



Low-voltage products and solutions

Batteries and Super Capacitors

Energy Storage Systems (ESS)

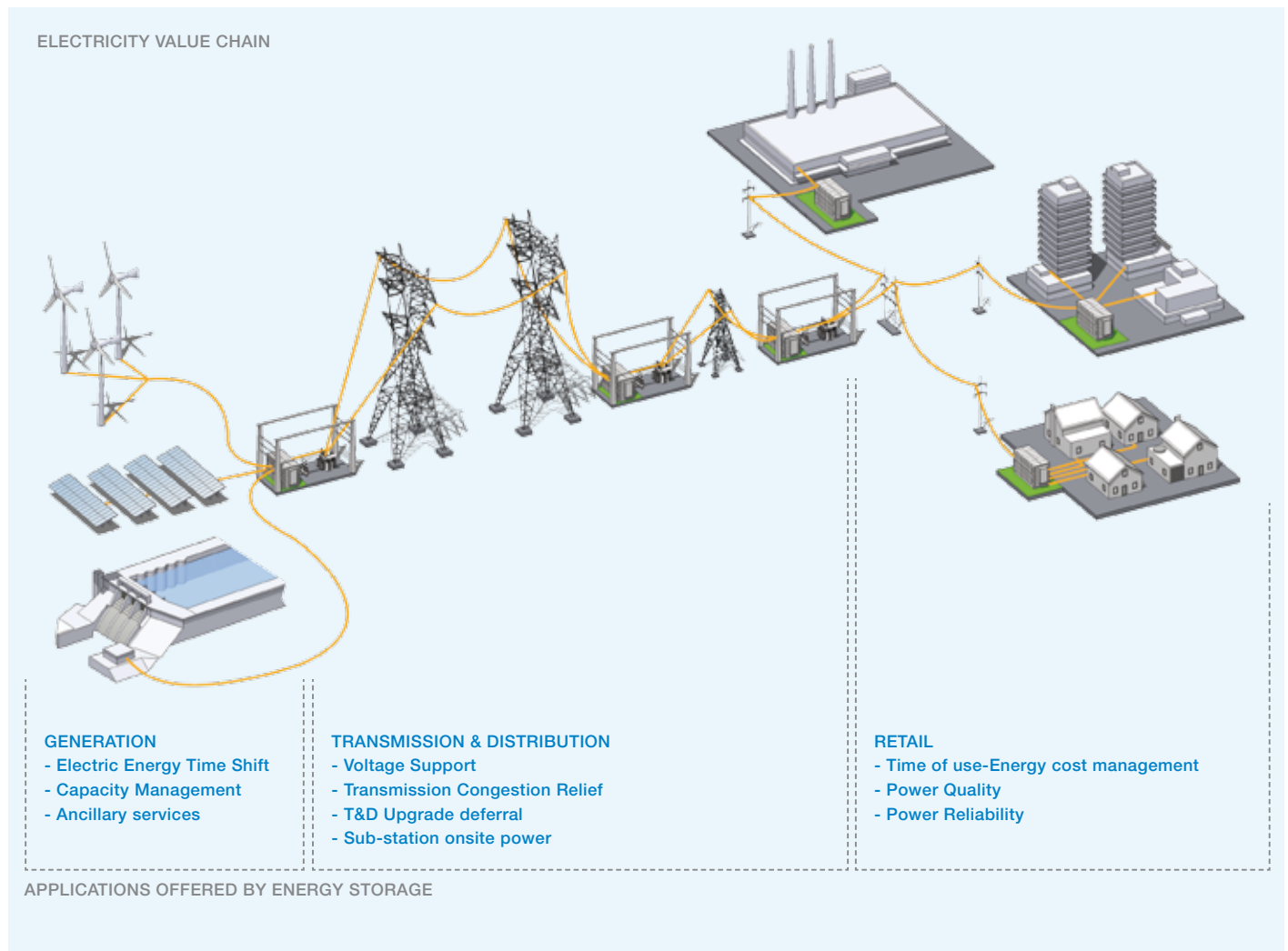
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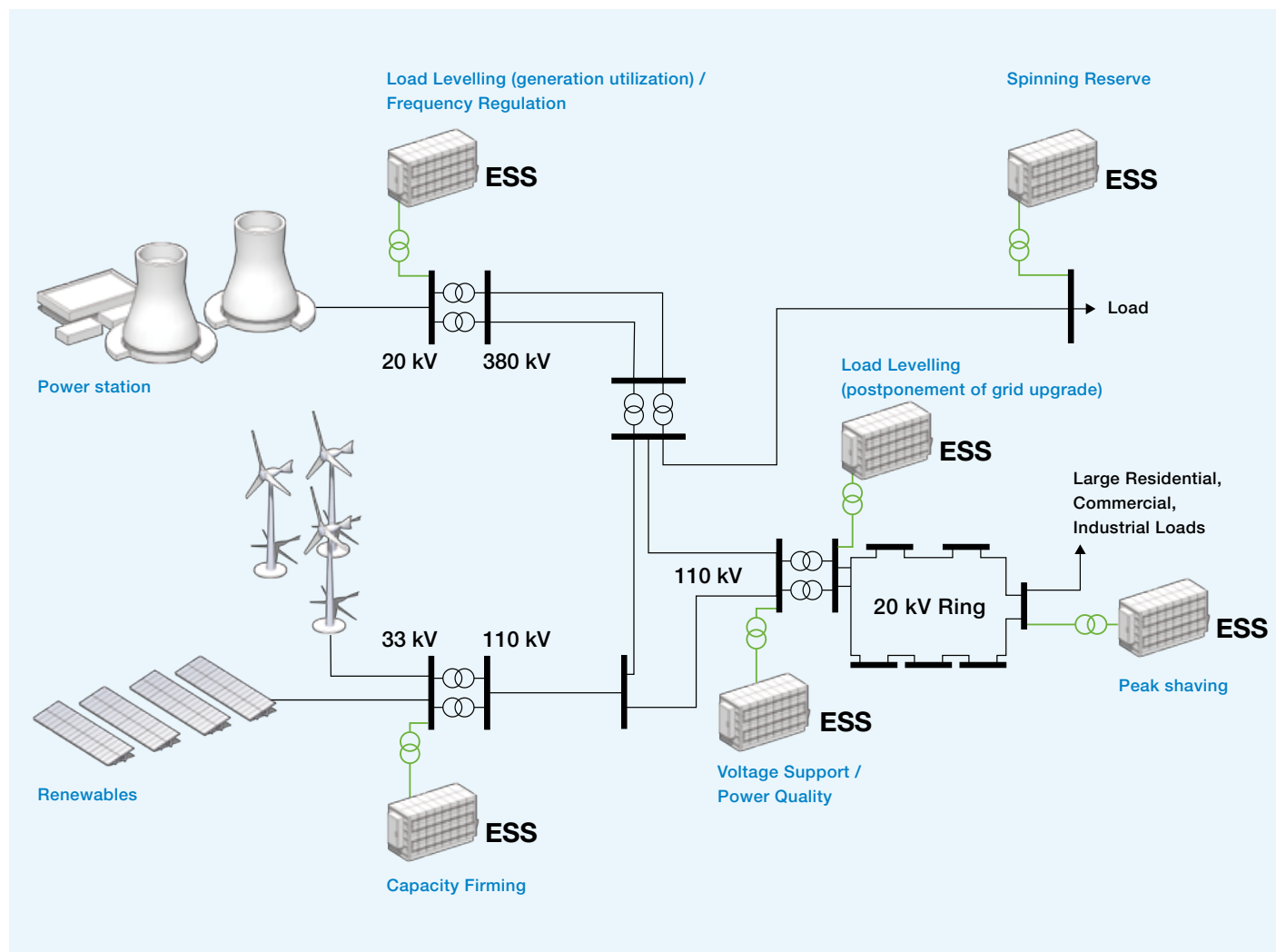
Energy Storage System for high efficiency electricity grids

Energy Storage Systems (ESS) are able to solve one of the well-known problems in the use of electricity: the electricity must be used immediately when it is generated, which is not always the same time the electricity is needed. To store energy, it must be converted temporarily to another form that is more convenient or more economical for storing. Then, when it is needed again, the energy must be re-converted back to a form that can be immediately utilized. Some technologies provide short-term energy storage, while others can provide energy storage for a longer duration. However, the goal is the same: an Energy Storage System is a solution that stores energy for use at a later time.

In figure 1, we can see the ESS value chain from Generation to end user; key advantage can be identified in "Efficiency": the use of ESS increases the efficiency of the electricity grid, at all levels.



In figure 2, the same concept is exemplified by means of a simple single-line diagram: ESS are normally connected in medium voltage, but the alternative source of energy (in most cases, batteries) is usually given in low-voltage.



The benefits of Energy Storage System in electrification value chain

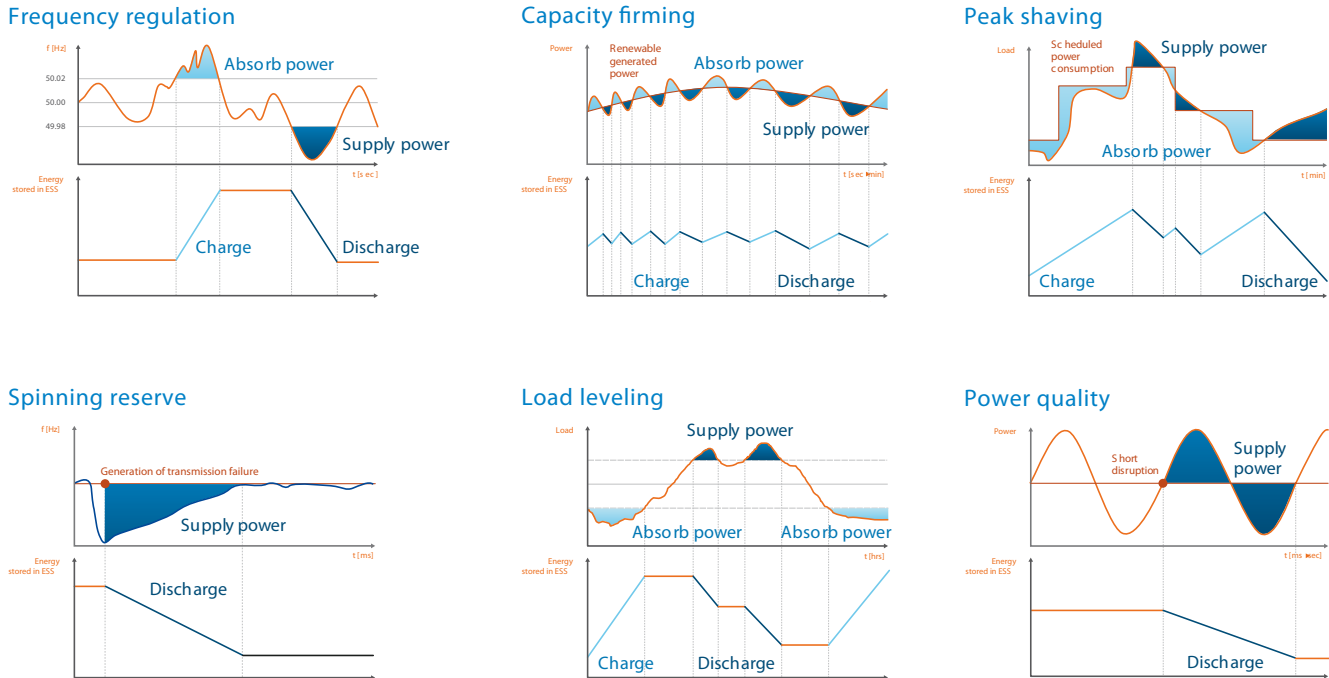


Figure 3

As can be understood from both figure 1 and 2, ESS can play a role in all the parts of the electrification value chain: generation, transmission, distribution and end-use applications. In figure 3, a visual representation of the benefit of ESS, while charging or discharging, is given.

