

Applicant : OBO Bettermann GmbH & Co.  
P.O. Box 1120  
58694 Menden  
Germany

Application Date : 8 May 2013

Order Number : 216337900-INC

Product : Surge protective devices

Trade name : OBO

Types/Models : V20-C/3PH-1000  
V20-C/3PHFS-1000

Arnhem, 16 September 2013

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Manufacturer/ Production sites: OBO Bettermann GmbH & Co.  
Hueingser Ring 52  
58710 Menden  
Germany

Subject : SPD Overload behaviour test

Requirements : EN 50539-11:2013  
Clause 7.4.7,

Conclusion : The products comply with the specified requirements

Tested by : C.H.J Addink



Checked by : C.C. Burger



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## 1 Subject

Surge protective devices for photovoltaic applications

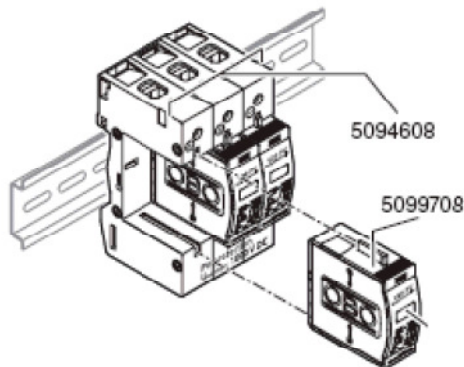
### Product information

Trade name	: OBO
Types/Models	: V20-C/3PH-1000 V20-C/3PHFS-1000
Location category	: indoor
Number of ports	: one
Mounting method	: fixed
SPD type (and test class)	: Type 2 (Class II)
Design topology	: voltage limiting
Modes of protection	: +/-, +/-PE, -/PE
Connection configuration	: Y - circuit

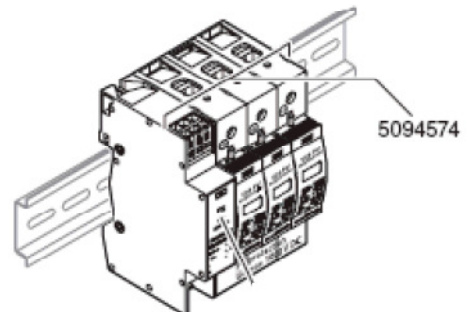
## 2 Ratings

Max. continuous operating voltage for PV appl.( $U_{cpv}$ )	: 1000 Vdc
Short-circuit current rating ( $I_{scpv}$ )	: 100 A
Nominal discharge current ( $I_n$ )	: 20 kA
Maximum discharge current ( $I_{max}$ )	: 40 kA
Total discharge current ( $I_{Total}$ )	: 40 kA
Voltage protection level ( $U_p$ )	: 4 kV
Connection	: solid/stranded 2,5 mm <sup>2</sup> – 35 mm <sup>2</sup> flexible 2,5 mm <sup>2</sup> – 35 mm <sup>2</sup>

## 3 Object identification



V20-C/3PH-1000



V20-C/3PHFS-1000

#### 4 Summary of type tests

Tests are performed according to EN 50539-11:2013

##### Test sequence 5:

Clause 6.2.5.2/7.4.7      SPD Overload behaviour test

#### 5 General Items

##### Location of the tests

The tests were carried out in the laboratory of DEKRA Certification B.V., Arnhem, the Netherlands.

##### Tests were carried out by

Mr C.H.J. Addink      DEKRA Certification B.V., Arnhem, the Netherlands  
Mr W.C. van Ginkel      DEKRA Certification B.V., Arnhem, the Netherlands

##### Manufacturer's representative(s) during tests

Mr M. Benzin      OBO Bettermann GmbH & Co., Menden, Germany  
Mr T. Hoffmann      OBO Bettermann GmbH & Co., Menden, Germany

##### The tests were supervised by

Mr C.C. Burger      DEKRA Certification B.V., Arnhem, the Netherlands

## 6 Type tests

### 6.1 Test sequence 5

#### 6.1.1 SPD overload behaviour

The verification of the SPD overload behaviour is done in conformity with clauses 6.2.5.2 and 7.4.7.

According to the manufacturer's declaration, the devices will disconnect (Open Circuit Mode, OCM) under overload behaviour status.

