

Certificate

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

Product: **Photovoltaic Inverter with integrated automatic disconnection device between a generator and the public low-voltage grid**

Model:	Multiplus			
	12/3000/120-16	12/3000/120-50	24/3000/70-16	24/3000/70-50
	48/3000/35-16		48/3000/35-50	
Rating:	2,4kW; 3,0kVA			

Intended use:

An automatic disconnection device with single-phase mains surveillance in accordance with Engineering Recommendation G83/2 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:

**Engineering Recommendation G83/2
Issue 2 – August 2012**

Recommendations for the connection of small-scale embedded generators in parallel with public low-voltage distribution networks.

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.

The above mentioned inverters are also in compliance with the standard, if installed in parallel and three-phase configurations up to 16A per phase. For configurations above 16A per phase the DNO must be consulted.

Report No: 15PP007-01

Certificate No: 15-110-02

Date of issue: 2015-12-01



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Certification Department



Power Quality. Harmonics.

Equipment Phases: Single Phase

Harmonic:	At 45-55% of rated output	At 100% of rated output	Harmonic Limit (A)
	Normalised Value (A)		
2nd	0,06	0,08	1,080
3rd	0,89	0,80	2,300
4th	0,05	0,05	0,430
5th	0,26	0,25	1,140
6th	0,03	0,03	0,300
7th	0,12	0,08	0,770
8th	0,03	0,03	0,230
9th	0,08	0,08	0,400
10th	0,02	0,03	0,184
11th	0,05	0,06	0,330
12th	0,00	0,00	0,153
13th	0,03	0,05	0,210
14th	0,00	0,00	0,131
15th	0,02	0,05	0,150
16th	0,00	0,00	0,115
17th	0,00	0,03	0,132
18th	0,00	0,00	0,102
19th	0,02	0,02	0,118
20th	0,00	0,00	0,092
21st	0,02	0,02	0,107
22nd	0,00	0,00	0,084
23rd	0,02	0,03	0,098
24th	0,00	0,00	0,077
25th	0,02	0,02	0,090
26th	0,00	0,00	0,071
27th	0,00	0,02	0,083
28th	0,00	0,00	0,066
29th	0,00	0,02	0,078
30th	0,00	0,00	0,061
31st	0,02	0,00	0,073
32nd	0,00	0,00	0,058
33rd	0,02	0,00	0,068
34th	0,00	0,00	0,054
35th	0,00	0,00	0,064
36th	0,00	0,00	0,051
37th	0,00	0,00	0,061
38th	0,00	0,00	0,048
39th	0,00	0,02	0,058
40th	0,00	0,00	0,046

Power Quality. Voltage Fluctuations and Flicker.

	Starting			Stopping			Running	
	dmax	dc	d(t)	Dmax	dc	d(t)	Pst	Plt 2 hours
Measured Values	0,311	0,150	0,311	1,509	0,036	1,509	0,018	0,018
Normalised to standard impedance	0,311	0,150	0,311	1,509	0,036	1,509	0,018	0,018
Limits	4%	3,3%	3,3% 500ms	4%	3,3%	3,3% 500ms	1,0	0,65

Power Quality. Power Factor.

Output Voltage	216,2V	230V	253V
Measured Value	0,997	0,998	0,995
Limit	>0,95		

Protection. Frquency Tests.

Function	Setting		Trip test		No trip test	
	Frequency	Time delay	Frequency	Time delay	Frequency time	Confirm no trip
U/F stage 1	47,5Hz	20s	47,50Hz	20,15s	47,7Hz 25s	No trip
U/F stage 2	47,0Hz	0,5s	47,00Hz	0,59s	47,2Hz 19,98s	No trip
					46,8Hz 0,48s	No trip
O/F stage 1	51,5Hz	90s	51,53Hz	90,20s	51,3Hz 95s	No trip
O/F stage 2	52,0Hz	0,5s	52,03Hz	0,59s	51,8Hz 89,98s	No trip
					52,2Hz 0,48s	No trip

Protection. Voltage Tests.

Function	Setting		Trip test		No trip test	
	Voltage	Time delay	Voltage	Time delay	Voltage time	Confirm no trip
U/V stage 1	200,1V	2,5s	200,1V	2,55s	204,1V 3,5s	No trip
U/V stage 2	184,0V	0,5s	184,0V	0,55s	188V 2,48s	No trip
					180V 0,48s	No trip
O/V stage 1	262,2V	1,0s	262,3V	1,05s	258,2V 2,0s	No trip
O/V stage 2	273,7V	0,5s	273,8V	0,59s	269,7V 0,98s	No trip
					277,7V 0,48s	No trip

Protection. Loss of Mains Test according BS EN 62116 for Inverters.

Test Power and imbalance	33% -5% Q	66% -5% Q	100% -5% Q	33% +5% Q	66% +5% Q	100% +5% Q
Trip time (s)	0,1	0,2	0,1	0,1	0,2	0,2

Protection. Reconnection Timer.

Reconnection Time	Under/Over voltage	Under/over frequency	Loss of mains
Minimum value	20 seconds		
Actual settings (sec)	20s	20s	20s
Recorded value (sec)	22,2s	22,7s	22,5s
	At 266,2V	At 196,1V	At 47,4Hz
Confirmation that the unit does not re-connect.	No connection to grid	No connection to grid	No connection to grid

Fault Level Contribution.

Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	ip	N/A	20ms	46,07 V	8,69 A
Initial Value of aperiodic current	A	N/A	100ms	27,48 V	0,02 A
Initial symmetrical short-circuit current	IK	N/A	250ms	27,43 V	0,02 A
Decaying (aperiodic) component of short-circuit current	iDC	N/A	500ms	27,41 V	0,02 A
Reactance/Resistance Ratio of source	X/R	N/A	Time to trip	31,27 ms	-

As SSEGs (small-scale embedded generators) for PV are inverter-connected the max. short circuit current is the max. AC current.