



geniol[®]
smart energy storage

genport
Power solutions

Geniol® Battery Energy Storage Series

GENIOL® is a modular high energy density lithium ion rechargeable Battery Energy Storage System (BESS) designed to be a longer-lasting replacement of lead acid batteries.

GENIOL® is an advanced configurable storage system suitable to maximize the use of energy generated by Renewable Energy Systems (RES).

GENIOL® is a smart energy storage system that minimizes the cost of backup power.

Its high energy density, long life, broad operating temperature range and multiple independent safety features improve performances and reduce total cost of ownership (TCO) in telecom, industrial and residential applications.





Applications

- Base Transmitting Station, Telecom Tower grid outage backup
- Residential, Hospital, Commercial Buildings
- Off-grid Agriculture Power Sources
- Military, Emergency Energy Storage Deployment
- Smart grid stabilization
- Distributed Energy Storage Application.

Main Features

- Designed in Italy
- Dual position case (horizontal & vertical)
- 19" standard compact layout
- Multiple Charge Option AC/DC
- Modular concept for increased scalability and redundancy
- Improved reliability in off-grid

- Zero environmental emissions, reduced lifecycle footprint
- Reduced weight and dimensions
- Optimized CAPEX
- Lowest off-grid Cost of Energy
- Simple installation, reduced maintenance
- Improved renewable power factors
- Increase overall micro-grid resilience
- Improve quality power
- Superior Li-ion battery technology
- Cell design with multiple, independent safety features
- Excellent calendar and cycle life
- Round trip efficiency greater than 95%
- Sophisticated Battery Management System implemented both at module and system levels
- Predictive energy management embedded into GenScada System
- Web monitoring, remote diagnostic and maintenance thru GenScada System
- Extremely low maintenance
- Plug & play installation

Battery Management System

- Patented Power Electronic Circuit (Patent Pending Nr. 102016000002586)
- Three battery management levels: battery module and battery system
- Full array of programmable protection features: voltage, current and temperature
- State of Charge measurement with better than 1% accuracy over battery life time
- Lifetime data logging
- Alarms and faults managements
- State of Health
- Battery module charger embedded
- Accurate active balancing charge and discharge
- Modbus serial bus communication between all battery modules and to the system level battery management
- Active balancing of state of charge between modules.

Safety

Redundant and independent safety features at cell level (Current Interrupt Device, twofold vents), at module level (logic fuse, voltage, current, temperature and balancing) and at system level (fuse, contactor, current sensor and disconnect switch).

Storage

Storage temperature	-40 to 60 °C
Storage time w/o check SOC (*)	6-8 months
Maximum altitude	3000 m a.s.l.
Maximum relative humidity	95% (not condensing)

Compliance international Standards

Cell safety	UL 1642; IEC 62133
Battery System Safety	IEC 62619
Electrical safety	IEC 60950
EMC	EN 55022; EN 61000
Marking	CE
Transport	UN 3480

Cell Cycle Life

GENIOL® guaranties the highest lifetime by controlling the optimal end of charge voltage and depth discharge (DOD).

Therefore, the overall Total Cost of Ownership (TCO) of GENIOL series is lower then traditional Acid Lead and LiFePO4 Batteries.

GENIOL® series is based on Boston-Power's Swing 5300 which has the highest usable energy density combined with a longer cycle life at broad operating temperatures and unmatched safety features. It is ideal for Stationary Energy Storage. Boston-Power's Swing® 5300 high density lithium-ion cell offers industry-leading performance for applications that value wide operating temperature (-40°C to 70°C), long cycle life (>1000 at 100% DOD, >3000 at 80% DOD), fast charge capability and unmatched safety features.

(*) After a prolonged storage period (6-8 months), it's recommended to check the SOC (State of Charge) of the battery and proceed to recharge the battery up to 50% of SOC. This procedure will guarantee the optimal state of health of the battery.

