

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.

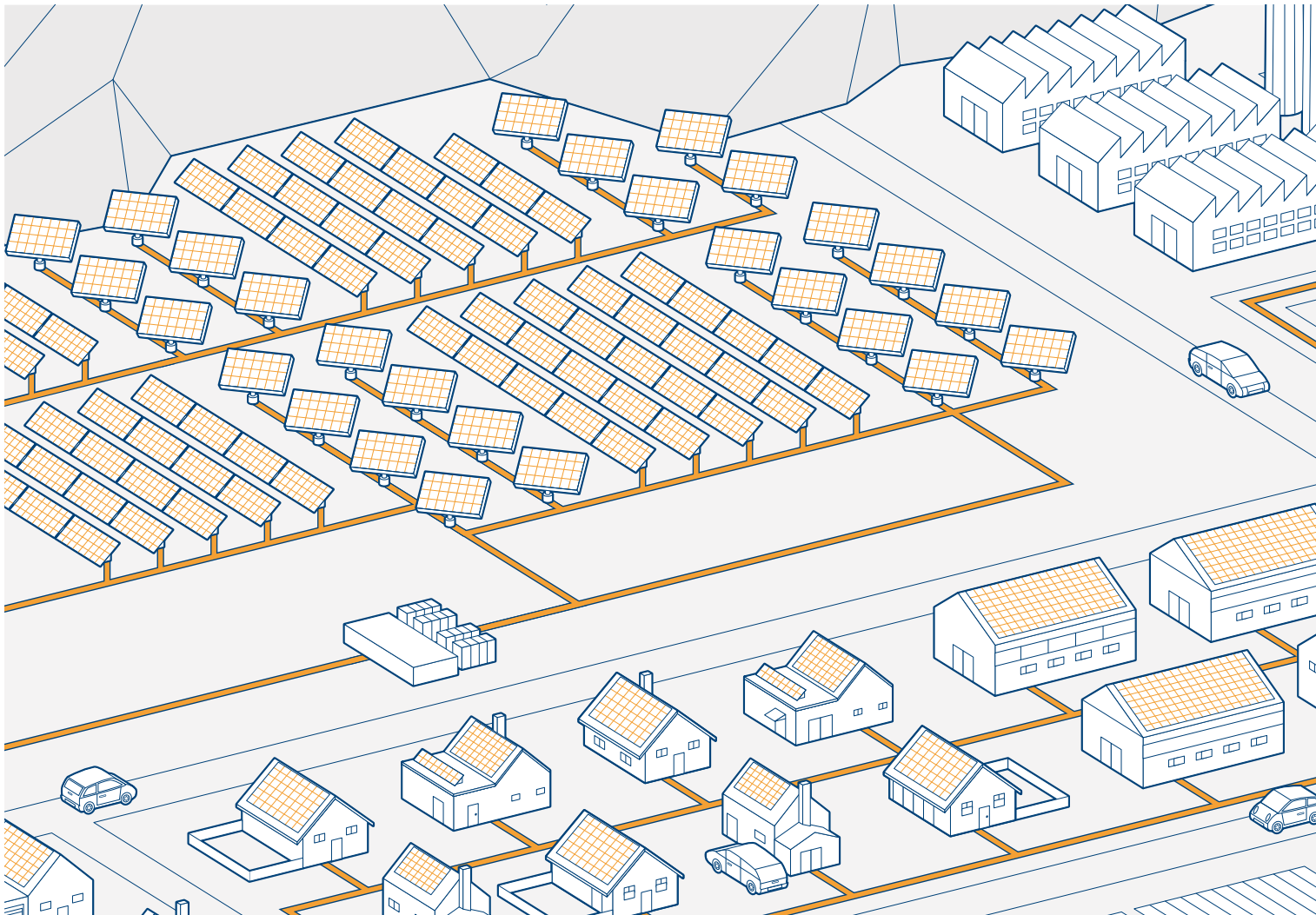


ABB for solar energy

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.

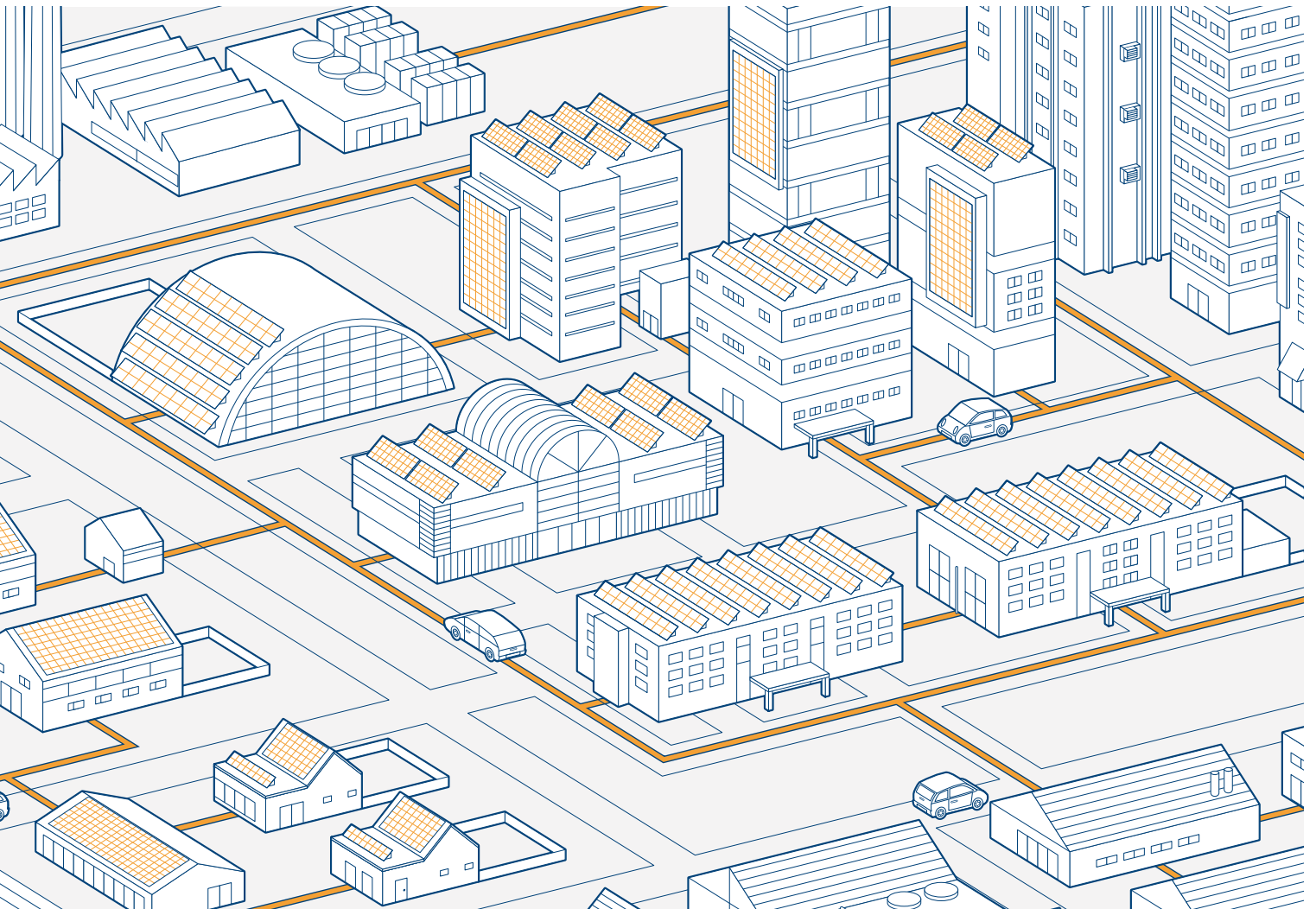
Today ABB offers a comprehensive range of competitive and reliable products to support the growth of renewable energies and, above all, solar energy.

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.



