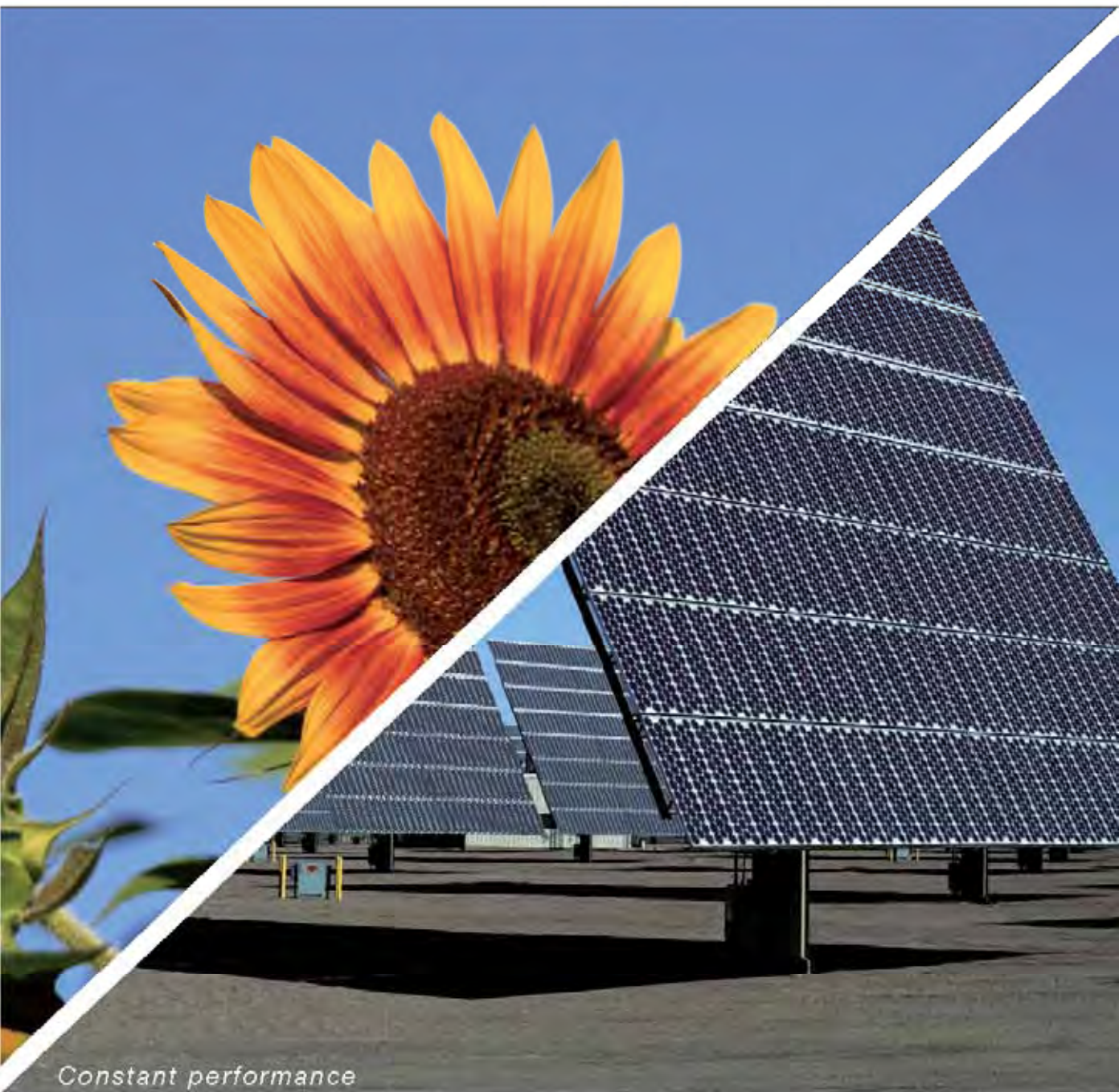


Photovoltaic Catalogue

INDUSTRIAL SWITCHING AND PROTECTION SYSTEMS **2009**



Constant performance



Welcome to your SOCOMEC catalogue dedicated to **photovoltaic applications**. The products are classified by application for an ultra-quick access. Let us guide you in the discovery of the extent of our solutions
Enjoy your visit!



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➤ The enterprise at your disposal

We are very committed to giving you the best response to your expectations. This is why we have a fully integrated sales network that really understands your industrial environment. Relevant departments work closely with you, depending on the project. With SOCOMEC, our specialists are always close to hand should you need them.

➤ The right product

We offer the widest range of switching and protection systems: thanks to customised solutions adapted from standard products, our range is able to cover a wide spectrum of applications. Concentrating on modular design and a full range of easy-to-mount accessories also means that you benefit from many complementary and cost-effective functions.

➤ Constant innovation

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JANUS 2008
DE L'INDUSTRIE

➤ JANUS award 2008 for industry

The latest example: The range of S-type handles has been awarded with the JANUS 2008 for industry. Awarded by the French Institute of Design, under the sponsorship of the Ministry of Foreign Trade, this prestigious prize rewards a range much appreciated by our clients.



STEFEN A



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STEFEN A

➤ Delivering on time

Real-time order and logistics management, which we carry out in close collaboration with our carriers, is our guarantee of a prompt and efficient delivery service.

➤ Direct and friendly contact

SOCOMEC also claims its own style: Personal commitment at your side, friendliness, solidarity in a common project, an adequate response to each of your requirements, these are the convictions of our teams of women and men.

➤ Integrated production and shorter lead-times

As an independent manufacturer, SOCOMEC controls its strategic design and manufacturing processes and makes full use of the latest advances as far as flexibility is concerned.

Our integrated production organised in autonomous working groups offers customers guaranteed manufacturing quality with full control over delivery times.

➤ Satisfaction guaranteed

An integrated laboratory approved by ASEFA-LOVAG, a large number of approvals and certifications guaranteeing the compliance of our devices with the international standards, an acknowledged and proven quality, universality and adaptability to your specific configuration all guarantee your complete satisfaction.



COLLIERE IN A

➔ Pierre SIAT electrical test station

Since 1965, the SOCOMEC production site has also included a test facility. This laboratory is a member of ASEFA (the French Association of Electrical Appliance Test Facilities) and is accredited by COFRAC, the French accreditation committee.

Today, SOCOMEC puts its know-how at your disposal and offers to carry out your own tests within this specialist facility.

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Innovative Power Solutions

Trading Address:

Route Vitrolles:
B.P. 10
13288 VITROLLES
Tel (33) 04 90 07 41 41
Fax (33) 04 90 07 42 20

DECLARATION DE PERFORMANCE N° DP 16113 CPE
Europe (certification)
CEI 60068-5 (2004-05)

MATRIEL : (nature)

Désignation : (désignation officielle)

Type : (type de l'équipement)

Référence : (référence de l'équipement)

Série : (série)

Constructeur : (constructeur)

Caractéristiques techniques :

The given technical product values at the following characteristics:

	10	20	30	40	50	60	70	80	90	100
A - Rated power (kW)	10	20	30	40	50	60	70	80	90	100
B - Rated current (A)	10	20	30	40	50	60	70	80	90	100
C - Voltage (V)	10	20	30	40	50	60	70	80	90	100
D - Rated power (kW)	10	20	30	40	50	60	70	80	90	100
E - Number of phases	1	2	3	4	5	6	7	8	9	10

Place Joubert

Date : 26 Août 2009

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Date 2009

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➔ Metrology

Can you guarantee the quality of the measurements that you take during the development, production or testing of your products?

SOCOMEc provides you with its metrological know-how to inspect and certify your measuring tools.



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Carried out by a specialist, the installation of your equipment is fully compatible with and adapted to your use.

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A broad range of features tailored to respond to the particular requirements and limitations of your electrical installation, and to help you deal with specific operational demands.

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You will receive training, specially adapted to your needs, in order to familiarise you with our equipment and enable you to use it to your best advantage.

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A wide range of preventive or corrective maintenance options designed to suit your installation and its environment, and to ensure continuity of service of your electrical networks.

Please do not hesitate to contact your SOCOMEC agency to discuss a service package tailored to your requirements.



History

Origins of market

Solar energy only needs to be captured and has always been a source of natural alternative and renewable energy. Its two forms, thermal and photovoltaic, allow to directly generate heat or electricity respectively. The former has the advantage of a simple and inexpensive installation, the latter easily transports energy to the place of consumption.

Apart from the first specific experiments in the 70s, the photovoltaic market started in the 80s through isolated residential and rural installations. From the 90s, the principle of electrical connection of grid-connected photovoltaic installations has been increasingly used.

The photovoltaic market

Since 1995, countries like Germany and Japan have been forerunners in this market and have favoured the implementation of photovoltaic installations at all levels worldwide.

In 2008, the world production of photovoltaic energy was approximately 15 000 MW.

Despite the evolution of the energy efficiency of photovoltaic installations, and in particular photosensitive panels, the key to this market remains the catchment surface available to channel this energy free of charge.

Main applications



404_239

Residential

Electric installations up to approximately 5 kW are affected by this application. It is composed of panels installed on house roofs which are mainly used for electric equipment. State aid in the form of tax deductions has strongly contributed to the development of this market.



© SMA solar technology 1105

Building (BIPV)

Electric installations up to approximately 250 kW are affected by this application. It is composed of panels installed on terraces, skylights, glass sections or on building façades. The designers make a compromise between optimisation of energy production and maximum reduction of installation costs.



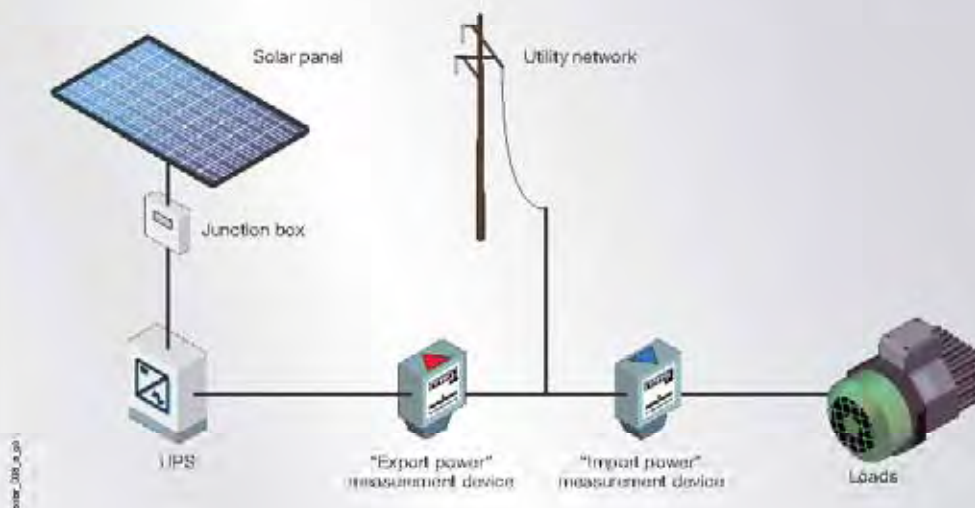
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Solar parks

Electrical installations of several MW are affected by this application destined for the resale of the produced energy to distributors (EDF...). It is composed of solar panels installed in fields of several acres. E.g., for an installation of 8 MW, a field of approximately 16 acres will be necessary.

➔ Principle diagram

The principle consists in capturing the maximum solar radiation and converting this energy in the most cost-effective way possible.



➔ Catchment

The production of photovoltaic energy is directly related to:

- geographical location (variation of sunlight),
- the catchment surface,
- the season and time of the day.

Via the panel orientation at 45°, solar energy can produce a power of 1000 Watts/m² surface.

This energy is captured by photovoltaic modules which present a yield between 3 and 25% according to the technology (mono-crystalline, multi-crystalline or amorphous silicon).

For instance, a 1 m² solar panel with a 14% yield generates a peak power of 140 Wp.

➔ Power generation

These modules generate a voltage of 12 or 24 volts and currents proportional to the module's surface. They are associated in series to increase the voltage and the maximum current up to the exploitation level required according to the application (see following paragraph). The created voltage is rectified in order to reach the subsequent levels:

- Approximately 300 to 600 VDC for low-power installations,
- Approximately 600 to 900 VDC for medium-power installations,

➔ Energy conversion

The direct current is converted by an inverter (DC/AC conversion) into monophasic or 3-phase alternate current for local use or for reinjection into the electric transmission grid. This conversion guarantees a yield between 90 and 95%, according to the inverter brand and type.

➔ Energy conversion

At its reinjection point, an energy meter allows the measurement of the energy in the grid.

Example of a domestic installation:

- received power: 1000 W/m²,
- yield: 14%,
- overall surface: ~20 m²,
- received power: 2.8 kWp.

The mean daily production will therefore be between 5 and 8 kWh.

➔ Energy balance and depreciation

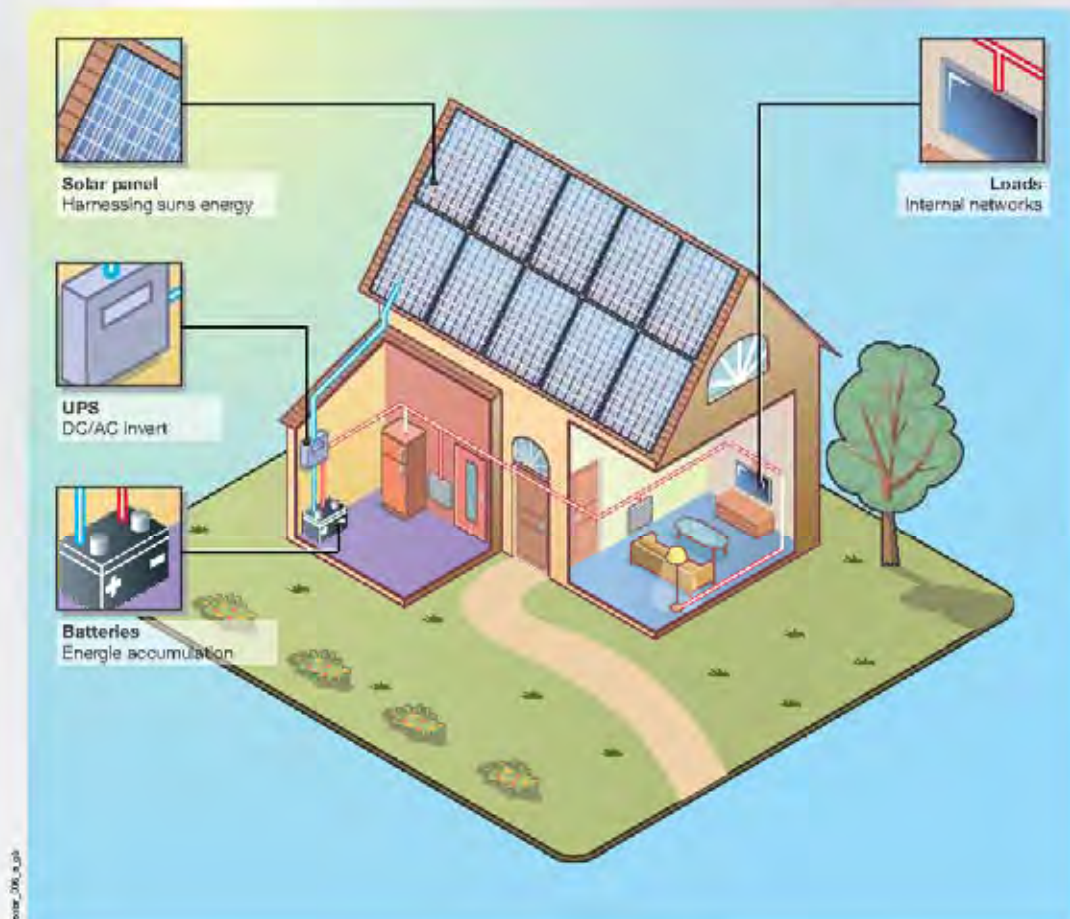
It is quite clear that the production of the entire installation essentially depends on the panel energy efficiency and on their surface.

On the other hand, the depreciation rate will mainly depend on the price and life duration of the photovoltaic panels.

Type of installation

Photovoltaic applications apply to 3 types of installation.

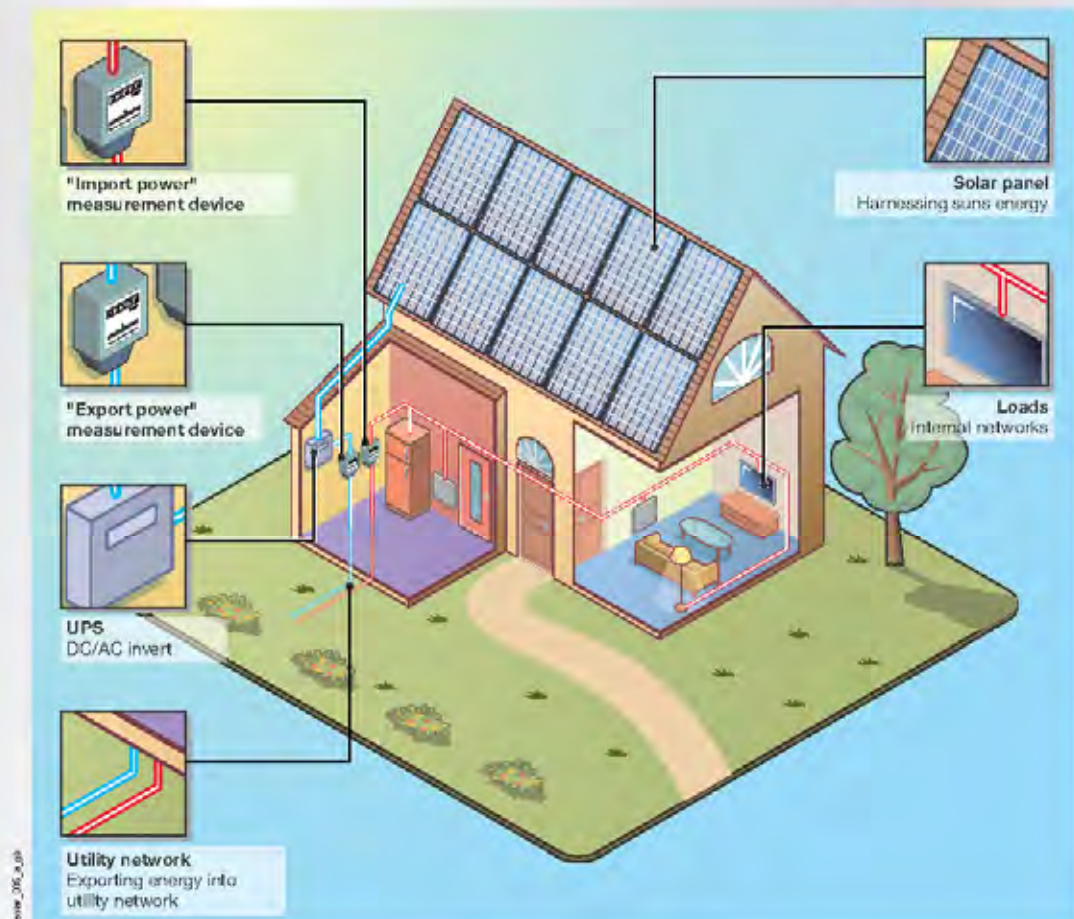
➤ Independent isolated installation



This type of installation is used for local energy supply to houses, farms, havens and buildings. The panels supply direct current with a voltage below 600 VDC for residential use and over 600 VDC for buildings and solar parks. This direct current is transformed by an inverter into alternate current adjusted at 230 volts or 400 volts and 50 Hz and redirected to accumulation batteries.

The energy supply is made directly from the inverter and the surplus will be stored in the batteries with an autonomy from 6 to 8 consecutive days. A cabinet ensures the safety and the control of the system.

➔ Grid-connected installations

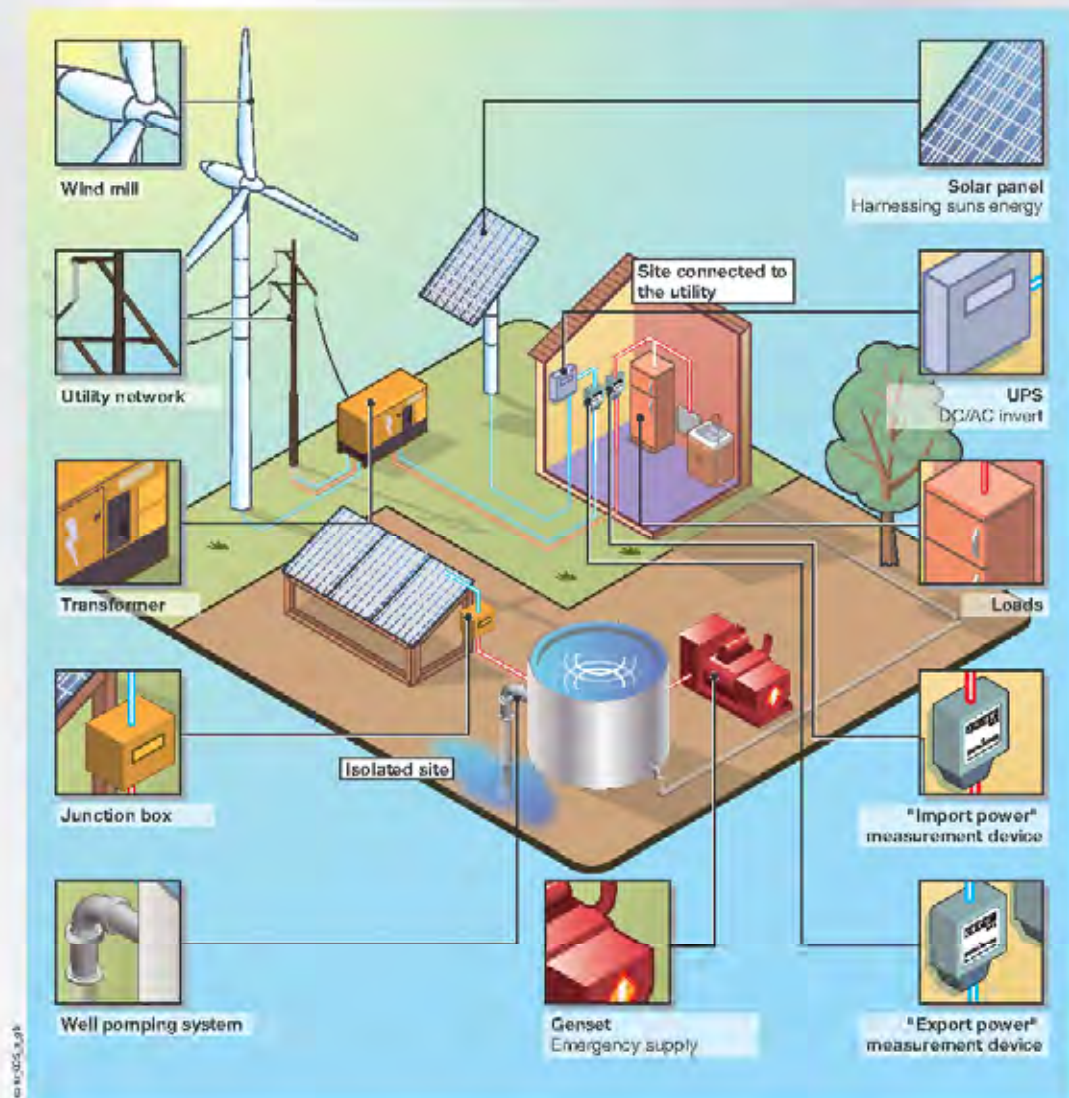


This type of installation is used for the local production on electric energy. It is applied to sites for residential and commercial use and to solar parks. Anyone can become a producer of renewable energy by injecting all or part of the locally produced energy into the public distribution grid. The energy suppliers (EDF...) systematically

purchase this energy at preferential rates defined in the regulatory framework established by the Government. The energy counting is done by 2 different meters for measuring the energy production and consumption respectively.

Type of installation

➔ Mixed installation



This type of installation is used for the local supply and production of electric energy. It is applied to sites for residential use and buildings and to solar parks. The purpose is to use the principles of a grid-connected installation (see below) completing it with another

energy production, such as wind energy, heat pumps or generators. This solution allows the creation of an installation that does not depend exclusively on sunlight.

Normative aspects

Low-voltage photovoltaic installations are submitted to the standards for low voltage electrical installations of each country:

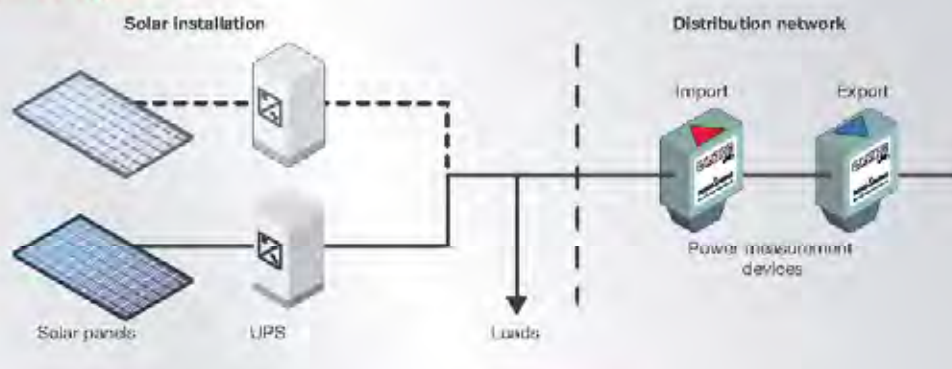
- IEC 60364 abroad,
- NF-C 15100 in France.

These standards describe the nature of the protection devices in order to ensure the safety, the choice and the implementation of the electric material.

Specific documents and chapters are directly applicable to the PV installations:

- UTE 15-712 (February 2008):
Practical guide to photovoltaic installations,
- IEC 60364-7-712 (2002-5 edition):
Buildings electrical installations - Rules for special locations - Solar photovoltaic power supplies (PV),
- ADEME guide (June 2006):
Grid-connected photovoltaic generators.

Limits of application



Earthing diagram

AC side, TNS-type earthing diagram
DC side, IT-type earthing diagram
(if the inverter presents a galvanic insulation).

Earthing of masses

The masses of the various devices (PV panels, inverters, other devices) must be connected via equipotential both at DC and AC.
The earthing must be carried out in a single point.

Protection

We remind you that the voltage levels implemented in PV installations go from 300 to 900 VDC and impose taking potential dangers into account.

Protections to be implemented

Type of protection	DC side	SOCOMEK recommends
Direct contacts	Reinforced insulation	-
Indirect contacts	Double insulation Class II materials or equivalent insulation	Coded impulse Permanent insulation controller
Overcharge	If the cable current rate > 1.25 x I _{sc} stc	gR fuses
Transitory overvoltage	Type 2 lightning arrester	Type 2 DC lightning arrester
Section	Disconnecting switch	load break switches
Type of protection	AC side	SOCOMEK recommends
Direct contacts	Insulation	
Indirect contacts	Differential device with automatic cut-off switch	Type A or type B differential relay (only if there is no galvanic insulation between the DC and the AC side of the inverter)
Over-current	Over-current protection	gG fuses - gR fuses
Transitory overvoltage	Type 2 lightning arrester	type 1 or type 2 mono AC lightning arrester
Section	Disconnecting switch	load break switches

Residential



Installations

Single houses or residential complexes

Residential installations are composed of photovoltaic panels with a surface of a few square metres up to around twenty square metres.

The panels are installed on the roofs of single houses or of small residential complexes.

➤ These installations are submitted to the following conditions

- **Catchment surface:** from 2 to 20 m²
- **Operating voltage:** from 250 to 500 VDC
- **Peak power:** from 2 to 5 kWp
- **Isc current:** from 2 to 20 A DC
- **Output voltage:** 230 VAC mono

The essential

Manual load break switches



SIRCOM DC
p. 24

Surge protection device



SURGYS G50-PV
p. 35

➤ Need a suggestion?

We will help you find the best solution for your application.

