



Compliance Verification Report with the G99 Issue 1 Amendment 3 2018

Test record for Type A Inverter Connected Power Generating Modules

Manufacturer	SMA Solar Technology AG
Address	Sonnenallee 1, 34266 Niestetal (Germany)

Type Tested reference number	ZE_G99-1_SI8.0H-13 / SI6.0H-13_en_11
Generating Unit technology	Single phase inverter
Test house details	SMA Solar Technology AG
Test period	From 2019-04-06 until 2019-06-18

Type reference	Max. apparent AC power (VA)	Rated AC power (W)	From FW Pack
SI 8.0_H-13	6000	6000	V3.01.04.R
SI 6.0_H-13	4600	4600	V3.01.04.R

The results of the G99/1 are summarized in this certificate. SMA declares that all units shipped to the UK, with at least the aforementioned FW version, are within the specifications and parameters set by the G99/1 Engineering Recommendation, Amendment 3 2018.

These settings cannot be changed by an installer, user or by any person without authorization from SMA.

Note that all tests were carried out with the biggest inverter of the family under test. The results for the other inverters of the family are equivalent.



Test Results

Power quality

Harmonics as per BS EN 61000-3-12								
Order	Frequency [Hz]	Thresholds I/In [%]	P/Pn [%]					
			50		100		Max. MV / Limit [%]	
			MV		MV			
2	100	8,00%	0,023 A	0,09%	0,045 A	0,17%	2,16%	✓
3	150	-	0,081 A	0,31%	0,167 A	0,64%	-	-
4	200	4,00%	0,004 A	0,02%	0,01 A	0,04%	0,96%	✓
5	250	10,70%	0,032 A	0,12%	0,068 A	0,26%	2,43%	✓
6	300	2,67%	0,008 A	0,03%	0,007 A	0,03%	1,15%	✓
7	350	7,20%	0,024 A	0,09%	0,021 A	0,08%	1,28%	✓
8	400	2,00%	0,004 A	0,02%	0,005 A	0,02%	0,96%	✓
9	450	-	0,019 A	0,07%	0,016 A	0,06%	-	-
10	500	1,60%	0,003 A	0,01%	0,004 A	0,02%	0,96%	✓
11	550	3,10%	0,015 A	0,06%	0,017 A	0,07%	2,10%	✓
12	600	1,33%	0,005 A	0,02%	0,004 A	0,02%	1,44%	✓
13	650	2,00%	0,015 A	0,06%	0,016 A	0,06%	3,07%	✓
14	700	-	0,004 A	0,02%	0,004 A	0,02%	-	-
15	750	-	0,014 A	0,05%	0,017 A	0,07%	-	-
16	800	-	0,005 A	0,02%	0,007 A	0,03%	-	-
17	850	-	0,013 A	0,05%	0,015 A	0,06%	-	-
18	900	-	0,005 A	0,02%	0,006 A	0,02%	-	-
19	950	-	0,009 A	0,03%	0,012 A	0,05%	-	-
20	1000	-	0,008 A	0,03%	0,006 A	0,02%	-	-
21	1050	-	0,007 A	0,03%	0,016 A	0,06%	-	-
22	1100	-	0,014 A	0,05%	0,022 A	0,08%	-	-
23	1150	-	0,047 A	0,18%	0,093 A	0,36%	-	-
24	1200	-	0,013 A	0,05%	0,023 A	0,09%	-	-
25	1250	-	0,01 A	0,04%	0,02 A	0,08%	-	-
26	1300	-	0,008 A	0,03%	0,007 A	0,03%	-	-
27	1350	-	0,008 A	0,03%	0,016 A	0,06%	-	-
28	1400	-	0,005 A	0,02%	0,006 A	0,02%	-	-
29	1450	-	0,006 A	0,02%	0,014 A	0,05%	-	-
30	1500	-	0,01 A	0,04%	0,007 A	0,03%	-	-
31	1550	-	0,009 A	0,03%	0,013 A	0,05%	-	-
32	1600	-	0,008 A	0,03%	0,005 A	0,02%	-	-
33	1650	-	0,008 A	0,03%	0,008 A	0,03%	-	-
34	1700	-	0,005 A	0,02%	0,007 A	0,03%	-	-
35	1750	-	0,006 A	0,02%	0,006 A	0,02%	-	-
36	1800	-	0,006 A	0,02%	0,005 A	0,02%	-	-
37	1850	-	0,003 A	0,01%	0,006 A	0,02%	-	-
38	1900	-	0,002 A	0,01%	0,004 A	0,02%	-	-
39	1950	-	0,003 A	0,01%	0,005 A	0,02%	-	-
40	2000	-	0,002 A	0,01%	0,004 A	0,02%	-	-

MV=Measured Value

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Active power operating range					
Test	Voltage	Frequency	cosphi	Time	Verification
1	195,5 V	47 Hz	1	20 s	✓
2	195,5 V	47,5 Hz	1	90 min	✓
3	253 V	51,5 Hz	1	90 min	✓
4	253 V	52 Hz	1	15 min	✓