During the tests, the SPDs itself and its disconnectors were mounted according to the manufacturer's instructions and connected with conductors of the highest cross-sectional area.

For this test a PV<sub>4</sub> source with

- I<sub>SCPV</sub>
- 10 A

was used to check the different operating conditions.

Upon agreement by the manufacturer, the PV<sub>4</sub> source was realised by using a linear DC source with the following prospective short-circuit currents:

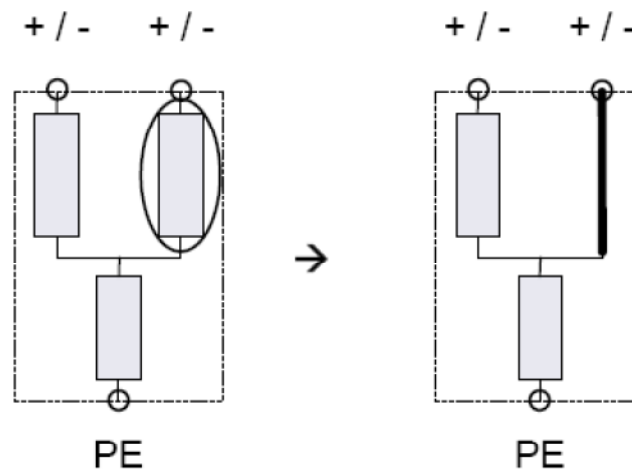
- for I<sub>SCPV</sub>: I<sub>P</sub> = 255 A (0/+5 %)
- for 10 A: I<sub>P</sub> = 24 A (0/+5 %)

to cover the requirements of the PV<sub>4</sub> source

#### Preparation of the test samples:

All voltage limiting components of one of the two current branches connected to + and - and/or - to PE and/or + to PE were prepared as described below, with separate batches of three samples for each test.

The voltage-limiting components were replaced by appropriate copper blocks (dummies). See figure 14 a) of the standard, given below. The internal connections and the cross-section area and surrounding material and packaging were not changed.



**Figure 14 Sample preparation for SPD overload behaviour test a) Y configuration (5.9.5 and 5.9.6)**

Performance of the tests:

The test circuits had an inductance of 100  $\mu\text{H}$  (+10%/-0) and a power source at  $U_{\text{cpv}/1,2}$  was used. The values of the test voltage including ripple remained between  $U_{\text{CPV}}$  and  $U_{\text{CPV}} - 5\%$  with a load current of 1A flowing.

The current of the source shall be interrupted by an internal or external SPD disconnectors:

- in less than 20 seconds when a prospective short circuit current of equal to  $I_{\text{SCPV}}$  is applied.
- in less than 20 min when a prospective short circuit current of 10 A is applied.

Test results:

All internal disconnectors operated within the specified time limits.

The disconnection was indicated correctly.

The tissue paper did not catch fire.

The test values are given in the table below.

