



Applicant: **Victron Energy B.V.**
De Paal 35
1351 JG Almere
Netherlands

Product: **Battery Inverter with integrated automatic disconnection device**

Model:	MultiPlus-II 48/3000/35-32, MultiPlus-II 48/3000/35-32 GX MultiPlus-II 48/5000/70-50, MultiPlus-II 48/5000/70-50 GX MultiPlus-II 24/3000/70-32, MultiPlus-II 24/3000/70-32 GX		
Rating:	MultiPlus-II 48/3000/35-32, MultiPlus-II 48/3000/35-32 GX	MultiPlus-II 48/5000/70-50, MultiPlus-II 48/5000/70-50 GX	MultiPlus-II 24/3000/70-32, MultiPlus-II 24/3000/70-32 GX
Mains voltage:	230V 50/60Hz		
Mains current:	11A	19A	11A
Output power (feed in on-grid):	2,5kVA / 2,47kW	4,5kVA / 4,4kW	2,5kVA / 2,47kW
Output power (off-grid):	3,0kVA / 2,4kW	5,0kVA / 4,0kW	3,0kVA / 2,4kW

Intended use:

Battery Inverter with an automatic disconnection device with single -phase mains surveillance in accordance with Engineering Recommendation G98 Issue 1 – Amendment 6 for photovoltaic systems with a single-phase parallel coupling via an inverter to the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter.

Applied standards and guidelines:

SOP-9-1_15 GCC Certification Program, 09/21

Based on:

Engineering Recommendation G98 Issue 1 – Amendment 6 September 2021

Requirements for the connection of Fully Type Tested Micro-generators (up to and including 16 A per phase) in parallel with public Low Voltage Distribution Networks on or after 27 April 2019

The safety concept of an aforementioned representative product corresponds at the time of issue of this certificate to the valid safety specifications for the specified use in accordance with regulations.

Report No: 17PP264-37_0

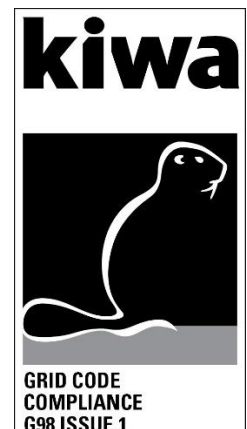
Certificate No: 22-272-00

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Raphael Rader
Certification Engineer



CERTIFICATE



Operating Range:					
	U [V]	f [Hz]	Cos ϕ	P [kW]	No disconnection occurs (Y/N)
Test 1	85%Un	47,00Hz	1,00	100%Pn	—
Measured 20s avg	195,5	47,00	1,000	2,1	Y
Test 2	85%	47,50Hz	1	100%Pn	—
Measured 90min avg	195,7	47,50	1,000	1,8	Y
Test 3	110%	51,50Hz	1	100%Pn	—
Measured 90min avg	252,9	51,50	0,998	2,1	Y
Test 4	110%	52,00Hz	1	100%Pn	—
Measured 15min avg	253,0	52,00	0,998	2,4	Y
Test 5	100%	50,00Hz	1	100%Pn	—
Measured 90min avg	229,9	50,00	0,999	2,2	Y
Test 6 RoCoF withstand	Start frequency	Change		End frequency	Confirm no trip
Positive frequency drift	49,5Hz	+1,0Hz/sec		50,0Hz	No Trip
Negative frequency drift	50,5Hz	-1,0Hz/sec		50,0Hz	No Trip



