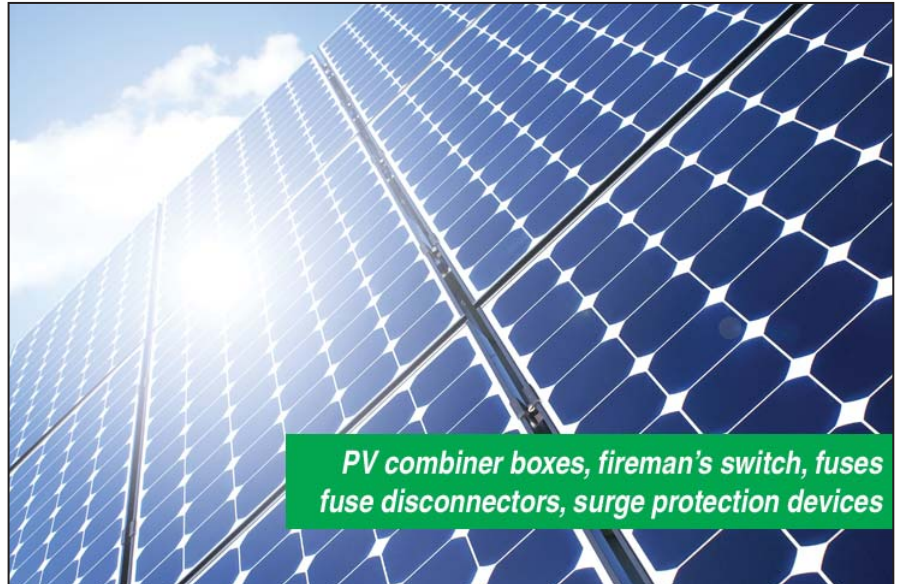


# CHS Controls

## Photovoltaic system protection



## Photovoltaic system protection - DC

Interest in renewable energy such as solar power is rapidly increasing, the industry for photovoltaic modules is growing at 30-40% per year. Rising energy prices has generated an increased interest also in Scandinavia.

A photovoltaic (PV) cell converts light into electrical current - DC. A PV module is an assembly comprising a number of interconnected PV cells. To be able to generate sufficient voltage, the PV modules are connected in series and form a string. A number of strings can then be connected in parallel, forming an array to achieve the desired output power. The PV modules should be protected against overcurrent and overvoltage.

Roof mounted PV modules does also affect how firefighter's can operate in case of a fire. Swedish Fire Departments recommends increased safety measures, allowing the fireman to isolate the lines between PV modules and the inverter from the building access points.

### System design

Un-earthed systems dominates, the voltage can reach up to 1000 VDC. The inverter may have one or more inputs (MPP trackers). Figure 2 shows an example of un-earthed system consisting of four strings connected in parallel, two by two. The strings are interconnected in a combiner box which contains fuses and surge protection devices. A fireman's switch, one for each inverter input, is installed close to the PV modules. If the cable length exceeds 10 m, a secondary surge protection device is installed close to the inverter.

### Overcurrent protection - fuses

PV systems present special cases for fuse protection. A trend in recent years is that the voltage increases up to 1000 VDC for larger installations. Fuses are installed on both sides of each string since the system is un-earthed.

The fuses should be able to interrupt the low-fault currents resulting from the failure of the solar cells while they also cope with high fault currents that may result from failure of an inverter. In addition, the fuse is exposed to cyclic loading, depending on the temperature of the PV module. Appropriate fuses meet operation class gPV according to IEC 60269-6. See page 8 for selection and fuse sizing information.

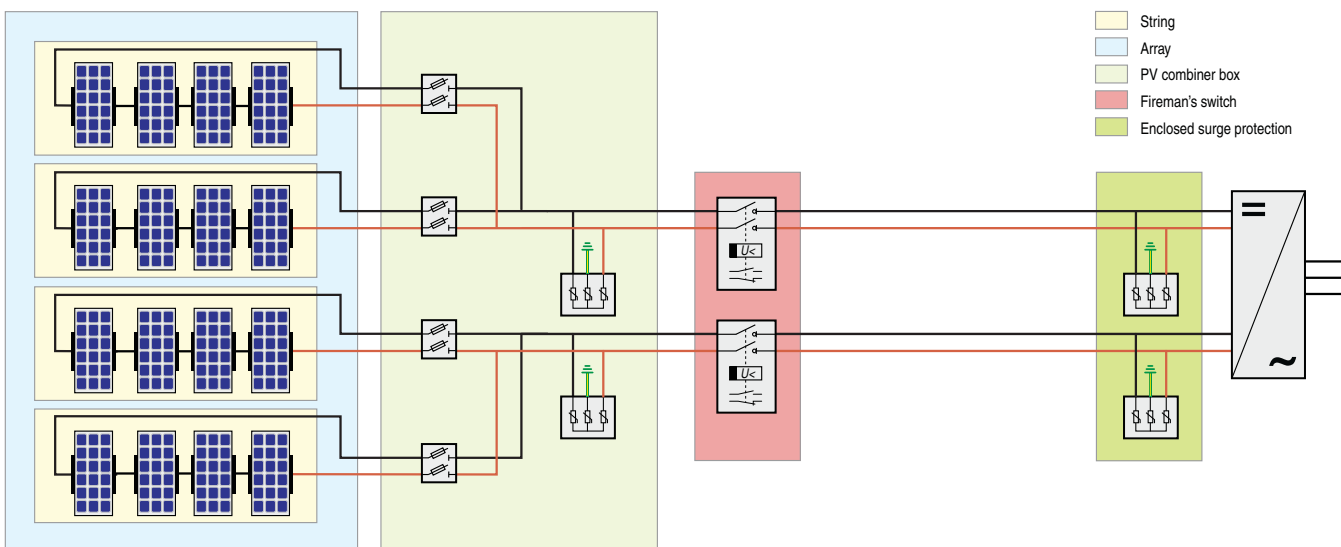


Figure 2.  
System design example of a PV system connected to the grid, DC side.