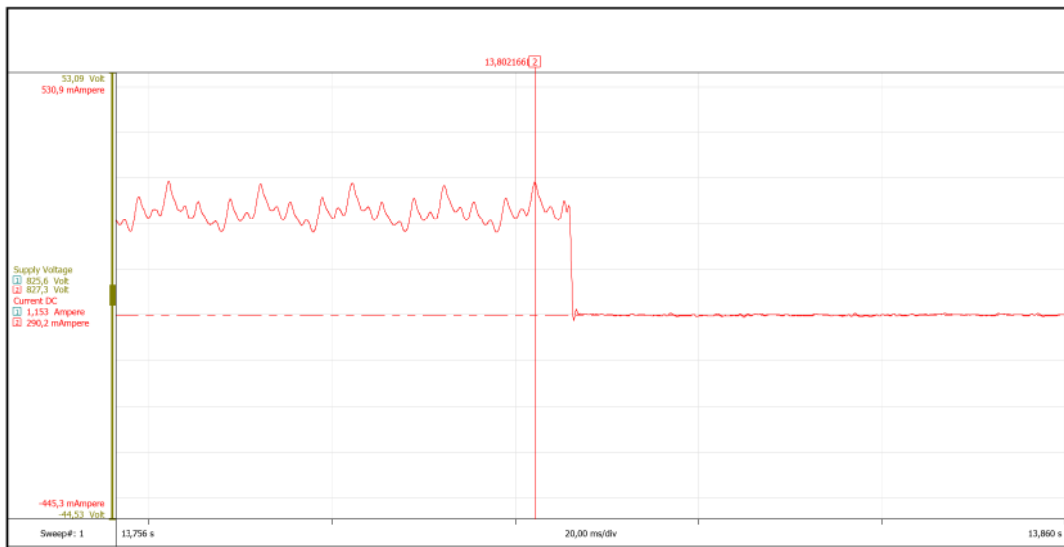
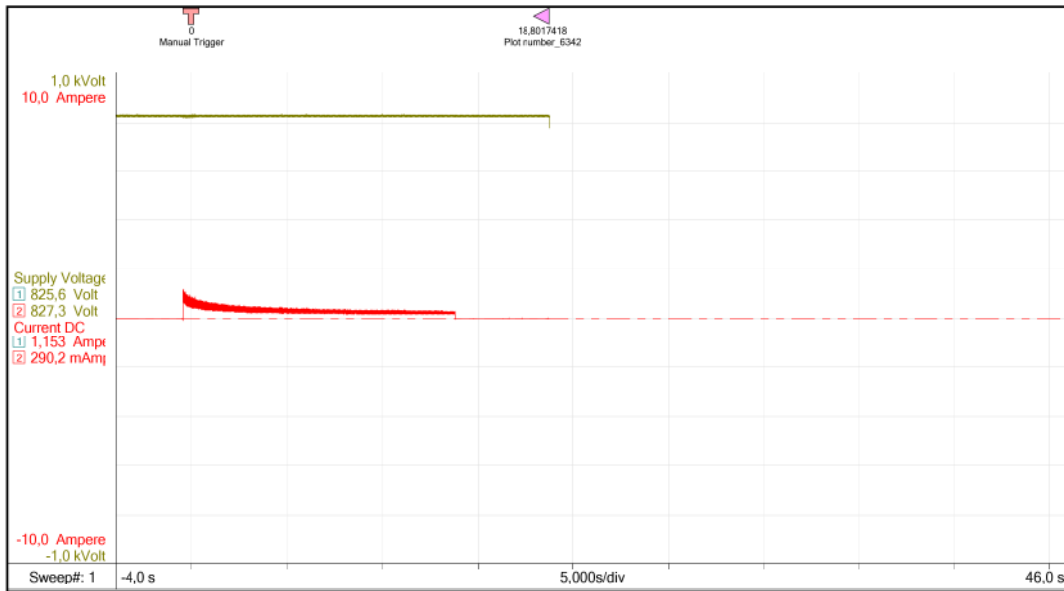
SPD type	$U_{\text{cpv}/1,2}$ [V]	Applied voltage [V]	Applied short-circuit current	
			$I_{\text{SCPV}}$ [A]	10 [A]
V20-C/3PHFS-1000	833	829	255	24

After the tests the leakage currents were measured to check effective disconnection. All measured values were below 0,05 mA.

Result: Pass.

