



**BUREAU
VERITAS**

Certificate of compliance

Applicant: SMA Solar Technology AG
Sonnenallee 1
34266 Niestetal
Germany

Product: Battery storage inverter

Model: SBS5.0-10
SBS6.0-10

Use in accordance with regulations:

Automatic disconnection device with single-phase mains surveillance in accordance with Engineering Recommendation G99/1 for photovoltaic systems with a single-phase parallel coupling via an inverter in the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter. This serves as a replacement for the disconnection device with isolating function, which can be accessed the distribution network provider at any time.

Applied rules and standards:

Engineering Recommendation G99/1-8:2021

Requirements for the connection of generation equipment in parallel with public distribution networks

DIN V VDE V 0126-1-1:2006-02 (4.1 Functional safety)

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

At the time of issue of this certificate the safety concept of an aforementioned representative product corresponds to the valid safety specifications for the specified use in accordance with regulations.

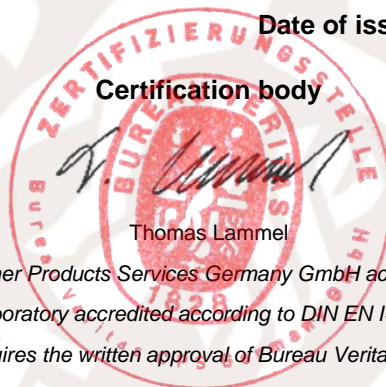
Report number: 17TH0338-G99-1-8_0

Certification program: NSOP-0032-DEU-ZE-V01

Certificate number: U22-0111

Date of issue: 2022-02-21

Certification body



Thomas Lammel



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

Testing laboratory accredited according to DIN EN ISO/IEC 17025

A partial representation of the certificate requires the written approval of Bureau Veritas Consumer Products Services Germany GmbH



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Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99

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Type Approval and declaration of compliance with the requirements of Engineering Recommendation G99.

PGM Technology:	Battery storage inverter		
Manufacturer / applicant:	SMA Solar Technology AG		
Address:	Sonnenallee 1 34266 Niestetal Germany		
Tel	+49 561 9522-0	Fax:	+49 561 9522-100
Email:	info@SMA.de	Website:	www.SMA.de

Rated values	SBS5.0-10	SBS6.0-10	--	--
MPP DC voltage range [V]	100 - 500	100 - 500	--	--
Input DC voltage range [V]	max. 600	max. 600	--	--
Input DC current [A]	3 x 10	3 x 10	--	--
Output AC voltage [V]	220/230/240 N/PE @50Hz/60Hz	220/230/240 N/PE @50Hz/60Hz	--	--
Output AC current [A]	21,7	26	--	--
Output power [VA]	5000	6000	--	--
Battery DC voltage range [V]	100 - 550	100 - 550	--	--
Battery charge current [A]	10	10	--	--
Battery discharge current [A]	10	10	--	--

Firmware version	03.12.21.R or higher
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Description of the structure of the power generation unit:

The power generation unit is equipped with a PV and line-side EMC filter. The power generation unit has no galvanic isolation between DC input and AC output. Output switch-off is performed with single-fault tolerance based on two series-connected relays in line and neutral. This enables a safe disconnection of the power generation unit from the network in case of error.

The above stated Generating Units are tested according the requirements in the Engineering Recommendation G99/1. 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 G99/1.



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Operating Range.	
Test 1	Voltage = 85% of nominal (195,5 V) Frequency = 47,0 Hz Power Factor = 1 Period of test 20 seconds
Connection:	Always connected
Limit:	Always connected
Test 2	Voltage = 85% of nominal (195,5 V) Frequency = 47,5Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit:	Always connected
Test 3	Voltage = 110% of nominal (253,0 V) Frequency = 51,5Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit:	Always connected
Test 4	Voltage = 110% of nominal (253,0 V) Frequency = 52,0Hz Power Factor = 1 Period of test 15 minutes
Connection:	Always connected
Limit:	Always connected
Test 5	Voltage = 100% of nominal (230,0 V) Frequency = 50,0 Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit:	Always connected
Test 6 RoCof withstand	Confirm that the Power Generating Module is capable of staying connected to the Distribution Network and operate at rates of change of frequency up to 1 Hzs-1 as measured over a period of 500 ms.
Connection:	Always connected
Limit:	Always connected



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Protection. Voltage tests.

Function	Setting		Trip test		No trip test	
	Voltage [V]	Time delay [s]	Voltage [V]	Time delay [s]	Voltage / time	Confirm no trip
U/V stage 1	184,0	2,5	185,9	2,517	188,0 V / 5,00 s	No trip
					180,0 V / 2,45 s	No trip
O/V stage 1	262,2	1,0	262,9	1,026	258,2 V / 5,00 s	No trip
O/V stage 2	273,7	0,5	274,4	0,526	269,7 V / 0,95 s	No trip
					277,7 V / 0,45 s	No trip

Note:

For Voltage tests the Voltage required to trip is the setting $\pm 3,45$ V. 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 ± 4 V and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

Protection. Frequency tests.

