



## Certificate EN 50438:2013

### European Standard

Manufacturer	<b>SMA Solar Technology AG</b>
Address	Sonnenallee 1, 34266 Niestetal (Germany)

Type Tested reference number	HK_EN50438_2013_STP50-40_en_12
Generating Unit technology	Three Phase inverter
Test house details	<b>SMA Solar Technology AG</b>
Test period	From 2017-07-24 until 2017-08-21

Type reference	Max. apparent AC power (VA)	Rated AC power (W)	From FW Pack
STP 50-40	50000	50000	01.01.19.R

The results of the EN 50438:2013 are summarized in this certificate. SMA declares that all units shipped to Europe, with at least the aforementioned FW version, are within the specifications and parameters set by the EN 50438:2013 European Standard.

The national deviations from Finland, Ireland and Sweden were tested as shown in the last pages of this document.



## Test Results - Protection

Interface protection							
Trip Tests	EN 50438:2013		Setting		Measures Values		Verification
Function	Magnitude	Time	Magnitude	Time	Magnitude	Time	
Undervoltage	195,5 V	1500 ms	195,5 V	1500 ms	194,91 V	1492 ms	✓
Overvoltage	264,5 V	200 ms	264,5 V	200 ms	264,93 V	192 ms	✓
Underfrequency	47,5 Hz	500 ms	47,5 Hz	500 ms	47,48 Hz	509 ms	✓
Overfrequency	52 Hz	500 ms	52 Hz	500 ms	52 Hz	490 ms	✓

Tolerances on trip values:  
 - Voltage: ±1% Vnom      - Frequency: ± 0,5% fnom      - Clearance time: in accordance with table 4 of EN 50438/2013

Loss of mains test according to the EN 62116						
Test power and imbalance	29 %	58 %	100 %	29 %	58 %	100 %
	-5%Q (Test 22)	-5%Q (Test 12)	-5%P (Test 5)	+5%Q (Test 31)	+5%Q (Test 21)	+5%P (Test 10)
Limit (s)	2 s	2 s	2 s	2 s	2 s	2 s
Measured Value (s)	1,64 s	0,22 s	1,63 s	0,28 s	0,27 s	0,55 s
Verification	✓	✓	✓	✓	✓	✓

Connection and starting to generate electrical power			
Test sequence	Limit	Test value	Verification
f < 47,45 Hz	no connect	no connect	✓
f ≥ 47,45 Hz	60 s	76,81 s	✓
f > 50,10 Hz	no connect	no connect	✓
f ≤ 50,10 Hz	60 s	73,32 s	✓
U < 0,84 Un	no connect	no connect	✓
U ≥ 0,84 Un	60 s	73,38 s	✓
U > 1,11 Un	no connect	no connect	✓
U ≤ 1,11 Un	60 s	73,44 s	✓
Power gradient after connection			
	Limit	Test value	Verification
max. allowed gradient	10 %P/min	9,44 %P/min	✓

Short-circuit current contribution		
Time after fault	Voltage (V)	Current (A)
< 50 ms	230,05	79,26
100 ms	10,3	0,76
250 ms	10,24	0,14
500 ms	10,24	0,14
Time to Trip	0,53	in seconds

DC injection			
P/Pn [%]	Limit	MV (A)	Verification
20	0,5% In	0,02203	✓
50	0,5% In	0,01562	✓
75	0,5% In	0,03503	✓
100	0,5% In	0,03123	✓

## Test Results - Power quality

Voltage fluctuations and flicker as per EN 61000-3-11					
	dmax	dc	d(t) in ms	Pst	Plt (2hours)
Limit	4,0%	3,3%	500	1	0,65
Test value	0,00%	0,00%	0,00	0,04	0,04
Verification	✓	✓	✓	✓	✓