- **A special requirement?** SOCOMEC makes specific products. Please feel free to consult us.

Residential installation



➡ The installation can be composed of the following units

Direct current side (DC)

- Photovoltaic panels
- load break switch
- DC surge protection

Alternate current side (AC)

- Differential protection device
- load break switches
- Energy metering device

The PV installation will have a class II insulation. All the equipment frames will be connected to earth in a single point via protection conductors.





Residential diagram

The PV unit is composed of panels which releases the direct current to an inverter

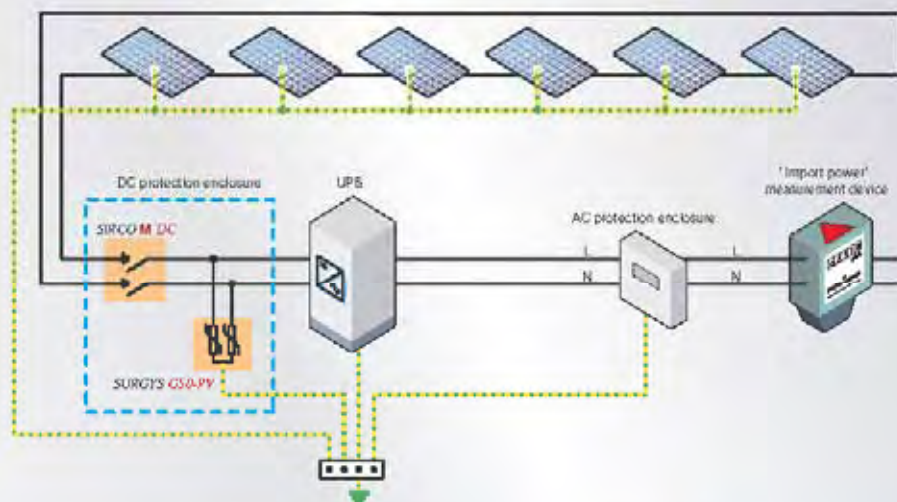
Upstream the latter is installed a DC protection kit including:

- a **SIRCO M DC** load break switch allowing to stop the PV system for maintenance, for example.
- A type 2 **SURGYS G50-500** surge protection device allowing to protect the inverter from transitory overvoltage due to lightning. A lightning rod is installed on the house in case of a high level of lightning strike (Nlc>25).

Downstream the inverter is installed an AC protection kit requiring a high-sensitivity differential protection device as well as a disconnecting device.

An energy meter is installed downstream the AC protection kit in order to record the energy reintjected into the grid.

According to the geographical location, a system with a power of 3 kWc can produce from 7 to 10 kWh per day.



Building (BIPV)



Installations Buildings (BIPV)

PV installations for commercial use are composed of PV panels from tens to hundreds square metres. These panels can be installed on roofs, terraces, on the façade of supermarkets, industries, public buildings, etc.

➤ These installations are submitted to the following conditions

- **Catchment surface:** from 10 to 600 m²
- **Operating voltage:** from 400 to 900 VDC
- **Peak power:** from 5 to 250 kWp
- **Isc current:** up to 100 A DC
- **Grid injection voltage:** 230 VAC monophasic or 230/400 VAC 3-phase

The same aids as for residential installations apply for installations, whose PV elements are integrative part of the building. On the other hand, an inclination of 45° of the PV panels is necessary in order to optimise their energy efficiency. This geometric limitation does not allow a forced integration of the panels in the building, therefore, they are not necessarily applicable for subsidy.

Hence it is necessary to find a compromise between obtaining the subsidy and energy efficiency by:

- vertically integrating the panels in the façade of the building to the detriment of energy efficiency,
- Disposing the panels at 45° on the building roof to the detriment of obtaining the integration subsidy,
- using flexible materials (amorphous type integrated in the roof sealing system) with weaker energy efficiency (7% against 14% for polycrystalline panels).

The essential

Switches

Disconnecting switch



Disconnecting switch fuses



Fuse

protection



Energy metering device



Surge protection device



➤ Need a suggestion?

We will help you find the best solution for your application.

➤ A special requirement?

SOCOMEK makes specific products. Please feel free to consult us.



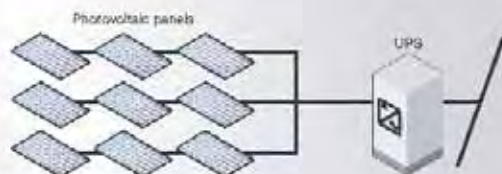
How to choose your installation

There are several types of installation structures for both the DC and the AC sides, which evolve according to the technology used in the AC-DC converters.

Moreover, we will present only a few relatively classic structures.

➤ Centralised inverter architecture

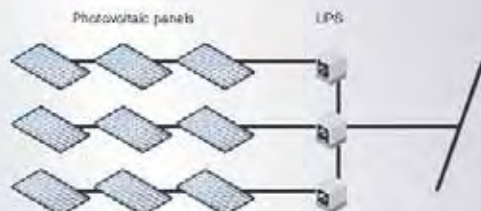
Several lines of modules are connected either directly (if the inverter allows it) or via a connection box to a centralised inverter.



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➤ String inverter architecture

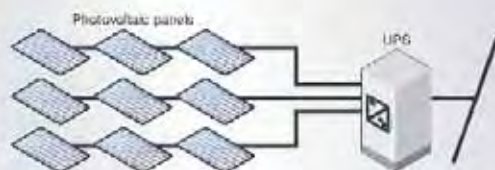
Each line of modules is connected to an inverter. The inverters are connected in parallel on the grid.



info_516_03b

➤ Multi-string inverter architecture

Several lines of modules are directly connected to a centralised inverter.



info_517_03b

➤ The installation can be composed of the following units

Direct current side (DC)

- Photovoltaic panels
- load break switch or inverter on each string
- load break switch at the inverter inlet
- DC surge protector

Alternate current side (AC)

- Differential protection device
- load break switch + fuse
- Energy metering device

The PV installation will have a class II insulation. All the equipment frames will be connected to earth in a single point via protection conductors.



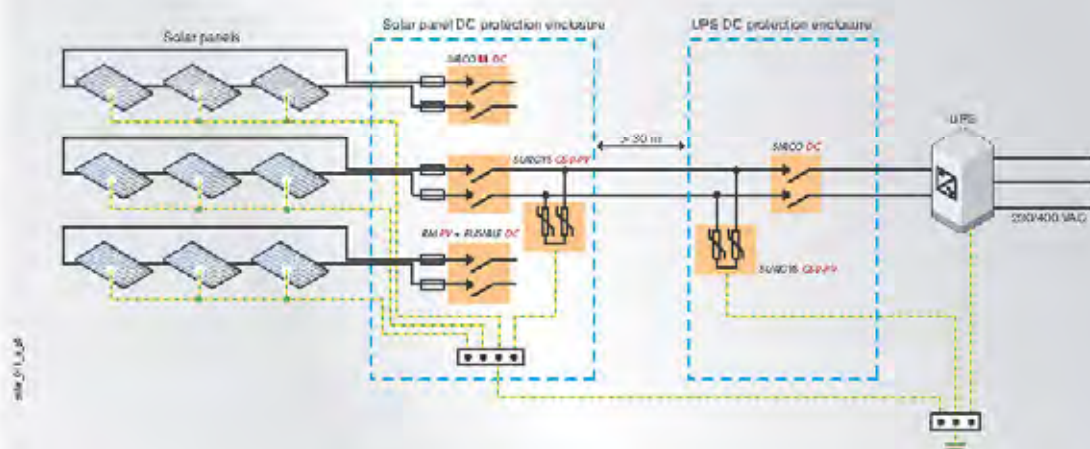
Buildings (BIPV) diagrams

Direct current side (DC)

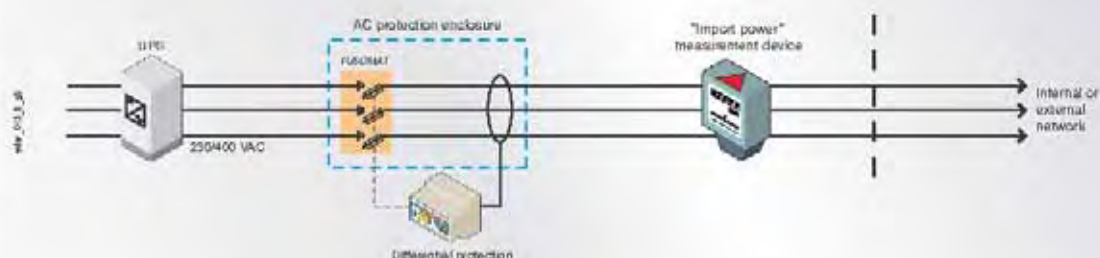
The DC protection kit has the same function as in the installations for residential use.

Any maintenance operation on a string must be carried out without interrupting the energy production. As such, each string can be cut independently thanks to a **SIRCO DC** switch installed in the junction box. On the other hand, each string is protected by a DC fuse which allows protecting the interested string in case of short-circuit (in case the total number of strings is higher or equal to 4).

The panels can be protected by a **SURGY5 G50-PV** surge protector if the junction boxes are at a distance of over 30 metres from the inverter.



Alternate current side (AC)



Solar parks



Installations Solar fields

Solar fields are composed of PV panels of several thousands square metres. These installations allow generating various powers and need a large rural site away from big buildings. These plants are remarkable not only for their power level, but also for the mechanisms that, in some plants, allow orienting the catchment surface according to the season and sunlight conditions in order to optimise the power level injected in the grid.

➤ These installations are submitted to the following conditions:

- **Catchment surface:** from hundreds to thousands m²
- **Operating voltage:** from 400 to 800 VDC
- **Peak power:** tens of MWc
- **Grid injection voltage:** 100 or 690 VAC for reinjection into the medium HTA voltage grid

Solar fields are composed of a large number of interconnected strings, as well as various inverters installed in parallel in order to generate a power of several MWc. These fields can have various subfields that have solar orientation from east to west in order to optimise the global energy efficiency throughout the day. Some fields are also equipped with solar tracking in order to monitor the solar panel position.

These vast solar installations require a protection study in order to determine with precision the various types of protection devices, as well as their installation location.

The essential

Switches disconnecting switch



Switches fuses



Disconnecting switch fuses



Fuse protection



Energy management



Protection differential



Surge protection device



➤ SERVICES & TECHNICAL ASSISTANCE:

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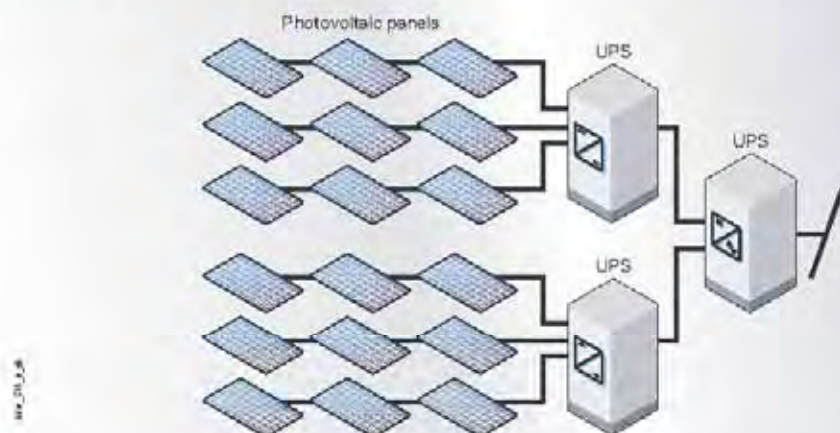
We will help you design your protection solution, guaranteeing a perfect integration of the products in your environment.

For further information, please contact your SOCOMEC agency.



There are several types of installation structures on the DC side. The energy generation surfaces are subdivided into subassemblies also composed of a multi-string structure. Each subassembly powers one or more medium-power multi-string inverters (from hundreds kWc to several MWc)

➤ Example of architecture



➤ The installation can be composed of the following units

Direct current (DC) side

As for the surface (length of conductors) and the complexity of the solar field, it is important to provide for various mechanisms in order to easily:

- protect the various solar panels from overvoltage due to weather,
- isolate one or more panels to detect any insulation fault at the DC grid,
- connect a string to earth or interrupt it for carrying out maintenance operations on the panels or on the conductors,
- implement a Insulation Monitoring Device (IMD) external to the inverter.

The PV installation will have a class II insulation. All the equipment frames will be connected to earth in a single point common to the AC and DC sides via protection conductors.

Alternate current side (AC)

- Differential protection device
- load break switch + fuse
- Energy metering device

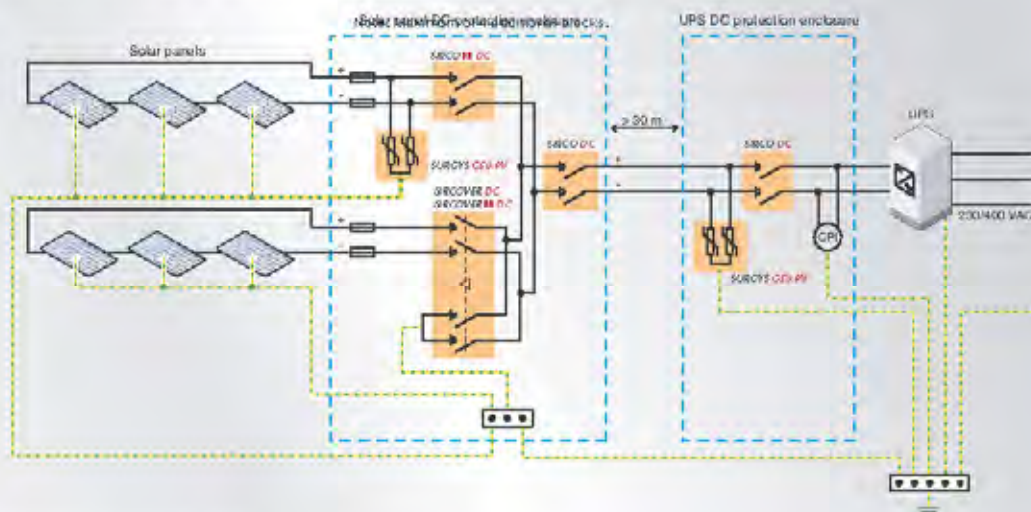
Industrial diagram

Direct current side (DC)

This DC side is similar to a building installation, only with a higher degree of complexity since the installation requires supplementary functions. Thus, the higher frequency of maintenance operations require supplementary precautions aiming, for example, at short-circuiting and earthing a string.

It is necessary to install a "Permanent Insulation Controller" function compatible with extension of the DC grid and, therefore, of its leakage capacity. This function is essential to show any loss of insulation in the PV unit. On the other hand, portable fault detection systems allow a rapid detection of any fault on the strings (degradation of a conductor, a surge at the end of its life, etc.).

This function is fundamental to quickly detect any earthing fault and rapidly correct it.

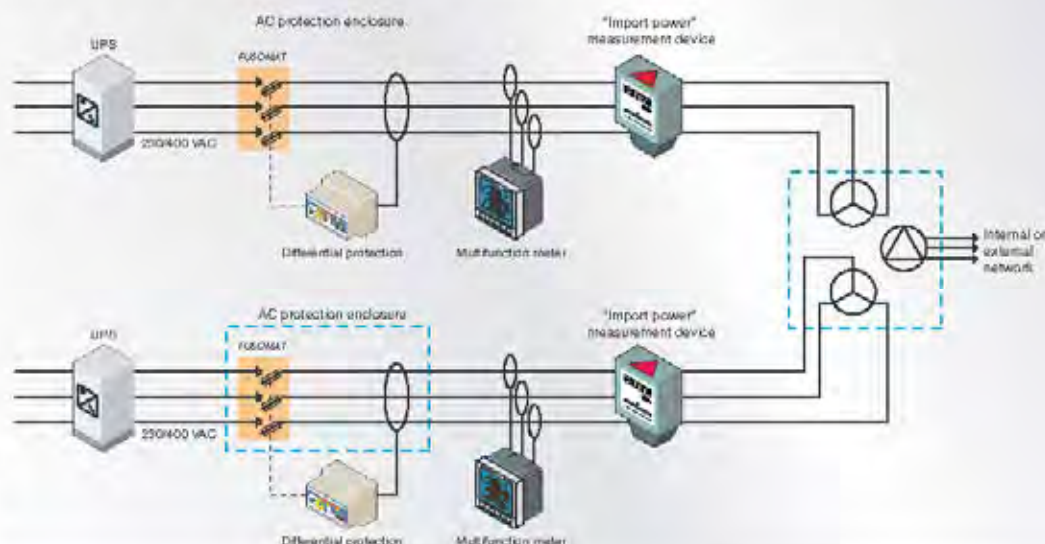


Alternate current side (AC)

The differential protection device in association with a trigger switch must be chosen as follows:

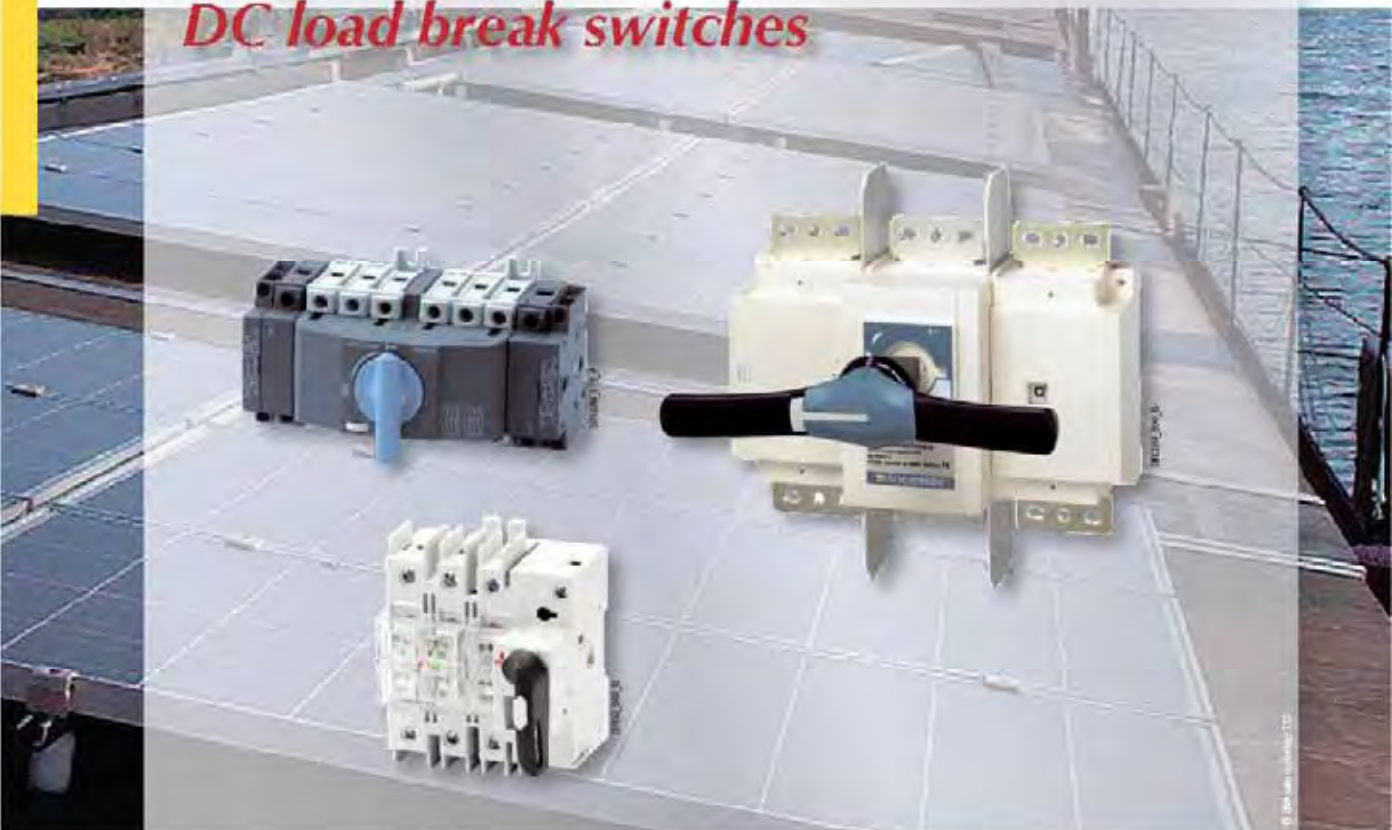
- Type A differential relay (RESYS M40) if the PV inverter does not generate a DC component connected to earth in case of a fault downstream.
- Type B differential relay (RESYS B420) in the opposite case.

An energy balance can be very helpful to compare the energy extracted from the various inverters. Several DIRIS A40 (1 per inverter) associated with a CONTROL VISION software will allow determining load curves in order to optimise the power generated by the entire PV unit.



Insight into DC load break switches

Load break switches



Load break switch for PV applications from 40 to 1250 A

➤ DC interruption and disconnection

The **DC disconnect** used for a PV application must be placed upstream the inverter. It allows the electrical insulation of the photovoltaic field during installation, maintenance or repair operations (IEC 60384-7-712 standards).

The disconnect must:

- insulate the 2 polarities,
- be dedicated to the application,
- be located upstream and close to the inverter.

However, to be sure that the disconnection is not made under charge (inadvertently or by an unsuited person), it is advisable to place a disconnection switch allowing a load break and disconnection.

➤ Load and overload interruption

This action is ensured by devices that have been defined to establish and break specific loads.

Type tests allow determining the devices applicable for establishing and breaking these loads.

These features correspond to the equipment use category.

➤ Breaking and making capacity

Taking all the possible sunlight variations into account, the maximum current in a PV installation can reach 1.25 times the running current.

According to the construction standards IEC 60947-1 and IEC 60947-3, the breaking capacity and the making capacity correspond to the maximum performance values of the categories of use.

Even after these extreme uses, the switch guarantees its features.

In the DC 21 category of use, the switch can establish and interrupt up to 1.5 times the running current.

Examples:

SIRCO DC 125 A, whose rated running current is of 83 A under 800 VDC in the DC21B category of use, will be able to occasionally establish and break a current of 84.5 A.

➤ Sizing a load break switch in extreme conditions

Circuit features

- Optimal working voltage, U_n :
 $24 \times 21V \text{ modules} = 504 \text{ VDC}$
- Open circuit voltage, V_{oc} :
 $24 \times 21,78V \text{ modules} = 522 \text{ VDC}$
- Short-circuit current, I_{sc} : 7 channels of $8 \text{ A} = 56 \text{ A}$

Sizing rule

The components are sized taking all the possible extreme weather variations into account:

Voltage: $V_{oc} \times 1,15 = 522 \times 1,15 = 600 \text{ VDC}$

Current: $I_{sc} \times 1,25 = 56 \times 1,25 = 70 \text{ A}$

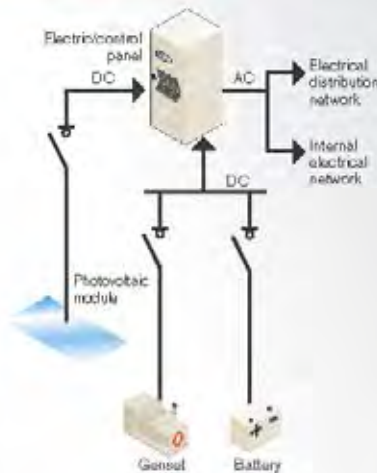
(under $504 \times 1,15 = 579,6 \text{ VDC}$)

➤ Reminder

DC difficulties derive from voltage interruption. Contrary to AC, it never returns to 0. Connecting the terminals in series eases breaking the load.

The load break switch placed in a DC kit must not be handled during normal operation. The installation insulation must be made on the AC side first, and then on the DC, thus giving the possibility, for example, to intervene on the inverter. This intervention must be carried out by a professional.

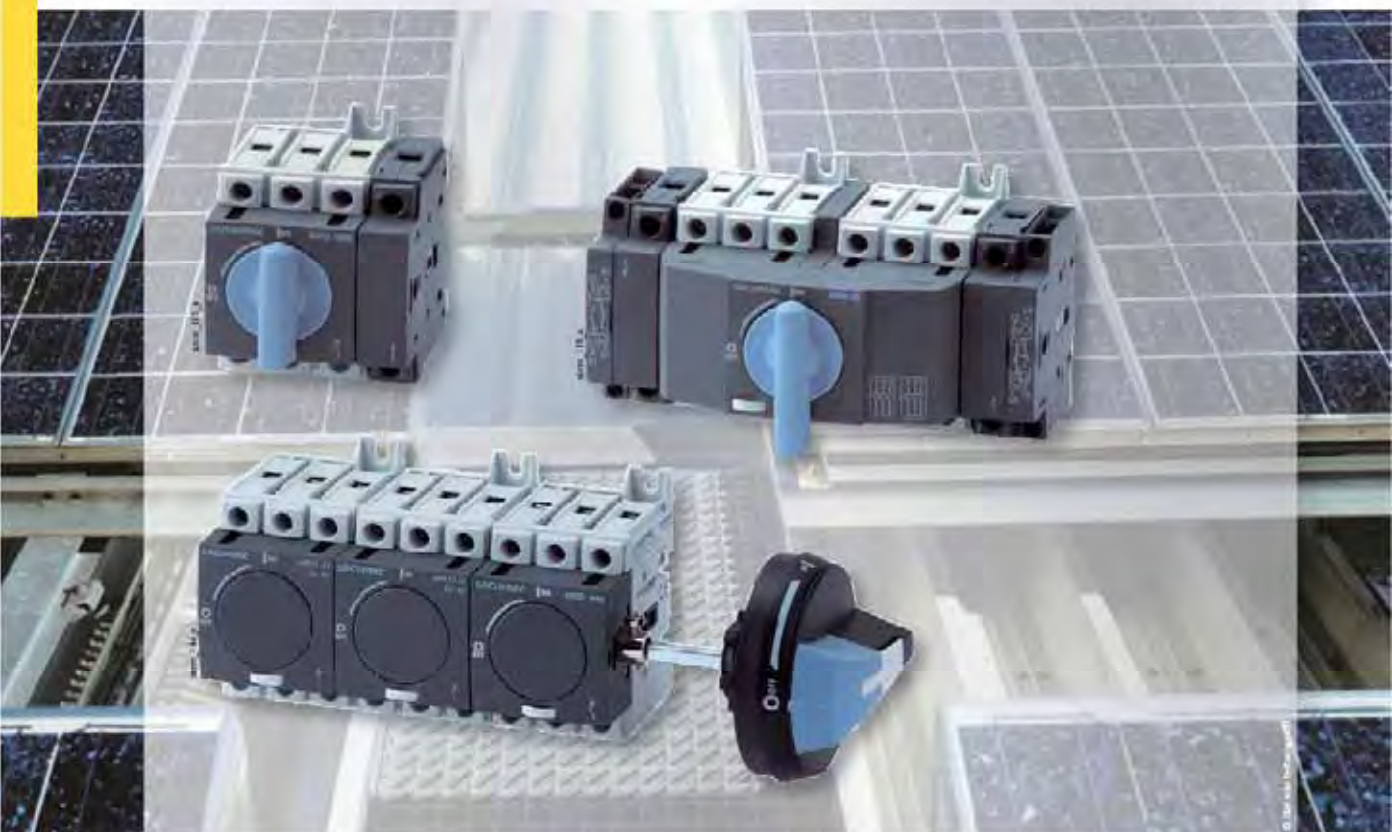
➤ What you need to know



PV is an application that requires DC21 category protection devices in compliance with the electrical safety standards.

A photovoltaic application must have a safety device to meet the technical requirements. The renewable energy producer must give a very clear separation between the solar panel and the rest of the installation to be able to provide an intervention.





Load break switch for 40 and 80 A PV applications

Function

SIRCO DC are manually operated multipolar load switches. They break on and off under load and provide safety isolation for any low voltage circuit of photovoltaic applications.

General characteristics

- Modular and modifiable device.
- Fully visible breaking.
- Double break per phase.
- Contact point technology.
- DIN railback plate mounted or mounted on modular panel with 45 mm front cutout.
- For panel mounting devices, use the "Door mounting kit" (see accessories).

