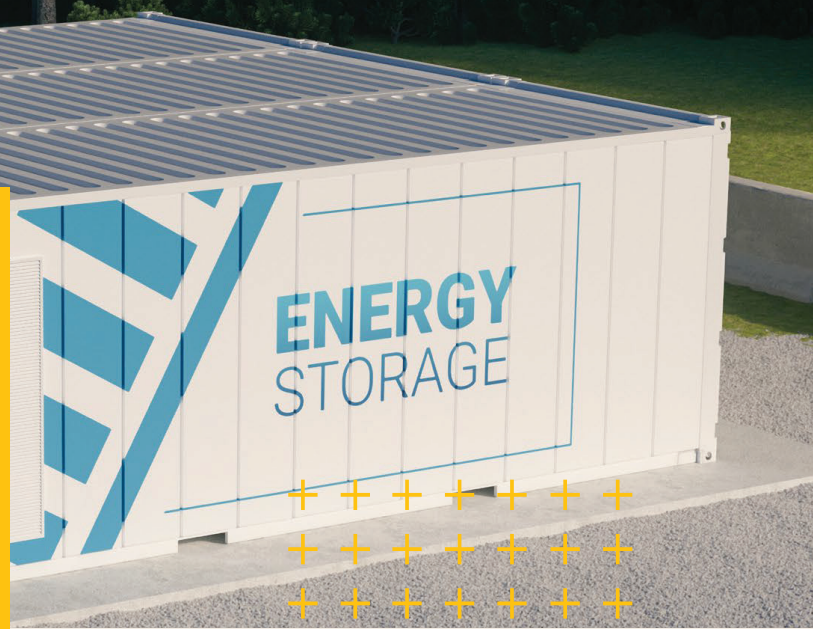


# Battery Energy Storage Systems

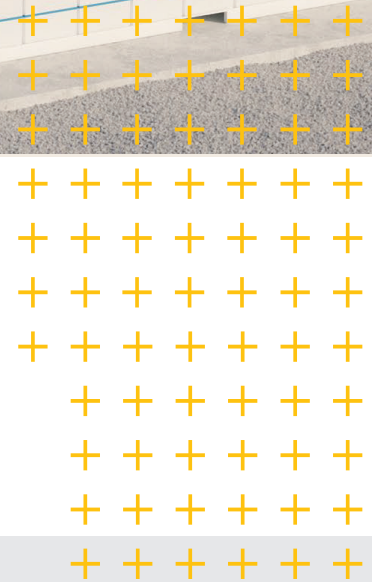
## Electrical Safety Solutions



### Minimize downtime by immediately locating ground faults.

As power generation around the world evolves to meet demand, more smart grids require efficient, environmentally-friendly methods of generating and storing electricity. Advances in photovoltaics and battery storage systems bring new challenges in proper protection of personnel and equipment.

Battery energy storage systems (BESS) most commonly operate as ungrounded systems, which means all line conductors are intentionally isolated from ground. Although these systems can continue to operate with a single ground fault, it is vital to indicate and clear the first fault as quickly as possible. If the fault is not cleared, a second fault will create a line-to-line short and a dangerous overcurrent situation.



### Benefits

#### **Detects faults without interrupting operation**

Ground faults or insulation breakdown issues can be **detected and located** while keeping the installation energized.

#### **Reduces maintenance costs**

Significant **decrease in maintenance costs** due to the accuracy of detection and decreased need for human interaction with the system.