Power quality

Voltage fluctuations and flicker as per BS EN 61000-3-11								
	Starting			Stopping			Running	
	dmax	dc	d(t) in ms	dmax	dc	d(t) in ms	Pst	Plt (2hours)
Limit	4,0%	3,3%	500	4,0%	3,3%	500	1	0,65
MV	3,4%	3,4%	708	3,7%	3,4%	1019	0,15	0,13
NV (to Z _{Ref})	5,5%	5,4%		5,9%	5,5%		0,24	0,21
NV (to Z _{Max})	3,3%	3,2%		3,5%	3,3%		0,14	0,13
Verification	✓	✓		✓	✓		✓	✓
Z _{Test}	R	0,25	Ω	XL	0,25	Ω		
Z _{Max}	R	0,24	Ω	XL	0,15	Ω		

DC injection			
P/P _n [%]	10	55	100
Limit	0,25% I _n	0,25% I _n	0,25% I _n
MV	A	A	A
%I _{nom}	0,00%	0,00%	0,00%
Verification	✓	✓	✓

Power factor			
Voltage [V]	216,2	230	253
Limit	>0,95	>0,95	>0,95
Measured	1,00	1,00	1,00
Verification	✓	✓	✓

MV - Measured value

NV - Normalised value

Protection - Grid monitoring and reconnection time

Trip Tests		G99/1		Setting		Measures Values		Verification
Function		Magnitude	Time	Magnitude	Time	Magnitude	Time	
Undervoltage		184 V	2,5 s	184 V	2,5 s	183,475 V	2,64 s	✓
Overvoltage stage 1		262,2 V	1 s	262,2 V	1 s	262,821 V	1,14 s	✓
Overvoltage stage 2		273,7 V	0,5 s	273,7 V	0,5 s	274,303 V	0,36 s	✓
Underfrequency stage 1		47,5 Hz	20 s	47,5 Hz	20 s	47,448 Hz	20,2 s	✓
Underfrequency stage 2		47 Hz	0,5 s	47 Hz	0,5 s	46,946 Hz	0,67 s	✓
Overfrequency		52 Hz	0,5 s	52 Hz	0,5 s	51,997 Hz	0,67 s	✓

No trip test	G99/1		Verification
	Magnitude	Time	
U/V 1	188 V	5,0 s	✓
U/V 2	180 V	2,45 s	✓
O/V 1	258,2 V	5,0 s	✓
O/V 2	269,7 V	0,95 s	✓
O/V 3	277,7 V	0,45 s	✓

No trip test	G99/1		Verification
	Magnitude	Time	
U/F 1	47,7 Hz	30 s	✓
U/F 2	47,2 Hz	19,5 s	✓
U/F 3	46,8 Hz	0,45 s	✓
O/F 1	51,8 Hz	120 s	✓
O/F 2	52,2 Hz	0,45 s	✓

Reconnection time			
Limit	Setting	MV	Verification
20 s	20 s	38,64 s	✓

No reconnection			
At 266,2 V	At 180 V	At 47,4 Hz	At 52,1 Hz
✓	✓	✓	✓



Protection - Loss of mains

Loss of mains test according to the BS EN 62116						
Test power and imbalance	28 % -5%Q (Test 22)	58 % -5%Q (Test 12)	100 % -5%P (Test 5)	28 % +5%Q (Test 31)	58 % +5%Q (Test 21)	100 % +5%P (Test 10)
Trip time limit (s)	0,5	0,5	0,5	0,5	0,5	0,5
Measured Value L1 (s)	0,309	0,303	0,372	0,302	0,304	0,392
Measured Value L1L2L3 (s) *	0	0	0	0	0	0
Verification	✓	✓	✓	✓	✓	✓

* Only applicable to three phase inverters

Frequency change - Stability test				
	Start frequency	Change	End frequency	Verification
Positive vector shift	49,5 Hz	+50 degrees	N/A	✓
Negative vector shift	50,5 Hz	-50 degrees	N/A	✓
Positive frequency drift	49 Hz	+0,95 Hz/s	51 Hz	✓
Negative frequency drift	51 Hz	-0,95 Hz/s	49 Hz	✓

Behavior in case of frequency changes

Over-frequency test								
Frequency	P > 80%				P 40% - 60%			
	PDC	P (W)	Gradient	Verification	PDC	P (W)	Gradient	Verification
50 Hz	6315	5999	N/A	✓	3157	2991	N/A	✓
50,45 Hz	6315	5937	N/A	✓	3157	2947	N/A	✓
50,70 Hz	6315	5635	-20,35%	✓	6315	2798	-20,22%	✓
51,15 Hz	6315	5109	-19,69%	✓	6315	2534	-19,91%	✓
50,70 Hz	6315	5606	18,60%	✓	6315	2794	19,61%	✓
50,45 Hz	6315	5909	20,41%	✓	6315	2944	20,36%	✓
50 Hz	6315	5998	N/A	✓	6315	2991	N/A	✓

Under-frequency test				
Frequency	P = P _n			
	PDC	P (W)	Gradient	Verification
50,00 Hz	6200	5990	N/A	✓
49,55 Hz	6200	5981	N/A	✓
47,55 Hz	6200	5982	-0,02%	✓

Various requirements

Fault level contribution		
Time after fault	Voltage (V)	Current (A)
< 50 ms	230,41	26,27
100 ms	12,64	0,23
250 ms	10,13	0,24
500 ms	11,51	0,02
Time to Trip	0,4	in seconds

Self monitoring - solid state switching
Not applicable as electro-mechanical relays are used

Active power curtailment
A Modbus signal can be used to cease Active Power output within 5 s

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