



Low Voltage Products

Solar energy

Protecting and isolating PV systems

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Low voltage products for renewable energy

Guide to the UK industry

The UK Government have introduced a new initiative aimed at encouraging the nationwide adoption of renewable energy technologies.

Called the Feed-in Tariff, this initiative will see owners of renewable energy equipment being paid not only for the energy they use but also the amount of surplus energy they supply to the UK National Grid.

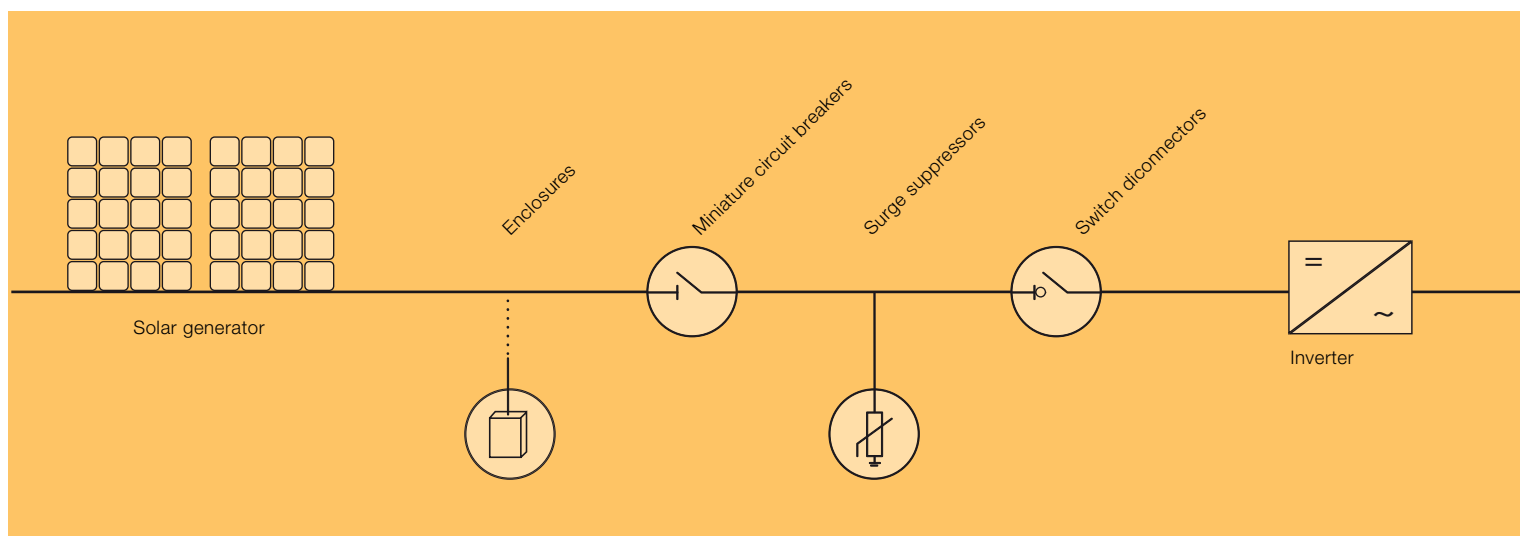
Inspired by similar schemes already operating in continental Europe, the UK Feed-in Tariff initiative is aimed at residential, commercial and industrial users of renewable energy sources. A table of the technologies covered are listed below.

How does the Feed-in Tariff Work?

The Feed-in Tariff is based on the amount of energy produced by a renewable energy source, plus where surplus energy is produced, a bonus to cover energy exported to the National Grid. By effectively paying producers more for the energy they don't use, the system is also aimed at encouraging energy efficiency.

To cover periods when the renewable energy source may be not producing sufficient electricity to cover demand, additional energy may be imported from the National Grid, with the user paying their electricity supplier for the amount consumed.

Technology	Tariff amount (pence per kWh) for installation fitted periods:		
	April 2010 - March 2011	April 2011 - March 2012	April 2012 - March 2013
Solar photovoltaic <4 kW (new)	36.1	36.1	36.1
Solar photovoltaic <4 kW (retrofit)	41.3	41.3	41.3
Solar photovoltaic >4 - 10kW	36.1	36.1	33.0
Solar photovoltaic >10 - 100 kW	31.4	31.4	28.7
Solar photovoltaic >100 - 5MW	29.3	29.3	26.8



DC Side

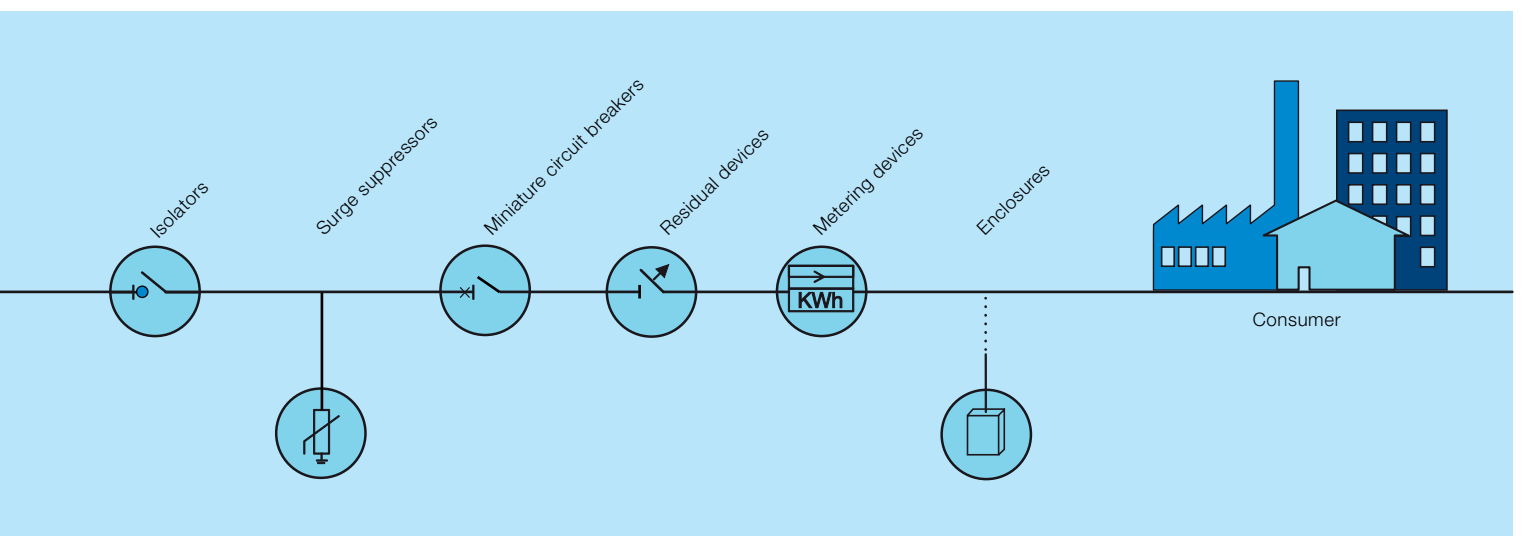
The components of photovoltaic systems

The efficiency and quality of a system are measured by the efficiency and quality of each individual component

An accurate choice of components, especially the modules and inverters, is of fundamental importance if a photovoltaic system is to be a success. Before it can be considered a good investment, a photovoltaic system must be able to function efficiently for at least 20 years in all weathers and under the blazing sun.

What is commonly called the “BOS” (Balance of System), i.e. the “rest of the system” (electromechanical equipment for protection, control and isolation purposes, cables), undoubtedly plays an important role in ensuring that people and the buildings connected to the system are properly protected, and that there is an adequate production of energy over the years. From an economic viewpoint, it is even more important for each individual component of a photovoltaic system to be chosen on the basis of the warranties provided by the product and by its manufacturer than it is for a normal electric system. This is because the operating specifications of each device must remain unchanged throughout the entire life cycle of the system and the relative investment.

