


# ENA G83/2 TYPE VERIFICATION TEST REPORT



Type approval and manufacturer/supplier declaration of compliance with the requirements of Engineering Recommendation G83/2.			
<b>SSEG Type reference number</b>	10005317		
<b>SSEG Type</b>	SolarMax 2000P		
<b>System Supplier name</b>	SolarMax Produktions GmbH		
<b>Address</b>	Zur Schönhalde 10, D-89352 Ellzee		
<b>Tel</b>	+49 37 33 50 78 4 0	<b>Fax</b>	+49 37 33 50 78 4 99
<b>Email</b>	info@solarmax.com	<b>Web site</b>	www.solarmax.com
<b>Connection option</b>			
2.00	kW single phase, single, split or three phase system		
-	kW three phase		
-	kW two phases in three phase system		
-	kW two phases split phase system		
SSEG manufacturer/supplier declaration. I certify on behalf of the company named above as a manufacturer/supplier of Small Scale Embedded generators, that all products manufactured/supplied by the company with the above SSEG Type reference number will be manufactured and tested to ensure that they perform as stated in this Type Verification Test Report, prior to shipment to site and that no site modifications are required to ensure that the product meets all the requirements of G83/2.			
Signed	Anton Spengler 	On behalf of	SolarMax Produktions GmbH Zur Schönhalde 10 D-89352 Ellzee +49 37 33 50 78 4 0 +49 37 33 50 78 4 99

## POWER QUALITY – HARMONICS

SSEG rating per phase (rpp) : 2.00 kW					NV=MV*3.68/rpp	
Harmonic	At 45-55 % of rated output		100 % of rated output		Limit in BS EN 61000-3-12 in Amps	Higher limit for odd harmonics 21 and above
	Measured Value (MV) in Amps	Normalised Value (NV) in Amps	Measured Value (MV) in Amps	Normalised Value (NV) in Amps		
2	0.007	0.013	0.014	0.025	1.080	
3	0.080	0.147	0.157	0.288	2.300	
4	0.003	0.005	0.002	0.003	0.430	
5	0.011	0.020	0.081	0.149	1.140	
6	0.002	0.003	0.002	0.003	0.300	
7	0.037	0.068	0.043	0.079	0.770	
8	0.002	0.003	0.002	0.003	0.230	
9	0.038	0.070	0.024	0.045	0.400	
10	0.002	0.003	0.001	0.002	0.184	
11	0.019	0.035	0.014	0.026	0.330	
12	0.002	0.003	0.002	0.003	0.153	
13	0.012	0.022	0.014	0.025	0.210	
14	0.001	0.002	0.001	0.002	0.131	
15	0.014	0.025	0.013	0.023	0.150	
16	0.001	0.002	0.001	0.002	0.115	
17	0.008	0.015	0.014	0.025	0.132	
18	0.005	0.010	0.006	0.012	0.102	
19	0.004	0.007	0.014	0.025	0.118	
20	0.001	0.002	0.001	0.002	0.092	
21	0.005	0.010	0.012	0.022	0.107	0.160

22	0.001	0.002	0.001	0.002	0.084	
23	0.006	0.012	0.009	0.017	0.098	0.147
24	0.002	0.003	0.001	0.002	0.077	
25	0.005	0.010	0.008	0.015	0.090	0.135
26	0.002	0.003	0.002	0.003	0.071	
27	0.001	0.002	0.005	0.008	0.083	0.124
28	0.002	0.003	0.002	0.003	0.066	
29	0.005	0.008	0.004	0.007	0.078	0.117
30	0.002	0.003	0.001	0.002	0.061	
31	0.005	0.010	0.003	0.005	0.073	0.109
32	0.002	0.003	0.002	0.003	0.058	
33	0.004	0.007	0.005	0.010	0.068	0.102
34	0.001	0.002	0.001	0.002	0.054	
35	0.003	0.005	0.005	0.008	0.064	0.096
36	0.002	0.003	0.001	0.002	0.051	
37	0.003	0.005	0.003	0.005	0.061	0.091
38	0.001	0.002	0.002	0.003	0.048	
39	0.002	0.003	0.003	0.005	0.058	0.087
40	0.002	0.003	0.001	0.002	0.046	

