

## *ENA Engineering Recommendation G83/2*

### *Appendix 4*

### *Type Verification Test Report*

<b>Type Approval and manufacturer/supplier declaration of compliance with the requirements of Engineering Recommendation G83/2</b>			
SSEG (Small-Scale Embedded Generator) Type reference number	UNO-DM-X.X-TL-PLUS-XYK-JVN where X.X may be 1.2 or 2.0 or 3.3 or 4.0 where XYK may be X: "blank" or S; Y: "blank" or B or E; K: "blank" where JVN may be J: "blank" or X; V: "blank" or G ; N: "blank"		
SSEG Type	SOLAR GRID TIED INVERTER		
System Supplier name	Power-One Italy S.p.A.		
Address	Via S. Giorgio, 642 52028 Terranuova Bracciolini Arezzo - Italy		
Tel.	+39-055-91951	Fax	+39-055-9195248
E:mail	servicer.solarinverters@it.abb.com	Web site	www.abb.com/solarinverters www.abb.com
Nominal / Maximum rated capacity	Connection Option		
	4.0 / 4.0 kW (*)	kW single phase (for UNO-DM-4.0-TL-PLUS-XYK-JVN)	
	3.3 / 3.3 kW	kW single phase (for UNO-DM-3.3-TL-PLUS-XYK-JVN)	
	2.0 / 2.0 kW	kW single phase (for UNO-DM-2.0-TL-PLUS-XYK-JVN)	
	1.2 / 1.2 kW	kW single phase (for UNO-DM-1.2-TL-PLUS-XYK-JVN)	
(*) When the grid standard UK G83 is selected for the model UNO-DM-4.0-TL-PLUS, the output AC current is limited to 16A and thus the rated and maximum active power are limited to 3600W.			
We, Power-One Italy S.p.A., as manufacturer/supplier of Small Scale Embedded Generators, certifies 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 products meet all the requirements of G83/2.			
Attachment: Extract of Test Report Ref. <b>28110272 006</b> , Determination of Electrical Properties, released by TUEV Rheinland			

Terranuova B.ni, 2017 February 03

  
Marcello Berlingozzi  
(Leadperson Quality Control)

  
Cristiano Ensoli  
(Manager Quality)

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<b>Type of System:</b>	Solar Grid tied inverter																			
<b>System Manufacturer:</b> <b>Manufacturer data:</b>	<b>Power-One Italy S.p.A.</b> Via S. Giorgio 642, 52028 Terranuova Bracciolini (AR) - Italy																			
<b>Reference test report:</b>	<b>28110272 006</b> Issued by TÜV Rheinland Italia S.r.l. on 16/12/2016																			
<b>Measuring period:</b>	From 19/12/2016 to 20/01/2017																			
<b>P<sub>acr</sub>:</b> (Rated AC Power) <b>P<sub>acmax</sub>:</b> (Maximum AC output Power)	<table border="1"> <thead> <tr> <th rowspan="2"></th> <th colspan="4">UNO-DM-X.X-TL-PLUS-XYK-JVN<sup>(1)</sup></th> </tr> <tr> <th>UNO-DM-1.2</th> <th>UNO-DM-2.0</th> <th>UNO-DM-3.3</th> <th>UNO-DM-4.0</th> </tr> </thead> <tbody> <tr> <td><b>P<sub>acr</sub> [W]</b> @cosφ=1</td> <td>1200</td> <td>2000</td> <td>3300</td> <td>4000<sup>(4)</sup></td> </tr> <tr> <td><b>P<sub>acmax</sub> [W]</b> @cosφ=1</td> <td>1200</td> <td>2000</td> <td>3300</td> <td>4000<sup>(4)</sup></td> </tr> </tbody> </table>		UNO-DM-X.X-TL-PLUS-XYK-JVN <sup>(1)</sup>				UNO-DM-1.2	UNO-DM-2.0	UNO-DM-3.3	UNO-DM-4.0	<b>P<sub>acr</sub> [W]</b> @cosφ=1	1200	2000	3300	4000 <sup>(4)</sup>	<b>P<sub>acmax</sub> [W]</b> @cosφ=1	1200	2000	3300	4000 <sup>(4)</sup>
	UNO-DM-X.X-TL-PLUS-XYK-JVN <sup>(1)</sup>																			
	UNO-DM-1.2	UNO-DM-2.0	UNO-DM-3.3	UNO-DM-4.0																
<b>P<sub>acr</sub> [W]</b> @cosφ=1	1200	2000	3300	4000 <sup>(4)</sup>																
<b>P<sub>acmax</sub> [W]</b> @cosφ=1	1200	2000	3300	4000 <sup>(4)</sup>																
<b>Software version</b>	Bundle Firmware Update Version <sup>(2)</sup> : <b>not less than 1705C</b> <sup>(3)</sup> with standard selection: <b>UK G83</b>																			
<b>Rated Voltage:</b>	Single-phase device 230 V (Phase/ Neutral)																			
<p><b>Remarks:</b></p> <p>(1) Model designation is made by UNO-DM-<b>X.X</b>-TL-PLUS-<b>XYK-JVN</b> where:  <b>X.X</b> = 1.2; 2.0; 3.3; 4.0;  <b>XYZ</b> = X: or blank or “S” (when the unit is natively equipped with a DC switch)  Y: or blank or “B” (when the unit is natively equipped with a WLAN) or “E” (when the unit is natively equipped with a WLAN and a ETHERNET board)  K: blank  <b>JVN</b> = J: blank or “X” (when the unit is natively equipped with UNO-DM-COM KIT)  V: blank or “G” (when the unit is natively equipped with a cable gland for AC connection instead of a connector)  N: blank</p> <p>(2) “Update version” identifies the Bundle Firmware Features by a sequential code: xxxxy where:  <ul style="list-style-type: none"> <li>• xxxx is a number indicates Year (two digits) and Week (two digits)</li> <li>• y is a letter from A to G indicates Day (form Sunday = A to Saturday=G)</li> </ul> </p> <p>(3) Not less than: MICRO (Supervisor): <b>C.0.4.0</b>; Booster (DC-DC): <b>A.1.1.9</b>; Inverter (DC-AC): <b>B.0.3.6</b></p> <p>(4) When the grid standard <b>UK G83</b> is selected for the model UNO-DM-4.0-TL-PLUS, the output AC current is limited to 16A and thus the rated and maximum active power are limited to 3600W.</p>																				

