

Low Voltage Products Solutions for solar energy

ABB and solar energy

Environment friendly energy

Energy is one of the biggest global challenges we face today and major companies are at the heart of this issue. This is because the world expects them to come up with new technologies and systems to produce energy with reduced pollution and greenhouse gas emissions, widely recognised as one of the main causes of global warming.

Clean energy from the sun

Renewable energy plays a fundamental role in future energy policy in the light of the mounting interest in safeguarding the environment and the search for more efficient uses of energy resources, with the recognition that traditional fossil fuels will not last forever.

Against this background, the sun is unquestionably an energy source of huge potential, one that can be exploited without harming the environment. At any time, the hemisphere of the earth exposed to the sun receives over 50,000 TW of power, nearly 10,000 times the quantity of energy consumed all over the world.

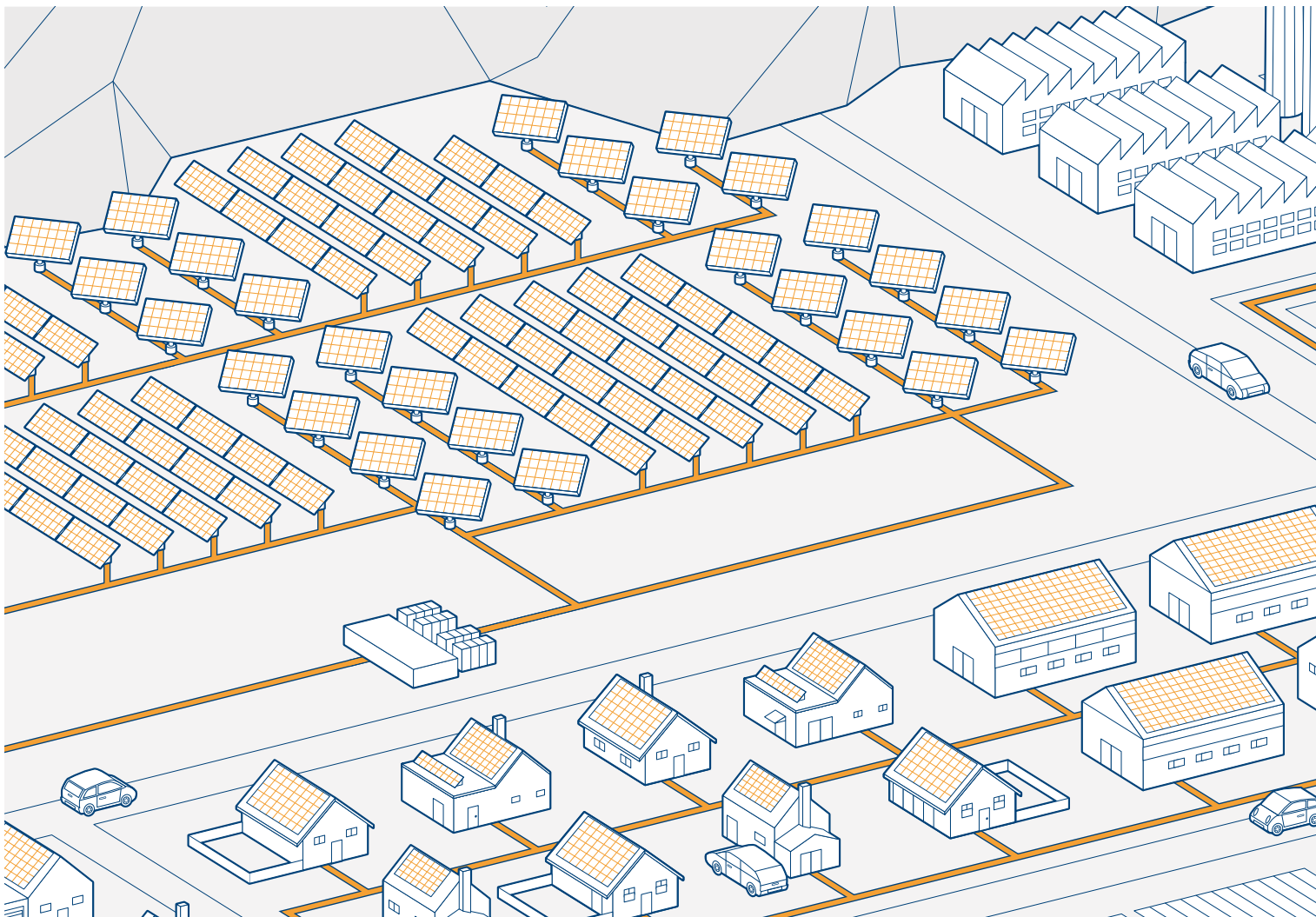


ABB for solar energy

ABB has long been active in creating products and solutions with low environmental impact and searching for new ways to develop and improve available technologies, anticipating customers needs.

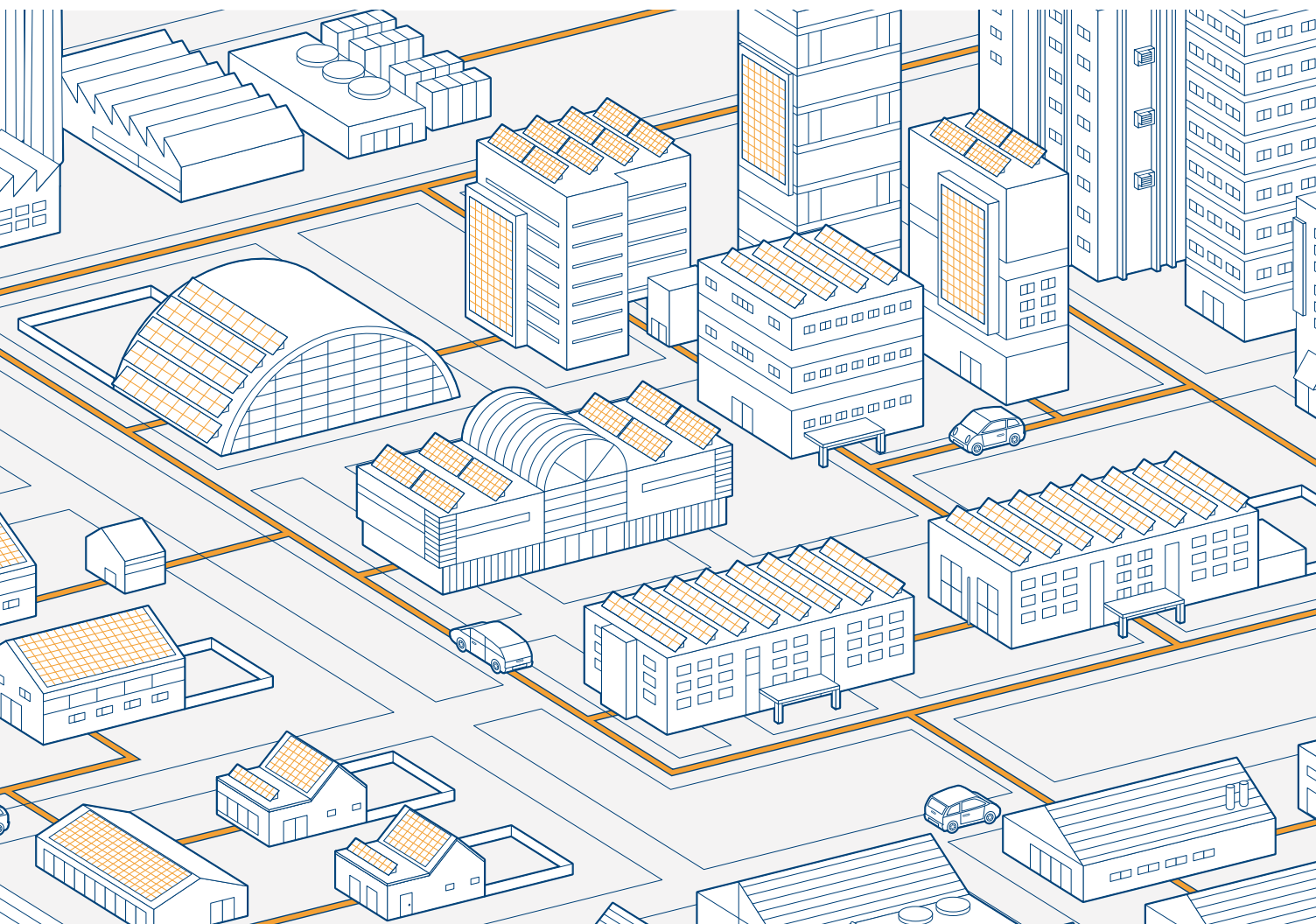
Today ABB offers a comprehensive range of competitive and reliable products to support the growth of renewable energies and, above all, solar energy.

Solar technologies for power generation

Solar energy can be used to generate electricity either directly using photovoltaic panels, or indirectly using solar thermal panels to produce heat which is then converted into electrical power.

In both cases, maximum yields can only be achieved by adopting equipment and components that guarantee the highest levels of quality with a range of products wide enough to meet the needs of every kind of plant.

With its extensive expertise, ABB is the ideal partner to provide clients with solutions designed to optimize investment and maximize results in terms of quality, reduced costs and operational efficiency.