GENIOL® - Technical Specification

Product name	Geniol 3100	Geniol 6200	Geniol 9300	Geniol 12400
Nominal Voltage (Vdc)	51,10			
Capacity (0.2C, 100% DOD) at +25°C (Ah)	62	124	186	248
Rated energy (0.2C) (Wh)	3.100	6.200	9.300	12.400
# Strings (3.100 Wh)	1	2	3	4

Mechanical Specification

Width (mm)	495			
Height (mm)	222	445	667	889
Depth (mm)	450			
Weight (Kg)	30	60	90	120

Electrical Specification

Voltage Discharge Range (Vdc)	40 - 57.5			
Max Continuous Discharge Current (A)	30	60	90	120
Max Continuous Discharge Power (W)	1.710	3.420	5.130	6.840
Max Pulsed (2s) Current (A)	45	90	135	180
Voltage AC Charge (Vac) - Optional	110 - 220 @ 50 - 60 Hz			
Voltage DC Charge (Vdc)	36 - 75			
Max Continuous Charge Power (W)	800	1.600	2.400	3.200
Max Continuous Charge Power (W) - Optional	1.550	3.100	4.650	6.200

Operating conditions

Operating temperature	-20 to 60 °C
Operating Ambient Relative Humidity (*)	5% to 95% n.c. without heater 2% to 100% (with internal heater + hygrostat)
Round trip efficiency	>95%
Calendar lifetime at +25°C	>10 years
Cycling lifetime at 80% DOD	>10K cycles
Cooling	Natural/Forced convection

(*) An anti-condensing heater with a hygrostat device can optionally be installed inside the battery cabinet to prevent condensation and extend the operation of the battery at ambient relative humidity from 2% to 100%.

Reliability

- **Cells.** Cell design incorporates multiple independent safety features that activate at precise trigger points. One of the safety devices is the integrated Current Interrupt Device (CID), which electrically disconnects the cell if internal pressures get too high. The CID is located inside the aluminum can, away from the vents for greater reliability.
- **Li-ion storage module** (either 4S6p or 3S6P). Each module is extremely reliable and robust. A total of four modules are connected in parallel among the two racks. Even in case of failure of one module, the output power and capacity is still 75% of the total available. The failure alarm signal is in real time detected remotely by GenScada.
- **DC/DC converter.** Each DC/DC converter supplies the recharge power to two modules in parallel. Each DC/DC has an MBTF of 1.5×10^6 hours. Even in case of failure of one DC/DC converter the remaining operating rack can still work at its nominal power both in charge and discharge. The failure alarm signal is in real time detected remotely by GenScada.
- **RTU.** The RTU has been designed to operate in harsh environment based on an extremely reliable and robust HW architecture. Even in case of failure of the RTU the discharge operation is still guaranteed at full power. The failure alarm signal is in real time detected remotely by GenScada.

An aspect that favors greatly the reliability of the Geniol as back up system is that it's not in function 24/7 but only when there is a grid outage (a few times per year). When the grid is on Geniol remains idle and only the remote communication is functioning. Geniol has negligible self-discharge rate compared to Lead Acid batteries. This has a relevant impact in terms of reduced cycles to keep the battery full charged and therefore this improves reliability.

As energy storage system Geniol can be cycled more than 10.000 time; if combined with a RES system, Geniol is cycled on average around 350 time each year; consequently the BESS preserves its feature for a long time.

Anti Theft Feature

An antitheft feature is provided inside Geniol. In case a thief wants to steal the battery pack, first he would need to disconnect all the cables from the rack front panel. Doing so he triggers an internal routine that will permanently block the battery disconnecting the battery voltage from its output connector. It will be necessary to send from remote an unblock command to enable the battery usable again.

Charge Control

Geniol embeds an **advanced charge control** function of the battery. This regulation is an important feature of Geniol. It either **maximizes** the fraction of intermittent energy generated by the primary renewable energy source (e.g. Photovoltaic, Wind Turbine) or **adjusts** the charge power to provide flexibility services in micro-grid electrical systems and energy balancing in off-grid systems.

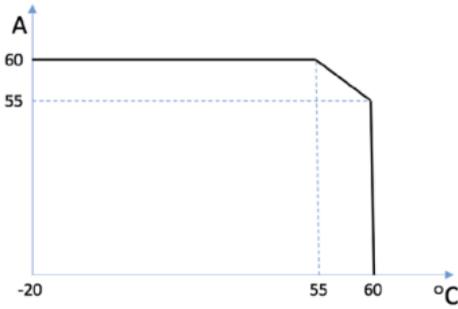
The charger control is implemented thru **two internal parameters**: the first is utilized by the MPPT to **maximize** the power of RES; the second parameter can be eventually utilized by an Energy Management Systems (EMS) to enable dynamically the adjustment of the charging power for **flexibility and balancing services**.

