Certificado de conformidade

Requerente: **SMA Solar Technology AG**
Sonnenallee 1
34266 Niestetal
Alemanha

Produto: **Microgerador em paralelo com redes de distribuição pública de baixa tensão**

Modelo: **SBS3.7-10**
SBS5.0-10
SBS6.0-10

Utilização de acordo com os regulamentos:

Dispositivo de desconexão automática com monitorização da rede monofásica para sistemas com um circuito paralelo monofásico através de um inversor na alimentação pela rede pública. O dispositivo de desconexão automática é parte integrante do inversor anteriormente mencionado.

Regras e normas aplicadas:

EN 50438:2013 / PN EN 50438:2015
Requisitos para as instalações de microprodução destinadas a serem ligadas em paralelo com as redes públicas de distribuição de baixa tensão

EN 50438:2013 / PN EN 50438:2015 com as definições de protecção de interface padrão para Portugal. O SBS5.0-10, SBS6.0-10 é dimensionado para uma corrente máxima >16 A por fase, mas todos os requisitos básicos da norma estão cumpridos.
Limites básicos:
sobretensão 264,5 V
subtensão 195,5 V
sobrefrequência 51,0 Hz
subfrequência 47,0 Hz

Aquando da emissão deste certificado, o conceito de protecção de interface de um produto representativo anteriormente mencionado corresponde a especificações de segurança válidas para a utilização especificada, de acordo com os regulamentos. Os testes e certificação foram realizados de acordo com a norma ISO / IEC sistema 5 – Guia 67:2004.

Número de relatório: **17TH0338-EN50438_0**
Número de certificado: **U18-0643**
Data de emissão: **2018-11-28** **Válido até:** **2023-11-27**

Órgão de certificação

Holger Schaffer
Órgão de certificação da Bureau Veritas Consumer Products Services Germany GmbH
Acreditado nos termos da norma DIN EN ISO/IEC 17065

DAkkS Deutsche Akkreditierungsstelle D-ZE-12024-01-00

Appendix E Type Verification Test Report	
Extract from test report according to EN 50438	**Nr. 17TH0338-EN50438_0**

Type Approval and declaration of compliance with the requirements of EN 50438.			
Manufacturer / applicant:	SMA Solar Technology AG Sonnenallee 1 34266 Niestetal Germany		
Micro-generator Type	Battery Inverter		
Rated values	SBS3.7-10	SBS5.0-10	SBS6.0-10
Maximum rated capacity	3680	5000	6000
Rated voltage	230V	230V	230V
Firmware version	1.00		
Measurement period:	2018-05-18 to 2018-11-07		
Description of the structure of the power generation unit: The power generation unit is equipped with a DC 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 micro-generators are tested according to the requirements in the EN 50438. 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 EN 50438.			

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Type testing of the interface protection

Over-/under-voltage tests

Parameter	Protection limit		Actual setting		Trip value (test result)	
	Voltage [V]	Disconnection time [s]	Voltage [V]	Disconnection time [s]	Voltage [V]	Disconnection time [s]
Over-voltage stage 1	253,0	600*	253,0	600*	253,0	499,4
Over-voltage stage 2	264,5	0,2	264,5	0,2	264,5	0,176
Under-voltage stage 1	195,5	1,5	195,5	1,5	195,4	1,478

Note.
Minimum operation time according to default interface protection:
Over-voltage stage 1 -
Over-voltage stage 2 0,1s
Under-voltage 1,2s

* The over-voltage-stage 1 is a 10-min-mean-value according to EN 50160. The disconnection after detection of an overvoltage at the 10-min-mean-value takes place within 200ms.

Over-/under-frequency tests

Parameter	Protection limit		Actual setting		Trip value (test result)	
	Frequency [Hz]	Disconnection time [s]	Frequency [Hz]	Disconnection time [s]	Frequency [Hz]	Disconnection time [s]
Over-frequency	52,0	0,5	52,0	0,5	52,00	0,481
Under-frequency	47,5	0,5	47,5	0,5	47,50	0,467

Note.
Minimum operation time according to default interface protection:
Over-frequency 0,5 s
Under-frequency 0,5 s

LoM test

Method used	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. Phase 1 fuse removed [ms]	989	990	985	1154	993	1007

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Extract from test report according to EN 50438 **Nr. 17TH0338-EN50438_0**

