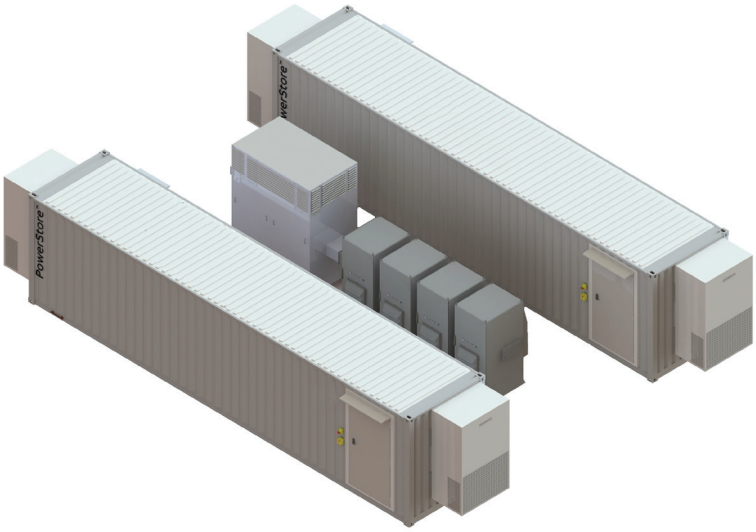
GRID EDGE SOLUTIONS

e-mesh PowerStore Modular

Flexible and scalable energy storage system



01 PowerStore Modular Containerized

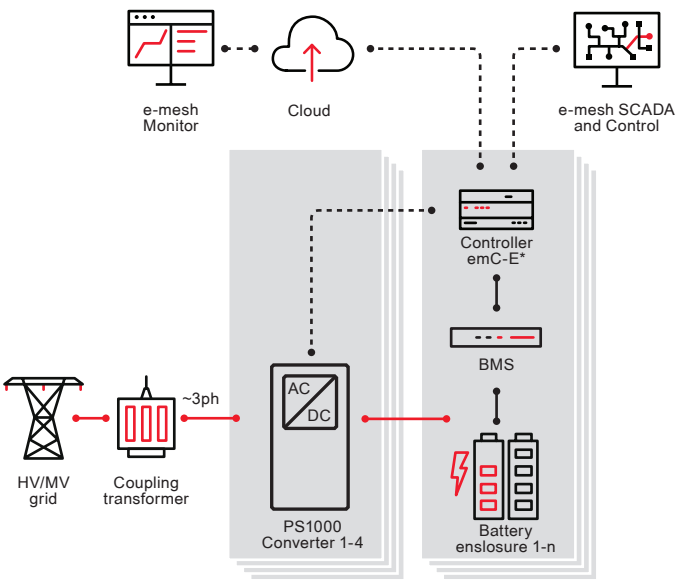
Hitachi ABB Power Grids' latest innovation in grid stabilizing technology incorporates advanced grid-forming converter and virtual generator capabilities for resilient and cost-effective access to power.

Hitachi ABB Power Grids' e-mesh™ PowerStore™ grid-forming battery energy storage systems are designed for both grid-connected and off-grid applications, ensuring reliable power, seamless renewable integration and grid stability while reducing operating costs and complying with main grid codes and standards.

Intended for large power applications across utilities and independent power producers, e-mesh PowerStore Modular scalable platform is specifically developed to offer a straightforward and simple solution to developers of utility-grade energy storage systems. In ~1 MW blocks, it offers a single scalable modular system that boasts high-performance controls and system redundancy.

Key automation features of the e-mesh PowerStore systems include:

- **Peak shaving**: Reduce peak demand from your facility or power system
- **Renewable shifting**: Store excess renewable production to be used during peak demand hours
- **Frequency and voltage support**: Proprietary Virtual Generator Mode algorithms manage frequency and voltage excursions
- **Renewable smoothing**: Smooth out the rapid fluctuations in power output from renewable generators and dynamic loads
- **Microgrid/Islanding**: Grid-forming, seamless transition and black start capabilities to provide power in the event of utility disruption
- **Cyber Security**: assuring high level of cyber security according NERC-CIP and IEEE 1686



Key components:
e-mesh Control
Outdoor grid-forming power conversion system with AC and DC protection included
Outdoor DC battery system including:
- Battery racks, BMS and battery protection
- Fire detection and suppression
- Enclosure with thermal management

Our experts will work with you to determine the optimal combination of outdoor rated PS1000 converter modules and outdoor battery enclosures or containers to comply with all project needs. Larger power applications achievable by replicating multiple systems in parallel.

