



# Photovoltaic system connections and protection

2014 EDITION



 **cabur**<sup>®</sup>  
CONNECTING ENERGY  
SINCE 1952

## The Company



UNI EN-ISO 9001



UNI EN-ISO 14001

Founded in 1952, Cabur quickly gained a leading position **among national constructors of terminal blocks for electrical panels**, pursuing a policy which focused particularly on installers' needs and proposing avant-garde technological solutions, which in time became generalised applications.

Above all, it was ahead of its time in the qualitative choices for its products, especially regarding raw materials, as well as guaranteed functioning, reliability over time and respect for the environment.

Thanks to all this, in 1985 Cabur obtained **Class 1E Qualification** (Equipment for Nuclear Power Generating Stations) and **ISO 9001** (Quality) and **ISO 14001** (Environment) Certifications, as well as certified conformity to the ATEX Directive and to the IEC Ex Scheme for "**Ex e**" installations on main terminal block lines.

In 2006 Cabur acquired a new advanced production site, which stretches over an area of 15,000 m<sup>2</sup> in the municipality of Altare (Savona). The extra surface space and a simultaneous increase in personnel allowed for rationalising and rendering even more efficient the production processes, as well as the logistics and sales activities.

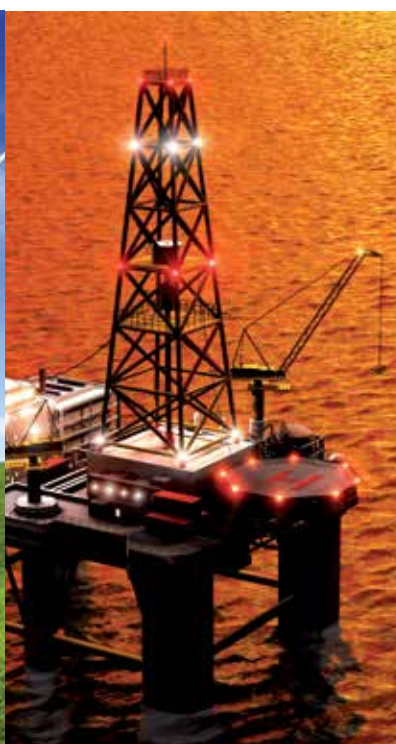
Present production, which is wide-ranging and diversified, represents the optimal synthesis of Cabur's long experience as a supplier to the main national energy boards and companies, together with activities and collaboration abroad. Today Cabur **develops and produces, to its own designs,**

a very wide range of products for the electro-technical and electronics industries, renowned for their reliability even in extreme working conditions, and created to provide optimal responses to users' various and complex installation needs.

The offer includes:

- a line of **terminal blocks** for electrical cabinets and panels, designed to satisfy the fundamental requirements of the most severe installation conditions.
- **power supplies** and **electronic products** for electrical panels, for plant automation, machine automation, and process control.
- a wide range of items for the completion of **connections** for **civil and industrial installations**.
- a line of products for the **connection** and protection of **photovoltaic systems**.
- a line of products and solutions for **industrial marking**.

For documentation on our products, visit our site [www.cabur.eu](http://www.cabur.eu); you can request all our publications and also receive invitations to trade fairs where Cabur is present, and a periodic e-mail newsletter.



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# Cabur

## Connected and safe ... in all circumstances

The choice of connection systems is one of the critical factors on which the effective performance of the PV system, its efficiency over time and its useful lifetime depend.

To maximise and guarantee efficiency over time, Cabur offers a **range of solutions which guarantee connections which conform with** the highest standards on the market.

From the Cabur offer, the installer can choose the right **connectors** for the technical features of the system and the specifications of the modules and inverters available on the market or already installed.

It is very simple to choose the best solution:

- for combination with the most common inverters/junction boxes, Cabur offers the Cabur Solar line, which includes connectors for PIN diameters (3 or 4 mm) identified by the "Line 3" or "Line 4" name;
- for connection with Tyco Electronics inverters/junction boxes, Cabur offers the Solarlok® connectors, for which it is the authorised dealer.

Both product families are excellent for joining photovoltaic wires and include a complete connection set, with **wires, tools and accessories**, as well as an ideal First Installation Kit.

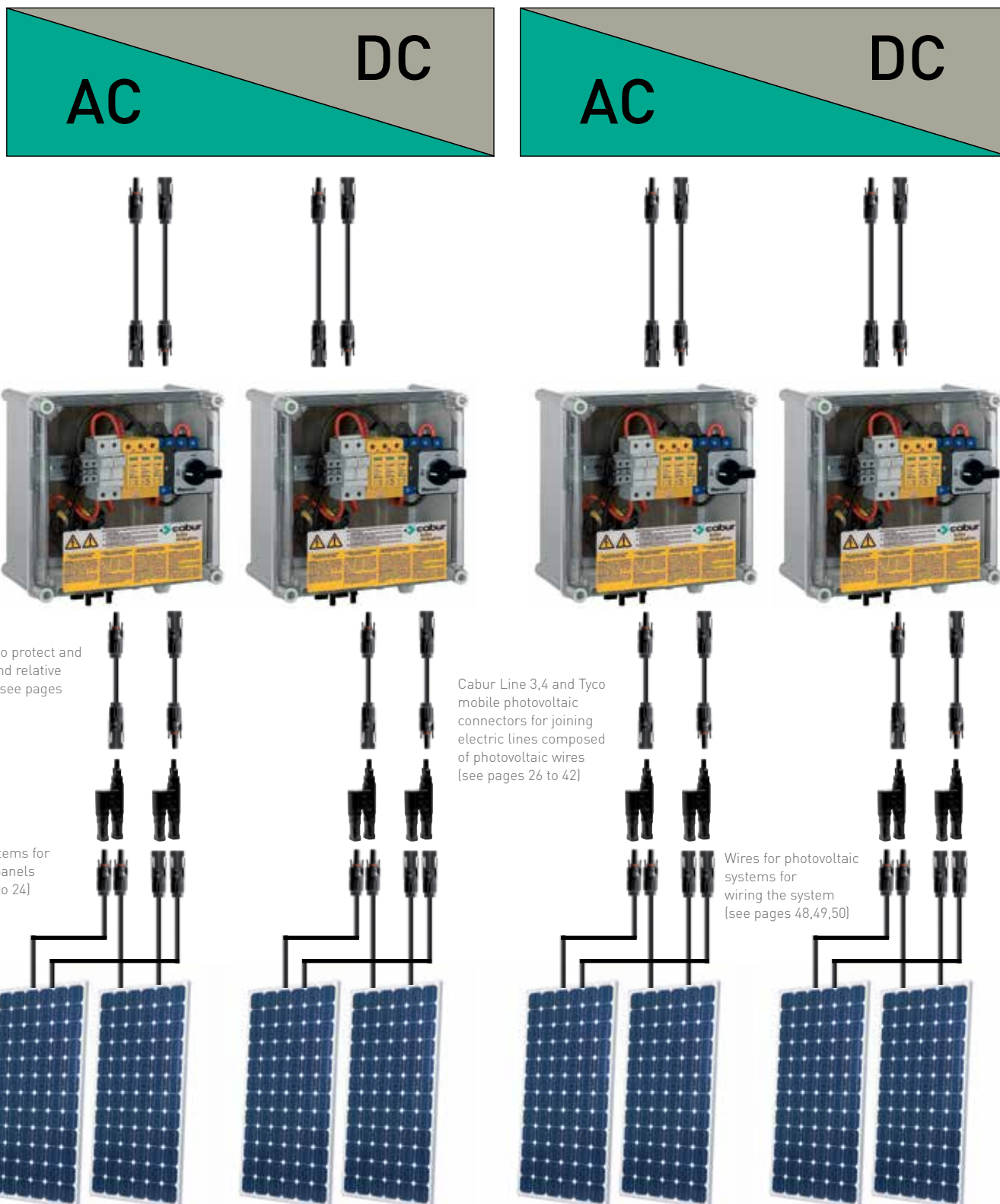
To guarantee safety, duration over time and maximum efficiency of the system, Cabur also offers selected products and components, such as:

- **mounting systems** for photovoltaic panels;
- a variety of **string boxes** conforming to safety standards;
- **solar combiner boxes** with integrated electronics for monitoring and measure power/energy;
- **control units** for civil systems;
- **surge protection devices**;
- **screw-clamp terminal blocks**;
- **distribution terminal boards**;
- **control rail assemblies**;
- **diodes for strings**;
- **switches and disconnectors**;
- **fuse holders**;
- **boxes and other components** for **distribution panels**;
- **warning labels**.



## Cabur Solar

A range of solutions for PV system connection and protection





# Photovoltaic systems

## Mounting systems

Innovative patented system for positioning and mounting photovoltaic panels equipped with metallic frames on any surface and at any angle.

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# Cabur Solar Fix

## A solution for every type of roof

TYPES OF SURFACES	TYPE OF ATTACHMENT OF THE PHOTOVOLTAIC PANEL				
	Recommended system of support	Essential elements of the system	Page	Optional accessories kit	Page
CORRUGATED METAL ROOFS		Brackets	13	Stainless steel anti-theft tear-off nut	15
		Anchoring plates	14	Rubber insulating sheets	15
		Fastening screws	14	Self-drilling and self-threading screws	15
		Plastic profile	20	Stainless steel anti-theft tear-off nut	24
		Sliding plastic cursor	23	Rubber insulating sheets	24
		Fastening angle bar	23	Self-drilling and self-threading screws	24
		Anchoring plates	23		
		Fastening screws	23		
CURVED TILE ROOF		ISFIXSP2 type supports	16	Clips for fastening wires to the rails	24
		Intermediate plates and end sections	18	Union joint	24
		Profiles in aluminium and zinc-plated steel	17	Stainless steel anti-theft tear-off nut	24
		ISFIXSP1 type supports	16	Clips for fastening wires to the rails	24
		Intermediate plates and end sections	18	Union joint	24
		Profiles in aluminium and zinc-plated steel	17	Stainless steel anti-theft tear-off nut	24
FLAT CEMENT ROOFS		Brackets	13	Stainless steel anti-theft tear-off nut	15
		Anchoring plates	14	Rubber insulating sheets	15
		Fastening screws	14	Self-drilling and self-threading screws	15
		Plastic profile	20	Stainless steel anti-theft tear-off nut	24
		Sliding plastic cursor	23	Rubber insulating sheets	24
		Fastening angle bar	23	Self-drilling and self-threading screws	24
		Anchoring plates	23		
		Fastening screws	24		
		Tilter	17		
		Profiles in aluminium and zinc-plated steel	17		
		Intermediate plates and end sections	18		
CORRUGATED METAL ROOFS		ISFIXSP1 type supports	16	Clips for fastening wires to the rails	24
		Intermediate plates and end sections	18	Union joint	24
		Profiles in aluminium and zinc-plated steel	17	Stainless steel anti-theft tear-off nut	24
		Type D brackets	13	Stainless steel anti-theft tear-off nut	24
		ISFIXPPL type plastic profiles	20	Rubber insulating sheets	24
		Sliding plastic cursor	23	Self-drilling and self-threading screws	24
		Fastening angle bar	23		
		Anchoring plates	23		
		Fastening screws	23		

# Cabur Solar Fix

## Support bracket for attaching photovoltaic panels to corrugated metal roofs

+ EFFICIENCY  
- COSTS

End bracket  
with plastic plate



Intermediate bracket  
with plastic plate



End bracket  
with plastic plate



Intermediate bracket  
with plastic plate



**Innovative patented system for positioning and fastening photovoltaic panels equipped with metallic frames on corrugated metal sheets and at any angle.**

The system is based on the use of brackets, complete with relative accessories (screws, washers and plates).

To satisfy various installation needs, models with different profiles are available (see drawings on page 13), each of which is available with stainless steel or plastic plates.

Panel anchorage requires a certain number of brackets with intermediate plates (to be inserted between adjacent panels) and brackets with end plates (to be inserted at the edges of the string), depending on the number of panels to be installed.

The difference between the intermediate and end plates is the shape: the end plates are in fact folded into an L to compensate for the lack of an adjacent panel.

To calculate the number of brackets, consult the specific paragraph (see page 13).

### Technical features

- Material: Durethan BKV 30H
- Estimated minimum duration: 20 years with exposure to the UVA component of sunlight
- Mechanical properties verified by the European Quality Institute in Fabriano (AN)
- Resistance to rain, wind, and UV rays verified by the European Quality Institute in Fabriano
- Maximum recommended tightening torque: 10 Nm

### Conservation of the mechanical properties

Regarding the plastic's conservation of its mechanical properties despite exposure to solar radiation -- UVA rays -- special tests were carried out by the **European Quality Institute in Fabriano (AN)**, under the inspection control of **TÜV Rheinland Italia**.

The tests show that the mechanical resistance of the Cabur Solar Fix brackets remains practically constant over time, even after prolonged exposure to UVA rays.

**PATENTS:** The Cabur Solar Fix Bracket is protected by an international patent.

# Cabur Solar Fix

## Many advantages and a saving of 30% with the use of the brackets for corrugated metal sheets

### 1. Take advantage of surfaces not otherwise used

Although it is true that a surface of PV panels that do not face in the optimum direction has a lower yield, it is also true that it will, in any case, yield a quantity of energy in addition to that produced by the other strings of the system. The construction of a photovoltaic system involves the installation of the panels in a manner which satisfies the basic requisites such as SOUTH facing and an optimum TILT angle, as well as other factors to minimise the effect of shade and dirt which could occur.

The table below shows, for example, that a panel facing west sloping 0° (to the horizontal) yields almost as much as the classic south-facing panel at a 30° tilt. Thanks to its versatility, the Cabur Solar Fix bracket means that panels can be attached at various angles, meaning that all available surfaces can be used.

Orientation	The angle of tilt			
	0°	30°	60°	90°
East	93%	90%	78%	55%
South-East	93%	96%	88%	66%
South	93%	100%	91%	68%
South-West	93%	96%	88%	66%
West	93%	90%	78%	55%

### 2. Maximum yield

The special shape of the bracket creates a hollow ventilation space, without the hindrance of secondary structures, of more than 4 cm between the photovoltaic module and the surface beneath. This means that the system is less subject to overheating, giving a greater yield.

### 3. Universal and versatile

Thanks to the two corrugation profiles, it is possible to cover practically every type of corrugated panel measurement; the holes in the wings at the base of the bracket also allow for use on wood or cement roofs.

The bracket can be used to anchor the photovoltaic panel strings on normal tiles roofs of civil buildings, as well as on metallic roofs typical of industrial buildings.

### 4. Simple and lightweight

Assembly is fast and simple: with a few steps, the bracket is ready to anchor the photovoltaic modules.

The support is light due to the material used (especially if compared to the traditional aluminium anchorage profiles). The bracket also has exceptional mechanical resistance which, together with its light weight, makes the installer's work much easier when laying the panels. It will no longer be necessary to lift up to the roof, sometimes working in extremely uncomfortable positions, large quantities of aluminium profiles, but above all it will no longer be necessary to cut and shape the metallic frames to adapt them to both the

## The Great Innovation in anchorage systems

1. With maximum exploitation of the surface, positioning the panels at different slopes, following the shape of the surface on which they rest.

2. Obtain the maximum output from the system, reducing heating of the panels to the minimum.

3. Universal and versatile, suitable for almost all sandwich panels on the market, on corrugated metal roofs, tiled, or wooden or cement roofs.

4. Allows simple and fast installation, with lightweight, easy to handle components.

5. For aesthetically and architecturally elegant and modern solutions.

6. Perfect for attaching panels to corrugated metal roofs, when replacing Eternit roofs, maximising the associated incentives.

7. Made of eco-friendly materials, chosen to ensure maximum duration of system components.

8. Costing about 30% less, for the same power installed, than traditional systems using aluminium profiles.

## Cabur Solar Fix

Many advantages and a saving of 30% with the use of the brackets for corrugated metal sheets



panels and the shape of the roofing. In addition, with the same surface area and using the same type of photovoltaic panels, with Cabur Solar Fix brackets more panels can be installed, placed much closer together and with only minimal space left between them.

### 5. Obtain modern solutions, aesthetically and architecturally elegant.

The system based on Cabur Solar Fix brackets allows architects to develop aesthetically elegant solutions and to give them a personal character, altering the geometry of the buildings according to photovoltaic technology, in an architectural combination of harmoniously pleasant forms and at the same time with a modern appearance, which can make a mark over time on the architectural style.

### 6. Possibility to exchange old and dangerous Eternit roofs still found on thousands of Italian buildings with an elegant and money-saving replacement<sup>1</sup>

Old roofs in Eternit are normally replaced by corrugated metallic roofs. Cement slabs containing asbestos on industrial roofs are generally replaced by steel-insulation-steel sandwich panels.

The Cabur Solar Fix device is ideal for anchoring photovoltaic modules to this type of roof, thanks to its design which adapts perfectly to the sizes of the standard corrugations. In the case of removal of asbestos roofs, **the photovoltaic energy production conversion incentive increases by 10% (please refer to the GSE regulations in effect for more information)<sup>1</sup>.**

### 7. Quality of the material

The bracket is made of Durethan BKV 30H by Bayer/Lanxess, already used in the automotive sectors and for other photovoltaic applications. Especially on metallic roofs, this material insulates the roof from the photovoltaic module, avoiding the formation of galvanic and creeping currents. This means that there will be no anodic oxidation of the metals in contact with each other, nor rust problems in areas near the shore where the atmosphere is warm, damp and salty. Furthermore, the material is not subject to rot or to freezing, and it is resistant at both high and low temperatures. Less energy is needed for its production than for metal brackets, which means lower CO<sup>2</sup> emissions into the atmosphere. The brackets are also made with 20% recycled material.

### 8. Cost

Since about 10 brackets are needed for every KW of photovoltaic power installed (including intermediate and end brackets), compared to traditional anchorage systems with aluminium profiles and with the same amount of photovoltaic power installed on the roof, **using Cabur Solar Fix reduces costs by about 30%.** Cabur Solar Fix furthermore satisfies the condition for applying the rebate (Art. 14 letter d) Italian Ministerial Decree 5 May 2011), which concerns the components other than the labour, referable to a product from within the European Union.

<sup>1</sup> The data and information provided here refers to the regulations in effect at the time this document was prepared. For up to date information, please refer to the official GSE documentation. (GSE: Gestore dei Servizi Energetici - Italian Energy Services Manager).

# Cabur Solar Fix

## Recommendations for correct use of the brackets

### Fixing of photovoltaic panels with metallic frame

The bracket allows for anchorage on:

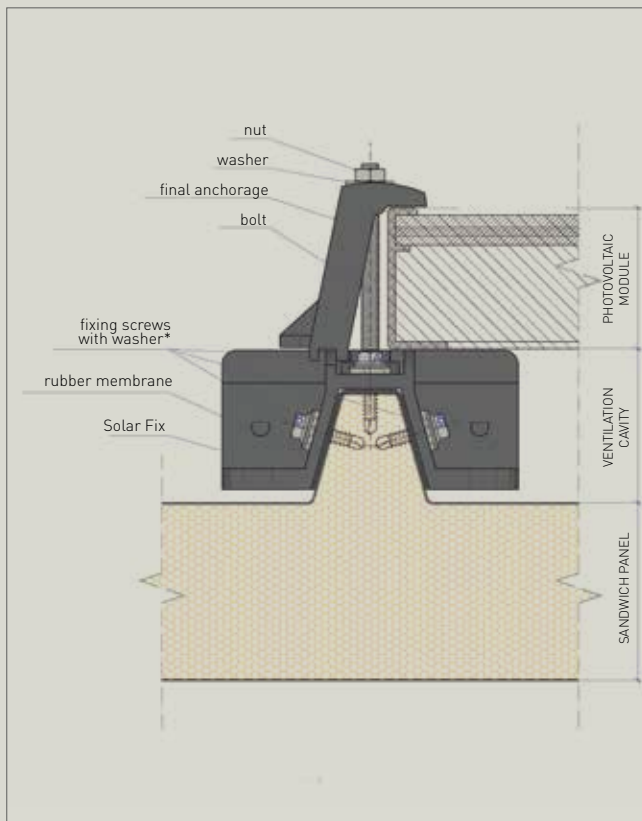
- sandwich panels (the typical roofs of industrial sheds);
- smooth sloping roofs (the typical roofs of residential dwellings with rounded tiles) and on cement mix surfaces or wooden boards;
- corrugated metal sheets.

Approximate indications are given below for the most common cases.

### Installation on corrugated metal roofing

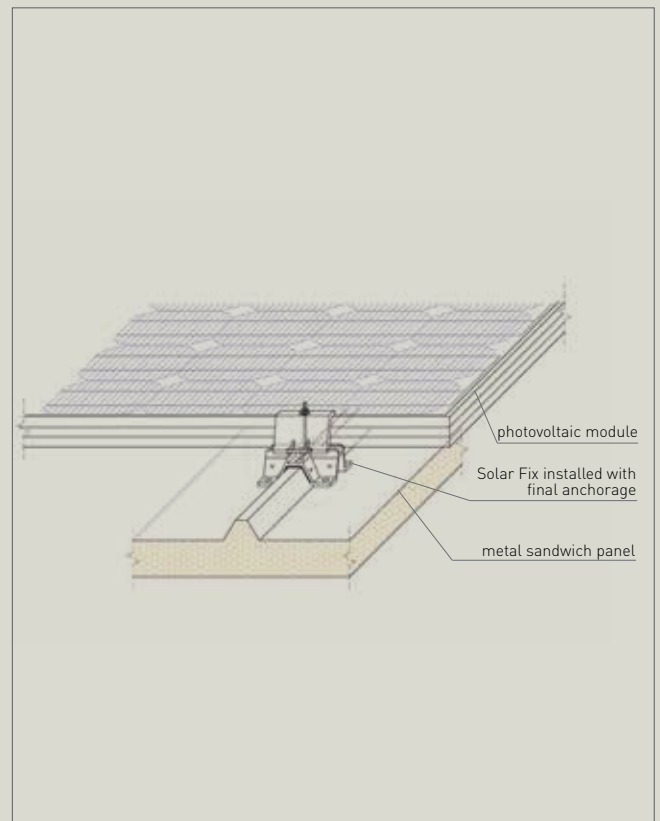
Most sandwich panels have two different corrugation sizes: narrow and wide. The bracket can be positioned according to the profile of the type of panel (see drawing below left).

EXAMPLE OF ASSEMBLY ON METAL SANDWICH PANELS WITH NARROW CORRUGATION



A - anchorage with screws on steel sandwich panels can be carried out with the upper vertical holes (A) and/or the prints on the sloping walls of the bracket (B)

EXAMPLE OF USE ON METAL SANDWICH PANEL



# Cabur Solar Fix

## Recommendations for correct use

### Installation on metallic roof sandwich panels

The following sequence of images shows the steps for the

creation of photovoltaic systems on metallic roofs of industrial sheds.



The brackets are anchored to the corrugations of the panels with perforating and self-threading screws at reciprocal distances depending on the size of the single photovoltaic panel.



The presence of the corrugations allows for fast and simple alignment of the brackets.



The various panels forming the photovoltaic strings are positioned and the string is "closed" with the end brackets on the perimeter. The intermediate wiring of each string, like its connection to the rest of the system, is carried out and assured with CABUR mobile photovoltaic connectors.



The system is finished and ready to be connected to the inverter.

# Cabur Solar Fix

## Recommendations for correct use

### Installation on rounded tiles

1. Decide on which slope of the roof the string will be placed.
2. Remove the tiles or pantiles to uncover the underlying waterproofing layer.
3. Position and fix the first series of brackets, using the panels themselves as a geometric reference.
4. Position the second series, marking the points where holes need to be drilled for the final fixing of the second row of brackets. Proceed in this way until all the supporting brackets have been fixed.

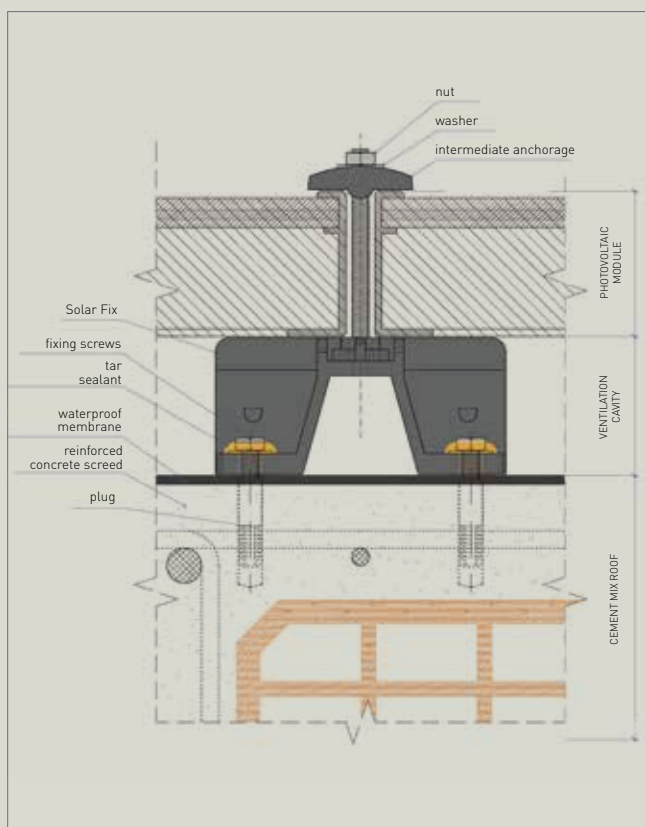
### Please note:

■ To avoid water seepage, every hole must be made waterproof, covering the head of each screw with an insulating material such as weather proof tar sealants, chemical or liquid resins, special weatherproof silicon, polyurethane sleeves, or sheet-metal silicon, which adheres to both the metallic head of the screw and the plastic base of the bracket preventing any penetration of water.

■ To obtain total architectonic integration, the photovoltaic panels must be positioned near the pantiles. It is best to cement the last row of tiles.

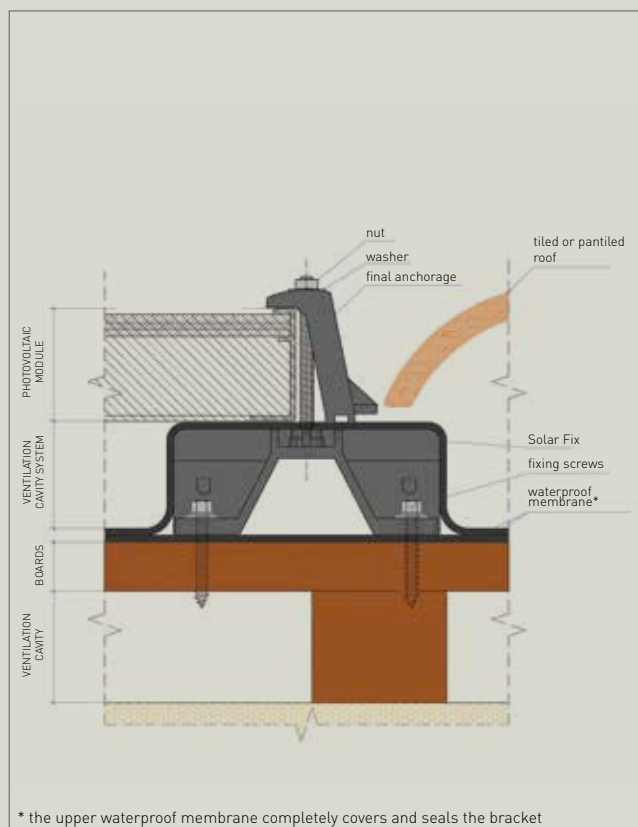
On completion, the series of panels covers the slope of the roof harmoniously and the photovoltaic system is linear, tidy and aesthetically clean, which certainly is not the case with the positioning of the classical aluminium beams on the tiles.

EXAMPLE OF INSTALLATION ON SMOOTH SLOPING ROOFS WITH A STRUCTURE IN CEMENT MIX



Example of installation on smooth sloping roofs with a structure in cement mix

EXAMPLE OF INSTALLATION ON SMOOTH SLOPING ROOFS MADE OF WOODEN BOARDS



Example of installation on smooth sloping roofs made of wooden boards

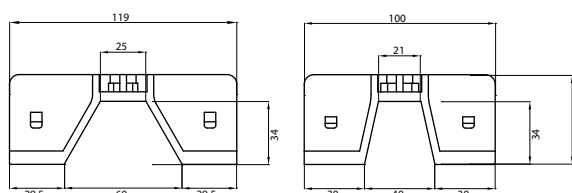
# Cabur Solar Fix

## Support brackets. How to order

**ATTENTION:** to guarantee the maximum adaptability of the Cabur Solar Fix system to the specific requirements of every installation, starting in 2012 the brackets are distributed without plates and screws, which must be selected based on the height and arrangement of the panels. Consequently, instead of the old items, the individual components (brackets, screws and plates) must be ordered.

**How to order:** every package includes the bracket and its rubber sheet. It does not include the plates, the screws and the accessory components, which must be ordered separately.

BRACKET TYPE A

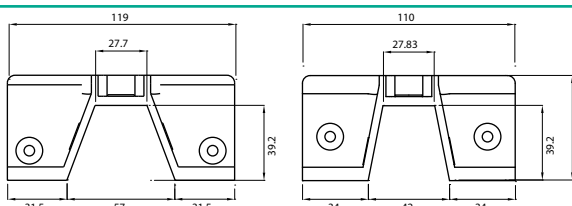


Code **ISFIX00**

Bracket profile A and 110x130 mm rubber sheet (the package does not contain any other accessories)

20 pieces per pack

BRACKET TYPE B

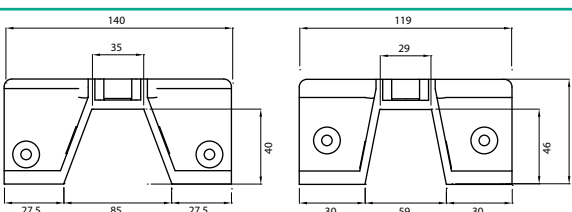


Code **ISFIX00B**

Bracket profile B and 110x130 mm rubber sheet (the package does not contain any other accessories)

20 pieces per pack

BRACKET TYPE C

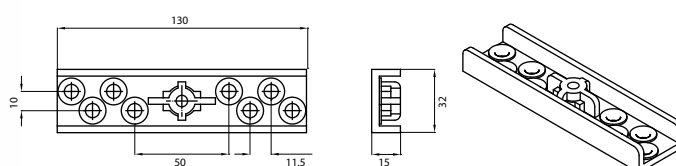


Code **ISFIX00C**

Bracket profile C and 110x130 mm rubber sheet (the package does not contain any other accessories)

20 pieces per pack

TYPE D BRACKET



Code **ISFIX00D**

Bracket profile D and silicon rubber washers (the package does not contain any other accessories)

20 pieces per pack

NOTE: The drawings are purely indicative. The proportions may not correspond to the actual ones. Therefore please refer to the quotes

given above for the real measurements.

## Calculation of the number of brackets

To calculate the quantity, take into consideration:

- the number of panels (P) in every row
- the number of rows of panels (N)
- the number of strings (Sr)

NOTE: the above formulas give the exact number of brackets required for each square or rectangular string with a continuous structure,

Calculation of the number of brackets (S):

- for 1 row of panels:  $S = 2P + 2$
- if the string has N rows:  $S = N(2P + 2)$
- if Sr is the number of strings of the system:  $S = SrN(2P + 2)$

i.e. with no empty spaces between them. For strings with other or irregular shapes, the formulae give a purely indicative value.

# Cabur Solar Fix

## The components for the brackets

The anchoring of the photovoltaic panels onto corrugated metal requires the use of the brackets (see page 13) and the necessary components, to be selected based on the characteristics of the installation.

- Select the number of plates by type (intermediate and end) based on the number and arrangement of the panels and strings

- Select the model of the plates based on the material chosen (plastic or stainless steel)
- Select the type of end plates and screws based on the thickness of the panels.



