APPLICATION NOTE

Switching and protection solutions for ABB PCS100 ESS in Battery Storage applications

IEC Commercial & Industrial

Are you searching for Switching and Protection solutions to protect your Power Conversion System (PCS) and keep it running in your Utility Scale Battery Energy Storage System (BESS)?
For switching and to protect your BESS installation from faults, overcurrent events and other hazards, the best product for your PCS can be easily found thanks to concrete examples.

What is a Power Conversion System (PCS)?
If you want your Utility scale BESS (battery energy storage system) installation to function efficiently, you need a Power Conversion System to convert the power from AC to DC and vice versa. The PCS is a bi-directional inverter that enables the batteries to charge and discharge with precision control.

Why you need a Switching and Protection (S&P) solution
The PCS requires adequate protection and switching capability on the AC and DC side in order to switch the system - also in the load condition - and protect the entire electrical circuit from faults and overcurrent events.
Our switching and protection devices will also provide your PCS with communication connectivity to the BESS control system.

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 SPD 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.

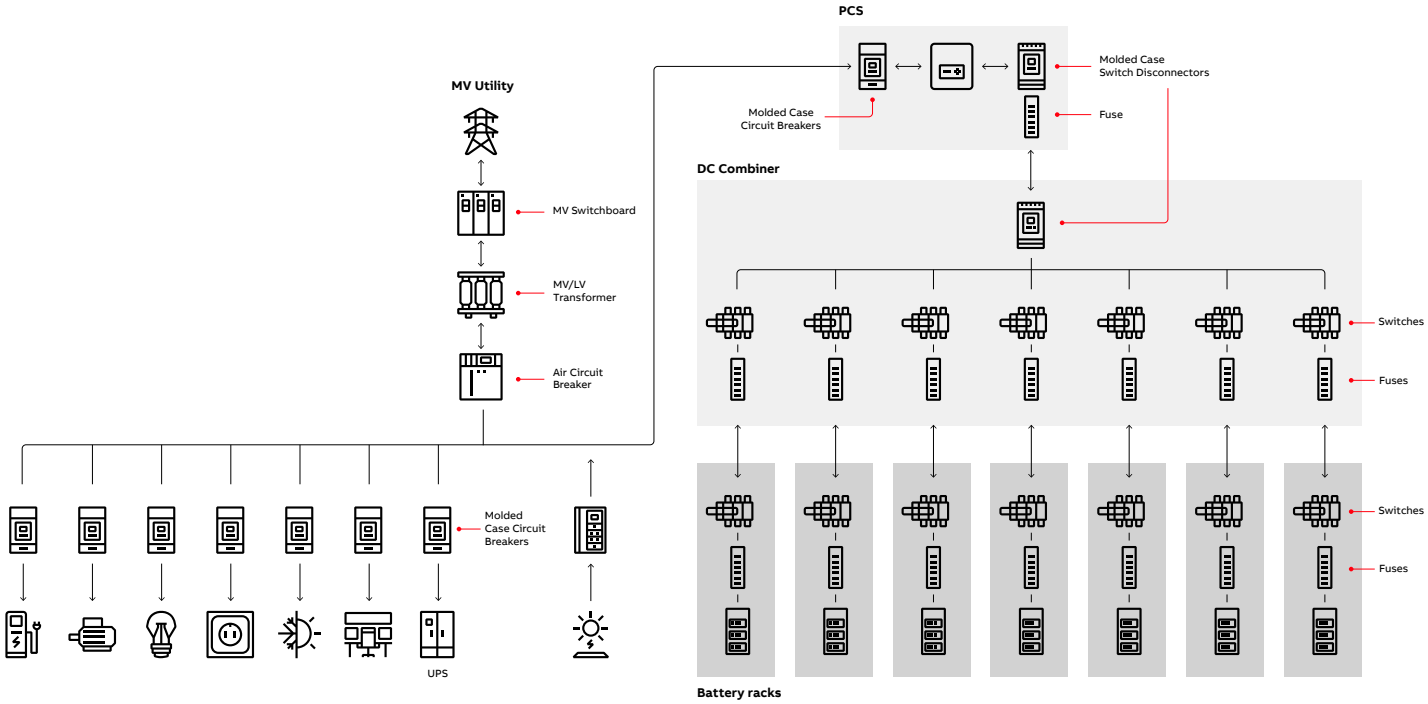
Smarter metering & monitoring
Maximizes power yield and cash generation by correct measurement of your BESS parameters.