Type testing of a micro-generator

Operating range SBS5.0-10

Test 1: U = 195,5 V; f = 47,5 Hz; P = 1,00 Sn; cosφ = 1
Test 2: U = 253,0 V; f = 51,5 Hz; P = 1,00 Sn; cosφ = 1

Test sequence	Voltage [V]	Frequency [Hz]	Output power [W]	Cos φ [1]
1	195,5	47,5	4451,8	1,000
2	253,0	51,5	5012,9	1,000

Active power at under-frequency SBS5.0-10			
5-min mean value (each)	**a) 50 ± 0,01 [Hz]**	**b) - 0,4 to – 0,5 [Hz]**	**c) - 2,4 to - 2,5 [Hz]**
Frequency [Hz]:	50,00	49,55	47,55
Active power [kW]:	4,968	4,968	4,966
ΔP/PM [%] per 1 Hz:			0

Power response to over-frequency SBS5.0-10							
1-min mean value [Hz]:	**a) 50,00**	**b) 50,25**	**c) 50,70**	**d) 51,15**	**e) 50,70**	**f) 50,25**	**g) 50,00**
1. Measurement a) to g): Active power output > 80% Pn							
Frequency [Hz]:	50,00	50,25	50,70	51,15	50,70	50,25	50,00
PM [kW]:	NA	4,927	4,546	4,167	4,546	4,927	NA
PE60 [kW]:	4,969	4,928	4,547	4,167	4,547	4,928	4,969
ΔPE60/PM [%]:	NA	0,012	0,010	0,004	0,012	0,013	NA
2. Measurement a) to g): Active power output 40% and 60% after freezing > 80% Pn							
Frequency [Hz]:	50,00	50,25	50,70	51,15	50,70	50,25	50,00
PM [kW]:	NA	2,501	2,308	2,115	2,308	2,501	NA
PE60 [kW]:	2,526	2,505	2,311	2,118	2,311	2,505	2,525
ΔPE60/PM [%]:	NA	0,080	0,066	0,054	0,065	0,082	NA
Limit ΔP/P1min:	+ 10 % of P_M						

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Controllable reactive power				
Inductive (supply reactive power)				
Power-BIN	**Active power [W]**	**Reactive power [Var]**	**Power factor (cos φ)**	**AC voltage [V]**
0% - 10%	208,4	202,8	0,861	230
10% - 20%	693,1	705,6	0,856	230
20% - 30%	1208,1	1220,5	0,853	230
30% - 40%	1713,8	1725,6	0,852	230
40% - 50%	2215,2	2226,6	0,851	230
50% - 60%	2723,2	2734,7	0,851	230
60% - 70%	3222,7	3233,7	0,850	230
70% - 80%	3719,3	3729,7	0,850	230
80% - 90%	4233,4	4229,0	0,854	230
90% - 100%	4732,9	4715,3	0,853	230
Capacitive (supply reactive power)				
Power-BIN	**Active power [W]**	**Reactive power [Var]**	**Power factor (cos φ)**	**AC voltage [V]**
0% - 10%	208,4	202,8	0,828	230
10% - 20%	693,1	705,6	0,841	230
20% - 30%	1208,1	1220,5	0,844	230
30% - 40%	1713,8	1725,6	0,846	230
40% - 50%	2215,2	2226,6	0,847	230
50% - 60%	2723,2	2734,7	0,848	230
60% - 70%	3222,7	3233,7	0,848	230
70% - 80%	3719,3	3729,7	0,849	230
80% - 90%	4233,4	4229,0	0,846	230
90% - 100%	4732,9	4715,3	0,846	230
Reactive power supply with set point Q=0				
Power-BIN	**Active power [W]**	**Reactive power [Var]**	**Power factor (cos φ)**	**AC voltage [V]**
0% - 10%	208,4	202,8	0,999	230
10% - 20%	693,1	705,6	1,000	230
20% - 30%	1208,1	1220,5	1,000	230
30% - 40%	1713,8	1725,6	1,000	230
40% - 50%	2215,2	2226,6	1,000	230
50% - 60%	2723,2	2734,7	1,000	230
60% - 70%	3222,7	3233,7	1,000	230
70% - 80%	3719,3	3729,7	1,000	230
80% - 90%	4233,4	4229,0	1,000	230
90% - 100%	4732,9	4715,3	1,000	230