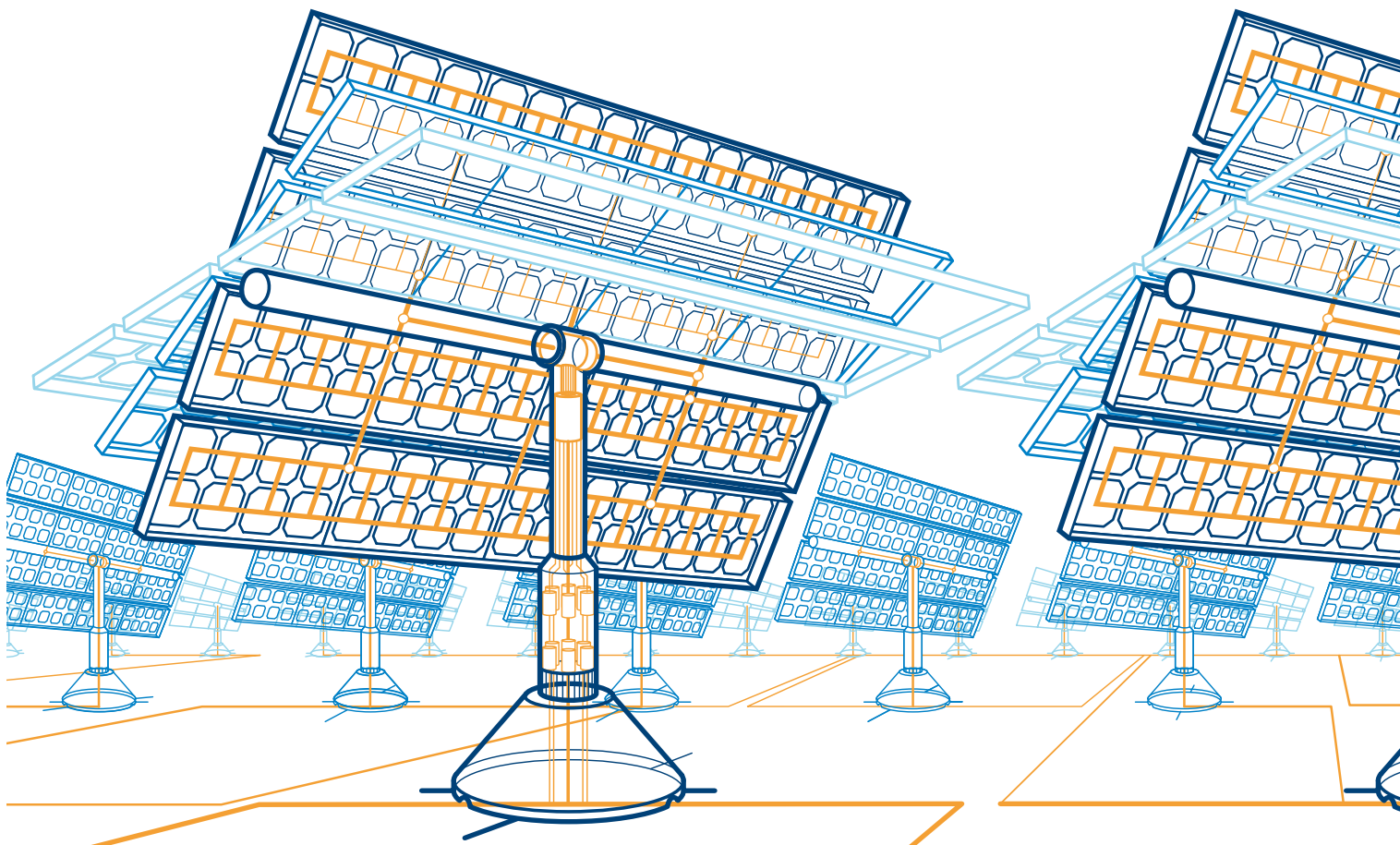
Photovoltaic energy

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.



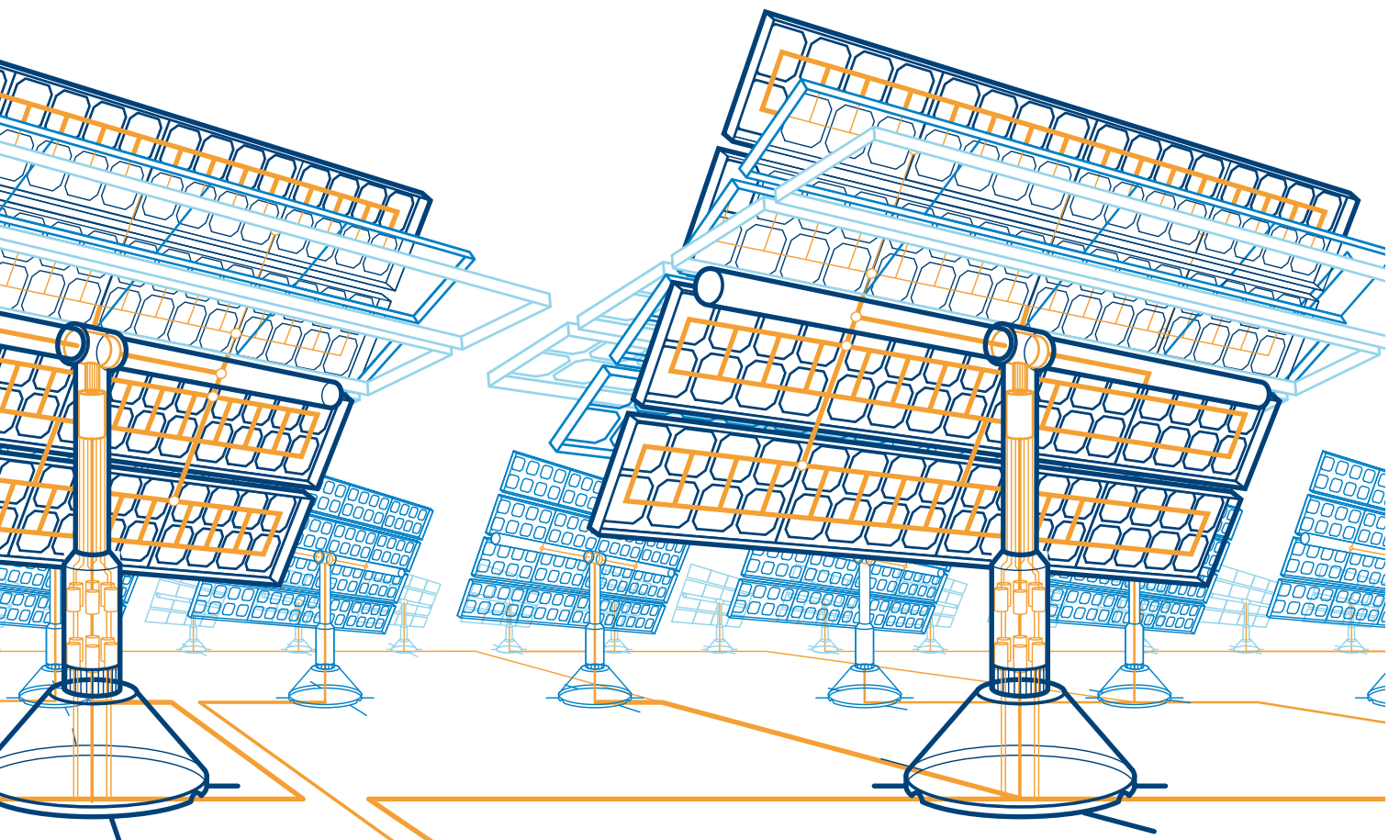
Photovoltaic systems

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.

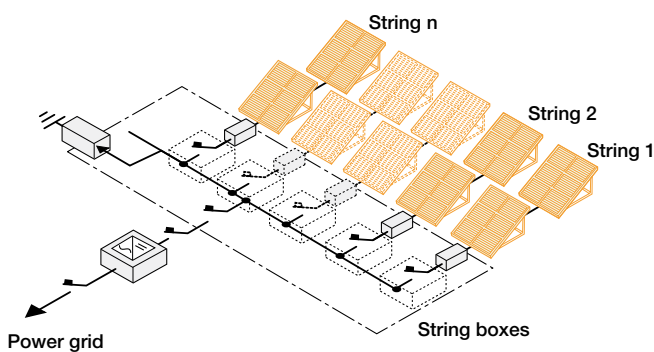
In accordance with the provisions established by Standard IEC 60364 (article 712), protection against overcurrents must be provided when cable carrying capacity is less than 1.25 times the calculated fault current in any point.