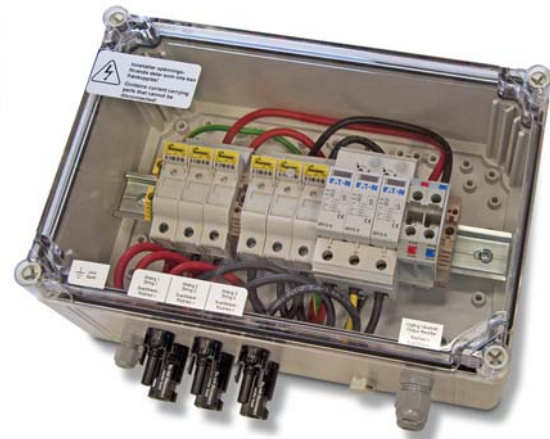


Figure 1.  
PV combiner box with DC fuses and surge protection device.

### Overvoltage protection – surge protection device

Photovoltaic systems are generally installed high and in open. They are therefore potentially exposed to lightning. Other transients and disturbances in the grid are also phenomenon to be taken into account. If the building is equipped with external lightning protection, Type 1/2 lightning/surge arrester shall be used. For buildings without external lightning protection, Type 2 surge arrester can be used, see page 10 for selection and recommendations. Surge protection device should also be installed on the AC side of the inverter.

### Disconnecting – DC disconnect switch

PV modules cannot be turned off by other means than shut out the light. A DC switch disconnecter which disconnects the DC-side is required, for example during maintenance of the inverter. A fireman's switch is a DC switch disconnecter equipped with undervoltage release, allowing the fireman to isolate the lines from the PV modules in case of a fire.

## Fireman's switch

*It is not unusual that the lines between the PV modules and the inverter can be long and are placed in cable routes together with AC cables. PV modules cannot be turned off by other means than shut out the light, hence the DC cables through the building are live. Live cables increase the hazard for the firefighters during a fire.*

Eaton's fireman's switch makes it possible to disconnect the lines between PV panels and the inverter. They allow firefighters to operate without risk of electrocution from live cables.

The fireman's switch is a DC disconnect switch equipped with a time delay undervoltage release. The time delay ensure that more than 93% of all brief power failures and voltage drops will not cause a trip. All fireman's switches feature NO-NC auxiliary contacts to be used for switch position indication.

Swedish Fire Departments have started to recommend increased safety measures, allowing safe operation for the firemen in buildings with PV systems.

The image to the right illustrate how the fireman's switches (A) are installed close to the PV modules, a pushbutton (B) is located in a manner that allows the firemen to trip the switches. The line between switches and inverter (green) will be isolated.

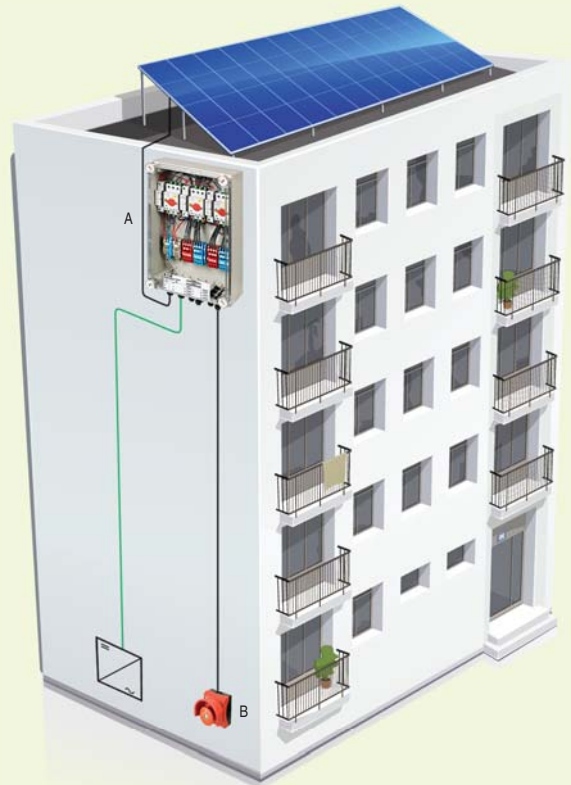


Figure 3.  
We can supply both components, fuses, off-load fuse disconnectors and surge protection devices as well as complete PV combiner boxes.

## Bypass diodes, blocking diodes

The PV module design is based on series connected PV cells. It is enough if only one PV cell is not operating properly, for example blocked by shading, the faulty PV cell will limit the output current for the entire PV module. The limitation applies also to all series connected PV modules in the string. The PV module manufacturer has integrated bypass diodes in the PV module to allow the current to pass the limiting point.

Some reverse currents may be blocked by blocking diodes, installed in series with PV modules in the string. Blocking diodes can never replace fuse for reverse current protection in the string. Blocking diodes may be required in the battery-powered facilities, ensuring that the batteries are not discharged during the night. It should be noted that the power losses in the blocking diodes are significant, and thus affects the efficiency of the system.

## PV combiner boxes – PV string protection

*PV combiner boxes are designed for easy and efficient installation and provide electrical protection for the PV modules. PV combiner boxes include overcurrent protection, fuses, and surge protection, Type 1/2 lightning/surge arrester or Type 2 surge arrester. The interconnected strings form an array.*

PV combiner boxes are normally installed close to the PV modules. To speed-up installation, the PV combiner boxes are normally equipped with connectors for fast and easy installation.

We offer a standard line of PV combiner boxes for up to 4 strings. We can also deliver PV combiner boxes equipped according to your specifications, contact us for a quotation.

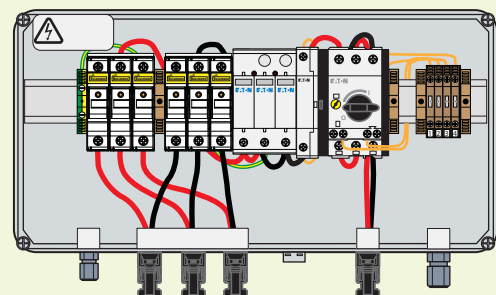


Figure 4.  
Example on a PV combiner box consisting of surge protection, fuses and fireman's switch.