Focusing on generation stage, ESS can be used mainly to create a smoother generation profile, and eventually, more cost-effective energy production. For example, large battery systems already play a significant role in integrating and balancing large amounts of wind and solar energy in real time. Fast reaction times mean that batteries are ideally suited to provide this kind of service. The amount of power generated by a wind farm can increase or decrease by as much as 25% in a five minute interval. This fast inrush or decline in wind power generation creates significant pressure on peak-load generators or on thermal power plants which may not be able to respond quickly to continue serving the loads. For the reason, ESS can be a great solution to scale up or scale down the wind power generation as needed and at any time.

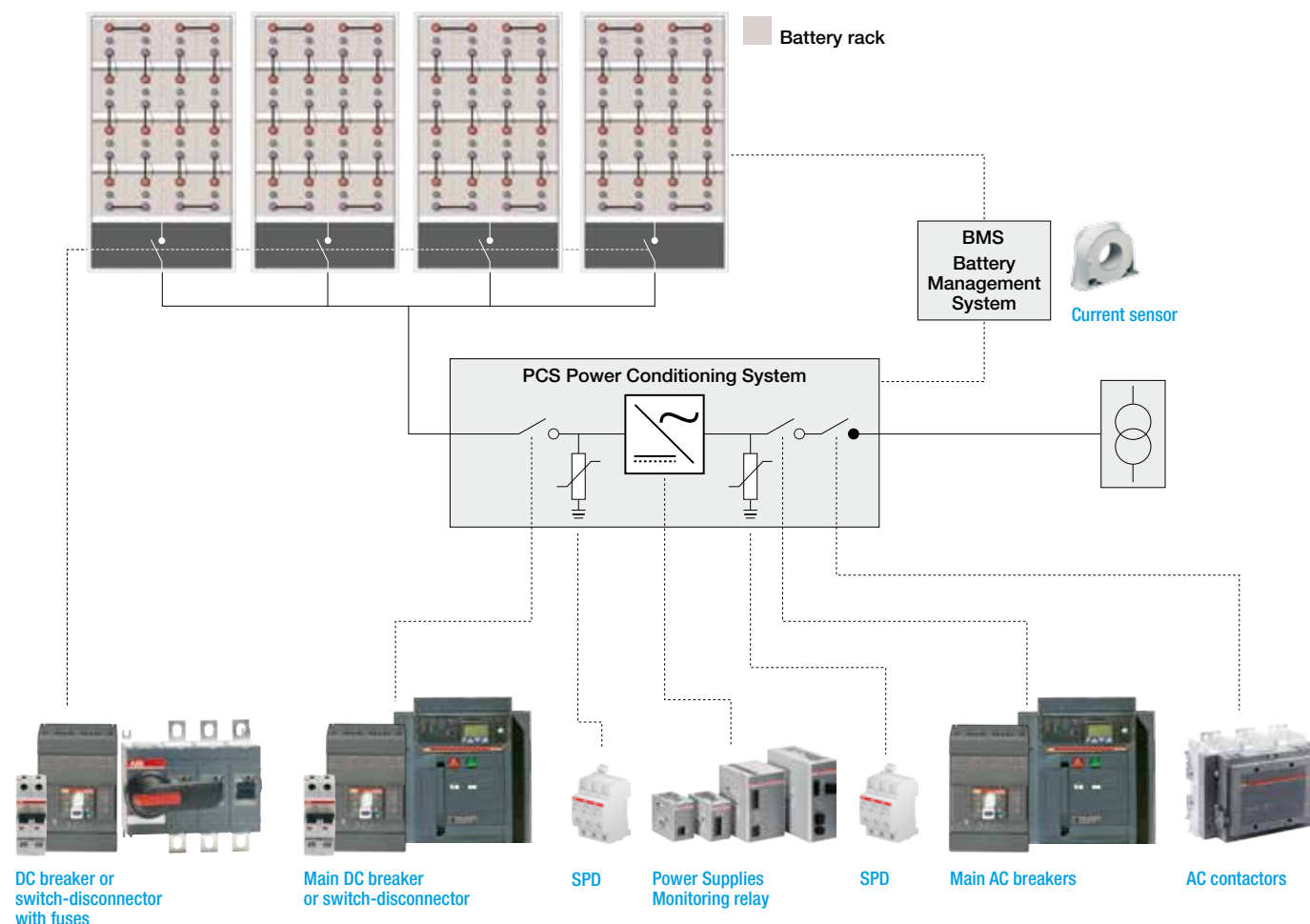
Therefore, a reasonable sizing of an ESS for a Wind farm could range between 15 to 25% of the total capacity. Finally, penalties in tariff rates can be avoided by wind and solar plant operators, by storing any surplus power produced or alternatively, by supplementing power from the ESS when needed to match the actual power needed at any given period in time.

Taking a look outside of the renewables world, we can observe in a practical example that a multi-MW ESS (based on batteries) was installed in Chile, to offload a thermal power plant of its frequency response ancillary services. The ESS is in operation since 2009 and is automatically responding to the frequency fluctuations in the grid. Whenever frequency drops by 0.3 Hz, the ESS is activated within 100 ms (milliseconds), unlike the response time of power plant which was between 5 and 10 minutes.

The System for Storing Energy

A large ESS can be described in its basic components in the following schematic:

Figure 4

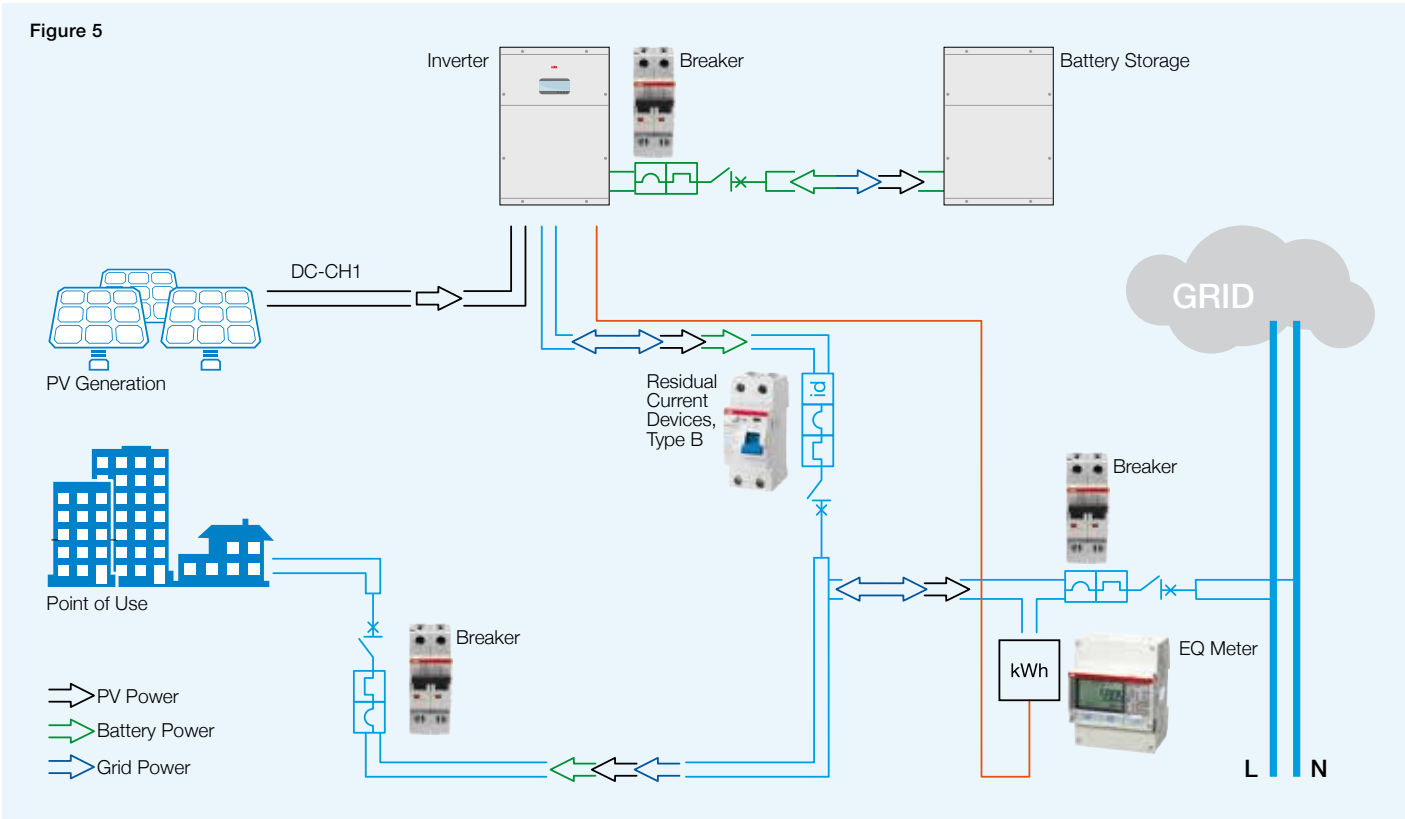


In Figure 4, a selection of ABB low-voltage products for each section of a large ESS is given. Each section represents distinctive challenges to the system integrator: a brief table with summarized ABB performances is reported in Table 1.

Table 1

	Challenge	ABB Product	Distinctive ABB feature
LV Main AC circuit-breaker	Compact dimensions	Tmax and Emax 2 ranges	Most compact breakers in the market
	Immunity from harmonics		Great level of immunity to high harmonics
LV components in converter	Low Power and Heat dissipation	CP-E Power Supply	High efficiency, up to 94 %
	High Rated Voltage on DC side	CM-IVN Insulation monitor	Up to 1000 VDC with coupling unit CM-IVN
Battery Protection Unit	Compact dimensions	Circuit Breaker: S800 , Tmax PV , Emax	Most compact products in the market
	High Rated Voltage	DC product ranges or Fusible Switch: OS product range	Up to 1500 VDC (S800 automatic CB), up to 1000 VDC (Tmax and Emax DC automatic CBs), up to 880 VDC (OS Fusible Switch)
Main DC breaker or switch-disconnector	High Rated Voltage	Tmax and Emax DC ranges	Up to 1000 VDC as automatic circuit-breakers and up to 1500 VDC as switch-disconnectors
LV components in BMS	High Accuracy even a high temperature	ES Series Current Sensors	Accuracy of 1% up to 70°C

The System for Storing Energy



Large ESS are normally ran under voltages ranging from 750 VDC up to 1100 VDC or even more (up to the limit of low-voltage, i. e. 1500 VDC).

Bouncing to the other extreme, the end-user applications, we can consider small commercial or even domestic applications (as in the diagram of figure 5), where the DC side voltage is normally not greater than 500 VDC (both for PV panels and battery units).

In this case a centralized inverter coupled with a battery system is depicted: another possible solution can be two separated inverters, one for the PV field and a second one for the battery system. Inside the inverter, of both types, a circuit-breaker or a switch-disconnector with fuses should be used on the DC battery side, to provide basic safety functions.

