UL | Technical Characteristics 330VAC

			330VAC - MPPt range 500Vdc-820Vdc						
			FRAME 0 - FS	FRAME 1 - FS		FRAME 2 - FS		FRAME 3 - FS	
	NUMBER OF MODULES		2	3	4	5	6	7	8
	FREESUN MODEL NUMBER		FS0250CU	FS0380CU	FS0501CU	FS0630CU	FS0750CU	FS0880CU	FS1001CU
OUTPUT	Continuous AC Output Power (kVA) [1]		250	380	500	630	750	880	1000
	Max. apparent Power (+10%) (kVA)[2]		280	410	550	690	830	960	1100
	Continuous Output AC Current(A)		438	656	875	1094	1313	1532	1750
	Operating Grid Voltage(VAC)		330Vac						
	Operating Range, Grid Frequency		60Hz						
	Voltage Ripple, PV Voltage		< 3%						
	Current Harmonic Distortion (THDi)		< 3% at nominal power						
	Power Factor (cos phi)/@max. power		0.0 leading...0.0 lagging / 0.90 leading ... 0.90 lagging (adjustable)						
	Power Curtailment (kVA)		0...110%/0.1% Steps						
INPUT	MPPt Range (VDC)[3]		500V-820V						
	Max. permissible DC voltage		1000V						
	Max. continuous DC current (A)		500A	750A	1000A	1250A	1500A	1750A	2000A
	Max. short circuit DC current (A)		650A	975A	1300A	1625A	1950A	2275A	2600A
EFFICIENCY & AUX. SUPPLY	Max. Efficiency PAC, nom (η)		98.6%	98.6%		98.6%		98.6%	
	Weighted CEC Efficiency (η)		98.0%	98.0%		98.0%		98.0%	
	Max. Standby Consumption (Pnight)		< approx. 40W/per module						
	Control Power Supply		Built-in Internal transformer as standard (Optional external 3x208VAC power supply and UPS backup system)						
	Avg. Power Consumption		920W	1380W	1840W	2300W	2760W	3220W	3680W
CABINET	Dimensions [WxDxH] mm	mm[4]	1900x1020x2400	2900x1020x2400		3900x1020x2400		4900x1020x2400	
		inches	74.8 x 40.2 x 94.5	114.2x 40.2 x 94.5		153.5 x 40.2 x 94.5		192.9 x 40.2 x 94.5	
	Weight[5]	kg	1720	2780		3850		4900	
		lbs	3800	6130		8500		10800	
	Air Flow		Intake through lower part blown out through upper side						
	Type of ventilation		Forced						
ENVIRON-MENT	Degree of protection		NEMA 3R						
	Permissible Ambient Temperature[6]		-4° F to +122° F / -20°C ...+50°C						
	Relative Humidity		4% to 100%						
	Max. Altitude (above sea level)[6]		1000m; >1000m power derating 1% Sn (kVA) per 100m						
	Noise level[7]		< 70 dBA						
CONTROL INTERFACE	Interface		Alphanumeric display						
	Communication		RS232 / RS485 / USB / Ethernet, (Modbus RTU Protocol, Modbus TCP/IP)						
	Analogue Inputs		1 programmable and differential inputs; (0-20mA or ± 10mV to ± 10V) and PT100						
	Digital Outputs		2 electrically-isolated programmable switched relays (250VAC, 8A or 30 VDC, 8A)						
PROTECTIONS	Ground Fault Protection		Floating PV array: Isolation Monitoring per MPP Grounded PV array (Positive pole and negative pole): GFDI protection per MPP						
	Heating Resistors		Standard						
	Emergency Stop		Optional						
	General AC Circuit Breaker		Standard; External Operation						
	AC contactor		Standard in each module						
	AC Circuit Breaker		Standard in each module						
	DC Contactor		Standard in each module						
	DC Fuses		Standard in each module						
	General DC protection		Optional Disconnecting Unit Cabinet (DC fuse protection and on-load disconnector with external operating handle)						
	Overvoltage Protection		DC and AC Inverter sides (Type 4) and Auxiliary Supply type 2- Internal Standard						
	Lightning Protections		Optional (Integrated in the inverter)						

NOTES
[[1] Values at 50°C.
[2] Maximum ambient temperature 40°C.
[3] Values at 1.00·Vac nom and cos Φ = 1.
[4] Units with integrated DU subsystem (HEC+) will increase 1000mm in width.
[5] Preliminary. Consult Power Electronics.
[6] Other characteristics consult with Power Electronics.
[7] Sound pressure level at a distance of 1m from the rear part.

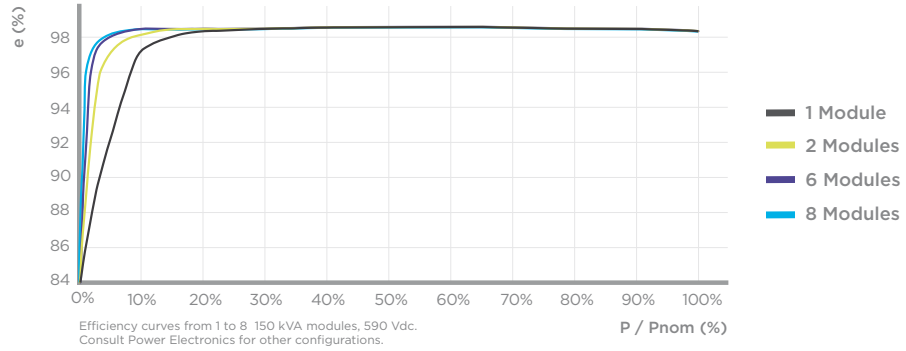
HEC-UL | Technical Characteristics 208VAC

			208VAC - MPPt range 330Vdc-600Vdc						
			FRAME 0 - FS	FRAME 1 - FS		FRAME 2 - FS		FRAME 3 - FS	
	NUMBER OF MODULES		2	3	4	5	6	7	8
	FREESUN MODEL NUMBER		FS0160CU	FS0240CU	FS0320CU	FS0400CU	FS0480CU	FS0560CU	FS0640CU
OUTPUT	Continuous AC Output Power (kVA)[1]		160	240	320	400	480	560	640
	Max. apparent Power (+10%) (kVA)[2]		176	264	352	440	528	616	704
	Continuous Output AC Current(A)		444	666	888	1110	1332	1554	1776
	Operating Grid Voltage(VAC)		208Vac						
	Operating Range, Grid Frequency		60Hz						
	Voltage Ripple, PV Voltage		< 3%						
	Current Harmonic Distortion (THDi)		< 3% at nominal power						
	Power Factor (cos phi)/@max. power		0.0 leading...0.0 lagging / 0.90 leading ... 0.90 lagging (adjustable)						
	Power Curtailment (kVA)		0...110%/0.1% Steps						
INPUT	MPPt Range (VDC)[3]		330V-600V						
	Max. permissible DC voltage		600V						
	Max. continuous DC current (A)		500A	750A	1000A	1250A	1500A	1750A	2000A
	Max. short circuit DC current (A)		650A	975A	1300A	1625A	1950A	2275A	2600A
EFFICIENCY & AUX. SUPPLY	Max. Efficiency PAC, nom (η)		98.6%	98.6%		98.6%		98.6%	
	Weighted CEC Efficiency (η)		98.0%	98.0%		98.0%		98.0%	
	Max. Standby Consumption (Pnight)		< approx. 40W/per module						
	Control Power Supply		Built-in Internal transformer as standard (Optional external 3x208VAC power supply and UPS backup system)						
	Avg. Power Consumption		920W	1380W	1840W	2300W	2760W	3220W	3680W
CABINET	Dimensions [WxDxH] mm	mm[4]	1900x1020x2400	2900x1020x2400		3900x1020x2400		4900x1020x2400	
		inches	74.8 x 40.2 x 94.5	114.2x 40.2 x 94.5		153.5 x 40.2 x 94.5		192.9 x 40.2 x 94.5	
	Weight[5]	kg	1720	2780		3850		4900	
		lbs	3800	6130		8500		10800	
	Air Flow		Intake through lower part blown out through upper side						
	Type of ventilation		Forced						
ENVIRON-MENT	Degree of protection		NEMA 3R						
	Permissible Ambient Temperature[6]		-4° F to +122° F /-20°C ...+50°C						
	Relative Humidity		4% to 100%						
	Max. Altitude (above sea level)[6]		1000m; >1000m power derating 1% Sn (kVA) per 100m						
	Noise level[7]		< 70 dBA						
CONTROL INTERFACE	Interface		Alphanumeric display						
	Communication		RS232 / RS485 / USB / Ethernet, (Modbus RTU Protocol, Modbus TCP/IP)						
	Analogue Inputs		1 programmable and differential inputs; (0-20mA or ± 10mV to ± 10V) and PT100						
	Digital Outputs		2 electrically-isolated programmable switched relays (250VAC, 8A or 30 VDC, 8A)						
PROTECTIONS	Ground Fault Protection		Floating PV array: Isolation Monitoring per MPP Grounded PV array (Positive pole and negative pole): GFDI protection per MPP						
	Heating Resistors		Standard						
	Emergency Stop		Optional						
	General AC Circuit Breaker		Standard; External Operation						
	AC contactor		Standard in each module						
	AC Circuit Breaker		Standard in each module						
	DC Contactor		Standard in each module						
	DC Fuses		Standard in each module						
	General DC protection		Optional Disconnecting Unit Cabinet (DC fuse protection and on-load disconnector with external operating handle)						
	Overvoltage Protection		DC and AC Inverter sides (Type 4) and Auxiliary Supply type 2- Internal Standard						
	Lightning Protections		Optional (Integrated in the inverter)						

NOTES
[[1] Values at 50°C.
[2] Maximum ambient temperature 40°C.
[3] Values at 1.00·Vac nom and cos Φ = 1.
[4] Units with integrated DU subsystem (HEC+) will increase 1000mm in width.
[5] Preliminary. Consult Power Electronics.
[6] Other characteristics consult with Power Electronics.
[7] Sound pressure level at a distance of 1m from the rear part.

HEC-UL | Efficiency Curves Operational Diagram

EFFICIENCY CURVES



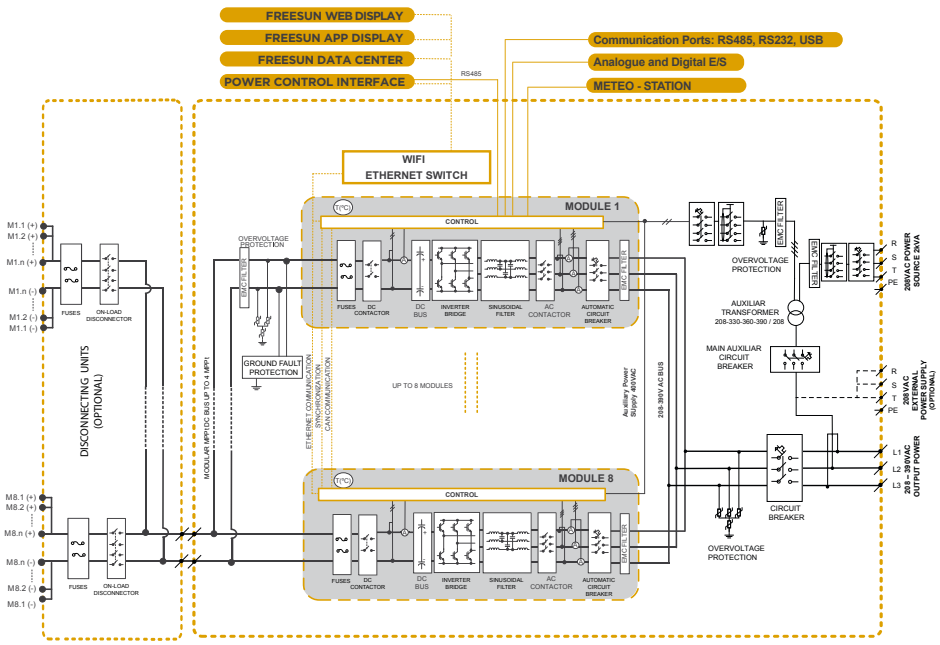
Efficiency curves from 1 to 8 150 kVA modules, 590 Vdc.
Consult Power Electronics for other configurations.

CONFIGURABLE RATINGS

	MPPt RANGE (VDC) [2]				
# MODULES	**330V-600V**	**500V-820V**	**540V-820V**	**585V-820V**	
2	160kVA	250kVA	280kVA	300kVA	Nominal AC Output Power (kVA)[1]
3	240kVA	380kVA	420kVA	450kVA	
4	320kVA	500kVA	560kVA	600kVA	
5	400kVA	630kVA	700kVA	750kVA	
6	480kVA	750kVA	830kVA	900kVA	
7	560kVA	880kVA	970kVA	1050kVA	
8	640kVA	1000kVA	1110kVA	1200kVA	
AC Output Voltage	**208VAC**	**330VAC**	**360Vac**	**390Vac**	

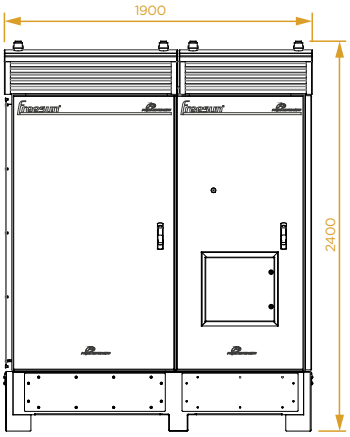
[1] Values at 50°C, 60Hz [2] Values at 1.00·Vac nom and cos Φ= 1.