Always ready to meet any new demand from the market, ABB has developed a whole range of reliable products dedicated to photovoltaic applications and able to meet all installation requirements, from the string on the direct current side through to the alternate current grid connection point. ABB's products include string boxes, miniature circuit breakers, switch-disconnectors, residual current-operated circuit breakers, interface relays, energy meters, fuse disconnecting switches and fuses, surge arresters, consumer units and enclosures suitable for outdoor installation, all specially designed for these applications. ABB can also provide a series of “plug & operate” solutions, i.e. finished, wired and certified switchgear able to suit the requirements of a vast range of installations: from the individual string for domestic use to the large solar park.



AC Side

Protection on the d.c. side

The direct current section of a typical photovoltaic system consists of a generator formed by the parallel of the strings of solar panels connected in series.

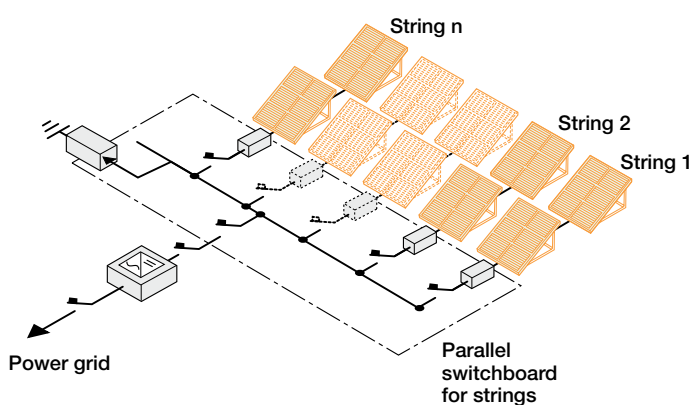
Along with the specific characteristic of the solar modules (inability to shut off the voltage other than by obscuring the solar panels and generation, by the strings, of short-circuit currents with values very near to those produced in normal conditions), the presence of voltage as high as 300-600 V d.c. and beyond requires a very careful assessment of the protection and isolating devices, which must be able to suppress direct fault currents under high voltages within a very short time.

In accordance with the provisions established by Standard IEC 64-8 (article 712), protection against overcurrents must be provided when the carrying capacity of the cable is less than 1.25 times the calculated fault current in any point. This means that in the majority of small systems or when several inverters have been installed, it is sufficient to install a switch-disconnector which, as established by Guide 82-25, must be of the DC21 class at least.

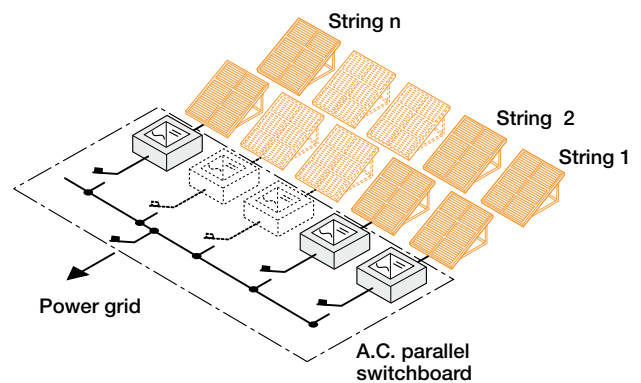
Guide 82-25 also specifies that it is advisable to install an isolating device on each string to allow this latter to be inspected or serviced without having to shut down other parts of the system.

The exposed conductive parts of all the equipment must be earthed by means of the protection conductor to as to protect persons from indirect contacts. The PV generator can only be earthed if it is separated from the low voltage distribution network by a transformer.

Various different methods can be used to connect the strings in parallel in a photovoltaic system connected to the power grid.



Centralized conversion



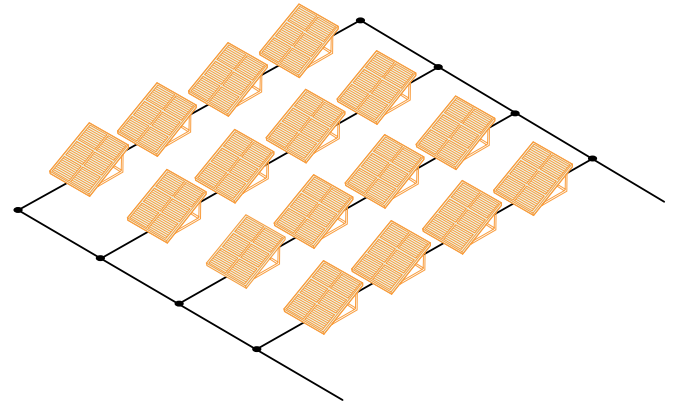
Distributed conversion

String protection against reverse currents

When the installation layout includes centralized conversion with the use of a single inverter, the strings must be protected against reverse current. This could circulate after faults or temporary unbalances in the system due, for example, to certain of the solar modules being partially in the shade or covered by snow, leaves, etc.

Recirculated current can reach extremely high values, especially when there are a large number of strings. The modules are unable to withstand this sort of current and, in the absence of protection devices, they develop faults within a very short time.

There are different methods for connecting the strings of solar modules in parallel in safe conditions: if there are only a few strings (1 or 2), obviously formed by the same number of modules, the parallel connection can be made without danger, otherwise protection devices must be installed in series with each string.



Protection for the parallel connection of the strings of photovoltaic modules. Simple parallel.

Advantages: simple to make

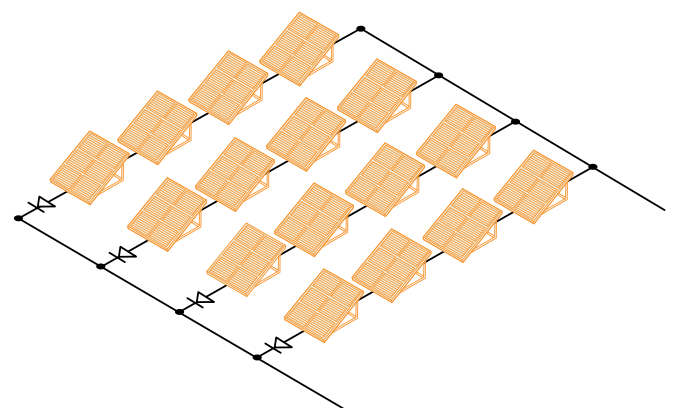
Disadvantages: the strings are liable to power reversals; can only be used for a very small number of strings

Reverse cut-off diode

This solution is inadvisable since not everyone considers it suitable for protecting the strings. It is not a substitute for over current protections (IEC TS 62257-7-1) as the blocking diode may not function correctly and could be short-circuited. Moreover, diodes lead to a power loss owing to the effect of the voltage drop on junction, a loss that can be reduced by using Schottky diodes with a 0.4 V drop instead of the 0.7 V drop created by conventional diodes.

If reverse cut-off diodes are chosen, their maximum reverse voltage (according to IEC 60364-7-712 standards) must be at least twice the open circuit UOC string voltage in STC conditions.

The direct over current must be higher than the short-circuit current ISC of the individual modules, with 1.25 ISC minimum value.



Protection for the parallel connection of the strings of photovoltaic modules. Reverse cut-off diodes.

Advantages: Prevent power reversal

Disadvantages: They are not considered to be protection devices.

They lead to a power loss in the circuit.

