



SESS Energy Storage Solutions





SEAPOWER ELECTRICAL SYSTEMS CO. Inc.

Seapower R&D and Innovation Center, providing critical solutions in the field of power electronics, operates in the shipyard area of Altinova/Yalova on a 10000m2 site.

SEAPOWER, being among the leading organizations in the energy sector with its customer-focused approach and contemporary management understanding, continues its work with a 100% customer satisfaction focus. With a top-quality service approach provided by our expert team, SEAPOWERR aims to offer future-oriented technologies to its customers and to provide solutions for their evolving new technology needs through long-term business partnerships.



Energy Storage for a Sustainable World

Fundamentally, countries worldwide are actively making steps towards creating more energy efficient and yet cleaner cities. As the energy industry moves away from carbon-heavy production, renewable energy and storage is being critical for delivering on the demand while securing the future of world energy and playing a prominent role in a grid that is migrating

to a higher penetration of renewable energy, smarter grids, and flexible grids.

However, high penetration creates power transmission instability challenges, thus Grid Operators require stringent dynamic and static grid support features for Power Conversion Systems.

For the challenge of energy stability, SEAPOW has solutions from kW to MW

For a stable transmission and distribution, the power grid operators need a real-time match between electricity supply and consumption.

Challenges that SEAPOW SESS can address:

- Output variability,
- The temporal (time-related) mismatch between generation and demand,
- Uncertainty regarding weather forecasts, and
- Undesirable electrical effects on the electrical grid caused by some RE generation.

SEAPOW SESS solution offers proven hardware to meet storage and grid support challenges.



SESS - An innovative Energy Storage Solutions for the smart management of electrical grids

SESS is a fully integrated turnkey energy storage solution that are ready for connection to medium-or high-voltage grids and cover a power range of hundreds of megawatts.

SEAPOWER has developed SESS Energy Storage Solutions for on grid and off grid application with typical loads between 400 kW and 1 MW.

The SESS system is fully compliant with grid systems to import and export power inline with the voltage and frequency regulations, FFR and DFFR schemes required by utilities to support the grid. The SESS can be used to support the stabilisation of the grid to manage the consumption and the production of renewable energy.

SEAPOWER SESS can help:



Reduce Fuel Use and carbon dioxide emissions with a greater use of clean electricity powered by wind and solar.



Increase Resiliency manage the intermittence of renewable energy production and improve overall resiliency when the wind does not blow and when the sun doesn't shine.



Improve Power Quality outages or disturbances in the grid, affecting their operation.



Save Money reduce utility bills and generate revenue, avoid costly system upgrades, reduce operating expenses.



Generate Income balancing electricity supply and demand, frequency response, capacity market, increased asset utilization.

Overview

In today's power systems energy storage devices such as new generation batteries, flywheels and super capacitors provide the opportunity to store energy from the electricity grid and return it when required. This offers a huge range of options to strengthen and enhance the performance, quality and reliability of smart electricity grids. Providing the grid connect interface for all types of energy storage devices, the SESS125 is the perfect solution to connect such energy storage devices to the grid.

The SESS125 is based on a LV converter platform especially developed for power quality issues and characterized by wide bandwidth performance and great flexibility thanks to its modular power electronic configuration. It offers two main modes of operation, namely Current Source mode and Voltage Source mode, which enables the SESS125 to cover a wide range of applications and power system requirements. Both modes offer independent control of both real power (P) and reactive power (Q) providing the highest possible flexibility to the operator.

In case the grid supply is lost the system can be set to shut down according to anti-islanding standards or to operate in island mode, where the SESS125 operates disconnected from the main grid but continues to supply local loads. When operating in island mode, the SESS125 can automatically re-synchronize the islanded network with the main grid, allowing a seamless transfer back to grid connect mode.

User Benefits

- Supports power system load levelling and thus helps defer network and generation investment
- Increases network stability and transmission capacity and thus facilitates increased use of renewables
- Delivers grid compliance for renewable and other generation systems
- Damps disturbances and oscillations in critical system configurations
- Modular design for highest availability
- Based on LV converter platform especially developed for power quality issues

Features

- Modular design providing high reliability and typically 30 minutes mean time to repair (MTTR)
- Grid fault detection
- Islanding and anti-islanding options
- Ratings from 100 kVA to 4000 kVA and voltages from 150 Vac to 480 Vac
- Allows a range of energy storage devices to be coupled to the grid
- Dynamic real power control (P)
- Dynamic reactive power control (Q)
- Voltage and frequency dynamic envelope/regulation functions
- Voltage clamping for reactive power grid support

Applications

- Load levelling for optimized generation utilization
- Spinning reserve in case of line loss
- Frequency regulation
- Peak shaving (end user)
- Micro grids, Islanding and Anti-Islanding

Number of Power Modules



SESS125
Power Module

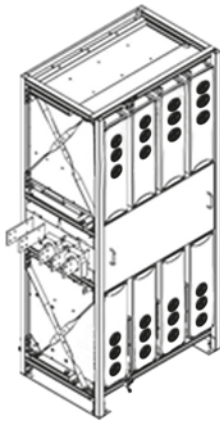
This is the number of modules used in the SESS125 system, which depends on the load kVA. One SESS125 cabinet can have up to 6 or 10 SESS125 power modules and one SESS125 rack converter up to 32 modules. In case a bigger system is required multiple SESS125 can be connected in parallel. In this case, the units must be tied together with separate transformers or multi-winding transformers.

