APPLICATION NOTE

Switching & Protection solutions for DC Combiners in Battery Systems

IEC Commercial & Industrial scale

Are you searching for Switching and Protection solutions to protect and secure DC combiners and keep them running in Commercial & Industrial Battery Energy Storage System (BESS)?
Easily find the best solution to fit in your DC combiner and quickly configure your BESS installation thanks to our Application Bundle based on concrete examples.

What is a DC Combiner?
If you want to connect several battery racks in parallel prior to connecting to the DC side of the Power Conversion System (PCS) or to the DC Recombiner, you need a DC Combiner. The DC Combiner is a switchboard where switching and protective devices are installed along with auxiliary and/or communication circuits.

Why do you need Switching & Protection solutions?
Every feeder supplying the related battery rack requires
adequate galvanically switching and protection against overcurrents which can come also from the other battery racks connected in parallel.

Main benefits

Smarter protection
Increases power in your installation and reduces CAPEX by using the full range of 1500 VDC LV components.

Safety
Avoids the risk of fire in your facility and loss of valuable assets by using a complete range of Surge Protection Devices (SPDs) to protect the whole electrical system from lightning and surges.

Speeds up your projects
Reduces CAPEX and speeds up your projects by using a range of products in compact sizes able to provide excellent performance at different temperatures and humidity ratings.

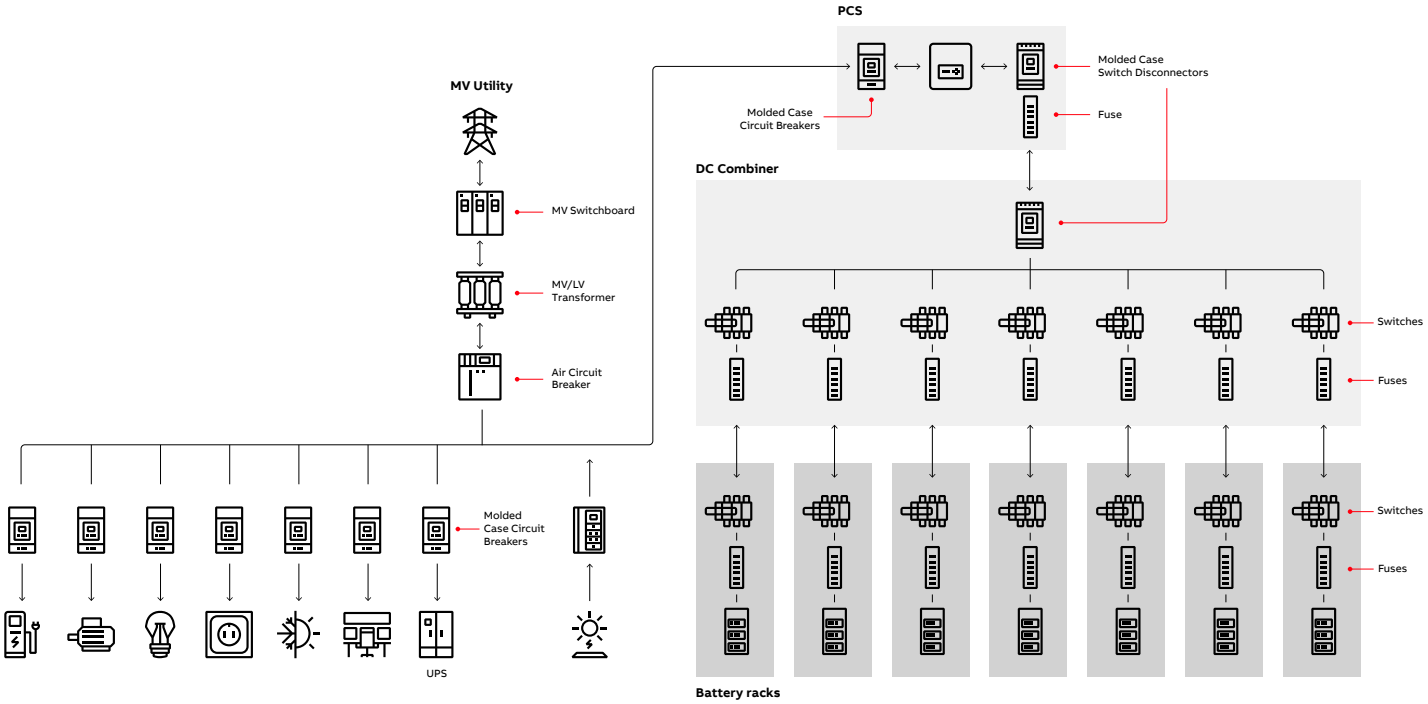
Smarter metering & monitoring
Maximizes power yield and cash generation by correct measurement of your BESS parameters.