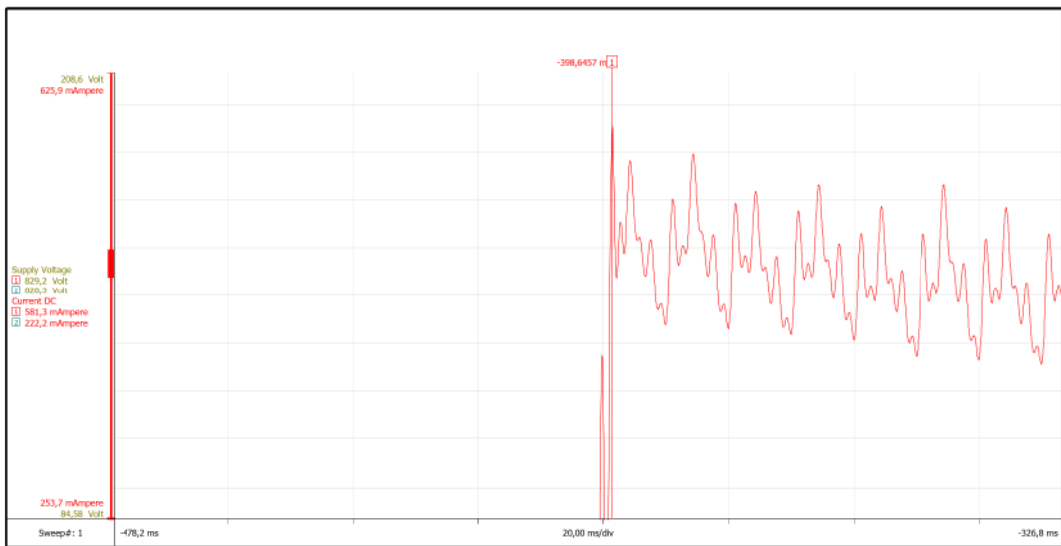
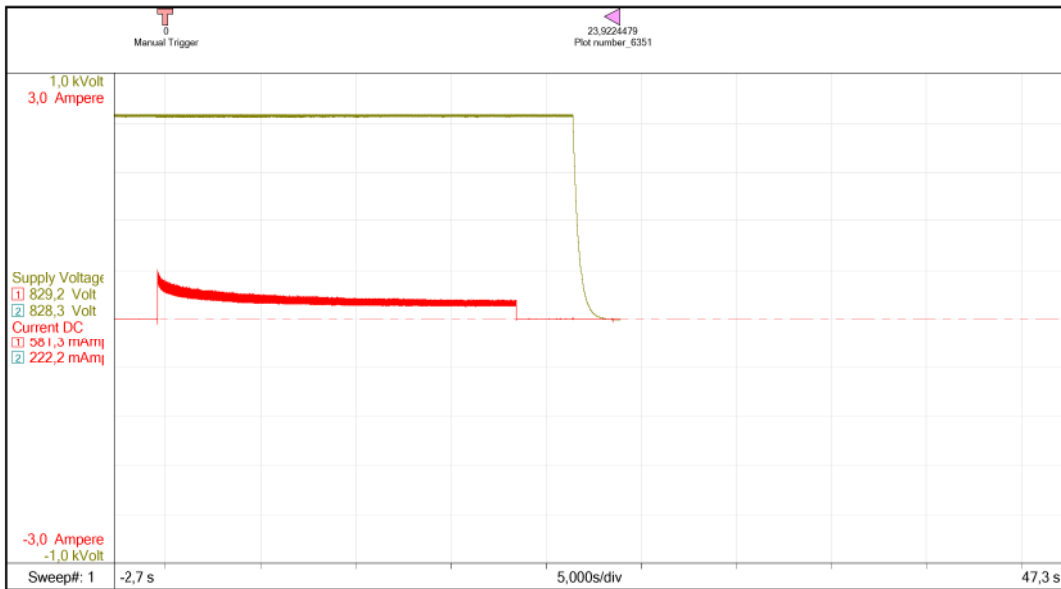
Appendix A Examples of oscillograms

Plot number\_6342  
15-5-2013 7:37:40



Measured values		
OC Voltage Vdc	CC Voltage Vdc	Current A
825,4	825,7	585,1 m
Time between cursors	Energy (I²t) A²sec	Peak current A
14,22	1,544	862,9 m

Plot number\_6351  
15-5-2013 8:31:38



Measured values		
OC Voltage Vdc	CC Voltage Vdc	Current A
829,1	829,1	370,3 m
Time between cursors	Energy (I <sup>2</sup> t) A <sup>2</sup> sec	Peak current A
18,80	995,2 m	452,2 m