SESS125 Model Range

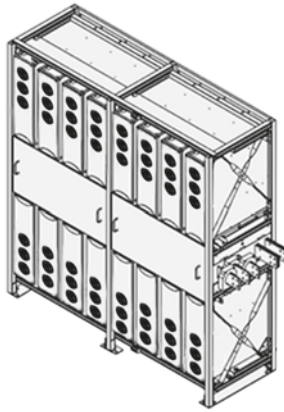
The model ratings of the SESS125 are defined by the number of power modules used to construct the system.

The SESS125 product range is summarized in table below.

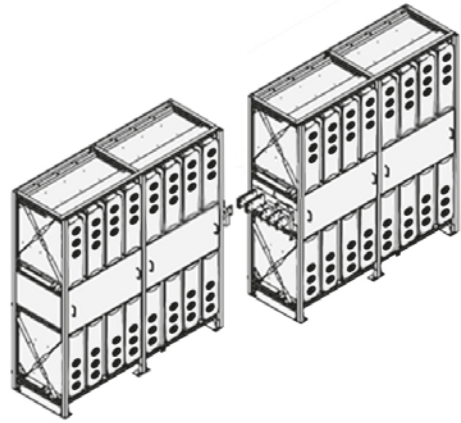
The ratings are given for a typical SESS125 system under nominal conditions.



8-Modules Rack Section



16-Modules Rack Section



32-Modules Rack Section

SESS125 Modules

The SESS125 modules are the link between the energy storage and the main grid. They present a regulated three phase AC voltage (in VSI mode) or a regulated three phase AC current (in CSI mode) to the grid and transfer power from the grid to the energy storage and vice versa.

As shown in Figure, the SESS125 modules include a sine filter and a RFI filter as part of the assembly, meaning the power electronics and filters are integrated into one module. Thanks to this and the use of state of the art IGBT technology the SESS125 modules have minimum impact on power quality of the supply network (harmonics and power factor). They are delivered in the compact package shown in Figure.

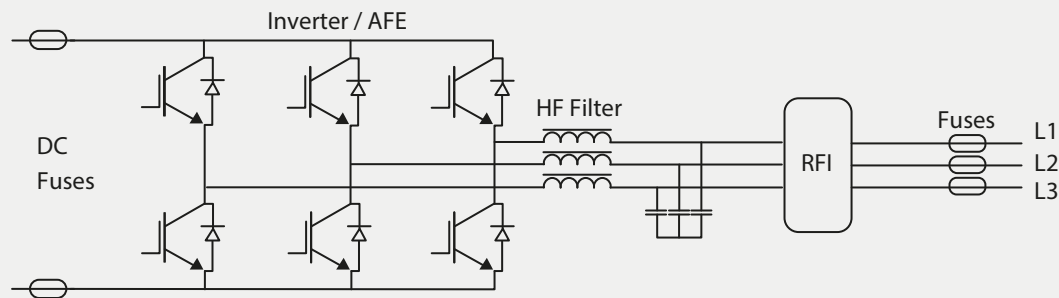


Diagram of a SESS125 Module

Number of Mod-Ules	Dimensions H x W x D (mm)	Weight (kg)	Rated Current Iac (A)	Heat Dissipation kW (Typical)	Airflow (m3/min)
1	1952x906x809	330	150	2.3	20
2	1952x906x809	410	300	4.5	40
3	1952x906x809	490	450	6.8	60
4	1952x1355x809	560	600	9.0	80
5	1952x1355x809	630	750	11.3	100
6	1952x1355x809	700	900	13.5	120
7	1952x1355x809	770	1050	15.8	140
8	1952x1355x809	840	1200	18.0	160
9	1952x1355x809	1020	1350	20.3	180
10	1952x1355x809	1080	1500	22.5	200
11	1952x2261x809	1150	1650	24.8	220
12	1952x2261x809	1220	1800	27.0	240
13	1952x2261x809	1300	1950	29.3	260
14	1952x2261x809	1370	2100	31.5	280
15	1952x2261x809	1710	2250	33.8	300
16	1952x2261x809	1780	2400	36.0	320