Function	Setting		Trip test		No trip test	
	Frequency [Hz]	Time delay [s]	Frequency [Hz]	Time delay [s]	Frequency / time	Confirm no trip
U/F stage 1	47,5	20,0	47,45	20,100	47,7 Hz / 30,00 s	No trip
U/F stage 2	47,0	0,5	46,95	0,586	47,2 Hz / 19,50 s	No trip
					46,8 Hz / 0,45 s	No trip
O/F stage 2	52,0	0,5	52,00	0,579	51,8 Hz / 120,00 s	No trip
					52,2 Hz / 0,45 s	No trip

Note:

For Frequency Trip tests the Frequency required to trip is the setting $\pm 0,1$ Hz. 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 $\pm 0,2$ Hz and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

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Protection. Loss of Mains.

Inverters tested according to BS EN 62116.

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. Ph1 fuse removed [s]	0,375	0,372	0,399	0,391	0,388	0,389

Note:

Trip time limit is 0,5 s.

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 10.1.

Over Voltage (266,2 V)

Time delay setting [s]	Measured delay [s]
20	35,14

Under Voltage (182,0 V)

Time delay setting [s]	Measured delay [s]
20	34,97

Over Frequency (52,1 Hz)

Time delay setting [s]	Measured delay [s]
20	33,99

Under Frequency (47,4 Hz)

Time delay setting [s]	Measured delay [s]
20	28,59

Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 1.

	At 266,2 V	At 180,0 V	At 47,4 Hz	At 52,1 Hz
Confirmation that the Generating Unit does not re-connect.	No reconnection	No reconnection	No reconnection	No reconnection



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Protection. Frequency change, Stability test.

	Start Frequency [Hz]	Change	Test Duration	Confirm no trip
Positive Vector Shift	49,5	+50 degrees		No trip
Negative Vector Shift	50,5	-50 degrees		No trip
Positive Frequency drift	49,0 to 51,0	+0,95 Hz/sec	2,1 s	No trip
Negative Frequency drift	51,0 to 49,0	-0,95 Hz/sec	2,1 s	No trip

Limited Frequency Sensitive Mode – Over Frequency

1-min mean value [Hz]:	a) 50,00	b) 50,45	c) 50,70	d) 51,15	e) 50,70	f) 50,45	g) 50,00
1. Measurement a) to g): Active power output > 80% P _n							
Frequency [Hz]:	50,00	50,45	50,70	51,15	50,70	50,45	50,00
P _{expected} [W]:	N/A	5808	5507	4969	5507	5807	5868
P _{measured} [W]:	5965	5851	5553	5018	5559	5857	5971
2. Measurement a) to g): Active power output 40% and 60% P _n							
Frequency [Hz]:	50,00	50,45	50,70	51,15	50,70	50,45	50,00
P _{expected} [W]:	N/A	2980	2681	2142	2681	2980	6000
P _{measured} [W]:	3033	2965	2667	2131	2673	2971	5970

Output Power with falling Frequency

Frequency setpoint [Hz]:	50,00	49,50	49,00	48,00	47,60	47,10
Frequency [Hz]:	50,00	49,50	49,00	48,00	47,60	47,10
Active power [W]:	5968	5974	5974	5975	5975	5465
ΔP/P _{max} [%]:		-0,4	-0,4	-0,4	-0,4	-8,9

Note:

Electronic inverter no power reduction take place.

Active power feed-in at under-frequency for electricity storage

Note:

Self-declaration provided by the manufacture



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Annex to the G99/1 certificate of compliance No. U22-0111

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Power Quality. Harmonics.