There are two options to manage the communication among Geniol, Inverters and EMS:

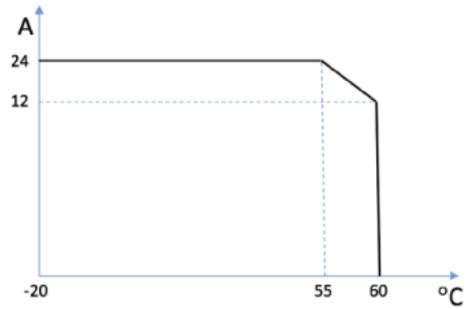
- **Modbus TCP/IP** (Geniol acts as Slave).
- **Analog input 0-5 V** to fast regulate the charge current.

Geniol 6200

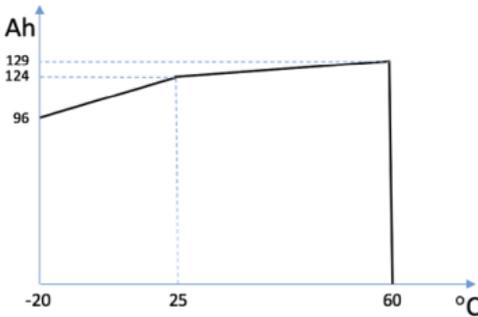
Charge and Discharge Current and Capacity versus Temperature.



Battery Discharge Current vs Temperature



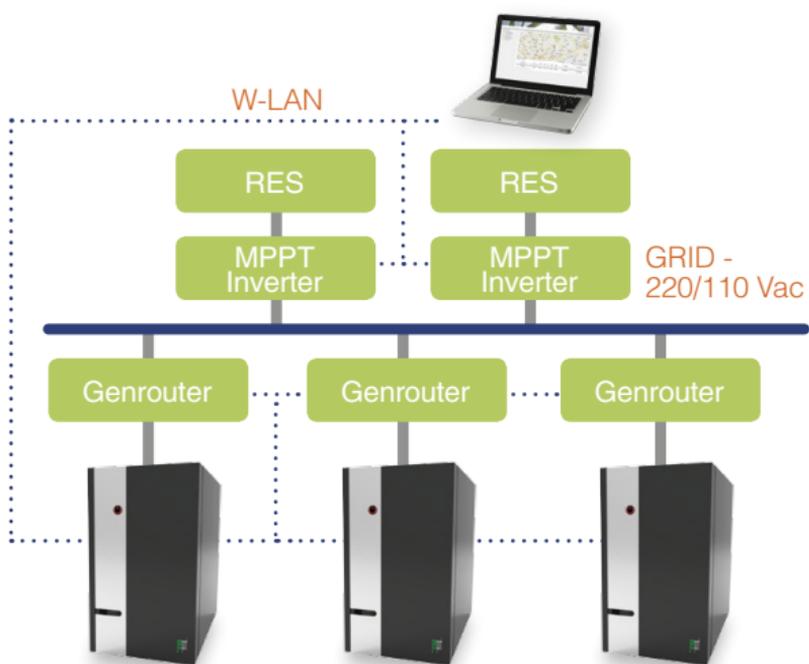
Battery Charge Current vs Temperature



Battery Capacity vs Temperature
(Discharge from 57.5V to 40V, 0.2C, 100% DOD)

