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| Device | What It Measures / Monitors | Core Specs | Related Variables |
| Victron Lynx Smart BMS / NG | -SoC, SoH (via cell data)  -Cell voltages and balancing  -Pack current & voltage - Protection alarms (OV/UV, temp, current) | • System voltages: 12/24/48 V  • Continuous current: 500–1000 A  • Peak: 600–1200 A (5 min)  • Temp: −40 °C to +60 °C • IP22 | bms1\_soc, bms1\_soh, bms1\_v, bms1\_c, bms1\_cell\_\* |
| SMA Sunny Central Storage PCS | -PCS DC voltage/current  -AC power output  -Efficiency & conversion losses  -Thermal status (sensors)  -Grid interface values | • DC input: 500–950 V (max 1100 V)  • DC current: up to 4000 A  • AC output: 1900–2900 kVA  • Eff.: 98.3–98.6% • Temp: −25 °C to +50 °C | pcs1\_ap, pcs1\_dcc, pcs1\_dcv, pcs1\_ia/ib/ic, pcs1\_uab/ubc/uca, pcs1\_t\_env, pcs1\_t\_a, pcs1\_t\_igbt |
| Ingeteam SUN Storage 3Power C | -DC bus voltage/current  -AC 3-phase output - PCS efficiency  -Thermal envelope  -Grid services (freq, reactive power) | • DC voltage: up to 1300 V  • Power: up to 3660 kVA  • Bidirectional  • 3-phase AC output  • Grid/island operation | Same as SMA PCS (pcs1\_\*) |
| ifm / Trafag / Endress+Hauser sensors | -Water outlet/return temps  -HVAC pressures & temps  -Cooling loop monitoring | • Pressure: 0–100 bar  • Temp: −40 °C to +125 °C (typ.)  • Industrial IP65/IP67 | ac1\_outside\_t, ac1\_outwater\_t, ac1\_rtnwater\_pre |
| Socomec / Janitza aux meters | -Auxiliary AC power  -Power factor | • Voltage: 230/400 V AC  • Current: up to 5 A CT inputs  • Accuracy: Class 0.5–1 | aux\_m\_ap, aux\_m\_pf |
| Sensirion / ifm probes | -Humidity & temperature sensors | • Humidity: 0–100% RH  • Temp: −40 °C to +125 °C | dh1\_humi, dh1\_temp |
| Siemens / Dräger / Bosch detectors | -Smoke, CO, fire alarms, error codes | • EN54-certified  • CO ppm ranges  • Smoke: optical/ionisation | fa1\_\* … fa5\_\* |
| Janitza / Socomec / Schneider meters | -Active energy (import/export)  -Active power  -Power factor | • 3-phase, 230/400 V AC  • Current: 1–5 A via CTs  • Accuracy: Class 0.2–0.5 | com\_ae, com\_ap, neg\_ae, pos\_ae, pf |

EU compliance

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| Device | Summary & EU Compliance | Cybersecurity / Security Notes |
| Victron Lynx Smart BMS / NG | Provides SoC, SoH, cell voltages & balancing, pack voltage/current, and protection alarms. CE-marked, designed and manufactured in the EU (NL), follows safety & EMC directives. | CAN bus is private; Bluetooth requires pairing/authentication. No Internet backdoors. Keep network isolated for max security. |
| SMA Sunny Central Storage PCS | Measures DC/AC power, voltage/current, thermal status, and grid interface values. CE-certified, EN50549-compliant for grid integration, ISO 9001/14001 certified production. | Supports password-protected SCADA/EMS access; firmware digitally signed; ISO 27001 software processes. No backdoors reported. Use VLAN/firewall for IP connectivity. |
| Ingeteam SUN Storage 3Power C | DC/AC bidirectional conversion, thermal monitoring, frequency/reactive power services. CE-marked, EN50549-compliant, meets EU grid code requirements. | Same as SMA PCS: secure firmware updates, authentication for SCADA, no known backdoors. Best practice: isolate LAN/VLAN. |
| ifm / Trafag / Endress+Hauser sensors | Monitors water/HVAC temps, pressures, cooling loops. CE-marked industrial sensors, IP65/IP67, designed for EU industrial safety standards. | Mostly analog or fieldbus (Modbus/Profibus). No Internet exposure → inherently secure because it is isolated. |
| Socomec / Janitza aux meters | Measures auxiliary AC power and power factor. CE-marked, EN50160-compliant power meters, suitable for EU industrial installations. | Uses Modbus/fieldbus; supports authentication. Keep meters on secure LAN for remote readout. No backdoors reported. |
| Sensirion / ifm probes | Humidity and temperature sensors. CE-marked, RoHS-compliant, EU-manufactured. | Analog/digital probe output, no Internet connection. Cybersecure by design. |
| Siemens / Dräger / Bosch detectors | Smoke, CO, fire alarms, error codes. EN54-certified fire safety devices for EU standards. | Hardwired or industrial bus systems, fail-safe design. No backdoors; inherently secure. |
| Janitza / Socomec / Schneider meters | Measures active energy (import/export), power, power factor. CE-marked, EN50160-compliant, RoHS, ISO 9001/14001 manufacturing. | Supports secure Modbus/IEC protocols (TLS/HTTPS for advanced models). Authentication enabled; no backdoors. |

**References**

* Victron Lynx Smart BMS / NG: <https://www.victronenergy.com/upload/documents/Datasheet-Lynx-Smart-BMS-EN.pdf>
* SMA Sunny Central Storage PCS: <https://files.sma.de/assets/275864.pdf>
* Ingeteam INGECON SUN Storage 3Power C Series: <https://www.ingeteam.com/en-us/sectors/photovoltaic-energy/p15_24_45/storage-3power.aspx>
* ifm electronic Sensors: <https://www.ifm.com/us/en/category/200_020_010?srsltid=AfmBOooF3k3wnQKg2XnBF2Cyw30nptb1HXKoGU9lcPqHj5jGp4T5ES9v>
* Trafag Pressure Transmitters: <https://www.trafag.com/us-en/products/pressure-transmitters/>
* Endress+Hauser Temperature Transmitters: <https://www.us.endress.com/en/field-instruments-overview/temperature-measurement-thermometers-transmitters/temperature-transmitter>
* Siemens Fire Safety: <https://new.siemens.com/global/en/products/buildings/fire-safety.html>
* Dräger Gas Detection: <https://www.draeger.com/en_XX/Products/Gas-Detection>
* Bosch Security Fire Detection: <https://www.boschsecurity.com/en/products/fire-detection>
* Janitza UMG 512-PRO: <https://www.janitza.com/en-us/products/umg-512-pro>
* Socomec DIRIS A-40: <https://www.socomec.us/en-us/p/diris-a-40>
* Schneider Electric PowerLogic PM Series: <https://www.se.com/us/en/product-range/62252-powerlogic-pm8000-power-quality-meters>