## Test Results - Power quality

Harmonics as per BS EN 61000-3-12								
Order	Frequency [Hz]	Thresholds I/In [%]	P/Pn [%]				Max. MV / Limit [%]	
			50		100			
			MV		MV			
2	100	8,00%	0,104 A	0,14%	0,19 A	0,26%	3,28%	✓
3	150	-	0,013 A	0,02%	0,034 A	0,05%	-	-
4	200	4,00%	0,058 A	0,08%	0,035 A	0,05%	1,98%	✓
5	250	10,70%	0,253 A	0,35%	0,296 A	0,41%	3,81%	✓
6	300	2,67%	0,041 A	0,06%	0,026 A	0,04%	2,10%	✓
7	350	7,20%	0,146 A	0,20%	0,212 A	0,29%	4,06%	✓
8	400	2,00%	0,009 A	0,01%	0,032 A	0,04%	2,19%	✓
9	450	-	0,011 A	0,01%	0,016 A	0,02%	-	-
10	500	1,60%	0,027 A	0,04%	0,027 A	0,04%	2,36%	✓
11	550	3,10%	0,07 A	0,10%	0,089 A	0,12%	3,96%	✓
12	600	1,33%	0,032 A	0,04%	0,025 A	0,03%	3,28%	✓
13	650	2,00%	0,066 A	0,09%	0,087 A	0,12%	5,97%	✓
14	700	-	0,027 A	0,04%	0,016 A	0,02%	-	-
15	750	-	0,009 A	0,01%	0,015 A	0,02%	-	-
16	800	-	0,028 A	0,04%	0,027 A	0,04%	-	-
17	850	-	0,04 A	0,06%	0,066 A	0,09%	-	-
18	900	-	0,026 A	0,04%	0,023 A	0,03%	-	-
19	950	-	0,031 A	0,04%	0,068 A	0,09%	-	-
20	1000	-	0,009 A	0,01%	0,013 A	0,02%	-	-
21	1050	-	0,009 A	0,01%	0,013 A	0,02%	-	-
22	1100	-	0,007 A	0,01%	0,011 A	0,02%	-	-
23	1150	-	0,022 A	0,03%	0,049 A	0,07%	-	-
24	1200	-	0,006 A	0,01%	0,012 A	0,02%	-	-
25	1250	-	0,019 A	0,03%	0,05 A	0,07%	-	-
26	1300	-	0,01 A	0,01%	0,01 A	0,01%	-	-
27	1350	-	0,008 A	0,01%	0,011 A	0,02%	-	-
28	1400	-	0,012 A	0,02%	0,01 A	0,01%	-	-
29	1450	-	0,019 A	0,03%	0,047 A	0,06%	-	-
30	1500	-	0,009 A	0,01%	0,009 A	0,01%	-	-
31	1550	-	0,022 A	0,03%	0,043 A	0,06%	-	-
32	1600	-	0,008 A	0,01%	0,01 A	0,01%	-	-
33	1650	-	0,008 A	0,01%	0,01 A	0,01%	-	-
34	1700	-	0,007 A	0,01%	0,008 A	0,01%	-	-
35	1750	-	0,021 A	0,03%	0,036 A	0,05%	-	-
36	1800	-	0,007 A	0,01%	0,009 A	0,01%	-	-
37	1850	-	0,021 A	0,03%	0,033 A	0,05%	-	-
38	1900	-	0,005 A	0,01%	0,007 A	0,01%	-	-
39	1950	-	0,006 A	0,01%	0,01 A	0,01%	-	-
40	2000	-	0,006 A	0,01%	0,008 A	0,01%	-	-

MV=Measured Value



## Test Results - Grid management

Operating range				
Test sequence	Voltage (V)	Frequency (Hz)	Power (W)	Verification
U=195,5 V; f=47,5 Hz P=1,00 Sn; cosφ=1	195,5	47,5	43562,8	✓
U=253 V; f=51,5 Hz P=1,00 Sn; cosφ=1	253	51,5	50344,8	✓

Active power feed-in at under-frequency				
Test sequence (Hz)	Frequency (Hz)	Power (W)	available power (W)	Verification
f <sub>nom</sub> ± 0,01	50	44975	44975	✓
f <sub>nom</sub> - 0,5	49,55	44957	44975	✓
f <sub>nom</sub> - 2,5	47,55	44975	44975	✓

Power response to over-frequency								
P > 80%, f <sub>1</sub> = 50,2 Hz and droop 12%					P > 40%, f <sub>1</sub> = 50,5 Hz and droop 2%			
Test sequence (Hz)	Frequency (Hz)	Power (W)	available power (W)	Verification	Frequency (Hz)	Power (W)	available power (W)	Verification
f <sub>nom</sub> ± 0,01	50	44822	44822	✓	50	24913	24977	✓
f <sub>1</sub> + 0,05	50,251	43835,87	44822	✓	50,551	23716,2	24977	✓
50,70 ± 0,10	50,701	40453,78	44822	✓	50,701	19974,07	24977	✓
51,15 ± 0,05	51,151	37063,23	44822	✓	51,151	8746,07	24977	✓
50,70 ± 0,10	50,701	40453,3	44822	✓	50,701	19973,57	24977	✓
f <sub>1</sub> + 0,05	50,251	43838,86	44822	✓	50,551	23716,42	24977	✓
Power gradient:		%Pm/min		✓	Power gradient:		9,86 %Pm/min	✓