## CHS Controls PV combiner boxes

Overcurrent and overvoltage protection

### Technical data



Rated voltage, $U_g$	1000 VDC, un-earthed system
Overcurrent protection	10x38 mm cylindrical fuses gPV, 1-30 A, off-load fuse disconnectors with lamp indicator
Surge protection	Type 1/2 lightning arrester, Type 2 surge protection
Connections	T4 connectors (MC4 connectors can be terminated) or screw terminals
Ambient temperature	-20 - + 55°C
Enclosure	Polycarbonate enclosure with transparent cover, UV resistant
Ingress prot., IEC 60529	IP 66
Standard, certificate	IEC 60269-1, IEC 60269-6, EN 50539-11, IEC 61439-1, IEC 60363-7-712, CE, RoHS

### Catalogue numbers - PV combiner boxes with 15 A fuses and surge protection device

PV modules No. of strings	Inverter No. of MPP inputs	Surge protection device Type <sup>1)</sup>	Quantity	Catalogue number <sup>2)</sup>	Wiring diagram	Enclosure size	Weight kg	Packing size
<b>PV combiner box with T4 connectors, <math>I_{sc}</math>: 30 A</b>								
1	1	Type 1/2	1	CHSPV10-1ST1X-F1-CC-15	A	175x175	1,1	1
2	1	Type 1/2	1	CHSPV10-1ST1X-F2-CC-15	A	300x200	2,1	1
2 (1+1)	2	Type 1/2	2	CHSPV10-2ST1X-F2-CC-15	B	300x200	2,4	1
3	1	Type 1/2	1	CHSPV10-1ST1X-F3-CC-15	A	300x200	2,2	1
3 (2+1)	2	Type 1/2	2	CHSPV10-2ST1X-F3-CC-15	B	300x200	2,6	1
3 (1+1+1)	3	Type 1/2	3	CHSPV10-3ST1X-F3-CC-15	B	400x200	2,9	1
4 (2+2)	2	Type 1/2	2	CHSPV10-2ST1X-F4-CC-15	B	400x200	3,2	1
4 (3+1)	2	Type 1/2	2	CHSPV10-2ST1X-F31CC-15	B	400x200	3,2	1

### PV combiner box with T4 connectors for the PV modules, screw terminals for the inverter, $I_{sc}$ : 50 A

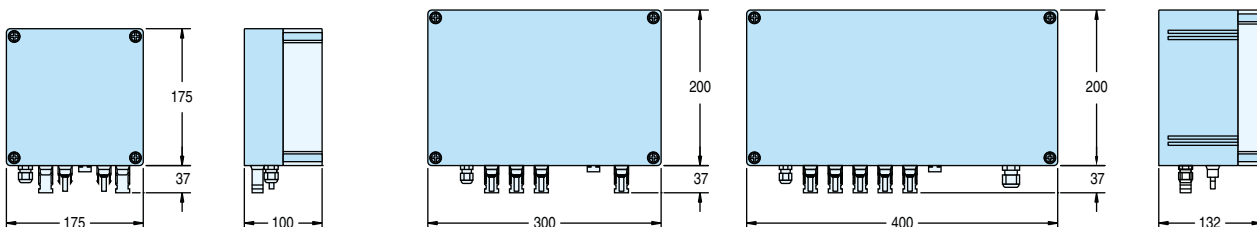
3	1	Type 1/2	1	CHSPV10-1ST1X-F3-CT-15	A	300x200	2,3	1
4	1	Type 1/2	1	CHSPV10-1ST1X-F4-CT-15	A	300x200	2,5	1

### Catalogue numbers - PV combiner boxes with surge protection only

#### PV combiner box with T4 connectors, $I_{sc}$ : 30 A

1	1	Type 1/2	1	CHSPV10-1ST1X-X1-CC-00	C	175x175	1	1
2	1	Type 1/2	1	CHSPV10-1ST1X-X2-CC-00	D	300x200	1,8	1
2 (1+1)	2	Type 1/2	2	CHSPV10-2ST1X-X2-CC-00	E	300x200	2,3	1
3 (2+1)	2	Type 1/2	2	CHSPV10-2ST1X-X3-CC-00	E	300x200	2,3	1
3 (1+1+1)	3	Type 1/2	3	CHSPV10-3ST1X-X3-CC-00	E	400x200	2,2	1

### Dimensions, mm



Enclosure 175x175

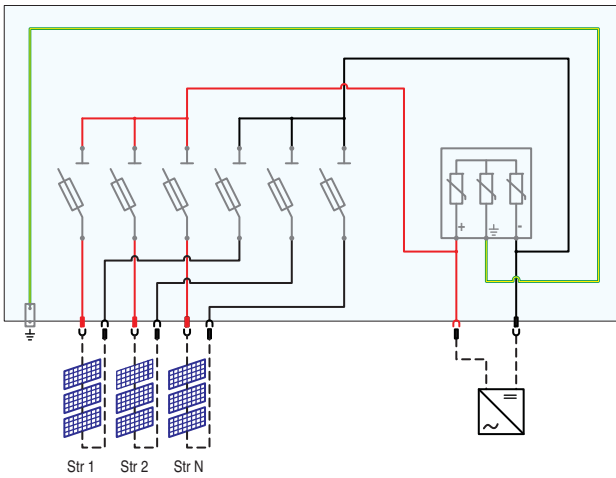
Enclosure 300x200

Enclosure 400x200

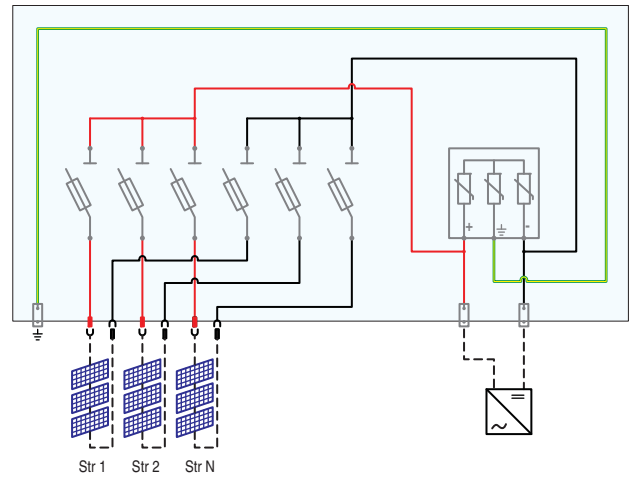
1) For Type 2 surge arrester, replace "ST1" with "ST2". Example: CHSPV10-1ST1X-F2-CC-15 will be CHSPV10-1ST2X-F2-CC-15.