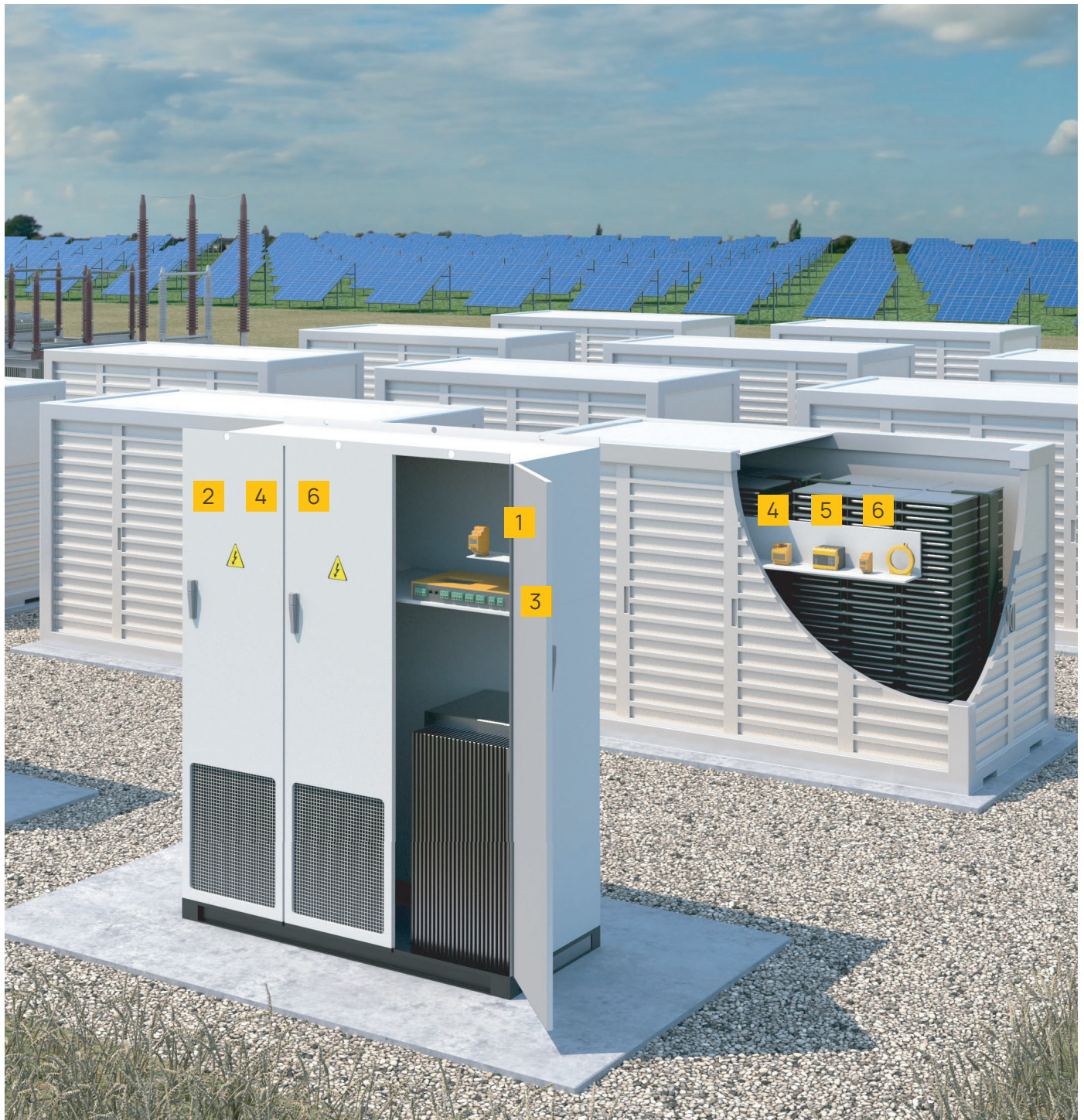
#### **Automatically locates faults**

**Automatic fault location** eliminates the need for opening branch circuit breakers or disconnecting equipment.

#### **Safety**

Ground-fault location at feeders and loads **minimizes employee shock hazards**, and quick repair can **prevent a fire**.





Smart grids demand smart electrical safety. Bender monitoring equipment uses the latest technology to ensure accurate, quick readings on arrays and battery systems of virtually all sizes. With a wide range of communication options, Bender devices integrate easily into industrial networks – including Ethernet and Modbus.



## 1 Insulation Monitoring Devices for Inverters (isoPC425 + AGH420, isoPV + AGHPV)

Monitor AC and DC ungrounded power systems ( $\leq 1$  MW)

- Protects inverters from damaging ground-faults and potential fire damage up to 1,000 VDC
- Offline monitoring feature prevents the inverter from energizing into a ground-fault condition



## 3 Insulation Monitoring Device for Inverters (isoPV1685)

Monitor AC and DC ungrounded power systems ( $\geq 1$  MW)

- Protects essential inverters from damaging ground-fault incidents and potential fire damage for systems up to 1,500 VDC
- Eliminates labor intensive fault location procedures by isolating faulted circuits automatically
- Offline monitoring feature prevents the inverter from energizing into a ground-fault condition
- Communicates all recorded values directly to personnel with Modbus® RTU or CAN bus protocol



## 5 Insulation Monitoring Device for Battery Storage Systems (iso685-D-P) and Earth Detection System (EDS 44x Series)

Monitor AC and DC ungrounded power systems with automatic fault location

- Minimizes unplanned outages and eliminates the need to interrupt power to identify faulted circuits
- Eliminates labor intensive fault location procedures by isolating faulted circuits automatically



## 2 Communications Gateway (COM465IP)

Gateway for Bender devices to Ethernet-TCP/IP networks

- Communications gateway that allows Bender devices to communicate with SCADA and other systems
- Provides a convenient way to connect third-party devices without additional gateways
- TCP/IP enables remote access via LAN, WAN, or Internet. HTML5 user interface provides barrier-free access.