Each section represents distinctive challenges: a brief table with summarized ABB performances is reported as Table 2:

	Challenge	ABB Product	Distinctive ABB feature
Inverter DC switch or circuit-breaker	Compact dimensions	OTDC or S200 M UC	Two-poles solution
	DC Rated Voltage		Up to 1500 VDC (with OTDC) Rated Voltage
Metering Section	Bus communication option	EQ Meters	EQ Meters offer different communication capabilities
	Generation profiling		Data storage available
Residual Current Device (AC side)	Sensing leakage currents with little DC component	F 200, Type B	Type B Residual Current Device
Surge protection devices for DC side	Granting maximum safety	OVR PV	OVR PV are self-protected against short-circuit at the end of life
Current Monitoring	Possibility to measure current flow in DC and AC	CMS	Able to measure both DC and AC currents

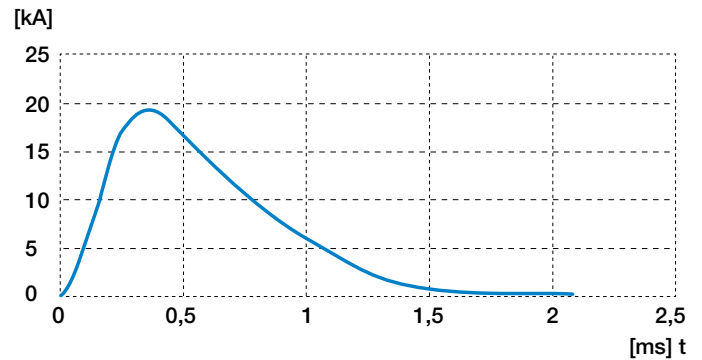
The choice of the suitable overcurrent device

Batteries are not the only type of storage component used in ESS; another widely used technology is ultracapacitor (sometimes associated with batteries).

Ultracapacitor technology allows ESS to charge and discharge far faster than batteries. In other words, the power density of ultracapacitors is tens of times higher than batteries. However, ultracapacitor cannot store an amount of energy as large as batteries.

Short-circuiting an ultracapacitor can lead to a very fast transient of current, a spike like the one depicted in figure 6.

Figure 6



Almost 20 kA of short circuit can be reached in a very short time: the overall transient is lasting for less than 3 ms.

In a situation like this, the choice of the overcurrent protection device can be trickier than the usual.

For example, assume to have a steady-state system designed for 250A and 500 VDC, which includes an ultracapacitor storing solution. When selecting the overcurrent protection for this type of system, a system integrator may choose a standard automatic circuit breaker, such as ABB Tmax XT3. This circuit breaker has Icu (rated ultimate short-circuit breaking capacity) equal to 36kA at 500 VDC and fixed magnetic threshold at 2500A (10 times the rated current). However, suppose there is a short circuit with a waveform similar to that shown in figure 6.

Is this circuit breaker selection correct? Well, maybe yes and maybe no.

The circuit-breaker selected is for sure able to open 20 kA of short-circuit current at 500Vdc, but what we have in this case is not a real short-circuit current, but a spike.

What could happen is that the contacts of the circuit-breaker would start opening, and then reclose right after, because of the insufficient energy given by the fastness of the transitory phenomenon.

Therefore, one possibility is that the circuit-breaker would end up with the contacts closed at the end of the transitory, and these contacts may be welded.

ABB has the expertise to help designers and project managers choose the most appropriate disconnecting and protecting devices for ESS, in all conditions.

DC products for Battery Protection Unit (BPU) and Power Conversion System (PCS)

Thanks to their advanced specifications, ABB's modular products and accessories address the huge challenges on DC side in terms of safety, security and monitoring of Battery Protection Units (BPUs) and Power Conversion Systems (PCSs). High power and high performance miniature circuit-breakers with rated voltages up to 1500 VDC and rated currents up to 125 A, surge protection devices specifically designed for DC systems, compact switch-disconnectors from 100 to 1600 A, DC specific circuit-breakers, innovative and high performing automatic circuit-breakers, LV circuit-breakers for DC applications up to 5000 A and many other complementary devices such as auxiliary contacts, under voltage releases and motorized commands, allow for a wide spectrum of configurations.



Miniature circuit-breakers

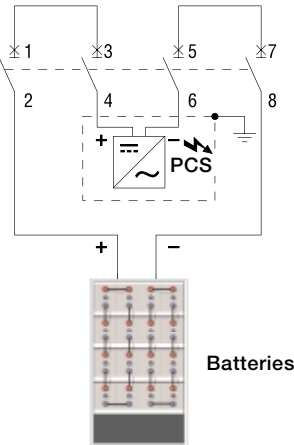
S204 M UC Z



The S200 M UC Z range of miniature circuit-breakers features permanent magnets on the internal arcing chutes able to extinguish an electric arc of up to 440 V DC acc. to IEC 60947-2 with Icu = 10 kA. However, use of these components establishes circuit-breaker polarity, thus they must be powered in a certain direction. A diagram showing how the batteries and PCS must be connected is given alongside.

Main technical specifications		S204 M UC Z
Reference Standards		IEC/EN 60898-2, IEC/EN 60947-2, UL1077, CSA 22.2 No. 335
Rated current In	A	0,5 ≤ In ≤ 63
Number of poles		4
Rated operational voltage Ue (DC)	V	440
Ultimate rated breaking capacity Icu - 4P	kA	10
Electromagnetic release		3 In ≤ Im ≤ 4,5 In
Operating temperature	°C	-25...+55
Mounting		on DIN rail EN 60715 (35 mm) by means of fast clip device

In IT systems an isolation monitoring device should not be installed.



Miniature circuit-breakers

S800S-UC



The S800S-UC DC high performance MCB is in a wide range of DC applications. Due to their high rated operational voltage of up to 750 V DC the max. rated current of 125 A and the high breaking capacity of up to 50 kA, make these devices suitable for applications in battery protection unit (BPU) or power conversion system (PCS).

Main technical specifications		S800S-UC
Tripping characteristics		UCB, UCK
Reference Standards		IEC / EN 60947-2
Number of poles		1 ... 4
Rated current I _e	A	10 ... 125
Rated frequency f	Hz	50/60
Rated insulation voltage U _i acc. to IEC/EN 60664-1V		DC 1000
Rated impulse withstand voltage U _{imp} . (1.2/50 µs) kV		8
Overtoltage category		III
Pollution degree		2
Suitability for isolation		yes
Data according to IEC/EN 60947-2		
Rated operational voltage U _e	V	DC 250 (1-pole); DC 500 (2-pole); DC 750 (3-pole); DC 750 (4-pole) (63 ... 125 A); DC 1000 (4-pole) (10 ... 50 A)
Rated ultimate short-circuit capacity I _{cu}	kA	DC 250 V (1-pole) = 50 kA; DC 500 V (2-pole) = 50 kA; DC 750 V (3-pole) = 50 kA; DC 750 V (4-pole) = 50 kA
Rated service short-circuit capacity I _{cs}	kA	DC 250 V (1-pole) = 50 kA; DC 500 V (2-pole) = 50 kA; DC 750 V (3-pole) = 50 kA; DC 750 V (4-pole) = 50 kA
Reference temperature for tripping characteristics	°C	UCB: 30 °C UCK: 40 °C
Electrical and Mechanical Endurance	ops.	10 ... 100 A: 1500 electrical/8500 mechanical; 125 A: 1000 electrical/7000 mechanical
Ambient temperature	°C	-25 ... +60

Miniature circuit-breakers

S800 PV-SP



The S800 PV-SP modular miniature circuit-breakers can be used in networks up to 1200 V DC (4-poles execution). The S800 PV-SP circuit breakers and its range of accessories (auxiliary contacts, undervoltage releases, motorized commands) allow for a wide spectrum of configurations.

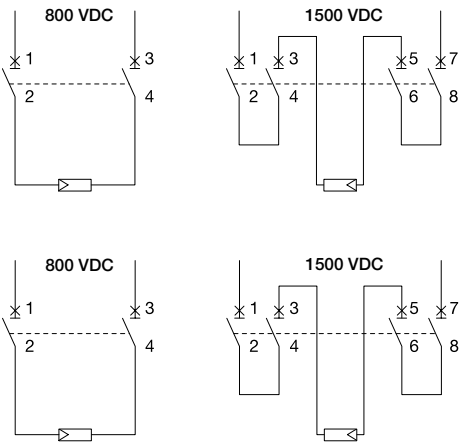
The main features of the S800 PV-SP circuit breakers include:

- interchangeable terminals
- central trip safe disconnection of all poles
- contact status displayed for each pole
- polarity independent wiring

Main technical specifications		S800 PV-SP	
Reference Standards		IEC EN 60947-2 and Annex P	
Rated current	A	5...125	125
Number of poles		2, 4	
Rated voltage Ue			
(DC) 2 poles*	V	800	
(DC) 4 poles*	V	1500	
Ultimate rated short-circuit breaking capacity Icu			
5...16A acc. IEC 60947-2 Annex P	kA	5	
20...125A acc. IEC 60947-2	kA	5	
20...125A acc. IEC 60947-2 Annex P	kA	3	
Thermomagnetic release characteristic		4 In ≤ Im ≤ 7 In	
Class of use		A	
Operating temperature	°C	-25...+60	
Mounting		DIN rail EN 60715 (35 mm) by means of fast clip device	

* Please refer to the wiring diagrams

Panel network in earth-insulated systems



Surge protective devices

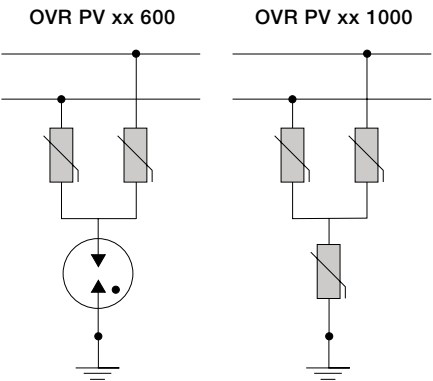
OVR PV



- ABB offers a wide range of surge protection devices specifically designed for DC systems. The main features of the OVR PV SPDs include:
- OVR PV T1 and T2 version
 - Auto-protected from end-of-life short circuits up to 10 kA DC thanks to the integrated thermal protection with direct current breaking capacity
 - pluggable cartridges for easy maintenance, no need to disconnect the line
 - auxiliary contact for remote signaling of line status (“TS” version)
 - absence of short circuit follow current
 - absence of risk for reversed polarity
 - “Y” configuration for a safer protection
 - bottom wiring to improve safety when there is humidity issues in enclosure
 - QS Quick Safe® Technology- Fast disconnection in case of end of life of the SPD avavoiding thermal runaway.

Main technical specifications		OVR PV T1	OVR PV T2 40 QS
Reference Standards		IEC 61643-11 / UTE C 61740-51 prEN 50539-11 UL 1449 4th edition*	
Configuration		Y	Y
SPDs Type / Test Class		T1 / I	T2 / II
Max. cont. Operating voltage Ucpv	V	670 / 1000	600 / 1000 / 1500
Nominal discharge current In (8/20 µs)	kA	6.25	20
Impulse current Iimp (10/350 µs)	kA	6.25	-
Maximum discharge current Imax (8/20 µs)	kA	-	40
Voltage protection level Up	kV	1.9 / 2.5	2.8 / 3.8
Short circuit DC current withstand Iscwpv	A	100	10000
Back-up protection:			
- if Iscwpv ≤100A		- not required	- not required
- if Iscwpv >100A		- 10A gPV fuse	- autoprotected up to 10 kA
Response time	ns	≤25	≤25
Specific integrated PV thermal disconnecter		Yes	QuickSafe Technology
Pluggable		Yes	QuickSafe Technology
Auxiliary contact		TS	TS

*UL version only for OVR PV 40



Switch-disconnectors

OTDC16...32



OTDC16...32F



OTDC16...32U



OTDCP16...32F

OTDC16...32 disconnect switches are available up to 32 amperes and 1000V. The modular structure offers a simple and cost effective solution for disconnecting up 1, 2, or 3 DC circuits within the same footprint area.

