

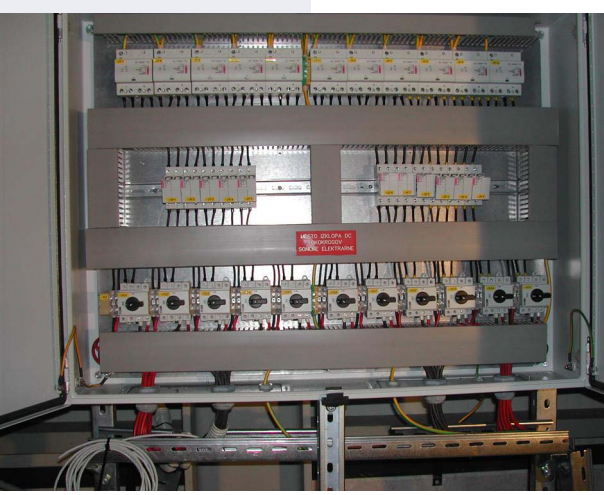
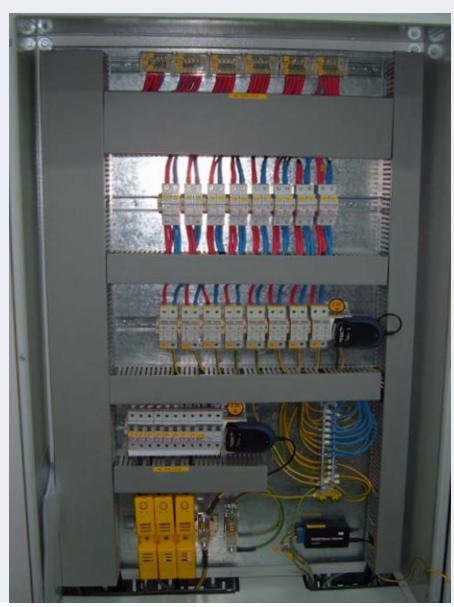
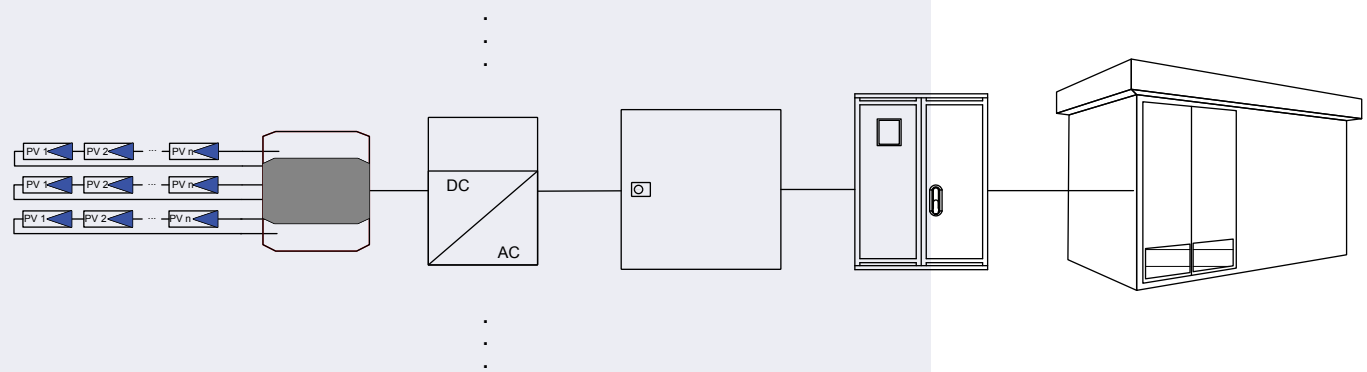
Protection of Photovoltaic Systems

ETI provides high-quality solutions for the complete overcurrent and overvoltage protection of applications in the field of photovoltaic and other renewable energy sources. We provide PV design, engineering and consulting services.

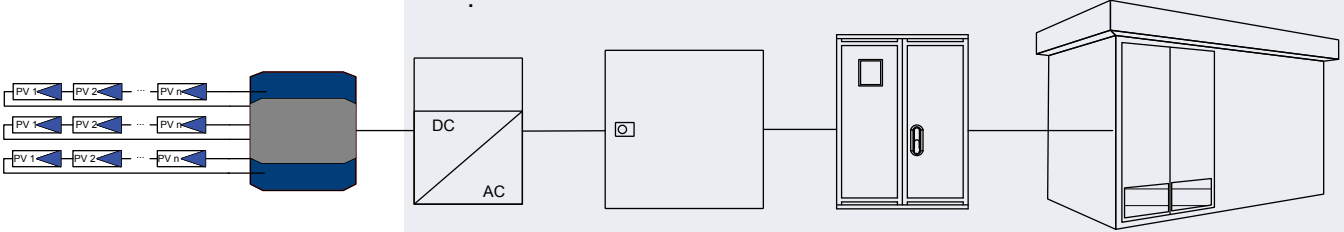
Our products are designed for complete protection of:

- DC circuits (overvoltage and reverse current protection)
- circuits inside DC/AC inverters (semiconductor protection)
- AC circuits between the inverter and the power grid (overvoltage, overcurrent and anti-islanding protection) and all protection for Meter distribution cabinet.