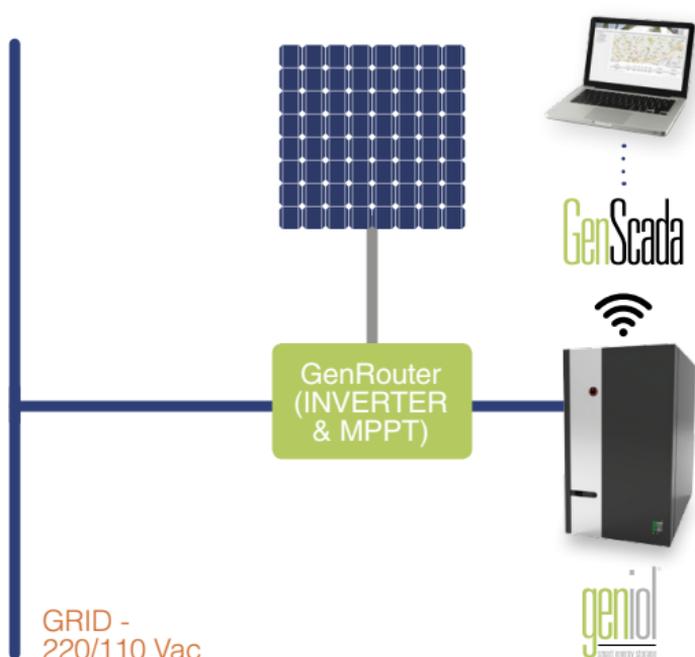
Distributed battery Energy Systems

- Centralized, Remote Management, Local Slave Management embedded into smart inverter
- Modular and scalable configuration up to dynamic and controlled requirements of grid parameters (V, f)
- Distributed architecture vs. centralized maximizes reliability and safety
- GENIOL modular concept enables flexible cost structure.



Power Line Connection

- Easy to interconnect with the power line in grid connected and off-grid thru commercial converter (SMA) and GenRouter (2017)
- Configurable Energy Module based on local statistical environmental irradiation and wind speed conditions allow to reduced CAPEX
- Reduced Levelized Cost of Energy (LCOE) due to GENIOL long lifetime and high Round Trip Efficiency.



GenScada Remote Man Machine Interface

GenScada is an advanced easy to use web scada application enabling a secure supervision and advanced control of Geniol installed in different remote locations.

An HMI apps downloaded into your smartphone enables to achieve a great and easy visibility of all the key process variables and performance. A powerful and easy to use Human Machine Interface (HMI) manages the complexity of the Geniol Battery Energy Storage System and lets you securely achieve greater visibility of its operations – all your graphics, performance, alarms and trends – from any location available in the palm of your hand.

GenScada saves travel cost by enabling the most suitable resource from any location to securely and instantly visualize, analyze and manage operations, diagnostics and maintenance-free, secure web-enabled HMI.

Installation and access

GenScada is an **Internet of Things** web application accessible thru any browser and PC thru the following address:

www.genscada.com.

The access is provided with username and password issued by Genport during the delivery of the Geniol. The profile of the user and the battery is configured in our factory. During the installation only the IP address has to be configured and then Geniol is ready to be interconnected to GenScada. An user-friendly dashboard allows to visualize in real time a wide variety of electrical parameters and diagnostic alarms.

Log of these data can be sorted and downloaded in different file format (excel, csv, pdf) or printed.

Alarm Management

Alarms are logged and visualized in a dedicated graphic page.

Active alarms are events out of a normal operating condition or events that are going to become out of a normal operating condition.

Non-active alarms are events that have returned within normal operation and acknowledged. The active alarms are prioritized in different categories (critical, non-critical and warnings).

Each category of *active alarms* is visualized with different color: red (critical), green (non-critical), yellow (warnings).

Each *active alarm* should be acknowledged by ticking the relevant check box.

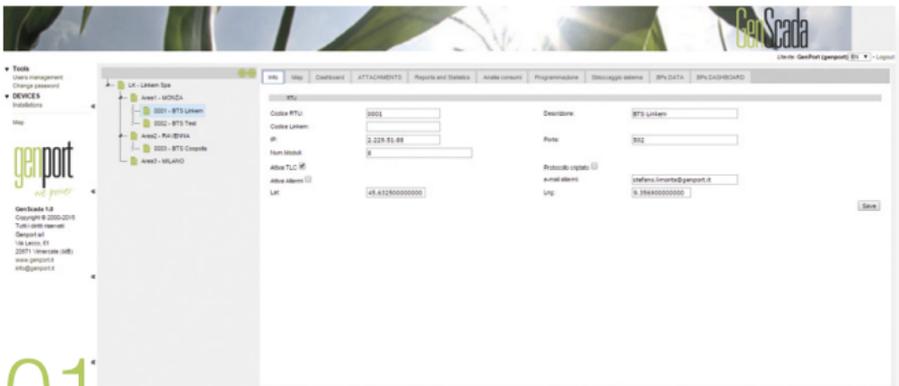
The Log of the alarms can be downloaded for reporting.