OPERATIONAL DIAGRAM

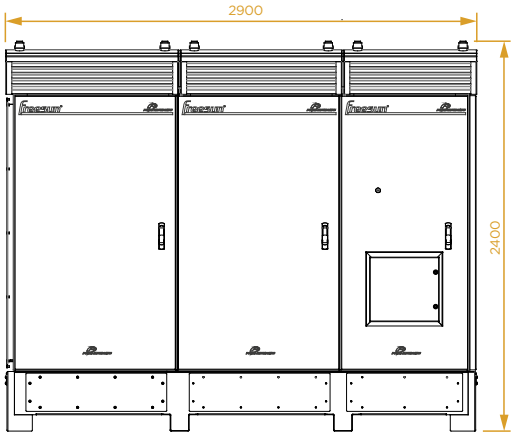


HEC-UL | Dimensions

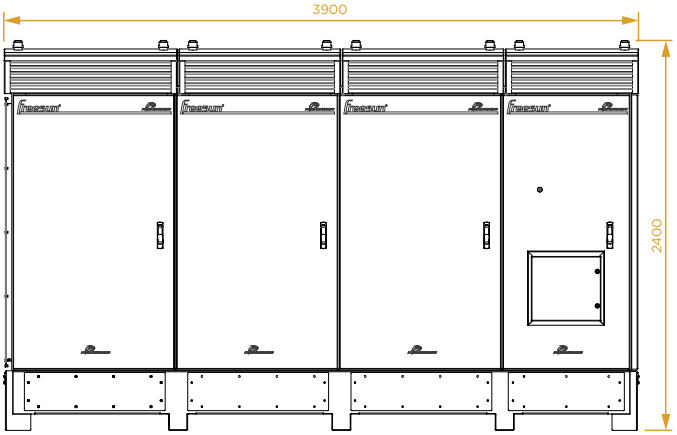
FRAME 0



FRAME 1

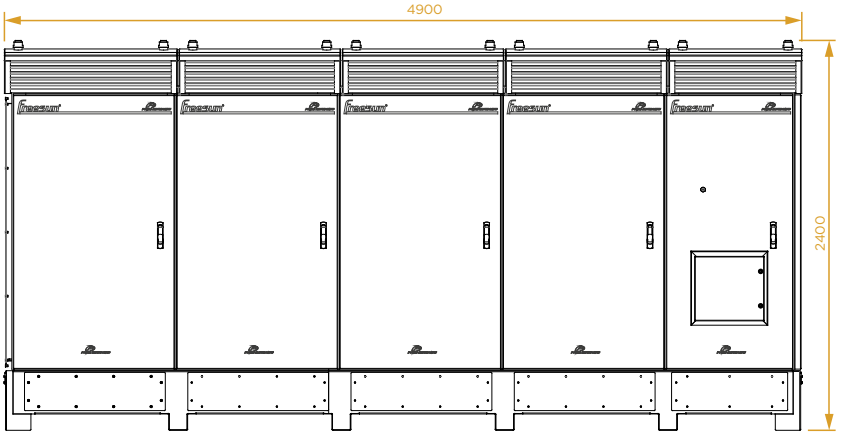


FRAME 2



	HEC	HEC+
FRAME 0	1900x1020x2400	2900x1020x2400
FRAME 1	2900x1020x2400	3900x1020x2400
FRAME 2	3900x1020x2400	4900x1020x2400
FRAME 3	4900x1020x2400	5900x1020x2400

FRAME 3



HEK
Solar Inverter

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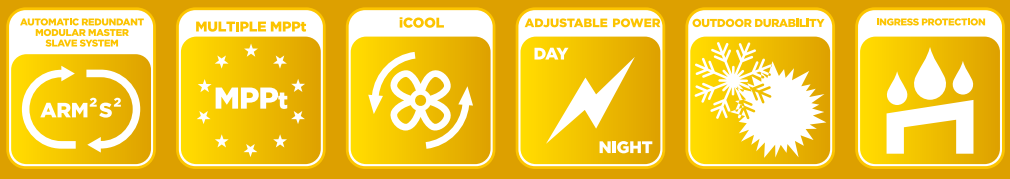
FREESUN HEK Open Skid Platforms are fully outdoor solutions tailored for large utility scale PV plants, complete with factory integrated DC disconnection and protection, Freesun HEC solar inverters, step-up pad-mount transformer and auxiliary equipment. The MW Skid blocks will reduce the project complexity and costs by improving the road transportation, installation, commissioning and maintenance.

Freesun HEC-UL inverters are equipped with the latest industrial developments which offer the maximum yield and proven reliability for your utility scale projects.

Freesun HEK open skid platform offers the maximum yield and reliability, being ready to connect up to 2.5MW



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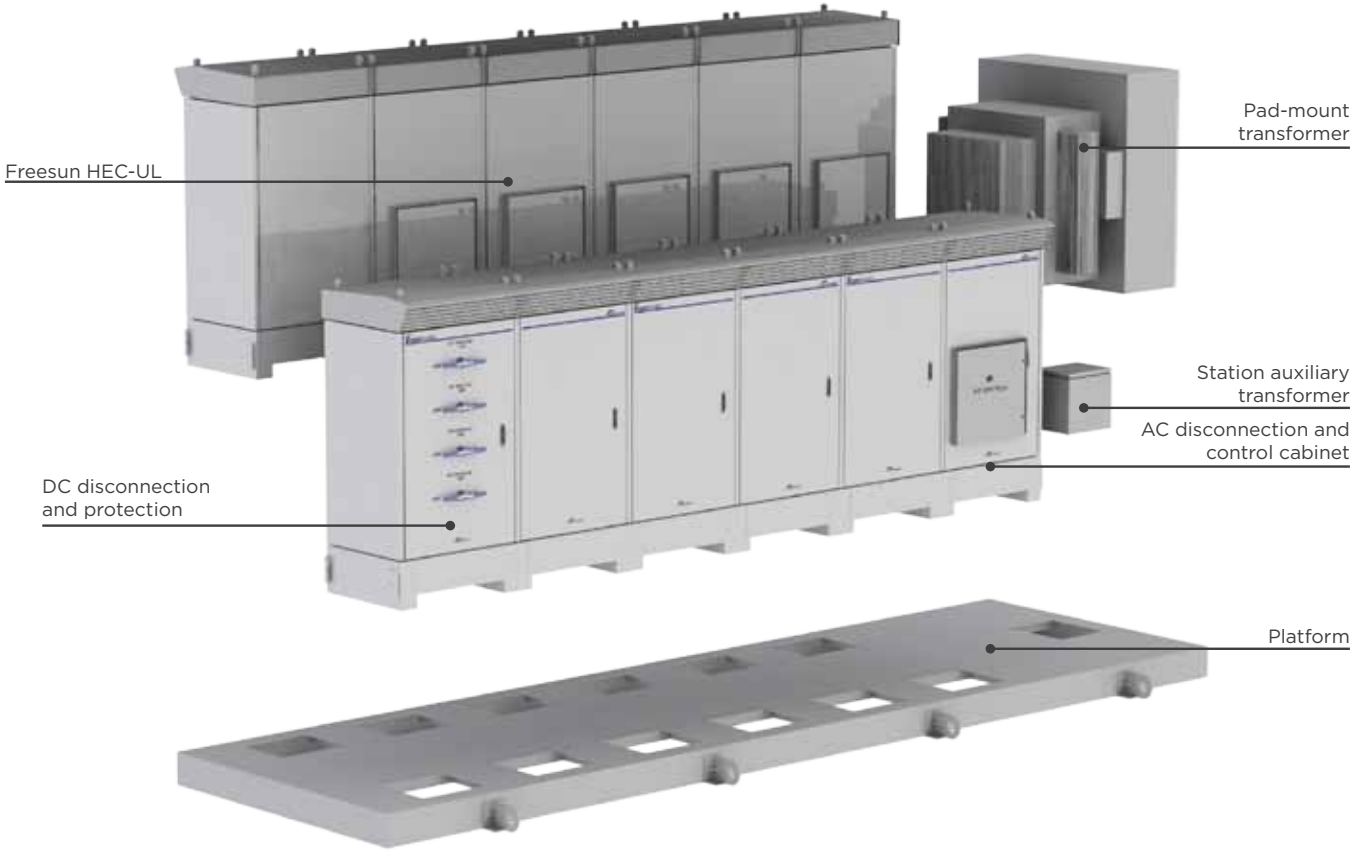
HEK | Technical Characteristics

	SAMPLE INVERTER CONFIGURATION	HEK - 1.2MW FS1200PU	HEK - 1.5MW 2x(FS0751PU)	HEK - 1.66MW 2x(FS0830PU)	HEK - 2MW 2x(FS1000PU)	HEK - 2.4MW 2x(FS1200PU)	HEK - 2.5MW 2x(FS1250PU)
AC OUTPUT	MV Output Voltage(V)	13.8kV(± 10%)					
	Nominal Power (kVA) @ 50°C[1]	1200kVA	1500kVA	1660kVA	2000kVA	2400kVA	2500kVA
	Inverter Output Voltage (V)	390Vac	390Vac	360Vac	330Vac	390Vac	390Vac
	Rated Frequency and Variation	60Hz (± 0.2%)					
	Inverter Max. Output Current (A)	1776	2x1110	2x1333	2x1750	2x1776	2x1850
	Current Harmonic Distortion (THDi)	<3% THDi					
	Power Factor(cos phi)[2]/@max. power	0.0 leading...0.0 lagging / 0.90 leading...0.90 lagging (adjustable)					
	Power curtailment (%)	0..100% /0.1% Steps					
TRANSFORMER & MV SWITCHGEAR	Transformer Type	Pad Mount - Loop or radial feed dead front					
	Input/Output Voltage	0.390kV/13.8kV	2x0.390kV/13.8kV	2x0.360kV/13.8kV	2x0.330kV/13.8kV	2x0.390kV/13.8kV	2x0.390kV/13.8kV
	Transformer Vector configuration	Dyn11	Dyn11 -Double or Single Winding (TWIN Inverters)				
	MV Switchgear	200A HV bushing					
		FR3 Dielectric fluid Winding temp. rise 65°C					
		2FCAN, 2FCBN @2.5%					
		Liquid temperature gauge, Pressure vacuum gauge, Liquid Level gauge, Pressure relief valve					
		200A two position load break switch					
		Bayonet fuse in series with the current limiting fuse					
INPUT W/DU	DC Voltage Range MPPT (VDC)[3]	520Vdc-820Vdc	520Vdc-820Vdc	540Vdc - 820Vdc	500Vdc-820Vdc	520Vdc-820Vdc	520Vdc-820Vdc
	Max. permissible DC voltage	1000Vdc					
	Max. continuous DC current (A)	2000A	2500A	3000A	4000A	4000A	4000A
	Max. shortcircuit current	2600A	2x1625A	2x1950A	2x2600A	2x2600A	2x2600A
	Array Configuration	Floating earth or grounded pole					
AUXILIARY SERVICE	Inverter Power Supply	Built-in transformer 3P -330/360/390/400Vac - 208Vac Optional built-in UPS System					
	Station Auxiliary transformer	Optional 15kVA,30kVA -208V,120V					
	Optional Equipment [5]	Communication Cabinet Low Voltage Cabinet					
MECHANICAL DATA	Dimensions (feet) (WxL) [6]	7´x 30´	9´- 7 3/4" x 34´				
	Weight (lb) [6]	30.000	45000 - 51500				
	Enclosure	Stainless Steel construction & Rockwool Panel Sandwich isolation					
	Cooling	Independent VSD control cooling - Intake through the bottom part blown out through the top					
	Skid construction	10" Channel base frame, skid base frame height 1"					
ENVIRONMENT	Degree of protection	Outdoor (NEMA3R)					
	Permissible Ambient Temperature[5]	-20°C ...+50°C					
	Humidity	0% to 95% Condensing – Active heating controlled by higrometer					
	Max. Altitude (above sea level)[5]	1000m; >1000m power derating 1% Sn (kVA) per 100m					
	Noise level	< 70 dBA					
CONTROL INTERFACE	Communication	RS232 / RS485 / USB / Ethernet, (Modbus RTU Protocol, Modbus TCP/IP, Optional GSM / GPRS)					
	Inputs & Outputs	1AI, 2DO, programmable per module					
	Interface	Graphic Display / Optional Freesun Web display or App display					
	Monitoring	Freesun Data Center, Freesun Web Portal, Open Modbus RTU protocol					
GRID SUPPORT & STANDARDS	Grid Support Functions	LVRT, HVRT, ZVRT, FRT, Ramp rate, Reconnection, Anti-Islanding, Power curtailment, PF control, Remote Stop, Compatible with every local requirement					
	Protections	E-Stop, 2xHV, 2x LV, 2xHF, 2xLF, current & voltage unbalance, OC protections, others consult PE					
	Standards Freesun Inverter	UL1741, CSA 22.2 No.1071-01, IEEE1547,					
	Standards Power Transformer	IEEE - C57.12.00, IEEE C57.12.34, IEEE C57.12.28, IEEE, C57.12.29, IEEE C57.12.70, IEEE, C57.12.80, IEEE C57.12.90, IEEE C57.9 and NEMA					

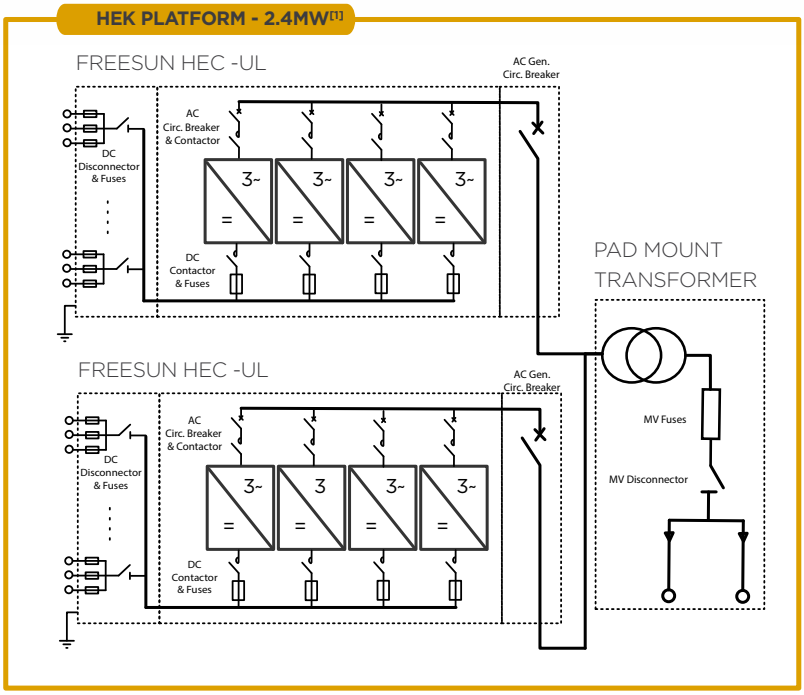
NOTES

[1] Consult Power Electronics for derating curves.
[2] Available adjustable power factor 0.80leading...0.80 lagging, consult P-Q charts.
[3] Values at 1.00Vac nom and cos Φ= 1.
[4] Maximum DC cable section per connexion and pole. The installer must also consider for the cable selection the factors such as length of cable for each installation, environmental conditions, aluminium conductors, installation methods and requirements set out in current regulations applicable in the country of installation.
[5] Other characteristics consult with Power Electronics.
[6] Preliminary dimensions and weight.

