



BUREAU
VERITAS

شهادة مطابقة

KACO new energy GmbH
Carl-Zeiss-Straße 1
74172 Neckarsulm
ألمانيا

المتقدم:

أداة فصل تلقائي بين المولد والشبكة العامة للجهد (الفولطية) المنخفض

المنتج:

KACO blueplanet 50.0 TL3 M1 WM OD IIGM
KACO blueplanet 50.0 TL3 M1 WM OD IIGB
KACO blueplanet 50.0 TL3 M1 WM OD IIGX
KACO blueplanet 50.0 TL3 M1 WM OD FRGX

نموذج:

الاستخدام طبقا للوائح:

الإشراف على موصلات أداة فصل أوتوماتيكي ثلاثية الأوجه طبقا للمعيار
للنظم الكهروضوئية للاقتزان على التوازي, DIN V VDE V 0126-1-1:2006-02, Engineering Recommendation G59/3:2013, طبقا للمعيار
ثلاثي الأوجه بواسطة عاكس للقدرة في إمداد الموصلات العامة. تعد أداة الفصل التلقائي جزءا تكامليا من عاكس التيار المذكور أعلاه. ويعمل هذا كبديل
لأداة الفصل ذات خاصية العزل التي يمكن لموفر شبكة التوزيع أن يصل إليها في أي وقت.

القواعد والمعايير المطبقة:

Engineering Recommendation G59/3:2013

Recommendation for the Connection of Generating Plant to the Distribution Systems of licensed Distribution Network Operators.

DIN V VDE V 0126-1-1 (VDE V 0126-1-1):2006-02

Automatic disconnection device between a generator and the public low-voltage grid

IEC 62116:2014

Test procedure of islanding prevention measures for utility-interconnected photovoltaic inverters

KACO blueplanet 50.0 TL3 M1 WM OD IIGM, KACO blueplanet 50.0 TL3 M1 WM OD IIGB, KACO
blueplanet 50.0 TL3 M1 WM OD FRGX يتم تصنيف KACO blueplanet 50.0 TL3 M1 WM OD IIGX لكل A16 < مرحلة و > KW50. وتم التحقق من القيم الافتراضية ل " محطات الطاقة الصغيرة " على الشبكة ذات الجهد المنخفض .

يتطابق مفهوم السلامة للمنتج المقدم أعلاه وقت إصدار هذه الشهادة مع مواصفات السلامة السارية للاستخدام المحدد طبقا للوائح.

15TH0250-G59/3_1

رقم التقرير:

U17-0471

رقم الشهادة:

2017-09-07

تاريخ الإصدار:



Certification body

Holger Schäffer

Certification body of Bureau Veritas Consumer Products Services Germany GmbH
Accredited according to DIN EN ISO/IEC 17065

Appendix 13.1 Type Testing a Generating Unit
 Extract from test report according the Engineering Recommendation G59/3 Nr. 15TH0250

Type Approval and declaration of compliance with the requirements of Engineering Recommendation G59/3.	
Manufacturer / applicant:	KACO new energy GmbH Carl-Zeiss-Straße 1 74172 Neckarsulm Germany
Generating Unit technology	Grid-tied photovoltaic inverter
Rated values	KACO blueplanet 50.0 TL3 M1 WM OD IIGM KACO blueplanet 50.0 TL3 M1 WM OD IIGB KACO blueplanet 50.0 TL3 M1 WM OD IIGX KACO blueplanet 50.0 TL3 M1 WM OD FRGX
Maximum rated capacity	50 kW
Rated voltage	400 V _{AC} (P-P) / 230 V _{AC} (3/PEN), 42-68 Hz
Firmware version	PKT: V4.09; ARM: V5.08; CFG: V6.0572; DSP-AC: V4.09, DSP-DC: V4.02
* The tests were performed with Firmwareversion V4.09. Changes in the Firmwareversion on position V4.x have no effect on the required electrical properties. x = could be any number or sign	
Measurement period:	2017-09-04 to 2017-09-08

Description of the structure of the power generation unit (Figure 1):
 The input and output are protected by varistors to earth. The unit is providing EMC filtering at the output toward mains. The unit does not provide galvanic separation from input to output (transformer-less). The output is switched off redundant by the high power switching bridge and two relays in series. This assures that the opening of the output circuit will also operate in case of one error.