Reactive power output								
Controllable reactive power					Reactive power output according to an assigned level			
P (%)	cosφ under-excited	cosφ unity	cosφ over-excited	Verification	Q setpoint (%Pmax)	Q setpoint (VA)	Q actual (VA)	Verification
5%	0,837	1	0,861	✓	0%	0	-199,5	✓
15%	0,843	1	0,856	✓	50%	25000	24979,5	✓
25%	0,845	1	0,855	✓	0%	0	131	✓
35%	0,846	1	0,854	✓	-50%	-25000	-25353,5	✓
45%	0,846	1	0,854	✓	0%	0	-200	✓
55%	0,846	1	0,853	✓				
65%	0,846	1	0,853	✓				
75%	0,846	1	0,853	✓				
85%	0,847	1	0,853	✓				
95%	0,847	1	0,853	✓				



## Test Results - National Deviations for Finland

Interface protection							
Trip Tests	EN 50438:2013		Setting		Measures Values		Verification
	Function	Magnitude	Time	Magnitude	Time	Magnitude	
Undervoltage	195,5 V	200 ms	195,5 V	200 ms	194,97 V	177 ms	✓
Overvoltage	253 V	200 ms	253 V	200 ms	253,69 V	177 ms	✓
Underfrequency	47,5 Hz	200 ms	47,5 Hz	200 ms	47,48 Hz	177 ms	✓
Overfrequency	51,5 Hz	200 ms	51,5 Hz	200 ms	51,5 Hz	162 ms	✓
Tolerances on trip values:							
- Voltage: ±1% Vnom      - Frequency: ± 0,5% fnom      - Clearance time: in accordance with table 4 of EN 50438/2013							

Loss of mains test according to the EN 62116						
Test power and imbalance	29 %	58 %	100 %	29 %	58 %	100 %
	-5%Q (Test 22)	-5%Q (Test 12)	-5%P (Test 5)	+5%Q (Test 31)	+5%Q (Test 21)	+5%P (Test 10)
Limit (s)	5 s	5 s	5 s	5 s	5 s	5 s
Measured Value (s)	0,98 s	0,97 s	1,05 s	1 s	0,99 s	1,05 s
Verification	✓	✓	✓	✓	✓	✓

To set the inverters the correct setting for Finland, please consider that only qualified staff are allowed to set the parameters and that you must have your personal ten-digits SMA Grid Guard Code to set the parameters. You can purchase it from SMA. (see order form for the SMA Grid Guard code at [www.SMA-Solar.com](http://www.SMA-Solar.com))

### Procedure for setting the inverter

1. Access as "installer" to the inverter
2. Enter the SMA Grid Guard mode
3. Select EN50438\_2013 as country standard
4. Change the following parameters:

Parameter (RS485)	Parameter name (WLAN/Speedwire)	Value
VolCtl.hLim	Voltage monitoring lower maximum threshold	253 V
VolCtl.lLimTmms	Voltage monitoring lower min. threshold trip. time	200 ms
VolCtl.Rpro	Voltage increase protection	280 V
FrqCtl.hLim	Frequency monitoring lower maximum threshold	51,5 Hz
FrqCtl.hLimTmms	Frq. monitoring lower max. threshold trip. time	200 ms
FrqCtl.lLimTmms	Frq. monitoring upper min. threshold trip. time	200 ms
Aid.HzMon.Stt	Status of islanding detection frequency monitor	on



## Test Results - National Deviations for Ireland

Interface protection							
Trip Tests	EN 50438:2013		Setting		Measures Values		Verification
	Function	Magnitude	Time	Magnitude	Time	Magnitude	
Undervoltage	207 V	500 ms	207 V	500 ms	206,51 V	477 ms	✓
Overvoltage	253 V	500 ms	253 V	500 ms	253,68 V	477 ms	✓
Underfrequency	48 Hz	500 ms	48 Hz	500 ms	47,98 Hz	460 ms	✓
Overfrequency	50,5 Hz	500 ms	50,5 Hz	500 ms	50,5 Hz	478 ms	✓
Tolerances on trip values:							
- Voltage: ±1% Vnom		- Frequency: ± 0,5% fnom		- Clearance time: in accordance with table 4 of EN 50438/2013			