### ANCHORING PLATES (in packs of 20 pieces)

Panel Thickness	Intermediate Plate		End Plate	
	in plastic	in stainless steel	in plastic	in stainless steel
31 mm	ISFIXSPPLI	ISFIXSPAZI	ISFIXSPPL31T	ISFIXSPA31T
35 mm			ISFIXSPPL35T	ISFIXSPA35T
38 mm			ISFIXSPPL38T	ISFIXSPA38T
40 mm			ISFIXSPPL40T	ISFIXSPA40T
42 mm			ISFIXSPPL42T	ISFIXSPA42T
46 mm			ISFIXSPPL46T	ISFIXSPA46T
50 mm			ISFIXSPPL50T	ISFIXSPA50T



### FIXING SCREWS

Code	ISFIXVTAZ60	ISFIXVTAZ65	ISFIXVTAZ70	ISFIXVTAZ75
Description	M6 x 60 screw including nut and washer	M6 x 65 screw including nut and washer	M6 x 70 screw including nut and washer	M6 x 75 screw including nut and washer
Panel thickness (mm)	31	35-38	40-42	46-50
Quantity per pack	100	100	100	100

# Cabur Solar Fix

## Bracket accessories



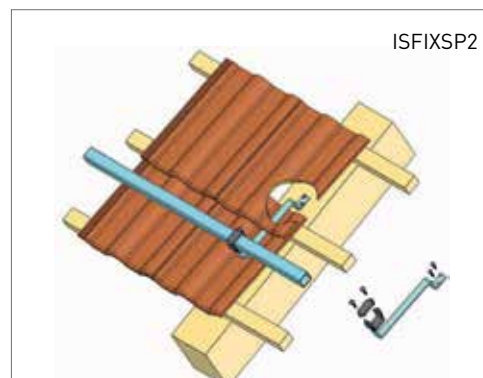
Code	ISFIXDAF	ISFIXVLO	ISFIXG
Description	Stainless steel anti-theft tear-off nut. M6.	Stainless steel self-piercing and self-threading screw for attachment to all Cabur Solar Fix brackets for corrugated sheet metal roofs. L=25mm - Ø=1.8mm	Insulating rubber sheets, 110x130 mm
Quantity per pack	50 pieces per pack	500 pieces per pack	10 pieces per pack



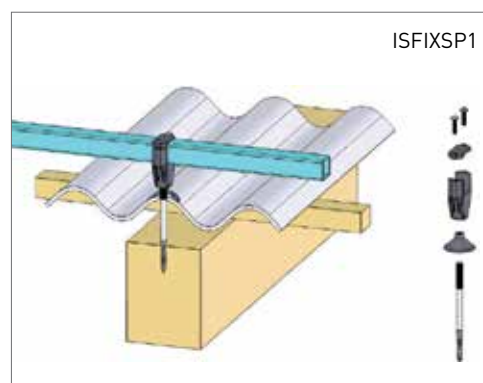
Code	ISFIXCLP	ISFIXDUO
Description	Clips for fastening wires to the profiles	Union joint for profiles
Quantity per pack	100 pieces per pack	5 pieces per pack

# Supports

## Supports for anchoring on curved/flat tiles and on corrugated sheets



**Supports for anchoring on curved tiles** (code ISFIXSP2) allow photovoltaic modules of any size to be fastened to curved tiles. The bracket, fastened to the roof, is composed of a galvanized steel part and a plastic part. The union of these two materials is the real peculiarity of this unique product.



**Supports for anchoring on corrugated sheets** (code ISFIXSP1) allow photovoltaic modules of any size to be fastened to corrugated metal sheets supported by wooden ties. The corrugated sheet is fastened to the ties with a self-threading screw. A thermoplastic rubber seal guarantees that it is watertight and prevents water from infiltrating.

Code	ID number	Description	Pcs x pack
ISFIXSP1	ISFIXSP1	Support for anchoring on corrugated metal sheets for 40x40 mm profiles	5
ISFIXSP2	ISFIXSP2	Support for anchoring on curved tiles for 40x40 mm profiles	5

NOTE: both products can be combined with the plates for ISFIXSP type panels...., as per page 18.

**Materials:** 30% fibreglass with nylon 6 and thermoplastic rubber. Both materials are tested for 20 years of use and wear, as required in photovoltaic installations.

# Tilter

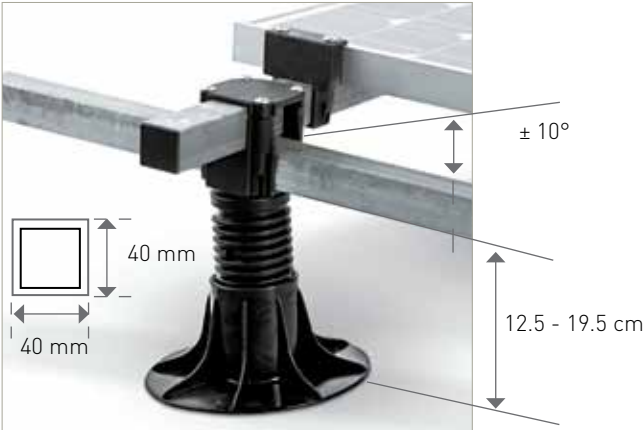
## Supports for flat roofs (code ISFIXINC)



The support for flat roofs is composed of 40mm x 40mm profiles and a plastic support with adjustable height.

It is designed to ensure the best output from the photovoltaic panels should it be necessary to install a support structure on a flat roof.

Its characteristic is that of allowing the modules to be tilted up to a 10° angle of tilt relative to the support surface.



Code	ID number	Description	Pcs x pack
ISFIXINC	ISFIXINC	Tilter	5
ISFIXCLP*	ISFIXCLP*	Fastening clips for wires	100
ISFIXDUO	ISFIXDUO	Union joint	5
ISFIXPAZ	ISFIXPAZ	40x40mm zinc-plated steel profile	5 bars of 3 m / each
ISFIXPAL	ISFIXPAL	40x40mm aluminium profile	5 bars of 3 m / each

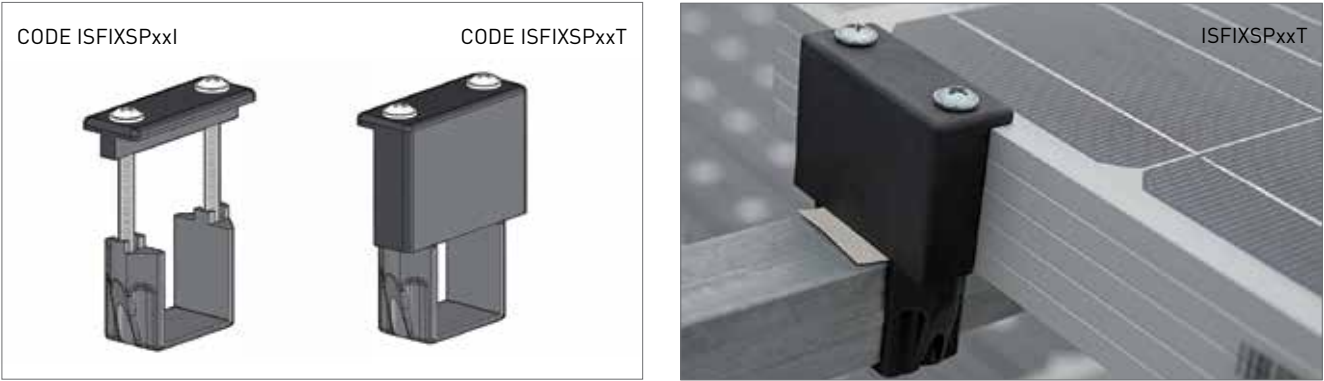
\* See page 14.

# Plates

## Plates for photovoltaic panels

**Intermediate plates and end plates:** this system allows galvanised metal plates to be supported and the photovoltaic modules fastened with plastic anchorage supports. These plates are made of 30% nylon 6 reinforced fibreglass and are divided into two groups: end plates and intermediate plates.

The first are used in external end modules and must be of the same height. The others are used in the intermediate modules and are a standard height. Clips are also available for anchoring and passing the photovoltaic wires (code ISFIXCLP - see page15).



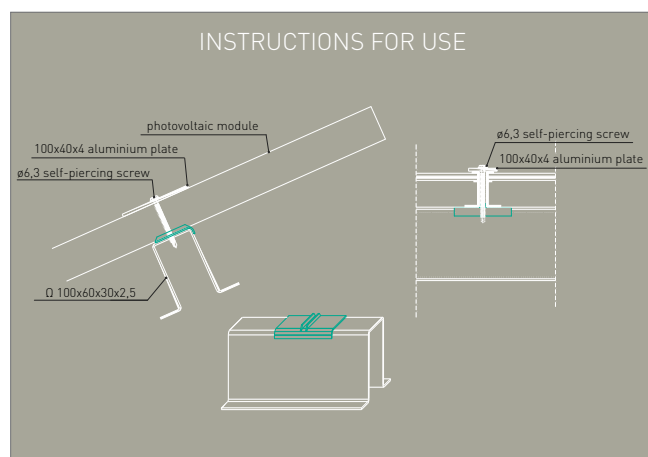
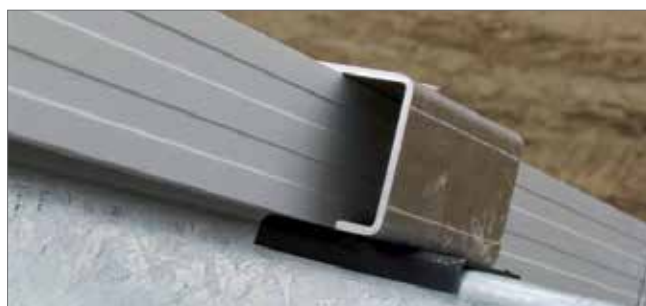
### PLATES FOR PHOTOVOLTAIC PANELS

(can be combined with ISFIXSP1, ISFIXSP2 and ISFIXINC)

Panel Thickness	Intermediate Plate	End Plate	Pcs x pack
31 mm	ISFIXSP31I	ISFIXSP31T	5
35 mm	ISFIXSP35I	ISFIXSP35T	5
38 mm	ISFIXSP38I	ISFIXSP38T	5
40 mm	ISFIXSP40I	ISFIXSP40T	5
42 mm	ISFIXSP42I	ISFIXSP42T	5
46 mm	ISFIXSP46I	ISFIXSP46T	5
50 mm	ISFIXSP50I	ISFIXSP50T	5

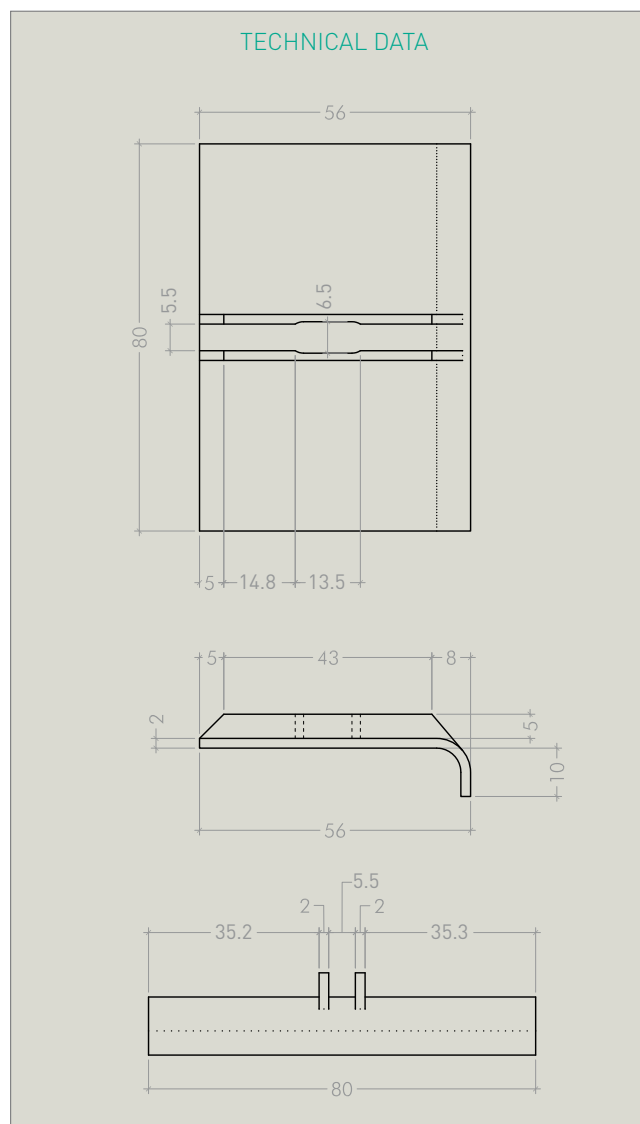
# Spacers

(code ISFIXDST)



It is strongly recommended for applications in which the photovoltaic modules come into contact with a support structure, normally in a material other than that of the modules which are in anodised aluminium.

In fact, in certain environmental conditions, such as salty fog, the different types of metal in contact oxidise over time which



deteriorates the components and downgrades the mechanical and functional characteristics. The spacer in an insulating material resolves the problem by separating the frame of the modules from the supporting structure.

Distributed in packs of 100 pieces

## Plastic profile

### The only rail in plastic for photovoltaic systems



Code **ISFIXPPL**

Description: **Profile in Durethan BKV 325 plastic material**

Quantity per pack: **5 bars of 3.20 m/each**

Components and accessories: **see pages 23-24**



This new anchoring system for photovoltaic panels is composed of extruded plastic Durethan BKV 325 bars 3.2 metres long attached to the roof by L-shaped stainless steel plates (see page 23).

The photovoltaic panel rests on the pair of bars and is fastened there with the items listed on page 23 and the locking KIT, selected based on the thickness of the panel.

## Use

- Cut the bars to size and drill them easily and at the worksite
- Use several screw systems for the anchoring (Figure 1)
- Use the same bar even for spans without bends or angles beyond the limit of one bar by joining two bars
- Create simple framed structures.

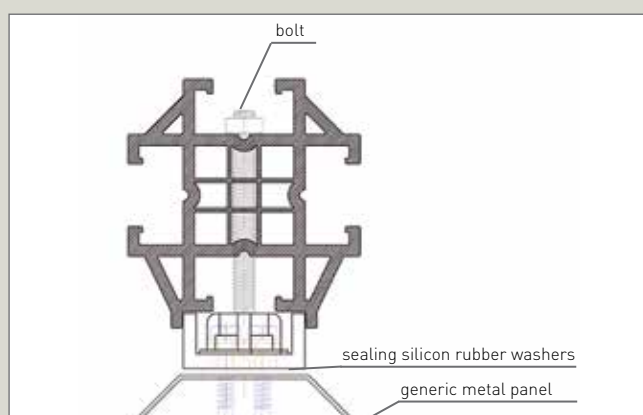
## Advantages of the system

- Electrically insulated (protects from galvanic currents, anodic oxidations, etc.)
- Free of oxidation and corrosion phenomena also where salty fogs are present
- Light.

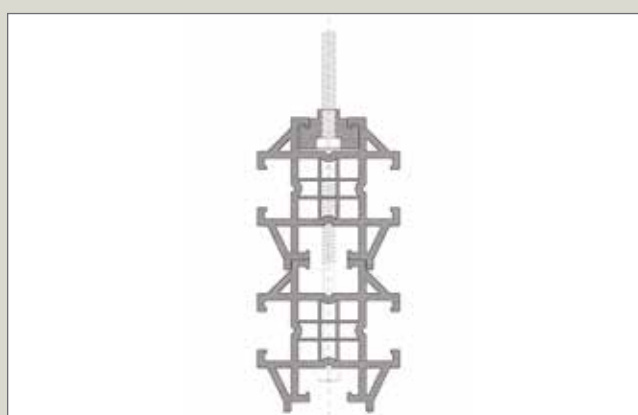
# Plastic profile

## Recommendations for correct use

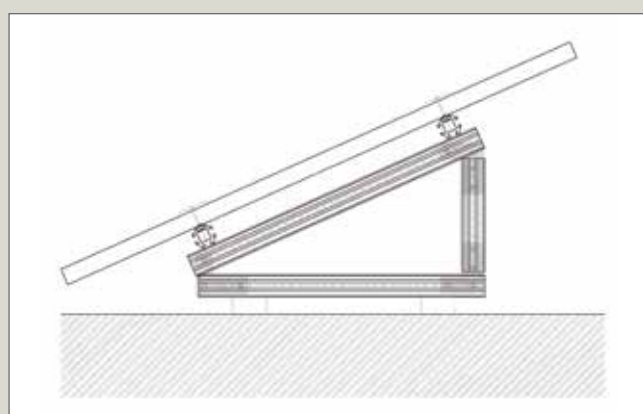
EXAMPLE OF ANCHORING WITH TYPE D BRACKET



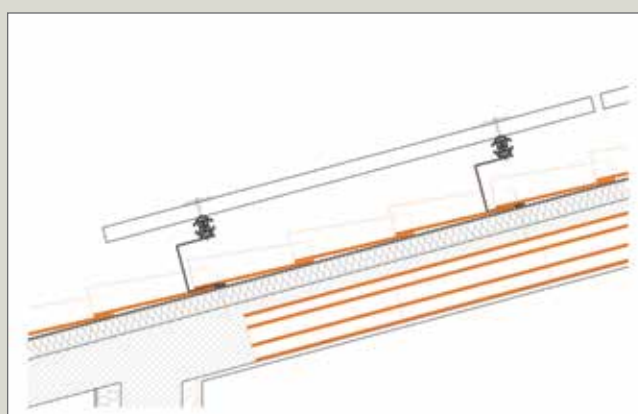
EXAMPLE OF OVERLAPPING PROFILES



EXAMPLE OF INSTALLATION ON FLAT SURFACES



EXAMPLE OF INSTALLATION ON ROOFS



130 kWp PV system created at the Cabur srl offices in Altare (Savona).

# Plastic profile

## Intermediate and final anchoring systems

### INTERMEDIATE ANCHORING SYSTEMS WITH PLASTIC PLATES



Anchoring example of panels using intermediate plastic plate

### FINAL ANCHORING SYSTEM WITH PLASTIC PLATES



Anchoring example of panels using plastic end plates

### INTERMEDIATE AND END PLASTIC ANCHORING KIT



Intermediate plate (left) and end plate (right) and their components for anchoring with the plastic profile

# Plastic profile

## The components

The anchoring of the photovoltaic panels with the profile requires components to be selected based on the characteristics of the system.

- Select the number of plates by type (intermediate and end) based on the number and arrangement of the panels and

strings

- Select the model of the plates based on the material chosen (plastic or stainless steel)

- Select the type of end plates and screws based on the thickness of the panels.



### ANCHORING PLATES (in packs of 20 pieces)

Panel Thickness	Intermediate Plate		End Plate	
	in plastic	in stainless steel	in plastic	in stainless steel
31 mm	ISFIXSPPLI	ISFIXSPAZI	ISFIXSPPL31T	ISFIXSPA31T
35 mm			ISFIXSPPL35T	ISFIXSPA35T
38 mm			ISFIXSPPL38T	ISFIXSPA38T
40 mm			ISFIXSPPL40T	ISFIXSPA40T
42 mm			ISFIXSPPL42T	ISFIXSPA42T
46 mm			ISFIXSPPL46T	ISFIXSPA46T
50 mm			ISFIXSPPL50T	ISFIXSPA50T



### FIXING SCREWS

Code	ISFIXVTAZ60	ISFIXVTAZ65	ISFIXVTAZ70	ISFIXVTAZ75
Description	M6 x 60 screw including nut and washer	M6 x 65 screw including nut and washer	M6 x 70 screw including nut and washer	M6 x 75 screw including nut and washer
Panel height (mm)	31	35-38	40-42	46-50
Quantity per pack	100	100	100	100



### OTHER COMPONENTS

Code	ISFIXCUR	ISFIXAGL
Description	Plastic sliding cursor to be inserted in the rail guide	Roof corner fastener in stainless steel
Quantity per pack	100	20

# Cabur Solar Fix

## Accessories of the supports



Code	ISFIXDAF	ISFIXVLO	ISFIXG
Description	Stainless steel anti-theft tear-off nut. M6.	Stainless steel self-piercing and self-threading screw for attachment to all Cabur Solar Fix brackets for corrugated sheet metal roofs. L=25mm - Ø=1.8mm	Insulating rubber sheets, 110x130 mm
Quantity per pack	50 pieces per pack	500 pieces per pack	10 pieces per pack



Code	ISFIXCLP	ISFIXDUO
Description	Clips for fastening wires to the profiles	Union joint for profiles
Quantity per pack	100 pieces per pack	5 pieces per pack



# Photovoltaic systems

## Connections and wiring

A range of solutions for creating safe and reliable connections with the most common inverters / junction boxes.

FROM PAGE 26 TO PAGE 50

26	Cabur Solar connectors. For connection with the most common inverters and junction boxes
27	Composition and materials
29	Electro-thermal tests
30	Line 3
34	Line 4
36	Accessories
37	Joint with MC connectors
38	Solarlok® connectors. For connection to Inverter and photovoltaic panels equipped with TYCO connectors
42	Connection to connectors. With Cabur Solar Y joints and Tyco mobile connectors
43	Tools for perfect photovoltaic connections
44	Tools. Matrices for crimper UMCT3149
45	Tools. Recommendations for correct use
47	First installation kit
48	Wires for small and large photovoltaic systems
49	Technical characteristics for FG21M21 IMQ certified wires
50	Technical characteristics for PV1-F TÜV certified wires

# Cabur Solar connectors

## For connection with the most common inverters and junction boxes

With Cabur Solar connectors, connections are simple and effective for the most common inverters/junction boxes.

There are essentially two categories or groups:

- Line 3, with 3mm diameter metal contacts;
- Line 4, with 4mm diameter metal contacts;

These lines can in turn be divided into:

- mobile connectors, male and female;
- panel connectors, male and female;
- Y connectors for forked lines;
- caps and accessories.

All Cabur Solar connectors feature:

- maximum voltage: 1,000 VDC;
- contact resistance: < 5 mΩ;
- contact material: tin-plated copper;
- insulation: PPO;
- degree of protection: IP67 (IEC 60529);
- temperature range: -40°C +85°C;
- flammability class: UL94-V0.

To guarantee correct fixing according to standards, Cabur recommends the use of the professional UMCT crimper, together with the matrix IS3153 for Line 3 connectors and IS3154 for Line 4 connectors, or the IS3161 crimper (see pages 43-46).

To ensure the guarantee's effectiveness, the use of Cabur Solar tools, in conformance with the standards and instructions found in Cabur official documentation, is an essential requirement.



The line includes mobile and panel connectors certified TÜV.

## Fast, simple, and effective: connection in just three steps

1. Insert the stripped wire into the contact to be crimped -CRIMP IT-.
2. Insert the wire complete with contact into the connector and push hard until you hear the typical CLICK which indicates that the plastic and metal parts are hooked together. Do not make any joints without checking that the plastic and metal parts are hooked together.
3. Screw on the wire gland washer manually until it is firmly home to guarantee IP67.



# Cabur Solar connectors

## Composition and materials

### Line 3 and 4 mobile male-female connectors

These are composed of 4 basic parts (figs. 1 and 4):



Fig. 1 - Exploded view of the panel connector body. The product is provided assembled]

**1.** A **metallic contact known as a PIN** (fig. 4) made of tin-plated copper and formed using a moulding technique. It has two wings necessary to anchor it to the electric wire. This is done by crimping or mechanically, using matrix **IS3153-IS3154** in the relevant pliers **UMCT3149**, which, by bending the wings on the metallic core of the photovoltaic wire (figs. 2, 3), ensures correct and safe anchoring in accordance with **CEI EN 60352-2**. Perfect insulation of the metallic contact can be further guaranteed by placing caps **IS51400** and **IS52400**

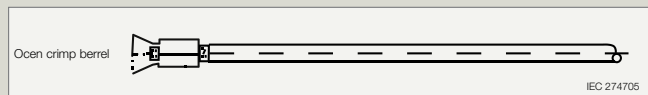


Fig. 2 - Wire crimped onto PIN

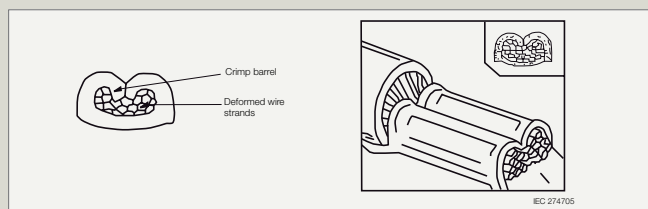


Fig. 3 - Wire crimped onto PIN

onto the connector. The PIN can be male or female and have a diameter of 3 or 4 mm. The male PIN with 3mm diameter has a cap which insulates the head to ensure insulation degree **IP20**. The male 4mm PIN, which remains deeply set into the insulating cavity of the relative connector, does not need an insulating cap (fig. 4).

**2.** A **rubber washer** for waterproofing the internal part of the connector, preventing the penetration of external agents such as humidity, dust, and oils, by squeezing the insulating sleeve of the electric wire.



Fig. 4 - series 3 (right hand pair) and series 4 (left hand pair) PINS

**3.** A **rigid PPO plastic washer** with a conical cavity that, after being screwed onto the main body of the connector, forces the reeds together, compressing the rubber sheath onto the wire insulation and hence acting to help ensure **IP67** protection established on the basis of Technical Standard **CEI EN 60529**.

**4.** A **main body made of PPO plastic** which holds the metallic PIN crimped onto the wire. The male connector holds the male metallic contact (PIN) while the female connector holds the female metallic contact (PIN). The male PIN penetrates the female PIN (as for every other electrical-mechanical connecting device), while the opposite is true for the plastic connector (the insulating sleeve): the female penetrates the male. For this reason, the outer surface of the female connector of Line 3 has two red rubber rings which act as insulating washers against the penetration of external atmospheric agents. Similarly, the female connector of Line 4 has a red rubber ring for the same purpose. The Line 3 connector, being shorter, is more exposed to atmospheric agents and for this reason is provided with a double ring, unlike Line 4 which has only one, as it can penetrate deeper into the relative male and is hence better protected from outside agents.

**The male and female connectors hook together mechanically by means of two pointed anchored elastic wings on the female connectors which must be inserted in the special slots on the insulating body of the male connectors. Everything is rigidly and firmly connected and accidental unhooking of the two connectors, or the chance interruption of the line from the photovoltaic field, is impossible. Disconnection is possible only by pressing on the two male wings with the fingers and simultaneously pulling the female out of the male manually, without the aid of any tool.**

# Cabur Solar connectors

## Male-female panel connectors of Lines 3 and 4

These are composed of 3 parts (fig. 5):

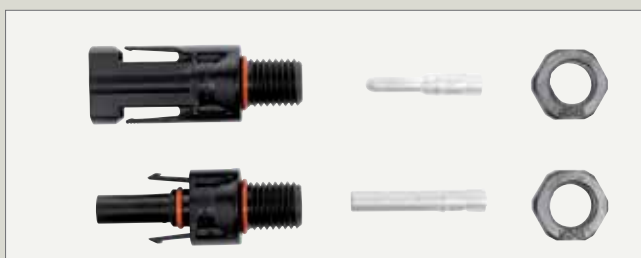


Fig. 5 – Exploded view of the connector body. The product is provided assembled.

1. A **metallic contact** that is the same as the PIN on the mobile version.
2. A **main body made of PP0 plastic** holding the metallic PIN crimped onto the wire which has a red rubber ring located between the surface of the connector and the wall of the box or sheet metal where the connector is installed. This ring acts to create a compressed washer between the connector and the panel able to protect both from being penetrated by atmospheric agents and hence guaranteeing **IP67** protection as in CEI EN 60529. Compression of the insulating ring occurs through tightening the relevant hexagonal nut to fix the panel. The mobile male connectors are hooked to the female panel connectors (or vice versa) as previously described for the connection between flying connectors. Everything is rigidly connected and there is no possibility of accidentally unhooking the two connectors and accidentally breaking the line coming from the photovoltaic system. Disconnection is only possible by pressing the two male wings and simultaneously pulling the female body out of the male body.
3. A **hexagonal nut** used to lock the connector against the steel surface of the panel. These connectors are in plastic and therefore the nut must not be tightened with too much force otherwise the thread would immediately be flattened.

For panel connectors, always attach the **DO NO DISCONNECT UNDER LOAD** sticker near the connector on the surface of the box where it will be fitted.

## Rubber-plastic mobile connectors for Line 3

These are appropriate for connections to both mobile and panel MC3 connectors. This means they can be used for connections for both photovoltaic panels (if provided with the appropriate retention hook), and for inverters (without retention hook). Both connectors, male and female, consist of:

- a metallic tin-plated copper PIN
- a rubber-plastic insulating body
- a washer to obtain IP67
- a closing washer

As the main body of the connector is made of two materials, it ensures speed and simplicity during assembly thanks to the plastic side as well as universal joints thanks to the rubber side. Using these connectors it is possible to connect to any type of photovoltaic device (panel, inverter, string box, etc.) and provide IP67 joints, with the use of Cabur Solar line tools. The joint is done by following the same operations provided for the other connectors of Line 3. The rubber side has a series of grooves which when combined with the similar grooves on the MC3 connectors, ensure their mechanical retention. The presence of the retention hook which is lowered onto the mobile MC3 connector guarantees an even stronger mechanical coupling. The choice of hook will depend on the dimensions of the MC3 connector to be used -- shorter for 40 mm mobile MC3 models and longer for 50 mm models.



Fig. 6 - Exploded view of the rubber connector.

# Cabur Solar connectors

## Electro-thermal tests

The electro-thermal tests carried out for various joints at the KEMA labs in Holland demonstrate the efficiency of Cabur Solar connectors.

The 5 images below show the results obtained from a joint created by the male-female coupling of IS14240 and IS24241 connectors from Line 4.

The results were excellent. The joint, subjected to amperage increasing from 10, to 20, 30, 40, and 50A did not show any signs of overheating which could make usage dangerous.

The thermograms show a generally linear thermal gradient, equal to  $1^{\circ}\text{C/A}$  such that, even for amperages which exceed the maximum allowed 30 A, the joint remains "cold", demonstrating low thermal generation due to the Joule effect. Consequently, there is a low contact resistance and hence low dissipation of electrical power, which has the final consequence of increasing the overall performance of the photovoltaic system. Similar results were obtained for all the other joints, both for Line 3 and Line 4 connectors.