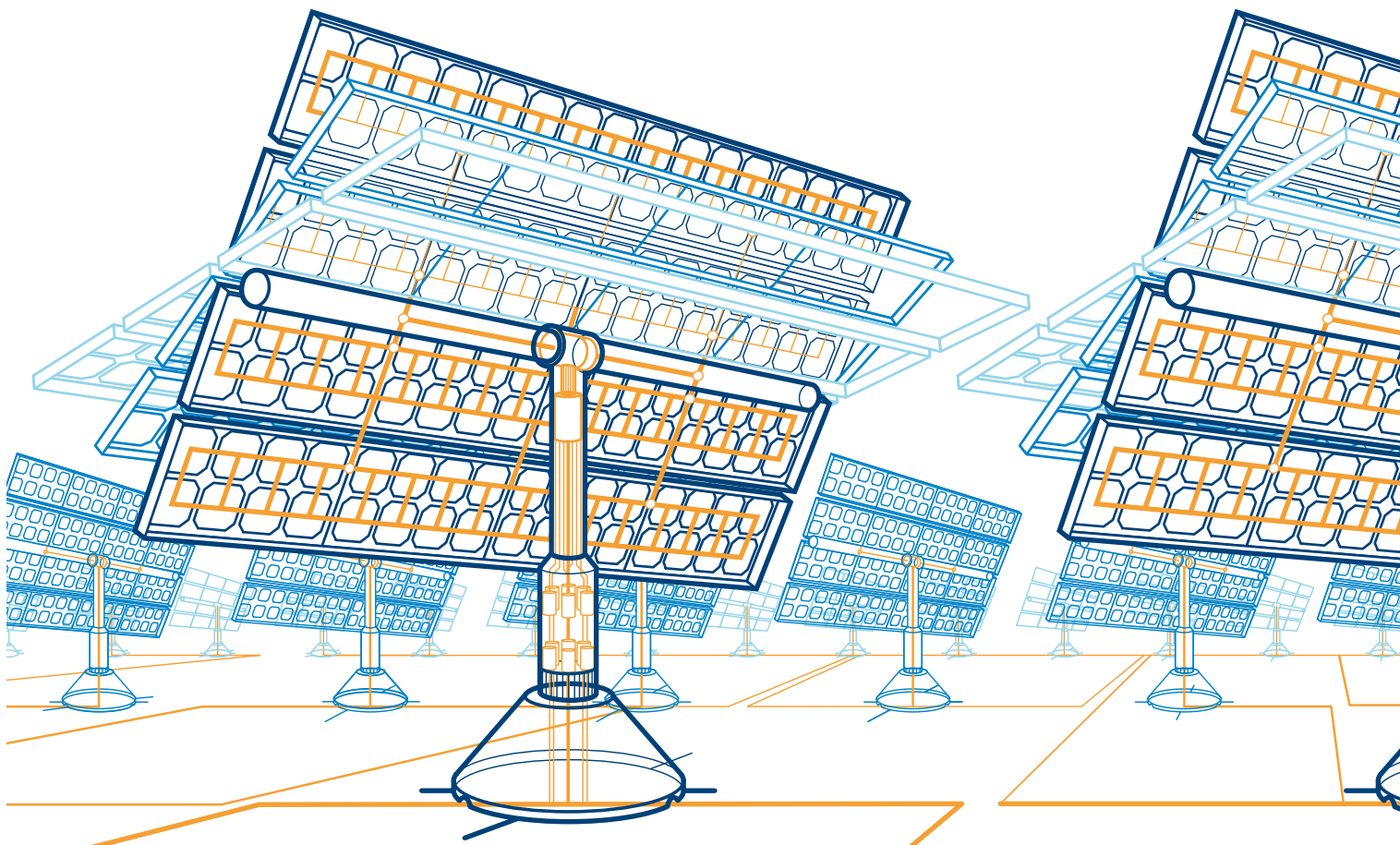
Photovoltaic energy

Efficiency and quality of a system are measured through efficiency and quality of each individual component

An accurate choice of components, especially modules and inverters, is of fundamental importance if a photovoltaic system has 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 weather conditions and under 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 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 related 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 strings on the direct current side through to the alternate current grid connection point. ABB product range includes circuit breakers, switch-disconnectors, fuse disconnectors and fuses, residual current-operated circuit-breakers, grid connection relays, metering devices, surge arresters, consumer units and enclosures suitable for outdoor installation, all specially designed for these applications. ABB can also provide a series of “plug & play” solutions, i.e. finished, wired and certified string boxes able to suit the requirements of a vast range of installations: from individual strings for residential applications to large photovoltaic plants.



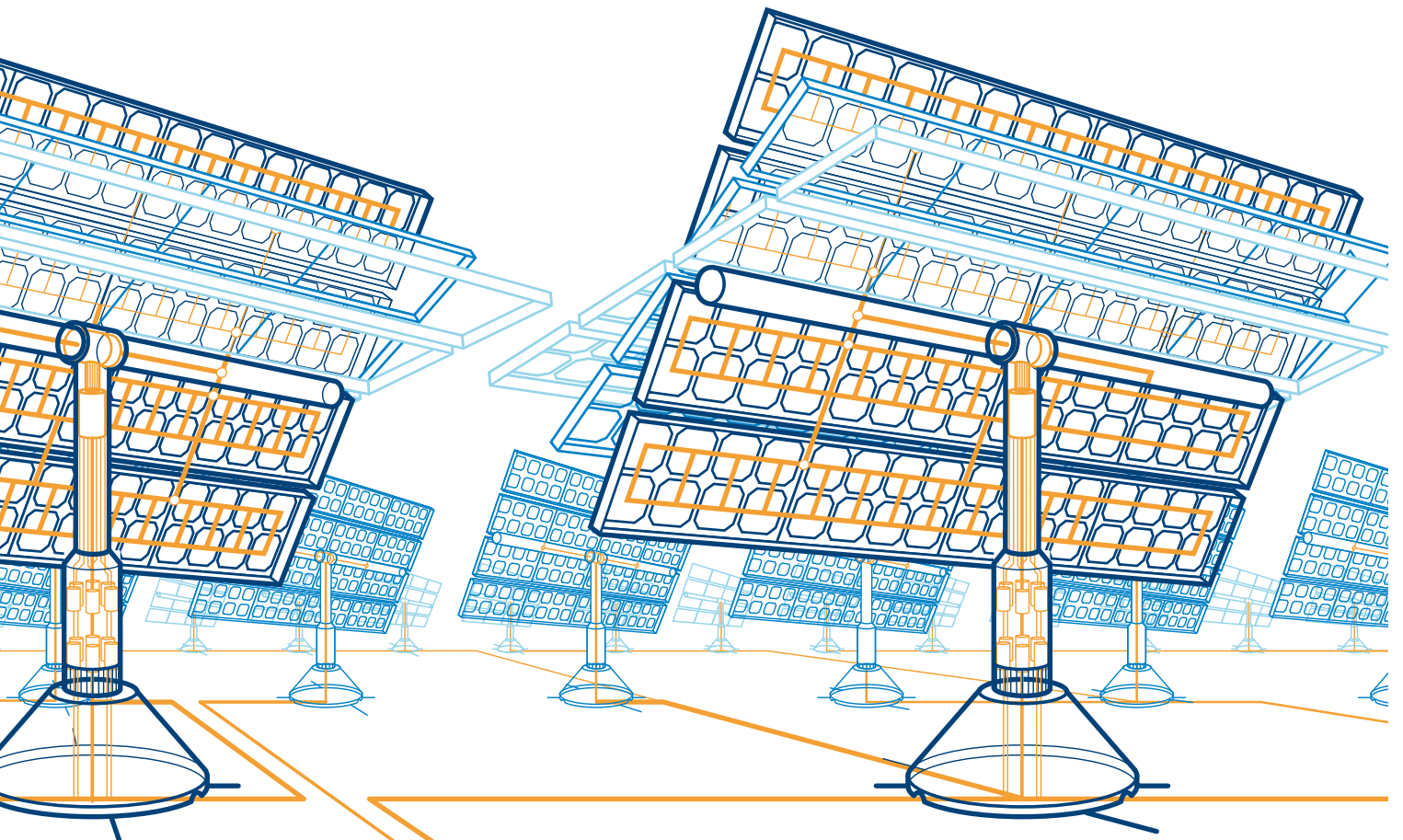
Photovoltaic systems

Protection and isolation in the DC side of PV systems

Similarly to any other electric system, a photovoltaic installation must be designed and built in accordance with all the technological solutions and standards able to guarantee the safest possible operation and the utmost protection for the people who must work on the structure.

An important role is played by isolating and protection equipments in both circuits on direct current side and those in alternate current section on the load side of the inverter.

There is a great variety of photovoltaic systems in reference to power, type of inverter (with a power-frequency transformer, high frequency transformer or without a transformer) and type of connection to the public grid (single-phase, three-phase, low or medium voltage), thus design engineers and installers need to carefully assess the components they choose.



Photovoltaic systems

Protections on the DC side

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

Along with the specific characteristic of solar modules and strings (inability to shut off the voltage other than by obscuring the solar panels or generation of short-circuit currents with values very near to those produced in normal conditions), the presence of voltage in the range of 300-600 V DC 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.

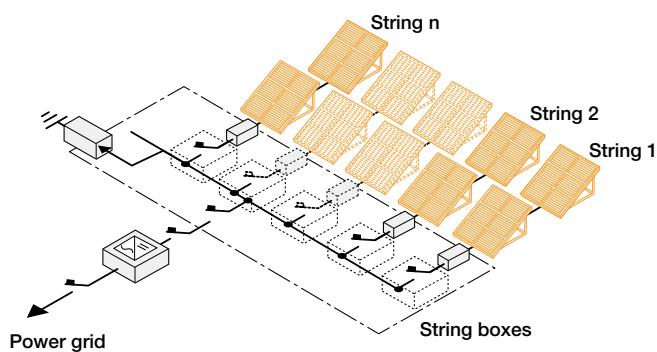
In accordance with the provisions established by Standard IEC 60364 (article 712), protection against overcurrents must be provided when cable carrying capacity is less than 1.25 times the calculated fault current in any point.

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 should be of the DC21 class at least.

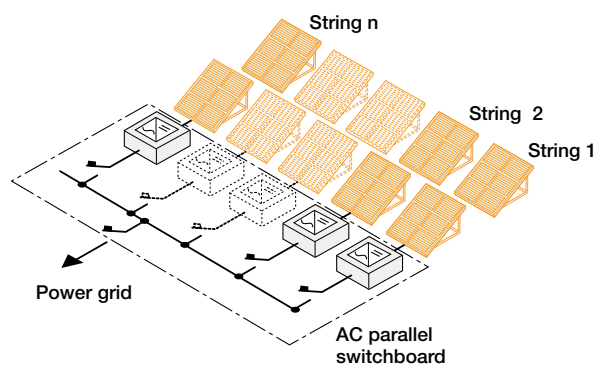
It is advisable to install an isolating device on each string to allow this latter to be inspected or serviced without having to shut down other parts of the system.

The exposed conductive parts of all the equipment must be earthed through the protection conductor with the aim 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



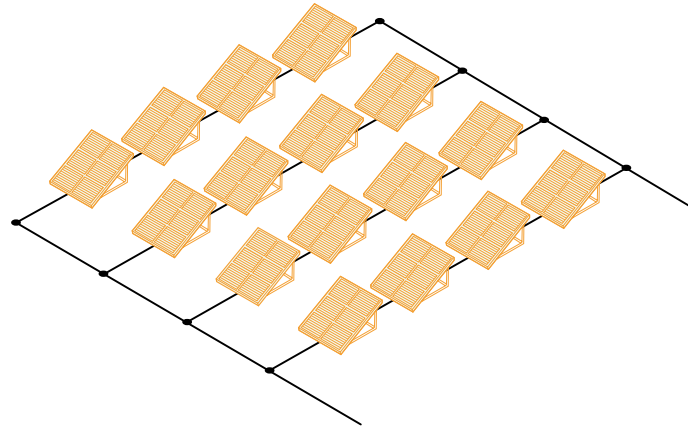
Distributed conversion

Photovoltaic systems

String protection against reverse currents

When the installation layout includes centralized conversion using a single inverter, 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.

Reverse currents can reach extremely high values, especially when there is a large number of strings. Modules are unable to withstand this sort of currents 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

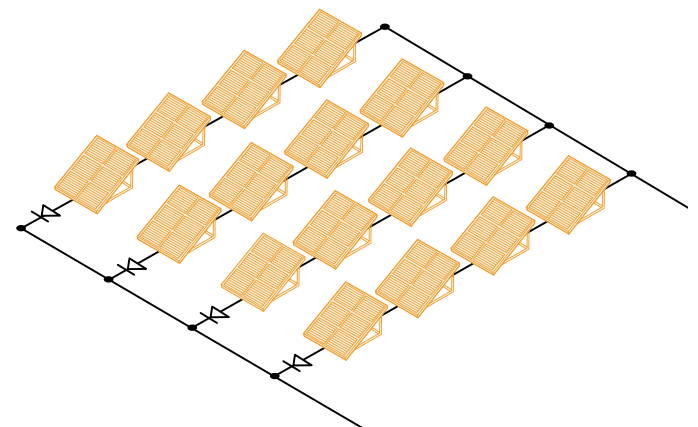
Disadvantages: the strings are liable to power reversals; can only be used for a very small number of strings

Reverse cut-off diode

This solution is unadvisable since not everyone considers it suitable for protecting the strings. It is not a substitute for overcurrent 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 U_{OC} string voltage in STC conditions.