Tip. ES	Stato	Data/ora in.	Data/ora cess.	Stato attuale	Cod. ES	Descr. ES	Cod. ES	Descr. ES	Fase	Impulsi	Val. misurato
	<input type="checkbox"/>	05/03/2015 12:35		ATTIVO	259	Allarme per mancata comunicazione con il modulo palo.	L01857	FSVEP PHOS - 40 LED 700mA 80W		0.00	0.00
	<input type="checkbox"/>	05/03/2015 12:33		ATTIVO	259	Allarme per mancata comunicazione con il modulo palo.	L01870	FSVEP PHOS - 40 LED 700mA 80W		0.00	0.00
	<input type="checkbox"/>	05/03/2015 12:36		ATTIVO	259	Allarme per mancata comunicazione con il modulo palo.	L01859	FSVEP PHOS - 40 LED 700mA 80W		0.00	0.00
	<input type="checkbox"/>	05/03/2015 12:36		ATTIVO	259	Allarme per mancata comunicazione con il modulo palo.	L01872	FSVEP PHOS - 40 LED 700mA 80W		0.00	0.00
	<input type="checkbox"/>	05/03/2015 12:36		ATTIVO	259	Allarme per mancata comunicazione con il modulo palo.	L01899	FSVEP PHOS - 40 LED 700mA 80W		0.00	0.00
	<input type="checkbox"/>	05/03/2015 12:36		ATTIVO	259	Allarme per mancata comunicazione con il modulo palo.	L01894	FSVEP PHOS - 40 LED 700mA 80W		0.00	0.00
	<input type="checkbox"/>	05/03/2015 12:36		ATTIVO	259	Allarme per mancata comunicazione con il modulo palo.	L01901	FSVEP PHOS - 40 LED 700mA 80W		0.00	0.00
	<input type="checkbox"/>	05/03/2015 12:36		ATTIVO	259	Allarme per mancata comunicazione con il modulo palo.	L01909	FSVEP PHOS - 40 LED 700mA 80W		0.00	0.00
	<input type="checkbox"/>	05/03/2015 12:36		ATTIVO	259	Allarme per mancata comunicazione con il modulo palo.	L01910	FSVEP PHOS - 40 LED 700mA 80W		0.00	0.00
	<input type="checkbox"/>	05/03/2015 12:36		ATTIVO	259	Allarme per mancata comunicazione con il modulo palo.	L01912	FSVEP PHOS - 40 LED 700mA 80W		0.00	0.00
	<input type="checkbox"/>	05/03/2015 12:36		ATTIVO	259	Allarme per mancata comunicazione con il modulo palo.	L01920	FSVEP PHOS - 40 LED 700mA 80W		0.00	0.00
	<input type="checkbox"/>	05/03/2015 12:36		ATTIVO	259	Allarme per mancata comunicazione con il modulo palo.	L01927	FSVEP PHOS - 40 LED 700mA 80W		0.00	0.00
	<input type="checkbox"/>	05/03/2015 12:36		ATTIVO	259	Allarme per mancata comunicazione con il modulo palo.	L01930	FSVEP PHOS - 40 LED 700mA 80W		0.00	0.00

Alarm log example

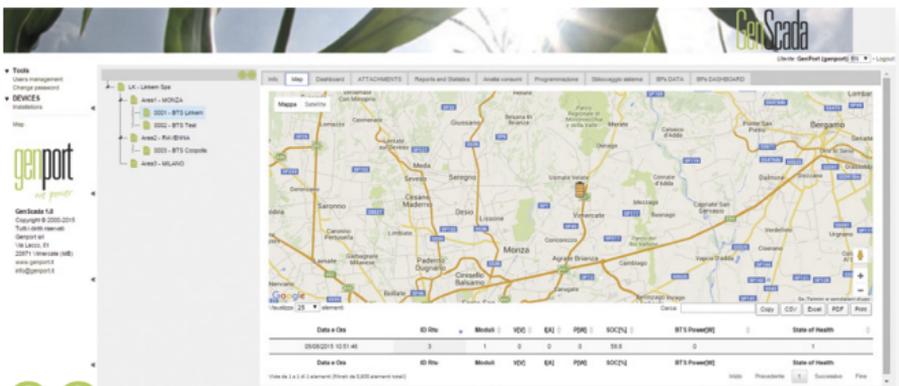
Main Graphic Pages

GenScada is structured in different graphic pages, hierarchically organized to provide at different level of details the following information: registry of each battery installation, the geographical location, synoptic dashboard, document attachments, log data, alarm management, battery consumptions, battery unlocking.



