ELECTRIC VEHICLE ENERGY STORAGE COMPANY

# ES-60128NA

**Power: 60kW**
**Energy: 128kWh**

**All-in-One Battery Energy Storage System**
**LiFePO4 Battery Technology**

## FEATURES

- All-in-one system complete with battery, hybrid inverter,, HVAC, fire suppression and local controller
- Maximum safety utilizing the safest type of lithium battery chemistry (LiFePO4) combined with an intelligent 3-level Battery Management System
- Outstanding performance and long lifespan with over 5000 cycles
- Bi-directional hybrid inverter with multiple modes for flexible charging and discharging of batteries
- Delivered 95% pre-assembled
- Optimized for both on-grid and off-grid applications
- Integrated local controller for operation status control, DC grid-connection control, protection and data exchange
- Designed for easy installation and maintenance

## APPROVALS

- UL 9540 certified
- UL 9540A thermal runaway tested
- UN 38.3 certified
- IEC62619/62477 certified
- UL 1741 hybrid inverter
- UL 1973 battery

## SYSTEM SPECIFICATIONS

### MPPT DATA

| | |
|---|---|
| **PV Voltage Range** | 520 - 900V (MPPT 520 - 800 V) |
| **Max. PV DC Current** | 192 A |

## SYSTEM SPECIFICATIONS

### AC DATA

| | |
|---|---|
| **Rated AC Power** | 60 kW |
| **Maximum Power** | 65 kW |
| **Input/ Output Voltage AC** | 480 Vac |
| **Input/output Frequency** | 60 Hz |
| **Out THDI** | <3% |
| **AC Current** | 60 A |
| **Grid** | 3Phase 4Wires isolated line transformer |

### GENERAL DATA

| | |
|---|---|
| **Communication** | RS485, Ethernet, GPRS |
| **Operating Temperature Range** | -4°F (-20°C) to 104°F (40°C) |
| **Cell Chemistry** | Lithium Iron Phosphate (LiFePO4) |
| **Dimensions (W x D x H)** | 2250 x 1300 x 2591 mm |
| **Weight (Approx.)** | 4500 kg |
| **Enclosure Protection** | IP54 |
| **Containerized System Includes** | Battery, BMS, hybrid inverter, HVAC, FSS, Local Controller |

## SYSTEM LAYOUT


The graphics shown may differ from the actual structure.

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## All-in-One Battery Energy Storage System
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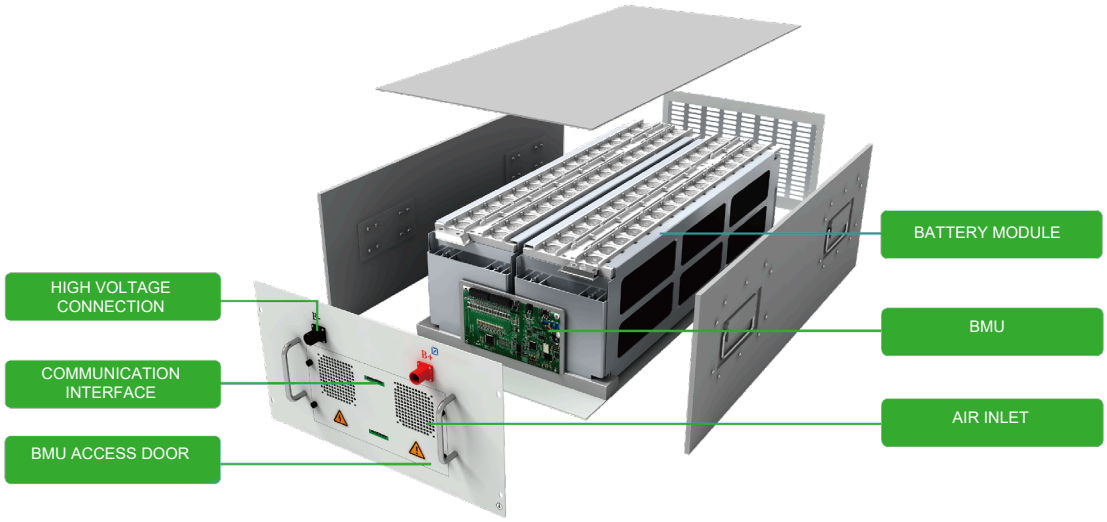
## BATTERY SPECIFICATIONS

| | |
|---|---|
| **Cell Type** | 3.2V 90Ah LiFePO4 |
| **Assembled Module Configuration** | 16s2p |
| **Assembled Rack Configuration** | 112s2p |
| **Number of Racks** | 2 in parallel |
| **Nominal Energy** | 128 kWh |
| **Nominal Capacity** | 360 Ah |
| **Nominal Voltage** | 358 V |
| **Voltage Range** | 314 - 398 Vdc |
| **System Voltage Balance** | <100ms |
| **BMS** | 3 level framework |
| **Life-span** | 5000 cycles @ 80% EoL 1C |