SKID TOPOLOGY



OPERATIONAL DIAGRAM



NOTES Other configurations consult Power Electronics. Some Freesun HEK units may differ from the concept shown in the image.

ENERGY STORAGE
Solar solutions

FREESUN SOLAR INVERTER / **POWER ELECTRONICS**


POWER ELECTRONICS®
POWERED BY Kokam

BESS

Battery Energy Storage System

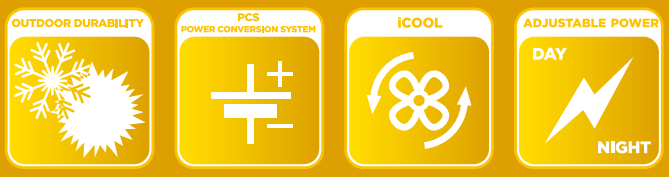
Freesun®

BESS SERIES

The decentralized and uncontrollable photovoltaic energy generation presents grid stability challenges and loss of profitability. Power Electronics' Battery Energy Storage System (BESS) is a turnkey and tailored solution designed for utility-scale PV plants that demand the stringent grid interconnection requirements. From on-grid applications that requires the fast dynamic support functions to those off-grid applications that look for load levelling strategies.

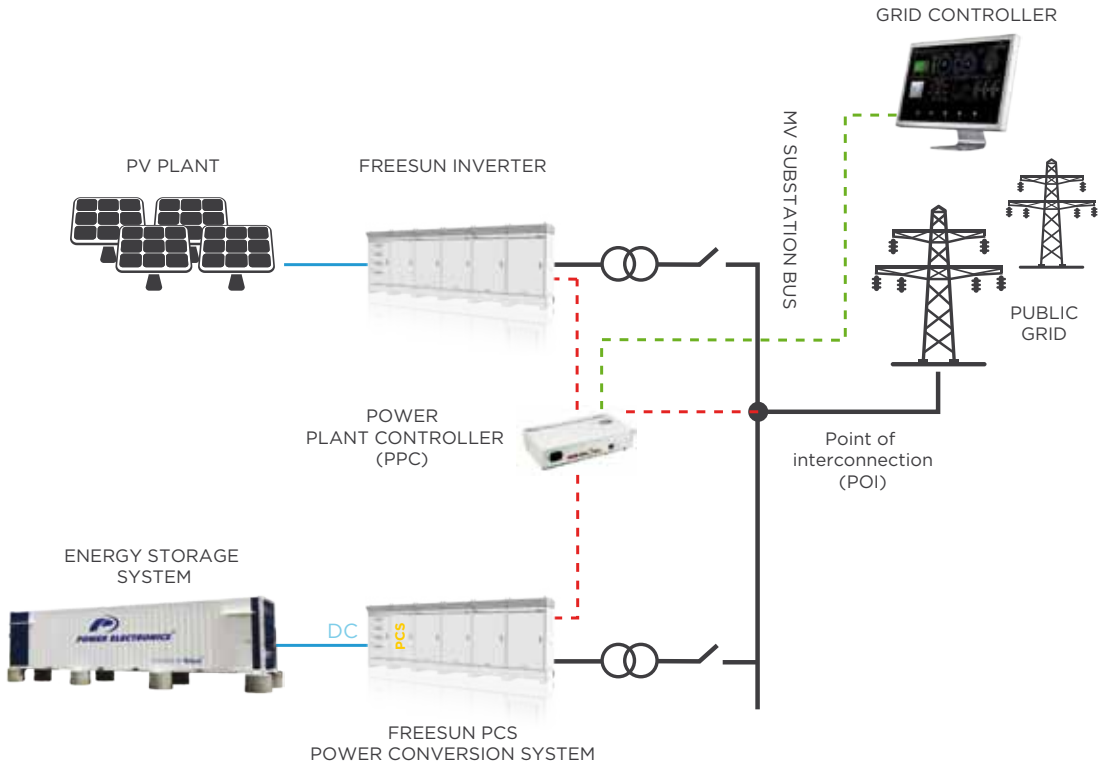
Freesun well-proven equipment can be connected with any available battery technology such as lithium-polymer, lithium-ion, Ni-Cd, Fe-Cl or Vn redox-flow,... However Power Electronics relies on lithium-polymer batteries powered by Kokam. A reliable and flexible manufacturer, committed to client and ready to face the challenges that the PV facilities are addressing worldwide.

Power Electronics' BESS offer reliability and flexibility to cutting-edge tech projects

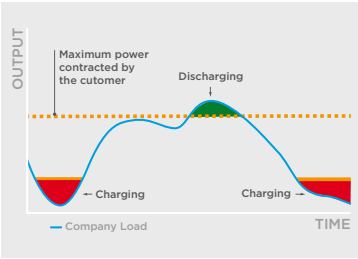


Battery Energy Storage System

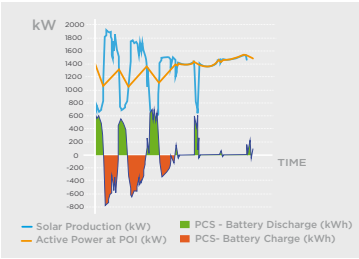
The BESS comprises a lithium-polymer battery container connected to a Freesun PCS (Power Conversion System) that follows the instruction of the main governor of the plant the Freesun PPC (Power Plant Controller).



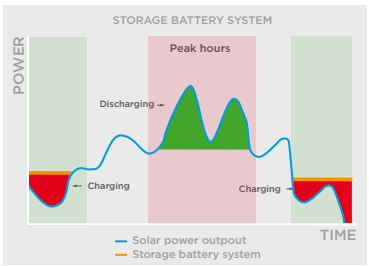
Freesun PPC is a PLC based microprocessor that monitors the POI (Point of Interconnection) and determines the active and reactive power set points of the inverter units. It can perform multiple power and dynamic grid support functions such as:



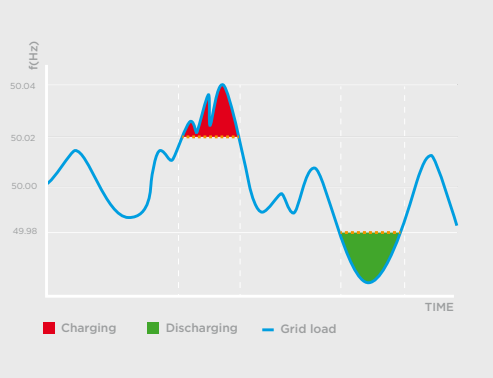
PEAK SHAVING
Reduce your fixed cost by reducing your maximum power demand.



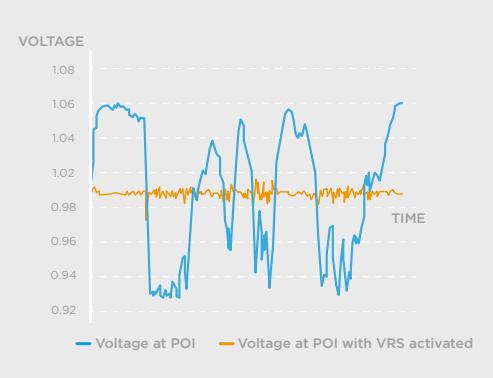
POWER RAMP UP/DOWN CONTROL
Smooth the rate of change of power due to a cloud cover or other sources.



LOAD LEVELLING
Reduce the maximum amount of energy purchased from utility during peak hours.

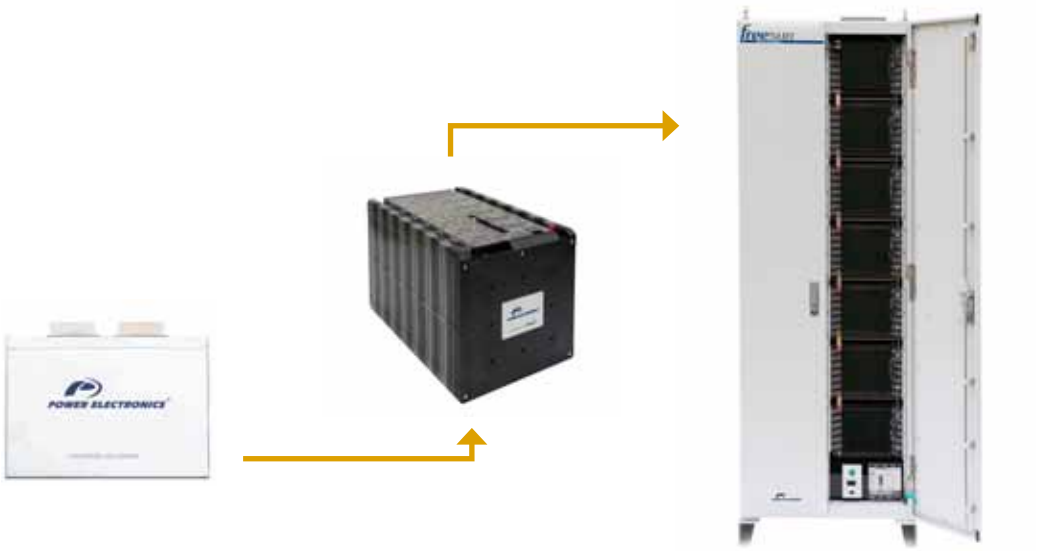


FREQUENCY REGULATION SYSTEM
Active power control to support the stabilization of the grid frequency. The BESS discharges and charges the battery in overfrequency and underfrequency issues respectively.



VOLTAGE REGULATION SYSTEM
Reactive power control to stabilize the grid voltage. Cos φ regulation from pure lagging to pure leading.

The KCE Battery Container is suited for medium and large scale application from 100kWh to 2MWh. It can be delivered in a 20 feet or 40 feet steel container that houses the battery banks, the BMS system, cooling system and the entire safety equipment ready to connect the DC wiring. Each battery bank can be equipped from 1 to 5 parallel connected battery racks, and at the same time the battery bank is connected to a Freesun PCS that transform the direct current to alternate current. Each battery rack comprises a connection of lithium-polymer battery modules in series that leads to an operating voltage range from 600Vdc to 800Vdc.



Battery cell *Battery module* *Battery rack*

Each battery rack is monitored by its own Data BMS that informs the system BMS and Freesun PCS about SoC (State of Charge), cells temperature, current and voltage protections, charge and discharge current and voltage limits.

A MODULAR ESS AND PCS ALLOW POWER ELECTRONICS TO ADDRESS EACH SINGLE CHALLENGE WITH THE MOST COST-EFFECTIVE PROPOSAL

PCS
Power Conversion System

Freesun®
SOLAR INVERTER

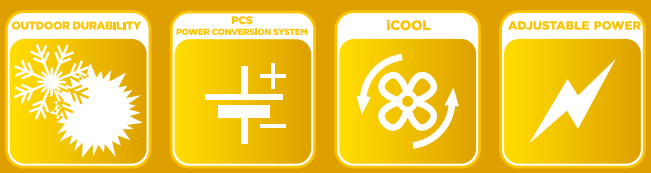
For decades, the energy production industry is being deregulated and new markets are embracing the renewable energy sources. Their high penetration is creating power transmission instability challenges, thus Grid Operators request stringent dynamic and static grid support features to solar inverters and Power Conversion Systems (PCS).

Freesun PCS offers proven hardware to cope with this new storage and grid support challenges. It includes high advance control software with the latest Voltage and Frequency Ride Through features, and together with the Freesun solar inverters, a Power Plant Controller and a battery set will supply the active power required to perform the desired Ramp Rate and frequency regulation Control.

Backed by our proven solar inverter series, Power Electronics offer indoor or outdoor units, or a complete PCS stations. The PCS stations are turnkey solutions that are ready to connect the battery container and the MV power distribution wiring. It is available over a concrete station, steel container or open skid platform that include the PCS unit, the MV power transformer, the MV protection cells and the LV auxiliary cabinets.

Freesun PCS is a modular IEC and UL compliant solution from 300kW to 1800kW with configurable DC and AC voltages that make it compatible with all the battery technologies and manufacturers. Power Electronics is the best partner for your MW installation by means of its reliability engineering and outstanding guarantee condition.