## 4 Residual Current Monitors (RCM, RCMA, RCMS, RCMB Series)

Monitor AC and DC solidly grounded and/or resistance grounded systems

- Recognizes, locates, and prevents destructive ground-fault conditions for power conversion equipment
- Minimizes unplanned outages and eliminates the need to interrupt power to identify faulted circuits
- Monitors a wide range of frequencies and harmonics that contribute towards nuisance tripping or damage



## 6 Ground Loop Monitor for Battery Storage Containers (GM420)

Monitor and detect deterioration of a grounding conductors

- Safeguards grounding and bonding connections to containers which are often overlooked during initial design
- Creates a safer working environment by reducing the risk of voltage potential on a storage container

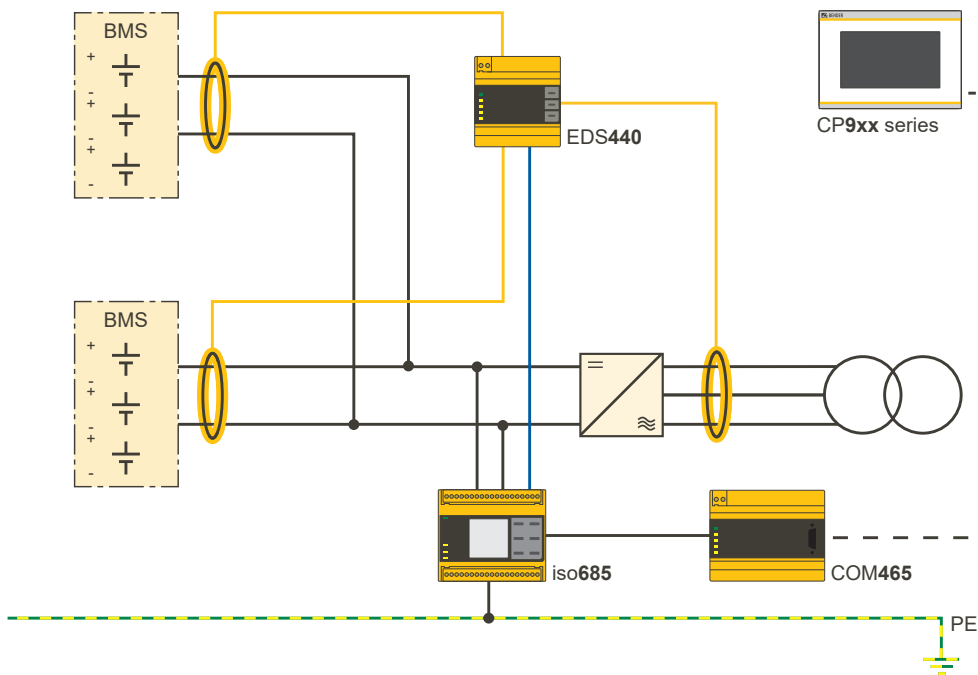


This symbol indicates the product technology has unique features either patented by or exclusive to Bender



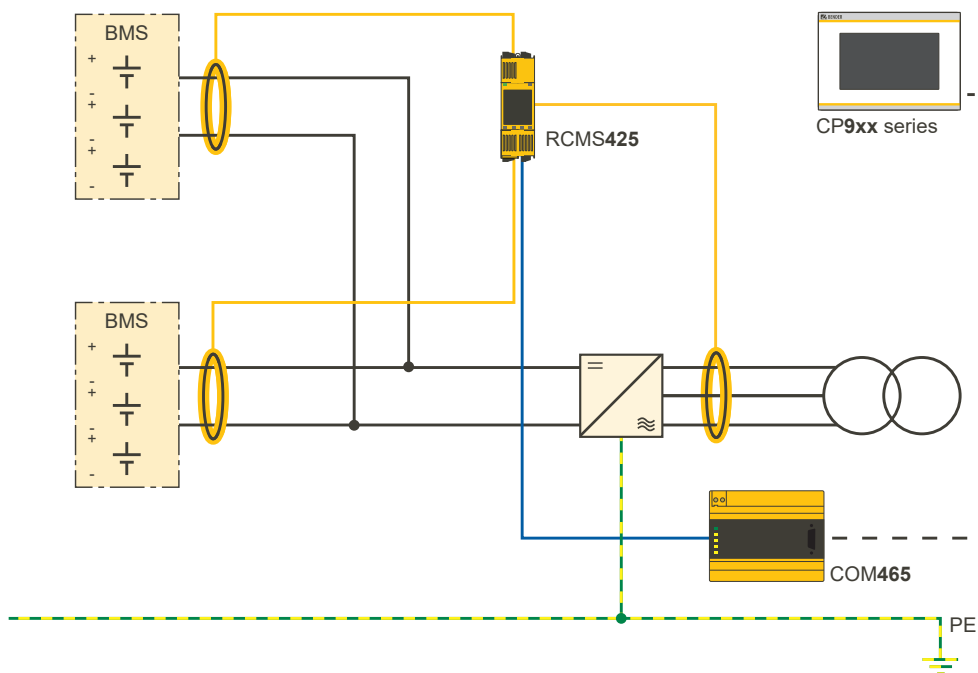
## Ungrounded Systems

Ground-fault detection and location setup that provides localized detection to each battery bank and inverter on an ungrounded system.



## Grounded Systems

Ground-fault detection and location setup that provides localized indication of leakage current values at each battery bank and inverter on a grounded system.



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