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## BATTERY MANAGEMENT SYSTEM

EVESCO's containerized energy storage systems come complete with an intelligent 3-level framework Battery Management System (BMS), which includes a BMU, SBMS and MBMS.

The BMS provides all round, real- time monitoring and protection of the lithium batteries within the ESS. It provides data on cell voltage, cell temperature, cable terminal temperature, battery string voltage, current, SOC and SOH.

The BMS has been configured with a set value over limit logic, which is integrated with the main control terminal to deliver complete protection and maximum battery life.

## FEATURES

- 3-level BMS offering complete battery protection
- Comprehensive monitoring of battery operating status, including voltage, current and temperature
- High voltage detection accuracy on battery cells, ensuring exceptional system data analysis reliability
- Multi point temperature monitoring to avoid battery thermal runaway and ensure system safety
- Passive cell balancing to maximize battery life
- Modular design with high scalability

| BMU SPECIFICATIONS | |
|---|---|
| **Cell Volt. Measurement Accuracy** | ±3 mV |
| **Cell Volt. Monitoring Interval** | 10 ms |
| **Cell Temp. Measurement Accuracy** | ±3°C |
| **Cell Temp. Measurement Interval** | 100 ms |
| **Cell Balancing Current** | ≥120 mA |
| **Cell Voltage Measurement Range** | 1 ~ 4.95 Volts |

| BMU SPECIFICATIONS (CONT..) | |
|---|---|
| **Balancing Method** | Passive balancing |
| **Over Temperature Protection** | Automatic |
| **Low Temp. Protection in Charging** | Automatic |
| **Over current Protection** | 250 A/1 s |
| **Short Circuit Protection** | 500 A/10 ms |
| **Input Insulation Resistance** | ≥10MΩ, 1000 VDC |
| **BMS Insulation Voltage** | All internal cables to shell: 2.2kVac/5mA, 1 minute, no arcing |

| SBMS SPECIFICATIONS | |
|---|---|
| **String Voltage Measurement Range** | 0~1000 Volts |
| **String Volt. Measurement Accuracy** | ±0.5% |
| **String Volt. Monitoring Interval** | 100 ms |
| **String Current Measurement Range** | ±400 A |
| **String Curt. Measurement Accuracy** | 1% |
| **String Current Monitoring Interval** | 20 ms |
| **String Temp. Measure. Accuracy** | ±2°C |
| **String Temp. Monitoring Interval** | 100 ms |
| **SOC Calculation Accuracy** | 8% |
| **Insulation Monitoring Resolution** | 1kΩ |
| **Input Insulation Resistance** | ≥10 MΩ, 1000 VDC |

| MBMS SPECIFICATIONS | |
|---|---|
| **Operating Voltage Range** | 220 VAC ±15% |
| **Operating Temperature** | -40°F (-40°C) to 122°F (50°C) |
| **Relative Humidity** | 20% ~ 90% RH |
| **Thermal Management Method** | Air cooling |
| **Insulation State Detection** | Yes |
| **Temperature Measurement Range** | -40°F (-40°C) to 122°F (50°C) |
| **Maximum Power Supply** | 10 W |
| **Input Insulation Resistance** | ≥10 MΩ, 1000 VDC |

