VENSYS Elektrotechnik

# VENSYS STORAGE TECHNOLOGY

## The smart Storage Solution

## VENSYS Quality >Made in Germany <

Our reliable and trustworthy systems minimise the risk and increase the benefits for customers and partners thanks to a 100 percent commitment research, development, safety and quality standards.

Safety and quality deserve top priority. Hence, only technologies from carefully selected suppliers are used in all our products. Each of our products has passed extensive testing in our own laboratory facilities to meet our high safety and quality standards.

# VENSTORE Lion Applications

VENSTORE storage solutions are unique thanks to their modular structure and the associated, nearly limitless scalability. The storage capacity runs from range of 115 kWh to multiple MWh. VENSTORE storage technology and VENSYS VENCON inverters guarantee high power density and versatility. Equipped with proven technology and innovative network management capabilities, this system solution is available in both, an indoor and outdoor cabinet.

**Self-consumption optimisation**
The amount of energy gained from volatile energy producers is often not in line with own energy needs. With VENSTORE Lion, excess energy can be stored and provided at a different point in time. Supply optimisations can also be enhanced.

**Frequency control**
The VENCON inverter family can react quickly to either over-frequency or under-frequency, so that the VENSYS system solution can support the grid frequency.

**Feed-in limitation**
If the system performance of the generating facilities happens to be higher than the power supply, the VENSTORE storage solution can store the excess energy and release it at a desired point in time.

**Power supply network**
Load peaks in the supply network can be compensated for with this solution, thereby avoiding a network expansion and minimising transfer loads from medium-voltage transformers.

**Provision of energy control**
In order to trap excess production, the network storage solution VENSTORE can temporarily store this energy. In doing so, no regenerative power generation must be reduced or switched off completely. Thus, the proportion of environmentally friendly electricity can be increased in the network without necessity to set up additional generating plants.

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# VENSTORE Lion

VENSYS-Quality guarantees reliability

Industrial/ Commercial Wind and Solar Power Plants | Off Grid Applications | Grid Utilities and Grid Operations

## HIGHLIGHTS

- Modular design and innovative IT management provide high scalability
- Compact outdoor cabinet for flexibility and low overhead costs
- Excellent safety standard thanks to safety devices and optimal monitoring
- Innovative Battery Management System
- Cell technology to highest industry standards
- Capacities up to 115k kWh per cabinet
- Optimised for wide climate range
- Connecting to VENSYS systems without additional inverters

## GENERAL DESIGN

Since 2016, the lithium storage system has been a VENSYS Elektrotechnik product. It was developed to cover customer demands for a high performing storage system suited for a larger temperature range. In this case, enormous emphasis was placed on safety, functionality and scalability.
The smallest unit of the outdoor cabinet comprises a capacity of 115k kWh and 250 kWh power. To increase the performance, the VENSTORE Lion can be coupled with multiple units, providing nearly unlimited scalability.

This VENSTORE has an innovative drawer system, whereby the batteries are divided into 10 extendable storage units. Each storage unit operates autonomously and independently from the other units in the system: each storage unit has its own Battery Management System (BMS) and optimised cooling technology, which offers an enormous degree of efficiency and safety.

Moreover, the unique design features tremendous benefits during the assembly and maintenance of the battery cells. The compact and efficient design ensures a high power density at low transportation costs, thus ensuring maximum returns with low overhead costs.

Thanks to the integrated air conditioner, VENSTORE Lion can be used in a wide range climate zones. Even at an ambient temperatures ranging from of -20 °C to 45 °C, this storage technology still provides full performance.

Safety was one of the core values during the development phase of this technology. The lithium cells are tested and inspected by VENSYS in our own laboratory facilities to ensure durability and to deliver a quality product to our customer.

The BMS instantly monitors each individual cell and detects defective, weak or overloaded cells as well as insulation failure in the entire system. If an error is detected, the BMS not only separates the battery from the connected inverters, but also all the storage units from each other. In addition, the individual units have a short-circuit protection. The VENSTORE Lion meets one of the highest safety standards across industries.

The BMS provides the following information: cell voltage (highest/lowest / average), internal resistance (highest/lowest/average), temperatures of units (highest/lowest), current, state of charge (SOC), battery condition (SOH) and number of cycles.
The BMS calculates the maximum permissible load of the lithium memory at any time in order to ensure a long lifetime of the lithium cells.

# LIFETIME

### Information on the service life evaluation of battery cells

The economic feasibility of a battery storage system is essentially characterised by its durability. To ensure comparability of different battery types, the lifetime is indicated in cycles. In each case, a cycle is one complete charge and discharge of the cell. The cell is discharged up to a discharge depth of 80 % from the nominal capacity and then fully recharged. Often, in addition to the number of cycles, the manufacturer also provides a temperature indication. So far so good, but is this enough? Can you really compare different types of batteries with these information?