Commercial & Industrial Battery Storage

Commercial & Industrial BESS, also known as customer-sited behind-the meter storage, represent an ideal solution for managing energy costs by leveraging on peak shaving, load shifting and maximization of self-consumption. By providing critical backup power for commercial & industrial facilities, BESS prevent revenue losses due to production outages and enable fuel savings by replacing gensets during electricity grid power outages of short-medium duration.

Key characteristics:

- Reduce electricity costs, minimize carbon footprint and improve resiliency.
- Manage energy consumption by leveraging on peak shaving, load shifting and maximization of self-consumption.
- Provide critical backup power by supporting/replacing gensets during electricity grid power outages of short-medium duration.
- Allow EV chargers to be installed without a dramatic increase in contractual power from the grid.

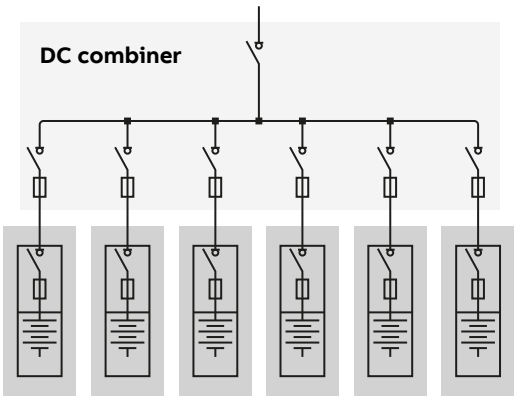


DC Combiner

Fundamentals, main components & functionalities

The power stored in battery racks and re-injected into the Utility through the Power Conversion System is collected by DC Combiners (in some cases also by a DC Recombiner).

The DC Combiner is a switchboard where several battery racks are placed in parallel by the related feeder. Every feeder requires adequate switching and protection against overcurrents.



DC combiner components
• Enclosure: System Pro-E
• Main Switch: Molded case switch disconnector (T5D/PV-E / OTDC500FV11-ESS)
• Surge Protection Device: OVR PV T1-T2
• Feeder switch disconnector: OTDC100GV11-ESS + fuses, S803PV-SD + fuses, S803PV-SP
• ARC flash mitigation: Active (TVOC-2 + SOR), Passive (Arc proof enclosure) & Preventive solutions

Main subsystem functionalities

- Combining of battery racks (range of hundreds of A)
- Overcurrent Protection of battery rack feeder
- Switching of battery rack feeder
- Main Switching to segregate the group of battery racks from the rest of the BESS (range of thousands of A)
- Surge Protection to protect against voltage spikes, such as from lightning