* In the outdoor batteries option, the controller is delivered in a separate enclosure

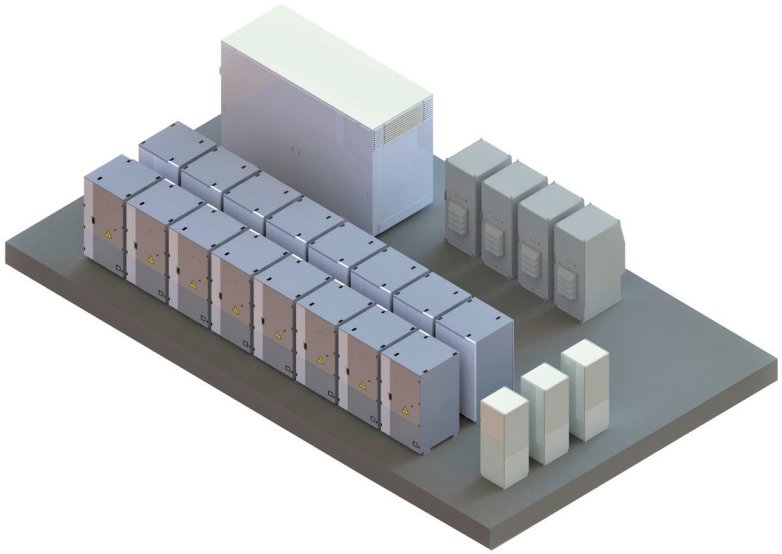
02 Power Conversion System

Power Conversion System
With world-class power density and an easy-to-install design, the flexible PowerStore PS1000 utility-grade energy storage power conversion system (PCS) will be commissioned quickly and easily.

For a more detailed information, please refer to the PS1000 data sheet (4CAE000825 & 4CAE000862)

Battery System Power & Energy ratings
The DC battery system is available in two versions:
- Standard 40 ft HC ISO container allocating 0,4 to 2 Cp battery strings and achieving up to 2.2 MWh (2Cp), 3.5 MWh (1Cp) and 5 MWh (0.5Cp) of energy storage capacity.
  Available in several DC voltages (1100 to 1500Vdc) and different walk-in and non walk-in container design.
- Outdoor enclosures allocating 0,5 and 1 Cp battery strings that can be connected in parallel for achieving maximum of 6MWh per PCS.

03 PowerStore Modular Outdoor



Technical specifications

GENERAL DATA

Product name	PowerStore Modular
AC voltage on the MV side	up to 35kV
MV/LV transformer rating	up to 12 MVA (external 3-winding transformer)
PCS AC voltage on the LV side	480 or 690V
PCS AC Power (40°C)	1 to 1.5 MVA
AC power range (40°C)	1MVA up to 12MVA per transformer
Nominal frequency	50 or 60 Hz
Charge/Discharge duration	0.5 to 4 hours for containerized DC systems 1 to 4 hours for outdoor DC systems
DC voltage range	750 – 1100 – 1500V

DC SUBSYSTEM FEATURES

Material	Metal Enclosure with Fire resistance internal panels
Protection degree	IP54
Painting	C5M
Fire resistance	60 minutes
Cooling	HVAC / Chiller
Operating temperature	-20°C to 50°C
Maximum operating altitude	2000 m without derating
Relative humidity	0 to 95% non-condensing
Installation	Base fixing on concrete footing or raised platform
Handling	Crane lifting

SAFETY & QUALITY

DC protection	Fuses & disconnector
Ground fault detection	Alarm & Trip with impedance monitoring
Lightning protection	Surge Protection Device DC (Type 1/2)
Fire detection & suppression	Included
Certification	UL & CE mark
Quality	ISO 9001

CONTROL SYSTEM

Local controller	e-mesh Control RTU
Control interface	Modbus-RTU, Modbus-TCP/IP, IEC60870-5-104. Others available upon request [1]
Web server	HMI Panel (Optional)
SCADA	e-mesh SCADA (Optional)
Remote access	e-mesh Monitor (Optional)
Remote communication	Wired: TCP-IP via ethernet Wireless: GSM/3G or 4G (Optional)
Basic control modes	
Grid following (on grid)	External PQ (power) | DQ (Current) | Cos Phi (pf) references
Grid transition (on/off)	Seamless transition in both directions available for PQ control
Grid forming (off grid)	External PQ references
Black start capable	Yes, includes DC pre-charge. Requires external auxiliary control power
Extended control modes	
Grid following (on grid)	External f & V references for our GSM [2] primary control functionalities: Fast Voltage & Frequency support based on droops & dead band Virtual Inertia
Grid transition (on/off)	Seamless transition from VGM [3] to GSM [2] in grid connected and island
Grid forming (off grid)	External f & V references for our VGM [3] primary control functionalities: - Droop control with dead band - Synthetic Inertia & Synthetic impedance - Current limiting during faults and inrush

[1] DNP3, IEC 61850 optional
[2] GSM: Grid Support Mode
[3] VGM: Virtual Generator Mode

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