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Power Quality. Harmonics. The requirement is specified in section 5.4.1, test procedure in Annex A or B 1.4.1						
SSEG rating per phase (rpp)			3.3	kW		
Harmonic	At 45-55% of rated output		100% of rated output		Mono Phase	
	Measured Value (MV) in Amps	Normalised Value (NV) in Amps	Measured Value (MV) in Amps	Normalised Value (NV) in Amps	Limit in BS EN 61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
2	0.038	0.042	0.437	0.487	1.080	
3	0.440	0.491	0.731	0.815	2.300	
4	0.008	0.009	0.065	0.072	0.430	
5	0.150	0.167	0.246	0.274	1.140	
6	0.009	0.010	0.033	0.037	0.300	
7	0.182	0.203	0.114	0.127	0.770	
8	0.006	0.007	0.019	0.021	0.230	
9	0.234	0.261	0.148	0.165	0.400	
10	0.005	0.006	0.007	0.008	0.184	
11	0.166	0.185	0.124	0.138	0.330	
12	0.005	0.006	0.010	0.011	0.153	
13	0.125	0.139	0.114	0.127	0.210	
14	0.002	0.002	0.007	0.008	0.131	
15	0.098	0.109	0.108	0.120	0.150	
16	0.004	0.004	0.014	0.016	0.115	
17	0.074	0.083	0.097	0.108	0.132	
18	0.002	0.002	0.011	0.012	0.102	
19	0.055	0.061	0.094	0.105	0.118	
20	0.003	0.003	0.014	0.016	0.092	
21	0.048	0.054	0.084	0.094	0.107	
22	0.003	0.003	0.015	0.017	0.084	
23	0.034	0.038	0.071	0.079	0.098	0.147
24	0.002	0.002	0.013	0.014	0.077	
25	0.031	0.035	0.062	0.069	0.090	0.135
26	0.003	0.003	0.013	0.014	0.071	
27	0.030	0.033	0.053	0.059	0.083	0.124
28	0.002	0.002	0.010	0.011	0.066	
29	0.024	0.027	0.043	0.048	0.078	0.117
30	0.003	0.003	0.012	0.013	0.061	
31	0.024	0.027	0.035	0.039	0.073	0.109
32	0.002	0.002	0.011	0.012	0.058	
33	0.026	0.029	0.027	0.030	0.068	0.102
34	0.004	0.004	0.008	0.009	0.054	
35	0.022	0.025	0.023	0.026	0.064	0.096

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**Power Quality. Harmonics. The requirement is specified in section 5.4.1, test procedure in Annex A or B 1.4.1**