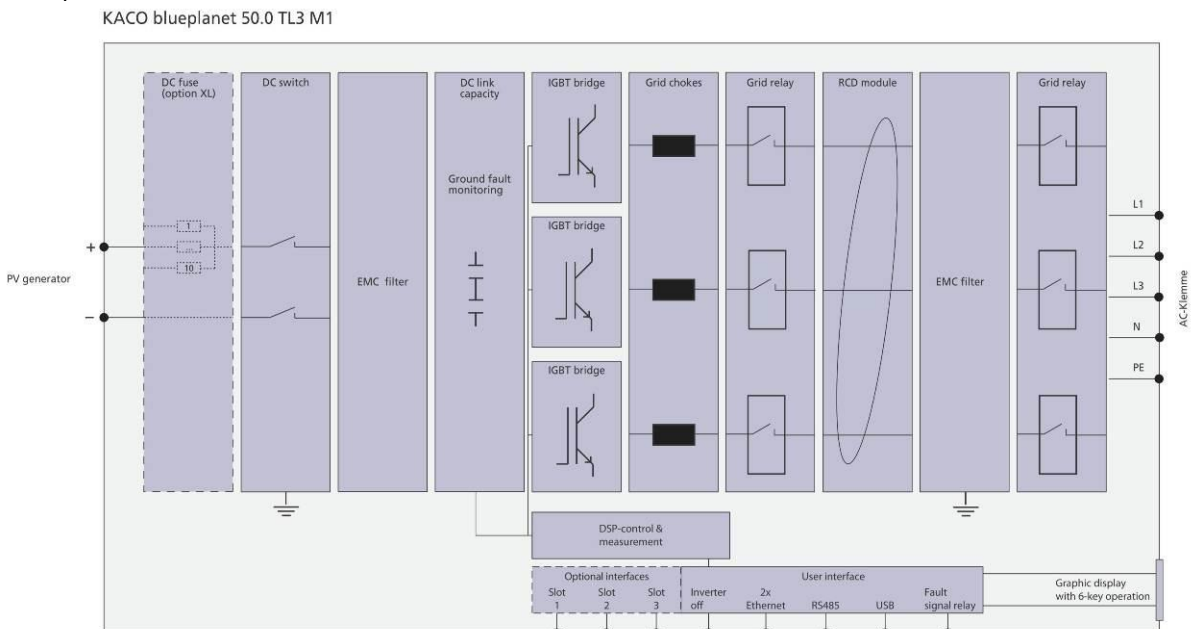


Figure 1 – Schematic structure of the power generation unit

The above stated Generating Units are tested according the requirements in the Engineering Recommendation G59/3. Any modification that affects the stated tests must be named by the manufacturer/supplier of the product to ensure that the product meets all requirements of the Engineering Recommendation G59/3.

Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3

Nr. 15TH0250

Protection. Voltage tests.						
Phase 1						
Function	Setting		Trip test		No trip test	
	Voltage	Time delay	Voltage	Time delay	Voltage / time	Confirm no trip
U/V stage 1	200,1V	2,5s	200,3V	2,5551s	204,1V / 3,5s	No trip
U/V stage 2	184V	0,5s	184,3V	0,5559s	188V / 2,48s	No trip
					180V / 0,48s	No trip
O/V stage 1	262,2V	1,0s	261,8V	1,0561s	258,2V 2,0s	No trip
O/V stage 2	273,7V	0,5s	272,7V	0,6564s	269,7V 0,98s	No trip
					277,7V 0,48s	No trip