Customised solutions

- SIRCO M DC 9 and 12 poles.
- SIRCO M DC and SIRCO M for simultaneous AC / DC circuit break.
- SIRCO M DC mixed rating.
- SIRCOVER M DC : see page 55.

Conformity to standards

- IEC 60947-3
- EN 60947-3
- IEC 60364-4-410 (protection against electric shock)
- IEC 60364-7-712 (building electrical installations - Part 7-712: rules for special installations or placements - Photovoltaic power supplies)

Available on request

- Other ratings: please consult us.
- Enclosed multipole devices: please consult us.

What you need to know

- SIRCO M DC can be operated in different ways:

Direct operation



External side operation



External operation



- SIRCO M DC is a 3-pole switch that can be configured according to the PV installation characteristics. Various accessories, such as auxiliary contacts and door-mounting kits, complete the range.
- SIRCO M DC is generally installed at the PV generator junction box.

Zoom



- Associate **SIRCO M DC** with **SIRCO M** to simultaneously break the DC and AC circuits (please consult us).
- Think about it...**
Associate a protection against overcurrents and overvoltage due to lightning (see page 86).
- Need an equipped enclosure?**
No problem with our customised product service. We have solutions for any requirement.
For further information, please contact your SOCOMEC agency.

References



SIRCO M DC from 40 to 80 A

Rating (A)	No. of poles	Switch body	Direct handle	Door interlocked external front and right side handle	Door interlocked external left side handle	Shaft extensions for external front and side handle	Switched fourth pole module	Auxiliary contacts	Conversion kit
40 A	3 P	22DC 3004	Blue 2299 5012 Red 2299 5013	S00-type I - 0 Black IP55 1471 1111 ⁽¹⁾ Black IP65 1473 1111 ⁽¹⁾	S00-type I - 0 Black IP65 147A 5111 Red/Yellow IP65 147B 5111	150 mm 1407 0515 200 mm 1407 0520 320 mm 1407 0532	1 P 22DC 1004	M-type 1 NO + NC contact 2299 0001	Load break switches 6/8 P 2269 6009 ⁽²⁾
80 A	3 P	22DC 3008		Red/Yellow IP65 1474 1111 ⁽¹⁾			1 P 22DC 1008	2 NO contact 2299 0011	

Accessories

Handles and shafts

Direct handle

M00 handle



For SIRCO M DC

Rating (A)	Handle colour	Handle	Reference
40 ... 60	Blue	M00-type	2299 5012
40 ... 80	Red	M00-type	2299 5013

Door interlocked external handle

S00 handle



Front and right side operation I - 0

Rating (A)	Handle colour	Handle	External IP	Reference
40 ... 60	Black	S00-type	IP55	1471 1111 ⁽¹⁾
40 ... 80	Black	S00-type	IP65	1473 1111 ⁽¹⁾
40 ... 80	Red/Yellow	S00-type	IP65	147A 1111 ⁽¹⁾

(1) Detachable handle.

Left side operation I - 0

Rating (A)	Handle colour	Handle	External IP	Reference
40 ... 60	Black	S00-type	IP65	147A 5111
40 ... 80	Red/Yellow	S00-type	IP65	147B 5111

Use

Compact and robust, the new "S" type rotary handle enables the same switch to be operated either with a front, left side or right side external handle.

Other reduced handles: please consult us

Shaft extensions for external handle



Use

Standard lengths:

- 150 mm

- 200 mm

- 320 mm

Other lengths: please consult us

As for 3 and 4-pole switches, shaft extensions are for front and external side handle.

For 6 and 8-pole switches associated with a conversion kit, shaft extensions for front handle only.

For 6 and 8-pole switches with pole joining accessories, shaft extension for external side handle only.

For SIRCO M DC

Rating (A)	Dimensions (mm)	Reference
40 - 80	150	1407 0515
40 - 80	200	1407 0520
40 - 80	320	1407 0532

Other accessories

Additional poles for SIRCO M DC

Switched fourth pole module

Use

Adds one or two poles and transforms:

- 3 pole load break switches into a 4 pole,

- 6 pole load break switches into a 8 pole.

Switched fourth pole module

Rating (A)	No. of poles	Type	Reference
40	1 P	switched	2200 1004
80	1 P	switched	2200 1008

Neutral pole



Use

Transforms the 2 pole switch into a 3-pole + solid neutral.

Neutral pole

Rating (A)	No. of poles	Type	Reference
40	1 P	unswitched	2200 5005
80	1 P	unswitched	2200 5009

Protective earth module



Use

Adds 1 protective earth module to the load break switch.

Protective earth module

Rating (A)	No. of poles	Type	Reference
40	1 P	unswitched	2200 9005
80	1 P	unswitched	2200 9009

Terminal shrouds



Use

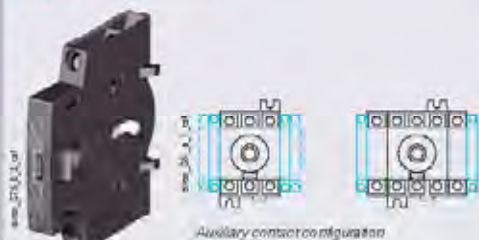
In batches of 2, they guarantee protection top and bottom against direct contact with the terminals or connection parts.
1 or 3-pole versions available.

Protections allowing thermographic inspection without removing.

For SIRCO M DC

Rating (A)	No. of poles	Position	Reference
40	1 P	top and bottom	2294 1005
40	3 P	top and bottom	2294 3005
80	1 P	top and bottom	2294 1009
80	3 P	top and bottom	2294 3009

M type auxiliary contacts



Use

Pre-break and signalisation of positions (1 and 1 by NO + NC or 2 NO) auxiliary contacts. They can be mounted on the left or on the right side of the device. Max 4 auxiliary contacts (2 modules).

Characteristics

NO+NC auxiliary contacts: IP2 with front operation

For SIRCO M DC

Rating (A)	Contact position	Contact type	Reference
40 ... 60	1 AC	NO + NC	2299 0001
40 ... 80	1 AC	2 NO	2299 0011

Conversion kit



Use

This accessory enables the assembly of two 3-pole switches + additional poles in order to achieve 6 or 8 pole SIRCO M load break switches. For direct operation, the handle is included but not the shaft. For external operation, add the handle + the shaft.

Rating (A)	Type	Reference
40 ... 80	6/8-pole load break switches	2299 6009

Door / Panel mounting kit



Use

This kit enables direct mounting of the standard 3 or 4-pole switch on the door panel, on the right or left side of the panel. Moreover, the connection clamps of the switch are always accessible.

The external handle is quick and easy to install due to an internal locking nut mounted on the inside of the enclosure.

2 kits are available:
- 1 for complete protection IP2X,
- 1 with overall dimensions reduced.

For SIRCO M DC

Rating (A)	No. of poles	Description	Reference
40 ... 60	3 / 4 P	Complete protection IP2X	2299 3309 ^(*)
40 ... 80	3 / 4 P	Overall dimensions reduced	2299 3409 ^(*)

(*) Delivered with shaft

Cap for side operation mounting



Use

Accessory for capping the front face of the SIRCO M DC when utilising in side operation. 20 units per pack.

This piece can be snapped on the switch body directly.

For SIRCO M DC

Rating (A)	Pack qty	Reference
40 ... 80	20 pieces	2299 6409

6/8 pole joining accessory



Use

40 units per pack; they allow the joining of two 3-pole switches (+ additional pole) in order to form a 6 or 8-pole switch for external side operation.

For multi-pole switches, please consult us.

For SIRCO M DC

Rating (A)	Pack qty	Reference
40 ... 60	40 pieces	2299 9909

Customised solutions



Our services are regularly sought for producing customised enclosures and panels meeting all your requirements:

- enclosures with simple load break switches,
- enclosed fuse protection switches,
- enclosed changeover switches,
- complete integrated equipment

Available on request:

- sheet metal, insulated, varnished (seaside) or brushed stainless steel versions,
- special colours (enclosure, handle),
- customised dimensions,
- customised connections: class II quick connectors

For any request of customised products, please contact your SOCOMEC agency

PV generator connection enclosure



When they are not intended to be mounted in a enclosure, load break, changeover or fuse protection switches are usually delivered enclosed. Located the nearest possible to the operator, they guarantee:

- protection for the inverters and PV generators against overvoltage coupling,
- disconnection under DC load between the inverters and PV generators (necessary according to the IEC 60364-712 standard)

Specialised in load break, changeover and fuse protection, SOCOMEC designs and produces a large number of standard or customised enclosures. This double expertise will allow you to make use of complete systems that meet all your requirements.

SIRCO M DC polycarbonate enclosure



➤ References

Empty enclosures

Rating (A)	No. of poles	Handle colour	Enclosure colour	Reference
40	3 P	Black	Grey	2215 9305
40	3 P	Red	Yellow	2215 9405
80	3 P	Black	Grey	2215 9309
80	3 P	Red	Yellow	2215 9409

Enclosed switches

Rating (A)	No. of poles	Handle colour	Enclosure colour	Reference
40	3 P	Black	Grey	220C 3304
40	3 P	Red	Yellow	220C 3404
80	3 P	Black	Grey	220C 3308
80	3 P	Red	Yellow	220C 3408

➤ General characteristics

- Equipped with a 3-pole SIRCO M DC.
- 1 removable neutral terminal and 1 removable earth terminal.
- Protection IP65.
- Possibility of 1 adding additional pole.
- Possibility of 1 adding M type auxiliary contact module.

Enclosed SIRCO M DC 40 A

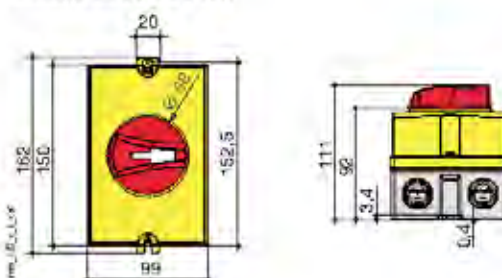
- 4 M16 pre-drill holes.
- 6 M20 pre-drill holes.
- 4 M25 pre-drill holes.

Enclosed SIRCO M DC 80 A

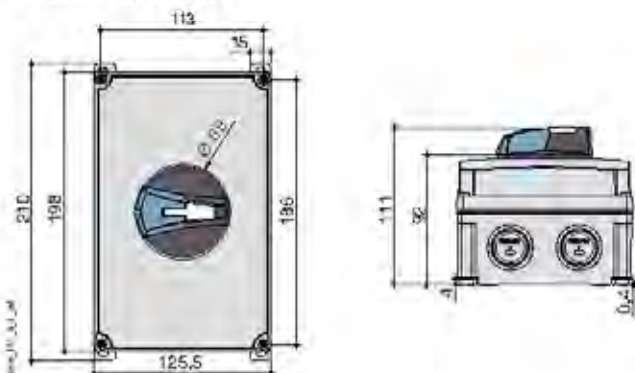
- 4 M16 pre-drill holes.
- 6 M25/M22 pre-drill holes.

➤ Dimensions

Enclosed SIRCO M DC 40 A



Enclosed SIRCO M DC 80 A



Characteristics according to IEC 60947-3

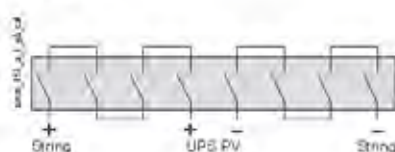
SIRCO M DC

Thermal current I_{th} 40°C				40 A	80 A
Rated insulation voltage U_i (V)				800	800
Rated impulse withstand voltage U_{imp} (kV)				8	8
Rated operational currents I_n (A)					
Rated voltage	Load duty category	Number of poles of the device	Number of poles in series per polarity	0	0
48 VDC	DC-21 B	3 P	1 P	40	80
220 VDC	DC-21 B	3 P	1 P	32	40
400 VDC	DC-21 B	4 P	2 P	32	40
440 VDC	DC-21 B	4 P	2 P	32	40
500 VDC	DC-21 B	4 P	2 P	32	40
600 VDC	DC-21 B	6 P	3 P	25	40
700 VDC	DC-21 B	6 P	4 P	25	40
750 VDC	DC-21 B	8 P	4 P	25	40
800 VDC	DC-21 B	8 P	4 P	25	40
Overload capacity					
Rated short-time withstand current $0.3 s$: I_{sc} (kA rms)				2.5	3
Rated short-circuit making capacity I_{cm} (kA peak) ⁽¹⁾				6	9
Connection					
Minimum Cu cable section (mm²)				1.5	2.5
Maximum Cu cable section (mm²)				16	25
Tightening torque min./max. (Nm)				2/2.2	3.5/3.65
Mechanical characteristics					
Endurance (number of operating cycles)				100 000	100 000
Operating effort (Nm)				0.8	1
Weight of 3 P switch (kg)				0.16	0.26

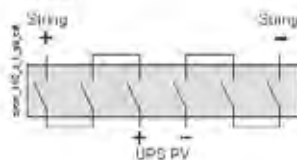
(1) For a rated operation voltage $U_L \leq 400$ VAC.

Connections

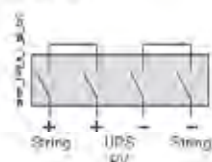
8 pole



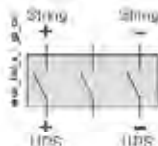
8 pole



4 pole



2 pole



Dimensions

SIRCO M DC

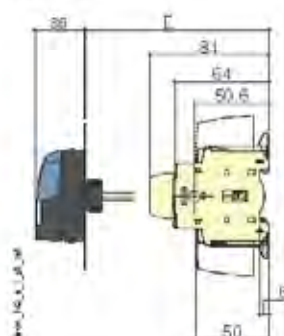
40 to 80 A

Direct operation with handle

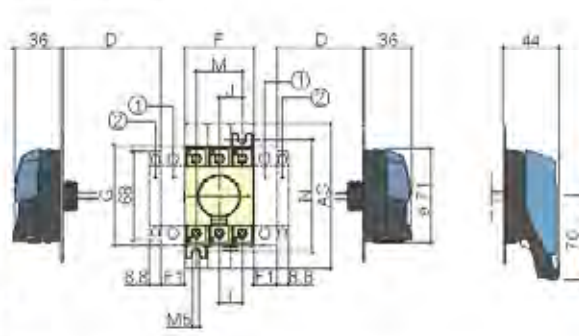


- 1: 1 switched fourth pole module (1 per device max.) or 1 unswitched neutral pole or 1 protective earth module or 1 auxiliary contact
2: 1 auxiliary contact only
Note: Max 4 additional blocks.

External frontal operation



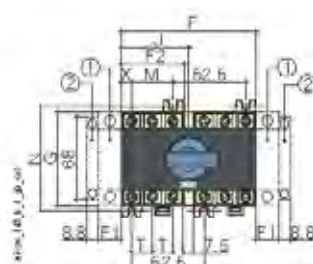
External side operation



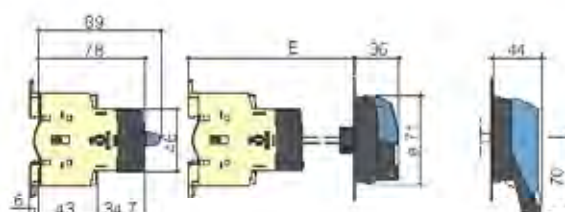
- 1: 1 switched fourth pole module (1 per device max.) or 1 unswitched neutral pole or 1 protective earth module or 1 auxiliary contact
2: 1 auxiliary contact only
Note: Max 4 additional blocks.

Rating (A)	Overall dimensions				Terminal		Switch body		Switch mounting	Connection terminals	
	D min	D max	E min	E max	AC	F	F1	G		N	T
40	30	235	100	372	110	45	15	68	30	75	15
80	30	235	100	372	110	52.5	17.5	76	35	85	17.5

Direct front operation for 6 and 8-pole device



Direct front external operation for 6 and 8-pole load break switches

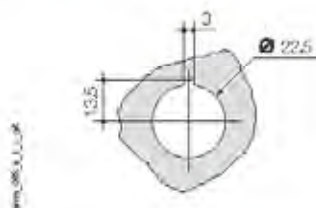


- 1: 1 switched fourth pole module (1 per device max.) or 1 unswitched neutral pole or 1 protective earth module or 1 auxiliary contact
2: 1 auxiliary contact only
Note: Max 4 additional blocks.

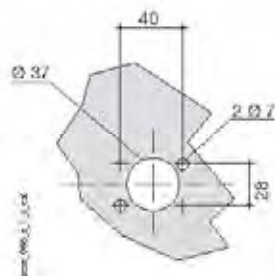
Rating (A)	Overall dimensions		Switch body		Switch mounting		Connection terminals	
	D min	E max	F	F1	F2	G	N	X
40	105	372	97.5	15	45	68	30	7.5
80	105	372	105	17.5	52.5	76	35	8.75

Door drilling - S00

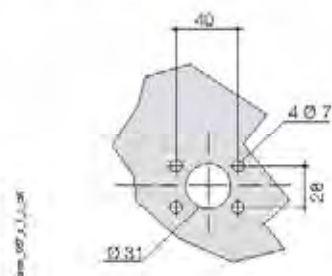
With fixing nut



IP55 - with 2 fixing clips

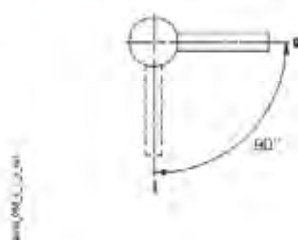


IP65 - with 4 fixing screws

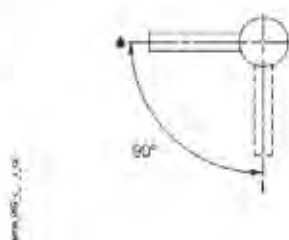


Operating handle - S00

Front and right side operation



Left side operation





What you need to know

- In front direct or external operation, SIRCO DC is available in 3 and 4-pole versions from 125 to 1250 A. The switch can be enclosed in a polyester or sheet metal housing from 125 to 1250 A.

DC disconnecting switch from 40 to 1250 A

Function

SIRCO DC are manually operated multipolar load break switches.

They break on and off under load and provide safety isolation for any low voltage circuit of photovoltaic applications.

General characteristics

- Fully visible breaking.
- Backplate or DIN rail mounting with 45mm cut-out up to 40 A.
- High thermal and dynamic withstand.
- $U_i = 1\,000\text{ VDC}$.



Available on request

- Motorised switch-disconnectors.
- Other ratings: please consult us.
- Enclosed devices: please consult us.

Conformity to standards

- IEC 60947-3
- EN 60947-3
- VDE 0660-107 (1992)
- IEC 60364-4-410 (protection against electric shock)
- IEC 60364-7-712 (building electrical installations - Part 7-712: rules for special installations or placements - Photovoltaic power supplies)
- DIN VDE 0126

References



Front operation

Rating (A)	No. of poles	Switch body	Direct front operation handle	External handle	Shaft extensions for external handle	Auxiliary contacts	Terminal shrouds	Terminal screen	Inter phase barrier	
40 A	3 P		Black 3629 4012 ⁽¹⁾	Type S1 Black IP55 1411 2111 ⁽¹⁾	200 mm 1401 0620 ⁽¹⁾	1 NC contact 3999 0701 ⁽²⁾ 1 NO contact 3999 0702 ⁽²⁾				
	4 P	260C 4004	Red 3629 4013	Black IP65 1413 2111 Red/Yellow IP65 1414 2111	320 mm 1401 0532	1 NO/NC contact 3999 0001 2 NO/NC contacts 3999 0002				
125 A	3 P	260C 3014	Black 2699 5042 ⁽¹⁾	Type S2 Black IP55 1421 2111 ⁽¹⁾	200 mm 1400 1020	1 st NO/NC contact 2699 0031 2 nd NO/NC contact 2699 0032	3 P 2694 3014 ⁽²⁾	3 P 2698 3012 ⁽²⁾	3 P 2998 0033	
	4 P	260C 4014	Red 2699 5043				4 P 2694 4014 ⁽²⁾	4 P 2698 4012 ⁽²⁾	4 P 2998 0034	
250 A	3 P	260C 3026	Black 2699 5052 ⁽¹⁾	Black IP65 1423 2111	320 mm 1400 1032 ⁽¹⁾		3 P 2694 3021 ⁽²⁾	3 P 2698 3020 ⁽²⁾	3 P 2998 0023	
	4 P	260C 4026					4 P 2694 4021 ⁽²⁾	4 P 2698 4020 ⁽²⁾	4 P 2998 0024	
315 A	3 P	260C 3032	Red 2699 5053	Red IP65 1424 2111	500 mm 1400 1050		3 P 2694 3051 ⁽²⁾	3 P 2698 3050 ⁽²⁾	3 P 2998 0013	
	4 P	260C 4032					4 P 2694 4061 ⁽²⁾	4 P 2698 4050 ⁽²⁾	4 P 2998 0014	
630 A	3 P	260C 3064	Black 2799 7012 Red 2799 7013	Type S4 Black IP65 1443 3111 Red/Yellow IP65 1444 3111	200 mm 1401 1520 320 mm 1401 1532 400 mm 1401 1540				3 P 2698 3080	
	4 P	260C 4064							4 P 2698 4080	
800 A	3 P	260C 3081								
	4 P	260C 4081								
1000 A	3 P	260C 3100								
	4 P	260C 4100							3 P 2698 3120	
1250 A	3 P	260C 3121							4 P 2698 4120	
	4 P	260C 4121								

(1) Standard.
(2) For external operation.
(3) Top / bottom.

Handles and shafts

Direct operation handle



Direct front operation handle SIRCO DC 40 A SIRCO DC 125 ... 315 A SIRCO DC 630 ... 1250 A

Rating (A)	Handle colour	Reference
40	Black	3629 40 12
40	Red	3629 40 13
125	Black	2699 50 42
125	Red	2699 50 43
250 ... 315	Black	2699 50 52
250 ... 315	Red	2699 50 53
630 ... 1250	Black	2799 70 12
630 ... 1250	Red	2799 70 13

External operation handle

S1-type handle S4-type handle



Use

The door interlocked external operation includes a padlockable handle, an escutcheon and must be combined with a shaft extension.

Front operation

Rating (A)	Handle	Handle colour	external IP ⁽¹⁾	Reference
40	Type S1	Black	IP65	1411 2111
40	Type S1	Black	IP65	1413 2111
40	Type S1	Red/Yellow	IP65	1414 2111
125 ... 315	Type S2	Black	IP65	1421 2111 ⁽²⁾
125 ... 315	Type S2	Black	IP65	1423 2111
125 ... 315	Type S2	Red/Yellow	IP65	1424 2111
630 ... 1250	Type S4	Black	IP65	1443 3111 ⁽²⁾
630 ... 1250	Type S4	Red	IP65	1444 3111

(1) IP: protection index according to the IEC 60529 standard

(2) Standard

S type handle adapter



Use

Enables new S type handles to be mounted using old fixing holes.

Dimensions

Adds 12 mm to the depth.

Handle colour	external IP ⁽¹⁾	To be ordered in multiples of	Reference
Black	IP65	10	1433 0000

(1) IP: protection index according to the IEC 60529 standard

Alternative S-type handle cover colours



Use

For single lever handles type S1, S2, S3 and double arm lever handle, type S4. Other colours: please consult us.

Handle colour	To be ordered in multiples of	Handle	Reference
Light grey	50	Type S1, S2	1401 0001
Dark grey	50	Type S1, S2	1401 0011
Light grey	50	Type S4	1401 0031
Dark grey	50	Type S4	1401 0041

Shaft extensions for external handle



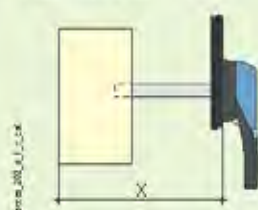
SIRCO DC 40 A shaft



SIRCO DC 125 shaft ... 315 A



SIRCO DC 630 shaft ... 1250 A



Use

Standard lengths:

- 200 mm
- 250 mm
- 320 mm
- 400 mm
- 500 mm
- 750 mm

Other lengths: please consult us

For 3/4 pole

Rating (A)	Dimension X (mm)	Shaft length (mm)	Reference
40	100 ... 245	200 mm	1401 0520
40	100 ... 365	320 mm	1401 0532
250	95 ... 230	200 mm	1400 1020
125	125 ... 300	250 mm	1400 1025
125	125 ... 370	320 mm	1400 1032²⁵
125	125 ... 550	500 mm	1400 1050
125	125 ... 860	750 mm	1400 1075
250	135 ... 265	200 mm	1400 1020
250	135 ... 315	250 mm	1400 1025
250	135 ... 385	320 mm	1400 1032²⁵
250	135 ... 565	500 mm	1400 1050
250	135 ... 880	750 mm	1400 1075
315	165 ... 295	200 mm	1400 1020
315	165 ... 345	250 mm	1400 1025
315	165 ... 415	320 mm	1400 1032²⁵
315	165 ... 695	500 mm	1400 1050
315	165 ... 940	750 mm	1400 1075
630 ... 1250	221 ... 343	200 mm	1401 1520
630 ... 1250	221 ... 463	320 mm	1401 1532²⁵
630 ... 1250	221 ... 543	400 mm	1401 1540

(1) Standard

Other accessories

Shaft guide for external operation



Use

To guide the shaft extension in the external handle.

This accessory enables the handle to engage extension shaft with axis alignment of up to 15 mm.

Required for a shaft length over 320 mm.

Description	Reference
Shaft guide	1429 0000

Door mounting kit

Use

This kit allows easy door mounting for the SIRCO range.

For 3 and 4-pole for frontal direct operation

Rating (A)	No. of poles	Reference
125	3 P	2699 3312
125	4 P	2699 4312
250	3 P	2699 3420
250	4 P	2699 4420

6/8 pole kit



Use

This accessory enables the assembly of 2 SIRCO DC 4x10A switches in order to obtain:

- an 8-pole load break switch;
- a 4-pole combination switch.

For 3 and 4-pole for frontal direct operation

Rating (A)	No. of poles	Reference
40	6/8 pole	3629 7710

Auxiliary contacts



A-type auxiliary contacts



U-type auxiliary contacts



Characteristics

For SIRCO DC 40A: Bifunction type NO/NC auxiliary contact.

- low level from 1 mA and 5 V
- standard up to 5 A and 250 V

For SIRCO DC 1250A:

NO/NC-NC: 1P2 with front and side operation

Connection to the control circuit

6.35 mm fast-on connection

Electrical characteristics

30 000 operations.

Characteristics

Rating (A)	Contact type	Current thermal current (A)	Rated operational current I _o (A)									
			220 VAC		400 VAC		24 VDC			48 VDC		
			AC-12	AC-13/15	AC-12	AC-13/15	DC-12	DC-13	DC-14	DC-12	DC-13	DC-14
125 ... 1250	NO/NC	16	16	4	12	3	2.5	2.5	1	2.5	1.2	0.2
125 ... 1250	NO+NC	16	16	4	16	3	16	5	1	2.5	1.2	0.2

Use

Pre-break and signalling of positions 0 and I.

- 1 to 2 NO/NC auxiliary contacts;
- 1 to 4 NO+NC auxiliary contacts;
- 1 to 2 low level NO/NC auxiliary contacts.

NO/NC contact for 3 and 4 pole SIRCO

Rating (A)	AC position	Type	Reference
40	1*	A-type	3999 0001
40	2**	A-type	3999 0002
125 ... 1250	1*	-	2699 0031
125 ... 1250	2**	-	2699 0032

NO/NC contact for 3 and 4 pole SIRCO

Rating (A)	AC position	Type	Reference
125 ... 1250	1*	-	2699 0141
125 ... 1250	2**	-	2699 0142

Low level NO/NC contact for 3/4 pole SIRCO

Rating (A)	AC position	Type	Reference
125 ... 1250	1*	-	2699 0301
125 ... 1250	2**	-	2699 0302

NO/NC contact for 3 and 4 pole SIRCO

Rating (A)	AC position	Type	Reference
40	1	U-type	3999 0701

NO/NC contact for 3 and 4 pole SIRCO

Rating (A)	AC position	Type	Reference
40	1	U-type	3999 0702

Terminal shrouds



Use

Top or bottom protection against direct contact with terminals or connection parts.