The products are internationally certified and carry several quality marks.



DC - distribution and protection



Protection on the DC side of a PV system

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

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

Features of ETI junction boxes

- Easy to install and operate,
- Short mounting times,
- Ample wiring space

Inside a PV array junction box

PV array

gPV cylindrical fuses for overcurrent protection of individual strings and protection against DC reverse currents

PV switch disconnector

gPV knife-blade fuses for overcurrent protection of wiring and protection against DC and AC reverse currents

Overcurrent protection:

- ETITEC B-PV is used in PV systems on buildings with external lightning protection
- ETITEC C-PV is used in PV systems on buildings without external lightning protection

Overview of Array Protection

Depending on the desired capacity of the Photovoltaic (PV) system, there may be several PV sub-arrays (each subarray consists of multiple strings) connected in parallel to achieve higher currents and subsequently more power. A fuse link on each sub-array will protect the conductors from fault current and help minimise any safety hazards. It will also isolate the faulted sub-array so that the rest of the PV system can continue to generate electricity.

Overview of String Protection

Depending on the desired capacity of the Photovoltaic (PV) system, there may be several PV strings connected in parallel to achieve higher currents and subsequently more power.

PV systems that have three or more strings connected in parallel need to have each string protected. Systems that have less than three strings will not generate enough fault current to damage the conductors, equipment or modules. Therefore they do not present a safety hazard, provided the conductor is sized correctly, based on local codes and installations requirements.

Where three or more strings are connected in parallel, a fuse link on each string will protect the conductors and modules from overcurrent faults and help minimise any safety hazards. It will also isolate the faulted string so that the rest of the PV system can continue to generate electricity. It should be remembered that PV module output changes with the module temperature as well as the amount of sun it is exposed to. The exposure is dependant on irradiance level, incline as well as shading effect from trees/buildings or clouds. In operation, fuse links, as thermal devices, are influenced by ambient temperature.

String protection against reverse currents

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

Fuses

ETI gPV fuses protect the installation against the inverse over-currents which could occur in photovoltaic installations.

General characteristics	UL file: E347771
Rated voltage	1000V d.c. L/R=2ms
Breaking capacity	10kA d.c. / 30kA d.c.
Standards	UL 2579, UL 248-1
Application	For protection of PV modules.

Lightning and Surge Arresters

ETITEC B-PV series of overvoltage surge protective devices has been developed to protect against direct and indirect lightning discharges and is intended to protect photovoltaic systems. The circuit topology consist of two varistors stages each protected by a thermal disconnection device. ETITEC B-PV is used for photovoltaic systems on buildings with External Lightning Protection

ETITEC C-PV series of overvoltage surge protective devices has been developed to protect against indirect discharges and is intended to protect photovoltaic systems. The circuit topology consist of two (three) varistors stages each protected by a thermal disconnection device. ETITEC C-PV is used for photovoltaic system on buildings without External Lightning Protection or when the inverter is installed at a distance of more than 10 m cable length to the building's main power distribution.

General characteristics		
	ETITEC B-PV	ETITEC C-PV
Category IEC/EN/VDE	Class I, II/Type 1,2/B+C High surge discharge ratings: $I_{imp} = 12,5kA$ /per pole, $I_{max} = 40kA$ /per pole	Class II/Type 2/C High surge discharge ratings: $I_{in} = 20kA$ /per pole, $I_{max} = 40kA$ /per pole
Location of use:	Photovoltaic systems- PV module side Internal protection and safety: Separate thermal disconnecter for each MOV block	Branch sub-distribution boards Internal protection and safety: Thermal disconnecter for each MOV block
Protective element : High Energy MOVs	Status indication: Mechanical flag + remote signalization contacts (RC)	

PV switch disconnecter

The construction of the switch ensures reliable switching up to 58A with 1000V in the category DC 21B.

The construction of the contacts and the material selection guarantee that no oxidation (small switching frequency develops, and is thus prevented inadmissible heating-up.

The switch disconnecter has 2, 4 or 4+2 contacts, by serial / parallel wiring of the contacts the contact rating will be increased.