### What does the service life depend on?

The number of cycles mainly depends on the depth of discharge, temperature and current carrying capacity. The number of cycles decreases with the depth of discharge. This means that one and the same cell will work much longer with discharge up to 60 % than the maximum usable depth of discharge of 80 %. However, with a 60 % depth of discharge, there is less usable capacity available than with an 80 % depth of discharge.

Temperature is another important factor: at high temperatures, the chemical processes are accelerated in the cell and the electrolyte decomposes. At low temperatures, the cell no longer has power, since the internal resistance increases, thus decreasing the power output. The optimum temperature range is 10 °C to 30 °C.

The current carrying capacity determines the dischargeable power of a battery. The current carrying capacity is often given in multiples of the rated capacity (C-rate). At high levels, the cell is heavily loaded. High loads have higher operating temperatures thanks to the self-heating capacity, which in turn speeds up the aging of the cell. A cell with a low load will therefore always last longer than one cell with a high load.

Since all three parameters affect the life of the cell, it is important to provide these parameters when specifying the number of cycles, in order to be able to compare the cells. Often one sees basic information, such as 4000 cycles at 80 % depth of discharge.
No cells can be compared with such a specification. The temperature ranges and the current carrying capacity of the cell remain uncertain. Some of the cells are not even tested by the systems suppliers, instead simply reproducing the cell manufacturers' data sheets 1:1.

### To state it quite clearly: this is exactly why VENSYS is testing the cells that are being used!

In order to provide our customers reliable and valid indications on the system’s durability, all cell types are tested by us in house. The information gathered provides details on all relevant operating data (current, depth of discharge, temperature, internal resistance). The cells are tested at maximum power and maximum depth of discharge.
This means that cells have been loaded with nominal current (1C) in the first case; then, after a short break of 3 minutes, the discharge with dual discharging current (2C) follows.

Once the cell is not able to keep up during discharge of the lower voltage limit, the test is interrupted, the depth of discharge is reduced by 10 % and the test is continued. The characteristic curve obtained, therefore represents the worst case situation. In comparison, an identical cell with minimal parameters at the same ambient temperature and the same depth of discharge is operated. The second cell was charged at 0.5C and discharged at 0.5C. The comparison of the two curves clearly reveals how much the number of cycles depends on the load of the cell. In addition, by comparing the two characteristics, the durability of the battery cells can be realistically assessed. This creates confidence and provides our customer with more security!

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# TECHNICAL DATA VENSTORE Lion

## GENERAL

| | |
|---|---|
| 1. Version | Outdoor |
| 2. Principle | DC/DC converter |
| 3. Number of DC/DC converters | 2 |
| 4. IGBT Type | SKiiP4 Technology |
| 5. Cell Type | LiFePO4 Lithium iron phosphate |
| 6. Battery strings | 2 |
| 7. Total weight | 2,900 kg |
| 8. Dimensions (WxDxH) | 1,652 x 1,718 x 2,080 mm |
| 9. Protection class battery cabinet | IP55 |

## DC CONNECTIONS

| | |
|---|---|
| 1. Number of DC connections | 1 |
| 2. Voltage range | 750-1200 V |
| 3. Short circuit protection per input | 450 A (aR-fuse) |
| 4. Max. current | 330 A |

## PERFORMANCE

| | |
|---|---|
| 1. Nominal power at charge | 60 kW |
| 2. Max. power at charge* | 115 kW |
| 3. Nominal power at discharge | 115 kW |
| 4. Max. power at discharge* | 250 kW |
| 5. Capacity | 115 kWh |
| 6. Charging time (30 % - 95 % SOC) | 45 Min |

## ENVIRONMENT

| | |
|---|---|
| 1. Operating temperature range | -20 °C ...+50 °C |
| 2. Storage temperature range | -20 °C ...+30 °C |
| 3. Max. Relative humidity | 95,00 % (not condensing) |
| 4. Max. installation height (altitude) | < 1.500 m (above sea level) |
| 5. Cooling system battery cabinet | Air conditioner |
| 6. Cooling system power electronics | Air cooled |