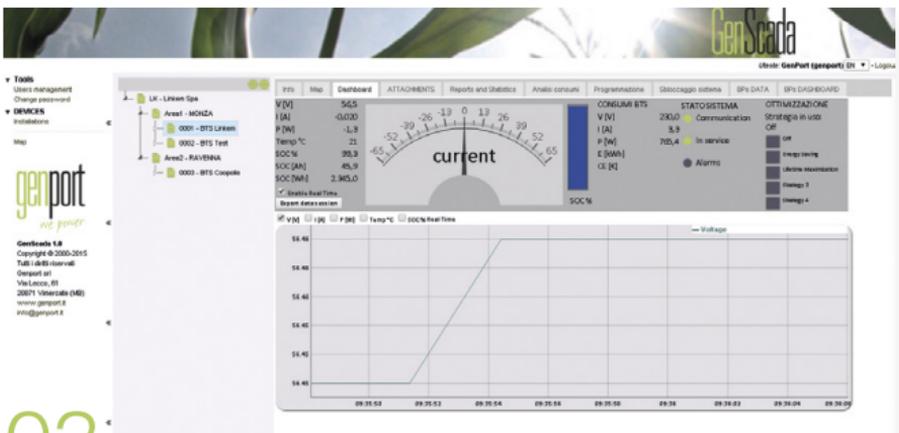
01

Registry of each battery installation



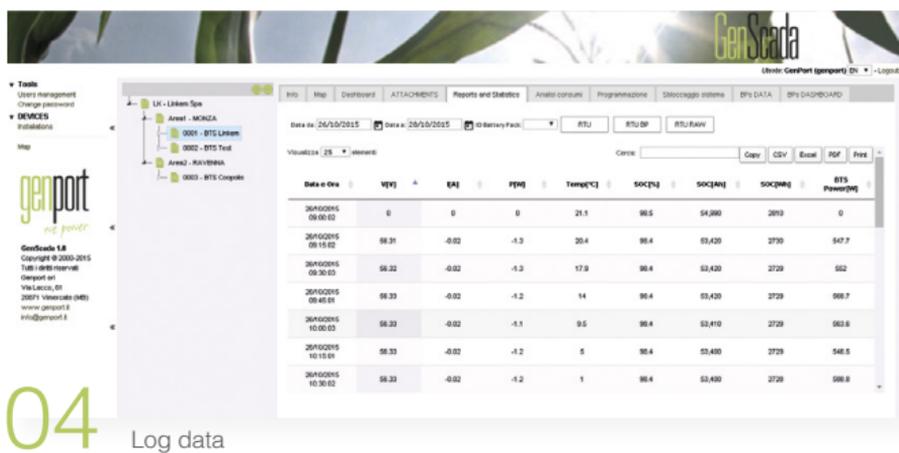
02

Geographical location



03

Synoptic dashboard



04 Log data



05 Battery Consumption

Reports and Statistics

Log Data can be retrieved in different format (pdf, excel, CSV) or printed from Genscada database by accessing to the graphic page: "Report & Statistics" (Pag.5 / Fig.4).

The log data can be retrieved by selecting a specific timeframe. Different type of data can be downloaded: battery electrical data and alarms.

Who We are

Genport is a developer and manufacturer of Resilient Power Sources based on the combination of Hydrogen Powered Fuel Cell with Lithium-Ion Energy Storage Systems.

These hybrid power solutions are configurable and designed to operate any time, anywhere in defense, emergency, telecommunication, medical, industrial, residential and agriculture applications.



genport
Power Solutions

Genport srl
Via Lecco, 61
20871 Vimercate (MB) - Italy
www.genport.it
email: genport@genport.it
Ph: + 39 039 5965 120
Fax: + 39 039 5965 129

Genport North America Corp.
1281 Win Hentschel Blvd.
West Lafayette, IN 47906
www.genportna.com
email: info@genportna.com
Ph: (765) 237 33 93
Fax: (765) 463-3501