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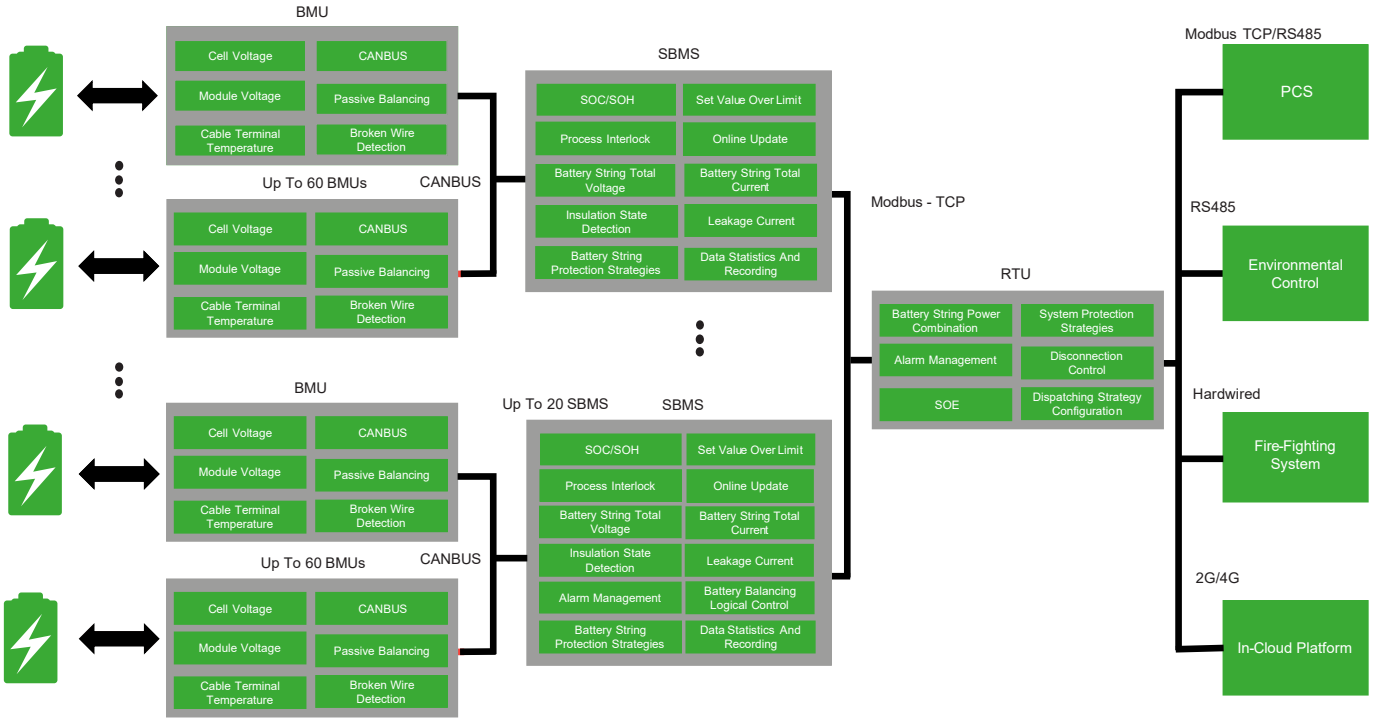
## BATTERY MANAGEMENT SYSTEM

The BMS includes a first level system main controller MBMS, a second level battery string management module SBMS, and a third level battery monitoring unit BMU, wherein the SBMS can mount up to 60 BMUs.

## 3-LEVEL FRAMEWORK





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## HYBRID INVERTER

EVESCO's all-in-one energy storage systems utilize a hybrid inverter with an advanced bi-directional conversion system which can charge and discharge the batteries with various modes. These modes offer flexibility for different charging/ discharging strategies based on the specific goals of your application.

## FEATURES

- Bi-directional conversion with multiple modes for flexible charging and discharging of batteries
- Modes for charging include constant current charging, equalized charging and float charging
- Grid-support functions
- Integrates with solar PV
- Off-grid independent operation
- Modular design and wide power range in single cabinet
- Fast and accurate power response
- Integrated transformer optional

**Hybrid Inverter specifications subject to change based on application.**

| GENERAL SPECIFICATIONS | |
|---|---|
| **Peak Efficiency** | 95.5% |
| **IP Level** | IP20 |
| **Operating Temperature** | -4°F (-20°C) to 122°F (50°C) |
| **Relative Humidity** | 0 ~ 95% (no condensation) |
| **Cooling** | Forced air cooling |
| **Dimensions (W x H x D)** | 800 x 2160 x 800 mm |
| **Weight** | 520 Kg |
| **Altitude** | 3000 m (>2000 m derating) |
| **Display** | Touch screen LCD |

| GENERAL SPECIFICATIONS (CONT..) | |
|---|---|
| **Noise** | 70dB |
| **Communication** | RS485, CAN, Ethernet |
| **AC Connection** | 3Phase, 4Wire |
| **Communication Interface** | RS485 |

| DC INPUT SPECIFICATIONS | |
|---|---|
| **Battery Voltage Range** | 250- 520 Vdc |
| **Max. DC Current** | 150 A |