## POWER QUALITY – VOLTAGE FLUCTUATIONS

	Starting			Stopping			Running	
	$d_{max}$	$d_c$	$d_{(t)}$	$d_{max}$	$d_c$	$d_{(t)}$	$P_{st}$	$P_{It}$ 2 hours
Measured Values	0.27	0.24	0.00	0.22	0.21	0.00	0.077	0.077
Normalised to standard impedance and 3.68kW for multiple units	0.50	0.44	0.00	0.40	0.39	0.00	0.142	0.142
Limits set under BS EN 61000-3-2	4 %	3.3 %	3.3 % 500ms	4 %	3.3 %	3.3 % 500ms	1.0	0.65
Test start date	26. September 2013			Test end date	26. September 2013			
Test location	Sputnik R&D Labs / Länggasse 85 / 2504 Biel/Bienne (Switzerland)							

## POWER QUALITY – DC INJECTION

Test power level	10 %	55 %	100 %
Recorded value	- 3 mA	2 mA	2 mA
as % of rated AC current	0.033	0.022	0.022
Limit	0.25 %	0.25 %	0.25 %

## POWER QUALITY – POWER FACTOR

	216.2 V	230 V	253 V
Measured Value	1.00	1.00	1.00
Limit	>0.95	>0.95	>0.95

## PROTECTION – FREQUENCY TESTS

Function	Setting		Trip test		“No trip tests”	
	Frequency	Time delay	Frequency	Time delay	Frequency/ time	Confirm no trip
U/F stage 1	47.5 Hz	20 s	47.49 Hz	20.49 s	47.7 Hz 25 s	Yes
U/F stage 2	47 Hz	0.5 s	47.00 Hz	0.97 s	47.2 Hz 19.98 s	Yes
					46.8 Hz 0.48 s	Yes
O/F stage 1	51.5 Hz	90 s	51.50 Hz	90.47 s	51.3 Hz 95 s	Yes
O/F stage 2	52 Hz	0.5 s	52.01 Hz	0.98 s	51.8 Hz 89.98 s	Yes
					52.2 Hz 0.48 s	Yes

## PROTECTION – VOLTAGE TESTS

Function	Setting		Trip test		“No trip tests”	
	Voltage	Time delay	Voltage	Time delay	Voltage/time	Confirm no trip
U/V stage 1	200.1 V	2.5 s	198.7 V	2.98 s	204.1 V 3.5 s	Yes
U/V stage 2	184 V	0.5 s	182.8 V	0.98 s	188 V 2.48 s	Yes
					180 V 0.48 s	Yes
O/V stage 1	262.2 V	1.0 s	261.7 V	1.46 s	258.2 V 2.0 s	Yes
O/V stage 2	273.7 V	0.5 s	273.0 V	0.97 s	269.7 V 0.98 s	Yes
					277.7 V 0.48 s	Yes

## PROTECTION – LOSS OF MAINS TEST

Test Power	10 %	55 %	100 %	10 %	55 %	100 %
Balancing load on islanded network	95 % of SSEG output	95 % of SSEG output	95 % of SSEG output	105 % of SSEG output	105 % of SSEG output	105 % of SSEG output
Trip time. Limit is 0.5 seconds	0.44 s	0.44 s	0.41 s	0.45 s	0.49 s	0.42 s

## PROTECTION – FREQUENCY CHANGE STABILITY TEST

	Start Frequency	Change	End Frequency	Confirm no trip
Positive Vector Shift	49.5 Hz	+9 degrees		Yes
Negative Vector Shift	50.5 Hz	- 9 degrees		Yes
Positive Frequency drift	49.5 Hz	+0.19 Hz/sec	51.5 Hz	Yes
Negative Frequency drift	50.5 Hz	- 0.19 Hz/sec	47.5 Hz	Yes

## PROTECTION – RE-CONNECTION TIMER

Time delay setting	Measured delay				
20 s	40.2 s	At 266.2 V	At 196.1 V	At 47.4 Hz	At 51.6 Hz
Confirmation that the SSEG does not re-connect.		Yes	Yes	Yes	Yes

## FAULT LEVEL CONTRIBUTION

For a Inverter SSEG		
Time after fault	Volts (Peak)	Amps (Peak)
20 ms	200	18.88
100 ms	198.7	27.55
250 ms	198.1	28.13
500 ms	198.1	27.55
Time to trip	0.62	In seconds

## SELF MONITORING SOLID STATE SWITCHING

	Yes/or NA
It has been verified that in the event of the solid state switching device failing to disconnect the SSEG, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0.5 seconds.	NA