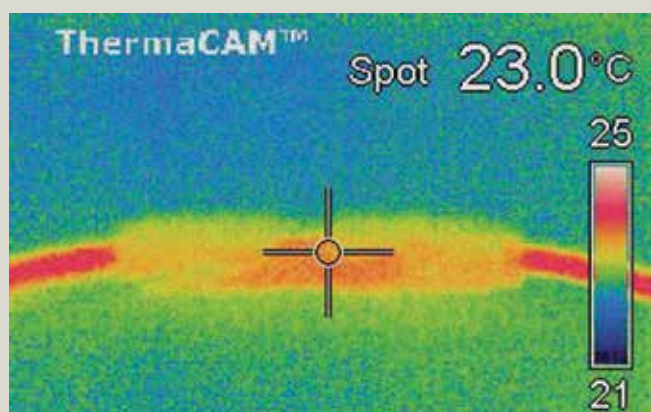


Fig. 1 - Thermogram at 10 A

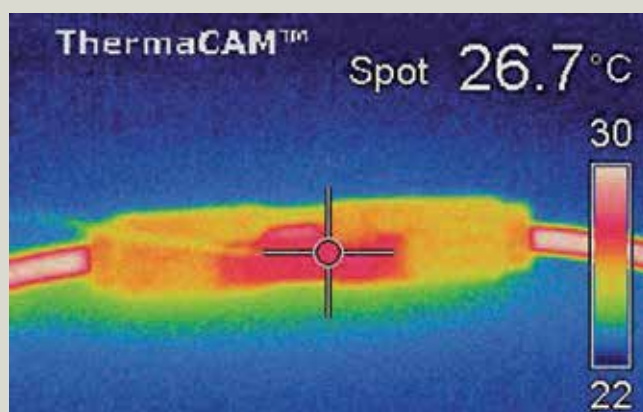


Fig. 2 - Thermogram at 20 A

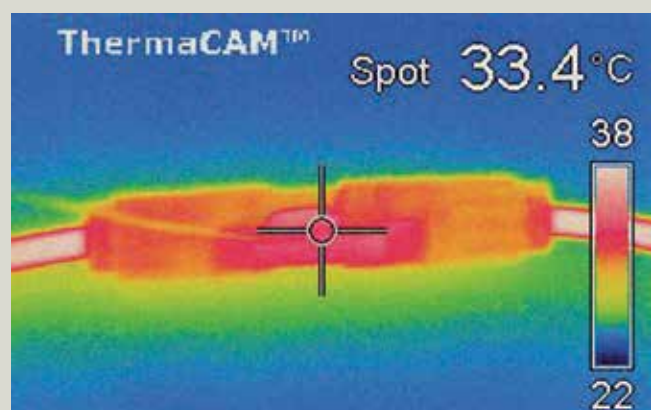


Fig. 3 - Thermogram at 30 A

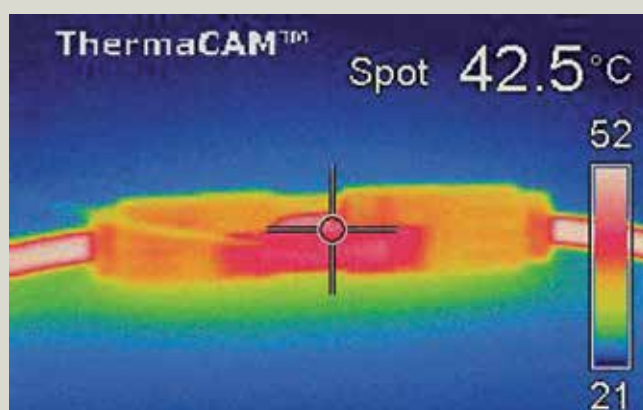


Fig. 4 - Thermogram at 40 A

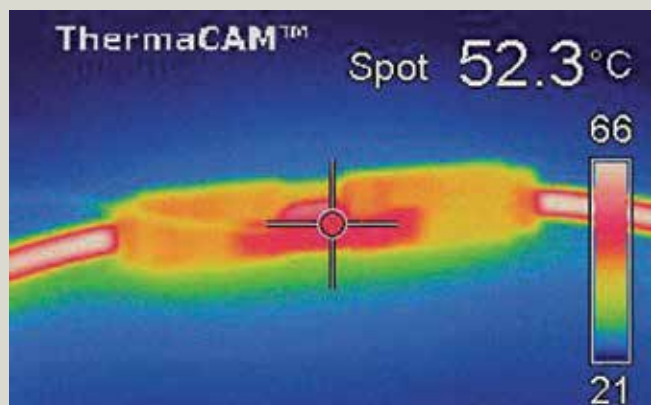


Fig. 5 - Thermogram at 50 A

### WARNING!

The maximum usable current for all Cabur Solar Line connectors is 25 A.

The thermograms shown here demonstrate extreme situations which illustrate the quality of the product. They are not intended to suggest or guarantee project conditions.

# Cabur Solar connectors

## Line 3



Normal packaging: the code refers to packets composed of plastic and metal parts (outer shell + PIN)

Use	On string boxes and/or inverters		Extensions (wire/wire connections)	
Code	IS13112	IS23113	IS13242	IS23243
ID number	KX03PM4060	KX03PF4060	KX03VM4060	KX03VF4060
Application	Panel	Panel	Flying connector	Flying connector
Connector type	Male	Female	Male	Female
PIN diameter	3 mm	3 mm	3 mm	3 mm
Section of crimpable wires	4 mm <sup>2</sup> 6 mm <sup>2</sup>	4 mm <sup>2</sup> 6 mm <sup>2</sup>	4 mm <sup>2</sup> 6 mm <sup>2</sup>	4 mm <sup>2</sup> 6 mm <sup>2</sup>
Pliers	UMCT3149	UMCT3149	UMCT3149	UMCT3149
Matrix	IS3153	IS3153	IS3153	IS3153
Features of metallic PIN	Tin-plated copper	Tin-plated copper	Tin-plated copper	Tin-plated copper
Contact resistance	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ
PIN type	Moulded	Moulded	Moulded	Moulded
Shell features	Plastic (PP0)	Plastic (PP0)	Plastic (PP0)	Plastic (PP0)
Maximum applicable voltage	1,000 VDC	1,000 VDC	1,000 VDC	1,000 VDC
Maximum applicable current	25 A	25 A	25 A	25 A
Admitted operating temperature range	- 40° < T < +85°	- 40° < T < +85°	- 40° < T < +85°	- 40° < T < +85°
Degree of protection	IP67	IP67	IP67	IP67
Flammability class	UL94-V0	UL94-V0	UL94-V0	UL94-V0
Certifications obtained	TÜV	TÜV	TÜV	TÜV
Quantity per pack	100	100	100	100
Packaging	One box contains 10 sachets. Every sachet contains 10 plastic shells and 10 metallic contacts (PINS)			

### Plastic shell only

Code	ISPAN3M	ISPAN3F	ISVOL3M	ISVOL3F
Packaging	One packet contains 100 plastic shells			

### Metallic contact (PIN) only

Code	ISPIN34060M	ISPIN34060F	ISPIN34060M	ISPIN34060F
Packaging	One packet contains 10 sachets and each sachet contains 10 PINS for a total of 100 PINS			

### Metallic contact on roll only

Code	IS0701207	IS0701209	IS0701207	IS0701209
Packaging	Ribbon with 2,000 PINS for wires with a 4 mm <sup>2</sup> or 6 mm <sup>2</sup> section		Ribbon with 2,000 PINS for wires with a 4 mm <sup>2</sup> or 6 mm <sup>2</sup> section	

Pre-wired connectors available on demand. For information contact the Cabur sales network

### Pre-wired connectors



For joints with MC connectors, see page 37 (except pre-wired connectors).

# Cabur Solar connectors

## Line 3



Normal packaging: the code refers to packets composed of plastic and metal parts (outer shell + PIN)

Use	Only for connections with photovoltaic panels with short-type MC3 (40 mm)		Only for connections with photovoltaic panels with long-type MC3 (50 mm)	
Code	IS15240	IS25241	IS15242	IS25243
ID number	KX03VM2540GC	KX03VF2540GC	KX03VM4060GL	KX03VF4060GL
Application	Flying connector with short retention hook		Flying connector with long retention hook	
Connector type	Male	Female	Male	Female
PIN diameter	3 mm	3 mm	3 mm	3 mm
Section of crimpable wires	2.5 mm <sup>2</sup> 4 mm <sup>2</sup>	2.5 mm <sup>2</sup> 4 mm <sup>2</sup>	4 mm <sup>2</sup> 6 mm <sup>2</sup>	4 mm <sup>2</sup> 6 mm <sup>2</sup>
Pliers	UMCT3149	UMCT3149	UMCT3149	UMCT3149
Matrix	IS3153	IS3153	IS3153	IS3153
Features of metallic PIN	Tin-plated copper	Tin-plated copper	Tin-plated copper	Tin-plated copper
Contact resistance	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ
PIN type	Moulded	Moulded	Moulded	Moulded
Shell features	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)
Maximum applicable voltage	1,000 VDC	1,000 VDC	1,000 VDC	1,000 VDC
Maximum applicable current	25 A	25 A	25 A	25 A
Admitted operating temperature range	- 40° < T < +85°	- 40° < T < +85°	- 40° < T < +85°	- 40° < T < +85°
Degree of protection	IP67	IP67	IP67	IP67
Flammability class	UL94-V0	UL94-V0	UL94-V0	UL94-V0
Certifications obtained	-	-	-	-
Quantity per pack	100	100	100	100
Packaging	One box contains 10 sachets. Every sachet contains 10 plastic shells and 10 metallic contacts (PINS)			

### Plastic shell only

Code	ISVOL3GM	ISVOL3GF	ISVOL3GML	ISVOL3GFL
Packaging	One packet contains 100 plastic shells			

### Metallic contact (PIN) only

Code	ISPIN34060M	ISPIN34060F	ISPIN34060M	ISPIN34060F
Packaging	One packet contains 10 sachets and each sachet contains 10 PINS for a total of 100 PINS			

### Metallic contact on roll only

Code	-	-	IS0701207	IS0701209
Packaging	-		Ribbon with 2,000 PINS for wires with a 4 mm <sup>2</sup> or 6 mm <sup>2</sup> section	

Pre-wired connectors available on demand. For information contact the Cabur sales network

### Hooks

IS15000 short hook (1)

IS15001 long hook (2)

(1)



(2)



For joints with MC connectors, see page 37 (except pre-wired connectors).

# Cabur Solar connectors

## Line 3



Normal packaging: the code refers to packets composed of plastic and metal parts (outer shell + PIN)

Use	For connections with photovoltaic panels with short-type MC3 (40 mm) or to connect to inverters that use MC3 (remove the hook from the Cabur connector when it is connected to the inverter)		For connections with photovoltaic panels with long-type MC3 (50 mm) or to connect to inverters that use MC3 (remove the hook from the Cabur connector when it is connected to the inverter)	
Code	IS15341	IS25342	IS15342	IS25343
ID number	KX03VM4060GC	KX03VF4060GC	KX03VM4060GL	KX03VF4060GL
Application	Flying connector with short retention hook	Flying connector with short retention hook	Flying connector with long retention hook	Flying connector with long retention hook
Connector type	Male	Female	Male	Female
PIN diameter	3 mm	3 mm	3 mm	3 mm
Section of crimpable wires	4 mm <sup>2</sup> 6 mm <sup>2</sup>	4 mm <sup>2</sup> 6 mm <sup>2</sup>	4 mm <sup>2</sup> 6 mm <sup>2</sup>	4 mm <sup>2</sup> 6 mm <sup>2</sup>
Pliers	UMCT3149	UMCT3149	UMCT3149	UMCT3149
Matrix	IS3153	IS3153	IS3153	IS3153
Features of metallic PIN	Tin-plated copper	Tin-plated copper	Tin-plated copper	Tin-plated copper
Contact resistance	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ
PIN type	Moulded	Moulded	Moulded	Moulded
Shell features	Rubber-Plastic (PPO)	Rubber-Plastic (PPO)	Rubber-Plastic (PPO)	Rubber-Plastic (PPO)
Maximum applicable voltage	1,000 VDC	1,000 VDC	1,000 VDC	1,000 VDC
Maximum applicable current	25 A	25 A	25 A	25 A
Admitted operating temperature range	- 40° < T < +85°	- 40° < T < +85°	- 40° < T < +85°	- 40° < T < +85°
Degree of protection	IP67	IP67	IP67	IP67
Flammability class	UL94-V0	UL94-V0	UL94-V0	UL94-V0
Certifications obtained	-	-	-	-
Quantity per pack	100	100	100	100
Packaging	One box contains 10 sachets. Every sachet contains 10 plastic shells and 10 metallic contacts (PINS)			

### Plastic shell only

Code	ISVOL3MGPGC	ISVOL3FGPGC	ISVOL3MGPGGL	ISVOL3FGPGGL
Packaging	One packet contains 100 plastic shells			

### Metallic contact only

Code	ISPIN34060M	ISPIN34060F	ISPIN34060M	ISPIN34060F
Packaging	One packet contains 10 sachets and each sachet contains 10 PINS for a total of 100 PINS			

### Metallic contact on roll only

Code	IS0701207	IS0701209	IS0701207	IS0701209
Packaging	Ribbon with 2,000 PINS for wires with a 4 mm <sup>2</sup> or 6 mm <sup>2</sup> section		Ribbon with 2,000 PINS for wires with a 4 mm <sup>2</sup> or 6 mm <sup>2</sup> section	

Pre-wired connectors available on demand. For information contact the Cabur sales network

### Hooks

IS15000 short hook (1)

IS15001 long hook (2)

(1)



(2)



For joints with MC connectors, see page 37 (except pre-wired connectors).

# Cabur Solar Y connectors

## Line 3



Normal packaging: the code refers to packets composed of plastic and metal parts [outer shell + PIN]

Use	To create parallel connections between strings of panels with short-type MC3 connectors (40 mm)		To create parallel connections between strings of panels with long-type MC3 connectors (50 mm)	
Code	IS41310S	IS42320S	IS41310L	IS42320L
ID number	KX03MFFGS	KX03FMMGS	KX03MFFGL	KX03FMMGL
Application	Flying connector	Flying connector	Flying connector	Flying connector
Connector type	Male/Female-Female	Female/Male-Male	Male/Female-Female	Female/Male-Male
PIN diameter	3 mm	3 mm	3 mm	3 mm
Section of crimpable wires	All	All	All	All
Pliers	NO	NO	NO	NO
Matrix	NO	NO	NO	NO
Features of metallic PIN	Tin-plated copper	Tin-plated copper	Tin-plated copper	Tin-plated copper
Contact resistance	$R_c < 5 \text{ m}\Omega$	$R_c < 5 \text{ m}\Omega$	$R_c < 5 \text{ m}\Omega$	$R_c < 5 \text{ m}\Omega$
PIN type	Moulded	Moulded	Moulded	Moulded
Shell features	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)
Maximum applicable voltage	1,000 VDC	1,000 VDC	1,000 VDC	1,000 VDC
Maximum applicable current	25 A	25 A	25 A	25 A
Admitted operating temperature range	$-40^\circ < T < +85^\circ$	$-40^\circ < T < +85^\circ$	$-40^\circ < T < +85^\circ$	$-40^\circ < T < +85^\circ$
Degree of protection	IP67	IP67	IP67	IP67
Flammability class	UL94-V0	UL94-V0	UL94-V0	UL94-V0
Certifications obtained	-	-	-	-
Quantity per pack	30	30	30	30
Packaging	One box contains 6 sachets. Every sachet contains 5 Y joints.			

### Plastic shell only

Code	-	-	-	-
Packaging	-	-	-	-

### Metallic contact (PIN) only

Code	-	-	-	-
Packaging	-	-	-	-

### Metallic contact on roll only

Code	-	-	-	-
Packaging	-	-	-	-

Pre-wired connectors available on demand. For information contact the Cabur sales network

### Hooks

IS15000 short hook (1)

IS15001 long hook (2)

(1)



(2)



For joints with MC connectors, see page 37 (except pre-wired connectors).

# Cabur Solar connectors

## Line 4



Normal packaging: the code refers to packets composed of plastic and metal parts (outer shell + PIN)

Use	On string boxes and/or inverters		Extensions (wire/wire connections) and for connection to photovoltaic and inverter panels with MC4	
Code	IS14110	IS24111	IS14240	IS24241
ID number	KX04PM4060	KX04PF4060	KX04VM4060	KX04VF4060
Application	Panel	Panel	Flying connector	Flying connector
Connector type	Male	Female	Male	Female
PIN diameter	4 mm	4 mm	4 mm	4 mm
Section of crimpable wires	4 mm <sup>2</sup> 6 mm <sup>2</sup>	4 mm <sup>2</sup> 6 mm <sup>2</sup>	4 mm <sup>2</sup> 6 mm <sup>2</sup>	4 mm <sup>2</sup> 6 mm <sup>2</sup>
Pliers	UMCT3149	UMCT3149	UMCT3149	UMCT3149
Matrix	IS3154	IS3154	IS3154	IS3154
Features of metallic PIN	Tin-plated copper	Tin-plated copper	Tin-plated copper	Tin-plated copper
Contact resistance	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ
PIN type	Moulded	Moulded	Moulded	Moulded
Shell features	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)
Maximum applicable voltage	1,000 VDC	1,000 VDC	1,000 VDC	1,000 VDC
Maximum applicable current	25 A	25 A	25 A	25 A
Admitted operating temperature range	- 40° < T < +85°	- 40° < T < +85°	- 40° < T < +85°	- 40° < T < +85°
Degree of protection	IP67	IP67	IP67	IP67
Flammability class	UL94-V0	UL94-V0	UL94-V0	UL94-V0
Certifications obtained	CE	CE	TÜV	TÜV
Quantity per pack	100	100	100	100
Packaging	One box contains 10 sachets. Every sachet contains 10 plastic shells and 10 metallic contacts (PINS)			

### Plastic shell only

Code	ISPAN4M	ISPAN4F	ISVOL4M	ISVOL4F
Packaging	One packet contains 100 plastic shells			

### Metallic contact (PIN) only

Code	ISPIN44060M	ISPIN44060F	ISPIN44060M	ISPIN44060F
Packaging	One packet contains 10 sachets and each sachet contains 10 PINS for a total of 100 PINS			

### Metallic contact on roll only

Code	IS0601207	IS0601209	IS0601207	IS0601209
Packaging	Ribbon with 2,000 PINS on roll.		Ribbon with 2,000 PINS on roll.	

Pre-wired connectors available on demand. For information contact the Cabur sales network

### Pre-wired connectors



For joints with MC connectors, see page 37 (except pre-wired connectors).

# Cabur Solar connectors

## Line 4



Normal packaging: the code refers to packets composed of plastic and metal parts (outer shell + PIN)

Use	Extensions (wire/wire connections) and for connection to photovoltaic and inverter panels with MC4		Y connectors	
Code	IS14242	IS24243	IS41410	IS42420
ID number	KX04VM100	KX04VF100	KX04MFF	KX04FMM
Application	Flying connector	Flying connector	Flying connector	Flying connector
Connector type	Male	Female	Male/Female-Female	Female/Male-Male
PIN diameter	4 mm	4 mm	4 mm	4 mm
Section of crimpable wires	10 mm <sup>2</sup>	10 mm <sup>2</sup>	All	All
Pliers	UMCT3149	UMCT3149	NO	NO
Matrix	IS3110	IS3110	NO	NO
Features of metallic PIN	Tin-plated copper	Tin-plated copper	Tin-plated copper	Tin-plated copper
Contact resistance	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ
PIN type	Shrouded	Shrouded	Moulded	Moulded
Shell features	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)
Maximum applicable voltage	1,000 VDC	1,000 VDC	1,000 VDC	1,000 VDC
Maximum applicable current	25 A	25 A	35 A	35 A
Admitted operating temperature range	- 40° < T < +85°	- 40° < T < +85°	- 40° < T < +90°	- 40° < T < +90°
Degree of protection	IP67	IP67	IP67	IP67
Flammability class	UL94-V0	UL94-V0	UL94-V0	UL94-V0
Certifications obtained	TÜV pending	TÜV pending	-	-
Quantity per pack	100	100	30	30
Packaging	One box contains 10 sachets. Every sachet contains 10 plastic shells and 10 metallic contacts (PINS).		One box contains 6 sachets. Every sachet contains 5 Y joints.	

### Plastic shell only

Code	-	-	-	-
Packaging				

### Metallic contact (PIN) only

Code	-	-	-	-
Packaging				

### Metallic contact on roll only

Code	-	-	-	-
Packaging				

Pre-wired connectors available on demand. For information contact the Cabur sales network

### Pre-wired connectors



For joints with MC connectors, see page 37 (except pre-wired connectors).

## Cabur Solar connectors

### Accessories



Use	Ring to block manual unhooking of Cabur Line 3 and 4 photovoltaic connectors	Unblocking key to unhook photovoltaic connectors
Code	IS15BLOCK	IS15SBLOCK
ID number	IS15BLOCK	IS15SBLOCK
Application	Plastic ring inserted manually at the time of connection	This accessory makes it possible to unhook connectors after connection using accessory IS15BLOCK. It's easy to use and means only authorised personnel with the appropriate tools can perform the unhooking procedure.
Connector type	All Cabur Solar Line 3 and 4 connectors	All Cabur Solar Line 3 and 4 connectors
Material	PP0	Aluminium
Quantity per pack	50	2
Packaging	Every sachet contains 50 blocking rings	Every sachet contains 2 unblocking keys



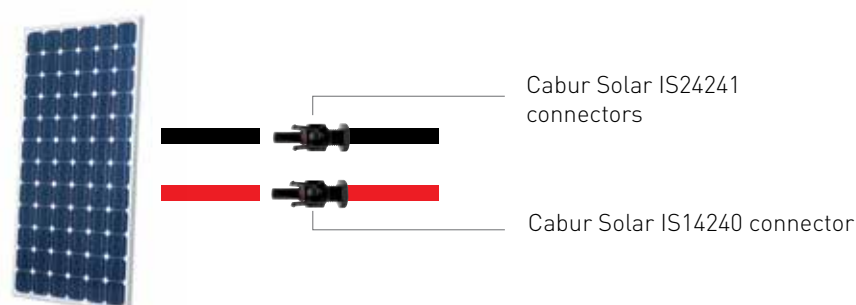
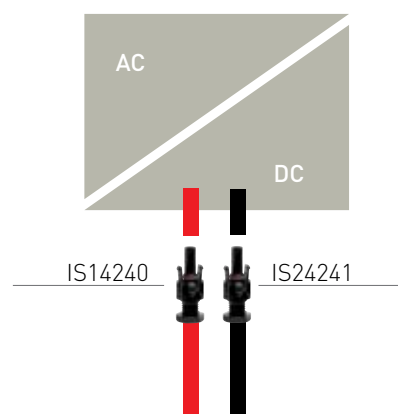
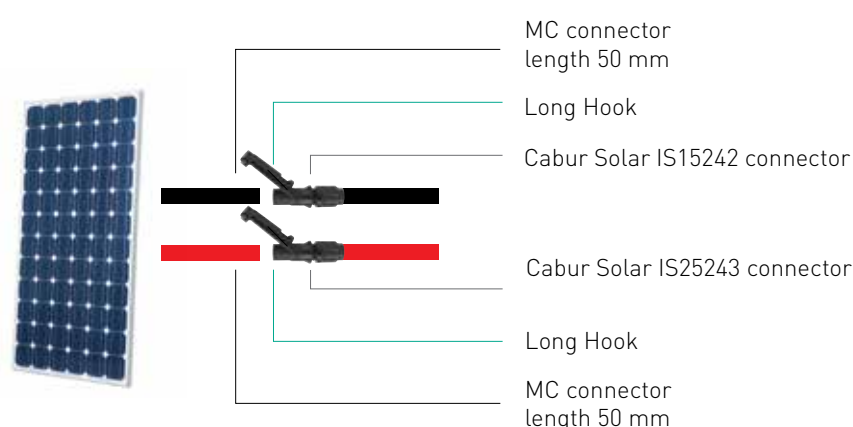
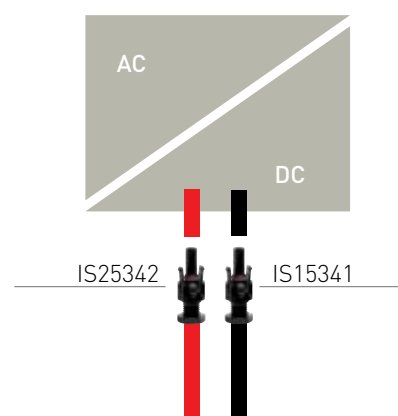
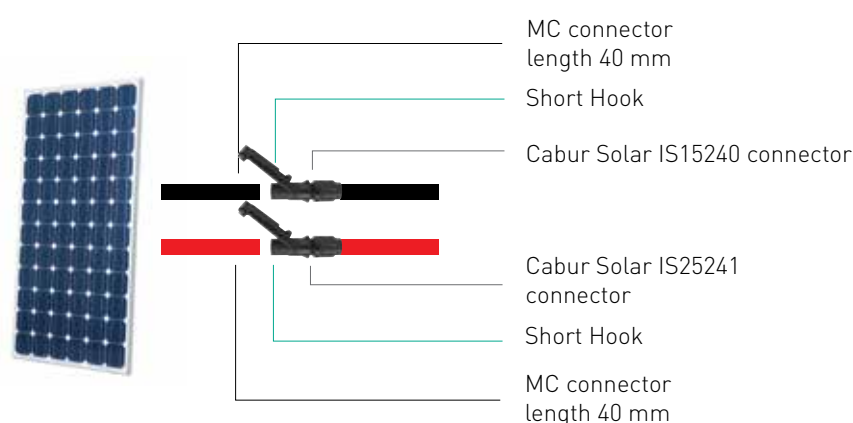
Use	Caps for Line 4 Connectors	
Code	IS51400	IS52400
ID number	KXCSLTAF	KXCSLTAM
Connector type	Female	Male
Admitted operating temperature range	- 40° < T < +90°	- 40° < T < +90°
Degree of protection	IP67	IP67
Flammability class	UL94-V0	UL94-V0
Quantity per pack	50	50
Packaging	One packet contains 50 caps	

# Cabur Solar connectors

## Joint with MC connectors

When the short (40 mm) rubber mobile Line 3 connectors exit from the PV panel, connection must be done using Cabur IS15240 and IS25241 mobile connectors, both provided with IS15000 retention hooks, which ensure proper hooking between the two PV connectors and is included in the package. When the male/female pair of rubber mobile Line 3 connectors exits from the photovoltaic panel, but long type (50 mm), it is necessary to connect them using a pair of Cabur IS15242 and IS25243 mobile connectors, along with IS15001 long retention hook, included in the package. Finally, if the pair of MC4 Line mobile connectors exits the

panel, the connection should be performed using the pair of Cabur mobile connectors IS14240 and IS24241 (see figure below). In regards to connection to Inverters and/or string boxes in the case in which the male and female pair of panel connectors from the MC3 Line are combined, it is necessary to use Cabur IS15341 and IS25342 mobile connectors. If the panel connectors are from the MC4 line, it is necessary to use a pair of Cabur IS14240 and IS24241 mobile connectors. For connection with TYCO mobile connectors exiting from the panels, procure the male and female with the same polarity as indicated in the figures below.



## Solarlok® connectors

### For connection to inverters and photovoltaic panels equipped with TYCO connectors

Solarlok® delivers a flexible, easy-to-use system solution for reliable interconnections from solar modules to the inverter. The entire concept is based on the reliable and efficient management of individual interconnecting system components.

The security of the coupling is guaranteed by polarity keyed housings, shrouded and silver plated contacts to be crimped, and a connection system with release on the application of

pressure. In addition, the wide operating temperature range and fulfilment of worldwide standards for photovoltaic connection systems make these products strong and reliable.

Apart from the 4 and 6 mm<sup>2</sup> connectors, the Cabur offer includes a set of professional tools, for specific use with Solarlok connectors and a first-installation KIT complete with all necessary accessories for connecting a photovoltaic system.



### Technical features

- Secure coupling achieved using coding keys
- Multiple insertion and removal cycles
- Wide operating temperature range  
-40 °C < T < +90 °C
- TÜV and UL approved
- Continuous 1,000 VDC voltage
- Continuous 25A current
- IP 67 protection degree

# Solarlok® connectors

For connection to inverters and photovoltaic panels equipped with TYCO connectors



Normal packaging: the code refers to packets composed of plastic and metal parts (outer shell + PIN)

Application	For connection to photovoltaic panels (to create simple joints and/or extensions use male and female connectors with the same polarity)		For connection to photovoltaic panels (to create simple joints and/or extensions use male and female connectors with the same polarity)		For connection to female connectors, both positive and negative
Code	IS401394462	IS301394461	IS301394462	IS401394461	IS261394461
ID number	KXSUN04FPNEG	KXSUN04MPPPOS	KXSUN04FPPPOS	KXSUN04MPNEG	KXSUN04MPNEU
Application	Flying connector	Flying connector	Flying connector	Flying connector	Flying connector
Polarity	Negative	Positive	Positive	Negative	Positive-Negative
Connector type	Female	Male	Female	Male	Male
PIN diameter	2.5 mm	2.5 mm	2.5 mm	2.5 mm	2.5 mm
Section of crimpable wires	4 mm <sup>2</sup>	4 mm <sup>2</sup>	4 mm <sup>2</sup>	4 mm <sup>2</sup>	4 mm <sup>2</sup>
Pliers	UMCT3149	UMCT3149	UMCT3149	UMCT3149	UMCT3149
Matrix	IS3152	IS3152	IS3152	IS3152	IS3152
Features of metallic PIN	Tin-plated copper	Tin-plated copper	Tin-plated copper	Tin-plated copper	Tin-plated copper
Contact resistance	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ
PIN type	Shrouded	Shrouded	Shrouded	Shrouded	Shrouded
Shell features	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)
Maximum applicable voltage	1,000 VDC	1,000 VDC	1,000 VDC	1,000 VDC	1,000 VDC
Maximum applicable current	25 A	25 A	25 A	25 A	25 A
Admitted operating temperature range	- 40° < T < +90°	- 40° < T < +90°	- 40° < T < +90°	- 40° < T < +90°	- 40° < T < +90°
Degree of protection	IP67	IP67	IP67	IP67	IP67
Flammability class	UL94-V0	UL94-V0	UL94-V0	UL94-V0	UL94-V0
Certifications obtained	TÜV & UL	TÜV & UL	TÜV & UL	TÜV & UL	TÜV & UL
Quantity per pack	100	100	100	100	100
Packaging	Every packet contains 100 plastic shells and 100 metallic contacts (PINS)		Every packet contains 100 plastic shells and 100 metallic contacts (PINS)		Every packet contains 100 plastic shells and 100 metallic contacts (PINS)

# Solarlok® connectors

For connection to inverters and photovoltaic panels equipped with TYCO connectors



## NOTE

IS651394462 and IS461394461 codes are available while stocks last. Contact the Sales Office to verify the substitute articles.



Normal packaging: the code refers to packets composed of plastic and metal parts (outer shell + PIN)

Application	On string boxes and/or inverters		For connection to photovoltaic panels (to create simple joints and/or extensions use male and female connectors with the same polarity)		For connection to female connectors, both positive and negative
Code	IS301394738	IS401394738	IS651394462	IS651394461	IS461394461
ID number	KXSUNDCAC4POS	KXSUNDCAC4NEG	KXSUN06FPNEG	KXSUN06MPPPOS	KXSUN06MPNEU
Application	Panel	Panel	Flying connector	Flying connector	Flying connector
Polarity	Positive	Negative	Negative	Positive	Positive-Negative
Connector type	Male	Male	Female	Male	Male
PIN diameter	2.5 mm	2.5 mm	2.5 mm	2.5 mm	2.5 mm
Section of crimpable wires	4 mm <sup>2</sup>	4 mm <sup>2</sup>	6 mm <sup>2</sup>	6 mm <sup>2</sup>	6 mm <sup>2</sup>
Pliers	UMCT3149	UMCT3149	UMCT3149	UMCT3149	UMCT3149
Matrix	IS3152	IS3152	IS3152	IS3152	IS3152
Features of metallic PIN	Tin-plated copper	Tin-plated copper	Tin-plated copper	Tin-plated copper	Tin-plated copper
Contact resistance	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ
PIN type	Shrouded	Shrouded	Shrouded	Shrouded	Shrouded
Shell features	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)
Maximum applicable voltage	1,000 VDC	1,000 VDC	1,000 VDC	1,000 VDC	1,000 VDC
Maximum applicable current	25 A	25 A	25 A	25 A	25 A
Admitted operating temperature range	- 40° < T < +90°	- 40° < T < +90°	- 40° < T < +90°	- 40° < T < +90°	- 40° < T < +90°
Degree of protection	IP67	IP67	IP67	IP67	IP67
Flammability class	UL94-V0	UL94-V0	UL94-V0	UL94-V0	UL94-V0
Certifications obtained	TÜV & UL	TÜV & UL	TÜV & UL	TÜV & UL	TÜV & UL
Quantity per pack	100	100	100	100	100
Packaging	Every packet contains 10 plastic shells and 10 metallic contacts (PIN)		Every packet contains 100 plastic shells and 100 metallic contacts (PINS)		Every packet contains 100 plastic shells and 100 metallic contacts (PINS)

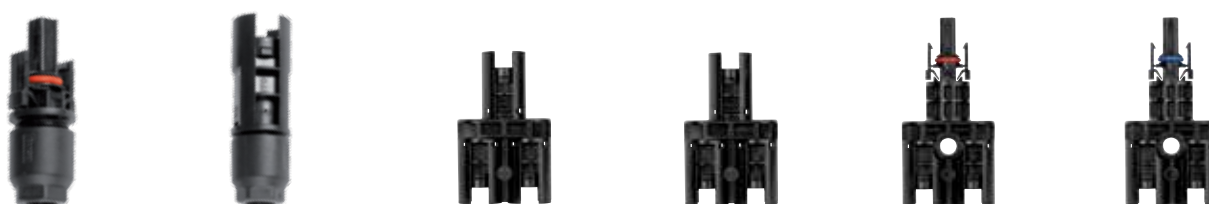
# Solarlok® connectors

For connection to inverters and photovoltaic panels equipped with TYCO connectors



## NOTE

IS551394462 and IS661394461 codes are available while stocks last. Contact the Sales Office to verify the substitute articles.