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.

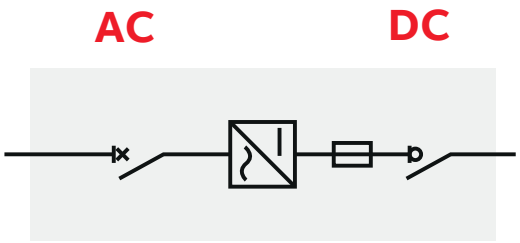


Power Conversion System

Fundamentals, main components & functionalities

Power is converted by an AC & DC Power Conversion System. This is a bi-directional inverter that enables the batteries to be charged/discharged with precision control.

The PCS requires appropriate protection and switching on the AC and DC side. In addition, the protection devices must provide communication connectivity with the BESS control system.



Main subsystem functionalities

- **AC Incoming or primary switching and protection.** A disconnect function, overcurrent protection and interfaced protection are required since the PCS is connected directly to a utility line in the majority of cases. The PCS can be supplied with either a fused manual disconnect switch or circuit breaker suitably rated for the incoming line voltage. The primary current and voltage transformers provided are connected to a protective relay and power metering equipment.
- **Auxiliary power**
  To provide the PCS with control and auxiliary power, an auxiliary power circuit is included. This comprises a fused disconnect switch, auxiliary power transformer, an uninterruptible power supply (UPS) and a power source for external battery heaters, if required.
- **Converter Modules**
  The converter drive modules are the heart of the power conversion unit. The modules used in this application convert DC to three-phase AC and vice versa. To achieve the total output rating required under specified conditions, twelve to sixteen identical modules are used for each 1 MW battery input. The converter modules are specifically designed for custom applications where enhanced system flexibility is needed.
- **DC switching and protection**
  The DC section of the PCS enclosure can contain either fused DC disconnect switches or DC circuit breakers, depending on the requirements of the battery supplier.
- **Local control**