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.

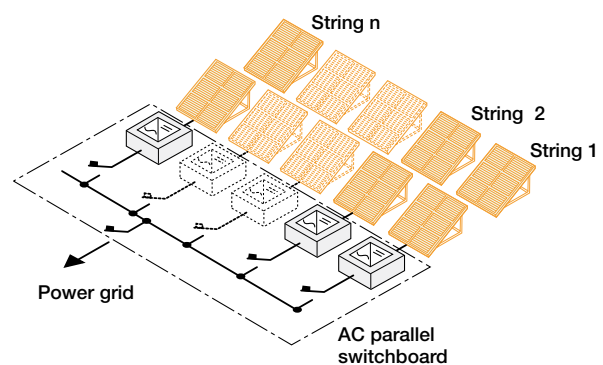
It is advisable to install an isolating device on each string to allow this latter to be inspected or serviced without having to shut down other parts of the system.

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

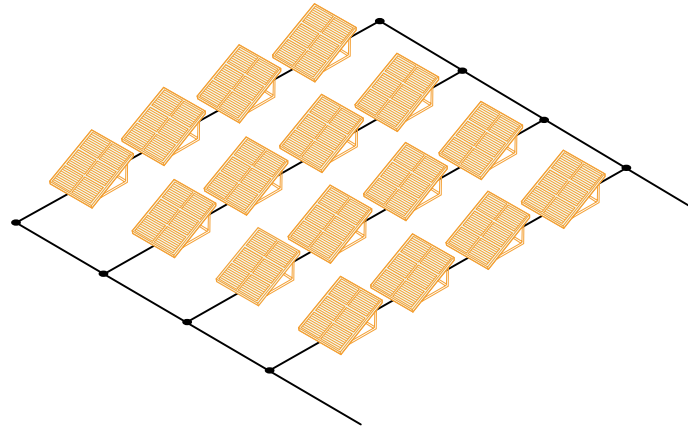
String protection against reverse currents

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

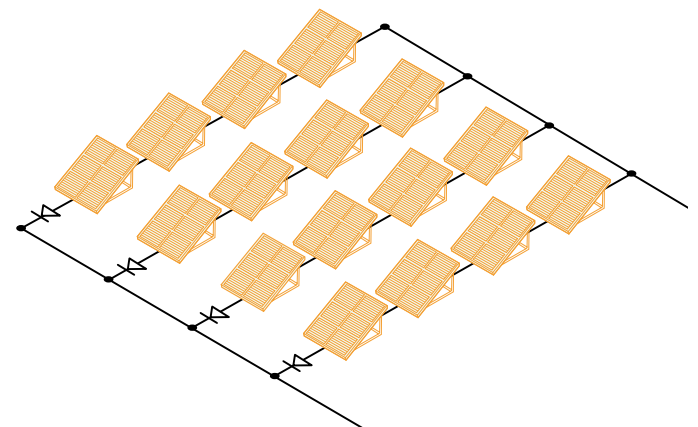
Disadvantages: the strings are liable to power reversals; can only be used for a very small number of strings

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

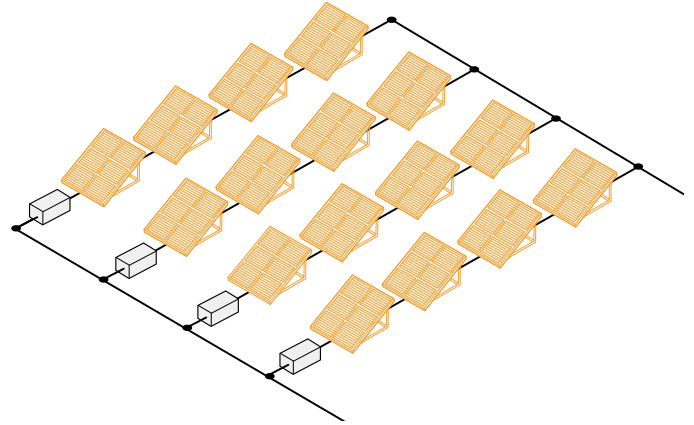
String protection against reverse currents

Fuses

Fuses are the string protection most widely used by designers since, unlike diodes, they 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 suitable for protecting photovoltaic circuits;
- 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.

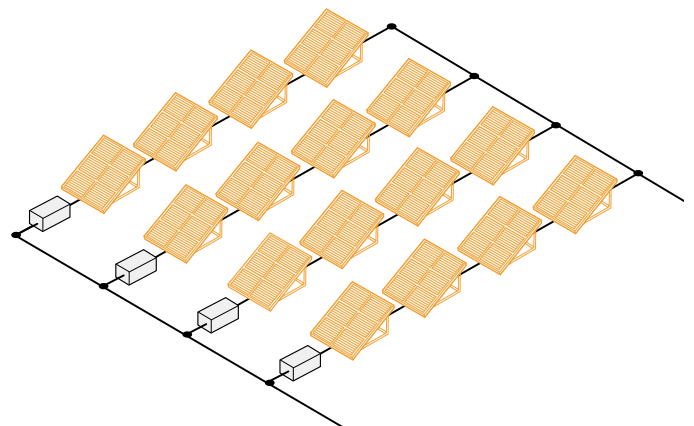
Advantages: simple to install; low cost; circuit disconnected if faults occur

Disadvantages: They must be replaced after a fault

Miniature circuit-breakers

Use of thermo-magnetic circuit-breakers is a further method 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.

Use of thermo-magnetic circuit-breakers is technically the best solution for protecting photovoltaic strings. 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 and undervoltage releases).



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.

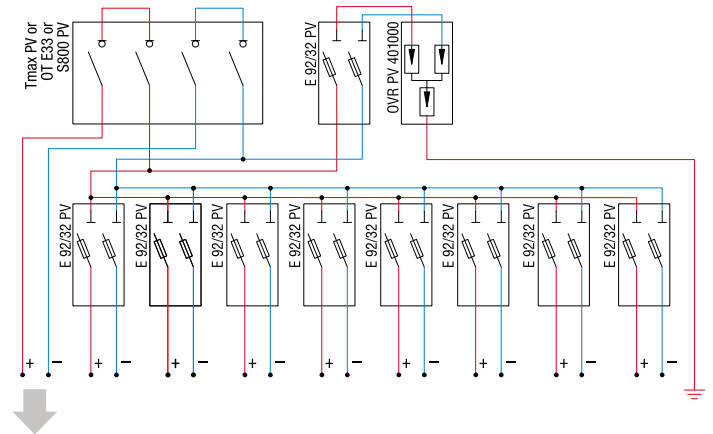


Diagram of a string box for 8 strings inclusive of SPD and switch-disconnector

Surge 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 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.

These SPD must therefore possess the following characteristics:

- type 2;
- maximum continuous operating voltage $U_c > 1.25 U_{oc}$;
- protection level $U_p \leq U_{inv}$, where U_{inv} is the impulse withstand voltage of the inverter on the DC side;
- rated flashover current $I_n \geq 5 \text{ kA}$;
- 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 latter 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 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.