Normal packaging: the code refers to packets composed of plastic and metal parts (outer shell + PIN)

For connection to photovoltaic panels (to create simple joints and/or extensions use male and female connectors with the same polarity)		For the creation of parallel connections between strings		For the creation of parallel connections between strings	
IS551394462	IS661394461	IS101534611	IS201534611	IS101740277	IS201740277
KXSUN06FPP0S	KXSUN06MPNEG	KXSUNPOSSMM	KXSUNNEGSM	KXSUNPOSPFM	KXSUNNEGPFM
Flying connector	Flying connector	Flying connector	Flying connector	Flying connector	Flying connector
Positive	Negative	Positive	Negative	Positive	Negative
Female	Male	Male/Male-Male	Male/Male-Male	Female/Male-Male	Female/Male-Male
2.5 mm	2.5 mm	2.5 mm	2.5 mm	2.5 mm	2.5 mm
6 mm <sup>2</sup>	6 mm <sup>2</sup>	4 mm <sup>2</sup> and 6 mm <sup>2</sup>	4 mm <sup>2</sup> and 6 mm <sup>2</sup>	4 mm <sup>2</sup> and 6 mm <sup>2</sup>	4 mm <sup>2</sup> and 6 mm <sup>2</sup>
UMCT3149	UMCT3149	NO	NO	NO	NO
IS3152	IS3152	NO	NO	NO	NO
Tin-plated copper	Tin-plated copper	Tin-plated copper	Tin-plated copper	Tin-plated copper	Tin-plated copper
Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ	Rc < 5 mΩ
Shrouded	Shrouded	Shrouded	Shrouded	Shrouded	Shrouded
Plastic (PPO)	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)	Plastic (PPO)
1,000 VDC	1,000 VDC	1,000 VDC	1,000 VDC	1,000 VDC	1,000 VDC
25 A	25 A	25 A	25 A	25 A	25 A
- 40° < T < +90°	- 40° < T < +90°	- 40° < T < +90°	- 40° < T < +90°	- 40° < T < +90°	- 40° < T < +90°
IP67	IP67	IP67	IP67	IP67	IP67
UL94-V0	UL94-V0	UL94-V0	UL94-V0	UL94-V0	UL94-V0
TÜV & UL	TÜV & UL	TÜV & UL	TÜV & UL	TÜV & UL	TÜV & UL
100	100	100	100	100	100

Every packet contains 100 plastic shells and 100 metallic contacts (PINS)

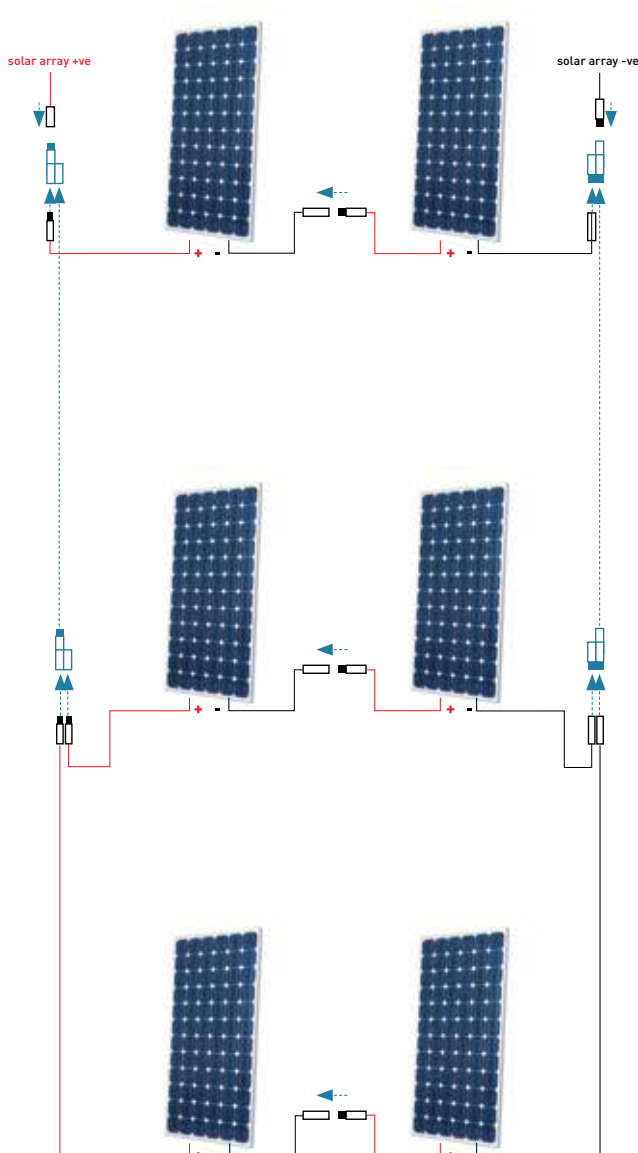
Every sachet contains 10 Y joints

Every sachet contains 10 Y joints

# Connection to connectors

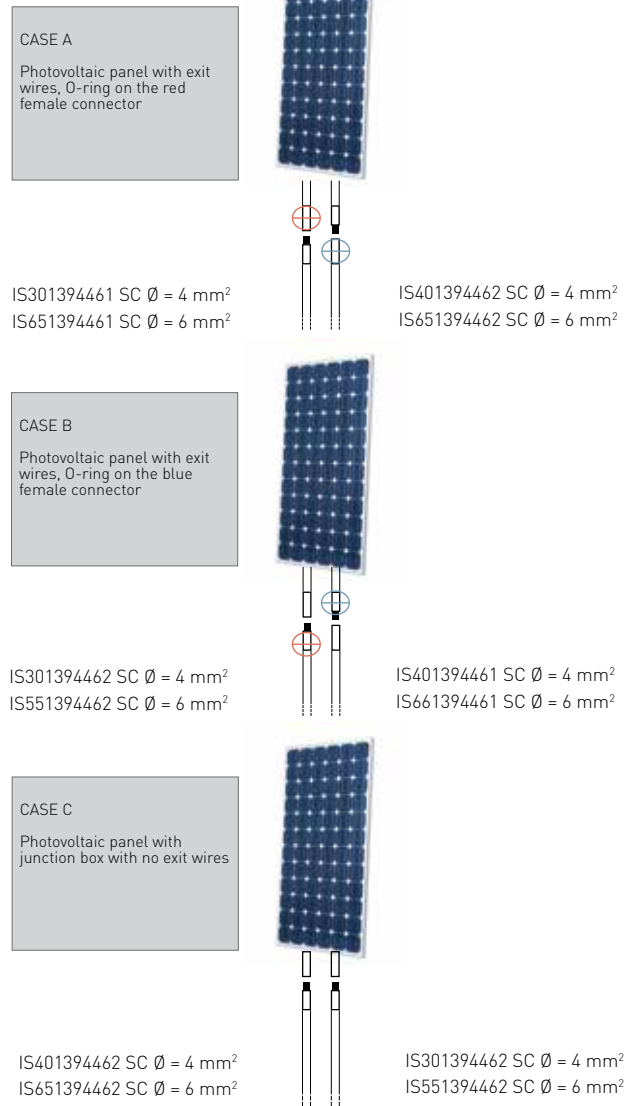
## Connection with Cabur Solar Y joints

Y joints are particularly useful for coupling the strings of panels in amorphous technology (thin film), where there are often parallel connections on the line leading to the inverter. They are therefore connections with low current and high voltage, typical with thin film.



## Connection with Tyco mobile connectors

For connection with TYCO mobile connectors exiting from the panels, procure the male and female with the same polarity as indicated in the figures below.



# Tools

## For perfect photovoltaic connections

To guarantee a result conforming to standard, in terms of the security of the connection and insulation degree, it is important to use suitable tools, according to the type of wire and connectors used.

Cabur wire strippers and crimpers are especially chosen to perform the specific operations with ease, in safety and

according to the technical requisites of the most efficient photovoltaic systems.

**To ensure the guarantee's effectiveness, the use of Cabur Solar tools, in conformance with the standards and instructions found in Cabur official documentation, is an essential requirement.**



<b>Code</b>	IS31579002
<b>ID number</b>	KXCSLSPE
<b>Description</b>	Cabur Solar wire stripper
<b>Pieces PK</b>	One



<b>Code</b>	UMCT3149
<b>ID number</b>	UMCT
<b>Description</b>	Crimp tool with interchangeable matrix (select matrix according to use)
<b>Pieces PK</b>	One
<b>Matrices</b>	see next page



<b>Code</b>	IS3170
<b>ID number</b>	IS3170
<b>Description</b>	Pocket Cabur Solar wire stripper
<b>Pieces PK</b>	One
<b>Accessory</b>	Spare blade code IS3170L



<b>Code</b>	IS3161
<b>ID number</b>	KXCRI2506
<b>Description</b>	Crimp tool for Cabur Solar connectors complete with matrix for wires with section 2.5 - 4 or 6 mm <sup>2</sup>
<b>Pieces PK</b>	One



<b>Code</b>	IS301102855
<b>ID number</b>	KXSUNESTRAT
<b>Description</b>	Solarlok extraction tool <sup>®</sup> by Tyco Electronics
<b>Pieces PK</b>	One



<b>Code</b>	IS3110
<b>ID number</b>	KXCRI10
<b>Description</b>	Crimper for CaburSolar 10 mm <sup>2</sup>
<b>Pieces PK</b>	One

SOLARLOK<sup>®</sup>; TE and Tyco Electronics are registered trademarks.

## Advantages of Cabur crimpers

### Fixed matrix crimper IS3161

1. Recommended for simple and quick crimping
2. Tool for small systems

### Interchangeable matrix crimper UMCT3149

1. Ideal for high-precision photovoltaic crimping, thanks to a lateral locating device that ensures correct positioning of the PIN and the form of the clamping indentations for perfect crimping.
2. Thanks to the interchangeable matrices, it can also be used to crimp ring, spade tongue terminals, closed end slices, and other wire terminals (see page 44 for more detail).

## Advantages of Cabur wire strippers

### Wire stripper IS31579002

1. It's well-built and robust, appropriate for thousands of cycles
2. It acts simultaneously on both the sheaths of the solar wire, cutting them precisely.
3. Allows for precise calibration of the length of the stripping, thanks to an adjustable mobile cursor.
4. The blades exercise a defined cutting pressure, in fact they are provided with attrition to protect the strands.
5. It can also be used to strip other wires.

### Wire stripper IS3170

1. Light, affordable, and pocket-sized.

## Tools

### Matrices for crimper UMCT3149



Matrix Code	ID number	Contact type	Section Wire	Pieces PK
IS3152	IS3152	Solarlok® by Tyco Electronics	2.5 - 4 or 6 mm <sup>2</sup>	One
IS3153	IS3153	Cabur Solar Line 3	2.5 - 4 or 6 mm <sup>2</sup>	One
IS3154	IS3154	Cabur Solar Line 4	2.5 - 4 or 6 mm <sup>2</sup>	One
UMCT3127	UMCT3127	Closed end slices	0.2 - 10 mm <sup>2</sup>	One
UMCT3153	UMCT3153	Closed end slices	16 - 25 mm <sup>2</sup>	One
UMCT3154	UMCT3154	Closed end slices	35 - 50 mm <sup>2</sup>	One
UMCT3129	UMCT3129	Ring and spade tongue terminals	1.5 - 2.5 mm <sup>2</sup>	One
UMCT3128	UMCT3128	Ring and spade tongue terminals	4 - 6 mm <sup>2</sup>	One

SOLARLOK®; TE and Tyco Electronics are registered trademarks.

#### Wire Stripping

Technical Standard CEI EN 60352-2 (Stapled connections - General rules, test methods and practical guide) leads to a stripped length of about 8 mm for our PIN contacts on both Line 3 and Line 4. Appropriate use of Cabur wire strippers guarantees optimal stripping (see instructions below).

#### Crimping with UMCT3149

The UMCT3149 crimper is designed for high precision photovoltaic crimping and therefore has a lateral positioner which ensures correct positioning of the PIN. The positioner is screwed onto all the matrices and, if necessary, can be removed. The geometry of the clamping indentations ensures highly effective crimping. Thanks to the interchangeable matrices, the **UMCT3149** can also be used for crimping ring, spade tongue terminals, closed end slices, and other wire

terminals used for normal wiring of electrical panels and for automation. For matrix substitution, please see the diagram on the next page. Thanks to the marks on the matrix, it's easy to correctly position the PIN for each contact: the wire section is indicated on the lower part and the PIN diameter on the upper part. Every matrix gives a specific crimp. Let's see which, using the example case of matrix **IS3153** for the PIN Cabur Solar Line 3 (the use of matrices IS3154 for the PIN Cabur Solar Line 4 and IS3152 for PIN Solarlok® is similar). With matrix **IS3153**, it is possible to crimp **only Line 3 PINS**, on all wire sections, using:

- the first indentation on the right is for the wire with a 2.5 mm<sup>2</sup> section;
- the second indentation in the middle is for the wire with a 4 mm<sup>2</sup> section;
- the third indentation on the left is for the wire with a 6 mm<sup>2</sup> section.

# Tools

## Recommendations for correct use

### How to strip wire using IS31579002



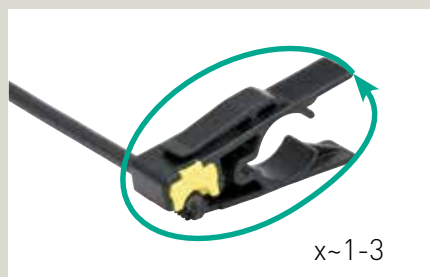
1. The wire stripper works like a guillotine, suitable for wires of various thicknesses, allowing for fast and safe stripping.
2. It acts simultaneously on both the sleeves of the photovoltaic wire, cutting them precisely.
3. The blades move parallel to the wire, expelling the sheared off sleeve.

### Stripping with IS3170

This wire stripper is able to strip wires with sections of 2.5, 4, 6 and 10 mm<sup>2</sup>. It is fitted with an end stop and allows for a stripped constant length of approx. 8 mm, compliant with the requirements of our PINS. The blade can be replaced.

- To strip wires with a 2.5 mm<sup>2</sup> section, the blade must make a complete turn around the external perimeter of the wire.
- To strip wires with a 4 mm<sup>2</sup> section, the blade must make two complete turns around the external perimeter of the wire.
- To strip wires with a 6 mm<sup>2</sup> section, the blade must make three complete turns around the external perimeter of the wire.

In order to preserve the number of strands, the blade should not be turned more times than those indicated in the recommendations above for each wire section.



# Tools

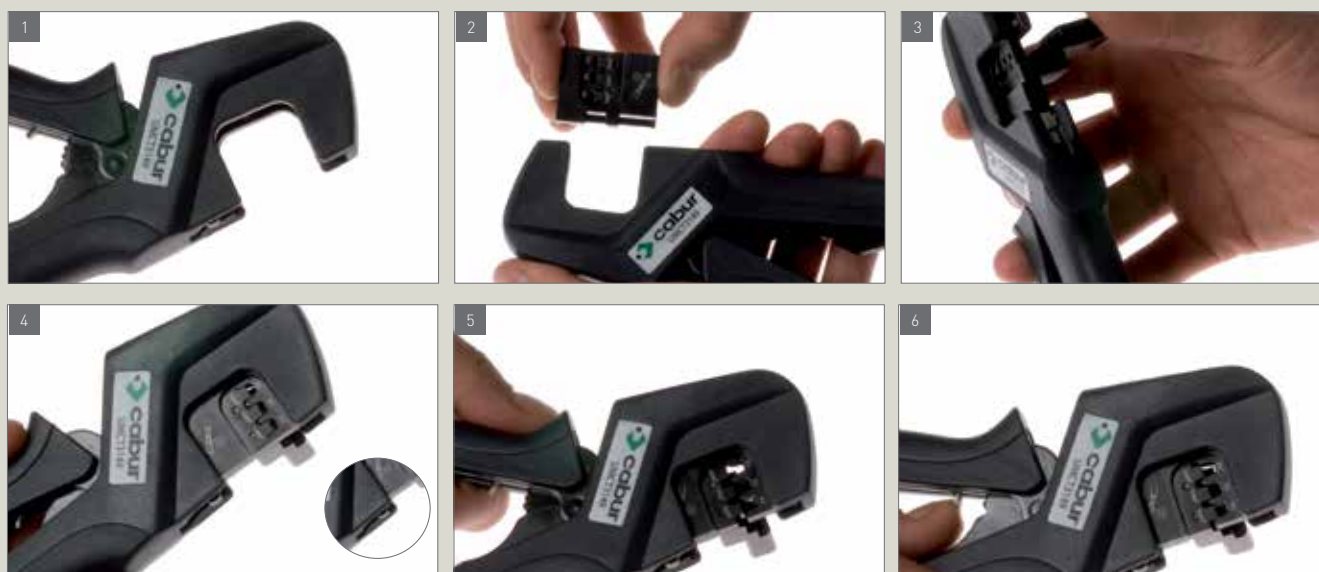
## Recommendations for correct use

### How to crimp



Example of use of the IS3161 crimper for Cabur Solar connectors.

### How to change the UMCT Crimper matrix



- Open the pliers as wide as possible (fig. 1);
- slowly bring the two levers of the pliers together, until the locking/release mechanism makes three clicks (fig. 2);
- observe the anchorage pin on the matrix (fig. 2);
- insert the matrix, moving the anchorage pin towards the internal part of the pliers chamber (fig.3);
- make sure that the plastic tooth has locked the matrix in place or that it has risen (fig.4);
- press the two levers of the pliers, closing them as tightly as possible (fig.4);
- release the handles; the pliers should open automatically and completely (fig.5);
- if, when the pliers are closing, you realise that the crimping is not successful or the crimp tool is blocked for any reason, it can be released by pressing and releasing the handles a few times and simultaneously pressing with your thumb on the release lever on the internal part of the handle (fig.6).

SOLARLOK®; TE and Tyco Electronics are registered trademarks.

# Wires

## For photovoltaic systems both small and large

- Single pole wire with flexible conductor in tin-plated copper class 5
- First insulation G21 special HEPR type
- Second Halogen Free Type Elastometric blend insulation M21
- For specific use with photovoltaic systems with nominal voltage of  $U_0/U = 600/1,000$  VAC under alternating current and not exceeding  $U_0/U = 900/1,500$  VDC under DC
- Non-flame propagating
- Halogen free
- Designed for a useful lifetime of at least 25 years
- Resistant to UV rays, water, ozone, salts, fluids, and atmospheric agents in general
- Standard colours: Black and Red

### IMQ certified wires - FG21M21

Code	ISCS02100	ISCS02101	ISCS02500	ISCS02501	ISCS04100	ISCS04101	ISCS04400
ID number	KXCSOL2N100	KXCSOL2R100	KXCSOL2N500	KXCSOL2R500	KXCSOL4N100	KXCSOL4R100	KXCSOL4N400
Section	2.5 mm <sup>2</sup>	2.5 mm <sup>2</sup>	2.5 mm <sup>2</sup>	2.5 mm <sup>2</sup>	4 mm <sup>2</sup>	4 mm <sup>2</sup>	4 mm <sup>2</sup>
Colour	Black	Red	Black	Red	Black	Red	Black
Packaging type	Skein	Skein	Spool	Spool	Skein	Skein	Spool
Length	100 m	100 m	500 m	500 m	100 m	100 m	400 m

Code	ISCS04401	ISCS06100	ISCS06101	ISCS06300	ISCS06301	ISCS10200	ISCS10201
ID number	KXCSOL4R400	KXCSOL6N100	KXCSOL6R100	KXCSOL6N300	KXCSOL6R300	KXCSOL10N200	KXCSOL10R200
Section	4 mm <sup>2</sup>	6 mm <sup>2</sup>	6 mm <sup>2</sup>	6 mm <sup>2</sup>	6 mm <sup>2</sup>	10 mm <sup>2</sup>	10 mm <sup>2</sup>
Colour	Red	Black	Red	Black	Red	Black	Red
Packaging type	Spool	Skein	Skein	Spool	Spool	Spool	Spool
Length	400 m	100 m	100 m	300 m	300 m	200 m	200 m

### The following are available on-demand:

- 1.5 mm<sup>2</sup> section copper wires
- 16 to 240 mm<sup>2</sup> section copper wires
- IMQ certified copper wires with sections from 4 to 6 mm<sup>2</sup> in 1,000 m spools
- Copper wires with 10 mm<sup>2</sup> sections in 1,000 m spools (certified IMQ or TÜV)
- UL certified copper wires
- Copper wires with blue insulation
- TÜV certified wires
- Aluminium wires

### Pre-wired cables

To connect the panels within the string, Cabur offers a range of solutions composed of Line 3 and Line 4 mobile connectors on black and red 4mm<sup>2</sup> and 6mm<sup>2</sup> wires.

Any other combination of section, colour, length and type of final connector is available in any quantity you need. For a customised quote contact the Cabur sales network

For times, min. quantities and packaging costs, contact the Cabur Sales Office.

# Technical characteristics for FG21M21 IMQ certified wires

- Continuous operating temperature:  $-40^{\circ} + 90^{\circ}\text{C}$
- Maximum operating temperature of the metallic core:  $90^{\circ}\text{C}$
- Minimum operating temperature:  $-25^{\circ}\text{C}$
- Temperature peak:  $250^{\circ}\text{C}$
- Lifetime: 25 years, provided that the temperature of the metallic core never exceeds  $90^{\circ}\text{C}$
- Test voltage in alternate current: 6,500 V
- Test voltage in direct current: 15,000 V
- Minimum radius curve: 4 times external diameter
- Breakage point under traction: 50 N/mm<sup>2</sup>
- Standard colours: Black, Red

## Approvals

- IMQ
- Conforming to RoHS

Flexible conductor made of tin-plated copper, class 5, conforming to CEI 60227



1st insulation: HEPR type G21 special

2nd insulation: Elastomeric compound Halogen Free type M21

## Laboratory tests carried out by IMQ for wire certifications

### Electrical tests

Conductor electrical resistance	EN 50395 art. 5
Voltage tests on finished wires	EN 50395 art. 6
Flaw-free insulation	EN 50395 art. 10
Sleeve surface resistance	EN 50395 art. 11
Insulation resistance on complete wire	CEI 20-13 art. 3.2.03
- at $20^{\circ}\text{C}$	
- at $90^{\circ}\text{C}$	
Stability under direct current	EN 50305 art. 6.7

### Verification of construction and dimension prescriptions

Verification of conformance to construction prescriptions	Visual exam and manual tests
Measurement of insulation thickness	EN 50396 art. 4.1
Measurement of sleeve thickness	EN 50396 art. 4.2
Measurement of external dimensions:	EN 50396 art. 4.4
- average value	
- ovalisation	

### Mechanical properties of insulation

Traction resistance test before ageing	EN 60811-1-1
Traction resistance test after ageing	EN 60811-1-2
Lengthening under heat	EN 60811-2-1
Water absorption test	EN 60811-1-3

### Mechanical properties of sleeve

Traction resistance test before ageing	EN 60811-1-1
Traction resistance test after ageing	EN 60811-1-2
Lengthening under heat	EN 60811-2-1
Water absorption test	EN 60811-1-3

### Compatibility test

EN 60811-1-2

### Tests at low temperature

Sleeve bending test	EN 60811-1-4 art. 8.1
Sleeve lengthening test	EN 60811-1-4 art. 8.2
Shock resistance test	EN 60811-1-4 art. 8.5

### Ozone resistance test

EN 50395 art. 8.1.3

### UV resistance test

HD 605/A1 art.2.4.20

### Reaction to fire

CEI 20-35/1-2

### Evaluation of halogens

Determination of HCl quantity	CEI 20-37/2-1
Determination of gas corrosiveness	CEI 20-37/2-2



# Technical characteristics of PV1-F wires certified TÜV

- Operating temperature: -40°C + 90°C
- Max. short circuit temperature: +200°C (5s max)
- Lifetime: 25 years
- Test voltage in alternate current: 6,500 V
- Test voltage in direct current: 15,000 V
- Uo/U nominal voltage; 0.6/1 kV AC; 1.8kV DC
- Minimum radius curve:  
mobile installation 15 x wire diameter  
fixed installation 6 x wire diameter
- Insulation resistance: >1014  $\Omega$  x cm at 20°C
- Standard colours: Black, Red



## Laboratory tests carried out by TÜV for wire certifications

Reference regulations: TÜV 2 Pfg 1169/08.2007

Ozone resistance	EN 50396 part 8.1.3
Resistance to UV rays	HD605/A1 part 2.4.20
Vertical flame propagation test	CEI EN 60332-1-2
High temperature pressure test on complete wire	EN 60811-3-1
Halogen content	CEI EN 50267-2-1, CEI EN 50267-2-2, EN 6084-2
Electrical resistance	CEI 20-29 EN60228 CL.5



# Photovoltaic systems

## String boxes, control units and their components

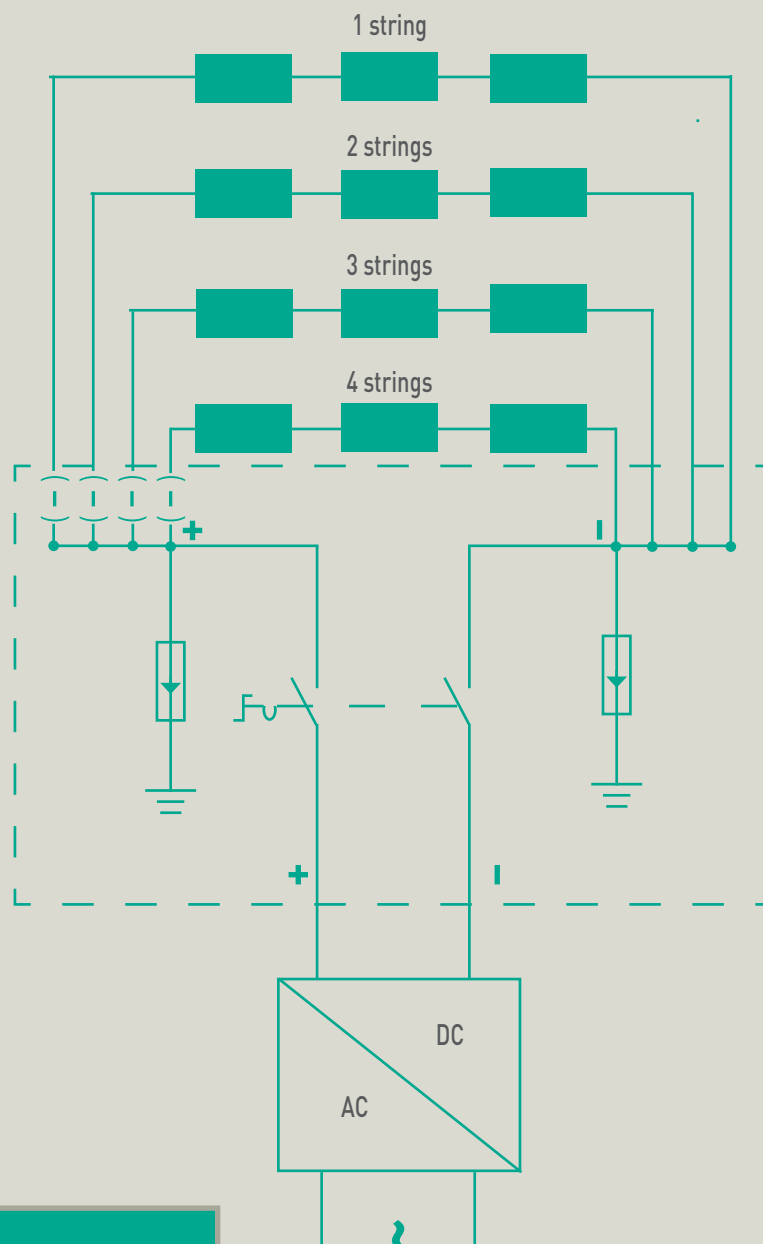
To connect strings, the monitoring of the efficiency of the installation and the distribution of the current in small, medium and large size photovoltaic systems.

FROM PAGE 52 TO PAGE 89

52	Connection diagram of the modules and strings of a photovoltaic generator
53	StringBox connection panels
56	StringBox control units for PV arrays
63	ISL series DC/AC control units for PV arrays
66	E-Box. String and monitoring boxes with electronics for monitoring
71	E-Box. Components
76	E-Box. Ordering codes table
77	Surge Protection Devices
84	Components for string boxes
84	Boxes for control units
85	Boxes for distribution panels
87	Switches and disconnectors
88	Fuse holders and fuses
89	Blocking diode

## Connection diagram of the modules and strings of a photovoltaic generator

EXAMPLE OF CONNECTION WITH 1 OUTPUT



NOTE: The line of StringBox control units includes products with several outputs (see following page).

## StringBox connection panels for photovoltaic panel strings

The connection panels of the StringBox series are designed and constructed according to Standard CEI 82-25.

This is a real solution for the various needs of this sector, which takes into due consideration the need for customised products.

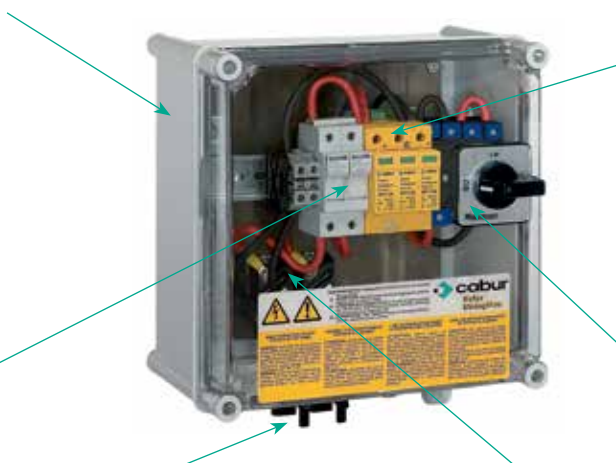
The boxes are available in 1, 2, 3, 4, 6 and 8 strings versions and include all components necessary for protection and for parallel connection of the strings of solar panels.

All components are pre-wired with a special solar wire, therefore in the case of electrical panels with connector input, the Customer must simply connect the same and provide for earth wiring and output towards the inverter, with considerable saving both in the management of the components and in installation.

The illustration below shows an example of the components that can be inserted into the panel.

**Boxes** for external use in polycarbonate with high UV resistance, with protection degree of IP 66.

**Fuse holders** 10.3 x 38 approved UL 1,000 VDC; the fuse holders are contained in the 4, 6 and 8 string boxes and can switch the strings off in the case of fault, string short circuit or short circuit on the connections; usually the 2 and 3 string panels do not have fuse holders because the max current generated by one or two strings would not be sufficient to cause a fuse to trip in the case of a fault in a string; the fuses must be chosen and ordered by the customer according to the value of the string current.



**Surge protection devices:** 20 kA (8/20), Ures ≤ 1.5 kV, available in voltages 500 VDC, 600 VDC, 800 VDC, and 1,000 VDC for better coordination with the voltage effectively generated by the system.

**DC-21A disconnecter:** Approved UL at 1 kVDC, available for nominal currents of 40 A and 63 A; as requested by CEI 82-25, it is approved as isolator switch under charge and allows for disconnecting the voltage generated by the strings for the execution of interventions downstream of the SolarBox panel in total safety.

**Connectors for special solar wires** with protection degree IP67, equipped with mechanical blocking device to avoid accidental unhooking.

**Blocking diodes** to prevent the current of fully efficient strings from circulating in "shaded" or faulty strings, or strings whose generation capacity is reduced and which are available as standard versions. The diodes

are fitted on aluminium plates to dissipate the heat generated by the current which runs through them. **WARNING:** CEI 82-25 recommends that the blocking diode be used for boxes with 3 or more strings.