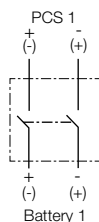
- The main features of the OTDC16...32 disconnect switches include:
- Patented design of DC main contacts offer:
 - Low temperature rise for minimal contribution to overall heat-rise within any enclosure.
 - High operational performance, 32A up to 1000V, in high ambient temperatures.
 - Increased energy efficiency
- Compactness and modularity: allow for consistent and optimized mounting in switchboard equipment, therefore reducing implementation costs and increased space savings.
- DINrail, base, or door-mounted versions for simple installation in a variety of enclosure designs.
- Compliant with many global standards, including UL 508i.
- OTDC16...32US versions are factory pre-connected for single-wire breaking applications.
- Enclosed OTDCP16...32 versions are suitable for outdoor use in harsh environments.

Examples

One DC Circuit

2 Pole

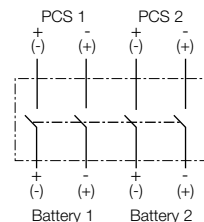
OTDC_F2, FT2
OTDC_U2, UT2



Two DC Circuit

4 Pole

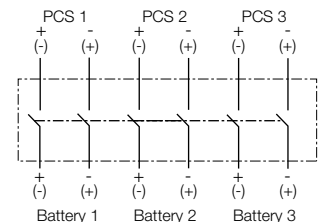
OTDC_F4, FT4
OTDC_U4, UT4



Three DC Circuit

6 Pole

OTDC_F6, FT6
OTDC_U6, UT6



Switch-disconnectors

OTDC16...32

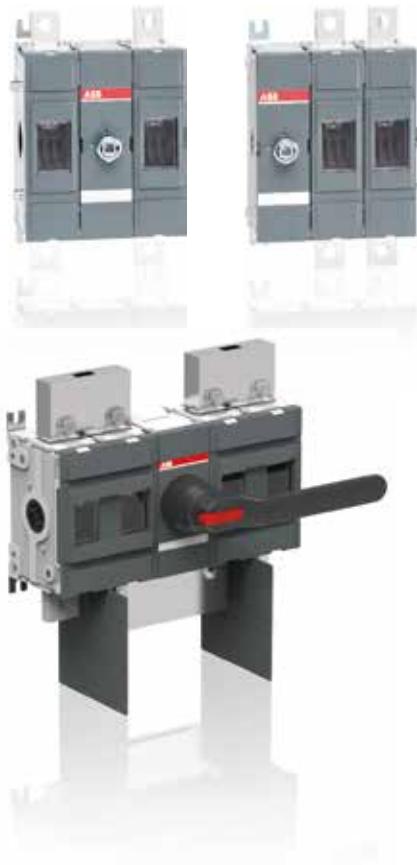
Main technical specifications ¹⁾		OTDC16...32	
Mounting Versions	Base and Din Mount	_F Type	_U Type
	Door Mount	OTDC_F_	OTDC_U_, OTDC_US_
Reference Standards		OTDC_FT_	OTDC_UT_, OTDC_UST_
Rated Insulation Voltage (UI)		IEC 60947-3	
Pollution degree 3	V	1000	
Rated Impulse Voltage (Uimp)	kV	8	
Nominal Current In (Amps)		16, 25, 32	16, 25, 32
Rated Thermal Current	in open air	25...45	40...63
Ith (Amps)	in enclosure 40°C	25...45	32...50
	in enclosure 60°C	25...32	25...40
Utilization Category		DC-21B	
Number of Poles		2...4	2...6
Rated Operational Current Ie (Amps) at 660 V DC	1 circuit	16...32	16...32
	2 circuits	16...32	16...32
	3 circuits		16...32
Rated Operational Current Ie (Amps) at 1000 V DC ²⁾	1 circuit	10...32	10...20
	2 circuits	10...32	10...20
	3 circuits		10...20
Wire Size Range	mm ²	2.5...16	
Reference Standards		UL508i	
Number of Poles		-	2...6
Rated Current (Amps) at 600 V DC	1 circuit	-	10...25
	2 circuits	-	16...32
	3 circuits	-	16
Ambient temperature	°C	-	-20...+60
Short Circuit Rating	kA, 600V	-	5
	Protection Type	-	RK5 Fuse
	A, Max Fuse Size	-	70
Wire Size Range	AWG	-	12-6 AWG

1) For additional technical details, refer to OTDC Main Catalog

2) 1000 V DC not applicable to OTDC_US, UST versions.

Switch-disconnectors

1000 V DC and up to 1600A: OTDC100...1600



The OTDC series of switch-disconnectors is available with nominal currents from 100 to 1600 A.

OTDC 100...800: two poles in series provides compact performance up to 1000 V DC. Up to three 1000 V circuits can be operated with a single device. It is also possible to use the switch as a combiner, with separate inputs and a combined output of up to 1500A.

OTDC1000...1600: four poles in series provides compact performance up to 1000 V DC for use in high power applications

The main features of the OTDC100...1600 switch-disconnectors include:

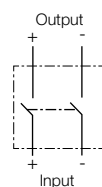
- Compactness: thanks to the patented DMB (Dual Magnetic Breaking) technology, the switches reach 1000 V DC with two poles in series for most sizes.
- Easy to install: connections are simple and independent from polarity, for providing greater wiring flexibility. The operating mechanism can be located between the poles or on the left side of the switch.
- Factory-installed or jumper kits available.
- Safety: Visible contacts allow a clear indication of position.

Examples

Single DC Circuit

1000 V DC IEC: 100-500A

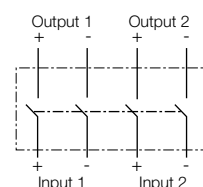
1000 V DC UL: 100-400A



Double DC Circuit

1000 V DC IEC: 100-500A

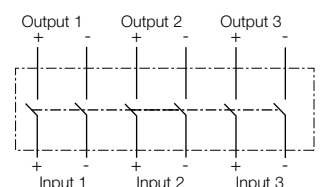
1000 V DC UL: 100-400A



Triple DC Circuit

1000 V DC

IEC: 315-500A



Switch-disconnectors

1000 V DC and up to 1600A: OTDC100...1600

Main technical specifications ¹⁾		OTDC100...250		OTDC250...800		OTDC1000...1600	
		OTDC100... 250E_	OTDC100... 200U_	OTDC315... 800E_	OTDC250... 600U_	OTDC1000... 1600E_	OTDC800... 1000U_
Wiring configuration	Two-wire breaking	E types	U types	E types	U types	E types	U types
	Single-wire breaking		US types		US types		US types
Reference Standard		IEC 60947-3		IEC 60947-3			
Nominal Current In (Amps)		100, 160, 200, 250	160, 200, 250	315, 400, 500, 630, 800	250, 320, 400, 600	1000, 1250, 1600	800, 1000
Rated Insulation Voltage (Ui)	V	1000		1500			
Pollution degree 3							
Rated Impulse Voltage (Uimp)	kV	12		12			
Number of Poles		2...6		2...6		4	
Rated Thermal Current Ith (A)	in open air	100...250		315...800		1000...1600	
	in enclosure 40°C	100...250		315...800		1000...1250	
	in enclosure 60°C	100...200		315...680		800...1000	
Utilization Category		DC-21B		DC-21B			
Rated Operational Current Ie (A) at 1000 V DC	1 circuit	100...250		315...800		1000...1600	
	2 circuits	100...250		315...500		-	
	3 circuits	-		315...500		-	
Rated Operational Current Ie of combined output (A) at 1000 V DC	2 input circuits, 1 output	-		315...500, 630...1000		-	
	3 input circuits, 1 output	-		315...500, 945...1500		-	
Reference Standard		UL 98B		UL 98B			
Number of Poles		-	2...4	-	2...4	-	4
Rated Current (A) at 1000 V DC	1 circuit	-	100...200	-	250...600	-	800...1000
	2 circuits	-	100...180	-	250...400	-	-
Rated Current (A) at 1000 V DC	2 input circuits, 1 output	-	-	-	250...400, 500...800	-	800...1000
	Ambient temperature °C	-	-20...+50	-	-20...+50	-	-20...+50
Short Circuit Rating	kA per input, 1000V	-	5	-	10	-	10
	Protection Type	-	Circuit breaker	-	Circuit breaker	-	Circuit breaker
Wire Size Range	MCM		#4-300		#2-600		4x #4-300

Switch-disconnectors

1500 V DC and up to 500A: OTDC250...500



The OTDC series of switch-disconnectors is also available for operating voltages up to 1500 V DC from 250A to 500A. Up to two separate 1500 V DC circuits can be operated with a single device.

The main features of the OTDC250...500 switch-disconnectors include:

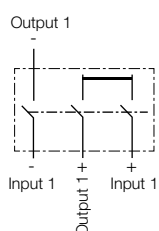
- Compactness: thanks to the patented DMB (Dual Magnetic Breaking) technology, the switches reach 1500 V DC with only 3 poles and a small footprint.
- Easy to install: connections are simple and independent from polarity, for providing greater wiring flexibility. The operating mechanism can be located between the poles or on the left side of the switch.
- Factory-installed or jumper kits available.
- Safety: Visible contacts allow a clear indication of position.

Main technical specifications		OTDC250...500	
1500 V DC basic versions		OTDC315...500E_	OTDC250...400U_
Wiring configuration	Two-wire breaking	E types	U types
	Single-wire breaking		US types
Reference Standard		IEC 60947-3	
Nominal Current In (Amps)		315, 400, 500	250, 320, 400
Rated Insulation Voltage (Ui)	V	1500	
Pollution degree 3			
Rated Impulse Voltage (Uimp)	kV	12	
Rated Thermal Current Ith (Amps)	in open air	315...630	
	in enclosure 40°C	315...550	
	in enclosure 60°C	315...440	
Number of Poles		3...6	
Utilization Category		DC-21B	
Rated Operational Current Ie (Amps) at 1500 V DC	One circuit	315...500	
	Two circuits	315...500	
Reference Standard		UL 98B	
Number of Poles		-	3
Rated Current (Amps) at 1500 V DC	One circuit	-	250...400
Ambient temperature	°C	-	-20...+50
Short Circuit Rating	kA, 1500V	-	10
	Protection Type	-	Circuit breaker
Wire Size Range	MCM	-	#2-600

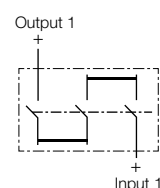
Examples

Single DC Circuit

1500 V DC IEC: 315-500A
1500 V DC UL: 250-400A
 Ungrounded System

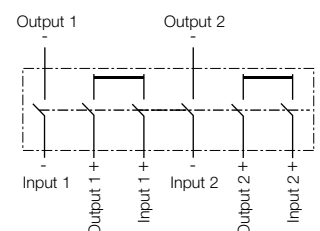


1500 V DC IEC: 315-500A
1500 V DC UL: 250-400A
 Grounded System



Double DC Circuit

1500 V DC IEC: 315-500A
 Ungrounded System



Switch-disconnectors

Tmax PV



Tmax PV circuit-breakers are available up to 1000 A and 1000 V DC whereas switch disconnectors are available up to 1600 A and 1500 V DC. The biggest innovation of the Tmax PV line is the availability of jumper kit provided by ABB, bringing the following benefit to the customer:

- easy and safe installation
- several electrical configurations
- wiring diagrams for poles connection in series already tested in ABB laboratories

The main features of the Tmax PV line include:

- complete offer for a large range of current and voltage
- compliant with the most important standard, IEC 60947-3 and UL489B
- availability of the three and four poles in fixed versions
- suitable for use in extreme condition thanks to operating temperature from -25°C up to 70 °C.