Advantage

Perforations allowing remote thermographic without removal. The terminal shrouds also provide phase separation for SIRCOs from 125 to 315 A.

For 3/4 pole

Rating (A)	No. of poles	Position	Reference
125	3 P	top / bottom	2694 3014
125	4 P	top / bottom	2694 4014
250	3 P	top / bottom	2694 3021
250	4 P	top / bottom	2694 4021
315	3 P	top / bottom	2694 3051
315	4 P	top / bottom	2694 4051

Terminal screen



Use

Top and bottom protection against direct contacts with terminals or connecting parts.

For 3/4 pole

Rating (A)	No. of poles	Position	Reference
125	3 P	top / bottom	2698 3012
125	4 P	top / bottom	2698 4012
250	3 P	top / bottom	2698 3020
250	4 P	top / bottom	2698 4020
315	3 P	top / bottom	2698 3050
315	4 P	top / bottom	2698 4050
630 ... 800	3 P	top / bottom	2698 3080
630 ... 800	4 P	top / bottom	2698 4080
1 000 ... 1 250	3 P	top / bottom	2698 3120
1 000 ... 1 250	4 P	top / bottom	2698 4120

Shrouded distribution block



Use

Easy connection of several equipotential conductors, can be dipped onto a symmetric DIN rail.

Rating (A)	No. of poles	No. of connections per section (mm ²)	Reference
125	3/4-pole	2 x 25 + 7 x 10	5420 4100
125	3/4-pole	2 x 25 + 2 x 16 + 9 x 10	5420 4112

Bottom distribution kit



Use

Easy connection of several equipotential conductors, downstream mounting of the SIRCO DC.

Rating (A)	No. of poles	No. of connections per section (mm ²)	Reference
125	3 P	1 x 95 + 8 x 25	5411 3015
125	4 P	1 x 95 + 8 x 25	5411 4016
250	3 P	1 x 150 + 8 x 50	5411 3025
250	4 P	1 x 150 + 8 x 50	5411 4025
315	3 P	1 x 240 + 8 x 95	5411 3040
315	4 P	1 x 240 + 8 x 95	5411 4040

Cage terminals



Use

Connection of bare copper cables onto the terminals (without spade lugs).

Rating (A)	No. of poles	Reference
125	3 P	5400 3015
125	4 P	5400 4016
250	3 P	5400 3025
250	4 P	5400 4025
315	3 P	5400 3040
315	4 P	5400 4040

Connections

Rating (A)	Cable section flexible (mm ²)	Cable section rigid (mm ²)	flexible bar width (mm)	Splitting over (mm)
125	16 ... 95	16 ... 95	13	22
250	16 ... 185	16 ... 185	18	27
315	16 ... 240	16 ... 300	20	34

Dimensions

Rating (A)	A	A1	C	R	B8	X1	Z
125	47.5	22.5	25	20	8.5	M12	101
250	62	31.5	31.5	25	10.5	M16	114
315	71.5	32	38	32	10.5	M20	115

Inter phase barrier



Use

Safety isolating separation between the terminals.
The terminal blocks also provide phase separation for SIRCOs from 125 to 315 A.

Rating (A)	No. of poles	Reference
125	3 P	2998 0033
125	4 P	2998 0034
250	3 P	2998 0023
250	4 P	2998 0024
315	3 P	2998 0013
315	4 P	2998 0014
630 ... 1250	3 / 4-pole	standard

Handle key interlocking accessories

Fig. 1

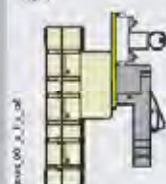


Fig. 2



Fig. 3



Use

Locking in position II of the front operation handle.
- using a padlock (not supplied) and factory integrated into the handle. From 125 to 1250 A, the padlock on the external front operation handle also locks the door.
- using lock (not included): see diagrams opposite.
- using undervoltage coil: the SIRCO can only be closed if the coil is live.

References

Locking using RONIS EL11AP lock (not included)

Rating (A)	No. of poles	Operation	Figure	Reference
125 ... 315	3 / 4-pole	front direct	1	2699 6009⁽¹⁾
630 ... 1250	3 / 4-pole	front direct	2	2699 6027
125 ... 1250	3 / 4-pole	external front	3	1489 7701

(1) Front operation handle included

Locking using 230 VAC undervoltage coil (other voltages: please consult us)

Rating (A)	No. of poles	Operation	Reference
125 ... 315	3 / 4-pole	external front	2699 9063⁽¹⁾
630 ... 1250	3 / 4-pole	front direct	2699 9315⁽¹⁾

(1) The locking system is directly mounted on the switch.

Other special accessories



- Mechanical coupling device for making switches with "n" poles of the same or different ratings.
- Mechanical interlocking device

Enclosed switches



When they are not intended to be mounted in a cabinet, load break, changeover or fuse protection switches are usually delivered enclosed. Located the nearest possible to the operator, they guarantee:

- protection for the inverters and PV generators against overvoltage coupling,
- disconnection under DC load between the inverters and PV generators (necessary according to the IEC 60364-712 standard)

Specialised in load break, changeover and fuse protection, SOCOMEC designs and produces a large number of standard or customised enclosures. This double expertise will allow you to make use of complete systems that meet all your requirements.

Please, feel free to consult us.

Available on request



Our services are regularly sought for producing customised enclosures and panels meeting all your requirements:

- enclosures with simple load break switches,
- enclosed fuse protection switches,
- enclosed changeover switches,
- complete integrated equipment

Available on request:

- sheet metal, insulated, varnished (powder) or brushed stainless steel versions,
- special colours (enclosure, handle),
- customised dimensions,
- customised connections: class II quick connectors.

For any request of customised products, please contact your SOCOMEC agency

Characteristics according to IEC 60947-3

SIRCO DC from 40 to 1250 A

Thermal current I_{th} (40°C)	40 A	125 A	250 A	315 A	630 A	800 A	1000 A	1250 A
Rated insulation voltage U_i (V)	600	600 ⁽¹⁾	600 ⁽¹⁾	1000	1000	1000	1000	1000
Rated impulse withstand voltage U_{imp} (kV)	8	8	8	12	12	12	12	12

Rated operational currents I_n (A)											
Rated voltage	Load duty category	Number of poles of the device	Number of poles in series per polarity	0	0	0	0	0	0	0	0
220 VDC	DC-21 B	3	1	40	125	250	315	630	800	1000	1250
400 VDC	DC-21 B	4	2	40	125	200	250	630	800	1000	1250
600 VDC	DC-21 B	4	2	20	80	100	250	630	800	1000	1250
800 VDC	DC-21 B	4	2	20	60	125	250	630	800	1000	1250

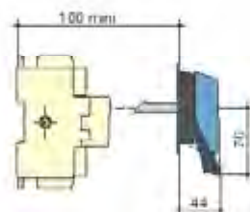
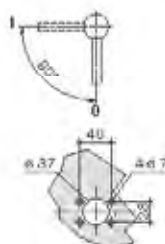
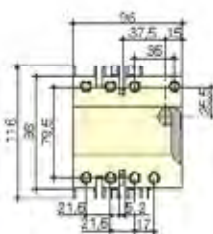
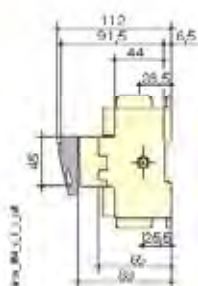
Overload capacity											
Rated short-time withstand current 0.3 s. I_{sw} (kA eff.)	2	15	17	25	50	50	100	100			
Rated short-circuit making capacity I_{sc} (kA peak) ⁽²⁾	5.5	20	30	45	55	55	110	110			

Connection											
Minimum Cu cable section (mm²)	2.5	35	95	150	2 x 185	2 x 185	-	-			
Minimum Cu busbar section (mm²)	-	-	-	-	2 x 40 x 5	2 x 40 x 5	2 x 60 x 5	2 x 60 x 5			
Maximum Cu rigid cable section (mm²)	16	50	150	240	2 x 300	2 x 300	4 x 185	4 x 185			
Maximum Cu busbar width (mm)	-	25	32	40	63	63	100	100			
Min. tightening torque (Nm)	2	9	20	20			40	40			

Mechanical characteristics											
Endurance (number of operating cycles)	20 000	10 000	10 000	5 000	3 000	3 000	4 000	4 000			
Operating effort (Nm)	-	5.5	10	14.5	37	37	55	55			
Weight of 3 P switch (kg)	0.4	1	2	3.5	8	8	12	12			
Weight of 4 P switch (kg)	0.4	1.5	2	4	10	10	15	15			

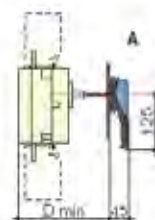
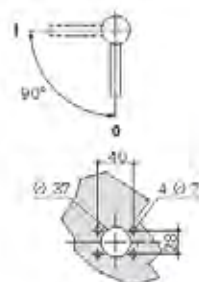
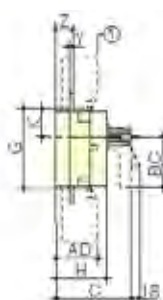
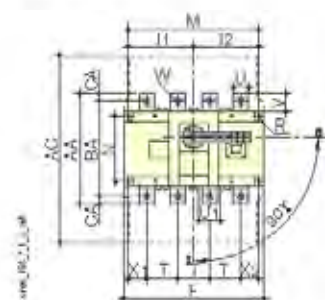
(1) For a rated operation voltage $U_i = 400$ VAC
(2) 1000 VDC if mounted on an insulation plate

Front external operation



SIRCO DC from 125 to 315 A

Front external operation

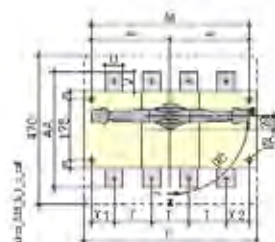


1. Terminal screen
S2-type handle

Rating (A)	Overall dimensions		Terminal blocks		Switch body										Switch housing				Connection terminals												
	C	H min	AC	AD	F 3p	F 4p	G	H	J1 3p	J1 4p	J2	K	OC	M 3p	M 4p	N	P	T	U	U1	V	W	X1 3p	X1 4p	X2	Y	Z	AA	BA	AC	
125	120	125	225	50	140	170	93	65	45	75	75	31.5	90	120	190	65	5.5	36	20	20.5	25	9	20	22	20	2.5	20.5	135	115	10	
250	125	135	280	60	180	230	108	75	55	105	105	34	115	160	210	80	5.5	50	25	25.5	30	11	33	33	27	3.5	22.5	180	130	15	
315	160	165	401	89	220	290	170	110	75	135	135	5.5	115	210	270	140	7	60	32	45.5	37.5	11	42	37	37.5	5	36	225	200	15	

SIRCO DC from 630 to 1250 A

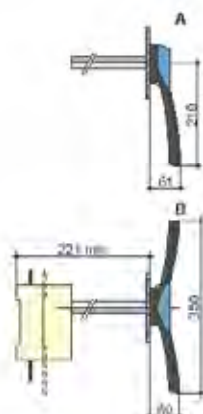
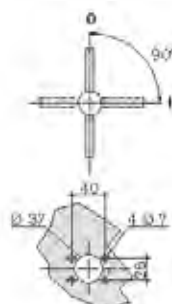
Front direct operation



- 1 Terminal screen
- 53 type handle
- 54 type multilayer handle



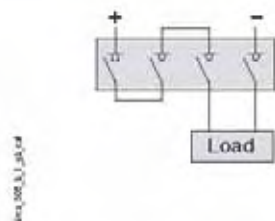
Front external operation



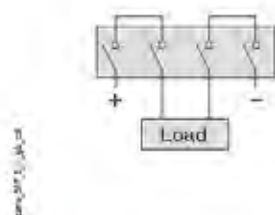
Rating (A)	Switch body		Switch mounting		Connection terminals							
	F3p	F4p	M3p	M4p	T	II	V	V	X1	X2	Z	AA
630	280	360	255	335	60	50	60.5	7	47.5	47.5	46.5	321
800	280	360	255	335	60	50	60.5	7	47.5	47.5	46.5	321
1000	372	492	347	467	120	90	44	8	53.5	53.5	47.5	288
1250	372	492	347	467	120	90	44	8	53.5	53.5	47.5	288

Pole connection in series

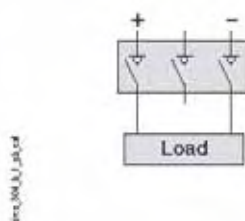
4 pole - top / bottom



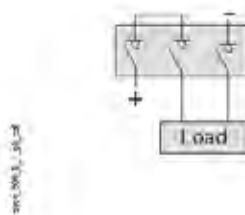
4 pole - bottom / bottom

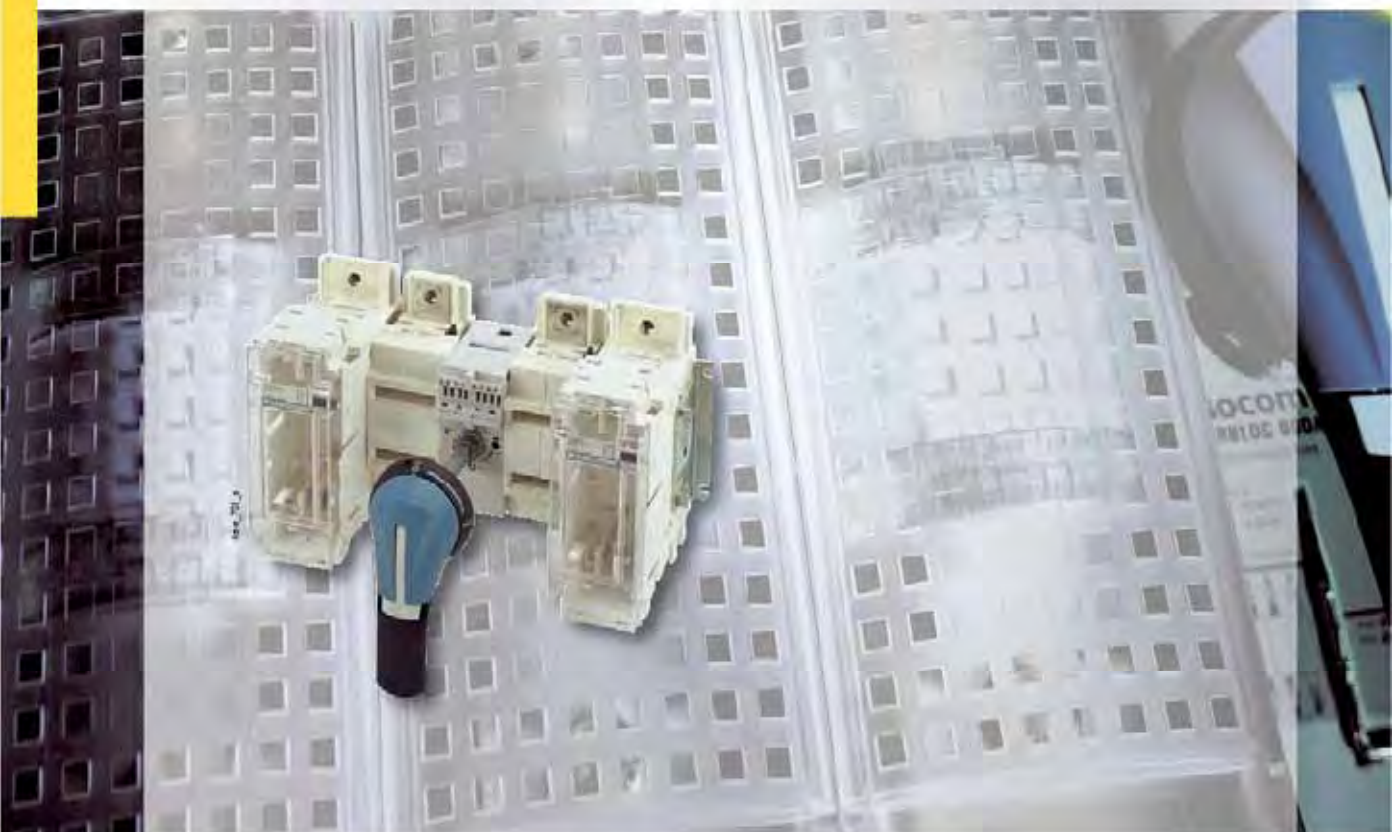


2 pole - top / bottom



3 poles





Manually operated fuse combination switches for PV applications

Function

FUSERBLOC DC is a manually operated multipolar fuse combination switch. They break or switch off on load and provide safety isolation and protection against overcurrent for any low voltage electrical circuit.

General characteristics

- Visible double breaking.
- Double break by phase (top and bottom of fuse).
- Protection against overcurrent by UR fuse circuit-breakers with high breaking capacity.
- IP2 protection with terminal shrouds.
- Up to 8 auxiliary contacts.

What you need to know

- Along with the FUSERBLOC rating, the choice depends on the fuse normative and functional specifications. SOCOMEC FUSERBLOC DC must be equipped with UR 11KN / 110 - 400 A - 1250 V fuses.
- The 1 and - poles of the UR fuse base are equipped with a SIDER ND breaking device. Connecting the SIDER ND in parallel increases the arc interruption capacity. The arc is thus interrupted in 8 points.

Please consult us:

- TEST position for testing control circuits without power using U type auxiliary contacts.
- FUSERBLOC DC can be configured according to your requirements. Possibility to group the breaking and the fuse modules.
- centred or offset external front operation.
- external side operation.
- other ratings.

Conformity to standards

- EN 60947-3
- IEC 60947-3
- IEC 60269-1
- IEC 60269-2
- IEC 60364-4-410 (protection against electric shock)
- IEC 60364-7-712 (building electrical installations - Part 7-712 : rules for special installations or placements - Photovoltaic power supplies)

References



FUSERBLOC DC

Rating (A) fuses	No. of poles	External right-hand side or front operation switch (switch body only)	External front handle	Shaft extensions for external handle	Fuse protection covers	Auxiliary contact prebreak and position in external front operation	Terminal shrouds
250 A ⁽¹⁾	4 P	38DC 1024	Type S2	1400 1032	2 P 3990 2839 ⁽²⁾	1 NC contact 3999 0701 1 NO contact 3999 0702	4 P 3988 4025
			Black IP55 1421 2111	320 mm 10 x 10			
			Black IP65 1423 2111	1400 1050 500 mm 10 x 10			
			Red IP65 1424 2111				

(1) Equipped with UR fuses.

(2) FUSERBLOC protection cover equipped with fuses with auxiliary contacts for fuse blown indication.

Accessories

Handles and shafts

Door interlocked external operation

S2-type handle.



For front operation

Rating (A)	Handle colour	Handle	external IP ⁽¹⁾	Reference
250	Black	Type S2	IP65	1421 2111 ⁽²⁾
250	Black	Type S2	IP65	1423 2111
250	Red	Type S2	IP65	1424 2111

(1) IP : protection index according to the IEC 60529 standard.

(2) Standard.

Shaft guide for external operation



Use

To guide the shaft extension in the external handle.

This accessory enables the handle to engage extension shaft with a misalignment of up to 15 mm.

Designed for a shaft length over 320 mm.

Description	Reference
Shaft guide	1429 0000

S type handle adapter



Use

Enables new S type handles to be mounted using old fixing holes.

Dimensions

Adds 12 mm to the depth.

Handle colour	external IP ⁽¹⁾	To be ordered in multiples of	Reference
Black	IP65	10	1401 0000

(1) IP : protection index according to the IEC 60529 standard.

Alternative S-type handle cover colours

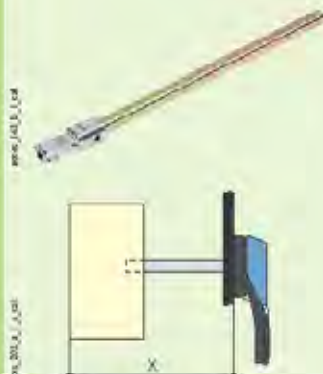


Use

S2 type single lever handle
Other colours : please consult us.

Handle colour	To be ordered in multiples of	Handle	Reference
Light grey	50	Type S1, S2	1401 0001
Dark grey	50	Type S1, S2	1401 0011

Shaft extensions for external handle



Use

Standard lengths:

- 200 mm,
- 320 mm,
- 500 mm,

Other lengths: please consult us.

For front operation

Rating (A)	Dimension X (mm)	Shaft length (mm)	Type	Reference
250	95 ... 230	200 mm	10 x 10	1400 1020
250	95 ... 350	320 mm	10 x 10	1400 1032 ⁽¹⁾
250	95 ... 530	500 mm	10 x 10	1400 1050

(1) Standard.

Other accessories

Pre-break and signalling auxiliary contact for front operation



Use
Pre-break and position 0 and I signalling.
1 to 4 NO or NC auxiliary contacts.

Connection to the control circuit
5.35 mm fast-on connection.
Electrical characteristics
30 000 operations.

NC contact

Rating (A)	AC position	Reference
250	1 to 4	3999 07 01 ²⁴

(1) For external operation.

NO contact

Rating (A)	AC position	Reference
250	1 to 4	3999 07 02 ²⁴

(1) For external operation.

Characteristics

Rating (A)	Contact type	Nominal current (A)	Rated operational currents I _n (A)			
			250 VAC AC-13	400 VAC AC-13	24 VDC DC-13	48 VDC DC-13
250	NO	10	6	4	5	3
250	NO	10	6	4	5	3

Signalling auxiliary contact for front operation - Type 5



Use
Position 0 and I signalling 1 to 4 NO+NC
auxiliary contacts.
Connection to the control circuit
By terminals with max. section 10 mm².

Electrical principle
The NO+NC S-type auxiliary contacts can
be configured as 2 NO or 2 NC.
Electrical characteristics
30 000 operations.

NO+NC contact

Rating (A)	AC position	Reference
250	1	3999 00 41

Characteristics

Rating (A)	Contact type	Nominal current (A)	Rated operational currents I _n (A)			
			250 VAC AC-13	400 VAC AC-13	24 VDC DC-13	48 VDC DC-13
250	NO + NC	20	10	8	-	-

Terminal shrouds



Use
Top or bottom protection against direct
contact with terminals or connection
parts.

Advantage
Perforations allowing remote
thermographic without removal
parts.

Rating (A)	Type	Position	Reference
250	Breaking module	top / bottom	3999 40 25

Cage terminals



Use

Connection of bare copper cables onto the terminals (without spade lugs)

Rating (A)	Type	Reference
250	Breaking module	5400 40 25
250	Fuse module	5400 40 40

Connections

Rating (A)	Cable section flexible (mm²)	Cable section rigid (mm²)	Width flexible bar (mm)	Stripped wire (mm)
250	16 - 185	16 - 185	18	27
250	60 - 240	60 - 300	20	34

Dimensions

Rating (A)	A	A1	C	B	B1	X1	Z
Breaking module	62	31,5	31,5	25	10,5	16	14
Fuse module	71,5	32	38	32	10,5	16/20	15

Handle key interlocking accessories

Fig. 1

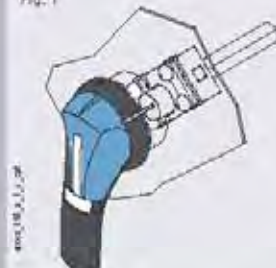
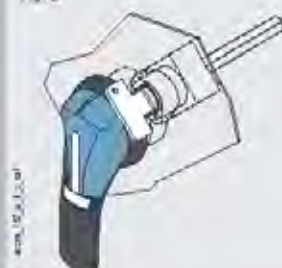


Fig. 2



Use

Locking in position 0 of the front operation handle:

- using RONIS EL11AP or CASTELL type K-type lock in external front operation (Fig. 1);
- using CASTELL PS-type locks in external front operation (Fig. 2).

Locking using **RONIS EL11AP** lock (not included)

Rating (A)	Operation	Figure	Reference
250	external front	3	1499 77 01

Locking using **type K CASTELL** lock (not included)

Rating (A)	Operation	Figure	Reference
250	external front	3	1499 77 02

Locking using **type PS CASTELL** lock (not included)

Rating (A)	Operation	Figure	Reference
250	external front	4	1499 77 03

Other special accessories



- Mechanical coupling device for making switches with "n" poles of the same or different ratings.
- Mechanical interlocking device.
- Mechanical pliers and rescutters for standard systems.

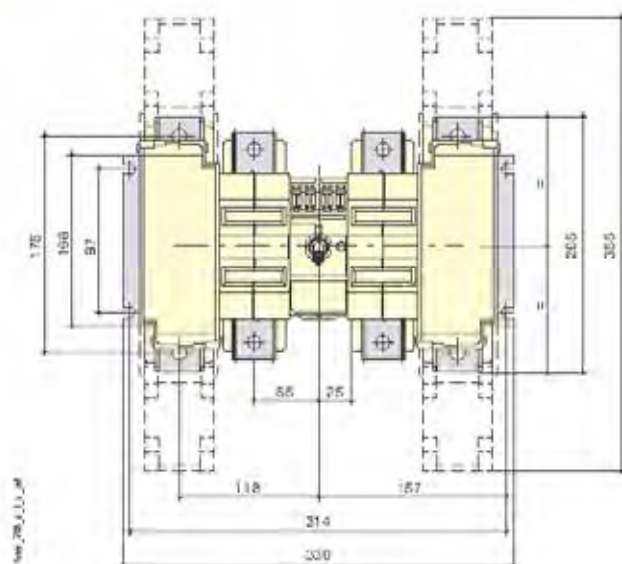
Electrical characteristics

FLISERBLOC DC 250A characteristics

Current I _B	250 A
Rated insulation voltage	1 000 VDC
Rated voltage	750 VDC
Rated current I (A)	120 A
Load duty category	DC-2/1 B

(7) 1000 VDC if manufacturer can not provide other data

➤ Dimensions





Modular circuit breaker 10 x 38 for PV application

Function

RM PV are modular unipolar or bipolar fuse disconnecting switches PV type cylindrical fuses 10x38. They provide safety disconnection and protection against overcurrents in any low voltage electrical photovoltaic circuit on the DC side. RM: fuse disconnect switches without signalisation (for fuses without striker).

General characteristics

- Rated voltage of 1000 VDC.
- Omnipolar and simultaneous breaking
- High dielectric strength.
- Modular DIN 45 mm cut-out.
- Self-extinguishing thermoplastic material.
- High capacity connection.

Conformity to standards

- IEC 60947-3
- IEC 60269-2-1
- IEC 60269-1
- IEC 60269-2
- NF EN 60269-1
- NF C 93-210
- NF C 63211
- VDE 0636-10
- DIN 43620

Approvals and certifications ⁽¹⁾

(1) Please consult us.

References



32 A
10 x 38
Reference
560C 0015
560C 0020

RM - Device without signalisation

No. of poles	To be ordered in multiples of
1 P	12
2 P	6

Accessories

Coupling system



Use

To link together multiple single-pole RM

Coupling system for RM

Rating (A)

32

Reference

5604 0003⁽¹⁾⁽²⁾

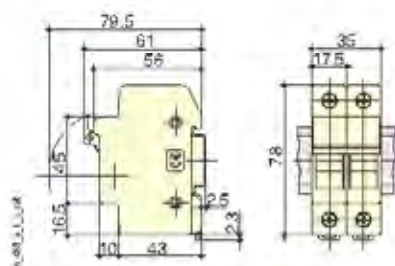
(1) A coupling up allows to couple 2 RM10x38
(2) 1 reference = 1 batch of 10 coupling systems

Characteristics according to IEC 60947-3

Thermal current I_n (20 °C)	32 A
Fuse size	10 x 38
Rated insulation voltage U (V)	1000
Fuse rating (A)	
Fuse rating (A)	4 to 20
Rated conditional short-circuit current with gG fuse	
Assumed short-circuit current (kA eff.) ⁽¹⁾	1.25 ⁽¹⁾
Design current derating coefficient for N pole side by side	
N = 1 ... 3	1
N = 4 ... 6	0.8
N = 7 ... 9	0.7
N ≥ 10	0.6
Connection	
Minimum Cu cable section (mm ²)	4
Maximum Cu rigid cable section (mm ²)	25 ⁽¹⁾ / 10 ⁽²⁾
Mechanical characteristics	
Weight of 1 P (kg)	0.1

(1) For a rated insulation voltage (U_n) = 400 V AC (2) Flexible cable (3) Rigid cable

Dimensions





PV fuses 10 x 38 gR 900 V DC for photovoltaic application

Function

SOCOMEC PV fuses protect installations and people from overcurrents in any PV installation low voltage electrical circuit.