Appendix B Photographs of the test setup



Appendix C Product information

V20-C/3PH-1000  
V20-C/3PHFS-1000

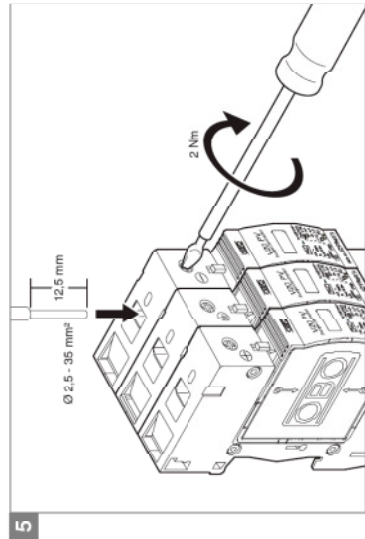
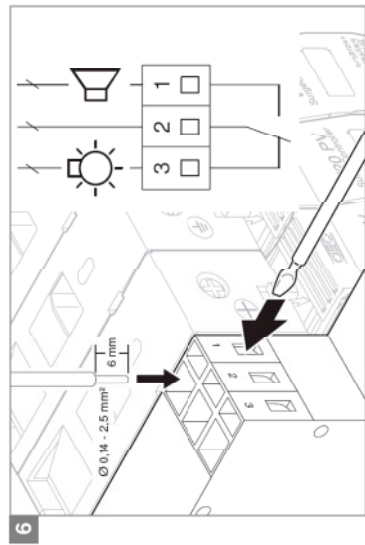
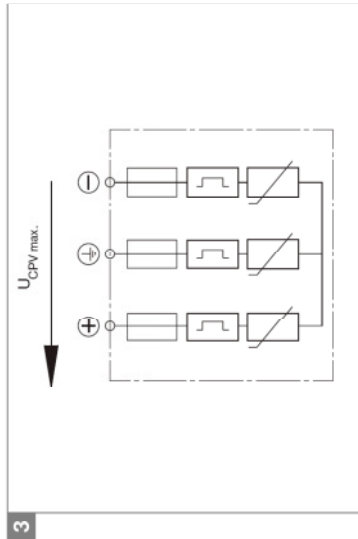
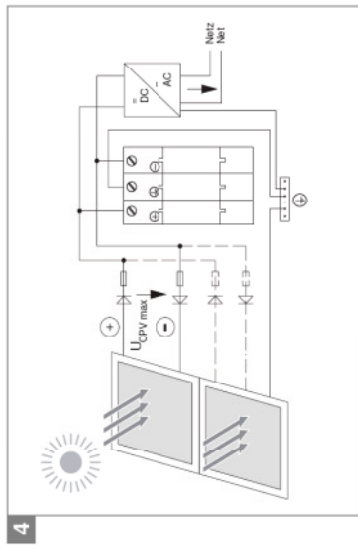
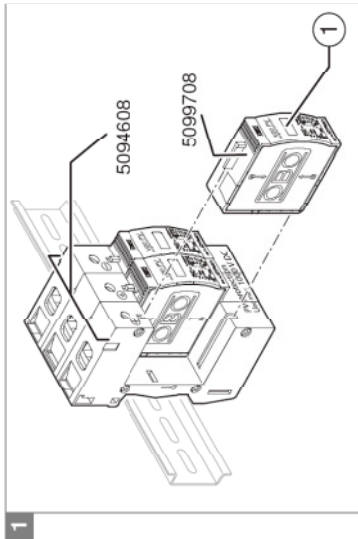
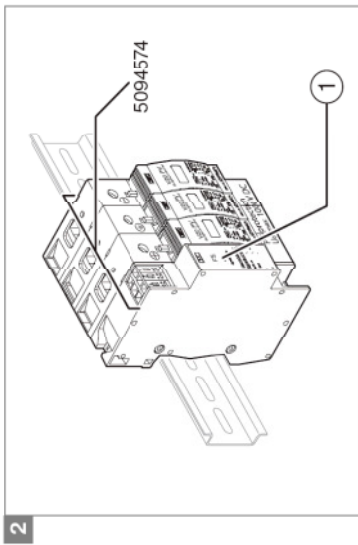
DE Überspannungs-Schutzgerät für  
Photovoltaik-DC-Systeme  
Installationsanleitung

EN Surge protective device for  
photovoltaic DC systems  
Installation instructions

OBO BETTERMANN GmbH & Co KG  
Postfach 1120  
58694 Merfelden  
Germany  
www.obo-bettermann.com

THINK CONNECTED

OPfO 120526 HAF A 495231 50 SmHd 06/2013





- Disposal**
- Packaging, as household waste
  - Protective device/arrester as electronic waste.
  - Comply with the local waste disposal regulations.