Molded case switch-disconnectors up to 1100V DC in compliance with IEC 60947-3

Main technical specifications		Tmax PV					
Tmax PV switch-disconnectors in compliance with the IEC60947-3		T1D/PV	T3D/PV	T4D/PV	T5D/PV	T6D/PV	T7D/PV ¹⁾
Conventional thermal current, Ith	(A)	160	250	250	630	800	1250-1600
Rated service current in category DC22 B, Ie	(A)	160	200	250	500	800	1250-1600
Number of poles	(No.)	4	4	4	4	4	4
Rated service voltage, Ue		1100V DC	1100V DC	1100V DC	1100V DC	1100V DC	1100V DC
Rated impulse withstand voltage, Uimp	(kV)	8	8	8	8	8	8
Rated insulation voltage, Ui	(V)	1150V DC	1150V DC	1150V DC	1150V DC	1150V DC	1150V DC
Test voltage at industrial frequency for 1 minute	(V)	3500	3500	3500	3500	3500	3500
Rated short-circuit making capacity, switch-disconnector only, Icm	(kA)	1.92	2.4	3	6	9.6	19.2
Rated short-time withstand current for 1s, Icw	(kA)	1.92	2.4	3	6	9.6	19.2
Versions		F	F	F	F	F	F
Standard terminals		FC Cu	FC Cu	F	F	F	F
Mechanical life with motor	(No. Operations)	15000	15000	7500	7500	7500	20000
Electrical life (operations @ 1100V DC)	(No. Operations)	500	500	500*	500*	500*	500*
Basic dimensions	W (mm/in)	102/4.02	140/5.52	140/5.52	186/7.33	280/11.02	280/11.02
	D (mm/in)	70/2.76	70/2.76	103.5/4.07	103.5/4.07	103.5/4.07	154/6.06 (manual) 178/7.01 (motorized)
	H (mm/in)	130/5.12	150/5.91	205/8.07	205/8.07	268/10.55	268/10.55
Weight (with standard terminals only)	(kg/lbs)	1.2/2.65	2/4.41	3.05/6.72	4.15/9.15	12/26.46	12.5/27.56 (manual) 14/30.86 (motorized)

1) installation in vertical position only

* openings with SOR or UVR

Molded case switch-disconnectors up to 1500V DC in compliance with IEC 60947-3

Main technical specifications		Tmax PV		
Tmax PV switch-disconnectors in compliance with the IEC60947-3		T4D/PV-E	T5D/PV-E	T7D/PV-E
Conventional thermal current, I _{th}	(A)	250	500	1250-1600
Rated service current in category DC22 A, I _e	(A)	250	500	1250-1600
Number of poles	(No.)	4	4	4
Rated service voltage, U _e		1500V DC	1500V DC	1500V DC
Rated impulse withstand voltage, U _{imp}	(kV)	8	8	8
Rated insulation voltage, U _i	(V)	1500V DC	1500V DC	1500V DC
Test voltage at industrial frequency for 1 minute	(V)	3500	3500	3500
Rated short-circuit making capacity, switch-disconnector only, I _{cm}	(kA)	3	6	19.2
Rated short-time withstand current for 1s, I _{cw}	(kA)	3	6	19.2
Versions		F	F	F
Standard terminals		F	F	F
Mechanical life	(No. Operations)	7500	7500	20000
Electrical life (operations @ 1500V DC)	(No. Operations)	1000*	1000*	500*
Basic dimensions	W (mm/in)	140/5.52	186/7.33	280/11.02
	D (mm/in)	103.5/4.07	103.5/4.07	178/7.01
	H (mm/in)	205/8.07	205/8.07	268/10.55
Weight (with standard terminals only)	(kg/lbs)	3.05/6.72	3,15/9.15	14/30.86

* openings with SOR or UVR

Molded case switch-disconnectors up to 1000V DC in compliance with UL 489B

Main technical specifications		Tmax PV				
Tmax PV UL switch-disconnectors		T1N-D/PV	T4N-D/PV	T5N-D/PV	T6N-D/PV	T7N-D/PV ¹⁾
Frame size	(A)	100	200	400	600-800	1000
Rated service current	(A)	100	200	400	600-800	1000
Number of poles	(No.)	4	3	3	4	4
Rated service voltage	(V)	1000V DC	1000V DC	1000V DC	1000V DC	1000V DC
Short-circuit current withstand	(kA)	1.2	3	5	10	18
Magnetic override	(kA)	-	3	5	10	-
Versions		F	F	F	F	F
Connections*		Jumpers	Jumpers	Jumpers	Jumpers	Jumpers
Terminals provided with Jumper kit		FCCu	FCCuAl	FCCu-ES	FCCuAl-EF	FCCuAl-F
Mechanical life with Motor	(No. Operations)	15000	7500	7500	7500	20000
Electrical life (operations @ 1000V DC)	(No. Operations)	1000	1000**	500**	500**	500**
Basic dimensions	W (mm/in)	102/4.02	105/4.13	140/5.52	280/11.02	280/11.02
	D (mm/in)	70/2.76	103.5/4.07	103.5/4.07	103.5/4.07	178/7.01
	H (mm/in)	130/5.12	205/8.07	205/8.07	268/10.55	268/10.55
Weight (with standard terminals only)	(kg/lbs)	1.2/2.65	2.35/5.18	3.25/7.17	12/26.46	14/30.86

1) installation in vertical position only

* Selection of one of the jumper connection options is mandatory for Tmax PV UL

** openings with SOR or UVR

Automatic Molded Case Circuit Breakers

Tmax PV

Whenever a consistent short-circuit current can be found, 1000V DC automatic circuit-breakers are available in the Tmax range.

Below is the UL489B automatic circuit-breaker offering:

Molded case circuit-breakers up to 1000V DC in compliance with UL 489B

Main technical specifications		Tmax PV		
Tmax PV UL MCCBs		T4N/PV	T5N/PV	T6N/PV
Frame size	(A)	200	400	600-800
Rated service current	(A)	40-200	225-250-300-400	600-800
Number of poles	(No.)	3	3	4
Rated service voltage	(V)	1000V DC	1000V DC	1000V DC
Short-circuit interrupting rating @ 1000V DC	(kA)	7.5	5	10
Trip Unit		TMD/TMA	TMF/TMA	TMA
Versions		F	F	F
Standard terminals		F	F	F
Connections*		Jumpers	Jumpers	Jumpers
Terminals provided with Jumper kit		FCCuAl	FCCuAl-FCCu-ES	FCCuAl-EF
Mechanical life with motor	(No. Operations)	7500	7500	7500
Electrical life (operations @ 1000 V DC)	(No. Operations)	1000**	500**	500**
Basic dimensions	W (mm/in)	105/4.13	140/5.52	280/11.02
	D (mm/in)	103.5/4.07	103.5/4.07	103.5/4.07
	H (mm/in)	205/8.07	205/8.07	268/10.55
Weight (with standard terminals only)	(kg/lbs)	2.35/5.18	3.25/7.17	12/26.46

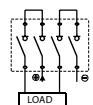
* Selection of one of the jumper connection options is mandatory for Tmax PV UL

** openings with SOR or UVR

Wiring diagram configurations

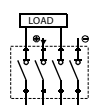
4 POLES

2+2 - lower



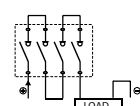
IEC 60947 **Amperage**
 1100 V DC: 160/200/250/500/800/1250/1600
 1500 V DC: 250/1250
UL 489B **Amperage**
 UL 1000 V DC: 100/800/1000

2+2 - upper



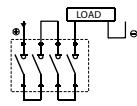
IEC 60947 **Amperage**
 1100 V DC: 160/200/250/500/800/1250/1600
 1500 V DC: 250/500/1250/1600
UL 489B **Amperage**
 UL 1000 V DC: 100/1000

4PS - lower



IEC 60947 **Amperage**
 1100 V DC: 160/200/250/500/800/1250/1600
 1500 V DC: 250/1250
UL 489B **Amperage**
 UL 1000 V DC: 100/800/1000

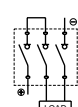
4PS - upper



IEC 60947 **Amperage**
 1100 V DC: 160/200/250/500/800/1250/1600
 1500 V DC: 250A
UL 489B **Amperage**
 UL 1000 V DC: 100/1000

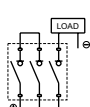
3 POLES

2+1 - lower



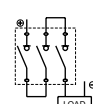
UL 489B **Amperage**
 UL 1000 V DC: 200/225/250/300/400

3PS - lower



UL 489B **Amperage**
 UL 1000 V DC: 200/225/250/300/400

3PS - upper



UL 489B **Amperage**
 UL 1000 V DC: 200/225/250/300/400

Automatic Air Circuit Breakers

Emax DC



Emax DC automatic circuit-breakers is the most innovative and high performing LV circuit-breaker on the market for DC applications up to 5000 A.

Main characteristics and features are the following:

- SACE Emax DC series of circuit-breakers for direct current applications complying with the IEC60947-2 .
- Thanks to the exclusive technology applied to the new SACE PR123/DC and PR122/DC trip units, the SACE Emax DC range allows all installation requirements to be met and with protection up to 1000V DC for IEC. Also available in a switch-disconnector version.
- The compact sheet metal structure of the Emax DC features a robust and durable construction which is directly attributed to its long life expectancies. Available in fixed-mounted and withdrawable versions.
- Configurable for use in grounded or un-grounded ESS Systems.
- Can be operated locally or remotely, via shunt trip and motor accessories.
- Emax DC can be fitted with the same terminal kits and most accessories common to the standard Emax range, reducing the need of stock for extra parts.
- With plant voltages higher than or equal to 100V, the electronic trip unit guarantees protection without the need of an auxiliary power supply
- Protection is guaranteed even when the electronic trip unit is not powered thanks to the PR120/DC module which always equips both the PR122/DC and the PR123/DC
- PR123/DC not only offers protection but also measurement of current and voltage of both polarities (+ and -), thus being suitable for any type of network.

Main technical specifications		Emax DC			
IEC60947-2		E2	E3	E4	E6
Rated operational voltage, Ue	[V DC]	750 (3 Poles), 1000 (4 Poles)			
Rated impulse withstand voltage, Uimp	[kV]	12	12	12	12
Rated insulation voltage, Ui	[V]	1000	1000	1000	1000
Rated uninterrupted current, Iu	[A]	800-1600	800-2500	1600-3200	3200-5000
Operating Temperature	[°C]	-25...+70			
Utilization category (IEC 60947-2)		B			
Version		Fixed and Withdrawable			

Switch-Disconnecter, Fusible

OS series



OS series represents the most advanced fusible switch disconnector in the market. It provides a means to safely open and close DC circuits protected by fuses. The contact design enables the switch to be operated under load and also enables rapid fault clearance.

- Main Features:
- Compact size and light weight structure.
 - Suitable for bi-directional current flow.
 - The modular structure provides flexibility for the mechanism and poles to be placed according to installation requirements.
 - Direct mounted or in-direct handle mounting, with adjustable shaft.