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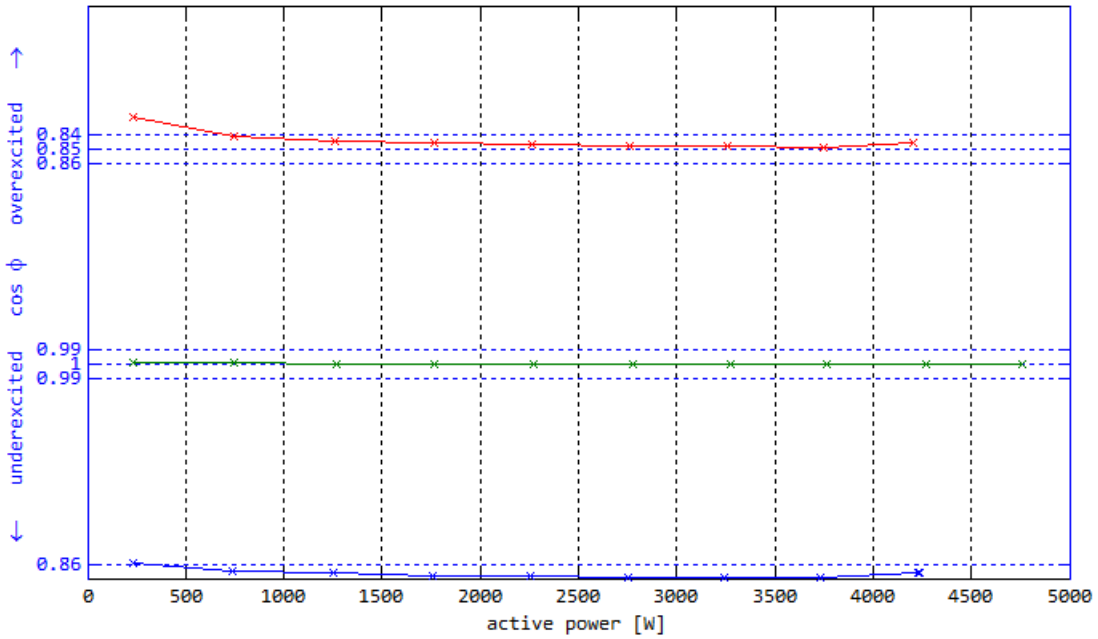
Diagram of inductive reactive power absorption



Q adjustment				
	Reactive power set point Q [Var]	**Measured reactive power Q [Var]**	**Measured cos φ**	**Deviation compared to setpoint ΔQ / PN [%]**
- Qmin	-3000,00	3015,52	N/A	0,15
0	0	9,77	N/A	0,20
+ Qmax	3000,00	-2992,34	N/A	0,31

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Connection and starting to generate electrical power		
Test according EN 50438 with standard setting	**Min. voltage for connection to grid:**	193,2V
	Max. voltage for connection to grid:	255,3V
	Min. frequency for connection to grid:	47,40Hz
	Max. frequency for connection to grid:	50,20Hz
	Observation time (≥60s)	60s

Test		
	Voltage conditions	
a) Start up for voltage range	**<84% Un for twice of observation time**	**>111% Un for twice of observation time**
Connection:	No connection	No connection
Limit:	No connection allowed	
b) In voltage range at start-up	**≥84% Un within twice setting observation time**	**≤111% Un within twice setting observation time**
Reconnection time [s]	67,06	66,06
Limit:	Connected after setting observation time (≥60s)	
Gradient:	For adjustable micro generators the maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute Max gradient: 10%Pn/min.	
c) In voltage range after voltage failure	**≥84% Un for twice of setting observation time**	**≤111% Un for twice of setting observation time**
Reconnection time [s]	67,06	66,06
Limit:	Reconnection after setting observation time (≥60s)	
Gradient:	For adjustable micro generators the maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute Max gradient: 10%Pn/min.	
	Frequency conditions	
d) Start up for frequency range	**<47,45 Hz for twice of setting observation time**	**>50,15 Hz for twice of setting observation time**
Connection:	No connection	No connection
Limit	No connection allowed	
e) In frequency range at start-up	**≥47,45 Hz within twice of setting observation time**	**≤51,15 Hz within twice of setting observation time**
Reconnection time [s]	66,69	66,24
Limit:	Connected after setting delay time(≥60s)	
Gradient:	For adjustable micro generators the maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute Max gradient: 10%Pn/min.	
f) In frequency range after frequency failure	**≥47,45 Hz for twice of setting observation time**	**≤51,15 Hz for twice of setting observation time**
Reconnection time [s]	66,69	66,24
Limit:	Reconnection after setting observation time (≥60s)	
Gradient:	For adjustable micro generators the maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute Max gradient: 10%Pn/min.	