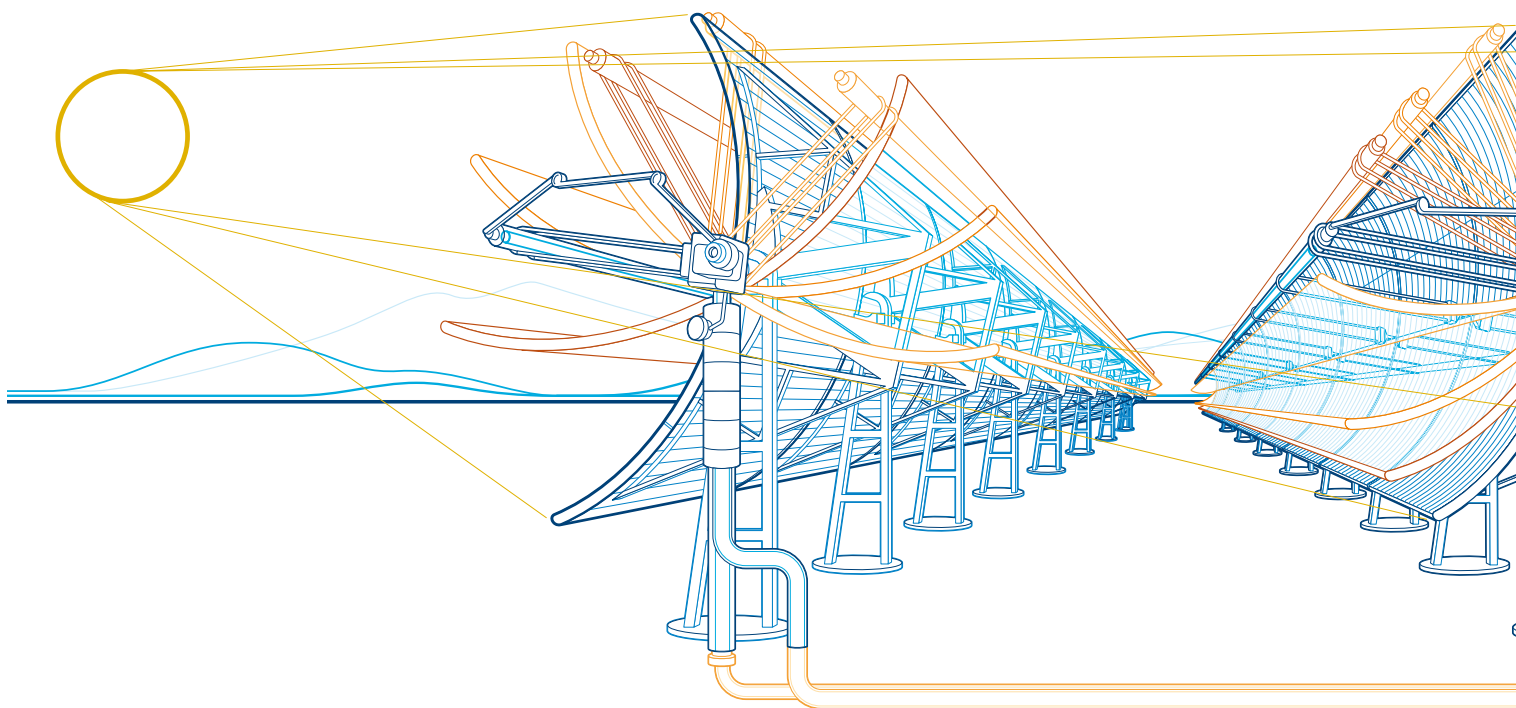
Two systems are used to generate power for the grid:

- 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.

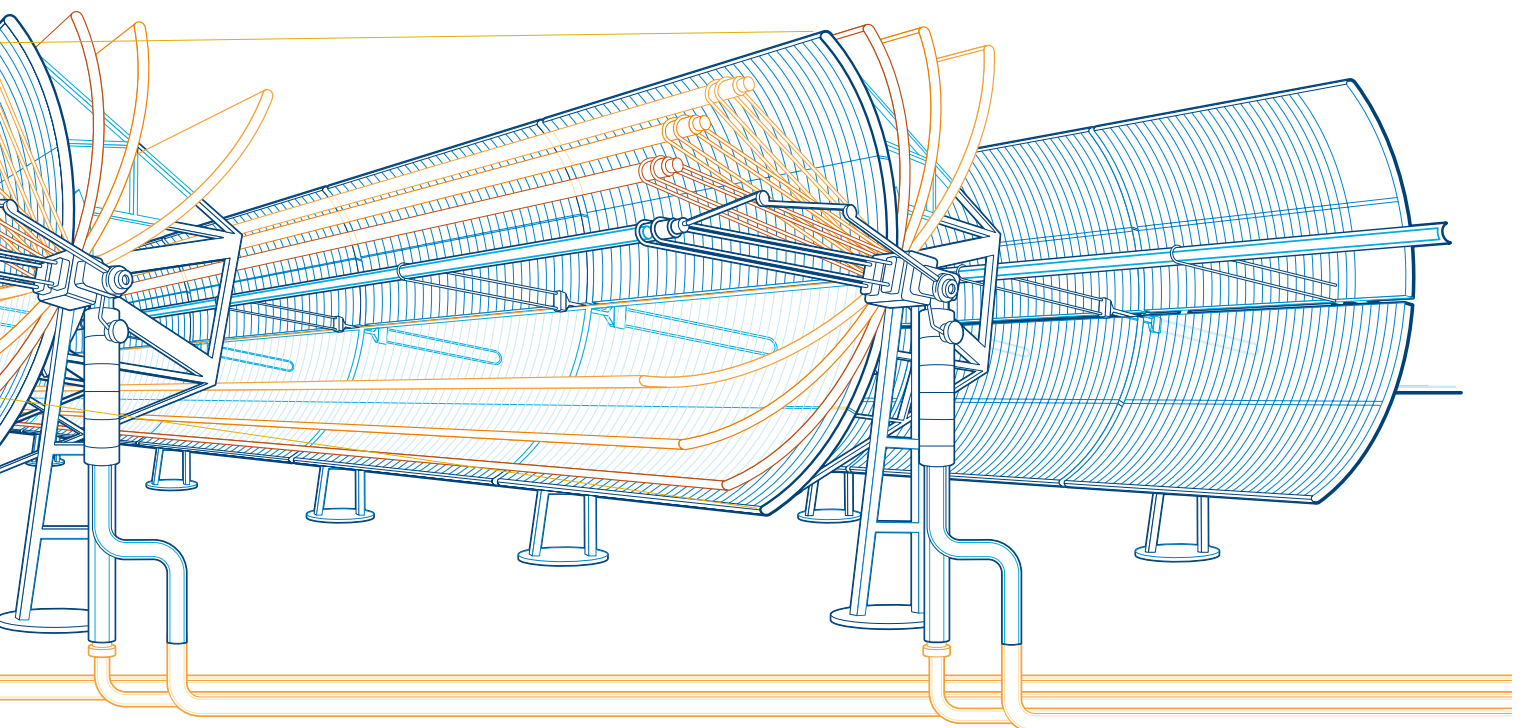
A high degree of accuracy is achieved thanks to the PLC real time clock together with azimuth and elevation calculations based on the date, solar time and mirror orientation.

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.