String protection against reverse currents

Fuses

Fuses are the string protection most widely used by designers since, unlike diodes, they disconnect the circuit if faults occur. However, although fuses are simple to use, the utmost care must be taken when they are sized and chosen as certain fundamental requirements must be considered:

- they must possess trip characteristic gR , suitable for protecting circuits with semi-conductors;
- they must be sized for current values of no less than $1.25 I_S$ and no more than the value indicated by the manufacturer for module protection. In the absence of specific indications, consider a value must be $2.0 I_S$ or less;
- they must be installed in dedicated fuse-disconnectors able to dissipate the power that develops in the worst operating conditions.

With its small size and competitive cost, this solution does not completely prevent reverse current from circulating in the modules, which must consequently be able to withstand values of at least twice or three times the I_{SC} (such values are normally supported by the majority of the modules available on the market).

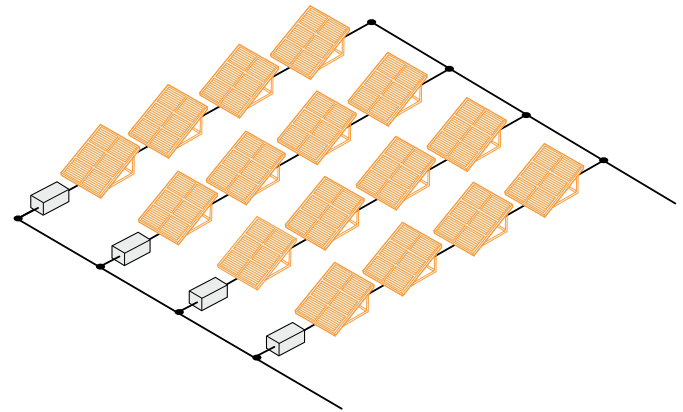
Miniature circuit-breakers

Use of thermo-magnetic circuit-breakers is a further method for protecting photovoltaic strings. Thus, manufacturers have created specific products comprising technological solutions able to function at high the direct current voltage values that are usual in these applications.

Technically speaking, this is the better solution even though it is not so economical.

In certain cases, it could also be liable to accidentally trip in the presence of transient overvoltage (e.g. of atmospheric origin). However, in such cases they can be reset without having to replace any components.

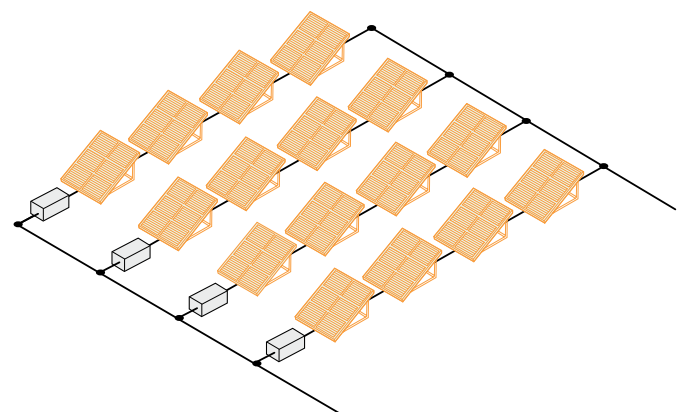
A further advantage is that the protection and isolating functions can be provided by a single device.



Protection for the parallel connection of the strings of photovoltaic modules. Simple parallel.

Advantages: simple to make

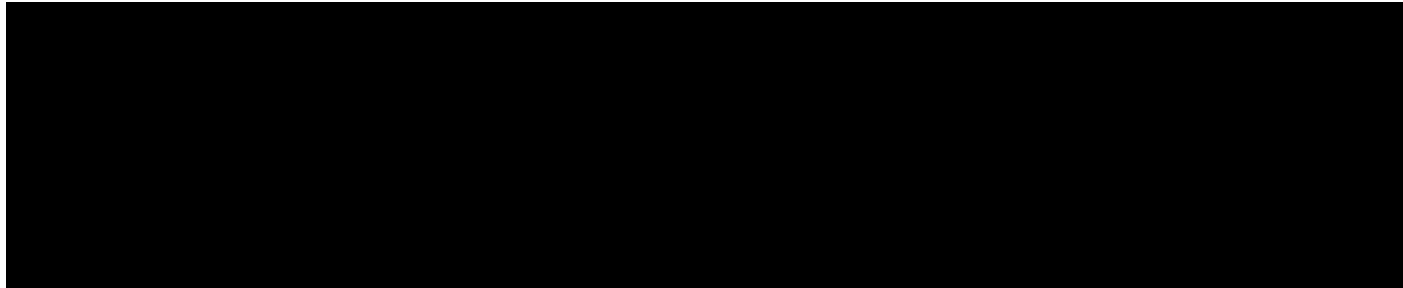
Disadvantages: the strings are liable to power reversals;
can only be used for a very small number of strings



Protection for the parallel connection of the strings of photovoltaic modules. Automatic circuit-breakers.

Advantages: a single device provides both the protection and isolating functions

Disadvantages: More expensive



Isolating devices

A class DC21 switch-disconnector can also be installed in the parallel switchboards to allow the solar energy source to be disconnected if a fault occurs or, more frequently, when servicing is required.

If it is installed in the subsystem's parallel switchboards, lower current values can be used than those that would be obtained with a single isolation on the load side of the inverter, while it also allows the various different strings to be disconnected in a selective way.

To conduct maintenance work and inspections in the utmost safety, it is advisable to install isolating devices on each individual string.

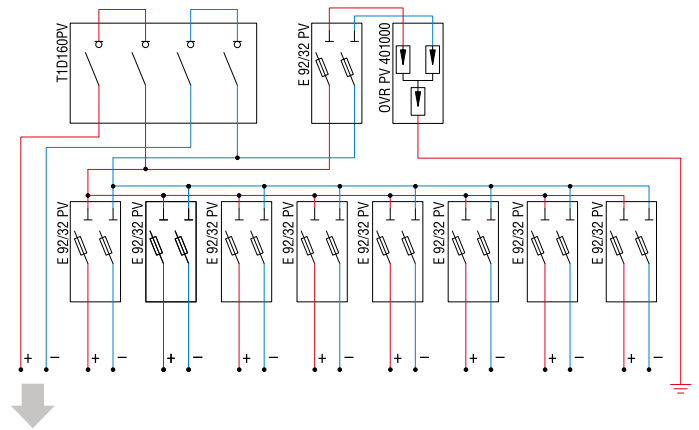


Diagram of a parallel switchboard for 8 strings inclusive of SPD and switch-disconnector

Surge arresters

Solar arrays, which are generally sited in exposed positions and, for the higher power versions, over wide areas, are subject to atmospheric activity and may be damaged by the over voltage generated by lightning.

To avoid problems, it is advisable to install Surge Protective Devices (SPD) on each polarity towards earth in the parallel switchboards once the risks have been correctly assessed in accordance with EN 62305-2 standards.

The impedance of these devices varies, depending on the voltage applied: when on hold, their impedance is extremely high and is reduced in the case of over voltage, by discharging the associated current towards earth.

It is advisable to choose the right sort of SPD with tripping thresholds that suit the operating voltage values of the circuit.

The state of efficiency of the equipment must be constantly displayed locally and in the remote mode if necessary, by use of products equipped with remote signalling contacts.

SPD with varistors or combined SPD should be used in the protection for the direct current side. Inverters generally possess internal protection against over voltage, but the addition of SPD's at the terminals prevents surges from reaching the inverter which means the inverter maintains the

production of energy and negates the need for the intervention of specialized personnel.

These SPD must therefore possess the following characteristics:

- type 2;
- maximum continuous operating voltage $U_c > 1.25 U_{oc}$;
- protection level $U_p < U_{inv}$, where U_{inv} is the impulse withstand voltage of the inverter on the d.c. side;
- rated flashover current $I_n > 5 \text{ kA}$;
- thermal protection with short-circuit extinction capacity at life end and coordination with a suitable backup protection.