Benefits

Performance

- Rated breaking capacity 30 kA under 900 V DC.
- High short circuit limitation capacity
- Simple and reliable discrimination

Reliability

- Absolute protection over time guaranteed by the simplicity of manufacture and function (Joule effect).

Safety

- The energy given off whilst eliminating the fault is contained within the cartridge.

Conformity to standards

- IEC 60947-3
- IEC 60269-1
- IEC 60269-2
- IEC 60269-2-1
- NF EN 60269-1
- NF C 93-210
- NF C 63211
- VDE 0636-10
- DIN 43620

Approvals and certifications⁽¹⁾

(1) Please consult us.



What you need to know

When to protect?

Up to three strings in parallel, protection against overvoltage will not be necessary if the cable section is sized to withstand at least $1.25 I_{oc} (stc)$ of the panels.

However, starting from 4 strings, the overvoltage current, although weak, may heat up the cables and therefore, must be removed.

How to protect?

The polarities cannot be earthed, therefore, it is essential to place a fuse on each polarity of each string.

Very high voltages

In a string, several photovoltaic modules are connected in series in order to obtain the desired DC voltage. These voltages are increasingly higher.

The fuse operating voltage must be 1.15 times the no-load voltage of the panels connected in series ($1.15 \times V_{oc} (stc) \times M$). Our fuses have been designed to operate up to 900 volts.

Weak overvoltage currents

As for PV panels, the short-circuit values generated in case of a fault are from two to three times the nominal current. Standard fuses are not suitable for this kind of protection and therefore, cannot be used.

These weak overvoltage values require the development of fuses capable of removing this type of fault.

Choosing the fuse rating

The fuse rating must be between 1.5 and 2 times the $I_{oc} (stc)$ current of each string.

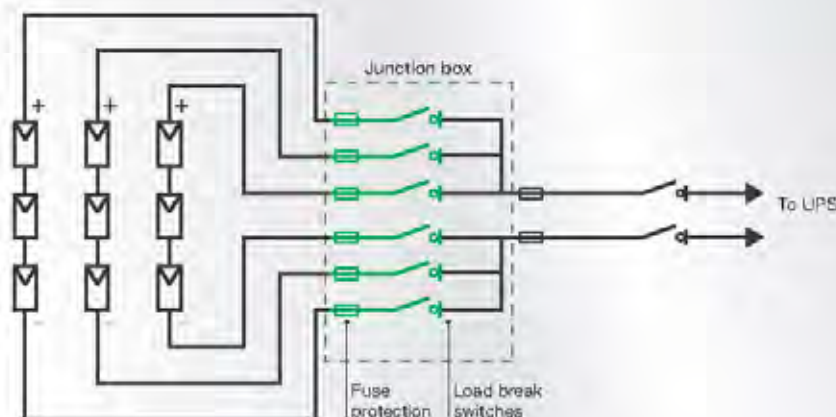
Choosing the cable

The cable must withstand a current over or equal to the cable fusing current.

Information for an effective protection

- M, number of modules in series
- N, number of strings in parallel
- $I_{oc} (stc)$, string fault current
- $V_{oc} (stc)$, open circuit voltage

stc: Standard Test Condition



References

PV 900 V DC fuses - Size 10 x 38

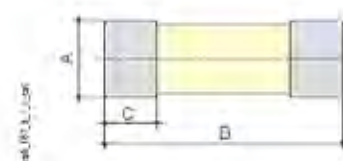


PV fuses
(in multiples
of 10)

Rated current I (A)	Rated voltage U DC (V)	Dissipated power		Breaking capacity	PI pre arc (A ² s)	PI total 900 V (A ² s)	To be ordered in multiples of	Reference
		W at 1n	W at 0,8 In					
4	900	1.10	1.05	30 kA	4	15	10	600C 0004
6	900	1.45	2.50	30 kA	9	42	10	600C 0006
8	900	0.95	1.60	30 kA	12	49	10	600C 0008
10	900	1.25	2.15	30 kA	19	69	10	600C 0010
12	900	1.40	2.40	30 kA	28	97	10	600C 0012
16	900	1.80	3.10	30 kA	48	178	10	600C 0016
20	900	2.20	3.60	30 kA	69	249	10	600C 0020

Normative dimensions (mm) according to IEC 60269-2-1

PV 10 x 38
without striker



Size	Striker	A	B	C
10 x 38	no	10.3	38	10.5



Zoom



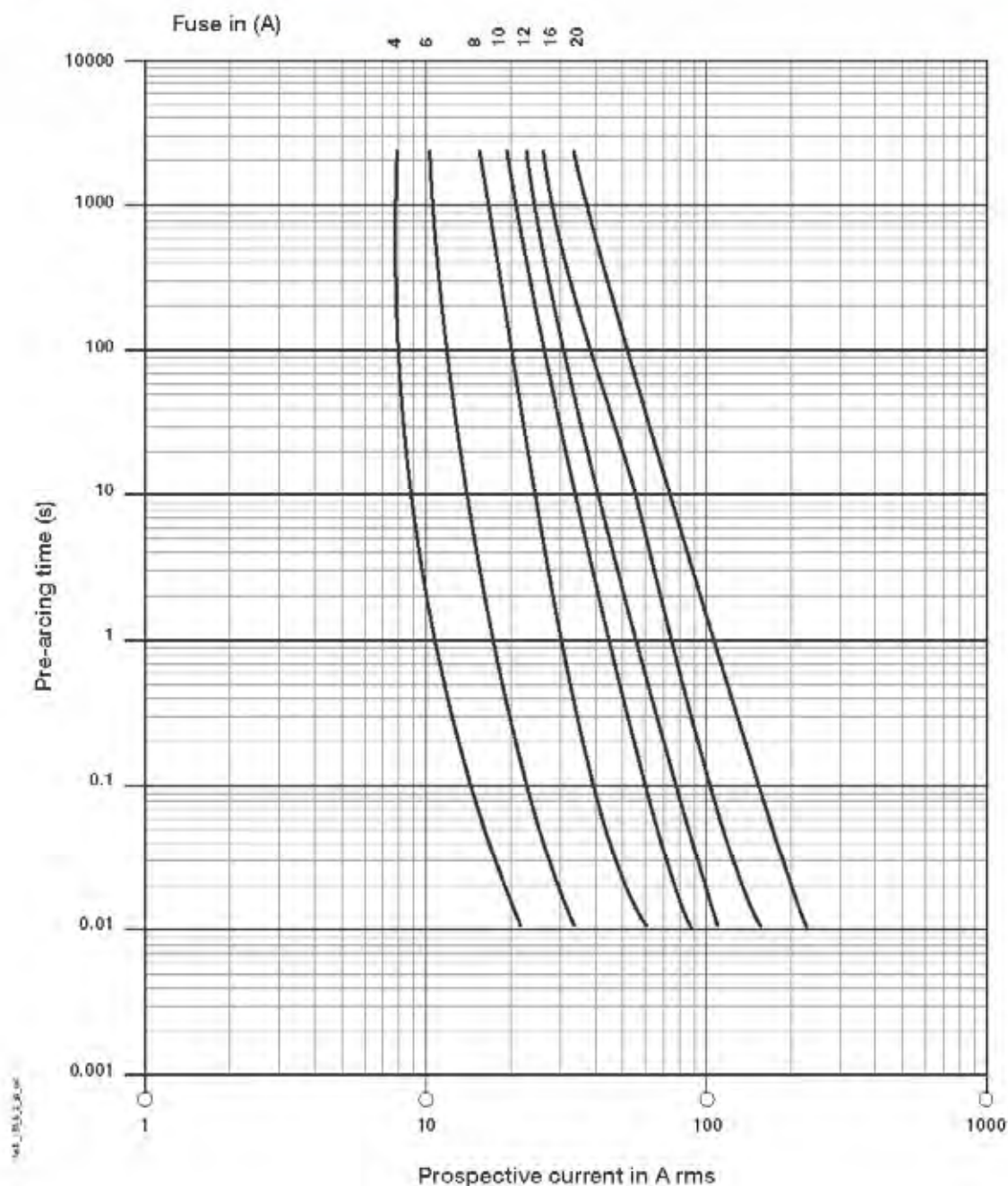
Fuse protection offers undeniable advantages in relation to the circuit-breaker in a large number of industrial applications. With an experience of over 85 years, SOCOMEC offers a range of switches and components useful for building a complete fuse protection solution.

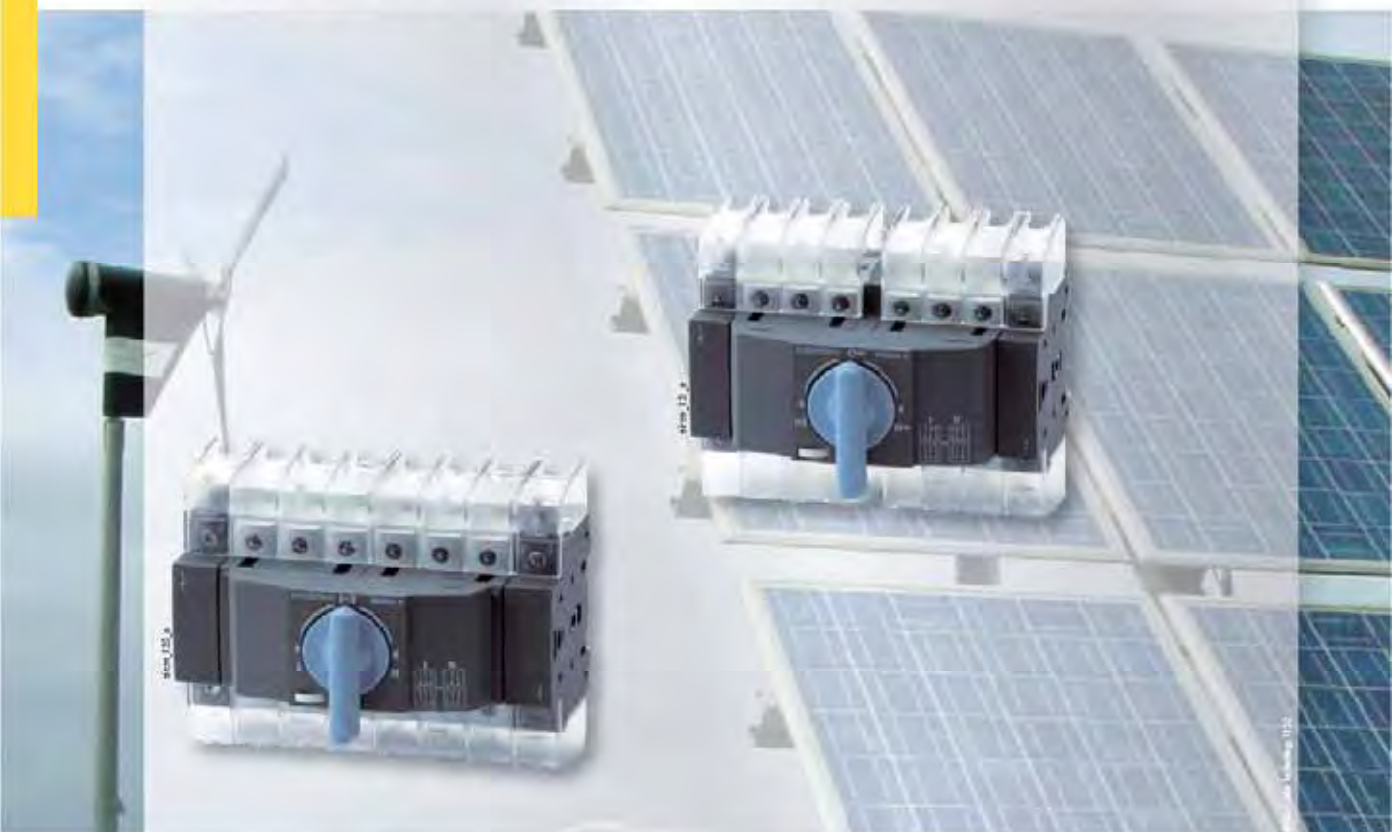
Designing an installation with fuse protection.
How to calculate a fuse protection.

The **INSTALFUSE** software carries out sizing calculations for low-voltage installations and fuse protection. Please consult us.

Characteristics of the time/current operation for PV fuses

PV 10 x 38





Manually operated changeover switches for 40 and 80 A photovoltaic applications

Function

SIRCOVER M DC are manually operated multipolar changeover switches. They are a combination of two SIRCO MDC load break switches and a changeover escutcheon. They provide changeover, source inversion or switching under load between two low voltage power circuits, as well as safety isolation.

General characteristic

- Modular and modifiable device.
- Fully visible breaking.
- Double break per phase.
- DIN rail/back plate mounted or mounted on modular panel with a 45 mm front cut-out.

Available on request

- Other ratings: please consult us.
- Enclosed devices: please consult us.

Applications

The choice of the material cannot be separated from the concept of energy management.

The numerous applications may require continuous power supply during a PV generator fault, in case of electrification of isolated sites, in developing countries, in telecommunications or pumping. SIRCOVER M DC changeover switches ensure source inversion or switching under load between two circuits.

Example:

Switching from DC to AC photovoltaic grid.



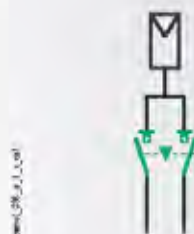
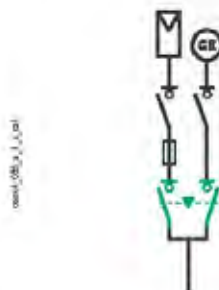
What you need to know

Application with two interlocked switches that can be used in isolated sites.

Source transfer, manual changeover between two photovoltaic sources or a photovoltaic source and a generator set.

Equipment earthing as for a string of photovoltaic panels.

Load inverter, switching the power supply from one load to another in order to guarantee continuous power supply during maintenance operations.



Please do not hesitate to contact us for suggestions or any special requirement. We adapt our products to your specific requirements.

References



SIRCOVER M DC

Rating (A)	No. of poles	Switch body	Escutcheon	External front handle	Shaft extensions for external handle	4th pole	Auxiliary contacts	Terminal shrouds
40 A	3 P	22DC 3004 ⁽¹⁾	changeover I, 0, II 2209 6009 ⁽²⁾	Type S00 I - 0 - II Black IP65 1473 1113	150 mm 1407 0515 200 mm 1407 0520	1 P 22DC 1004	Type M 1 NO + NC auxiliary contact 2299 0001	1 P 2294 1005 ⁽³⁾ 3 P 2294 3005 ⁽³⁾
80 A	3 P	22DC 3008	I - I+II - II 2299 6009 ⁽²⁾	I - I+II - II Black IP65 1473 1114	320 mm 1407 0532		Type M 1 - 2 NC auxiliary contact 2299 0011	1 P 2294 1009 3 P 2294 3009

(1) For a 3-pole direct operation SIRCOVER M DC, you need to order 2 SIRCOVER M DC load break switches + a I-0-II or I-I+II-II changeover escutcheon.

(2) Top / bottom.

(3) Delivered with direct handle.

Accessories

Escutcheon



Escutcheon for 3 and 4-pole changeover switches

Use

The escutcheon allows combining two 3-pole SIRCOVER M DC switches (+ additional pole) in order to obtain a 3 or 4-pole front operator SIRCOVER M DC changeover switch.

For SIRCOVER M DC

Rating (A)	Type	Reference
40 ... 80	I - 0 - II	2209 6009
40 ... 80	I - I+II - II	2299 6009

Door interlocked external operation

S00 handle



Use

Compact and robust, the new "S" type rotary handle enables the switch to be operated with a front external handle.

Front operation

Rating (A)	Handle colour	Handle	External IP	Type	Reference
40 ... 80	Black	Type S00	IP65	I - 0 - II	1473 1113
40 ... 80	Black	Type S00	IP65	I - I+II - II	1473 1114

Shaft extensions for external handle



Use

Standard lengths:
- 150 mm
- 200 mm
- 320 mm
Other lengths: please consult us.

For SIRCOVER M DC

Rating (A)	Shaft length (mm)	Reference
40 ... 80	150	1407 0515
40 ... 80	200	1407 0520
40 ... 80	320	1407 0532

Other accessories

4th pole



Use

The main poles are directly mounted on the right and on the left hand side of the 3-pole changeover switch, thus transforming it into a 4-pole switch.

For SIRCOVER M DC

Rating (A)	No. of poles	Type	Reference
40	1 P	switched	220C 1004
80	1 P	switched	220C 1008

M type auxiliary contacts



Auxiliary contact configuration for SIRCOVER M DC

Use

These auxiliary contacts with pre-break and signalisation of positions 0 and I are available in NO+NC or 2 NC versions. They allow anticipating the main poles interruption. They can be mounted on the right or on the left side of the device. You can add up to 4 auxiliary contacts (2 modules).

Characteristics

NO+NC auxiliary contact (PC with front operation)

For SIRCOVER M DC

Rating (A)	Contact position	Type of auxiliary contact	Reference
40 ... 80	1 AC	NO + NC	2299 0001
40 ... 80	1 AC	2 NC	2299 0011

Characteristics

Contact type	Nominal current (A)	Rated operational currents I _n (A)	
		230 VAC	AC-15
NO+NC	10	10	6

Terminal shrouds



Use

In batches of 2, they guarantee protection against misuse and downstream against direct contact with the switch.

Preferably allowing remote thermographic inspection without removal.

For SIRCOVER M DC

Rating (A)	No. of poles	Position	Reference
40	1 P	Top and bottom	2294 1005
40	3 P	Top and bottom	2294 3005
80	1 P	Top and bottom	2294 1009
80	3 P	Top and bottom	2294 3009

Enclosed switches

When they are not intended to be mounted in a cabinet, load break, changeover or fuse protection switches are usually delivered enclosed. Located the closest possible to the operator, they guarantee:

- protection for the inverters and PV generators against overvoltage coupling, disconnection under DC load between the inverters and PV generators (necessary according to the IEC 60364-712 standard)

Specialised in load break, changeover and fuse protection, SOCOMEC designs and produces a large number of standard or customised enclosures. This double expertise will allow you to make use of complete systems that meet all your requirements.

Available on request



Our services are regularly sought for producing customised enclosures and panels meeting all your requirements:

- enclosures with simple load break switches;
- enclosed fuse protection switches;
- enclosed changeover switches;
- complete integrated equipment.

For any request of customised products, please contact your SOCOMEC agency.

Characteristics according to IEC 60947-3

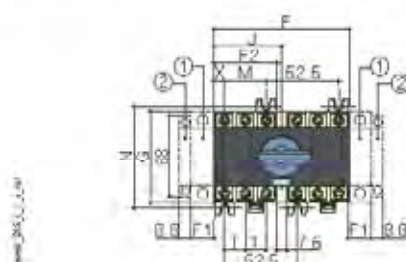
Thermal current I_{th} 40°C				40 A	80 A
Rated insulation voltage U_i (V)				800	800
Rated impulse withstand voltage U_{imp} (kV)				8	8
Rated operational currents I_n (A)					
Rated voltage	Load duty category	Number of poles of the device	Number of poles in series per polarity	8	8
48 VDC	DC-21 B	3 P	1 P	40	80
220 VDC	DC-21 B	3 P	1 P	32	40
400 VDC	DC-21 B	4 P	2 P	32	40
440 VDC	DC-21 B	4 P	2 P	32	40
500 VDC	DC-21 B	4 P	2 P	32	40
Overload capacity					
Rated short-time withstand current $I_{ts} \leq I_n$ (kA off)				2,5	3
Rated short-circuit making capacity I_{cc} (kA peak)				6	9
Connection					
Minimum Cu cable section (mm²)				1,5	2,5
Minimum Cu cable section (mm²)				16	35
Tightening torque min./max./N·m				2/2,2	0,5/0,85
Mechanical characteristics					
Endurance (number of operating cycles)				100 000	100 000
Operating effort (Nm)				0,8	1
Weight of 3 P switch (kg)				0,16	0,26

(1) For a rated operation voltage $U_n = 400$ VAC.

Dimensions

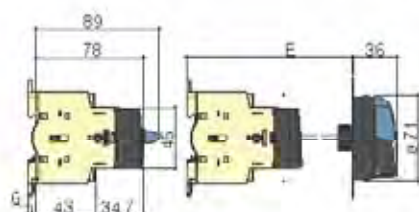
SIRCOVER M DC 40 to 80 A

Direct front operation for 3 and 4-pole changeover switches



1. Location for 1 main pole (maximum 1 per switch) or 1 auxiliary contact.
2. Location for 1 auxiliary contact only.

External front operation for 3 and 4-pole changeover switches



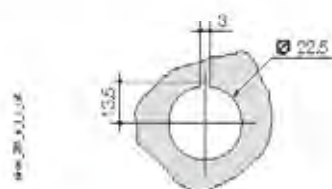
Note: the total number of additional modules is maximum 34.

Rating (A)	Overall dimensions		Switch body				Switch mounting		Connection terminals	
	E min	E max	F	F1	h	J	M	W	T	X
40	105	372	97,5	15	60	48,75	30	75	15	7,5
80	105	372	105	17,5	76	52,5	35	65	17,5	8,75

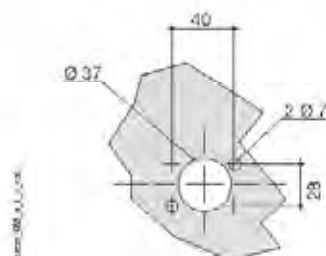
Door drilling - S00

SIRCOVER M DC 40 to 80 A

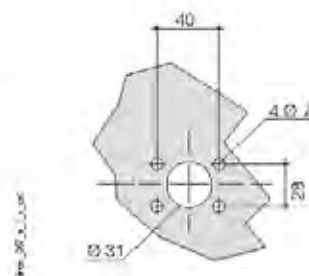
With nut mounting



IP55 - with 2 fixing clips



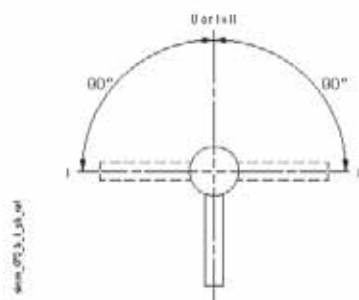
IP65 - with 4 fixing screws



Operating handle - S00

SIRCOVER M DC 40 to 80 A

Front operation for SIRCOVER I - 0 - II or I - II or I - II - II changeover switches





Manually operated changeover switch for PV applications from 125 to 1250 A

Function

SIRCOVER DC products are manually operated multipolar changeover switches. They ensure source inversion or changeover under load of two photovoltaic installation circuits.

General characteristics

- 3 stable positions (I, 0, II) and ease to switch from one to the other under load (DC-21)
- Disconnection by fully visible breaking.
- IP20 device and accessories.

What you need to know

- On models with 3 stable positions (I-0-II), SIRCOVER DC switches are available in the 3 and 4-pole versions from 125 to 1250 A. They can come in sheet steel or coilframe 1016 or polyester enclosures from 125 to 1250 A.
- SIRCOVER DC are available with direct front or external operation.

Conformity to standards

- IEC 60947-3
- EN 60947-3
- VDE 0660-107 (1992)
- NEN EN 60047-3
- BS EN 60947-3

Available on request

- For 8/8 pole switches.
- SIRCOVER DC I-H-II
- SIRCOVER DC BY-PASS
- Other ratings



Application

The choice of the material cannot be separated from the concept of energy management.

The numerous applications may require continuous power supply during a PV generator fault, in case of electrification of isolated sites, in developing countries, in telecommunications or pumping. **SIRCOVER MDC** changeover switches ensure source inversion or switching under load between two circuits.

Example:

Switching from DC to AC photovoltaic grid.

Source transfer, manual changeover between two photovoltaic sources or a photovoltaic source and a generator set.



sirel_008_00_00_00

Equipment earthing as for a string of photovoltaic panels.



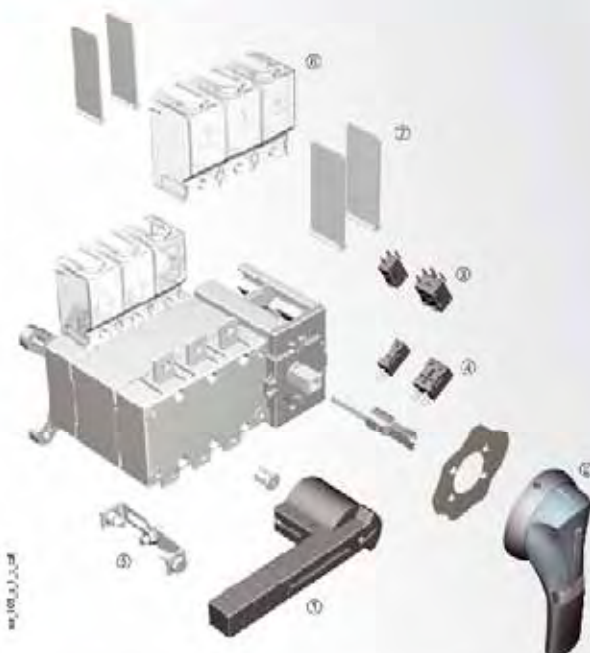
sirel_008_00_00_00

Load inverter, switching the power supply from one load to another in order to guarantee continuous power supply during maintenance operations.



sirel_008_00_00_00

Principle diagram



sirel_008_00_00_00

1. Direct front handle
2. Door interlocked external front handle
- 3 and 4. auxiliary contacts
5. Bridging bar
6. Terminal shrouds
7. Inter phase barrier



SIRCOVER DC I-O-II

Rating (A)	No. of poles	Switch body	Direct operation handle	External handle	Shaft extensions for external handle	Bridging bar	Auxiliary contacts	Terminal shrouds	Terminal screen
125 A	3 P	41DC 3013	Black 4109 6012 ⁽¹⁾	Type S2 Black IP55 1421 2113 ⁽¹⁾	200 mm 1400 1020 320 mm ⁽¹⁾ 1400 1032 ⁽¹⁾	3 P 4109 3019	1st / 2nd NO/NC auxiliary contact 4109 0021 ⁽²⁾	3 P 2694 3014 ⁽³⁾	3 P 1509 3012 ⁽⁴⁾
	4 P	41DC 4013				4 P 4109 4019		4 P 2694 4014 ⁽³⁾	4 P 1509 4012 ⁽⁴⁾
250 A	3 P	41DC 3025				3 P 4109 3025		3 P 2694 3021 ⁽³⁾	3 P 1509 3025 ⁽⁴⁾
	4 P	41DC 4025				4 P 4109 4025		4 P 2694 4021 ⁽³⁾	4 P 1509 4025 ⁽⁴⁾
315 A	3 P	41DC 3032				3 P 4109 3050		3 P 2694 3051	3 P 1509 3063
	4 P	41DC 4032				4 P 4109 4050		4 P 2694 4051	4 P 1509 4063
630 A	3 P	41DC 3053	Black 2709 7052 ⁽¹⁾	Type S4 Black IP65 1443 3113 ⁽¹⁾	200 mm 1401 1520 320 mm 1401 1532 ⁽¹⁾	3 P 4109 3080			3 P 1509 3080 ⁽⁴⁾
	4 P	41DC 4053				4 P 4109 4080			4 P 1509 4080 ⁽⁴⁾
800 A	3 P	41DC 3080				3 P 4109 3160			3 P 1509 3160 ⁽⁴⁾
	4 P	41DC 4080				4 P 4109 4160			4 P 1509 4160 ⁽⁴⁾
1000 A	3 P	41DC 3100				3 P 4109 3160			3 P 1509 3160 ⁽⁴⁾
	4 P	41DC 4100				4 P 4109 4160			4 P 1509 4160 ⁽⁴⁾
1250 A	3 P	41DC 3120				3 P 4109 3160			3 P 1509 3160 ⁽⁴⁾
	4 P	41DC 4120				4 P 4109 4160			4 P 1509 4160 ⁽⁴⁾

(1) Standard.