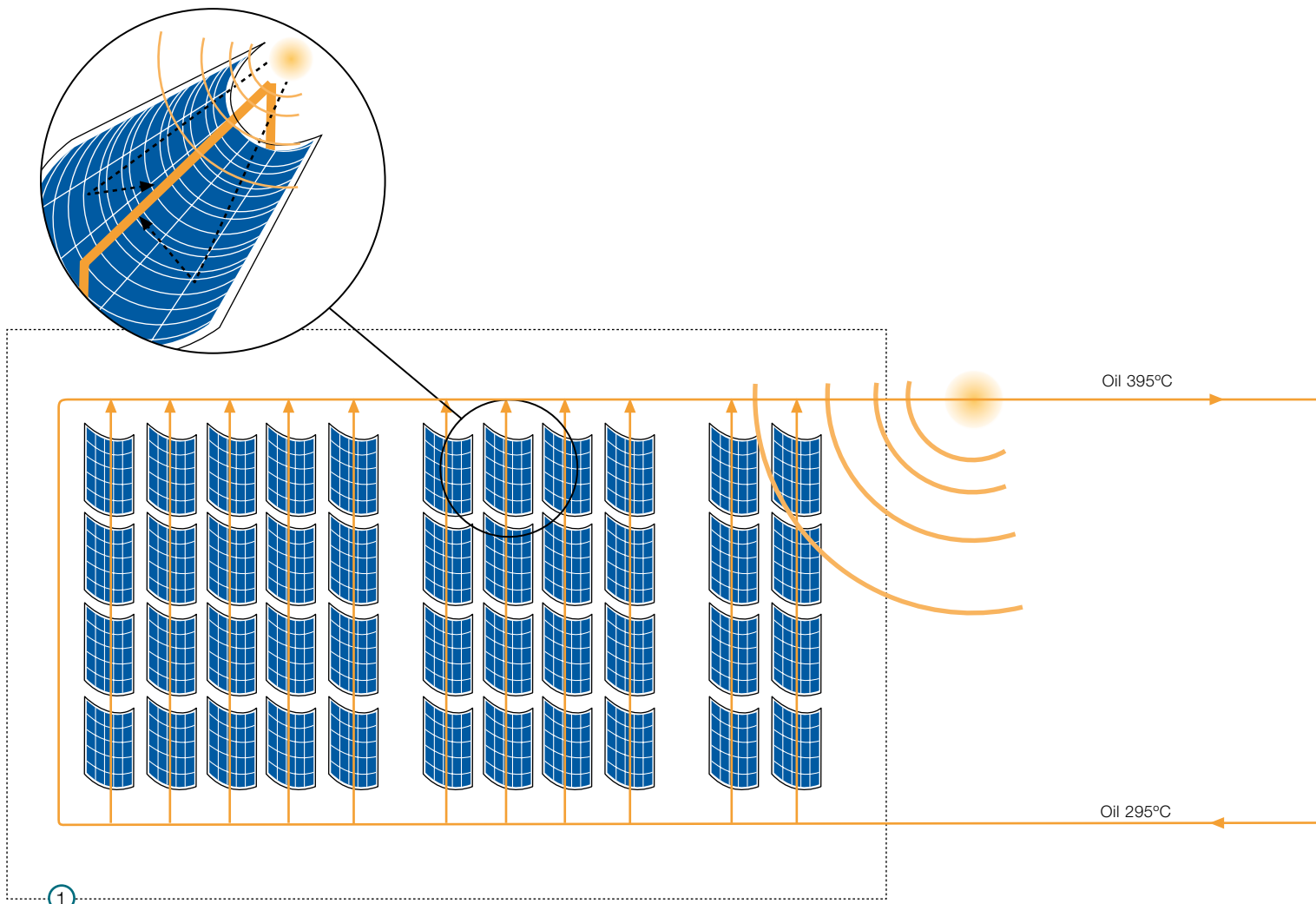


Solar thermal energy

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

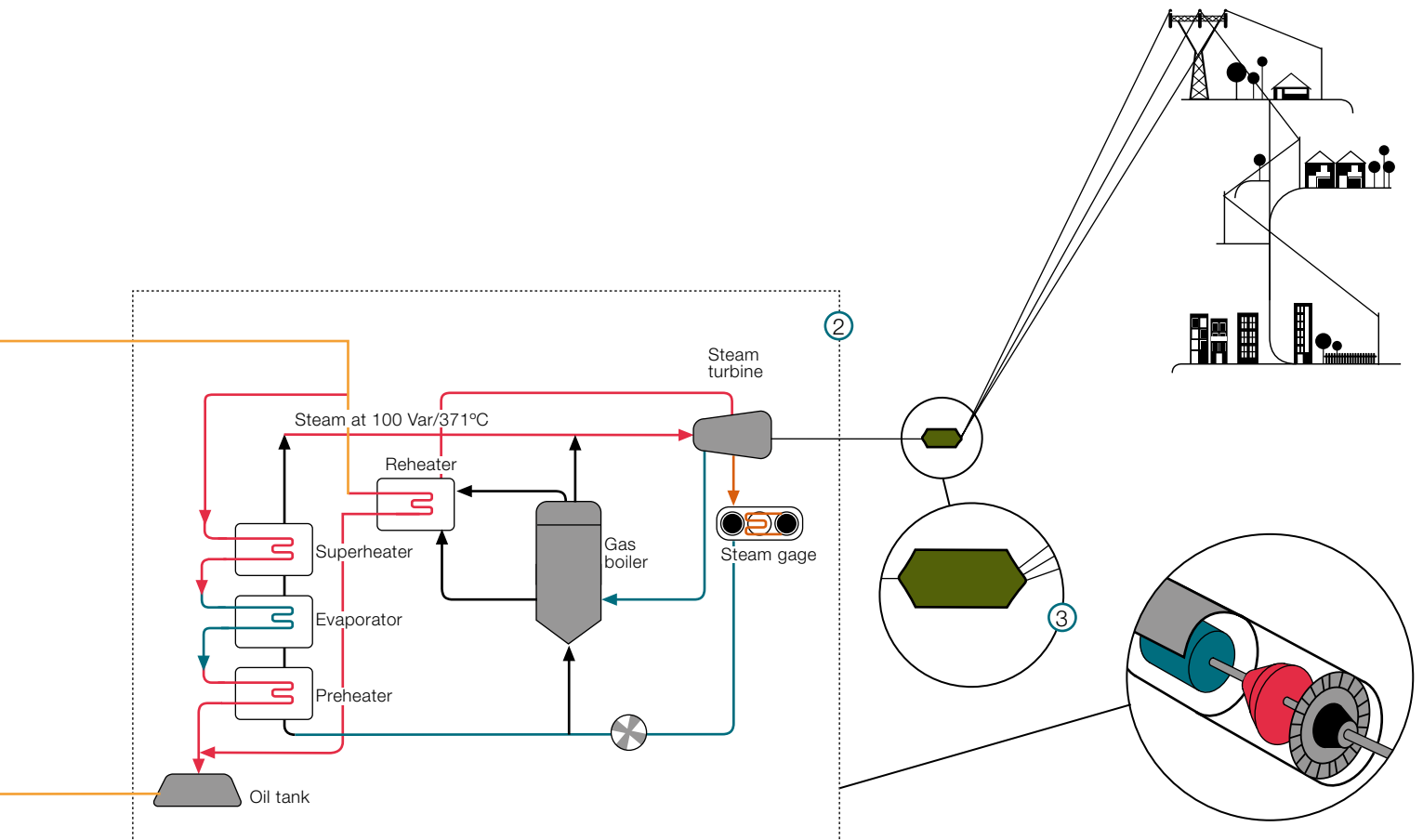
2 - Power block

- 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.