Since the impulse withstand voltage of the string modules is generally higher than that of the inverter, the SPD installed to protect these generally allow the modules to be protected as well, so long as the distance between the modules and inverter is less than 10 meters. The SPD must be installed on the supply side (direction of the PV generator's energy) of the inverter's isolating device so that it also protects the modules when the isolating device is open.

Miniature circuit-breakers S800 PV-S



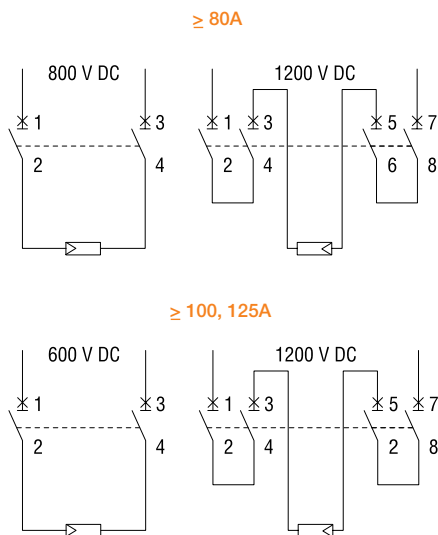
S800 PV-S miniature circuit-breakers can be used in networks up to 1200 V d.c. (four-pole version). These products and their vast range of accessories (auxiliary contacts, release coils) can be used to create countless system configurations. The main features of S800 PV-S circuit-breakers are:

- interchangeable terminals
- fault signalling lever in the central position
- contact status displayed for each individual pole
- no restrictions as to polarity or power direction in the wiring
- use of the rotary door operating handle

Main technical specifications		S800 PV-S	
Reference Standards		IEC EN 60947-2	
Rated current I_n	[A]	10...80	100, 125
Number of poles		2, 4	
Rated voltage U_e			
(d.c.) 2 poles*	[V]	800	1200
(d.c.) 4 poles*	[V]	600	1200
Ultimate rated short-circuit breaking capacity I_{cu}			
(d.c.) 600/800 V (2 poles) *	[kA]	5	5
(d.c.) 1200 V (4 poles) *	[kA]	5	5
Thermomagnetic release characteristic		$4 I_n \leq I_m \leq 7 I_n$	
Class of use		A	
Operating temperature	[°C]	-25...+60	
Mounting		on EN 60715 channel (35 mm) with a quick coupling device	

Please refer to wiring diagrams*

Poles	Rated current I_n [A]	Description Type	Order code
2	10	S802PV-S10	2CCP842001R1109
2	13	S802PV-S13	2CCP842001R1139
2	16	S802PV-S16	2CCP842001R1169
2	20	S802PV-S20	2CCP842001R1209
2	25	S802PV-S25	2CCP842001R1259
2	32	S802PV-S32	2CCP842001R1329
2	40	S802PV-S40	2CCP842001R1409
2	50	S802PV-S50	2CCP842001R1509
2	63	S802PV-S63	2CCP842001R1639
2	80	S802PV-S80	2CCP842001R1809
2	100	S802PV-S100	2CCP842001R1829
2	125	S802PV-S125	2CCP842001R1849
4	10	S804PV-S10	2CCP844001R1109
4	13	S804PV-S13	2CCP844001R1139
4	16	S804PV-S16	2CCP844001R1169
4	20	S804PV-S20	2CCP844001R1209
4	25	S804PV-S25	2CCP844001R1259
4	32	S804PV-S32	2CCP844001R1329
4	40	S804PV-S40	2CCP844001R1409
4	50	S804PV-S50	2CCP844001R1509
4	63	S804PV-S63	2CCP844001R1639
4	80	S804PV-S80	2CCP844001R1809
4	100	S804PV-S100	2CCP844001R1829
4	125	S804PV-S125	2CCP844001R1849



Connection
Photovoltaic panel network
in earth-insulated systems

Miniature circuit-breakers S800 PV-M

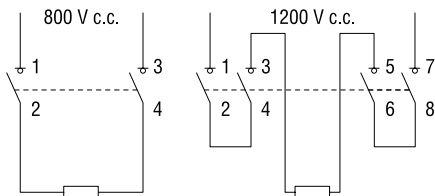


S800 PV-M switch-disconnectors can be used in networks up to 1200 V d.c. (four-pole version). These products and their vast range of accessories (auxiliary contacts, release coils) can be used to create countless system configurations. The main features of S800 PV-M switch-disconnectors are:

- interchangeable terminals
- contact status displayed for each individual pole
- no restrictions as to polarity or power direction in the wiring
- use of the rotary door operating handle

Main technical specifications		S800 PV-M
Reference Standards		IEC EN 60947-3
Rated current I_n	[A]	32, 63, 125
Number of poles		2, 4
Rated voltage U_e		
(d.c.) 2 poles*	[V]	800
(d.c.) 4 poles*	[V]	1200
Ultimate rated short-circuit breaking capacity I_{cu}		
(d.c.) 600/800 V (2 poles) *	[kA]	1.5
(d.c.) 1200 V (4 poles) *	[kA]	1.5
Class of use		DC-21A
Operating temperature	[°C]	-25...+60
Mounting		on EN 60715 channel (35 mm) with a quick coupling device

Please refer to wiring diagrams*



Connection
Photovoltaic panel network
in earth-insulated systems

Poles	Rated current I_n [A]	Description Type	Order code
2	32	S802PV-M32	2CCP812001R1329
2	63	S802PV-M63	2CCD842001R1590
2	125	S802PV-M125	2CCP812001R1849
4	32	S804PV-M32	2CCP814001R1329
4	63	S804PV-M63	2CCD844001R1590
4	125	S804PV-M125	2CCP814001R1849

Isolators OT



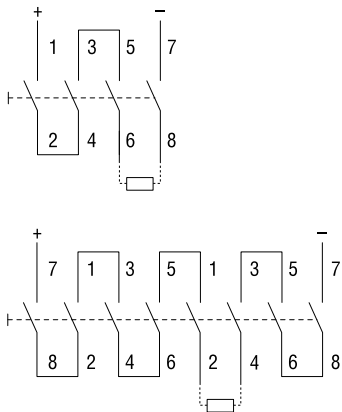
OT series disconnectors are available with 16 A to 125 A rated current values in 3, 4, 6 and 8 pole versions, depending on the direct current voltage used.

The main features of OT disconnectors are:

- quick make-break mechanism with independent tripping function (in the OT 45...125 versions).
- accessories that are snap-fitted on the circuit-breakers
- OT 45 ... 125 switch-disconnector mechanism for installation on DIN channel.
- can be locked with a locking adapter

Main technical specifications		OT		
Reference Standards		IEC EN 60947-3		
Rated current I _n	[A]	16, 25, 32		
Number of poles		4	6	8
Rated voltage U _e				
(d.c.) 4 poles*	[V]	500		
(d.c.) 6 poles*	[V]		550	
(d.c.) 8 poles*	[V]			800
Class of use		DC-21A		
Operating temperature	[°C]	-25...+60		
Mounting		on EN 60715 channel (35 mm) with a quick coupling device		

Please refer to wiring diagrams*



Circuit Diagram

Poles	Rated current I _n [A]	Rated current/DC21 [A/V d.c.] voltage	Description Type	Order code
4	16	16/440	OT16F4N2	1SCA104829R1001
6	16	16/550	OT16F6	1SCA104834R1001
6	25	25/550	OT25F6	1SCA104880R1001
6	32	32/550	OT40F6	1SCA104936R1001
8	16	16/800	OT16F8	1SCA104836R1001
8	25	25/800	OT25F8	1SCA104882R1001
8	32	32/800	OT40F8	1SCA104938R1001

Switch-disconnectors Tmax PV

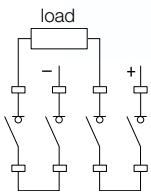


Tmax PV series disconnectors are available with up to 1600 A class DC-22B rated operating current values, for 1100 V d.c. maximum rated operating voltage. The switching devices of the Tmax PV series are the first box disconnectors for direct current high voltage available on the market. They are certainly of interest for use in any type of photovoltaic installation since they are ideal for all disconnecting requirements.