| UTILITY INTERACTIVE MODE SPECIFICATIONS | |
|---|---|
| **PV Voltage Range** | 520 - 900 V (MPPT 520 - 800 V) |
| **PV DC Max. Current** | 192 A |
| **AC Voltage Range** | 480 Vac (423 - 528 V) |
| **AC Current** | 60 A |
| **Nominal Power** | 60 kVA |
| **AC Frequency** | 60 Hz |
| **AC Power Factor** | 0.8 - 1 leading or lagging (controllable) |
| **THDi** | <3% |

| STAND-ALONE MODE SPECIFICATIONS | |
|---|---|
| **AC output Voltage** | 480 VAC (+/- 10% configurable) |
| **AC Output Current** | 60 A (66 A Max) |
| **Nominal AC Output** | 60 kVA |
| **AC Max Power** | 65 kVA) |
| **Output THDu** | <2% |
| **AC Frequency** | 60 Hz |
| **AC Power Factor** | 0.8 - 1 leading or lagging (controllable |
| **Overload Capability** | 105%-115% (10min), 115%-125% (1min), 125%-150% (200ms) |

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## HVAC

The environmental control system inside the ESS adopts precision heating, ventilation and air conditioning designed to ensure ideal internal temperature whether discharging, charging or on standby.

The operation of the HVAC is fully automatic and responds to the internal temperature of the container. It is a highly reliable system and has a number of easy to use functions.

- **Cooling** - cooling starts when the containers internal temperature exceeds the cooling set point, and it stops when the temperature drops below the cooling set point.
- **Heating** - heating starts when the containers internal temperature is lower than the heating set point, and it stops when the temperature rises above the heating set point.
- **Dehumidification** - dehumidification starts when the containers internal humidity exceeds the dehumidification set point, and it stops when the humidity drops below the dehumidification set point.

**HVAC SPECIFICATIONS**

| PARAMETER | DEFAULT | SETTING RANGE |
|---|---|---|
| **Cooling Set Point** | 77°F (25°C) | 59 ~ 122°F (15 ~ 50°C) |
| **Return Difference** | 50°F (10°C) | 34 ~ 50°F (1 ~ 10°C) |
| **Heating Set Point** | 59°F (15°C) | 5 ~ 59°F (-15 ~ 15°C) |
| **Return Difference** | 50°F (10°C) | 34 ~ 50°F (1 ~ 10°C) |
| **Dehumidification Set Point** | 60% | 40 ~ 90 % |
| **Return Difference** | 50% | 34 ~ 86% |

## FIRE SUPPRESSION SYSTEM

The fire suppression system is designed according to the enclosure size. Each system is equipped with a nickel plated brass valve, a pressure gauge to monitor cylinder pressure, and a quarter turn ball valve that interfaces with the detection tubing. A piston in the valve bore is equipped with a static seal that keeps the agent under pressure within the cylinder, while allowing the pressure to equalize on both sides of the piston.

When the pressure from the top assembly is released by means of automatic or manual activation, the internal piston slides to its fully open position and allows the HFC-227ea agent to discharge through the two outlets.


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## LOCAL CONTROLLER

The local controller is a dedicated controller which has been developed specifically for energy storage systems. It has been designed for the control, protection, communication and scheduling of the ESS subsystems (BMS, HMI, HVAC, fire suppression, electricity meter etc.)

## DATA ACQUISITION

- State-of-charge and fault signal of each battery string; PCS fault signal; system emergency stop signal; AC & DC circuit breaker position signal; DC contactor position signal; air conditioning operation signal; gas fire extinguishing system alarming signal;
- Total DC and voltage, DC and voltage of each battery string, grid access point active power, demand power, and container ambient temperature signal;
- Communication Control: In-cloud EMS, hybrid inverter, BMS, air conditioning, fire protection, third-party platform;

## LOGIC CONTROLLER

- Monitor the DC voltage level difference between battery strings, and block the DC busbar connection to avoid circulating current due to the massive voltage difference;
- Monitor battery temperature and container ambient temperature, automatically start the fan and air conditioner in the battery cabinet to meet the battery working environment requirements;

## REMOTE MONITORING & MANAGEMENT

The controller can access 4G Internet, enabling communication with remote servers to facilitate remote monitoring and management. The control delay time is <500 ms. Internet infrastructure and additional hardware will be required.