SSEG rating per phase (rpp)		3.3	kW			
Harmonic	At 45-55% of rated output		100% of rated output		Mono Phase	
	Measured Value (MV) in Amps	Normalised Value (NV) in Amps	Measured Value (MV) in Amps	Normalised Value (NV) in Amps	Limit in BS EN 61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
36	0.002	0.002	0.008	0.009	0.051	
37	0.024	0.027	0.020	0.022	0.061	0.091
38	0.002	0.002	0.009	0.010	0.048	
39	0.024	0.027	0.011	0.012	0.058	0.087
40	0.003	0.003	0.005	0.006	0.046	

**Power Quality. Voltage fluctuations and Flicker. The requirement is specified in section 5.4.2, test procedure in Annex A or B 1.4.3**

Parameter	Measured Value	Limit	Verdict
$P_{st}$	0.027	1.00	P
$P_{it}$	0.028	0.65	P
$d_c$ [%]	0.013	3.30	P
$d_{max}$ [%]	0.201	4.00	P
$dt$ [s]	0.000	0.50	P
Standard used:	EN/IEC 61000-3-3 Flicker		
Short time ( $P_{st}$ ):	10 min		
Observation time:	120 min (12 Flicker measurements)		
Flickermeter:	230V / 50Hz according IEC 61000-4-15 Ed.2		
Flicker Impedance:	$Z_{ref}$ (IEC 60725)		

**Power quality. DC injection. The requirement is specified in section 5.5, test procedure in Annex A or B 1.4.4 (of reference document G83/2)**

Test power level	10%	55%	100%
Recorded value	1 mA	1 mA	1 mA
as % of rated AC current	0.01 %	0.01 %	0.01 %
Limit	0.25 %	0.25 %	0.25 %

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**Protection. Voltage tests** The requirement is specified in section 5.3.1, test procedure in Annex A or B 1.3.2

Function	Setting		Trip test		“No trip tests”	
	Voltage	Time delay	Voltage	Time delay	Voltage/Time	Confirm no trip
<b>U/V stage 1</b>	200.1V	2.55s	200.13	2.558	204.1V/3.5s	No Trip
<b>U/V stage 2</b>	184V	0.55s	183.53	0.552	188V/2.48s	No Trip
					180V/0.48s	No Trip
<b>O/V stage 1</b>	262.2V	1.0s	262.16	1.044	258.2V/2.0s	No Trip
<b>O/V stage 2</b>	273.7V	0.5s	273.69	0.541	269.7V/0.98s	No Trip
					277.7V/ 0.48s	No Trip

**Protection. Frequency tests** The requirement is specified in section 5.3.1, test procedure in Annex A or B 1.3.3

**Protection. Frequency tests.**

Function	Setting		Trip test		“No trip tests”	
	Frequency	Time delay	Frequency	Time delay	Frequency /time	Confirm no trip
<b>U/F stage 1</b>	47.5Hz	20.05s	47.495	20.114	47.7Hz/ 25s	No Trip
<b>U/F stage 2</b>	47Hz	0.55s	46.996	0.546	47.2Hz/ 19.98s	No Trip
					46.8Hz/ 0.48s	No Trip
<b>O/F stage 1</b>	51.5Hz	90.05s	51.512	90.093	51.3Hz/95s	No Trip
<b>O/F stage 2</b>	52Hz	0.55s	52.007	0.558	51.8Hz/ 89.98s	No Trip
					52.2Hz/ 0.48s	No Trip

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**Protection. Loss of Mains test. The requirement is specified in section 5.3.2, test procedure in Annex A or B 1.3.4**