Proven hardware and rugged outdoor design featured with the latest control



freesun
SOLAR INVERTER

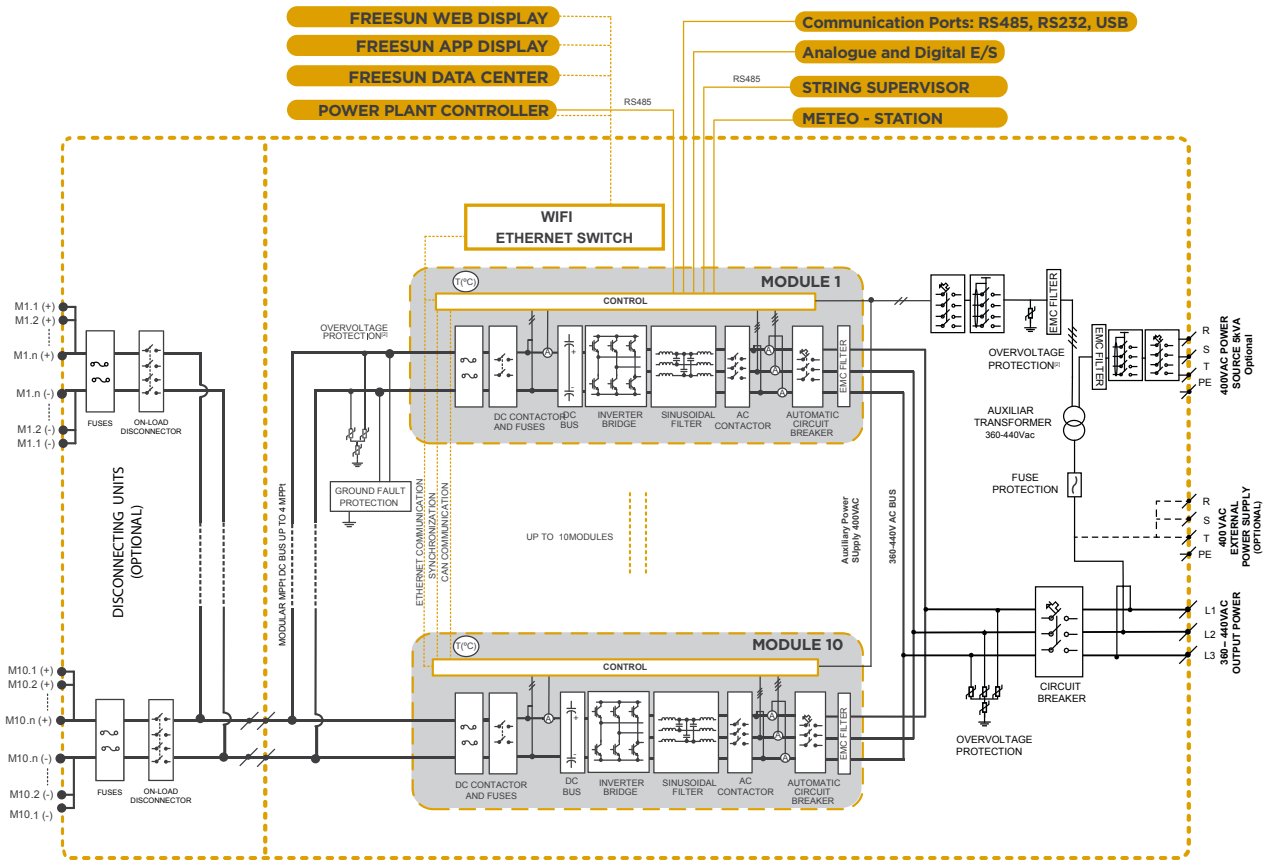
PCS | Technical Characteristics

			FREESUN PCS
OUTPUT	Nominal AC Output Power (kVA) [1]		125kVA – 1800kVA
	Overload (%)		125% < 60s
	Output Voltage (VC)	PCS unit	360Vac - 440Vac
		PCS stations	10kV - 36kV
	Grid frequency		50Hz – 60Hz
	Voltage ripple, PV Voltage		< 3%
	Current Harmonic Distortion (THDi)		< 3% at nominal power
	Reactive power compensation		0.0 leading... 0.0 lagging adjustable
INPUT	DC voltage range (Vdc)		540V-850V
	Maximum DC voltage (Vdc)		1000V
	Maximum DC current (A)		500A - 3000A
	Battery technology		All compatible (BMS required)
EFFICIENCY	Efficiency PAC (η)		> 97% at rated power
	Standby consumption (P_{night})		< aprox. 400W
ENVIRONMENTAL CONDITIONS	Degree of protection		Indoor Units -IP21
			Outdoor Units - IP54
	Maximum ambient temperature [2]		-20°C ...+50°C
	Relative Humidity (%)		Indoor units: 10% to 95% non condensing Outdoor units: 4% to 100% condensing
	Max. Altitude (above sea level) [2]		1000m; 1000m 1% power derating Sn (kVA) per 100m
	Noise level [3]		< 79dBA
	Cooling		Forced VSD cooling
CONTROL	Communications		RS232 / RS485 / USB / Ethernet, (Protocol Modbus RTU, Ethernet TCP/IP, Optional GSM / GPRS)
	User interconnection		1AI, 2DO, programmable per module (Max. 8-10)
	Plant Manager		Freesun Power Plant Controller (PPC)
DYNAMIC GRID SUPPORT	Reactive Power Compensation		Local or remote by PPC setting (cos ϕ or %) Automatic curve Q(Active Power) Automatic step curve Q(AC voltage) Automatic hysteresis curve Q(AC voltage)
	Voltage Ride Trough capability		Dual setting high and low voltage protection - 0-470Vac, 0.01s -60s
	Frequency Ride Trough capability		Dual setting high and low frequency protection, -5% to +4%, 0.01s -100s
	Grid Support Voltage DIPs		Standard built-in
	Anti-islanding		Standard built-in
	PCS reconnection		Configurable: 5..120s delay time, 1 to 30 attempts, Attempts auto-reset
	Reconnection ramp rate		Adjustable
PROTECTIONS	AC disconnection		AC circuit breaker
	DC Overcurrent protection		Optional General DC fuse cabinet and DC on-load disconnectors
	Ground fault		Ground fault monitoring

NOTES

[1] Values at 40°C
[2] Other characteristics, consult Power Electronics.
[3] Sound level at a distance of 1m from the rear and front part.

OPERATIONAL DIAGRAM



PPC
Power Plant Controller

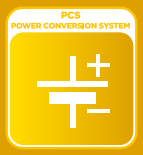
Freesun®
SOLAR INVERTER

For decades, high power facilities have been located in isolated areas that have made investment in grid connection unfeasible, so many have been powered by gas, diesel or fuel generators. Despite a rising trend in oil prices and government taxes imposed on high CO_2 producers, any other feasible technologies have not been available until now.

The integration of an alternative power source creates an unprecedented opportunity to reduce operational costs to off-grid industrial and commercial facilities. Freesun's design and topology bring together the engineering expertise in industrial power electronics development, and the solar plants economic and technical capability. We are aware of continuous operation applications and we understand that a process shutdown could result in a large reduction of income for your company. Therefore a unique modular and redundant system, ensures the availability of string inverters and the competiveness of central inverters. We offer a set of solutions that can be customised to your facilities to ensure maximum yield and optimal energy management.

Power Electronics is already supplying in world leading companies in Mining, Water and the Oil & Gas sector around the globe (Australia, Brazil, Chile, Germany, Mexico, Mongolia, New Zealand, Korea, South Africa, Spain...) due to a highly reliable product and from what has brought us to where we are now; outstanding technical service POWER ON SUPPORT, together with our vertically integrated production which allows us to offer unique delivery times.

It's a reality, we have already reached photovoltaic – diesel parity!



PPC | Technical Characteristics

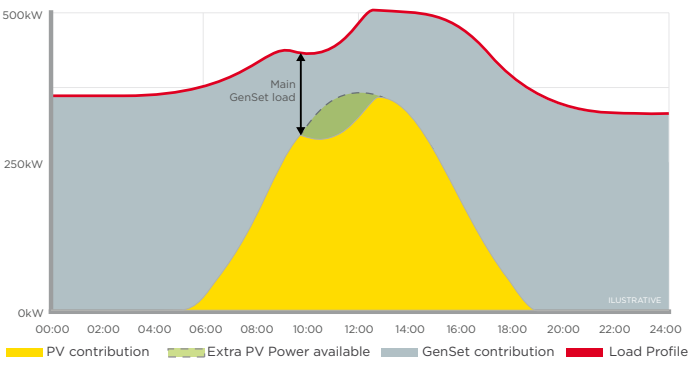
GENERAL DATA	Dimensions (WxDxH)	265 x 146 x 66 mm
	Weight	635g
	Enclosure	2mm Steel
	Mounting system	DIN35 rail, wall mounting anchorages
	Compatible Inverters	Freesun HE and PCS by Power Electronics
POWER SUPPLY	Voltage, Consumption, Freq.	100Vac -240 VAC , 100mA, 50Hz-60Hz
	Socket	C type
DIGITAL INPUTS	4 x Digital Inputs: Programmable inputs and active high (24Vdc). Optically isolated	
COMMUNICATIONS [1]	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°-128°F)
	Altitude	< 2000m above sea level
	Storage temperature	-20 - 80°C (-4°-176°F)
	Humidity	5 - 95% (non-condensing)
	Degree of protection	IP20
CERTIFICATES	CE	
OTHERS	Web interface for local and remote monitoring	
	Customised solution	

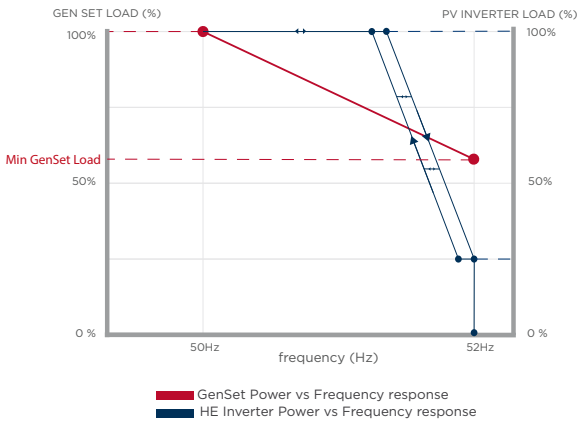
[1] Communication parts can be customized depending on PV plant design without prior notice.

PLUG AND PLAY

Facilities with a high load profile that are considering a progressive PV penetration in their off-grid power supply are able to install the Freesun HE solar inverters without any additional control, measurement or communication hardware. The GenSet acts as the main governor of the system running under normal operation mode by balancing the power through the variation of the grid frequency (ISO8528-5:2005). The HEC Inverter, coupled by the AC bus, monitors the frequency and adjusts its power injection in order to both maximize the fuel saving, and to ensure minimum GenSet load and spinning reserve. Additionally, dynamic grid support features can be programmed to enhance your plant power quality.

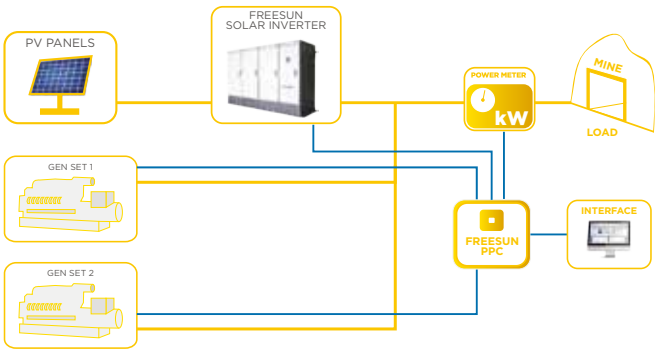
- Compatible with new and retrofit projects
- Scalable system
- No additional hardware
- PV penetration depends on the load profile

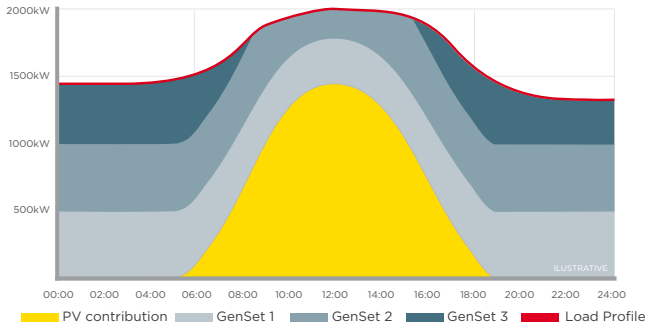




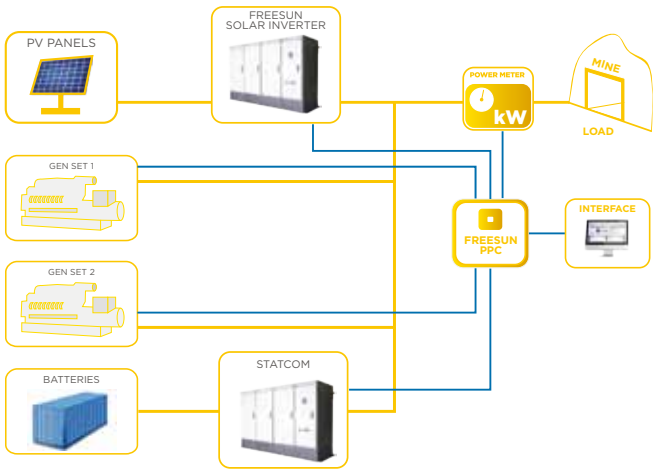
POWER PLANT CONTROLLER

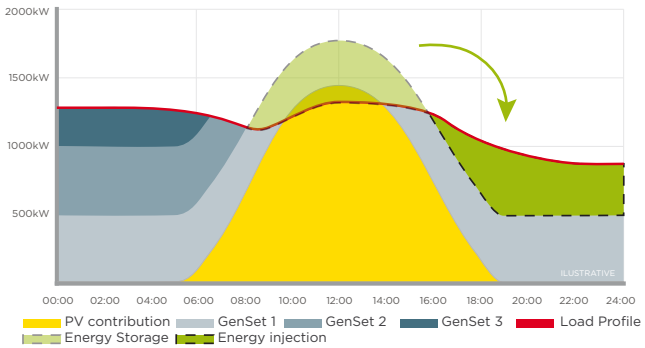
The Freesun Power Plant Controller (PPC) will be the main governor of the most complex hybrid systems by monitoring the point of interconnection (POI) and at the same time controlling the power generation and storage equipment.The PPC is equipped with the latest PLC based microprocessor that interacts through the programmable digital/analogue signals and communication ports (Modbus RTU –RS485/ fiber optics or Modbus TCP/IP- Ethernet TCP/IP). The Freesun PPC together with the Freesun HE family inverter series can be customised 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 GenSets control
- No storage- PV penetration depends on load profile
- Centralized dynamic grid support at POI





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

COMMERCIAL SCALE
Solar Inverters

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TÜVRheinland
ID:2000000000

BAUART GEPRÜFT

TYPE APPROVED


POWER ELECTRONICS

LVT
Solar Inverter

Freesun®
LVT SERIES

Freesun LVT series is the perfect solution for commercial scale solar PV plants, being available from 20 to 100kW.