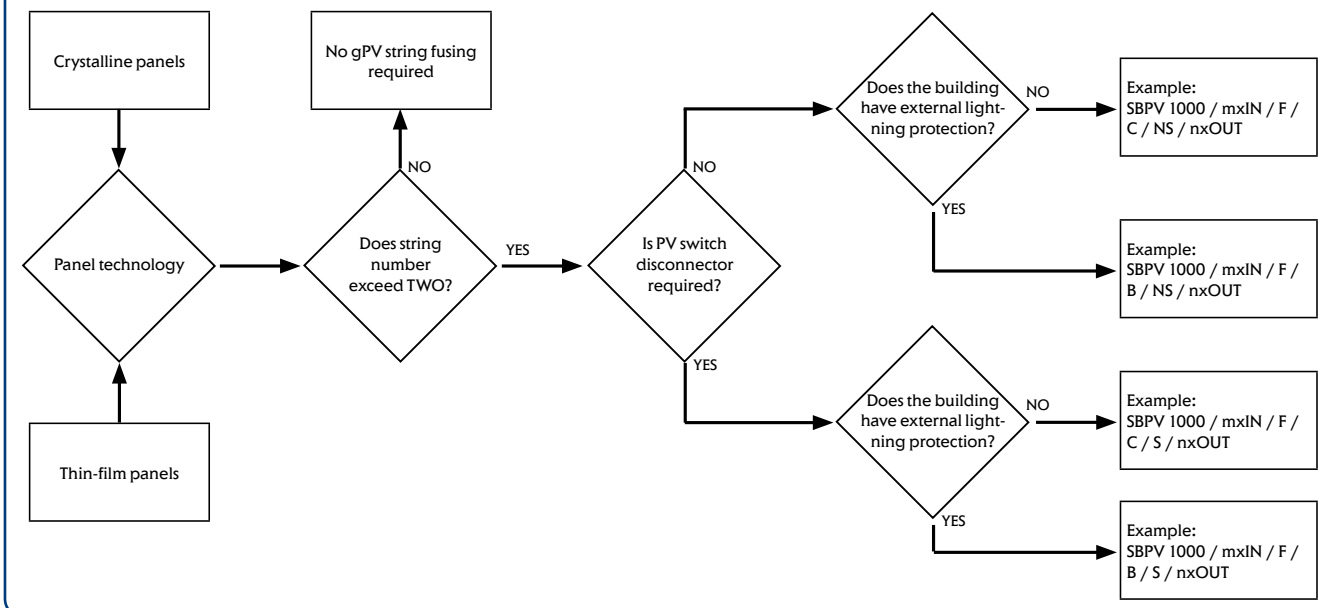
The switching speed at the manually operated handle does not have an effect on the switching attitude of the contacts.

Enclosures

- Fibreglass reinforced polyester (GRP/SMC) rear back panel - Light grey colour RAL 7035
- Polycarbonate cover, 2 versions : transparent or opaque, UV stabilized
- High Insulation rating IP66 and impact resistance IK10
- Big range of accessories : viewing windows, mounting plates, cable entry flanges, hinges, screws, wall mounting brackets, depth extensions, ventilation devices, etc
- Most complete range of sizes in the market : 24 different sizes, each one of them available on 2 different versions, transparent or opaque cover
- Modularity: Used as an individual enclosure or connected together to build up complete Low-Voltage switch-gear and control gear panels

General characteristics		
Description	Rating	Standard
Fibreglass reinforced polyester Enclosure (GRP)	RAL-7035 colour	IEC 62208
Polycarbonate Cover	UV Stabilized	IEC 62208
Double Insulation	Halogen Free	IEC 60439-1
Mechanical (Impact) Resistance	IK10	IEC-62262
Protection against dust-water	IP-66	IEC-60529
Thermal Class	A	UNE-21305
Self extinguishing material	960°C	IEC 60695-2
Temperature Range	-30°C +60°C	IEC 60670
Current Rating	1,000A	IEC 60439-5
Dielectric Strength	5,000V	IEC 60439-5
Insulation Rating	5MΩ	IEC 60439-5