(2) 2 pieces: one in position I and the other in position II.

(3) For universal front, rear, top and bottom protection reference is required.

(4) For top and bottom protection, 2 references are required.

(5) 2 pieces: one for top side and another for bottom side.

Accessories

Handles and shafts

Direct operation handle



Rating (A)	No. of poles	Handle colour	Handle type	Reference
125 ... 315	3 / 4-pole	Black	Single lever	4199 5012
630 ... 1250	3 / 4-pole	Black	Single lever	2799 7052

Door interlocked external operation



Use

The door interlocked external operation includes one padlockable handle, an escutcheon and must be combined with a shaft extension.

Rating (A)	Changeover operation type	No. of poles	external IP ⁽¹⁾	Handle type	Reference
125 ... 315	I - 0 - II	3 / 4-pole	IP65	Type S2	1421 2113
125 ... 315	I - 0 - II	3 / 4-pole	IP65	Type S2	1423 2113
630 ... 1250	I - 0 - II	3 / 4-pole	IP65	Type S4	1443 3113

(1) IP: protection index according to the IEC 60529 standard.

S type handle adapter



Use

Enables new S type handles to be mounted using old fixing holes.

Dimensions

Adds 12 mm to the depth.

Handle colour	external IP ⁽¹⁾	To be ordered in multiples of	Reference
Black	IP65	10	1493 0000

(1) IP: protection index according to the IEC 60529 standard.

Alternative S-type handle cover colours



Use

For S2- type single lever handles and S4- type double lever handle.
Other colours: please consult us.

Colour	To be ordered in multiples of	Handle	Reference
Light grey	50	Type S2	1401 0001
Dark grey	50	Type S2	1401 0011
Light grey	50	Type S4	1401 0031
Dark grey	50	Type S4	1401 0041

Shaft guide for external operation



Use

To guide the shaft extension in the external handle.
This accessory enables the handle to engage extension shaft with a misalignment of up to 15 mm.

Required for a shaft length over 320 mm.

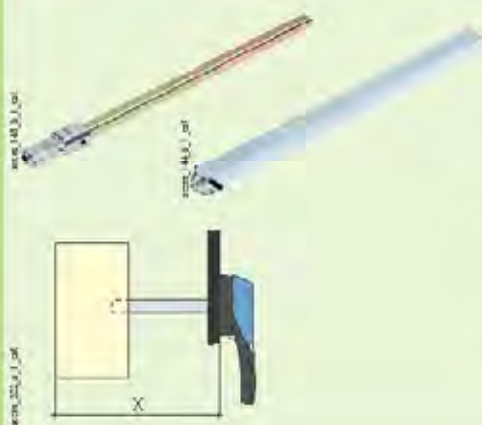
Description

Shaft guide

Reference

1429 0000

Shaft extensions for external handle



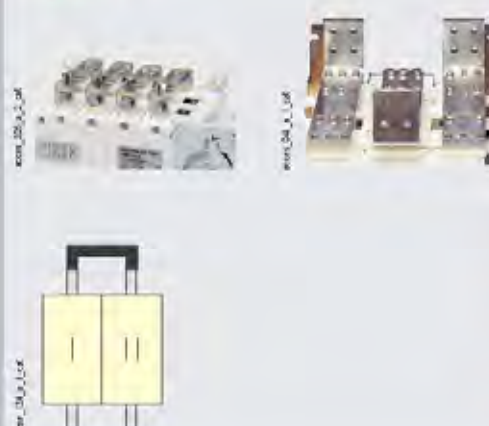
Use

Standard lengths:
- 200 mm,
- 320 mm.
Other lengths: please consult us.

Rating (A)	Shaft length (mm)	Dimension X (mm)	Type	Reference
125 ... 250	200	210 ... 310	10 x 10	1400 1020
125 ... 250	320	210 ... 430	10 x 10	1400 1032
315	200	280 ... 390	10 x 10	1400 1020
315	320	280 ... 510	10 x 10	1400 1032
630 ... 1250	200	425 ... 577	15 x 12	1401 1520
630 ... 1250	320	425 ... 697	15 x 12	1401 1532

Other accessories

Bridging bars



Use

Creation of a common link, on the top or bottom side of the switch, between positions I and II.

Rating (A)	No. of poles	Section (mm)	Mounting	Reference
125	1 P	20 x 2.5	clint	4 109 0019
125	3 P	20 x 2.5	clint	4 109 3019
125	4 P	20 x 2.5	clint	4 109 4019
250	1 P	25 x 2.5	clint	4 109 0025
250	3 P	25 x 2.5	clint	4 109 3025
250	4 P	25 x 2.5	clint	4 109 4025
315	1 P	32 x 5	clint	4 109 0050
315	3 P	32 x 5	clint	4 109 3050
315	4 P	32 x 5	clint	4 109 4050
630 ... 800	1 P	50 x 6	clint	4 109 0080
630 ... 800	3 P	50 x 6	clint	4 109 3080
630 ... 800	4 P	50 x 6	clint	4 109 4080
1000 ... 1250	1 P	90 x 10	clint	4 109 0160
1000 ... 1250	3 P	90 x 10	clint	4 109 3160
1000 ... 1250	4 P	90 x 10	clint	4 109 4160

Auxiliary contacts



Use

Pre-break and signalling of positions I and II. 1 or 2 NO/NC auxiliary contacts in each position.
Low level auxiliary contacts: please consult us.

Connection to the control circuit

6.35 mm fast-on connection.

Electrical characteristics

30 000 operations.

Characteristics

Rating (A)	Contact type	Current Nominal current (A)	Rated operational currents I_n (A)			
			250 VAC AC-13	400 VAC AC-13	24 VDC DC-13	48 VDC DC-13
125 ... 1250	NO/NC	16	12	0	14	6

changeover contact NO/NC

Rating (A)	Contact(s)	Reference
125 ... 1250	14 / 24	4 109 0021

Terminal shrouds



Use

Protection against direct contacts with terminals or connecting parts.

Advantages of the terminal shrouds

Perforations allowing remote thermographic inspection without removal.

Rating (A)	No. of poles	Position	Batch of	Reference
125	3 P	top / bottom / front (I) / rear (II)	1	2694 3014 ^{new}
125	4 P	top / bottom / front (I) / rear (II)	1	2694 4014 ^{new}
250	3 P	top / bottom / front (I) / rear (II)	1	2694 3021 ^{new}
250	4 P	top / bottom / front (I) / rear (II)	1	2694 4021 ^{new}
315	3 P	top / bottom / front (I) / rear (II)	1	2694 3051 ^{new}
315	4 P	top / bottom / front (I) / rear (II)	1	2694 4051 ^{new}

- (1) For an overall SIRCOVER front, rear, top and bottom protection 4 references required.
For SIRCOVER BY-PASS 6 references required.
(2) For an overall SIRCOVER front, rear, top and bottom protection, 2 references required.
For SIRCOVER BY-PASS 3 references required.

Terminal screen



Use

Top and bottom protection against direct contacts with terminals or connecting parts.

Rating (A)	No. of poles	Position	Batch of	Reference
125	3 P	top / bottom	2	1509 3012
125	4 P	top / bottom	2	1509 4012
250	3 P	top / bottom	2	1509 3025
250	4 P	top / bottom	2	1509 4025
315	3 P	top / bottom	2	1509 3063
315	4 P	top / bottom	2	1509 4063
630 ... 800	3 P	top / bottom	2	1509 3080
630 ... 800	4 P	top / bottom	2	1509 4080
1000 ... 1250	3 P	top / bottom	2	1509 3160
1000 ... 1250	4 P	top / bottom	2	1509 4160

Handle key interlocking accessories

Fig. 1

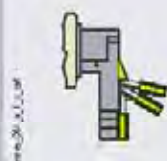


Fig. 2

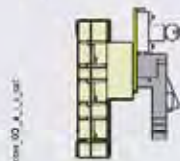


Fig. 3



Fig. 4



Use

- (Using padlock (not included)) This device is factory mounted onto the direct or external operation handle and allows using up to 3 padlocks.
 - Locking:
 - using lock (not included),
 - using undervoltage coil
- The interlocking positions are either determined as standard or configured by the user by cutting the strips.
- Padlocking and locking can be combined.

Padlocking in position I, 0 or II

Rating (A)	Operation	Figure	Reference
SIRCOVER			
125 ... 315	external	1	1423 2813

Locking using RONIS EL11AP lock in position 0 (not included)

Rating (A)	Operation	Figure	Reference
SIRCOVER			
125 ... 315	direct	2	4 109 1005 ⁽¹⁾
630 ... 1250	direct	3	4 109 1004 ⁽¹⁾
125 ... 1250	external	4	1499 7701

(1) Special handle included

(2) This locking facility can be configured by the user in the 3 positions

Locking using RONIS EL11AP lock in positions I, 0, II (not included)

Rating (A)	Operation	Figure	Reference
SIRCOVER			
125 ... 315	direct	2	4 109 1002 ⁽¹⁾
630 ... 1250	direct	3	4 109 1004 ⁽¹⁾
125 ... 315	external	4	1499 7701

(1) Special handle included

(2) This locking facility can be configured by the user in the 3 positions

Locking using 230 VAC undervoltage coil in position 0 (factory fitted)

Rating (A)	Operation	Figure	Reference
SIRCOVER			
630 ... 1250	direct	3	please consult us

Locking using type K CASTELL lock (not included)

Rating (A)	Operation	Figure	Reference
SIRCOVER			
125 ... 1250	External	4	1499 7702

Other special accessories

- Customised protection sleeves (for special dimensions or high ambient temperatures).
- Inter phase barrier
- Connection accessories
- Low level auxiliary contacts



☛ Characteristics according to IEC 60947-3

Thermal current I_t 40°C	125 A	250 A	315 A	630 A	800 A	1000 A	1250 A
Rated insulation voltage U_i (V)	800	800	1000	1000	1000	1000	1000
Rated impulse withstand voltage U_{imp} (kV)	8	8	12	12	12	12	12

Rated operational currents I_n (A)										
Rated voltage	Load duty category	Number of poles of the device	Number of poles in series per polarity	D	D	D	D	D	D	D
220 VDC	DC-21 B	3 P	1 P	125	250	315	630	800	1000	1250
400 VDC	DC-21 B	4 P	2 P	125	200	250	630	800	1000	1250
600 VDC	DC-21 B	4 P	2 P	80	100	250	630	800	1000	1250
800 VDC	DC-21 B	4 P	2 P	63	125	250	630	800	1000	1250

Overload capacity							
Rated short-time withstand current 0.3 s. I_{sw} (kA eff.)				15	17	25	50
Rated short-circuit making capacity I_{sc} (kA peak) ⁽¹⁾				20	30	45	55

Connection							
Minimum Cu cable section (mm²)				35	95	150	2 x 185
Minimum Cu busbar section (mm²)				-	-	-	2 x 40 x 5
Maximum Cu cable section (mm²)				50	150	240	2 x 300
Maximum Cu busbar width (mm)				25	32	40	63
Max. tightening torque (Nm)				9	20	20	40

Mechanical characteristics							
Endurance (number of operating cycles) ⁽²⁾				10 000	10 000	5 000	3 000
Weight of 3 P switch (kg)				1.5	2	3.5	17.5
Weight of 4 P switch (kg)				1.6	2.1	4	21

(1) For a rated operation voltage $U_n = 400$ VAC

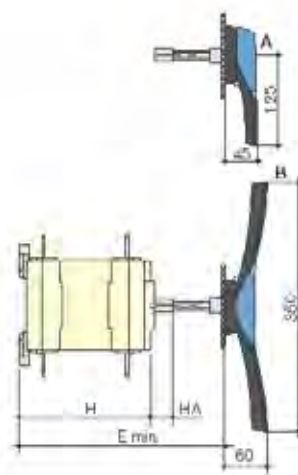
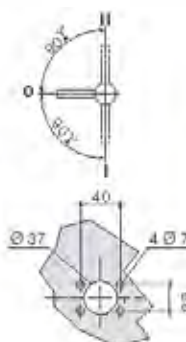
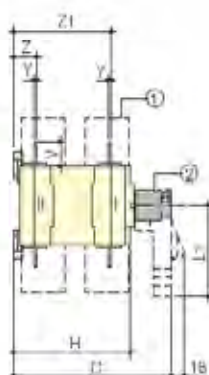
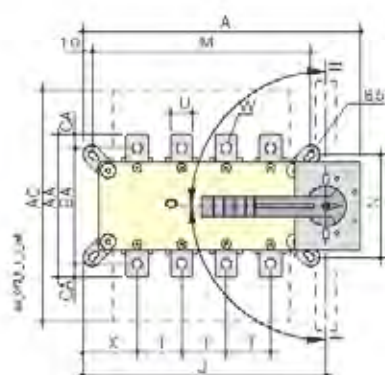
(2) Increased endurance. Please consult us

➤ Dimensions

SIRCO DC from 125 to 1250 A

Front direct operation

Front external operation



A 32-type handle for external operation: 125-4315-A

- A. 32-type handle for external operation: 723-a 373-a
- B. 54-type handle for external operation: 630-a 7250-a

1. Terminal shroud 5

2. Direct operation/handle

- 125 A (L = 140 mm)
- 250 to 1250 A (L = 210 mm)

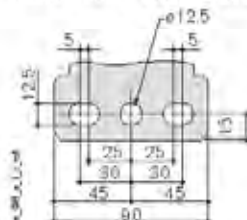
Rating (A)	Overall dimensions:				E min.	Terminal devote		Switch body				Switch mounting		Connection terminals											
	X3p.	A	B	C		AD	H	HA	J3p.	J4p.	M3p.	M4p.	N	T	U	V	W	X3p.	X4p.	Y	Z	Z1	AA	BA	AC
125	221	251	218	208	436	236	148	25	182	212	156	186	101	36	20	25	8,5	56	90	3,5	28	124	136	116	10
250	262	312	248	208	436	281	148	25	223	273	196	246	116	61	25	30	11	61	61	31	30	124	160	130	15
315	319	379	296	205	513	401	225	25	272	332	246	306	176	65	32	37	13	70,5	65,5	5	43	100	235	205	15
630	386	466	375	425	577	459	298	29	306,5	386,5	336	336	250	80	50	60,5	15	48	48	7	66,5	233,5	321	-	25,5
900	386	466	391	425	577	459	298	29	306,5	386,5	336	336	250	80	50	60,5	15	48	48	7	66,5	233,5	321	-	25,5
1000	478	598	375	425	577	461	298	29	306,5	386,5	347	467	250	120	90	43,5	12,5x5	54	54	8	66,5	255,5	268	-	15
1250	478	598	375	425	577	461	298	29	306,5	386,5	347	467	250	120	90	43,5	12,5x5	54	54	8	66,5	255,5	268	-	15

➤ **Connection terminals**

SIRCOVER DC 630 to 800 A



SIRCOVER DG 1000 to 1250 A

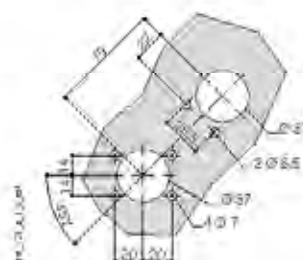
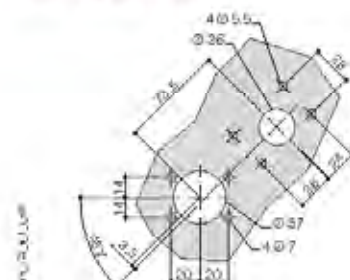


➤ Door drilling

SIRCOVER DG 125 to 1250 A

WITH RONI'S EL11AP 100k

With CASTELL K lock





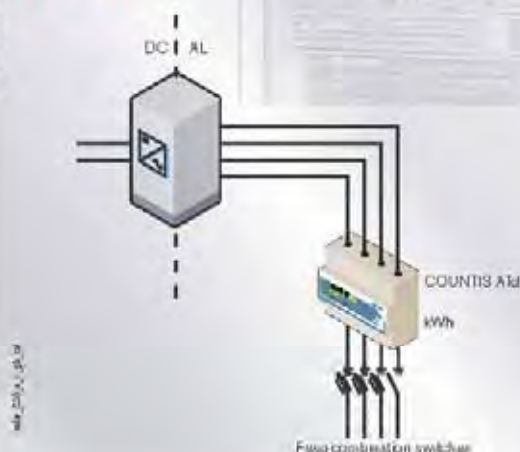
3-phase - Direct 80 A

Function

The **COUNTIS ATd** is a direct powered instrument designed for applications in sub-metering three phase active energy up to 80 A. This product is based on a principle which is unique on the market: using direct passage measurement with 3 or 4 cables (with or without neutral) or via standard connection terminals.

Passing cables through holes means that from 3 or 4 cables, 3 currents and 3 voltages can be measured and the device can be powered. Measurement of voltages and power supply are made through insulation piercing screws.

Applications



COUNTIS ATd has as standard a totalising meter allowing a direct reading of the kWh and a pulse output. A partial counter (with RESET) enables totalling of energy for specific time periods. It can be fully configured by the user via the keypad and the display (type of network; pulse duration). Furthermore, associated with a **COUNTIS Ci**, a consumption centralisation is possible via a PLC or a PC equipped with the **CONTROL VISION** software.

Conformity to standards

- IEC 61036 classe 1
- IEC 61010-1
- IEC 61000-4-2
- IEC 61000-4-3
- IEC 61000-4-4
- IEC 61000-4-5
- IEC 61000-4-6
- IEC 61000-4-8
- IEC 61000-4-11
- IEC 60669-2-6
- IEC 60869-1
- IEC 60669-2

Front panel



References

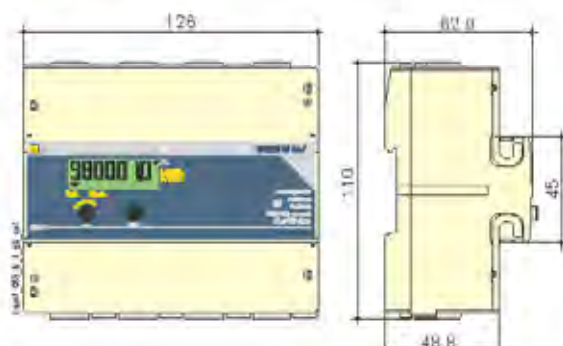
Network voltage between phases	COUNTIS ATd Reference
230 VAC	4850 0300
400 VAC	4850 1300

Electrical characteristics

Current measurement (TRMS)	
Type	direct
Measurement range	0.8 ... 80 A
Input consumption	2.5 VA
Sustained overload	125 A
Overload	30 % for 0.01 s
Voltage measurements (TRMS)	
Direct measurement between phases	230 ± 20% / 400 ± 15% VAC
Input consumption	2 VA
Frequency	50 / 60 Hz
Energy accuracy	
Active (according to IEC 61036)	Class 1

Auxiliary power supply	
Self-supplied	yes
Consumption	2 VA
Output (pulsed)	
Number	1
Type reed relay	100 VDC - 0.5 A - 12 VA
Fixed weight of impulses	100 Wh
Impulse duration	60 ... 900 ms
Max. number of operations	5 x 10 ⁶
Operating conditions	
Operating temperature	-5 ... +45 °C
Storage temperature	-20 ... +70 °C
Relative humidity	85 %

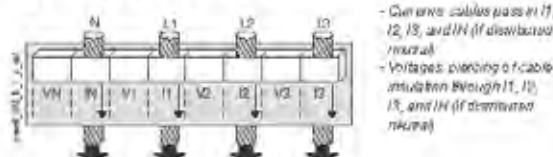
Overall dimensions



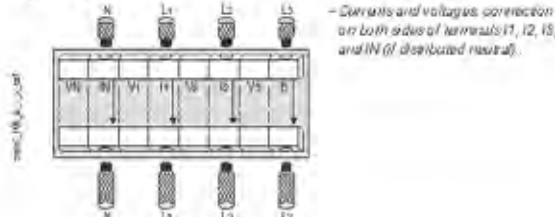
Type	module
Number of modules	7
Dimensions L x H x D	126 x 110 x 82.9 mm
Case protection rating	IP20
Front protection rating	IP40
Display type	LCD
Terminal block type	fixed
Max. section of connection per cable channel	25 mm ²
Max. section of connections to terminals	50 mm ²
Rigid connection section of the impulse output	1.5 ... 10 mm ²
Flexible connection section of the impulse output	1 ... 8 mm ²
Weight	700 g

Terminals and connections

By passing the cables through



By cutting the cables





Photovoltaic network quality control and analysis

Function

DIRIS A40 is a multi-function meter for measuring electrical values in all networks. They allow starting from the front panel to configure and display all the electric parameters and to exploit the functions of measurement, metering and energy management, harmonics analysis, remote control and control state of control devices, communication and detection of high voltages, peaks and voltage disconnections.

In addition, DIRIS A40 are provided with a function for correcting connection errors.

Conformity to standards

- IEC 62053-22
- IEC 62053-23
- IEC 61010-1
- IEC 61010-2
- IEC 61010-3
- IEC 61010-4
- IEC 61000-4-5
- IEC 61000-4-6
- IEC 61000-4-8
- IEC 61000-4-11
- IEC 60068-2-6
- IEC 60068-2-11
- IEC 60068-2-30

Applications

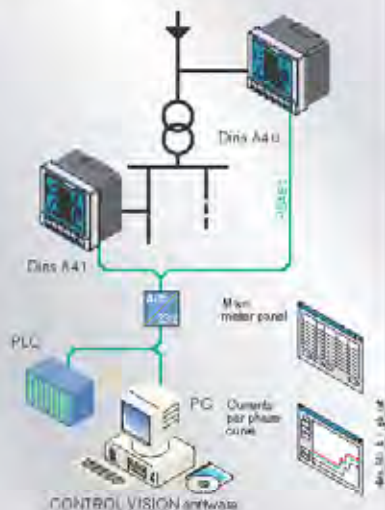
DIRIS A40, with its six direct access keys keyboard and LCD display, allows exploiting all the parameters of a LV and HV installation. These parameters can be centralised on a PC or PLC through an RS485 link using JBUS/MODBUS[®] protocol. The casing is designed so that the installer can easily fit the DIRIS A40 to a cabinet door. To facilitate and optimise the operator's work, DIRIS A40 use one of the most functional principles for integrating communications, metering, harmonics, analog outputs or even alarm relays. Simply fit a module on the rear of the casing to add a function.

Instantaneous average and maximum values (TRMS) of:

- currents,
- phase-to-neutral and phase-to-phase voltages,
- frequency,
- active power on 4 quadrants (e),
- reactive power on 4 quadrants (e),
- apparent power,
- Power Factor (PF),
- harmonic distortion rate (THD) up to 51 on the phase-to-neutral and phase-to-phase voltages and currents.

Metering

- Active power meter on 4 quadrants.
- Reactive power meter on 4 quadrants.
- Apparent power meter
- Programmable hour-run meter.



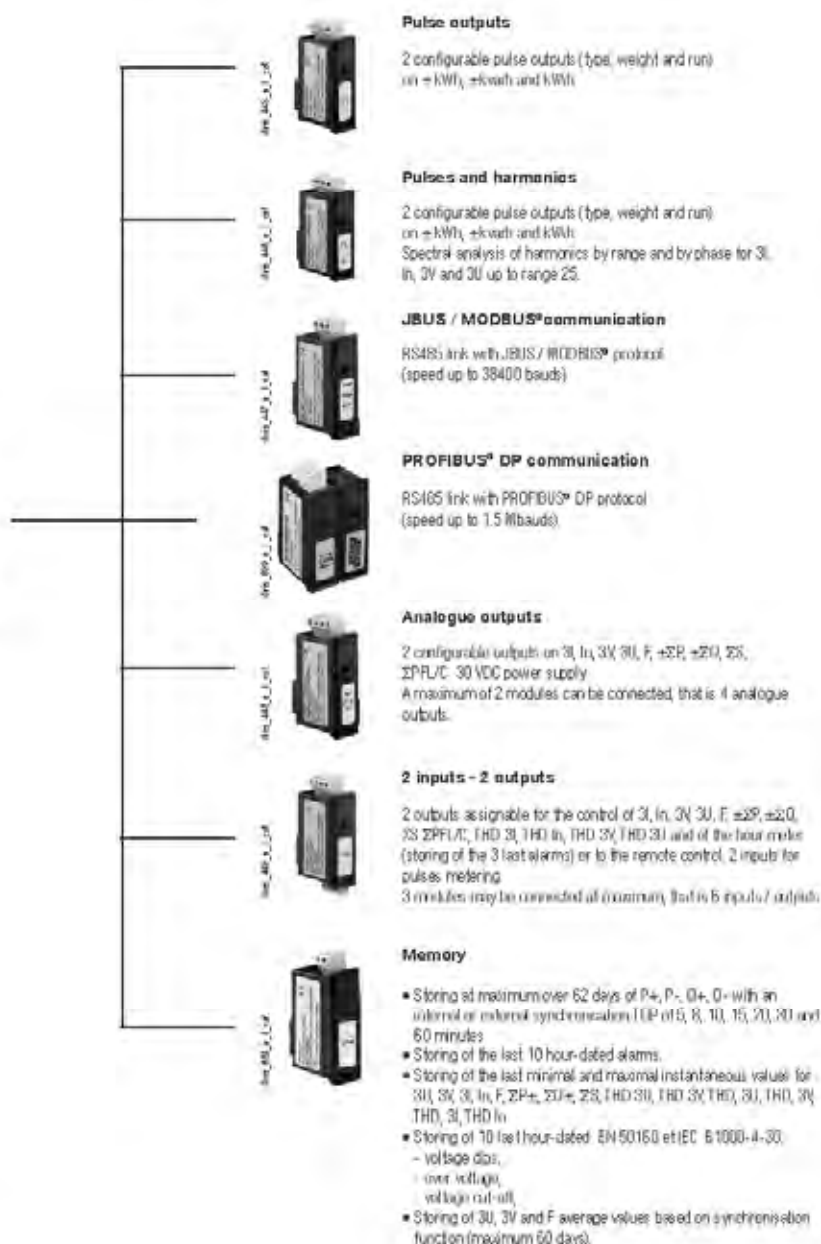
Front panel



1. Backlit LCD display
2. Pushbutton for currents and zero-wiring correction
3. Pushbutton for voltages and frequency
4. Pushbutton for active, reactive, apparent power and power factor
5. Pushbutton for maximal and average current and power values
6. Pushbutton for harmonics values
7. Pushbutton for energy and hour run meter

Plug-in modules

DIRIS[®] A40



Characteristics

Current measurement on insulated inputs (TRMS)

CT primary	10 000 A
CT secondary	1 and 5
Measurement range	0 ... 11 kA
Input consumption	≤ 0.1 VA
Measurement updating period	1 s
Accuracy	0.2 %
Sustained overload	5 A
Intermittent overload	10 A for 1 s

Voltage measurements (TRMS)

Direct measurement between phases	18 ... 700 VAC
Direct measurement between phase and neutral	11 ... 404 VAC
VT primary	500 000 VAC
VT secondary	60, 100, 110, 173, 190 VAC
Frequency	50 / 60 Hz
Input consumption	≤ 0.1 VA
Measurement updating period	1 s
Accuracy	0.2 %
Sustained overload	760 VAC

Current-voltage product

Limitation for 1A CT	10 000 000
Limitation for 5A CT	10 000 000

Power measurement

Measurement updating period	1 s
Accuracy	0.5 %

Power factor measurement

Measurement updating period	1 s
Accuracy	0.5 %

Frequency measurement

Measurement range	45 ... 65 Hz
Measurement updating period	1 s
Accuracy	0.1 %

Energy accuracy

Active (according to IEC 62053-22)	class 0.5 S
Reactive (according to IEC 62053-22)	class 2