SBS6.0-10

Generating Unit rating per phase (rpp)						
	At 45-55% of rated output 3042 W		100% of rated output 5860 W			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,0300	0,227	0,0330	0,130	8%	8%
3rd	0,2500	1,894	0,6410	2,516	21,6%	--
4th	0,0250	0,189	0,0350	0,137	4%	4%
5th	0,1610	1,220	0,4070	1,597	10,7%	10,7%
6th	0,0230	0,174	0,0260	0,102	2,67%	2,67%
7th	0,0800	0,606	0,3090	1,213	7,2%	7,2%
8th	0,0230	0,174	0,0250	0,098	2%	2%
9th	0,0660	0,500	0,1150	0,451	3,8%	--
10th	0,0200	0,151	0,0210	0,082	1,6%	1,6%
11th	0,0700	0,530	0,0800	0,314	3,1%	3,1%
12th	0,0180	0,136	0,0190	0,075	1,33%	1,33%
13th	0,0620	0,470	0,0690	0,271	2%	2%
14th	0,0160	0,121	0,0170	0,067	--	--
15th	0,0530	0,401	0,1050	0,412	--	--
16th	0,0150	0,114	0,0140	0,055	--	--
17th	0,0450	0,341	0,0600	0,235	--	--
18th	0,0160	0,121	0,0130	0,051	--	--
19th	0,0400	0,303	0,0720	0,283	--	--
20th	0,0140	0,106	0,0130	0,051	--	--
21th	0,0320	0,242	0,0580	0,228	--	--
22th	0,0130	0,098	0,0140	0,055	--	--
23th	0,0300	0,227	0,0700	0,275	--	--
24th	0,0110	0,083	0,0110	0,043	--	--
25th	0,0290	0,220	0,0550	0,216	--	--
26th	0,0130	0,098	0,0110	0,043	--	--
27th	0,0240	0,182	0,0570	0,224	--	--
28th	0,0100	0,076	0,0100	0,039	--	--
29th	0,0240	0,182	0,0520	0,204	--	--
30th	0,0090	0,068	0,0090	0,035	--	--
31th	0,0230	0,174	0,0510	0,200	--	--
32th	0,0100	0,076	0,0100	0,039	--	--
33th	0,0210	0,159	0,0470	0,184	--	--
34th	0,0080	0,061	0,0080	0,031	--	--
35th	0,0220	0,167	0,0500	0,196	--	--
36th	0,0090	0,068	0,0080	0,031	--	--
37th	0,0220	0,167	0,0450	0,177	--	--
38th	0,0090	0,068	0,0080	0,031	--	--
39th	0,0210	0,159	0,0430	0,169	--	--
40th	0,0080	0,061	0,0080	0,031	--	--
THD ₄₀ [%]	0,030		2,976		23%	13%
PWHD [%]	0,250		2,496		23%	22%



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Power Quality. Power factor.				
Output power	216,2 V	230,0 V	253,0 V	Measured at three voltage levels and at full output. Voltage to be maintained within $\pm 1,5\%$ of the stated level during the test.
20%	0,999	0,999	0,999	
50%	0,999	0,999	0,999	
75%	0,999	0,999	0,999	
100%	0,999	0,999	0,999	
Limit	>0,95	>0,95	>0,95	

Power Quality. Voltage fluctuation and Flicker.								
	Starting			Stopping			Running	
	d_{max} [%]	d_c [%]	$d_{(t)}$ [ms]	d_{max} [%]	d_c [%]	$d_{(t)}$ [ms]	P_{St}	P_{It} 2 hours
Measured values at test impedance	0,115	0,049	0,0	0,187	0,040	0,0	0,093	0,093
Measured values at standard impedance	0,153	0,065	0,0	0,249	0,053	0,0	0,124	0,124
Values for maximum impedance	0,804	0,342	0,0	1,307	0,280	0,0	0,650	0,650
Limits set under BS EN 61000-3-11	4%	3,3%	3,3% 500ms	4%	3,3%	3,3% 500ms	1,0	0,65
Test impedance	R	0,250	Ω	X_l	0,250	Ω		
	Z	0,350	Ω					
Standard impedance	R	0,400	Ω	X_l	0,250	Ω		
	Z	0,470	Ω					
Maximum impedance	R	2,100	Ω	X_l	1,310	Ω		
	Z_{max}	2,470	Ω					

Power Quality. DC injection.			
Test level power [%]	10	55	100
Recorded value [mA]	3,29	8,55	11,61
Recorded value [%]	0,02	0,05	0,07
Limit [%]	0,25	0,25	0,25



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Fault level Contribution.					
For a directly coupled SSEG			For a Inverter SSEG		
Parameter	Symbol	Value	Time after fault	Volts [V]	Amps [A]
Peak Short Circuit current	I_p	N/A	20 ms	230,5	39,4
Initial Value of aperiodic current	A	N/A	100 ms	29,0	27,4
Initial symmetrical short-circuit current*	I_k	N/A	250 ms	26,9	27,4
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500 ms	27,8	27,4
Reactance/Resistance Ratio of source*	X/R	N/A	Time to Trip [s]	2,470	

For rotating machines and linear piston machines the test should produce a 0 s – 2 s 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.	N/A
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 (Functional safety of the internal automatic disconnection device according to VDE 0126-1-1).	

Wiring functional tests if required by para. 15.2.1	N/A
Type test of components wired correct together on site is part of the commissioning test.	N/A

Logic Interface (input port)	P
Confirm that an input port is provided and can be used to shut down the module.	Yes