### Advantages of the StringBox series

1. Fast installation: components are already wired, able to connect using extractable connectors
2. Standardised product, in conformance with the regulations in effect: ideal to minimize design and inspection times and costs
3. Quality components in conformance with the regulations in effect
4. Large product range able to satisfy a wide range of needs
5. Box assembly completed and inspected by qualified personnel

### The range is divided into three series

**Standard:** the most commonly used models, which include panels for ungrounded floating systems with both positive and negative, and for negative ground systems; usually always in stock (see pages 54 and 55)

**Special:** models which satisfy less common needs; including panels with grounded positive pole and panels with modifications which can be derived from standard panels; for codes and sales conditions, please contact our sales network

**Custom:** string boxes for specific needs, which Cabur constructs at the Customer's request, not included in the above categories. For information, please contact our sales network

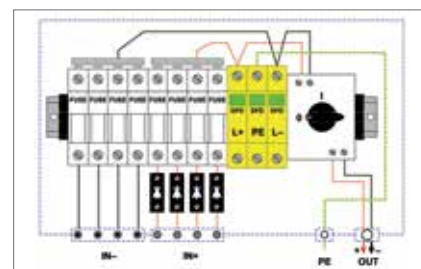
# Standard StringBox panels with fuses at both poles for floating systems

Panels for strings with fuse holders on both poles, suitable for systems with neither pole earthed; also usable in systems with one earthed pole, inserting small short-circuit protection cylinders instead of the fuses of the common earthed poles. Produced in versions with or without diodes, string input by means of solar connectors (models KX04PM4060 and

KX04PF4060) for wires of 4 mm<sup>2</sup> and 6 mm<sup>2</sup>. The fuse holders do not have fuses, which must be chosen and ordered by the customer according to the string current (see page 88). Special versions can be constructed on request, with string input through cable glands and/or 500 VDC limit devices. All the StringBox panels are supplied in packs of 1 piece.

## Version with blocking diode

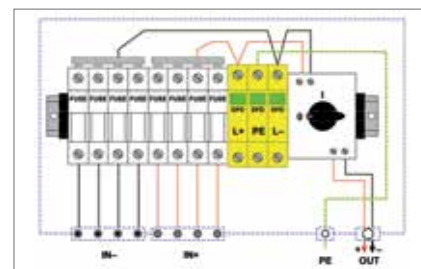
Code	Panel rated U/I	N° of Strings	UCmax /UDC STC Limit device	Dimensions (LxHxW)
ISB02HDCA06	40A 480Vdc	2	600/1,200V	300x300x180
ISB02HDCA08	40A 690Vdc	2	800/1,600V	300x300x180
ISB02HDCA10	40A 690Vdc	2	1,000/2,000V	300x300x180
ISB03HDCA06	40A 480Vdc	3	600/1,200V	300x300x180
ISB03HDCA08	40A 690Vdc	3	800/1,600V	300x300x180
ISB03HDCA10	40A 690Vdc	3	1,000/2,000V	300x300x180
ISB04HDCA06	40A 480Vdc	4	600/1,200V	450x450x180
ISB04HDCA08	40A 690Vdc	4	800/1,600V	450x450x180
ISB04HDCA10	40A 690Vdc	4	1,000/2,000V	450x450x180
ISB06HDCB06	63A 690Vdc	6	600/1,200V	540x360x180
ISB06HDCB08	63A 690Vdc	6	800/1,600V	540x360x180
ISB06HDCB10	63A 690Vdc	6	1,000/2,000V	540x360x180
ISB08HDCB06	63A 690Vdc	8	600/1,200V	540x540x180
ISB08HDCB08	63A 690Vdc	8	800/1,600V	540x540x180
ISB08HDCB10	63A 690Vdc	8	1,000/2,000V	540x540x180



Example in photo and diagram of model ISB04HDCA06

## Version without diode

Code	Panel rated U/I	N° of Strings	UCmax /UDC STC Limit device	Dimensions (LxHxW)
ISB01HXCA06	40A 480Vdc	1	600/1,200V	300x300x180
ISB01HXCA08	40A 690Vdc	1	800/1,600V	300x300x180
ISB01HXCA10	40A 690Vdc	1	1,000/2,000V	300x300x180
ISB02HXCA06	40A 480Vdc	2	600/1,200V	300x300x180
ISB02HXCA08	40A 690Vdc	2	800/1,600V	300x300x180
ISB02HXCA10	40A 690Vdc	2	1,000/2,000V	300x300x180
ISB03HXCA06	40A 480Vdc	3	600/1,200V	300x300x180
ISB03HXCA08	40A 690Vdc	3	800/1,600V	300x300x180
ISB03HXCA10	40A 690Vdc	3	1,000/2,000V	300x300x180
ISB04HXCA06	40A 480Vdc	4	600/1,200V	450x450x180
ISB04HXCA08	40A 690Vdc	4	800/1,600V	450x450x180
ISB04HXCA10	40A 690Vdc	4	1,000/2,000V	450x450x180
ISB06HXCBO6	63A 690Vdc	6	600/1,200V	540x360x180
ISB06HXCBO8	63A 690Vdc	6	800/1,600V	540x360x180
ISB06HXCBO10	63A 690Vdc	6	1,000/2,000V	540x360x180
ISB08HXCBO6	63A 690Vdc	8	600/1,200V	540x360x180
ISB08HXCBO8	63A 690Vdc	8	800/1,600V	540x360x180
ISB08HXCBO10	63A 690Vdc	8	1,000/2,000V	540x360x180



Example in photo and diagram of model ISB04HXCA06

Note: the limit device (or discharge device) must have a size such that it has a  $U_c$  voltage of at least 25% more than the  $U_{oc}$  (string voltage)

The range could vary and be expanded, even in the very near future, to effectively answer the needs of a rapidly evolving market; it is therefore advisable to check on possible updating at the website [www.cabur.eu](http://www.cabur.eu).

# Standard StringBox panels

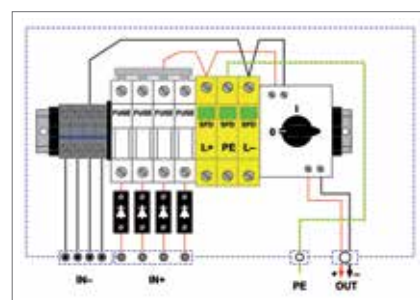
## with fuse on the positive pole for positive-grounded systems

String panels with fuse holder on positive pole suitable for systems with earthed negative pole. Produced in versions with or without diodes, string input by means of solar connectors (models KX04PM4060 and KX04PF4060) for wires of 4 mm<sup>2</sup> and 6 mm<sup>2</sup>. The fuse holders do not have fuses, which must be

chosen and ordered by the customer according to the string current (see page 88). Special versions can be constructed on request, with string input through cable glands and/or 500 VDC limit devices.

### Version with blocking diode

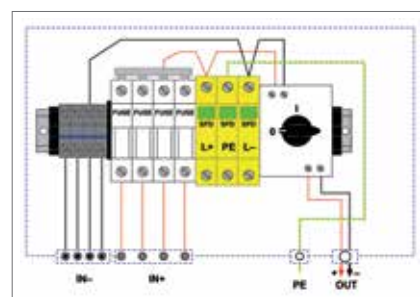
Code	Panel rated U/I	N° of Strings	UCmax /UDC STC Limit device	Dimensions (LxHxW)
ISB01FDCA06	40A 480Vdc	1	600/1,200V	300x300x180
ISB01FDCA08	40A 690Vdc	1	800/1,600V	300x300x180
ISB01FDCA10	40A 690Vdc	1	1,000/2,000V	300x300x180
ISB02FDCA06	40A 480Vdc	2	600/1,200V	300x300x180
ISB02FDCA08	40A 690Vdc	2	800/1,600V	300x300x180
ISB02FDCA10	40A 690Vdc	2	1,000/2,000V	300x300x180
ISB03FDCA06	40A 480Vdc	3	600/1,200V	300x300x180
ISB03FDCA08	40A 690Vdc	3	800/1,600V	300x300x180
ISB03FDCA10	40A 690Vdc	3	1,000/2,000V	300x300x180
ISB04FDCA06	40A 480Vdc	4	600/1,200V	450x450x180
ISB04FDCA08	40A 690Vdc	4	800/1,600V	450x450x180
ISB04FDCA10	40A 690Vdc	4	1,000/2,000V	450x450x180
ISB06FDCB06	63A 690Vdc	6	600/1,200V	540x360x180
ISB06FDCB08	63A 690Vdc	6	800/1,600V	540x360x180
ISB06FDCB10	63A 690Vdc	6	1,000/2,000V	540x360x180
ISB08FDCB06	63A 690Vdc	8	600/1,200V	540x540x180
ISB08FDCB08	63A 690Vdc	8	800/1,600V	540x540x180
ISB08FDCB10	63A 690Vdc	8	1,000/2,000V	540x540x180



Example in photo and diagram of model ISB04FDCA06

### Version without diode

Code	Panel rated U/I	N° of Strings	UCmax /UDC STC Limit device	Dimensions (LxHxW)
ISB01FXCA06	40A 480Vdc	1	600/1,200V	300x300x180
ISB01FXCA08	40A 690Vdc	1	800/1,600V	300x300x180
ISB01FXCA10	40A 690Vdc	1	1,000/2,000V	300x300x180
ISB02FXCA06	40A 480Vdc	2	600/1,200V	300x300x180
ISB02FXCA08	40A 690Vdc	2	800/1,600V	300x300x180
ISB02FXCA10	40A 690Vdc	2	1,000/2,000V	300x300x180
ISB03FXCA06	40A 480Vdc	3	600/1,200V	300x300x180
ISB03FXCA08	40A 690Vdc	3	800/1,600V	300x300x180
ISB03FXCA10	40A 690Vdc	3	1,000/2,000V	300x300x180
ISB04FXCA06	40A 480Vdc	4	600/1,200V	450x450x180
ISB04FXCA08	40A 690Vdc	4	800/1,600V	450x450x180
ISB04FXCA10	40A 690Vdc	4	1,000/2,000V	450x450x180
ISB06FXCB06	63A 690Vdc	6	600/1,200V	540x360x180
ISB06FXCB08	63A 690Vdc	6	800/1,600V	540x360x180
ISB06FXCB10	63A 690Vdc	6	1,000/2,000V	540x360x180
ISB08FXCB06	63A 690Vdc	8	600/1,200V	540x360x180
ISB08FXCB08	63A 690Vdc	8	800/1,600V	540x360x180
ISB08FXCB10	63A 690Vdc	8	1,000/2,000V	540x360x180



Example in photo and diagram of model ISB04FXCA06

Note: the limit device (or discharge device) must have a size such that it has a Uc voltage of at least 25% more than the Uoc (string voltage)

The range could vary and be expanded, even in the very near future, to effectively answer the needs of a rapidly evolving market; it is therefore advisable to check on possible updating at the website [www.cabur.eu](http://www.cabur.eu).

# StringBox control units

## Applications and advantages



The models are differentiated by the number of inputs, number of outputs, number of fuse boxes, SPD models and therefore the size of the box. Model are also available with release coil.

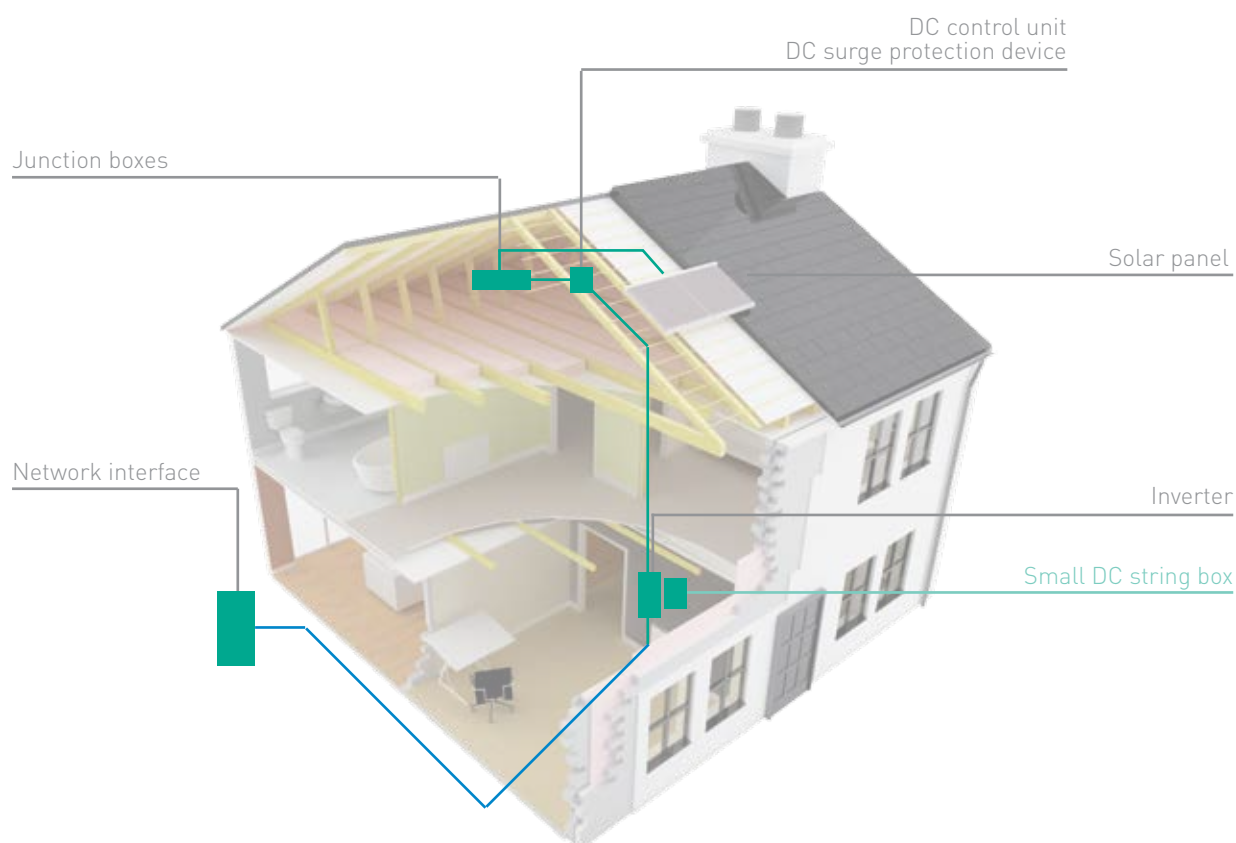
### Applications

- Suitable for civil systems
- Suitable both for inside and outside
- Suitable for medium and small power installations
- Degree of protection IP65
- 1,000 VDC voltage
- Multiple outputs for connections to latest generation inverters

### Advantages

- Appearance: ideal design for installation in civil systems
- High reliability
- Toughness

## Installation diagram of a photovoltaic system connected to the network



The CaburSolar control units have IP65 level of protection and are pleasing to the eye making them easy to integrate into any environment. They are therefore the ideal solution for creating string boxes in domestic and small service industry applications.

The connection panels of the StringBox series are designed and constructed according to the Photovoltaic Guide CEI 82-25. This is a real solution for the various needs of this sector, which takes into due consideration the need for customised products.

In most cases the photovoltaic systems are generally placed in very exposed positions (fields, roofs, etc.) and therefore are subject to atmospheric phenomena and can be damaged due to surges generated by lightning in the installations.

The control units of the Cabur StringBox Series are always equipped with surge protectors (SPD) on every polarity to earth in accordance with the risk analysis done based on standard EN 62305-2.

# StringBox control units

## Technical features

The StringBox series control units are made with the following components:

- A 1,000 VDC disconnecter to be able to intervene in complete safety
- A 600 or 1,000 VDC surge protection device in Y configuration
- Terminal block with screws for the connections (inverter, strings,...)
- Connectors for input Cabur Solar Line 4 type strings
- Cable glands for outputs to inverter

- Release coil to switch-off remotely in conformity with the new regulations provided by the guide CEI 82-25 for public access locations with risk of fire

The control units differ by number of inputs, number of outputs, by SPD models and by number of fuses and consequently by size of box

The following are available:

- Models with fuse boxes on positive or on positive-negative pole
- Accessories: door key and lock
- Multiple output

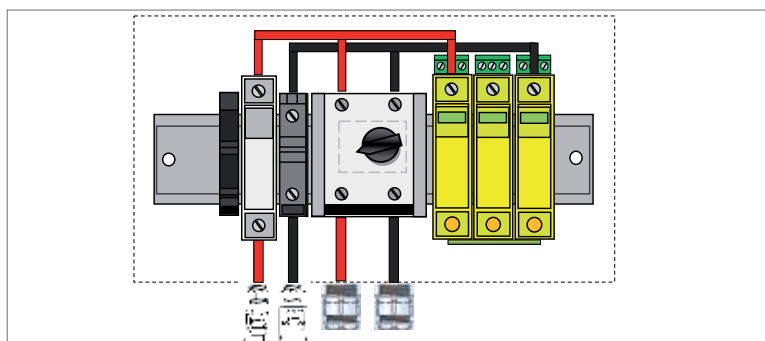


Models are available with release coil to switch-off remotely in conformity with the new regulations provided by the guide CEI 82-25 for public access locations with risk of fire.

# StringBox control units

## Technical features

Wiring diagram example for 1 string input, 1 output



ISB0101FXCAxx

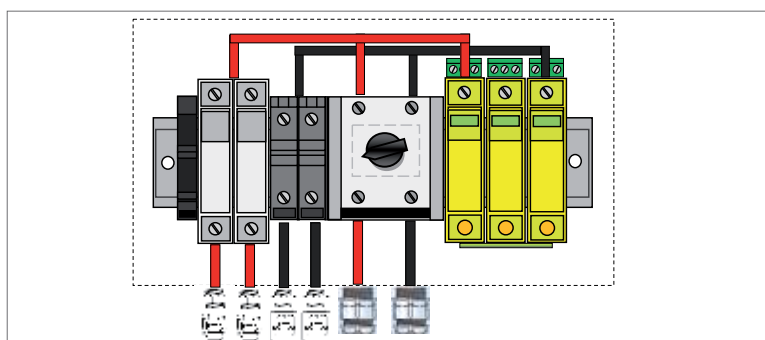
Container IP65

Dimensions in  
Modules: 9

Dimensions in mm:  
200x238x111



Wiring diagram example for 2 string input, 1 output



ISB0201FXCAxx

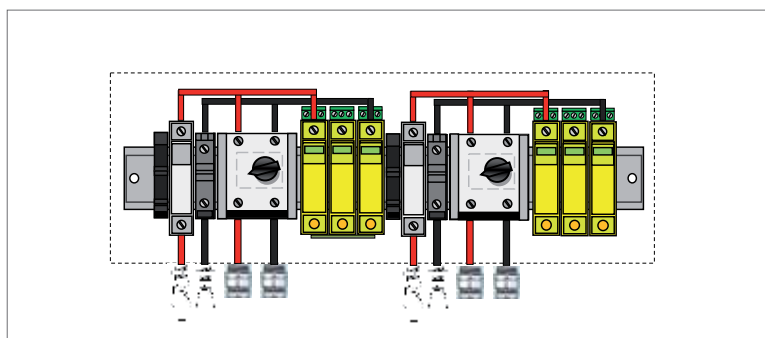
Container IP65

Dimensions in  
Modules: 12

Dimensions in mm:  
295x333x129



Wiring diagram example for 2 string input, 2 output



ISB0202FXCAxx

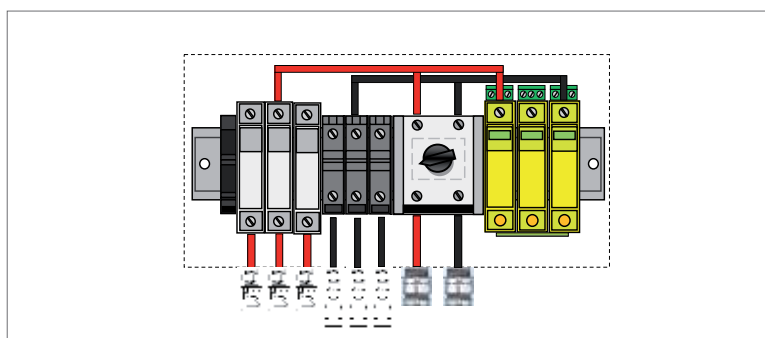
Container IP65

Dimensions in  
Modules: 18

Dimensions in mm:  
403x333x129



Wiring diagram example for 3 string input, 1 output



ISB0301FXCAxx

Container IP65

Dimensions in  
Modules: 12

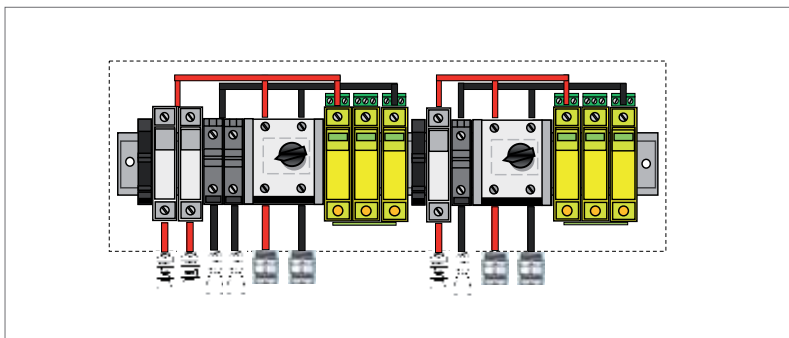
Dimensions in mm:  
295x333x129



# StringBox control units

## Technical features

Wiring diagram example for 3 string input, 2 output



ISB0302FXCAxx

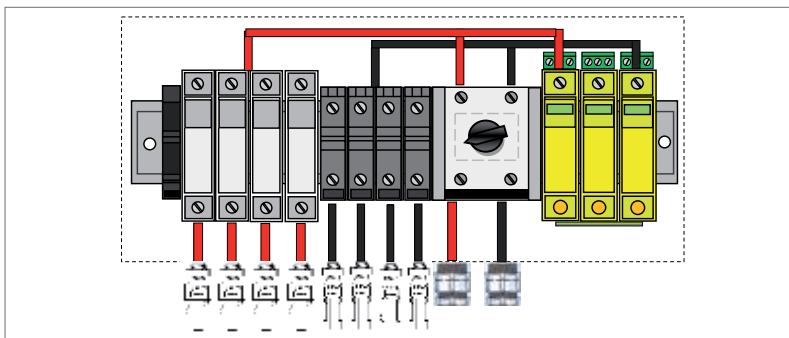
Container IP65

Dimensions in  
Modules: 18

Dimensions in mm:  
403x333x129



Wiring diagram example for 4 string input, 1 output



ISB0401FXCAxx

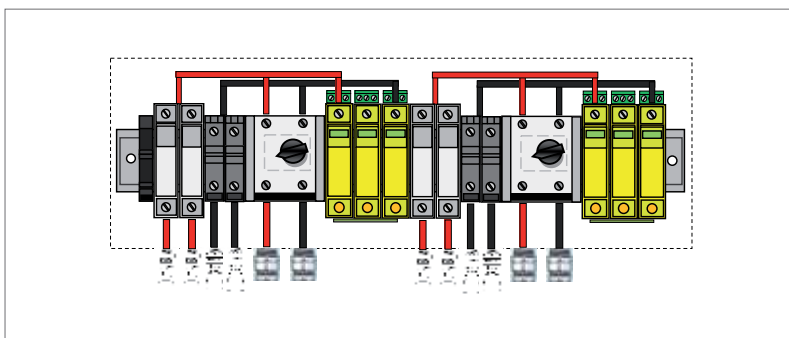
Container IP65

Dimensions in  
Modules: 18

Dimensions in mm:  
403x333x129



Wiring diagram example for 4 string input, 2 output



ISB0402FXCAxx

Container IP65

Dimensions in  
Modules: 12x2

Dimensions in mm:  
295x458x129



## StringBox control units

### Selection table of the models without release coil

All the StringBox control panels are supplied in packs of 1 piece.

Code	Inputs	Outputs	Fuse holder		UC voltage discharger	Disconnectors (1,000 VDC)	Release coil	Dimensions in modules	Dimensions in mm (LxHxW)
			Positive	Negative					
ISB0101FXCA06	1	1	x		600 V	20 A	-	9	200x238x111
ISB0101FXCA10	1	1	x		1,000 V	20 A	-	9	200x238x111
ISB0101HXCA06	1	1	x	x	600 V	20 A	-	9	200x238x111
ISB0101HXCA10	1	1	x	x	1,000 V	20 A	-	9	200x238x111
ISB0201FXCA06	2	1	x		600 V	20 A	-	12	295x333x129
ISB0201FXCA10	2	1	x		1,000 V	20 A	-	12	295x333x129
ISB0201HXCA06	2	1	x	x	600 V	20 A	-	12	295x333x129
ISB0201HXCA10	2	1	x	x	1,000 V	20 A	-	12	295x333x129
ISB0202FXCA06	2	2	x		600 V	20 A	-	18	403x333x129
ISB0202FXCA10	2	2	x		1,000 V	20 A	-	18	403x333x129
ISB0202HXCA06	2	2	x	x	600 V	20 A	-	18	403x333x129
ISB0202HXCA10	2	2	x	x	1,000 V	20 A	-	18	403x333x129
ISB0301FXCA06	3	1	x		600 V	32 A	-	12	295x333x129
ISB0301FXCA10	3	1	x		1,000 V	32 A	-	12	295x333x129
ISB0301HXCA06	3	1	x	x	600 V	32 A	-	18	403x333x129
ISB0301HXCA10	3	1	x	x	1,000 V	32 A	-	18	403x333x129
ISB0302FXCA06	3	2	x		600 V	32 A	-	18	403x333x129
ISB0302FXCA10	3	2	x		1,000 V	32 A	-	18	403x333x129
ISB0302HXCA06	3	2	x	x	600 V	32 A	-	12x2	295x458x129
ISB0302HXCA10	3	2	x	x	1,000 V	32 A	-	12x2	295x458x129
ISB0303FXCA06	3	3	x		600 V	20 A	-	12x2	295x458x129
ISB0303FXCA10	3	3	x		1,000 V	20 A	-	12x2	295x458x129
ISB0401FXCA06	4	1	x		600 V	32 A	-	18	403x333x129
ISB0401FXCA10	4	1	x		1,000 V	32 A	-	18	403x333x129
ISB0401HXCA06	4	1	x	x	600 V	32 A	-	18	403x333x129
ISB0401HXCA10	4	1	x	x	1,000 V	32 A	-	18	403x333x129
ISB0402FXCA06	4	2	x		600 V	32 A	-	12x2	295x458x129
ISB0402FXCA10	4	2	x		1,000 V	32 A	-	12x2	295x458x129
ISB0402HXCA06	4	2	x	x	600 V	32 A	-	12x2	295x458x129
ISB0402HXCA10	4	2	x	x	1,000 V	32 A	-	12x2	295x458x129

Models are available without fuses. Contact the Cabur sales network for more information.

## StringBox control units

Selection table of models with release coil in accordance with the Italian Fire and Rescue Services Circular

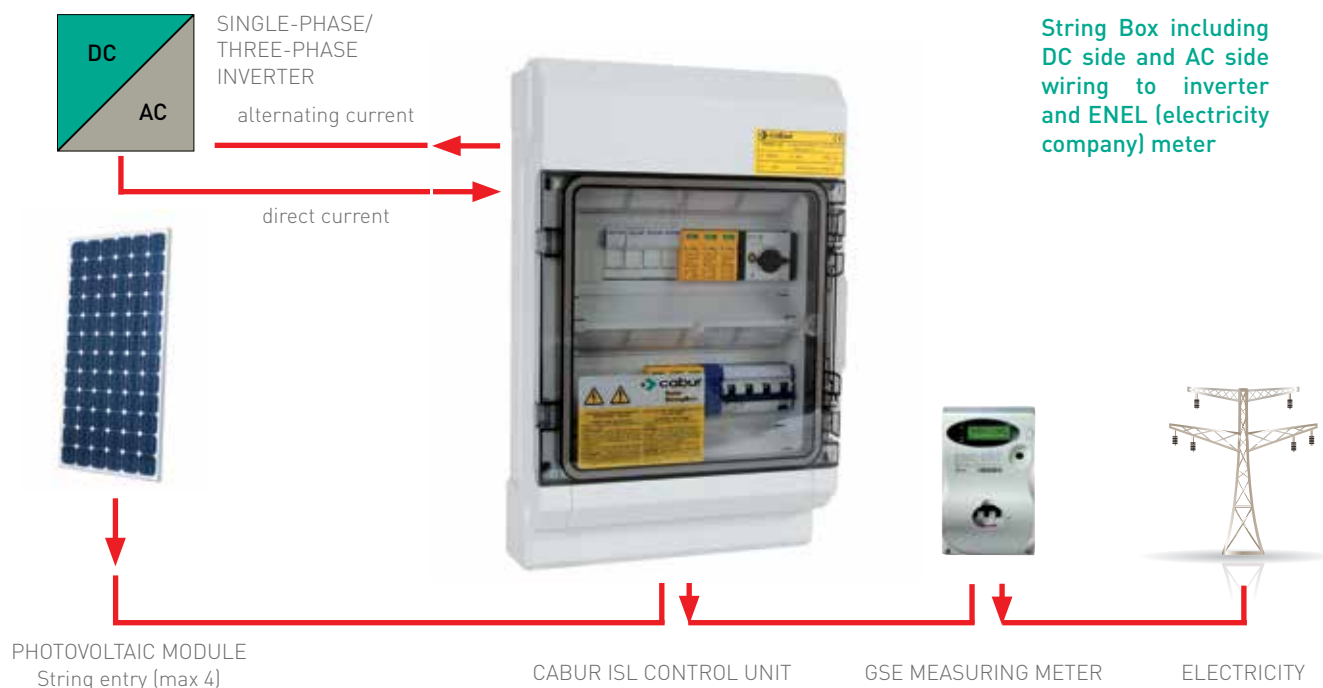
All the StringBox control panels are supplied in packs of 1 piece.

Code	Inputs	Outputs	Fuse holder		UC voltage discharger	Disconnectors (1,000 VDC)	Release coil	Dimensions in modules	Dimensions in mm (LxHxW)
			Positive	Negative					
ISA0101FXCA06	1	1	x		600 V	20 A	x	9	200x238x111
ISA0101FXCA10	1	1	x		1,000 V	20 A	x	9	200x238x111
ISA0101HXCA06	1	1	x	x	600 V	20 A	x	12	295x333x129
ISA0101HXCA10	1	1	x	x	1,000 V	20 A	x	12	295x333x129
ISA0201FXCA06	2	1	x		600 V	32 A	x	12	295x333x129
ISA0201FXCA10	2	1	x		1,000 V	32 A	x	12	295x333x129
ISA0201HXCA06	2	1	x	x	600 V	32 A	x	12	295x333x129
ISA0201HXCA10	2	1	x	x	1,000 V	32 A	x	12	295x333x129
ISA0202FXCA06	2	2	x		600 V	20 A	x	18	403x333x129
ISA0202FXCA10	2	2	x		1,000 V	20 A	x	18	403x333x129
ISA0202HXCA06	2	2	x	x	600 V	20 A	x	18	403x333x129
ISA0202HXCA10	2	2	x	x	1,000 V	20 A	x	18	403x333x129
ISA0301FXCA06	3	1	x		600 V	32 A	x	12	295x333x129
ISA0301FXCA10	3	1	x		1,000 V	32 A	x	12	295x333x129
ISA0301HXCA06	3	1	x	x	600 V	32 A	x	18	295x333x129
ISA0301HXCA10	3	1	x	x	1,000 V	32 A	x	18	295x333x129
ISA0302FXCA06	3	2	x		600 V	32 A	x	12x2	295x458x129
ISA0302FXCA10	3	2	x		1,000 V	32 A	x	12x2	295x458x129
ISA0302HXCA06	3	2	x	x	600 V	32 A	x	12x2	295x458x129
ISA0302HXCA10	3	2	x	x	1,000 V	32 A	x	12x2	295x458x129
ISA0401FXCA06	4	1	x		600 V	32 A	x	18	403x333x129
ISA0401FXCA10	4	1	x		1,000 V	32 A	x	18	403x333x129
ISA0401HXCA06	4	1	x	x	600 V	32 A	x	18	403x333x129
ISA0401HXCA10	4	1	x	x	1,000 V	32 A	x	18	403x333x129
ISA0402FXCA06	4	2	x		600 V	32 A	x	12x2	295x458x129
ISA0402FXCA10	4	2	x		1,000 V	32 A	x	12x2	295x458x129
ISA0402HXCA06	4	2	x	x	600 V	32 A	x	12x2	295x458x129
ISA0402HXCA10	4	2	x	x	1,000 V	32 A	x	12x2	295x458x129

Models are available without fuses. Contact the Cabur sales network for more information.