How to choose correct protection for PV junction boxes

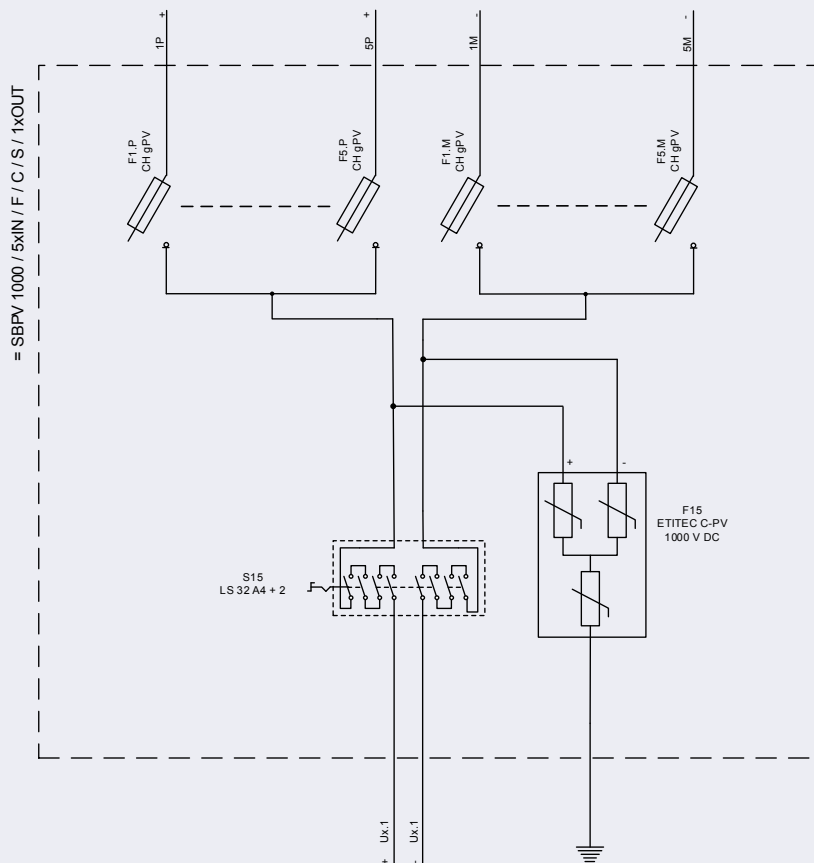
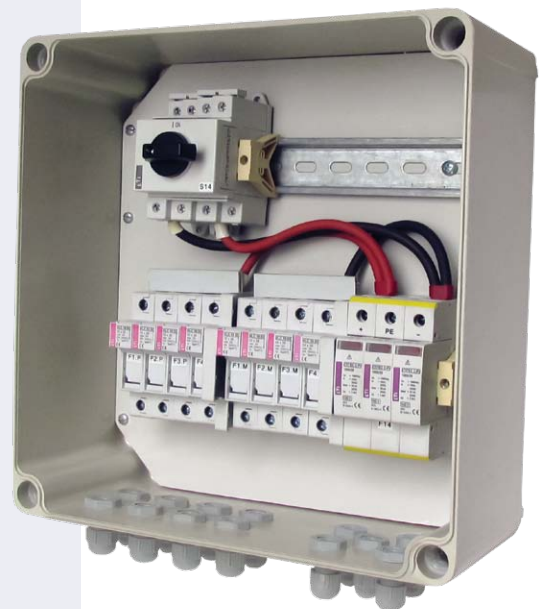
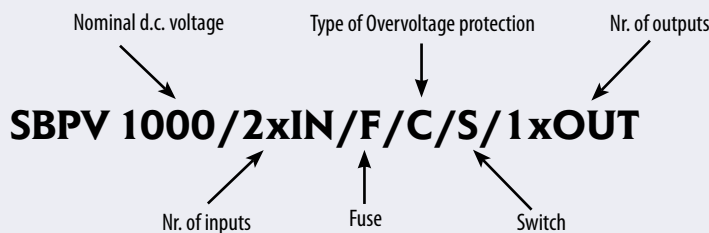


Standard junction box 1 x OUTPUT

1 x OUTPUT							
Max. U	Overvoltage protection	Inputs	Switch	Designation	Code No.	Max. I [A]	Dimensions WxHxD [mm]
1000 V d.c.	B	2	✗	SBPV 1000 / 2xIN / F / B / NS / 1xOUT	001110000	25	270x180x170
			✓	SBPV 1000 / 2xIN / F / B / S / 1xOUT	001110001	25	270x180x170
		3	✗	SBPV 1000 / 3xIN / F / B / NS / 1xOUT	001110004	25	270x180x170
			✓	SBPV 1000 / 3xIN / F / B / S / 1xOUT	001110005	25	270x180x170
		4	✗	SBPV 1000 / 4xIN / F / B / NS / 1xOUT	001110008	32	270x180x170
			✓	SBPV 1000 / 4xIN / F / B / S / 1xOUT	001110009	32	360x360x170
	C	5	✗	SBPV 1000 / 5xIN / F / B / NS / 1xOUT	001110012	58	360x360x170
			✓	SBPV 1000 / 5xIN / F / B / S / 1xOUT	001110013	58	360x360x170
		2	✗	SBPV 1000 / 2xIN / F / C / NS / 1xOUT	001110002	25	270x180x170
			✓	SBPV 1000 / 2xIN / F / C / S / 1xOUT	001110003	25	270x180x170
		3	✗	SBPV 1000 / 3xIN / F / C / NS / 1xOUT	001110006	25	270x180x170
			✓	SBPV 1000 / 3xIN / F / C / S / 1xOUT	001110007	25	270x180x170
		4	✗	SBPV 1000 / 4xIN / F / C / NS / 1xOUT	001110010	32	270x180x170
			✓	SBPV 1000 / 4xIN / F / C / S / 1xOUT	001110011	32	360x360x170
		5	✗	SBPV 1000 / 5xIN / F / C / NS / 1xOUT	001110014	58	360x360x170
	✓	SBPV 1000 / 5xIN / F / C / S / 1xOUT	001110015	58	360x360x170		

- 2 - 5 x PV string inputs
- 1 x output
- 1 x DC type B or C surge arrester
- Suitable for outdoor installation, UV resistant
- Current per PV string: DC 9,5 A max.
- Maximum voltage DC 1000 V
- Equipped with cable glands
- Option for connection with plug-in connectors compatible to MC4,
- Rated connecting capacity PE: 1,5 - 16 mm²

Type designation:



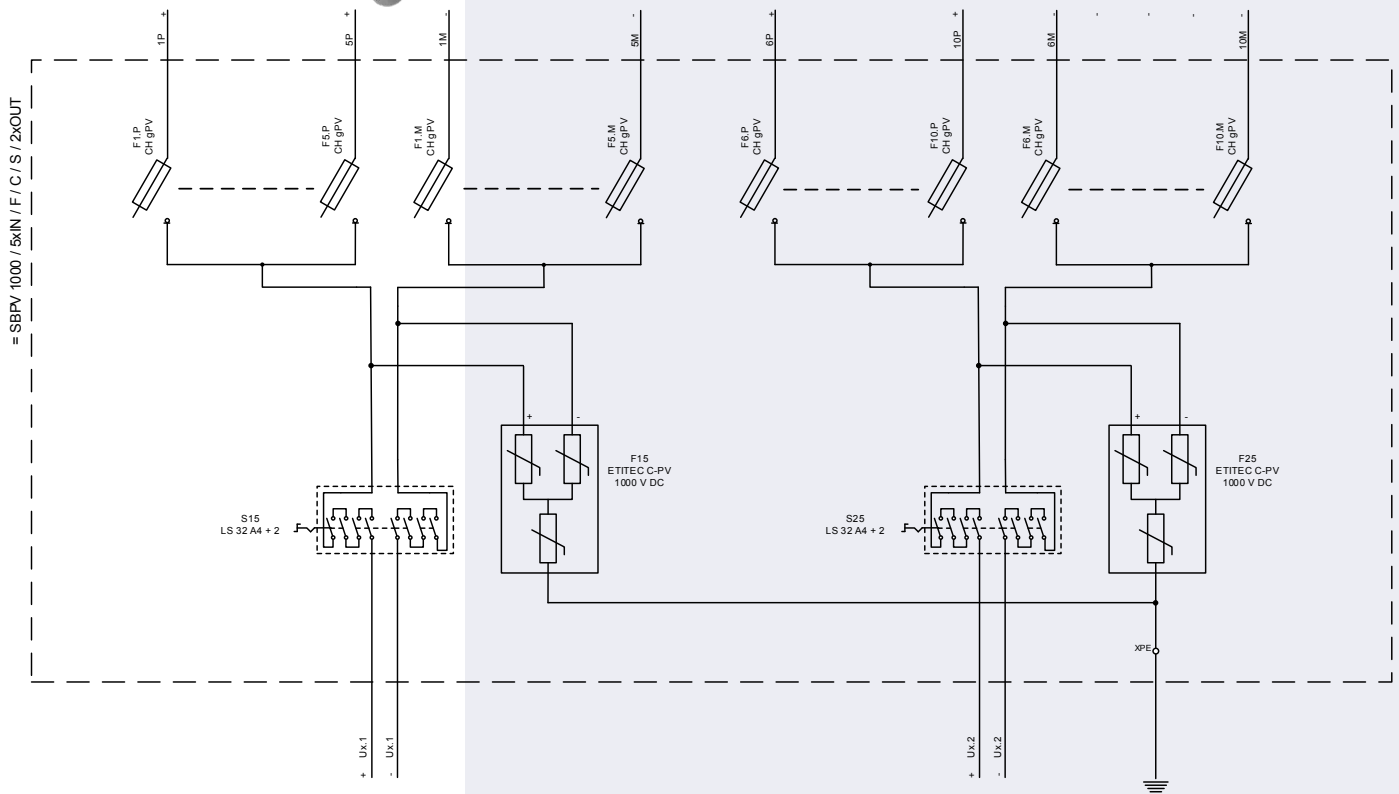
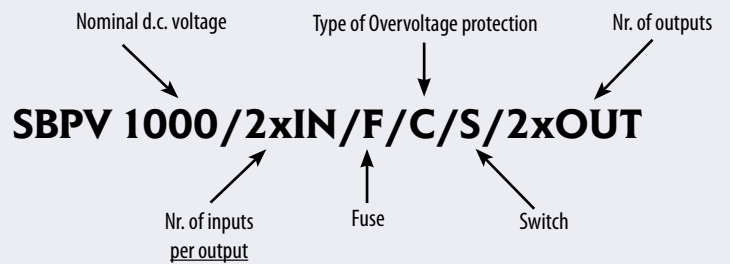
Standard junction box 2 x OUTPUTS

- 1-5 x PV string inputs
- 2 x outputs
- 2 x DC type B or C surge arrester
- Suitable for outdoor installation, UV resistant
- Current per PV string: DC 9,5 A max.
- Maximum voltage DC 1000 V
- Equipped with cable glands
- Option for connection with plug-in connectors compatible to MC4,
- Rated connecting capacity PE: 1,5 - 16 mm²