2) For different fuse rating, replace the last digits with requested rated current. Example: PV combiner box with two strings with 10 A fuses will be CHSPV10-1ST1X-F2-CC-10.

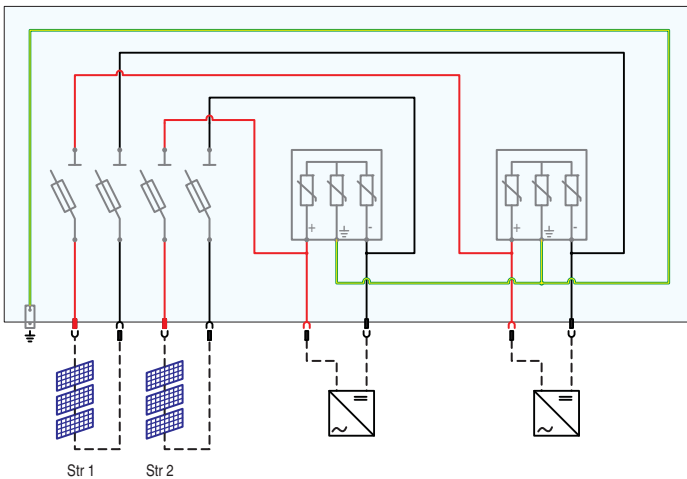
Wiring diagram



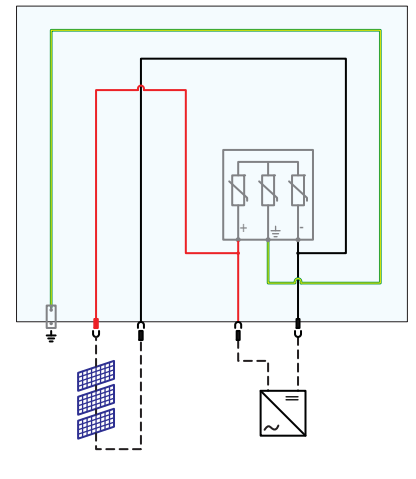
Wiring diagram A, T4 connectors



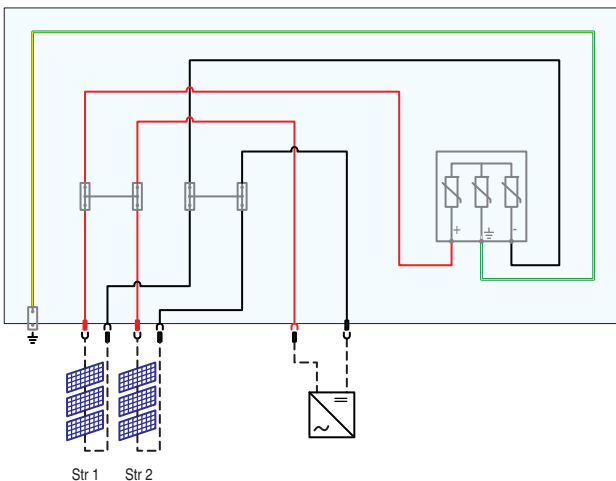
Wiring diagram A, T4 connectors for PV modules, screw terminals for inverter



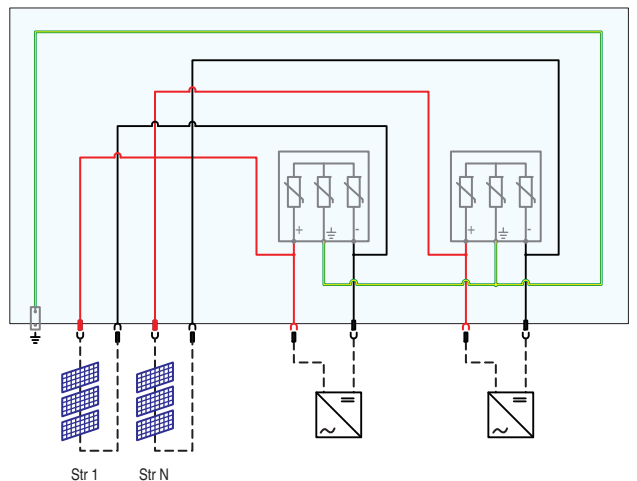
Wiring diagram B



Wiring diagram C



Wiring diagram D



Wiring diagram E

## Eaton fireman's switch

Reliable isolation in case of fire

### Technical data



Rated voltage, $U_e$	1000 VDC
Rated current, $I_e$	30 A
Utilization category	DC-21A
Undervoltage release	230 VAC, time delay 600 ms, power consumption 5 VA
Auxiliary contact	sl-br, 240 VAC/1 A
Connections	MC4 connectors or screw terminals, max 6 mm <sup>2</sup>
Ambient temperature	-25 - +60°C
Enclosure	Glass fibre reinforced polycarbonate
Ingress protection, IEC 60529	IP 65
Standard	IEC 60947-3
Certificate	CE, RoHS