The direct overcurrent must be higher than the short-circuit current I_{SC} of the individual modules, with 1.25 I_{SC} 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

Photovoltaic systems

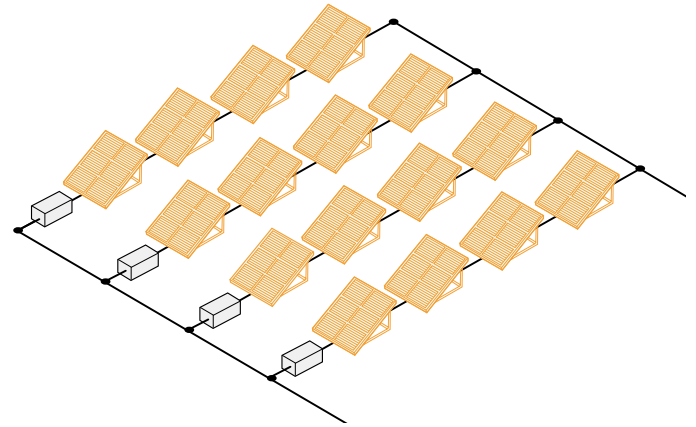
String protection against reverse currents

Fuses

Fuses are the string protection most widely used by designers since, unlike diodes, they interrupt 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 gPV trip characteristic suitable for protecting photovoltaic circuits according to IEC 60269-6;
- 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).



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

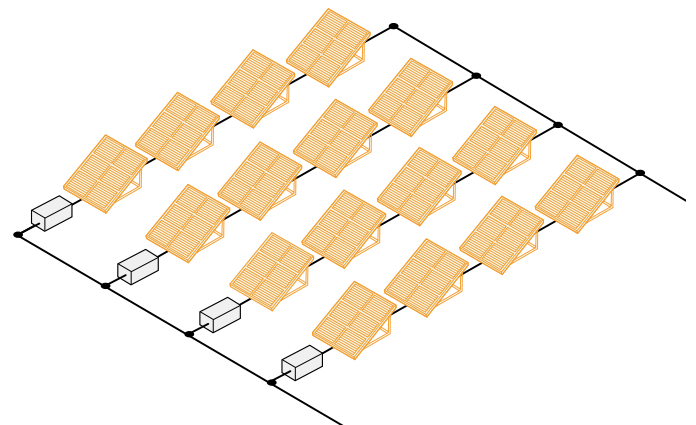
Advantages: simple to install; low cost; circuit disconnected if faults occur

Disadvantages: They must be replaced after a fault

Miniature circuit-breakers

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

ABB has created specific PV miniature circuit-breaker suitable for PV applications and able to safely extinguish dangerous DC arcs even in case of double faults. They provide high system availability, safe disconnection of all poles and easy and safe reset. In addition protection and isolating functions are provided by a single device which can be equipped with a wide variety of accessories (auxiliary and signal contacts, shunt, undervoltage releases and remote switching unit).



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

Advantages: a single device provides both protection and isolating functions. High system availability through fast resetting after fault

Isolating devices

A class DC21 switch-disconnector can also be installed in the string boxes 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 string boxes, 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.

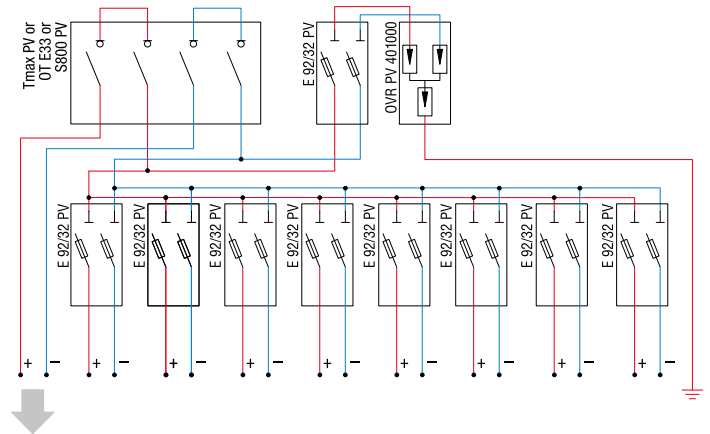


Diagram of a string box for 8 strings inclusive of SPD and switch-disconnector

Surge protective devices

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

To avoid problems, it is advisable to install Surge Protective Devices (SPD) on each polarity towards earth in the string boxes 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 case of overvoltage 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 remote mode if necessary, using products equipped with remote signalling contacts.

SPD with varistors or combined SPD should be used in the protection for the direct current side. Inverters usually are equipped with internal protection against overvoltage, but the addition of SPD to the terminals of the inverter improves the protection provided for this latter and stops inverter internal

protections from operating if they trip, an event that would halt the production of energy and require the intervention of specialized personnel.

SPDs for solar installations must be specific to PV-DC networks. Thus, according to UTE C 61740-51 and prEN 50539-11, PV-DC SPDs shall have the following indications:

- PV symbol on the product
- U_{cpv} maximum continuous operating voltage
- I_n nominal discharge current
- I_{lim} or I_{max} depending on if it is a Type 1 or Type 2 SPD
- Up protection level
- I_{scwpv} short circuit DC PV current withstand

A specific back-up protection (fuses or MCBs) is also generally recommended. However, on PV-DC networks due to low current and high DC voltages, it is much more difficult to disconnect the MOV of the SPD in case of end of life in short circuit. Thus, for safety reasons a PV-SPD with a specific integrated thermal disconnection must be chosen. The SPD must be installed on the supply side (direction of the PV generator energy) of the inverter isolating device so that it also protects the modules when the isolating device is open.

Solar thermal energy

Controlling the plant

Solar thermal energy (STE) is a system that indirectly produces electricity using different technologies to collect and concentrate sun radiation.

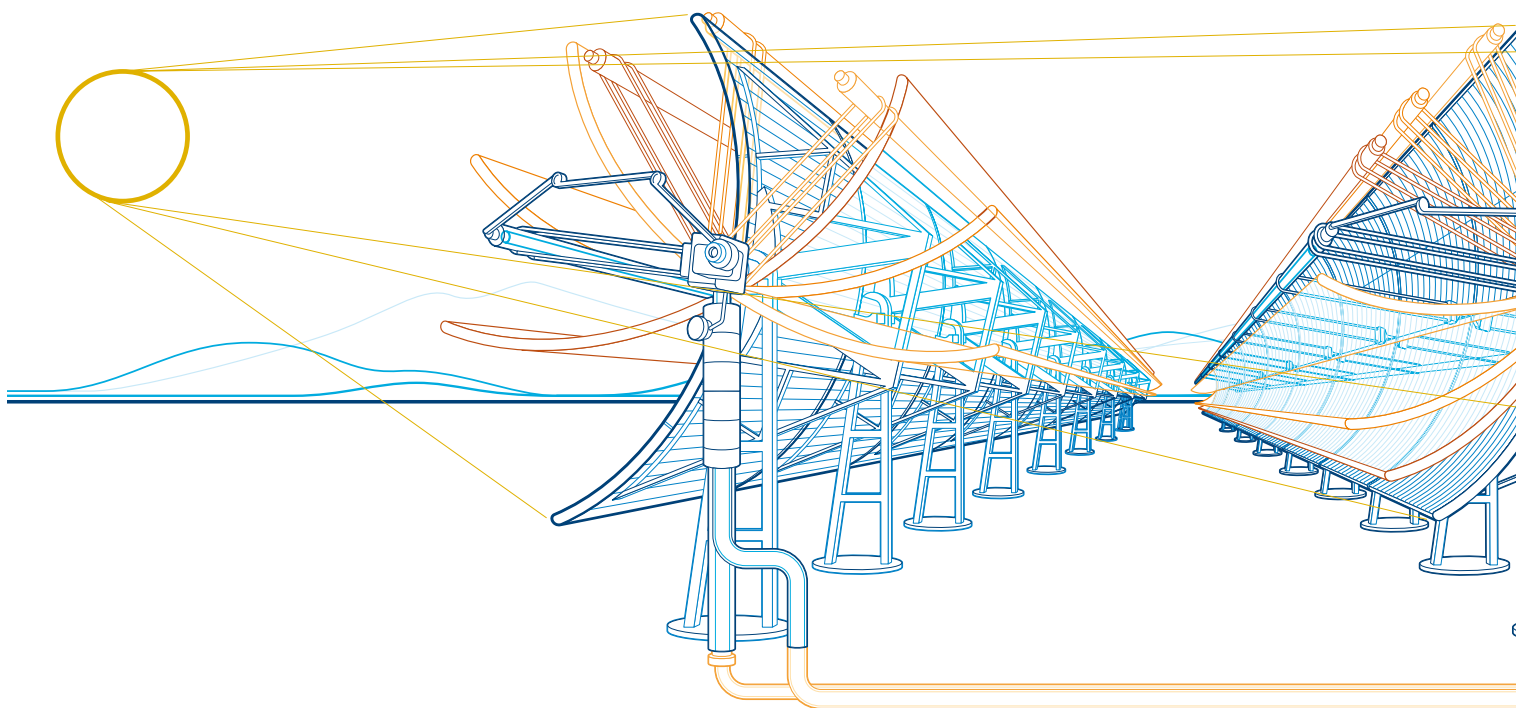
Two systems are used to generate power for the grid:

- parabolic trough systems
- power tower systems

In both cases, the system must track the sun movement precisely along one or two moving axes. ABB answer to this problem is AC500 PLC. It incorporates a special astronomical algorithm that ensures high precision control of horizontal rotation and vertical tilt, ensuring the correct incidence of the sun rays on the mirrors thereby optimizing system productivity.