2 x OUTPUTS							
Max. U	Overvoltage protection	Inputs	Switch	Designation	Code No.	Max. I [A]	Dimensions WxHxD [mm]
1000 V d.c.	B	2	✗	SBPV 1000 / 2xIN / F / B / NS / 2xOUT	001110016	25	360x360x170
			✓	SBPV 1000 / 2xIN / F / B / S / 2xOUT	001110017	25	360x360x170
		3	✗	SBPV 1000 / 3xIN / F / B / NS / 2xOUT	001110020	25	360x360x170
			✓	SBPV 1000 / 3xIN / F / B / S / 2xOUT	001110021	25	540x360x170
		4	✗	SBPV 1000 / 4xIN / F / B / NS / 2xOUT	001110024	32	540x360x170
			✓	SBPV 1000 / 4xIN / F / B / S / 2xOUT	001110025	32	540x360x170
	C	5	✗	SBPV 1000 / 5xIN / F / B / NS / 2xOUT	001110028	58	540x360x170
			✓	SBPV 1000 / 5xIN / F / B / S / 2xOUT	001110029	58	540x360x170
		2	✗	SBPV 1000 / 2xIN / F / C / NS / 2xOUT	001110018	25	360x360x170
			✓	SBPV 1000 / 2xIN / F / C / S / 2xOUT	001110019	25	360x360x170
		3	✗	SBPV 1000 / 3xIN / F / C / NS / 2xOUT	001110022	25	360x360x170
			✓	SBPV 1000 / 3xIN / F / C / S / 2xOUT	001110023	25	360x360x170
		4	✗	SBPV 1000 / 4xIN / F / C / NS / 2xOUT	001110026	32	540x360x170
			✓	SBPV 1000 / 4xIN / F / C / S / 2xOUT	001110027	32	540x360x170
		5	✗	SBPV 1000 / 5xIN / F / C / NS / 2xOUT	001110030	58	540x360x170
			✓	SBPV 1000 / 5xIN / F / C / S / 2xOUT	001110031	58	540x360x170

Type designation:



Standard junction box 3 x OUTPUTS

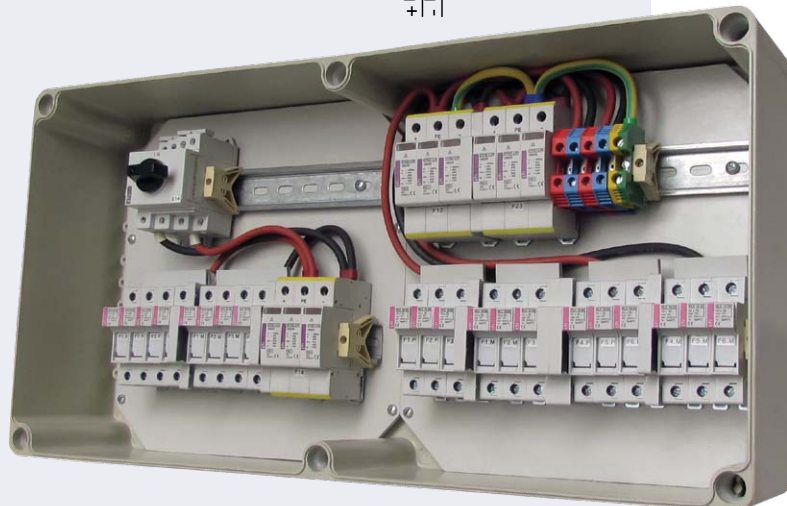
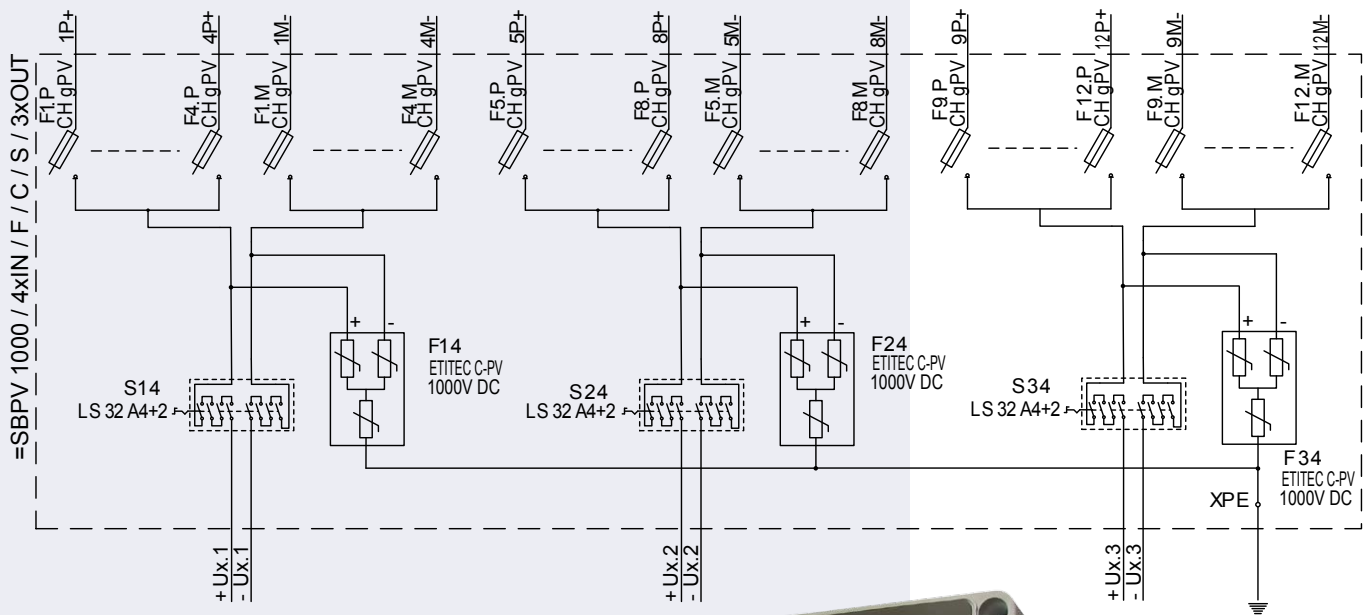
3 x OUTPUTS							
Max. U	Overvoltage protection	Inputs	Switch	Designation	Code No.	Max. I [A]	Dimensions WxHxD [mm]
1000 V d.c.	B	2	✗	SBPV 1000 / 2xIN / F / B / NS / 3xOUT	001110032	25	540x360x170
			✓	SBPV 1000 / 2xIN / F / B / S / 3xOUT	001110033	25	540x360x170
		3	✗	SBPV 1000 / 3xIN / F / B / NS / 3xOUT	001110036	25	540x360x170
			✓	SBPV 1000 / 3xIN / F / B / S / 3xOUT	001110037	25	540x360x170
		4	✗	SBPV 1000 / 4xIN / F / B / NS / 3xOUT	001110040	32	540x360x170
			✓	SBPV 1000 / 4xIN / F / B / S / 3xOUT	001110041	32	540x360x170
	C	2	✗	SBPV 1000 / 2xIN / F / C / NS / 3xOUT	001110034	25	360x360x170
			✓	SBPV 1000 / 2xIN / F / C / S / 3xOUT	001110035	25	540x360x170
		3	✗	SBPV 1000 / 3xIN / F / C / NS / 3xOUT	001110038	25	540x360x170
			✓	SBPV 1000 / 3xIN / F / C / S / 3xOUT	001110039	25	540x360x170
		4	✗	SBPV 1000 / 4xIN / F / C / NS / 3xOUT	001110042	32	540x360x170
			✓	SBPV 1000 / 4xIN / F / C / S / 3xOUT	001110043	32	540x360x170