## MULTIPLE PROTECTION

- Overload protection in charging: monitor the transformer load status at the grid access point busbar in charging, and adjust the charging power or stop charging when overloading;
- Reverse power protection in discharging: monitor the transformer load status at the grid access point busbar in discharging, and adjust the discharging power or stop discharging when there's reverse power;
- Unlike the conventional integrated system's three- or four-level architecture, the Local Controller is designed according to the relay protection control logic derived from the transformer substation integrated automation system. It De-couples' interactions between hybrid inverter, BMS, EMS, and auxiliary system, which becomes a central control unit to avoid crossing controls.

## LOCAL CONTROLLER SPECIFICATIONS

| | |
|---|---|
| **PCS Communication** | TCP, RS485 |
| **HVU Communication** | TCP, IP |
| **HVAC Communication** | RS485 |
| **Supported Communication Protocols** | Ethernet, Analog and digital I/O, MODBUS, DNP, IEC 102, IEC61850 |
| **Relay** | 4 dry contacts inputs/outputs |
| **Grid Control Application** | Time shifting, peak shaving, renewable moving average |
| **Off-Grid Control Application** | Backup power, PV/DG/EV/ ESS integrated micro-grid control |
| **Battery Management System** | DC busbar incoming control |

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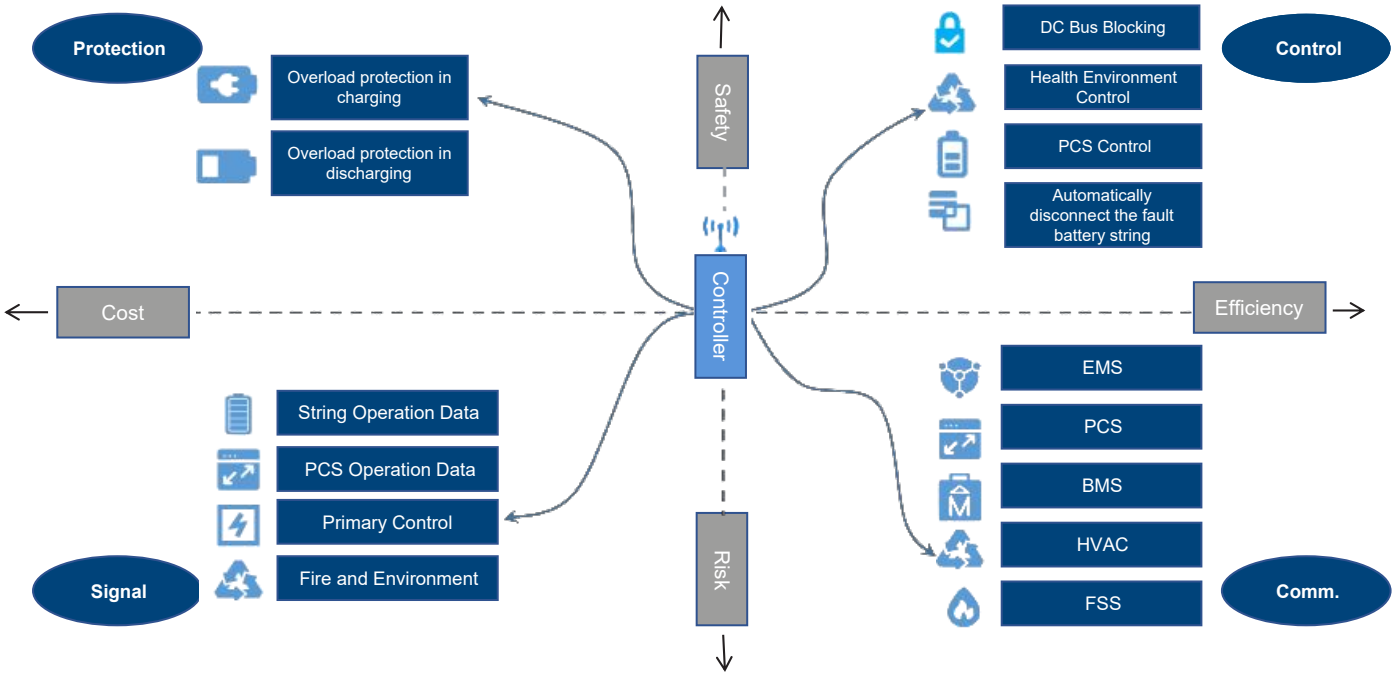
## LOCAL CONTROLLER

The local controller is a device that realizes system operation, status control, DC grid connection control, system protection and data exchange. It is at the core of the ESS operation.





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