Auxiliary power supply

AC voltage	110 ... 400 VAC
AC tolerance	± 10 %
DC voltage	120 ... 350 VDC / 12 ... 48 VDC
DC tolerance	± 20 % / - 5 ... + 20 %
Frequency	50 / 60 Hz
Consumption	≤ 10 VA

Phototransistor inputs

Number	2 ... 6
Power supply	10 ... 30 VDC
Minimal signal width	10 ms
Minimum length between 2 impulses	18 ms
Type	phototransistor

Outputs (alarms / control)

Number of relays	2 ... 6
Type	250 VDC - 5 A - 1150 VA

Outputs (pulse)

Number of relays	2
Type	100 VDC - 0.5 A - 10 VA
Max. number of operations	≤ 10 ⁶

Outputs (analogue)

Number of outputs	2 ... 4
Type	insulated
Range	0 / 4 ... 20 mA
Charging resistance	600 Ω
Maximum current	30 mA

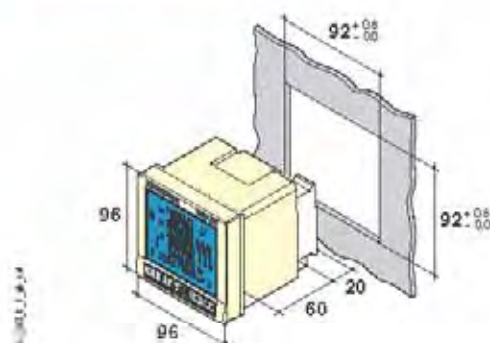
Communication

Link	RS485
Type	2 ... 3 half duplex wires
Protocol	JBUS/MODBUS* in RTU mode
JBUS / MODBUS* speed	1400 ... 38400 bauds
Protocol	PROFIBUS* DP
PROFIBUS* speed	9.6 kbauds ... 1.5 Mbauds

Operating conditions

Operating temperature	-10 ... +55 °C
Storage temperature	-20 ... +55 °C
Relative humidity	95 %

Overall dimensions



Type	panel mounting
Dimensions H x W x D	96 x 96 x 60 mm
Case protection rating	IP30
Front protection rating	IP52
Display type	LCD
Terminal block type	fixed or pull-out
Voltage and other connection section	0.2 ... 2.5 mm ²
Current connection section	0.5 ... 6 mm ²
Weight	400 g

References

Basic device

Auxiliary power supply U₁

110	400 VAC / 120	350 VDC
12	48 VDC	



DIRIS A40

Reference

4825 0A40

4825 1A40

Optional

Plug-in modules⁽¹⁾

	Reference
Pulse outputs	4825 0090
Pulse outputs + harmonics	4825 0091
RS485 / BUS / MODBUS [®] communication	4825 0092
Analog outputs	4825 0093
2 inputs / 2 outputs	4825 0094
RS485 / MODBUS [®] / DI communication	4825 0095
Memory	4825 0097

Accessory description

	Reference
IP65 protection cover	4825 0089
Rail mounting kit for a 44 x 96 mm circuit	4825 0088

(1) Ease of integration for additional functions (maximum 4) by the user at any time via clickable modules on the rear of the device



Permanent insulation monitoring device

Function

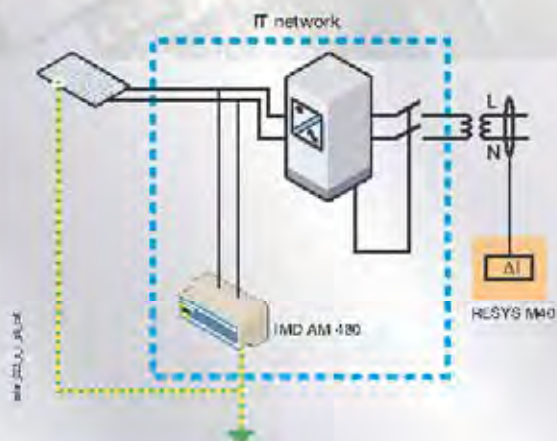
The AM 480 Insulation monitoring devices control the insulation level of isolated photovoltaic circuits. The measurement is carried out between the solar panel and inverter compound circuit and the earth circuit.

General characteristics

- Measurement by injection of a multi-frequency coded signal.
- Monitoring symmetrical DC faults.
- Led combining information regarding power on, alarms or connection failures.
- Storing the fault data or not.
- Connection self-monitoring.

Applications

Photovoltaic circuits



Note:

In compliance with the IEC 61557-8 and EN 61557-8 standards, the use of IMDs enabled to detect symmetrical faults is mandatory for low-voltage DC circuits (> 120 VDC smoothed or 140 VDC peak).

Conformity to standards

- | | |
|---------------|-------------------|
| • IEC 60384 | • NF C 15-100 |
| • IEC 61557-8 | • DIN 61557-8 |
| • EN 61557-8 | • VDE 0413 part 8 |

Front panel



1: LED combining the indication for operation under voltage (fixed) or the occurrence of an alarm (flashing)

References

Standard device

Auxiliary power supply U_1
12 ... 64 VDC

AM 480

Reference
47248611

Electrical characteristics

Network voltage U_1

Maximum voltage	1000 VDC / 800 VAC
Maximum three-phase circuit voltage	828 VAC
Frequency	42 ... 460 Hz
Rated insulation voltage	1000 VAC
Maximum DC component	1000 VAC

Auxiliary power supply U_1

Maximum consumption	3.5 VA
---------------------	--------

Fault signalling

Number of thresholds	1
Type of threshold	fixed
Threshold value I_1	30 kΩ
Maximum leakage capacity	60 μF

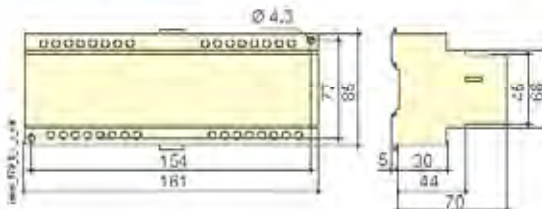
Output contacts

Number of contacts	1
Contact type	inverter
DC making capacity	1500 W
AC making capacity	1250 VA
AC nominal voltage	250 VAC
DC nominal voltage	300 VDC
Continuous current	5 A
Operating mode	stand-by
Default operating mode	stand-by

Operating conditions

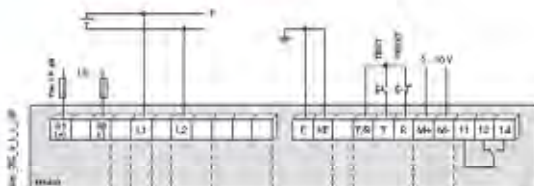
Operating temperature	-40 ... +55 °C
Storage temperature	-40 ... +70 °C

Overall dimensions



Type	modular
Dimensions H x W x D	161 x 89 x 75 mm
Case protection rating	IP20
Terminal protection rating	IP20
Rigid connection section	0.2 ... 4 mm ²
Flexible connection section	0.2 ... 2.5 mm ²
Weight	300 g

Terminals and connections



A1 - A2: auxiliary power supply U_1

L1 - L2: network voltage U_1

T1 - T2 - T3 - T4: alarm relay output

E - KE: Earthing

M+ / M-: Isolation level remote indicator

T: external test pushbutton

R: external reset pushbutton

T/R: TEST and RESET combined pushbutton



Type B "variable speed drive" differential relays

Function

RESYS B 420 differential relays are associated with a remote trip breaking device (automatic power out-off), thus providing the following functions:

- protection against indirect contacts,
- limitation of leakage currents.

They also preventively monitor electrical installations via their (configurable) pre-alarm function or when used as signal relays.

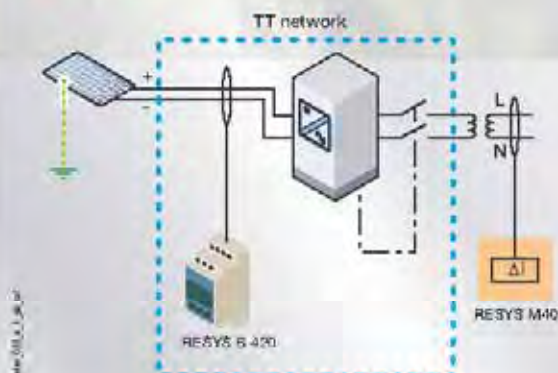
They are particularly suited to installations where continuous components disturb conventional differential devices limited to type AC or A.

Core balance transformers : see page 82.

Conformity to standards

- IEC 60755
- IEC 60547-2
- IEC 62020
- IEC 60364

Applications

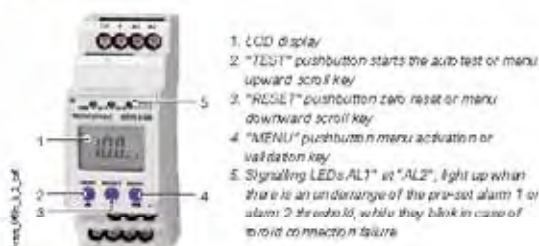


Rapid recognition of an insulation fault increases the availability of the distribution network by preventing accidental power cuts and the resulting loss of production. TRMS measurement avoids repeated random tripping and the bargraph allows the display of permanent leakage current.

General characteristics

- RESYS B 420 with 2 configurable relays:
 - either 2 alarm relays,
 - or 1 alarm relay and 1 pre-alarm relay (50 % to 100 % $I_{\Delta n}$).
- Adjustment sensitivity 10 ... 500 mA.
- Time delay 0 to 10 s.
- Measurement accuracy by TRMS.
- Positive or negative security configurable by the user.
- Automatic permanent relay toroid connection test
- Sealable cover.

Front panel



References

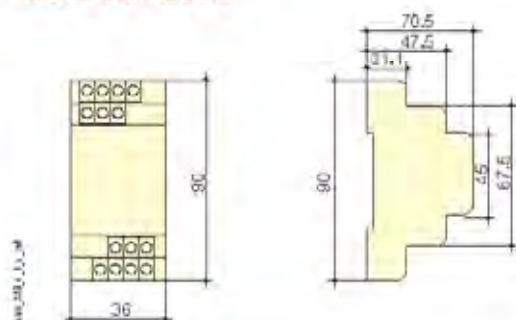
Auxiliary power supply U_1	RESYS B 420 Reference
16 ... 72 VAC / 9.6 ... 94 VDC	4931 460 2 ¹⁾
70 ... 300 VDC	4931 472 3 ²⁾

(1) References and characteristics of the core balance transformers: see page 62 "Core balance transformers"

Electrical characteristics

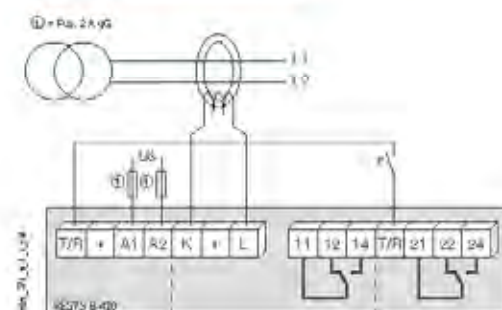
Auxiliary power supply U_1		Alarm Manual by pushbutton / using terminal	
Frequency	50 / 60 Hz	Alarm configuration mode	memory / automatic reset
AC operating zone	see reference table	Alarm factory setting	memory
DC operating zone	see reference table	RESET	manual by pushbutton / using terminal
Maximum consumption	3 VA		
Insulation (according to IEC 60664-1)		Positive security output contacts	
Rated insulation voltage	750 VAC	Number of contacts	2
Rated impulse voltage	2.5 kV	Type of ALARM 1 contact	230 VAC - 5 A - 1150 VA
Degree of pollution	class 3	Type of ALARM 2 or PRE-ALARM contact	230 VAC - 5 A - 1150 VA
Threshold values		ALARM 1 operating mode	positive / negative security
Setting $I_{\Delta n}$	10 - 500 mA	ALARM 2 or PRE-ALARM operating mode	positive / negative security
Accuracy of tripping	-35 ... 100 % $I_{\Delta n}$	Factory setting of ALARM 1 operating mode	positive security
Domain of network frequency	0 ... 2000 Hz	Factory setting of ALARM 2 operating mode	positive security
Spurious tripping	$n = 10$		
PRE-ALARM relay tripping	50 - 100 % $I_{\Delta n}$	Operating conditions	
Hysteresis of the PRE-ALARM relay	15 % $I_{\Delta n}$	Operating temperature	-25 ... +55 °C
		Storage temperature	-30 ... +70 °C

Overall dimensions



Type	modular
Number of modules	2
Dimensions H x W x D	36 x 90 x 70.5 mm
Case protection rating	IP30
Terminal protection rating	IP20
Rigid connection section	0.2 ... 1.5 mm ²
Flexible connection section	0.2 ... 1.5 mm ²
Weight	150 g

Terminals and connections





Type A differential relays

Function

RESYS M40 differential relays are associated with a remote trip breaking device (automatic power cut-off), thus providing the following functions:

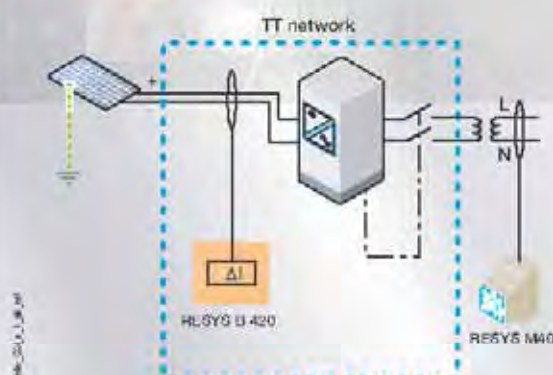
- protection against indirect contacts,
- limitation of leakage currents.

They also preventively monitor electrical installations via their (configurable) pre-alarm function or when used as signal relays.

Conformity to standards

- IEC 60755
- IEC 60947-2
- IEC 62020
- IEC 60364

Applications



Rapid recognition of an insulation fault increases the availability of the distribution network by preventing accidental power cuts and the resulting loss of production. TRMS measurement avoids repeated random tripping and the bargraph allows the display of permanent leakage current.

General characteristics

- RESYS M40 with 2 configurable relays:
 - either 2 alarm relays,
 - or 1 alarm relay and 1 pre-alarm relay (50% to 100 % $I_{\Delta n}$).
- Adjustment sensitivity from 0.03 to 30 A.
- Time delay 0 to 10 s.
- Measurement accuracy by TRMS.
- Automatic instantaneous tripping at 30 mA.
- Positive or negative security configurable by the user.
- Selection of toroid ratio.
- Automatic permanent relay-toroid connection test
- Sealed cover.

Front panel



1. Setting I_{Δn}
2. Time delay setting
3. Configuration micro-switches (x4)
4. "ON" Led
5. "RESET" pushbutton
6. "TRIP" alarm LED
7. LED bargraph (% x I_{Δn})
8. "TEST" pushbutton

References

Auxiliary power supply U_a(A.N.15)

	RESYS M40
115 / 230 VAC	43412723 ⁽¹⁾
400 VAC	43412740 ⁽¹⁾
12 ... 125 VDC	43412602 ⁽¹⁾

(1) For references and characteristics of closed, opening and rectangular transformers, please see page 62 "Core Balance Transformers".

Electrical characteristics

Auxiliary power supply U_a

Frequency	47 ... 63 Hz
AC operating zone	0.8 ... 1.15 U _a
DC operating zone	0.8 ... 1.05 U _a
Maximum consumption	5 VA (AC) / 5 W (DC)

Insulation (according to IEC 60664-1)

Rated insulation voltage	250 VAC
Rated impulse voltage	2.5 kV (115 VAC) / 4 kV (230/400 VAC)
Degree of pollution	class 3

Threshold values

Setting I _{Δn}	0.03 - 0.1 - 0.3 - 0.5 - 1 - 3 - 5 - 10 - 30 A
Accuracy of tripping	-20 ... +10 % I _{Δn}
Domain of network frequency	15 ... 400 Hz
Specified time setting	0.1 (0.06 - 0.15) - 0.30 - 0.50 - 0.80 - 1 - 4 - 10 s
PRE-ALARM relay tripping	50 % I _{Δn}
Hysteresis of the PRE-ALARM relay	20 % I _{Δn}

Alarm

Alarm configuration mode	memory / automatic reset
Alarm factory setting	memory
RESET	manual (by pushbutton / using terminal)

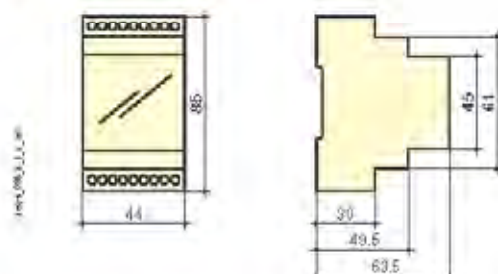
Output contacts

Number of contacts	2
Type of ALARM 1 contact	250 VAC - 0 A - 2000 VA
Type of ALARM 2 or PRE-ALARM contact	250 VAC - 5 A - 7500 VA
ALARM 1 operating mode	positive / negative security
ALARM 2 or PRE-ALARM operating mode	positive / negative security
Factory setting of ALARM 1 operating mode	negative security
Factory setting of ALARM 2 operating mode	positive security

Operating conditions

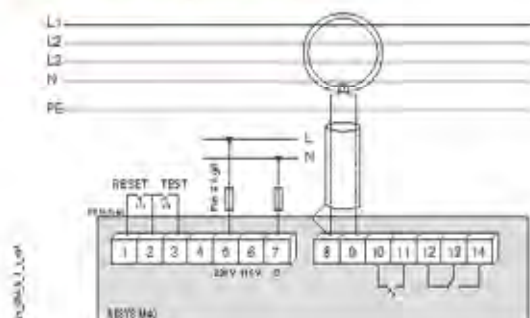
Operating temperature	-20 ... +55 °C
Storage temperature	-30 ... +70 °C

Overall dimensions



Type	modular
Number of modules	2.5
Dimensions H x W x D	44 x 65 x 63.5 mm
Case protection rating	IP40
Terminal protection rating	IP20
Rigid connection section	0.2 ... 4 mm ²
Flexible connection section	0.2 ... 2.5 mm ²
Weight	191 g

Terminals and connections



- 1 - 2 - 3: external pushbuttons
- 5 - 6 - 7: auxiliary power supply U_a
- 8 - 9: SECOPIC differential faulted connections
- 10 - 11: alarm relay 2 or pre-alarm outputs
- 13 - 14: alarm relay 1 outputs

NOTE: The earthing must not pass through the C.T. For single phase applications, only the two and neutral need to be passed through the C.T.

Cabling: for distances > 1 m, use twisted pair cable between the unit and C.T. Do not connect the common medium to earth.

Closed toroids



Split core toroids



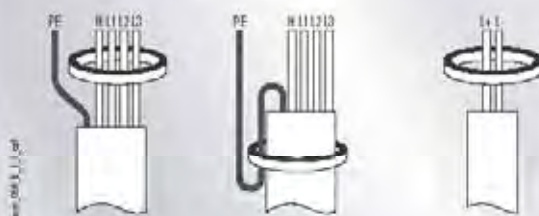
Rectangular closed transformers



Installation of the core transformers

The detection toroid must be simultaneously crossed by all the active conductors. The protective conductor must necessarily pass on the outside of the toroid or pass once for each direction.

Installation of the detection toroids



Installation limiting distortions during heavy load switching



Example: 250 to 400 A FUSOMAT with a undervoltage coil and work mode of the negative security relay.

Core balance transformers type A and type B

Function

The installation of protection or signalling resources such as earth leakage protection relays involves the use of **core balance transformers**.

These enclose active conductors, providing the differential summation of vector currents and revealing leakage current. The core balance transformers (toroids) proposed by SOCOMEC meet requirements in terms of measurement sensitivity and are suitable for differential relays RESYS M20/M40/P40. Closed (series W, WR and TFR) or opening (series WS) types, suit all wiring configurations. A special range is proposed for RESYS B420 relays.

Conformity to standards

- IEC 60044-1

References



Closed toroids W series

Reference

Type	Toroid diameter (mm)	Reference
W0-S15	15	4793 2001 ^(*)
W1-S35	35	4793 2003 ^(*)
W2-S70	70	4793 2007 ^(*)
W3-S105	105	4793 2010 ^(*)
W4-S140	140	4793 2014 ^(*)
W5-S210	210	4793 2020 ^(*)

(*) Toroids for RESYS M40 relays.



Rectangular closed toroids
WR and TFR series

Reference

Type	Toroid diameter (mm)	Reference
WR 70 x 175	70 x 175	4795 0717 ^(*)
WR 115 x 305	115 x 305	4795 1130 ^(*)
WR 150 x 350	150 x 350	4795 1535 ^(*)
TFR 200 x 500	200 x 500	4795 2050 ^(*)

(*) Toroids for RESYS M40 relays.



Split core toroids
WS series

Reference

Type	Toroid diameter (mm)	Reference
WS 50 x 80	50 x 80	4795 0508 ^(*)
WS 80 x 80	80 x 80	4795 0808 ^(*)
WS 80 x 120	80 x 120	4795 0812 ^(*)
WS 80 x 160	80 x 160	4795 0816 ^(*)

(*) Toroids for RESYS M40 relays.



Special toroids for
RESYS B 420

Reference

Type	Toroid diameter (mm)	Reference
W0-B20	20	4730 0020
W1-B35	35	4730 0035
W2-B60	60	4730 0060

Accessories for RESYS B420

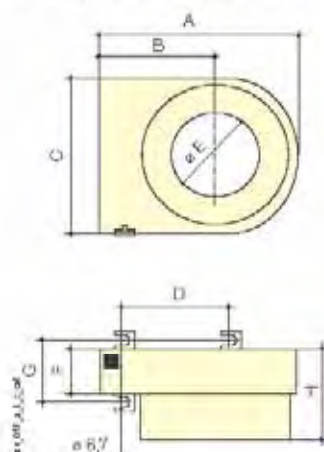
	Reference
Connecting cable (L = 1 m)	4930 0001
Connecting cable (L = 2 m)	4930 0002
Connecting cable (L = 5 m)	4930 0005
Connecting cable (L = 10 m)	4930 0010

Characteristics

Insulation coordination	according to IEC 664-1
Rated insulation voltage	690 VAC
Dielectric quality	6 kV
Degree of pollution	3
Test voltage according to IEC 60255	3 kVAC
CT ratio	600 / 1
Winding resistance	$\approx 7 \Omega$
Rated primary current (W/WR/FR/WS, Imin/Im)	10 A
Rated primary current (special toroids for RESYS B470B471)	3 A
Permanent current withstand	20 A
Associated thermal short-circuit current	14 kA / 1 s
Nominal power	50 mVA
Max. accuracy index	5
Operating temperature	-10 ... +55°C
Inflammability class	UL94V-0

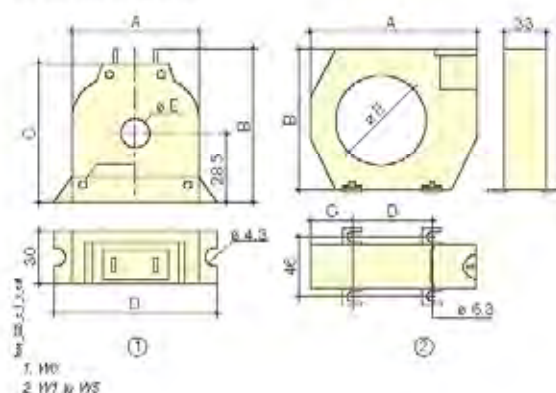
Dimensions

Special toroids for RESYS B 420



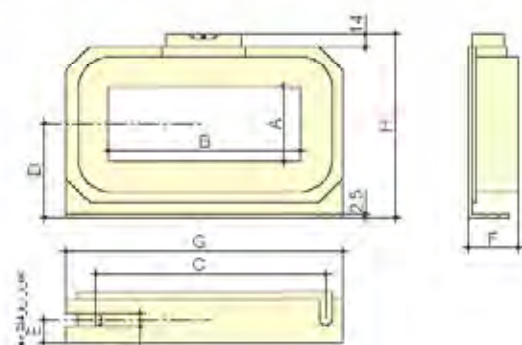
Type	A	B	C	D	E	F	G	H	Weight (kg)
W0-B20	76.4	50	56.3	21.4	20	30	47	40.5	0.10
W1-B35	99.5	62	79.2	49.8	35	30	47	55	0.35
W2-B60	135	79	116.3	66	60	37	54	67	0.57

Closed toroids series W



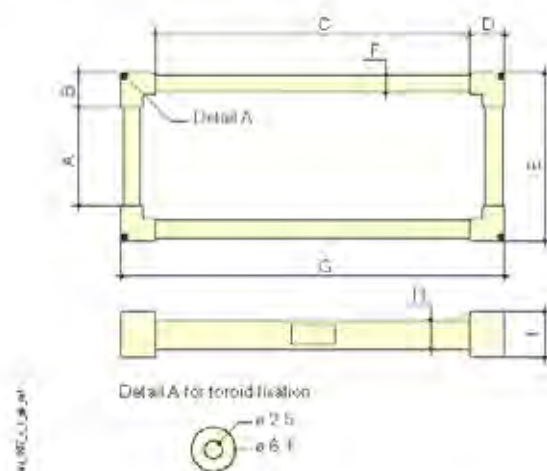
Type	A	B	C	D	E	Weight (kg)
W0-S15	64.5	71	62	75	14.5	0.09
W1-S35	100	79	25	40.5	35	0.25
W2-S70	130	110	32	60	70	0.30
W3-S105	170	145	38	94	105	0.70
W4-S140	220	195	48.5	123	140	1.50
W5-S210	229	204	69	161	210	2.50

Rectangular closed toroids WR series



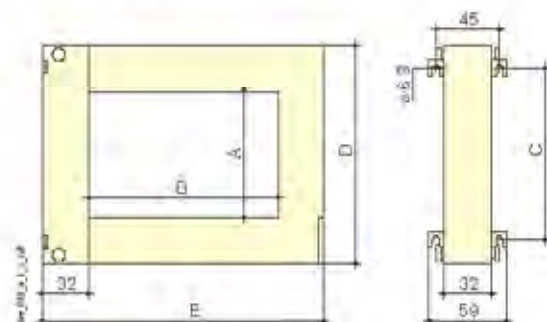
Type	A	B	C	D	E	F	G	H	I
WR 70 x 175	70	175	225	85	22	46	261	176	7.5
WR 115 x 305	115	305	360	116	25	59	402	240	8
WR 150 x 350	150	350	415	140	28	55	460	285	8

Rectangular closed toroids TFR series



Type	A	B	C	D	E	F	G	H	I	Weight (kg)
TFR 2000 x 500	128	48	460	48	234	25	540	40	7.6	7.2

Split core toroids WS series



Type	A	B	C	D	E
WS 30 x 80	30	80	78	114	145
WS 60 x 80	60	80	100	144	145
WS 80 x 120	80	120	108	144	185
WS 80 x 160	80	160	108	144	225



Type 2 "photovoltaic panels" surge arrestor

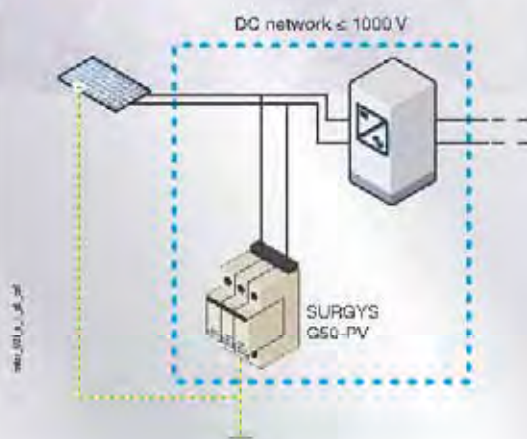
Function

SURGYS® G50-PV surge protection is designed to ensure protection for photovoltaic supply networks against transient overvoltages.