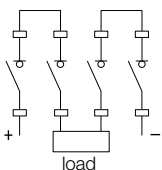
The main features of Tmax PV disconnectors are:

- Comprehensive range. There are 6 different sizes, from the compact T1 (which can be fixed to DIN channel) to T7, available in the two versions with operating lever and motor control
- Excellent performance-dimensions ratio
- Wide choice of accessories to suit every requirement

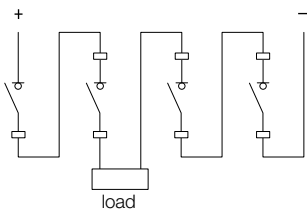
Main technical specifications		Tmax PV
Reference Standards		IEC EN 60947-3
Rated current I_n	[A]	160 - 1600
Number of poles		4
Rated voltage U_e	[Vd.c.]	1100
Rated insulation voltage U_i	[Vd.c.]	1150
Short time current I_{cw}	[kA]	1.5 - 19.2
Class of use		DC-22B



Circuit Diagram
Valid for T1D PV, T3D PV,
T6D PV, T7D PV,



Circuit Diagram
Valid for T4D PV, T5D PV



Circuit Diagram
Valid for all Tmax series

Poles	lth	Operating current DC 22B [A/V d.c.]	Description Type	Order code
4	160	160/1100	T1D 160 PV	1SDA066881R1
4	250	200/1100	T3D 200 PV	1SDA066882R1
4	250	250/1100	T4D 250 PV	1SDA066883R1
4	630	500/1100	T5D 500 PV	1SDA066884R1
4	800	800/1100	T6D 800 PV	1SDA066885R1
4	1600	1600/1100	T7D 1600 PV	1SDA066886R1
4	1600	1600/1100	T7D 1600 PM	1SDA066887R1

Fuse disconnectors E 90 PV



The E 90 PV series fuse disconnectors has been designed for up to 1000 V direct current voltage with DC-20B class of use. The E 90 PV series is specifically used for protecting photovoltaic systems against overcurrents and provides a reliable, compact and inexpensive solution since it uses 10.3 x 38 mm cylindrical fuses. The main features of E 90 PV fuse disconnectors are:

- Handle opening through 90° that allows the horizontal fuse to be easily inserted even when wearing gloves or using the thumb
- Only an additional 17 mm larger in the open position than in the closed position
- 25 mm² terminals with knurled terminal cage to allow the cable to be clamped in a better way
- Fully compatible with electric screwdrivers
- Pozidrive screws for flat-head and cross-point screwdrivers
- Lockable in the open position using the padlocks commonly available on the market, so as to ensure safe maintenance work
- Can be sealed in the closed position to prevent improper use
- Cooling chambers and ventilation slits to facilitate heat dispersion
- Versions with indicator light are available

Main technical specifications		E 90/32 PV
Reference Standards		IEC EN 60947-3
Rated service voltage	[V.d.c.]	1000
Class of use		DC-20B
Fuse	[mm]	10 x 38
Type of current		d.c.
Rated current	[A]	32
IP Rating		IP20
Lockable (when open)		Yes
Sealable (when closed)		Yes

Poles	Rated current In [A]	Modules	Description Type	Order code
1	32	1	E 91/32 PV	2CSM204713R1801
1	32	1	E 91/32 PVs*	2CSM204693R1801
2	32	2	E 92/32 PV	2CSM204703R1801
2	32	2	E 92/32 PVs*	2CSM256913R1801

*s: version with LED for blown fuse indication

Surge arresters for DC OVR PV

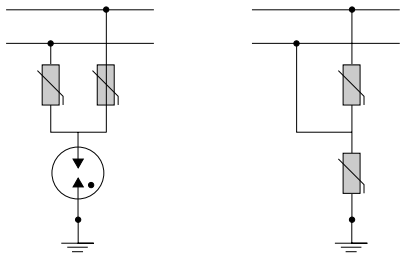


ABB provides a wide range of surge protection devices that have been specifically designed for photovoltaic systems.

The main features of the OVR PV surge arresters are:

- built-in thermal protection with 25 A d.c. breaking capacity*
- removable cartridges for easy maintenance with no need to isolate the line
- remote signalling contact for monitoring the operating status (TS versions)
- no subsequent short-circuit current
- no risk if the polarity is reversed

Main technical specifications		OVR PV
Electrical specifications		
Type of network		photovoltaic systems
Type		2
Response time	[ns]	25
Residual current	[mA]	< 1
Protection class		IP20
Built-in thermal protection		self-protected for up to 100 A d.c. short-circuit current
Back-up protection current I _{cc} < 100A		not required
Back-up protection current I _{cc} > 100A		10 A gR fuse
Mechanical specifications		
L/PE terminals		
rigid	[mm ²]	2,5...25
flexible	[mm ²]	2,5...16
Tightening torque L [Nm]	2,80
Status indicator		yes
Remote signal contact		
Type		1 NA/NC
Minimum rating		12 V d.c. - 10 mA
Maximum rating		250 V a.c. - 1 A
Cable section	[mm ²]	1,5
TS versions		
Operating temperature	[°C]	-40...+80
Storage temperature	[°C]	- 40...+80
Maximum altitude	[m]	2000
Housing material		PC RAL 7035
UL94 fire resistance		V0
Reference standards		IEC 61643-1 / EN 61643-11

***Note:**

For surge protection device installed at points of the network where short circuit current exceeds 25A DC suitable protection must be provided

I Max	Protection Level (L-L/L-PE) kV	Description Type	Order code
40A	2.8/1.4	OVR PV 40 600 P	2CTB803953R5300
	2.8/1.4	OVR PV 40 600 P TS	2CTB803953R5400
	3.8	OVR PV 40 1000 P	2CTB803953R6400
	3.8	OVR PV 40 1000 P TS	2CTB803953R6500

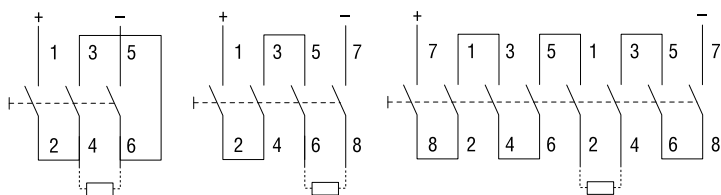
Enclosed switch disconnectors DC OTP



Plastic enclosed switch-disconnectors 3 - 4 - 8 pole IP65

- IP65 rated
- Grey plastic enclosure
- Standard handle - Red/Yellow (padlockable in the off position)
- Cable entries top and bottom

1th [A]	No. Poles	Rated Operated Current/ voltage DC21-A[A]/[VDC]	Cable Outlets Side	Order Code
25	3	16/220	2xM20	OTP16BA3MS
	4	16/500	2xM25+M16	OTP16BA4MS
	8	16/800	2xM25+M16	OTP16BA8MS
32	3	32/220	2xM25+M16	OTP32BA3MS
	8	32/800	2xM25+M16	OTP32BA8MS



Circuit Diagram

Surge Arresters for AC OVR T2



The OVR T2 protects inverters and installations from over voltages and impulse currents, such as switching and lighting surges. The device ensures the limitation of over voltage to an acceptable level for the equipment to be protected.