Loss of mains test according to the EN 62116						
Test power and imbalance	29 %	58 %	100 %	29 %	58 %	100 %
	-5%Q (Test 22)	-5%Q (Test 12)	-5%P (Test 5)	+5%Q (Test 31)	+5%Q (Test 21)	+5%P (Test 10)
Limit (s)	0,5 s	0,5 s	0,5 s	0,5 s	0,5 s	0,5 s
Measured Value (s)	0,12 s	0,12 s	0,15 s	0,13 s	0,12 s	0,15 s
Verification	✓	✓	✓	✓	✓	✓

To set the inverters the correct setting for Ireland, please consider that only qualified staff are allowed to set the parameters and that you must have your personal ten-digits SMA Grid Guard Code to set the parameters. You can purchase it from SMA. (see order form for the SMA Grid Guard code at [www.SMA-Solar.com](http://www.SMA-Solar.com))

### Procedure for setting the inverter

1. Access as "installer" to the inverter
2. Enter the SMA Grid Guard mode
3. Select EN50438\_2013 as country standard
4. Change the following parameters:

Parameter (RS485)	Parameter name (WLAN/Speedwire)	Value
VolCtl.lLim	Voltage monitoring lower minimum threshold	207 V
VolCtl.lLimTmms	Voltage monitoring lower min. threshold trip. time	500 ms
VolCtl.hLim	Voltage monitoring lower maximum threshold	253 V
VolCtl.hLimTmms	Voltage monitoring lower max. threshold trip time	500 ms
FrqCtl.lLim	Frequency monitoring upper minimum threshold	48 Hz
FrqCtl.hLim	Frequency monitoring lower maximum threshold	50,5 Hz
Aid.HzMon.Stt	Status of islanding detection frequency monitor	on
Aid.HzMon.Stt.Tmms	Tripping time of islanding detection frq. monitor	500 ms



## Test Results - National Deviations for Sweden in accordance with SEK TK8

Interface protection							
Trip Tests	EN 50438:2013		Setting		Measures Values		Verification
	Function	Magnitude	Time	Magnitude	Time	Magnitude	
Undervoltage	195,5 V	200 ms	195,5 V	200 ms	194,89 V	177 ms	✓
Overvoltage st.1	264,5 V	200 ms	264,5 V	200 ms	264,74 V	177 ms	✓
Overvoltage st.2	255,3 V	60000 ms	255,3 V	60000 ms	256,19 V	59976 ms	✓
Underfrequency	47 Hz	500 ms	47 Hz	500 ms	46,98 Hz	488 ms	✓
Overfrequency	51 Hz	500 ms	51 Hz	500 ms	51 Hz	475 ms	✓
Tolerances on trip values:							
- Voltage: ±1% Vnom      - Frequency: ± 0,5% fnom      - Clearance time: in accordance with table 4 of EN 50438/2013							

To set the inverters the correct setting for Sweden, please consider that only qualified staff are allowed to set the parameters and that you must have your personal ten-digits SMA Grid Guard Code to set the parameters. You can purchase it from SMA. (see order form for the SMA Grid Guard code at [www.SMA-Solar.com](http://www.SMA-Solar.com))

Procedure for setting the inverter

1. Access as "installer" to the inverter
2. Enter the SMA Grid Guard mode
3. Select EN50438\_2013 as country standard
4. Change the following parameters:

Parameter (RS485)	Parameter name (WLAN/Speedwire)	Value
VolCtl.hhLim	Voltage monitoring median maximum threshold	264,5 V
VolCtl.hhLimTmms	Voltage monitoring median max. threshold trip.time	200 ms
VolCtl.hLim	Voltage monitoring lower maximum threshold	255,3 V
VolCtl.hLimTmms	Voltage monitoring lower max. threshold trip time	60000 ms
VolCtl.lLimTmms	Voltage monitoring lower min. threshold trip. time	200 ms
VolCtl.Rpro	Voltage increase protection	280 V
FrqCtl.lLim	Frequency monitoring upper minimum threshold	47 Hz
FrqCtl.hLim	Frequency monitoring lower maximum threshold	51 Hz
Aid.HzMon.Stt	Status of islanding detection frequency monitor	on