## CONNECTION

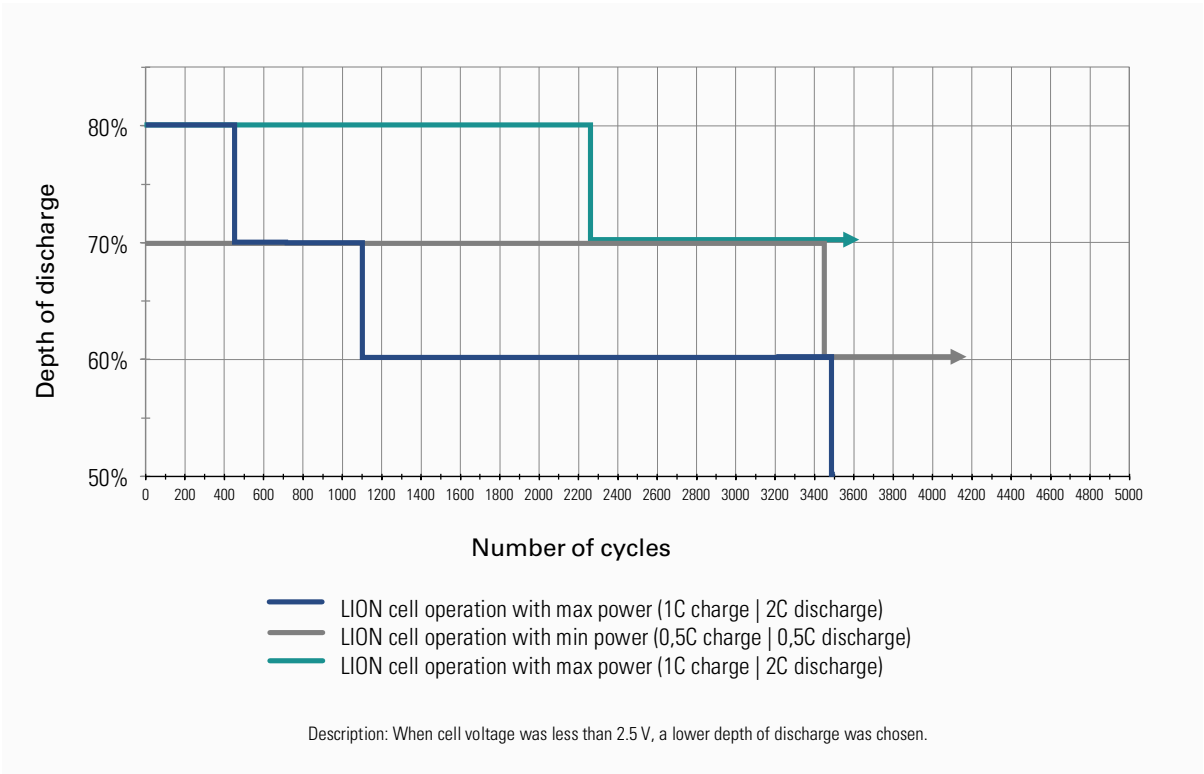
| | |
|---|---|
| 1. Supply voltage | 400 (3p) Vac |
| 2. Supply voltage range | ±10 % |
| 3. Supply frequency | 50/60 Hz |
| 4. Self-consumption (standby / maximum) | 20 W / 4600 W |
| 5. External communication | Ethernet (Modbus TCP) |

## SAFETY

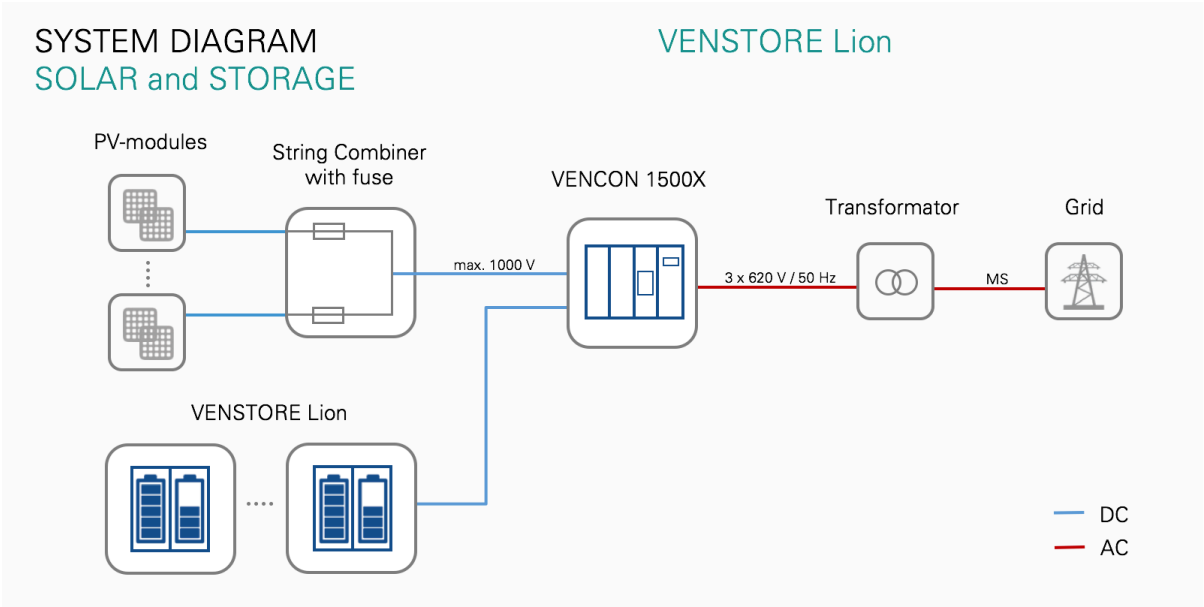
| | |
|---|---|
| 1. Isolation monitoring | Installed |
| 2. Battery-Split in case of errors | <120 V units |
| 3. Short circuit protection | Installed, per battery unit |
| 4. Manual circuit breaker | Installed, per battery string |
| 5. Overvoltage protection (self-supply) | Optional |
| 6. Compliance | EN 55011:2009/A1:2010 / EN 61000-4-2 |