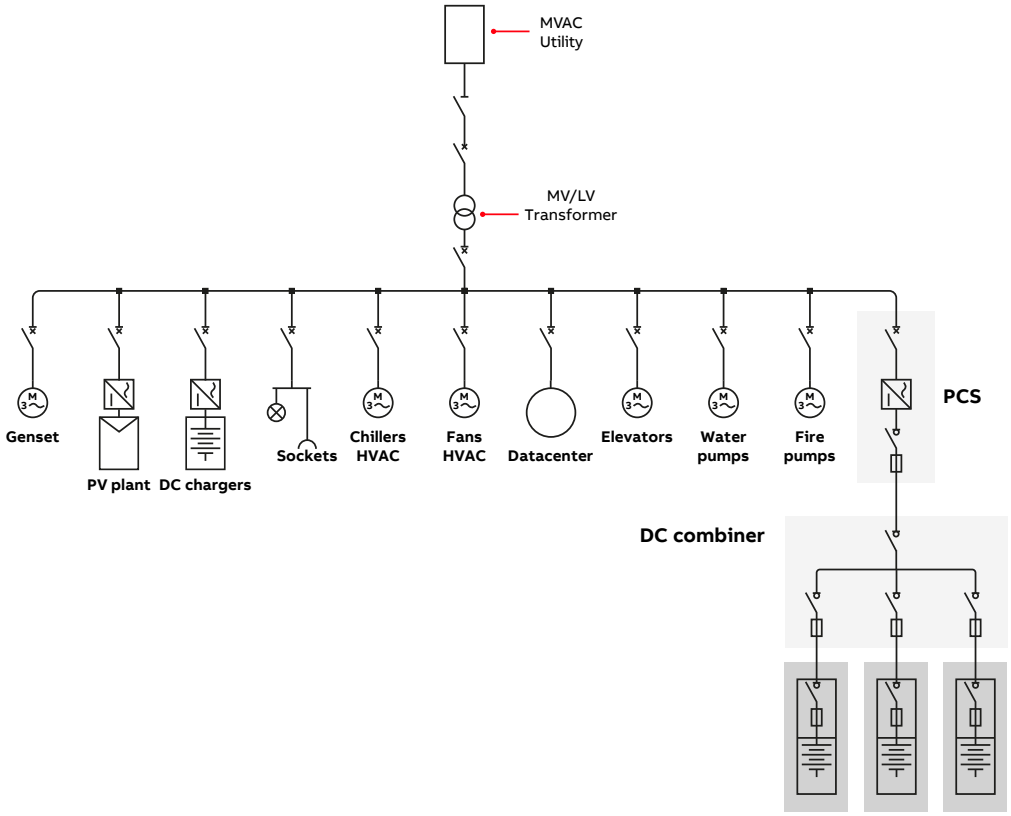
Additional subsystem functionality

- Monitoring: mainly where any drop in BESS plant performance may represent a significant economic loss
  - Voltage, current, or temperature monitoring
  - Communication: to communicate parameters to centralized monitoring system.
- Remotely-operated: need for remote control
- Arc flash mitigation

Switching and protection solutions for DC Combiners in BESS Commercial & Industrial applications

Discover our Switching & Protection solutions for easy DC combiners configuration considering a 500 kWh BESS architecture with 1 single 500 kWh system module.

Single-line diagram of one 500 kWh PCS module Commercial & Industrial application