The device has a remote signal control and removable cartridge for easy maintenance without needing to isolate the line.

These devices are available with a remote signal control and removable cartridge (...P TS) for easy maintenance without needing to isolate the line.

Main technical specifications	OVR T2
Rated operating voltage	230V and 400V AC
Poles	1, 2, 3, 4
Maximum discharge current	15, 40, 70kA
Residual current	< 1
Voltage protection level	1.2 3.8kV
Standards	IEC 61643-1 IEC 61643-11

Network TT	I Max	Type	Order code
TT (3 + N)	25	OVR T1 3N 25 255 TS	2CTB815101R0700
TT (1 + N)	40	OVR T2 1N 40 275 SP TS	2CTB803952R0200
TT (3 + N)	70	OVR T2 3N 70 275 SP TS	2CTB803953R0100
TT (1 + N)	15	OVR T2 1N 15 275 P	2CTB803952R1200

Isolators for AC E 200



The isolator is used as a master switch on the AC side. It offers reliable and safe switching under load.

Ease of maintenance is guaranteed by the special fastening for easy removal of the device from its present installation. The wide range of accessories facilitates use of all applications.

Main technical specifications	E 200
Reference Standards	IEC 947-3
Rated operating voltage	230V/400V AC
Rated current	16 ... 125A

Poles	Nominal Current	Description Type	Order code
2	100	E202/100R	2CDE282001R0100
3	100	E203/100R	2CDE283001R0100
4	100	E204/100R	2CDE284001R0100

Miniature circuit breaker for AC

S 200M



The S200 M protect installations against overload and short circuit, ensuring reliability and safety for operations. They are selectively switchable, even under load, in the event of a fault or for maintenance purposes. The standstill times are minimised thanks to the devices' reclosing capability. These devices offer users confidence thanks to their 100% factory testing. The devices, with their wide range of accessories, are suitable for international use.

The S200 M are known for their ease of maintenance – thanks to a special type of fastening for easy removal of the device from its present installation. Supply is possible from above or below, also for busbars. Without busbars, two terminal sections can be used. The tripping behaviour caters to customer requirements (B, C, D, K, Z characteristics)

Main technical specifications		S 200M
Reference Standards		IEC 60898, IEC 60947-2 UL 489, UL 1077
Rated operating current	[Vd.c.]	0,5 ... 63 A
Ultimate short-circuit breaking capacity		6, 10, 25 kA
Rated operating voltage	1-pole	12 ... 230 VAC
	2-4 pole	12 ... 400 VAC

Rated current In [A]	Rated breaking capacity [kA]	Poles	Description Type	Order code
10	10kA	2	S202MC10	2CDS272001R0104
16			S202MC16	2CDS272001R0164
20			S202MC20	2CDS272001R0204
25			S202MC25	2CDS272001R0254
32			S202MC32	2CDS272001R0324
10			3	S203MC10
16		S203MC16		2CDS273001R0164
20		S203MC20		2CDS273001R0204
25		S203MC25		2CDS273001R0254
32		S203MC32		2CDS273001R0324
10		4		S204MC10
16			S204MC16	2CDS274001R0164
20	S204MC20		2CDS274001R0204	
25	S204MC25		2CDS274001R0254	
32	S204MC32		2CDS274001R0324	

RCDs for AC F200 PV-B



Residual current devices ensure protection of people and installations against fault current to earth and fire risks. An RCD B type is required on the AC side in case of lack of electrical separation between the AC and the DC side.

The devices save money and improve global efficiency by using PV connectors without an internal insulation transformer. The devices, with their wide range of accessories are suitable for international use.

The RCCBs F202 PV B and F204 B are intended for installation of single and three phase PV converters. they protect against fire risks and leakage currents.

Main technical specifications	F202 PV B, F204 B
Rated operating current	25, 40, 63, 125A
Rated sensitivity current	30, 300, 500mA
Rated operating voltage	230 ... 400 VAC
Poles	2 ... 4
Type	B, B S (selective version)
Reference Standards	IEC/EN61008 IEC52423

Poles	A / mA	Description Type	Order code
2	40 / 300	F202-A-40/300mA	2CSF202121R3400
2	63 / 300	F202-A-63/300mA	2CSF202121R3630
4	40 / 300	F204-A-40/300mA	2CSF204121R3400
4	63 / 300	F204-A-63/300mA	2CSF204121R3630
4	63 / 300	F204-B-63/300mA	2CSF204501R3630

Enclosed switch disconnectors AC OTP



Plastic enclosed switch-disconnectors 3 - 4 pole IP65

- IP65 rated
- Grey plastic enclosure
- Standard handle - Red/Yellow (padlockable in the off position)
- Cable entries top and bottom

1th [A]	No. Poles	AC22	AC23	kW	Cable Outlets Side	Order Code
25	3	16	16	7.5	2xM20	OTP16BA3M
	4				2xM25+M16	OTP16BA4M
32	3	25	20	9	2xM25+M16	OTP25BA3M
	4				2xM25+M16	OTP25BA4M

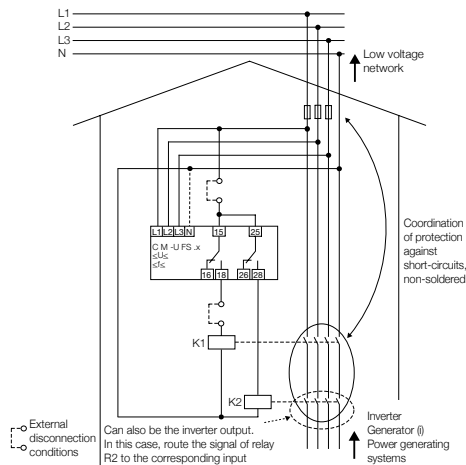
Interface relay for connection to the power grid CM-UFS



Even small distributed generating systems need to be connected to the power grid with guarantees as to completely safe operation, especially when the energy flow towards the network must be shut off for maintenance or if a fault occurs in the network itself. Rapid disconnection is essential if hazardous situations for the people who must work on the lines are to be avoided. This sort of protection can be achieved with an automatic monitoring device able to immediately detect faults in the network. The CM-UFS interface, which conforms to both the Italian ENEL Distribuzione Directive for connections to the electricity main and to German DIN V VDE 0126-1-1, answers to the need for safety for both the installations and the operators in the case of faults and malfunctions in the public power grid during parallel operation.

The main features of the CM-UFS interface relay are:

- Undervoltage protection
- Overvoltage protection
- Minimum frequency protection
- Maximum frequency protection
- Installation on DIN channel, dimension 22 mm
- Configurable connection for the neutral conductor
- 3 LED to indicate the operating status
- Power supply from the circuit under control
- Measurement of the true RMS value
- Can also be used for monitoring single-phase systems
- 2 switch contacts (SPDT)