Protection. Voltage tests.						
Phase 2						
Function	Setting		Trip test		No trip test	
	Voltage	Time delay	Voltage	Time delay	Voltage / time	Confirm no trip
U/V stage 1	200,1V	2,5s	200,0V	2,5594	204,1V / 3,5s	No trip
U/V stage 2	184V	0,5s	184,4V	0,5589s	188V / 2,48s	No trip
					180V / 0,48s	No trip
O/V stage 1	262,2V	1,0s	262,7V	2,5589s	258,2V 2,0s	No trip
O/V stage 2	273,7V	0,5s	272,6V	0,5593s	269,7V 0,98s	No trip
					277,7V 0,48s	No trip

Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3

Nr. 15TH0250

Protection. Voltage tests.						
Phase 3						
Function	Setting		Trip test		No trip test	
	Voltage	Time delay	Voltage	Time delay	Voltage / time	Confirm no trip
U/V stage 1	200,1V	2,5s	200,2V	2,5516s	204,1V / 3,5s	No trip
U/V stage 2	184V	0,5s	184,3V	0,5518s	188V / 2,48s	No trip
					180V / 0,48s	No trip
O/V stage 1	262,2V	1,0s	262,7V	2,5521s	258,2V 2,0s	No trip
O/V stage 2	273,7V	0,5s	272,5V	0,5515s	269,7V 0,98s	No trip
					277,7V 0,48s	No trip
<p>Note. For Voltage tests the Voltage required to trip is the setting $\pm 3,45V$. The time delay can be measured at a larger deviation than the minimum required to operate the protection. The No trip tests need to be carried out at the setting $\pm 4V$ and for the relevant times as shown in the table above to ensure that the protection will not trip in error.</p>						

Protection. Frequency tests.						
Function	Setting		Trip test		No trip test	
	Frequency	Time delay	Frequency	Time delay	Frequency / time	Confirm no trip
U/F stage 1	47,5Hz	20s	47,49Hz	20,085s	47,7Hz / 25s	No trip
U/F stage 2	47Hz	0,5s	46,99Hz	0,582s	47,2Hz / 19,98s	No trip
					46,8Hz / 0,48s	No trip
O/F stage 1	51,5Hz	90s	51,51Hz	90,07s	51,3Hz / 95s	No trip
O/F stage 2	52Hz	0,5s	52,00Hz	0,575s	51,8Hz / 89,98s	No trip
					52,2Hz / 0,48s	No trip
<p>Note. For Frequency Trip tests the Frequency required to trip is the setting $\pm 0,1Hz$. In order to measure the time delay a larger deviation than the minimum required to operate the projection can be used. The "No-trip tests" need to be carried out at the setting $\pm 0,2Hz$ and for the relevant times as shown in the table above to ensure that the protection will not trip in error.</p>						

Appendix 13.1 Type Testing a Generating Unit

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Nr. 15TH0250

Protection. Loss of Mains.

Note as an alternative, inverters can be tested to BS EN 62116. The following sub set of tests should be recorded in the following table.

Balancing load on islanded network	33% of -5% Q Test 22	66% of -5% Q Test 12	100% of -5% P Test 5	33% of +5% Q Test 31	66% of +5% Q Test 21	100% of +5% P Test 10
Trip time	211,6	210,3	601,6	235,5	229,9	363,4

Note for technologies which have a substantial shut down time this can be added to the 0,5 seconds in establishing that the trip occurred in less than 0,5s. Maximum shut down time could therefore be up to 1,0 seconds for these technologies.

Indicate additional shut down time included in above results.
(Integrated interface switch)

Type of switching equipment 1:
Finder 67.23 with 35ms
Type of switching equipment 2:
Finder 67.23 with 35ms

Note. All relays are direct coupled and open directly by receiving the islanding signal from the controller. Therefore the measured disconnection time on all phase is valid for three phases of the inverter.

Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3

Nr. 15TH0250

Protection. Re-connection timer.					
Test should prove that the reconnection sequence starts in no less than 20 seconds for restoration of voltage and frequency to within the stage 1 settings of table 10.5.7.1.					
Voltage					
Time delay setting		Measured delay			
20s		81,0s			
Frequency					
Time delay setting		Measured delay			
20s		77,0s			
		Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 1.			
		At 266,2V	At 196,1V	At 47,4Hz	At 51,6Hz
Confirmation that the Generating Unit does not re-connect.	No reconnection	No reconnection	No reconnection	No reconnection	

Protection. Frequency change, Stability test.				
	Start Frequency	Change	End Frequency	Confirm no trip
Positive Vector Shift	49,5Hz	+9 degrees		No trip
Negative Vector Shift	50,5Hz	- 9 degrees		No trip
Positive Frequency drift	49,5Hz	+0,19Hz/sec	51,5Hz	No trip
Negative Frequency drift	50,5Hz	-0,19Hz/sec	47,5Hz	No trip

Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3

Nr. 15TH0250

Power Quality. Harmonics.						
Phase 1						
Generating Unit tested to BS EN 61000-3-12						
Generating Unit rating per phase (rpp)						
	At 45-55% of rated output 25 kW		100% of rated output 50 kW			
Harmonic	Measured Value (MV) in Amps	Measured Value (MV) in %	Measured Value (MV) in Amps	Measured Value (MV) in %	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,162	0,223	0,270	0,370	8%	8%
3rd	0,151	0,207	0,112	0,154	21,6%	N/A
4th	0,089	0,122	0,101	0,139	4%	4%
5th	0,345	0,474	0,373	0,511	10,7%	10,7%
6th	0,044	0,060	0,064	0,088	2,67%	2,67%
7th	0,271	0,372	0,270	0,370	7,2%	7,2%
8th	0,026	0,036	0,039	0,054	2%	2%
9th	0,050	0,068	0,051	0,070	3,8%	N/A
10th	0,022	0,030	0,034	0,047	1,6%	1,6%
11th	0,201	0,276	0,185	0,254	3,1%	3,1%
12th	0,028	0,039	0,041	0,056	1,33%	1,33%
13th	0,195	0,267	0,187	0,257	2%	2%
14th	0,027	0,037	0,031	0,042	N/A	N/A
15th	0,028	0,038	0,034	0,047	N/A	N/A
16th	0,025	0,034	0,029	0,040	N/A	N/A
17th	0,180	0,247	0,147	0,202	N/A	N/A
18th	0,026	0,035	0,035	0,048	N/A	N/A
19th	0,201	0,276	0,171	0,235	N/A	N/A
20th	0,031	0,043	0,036	0,049	N/A	N/A
21th	0,030	0,042	0,037	0,051	N/A	N/A
22th	0,031	0,042	0,034	0,047	N/A	N/A
23th	0,208	0,286	0,146	0,201	N/A	N/A
24th	0,026	0,036	0,035	0,048	N/A	N/A
25th	0,220	0,302	0,170	0,233	N/A	N/A
26th	0,036	0,049	0,040	0,055	N/A	N/A
27th	0,035	0,048	0,046	0,063	N/A	N/A
28th	0,034	0,046	0,040	0,054	N/A	N/A
29th	0,230	0,316	0,158	0,217	N/A	N/A
30th	0,028	0,038	0,034	0,047	N/A	N/A
31th	0,231	0,317	0,147	0,201	N/A	N/A
32th	0,033	0,045	0,038	0,052	N/A	N/A
33th	0,032	0,044	0,043	0,059	N/A	N/A
34th	0,027	0,037	0,034	0,047	N/A	N/A
35th	0,194	0,267	0,112	0,154	N/A	N/A
36th	0,023	0,032	0,024	0,033	N/A	N/A
37th	0,160	0,220	0,089	0,123	N/A	N/A
38th	0,019	0,027	0,023	0,032	N/A	N/A
39th	0,021	0,029	0,029	0,040	N/A	N/A
40th	0,015	0,020	0,020	0,027	N/A	N/A
THD ₄₀	2,28%		1,04%		23%	13%
PWHD	0,048%		0,006%		23%	22%

Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3

Nr. 15TH0250

Power Quality. Harmonics.						
Phase 2						
Generating Unit tested to BS EN 61000-3-12						
Generating Unit rating per phase (rpp)						
	At 45-55% of rated output 25 kW		100% of rated output 50 kW			
Harmonic	Measured Value (MV) in Amps	Measured Value (MV) in %	Measured Value (MV) in Amps	Measured Value (MV) in %	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,162	0,222	0,256	0,351	8%	8%
3rd	0,066	0,091	0,109	0,149	21,6%	N/A
4th	0,086	0,118	0,089	0,122	4%	4%
5th	0,336	0,461	0,365	0,499	10,7%	10,7%
6th	0,028	0,038	0,043	0,059	2,67%	2,67%
7th	0,241	0,330	0,239	0,328	7,2%	7,2%
8th	0,027	0,037	0,038	0,052	2%	2%
9th	0,040	0,055	0,051	0,070	3,8%	N/A
10th	0,022	0,031	0,033	0,045	1,6%	1,6%
11th	0,201	0,275	0,197	0,270	3,1%	3,1%
12th	0,021	0,029	0,023	0,031	1,33%	1,33%
13th	0,199	0,272	0,172	0,236	2%	2%
14th	0,023	0,031	0,029	0,040	N/A	N/A
15th	0,023	0,031	0,034	0,047	N/A	N/A
16th	0,019	0,026	0,028	0,039	N/A	N/A
17th	0,188	0,257	0,160	0,219	N/A	N/A
18th	0,030	0,041	0,027	0,036	N/A	N/A
19th	0,200	0,274	0,158	0,217	N/A	N/A
20th	0,024	0,033	0,031	0,043	N/A	N/A
21th	0,025	0,034	0,038	0,052	N/A	N/A
22th	0,023	0,031	0,030	0,041	N/A	N/A
23th	0,220	0,302	0,166	0,228	N/A	N/A
24th	0,038	0,052	0,037	0,051	N/A	N/A
25th	0,231	0,316	0,167	0,229	N/A	N/A
26th	0,027	0,037	0,035	0,048	N/A	N/A
27th	0,028	0,038	0,044	0,060	N/A	N/A
28th	0,029	0,040	0,034	0,047	N/A	N/A
29th	0,263	0,360	0,182	0,249	N/A	N/A
30th	0,039	0,054	0,039	0,054	N/A	N/A
31th	0,245	0,336	0,157	0,215	N/A	N/A
32th	0,026	0,036	0,030	0,041	N/A	N/A
33th	0,025	0,035	0,041	0,056	N/A	N/A
34th	0,025	0,034	0,027	0,037	N/A	N/A
35th	0,210	0,288	0,124	0,170	N/A	N/A
36th	0,027	0,037	0,027	0,036	N/A	N/A
37th	0,177	0,243	0,100	0,137	N/A	N/A
38th	0,018	0,024	0,020	0,027	N/A	N/A
39th	0,018	0,024	0,028	0,039	N/A	N/A
40th	0,015	0,020	0,017	0,023	N/A	N/A
THD ₄₀	2,28%		1,03%		23%	13%
PWHD	0,055%		0,007%		23%	22%

Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3

Nr. 15TH0250

Power Quality. Harmonics.						
Phase 3						
Generating Unit tested to BS EN 61000-3-12						
Generating Unit rating per phase (rpp)						
	At 45-55% of rated output 25 kW		100% of rated output 50 kW			
Harmonic	Measured Value (MV) in Amps	Measured Value (MV) in %	Measured Value (MV) in Amps	Measured Value (MV) in %	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,270	0,370	0,162	0,223	8%	8%
3rd	0,112	0,154	0,151	0,207	21,6%	N/A
4th	0,101	0,139	0,089	0,122	4%	4%
5th	0,373	0,511	0,345	0,474	10,7%	10,7%
6th	0,064	0,088	0,044	0,060	2,67%	2,67%
7th	0,270	0,370	0,271	0,372	7,2%	7,2%
8th	0,039	0,054	0,026	0,036	2%	2%
9th	0,051	0,070	0,050	0,068	3,8%	N/A
10th	0,034	0,047	0,022	0,030	1,6%	1,6%
11th	0,185	0,254	0,201	0,276	3,1%	3,1%
12th	0,041	0,056	0,028	0,039	1,33%	1,33%
13th	0,187	0,257	0,195	0,267	2%	2%
14th	0,031	0,042	0,027	0,037	N/A	N/A
15th	0,034	0,047	0,028	0,038	N/A	N/A
16th	0,029	0,040	0,025	0,034	N/A	N/A
17th	0,147	0,202	0,180	0,247	N/A	N/A
18th	0,035	0,048	0,026	0,035	N/A	N/A
19th	0,171	0,235	0,201	0,276	N/A	N/A
20th	0,036	0,049	0,031	0,043	N/A	N/A
21th	0,037	0,051	0,030	0,042	N/A	N/A
22th	0,034	0,047	0,031	0,042	N/A	N/A
23th	0,146	0,201	0,208	0,286	N/A	N/A
24th	0,035	0,048	0,026	0,036	N/A	N/A
25th	0,170	0,233	0,220	0,302	N/A	N/A
26th	0,040	0,055	0,036	0,049	N/A	N/A
27th	0,046	0,063	0,035	0,048	N/A	N/A
28th	0,040	0,054	0,034	0,046	N/A	N/A
29th	0,158	0,217	0,230	0,316	N/A	N/A
30th	0,034	0,047	0,028	0,038	N/A	N/A
31th	0,147	0,201	0,231	0,317	N/A	N/A
32th	0,038	0,052	0,033	0,045	N/A	N/A
33th	0,043	0,059	0,032	0,044	N/A	N/A
34th	0,034	0,047	0,027	0,037	N/A	N/A
35th	0,112	0,154	0,194	0,267	N/A	N/A
36th	0,024	0,033	0,023	0,032	N/A	N/A
37th	0,089	0,123	0,160	0,220	N/A	N/A
38th	0,023	0,032	0,019	0,027	N/A	N/A
39th	0,029	0,040	0,021	0,029	N/A	N/A
40th	0,020	0,027	0,015	0,020	N/A	N/A
THD ₄₀	2,28%		1,04%		23%	13%
PWHD	0,048%		0,006%		23%	22%

Appendix 13.1 Type Testing a Generating Unit

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Nr. 15TH0250

Power Quality. Power factor.				
	216,2V	230V	253V	Measured at three voltage levels and at full output. Voltage to be maintained within $\pm 1.5\%$ of the stated level during the test.
Measured value	0,999	0,999	0,999	
Limit	>0,95	>0,95	>0,95	

Power Quality. Voltage fluctuation and Flicker.								
	Starting			Stopping			Running	
	dmax	dc	d(t)	dmax	dc	d(t)	Pst	Plt 2 hours
Measured values at test impedance	0,33%	3,3%	0,0%	0,33%	3,3%	0,0%	0,086	0,086
Limits set under BS EN 61000-3-11	4%	3,3%	3,3% 500ms	4%	3,3%	3,3% 500ms	1,0	0,65
Standard impedance	R	0,24* 0,4^	Ω	XI	0,15* 0,25^	Ω		

Power Quality. DC injection.			
Test level power	10%	55%	100%
Recorded value	59,15 mA	71,52 mA	29,74 mA
As % of rated AC current	0,08 %	0,10%	0,04%
Limit	0,25%	0,25%	0,25%

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Extract from test report according the Engineering Recommendation G59/3

Nr. 15TH0250

Fault level Contribution.					
For a directly coupled SSEG			For a Inverter SSEG		
Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	I_p	N/A	20ms	46,9	94,6
Initial Value of aperiodic current	A	N/A	100ms	47,0	96,8
Initial symmetrical short-circuit current*	I_k	N/A	250ms	47,2	96,7
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	47,1	96,4
Reactance/Resistance Ratio of source*	X/R	N/A	Time to trip	0,555	In seconds

For rotating machines and linear piston machines the test should produce a 0s – 2s plot of the short circuit current as seen at the Generating Unit terminals.

* Values for these parameters should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot.

Self Monitoring – Solid state switching.	N/A
It has been verified that in the event of the solid state switching device failing to disconnect the Generating Unit, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0,5 seconds.	
Note. Unit do not provide solid state switching relays. In case the semiconductor bridge is switched off, then the voltage on the output drops to 0. In this case the relays on the output will also open.	