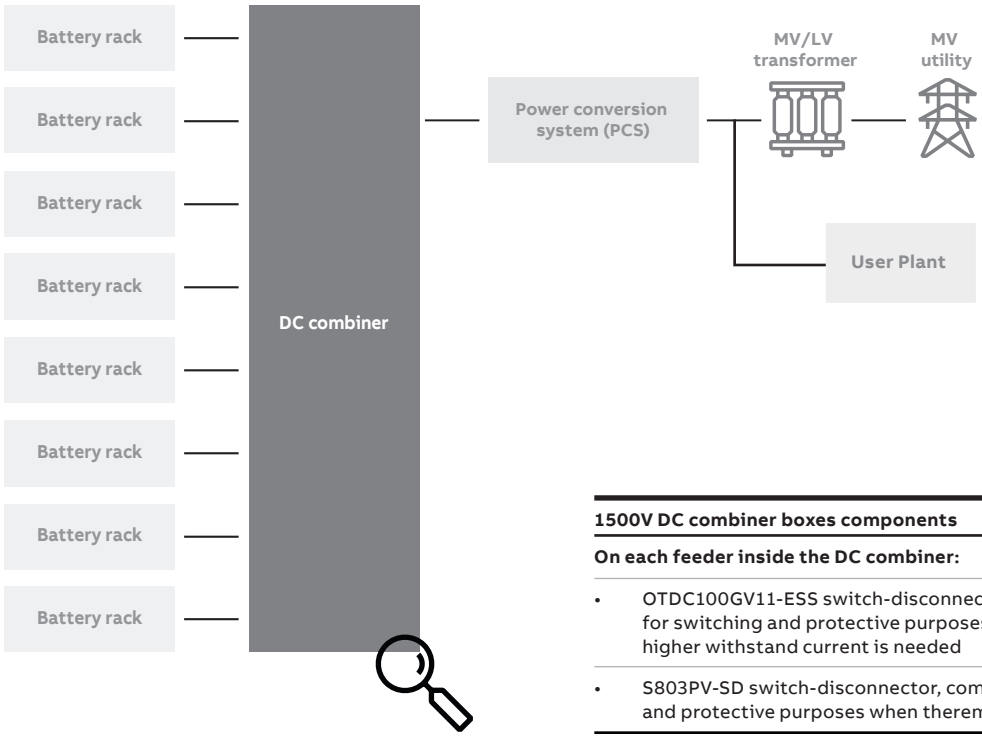


Specifications of electrical quantities with a 500 kWh PCS

Input data		
Rated power	[kW]	500
Rated stored energy	[kWh]	500
Rated DC voltage	[V] + 12%	1200
Rated AC voltage	[V] + 10%	528
Rated AC current	[A]	676
Prospective AC short circuit current	[kA]	50
Rack short circuit current	[kA]	7
N. containers		1
Rated DC voltage per module	[V] + 12%	50
N. modules per rack		24
Module capacity	[Ah]	4
Rack capacity	[Ah]	97
Energy per rack	[kWh]	116
N. racks per container		4
N. containers		1
Charging time	[h]	1
Rack rated current	[A]	97
DC bus max current	[A]	417
DC bus short circuit current [kA]		30
DC recombiner box		NO

ABB’s offering (IEC)

DC combiner panel



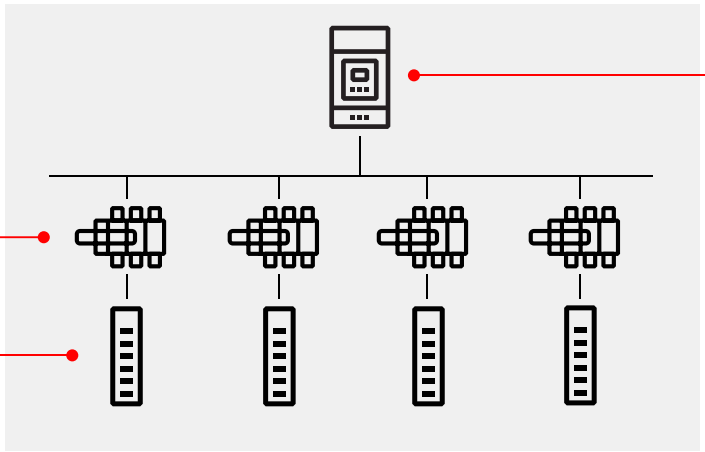
1500V DC combiner boxes components
On each feeder inside the DC combiner:
• OTDC100GV11-ESS switch-disconnector, combined with fuses, is installed for switching and protective purposes when the remote control is not needed while higher withstand current is needed
• S803PV-SD switch-disconnector, combined with fuses, is installed for switching and protective purposes when theremote control is needed
As main combiner switch:
• Tmax T5D/PV-E* Molded case switch-disconnector in fixed execution is installed for switching purposes and YU when the remote control is needed
• OTDC500FV11-ESS switch disconnector with fuses**
• Protection against overvoltages: OVR PV T1-T2 10-1500 P TS QS
• Arc flash mitigation solution: TVOC-2 + SOR installed on T5D

* For Tmax T5D/PV-E fuse to be added in series to protect the switch disconnector from short circuit peak current if the feeder fuses are not able to protect the switch disconnector itself
** As alternative or in addition to feeder fuses

High Performance Switch Disconnector

OTDC Switch disconnector

Molded Case Switch disconnector



Fuse

Product offering

Tmax T PV

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OTDC

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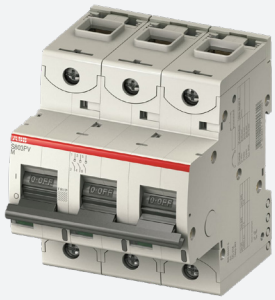
S800PV



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