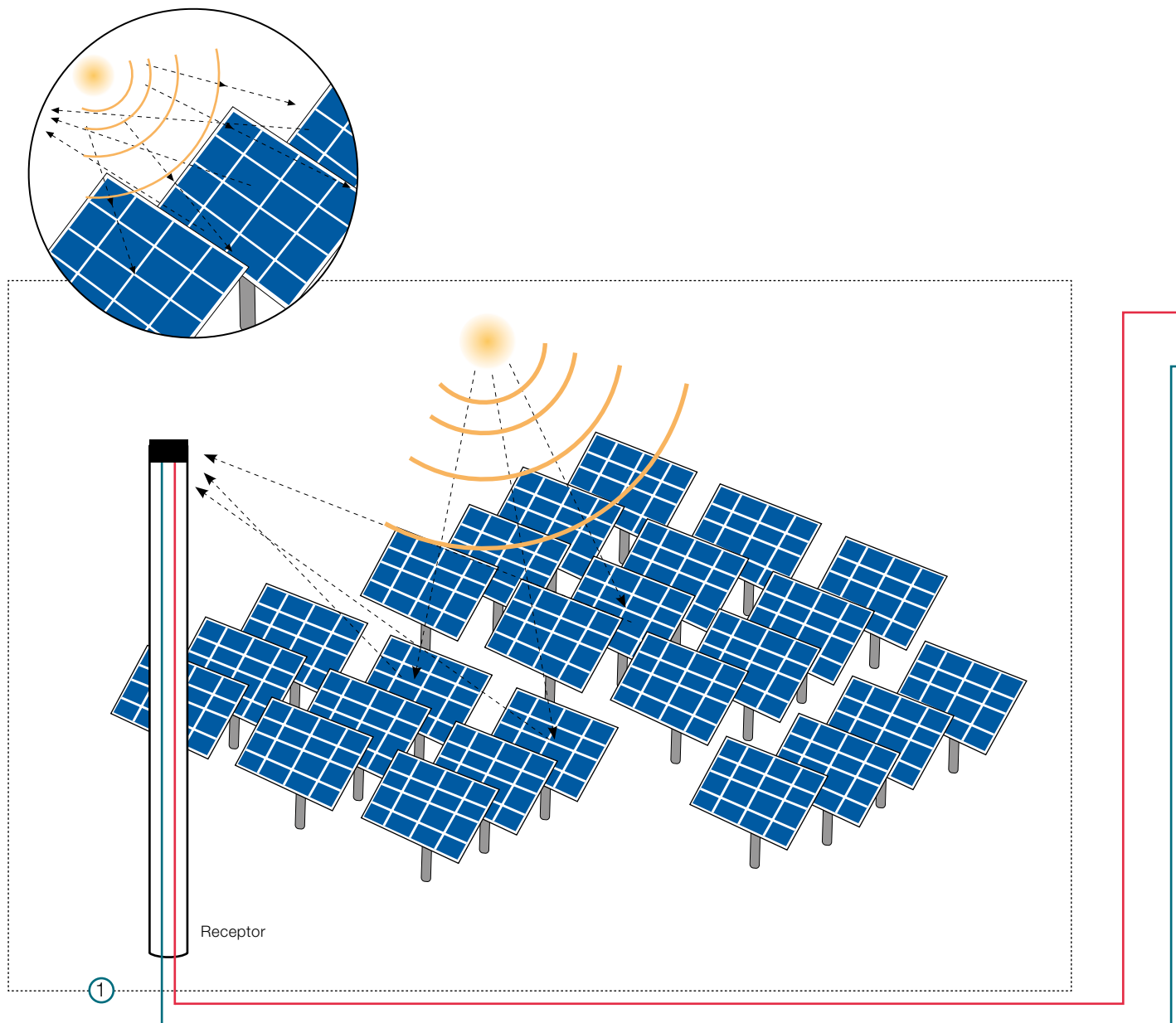


Solar thermal energy

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

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

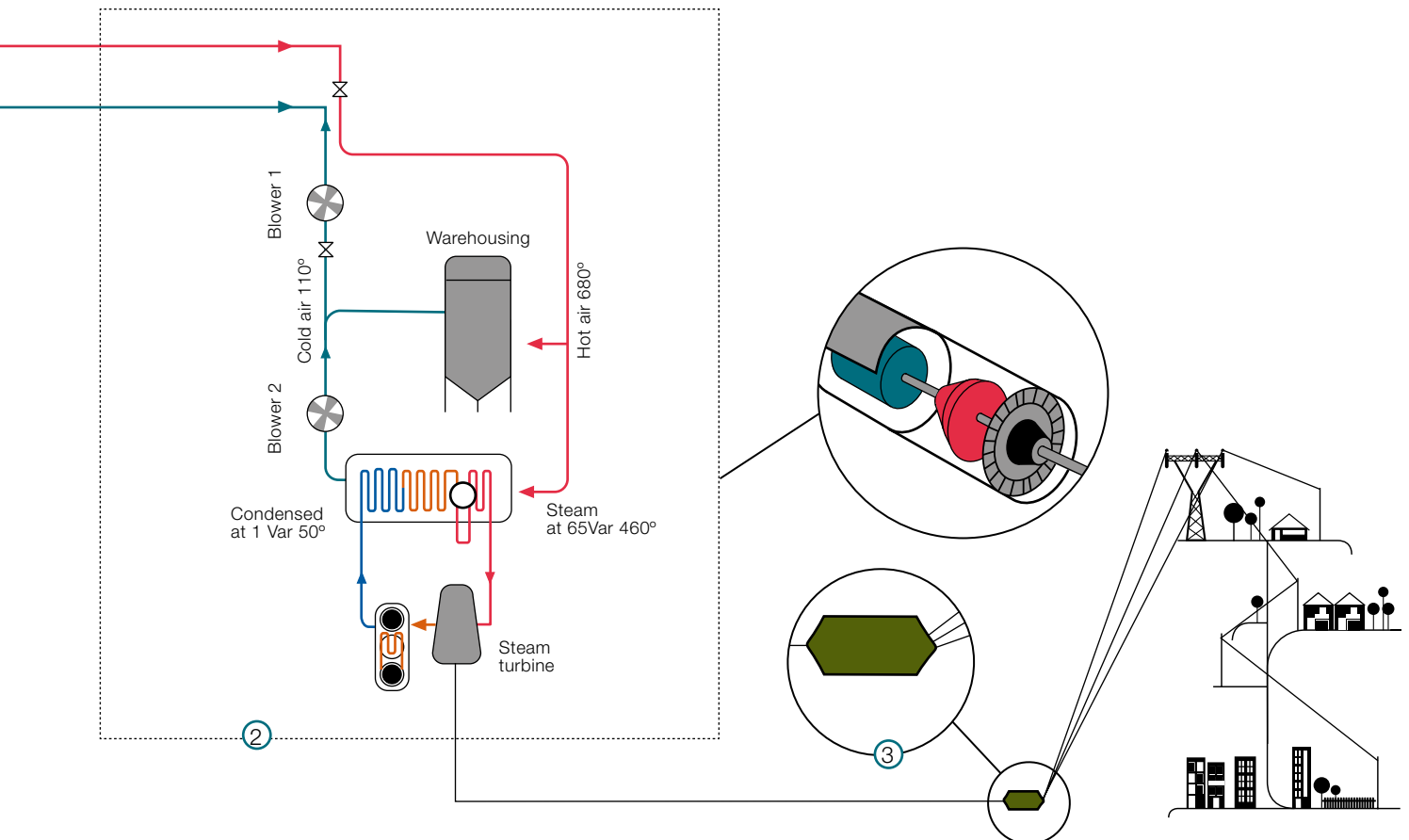
- Single phase power source.
- Emergency pushbuttons and momentary 2-position selectors.
- Surge Arresters.
- Surge Arresters for telecommunications.
- Temperature sensors.
- Terminal fuse holder.
- Connection terminal.
- Plastic enclosure.

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.



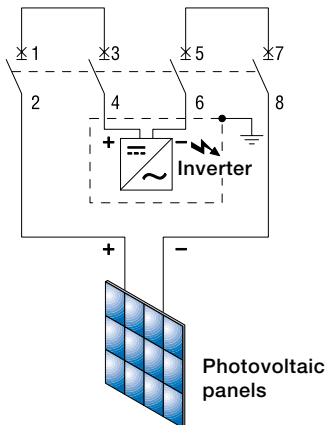
Products

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 484 V DC with $I_{cu} = 4.5$ 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
Reference Standards		IEC EN 60947-2
Rated current I_n	A	$6 \leq I_n \leq 63$
Number of poles		4
Maximum operating voltage (DC) 4P	V	484
Ultimate rated breaking capacity I_{cu} 4P - 484 V DC	kA	4,5
Thermomagnetic release characteristic		Z: $3 I_n \leq I_m \leq 4.5 I_n$
Operating temperature	°C	-25...+55
Mounting		on DIN rail EN 60715 (35 mm) by means of fast clip device



Products

Miniature circuit-breakers S800PV-S



S800PV-S miniature circuit-breakers can be used in networks up to 1200 V DC.
S800PV-S was specially designed for use in PV applications as it safely extinguishes dangerous DC arcs even in case of double faults.

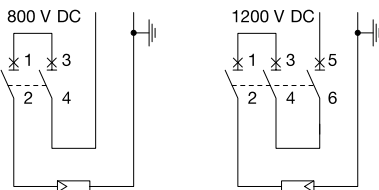
The main features of S800PV-S circuit breakers are:

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

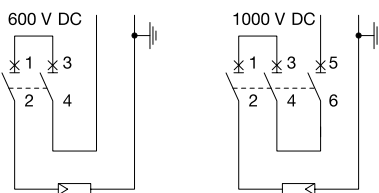
Main technical specifications		S800PV-S	
Reference Standards		IEC EN 60947-2	
Rated current	A	10...80	100, 125
Number of poles		2, 3, 4	
Rated voltage Ue			
(DC) 2 poles*	V	800	600
(DC) 3 poles*	V	1200	1000
(DC) 4 poles*	V	1200	1200
Ultimate rated short-circuit breaking capacity Icu			
(DC) 2 poles * 800 V	kA	5	5
(DC) 3 poles * 1200 V	kA	5	5
(DC) 4 poles * 1200 V	kA	5	5
Rated insulation voltage	V	1500	
Thermomagnetic release characteristic		4 I _n ≤ I _m ≤ 7 I _n	
Class of use		A	
Operating temperature	°C	-25...+60	
Mounting		on DIN rail EN 60715 (35 mm) by means of fast clip device	
Accessories		shunt opening releases, undervoltage releases, signal / auxiliary contacts, rotary drive adapter and rotary handle remote switching unit	