Equipped with a high efficiency low voltage transformer, it is the most robust and compact central inverter both indoor and outdoor versions, featuring the last dynamic grid support features, FFA (Full Frontal Access), stand alone cabin, DC/AC protections, and PMTA (Power Multiple Tracking Algorithm).

Easy to install and ready to produce with the highest quality performance certified by TÜV Rheinland.

Freesun LVT is the perfect definition of solar technology, reliable and comprenhensive

Full Frontal Access FFA

Based on our experience in the industrial sector, we know how important it is to have full access to the vital elements of the equipment. This not only means that you can see the "inside" of your inverter easily, it also helps any servicing and maintenance to be made with no effort. In Power Electronics we believe that doing things better is always an advantage for the client, and this is why we work to make give full access to all the important elements of the inverter.

Efficiency

It has a yield of 96.5% and 97.1% European maximum efficiency. However, we know that what gives an inverter a true efficiency throughout the years is not only the rates, but a number of other important aspects to be considered.

Conditions. The LVT inverter is able to operate in adverse weather conditions being tested to work without derating or production loss in temperatures ranging from -20°C to +50°C. Thus the series LVT can be considered one of the strongest inverters in the market .

Testing. Also, after thorough testing in our laboratories with a climatic and anechoic chamber, the inverter LVT has passed all European certifications regarding electromagnetic emissions, which make it a compatible system with the strictest requirements of our customers.

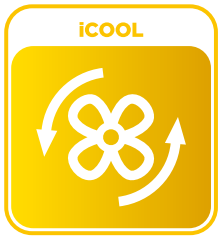
Certification. The quality and safety design have been certified by TÜV Rheinland.

Protections. The use of all necessary protections: overvoltage protector, isolating monitoring, DC EMC filter and EMC output filter, and the overvoltage protector among others, provide the LVT with all possible control elements to guarantee the safety of the inverter, the installation and the grid.

Conformal Coating. All the electronics are treated with a selective varnish, which we use as standard for all our equipment, specially designed to resist in environments with high presence of aggressive agents in the toughest conditions all over the world.

PMTA. The most advanced control of Maximum Power Point with our PMTA algorithm.

True 24h service. Not to forget Power Electronics' commitment to 24h service every day of the year, which means that you will have the fastest and best service in the market, with a permanent true Power On Support phone line available with direct contact with technical engineers. This is what we call... Efficiency.



Ventilation

Available both for indoor and outdoor versions the most advanced cooling system keeps the electronic components within the operating temperature range even in the most difficult situations without ongoing maintenance. We have great experience in high temperature environments (around 50°) with no power derating.

Commissioning (Start Up)

Freesun LVT series inverters are easy to install, all parameters are factory pre set to allow a quick installation. Once you make connections, the inverter is able to synchronize automatically.

Anyone can start up the LVT without having specific training.

Protections

Simple reliable and safe, the LVT has all the necessary protections based on the latest legislation such as the Italian CEI 0-21, G 59/2 English and German VDE.

Any anomaly coming from the PV installation will not affect the solar inverter or the grid due to both the DC and AC protections built in the inverter.

LVT | Technical Characteristics

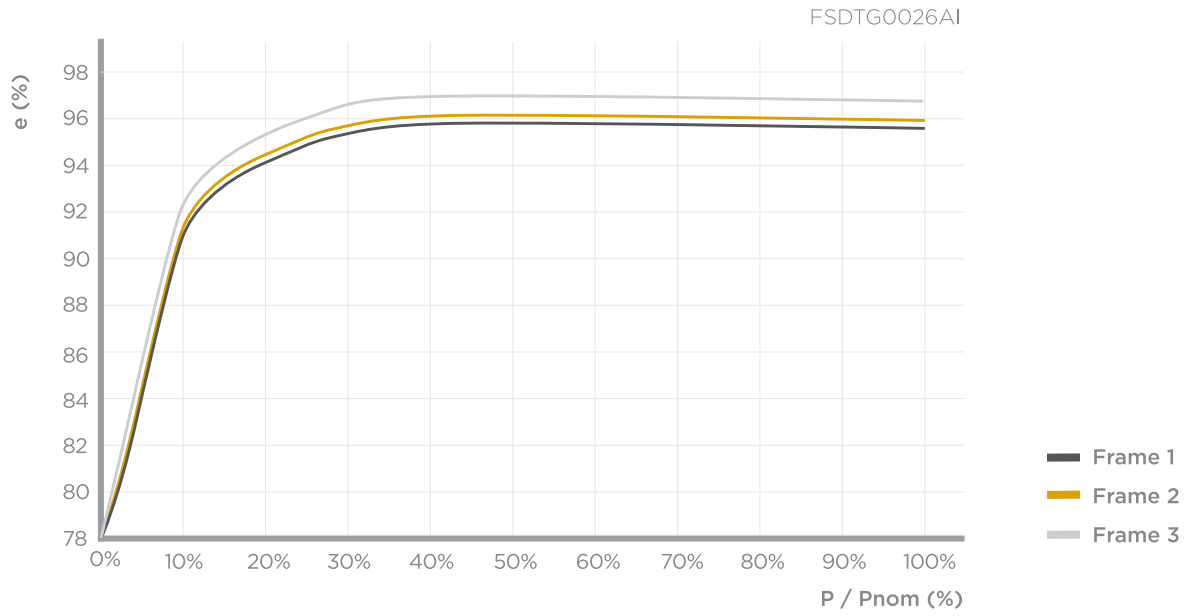
FREESUN LVT SERIES			FRAME 1 - FS				FRAME 2 - FS			FRAME 3 - FS	
			FS0020_T	FS0025_T	FS0030_T	FS0035_T	FS0040_T	FS0050_T	FS0060_T	FS0080_T	FS0100_T
OUTPUT	Nominal AC Output Power (kW)		20	25	30	35	40	50	60	80	100
	Operating Grid Voltage(VAC)		400V (± 10%)								
	Operating Range, Grid Frequency		50Hz - 60Hz								
	Voltage Ripple, PV Voltage		< 3%								
	Nominal AC Current (A)		30	36	43	51	58	73	87	116	145
	Current Harmonic Distortion (THDi)		< 3% at nominal power								
	Power Factor (cosine Φ)		0.95 leading ... 0.95 lagging adjustable								
INPUT	DC Voltage Range MPPt (VDC)		450V - 820V								
	Maximum permissible DC voltage[1]		900V / 1000V (Optional)								
	Maximum permissible DC current (A)		52	65	77	90	103	129	155	206	258
	Maximum PV Power (kWp)[2]		24	30	36	42	48	60	72	96	120
	Number of DC connections		3 per pole				3 per pole			4 per pole	
	Recommended cable section (mm^2)[3]		16	16	25	25	35	50	70	95	95
EFFICIENCY	Max. Efficiency PAC, nom(η)		95.9%				96.2%			97.1%	
	Euroeta (η)		95.0%				95.5%			96.5%	
	Max. Standby Consumption (P_{night})		< approx. 40W								
AUXILIARY	External Auxiliary Voltage		230V, 50 / 60Hz								
	External Back-up Fuse for Auxiliary Supply		B16A, 1-pole								
CABINET	Dimensions [WxDxH] mm	Indoor	802 x 723 x 1525				1003 x 723 x 1525			1403 x 1008 x 1625	
		Outdoor	840 x 755 x 1600				1040 x 755 x 1600			1440 x 1040 x 1700	
	Weight (kg)	Indoor	528				742			1116	
		Outdoor	535				750			1125	
	Air Flow		Intake thorough rear lower part and both sides blown out through upper side (Outdoor) Intake thorough rear lower part blown out through upper side (Indoor)								
ENVIRON-MENT	Degree of protection: Electronic area / connection area		IP54 / IP44 (Outdoor) IP21 (Indoor)								
	Permissible Ambient Temperature[4]		-20ºC ...+50ºC								
	Relative Humidity		Indoor (10% to 95% non-condensing) Outdoor (4% to 100% condensing)								
	Pollution Degree		PD3								
	Max. Altitude MASL[4]		1000m								
	Noise level		<72dBA								
CONTROL INTERFACE	Communication		RS232 / RS485 / USB / Ethernet. (Modbus RTU, Ethernet TCP/IP, Optional GSM / GPRS)								
	Digital Inputs		2 programmable inputs. Galvanically isolated.								
	Analogue Inputs		2 programmable and differential inputs Current signal: 0-20mA Voltage signal: full scale configurable (± 10mV to ± 10V), and 1 x PT100 Input								
	String Supervisor Interface		RS485 / Modbus RTU								
	Digital Outputs		2 electrically-isolated programmable switched relays (250VAC, 8A or 30 VDC, 8A)								
	Analogue Outputs		1 Analogue. Output galvanically isolated.								
PROTEC-TIONS	Ground Fault Monitoring[5]		Standard built in / Optional configurable.								
	Heating Resistors		Standard (Outdoor) / Optional (Indoor)								
	Emergency Stop		No (Outdoor) / Optional (Indoor)								
	Contactor AC Side		Standard								
	Circuit breaker AC side		Standard								
	Motorized Circuit breaker		MCB as standard								
	AC Overvoltage Protectors		Internal Standard Type 2								
	DC Overvoltage Protectors		Internal Standard Type 2								
	Overvoltage Protectors for Auxiliary Supply		Internal Standard Type 2								
	Lightning Protections		Optional Type 1								

NOTES

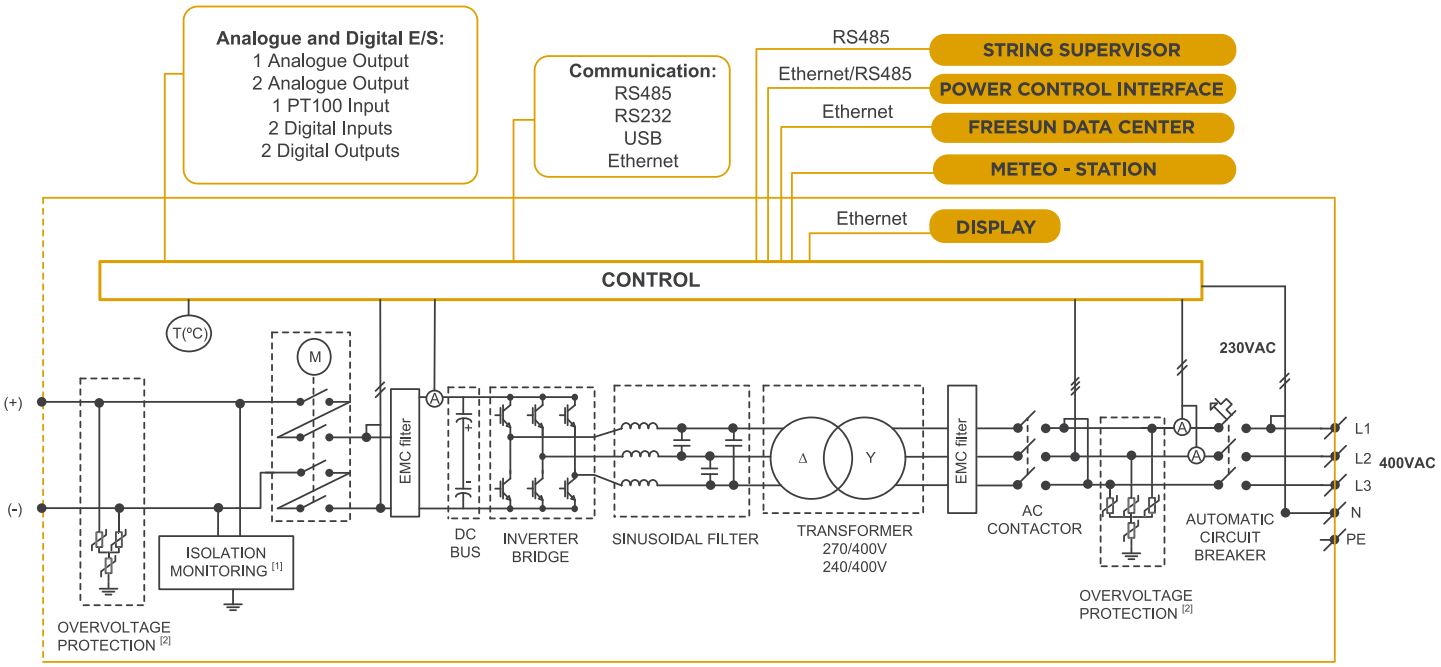
[1] Maximum ambient temperature 40ºC.
[2] The maximum PV Power depends on the geographic location and type of installation.
[3] Recommended DC cable section per connexion and pole. The installer must also consider for the cable selection the factors such as length of cable for each installation, environmental conditions, aluminium conductors, installation methods and requirements set out in current regulations applicable in the country of installation.
[4] Other characteristics consult with Power Electronics.
[5] In cases where the installation has the positive pole or the negative pole earth connected, this protection will be disconnected.