Number of Mod-Ules	Dimensions H x W x D (mm)	Weight (kg)	Rated Current Iac (A)	Heat Dissipation kW (Typical)	Airflow (m3/min)
17	1952x2710x809	1850	2550	38.3	340
18	1952x2710x809	1920	2700	40.5	360
19	1952x2710x809	1990	2850	42.8	380
20	1952x2710x809	2070	3000	45.0	400
21	1952x3616x809	2140	3150	47.3	420
22	1952x3616x809	2210	3300	49.5	440
23	1952x3616x809	2280	3450	51.8	460
24	1952x3616x809	2350	3600	54.0	480
25	1952x3616x809	2520	3750	56.3	500
26	1952x3616x809	2590	3900	58.5	520
27	1952x4065x809	2660	4050	60.8	540
28	1952x4065x809	2730	4200	63.0	560
29	1952x4065x809	2800	4350	65.3	580
30	1952x4065x809	2870	4500	67.5	600
31	1952x4971x809	2940	4650	69.8	620
32	1952x4971x809	3010	4800	72.0	640

Features

- Modular, flexible and scalable up to hundreds of MW
- Plug-and-play containerised design saving time and cost with minimum deployment time
- Fully integrated turn key solution for smart energy management
- Compatible with different battery technologies

Specifications

	20ft Container	40ft Container	Containers in paralel
			
Maximum Capacity	362 KWh/ 456 KWh	1 MWh/ 1.16 MWh	
System Contents	• Power Converter/Freq. Converter etc. • Genset • Main AC In/Out Electrical Panel • Internal AC Distribution Electrical Panel • Battery Breaker Panel • AC Aircon • Battery • Environment Control system • Fire detection and protection • Digital Power and Switchgear Controls		

Bi-Directional Power Converter

With SEAPOWERS ESS Bi-directional Power Converter, SESS has dual-function storage capability which enables the energy available during the day to be stored in cyclic batteries, then converted and fed back into the network as usable AC current that is injected into the grid.

SEAPOWERS ESS Bi-directional Power Converter is capable to manage energy supply to meet demand and can be programmed to operate according to a charging and discharging schedule settled in advance by the national utility provider.

SEAPOWERS ESS provides and outstanding conversion efficiency factor for both charging and discharging phases. Thanks to its wide DC input range, it can be used with all battery technologies.

- High Efficiency: 98%
- Wide Battery DC Voltage Range
- High Power Density in Outdoor Application
- Quick Power Transfer/System Response Time (<40ms)
- Integrated AC and DC Switches for Easy Installation and Maintenance
- Black Start and Off-Grid Options for Power Back Up and Microgrid Applications

Multi Grid Support Functions:
 Demand Charge Management (Peak Shaving)
 Load Shifting (Time-Of-Use Optimization)
 Grid Ancillary Service (Frequency Regulation and Voltage Support)
 Power Backup for Grid Power Outage Situation

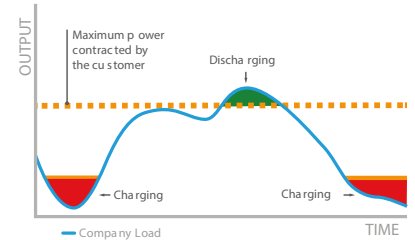
MODEL RANGE	
AC Rating	150A – 4800A
UTILITY SIDE (AC)	
Rated Voltage	150 - 480 V
Voltage Tolerance	± 10%
Nominal Frequency	50 Hz or 60 Hz
Frequency Tolerance	±5%
Power System	3-Phase Center Ground Referenced (TN-S) - Coupling Transformer Required ¹ 3-Phase Floating System (IT) - Insulation Monitoring Required ² 3P or 3P 4W
Overvoltage Category	III – 4kV (IEC 60664)
Fault Capacity	25 kA (Vabinet), 65 kA (Rack)
Overload Capability	200 % for 2 Seconds ¹ 150 % for 30 seconds 120 % for 600 Seconds ¹
Circuit Protection	Circuit Breaker or Fuse (Not Included)
Voltage Harmonic Compatibility	IEC 61000-2-4 Class 2 (Utility THDv <8%)
Power Module Volt. Harmonic Distortion	THDv <2.5% for Linear Loads
ENERGY STORAGE SIDE (DC)	
Rated Voltage	±125Vdc up to ±410Vdc (Single 250 up to 820 VDC - Dual 1500 VDC)
Supply Earth Referencing	DC Center Referenced
Overvoltage Category	II (IEC 60664) 4kV
Maximum, Voltage to Ground	±600Vdc
Circuit Protection	Circuit Breaker or Fuse (Not Included)
STANDARDS AND CERTIFICATIONS	
Quality	ISO 9001
Marking	CE
Safety	IEC 62040-1
Electromagnetic Compatibility	IEC 62040-2
ENVIRONMENTAL	
Operating Temperature Range	-20°C to 55°C
Temperature Derating	Above 40°C, Derate at 2% Load Per °C
Operating Altitude	< 1000 m Without Derating
Capacity Derating With Altitude	1% Every 100 m Above 1000 m, 2000 m Maximum
Inverter Cooling	Forced Ventilation
Humidity	< 95%, Non-Condensing
Pollution Degree Rating	2
Noise	< 80 dBA @ 2 m Note: Average From Measurements Taken All Around Of a 32 Modules Rack @ Fully Loaded.
PROTECTION RATING	
Rack/Cabinet Rating	IP20 / NEMA 1 Note: On Rack Systems, The IP Rating is Characterized By The Inverter Modules Only. Final Protection Degree Dependent On Application.
SERVICE	
MTTR	30 Min Typical By Module Exchange
Diagnostics	Non-Volatile Event & Service Log
USER INTERFACE	
User Interface	7.0" Color Touch Panel
Touch Panel	Full Parameter Control, System Event Log
Control Inputs	5 Digital Inputs 24 Vdc (<50ms) 1 High Speed Digital Inputs 5 Vdc (<100us) -Star/Stop/EPO 2 Analog Inputs On The Extended I/O Board -10...+10 V Resolution 0.1%, Accuracy ±2% 3 NTC inputs
Control Outputs	5 Digital Relay Outputs, 250 V/1~, 30 Vdc (1 A)
Communication	Ethernet Modbus TCP/IP RS485, Modbus RTU