Power Quality: Harmonics						
MultiPlus-II xx/3000						
Micro-Generator tested to BS EN 61000-3-2						
Micro-Generator rating per phase (rpp)			2,47	kW		
For 3-phase Micro-generators, tick this box if harmonic measurements are identical for all three phases. If the harmonics are not identical for each phase, please replicate this section with the results for each phase.				<input type="checkbox"/>		
Harmonic	At 45-55% of Registered capacity		100% of Registered capacity		Limit in BS EN 61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
	Measured Value (MV) in Amps		Measured Value (MV) in Amps			
2	0,067		0,044		1,080	
3	0,076		0,077		2,300	
4	0,058		0,040		0,430	
5	0,154		0,083		1,140	
6	0,039		0,027		0,300	
7	0,112		0,054		0,770	
8	0,024		0,016		0,230	
9	0,063		0,043		0,400	
10	0,014		0,010		0,184	
11	0,054		0,026		0,330	
12	0,009		0,005		0,153	
13	0,036		0,014		0,210	
14	0,003		0,002		0,131	
15	0,021		0,012		0,150	
16	0,002		0,001		0,115	
17	0,026		0,015		0,132	
18	0,001		0,001		0,102	
19	0,025		0,013		0,118	
20	0,001		0,001		0,092	
21	0,018		0,005		0,107	0,160
22	0,002		0,001		0,084	
23	0,021		0,004		0,098	0,147
24	0,001		0,001		0,077	
25	0,014		0,010		0,090	0,135
26	0,001		0,001		0,071	
27	0,022		0,006		0,083	0,124
28	0,001		0,001		0,066	
29	0,013		0,010		0,078	0,117
30	0,001		0,001		0,061	
31	0,016		0,009		0,073	0,109
32	0,001		0,001		0,058	
33	0,024		0,010		0,068	0,102
34	0,002		0,001		0,054	
35	0,026		0,011		0,064	0,096
36	0,002		0,001		0,051	
37	0,022		0,011		0,061	0,091
38	0,003		0,001		0,048	
39	0,021		0,011		0,058	0,087
40	0,007		0,002		0,046	



MultiPlus-II xx/5000						
Micro-Generator tested to BS EN 61000-3-2						
Micro-Generator rating per phase (rpp)		4,4		kW		
For 3-phase Micro-generators, tick this box if harmonic measurements are identical for all three phases. If the harmonics are not identical for each phase, please replicate this section with the results for each phase.				<input type="checkbox"/>		
Harmonic	At 45-55% of Registered capacity		100% of Registered capacity		Limit in BS EN 61000-3-2 in Amps	
	Measured Value (MV) in Amps		Measured Value (MV) in Amps			
2	0,053		0,048		1,080	
3	0,600		0,304		2,300	
4	0,055		0,040		0,430	
5	0,256		0,285		1,140	
6	0,038		0,032		0,300	
7	0,193		0,130		0,770	
8	0,029		0,023		0,230	
9	0,143		0,090		0,400	
10	0,021		0,017		0,184	
11	0,052		0,069		0,330	
12	0,015		0,011		0,153	
13	0,027		0,053		0,210	
14	0,010		0,008		0,131	
15	0,034		0,032		0,150	
16	0,006		0,004		0,115	
17	0,015		0,015		0,132	
18	0,004		0,002		0,102	
19	0,017		0,010		0,118	
20	0,004		0,002		0,092	
21	0,002		0,017		0,107	0,160
22	0,002		0,002		0,084	
23	0,008		0,019		0,098	0,147
24	0,002		0,002		0,077	
25	0,013		0,006		0,090	0,135
26	0,002		0,002		0,071	
27	0,011		0,015		0,083	0,124
28	0,002		0,002		0,066	
29	0,013		0,004		0,078	0,117
30	0,004		0,002		0,061	
31	0,013		0,004		0,073	0,109
32	0,002		0,002		0,058	
33	0,017		0,013		0,068	0,102
34	0,002		0,002		0,054	
35	0,019		0,011		0,064	0,096
36	0,002		0,002		0,051	
37	0,017		0,008		0,061	0,091
38	0,004		0,002		0,048	
39	0,019		0,006		0,058	0,087
40	0,004		0,002		0,046	