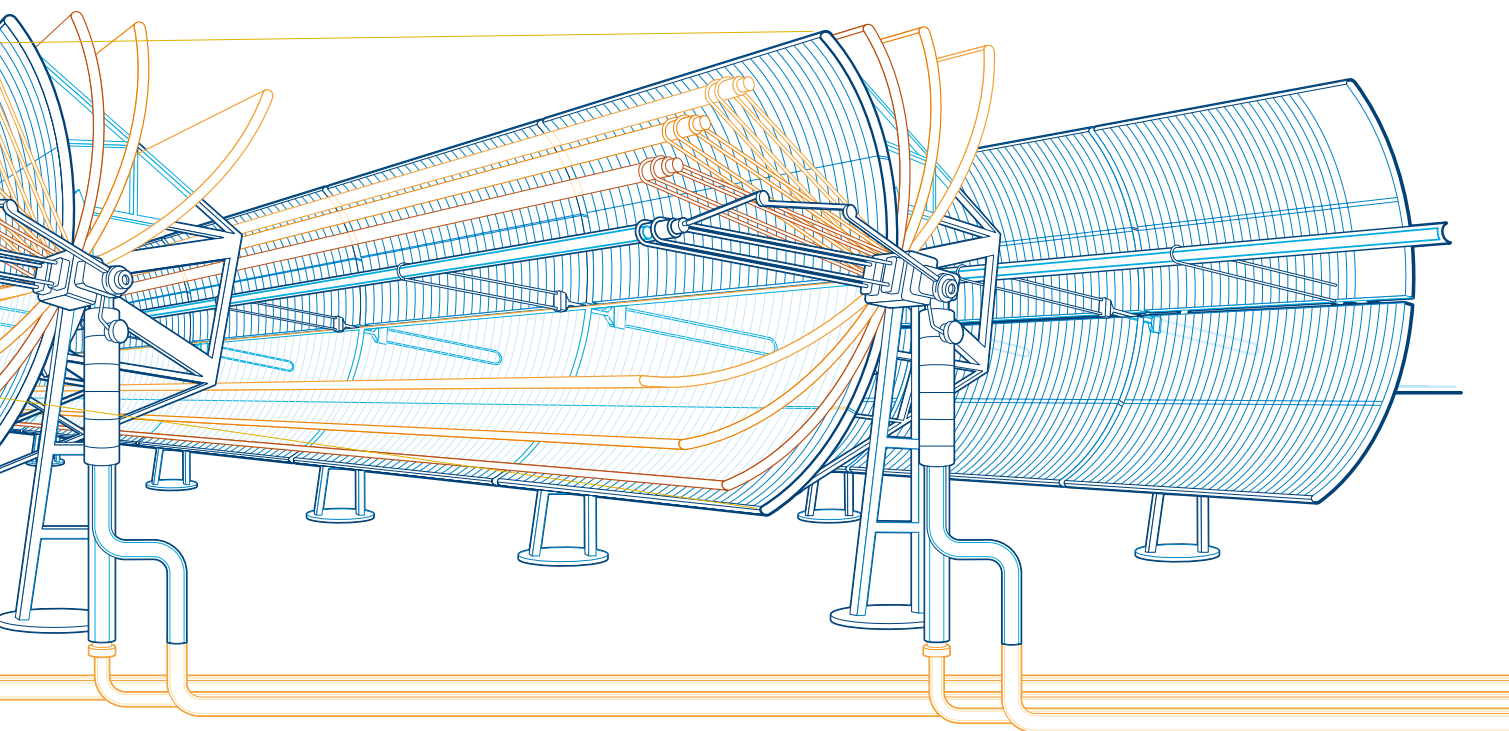
A high degree of accuracy is achieved thanks to the PLC real time clock together with azimuth and elevation calculations based on the date, solar time and mirror orientation.

Astronomic positioning is achieved using a trigonometric function which maintains optimal orientation with respect to the sun with a margin of error of less than a thousandth of a degree. In the event of wind, snow, hail or other emergency situations, the mirror is turned to the position of greatest safety.



Based on AC500 modular platform technology, a multitasking PLC can control several mirrors simultaneously. The PLC has incremental or absolute encoder fast counter inputs, analogue inputs (anemometers, rain gauges, etc), analogue outputs (controlling the frequency converters), a real time clock and dialogues with other PLCs or SCADA systems via Modbus RTU, Modbus TCP, DDE or OPC. It communicates with other PLCs or DCS systems using various protocols including Profibus DP, DeviceNet, CAN open, PROFINET and EtherCAT and has specific software libraries and engineering support. Maintenance is facilitated by a frontal display and an easy-to-remove standard SD card for security backups, firmware updates or source code downloads / uploads.

In addition, a typical ABB mirror control cabinet provides frequency converters (for axis movement), differential and thermo-magnetic protection with mini-contactors (for remote control of the electrical coupling of the axis systems and to shut off the power in case of emergency). All components must be able to tolerate high working temperatures, typical in this type of installation. On the power block, the switchboards for turbine/alternator group circuits must guarantee maximum safety for operating personnel. They must also allow for simple inspection and maintenance, easy installation and wiring and be compact in size.

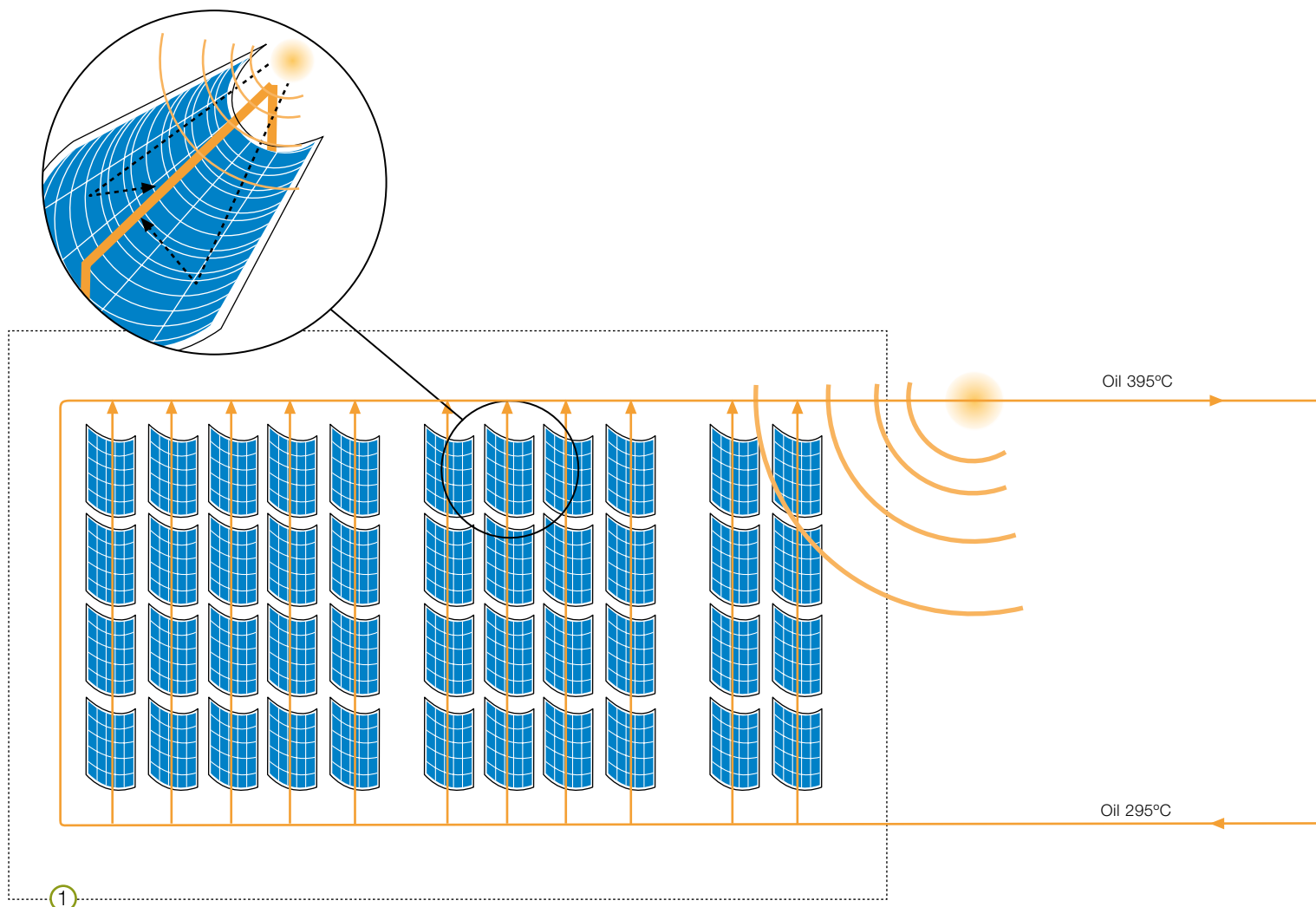


Solar thermal energy

Parabolic trough systems

In parabolic trough systems, solar field has a modular structure consisting of parabolic mirrors connected in series and arranged in parallel rows hundreds of meters long.

Each collector consists of a parabolic reflector (a common glass mirror) which focuses the sun radiation onto an absorber tube (or receiver) positioned at the focal point of the mirror. The heat transfer fluid, normally mineral oil, is pumped through the receivers and fed to a power station at the centre of the solar field. The heat generated is converted to steam to drive a steam turbine electricity generator. Operating temperatures typically reach 400°C.



Heliostats field

- 1 - Heliostats Automation
 - PLC AC500.
 - Frequency converters.
 - Motors.
 - Miniature circuit breakers.
 - Residual Current breakers.
 - Mini contactors.
 - Manual Motor Starter.
 - Plug-in relays.

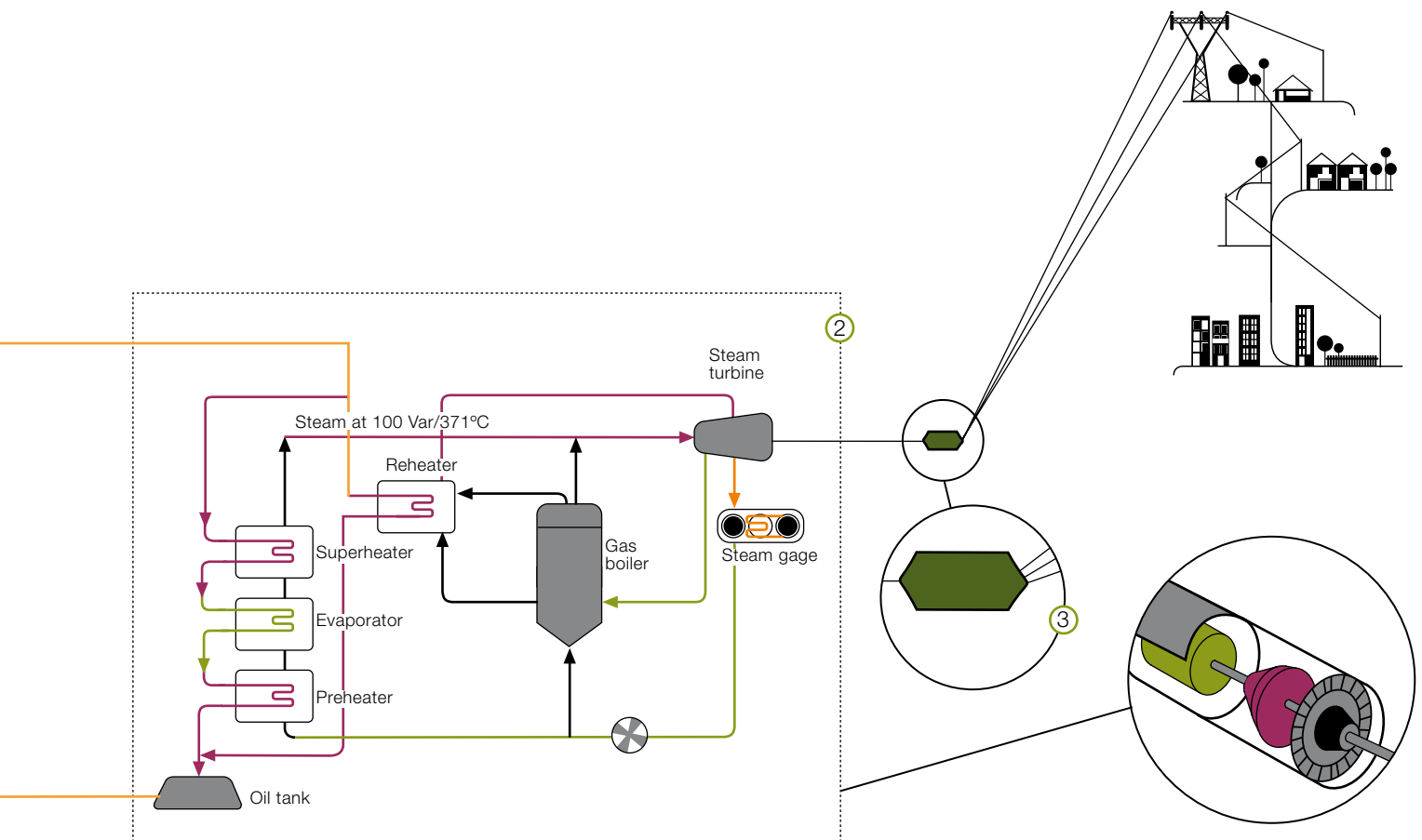
- Single phase power source.
- Emergency pushbuttons and momentary 2-position selectors.
- Surge Arresters.
- Surge Arresters for telecommunications.
- Temperature sensors.
- Terminal fuse holder.
- Connection terminal.
- Plastic enclosure.