### Catalogue numbers - Fireman's switch

No. of switches	Inputs		Output		Catalogue number	Weight kg	Packing size
	Quantity	Connections	Quantity	Connections			
1	2	MC4 connector	1	MC4 connector	SOL30-SAFETY-2MC4-U	0,47	1
1	2	Terminals, M12 cable gland	1	Terminals, M12 cable gland	SOL30-SAFETY-2MV-U	0,47	1
2	2	MC4 connector	2	MC4 connector	SOL30X2-SAFETY-MC4-U	5,1	1
2	2	Terminals, M12 cable gland	2	Terminals, M12 cable gland	SOL30X2-SAFETY-MV-U	5,1	1
3	3	MC4 connector	3	MC4 connector	SOL30X3-SAFETY-MC4-U	5,5	1
3	3	Terminals, M12 cable gland	3	Terminals, M12 cable gland	SOL30X3-SAFETY-MV-U	5,5	1
4	4	MC4 connector	4	MC4 connector	SOL30X4-SAFETY-MC4-U	6,8	1
4	4	Terminals, M12 cable gland	4	Terminals, M12 cable gland	SOL30X4-SAFETY-MV-U	6,8	1
6	4	MC4 connector	6	MC4 connector	SOL30X6-SAFETY-MC4-U	9,5	1
6	4	Terminals, M12 cable gland	6	Terminals, M12 cable gland	SOL30X6-SAFETY-MV-U	9,5	1

## Eaton enclosed pushbutton for tripping the fireman's switch

### Technical data

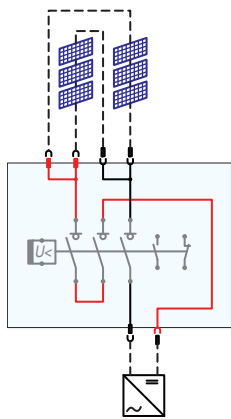


Insulating voltage, $U_i$	500 V
Rated current at 240 VAC, AC-15, $I_e$	6 A
Terminals	Screw terminal, $\leq 2,5$ mm <sup>2</sup>
Ambient temperature	-25 - +70°C
Enclosure	Glass fibre reinforced polycarbonate, red
Ingress protection, IEC 60529	IP 67
Standard	IEC 60947. ISO 13850/EN 418
Certificate	CE, RoHS

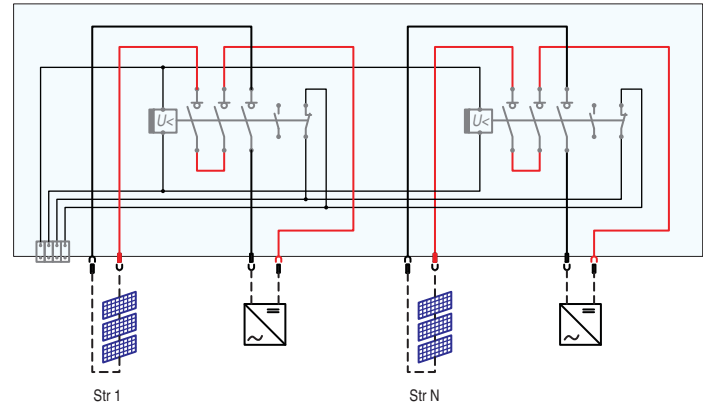
### Catalogue numbers - Enclosed red pushbutton

Description	Contacts	Catalogue number	kg	Weight size	Packing size
Enclosed pushbutton with protection collar, twist release	NO-NC	M22-SOL-PVT45PMPI11Q	0,4	1	1
Enclosed pushbutton with protection collar, twist release	2 NC	M22-SOL-PVT45PMPI02Q	0,4	1	1
Enclosed pushbutton, pull to release, sealable	NO-NC	M22-SOL-PVLPL11-230Q	0,4	1	1

Wiring diagram

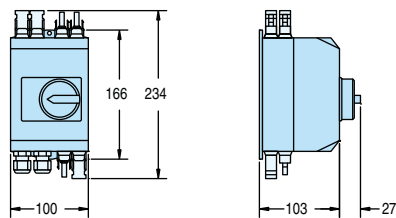


1 switch

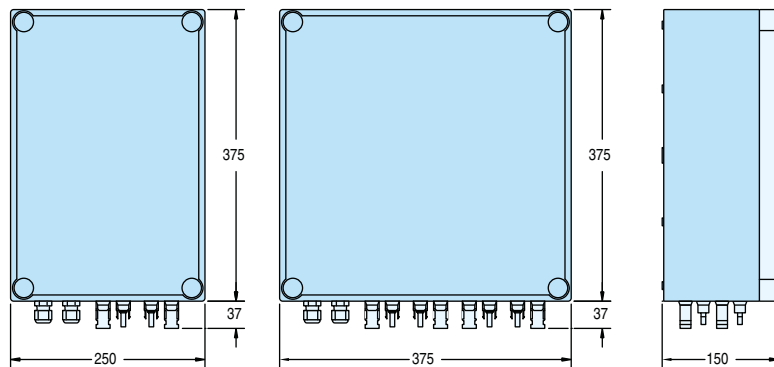


2-6 switches

Dimensions, mm

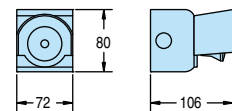


1 switch

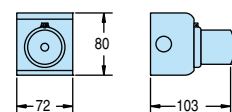


2-3 switches

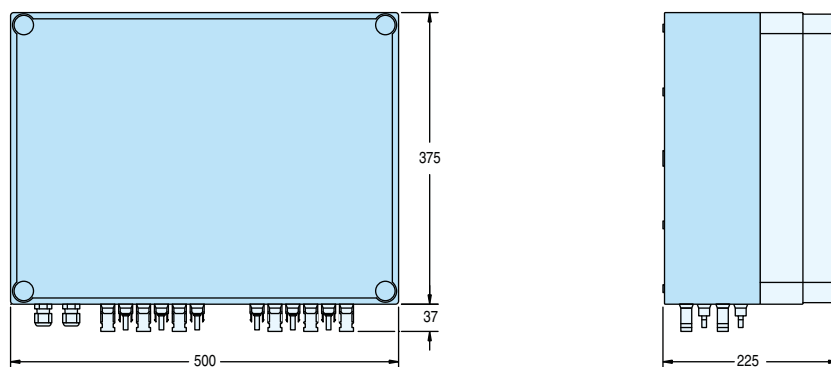
4 switches



Pushbutton, twist release



Pushbutton, pull to release, sealable



6 switches

## Eaton Bussmann Series cylindrical fuses

1000 VDC class gPV 10x38 mm

### Technical data



Material	Ceramic body (25-30A glass fibre body), tin plated ferrules of copper alloy
Rated voltage, Un	1000 VDC
Operating class	gPV
Rated breaking capacity	50 kA, 25-30 A 20 kA
Minimum breaking current	1,3 x In
Standard	IEC 60269-6, UL 2579
Certificate, approvals	CE, RoHS, UL file E335324, 1-15 A CCC