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Short-circuit current contribution					
Short-circuit current parameters SBS 3.7-10					
For a directly coupled micro-generator			**For a Inverter micro-generator**		
Parameter	**Symbol**	**Value**	**Time after fault**	**Volts**	**Amps**
Peak Short Circuit current	I_p	N/A	20ms	231,72	21,29
Initial Value of aperiodic current	A	N/A	100ms	12,72	0,09
Initial symmetrical short-circuit current*	I_k	N/A	250ms	11,47	0,09
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	11,67	0,07
Reactance/Resistance Ratio of source*	X/R	N/A	**Time to trip**	0,53	In seconds
Short-circuit current parameters SBS 6.0-10					
For a directly coupled micro-generator			**For a Inverter micro-generator**		
Parameter	**Symbol**	**Value**	**Time after fault**	**Volts**	**Amps**
Peak Short Circuit current	I_p	N/A	20ms	231,48	32,7
Initial Value of aperiodic current	A	N/A	100ms	13	0,08
Initial symmetrical short-circuit current*	I_k	N/A	250ms	11,43	0,08
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	12,1	0,07
Reactance/Resistance Ratio of source*	X/R	N/A	**Time to trip**	0,53	In seconds

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Power Quality. Harmonic current emission				
micro-generator		SBS5.0-10		
Harmonic order n	Current Magnitude [A] at 100% rated output power	% of Fundamental	Phase	Harmonic current limit EN 61000-3-2, Class A [A]
1st	21,6310	21,622	Phase 1	-
2nd	0,0230	0,005	Phase 1	1,080
3rd	0,2300	0,169	Phase 1	2,300
4th	0,0190	0,01	Phase 1	0,430
5th	0,2110	0,15	Phase 1	1,140
6th	0,0220	0,006	Phase 1	0,300
7th	0,1140	0,079	Phase 1	0,770
8th	0,0180	0,008	Phase 1	0,230
9th	0,1270	0,083	Phase 1	0,400
10th	0,0200	0,004	Phase 1	0,184
11th	0,1080	0,059	Phase 1	0,330
12th	0,0180	0,004	Phase 1	0,153
13th	0,1120	0,067	Phase 1	0,210
14th	0,0150	0,004	Phase 1	0,131
15th	0,0800	0,048	Phase 1	0,150
16th	0,0150	0,004	Phase 1	0,115
17th	0,0880	0,056	Phase 1	0,132
18th	0,0130	0,004	Phase 1	0,102
19th	0,0670	0,041	Phase 1	0,118
20th	0,0110	0,003	Phase 1	0,092
21th	0,0680	0,044	Phase 1	0,107
22th	0,0130	0,002	Phase 1	0,084
23th	0,0620	0,038	Phase 1	0,098
24th	0,0110	0,002	Phase 1	0,077
25th	0,0520	0,041	Phase 1	0,090
26th	0,0110	0,002	Phase 1	0,071
27th	0,0520	0,034	Phase 1	0,083
28th	0,0090	0,002	Phase 1	0,066
29th	0,0530	0,034	Phase 1	0,078
30th	0,0100	0,002	Phase 1	0,061
31th	0,0460	0,032	Phase 1	0,073
32th	0,0090	0,002	Phase 1	0,058
33th	0,0410	0,029	Phase 1	0,068
34th	0,0080	0,002	Phase 1	0,054
35th	0,0430	0,031	Phase 1	0,064
36th	0,0090	0,002	Phase 1	0,051
37th	0,0390	0,027	Phase 1	0,061
38th	0,0080	0,002	Phase 1	0,048
39th	0,0380	0,027	Phase 1	0,058
40th	0,0080	0,002	Phase 1	0,046

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Voltage fluctuation and Flicker.					
SBS6.0-10	Maximum permissible flicker and voltage fluctuation as per EN 61000-3-3				
Value	**Pst**	**Plt 2 hours**	**d(t) $_{500ms}$**	**dc**	**dmax**
Limit	1,0	0,65	3,3%	3,3%	4%
Test value	0,093	0,093	0,00%	0,080%	0,240%

DC-Injection.				
Protection limit SBS5.0-10	Tested at four power levels, limit 0,5% of IAC_{nom} (109mA)			
Output power	**~20%**	**~50%**	**75%**	**~100%**
Max. test value (phase L1) [mA]	5,79	9,18	9,08	13,38