Steam system

- 2 - Power block
 - Switchboards.
 - Motor control centers.
 - Distributed control.
 - Electrical switching for regulation of heat interchanging pumps:
 - Frequency converters.
 - Motors.

Transformation centre

- 3 - Transformation centre
 - Dry transformer.
 - Cabinets.

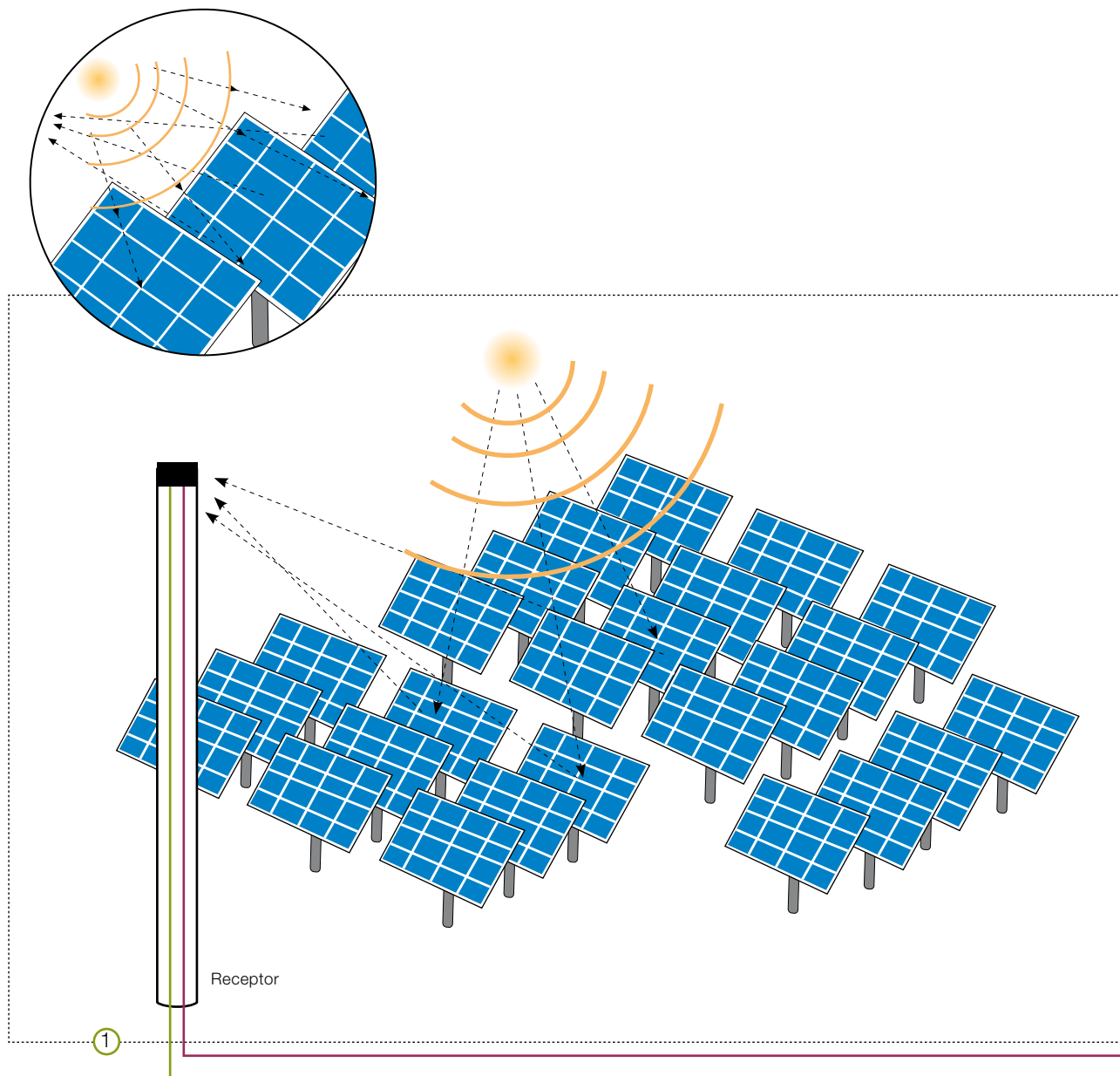


Solar thermal energy

Power tower systems

In tower plants thousands of flat mirrors (or heliostats) track sun movement and focus its rays on a receiver mounted on top of a tower at the centre of the plant.

The receiver contains a blend of molten salts which absorb the concentrated heat. Salts are stored in special tanks at temperatures of over 400° C and used to produce steam which drives a turbine generator.



Heliostats field

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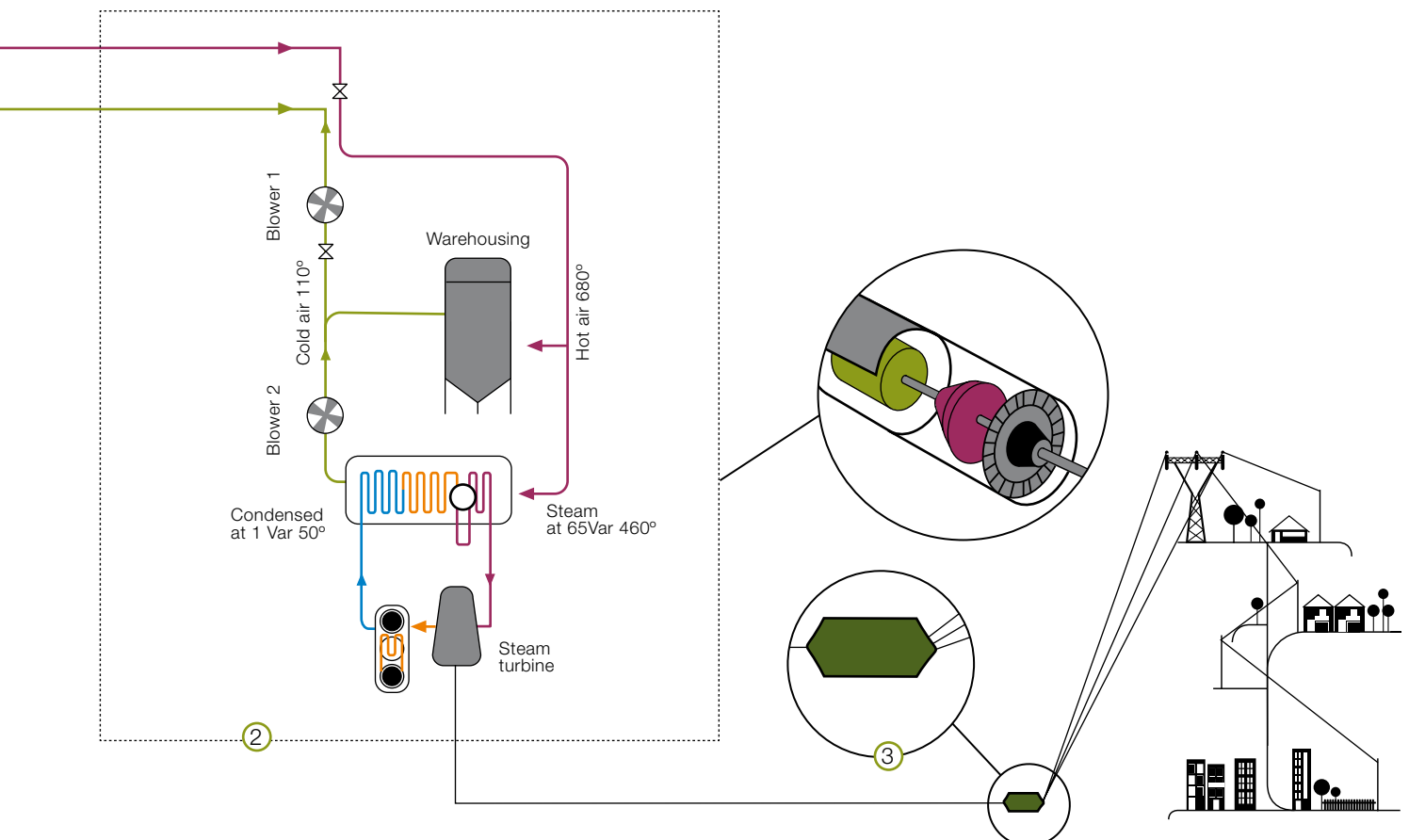
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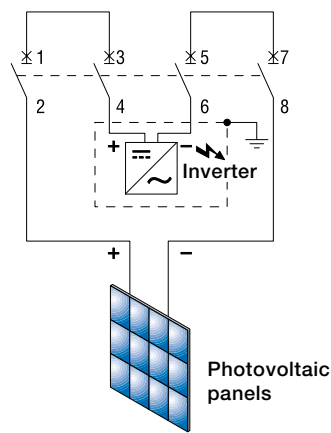


Products

Miniature circuit-breakers S284 UC Z



The S280 UC range of miniature circuit-breakers features permanent magnets on the internal arcing chutes able to extinguish an electric arc of up to 500 V DC with Icu = 4.5 kA. However, use of these components establishes circuit-breaker polarity, thus they must be powered in a certain direction. A diagram showing how the string and inverter must be connected is given alongside.



Main technical specifications		S284 UC Z
Rated current In	A	0,5 ≤ In ≤ 63
Number of poles		4
Maximum operating voltage (DC)	V	500
Ultimate rated breaking capacity Icu - 4P		
500 V DC In ≤ 32A	kA	4,5
500 V DC In ≥ 40A	kA	2
484 V DC 0,5 ≤ In ≤ 63	kA	4,5
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.

Products

Miniature circuit-breakers S800 PV-S



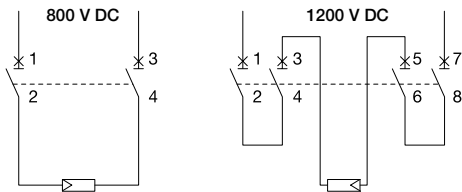
S800 PV-S miniature circuit-breakers can be used in networks up to 1200 V DC.

S800 PV-S was specially designed for use in PV applications as it safely extinguishes dangerous DC arcs even in case of double faults.