- 1-4 x PV string inputs
- 3 x outputs
- 3 x DC type B or C surge arrester
- Suitable for outdoor installation, UV resistant
- Current per PV string: DC 9,5 A max.
- Maximum voltage DC 1000 V
- Equipped with cable glands
- Option for connection with plug-in connectors compatible to MC4,
- Rated connecting capacity PE: 1,5 - 16 mm²

Nominal d.c. voltage Type of Overvoltage protection Nr. of outputs

Type designation: **SBPV 1000 / 2xIN / F / C / S / 3xOUT**

Nr. of inputs per output Fuse Switch



Non - standard solutions (upon customer's request)

In addition to our standard junction boxes we can also provide customized superior solutions, tailored to the needs of our customers.

DC junction boxes for large grid-connected photovoltaic power systems

We can prepare drawings, layout and ready made DC junction boxes for large PV plants, incorporating our groundbreaking knife-blade fuses.



Advantages of ETI NH gPV fuses:

- Breaking capacity up to 1500 VDC
- Product dedicated to PV installations
- Operating ranges adjusted for small over-currents specific to PV installations.
- High reliability
- Absolute protection over time guaranteed by the simplicity of manufacture and function (Joule effect).
- No downgrading of fuse characteristics over time.

DC junction boxes with superior safety and durability

We can offer solutions adhering to the new standard EN50539-11 with increased safety when disconnecting DC current in case of thermal overload and prolonged durability.



Advantages of ETITEC S Series:

- Current limiting for long duration; overvoltage path through mov – no degradation, long life guaranteed
- Improved thermal disconnection mechanism - rotating barrier, secure arcing shutdown, no risk of fire

DC junction boxes with additional protection of surge arresters

Varistors inside surge arresters may degrade over time due to repeated lightning strikes, overheating etc. which in turn may cause short-circuiting and explosion of the arrester. To prevent this, special cylindrical SRF fuses are used that provide overcurrent protection of the arrester.



Features of ETI SRF fuses:

- Rated voltage 600V a.c. (8/20 μ s) or 400V a.c. (10/350 μ s)
- Breaking capacity 200 kA (8/20 μ s) or 50kA (10/350 μ s)
- Available in Surge Ratings from 10 kA to 40 kA (8/20 μ s) and 25 kA (10/350 μ s)
- Designed to meet UL1449 Second Edition requirements,
- Comply with the applicable requirements in UL 248-1

Fault and additional protection against smooth DC and high frequency AC residual currents

Smooth DC currents and high frequency AC currents frequently occur in small photovoltaic plants on the roofs of family houses, because inverters in these PV systems are usually without insulating transformers. The problem with fault and additional protection of such installations is that A-type RCCBs do not detect smooth DC residual currents and may even become "blinded" by them, causing them to fail completely. The solution, according to IEC/EN 62423 standard is the new universal RCCB B-type, which is an upgrade of A-type RCCB with an additional current transformer, sensitive to smooth DC residual currents and also high frequency AC currents.