Power Quality: Voltage fluctuations and flicker								
Test start date	2019-07-18			Test End date	2019-07-18			
Test Location	Kiwa Primara GmbH, Gewerbestraße 28, 87600 Kaufbeuren, Germany							
MultiPlus-II xx/3000								
	Starting			Stopping			Running	
	d_{max} [%]	d_c [%]	$d_{(t)}$ [ms]	d_{max} [%]	d_c [%]	$d_{(t)}$ [ms]	P_{st}	P_{It} 2 hours
Measured Values at test impedance	0,313	0,313	0,0	0,388	0,274	0,0	0,021	0,021
Normalised to standard impedance	0,313	0,313	0,0	0,388	0,274	0,0	0,021	0,021
Normalised to required maximum impedance	N/A							
Limits set under BS EN 61000-3-11	4%	3,3%	3,3%*	4%	3,3%	3,3%*	1,0	0,65
*500ms is the maximum allowed time above 3,3%.								
Test impedance	R	0,4	Ω	X	0,25	Ω		
Standard impedance	R	0,4	Ω	X	0,25	Ω		
Maximum impedance	R	—	Ω	X	—	Ω		
MultiPlus-II xx/5000								
	Starting			Stopping			Running	
	d_{max} [%]	d_c [%]	$d_{(t)}$ [ms]	d_{max} [%]	d_c [%]	$d_{(t)}$ [ms]	P_{st}	P_{It} 2 hours
Measured Values at test impedance	3,344	3,344	150,0	-3,469	-3,377	0,0	0,027	0,027
Normalised to standard impedance	3,344	3,344	150,0	-3,469	-3,377	0,0	0,027	0,027
Normalised to required maximum impedance	3,268	3,268	0,0	-3,390	-3,300	0,0	0,026	0,026
Limits set under BS EN 61000-3-11	4%	3,3%	3,3%*	4%	3,3%	3,3%*	1,0	0,65
*500ms is the maximum allowed time above 3,3%.								
Test impedance	R	0,4	Ω	X	0,25	Ω		
Standard impedance	R	0,4	Ω	X	0,25	Ω		
Maximum impedance	R	0,39	Ω	X	0,24	Ω		



Power Quality: DC injection.								
Test power level	20%		50%		75%		100%	
Recorded DC value in Amps	-0,008		-0,007		-0,007		-0,005	
as % of rated AC current	-0,23%		-0,20%		-0,19%		-0,16%	
Limit	0,25%		0,25%		0,25%		0,25%	
Power Quality: Power factor.								
	216,2V		230V		253V			
20% of Registered Capacity	1,000		1,000		1,000		0,998	
50% of Registered Capacity	1,000		1,000		1,000		0,999	
75% of Registered Capacity	1,000		1,000		1,000		0,999	
100% of Registered Capacity	1,000		1,000		1,000		1,000	
Limit	>0,95		>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	47,5Hz	20,0s	-	-	47,7Hz 30s	No trip		
U/F stage 2	47,0Hz	0,5s	-	-	47,2Hz 19,95s	No trip		
					46,8Hz 0,45s	No trip		
O/F stage 1	52,0Hz	0,5s	-	-	51,8Hz 120,0s	No trip		
					52,2Hz 0,45s	No trip		
Protection: Voltage tests								
Function	Setting		Trip test		"No trip tests"			
	Voltage	Time delay	Voltage	Time delay	Voltage / time	Confirm no trip		
U/V stage	184,0V	2,5s	182,5V	2,54s	188,0V 5,0s	No trip		
					180,0V 2,45s	No trip		
O/V stage 1	262,2V	1.0s	261,2V	1,07s	258,2V 5,0s	No trip		
O/V stage 2	273,7V	0,5s	273,0	0,59s	269,7V 0,95s	No trip		
					277,7V 0,45s	No trip		