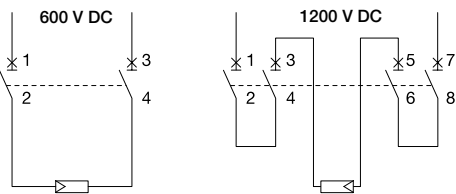
The main features of S800 PV-S circuit breakers are:

- safe disconnection of all poles
- polarity independent
- wide range of accessories
- remote controllable with S800-RSU remote switching unit

Earthed network $\leq 80A$



100, 125A



Main technical specifications		S800 PV-S	
Reference Standards		IEC EN 60947-2	
Rated current	A	10...80	100, 125
Number of poles		2, 4	
Rated voltage Ue (DC) 2 poles* (DC) 4 poles*	V	800	600
	V	1200	1200
Ultimate rated short-circuit breaking capacity Icu (DC) 2 poles * 800 V (DC) 4 poles * 1200 V	kA	5	5
	kA	5	5
Thermomagnetic release characteristic		4 In ≤ Im ≤ 7 In	
Class of use		A	
Operating temperature	°C	-25...+60	
Mounting		on DIN rail EN 60715 (35 mm) by means of fast clip device	

* Please refer to the wiring diagrams

Products

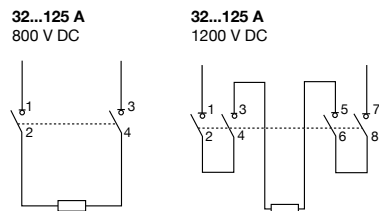
Switch-disconnectors S800 PV-M



S800 PV-M switch-disconnectors can be used in networks up to 1200 V DC S800 PV-M was specially designed for the use in PV applications as it safely switches DC arcs. Disconnector features are:

- compact design
- derating-free up to 60°C
- safe disconnection of all poles
- polarity independent
- wide range of accessories
- remote controllable with S800-RSU remote switching unit

Panel network
in earth-insulated systems



Main technical specifications		S800 PV-M
Reference Standards		IEC EN 60947-3
Rated current	A	32, 63, 125
Number of poles		2, 4
Rated voltage Ue (DC) 2 poles* (DC) 4 poles*	V	800
	V	1200
Rated short-time withstand current Icu (DC) 2 poles * 800 V (DC) 4 poles * 1200 V	kA	1.5
	kA	1.5
Class of use		DC-21 A
Operating temperature	°C	-25...+60
Mounting		on DIN rail EN 60715 (35 mm) by means of fast clip device

* Please refer to the wiring diagrams

Products

OT switch-disconnectors



The switch-disconnector range goes from 16 to 600 A, with rated voltages up to 1200 VDC. They provide isolation and allow a safe maintenance of string boxes and inverters.

OTDC switch-disconnectors from 16 to 32 Amperes are available in 2, 3 and 4 pole versions. OTDC is a compact solution with a modular design. This makes it possible to scale the rated operation voltages according to needs without increasing the footprint area.

OT switch disconnectors from 200 to 630 Amperes are available in 5 and 6 pole versions.

For OT and OTDC, there is a wide variety of accessories to make installation flexible and easy.

Main technical specifications		OTDC (16...32)			OT (200...630)	
Reference standards		IEC EN 60947-3			IEC EN 60947-3	
Rated current Ie	A	16,25,32			200, 315, 400, 600	
Number of poles in series		2	3	4	5	6
Rated voltage Ue	V	660	1000	1200	800	1000
Utilization category		DC 21-B			DC 21-B	
Operating temperature	°C	-25...+60*			-25...+45	

* For detailed information, contact ABB Low Voltage Switches

Products

Switch-disconnectors Tmax PV

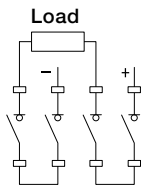


Tmax PV series disconnectors are available with up to 1600 A class DC-22B rated operating current values, for 1100 V DC maximum rated operating voltage. The switching devices of the Tmax PV series are the first box disconnectors for direct current high voltage available on the market. They are certainly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

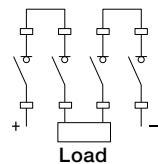
The main features of Tmax PV disconnectors are:

- 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

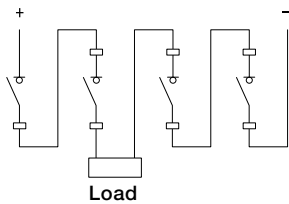
Main technical specifications		Tmax PV
Reference Standards		IEC EN 60947-3
Operating current (DC 22B)	A	160 – 1600
Number of poles		4
Rated voltage Ue	V DC	1100
Rated insulation voltage Ui	V DC	1150
Short-time current Icw	kA	1,5 – 19,2
Class of use		DC-22B



Circuit diagram
Valid for T1D PV, T3D PV,
T6D PV and T7D PV



Circuit diagram
Valid for T4D PV and T5D PV



Circuit diagram
Valid for all Tmax PV sizes

Products

Automatic moulded case circuit-breakers Tmax



TMAX automatic moulded case CBs are available from 1 A to 800 A in 3 and 4 pole versions, according to the voltage level.

TMAX MCCBs flexible range can provide complete solutions for protection and isolation inside string boxes or inverter switchboards. Three different kind of thermomagnetic trip unit are provided for every application need.

Main features include:

- Fixed, plug-in, withdrawable versions
- Remote control available for all the sizes
- Wide range of electrical and mechanical accessories

Main technical specifications		Tmax
Reference Standards		IEC EN 60947-2
Rated Uninterrupted Current Iu	A	1 – 800
Number of poles		3, 4
Rated voltage Ue	V DC	
3 poles		250, 500, 750
4 poles		1000
Breaking capacity Icu at 750 V DC	kA	up 70
Breaking capacity Icu at 1000 V DC	kA	40

Products

Fuse disconnectors E 90 PV



The E 90 PV series fuse disconnectors have been designed for up to 1000 V direct current voltage with DC-20B utilization category. 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:

- UR and CSA approval for installation on American and Canadian market
- 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 deeper 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
- Pozidriv 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
- Special CCC approved devices for Chinese market

When E 90 PV are installed in battery, blown fuse indicator allows an easy detection of the pole where the blown cartridge must be replaced. Thanks to the red colored LED on the handle, user can see whether the fuse is working or blown.

Main technical specifications		E 90/32 PV
Reference Standards		IEC EN 60947-3
Rated service voltage	V	1000
Utilization category		DC-20B
Fuse size	mm	10 x 38
Max dissipated power	W	3
Type of current		DC
Rated current	A	32
Tightening torque values	Nm	PZ2 2-2.5
Protection class		IP20
Lockable (when open)		yes
Sealable (when closed)		yes

Products

Cylindrical fuses E 9F PV



E 9F PV range of cylindrical fuses has been specifically designed to protect direct current circuits up to 1000 V according to IEC 60269-6 Standard.

E 9F PV 10.3 x 38 mm fuses are the best solution for protecting strings, inverters and surge arresters in photovoltaic systems up to 30 A rated current.

Main technical specifications		E 9F PV
Rated voltage	V	1000 DC
Rated current	A	1...30
Breaking capacity	kA	10
Utilization category		gPV
Minimum breaking capacity		1.35 x I _n
Dimensions	mm	10.3 x 38
Max dissipated power 0,7I _n	W	2
Standards		IEC 60269-6
Weight	g	7
Approvals		UL, CSA

Products

Surge protective devices OVR PV



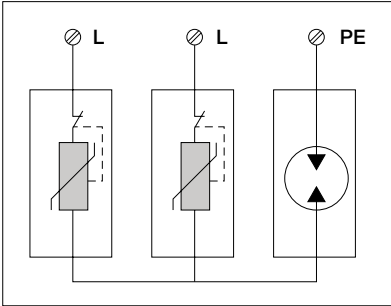
ABB provides a wide range of surge protection devices that have been specifically designed for photovoltaic systems. With a dedicated thermal disconnection for photovoltaic systems, your equipment are protected in case of end of life of the SPD.

The main features of the OVR PV SPDs are:

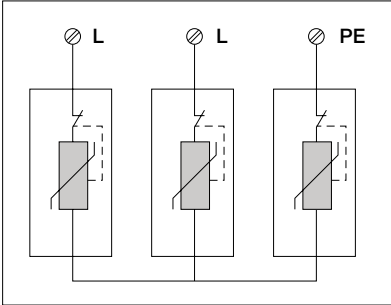
- a DC PV current withstand (I_{scwpv}) up to 100 A without any back-up protection
- pluggable cartridges for easy maintenance
- auxiliary contact with the “TS” option
- “Y” configuration for a better and safer protection
- no risk if the polarity is reversed

Main technical specifications		OVR PV
Reference standards		IEC 61643-11 / UTE 61 740-51 prEN 50539-11
IEC Type		II
Configuration		Y
Max. cont. Operating voltage U_{cpv}	V	670 / 1000
Nominal discharge current I_n (8/20 μ s)	kA	20
Maximum discharge current I_{max} (8/20 μ s)	kA	40
Voltage protection level U_p	kV	2.8 / 3.8
Short circuit DC current withstand I_{scwpv}	A	100
Back-up protection if $I_{scwpv} \leq 100$ A if $I_{scwpv} \geq 100$ A		not required 10 A gPV fuse or MCB
Response time	ns	< 25
Specific integrated PV thermal disconnecter		Yes
Pluggable		Yes
Auxiliary contact		TS
Weight	g	360

OVR PV 40 600



OVR PV 40 1000



Products

Surge protective devices OVR T1 / OVR T2



To provide efficient protection for a photovoltaic system, the alternate current side, on the load side of the inverter, must also be protected against overvoltage. With OVR T1 and OVR T2 SPDs range, a complete offer is proposed for the safety of your equipment on the AC side.

The main features 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).

Main technical specifications		OVR T1	OVR T2
Reference Standards		IEC 61643-11	
IEC Type		I	II
Max. cont. Operating voltage Uc	V	255	275
Nominal discharge current In (8/20 µs)	kA	15 and 25	5, 20 and 30
Impulse current Iimp (10/350 µs)	kA	15 and 25	/
Maximum discharge current Imax (8/20 µs)	kA	/	20, 40 and 70
Response time	ns	< 100	< 25
Safety reserve		/	"s" version
Pluggable		/	"P" version
Auxiliary contact		"TS" version	"TS" version

Products

Residual current devices for AC F202 PV B, F204 B



Residual current circuit-breakers type B are also sensitive to fault currents with a low level ripple similar to continuous fault currents. They however remain sensitive to sinusoidal alternating and pulsating continuous earth fault currents.

When a photovoltaic plant includes an inverter without at least a simple DC/AC separation, so that it injects continuous earth fault currents, the residual device installed to provide protection against indirect contact by automatic supply disconnection must be of type B according to IEC 62423.

Main technical specifications		F200 type B
Rated current I _n	A	25, 40, 63, 125
Rated sensitivity I _{Δn}	A	0,03 - 0,3 - 0,5
Operating frequency range	Hz	0 - 1000
Minimum supply voltage		
- to detect currents of type A / AC	V	0
- to detect currents of type B	V AC	30
Number of poles		2P, 4P
Conditional short-circuit current I _{nc}	kA	10
Conditional residual short-circuit current I _{Δc}	kA	10
Degree of protection		IP40 (after installation in a distribution network)
Ambient temperature	°C	-25...+40
Reference standards		IEC 62423

Products

DDA200 type B RCD-blocks



DDA202 B, DDA203 B and DDA204 B RCD-blocks type B are also sensitive to fault currents with a low level ripple similar to continuous fault currents. In combination with S200 series MCBs, the protection of people and installations against fire risks, short circuit and overcurrent is assured.

They however remain sensitive to sinusoidal alternating and pulsating continuous earth fault currents. When a photovoltaic plant includes an inverter without at least a simple DC/AC separation, so that it injects continuous earth fault currents, the residual device installed to provide protection against indirect contact by automatic supply disconnection must be of type B.