LVT | Efficiency Curves Operational Diagram

EFFICIENCY CURVES



OPERATIONAL DIAGRAM

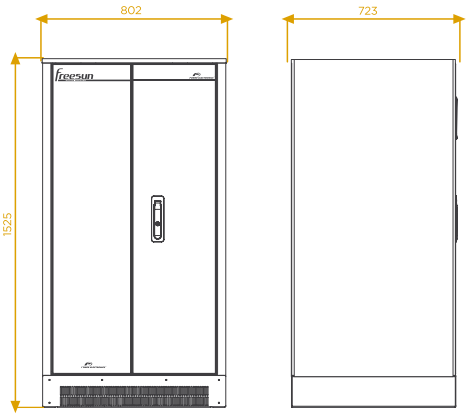


[1] In positive pole or negative pole earth connected installations, the protection must be disconnected.
[2] Optional AC and DC lightning protection.

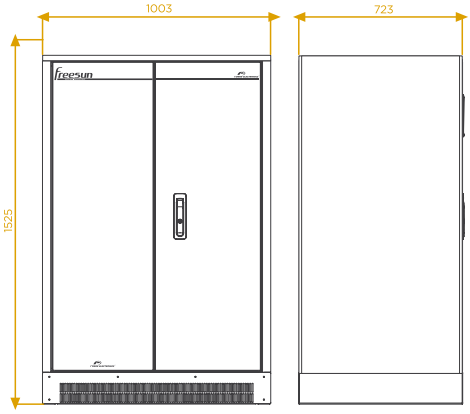
FSDTG0006CI

LVT | Dimensions

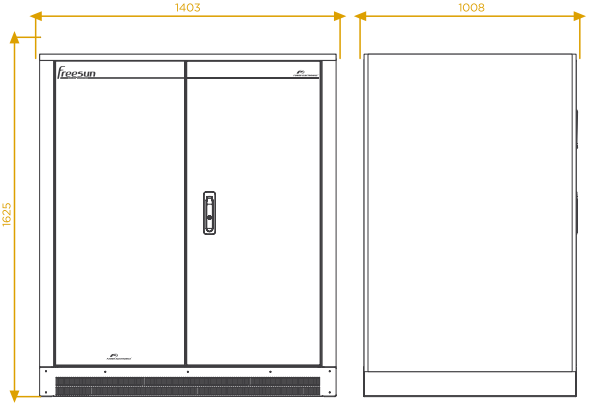
INDOOR



FRAME	REFERENCE	DIMENSIONS (mm)			WEIGHT (kg)
		HEIGHT (H)	WIDTH (W)	DEPTH (D)	
1	FS0020 IT□□□□□□ FS0025 IT□□□□□□ FS0030 IT□□□□□□ FS0035 IT□□□□□□	1525	802	723	528



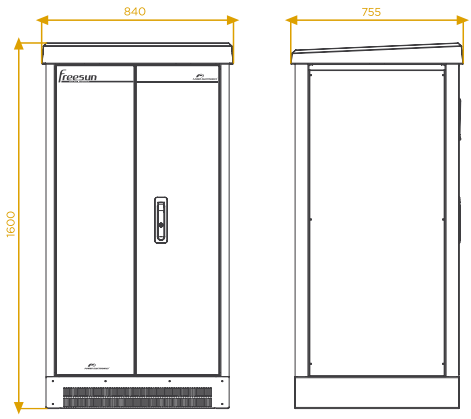
FRAME	REFERENCE	DIMENSIONS (mm)			WEIGHT (kg)
		HEIGHT (H)	WIDTH (W)	DEPTH (D)	
2	FS0040 IT□□□□□□ FS0050 IT□□□□□□ FS0060 IT□□□□□□	1525	1003	723	742



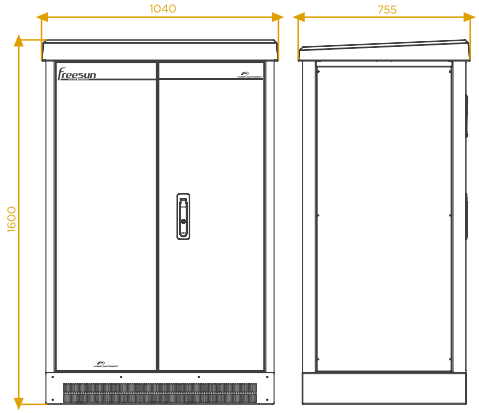
FRAME	REFERENCE	DIMENSIONS (mm)			WEIGHT (kg)
		HEIGHT (H)	WIDTH (W)	DEPTH (D)	
3	FS0080 IT□□□□□□ FS0100 IT□□□□□□	1625	1403	1008	1116

LVT | Dimensions

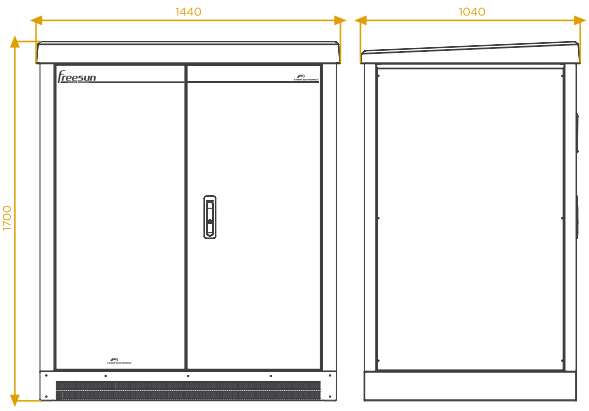
OUTDOOR



FRAME	REFERENCE	DIMENSIONS (mm)			WEIGHT (kg)
		HEIGHT (H)	WIDTH (W)	DEPTH (D)	
1	FS0020 OT□□□□□□□ FS0025 OT□□□□□□□ FS0030 OT□□□□□□□ FS0035 OT□□□□□□□	1600	840	755	535



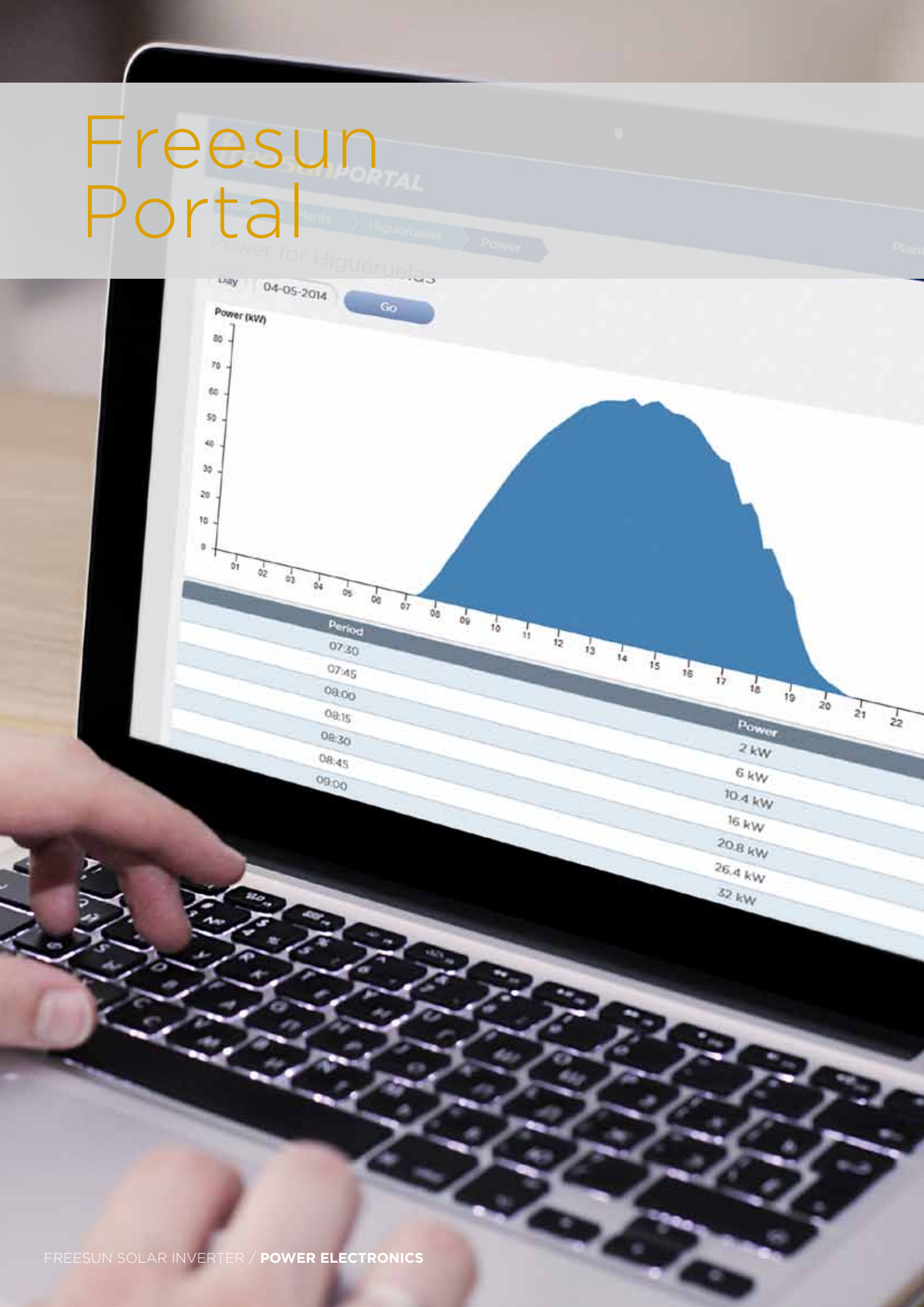
FRAME	REFERENCE	DIMENSIONS (mm)			WEIGHT (kg)
		HEIGHT (H)	WIDTH (W)	DEPTH (D)	
2	FS0040 OT□□□□□□□ FS0050 OT□□□□□□□ FS0060 OT□□□□□□□	1600	1040	755	750



FRAME	REFERENCE	DIMENSIONS (mm)			WEIGHT (kg)
		HEIGHT (H)	WIDTH (W)	DEPTH (D)	
3	FS0080 OT□□□□□□□ FS0100 OT□□□□□□□	1700	1440	1040	1125

Monitoring Solutions

Freesun Portal



• Freesun Portal

Go online! Freesun Portal is an attractive and comprehensive monitoring tool available with one click through a free web service. The data sent by the Datalogger is stored in Power Electronics Database and meaningful plotted or exported. Whether an EPC or end user can easily check in real time, in any place in the world, and in any device, all the data retrieved by the inverter.

The system refresh every minute the data showing an accurate and comprehensive status of your PV facilities. A single password can give you access to multiple PV plants and at the same time a PV plant can be monitored by many users with different security levels. The web application allows you to introduce the plant information, to select multiple charts or plot intervals, to create daily, monthly or annual reports, and to export data to xls files

Website access	www.freesunportal.com
Available Information	Inverter and module status, Inverter and module Power (kW), Daily Energy (kWh), Total Energy (MWh), Inverter current (A), String current (A), Inverter and Module faults, Others available.
Features	Comprehensive and flexible charts Annual, Monthly, daily reports. Generation of historic data tables Historic data exportation XLS. Files Multiple user licences and administrator capabilities
Language	English, Spanish
System Requirements	Internet Explorer 8, Firefox 5, Google Chrome 14, Safari 5, Opera 11 Java Script and Cookies activated
Communication	Modbus TCP/IP
Ethernet Ports	Ethernet Switch (2x10/100 BaseT RJ45ports)
Data	4Gb SD Card
Features	Real Time Clock, Watch Dog Timer
Installation	Indoor,
Operating/ Storage Temperature	0 to 50°C (32° to 122°F) / -20 to 70°C (-4° to 158°F)
Operating /Storage Humidity	20 to 95% (non-condensing) / 0 to 95% (non-condensing)
Certifications	CE

freesunPORTAL

Consult availability.

Freesun Data Center

• Freesun Data Center

The Freesun Data Center is a data logger suitable for solar farms' remote monitoring and control. Thanks to the dedicated Microsoft Windows Desktop application, you will easily receive e-mail alerts, or check from your home, office or laptop the daily energy production, weather conditions, security system, inverter status...