**Technical data**

Characteristic	Value
Type/Item number	V20-C3PH-1000/5094608
SPD type according to EN 61643-11	V20-C3PHFS-1000/5094574
Lighting protection zone	PV Type II
Maximum continuous voltage U <sub>cpv</sub>	1 → 2
Short-circuit resistance I <sub>scpv</sub>	1000 V DC
Protective conductor current I <sub>pe</sub> at U <sub>cpv</sub>	100 A
Continuous operating current I <sub>cpv</sub>	< 1 mA a.c. / < 0.1 mA d.c.
Protection level V <sub>p</sub>	< 0.1 mA
Nominal discharge current I <sub>n</sub>	4 kV (+/-, +PE, -PE)
Max. discharge current I <sub>max</sub>	20 kA (8/20)
Total discharge surge current I <sub>total</sub>	40 kA (8/20)
Ports	40 kA (8/20)
Error behaviour	One-Port-SPD
SPD topology	OCM (disconnection)
Application	Voltage-limiting SPD
Protection path	Insulated and earthed PV networks
Testing standard	+/-, +PE, -PE
Protection type/installation location	EN 61643-11 EN 50539-11
Visual display	IP 20/interior Green = ok Red = replace
Temperature range	-40 °C to +80 °C
Humidity	5% to 95%
Connection cross-section, I <sub>gld</sub>	2.5 - 35 mm <sup>2</sup>
Connection cross-section, multi-wire	2.5 - 35 mm <sup>2</sup>
Stripping length	2.5 - 35 mm <sup>2</sup>
Tightening torque	125 mm
Dimensions W x H x D	2 Nm
Item 5094608	90 x 54 x 61.5 mm
Item 5094574	90 x 70 x 61.5 mm
Installation position	Any
Minimum distance to other earthed components/surfaces	0 mm
Remote signalling (only 5094574)	Potential-free changeover contact
Switching function	0.14 - 25 mm <sup>2</sup>
Connection cross-section	6 mm
Stripping length	Spring terminal
Connection	250 V AC (30 V DC)
Max. operating voltage	6 A AC (1 A DC)
Max. operating current	

- EN**
- V20-C3PH-1000, V20-C3PHFS-1000

**Product description**

Surge protective device for photovoltaic DC systems with or without separate insulated lightning protection system for surge voltage equipotential bonding according to VDE 0100-443 (IEC 60364-4-44), for insulated or actively-earthed PV systems (plus or minus pole earthed). For mounting on hat rails and use in distributor housings. Arresters can be connected individually, possess a thermodynamic cut-off unit and have an arresting capacity of up to 40 kA (8/20). If there is an error, the visual display (Figure 1) switches from green to red. Internal circuit diagram, see Figure 2. With module for remote signalling through potential-free changeover contact (Figure 3).

**Target group**

The device may only be mounted and connected by an electrical technician.

**General safety information**

- Before working on power cables, ensure that they are de-energised and secure them against unintentional switch-on!
- Do not carry out mounting work during a storm!
- Comply with national laws and standards (e.g. IEC 60364-5-53; VDE 0100 Part 534)!

**Installation**

The device can be installed in any position (e.g. vertical or horizontal).

- Clamp the protective device on the hat rail.
- Connection according to the circuit diagram 4, observing the cable cross-section and the stripping length (Figure 5).

**Note:** When using overvoltage protection, we recommend including all the poles of electrical devices in the local equipotential bonding. Besides power connections (DC/AC), data and telecommunication cables also need to be included (e.g. AC-side (3L, N, PE); OBO Art. No. 5094656, Data/TC cables; OBO Art. No. 5097975).

**Faults**

If the integrated cut-off unit trips (e.g. due to age on account of multiple, very high overvoltages), the visual display (Figure 1) switches from green to red. In this case, remove the arrester and insert a new arrester (available separately, item no. 5095708). It must be assumed that the other arresters of this protective device have experienced the same load. We recommend that you check them and, if necessary, also replace them. Dispose the replaced arresters.

**Remote signalling**

Figure 3 (only V20-C3PHFS-1000): When at least one arrester is disconnected, the changeover contact in the remote signalling module switches from 2/3 to 2/1. This allows control of suitable signalling components (e.g. central error messages, light or acoustic signal).

**Maintenance**

- As shown in Figure 6, forcibly open the spring terminal with a screwdriver and insert the cable from above.

We recommend carrying out a visual check of the visual display every 2-4 years or after lightning strikes.

- EN**
- V20-C3PH-1000, V20-C3PHFS-1000

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