Main technical specifications		DDA200 type B
Type		B (instantaneous) and B S (selective)
Rated current I_n	A	63
Rated sensitivity $I_{\Delta n}$	A	0,03 - 0,3
Operating frequency range	Hz	0 - 1000
Operating voltage	V	230...400
Number of poles		2P - 3P - 4P
Ambient temperature	°C	-25...+40
Reference standards		IEC 61009 Annex G, IEC 60755

Products

Insulation monitoring devices ISL-A 600



The ISL-A 600 is the ABB modular Din-Rail solution designed for small photovoltaic plants with rated voltage of up to 600 V DC. The ISL-A 600 insulation monitor continuously measures the earth voltage resistance of the IT circuit downstream of the inverter in order to detect earthing malfunctions. By monitoring the insulation it is possible to ensure an uninterrupted functioning of the photovoltaic plants up to 600 V DC, thus reducing downtime costs and optimizing plant maintenance.

Main technical specifications		ISL-A 600
Controlled line voltage	V DC	600
Adjustable trip threshold	kΩ	30÷300
Max. current measurement	mA	1,5
Internal impedance	kΩ	450 L/PE
Relay number NA-C-NC		1
Max. terminals blocks section	mm²	2,5
Overall dimensions (modules)		6
Reference standards		IEC EN 61010-1, IEC EN 61557-8, IEC EN 61326-1

Products

Insulation monitoring device CM-IWN



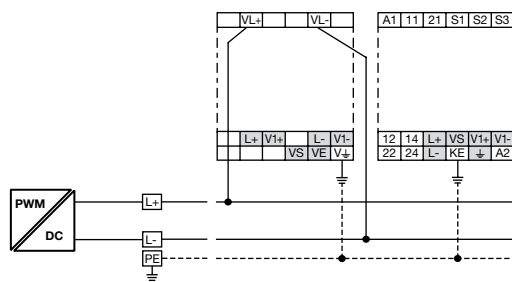
The CM- IWX series offers an innovative insulation monitoring device. In combination with a new measurement principle, networks up to 1000 V DC or 690 V AC (15-400 Hz monitor range) can be measured.

Measurement principle

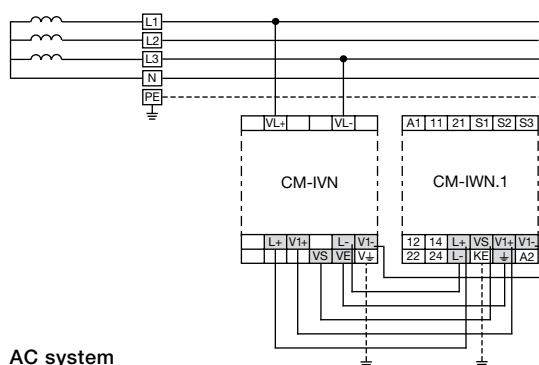
Using CM-IW.x, a pulsating measurement signal is sent to the system to be monitored and the insulation resistance is calculated. This pulsating measurement signal alters depending on the insulation resistance and system dispersion capacity. The change in the insulation resistance can be forecast from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

When the forecast 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.



DC system



AC system

Main Characteristics

- Compliance with IEC/EN 61557-8 reference standards
- Direct connection to systems up to 690 V AC and 1000 V DC with coupling module CM-IVN
- 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
- Predictive measurement principle

In solar applications system leakage capacitances are dynamic depending on the environmental influences to the PV modules (humidity).

Per 500 kW the capacitance can vary between 30 μ F and 120 μ F

Products specifically developed for this are:

CM-IWN.4 for systems with leakage capacitance C_e of up to 500 μ F

CM-IWN.5 for systems with leakage capacitance C_e of up to 1000 μ F

CM-IWN.6 for systems with leakage capacitance C_e of up to 2000 μ F

For lower leakage capacitance, CM-IWN.1 can be used

DC string application

- Isolated systems as described above
- Earthed systems:

With procedure to temporary disconnect earth, also earthed systems can use this monitoring:

Add contactor in series with connection to earth.

1) Open contactor to disconnect earth

2) Perform measuring

3) Close contactor and run system as normal

This can e.g. be done every morning before connecting system to grid.

Products

Grid connection relays 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:

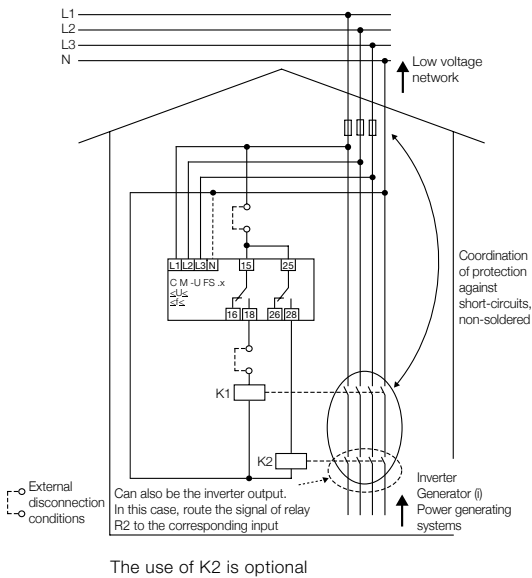
- Undervoltage protection
- Overvoltage protection
- Minimum frequency protection
- Maximum frequency protection
- Installation on DIN channel, dimension 22 mm
- Configurable connection for the neutral conductor
- 3 LED to indicate the operating status
- Power supply from the circuit under control
- 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	V_n	> 115 %
Minimum voltage	V_n	< 80 %
Maximum frequency	Hz	> 50.2
Minimum frequency	Hz	< 47.5
Mean value		10 minutes
	V_n	110 to 115 % adjustable

For markets where the German standard VDE is implemented

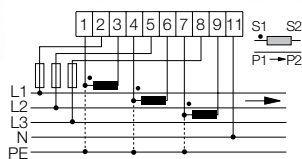
Main technical specifications		CM-UFS.2
Maximum voltage	V_n	> 120 %
Minimum voltage	V_n	< 80 %
Maximum frequency	Hz	> 50.3 or 51 upon the request of ENEL personnel
Minimum frequency	Hz	> 49.5 or 49 upon the request of ENEL personnel

Specifically produced for the Italian market, in accordance with the most recent ENEL Distribuzione specification (edition of 1 December 2008)



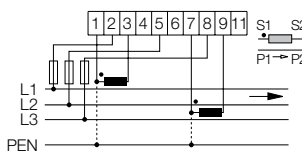
Products

DELTAplus modular energy meters



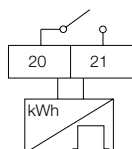
DAB13000

3-phase system with neutral



DAB12000

3-phase system without neutral



Active energy meters impulsive output



Modular energy meters are ideal for metering and monitoring the energy produced by a photovoltaic plant, with measurement point M2 downstream of the inverter. All 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 purposes.

UTF certified measurement groups are also available, including energy meter and the associated current transformers, previously tested individually by the metrology laboratory with a mandate by Customs. Several UTF certified measurement groups codes are available in the System pro M compact technical catalogue, based on the rated capacity of the current transformer and on the distribution system.

DELTAplus:

- Accuracy class B (1)
- MID certified for billing purposes
- Connection by current and voltage transformers
- Active energy metering in 3-phase systems
- Programmable impulsive output
- Electrical parameters, voltage, current, power and frequency displayed
- Installation testing: phase presence and sequence
- Frontal LED for checking load

Main technical specifications	DELTAplus
Reference standards	IEC EN 50470-1 - IEC EN 50470-3
Voltage	3x57- 288 V (P+N) - 3x100 - 500 V (P-P)
Maximum connection current	6 A
Start-up current	2 mA
Frequency	50-60 Hz \pm 5%
Accuracy class	B (Class 1)

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

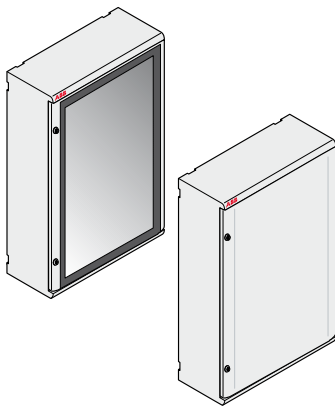
Communication adapters allow the serial data communication between energy meter and remote supervision system. The adapters allow data on energy consumption and electrical parameters to be collected via serial protocols such as: Modbus RTU, MeterBus, MeterBus Ethernet, GSM / GPRS, KNX / EIB, LonWorks.

Products

Switchboards Gemini IP 66



Main technical specifications	Gemini IP 66
Protection	
Protection class	IP 66 (IEC EN 60529)
Insulation	class II
Strength	
Material	joint-injection moulded thermo-plastic
Heat and fire resistance	up to 750 °C (IEC EN 60695-2-11)
Shock resistance	IK10 (IEC EN 50102)
Protection against chemicals and weather conditions	water, saline solutions, acids, basics, mineral oils, UV rays
Operating temperature	-25 °C...+100 °C
Performance	
Rated insulation voltage	1000 V AC – 1500 V DC
Flexibility WxHxD, external dimensions	6 sizes from 335 x 400 x 210 mm to 840 x 1005 x 360 mm DIN modules from 24 to 216
Installation	Snap-in assembly of all components
Standards, quality, environment	IEC EN 50298, IEC 23-48, IEC 23-49, IEC 60670, IEC EN 60439-1 IMQ Mark according to the IEC EN 50298 standard. Fully recyclable



Boxes and doors

- RAL 7035 grey colour

Size	External WxHxD (mm)	Internal WxHxD (mm)	Max num. DIN mod.
1	335 x 400 x 210	250 x 300 x 180	24 (12 x 2)
2	460 x 550 x 260	375 x 450 x 230	54 (18 x 3)
3	460 x 700 x 260	375 x 600 x 230	72 (18 x 4)
4	590 x 700 x 260	500 x 600 x 230	96 (24 x 4)
5	590 x 855 x 360	500 x 750 x 330	120 (24 x 5)
6	840 x 1005 x 360	750 x 900 x 330	216 (36 x 6)

Products

Consumer units 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 AC; 1500 V DC
- 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 Type	Dimensions
IP65 consumer unit P/smoke grey 4M	140 x 220 x 140
IP65 consumer unit P/smoke grey 8M	205 x 220 x 140
IP65 consumer unit P/smoke grey 12M	275 x 220 x 140
IP65 consumer unit P/smoke grey 8M 1 row	380 x 220 x 140
IP65 consumer unit P/smoke grey 24M 2 rows	275 x 370 x 140
IP65 consumer unit P/smoke grey 36M 2 rows	380 x 370 x 140

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 AC; 1500 V DC
- shock resistance: 20 joules (IK 10 degrees)
- junction boxes in compliance with IEC 23-48 and IEC 60670 standards
- IMQ Mark

Description Type	Dimensions
Box IP65 PC	140 x 220 x 140
Box IP65 PC	205 x 220 x 140
Box IP65 PC	275 x 220 x 140

Products

Direct current string boxes for applications in the photovoltaic sector



1 string
Europa consumer unit
IP65 8 modules
Sizes*: 205 x 220 x 140

10 A, 500 V DC***
Miniature circuit breaker
S284 UC Z10
Surge arrester
OVR PV 40 600 P

16 A, 500 V DC
Disconnecting switch
OT16F4N2
Surge arrester
OVR PV 40 600 P
Fuse disconnectors
E 92/32 PV
Fuse from 10,3x38 mm
1.000 V DC 10 A