### Catalogue numbers - 10x38 mm cylindrical fuses

Rated current In, A	I <sup>2</sup> t Pre-arc 1 ms, A <sup>2</sup> s	I <sup>2</sup> t Total Un, A <sup>2</sup> s	Power loss W at In	Catalogue number	Weight each, g	Packing size
1	0,15	0,4	1,5	CBPV-1A10F	11	10
2	1,2	3,4	1	CBPV-2A10F	11	10
3	4	11	1,3	CBPV-3A10F	11	10
3,5	6,6	18	1,4	CBPV-3-5A10F	11	10
4	9,5	26	1,3	CBPV-4A10F	11	10
5	19	50	1,6	CBPV-5A10F	11	10
6	30	90	1,8	CBPV-6A10F	11	10
8	3	32	2,1	CBPV-8A10F	11	10
10	7	70	2,3	CBPV-10A10F	11	10
12	12	120	2,7	CBPV-12A10F	11	10
15	22	220	2,9	CBPV-15A10F	11	10
20	34	350	3,6	CBPV-20A10F	11	10
25	325	1860	2,91	CBPV10M-25	11	10
30	536	3360	3,31	CBPV10M-30	11	10

## Eaton Bussmann Series off-load fuse disconnectors

10x38 mm cylindrical fuses

### Technical data



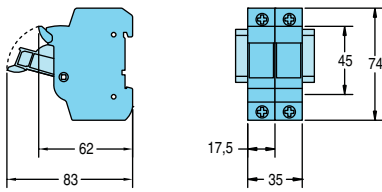
Material	Polyester, UL 94V0
Rated voltage, Un	1000 VDC
Rated current, In	32 A
Max power loss/pole	3 W
Short circuit current, SCCR	33 kA
Terminal	Box terminal, 1-16 mm <sup>2</sup>
Ingress protection, IEC 60529	IP 20
Standard, certificate, approvals	IEC 60269-1&2, UL 4248-19, CE, RoHS, cUL file E348242

### Catalogue numbers - Off-load fuse disconnectors, DIN rail mounting

Description	Catalogue number	Weight each, g	Packing size
1 pole	CBCHPV1U	53	1
1 pole with lamp indicator	CBCHPV1IU	53	1
2 pole	CBCHPV2U	106	1
2 pole with lamp indicator	CBCHPV2IU	106	1
Busbar 1000 VDC, 100 A, 57 pins, cuttable, short circuit current SCCR 10 kA	CBBB1P100M57	0,45	1



## Dimensions, mm



## Fuse sizing, class gPV fuses

For un-earthed systems, fuses are installed on both sides of the string. The following information is required for proper sizing of the fuse.

- Short-circuit current for the PV module at standard test conditions,  $I_{sc}$
- Open circuit voltage for the PV module at standard test conditions,  $V_{oc}$
- Number of series connected PV modules,  $N_s$
- Number of parallel connected strings,  $N_p$
- Maximum fusing rating for the PV module according to IEC 61730-2,  $I_{mod\_max\_OCPD}$
- Conductor size and current carrying capacity,  $I_z$
- Array conductor current capacity,  $I_{sc\_array}$ , calculated as  $(N_p - 1) \times 1,25 \times I_{sc}$
- Fuse ambient temperature

If  $N_p < 3$ , ie an array consists of a maximum of two parallel connected strings, and when the array conductor current capacity exceeds  $I_{sc} \times 1.56$ , fuses are normally not required.

Systems consisting of an array with three or more parallel strings and/or with the array short-circuit current,  $I_{sc\_array} > I_z$  fuses shall be installed.

The fuse/fuses that protect a string shall be sized according to the following

- Fuse rated current,  $I_n < I_z$
- Fuse rated current,  $I_n > 1,56 \times I_{sc}$
- Fuse rated voltage,  $U_n > V_{oc} \times 1,2 \times N_s$
- Fuse current carrying capability to be de-rated for high ambient temperature according to figure 5

The fuse will protect the wiring and equipment against overloads, earth faults, and reverse current faults.

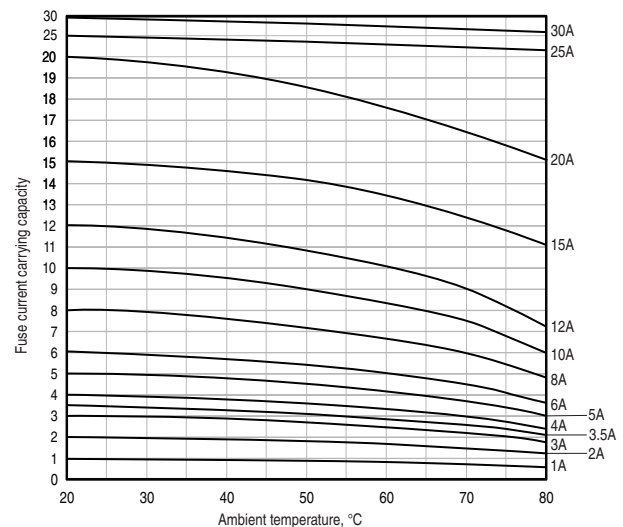


Figure 5.  
Fuse current carrying capability at high ambient temperature, 10x38 mm cylindrical fuse class gPV.