Protection: Loss of Mains test and single phase test						
Test power and imbalance	33% -5% Q Tests 22	66% -5% Q Test 12	100% -5% P Test 5	33% +5% Q Test 31	66% +5% Q Test 21	100% +5% P Test 10
Trip time. Limit is 0.5s	0.199s	0.209s	0.263s	0.151s	0.166s	0.150s
Protection: Frequency change, Vector Shift Stability test.						
	Start frequency	Change	Confirm no trip			
Positive vector shift	49,5Hz	+50 degrees	No trip			
Negative vector shift	50,5Hz	-50 degrees	No trip			
Protection: Frequency Change, RoCoF Stability Test						
Ramp range	Test frequency ramp	Test duration	Confirm no Trip			
49,0 Hz to 51,0 Hz	+0,95Hz/s	2,1 s	No trip			
51,0 Hz to 49,0 Hz	-0,95Hz/s	2,1 s	No trip			
Protection: Limited Frequency Sensitive Mode – Overfrequency test						
Test sequence at Registered Capacity >80%	Measured Active Power Output	Frequency	Primary Power Source	Active Power Gradient		
Step a) 50,00 Hz± 0,01Hz	2,40	50,00	DC	—		
Step b) 50,45 Hz± 0,05Hz	2,37	50,45		—		
Step c) 50,70 Hz± 0,10Hz	2,24	50,70		—		
Step d) 51,15 Hz± 0,05Hz	2,02	51,15		—		
Step e) 50,70 Hz± 0,10Hz	2,24	50,70		—		
Step f) 50,45 Hz± 0,05Hz	2,37	50,45		—		
Step g) 50,00 Hz± 0,01Hz	2,40	50,00		8,59%		
Test sequence at Registered Capacity 40% - 60%	Measured Active Power Output	Frequency	Primary Power Source	Active Power Gradient		
Step a) 50,00 Hz± 0,01Hz	1,21	50,00		—		
Step b) 50,45 Hz± 0,05Hz	1,21	50,45		—		
Step c) 50,70 Hz± 0,10Hz	1,08	50,70		—		
Step d) 51,15 Hz± 0,05Hz	0,87	51,15		—		
Step e) 50,70 Hz± 0,10Hz	1,08	50,70		—		
Step f) 50,45 Hz± 0,05Hz	1,21	50,45		—		
Step g) 50,00 Hz± 0,01Hz	1,20	50,00		8,59%		
Protection: Power output with falling frequency test						
Test sequence	Measured Active Power output	Frequency	Primary power source			
Test a) 50 Hz ± 0,01 Hz	2,40	50,00	DC			
Test b) Point between 49,5 Hz and 49,6 Hz	2,40	49,53	DC			
Test c) Point between 47,5 Hz and 47,6 Hz	2,40	47,55	DC			



Protection: Re-connection timer.					
Time delay settings (s)	Measured delay (s)	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 10.5.7.1			
20s	Max. 27,3 Min. 25,2	At 266,2V	At 180,0V	At 47,4Hz	At 52,1Hz
Confirmation that the Micro-generator does not re-connect		No reconnection	No reconnection	No reconnection	No reconnection
Fault Level contribution.					
For machines with electro-magnetic output			For inverter output		
Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	i_p	-	20ms	85,1	19,27
Initial Value of aperiodic current	A	-	100ms	0,0	0,0
Initial symmetrical short-circuit current	I_k	-	250ms	0,0	0,0
Decaying (aperiodic) component of short-circuit current	i_{DC}	-	500ms	0,0	0,0
Reactance/Resistance Ratio of source	X/R	-	Time to trip	0,03	In seconds
Logic Interface (input port)					
Confirm that an input port is provided and can be used to reduce the Active Power output to zero					YES
Provide high level description of logic interface, e.g. details in 9.4.3 such as AC or DC signal (the additional comments box below can be used)					YES*
<p><i>*When the switch is closed the Micro-generator can operate normally. When the switch is opened the Micro-generator will reduce its Active Power to zero within 5 s. The signal from the Micro-generator that is being switched is DC (maximum value 5V).</i></p>					
Self Monitoring solid state switching					
It has been verified that in the event of the solid state switching device failing to disconnect the Micro-Generator, the voltage on the output side of the switching device is reduced to a value below 50 volt within 0,5s.					N/A
Note: electromechanical relays used					
Cyber security					
Confirm that the Manufacturer or Installer of the Micro-generator has provided a statement describing how the Micro-generator has been designed to comply with cyber security requirements, as detailed in 9.7.					YES
Additional comments					
<p>Test results indicated with MultiPlus-II xx/3000 are representative for models: MultiPlus-II 48/3000/35-32, MultiPlus-II 48/3000/35-32 GX, MultiPlus-II 24/3000/70-32, MultiPlus-II 24/3000/70-32 GX</p> <p>Test results indicated with MultiPlus-II xx/5000 are representative for models: MultiPlus-II 48/5000/70-50, MultiPlus-II 48/5000/70-50 GX</p> <p>Test results with no model indication are representative for all declared models.</p>					