No.	$P_{EUT}^{1)}$ (% of EUT rating)	Reactive load (% of $Q_L$ in 6.1.d1)	$P_{AC}^{2)}$ (% of nominal)	$Q_{AC}^{3)}$ (% of nominal)	Run on time (ms)**	$P_{EUT}$ (W)	$V_{DC}$ (V)	Remarks <sup>4)</sup>	Verdict
1	100	100	0	0	779	3300	446	Test A at BL	P
2	66	66	0	0	797	2178	310	Test B at BL	P
3	33	33	0	0	781	1089	174	Test C at BL	P
4	100	100	-5	-5	657	3300	446	Test A at IB	P
5	100	100	-5	0	945	3300	446	Test A at IB	P
6	100	100	-5	+5	637	3300	446	Test A at IB	P
7	100	100	0	-5	651	3300	446	Test A at IB	P
8	100	100	0	+5	641	3300	446	Test A at IB	P
9	100	100	+5	-5	639	3300	446	Test A at IB	P
10	100	100	+5	0	859	3300	446	Test A at IB	P
11	100	100	+5	+5	633	3300	446	Test A at IB	P
12	66	66	0	-5	657	2178	310	Test B at IB	P
13	66	66	0	-4	651	2178	310	Test B at IB	P
14	66	66	0	-3	665	2178	310	Test B at IB	P
15	66	66	0	-2	677	2178	310	Test B at IB	P
16	66	66	0	-1	707	2178	310	Test B at IB	P
17	66	66	0	1	677	2178	310	Test B at IB	P
18	66	66	0	2	671	2178	310	Test B at IB	P
19	66	66	0	3	637	2178	310	Test B at IB	P
20	66	66	0	4	627	2178	310	Test B at IB	P
21	66	66	0	5	619	2178	310	Test B at IB	P
22	33	33	0	-5	649	1089	174	Test C at IB	P
23	33	33	0	-4	641	1089	174	Test C at IB	P
24	33	33	0	-3	653	1089	174	Test C at IB	P
25	33	33	0	-2	647	1089	174	Test C at IB	P
26	33	33	0	-1	681	1089	174	Test C at IB	P
27	33	33	0	1	679	1089	174	Test C at IB	P
28	33	33	0	2	651	1089	174	Test C at IB	P
29	33	33	0	3	639	1089	174	Test C at IB	P
30	33	33	0	4	627	1089	174	Test C at IB	P
31	33	33	0	5	619	1089	174	Test C at IB	P
32	100	100	-10	-10	631	3300	446	Test A at IB	P
33	100	100	-10	-5	653	3300	446	Test A at IB	P
34	100	100	-10	0	789	3300	446	Test A at IB	P
35	100	100	-10	+5	647	3300	446	Test A at IB	P
36	100	100	-10	+10	615	3300	446	Test A at IB	P
37	100	100	-5	+10	611	3300	446	Test A at IB	P

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**Protection. Loss of Mains test. The requirement is specified in section 5.3.2, test procedure in Annex A or B 1.3.4**

No.	$P_{EUT}^{1)}$ (% of EUT rating)	Reactive load (% of $Q_L$ in 6.1.d)1)	$P_{AC}^{2)}$ (% of nominal)	$Q_{AC}^{3)}$ (% of nominal)	Run on time (ms)**	$P_{EUT}$ (W)	$V_{DC}$ (V)	Remarks <sup>4)</sup>	Verdict
38	100	100	0	+10	615	3300	446	Test A at IB	P
39	100	100	+5	+10	621	3300	446	Test A at IB	P
40	100	100	-5	-10	627	3300	446	Test A at IB	P
41	100	100	0	-10	609	3300	446	Test A at IB	P
42	100	100	+5	-10	617	3300	446	Test A at IB	P
43	100	100	+10	-10	605	3300	446	Test A at IB	P
44	100	100	+10	-5	629	3300	446	Test A at IB	P
45	100	100	+10	0	931	3300	446	Test A at IB	P
46	100	100	+10	+5	627	3300	446	Test A at IB	P
47	100	100	+10	+10	619	3300	446	Test A at IB	P

<sup>1)</sup>  $P_{EUT}$ : EUT output power

<sup>2)</sup>  $P_{AC}$ : Real power flow at S1 as in Figure 1. Positive value means the power from EUT to utility. Nominal value is the 0% test condition value.

<sup>3)</sup>  $Q_{AC}$ : Reactive power flow at S1 as in Figure 1. Positive value means the power from EUT to utility. Nominal value is the 0% test condition value

<sup>4)</sup> BL: Balance condition, IB: Imbalance condition

\*: Needs to be measured if any of the recorded run-on times at imbalanced condition are longer than the one recorded for the rated balance condition at test condition A

\*\* “Run on time” must be < 2s

The filled out switch-off time values the highest among the three phase

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**Protection. Re-connection timer. The requirement is specified in section 5.3.4, test procedure in Annex A or B 1.3.5 (of reference document G83/2)**

Time delay setting	Measured delay	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 1.			
20s	30.12s	At 266.2V	At 196.1V	At 47.4Hz	At 51.6Hz
Confirmation that the SSEG does not re-connect.		No reconnection	No reconnection	No reconnection	No reconnection

**Protection. Frequency change, Stability test The requirement is specified in section 5.3.3, test procedure in Annex A or B 1.3.6 (of reference document G83/2)**

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

**Fault level contribution. The requirement is specified in section 5.7, test procedure in Annex A or B 1.4.6 (of reference document G83/2)**

Time after fault	Volts	Amps (rms)
20ms	20.02	24.80
60ms	10.65	12.31
100ms	7.59	7.78
1000ms	4.56	4.46
Time to trip	<1	In seconds



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This extract from the test report is only valid in conjunction with the test report no.: **28110272 006**

**Reviewed by:**

31.01.2017	Marco Piva / BFM	
<b>Datum</b>	<b>Name/Stellung</b>	<b>Unterschrift</b>
<i>Date</i>	<i>Name/Position</i>	<i>Signature</i>