### Sizing example

#### System data

PV module type	Polycrystalline
Open circuit voltage, $V_{oc}$	43,1 V
Short-circuit current, $I_{sc}$	5,37 A
Maximum fuse rating, $I_{mod\_max\_OCPD}$	15 A

Number of series connected modules, $N_s$	18
Number of parallel connected strings, $N_p$	4
Cond. size, 2,5 mm <sup>2</sup> , current carrying cap., $I_z$	11,5 A at 60°C
Ambient temperature, fuse	-30 - +40°C

#### Calculations

- Four parallel strings forms an array.
- Array short-circuit current,  $I_{sc\_array} = (N_p - 1) \times 1,25 \times I_{sc}$   
 $(4 - 1) \times 1,25 \times 5,37 = 20,1$  A
- The array consists of three or more parallel strings and/or  $I_{sc\_array} > I_z$ , fuses shall be installed.

The fuse is sized according to below:

- Fuse rated voltage  $U_n \geq V_{oc} \times 1,2 \times N_s$   
 $43,1 \times 1,2 \times 18 = 931$  VDC
- Fuse rated current  $I_n > 1,56 \times I_{sc}$   
 $5,37 \times 1,56 = 8,38$  A
- Fuse rated current,  $I_n < I_z$  conductor current capacity  $I_z$  11,5 A
- Take fuse current carrying capability into consideration when ambient temperature exceed 20°C, see figure 2

#### Selection

The fuse rated voltage,  $U_n$  shall be 1000 VDC, fuse rated current,  $I_n$ , shall be next standard size above 8,38 A, ie 10 A. Suitable fuse is CBPV-10A10F. Ambient temperature is 40°C which reduce the fuse current carrying capability to 9,5 A, see figure 2, which exceed 8,38 A.

## Eaton Bussmann Series Lightning/surge arrester



Technology	Metal oxide varistor
Design	Base unit with exchangeable protection modules
Indication	Visual indication and remote signal contact, some versions
Installation	On 35 mm DIN rail
Ingress prot.	IP 20

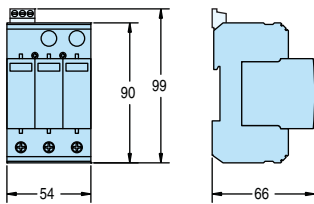
### Catalogue numbers

Description	Catalogue number		Weight each, kg	Packing size
	Unit without signal contact	Unit with signal contact		
Type 1/2 combination lightning/surge arrester	CBSPPVT12-10-2-PE	CBSPPVT12-10-2-PE-AX	0,35	1
Type 2 High Performance surge arrester	CBSPPVT2H-10-2-PE	CBSPPVT2H-10-2-PE-AX	0,35	1
Type 2 Standard surge arrester	CBSPPVT2-10-2-PE	CBSPPVT2-10-2-PE-AX	0,35	1

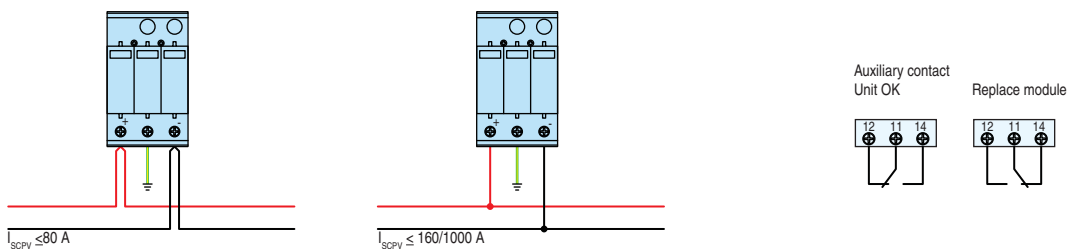
### Technical data

	Combination lightning/surge arrester	High performance surge arrester	Standard surge arrester
<b>Technology</b>	Metal oxide varistor	Metal oxide varistor	Metal oxide varistor
<b>Electrical data</b>			
Classification test, EN 50539-11	PV T1/PV T2	PV T2	PV T2
Rated voltage, $U_n$	1000 VDC	1000 VDC	1000 VDC
Max continuous operating voltage, $U_{CPV}$	1050 VDC	1170 VDC	1170 VDC
Open circuit voltage, Standard Test Conditions, $U_{OC\ STC}$	$\leq 875$ VDC	$\leq 970$ VDC	$\leq 970$ VDC
Short circuit current rating, $I_{SCPV}$	1000 A	1000 A	160 A
Rated load current, $I_L$	80 A	80 A	80 A
Impulse discharge current 10/350 $\mu s$ , $I_{imp}$	5 kA		
Total discharge current, 10/350 $\mu s$ , $I_{total}$	5 kA		
Nominal discharge current, 8/20 $\mu s$ , $I_n$	15 kA	15 kA	15 kA
Max discharge current, 8/20 $\mu s$ , $I_{max}$	40 kA	40 kA	40 kA
Total discharge current, 8/20 $\mu s$ , $I_{total}$	40 kA	40 kA	40 kA
Voltage protection level L+/L- to PE, $U_p$	3,5 kV	3,7 kV	3,7 kV
Limiting voltage L+/L- to PE, 8/20 $\mu s$ , $U_{res}$ at $I_n$	$\leq 3,5$ kV	$\leq 3,7$ kV	$\leq 3,7$ kV
at 5 kA	$\leq 2,9$ kV	$\leq 3,1$ kV	$\leq 3,1$ kV
at 10 kA	$\leq 3,2$ kV	$\leq 3,5$ kV	$\leq 3,5$ kV
at 20 kA	$\leq 3,7$ kV	$\leq 4$ kV	$\leq 4$ kV
at 30 kA	$\leq 4,1$ kV	$\leq 4,6$ kV	$\leq 4,6$ kV
at 40 kA	$\leq 4,6$ kV	$\leq 5$ kV	$\leq 5$ kV
Response time, $t_A$	< 25 ns	< 25 ns	< 25 ns
<b>Status indication</b>			
Visual	Grey ok, red replace module	Grey ok, red replace module	Grey ok, red replace module
Remote indication, some versions	Type Data	Changeover contact 250 VAC/30 VDC 1,5 A	Changeover contact 250 VAC/30 VDC 1,5 A
		Changeover contact 250 VAC/30 VDC 1,5 A	Changeover contact 250 VAC/30 VDC 1,5 A
<b>Terminal data, environment</b>			
Cross section area, starnded conductor	Main Signal	1,5 - 25 mm <sup>2</sup> 0,14 - 1,5 mm <sup>2</sup>	1,5 - 25 mm <sup>2</sup> 0,14 - 1,5 mm <sup>2</sup>
Ambient temperature		-40 - +80°C	-40 - +80°C
Standard Certificate		EN 50539-11 CE, RoHS	EN 50539-11 CE, RoHS

## Dimensions, mm



## Wiring diagram



## Surge protection selection

Lightning and power surges may damage both the PV modules and inverter. Surges are generated by direct lightning strikes or from indirect impacts that generate transients that can damage the installed equipment. To reduce the risk for damages, surge protection should also be installed on the DC side.