*Depends on the calculated limit of the BMS. The BMS will reduce the performance with an increase of the resistance of the cell. This could happen at e.g. too low or too high temperature.

# NUMBER OF CYCLES IN DEPENDENCE OF THE LOAD




Description: When cell voltage was less than 2.5 V, a lower depth of discharge was chosen.



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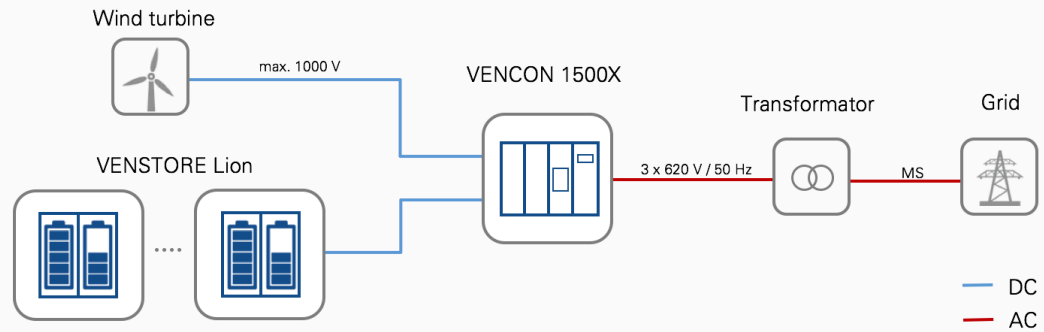
## SYSTEM DIAGRAM
## WIND and STORAGE

VENSTORE Lion

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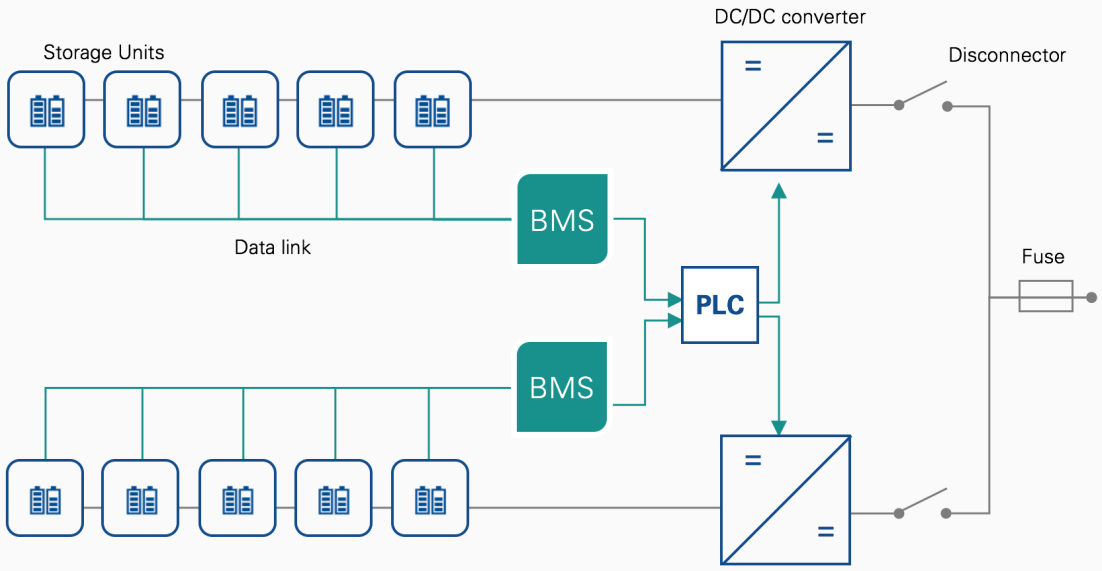
VENSTORE Lion

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