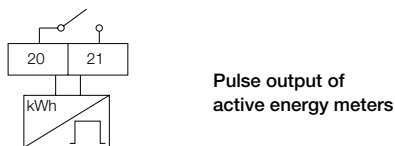
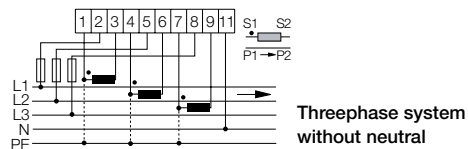
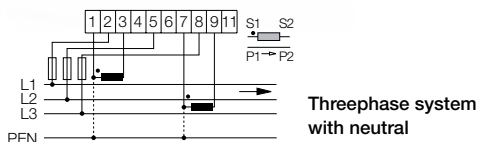
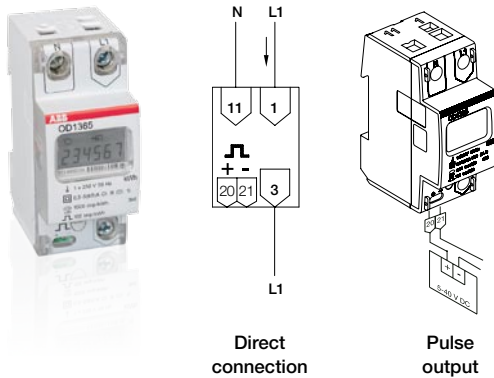
Main technical specifications		CM-UFS.1
Maximum voltage	[Vn]	> 115 %
Minimum voltage	[Vn]	< 80 %
Maximum frequency	[Hz]	> 50.2
Minimum frequency	[Hz]	< 47.5
Mean value	[Vn]	10 minutes
		110 to 115 % adjustable

For markets where the German standard VDE is implemented

Main technical specifications		CM-UFS.2
Maximum voltage	[Vn]	> 120 %
Minimum voltage	[Vn]	< 80 %
Maximum frequency	[Hz]	> 50.3 or 51 upon the request of ENEL personnel
Minimum frequency	[Hz]	> 49.5 or 49 upon the request of ENEL personnel

Description Type	Order code
Interface device (VDE Type-approved) CM-UFS.1	1SVR630736R0300
Interface device (ENEL Type-approved) CM-UFS.2	1SVR630736R1300

Modular energy meters ODINsingle and DELTAplus



Modular energy meters are ideal for metering and monitoring the energy produced by a photovoltaic system. All the meters are tested and comply with the European MID directive, which allows the meters to be used whenever the energy readings must be used for payment quantification purposes. The terminal boards can be sealed so as to prevent the meter's programming functions from being accessed and to safeguard the inputs of the measuring signals.

ODINsingle:

- Accuracy class B (1)
- MID certified for sub-billing purposes
- Direct connection in single-phase systems of up to 65 A
- OD1365 with pulse output
- OD1365 with re-settable register
- LCD display, excellent visibility in all lighting conditions
- Front LED for checking load

DELTAplus:

- Accuracy class B (1)
- MID certified for sub-billing purposes
- Connection by current and voltage transformers
- Active energy metering in three phase systems
- With programmable pulse output
- Electric parameters, voltage, current, power and frequency displayed
- Installation assessment: phase presence and sequence
- Front LED for checking load

Main technical specifications	ODINsingle	DELTAplus
Reference Standards	IEC EN 50470-1 IEC EN 50470-1	IEC EN 50470-3 IEC EN 50470-3
Voltage	230 V a.c.	3 x 57- 288 V (P+N) 3 x 100 - 500 V (P-P)
Max connection current	65 A	6 A
Start-up current	25 mA	2 mA
Frequency	50-60 Hz ± 5 %	50-60 Hz ± 5 %
Accuracy class	B (Class 1)	B (Class 1)

Poles	Description	Type	Order code
1 + N	65A Direct Class B	OD1065	2CMA131040R1000
1 + N	65A Direct with Reset	OD1365	2CMA131041R1000
3 + N	65A Direct Class A	OD4165	2CMA131024R1000
3 + N	80A Direct Class A	DBB23000	2CMA180800R1000
3 + N	80A Direct Class B	DBB13000	2CMA180801R1000
3 + N	80A Direct Class A	DBB22000	2CMA180802R1000

Enclosures Europa Series



The Europa series wall-mounted consumer units feature IP65 protection which makes them ideal for installation outdoors. This means that they can be used for making string boxes on the load side of photovoltaic strings.

The main features of the Europa series wall-mounted consumer units:

- class II insulation
- manufactured in self-extinguishing thermoplastic material able to withstand abnormal heat and fire up to 650 °C (glow wire test) in compliance with IEC 60695-2-11 standards
- installation temperature: -25 °C to +60 °C
- rated insulation voltage: 1000 V a.c.; 1500 V d.c.
- shock resistance: 6 joules (IK 08 degrees)
- pull-out DIN channel holder frame for more convenient bench wiring. Can be disassembled (and re-assembled by means of a snap-fit mechanism) to make the individual wires easier to route
- 53, 68 and 75 mm depth switchgear can be installed
- models with 8 or more modules equipped with bi-metal and rigid flanges for easier insertion of pipes and cables
- consumer units in compliance with IEC 23-48, IEC 23-49 and IEC 60670 standards- IMQ Mark



Description	Dimensions	Order code
IP65 consumer unit P/smoke grey 4M	140 x 220 x 140	12744
IP65 consumer unit P/smoke grey 8M	205 x 220 x 140	12748
IP65 consumer unit P/smoke grey 12M	275 x 220 x 140	12752
IP65 consumer unit P/smoke grey 8M 1 row	380 x 220 x 140	12753
IP65 consumer unit P/smoke grey 24M 2 rows	275 x 370 x 140	12754
IP65 consumer unit P/smoke grey 36M 2 rows	380 x 370 x 140	12755

Cable gland		Nut		Dimensions mm		
Description	Order code	Description	Order code	Gauge	Min	Max
M12 cable gland with metric pitch	00 951	Nut for M12 cable gland	00 96	12 x 1.5	3.5	7
M16 cable gland with metric pitch	00 952	Nut for M16 cable gland	00 962	16 x 1.5	5.5	10

Junction boxes



ABB also provides IP65 polycarbonate junction boxes that are perfect for use in outdoor installations.

The main features of the junction boxes are:

- class II insulation
- manufactured in self-extinguishing thermoplastic material able to withstand abnormal heat and fire up to 960 °C (glow wire test) in compliance with IEC 60695-2-11 standards
- installation temperature: -25 °C to +60 °C
- rated insulation voltage: 1000 V a.c.; 1500 V d.c.
- shock resistance: 20 joules (IK 10 degrees)
- junction boxes in compliance with IEC 23-48 and IEC 60670 standards
- IMQ Mark

Description	Dimensions	Order code
Box IP65 PC	140 x 220 x 140	12804
	205 x 220 x 140	12808
	275 x 220 x 140	12812

Modular terminal blocks



ABB produces a complete range of modular terminal blocks, from the conventional screw-clamp and spring-clamp versions to the most technologically advanced self-stripping connection that provides a quick, safe and reliable connection (ADO) by means of a special tool. The screw-clamp or ADO (self-stripping technology) versions are more suitable for photovoltaic applications as they provide a more reliable long term connection.

Innovative and compact, ABB's new SNK series terminal blocks feature a modern design and can be supplied with countless accessories to suit the customers' requirements. They comply with all worldwide standards.