10 A, 800 V DC
Miniature circuit breaker
S802PV-S10
Surge arrester
OVR PV 40 1000 P



2 strings
Europa consumer unit
IP65 12 modules
Sizes*: 275 x 220 x 140

16 A, 500 V DC***
Miniature circuit breaker
S284 UC Z16
Surge arrester
OVR PV 40 600 P

16 A, 500 V DC
Disconnecting switch
OT16F4N2
Surge arrester
OVR PV 40 600 P
Fuse disconnectors
E 92/32 PV for each string
Fuse from 10,3x38 mm
1.000 V DC 8 A

16 A, 800 V DC
Miniature circuit breaker
S802PV-S16**
Surge arrester
OVR PV 40 1000 P



3 strings
Europa consumer unit
IP65 18 modules
Sizes*: 380 x 220 x 140

25 A, 750 V DC
Disconnecting switch
OT25F8
Surge arrester
OVR PV 40 1000 P
Fuse disconnectors
E 92/32 PV for each string
Fuse from 10,3x38 mm
1.000 V DC 8 A

32 A, 800 V DC
Miniature circuit breaker
S802PV-S32**
Surge arrester
OVR PV 40 1000 P
Fuse disconnectors
E 92/32 PV for each string
Fuse from 10,3x38 mm
1.000 V DC 10 A
10 A gR protection fuse
OVR PV surge protective devices

Special custom made DC string boxes can be manufactured upon request

* Sizes: wxdxh mm

** S800PV-S / additional protection for fuse holders for current limiting of fuses higher than 8 A

*** In IT systems an isolation monitoring device should be installed.



4 strings
Europa consumer unit
IP65 36 modules
Sizes*: 380 x 370 x 140

32 A, 750 V DC

Disconnecting switch
OT40F8

Surge arrester

OVR PV 40 1000 P

Fuse disconnectors

E 92/32 PV for each string

Fuse from 10,3x38 mm – 1.000 V DC 8 A

10 A gR protection fuse

OVR PV surge protective devices

32 A, 800 V DC

Disconnecting switch
S802PV-M32

Surge arrester

OVR PV 40 1000 P

Fuse disconnectors

E 92/32 PV for each string

Fuse from 10,3x38 mm – 1.000 V DC 8 A

10 A gR protection fuse

OVR PV surge protective devices

40 A, 800 V DC

Miniature circuit breaker
S802PV-S40**

Surge arrester

OVR PV 40 1000 P

Fuse disconnectors

E 92/32 PV for each string

Fuse from 10,3x38 mm – 1.000 V DC 10 A

10 A gR protection fuse

OVR PV surge protective devices



5 strings
Gemini Switchboards
size 1 IP66
Sizes*: 335 x 400 x 210

50 A, 800 V DC

Disconnecting switch
T1D 160 PV

Surge arrester

OVR PV 40 1000 P

Fuse disconnectors

E 92/32 PV for each string

Fuse from 10,3x38 mm – 1.000 V DC 10 A

10 A gR protection fuse

OVR PV surge protective devices

50 A, 800 V DC

Miniature circuit breaker
S802PV-S50**

Surge arrester

OVR PV 40 1000 P

Fuse disconnectors

E 92/32 PV for each string

Fuse from 10,3x38 mm – 1.000 V DC 10 A

10 A gR protection fuse

OVR PV surge protective devices



6 strings
Gemini Switchboards
size 2 IP66
Sizes*: 460 x 550 x 260

63 A, 800 V DC

Disconnecting switch **T1D 160 PV**

Surge arrester **OVR PV 40 1000 P**

Fuse disconnectors

E 92/32 PV for each string

Fuse from 10,3x38 mm – 1.000 V DC 10 A

10 A gR protection fuse

OVR PV surge protective devices

63 A, 800 V DC

Miniature circuit breaker **S802PV-S63****

Surge arrester **OVR PV 40 1000 P**

Fuse disconnectors

E 92/32 PV for each string

Fuse from 10,3x38 mm – 1.000 V DC 10 A

10 A gR protection fuse

OVR PV surge protective devices

8 strings

80 A, 1.000 V DC

Disconnecting switch **T1D 160 PV**

Surge arrester **OVR PV 40 1000 P**

Fuse disconnectors

E 92/32 PV for each string

Fuse from 10,3x38 mm – 1.000 V DC 10 A

10 A gR protection fuse

OVR PV surge protective devices

80 A, 1.000 V DC

Miniature circuit breaker **S804PV-S80****

Surge arrester **OVR PV 40 1000 P**

Fuse disconnectors

E 92/32 PV for each string

Fuse from 10,3x38 mm – 1.000 V DC 10 A

10 A gR protection fuse

OVR PV surge protective devices

Products

Screw clamp terminal blocks



The screw clamp terminal blocks of the new SNK series are particularly suitable for use in photovoltaic plants. The SNK series is modern in design, innovative and compact, offering a multitude of accessories for a very wide range of requirements and has been given the highest international certifications.

Main technical specifications		
Electrical specifications		
Rated voltage	V	1000
Rated current	A	max 232
Rated section	mm²	max 95

Compliance with IEC 60947-7-1, IEC 60947-7-2 standards
Parallel interconnections are available
Self-extinguishing material UL94V0



The screw clamp terminal blocks are available in single pole, 3-pole and 4-pole versions.

Main technical specifications	
Electrical specifications	
Rated voltage	1000 V AC / 1500 V DC
Rated current	max 400 A per single pole
	max 175 A per 3-pole
	125 A for 4-pole

Cable glands and nuts with metric pitch



- Main technical features of the cable glands and nuts with metric pitch:
- IP 68 protection class
 - material: polyamide 6.6, self-extinguishing material in accordance with the UL94 V2 standard. Withstands abnormal heat and fire up to 750 °C (glow wire test) according to IEC 60695-2-11 standards
 - utilization temperature: from -20 °C to +120 °C (brief period)
 - neoprene seal
 - tightening by means of a lamellar crown around the entire cable diameter (prevents the cable from being damaged)
 - the cable glands can be reused without reducing their efficacy.

Products

Contactors (standard) A and AF range



The A and AF ranges are standard, all purpose block contactors for reliable remote switching of both AC and DC circuits.

Main technical specifications	A9-AF2050
Rated operational voltage	1000 V
Current ratings	9 – 2050A (AC)max 1900A DC at 600 V acc to cULus
Control voltage, A range	Direct operation, AC or DC
Control voltage, AF range	Electronically controlled AC/DC
Number of poles	3
Reference standards	IEC60947-1 , -4-1

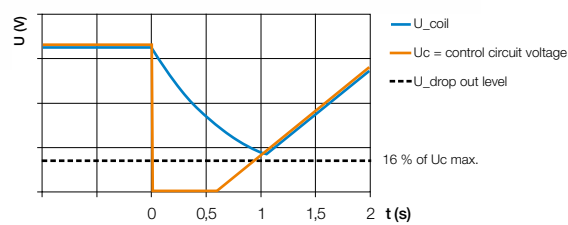
Products

Contactors (for grid compliance) AF..T range



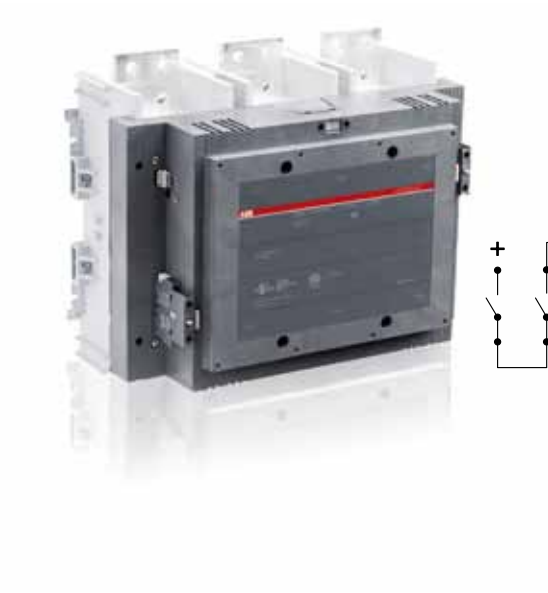
The AF..T range is specially designed for renewable energy AC switching applications with “Low Voltage Ride Through” function. The AF..T contactor is able to withstand a voltage drop on the control voltage without opening. The built-in drop-out delay circuit provides enough energy for the coil voltage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

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



Products

Contactors (for DC switching) GAF & bar contactors



The GAF range is dedicated to DC switching. Based on the A range, these are reliable and modern contactors.*
When DC voltage and/or current ratings higher than below table, ABB offers bar contactors, designed by customer specification.

Main technical specifications	GAF
Rated operational voltage	1000 V DC
Current ratings, DC-1	275 – 2050 A
Control voltage	Electronically controlled AC/DC
Number of poles	3 (connect in series)
Reference standards	IEC60947-1, -4-1

*Available from end 2010

Products

Manual motorstarters MS



ABB's new manual motor starters, MS116 and MS132 covers all needs, including overload and short circuit protection (with trip identification) for motors as well as disconnection/isolation by manual switching. Wide range of accessories is available.

Main technical specifications	MS116, MS132
Rated operational voltage	690 V AC
Current ratings	0,16 - 32 A
Trip class	10
Number of poles	3
Reference standards	IEC60947-1, -2, -4-1, -5-1

Products

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	
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)

Electronic Products and Relays EPR



ABB has a complete range of Electronic Products and Relays. In addition to monitoring relays and timers, the "PLC peripheral products" are;

- Power supplies
- Serial data converters
- Analog signal converters
- Pluggable interface relays
- Compact/boxed interface relays and Opto couplers

If you require further details about products, please refer to the following technical catalogues.

Document	Code
Sustainable solar power	9AKK105152A5494
Technical application handbook N° 10	1SDC007109G0202
Gemini. Low voltage insulated consumer units	1SLC805001D0204
Insulating enclosures and installation materials	1SLC001001D0203
System pro <i>M</i> compact®	2CSC400002D0209
S800PV. The High Performance MCB	2CCC413002C0202
S800-RSU/S500-RSU. Remote Switching Units for High Performance MCBs	2CCC413002L0202
Technical catalogue 2010 S800/S500. The high performance MCB	2CCC413003C0201
Lighting and overvoltage protection. Photovoltaic systems	2CTC432008B0203
Electricity meters for modular enclosures and DIN rail	2CMC480022C0003
Control and protection equipment. Disconnectors	1SCC301009K0201
CM-UFS. Interface for connection to the power grid	1SDC112001L0201
Switches for solar segment	1SCC301009K0201
OTDC switch-disconnectors 16...32 Amperes	1SCC301006B0201
Switches. Applications in photovoltaic systems	1SCC301012K0201
Tmax. T generation	1SDC210015D0206
Tmax PV	1SDC210046L0201
Contactors and Motor protection	1SBC100122C0202
Large contactors for wind and solar applications	1SFC101004L0201
Motor protection and control up to 18.5 kW/20hp	1SBC100155C0202
R series contactors. Control of DC power circuits up to 5000 A	1SBC104116B0201
Electronic products and relays	2CDC110004C0205
Insulation monitoring relays	2CDC112147B0201
Pilot devices, 22 mm	1SFC151003C0201
Connection. Terminal blocks	1SNC160001C0207
SNK Series main catalogue	1SNK161001C0204

Contacts

www.abb.com/solar

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