# DC/AC ISL series control units for PV arrays

## Pre-wired for single-phase and three-phase DC/AC



The Cabur StringBox ISL connection control units are designed and constructed in accordance with the CEI 82-25 Photovoltaic Guide, precisely to be able to give the installer that product guarantee necessary to maintain unchanged for the entire useful life of the system and the correlated investment. The ISL Series control units include the complete DC wiring (parallel connections, protection

and disconnection of strings) and the AC side (protection, disconnection with magneto-thermal switch) towards inverter and ENEL meter. **The CaburSolar control units are also available with release coil to switch-off remotely in conformity with the new regulations provided by the guide CEI 82-25 for public access locations with risk of fire.**

### 4 ISL control units

The CaburSolar ISL Series control units are available in the versions 1-2-3-4 strings in input and include:

- all the components necessary for the protection and connection in parallel of the photovoltaic panel strings
- all the components necessary for the connection and protection of the inverter output to the distribution network.

### How they are composed

The DC side of the control units includes:

- A disconnector to be able to intervene in complete safety
- A DC surge protection device in Y configuration
- Fuse holder with possibility of LED signalling
- Terminal block with screws for the connections (inverter, strings,...)
- Connectors for input CaburSolar Line 4 type strings
- Cable glands for outputs to inverter

AC side:

- Cable glands in input from inverter (AC)
- Magneto-thermal switch - differential
- Protection with Varistor Dischargers + Gas Discharger

# DC/AC ISL series control units for PV arrays

## 1 output control unit technical tables

### Control unit codes with fuses only on positive

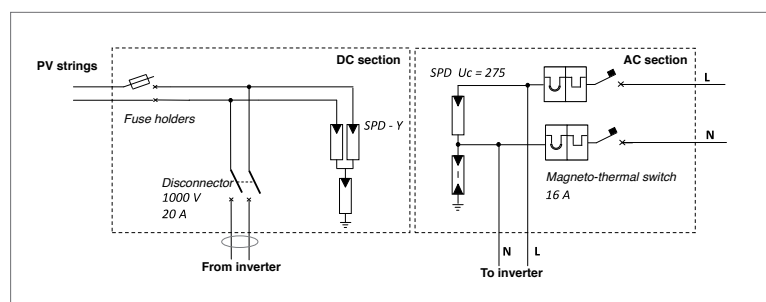
	ISL0101FXCAXX		ISL0201FXCAXX		ISL0301FXCAXX		ISL0401FXCAXX	
Final Code XX =	06	10	06	10	06	10	06	10
Number of input strings	1		2		3		4	
Maximum voltage:	1,000 VDC		1,000 VDC		1,000 VDC		1,000 VDC	
Maximum string current	20 A		15 A		10 A		8 A	
DC Uc discharger (volts)	600	1,000	600	1,000	600	1,000	600	1,000
Discharger in AC	275		275		440		440	
Magneto-thermal carrying capacity	16 Single-phase		32 Single-phase		32 Three-phase		32 Three-phase	
Degree of protection (A)	IP65		IP65		IP65		IP65	
Input connectors	Cabur Line 4		Cabur Line 4		Cabur Line 4		Cabur Line 4	
Input wires section	4-6 mm <sup>2</sup>		4-6 mm <sup>2</sup>		4-6 mm <sup>2</sup>		4-6 mm <sup>2</sup>	
Dimensions	295x458x129		295x458x129		295x458x129		295x458x129	
Conformity standards/guides	CEI 82-25		CEI 82-25		CEI 82-25		CEI 82-25	
Recommended for systems	< 3kW		< 6kW		< 10kW		< 20kW	
Quantity per pack	1		1		1		1	

### Control unit codes with fuses only on positive and negative

	ISL0101HXCAXX		ISL0201HXCAXX		ISL0301HXCAXX		ISL0401HXCAXX	
Final Code XX =	06	10	06	10	06	10	06	10
Number of input strings	1		2		3		4	
Maximum voltage:	1,000 VDC		1,000 VDC		1,000 VDC		1,000 VDC	
Maximum string current	20 A		15 A		10 A		8 A	
DC Uc discharger (volts)	600	1,000	600	1,000	600	1,000	600	1,000
Discharger in AC	275		275		440		440	
Magneto-thermal carrying capacity	16 Single-phase		32 Single-phase		32 Three-phase		32 Three-phase	
Degree of protection (A)	IP65		IP65		IP65		IP65	
Input connectors	Cabur Line 4		Cabur Line 4		Cabur Line 4		Cabur Line 4	
Input wires section	4-6 mm <sup>2</sup>		4-6 mm <sup>2</sup>		4-6 mm <sup>2</sup>		4-6 mm <sup>2</sup>	
Dimensions	295x458x129		295x458x129		295x458x129		295x458x129	
Conformity standards/guides	CEI 82-25		CEI 82-25		CEI 82-25		CEI 82-25	
Recommended for systems	< 3kW		< 6kW		< 10kW		< 20kW	
Quantity per pack	1		1		1		1	

# DC/AC ISL series control units for PV arrays

## Connection examples

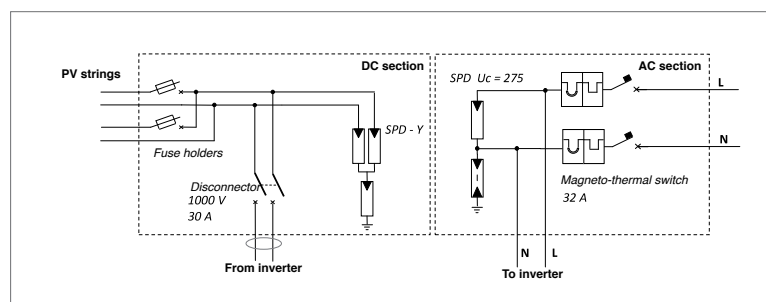


### ISL0101FXCAxx

Container IP65

Dimensions in Modules: 2x12

Dimensions in mm: 295x458x129

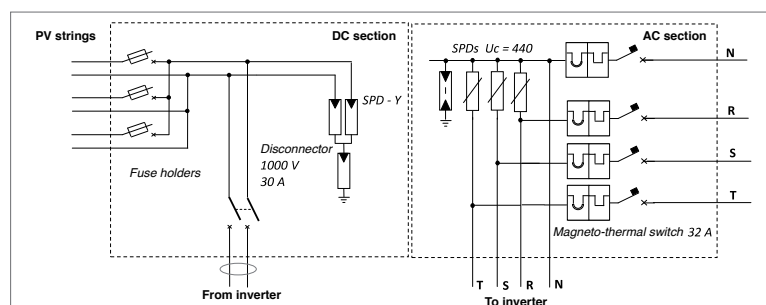


### ISL0201FXCAxx

Container IP65

Dimensions in Modules: 2x12

Dimensions in mm: 295x458x129

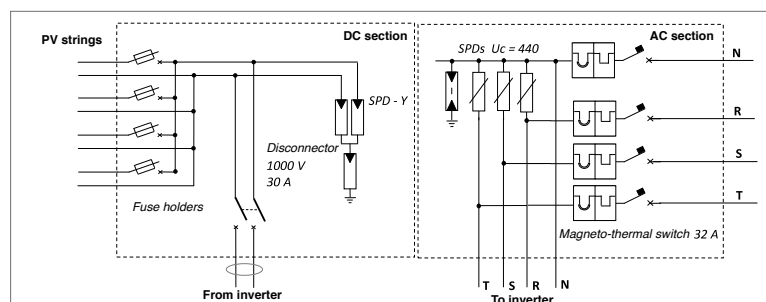


### ISL0301FXCAxx

Container IP65

Dimensions in Modules: 2x12

Dimensions in mm: 295x458x129



### ISL0401FXCAxx

Container IP65

Dimensions in Modules: 2x12

Dimensions in mm: 295x458x129



## E-Box

# String and monitoring boxes with electronics for monitoring

### Combiner boxes with integrated electronics for monitoring and measure power/energy

The connection panels of the E-Box series are designed and constructed according to the Photovoltaic Guide CEI 82-25. This is **a real solution for the various needs of this sector**, which takes into due consideration the need for customised products. The Cabur line in fact includes String Boxes, fuses and fuse holders, surge protection devices, control units and sleeves suitable for use outside, all specially designed for this type of application.

The E-Box panels are available in the 4, 8 and 16 string versions and include all the components necessary to connect strings in parallel, to protect the system, to disconnect and transmit the characteristic data of the panel, such as voltage and current of each string.

The Cabur E-Box line parallel panel therefore uses its own inner instruments capable of measuring the currents flowing in the photovoltaic strings, the string parallel voltage and at the same time detect the operating status of input signals relative

to the status of the protection and alarm devices installed in the panels. The measurements of the string current are done with modules using amperometric Hall effect sensors which guarantee a high degree of insulation with the control and measurement unit.

The string box has at output an RS485 serial port used to transfer the instantaneous data from the panel to a possible remote PC. The serial transmission on RS485 twisted pair with protocol Modbus RTU allows a network of interconnected modules (slaves) and a remote PC unit (master) which acts as data logger to be constructed. By operating on bridges, it is possible to direct every field module in order to construct the multi-slave network.

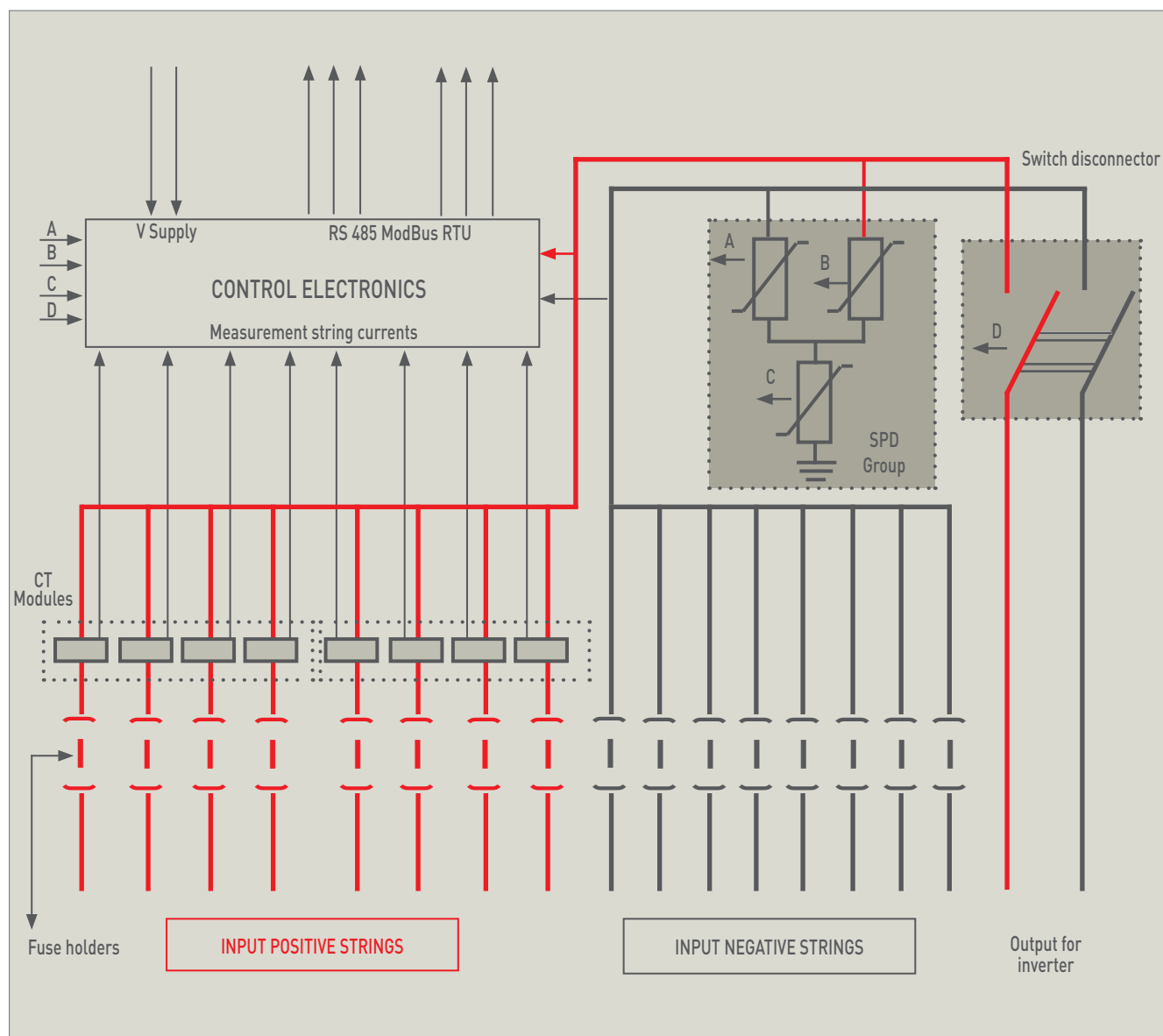


# E-Box

## Connection Diagram

### E-Box is composed of:

- A disconnecter to be able to intervene in complete safety
- A DC Cabur surge protection device in Y configuration
- Fuse holder 10x38 for voltages up to 1,000 V
- Cabur Series CBC and GPA terminal block with screws for the connections (inverter, strings,...)
- Connectors for input Cabur Solar Line 4 type strings
- Cable glands for outputs to inverter
- Control unit with microprocessor for data transmission
- Current transformers (CT) modules with Hall sensors for measuring current
- Voltage transformer (VT) module for measuring voltage



# E-Box

## Codes and technical characteristics

- Designed and built in accordance with the Photovoltaic Guide CEI 82-25
- Provided with an RS485 serial port at output used to transfer the instantaneous data from the panel to a possible remote PC
- Protocol of transmission: Modbus RTU
- Versions available for systems with 4, 8, 16 strings at input



TECHNICAL CHARACTERISTICS		STANDARD E-BOX CODES		
		for systems with 4 strings at input	for systems with 8 strings at input	for systems with 16 strings at input
With fuse holder on positive		ISE04FXCD10	ISE08FXCD10	ISE16FXCE10
With fuse holder on positive and negative		ISE04HXC10	ISE08HXC10	ISE16HXC10
No. inputs	Number of input strings	4	8	16
No. outputs	Number of output strings	1	1	1
Voltage	Maximum operating voltage under load	800 V	800 V	1,000 V
Current	Maximum string current	10 A	10 A	10 A
	Maximum parallel current	40 A	80 A	160 A
	Maximum operating current under load	40 A	80 A	120 A
SPD	Continuous current UC discharger	1,000 V	1,000 V	1,000 V
	Protection impulsive voltage UP	3,000 V	3,000 V	3,000 V
Protection	Degree of protection water	IP65	IP65	IP65
Connection	Connectors input positive string	IS24111	IS24111	IS24111
	Connectors input negative string	IS14110	IS14110	IS14110
	Cable glands in output strings parallel	PG21	PG21	PG21
	Cable glands in output connection to earth	PG9	PG9	PG9
Wire section	Wire section input strings	4-6 mm <sup>2</sup>	4-6 mm <sup>2</sup>	4-6 mm <sup>2</sup>
	Wire section output strings	25-95 mm <sup>2</sup>	25-95 mm <sup>2</sup>	25-95 mm <sup>2</sup>
Oper. Cond.	Minimum operating temp. control unit	-10° C	-10° C	-10° C
	Maximum operating temp.	+65° C	+65° C	+65° C
Hall sensors	Number of cards with Hall sensors	1	2	4
	Hall sensors used	4	8	16
Control Unit	Number of current reading channels	8	8	16
Transm. Data	Serial type	RS485	RS485	RS485
	Communication protocol	Modbus RTU	Modbus RTU	Modbus RTU
Dimensions	Outside dimensions	540x540x127	540x540x127	540x540x127
Standards	Conformity standards/guides	CEI 82-25 CEI 17-13	CEI 82-25 CEI 17-13	CEI 82-25 CEI 17-13
Q.ty / pack		1	1	1

NOTE: It is possible to request custom solutions by contacting the Cabur sales network.

# E-Box

## General features

### Operating conditions

To guarantee an optimal measurement of the panel, we recommend installing in an environment with minimum temperature  $-10^{\circ}\text{C}$  and maximum temperature  $65^{\circ}\text{C}$  with a relative humidity of between 5% and 95% without condensation.

### System of communication

The String Box has in the control unit a serial port on standard physical RS485.

The serial port allows the instantaneous measures of the data coming from the CT modules to be sent to a remote unit such as a PC. The serial port should be used if a connection network between several Cabur field panels is being created. The RS485 communication line between the various panels or between the panels and the PC should preferably be done with twisted and screened wire in order to reduce problems from electromagnetic interference. The maximum connection distance between the first and last network device must not exceed 1200 metres. We recommend using screened wire in environments affected by electromagnetic noise. The protection screen must be connected to one of the two earthed points between signal arrival and departure. We recommend no connecting the GND end of reference of the RS485 line to the earthed end or to the protection screen in order to avoid abnormal currents from circulating. It is recommended that

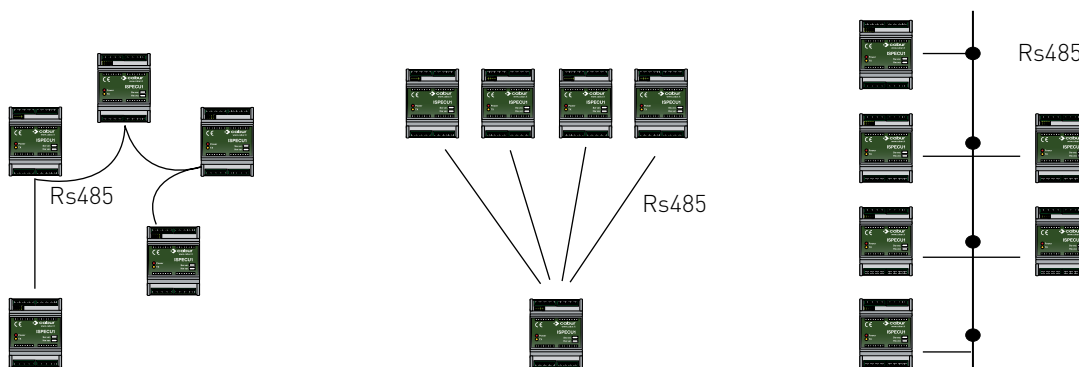
the devices be connected in input and output mode rather than creating connections with branches. Never use a star connection. It is preferable to connect the parallel devices in enter-exit mode rather than creating a principal bus with numerous branches.

The communication protocol use by the string boxes is the Modbus type with RTU mode. Every unit can be identified by a single address. This address can be set through bridges present on the chart of the electronic module.

### Input and output lines String Box

Positive photovoltaic lines max 16	- input
Negative photovoltaic lines max 16	- input
Positive output photovoltaic line per inverter	- output
Negative output photovoltaic line per inverter	- output
Electronic Supply line Control Unit/Power Supply VAC 230 PHASE	- input
Electronic Supply line Control Unit/Power Supply VAC 230 NEUTRAL	- input
Line RS485 data RX modbus RTU	- input
Line RS485 data TX modbus RTU	- output

### Types of connection with RS485 twisted pair



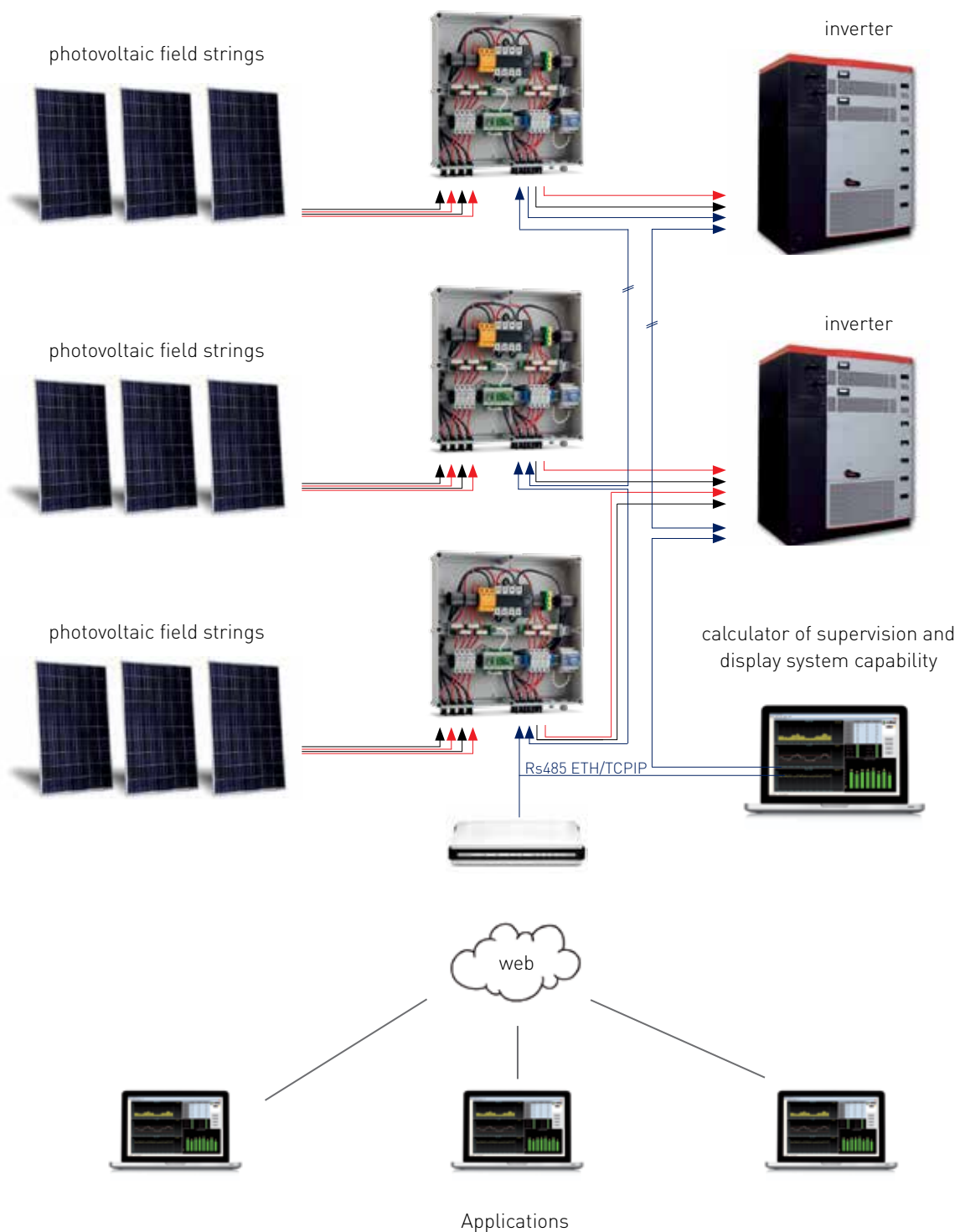
EXCELLENT

NO

NOT RECOMMENDED

## E-Box

Panel for parallel connections with monitoring electronics



## E-Box components

### Control and measurement control unit (code ISPECU1)

- Does not require configuration in terms of the voltage and/or current measurement
- Input of power supply with direct current from +15 to 28 VDC max
- Max input of voltage: 1,000 VDC with connection to the module ISPVL1
- Input current: 25A (with Hall effect sensors) with connection to the module ISAMP4
- Protocol of transmission: Modbus RTU
- 2 digital inputs
- 1 serial port RS485
- Quantity per pack: 1



# Control unit ISPECU1

## Technical features

### Power supply

The electronic control unit has a power supply input of direct current from +15 V to 28 DC max.

### Consumption

Voltage in DC: 24 DC +/- 10%

Consumption in DC: 250 mA max

### System of communication

The control unit uses the Modbus RTU transmission protocol to send the data. Modbus is the most widespread serial communication protocol between industrial electronic devices. Modbus permits the communication between various devices connected to the same network, it is used to connect a supervisor computer with a remote terminal unit (RTU) in the supervision control and data acquisition systems (SCADA).

Reference: ModBus RTU

Speed of transmission: 19,200 baud

Length datum: 8bit

Parity: none

Stop bit: 1bit

### Connection digital inputs

The control unit has 2 clean contact digital inputs and a common terminal with 24 DC output voltage for the detection of the logic status of the protection systems or other command devices installed in the photovoltaic field.

The control unit continuously controls in real time the logic status (open or closed) of the digital inputs and, through the RS485 serial port connected to PC transmits the information to the supervision software. The use of these digital inputs is optional and does not affect in any way the remaining features of the control unit device.

### Connection to PC through serial port (salve)

The control unit has 1 RS485 serial to transfer the instantaneous measurements to PC. The RS485 connection line must be done using a twisted and screen communication wire (minimum 3 conductors) preferably with the following characteristics:

- flexible
- category 5 or greater
- 4 conductors Ø 0.5 mm<sup>2</sup>
- with screen

The maximum connection distance between the first and last device inserted on the RS485 line must not exceed 1,200 metres.

For short connection distances (< 5 metres) the wire used does not have to have a screen. For greater distances or areas particularly affected by electrical and electromagnetic noise and disturbances, it is instead necessary to use screened wires. The protection screen should be connected to an earthed terminal on one of the ends of the RS485 line in order to discharge to earth any disturbances induced. Do not connect the GND end of reference of the RS485 line to the earthed terminal or to the protection screen in order to avoid abnormal currents from circulating to different potentials.

### Configuration

The measurement control unit does not require any configuration relative to the measurement of voltage and/or current since the flow meters are already set and defined. Instead every single device must be configured for communication to PC and for the connection in multi-slave cascade mode.

### Communication protocol

The communication protocol used by the control units is the MODBUS type with RTU mode.

The RS485 serial port is used to connect the unit of measurement to a continuous monitoring system. It is necessary to identify every single unit through a unique and unambiguous identification address.

# ISPECU1 control unit

## Types of connection with RS485 twisted pair

### ModBus protocol

The control unit transfers the information to PC using the communication protocol MODBUS with RTU mode. Every message is composed of 8 codes containing 2 hexadecimal characters of 4 bytes.

The format of every byte in RTU mode is the following:

<b>Code</b>	8 bit binaries in hexadecimal from 0 to 9 A-F, 2 hexadecimal characters contained in every 8 bit field of the message
Bit per byte	8 bit
Check error field	CRC (Cyclical Redundancy Check) type

### ModBus registers

The following table lists the codes of the MODBUS addresses relative to the units (slaves).

Parameter	Abbreviation	ModBus address	Unit of measure
Current of string 1	I1	0x0000	A x 100
Current of string 2	I2	0x0001	A x 100
Current of string 3	I3	0x0002	A x 100
Current of string 4	I4	0x0003	A x 100
Current of string 5	I5	0x0004	A x 100
Current of string 6	I6	0x0005	A x 100
Current of string 7	I7	0x0006	A x 100
Current of string 8	I8	0x0007	A x 100
Analogue 0	A0	0x0009	V x 100
Analogue 1	A1	0x000A	V x 100
Analogue 2	A2	0x000B	V x 100
Analogue 3	A3	0x000C	V x 100
Digital 0 - 1	D0 D1	0x000D	-
Temperature	T	0x000E	°C
Power supply voltage	Va	0x000F	V
String voltage	V1	0x0010	V
Peripheral address	Ad	0x0011	-

Cabur reserves the right to change the technical data listed in the table, without advance notice, for production needs or development of improvements. Please refer to the Cabur technical-commercial organisation for updates on the technical data of the product.

## E-Box components

### Single-phase switching power supply Series DOMOTIC POWER (code XCSD30C)

The single-phase switching power supply for DIN rail with 30W power, ideal for applications in civil and industrial automation. Standard modular DIN measurements for installations in control units. High output and a contained operating temperature to promote energy savings and longer component life.

Main characteristics:

- Small size
- Use on all power supply networks
- Insulation class II
- Thermal protection
- IP20 protection degree against accidental contact according to IEC529
- Reduced time and cost for installation in remote panels and surveillance and monitoring systems (an earth connection is required)
- Quantity per pack: 1

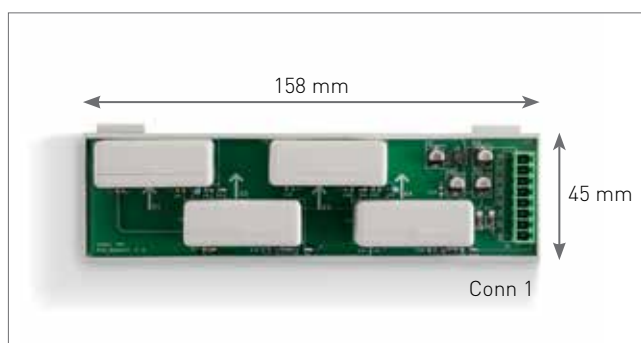


### Measurement currents card (code ISPAMP4)

In the E-Box combiner boxes there are 4 module units with magnetic Hall sensors for reading the string current. The measurement is possible thanks to the Hall effect which allows non-invasive work to be carried out in the power circuit by keeping a very high galvanic insulation.

Characteristics:

- Accuracy of the measurement
- 3KV of insulation
- Fast response to transients
- Quantity per pack: 1



General data	Value
Nominal current	25 A
Conversion ratio	1,000: 1
Power supply	15V - 15V + - 5%
Electricity consumption	16 mA
Minimum resistance of load	150 Ohm
Operating temperature	-10 °C ÷ +70 °C
Storage temperature	-25 °C ÷ +85 °C
Linearity	1% full scale
Limit of linearity	+55 A
Accuracy	5 % full scale
Band width	DC - 200 kHz
Quantity per pack	1

# E-Box components

## Measurement card string voltage (code ISPVLT1)

In the E-Box combiner boxes there is a unit for reading the string voltage. The measurement is possible thanks to the Hall effect which allows non-invasive work to be carried out in the power circuit by keeping a very high galvanic insulation. The ISPVLT1 module permits a measurement of the voltage by maintaining a galvanic separation between the primary and the secondary circuit. Connector 1 is connected to the string potentials and connector 2 is connected at input to the ISPECU1 control unit.



General data	Value
Primary current	10 mA
Primary current - field of measurement	0 .. ± 14 mA
Conversion ratio	2,500: 1,000
Power supply	± 12 .. 15 V
Electricity consumption	25 mA
Insulation voltage	2.5 kV
Quantity per pack	1

# E-Box

## Ordering codes table

### String Boxes



CODES		DESCRIPTIONS
With fuse holder only on positive	With fuse holder on positive and negative	
ISE04FXCD10	ISE04HXCD10	4 string combiner box 800 VDC / 80 A 1,000 UC dischargers
ISE08FXCD10	ISE08HXCD10	8 string combiner box 800 VDC / 80 A 1,000 UC dischargers
ISE16FXCE10	ISE16HXCE10	16 string combiner box 1,000 VDC / 160 A 1,000 UC dischargers

### Components

<p>Code <b>ISPECU1</b></p> <p>Control and measurement unit - data transmission</p>	<p>Code <b>ISPAMP4</b></p> <p>4-channel current reading module with CT Hall sensors</p>	<p>Code <b>ISPVL1</b></p> <p>Insulated module for reading voltage</p>	<p>Code <b>XCSD30C</b></p> <p>Power supply CSD30C 24 V / 1 A</p>	<p>Code <b>ISPD600V3G0A</b></p> <p>600 UC dischargers with Y configuration</p>
<p>Code <b>ISPD1000V3G0A</b></p> <p>1,000 UC dischargers with Y configuration</p>	<p>Code <b>9000499</b></p> <p>800 VDC / 80 A disconnector</p>	<p>Code <b>9000375</b></p> <p>Fuse holder Ui - 1,000 VDC</p> <p>White stocks last. It will be replaced by Cod. 9000446</p>	<p>Code <b>IS14110</b></p> <p>Connectors for panel for connecting male strings</p>	<p>Code <b>IS24111</b></p> <p>Connectors for panel for connecting male strings</p>

NOTE: The images are purely indicative

## Surge protection devices for PV systems

Surge protection devices (SPD) prevent sudden electrical surges induced to the PV array by the earthed network and conducted to the AC power supply network or signal line from damaging the electronic equipment. The protection devices in the ISPD1455xBY7-40/3 series limit dangerous electrical surges to normal levels tolerated by the devices recommended for use in Surge Category II (less than 4KV with  $U_{oc}$  1,000 VDC) in Surge Protection Zone C, SPD Test Class II, as required by the IEC1024, IEC1312-1, and EN50083-1 regulations.