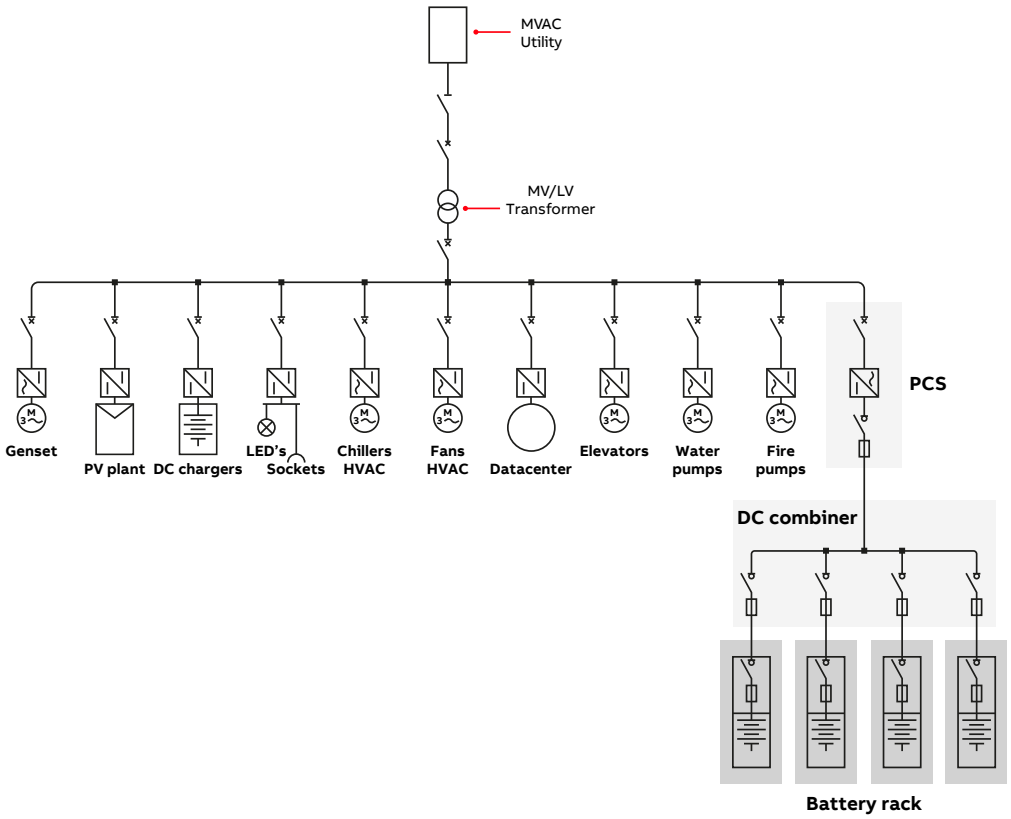
Additional subsystem functionalities

- **Arc flash mitigation:** Active, Passive & Preventive solutions.
- **Surge protection device** on AC and DC side, against direct lightning.

Switching and protection solutions for ABB PCS100 ESS in BESS Commercial & Industrial applications

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

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

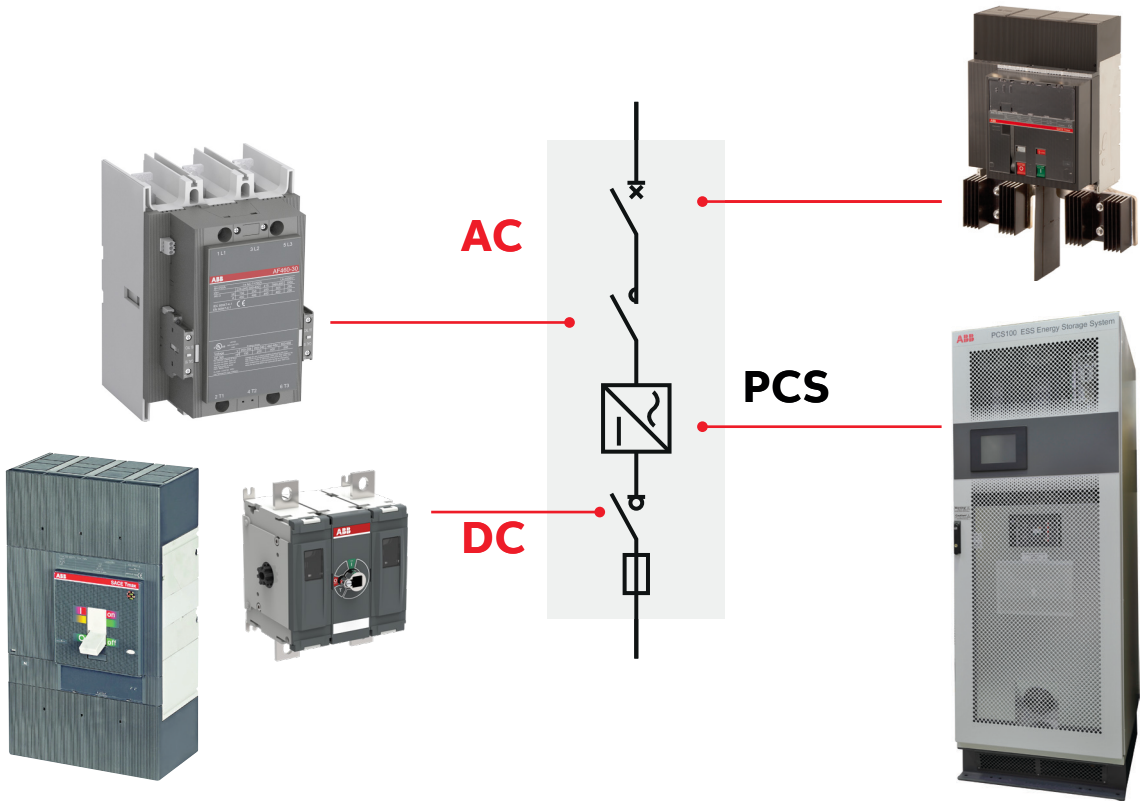


Specifications of electrical quantities with a 500 kWh PCS

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 combiner		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 offering