Main technical specifications

Connection	New SNK series screw type	self-stripping type (ADO System)*	spring type
Voltage max	1000 V max	1000 V max	800 V
Current	max 232 A	max 32 A	max 125 A
Section	max 95 mm ²	max 4 mm ²	max 35 mm ²

Conform to IEC 60947-7-1, IEC 60947-7-2 standards

Parallel interconnections are available

V0 self-extinguishing material

*Also available in the ADO-screw version

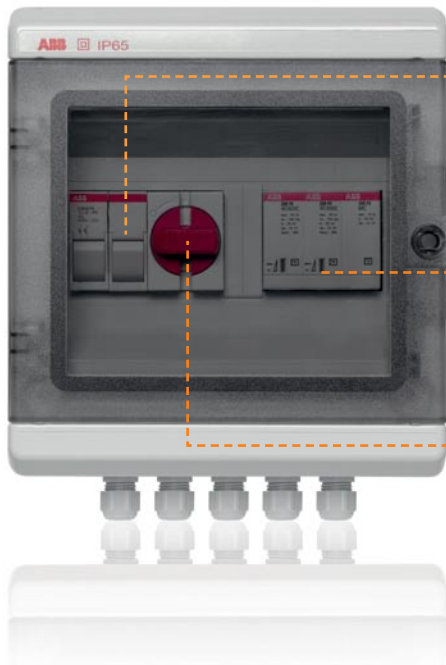
Description Type	Application	Section	I [A]	V [V]	Order code
Screw-screw terminal block					
ZS4	F	4 mm ²	32	1000	1SNK505010R0000
ZS6	F	6 mm ²	41	1000	1SNK506010R0000
ZS10	F	10 mm ²	57	1000	1SNK508010R0000
ZS4-BL	N	4 mm ²	32	1000	1SNK505020R0000
ZS6-BL	N	6 mm ²	41	1000	1SNK506020R0000
ZS10-BL	N	10 mm ²	57	1000	1SNK508020R0000
ZS4-PE	PE	4 mm ²	480A/1s		1SNK505150R0000
ZS6-PE	PE	6 mm ²	720A/1s		1SNK506150R0000
ZS10-PE	PE	10 mm ²	1200A/1s		1SNK508150R0000

Accessories

End section	1SNK505910R0000
End stop	1SNK900001R0000
Circuit separator	1SNK900103R0000
Blank marker	1SNK149999R0000
Protective cover 5mm	1SNK900618R0000
Protective cover 6mm	1SNK900619R0000
Protective cover 8mm	1SNK900620R0000

String boxes

1 string 16A 500V



Fuse Disconnectors E90 PV

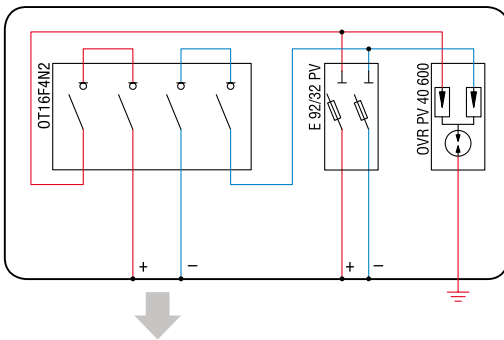
E90 PV have been designed for up to 1000 V d.c. voltage values (class DC-20B) and are ideally used in photovoltaic systems to isolate the individual strings and protect them against short circuits. All ABB string boxes are supplied with fuses as part of the standard equipment.

Surge Arresters OVR PV

All ABB string boxes are equipped with OVR PV series surge arresters specifically designed for photovoltaic applications. Only a specifically designed product can ensure that the cartridge functions properly until the end of its useful life, without the risk of short-circuits or dangerous polarity reversals.

Disconnectors OT

High-performance, readily available OT disconnectors stand out for their high voltage values and compliance with the most advanced international standards. They are an excellent choice for small systems both cost-wise and as to performance.



Note:

The following string boxes show options for 1, 2, 3 and 4 string. Please consult us for other variations.

Direct current string boxes



One string 16 A 500 V

DC string box for string protection and isolation, consisting of:

- Europa series IP 65 wall-mounted 8-module consumer unit.
- disconnecter OT 16 F4 N2
- surge arrester OVR PV 40 600 P
- fuse-disconnector E 92/32 PV 10.3 x 38 mm fuses – 1000 V d.c. 10 A
- 2.5 to 10 mm² screw-clamp terminals (57 A) or above, for voltage up to 1000 V

Description	Dimensions (wxhxd mm)	Order code
DC string box 1str 16 A 500 V sd OT 16 F4 N2	205 x 220 x 140	1TVS151800S1991



One string 10 A 800 V

DC string box for string protection and isolation, consisting of:

- Europa series IP 65 wall-mounted 8-module consumer unit.
- miniature circuit-breaker S802 PV S10
- surge arrester OVR PV 40 1000 P
- 2.5 to 10 mm² screw-clamp terminals (57 A) or above, for voltage up to 1000 V

Description	Dimensions (wxhxd mm)	Order code
DC string box 1str 10 A 800 V cd S802PV-S10	205 x 220 x 140	1TVS151800S1993

Direct current string boxes



Two strings 16 A 500 V

DC string box for string protection and isolation, consisting of:

- Europa series IP 65 wall-mounted 12-module consumer unit.
- disconnecter OT 16 F4 N2
- surge arrester OVR PV 40 600 P
- fuse-disconnector E 92/32 PV 10.3 x 38 mm fuses – 1000 V d.c. 8 A
- 2.5 to 10 mm² screw-clamp terminals (57 A) or above, for voltage up to 1000 V

Description	Dimensions (wxhxd mm)	Order code
DC string box 2str 16 A 500 V sd OT 16 F4 N2	275 x 220 x 140	1TVS151800S1995



Two strings 16 A 800 V

DC string box for string protection and isolation, consisting of:

- Europa series IP 65 wall-mounted 12-module consumer unit.
- miniature circuit-breaker S802 PV S16
- surge arrester OVR PV 40 1000 P
- 2.5 to 10 mm² screw-clamp terminals (57 A) or above, for voltage up to 1000 V

Description	Dimensions (wxhxd mm)	Order code
DC string box 2str 16 A 800 V cb S802PV-S16	275 x 220 x 140	1TVS151800S1997

Direct current string boxes



Three strings 25 A 750 V

DC string box for string protection and isolation, consisting of:

- Europa series IP 65 wall-mounted 18-module consumer unit.
- disconnector OT 25 F8
- surge arrester OVR PV 40 1000 P
- fuse-disconnector E 92/32 PV 10.3 x 38 mm fuses – 1000 V d.c. 8 A
- 2.5 to 10 mm² screw-clamp terminals (57 A) or above, for voltage up to 1000 V

Description	Dimensions (wxhxd mm)	Order code
DC string box 3str 25 A 750 V sd OT 25 F8	380 x 220 x 140	1TVS151800S1999



Three strings 32 A 800 V

DC string box for string protection and isolation, consisting of:

- Europa series IP 65 wall-mounted 18-module consumer unit.
- miniature circuit-breaker S802 PV-S32
- surge arrester OVR PV 40 1000 P
- fuse-disconnector E 92/32 PV 10.3 x 38 mm fuses – 1000 V d.c. 10 A
- 4A gR fuses for protecting OVR surge arrester
- 2.5 to 10 mm² screw-clamp terminals (57 A) or above, for voltage up to 1000 V

Description	Dimensions (wxhxd mm)	Order code
DC string box 3str 32 A 800 V cb S802PV-S32	380 x 220 x 140	1TVS151800S2001



Four strings 32 A 750 V

DC string box for string protection and isolation, consisting of:

- Europa series IP 65 wall-mounted 36-module consumer unit.
- disconnector OT 40 F8
- surge arrester OVR PV 40 1000 P
- fuse-disconnector E 92/32 PV 10.3 x 38 mm fuses – 1000 V d.c. 10 A
- 4A gR fuses for protecting OVR surge arrester
- 2.5 to 10 mm² screw-clamp terminals (57 A) or above, for voltage up to 1000 V

Description	Dimensions (wxhxd mm)	Order code
DC string box 4str 32 A 750 V sd OT 40 F8	380 x 370 x 140	1TVS151800S2003

Technical literature

Installation Equipment



2CSC400002D0208

MCCBs



1SDC210015D0204

Switch Disconnectors



1SCC301001C0201

SNK Series



1SNK161001C0201

5000 Series



1SNC160001C0207

Interface CM-UFS



1SDC112001L0901

Gemini Series



1SLC805001D0906



Contractor LV Essentials

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Industrial LV Essentials

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