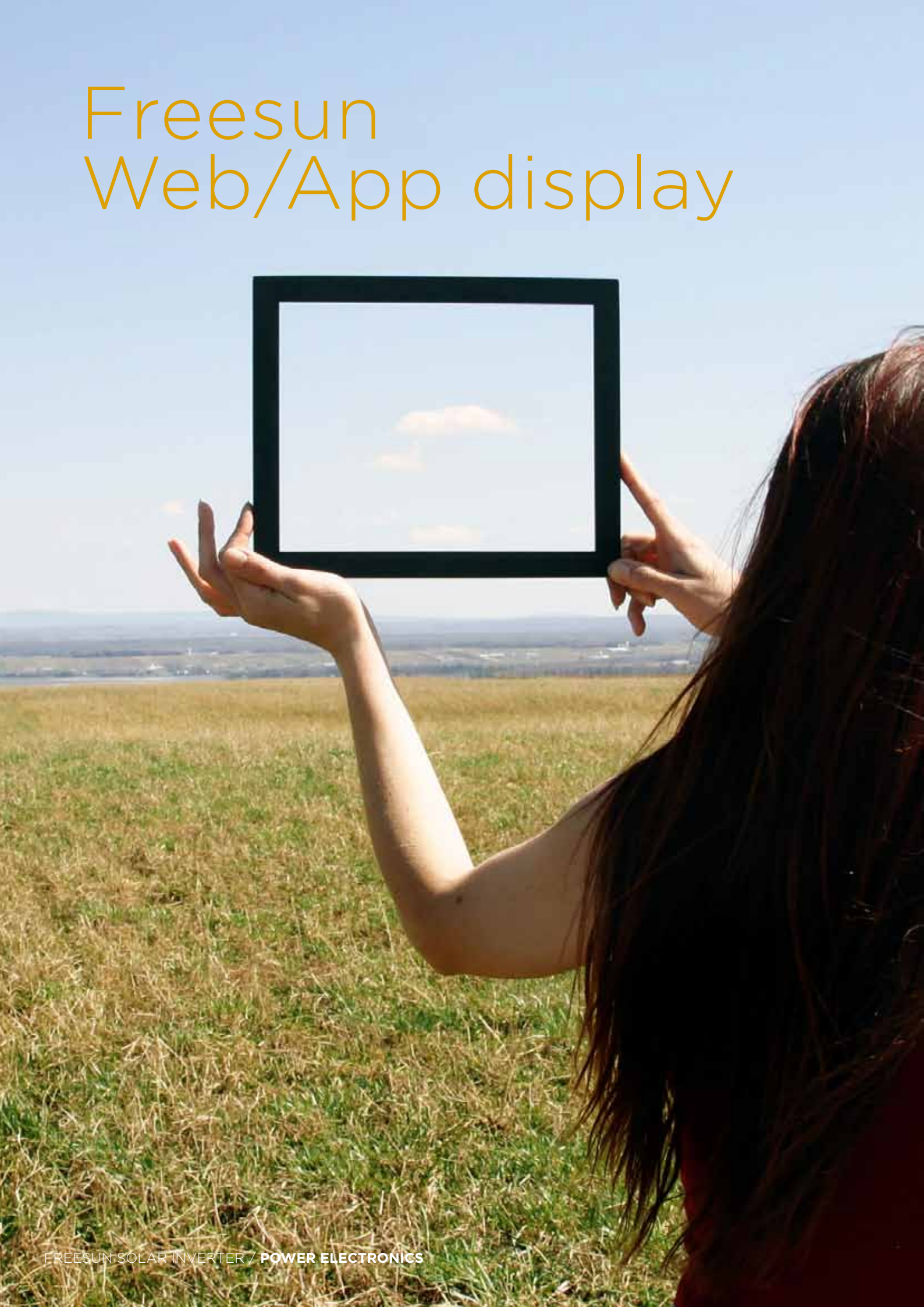
The system captures data every 15min showing an accurate and comprehensive status of the solar plant. The application allows you to customize the graphs characteristics and plot intervals (quarterly, hourly, daily, yearly). The trend graphs applet and the Excel export function gives you the opportunity to share the data or to compare the long term performance with other PV plants.

Freesun Data Center is compatible with multiple weather and control accessories such as: irradiance sensors, pyranometers, weather stations, security cameras or optical probes for energy meters.

For those interested in holding its own database, the Freesun Data Center is able to send simultaneously data frames to one or more remote servers. If the communication is lost, the FDC will locally save the data until the communication is restored.

Available Information	Inverter status, Inverter Power (kW), Daily Energy (kWh), Total Energy (MWh), Inverter current (A), String current (A), DC and AC voltages (V). Energy Meters Power (kW), Energy Meters data (MWh), Total Revenues (local currency), CO_2 savings ($kgCO_2$), Performance Ratio Calculation, Others available.
Features	Comprehensive and flexible charts Generation of historic data tables Historic data exportation XLS. Files Multiple user licences and administrator capabilities
Programmable notifications	SMS Messages (Requires GSM modem) - Email Notifications
Language	English, Spanish, German, Italian
System Requirements	Windows XP/Vista/7; Internet Connection; Router Settings Access Intel Celeron, Intel Pentium, Intel Core processor 32 et 64 bits A minimum of 2GB RAM is recommended. 60MB free hard disk place Minimum Microsoft .Net Framework 4.0
Datalogger	Freesun Data Center (Webdom Labs)
Communication	Modbus
Serial Ports	2xRS232, 2xRS232/422/485 w/DB9, Automatic RS485 data flow control RS232: 300 to 115.2kbps ; RS422/485: 300 to 115.2kbps
Ethernet Ports	2x10/100 BaseT RJ45ports
External Signals	Analog Output 4..20mA; 0..10V, (PT100/PT1000 compatible) Digital Input (+10Vdc to +30Vdc)
Power Supply	Internal Inverter Supply (12Vdc – 30Vdc) 10W
Data	Onboard 32MB Flash memory - 4Gb Compact Flash Memory
Features	Real Time Clock, Watch Dog Timer
Weather Stations and sensors	Davis Vantage Pro 2, Mencke, Irradiance Sensor, Delta Ohm LP PYRA -02, -03, -10
Other accessories	Optical Probe IEC1107 - Camera ACM-3100 Domo IP SuperCMOS Outdoor Camera SONY Super HAD ¼"
Installation	Indoor,DIN Rail
Operating/ Storage Temperature	0 to 70°C (32° to 158°F) / -20 to 95°C (-4° to 176°F)
Operating /Storage Humidity	20 to 95% (non-condensing) / 0 to 95% (non-condensing)
Certifications	CE, FCC and class A
Monitoring Protocols	IEC870-5-102; DLMS/COSEM, Backfilling System av

Freesun
Web/App display



• Freesun Web/App display

Go Wireless! The ultimate Freesun Web Display and Freesun APP display applications will play a key role on your Plant Service and Management. Any Windows, Android or IOS device will be easily wirelessly connected to the inverter creating 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 under rain, snow or heavy sunny conditions, without opening or standing in front of the unit.

Freesun Web Display is an embebed application that allows the user to go deep into the unit by using a laptop. Freesun APP Display is a comprehensive APP compatible with IOS and Android devices. Both tools allow the user to monitor the inverter status and to modify the settings.

App display

Available Information	Inverter status, Inverter Power (kW), Daily Energy (kWh), Total Energy (MWh), Inverter current (A), String current (A), DC and AC voltages (V). Energy Meters Power (kW), Weather Station status, Energy Meters data (MWh), Others available.
Settings control	Yes
Features	Easy Wireless connection Comprehensive interface Real time data Save and copy settings
Language	English, Spanish
System Requirements	IOS or ANDROID devices
Datalogger	No
Communication	Modbus TCP/IP (Wireless)

Web display

Available Information	Inverter status, Inverter Power (kW), Daily Energy (kWh), Total Energy (MWh), Inverter current (A), String current (A), DC and AC voltages (V). Energy Meters Power (kW), Weather Station status, Energy Meters data (MWh), Others available.
Settings control	Yes
Features	Easy Wireless connection Comprehensive interface Real time data Save and copy settings
Language	English, Spanish
System Requirements	Internet Explorer 8, Firefox 5, Google Chrome 14, Safari 5, Opera 11 Java and Cookies activated
Datalogger	No
Communication	Modbus TCP/IP (Wireless)

Consult availability.

Accessories & Customised Solutions

Customers' needs are continuously changing. That's why Power Electronics provide full flexibility to large installation customers by adapting standard units to each project requirements. We are committed to create a smooth workflow and to offer the most suited solution to each single project worldwide. A team of qualified PV Engineers will support you during the whole plant life being the best partners for your investment.

DISCONNECTION AND PROTECTION

• DC built-in

A combination of DC fuses and on-load disconnectors can be fitted in one or two module's frame. This solution leads to a limitation of the maximum inverter modules that can be fitted in the same inverter frame size.

• Outdoor wall-mounted cabinets

It's a fully customizable wall-mounted outdoor cabinet suited for Freesun HES Stations. Ordering the complete PV station it will be delivered all wired to the inverter and assembled to the station.

• DC Outdoor stand-alone cabinets

Outdoor disconnection and protection unit that can fit 6 on-load disconnectors, which can be externally activated, 24 independent channels monitoring and a flexible set of fuses. It is suited to Freesun HEC outdoor inverters under harsh weather conditions.

• AC Built in-AC fuses or Circuit breaker

Freesun HE inverters can fit AC fuses or Circuit breaker that protects Freesun inverters from AC shortcircuit.

• Indoor stand-alone AC cabinets

An indoor LV or MV AC cabinet can fit any external relays, breaker and protections required by the utility. Consult Power Electronics.

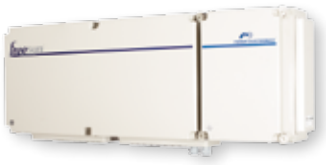
STRING SUPERVISOR BOXES

Considering that large photovoltaic systems are normally connecting in parallel a great number of strings, it can be difficult to detected malfunctions in individual modules. With the STRING SUPERVISOR system developed by Power Electronics, we enhance plant efficiency and module protection by monitoring and protecting from 8 to 24 independent channels. Every string supervisor box is featured with:

- Max. 1000Vdc and compatible with any module.
- Positive and negative poles can be fuse protected.
- Built-in overvoltage protection
- IP65 Robust outdoor enclosure with low maintenance and minimal wear.
- Low stand-by consumption
- RS485 Modbus TCP communication
- Flexible wiring and connection

• SFS 16, 24 String supervisor structure mounted

IEC compliance string supervisor that can monitor from 8 to 24 individual channels. It is suitable to be mounted over the structure of the PV panels..



• SFS 8 String supervisor

IEC compliance string supervisor that can monitor 8 individual channels. Two strings can be combined in a single channel duplicating the box capacity.

Ordering Info & Standards

HE - LVT | Configuration Table

		FREESUN SERIES	
		LVT SERIES	**HE SERIES**
Output Power	0080	80kVA	
	0100	100 kVA	
	...	...	
	1500	1500kVA	
Inverter Location	I	Indoor	
	O	Outdoor	Outdoor HES-S (Standard concrete station)
	R	-	Outdoor HES-R (Reduced concrete station)
	C	-	Outdoor HEC inverter
	P		Outdoor HEC Inverter w/ integrated DC subsystem
	T		Outdoor HET (ISO container station)
	K	-	Outdoor Open Skid station
Topology	T	Low Voltage Transformer (LVT Series)	-
	H	-	IEC High Efficiency Inverter
	U		UL High Efficiency Inverter
	B		UL High Efficiency PCS
	S		IEC High Efficiency PCS
	J	-	JP High Efficiency Inverter
Maximum input voltage	06		600VDC
	09	900VDC	
	10		1000VDC
Isolating monitoring	A	Adjustable isolation between (+), (-) and earth	
	N	Negative of the photovoltaic installation earth connected	
	P	Positive of the photovoltaic installation earth connected	
Lightning and overvoltage protections	N	Without overvoltage protection	
	V	With AC and DC overvoltage protection	
	R	With AC and DC overvoltage protection and lightning protection	
Output voltage	0	-	390VAC - (UL SERIES)
	1	-	360VAC
	2	-	330VAC
	3	-	300VAC
	4	270VAC	
	5	240VAC	-
	6	-	208VAC - (UL SERIES)
	7	-	380VAC (HEC Gen II)
	8	-	400VAC (HEC Gen II)
Auxiliary supply	N	Not included	
	F	With auxiliary 24VDC power supply for String Supervisor 8 (SFS08)	
Humidiy Control	N	Not included	
	R	With heating resistors	
	A	Active Heating	
Medium Voltage Output	15	-	15kV
	20	-	20kV
	22	-	22kV
	24	-	24kV
	30	-	30kV
	33	-	33kV
	36	-	Under request [1]
MPPt Configuration[1]	1	-	1MPPt
	2	-	2MPPt
	...	-	...
	10	-	10MPPt
Other	I	-	Left side - AC module
	..	Under request	

EXAMPLE
CODE: **FS 0100 C H 10 A N 2 N N - 2**

NOTES [1] The maximum number of MPPt´s depends on the number of modules implemented in each inverter with a maximum of one or two MPPt per module. This is an optional kit configured according to the MPPt number and Inverter Serie.

HE - LVT | Standards

FREESUN HE, HES, HEC

		HE-HEC SERIES
REGULATIONS	CE conformity	LVD Directive 2006/95/CE - EMC Directive 2004/108/CE
	EMC	EN 61000-6-2,-4; EN 61000-3-4
	Safety	EN 62109-1,-2 (Certified by SGS) ; EN 62271-202, -200 [1]
	International Standards	IEC 62109-1; IEC 62109-2; IEC 62116 (Anti Islanding)
	Grid Connection	
	Germany	BDEW MV Guideline
	Spain	RD 1699/2011, P.O. 12.3,
	Italy	CEI 0-16 [2]
	France	Arrêté du 23/04/08
	Romania	ANRE Interconnection Code
	United Kingdom	G59/3 [3]
	Israel	IEC (Israel Electrical Company) listed
	Puerto Rico	PREPA Technical Requirements
	South Africa	RSA Renewable Grid Code
	Mexico	General requirements for National Electric System connection
	Hawaii	Heco Technical requirements
	Other countries and regulations	Consult Power Electronics

FREESUN HEC-UL

		HEC-UL SERIES
REGULATIONS	Safety	UL 1741; CSA 22.2 No.107.1-01 [4]
	Utility Interconnect	IEEE 1547
	Grid support (optional)	LVRT, Active & Reactive Power Control, etc.
	Efficiency	CEC testing

FREESUN LVT

		LVT SERIES
REGULATIONS	CE conformity	LVD Directive 2006/95/CE; EMC Directive 2004/108/CE
	EMC	EN 61000-6-1,-2,-3,-4; EN 61000-3-4; EN 61000-3-12
	Safety	IEC/EN 62109-1 (Certified by TÜV); IEC 62109 -2
	Grid Connection	
	Germany	VDE-AR-N 4105
	Spain	RD 1699/2011, P.O. 12.3
	Italy	CEI 0-21
	France	UTE C-15-712-1
	United Kingdom	G59/3
	Israel	IEC (Israel Electrical Company) listed ; >51kW
	Other countries and regulations	Certificate VDE 0126-1-1, Consult Power Electronics.