* Please refer to the wiring diagrams

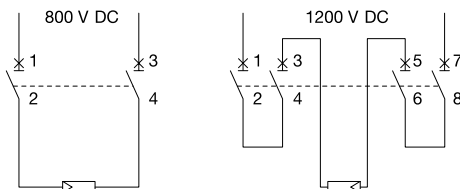
Earthed network ≤ 80A



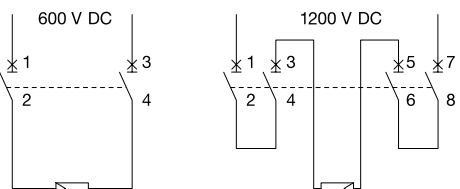
100, 125A



Non-earthed network ≤ 80A



100, 125A



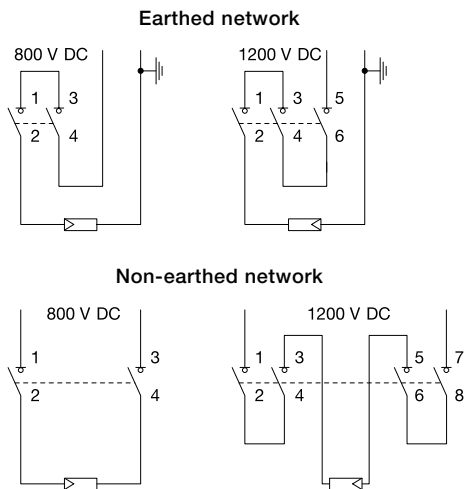
Products

Switch-disconnectors S800PV-M



S800PV-M switch-disconnectors can be used in networks up to 1200 V DC. S800PV-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



Main technical specifications		S800PV-M
Reference Standards		IEC EN 60947-3
Rated current	A	32, 63, 125
Number of poles		2, 3, 4
Rated voltage Ue		
(DC) 2 poles*	V	800
(DC) 3 poles*	V	1200
(DC) 4 poles*	V	1200
Rated short-time withstand current Icu		
(DC) 2 poles * 800 V	kA	1.5
(DC) 3 poles * 1200 V	kA	1.5
(DC) 4 poles * 1200 V	kA	1.5
Rated insulation voltage	V	1500
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
Accessories		shunt opening releases, undervoltage releases, signal / auxiliary contacts, rotary drive adapter and rotary handle remote switching unit

* Please refer to the wiring diagrams

Products

Switch-disconnectors OT



OT switch-disconnectors are available from 16 A to 600 A up to 1000 V DC. OT series from 16 to 40 A are an ideal solution for string boxes in residential applications and/or residential inverters where reliable isolation is required and safety is a must.

OT series from 200 to 630 A are a cost-effective solution either for string boxes in commercial/large-scale installations or inside central inverters where they provide reliable isolation while simplifying maintenance and improving overall safety.

Main features include:

- Reliable position indication
- Contact opening non-dependent on speed of operation
- Wide range of accessories

Main technical specifications		OT (16-40)		OT (200-630)	
Reference Standards		IEC EN 60947-3		IEC EN 60947-3	
Rated Current In	A	16*, 25, 32		200, 315, 400, 600	
Number of poles in series		6	8	5	6
Rated voltage Ue	V	550	750	800	1000
Utilization category		DC 21 A		DC 21 B	
Operating temperature	°C	-25...+45		-25...+45	

* OT16F8 can reach 16 A at 800 V DC

Products

Switch-disconnectors Tmax PV

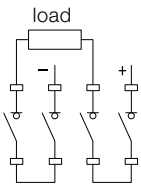


Tmax PV series disconnectors are available with up to 1600 A class DC-22B rated operating current values, for 1100 V DC maximum rated operating voltage. The switching devices of the Tmax PV series are the first box disconnectors for direct current high voltage available on the market. They are certainly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

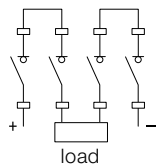
The main features of Tmax PV disconnectors are:

- 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

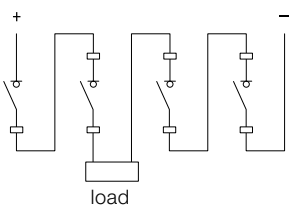
Main technical specifications		Tmax PV
Reference Standards		IEC EN 60947-3
Operating current (DC 22B)	A	160 – 1600
Number of poles		4
Rated voltage Ue	V DC	1100
Rated insulation voltage Ui	V DC	1150
Short-time current Icw	kA	1,5 – 19,2
Class of use		DC-22B



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 I _u	A	1 – 800
Number of poles		3, 4
Rated voltage U _e	V DC	
3 poles		250, 500, 750
4 poles		1000
Breaking capacity I _{cu} at 750 V DC	kA	up 70
Breaking capacity I _{cu} 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:

- 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

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	mm	10 x 38
Type of current		DC
Rated current	A	32
Max power consumption	W	3
Tightening torque values	Nm	PZ2 2-2.5
Terminals cross section	mm ²	25
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. 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	50
Minimum breaking capacity		from 1 A to 7 A = 1.3 x I _n from 8 A to 30 A = 2.0 x I _n
Dimensions	mm	10.3 x 38
Standards		ROHS 2002/98/EC
Weight	g	7

Products

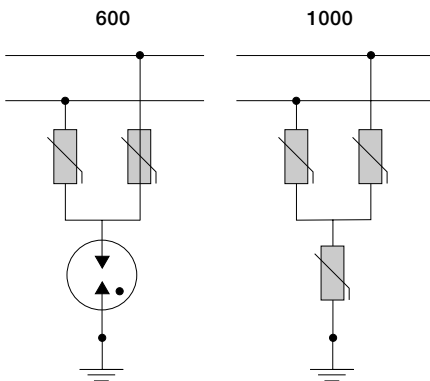
Surge arresters OVR PV



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 surge arrester.

The main features of the OVR PV surge arresters are:

- a DC PV current withstand (I_{scwmpv}) 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 protection
- no risk if the polarity is reversed



Main technical specifications		OVR PV
Electrical specifications		
Type of network		photovoltaic systems
Type		2
Maximum discharge current I_{max}	kA	40
Response time	ns	25
Residual current	mA	< 1
Protection class		IP20
Short circuit DC current withstand I_{scwpv}	A	100 A
Back-up protection current $I_{cc} < 100$ A current $I_{cc} > 100$ A		not required E 90 PV 10 A fuse or S802PV-S10 (OVR PV 600) and S804PV-S10 (OVR PV 1000)
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		TS versions
Type		1 NO/NC
Minimum rating		12 V DC - 10 mA
Maximum rating		250 V AC - 1 A
Cable section	mm ²	1,5
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 UTE 61 740-51

Products

Surge arresters 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. The products in the OVR T2 range are the ideal solution as they guarantee no-break service and safeguard the functionality of the systems. Amongst the main features of the OVR T2 range:

- installation on the supply side of the residual current protection devices (layouts “3+1” and “1+1”)
- simplified maintenance with the pluggable cartridges (P option)
- Increased security with the safety reserved (S option)
- constant monitoring of the status of the product through the built-in signalling contact (TS versions)

All Type 2 OVR surge arresters are coordinated with a distance of at least 1 m between.

Main technical specifications		OVR T2
Reference Standards		IEC 61643-11
Type		2
Maximum discharge current I _{max}	kA	40
Operating maximum voltage U _c	V	275
Remote signal contact		“TS” versions

Products

Insulation monitoring devices ISL-A 600



ISL range allows protection in IT circuits monitoring the insulation to earth downstream the inverter. In PV plants, where operational continuity is important, insulation monitoring device can be installed in order to prevent faults and reduce maintenance which affect the overall pay back period on the investment. No auxiliary supply is needed.

Main technical specifications	ISL-A 600
Rated voltage	600 V DC
Network type	IT
Tripping threshold adjustment	from 30 to 300 k Ω
Output relay	1 NO-C-NC
Fail safe relay	yes
DIN modules	6
Test and Reset	locally and remotely by a pushbutton
Visual indication of the faulty pole	yes
Standard reference	IEC 61557-8

Products

Residual current devices for AC F202 PV B, F204 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 DC side.