# Limitatori di sovratensione per impianti FV

## Where and how SPDs should be used

In the case of transitory power surges, the only way to protect equipment is to limit the difference in voltage between the various conductors that exit/enter the device. For this reason, in PV systems the surge protection must always be installed on both the AC and DC sides, so as to guarantee equal voltage between all the various system conductors, both in the case that the surge arrives from the PV array or from the AC or earthed network.

In the case of a power surge on the PV array, the DC side SPDs create an instantaneous short-circuit between the positive, negative, and earthed conductors, establishing a transitory voltage equilibrium. Hence the three conductors on the DC side of the inverter rise to thousands of V, but as the SPDs limit the difference in voltage between the three conductors to 4kV, no malfunctions will occur on the DC side of the inverter, which will have a resistance to impulse power surges greater

than 4kV.

Alone, however, this is insufficient to protect the inverter from malfunctioning, because if the three conductors on the DC side rise to 10kV and on the AC side there are no SPDs able to create transitory voltage equilibrium with the DC side, then the DC side at 10kV will "see" the 230-400 AC exiting from the inverter as a lower voltage to which it can discharge through the insulation and/or components of the inverter, destroying them. Similarly, the same thing would occur if the power surge occurred on the AC side.

The concept of equal voltage requires the use of SPDs on all conductors that exit and enter the inverter, because only by limiting the difference in voltage between the AC and DC sides and the earthing, that is to say within the surge levels that the device is able to support, can destructive surges to the insulations or components be avoided.

## Safe use of SPDs up to 1,000 VDC

The varistor, the active element of the SPD, is a component that is able to support a limited number of discharges. It can still short circuit if subjected to a discharge that exceeds its max  $I_{sc}$ , or if it is subjected to multiple discharges below its max  $I_{sc}$ , gradually deteriorating its performance. Under these conditions, its resistance, which normally is in tens of M $\Omega$ , will decrease to a few hundreds/tens of  $\Omega$ , the varistor will overheat due to the passage of current between the line and the earthing, and it can catch fire.

Regulations regarding Test Class II SPDs requires them to be provided with a device which disconnects them from the line at the end of their useful life. The device consists of a contact in series on the side of the line which has its ends welded airtight, one of which is spring-loaded. When the overheated varistor exceeds the fusion temperature of the seal, the spring-loaded conductor disconnects, opening the contact and disconnecting the varistor from the line, thereby preventing damage.

In modern SPDs, created for use on AC lines, in which the disconnection device is able to eliminate the arc, during the pass to zero of the AC current, consequent to the opening of the broken varistor through which the short L/earthing

current passes.

In PV systems the varying conditions make the automatic disconnection task of the SPDs more difficult. DC voltages from 500 to 1,000 V and no pass to zero for the voltage/current makes interruption of the arc between the contacts at entry more difficult, because the air and surface distances designed for AC are not sufficient to guarantee disconnection power for the arc in DC. The problem is solved by using three varistors set up in a "Y" formation. With the Y set up, the discharge is divided into three varistors instead of the two found in the classic formation. This makes it much less likely that one of them will malfunction. Nevertheless, in the case of a short-circuit in one of the varistors, in the circuit between the Line and the earthing, once the surge has passed, the second intact varistor returns to the resistance M $\Omega$ , cutting off the current to the contact on the malfunctioning varistor.

Cabur does not recommend the use of earthed gas discharge devices on the DC side, because while they are able to ensure insulation in terms of earthing, in the case of a short or semi-short circuit to a varistor, the gas discharge device would not be set off by the DC voltage, meaning that the string  $I_{sc}$  would pass through the varistor, and it could catch fire.

# Limitatori di sovratensione per impianti FV

## Construction characteristics of ISPD1455x BY7-40/3 series SPDs

These consist of a wiring base which can be assembled on a DIN rail and an extractable protection cartridge which contains the varistor (VDR, Voltage Dependent Resistor), which it makes it easy to disconnect the protection during insulation tests or for quick replacement when useful life has ended. ISPD1455x BY7-40/3 series SPD bases and cartridges are provided with a coding device that make it impossible to insert the wrong cartridge -- i.e. inserting 230 VAC in a 400 VAC base or vice versa.

ISPD1455x series SPDs are able to support 10 surges of  $I_{sc}$  20kA impulse 8/20 and a single surge of 40kA, which

statistically is very rare.

**ISPD1455x BY7-40/3** series SPDs are provided with an internal auto-disconnection thermal fuse device able to disconnect the varistor from the line in the case of malfunctioning, providing information about the malfunction visible on the front of the cartridge, and offering notification by switching an exchange contact which can be used as a remote signal. When an SPD has reached the end of its useful life, after several surges and years of service, it can be quickly replaced by extracting it from the base and replacing it with the same model without disconnecting the power supply.

## SPD protective devices and fuses

The insertion of protective fuses on the main line or upstream from the SPD is a difficult problem, mainly due to the difficulty of coordinating the value of the fuse so as to be able to resist the discharge current without opening the circuit before the SPD has completed its task.

The problem is made more complex by the specific characteristics of PV fuses, as the fuse that ensures intervention to the string  $I_{sc}$  may not be able to resist the current of the discharge, and will burn before the SPD has completely eliminated the power surge.

# Surge Protection Devices with direct current

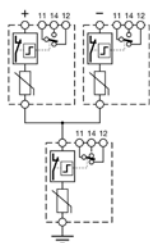
The Surge Protection Devices (SPDs) protect the photovoltaic system against excess voltage induced by atmospheric discharge (lightening) and protect the DC circuit at the PV array side, upstream of the inverter.

The range includes four models with activation voltages of 500 - 600 - 800 - 1,000 V.

The features of each model are given in the table below.

Available while stocks last. They will be replaced by the models on page 81

Available while stocks last. They will be replaced by the models on page 81



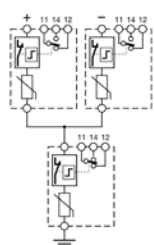
Code	ISPD14555
ID number	BY7-40/3-500
Use category	II
Earthing system	-
Technology	MOV (Metal Oxide Varistor)
Maximum Continuous Voltage	Uc 500 VDC
Protection Level	Up 1,800 VDC
Nominal Discharge Impulsive Current 8/20	under 20 kA
Maximum Discharge Current 8/20	I <sub>max</sub> 40 kA
Connection Wire Sections	4 ... 25 mm <sup>2</sup>
Reaction Time	t <sub>a</sub> < 25 nS
Operating Temperature	-40°C < T < 80°C
Failure Indicator	Green OK/Red FAILURE
Remote Failure Signal	Contact SPDT 1 A/230 VAC*
Remote Signal Connections	Extractable terminal blocks - 1.5 mm <sup>2</sup> - 6 A - 120 V
Assembly	On omega TH35 rail
Case Material	Self-extinguishing UL94V0
Degree of protection	IP20
Colour	Yellow
Pieces per Pack	1
Dimensions (LxHxD) mm	52.5x81x68

\* NOTE: When the discharge device is efficient, the 11 - 14 contact is closed; when the discharge device is broken down or removed, the 11 - 14 contact opens and closes the 11 - 12 contact.

# Surge Protection Devices with direct current

Cabur, constantly involved in the development of new systems and new technologies to increase the reliability and safety of the systems, offers an innovative line of grey-coloured surge protection devices, which use a system of arc damping in direct

current that makes them very safe and in conformity with the specific requirements of the most modern photovoltaic systems.



Code	ISPD500V3G0A	ISPD600V3G0A	ISPD800V3G0A	ISPD1000V3G0A
ID number	BY7-40/3-500	BY7-40/3-600	BY7-40/3-800	BY7-40/3-1000
Use category	II	II	II	II
Earthing system	-	-	-	-
Technology	MOV (Metal Oxide Varistor)	MOV (Metal Oxide Varistor)	MOV (Metal Oxide Varistor)	MOV (Metal Oxide Varistor)
Maximum Continuous Voltage	Uc 500 VDC	Uc 600 VDC	Uc 800 VDC	Uc 1,000 VDC
Protection Level	Up 1,800 VDC	Up 2,000 VDC	Up 2,500 VDC	Up 3,000 VDC
Nominal Discharge Impulsive Current 8/20	under 20 kA	under 20 kA	under 20 kA	under 20 kA
Maximum Discharge Current 8/20	I <sub>max</sub> 40 kA	I <sub>max</sub> 40 kA	I <sub>max</sub> 40 kA	I <sub>max</sub> 40 kA
Connection Wire Sections	4 ... 25 mm <sup>2</sup>	4 ... 25 mm <sup>2</sup>	4 ... 25 mm <sup>2</sup>	4 ... 25 mm <sup>2</sup>
Reaction Time	t <sub>a</sub> < 25 nS	t <sub>a</sub> < 25 nS	t <sub>a</sub> < 25 nS	t <sub>a</sub> < 25 nS
Operating Temperature	-40°C < T < 80°C	-40°C < T < 80°C	-40°C < T < 80°C	-40°C < T < 80°C
Failure Indicator	Green OK/Red FAILURE	Green OK/Red FAILURE	Green OK/Red FAILURE	Green OK/Red FAILURE
Remote Failure Signal	Contact SPDT 1 A/230 VAC*	Contact SPDT 1 A/230 VAC*	Contact SPDT 1 A/230 VAC*	Contact SPDT 1 A/230 VAC*
Remote Signal Connections	Extractable terminal blocks - 1.5 mm <sup>2</sup> - 6 A - 120 V	Extractable terminal blocks - 1.5 mm <sup>2</sup> - 6 A - 120 V	Extractable terminal blocks - 1.5 mm <sup>2</sup> - 6 A - 120 V	Extractable terminal blocks - 1.5 mm <sup>2</sup> - 6 A - 120 V
Assembly	On omega TH35 rail	On omega TH35 rail	On omega TH35 rail	On omega TH35 rail
Case Material	Self-extinguishing UL94V0	Self-extinguishing UL94V0	Self-extinguishing UL94V0	Self-extinguishing UL94V0
Degree of protection	IP20	IP20	IP20	IP20
Colour	Gray	Gray	Gray	Gray
Pieces per Pack	1	1	1	1
Dimensions (LxHxD) mm	52.5x81x68	52.5x81x68	52.5x81x68	52.5x81x68

\* NOTE: When the discharge device is efficient, the 11 - 14 contact is closed; when the discharge device is broken down or removed, the 11 - 14 contact opens and closes the 11 - 12 contact.

# Modular Surge Protection Devices under alternating current

Cabur, constantly involved in the development of new systems and new technologies to increase the reliability and safety of the systems, offers an innovative line of grey-coloured surge protection devices, which use a system of arc damping in direct

current that makes them very safe and in conformity with the specific requirements of the most modern photovoltaic systems.



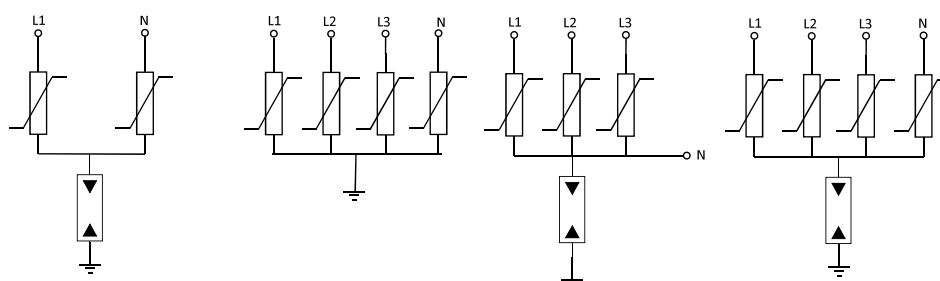
Code	ISPD275V1G0A	ISPD275V0G1A	ISPD440V1G0A	ISPD440V0G1A
ID number	BY7-40/1-275	BY7-NPE/40-275	BY7-40/1-440	BY7-NPE/40-440
Use category	II	II	II	II
Earthing system	TN-S; TN-C; TT; IT	TN-S; TN-C; TT; IT	TN-S; TN-C; TT; IT	TN-S; TN-C; TT; IT
Technology	MOV (Metal Oxide Varistor)	GDT (Gas Discharge Tube)	MOV (Metal Oxide Varistor)	GDT (Gas Discharge Tube)
Nominal Voltage	Un 230 AC	Un 230 AC	Un 400 AC	Un 400 AC
Maximum Continuous Voltage	Uc 275 AC	Uc 255 AC	Uc 440 AC	Uc 440 AC
Protection Level	Up ≤ 1,200 V	Up ≤ 1,800 V	Up ≤ 2,000 V	Up ≤ 1,800 V
Nominal Discharge Impulsive Current 8/20	under 20 kA	under 30 kA	under 20 kA	under 30 kA
Maximum Discharge Current 8/20	I <sub>max</sub> 40 kA	I <sub>max</sub> 40 kA	I <sub>max</sub> 40 kA	I <sub>max</sub> 40 kA
Connection Wire Sections	4 ... 25 mm <sup>2</sup>	4 ... 25 mm <sup>2</sup>	4 ... 25 mm <sup>2</sup>	4 ... 25 mm <sup>2</sup>
Reaction Time	t <sub>a</sub> < 25 nS	t <sub>a</sub> < 25 nS	t <sub>a</sub> < 25 nS	t <sub>a</sub> < 25 nS
Operating Temperature	-40°C < T < 80°C	-40°C < T < 80°C	-40°C < T < 80°C	-40°C < T < 80°C
Failure Indicator	Green OK/Red FAILURE	No	Green OK/Red FAILURE	No
Remote Failure Signal	Contact SPDT 1 A/230 VAC*	No	Contact SPDT 1 A/230 VAC*	No
Remote Signal Connections	Extractable terminal blocks - 1.5 mm <sup>2</sup> - 6 A - 120 V	No	Extractable terminal blocks - 1.5 mm <sup>2</sup> - 6 A - 120 V	No
Assembly	On omega TH35 rail	On omega TH35 rail	On omega TH35 rail	On omega TH35 rail
Case Material	Self-extinguishing UL94V0	Self-extinguishing UL94V0	Self-extinguishing UL94V0	Self-extinguishing UL94V0
Degree of protection	IP20	IP20	IP20	IP20
Colour	Grey	Grey/Blue	Grey	Grey/Blue
Pieces per Pack	1	1	1	1
Cross-connections	<b>2 poles</b>	9000392 (BP2)	9000392 (BP2)	9000392 (BP2)
	<b>3 poles</b>	9000393 (BP3)	9000393 (BP3)	9000393 (BP3)
	<b>4 poles</b>	9000394 (BP4)	9000394 (BP4)	9000394 (BP4)
Dimensions (LxHxD) mm	17.5x81x68	17.5x81x68	17.5x81x68	17.5x81x68

\* NOTE: When the discharge device is efficient, the 11 - 14 contact is closed; when the discharge device is broken down or removed, the 11 - 14 contact opens and closes the 11 - 12 contact.

# Surge Protection Devices under alternating current

Cabur, constantly involved in the development of new systems and new technologies to increase the reliability and safety of the systems, offers an innovative line of grey-coloured surge protection devices, which use a system of arc damping in direct

current that makes them very safe and in conformity with the specific requirements of the most modern photovoltaic systems.



Code	ISPD275V2G1B	ISPD440V4G0B	ISPD440V3G1B	ISPD440V4G1B
ID number	BY7-40/2+1-275	BY7-40/4-440	BY7-40/3+1-440	BY7-40/4+1-440
Use category	II	II	II	II
Earthing system	-	-	-	-
Technology	2 MOV + 1 GDT	4 MOV	3 MOV + 1 GDT	4 MOV + 1 GDT
Nominal Voltage	Un 230	Un 400	Un 400	Un 400
Maximum Continuous Voltage	Uc 275	Uc 440	Uc 440	Uc 440
Protection Level Cartridge	Up < 1,200	Up < 2,000	Up < 2,000	Up < 2,000
Nominal Discharge Impulsive Current 8/20	under 20 kA	under 20 kA	under 20 kA	under 20 kA
Maximum Discharge Current 8/20	I <sub>max</sub> 40 kA	I <sub>max</sub> 40 kA	I <sub>max</sub> 40 kA	I <sub>max</sub> 40 kA
Connection Wire Sections	4 ... 25 mm <sup>2</sup>	4 ... 25 mm <sup>2</sup>	4 ... 25 mm <sup>2</sup>	4 ... 25 mm <sup>2</sup>
Reaction Time	ta < 25 nS	ta < 25 nS	ta < 25 nS	ta < 25 nS
Operating Temperature	-40°C < T < 80°C	-40°C < T < 80°C	-40°C < T < 80°C	-40°C < T < 80°C
Failure Indicator	Green OK/Red FAILURE	Green OK/Red FAILURE	Green OK/Red FAILURE	Green OK/Red FAILURE
Remote Failure Signal	No	No	No	No
Remote Signal Connections	No	No	No	No
Assembly	On omega TH35 rail	On omega TH35 rail	On omega TH35 rail	On omega TH35 rail
Case Material	Self-extinguishing UL94V0	Self-extinguishing UL94V0	Self-extinguishing UL94V0	Self-extinguishing UL94V0
Degree of protection	IP20	IP20	IP20	IP20
Colour	Gray	Gray	Gray	Gray
Pieces per Pack	1	1	1	1
Dimensions (LxHxD) mm	52.5x81x68	52.5x81x68	52.5x81x68	52.5x81x68

\* NOTE: When the discharge device is efficient, the 11 - 14 contact is closed; when the discharge device is broken down or removed, the 11 - 14 contact opens and closes the 11 - 12 contact.

## Components for string boxes

### Accessories and spare parts

Cabur offers a range of accessories and spare parts for its own string boxes and components for the customer to construct his/her own panels.

The range, which includes a selection of articles which comply with the quality standards and the most common market needs, is composed of:

- Boxes for distribution panels and relative accessories for

assembly

- Blocking diodes
- Fuse holders and fuses
- Disconnectors
- Screw-clamp terminal blocks and distribution terminal boards (please refer to the specific chapter, pages 90 - 102)

## Boxes for control boxes

### Resistant to atmospheric agents

For the construction of customised panels, 4 box models in polycarbonate are available, with insulation class 2, IP65,

resistant to UV rays and to corrosion caused by environmental agents, suitable for use in photovoltaic systems.



Code	9000502	9000503	9000504	9000513
ID number	KV_PC_810	KV_8112_M	KV_8118_M	KV_8224_M
Height (mm)	200	295	403	295
Width (mm)	238	300	333	458
Depth (mm)	111	129	129	129
Quantity per pack	1	1	1	1

The images are purely indicative.

## Boxes for distribution panels

### Resistant to atmospheric agents

For the construction of customised panels, 4 box models in polycarbonate are available, with insulation class 2, IP65,

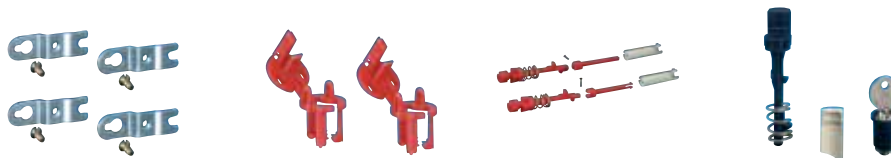
resistant to UV rays and to corrosion caused by environmental agents, suitable for use in photovoltaic systems.



Code	9000417	9000418	9000419	9000420
ID number	MI0100	MI0200	MI0300	MI0400
Height (mm)	150	300	450	600
Width (mm)	300	300	300	300
Depth (mm)	180	180	180	180
Quantity per pack	1	1	1	1

## Boxes for distribution panels

### Accessories



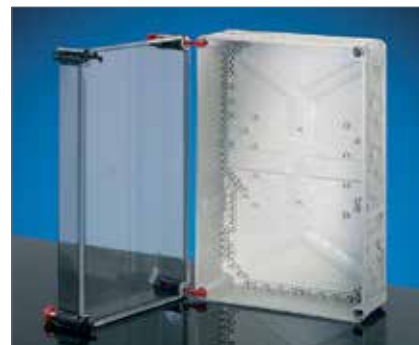
Code	9000430	9000432	9000431	9000434
ID number	MIAL40	MIZS20	MIPL2	MIZS11
Description	External bracket to fix box	Cover hinge	Closure caps which can be lead sealed	Key closure
Q.ty per Pack	4	2	2	2

# Boxes for distribution panels

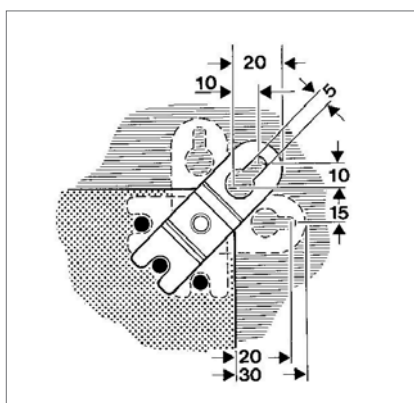
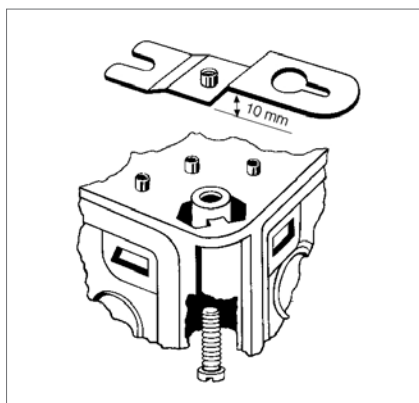
## Accessories

### Positioning for MIZS20 hinges

Box Code		9000417	9000418	9000419	9000420
Box in vertical position	Left	Yes	Yes	Yes	Yes
	Right	Yes	Yes	Yes	Yes
	Above	Yes	Yes	Yes	Yes
	Below	Yes	Yes	No	No
Box in horizontal position	Left	Yes	Yes	No	No
	Right	Yes	Yes	No	No
	Above	Yes	Yes	Yes	Yes
	Below	Yes	Yes	Yes	Yes



### Example of positioning of MIAL40 brackets



## Technical features

- Material: high quality polycarbonate
- Shock resistance IK 8 (equal to 5 Joules) according to DIN 50102
- Without halogen gas
- Without silicones
- Resistant to aggressive chemicals, acids, benzenes and mineral oils (10% acid, 10% alkaline)
- Insulation class 2
- Resistant to temperatures from - 40 to + 120°C
- Operating temperature from - 25 to +45°C
- Humidity 50% at 40°C, 100% at 25°C
- IP 66 protection degree
- Maximum current: 630 A. according to IEC 60 439.1
- Resistant to UV rays, tested and certified for installation in direct sunlight
- Resistant to corrosion cause by weather such as rain, ice, and snow
- Tested with incandescent wire at 960°C according to IEC 60 695 - 2 - 11
- Self-extinguishing
- With 3 smooth walls and one perforated
- With transparent cover
- Available accessory for lead sealed closure

# Switches and Disconnectors

## For photovoltaic applications

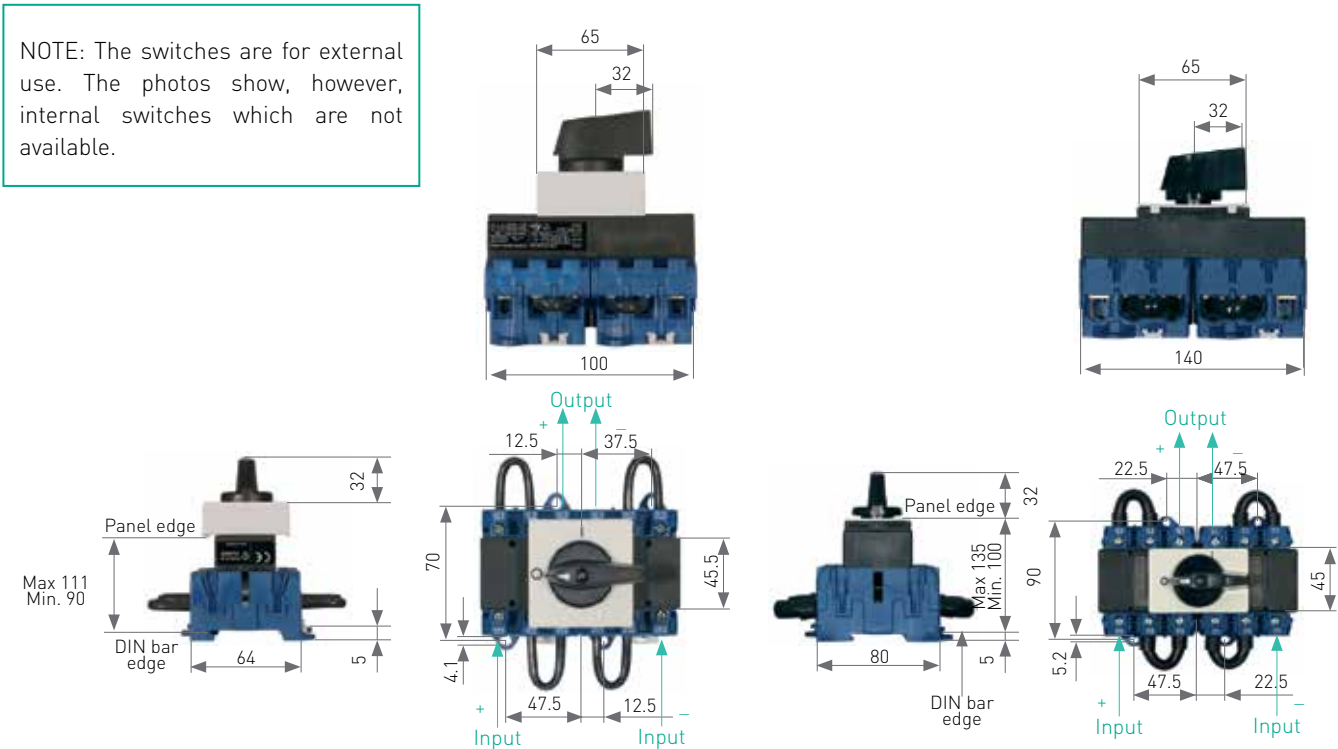
The offer is for 2 switches-disconnectors:

- conforming to standard EN 60947-3 with reference to VDE 0660 Part 107
- use category: DC-21A for photovoltaic applications
- operating temperature: 50°C (max. 55°C for short periods)

- finger-proof switch IP 20 according to VDE 0660-514
- external use

The size and structure of the switches are optimised for use with Cabur boxes.

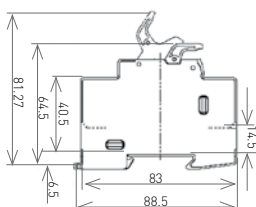
NOTE: The switches are for external use. The photos show, however, internal switches which are not available.



Code	9000373	9000374
ID number	KG41B	KG80
Connection Diagram		
Ribbon length	10	14
Current and Nominal Voltage	DC-21A: 40 A 690 VDC DC-22A: 32 A 650 VDC	DC-21A: 80 A 690 VDC DC-22A: 63 A 650 VDC
Max Disconnect Voltage	690 V DC	690 V DC
Insulation voltage	1,000 V	1,000 V
Max wire section: - Standard wire - Flexible wire	16 mm <sup>2</sup> 10 mm <sup>2</sup>	50 mm <sup>2</sup> 35 mm <sup>2</sup>
Stripping length	10 mm	14 mm
Tightening torque	1.80 Nm	3.00 Nm
Assembly	On IEC 60715/TH35 rails and on panels by means of anchorage screws	On IEC 60715/TH35 rails and on panels by means of anchorage screws
Quantity / Packaging	1	1

# Fuse holders and fuses

## For string protection



### Fuse holders for fuses of 10.3 x 38 mm

- For use with rigid wires from 1 to 16 mm<sup>2</sup>, (18-6 AWG) or with multistrand wires from 0.75 to 10 mm<sup>2</sup> (18-8AWG)
- Maximum tightening torque: 2.5 Nm (22lb-in)
- IR for fuses: 120KA @ 500V IEC – 80KA @ 690V IEC – 80KA @ 700V UL



<b>Code</b>	<b>9000375</b>
<b>ID number</b>	US101
<b>Nominal Voltage</b>	800 VAC 1,000 VDC
<b>Insulation voltage</b>	6 kV
<b>Nominal Current</b>	30 A
<b>Max Dissipated Power</b>	3 W
<b>Nominal Current of Fuses</b>	1 ... 30 A
<b>Assembly</b>	On omega TH35 rail
<b>Pieces per pack</b>	12

While stocks last. It will be replaced by Cod. 9000446

### Fuses of 10.3 x 38 mm

- Nominal voltage: 750 VAC – 1,000 VDC
- Interruption power 100kA
- Approved UL-FILE E60314
- Conforming with ROHS and REACH



<b>Code</b>	<b>9000401</b>	<b>9000402</b>	<b>9000403</b>	<b>9000404</b>	<b>9000405</b>	<b>9000406</b>	<b>9000407</b>
<b>ID number</b>	DCT1-2	DCT2-2	DCT3-2	DCT4-2	DCT5-2	DCT6-2	DCT7-2
<b>Nominal Current</b>	1 A	2 A	3 A	4 A	5 A	6 A	7 A
<b>Q.ty / Pack</b>	10	10	10	10	10	10	10

<b>Code</b>	<b>9000408</b>	<b>9000409</b>	<b>9000410</b>	<b>9000411</b>	<b>9000412</b>	<b>9000413</b>	<b>9000414</b>
<b>ID number</b>	DCT8-2	DCT10-2	DCT12-2	DCT15-2	DCT20-2	DCT25-2	DCT30-2
<b>Nominal Current</b>	8 A	10 A	12 A	15 A	20 A	25 A	30 A
<b>Q.ty / Pack</b>	10	10	10	10	10	10	10

# Diodes

## For strings of photovoltaic panels

Designed to facilitate photovoltaic system designers and installers in fitting the blocking diode on the solar panels. The DIN rail clamp makes installation fast and safe.

Operating voltage allows for use of systems according to IEC 60364-7-712 standard.



Code	ISDS3516	ISDS102	9000395	SF903GR
ID number	KXDS3516	KXDS102	T20HF220	SFR.4/D3A/GR
Description	Diode for PV strings	Diode for PV strings	Diode for PV strings	Sectionable diode holder
Insulation voltage towards the DIN rail	3.75 kVca/ 5 secs	3.75 kVca/ 5 secs	5 kVac/ 60 secs	3 kVac/ 60 secs
Max Inverse Voltage	1.6 kV	2 kV	2.2 kV	1.3 kV
Max. String Voltage	800 V	1,000 V	1.1 kV	650 V
Nominal Current	10 A @ 25°C	10 A @ 25°C	12 A @ 45°C	3 A @ 25°C
Max Operating Current Transitional	15 A	15 A	250 A x 10 ms	20 A
Max Operating Temperature	45° C	45° C	95° C	45° C
Dissipated power	8 W @ 10 A	16 W @ 10 A	10 W @ 7.5 A; 20 W to 17 A	3.3 W @ 3 A
Connections	Faston 6.3	Faston 6.3	Wire terminals Ø 5 mm	4 mm screw-on terminal
Assembly	On omega TH35 rail	On omega TH35 rail	Screwed onto metallic panel (recommended thickness 3 mm) or heat sink	On omega TH35 rail
Weight	235 g	235 g	54 g	35 g
Dimensions (LxHxD) mm	24x77x80	24x77x80	24x41x25	8x52x52
Quantity per pack	10	10	10	70



# Photovoltaic systems

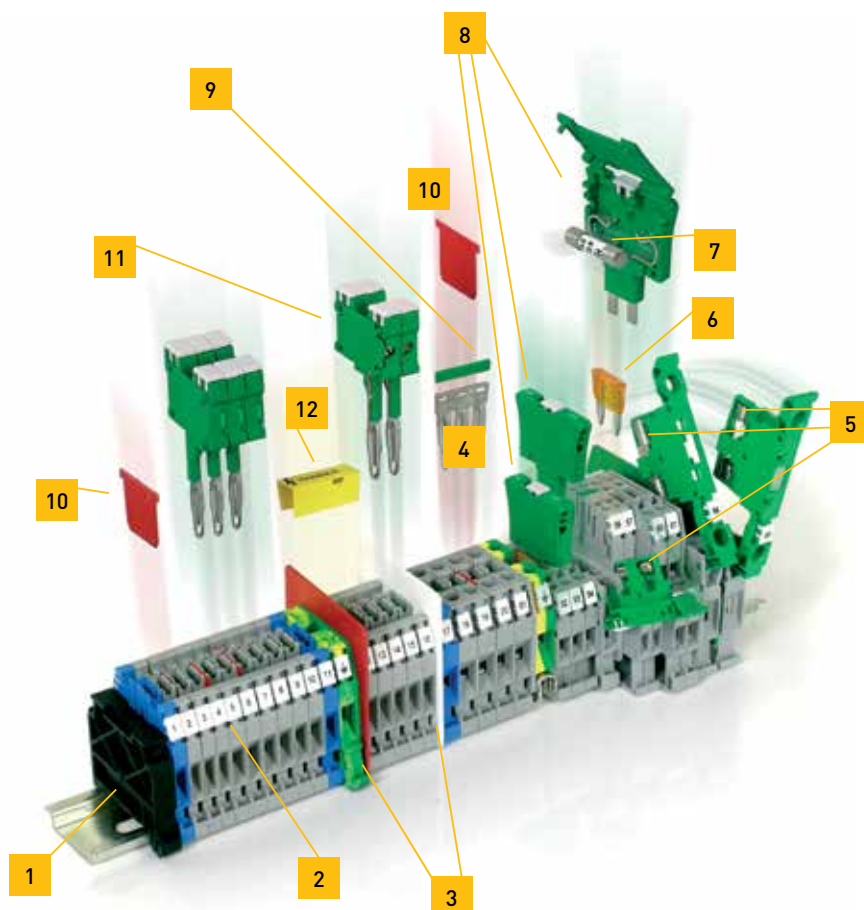
## Terminal blocks

Modular terminal blocks and distribution and control terminal boards suitable for use in photovoltaic systems.