General characteristics

- Type 2 surge arrestor.
- Available with protection to 500 VDC or 1000 VDC.
- Max. discharge current 40 kA.
- Common mode / differential mode protection
- Remote signalisation contact.
- End of service life indicator.
- Pull-out module

Applications

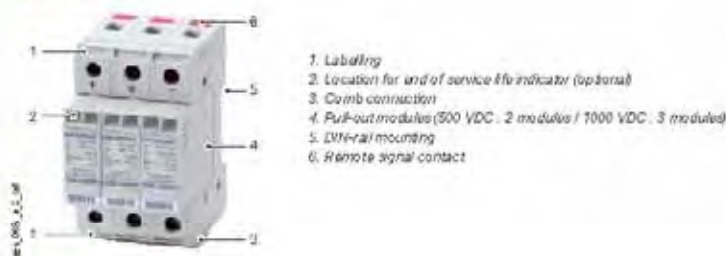


Protection at the head of the photovoltaic network: SURGYS G50-PV is installed at the level of the generator casing or enclosure, thus protecting the buildings located downstream against the indirect effects of lightning.

Conformity to standards

- NF EN 61643-11 test class 2
- IEC 61643-1 class 1

Front panel



References

Network voltage U _N DC	Description	No. of poles	Protection mode	Number of juxtaposed casings	Reference
500	without remote signal	2 P	MC	2	4982 0500
500	with remote signal	2 P	MC	2	4982 0501
1000	without remote signal	2 P	MC / MD	3	4982 0520
1000	with remote signal	2 P	MC / MD	3	4982 0521

Electrical characteristics

Network	
Type of network:	following reference
Nominal voltage U _N	following reference
Max. voltage U _M	530 VDC (version 500V) / 1060 VDC (version 1000 V)

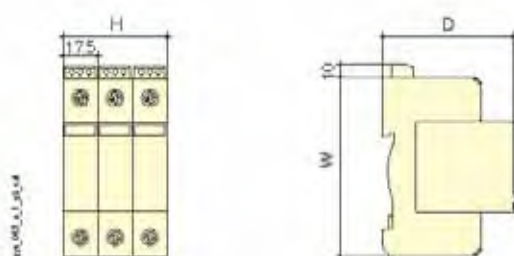
Protection characteristics	
Protection level U _p	1.0 kV (500 V) / 3.6 kV (1000 V)
Max. discharge current (1 impulse 8/20 µs) I _{max}	40 kA
Nominal discharge current (15 impulses 8/20 µs) I _{wn}	20 kA
Protection mode	common and differential

Associated characteristics	
Residual current I _Δ	< 1 mA
Response time t	< 25 ns
Follow-on current I _Δ	none
Short-circuit current I _{sc}	20 kA
Type of disconnection indicator	mechanical
Number of disconnection indicator	1

Remote signal contacts	
Number of contacts per pole	1
Contact type	inverter
AC making capacity	3 A
DC making capacity	2 A
AC nominal voltage	125 VAC
DC nominal voltage	30 VDC
Continuous current	2 A
Type of connection	screw block
Max. section of conductors to terminate	1.5 mm ²

Operating conditions	
Operating temperature	-40 ... +55 °C
Storage temperature	-40 ... +65 °C

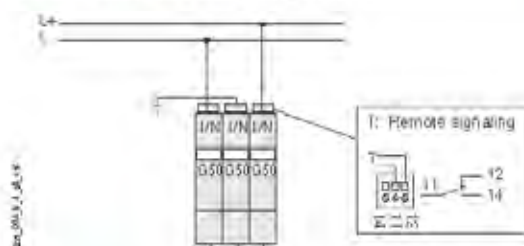
Overall dimensions



Type:	modular
Dimensions H x W x D 2 poles	35 x 90 x 67 mm (500 VDC version)
Dimensions H x W x D 3 poles	62.5 x 90 x 67 mm (1000 VDC version)
Case protection rating	IP20
Terminal protection rating	IP20
Casing material	UL94-V0 thermoplastic
Network connection section	4 ... 25 mm ²
Earthing section	4 ... 25 mm ²

Connection

Common mode / differential mode protection



UPS range



Availability of high quality energy

➤ Equipment and services for your high quality power supply

Teams of specialised designers, highly integrated production and a dedicated commercial network have led SOCOMEC to forge the most complete ranges of high quality power supplies, industrial switching and protection components, on the market.

Marketed under the SOCOMEC UPS brand, our range of products and services meet your requirements for a quality, continuous electrical power supply. Inverters, secure power supplies, harmonic equalisers, rectifiers, DC/AC converters, covering a very wide range of applications for every sector of the market.

They have gained approval from the most demanding of users: telecoms operators, the nuclear industry, naval industry etc.



A

AC

Abbreviation of Alternating Current

ADEME

Agence De l'Environnement et de la Maîtrise de l'Energie
French Environment and Energy Management Agency. Its mission includes encouraging, supervising, coordinating, facilitating and undertaking operations with the aim of protecting the environment and managing energy.

Alternate current side (AC)

Part of the PV installation located downstream the AC terminals of the conversion equipment

Amorphous

In chemistry an amorphous compound is a compound in which the atoms do not respect any order with average and long distance, thus distinguishing them from crystallised compounds. Glass, non-crystalline polymers and liquids are all amorphous compounds. Silicon is amorphous when not crystallised (contrary to mono or polycrystalline). This way, it can be deposited on a glass sheet.

Amorphous silicon (a-Si)

The non-crystalline form of silicon. The conversion energy efficiency of an amorphous cell is between 5 % and 8 %. The atoms in an amorphous material are spread in an uneven manner. Due to a layer thickness of only 1/2 micron, the thin layer technology is particularly inexpensive.

Amorphous solar cell

Solar cell from amorphous silicon. They are produced using the so-called thin layers technique.

Angle of incidence

The angle formed by a ray (or wave) striking a surface and a line perpendicular to the surface at the point of impact.

Anti-reflex layer

Transparent layer of just a few millionths of a millimeter, which minimises reflection losses. The light reflecting on the cell surface cannot be absorbed and transformed into energy. Therefore, the Anti-reflex layer increases photonic conversion, thus leading to a higher efficiency of the solar cell.

B

Back contact

Type of cell where the contacts are not deposited on top of the cell active surface, but on the bottom of the module. This method has two advantages. A homogeneous cell aspect, facilitating the aesthetic integration of the modules and the absence of metal tracks, thus increasing the cell energy efficiency.

Balance of System (BOS)

See "Other components of the system".

BIPV (Building Integrated Photovoltaics)

Building Integrated Photovoltaics referring to the photovoltaic elements that are integrative part of a building and have a double function: electrical energy production and architectural element.

Bottom of the module

Rear part of the modules where the cells are located, which can be made from various materials, such as PVF or glass.

Bridge

Changeover for converting DC in AC. A bridge is composed of transistors, capacitors and inductances and, when needed, of a step-up substation (versions without transformer) or an output transformer for the versions with transformers.

Building integration

Regards the eligibility of a building to its integration in order to obtain the purchase (\$5 cts/€ per Kw/h) by the electricity company for a photovoltaic installation (roof, curtain wall, glass roof and balcony integration).

BY-PASS diode

A diode mounted in parallel which, in case of shadowing on a row of cells (if connected in series), the current is short-circuited to the concerned cell. Hot spot.

C

Cell features

To obtain these cells, all you need to do is connect a load (resistance) between its terminals so that its value varies from zero to infinity. By measuring current I and voltage V at the cell terminals, we obtain a curve $I(V)$ for a determined temperature and radiation. $V_{oc}[V]$: Open circuit voltage when the load is infinite. $I_{sc}[A]$: Short circuit current with zero load. Knowing that the power is given by the product of the current and voltage, we obtain the $P(V)$ power curve in function of the voltage, when the load varies from zero to infinity. As we can see, for a constant temperature and radiation there is a voltage value (therefore a load) where the cell provides maximum power. At this point, the MPP (Maximum Power Point), the cell energy efficiency is at its maximum.

COM-Card

Communication connectors between converters, including including datalogger.

Connection contract

Document defining the procedure, managed by the distributor, for connecting electricity-producing installations to the public electric network.

Conversion energy efficiency

Relationship between the electric power supplied by a PV component and the solar power received by the latter. E.g.: if a square cell with a 0.1 m side receives an irradiance of 1000 W/m² (a typical global radiation value) and supplies an electric power of 1.2 W, its conversion energy efficiency will be: $1.2 \text{ W} / (1000 \text{ W/m}^2 \times 0.01 \text{ m}^2) = 12 \%$. It is important to distinguish intrinsic conversion energy efficiency of the used semiconductor material and that of the PV modules (which also depends on the relationship between the panel active surface and its overall surface).

COP (Coefficient of performance)

Energy performance of a heat pump is defined by the relationship between the quantity of heat produced by the latter and the electric energy consumed by the compressor. This ratio defines the Coefficient of Performance (COP).

Crystalline (mono or poly)

Silicon in the form of crystals for manufacturing photovoltaic cells. See also "Crystalline solar cells".

Crystalline solar cell

The most widespread photovoltaic technology (approximately 90% of the market). The cell is the basic element of photovoltaic generation. It is composed by a "wafer", i.e., a very thin block of silicon. Silicon is a semiconductor material, which converts solar radiation into electrical energy. It can be monocrystalline and polycrystalline.

D

Datalogger

Electronic device for recording and storing the experiment measures.

DC

Abbreviation for Direct Current.

Degradation (power loss)

This effect appears with amorphous silicon cells. After approximately 1 000 hours of sunlight, this power stabilises at the level of the nominal power displayed by the manufacturer.

DIDEME

Demand and Energy Markets Department. Its role is to ensure the proper functioning and to define the public service gas and electric policy, as well as to monitor the renewable energy market, to layout a regulation and deal with the statutory problems of these enterprises.

Direct current side (DC)

Part of the PV installation located between the PV modules and the DC terminals of the PV conversion equipment.

Direct solar radiation

Solar radiation reaching the Earth directly from the solar disc.

Distance mounting

PV module field mounting technique on sloping roofs, according to which a gap is left between the modules and the roof, inclining the modules to the optimal angle.

Dumppload

In case of energy surplus, consumers connected spontaneously can be used to balance significant fluctuating loads. From an energy point of view, the best suited consumers are those with storage means (well pumps, refrigeration equipment, boilers). However, for a strictly technical function, a load resistance will suffice.

E

Easement

Legal agreement, whether verbal or written, defining an interest in (exclusive) or common use of a private property or of the airspace above it. The "right of way" is the concept whereby an electricity public service can install electric lines on private property as a type of easement. (See also "Restrictive clause".)

Encapsulation

Glass or plastic coating of PV panels for the protection of the cells.

Energy management material

Electrical equipment used to convert energy generated by the PV modules into usable energy. Collective term referring to the inverter, the converter, the battery charge regulator and the bypass diode.

Energy payback time

See "EPBT".

Energy Payback Time (EPBT)

The energy payback time is the number of years taken for a complete photovoltaic system (modules, cables and electronic devices) to be compensated by the energy production.

Energy Return Factor (ERF)

The Energy Return Factor is the ratio of the energy produced by a photovoltaic installation during its service life and the energy invested in its manufacturing.

ENS

Abbreviation for "facility for net monitoring with an assigned switch in series", in French "Équipement de surveillance de Réseau avec Sectionneur assigné". Part of a "automatic disconnection switch for self-generation installations". It is a device required for safety reasons, which prevents the continued injection of solar energy in an external grid in case of network shutdown.

EVA

EVA is the abbreviation of ethylene vinyl acetate. This plastic resin is used for the encapsulation of the PV cells by lamination.

F

Factor 4

Aim to cut by a factor four the emissions of greenhouse gases of industrialised countries by 2050 compared to 1990, in order to limit the Earth warming to 2°C.

Final yield (Yf)

The final yield is defined as the relationship between the usable energy (at the inverter output, when present) produced by an installation over a given period and the nominal power of said installation. The final yield is measured in (kWh/kWp).

Frame

External part of the modules for the protection of said modules and their fixation.

G

Galvanic separation

Interruption of a direct electrical connection, for example via a transformer. During this process, electrical energy is converted into magnetic energy, and then reconverted in electrical energy.

Global solar irradiance and radiation (W/m²)

Solar irradiance is the solar power per unit surface, measured in (W/m²), on a determined surface (position and orientation). The global solar radiation is the total of direct solar radiation measured on Earth and measured on the horizontal plane.

Grid-connection

Connection of a photovoltaic installation to the public electric grid in order to sell all or part of the electric production.

Grid-connected system

A system that is connected to the grid in order to be powered, or used as an energy source (primary or secondary).

Grid, contacts

PV panel metal grid which allows the series or parallel connection of the cells.

H

Heliotrope system

Special support system, thanks to which the solar panel orientation continuously follows the solar phase, so that the solar radiation always falls vertically on the cells.

HESPUL (formerly Phebus)

Association which aims at developing energy-efficiency as well as renewable energies.

Horsepower (HP)

The imperial (British) unit of power equal to 746 watts.

Hot spot.

Hot spots result from shadowing in a single solar cell. In a panel, the cells are connected in series to form a row. A shadowed cell behaves like an electrical resistance and could be destroyed by heat if the power of other cells passes through. To prevent this, bypass diodes are installed parallel to these cells.

I

I-V curve

The "Current (I) Voltage (V)" curve represents the typical behaviour of a solar cell. See also "Cell features".

Inverter

A device that converts the direct current produced by the PV panels to alternating current. This device is necessary for connecting the PV system to the electric distribution network.

Inverter without transformer

Inverter without network transformer with very high energy-efficiency.

Isolated or stand alone system

A system that is not connected to an electric network and operates independently via a battery system.

K

Kilowatt-hour (kWh)

Energy unit equal to the work done in an hour by a machine with 1000 watts of power (1000 W) > 1 MW/h = 1000 KW/h.

Kyoto Protocol

Ratified in 1997, The Kyoto Protocol is an international agreement that aims at tackling climate change by reducing GHG emissions, responsible for global warming.

L

Load

All that, in an electric circuit, draws energy from the circuit when powered (lamps, appliances, tools, pumps, etc.).

M

Maximum Power Point (MPP)

Abbreviation: MPP. The point in the current-voltage (I-V) curve in which the maximum power of solar cell can be withdrawn. This point can be found and used for each function thanks to MPP Tracking. See also "Cell features".

Meter

Mechanical or electronic device for measuring the produced and/or consumed energy.

Minimum power

Equal to the nominal power minus the tolerance margins.

Monocrystalline

When cooled, molten silicon solidifies forming a single large-sized crystal. This crystal is cut into small pieces to obtain photovoltaic cells. Monocrystalline is distinguished by a regular sequence of atoms, which spread across the entire block of material. The energy-efficiency of monocrystalline solar cells is higher than that of polycrystalline silicon cells.

Monocrystalline silicon

Name for silicon in the form of a single crystal. The conversion energy-efficiency of a monocrystalline cell is between 15 and 22%.

MPP-Tracking

Regulation of the released power so that the photovoltaic system is continuously operated in MPP mode. This allows preventing electrical energy losses. It is an integrative component of a regulator and a converter.

Multi-String Inverter

This type of inverter has both the advantages of various strings (separated MPP regulation of several individual strings) and of a central inverter (lower specific power costs).

O

Open circuit voltage

Voltage present in a photovoltaic cell exposed to maximum sunlight, in a no-load condition. Maximum voltage possible.

Other components of the system

Components of a photovoltaic system other than modules and batteries. They include switches, controllers, meters, energy management material, solar tracking devices and the structure supporting the photovoltaic modules field.

P

Parallel connection

Method for interconnecting electricity-producing or electricity-consuming devices, according to which, the produced or required voltage remains constant while the device current increases. Opposite of "series connection".

Peak megawatt (Mw_p)

Peak Watt is the unit of measurement of the power of a photovoltaic system per time unit.

Peak or nominal power Watt Peak (W_p)

Nominal power of a photovoltaic device in STC, i.e., "Standard Test Conditions" (irradiance of 1000W/m² and temperature of 25°C). The peak or nominal power is expressed in "Watt-peak" [W_p].

Peak power

Maximum or optimal power (expressed in W_p) released by a photovoltaic cell in STC (Standard Test Conditions) under an illumination of 1 kW/m² and a junction temperature of 25°C.

Performance ratio (PR)

The performance ratio is defined as the relationship between final yield Y_f and target yield Y_t (energy theoretically available per installed kW_p, in [kWh/kW_p]), over the same period. The performance ratio is measured in [%].

Photovoltaics (abbreviation: PV)

The technique that allows transforming solar energy into electrical energy (current) via solar cells.

Photovoltaic generator

A complete system that ensures the production and management of the electricity provided by the PV modules. The energy is stored in batteries and/or converted into AC according to the type of application.

Photovoltaic module

Interconnected (in series or in parallel) photovoltaic cells that are usually mounted in a sealed unit with a practical dimension for easy shipment, handling and assembly in module fields. Synonym of "photovoltaic panel".

Photovoltaic module field

A set of interconnected photovoltaic modules that operate as a single electricity production unit. The modules are assembled on a common support or building. In case of a system with reduced dimensions, it can be a set of two modules on their support or building.

Photovoltaic principle

describes the formation of voltage in a semiconductor or in a pigment molecule, when light radiation excites the load sensor. Electrical energy in the form of current is obtained by extracting these load sensors. The photovoltaic principle was discovered by Becquerel.

Poly or multicrystalline silicon (mc-Si ou poly-Si)

Form of crystalline silicon composed of several silicon crystals. It is composed of small interconnected crystals with a size that ranges from a few millimetres to several centimetres. Its production is thus very simplified, compared to monocrystalline silicon. The conversion of a multicrystalline cell is between 10 and 15%.

Polycrystalline

When cooled, silicon solidifies, forming many crystals. This type of cell is also blue, but not homogeneous, the various crystals create a shimmering structure.

Power (W)

Amount of work (or energy) produced or consumed by a system per time unit. It is measured in Watts [W], corresponding to 1 Joule per second.

Power line communication

Term used to define the data transmission via the network line.

Power optimiser

See "MPP Tracking".

PV

Abbreviation of "photovoltaic", the term refers to the conversion of solar energy into electrical energy.

PV DC main cable

Cable connecting the PV generator junction box to the conversion equipment DC terminals.

PV generator junction box or panel array

Casing in which all the PV units are electrically connected or where protection devices can be placed.

PV laminate

PV module without frame, resulting from encapsulation. It presents itself with a glass-glass, glass-PVF or resinating glass sandwich structure.

PV panel, module or component

A set of PV cells connected via grids and contacts, encapsulated and operating as a single system within a PV installation.

PV string cable

Cable connecting the PV strings to the generator or the PV unit junction box.

PV system

A system composed of photovoltaic modules, cables, inverter(s) and motor(s) used for electrical energy production.

PV unit cable

Cable connecting the PV unit junction boxes to the PV generator junction box.

PVB

Abbreviation of Polyvinyl butyral. This plastic resin is used for the encapsulation of the PV cells by lamination.

PVF

Abbreviation of Polyvinyl fluoride. This plastic resin is used for the encapsulation of the PV cells by lamination. Tedlar® is the commercial name for PVF.

R

Rear ventilation

By ventilating the rear of the panel, its temperature remains minimum and its energy efficiency optimal.

Reflection losses

The light reflecting on the cell surface cannot be transformed into energy. An Anti-reflex layer prevents this phenomenon.

Restrictive clause

Special agreement to ensure access to solar radiation in case of solar or wind system. See also "Easement".

S

Series connection

Method for interconnecting electrically producing or electrically consuming devices, according to which, the device voltage increases while the current remains constant. Opposite of "parallel connection".

Shadowing

Obstacle to direct radiation projecting a shadow on all or on part of the cells, modules, strings or PV installations. Shadows are divided in the so-called core shadows, distant enough to almost instantly project the shadow on the entire installation (horizon effect), and half shadows, which project partial shadows. The latter are to be avoided, since they cause power losses in installations and modules that are much higher than the shadowed surface. In case of a system with an inverter per string, it is advisable to cable the strings in parallel to the largest shadow. For example, if a tree is projected on a PV system during the day, the strings must be cabled vertically.

Short-circuit current: I_{sc} (std)

Short-circuit current of a module, string or PV unit in standard test conditions. The current flowing freely through an external circuit that has no load or resistance, the maximum current possible. See also "Cell features".

Silicon

Symbol: Si. Chemical element of the family of the Cristallogènes. The most abundant element on earth after oxygen. It does not exist in the free state, but only in the form of compounds (dioxide, silicon in the sand, quartz, etc.) or of silicates. Chemical element that can have four combinations with neighbouring atoms. Silicon is the semiconductor that plays the most important role in the semiconductor and photovoltaic industries. This raw material which is silicon dioxide (sand) can be processed into monocrystalline, polycrystalline or amorphous silicon.

Solar diagram

Representation in rectangular coordinates of the path of the sun in the sky. The used coordinates are the solar height and azimuth, which univocally define the position of the sun in a certain moment. By representing the solar phases of different days of the year on the same diagram, it is possible to obtain a description of the sunlight in a certain place over the year.

Solar energy

The energy derived from the sunlight or solar radiation (heat or UV radiation).

Solar or photovoltaic cell

Electronic component providing electrical energy when exposed to solar radiation. In case the electrical voltage of a single solar cell is too low (0.5 V env.), more solar cells are grouped together to form photovoltaic panels. The most common material currently used to make solar cells is silicon, which can be used after various treatments (monocrystalline, polycrystalline, amorphous silica). Moreover, in many technical variants aiming at an increased energy efficiency, innovative materials are being tested (cadmium telluride, indium cadmium sulfide, titanium dioxide and many more).

Standard test conditions

Test conditions provided by EN 60904-3 for PV cells and modules.

Standard Test Conditions (STC)

Measurement of the maximum nominal power of a solar panel with AM=1.5 times the solar spectrum, a cell temperature of 25°C, and a solar radiation of 1000 W/m².

String

A string is composed of any number of cells, modules or panels connected in series in order to obtain a certain voltage.

String

See "String".

String inverter

This type of inverter allows preventing inconveniences to the centralised inverter. The PV generator is divided in different strings, each coupled to the national network via single-string inverters. This way, installation results much easier and the reduction of energy efficiency due to manufacture dispersion or to shadows on the solar panels, are greatly limited.

Subsidies, allowances

Financial services provided by law in order to promote PV through the repurchase of the produced electrical energy at a higher price than that on the market, aimed to offset the cost of installation or a tax discount.

T

Telemetry

Remote measurement of a physical quantity with instruments that convert this measurement in a transmissible signal.

Thin film cell

Second generation cells based on a very thin film of semiconductor material. This type of cell is characterised by a lower production cost. Various semiconductor materials may be used for this technology: Amorphous and microcrystalline silicon, CdTe (Cadmium telluride), CIGS (Copper Indium Gallium Selenum), etc.

Thin layer solar cell

Name for thin solar cells. The manufacturing process does not require the wafer (crystalline silicon). This process can be carried out using considerably less power.

Tilt

Angle characterising the module tilt over the horizon, positively measured from the horizontal plane upwards. A PV panel placed horizontally has a zero tilt.

Transparent, semi-transparent, partially transparent

Feature of a PV module defining the quantity of light that crosses it. The module is supplied with a degree of transparency: if it is equal to 0, the module is opaque. The energy efficiency of a semi-transparent module is always lower than that of an opaque module with the same technology and service. The visual aspect varies considerably according to the production method.

- 1) On a glass substrate, deposit a film of active material thin enough to allow obtaining a homogeneous degree of transparency. This type of photovoltaic module is ideal for sites where a contrasting shadowing is not advisable, such as offices, schools, etc.
- 2) Etch transparent zones on the (opaque) crystalline silicon substrate by material withdrawal following the size of the etched pattern. The module can appear with a different degree of transparency.

3) When laminating, the space between mono- or multicrystalline cells can be modified, thus allowing to choose the degree of transparency.

The minimum degree of transparency, or the amount of light crossing the module, corresponds to approximately 10%. This value is given by the minimum space of 2 mm between cells. Starting from the degree of transparency, an optimal ratio is chosen between transparency and energy production.

W

Wafer

A thin sheet of semiconductor material. The wafer is the main component for the production of computer chips and solar cells. The slices are generally cut in semiconductor blocks and have a thickness from 0.2 to 0.3 mm.

Watt hour (Wh - kilo-, Mega-, Giga-)

Amount of energy corresponding to 1W in one hour, i.e., 3'600 Joules. A kilowatthour [kWh] corresponds to 1000 Wh, 1 megawatthour [MWh] to 1000000 Wh and 1 gigawatthour [GWh] to 1000000000 Wh.

Watt Peak

The power released by a photovoltaic module under an optimal sunlight from 1 kW/m² to 25°C (Performances are function of temperatures)

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Socomec worldwide

IN EUROPE

BELGIUM

SOCOMECH BELGIE

B - 1190 Brussel

Tel. +32 (0)2 340 02 30 - Fax +32 (0)2 346 28 99

be.scg.order@socomec.com

FRANCE

SOCOMECH

F - 67235 Benfeld Cedex

Tel. +33 (0)3 88 57 41 41 - Fax +33 (0)3 88 74 08 00

fr.scg.vex@socomec.com

GERMANY

SOCOMECH GmbH

D - 76275 Ettlingen

Tel. +49 (0)7243 66 29 2 0 - Fax +49 (0)7243 66 29 2 13

info@socomec.com

ITALY

SOCOMECH Elettrotecnica s.r.l.

I - 20098 San Giuliano Milanese (MI)

Tel. +39 02 98 498 21 - Fax +39 02 98 243 310

it.scg.info@socomec.com

SPAIN

SOCOMECH ELECTRO, S.L.

E - 08310 Argentona (Barcelona)

Tel. +34 93 741 60 67 - Fax +34 93 757 49 52

es.scg.info@socomec.com

THE NETHERLANDS

SOCOMECH B.V.

NL - 3992 De Houten

Tel. +31 (0)30 63 71 504 - Fax +31 (0)30 63 72 166

info@socomec.nl

UNITED KINGDOM

SOCOMECH Ltd

Hitchin Hertfordshire SG4 0TY

Tel. +44 (0)1452 440033 - Fax +44 (0)1452 431143

sales.uk.scg@socomec.com

IN ASIA

NORTH EAST ASIA

SOCOMECH CHINA

CN - 20030 P.R.C. Shanghai

Tel. +86 21 5298 9555 - Fax +86 21 6228 3468

socomec@socomec-shanghai.com

SOUTH EAST ASIA & PACIFIC

SOCOMECH SWITCHING AND PROTECTION

UBI TECHPARK - Singapore

Tel. +65 65 07 94 90 - Fax +65 65 47 86 93

sg.scg.socomec@socomec.com

SOUTH ASIA

SOCOMECH-HPL PVT

Gurgaon, Haryana, India

Tel. +91 124 2210970 - 74 - Fax +91 124 2210976

in.scg.socomec-hpl@socomec.com

IN MIDDLE EAST

UNITED ARAB EMIRATES

SOCOMECH Middle East

Dubai, U.A.E.

Tel. +971 4 88 11 623 - Fax +971 4 88 19 887

sales.ae.scg@socomec.com

IN NORTH AMERICA

USA, CANADA & MEXICO

SOCOMECH Inc.

Cambridge, MA 02142 USA

Tel. +1 617 245 0447 - Fax +1 617 245 0437

us.scg.sales@socomec.com

HEAD OFFICE

SOCOMECH GROUP

S.A. SOCOMECH capital 11 302 300 e

R.C.S. Strasbourg B 548 500 149

B.P. 60010 - 1, rue de Westhouse

F-67235 Benfeld Cedex - FRANCE

INTERNATIONAL SALES DEPARTMENT

SOCOMECH

1, rue de Westhouse - B.P. 60010

F - 67235 Benfeld Cedex - FRANCE

Tel. +33 (0)3 88 57 41 41 - Fax +33 (0)3 88 74 08 00

scg.vex@socomec.com

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www.socomec.com

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