The devices save money and improve global efficiency by using PV converters 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 mono- 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, 125 A
Rated operating voltage	230 ... 400 V AC
Rated sensitivity current	30, 300, 500 mA
Number of poles	2, 4
Type	B, B S (selective version)
Standard	IEC EN 61 008 IEC 62423 (for instantaneous version) E DIN VDE 0664 Pt.100 (for selective version)

Products

Residual current devices for AC DDA202 B, DDA203 B, DDA204 B



The RCD-Blocks DDA202 B, DDA203 B and DDA204 B are designed for installations of mono and three-phase PV converters. In combination with S 200 series MCBs, the protection of people and installations against fire risks, leakage and over current is assured.

Main technical specifications	RCD-Blocks DDA202 B, DDA203 B, DDA204 B
Rated operating current	up to 63 A
Rated operating voltage	230 ... 400 V AC
Rated sensitivity current	30, 300, mA
Number of poles	2, 3, 4
Type	B, B S (selective version)
Standard	IEC/EN 61 009 Ann. G IEC 60755

Products

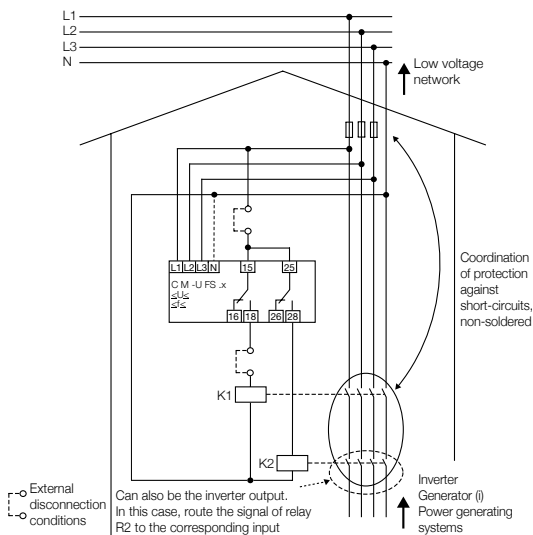
Grid connection relays CM-UFS



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

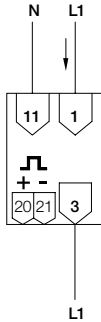
For markets where the German standard VDE is implemented

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

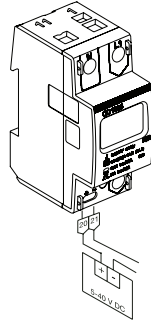
Specifically produced for the Italian market, in accordance with the most recent ENEL Distribuzione specification (edition of 1 December 2008)

Products

Metering devices for AC ODINsingle, DELTAmax



Direct connection



Pulse output

The compact meters measure the electrical energy produced in a photovoltaic installation. They can be easily integrated into measured data collection systems via serial communication adapters. The devices are approved to the Measuring Instruments Directive (MID) European Directive 2004/22/EC and IEC.

ODINsingle meters

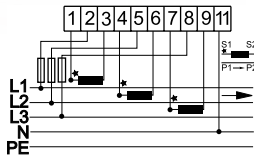
Are only 2 DIN modules wide and easy to use (no configuration needed). They are prepared for external communication via their serial communication adapter (SCA). A second, resettable counter is available as an option.

The DELTAmax types

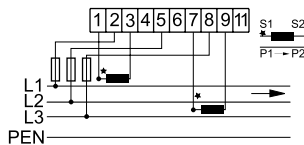
Are available for three phase networks. They allow active energy or combined (active and reactive) energy to be measured. DELTAmax measures in two directions, both import and export of energy. The meters are prepared for external communication via their built-in communication interface or via a serial communication adapter (SCA). I/O functions and a built-in clock function for data logging and control.

CT current transformers

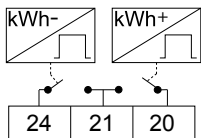
Whenever indirect measurement is needed, the ABB CT current transformers range is the best solution to complete energy measurement system, ensuring its accuracy and endurance.



Threephase system with neutral



Threephase system without neutral



Pulse output of active energy meters

Main technical specifications	ODINsingle
Single phase measuring	
Active energy, accuracy class	B, CL1
Direct metering	up to 65 A
Voltage range	1 x 200-240 V
Optional pulse output	
IR communication for SCA	
Memory back-up (EEPROM)	
Standards	IEC 62052-11, IEC 62053-21, EN 50470-1, EN 50470-3

Main technical specifications	DELTAmax
Active and reactive energy accuracy class	B, CL1
Direct metering	up to 80 A
Transformer metering for	1, 2 or 5 A
Wide voltage range	3 x 57-288/100-500 V
4 quadrant metering, import + export	
Instrumentation, load profiles, max demand, THD	
Automatic installation control	
Tariff versions	1, 2 or 4

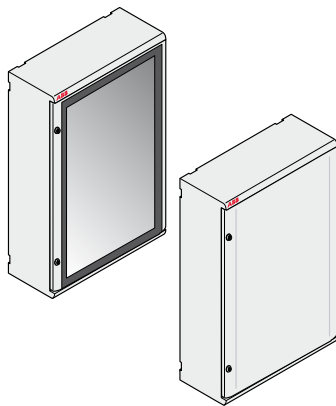


Products

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

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 are covered by certifications recognized worldwide.

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

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

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, 440 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
with E 9F8 PV fuses

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, 440 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
with E 9F8 PV fuses

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
with E 9F8 PV fuses

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
with E 9F8 PV fuses

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



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
 with E 9F8 PV fuses

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
 with E 9F8 PV fuses

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
 with E 9F8 PV fuses

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



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
 with E 9F8 PV fuses

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
 with E 9F8 PV fuses

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



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
 with E 9F8 PV fuses

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
 with E 9F8 PV fuses

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

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
 with E 9F8 PV fuses

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
 with E 9F8 PV fuses

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

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.

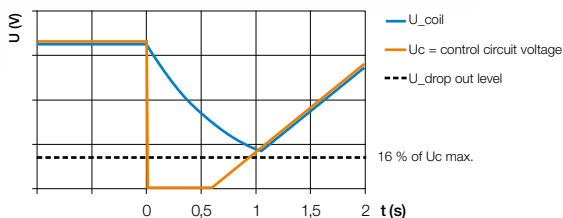
Main technical specifications	A9-AF2050
Rated operational voltage	1000 V
Current ratings	9 – 2050A (AC)max 1900A DC at 600 V acc to cULus
Control voltage, A range	Direct operation, AC or DC
Control voltage, AF range	Electronically controlled AC/DC
Number of poles	3
Reference standards	IEC60947-1, -4-1

Contactors (for grid compliance) AF..T range



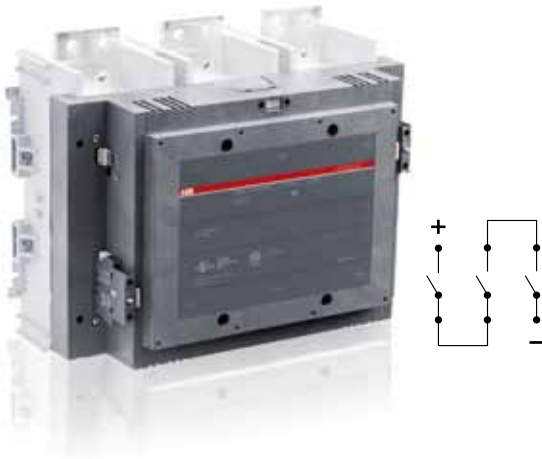
The AF..T range is specially designed for renewable energy AC switching applications with “Low Voltage Ride Through” function. The AF..T contactor is able to withstand a voltage drop on the control voltage without opening. The built-in drop-out delay circuit provides enough energy for the coil voltage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

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	1000 V DC
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®	2CSC400002D0208
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. Switch disconnectors OT	1SCC301009K0201
Switches. Applications in photovoltaic systems	1SCC301012K0201
Tmax. T generation	1SDC210015D0205
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

The data and illustrations are not binding. We reserve the right to modify the contents of this document on the basis of technical development of the products, without prior notice.

Copyright 2010 ABB. All right reserved.

1SDC007350B0201 - 12/2010 - 1.000 Pz.