High DC voltage combined with special characteristic of the PV modules challenge the surge protection. The new standard EN 50539-11 defines two types, Type 1 lightning arrester and Type 2 surge arrester.

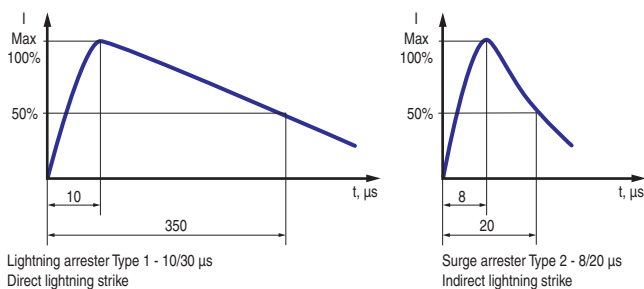


Figure 6.  
Current waves for lightning arrester and surge arrester.

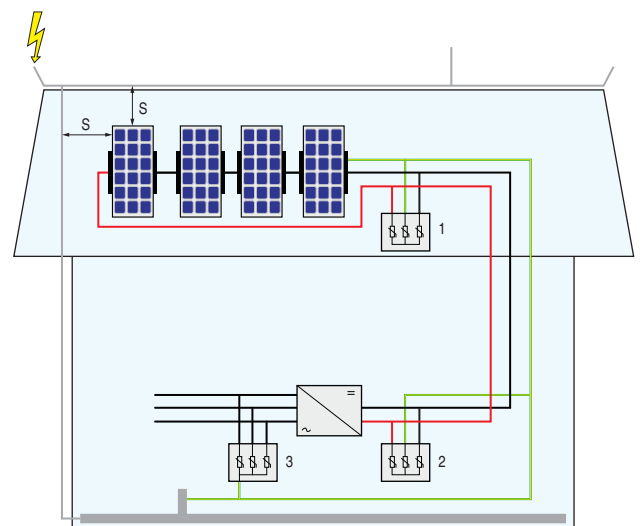
Eaton Bussmann Series offers three types of surge protection

- Combination lightning/surge arrester Type 1/2
- High Performance surge arrester Type 2 intended for larger systems,  $I_{SCPV} = 1000 \text{ A}$
- Standard surge arrester Type 2,  $I_{SCPV} = 160 \text{ A}$

In most cases, the surge protection device is installed close either to the inverter or close the PV modules. If the cables between the PV modules and the inverter exceed 10 m, an additional surge protection device should be installed, a requirement in EN 50539-12. Surges and transients can be induced onto long cable runs even after the first surge protection device started to operate, these can be handled by a second surge protection device.

Keep in mind that one set of surge protection devices are required for each MPP input of the inverter.

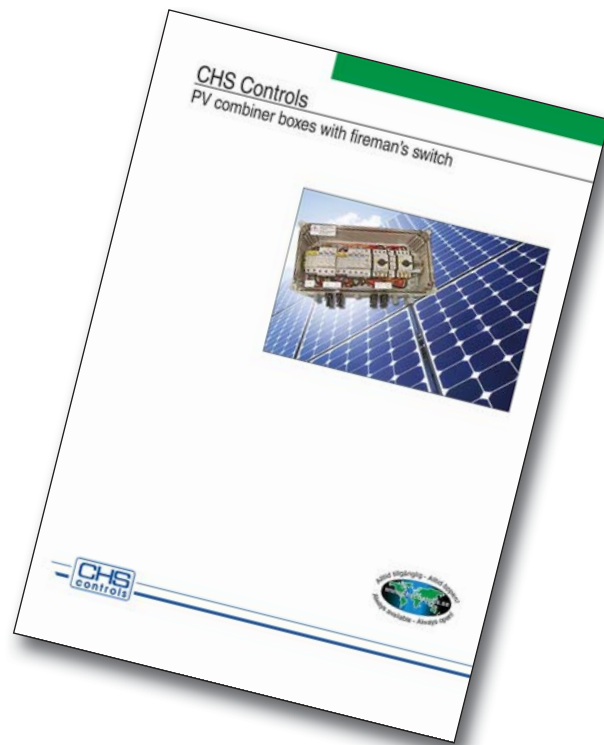
When PV modules are installed on a building with an external lightning rod, it is important that there is a separation distance according to IEC 62305-2 between the PV modules and the lightning protection system. If the separation distance is not kept, Type 1 lightning arrester should be used. If the building is not equipped with external lightning protection system or if the separation distance is kept, Type 2 surge arrester can be installed.



- S Separation distance between external lightning protection system and PV modules.
- 1 If the separation distance between the solar modules and the lightning rod is kept - Type 2 surge arrester. If the separation distance between the solar modules and the lightning rod is not kept - Type 1/2 lightning arrester. If the building does not have external lightning protection system - Type 2 surge arrester.
- 2 Surge protection device is excluded if cable length between PV modules and inverter is less than 10 m.
- 3 Inverter AC side should also be equipped with surge protection, contact CHS Controls.

Figur 7.  
Typisk installation av åskskydd/överspänningskydd, byggnad med åskledare.

*PV combiner boxes with fireman's switch can be found in a separate catalogue*



**CHS Controls AB**  
Florettgatan 33  
254 67 Helsingborg, Sweden  
Phone +46 42 386100, fax +46 42 386129  
chs@chscontrols.se  
www.chscontrols.se