Main technical specifications according to IEC 60947

Switch size		A	32G	50G	63G
Rated insulation voltage (Pollution degree 3)		V	1.000	1.000	1.000
Dielectric strength	50 Hz 1min.	kV	10	10	10
Rated impulse withstand voltage		kV			
Rated operational voltage AC-20 and DC-20		V	1.000	1.000	1.000
Rated operational current / poles in series	24 - 48 V	A	32 / 2	50 / 2	63 / 2
DC-21B	220 V	A	32 / 2	50 / 2	63 / 2
	440 V	A	32 / 4	50 / 4	50 / 4
	660 V	A			
	880 V	A			
Rated short-time withstand current, 1s. (R.M.S. -value)	690 V	kA	2,5	2,5	2,5
Rated capacitor power. (1)	400V	kVAr	15	20	25
When no initial charge on the capacitor.	415 V	kVAr	15	25	32
	690 V	kVAr	25	42	50
Fuse types, IEC 60269-2					
Sec. I, DIN 43620			000		000
Sec. IA, NFC 0-3 Ref.A, 4a Ref.B				14x51	
Sec. II, BS 88			A2 - A3		A2 - A3
-size / distance of fuse-link bolts		mm	M5 / 73		M5 / 73

(1) The capacitor ratings of the switch-fuses are limited by the fuse links.

	100G	125G	160G	200	250	400	630	800
	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	10	10	10	10	10	10	10	10
	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	100 / 2	125 / 2	160 / 2	200 / 1	250 / 1	400 / 1	630 / 1	800 / 1
	100 / 2	125 / 2	125 / 2	200 / 1	250 / 1	400 / 2	630 / 1	800 / 1
	100 / 2	125 / 2	125 / 2	200 / 2	250 / 2	400 / 3	630 / 2	800 / 2
				200 / 3	250 / 3	400 / 4	630 / 3	720 / 3
				180 / 4	230 / 4		630 / 4	720 / 4
5	5	5	5	8	8	14	18	18
40	50	60	90	105	180	250	310	310
42	55	65	100	115	200	270	340	340
75	90	100	160	190	325	450	550	550
		00, 000	00, 000	0	0 - 1	0 - 2	2 - 3	2 - 3
		22x58		-	1	2	3	3
A2 - A4	A2 - A4	A2 - A4	B1 - B2	B1 - B3 2)	B1 - B4	C1 - C2	C1 - C3	
M5 / 73, M8 / 94	M5 / 73, M8 / 94	M5 / 73, M8 / 94	M6 / 111	M8 / 111	M8 / 111	M10 / 133 , 184	M10 / 133 , 184	

AC products for Power Conversion System (PCS) and connection to the grid

The AC side of Power Conversion System and connection to the grid have specific protection and operating requirements. The ABB's products portfolio for residential, commercial and industrial electrical installations offers the ultimate solution for the AC infrastructure powered by energy converted from batteries and super-capacitors energy storage systems.

Miniature circuit breakers for protection of electric lines and equipment from overloads and short circuits, residual current circuit-breakers sensitive to fault currents, moulded-case circuit-breakers up to 3200 A, air circuit breakers for electrical installations up to 6300 A, contactors specially designed for renewable energy AC switching applications and surge protective devices: all of them contribute to get a cost-effective, efficient and secure power distribution system.



Miniature Circuit Breaker

S 200, S800



Miniature circuit breakers are necessary also on the AC side of the ESS installation for protection of electric lines and equipment from overload and short circuit. They provide protection of the cables that exit from power conversion system (PCS) to the network as well as the different auxiliary circuits in the battery management system (BMS).

S 200

S 200 is a new enhanced series of miniature circuit breakers.

The main features of the S 200 MCBs are:

- Available with all the tripping curve B, C, D, K and Z.
- Terminal for cable up to 35 mm² with protective flap to avoid accidental contact with the live parts.
- High temperature and shocks resistance thanks to a new type of thermoplastic materials
- Indelible laser screen-printing
- Multiple certification marks visible on the upper and lower face of the S200 circuit breakers.

Main technical specifications		S 200
Reference Standard		IEC 60898, IEC/EN 60947-2, UL 1077
Nominal Current (In)	A	0,5 ... 63
Breaking capacity (Icu)	kA	6 (S200), 10 (S200M), 15 (S200P), 25 (S200P)
Nominal Voltage (Ue)	V AC	1P: 12 ... 230 / 2P ... 4P: 12 ... 400
Operation Temperature	C	-25 ... +55



S800

S800 is a high performance miniature circuit breaker.

The main features of the S800 HPMCBs are:

- Designed for high short-circuit protection up to 50 kA
- Available with tripping curves B, C, D and K.
- Switch with intermediate trip position (TRIP).
- Differentiate manual actuation from over-current trip.

Main technical specifications		S800
Reference Standard		IEC 60898, IEC/EN 60947-2
Nominal Current (In)	A	6 ... 125
Breaking capacity (Icu)	kA	16 (S800B), 25 (S800C), 36 (S800N), 50 (S800S)
Nominal Voltage (Ue)	V AC	1P: 12 ... 230 / 2P ... 4P: 12 ... 400
Operation Temperature	C	-25...+60

Residual Current Circuit-breakers (RCCBs)

F200, F204 B, F202 B



Residual current circuit-breakers type B are also sensitive to fault currents with a low ripple level, similar to continuous fault currents. They however remain sensitive to sinusoidal alternating and pulsating continuous earth fault currents. In systems that include power conversion system without at least a simple DC/AC separation, it's necessary to install on DC side an RBCO of B class, according to IEC 60364-7 art. 712.413.1.1.1.2:

“Where an electrical installation includes a DC power supply system without at least simple separation between the AC side and the DC side, an RCD installed to provide fault protection by automatic disconnection of supply should be type B. If the power conversion by construction is not able to feed DC fault current into the electrical installation a B-type RCD is not mandatory”.

Main technical specifications		F200 type B
Rated current I _n		25, 40, 63, 125 A
Rated sensitivity I _{Δn}		0.03 - 0.3 - 0.5 A
Operating frequency range		0 - 1000 Hz
Minimum supply voltage		
- to detect currents of type A / AC		0 V
- to detect currents of type B		30 V AC
Number of poles		2P, 4P
Conditional short-circuit current I _{nc}		10 kA
Conditional residual short-circuit current I _{Δc}		10 kA
IP Class		IP40 (when installed into a switchboard)
Operating temperature		-25°C...+40°C
Reference standards		IEC 62423 ed. 2

On the other hand, in case a DC/AC electrical separation exists, residual current circuit breaker type A can be used.



Main technical specifications		F200 A
Reference Standard		Standard IEC/EN 61008
Nominal Current (I _n)	A	16 ... 125
Nominal Voltage (U _e)	V AC	230...400
Sensitivity	mA	10 – 30 – 100 – 300 – 500
Number of poles		2P, 4P
Operation Temperature	C	-25...+55

Moulded Case Circuit Breakers

Tmax



Moulded-case circuit-breakers can be used in low-voltage civil and industrial installations with 10 A to 3200 A operating current.

The Tmax family includes 9 circuit-breaker sizes in three- or four-pole versions:

- XT1, XT2, XT3 and XT4 up to 250A;
- T4, T5 and T6 up to 1000A;
- T7 and T8 up to 3200A.

Main technical specifications of the Tmax family are:

- High breaking capacity in compact dimensions: the ultimate short-circuit breaking capacity (Icu) at 415V ranges from 18kA to 200kA, or up to 80kA for 690V
- Ease of use and installation flexibility: a complete range of mechanical and electrical cabled accessories and a solution for electronic trip units to adapt Tmax to each application scenario
- Increased safety for operators: wide range of keylocks and padlocking options, plug in and withdrawable versions to speed up maintenance operations and improved diagnostic to have ready to use information about breakers' status
- Information availability: Modbus communication modules for integration in a supervision system and for remote control

Air Circuit Breaker

Emax 2



Emax 2 air circuit breakers can be used in several electrical installations with 100 A up to 6300 A. The Emax 2 family includes 4 circuit breaker sizes in three or four poles and fixed or withdrawable versions:

- E1.2 up to 1600 A
- E2.2 up to 2500 A
- E4.2 up to 4000 A
- E6.2 up to 6300 A

Main technical specifications and advantages of the Emax 2 family include:

- High breaking capacity in compact dimension, from 42 kA up to 200 kA, to match the needs of today's installations
- Increased safety for operators with a wide range of locking accessories
- No need for costly and difficult external conversion modules for fieldbus connection thanks to 7 different protocols integrated communication modules
- Emax 2 is designed with highly efficient contacts and smart thermal performance which offers proven material and space savings.
- Up to 25% savings in enclosure material costs versus leading competitors
- Up to 18% savings in copper material for bus-bars versus leading competitors
- Up to 20% floor space savings in final equipment installation versus leading competitors.
- Provides increased flexibility for implementation in customer equipment with connection terminals that can be configured for vertical or horizontal bus-bar connections without any additional parts.
- Fast and flexible upgrades with new interchangeable trip units.

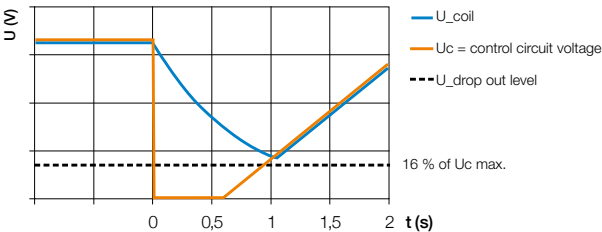
Contactors (for grid compliance)

AF..T range



The AF..T range is specially designed for renewable energy AC switching applications with “Low-voltage Ride Through” function. The AF..T contactor is able to withstand a voltage drop on the control voltage without opening. The built-in drop-out delay circuit provides enough energy for the coil voltage to remain above the drop-out level.

Main technical specifications	AF1350T – AF2050T
Reference standards	IEC60947-1, -4-1
Rated operational voltage	1000 V
Current ratings	1350 – 2050 A
Control voltage, AF range	Electronically controlled AC/DC
Number of poles	3



Surge protective devices

OVR T1, OVR T2



To provide efficient protection for a energy storage system the alternate current side must also be protected against overvoltage.

OVR T1, Type-1 SPD, is installed in the main (AC side) switchboard at the system input and is able to conduct the direct lightning current to earth and to ensure safety in the case of a direct lightning strike.

OVR T2, Type-2 SPDs, are installed on the load side of the power conversion system and in possible other sub-switchboard to protect against switching surges and the indirect effect of lightning.

Main technical specifications of the OVR range are:

- Network configuration in single pole, 3 poles, 1 Phase+N and 3 Phases+N
- Simplified maintenance with the pluggable cartridges (P option)
- Increased security with the safety reserve (S option)
- Remote indication with the auxiliary contact (TS option)
- Certified to the last IEC 61643-11:2012 standard with the new QuickSafe technology3.

Main technical specifications		OVR T1	OVR T1-T2 QS	OVR T2 QS
Reference Standards		IEC EN 61643-11 / UL 1449 3rd edition*	IEC EN 61643-11	IEC EN 61643-11 / UL 1449 3rd edition*
IEC Type		T1 / I	T1-T2 / I-II	T2 / II
Max. cont. Operating Voltage Uc	V	255	275	275
Nominal discharge current In (8/20 µs)	kA	25	30	5, 20 and 30
Impulse current Iimp (10/350 µs)	kA	25	12.5	/
Maximum discharge current Imax (8/20 µs)	kA	/	80	20, 40 and 70
Response time	ns	< 100	< 25	< 25
Safety reserve		/	yes	"S" Version
Pluggable		/	"P" Version	"P" Version
Remote indicator		"TS" Version	"TS" Version	"TS" Version

* UL Version only for OVR T2 U

Auxiliary products for Battery Management System (BMS)

ABB's range of SPD and monitoring devices offer a complete choice to increase the efficiency and reliability of all Battery Management Systems (BMSs), which are often the core element of the power infrastructure. ABB's SPDs are right choice to protect the monitoring lines from surges. The line of flexible current sensors is an ideal solution for space constrained applications, giving a chance to choose between horizontal or vertical fastening. The smart modular energy meters and current measurement systems increase the efficiency and improve service, operating and billing processes. Power supplies, insulation monitoring devices and many other electronic products complete a line of professional solutions for most demanding DC applications.