Factory inspection by AENOR and CSA

NOTES

[1] Applicable for medium voltage side HES series.
[2] For the entire fulfilment of regulation CEI 0-16 it is required to add the following external protection devices approved by ENEL.
• General Protection Device (according to DK 5600)
• Interface Protection Device (according to DK 5740)
The customer is responsible of both the correct selection and installation of these devices.
[3] For the entire fulfillment of regulation G59 it is required to add external hardware that are not PE scope of supply. The client is responsible of both the correct selection and installation.
[4] On certification process.

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BAUART GEPRÜFT

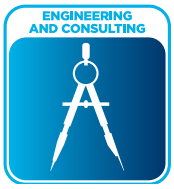
TYPE APPROVED

SGS

Power On Support

POWER ON SUPPORT is the concept which explains the customer oriented strategy implemented by Power Electronics since its origins more than 25 years ago. We do not simply consider ourselves an advanced power electronics manufacturer, but a service company which takes care of all our customers' needs and adapt to their requirements.

We know that each location, project and client is different, that's why Power Electronics addresses each single request by customizing modular services comprising warranty extensions, maintenance and spare parts contracts. This document explains the available service packages that aim to get the maximum yield and reliability for your facilities.



ENGINEERING SUPPPORT

Power Electronics offers pre-sales support to EPCs, developers, operators and investors, because our success is based on your satisfaction. Power Electronics customizes our products to comply with your stringent requirements, thanks to the vertical integration of our production line and our dedicated engineering department.

Power Electronics supports you during the whole documentation submission process and factory acceptance test protocols. Power Electronics helps you during all the project stages to get all the work done on time.

FREE COMMISIONING

Power Electronics includes free equipment commissioning in every proposal worldwide, covering: correct installation, correct AC, DC and data cabling, communications tests, and inverter parameters setting. Power Electronics personnel start the inverters and train the operator(s) on the basic inverter parts and relevant settings. No matter the time or the units, because we believe in a well performed job.

COMPRENHENSIVE 5 YEAR FACTORY WARRANTY

Power Electronics offers 60 months factory warranty from the date of commissioning (Annex I). Power Electronics will repair the defective parts, if feasible, within the next 24h or 48h (depending on the country) after the client's notification without any cost to the client. The factory warranty covers Power Electronics costs for labor and materials necessary to reestablish trouble free operation. Additionally Power Electronics warranty includes free of charge:

- 24/7d Remote monitoring & customer support
- 24h/7d on-site technical service

6-10 YEAR FACTORY WARRANTY EXTENSION PACKAGES

Power Electronics offer 60 months extension factory warranty packages with a maximum of 25 years from the date of commissioning. The extension warranty will be invoiced yearly and covers the services described in the general factory warranty.

24h/7d REMOTE MONITORING & CUSTOMER SUPPORT

Power Electronics offers real time remote monitoring and assistance. Experience engineers from our HQ in Valencia will detect and aware you from premature failures or inverter underperformance. We are willing to get the maximum yield to those who trust us.
This service is complimentary during warranty period.

24h/7d ON-SITE TECHNICAL SERVICE

Power Electronics does not have customer categories or preferred areas we offer an on-site service response within 24h/7d given by Power Electronics trained personnel when a remote assistance is not enough. The on-site technical assistance covers Power Electronics costs for labor and materials necessary to reestablish trouble free operation.
This service is complimentary during warranty period.

MAINTENANCE CONTRACT

To extend the end of life of the inverter, Power Electronics offers a maintenance plan that includes components replacement and cleaning, firmware update and inverter inspection. Maintenance contracts are agreed and customized to the possibilities of the client and the PV plant location.

SPARE PARTS WARRANTY

Be confident over the entire PV plant life cycle, Power Electronics offers under the period agreed floating and updated spare parts stock. The scope of the spare parts warranty includes the equipment listed in Annex III, exworks conditions and a shipping time from 24h-48h that can differ depending on the location. Labor cost are not included if the warranty of the equipment is expired.

99% INVERTER TECHNICAL AVAILABILITY

Power Electronics offers 99% inverter technical availability contracts services free of charge. Our unique inverter topology, manufacturing quality controls and 24/7d on-site repair service make it possible.

If required, Power Electronics will deliver an annual report evaluating the technical availability by Power Electronics..

References

Wietzendorf - Naundorf (Germany)
FREESUN HES 5MW

Great Glemham (United Kingdom)
FREESUN HEC 17.6MW

Marley Thatch (United Kingdom)
FREESUN HES-R 6.2MW

Marino Pole,
Blagoevgrad (Bulgary)
FREESUN HEC 8MW

Los Puquios SPA (Chile),
FREESUN HEK 2.8MW

Zouerate (Mauritania),
FREESUN HET 3MW

Kladruby (Check Republic)
FREESUN HEC 3.8MW

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Warranty

POWER ELECTRONICS guarantees supply against any anomaly which can be directly and exclusively attributed to design, fabrication, manufacture or material defect, thus in case those faults or defects are identified before the end of warranty, POWER ELECTRONICS undertakes to repair them in a maximum time span of 24/48h. POWER ELECTRONICS provides its clients with a 24h/365 days a year technical service. Lacking a specific agreement in particular terms, the period of the warranty is of FIVE years. In application of that warranty, POWER ELECTRONICS commits to repair or replace the faulty parts. The client must communicate to POWER ELECTRONICS immediately any obvious defect, describing its nature in detail and allowing POWER ELECTRONICS to control and correct this fault. The possible expenses caused by transport, customs, expenses, etc and those related to dismounting and assembling the corrected or substituted part, will be covered by POWER ELECTRONICS, except in those cases in which the client whishes to carry out those tasks with the previous approval by POWER ELECTRONICS, which no cost for the manufacturer.

The warranty will only be valid when the transport, storage, assembly, installation, commissioning, functioning and maintenance in the delivery have all been carried out correctly by authorized personnel and in accordance with the enclosed instructions manual. The warranty exclusively includes the repair of defects and/or exchange of faulty parts on our own products. The warranty will be void in normal cases of wear and tear, being ordinary caused by functioning or external causes, or extraordinary caused by an overcharge of work load, wrong use or external causes as can be excessive humidity, dust, corroding products, electromagnetic fields, static energy, fluctuations in the quality of the electrical supply, etc. And, does not cover defects caused by accidents, by transport, inadequate storage or conservation, and in general faults which are not attributable or are out of POWER ELECTRONICS' control.

The client does not have authorization to personally repair, or do so through a third party, nor can he send the equipment to be corrected or replaced, without the specific authorization by POWER ELECTRONICS. The warranty will be void if the client or any third parties make any intervention, modification, or repair without the previous written consent by POWER ELECTRONICS, or if they do not fulfill the immediate requirements to avoid an aggravation of the damage. The warranty will not cover in any case the damage, whether direct or not, to people or objects, and in no case will the faulty equipment include compensation or payment for lack of productivity by the client or by the final user, and this is the only warranty given to the client, substituting any previous mentioned conditions or warranty, both implicit and legal, which have not been expressly accepted by POWER ELECTRONICS. The warranty always frees POWER ELECTRONICS from having to answer to faults which occur after the mentioned period. The repair or replacement of a faulty equipment at arrival will not modify the initial date of the warranty period for the global equipment. The substituted equipment will be property of POWER ELECTRONICS.

Optional additional Warranties

In Power Electronics we believe in the quality and durability of our inverters. That is why we offer an all inclusive 5 year warranty on our equipment. We know that the inverter is the heart of the installation and it must never stop, this is why we have made our top priority to create a strong and competitive inverter and give you the best service and warranty along with it. During those 5 years you won't have to pay any technical service or advice, even when made on site, and this is the best insurance for your investment. Extended warranty packages up to 25 years are also available.

Contact

24H/7D TECHNICAL ASSISTANCE	HEADQUARTERS - VALENCIA - SPAIN
	C/ Leonardo da Vinci, 24 - 26 - Parque Tecnológico - 46980 - PATERNA - VALENCIA - SPAIN Tel. 902 40 20 70 - Tel. (+34) 96 136 65 57 - Fax (+34) 96 131 82 01

	INTERNATIONAL SUBSIDIARIES
AUSTRALIA	• Power Electronics Australia Pty Ltd - U6, 30-34 Octal St, Yatala, • BRISBANE • QUEENSLAND 4207 • P.O. Box 6022, Yatala DC, Yatala Qld 4207 • AUSTRALIA • Tel. (+61) 7 3386 1993 • Fax (+61) 7 3386 1993 **sales@power-electronics.com.au**
BRAZIL	Power Electronics Brazil Ltda - Rua Odeon, 102 - Centro • CEP 09720-290 SÃO BERNARDO DO CAMPO • SP • BRASIL • Tel. (+55) 11 5891 9612 • Tel. (+55) 11 5891 9762 **comercialbrasil@power-electronics.com**
CHILE	• Power Electronics Chile Ltda • Los Productores # 4439 • Huechuraba • SANTIAGO • CHILE Tel. (+56) (2) 244 0308 · 0327 · 0335 - Fax (+56) (2) 244 0395 • Oficina Petronila # 246, Casa 19 - ANTOFAGASTA • CHILE • Tel. (+56) (55) 793 965 **ventas@pech.cl**
CHINA	• Power Electronics Beijing - Room 606, Yiheng Building • No 28 East Road, Beisanhuan • 100013, Chaoyang District, BEIJING - R.P. CHINA • Tel. (+86 10) 6437 9197 • Fax (+86 10) 6437 9181 • Power Electronics Asia Ltd - 20/F Winbase Centre - 208 Queen's Road Central • HONG KONG • R.P. CHINA **sales@power-electronics.com.cn**
GERMANY	• Power Electronics Solar GmbH - Dieselstrasse, 77 • D·90441 • NÜRNBERG • GERMANY Tel. (+49) 911 99 43 99 0 • Fax (+49) 911 99 43 99 8 **info@ped-deutschland.de**
INDIA	• Power Electronics India - N.5, Cunningham Crescent, 1st floor. Bangalore 560052 - INDIA Tel./Fax +91 80 6569 0489 **salesindia@power-electronics.com**
ITALY	• Power Electronics Italia Srl - Piazzale Cadorna, 6 20123 • MILANO • ITALIA • Tel. (+39) 342 50 73 691 **infoitalia@power-electronics.com**
JAPAN	• Power Electronics Japan KK - Nishi-Shinbashi 2-17-2 - HF Toranomon Bldg. 5F 105-0003 • Minato-Ku • TOKYO Tel. (+81) 03 6355 8911 - Fax (+81) 03 3436 5465 **salesjapan@power-electronics.com**
KOREA	• Power Electronics Asia HQ Co - Room #305, SK Hub Primo Building - 953-1 Dokok-dong, Gangnam-gu - 135-270 • SEOUL • KOREA Tel. (+82) 2 3462 4656 • Fax (+82) 2 3462 4657 **sales@power-electronics.kr**
MEXICO	• P.E. Internacional Mexico S de RL - Avda. Tejocotes lote 76 A S/N • San Martin Obispo Tepetlixpa • CP 54763 • CUAUTITLAN IZCALLI • MEXICO Tel. (+52) 55 5390 8818 • Tel. (+52) 55 5390 8363 **ventasmexico@power-electronics.com**
MOROCCO	• Power Electronics - Ekoakua • Geea sarl , N°184 Bloc Hay EL.Massira Aït Melloul •CP 80150 • Agadir • MAROC Tel. + 212 5 28 24 04 57 • Mob. (+34) 628 11 76 72 **ventesmaroc@power-electronics.com**
NEW ZEALAND	• Power Electronics New Zealand Ltd - 12A Opawa Road, Waltham - CHRISTCHURCH 8023 • P.O. Box 1269 CHRISTCHURCH 8140 • NEW ZEALAND Tel. (+64 3) 379 98 26 - Fax.(+64 3) 379 98 27 **sales@power-electronics.co.nz**
SOUTH AFRICA	• Power Electronics South Africa Pty Ltd • Central Office Park Unit 5 • 257 Jean Avenue Centurion 0157 • SOUTH AFRICA Tel. (+34) 96 136 65 57 • Fax (+34) 96 131 82 01 **salesza@power-electronics.com**
TURKEY	• Perpa Ticaret Merkezi A Blok Kat:2 No:9/0034 - 34384 Okmeydanı Şişli • Istanbul • TURKEY Tel: 0 212 221 48 48 (124) • Fax 0 212 221 17 00 **turkiyesatis@power-electronics.com**
UNITED KINGDOM	• Power Electronics UK Pty Ltd· Wells House, 80 Upper Street, Islington London, N1 0NU · 147080 Islington 5 • Tel. (+44) 149 437 00 29 **uksales@power-electronics.com**
UNITED STATES	• Power Electronics USA Inc. • 505 Montgomery Street, 11th Floor San Francisco • CA 94111 • USA Tel. (415) 874-3668 • Fax (415) 874-3001 • Mob.(415) 376-1471 **sales@power-electronics.us**

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