FROM PAGE 91 TO PAGE 102

- 91 Screw-clamp terminal blocks
- 95 QBLOK rail assemblies with two poles
- 96 Accessories
- 97 Control rail assemblies. UTF meter control operating through CTs and VTs
- 98 Control rail assemblies. MCM series
- 101 Control rail assemblies. MCT/SA series

## Screw-clamp terminal blocks 1,000 VDC nominal voltage



### Railassembly Series CBC and relative Accessories

- 1 - End bracket
- 2 - ID Number
- 3 - Cross connection barrier
- 4 - PTC Easy Bridge cross-connection
- 5 - Conductor element
- 6 - Blade fuse\*
- 7 - 5x20 fuse\*
- 8 - CPF/5 tool holder cartridge (fuse / resistance / diode)\*
- 9 - Bridge identification strip
- 10 - Cross connection barrier
- 11 - Modular test plugs
- 12 - Warning plate

\*Accessories no suitable for PV applications. For suitable fuses, see Page 88

To construct the connections of photovoltaic wires with a section larger than 6 mm<sup>2</sup>, we recommend, inside of the junction boxes and/or electrical panels, our series of CBC terminal blocks (for wires with sections between 4 and 35 mm<sup>2</sup>), CBD (for wires with sections between 4 and 70 mm<sup>2</sup>), GPA (for wires with sections between 50 and 240 mm<sup>2</sup>) and GPM (for wires with sections between 95 and 240 mm<sup>2</sup>). These terminal block families are particularly suitable for

photovoltaic environments both for their well known technical-qualitative features which have made them famous in various other application fields, and above all because they can be used under direct current up to 1,000V.

To connect the strings, Line 3 and 4 photovoltaic connectors are recommended, while for connections with high current the terminal blocks found on the pages below are recommended.

# Screw-clamp terminal blocks

## 1,000 VDC nominal voltage



### CBC series



Code	CBC02GR	CBC04GR	CBC06GR	CBC10GR	CBC16GR	CBC35GR
ID number	CBC.2/GR	CBC.4/GR	CBC.6/GR	CBC.10/GR	CBC.16/GR	CBC.35/GR
For flexible/rigid conductors	from 0.2 to 4 mm <sup>2</sup>	from 0.2 to 6 mm <sup>2</sup>	from 0.2 to 10 mm <sup>2</sup>	from 1.5 to 16 mm <sup>2</sup>	from 1.5 to 25 mm <sup>2</sup>	from 2.5 to 50 mm <sup>2</sup>
Nominal current according to CEI EN 60947-7-1	24 A	32 A	41 A	57 A	101 A (25 mm <sup>2</sup> )	150 A (50 mm <sup>2</sup> )
Nominal voltage according to CEI 60947-7-1	1,000 V	1,000 V	1,000 V	1,000 V	1,000 V	1,000 V
Height/ Width/Thickness (mm)						
TH/35 7.5 mm	52/ 44/ 5	52/ 44/ 6	52/ 44/ 8	52/ 44/ 10	56/ 47/ 12	63/ 56/ 16
TH/35 15 mm	60/ 44/ 6	60/ 44/ 6	60/ 44/ 8	60/ 44/ 10	64/ 47/ 12	71/ 56/ 16
Quantity per pack	120	100	100	100	50	50
Earth terminal block	Code	TO910	TO430	TO120	TO510	TO220
	ID number	TEO.2	TEO.4	TEC.6/0	TEC.10/0	TEC.16/0
						TEC.35/0

### GPA Series Power Terminal Blocks



Code	GA400GR	GA100GR	GA200GR	GA300GR
ID number	GPA.70/GR	GPA.95/GR	GPA.150/GR	GPA.240/GR
For flexible/rigid conductors	from 10 to 95 mm <sup>2</sup>	from 10 to 95 mm <sup>2</sup> / from 10 to 120 mm <sup>2</sup>	from 50 to 150 mm <sup>2</sup> / from 50 to 185 mm <sup>2</sup>	from 95 to 240 mm <sup>2</sup> / from 50 to 300 mm <sup>2</sup>
Nominal current according to CEI EN 60947-7-1	192 A	232 A	309 A	415 A
Nominal voltage according to CEI 60947-7-1	1,000 V	1,000 V	1,000 V	1,000 V
Height/ Width/Thickness (mm)				
TH/35 7.5 mm	70/ 91/ 20.5	87/ 98/ 26	99/ 108/ 31	120/ 119/ 37
TH/35 15 mm	78/ 91/ 20.5	95/ 98/ 26	106/ 108/ 31	128/ 119/ 37
Quantity per pack	25	10	8	4
Earth terminal block	Code	TO810	-	-
	ID number	TEC. 70/0	-	-

# Screw-clamp terminal blocks



**CBD Series Terminal Blocks**



Code	CB240	CB340	CB440
ID number	CBD.4	CBD.6	CBD.10
For flexible/rigid conductors	from 0.5 to 6 mm <sup>2</sup>	from 0.5 to 10 mm <sup>2</sup>	from 0.5 to 16 mm <sup>2</sup>
Nominal current according to CEI EN 60947-7-1	32 A	41 A	57 A
Nominal voltage according to CEI 60947-7-1	1,000 V	1,000 V	1,000 V
Height/ Width/Thickness (mm)			
TH/35 7.5 mm	52/ 44/ 6.5	52/ 44/ 8	52/ 44/ 10
TH/35 15 mm	60/ 44/ 6.5	60/ 44/ 8	63/ 44/ 10
Quantity per pack	100	100	100

**CBD Series Terminal Blocks**



Code	CB510	CB610	CB710	CB810
ID number	CBD.16	CBD.35	CBD.50	CBD.70
For flexible/rigid conductors	from 0.5 to 25 mm <sup>2</sup>	from 0.5 to 35 mm <sup>2</sup>	from 1.5 to 50 mm <sup>2</sup>	from 1.5 to 95 mm <sup>2</sup>
Nominal current according to CEI EN 60947-7-1	76 A	125 A	150 A	192 A
Nominal voltage according to CEI 60947-7-1	1,000 V	1,000 V	1,000 V	1,000 V
Height/ Width/Thickness (mm)				
TH/35 7.5 mm	57/ 47/ 12	60/ 52/ 16	62/ 57/ 18	71/ 62/ 20.5
TH/35 15 mm	65/ 47/ 12	68/ 52/ 16	70/ 57/ 18	79/ 62/ 20.5
Quantity per pack	50	75	50	40

# Screw-clamp terminal blocks

## 1,000 VDC nominal voltage



GPM Series Power Terminal Block



Code	GP100	GP400	GP700	GP200
ID number	GPM.95/BB	GPM.150/BB	GPM.240/BB	GPM.95/BC
For flexible/rigid conductors	-	-	-	from 35 to 120 mm <sup>2</sup> / from 25 to 120 mm <sup>2</sup>
Nominal current according to CEI EN 60947-7-1	269 A	353 A	452 A	269 A
Nominal voltage according to CEI 60947-7-1	1,000 V	1,000 V	1,000 V	1,000 V
Height/ Width/Thickness (mm) TH/35 7.5 mm TH/35 15 mm	81/ 176/ 32 88/ 176/ 32	81/ 200/ 42 88/ 200/ 42	89/ 250/ 52 96/ 250/ 52	81/ 176/ 32 88/ 176/ 32
Quantity per pack	10	6	4	10
Version for anchoring to the panel				
Code	GP110	GP410	GP710	GP210
ID number	GPM.95/BB/FIX	GPM.150/BB/FIX	GPM.240/BB/FIX	GPM.95/BC/FIX



Code	GP500	GP800	GP300	GP600	GP900
ID number	GPM.150/BC	GPM.240/BC	GPM.95/CC	GPM.150/CC	GPM.240/CC
For flexible/rigid conductors	from 50 to 185 mm <sup>2</sup> from 35 to 185 mm <sup>2</sup>	from 95 to 300 mm <sup>2</sup>	from 35 to 120 mm <sup>2</sup> from 25 to 120 mm <sup>2</sup>	from 50 to 185 mm <sup>2</sup> from 35 to 185 mm <sup>2</sup>	from 95 to 300 mm <sup>2</sup>
Nominal current according to CEI EN 60947-7-1	353 A	452 A	269 A	353 A	452 A
Nominal voltage according to CEI 60947-7-1	1,000 V	1,000 V	1,000 V	1,000 V	1,000 V
Height/ Width/Thickness (mm) TH/35 7.5 mm TH/35 15 mm	81/ 200/ 42 88/ 200/ 42	89/ 250/ 52 96/ 250/ 52	81/ 176/ 32 88/ 176/ 32	81/ 200/ 42 88/ 200/ 42	89/ 250/ 52 96/ 250/ 52
Quantity per pack	6	4	10	6	4
Version for anchoring to the panel					
Code	GP510	GP810	GP310	GP610	GP910
ID number	GPM.150/BC/FIX	GPM.240/BC/FIX	GPM.95/CC/FIX	GPM.150/CC/FIX	GPM.240/CC/FIX

\*Version for anchoring to the panel code GP510 is supplied in packs of 4 pieces.

# Two pole QBL0K rail assembly

## Distribution terminal board

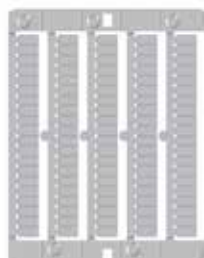
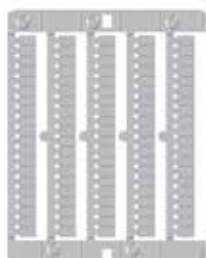


Code	QBL0K2100	QBL0K2125	QBL0K2126
ID number	QBL0K2P100A7	QBL0K2P125A11	QBL0K2P125A15
Description	Rail assembly with 2 holes ø 7.5 mm + 5 holes ø 5.4 mm	Rail assembly with 2 holes ø 9 mm + 2 holes ø 7.5 mm + 7 holes ø 5.4 mm	Rail assembly with 2 holes ø 9 mm + 2 holes ø 7.5 mm + 11 holes ø 5.4 mm
Height/ Width/ Thickness			
TH/35 7.5 mm	52/49/72	52/49/109	52/97/137
TH/35 15 mm	59/49/72	59/49/109	59/97/137
Use/Type	Bipolar distribution terminal board	Bipolar distribution terminal board	Bipolar distribution terminal board
Nominal section (mm <sup>2</sup> )	25	35	35
Connection capacity (hole ø 9 mm)			
Flexible conductors (mm <sup>2</sup> )	-	10 ÷ 35	10 ÷ 35
Rigid conductors (mm <sup>2</sup> )	-	10 ÷ 35	10 ÷ 35
Max flexible conductor with terminal (mm <sup>2</sup> ) - terminal ID number	-	25 - WP250/29	25 - WP250/29
Connection capacity (hole ø 7.5 mm)			
Flexible conductors (mm <sup>2</sup> )	10 ÷ 25	10 ÷ 25	10 ÷ 25
Rigid conductors (mm <sup>2</sup> )	10 ÷ 25	10 ÷ 25	10 ÷ 25
Max flexible conductor with terminal (mm <sup>2</sup> ) - terminal ID number	16 - WP160/22	16 - WP160/22	16 - WP160/22
Connection capacity (hole ø 5.4 mm)			
Flexible conductors (mm <sup>2</sup> )	2.5 ÷ 6	2.5 ÷ 6	2.5 ÷ 6
Rigid conductors (mm <sup>2</sup> )	2.5 ÷ 6	2.5 ÷ 6	2.5 ÷ 6
Max flexible conductor with terminal (mm <sup>2</sup> ) - terminal ID number	4 - WP40/16	4 - WP40/16	4 - WP40/16
Rated voltage/Rated current/Gauge	1,000V/100A/- acc. to EN 60947-1	1,000V/125A/- acc. to EN 60947-1	1,000V/125A/- acc. to EN 60947-1
Short term current allowed (I <sub>cw</sub> )	3 kA (effective for 1s) according to EN 60947-7-1	4.2 kA (effective for 1s) according to EN 60947-7-1	4.2 kA (effective for 1s) according to EN 60947-7-1
Impulse withstand voltage / Degree of pollution	8 kV/3	8 kV/3	8 kV/3
Stripping length (mm)	13	13	13
Test/Recommended tightening torque	1.8/2.2 Nm	1.8/2.2 Nm	1.8/2.2 Nm
Certifications	IMQ	IMQ	IMQ
Quantity per pack	4	2	2

IMQ certification pending

## Two pole QBL0K rail assemblies

### Accessories



Code	NU0851	NU1051	BT005
ID number	CNU/8/51/...	CNU/10/51/...	BTU for PR/DIN and PR/3
Description	ID label (numbered or neutral)	ID label (numbered or neutral)	End bracket
Quantity per pack	1,500 tags	1,500 tags	25



Code	BT003-BT007	PR003	PR005
ID number	BT/3-BT0 only for PR/3	PR/3/AC in steel	PR/3/AS same with slots
Description	End bracket	Mounting rail conforms to IEC 60715	Mounting rail conforms to IEC 60715
Quantity per pack	25	40	40

### Technical characteristics of QBL0K rail assemblies

- Mounted onto PR/3 rails conforming to IEC 60715 standards TH/35 type or directly onto the panel
- Insulating supports made of 6.6 UL94V-0 polyamide and insulating cover of transparent polycarbonate
- Insulating screen for each conducting busbar
- Power supply holes intentionally offset for better conductor wiring
- Possible to label each bar with a CNU/8 or CNU/10 tag
- Conform to EN 60947-7-1
- Nominal insulation voltage: 1,000 V - according to EN 60947-1 (AC or DC effective value)
- Appropriate for photovoltaic systems

## Control rail assemblies

### UTF meter control operating through CTs and VTs



Cabur control rail assemblies are designed to allow electricity providers and Users the possibility of easily checking on the measuring instruments, without interrupting current flow during control or during possible replacement of the instruments.

ENEL has adopted a special colour system to identify phases according to the geographic areas where the rail assemblies will be installed.

Every rail assembly is composed of an insulating base which holds the terminal blocks, in copper-zinc alloy, of the volt and amp meter circuits, and the devices for disconnection and short circuit operations. The base of the single-phase rail assembly is made of heat-hardened resin (black phenol resin). For the bi- and three-phase rail assemblies, the insulating base is made of Kelon (Ceramic + Nylon). This is a polymer with a nylon 6 base,

self-extinguishing UL94V-0, to which is added special ceramic spheres, after which it is thermally stabilized. The inclusion of the microspheres and the thermal procedure render the final product extremely resilient -- rigid but still able to resist shocks and wear.

Every rail assembly has a transparent cover (in cellulose acetate), provided with special screws that cannot be lost, by which the whole can be sealed.

Every screw has a special hole for the passage of the lead-sealing wire for UTF.

The phases are indicated in different colours, to be specified when ordering. The rail assemblies should be positioned upstream of the two-direction meter or, as in the CEI 82-25 electrical diagrams, between meter and delivery point.

## Technical features

- Rated cross-section: 6 mm<sup>2</sup>
- Connection capacity:
  - flexible conductors: 0.5 ÷ 6 mm<sup>2</sup>
  - rigid conductors: 0.5 ÷ 6 mm<sup>2</sup>
- Hole for inserting conductors: ø 4.1 (mm)
- Tightening torque: 1.2 (Nm)
- Rated current (according to IEC 60947-7-1 regulations): 57 A
- Rated voltage (according to IEC 60947-7-1 regulations): 500 V
- Voltage stability at impulse/degree of pollution 6 KV/3

# Control rail assemblies

## MCM Series

With the MCM series rail assemblies, the following can be done:

- both up and down stream disconnection of measurement tools
- insertion of a sample device, either before or after the measurement device
- derivation, through the use of shared plugs, of the four connection terminal blocks
- passage of voltage from the entry of the amp meter circuit to the lever, through a bridge that should be installed beforehand.

During normal operations, the volt meter power supplies are inserted onto the R-S-T terminal blocks, while the amp meter ones are inserted onto the terminal blocks labelled R1-R2, S1-S2, and T1-T2. The instruments are then connected to terminal blocks 1 and 2. The vertical cursor connections are closed, while the horizontal cursor ones are open.

In the case that control devices are inserted, the process is as

follows:

- using normal pins, the volt meter power supplies of the sample device are derived to the voltage plugs of the disconnecting levers or the fuse holder connection blocks;
- the amp meter power supplies of the control device are inserted to plugs 1 and R1 or to 2 and R2 and, similarly, to the other phases;
- then, the corresponding vertical cursor is disconnected.

In the case that measurement tools are replaced, it is necessary to first close the horizontal cursors, disconnect the vertical cursors, and open the levers. Entry and exit of the power supplies takes place at the rear part of the rail assembly (rear panel entry), with conductors that are fed through holes made in the insulating base of the rail assemblies themselves.

All the control rail assemblies Series MCM are supplied in packs of 1 piece.

### For meters with single phase insertion

#### MCM.1

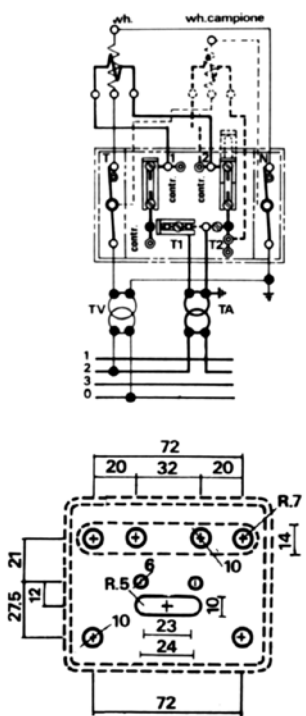


Maximum volume  
(with cover inserted):  
95 x 85 x 48 mm

First drawing:  
APPLICATION  
DIAGRAM  
Second drawing:  
FIXING TEMPLATE

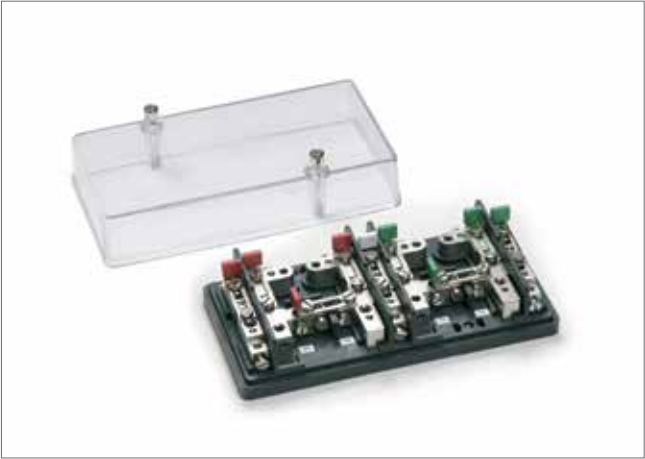
ENEL has adopted a special colour system to identify phases according to the compartments where the rail assemblies will be installed. Starting from the left, the phases are identified as follows:

Code	MC201B	MC201G	MC201R
ID number	MCM.1/B	MCM.1/G	MCM.1/R
Colour	White	Yellow	Red
Region	Campania and Lombardy	Veneto and Trentino Alto Adige	Rest of Italy



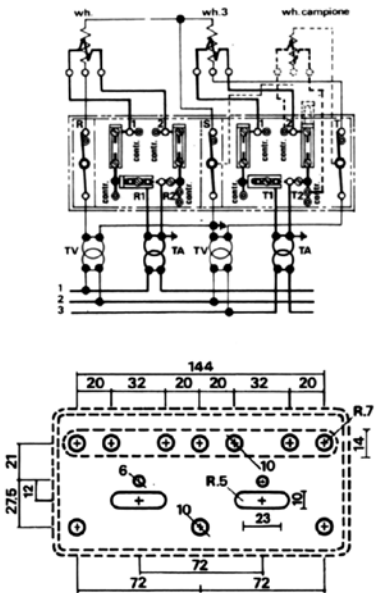
For meters with ARON insertion

MCM.2



Maximum volume  
(with cover inserted):  
170 x 85 x 48 mm

First drawing:  
APPLICATION  
DIAGRAM  
Second drawing:  
FIXING TEMPLATE

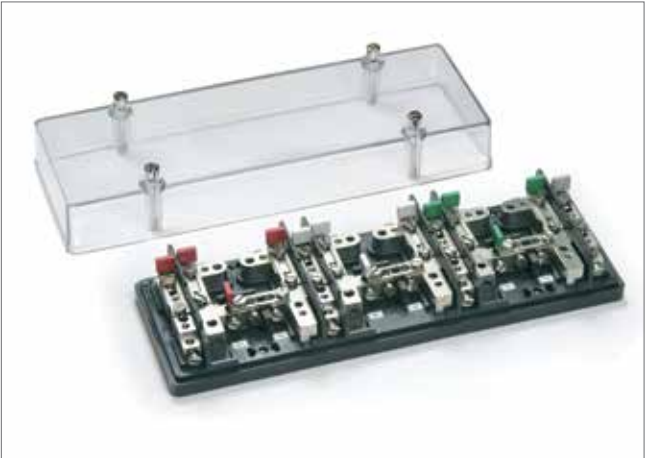


ENEL has adopted a special colour system to identify phases according to the compartments where the rail assemblies will be installed. Starting from the left, the phases are identified as follows:

Code	MC202B	MC202G	MC202R
ID number	MCM.2/B	MCM.2/G	MCM.2/R
Colour	White	Yellow	Red
Region	Campania and Lombardy	Veneto and Trentino Alto Adige	Rest of Italy

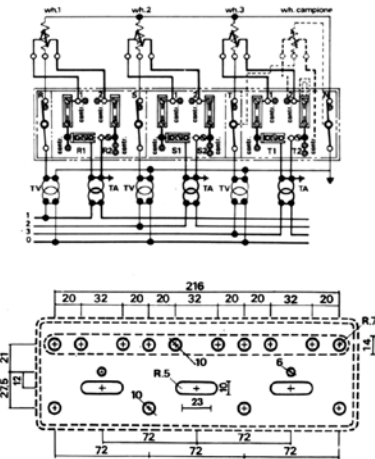
For meters with three-phase and neutral insertion

MCM.3



Maximum volume  
(with cover inserted):  
95 x 85 x 48 mm

First drawing:  
APPLICATION  
DIAGRAM  
Second drawing:  
FIXING TEMPLATE

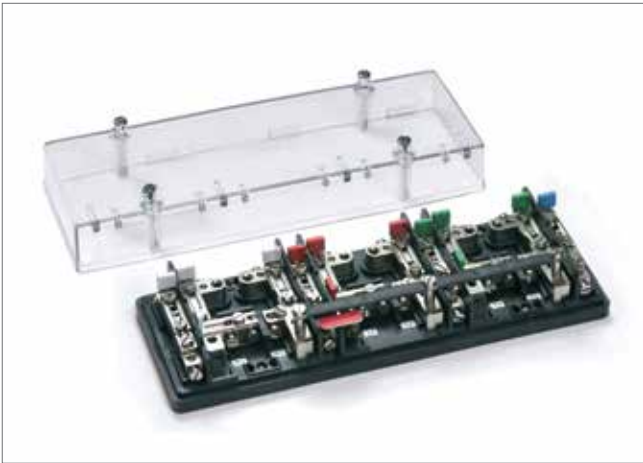


ENEL has adopted a special colour system to identify phases according to the compartments where the rail assemblies will be installed. Starting from the left, the phases are identified as follows:

Code	MC203B	MC203G	MC203R
ID number	MCM.3/B	MCM.3/G	MCM.3/R
Colour	White	Yellow	Red
Region	Campania and Lombardy	Veneto and Trentino Alto Adige	Rest of Italy

For meters with three-phase and neutral insertion

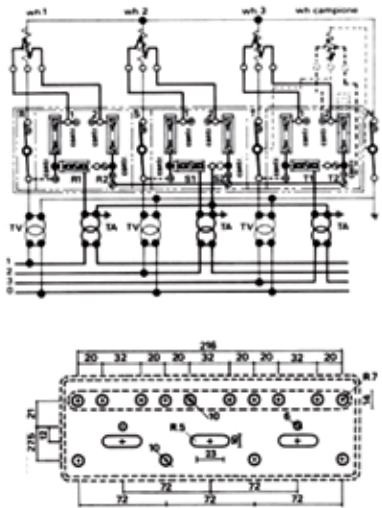
MCM.3/VE



Maximum volume  
(with cover inserted):  
245 x 85 x 48 mm

First drawing:  
APPLICATION  
DIAGRAM

Second drawing:  
FIXING TEMPLATE



ENEL has adopted a special colour system to identify phases according to the compartments where the rail assemblies will be installed. Starting from the left, the phases are identified as follows:

Code	MC233B	MC233G	MC233R
ID number	MCM.3/VE/B	MCM.3/VE/G	MCM.3/VE/R
Colour	White	Yellow	Red
Region	Campania and Lombardy	Veneto and Trentino Alto Adige	Rest of Italy

# Control rail assemblies

## MCT/SA Series

The series MCT/SA differs from the MCM series in the following ways:

- switching of voltages is done through the use of cursors, rather than levers
- both entry and exit of power supplies takes place at the front of the rail assembly, with conductors that pass through open slots created on the upper and lower walls of the cover
- there is a door cover with safety blocks which prevent it from closing when the cursors are not in the proper position. Methods of use for MCT/SA rail assemblies are the same as those for the MCM series.

All the control rail assemblies Series MCT/SA are supplied in packs of 1 piece.

### For meters with single phase insertion

### MCT.1/SA

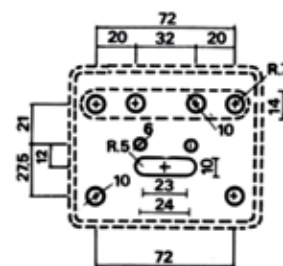
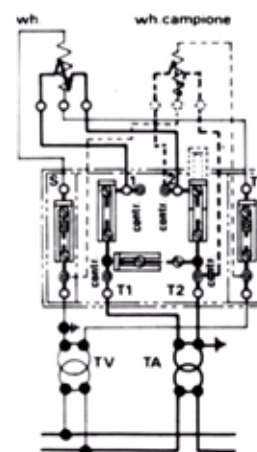


Maximum volume  
(with cover inserted):

95 x 85 x 48 mm

First drawing:  
APPLICATION  
DIAGRAM

Second drawing:  
FIXING TEMPLATE

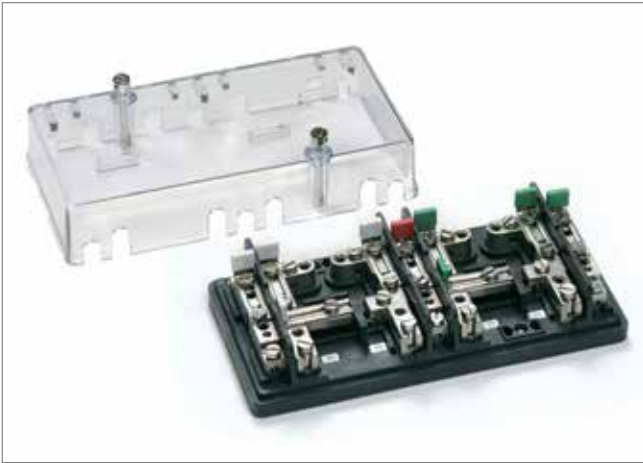


ENEL has adopted a special colour system to identify phases according to the compartments where the rail assemblies will be installed. Starting from the left, the phases are identified as follows:

Code	MC401B	MC401G	MC401R
ID number	MCT.1/SA/B	MCT.1/SA/G	MCT.1/SA/R
Colour	White	Yellow	Red
Region	Campania and Lombardy	Veneto and Trentino Alto Adige	Rest of Italy

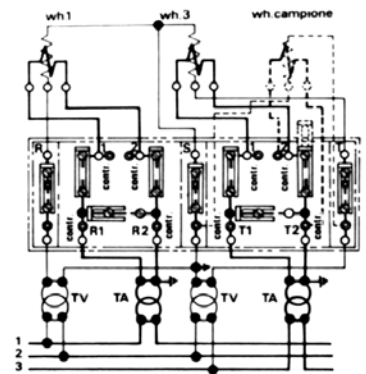
For meters with ARON insertion

MCT.2/SA



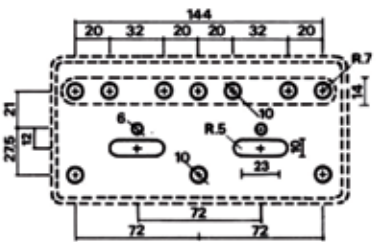
Maximum volume  
(with cover inserted):  
170 x 85 x 48 mm

First drawing:  
APPLICATION  
DIAGRAM  
Second drawing:  
FIXING TEMPLATE



ENEL has adopted a special colour system to identify phases according to the compartments where the rail assemblies will be installed. Starting from the left, the phases are identified as follows:

Code	MC402B	MC402G	MC402R
ID number	MCT.2/SA/B	MCT.2/SA/G	MCT.2/SA/R
Colour	White	Yellow	Red
Region	Campania and Lombardy	Veneto and Trentino Alto Adige	Rest of Italy



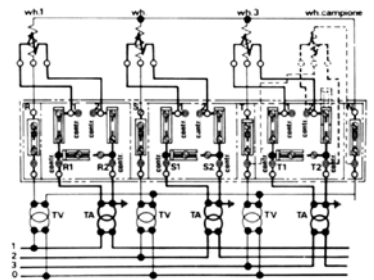
For meters with three-phase and neutral insertion

MCT.3/SA



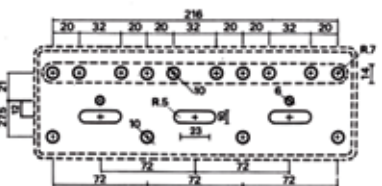
Maximum volume  
(with cover inserted):  
245 x 85 x 48 mm

First drawing:  
APPLICATION  
DIAGRAM  
Second drawing:  
FIXING TEMPLATE



ENEL has adopted a special colour system to identify phases according to the compartments where the rail assemblies will be installed. Starting from the left, the phases are identified as follows:

Code	MC403B	MC403G	MC403R
ID number	MCT.3/SA/B	MCT.3/SA/G	MCT.3/SA/R
Colour	White	Yellow	Red
Region	Campania and Lombardy	Veneto and Trentino Alto Adige	Rest of Italy



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FOR ELECTRICAL PANELS



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FOR THE CONNECTION  
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