Surge protective devices

OVR TC



OVR TC

With increasing request of monitoring systems, OVR TC data line SPDs are right choice to protect the monitoring lines of the systems from surges. They are installed in series with the network and have removable cartridges, making maintenance simple, without having to cut the power to the telecommunications line.

Main technical specifications		OVR TC
Reference Standard		IEC/EN 61643-21 - UL497B
IEC type		C2
Max. cont. operating voltage Uc	V	7 to 220V (AC/DC)
Nominal Discharge current In (8/20us)	kA	5
Max. discharge current Imax (8/20us)	kA	10
Response time	ns	1
Pluggable		Yes

Current sensors

ES range



As components get smaller but more powerful, installing current sensors is becoming a real problem. But with ES range, the whole thing is child's play. By being the first in the field to offer these smaller current sensors that maintain your high-performance objectives, ABB met the challenge of giving you the space you always needed.

Once again ABB lead the field by giving installers a chance to choose between two ways of fastening sensors: horizontally or vertically. This flexibility means that ES sensors can be installed in any position.

This is a major breakthrough that greatly simplifies the task of systems integrators. The ES range is the ideal way of reducing the size of equipment.

The main features are:

- Plastic case and insulating resin are self-extinguishing.
- Fixing holes in the case moulding for two positions at right angles.
- Direction of the current: A primary current flowing in the direction of the arrow results in a positive secondary output current from terminal M.

Primary connection

- Hole for primary conductor.
- The temperature of the primary conductor in contact with the case must not exceed 100°C.

Secondary connection

- Molex type HE14 connector
- JST connector (ref.: B3P-VH)
- 3 x 200 mm cables (cross section 0.38 mm²)

Main technical specifications			ES range						
	Molex type HE14 connector		ES100C	ES300C	ES500C	ES500-9672	ES1000C	ES1000-9678	ES2000C
	JST connector		–	ES300S	ES500S	ES500-9673	ES1000S	ES1000-9679	ES2000S
	Cables		ES100F	ES300F	ES500F	ES500-9674	ES1000F	ES1000-9680	ES2000F
Nominal primary current		A r.m.s.	100	300	500	500	1000	1000	2000
Accuracy at I _{PN}	-5 ... +70°C	%	≤ ± 1	≤ ± 1	≤ ± 1	≤ ± 1	≤ ± 1	≤ ± 1	≤ ± 1

Line monitoring

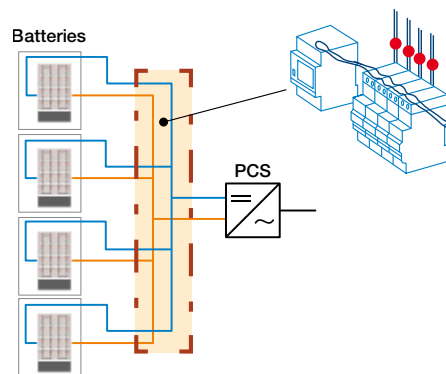
Current Measurement System (CMS)






The CMS line monitoring increases the efficiency of your energy storage system. The easy-to-integrate system enables you to immediately detect either a defective circuit or a loss in performance, e.g., caused by contaminated or damaged battery and to quickly implement appropriate countermeasures.

Benefits:

- small sizes
- high accuracy
- quick installation start up time
- freely selectable amount of measurement points



Main technical specification		CMS
Measurement range CMS-100 Series (18mm Sensor)	A	80, 40, 20
Measurement range CMS-200 Series (25mm Sensor)	A	160, 80, 40
Insulation Voltage	V	1500 V DC
DC Accuracy (TA = +25 °C)	%	0,7 – 1,7
Operating temperature	°C	-25 .. +70
Communication	-	Modbus RTU (RS485 2 wire)

Mounting	System pro M	DIN rail	Cable Ties
AC accuracy* $\leq \pm 1.0\%$ The Laying Method Influences the accuracy	For all MCBs with dual terminals	universal use	universal use
			
18mm			
CMS-120xx (80 A)	CMS-120PS	CMS-120DR	CMS-120CA
CMS-121xx (40 A)	CMS-121PS	CMS-121DR	CMS-121CA
CMS-122xx (20 A)	CMS-122PS	CMS-122DR	CMS-122CA

Main technical specification		CMS-120xx	CMS-121xx	CMS-122xx
Measurement range	A	80	40	20
Measuring method		TRMS, AC 50/60 Hz, DC		
Peak factor, distorted waveform		≤ 1.5	≤ 3	≤ 6
AC accuracy (TA = + 25 °C)*		≤ ± 1 %		
AC temperature coefficient*		≤ ± 0,04 %		
DC accuracy (TA = + 25 °C)*		≤ ± 1.2 %	≤ ± 1.4 %	≤ ± 1.8 %
DC temperature coefficient*		≤ ± 1.4 %	≤ ± 0.24 %	≤ ± 0.44 %
Resolution	A	0.01		
Sampling rate, internal	Hz	5000		
Response time (±1 %)	sec	typ. 0.34		
Conductor penetration	mm	9,6		
Insulation strength	V	690 V AC/1500 V DC		
Dimensions				
CMS-120PS Serie	mm	17.4x41.0x26.5		17.4x41.0x30.9
CMS-120CA Serie	mm	17.4x41.0x29.0		
CMS-120DR Serie	mm	17.4x51.5x43.2		

Modular energy meters

EQ meters



Modular energy meters are ideal for metering and monitoring the energy during charging and discharging of the storage system. ABB EQ meters are compliant and tested according to the European MID directive, which allows meters to be used whenever an energy consumption reading is requested for billing.

The EQ meters are available in three different product ranges, A, B and C series

A series:

- Single phase or three phase
- Direct connected up to 80 A or transformer current- and/or voltage transformers (CTVT)
- Active energy measurement Class B (Cl. 1) or Class C (Cl. 0,5 S) on CTVT connected meters
- Wide voltage range 100 - 500 V phase to phase 57,7 - 288 V phase to neutral
- Alarm function
- MID
- Reactive energy measurement
- Import/export measurement of energy
- Optional communication via M-Bus or RS-485
- 4 tariffs controlled by inputs, communication or built-in clock
- Previous values (by day, week or month)
- Demand measurement (max and min)
- Load profiles (8 channels)
- Harmonics measurement up to 16th harmonic and evaluation of THD

B series:

- Single phase or three phase
- Direct connected up to 65 A or CT connected (three phase versions)
- Active energy measurement Class B (Cl. 1) or Class C (Cl. 0,5 S)
- Alarm function
- MID
- Reactive energy measurement
- Import/export measurement of energy
- Optional communication via M-Bus or RS-485
- 4 tariffs controlled by input or communication

C series:

- Single phase or three phase
- Very compact, 1 & 3 modules.
- Direct connected up to 40 A
- Active energy measurement
- Instrument values
- Accuracy class 1 or class B (MID versions)
- Alarm function
- Optional MID

Modular energy meters

EQ meters



Standards

IEC 62052-11, IEC 62053-21 class 1 & 2, IEC 62053-22 class 0,5 S, IEC 62053-23 class 2, IEC 62054-21, EN 50470-1, EN 50470-3 category A, B & C.

Communication

Built-in communication interfaces and separate communication devices enable serial data communication between energy meter and remote supervision system. Data on energy consumption and electrical parameters to be collected via serial protocols such as: Modbus RTU, M-Bus, Ethernet TCP/IP and KNX.

CT current transformers

Whenever indirect measurement is required, CT current transformers are the best solution to create a complete plant, ensuring long-term accuracy and precision of measurements.

Serial Communication Adapters

Communication adapters allow the serial data communication between energy meter and remote supervision system. The adapters allow data on energy consumption and electrical parameters to be collected via serial protocols such as: Modbus RTU, MeterBus, Ethernet TCP/IP, KNX.

Primary switch mode power supplies

CP-E and CP-C.1 range



CP-C.1 range

The CP-C.1 power supplies are ABB's higher performance and most advanced range. With excellent efficiency, high reliability and innovative functionality it is prepared for the most demanding industrial applications. These power supplies have a 50 % integrated power reserve and operate at an efficiency of up to 94 %. They are equipped with overheat protection and active power factor correction. Combined with a broad AC and DC input range and extensive worldwide approvals the CP-C.1 power supplies are the preferred choice for professional DC applications.

Giving the power to control.

Key features

- Rated output voltage 24 V DC
- Power reserve design delivers up to 150 % at $T_a \leq 40^\circ\text{C}$
- Output voltage adjustable via front-face rotary potentiometer "OUTPUT Adjust", 22.5-28.5 V
- Input voltage range 100-240 V AC, 90-300 V DC
- High efficiency
- Low power dissipation and low heating
- Free convection cooling (no forced cooling)
- Ambient temperature range during operation $-25...+70^\circ\text{C}$
- Open-circuit, overload and short-circuit stable
- Integrated input fuse
- DC OK - signaling output "13-14" (Relay),
- Power reserve signaling output " $I > I_R$ " (Transistor)
- Redundancy unit CP-A RU offering true redundancy, available as accessory



CP-E range for 24 V DC applications

The CP-E range offers enhanced functionality while the number of different types has been considerably reduced. Now all power supply units can be operated at an ambient temperature of up to $+70^\circ\text{C}$.

Key features

- Output voltage 24 V DC
- Adjustable output voltages
- Output currents 0.75 A / 1.25 A / 2.5 A / 5 A / 10 A / 20 A
- Power range 15 W, 30 W, 60 W, 120 W, 240 W, 480 W
- High efficiency of up to 90 %
- Low power dissipation and low heating
- Free convection cooling (no forced cooling with ventilators)
- Ambient temperature range during operation $-40...+70^\circ\text{C}$
- Open-circuit, overload and short-circuit stable
- Integrated input fuse
- U/I characteristic curve on devices $> 18\text{ W}$
(fold-forward behaviour at overload – no switch-off)
- Redundancy units offering true redundancy
- LED(s) for status indication
 - Signalling output/contact for output voltage OK
Transistor on 24 V devices $> 18\text{ W}$ and $< 120\text{ W}$
 - Solid-state on 24 V devices $\geq 120\text{ W}$
- Approvals / Marks (depending on device, partly pending):



Insulation monitoring device

CM-IWx



The CM-IWx series offers an innovative insulation monitoring device. In combination with a new measurement principle, networks up to 1000 V DC or 690 V AC (15-400 Hz monitor range) can be measured.

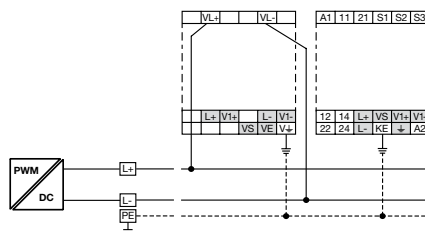
Measurement principle

Using CM-IWx, a pulsating measurement signal is sent to the system to be monitored and the insulation resistance is calculated. This pulsating measurement signal changes depending on the insulation resistance and system dispersion capacity. The change in the insulation resistance can be forecast from this alteration.