Peak Shaving



With peak shaving, the energy is stored during periods of low demand (overnight, troughs in the day) and discharged during periods of high demand when the monthly peak consumption could be set. Given the anticipated cycling, duration and power needs of peak shaving, energy storage is very effective. The higher the peak related to the duration of the peak, the better the energy storage economics.

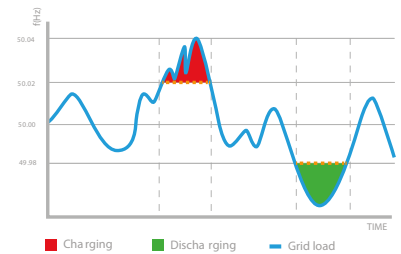
Applications



Frequency Regulation



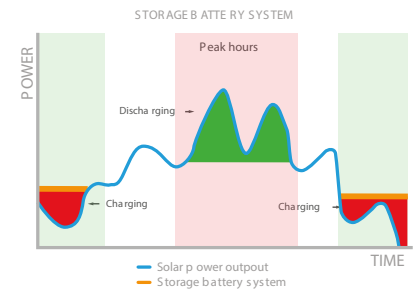
SESS Demand Response Module provides ability to regulate grid frequency in both directions. When there is a grid over frequency (generation > demand) inverter power output is curtailed and this energy is stored. When there is a grid under-frequency (generation < demand) inverter power output is increased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



Load Levelling



Load levelling is similar to peak shaving but is focused on reducing the kWh costs on a utility bill, and effectively captures the difference between buying energy at low prices and discharging at higher prices. Load levelling typically provides incremental value to a system that is providing other functionality like peak shaving.

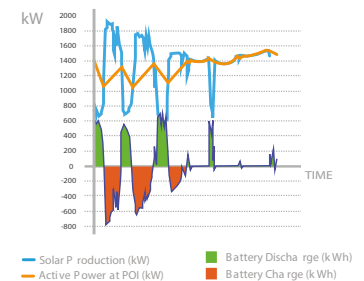


Renewables Capacity Firing / Ramping



Capacity firing is the conversion of available uncontrolled random power from renewable sources, into "dispatchable power" with an agreed level and duration which can be committed as part of the utility's generating assets.

SEAPOWER Energy Storage Solutions attenuates the intermittent nature of renewable energy sources, to provide a smoother power output. SESS controls the ramp rate at which power is injected into the grid, and thus reduces the impact of rapid power fluctuations due to sudden or transient conditions experienced by the PV array.



Power Quality



Facility load power factor can cause power quality issues. Often demand charges are related to facility loads with low power factor, when a higher cost is paid for lower power factor. An energy storage solutions can improve the facility power factor, improve power quality and save money on utility bills

mt *CONVERTER*

mt *TRANSFORMER*

mt *UPS*

mt *CHARGER*



SEAPOWER ELECTRICAL SYSTEMS CO. Inc.

FACTORY: Hersek Mah. Halil İnalçık Cad. 4. Sok. No:5 Altınova – Yalova – TÜRKİYE T:+90 226 531 07 32

ISTANBUL OFFICE: Aydıntepe Mah. Sahil Bulvarı No:191/39 Tuzla – İstanbul – TÜRKİYE T:+90 216 494 62 07

info@seapower.com.tr

www.seapower.com.tr