Features of EFI B and B+ type RCCB:

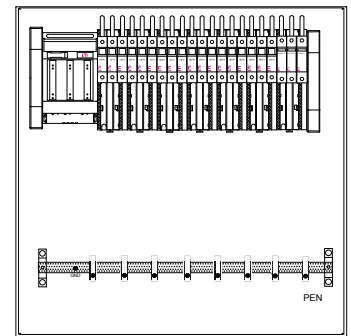
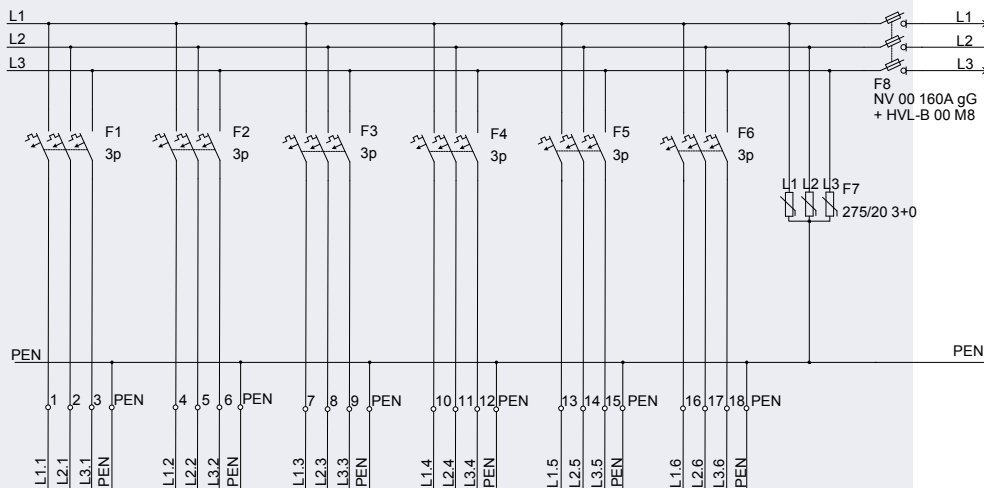
- Fault protection (protection against indirect contact of live parts) against smooth DC and high frequency AC residual currents
- Additional protection (protection in case of direct contact of live parts, $I_{\Delta n} \leq 30mA$) against smooth DC and high frequency AC residual currents
- Fire Protection (for locations exposed to fire hazard) against smooth DC and high frequency AC residual currents

AC - distribution and protection

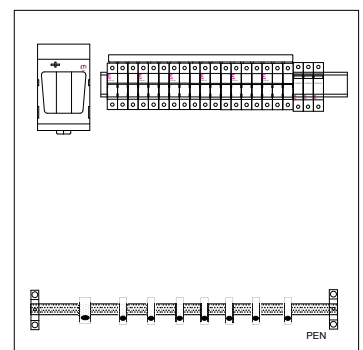
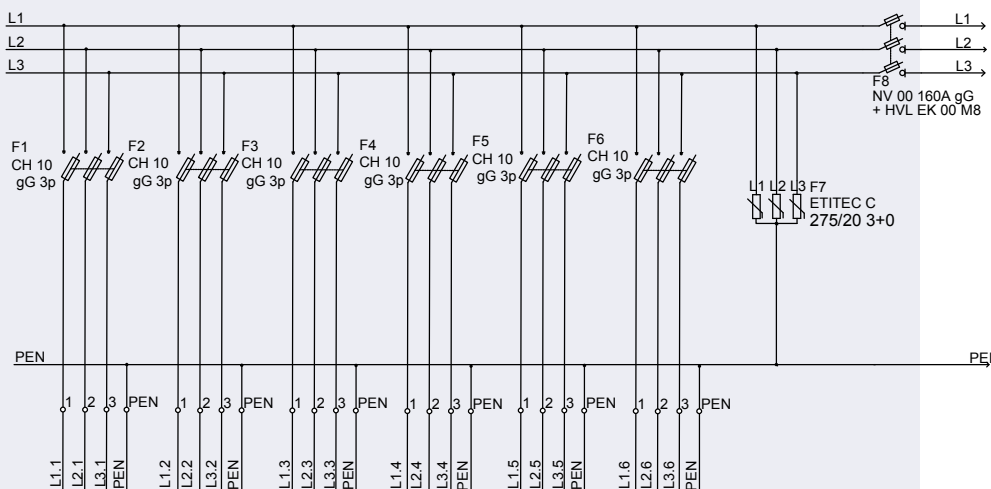
AC Photovoltaic installations require different protection than ordinary residential installations

- Overcurrent protection must be determined according to the respective load of the solar inverter on the AC side
- Distribution boards in PV installations must not be dimensioned simply according to the number of consumers (as is the case with ordinary residential installations, where simultaneity factor is low), but you need to take into account wider cable cross-sections, higher rated currents etc.
- High power dissipation, as a result of constant high loads, is typical for PV installations and needs to be reduced below the maximum operating temperature of individual devices (larger enclosures, setting devices further apart to allow air circulation etc).

We provide design, engineering and consulting services and production of custom made AC PV junction boxes. You can choose between busbar system and mounting plate system.



Busbar system



Mounting plate system

Battery Storage Protection

We provide consulting, drawings and layout for battery storage systems. The use of battery fuses with special characteristic intended specifically for battery. When selecting appropriate battery fuse is necessary to consider the maximum current during discharging batteries!