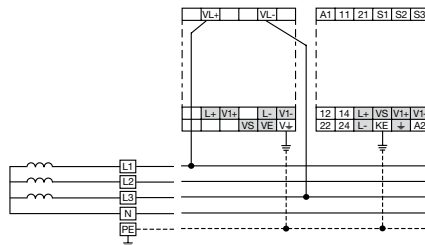
When the estimated insulation resistance corresponds to the insulation resistance calculated in the next measurement cycle and is below the pre-set value, the output relays are either activated or deactivated depending on the configuration of the device. This measurement principle is also useful to detect symmetrical insulation faults.

Main Characteristics

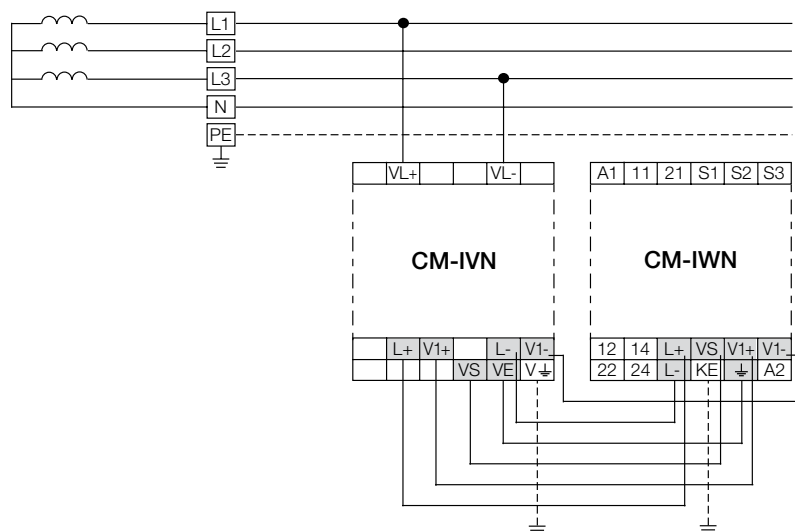
- Compliance with IEC/EN 61557-8 or IEC/EN 60255-1 reference Standards
- Direct connection to systems up to 690 V AC and 1000 V DC with coupling module CM-IVN
- Nominal frequency 15-400 Hz
- Wire interruption monitoring
- Faulty setting monitoring
- High reliability with built-in system start-up test
- Possibility to reset and test at product front or via remote control
- New predictive measurement principle
- Maximum capacity of earth leakage up to 2000 μF



2 wires DC system



4 wires AC system



Electronic Products and Relays EPR



ABB could offer a wide and complete range of EPR products for any kind of use:

- electronic timers provide timing functions for all applications
- measuring and monitoring relays to measure voltage, current, temperature, isolation and more
- high efficient switch mode power supplies for single and 3 phase applications
- signal converters for analog signal conversion and isolation and for serial data transmission
- interface Relays and Optocouplers in pluggable and compact version for multi purpose usage in all kind of control applications

Other products for installation

Even in DC systems, additional products can be decisive for the quality of the infrastructure.

From high-performance distribution blocks to terminal blocks, from ties to cable protection products, from fittings to pilot devices, ABB has a complete range of installation accessories for power control, distribution and connection, and for command, signaling and wiring. All products contribute to improve the operation and the security of most demanding systems.



Distribution blocks

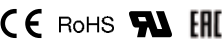
DBL



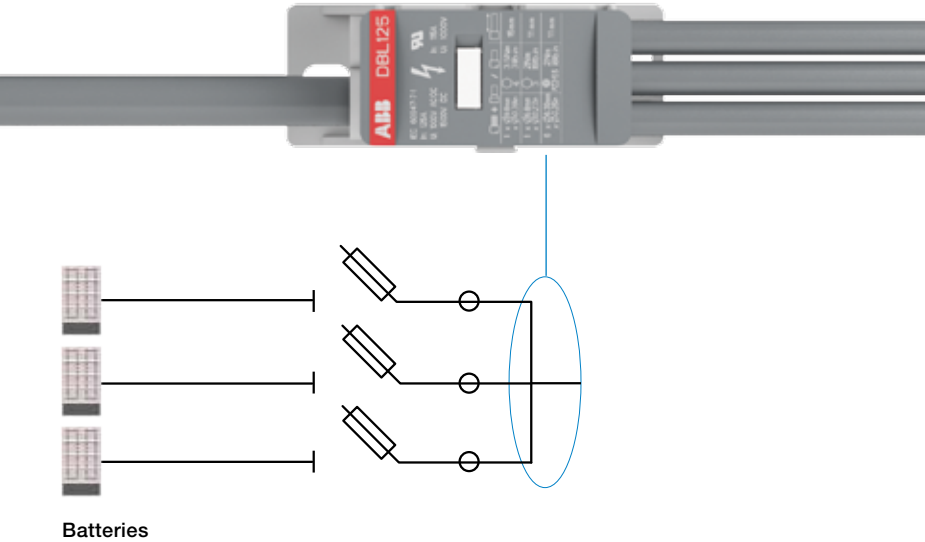
The DBL distribution blocks are adapted to the most recent energy storage system requirements with a voltage rating going up to 1500V DC IEC (1000V DC UL). They provide the benefit of 3 configurations in 1 single product: grouping several inputs into one output for DC applications, or single and multipole splitting for AC power applications.

The reversible cover facilitates identification and wiring tasks, and the modular and touch proof design eliminates the need for bus bars, isolators, fasteners or protection screens.

Finally it saves up to 50% rail space compared to conventional distribution bars.



Main technical specifications						DBL
Section			Number of inputs	Rated voltage		
16 mm ²	4 AWG	80A	7	1500 V DC (IEC)	1000 V DC (UL)	DBL80
35 mm ²	2 AWG	125A	8			DBL125
50 mm ²	2/0 AWG	160A	8			DBL160
		175A	12			DBL175
95 mm ²	250 Kcmil	250A	12			DBL250
150 mm ²	400 Kcmil	400A	12			DBL400



Connection devices

SNK terminal blocks



The SNK terminal blocks are suitable for AC power applications and DC systems with a voltage rating going up to 1250V DC IEC and 1000V DC UL.

- 2 technologies are available with common accessories:
- The screw clamp technology is the most accepted technology providing the highest choice of functions and enabling to connect 2 wires in 1 clamp.
 - The PI-Spring technology is a screwless technology that combines 2 connection modes: direct push-in for 50% time saving compared to screw, and connection using a screwdriver for improved comfort. It is particularly well adapted for high demanding environment with vibration and shock.

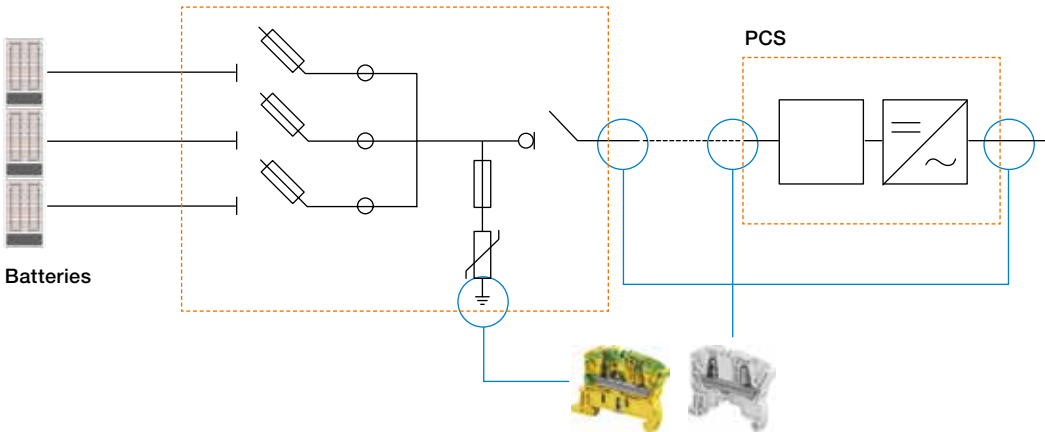


DC side

DC side	Main technical specifications							SNK
	Section (mm²)	AWG	Current IEC (A)	UL (A)	N. of connections	Rated voltage IEC UL		
Screw clamp	2.5 to 10	14 to 6	32 to 57	20 to 42	2	1030V DC	600V DC	ZS4...10
	16	4	76	67		1050V DC		ZS16
	25	3	101	100			1000V DC *	ZS25
	50 to 95	1/0 to 3/0	150 to 232	140 to 230		1250V DC	1000V DC	ZS50...95
PI-Spring	2.5 to 10	12 to 6	24 to 57	20 to 55	2/3	1000V DC	600V DC	ZK2.5...10
								ZK2.5...10-3P
	2.5 and 4	12 and 10	24 and 32	20 to 30	4	1000V DC	600V DC	ZK2.5-4P
								ZK4-4P
	10 and 16	6 and 4	57 and 76	55 to 75	2	1000V DC	600V DC	ZK10
								ZK16
					3	1250V DC	1000V DC	ZK10-3P
								ZK16-3P

* With dedicated accessories

For AC side, all the SNK terminal blocks can be used.



Polyamide 6.6 and 12 cable ties - UV-resistant black



- The main features of the cable ties include:
- UV-resistant version, especially recommended for outdoor applications
 - Black version (2% carbon for military specifications)
 - Also available in heat stabilised + UV-resistant version, for outdoor applications that also require a resistance to high temperature (+105 °C). See page 21 (TY...MX-A series)
 - Several lengths and 6 typical widths with a tensile strength up to 780N, to cover the most demanding applications
 - Packaging: OEM bulk quantities in recyclable polythene bags
 - Also available in small bags with Euroslot and in workbench boxes

Main technical specifications	Cable ties
Material - Moulding	polyamide 6.6 and polyamide 12
Material - Locking barb	316 grade stainless steel
Temperature range	-40°C to +85°C
Colour	black
Flammability rating	UL 94 V-2
Other properties	UV-resistant, Halogen free, Silicone free



PMA Cable Protection System Solutions



PMA offers a broad product portfolio of cable protection products.

Our 30 years' experience in the design and production of cable protection systems guarantees optimal solutions for use in power generation applications whether they are driven by water, wind, sunlight or gas.

Comprehensive selection fittings:

- Protection degree: IP66 / IP68 and IP69K
- Metric, NPT and PG threads made of metal and plastic
- Available with strain relief elements
- Compatible with all leading component manufacturers
- EMC fittings in the standard range
- Junction pieces available from stock



Comprehensive selection conduits:

- Continuous operating temperature: -100°C to $+200^{\circ}\text{C}$
- Both for internal and external use
- Excellent UV resistance
- Resistant to high dynamic loading
- Extremely high compression strength
- Electro-statically discharging materials
- Nominal diameters: 07 to 125
- Closed and divisible conduits types
- Free from halogens, REACH + ROHS compliant



Comprehensive selection of accessories:

- Various support systems for all requirements
- Connection and branching parts available
- Compatible with all PMA products



All PMA products are rigorously tried and tested to meet the demands of industry worldwide:



Pilot Devices

Modular or Compact ranges



ABB has a complete range of pilot devices; emergency stops, pilot lights, push buttons and selector switches. Two ranges are available; the Modular range for flexibility and quick assembly and the Compact range for high quality at low cost by "all-in-one" design. Both ranges are with high ratings. Compact range offers high degree of protection with IP67/IP69K.

Main technical specifications	Pilot devices
Hole diameter	22 mm (30 mm adaptors available)
Contacts	690 V, 10 A, wiping action Low energy block (gold plated or micro switch) available
Colours	Red, Green, Yellow, Blue, White, Black, Clear
Customized marking available	Yes ("L-mark" system)
Enclosures	Plastic or metallic. Separate enclosures or complete assembled stations
Reference standards	IEC60947 (general) IEC60947-5-5 (emergency stops)

For your notes

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For your notes

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