PCS with single inverter per module



AC side	
AF 460 (700A – AC1) contactor for switching	
Tmax XT7H	**Tmax XT7H M 800 3p In=800A Ekip Dip LS/I** circuit breaker for protection and isolation, equipped with Ekip com Modbus TCP communication module as well as SOR* and motor operator to open/close remotely
	Tmax XT7H M 800 3p In=800A Ekip Touch Measuring LSI circuit breaker for protection and isolation, equipped with Ekip com Modbus TCP communication module as well as SOR* and motor operator to open/close remotely
	Tmax XT7H M 800 3p In=800A Ekip Hi-Touch LSI circuit breaker for protection and isolation, equipped with Ekip com Modbus TCP communication module as well as SOR* and motor operator to open/close remotely
OVR T2 3L 40-600 P TS QS to protect against overvoltage from the AC Utility	
TVOC-2 + RELT Module for Arc Flash Mitigation	
PCS100 ESS C-Type PCS100 19-07C-B1x (Iac=735A) The inverter drive modules are the heart of the power conversion unit. PCS100 ESS modular design and advanced control maximize the availability, value and performance of both large and small energy storage systems in a variety of applications. PCS100 ESS allows both real power (P) and reactive power (Q) to be controlled, thereby enabling it to cover a wide range of system requirements	

* Shunt Opening Release (SOR)

DC side	
Tmax T5D/PV-E Molded case switch-disconnector in fixed version combined with fuses. The switch-disconnector is equipped with YU* undervoltage release and motor operator to open/close remotely	
OTDC500FV11-ESS switch disconnector combined with fuses whether remote tripping is needed or not	
OVR PV T1-T2 10-1500P TS QS surge protection device to protect against overvoltages	

* Undervoltage Release (YU)

Web page

Catalog

PCS100 ESS C-Type

- Modular design providing high reliability and short mean time to repair (MTTR)
- Grid fault detection
- Islanding and anti-islanding options
- Ratings from 100 kVA to 4000 kVA and
- Voltages from 150 VAC to 480 VAC
- Allows a range of energy storage devices to be coupled to the grid
- Dynamic real power control (P)
- Dynamic reactive power control (Q)
- Generator emulating control mode
- Grid stabilization features including synthetic inertia and active damping
- Low voltage ride through (LVRT)
- Voltage and frequency dynamic envelope/ regulation functions.

General data	
AC rating	150A - 4800A D-type module
	105A - 3360A C-type module

Utility side (AC)	
Rated voltage	150 - 480 V +/- 10%
Nominal frequency	50 Hz or 60 Hz +/- 5%
Power system	3-phase center ground referenced (TN-S) - coupling transformer required
	3-phasefloating system (IT) - insulation monitoring required
Overvoltage category	III - 4kV (IEC 60664)
Fault capacity	25 kA (cabinet), 65 kA (rack)
Achievable efficiency	98%
Overload capability	200% for 2 seconds
	150% for 30 seconds
	120% for 600 seconds
Circuit protection	Circuit breaker or fuse (not included)
Voltage harmonic compatibility	IEC 61000-2-4 Class 2 (Utility THDv < 8%)
Power module voltage harmonic distortion	THDv < 2.5% for linear loads

Energy Storage Side (DC)	
Rated voltage	+/- 125 VDC up to +/- 560 VDC (250 up to 1120 VDC) for C-type
	+/- 125 VDC up to +/- 410 VDC (250 up to 820 VDC) for D-type
Supply earth referencing	DC center referenced
Overvoltage category	II (IEC 60664)
	4 kV D-type module
	6 kV C-type module
Maximum voltage to ground	+/- 600 VDC
Circuit protection	Circuit breaker or fuse (not included)

Product offering

Contactors:

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CATALOG
INTERACTIVE CATALOG

Tmax XT:

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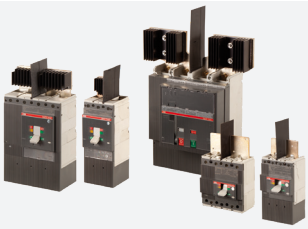
CATALOG

Tmax T - PV:



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